

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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**SWITCHING**  
**N-CHANNEL POWER MOS FET**  
**INDUSTRIAL USE**

**DESCRIPTION**

The 2SK3111 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, actuator driver.

**ORDERING INFORMATION**

PART NUMBER	PACKAGE
2SK3111	TO-220AB
2SK3111-S	TO-262
2SK3111-ZJ	TO-263

**FEATURES**

- Gate voltage rating  $\pm 30$  V
- Low on-state resistance  
 $R_{DS(on)} = 180 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 10 \text{ A)}$
- Low input capacitance  
 $C_{iss} = 1000 \text{ pF TYP. (} V_{DS} = 10 \text{ V, } V_{GS} = 0 \text{ V)}$
- Avalanche capability rated
- Built-in gate protection diode
- Surface mount device available

**ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25 °C)**

Drain to source voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	200	V
Gate to source voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 30$	V
Drain current (DC) ( $T_C = 25 \text{ }^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 20$	A
Drain current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 60$	A
Total power dissipation ( $T_A = 25 \text{ }^\circ\text{C}$ )	$P_{T1}$	1.5	W
Total power dissipation ( $T_C = 25 \text{ }^\circ\text{C}$ )	$P_{T2}$	65	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>	$I_{AS}$	20	A
Single avalanche energy <sup>Note2</sup>	$E_{AS}$	100	mJ

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

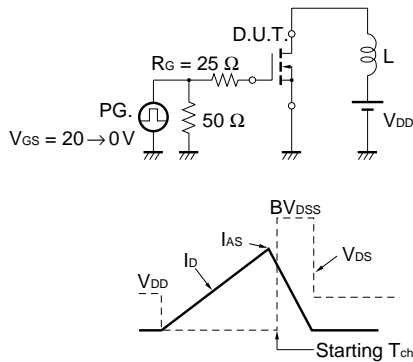
2. Starting  $T_{ch} = 25 \text{ }^\circ\text{C}$ ,  $V_{DD} = 100 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \text{ V} \rightarrow 0 \text{ V}$

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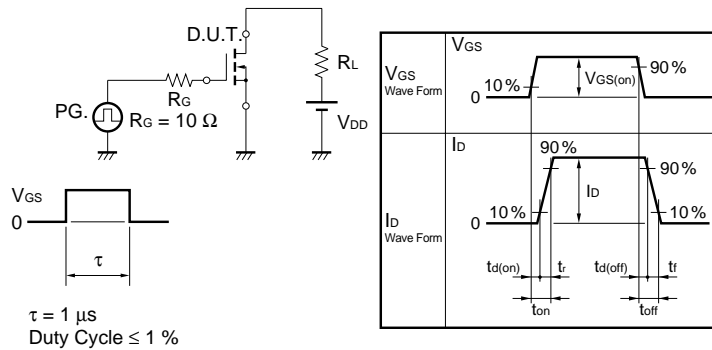
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

Characteristics	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Drain Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 200 V, V <sub>GS</sub> = 0 V			100	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V			±10	μA
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.5		4.5	V
Forward Transfer Admittance	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 10 A	3.0			S
Drain to Source On-state Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A		120	180	mΩ
Input Capacitance	C <sub>iSS</sub>	V <sub>DS</sub> = 10 V		1000		pF
Output Capacitance	C <sub>oSS</sub>	V <sub>GS</sub> = 0 V		300		pF
Reverse Transfer Capacitance	C <sub>rSS</sub>	f = 1 MHz		150		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 100 V		25		ns
Rise Time	t <sub>r</sub>	I <sub>D</sub> = 10 A		90		ns
Turn-off Delay Time	t <sub>d(off)</sub>	V <sub>GS(on)</sub> = 10 V		80		ns
Fall Time	t <sub>f</sub>	R <sub>G</sub> = 10 Ω		40		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 160 V		40		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		7		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 20 A		25		nC
Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 20 A, V <sub>GS</sub> = 0 V		1.0		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 20 A, V <sub>GS</sub> = 0 V		300		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 50 A/μs		1.7		μC

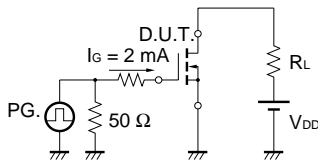
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



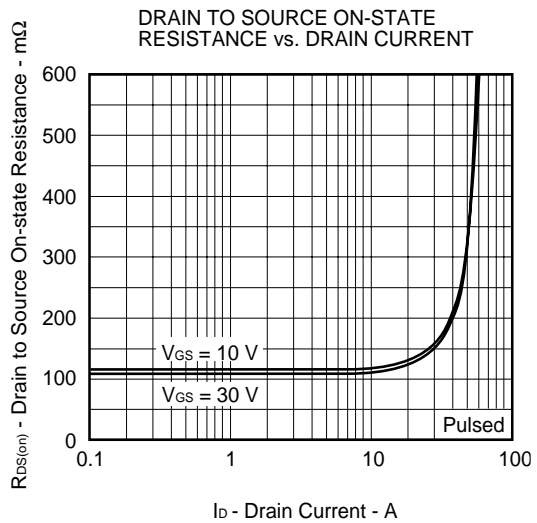
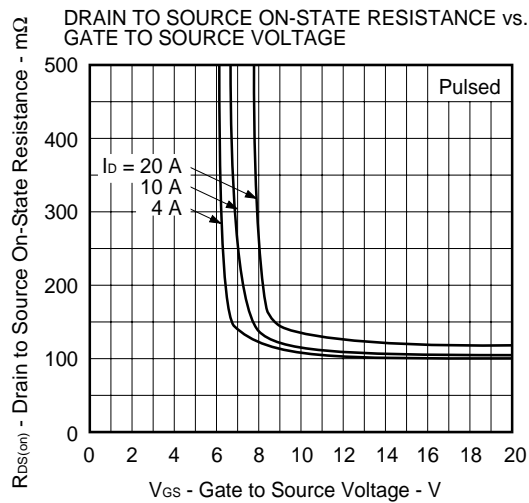
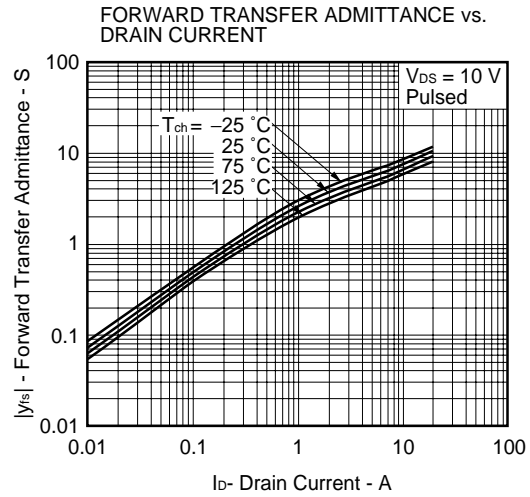
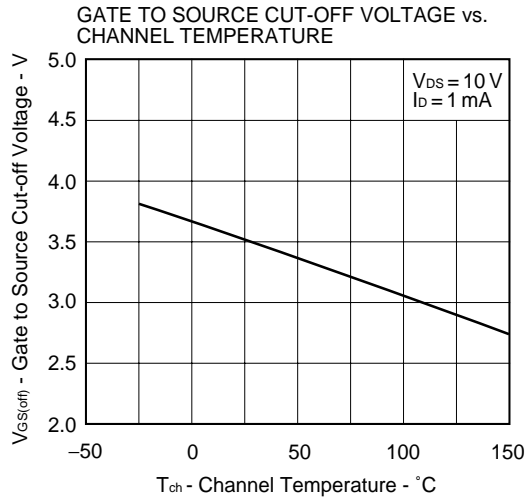
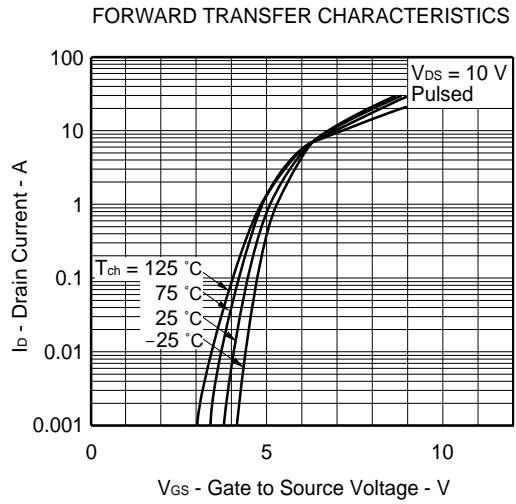
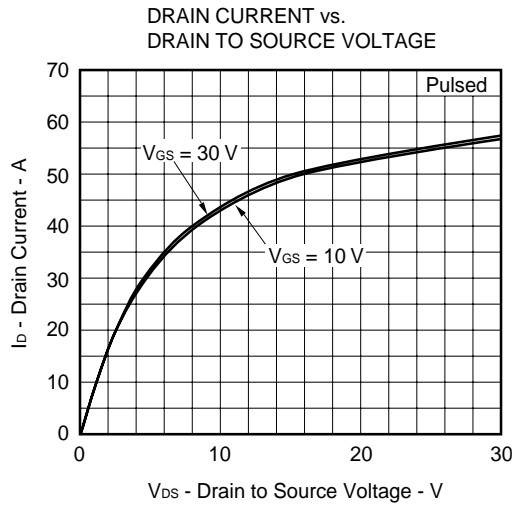
**TEST CIRCUIT 2 SWITCHING TIME**

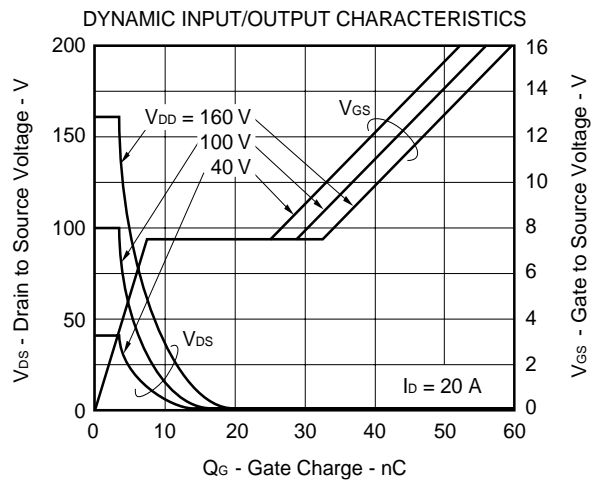
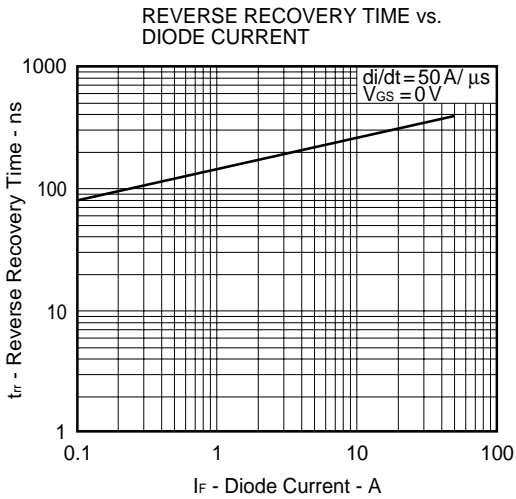
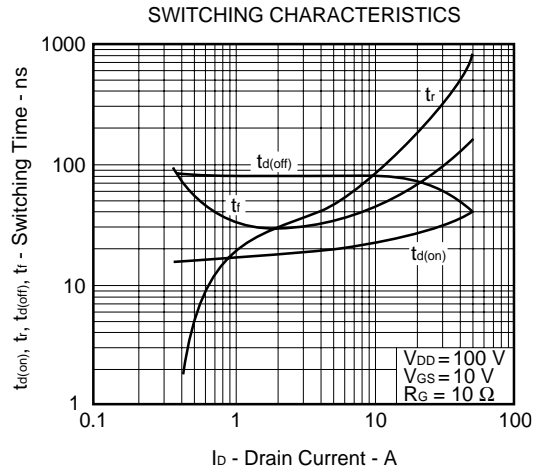
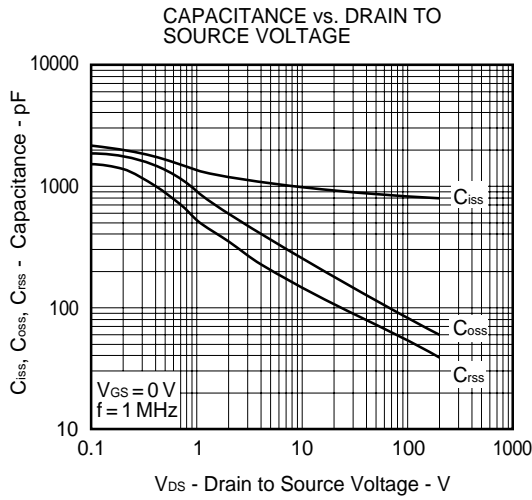
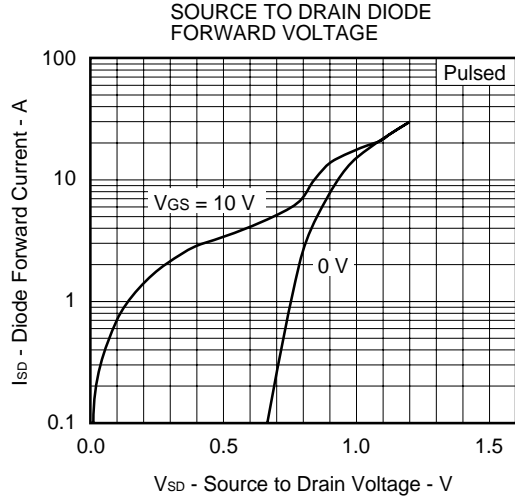
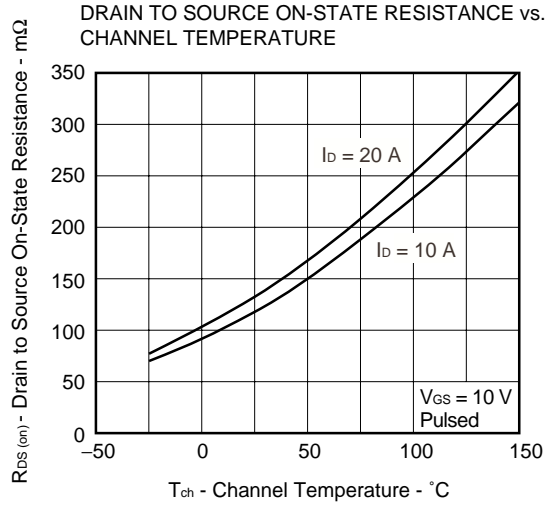


**TEST CIRCUIT 3 GATE CHARGE**

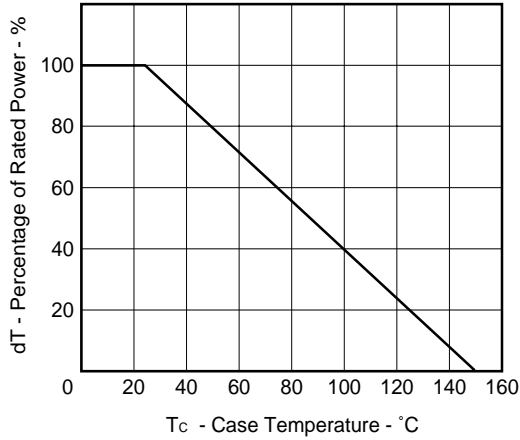


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

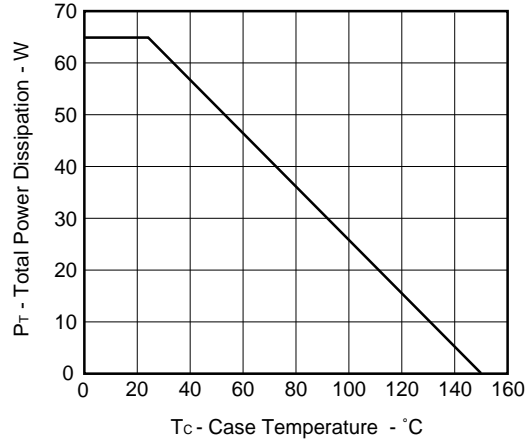




DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA

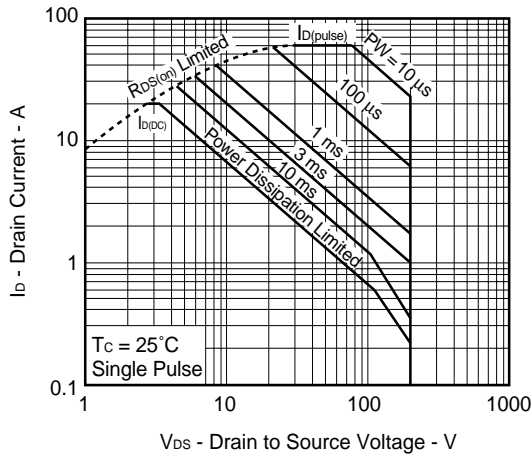


TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

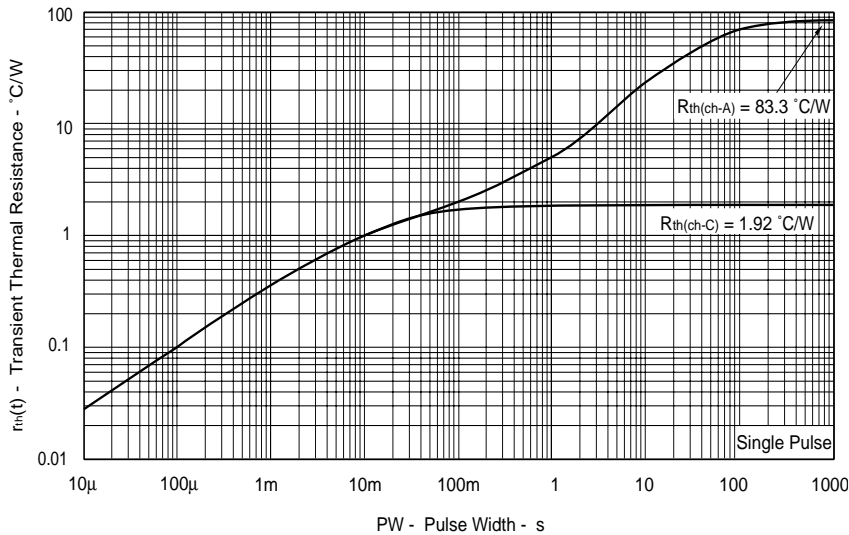


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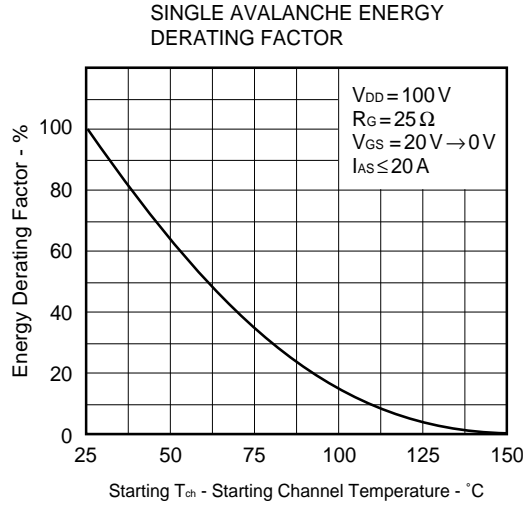
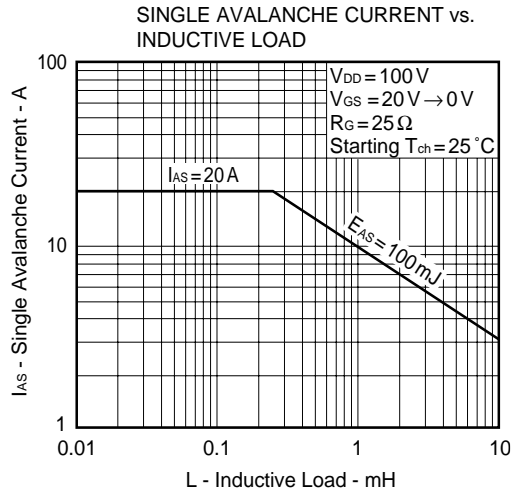
FORWARD BIAS SAFE OPERATING AREA



TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



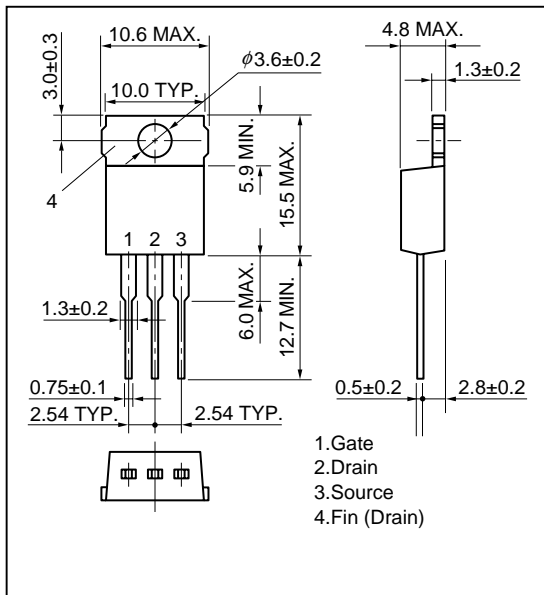
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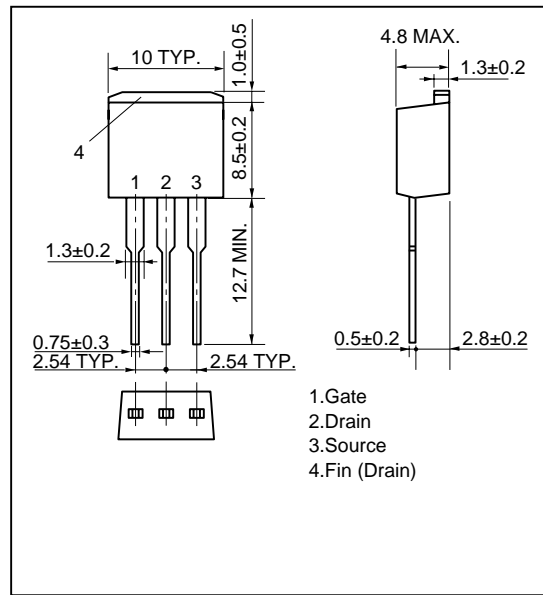


★ PACKAGE DRAWINGS (Unit : mm)

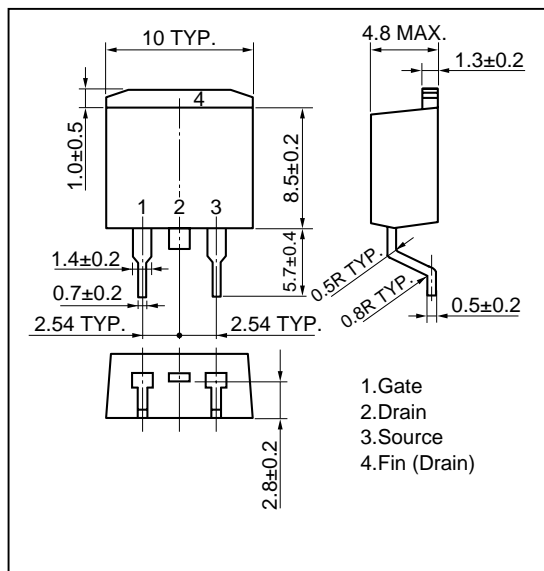
1) TO-220AB (MP-25)



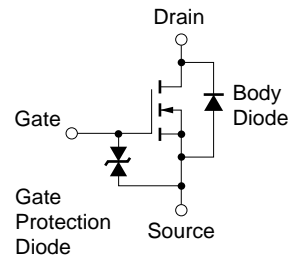
2) TO-262 (MP-25 Fin Cut)



3) TO-263 (MP-25ZJ)



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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