

To our customers,

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## Old Company Name in Catalogs and Other Documents

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

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

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## SWITCHING

### P-CHANNEL POWER MOS FET

#### DESCRIPTION

The 2SJ599 is P-channel MOS Field Effect Transistor designed for solenoid, motor and lamp driver.

#### FEATURES

- Low on-state resistance:  
 $R_{DS(on)1} = 75 \text{ m}\Omega \text{ MAX. (} V_{GS} = -10 \text{ V, } I_D = -10 \text{ A)}$   
 $R_{DS(on)2} = 111 \text{ m}\Omega \text{ MAX. (} V_{GS} = -4.0 \text{ V, } I_D = -10 \text{ A)}$
- Low input capacitance:  
 $C_{iss} = 1300 \text{ pF TYP. (} V_{DS} = -10 \text{ V, } V_{GS} = 0 \text{ V)}$
- Built-in gate protection diode
- TO-251/TO-252 package

#### 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) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 20$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 50$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_T$	35	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_T$	1.0	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>	$I_{AS}$	-20	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	40	mJ

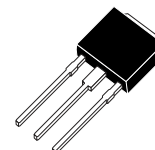
**Notes 1.**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

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

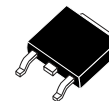
#### ORDERING INFORMATION

PART NUMBER	PACKAGE
2SJ599	TO-251 (MP-3)
2SJ599-Z	TO-252 (MP-3Z)

(TO-251)



(TO-252)

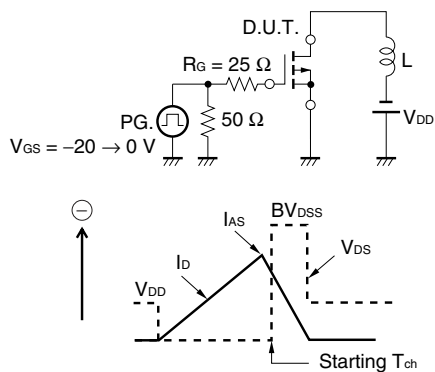


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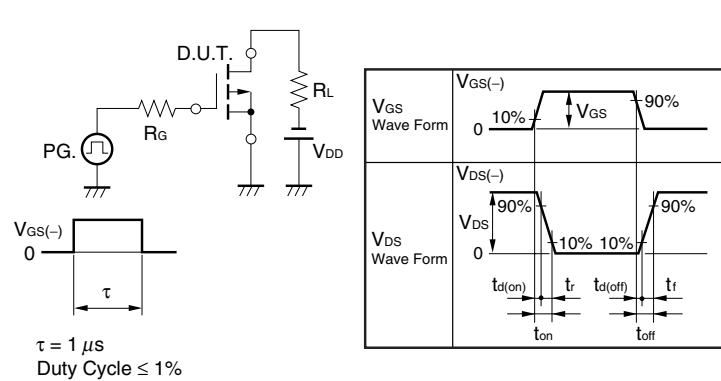
**ELECTRICAL CHARACTERISTICS (TA = 25°C)**

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$			-10	$\mu\text{A}$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \mp 20\text{ V}, V_{DS} = 0\text{ V}$			$\mp 10$	$\mu\text{A}$
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	$ y_{fs} $	$V_{DS} = -10\text{ V}, I_D = -10\text{ A}$	8	16		S
Drain to Source On-state Resistance	$R_{DS(on)1}$	$V_{GS} = -10\text{ V}, I_D = -10\text{ A}$		60	75	$\text{m}\Omega$
	$R_{DS(on)2}$	$V_{GS} = -4.0\text{ V}, I_D = -10\text{ A}$		78	111	$\text{m}\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = -10\text{ V}$		1300		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}$		240		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1\text{ MHz}$		100		pF
Turn-on Delay Time	$t_{d(on)}$	$I_D = -10\text{ A}$		8		ns
Rise Time	$t_r$	$V_{GS} = -10\text{ V}$		9		ns
Turn-off Delay Time	$t_{d(off)}$	$V_{DD} = -30\text{ V}$		52		ns
Fall Time	$t_f$	$R_G = 0\ \Omega$		16		ns
Total Gate Charge	$Q_G$	$I_D = -20\text{ A}$		26		nC
Gate to Source Charge	$Q_{GS}$	$V_{DD} = -48\text{ V}$		5		nC
Gate to Drain Charge	$Q_{GD}$	$V_{GS} = -10\text{ V}$		7		nC
Body Diode Forward Voltage	$V_{F(S-D)}$	$I_F = 20\text{ A}, V_{GS} = 0\text{ V}$		1.0		V
Reverse Recovery Time	$t_{rr}$	$I_F = 20\text{ A}, V_{GS} = 0\text{ V}$		51		ns
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 100\text{ A}/\mu\text{s}$		102		nC

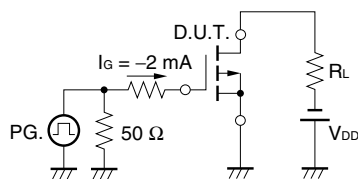
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



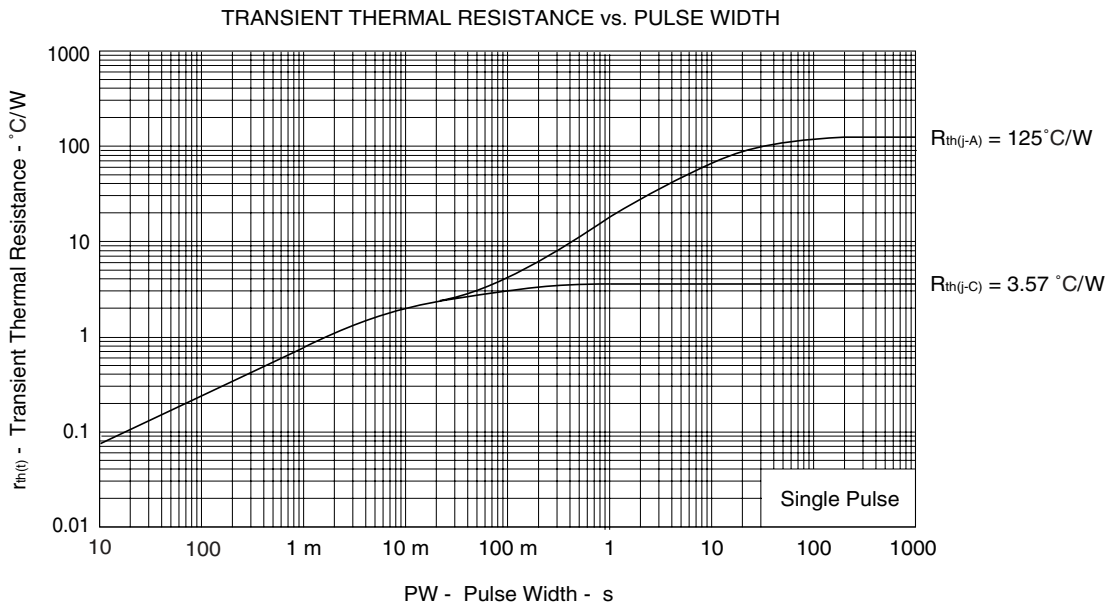
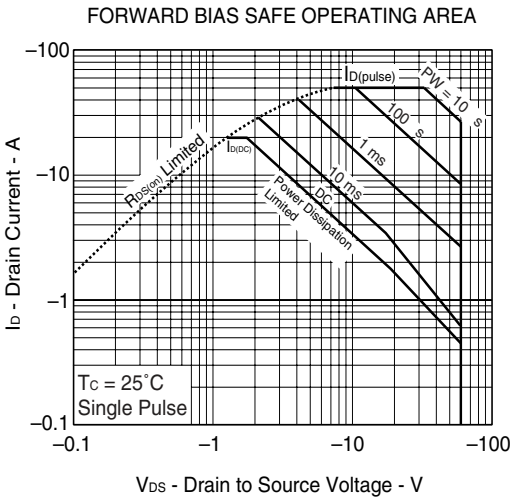
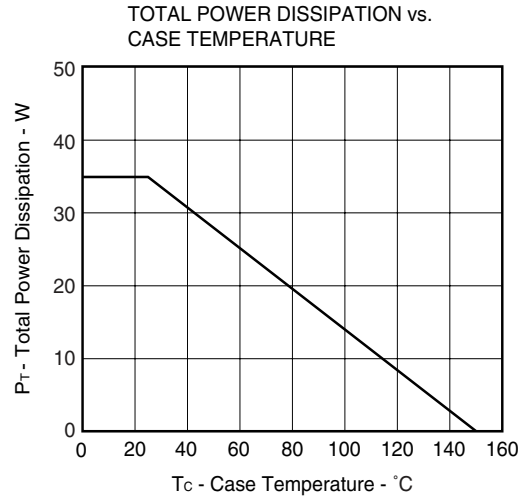
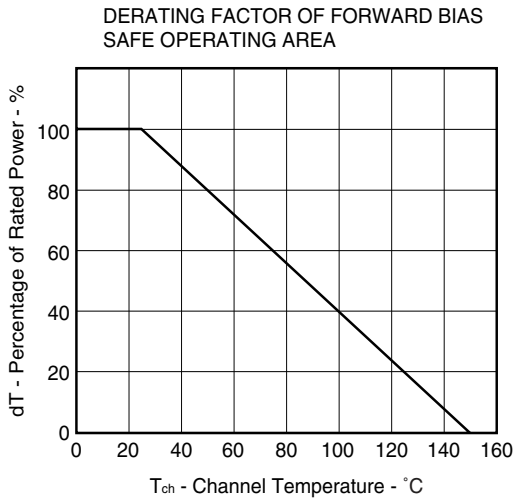
**TEST CIRCUIT 2 SWITCHING TIME**



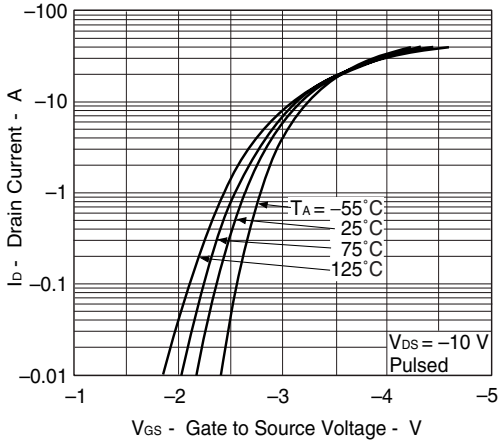
**TEST CIRCUIT 3 GATE CHARGE**



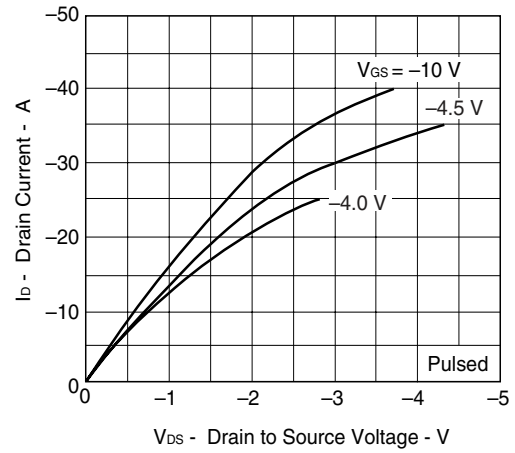
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



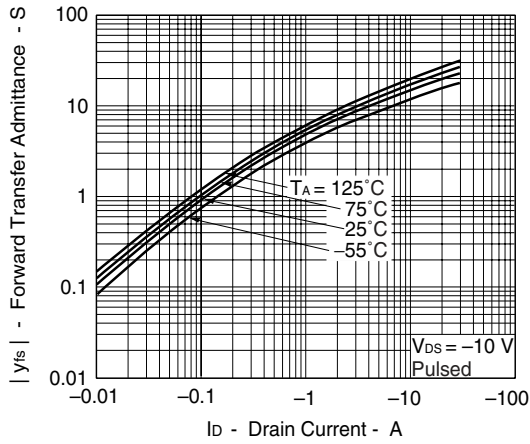
FORWARD TRANSFER CHARACTERISTICS



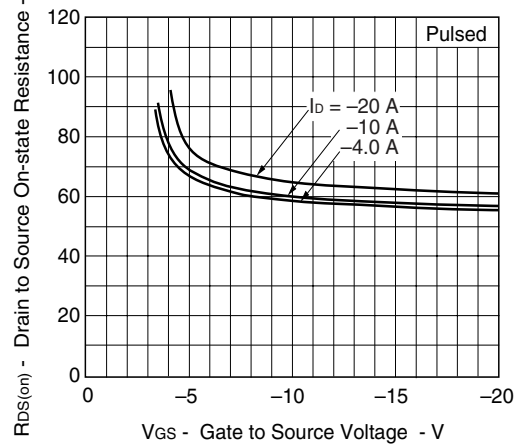
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



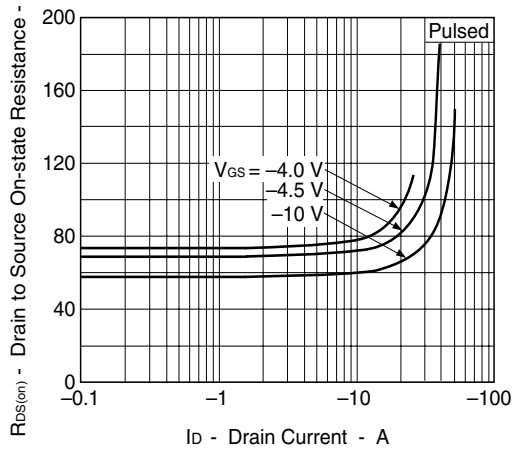
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



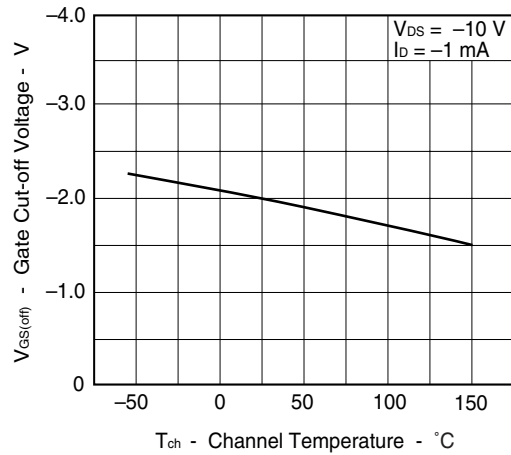
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

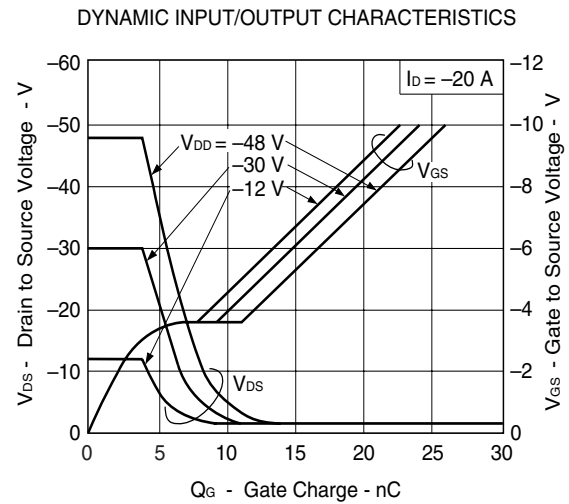
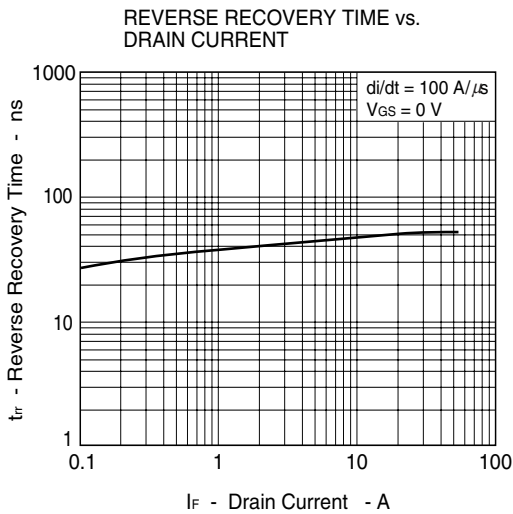
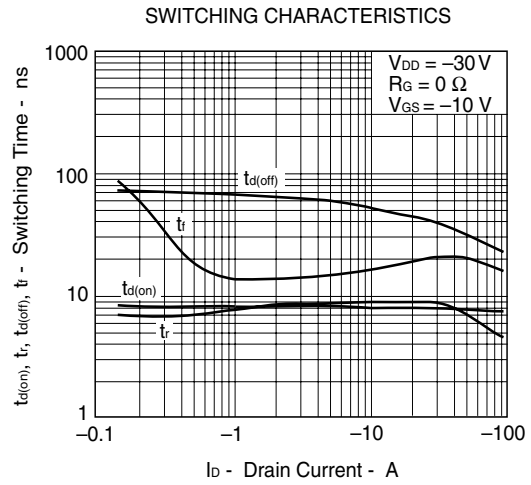
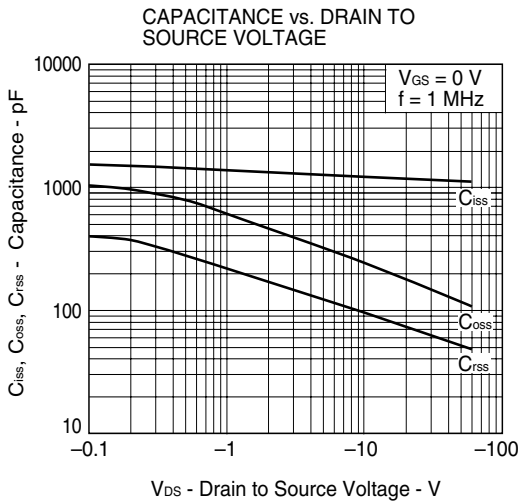
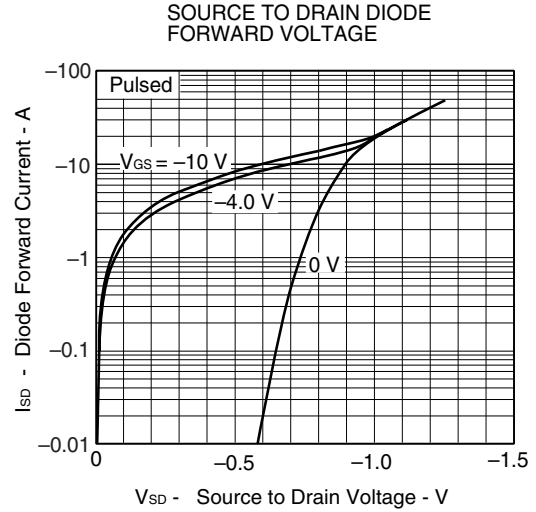
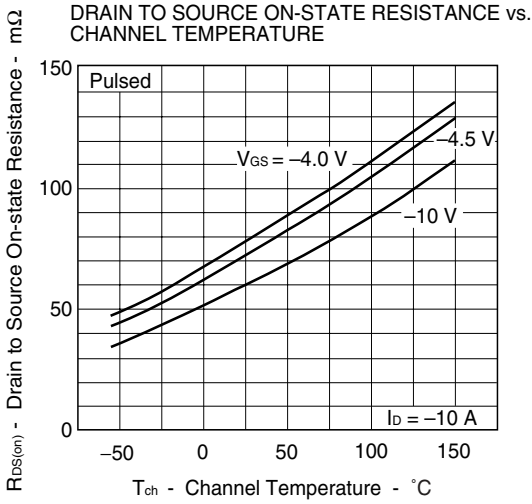


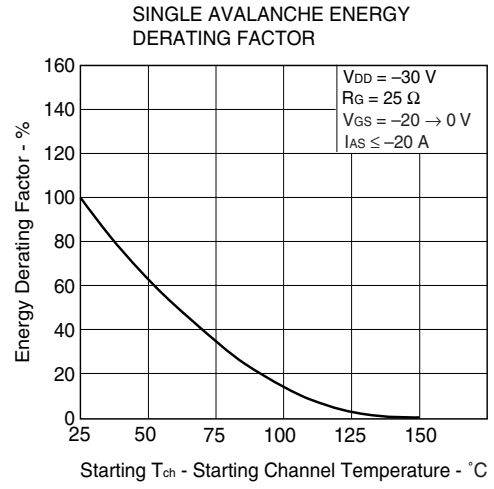
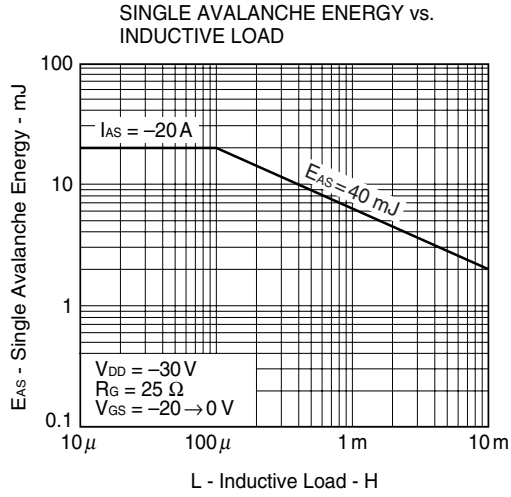
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



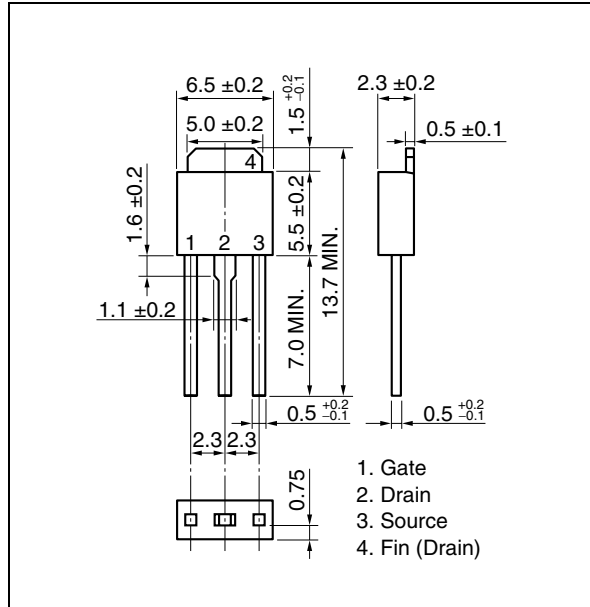




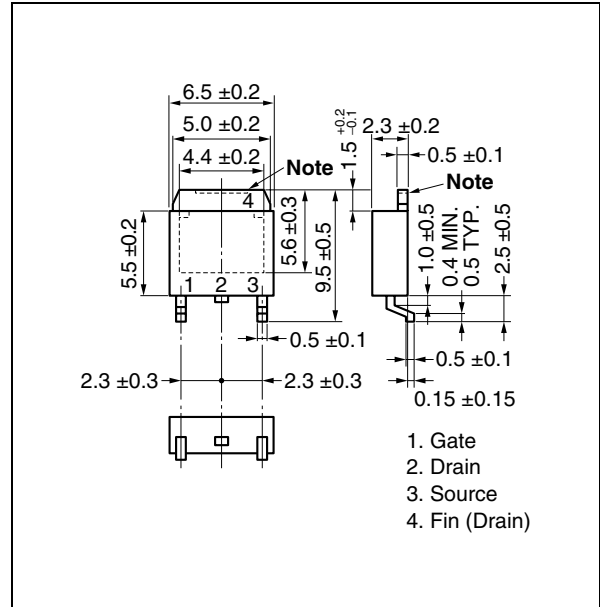


PACKAGE DRAWINGS (Unit: mm)

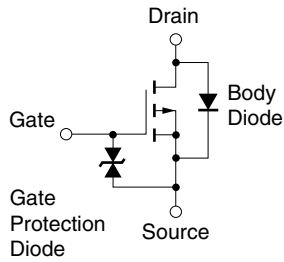
1) TO-251 (MP-3)



<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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