

To our customers,

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## Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: <http://www.renesas.com>

April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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## SWITCHING

### N-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SK3716 is N-channel MOS Field Effect Transistor designed for high current switching applications.

#### FEATURES

- Super low on-state resistance:  
 $R_{DS(on)1} = 6.5 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 30 \text{ A)}$   
 $R_{DS(on)2} = 9.1 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 30 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 2700 \text{ pF TYP.}$
- Built-in gate protection diode

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

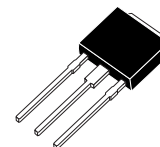
Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	40	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_c = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 60$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 240$	A
Total Power Dissipation ( $T_c = 25^\circ\text{C}$ )	$P_{T1}$	84	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 to +150	$^\circ\text{C}$
Repetitive Avalanche Current <sup>Note2</sup>	$I_{AS}$	32	A
Repetitive Avalanche Energy <sup>Note2</sup>	$E_{AS}$	100	mJ

- Notes 1.**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$   
**2.**  $V_{DD} = 20 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$ ,  $T_{ch(peak)} \leq 150^\circ\text{C}$

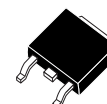
#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3716	TO-251 (MP-3)
2SK3716-Z	TO-252 (MP-3Z)

(TO-251)



(TO-252)



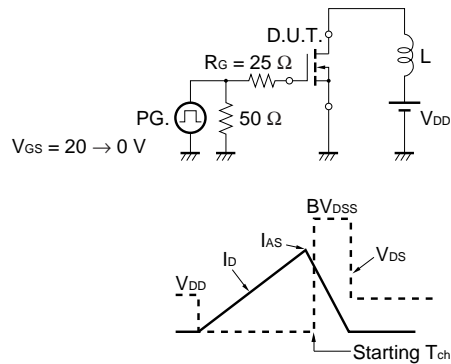
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**ELECTRICAL CHARACTERISTICS (TA = 25°C)**

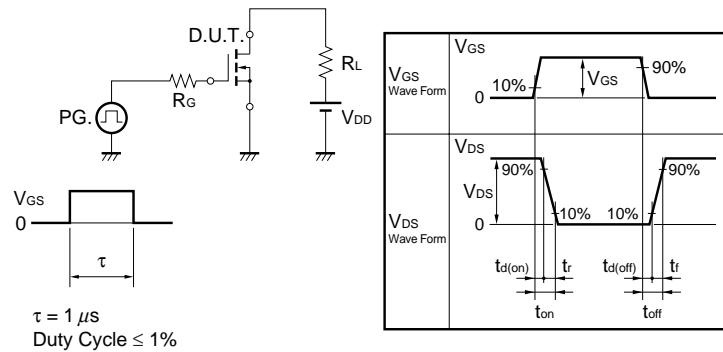
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$
Gate Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.5	2.0	2.5	V
Forward Transfer Admittance <sup>Note</sup>	$ y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 30\text{ A}$	22	43		S
Drain to Source On-state Resistance <sup>Note</sup>	$R_{DS(on)1}$	$V_{GS} = 10\text{ V}, I_D = 30\text{ A}$		5.2	6.5	$\text{m}\Omega$
	$R_{DS(on)2}$	$V_{GS} = 4.5\text{ V}, I_D = 30\text{ A}$		6.6	9.1	$\text{m}\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}$		2700		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}$		770		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1\text{ MHz}$		290		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, I_D = 30\text{ A}$		11		ns
Rise Time	$t_r$	$V_{GS} = 10\text{ V}$		13		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 0\ \Omega$		69		ns
Fall Time	$t_f$			14		ns
Total Gate Charge	$Q_G$	$V_{DD} = 32\text{ V}$		50		nC
Gate to Source Charge	$Q_{GS}$	$V_{GS} = 10\text{ V}$		9		nC
Gate to Drain Charge	$Q_{GD}$	$I_D = 60\text{ A}$		13		nC
Body Diode Forward Voltage <sup>Note</sup>	$V_{F(S-D)}$	$I_F = 60\text{ A}, V_{GS} = 0\text{ V}$		0.94	1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = 60\text{ A}, V_{GS} = 0\text{ V}$		40		ns
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 100\text{ A}/\mu\text{s}$		42		nC

**Note** Pulsed

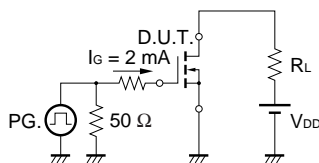
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



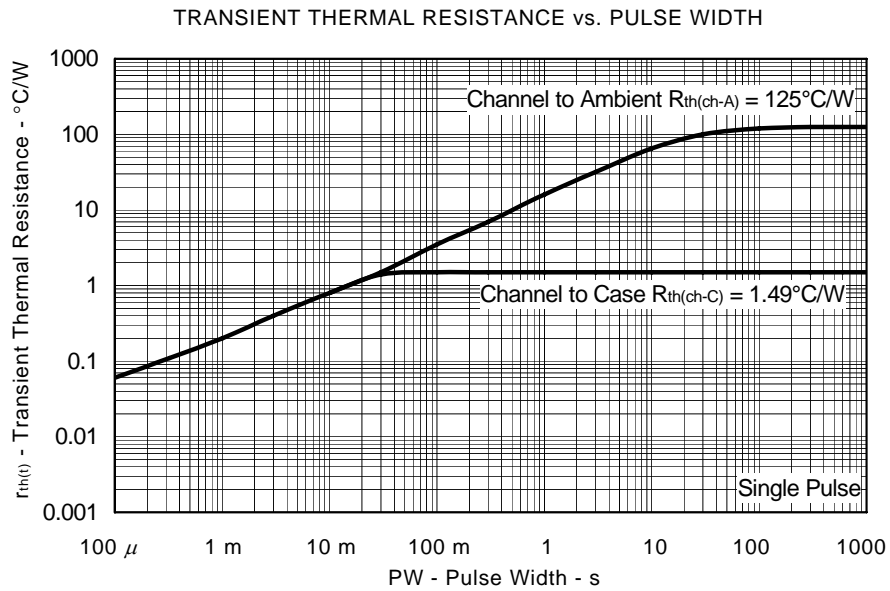
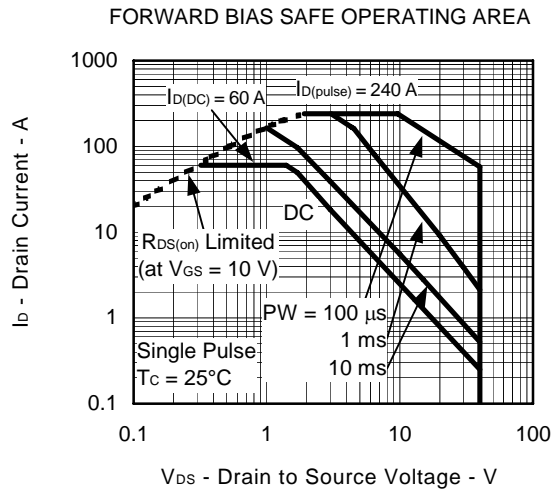
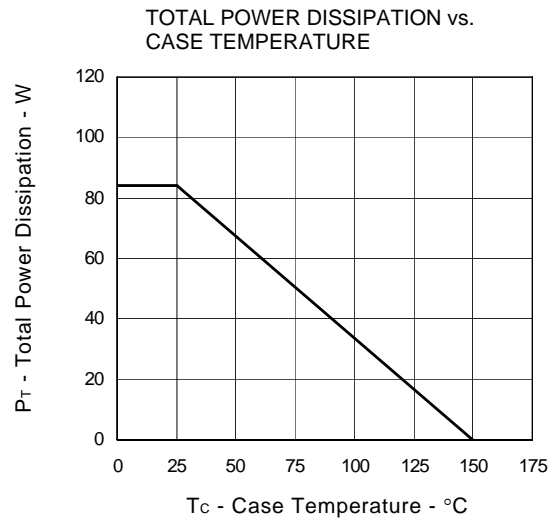
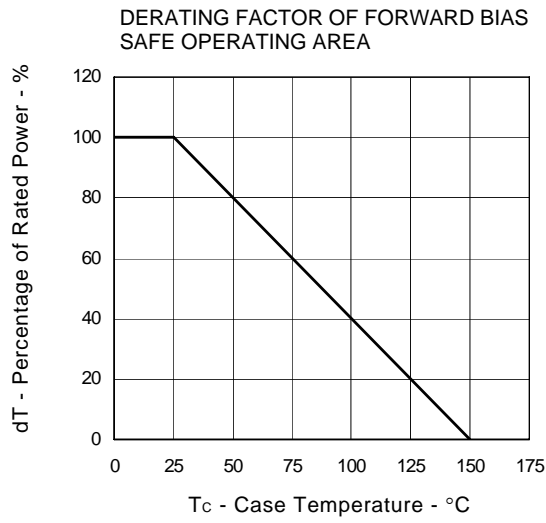
**TEST CIRCUIT 2 SWITCHING TIME**



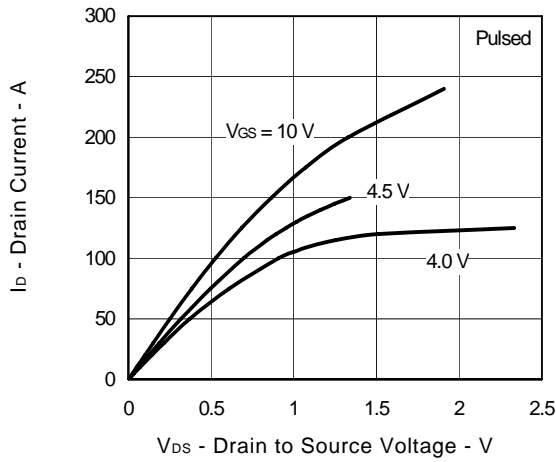
**TEST CIRCUIT 3 GATE CHARGE**



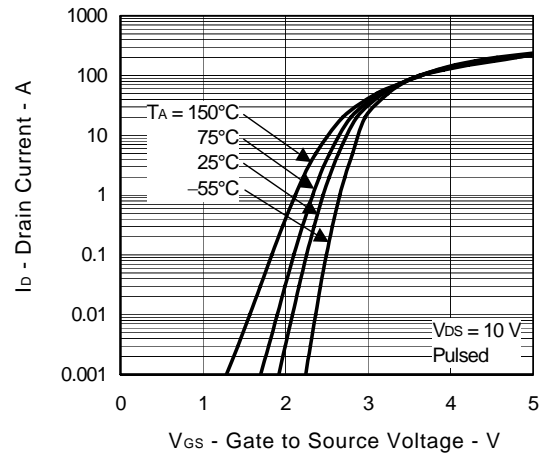
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



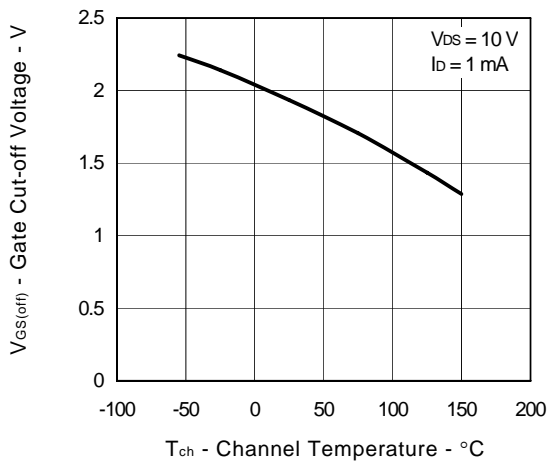
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



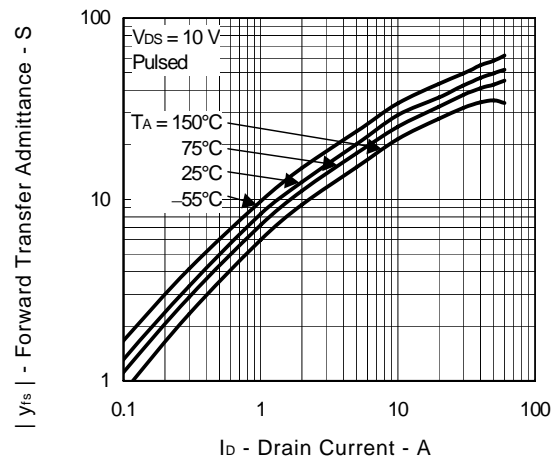
FORWARD TRANSFER CHARACTERISTICS



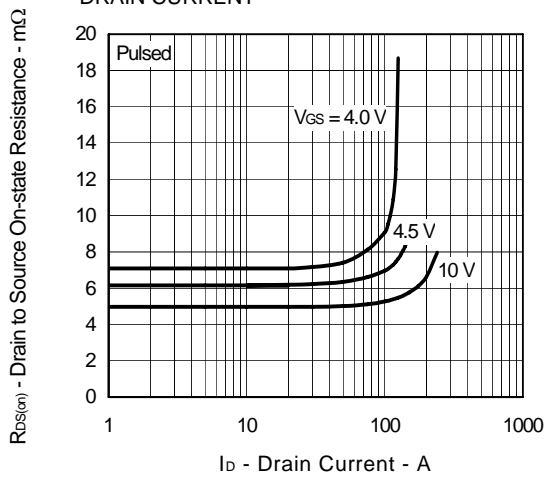
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



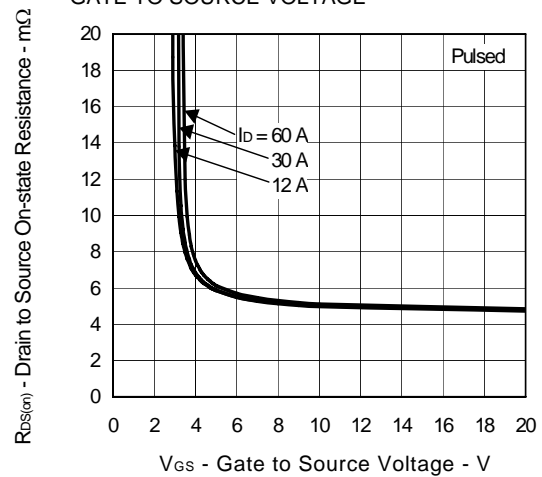
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



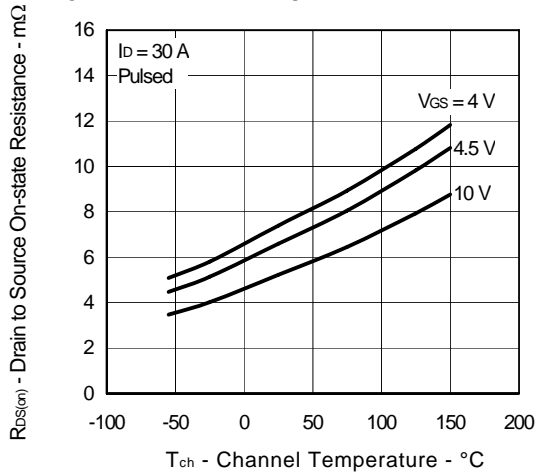
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



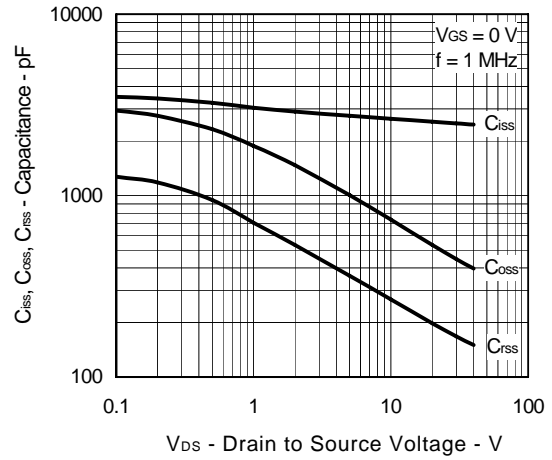
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



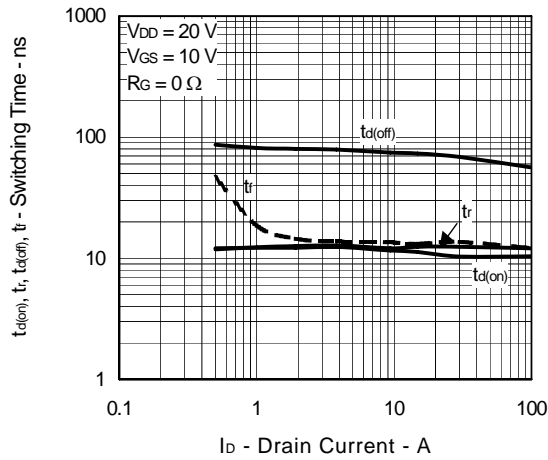
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



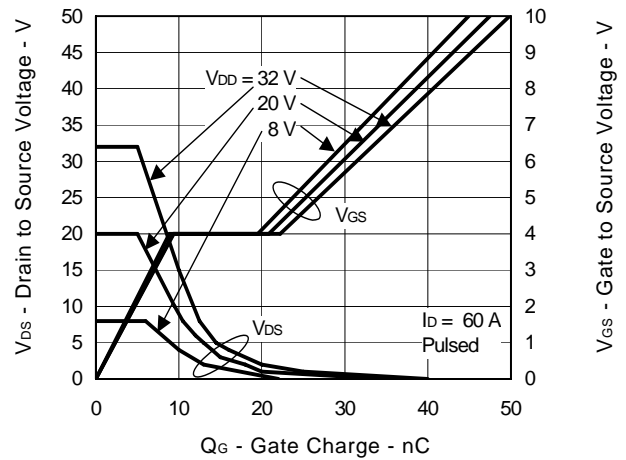
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



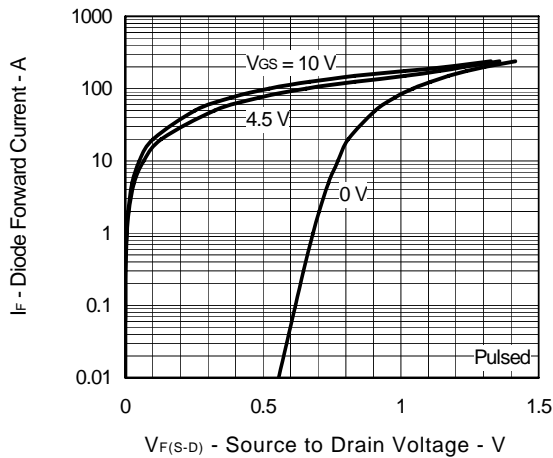
SWITCHING CHARACTERISTICS



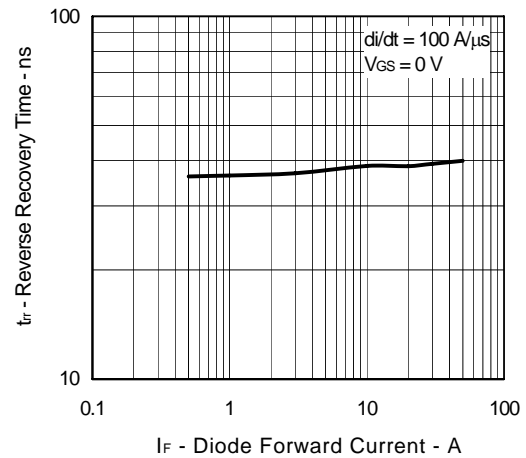
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

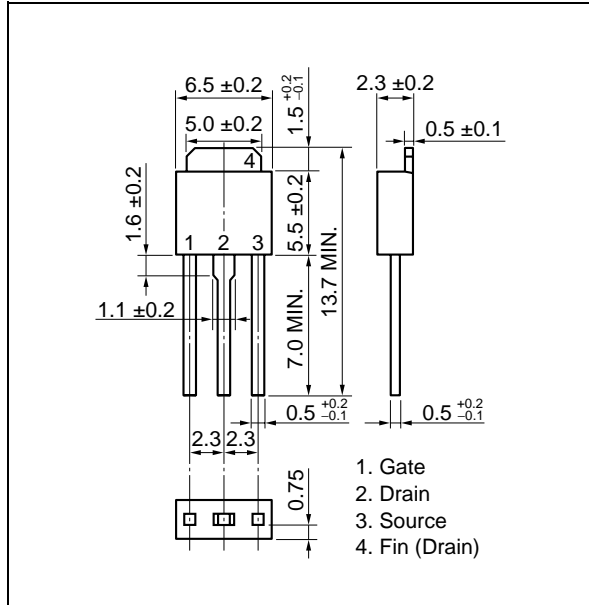


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

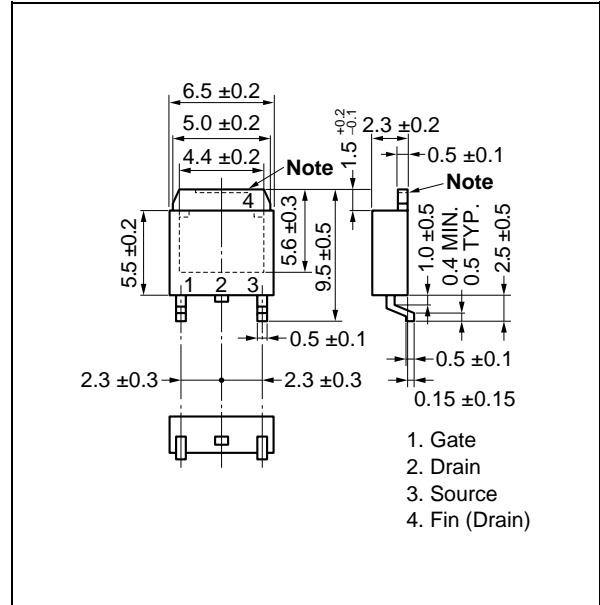


PACKAGE DRAWINGS (Unit: mm)

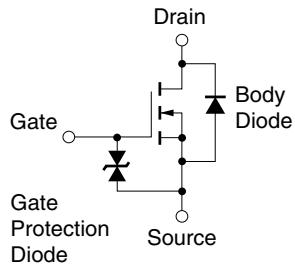
1) TO-251 (MP-3)



<R> 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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