

# MOS FIELD EFFECT TRANSISTOR

# 2SK3056

## SWITCHING

## N-CHANNEL POWER MOS FET

## INDUSTRIAL USE

### DESCRIPTION

The 2SK3056 is N-Channel MOS Field Effect Transistor designed for high current switching applications.

### FEATURES

- Low On-state Resistance  
 $R_{DS(on)1} = 34 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 16 \text{ A)}$   
 $R_{DS(on)2} = 50 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.0 \text{ V, } I_D = 16 \text{ A)}$
- Low  $C_{iss}$  :  $C_{iss} = 920 \text{ pF TYP.}$
- Built-in Gate Protection Diode

### 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 ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS(AC)}$	$\pm 20$	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS(DC)}$	+20, -10	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 32$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 100$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	34	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 Current <sup>Note2</sup>	$I_{AS}$	16	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	25.6	mJ

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

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

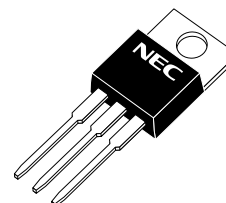
### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3056	TO-220AB
2SK3056-S	TO-262
2SK3056-ZJ	TO-263
2SK3056-Z	TO-220SMD <sup>Note</sup>

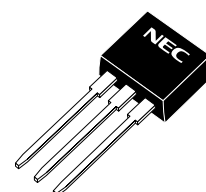
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★ **Note** TO-220SMD package is produced only in Japan.

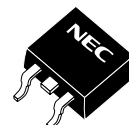
(TO-220AB)



(TO-262)



(TO-263, TO-220SMD)

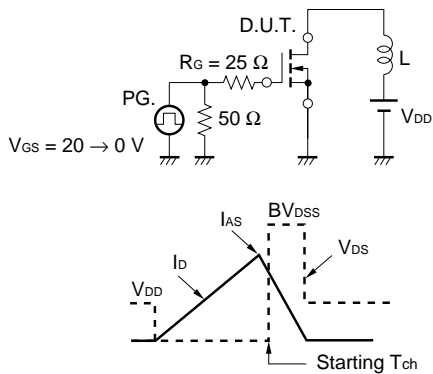


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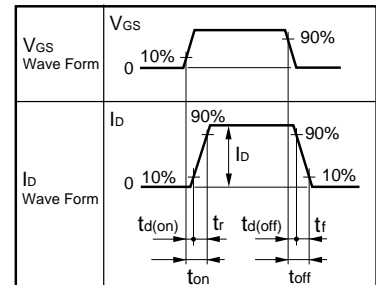
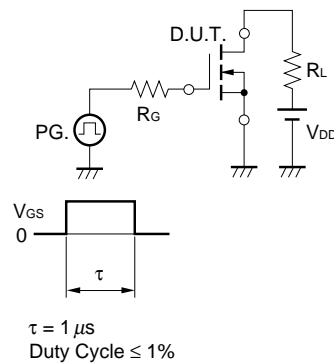
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)**

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	1.0	1.5	2.0	V
Forward Transfer Admittance	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 16 A	8.0	20		S
Drain to Source On-state Resistance	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 16 A		24	34	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 16 A		35	50	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		920		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		280		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		120		pF
Turn-on Delay Time	t <sub>d(on)</sub>	I <sub>D</sub> = 16 A		25		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V		300		ns
Turn-off Delay Time	t <sub>d(off)</sub>	V <sub>DD</sub> = 30 V		70		ns
Fall Time	t <sub>f</sub>	R <sub>G</sub> = 10 Ω		120		ns
Total Gate Charge	Q <sub>G</sub>	I <sub>D</sub> = 32 A		25		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>DD</sub> = 48 V		3.3		nC
Gate to Drain Charge	Q <sub>GD</sub>	V <sub>GS</sub> = 10 V		7.0		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 32 A, V <sub>GS</sub> = 0 V		1.0		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 32A, V <sub>GS</sub> = 0 V		50		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs		68		nC

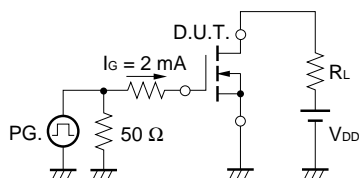
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



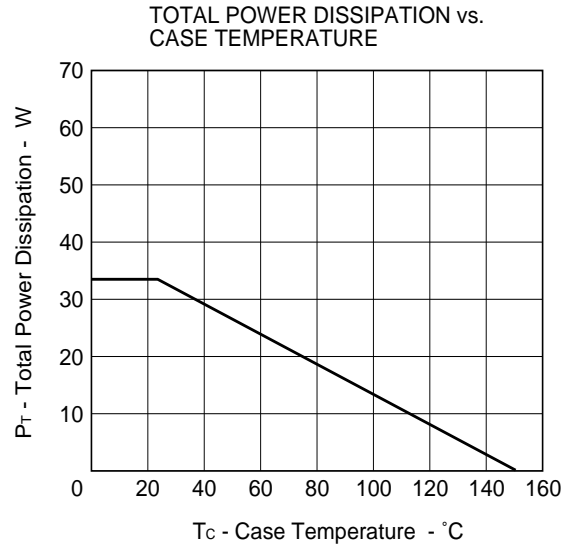
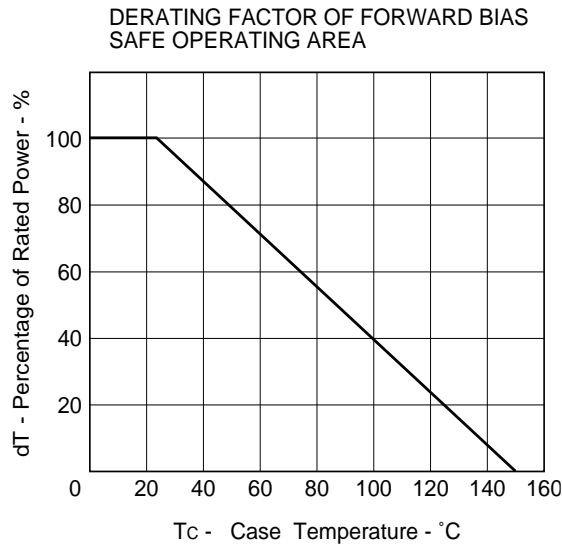
**TEST CIRCUIT 2 SWITCHING TIME**



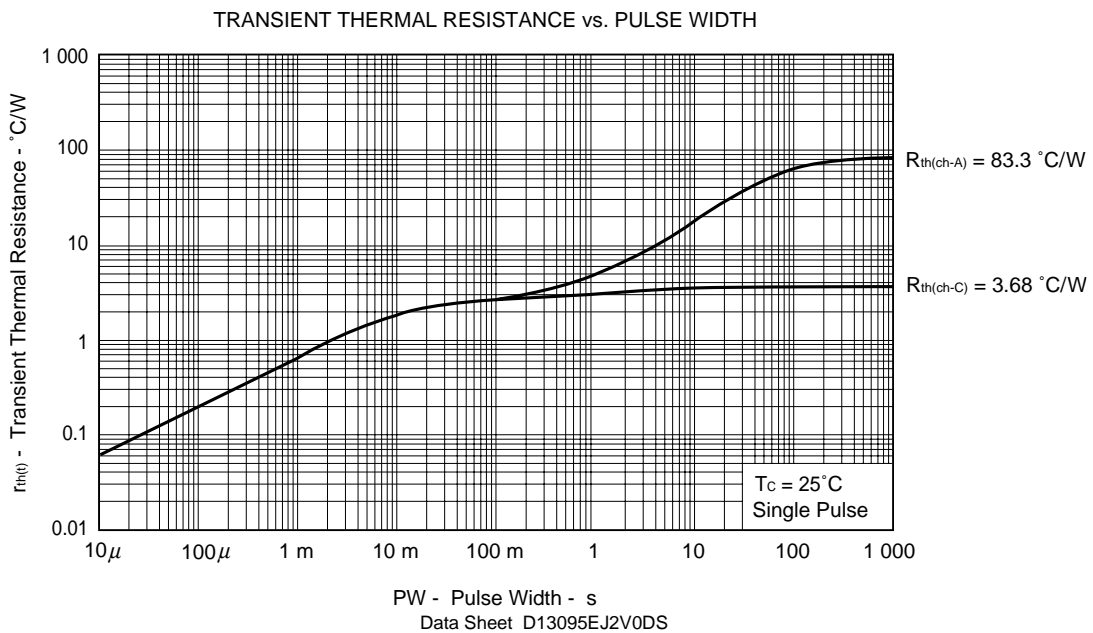
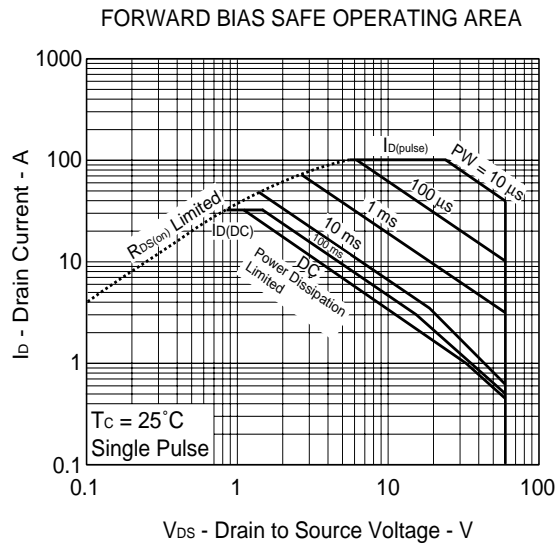
**TEST CIRCUIT 3 GATE CHARGE**



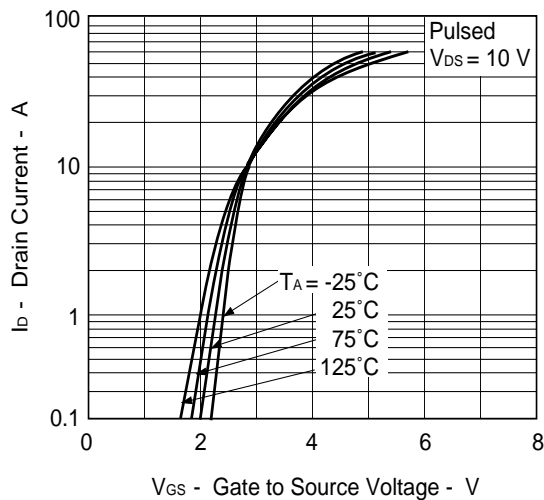
TYPICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )



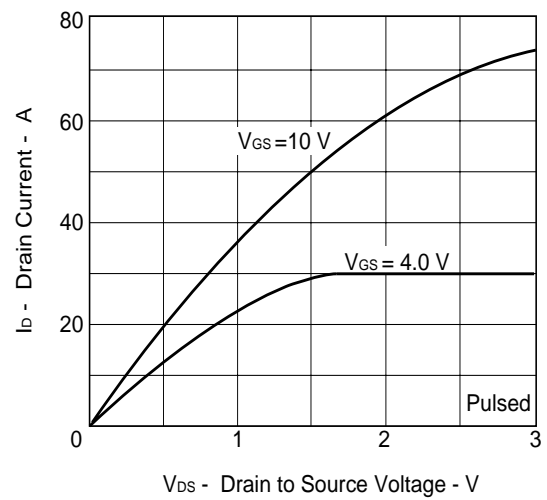
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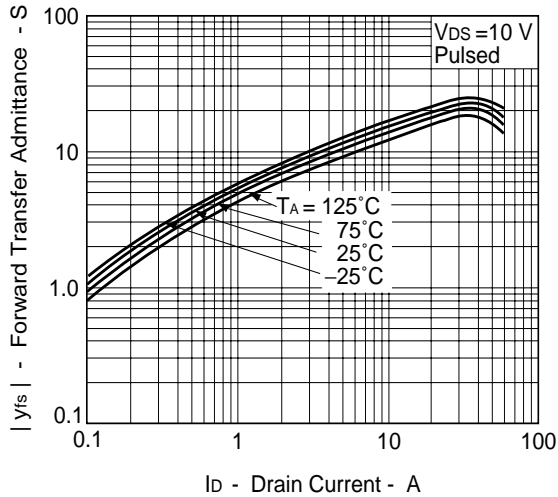
FORWARD TRANSFER CHARACTERISTICS



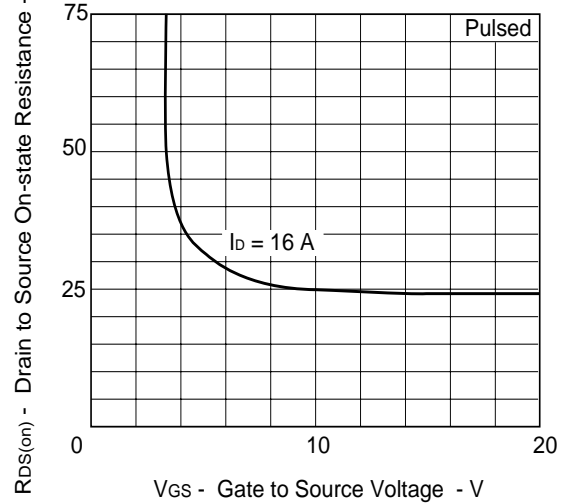
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



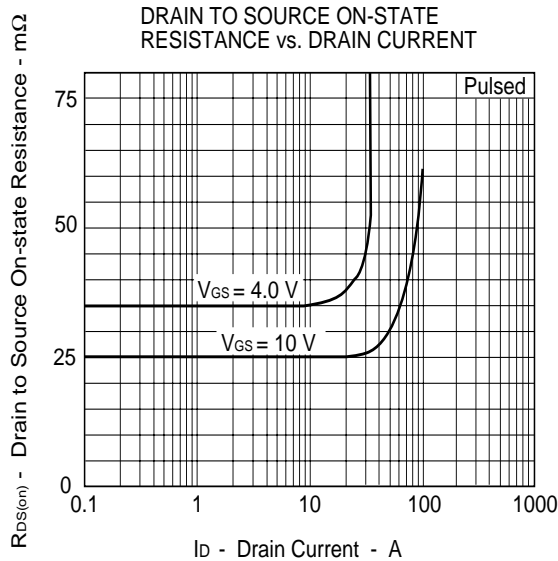
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



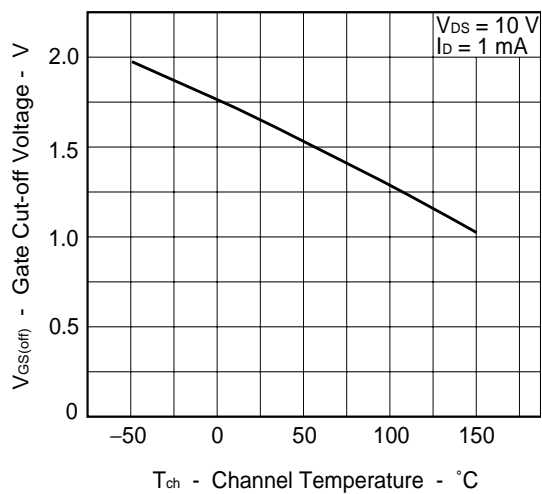
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



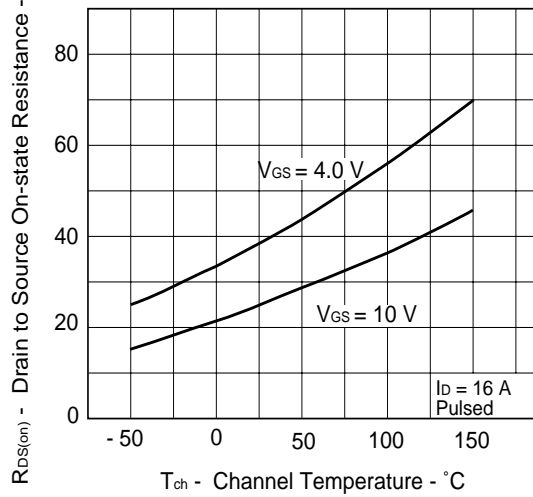
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE

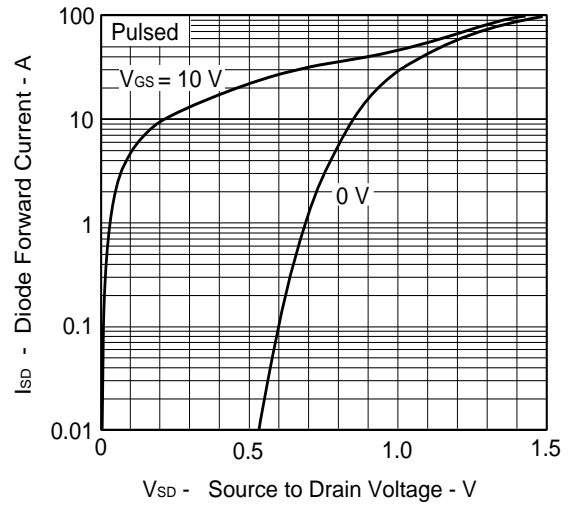


DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE

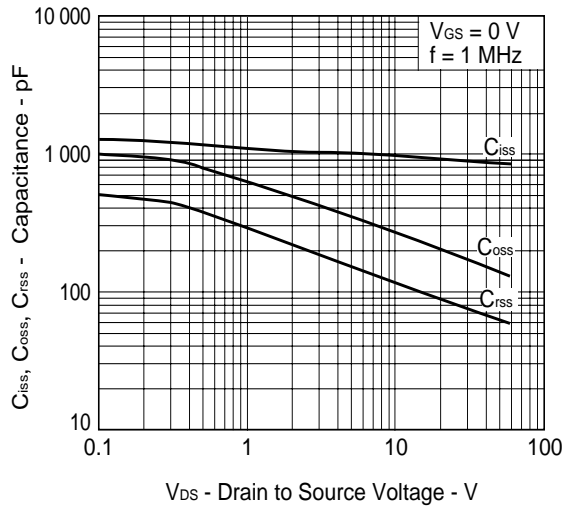


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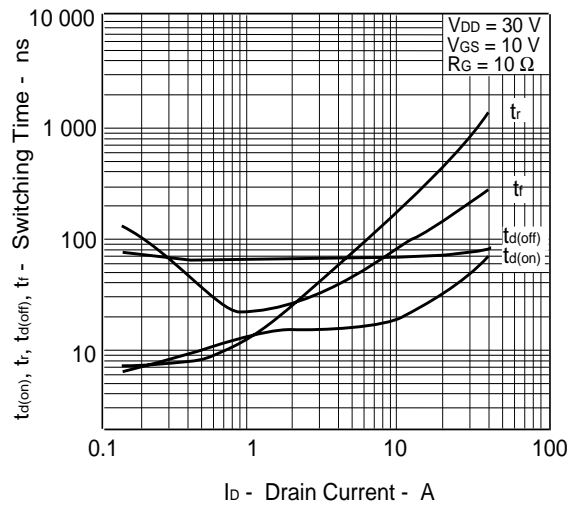
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



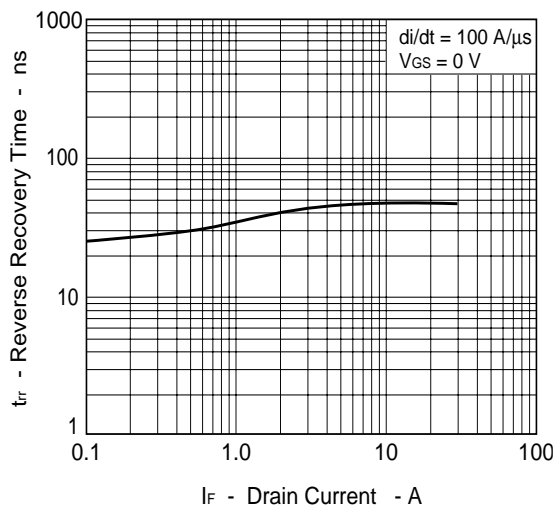
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



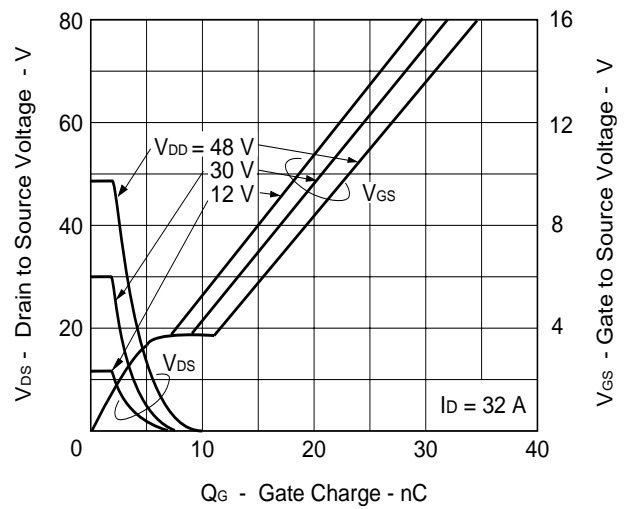
SWITCHING CHARACTERISTICS

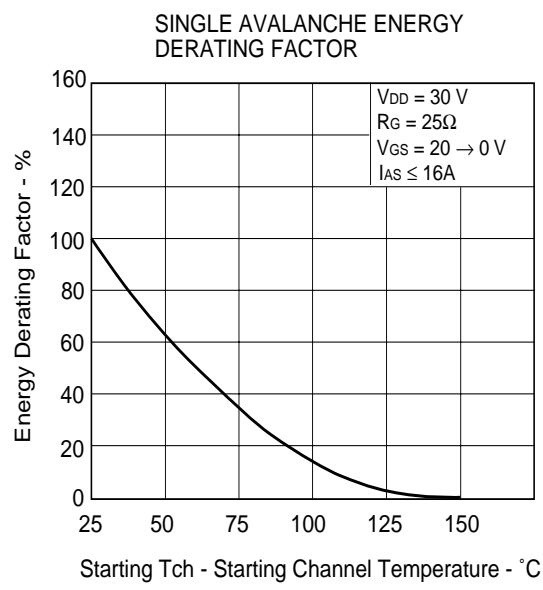
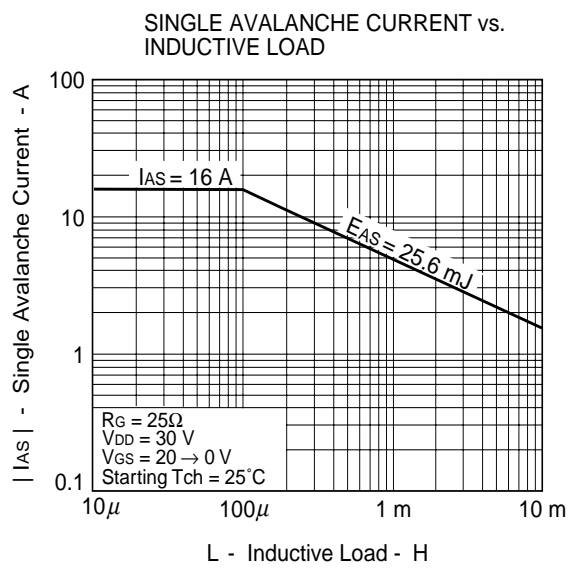


REVERSE RECOVERY TIME vs. DRAIN CURRENT



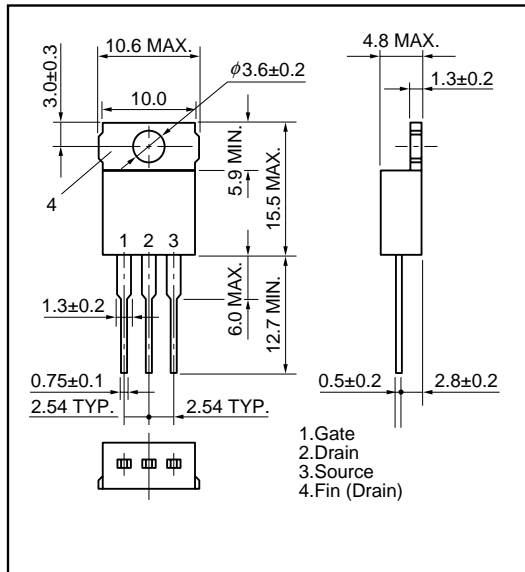
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



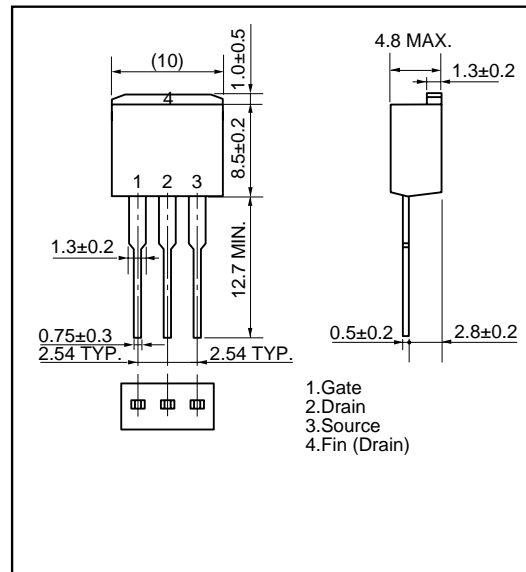


★ **PACKAGE DRAWINGS (Unit: mm)**

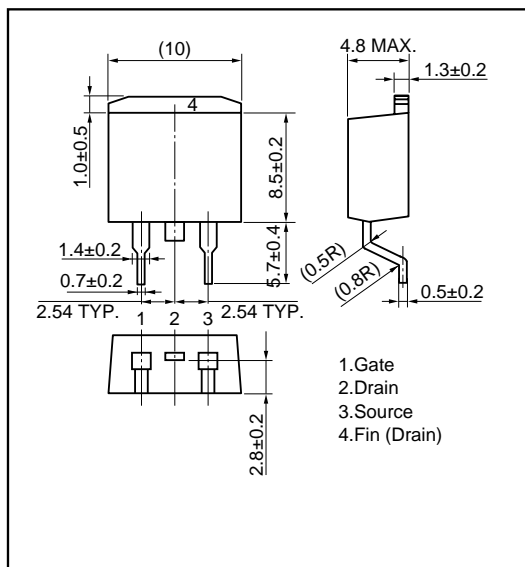
1) TO-220AB(MP-25)



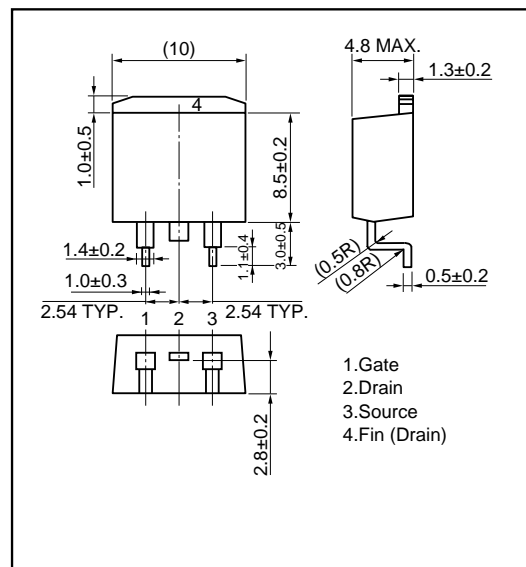
## 2) TO-262(MP-25 Fin Cut)



3) TO-263 (MP-25ZJ)

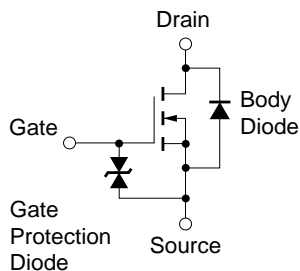


4) TO-220SMD(MP-25Z)<sup>Note</sup>



**Note** This package is produced only in Japan.

### 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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