

# MOS FIELD EFFECT TRANSISTOR

# 2SK3456

## SWITCHING

### N-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SK3456 is N-channel DMOS FET device that features a low gate charge and excellent switching characteristics, designed for high voltage applications such as switching power supply, AC adapter.

#### FEATURES

- Low gate charge  
 $Q_G = 30 \text{ nC TYP. (} V_{DD} = 400 \text{ V, } V_{GS} = 10 \text{ V, } I_D = 12 \text{ A)}$
- Gate voltage rating  $\pm 30 \text{ V}$
- Low on-state resistance  
 $R_{DS(on)} = 0.60 \text{ } \Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 6.0 \text{ A)}$
- Avalanche capability ratings
- Surface mount package available

#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3456	TO-220AB
2SK3456-S	TO-262
2SK3456-ZJ	TO-263

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

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	500	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 30$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 12$	A
Drain Current (Pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 36$	A
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T1}$	1.5	W
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T2}$	100	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>	$I_{AS}$	12	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	103	mJ

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

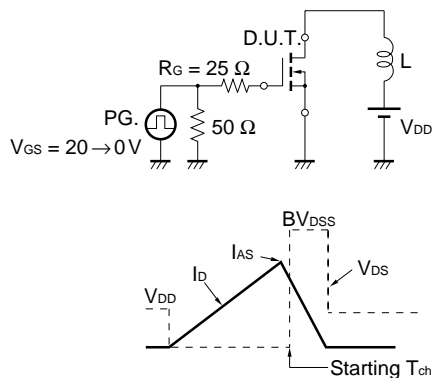
2. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 150 \text{ V}$ ,  $R_G = 25 \text{ } \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$

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 Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

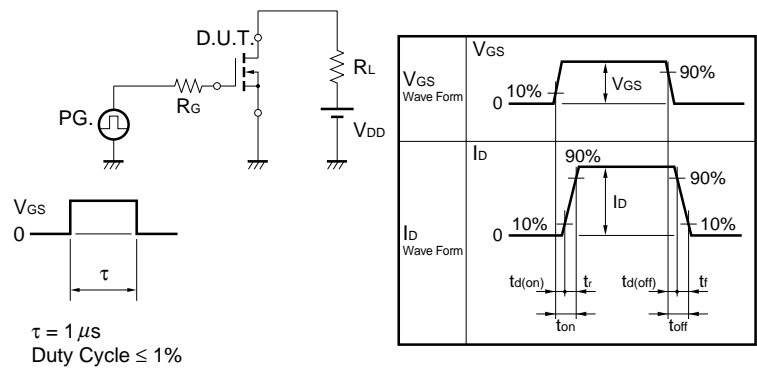
**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 500\text{ V}, V_{GS} = 0\text{ V}$			100	$\mu\text{A}$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 30\text{ V}, V_{DS} = 0\text{ V}$			$\pm 100$	nA
Gate Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	2.5		3.5	V
Forward Transfer Admittance	$ y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 6.0\text{ A}$	2.0			S
Drain to Source On-state Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 6.0\text{ A}$		0.48	0.60	$\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}$		1620		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}$		250		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1\text{ MHz}$		10		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 150\text{ V}, I_D = 6.0\text{ A}$		24		ns
Rise Time	$t_r$	$V_{GS} = 10\text{ V}$		18		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 10\ \Omega$		50		ns
Fall Time	$t_f$			15		ns
Total Gate Charge	$Q_G$	$V_{DD} = 400\text{ V}$		30		nC
Gate to Source Charge	$Q_{GS}$	$V_{GS} = 10\text{ V}$		9		nC
Gate to Drain Charge	$Q_{GD}$	$I_D = 12\text{ A}$		11		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	$I_F = 12\text{ A}, V_{GS} = 0\text{ V}$		1.0		V
Reverse Recovery Time	$t_{rr}$	$I_F = 12\text{ A}, V_{GS} = 0\text{ V}$		1.5		$\mu\text{s}$
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 50\text{ A}/\mu\text{s}$		11		$\mu\text{C}$

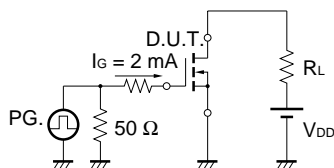
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



**TEST CIRCUIT 2 SWITCHING TIME**

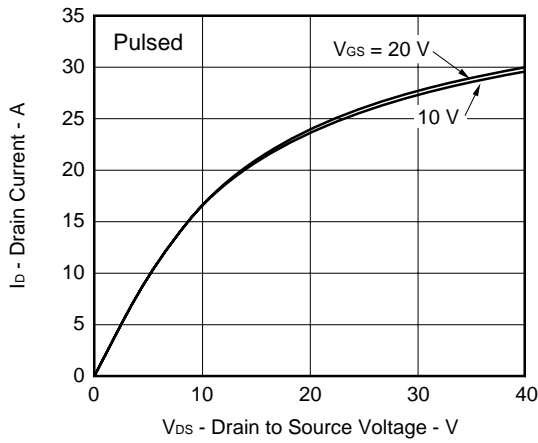


**TEST CIRCUIT 3 GATE CHARGE**

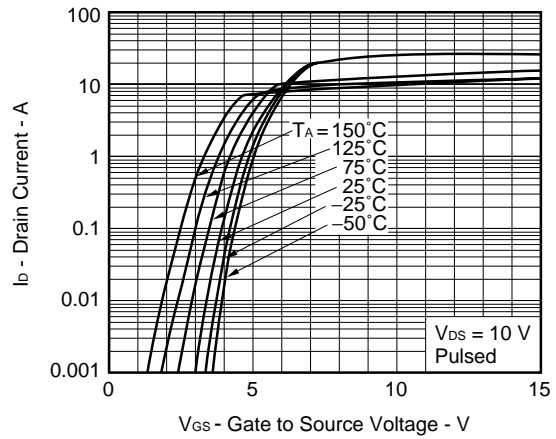


TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

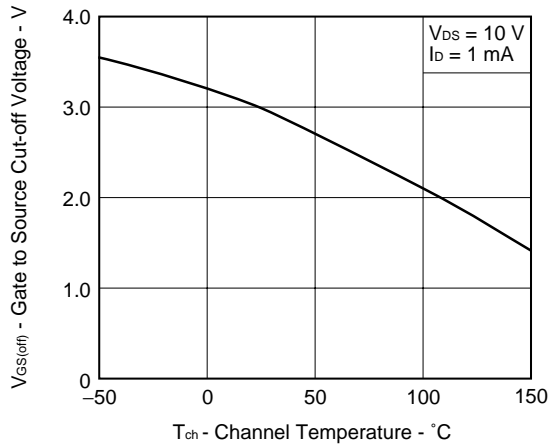
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



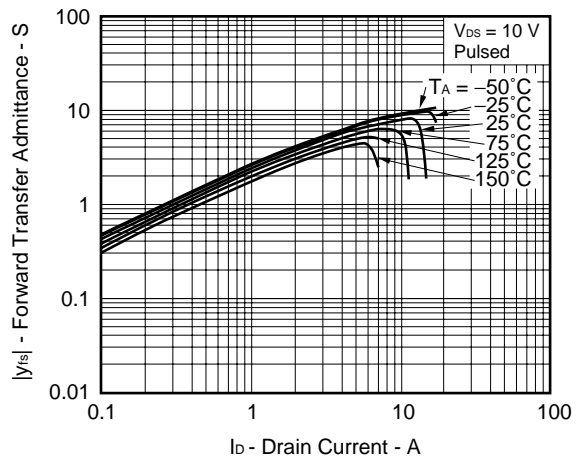
FORWARD TRANSFER CHARACTERISTICS



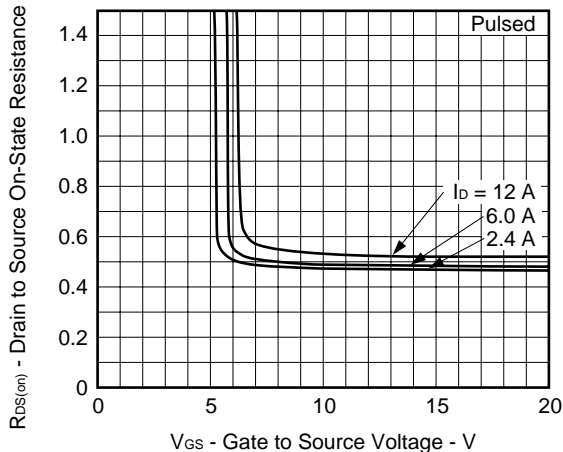
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



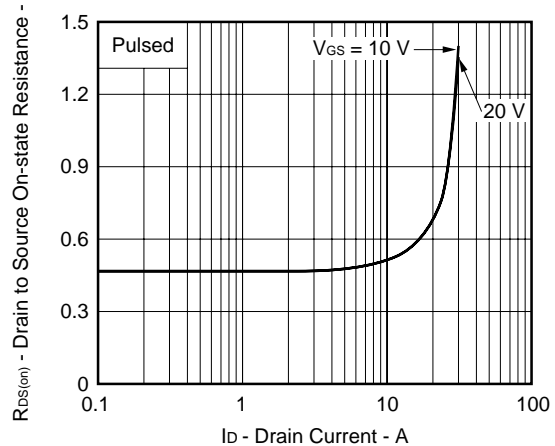
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT

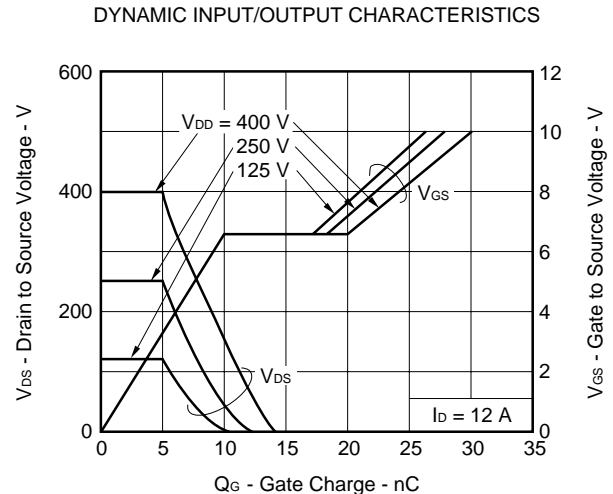
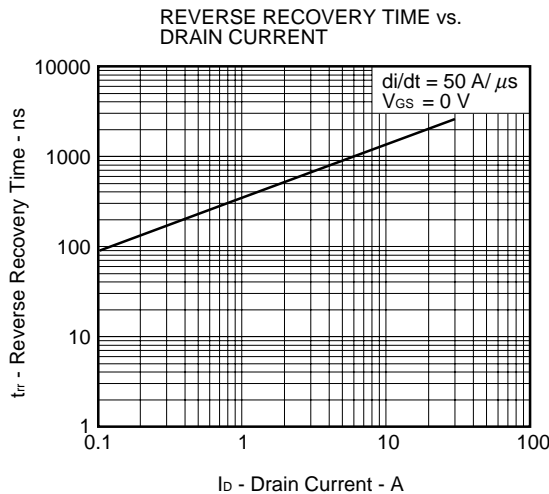
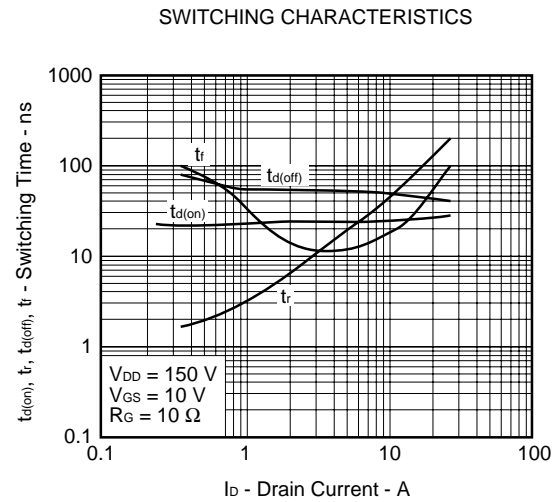
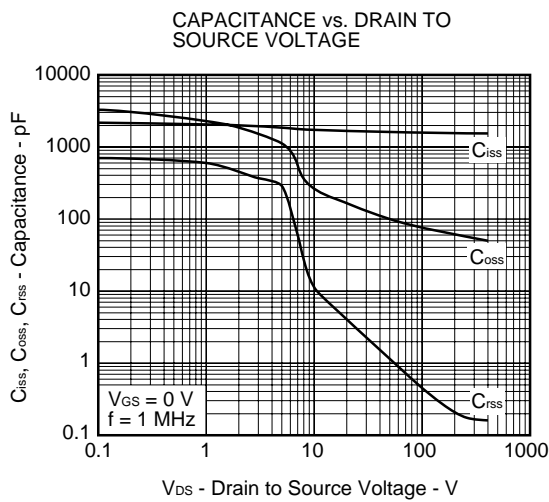
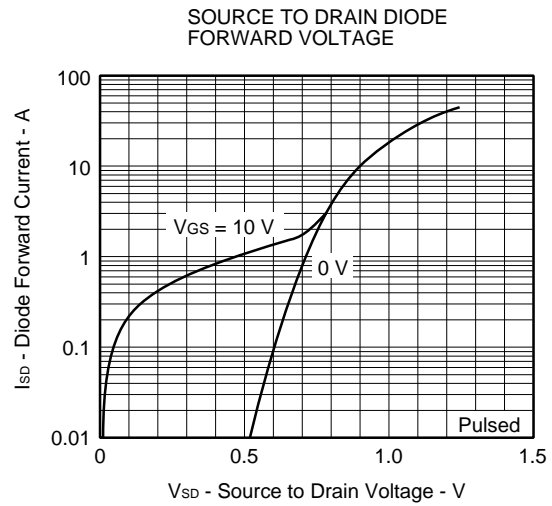
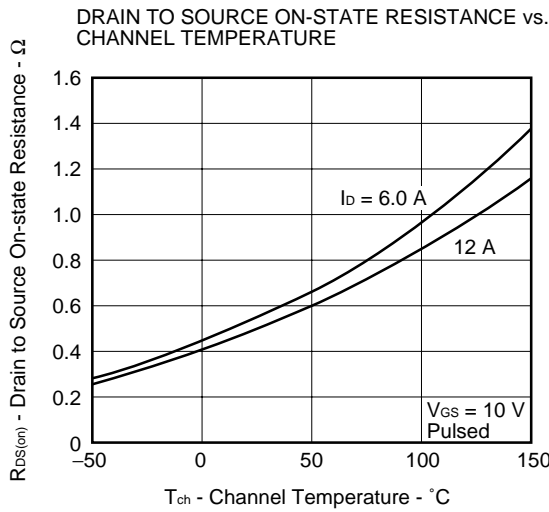


DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

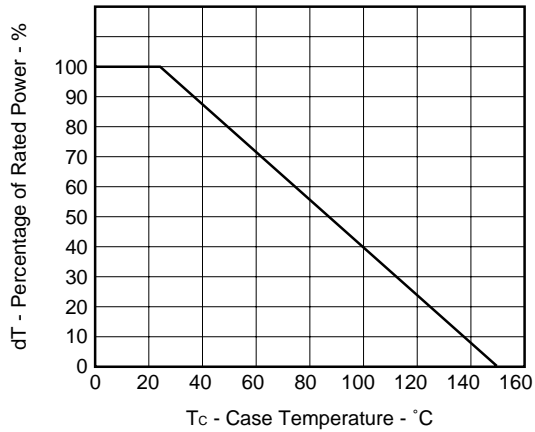


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT

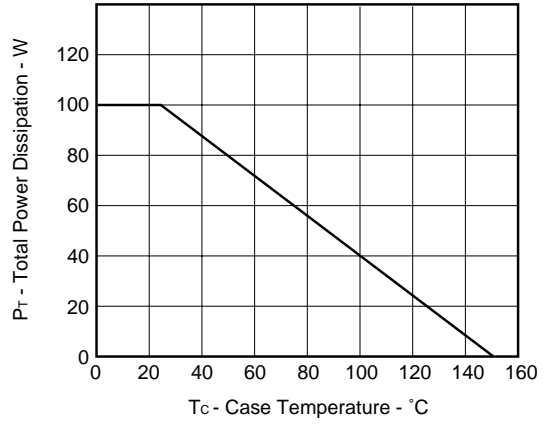




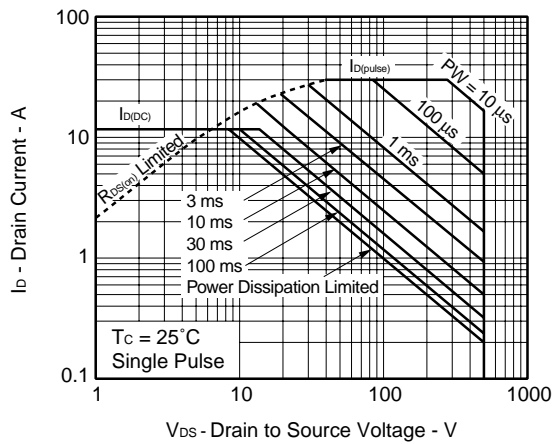
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



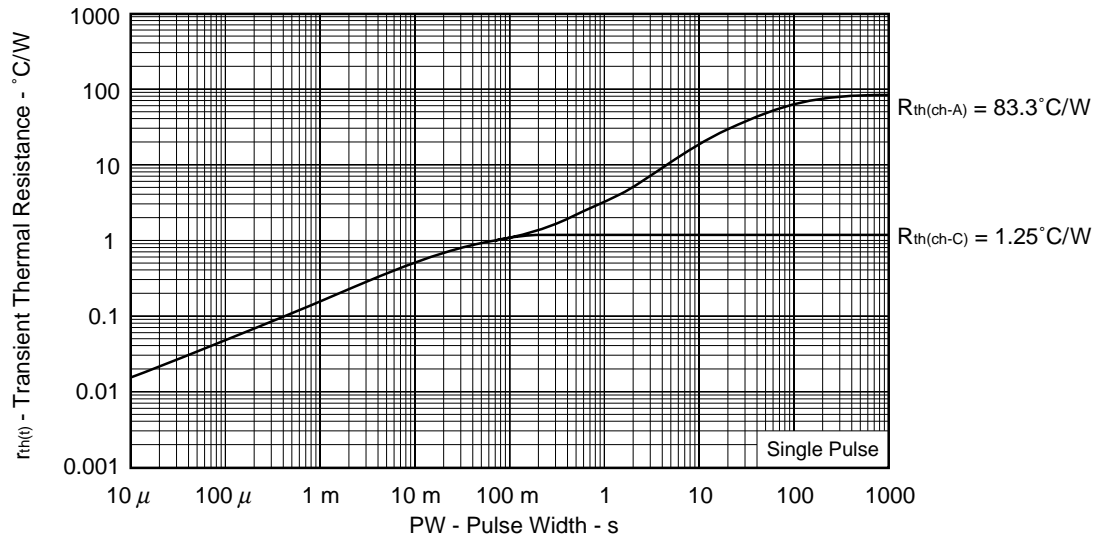
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



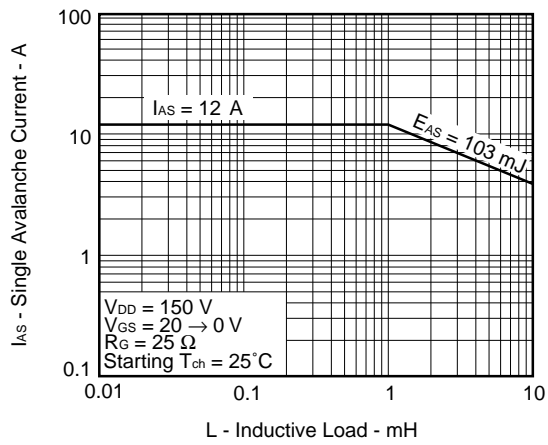
FORWARD BIAS SAFE OPERATING AREA



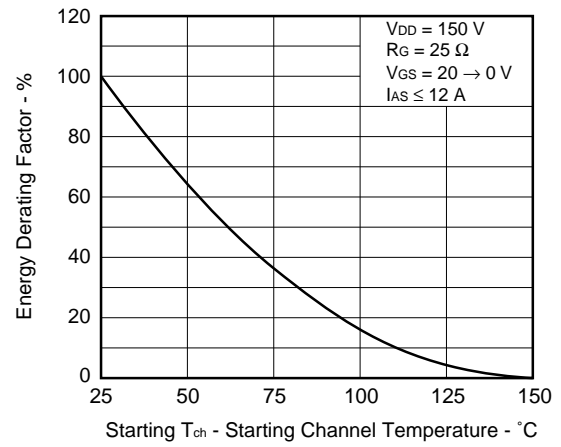
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD

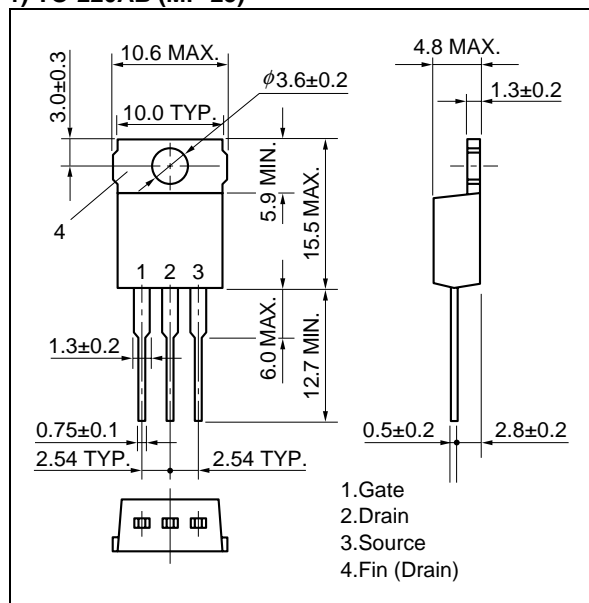


SINGLE AVALANCHE ENERGY DERATING FACTOR

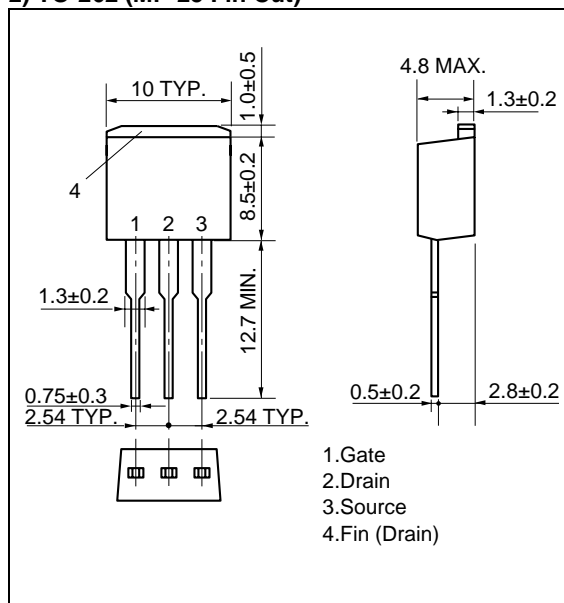


PACKAGE DRAWINGS (Unit: mm)

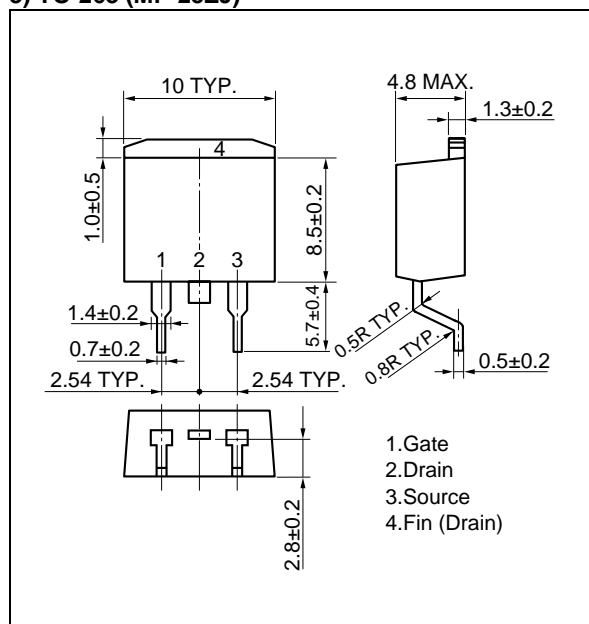
1) TO-220AB (MP-25)



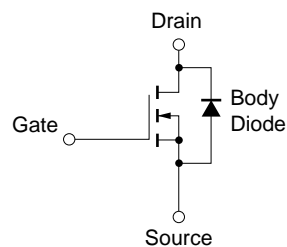
2) TO-262 (MP-25 Fin Cut)



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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