TOSHIBA Field Effect Transistor   Silicon P Channel MOS Type ($L^2−π−MOSVI$)

TPC8302

Lithium Ion Battery Applications

Portable Equipment Applications

Notebook PCs

Unit: mm

- 2.5 V Gate drive
- Small footprint due to small and thin package
- Low drain−source ON resistance: $R_{DS (ON)}$ = 100 mΩ (typ.)
- High forward transfer admittance: $|Y_{fs}|$ = 5 S (typ.)
- Low leakage current: I_{DSS} = −10 μA (max) (V_{DS} = −20 V)
- Enhancement−mode: V_{th} = −0.5~ −1.1 V (V_{DS} = −10 V, I_D = −200 μA)

Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit
Drain−source voltage		V_{DSS}	−20	V
Drain−gate voltage (R_{GS} = 20 kΩ)		V_{DGR}	−20	V
Gate−source voltage		V_{GSS}	±12	V
Drain current	D C (Note 1)	I_D	−3.5	A
	Pulse (Note 1)	I_{DP}	−14	
Drain power dissipation (t = 10s) (Note 2a)	Single-device operation (Note 3a)	$P_{D (1)}$	1.5	W
	Single-devece value at dual operation (Note 3b)	$P_{D (2)}$	1.0	
Drain power dissipation (t = 10s) (Note 2b)	Single-device operation (Note 3a)	$P_{D (1)}$	0.75	W
	Single-devece value at dual operation (Note 3b)	$P_{D 2)}$	0.45	
Single pulse avalanche energy (Note 4)		E_{AS}	16	mJ
Avalanche current		I_{AR}	−3.5	A
Repetitive avalanche energy (Note 2a, Note 3b, Note 5)		E_{AR}	0.1	mJ
Channel temperature		T_{ch}	150	
Storage temperature range		T_{stg}	−55 150	

Note: For (Note 1), (Note 2a), (Note 2b), (Note 3a), (Note 3b), (Note 4) and (Note 5), please refer to the next page.
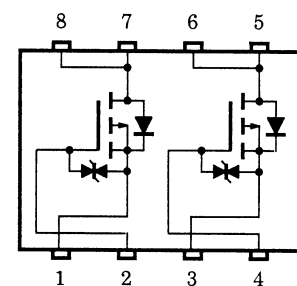
This transistor is an electrostatic sensitive device. Please handle with caution.

JEDEC	—
JEITA	—
TOSHIBA	2-6J1E

Weight: 0.080 g (typ.)

1   SOURCE   4   GATE
2   GATE   5, 6 DRAIN
3   SOURCE   7, 8 DRAIN
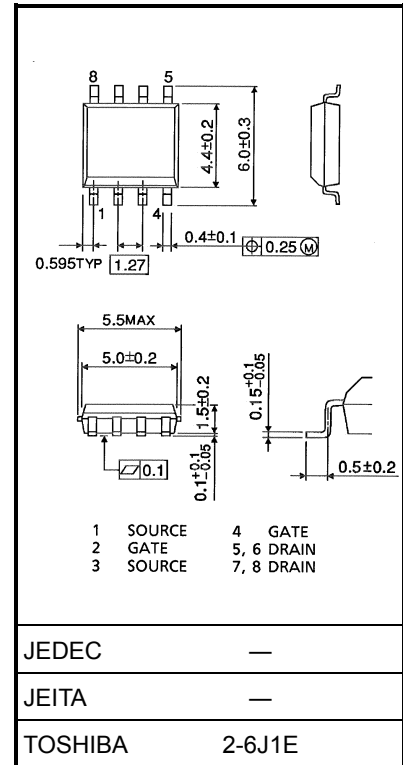
Circuit Configuration

Thermal Characteristics

| Characteristics		Symbol	Max	Unit
Thermal resistance, channel to ambient (t = 10s) (Note 2a)	Single-device operation (Note 3a)	$R_{th\ (ch-a)\ (1)}$	83.3	
	Single-device value at dual operation (Note 3b)	$R_{th\ (ch-a)\ (2)}$	125	°C/W
Thermal resistance, channel to ambient (t = 10s) (Note 2b)	Single-device operation (Note 2a)	$R_{th\ (ch-a)\ (1)}$	167	
	Single-device value at dual operation (Note 2b)	$R_{th\ (ch-a)\ (2)}$	278	

Marking

TPC8302 ◄—— Type

*
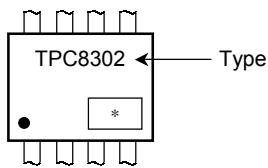
Note 1: Please use devices on condition that the channel temperature is below 150°C.

Note 2:

a) Device mounted on a glass-epoxy board (a)   b) Device mounted on a glass-epoxy board (b)

FR-4
$25.4 \times 25.4 \times 0.8$
(unit: mm)

(a)

FR-4
$25.4 \times 25.4 \times 0.8$
(unit: mm)

(b)
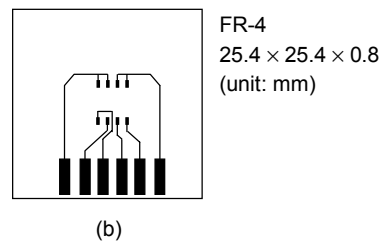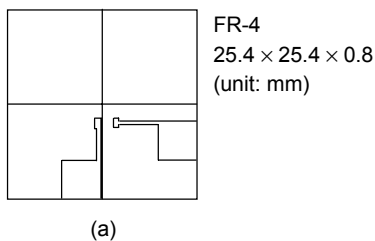
Note 3:

a) The power dissipation and thermal resistance values are shown for a single device (During single-device operation, power is only applied to one device.)

b) The power dissipation and thermal resistance values are shown for a single device (During dual operation, power is evenly applied to both devices.)

Note 4:

V_{DD} = −16 V, T_{ch} = 25°C (Initial), L = 1.0 mH, R_G = 25 Ω, I_{AR} = −3.5 A

Note 5: Repetitive rating: pulse width limited by maximum channel temperature

Note 6: • on lower left of the marking indicates Pin 1.
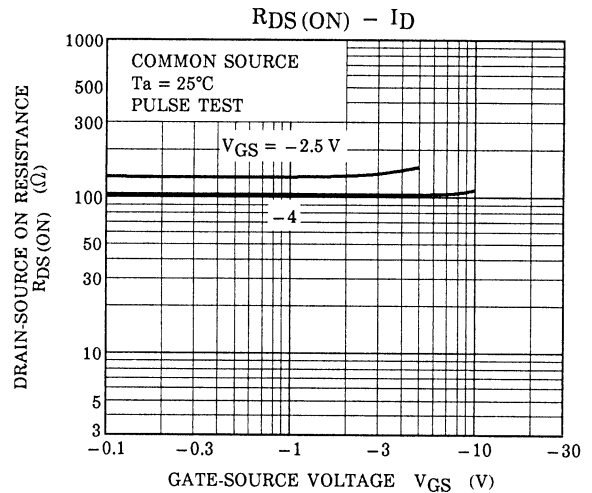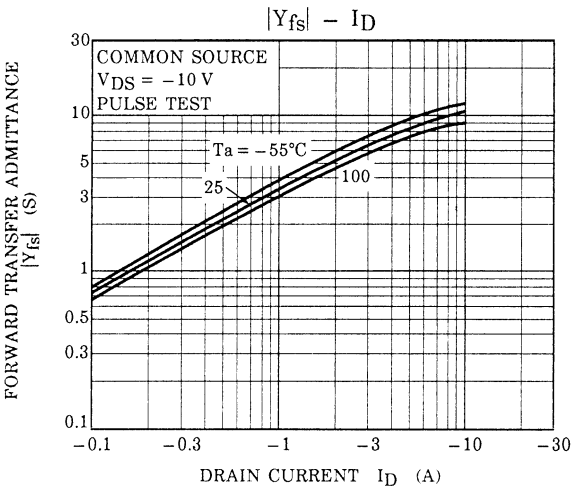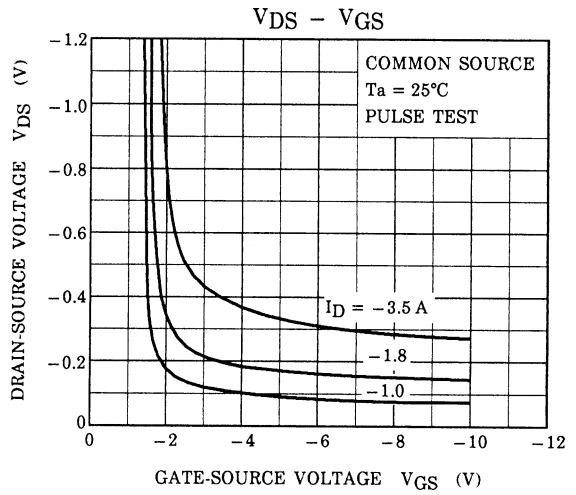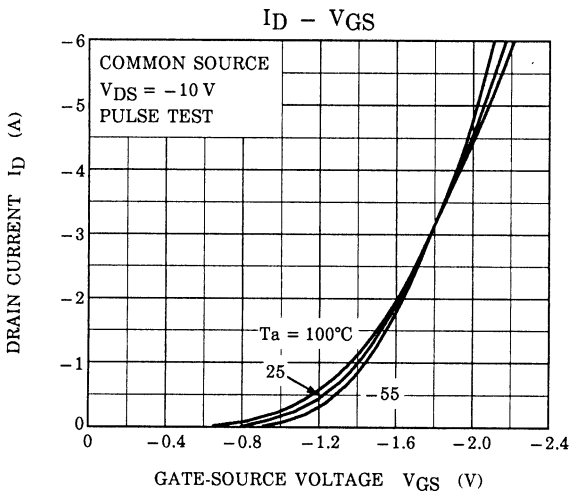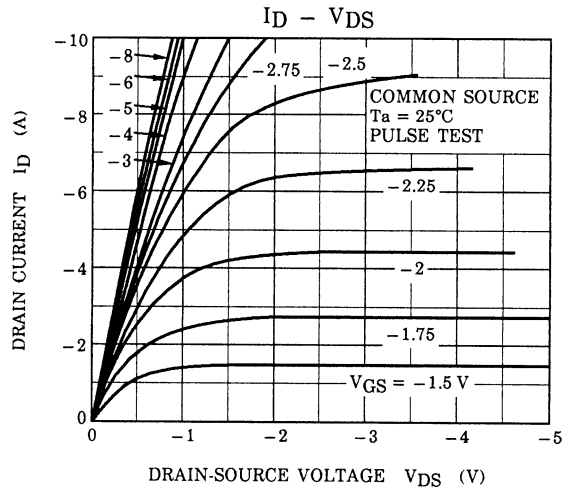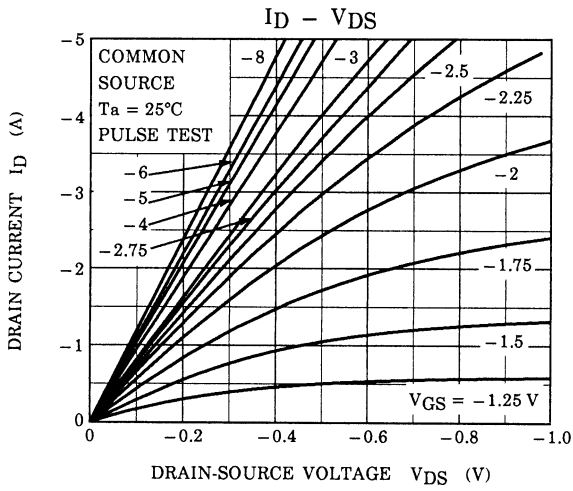* shows lot number. (year of manufacture: last decimal digit of the year of manufacture, month of manufacture: January to December are denoted by letters A to L respectively.)
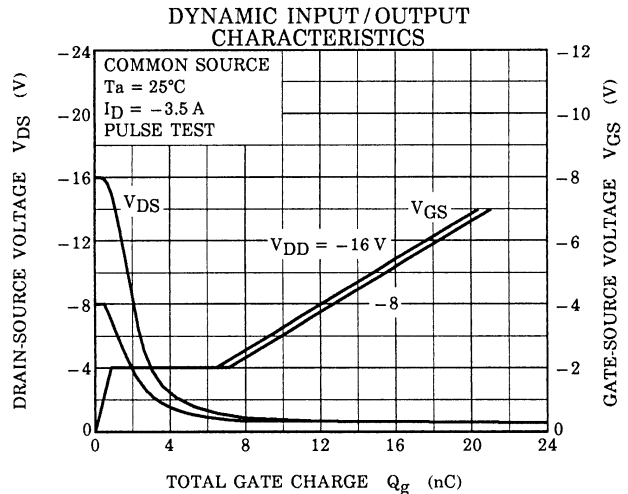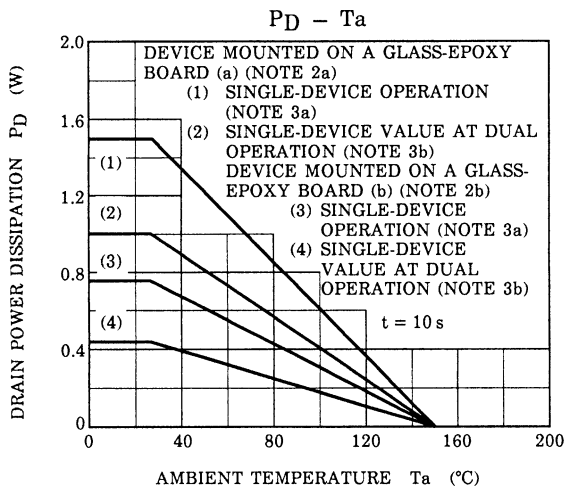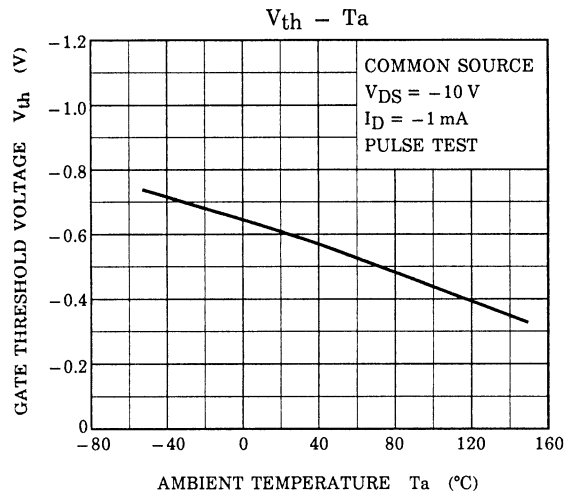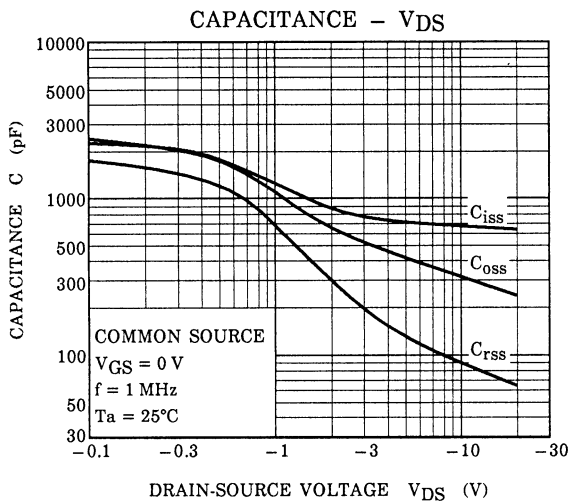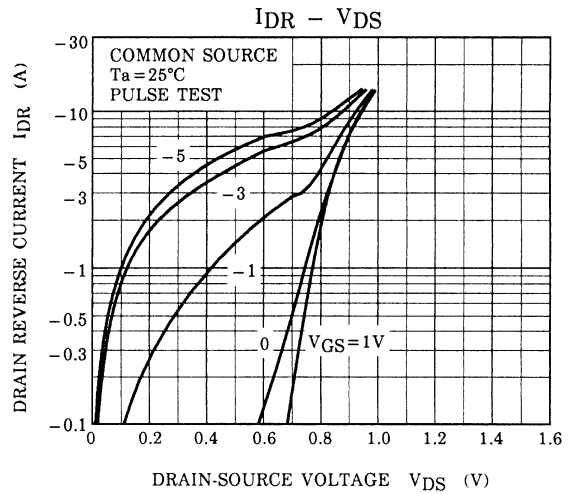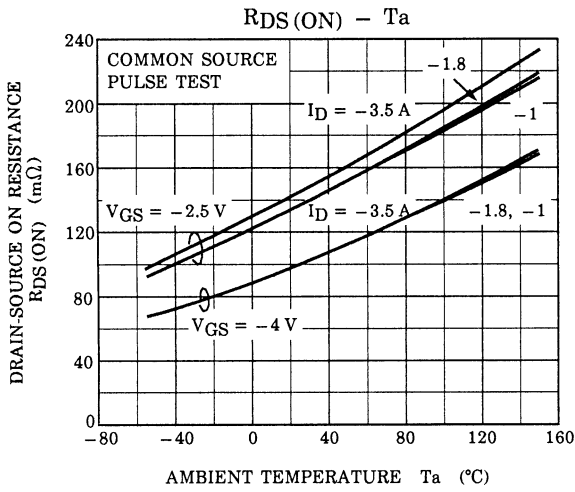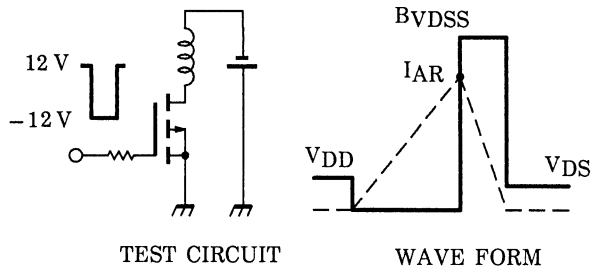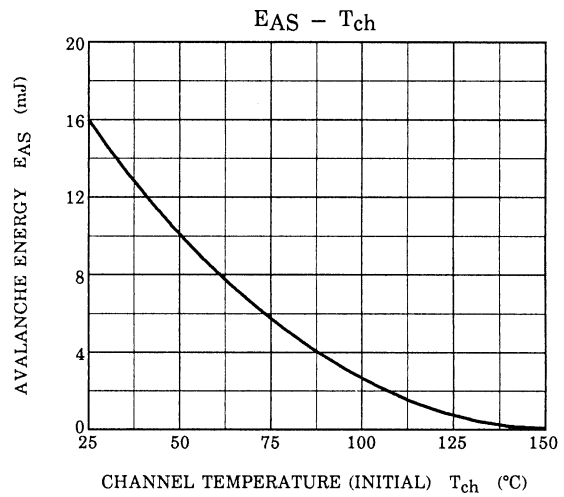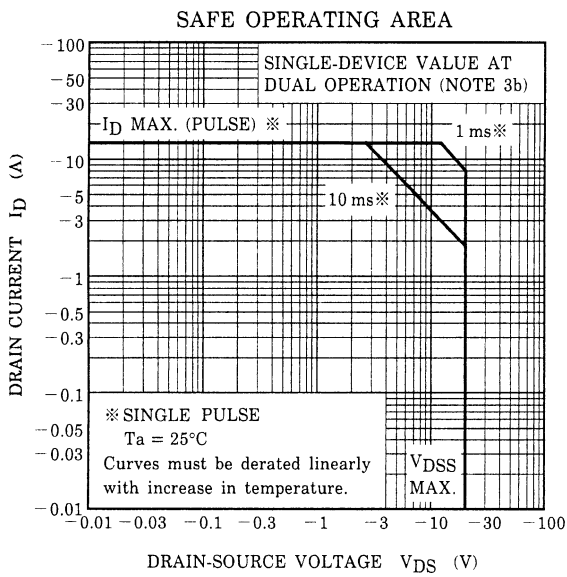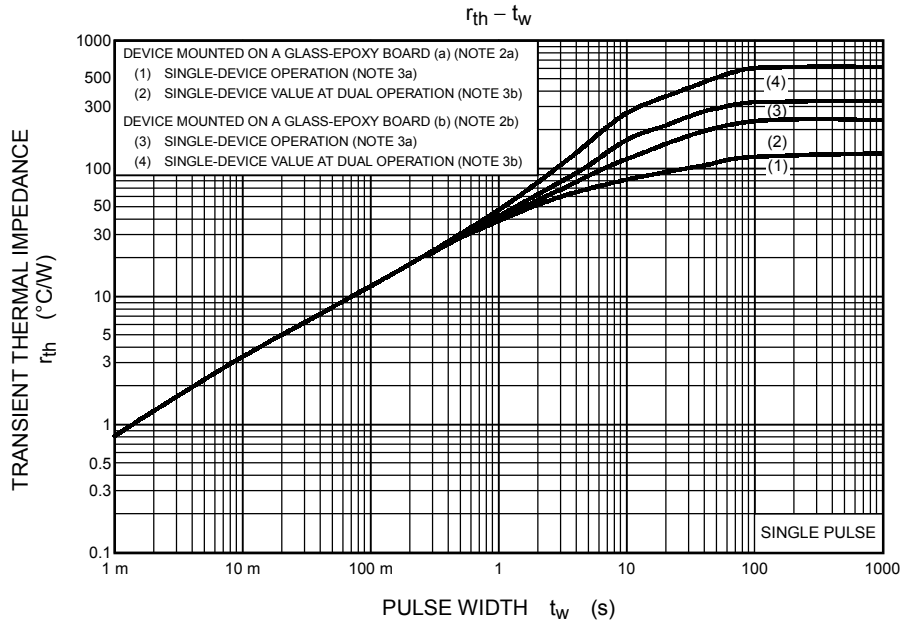
Electrical Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Gate leakage current		I_{GSS}	$V_{GS} = \pm10$ V, $V_{DS} = 0$ V	—	—	±10	μA
Drain cut−OFF current		I_{DSS}	$V_{DS} = -20$ V, $V_{GS} = 0$ V	—	—	−10	μA
Drain−source breakdown voltage		$V_{(BR)DSS}$	$I_D = -10$ mA, $V_{GS} = 0$ V	−20	—	—	V
Gate threshold voltage		V_{th}	$V_{DS} = -10$ V, $I_D = -200$ μA	−0.5	—	−1.1	V
Drain−source ON resistance	$R_{DS (ON)}$		$V_{GS} = -2.5$ V, $I_D = -1.8$ A	—	135	170	mΩ
	$R_{DS (ON)}$		$V_{GS} = -4$ V, $I_D = -1.8$ A	—	100	120	
Forward transfer admittance		$|Y_{fs}|$	$V_{DS} = -10$ V, $I_D = -1.8$ A	2.5	5	—	S
Input capacitance		C_{iss}	$V_{DS} = -10$ V, $V_{GS} = 0$ V, f = 1 MHz	—	680	—	pF
Reverse transfer capacitance		C_{rss}		—	90	—	
Output capacitance		C_{oss}		—	310	—	
Switching time	Rise time	t_r		—	17	—	ns
	Turn−ON time	t_{on}		—	24	—	
	Fall time	t_f		—	20	—	
	Turn−OFF time	t_{off}		—	63	—	
Total gate charge (Gate−source plus gate−drain)		Q_g	$V_{DD} \approx -16$ V, $V_{GS} = -5$ V, $I_D = -3.5$ A	—	16	—	nC
Gate−source charge		Q_{gs}		—	10	—	
Gate−drain ("miller") charge		Q_{gd}		—	6	—	

Switching time test circuit:

V_{GS} 0 V, -5 V ; $I_D = -1.8$ A ; V_{OUT} ; $4.7\,\Omega$; $R_L = 5.6\,\Omega$; $V_{DD} \doteq -10$ V ; Duty $\leqq$ 1%, $t_W = 10\,\mu s$

Source−Drain Ratings and Characteristics (Ta = 25°C)

Characteristics		Symbol	Test Condition	Min	Typ.	Max	Unit
Drain reverse current	Pulse (Note 1)	I_{DRP}	—	—	—	−14	A
Forward voltage (diode)		V_{DSF}	$I_{DR} = -3.5$ A, $V_{GS} = 0$ V	—	—	1.2	V

$I_D - V_{DS}$

COMMON SOURCE
Ta = 25°C
PULSE TEST

DRAIN CURRENT I_D (A)

DRAIN-SOURCE VOLTAGE V_{DS} (V)

$V_{GS} = -1.25\,V$

$I_D - V_{DS}$

COMMON SOURCE
Ta = 25°C
PULSE TEST

DRAIN CURRENT I_D (A)

DRAIN-SOURCE VOLTAGE V_{DS} (V)

$V_{GS} = -1.5\,V$

$I_D - V_{GS}$

COMMON SOURCE
$V_{DS} = -10\,V$
PULSE TEST

DRAIN CURRENT I_D (A)

GATE-SOURCE VOLTAGE V_{GS} (V)

Ta = 100°C
25
-55

$V_{DS} - V_{GS}$

COMMON SOURCE
Ta = 25°C
PULSE TEST

DRAIN-SOURCE VOLTAGE V_{DS} (V)

GATE-SOURCE VOLTAGE V_{GS} (V)

$I_D = -3.5\,A$
-1.8
-1.0

$|Y_{fs}| - I_D$

COMMON SOURCE
$V_{DS} = -10\,V$
PULSE TEST

FORWARD TRANSFER ADMITTANCE $|Y_{fs}|$ (S)

DRAIN CURRENT I_D (A)

Ta = -55°C
25
100

$R_{DS(ON)} - I_D$

COMMON SOURCE
Ta = 25°C
PULSE TEST

DRAIN-SOURCE ON RESISTANCE $R_{DS(ON)}$ (Ω)

GATE-SOURCE VOLTAGE V_{GS} (V)

$V_{GS} = -2.5\,V$
-4

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$R_{DS(ON)}$ − Ta

DRAIN-SOURCE ON RESISTANCE $R_{DS(ON)}$ (mΩ)

AMBIENT TEMPERATURE Ta (°C)

COMMON SOURCE
PULSE TEST

$I_D = -3.5$ A

−1.8

−1

$V_{GS} = -2.5$ V $I_D = -3.5$ A   −1.8, −1

$V_{GS} = -4$ V

I_{DR} − V_{DS}

DRAIN REVERSE CURRENT I_{DR} (A)

DRAIN-SOURCE VOLTAGE V_{DS} (V)

COMMON SOURCE
Ta = 25°C
PULSE TEST

−5

−3

−1

0   $V_{GS} = 1$ V

CAPACITANCE − V_{DS}

CAPACITANCE C (pF)

DRAIN-SOURCE VOLTAGE V_{DS} (V)

C_{iss}

C_{oss}

C_{rss}

COMMON SOURCE
$V_{GS} = 0$ V
f = 1 MHz
Ta = 25°C

V_{th} − Ta

GATE THRESHOLD VOLTAGE V_{th} (V)

AMBIENT TEMPERATURE Ta (°C)

COMMON SOURCE
$V_{DS} = -10$ V
$I_D = -1$ mA
PULSE TEST

P_D − Ta

DRAIN POWER DISSIPATION P_D (W)

AMBIENT TEMPERATURE Ta (°C)

DEVICE MOUNTED ON A GLASS-EPOXY
BOARD (a) (NOTE 2a)
(1)   SINGLE-DEVICE OPERATION
      (NOTE 3a)
(2)   SINGLE-DEVICE VALUE AT DUAL
      OPERATION (NOTE 3b)
      DEVICE MOUNTED ON A GLASS-
      EPOXY BOARD (b) (NOTE 2b)
(3)   SINGLE-DEVICE
      OPERATION (NOTE 3a)
(4)   SINGLE-DEVICE
      VALUE AT DUAL
      OPERATION (NOTE 3b)
      t = 10 s

(1)
(2)
(3)
(4)

DYNAMIC INPUT / OUTPUT CHARACTERISTICS

DRAIN-SOURCE VOLTAGE V_{DS} (V)

GATE-SOURCE VOLTAGE V_{GS} (V)

TOTAL GATE CHARGE Q_g (nC)

COMMON SOURCE
Ta = 25°C
$I_D = -3.5$ A
PULSE TEST

V_{DS}

V_{GS}

$V_{DD} = -16$ V

−8

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$r_{th} - t_w$

DEVICE MOUNTED ON A GLASS-EPOXY BOARD (a) (NOTE 2a)
(1) SINGLE-DEVICE OPERATION (NOTE 3a)
(2) SINGLE-DEVICE VALUE AT DUAL OPERATION (NOTE 3b)
DEVICE MOUNTED ON A GLASS-EPOXY BOARD (b) (NOTE 2b)
(3) SINGLE-DEVICE OPERATION (NOTE 3a)
(4) SINGLE-DEVICE VALUE AT DUAL OPERATION (NOTE 3b)

TRANSIENT THERMAL IMPEDANCE r_{th} (°C/W)

SINGLE PULSE

PULSE WIDTH t_w (s)

SAFE OPERATING AREA

SINGLE-DEVICE VALUE AT DUAL OPERATION (NOTE 3b)

I_D MAX. (PULSE) ※   1 ms ※

10 ms ※

DRAIN CURRENT I_D (A)

※ SINGLE PULSE
Ta = 25°C
Curves must be derated linearly
with increase in temperature.

V_{DSS} MAX.

DRAIN-SOURCE VOLTAGE V_{DS} (V)

$E_{AS} - T_{ch}$

AVALANCHE ENERGY E_{AS} (mJ)

CHANNEL TEMPERATURE (INITIAL) T_{ch} (°C)

12 V
−12 V

TEST CIRCUIT

B_{VDSS}
I_{AR}
V_{DD} V_{DS}

WAVE FORM

T_{ch} = 25°C (Initial)
Peak I_{AR} = −3.5 A, R_G = 25 Ω
V_{DD} = −16 V, L = 1.0 mH

$$E_{AS} = \frac{1}{2} \cdot L \cdot I^2 \cdot \left(\frac{B_{VDSS}}{B_{VDSS} - V_{DD}} \right)$$

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RESTRICTIONS ON PRODUCT USE

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