To our customers,

Old Company Name in Catalogs and Other Documents

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April 1st, 2010
Renesas Electronics Corporation

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RENESAS

MOS FIELD EFFECT TRANSISTOR
2SK3813

SWITCHING
N-CHANNEL POWER MOS FET

DESCRIPTION

The 2SK3813 is N-channel MOS Field Effect Transistor designed for high current switching applications.

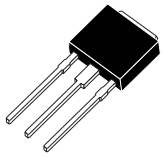
ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3813	TO-251 (MP-3)
2SK3813-Z	TO-252 (MP-3Z)

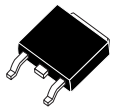
FEATURES

- Super low on-state resistance
  $R_{DS(on)1}$ = 5.3 mΩ MAX. (V_{GS} = 10 V, I_D = 30 A)
  $R_{DS(on)2}$ = 7.1 mΩ MAX. (V_{GS} = 4.5 V, I_D = 30 A)
- Low C_{iss}: C_{iss} = 5500 pF TYP.

(TO-251)



(TO-252)



ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	40	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	±20	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	±60	A
Drain Current (pulse) Note1	$I_{D(pulse)}$	±240	A
Total Power Dissipation (T_C = 25°C)	P_{T1}	84	W
Total Power Dissipation (T_A = 25°C)	P_{T2}	1.0	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature	T_{stg}	−55 to +150	°C
Single Avalanche Energy Note2	E_{AS}	137	mJ
Repetitive Avalanche Current Note3	I_{AR}	37	A
Repetitive Avalanche Energy Note3	E_{AR}	137	mJ

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. Starting T_{ch} = 25°C, V_{DD} = 20 V, R_G = 25 Ω, V_{GS} = 20 → 0 V, L = 100 μH

3. $T_{ch(peak)}$ ≤ 150°C, R_G = 25 Ω

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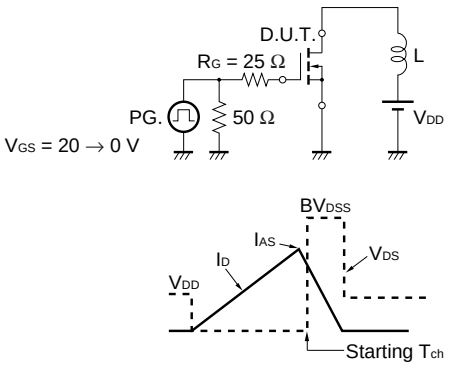
The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

ELECTRICAL CHARACTERISTICS (T_A = 25°C)

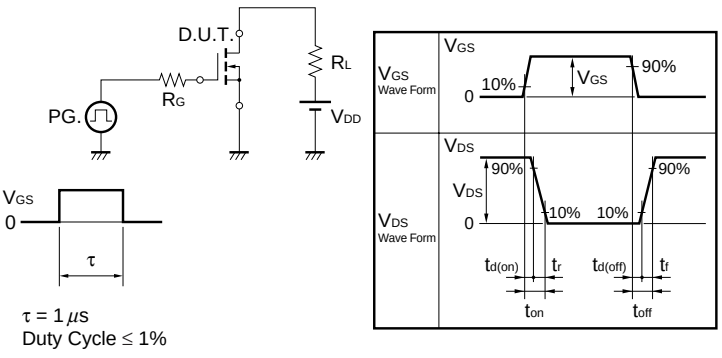
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V			10	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ±20 V, V_{DS} = 0 V			±100	nA
Gate Cut-off Voltage	$V_{GS(off)}$	V_{DS} = 10 V, I_D = 1 mA	1.5	2.0	2.5	V
Forward Transfer Admittance **Note**	$\|y_{fs}\|$	V_{DS} = 10 V, I_D = 30 A	21	42		S
Drain to Source On-state Resistance **Note**	$R_{DS(on)1}$	V_{GS} = 10 V, I_D = 30 A		4.2	5.3	mΩ
	$R_{DS(on)2}$	V_{GS} = 4.5 V, I_D = 30 A		5.3	7.1	mΩ
Input Capacitance	C_{iss}	V_{DS} = 10 V		5500		pF
Output Capacitance	C_{oss}	V_{GS} = 0 V		740		pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		490		pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = 20 V, I_D = 30 A		25		ns
Rise Time	t_r	V_{GS} = 10 V		8.5		ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 0 Ω		81		ns
Fall Time	t_f			10		ns
Total Gate Charge	Q_G	V_{DD} = 32 V		96		nC
Gate to Source Charge	Q_{GS}	V_{GS} = 10 V		18		nC
Gate to Drain Charge	Q_{GD}	I_D = 60 A		23.5		nC
Body Diode Forward Voltage **Note**	$V_{F(S-D)}$	I_F = 60 A, V_{GS} = 0 V		0.94	1.5	V
Reverse Recovery Time	t_{rr}	I_F = 60 A, V_{GS} = 0 V		35		ns
Reverse Recovery Charge	Q_{rr}	di/dt = 100 A/μs		31		nC

Note Pulsed

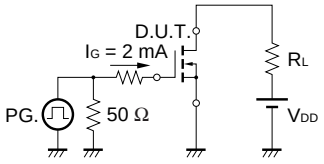
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

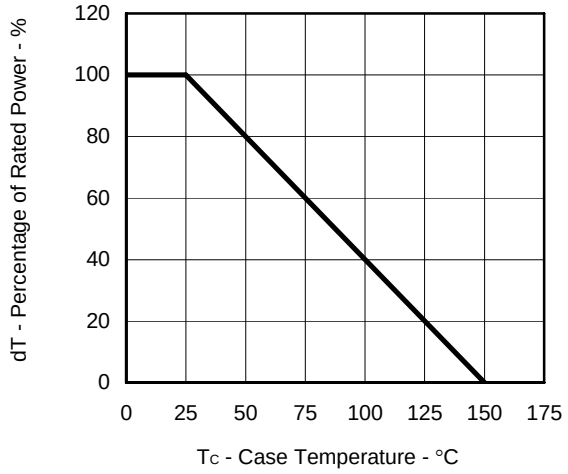


TEST CIRCUIT 3 GATE CHARGE

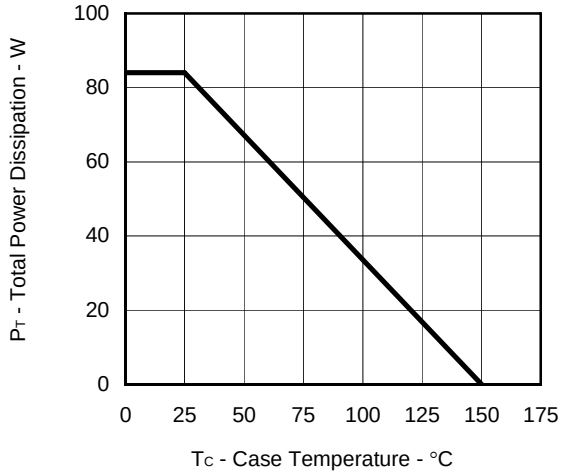


TYPICAL CHARACTERISTICS (T_A = 25°C)

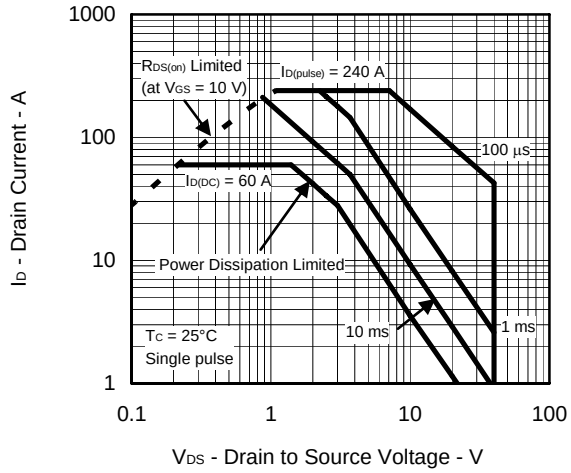
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



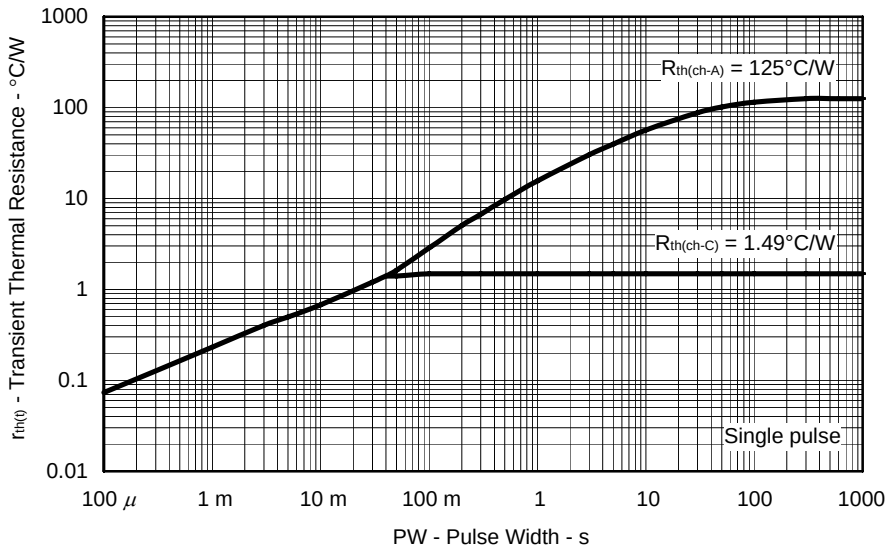
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



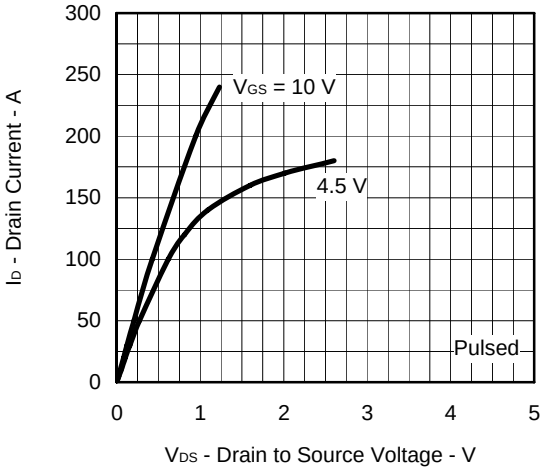
FORWARD BIAS SAFE OPERATING AREA



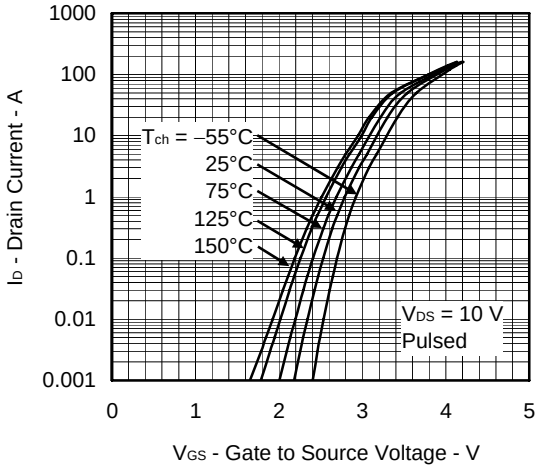
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



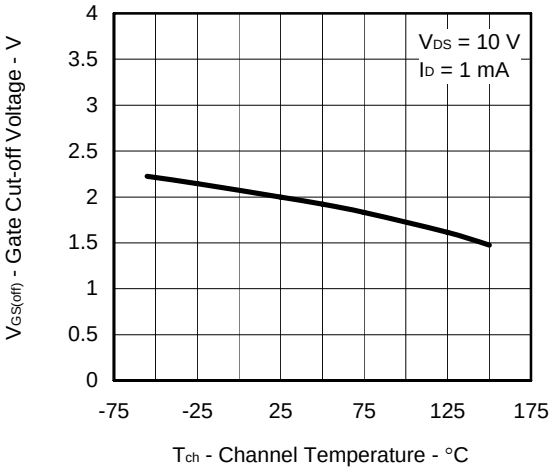
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



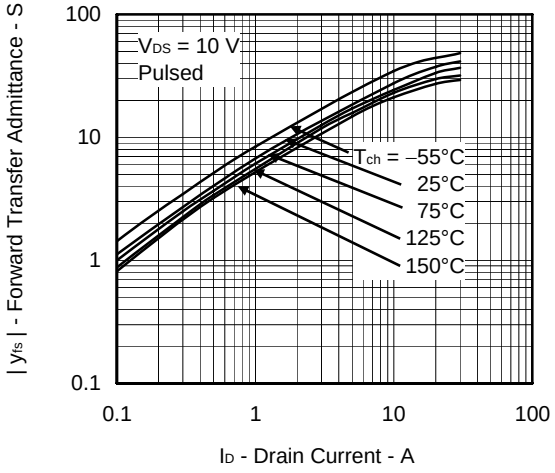
FORWARD TRANSFER CHARACTERISTICS



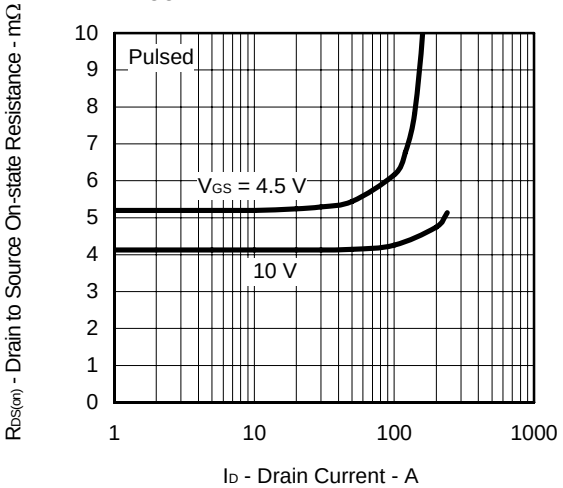
GATE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



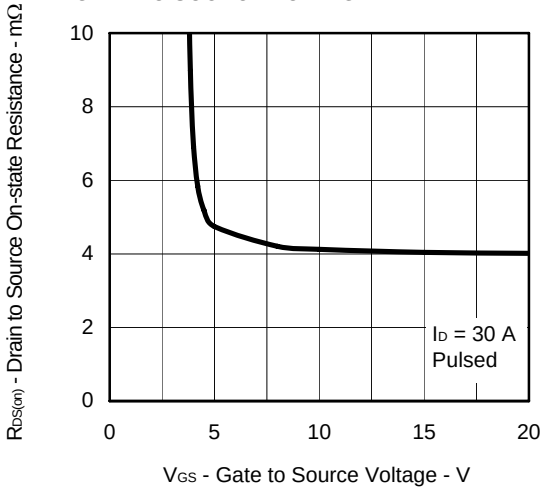
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



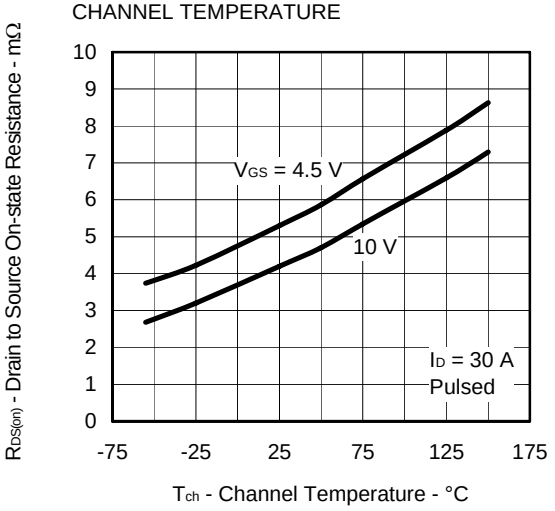
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



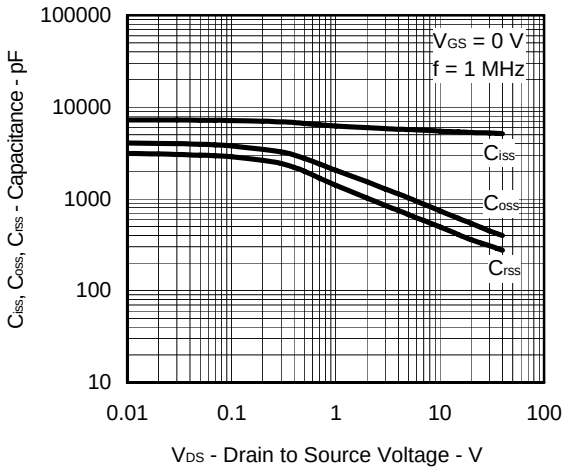
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



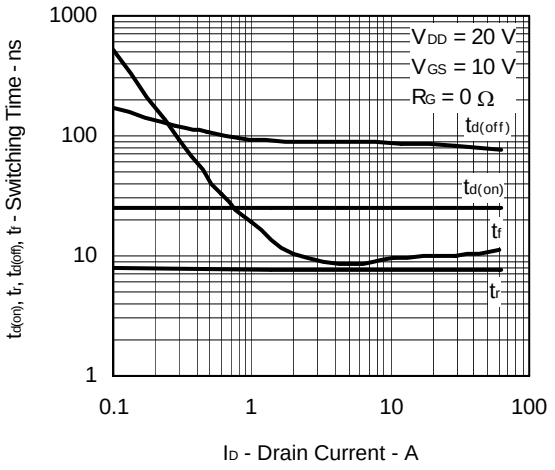
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



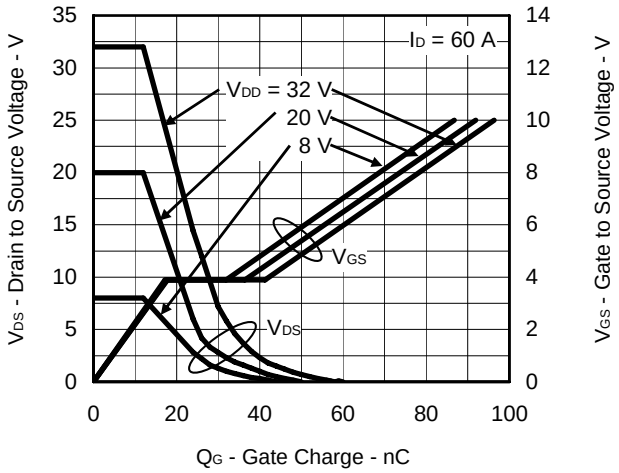
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



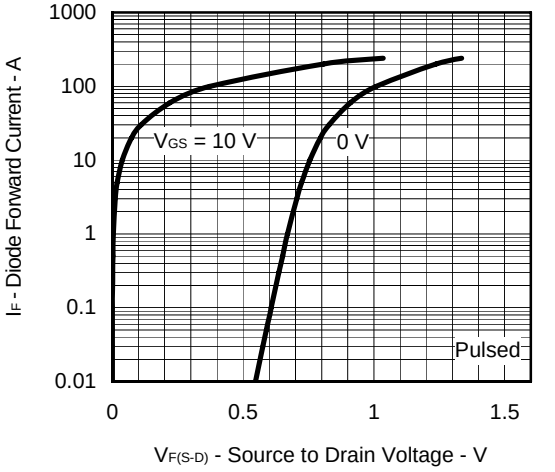
SWITCHING CHARACTERISTICS



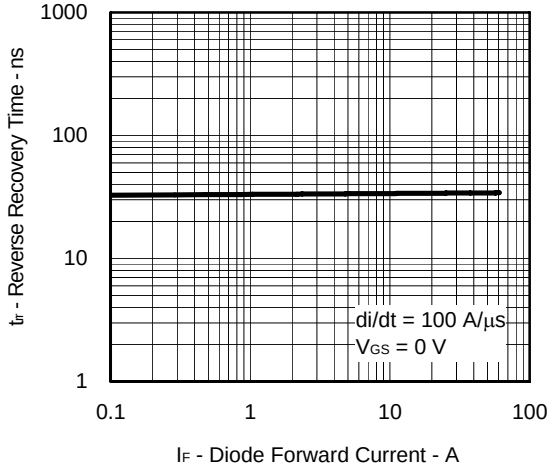
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



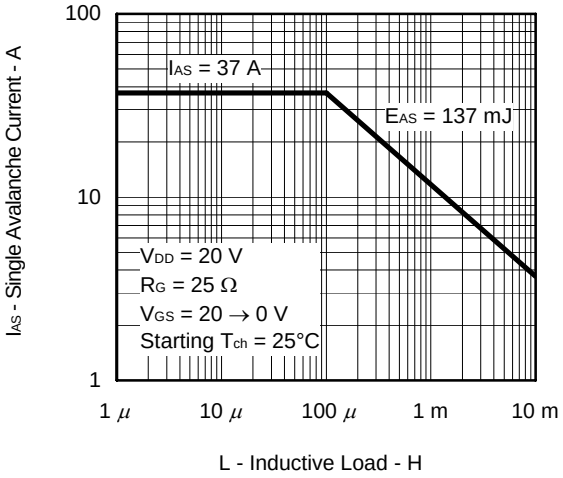
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



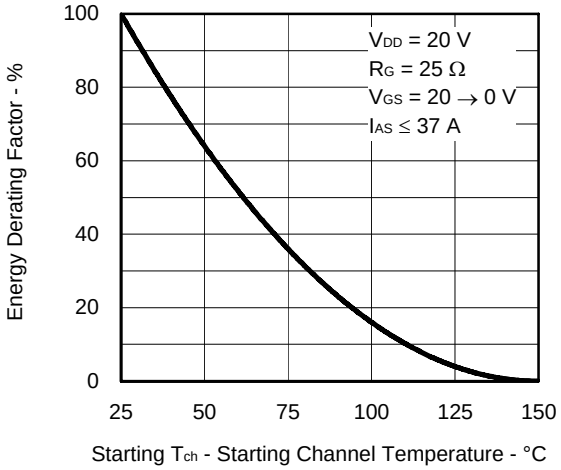
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



SINGLE AVALANCHE CURRENT vs.
INDUCTIVE LOAD

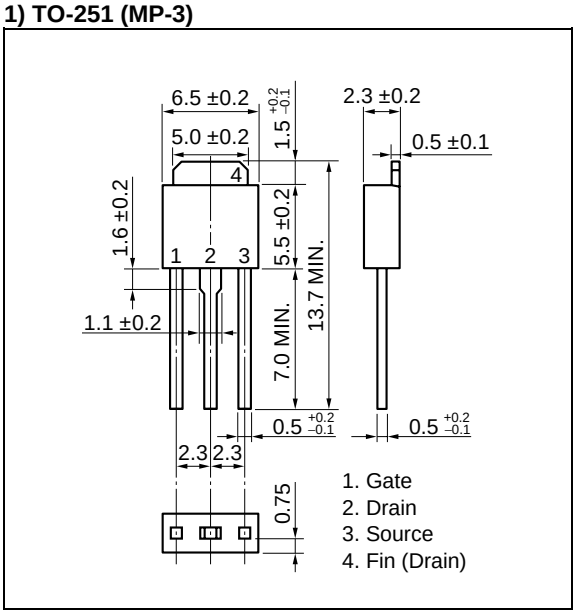


SINGLE AVALANCHE ENERGY
DERATING FACTOR

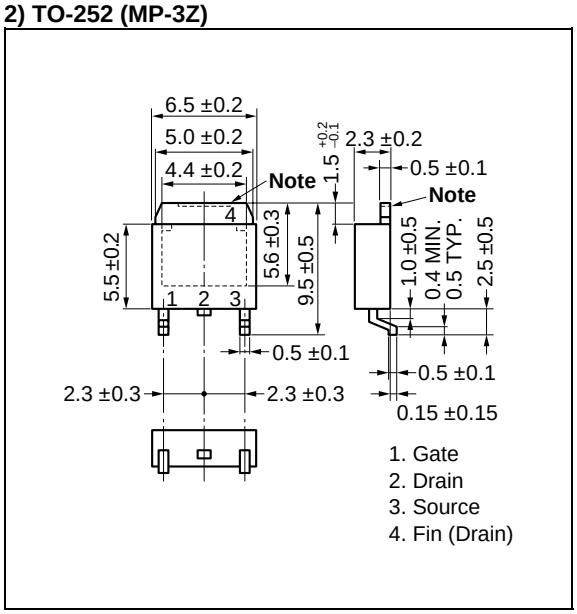


PACKAGE DRAWINGS (Unit: mm)

1) TO-251 (MP-3)

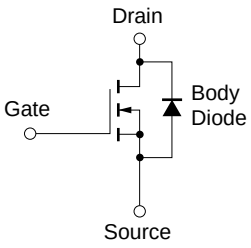


<R> **2) TO-252 (MP-3Z)**



Note The depth of notch at the top of the fin is from 0 to 0.2 mm.

EQUIVALENT CIRCUIT



Remark Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

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