To our customers,

Old Company Name in Catalogs and Other Documents

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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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RENESAS

DATA SHEET

MOS FIELD EFFECT TRANSISTOR
N0400P

SWITCHING
P-CHANNEL POWER MOSFET

DESCRIPTION

The N0400P is P-channel MOS Field Effect Transistor designed for high current and 2.5 V drive switching applications.

ORDERING INFORMATION

PART NUMBER	LEAD PLATING	PACKING	PACKAGE
N0400P-ZK-E1-AY Note	Pure Sn (Tin)	Tape 2500 p/reel	TO-252 (MP-3ZK)
N0400P-ZK-E2-AY Note			

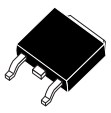
Note Pb-free (This product does not contain Pb in external electrode.)

FEATURES

- 2.5 V drive available
- Super low on-state resistance
  $R_{DS(on)1}$ = 40 mΩ MAX. (V_{GS} = –4.5 V, I_D = –7.5 A)
  $R_{DS(on)2}$ = 73 mΩ MAX. (V_{GS} = –2.5 V, I_D = –7.5 A)
- Built-in gate protection diode

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C)

(TO-252)



Drain to Source Voltage (V_{GS} = 0 V)	V_{DSS}	–40	V
Gate to Source Voltage (V_{DS} = 0 V)	V_{GSS}	∓12	V
Drain Current (DC) (T_C = 25°C)	$I_{D(DC)}$	∓15	A
Drain Current (pulse) Note1	$I_{D(pulse)}$	∓45	A
Total Power Dissipation (T_C = 25°C)	P_{T1}	25	W
Total Power Dissipation (T_A = 25°C)	P_{T2}	1.0	W
Channel Temperature	T_{ch}	150	°C
Storage Temperature	T_{stg}	–55 to +150	°C
Single Avalanche Current Note2	I_{AS}	–16	A
Single Avalanche Energy Note2	E_{AS}	25	mJ

Notes 1. PW ≤ 10 μs, Duty Cycle ≤ 1%

2. Starting T_{ch} = 25°C, V_{DD} = –20 V, R_G = 25 Ω, V_{GS} = –12 → 0 V

THERMAL RESISTANCE

Channel to Case Thermal Resistance	$R_{th(ch-C)}$	5.0	°C/W
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	125	°C/W

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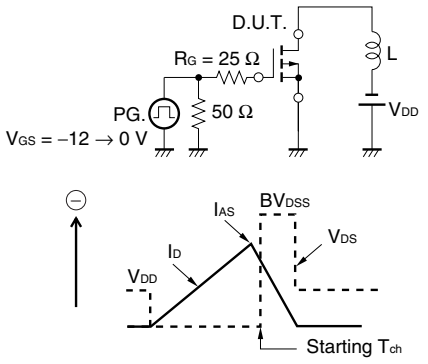
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ELECTRICAL CHARACTERISTICS (T_A = 25°C)

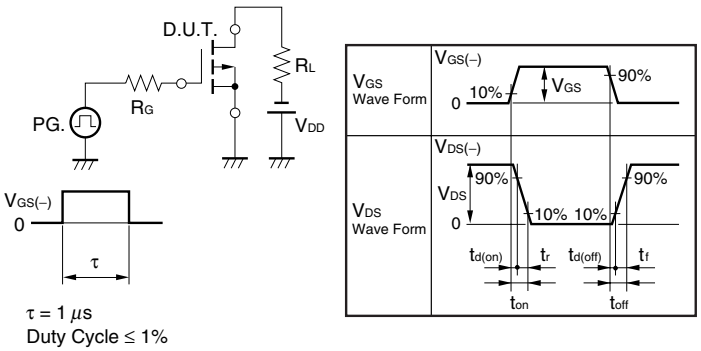
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = –40 V, V_{GS} = 0 V			–10	μA
Gate Leakage Current	I_{GSS}	V_{GS} = ∓20 V, V_{DS} = 0 V			∓10	μA
Gate to Source Cut-off Voltage	$V_{GS(off)}$	V_{DS} = –10 V, I_D = –1 mA	–0.5	–1.0	–1.5	V
Forward Transfer Admittance Note	$\|y_{fs}\|$	V_{DS} = –10 V, I_D = –7.5 A	6.0			S
Drain to Source On-state Resistance Note	$R_{DS(on)1}$	V_{GS} = –4.5 V, I_D = –7.5 A		31	40	mΩ
	$R_{DS(on)2}$	V_{GS} = –2.5 V, I_D = –7.5 A		40	73	mΩ
Input Capacitance	C_{iss}	V_{DS} = –10 V,		1400		pF
Output Capacitance	C_{oss}	V_{GS} = 0 V,		200		pF
Reverse Transfer Capacitance	C_{rss}	f = 1 MHz		155		pF
Turn-on Delay Time	$t_{d(on)}$	V_{DD} = –20 V, I_D = –7.5 A,		11		ns
Rise Time	t_r	V_{GS} = –4.5 V,		16		ns
Turn-off Delay Time	$t_{d(off)}$	R_G = 0 Ω		104		ns
Fall Time	t_f			93		ns
Total Gate Charge	Q_G	V_{DD} = –32 V,		16		nC
Gate to Source Charge	Q_{GS}	V_{GS} = –4.5 V,		3		nC
Gate to Drain Charge	Q_{GD}	I_D = –15 A		7		nC
Body Diode Forward Voltage Note	$V_{F(S-D)}$	I_F = –15 A, V_{GS} = 0 V		0.94	1.5	V
Reverse Recovery Time	t_{rr}	I_F = –15 A, V_{GS} = 0 V,		32		ns
Reverse Recovery Charge	Q_{rr}	di/dt = –100 A/μs		33		nC

Note Pulsed: PW ≤ 350 μs, Duty Cycle ≤ 2%

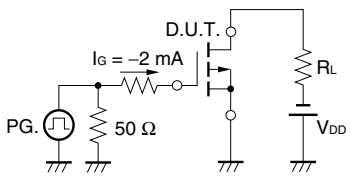
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

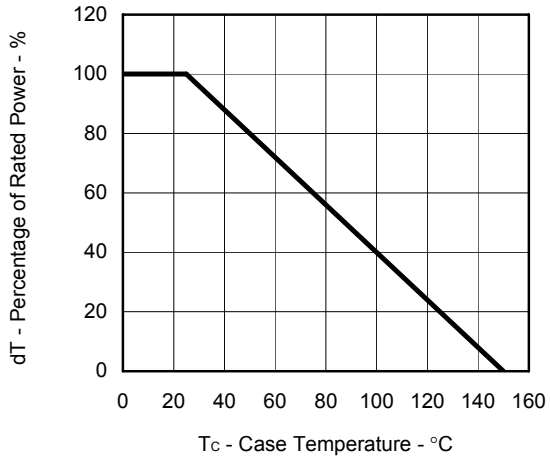


TEST CIRCUIT 3 GATE CHARGE

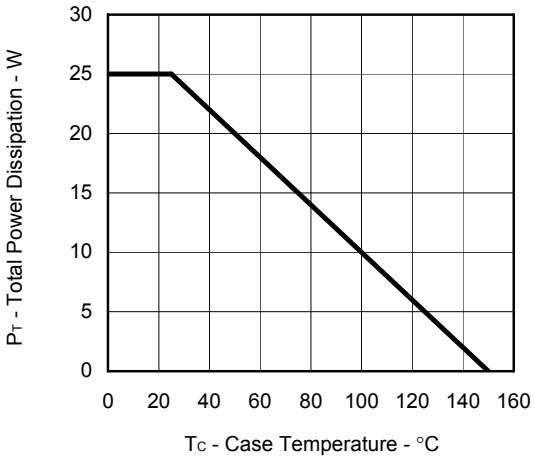


TYPICAL CHARACTERISTICS (T_A = 25°C)

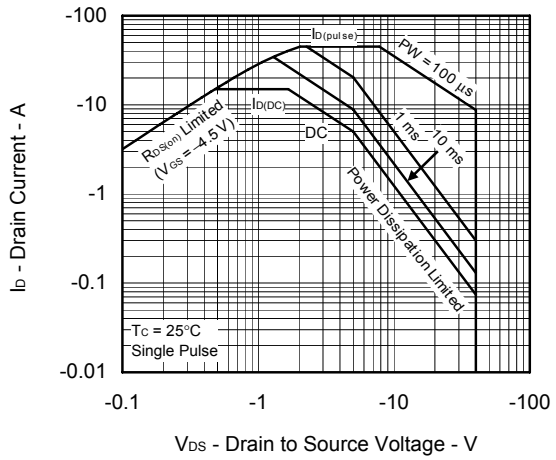
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



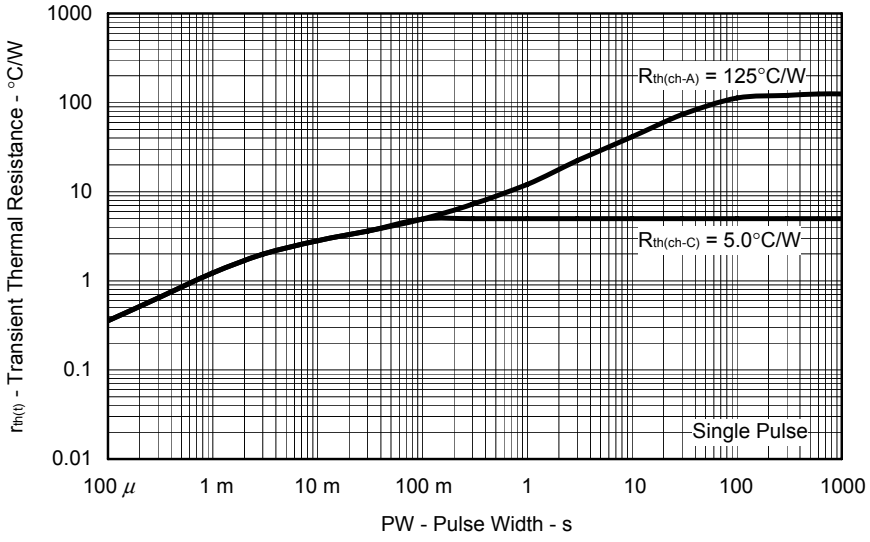
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



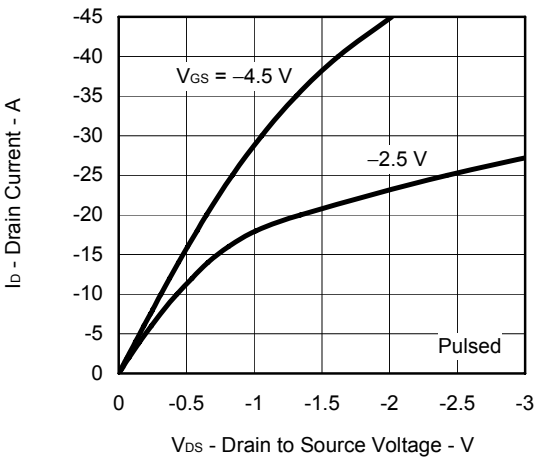
FORWARD BIAS SAFE OPERATING AREA



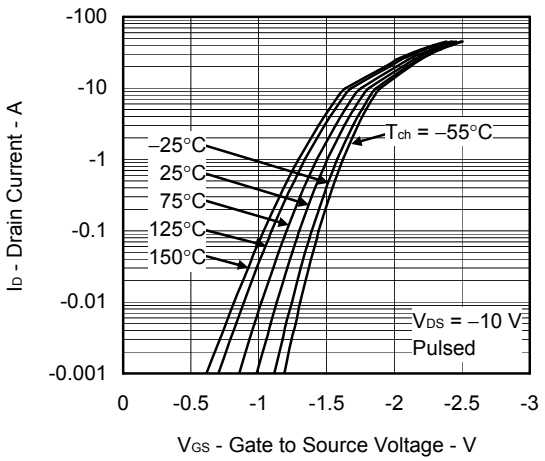
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



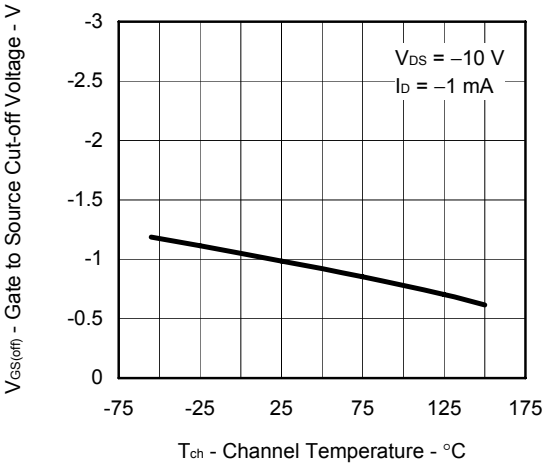
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



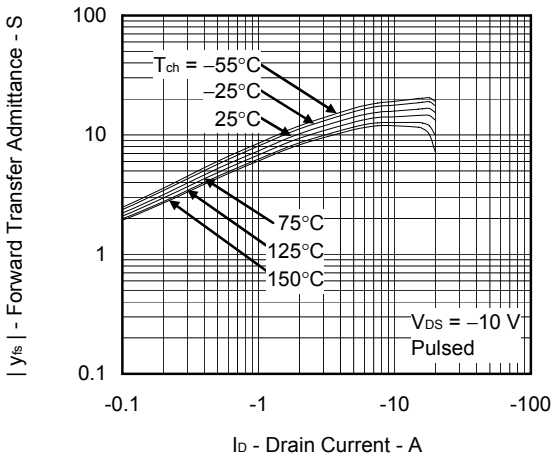
FORWARD TRANSFER CHARACTERISTICS



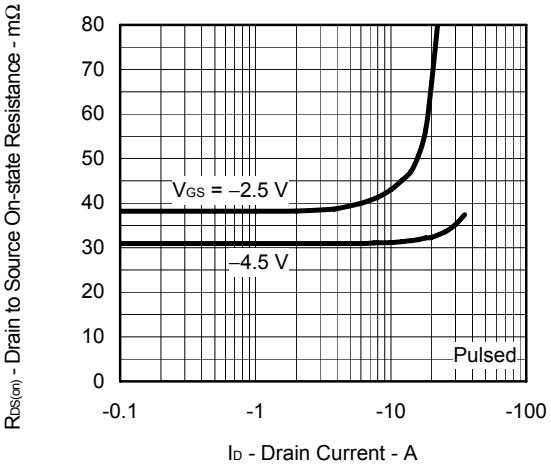
GATE TO SOURCE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



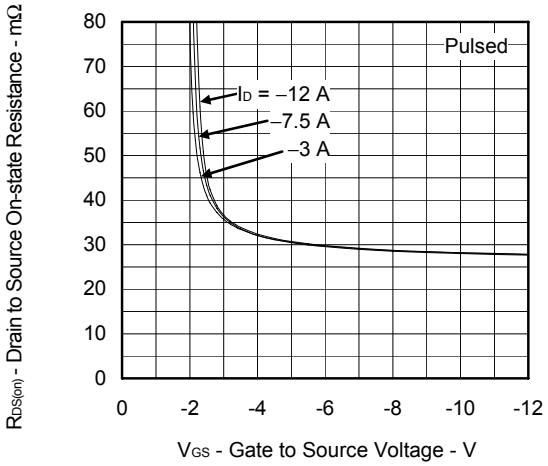
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



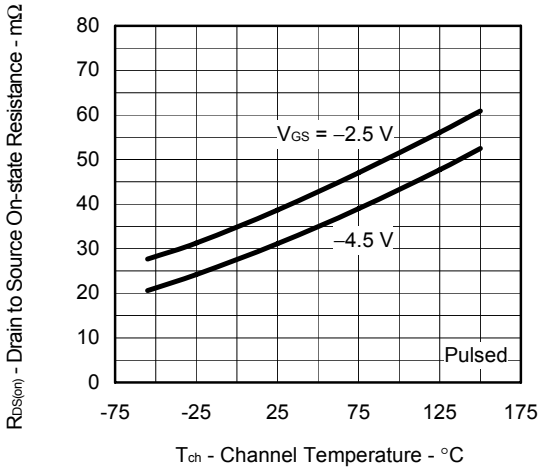
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT



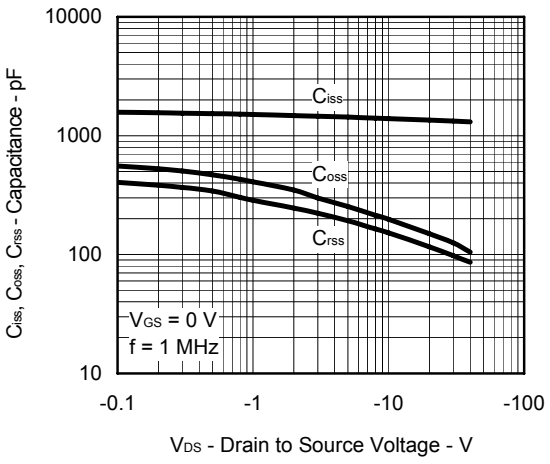
DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE



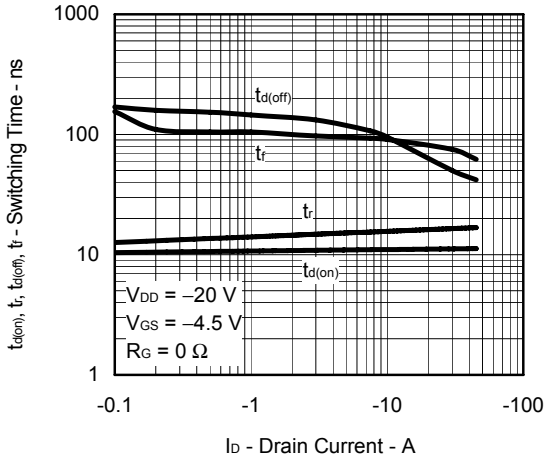
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



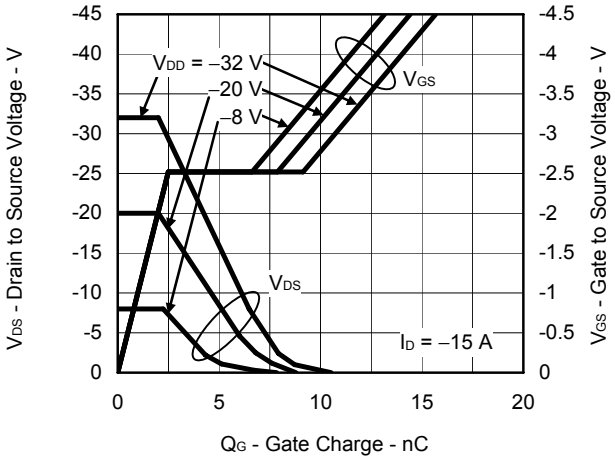
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



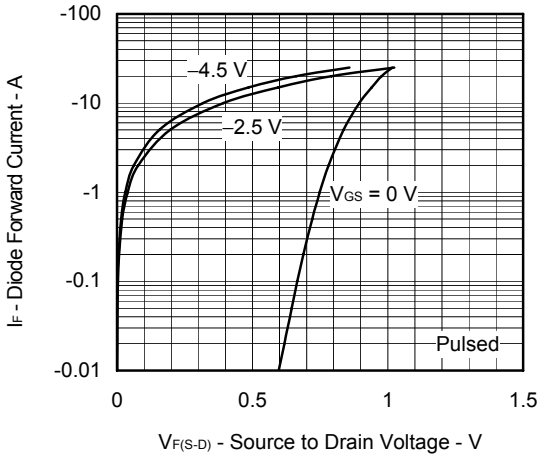
SWITCHING CHARACTERISTICS



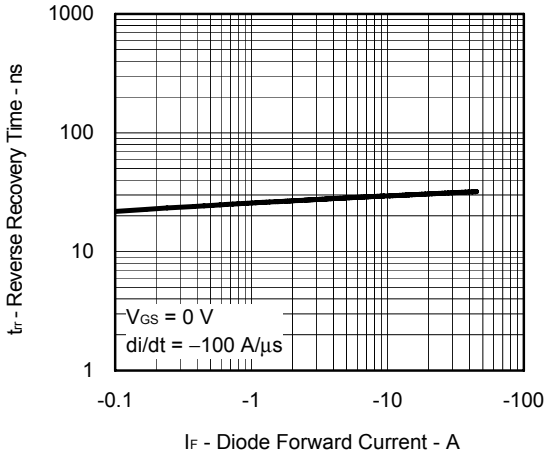
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



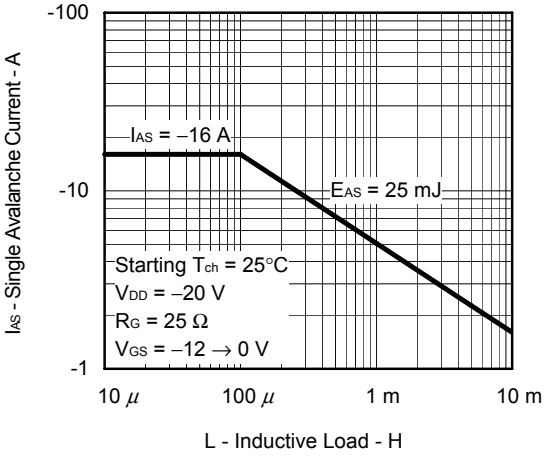
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



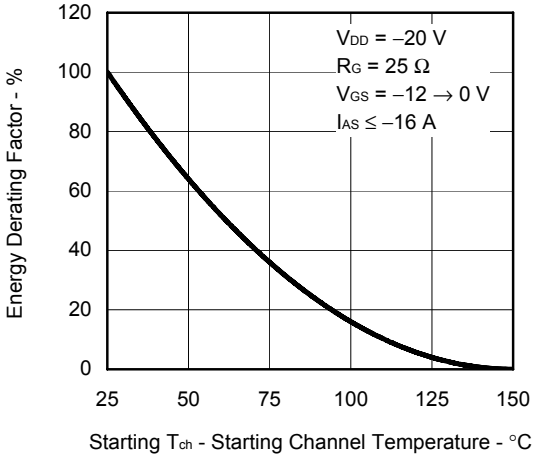
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



SINGLE AVALANCHE CURRENT vs.
INDUCTIVE LOAD

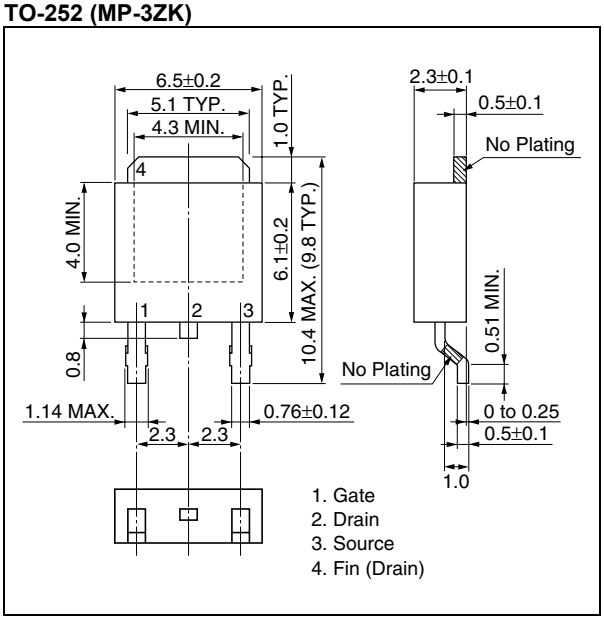


SINGLE AVALANCHE ENERGY
DERATING FACTOR

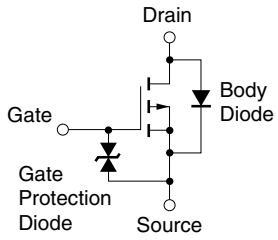


PACKAGE DRAWING (Unit: mm)

TO-252 (MP-3ZK)



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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