

# MOS FIELD EFFECT TRANSISTOR

# 2SK3109

## SWITCHING

### N-CHANNEL POWER MOS FET

### INDUSTRIAL USE

#### DESCRIPTION

The 2SK3109 is N channel MOS FET device that features a low on-state resistance and excellent switching characteristics, and designed for high voltage applications such as DC/DC converter.

#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3109	TO-220AB
2SK3109-S	TO-262
2SK3109-ZJ	TO-263

#### FEATURES

- Gate voltage rating  $\pm 30$  V
- Low on-state resistance  
 $R_{DS(on)} = 0.4 \Omega$  MAX. ( $V_{GS} = 10$  V,  $I_D = 5.0$  A)
- Low input capacitance  
 $C_{iss} = 400$  pF TYP. ( $V_{DS} = 10$  V,  $V_{GS} = 0$  V)
- Avalanche capability rated
- Built-in gate protection diode
- Surface mount device available

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C)

Drain to source voltage ( $V_{GS} = 0$ V)	$V_{DSS}$	200	V
Gate to source voltage ( $V_{DS} = 0$ V)	$V_{GSS}$	$\pm 30$	V
Drain current (DC) ( $T_C = 25$ °C)	$I_{D(DC)}$	$\pm 10$	A
Drain current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 30$	A
Total power dissipation ( $T_A = 25$ °C)	$P_{T1}$	1.5	W
Total power dissipation ( $T_C = 25$ °C)	$P_{T2}$	50	W
Channel temperature	$T_{ch}$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C
Single avalanche current <sup>Note2</sup>	$I_{AS}$	10	A
Single avalanche energy <sup>Note2</sup>	$E_{AS}$	35	mJ

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

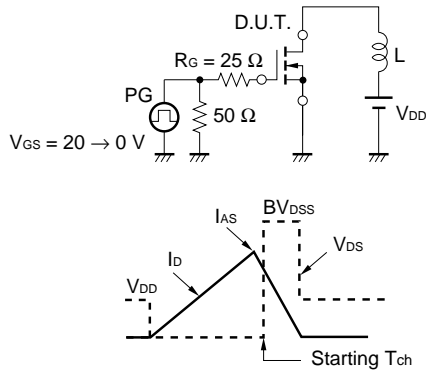
2. Starting  $T_{ch} = 25$  °C,  $V_{DD} = 100$  V,  $R_G = 25 \Omega$ ,  $V_{GS} = 20$  V  $\rightarrow$  0 V

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

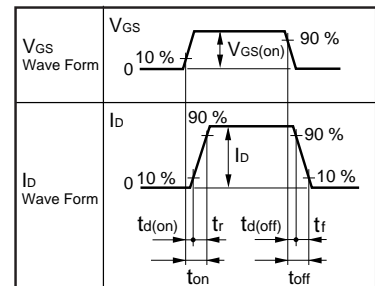
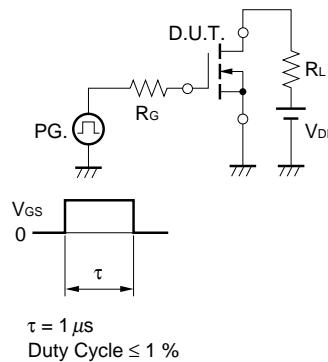
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

Characteristics	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Drain Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 200 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			±10	μA
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.5		4.5	V
Forward Transfer Admittance	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 5.0 A	1.5			S
Drain to Source On-state Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 5.0 A		0.32	0.4	Ω
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		400		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		110		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		55		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 100 V		12		ns
Rise Time	t <sub>r</sub>	I <sub>D</sub> = 5.0 A		34		ns
Turn-off Delay Time	t <sub>d(off)</sub>	V <sub>GS(on)</sub> = 10 V		40		ns
Fall Time	t <sub>f</sub>	R <sub>G</sub> = 10 Ω		20		ns
★ Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 160 V		18		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		3.5		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 10 A		10		nC
Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 10 A, V <sub>GS</sub> = 0 V		1.0		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 10 A, V <sub>GS</sub> = 0 V		250		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 50 A/μs		1.0		μC

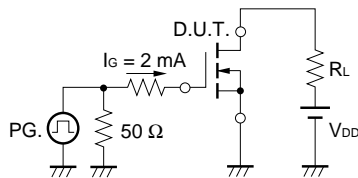
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



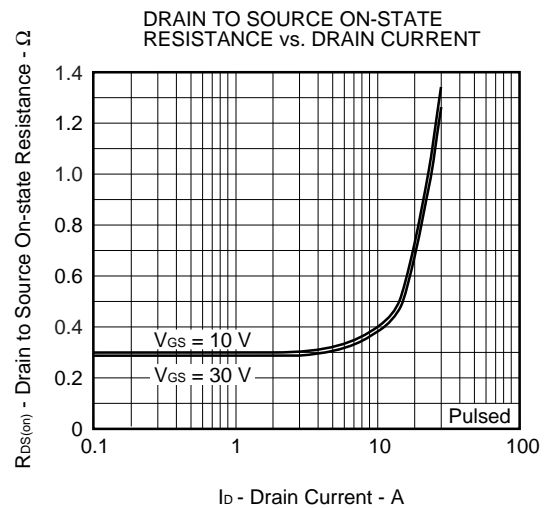
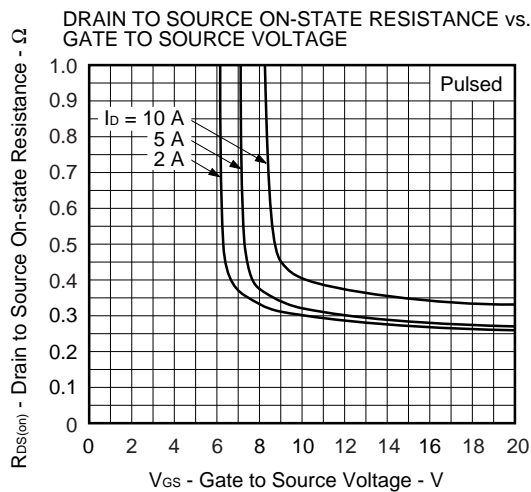
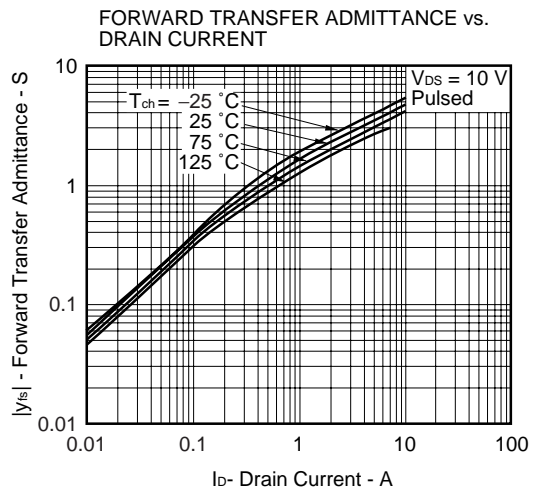
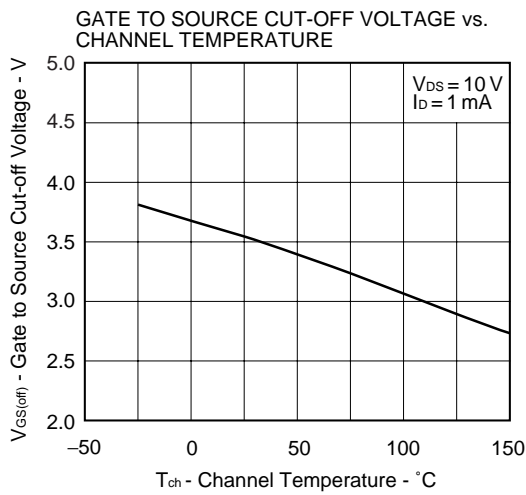
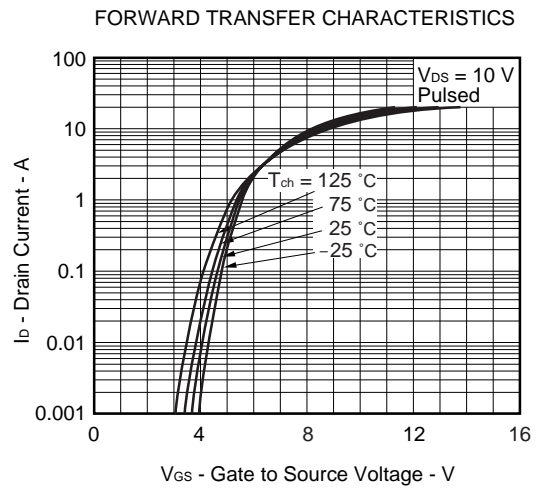
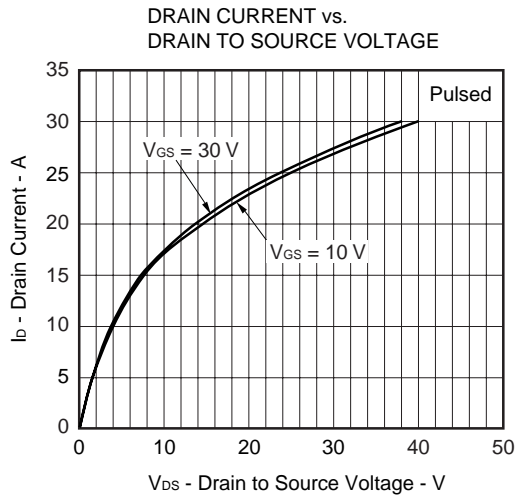
**TEST CIRCUIT 2 SWITCHING TIME**



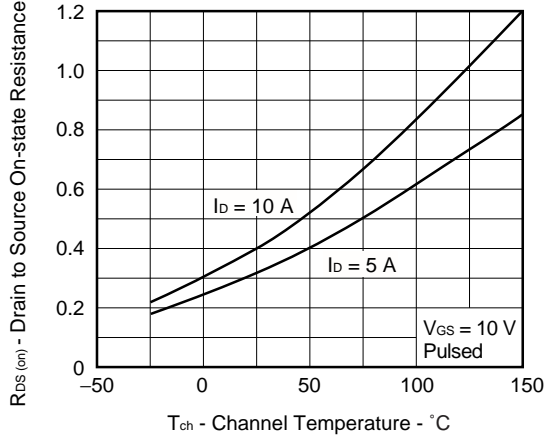
**TEST CIRCUIT 3 GATE CHARGE**



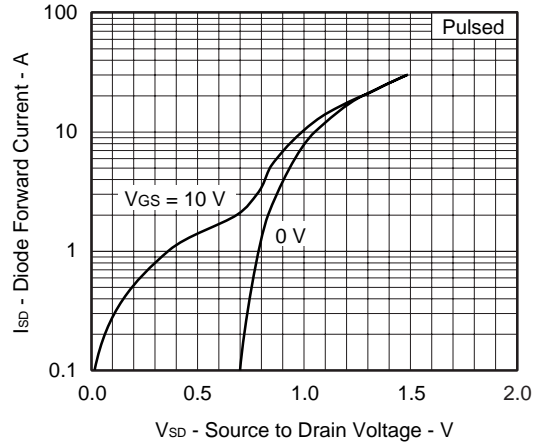
★ TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)



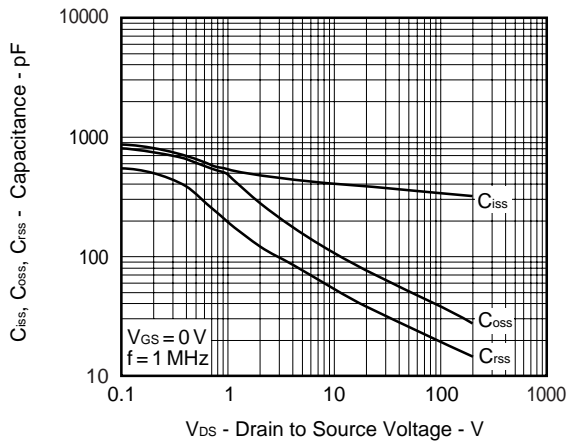
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



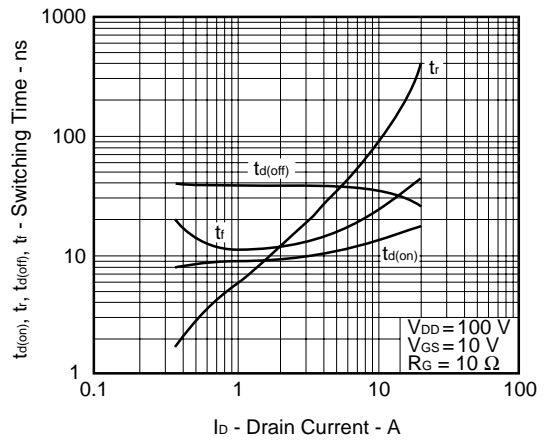
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



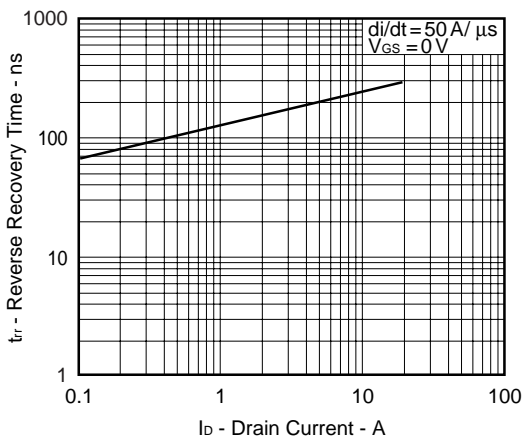
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



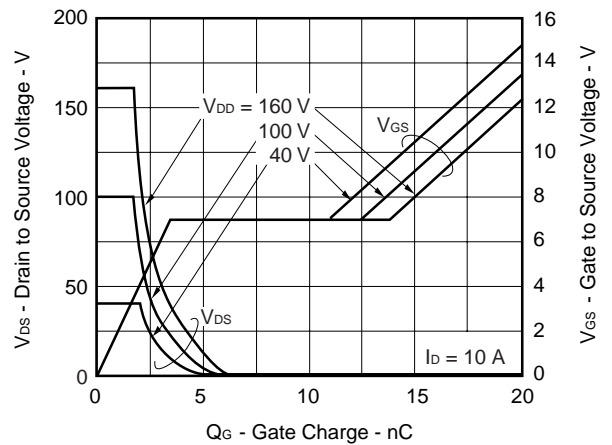
SWITCHING CHARACTERISTICS

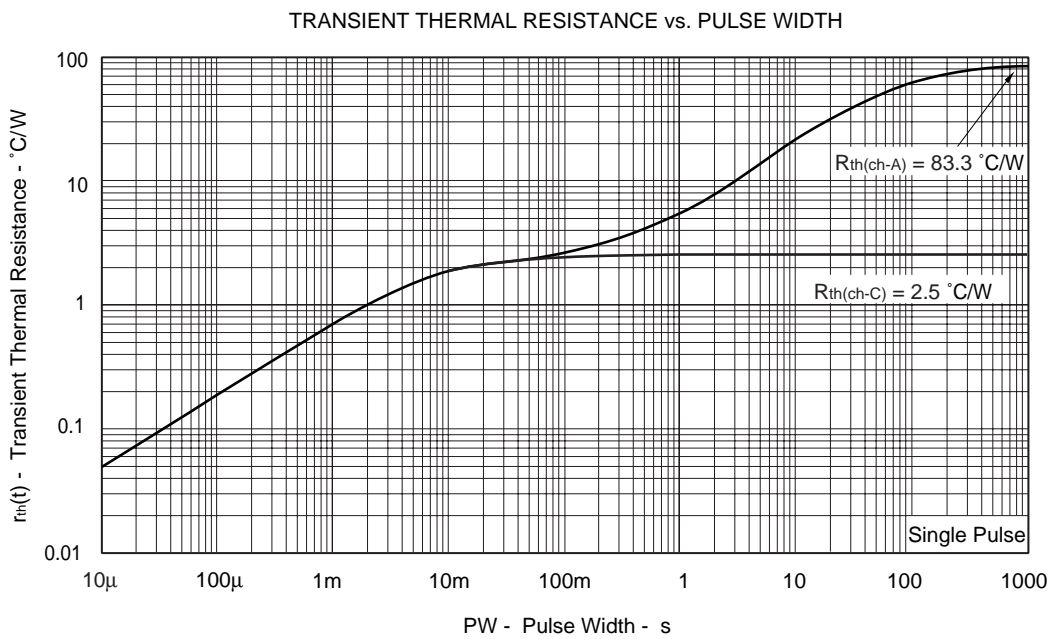
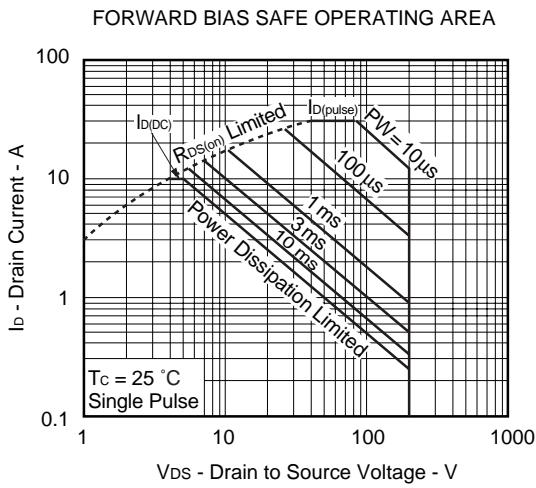
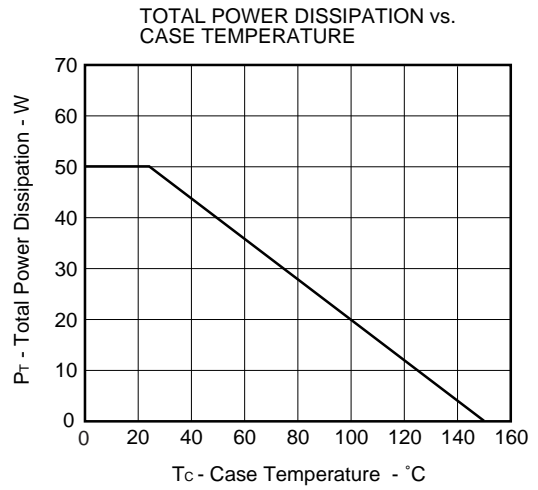
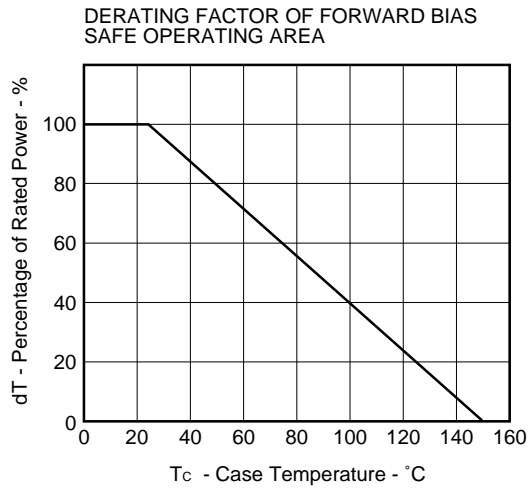


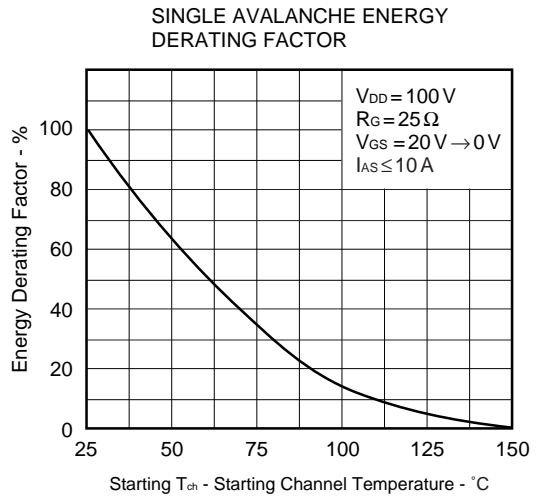
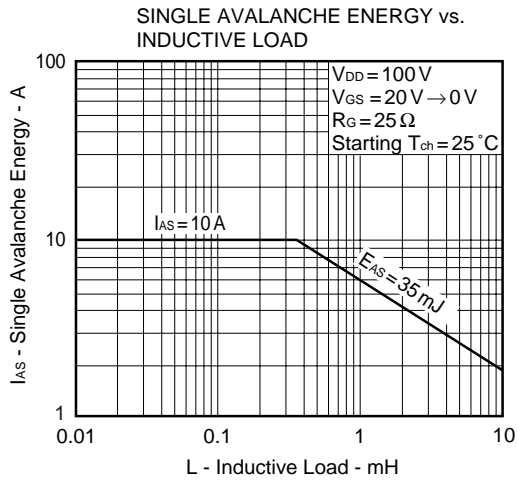
REVERSE RECOVERY TIME vs. DRAIN CURRENT



DYNAMIC INPUT/OUTPUT CHARACTERISTICS

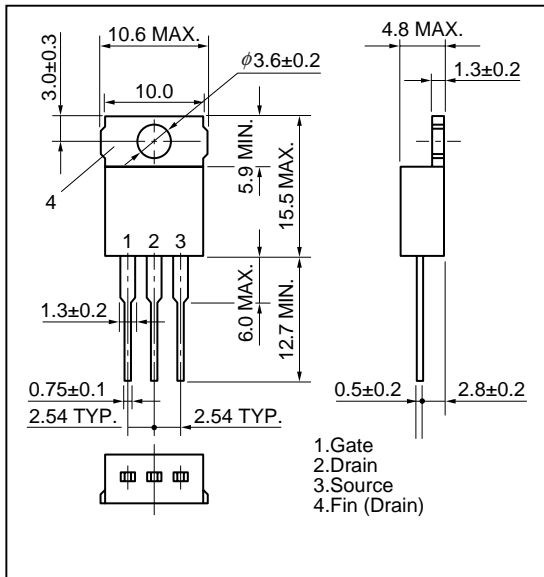




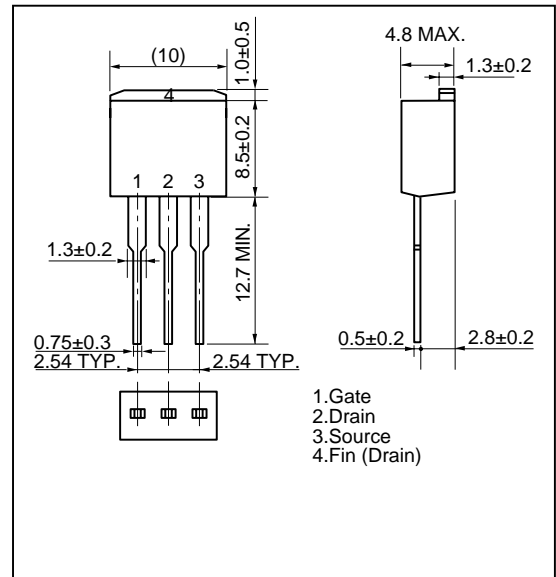


PACKAGE DRAWINGS (Unit : mm)

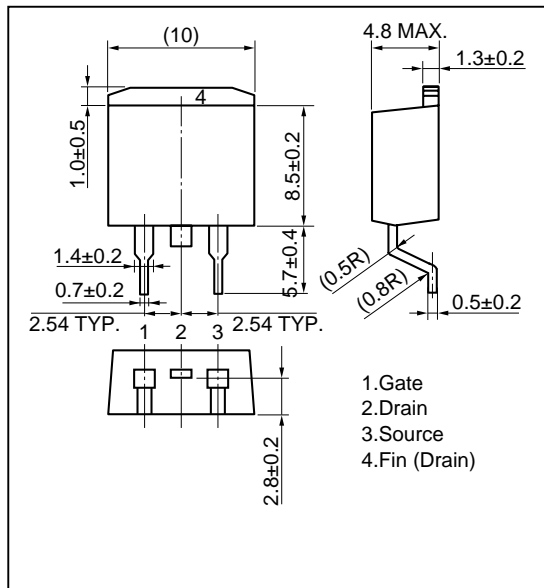
1)TO-220AB (MP-25)



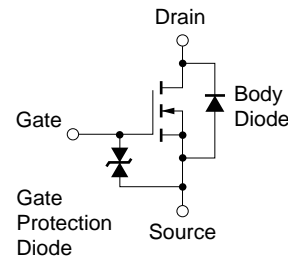
2)TO-262 (MP-25 Fin Cut)



3)TO-263 (MP-25ZJ)



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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