

SWITCHING  
N-CHANNEL POWER MOS FET

## DESCRIPTION

The 2SK3402 is N-Channel MOS Field Effect Transistor designed for high current switching applications.

## FEATURES

- Low On-State Resistance  
 $R_{DS(on)1} = 15 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 18 \text{ A)}$   
 $R_{DS(on)2} = 22 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.0 \text{ V, } I_D = 18 \text{ A)}$
- Low  $C_{iss}$  :  $C_{iss} = 3200 \text{ pF TYP.}$
- Built-in Gate Protection Diode
- TO-251/TO-252 package

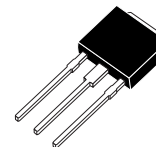
## ★ ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3402	TO-251 (MP-3)
2SK3402-Z	TO-252 (MP-3Z)

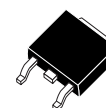
ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

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) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 36$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 144$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	40	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	1.0	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	$-55 \text{ to } +150$	$^\circ\text{C}$
Single Avalanche Current <sup>Note2</sup>	$I_{AS}$	35	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	123	mJ

(TO-251)



(TO-252)



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

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

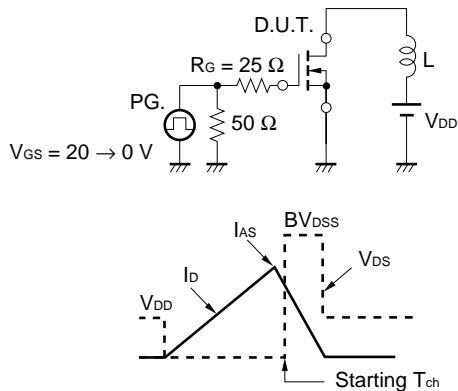
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**ELECTRICAL CHARACTERISTICS (TA = 25°C)**

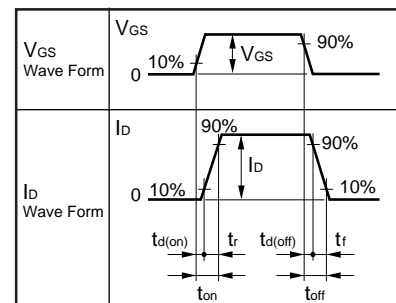
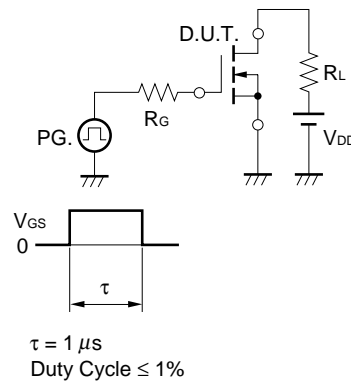
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$
Gate Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.5	2.0	2.5	V
Forward Transfer Admittance <b>Note</b>	$ y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 18\text{ A}$	13	27		S
Drain to Source On-state Resistance <b>Note</b>	$R_{DS(on)1}$	$V_{GS} = 10\text{ V}, I_D = 18\text{ A}$		12	15	$\text{m}\Omega$
	$R_{DS(on)2}$	$V_{GS} = 4.0\text{ V}, I_D = 18\text{ A}$		15	22	$\text{m}\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}$		3200		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}$		520		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1\text{ MHz}$		270		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 30\text{ V}, I_D = 18\text{ A}$		36		ns
Rise Time	$t_r$	$V_{GS} = 10\text{ V}$		310		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 10\ \Omega$		170		ns
Fall Time	$t_f$			180		ns
Total Gate Charge	$Q_G$	$V_{DD} = 48\text{ V}$		61		nC
Gate to Source Charge	$Q_{GS}$	$V_{GS} = 10\text{ V}$		8.2		nC
Gate to Drain Charge	$Q_{GD}$	$I_D = 36\text{ A}$		17		nC
Body Diode Forward Voltage <b>Note</b>	$V_{F(S-D)}$	$I_F = 36\text{ A}, V_{GS} = 0\text{ V}$		1.0		V
Reverse Recovery Time	$t_{rr}$	$I_F = 36\text{ A}, V_{GS} = 0\text{ V}$		48		ns
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 100\text{ A}/\mu\text{s}$		89		nC

**Note** Pulsed

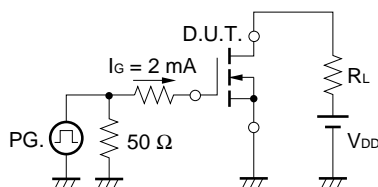
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



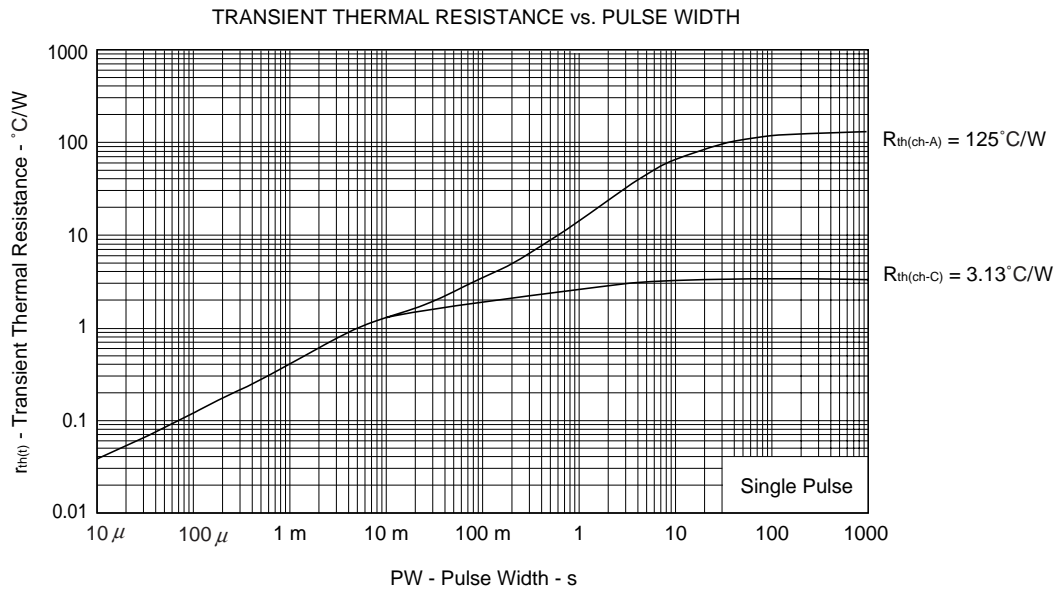
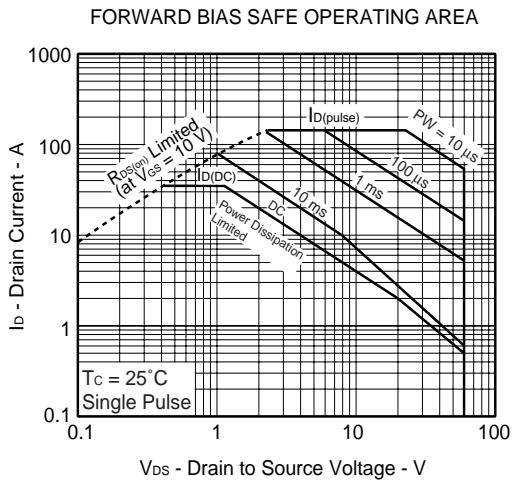
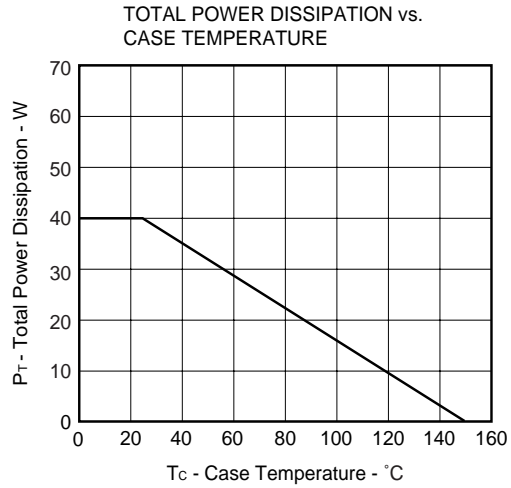
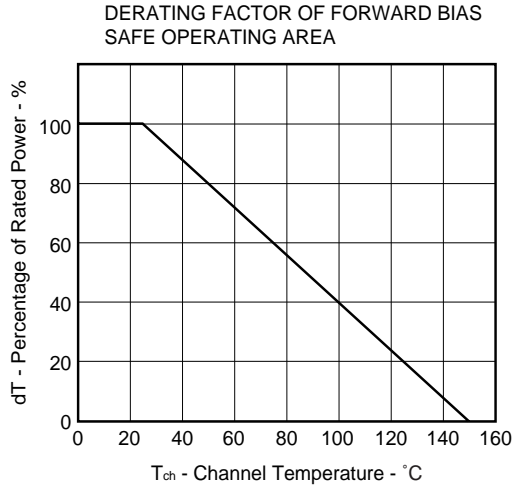
**TEST CIRCUIT 2 SWITCHING TIME**



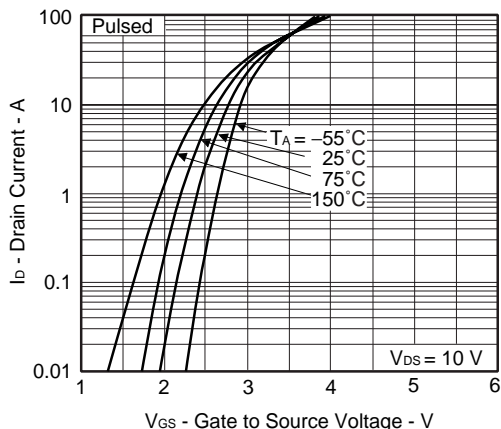
**TEST CIRCUIT 3 GATE CHARGE**



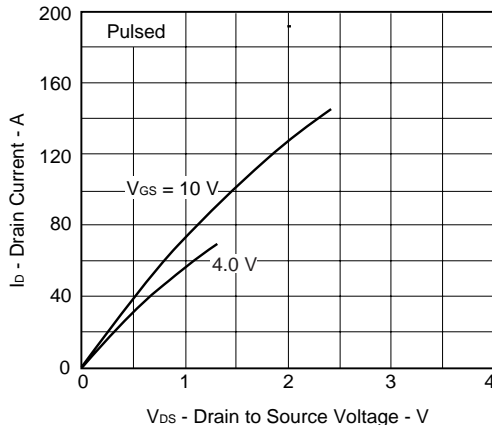
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



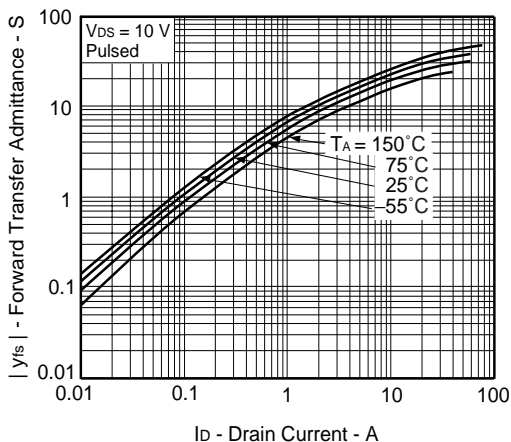
FORWARD TRANSFER CHARACTERISTICS



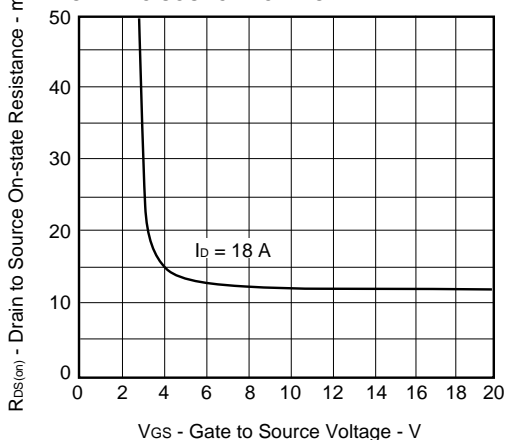
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



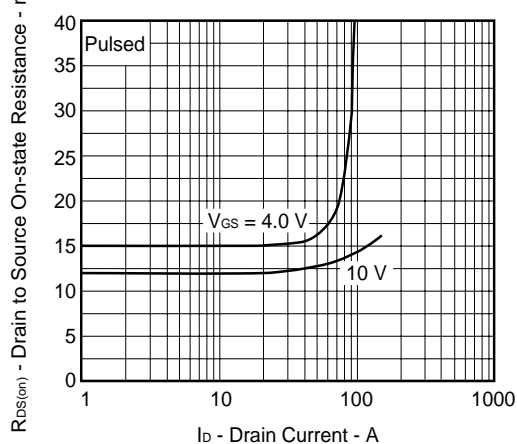
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



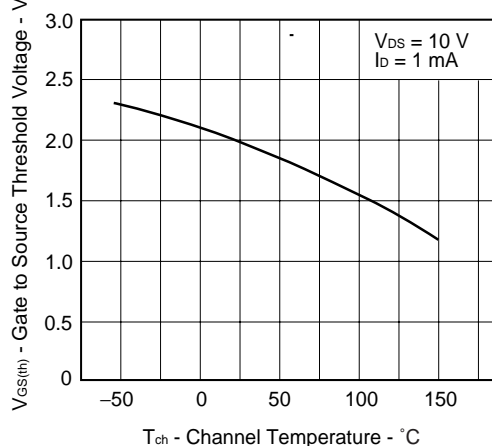
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



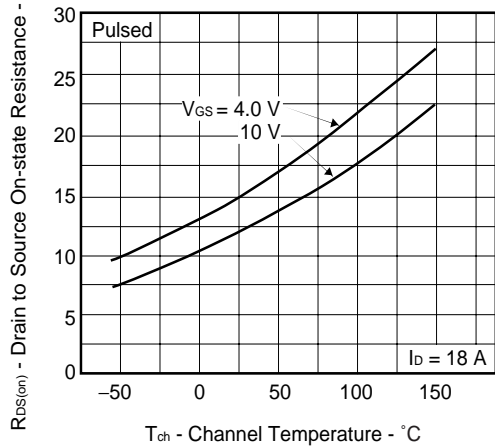
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



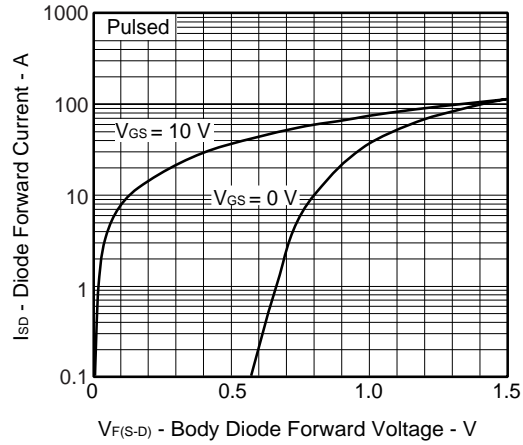
GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



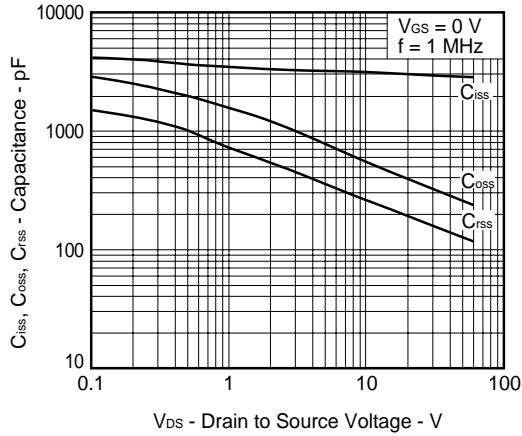
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



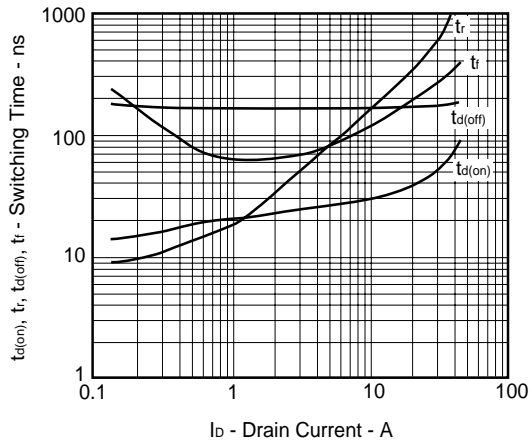
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



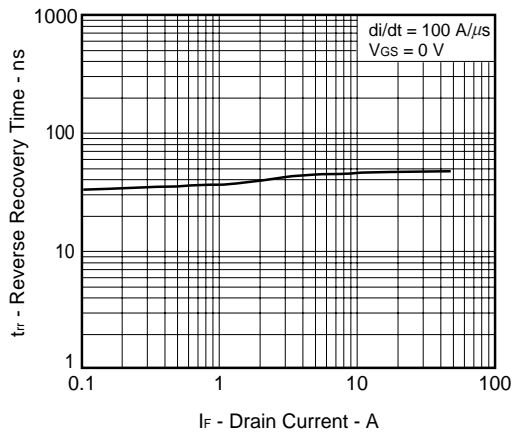
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



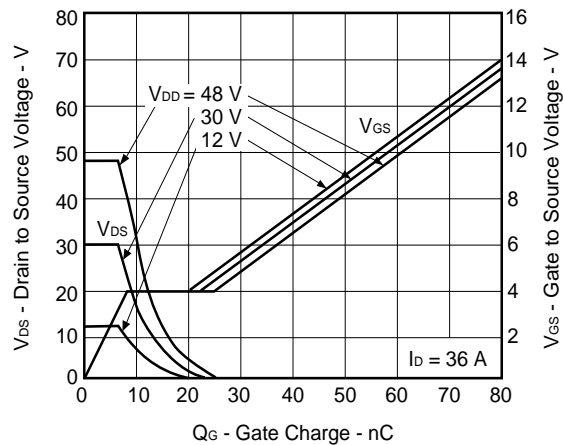
SWITCHING CHARACTERISTICS

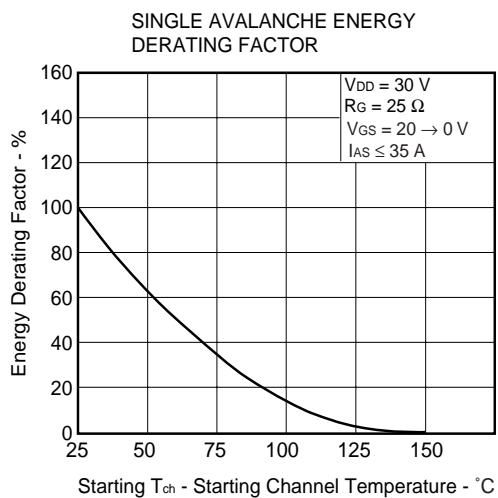
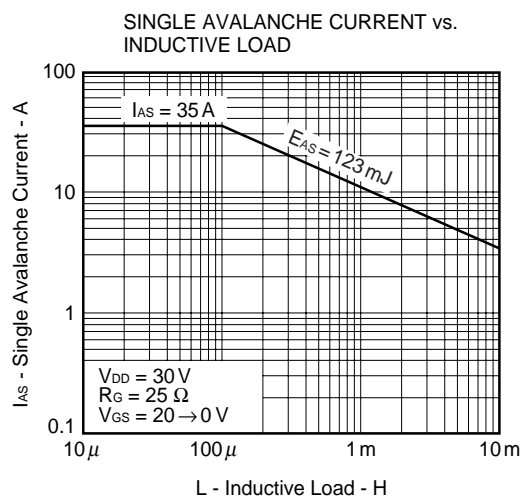


REVERSE RECOVERY TIME vs. DRAIN CURRENT



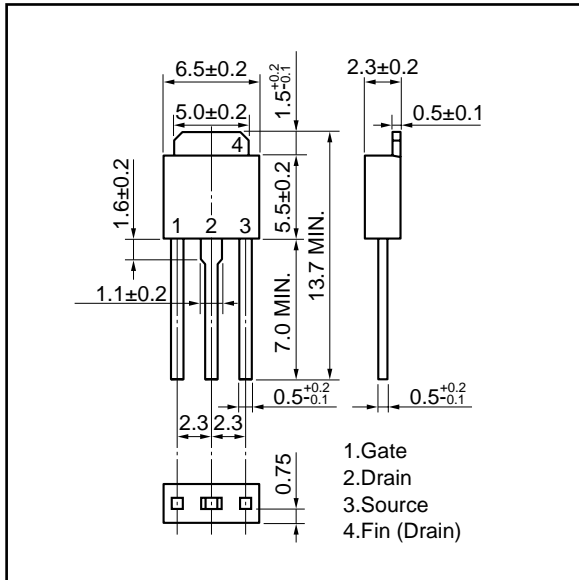
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



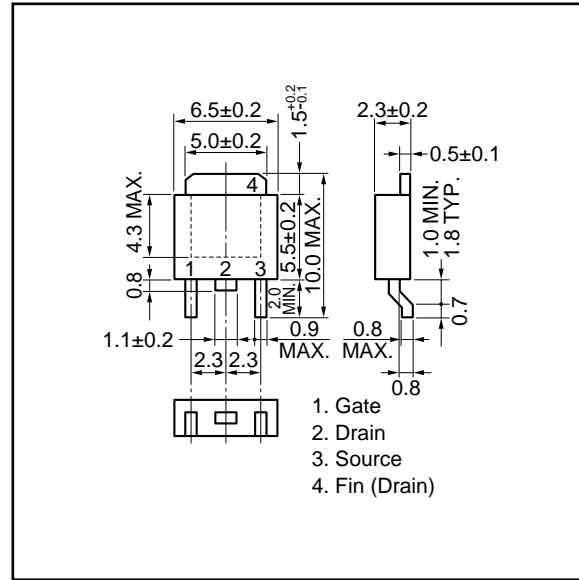


PACKAGE DRAWINGS (Unit: mm)

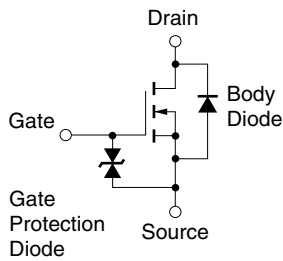
1) TO-251 (MP-3)



2) TO-252 (MP-3Z)



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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