The RF Sub-Micron MOSFET Line
RF Power Field Effect Transistors
N-Channel Enhancement-Mode Lateral MOSFETs

MRF5S19130R3
MRF5S19130SR3

Designed for PCN and PCS base station applications at frequencies from 1.9 to 2.0 GHz. Suitable for TDMA, CDMA and multicarrier amplifier applications.

- Typical 2-Carrier N-CDMA Performance for V_{DD} = 28 Volts, I_{DQ} = 1200 mA, f1 = 1958.75 MHz, f2 = 1961.25 MHz IS-95 CDMA (Pilot, Sync, Paging, Traffic Codes 8 Through 13) 1.2288 MHz Channel Bandwidth Carrier. Adjacent Channels Measured over a 30 kHz Bandwidth at f1 -885 kHz and f2 +885 kHz. Distortion Products Measured over 1.2288 MHz Bandwidth at f1 -2.5 MHz and f2 +2.5 MHz. Peak/Avg. = 9.8 dB @ 0.01% Probability on CCDF.
    Output Power — 26 Watts Avg.
    Power Gain — 13 dB
    Efficiency — 25%
    IM3 — -37 dBc
    ACPR — -51 dB
- Internally Matched, Controlled Q, for Ease of Use
- High Gain, High Efficiency and High Linearity
- Integrated ESD Protection
- Designed for Maximum Gain and Insertion Phase Flatness
- Capable of Handling 10:1 VSWR, @ 28 Vdc, f1 = 1960 MHz, 110 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Qualified Up to a Maximum of 32 V Operation
- Available in Tape and Reel. R3 Suffix = 250 Units per 56 mm, 13 inch Reel.

**1990 MHz, 26 W AVG.,
2 x N-CDMA, 28 V
LATERAL N-CHANNEL
RF POWER MOSFETs**
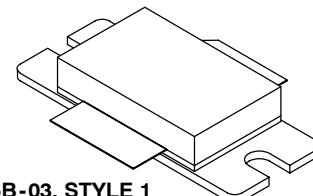
**CASE 465B-03, STYLE 1
NI-880
MRF5S19130R3**
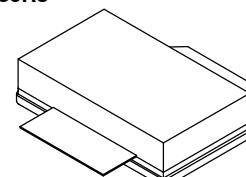
**CASE 465C-02, STYLE 1
NI-880S
MRF5S19130SR3**

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	-0.5, +15	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	324 1.85	Watts W/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C
Operating Junction Temperature	T_J	200	°C
CW Operation	CW	110	Watts

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case Case Temperature 80°C, 110 W CW Case Temperature 80°C, 26 W CW	$R_{\theta JC}$	0.54 0.60	°C/W

NOTE - **CAUTION** - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

REV 1

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ESD PROTECTION CHARACTERISTICS

Test Conditions	Class
Human Body Model	2 (Minimum)
Machine Model	M4 (Minimum)
Charge Device Model	C7 (Minimum)

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Zero Gate Voltage Drain Leakage Current (V_{DS} = 65 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	10	µAdc
Zero Gate Voltage Drain Leakage Current (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc)	I_{DSS}	—	—	1	µAdc
Gate-Source Leakage Current (V_{GS} = 5 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1	µAdc
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 200 µAdc)	$V_{GS(th)}$	2.5	2.8	3.5	Vdc
Gate Quiescent Voltage (V_{DS} = 28 Vdc, I_D = 1200 mAdc)	$V_{GS(Q)}$	—	3.8	—	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 3 Adc)	$V_{DS(on)}$	—	0.26	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 3 Adc)	g_{fs}	—	7.5	—	S
DYNAMIC CHARACTERISTICS					
Reverse Transfer Capacitance (1) (V_{DS} = 28 Vdc ± 30 mV(rms)ac @ 1 MHz, V_{GS} = 0 Vdc)	C_{rss}	—	2.7	—	pF

FUNCTIONAL TESTS (In Motorola Test Fixture, 50 ohm system) 2-Carrier N-CDMA, 1.2288 MHz Channel Bandwidth Carriers. Peak/Avg = 9.8 dB @ 0.01% Probability on CCDF.

Characteristic	Symbol	Min	Typ	Max	Unit
Common-Source Amplifier Power Gain (V_{DD} = 28 Vdc, P_{out} = 26 W Avg, I_{DQ} = 1200 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz)	G_{ps}	12	13	—	dB
Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 26 W Avg, I_{DQ} = 1200 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz)	η	23	25	—	%
Third Order Intermodulation Distortion (V_{DD} = 28 Vdc, P_{out} = 26 W Avg, I_{DQ} = 1200 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz; IM3 measured over 1.2288 MHz Bandwidth at f1 -2.5 MHz and f2 +2.5 MHz referenced to carrier channel power.)	IM3	—	-37	-35	dBc
Adjacent Channel Power Ratio (V_{DD} = 28 Vdc, P_{out} = 26 W Avg, I_{DQ} = 1200 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz; ACPR measured over 30 kHz Bandwidth at f1 -885 kHz and f2 +885 kHz)	ACPR	—	-51	-48	dBc
Input Return Loss (V_{DD} = 28 Vdc, P_{out} = 26 W Avg, I_{DQ} = 1200 mA, f1 = 1930 MHz, f2 = 1932.5 MHz and f1 = 1987.5 MHz, f2 = 1990 MHz)	IRL	—	-15	-9	dB

(1) Part is internally matched both on input and output.

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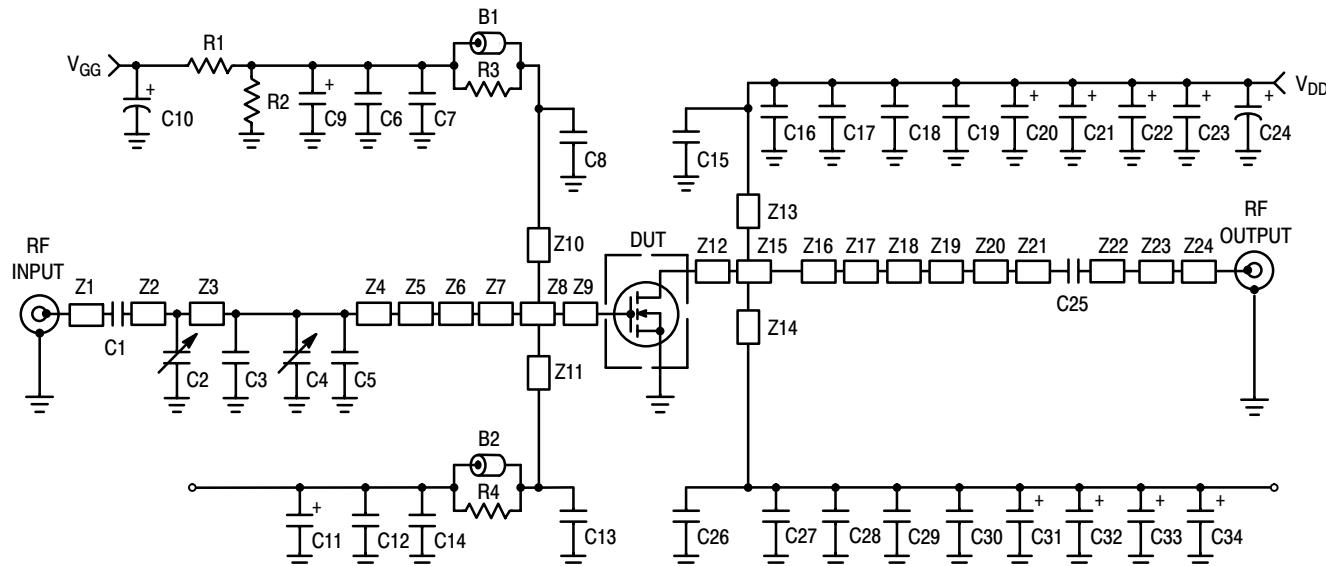
Z1	0.200″ x 0.085″ Microstrip	Z13, Z14	1.125″ x 0.068″ Microstrip
Z2	0.170″ x 0.085″ Microstrip	Z15	0.071″ x 1.080″ Microstrip
Z3	0.480″ x 0.085″ Microstrip	Z16	0.060″ x 1.080″ Microstrip
Z4	0.926″ x 0.085″ Microstrip	Z17	0.290″ x 1.080″ Microstrip
Z5	0.590″ x 0.085″ Microstrip	Z18	1.075″ x 0.825″ x 0.125″ Taper
Z6	0.519″ x 0.955″ x 0.160″ Taper	Z19	0.635″ x 0.120″ Microstrip
Z7	0.022″ x 0.955″ Microstrip	Z20	0.185″ x 0.096″ Microstrip
Z8	0.046″ x 0.955″ Microstrip	Z21	0.414″ x 0.084″ Microstrip
Z9	0.080″ x 0.955″ Microstrip	Z22	0.040″ x 0.084″ Microstrip
Z10, Z11	1.280″ x 0.046″ Microstrip	Z23	0.199″ x 0.057″ Microstrip
Z12	0.053″ x 1.080″ Microstrip	PCB	Arlon GX0300-55-22, 0.03″, ε_r = 2.55

Figure 1. MRF5S19130R3(SR3) Test Circuit Schematic

Table 1. MRF5S19130R3(SR3) Test Circuit Component Designations and Values

Part	Description	Value, P/N or DWG	Manufacturer
B1, B2	Short RF Bead	95F786	Newark
C1	0.8 pF Chip Capacitor, B Case	100B0R8BP 500X	ATC
C2, C4	0.6 − 4.5 pF Gigatrim Variable Capacitors	44F3358	Newark
C3	2.2 pF Chip Capacitor, B Case	100B2R2BP 500X	ATC
C5	1.7 pF Chip Capacitor, B Case	100B1R7BP 500X	ATC
C8, C13	9.1 pF Chip Capacitors, B Case	100B9R1CP 500X	ATC
C9, C11	1 µF, 25 V Tantalum Capacitors	92F1845	Newark
C10	47 µF, 50 V Electrolytic Capacitor	51F2913	Newark
C6, C14, C17, C18, C19, C28, C29, C30	0.1 µF Chip Capacitors, B Case	CDR33BX104AKWS	Kemet
C7, C12, C16, C27	1000 pF Chip Capacitors, B Case	100B102JP 500X	ATC
C15, C26	8.2 pF Chip Capacitors, B Case	100B8R2CP 500X	ATC
C20, C21, C22, C23, C31, C32, C33, C34	22 µF, 35 V Tantalum Capacitors	92F1853	Newark
C24	470 µF, 63 V Electrolytic Capacitor	95F4579	Newark
C25	6.2 pF Chip Capacitor, B Case	100B6R2CP 500X	ATC
R1	1 kΩ Chip Resistor	D5534M07B1K00R	Newark
R2	560 kΩ Chip Resistor	CR1206 564JT	Newark
R3, R4	12 Ω Chip Resistors	RM73B2B120JT	Garrett Electtonics
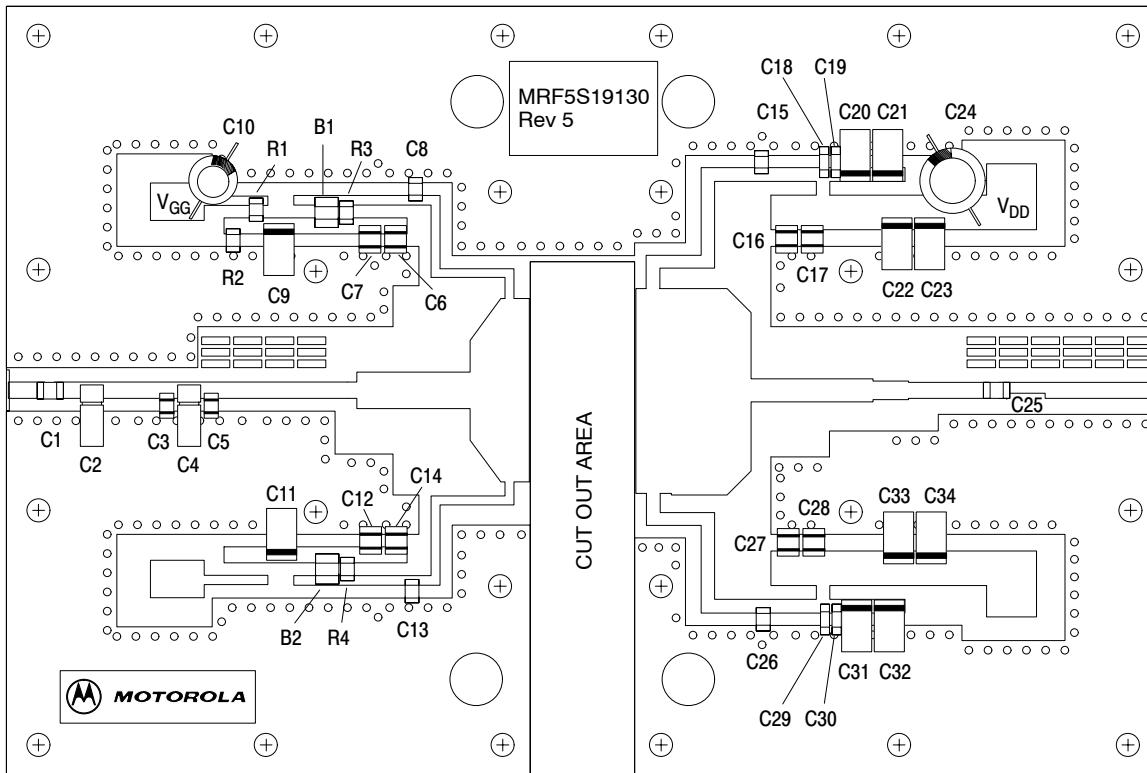
Figure 2. MRF5S19130R3(SR3) Test Circuit Component Layout

TYPICAL CHARACTERISTICS

V_{DD} = 28 Vdc, P_{out} = 26 W (Avg.), I_{DQ} = 1200 mA
2-Carrier N-CDMA, 2.5 MHz Carrier Spacing
1.2288 MHz Channel Bandwidth
Peak/Avg. = 9.8 dB @ 0.01% Probability (CCDF)
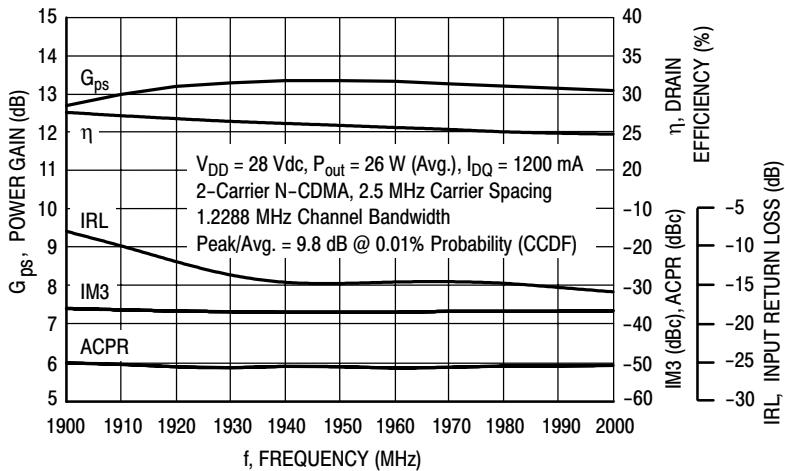
Figure 3. 2-Carrier N-CDMA Broadband Performance

V_{DD} = 28 Vdc, f1 = 1958.75 MHz, f2 = 1961.25 MHz
Two-Tone Measurement, 2.5 MHz Tone Spacing
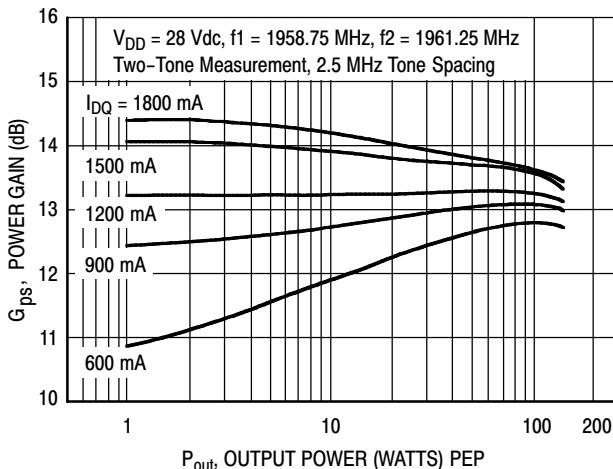
Figure 4. Two-Tone Power Gain versus Output Power

V_{DD} = 28 Vdc, f1 = 1958.75 MHz, f2 = 1961.25 MHz
Two-Tone Measurement, 2.5 MHz Tone Spacing
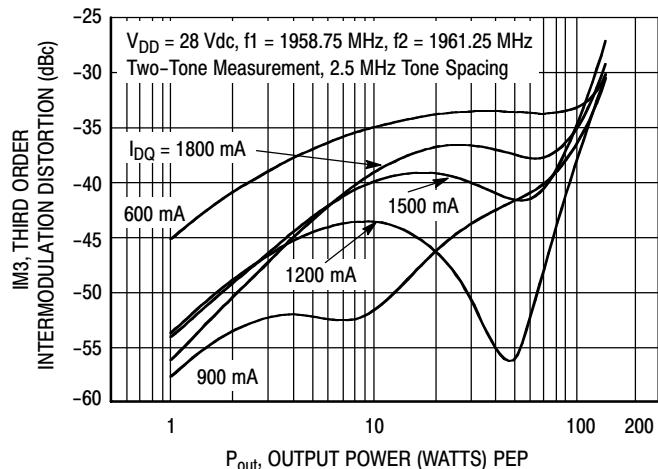
Figure 5. Third Order Intermodulation Distortion versus Output Power

V_{DD} = 28 Vdc, P_{out} = 130 W (PEP), I_{DQ} = 1200 mA
Two-Tone Measurements, Center Frequency = 1960 MHz
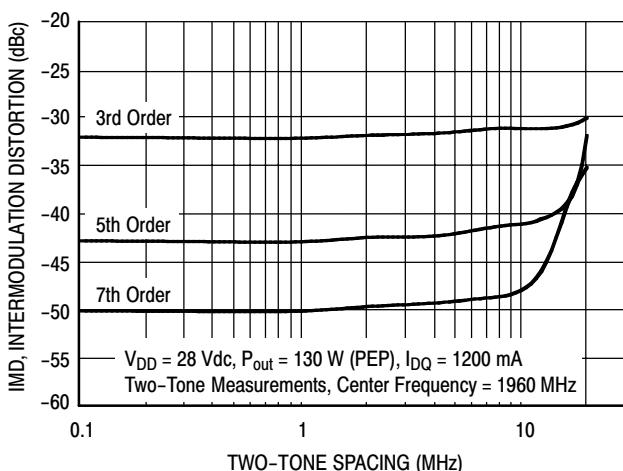
Figure 6. Intermodulation Distortion Products versus Tone Spacing

P3dB = 53.11 dBm (205.57 W)

P1dB = 52.54 dBm (179.61 W)

V_{DD} = 28 Vdc, I_{DQ} = 1200 mA
Pulsed CW, 8 μsec (on), 1 msec (off)
Center Frequency = 1960 MHz
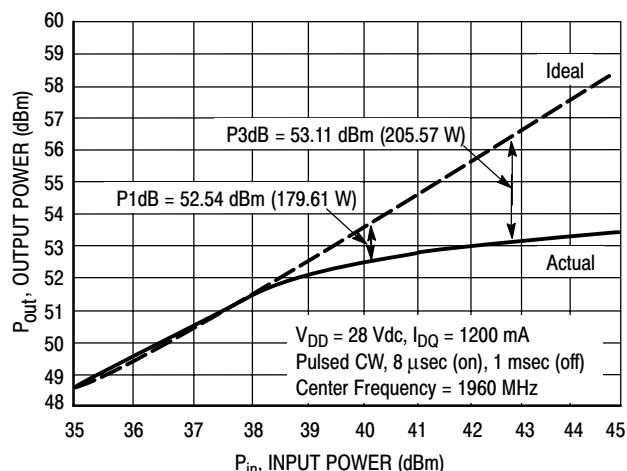
Figure 7. Pulse CW Output Power versus Input Power


TYPICAL CHARACTERISTICS
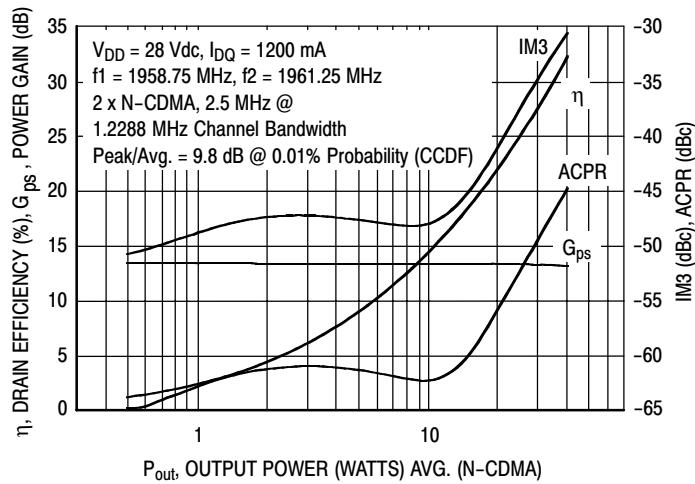
Figure 8. 2-Carrier N-CDMA ACPR, IM3,
Power Gain and Drain Efficiency
versus Output Power
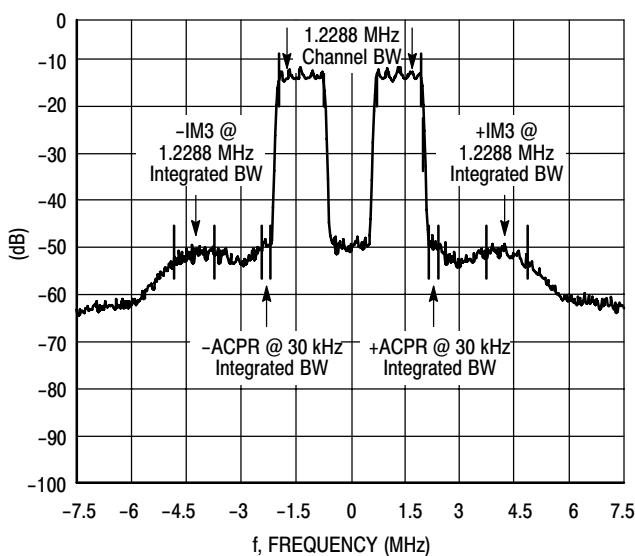
Figure 9. 2-Carrier N-CDMA Spectrum
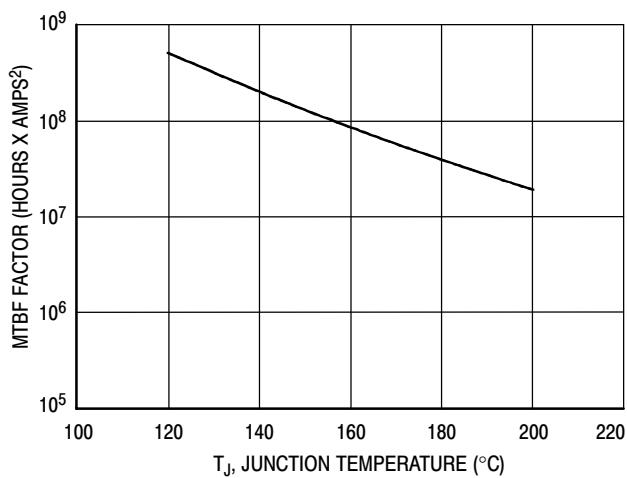
This above graph displays calculated MTBF in hours x ampere[2] drain current. Life tests at elevated temperatures have correlated to better than ±10% of the theoretical prediction for metal failure. Divide MTBF factor by I_D^2 for MTBF in a particular application.

Figure 10. MTBF Factor versus Junction
Temperature

MRF5S19130R3 MRF5S19130SR3

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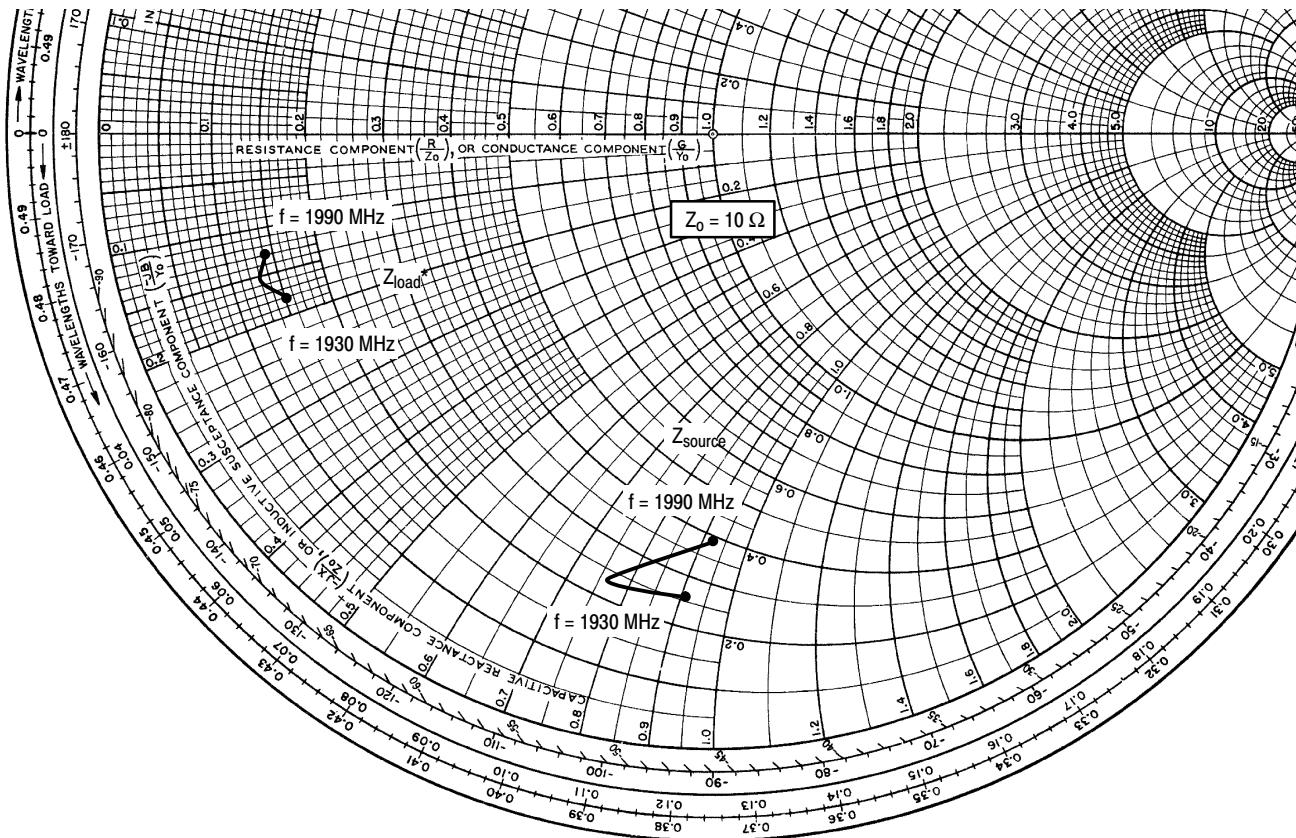
V_{DD} = 28 V, I_{DQ} = 1.2 A, P_{out} = 26 W (2-Carrier N-CDMA)

f MHz	Z_{source} Ω	Z_{load} Ω
1930	2.57 - j9.1	1.48 - j1.8
1960	2.35 - j7.6	1.28 - j1.5
1990	3.86 - j9.2	1.42 - j1.3

Z_{source} = Test circuit impedance as measured from gate to ground.

Z_{load} = Test circuit impedance as measured from drain to ground.
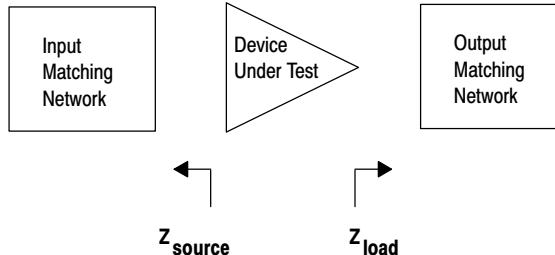
**Figure 11. Series Equivalent Source and Load Impedance**

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NOTES

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NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.
4. DELETED

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	1.335	1.345	33.91	34.16
B	0.535	0.545	13.6	13.8
C	0.147	0.200	3.73	5.08
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
G	1.100 BSC		27.94 BSC	
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.872	0.888	22.15	22.55
N	0.871	0.889	19.30	22.60
Q	∅.118	∅.138	∅3.00	∅3.51
R	0.515	0.525	13.10	13.30
S	0.515	0.525	13.10	13.30
aaa	0.007 REF		0.178 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

CASE 465B-03
ISSUE B
NI-880
MRF5S19130R3

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M–1994.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES MIN	INCHES MAX	MILLIMETERS MIN	MILLIMETERS MAX
A	0.905	0.915	22.99	23.24
B	0.535	0.545	13.60	13.80
C	0.147	0.200	3.73	5.08
D	0.495	0.505	12.57	12.83
E	0.035	0.045	0.89	1.14
F	0.003	0.006	0.08	0.15
H	0.057	0.067	1.45	1.70
K	0.170	0.210	4.32	5.33
M	0.872	0.888	22.15	22.55
N	0.871	0.889	19.30	22.60
R	0.515	0.525	13.10	13.30
S	0.515	0.525	13.10	13.30
aaa	0.007 REF		0.178 REF	
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

CASE 465C-02
ISSUE A
NI-880S
MRF5S19130SR3

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