VMMA

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ENGINEERING SOLUTIONS ON A CHIP FROM INTERSIL

Product offerings described in this data book reflect Intersil's commitment to industry leadership as a producer of advanced low-power analog and digital semiconductor components and data acquisition systems.

These components are fabricated using a wide variety of process technologies and are intended to provide state-of-the-art performance and maximum cost effectiveness.

Product areas in which Intersil demonstrates its innovative approach to providing engineering solutions on a chip include:

- **FIELD EFFECT AND DUAL MATCHED BIPOLAR TRANSISTORS**
  A complete line of high-performance junction FETs, dual JFETs, MOSFETs and matched dual bipolar devices.

- **DIGITAL**
  Very low-power CMOS ROMs and EPROMs, as well as high-speed HMOS ROMs; CMOS microprocessors, peripherals and UARTs.

- **ANALOG SWITCHES AND MULTIPLEXERS**
  The industry's broadest offering of highest-performance switches, including a video-RF switch with excellent isolation at 100 MHz, and multiplexers featuring the least error as well as unprecedented input overload protection.

- **ANALOG-TO-DIGITAL AND DIGITAL-TO-ANALOG CONVERTERS**
  3½- and 4½-digit display output (DVM) analog-to-digital converters; 12-, 14- and 16-bit microprocessor-compatible analog-to-digital converters; and high-speed precision digital-to-analog converters up to 14 bits.

- **LINEAR**
  A new set of low-power devices with unequalled performance—1-μV offset voltage op amps, 4-μA quiescent current regulators and supply monitors, 95-per-cent-efficient voltage converters and 1ppm/°C voltage references; a complete family of CMOS op amps; and a wide variety of special analog function circuits.

- **TIMERS, COUNTERS AND DISPLAY DRIVERS**
  A wide range of low-power counters, timers and multidigit LED, LCD and vacuum fluorescent display decoder/drivers, including those with full alphanumeric capability.

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General Information

EXPLANATION OF TERMS, INDICES AND SPECIAL SUBSECTIONS

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PRODUCTION DATA SHEET
This is a full, final data sheet, and describes a mature product in full production. Although Intersil reserves the right to make changes in specifications contained in these data sheets at any time without notice, such changes are not common and are usually minor, generally relating to yield and processing improvements. These data sheets are not marked; others are marked preliminary.

PRELIMINARY DATA SHEET
A preliminary data sheet is issued in advance of the availability of production samples and generally indicates that at the time of printing, the device had not been fully characterized. In the case of a second-source part, the specifications are already determined, and a "preliminary" designation indicates the anticipated availability of the device.

ALPHANUMERIC INDEX
This part number index is arranged first by alpha sequence, (ie: ADCxxxx, DGxxx, Gxxx, ICLxxxx, ICMxxxx, etc.) then by numeric sequence (ie: LM100, LM101A, LM102, LM105, etc.) and ignoring package/temperature/pin number suffixes. The basic numbering sequence, is sorted by reading the part number characters from left to right. Reading the left character first (which is usually an alpha character), then the next character to the right and so forth.

BASE NUMBER INDEX
If only the basic part number is known, use the Base Number Index as a locator aid. The Base Number Index is organized in numeric sequence (with alpha prefixes appearing in bold type and numeric characters set in medium type). Devices are arranged in this index according to the numeric value of the first digit on the left, then the value of the second digit, then the third, and so on. For example, device number ICM7218 precedes ICL741, no package/temperature/pin number suffixes are included, but these may be obtained from the specific product data sheet.

FUNCTION INDEX
This is an index of Intersil device types categorized by product grouping and function. The first major subsection, DISCRETES, is further subdivided into categories for JFETs and Special Function devices.

All remaining major subsections (ANALOG SWITCHES/MULTIPLEXERS, DATA ACQUISITION, LINEAR, TIMERS/COUNTERS, TIMEKEEPING/DTMF, MEMORIES and MICROPROCESSORS/PERIPHERALS) are organized alphabetically by function. The Functional Index appears in its entirety in section A, and an appropriate subindex appears at the beginning of each major product section.

CROSS-REFERENCE GUIDES
Two cross-reference guides are provided: one for Discrete Devices and one for Integrated Circuits.

The Discrete Cross-Reference Guide indicates whether Intersil can provide the industry-standard type, or an Intersil preferred part instead.

The IC Alternate Source Cross-Reference Guide lists competitive manufacturer device types for which Intersil makes pin-for-pin replacements. In the left-hand column, the competitive device part number is organized alphabetically by manufacturer. The Intersil pin-for-pin replacement appears in the right hand column.

SELECTOR GUIDES
Selector guide tables appear at the front of each major product category subsection and provides a quick reference of key parameters for devices contained in that section.

DEVICE FUNCTION/PACKAGE CODES
Package dimensions and diagrams explaining device prefix and suffix codes appear in Appendix B.

DIE SELECTION CRITERIA
Many of Intersil's semiconductor products are available in die form. This subsection of Appendix B contains general information on criteria for transistor and integrated circuit die selection, including physical parameters, packaging for shipment, assembly, testing and purchase options.

HIGH-RELIABILITY PROCESSING
This subsection of Appendix B defines Intersil's commitment to 100 percent compliance with MIL-STD-883, MIL-STD-750, MIL-M-38510 and MIL-S-19500 specifications. It also outlines Intersil's programs for quality conformance, quality testing and limited use qualification and includes a glossary of military/aerospace Hi-Rel terms.

ALPHANUMERIC INDEX

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** Obsolete product, refer to page A-9.

A ALPHANUMERIC INDEX

**Obsolete product, refer to page A-9.

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2N 4044	1-20
2N 4045	1-20
U 405	1-90
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2N 4092	1-22
ITE 4092	1-22
2N 4093	1-22
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**Obsolete product, refer to page A-9.

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BASE NUMBER INDEX

**Obsolete product, refer to page A-9.

DISCRETES

JFET Single Switches

JFET Single Amplifiers

JFET Dual Amplifiers

MOSFET Switches/ Amplifiers

Bipolar Dual Amplifiers

Special Function

DIGITAL

Memory

Peripherals

ANALOG SWITCHES AND MULTIPLEXERS

Multiplexers

Analog Switch Drivers/ Level Translators

Analog Switches with Drivers

Video/RF Switch

DATA ACQUISITION

A/D Converters DVM Circuits

†The ICL7136 is recommended for all applications which currently employ the ICL7126.

D/A Converters

D/A Current Switches

LINEAR

Amplifiers

A FUNCTIONAL INDEX

**Obsolete product, refer to page A-9.

OBSOLETE PRODUCTS

The products listed below have been designed into circuits in the past, but are no longer likely to be the most economic choice for new designs.

These products are still available for use in existing designs. Data sheets for these products are available upon request.

AM2502/3/4	AD503
AM25L02/3/4	SU/NE536
DG126A Family	μA740
G115/123	LM101/301
G116-19	LM107/307
G125-32	μA741
ICL7600/01	AD741K
ICL8052/7101	μA748
ICL8052/71C03	LH2101/2301
ICL8068/71C03	IH5101
ICL8052/53	LM4250
IH401	μA733
IMF5911/12	LM102/302
LD110/111	LM110/310
LD114	LH2110/2310
MM450/550	LH2111/2311
MM451/551	LM111/311
MM452/552	LM100/300
MM455/555	LM105/305
VCR5P	μA723
LH0042	ICM7201

IC ALTERNATIVE SOURCE INDEX

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AMD	Intersil
AM9232	IM7332
AM9264	IM7364
LH2101	LH2101
LH2301	LH2301
LH2311	LH2311
LM101	LM101
LM102	LM102
LM105	LM105
LM107	LM107
LM108	LM108
LM110	LM110
LM111	LM111
LM301	LM301
LM302	LM302
LM305	LM305
LM307	LM307
LM308	LM308
LM310	LM310
LM311	LM311
723	µA723
733	µA733
741	µA741
748	µA748

AMI	Intersil
S68332	IM7332
S68364	IM7364

Analog Devices	Intersil
AD101	LM101
AD108	LM108
AD301	LM301
AD308	LM308
AD503	AD503
AD590	AD590
AD741	µA741
AD7506/COM/CHIPS	IH6116C/D
AD7506/MIL/CHIPS	IH6116M/D
AD7506JD	IH6116CJI
AD7506JD/883B	IH6116JI/883B
AD7506JN	IH6116CPI
AD7506KD	IH6116CJI
AD7506KD/883B	IH6116CJI/883B
AD7506KN	IH6116CPI
AD7506SD	IH6116MJI
AD7506SD/883B	IH6116MJI/883B
AD7506TD	IH6116MJI
AD7506TD/883B	IH6116MJI/883B
AD7507/COM/CHIPS	IH6216C/D
AD7507/MIL/CHIPS	IH6216M/D
AD7507JD	IH6216CJI
AD7507JD/883B	IH6216CJI/883B
AD7507JN	IH6216CPI
AD7507KD	IH6216CJI
AD7507KD/883B	IH6216CJI/883B
AD7507KN	IH6216CPI
AD7507SD	IH6216MJI
AD7507SD/883B	IH6216MJI/883B
AD7507TD	IH6216MJI
AD7507TD/883B	IH6216MJI/883B
AD7520JD	AD7520JD
AD7502JN	AD7520JN
AD7520KD	AD7520KD
AD7520KN	AD7520KN
AD7520LD	AD7520LD
AD7520LN	AD7520LN
AD7520SD	AD7520SD
AD7520TD	AD7520TD
AD7520UD	AD7520UD
AD7521JD	AD7521JD
AD7521JN	AD7521JN
AD7521KD	AD7521KD
AD7521KN	AD7521KN
AD7521LD	AD7521LD
AD7521LN	AD7521LN
AD7521SD	AD7521SD
AD7521TD	AD7521TD
AD7521UD	AD7521UD
AD7523AD	AD7523AD
AD7523BD	AD7523BD
AD7523CD	AD7523CD
AD7523JN	AD7523JN
AD7523KN	AD7523KN
AD7523LN	AD7523LN
AD7523SD	AD7523SD
AD7523TD	AD7523TD
AD7523UD	AD7523UD
AD7530JD	AD7530JD
AD7530JN	AD7530JN
AD7530KD	AD7530KD
AD7530KN	AD7530KN
AD7530LD	AD7530LD
AD7530LN	AD7530LN
AD7531JD	AD7531JD
AD7531JN	AD7531JN
AD7531KD	AD7531KD
AD7531KN	AD7531KN
AD7531LD	AD7531LD
AD7531LN	AD7531LN
AD7533AD	AD7533AD
AD7533BD	AD7533BD
AD7533CD	AD7533CD
AD7533JN	AD7533JN
AD7533KN	AD7533KN
AD7533LN	AD7533LN
AD7533SD	AD7533SD
AD7533TD	AD7533TD
AD7533UD	AD7533UD
AD7541AD	AD7541AD
AD7541BD	AD7541BD
AD7541JN	AD7541JN
AD7541KN	AD7541KN
AD7541SD	AD7541SD
AD7541TD	AD7541TD

Commodore	Intersil
2332	IM7332
2364	IM7364

Datel	Intersil
AMC-8013	ICL8013
DAC7520	AD7520
DAC7521	AD7521
DAC7523	AD7523
DAC7533	AD7533
DAC7541	AD7541
TT-590	AD590
WG-8038	ICL8038
VR-8069	ICL8069

Eurosil	Intersil
E1115	ICM1115A
E1151	ICM1115B

Exar	Intersil
XR2240	ICM7240
XR8038	ICL8038
XRL555	ICM7555
XRL556	ICM7556
XR2242	ICM7242

Fairchild	Intersil
µA101	LM101
µA102	LM102
µA105	LM105
µA107	LM107
µA108	LM108
µA110	LM110
µA111	LM111
µA301	LM301
µA302	LM302
µA305	LM305
µA307	LM307
µA308	LM308
µA310	LM310
µA311	LM311
µA723	µA723
µA733	µA733
µA740	µA740
µA741	µA741
µA748	µA748
µA777	µA777

GI	Intersil
9332	IM7332
9364	IM7364

GTE	Intersil
2114	2114
2332	IM7332
2364	IM7364

Harris	Intersil
HA2720	ICL8021
HD6402	IM6402
HI0-0200-5	DG200B/D
HI1-0200-2	DG200AK
HI1-0200-4	DG200BK
HI1-0200-5	DG200BK
HI1-0200-8	DG200AK/883B
HI2-0200-2	DG200AA
HI2-0200-4	DG200BA
HI2-0200-5	DG200BA
HI2-0200-8	DG200AA/883B
HI3-0200-5	DG200CJ
HI0-0201-6	DG201B/D
HI1-0201-2	DG201AK
HI1-0201-4	DG201BK
HI1-0201-5	DG201BK
HI1-0201-8	DG201AK/883B
HI3-0201-5	DG201CJ
HI0-0508-6	IH6108C/D
HI1-0508-2	IH6108MJE
HI1-0508-5	IH6108CJE
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HI1-0508A-2	IH5108MJE
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HI1-0508A-8	IH5108MJE/883B
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HI1-0509-2	IH6208MJE
HI1-0509-5	IH6208CJE
HI1-0509-8	IH6208MJE/883B
HI3-0509-5	IH6208CPE
HI0-0509A-6	IH5208C/D
HI1-0509A-2	IH5208MJE
HI1-0509A-5	IH5208IJE
HI1-0509A-8	IH5208MJE/883B
HI3-0509A-5	IH5208CPE
HI0-0506-6	IH6116C/D
HI1-0506-2	IH6116MJI
HI1-0506-5	IH6116CJI
HI1-0506-8	IH6116MJI/883B
HI3-0506-5	IH6116CPI
HI0-0507-6	IH6216C/D
HI1-0507-2	IH6216MJI
HI1-0507-5	IH6216CJI
HI1-0507-8	IH6216MJI/883B
HI3-0507-5	IH6216CPI
HI0-5040-6	IH5040C/D
HI1-5040-2	IH5040MJE
HI1-5040-5	IH5040CPE
HI1-5040-8	IH5040MJE/883B
HI0-5041-6	IH5041C/D
HI1-5041-2	IH5041MJE
HI1-5041-5	IH5041CPE
HI1-5041-8	IH5041MJE/883B
HI0-5042-6	IH5042C/D
HI1-5042-2	IH5042MJE
HI1-5042-5	IH5042CPE
HI1-5042-8	IH5042MJE/883B
HI0-5043-6	IH5043C/D
HI1-5043-2	IH5043MJE
HI1-5043-5	IH5043CPE
HI1-5043-8	IH5043MJE/883B
HI0-5044-6	IH044C/D
HI1-5044-2	IH5044MJE
HI1-5044-5	IH5044CPE
HI1-5044-8	IH5044MJE/883B
HI0-5045-6	IH5045C/D
HI1-5045-2	IH5045MJE
HI1-5045-5	IH5045CPE
HI1-5045-8	IH5045MJE/883B
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HI1-5046-2	IH5046MJE
HI1-5046-5	IH5046CPE
HI1-5046-8	IH5046MJE/883B
HI0-5047-6	IH5047C/D
HI1-5047-2	IH5047MJE
HI1-5047-5	IH5047CPE
HI1-5047-8	IH5047MJE/883B
HI0-5048-6	IH5048C/D
HI1-5048-2	IH5048MJE
HI1-5048-5	IH5048CJE,CPC
HI1-5048-8	IH5048MJE/883B
HI0-5049-6	IH5049C/D
HI1-5049-2	IH5049MJE
HI1-5049-5	IH5049CJE,CPE
HI1-5049-8	IH5049MJE/883B
HI0-5050-6	IH5050C/D
HI1-5050-2	IH5050MJE
HI1-5050-5	IH5050CJE,CPE
HI1-5050-8	IH5050MJE/883B
HI0-5051-6	IH5051C/D
HI1-5051-2	IH5051MJE
HI1-5051-5	IH5051CJE,CPE
HI1-5051-8	IH5051MJE/883B
LM101	LM101
LM4250	LM4250

MicroPower Systems	Intersil
MP7520JD	AD7520JD
MP7520JN	AD7520JN
MP7520KD	AD7520KD
MP7520KN	AD7520KN
MP7520LD	AD7520LD
MP7520LN	AD7502LN
MP7520SD	AD7520SD
MP7520TD	AD7520TD

IC Alternate Source Index (continued)

continued

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MP7521JN	AD7521JN
MP7521KD	AD7521KD
MP7521KN	AD7521KN
MP7521LD	AD7521LD
MP7521LN	AD7521LN
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MP7521TD	AD7521TD
MP7521UD	AD7521UD
MP7523JN	AD7523JN
MP7523KN	AD7523KN
MP7523LN	AD7523LN
MP7530JD	AD7530JD
MP7530JN	AD7530JN
MP7530KD	AD7530KD
MP7530KN	AD7530KN
MP7530LD	AD7530LD
MP7530LN	AD7530LN
MP7531JD	AD7531JD
MP7531JN	AD7531JN
MP7531KD	AD7531KD
MP7531KN	AD7531KN
MP7531LD	AD7531LD
MP7531LN	AD7531LN
MP7533AD	AD7533AD
MP7533BD	AD7533BD
MP7533CD	AD7533CD
MP7533JN	AD7533JN
MP7533KN	AD7533KN
MP7533LN	AD7533LN
MP7533SD	AD7533SD
MP7533TD	AD7533TD
MP7533UD	AD7533UD
MP7621AD	AD7541AD
MP7621BD	AD7541BD
MP7621JN	AD7541JN
MP7621KN	AD7541LN
MP7621SD	AD7541SD
MP7621TD	AD7541TD

Mitsubishi	**Intersil**
M58435P	ICM1115B

Motorola	**Intersil**
LM101	LM101
LM105	LM105
LM107	LM107
LM110	LM110
LM111	LM111
LM301	LM301
LM305	LM305
LM307	LM307
LM308	LM308
LM310	LM310
LM311	LM311
MCM68332	IM7332
MCM68364	IM7364
MC1723	µA723
MC1741	µA741
MC1748	µA748
MHW590	AD590

National Semiconductor	**Intersil**
AD7520JD (DAC1022LCD)	AD7520JD
AD7520JN (DAC1022LCN)	AD7520KD
AD7520KN (DAC1021LCD)	AD7520KD
AD7520KN (DAC1021LCN)	AD7520KN
AD7520LD (DAC1020LCD)	AD7520LD
AD7520LN (DAC1020LCN)	AD7520LN
AD7520SK (DAC1022LD)	AD7520SD
AD7520TD (DAC1021LD)	AD7520TD
AD7520UD (DAC1020LD)	AD7520UD
AD7521JD (DAC1222LCD)	AD7521JD
AD7521JN (DAC1222LCN)	AD7521JN
AD7521KD (DAC1221LCD)	AD7521KD
AD7521KN (DAC1221LCN)	AD7521KN
AD7521LD (DAC1220LCD)	AD7521LD
AD7521LN (DAC1220LCN)	AD7521LN
AD7521SD (DAC1222LD)	AD7521SD
AD7521TD (DAC1221LD)	AD7521TD
AD7521UD (DAC1220LD)	AD7521UD
AD7530JD (DAC1022LCD)	AD7530JD
AD7530JN (DAC1022LCN)	AD7530JN
AD7530KD (DAC1021LCD)	AD7530KD
AD7530KN (DAC1021LCN)	AD7530KN
AD7530LD (DAC1020LCD)	AD7530LD
AD7530LN (DAC1020LCN)	AD7530LN
AD7531JD (DAC1222LCD)	AD7531JD
AD7531JN (DAC1222LCN)	AD7531JN
AD7531KD (DAC1221LCD)	AD7531KD
AD7531KN (DAC1221LCN)	AD7531KN
AD7531LD (DAC1220LCD)	AD7531LD
AD7531LN (DAC1220LCN)	AD7531LN
AD7533AD (DAC1022LCD)	AD7533AD
AD7533BD (DAC1021LCD)	AD7533BD
AD7533CD (DAC1020LCD)	AD7533CD
AD7533JN (DAC1022LCN)	AD7533JN
AD7533KN (DAC1021LCN)	AD7533KN
AD7533LN (DAC1020LCN)	AD7533LN
AD7533SD (DAC1022LD)	AD7533SD
AD7533TD (DAC1021LC)	AD7533TD
AD7533UD (DAC1020LD)	AD7533UD
AH0139CD	DG139BK
AH0139D	DG139AK
AH0139D/883	DG139AK/883B
AH0142CD	DG142BK
AH0142D	DG142AK
AH0142D/883	DG142AK/883B
AH0143CD	DG143BK
AH0143D	DG143AK
AH0143D/883	DG143AK/883B
AH0144CD	DG144BK
AH0144D	DG144AK
AH0144D/883	DG144AK/883B
AD0145CD	DG145BK
AH0145D	DG145AK
AH0145D/883	DG145AK/883B
AH0146CD	DG146BK
AH0146D	DG146AK
AH0146D/883	DG146AK/883B
AH0161CD	DG161BK
AH0161D	DG161AK
AH0161D/83	DG161AK/883B
AH0162CD	DG162BK
AH0162D	DG162AK
AH0162D/883B	DG162AK/883B
AH0163CD	DG163BK
AH0163	DG163AK
AH0163D/883	DG163AK/883B
AH0164CD	DG164BK
AH0164D	DG164AK
AH0164D/883	DG164AK/883B
AH5009CN	IH5009CPD
AH5010CN	IH5010CPD
AH5011CN	IH5011CPE
AH5012CN	IH5012CPE
AN5013CN	IH5013CPD
AH5014CN	IH5014CPD
AH5015CN	IH5015CPE
AH5016CN	IH5016CPE
AM9709CN	IH5009CPD
AM97C09CN	IH5009CPD
AM9710CN	IH5010CPD
AM97C10CN	IH5010CPD
AM9711CN	IH5011CPE
AM97C11CN	IH5011CPE
AM9712CN	IH5012CPE
AM97C12CN	IH5012CPE
DM7555	ICM7555
DM7556	ICM7556
LF11201D	DG201AK
LF11201D/883	DG201AK/883B
LF11508D	IH6108MJE
LF11508D/883	IH6108MJE/883B
LF11509D	IH6208MJE
LF11509D/883	IH6208MJE/883B
LF13201	DG201
LH0042	LH0042
LH2108	LH2108
LH2110	LH2110
LH2111	LH2111
LH2301	LH2301
LH2308	LH2308
LH2310	LH2310
LH2311	LH2311
LM100	LM100
LM101	LM101
LM102	LM102
LM105	LM105
LM107	LM107
LM108	LM108
LM110	LM110
LM111	LM111
LM300	LM300
LM301	LM301
LM302	LM302
LM305	LM305
LM307	LM307
LM308	LM308
LM310	LM310
LM311	LM311
LM4250	LM4250
LM723	µA723
LM733	µA733
LM740	µA740
LM741	µA741
LM742	µA748
MM52132	IM7332
MM52164	IM7364
MM74C946	ICM7224

NEC	**Intersil**
µPD816C	ICM7038B
µPD820C	ICM1115B
µPD833G	ICM7223
µPD1963C	ICM7050
µPD2332	IM7332
µPD2364	IM7364

NPC	**Intersil**
SM5510	ICM1115B

OKI	**Intersil**
MSM503	AD503

Panasonic/Matsushita	**Intersil**
MN6091	ICM7038B
MN6093	ICM7051A

Phillips/Fasalec	**Intersil**
MB7B	ICM7245U
MB101	ICM7245B
MB103	ICM7245E
MB105	ICM7245U
MB107	ICM7245D
MB108	ICM7245E
MB143	ICM7245A
MB144	ICM7245F
MB510	ICM1115B

Plessey	**Intersil**
SC748	µA748

PMI	**Intersil**
PM308	LM308
SSS741	µA741

Raytheon	**Intersil**
LH2101	LH2101
LH2301	LH2301
LH2311	LH2311
LM101	LM101
LM105	LM105
LM107	LM107
LM108	LM108
LM301	LM301
LM305	LM305
LM307	LM307
LM308	LM308
LM311	LM311
RC723	µA723
RC733	µA733
RC741	µA741
RC748	µA748
RM723	µA723
RM741	µA741
RM748	µA748

RCA	**Intersil**
CA101	LM101
CA107	LM107
CA111	LM111
CA301	LM301
CA307	LM307
CA308	LM308
CA311	LM311
CA723	µA723
CA741	µA741
CA748	µA748
CD22015E	ICM7051A
CPD6402	IM6402

Samsong	**Intersil**
KS5240U01E	ICM7245U
KS5240B01J	ICM7245A
KS5240B01H	ICM7245B
KS5240B10H	ICM7245D
KS5240B12H	ICM7245E
KS5240B20H	ICM7245F

Sanyo	**Intersil**
LC7523	AD7523

Signetics	**Intersil**
µA723	µA723
µA733	µA733
µA740	µA740
µA741	µA741
µA748	µA748
LH2101	LH2101
LH2108	LH2108
LH2301	LH2301
LH2308	LH2308

IC Alternate Source Index (continued)

A

continued

Silicon General	Intersil
µA777	µA777
SG101	LM101
SG105	LM105
SG107	LM107
SG108	LM108
SG110	LM110
SG111	LM111
SG301	LM301
SG305	LM305
SG307	LM307
SG308	LM308
SG311	LM311
SG4250	LM4250
SG723	µA723
SG733	µA733
SG741	µA741
SG748	µA748
SG7520	AD7520
SG7521	AD7521
SG7523	AD7523

Siliconix	Intersil
DF412	ICM7211
DG123AL	DG123AL
DG123AP	DG123AK
DG123BP	DG123BK
DG125AL	DG125AL
DG125AP	DG125AK
DG125BP	DG125BK
DG139AL	DG139AL
DG139AP	DG139AK
DG139BP	DG139BK
DG142AL	DG142AL
DG142AP	DG142AK
DG142BP	DG142BK
DG143AL	DG143AL
DG143AP	DG143AK
DG143BP	DG143BK
DG144AL	DG144AL
DG144AP	DG144AK
DG144AP	DG144BK
DG145AL	DG145AL
DG145AP	DG145AK
DG145BP	DG145BK
DG146AL	DG146AL
DG146AP	DG146AK
DG146BP	DG146BK
DG161AL	DG161AL
DG161AP	DG161AK
DG161BP	DG161BK
DG162AL	DG162AL
DG162AP	DG162AK
DG162BP	DG162BK
DG163AL	DG163AL
DG163AP	DG163AK
DG163BP	DG163BK
DG164AL	DG164AL
DG164AP	DG164AK
DG164BP	DG164BK
DG180AA	DG180AA
DG180AL	DG180AL
DG180AP	DG180AK
DG180BA	DG180BA
DG180BP	DG180BK
DG181AA	DG181AA
DG181AL	DG181AL
DG181AP	DG181AK
DG181BA	DG181BA
DG181BP	DG181BK
DG182AA	DG182AA
DG182AL	DGM182AA DG182AL
DG182AP	DGM182AL DG182AK
DG182BA	DGM182AK DG182BA
DG182BP	DGM182BA DG182BK
DG183AL	DGM182BK DG183AL
DG183AP	DG183AK
DG183BP	DG183BK
DG184AL	DG184AL
DG184AP	DG184AK
DG184BP	DG184BK
DG185AL	DG185AL
DG185AP	DGM185AL DG185AK
DG185BP	DGM185AK DG185BK
DG186AA	DGM185BK DG186AA
DG186AL	DG186AL
DG186AP	DG186AK
DG186BA	DG186BA
DG186BP	DG186BK
DG187AA	DG187AA
DG187AL	DG187AL
DG187AP	DG187AK
DG187BA	DG187BA
DG187BP	DG187BK
DG188AA	DG188AA
DG188AL	DGM188AA DG188AL
DG188AP	DG188AK
DG188BA	DG188BA
DG188BP	DGM188BA DG188BK
DG189AL	DG189AL
DG189AP	DG189AK
DG189BP	DG189BK
DG190AL	DG190AL
DG190AP	DG190AK
DG190BP	DG190BK
DG191AL	DG191AL
DG191AP	DGM191AL DG191AK
DG191BP	DGM191AK DG191BK
DG200AA	DGM191BK DG200AA
DG200AL	DG200AL
DG200AP	DG200AK
DG200BA	DG200BA
DG200BP	DG200BK
DG200CJ	DG200CJ
DG201AP	DG201AK
DG201BP	DG201BK
DG201CJ	DG201CJ
DG381AA	DGM182AA
DG381AK	DGM182AK
DG381AP	DGM182AK
DG381BA	DGM181BA
DG381BK	DGM181BK
DG381BP	DGM181BK
DG381CJ	DGM181CJ
DG384AK	DGM185AK
DG384AP	DGM185AK
DG384BK	DGM184BK
DG384BP	DGM184BK
DG384CJ	DGM184CJ
DG387AA	DGM188AA
DG387AK	DGM188AK
DG387AP	DGM188AK
DG387BA	DGM187BA
DG387BK	DGM187BK
DG387BP	DGM187BK
DG390AK	DGM191AK
DG390AP	DGM191AK
DG390BK	DGM190BK
DG390BP	DGM190BK
DG390CJ	DGM190CJ
DG503	AD503
DG506AR	IH6116MJI
DG506BR	IH6116CJI
DG506CJ	IH6116CPI
DG507AR	IH6216MJI
DG507BR	IH6216CJI
DG507CJ	IH6216CPI
DG508AP	IH6108MJE
DG508BP	IH6108CJE
DG508CJ	IH6108CPE
DG509AP	IH6208MJE
DG509BP	IH6208CJE
DG509CJ	IH6208CPE
D123AL	D123AL
D123AP	D123AK
D123BP	D123BK
D125AL	D125BJ
D125AP	D125AL D125AK
D125BP	D125BK D125BJ
D129AL	D129AL
D129AP	D129AK
D129BP	D129BK

Sprague	Intersil
UCN-4112M	ICM7051A
UCN-4113M	ICM7038B
UHP-503	AD503

Synertek	Intersil
SY2332	IM7332
SY2364	IM7364

TI	Intersil
µA723	µA723
µA733	µA733
µA741	µA741
µA748	µA748
µA777	µA777
LM101	LM101
LM105	LM105
LM107	LM107
LM111	LM111
LM301	LM301
LM305	LM305
LM307	LM307
LM311	LM311
SN74S188	DGM182BA
TL182CL	DGM182BA
TL182CN	DGM182CJ
TL182IL	DGM182BA
TL182IN	DGM182CJ
TL182ML	DGM182AA
TL185CJ	IH5045CJE
TL185CN	IH5045CPE
TL185IJ	IH5045CJE
TL185IN	IH5045CPE
TL185MJ	IH5045MJE
TL188CL	IH5042CTW
TL188CN	IH5042CPE
TL188IL	IH5042CTW
TL188IN	IH5042CPE
TL188ML	IH5042MTW
TL191CJ	IH5043CJE
TL191CN	IH5043CPE
TL191IJ	IH5043CJE
TL191IN	IH5043CPE
TL191MJ	IH5043MJE
TL503	AD503

Toshiba	Intersil
TC8031P	ICM7038A
TC8051P	ICM7038B
TC8056PA	ICM1115B
TC8057P	ICM7038D
TMM2114	2114
TMM2332	IM7332
TMM2364	IM7364

DISCRETE CROSS REFERENCE

ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
100S	2N5458	2N2606	2N2607	2N3331	2N5270	2N3814	IT132
100U	2N3684	2N2607	2N2607	2N3332	2N5268	2N3815	IT132
102M	2N5686	2N2608	2N2608	2N3333	IT132	2N3816	IT130
102S	2N5457	2N2609	2N2609	2N3334	IT132	2N3816A	IT130A
103M	2N5457	2N2609JAN	2N2609JAN	2N3335	IT132	2N3817	IT130
103S	2N5459	2N2639	IT120	2N3336	IT132	2N3817A	IT130A
104M	2N5459	2N2640	IT122	2N3347	IT137	2N3819	2N5484
105M	2N5459	2N2641	IT122	2N3348	IT138	2N3820	2N2608
105U	2N4340	2N2642	IT120	2N3349	IT139	2N3821	2N3821
106M	2N5485	2N2643	IT122	2N3350	IT137	2N3822	2N3822
107M	2N5485	2N2644	IT122	2N3351	IT138	2N3823	2N3823
110U	2N3685	2N2652	IT120	2N3352	IT139	2N3824	2N3824
120U	2N3686	2N2652A	IT120	2N3365	2N4340	2N3907	IT120
125U	2N4339	2N2720	IT120	2N3366	2N4338	2N3908	IT120
1277A	2N3822	2N2721	IT122	2N3367	2N4338	2N3909	2N2609
1278A	2N3821	2N2722	IT120	2N3368	2N4341	2N3909A	2N2609
1279A	2N3821	2N2802	IT139	2N3369	2N4339	2N3921	2N3921
1280A	2N4224	2N2803	IT139	2N3370	2N4338	2N3922	2N3922
1281A	2N3822	2N2804	IT139	2N3376	2N2608	2N3949	IT132
1282A	2N4341	2N2805	IT139	2N3378	2N2608	2N3950	IT132
1283A	2N4340	2N2806	IT139	2N3380	2N2609	2N3954	2N3954
1284A	2N4222	2N2807	IT139	2N3382	2N3994	2N3954A	2N3954A
1285A	2N3821	2N2841	2N2607	2N3384	2N3993	2N3955	2N3955
1286A	2N4220	2N2842	2N2607	2N3386	2N5114	2N3955A	2N3955A
130U	2N3687	2N2843	2N2607	2N3409	IT122	2N3956	2N3956
1325A	2N4222	2N2844	2N2607	2N3410	IT122	2N3957	2N3957
135U	2N4339	2N2903	IT122	2N3411	IT122	2N3966	2N4416
14T	2N4224	2N2903A	IT120	2N3423	IT122	2N3967	2N4221
155U	2N4416	2N2910	IT122	2N3424	IT122	2N3967A	2N4221
1714A	2N4340	2N2913	IT122	2N3425	IT122	2N3968	2N3685
182S	2N4391	2N2914	IT120	2N3436	2N4341	2N3968A	2N3685
183S	2N3823	2N2915	IT120	2N3437	2N4340	2N3969	2N3685
197S	2N4338	2N2915A	IT120	2N3438	2N4338	2N3969A	2N3685
198S	2N4340	2N2916	IT120	2N3452	2N4220	2N3970	2N3970
199S	2N4341	2N2916A	IT120	2N3453	2N4338	2N3971	2N3971
2000M	2N3823	2N2917	IT122	2N3454	2N4338	2N3972	2N3972
2001M	2N3823	2N2918	IT122	2N3455	2N4340	2N3993	2N3993
200S	2N4392	2N2919	IT120	2N3456	2N4339	2N3993A	2N3993
200U	2N3824	2N2919A	IT120	2N3457	2N4338	2N3994	2N3994
201S	2N4391	2N2920	2N2920	2N3458	2N4341	2N3994A	2N3994
202S	2N4392	2N2920A	2N2920	2N3459	2N4339	2N4009	IT132
203S	2N3821	2N2936	IT120	2N3460	2N4338	2N4010	IT132
204S	2N3821	2N2937	IT120	2N3513	IT122	2N4011	IT132
2078A	2N3955	2N2972	IT122	2N3514	IT122	2N4015	IT139
2079A	2N3955	2N2973	IT122	2N3515	IT122	2N4016	IT137
2080A	2N3955A	2N2974	IT120	2N3516	IT122	2N4017	IT139
2081A	2N3955A	2N2975	IT120	2N3517	IT122	2N4018	IT139
2093M	2N3687	2N2976	IT120	2N3521	IT122	2N4019	IT139
2094M	2N3686	2N2977	IT120	2N3522	IT122	2N4020	IT139
2095M	2N3686	2N2978	IT120	2N3574	2N2607	2N4021	IT139
2098A	2N3954	2N2979	IT120	2N3575	2N2607	2N4022	IT139
2099A	2N3955A	2N2980	IT121	2N3578	2N2609	2N4023	IT137
210U	2N4416	2N2981	IT122	2N3587	IT122	2N4024	IT137
2130U	2N5452	2N2982	IT122	2N3608	3N172	2N4025	IT137
2132U	2N3955	2N3043	IT121	2N3660	IT120	2N4026	3N163
2134U	2N3956	2N3044	IT122	2N3684	2N3684	2N4038	2N4351
2136U	2N3957	2N3045	IT122	2N3684A	2N3684	2N4039	2N4351
2138U	2N3958	2N3046	IT121	2N3685	2N3685	2N4065	3N163
2139U	2N3958	2N3047	IT122	2N3685A	2N3685	2N4066	3N166
2147U	2N3958	2N3048	IT122	2N3686	2N3686	2N4067	3N166
2148U	2N3958	2N3049	IT139	2N3686A	2N3686	2N4082	2N3954
2149U	2N3958	2N3050	IT139	2N3687	2N3687	2N4083	2N3955
231S	2N3954	2N3051	IT139	2N3687A	2N3687	2N4084	2N3954
232S	2N3955	2N3052	IT129	2N3726	IT131	2N4085	2N3955
233S	2N3956	2N3059	IT139	2N3727	IT130	2N4091	2N4091
234S	2N3957	2N3066	2N4340	2N3728	IT122	2N4091A	2N4091
235S	2N3958	2N3067	2N4338	2N3729	IT121	2N4091JAN	2N4091JAN
241U	2N4869	2N3068	2N4338	2N3800	IT132	2N4091JANTX	2N4091JANTX
250U	2N4091	2N3069	2N4341	2N3801	IT132	2N4091JANTXV	2N4091JANTXV
251U	2N4392	2N3070	2N4339	2N3802	IT132	2N4092	2N4092
2N2060	IT120	2N3071	2N4338	2N3803	IT132	2N4092A	2N4092
2N2060A	IT121	2N3084	2N4339	2N3804	IT130	2N4092JAN	2N4092JAN
2N2060B	IT121	2N3085	2N4339	2N3804A	IT130A	2N4092JANTX	2N4092JANTX
2N2223	IT122	2N3086	2N4339	2N3805	IT130	2N4092JANTXV	2N4092JANTXV
2N2223A	IT121	2N3087	2N4339	2N3805A	IT130A	2N4093	2N4093
2N2386	2N2608	2N3088	2N4339	2N3806	IT122	2N4093A	2N4093
2N2386A	2N2608	2N3088A	2N4339	2N3807	IT122	2N4093JAN	2N4093JAN
2N2453	IT122	2N3089	2N4339	2N3808	IT122	2N4093JANTX	2N4093JANTX
2N2453A	IT121	2N3089A	2N4339	2N3809	IT122	2N4093JANTXV	2N4093JANTXV
2N2480	IT122	2N3113	2N2607	2N3810	2N3810	2N4100	2N4100
2N2480A	IT121	2N3277	2N2608	2N3810A	2N3810A	2N4117	2N4117
2N2497	2N2608	2N3278	2N2607	2N3811	2N3811	2N4117A	2N4117A
2N2498	2N2608	2N3328	2N5265	2N3811A	2N3811A	2N4118	2N4118
2N2499	2N2608	2N3329	2N5267	2N3812	IT132	2N4118A	2N4118A
2N2500	2N2608	2N3330	2N5266	2N3813	IT132	2N4119	2N4119

**CONSULT FACTORY

DISCRETE CROSS REFERENCE (cont.)

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ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
2N4119A	2N4119A	2N5045	2N5453	2N5484	2N5484	2N6484	2N6484
2N4120	3N163	2N5046	2N5454	2N5485	2N5485	2N6485	2N6485
2N4139	2N3822	2N5047	2N5454	2N5486	2N5486	2N6502	IT122
2N4220	2N4220	2N5078	2N5397	2N5515	2N5515	2N6503	IT123
2N4220A	2N4220	2N5090	IT122	2N5516	2N5516	2N6550	2N4868A
2N4221	2N4221	2N5103	2N4416	2N5517	2N5517	2N6568	2N5432
2N4221A	2N4221	2N5104	2N4416	2N5518	2N5518	2SC294	IT122
2N4222	2N4222	2N5105	2N4416	2N5519	2N5519	2SJ11	2N2607
2N4222A	2N4222	2N5114	2N5114	2N5520	2N5520	2SJ12	2N2607
2N4223	2N4223	2N5114JAN	2N5114JAN	2N5521	2N5521	2SJ13	2N5270
2N4224	2N4224	2N5114JANTX	2N5114JANTX	2N5522	2N5522	2SJ15	2N2607
2N4267	3N163	2N5114JANTXV	2N5114JANTXV	2N5523	2N5523	2SJ16	2N2607
2N4268	3N161	2N5115	2N5115	2N5524	2N5524	2SJ47	**
2N4302	2N4302	2N5115JAN	2N5115JAN	2N5545	2N3954	2SJ48	**
2N4303	2N5459	2N5115JANTX	2N5115JANTX	2N5546	2N3955A	2SJ49	**
2N4304	2N5458	2N5115JANTXV	2N5115JANTXV	2N5547	2N3955	2SJ50	**
2N4338	2N4338	2N5116	2N5116	2N5548	2N4093	2SJ76	**
2N4339	2N4339	2N5116JAN	2N5116JAN	2N5555	J310	2SJ78	**
2N4340	2N4340	2N5116JANTX	2N5116JANTX	2N5556	2N3685	2SJ80	**
2N4341	2N4341	2N5116JANTXV	2N5116JANTXV	2N5557	2N3684	2SK11	2N5457
2N4342	2N5461	2N5117	2N5117	2N5558	2N3684	2SK12	2N5457
2N4343	2N5462	2N5118	2N5118	2N5561	U401	2SK13	2N5457
2N4351	2N4351	2N5119	2N5119	2N5562	U402	2SK132	**
2N4352	3N163	2N5120	IT131	2N5563	U404	2SK133	**
2N4353	3N172	2N5121	IT132	2N5564	IT550	2SK134	**
2N4360	2N5460	2N5122	IT132	2N5565	IT550	2SK135	**
2N4361	2N2609	2N5123	IT131	2N5566	IT550	2SK15	2N4868
2N4382	2N5115	2N5124	IT132	2N5592	2N3822	2SK17	2N5484
2N4391	2N4391	2N5125	IT132	2N5593	2N3822	2SK178	**
2N4392	2N4392	2N5158	2N5434	2N5594	2N3822	2SK179	**
2N4393	2N4393	2N5159	2N5433	2N5638	2N5638	2SK18	2N3821
2N4416	2N4416	2N5163	2N3822	2N5639	2N5639	2SK180	**
2N4416A	2N4416A	2N5196	2N5196	2N5640	2N5640	2SK19	ITE4416
2N4417	2N4416	2N5197	2N5197	2N5647	2N4117A	2SK23	2N5459
2N4445	2N5432	2N5198	2N5198	2N5648	2N4117A	2SK30	2N5458
2N4446	2N5434	2N5199	2N5199	2N5649	2N4117A	2SK32	2N3822
2N4447	2N5432	2N5245	ITE4416	2N5653	2N5638	2SK33	2N5397
2N4448	2N5434	2N5246	2N5484	2N5654	2N5639	2SK34	2N3822
2N4856	2N4856	2N5247	2N5486	2N5668	2N5484	2SK37	2N5484
2N4856A	2N4856	2N5248	2N5486	2N5669	2N5485	2SK41	2N5459
2N4856JAN	2N4856JAN	2N5254	IT132	2N5670	2N5486	2SK42	2N3822
2N4856JANTX	2N4856JANTX	2N5255	IT132	2N5793	IT129	2SK43	ITE4092
2N4856JANTXV	2N4856JANTXV	2N5256	IT130	2N5794	IT128	2SK44	ITE4416
2N4857	2N4857	2N5257	2N5457	2N5795	IT139	2SK46	2N5459
2N4857A	2N4857	2N5258	2N5458	2N5796	IT139	2SK48	2N3821
2N4857JAN	2N4857JAN	2N5259	2N5459	2N5797	2N2608	2SK49	2N5484
2N4857JANTX	2N4857JANTX	2N5265	2N2607	2N5798	2N2608	2SK50	ITE4416
2N4857JANTXV	2N4857JANTXV	2N5266	2N2607	2N5799	2N2608	2SK54	2N3822
2N4858	2N4858	2N5267	2N2608	2N5800	2N2608	2SK55	2N3822
2N4858A	2N4858	2N5268	2N2608	2N5801	2N4393	2SK56	2N5459
2N4858JAN	2N4858JAN	2N5269	2N2609	2N5802	2N4393	2SK61	2N5397
2N4858JANTX	2N4858JANTX	2N5270	2N2609	2N5803	2N4392	2SK65	J201
2N4858JANTXV	2N4858JANTXV	2N5277	2N4341	2N5843	IT130	2SK66	2N3821
2N4859	2N4859	2N5278	2N4341	2N5844	IT130	2SK68	2N3822
2N4859A	2N4859	2N5358	2N4220	2N5902	2N5902	2SK72	2N5196
2N4859JAN	2N4856JAN	2N5359	2N4220	2N5903	2N5903	3G6	2N3821
2N4859JANTX	2N4856JANTX	2N5360	2N4221	2N5904	2N5904	3N145	3N163
2N4860	2N4860	2N5361	2N4221	2N5905	2N5905	3N146	3N163
2N4860A	2N4860	2N5362	2N4222	2N5906	2N5906	3N147	3N189
2N4860JAN	2N4857JAN	2N5363	2N4222	2N5907	2N5907	3N148	3N188
2N4860JANTX	2N4857JANTX	2N5364	2N4222	2N5908	2N5908	3N149	3N161
2N4861	2N4861	2N5391	2N4867A	2N5909	2N5909	3N150	3N163
2N4861A	2N4861	2N5392	2N4868A	2N5911	2N5911	3N151	3N190
2N4861JAN	2N4858JAN	2N5393	2N4869A	2N5912	2N5912	3N155	3N163
2N4861JANTX	2N4858JANTX	2N5394	2N4869A	2N5948	2N5486	3N155A	3N163
2N4867	2N4867	2N5395	2N4869A	2N5950	2N5486	3N156	3N163
2N4867A	2N4867A	2N5396	2N4869A	2N5951	2N5486	3N156A	3N163
2N4868	2N4868	2N5397	2N5397	2N5952	2N5484	3N157	3N163
2N4868A	2N4868A	2N5398	2N5398	2N5953	2N5484	3N157A	3N163
2N4869	2N4869	2N5432	2N5432	2N6085	IT122	3N158	3N163
2N4869A	2N4869A	2N5433	2N5433	2N6086	IT122	3N158A	3N163
2N4879	2N4879	2N5434	2N5434	2N6087	IT121	3N160	3N161
2N4879	2N4879	2N5452	2N5452	2N6088	IT121	3N161	3N161
2N4880	2N4880	2N5453	2N5453	2N6089	IT122	3N163	3N163
2N4937	IT131	2N5454	2N5454	2N6090	IT121	3N164	3N164
2N4938	IT132	2N5457	2N5457	2N6091	IT121	3N165	3N165
2N4939	IT132	2N5458	2N5458	2N6092	IT121	3N166	3N166
2N4940	IT132	2N5459	2N5459	2N6441	IT122	3N167	3N161
2N4941	IT131	2N5460	2N5460	2N6442	IT122	3N168	3N161
2N4942	IT132	2N5461	2N5461	2N6443	IT122	3N169	3N170
2N4955	IT122	2N5462	2N5462	2N6444	IT122	3N170	3N170
2N4956	IT122	2N5463	2N5463	2N6445	IT121	3N171	3N171
2N4977	2N5433	2N5464	2N5464	2N6446	IT121	3N172	3N172
2N4978	2N5433	2N5465	2N5465	2N6447	IT121	3N173	3N173
2N4979	2N4859	2N5471	2N5265	2N6448	IT121	3N174	3N163
2N5018	2N5018	2N5472	2N5265	2N6451	U310	3N175	3N170
2N5019	2N5018	2N5473	2N5265	2N6452	U310	3N176	3N170
2N5020	2N2643	2N5474	2N5265	2N6453	U310	3N177	3N171
2N5021	2N2607	2N5475	2N5265	2N6454	U310	3N178	3N172
2N5033	2N5460	2N5476	2N5266	2N6483	2N6483	3N179	3N172

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ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
3N190	3N172	8CY89	IT122	BFX78	2N5397	CM552	2N5432
3N191	3N161	BF244	2N5486	BFX82	2N5019	CM553	2N5433
3N192	3N161	BF244A	2N5484	BFX83	2N5019	CM697	2N5433
3N193	3N161	BF244B	2N5485	BFX89	IT120A	CM800	2N5439
3N198	3N188	BF244C	2N5486	BFY20	IT122	CM856	2N5433
3N189	3N189	BF245	2N5486	BFY81	IT122	CM860	2N4868A
3N190	3N190	BF245A	2N4416	BFY82	IT122	CMX740	2N5432
3N191	3N191	BF245B	2N4416	BFY83	IT122	CP640	2N4091
3N207	3N190	BF245C	2N4416	BFY84	IT122	CP643	2N5434
3N208	3N188	BF246	2N5485	BFY85	IT122	CP650	2N5432
3SK22	2N5485	BF246A	2N5638	BFY86	IT122	CP651	2N5433
3SK23	2N5397	BF246B	2N5638	BFY91	IT122	CP652	2N5433
3SK28	2N5397	BF246C	2N5638	BFY92	IT122	CP653	2N5493
4ST	2N4392	BF247	2N4091	BN208	IT122	D1101	2N3821
4360TP	2N5462	BF247A	2N4091	BSV22	2N4416	D1102	2N3821
5032TP	2N5460	BF247B	2N4091	BSV78	2N4856A	D1103	2N4338
588U	2N4416	BF247C	2N4091	BSV79	2N4857A	D1177	2N3821
59T	2N5457	BF255	2N5484	BSV80	2N4858A	D1178	2N3821
59T	2N4416	BF255A	2N5484	BSX82	2N3822	D1179	2N4338
703U	2N4220	BF256B	2N4416	C21	2N3821	D1180	2N3822
704U	2N4220	BF256C	2N4416	C230B	2N5196	D1181	2N4338
705U	2N4224	BF320	2N5461	C36	2N4338	D1182	2N4338
707U	2N4860	BF320A	2N5460	C413N	2N5434	D1183	2N4341
714U	2N3822	BF320B	2N5461	C610	2N4392	D1184	2N4340
734EU	2N4416	BF320C	2N5462	C611	2N4221	D1185	2N4339
734U	2N5516	BF345	IT54392	C612	2N4221	D1201	2N4224
751U	2N4340	BF347	J201	C613	2N4221	D1202	2N3821
752U	2N4340	BF348	J310	C614	2N4220	D1203	2N4220
753U	2N4341	BF800	2N4867	C615	2N4221	D1301	2N4222
754U	2N4340	BF801	2N4867	C620	2N4220	D1302	2N4220
755U	2N4341	BFB02	2N4338	C621	2N4220	D1303	2N4220
756U	2N4340	BFB04	2N4338	C622	2N4220	D1420	2N4868
A190	ITE4416	BFB05	2N4859	C623	2N4220	D1421	2N3822
A191	ITE4416	BFB06	2N4859	C624	2N4220	D1422	2N4869
A192	2N4416	BFB08	2N4858	C625	2N4220	D2T2218	IT129
A193	2N5484	BFB10	2N4858	C650	2N4220	D2T2218A	IT129
A194	2N5484	BFB11	2N4858	C651	2N4220	D2T2219	IT129
A195	2N5484	BFB15	2N4859	C652	2N4220	D2T2219A	IT129
A196	ITE4416	BFB16	2N4858	C653	2N4220	D2T2904	IT139
A197	ITE4391	BFB17	2N4858	C6690	2N4341	D2T2904A	IT139
A198	ITE4392	BFB18	2N4858	C6691	2N4341	D2T2905	IT139
A199	ITE4393	BFQ10	U401	C6692	2N4339	D2T2905A	IT139
A5T3821	2N5484	BFQ11	U401	C673	2N4341	D2T918	IT129
A5T3822	2N5484	BFQ12	U402	C674	2N4341	DA102	2N5196
A5T3823	2N4416	BFQ13	U403	C680	2N4338	DA402	2N5196
A5T3824	2N4341	BFQ14	U404	C680A	2N4338	DN3066A	2N3821
A5T5460	2N5460	BFQ15	U405	C681	2N4338	DN3067A	2N4338
A5T5461	2N5461	BFQ16	U406	C681A	2N4338	DN3068A	2N4338
A5T5462	2N5462	BFQ23	IT5912	C682	2N4339	DN3069A	2N3822
AD3954	2N3954	BFQ26	U403	C682A	2N4339	DN3070A	2N3821
AD3954A	2N3954A	BFQ44	IT5912	C683	2N4339	DN3071A	2N4338
AD3955	2N3955	BFQ45	IT5912	C683A	2N4339	DN3365A	2N4220
AD3956	2N3956	BFQ49A	2N3055	C684	2N4220	DN3365B	2N4091
AD3958	2N3958	BFQ49B	2N3958	C684A	2N4220	DN3366A	2N3586
AD5905	2N5905	BFQ49C	2N3958	C685	2N4220	DN3366B	2N4091
AD5906	2N5906	BFS21	2N5199	C685A	2N4220	DN3367A	2N3687
AD5907	2N5907	BFS21A	2N5199	C80	2N4338	DN3367B	2N4051
AD5908	2N5908	BFS67	2N3821	C81	2N4338	DN3368A	2N4341
AD5909	2N5909	BFS67P	2N5459	C84	2N4338	DN3368B	2N4221
AD810	2N4878	BFS68	2N3823	C85	2N4339	DN3369A	2N4339
AD811	2N4878	BFS68P	2N4416	C91	2N4858	DN3369B	2N4220
AD812	2N4878	BFS70	2N3821	C92	2N4091	DN3370A	2N4338
AD813	2N4878	BFS71	2N3822	C93	2N4393	DN3370B	2N4338
AD814	IT124	BFS72	2N3823	C94	2N5457	DN3436A	2N4341
AD815	IT124	BFS73	2N3821	C94E	2N5457	DN3436B	2N4222
AD816	IT120A	BFS74	2N4858	C95	2N5457	DN3437A	2N4340
AD818	IT140	BFS75	2N4857	C95E	2N5459	DN3437B	2N4220
AD820	IT132	BFS76	2N4858	C96E	2N5484	DN3438A	2N4338
AD821	IT130A	BFS77	2N4859	C97E	2N3822	DN3438B	2N4339
AD822	IT130A	BFS78	2N4860	C98E	2N3822	DN3458A	2N4341
AD830	2N5520	BFS79	2N4861	CC4445	2N5432	DN3458B	2N4222
AD831	2N5521	BFS80	2N4416A	CC4446	2N5434	DN3459A	2N4336
AD832	2N5522	BFT10	2N5397	CC897	2N4856	DN3459B	2N4220
AD833	2N5523	BFT11	2N5019	CF2386	2N5458	DN3460A	2N4338
AD835A	2N5524	BFW10	2N3823	CF24	2N3824	DN3460B	2N4220
AD835	2N3954	BFW11	2N3822	CFM13026	2N4858	DNX1	2N4338
AD836	2N3955	BFW12	2N4416	CM600	2N4092	DNX2	2N4338
AD837	2N3955	BFW13	2N4867	CM601	2N4091	DNX3	2N4338
AD838	2N3956	BFW39	IT129	CM602	2N4091	DNX4	2N4869
AD839	2N3957	BFW39A	IT120	CM603	2N4091	DNX5	2N4868
AD840	2N5520	BFW54	2N3822	CM640	2N4093	DNX6	2N4338
AD841	2N5521	BFW55	2N3822	CM641	2N4093	DNX7	2N4416
AD842	2N5523	BFW56	2N4860	CM642	2N4093	DNX8	2N4416
BC264	2N5458	BFW61	2N4224	CM643	2N4092	DNX9	2N4339
BC264A	2N5457	BFX11	IT132	CM644	2N4092	DU4339	2N5397
BC264B	2N5458	BFX15	IT122	CM645	2N4092	DU4340	2N5398
BC264C	2N5458	BFX36	IT131	CM646	2N4092	E100	2N5458
BC264D	2N4416	BFX70	IT122	CM647	2N4091	E101	J204
BCY87	IT121	BFX71	IT122	CM650	2N5432	E102	2N5457
BCY88	IT122	BFX72	IT122	CM651	2N5433	E103	2N5459

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ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
E105	J105	FF400	2N5457	IT127	IT127	ITE2977	IT120
E106	J106	FM1100	2N3954A	IT128	IT128	ITE2978	IT120
E107	J107	FM1100A	2N5906	IT129	IT129	ITE2979	IT120
E108	J105	FM1101A	2N5906	IT130	IT130	ITE3066	2N3685
E109	J106	FM1102	2N3954	IT130A	IT130A	ITE3067	2N3686
E110	J107	FM1102A	2N5906	IT131	IT131	ITE3068	2N3687
E111	J111	FM1103	2N3955	IT132	IT132	ITE3347	IT137
E111A	J111	FM1103A	2N5909	IT136	IT136	ITE3348	IT138
E112	J112	FM1104	2N3957	IT137	IT137	ITE3349	IT139
E112A	J112	FM1104A	2N5909	IT138	IT138	ITE3350	IT137
E113	J113	FM1105	2N3954A	IT139	IT139	ITE3351	IT138
E113A	J113	FM1105A	IT500	IT140	IT140	ITE3680	IT120
E114	J204	FM1106	2N3954A	IT1700	IT1700	ITE3800	IT132
E174	J174	FM1106A	IT500	IT1701	3N172	ITE3802	IT132
E175	J175	FM1107	2N3954	IT1702	3N163	ITE3804	IT130
E176	J176	FM1107A	IT500	IT1750	IT1750	ITE3806	IT132
E177	J177	FM1108	2N3955	IT2700	3N165	ITE3807	IT132
E201	J201	FM1108A	IT502	IT2701	3N166	ITE3808	IT132
E202	J202	FM1109	2N3957	IT400	2N4392	ITE3809	IT132
E203	J203	FM1109A	IT503	IT500	IT500	ITE3810	IT130
E204	J204	FM1110	2N3955	IT500P	IT500	ITE3811	IT130
E210	2N5397	FM1110A	2N5908	IT501	IT501	ITE3907	IT120
E211	2N5397	FM1111	2N3957	IT501P	IT501	ITE3908	IT120
E212	2N5397	FM1111A	2N5909	IT502	IT502	ITE4017	IT139
E230	2N4867	FM1112	2N5196	IT502P	IT502	ITE4018	IT139
E231	2N4868	FM1200	2N3954	IT503	IT503	ITE4019	IT139
E232	2N4869	FM1201	2N3954	IT503P	IT503	ITE4020	IT139
E270	J270	FM1202	2N3954	IT504	IT504	ITE4021	IT139
E271	J271	FM1203	2N3955A	IT505	IT505	ITE4022	IT139
E300	2N5397	FM1204	2N3955	IT550	IT550	ITE4023	IT137
E304	2N5486	FM1205	2N3954	IT5911	IT5911	ITE4024	IT137
E305	2N5484	FM1206	2N3954	IT5912	IT5912	ITE4025	IT137
E308	J308	FM1207	2N3954	ITC2972	IT122	ITE4091	ITE4091
E309	J309	FM1208	2N3955A	ITC2973	IT122	ITE4092	ITE4092
E310	J310	FM1209	2N3955	ITC2974	IT120	ITE4093	ITE4093
E311	J310	FM1210	2N3955A	ITC2975	IT120	ITE4117	2N4117
E312	2N5397	FM1211	IT5911	ITC2976	IT120	ITE4118	2N4118
E400	2N3955	FM3954	2N3954	ITC2977	IT120	ITE4119	2N4119
E401	2N3955	FM3954A	2N3954A	ITC2978	IT120	ITE4338	2N4338
E402	2N3957	FM3955	2N3955	ITC2979	IT120	ITE4339	2N4339
E410	2N3955	FM3955A	2N3955A	ITC3347	IT137	ITE4340	2N4340
E411	IT5911	FM3956	2N3956	ITC3348	IT138	ITE4341	2N4341
E412	IT5911	FM3957	2N3957	ITC3349	IT139	ITE4391	ITE4391
E413	2N5454	FM3958	IT5911	ITC3350	IT137	ITE4392	ITE4392
E414	2N3956	FP4339	2N4339	ITC3351	IT138	ITE4393	ITE4393
E415	2N3957	FP4340	2N4340	ITC3352	IT139	ITE4416	ITE4416
E420	IT5911	FT0654A	2N5486	ITC3900	IT132	ITE4857	2N4857
E421	IT5912	FT0654B	2N5486	ITC3902	IT132	ITE4858	2N4858
E430	J309(X2)	FT0654C	2N4221	ITC3904	IT130	ITE4859	2N4859
E431	J310(X2)	FT0654D	2N4221	ITC3906	IT132	J100	2N5458
ESM25	U401	FT3820	2N5019	ITC3907	IT132	J101	2N4338
ESM25A	U401	FT3820	2N5460	ITC3908	IT132	J102	2N5457
ESM4091	2N4091	FT3909	2N5018	ITC3909	IT132	J103	2N5459
ESM4092	2N4092	FT703	3N161	ITC3910	IT130	J105	J105
ESM4093	2N4093	FT704	3N163	ITC3911	IT130	J105-18	J105
ESM4302	2N5457	GET5457	2N5457	ITC4017	IT139	J106	J106
ESM4303	2N5459	GET5458	2N5458	ITC4018	IT139	J106-18	J106
ESM4304	2N5458	GET5459	2N5459	ITC4019	IT139	J107	J107
ESM4445	2N5432	HA7807	IT132	ITC4020	IT139	J107-18	J107
ESM4446	2N5434	HA7809	IT132	ITC4021	IT139	J108	J105
ESM4447	2N5432	HDIG1030	3N163	ITC4022	IT139	J108-18	J105
ESM4448	2N5434	HEP801	2N3822	ITC4023	IT137	J109	J106
FE0554A	2N4386	HEP802	2N5484	ITC4024	IT137	J109-18	J106
FE0554B	2N5485	HEP803	2N5019	ITC4025	IT137	J110	J107
FE100	2N3821	HEPF0021	2N5484	ITE2453	IT120	J110-18	J107
FE100A	2N3821	HEPF1035	J175	ITE2639	IT120	J111	J111
FE102	2N4119	HEPF2004	2N5484	ITE2640	IT122	J111-18	J111
FE102A	2N4119	HEPF2005	2N5459	ITE2641	IT122	J111A	J111
FE104	2N4118	ID100	ID100	ITE2642	IT120	J111A-18	J111
FE104A	2N4118	ID101	ID101	ITE2643	IT122	J112	J112
FE1600	2N4092	IMF3954	2N3954	ITE2644	IT122	J112-18	J112
FE200	2N3821	IMF3954A	2N3954A	ITE2720	IT120	J112A	J112
FE202	2N3821	IMF3955	2N3955	ITE2721	IT122	J112A-18	J112
FE204	2N3821	IMF3955A	2N3955A	ITE2722	IT120	J113	J113
FE300	2N3822	IMF3956	2N3956	ITE2903	IT122	J113-18	J113
FE302	2N3821	IMF3957	2N3957	ITE2913	IT122	J113A	J113
FE304	2N3821	IMF3958	2N3958	ITE2914	IT122	J113A-18	J113
FE3819	2N5484	IMF5911	IMF5911	ITE2915	IT120	J114	2N5555
FE4302	2N5457	IMF5912	IMF5912	ITE2916	IT120	J1401	IT501
FE4303	2N5458	IMF6485	IMF6485	ITE2917	IT122	J1402	IT502
FE4304	2N5459	IT100	IT100	ITE2918	IT122	J1403	IT503
FE5245	2N4416	IT101	IT101	ITE2919	IT120	J1404	IT503
FE5246	2N5484	IT108	ITE4416	ITE2920	IT120	J1405	IT504
FE5247	2N5486	IT109	ITE4416	ITE2936	IT120	J1406	IT505
FE5457	2N5457	IT120	IT120	ITE2937	IT120	J174	J174
FE5458	2N5458	IT120A	IT120A	ITE2972	IT122	J174-18	J174
FE5459	2N5459	IT121	IT121	ITE2973	IT122	J175	J175
FE5484	2N5484	IT122	IT122	ITE2974	IT120	J175-18	J175
FE5485	2N5485	IT124	IT124	ITE2975	IT120	J176	J176
FE5486	2N5486	IT126	IT126	ITE2976	IT120	J176-18	J176

**CONSULT FACTORY

DISCRETE CROSS REFERENCE (cont.)

ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
J177	J177	K309-18	J309	LS5105	2N5486	MD7002B	IT122
J177-18	J177	K310-18	J310	LS5245	ITE4416	MD7003	IT132
J201	J201	KE3684	2N3684	LS5246	2N5484	MD7003A	IT132
J201-18	J201	KE3685	2N3685	LS5247	2N5486	MD7003B	IT132
J202	J202	KE3686	2N3686	LS5248	2N5486	MD7004	IT129
J202-18	J202	KE3687	2N3687	LS5358	J204	MD7007	IT129
J203	J203	KE3823	2N3823	LS5359	J204	MD7007A	IT129
J203-18	J203	KE3970	ITE4391	LS5360	J202	MD7007B	IT128
J204	J204	KE3971	ITE4392	LS5361	J202	MD708	IT129
J204-18	J204	KE3972	ITE4393	LS5362	J203	MD708A	IT129
J210	2N5397	KE4091	ITE4091	LS5363	J203	MD708B	IT129
J211	2N5397	KE4092	ITE4092	LS5364	J203	MD8001	IT120
J212	2N5397	KE4093	ITE4093	LS5391	2N4867A	MD8002	IT120
J230	2N4867	KE4220	2N5457	LS5392	2N4868A	MD8003	IT122
J231	2N4868	KE4221	2N5458	LS5393	2N4868A	MD918	IT122
J232	2N4868	KE4222	2N5459	LS5394	2N4868A	MD918A	IT122
J270	J270	KE4223	J204	LS5395	2N4868A	MD918B	IT122
J270-18	J270	KE4391	ITE4391	LS5396	2N4868A	MD982	IT139
J271	J271	KE4392	ITE4392	LS5457	2N5457	MD984	IT139
J271-18	J271	KE4393	ITE4393	LS5458	2N5458	MEF103	2N5457
J300	2N5397	KE4416	ITE4416	LS5459	2N5459	MEF104	2N5459
J304	2N5486	KE4856	ITE4391	LS5484	2N5484	MEF3069	2N4341
J305	2N5484	KE4857	ITE4392	LS5485	2N5485	MEF3070	2N4339
J308	J308	KE4858	ITE4393	LS5486	2N5486	MEF3458	2N4341
J309	J309	KE4859	ITE4391	LS5556	2N3685	MEF3459	2N4339
J310	J310	KE4860	ITE4392	LS5557	2N3684	MEF3460	2N4338
J315	2N5397	KE4861	ITE4393	LS5558	2N3684	MEF3684	2N3684
J316	U309	KE510	ITE4393	LS5638	2N5638	MEF3685	2N3685
J317	U310	KE5103	J204	LS5639	2N5639	MEF3686	2N3686
J3970	ITE4391	KE5104	ITE4416	LS5640	2N5640	MEF3687	2N3687
J3971	ITE4392	KE5105	ITE4416	M103	3N161	MEF3821	2N3821
J3972	ITE4393	KE511	ITE4392	M104	3N161	MEF3822	2N3822
J401	IT501	KH5196	2N5196	M106	3N166	MEF3823	2N3823
J402	IT502	KH5197	2N5197	M107	3N165	MEF3954	2N3954
J403	IT503	KH5198	2N5198	M108	3N191	MEF3955	2N3955
J404	IT503	KH5199	2N5199	M113	3N161	MEF3956	2N3956
J405	IT504	LDF603	2N4221	M114	3N161	MEF3957	2N3957
J406	IT505	LDF604	2N4221	M116	M116	MEF3958	2N3958
J4091	ITE4091	LDF605	2N4221	M117	2N4351	MEF4223	2N4223
J4092	ITE4092	LM114	IT120	M119	3N161	MEF4224	2N4224
J4093	ITE4093	LM114A	IT120A	M163	3N163	MEF4391	ITE4391
J410	IT502	LM114AH	IT120A	M164	3N164	MEF4392	ITE4392
J411	IT503	LM114H	IT120	M511	3N172	MEF4393	ITE4393
J412	IT503	LM115	IT120	M511A	3N172	MEF4416	ITE4416
J420	IT5911	LM115A	IT120A	M517	3N163	MEF4856	2N4856
J421	IT5912	LM115AH	IT120A	MA7807	IT132	MEF4857	2N4857
J4220	J204	LM115H	IT120	MA7809	IT132	MEF4858	2N4858
J4221	J202	LM194	IT120A	MAT-01AH	IT140	MEF4859	2N4859
J4222	J203	LM394	IT120A	MAT-01FH	IT140	MEF4860	2N4860
J4223	J202	LS3069	2N5458	MAT-01GH	IT140	MEF4861	2N4861
J4224	J202	LS3070	2N5458	MAT-01H	IT140	MEF5103	ITE4416
J430	J308(X2)	LS3071	2N5458	MD1120	IT122	MEF5104	ITE4416
J4302	2N4302	LS3458	J204	MD1121	IT122	MEF5105	ITE4416
J4303	2N5459	LS3459	J204	MD1122	IT122	MEF5245	ITE4416
J4304	2N5458	LS3460	J204	MD1123	IT139	MEF5246	2N5484
J431	J310(X2)	LS3684	2N3684	MD1129	IT129	MEF5247	2N5486
J433	2N5457	LS3685	2N3685	MD1130	IT139	MEF5248	2N5486
J4338	2N5457	LS3686	2N3686	MD2218	IT129	MEF5284	2N5484
J4339	2N5457	LS3687	2N3687	MD2218A	IT129	MEF5285	2N5485
J4391	ITE4391	LS3819	2N5484	MD2219	IT129	MEF5286	2N5486
J4392	ITE4392	LS3821	2N5457	MD2219A	IT129	MEF5561	U401
J4393	ITE4393	LS3822	2N5458	MD2369	IT129	MEF5562	U402
J4416	ITE4416	LS3823	2N5459	MD2369A	IT129	MEF5563	U403
J4856	ITE4856	LS3921	2N5921	MD2369B	IT122	MEM511	3N172
J4857	ITE4857	LS3922	2N3922	MD2904	IT139	MEM511A	3N172
J4858	ITE4858	LS3966	ITE4416	MD2904A	IT139	MEM511C	3N172
J4859	ITE4859	LS3967	ITE4416	MD2905	IT139	MEM517	3N172
J4860	ITE4860	LS3968	ITE4416	MD2905A	IT139	MEM517A	3N172
J4861	ITE4861	LS3969	ITE4416	MD2974	IT120	MEM517B	3N172
J4867	2N4867	LS4220	J204	MD2975	IT120	MEM517C	3N172
J4867A	2N4867A	LS4221	J202	MD2978	IT120	MEM550	3N189
J4867RR	2N4867	LS4222	J203	MD2979	IT120	MEM550C	3N189
J4868	2N4868	LS4223	J202	MD3008	IT120	MEM550F	3N189
J4868A	2N4868A	LS4224	J202	MD3250	IT132	MEM551	3N190
J4868RR	2N4868	LS4338	2N5457	MD3250A	IT131	MEM551C	3N189
J4869	2N4869	LS4339	2N5457	MD3251	IT132	MEM555	3N172
J4869A	2N4869A	LS4340	2N5457	MD3251A	IT131	MEM556C	3N172
J4869RR	2N4869	LS4341	2N5458	MD3409	IT129	MEM560	3N161
J5103	2N5484	LS4391	ITE4391	MD3410	IT129	MEM560C	3N161
J5104	2N5485	LS4392	ITE4392	MD3467	IT139	MEM561	3N163
J5105	2N5486	LS4393	ITE4393	MD3725	IT129	MEM561C	3N163
J5163	2N5486	LS4416	ITE4416	MD3762	IT139	MEM562	2N4351
K114-18	2N5555	LS4856	ITE4091	MD4957	IT132	MEM562C	2N4351
K210-18	2N5397	LS4857	ITE4092	MD5000	IT132	MEM563	2N4351
K211-18	2N5397	LS4858	ITE4093	MD5000A	IT132	MEM563C	2N4351
K212-18	2N5397	LS4859	ITE4091	MD5000B	IT132	MEM711	M116
K300-18	2N5397	LS4860	ITE4092	MD7000	IT129	MEM712	M116
K304-18	2N5486	LS4861	ITE4093	MD7001	IT139	MEM712A	M116
K305-18	2N5484	LS5103	2N5484	MD7002	IT122	MEM713	3N170
K308-18	J308	LS5104	2N5485	MD7002A	IT122	MEM806	3N163

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DISCRETE CROSS REFERENCE (cont.)

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ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
MEM806A	3N163	MPB40	2N5520	NKT80111	2N4220	SA2718	IT122
MEM807	3N172	MPB41	2N5521	NKT80112	2N4220	SA2719	IT120
MEM807A	3N172	MPB42	2N5523	NKT80113	2N3821	SA2720	IT121
MEM814	3N161	MPF102	2N5486	NKT80211	2N4339	SA2721	IT122
MEM816	3N172	MPF103	2N5457	NKT80212	2N4339	SA2722	IT120
MEM817	3N172	MPF104	2N5458	NKT80213	2N4339	SA2723	IT121
MEM823	MFE823	MPF105	2N5459	NKT80214	2N4339	SA2724	IT122
MEM954	3N188	MPF106	2N5485	NKT80215	2N4339	SA2726	IT122
MEM954A	3N188	MPF107	2N5486	NKT80216	2N4339	SA2727	IT122
MEM954B	3N188	MPF108	2N5486	NKT80421	2N4220	SA2738	IT120A
MEM955	3N190	MPF109	2N5484	NKT80422	2N4220	SA2739	IT120
MEM955A	3N190	MPF111	2N5458	NKT80423	2N4220	SDF1001	2N5432
MEM955B	3N190	MPF112	2N5458	NKT80424	2N4220	SDF1002	2N5433
MF510	2N4082	MPF161	2N5398	NPC108	2N5484	SDF1003	2N5434
MF903	2N4338	MPF208	2N3821	NPC211N	2N4338	SDF500	2N5520
MF818	2N485B	MPF209	2N3821	NPC212N	2N4338	SDF501	2N5520
MFE2000	2N4416	MPF255	ITE4416	NPC213N	2N4338	SDF502	2N5520
MFE2001	2N4416	MPF4391	ITE4391	NPC214N	2N4339	SDF503	2N5520
MFE2004	2N4093	MPF4392	ITE4392	NPC215N	2N4339	SDF504	2N5520
MFE2005	2N4092	MPF4393	ITE4393	NPC216N	2N4339	SDF505	2N5520
MFE2006	2N4091	MPF820	J310	NPD5564	IT550	SDF506	2N5520
MFE2007	2N4860	MPF970	J175	NPD5565	IT550	SDF507	2N5520
MFE2008	2N4859	MPF971	J175	NPD5566	IT550	SDF508	2N5520
MFE2009	2N4859	MTF101	2N5484	NPD8301	2N3954	SDF509	2N5520
MFE2010	2N4859	MTF102	2N5484	NPD8302	2N3955	SDF510	2N3954
MFE2011	2N5433	MTF103	2N5457	NPD8303	2N3956	SDF512	2N3954
MFE2012	2N5433	MTF104	2N5459	OT3	2N4338	SDF513	2N3954
MFE2012	2N5434	ND5700	IT120A	P1004	2N5116	SDF514	2N3954
MFE2093	2N4338	ND5701	IT120A	P1005	2N5115	SDF661	IT122
MFE2094	2N4339	ND5702	IT120	P1007	2N5267	SDF662	IT122
MFE2095	2N4340	NDF9401	IT500	P1028	2N5270	SDF663	IT122
MFE2133	2N4860	NDF9402	IT501	P1029	2N5270	SES3819	2N5484
MFE2912	2N5433	NDF9403	IT502	P1058E	2N2609	SFT601	2N4338
MFE3002	3N170	NDF9404	IT503	P1066E	2N5115	SFT602	2N4338
MFE3003	3N164	NDF9405	IT504	P1087E	2N5516	SFT603	2N4339
MFE3020	3N165	NDF9406	IT500	P1117E	2N5640	SFT604	2N4339
MFE3021	3N166	NDF9407	IT501	P1118E	2N5641	SL301AT	IT129
MFE4007	2N3686	NDF9408	IT502	P1119E	2N5640	SL301BT	IT129
MFE4008	2N3686	NDF9409	IT503	PF510	2N5115	SL301CT	IT129
MFE4009	2N3685	NDF9410	IT504	PF5101	2N4867	SL301ET	IT129
MFE4010	2N2608	NF3819	2N5484	PF5102	2N4867	SL360C	IT129
MFE4011	2N2608	NF4302	2N5457	PF5103	2N4867	SL362C	IT129
MFE4012	2N2609	NF4303	2N5459	PF511	2N5114	SU2000	2N4340
MFE823	IT1700	NF4304	2N5458	PF5301	2N4118A	SU2020	2N3954
MK10	2N4416	NF4445	2N5432	PF5301-1	2N4117A	SU2021	2N3954
MMF1	2N5197	NF4446	2N5433	PF5301-2	2N4118A	SU2022	2N3954
MMF2	2N3921	NF4447	2N5434	PF5301-3	2N4118A	SU2023	2N3954
MMF3	2N5198	NF4448	2N5433	PL1091	2N3823	SU2024	2N3954
MMF4	2N3922	NF500	2N4224	PL1092	2N3823	SU2025	2N3954
MMF5	2N5199	NF501	2N4224	PL1093	2N3823	SU2026	2N3954
MMF6	2N3955A	NF506	2N4416	PL1094	2N3823	SU2027	2N3954
MMT3823	2N3823	NF5101	2N4867	PN3684	2N3684	SU2028	2N3954
MP301	IT124	NF5102	2N4867	PN3685	2N3685	SU2029	2N3954
MP302	IT124	NF5103	2N4867	PN3686	2N3686	SU2029	2N5197
MP303	IT124	NF511	2N4860	PN3687	2N3687	SU2030	2N3954
MP310	2N4045	NF5163	2N4341	PN4091	ITE4091	SU2030	2N3955
MP311	2N4045	NF520	2N3684	PN4092	ITE4092	SU2031	2N3954
MP312	2N4044	NF521	2N3685	PN4093	ITE4093	SU2031	2N5198
MP313	IT124	NF522	2N3686	PN4220	J204	SU2032	2N3954
MP318	IT120A	NF523	2N3865	PN4221	J202	SU2033	2N3954
MP350	IT132	NF530	2N4341	PN4222	J203	SU2034	2N3954
MP351	IT130	NF5301	2N4118A	PN4223	J204	SU2034	2N3955
MP352	IT130	NF5301-1	2N4117A	PN4224	J202	SU2035	2N3954
MP358	IT130A	NF5301-2	2N4118A	PN4342	2N5461	SU2035	2N3955
MP360	IT132	NF5301-3	2N4118A	PN4360	2N5460	SU2074	2N3954
MP361	IT130A	NF531	2N4339	PN4391	ITE4391	SU2075	2N3954
MP362	IT130A	NF532	2N4341	PN4392	ITE4392	SU2076	2N3954
MP3954	2N3954	NF533	2N4339	PN4416	ITE4416	SU2077	2N3954
MP3954A	2N3954A	NF5457	2N5457	PN4856	2N4856	SU2077	2N3955
MP3955	2N3955	NF5458	2N5458	PN4857	2N4857	SU2078	2N3955
MP3956	2N3956	NF5459	2N5459	PN4858	2N4858	SU2079	2N3955
MP3957	2N3957	NF5484	2N5484	PN4859	2N4859	SU2080	U404
MP3958	2N3958	NF5485	2N5485	PN4860	2N4860	SU2081	U404
MP5905	2N5905	NF5486	2N5486	PN4861	2N4861	SU2098	2N5197
MP5906	2N5906	NF5555	2N5484	PN5033	2N5460	SU2098A	2N5197
MP5907	2N5907	NF5638	2N5638	PTC151	2N5484	SU2098B	2N5196
MP5908	2N5908	NF5639	2N5639	PTC152	2N5485	SU2099	2N5197
MP5909	2N5909	NF5640	2N5640	SA2253	IT122	SU2099A	2N5197
MP5911	2N5911	NF5653	2N4860	SA2254	IT122	SU2365	2N3954
MP5912	2N5912	NF5654	2N4861	SA2255	IT122	SU2365A	2N3954
MP804	2N5520	NF580	2N5432	SA2644	IT120	SU2365	2N3955
MP830	2N5520	NF581	2N5432	SA2648	IT120	SU2365A	2N3955
MP831	2N5521	NF582	2N5433	SA2710	IT120	SU2367	2N3955
MP832	2N5522	NF583	2N5434	SA2711	IT120	SU2367A	2N3955
MP833	2N5523	NF584	2N5433	SA2712	IT121	SU2368	2N3956
MP835	2N3954	NF585	2N4859	SA2713	IT121	SU2368A	2N3956
MP836	2N3955	NF6451	U310	SA2714	IT122	SU2369	2N3957
MP837	2N3955	NF6452	U310	SA2715	IT120	SU2369A	2N3957
MP838	2N3956	NF6453	U310	SA2716	IT120	SU2410	2N5907
MP839	2N3957	NF6454	U310	SA2717	IT121	SU2411	2N5909

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DISCRETE CROSS REFERENCE (cont.)

ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
SU2412	2N5909	TD5909A	2N5909	U183	2N3824	U405	U405
SU2652	U401	TD5911	IT5911	U1837E	2N5486	U406	U406
SU2652M	U401	TD5911A	IT5911	U184	2N5397	U410	2N3955
SU2653	U401	TD5912	IT5912	U1897E	U1897	U411	2N3956
SU2653M	U401	TD5912A	IT5912	U1898E	U1898	U412	2N3958
SU2654	U401	TD700	IT122	U1899E	U1899	U421	2N5908
SU2654M	U401	TD701	IT122	U197	2N4338	U422	2N5906
SU2655	U402	TD709	IT122	U198	2N4340	U423	2N5909
SU2655M	U402	TD710	IT122	U199	2N4341	U424	2N5908
SU2656	U404	TD711	IT122	U1994E	2N4416	U425	2N5908
SU2656M	U404	TD713	IT122	U200	2N4861	U426	2N5909
SX3819	2N5484	TIS14	2N4340	U201	2N4860	U430	J309(X2)
SX3820	2N2608	TIS25	2N3954	U202	2N4858	U431	J310(X2)
TD100	IT129	TIS26	2N3954	U2047E	2N4416	U440	IT5911
TD101	IT129	TIS27	2N3955	U221	2N4391	U441	IT5912
TD102	IT129	TIS34	2N5486	U222	2N4391	UC100	2N3684
TD200	IT129	TIS41	2N4859	U231	U231	UC110	2N3685
TD201	IT129	TIS42	2N4353	U232	U232	UC115	2N4340
TD202	IT129	TIS58	2N5484	U233	U233	UC120	2N3686
TD221S	IT129	TIS59	2N5486	U234	U234	UC130	2N3687
TD224	IT122	TIS88	2N3955A	U235	U235	UC155	2N4416
TD225	IT122	TIS89	2N3955A	U240	2N5432	UC1700	3N163
TD226	IT122	TIS70	2N3955	U241	2N5433	UC1754	3N163
TD227	IT122	TIS73	ITE4391	U242	2N5432	UC20	2N3686
TD228	IT122	TIS74	ITE4392	U243	2N5433	UC200	2N3824
TD229	IT122	TIS75	ITE4393	U244	2N5433	UC201	2N3824
TD230	IT121	TIS88	2N4416	U248	2N5902	UC21	2N3687
TD231	IT121	TIS88A	2N4416	U248A	2N5906	UC210	2N4416
TD232	IT122	TIXS33	2N4392	U249	2N5903	UC2130	2N5452
TD233	IT122	TIXS35	2N4857	U249A	2N5907	UC2132	2N5453
TD234	IT122	TIXS36	2N4391	U250	2N5904	UC2134	2N5454
TD235	IT122	TIXS41	2N4859	U250A	2N5908	UC2136	2N5454
TD236	IT122	TIXS42	2N5639	U251	2N5905	UC2138	2N5454
TD237	IT122	TIXS55	2N5459	U251A	2N5909	UC2139	2N3958
TD238	IT122	TIXS78	2N4341	U252	IT5911	UC2147	2N3958
TD239	IT122	TIXS79	2N4341	U253	IT5912	UC2148	2N3958
TD240	IT121	TN4117	2N4117	U254	2N4859	UC2149	2N3958
TD241	IT121	TN4117A	2N4117A	U255	2N4860	UC220	2N3822
TD242	IT120A	TN4118	2N4118	U256	2N4861	UC240	2N4869
TD243	IT120A	TN4118A	2N4118A	U257	U257	UC241	2N4869
TD244	IT129	TN4119	2N4119	U257/TO-71	U257/TO-71	UC250	2N4091
TD245	IT129	TN4119A	2N4119A	U266	2N4856	UC251	2N4392
TD246	IT129	TN4338	2N4338	U273	2N4118A	UC2756	3N166
TD247	IT129	TN4339	2N4339	U273A	2N4118A	UC300	2N2608
TD248	IT129	TN4340	2N4340	U274	2N4119A	UC310	2N2607
TD250	IT120A	TN4341	2N4341	U274A	2N4119A	UC320	2N2607
TD2905	IT139	TN5277	2N4341	U275	2N4119A	UC330	2N2607
TD400	IT139	TN5278	2N4341	U275A	2N4119A	UC340	2N2607
TD401	IT139	TP5114	2N5114	U280	2N5452	UC40	2N2608
TD402	IT139	TP5115	2N5115	U281	2N5453	UC400	2N5270
TD500	IT139	TP5116	2N5116	U282	2N5453	UC401	2N5116
TD501	IT139	U110	2N2608	U283	2N5453	UC41	2N2608
TD502	IT139	U111	2N2608	U284	2N5454	UC410	2N5268
TD509	IT132	U112	2N2608	U285	2N5454	UC420	2N5267
TD510	IT132	U113	2N2608	U290	2N5432	UC450	2N5114
TD511	IT132	U114	2N2608	U291	2N5434	UC451	2N5116
TD512	IT132	U1177	2N4220	U295	2N5432	UC588	2N4416
TD513	IT132	U1178	2N3821	U296	2N5434	UC703	2N4220
TD514	IT132	U1179	2N3821	U300	2N5114	UC704	2N4220
TD517	IT132	U1180	2N4221	U3000	2N4341	UC705	2N4224
TD518	IT132	U1181	2N4220	U3001	2N4339	UC707	2N4860
TD519	IT132	U1182	2N3821	U3002	2N4338	UC714	2N3822
TD520	IT139	U1277	2N3684	U301	2N5115	UC714E	2N4341
TD521	IT139	U1278	2N3685	U301D	2N4341	UC734	2N4416
TD522	IT139	U1279	2N3686	U3011	2N4340	UC734E	2N4416
TD523	IT139	U1280	2N3684	U3012	2N4338	UC751	2N4340
TD524	IT139	U1281	2N3822	U304	U304	UC752	2N4340
TD525	IT132	U1282	2N4341	U305	U305	UC753	2N4341
TD526	IT132	U1283	2N4340	U306	U306	UC754	2N4340
TD527	IT131	U1284	2N4341	U308	U308	UC755	2N4341
TD528	IT131	U1285	2N4220	U309	U309	UC756	2N4340
TD5432	2N5432	U1286	2N4341	U310	U310	UC805	2N5270
TD5433	2N5433	U1287	2N4092	U311	U310	UC807	2N5115
TD5434	2N5434	U1321	2N4860	U312	2N5397	UC814	2N5270
TD550	IT129	U1322	2N3922	U314	2N5555	UC851	2N2608
TD5902	2N5902	U1323	2N3822	U315	2N5397	UC853	2N2608
TD5902A	2N5902	U1324	2N3687	U316	U309	UC854	2N2608
TD5903	2N5903	U1325	2N3686	U317	U310	UC855	2N2609
TD5903A	2N5903	U133	2N2609	U320	2N5433	UT100	2N5397
TD5904	2N5904	U1420	2N3821	U321	2N5434	UT101	2N5397
TD5904A	2N5904	U1421	2N3822	U322	2N5433	UXC2910	IT126
TD5905	2N5905	U1422	2N3822	U328	**	VCR10N	2N4869
TD5905A	2N5905	U146	2N2608	U329	**	VCR11N	VNR11N
TD5906	2N5906	U147	2N2608	U330	**	VCR12N	2N3958
TD5906A	2N5906	U148	2N2608	U331	**	VCR13N	2N3958
TD5907	2N5907	U149	2N2609	U350	**	VCR20N	2N4341
TD5907A	2N5907	U169	2N2609	U401	U401	VCR2N	VCR2N
TD5908	2N5908	U1714	2N4340	U402	U402	VCR3P	VCR3P
TD5908A	2N5908	U1715	2N4340	U403	U403	VCR4N	VCR4N
TD5909	2N5909	U182	2N4857	U404	U404	VCR5P	VCR5P

**CONSULT FACTORY

DISCRETE CROSS REFERENCE (cont.)

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ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
VCR6P	VCR6P						
VCR7N	VCR7N						
VF28	2N4392						
VF811	2N4858						
VF815	2N4858						
VFW40	IT122						
VFW40A	IT120						
W245A	ITE4416						
W245B	ITE4416						
W245C	ITE4416						
W300	2N5398						
W300A	2N5397						
W300B	2N5397						
W300C	2N5397						
W300D	2N5398						
WK5457	2N5457						
WK5458	2N5458						
WK5459	2N5459						
ZDT40	IT129						
ZDT41	IT129						
ZDT42	IT129						
ZDT44	IT129						
ZDT45	IT129						

**CONSULT FACTORY

ANALOG SWITCH CROSS REFERENCE

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ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
AD7506/COM/CHIPS	IH6116C/D	AH5010CN	IH5010CPD	DG180AP	DG180AK	DG200AK	DG200AK
AD7506/MIL/CHIPS	IH6116M/D	AH5012CN	IH5012CPE	DG180BA	DG180BA	DG200AL	DG200AL
AD7506JD	IH6116CJI	AH5013CN	IH5013CPD	DG180BP	DG180BK	DG200AP	DG200AK
AD7506JD/883B	IH6116CJI/883B	AH5014CN	IH5014CPD	DG181AA	DG181AA	DG200BA	DG200BA
AD7506JN	IH6116CPI	AH5015CN	IH5015CPE	DG181AA	DGM181AA	DG200BK	DG200BK
AD7506KD	IH6116CJI	AH5016CN	IH5016CPE	DG181AL	DG181AL	DG200BP	DG200BK
AD7506KD/883B	IH6116CJI/883B	AM5011CN	IH5011CPE	DG181AP	DGM181AL	DG200CJ	DG200CJ
AD7506KN	IH6116CPI	D123AL	D123AL	DG181AP	DG181AK	DG201AK	DG201AK
AD7506SD	IH6116MJI	D123AP	D123AK	DG181AP	DGM181AK	DG201AP	DG201AK
AD7506SD/883B	IH6116MJI/883B	D123BP	D123BJ	DG181BA	DG181BA	DG201BK	DG201BK
AD7506TD	IH6116MJI	D123BP	D123BK	DG181BA	DGM181BA	DG201CJ	DG201CJ
AD7506TD/883B	IH6116MJI/883B	D125AL	D125AL	DG181BP	DG181BK	DG201BP	DG201BK
AD7507/COM/CHIPS	IH6216C/D	D125AP	D125AP	DG181BP	DGM181BK	DG281AA	IH182MTW
AD7507/MIL/CHIPS	IH6216M/D	D125BP	D125BK	DG181BP	DGM181CJ	DG281AP	IH182MJD
AD7507JD	IH6216CJI	D129AL	D129AL	DG182AA	DG182AA	DG281BA	IH182CTW
AD7507JD/883B	IH6216CJI/883B	D129AP	D129AK	DG182AA	DGM182AA	DG281BP	IH182CJD
AD7507JN	IH6216CPI	D129BP	D129BK	DG182AL	DG182AL	DG284AP	IH185MJE
AD7507KD	IH6216CJI	DG123AL	DG123AL	DG182AL	DGM182AL	DG284BP	IH185CJE
AD7507KD/883B	IH6216CJI/883B	DG123AP	DG123AK	DG182AP	DG182AK	DG287AA	IH188MTW
AD7507KN	IH6216CPI	DG123BP	DG123BK	DG182AP	DGM182AK	DG287AP	IH188MJD
AD7507SD	IH6216M/D	DG125AL	DG125AL	DG182BA	DG182BA	DG287BA	IH188CTW
AD7507SD/883B	IH6216MJI/883B	DG125AP	DG125AK	DG182BA	DGM182BA	DG287BP	IH188CJD
AD7507TD	IH6216MJI	DG125BP	DG125BK	DG182BP	DG182BK	DG290AP	IH191MJE
AD7507TD/883B	IH6216MJI/883B	DG126AK	DG126AK	DG182BP	DGM182BK	DG290BP	IH191CJE
AH0126CD	DG126BK	DG126AL	DG126AL	DG182BP	DGM182CJ	DG381AA	DGM182AA
AH0126D	DG126AK	DG126BP	DG126BK	DG183AL	DG183AL	DG381AK	DGM182AK
AH0126D/883	DG126AK/883B	DG129AL	DG129AL	DG183AP	DG183AK	DG381AP	DGM182AK
AH0129CD	DG129BK	DG129AP	DG129AK	DG183BP	DG183BK	DG381BA	DGM181BA
AH0129D	DG129AK	DG129BP	DG129BK	DG184AL	DG184AL	DG381BK	DGM181BK
AH0129D/883	DG129AK/883B	DG133AL	DG133AL	DG184AL	DGM184AL	DG381BP	DGM181BK
AH0133CD	DG133BK	DG133AP	DG133AK	DG184AP	DG184AK	DG381CJ	DGM181CJ
AH0133D	DG133AK	DG133BP	DG133BK	DG184AP	DGM184AK	DG384AK	DGM185AK
AH0133D/883	DG133AK/883B	DG134AL	DG134AL	DG184BP	DG184BK	DG384AP	DGM185AK
AH0134CD	DG134BK	DG134AP	DG134AK	DG184BP	DGM184BK	DG384BK	DGM184BK
AH0134D	DG134AK	DG134BP	DG134BK	DG184BP	DGM184CJ	DG384BP	DGM184BK
AH0134D/883	DG134AK/883B	DG139AL	DG139AL	DG185AL	DG185AL	DG384CJ	DGM184CJ
AH0139CD	DG139BK	DG139AP	DG139AK	DG185AL	DGM185AL	DG387AA	DGM188AA
AH0139D	DG139AK	DG139BP	DG139BK	DG185AP	DG185AK	DG387AK	DGM188AK
AH0139D/883	DG139AK/883B	DG140AL	DG140AL	DG185AP	DGM185AK	DG387AP	DGM188AK
AH0140CD	DG140BK	DG140AP	DG140AK	DG185BP	DG185BK	DG387BA	DGM187BA
AH0140D	DG140AK	DG140BP	DG140BK	DG185BP	DGM185BK	DG387BK	DGM187BK
AH0140D/883	DG140AK/883B	DG141AL	DG141AL	DG185BP	DGM185CJ	DG387BP	DGM187BK
AH0141CD	DG141BK	DG141AP	DG141AK	DG186AA	DG186AA	DG390AK	DGM191AK
AH0141D	DG141AK	DG141BP	DG141BK	DG186AL	DG186AL	DG390AP	DGM191AK
AH0141D/883	DG141AK/883B	DG142AL	DG142AL	DG186AP	DG186AK	DG390BK	DGM190BK
AH0142CD	DG142BK	DG142AP	DG142AK	DG186BA	DG186BA	DG390BP	DGM190BK
AH0142D	DG142AK	DG142BP	DG142BK	DG186BP	DG186BK	DG390CJ	DGM190CJ
AH0142D/883	DG142AK/883B	DG143AL	DG143AL	DG187AA	DG187AA	DG5040AK	IH5040MJE
AH0143CD	DG143BK	DG143AP	DG143AK	DG187AA	DGM187AA	DG5040AL	IH5040MFD
AH0143D	DG143AK	DG143BP	DG143BK	DG187AL	DG187AL	DG5040CJ	IH5040CPE
AH0143D/883	DG143AK/883B	DG144AL	DG144AL	DG187AL	DGM187AL	DG5040CK	IH5040CJE
AH0144CD	DG144BK	DG144AP	DG144AK	DG187AP	DG187AK	DG5041AA	IH5041MTW
AH0144D	DG144AK	DG144BP	DG144BK	DG187AP	DGM187AK	DG5041AK	IH5041MJE
AH0144D/883	DG144AK/883B	DG145AL	DG145AL	DG187BA	DG187BA	DG5041AL	IH5041MFD
AH0145CD	DG145BK	DG145AP	DG145AK	DG187BA	DGM187BA	DG5041CJ	IH5041CPE
AH0145D	DG145AK	DG145BP	DG145BK	DG187BP	DG187BK	DG5041CK	IH5041CJE
AH0145D/883	DG145AK/883B	DG146AL	DG146AL	DG187BP	DGM187BK	DG5042AA	IH5042MTW
AH0146CD	DG145BK	DG146AP	DG145AK	DG188AA	DG188AA	DG5042AK	IH5042MJE
AH0146D	DG146AK	DG146BP	DG146BK	DG188AA	DGM188AA	DG5042AL	IH5042MFD
AH0146D/883	DG146AK/883B	DG151AL	DG151AL	DG188AL	DG188AL	DG5042CJ	IH5042CPE
AH0151CD	DG151BK	DG151AP	DG151AK	DG188AL	DGM188AL	DG5042CK	IH5042CJE
AH0151D/883	DG151AK/883B	DG151BP	DG151BK	DG188AP	DG188AK	DG5043AK	IH5043MJE
AH0152CD	DG152BK	DG152AL	DG152AL	DG188AP	DGM188AK	DG5043AL	IH5043MFD
AH0152D	DG152AK	DG152AP	DG152AK	DG188AP	DGM188BK	DG5043CJ	IH5043CPE
AH0152D/883	DG152AK/883B	DG152BP	DG152BK	DG188BA	DG188BA	DG5043CK	IH5043CJE
AH0153CD	DG153BK	DG153AL	DG153AL	DG188BA	DGM188BA	DG5044AA	IH5044MTW
AH0153D	DG153AK	DG153AP	DG153AK	DG188BP	DG188BK	DG5044AK	IH5044MJE
AH0153D/883	DG153AK/883B	DG153BP	DG153BK	DG189AL	DG189AL	DG5044AL	IH5044MFD
AH0154CD	DG154BK	DG154AL	DG154AL	DG189AP	DG189AK	DG5044CJ	IH5044CPE
AH0154D	DG154AK	DG154AP	DG154AK	DG189BP	DG189BK	DG5044CK	IH5044CJE
AH0154D/883	DG143AK/883B	DG154BP	DG154BK	DG190AL	DG190AL	DG5045AK	IH5045MJE
AH0155D	DG151AK	DG161AL	DG161AL	DG190AL	DGM190AL	DG5045AL	IH5045MFD
AH0161CD	DG161BK	DG161AP	DG161AK	DG190AP	DG190AK	DG5045CJ	IH5045CPE
AH0161D	DG161AK	DG161BP	DG161BK	DG190AP	DGM190AK	DG5045CK	IH5045CJE
AH0161D/883	DG161AK/883B	DG162AL	DG162AL	DG190BP	DG190BK	DG506AR	IH6116MJI
AH0162CD	DG162BK	DG162AP	DG162AK	DG190BP	DGM190BK	DG506BR	IH6116CJI
AH0162D	DG162AK	DG162BP	DG162BK	DG190BP	DGM190CJ	DG506CJ	IH6116CPI
AH0162D/883B	DG162AK/883B	DG163AL	DG153AL	DG191AL	DG191AL	DG507AR	IH6216MJI
AH0163CD	DG163BK	DG163AP	DG163AK	DG191AL	DGM191AL	DG507BR	IH6216CJI
AH0163D	DG163AK	DG163BP	DG163BK	DG191AP	DG191AK	DG507CJ	IH6216CPI
AH0163D/883	DG163AK/883B	DG164AL	DG164AL	DG191AP	DGM191AK	DG508AP	IH6108MJE
AH0164CD	DG164BK	DG164AP	DG164AK	DG191BP	DG191BK	DG508BP	IH6108CJE
AH0164D	DG164AK	DG164BP	DG164BK	DG191BP	DGM191BK	DG508CJ	IH6108CPE
AH0164D/883	DG164AK/883B	DG180AA	DG180AA	DG191BP	DGM191CJ	DG509AP	IH5208MJE
AH5009CN	IH5009CPD	DG180AL	DG180AL	DG200AA	DG200AA	DG509BP	IH5208CJE

**CONSULT FACTORY

ANALOG SWITCH CROSS REFERENCE (cont.)

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ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
DG509CJ	IH5208CPE	HI1-5041-5	IH5041CJE	TL182CN	DGM182CJ		
DGM111AL	DG111AL	HI1-5041-8	IH5041MJE/883B	TL182IJ	DGM182BA		
DGM111AP	DG111AK	HI1-5042-2	IH5042MJE	TL182IN	DGM182CJ		
DGM111BP	DG111BK	HI1-5042-5	IH5042CJE	TL182ML	DGM182AA		
G115AP	G115AK	HI1-5042-8	IH5142MJE/883B	TL185CJ	IH5045CJE		
G115BP	G115BJ	HI1-5043-2	IH5143MJE	TL185CN	IH5045CPE		
G115BP	G115BK	HI1-5043-5	IH5143CJE	TL185IJ	IH5045CJE		
G116AL	G116AL	HI1-5043-8	IH5143MJE/883B	TL185IN	IH5045CPE		
G116AP	G116AK	HI1-5044-2	IH5144MJE	TL185MJ	IH5045MJE		
G116BP	G116BJ	HI1-5044-5	IH5144CJE	TL188CL	IH5042CTW		
G116BP	G116BK	HI1-5044-8	IH5144MJE/883B	TL188CN	IH5042CPE		
G117AL	G117AL	HI1-5045-2	IH5145MJE	TL188IL	IH5042CTW		
G118AL	G118AL	HI1-5045-5	IH5145CJE	TL188IN	IH5042CPE		
G118AP	G118AK	HI1-5045-8	IH5145MJE/883B	TL188ML	IH5042MTW		
G119AL	G119AL	HI1-5046-2	IH5046MJE	TL191CJ	IH5043CJE		
G123AL	G123AL	HI1-5046-5	IH5046CJE	TL191CN	IH5043CPE		
G123AP	G123AK	HI1-5046-8	IH5046MJE/883B	TL191IJ	IH5043CJE		
HI0-0201-5	DG201C/D	HI1-5047-2	IH5047MJE	TL191IN	IH5043CPE		
HI0-0381-5	DGM181C/D	HI1-5047-5	IH5047CJE	TL191MJ	IH5043MJE		
HI0-0384-5	DGM184C/D	HI1-5047-8	IH5047MJE/883B				
HI0-0387-5	DGM187C/D	HI1-5049-2	IH5149MJE				
HI0-0390-5	DGM190C/D	HI1-5049-5	IH5149CJE				
HI0-0506-5	IH5116C/D	HI1-5049-8	IH5149MJE/883B				
HI0-0506A-5	IH5116C/D	HI1-5050-2	IH5150MJE				
HI0-0507-5	IH6216C/D	HI1-5050-5	IH5150CJE				
HI0-0507A-5	IH5216C/D	HI1-5050-8	IH5150MJE/883B				
HI0-0508-5	IH6108C/D	HI1-5051-2	IH5151MJE				
HI0-0508A-5	IH5108C/D	HI1-5051-5	IH5151CJE				
HI0-0509-5	IH6208C/D	HI1-5051-8	IH5151MJE/883B				
HI0-0509A-5	IH5208C/D	HI2-0200-2	DG200AA				
HI0-5040-5	IH5140C/D	HI2-0200-4	DG200BA				
HI0-5041-5	IH5141C/D	HI2-0200-5	DG200BA				
HI0-5042-5	IH5142C/D	HI2-0200-8	DG200AA/883B				
HI0-5043-5	IH5143C/D	HI2-0381-2	DGM182AA				
HI0-5044-5	IH5144C/D	HI2-0381-5	DGM181BA				
HI0-5045-5	IH5145C/D	HI2-0381-8	DGM181AA/883B				
HI0-5046-5	IH5046C/D	HI2-0387-2	DGM188AA				
HI0-5047-5	IH5047C/D	HI2-0387-5	DGM187BA				
HI0-5049-5	IH5149C/D	HI2-0387-8	DGM188AA/883B				
HI0-5050-5	IH5150C/D	HI3-0200-5	DG200CJ				
HI0-5051-5	IH5051C/D	HI3-0201-5	DG201CJ				
HI1-0200-2	DG200AK	HI3-0381-5	DGM181CJ				
HI1-0200-4	DG200BK	HI3-0384-5	DGM184CJ				
HI1-0200-5	DG200BK	HI3-0390-5	DGM190CJ				
HI1-0200-8	DG200C/D	HI3-0506-5	IH6116CPI				
HI1-0200-8	DG200AK/883B	HI3-0506A-5	IH5116CPI				
HI1-0201-2	DG201AK	HI3-0507-5	IH6216CPI				
HI1-0201-4	DG201BK	HI3-0507A-5	IH5216CPI				
HI1-0201-5	DG201BK	HI3-0508-5	IH6108CPE				
HI1-0201-8	DG201AK/883B	HI3-0508A-5	IH5108CPE				
HI1-0381-2	DGM182AK	HI3-0509-5	IH6208CPE				
HI1-0381-5	DGM181BK	HI3-0509A-5	IH5208CPE				
HI1-0381-8	DGM182AK/883B	LF11201D	DG201AK				
HI1-0384-2	DGM185AK	LF11201D/883	DG201AK/883B				
HI1-0384-5	DGM184BK	LF11202D	IH202MJE				
HI1-0384-8	DGM185AK/883B	LF11202D/883	IH202MJE/883B				
HI1-0387-2	DGM188AK	LF11509D	IH6109MJE				
HI1-0387-5	DGM187BK	LF11508D/883	IH6108MJE/883B				
HI1-0387-8	DGM188AK/883B	LF11509D	IH6208MJE				
HI1-0390-2	DGM191AK	LF11509D/883	IH6208MJE/883B				
HI1-0390-5	DGM190BK	LF13201D	DG201BK				
HI1-0390-8	DGM191AK/883B	LF13201N	DG201CJ				
HI1-0506-2	IH6116MJI	LF13202D	IH202CJE				
HI1-0506-5	IH6116CJI	LF13508D	IH6108CJE				
HI1-0506-8	IH6116MJI/883B	LF13508N	IH6108CPE				
HI1-0506A-2	IH5116MJI	LF13509D	IH6208CJE				
HI1-0506A-5	IH5116IJI	LF13509N	IH6208CPE				
HI1-0506A-8	IH5116MJI/883B	MM450H	MM450H				
HI1-0507-2	IH6216MJI	MM451H	MM451H				
HI1-0507-5	IH6216CJI	MM452D	MM452J				
HI1-0507-8	IH6216MJI/883B	MM452F	MM452F				
HI1-0507A-2	IH5216MJI	MM455H	MM455H				
HI1-0507A-5	IH5216IJI	MM550H	MM550H				
HI1-0507A-8	IH5216MJI/883B	MM551H	MM551H				
HI1-0508-2	IH6108MJE	MM552D	MM552J				
HI1-0508-5	IH6108CJE	MM552F	MM552F				
HI1-0508-8	IH6108MJE/883B	MM555H	MM555H				
HI1-0508A-2	IH5108MJE	SJM181BCD	JM38510/11101BCC				
HI1-0508A-5	IH5108IJE	SJM181BIC	JM38510/11101BIC				
HI1-0508A-8	IH5108MJE/883B	SJM182BCC	JM38510/11102BCC				
HI1-0509-2	IH6208MJE	SJM182BIC	JM38510/11102BIC				
HI1-0509-5	IH6208CJE	SJM184BEC	JM38510/11103BEC				
HI1-0509-8	IH6208MJE/883B	SJM185BEC	JM38510/11104BEC				
HI1-0509A-2	IH5208MJE	SJM187BCC	JM38510/11105BCC				
HI1-0509A-5	IH5208IJE	SJM187BIC	JM38510/11105BIC				
HI1-0509A-8	IH5208MJE/883B	SJM188BCC	JM38510/11106BCC				
HI1-5040-2	IH5040MJE	SJM188BIC	JM38510/11106BIC				
HI1-5040-5	IH5040CJE	SJM190BEC	JM38510/11107BEC				
HI1-5040-8	IH5040MJE/883B	SJM191BEC	JM38510/11108BEC				
HI1-5041-2	IH5041MJE	TL182CL	DGM182BA				

**CONSULT FACTORY

DATA ACQUISITION CROSS REFERENCE

A

ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
AD7520JD	AD7520JD	MP7521LN	AD7521LN				
AD7520JN	AD7520JN	MP7521SD	AD7521SD				
AD7520KD	AD7520KD	MP7521TD	AD7521TD				
AD7520KN	AD7520KN	MP7521UD	AD7521UD				
AD7520LD	AD7520LD	MP7523JN	AD7523JN				
AD7520LN	AD7520LN	MP7523KN	AD7523KN				
AD7520SD	AD7520SD	MP7523LN	AD7523LN				
AD7520TD	AD7520TD	MP7621AD	AD7541AD				
AD7520UD	AD7520UD	MP7621BD	AD7541BD				
AD7521JD	AD7521JD	MP7621JN	AD7541JN				
AD7521JN	AD7521JN	MP7621KN	AD7541KN				
AD7521KD	AD7521KD	MP7621SD	AD7541SD				
AD7521KN	AD7521KN	MP7621TD	AD7541TD				
AD7521LD	AD7521LD						
AD7521LN	AD7521LN						
AD7521SD	AD7521SD						
AD7521TD	AD7521TD						
AD7521UD	AD7521UD						
AD7523AD	AD7523AD						
AD7523BD	AD7523BD						
AD7523CD	AD7523CD						
AD7523JN	AD7523JN						
AD7523KN	AD7523KN						
AD7523LN	AD7523LN						
AD7523SD	AD7523SD						
AD7523TD	AD7523TD						
AD7523UD	AD7523UD						
AD7530JD	AD7530JD						
AD7530JN	AD7530JN						
AD7530KD	AD7530KD						
AD7530KN	AD7530KN						
AD7530LD	AD7530LD						
AD7530LN	AD7530LN						
AD7531JD	AD7531JD						
AD7531JN	AD7531JN						
AD7531KD,	AD7531KD						
AD7531KN	AD7531KN						
AD7531LD	AD7531LD						
AD7531LN	AD7531LN						
AD7533AD	AD7533AD						
AD7533BD	AD7533BD						
AD7533CD	AD7533CD						
AD7533JN	AD7533JN						
AD7533KN	AD7533KN						
AD7533LN	AD7533LN						
AD7533SD	AD7533SD						
AD7533TD	AD7533TD						
AD7533UD	AD7533UD						
AD7541AD	AD7541AD						
AD7541BD	AD7541BD						
AD7541JN	AD7541JN						
AD7541KN	AD7541KN						
AD7541SD	AD7541SD						
AD7541TD	AD7541TD						
DAC1020LCD	AD7520LD						
DAC1020LD	AD7520UD						
DAC1021LCD	AD7520KD						
DAC1021LD	AD7520TD						
DAC1022LCD	AD7520JD						
DAC1022LD	AD7520SD						
DAC1218LCD	AD7541BD						
DAC1218LCN	AD7541KN						
DAC1218LCN	AD7541LN						
DAC1219LCD	AD7541AD						
DAC1219LCN	AD7541JN						
DAC1220LCD	AD7521LD						
DAC1220LD	AD7521UD						
DAC1221LCD	AD7521KD						
DAC1221LD	AD7521TD						
DAC1222LCD	AD7521JD						
DAC1222LD	AD7521SD						
MP7520JD	AD7520JD						
MP7520JN	AD7520JN						
MP7520KD	AD7520KD						
MP7520KN	AD7520KN						
MP7520LD	AD7520LD						
MP7520LN	AD7520LN						
MP7520SD	AD7520SD						
MP7520TD	AD7520TD						
MP7520UD	AD7520UD						
MP7521JD	AD7521JD						
MP7521JN	AD7521JN						
MP7521KD	AD7521KD						
MP7521KN	AD7521KN						
MP7521LD	AD7521LD						

**CONSULT FACTORY

WATCH & CLOCK CROSS REFERENCE

ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
CD22001H	ICM1424C						
CD22015E	ICM7051A						
E1115	ICM1115A						
E1151	ICM1115B						
E1426	ICM7050U						
HD43871	ICM7050G						
HD43871	ICM7050H						
KS5183	ICM7269						
KS5240B01H	ICM7245B						
KS5240B01J	ICM7245A						
KS5240B10H	ICM7245D						
KS5240B12H	ICM7245E						
KS5240B20H	ICM7245F						
KS5240U01E	ICM7245U						
M5001	ICM7269						
M58434P	ICM7038D						
M58435P	ICM1115B						
M58436-001P	ICM7050G						
M58437-001P	ICM7070L						
MB101	ICM7245B						
MB103	ICM7245E						
MB105	ICM7245U						
MB107	ICM7245D						
MB108	ICM7245E						
MB143	ICM7245A						
MB144	ICM7245F						
MB510	ICM1115B						
MB511	ICM7050H						
MB512	ICM7050H						
MB513	ICM7050G						
MB521	ITS9068						
MB522	ITS9068						
MB531	ICM7050H						
MB533	ICM7050H						
MB541	ICM7052						
MB542	ICM7052						
MB7B	ICM7245U						
MCC14440	ICM1424C						
MCC14483	ICM7210						
MJ41	ICM1424C						
MJ6	ICM7220						
MN5091	ICM7038B						
MN5092A	ICM7038E						
MN5093	ICM7051A						
MN6252	ICM7050G						
MSM5001	ICM7269						
MSM5011	ICM1424C						
MSM5977	ICM1424C						
S1424	ICM1424C						
SCL54301	ICM1424C						
SCL5478	ICM7269						
SM5011	ICM7050G						
SM5510	ICM1115B						
SM5530B	ICM7070P						
TC8031P	ICM7038A						
TC8032P	ICM7038F						
TC8051P	ICM7038B						
TC8052P	ICM7038E						
TC8056PA	ICM1115B						
TC8057P	ICM7038D						
UCN-4111M	ICM7038C						
UCN-4112M	ICM7051A						
UCN-4113M	ICM7038B						
UPD1952P	ICM7220MFA						
UPD1962C	ICM7050G						
UPD1963C	ICM7050						
UPD815C	ICM7038E						
UPD816C	ICM7038B						
UPD820C	ICM1115B						
UPD833G	ICM7223						

[1] CONSULT FACTORY

LINEAR CROSS REFERENCE

ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT	ALTERNATE SOURCE PRODUCT	INTERSIL EQUIVALENT
723	UA723	MC1741	UA741				
733	UA733	MC1748	UA748				
741	UA741	MHW590	AD590				
748	UA748	MPS5010	ICL8069				
AD101	LM101	NE590	AD590				
AD108	LM108	NE592	NE592				
AD301	LM301	OP-05	OP-05				
AD308	LM308	OP-07	OP-07				
AD503	AD503	OP-08	OP-08				
AD532	AD532	PM308	LM308				
AD534	AD534	RC723	UA723				
AD590	AD590	RC733	UA733				
AD741	UA741	RC741	UA741				
AM2502	AM2502	RC748	UA748				
AM2503	AM2503	RM723	UA723				
AM2504	AM2504	RM741	UA741				
AM5402	HA2505	RM748	UA748				
AM5402	HA2525	SC748	UA748				
CA101	LM101	SG101	LM101				
CA107	LM107	SG105	LM105				
CA111	LM111	SG107	LM107				
CA301	LM301	SG108	LM108				
CA307	LM307	SG110	LM110				
CA308	LM308	SG111	LM111				
CA311	LM311	SG2502	AM2502				
CA723	UA723	SG2503	AM2503				
CA741	UA741	SG301	LM301				
CA748	UA748	SG305	LM305				
DG503	AD503	SG307	LM307				
DM2502	AM2502	SG308	LM308				
DM2503	AM2503	SG311	LM311				
DM2504	AM2504	SG4250	LM4250				
HA2500	HA2500	SG723	UA723				
HA2502	HA2502	SG733	UA733				
HA2505	HA2505	SG741	UA741				
HA2507	HA2507	SG748	UA748				
HA2510	HA2510	SS5741	UA741				
HA2512	HA2512	SU536	SU536				
HA2515	HA2515	TL503	AD503				
HA2517	HA2517	TL592	NE592				
HA2520	HA2520	TT-590	AD590				
HA2522	HA2522	UA101	LM101				
HA2525	HA2525	UA102	LM102				
HA2527	HA2527	UA105	LM105				
HA2600	HA2600	UA107	LM107				
HA2602	HA2602	UA108	LM108				
HA2605	HA2605	UA110	LM110				
HA2607	HA2607	UA111	LM111				
HA2620	HA2620	UA301	LM301				
HA2622	HA2622	UA302	LM302				
HA2625	HA2625	UA305	LM305				
HA2627	HA2627	UA307	LM307				
HA2720	ICL8021	UA308	LM308				
LH0042	LH0042	UA310	LM310				
LH2101	LH2101	UA311	LM311				
LH2108	LH2108	UA723	UA723				
LH2110	LH2110	UA733	UA733				
LH2111	LH2111	UA740	UA740				
LH2301	LH2301	UA741	UA741				
LH2308	LH2308	UA748	UA748				
LH2310	LH2310	UA777	UA777				
LH2311	LH2311	UHP-503	AD503				
LM100	LM100	VR-8069	ICL8069				
LM101	LM101	WG-8038	ICL8038				
LM102	LM102	XR8038	ICL8038				
LM105	LM105						
LM107	LM107						
LM108	LM108						
LM110	LM110						
LM111	LM111						
LM300	LM300						
LM301	LM301						
LM302	LM302						
LM305	LM305						
LM307	LM307						
LM308	LM308						
LM310	LM310						
LM311	LM311						
LM4250	LM4250						
LM723	UA723						
LM733	UA733						
LM740	UA740						
LM741	UA741						
LM748	UA748						
MC1723	UA723						

**CONSULT FACTORY

Discretes

1

Switches — Junction FET

Ordering Information Preferred Part Number	Package	$r_{DS(on)}$ max Ω	V_p min/max V		I_{GSS} max pA	BV_{GSS} min V	$I_{D(off)}$ max pA	I_{DSS} min/max mA		t_{total} max ns	C_{iss} max pF	C_{rss} max pF
N-channel: Generally requires driver circuit to translate the popular logic levels to voltages required to drive the JFET.												
2N3970	TO-18	30	−4.0	−10.0	(−250)	−40	250	50	150	50	25	6.0
2N3971	TO-18	60	−2.0	−5.0	(−250)	−40	250	25	75	90	25	6.0
2N3972	TO-18	100	−0.5	−3.0	(−250)	−40	250	5	30	180	25	6.0
2N4091	TO-18	30	−5.0	−10.0	−200	−40	200	30		65	16	5.0
2N4092	TO-18	50	−2.0	−7.0	−200	−40	200	15		95	16	5.0
2N4093	TO-18	80	−1.0	−5.0	−200	−40	200	8		140	16	5.0
2N4391	TO-18	30	−4.0	−10.0	−100	−40	100	50	150	55	14	3.5
2N4392	TO-18	60	−2.0	−5.0	−100	−40	100	25	75	75	14	3.5
2N4393	TO-18	100	−0.5	−3.0	−100	−40	100	5	30	100	14	3.5
2N4856	TO-18	25	−4.0	−10.0	−250	−40	250	50		34	18	8.0
2N4857	TO-18	40	−2.0	−6.0	−250	−40	250	20	100	60	18	8.0
2N4858	TO-18	60	−0.8	−4.0	−250	−40	250	8	80	120	18	8.0
2N4859	TO-18	25	−4.0	−10.0	−250	−30	250	50		34	18	8.0
2N4860	TO-18	40	−2.0	−6.0	−250	−30	250	20	100	60	18	8.0
2N4861	TO-18	60	−0.8	−4.0	−250	−30	250	8	80	120	18	8.0
2N5432	TO-52	5	−4.0	−10.0	−200	−25	200	150		41	30	15.0
2N5433	TO-52	7	−3.0	−9.0	−200	−25	200	100		41	30	15.0
2N5434	TO-52	10	−1.0	−4.0	−200	−25	200	30		41	30	15.0
2N5638	TO-92	30		−12.0	−1nA	−30	1nA	50		24	10	4.0
2N5639	TO-92	60		−8.0	−1nA	−30	1nA	25		44	10	4.0
2N5640	TO-92	100		−6.0	−1nA	−30	1nA	5		63	10	4.0
ITE4091	TO-92	30	−5.0	−10.0	−200	−40	200	30		65	16	5.0
ITE4092	TO-92	50	−2.0	−7.0	−200	−40	200	15		95	16	5.0
ITE4093	TO-92	80	−1.0	−5.0	−200	−40	200	8		140	16	5.0
ITE4391	TO-92	30	−4.0	−10.0	−100	−40	100	50	150	55	14	3.5
ITE4392	TO-92	60	−2.0	−5.0	−100	−40	100	25	75	75	14	3.5
ITE4393	TO-92	100	−0.5	−3.0	−100	−40	100	5	30	100	14	3.5
J105	TO-92	3	−4.5	−10.0	−3nA	−25	3nA	500	—	60	(70)	(3.5)
J106	TO-92	6	−2.0	−6.0	−3nA	−25	3nA	200	—	60	(70)	(3.5)
J107	TO-92	8	−0.5	−4.5	−3nA	−25	3nA	100	—	60	(70)	(3.5)
J111	TO-92	30	−3.0	−10.0	−1nA	−35	1nA	20		48	(16)	(5.0)
J112	TO-92	50	−1.0	−5.0	−1nA	−35	1nA	5		48	(16)	(5.0)
J113	TO-92	100	−0.5	−3.0	−1nA	−35	1nA	2		48	(16)	(5.0)
P-channel:												
2N3993	TO-72	150	4.0	9.5	1.2nA	25	1.2nA	−10.0			16	4.5
2N3994	TO-72	300	1.0	5.5	1.2nA	25	1.2nA	−2.0			16	4.5
2N5114	TO-18	75	5.0	10.0	500	30	500	−30.0	−90	37	25	7.0
2N5115	TO-18	100	3.0	6.0	500	30	500	−15.0	−60	68	25	7.0
2N5116	TO-18	150	1.0	4.0	500	30	500	−5.0	−25	102	25	7.0
IT100	TO-18	75	2.0	4.5	200	35	100	−10.0			35	12.0
IT101	TO-18	60	4.0	10.0	200	35	100	−20.0			35	12.0
J174	TO-92	85	5.0	10.0	1nA	30	−1nA	−20.0	−100	22	(25)	(8.0)
J175	TO-92	125	3.0	6.0	1nA	30	−1nA	−7.0	−60	45	(25)	(8.0)
J176	TO-92	250	1.0	4.0	1nA	30	−1nA	−2.0	−25	70	(25)	(8.0)
J177	TO-92	300	0.8	2.25	1nA	30	−1nA	−1.5	−20	90	(25)	(8.0)
J270	TO-92	—	0.5	2.0	200	30	—	−2.0	−15	—	32 typ.	4.0 typ.
J271	TO-92	—	1.5	4.5	200	30	—	−6.0	−50	—	32 typ.	4.0 typ.
P1086	TO-92	75	—	10.0	2nA	30	−10nA	−10.0	—	100	45	10.0
P1087	TO-92	150	—	5.0	2nA	30	−10nA	−5.0	—	215	45	10.0

( ) Approximate Value

Switches and Amplifiers — MOSFET

Ordering Information Preferred Part Number	Package	$V_{GS(TH)}$ $V_{GS(OFF)}$ min/max V		BV_{GSS} min V	I_{DSS} max pA	I_{GSS} max pA	G_{fs} min µmho	$r_{DS(ON)}$ max Ω	I_D $I_{D(ON)}$ min/max mA	
P-Channel Enhancement: Gen. used where max isolation between signal source and logic drive required; sw. "On" resistance varies with signal amplitude.										
3N161	TO-72	−1.5	−5.0	−25	−10nA	−100.0	3500.0	(125)	−40	−120 Diode Protected
3N163	TO-72	−2.0	−5.0	−40	−200	−10.0	2000.0	250	− 5	− 30
3N164	TO-72	−2.0	−5.0	−30	−400	−10.0	2000.0	300	− 3	− 30
3N172	TO-72	−2.0	−5.0	−40	−400	−200.0	(2000.0)	250	− 5	− 30 Diode Protected
3N173	TO-72	−2.0	−5.0	−30	−10nA	−500.0	(1000.0)	350	− 5	− 30 Diode Protected
IT1700	TO-72	−2.0	−5.0	−40	−200	−10.0	2000.0	400	− 2	—
N-Channel Enhancement: Can switch positive signals directly from TTL logic; gen. requires driver or translator circuit to switch bipolar signals.										
2N4351	TO-72	1.0	5.0	25	10nA	10.0	1000.0	300	3	
3N170	TO-72	1.0	2.0	25	10nA	10.0	1000.0	200	10	
3N171	TO-72	1.5	3.0	25	10nA	10.0	1000.0	200	10	
IT1750	TO-72	0.5	3.0	25	10nA	10.0	3000.0	50	10	100
M116	TO-72	1.0	5.0	30	(10nA)	100.0	(1000.0)	100	—	Diode Protected

Amplifiers — N-Channel Junction FET

Ordering Information Preferred Part Number	Package	g_{fs} min µmho	I_{DSS} min/max mA		V_P min/max V		I_{GSS} max pA	BV_{GSS} min V	C_{iss} max pF	C_{rss} max pF	e_n max nv/√Hz
2N3684	TO-72	2000	2.5	7.5	−2.0	−5.0	−100	−50	4	1.2	140 @ 100Hz
2N3685	TO-72	1500	1.0	3.0	−1.0	−3.5	−100	−50	4	1.2	140 @ 100Hz
2N3686	TO-72	1000	0.4	1.2	−0.6	−2.0	−100	−50	4	1.2	140 @ 100Hz
2N3687	TO-72	500	0.1	0.5	−0.3	−1.2	−100	−50	4	1.2	140 @ 100Hz
2N3821	TO-72	1500	0.5	2.5		−4.0	−100	−50	6	3.0	200 @ 10Hz
2N3822	TO-72	3000	2.0	10.0		−6.0	−100	−50	6	3.0	200 @ 10Hz
2N3823	TO-72	3500	4.0	20.0		−8.0	−500	−30	6	2.0	—
2N3824	TO-72	—	—	—		(−8.0)	−100	−50	6	3.0	—
2N4117	TO-72	70	0.03	0.09	−0.6	−1.8	−10	−40	3	1.5	—
2N4117A	TO-72	70	0.03	0.09	−0.6	−1.8	−1	−40	3	1.5	—
2N4118	TO-72	80	0.08	0.24	−1.0	−3.0	−10	−40	3	1.5	—
2N4118A	TO-72	80	0.08	0.24	−1.0	−3.0	−1	−40	3	1.5	—
2N4119	TO-72	100	0.2	0.6	−2.0	−6.0	−10	−40	3	1.5	—
2N4119A	TO-72	100	0.2	0.6	−2.0	−6.0	−1	−40	3	1.5	—
2N4220	TO-72	1000	0.5	0.3		−4.0	−100	−30	6	2.0	—
2N4221	TO-72	2000	2.0	6.0		−6.0	−100	−30	6	2.0	—
2N4222	TO-72	2500	5.0	15.0		−8.0	−100	−30	6	2.0	—
2N4223	TO-72	3000	3.0	18.0	−0.1	−8.0	−250	−30	6	2.0	—
2N4224	TO-72	2000	2.0	20.0	−0.1	−8.0	−500	−30	6	2.0	—
2N4338	TO-18	600	0.2	0.6	−0.3	−1.0	−100	−50	7	3.0	65 @ 1kHz
2N4339	TO-18	800	0.5	1.5	−0.6	−1.8	−100	−50	7	3.0	65 @ 1kHz
2N4340	TO-18	1300	1.2	3.6	−1.0	−3.0	−100	−50	7	3.0	65 @ 1kHz
2N4341	TO-18	2000	3.0	9.0	−2.0	−6.0	−100	−50	7	3.0	65 @ 1kHz
2N4416	TO-72	4500	5.0	15.0		−6.0	−100	−30	4	2.0	—
2N4867	TO-72	700	0.4	1.2	−0.7	−2.0	−250	−40	25	5.0	10 @ 1kHz
2N4867A	TO-72	700	0.4	1.2	−0.7	−2.0	−250	−40	25	5.0	5 @ 1kHz
2N4868	TO-72	1000	1.0	3.0	−1.0	−3.0	−250	−40	25	5.0	10 @ 1kHz
2N4868A	TO-72	1000	1.0	3.0	−1.0	−3.0	−250	−40	25	5.0	5 @ 1kHz
2N4869	TO-72	1300	2.5	7.5	−1.8	−5.0	−250	−40	25	5.0	10 @ 1kHz
2N4869A	TO-72	1300	2.5	7.5	−1.8	−5.0	−250	−40	25	5.0	5 @ 1kHz
2N5397	TO-72	6000	10.0	30.0	−1.0	−6.0	−100	−25	5	1.2	3.5dB @ 450MHz
2N5398	TO-72	5500	5.0	40.0	−1.0	−6.0	−100	−25	5.5	1.3	—
2N5457	TO-92	1000	1.0	5.0	−0.1	−6.0	−1nA	−25	7	3.0	—
2N5458	TO-92	1500	2.0	9.0	−1.0	−7.0	−1nA	−25	7	3.0	—
2N5459	TO-92	2000	4.0	16.0	−2.0	−8.0	−1nA	−25	7	3.0	—

Amplifiers — N-Channel Junction FET (continued)

Ordering Information Preferred Part Number	Package	g_{fs} min μmho	I_{DSS} min/max mA		V_P min/max V		I_{GSS} max pA	BV_{GSS} min V	C_{iss} max pF	C_{rss} max pF	e_n max nv/√Hz
2N5484	TO-92	3000	1.0	5.0	−0.3	−3.0	−1nA	−25	5	1.0	120 @ 1kHz
2N5485	TO-92	3500	4.0	10.0	−0.5	−4.0	−1nA	−25	5	1.0	120 @ 1kHz
2N5486	TO-92	4000	8.0	20.0	−2.0	−6.0	−1nA	−25	5	1.0	120 @ 1kHz
ITE4416	TO-92	4500	5.0	15.0		−6.0	−100	−30	4	2.0	—
J201	TO-92	500	0.2	1.0	−0.3	−1.5	−100	−40	4	1.0	5 @ 1kHz
J202	TO-92	1000	0.9	4.5	−0.8	−4.0	−100	−40	4	1.0	5 @ 1kHz
J203	TO-92	1500	4.0	20.0	−2.0	−10.0	−100	−40	4	1.0	5 @ 1kHz
J204	TO-92	1500	1.2	typ.	−0.5	−2.0	−100	−25	4	1.0	10 @ 1kHz
J308	TO-92	8000	12.0	60.0	−1.0	−6.5	−1nA	−25	(8)	(5.0)	—
J309	TO-92	10,000	12.0	30.0	−1.0	−4.0	−1nA	−25	(8)	(5.0)	—
J310	TO-92	8000	24.0	60.0	−2.0	−6.5	−1nA	−25	(8)	(5.0)	—
U308	TO-52	10,000	12.0	60.0	−1.0	−6.0	−150	−25	7 typ.	4.0 typ.	10 @ 100Hz typ.
U309	TO-52	10,000	12.0	30.0	−1.0	−4.0	−150	−25	7 typ.	4.0 typ.	10 @ 100Hz typ.
U310	TO-52	10,000	24.0	60.0	−2.5	−6.0	−150	−25	7 typ.	4.0 typ.	10 @ 100Hz typ.

Amplifiers — P-Channel Junction FET

Ordering Information Preferred Part Number	Package	g_{fs} min μmho	I_{DSS} min/max mA		V_P min/max V		I_{GSS} max nA	BV_{GSS} min V	C_{iss} max pF	C_{rss} max pF	e_n max nv/√Hz
2N2607	TO-18	330	−0.3	−1.5	1.0	4.0	3	30	10	—	400 @ 1kHz
2N2608	TO-18	1000	−0.9	−4.5	1.0	4.0	10	30	17	—	140 @ 1kHz
2N2609	TO-18	2500	−2.0	−10.0	1.0	4.0	30	30	30	—	140 @ 1kHz
2N5460	TO-92	1000	−1.0	−5.0	0.75	6.0	5	40	7	2	115 @ 100Hz
2N5461	TO-92	1500	−2.0	−9.0	1.0	7.5	5	40	7	2	115 @ 100Hz
2N5462	TO-92	2000	−4.0	−16.0	1.8	9.0	5	40	7	2	115 @ 100Hz
2N5463	TO-92	1000	−1.0	−5.0	0.75	6.0	5	60	7	2	115 @ 100Hz
2N5464	TO-92	1500	−2.0	−9.0	1.0	7.5	5	60	7	2	115 @ 100Hz
2N5465	TO-92	2000	−4.0	−16.0	1.8	9.0	5	60	7	2	115 @ 100Hz
U304	TO-18	—	−30.0	−90.0	5.0	10.0	.5	30	27	7	—
J305	TO-18	—	−15.0	−60.0	3.0	6.0	.5	30	27	7	—
U306	TO-18	—	−5.0	−25.0	1.0	4.0	.5	30	27	7	—

Differential Amplifiers — Dual Monolithic N-Channel Junction FET

Preferred Part Number	Package	V_{GS1-2} max mV	ΔV_{GS} max µV/°C	I_G max pA	BV_{GSS} min V	V_P min/max V		g_{fs} min/max µmho		I_{DSS} min/max mA		e_n max nV/√Hz
2N3921	TO-71	5	10	−250	−50	—	−3.0	1500	7500	1.0	10.0	—
2N3922	TO-71	5	25	−250	−50	—	−3.0	1500	7500	1.0	10.0	—
2N3954	TO-71	5	10	−50	−50	−1.0	−4.5	1000	3000	0.5	5.0	160 @ 100Hz
2N3954A	TO-71	5	5	−50	−50	−1.0	−4.5	1000	3000	0.5	5.0	160 @ 100Hz
2N3955	TO-71	10	25	−50	−50	−1.0	−4.5	1000	3000	0.5	5.0	160 @ 100Hz
2N3955A	TO-71	15	15	−50	−50	−1.0	−4.5	1000	3000	0.5	5.0	160 @ 100Hz
2N3956	TO-71	15	50	−50	−50	−1.0	−4.5	1000	3000	0.5	5.0	160 @ 100Hz
2N3957	TO-71	20	75	−50	−50	−1.0	−4.5	1000	3000	0.5	5.0	160 @ 100Hz
2N3958	TO-71	25	100	−50	−50	−1.0	−4.5	1000	3000	0.5	5.0	160 @ 100Hz
2N5196	TO-71	5	5	−15	−50	−0.7	−4.0	700 @ 200µA		0.7	7.0	20 @ 1kHz
2N5197	TO-71	5	10	−15	−50	−0.7	−4.0	700 @ 200µA		0.7	7.0	20 @ 1kHz
2N5198	TO-71	10	20	−15	−50	−0.7	−4.0	700 @ 200µA		0.7	7.0	20 @ 1kHz
2N5199	TO-71	15	40	−15	−50	−0.7	−4.0	700 @ 200µA		0.7	7.0	20 @ 1kHz
2N5452	TO-71	5	5	IGSS−100	−50	−1.0	−4.5	1000	4000	0.5	5.0	20 @ 1kHz
2N5453	TO-71	10	10	IGSS−100	−50	−1.0	−4.5	1000	4000	0.5	5.0	20 @ 1kHz
2N5454	TO-71	15	25	IGSS−100	−50	−1.0	−4.5	1000	4000	0.5	5.0	20 @ 1kHz
2N5515	TO-71	5	5	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	30 @ 10Hz
2N5516	TO-71	5	10	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	30 @ 10Hz
2N5517	TO-71	10	20	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	30 @ 10Hz
2N5518	TO-71	15	40	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	30 @ 10Hz
2N5519	TO-71	15	80	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	30 @ 10Hz
2N5520	TO-71	5	5	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	15 @ 10Hz
2N5521	TO-71	5	10	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	15 @ 10Hz
2N5522	TO-71	10	20	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	15 @ 10Hz
2N5523	TO-71	15	40	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	15 @ 10Hz
2N5524	TO-71	15	80	−100	−40	−0.7	−4.0	1000	4000	0.5	7.5	15 @ 10Hz
2N5902	TO-99	5	5	−3	−40	−0.6	−4.5	70	250	0.3	0.5	200 @ 1kHz
2N5903	TO-99	5	10	−3	−40	−0.6	−4.5	70	250	0.03	.05	200 @ 1kHz
2N5904	TO-99	10	20	−3	−40	−0.6	−4.5	70	250	0.03	.05	200 @ 1kHz
2N5905	TO-99	15	40	−3	−40	−0.6	−4.5	70	250	0.03	.05	200 @ 1kHz
2N5906	TO-99	5	5	−1	−40	−0.6	−4.5	70	250	0.03	.05	100 @ 1kHz
2N5907	TO-99	5	10	−1	−40	−0.6	−4.5	70	250	0.03	.05	100 @ 1kHz
2N5908	TO-99	10	20	−1	−40	−0.6	−4.5	70	250	0.03	.05	100 @ 1kHz
2N5909	TO-99	15	40	−1	−40	−0.6	−4.5	70	250	0.03	.05	100 @ 1kHz
2N5911	TO-99	10	20	−100	−25	−1.0	−5.0	5/10 @ 5 mA		7.0	40.0	20 @ 10kHz
2N5912	TO-99	15	40	−100	−25	−1.0	−5.0	5/10 @ 5 mA		7.0	40.0	20 @ 10kHz
2N6483	TO-71	5	5	−100	−50	−0.7	−4.0	1000	4000	0.5	7.5	10 @ 10Hz
2N6484	TO-71	10	10	−100	−50	−0.7	−4.0	1000	4000	0.5	7.5	10 @ 10Hz
2N6485	TO-71	15	25	−100	−50	−0.7	−4.0	1000	4000	0.5	7.5	10 @ 10Hz
IMF6485	TO-71	25	40	−100	−50	−0.7	−4.0	1000	4000	0.5	7.5	15 @ 10Hz
IT500	TO-52	5	5	−5	−50	−0.7	−4.0	700	1600	0.7	7.0	35 @ 10Hz
IT501	TO-52	5	10	−5	−50	−0.7	−4.0	700	1600	0.7	7.0	35 @ 10Hz
IT502	TO-52	10	20	−5	−50	−0.7	−4.0	700	1600	0.7	7.0	35 @ 10Hz
IT503	TO-52	15	40	−5	−50	−0.7	−4.0	700	1600	0.7	7.0	35 @ 10Hz
IT504	TO-52	25	100	−5	−50	−0.7	−4.0	700	1600	0.7	7.0	35 @ 10Hz
IT505	TO-52	50	200	−5	−50	−0.7	−4.0	700	1600	0.7	7.0	35 @ 10Hz
IT5911	TO-71	10	20	−100	−25	−1.0	−5.0	5/10 @ 5 mA		7.0	40.0	20 @ 10kHz
IT5912	TO-71	15	40	−100	−25	−1.0	−5.0	5/10 @ 5 mA		7.0	40.0	20 @ 10kHz
U257	TO-99	100	—	IGSS−100	−25	−1.0	−5.0	5000	10000	5.0	40.0	30 @ 10kHz
U401	TO-71	5	10	−15	−50	−0.5	−2.5	2000	7000	0.5	10.0	20 @ 10Hz
U402	TO-71	10	10	−15	−50	−0.5	−2.5	2000	7000	0.5	10.0	20 @ 10Hz
U403	TO-71	10	25	−15	−50	−0.5	−2.5	2000	7000	0.5	10.0	20 @ 10Hz
U404	TO-71	15	25	−15	−50	−0.5	−2.5	2000	7000	0.5	10.0	20 @ 10Hz
U405	TO-71	20	40	−15	−50	−0.5	−2.5	2000	7000	0.5	10.0	20 @ 10Hz
U406	TO-71	40	80	−15	−50	−0.5	−2.5	2000	7000	0.5	10.0	20 @ 10Hz
U421	TO-99	10	10	0.1	−60	−0.4	−2.0	300	800	60-1000µA		20 @ 10Hz
U422	TO-99	15	25	0.1	−60	−0.4	−2.0	300	800	60-1000µA		20 @ 10Hz
U423	TO-99	25	40	0.1	−60	−0.4	−2.0	300	800	60-1000µA		20 @ 10Hz
U424	TO-99	10	10	0.5	−60	−0.4	−3.0	300	1000	60-1000µA		20 @ 10Hz
U425	TO-99	15	25	0.5	−60	−0.4	−3.0	300	1000	60-1000µA		20 @ 10Hz
U426	TO-99	25	40	0.5	−60	−0.4	−3.0	300	1000	60-1000µA		20 @ 10Hz

Differential Amplifiers — Dual Monolithic P-Channel MOSFETS (Enhancement)

Ordering Information Preferred Part Number	Package	$V_{GS(TH)}$ min/max V		BV_{DSS} min/max V	I_{DSS} max pA	I_{GSS} max pA	G_{fs} min μmho	$I_{DS(ON)}$ min/max mA		$r_{DS(ON)}$ max Ω	$V_{OS\ 1-2}$ max mV	
3N165	TO-99	−2	−5	−40	−200	−10	1500	−5.0	−30	300	100	
3N166	TO-99	−2	−5	−40	−200	−10	1500	−5.0	−30	300		
3N188	TO-99	−2	−5	−40	−200	−200	1500	−5.0	−30	300	100	Zener Protected
3N189	TO-99	−2	−5	−40	−200	−200	1500	−5.0	−30	300		Zener Protected
3N190	TO-99	−2	−5	−40	−200	−200	1500	−5.0	−30	300	100	Zener Protected
3N191	TO-99	−2	−5	−40	−200	−200	1500	−5.0	−30	300		

Differential Amplifiers — Dual NPN Bipolar Transistors

Ordering Information Preferred Part Number	Package	$V_{BE\ 1-2}$ mV max	ΔV_{BE} μV/°C max	h_{FE} @ $I_C = 10\mu A$ $V_{CE} = 5V$ min	$I_{B\ 1-2}$ @ $I_C = 10\mu A$ $V_{CE} = 5V$ nA max	BV_{CEO} V min	I_{CBO} nA max	Noise dB max	f_t MHz@I_C min	C_{obo} pF max	Structure
2N4044	TO-78	3	3	200	5	60	.1	2	200 @ 1mA	0.8	Dielec. Isol.
2N4045	TO-78	5	10	80	25	45	.1	3	150 @ 1mA	0.8	Dielec. Isol.
2N4100	TO-78	5	5	150	10	55	.1	3	150 @ 1mA	0.8	Dielec. Isol.
2N4878	TO-71	3	3	200	5	60	.1	2	200 @ 1mA	0.8	Dielec. Isol.
2N4879	TO-71	5	5	150	10	55	.1	3	150 @ 1mA	0.8	Dielec. Isol.
2N4880	TO-71	5	10	80	25	45	.1	3	150 @ 1mA	0.8	Dielec. Isol.
IT120	TO-78 TO-71	2	5	200	5	45	1	2 typ.	220 @ 1mA	2	Junc. Isol.
IT120A	TO-78 TO-71	1	3	200	2.5	45	1	2 typ.	220 @ 1mA	2	Junc. Isol.
IT121	TO-78 TO-71	3	10	80	25	45	1	2 typ.	180 @ 1mA	2	Junc. Isol.
IT122	TO-78 TO-71	5	20	80	25	45	1	2 typ.	180 @ 1mA	2	Junc. Isol.
IT124	TO-78	5	15	1500	0.6 @ $V_{CE} = 1V$	2	.1	3	100 @ 100μA	0.8	Junc. Isol.
IT126	TO-78 TO-71	1	3	200	2.5	60	.1	1 typ.	250 @ 10mA	4	Dielec. Isol.
IT127	TO-78 TO-71	2	5	200	5	60	.1	1 typ.	250 @ 10mA	4	Dielec. Isol.
IT128	TO-78 TO-71	3	10	150	10	45	.1	1 typ.	200 @ 10mA	4	Dielec. Isol.
IT129	TO-78 TO-71	5	20	100	20	45	.1	1 typ.	150 @ 10mA	4	Dielec. Isol.

Differential Amplifiers — Dual PNP Bipolar Transistors

Ordering Information

Preferred Part Number	Package	V_{BE} 1-2 mV max	ΔV_{BE} µV/°C max	h_{FE} @ I_C=10µA V_{CE}=5V min	I_C=10µA V_{CE}=5V nA max	BV_{CEO} V min	I_{CBO} nA max	Noise dB max	f_t MHz@I_C min	C_{obo} pF max	Structure
2N5117	TO-78	3	3	100	10	45	.1	4	100 @0.5mA	.8	Dielec. Isol.
2N5118	TO-78	5	5	100	15	45	.1	4	100 @0.5mA	.8	Dielec. Isol.
2N5119	TO--78	5	10	50	40	45	.1	4	100 @0.5mA	.8	Dielec. Isol.
IT130	TO-78 TO-71	2	5	200	5	−45	1	2 typ.	110 @1mA	2	Junc. Isol.
IT130A	TO-78 TO-71	1	3	200	2.5	−60	1	2 typ.	110 @1mA	2	Junc. Isol.
IT131	TO-78 TO-71	5	10	80	10	−45	1	2 typ.	90 @1mA	2	Junc. Isol.
IT132	TO-78 TO-71	10	20	80	25	−45	1	2 typ.	90 @1mA	2	Junc. Isol.
IT136	TO-78 TO-71	1	3	150	2.5	−60	.1	2 typ.	150 @10mA	4	Dielec. Isol.
IT137	TO-78 TO-71	2	5	150	5	−60	.1	2 typ.	150 @10mA	4	Dielec. Isol.
IT138	TO-78 TO-71	3	10	120	10	−55	.1	2 typ.	180 @10mA		Dielec. Isol.
IT139	TO-78 TO-71	5	20	70	20	−45	.1	2 typ.	100 @10mA	4	Dielec. Isol.

Specialty Items

ID-100
ID-101 — This product is a diode combination used to protect those P-channel MOSFET duals which are not diode protected. Their chief characteristic is <1 pA leakage when voltage across them is less than 5 mV. If voltage across diodes is adjusted to 0V ±0.1mV, leakage is less than 0.01 pA.

VCR2N
VCR3P
VCR4N
VCR5P
VCR7N
VCR11N (Dual) — The VCR family consists of three terminal variable resistors where the resistance value between two of the terminals is controlled by the voltage potential applied to the third.

Note: Intersil offers the following military qualified devices:*

N-channel switches	N-channel amplifiers	P-channel switches	P-channel amplifiers
2N4091 JAN, JANTX, JANTXV	2N3821 JAN, JANTX, JANTXV	2N5114 JAN, JANTX, JANTXV	2N2609 JAN
2N4092 JAN, JANTX, JANTXV	2N3823 JAN, JANTX, JANTXV	2N5115 JAN, JANTX, JANTXV	
2N4093 JAN, JANTX, JANTXV		2N5116 JAN, JANTX, JANTXV	
2N4856 JAN, JANTX, JANTXV			
2N4857 JAN, JANTX, JANTXV			
2N4858 JAN, JANTX, JANTXV			

*JAN processing consists of a sample Group B pulled from the production run.
JANTX processing consists of JAN processing plus 100% electrical read and record, and 100% burn-in.
JANTVX processing consists of JANTX processing plus 100% pre-cap visual and on-shore assembly.

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DISCRETE SELECTOR GUIDE

	Detailed Application	Important Parameters	Recommended Part Numbers							
			Single N-Channel JFET	Single P-Channel JFET	Dual N-Channel JFET	Single N-Channel MOSFET	Single P-Channel MOSFET	Dual P-Channel MOSFET	Dual NPN Bipolar	Dual PNP Bipolar
Amplifiers	Audio	low noise	2N4220, 2N3821	2N2607 2N5460	2N3958 IT505	2N4351 3N170-1	3N163 3N164		2N4044 2N4878	IT130
	Buffer	low leakage, high gain	2N4221	2N2609 2N5462	2N5905 IT505	M116 IT1750	3N172 IT1700		IT120	IT136
	Differential	good matching & drift	—	—	2N3954 U401	—	—	3N165	IT126	2N3810
	Fet Input Op Amp		—	—	2N5515	—	—		—	—
	High Impedance	low leakage	2N4117A	IT100 J176 2N5116	2N5905 IT505 U426	IT1750	IT1700		—	—
	High Frequency	high gain, low capacitance	U308 2N5397	2N5114 J176	2N5912 IT5912	2N4351	3N163 3N164	3N188	2N4044 2N4878 IT120	IT130 IT136
	Low Supply Voltage	low pinch-off voltage	2N4338 2N3687	2N5265 J177	U406 2N3958	3N170-1			IT126 IT140	2N3810
	Low Noise	low noise	2N4867A	2N5116 J176	2N5519 2N5199	M116	3N172		2N4044	IT130
	Preamplifier	high gain	2N5397 U310	2N5116 J176	IT550 U406				2N4044 2N4878 IT120	IT130 IT136
	Video	high gain, low capacitance	2N4393 ITE4393	IT100	IT5912 2N5912				IT126	2N3810
Mixers	VHF	RF parameters, high g_{fs}/C_{iss}	U310 2N5397	IT100 J174	2N6485	—	—	—	—	—
	UHF		J310 2N5484	2N5114	IT5912 2N5912					
Switches	Commutators	low C_{rss}	2N4391 ITE4391	2N3993-4 IT100-1 2N5114-6	IT550	IT1750	IT1700 3N163	3N165	—	—
	Sample and Hold									
	Analog Gates	fast switching, low $r_{DS(on)}$	2N4091-3 2N4391-3	2N5114-6	2N5912					
	Digital		ITE4391-3 2N5432-4	J174-7 IT100-1	IT5912	3N170-1	3N164 3N172	3N188		
	Chopper									
	Integrator Reset	low $r_{DS(on)}$, high I_{DSS}	J111-3 J105-7							
Voltage Control Resistors	Gain Control Amplitude Stability Attenuators	high $V_{GS(off)}$	VCR2N VCR4N VCR7N	VCR3P	VCR11N	—	—	—	—	—
Protection Diodes	Signal Clipping and Clamping	low leakage current	—	—	—	—	—	—	ID100-1	IT139

2N2607-2N2609
2N2609 JAN
P-Channel JFET

1

APPLICATIONS

- Low-level Choppers
- Data Switches
- Commutators

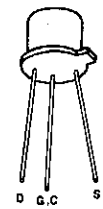
ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise noted)

Gate-Source Voltage	30 V
Gate-Drain Voltage	30 V
Gate Current	50 mA
Storage Temperature Range	-65° C to +200° C
Operating Temperature Range	-55° C to +150° C
Lead Temperature (Soldering, 10 sec)	+300° C
Power Dissipation	300 mW
Derate above 25° C	2 mW/° C

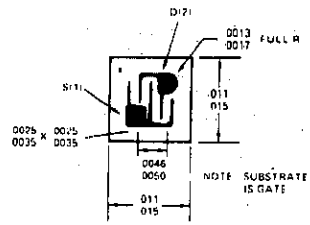
PIN CONFIGURATION

TO-18

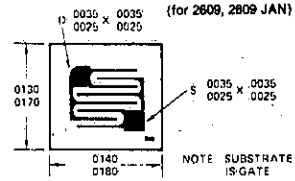


CHIP TOPOGRAPHY

5510 (for 2N2607, 8)



5503 (for 2609, 2809 JAN)



ORDERING INFORMATION*

TO-18	WAFER	DICE
2N2607	2N2607/W	2N2607/D
2N2608	2N2608/W	2N2608/D
2N2609	2N2609/W	2N2609/D
2N2609 JAN	—	—

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (@ 25°C unless otherwise noted)

PARAMETER		2N2607		2N2608		2N2609		Unit	Test Conditions	
		Min	Max	Min	Max	Min	Max			
I_{GSSR}	Gate Reverse Current		3		10		30	nA	V_{GS} = 30 V, V_{DS} = 0	
			3		10		30	μA	V_{GS} = 5 V, V_{DS} = 0, T_A = 150° C	
BV_{GSS}	Gate-Drain Breakdown Voltage	30		30		30		V	I_G = 1 μA, V_{DS} = 0	
V_P	Gate-Source Pinch-Off Voltage	1	4	1	4	1	4	V	V_{DS} = -5 V, I_D = -1 μA	
I_{DSS}	Drain Current at Zero Gate Voltage	-0.30	-1.50	-0.90	-4.50	-2	-10	mA	V_{DS} = -5 V, V_{GS} = 0	
g_{fs}	Small-Signal Common-Source Forward Transconductance	330		1000		2500		μmho	V_{DS} = -5 V, V_{GS} = 0, f = 1 kHz	
C_{iss}	Common-Source Input Capacitance		10		17		30	pF	V_{DS} = -5 V, V_{GS} = 1 V, f = 140 kHz	
NF	Noise Figure		3					dB	V_{DS} = -5 V, V_{GS} = 0, f = 1 kHz	R_G = 10 MΩ
					3		3			R_G = 1 MΩ

2N3684-2N3687
N-Channel JFET

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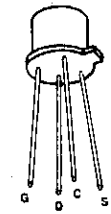
FEATURES
- **Low Noise**
- **High Input Impedance**
- **Low Capacitance**

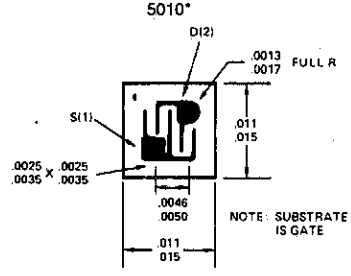
APPLICATIONS
- Low Level Choppers
- Data Switches
- Multiplexers
- Low Noise Amplifiers

PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY



*DICE WITH 4 MIL BONDING PADS AVAILABLE. CONSULT FACTORY FOR DETAILS.

ORDERING INFORMATION*

TO-72	WAFER	DICE
2N3684	2N3684/W	2N3684/D
2N3685	2N3685/W	2N3685/D
2N3686	2N3686/W	2N3686/D
2N3687	2N3687/W	2N3687/D

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage ..... -50V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 300 mW
Derate above 25°C ..... 1.7 mW/°C

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N3684		2N3685		2N3686		2N3687		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
BV_{GSS}	Gate to Source Breakdown Voltage	-50		-50		-50		-50		V	V_{DS} = 0, I_G = 1.0 μA
V_P	Pinch-Off Voltage	2.0	5.0	1.0	3.5	0.6	2.0	0.3	1.2		V_{DS} = 20 V, I_D = 0.001 μA
I_{GSS}	Total Gate Leakage Current		-0.1		-0.1		-0.1		-0.1	nA	V_{GS} = -30 V, V_{DS} = 0
	T_A = 150°C		-0.5		-0.5		-0.5		-0.5	μA	
I_{DSS}	Saturation Current, Drain-to-Source	2.5	7.5	1.0	3.0	0.4	1.2	0.1	0.5	mA	V_{GS} = 0, V_{DS} = 20 V
$\|Y_{fs}\|$	Forward Transadmittance	2000	3000	1500	2500	1000	2000	500	1500	μmhos	
G_{os}	Common Source Output Conductance		50		25		10		5	μmhos	V_{DS} = 20 V, V_{GS} = 0, f = 1 kHz
C_{iss}	Common Source Input Capacitance		4.0		4.0		4.0		4.0	pF	
C_{rss}	Common Source Short Circuit Reverse Transfer Capacitance		1.2		1.2		1.2		1.2	pF	
$r_{DS(on)}$	On Resistance		600		800		1200		2400	Ohms	V_{DS} = 0, V_{GS} = 0
NF	Noise Figure		0.5		0.5		0.5		0.5	dB	f = 100 Hz, R_G = 10 MΩ NBW = 6 Hz, V_{DS} = 10V V_{GS} = 0V

2N3810/A, 2N3811/A Monolithic Dual Matched PNP Transistor

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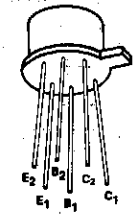
ABSOLUTE MAXIMUM RATINGS
(T_A = 25° C unless otherwise noted)

Emitter-Base Voltage (Note 1) ..... -5V
Collector-Base or Collector-Emitter Voltage (Note 1) ... -60V
Collector Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	500 mW	600 mW
Derate above 25°C	2.9 mW/°C	3.4 mW/°C

PIN CONFIGURATION
TO-78



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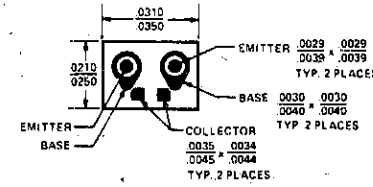
CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-78	WAFER	DICE
2N3810	2N3810/W	2N3810/D
2N3810A		
2N3811	2N3811/W	2N3811/D
2N3811A		

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25°C Ambient Temperature unless otherwise noted

SYMBOL	PARAMETER	2N3810/A MIN	2N3810/A MAX	2N3811/A MIN	2N3811/A MAX	UNITS	TEST CONDITIONS	
BV_{CBO}	Collector-Base Breakdown Voltage	-60		-60		V	I_C = -10 μA, I_E = 0	
BV_{CEO}	Collector-Emitter Breakdown Voltage (Note 2	-60		-60		V	I_C = -10 mA, I_B = 0	
BV_{EBO}	Emitter-Base Breakdown Voltage	-5		-5		V	I_E = -10 μA, I_C = 0	
$I_{C(off)}$	Collector Cutoff Current		-10		-10	nA	V_{CB} = -50V, I_E = 0	
	T_A=+150°C		-10		-10	μA		
$I_{E(off)}$	Emitter Cutoff Current		-20		-20	nA	V_{BE} = 4V, I_C = 0	
h_{FE}	Static Forward Current Transfer Ratio (Note 2)	100		225			V_{CE} = -5V	I_C = -10μA
		150	450	300	900			I_C = -100μA to -1 mA
		125		250				I_C = 10 mA
	T_A = -55°C	75		150				I_C = 100 μA
$V_{BE(sat)}$	Base-Emitter Saturation Voltage (Note 2)		-0.7		-0.7	V	V_{CE} = -5V,	I_B = -10μA
			-0.8		-0.8		I_C = -100 μA	I_B = -100 μA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage (Note 2		-0.2		-0.2	V	I_B = -10 μA, I_C = -100 μA	
			-0.25		-0.25		I_B = -100 μA, I_C = -1 mA	
h_{ie}	Input Impedance	3	30	10	40	kΩ	V_{CE} = -10V, I_C = -1 mA, f = 1 KHz	
h_{fe}	Forward Current Transfer Ratio	150	600	300	900			
h_{re}	Reverse Voltage Transfer Ratio		0.25		0.25			
h_{oe}	Output Admittance	5	60	5	60	μmho		
$\|h_{fe}\|$	Magnitude of small signal current gain	1	5	1	5		V_{CE} = -5V	I_C = -1mA, f = 100 MHz
		1		1				I_C = -500 μA, f = 30 MHz

NOTES:
1. Per transistor.
2. Pulse witdth ≤ 300 μs, duty cycle ≤ 2.0%.

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ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25°C Ambient Temperature unless otherwise noted

SYMBOL	PARAMETER		2N3810/A MIN	2N3810/A MAX	2N3811/A MIN	2N3811/A MAX	UNITS	TEST CONDITIONS
C_{obo}	Output Capacitance			4		4	pF	V_{CB} = -5V, I_E = 0, f = 100 MHz
C_{ibo}	Input Capacitance			8		8		V_{CB} = -0.5V, I_C = 0, f = 100 KHz
h_{FE_1}/h_{FE_2}	DC Current Gain Ratio		0.9	1.0	0.9	1.0		V_{CE} = -5V, I_C = 100 μA
		A devices	0.95	1.0	0.95	1.0		
$\lvert V_{BE_1}-V_{BE_2}\rvert$	Base-Emitter Voltage Differential			-5		-5	mV	V_{CE} = -5V, I_C = 10 μA to 10 mA
		A devices		-2.5		-2.5		
				-3		-3		I_C = 100 μA
		A devices		-1.5		-1.5		
$\frac{\Delta V_{BE_1}-V_{BE_2}}{\Delta T}$	Base-Emitter Voltage Differential Gradient			10		10	μV/°C	V_{CE} = -5, I_C = 100 μA
		A devices		5		5		
NF	Spot Noise Figure			7		4	dB	V_{CE} = -10V, I_C = -100 μA, R_G = 3kΩ, f = 100 Hz, Noise Bandwidth = 20Hz
				3		1.5		V_{CE} = -10V, I_C = -100 μA, R_G = 3kΩ, f = 1kHz, Noise Bandwidth = 200 kHz
				2.5		1.5		V_{CE} = -10V, I_C = -100μA, R_G = 3 kΩ f = 10 kHz, Noise Bandwidth = 2 kHz
				3.5		2.5		V_{CE} = -10V, I_C = -100 μA, R_G = 3kΩ, Noise Bandwidth = 15.7 kHz (Note 3)

NOTES:

3 3 dB down at 10 Hz and 10 kHz.

2N3821, 2N3822
N-Channel JFET

FEATURES

- **Low Capacitance**
- **Up to 6500 μmho Transconductance**

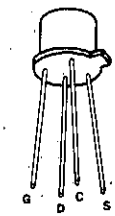
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source Voltage	-50V
Gate-Drain Voltage	-50V
Gate Current	10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

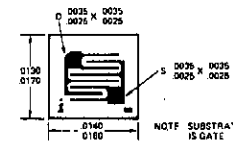
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

5003



ORDERING INFORMATION*

TO-72	WAFER	DICE
2N3821	2N3821/W	2N3821/D
2N3822	2N3822/W	2N3822/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N3821 MIN	2N3821 MAX	2N3822 MIN	2N3822 MAX	UNIT	TEST CONDITIONS	
I_{GSS}	Gate Reverse Current		-0.1		-0.1	nA	V_{GS} = -30 V, V_{DS} = 0	
	T_A = 150°C		-0.1		-0.1	μA		
BV_{GSS}	Gate-Source Breakdown Voltage	-50		-50		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage		-4		-6		V_{DS} = 15 V, I_D = 0.5 nA	
V_{GS}	Gate-Source Voltage	-0.5	-2				V_{DS} = 15 V, I_D = 50 μA	
				-1	-4		V_{DS} = 15 V, I_D = 200 μA	
I_{DSS}	Saturation Drain Current	0.5	2.5	2	10	mA	V_{DS} = 15 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 1)	1500	4500	3000	6500	μmho	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
$\lvert y_{fs} \rvert$	Common-Source Forward Transadmittance	1500		3000				f = 100 MHz
g_{os}	Common-Source Output Conductance (Note 1)		10		20			f = 1 kHz
C_{iss}	Common-Source Input Capacitance		6		6	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		3		3			
NF	Noise Figure		5		5	dB	V_{DS} = 15 V, V_{GS} = 0, R_{gen} = 1 meg, BW = 5 Hz	f = 10 Hz
$\overline{e_n}$	Equivalent Input Noise Voltage		200		200	$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 15 V, V_{GS} = 0, BW = 5 Hz	

Note 1: These parameters are measured during a 2 msec interval 100 msec after DC power is applied.

2N3823
N-Channel JFET

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FEATURES

- **Low Noise**
- **Low Capacitance**
- **Transductance up to 6500 μmho**

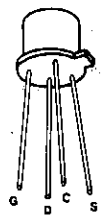
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage ..... -30V
Gate Current ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 300 mW
Derate above 25°C ..... 1.7 mW/°C

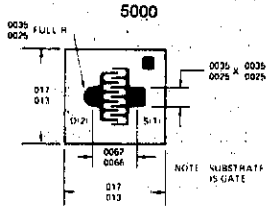
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

5000



ORDERING INFORMATION*

TO-72	WAFER	DICE
2N3823	2N3823/W	2N3823/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		MIN	MAX	UNIT	TEST CONDITIONS	
I_{GSS}	Gate Reverse Current		-0.5	nA	V_{GS} = -20V, V_{DS} = 0	
	T_A = 150°C		-0.5	μA		
BV_{GSS}	Gate-Source Breakdown Voltage	-30		V	I_G = 1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage		-8		V_{DS} = 15V, I_D = 0.5 nA	
V_{GS}	Gate-Source Voltage	-1.0	-7.5		V_{DS} = 15V, I_D = 400 μA	
I_{DSS}	Saturation Drain Current	4	20	mA	V_{DS} = 15V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance	3,500	6,500	μmho	V_{DS} = 15V, V_{GS} = 0	f = 1 kHz (Note 1)
$\|Y_{fs}\|$	Common-Source Forward Transadmittance	3,200				f = 100 MHz
g_{os}	Common-Source Output Transconductance		35			f = 1 kHz (Note 1)
g_{iss}	Common-Source Input Conductance		800			f = 200 MHz
g_{oss}	Common-Source Output Conductance		200			
C_{iss}	Common-Source Input Capacitance		6	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		2			
NF	Noise Figure		2.5	dB	V_{DS} = 15V, V_{GS} = 0 R_G = 1 kΩ	f = 100 MHz

NOTE 1: These parameters are measured during a 2 msec interval 100 msec after DC power is applied.

2N3824
N-Channel JFET

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FEATURES

- r_{ds} < 250 ohms
- $I_{D(off)}$ < 0.1 nA

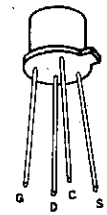
ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise noted)

Gate-Source or Gate-Drain Voltage	-50V
Gate Current	10 mA
Storage Temperature Range	-65° C to +200° C
Operating Temperature Range	-55° C to +150° C
Load Temperature (Soldering, 10 sec.)	+300° C
Power Dissipation	300 mW
Derate above 25° C	1.7 mW/° C

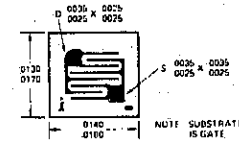
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

5003



ORDERING INFORMATION*

TO-72	WAFER	DICE
2N3824	2N3824/W	2N3824/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25° C unless otherwise noted

PARAMETER			MIN	MAX	UNIT	TEST CONDITIONS	
I_{GSS}	Gate Reverse Current			-0.1	nA	V_{GS} = -30V, V_{DS} = 0	
		T_A = 150° C		-0.1	μA		
BV_{GSS}	Gate-Source Breakdown Voltage		-50		V	I_G = 1 μA, V_{DS} = 0	
$I_{D(off)}$	Drain Cutoff Current			0.1	nA	V_{DS} = 15V, V_{GS} = -8V	
		T_A = 150° C		0.1	μA		
$r_{ds(on)}$	Drain-Source ON Resistance			250	Ω	V_{GS} = 0V, I_D = 0	f = 1 kHz
C_{iss}	Common-Source Input Capacitance			6	pF	V_{DS} = 15V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance			3		V_{GS} = -8V, V_{DS} = 0	

2N3921, 2N3922 Monolithic Dual N-Channel JFET

1

FEATURES

- **Low Drain Current**
- **High Output Impedance**
- **Matched V_{GS}, ΔV_{GS}, and g_{fs}**

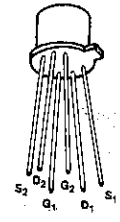
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage (Note 1) ..... -50V
Gate Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Load Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 300 mW
Derate above 25°C ..... 1.7 mW/°C

PIN CONFIGURATION

TO-71



CHIP TOPOGRAPHY

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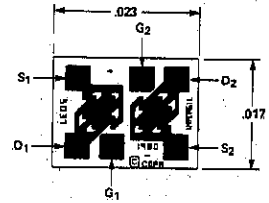


ALL BOND PADS ARE 4 x 4 MIL.

ORDERING INFORMATION*

TO-71	WAFER	DICE
2N3921	2N3921/W	2N3921/D
2N3922	2N3922/W	2N3922/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: (25°C unless otherwise noted)

PARAMETER			MIN	MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current			-1	nA		
		T_A = 100°C		-1	µA	V_{GS} = -30V, V_{DS} = 0	
BV_{DGO}	Drain-Gate Breakdown Voltage		50		V	I_D = 1 µA, I_S = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage			-3		V_{DS} = 10V, I_D = 1 nA	
V_{GS}	Gate-Source Voltage		-0.2	-2.7		V_{DS} = 10V, I_D = 100µA	
I_G	Gate Operating Current			-250	pA	V_{DG} = 10V, I_D = 700µA	
		T_A = 100°C		-25	nA		
I_{DSS}	Saturation Drain Current (Note 1)		1	10	mA	V_{DS} = 10V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 2)		1500	7500	µmho	V_{DS} = 10V, V_{GS} = 0	f = 1 kHz
g_{os}	Common-Source Output Conductance			35			
C_{iss}	Common-Source Input Capacitance			18	pF		
C_{rss}	Common-Source Reverse Transfer Capacitance			6			
g_{fs}	Common-Source Forward Transconductance		1500		µmho	V_{DG} = 10V, I_D = 700 µA	f = 1 kHz
g_{oss}	Common-Source Output Conductance			20			
NF	Spot Noise Figure			2	dB	V_{DS} = 10V, V_{GS} = 0	f = 1 kHz, R_G = 1 meg

MATCHING CHARACTERISTICS		2N3921 MIN	2N3921 MAX	2N3922 MIN	2N3922 MAX	UNIT	TEST CONDITIONS	
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		5		5	mV		
$\frac{\Delta\lvert V_{GS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Differential Voltage Change with Temperature		10		25	µV/°C	V_{DG} = 10V, I_D = 700 µA	T_A = 0°C, T_B = 100°C
g_{fs2}	Transconductance Ratio	0.95	1.0	0.95	1.0			f = 1 kHz

NOTES: 1. Per transistor.
2. Pulse test duration = 2 ms.

2N3954-2N3958 Monolithic Dual N-Channel JFET

FEATURES

- **Low Offset and Drift**
- **Low Capacitance**
- **Low Noise**
- **Superior Tracking Ability**
- **Low Output Conductance**

ABSOLUTE MAXIMUM RATINGS

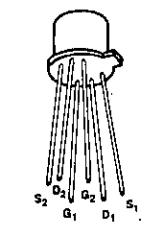
(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Breakdown Voltage (Note 1) 50V
Any Pin to Case Voltage 100V
Gate Current (Note 1) ..... 50 mA
Storage Temperature .. -65°C to +200°C
Operating Temperature -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

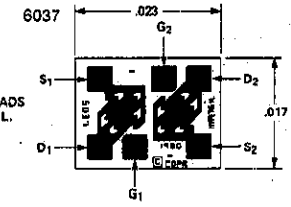
	ONE SIDE	BOTH SIDES
Power Dissipation	250 mW	500 mW
Derate above 25°C	2.8 mW/°C	4.3 mW/°C

PIN CONFIGURATION

TO-71



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-71	WAFER	DICE
2N3954	2N3954/W	2N3954/D
2N3954A	2N3954A/W	2N3954A/D
2N3955	2N3955/W	2N3955/D
2N3955A	2N3955A/W	2N3955A/D
2N3956	2N3956/W	2N3956/D
2N3957	2N3957/W	2N3957/D
2N3958	2N3958/W	2N3958/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N3954		2N3954A		2N3955		2N3955A		2N3956		2N3957		2N3958		UNIT	TEST CONDITIONS	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
I_{GSSR}	Gate Reverse Current		-100		-100		-100		-100		-100		-100		-100	pA	V_{GS} = -30 V,	
	T_A = 125°C		-500		-500		-500		-500		-500		-500		-500	nA	V_{DS} = 0	
BV_{GSS}	Gate-Source Breakdown Voltage	-50		-50		-50		-50		-50		-50		-50		V	V_{DS} = 0, I_G = -1 μA	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1.0	-4.5	-1.0	-4.5	-1.0	-4.5	-1.0	-4.5	-1.0	-4.5	-1.0	-4.5	-1.0	-4.5	V	V_{DS} = 20 V, I_D = 1 nA	
$V_{GS(f)}$	Gate-Source Forward Voltage		2.0		2.0		2.0		2.0		2.0		2.0		2.0	V	V_{DS} = 0, I_G = 1 mA	
V_{GS}	Gate-Source Voltage		-4.2		-4.2		-4.2		-4.2		-4.2		-4.2		-4.2	V	V_{DS} = 20 V	I_D = 50 μA
		-0.5	-4.0	-0.5	-4.0	-0.5	-4.0	-0.4	-4.0	-0.5	-4.0	-0.5	-4.0	-0.5	-4.0	V		I_D = 200 μA
I_G	Gate Operating Current		-50		-50		-50		-50		-50		-50		-50	pA	V_{DS} = 20 V,	
	T_A = 125°C		-250		-250		-250		-250		-250		-250		-250	nA	I_D = 200 μA	
I_{DSS}	Saturation Drain Current	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	0.5	5.0	mA	V_{DS} = 20 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance	1000	3000	1000	3000	1000	3000	1000	3000	1000	3000	1000	3000	1000	3000	μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
		1000		1000		1000		1000		1000		1000		1000				f = 200 MHz
g_{os}	Common-Source Output Conductance		35		35		35		35		35		35		35	μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
C_{iss}	Common-Source-Input Capacitance		4.0		4.0		4.0		4.0		4.0		4.0		4.0	pF	V_{DS} = 20 V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common Source Reverse Transfer Capacitance		1.2		1.2		1.2		1.2		1.2		1.2		1.2	pF	V_{DS} = 20 V, V_{GS} = 0	f = 1 MHz
C_{dgo}	Drain-Gate Capacitance		1.5		1.5		1.5		1.5		1.5		1.5		1.5	pF	V_{DG} = 10 V, I_S = 0	f = 1 MHz
NF	Common-Source Spot Noise Figure		0.5		0.5		0.5		0.5		0.5		0.5		0.5	dB	V_{DS} = 20 V, V_{GS} = 0, R_G = 10 MΩ	f = 100 Hz
$\lvert I_{G1}-I_{G2}\rvert$	Differential Gate Current		10		10		10		10		10		10		10	nA	V_{DS} = 20 V, I_D = 200 μA	T = 125°C
I_{DSS1}/I_{DSS2}	Drain Saturation Current Ratio	0.95	1.0	0.95	1.0	0.95	1.0	0.95	1.0	0.95	1.0	0.90	1.0	0.85	1.0		V_{DS} = 20 V, V_{GS} = 0	
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		5.0		5.0		10.0		5.0		15		20		25	mV	V_{DS} = 20 V, I_D = 200 μA	
$\frac{\Delta\lvert V_{GS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Differential Voltage Change with Temperature		0.8		0.4		2.0		1.2		4.0		6.0		8.0			T = 25°C to -55°C
			1.0		0.5		2.5		1.5		5.0		7.5		10.0			T = 25°C to 125°C
g_{fs1}/g_{fs2}	Transconductance Ratio	0.97	1.0	0.97	1.0	0.97	1.0	0.95	1.0	0.95	1.0	0.90	1.0	0.85	1.0			f = 1 kHz

NOTE 1: Per transistor.

2N3970-2N3972
N-Channel JFET

1

FEATURES

- Low $r_{DS(on)}$
- $I_{D(off)}$ < 250 pA
- Fast Switching

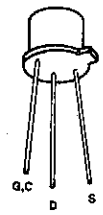
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage ..... -40V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipaton 1.8W
Derate above 25°C ..... 10 mW/°C

PIN CONFIGURATION

TO-18



CHIP TOPOGRAPHY

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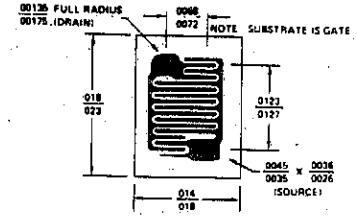


ORDERING INFORMATION*

TO-18	WAFER	DICE
2N3970	2N3970/W	2N3970/D
2N3971	2N3971/W	2N3971/D
2N3972	2N3972/W	2N3972/D

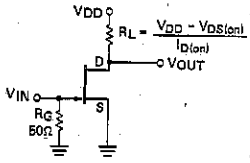
*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25°C unless otherwise noted

	PARAMETER	2N3970 MIN	2N3970 MAX	2N3971 MIN	2N3971 MAX	2N3972 MIN	2N3972 MAX	UNIT	TEST CONDITIONS
BV_{GSS}	Gate Reverse Breakdown Voltage	-40		-40		-40		V	I_G = -1μA, V_{DS} = 0
I_{DGO}	Drain Reverse Current		250		250		250	pA	V_{DG} = 20V, I_S = 0
	T_A = 150°C		500		500		500	nA	
$I_{D(off)}$	Drain Cutoff Current		250		250		250	pA	V_{DG} = 20V, V_{GS} = -12V
	T_A = 150°C		500		500		500	nA	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-4	-10	-2	-5	-0.5	-3	V	V_{DS} = 20V, I_D = 1 nA
I_{DSS}	Saturation Drain Current (Pulse width 300μs, duty cycle ≤ 3%)	50	150	25	75	5	30	mA	V_{DS} = 20V, V_{GS} = 0
$V_{DS(on)}$	Drain-Source ON Voltage						2	V	V_{GS} = 0, I_D = 5 mA
					1.5				V_{GS} = 0, I_D = 10 mA
			1						V_{GS} = 0, I_D = 20 mA
$r_{DS(on)}$	Static Drain-Source ON Resistance		30		60		100	Ω	V_{GS} = 0, I_D = 1 mA
$r_{ds(on)}$	Drain-Source ON Resistance		30		60		100	Ω	V_{GS} = 0, I_D = 0, f = 1 kHz
C_{iss}	Common-Source Input Capacitance		25		25		25	pF	V_{DS} = 20V, V_{GS} = 0, f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		6		6		6	pF	V_{DS} = 0, V_{GS} = -12V, f = 1 MHz
t_d	Turn-On Delay Time		10		15		40	ns	V_{DD} = 10V, $V_{GS(on)}$ = 0
t_r	Rise Time		10		15		40	ns	
t_{off}	Turn-Off Time		30		60		100	ns	

	$I_{D(on)}$	$V_{GS(off)}$	R_L
2N3970	20 mA	-10V	450Ω
2N3971	10 mA	- 5V	850Ω
2N3972	5 mA	- 3V	1.6KΩ



INPUT PULSE
RISE TIME 0.25 ns
FALL TIME 0.75 ns
PULSE WIDTH 200 ns
PULSE RATE 550 pps

SAMPLING SCOPE
RISE TIME 0.4 ns
INPUT RESISTANCE 10 M
INPUT CAPACITANCE 1.5 pF

2N3993, 2N3994
P-Channel JFET

FEATURES

- Low $r_{DS(on)}$
- High Y_{fs}/C_{iss} Ratio (High-Frequency Figure-of-Merit)

APPLICATIONS

Used in high-speed commutator and chopper applications. Also ideal for "Virtual Gnd" switching; needs no ext. translator circuit to switch ±10 VAC. Can be driven direct from T^2L or CMOS logic.

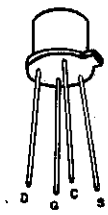
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Drain-Gate Voltage	-25V
Drain-Source Voltage	-25V
Continuous Forward Gate Current	-10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

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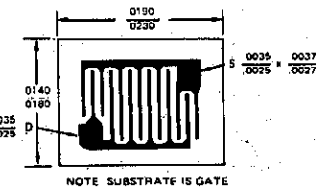


ORDERING INFORMATION*

TO-72	WAFER	DICE
2N3993	2N3993/W	2N3993/D
2N3994	2N3994/W	2N3994/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS @ 25°C free-air temperature (unless otherwise noted)

SYMBOL	PARAMETER	2N3993		2N3994		UNIT	TEST CONDITIONS (Note 3)
		MIN	MAX	MIN	MAX		
BV_{GSS}	Gate-Source Breakdown Voltage	25		25		V	I_G = 1 μA, V_{DS} = 0
I_{DGO}	Drain Reverse Current		-1.2		-1.2	nA	V_{DG} = -15 V, I_S = 0
			-1.2		-1.2	μA	V_{DG} = -15 V, I_S = 0, T_A = 150°C
I_{DSS}	Zero-Gate-Voltage Drain Current	-10		-2		mA	V_{DS} = -10 V, V_{GS} = 0, (See Note 1)
$I_{D(off)}$	Drain Cutoff Current				-1.2	nA	V_{DS} = -10 V, V_{GS} = 6 V
					-1	μA	V_{DS} = -10 V, V_{GS} = 6 V, T_A = 150°C
			-1.2			nA	V_{DS} = -10 V, V_{GS} = 10 V
			-1			μA	V_{DS} = -10 V, V_{GS} = 10 V, T_A = 150°C
$V_{GS(off)}$	Gate-Source Voltage	4	9.5	1	5.5	V	V_{DS} = -10 V, I_D = -1 μA
$r_{ds(on)}$	Small-Signal Drain-Source On-State Resistance		150		300	Ω	V_{GS} = 0, I_D = 0, f = 1 kHz
$\|y_{fs}\|$	Small-Signal Common-Source Forward Transfer Admittance	6	12	4	10	mmho	V_{DS} = -10 V, V_{GS} = 0, f = 1 kHz, (See Note 1)
C_{iss}	Common-Source Short-Circuit Input Capacitance		16		16	pF	V_{DS} = -10 V, V_{GS} = 0, f = 1 MHz, (See Note 2)
C_{rss}	Common-Source Short-Circuit Reverse Transfer Capacitance				5	pF	V_{DS} = 0, V_{GS} = 6 V, f = 1 MHz
			4.5			pF	V_{DS} = 0, V_{GS} = 10 V, f = 1 MHz

NOTES: 1. These parameters must be measured using pulse techniques. t_p = 100 ms, duty cycle ≤ 10%.
2. This parameter must be measured with bias voltage applied for less than 5 seconds to avoid overheating.
3. The case should be connected to the source for all measurements.

2N4044, 2N4045, 2N4100, 2N4878, 2N4879, 2N4880 Dielectrically Isolated Dual NPN Transistor

1

FEATURES

- **High Gain at Low Current**
- **Low Output Capacitance**
- **Good h_{FE} Match**
- **Tight V_{BE} Tracking**
- **Dielectrically Isolated Matched Pairs for Differential Amplifiers.**

ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

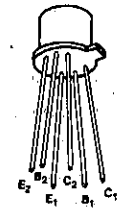
Collector-Base or Collector-Emitter Voltage (Note 1)
- 2N4044, 2N4878 ..... 60V
- 2N4100, 2N4879 ..... 55V
- 2N4045, 2N4880 ..... 45V

Collector-Collector Voltage 100V
Emitter-Base Voltage (Note 2) 7V
Collector Current (Note 1) ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	TO-71		TO-78	
	ONE SIDE	BOTH SIDES	ONE SIDE	BOTH SIDES
Power Dissipation ..	300 mW	500 mW	400 mW	750 mW
Derate above 25°C (mW/°C)	1.7	2.9	2.3	4.3

PIN CONFIGURATION

TO-71
TO-78



CHIP TOPOGRAPHY

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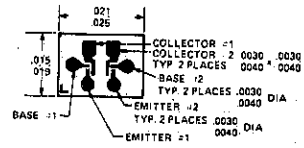


ORDERING INFORMATION*

TO-78	TO-71	WAFER	DICE
2N4044	2N4878	2N4044/W	2N4044/D
2N4045	2N4879	2N4045/W	2N4045/D
2N4100	2N4880	2N4100/W	2N4100/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	200	600	150	600	80	800	V	I_C = 10 μA, V_{CE} = 5V
		225		175		100			I_C = 1.0 mA, V_{CE} = 5 V
	T_A = -55°C	75		50		30			I_C = 10 μA, V_{CE} = 5 V
$V_{BE(on)}$	Emitter-Base On Voltage		0.7		0.7		0.7		
$V_{CE(sat)}$	Collector Saturation Voltage		0.35		0.35		0.35		I_C = 1.0 mA, I_B = 0.1 mA
I_{CBO}	Collector Cutoff Current		0.1		0.1		0.1*	nA	I_E = 0, V_{CB} = 45 V, 30 V*
	T_A = 150°C		0.1		0.1		0.1*	μA	
I_{EBO}	Emitter Cutoff Current		0.1		0.1		0.1	nA	I_C = 0, V_{EB} = 5 V
C_{obo}	Output Capacitance		0.8		0.8		0.8	pF	I_E = 0, V_{CB} = 5 V

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
C_{te}	Emitter Transition Capacitance		1		1		1	pF	$I_C = 0$, $V_{EB} = 0.5V$
C_{C_1, C_2}	Collector to Collector Capacitance		0.8		0.8		0.8	pF	$V_{CC} = 0$
I_{C_1, C_2}	Collector to Collector Leakage Current		5		5		5	pA	$V_{CC} = \pm 100V$
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	60		55		45		V	$I_C = 1mA$, $I_B = 0$
f_t,	Current Gain Bandwidth Product	200		150		150		MHz	$I_C = 1mA$, $V_{CE} = 10V$
f_t	Current Gain Bandwidth Product	20		15		15		MHz	$I_C = 10\mu A$, $V_{CE} = 10V$
NF	Narrow Band Noise Figure		2		3		3	dB	$I_C = 10\mu A$, $V_{CE} = 5V$, $R_G = 10$ kohms, $f = 1kHz$, BW = 200 Hz
BV_{CBO}	Collector Base Breakdown Voltage	60		55		45		V	$I_C = 10\mu A$, $I_E = 0$
BV_{EBO}	Emitter Base Breakdown Voltage	7		7		7		V	$I_E = 10\mu A$, $I_C = 0$

MATCHING CHARACTERISTICS (25°C unless otherwise noted)

h_{FE_1}/h_{FE_2}	DC Current Gain Ratio (Note 3)	0.9	1	0.85	1	0.8	1		$I_C = 10\mu A$ to 1mA, $V_{CE} = 5V$
$\lvert V_{BE_1}-V_{BE_2}\rvert$	Base Emitter Voltage Differential		3		5		5	mV	$I_C = 10\mu A$, $V_{CE} = 5V$
$\lvert I_{B_1}-I_{B_2}\rvert$	Base Current Differential		5		10		25	nA	$I_C = 10\mu A$, $V_{CE} = 5V$
$\lvert\Delta(V_{BE_1}-V_{BE_2})\rvert/\Delta T$	Base Emitter Voltage Differential Change with Temperature		3		5		10	$\mu V/°C$	$I_C = 10\mu A$, $V_{CE} = 5V$, $T_A = -55°C$ to $+125°C$
$\lvert\Delta(I_{B_1}-I_{B_2})\rvert/\Delta T$	Base Current Differential Change with Temperature		0.3		0.5		1	nA/°C	

SMALL SIGNAL CHARACTERISTICS

PARAMETER		TYPICAL VALUE	UNIT	TEST CONDITIONS
h_{ib}	Input Resistance	28	ohms	$I_C = 1mA$, $V_{CB} = 5V$
h_{rb}	Voltage Feedback Ratio	43	x 10^{-3}	
h_{fe}	Small Signal Current Gain	250		$I_C = 1mA$, $V_{CE} = 5V$
h_{ob}	Output Conductance	60	μmhos	
h_{ie}	Input Resistance	9.6	k ohms	
h_{re}	Voltage Feedback Ratio	42	x 10^{-3}	
h_{oe}	Output Conductance	12	μmhos	

NOTES:
1. Per transistor.
2. The reverse base-emitter voltage must never exceed 7.0 volts and the reverse base-emitter current must never exceed 10 μamps.
3. The lowest of two h_{FE} readings is taken as h_{FE_1} for purposes of this ratio.

INTERSIL

ITE4091-ITE4093
2N4091-2N4093, JANTX*
N-Channel JFET

1

FEATURES

- Low $r_{DS(on)}$
- $I_{D(OFF)}$ < 100 pA (JAN TX Types)
- Fast Switching

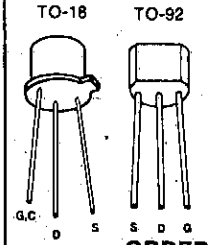
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

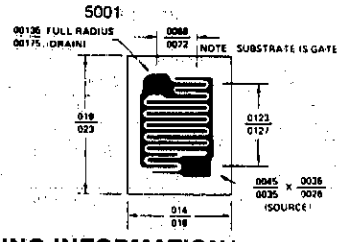
Gate-Source or Gate-Drain Voltage ..... -40V
Gate Current ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	TO-18	TO-92
Power Dissipation	1.8W	360 mW
Derate above 25°C	1.7 mW/°C ..	3.0 mW/°C

PIN CONFIGURATIONS



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-92	TO-18†	WAFER	DICE
ITE 4091	2N4091	2N4091/W	2N4091/D
ITE 4091A	2N4091A		
ITE 4092	2N4092	2N4092/W	2N4092/D
ITE 4092A	2N4092A		
ITE 4093	2N4093	2N4093/W	2N4093/D
ITE 4093A	2N4093A		

†add JANTX to these part numbers if JANTX processing is desired.

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

	PARAMETER		2N/ITE 4091 Min.	2N/ITE 4091 Max.	2N/ITE 4092 Min.	2N/ITE 4092 Max.	2N/ITE 4093 Min.	2N/ITE 4093 Max.	Unit	Test Conditions	
BV_{GSS}	Gate-Source Breakdown Voltage		-40		-40		-40		V	I_G = -1μA, V_{DS} = 0	
I_{DGO}	Drain Reverse Current (Not JANTX Specified)			200		200		200	pA		
		T_A = 150°C		400		400		400	nA	V_{GD} = -20V, I_S = 0	
I_{GSS}	Gate Reverse Current (JANTX, ITE devices only)			-100		-100		-100	pA		
		T_A = 150°C		-200		-200		-200	nA	V_{GS} = -20V, V_{DS} = 0	
$I_{D(OFF)}$	JANTX; T_A = 25°C			100		100		100	pA	V_{DS} = 20V	V_{GS} = -12V(4091)
				200		200		200			V_{GS} = -8V(4092)
											V_{GS} = -6V(4093)
	Drain Cutoff Current			200		200		200			
	JANTX, T_A = 150°C			400		400		400	nA		
V_P	Gate-Source Pinch-Off Voltage		-5	-10	-2	-7	-1	-5	V	V_{DS} = 20V, I_D = 1 nA	
I_{DSS}	Drain Current at Zero Gate Voltge		30		15		8		mA	V_{DS} = 20V, V_{GS} = 0, Pulse Test Duraton = 2 ms	
$V_{DS(ON)}$	Drain-Source ON Voltage							0.2	V	V_{GS} = 0	I_D = 2.5 mA
						0.2					I_D = 4 mA
				0.2							I_D = 6.6 mA
$r_{DS(on)}$	Static Drain-Source ON Resistance			30		50		80	Ω	V_{GS} = 0, I_D = 1 mA	
$r_{ds(on)}$	Static Drain Source ON Resistance			30		50		80	Ω	V_{GS} = 0, I_D = 0, f = 1 kHz	
C_{iss}	Common-Source Input Capacitance			16		16		16	pF	V_{DS} = 20V, V_{GS} = 0, f = 1 MHz	
C_{rss}	JANTX Only			5		5		5			
	Common-Source Reverse Transfer Capacitance			5		5		5		V_{DS} = 0, V_{GS} = -20V, f = 1 MHz	
$t_{d(ON)}$	Turn-ON Delay Time			15		15		20	ns	V_{DD} = 3V, $V_{GS(ON)}$ = 0	
t_r	Rise Time			10		20		40			
t_{off}	Turn-OFF Time			40		60		80			

	$I_{D(on)}$	$V_{GS(off)}$	R_L
4091	6.6 mA	-12V	425Ω
4092	4 mA	-8V	700Ω
4093	2.5 mA	-5V	1120Ω

2N4044, 2N4045, 2N4100, 2N4878, 2N4879, 2N4880 Dielectrically Isolated Dual NPN Transistor

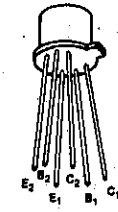
1

FEATURES

- **High Gain at Low Current**
- **Low Output Capacitance**
- **Good h_{FE} Match**
- **Tight V_{BE} Tracking**
- **Dielectrically Isolated Matched Pairs for Differential Amplifiers.**

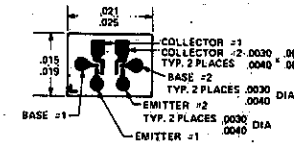
PIN CONFIGURATION

TO-71
TO-78



CHIP TOPOGRAPHY

4000



ORDERING INFORMATION*

TO-78	TO-71	WAFER	DICE
2N4044	2N4878	2N4044/W	2N4044/D
2N4045	2N4879	2N4045/W	2N4045/D
2N4100	2N4880	2N4100/W	2N4100/D

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Collector-Base or Collector-Emitter Voltage (Note 1)
- 2N4044, 2N4878 ..... 60V
- 2N4100, 2N4879 ..... 55V
- 2N4045, 2N4880 ..... 45V

Collector-Collector Voltage 100V
Emitter-Base Voltage (Note 2) 7V
Collector Current (Note 1) ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	TO-71		TO-78	
	ONE SIDE	BOTH SIDES	ONE SIDE	BOTH SIDES
Power Dissipation ..	300 mW	500 mW	400 mW	750 mW
Derate above 25°C (mW/°C)	1.7	2.9	2.3	4.3

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	200	600	150	600	80	800		I_C = 10 μA, V_{CE} = 5V
		225		175		100			I_C = 1.0 mA, V_{CE} = 5 V
	T_A = -55°C	75		50		30		V	I_C = 10 μA, V_{CE} = 5 V
$V_{BE(on)}$	Emitter-Base On Voltage		0.7		0.7		0.7		
$V_{CE(sat)}$	Collector Saturation Voltage		0.35		0.35		0.35		I_C = 1.0 mA, I_B = 0.1 mA
I_{CBO}	Collector Cutoff Current		0.1		0.1		0.1*	nA	I_E = 0, V_{CB} = 45 V, 30 V*
	T_A = 150°C		0.1		0.1		0.1*	μA	
I_{EBO}	Emitter Cutoff Current		0.1		0.1		0.1	nA	I_C = 0, V_{EB} = 5 V
C_{obo}	Output Capacitance		0.8		0.8		0.8	pF	I_E = 0, V_{CB} = 5 V

1

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
C_{te}	Emitter Transition Capacitance		1		1		1	pF	$I_C = 0$, $V_{EB} = 0.5V$
C_{C_1, C_2}	Collector to Collector Capacitance		0.8		0.8		0.8	pF	$V_{CC} = 0$
I_{C_1, C_2}	Collector to Collector Leakage Current		5		5		5	pA	$V_{CC} = \pm 100V$
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	60		55		45		V	$I_C = 1mA$, $I_B = 0$
f_t	Current Gain Bandwidth Product	200		150		150		MHz	$I_C = 1mA$, $V_{CE} = 10V$
f_t	Current Gain Bandwidth Product	20		15		15		MHz	$I_C = 10\mu A$, $V_{CE} = 10V$
NF	Narrow Band Noise Figure		2		3		3	dB	$I_C = 10\mu A$, $V_{CE} = 5V$, $R_G = 10$ kohms, f = 1kHz, BW = 200 Hz
BV_{CBO}	Collector Base Breakdown Voltage	60		55		45		V	$I_C = 10\mu A$, $I_E = 0$
BV_{EBO}	Emitter Base Breakdown Voltage	7		7		7		V	$I_E = 10\mu A$, $I_C = 0$

MATCHING CHARACTERISTICS (25°C unless otherwise noted)

h_{FE_1}/h_{FE_2}	DC Current Gain Ratio (Note 3)	0.9	1	0.85	1	0.8	1		$I_C = 10\mu A$ to 1mA, $V_{CE} = 5V$
$\lvert V_{BE_1}-V_{BE_2}\rvert$	Base Emitter Voltage Differential		3		5		5	mV	$I_C = 10\mu A$, $V_{CE} = 5V$
$\lvert I_{B_1}-I_{B_2}\rvert$	Base Current Differential		5		10		25	nA	$I_C = 10\mu A$, $V_{CE} = 5V$
$\lvert\Delta(V_{BE_1}-V_{BE_2})\rvert/\Delta T$	Base Emitter Voltage Differential Change with Temperature		3		5		10	$\mu V/°C$	$I_C = 10\mu A$, $V_{CE} = 5V$, $T_A = -55°C$ to $+125°C$
$\lvert\Delta(I_{B_1}-I_{B_2})\rvert/\Delta T$	Base Current Differential Change with Temperature		0.3		0.5		1	nA/°C	

SMALL SIGNAL CHARACTERISTICS

PARAMETER		TYPICAL VALUE	UNIT	TEST CONDITIONS
h_{ib}	Input Resistance	28	ohms	$I_C = 1mA$, $V_{CB} = 5V$
h_{rb}	Voltage Feedback Ratio	43	$x\ 10^{-3}$	
h_{fe}	Small Signal Current Gain	250		$I_C = 1mA$, $V_{CE} = 5V$
h_{ob}	Output Conductance	60	μmhos	
h_{ie}	Input Resistance	9.6	k ohms	
h_{re}	Voltage Feedback Ratio	42	$x\ 10^{-3}$	
h_{oe}	Output Conductance	12	μmhos	

NOTES:
1. Per transistor.
2. The reverse base-emitter voltage must never exceed 7.0 volts and the reverse base-emitter current must never exceed 10 μamps.
3. The lowest of two h_{FE} readings is taken as h_{FE_1} for purposes of this ratio.

2N4117-19, 2N4117A-19A
N-Channel JFET

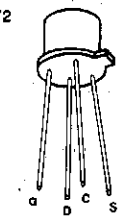
FEATURES
- **Low Leakage**
- **Low Capacitance**

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

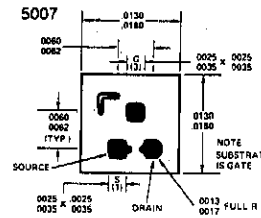
Gate-Source or Gate-Drain Voltage ..... -40V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 300 mW
Derate above 25°C ..... 1.7 mW/°c

PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-72	WAFER	CHIP
2N4117	2N4117/W	2N4117/D
2N4117A	—	—
2N4118	2N4118/W	2N4118/D
2N4118A	—	—
2N4119	2N4119/W	2N4119/D
2N4119A	—	—

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4117 2N4117A		2N4118 2N4118A		2N4119 2N4119A		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
BV_{GSS}	Gate-Source Breakdown Voltage	-40		-40		-40		V	I_G = -1 μA, V_{DS} = 0
I_{GSSR}	Gate Reverse Current		-10		-10		-10	pA	V_{GS} = -20 V, V_{DS} = 0
	A devices		-1		-1		-1		
	T_A = +100°C		-25		-25		-25	nA	
	A devices		-2.5		-2.5		-2.5		
$V_{GS(off)}$	Gate-Source Pinch-Off Voltage	-0.6	-1.8	-1	-3	-2	-6	V	V_{DS} = 10 V, I_D = 1 nA
I_{DSS}	Drain Current at Zero Gate Voltage (Note 1)	0.02	0.09	0.08	0.24	0.20	0.60	mA	V_{DS} = 10 V, V_{GS} = 0
g_{fs}	Common-Source Forward Transconductance (Note 1)	70	210	80	250	100	330	μmho	V_{DS} = 10 V, f = 1 kHz
g_{fs}	Common-Source Forward Transconductance	60		70		90			V_{GS} = 0, f = 30 MHz
g_{os}	Common-Source Output Conductance		3		5		10		V_{DS} = 10 V, V_{GS} = 0, f = 1 kHz
C_{iss}	Common-Source Input Capacitance		3		3		3	pF	V_{DS} = 10 V, V_{GS} = 0, f = 1 kHz
C_{rss}	Common-Source Reverse Transfer Capacitance		1.5		1.5		1.5		V_{DS} = 10 V, V_{GS} = 0, f = 1 kHz

NOTE: 1. Pulse test: Pulse duration of 2 ms used during test.

2N4220 - 2N4222
N-Channel JFET

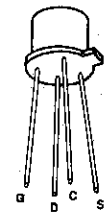
FEATURES
- C_{rss} < 2 pF
- Moderately High Forward Transconductance

1

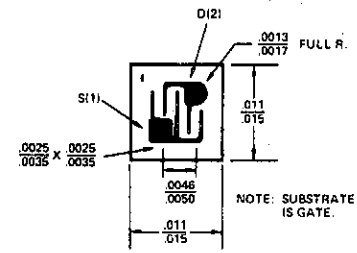
ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage	-30V
Gate Current	10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

PIN CONFIGURATION
TO-72



CHIP TOPOGRAPHY
5010*



*DICE WITH 4 MIL BONDING PADS AVAILABLE. CONSULT FACTORY FOR DETAILS.

ORDERING INFORMATION*

TO-72	WAFER	DICE
2N4220	2N4220/W	2N4220/D
2N4221	2N4221/W	2N4221/D
2N4222	2N4222/W	2N4222/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4220		2N4221		2N4222		UNIT	TEST CONDITIONS	
		MIN	MAX	MIN	MAX	MIN	MAX			
I_{GSSR}	Gate Reverse Current		-0.1		-0.1		-0.1	nA	V_{GS} = -15 V, V_{DS} = 0	
	T_A = 150°C		-0.1		-0.1		-0.1	µA		
BV_{GSS}	Gate-Source Breakdown Voltage	-30		-30		-30		V	I_G = -10 µA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage		-4		-6		-8		V_{DS} = 15 V, I_D = 0.1 nA	
V_{GS}	Gate-Source Voltage	-0.5	-2.5	-1	-5	-2	-6	V	V_{DS} = 15V	I_D = 50 µA (2N4220) I_D = 200 µA (2N4221) I_D = 500 µA (2N4222)
I_{DSS}	Saturation Drain Current (Note 3)	0.5	3	2	6	5	15	mA	V_{DS} = 15 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 1)	1000	4000	2000	5000	2500	6000	µmho	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
$\|Y_{fs}\|$	Common-Source Forward Transadmittance	750		750		750				f = 100 MHz
g_{os}	Common-Source Output Conductance (Note 1)		10		20		40			f = 1 kHz
C_{iss}	Common-Source Input Capacitance		6		6		6	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		2		2		2			

NOTE 1: Pulse test duration 2 ms.

2N4223, 2N4224
N-Channel JFET

FEATURES

- NF = 3 dB Typical at 200 MHz
- C_{rss} < 2 pF

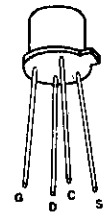
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

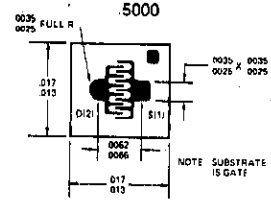
Gate-Source or Gate-Drain Voltage ..... -30V
Gate Current ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 300 mW
Derate above 25°C ..... 1.7 mW/°C

PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-72	WAFER	DICE
2N4223	2N4223/W	2N4223/D
2N4224	2N4224/W	2N4224/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4223 MIN	2N4223 MAX	2N4224 MIN	2N4224 MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-0.25		-0.5	nA	V_{GS} = -20 V, V_{DS} = 0	
	T_A = +150°C		-0.25		-0.5	µA		
BV_{GSS}	Gate-Source Breakdown Voltage	-30		-30		V	I_G = -10 µA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.1	-8	-0.1	-8	V	V_{DS} = 15V	I_D = 0.25 nA (2N4223), I_D = 0.5 nA (2N4224)
V_{GS}	Gate-Source Voltage	-1.0	-7.0	-1.0	-7.5	V	V_{DS} = 15V	I_D = 0.3 mA (2N4223), I_D = 0.2 mA (2N4224)
I_{DSS}	Saturation Drain Current (Note 1)	3	18	2	20	mA	V_{DS} = 15 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 1)	3000	7000	2000	7500	µmho	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
C_{iss}	Common-Source Input Capacitance (Output Shorted)		6		6	pF	V_{DS} = 15 V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		2		2	pF	V_{DS} = 15 V, V_{GS} = 0	f = 1 MHz
$\|Y_{fs}\|$	Common-Source Forward Transadmittance	2700		1700		µmho	V_{DS} = 15 V, V_{GS} = 0	f = 200 MHz
g_{iss}	Common-Source Input Conductance (Output Shorted)		800		800	µmho	V_{DS} = 15 V, V_{GS} = 0	f = 200 MHz
g_{oss}	Common-Source Output Conductance (Input Shorted)		200		200	µmho	V_{DS} = 15 V, V_{GS} = 0	f = 200 MHz
G_{ps}	Small Signal Power Gain	10				dB	V_{DS} = 15 V, V_{GS} = 0, R_{gen} = 1kΩ	f = 200 MHz
NF	Noise Figure		5			dB	V_{DS} = 15 V, V_{GS} = 0, R_{gen} = 1kΩ	f = 200 MHz

Note 1: Pulse test, duration 2 msec.

2N4338-2N4341
N-Channel JFET

1

FEATURES

- **Exceptionally High Figure of Merit**
- **Radiation Immunity**
- **Extremely Low Noise and Capacitance**
- **High Input Impedance**

APPLICATIONS

- Low-level Choppers
- Data Switches
- Multiplexers and Low Noise Amplifiers

ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise noted)

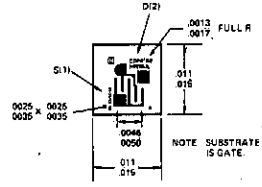
Gate-Source or Gate-Drain Voltage ..... -50V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65° C to +200° C
Operating Temperature Range ..... -55° C to +150° C
Lead Temperature (Soldering, 10 sec.) ..... +300° C
Power Dissipation ..... 300 mW
Derate above 25° C ..... 1.7 mW/° C

PIN CONFIGURATION

TO-18

CHIP TOPOGRAPHY

5040



*DICE WITH 4 MIL BONDING PADS AVAILABLE. CONSULT FACTORY FOR DETAILS.

ORDERING INFORMATION*

TO-18	WAFER	DICE
2N4338	2N4338/W	2N4338/D
2N4339	2N4339/W	2N4339/D
2N4340	2N4340/W	2N4340/D
2N4341	2N4341/W	2N4341/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25° C unless otherwise noted)

PARAMETER		2N4338		2N4339		2N4340		2N4341		UNITS	TEST CONDITIONS	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
I_{GSS}	Gate Reverse Current		-0.1		-0.1		-0.1		-0.1	nA	V_{GS} = -30 V, V_{DS} = 0	
	T_A=150°C		-0.1		-0.1		-0.1		-0.1	μA		
BV_{GSS}	Gate-Source Breakdown Voltage	-50		-50		-50		-50		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.3	-1	-0.6	-1.8	-1	-3	-2	-6		V_{DS} = 15 V, I_D = 0.1 μA	
$I_{D(off)}$	Drain Cutoff Current		0.05 (-5)		0.05 (-5)		0.05 (-5)		0.07 (-10)	nA (V)	V_{DS} = 15V, V_{GS} = ( )	
I_{DSS}	Saturation Drain Current	0.2	0.6	0.5	1.5	1.2	3.6	3	9	mA	V_{DS} = 15 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance	600	1800	800	2400	1300	3000	2000	4000	μmho	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
g_{os}	Common-Source Output Conductance		5		15		30		60			
$r_{DS(on)}$	Drain-Source ON Resistance		2500		1700		1500		800	ohm	V_{DS} = 0, I_{DS} = 0	
C_{iss}	Common-Source Input Capacitance		7		7		7		7	pF	V_{DS} = 15 V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		3		3		3		3			
NF	Noise Figure		1		1		1		1	dB	V_{DS} = 15 V, V_{GS} = 0 R_{gen} = 1 meg, BW = 200 Hz	f = 1 kHz

2N4351

N-Channel Enhancement Mode MOS FET

FEATURES

- **Low ON Resistance**
- **Low Capacitance**
- **High Gain**
- **High Gate Breakdown Voltage**
- **Low Threshold Voltage**

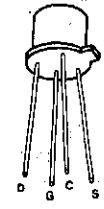
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Drain-Source Voltage or Drain-Gate Voltage	25V
Peak Gate-Source Voltage (Note 1)	±125V
Drain Current	100 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	375 mW
Derate above 25°C	3 mW/°C

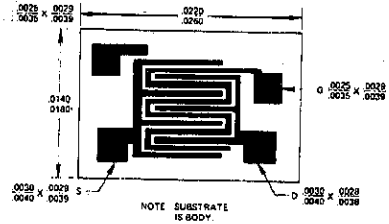
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

1003



ORDERING INFORMATION*

TO-72	WAFER	DICE
2N4351	2N4351/W	2N4351/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

Substrate connected to source.

	PARAMETER	MIN	MAX	UNITS	TEST CONDITIONS
BV_{DSS}	Drain-Source Breakdown Voltage	25		V	I_D = 10 μA, V_{GS} = 0
I_{GSS}	Gate Leakage Current		10	pA	V_{GS} = ±30 V, V_{DS} = 0
I_{DSS}	Zero-Gate-Voltage Drain Current		10	nA	V_{DS} = 10 V, V_{GS} = 0
$V_{GS(th)}$	Gate-Source Threshold Voltage	1	5	V	V_{DS} = 10 V, I_D = 10 μA
$I_{D(on)}$	"ON" Drain Current	3		mA	V_{GS} = 10 V, V_{DS} = 10 V
$V_{DS(on)}$	Drain-Source "ON" Voltage		1	V	I_D = 2 mA, V_{GS} = 10 V
$r_{DS(on)}$	Drain-Source Resistance		300	ohms	V_{GS} = 10 V, I_D = 0, f = 1 kHz
$\|y_{fs}\|$	Forward Transfer Admittance	1000		μmho	V_{DS} = 10 V, I_D = 2 mA, f = 1 kHz
C_{rss}	Reverse Transfer Capacitance		1.3	pF	V_{DS} = 0, V_{GS} = 0, f = 140 kHz
C_{iss}	Input Capacitance		5.0	pF	V_{DS} = 10 V, V_{GS} = 0, f = 140 kHz
$C_{d(sub)}$	Drain-Substrate Capacitance		5.0	pF	$V_{D(SUB)}$ = 10 V, f = 140 kHz
$t_{d(on)}$	Turn-On Delay		45	ns	FIGURE 1 – SWITCHING CIRCUIT and WAVEFORMS
t_r	Rise Time		65	ns	
$t_{d(off)}$	Turn-Off Delay		60	ns	
t_f	Fall Time		100	ns	

Note 1. Device must not be tested at ±125V more than once or longer than 300 ms.

ITE4391-ITE4393
2N4391-2N4393
N-Channel JFET

FEATURES

- $r_{ds(on)} \leq$ 30 ohms (2N4391)
- $I_{D(off)} <$ 100 pA
- Switches ±10 VAC with ±15V Supplies (2N4392, 2N4393)

ABSOLUTE MAXIMUM RATINGS

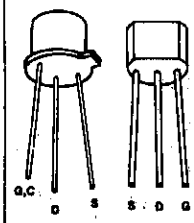
(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage ..... -40V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	TO-18	TO-92
Power Dissipation	1.8W	360 mW
Derate above 25°C	1.7 mW/°C ..	3.0 mW/°C

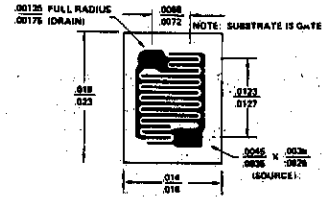
PIN CONFIGURATIONS

TO-18 TO-92



CHIP TOPOGRAPHY

5001



ORDERING INFORMATION*

TO-92	TO-18	WAFER	DICE
ITE 4391	2N4391	2N4391/W	2N4391/D
ITE 4392	2N4392	2N4392/W	2N4392/D
ITE 4393	2N4393	2N4393/W	2N4393/D

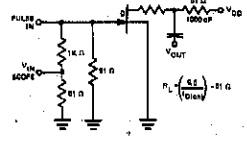
*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		4391 MIN	4391 MAX	4392 MIN	4392 MAX	4393 MIN	4393 MAX	UNIT	TEST CONDITIONS
I_{GSS}	Gate Reverse Current		-100		-100		-100	pA	V_{GS} = -20 V, V_{DS} = 0
	T_A = 150°C		-200		-200		-200	nA	
BV_{GSS}	Gate-Source Breakdown Voltage	-40		-40		-40		V	I_G = 1 µA, V_{DS} = 0
$I_{D(off)}$	Drain Cutoff Current		100		100		100	pA	V_{DS} = 20 V; V_{GS} = -5 V (4393), V_{GS} = -7 V (4392), V_{GS} = -12 V (4391)
	T_A = 150°C		200		200		200	nA	
$V_{GS(f)}$	Gate-Source Forward Voltage		1		1		1	V	I_G = 1 mA, V_{DS} = 0
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-4	-10	-2	-5	-0.5	-3	V	V_{DS} = 20 V, I_D = 1 nA
I_{DSS}	Saturation Drain Current (Note 1)	50	150	25	75	5	30	mA	V_{DS} = 20 V, V_{GS} = 0
$V_{DS(on)}$	Drain Source ON Voltage		0.4		0.4		0.4	V	V_{GS} = 0; I_D = 3 mA (4393), I_D = 6 mA (4392), I_D = 12 mA (4391)
$r_{DS(on)}$	Static Drain-Source ON Resistance		30		60		100	Ω	V_{GS} = 0, I_D = 1 mA
$r_{ds(on)}$	Drain-Source ON Resistance		30		60		100	Ω	V_{GS} = 0, I_D = 0, f = 1 kHz
C_{iss}	Common-Source Input Capacitance		14		14		14	pF	V_{DS} = 20 V, V_{GS} = 0
C_{rss}	Common-Source Reverse Transfer Capacitance						3.5	pF	V_{DS} = 0; V_{GS} = -5 V
					3.5			pF	V_{DS} = 0; V_{GS} = -7 V, f = 1 MHz
			3.5					pF	V_{DS} = 0; V_{GS} = -12 V
t_d	Turn-ON Delay Time		15		15		15	ns	V_{DD} = 10 V, $V_{GS(on)}$ = 0
t_r	Rise Time		5		5		5	ns	
t_{off}	Turn-OFF Delay Time		20		35		50	ns	
t_f	Fall Time		15		20		30	ns	

	$I_{D(on)}$	$V_{GS(off)}$
4391	12 mA	-12 V
4392	6	-7
4393	3	-5

NOTE:
1. Pulse test required, pulse width = 300 µs, duty cycle ≤ 3%



INPUT PULSE
RISE TIME < 0.5 ns
FALL TIME < 0.5 ns
PULSE DUTY CYCLE 1%

SAMPLING SCOPE
RISE TIME 0.4 ns
INPUT RESISTANCE 50 Ω

ITE4416, 2N4416/A
N-Channel JFET

FEATURES

- **Low Noise**
- **Low Feedback Capacitance**
- **Low Output Capacitance**
- **High Transconductance**
- **High Power Gain**

ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage
- 2N4416, ITE4416 ..... -30V
- 2N4416A ..... -35V

Gate Current ..... 10 mA

Storage Temperature Range
- 2N4416/2N4416A ..... -65°C to +200°C
- ITE4416 ..... -55°C to +125°C

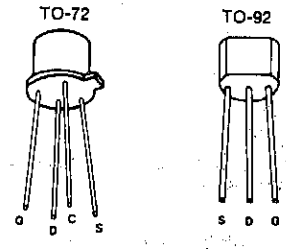
Operating Temperature Range
- 2N4416/2N4416A ..... -65°C to +200°C
- ITE4416 ..... -55°C to +125°C

Lead Temperature (Soldering, 10 sec.) ..... +300°C

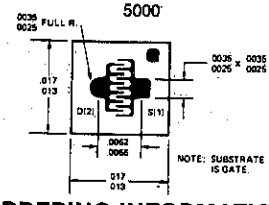
Power Dissipation ..... 300 mW

Derate above 25°C .....
- 2N4416/2N4416A ..... 1.7 mW/°C
- ITE4416 ..... 3.0 mW/°C

PIN CONFIGURATIONS



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-92	TO-72	WAFER	DICE
ITE 4416	2N4416	2N4416/W	2N4416/D
—	2N4416A	2N4416A/W	2N4416A/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER			MIN	MAX	UNIT	TEST CONDITIONS	
$V_{GS(f)}$	Gate–Source Forward Voltage			1	V	I_G = 1 mA, V_{DS} = 0	
I_{GSS}	Gate Reverse Current			-0.1	nA	V_{GS} = -20 V, V_{DS} = 0	
		T_A = 150°C		-0.1	μA		
BV_{GSS}	Gate-Source Breakdown Voltage	2N4416/ITE4416	-30		V	I_G = -1 μA, V_{DS} = 0	
		2N4416A	-35				
$V_{GS(off)}$	Gate-Source Cutoff Voltage	2N4416/ITE4416		-6		V_{DS} = 15 V, I_D = 1 nA	
		2N4416A	-2.5	-6			
I_{DSS}	Drain Current at Zero Gate Voltage		5	15	mA	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
g_{fs}	Common-Source Forward Transconductance		4500	7500	μmho		
g_{os}	Common-Source Output Conductance			50	μmho		
C_{rss}	Common-Source Reverse Transfer Capacitance			0.8	pF		
C_{iss}	Common-Source Input Capacitance			4	pF		f = 1 MHz
C_{oss}	Common-Source Output Capacitance			2			

PARAMETER		100 MHz		400 MHz		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
g_{iss}	Common-Source Input Conductance		100		1000	μmho	V_{DS} = 15 V, V_{GS} = 0
b_{iss}	Common-Source Input Susceptance		2500		10,000		
g_{oss}	Common-Source Output Conductance		75		100		
b_{oss}	Common-Source Output Susceptance		1000		4000		
g_{fs}	Common-Source Forward Transconductance			4000			
G_{ps}	Common-Source Power Gain	18		10		dB	V_{DS} = 15 V, I_D = 5 mA
NF	Noise Figure		2		4		V_{DS} = 15 V, I_D = 5 mA, R_G = 1 KΩ

2N4856-2N4861
2N4856-2N4858 JAN, JTX, JTXV*
N-Channel JFET

1

FEATURES

- Low $r_{DS(on)}$
- $I_{D(off)}$ <250 pA
- Switches ±10V Signals with ±15V Supplies (2N4858, 2N4861)

ABSOLUTE MAXIMUM RATINGS

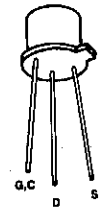
(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage
- 2N4856-58 ..... -40V
- 2N4859-61 ..... -30V

Gate Current ..... 50 mA
Storage Temperature ..... -65°C to +200°C
Operating Temperature Range ... -55°C to +150°C
Led Temperature (Soldering, 10 sec.) .... +300°C
Power Dissipation 1.8W
Derate above 25°C ..... 10 mW/°C

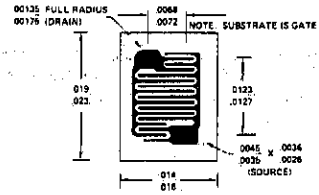
PIN CONFIGURATION

TO-18



CHIP TOPOGRAPHY

5001



ORDERING INFORMATION*

TO-18	WAFER	DICE
2N4856 †	2N4856/W	2N4856/D
2N4857 †	2N4857/W	2N4857/D
2N4858 †	2N4858/W	2N4858/D
2N4859	2N4859/W	2N4859/D
2N4860	2N4860/W	2N4860/D
2N4861	2N4861/W	2N4861/D

† add JAN, JTX, JTXV, to basic part number to specify these devices.

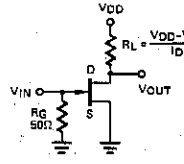
*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

(25°C unless otherwise noted)

PARAMETER			2N4856,59 MIN	2N4856,59 MAX	2N4857,60 MIN	2N4857,60 MAX	2N4858,61 MIN	2N4858,61 MAX	UNIT	TEST CONDITIONS	
BV_{GSS}	Gate-Source Breakdown Voltage	2N4856-58	-40		-40		-40		V	I_G = -1 μA, V_{DS} = 0	
		2N4859-61	-30		-30		-30				
I_{GSSR}	Gate-Reverse Current			-250		-250		-250	pA	V_{GS} = -20 V, V_{DS} = 0	
		T_A = 150°C		-500		-500		-500	nA	V_{GS} = -15 V, V_{DS} = 0	
$I_{D(off)}$	Drain Cutoff Current			250		250		250	pA	V_{DS} = 15 V, V_{GS} = -10 V	
		T_A = 150°C		500		500		500	nA		
$V_{GS(off)}$	Gate-Source Cutoff Voltage		-4	-10	-2	-6	-0.8	-4	V	V_{DS} = 15 V, I_D = 0.5 nA	
I_{DSS}	Saturation Drain Current (Note 1)		50		20	100	8	80	mA	V_{DS} = 15 V, V_{GS} = 0	
$V_{DS(on)}$	Drain-Source ON Voltage			0.75 (20)		0.50 (10)		0.50 (5)	V (mA)	V_{GS} = 0, I_D = ( )	
$r_{ds(on)}$	Drain-Source ON Resistance			25		40		60	ohm	V_{GS} = 0, I_D = 0	f = 1 kHz
C_{iss}	Common-Source Input Capacitance			18		18		18	pF	V_{DS} = 0, V_{GS} = -10 V	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance			8		8		8			
t_d	Turn-ON Delay Time			6		6		10	ns	464 Ω (2N4856,59)	
t_r	Rise Time			3		4		10		V_{DD} = 10 V, R_L = 953 Ω (2N4857,60)	
t_{off}	Turn-OFF Time			25		50		100		$V_{GS(on)}$ = 0 1910 Ω (2N4858,61)	
										$V_{GS(off)}$=-10V, I_D = 20 mA (2N4856, 9)	
										$V_{GS(off)}$=-6V, I_D = 10 mA (2N4857, 60)	
										$V_{GS(off)}$=-4V, I_D = 5 mA (2N4858, 61)	

NOTE:
1. Pulse test required, pulsewidth = 100 μs, duty cycle ≤ 10%.



INPUT PULSE
RISE TIME 0.25 ns
FALL TIME 0.75
PULSE WIDTH 100 ns
PULSE DUTY CYCLE < 10%

SAMPLING SCOPE
RISE TIME 0.75 ns
INPUT RESISTANCE 1 M
INPUT CAPACITANCE 2.5 pf

2N4867/A-2N4869/A
N-Channel JFET

1

FEATURES

- **Low Noise Voltage**
- **Low Leakage**
- **High Gain**

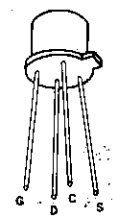
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage ..... -40V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 300 mW
Derate above 25°C ..... 1.7 mW/°c

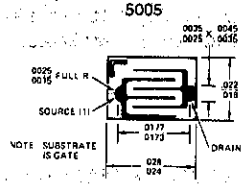
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

5005



ORDERING INFORMATION*

TO-72	WAFER	DICE
2N4867	2N4867/W	2N4867/D
2N4867A	2N4867A/W	2N4867A/D
2N4868	2N4868/W	2N4868/D
2N4868A	2N4868A/W	2N4868A/D
2N4869	2N4869/W	2N4869/D
2N4869A	2N4869A/W	2N4869A/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER			2N4867 2N4867A MIN	2N4867 2N4867A MAX	2N4868 2N4868A MIN	2N4868 2N4868A MAX	2N4869 2N4869A MIN	2N4869 2N4869A MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current			-0.25		-0.25		-0.25	nA	V_{GS} = -30 V, V_{DS} = 0	
		T_A = 150°C		-0.25		-0.25		-0.25	μA		
BV_{GSS}	Gate-Source Breakdown Voltage		-40		-40		-40		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage		-0.7	-2	-1	-3	-1.8	-5		V_{DS} = 20 V, I_D = 1 μA	
I_{DSS}	Saturation Drain Current (Note 1)		0.4	1.2	1	3	2.5	7.5	mA	V_{DS} = 20 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 1)		700	2000	1000	3000	1300	4000	μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
g_{os}	Common-Source Output Conductance			1.5		4		10			
C_{rss}	Common-Source Reverse Transfer Capacitance			5		5		5	pF		f = 1 MHz
C_{iss}	Common-Source Input Capacitance			25		25		25			
$\overline{e}_n$	Short Circuit Equivalent Input Noise Voltage			20		20		20	nV/√Hz	V_{DS} = 10 V, V_{GS} = 0	f = 10 Hz
				10		10		10			f = 1KHz
		A devices		10		10		10			f = 10 Hz
				5		5		5			f = 1 kHz
NF	Spot Noise Figure			1		1		1	dB	V_{DS} = 10 V, V_{GS} = 0 R_{gen} = 20K, (2N4867 Series) R_{gen} = 5K, (2N4867A Series)	f = 1 kHz

NOTE: 1. Pulse test duration = 2 ms.

2N4044, 2N4045, 2N4100, 2N4878, 2N4879, 2N4880 Dielectrically Isolated Dual NPN Transistor

1

FEATURES

- **High Gain at Low Current**
- **Low Output Capacitance**
- **Good h_{FE} Match**
- **Tight V_{BE} Tracking**
- **Dielectrically Isolated Matched Pairs for Differential Amplifiers.**

ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

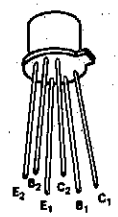
Collector-Base or Collector-Emitter Voltage (Note 1)
- 2N4044, 2N4878 ..... 60V
- 2N4100, 2N4879 ..... 55V
- 2N4045, 2N4880 ..... 45V

Collector-Collector Voltage 100V
Emitter-Base Voltage (Note 2) 7V
Collector Current (Note 1) ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	TO-71		TO-78	
	ONE SIDE	BOTH SIDES	ONE SIDE	BOTH SIDES
Power Dissipation ..	300 mW	500 mW	400 mW	750 mW
Derate above 25°C (mW/°C)	1.7	2.9	2.3	4.3

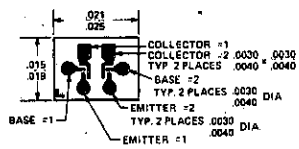
PIN CONFIGURATION

TO-71
TO-78



CHIP TOPOGRAPHY

4000



ORDERING INFORMATION*

TO-78	TO-71	WAFER	DICE
2N4044	2N4878	2N4044/W	2N4044/D
2N4045	2N4879	2N4045/W	2N4045/D
2N4100	2N4880	2N4100/W	2N4100/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	200	600	150	600	80	800	V	I_C = 10 μA, V_{CE} = 5V
		225		175		100			I_C = 1.0 mA, V_{CE} = 5 V
	T_A = -55°C	75		50		30			I_C = 10 μA, V_{CE} = 5 V
$V_{BE(on)}$	Emitter-Base On Voltage		0.7		0.7		0.7		
$V_{CE(sat)}$	Collector Saturation Voltage		0.35		0.35		0.35		I_C = 1.0 mA, I_B = 0.1 mA
I_{CBO}	Collector Cutoff Current		0.1		0.1		0.1*	nA	I_E = 0, V_{CB} = 45 V, 30 V*
	T_A = 150°C		0.1		0.1		0.1*	μA	
I_{EBO}	Emitter Cutoff Current		0.1		0.1		0.1	nA	I_C = 0, V_{EB} = 5 V
C_{obo}	Output Capacitance		0.8		0.8		0.8	pF	I_E = 0, V_{CB} = 5 V

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N4044 2N4878		2N4100 2N4879		2N4045 2N4880		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX		
C_{te}	Emitter Transition Capacitance		1		1		1	pF	$I_C = 0$, $V_{EB} = 0.5V$
C_{C_1, C_2}	Collector to Collector Capacitance		0.8		0.8		0.8	pF	$V_{CC} = 0$
I_{C_1, C_2}	Collector to Collector Leakage Current		5		5		5	pA	$V_{CC} = \pm 100V$
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	60		55		45		V	$I_C = 1mA$, $I_B = 0$
f_t	Current Gain Bandwidth Product	200		150		150		MHz	$I_C = 1mA$, $V_{CE} = 10V$
f_t	Current Gain Bandwidth Product	20		15		15		MHz	$I_C = 10\mu A$, $V_{CE} = 10V$
NF	Narrow Band Noise Figure		2		3		3	dB	$I_C = 10\mu A$, $V_{CE} = 5V$, $f = 1kHz$; $R_G = 10$ kohms, BW = 200 Hz
BV_{CBO}	Collector Base Breakdown Voltage	60		55		45		V	$I_C = 10\mu A$, $I_E = 0$
BV_{EBO}	Emitter Base Breakdown Voltage	7		7		7		V	$I_E = 10\mu A$, $I_C = 0$

MATCHING CHARACTERISTICS (25°C unless otherwise noted)

h_{FE_1}/h_{FE_2}	DC Current Gain Ratio (Note 3)	0.9	1	0.85	1	0.8	1		$I_C = 10\mu A$ to 1mA, $V_{CE} = 5V$
$\lvert V_{BE_1}-V_{BE_2}\rvert$	Base Emitter Voltage Differential		3		5		5	mV	$I_C = 10\mu A$, $V_{CE} = 5V$
$\lvert I_{B_1}-I_{B_2}\rvert$	Base Current Differential		5		10		25	nA	$I_C = 10\mu A$, $V_{CE} = 5V$
$\lvert\Delta(V_{BE_1}-V_{BE_2})\rvert/\Delta T$	Base Emitter Voltage Differential Change with Temperature		3		5		10	μV/°C	$I_C = 10\mu A$, $V_{CE} = 5V$, $T_A = -55°C$ to $+125°C$
$\lvert\Delta(I_{B_1}-I_{B_2})\rvert/\Delta T$	Base Current Differential Change with Temperature		0.3		0.5		1	nA/°C	

SMALL SIGNAL CHARACTERISTICS

PARAMETER		TYPICAL VALUE	UNIT	TEST CONDITIONS
h_{ib}	Input Resistance	28	ohms	$I_C = 1mA$, $V_{CB} = 5V$
h_{rb}	Voltage Feedback Ratio	43	x 10^{-3}	
h_{fe}	Small Signal Current Gain	250		$I_C = 1mA$, $V_{CE} = 5V$
h_{ob}	Output Conductance	60	μmhos	
h_{ie}	Input Resistance	9.6	k ohms	
h_{re}	Voltage Feedback Ratio	42	x 10^{-3}	
h_{oe}	Output Conductance	12	μmhos	

NOTES:
1. Per transistor.
2. The reverse base-emitter voltage must never exceed 7.0 volts and the reverse base-emitter current must never exceed 10 μamps.
3. The lowest of two h_{FE} readings is taken as h_{FE_1} for purposes of this ratio.

2N5018, 2N5019
P-Channel JFET

1

FEATURES
- **Low Insertion Loss**
- **No Offset or Error Voltages Generated by Closed Switch**
- **Purely Resistive**

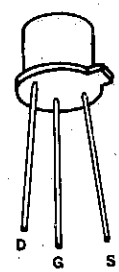
APPLICATIONS
- Analog Switches
- Commutators
- Choppers

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

Gate-Drain or Gate-Source Voltage 30V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ... +300°C
Power Dissipation ..... 500 mW
Derate above 25°C ..... 3 mW/°C

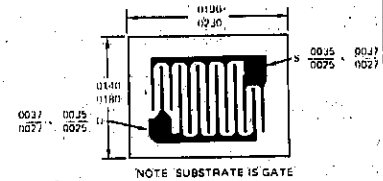
PIN CONFIGURATION

TO-18



CHIP TOPOGRAPHY

5508



ORDERING INFORMATION*

TO-18	WAFER	DICE
2N5018	2N5018/W	2N5018/D
2N5019	2N5019/W	2N5019/D

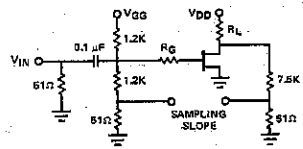
*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (@ 25°C unless otherwise noted)

PARAMETER		2N5018 Min	2N5018 Max	2N5019 Min	2N5019 Max	Unit	Test Conditions	
BV_{GSS}	Gate-Source Breakdown Voltage	30		30		V	I_G = 1 μA, V_{DS} = 0	
I_{GSSR}	Gate Reverse Current		2		2	nA	V_{GS} = 15 V, V_{DS} = 0	
$I_{D(off)}$	Drain Cutoff Current		−10		−10	nA	V_{DS} = −15 V, V_{GS} = 12 V (2N5018)	
	T_A = 150°C		−10		−10	μA	V_{DS} = −15 V, V_{GS} = 7 V (2N5019)	
I_{DGO}	Drain Reverse Current		−2		−2	nA	V_{DG} = −15 V, I_S = 0	
	T_A = 150°C		−3		−3	μA		
$V_{GS(off)}$	Gate-Source Cutoff Voltage		10		5	V	V_{DS} = −15 V, I_D = −1 μA	
I_{DSS}	Saturation Drain Current	−10		−5		mA	V_{DS} = −20 V, V_{GS} = 0	
$V_{DS(on)}$	Drain-Source ON Voltage		−0.5		−0.5	V	V_{GS} = 0, I_D = −6 mA (2N5018), I_D = −3 mA (2N5019)	
$r_{DS(on)}$	Static Drain-Source ON Resistance		75		150	Ω	I_D = −1 mA, V_{GS} = 0	
$r_{ds(on)}$	Drain-Source ON Resistance		75		150		I_D = 0, V_{GS} = 0	f = 1 kHz
C_{iss}	Common-Source Input Capacitance		45		45	pF	V_{DS} = −15 V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		10		10		V_{DS} = 0, V_{GS} = 12 V (2N5018), V_{GS} = 7 V (2N5019)	f = 1 MHz
$t_{d(on)}$	Turn-ON Delay Time		15		15	ns	V_{DD} = −6 V, $V_{GS(on)}$ = 0	
t_r	Rise Time		20		75			
$t_{d(off)}$	Turn-Off Delay Time		15		25			
t_f	Fall Time		50		100			

	$V_{GS(off)}$	$I_{D(on)}$	R_L
2N5018	12 V	−6 mA	910Ω
2N5019	7V	−3 mA	1.8KΩ

NOTE 1: Due to symmetrical geometry these units may be operated with source and drain leads interchanged.



INPUT PULSE
RISE TIME < 1 ns
FALL TIME < 1 ns
PULSE WIDTH 100 ns
REPLETION RATE 1 MHz

SAMPLING SCOPE
RISE TIME 0.4 ns
INPUT RESISTANCE 10 MΩ
INPUT CAPACITANCE 1.5 pF

2N5114-2N5116 JAN, JTX P-Channel JFET

1

FEATURES

- **Low ON Resistance**
- **$I_{D(off)}$ < 500 pA**
- **Switches directly from T^2L Logic**

GENERAL DESCRIPTION

Ideal for inverting switching or "Virtual Gnd" switching into inverting input of Op. Amp. No driver is required and ±10 VAC signals can be handled using only +5V logic (T^2L or CMOS).

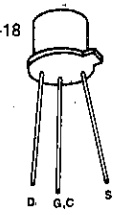
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

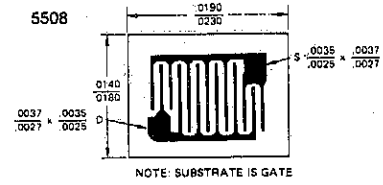
Gate-Drain or Gate-Source Voltage 30V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ... +300°C
Power Dissipation ..... 500 mW
Derate above 25°C ..... 3 mW/°C

PIN CONFIGURATION

TO-18



CHIP TOPOGRAPHY



NOTE: SUBSTRATE IS GATE

ORDERING INFORMATION*

TO18†	WAFER	DICE
2N5114	2N5114/W	2N5114/D
2N5115	2N5115/W	2N5115/D
2N5116	2N5116/W	2N5116/D

†add JAN, JTX to basic part number to specify these devices

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5114 MIN	2N5114 MAX	2N5115 MIN	2N5115 MAX	2N5116 MIN	2N5116 MAX	UNIT	TEST CONDITIONS
BV_{GSS}	Gate-Source Breakdown Voltage	30		30		30		V	I_G = 1 µA, V_{DS} = 0
I_{GSSR}	Gate Reverse Current		500		500		500	pA	V_{GS} = 20 V, V_{DS} = 0
	T_A = 150°C		1.0		1.0		1.0	µA	
$I_{D(off)}$	Drain Cutoff Current		-500		-500		-500	pA	V_{DS} = -15 V, V_{GS} = 2N5114 = 12 V, 2N5115 = 7 V, 2N5116 = 5 V
	T_A = 150°C		-1.0		-1.0		-1.0	µA	
V_P	Gate-Source Pinch-Off Voltage	5	10	3	6	1	4	V	V_{DS} = -15 V, I_D = -1 nA
I_{DSS}	Drain Current at Zero Gate Voltage (Note 1)	-30	-90	-15	-60	-5	-25	mA	V_{GS} = 0, V_{DS} = 2N5114 = -18 V, 2N5115 = -15 V, 2N5116 = -15 V
V_{GSSF}	Forward Gate-Source Voltage		-1		-1		-1	V	I_G = -1 mA, V_{DS} = 0
$V_{DS(on)}$	Drain-Source ON Voltage		-1.3		-0.8		-0.6	V	V_{GS} = 0, I_D = 2N5114 = -15 mA, 2N5115 = - 7 mA, 2N5116 = - 3 mA
$r_{DS(on)}$	Static Drain-Source ON Resistance		75		100		150	Ω	V_{GS} = 0, I_D = -1 mA
$r_{ds(on)}$	Small-Signal Drain-Source ON Resistance		75		100		150	Ω	V_{GS} = 0, I_D = 0, f = 1 kHz
	Jan TX only		75		100		175		
C_{iss}	Common-Source Input Capacitance		25		25		25	pF	V_{DS} = -15 V, V_{GS} = 0, f = 1 MHz
	Jan TX only		25		25		27		
C_{rss}	Common-Source Reverse Transfer Capacitance		7		7		7	pF	V_{DS} = 0, V_{GS} = 2N5114 = 12 V, 2N5115 = 7 V, 2N5116 = 5 V, f = 1 MHz

Note 1. Pulse test; duration = 2 ms.

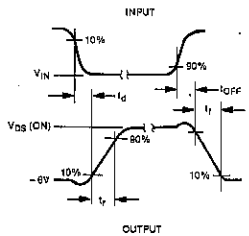
INTERSIL

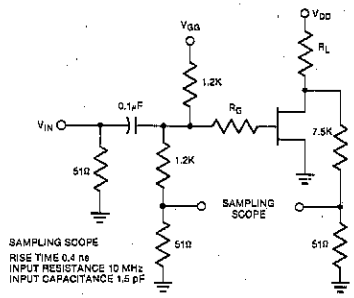
SWITCHING CHARACTERISTICS (25°C unless otherwise noted)

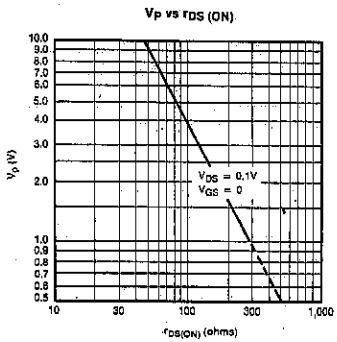
PARAMETER	2N5114	2N5115	2N5116	JAN TX 2N5114	JAN TX 2N55115	JAN TX 2N5116	UNIT
	MAX	MAX	MAX	MAX	MAX	MAX	
t_d Turn-ON Delay Time	6	10	12	6	10	25	
t_r Rise Time	10	20	30	10	20	35	ns
t_{off} Turn-OFF Delay Time	6	8	19	6	8	29	
t_f Fall Time	15	30	50	(not JAN TX specified)			

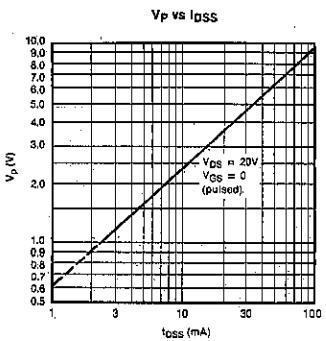
1

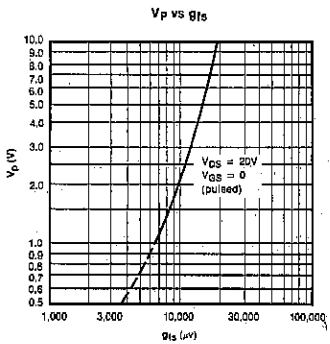
TEST CONDITIONS			
	2N5114	2N5115	2N5116
V_{DD}	−10V	−6V	−6V
V_{GG}	20V	12V	8V
R_L	430Ω	910Ω	2 KΩ
R_G	100Ω	220Ω	390Ω
$I_{D(ON)}$	−15mA	−7mA	−3mA
V_{IN}	−12V	−7V	−5V











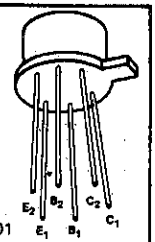
2N5117-2N5119
Dielectrically Isolated Dual PNP Transistor

FEATURES

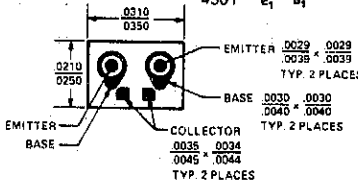
- **High Gain at Low Current**
- **Low Output Capacitance**
- **Good h_{FE} Match**
- **Tight V_{BE} Tracking**
- **Dielectrically Isolated Matched Pairs for Differential Amplifiers.**

PIN CONFIGURATION

TO-78



CHIP TOPOGRAPHY



ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Collector-Base or Collector-Emitter Voltage (Note 1) 45V
Emitter-Base Voltage (Notes 1 and 2) 7V
Collector-Collector Voltage 100V
Collector Current (Note 1) ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	400 mW	750 mW
Derate above 25°C	2.3 mW/°C	4.3 mW/°C

ORDERING INFORMATION*

TO-78	WAFER	DICE
2N5117	2N5117/W	2N5117/D
2N5118	2N5118/W	2N5118/D
2N5119	2N5119/W	2N5119/D

*When ordering wafer/dice refer to Appendix B-23

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5117 2N5118 MIN	2N5117 2N5118 MAX	2N5119 MIN	2N5119 MAX	UNIT	TEST CONDITIONS
h_{FE}	DC Current Gain	100	300	50			I_C = 10 μA, V_{CE} = 5.0 V
		100		50			I_C = 500 μA, V_{CE} = 5.0 V
	T_A = -55°C	30		20			I_C = 10 μA, V_{CE} = 5.0 V
I_{CBO}	Collector Cutoff Current		0.1		0.1	nA	I_E = 0, V_{CB} = 30 V
	T_A = 150°C		0.1		0.1	μA	
I_{EBO}	Emitter Cutoff Current		0.1		0.1	nA	I_C = 0, V_{EB} = 5.0 V
$I_{C_1-C_2}$	Collector-Collector Leakage		5.0		5.0	pA	V_{CC} = 100 V
GBW	Current Gain Bandwith Product	100		100		MHz	I_C = 500 μA, V_{CE} = 10 V
C_{ob}	Output Capacitance		0.8		0.8	pF	I_E = 0, V_{CB} = 5.0 V
C_{te}	Emitter Transition Capacitance		1.0		1.0		I_C = 0, V_{EB} = 0.5 V
$C_{C_1-C_2}$	Collector-Collector Capacitance		0.8		0.8		V_{CC} = 0
$V_{CEO(sust)}$	Collector-Emitter Sustaining Voltage	45		45		V	I_C = 1.0 mA, I_B = 0
NF	Narrow Band Noise Figure		4.0		4.0	dB	I_C = 10 μA, V_{CE} = 5.0 V, BW = 200 Hz; f = 1 KHz, R_G = 10 KΩ
BV_{CBO}	Collector Base Breakdown Voltage	45		45		V	I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter Base Breakdown Voltage	7.0		7.0		V	I_E = 10 μA, I_C = 0

MATCHING CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5117 MIN	2N5117 MAX	2N5118 MIN	2N5118 MAX	2N5119 MIN	2N5119 MAX	UNIT	TEST CONDITIONS	
h_{FE_1}/h_{FE_2}	DC Current Gain Ratio (Note 3)	0.9	1.0						I_C = 10 μA to 500 μA, V_{CE} = 5 V	
				0.85	1.0	0.8	1.0		I_C = 10 μA, V_{CE} = 5.0 V	
$V_{BE_1}-V_{BE_2}$	Base-Emitter Voltage Differential		3.0					mV	I_C = 10 μA to 500 μA, V_{CE} = 5 V	
					5.0		5.0			
$I_{B_1}-I_{B_2}$	Base Current Differential		10.0		15		40	nA	I_C = 10 μA, V_{CE} = 5.0 V	
$\Delta(V_{BE_1}-V_{BE_2})/\Delta T$	Base Voltage Differential Change with Temperature		3.0		5.0		10	μV/°C		T_A = -55°C to +125°C
$\Delta(I_{B_1}-I_{B_2})/\Delta T$	Base-Current Differential Change with Temperature		0.3		0.5		1.0	nA/°C		T_A = -55°C to +125°C

1. Per transistor.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10 μA.
3. Lower of two h_{FE} readings is defined as h_{FE_1}.

2N5196-2N5199 Dual Monolithic N-Channel JFET

1

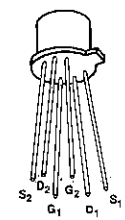
ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage (Note 1) ..... -50V
Gate Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDE
Power Dissipation	250 mW ...	500 mW
Derate above 25°C	2.6 mW/°C ..	4.3 mW/°C

PIN CONFIGURATION

TO-18



CHIP TOPOGRAPHY

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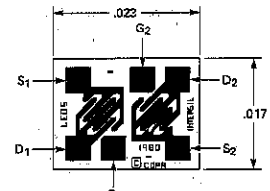


ALL BOND PADS ARE 4 x 4 MIL.

ORDERING INFORMATION*

TO-71	WAFER	DICE
2N5196	2N5196/W	2N5196/D
2N5197	2N5197/W	2N5197/D
2N5198	2N5198/W	2N5198/D
2N5199	2N5199/W	2N5199/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		MIN	MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-25	pA	V_{GS} = -30 V, V_{DS} = 0	
	T_A = 150°C		-50	nA		
BV_{GSS}	Gate-Source Breakdown Voltage	-50		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.7	-4		V_{DS} = 20 V, I_D = 1 nA	
V_{GS}	Gate-Source Voltage	-0.2	-3.8			
I_G	Gate Operating Current		-15	pA	V_{DG} = 20 V, I_D = 200 μA	
	T_A = 125°C		-15	nA		
I_{DSS}	Saturation Drain Current (Note 2)	0.7	7	mA	V_{DS} = 20 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance	1000	4000	μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
g_{fs}	Common-Source Forward Transconductance	700	1600		V_{DG} = 20 V, I_D = 200 μA	
g_{os}	Common-Source Output Conductance		50		V_{DS} = 20 V, V_{GS} = 0	
g_{os}	Common-Source Output Conductance		4		V_{DG} = 20 V, I_D = 200 μA	
C_{iss}	Common-Source Input Capacitance		6	pF	V_{DS} = 20 V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		2			
NF	Spot Noise Figure		0.5	dB		f = 100 Hz, R_G = 10 MΩ
$\overline{e_n}$	Equivalent Input Noise Voltage		20	$\frac{\mu nV}{\sqrt{Hz}}$		f = 1 kHz

PARAMETER		2N5196		2N5197		2N5198		2N5199		UNIT	TEST CONDITIONS	
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX			
$\lvert I_{G1}-I_{G2}\rvert$	Differential Gate Current		5		5		5		5	nA	V_{DG} = 20 V, I_D = 200 μA	125°C
I_{DSS1}/I_{DSS2}	Saturation Drain Current Ratio (Note 2)	0.95	1	0.95	1	0.95	1	0.95	1		V_{DS} = 20 V, V_{GS} = 0 V	
g_{fs1}/g_{fs2}	Transconductance Ratio (Note 2)	0.97	1	0.97	1	0.95	1	0.95	1		V_{DG} = 20 V, I_D = 200 μA	f = 1 kHz
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		5		5		10		15	mV		
$\frac{\Delta\lvert V_{GS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Differential Voltage Change with Temperature (Note 3)		5		10		20		40	μV/°C		T_A = 25°C T_B = 125°C
			5		10		20		40			T_A = -55°C T_B = 25°C
$\lvert g_{os1}-g_{os2}\rvert$	Differential Output Conductance		1		1		1		1	μmho		f = 1 kHz

NOTES: 1. Per transistor.
2. Pulse test required, pulsewidth = 300 μs, duty cycle < 3%.
3. Measured at endpoints T_A and T_B.

2N5397, 2N5398
N-Channel JFET

1

FEATURES

- G_{ps} = 15 dB Minimum (Common Gate) at 450 MHz
- Low Noise
- Low Capacitance

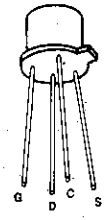
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Drain-Gate Voltage	-25V
Drain-Source Voltage	-25V
Continuous Forward Gate Current	-10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

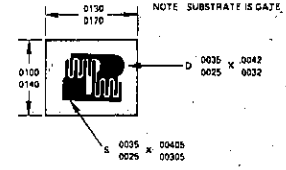
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

5011



ORDERING INFORMATION*

TO-72	WAFER	DICE
2N5397	2N5397/W	2N5397/D
2N5398	2N5398/W	2N5398/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5397 MIN	2N5397 MAX	2N5398 MIN	2N5398 MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-0.1		-0.1	nA	V_{GS} = -15 V, V_{DS} = 0	
	T_A = +150°C		-0.1		-0.1	μA		150°C
BV_{GSS}	Gate-Source Breakdown Voltage	-25		-25		V	V_{DS} = 0, I_G = -1 μA	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1.0	-6.0	-1.0	-6.0	V	V_{DS} = 10 V, I_D = 1 nA	
I_{DSS}	Saturation Drain Current (Note 1)	10	30	5	40	mA	V_{DS} = 10 V, V_{DS} = 0	
$V_{GS(f)}$	Gate-Source Forward Voltage		1		1	V	V_{DS} = 0, I_G = 1 mA	
g_{fs}	Common-Source Forward Transconductance (Note 1)	6000	10,000			μmho	V_{DS} = 10V, I_D = 10 mA	f = 1 kHz
				5500	10,000		V_{DS} = 10 V, V_{GS} = 0	
g_{oss}	Common-Source Output Conductance		200				V_{DS} = 10 V, I_D = 10 mA	
					400		V_{DS} = 10 V, V_{GS} = 0	
C_{rss}	Common-Source Reverse Transfer Capacitance		1.2			pF	V_{DS} = 10 V, I_D = 10 mA	f = 1 MHz
					1.3		V_{DS} = 10 V, V_{GS} = 0	
C_{iss}	Common-Source Input Capacitance		5.0				V_{DG} = 10 V, I_D = 10 mA	
					5.5		V_{DS} = 10 V, V_{GS} = 0	
g_{iss}	Common-Source Input Conductance		2000			μmho	V_{DG} = 10 V, I_D = 10 mA	f = 450 MHz
					3000		V_{DG} = 10 V, V_{GS} = 0	
g_{oss}	Common-Source Output Conductance		400				V_{DG} = 10 V, I_D = 10 mA	
					500		V_{DS} = 10 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 1)	5500	9000				V_{DG} = 10 V, I_D = 10 mA	
				5000	10,000		V_{DS} = 10 V, V_{GS} = 0	
G_{ps}	Common-Source Power Gain (neutralized)	15				dB	V_{DG} = 10 V, I_D = 10 mA	
NF	Common-Source, Spot Noise Figure (neutralized)		3.5					

Note 1: Pulse test duration = 2ms

2N5432-2N5434
N-Channel JFET

FEATURES

- Low $r_{ds(on)}$
- Excellent Switching
- Low Cutoff Current

1

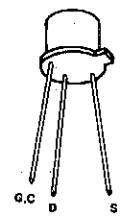
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source Voltage	-25V
Gate-Drain Voltage	-25V
Gate Current	100mA
Drain Current	400 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	2.3 mW/°C

PIN CONFIGURATION

TO-52



CHIP TOPOGRAPHY

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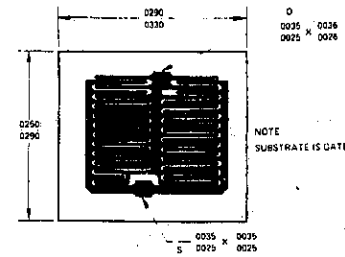


ORDERING INFORMATION*

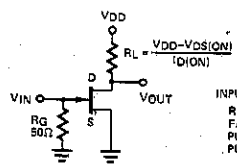
TO-52	WAFER	DICE
2N5432	2N5432/W	2N5432/D
2N5433	2N5433/W	2N5433/D
2N5434	2N5434/W	2N5434/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5432		2N5433		2N5434		UNIT	TEST CONDITIONS	
		MIN	MAX	MIN	MAX	MIN	MAX			
I_{GSSR}	Gate Reverse Current		-200		-200		-200	pA	V_{GS} = -15 V, V_{DS} = 0	
	T_A = 150°C		-200		-200		-200	nA		
BV_{GSS}	Gate Source Breakdown Voltage	-25		-25		-25		V	I_G = -1 μA, V_{DS} = 0	
$I_{D(off)}$	Drain Cutoff Current		200		200		200	pA	V_{DS} = 5 V, V_{GS} = -10 V	
	T_A = 150°C		200		200		200	nA		
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-4	-10	-3	-9	-1	-4	V	V_{DS} = 5 V, I_D = 3 nA	
I_{DSS}	Saturation Drain Current (Note 1)	150		100		30		mA	V_{DS} = 15 V, V_{GS} = 0	
$r_{DS(on)}$	Static Drain-Source ON Resistance	2	5		7		10	ohm	V_{GS} = 0, I_D = 10 mA	
$V_{DS(on)}$	Drain-Source ON Voltage		50		70		100	mV		
$r_{ds(on)}$	Drain-Source ON Resistance		5		7		10	ohm	V_{GS} = 0, I_D = 0	f = 1 kHz
C_{iss}	Common-Source Input Capacitance		30		30		30	pF	V_{DS} = 0, V_{GS} = -10 V	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		15		15		15			
t_d	Turn-ON Delay Time		4		4		4	ns	V_{DD} = 1.5 V, $V_{GS(on)}$ = 0, $V_{GS(off)}$ = -12 V, $I_{D(on)}$ = 10 mA	
t_r	Rise Time		1		1		1			
t_{off}	Turn-OFF Delay Time		6		6		6			
t_f	Fall Time		30		30		30			

NOTE: 1. Pulse test required, pulsewidth 300 μs, duty cycle ≤ 3%.



INPUT PULSE
RISE TIME 0.25 ns
FALL TIME 0.75
PULSE WIDTH 200 ns
PULSE RATE 550 pps

SAMPLING SCOPE
RISE TIME 0.4 ns
INPUT RESISTANCE 10 M
INPUT CAPACITANCE 1.5 pF

R_L = 145Ω (2N5432) 143Ω (2N5433) 140Ω (2N5434)

2N5452-2N5454 Dual Monolithic N-Channel JFET

FEATURES

- **Low Offset Voltage**
- **Low Drift**
- **Low Capacitance**
- **Low Output Conductance**

GENERAL DESCRIPTION

Matched FET pairs for differential amplifiers. This family of general purpose FETs is characterized for low and medium frequency differential amplifier applications requiring low drift and low offset voltage.

ABSOLUTE MAXIMUM RATINGS

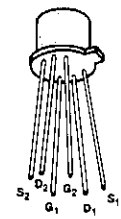
(T_A = 25°C unless otherwise noted)

Gate-Source or Gate Drain
Voltage (Note 1) ..... -50V
Gate Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	250 mW	500 mW
Derate above 25°C	2.9 mW/°C	4.3 mW/°C

PIN CONFIGURATION

TO-71



CHIP TOPOGRAPHY

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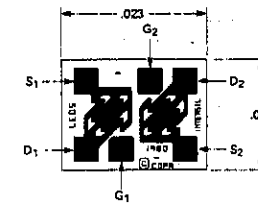


ALL BOND PADS ARE 4 x 4 MIL.

ORDERING INFORMATION*

TO-71	WAFER	DICE
2N5452	2N5452/W	2N5452/D
2N5453	2N5453/W	2N5453/D
2N5454	2N5454/W	2N5454/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

PARAMETER		2N5452 MIN	2N5452 MAX	2N5453 MIN	2N5453 MAX	2N5454 MIN	2N5454 MAX	UNITS	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-100		-100		-100	pA	V_{GS} = -30 V, V_{DS} = 0	
	T_A = 150°C		-200		-200		-200	nA		
BV_{GSS}	Gate-Source Breakdown Voltage	-50		-50		-50		V	V_{DS} = 0, I_G = -1 μA	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1	-4.5	-1	-4.5	-1	-4.5	V	V_{DS} = 20 V, I_D = 1 nA	
V_{GS}	Gate-Source Voltage	-0.2	-4.2	-0.2	-4.2	-0.2	-4.2	V	V_{DS} = 20 V, I_D = 50 μA	
$V_{GS(f)}$	Gate-Source Forward Voltage		2		2		2	V	V_{DS} = 0, I_G = 1 mA	
I_{DSS}	Saturation Drain Current	0.5	5.0	0.5	5.0	0.5	5.0	mA	V_{DS} = 20 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance	1000	3000	1000	3000	1000	3000	μmho	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
		1000		1000		1000				f = 100 MHz
g_{os}	Common-Source Output Conductance		3.0		3.0		3.0			f = 1 kHz
			1.0		1.0		1.0		V_{DS} = 20 V, I_D = 200 μA	
C_{iss}	Common-Source Input Capacitance		4.0		4.0		4.0	pF	V_{DS} = 20 V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		1.2		1.2		1.2			
C_{dgo}	Drain-Gate Capacitance		1.5		1.5		1.5		V_{DG} = 10 V, I_S = 0	
$\overline{e_n}$	Equivalent Short Circuit Input Noise Voltage		20		20		20	$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 20 V, V_{GS} = 0	f = 1 kHz
NF	Common-Source Spot Noise Figure		0.5		0.5		0.5	dB	V_{DS} = 20 V, V_{GS} = 0, R_G = 10 MΩ	f = 100 Hz
I_{DSS1}/I_{DSS2}	Drain Saturation Current Ratio	0.95	1.0	0.95	1.0	0.95	1.0		V_{DS} = 20 V, V_{GS} = 0	
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		5.0		10.0		15.0	mV	V_{DS} = 20 V, I_D = 200 μA	
$\Delta\lvert V_{GS1}-V_{GS2}\rvert$	Gate-Source Voltage Differential Change with Temperature		0.4		0.8		2.0			T = 25°C to -55°C
			0.5		1.0		2.5			T = 25°C to +125°C
g_{fs1}/g_{fs2}	Transconductance Ratio	0.97	1.0	0.97	1.0	0.95	1.0			
$\lvert g_{os1}-g_{os2}\rvert$	Differential Output Conductance		0.25		0.25		0.25	μmhos		f = 1 kHz

NOTE: 1. Per transistor.

2N5457-2N5459
N-Channel JFET

1

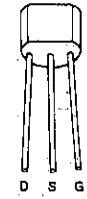
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Drain-Gate Voltage	25V
Drain-Source Voltage	25V
Continuous Forward Gate Current	10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

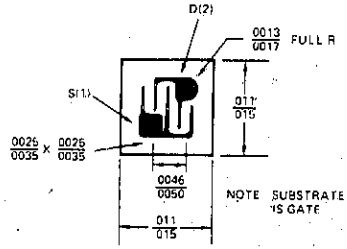
PIN CONFIGURATION

TO-92



CHIP TOPOGRAPHY

5010*



*DICE WITH 4 MIL BONDING PADS AVAILABLE. CONSULT FACTORY FOR DETAILS.

ORDERING INFORMATION*

TO-92	WAFER	DICE
2N5457	2N5457/W	2N5457/D
2N5458	2N5458/W	2N5458/D
2N5459	2N5459/W	2N5459/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER			MIN	TYP	MAX	UNITS	TEST CONDITIONS
BV_{GSS}	Gate-Source Breakdown Voltage		-25	-60		V	I_G = -10 μA, V_{DS} = 0
I_{GSS}	Gate Reverse Current			.05	-1.0	nA	V_{GS} = -15 V, V_{DS} = 0
					-200		V_{GS} = -15 V, V_{DS} = 0, T_A = 100°C
$V_{GS(off)}$	Gate-Source Cutoff Voltage	2N5457	-0.5		-6.0	V	V_{DS} = 15 V, I_D = 10 nA
		2N5458	-1.0		-7.0		
		2N5459	-2.0		-8.0		
V_{GS}	Gate-Source Voltage	2N5457		2.5		V	V_{DS} = 15 V, I_D = 100 μA
		2N5458		3.5			V_{DS} = 15 V, I_D = 200 μA
		2N5459		4.5			V_{DS} = 15 V, I_D = 400 μA
I_{DSS}	Zero-Gate-Voltage Drain Current	2N5457	1.0	3.0	5.0	mA	V_{DS} = 15 V, V_{GS} = 0
		2N5458	2.0	6.0	9.0		
		2N5459	4.0	9.0	16		
$\|y_{fs}\|$	Forward Transfer Admittance	2N5457	1000	3000	5000	μmho	V_{DS} = 15 V, V_{GS} = 0, f = 1 kHz
		2N5458	1500	4000	5500		
		2N5459	2000	4500	6000		
$\|y_{os}\|$	Output Admittance			10	50	μmho	V_{DS} = 15 V, V_{GS} = 0, f = 1 kHz
C_{iss}	Input Capacitance			4.5	7.0	pF	V_{DS} = 15 V, V_{GS} = 0, f = 1 MHz
C_{rss}	Reverse Transfer Capacitance			1.5	3.0	pF	V_{DS} = 15 V, V_{GS} = 0, f = 1 MHz
NF	Noise Figure				3.0	dB	V_{DS} = 15 V, V_{GS} = 0, R_G = 1 MHz BW = 1 Hz, f = 1 KHz

Pulse test required. PW ≤ 630 ms, duty cycle ≤ 10%

2N5460-2N5465
P-Channel JFET

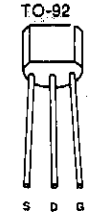
1

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

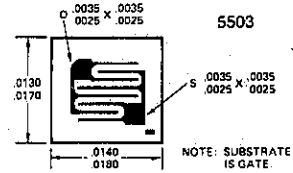
Drain-Gate or Source-Gate Voltage
- 2N5460 - 2N5462 ..... 40V
- 2N5463 - 2N5465 ..... 60V

Gate Current ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 310 mW
- Derate above 25°C ..... 2.8 mW/°C

PIN CONFIGURATION
TO-92



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-92	WAFER	DICE
2N5460	2N5460/W	2N5460/D
2N5461	2N5461/W	2N5461/D
2N5462	2N5462/W	2N5462/D
2N5463	2N5463/W	2N5463/D
2N5464	2N5464/W	2N5464/D
2N5465	2N5465/W	2N5465/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

	PARAMETER		MIN	TYP	MAX	UNITS	TEST CONDITIONS	
BV_{GSS}	Gate-Source Breakdown Voltage	2N5460, 2N5461, 2N5462	40			V	I_G = 10 μAdc, V_{DS} = 0	
		2N5463, 2N5464, 2N5465	60					
$V_{GS(off)}$	Gate-Source Cutoff Voltage	2N5460, 2N5463	0.75		6.0	V	V_{DS} = 15 Vdc, I_D = 1.0 μAdc	
		2N5461, 2N5464	1.0		7.5			
		2N5462, 2N5465	1.8		9.0			
I_{GSSR}	Gate Reverse Current	2N5460, 2N5461, 2N5462			5.0	nA	V_{DS} = 0	V_{GS} = 20V
		2N5463, 2N5464, 2N5465			5.0			V_{GS} = 30V
	T_A = 100°C	2N5460, 2N5461, 2N5462			1.0	μA		V_{GS} = 20V
		2N5463, 2N5464, 2N5465			1.0			V_{GS} = 30V
I_{DSS}	Zero-Gate Voltage Drain Current	2N5460, 2N5463	-1.0		-5.0	mA	V_{DS} = -15V	V_{GS} = 0
		2N5461, 2N5464	-2.0		-9.0			
		2N5462, 2N5465	-4.0		-16			
V_{GS}	Gate-Source Voltage	2N5460, 2N5463	0.5		4.0	V		I_D = 0.1 mA
		2N5461, 2N5464	0.8		4.5			I_D = -0.2 mA
		2N5462, 2N5465	1.5		6.0			I_D = -0.4 mA
g_{fs}	Forward Transadmittance	2N5460, 2N5463	1000		4000	μmho	V_{DS} = -15V, V_{GS} = 0V	f = 1.0 kHz
		2N5461, 2N5464	1500		5000			
		2N5462, 2N5465	2000		6000			
g_{os}	Output Admittance				75	μmho		
C_{iss}	Input Capacitance			5.0	7	pF		
C_{rss}	Reverse Transfer Capacitance			1.0	2.0	pF		
NF	Common-Source Noise Figure			1.0	2.5	dB		f = 100 Hz, BW = 1.0 Hz, R_G = 1.0 MΩ
$\bar{e}_n$	Equivalent Short-Circuit Input Noise Voltage			.60	115	$nV/\sqrt{Hz}$		

2N5484-2N5486
N-Channel JFET

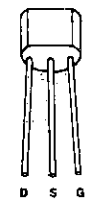
1

FEATURES
- **Up to 400 MHz Operation**
- **Economy Packaging**
- **C_{rss} < 1.0 pF**

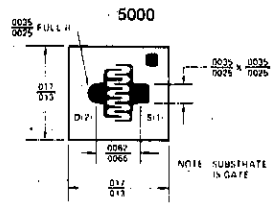
ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise specified)

Drain-Gate Voltage	25V
Source Gate Voltage	25V
Drain Current	30 mA
Forward Gate Current	10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	310 mW
Derate above 25°C	2.8 mW/°C

PIN CONFIGURATION
TO-92



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-92	WAFER	DICE
2N5484	2N5484/W	2N5484/D
2N5485	2N5485/W	2N5485/D
2N5486	2N5486/W	2N5486/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5484 MIN	2N5484 MAX	2N5485 MIN	2N5485 MAX	2N5486 MIN	2N5486 MAX	UNITS	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-1.0		-1.0		-1.0	nA	V_{GS} = -20 V, V_{DS} = 0	
	T_A = 100°C		-200		-200		-200			
BV_{GSS}	Gate-Source Breakdown Voltage	-25		-25		-25		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.3	-3.0	-0.5	-4.0	-2.0	-6.0		V_{DS} = 15 V, I_D = 10 nA	
I_{DSS}	Saturation Drain Current	1.0	5.0	4.0	10	8.0	20	mA	V_{DS} = 15 V, V_{GS} = 0 (Note 1)	
g_{fs}	Common-Source Forward Transconductance	3000	6000	3500	7000	4000	8000	μmhos	V_{DS} = 15 V, V_{GS} = 0	f = 1 kHz
g_{os}	Common-Source Output Conductance		50		60		75			
$Re(y_{fs})$	Common-Source Forward Transconductance	2500								f = 100 MHz
				3000		3500				f = 400 MHz
$Re(y_{os})$	Common-Source Output Conductance		75							f = 100 MHz
					100		100			f = 400 MHz
$Re(y_{is})$	Common-Source Input Conductance		100							f = 100 MHz
					1000		1000			f = 400 MHz
C_{iss}	Common-Source Input Capacitance		5.0		5.0		5.0	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		1.0		1.0		1.0			
C_{oss}	Common-Source Output Capacitance		2.0		2.0		2.0			
NF	Noise Figure		2.5		2.5		2.5	dB	V_{DS} = 15 V, V_{GS} = 0, R_G = 1 MΩ	f = 1 kHz
			3.0						V_{DS} = 15 V, I_D = 1 mA, R_G = 1 kΩ	f = 100 MHz
					2.0		2.0		V_{DS} = 15 V, I_D = 4 mA, R_G = 1 kΩ	
					4.0		4.0			f = 400 MHz
G_{ps}	Common-Source Power Gain	16	25						V_{DS} = 15 V, I_D = 1 mA	f = 100 MHz
				18	30	18	30		V_{DS} = 15 V, I_D = 4 mA	
				10	20	10	20			f = 400 MHz

NOTE: Pulse test required. Pulse width = 300μs, duty cycle ≤ 3%.

2N5515-2N5524 Monolithic Dual N-Channel JFET

1

FEATURES

- **Tight Temperature Tracking**
- **Tight Matching**
- **High Common Mode Rejection**
- **Low Noise**

ABSOLUTE MAXIMUM RATINGS

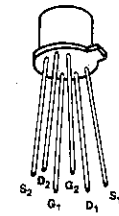
(T_A = 25°C unless otherwise specified)

Gate-Source or Gate-Drain Voltage	-40V
Gate Current (Note 1)	50 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	250 mW	500 mW
Derate above 25°C	3.8 mW/°C	7.7 mW/°C

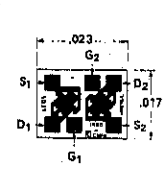
PIN CONFIGURATION

TO-71

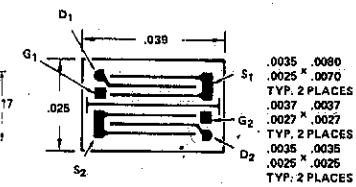


CHIP TOPOGRAPHY

(2N5515-19)
6037



(2N5520-24)
6019



ALL BOND PADS ARE 4 x 4 MIL.

ORDERING INFORMATION*

TO-72	WAFER	DICE
2N5515	2N5515/W	2N5515/D
2N5516	2N5516/W	2N5516/D
2N5517	2N5517/W	2N5517/D
2N5518	2N5518/W	2N5518/D
2N5519	2N5519/W	2N5519/D
2N5520		
2N5521		
2N5522		
2N5523		
2N5524		

*When ordering wafer/dice refer to Appendix B-23.

NOTE: Per transistor.

INTERSIL

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER			MIN	MAX	UNITS	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current			-250	pA	V_{GS} = -30 V, V_{DS} = 0	
		T_A = 150°C		-250	nA		
BV_{GSS}	Gate-Source Breakdown Voltage		-40		V	I_G = -1 μA, V_{DS} = 0	
V_P	Gate-Source Pinch-Off Voltage		-0.7	-4		V_{DS} = 20 V, I_D = 1 nA	
I_{DSS}	Drain Current at Zero Gate Voltage (Note 1)		0.5	7.5	mA	V_{DS} = 20 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 1)		1000	4000	μmho		f = 1 kHz
g_{oss}	Common-Source Output Conductance			10			
C_{rss}	Common-Source Reverse Transfer Capacitance			5	pF		f = 1 MHz
C_{iss}	Common-Source Input Capacitance			25			
$\bar{e}_n$	Equivalent Input Noise Voltage	2N5515-19		30	nV/√Hz	V_{DG} = 20 V, I_D = 200 μA	f = 10 Hz
		2N5520-24		15			f = 1 kHz
		2N5515-24		10			
I_G	Gate Current			-100	pA		
		T_A = 125°C		-100	nA		
V_{GS}	Gate Source Voltage		-0.2	-3.8	V		
g_{fs}	Common-Source Forward Transconductance (Note 1)		500	1000	μmho		f = 1 kHz
g_{oss}	Common-Source Output Conductance			1	μmho		

MATCHING CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5515,20		2N5516,21		2N5517,22		2N5518,23		2N5519,24		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
I_{DSS1}	Drain Current Ratio at	0.95	1	0.95	1	0.95	1	0.95	1	0.90	1		V_{DS} = 20 V, V_{GS} = 0
I_{DSS2}	Zero Gate Voltage (Note 1)												
$\lvert I_{G1} - I_{G2} \rvert$	Differential Gate Current (+125°C)		10		10		10		10		10	nA	V_{DG} = 20 V, I_D = 200 μA
g_{fs1}	Transconductance Ratio	0.97	1	0.97	1	0.95	1	0.95	1	0.90	1		V_{DG} = 20 V, I_D = 200 μA f = 1 KHz
g_{fs2}	(Note 1)												
$\lvert g_{oss1} - g_{oss2} \rvert$	Differential Output Conductance		0.1		0.1		0.1		0.1		0.1	μmho	V_{DG} = 20 V, I_D = 200 μA f = 1 KHz
$\lvert V_{GS1} - V_{GS2} \rvert$	Differential Gate-Source Voltage		5		5		10		15		15	mV	V_{DG} = 20 V, I_D = 200 μA
$\frac{\Delta\lvert V_{GS1} - V_{GS2} \rvert}{\Delta T}$	Gate-Source Voltage Differential Drift (T_A = -55°C to +125°C)		5		10		20		40		80	μV/°C	V_{DG} = 20 V, I_D = 200 μA
CMRR	Common Mode Rejection Ratio (Note 2)	100		100		90						dB	V_{DD} = 10 to 20 V, I_D = 200 μA

NOTES:

1. Pulse duration of 28 ms used during test.
2. CMRR = 20 $Log_{10} \Delta V_{DD} / \Delta \lvert V_{GS1} - V_{GS2} \rvert$, ($\Delta V_{DD}$ = 10V)

2N5638-2N5640
N-Channel JFET

FEATURES

- **Economy Packaging**
- **Fast Switching**
- **Low Drain-Source 'ON' Resistance**

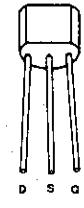
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise specified)

Drain-Source Voltage	30V
Drain-Gate Voltage	30V
Source-Gate Voltage	30V
Forward Gate Current	10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	310 mW
Derate above 25°C	2.8 mW/°C

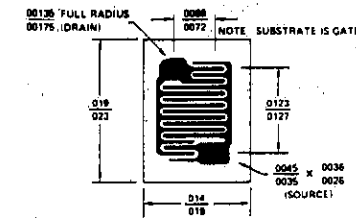
PIN CONFIGURATION

TO-92



CHIP TOPOGRAPHY

5001



ORDERING INFORMATION*

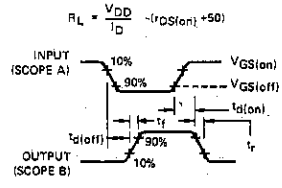
TO-92	WAFER	DICE
2N5638	2N5638/W	2N5638/D
2N5639	2N5639/W	2N5638/D
2N5640	2N5640/W	2N5640/D

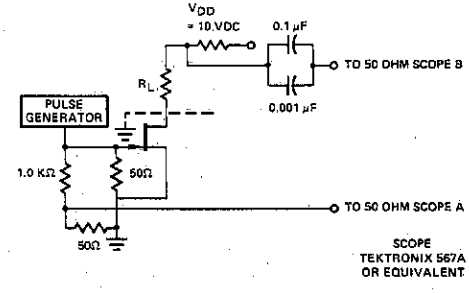
*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5638		2N5639		2N5640		UNIT	TEST CONDITIONS	
		MIN	MAX	MIN	MAX	MIN	MAX			
BV_{GSS}	Gate Reverse Breakdown Voltage	-30		-30		-30		V	I_G = -10 μA, V_{DS} = 0	
I_{GSSR}	Gate Reverse Current		-1.0		-1.0		-1.0	nA	V_{GS} = -15 V, V_{DS} = 0	
	T_A = 100°C		-1.0		-1.0		-1.0	μA		
$I_{D(off)}$	Drain Cutoff Current		1.0		1.0		1.0	nA	V_{DS} = 15 V, V_{GS} = -12 V (2N5638)	
	T_A = 100°C		1.0		1.0		1.0	μA	V_{GS} = -8 V (2N5639), V_{GS} = -6 V (2N5640)	
I_{DSS}	Saturation Drain Current	50		25		5.0		mA	V_{DS} = 20 V, V_{GS} = 0 (Note 1)	
$V_{DS(on)}$	Drain-Source ON Voltage		0.5		0.5		0.5	V	V_{GS} = 0, I_D = 12 mA (2N5638), I_D = 6 mA (2N5639), I_D = 3 mA (2N5640)	
$r_{DS(on)}$	Static Drain-Source ON Resistance		30		60		100	Ω	I_D = 1 mA, V_{GS} = 0	
$r_{ds(on)}$	Drain-Source ON Resistance		30		60		100		V_{GS} = 0, I_D = 0	f = 1 kHz
C_{iss}	Common-Source Input Capacitance		10		10		10	pF	V_{GS} = -12 V, V_{DS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		4.0		4.0		4.0			
$t_{d(on)}$	Turn-On Delay Time		4.0		6.0		8.0	ns	V_{DD} = 10 V $I_{D(on)}$ = 12 mA (2N5638) $V_{GS(on)}$ = 0 $I_{D(on)}$ = 6 mA (2N5639) $V_{GS(off)}$ = -10 V $I_{D(on)}$ = 3 mA (2N5640) R_G = 50 Ω	
t_r	Rise Time		5.0		8.0		10			
t_d	Turn-OFF Delay Time		5.0		10		15			
t_f	Fall Time		10		20		30			

NOTE: 1. Pulse test; PW ≤ 300μs, duty cycle ≤ 3.0%.





2N5902-2N5909 Monolithic Dual N-Channel JFET

1

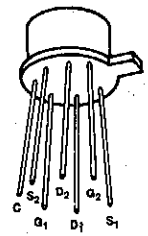
FEATURES
- **Tight Tracking**
- **Good Matching**

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise specified)

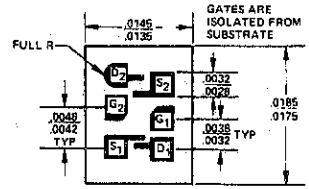
Gate-Drain or Gate-Source Voltage (Note 1) ..... -40V
Gate Current (Note 1) ..... 10 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	367 mW	500 mW
Derate above 25°C	3 mW/°C	4 mW/°C

PIN CONFIGURATION
TO-99



CHIP TOPOGRAPHY
6015



ORDERING INFORMATION*

TO-99	WAFER	DICE	TO-99	WAFER	DICE
2N5902	2N5902/W	2N5902/D	2N5906	2N5906/W	2N5906/D
2N5903	2N5903/W	2N5903/D	2N5907	2N5907/W	2N5907/D
2N5904	2N5904/W	2N5904/D	2N5908	2N5908/W	2N5908/D
2N5905	2N5905/W	2N5905/D	2N5909	2N5905/W	2N5909/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		2N5902-5 MIN	2N5902-5 MAX	2N5906-9 MIN	2N5906-9 MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-5		-2	pA	V_{GS} = -20 V, V_{DS} = 0	
	T_A = 125°C		-10		-5	nA		
BV_{GSS}	Gate-Source Breakdown Voltage	-40		-40		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.6	-4.5	-0.6	-4.5		V_{DS} = 10 V, I_D = 1 nA	
V_{GS}	Gate Source Voltage		-4		-4			
I_G	Gate Operating Current		-3		-1	pA	V_{DG} = 10 V, I_D = 30 μA	
	T_A = 125°C		-3		-1	nA		
I_{DSS}	Saturation Drain Current	30	500	30	500	μA	V_{DS} = 10 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance	70	250	70	250	μmho		f = 1 kHz
g_{os}	Common-Source Output Conductance		5		5			
C_{iss}	Common-Source Input Capacitance		3		3	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		1.5		1.5			
g_{fs}	Common-Source Forward Transconductance	50	150	50	150	μmho	V_{DG} = 10 V, I_D = 30 μA	f = 1 kHz
g_{os}	Common-Source Output Conductance		1		1			
$\overline{e_n}$	Equivalent Short Circuit Input Noise Voltage		0.2		0.1	$\frac{\mu V}{\sqrt{Hz}}$	V_{DS} = 10 V, V_{GS} = 0	
NF	Spot Noise Figure		3		1	dB		f = 100 Hz, R_G = 10 MΩ

PARAMETER		2N5902-6 MIN	2N5902-6 MAX	2N5903-7 MIN	2N5903-7 MAX	2N5904-8 MIN	2N5904-8 MAX	2N5905-9 MIN	2N5905-9 MAX	UNIT	TEST CONDITIONS	
$\lvert I_{G1}-I_{G2}\rvert$	Differential Gate Current		2.0		2.0		2.0		2.0	nA	V_{DG} = 10 V, I_D = 30 μA, T_A = 125°C	2N5902-5
			0.2		0.2		0.2		0.2			2N5906-9
$\frac{I_{DSS1}}{I_{DSS2}}$	Saturation Drain Current Ratio	0.95	1	0.95	1	0.95	1	0.95	1		V_{DS} = 10 V, V_{GS} = 0	
$\frac{g_{fs1}}{g_{fs2}}$	Transconductance Ratio	0.97	1	0.97	1	0.95	1	0.95	1		V_{DG} = 10 V, I_D = 30 μA	f = 1 kHz
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		5		5		10		15	mV		
$\frac{\Delta\lvert V_{BS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Voltage Differential Drift (Measured at end points T_A and T_B)		5		10		20		40	μV/°C		T_A = 25°C, T_B = 125°C
			5		10		20		40			T_A = -55°C, T_B = 25°C
$\lvert g_{os1}-g_{os2}\rvert$	Differential Output Conductance		0.2		0.2		0.2		0.2	μmho		f = 1 kHz

NOTE 1: Per transistor.

2N5911, 2N5912
IT5911, IT5912
Monolithic Dual N-Channel JFET

1

FEATURES

- **Tight Tracking**
- **Low Insertion Loss**
- **Good Matching**

ABSOLUTE MAXIMUM RATINGS

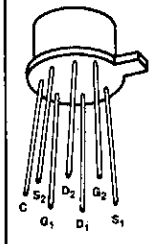
(T_A = 25°C unless otherwise noted)

Gate-Drain or Gate Source Voltage ..... -25V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	TO-71		TO-99	
	ONE SIDE	BOTH SIDES	ONE SIDE	BOTH SIDES
Power Dissipation	300 mW	500 mW	300 mW	500 mW
Derate above 25°C	1.7 mW/°C	2.9 mW/°C	3.0 mW/°C	4.0 mW/°C

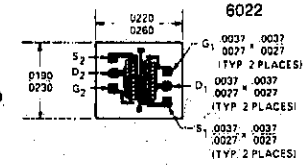
PIN CONFIGURATION

TO-99



TO-71

CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-71	TO-99	WAFER	DICE
IT5911	2N5911	2N5911/W	2N5911/D
IT5912	2N5912	2N5912/W	2N5912/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		MIN	MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-100	pA	V_{GS} = -15 V, V_{DS} = 0	
	T_A = 150°C		-250	nA		
BV_{GSS}	Gate Reverse Breakdown Voltage	-25		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1	-5		V_{DS} = 10 V, I_D = 1 nA	
V_{GS}	Gate-Source Voltage	-0.3	-4		V_{DG} = 10 V, I_D = 5 mA	
I_G	Gate Operating Current		-100	pA		
	T_A = 125°C		-100	nA		
I_{DSS}	Saturation Drain Current (Pulsewidth 300 μs, duty cycle ≤ 3%)	7	40	mA	V_{DS} = 10 V, V_{GS} = 0 V	
g_{fs}	Common-Source Forward Transconductance	5000	10,000	μmho	V_{DG} = 10 V, I_D = 5 mA	f = 1 kHz
g_{fs}	Common-Source Forward Transconductance	5000	10,000			f = 100 MHz
g_{os}	Common-Source Output Conductance		100			f = 1 kHz
g_{oss}	Common-Source Output Conductance		150			f = 100 MHz
C_{iss}	Common-Source Input Capacitance		5	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		1.2			
$\bar{e}_n$	Equivalent Short Circuit Input Noise Voltage		20	$\frac{nV}{\sqrt{Hz}}$		f = 10 kHz
NF	Spot Noise Figure		1	dB		f = 10 kHz, R_G = 100KΩ

PARAMETER		IT, 2N5911		IT, 2N5912		UNIT	TEST CONDITIONS	
		MIN	MAX	MIN	MAX			
$\lvert I_{G1}-I_{G2}\rvert$	Differential Gate Current		20		20	nA	V_{DG} = 10 V, I_D = 5 mA	125°C
$\frac{I_{DSS1}}{I_{DSS2}}$	Saturation Drain Current Ratio	0.95	1	0.95	1		V_{DS} = 10 V, V_{GS} = 0 (Pulsewidth 300 μs, duty cycle ≤ 3%)	
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		10		15	mV	V_{DG} = 10 V, I_D = 5 mA	
$\frac{\Delta\lvert V_{GS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Voltage Differential Drift (Measured at end points, T_A and T_B)		20		40	μV/°C		T_A = 25°C, T_B = 125°C
			20		40			T_A = -55°C, T_B = 25°C
$\frac{g_{fs1}}{g_{fs2}}$	Transconductance Ratio	0.95	1	0.95	1			f = 1 kHz

2N6483-2N6485
Monolithic Low Noise Dual N-Channel JFET

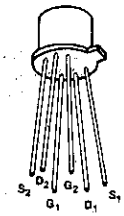
FEATURES

- **Ultra Low Noise**
- **High CMRR**
- **Low Offset**
- **Tight Tracking**

1

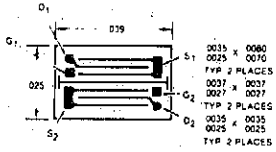
PIN CONFIGURATION

TO-71



CHIP TOPOGRAPHY

6019



ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage (Note 1) ..... -50V
Gate-Gate Voltage ..... ±50V
Gate Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	250 mW	500 mW
Derate above 25°C ...	3.8 mw/°C	7.7 mW/°C

ORDERING INFORMATION*

TO-71	WAFER	DICE
2N6483	2N6483/W	2N6483/D
2N6484	2N6484/W	2N6484/D
2N6485	2N6485/W	2N6485/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT	TEST CONDITIONS
I_{GSS}	Gate Reverse Current		200	pA	V_{GS} = -30 V, V_{DS} = 0,
	T_A = 150°C		200	nA	
BV_{GSS}	Gate Source Breakdown Voltage	50		V	I_G = 1 µA, V_{DS} = 0
V_P	Gate Source Pinch Off Voltage	0.7	4.0		V_{DS} = 20 V, I_D = 1 nA
I_{DSS}	Drain Current at Zero Gate Voltage (Note 2)	0.5	7.5	mA	V_{DS} = 20 V, V_{GS} = 0
g_{fs}	Common Source Forward Transconductance (Note 2)	1000	4000	µmho	V_{DS} = 20 V, V_{GS} = 0, f = 1 KHz
g_{oss}	Common Source Output Conductance		10		
C_{iss}	Common Source Input Capacitance		20	pF	V_{DS} = 20 V, V_{GS} = 0, f = 1 MHz
C_{rss}	Common Source Reverse Transfer Capacitance		3.5		
I_G	Gate Current		100	pA	V_{GD} = 20 V, I_D = 200 µA,
	T_A = 150°C		100	nA	
V_{GS}	Gate Source Voltage	0.2	3.8	V	V_{DG} = 20 V, I_D = 200 µA
g_{fs}	Common Source Forward Transconductance	500	1500	µmho	V_{DG} = 20 V, I_D = 200 µA, f = 1 KHz
g_{os}	Common Source Output Conductance		1		V_{DG} = 20 V, I_D = 200 µA
$\bar{e}_n$	Equivalent Input Noise Voltage		10	nV/√Hz	V_{DS} = 20 V, I_D = 200 µA, f = 10 Hz
			5		V_{DS} = 20 V, I_D = 200 µA, f = 1 KHz

NOTES: 1. Per transistor.
2. Pulse test required; pulse width = 2 ms.

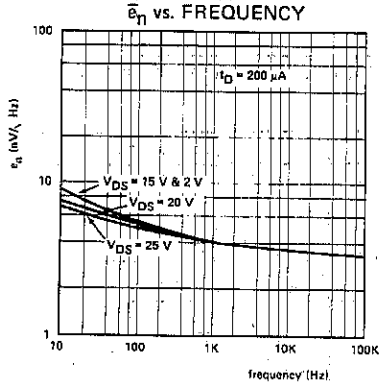
MATCHING CHARACTERISTICS (@ 25°C unless otherwise noted)

SYMBOL	PARAMETER	2N6483		2N6484		2N6485		UNIT	CONDITIONS
		MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
$\frac{I_{DSS1}}{I_{DSS2}}$	Drain Current Ratio at Zero Gate Voltage	0.95	1	0.95	1	0.95	1		V_{DS} = 20 V, V_{GS} = 0 (Note 2)
$\lvert I_{G1} - I_{G2} \rvert$	Differential Gate Current		10		10		10	nA	V_{DG} = 20 V, I_D = 200 μA T_A = +125°C
$\frac{g_{fs1}}{g_{gs2}}$	Transconductance Ratio	0.97	1	0.97	1	0.95	1		V_{DG} = 20 V, I_D = 200 μA, f = 1 KHz (Note 2)
$\lvert g_{os1} - g_{os2} \rvert$	Differential Output Conductance		0.1		0.1		0.1	μmho	V_{DG} = 20 V, I_D = 200 μA, f = 1 KHz
$\lvert V_{GS1} - V_{GS2} \rvert$	Differential Gate-Source Voltage		5		10		15	mV	V_{DG} = 20 V, I_D = 200 μA
$\frac{\Delta \lvert V_{GS1} - V_{GS2} \rvert}{\Delta T}$	Gate-Source Voltage Differential Drift		5		10		25	μV/°C	V_{DG} = 20 V, I_D = 200 μA T_A = −55°C to +125°C
CMRR	Common Mode Rejection Ratio	100		100		90		dB	V_{DD} = 10 to 20 V, I_D = 200 μA (Note 3)

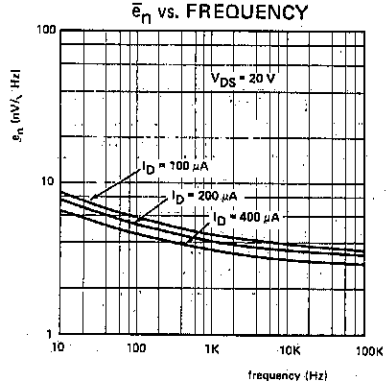
NOTES: 1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. Pulse duration of 2 ms used during test.
3. CMRR = $20\text{Log}_{10}\Delta V_{DD}/\Delta\lvert V_{GS1} - V_{GS2}\rvert$, ($\Delta V_{DD}$ = 10 V), not included in JEDEC registration

TYPICAL OPERATING CHARACTERISTICS

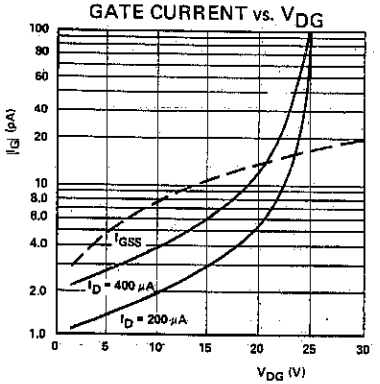
$\bar{e}_n$ vs. FREQUENCY



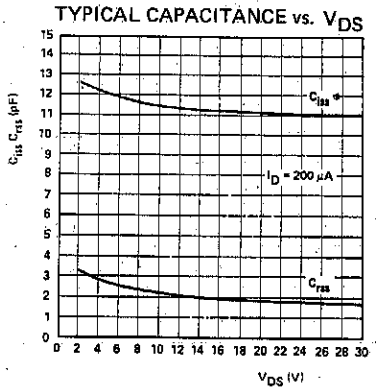
$\bar{e}_n$ vs. FREQUENCY



GATE CURRENT vs. V_{DG}



TYPICAL CAPACITANCE vs. V_{DS}



IMF6485
Monolithic Low Noise Dual N-Channel JFET

FEATURES

- **Ultra Low Noise**
- **High CMRR**
- **Low Offset**
- **Tight Tracking**

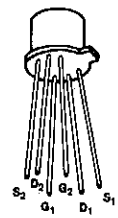
1

GENERAL DESCRIPTION

This N-Channel Junction FET is characterized for ultra low noise applications requiring tightly controlled and specified noise parameters at 10 Hz and 1000 Hz. Tight matching specifications make this device ideal as the input stage for low frequency differential instrumentation amplifiers.

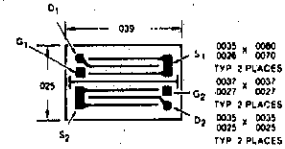
PIN CONFIGURATION

TO-71



CHIP TOPOGRAPHY

6019



ORDERING INFORMATION*

TO-71	WAFER	DICE
IMF6485	IMF6485/W	IMF6485/D

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source or Gate-Drain Voltage (Note 1) ..... -50V
Gate-Gate Voltage ..... ±50V
Gate Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	250 mW	500 mW
Derate above 25°C	3.8 mW/°C	7.7 mW/°C

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT	TEST CONDITIONS
I_{GSS}	Gate Reverse Current		-200	pA	V_{GS} = -30 V, V_{DS} = 0,
	T_A = 150°C		-200	nA	
BV_{GSS}	Gate-Source Breakdown Voltage	-50		V	I_G = -1 μA, V_{DS} = 0
V_p	Gate-Source Pinch-Off Voltage	-0.7	-4.0		V_{DS} = 20 V, I_D = 1 nA
I_{DSS}	Drain Current at Zero Gate Voltage (Note 2)	0.5	7.5	mA	V_{DS} = 20 V, V_{GS} = 0
g_{fs}	Common-Source Forward Transconductance (Note 2)	1000	4000	μmho	V_{DS} = 20 V, V_{GS} = 0, f = 1 KHz
g_{oss}	Common-Source Output Conductance		10		V_{DS} = 20 V, V_{GS} = 0, f = 1 KHz
C_{iss}	Common-Source Input Capacitance		20	pF	V_{DS} = 20 V, V_{GS} = 0, f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		3.5		V_{DS} = 20 V, V_{GS} = 0, f = 1 MHz
I_G	Gate Current		-100	pA	V_{GD} = 20 V, I_D = 200 μA,
	T_A = 150°C		-100	nA	
V_{GS}	Gate-Source Voltage	0.2	-3.8	V	V_{DG} = 20 V, I_D = 200 μA
g_{fs}	Common-Source Forward Transconductance	500	1500	μmho	V_{DG} = 20 V, I_D = 200 μA, f = 1 KHz
g_{os}	Common-Source Output Conductance		1		V_{DG} = 20 V, I_D = 200 μA
$\bar{e}_n$	Equivalent Input Noise Voltage		15	nV/√Hz	V_{DS} = 20 V, I_D = 200 μA, f = 10 Hz
			10		V_{DS} = 20 V, I_D = 200 μA, f = 1 KHz

NOTES:
1. Per transistor.
2. Pulse test required; pulse width = 2 ms.

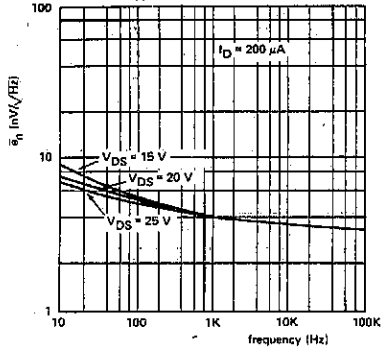
MATCHING CHARACTERISTICS (@ 25° C unless otherwise noted)

SYMBOL	PARAMETER	MIN.	MAX.	UNIT	CONDITIONS
$\frac{I_{DSS1}}{I_{DSS2}}$	Drain Current Ratio at Zero Gate Voltage	0.95	1		V_{DS} = 20 V, V_{GS} = 0 (Note 2)
$\lvert I_{G_1} - I_{G_2} \rvert$	Differential Gate Current		10	nA	V_{DG} = 20 V, I_D = 200 μA T_A = +125° C
$\frac{g_{fs1}}{g_{gs2}}$	Transconductance Ratio	0.95	1		V_{DG} = 20 V, I_D = 200 μA, f = 1 KHz (Note 2)
$\lvert g_{os1} - g_{os2} \rvert$	Differential Output Conductance		0.1	μmho	V_{DG} = 20 V, I_D = 200 μA, f = 1 KHz
$\lvert V_{GS1} - V_{GS2} \rvert$	Differential Gate-Source Voltage		25	mV	V_{DG} = 20 V, I_D = 200 μA
$\frac{\Delta \lvert V_{GS1} - V_{GS2} \rvert}{\Delta T}$	Gate-Source Voltage Differential Drift		40	μV/° C	V_{CG} = 20 V, I_D = 200 μA T_A = -55°C to +125° C
CMRR	Common Mode Rejection Ratio	90		dB	V_{DD} = 10 to 20 V, I_D = 200 μA (Note 3)

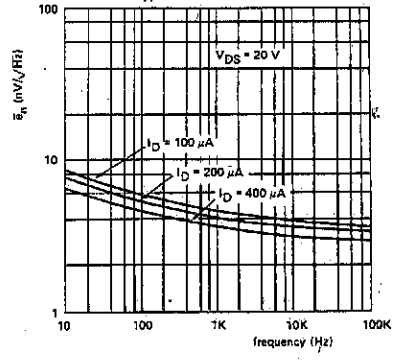
NOTES: 1. These ratings are limiting values above which the serviceability of any individual semiconductor device may be impaired.
2. Pulse duration of 2 ms used during test.
3. CMRR = $20\text{Log}_{10}\Delta V_{DD}/\Delta\lvert V_{GS1} - V_{GS2}\rvert$, ($\Delta V_{DD}$ = 10 V)

TYPICAL OPERATING CHARACTERISTICS

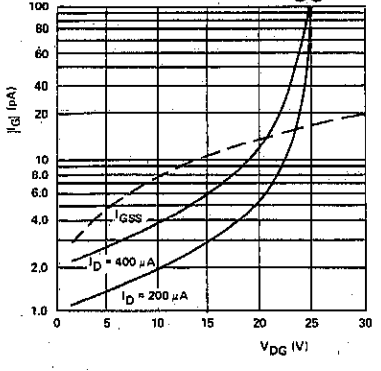
$\overline{e}_n$ vs. FREQUENCY



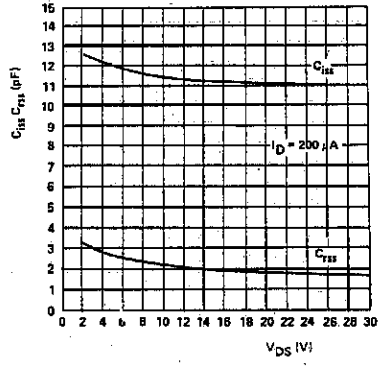
$\overline{e}_n$ vs. FREQUENCY



GATE CURRENT vs. V_{DG}



TYPICAL CAPACITANCE vs. V_{DS}



3N161
Diode Protected P-Channel Enhancement Mode MOSFET

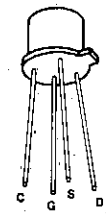
1

FEATURES
- **Channel Cut Off with Zero Gate Voltage**
- **Square-Law Transfer Characteristic Reduces Distortion**
- **Independent Substrate Connection Provides Flexibilty in Biasing**
- **Internally Connected Diode Protects Gate from Damage due to Overvoltage**

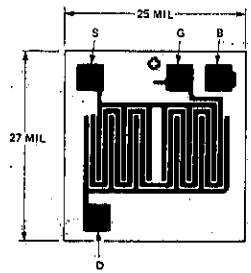
ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

Drain-Source or Drain-Gate Voltage	40V
Drain Current	50 mA
Gate Forward Current	10 μA
Gate Reverse Current	1 mA
Storage Temperature	-65°C to +200°C
Operating Temperature	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	375 mW
Derate above 25°C	3.0 mW/°C

PIN CONFIGURATION
TO-72



CHIP TOPOGRAPHY 1507



ORDERING INFORMATION*

TO-72	WAFER	DICE
3N161	3N161/W	3N161/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

	PARAMETER	MIN	TYP	MAX	UNIT	TEST CONDITIONS	
I_{GSSF}	Forward Gate-Terminal Current		-100		pA	V_{GS} = -25 V, V_{DS} = 0	
	T_A = +100°C			-1	nA		
BV_{GSS}	Forward Gate-Source Breakdown Voltage	-25			V	I_G -0.1 mA, V_{DS} = 0,	
I_{DSS}	Zero-Gate-Voltage Drain Current			-10	nA	V_{DS} = -15 V, V_{GS} = 0	
				-10	μA	V_{DS} = -25 V, V_{GS} = 0	
$V_{GS(th)}$	Gate-Source Threshold Voltage	-1.5		-5	V	V_{DS} = -15V, I_D = -10 μA	
V_{GS}	Gate-Source Voltage	-4.5		-8		V_{DS} = -15 V, I_D = -8 mA	
$I_{D(on)}$	On-State Drain Current	-40		-120	mA	V_{DS} = -15 V, V_{GS} = -15 V	
$\|y_{fs}\|$	Small-Signal Common-Source Forward Transfer Admittance	3500		6500	μmho	V_{DS} = -15 V, I_D = -8 mA	f = 1 kHz
$\|y_{os}\|$	Small-Signal Common-Source Output Admittance			250			
C_{iss}	Common-Source Short-Circuit Input Capacitance			10	pF		f = 1 MHz
C_{rss}	Common-Source Short-Circuit Reverse Transfer Capacitance			4			

3N163, 3N164
P-Channel Enhancement Mode MOS FET

FEATURES
- **Very High Input Impedance**
- **High Gate Breakdown**
- **Fast Switching**
- **Low Capacitance**

ABSOLUTE MAXIMUM RATINGS (Note 1)
(T_A = 25°C unless otherwise noted)

Drain-Source or Drain-Gate Voltage
- 3N163 ..... 40V
- 3N164 ..... 30V

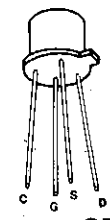
Static Gate-Source Voltage
- 3N163 ..... ±40V
- 3N164 ..... ±30V

Transient Gate-Source Voltage (Note 2) ..... ±125V
Drain Current ..... 50 mA
Storage Temperature ..... -65°C to +200°C
Operating Temperature ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 375 mW
Derate above +25°C ..... 3.0 mW/°C

NOTES:
1. See handling precautions on 3N170 data sheet.
2. Devices must not be tested at ±125V more than once, nor for longer than 300 ms.

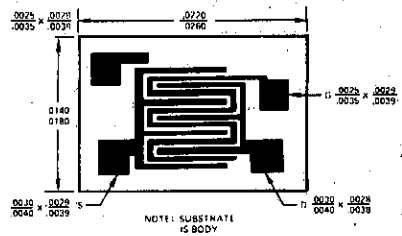
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

1503



ORDERING INFORMATION*

TO-72	WAFER	DICE
3N163	3N163/W	3N163/D
3N164	3N164/W	3N164/D

*When ordering wafer/dice refer to Appendix B-23.

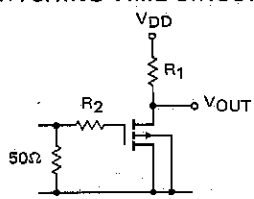
ELECTRICAL CHARACTERISTICS (@ 25°C and V_{BS} = 0 unless noted)

Symbol	Parameter	3N163 MIN	3N163 MAX	3N164 MIN	3N164 MAX	UNITS	TEST CONDITIONS
I_{GSSR}	Gate Reverse Leakage Current		10		10	pA	V_{GS} = -40V (3N163) V_{GS} = -30V (3N164)
I_{GSSF}	Gate Forward Current		-10		-10	pA	
	T_A = +125°C		-25		-25	pA	
BV_{DSS}	Drain-Source Breakdown Voltage	-40		-30		V	I_D = -10 µA, V_{GS} = 0
BV_{SDS}	Source Drain Breakdown Voltage	-40		-30		V	I_S = -10 µA, V_{GD} = 0, V_{DB} = 0
$V_{GS(th)}$	Threshold Voltage	-2.0	-5.0	-2.0	-5.0	V	V_{DS} = V_{GS}, I_D = -10 µA
$V_{GS(th)}$	Threshold Voltage	-2.0	-5.0	-2.0	-5.0	V	V_{DS} = -15V, I_D = -10 µA
V_{GS}	Gate Source Voltage	-3.0	-6.5	-3.0	-6.5	V	V_{DS} = -15V, I_D = -0.5 mA
I_{DSS}	Zero Gate Voltage Drain Current		200		400	pA	V_{DS} = -15V, V_{GS} = 0
I_{SDS}	Source Drain Current		400		800	pA	V_{SD} = 15V, V_{GS} = V_{DB} = 0
$r_{DS(on)}$	Drain-Source on Resistance		250		300	ohms	V_{GS} = -20V, I_D = -100 µA
$I_{D(on)}$	On Drain Current	-5.0	-30.0	-3.0	-30.0	mA	V_{DS} = -15V, V_{GS} = -10V
g_{fs}	Forward Transconductance	2000	4000	1000	4000	µmhos	V_{DS} = -15V, I_D = -10 mA, f = 1 KHz
g_{os}	Output Admittance		250		250	µmhos	V_{DS} = -15V, I_D = -10 mA, f = 1 KHz
C_{iss}	Input Capacitance - Output Shorted		2.5		2.5	pF	V_{DS} = -15V, I_D = -10 mA, f = 1 MHz
C_{rss}	Reverse Transfer Capacitance		0.7		0.7	pF	V_{DS} = -15V, I_D = -10 mA, f = 1 MHz
C_{bs}	Output Capacitance Input Shorted		3.0		3.0	pF	V_{DS} = -15V, I_D = -10 mA, f = 1 MHz

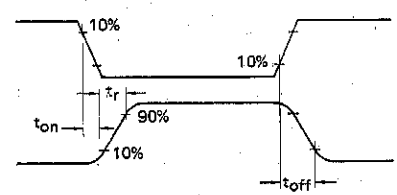
SWITCHING CHARACTERISTICS (@ 25°C and V_{BS} = 0)

t_{on}	Turn-On Delay Time		12		12	ns	V_{DD} = -15V
t_r	Rise Time		24		24	ns	$I_{D(on)}$ = -10 mA
t_{off}	Turn-Off Time		50		50	ns	R_G = R_L = 1.4 kΩ

SWITCHING TIME CIRCUIT



SWITCHING WAVEFORM



3N165, 3N166 Dual P-Channel Enhancement Mode MOS FET

FEATURES

- **Very High Impedance**
- **High Gate Breakdown**
- **Low Capacitance**

1

ABSOLUTE MAXIMUM RATINGS (Note 1)

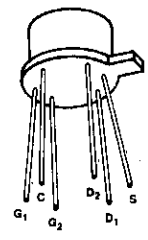
(T_A = 25°C unless otherwise specified)

Drain-Source or Drain-Gate Voltage (Note 2)

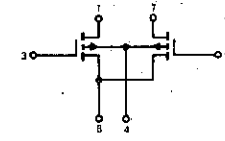
3N165	40V
3N166	30V
Transient Gate-Source Voltage (Note 3)	±125
Gate-Gate Voltage	±80V
Drain Current (Note 2)	50 mA
Storage Temperature	-65°C to +200°C
Operating Temperature	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	
One Side	300 mW
Both Sides	525 mW
Total Derating above 25°C	4.2 mW/°C

PIN CONFIGURATION

TO-99

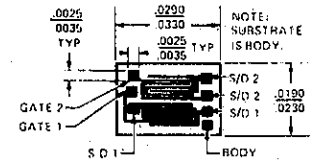


DEVICE SCHEMATIC



CHIP TOPOGRAPHY

2506



ORDERING INFORMATION*

TO-99	WAFER	DICE
3N165	3N165/W	3N165/D
3N166	3N166/W	3N166/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (@ 25°C and V_{BS} = 0 unless notes)

PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
I_{GSSR}	Gate Reverse Leakage Current		10	pA	V_{GS} = 40V
I_{GSSF}	Gate Forward Leakage Current		-10		V_{GS} = -40V
	T_A = +125°C		-25		
I_{DSS}	Drain to Source Leakage Current		-200		V_{DS} = -20V
I_{SDS}	Source to Drain Leakage Current		-400		V_{SD} = -20, V_{DB} = 0
$I_{D(on)}$	On Drain Current	-5	-30	mA	V_{DS} = -15V, V_{GS} = -10V
$V_{GS(th)}$	Gate Source Threshold Voltage	-2	-5	V	V_{DS} = -15V, I_D = -10μA
$V_{GS(th)}$	Gate Source Threshold Voltage	-2	-5		V_{DS} = V_{GS}, I_D = -10μA
$r_{DS(on)}$	Drain Source ON Resistance		300	ohms	V_{GS} = -20V, I_D = -100μA
g_{fs}	Forward Transconductance	1500	3000	μmhos	V_{DS} = -15V, I_D = -10mA, f = 1kHz
g_{os}	Output Admittance		300		
C_{iss}	Input Capacitance		3.0	pF	V_{DS} = -15V, I_D = -10mA, f = 1MHz
C_{rss}	Reverse Transfer Capacitance		0.7		
C_{oss}	Output Capacitance		3.0		
$R_E(Y_{fs})$	Common Source Forward Transconductance	1200		μmhos	V_{DS} = -15V, I_D = -10mA, f = 100MHz

MATCHING CHARACTERISTICS 3N165

PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
Y_{fs1}/Y_{fs2}	Forward Transconductance Ratio	0.90	1.0		V_{DS} = -15V, I_D = -1500μA, f = 1KHz
V_{GS1-2}	Gate-Source Threshold Voltage Differential		100	mV	V_{DS} = -15V, I_D = -500μA
$\frac{\Delta V_{GS1-2}}{\Delta T}$	Gate Source Threshold Voltage Differential Change with Temperature		100	μV/°C	V_{DS} = -15V, I_D = -500μA, T_A = -55°C to +25°C
			100		

Note 1: See handling precautions on 3N170 data sheet.

Note 2: Per transistor.

Note 3: Devices must not be tested at ±125V more than once, nor for longer than 300 ms.

3N170, 3N171
N-Channel Enhancement Mode MOS FET

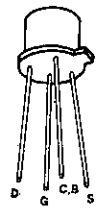
1

FEATURES
- **Low Switching Voltages**
- **Fast Switching Times**
- **Low Drain-Source Resistance**
- **Low Reverse Transfer Capacitance**

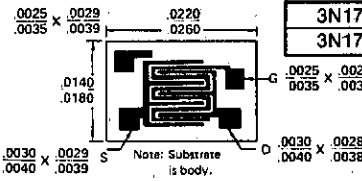
ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

Drain-Gate Voltage	±35V
Drain-Source Voltage	25V
Gate-Source Voltage	±35V
Drain Current	30 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

PIN CONFIGURATION
TO-72



CHIP TOPOGRAPHY
1003



HANDLING PRECAUTIONS
MOS field-effect transistors have extremely high input resistance and can be damaged by the accumulation of excess static charge. To avoid possible damage to the device while wiring, testing, or in actual operation, follow the procedures outlined below.

1. To avoid the build-up of static charge, the leads of the devices should remain shorted together with a metal ring except when being tested or used.
2. Avoid unnecessary handling. Pick up devices by the case instead of the leads.
3. Do not insert or remove devices from circuits with the power on as transient voltages may cause permanant damage to the devices.

ORDERING INFORMATION*

TO-72	WAFER	DICE
3N170	3N170/W	3N170/D
3N171	3N170/W	3N170/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted) Substrate connectored to source.

	PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
BV_{DSS}	Drain-Source Breakdown Voltage		25		V	I_D = 10 µA, V_{GS} = 0
I_{GSS}	Gate Leakage Current			10	pA	V_{GS} = -35 V, V_{DS} = 0
		T_A = 125°C		100		
I_{DSS}	Zero-Gate-Voltage Drain Current			10	nA	V_{DS} = 10 V, V_{GS} = 0
		T_A = 125°C		1.0	µA	
$V_{GS(th)}$	Gate-Source Threshold Voltage	3N170	1.0	2.0	V	V_{DS} = 10 V, I_D = 10 µA
		3N171	1.5	3.0		
$I_{D(on)}$	"ON" Drain Current		10		mA	V_{GS} = 10 V, V_{DS} = 10 V
$V_{DS(on)}$	Drain-Source "ON" Voltage			2.0	V	I_D = 10 mA, V_{GS} = 10 V
$r_{ds(on)}$	Drain-Source ON Resistance			200	Ω	V_{GS} = 10 V, I_D = 0, f = 1.0 kHz
$\|Y_{fs}\|$	Forward Transfer Admittance		1000		µmhos	V_{DS} = 10 V, I_D = 2.0 mA, f = 1.0 kHz
C_{rss}	Reverse Transfer Capacitance			1.3	pF	V_{DS} = 0, V_{GS} = 0, f = 1.0 MHz
C_{iss}	Input Capacitance			5.0		V_{DS} = 10 V, V_{GS} = 0, f = 1.0 MHz
$C_{d(sub)}$	Drain-Substrate Capacitance			5.0		$V_{D(SUB)}$ = 10 V, f = 1.0 MHz
$t_{d(on)}$	Turn-On Delay Time			3.0	ns	V_{DD} = 10 V, $I_{D(on)}$ = 10 mA, $V_{GS(on)}$ = 10 V, $V_{GS(off)}$ = 0, R_G = 50 Ω
t_r	Rise Time			10		
$t_{d(off)}$	Turn-Off Delay Time			3.0		
t_f	Fall Time			15		

3N172, 3N173 Diode Protected P-Channel Enhancement Mode MOS FET

FEATURES
- High Input Impedance
- Diode Protected Gate

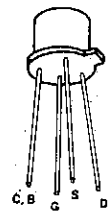
1

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

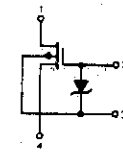
Drain-Source or Drain-Gate Voltage	
3N172	40V
3N173	30V
Drain Current	50 mA
Gate Forward Current	10 μA
Gate Reverse Current	1 mA
Storage Temperature	-65°C to +200°C
Operating Temperature	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	375 mW
Derate above 25°C	3.0 mW/°C

PIN CONFIGURATION

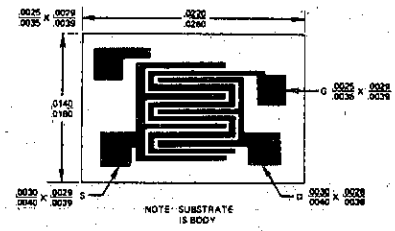
TO-72



DEVICE SCHEMATIC



CHIP TOPOGRAPHY 1503Z



ORDERING INFORMATION*

TO-72	WAFER	DICE
3N172	3N172/W	3N172/D
3N173	3N173/W	3N173/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (@ 25°C and V_{BS} = 0 unless noted)

PARAMETER		3N172		3N173		UNITS	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
I_{GSSR}	Gate Reverse Current		-200		-500	pA	V_{GS} = -20V
	T_A = +125°C		-0.5		-1.0	μA	
BV_{GSS}	Gate Breakdown Voltage	-40	-125	-30	-125	V	I_D = -10 μA
BV_{DSS}	Drain-Source Breakdown Voltage	-40		-30			I_D = -10 μA
BV_{SDS}	Source-Drain Breakdown Voltage	-40		-30			I_S = -10 μA, V_{DB} = 0
$V_{GS(th)}$	Threshold Voltage	-2.0	-5.0	-2.0	-5.0		V_{DS} = V_{GS}, I_D = -10 μA
		-2.0	-5.0	-2.0	-5.0		V_{DS} = -15V, I_D = -10 μA
V_{GS}	Gate Source Voltage	-3.0	-6.5	-2.5	-6.5		V_{DS} = -15V, I_D = -500 μA
I_{DSS}	Zero Gate Voltage Drain Current		-0.4		-10	nA	V_{DS} = -15V, V_{GS} = 0
I_{SDS}	Zero Gate Voltage Source Current		-0.4		-10		V_{SD} = -15V, V_{DB} = 0, V_{GD} = 0
$r_{DS(on)}$	Drain Source On Resistance		250		350	ohms	V_{GS} = -20V, I_D = -100 μA
$I_{D(on)}$	On Drain Current	-5.0	-30	-5.0	-30	mA	V_{DS} = -15V, V_{GS} = -10V

3N188-3N191
Dual P-Channel Enhancement Mode MOSFET

FEATURES

- **Very High Input Impedance**
- **High Gate Breakdown 3N190-3N191**
- **Zener Protected gate 3N188-3N189**
- **Low Capacitance**

ABSOLUTE MAXIMUM RATINGS

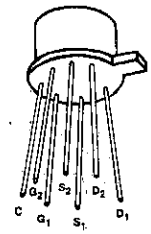
(T_A = 25° C unless otherwise noted)

Drain-Source or Drain-Gate Voltage (Note 1)
- 3N188, 3N189 ..... 40V
- 3N190, 3N191 ..... 30V

Transient Gate-Source Voltage (Notes 1 and 2) .. ±125V
Gate-Gate Voltagae ..... ±80V
Drain Current (Note 1) ..... 50 mA
Storage Temperature ..... -65° C to +200° C
Operating Temperature ..... -55° C to +150° C
Lead Temperature (Soldering, 10 sec.) ..... +300° C
Power Dissipation
- One Side ..... 300 mW
- Both Sides ..... 525 mW
- Total Derating above 25° C ..... 4.2 mW/° C

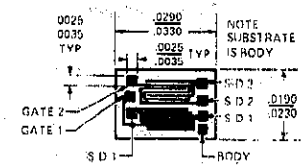
PIN CONFIGURATION

TO-99



CHIP TOPOGRAPHY

2506



NOTE: Body is connected to case.

ORDERING INFORMATION*

TO-99	WAFER	DICE
3N188	—	—
3N189	—	—
3N190	3N190/W	3N190/D
3N191	3N191/W	3N191/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25° C and V_{BS} = 0 unless otherwise noted)

PARAMETER		3N188 3N189 MIN	3N188 3N189 MAX	3N190 3N191 MIN	3N190 3N191 MAX	UNITS	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current				10	pA	V_{GS} = 40V	
I_{GSSF}	Gate Forward Current		-200		-10	pA	V_{GS} = -40V	
	T_A = 125° C		-200		-25	pA		
BV_{DSS}	Drain-Source Breakdown Voltage	-40		-40		V	I_D = -10μA	
BV_{SDS}	Source-Drain Breakdown Voltage	-40		-40		V	I_S = -10μA, V_{BD} = 0	
$V_{GS(th)}$	Threshold Voltage	-2.0	-5.0	-2.0	-5.0	V	V_{DS} = -15V, I_D = -10 μA	
		-2.0	-5.0	-2.0	-5.0	V	V_{DS} = V_{GS}, I_D = -10 μA	
V_{GS}	Gate Source Voltage	-3.0	-6.5	-3.0	-6.5	V	V_{DS} = -15V I_D = -500 μA	
I_{DSS}	Zero Gate Voltage Drain Current		-200		-200	pA	V_{DS} = -15V	
I_{SDS}	Source Drain Current		-400		-400	pA	V_{SD} = -15V, V_{DB} = 0	
$r_{DS(on)}$	Drain-Source on Resistance		300		300	ohms	V_{DS} = -20V, I_D = -100 μA	
$I_{D(on)}$	On Drain Current	-5.0	-30.0	-5.0	-30.0	mA	V_{DS} = -15V, V_{GS} = -10V	
g_{fs}	Forward Transconductance(Note 3)	1500	4000	1500	4000	μmhos	V_{DS} = -15V, I_D = -5 mA	f = 1kHz
Y_{os}	Output Admittance		300		300	μmhos		
C_{iss}	Input Capacitance Output Shorted		4.5		4.5	pF		f = 1MHz
C_{rss}	Reverse Transfer Capacitance		1.5		1.0	pF		
C_{oss}	Output Capacitance Input Shorted		3.0		3.0	pF		

SWITCHING CHARACTERISTICS (@ 25° C and V_{BS} = 0 unless noted)

		MIN	MAX	UNITS	TEST CONDITIONS
$t_{d(on)}$	Turn On Delay Time		15	ns	V_{DD} = -15V, I_D = -5 mA
t_r	Rise Time		30	ns	R_G = R_L = 1.4 kΩ
t_{off}	Turn Off Time		50	ns	

MATCHING CHARACTERISTICS (@ 25° C and V_{BS} = 0 unless noted) 3N188 and 3N190

		MIN	MAX	UNITS	
Y_{fs1}/Y_{fs2}	Forward Transconductance Ratio	0.85	1.0		V_{DS} = -15V, I_D = -500 μA, f = 1 kHz
V_{GS1-2}	Gate Source Threshold Voltage-Differential		100	mV	V_{DS} = -15V, I_D = -500 μA
$\frac{\Delta V_{GS1-2}}{\Delta T}$	Gate Source Threshold Voltage Differential Change with Temperature(Note 4)		100	μV/° C	V_{DS} = -15V, I_D = -500 μA, T = -55° C to + 25° C
$\frac{\Delta VGS1-2}{\Delta T}$	Gate Source Threshold Voltage Differential Change with Temperature(Note 4)		100	μV/° C	V_{DS} = -15V, I_D = -500μA T = +25° C to +125° C

NOTES:
1. Per transistor
2. Approximately doubles for every 10° C increase in T_A.
3. Pulse test duration = 300 μsec; duty cycle ≤ 3%.
4. Measured at end points, T_A and T_B.

INTERSIL

FEATURES

- I_R = 0.1 pA (typical)
- BV_R > 30 V
- C_{rss} = 0.75 pF (typical)

1

GENERAL DESCRIPTION

The ID100 and ID101 are monolithic dual diodes intended for use in applications requiring extremely low leakage currents. Applications include interstage coupling with reverse isolation, signal clipping and clamping and protection of ultra low leakage FET differential dual and operational amplifiers.

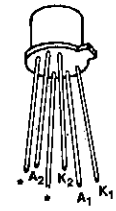
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Diode Reverse Voltage	30V
Diode to Diode Voltage	±50V
Forward Current	20 mA
Reverse Current	100 μA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

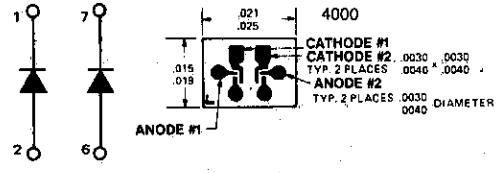
PIN CONFIGURATIONS

TO-71
TO-78



*These leads must not be tied together nor connected to the circuit in any way.

CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO78	TO71	WAFER	CHIP
ID100	ID101	ID100/W	ID100/D

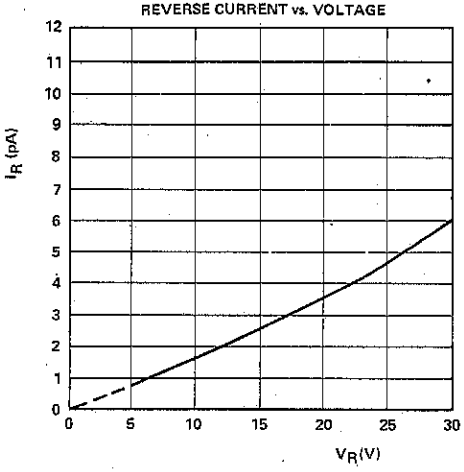
*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (@ 25°C unless otherwise noted)

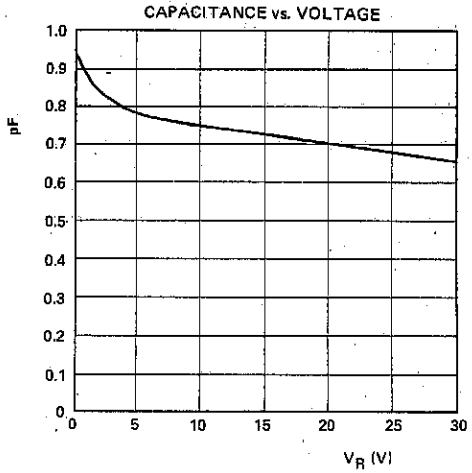
PARAMETER		ID100, ID101 MIN.	ID100, ID101 TYP.	ID100, ID101 MAX.	UNITS	TEST CONDITIONS
V_F	Forward Voltage Drop	0.8		1.1	V	I_F = 10 mA
BV_R	Reverse Breakdown Voltage	30			V	I_R = 1 μA
I_R	Reverse Leakage Current		0.1		pA	V_R = 1 V
			2.0	10		
	T_A = 125°C			10	nA	V_R = 10 V
$\lvert I_{R_1} - I_{R_2} \rvert$	Differential Leakage Current			3	pA	
C_{rss}	Total Reverse Capacitance		0.75	1	pF	V_R = 10 V, f = 1 MHz

TYPICAL CHARACTERISTICS OF ID100/ID101

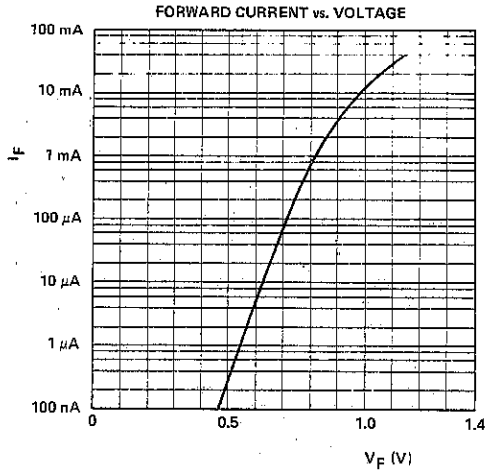
REVERSE CURRENT vs. VOLTAGE



CAPACITANCE vs. VOLTAGE



FORWARD CURRENT vs. VOLTAGE



IT100, IT101
P-Channel JFET

1

FEATURES

- Interfaces Directly w/T^2L Logic Elements
- $r_{DS(on)}$ < 75Ω for 5V Logic Drive
- $I_{D(off)}$ < 100 pA

GENERAL DESCRIPTION

This P-channel JFET has been designed to directly interface with T^2L logic, thus eliminating the need for costly drivers, in analog gate circuitry. Bipolar inputs of ±15 V can be switched. The FET is OFF for hi level inputs (+5 V or +15 V) and ON for low level inputs (< 0.5 V for IT100; < 1.5 V for IT101.

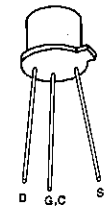
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Source Voltage	35V
Gate-Drain Voltage	35V
Gate Current	50mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

PIN CONFIGURATION

TO-18



CHIP TOPOGRAPHY

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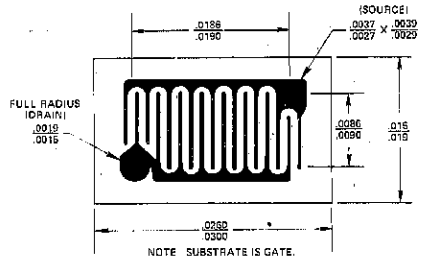


ORDERING INFORMATION*

TO-18	WAFER	DICE
IT100	IT100/W	IT100/D
IT101	IT101/W	IT101/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		IT100		IT101		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX		
I_{DSS}	Drain Current	-10		-20		mA	V_{GS} = 0, V_{DS} = -15 V
V_P	Pinch Off Voltage	2	4.5	4	10	V	I_D = 1 nA, V_{DS} = -15 V
BV_{GSS}	Gate-Source Breakdown Voltage	35		35			I_G = 1 μA, V_{DS} = 0
I_{GSSR}	Gate Reverse Current		200		200	pA	V_{GS} = 20 V, V_{DS} = 0
g_{fs}	Transconductance	8		8		mmho	V_{GS} = 0, V_{DS} = -15 V
g_{os}	Output Conductance		1		1		
$I_{D(off)}$	Drain (OFF) Leakage		-100		-100	pA	V_{DS} = -10 V, V_{GS} = 15 V
$r_{DS(on)}$	Drain-Source "ON" Resistance		75		60	Ω	V_{GS} = 0, V_{DS} = -0.1 V
C_{iss}	Input Capacitance		35		35	pF	V_{DG} = -20 V, V_{GS} = 0
C_{rss}	Reverse Transfer Capacitance		12		12		V_{DG} = -10 V, I_S = 0

IT120-IT122 Monolithic Dual NPN Transistor

1

FEATURES

- **High h_{FE} at Low Current**
- **Low Output Capacitance**
- **Good Matching**
- **Tight V_{BE} Tracking**

ABSOLUTE MAXIMUM RATINGS

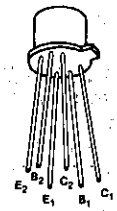
(T_A = 25°C unless otherwise noted)

Collector-Base Voltage (Note 1) 45V
Collector-Emitter Voltage (Note 1) 45V
Emitter Base Voltage (Notes 1 and 2) 7V
Collector Current (Note 1) ..... 50 mA
Collector-Collector Voltage 60V
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec) ..... +300°C

	TO-71		TO-78	
Power	ONE SIDE	BOTH SIDES	ONE SIDE	BOTH SIDES
Dissipation ...	400 mW	750 mW	300 mW	500 mW
Derate Above 25°C	1.7 mW/°C	2.9 mW/°C	2.3 mW/°C	4.3 mW/°C

PIN CONFIGURATION

TO-71
TO-78



CHIP TOPOGRAPHY

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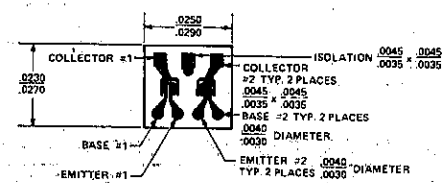


ORDERING INFORMATION*

TO-78	TO-71	WAFER	DICE
IT120	IT120-TO71	IT120/W	IT120/D
IT121	IT121-TO71	IT121/W	IT121/D
IT122	IT122-TO71	IT122/W	IT122/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

(25°C unless otherwise noted)

PARAMETER		IT120A MIN	IT120A MAX	IT120 MIN	IT120 MAX	IT121 MIN	IT121 MAX	IT122 MIN	IT122 MAX	UNIT	TEST CONDITIONS
h_{FE}	DC Current Gain	200		200		80		80			I_C = 10 μA, V_{CE} = 5.0 V
		225		225		100		100			I_C = 1.0 mA, V_{CE} = 5.0 V
	T_A = -55°C	75		75		30		30			
$V_{BE(ON)}$	Emitter-Base On Voltage		0.7		0.7		0.7		0.7	V	I_C = 10 μA, V_{CE} = 5.0 V
$V_{CE(SAT)}$	Collector Saturation Voltage		0.5		0.5		0.5		0.5		I_C = 0.5 mA, I_B = 0.05 mA
I_{CBO}	Collector Cutoff Current		1.0		1.0		1.0		1.0	nA	I_E = 0, V_{CB} = 45 V
	T_A = +150°C		10		10		10		10	μA	
I_{EBO}	Emitter Cutoff Current		1.0		1.0		1.0		1.0	nA	I_C = 0, V_{EB} = 5.0 V
C_{obo}	Output Capacitance		2.0		2.0		2.0		2.0	pF	I_E = 0, V_{CB} = 5.0 V, f = 1 MHz
C_{ie}	Emitter Transition Capacitance		2.5		2.5		2.5		2.5		I_C = 0, V_{EB} = 0.5 V, f = 1 MHz
C_{C_1,C_2}	Collector to Collector Capacitance		4.0		4.0		4.0		4.0		V_{CC} = 0
I_{C_1,C_2}	Collector to Collector Leakage Current		10		10		10		10	nA	V_{CC} = ±60 V
$V_{CEO(SUST)}$	Collector to Emitter Sustaining Voltage	45		45		45		45		V	I_C = 1.0 mA, I_B = 0
GBW	Current Gain Bandwidth Product	10 220		10 220		7 180		7 180		MHz	I_C = 10 μA, V_{CE} = 5 V I_C = 1 mA, V_{CE} = 5 V
$\lvert V_{BE_1}-V_{BE_2}\rvert$	Base Emitter Voltage Differential		1		2		3		5	mV	I_C = 10 μA, V_{CE} = 5.0 V
$\lvert I_{B_1}-I_{B_2}\rvert$	Base Current Differential		2.5		5		25		25	nA	
$\Delta(V_{BE_1}-V_{BE_2})/\Delta T$	Base-Emitter Voltage Differential Change with Temperature		3		5		10		20	μV/°C	T_A = -55°C to +125°C I_C = 10 μA, V_{CE} = 5.0 V

NOTES: 1. Per transistor.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10 μA.

IT124
Monolithic Dual Super-Beta NPN Transistor

1

FEATURES

- **Very High Gain**
- **Low Output Capacitance**
- **Tight V_{BE} Matching**
- **High GBW**

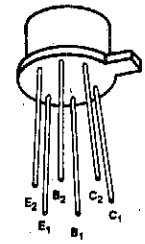
ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise noted)

Collector-Base Voltage (Note 1) 2V
Collector-Emitter Voltage (Note 1) 2V
Emitter-Base Voltage (Notes 1 and 2) 7V
Collector-Current (Note 1) ..... 10 mA
Collector-Collector Voltage 100V
Storage Temperature Range ..... -65° C to +200° C
Operating Temperature Range ..... -55° C to +150° C
Lead Temperature (Soldering, 10 sec) ..... +300° C

	TO-78 ONE SIDE	TO-78 BOTH SIDES
Power Dissipation	300 mW	500 mW
Derate above 25° C	1.7 mW/° C	4.3 mW/° C

PIN CONFIGURATION
TO-78



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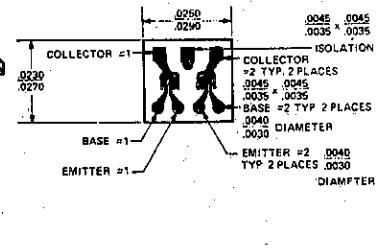


ORDERING INFORMATION*

TO-78	WAFER	DICE
IT124	IT124/W	IT124/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS @ 25° C (unless otherwise noted)

SYMBOL	PARAMETER	MIN	MAX	UNITS	CONDITIONS
h_{FE}	DC Current Gain	1500			I_C = 1μA, V_{CE} = 1V
		1500			I_C = 10μA, V_{CE} = 1V
	T_A = -55° C	600			
$V_{BE(ON)}$	Emitter-Base "ON" Voltage		0.7	V	
$V_{CE(SAT)}$	Collector Saturation Voltage		0.5		I_C = 1mA, I_B = 0.1mA
I_{CBO}	Collector Cutoff Current		100	pA	I_E = 0, V_{CB} = 1V
	T_A = +150° C		100	nA	
I_{EBO}	Emitter Cutoff Current		100	pA	I_C = 0, V_{EB} = 5V
C_{obo}	Output Capacitance		0.8	pF	I_E = 0, V_{CB} = 1V; f = 1 MHz
C_{te}	Emitter Transition Capacitance		1.0		I_C = 0, V_{EB} = 0.5V; f = 1 MHz
$C_{C_1C_2}$	Collector to Collector Capacitance		0.8		V_{CC} = 0
$I_{C_1C_2}$	Collector to Collector Leakage Current		250	pA	V_{CC} = ±50V
GBW	Current Gain Bandwidth Product	10		MHz	I_C = 10μA, V_{CE} = 1V
		100			I_C = 100μA, V_{CE} = 1V
NF	Narrow Band Noise Figure		3	dB	I_C = 10μA, V_{CE} = 3V, f = 1 KHz, R_G = 10 Kohms, BW = 200 Hz
BV_{CBO}	Collector-Base Breakdown Voltage	2		V	I_C = 10μA, I_E = 0
BV_{EBO} (Note 2)	Emitter-Base Breakdown Voltage	7			I_E = 10μA, I_C = 0
$V_{CEO(SUST)}$	Collector-Emitter Sustaining Voltage	2			I_C = 1mA, I_B = 0

MATCHING CHARACTERISTICS @ 25° C (unless otherwise noted)

SYMBOL	PARAMETER	TYP	MAX	UNITS	CONDITIONS
$\lvert V_{BE1}-V_{BE2}\rvert$	Base Emitter Voltage Differential	2	5	mV	I_C = 10μA, V_{CE} = 1V
$\Delta\lvert(V_{BE1}-V_{BE2})\rvert/\Delta T$	Base Emitter Voltage Differential Change with Temperature	5	15	μV/° C	I_C = 10μA, V_{CE} = 1V T = -55° C to +125° C
$\lvert I_{B1}-I_{B2}\rvert$	Base Current Differential		.6	nA	T_C = 10μA, V_{CE} = 1V

NOTES:
1. Per transistor.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10μA.

IT126-IT129 Monolithic Dual NPN Transistor

FEATURES

- **High Gain at Low Current**
- **Low Output Capacitance**
- **Tight I_B Match**
- **Tight V_{BE} Tracking**
- **Dielectric Isolated Matched Pairs for Differential Amplifiers**

ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise specified)

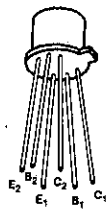
Collector-Base Voltage (Note 1)
- IT126, IT127 ..... 60V
- IT128 ..... 55V
- IT129 ..... 45V

Collector-Emitter Voltage (Note 1)
- IT126, IT127 ..... 60V
- IT128 ..... 55V
- IT129 ..... 45V

Emitter-Base Voltage (Notes 1 and 2) 7.0V
Collector Current (Note 1) ..... 100 mA
Collector-Collector Voltage 70V
Storage Temperature Range ..... -65° C to +200° C
Operating Temperature Range ..... -55° C to +150° C
Lead Temperature (Soldering, 10 sec.) ..... +300° C

	TO71		TO78	
Power Dissipation	One Side	Both Sides	One Side	Both Sides
Total Dissipation at 25°C Cast Temperature	0.3 Watt	0.5 Watt	0.4 Watt	0.75 Watt
Derating Factor	1.7 mW/°C	2.9 mW/°C	2.5 mW/°C	4.3 mW/°C

PIN CONFIGURATION
TO-71 TO-78



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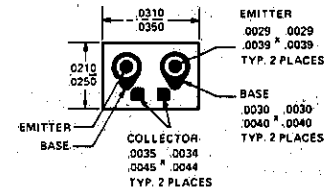


ORDERING INFORMATION*

TO78	TO-71	WAFER	DICE
IT126	IT126-TO71	IT126/W	IT126/D
IT127	IT127-TO71	IT127/W	IT127/D
IT128	IT128-TO71	IT128/W	IT128/D
IT129	IT129-TO71	IT128/W	IT128/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25° C unless otherwise noted)

PARAMETER		IT126		IT127		IT128		IT129		UNITS	CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	150		150		100		70			I_C = 10 μA, V_{CE} = 5V
		200	800	200	800	150	800	100			I_C = 1.0 mA, V_{CE} = 5V
		230		230		170		115			I_C = 10 mA, V_{CE} = 5V
		100		100		75		50			I_C = 50 mA, V_{CE} = 5V
	T_A = -55°C	75		75		60		40			I_C = 1 mA, V_{CE} = 5V
$V_{BE(on)}$	Emitter-Base On Voltage		.9		.9		.9		.9	V	I_C = 10 mA, V_{CE} = 5V
			1.0		1.0		1.0		1.0		I_C = 50 mA, V_{CE} = 5V
$V_{CE(sat)}$	Collector Saturation Voltage		.3		.3		.3		.3		I_C = 10 mA, I_B = 1 mA
			1.0		1.0		1.0		1.0		I_C = 50 mA, I_B = 5 mA
I_{CBO}	Collector Cutoff Current		0.1		0.1		0.1		0.1*	nA	I_E = 0, V_{CB} = 45V, 30V*
	T_A = +150°C		0.1		0.1		0.1		0.1*	μA	
I_{EBO}	Emitter Cutoff Current		0.1		0.1		0.1		0.1	nA	I_C = 0, V_{EB} = 5V
C_{obo}	Output Capacitance		3		3		3		3	pF	I_E = 0, V_{CB} = 20V
$BV_{C_1C_2}$	Collector to Collector Breakdown Voltage	± 100		± 100		± 100		± 100		V	I_C = ±1 μA
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	60		60		55		45			I_C = 1 mA, I_B = 0
BV_{CBO}	Collector Base Breakdown Voltage	60		60		55		45			I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter Base Breakdown Voltage	7		7		7		7			I_E = 10 μA, I_C = 0
MATCHING CHARACTERISTICS											
$\lvert V_{BE_1} - V_{BE_2} \rvert$	Base Emitter Voltage Differential		1		2		3		5	mV	I_C = 1 ma , V_{CE} = 5V
$\Delta(\lvert V_{BE_1} - V_{BE_2} \rvert / \Delta T$	Base Emitter Voltage Differential Change with Temperature		3		5		10		20	μV/°C	I_C = 1 mA, V_{CE} = 5V T_A = -55°C to +125°C
$\lvert I_{B_1} - I_{B_2} \rvert$	Base Current Differential		2.5		5		10		20	nA	I_C = 10 μA, V_{CE} = 5V
			.25		.5		1.0		2.0	μA	I_C = 1 mA, V_{CE} = 5V

NOTES:
1. Per transistor.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10μ Amps.

IT130-IT132 Monolithic Dual PNP Transistor

FEATURES

- High h_{FE} at Low Current
- Low Output Capacitance
- Tight I_B Match
- Tight V_{BE} Tracking

ABSOLUTE MAXIMUM RATINGS

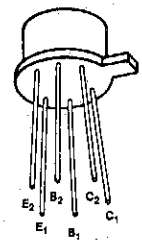
(T_A = 25° C unless otherwise specified)

Collector-Base Voltage (Note 1)	45V
Collector-Emitter Voltage (Note 1)	45V
Emitter Base Voltage (Notes 1 and 2)	7V
Collector Current (Note 1)	50 mA
Collector-Collector Voltage	60V
Storage Temperature Range	-65° C to +200° C
Operating Temperature Range	-55° C to +150° C
Lead Temperature (Soldering, 10 sec)	+300° C

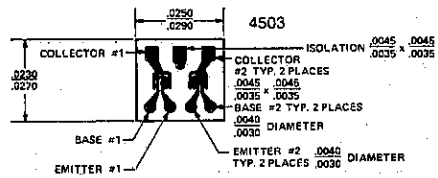
	TO-71		TO-78	
	ONE SIDE	BOTH SIDES	ONE SIDE	BOTH SIDES
Power Dissipation	400 mW 2.3 mW/° C	750 mW 4.3 mW/° C	300 mW 1.7 mW/° C	500 mW 4.3 mW/° C

PIN CONFIGURATIONS

TO-71
TO-78



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-78	TO-71	WAFER	DICE
IT130A	IT130A-TO71	IT130A/W	IT130A/D
IT130	IT130-TO71	IT130/W	IT130/D
IT131	IT131-TO71	IT131/W	IT131/D
IT132	IT132-TO71	IT132/W	IT132/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25° C unless otherwise noted)

	PARAMETER	IT130A		IT130		IT131		IT132		UNIT	TEST CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	200		200		80		80			I_C = 10 μA, V_{CE} = 5.0 V
		225		225		100		100			I_C = 1.0 mA, V_{CE} = 5.0 V
	T_A = -55°C	75		75		30		30			I_C = 10 μA, V_{CE} = 5.0 V
V_{BE}(ON)	Emitter-Base On Voltage		0.7		0.7		0.7		0.7	V	I_C = 10 μA, V_{CE} = 5.0 V
V_{CE}(SAT)	Collector Saturation Voltage		0.5		0.5		0.5		0.5		I_C = 0.5 mA, I_B = 0.05 mA
I_{CBO}	Collector Cutoff Current		-1.0		-1.0		-1.0		-1.0	nA	I_E = 0, V_{CB} = 45 V
	T_A = +150°C		-10		-10		-10		-10	μA	
I_{EBO}	Emitter Cutoff Current		-1.0		-1.0		-1.0		-1.0	nA	I_C = 0, V_{EB} = 5.0 V
C_{ob}	Output Capacitance		2.0		2.0		2.0		2.0	pF	I_E = 0, V_{CB} = 5.0 V
C_{te}	Emitter Transition Capacitance		2.5		2.5		2.5		2.5		I_C = 0, V_{EB} = 0.5 V
$C_{C_1-C_2}$	Collector to Collector Capacitance		4.0		4.0		4.0		4.0		V_{CC} = 0
$I_{C_1-C_2}$	Collector to Collector Leakage Current		10		10		10		10	nA	V_{CC} = ±60 V
V_{CEO}(SUST)	Collector to Emitter Sustaining Voltage	-45		-45		-45		-45		V	I_C = 1.0 mA, I_B = 0
GBW	Current Gain	5		5		4		4		MHz	I_C = 10 μA, V_{CE} = 5 V
	Bandwidth Product	110		110		90		90			I_C = 1 mA, V_{CE} = 5 V
$\lvert V_{BE_1}-V_{BE_2}\rvert$	Base Emitter Voltage Differential		1		2		3		5	mV	I_C = 10 μA, V_{CE} = 5.0 V
$\lvert I_{B_1}-I_{B_2}\rvert$	Base Current Differential		2.5		5		25		25	nA	I_C = 10 μA, V_{CE} = 5.0 V
$\Delta(V_{BE_1}-V_{BE_2})/\Delta T$	Base-Emitter Voltage Differential Change with Temperature		3		5		10		20	μV/°C	T_A = -55°C to +125°C I_C = 10 μA, V_{CE} = 5.0 V

NOTES:
1. Per transistor.
2. The reverse base-to-emitter voltage must never exceed 7.0V, and the reverse base-to-emitter current must never exceed 10 μA.

IT136-IT139
Monolithic Dual PNP Transistor

1

FEATURES
- **High Gain at Low Current**
- **Low Output Capacitance**
- **Tight I_B Match**
- **Tight V_{BE} Tracking**
- **Dielectrically Isolated Matched Pairs for Differential Amplifiers**

ABSOLUTE MAXIMUM RATINGS
(T_A = 25° C unless otherwise noted)

Collector-Base Voltage (Note 1)
- IT136, IT137 ..... 60V
- IT138 ..... 55V
- IT139 ..... 45V

Collector-Emitter Voltage (Note 1)
- IT136, IT137 ..... 60V
- IT138 ..... 55V
- IT139 ..... 45V

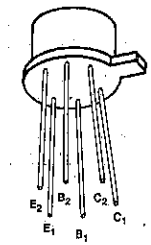
Emitter-Base Voltage (Notes 1 and 2) 7V
Collector Current (Note 1) ..... 100 mA
Collector-Collector Voltage 70V
Storage Temperature Range ..... -65° C to +200° C
Operating Temperature Range ..... -55° C to +150° C
Lead Temperature (Soldering, 10 sec.) ..... +300° C

	TO78 ONE SIDE	TO78 BOTH SIDES
Power Dissipation	0.4 Watt	0.75 Watt
Derate above 25° C	2.3 mW/° C	4.3 mW/° C

	TO71 ONE SIDE	TO71 BOTH SIDES
Power Dissipation	0.3 Watt	0.5 Watt
Derate above 25° C	1.7 mW/° C	2.9 mW/° C

PIN CONFIGURATION

TO-71
TO-78



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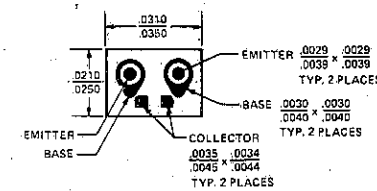
CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-78	TO-71	WAFER	DICE
IT136	IT136-TO71	IT136/W	IT136/D
IT137	IT137-TO71	IT137/W	IT137/D
IT138	IT138-TO71	IT138/W	IT138/D
IT139	IT139-TO71	IT139/W	IT139/D

*When ordering wafer/dice refer to Appendix B-23.

INTERSIL

ELECTRICAL CHARACTERISTICS (@ 25°C unless otherwise noted)

PARAMETER		IT136		IT137		IT138		IT139		UNITS	CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
h_{FE}	DC Current Gain	150		150		100		70			I_C = 10 μA, V_{CE} = 5V
		150	800	150	800	100	800	70	800		I_C = 1.0 mA, V_{CE} = 5V
		125		125		80		50			I_C = 10 mA, V_{CE} = 5V
		65		60		40		25			I_C = 50 mA, V_{CE} = 5V
	T_A = 55°C	75		75		60		40			I_C = 1 mA, V_{CE} = 5V
$V_{BE(on)}$	Emitter - Base On Voltage		.9		.9		.9		.9	V	I_C = 10 mA, V_{CE} = 5V
			1.0		1.0		1.0		1.0		I_C = 50 mA, V_{CE} = 5V
$V_{CE(sat)}$	Collector Saturation Voltage		.3		.3		.3		.3		I_C = 1 mA, I_B = .1 mA
			.6		.6		.6		.6		I_C = 10 mA, I_B = 1 mA
I_{CBO}	Collector Cutoff Current		0.1		0.1		0.1		0.1*	nA	I_E = 0, V_{CB} = 45V, 30V*
	T_A = +150°C		0.1		0.1		0.1		0.1*	μA	
I_{EBO}	Emitter Cutoff Current		0.1		0.1		0.1		0.1	nA	I_C = 0, V_{EB} = 5V
C_{obo}	Output Capacitance		3		3		3		3	pF	I_E=0, V_{CB}=20V, f=1 MHz

PARAMETERS		IT136		IT137		IT138		IT139		UNITS	CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
$BV_{C_1C_2}$	Collector to Collector Breakdown Voltage	± 100		± 100		± 100		± 100		V	I_C = ±1 μA
$V_{CEO(sust)}$	Collector to Emitter Sustaining Voltage	60		60		55		45			I_C = 1 mA, I_B = 0
BV_{CBO}	Collector Base Breakdown Voltage	60		60		55		45			I_C = 10 μA, I_E = 0
BV_{EBO}	Emitter Base Breakdown Voltage	7		7		7		7			I_E = 10 μA, I_C = 0

PARAMETERS		IT136		IT137		IT138		IT139		UNITS	CONDITIONS
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX		
$\lvert V_{BE_1} - V_{BE_2} \rvert$	Base Emitter Voltage Differential		1		2		3		5	mV	I_C = 1 ma, V_{CE} = 5V
$\Delta\lvert(V_{BE_1} - V_{BE_2})\rvert/\Delta T$	Base Emitter Voltage Differential Change with Temperature		3		5		10		20	μV/°C	I_C = 1 mA, V_{CE} = 5V T_A = -55°C to +125°C
$\lvert I_{B_1} - I_{B_2} \rvert$	Base Current Differential		2.5		5		10		20	nA	I_C = 10 μA, V_{CE} = 5V
			.25		.5		1.0		2.0	μA	I_C = 1 mA, V_{CE} = 5V

NOTES: 1. Per transistor.
2. The reverse base-to-emitter voltage must never exceed 7.0 volts and the reverse base-to-emitter current must never exceed 10μA

IT500-IT505 Monolithic Dual Cascoded N-Channel JFET

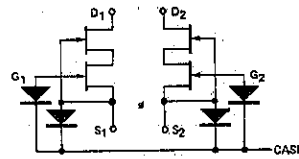
1

FEATURES

- C_{MRR} > 120 dB
- I_G < 5pA @ 50V_{DG}
- C_{rss} < 0.5 pF
- g_{os} > .025 μmhos

GENERAL DESCRIPTION

A low noise, low leakage FET that employs a cascode structure to accomplish very low I_G at high voltage levels, while giving high transconductance and very high common mode rejection ratio.



ABSOLUTE MAXIMUM RATINGS

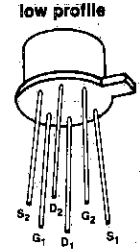
(T_A = 25° C unless otherwise specified)

Drain-Source and Drain-Gate Voltages (Note 1)	60V
Drain Current (Note 1)	50 mA
Gate-Gate Voltage	±60V
Storage Temperature	-65° C to +200° C
Operating Temperature	-55° C to +150° C
Lead Temperature (Soldering, 10 sec.)	+300° C

	ONE SIDE	BOTH SIDES
Power Dissipation	250 mW	500 mW
Derate above 25° C	3.8 mW/° C	7.7 mW/° C

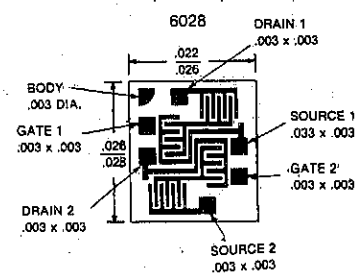
PIN CONFIGURATION

TO-71
low profile



CHIP TOPOGRAPHY

(Note 2)



ORDERING INFORMATION*

TO-78	WAFER	DICE
IT500	IT500/W	IT500/D
IT501	IT501/W	IT501/D
IT502	IT502/W	IT502/D
IT503	IT503/W	IT503/D
IT504	IT504/W	IT504/D
IT505	IT505/W	IT505/D

*When ordering wafer/dice refer to Appendix B-23.

NOTE 1. Per transistor.

NOTE 2. Due to the non-symmetrical structure of these devices, the drain and source ARE NOT interchangeable.

INTERSIL

ELECTRICAL CHARACTERISTICS (@ 25°C unless otherwise specified)

Symbol	Characteristics	Min	Max	Unit	Test Conditions
I_{GSSR}	Gate Reverse Current		-100	pA	V_{GS} = -20V, V_{DS} = 0
	T_A = 125°C		-5	nA	
BV_{GSS}	Gate-Source Breakdown Voltage	-60		V	I_G = -1 μA, V_{DS} = 0
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.7	-4		V_{DS} = 20V, I_D = 1 nA
V_{GS}	Gate-Source Voltage	-0.2	-3.8		
I_G	Gate Operating Current		-5	pA	V_{DG} = 50V, I_D = 200 μA
	T_A = 125°C		-5	nA	
I_{DSS}	Saturation Drain Current (Note 1)	0.7	7	mA	V_{DS} = 20V, V_{GS} = 0
g_{fs}	Common-Source Forward Transconductance (Note 1)	1000	4000	μmho	V_{DS} = 20V, V_{GS} = 0 — f = 1 kHz
g_{fs}	Common-Source Forward Transconductance (Note 1)	700	1600		V_{DG} = 20V, I_D = 200 μA — f = 1 kHz
g_{os}	Common-Source Output Conductance		1		V_{DS} = 20V, V_{GS} = 0 — f = 1 kHz
g_{os}	Common-Source Output Conductance		0.025		V_{DS} = 20V, I_D = 200 μA — f = 1 kHz
C_{g1g2}	Gate to Gate Capacitance		3.5	pF	V_{G1} = V_{G2} = 10V
C_{iss}	Common-Source Input Capacitance		7	pF	V_{DS} = 20V, V_{GS} = 0 — f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance (Note 3)		0.5		V_{DS} = 20V, V_{GS} = 0 — f = 1 MHz
NF	Spot Noise Figure		0.5	dB	f = 100 Hz, R_G = 10 MΩ
$\bar{e}_n$	Equivalent Input Noise Voltage		0.035	$\frac{\mu V}{\sqrt{Hz}}$	f = 10 Hz
			0.010		f = 1 kHz

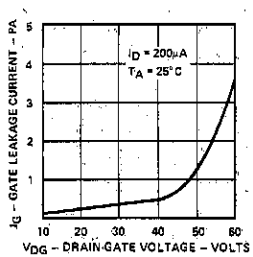
Symbol	Characteristics	IT500 Min	IT500 Max	IT501 Min	IT501 Max	IT502 Min	IT502 Max	IT503 Min	IT503 Max	IT504 Min	IT504 Max	IT505 Min	IT505 Max	Unit	Test Conditions
I_{G1}-I_{G2}	Differential Gate Current		5		5		5		5		10		15	nA	V_{DG} = 20V, I_D = 200 μA +125°C
$\frac{I_{DSS1}}{I_{DSS2}}$	Saturation Drain Current Ratio (Note 1)	0.95	1	0.95	1	0.95	1	0.95	1	0.9	1	0.85	1		V_{DS} = 20V, V_{GS} = 0V
g_{fs1}/g_{fs2}	Transconductance Ratio (Note 1)	0.97	1	0.97	1	0.95	1	0.95	1	0.90	1	0.85	1		f = 1 kHz
V_{GS1}-V_{GS2}	Differential Gate-Source Voltage		5		5		10		15		25		50	mV	
$\frac{\Delta V_{GS1}\text{-}V_{GS2}}{\Delta T}$	Gate-Source Differential Voltage		5		10		20		40		100		200	μV/°C	V_{DG} = 20V, I_D = 200 μA; T_A = 25°C, T_B = 125°C
	Change with Temp. (Note 2)		5		10		20		40		100		200		T_A = -55°C, T_B = 25°C
C_{MRR}**	Common Mode Rejection Ratio	120		120		120		120		120		120		dB	ΔV_{DD} = 10V, I_D = 200 μA

** $C_{MRR} = 20 \log_{10} \Delta V_{DD} / \Delta (V_{gs1} - V_{gs2})$, ΔV_{DD} = 10/-20V

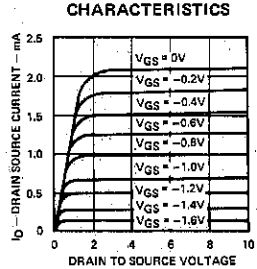
NOTES: 1. Pulse test required, pulsewidth = 300 μs, duty cycle ≤3%. 2. Measured at end points, T_A and T_B.
3. With case guarded C_{rss} is typically < 0.15 pF.

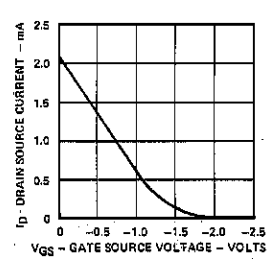
TYPICAL PERFORMANCE CURVES

GATE LEAKAGE

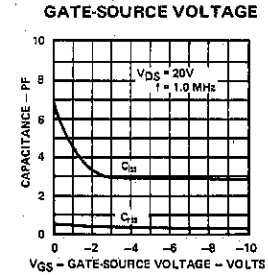


OUTPUT CHARACTERISTICS





TYPICAL CAPACITANCE VS. GATE-SOURCE VOLTAGE



AO50 Using the IT500 Family to Improve the Input Bias Current of BIFET OPAMPS

1

INTRODUCTION

The LF156 family of BIFET OPAMPS is very popular because of the combination of high slew rate (typically 12V/μs @ unity gain) and moderate offset voltage (about 2mV). Input bias current, however, varies directly with input voltage, rising from 30pA @ V_{IN} = -10V, to 50 pA @ V_{IN} = 0V, and finally to 80pA @ V_{IN} = +10V. This can be improved markedly by using one of the IT500 series to drive the inputs of the LF156.

The IT500, like the others in its family, is a dual cascoded n-channel JFET pair, featuring a typical input bias current of <1pA with inputs ranging from -15V to +15V; actual I_G is guaranteed to be less than 5pA @ V_{DG} = 50V.

Figure 1 shows an IT500 being used to drive the inputs of an LF156. This greatly reduces the input bias current, and in no way affects the already superior slew rate; the offset voltage is not significantly degraded because of the excellent matching of the IT500.

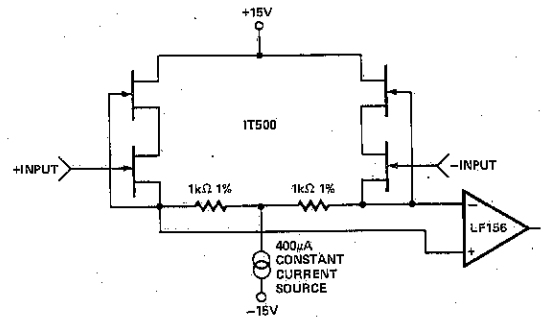


FIGURE 1. INPUT DRIVE CIRCUIT USING IT500

The constant current source can be designed with any transistor pair having a high beta @ I_C = 400μA. See Figure 2.

An added bonus of the IT500 is its CMRR > 100dB, compared to the LF156 CMRR of 85dB.

This configuration is ideal for electrometer circuits, with good measurement accuracy down to 10pA of input current (< 10% error with 10pA of input current). A 10MΩ glass feedback resistor connected between the -INPUT and OPAMP OUTPUT does the trick. Other possible applications include sample and hold amplifiers, instrumentation amplifiers, etc.

Although this application note has dealt solely with the LF156, all present day BIFET OPAMPS exhibit the same I_{BIAS} vs. V_{IN} dependancy, and all will benefit from using the IT500 as a preamplifier.

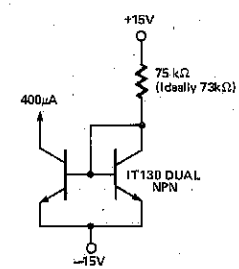


FIGURE 2. CONSTANT CURRENT SOURCE

IT550
Dual N-Channel JFET

1

FEATURES

- **Specified Matching Characteristics**
- **High Gain**
- **Low "ON" Resistance**

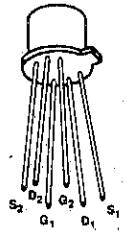
ABSOLUTE MAXIMUM RATINGS

(25°C Unless otherwise noted)

Gate-Drain or Gate-Source Voltage	-40V
Gate Current	50 mA
Gate-Gate Voltage	±60V
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C

	One Side	Both Sides
Power Dissipation	325mW	650mW
Derate above 25°C	2.2mW/°C	3.3mW/°C

PIN CONFIGURATION
TO-71



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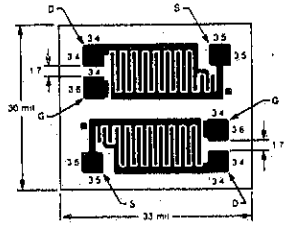


ORDERING INFORMATION*

TO-71	WAFER	DICE
IT550	IT550/W	IT550/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS (25°C unless otherwise noted)

SYMBOL	PARAMETERS	TEST CONDITIONS		MIN.	MAX.	UNIT
I_{GSSR}	Gate-Reverse Current	$V_{GS} = -20V, V_{DS} = 0$			-100	pA
	$T_A = 150°C$				-200	mA
BV_{GSS}	Gate-Source Breakdown Voltage	$I_G = -1\mu A, V_{DS} = 0$		-40		V
$V_{GS(off)}$	Gate-Source Cutoff Voltage	$V_{DS} = 15V, I_D = 1nA$		-0.5	-3	V
$V_{GS(f)}$	Gate-Source Voltage	$V_{DS} = 0V, I_G = 2mA$			1.0	V
I_{DSS}	Saturation Drain Current (Note 1)	$V_{DS} = 15V, V_{GS} = 0$		5	30	mA
$r_{DS(on)}$	Static Drain Source ON Resistance	$I_D = 1mA, V_{GS} = 0$			100	Ω
g_{fs}	Common-Source Forward Transconductance (Note 1)	$V_{DG} = 15V, I_D = 2mA$	f = 1kHz	7500	12,500	μmho
			f = 100MHz	7000		
g_{os}	Common-Source Output Conductance		f = 1kHz		45	
C_{rss}	Common-Source Reverse Transfer Capacitance		f = 1MHz		3	pF
C_{iss}	Common-Source Input Capacitance				12	
NF	Spot Noise Figure		f = 10Hz, R_g = 1M		1.0	dB
e_n	Equivalent Short Circuit Input Noise Voltage		f = 10Hz		50	$\frac{nV}{\sqrt{Hz}}$

SYMBOL	PARAMETERS	CONDITIONS	IT550 MIN.	IT550 MAX.	UNIT
$\frac{I_{DSS1}}{I_{DSS2}}$	Saturation Drain Current Ratio (Notes 1 and 2)	$V_{DS} = 15V, V_{GS} = 0$	0.95	1	—
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage	$V_{DS} = 15V, I_D = 2mA$ ($T_A = -55°C$ to $+125°C$)		50	mV
$\Delta\frac{\lvert V_{GS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Voltage Differential Drift (Note 3)			100	μV/°C
$\frac{g_{fs1}}{g_{fs2}}$	Transconductance Ratio (Notes 1 and 2)	$V_{DS} = 15V, I_D = 2mA$ f = 1kHz	0.90	1	—

NOTES:
1. Pulse test required; pulse width 300μs, duty cycle ≤ 3%.
2. Assumes smaller value in numerator
3. Measured at end points T_A and T_B

IT1700
P-Channel Enhancement Mode MOSFET

1

FEATURES

- **Low ON-Resistance**
- **High Gain**
- **Low Noise Voltage**
- **High Input Impedance**
- **Low Leakage**

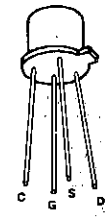
ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise noted)

Drain-Source and Gate-Source Voltage	-40 V
Peak Gate-Source Voltage (Note 1)	±125 V
Drain Current	50 mA
Storage Temperature	-65° C to +200° C
Operating Temperature Range	-55° C to +150° C
Lead Temperature (Soldering, 10 sec)	+300° C
Power Dissipation	375 mW
Derate above 25° C	3 mW/° C

PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

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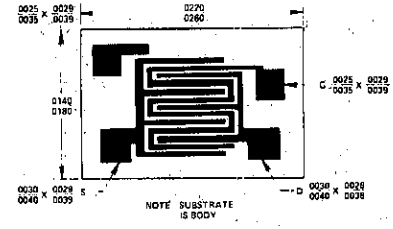


ORDERING INFORMATION*

TO-72	WAFER	DICE
IT1700	IT1700/W	IT1700/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25° C unless otherwise noted), V_{BS} = 0 unless otherwise noted.

PARAMETER		MIN	MAX	UNITS	TEST CONDITIONS
BV_{DSS}	Drain to Source Breakdown Voltage	-40		V	V_{GS} = 0, I_D = -10 μA
BV_{SDS}	Source to Drain Breakdown Voltage	-40		V	V_{GS} = 0, I_D = -10 μA
I_{GSS}	Gate Leakage Current		(See note 2)		
I_{DSS}	Drain to Source Leakage Current		200	pA	V_{GS} = 0, V_{DS} = -20 V
I_{DSS} (150°C)	Drain to Source Leakage Current		0.4	μA	
I_{SDS}	Source to Drain Leakage Current		400	pA	
I_{SDS} (150°C)	Source to Drain Leakage Current		0.8	μA	
$V_{GS(th)}$	Gate Threshold Voltage	-2	-5	V	V_{GS} = V_{DS}, I_D = -10 μA
r_{DS} (on)	Static Drain to Source "on" Resistance		400	ohms	V_{GS} = -10 V, V_{DS} = 0
I_{DS} (on)	Drain to Source "on" Current	2		mA	V_{GS} = -10 V, V_{DS} = -15 V
g_{fs}	Forward Transconductance Common Source	2000	4000	μmhos	V_{DS} = -15 V, I_D = -10 mA f = 1 kHz
C_{iss}	Small Signal, Short Circuit, Common Source, Input Capacitance		5	pF	V_{DS} = -15V, I_D = -10 mA f = 1 MHz
C_{rss}	Small Signal, Short Circuit, Common Source, Reverse Transfer Capacitance		1.2	pF	V_{DG} = -15 V, I_D = 0 f = 1 MHz
C_{oss}	Small Signal, Short Circuit, Common Source, Output Capacitance		3.5	pF	V_{DS} = -15 V, I_D = -10 mA f = 1 MHz

NOTES: 1. Device must not be tested at ±125V more than once nor longer than 300 ms.
2. Actual gate current is immeasurable. Package suppliers are required to guarantee a package leakage of < 10 pA. External package leakage is the dominant mode which is sensitive to both transient and storage environment, which cannot be guaranteed.

IT1750
N-Channel Enhancement Mode MOSFET

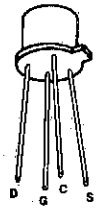
1

FEATURES

- **Low ON Resistance**
- **Low C_{dg}**
- **High Gain**
- **Low Threshold Voltage**

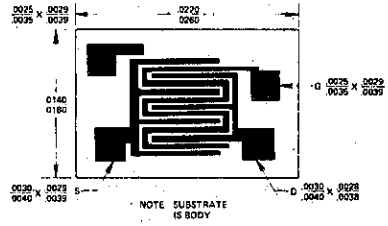
PIN CONFIGURATION

TO-72



CHIP TOPOGRAPHY

1003



ORDERING INFORMATION*

TO-72	WAFER	DICE
IT1750	IT1750/W	IT1750/D

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Drain-Source and Gate-Source Voltage	25V
Peak Gate-Source Voltage (Note 1)	±125V
Drain Current	100 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	375 mW
Derate above 25°C	3 mW/°C

ELECTRICAL CHARACTERISTICS (T_A = 25°C, Body connected to Source and V_{BS} = 0 unless otherwise noted)

	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
$V_{GS(th)}$	Gate to Source Threshold Voltage	0.50	1.5	3.0	V	V_{DS} = V_{GS}, I_D = 10 μA
I_{DSS}	Drain Leakage Current		0.1	10	nA	V_{DS} = 10 V, V_{GS} = 0
I_{GSS}	Gate Leakage Current		See note 2.			
BV_{DSS}	Drain Breakdown Voltage	25			V	I_D = 10 μA, V_{GS} = 0
$r_{DS(on)}$	Drain To Source on Resistance		25	50	ohms	V_{GS} = 20 V
$I_{D(on)}$	Drain Current	10	50		mA	V_{DS} = V_{GS} = 10 V
Y_{fs}	Forward Transadmittance	3,000			μmhos	V_{DS} = 10 V, I_D = 10 mA, f = 1 KHz
C_{iss}	Total Gate Input Capacitance		5.0	6.0	pF	I_D = 10 mA, V_{DS} = 10 V, f = 1 MHz
C_{dg}	Gate to Drain Capacitance		1.3	1.6	pF	V_{DG} = 10 V, f = 1 MHz

NOTES:

1. Devices must not be tested at ±125V more than once nor longer than 300 ms.
2. Actual gate current is immeasurable. Package suppliers are required to guarantee a package leakage of < 10pA. External package leakage is the dominant mode which is sensitive to both transient and storage environment, which cannot be guaranteed.

J105-J107
N-Channel JFET

1

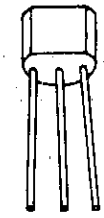
FEATURES
- Low $r_{DS(on)}$

APPLICATIONS
- Analog Switches
- Choppers
- Commutators

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

Gate-Drain or Gate-Source Voltage ..... -25V
Gate Current ..... 50 mA
Storage Temperature Range .. -65°C to +200°C
Operating Temperature Range -55°C to +150°C
Lead Temperature (Soldering, 10 sec.)...+300°C
Power Dissipation ..... 360 mW
Derate above 25°C ..... 3.3 mW/°C

PIN CONFIGURATION
TO-92



ORDERING INFORMATION*

J105	TO-92 only
J106	TO-92 only
J107	TO-92 only

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS: 25°C unless otherwise noted

	PARAMETER	J105 MIN	J105 TYP	J105 MAX	J106 MIN	J106 TYP	J106 MAX	J107 MIN	J107 TYP	J107 MAX	UNIT	TEST CONDITIONS
I_{GSS}	Gate-Reverse Current (Note 1)			-3			-3			-3	nA	V_{DS}=0V, V_{GS}=-15V
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-4.5		-10	-2		-6	-0.5		-4.5	V	V_{DS}=5V, I_D=1 μA
BV_{GSS}	Gate-Source Breakdown Voltage	-25			-25			-25			V	V_{DS}=0V, I_G=-1 μA
I_{DSS}	Drain Saturation Current (Note 2)	500			200			100			mA	V_{DS}=15V, V_{GS}=0V
$I_{D(off)}$	Drain Cutoff Current (Note 1)			3			3			3	nA	V_{DS}=5V, V_{GS}=-10V
$r_{DS(on)}$	Drain source ON Resistance			3			6			8	Ω	V_{DS}≤0.1V, V_{GS}=0V
$C_{dg(off)}$	Drain Gate OFF Capacitance			35			35			35	pF	V_{DS}=0V, V_{GS}=-10V, f=1 MHz
$C_{sg(off)}$	Source Gate OFF Capacitance			35			35			35		
$C_{dg(on)}$ + $C_{sg(on)}$	Drain Gate plus Source Gate ON Capacitance			160			160			160		V_{DS}=V_{GS}=0V, f=1 MHz
$t_{d(on)}$	Turn On Delay Time		15			15			15		ns	Switching Time Test Conditions: J105 / J106 / J107
t_r	Rise Time		20			20			20			V_{DD}: 1.5V / 1.5V / 1.5V
$t_{d(off)}$	Turn Off Delay Time		15			15			15			$V_{GS(off)}$: -12V / -7V / -5V
t_f	Fall Time		20			20			20			R_L: 50Ω / 50Ω / 50Ω

NOTES: 1. Approximately doubles for every 10°C increase in T_A.
2. Pulse test duration =300 μs; duty cycle≤3%.

J111-J113
N-Channel JFET

1

FEATURES

- **Low Cost**
- **Automated Insertion Package**
- **Low Insertion Loss**
- **No Offset or Error Voltage Generated by Closed Switch**
  - **Purely Resistive**
  - **High Isolation Resistance from Driver**
- **Fast Switching**
- **Short Sample and Hold Aperture Time**

APPLICATIONS

- Analog Switches
- Choppers
- Commutators

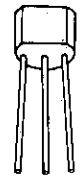
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Gate-Drain or Gate-Source Voltage ..... -35V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C
Power Dissipation ..... 310 mW
Derate Above 25°C ..... 2.8 mW/°C

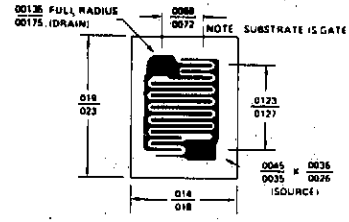
PIN CONFIGURATION

TO-92



CHIP TOPOGRAPHY

5001



ORDERING INFORMATION*

TO-92	WAFER	DICE
J111	J111/W	J111/D
J112	J112/W	J112/D
J113	J113/W	J113/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25°C unless otherwise noted

PARAMETERS		J111			J112			J113			UNIT	TEST CONDITIONS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
I_{GSSR}	Gate Reverse Current (Note 1)			-1			-1			-1	nA	V_{DS} = 0V, V_{GS} = -15V
$V_{GS(off)}$	Gate Source Cutoff Voltage	-3		-10	-1		-5	-0.5		-3	V	V_{DS} = 5V, I_D = 1μA
BV_{GSS}	Gate Source Breakdown Voltage	-35			-35			-35				V_{DS} = 0V, I_G = -1μA
I_{DSS}	Drain Saturation Current (Note 2)	20			5			2			mA	V_{DS} = 15V, V_{GS} = 0V
$I_{D(off)}$	Drain Cutoff Current (Note 1)			1			1			1	nA	V_{DS} = 5V, V_{GS} = -10V
$r_{DS(on)}$	Drain Source ON Resistance			30			50			100	Ω	V_{DS} = 0.1V, V_{GS} = 0V
$C_{dg(off)}$	Drain Gate OFF Capacitance			5			5			5	pF	V_{DS} = 0V, V_{GS} = -10V, f = 1 MHz
$C_{sg(off)}$	Source Gate OFF Capacitance			5			5			5		
$C_{dg(on)}$ + $C_{sg(on)}$	Drain Gate Plus Source Gate ON Capacitance			28			28			28		V_{DS} = V_{GS} = 0, f = 1 MHz
$t_{d(on)}$	Turn On Delay Time		7			7			7		ns	Switching Time Test Conditions
t_r	Rise Time		6			6			6			
$t_{d(off)}$	Turn Off Delay Time		20			20			20			
t_f	Fall Time		15			15			15			

Switching Time Test Conditions	J111	J112	J113
V_{DD}	10V	10V	10V
$V_{GS(off)}$	-12V	-7V	-5V
R_L	0.8kΩ	1.6kΩ	3.2kΩ

NOTES:

1. Approximately doubles for every 10°C increase in T_A.
2. Pulse Test duration 300μs; duty cycle ≤ 3%.

J174-J177
P-Channel JFET

FEATURES

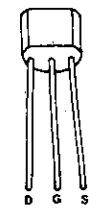
- **Low Insertion Loss**
- **No Offset or Error Generated by Closed Switch**
  - **Purely Resistive**
  - **High Isolation Resistance from Driver**
- **Short Sample and Hold Aperture Time**
- **Fast Switching**

APPLICATIONS

- Analog Switches
- Choppers
- Commutators

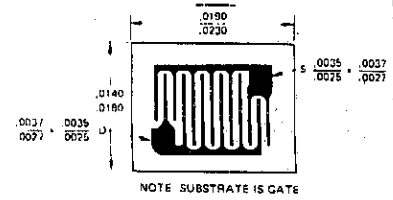
PIN CONFIGURATION

TO-92



CHIP TOPOGRAPHY (Note 1)

5508



ORDERING INFORMATION*

TO-92	WAFER	DICE
J17X	J17X/W	J17X/D

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Gate-Drain or Gate-Source Voltage (Note 1)	30V
Gate Current	50 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	300°C
Power Dissipation	350 mW
Derate above 25°C	3.5 mW/°C

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25°C unless otherwise noted

PARAMETERS		J174			J175			J176			J177			UNIT	TEST CONDITIONS
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX		
I_{GSSR}	Gate Reverse Current (Note 2)			1			1			1			1	nA	V_{DS} = 0, V_{GS} = 20V
$V_{GS(off)}$	Gate-Source Cutoff Voltage	5		10	3		6	1		4	0.8		2.25	V	V_{DS} = −15V, I_D = −10nA
BV_{GSS}	Gate-Source Breakdown Voltage	30			30			30			30			V	V_{DS} = 0, I_G = 1μA
I_{DSS}	Saturation Drain Current (Note 3)	-20		-100	-7		-60	-2		-25	-1.5		-20	mA	V_{DS} = −15V, V_{GS} = 0
$I_{D(off)}$	Drain Cutoff Current (Note 2)			-1			-1			-1			-1	nA	V_{DS} = −15V, V_{GS} = 10V
$r_{DS(on)}$	Drain-Source ON Resistance			85			125			250			300	Ω	V_{GS} = 0, V_{DS} = −0.1V
$C_{dg(off)}$	Drain-Gate OFF Capacitance		5.5			5.5			5.5			5.5		pF	V_{DS} = 0, V_{GS} = 10V; f = 1 MHz
$C_{sg(off)}$	Source-Gate OFF Capacitance		5.5			5.5			5.5			5.5		pF	V_{DS} = 0, V_{GS} = 10V; f = 1 MHz
$C_{dg(on)}$ + $C_{sg(on)}$	Drain-Gate Plus Source Gate ON Capacitance		40			40			40			40		pF	V_{DS} = V_{GS} = 0; f = 1 MHz
$t_{d(on)}$	Turn On Delay Time		2			5			15			20		ns	Switching Time Test Conditions
t_r	Rise Time		5			10			20			25		ns	
$t_{d(off)}$	Turn Off Delay Time		5			10			15			20		ns	
t_f	Fall Time		10			20			20			25		ns	

Switching Time Test Conditions	J174	J175	J176	J177
V_{DD}	−10V	−6V	−6V	−6V
$V_{GS(off)}$	12V	8V	6V	3V
R_L	560Ω	12KΩ	5.6KΩ	10KΩ
$V_{GS(on)}$	0V	0V	0V	0V

NOTES:

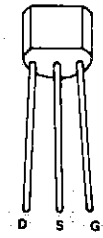
1. Geometry is symmetrical. Units may be operated with source and drain leads interchanged.
2. Approximately doubles for every 10°C increase in T_A.
3. Pulse test duration ~300μs; duty cycle ≤ 3%.

J201-J204
N-Channel JFET

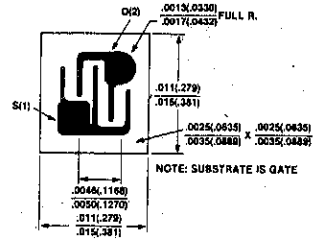
1

FEATURES
- **High Input Impedance**
- **Low I_{GSS}**

PIN CONFIGURATION
TO-92



CHIP TOPOGRAPHY
5010*



ORDERING INFORMATION*

TO-92	WAFER	DICE
J201	J201/W	J201/D
J202	J202/W	J202/D
J203	J203/W	J203/D
J204	J204/W	J204/D

*DICE WITH 4 MIL BONDING PADS AVAILABLE. CONSULT FACTORY FOR DETAILS.

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise noted)

Gate-Source or Gate-Drain Voltage ..... -40V
Gate Current ..... 50 mA
Storage Temperature Range ... -65° C to +200° C
Operating Temperature Range -55° C to +150° C
Lead Temperature (Soldering, 10 sec.)... +300° C
Power Dissipation ..... 360 mW
Derate above 25° C ..... 3.3mW/° C

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25 °C unless otherwise noted

	PARAMETERS	J201			J202			J203			J204			UNIT	TEST CONDITIONS	
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX			
I_{GSS}	Gate Reverse Current (Note 2)			-100			-100			-100			-100	pA	V_{DS} = 0, V_{GS} = -20V	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.3		-1.5	-0.8		-4.0	-2.0		-10.0	-0.5		-2.0	V	V_{DS} = 20V, I_D = 10 nA	
BV_{GSS}	Gate-Source Breakdown Voltage	-40			-40			-40			-25				V_{DS} = 0, I_G = -1μA	
I_{DSS}	Saturation Drain Current (Note 3)	0.2		1.0	0.9		4.5	4.0		20		1.2		mA	V_{DS} = 20V, V_{GS} = 0	
I_G	Gate Current (Note 1)		-3.5			-3.5			-3.5			-3.5		pA	V_{DG} = 20V, I_D = 200μA	
g_{fs}	Common-Source Forward Transconductance (Note 2)	500			1,000			1,500				1500		μmho	V_{DS} = 20V, V_{GS} = 0	f = 1 kHz
g_{os}	Common Source Output Conductance		1			3.5			10			2.5				
C_{iss}	Common-Source Input Capacitance		4			4			4			4		pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		1			1			1			1				
$\bar{e}_n$	Equivalent Short-Circuit Input Noise Voltage		5			5			5			10		$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 10V, V_{GS} = 0	f = 1 kHz

NOTES: 1. Approximately doubles for every 10 °C increase in T_A.
2. Pulse test duration = 2ms.

	PARAMETERS		J204 MIN	J204 TYP	J204 MAX	UNIT	TEST CONDITIONS	
STATIC	I_{GSS}	Gate Reverse Current (Note 2)			−100	pA	V_{DS} = 0, V_{GS} = −20V	
	$V_{GS(off)}$	Gate-Source Cutoff Voltage	−0.5		−2.0	V	V_{DS} = 20V, ID = 10nA	
	BV_{GSS}	Gate-Source Breakdown Voltage	−25				V_{DS} = 0, I_G = −μA	
	I_{DSS}	Saturation Drain Current (Note 3)		1.2		mA	V_{DS} = 20V, V_{GS} = 0	
	I_G	Gate Current (Note 1)		−3.5		pA	V_{DG} = 20V, I_D 200μA	
DYNAMIC	g_{fs}	Common-Source Forward Transconductance (Note 2)		1500		μmho	V_{DS} = 20V, V_{GS} = 0	f = 1kHz
	g_{os}	Common Source Output Conductance		2.5				
	C_{iss}	Common-Source Input Capacitance		4		pF		f = 1MHz
	C_{rss}	Common-Source Reverse Transfer Capacitance		1				
	e_n	Equivalent Short-Circuit Input Noise Voltage		10		$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 10V, V_{GS} = 0	f = 1kHz

J308-J310
N-Channel JFET

1

FEATURES
- **Industry Standard Part in Low Cost Plastic Package**
- **High Power Gain**
- **Low Noise**
- **Dynamic Range Greater than 100 dB**
- **Easily Matched to 75Ω Input**

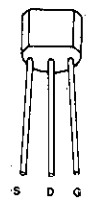
APPLICATIONS
- VHF/UHF Amplifiers
- Oscillators
- Mixers

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

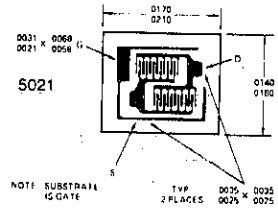
Drain-Gate Voltage	-25V
Drain-Source Voltage	-25V
Continuous Forward Gate Current	-10 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	1.7 mW/°C

PIN CONFIGURATION

TO-92



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-92	WAFER	DICE
J30X	J30X/W	J30X/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS: 25°C unless otherwise noted

PARAMETER		J308			J309			J310			UNIT	TEST CONDITIONS	
		MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX			
BV_{GSS}	Gate-Source Breakdown Voltage	-25			-25			-25			V	I_G = -1μA, V_{DS} = 0	
I_{GSSR}	Gate Reverse Current			-1.0			-1.0			-1.0	nA	V_{GS} = -15V,	
	T_A = 125°C			-1.0			-1.0			-1.0	μA	V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1.0		-6.5	-1.0		-4.0	-2.0		-6.5	V	V_{DS} = 10V, I_D = 1nA	
I_{DSS}	Saturation Drain Current (Note 1)	12		60	12		30	24		60	mA	V_{DS} = 10V, V_{GS} = 0	
$V_{GS(f)}$	Gate-Source Forward Voltage			1.0			1.0			1.0	V	V_{DS} = 0, I_G = 1 mA	
g_{fs}	Common-Source Forward Transconductance	8,000		20,000	10,000		20,000	8,000		18,000			
g_{os}	Common-Source Output Conductance			200			200			200			
g_{fg}	Common-Gate Forward Transconductance		13,000			13,000			12,000		μmhos	V_{DS} = 10V, I_D = 10mA	f = 1 kHz
g_{og}	Common Gate Output Conductance		150			150			150				
C_{gd}	Gate-Drain Capacitance		1.6	2.5		1.8	2.5		1.8	2.5			
C_{gs}	Gate-Source Capacitance		4.3	5.0		4.3	5.0		4.3	5.0	pF	V_{DS} = 0, V_{GS} = -10V	f = 1 MHz
e_n	Equivalent Short-Circuit Input Noise Voltage		10			10			10		$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 10V, I_D = 10 mA	f = 100 Hz
$Re_{(Vfs)}$	Common-Source Forward Transconductance		12			12			12				
$Re_{(Vfg)}$	Common-Gate Input Conductance		14			14			14				
$Re_{(Vis)}$	Common-Source Input Conductance		0.4			0.4			0.4		mmho		f = 105 MHz
$Re_{(Vos)}$	Common-Source Output Conductance		0.15			0.15			0.15			V_{DS} = 10V, I_D = 10mA	
G_{pg}	Common-Gate Power Gain at Noise Match		16			16			16				
NF	Noise Figure		1.5			1.5			1.5				
G_{pg}	Common-Gate Power Gain at Noise Match		11			11			11		dB		
NF	Noise Figure		2.7			2.7			2.7				f = 450 MHz

NOTE: 1. Pulse test PW 300 μs, duty cycle ≤ 3%.

LM114/H, LM114A/AH Monolithic Dual NPN Transistor

GENERAL DESCRIPTION

These devices contain a pair of junction-isolated NPN transistors fabricated on a single silicon substrate. This monolithic structure makes possible extremely tight parameter matching at low cost. Further, advanced processing techniques yield exceptionally high current gains at low collector currents, virtual elimination of "popcorn noise," low leakages and improved long-term stability.

Although designed primarily for high breakdown voltage and exceptional DC characteristics, these transistors have surprisingly good high-frequency performance. The gain-bandwidth product is 300MHz with 1mA collector current and 5V collector-base voltage and 22MHz with 10μA collector current. Typical collector-base capacitance is only 1.6 pF at 5V.

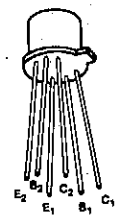
FEATURES

- Low offset voltage
- Low drift
- High current gain
- Tight beta match
- High breakdown voltage
- Matching guaranteed over a 0V to 45V collector-base voltage range
- CMRR > 100 dB

1

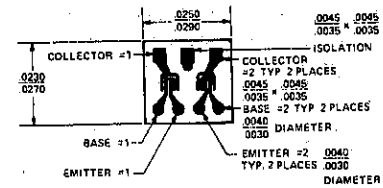
PIN CONFIGURATION

TO-71
TO-78



CHIP TOPOGRAPHY

4003



ORDERING INFORMATION*

TO-71	TO-78	WAFER	DICE
LM114	LM114H	LM114/W	LM114/D
LM114A	LM114AH		

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

Collector-Base Voltage (1)	45V
Collector-Emitter Voltage (1)	45V
Collector-Collector Voltage	45V
Emitter-Base Voltage (1)	6V
Collector Current (1)	20mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	800mW
Derate above 25°C	14mW/°C

ELECTRICAL CHARACTERISTICS (Note 2)

PARAMETER	MAXIMUM LIMITS LM114A, AH	MAXIMUM LIMITS LM114, H	UNITS	CONDITIONS
Offset Voltage	0.5	2.0	mV	$1\mu A \le I_C \le 100\mu A$
Offset Current	2.0	10	nA	$I_C = 10\mu A$
Bias Current	0.5	40	nA	$I_C = 1\mu A$
	20			$I_C = 10\mu A$
	3.0			$I_C = 1\mu A$
Offset Voltage Change	0.2	1.5	mV	$0V \le V_{CB} \le V_{MAX}$, $I_C = 10\mu A$
Offset Current Change	1.0	4.0	nA	
Offset Voltage Drift	2.0	10	μV/°C	$-55°C \le T_A \le +125°$, $I_C = 10\mu A$
Offset Current	12	50	nA	
Bias Current	60	150		
Collector-Base Leakage Current	10	50	pA	$V_{CB} = V_{MAX}$
T_A = 125°C	10	50	nA	
Collector-Emitter Leakage Current	50	200	pA	$V_{CE} = V_{MAX}$, $V_{EB} = 0V$
T_A = 125°C	50	200	nA	
Collector-Collector Leakage Current	100	300	pA	$V_{CC} = V_{MAX}$
T_A = 125°C	100	300	nA	

Note 1: Per transistor.

Note 2: These specifications apply for T_A = +25°C and $0V \le V_{CB} \le V_{MAX}$, unless otherwise specified. For the LM114 and LM114A, V_{MAX} = 30V.

M116
Diode Protected N-Channel Enhancement Mode MOSFET

1

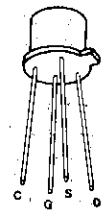
FEATURES
- Low I_{GSS}
- Integrated Zener Clamp for Gate Protection

ABSOLUTE MAXIMUM RATINGS
(T_A = 25°C unless otherwise noted)

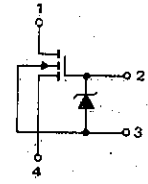
Drain to Source Voltage	30V
Gate to Drain Voltage	30V
Drain Current	50 mA
Gate Zener Current	±0.1 mA
Storage Temperature Range	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	300 mW
Derate above 25°C	2.2 mW/°C

PIN CONFIGURATION

TO-72

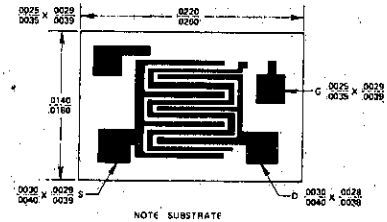


DEVICE SCHEMATIC



CHIP TOPOGRAPHY

1003



ORDERING INFORMATION*

TO-72	WAFER	DICE
M116	M116/W	M116/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

PARAMETER		M116 MIN	M116 MAX	UNITS	TEST CONDITIONS
$r_{DS(on)}$	Drain Source ON Resistance		100	Ω	V_{GS} = 20 V, I_D = 100 μA, V_{BS} = 0
			200		V_{GS} = 10 V, I_D = 100 μA, V_{BS} = 0
$V_{GS(th)}$	Gate Threshold Voltage	1	5	V	V_{GS} = V_{DS}, I_D = 10 μA, V_{BS} = 0
BV_{DSS}	Drain-Source Breakdown Voltage	30			I_D = 1 μA, V_{GS} = V_{BS} = 0
BV_{SDS}	Source-Drain Breakdown Voltage	30			I_S = 1 μA, V_{GD} = V_{BD} = 0
BV_{GBS}	Gate-Body Breakdown Voltage	30	60		I_G = 10 μA, V_{SB} = V_{DB} = 0
$I_{D(OFF)}$	Drain Cutoff Current		10	nA	V_{DS} = 20 V, V_{GS} = V_{BS} = 0
$I_{S(OFF)}$	Source Cutoff Current		10		V_{SD} = 20 V, V_{GD} = V_{BD} = 0
I_{GSS}	Gate-Body Leakage		100	pA	V_{GS} = 20 V, V_{DS} = V_{BS} = 0
C_{gs}	Gate-Source		2.5	pF	V_{GB} = V_{DB} = V_{SB} = 0, f = 1 MHz Body Guarded
C_{gd}	Gate-Drain Capacitance		2.5		
C_{db}	Drain-Body Capacitance		7		V_{GB} = 0, V_{DB} = 10 V, f = 1 MHz
C_{iss}	Input Capacitance		10		V_{GB} = 0, V_{DB} = 10 V, V_{BS} = 0 f = 1 MHz

U200-U202
N-Channel JFET

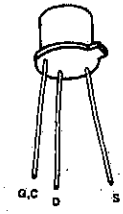
1

FEATURES
- Low Insertion Loss
- Good OFF Isolation

APPLICATIONS
- Analog Switches
- Commutators
- Choppers

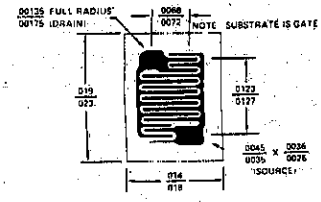
PIN CONFIGURATION

TO-18



CHIP TOPOGRAPHY

5001



ORDERING INFORMATION*

TO-18	WAFER	DICE
U200	U200/W	U200/D
U201	U201/W	U201/D
U202	U202/W	U202/D

*When ordering wafer/dice refer to Appendix B-23.

ABSOLUTE MAXIMUM RATINGS (T_A = 25° C unless otherwise noted)

Gate-Drain or Gate-Source Voltage	-30V
Gate Current	50 mA
Storage Temperature Range	-65° C to +200° C
Operating Temperature Range	-55° C to +150° C
Lead Temperature (Soldering, 10 sec.)	+300° C
Total Device Dissipation	1.8W
Derate above 25° C	10 mW/° C

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

Parameter		U200		U201		U202		Unit	Test Conditions	
		Min	Max	Min	Max	Min	Max			
I_{GSS}	Gate Reverse Current		-1		-1		-1	nA	V_{GSS} = 20 V, V_{DS} = 0	
	T_A = 150° C		-1		-1		-1	μA		
BV_{GSS}	Gate-Source Breakdown Voltage	-30		-30		-30		V	I_G = 1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.5	-3	-1.5	-5	-3.5	-10		V_{DS} = 20 V, I_D = 10 nA	
$I_{D(off)}$	Drain Cutoff Current		1		1		1	nA	V_{DS} = 10 V, V_{GS} = -12 V	
	T_A = 150° C		1		1		1	μA		
I_{DSS}	Saturation Drain Current (Note 1)	3	25	15	75	30	150	mA	V_{DS} = 20 V, V_{GS} = 0	
$r_{ds(on)}$	Drain-Source ON Resistance		150		75		50	ohm	V_{GS} = 0, I_D = 0	f = 1 kHz
C_{iss}	Common-Source Input Capacitance (Note 1)		30		30		30	pF	V_{DS} = 20 V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common Source Reverse Transfer Capacitance		8		8		8		V_{DS} = 0, V_{GS} = -12 V	

NOTE 1: Pulse test required, pulsewidth = 300 μsec, duty cycle ≤3%.

INTERSIL

U231-U235
Monolithic Dual N-Channel JFET

1

FEATURES
- **Good Matching Characteristics**

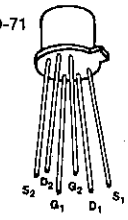
APPLICATIONS
- Differential Amplifiers
- Low and Maximum Frequency Amplifiers

ABSOLUTE MAXIMUM RATINGS
(T_A = 25° C unless otherwise noted)

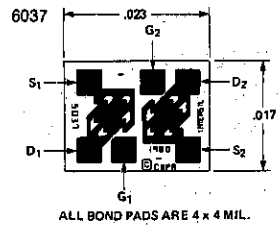
Gate-Source or Gate-Drain Voltage (Note 1) ..... -50V
Gate Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65° C to +200° C
Operating Temperature Range ..... -55° C to +150° C
Load Temperature (Soldering, 10 sec.) ..... +300° C
Power Dissipation ..... 300 mW
Derate above 25° C ..... 1.7 mW/° C

PIN CONFIGURATION

TO-71



CHIP TOPOGRAPHY



ALL BOND PADS ARE 4 x 4 MIL.

ORDERING INFORMATION*

TO-71	WAFER	DICE
U23X	U23X/W	U23X/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS: 25° C unless otherwise noted.

Parameter		Min	Max	Unit	Test Conditions	
I_{GSSR}	Gate Reverse Current		-100	pA	V_{GS} = -30V, V_{DS} = 0	
	T_A = 150° C		-500	nA		
BV_{GSS}	Gate-Source Breakdown Voltage	-50		V	I_G = 1μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-0.5	-4.5		V_{DS} = 20V, I_D = 1 nA	
V_{GS}	Gate-Source Voltage	-0.3	-4.0			
I_G	Gate Operating Current		-50	pA	V_{DG} = 20V, I_D = 200μA	
	T_A = 125° C		-250	nA		
I_{DSS}	Saturation Drain Current (Note 2)	0.5	5.0	mA	V_{DS} = 20V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance (Note 1)	1000	3000	μmho	V_{DS} = 20V, V_{GS} = 0	f = 1 kHz
		1000				f = 100 MHz
g_{fs}	Common-Source Forward Transconductance (Note 1)	600	1600		V_{DG} = 20V, I_D = 200μA	f = 1 kHz
g_{os}	Common-Source Output Capacitance		35		V_{DS} = 20V, V_{GS} = 0	
g_{os}	Common-Source Output Conductance		10		V_{DG} = 20V, I_D = 200μA	
C_{iss}	Common-Source Input Capacitance		6	pF	V_{DS} = 20V, V_{GS} = 0	f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		2			
$\overline{e}_n$	Equivalent Short Circuit Input Noise Voltage		80	$\frac{nV}{\sqrt{Hz}}$		f = 100 Hz

Matching Characteristics		U231 Max	U232 Max	U233 Max	U234 Max	U235 Max	Unit	Test Conditions	
$\lvert I_{G1}-I_{G2}\rvert$	Differential Gate Current	10	10	10	10	10	nA	V_{DG} = 20V, I_D = 200μA	125° C
$\frac{(I_{DSS1}-I_{DSS2})}{I_{DSS1}}$	Saturation Drain Current Match (Note 2)	5	5	5	10	15	%	V_{DS} = 20V, V_{GS} = 0	
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage	5	10	15	20	25	mV	V_{DG} = 20V, I_D = 200μA	
$\frac{\Delta\lvert V_{GS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Voltage Differential Drift (Note 3)	10	25	50	75	100	μV/° C		T_A = 25° C T_B = 125° C
		10	25	50	75	100			T_A = -55° C T_B = 25° C
$\frac{(g_{fs1}-g_{fs2})}{g_{fs1}}$	Transconductance Match (Note 2)	3	5	5	10	15	%		f = 1 kHz
$\lvert g_{os1}-g_{os2}\rvert$	Differential Output Conductance	5	5	5	5	5	μmho		

NOTES:
1. Per transistor.
2. Pulse test required, pulse width = 300 μs, duty cycle ≤ 3%.
3. Measured at end points, T_A and T_B.

U257
Monolithic Dual N-Channel JFET

1

FEATURES
- g_{fs} > 5000 μmho from DC to 100 MHz
- Matched V_{GS}, g_{fs} and g_{os}

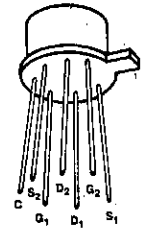
ABSOLUTE MAXIMUM RATINGS
(T$_A$ = 25°C unless otherwise noted)

Gate-Drain or Gate-Source Voltage (Note 1) ..... -25V
Gate Current (Note 1) ..... 50 mA
Storage Temperature Range ..... -65°C to +200°C
Operating Temperature Range ..... -55°C to +150°C
Lead Temperature (Soldering, 10 sec.) ..... +300°C

	ONE SIDE	BOTH SIDES
Power Dissipation	250 mW	500 mW
Derate above 25°C	3.8 mW/°C	7.7 mW/°C

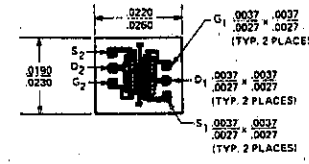
PIN CONFIGURATION

TO-99



CHIP TOPOGRAPHY

6022



ORDERING INFORMATION*

TO-99	WAFER	DICE
U257	U257/W	U257/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

	PARAMETER	MIN	MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current		-100	pA	V_{GS} = 15 V, V_{DS} = 0	
	T_A = 150°C		-250	nA		
BV_{GSS}	Gate-Source Breakdown Voltage	-25		V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1	-5		V_{DS} = 10 V, I_D = 1 nA	
I_{DSS}	Saturation Drain Current (Note 2)	5	40	mA	V_{DS} = 10 V, V_{GS} = 0	
g_{fs}	Common-Source Forward Transconductance	5000	10,000	μmho	V_{DS} = 10 V, I_D = 5 mA	f = 1 kHz
g_{fs}	Common-Source Forward Transconductance	5000	10,000		V_{DG} = 10 V, I_D = 5 mA	f = 100 MHz
g_{os}	Common-Source Output Conductance		150		V_{DS} = 10 V, I_D = 5 mA	f = 1 kHz
g_{oss}	Common-Source Output Conductance		150		V_{DG} = 10 V, I_D = 5 mA	f = 100 MHz
C_{iss}	Common-Source Input Capacitance		5	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		1.2			
$\overline{e_n}$	Equivalent Input Noise Voltage		30	$\frac{nV}{\sqrt{Hz}}$		f = 10 kHz
$\frac{I_{DSS1}}{I_{DSS2}}$	Drain Current Ratio at Zero Gate Voltage (Note 2)	0.85	1		V_{DS} = 10 V, V_{GS} = 0	
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		100	mV	V_{DG} = 10 V, I_D = 5 mA, f = 1 kHz	
$\frac{g_{fs1}}{g_{fs2}}$	Transconductance Ratio	0.85	1			
$\lvert g_{os1}-g_{os2}\rvert$	Differential Output Conductance		20	μmho		

NOTES:
1. Per transistor.
2. Pulse test required, pulse width = 300 μs, duty cycle ≤ 3%.

U304-U306
P-Channel JFET

FEATURES
- **Low ON Resistance**
- **$I_{D(off)}$ <500 pA**
- **Switches directly from T^2L Logic (U306)**

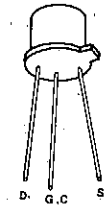
1

APPLICATIONS
- Analog Switches
- Commutators
- Choppers

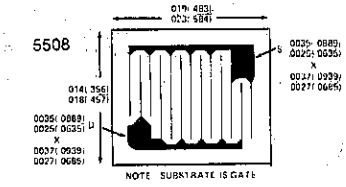
ABSOLUTE MAXIMUM RATINGS
(T_A = 25° C unless otherwise noted)

Gate-Drain or Gate-Source Voltage (Note 1) 30V
Gate Current ..... 50 mA
Storage Temperature Range ..... -65° C to +200° C
Operating Temperature Range ..... -55° C to +150° C
Lead Temperature (Soldering, 10 sec.) ..... 300° C
Power Dissipation ..... 350 mW
Derate above 25° C ..... 2.8 mW/° C

PIN CONFIGURATION
TO-18



CHIP TOPOGRAPHY (Note 1)



ORDERING INFORMATION*

TO-18	WAFER	DICE
U304	U304/W	U304/D
U305	U305/W	U305/D
U306	U306/W	U306/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS: 25° C unless otherwise noted.

Parameter		U304 Min	U304 Max	U305 Min	U305 Max	U306 Min	U306 Max	Unit	Test Conditions
I_{GSSR}	Gate Reverse Current		500		500		500	pA	V_{GS} = 20V, V_{DS} = 0
	T_A = 150° C		1.0		1.0		1.0	μA	
BV_{GSS}	Gate-Source Breakdown Voltage	30		30		30		V	I_G = 1 μA, V_{DS} = 0
$V_{GS(off)}$	Gate-Source Cutoff Voltage	5	10	3	6	1	4	V	V_{DS} = -15V, I_D = -1μA
$V_{DS(on)}$	Drain-Source ON Voltage		-1.3		-0.8		-0.6	V	V_{GS} = 0, I_D = -15mA(U304), I_D = -7mA (U305), I_D = -3mA (U306)
I_{DSS}	Saturation Drain Current (Note 2)	-30	-90	-15	-60	-5	-25	mA	V_{DS} = -15V, V_{GS} = 0
$I_{D(off)}$	Drain Cutoff Current		-500		-500		-500	pA	V_{DS} = -15V, V_{GS} = 12V (U304) V_{GS} = 7V (U305) V_{GS} = 5V (U306)
	T_A = 150° C		-1.0		-1.0		-1.0	μA	
$r_{DS(on)}$	Static Drain-Source ON Resistance		85		110		175	Ω	V_{GS} = 0V, I_D = -1mA
$r_{ds(on)}$	Drain-Source ON Resistance		85		110		175	Ω	V_{GS} = 0V, I_D = 0, f = 1 kHz
C_{iss}	Common-Source Input Capacitance		27		27		27	pF	V_{DS} = -15V, V_{GS} = 0
C_{rss}	Common-Source Reverse Transfer Capacitance		7		7		7	pF	V_{DS} = 0, V_{GS} = 12V (U304) V_{GS} = 7V (U305), V_{GS} = 5V (U306), f = 1 MHz

		U304	U305	U306
$t_{d(on)}$	Turn-ON Delay Time	20	25	25
t_r	Rise Time	15	25	35
$t_{d(off)}$	Turn-OFF Delay Time	10	15	20
t_f	Fall Time	25	40	60
	ns			
V_{DD}		-10V	-6V	-6V
$V_{GS(off)}$		12V	7V	5V
R_L		580Ω	743Ω	1800Ω
$V_{GS(on)}$		0	0	0
$I_{D(on)}$		-15mA	-7mA	-3mA

NOTES:
1. Due to symmetrical geometry these units may be operated with source and drain leads interchanged.
2. Pulse test pulsewidth = 300μs, duty cycle ≤3%.

U308-U310
N-Channel JFET

FEATURES

- Industry Standard Part in Low Cost Plastic Package
- High Power Gain
- Low Noise
- Dynamic Range Greater than 100 dB
- Easily Matched to 75Ω Input

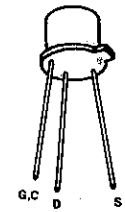
ABSOLUTE MAXIMUM RATINGS

(T_A = 25°C unless otherwise noted)

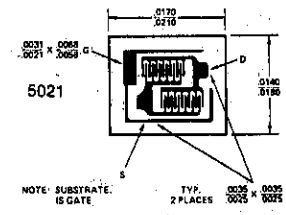
Gate-Drain or Gate-Source Voltage	-25V
Gate Current	20 mA
Storage Temperature	-65°C to +200°C
Operating Temperature Range	-55°C to +150°C
Led Temperature (Soldering, 10 sec.)	+300°C
Power Dissipation	500 mW
Derate above 25°C	4mW/°C

PIN CONFIGURATIONS

TO-52



CHIP TOPOGRAPHY



ORDERING INFORMATION*

TO-52	WAFER	DICE
U308	U308/W	U308/D
U309	U309/W	U309/D
U310	U310/W	U310/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

SYMBOL	PARAMETER	U308 MIN	U308 TYP	U308 MAX	U309 MIN	U309 TYP	U309 MAX	U310 MIN	U310 TYP	U310 MAX	UNIT	TEST CONDITIONS	
I_{GSSR}	Gate Reverse Current			-150			-150			-150	pA	V_{GS} = -15 V	
	T_A = 125°C			-150			-150			-150	nA	V_{GS} = 0	
BV_{GSS}	Gate-Source Breakdown Voltage	-25			-25			-25			V	I_G = -1 μA, V_{DS} = 0	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-1.0		-6.0	-1.0		-4.0	-2.5		-6.0	V	V_{DS} = 10 V, I_D = 1 nA*	
I_{DSS}	Saturation Drain Current (Note 1)	12		60	12		30	24		60	mA	V_{DS} = 10 V, V_{GS} = 0	
$V_{GS(f)}$	Gate-Source Forward Voltage			1.0			1.0			1.0	V	I_G = 10 mA, V_{DS} = 0	
g_{fg}	Common-Gate Forward Transconductance (Note 1)	10		20	10		20	10		18	mmho	V_{DS} = 10 V, I_D = 10 mA	f = 1 kHz
g_{ogs}	Common-Gate Output Conductance			150			150			150	μmho		
C_{gd}	Drain-Gate Capacitance			2.5			2.5			2.5	pF	V_{GS} = -10 V, V_{DS} = 10 V	f = 1 MHz
C_{gs}	Gate-Source Capacitance			5.0			5.0			5.0			
$\bar{e}_n$	Equivalent Short Circuit Input Noise Voltage		10			10			10		$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 10 V, I_D = 10 mA	f = 100 Hz
g_{fg}	Common-Gate Forward Transconductance		15			15			15		mmho	V_{DS} = 10 V, I_D = 10 mA	f = 100 MHz
			14			14			14				f = 450 MHz
g_{ogs}	Common-Gate Output Conductance		0.18			0.18			0.18				f = 100 MHz
			0.32			0.32			0.32				f = 450 MHz
G_{pg}	Common-Gate Power Gain		16			16			16		dB		f = 100 MHz
			11			11			11				f = 450 MHz
NF	Noise Figure		1.5			1.5			1.5				f = 100 MHz
			2.7			2.7			2.7				f = 450 MHz

NOTE: Pulse test duration = 2 ms.

U401-U406
Monolithic Dual N-Channel JFET

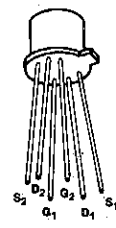
FEATURES

- Minimum System Error and Calibration
- Low Drift with Temperature
- Operates from Low Power Supply Voltages
- High Output Impedance

1

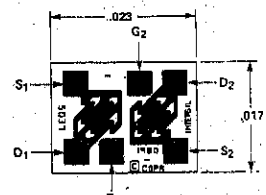
PIN CONFIGURATION

TO-71



CHIP TOPOGRAPHY

6037



ALL BOND PADS ARE 4 x 4 MIL.

ABSOLUTE MAXIMUM RATINGS

(T_A = 25° C unless otherwise noted)

Gate-Drain or Gate-Source Voltage (Note 1) 50V
Gate Current (Note 1) ..... 10 mA
Storage Temperature Range ..... -65° C to +200° C
Operating Temperature Range ..... -55° C to +150° C
Lead Temperature (Soldering, 10 sec) ..... +300° C

	ONE SIDE	BOTH SIDES
Power Dissipation	300 mW	500 mW
Derate above 25° C ..	2.6 mW/° C	5 mW/° C

ORDERING INFORMATION*

TO-71	WAFER	DICE
U40X	U40X/W	U40X/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS

TEST CONDITIONS: 25° unless otherwise noted.

Parameters		U401		U402		U403		U404		U405		U406		Unit	Test Conditions	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max			
BV_{GSS}	Gate-Source Breakdown Voltage	-50		-50		-50		-50		-50		-50		V	V_{DS} = o, I_G = -1μA	
I_{GSS}	Gate Reverse Current (Note 2)		-25		-25		-25		-25		-25		-25	pA	V_{DS} = 0, V_{GS} = -30V	
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-5	-2.5	-5	-2.5	-5	-2.5	-5	-2.5	-5	-2.5	-5	-2.5	V	V_{DS} = 15V, I_D = 1 nA	
$V_{GS(on)}$	Gate-Source Voltage (on)		-2.3		-2.3		-2.3		-2.3		-2.3		-2.3		V_{DG} = 15V, I_D = 200μA	
I_{DSS}	Saturation Drain Current (Note 3)	0.5	10.0	0.5	10.0	0.5	10.0	0.5	10.0	0.5	10.0	0.5	10.0	mA	V_{DS} = 10V, V_{GS} = 0	
I_G	Operating Gate Current (Note 2)		-15		-15		-15		-15		-15		-15	pA	V_{DG} = 15V, I_D = 200μA	
	T_A = 125° C		-10		-10		-10		-10		-10		-10	nA		
BV_{G1-G2}	Gate-Gate Breakdown Voltage	±50		±50		±50		±50		±50		±50		V	V_{DS} = 0, V_{GS} = 0, I_G = ±1μA	
g_{fs}	Common-Source Forward Transconductance (Note 3)	2000	7000	2000	7000	2000	7000	2000	7000	2000	7000	2000	7000	μmho	V_{DS} = 10V, V_{GS} = 0	f = 1 kHz
g_{os}	Common-Source Output Conductance		20		20		20		20		20		20			
g_{fs}	Common-Source Forward Transconductance	1000	1600	1000	1600	1000	1600	1000	1600	1000	1600	1000	1600		V_{DG} = 15V, I_D = 200μA	f = 1 kHz
g_{os}	Common-Source Output Conductance		2.0		2.0		2.0		2.0		2.0		2.0			
C_{iss}	Common-Source Input Capacitance		8.0		8.0		8.0		8.0		8.0		8.0	pF		f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		3.0		3.0		3.0		3.0		3.0		3.0			
e_n	Equivalent Short-Circuit Input Noise Voltage		20		20		20		20		20		20	$\frac{nV}{\sqrt{Hz}}$	V_{DS} = 15V, V_{GS} = 0	f = 10 Hz
CMRR	Common-Mode Rejection Ratio (Note 4)	95		95		95		95		90				dB	V_{DG} = 10 to 20V, I_D = 200μA	
$\lvert V_{GS1}-V_{GS2}\rvert$	Differential Gate-Source Voltage		5		10		10		15		20		40	mV	V_{DG} = 10V, I_D = 200μA	
$\frac{\Delta\lvert V_{GS1}-V_{GS2}\rvert}{\Delta T}$	Gate-Source Voltage Differential Drift (Note 5)		10		10		25		25		40		80	μV/° C	V_{DG} = 10V, I_D = 200μA	T_A = -55° C, T_B = +25° C, I_D = 200μA T_C = +125° C

NOTES:

1. Per transistor.
2. Approximately doubles for every 10° C increase in T_A.
3. Pulse test duration = 300 μsec; duty cycle ≤ 3%.
4. Measured at end points, T_A and T_B.
5. $CMRR = 20 \log_{10}\left[\frac{\Delta V_{DD}}{\Delta\lvert V_{GS_1}-V_{GS_2}\rvert}\right]$, ΔV_{DD} = 10 V.

U1897-U1899
N-Channel JFET

1

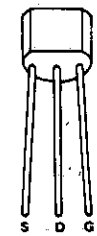
FEATURES
- **Low Insertion Loss**
- **No Error or Offset Voltage Generated by Closed Switch**

APPLICATIONS
Analog Switches, Choppers

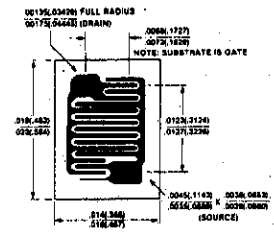
ABSOLUTE MAXIMUM RATINGS
(T_A = 25° C unless otherwise noted)

Gate-Drain or Gate-Source Voltage ..... -40V
Forward Gate Current ..... 10 mA
Storage Temperature Range .. -65° C to +200° C
Operating Temperature Range. .-55° C to +150° C
Lead Temperature (Soldering, 10 sec). . . +300° C
Power Dissipation ..... 350 mW
Derate above 25° C ..... 3.5 mW/° C

PIN CONFIGURATION
TO-92



CHIP TOPOGRAPHY
5001



ORDERING INFORMATION*

TO-92	TO-92-18	WAFER	DICE
U1897	U1897-18	U1897/W	U1897/D
U1898	U1898-18	U1898/W	U1898/D
U1899	U1899-18	U1899/W	U1899/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS
TEST CONDITIONS: 25 °C unless otherwise noted

PARAMETERS		U1897 MIN	U1897 MAX	U1898 MIN	U1898 MAX	U1899 MIN	U1899 MAX	UNIT	TEST CONDITIONS
BV_{GSS}	Gate-Source Breakdown Voltage	-40		-40		-40		V	$I_G = -1\mu A$, $V_{DS} = 0$
I_{GSSR}	Gate Reverse Current		-400		-400		-400	pA	$V_{GS} = -20V$, $V_{DS} = 0$
I_{DGO}	Drain-Gate Leakage Current		200		200		200	pA	$V_{DG} = 20V$, $I_S = 0$
I_{SGO}	Source-Gate Leakage Current		200		200		200	pA	$V_{SG} = 20V$, $I_D = 0$
$I_{D(off)}$	Drain Cutoff Current		200		200		200	pA	$V_{DS} = 20V$, $V_{GS} = -12V$ (U1897)
	$T_A = 85°C$		10		10		10	nA	$V_{GS} = -8V$ (U1898) $V_{GS} = -6V$ (U1899)
$V_{GS(off)}$	Gate-Source Cutoff Voltage	-5.0	-10	-2.0	-7.0	-1.0	-5.0	V	$V_{DS} = 20V$, $I_D = 1$ na
I_{DSS}	Saturation Drain Current (Note 1)	30		15		8.0		mA	$V_{DS} = 20V$, $V_{GS} = 0$
$V_{DS(on)}$	Drain-Source ON Voltage		0.2		0.2		0.2	V	$V_{GS} = 0$, $I_D = 6.6mA$ (U1897) $I_D = 4.0mA$ (U1898) $I_D = 2.5mA$ (U1899)
$r_{DS(on)}$	Static Drain-Source ON Resistance		30		50		80	Ω	$I_D = 1mA$, $V_{GS} = 0$
C_{dg}	Drain-Gate Capacitance		5		5		5	pF	$V_{DG} = 20V$, $I_S = 0$ f = 1 MHz
C_{sg}	Source-Gate Capacitance		5		5		5	pF	$V_{SG} = 20V$, $I_D = 0$ f = 1 MHz
C_{iss}	Common-Source Input Capacitance		16		16		16	pF	$V_{DS} = 20V$, $V_{GS} = 0$ f = 1 MHz
C_{rss}	Common-Source Reverse Transfer Capacitance		3.5		3.5		3.5	pF	$V_{DS} = 20V$, $V_{GS} = 0$ f = 1 MHz
$t_{d(on)}$	Turn ON Delay Time		15		15		20	ns	Switching Time Test Conditions
t_r	Rise Time		10		20		40	ns	
t_{off}	Turn OFF Time		40		60		80	ns	

	U1897	U1898	U1899
V_{DD}	3V	3V	3V
$V_{GS(on)}$	0	0	0
$V_{GS(off)}$	-12V	-8V	-6V
R_L	425Ω	770Ω	1120Ω
$I_{D(on)}$	6.6mA	4mA	2.5mA

NOTE: 1. Pulse test pulsewidth = 300 μS; duty cycle < 3%

VCR2N/3P/4N/7N Voltage Controlled Resistors

1

APPLICATIONS

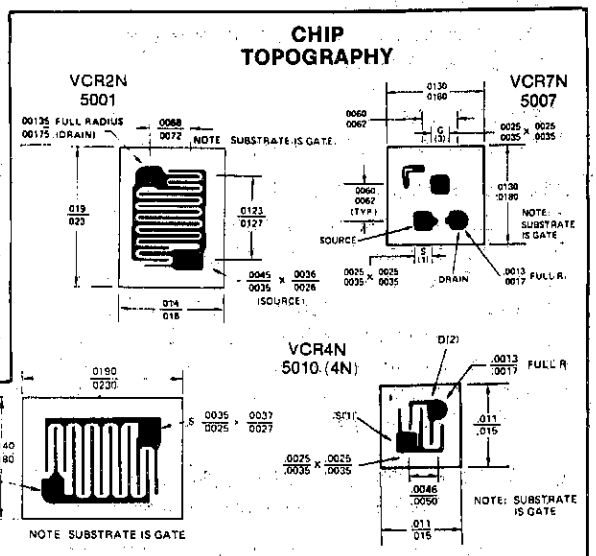
- Small Signal Attenuators
- Filters
- Amplifier Gain Control
- Oscillator Amplitude Control

ABSOLUTE MAXIMUM RATINGS

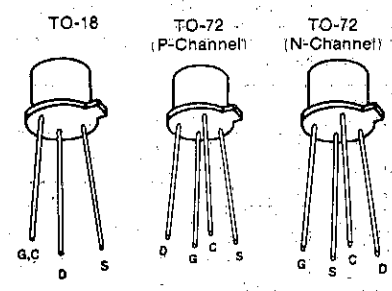
(T_A = 25°C unless otherwise noted)

Gate-Drain or Gate-Source Voltage 15V
Gate Current ..... 10 mA
Storage Temperature Range .. -65°C to +200°C
Operating Temperature Range ..-55°C to +150°C
Lead Temperature (Soldering, 10 sec.)...+300°C
Power Dissipation ..... 300 mW
Derate above 25°C ..... 2 mW/°C

CHIP TOPOGRAPHY



PIN CONFIGURATIONS



ORDERING INFORMATION*

TO-18	TO-72	WAFER	DICE
VCR2N	—	VCR2N/W	VCR2N/D
VCR4N	—	VCR4N/W	VCR4N/D
—	VCR3P	VCR3P/W	VCR3P/D
—	VCR7N	VCR7N/W	VCR7N/D

*When ordering wafer/dice refer to Appendix B-23.

ELECTRICAL CHARACTERISTICS (25°C unless otherwise noted)

N-Channel VCR FETs

		Parameter	VCR2N Min	VCR2N Max	VCR4N Min	VCR4N Max	VCR7N Min	VCR7N Max	Unit	Test Conditions	
STATIC	I_{GSS}	Gate Reverse Current		-5		-0.2		-0.1	nA	V_{GS} = -15V, V_{DS} = 0	
	BV_{GSS}	Gate-Source Breakdown Voltage	-15		-15		-15		V	I_G = -1 μA, V_{DS} = 0	
	$V_{GS(off)}$	Gate-Source Cutoff Voltage	-3.5	-7	-3.5	-7	-2.5	-5		I_D = 1 μA, V_{DS} = 10V	
	$r_{ds(on)}$	Drain Source ON Resistance	20	60	200	600	4,000	8,000	Ω	V_{GS} = 0, I_D = 0	f = 1 kHz
DY	C_{dgo}	Drain-Gate Capacitance		7.5		3		1.5	pF	V_{GD} = -10V, I_S = 0	f = 1 MHz
	C_{sgo}	Source-Gate Capacitance		7.5		3		1.5		V_{GS} = -10V, I_D = 0	

P-Channel VCR FETs

		Parameter	VCR3P		Unit	Test Conditions	
STATIC	I_{GSS}	Gate Reverse Current		20	nA	V_{GS} = 15V, V_{DS} = 0	
	BV_{GSS}	Gate-Source Breakdown Voltage	15		V	I_G = 1μA, V_{DS} = 0	
	$V_{GS(off)}$	Gate-Source Cutoff Voltage	3.5	7		I_D = -1μA, V_{DS} = -10V	
	$r_{ds(on)}$	Drain-Source ON Resistance	70	200	Ω	V_{GS} = 0, I_D = 0	f = 1 kHz
DY	C_{dgo}	Drain-Gate Capacitance		6	pF	V_{GD} = 10V, I_S = 0	f = 1 MHz
	C_{sgo}	Source-Gate Capacitance		6		V_{GS} = 10V, I_D = 0	

JFETS AS VOLTAGE CONTROLLED RESISTORS

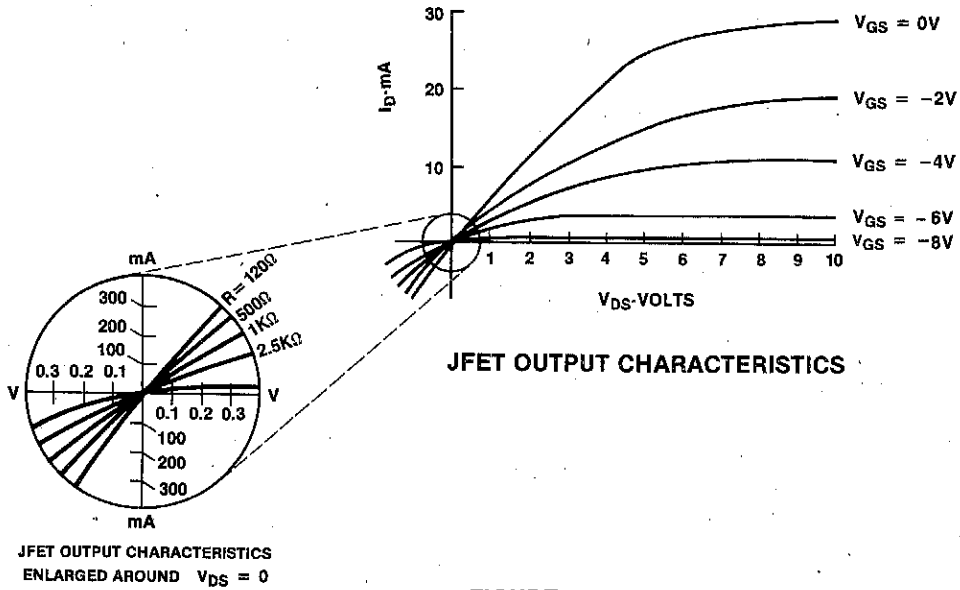
The voltage controlled resistor is a junction field effect transistor whose drain to source ON resistance is controlled by gate to source voltage.

The gate control terminal is high impedance thereby allowing negligible control current. The gate voltage is zero for minimum resistance, and increases as the gate voltage approaches the pinch-off voltage.

This VCR is intended for use on applications using low level AC signals. Figure 1 shows the output characteristics, with an enlarged graph of VDS = 0 for AC signals with no DC component. Operation is in the first and third quadrants; the device will operate in the first quadrant only if a constant current is applied to the drain and the input signal level is kept low.

Figure 1 also shows that certain combinations of gate control voltage and signal levels will cause resistance modulation. This distortion may be improved by introducing local feedback as shown in figure 2 for best frequency response and impedance levels; eliminating the feedback capacitor will require the gate control voltage to be double for the same ON resistance. The resistor values should be equal, and about 100kΩ.

Best gate control voltage for best linearity is up to about $0.8V_{PK}$; ON resistance increases rapidly beyond this point.



JFET OUTPUT CHARACTERISTICS

JFET OUTPUT CHARACTERISTICS ENLARGED AROUND V_{DS} = 0

FIGURE 1

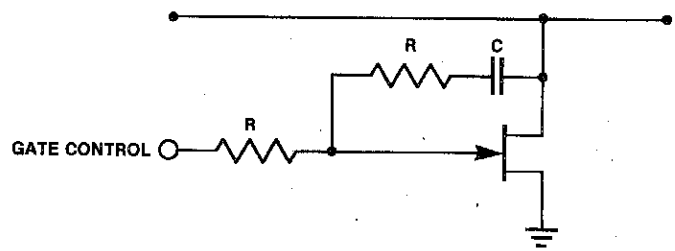


FIGURE 2