

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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# MOS FIELD EFFECT TRANSISTOR

# 2SK3116

## SWITCHING

### N-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SK3116 is N-channel DMOS FET device that features a low gate charge and excellent switching characteristics, and designed for high voltage applications such as switching power supply, AC adapter.

#### FEATURES

- Low gate charge  
 $Q_G = 26 \text{ nC TYP. (} I_D = 7.5 \text{ A, } V_{DD} = 450 \text{ V, } V_{GS} = 10 \text{ V)}$
- Gate voltage rating  $\pm 30 \text{ V}$
- Low on-state resistance  
 $R_{DS(on)} = 1.2 \Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 3.75 \text{ A)}$
- Avalanche capability ratings

#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3116	TO-220AB
2SK3116-S	TO-262
2SK3116-ZJ	TO-263

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

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	600	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 30$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 7.5$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 30$	A
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T1}$	1.5	W
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T2}$	70	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>	$I_{AS}$	7.5	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	37.5	mJ
Diode Recovery $dv/dt$ <sup>Note3</sup>	$dv/dt$	3.5	V/ns

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

**2.** Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 150 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$

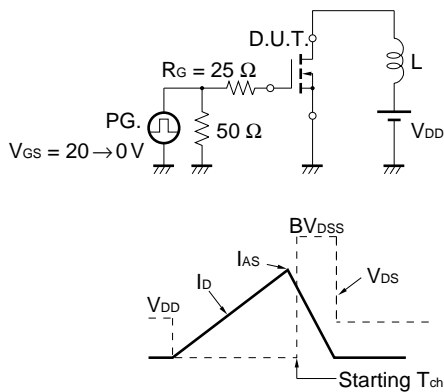
**3.**  $I_F \leq 3.0 \text{ A}$ ,  $V_{clamp} = 600 \text{ V}$ ,  $di/dt \leq 100 \text{ A}/\mu\text{s}$ ,  $T_A = 25^\circ\text{C}$

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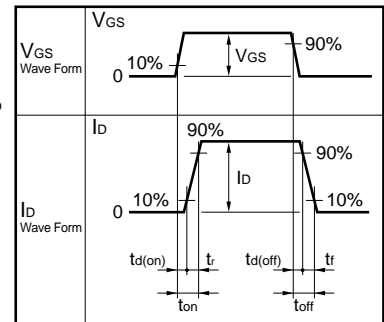
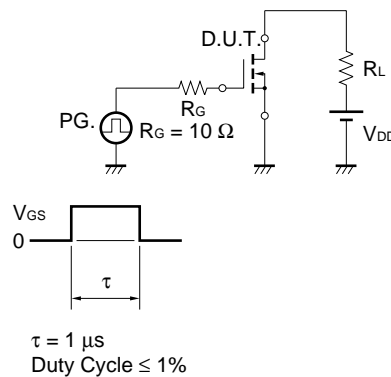
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 600 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			±100	nA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.5		3.5	V
Forward Transfer Admittance	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 3.75 A	2.0			S
Drain to Source On-state Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 3.75 A		0.9	1.2	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		1100		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		200		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		20		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 150 V, I <sub>D</sub> = 3.75 A		18		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V		15		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		50		ns
Fall Time	t <sub>f</sub>	R <sub>L</sub> = 50 Ω		15		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 450 V		26		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		6		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 7.5 A		10		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 7.5 A, V <sub>GS</sub> = 0 V		1.0		V
Reverse Recovery Time	T <sub>rr</sub>	I <sub>F</sub> = 7.5 A, V <sub>GS</sub> = 0 V		1.6		μs
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 50 A/μs		7.6		μC

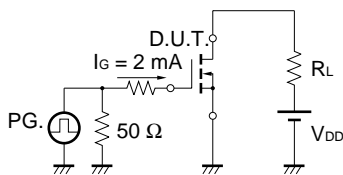
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



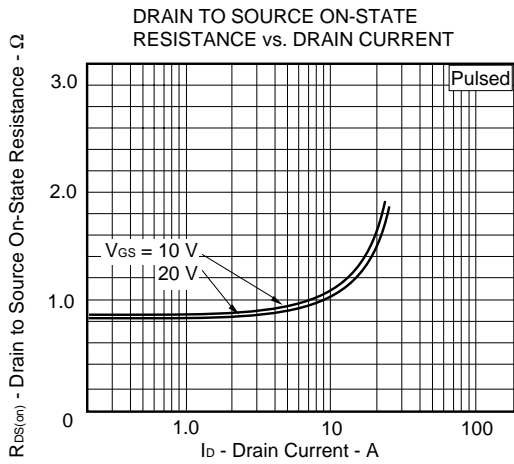
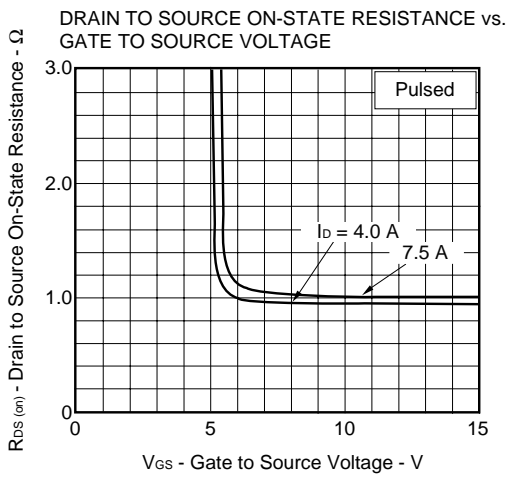
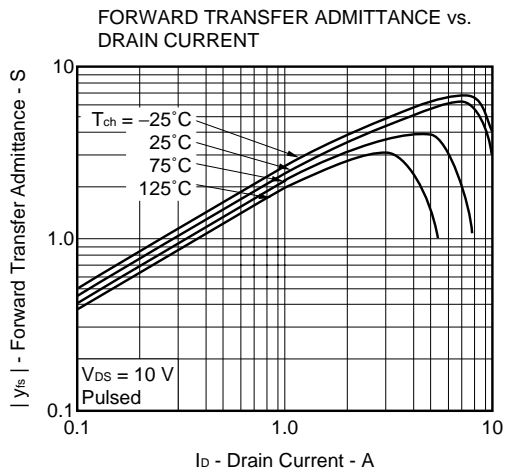
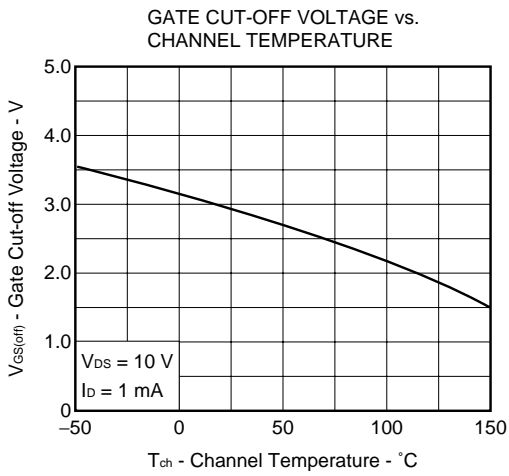
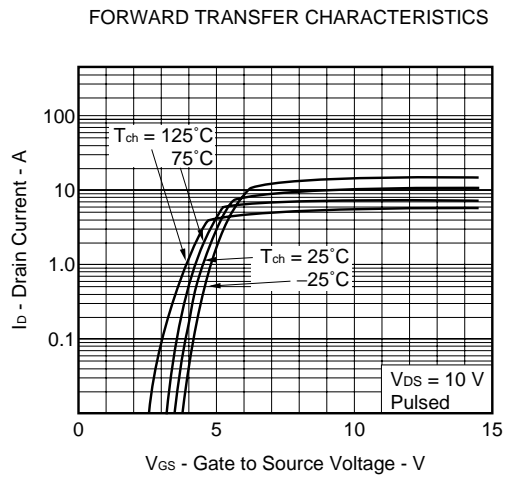
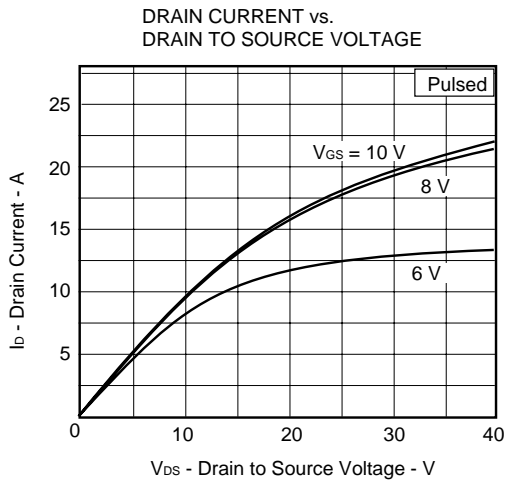
**TEST CIRCUIT 2 SWITCHING TIME**

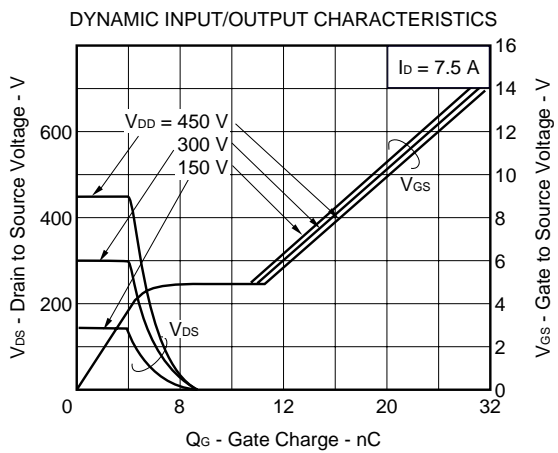
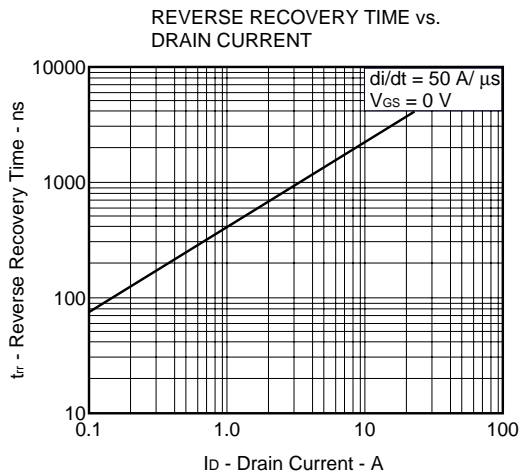
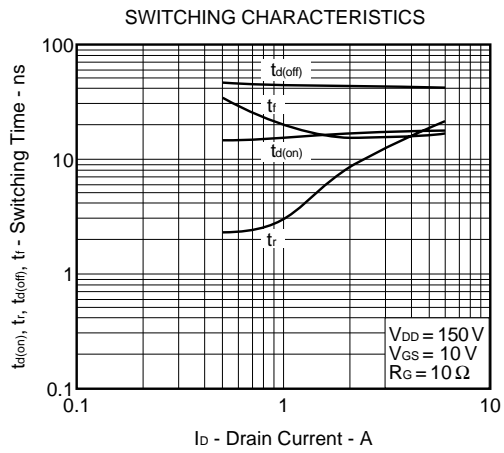
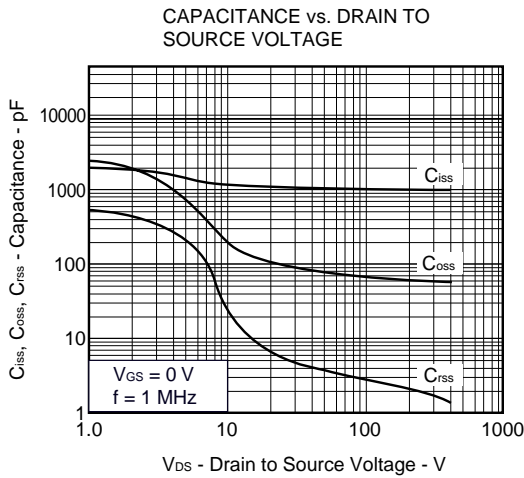
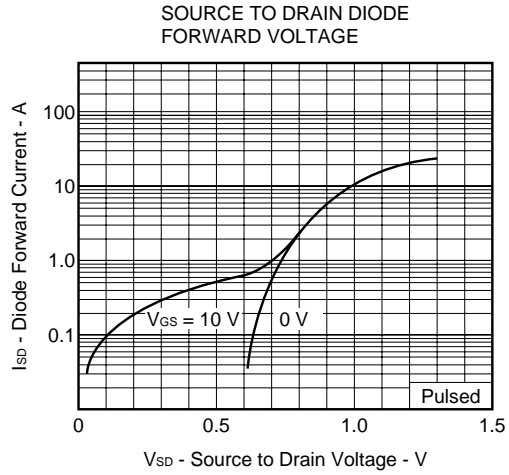
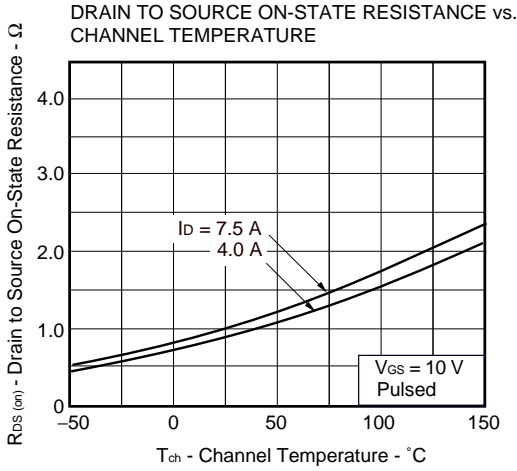


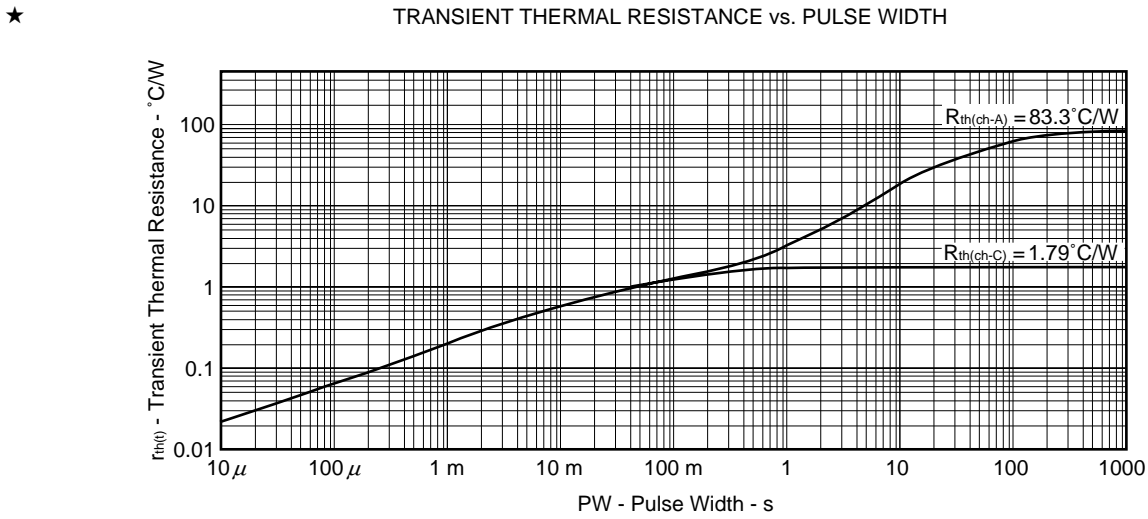
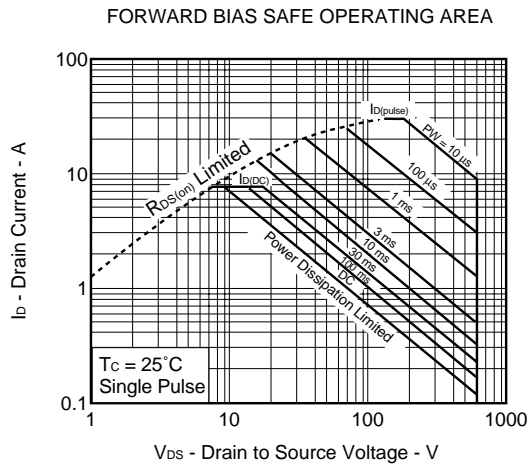
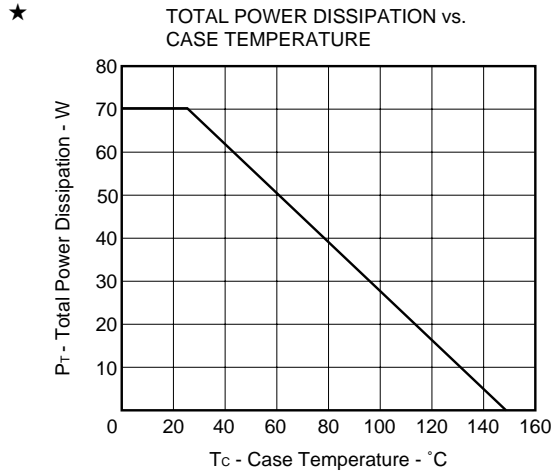
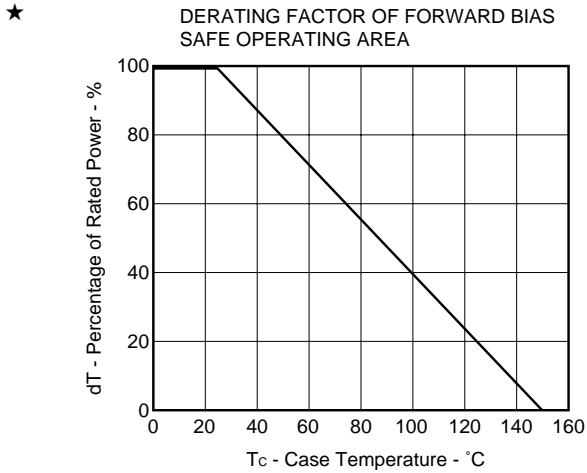
**TEST CIRCUIT 3 GATE CHARGE**

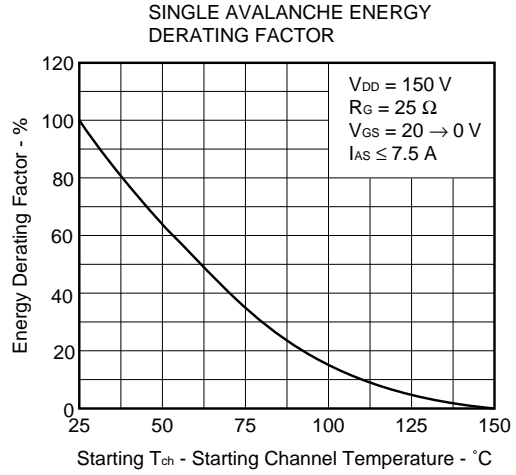
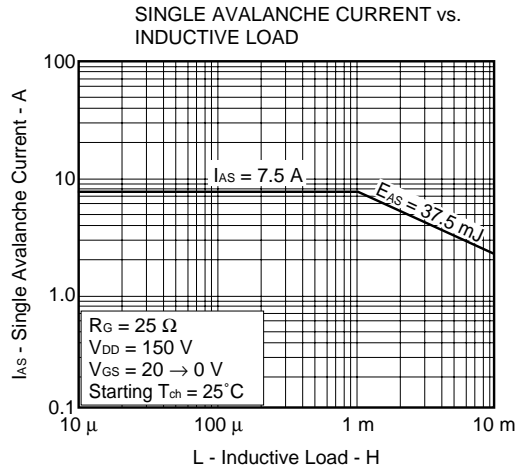


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)





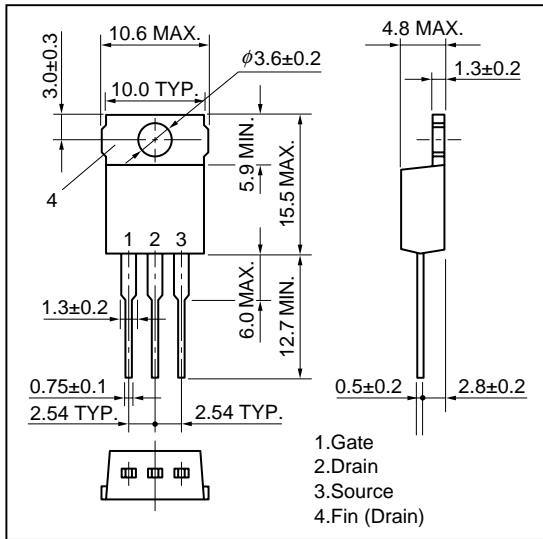




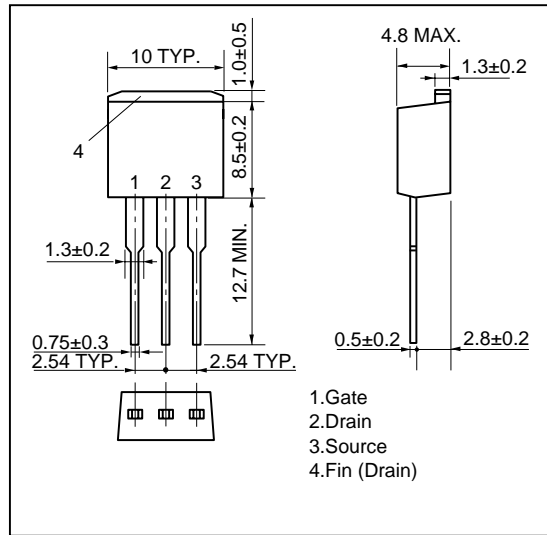


★ PACKAGE DRAWINGS (Unit: mm)

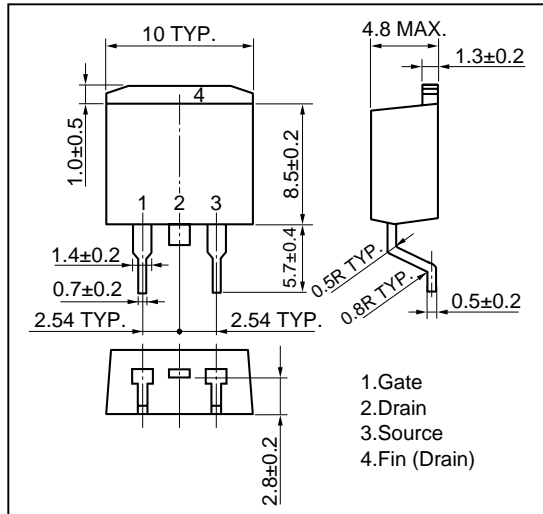
1) TO-220AB (MP-25)



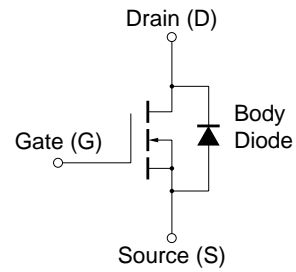
2) TO-262 (MP-25 Fin Cut)



3) TO-263 (MP-25ZJ)



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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