

# MOS FIELD EFFECT TRANSISTOR 2SK3712

## SWITCHING N-CHANNEL POWER MOS FET

### DESCRIPTION

The 2SK3712 is N-channel MOS FET device that features a low on-state resistance and excellent switching characteristics, and designed for high voltage applications such as DC/DC converter.

### FEATURES

- High voltage:  $V_{BSS} = 250$  V
- Gate voltage rating:  $\pm 30$  V
- Low on-state resistance  
 $R_{DS(on)} = 0.58 \Omega$  MAX. ( $V_{GS} = 10$  V,  $I_D = 4.5$  A)
- Low  $C_{iss}$ :  $C_{iss} = 450$  pF TYP. ( $V_{DS} = 10$  V,  $I_D = 0$  A)
- Built-in gate protection diode
- TO-251/TO-252 package

### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage ( $V_{GS} = 0$ V)	$V_{DSS}$	250	V
Gate to Source Voltage ( $V_{DS} = 0$ V)	$V_{GSS}$	$\pm 30$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 9.0$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 27$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	40	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	1.0	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Single Avalanche Current <sup>Note2</sup>	$I_{AS}$	9	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	8.1	mJ
Repetitive Avalanche Current <sup>Note3</sup>	$I_{AR}$	9	A
Repetitive Pulse Avalanche Energy <sup>Note3</sup>	$E_{AR}$	8.1	mJ

**Notes 1.**  $PW \leq 10 \mu\text{s}$ , Duty cycle  $\leq 1\%$

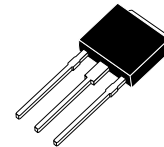
**2.** Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 125$  V,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0$  V,  $L = 100 \mu\text{H}$

**3.**  $T_{ch(peak)} \leq 150^\circ\text{C}$ ,  $L = 100 \mu\text{H}$

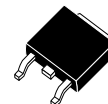
### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3712	TO-251
2SK3712-Z	TO-252

(TO-251)



(TO-252)



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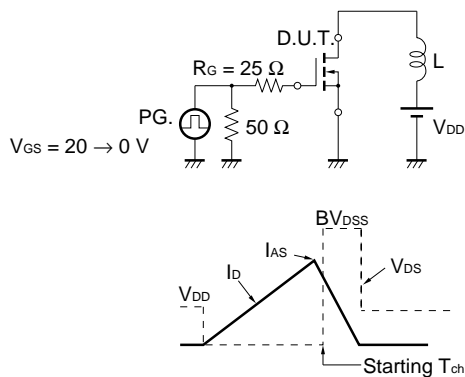
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**ELECTRICAL CHARACTERISTICS (TA = 25°C)**

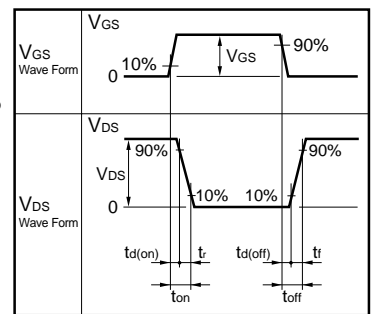
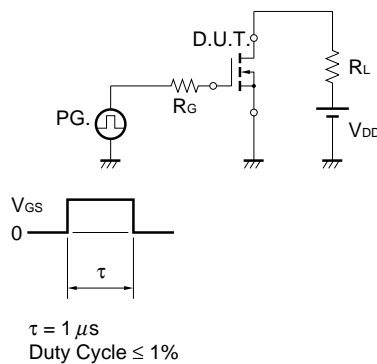
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 250\text{ V}, V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$
Gate Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2.5	3.5	4.5	V
Forward Transfer Admittance <sup>Note</sup>	$ y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 4.5\text{ A}$	3	6		S
Drain to Source On-state Resistance <sup>Note</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 4.5\text{ A}$		0.45	0.58	$\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}$		450		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}$		100		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1\text{ MHz}$		40		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 125\text{ V}, I_D = 4.5\text{ A}$		8		ns
Rise Time	$t_r$	$V_{GS} = 10\text{ V}$		8		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 0\ \Omega$		21		ns
Fall Time	$t_f$			6		ns
Total Gate Charge	$Q_G$	$V_{DD} = 200\text{ V}$		14		nC
Gate to Source Charge	$Q_{GS}$	$V_{GS} = 10\text{ V}$		3		nC
Gate to Drain Charge	$Q_{GD}$	$I_D = 9.0\text{ A}$		7		nC
Body Diode Forward Voltage <sup>Note</sup>	$V_{F(S-D)}$	$I_F = 9\text{ A}, V_{GS} = 0\text{ V}$		0.9	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = 9\text{ A}, V_{GS} = 0\text{ V}$		150		ns
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 100\text{ A}/\mu\text{s}$		630		nC

**Note** Pulsed:  $PW \leq 800\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$

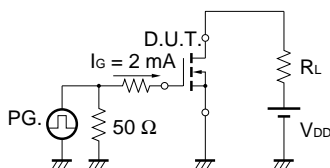
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



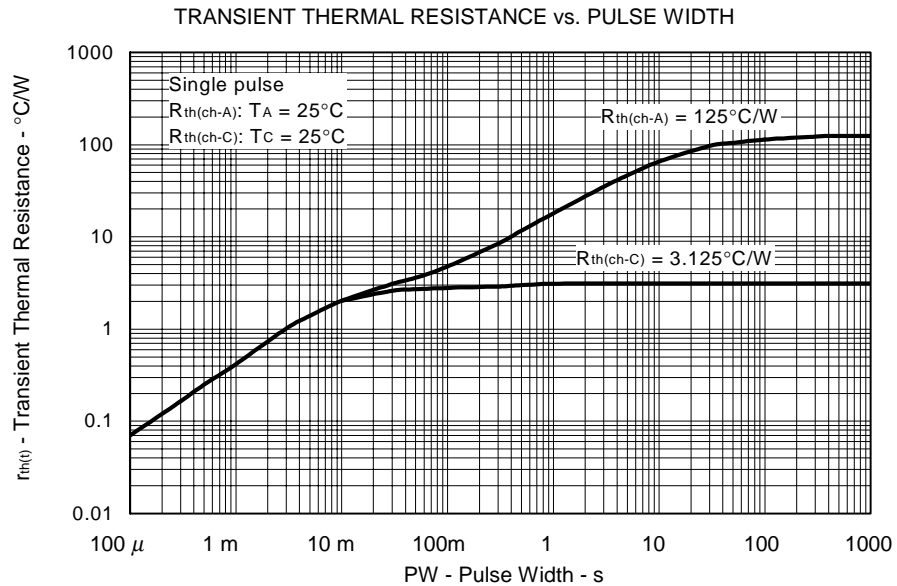
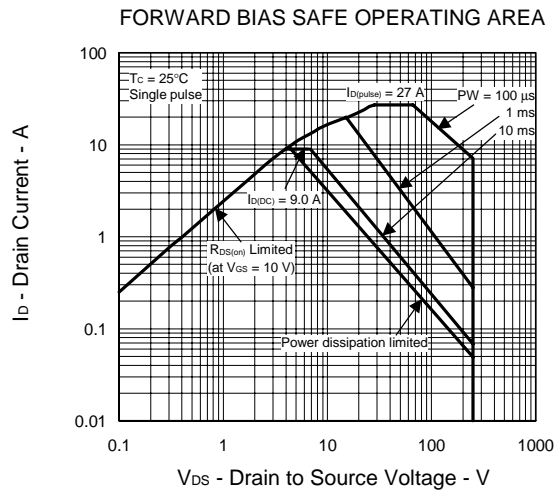
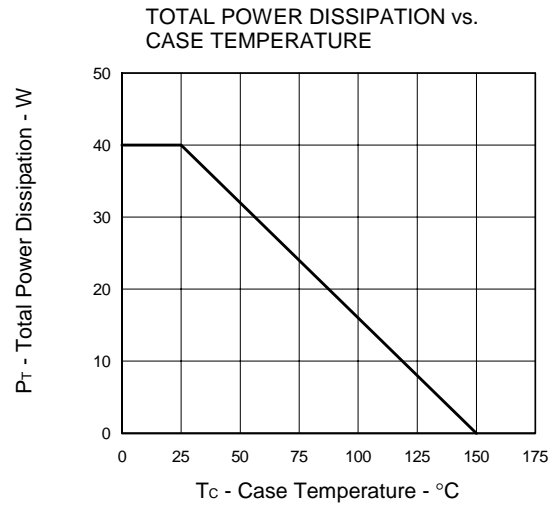
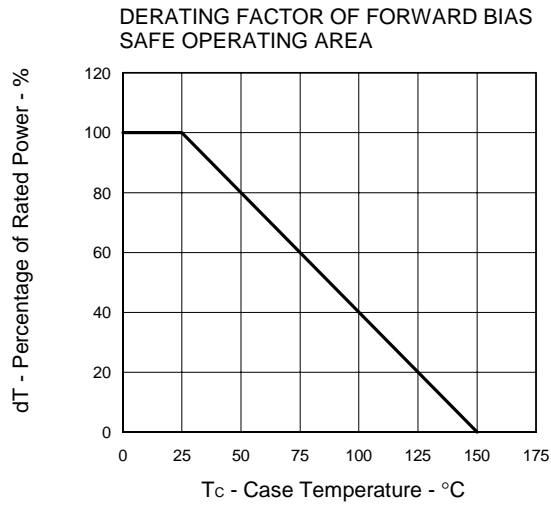
**TEST CIRCUIT 2 SWITCHING TIME**



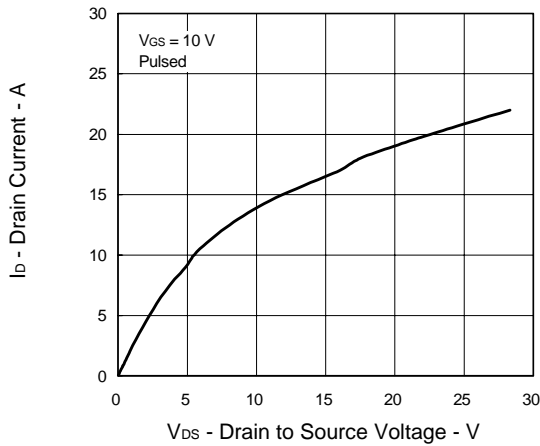
**TEST CIRCUIT 3 GATE CHARGE**



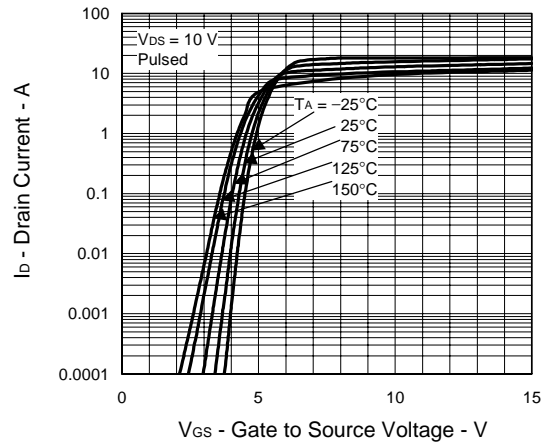
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



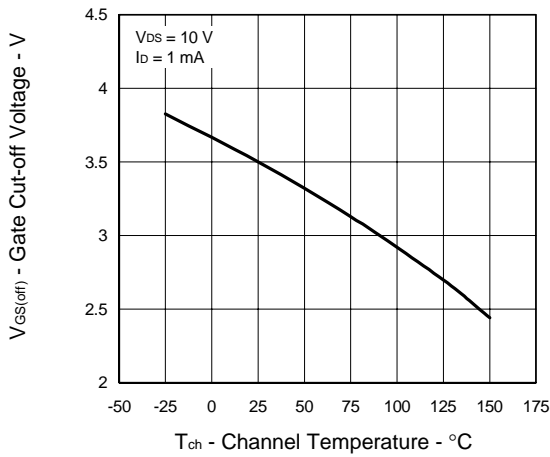
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



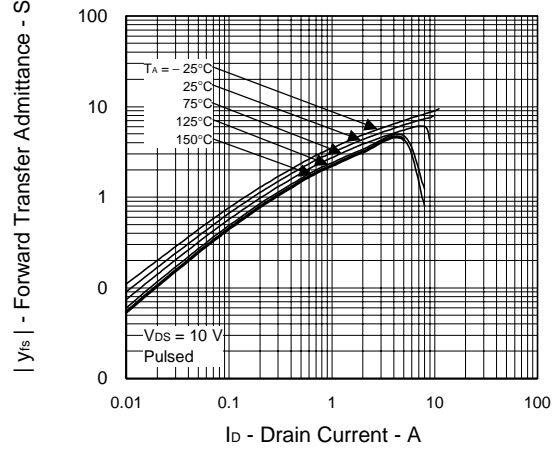
FORWARD TRANSFER CHARACTERISTICS



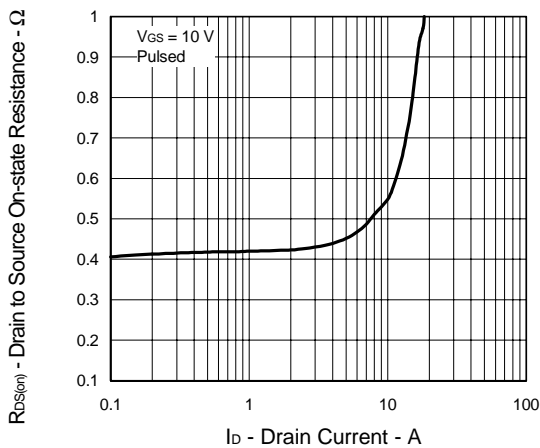
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



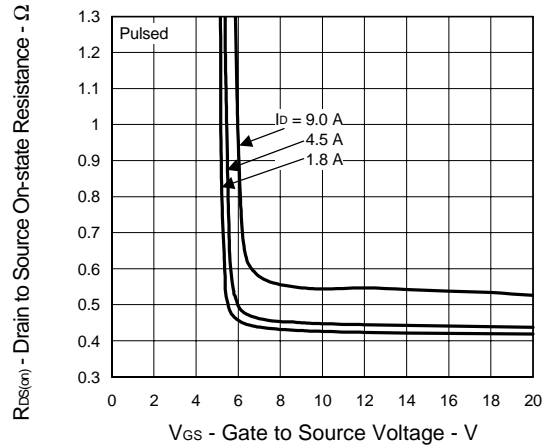
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



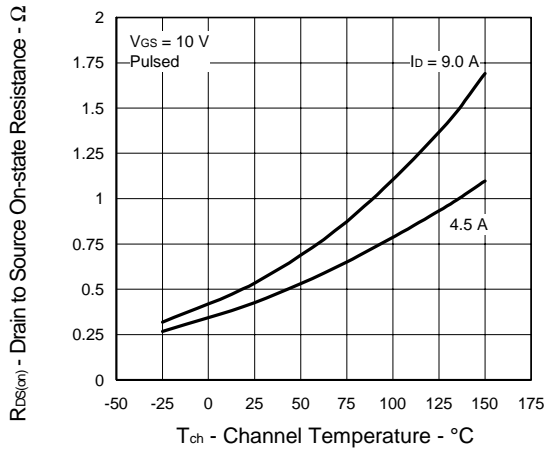
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



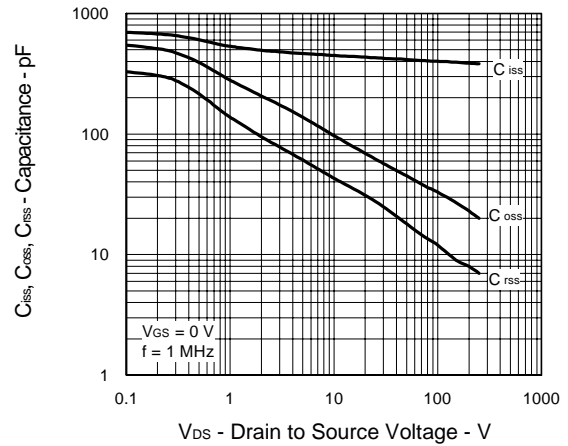
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



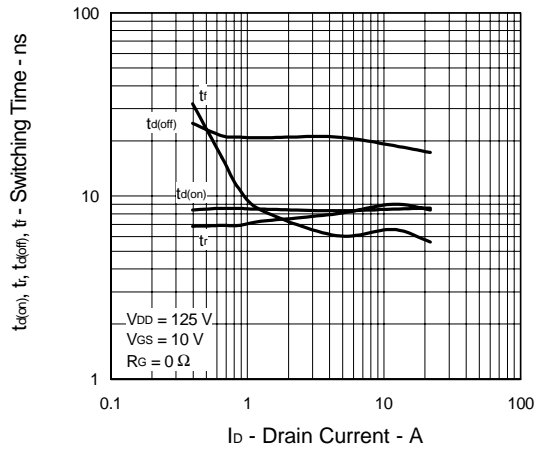
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



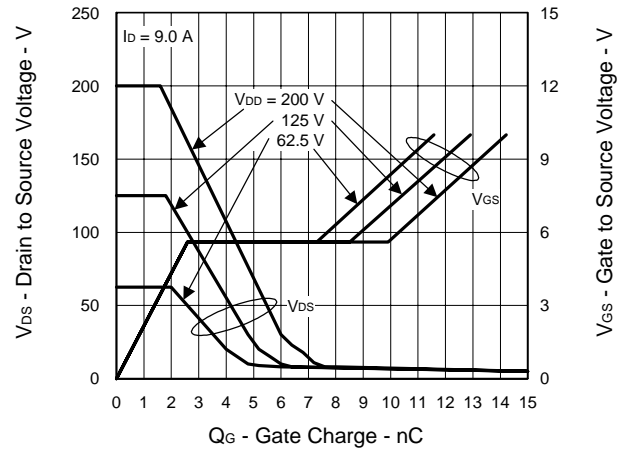
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



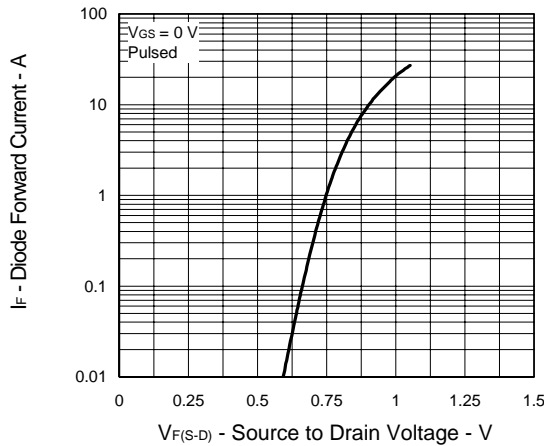
SWITCHING CHARACTERISTICS



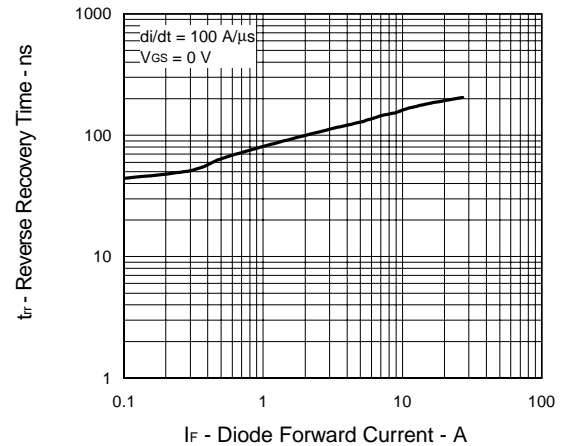
DYNAMIC INPUT/OUTPUT CHARACTERISTICS

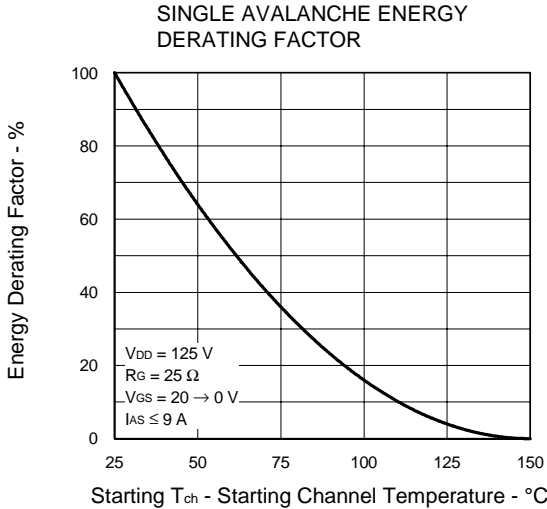
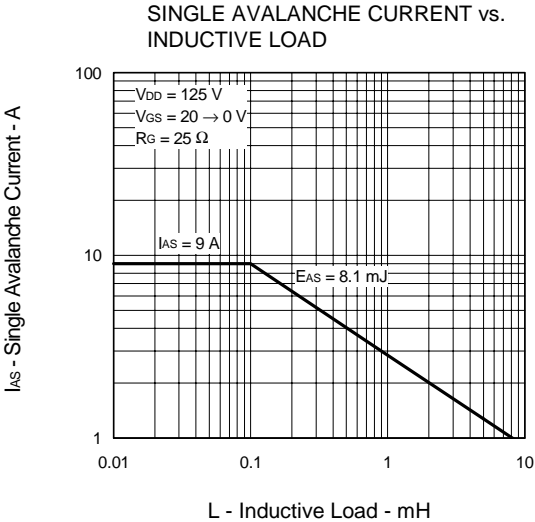


SOURCE TO DRAIN DIODE FORWARD VOLTAGE



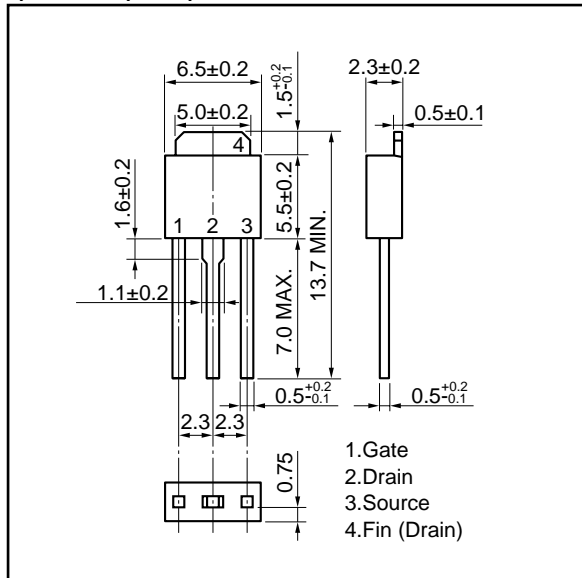
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



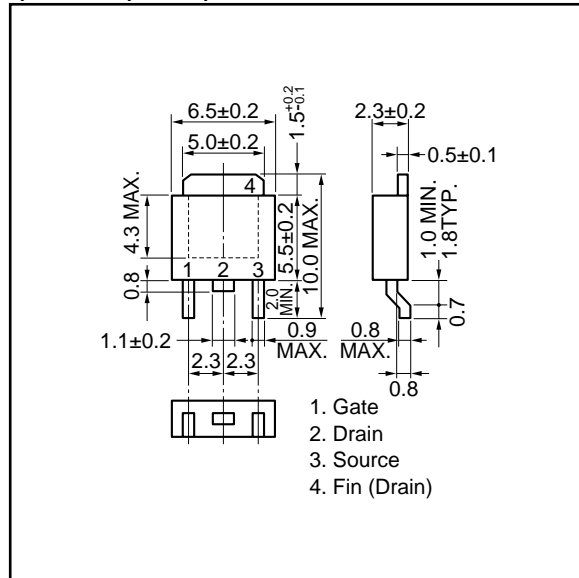


PACKAGE DRAWINGS (Unit: mm)

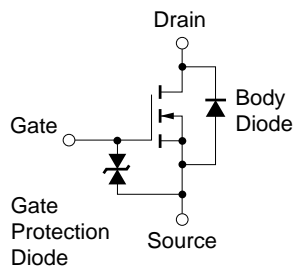
1) TO-251 (MP-3)



2) TO-252 (MP-3Z)



EQUIVALENT CIRCUIT



**Remark** The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

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