

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

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# MOS FIELD EFFECT TRANSISTOR

# 2SK4080

## SWITCHING

## N-CHANNEL POWER MOS FET

### DESCRIPTION

The 2SK4080 is N-channel MOS FET device that features a low on-state resistance and excellent switching characteristics, and designed for low voltage high current applications such as DC/DC converter with synchronous rectifier.

### FEATURES

- Low on-state resistance  
 $R_{DS(on)1} = 9.0 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 24 \text{ A)}$
- Low  $Q_{GD}$ :  $Q_{GD} = 6.3 \text{ nC TYP.}$
- 4.5 V drive available

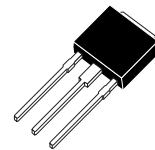
### ORDERING INFORMATION

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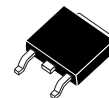
PART NUMBER	PACKAGE
2SK4080(1)-S27-AY <sup>Note</sup>	TO-251 (MP-3-b)
2SK4080-ZK-E1-AY <sup>Note</sup>	TO-252 (MP-3ZK)
2SK4080-ZK-E2-AY <sup>Note</sup>	TO-252 (MP-3ZK)

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

(TO-251)



(TO-252)



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

Drain to Source Voltage (V <sub>GS</sub> = 0 V)	V <sub>DSS</sub>	30	V
Gate to Source Voltage (V <sub>DS</sub> = 0 V)	V <sub>GSS</sub>	±20	V
Drain Current (DC) (T <sub>C</sub> = 25°C)	I <sub>D(DC)</sub>	±48	A
Drain Current (pulse) <sup>Note1</sup>	I <sub>D(pulse)</sub>	±144	A
Total Power Dissipation (T <sub>C</sub> = 25°C)	P <sub>T1</sub>	29	W
Total Power Dissipation	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>Note2</sup>	I <sub>AS</sub>	21	A
Single Avalanche Energy <sup>Note2</sup>	E <sub>AS</sub>	44.1	mJ

**Notes 1.** PW ≤ 10 μs, Duty Cycle ≤ 1%

**2.** Starting T<sub>ch</sub> = 25°C, V<sub>DD</sub> = 15 V, R<sub>G</sub> = 25 Ω, V<sub>GS</sub> = 20 → 0 V, L = 100 μH

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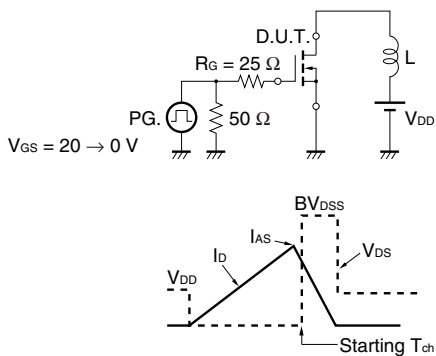
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**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

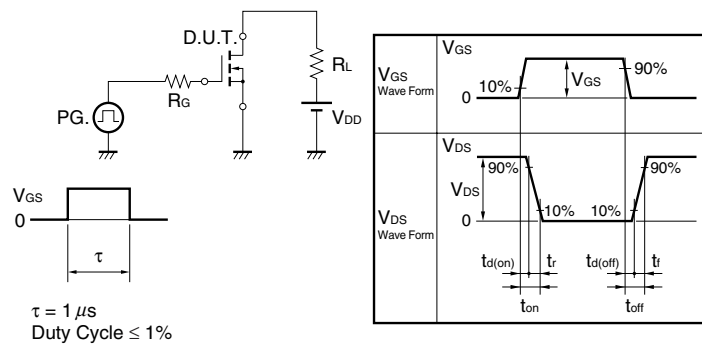
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>bss</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			10	μA
Gate Leakage Current	I <sub>gss</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±100	nA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	1.5	2.0	2.5	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 12 A	7	14		S
Drain to Source On-state Resistance <sup>Note</sup>	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 24 A		7.0	9.0	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 24 A		10.2	15	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		1670		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		290		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> = 15 V		10		ns
Rise Time	t <sub>r</sub>	I <sub>D</sub> = 30 A		5.3		ns
Turn-off Delay Time	t <sub>d(off)</sub>	V <sub>GS</sub> = 12 V		42		ns
Fall Time	t <sub>f</sub>	R <sub>G</sub> = 3 Ω		6.1		ns
Total Gate Charge	Q <sub>G1</sub>	V <sub>DD</sub> = 15 V, V <sub>GS</sub> = 12 V, I <sub>D</sub> = 30 A		32		nC
	Q <sub>G2</sub>	V <sub>DD</sub> = 15 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 30 A		13		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>DD</sub> = 15 V		4.6		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 30 A		6.3		nC
Gate Resistance	R <sub>G</sub>			2.4		Ω
Body Diode Forward Voltage <sup>Note</sup>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V		0.94	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V		29		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		23		nC

**Note** Pulsed

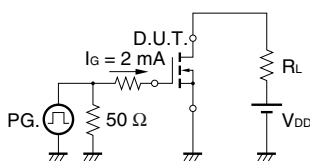
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



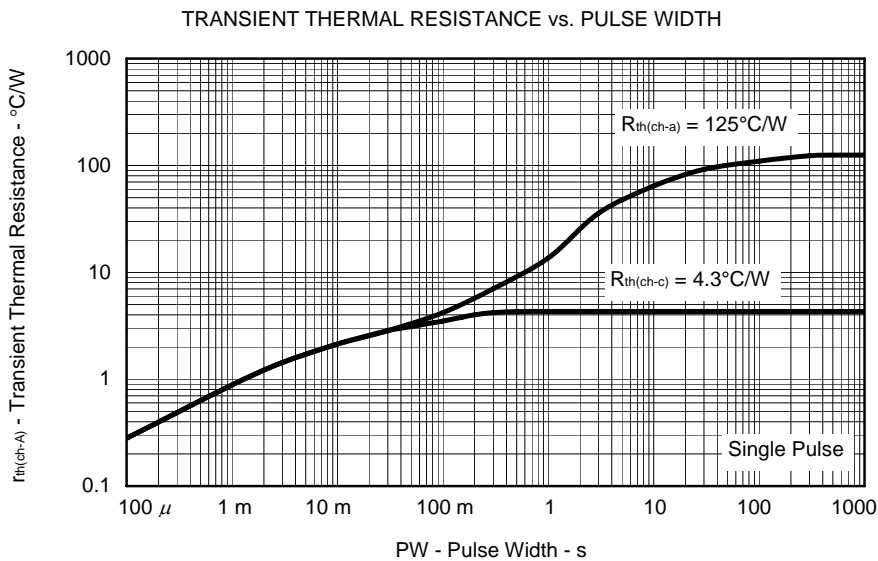
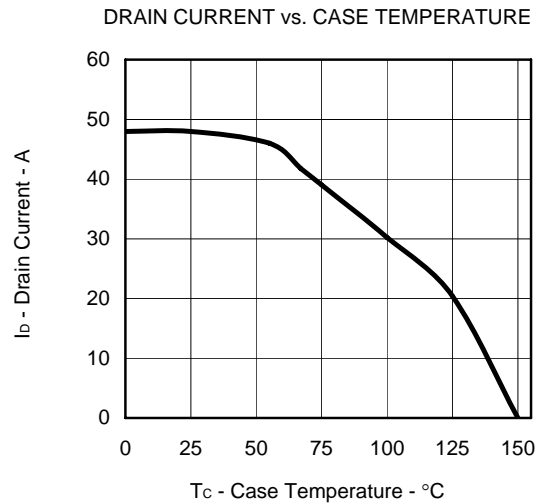
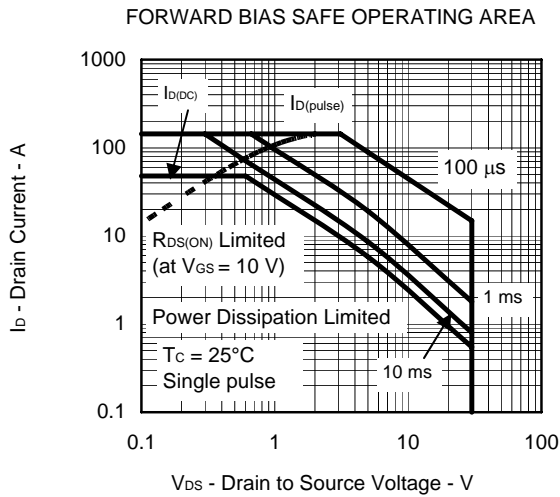
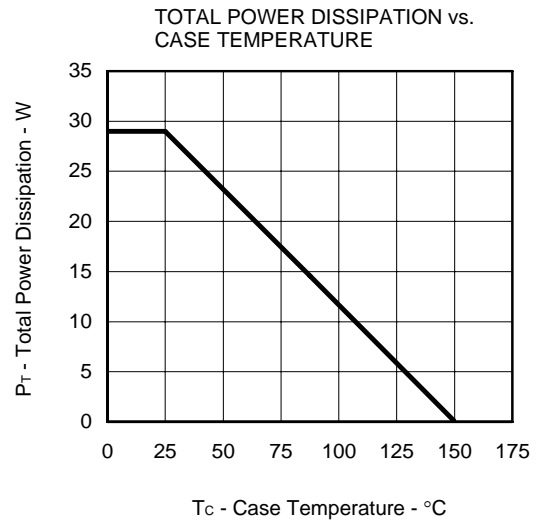
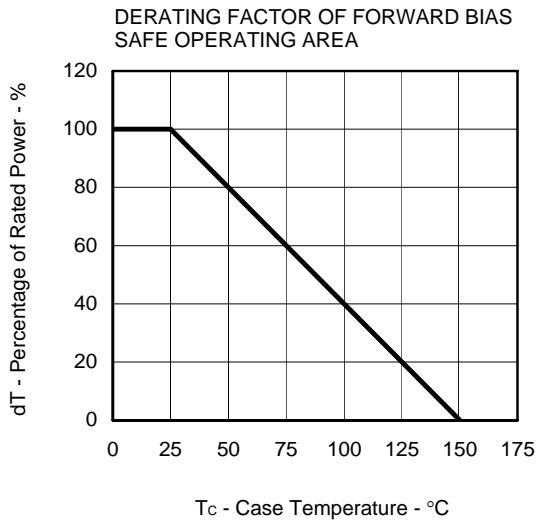
**TEST CIRCUIT 2 SWITCHING TIME**



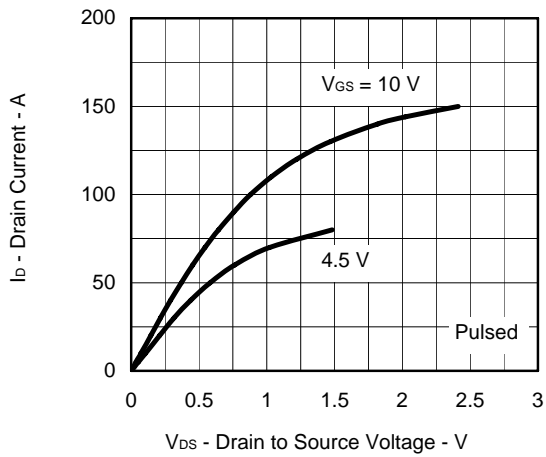
**TEST CIRCUIT 3 GATE CHARGE**



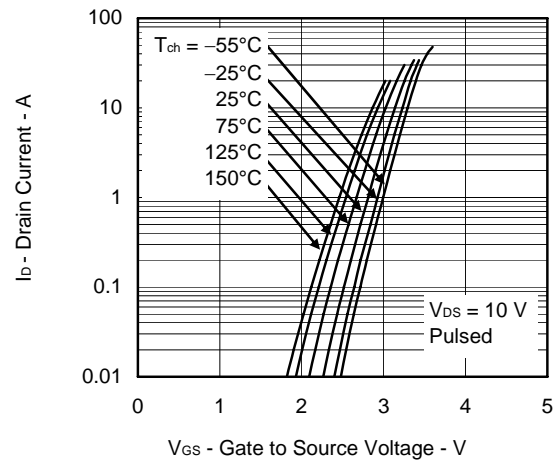
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



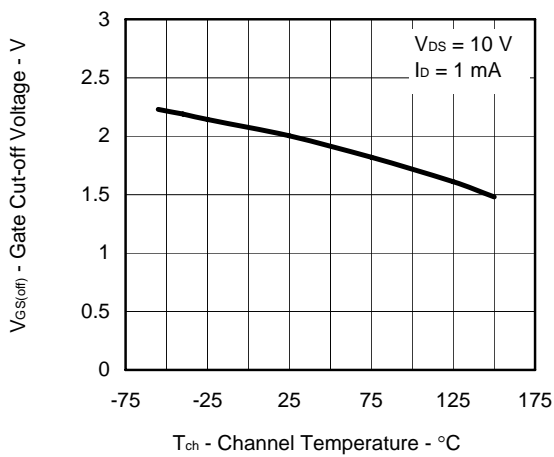
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



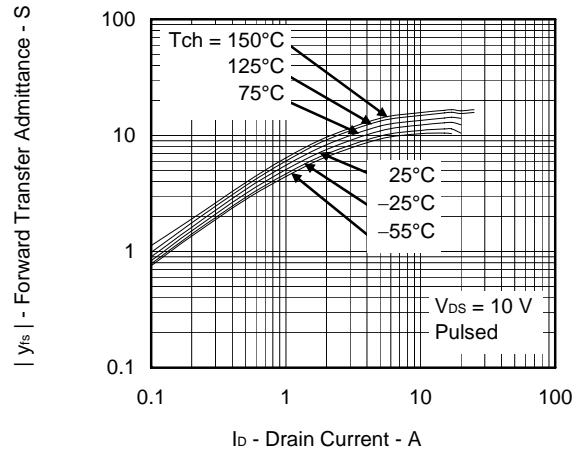
FORWARD TRANSFER CHARACTERISTICS



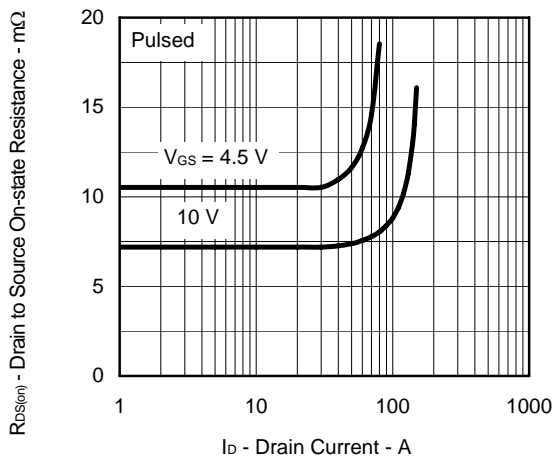
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



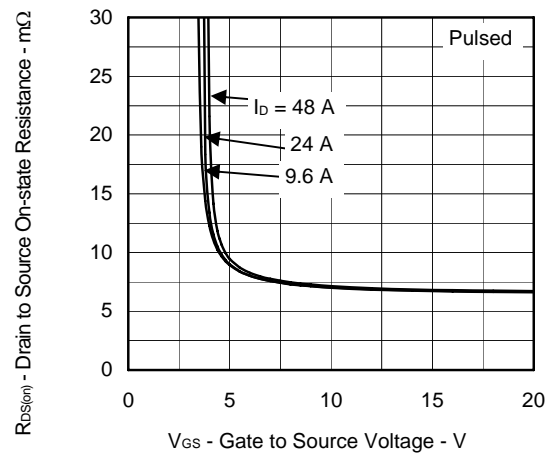
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



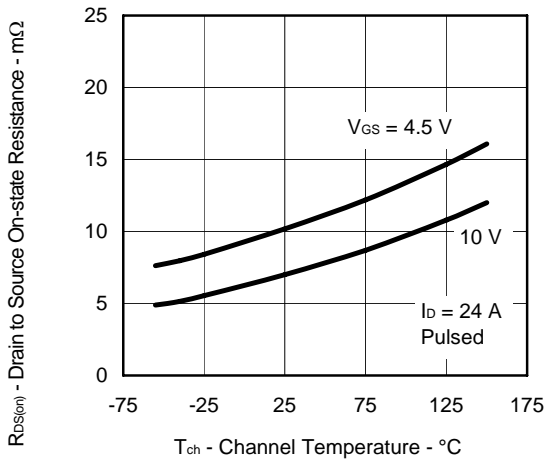
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



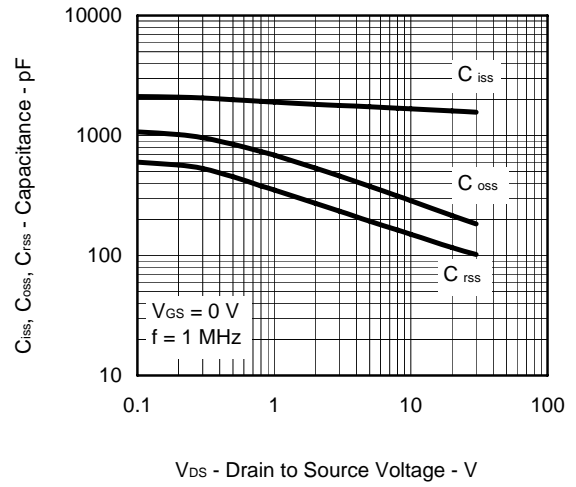
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



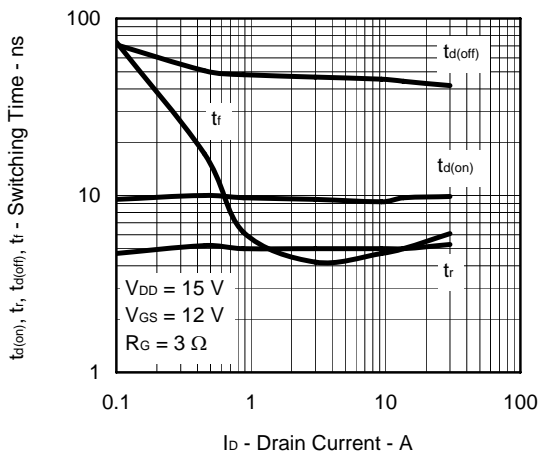
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



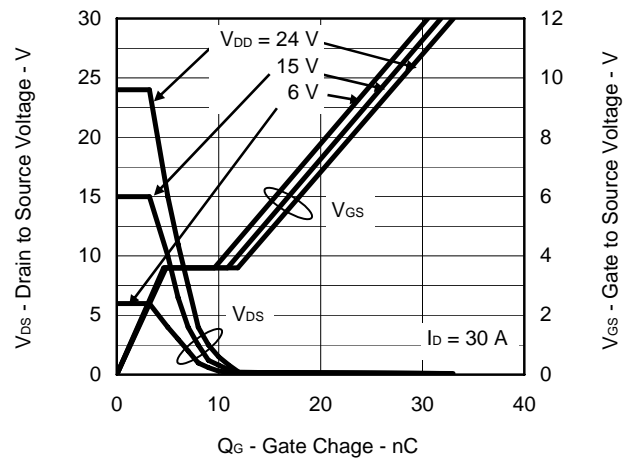
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



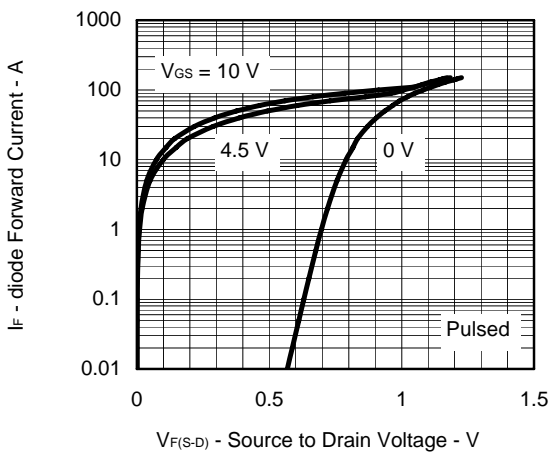
SWITCHING CHARACTERISTICS



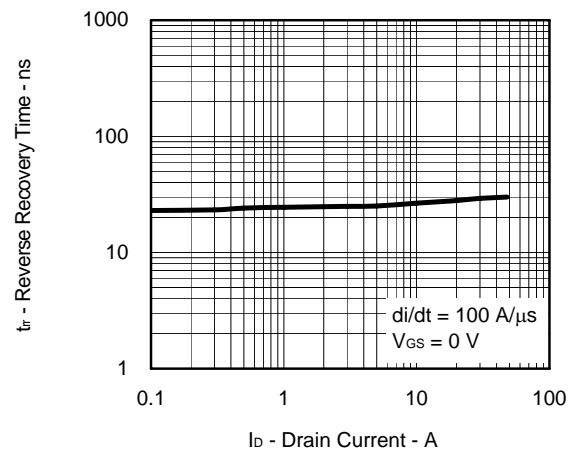
DYNAMIC INPUT/OUTPUT CHARACTERISTICS

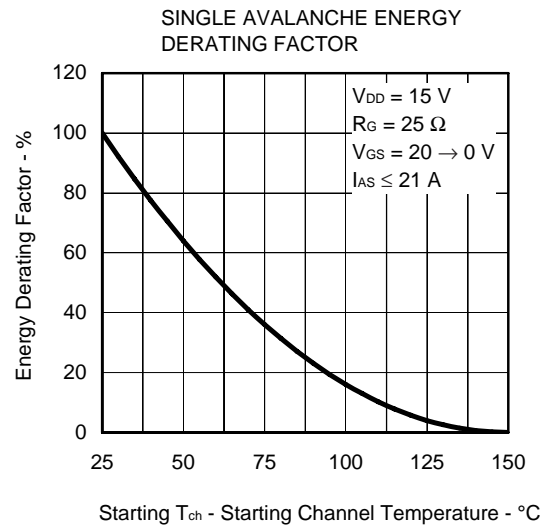
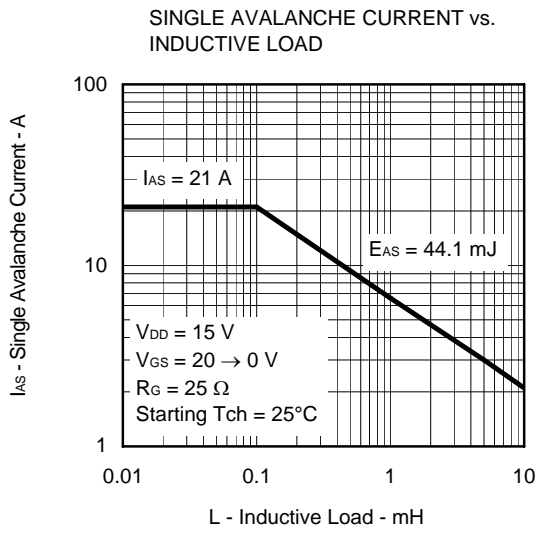


SOURCE TO DRAIN DIODE FORWARD VOLTAGE



REVERSE RECOVERY TIME vs. DRAIN CURRENT



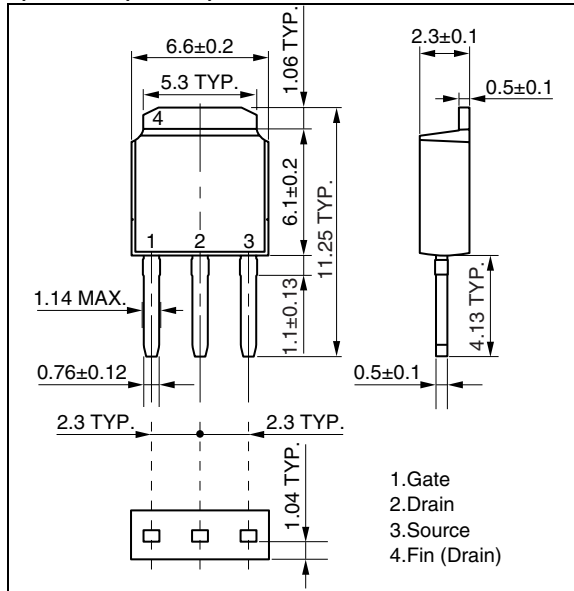




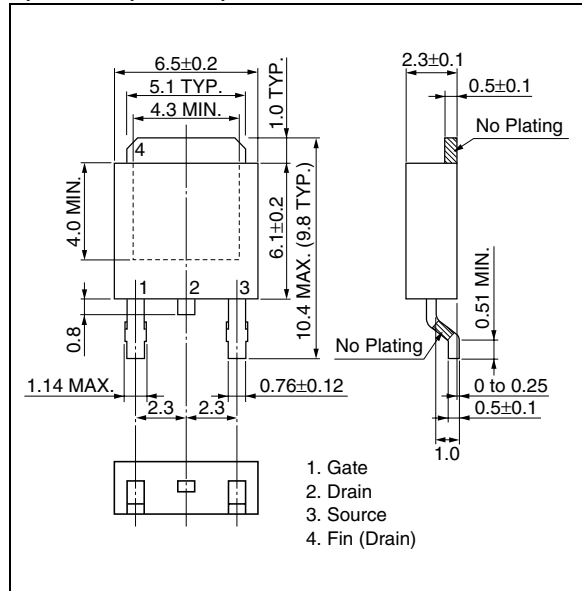
PACKAGE DRAWINGS (Unit: mm)

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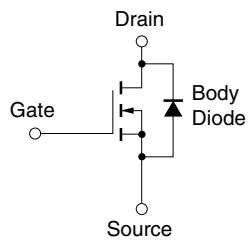
1) TO-251 (MP-3-b)



2) TO-252 (MP-3ZK)



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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