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

April 1st, 2010
Renesas Electronics Corporation

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

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MOS FIELD EFFECT TRANSISTOR

2SK3402

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

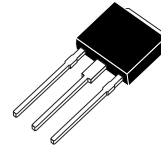
ORDERING INFORMATION

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

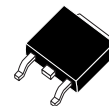
ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

Drain to Source Voltage ($V_{GS} = 0 \text{ V}$)	V_{DSS}	60	V
Gate to Source Voltage ($V_{DS} = 0 \text{ V}$)	V_{GSS}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 36	A
Drain Current (pulse) ^{Note1}	$I_{D(pulse)}$	± 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 to +150	$^\circ\text{C}$
Single Avalanche Current ^{Note2}	I_{AS}	35	A
Single Avalanche Energy ^{Note2}	E_{AS}	123	mJ

(TO-251)



(TO-252)



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

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

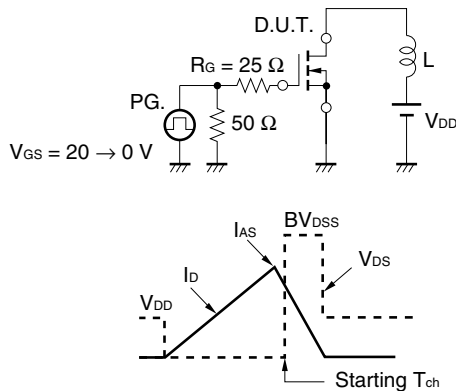
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ELECTRICAL CHARACTERISTICS (TA = 25°C)

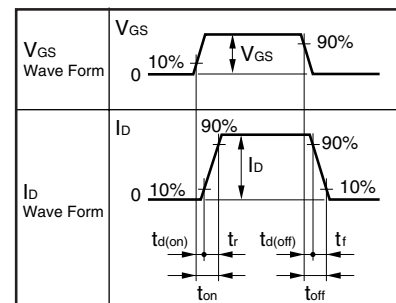
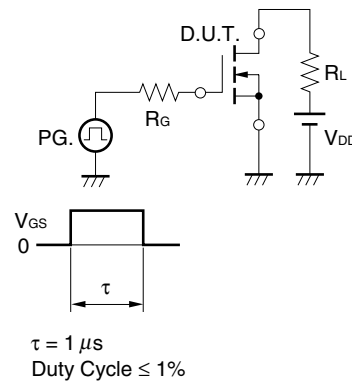
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 60\text{ V}, V_{GS} = 0\text{ V}$			10	μA
Gate Leakage Current	I_{GSS}	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			± 10	μA
Gate Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.5	2.0	2.5	V
Forward Transfer Admittance Note	$ y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 18\text{ A}$	13	27		S
Drain to Source On-state Resistance Note	$R_{DS(on)1}$	$V_{GS} = 10\text{ V}, I_D = 18\text{ A}$		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 Note	$V_{F(S-D)}$	$I_F = 36\text{ A}, V_{GS} = 0\text{ V}$		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

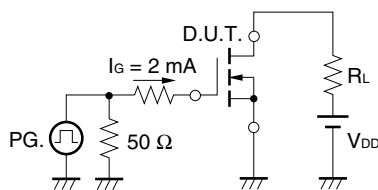
TEST CIRCUIT 1 AVALANCHE CAPABILITY



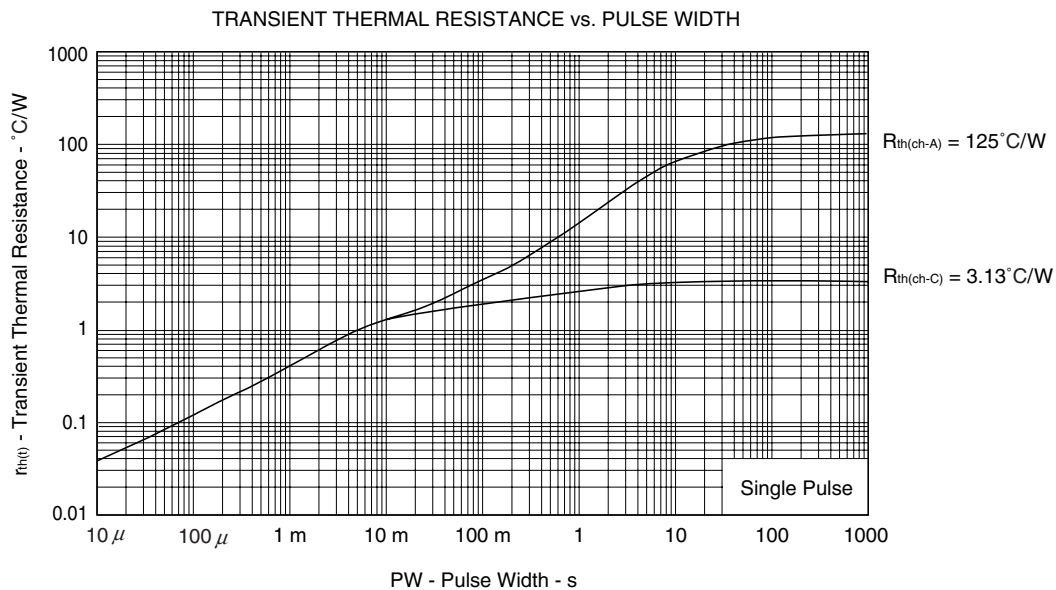
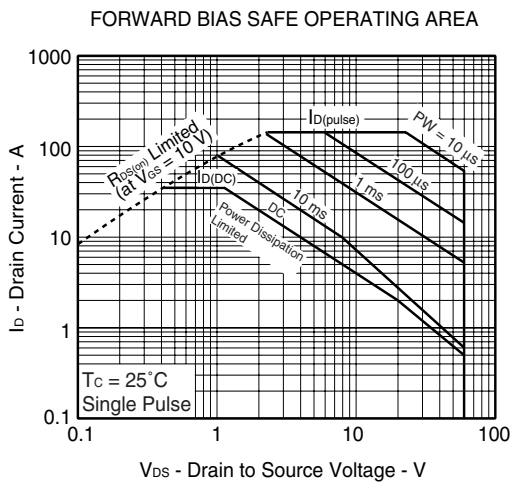
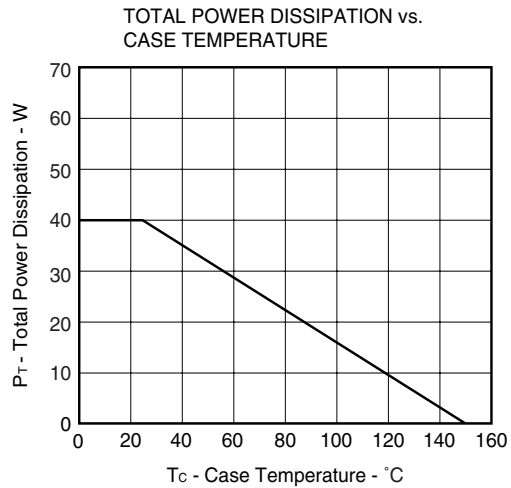
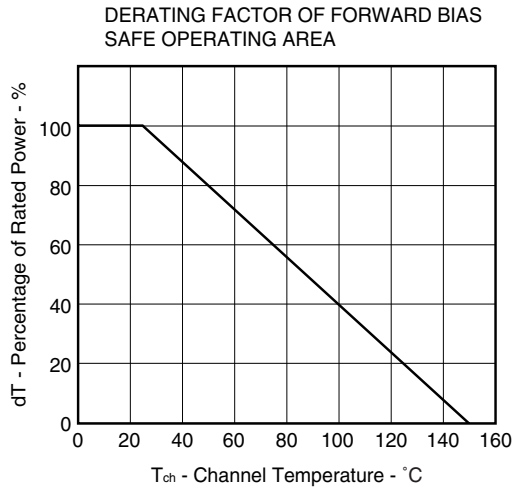
TEST CIRCUIT 2 SWITCHING TIME



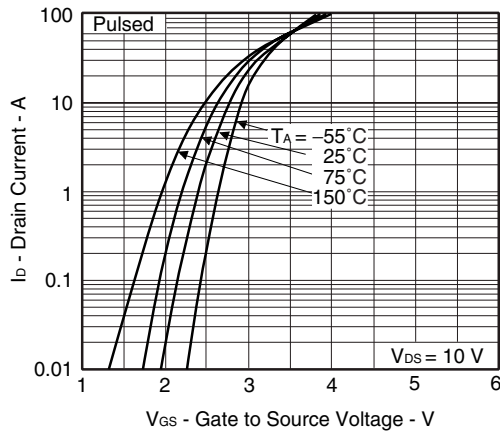
TEST CIRCUIT 3 GATE CHARGE



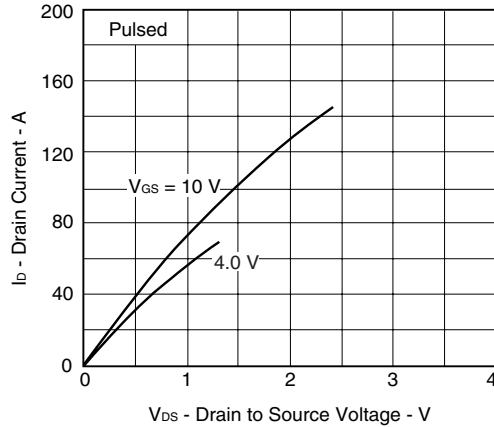
TYPICAL CHARACTERISTICS (T_A = 25°C)



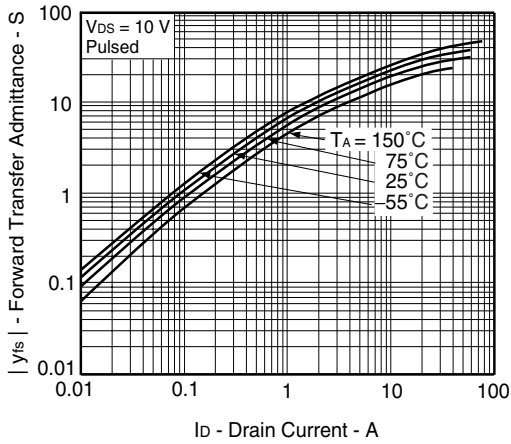
FORWARD TRANSFER CHARACTERISTICS



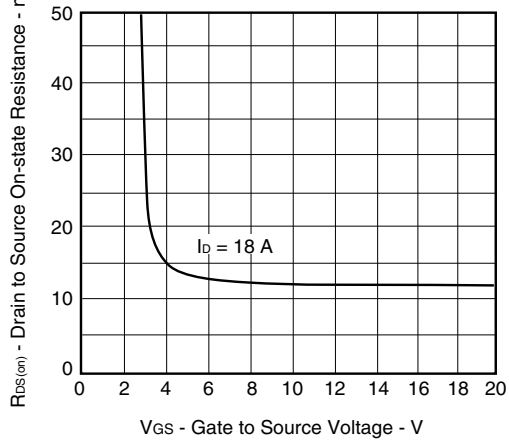
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



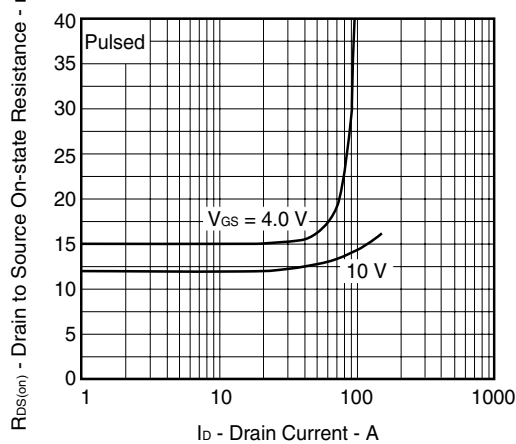
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



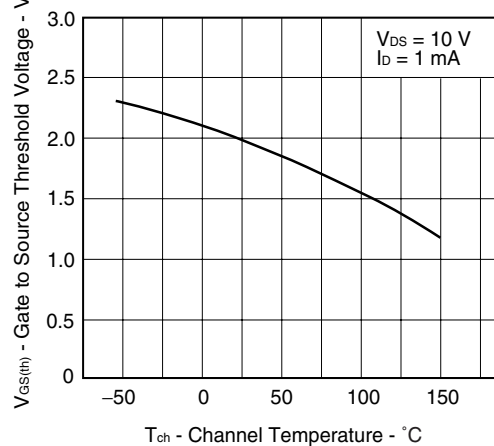
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

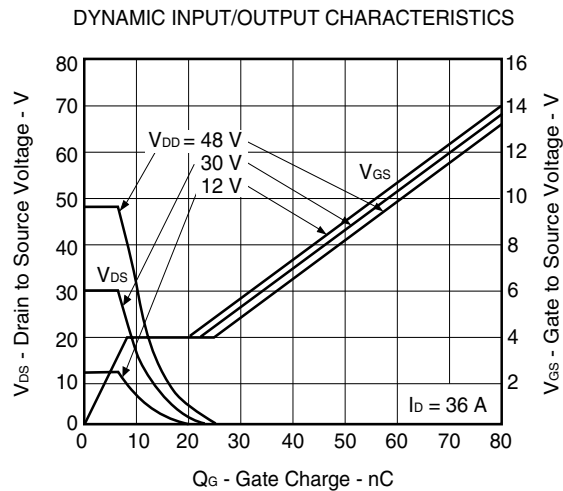
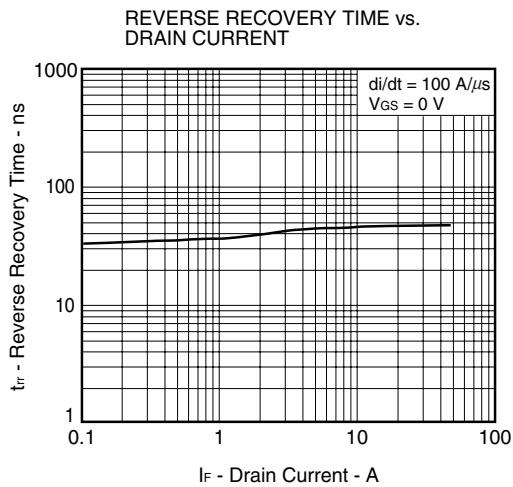
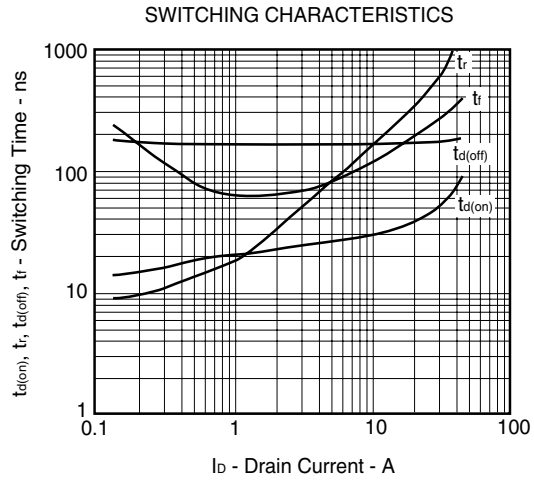
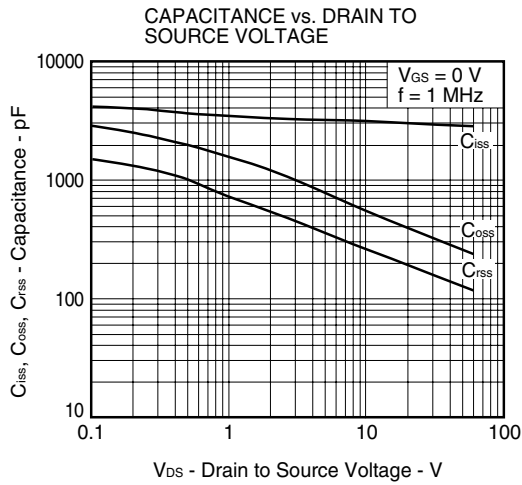
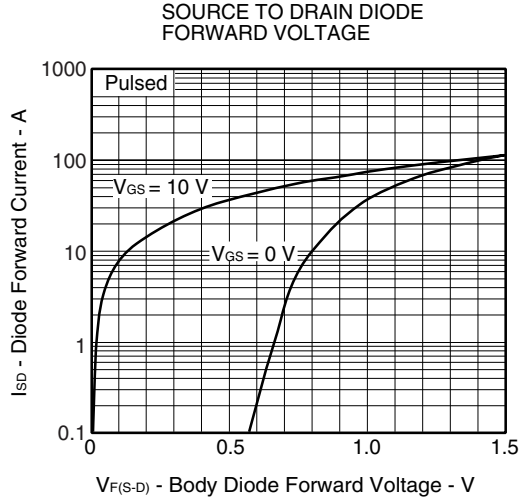
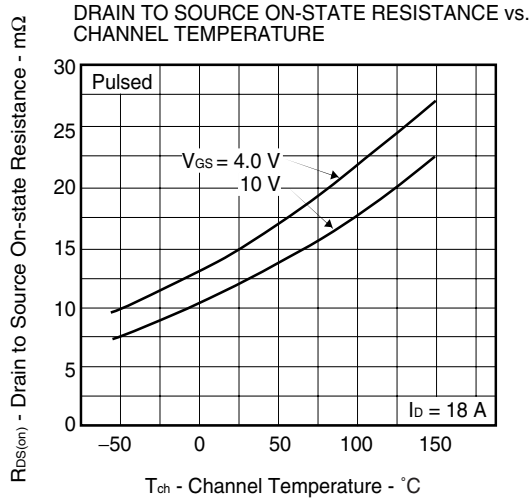


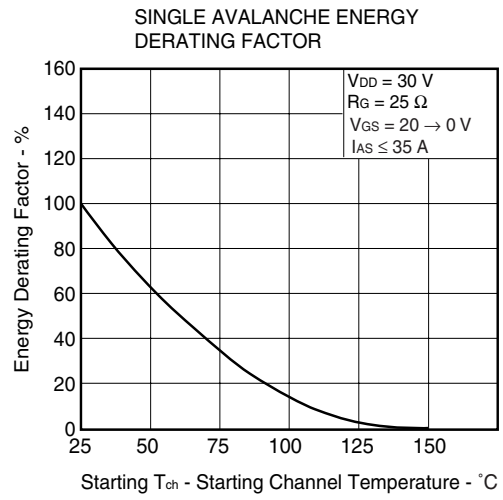
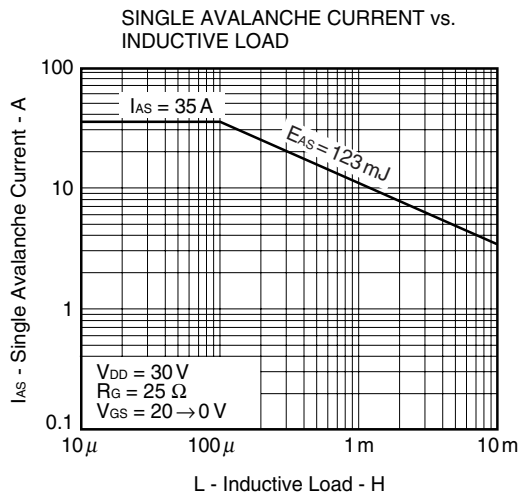
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



GATE TO SOURCE THRESHOLD VOLTAGE vs. CHANNEL TEMPERATURE



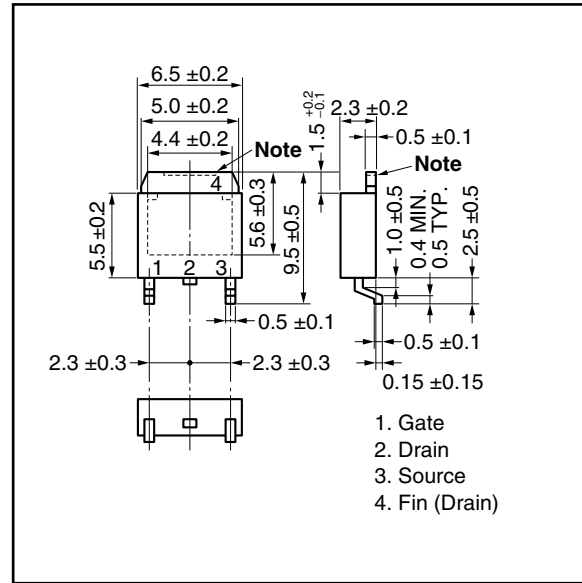
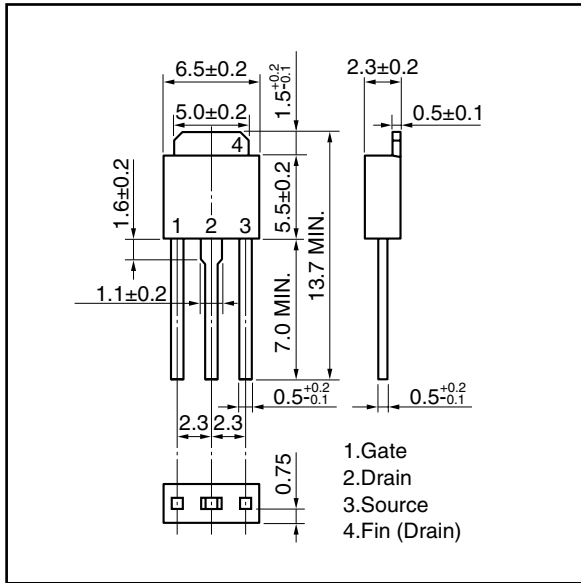




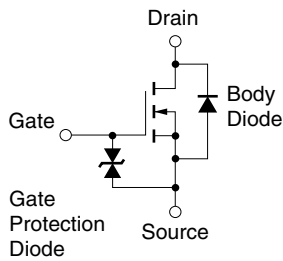
PACKAGE DRAWINGS (Unit: mm)

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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