

### SWITCHING N-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SK3902 is N-channel MOS Field Effect Transistor designed for high current switching applications.

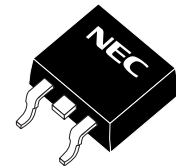
#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3902-ZK	TO-263 (MP-25ZK)

#### FEATURES

- Super low On-state resistance  
 $R_{DS(on)1} = 21 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 15 \text{ A)}$   
 $R_{DS(on)2} = 26 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 15 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 1200 \text{ pF TYP.}$
- Built-in gate protection diode

(TO-263)



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

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	60	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 30$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 90$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	45	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	1.5	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	40	mJ
Repetitive Avalanche Current <sup>Note3</sup>	$I_{AR}$	20	A
Repetitive Avalanche Energy <sup>Note3</sup>	$E_{AR}$	40	mJ

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

**2.** Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 30 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$ ,  $L = 100 \mu\text{H}$

**3.**  $R_G = 25 \Omega$ ,  $T_{ch(peak)} \leq 150^\circ\text{C}$

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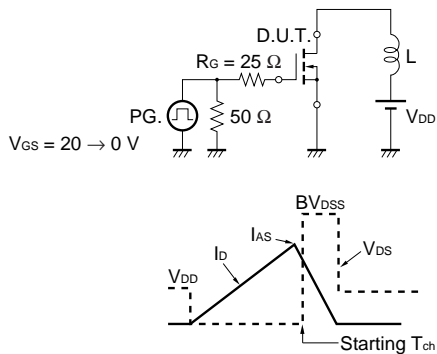
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**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

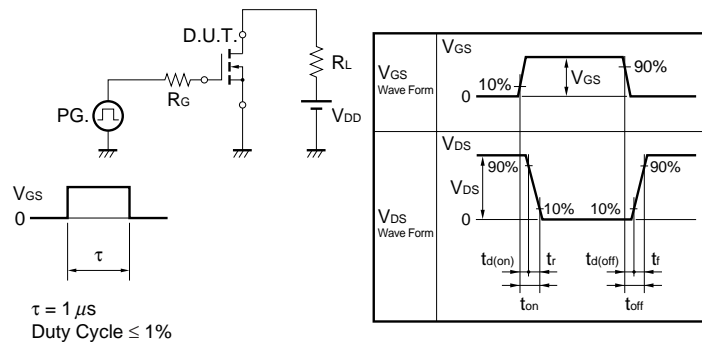
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			10	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±10	μA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <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> = 15 A	9.5	19		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> = 15 A		16.8	21	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 15 A		19.5	26	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		1200		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		250		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		85		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, I <sub>D</sub> = 15 A		10		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V		4		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 0 Ω		37		ns
Fall Time	t <sub>f</sub>			4		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 48 V		25		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		4.5		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 30 A		6.0		nC
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		0.92	1.5	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 30 A, V <sub>GS</sub> = 0 V		31		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		34		nC

**Note** Pulsed

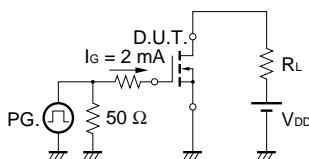
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



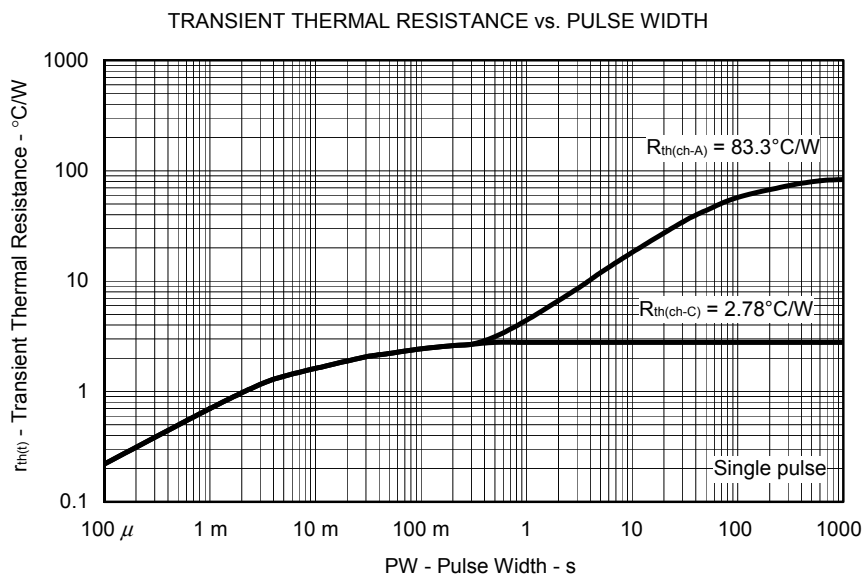
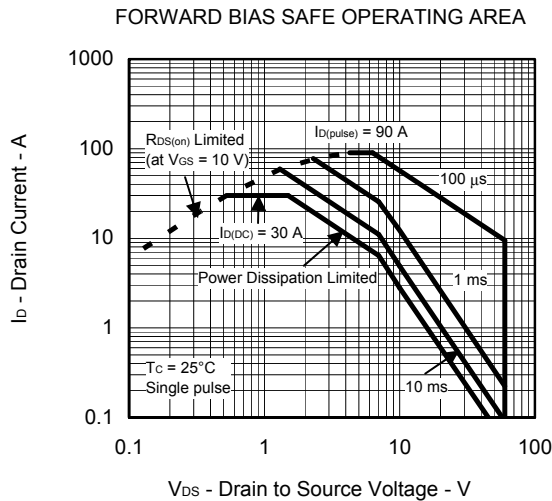
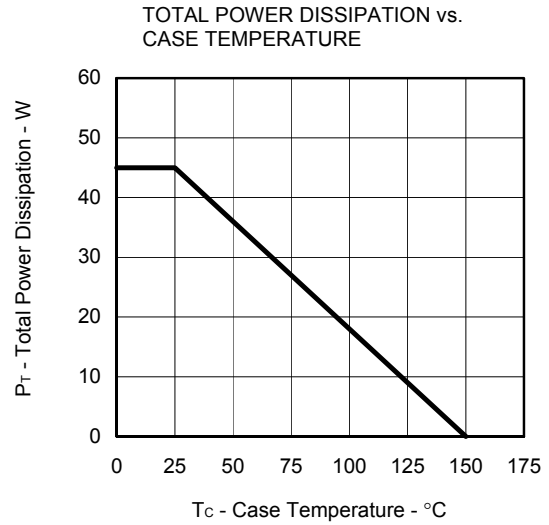
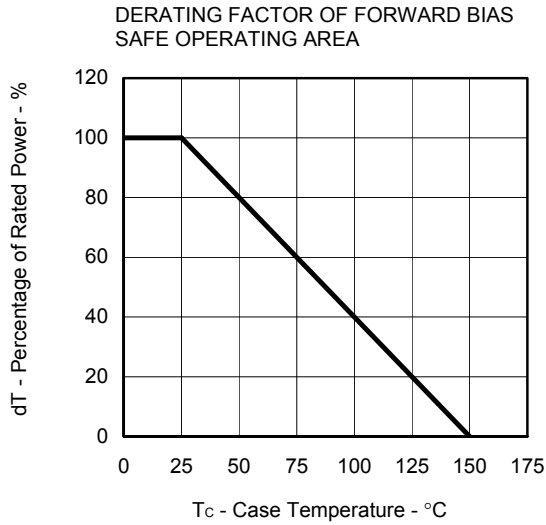
**TEST CIRCUIT 2 SWITCHING TIME**



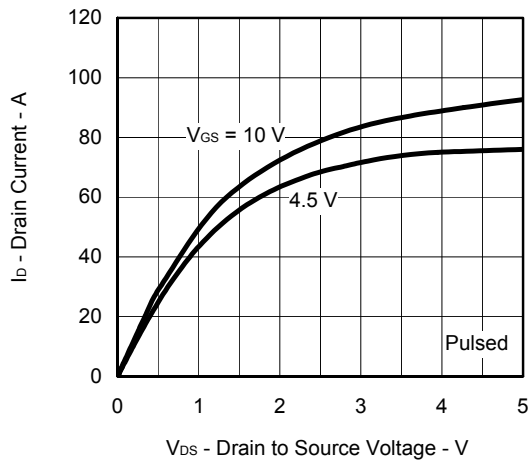
**TEST CIRCUIT 3 GATE CHARGE**



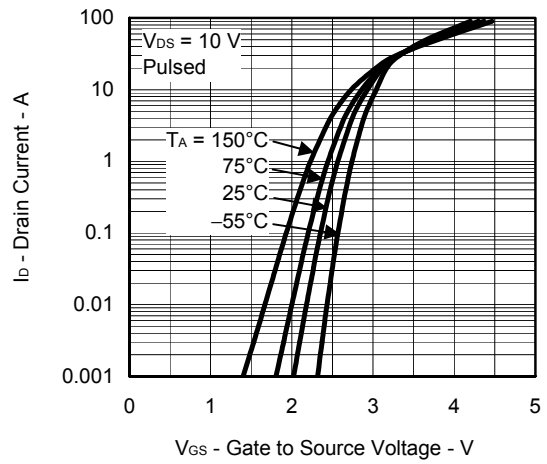
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



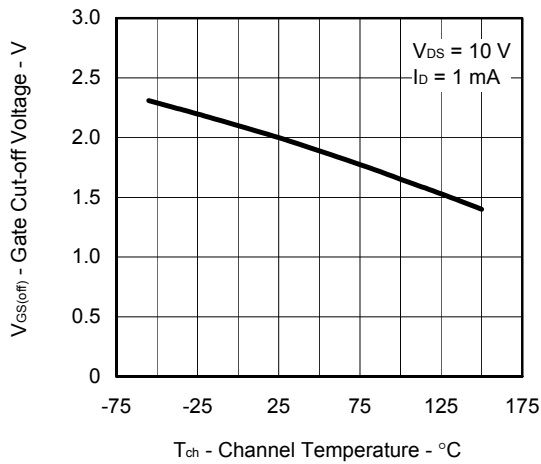
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



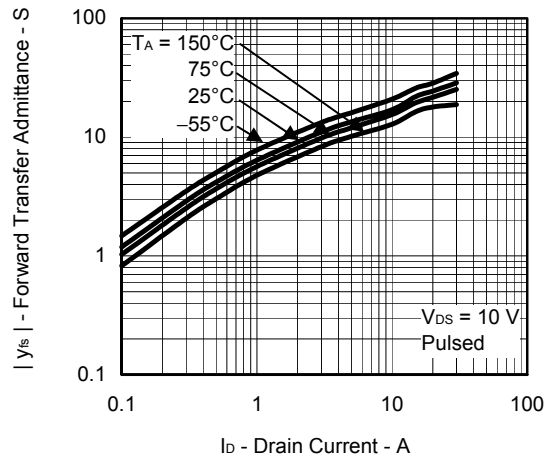
FORWARD TRANSFER CHARACTERISTICS



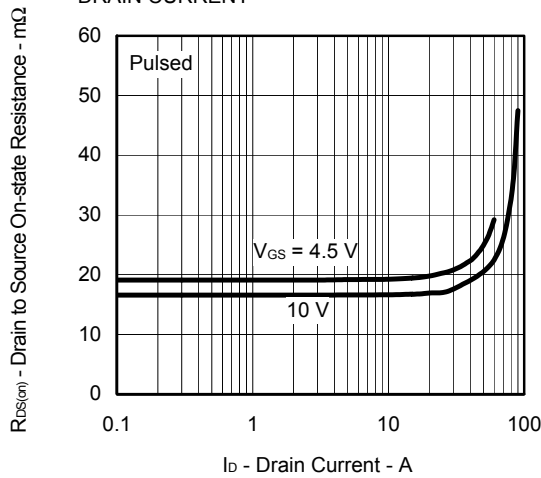
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



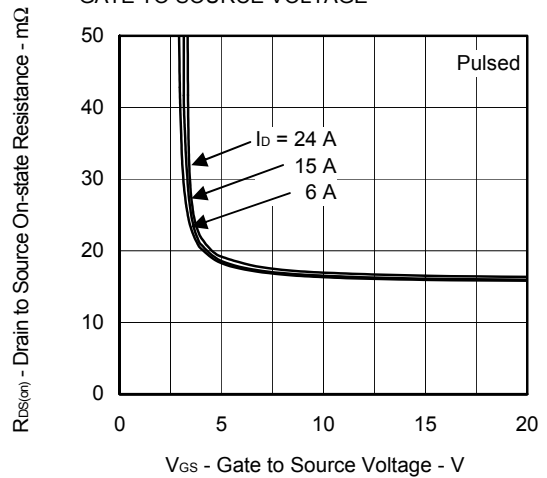
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



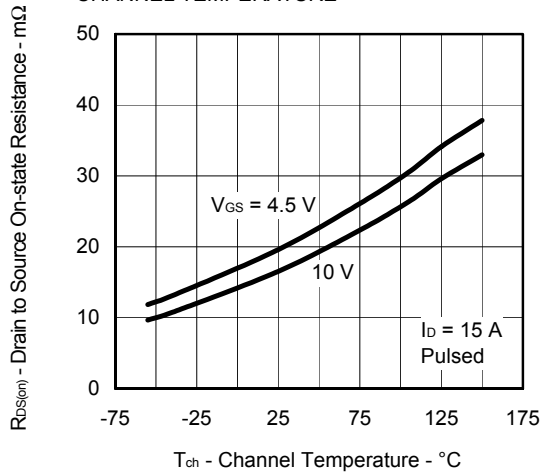
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



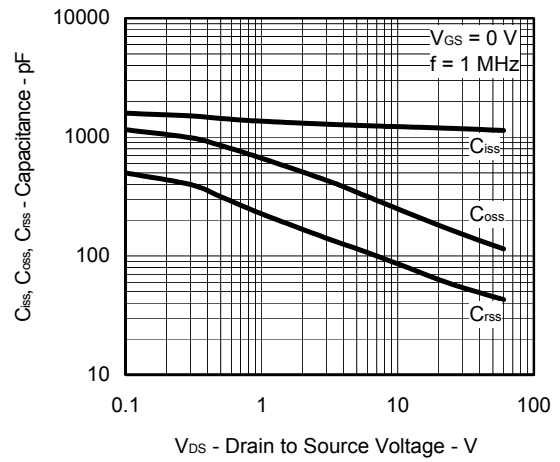
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



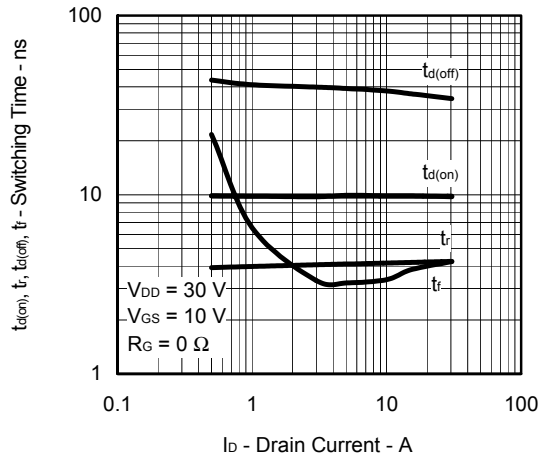
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



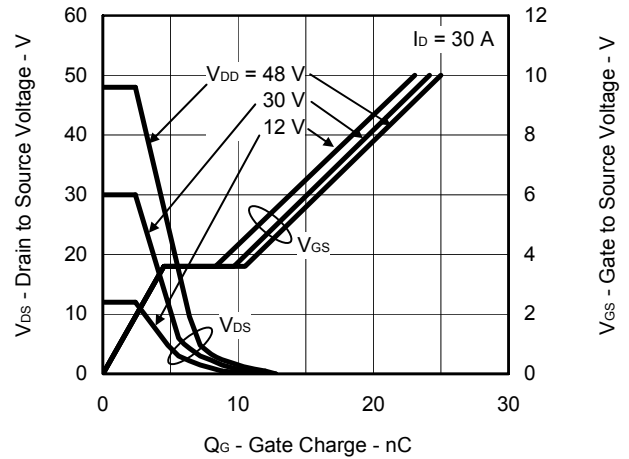
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



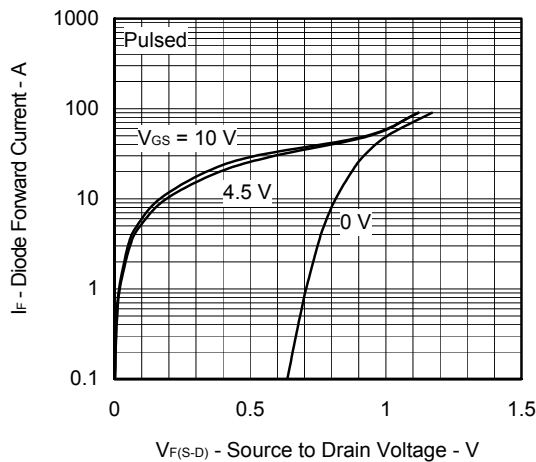
SWITCHING CHARACTERISTICS



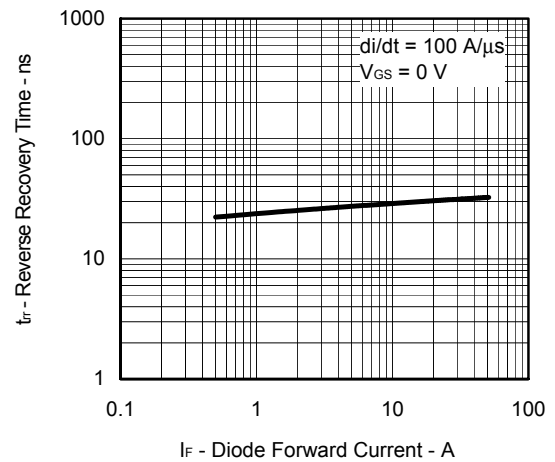
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



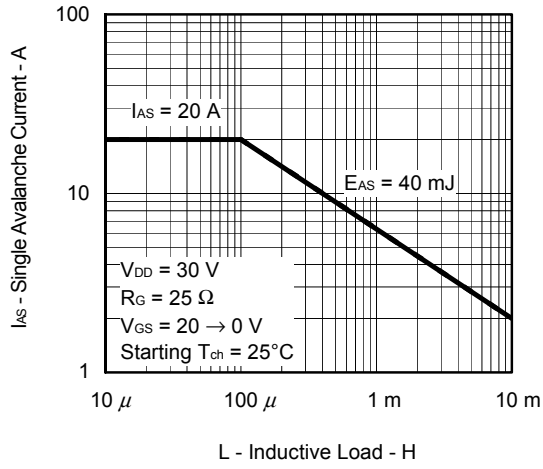
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



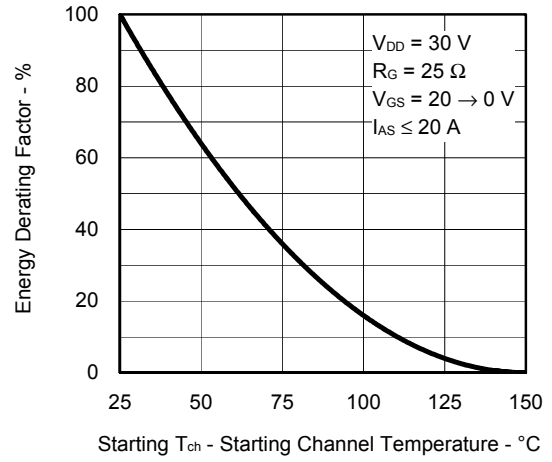
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD

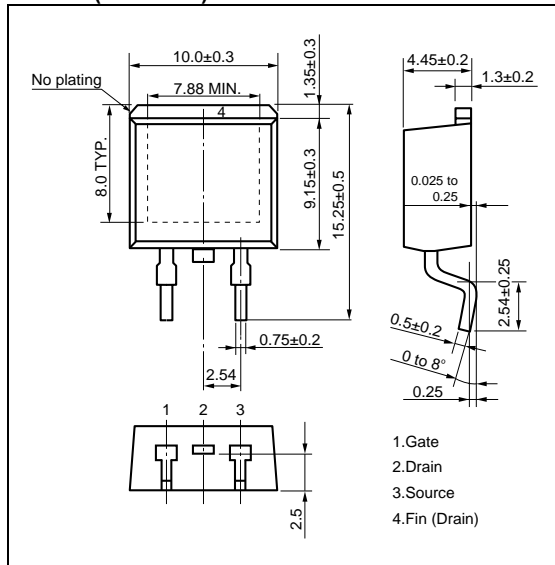


SINGLE AVALANCHE ENERGY DERATING FACTOR

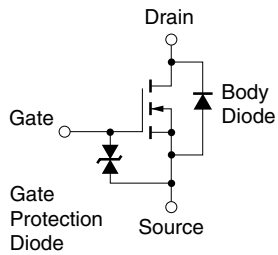


PACKAGE DRAWING (Unit: mm)

TO-263 (MP-25ZK)



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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