

To our customers,

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## Old Company Name in Catalogs and Other Documents

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

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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### MOS FIELD EFFECT TRANSISTOR

# 2SK4070

## SWITCHING N-CHANNEL POWER MOS FET

### DESCRIPTION

The 2SK4070 is N-channel MOS 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 on-state resistance  
 $R_{DS(on)} = 11 \Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 0.5 \text{ A)}$
- Low gate charge  
 $Q_G = 5 \text{ nC TYP. (} V_{DD} = 450 \text{ V, } V_{GS} = 10 \text{ V, } I_D = 1.0 \text{ A)}$
- Gate voltage rating :  $\pm 30 \text{ V}$
- Avalanche capability ratings

### <R> ORDERING INFORMATION

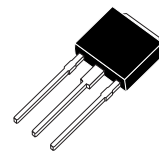
PART NUMBER	LEAD PLATING	PACKING	PACKAGE
2SK4070-S15-AY <sup>Note</sup>	Pure Sn (Tin)	Tube 70 p/tube	TO-251 (MP-3-a) typ. 0.39 g
2SK4070(1)-S27-AY <sup>Note</sup>		Tube 75 p/tube	TO-251 (MP-3-b) typ. 0.34 g
2SK4070-ZK-E1-AY <sup>Note</sup>		Tape 2500 p/reel	TO-252 (MP-3ZK) typ. 0.27 g
2SK4070-ZK-E2-AY <sup>Note</sup>			

**Note** Pb-free (This product does not contain Pb in external electrode.)

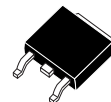
### ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C)

Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	600	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±30	V
Drain Current (DC) (T <sub>C</sub> = 25°C)	I <sub>D(DC)</sub>	±1.0	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±4.0	A
Total Power Dissipation (T <sub>C</sub> = 25°C)	P <sub>T1</sub>	22	W
Total Power Dissipation (T <sub>A</sub> = 25°C) <sup>Note2</sup>	P <sub>T2</sub>	1.0	W
Channel Temperature	T <sub>ch</sub>	150	°C
Storage Temperature	T <sub>stg</sub>	-55 to +150	°C
Single Avalanche Current <sup>Note3</sup>	I <sub>AS</sub>	0.8	A
Single Avalanche Energy <sup>Note3</sup>	E <sub>AS</sub>	38.4	mJ

(TO-251)



(TO-252)



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

2. Mounted on glass epoxy board of 40 mm × 40 mm × 1.6 mm

3. Starting T<sub>ch</sub> = 25°C, V<sub>DD</sub> = 150 V, R<sub>G</sub> = 25 Ω, V<sub>GS</sub> = 20 → 0 V

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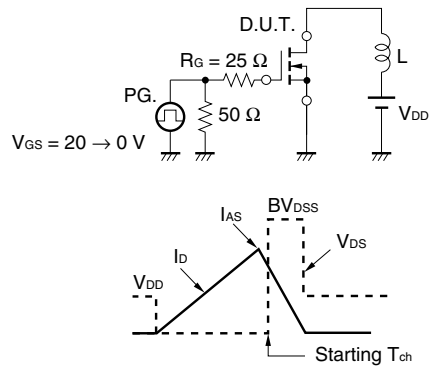
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**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

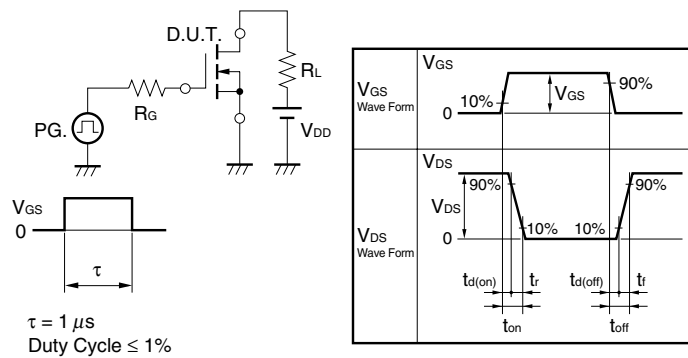
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V			100	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V			±100	nA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.5	2.9	3.5	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 0.5 A	0.2	0.4		S
Drain to Source On-state Resistance <sup>Note</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 0.5 A		9.2	11	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V,		110		pF
Output Capacitance	C <sub>oss</sub>	f = 1 MHz		50		pF
Reverse Transfer Capacitance	C <sub>rss</sub>			11		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 150 V, I <sub>D</sub> = 0.5 A,		7.5		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V,		6		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		11		ns
Fall Time	t <sub>f</sub>			18		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 450 V,		5		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V,		1		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 1.0 A		2.8		nC
Body Diode Forward Voltage <sup>Note</sup>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 1.0 A, V <sub>GS</sub> = 0 V		0.86	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 1.0 A, V <sub>GS</sub> = 0 V,		135		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		285		nC

**Note** Pulsed

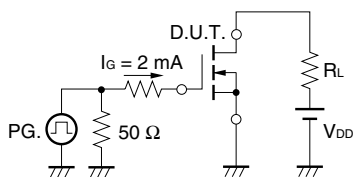
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



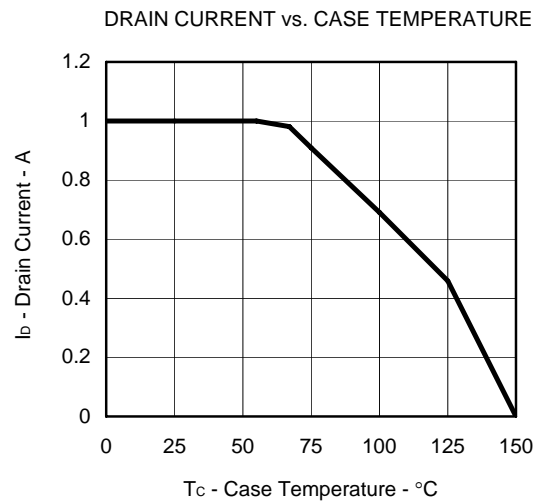
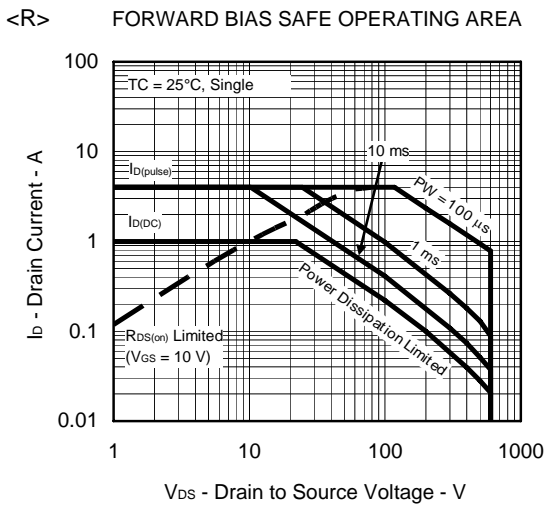
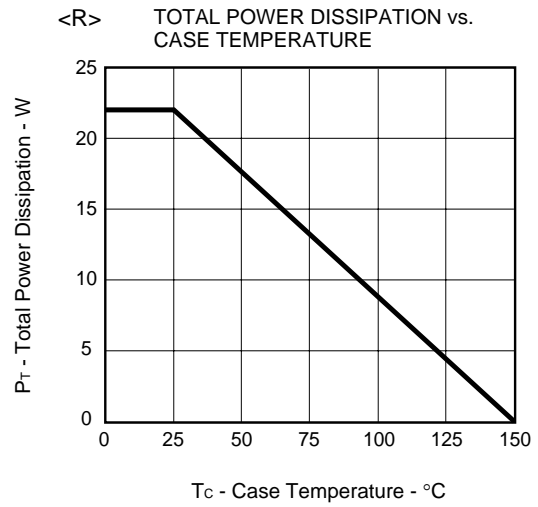
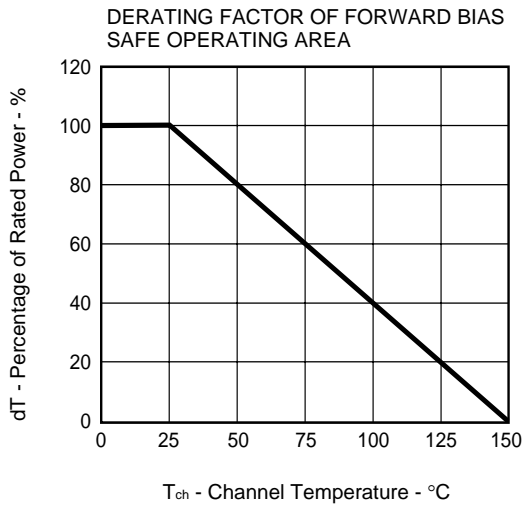
**TEST CIRCUIT 2 SWITCHING TIME**



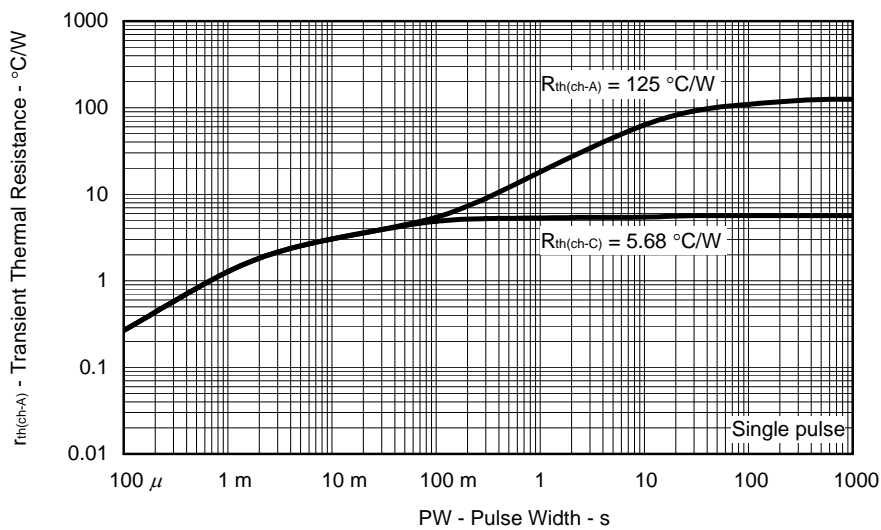
**TEST CIRCUIT 3 GATE CHARGE**



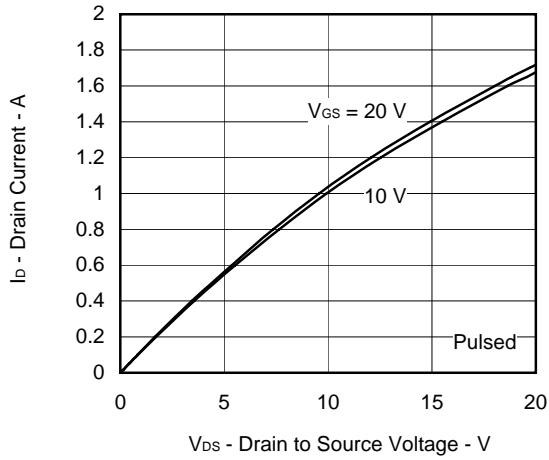
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



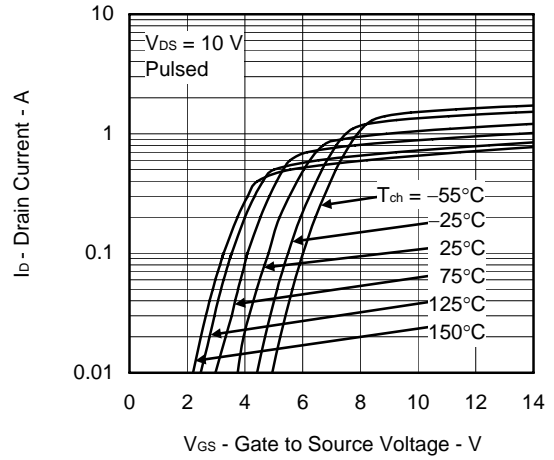
<R> TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



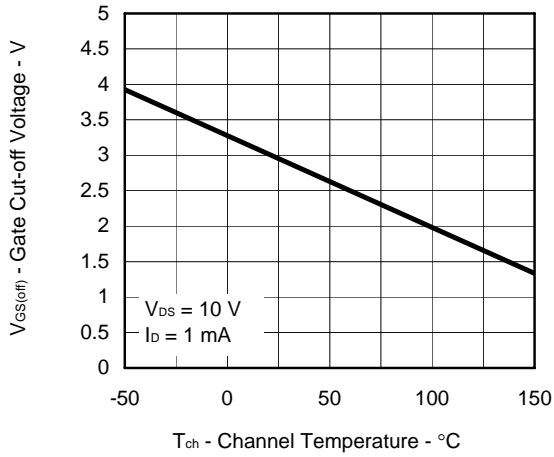
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



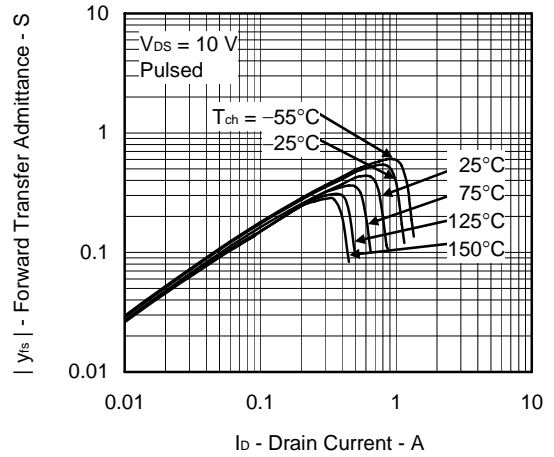
FORWARD TRANSFER CHARACTERISTICS



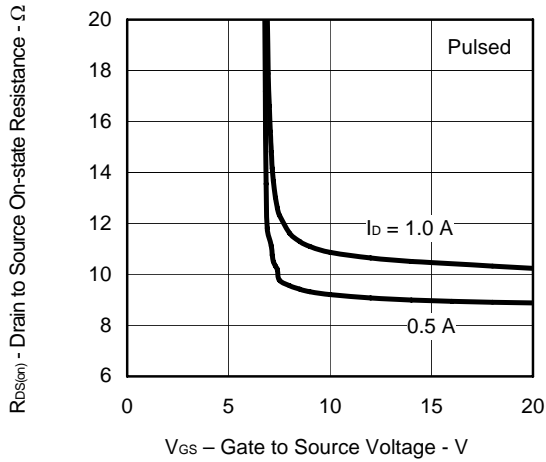
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



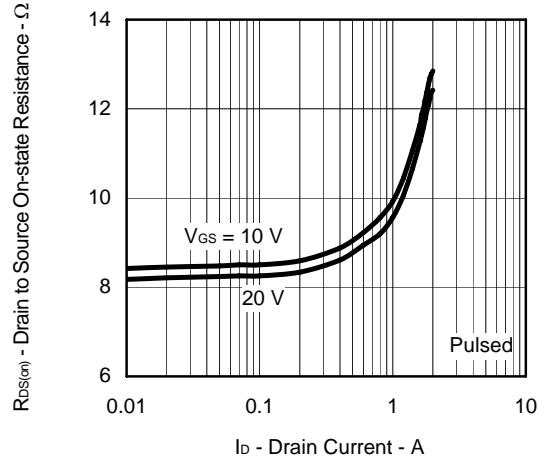
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



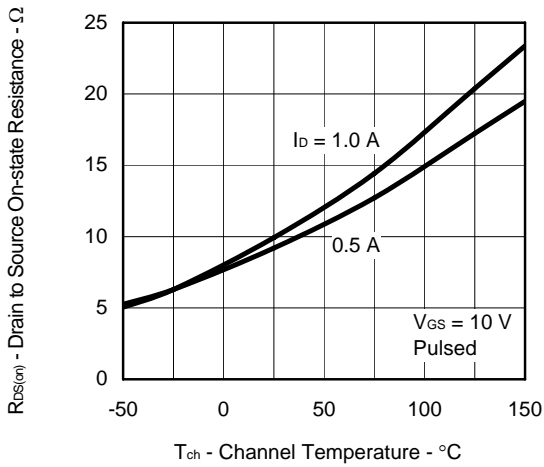
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



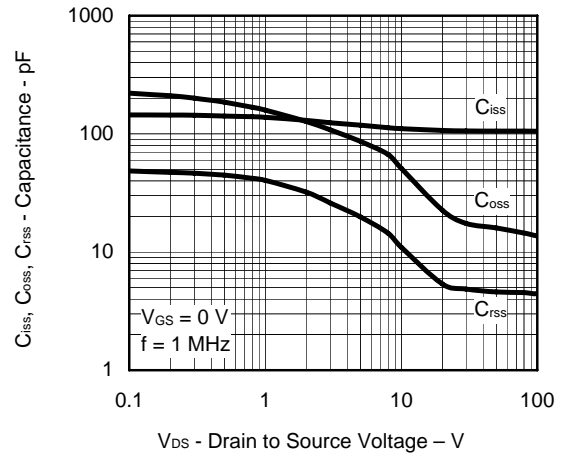
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



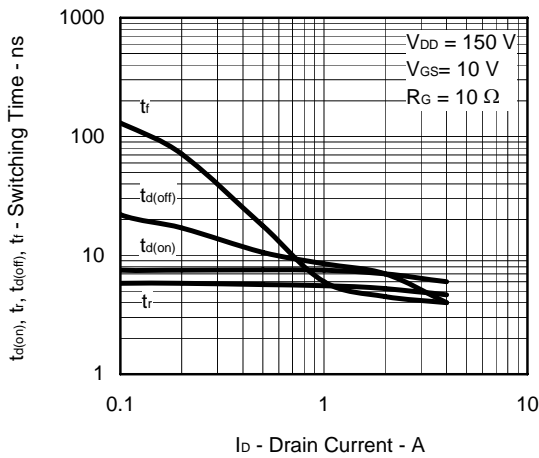
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



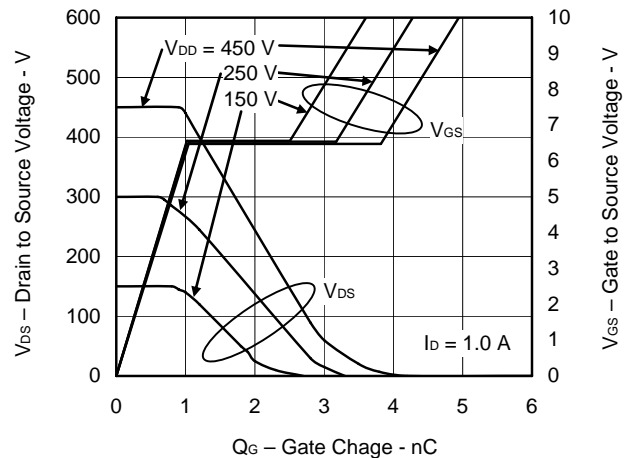
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



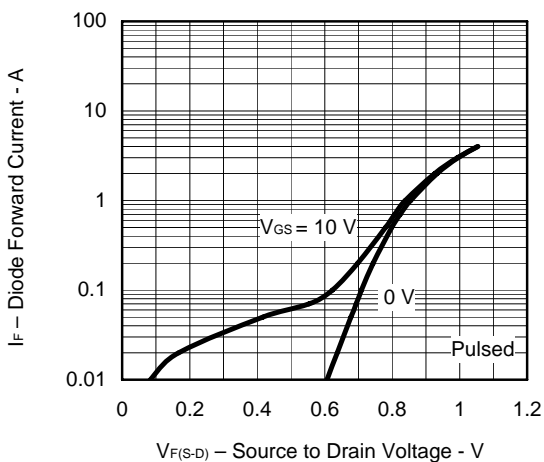
SWITCHING CHARACTERISTICS



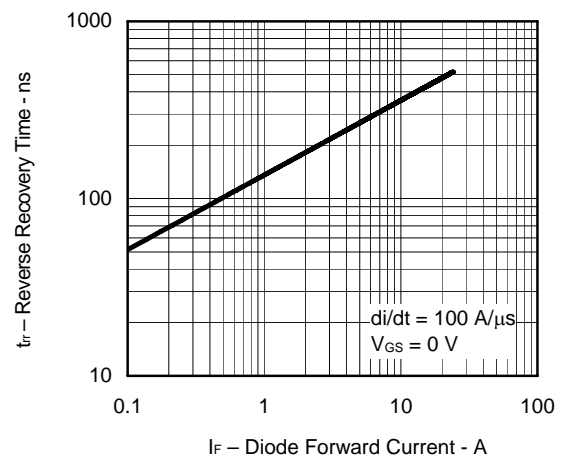
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



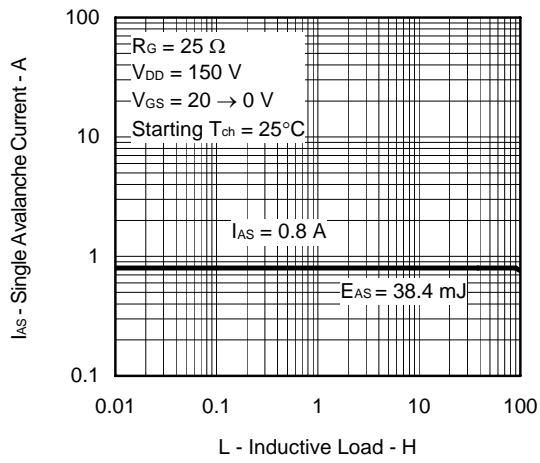
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



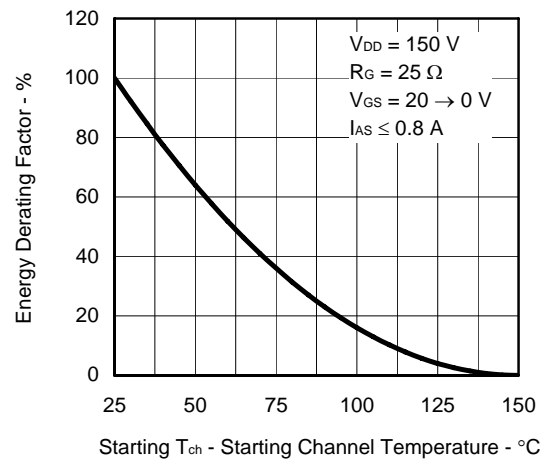
REVERSE RECOVERY TIME vs. DRAIN CURRENT



SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD



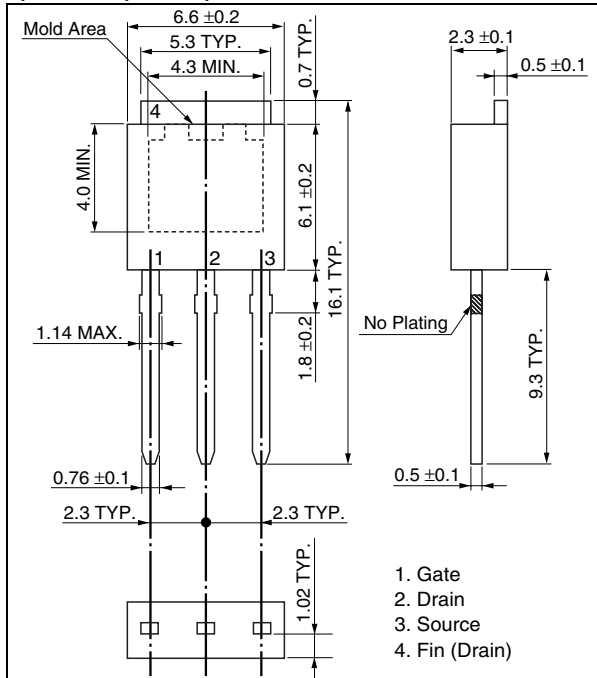
SINGLE AVALANCHE ENERGY DERATING FACTOR



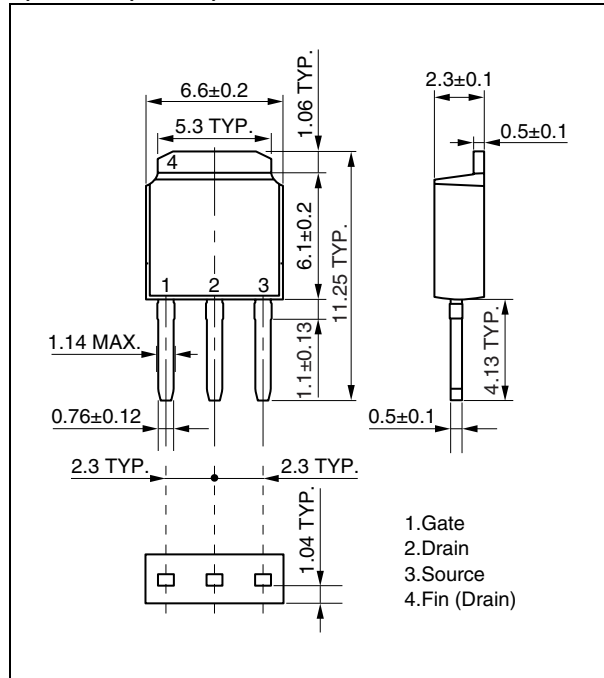


<R> PACKAGE DRAWINGS (Unit: mm)

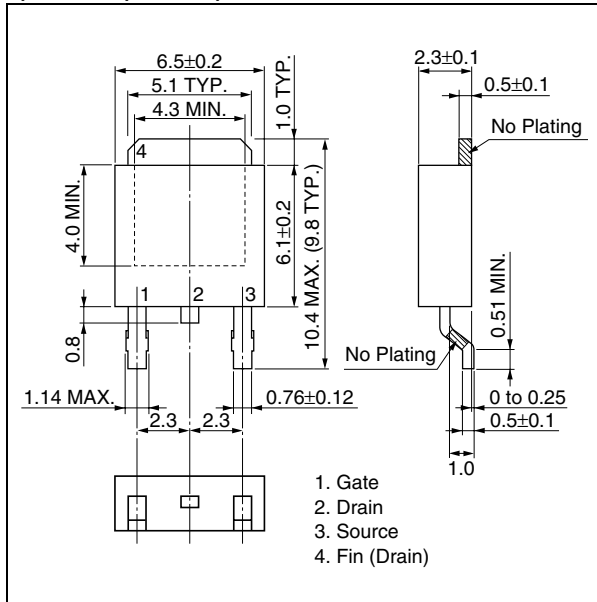
1) TO-251 (MP-3-a)



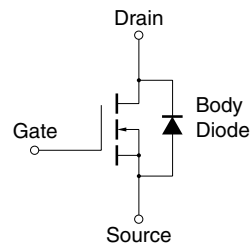
2) TO-251 (MP-3-b)



3) TO-252 (MP-3ZK)



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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