

MOS FIELD EFFECT TRANSISTOR

2SK3993

SWITCHING

N-CHANNEL POWER MOS FET

DESCRIPTION

The 2SK3993 is N-channel MOS FET device that features a low on-state resistance and excellent switching characteristics, and designed for low voltage high current applications such as DC/DC converter with synchronous rectifier.

ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3993	TO-251 (MP-3)
2SK3993-ZK	TO-252 (MP-3ZK)

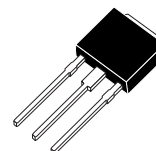
FEATURES

- Low on-state resistance
 $R_{DS(on)1} = 3.8 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 32 \text{ A)}$
- Low C_{iss} : $C_{iss} = 4770 \text{ pF TYP.}$
- 5 V drive available

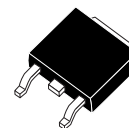
ABSOLUTE MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

Drain to Source Voltage ($V_{GS} = 0 \text{ V}$)	V_{DSS}	25	V
Gate to Source Voltage ($V_{DS} = 0 \text{ V}$)	V_{GSS}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 64	A
Drain Current (pulse) ^{Note1}	$I_{D(pulse)}$	± 256	A
Total Power Dissipation ($T_C = 25^\circ\text{C}$)	P_{T1}	40	W
Total Power Dissipation	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 ^{Note2}	I_{AS}	41	A
Single Avalanche Energy ^{Note2}	E_{AS}	168	mJ

(TO-251)



(TO-252)



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

2. Starting $T_{ch} = 25^\circ\text{C}$, $V_{DD} = 12.5 \text{ V}$, $R_G = 25 \Omega$, $V_{GS} = 20 \rightarrow 0 \text{ V}$

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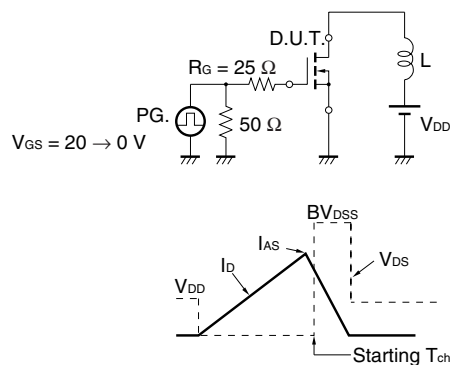
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ELECTRICAL CHARACTERISTICS (T_A = 25°C)

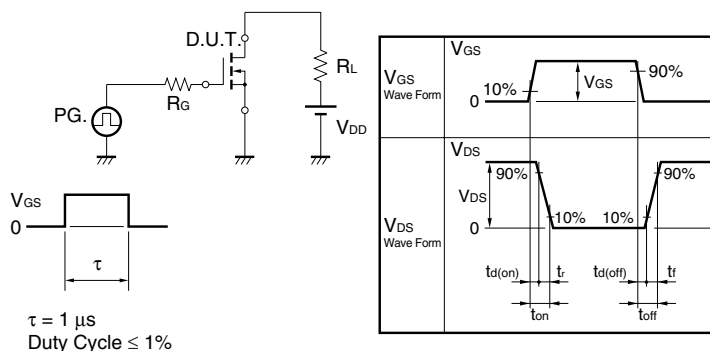
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 25 V, V _{GS} = 0 V			10	μA
Gate Leakage Current	I _{GSS}	V _{GS} = ±20 V, V _{DS} = 0 V			±100	nA
Gate Cut-off Voltage	V _{GS(off)}	V _{DS} = 10 V, I _D = 1 mA	2.0	2.4	3.0	V
Forward Transfer Admittance ^{Note}	y _{fs}	V _{DS} = 10 V, I _D = 16 A	15			S
Drain to Source On-state Resistance ^{Note}	R _{DS(on)1}	V _{GS} = 10 V, I _D = 32 A		2.7	3.8	mΩ
	R _{DS(on)2}	V _{GS} = 5.0 V, I _D = 16 A		4.1	7.8	mΩ
Input Capacitance	C _{iss}	V _{DS} = 10 V		4770		pF
Output Capacitance	C _{oss}	V _{GS} = 0 V		1000		pF
Reverse Transfer Capacitance	C _{rss}	f = 1 MHz		690		pF
Turn-on Delay Time	t _{d(on)}	V _{DD} = 12.5 V, I _D = 32 A		27		ns
Rise Time	t _r	V _{GS} = 10 V		38		ns
Turn-off Delay Time	t _{d(off)}	R _G = 10 Ω		107		ns
Fall Time	t _f			54		ns
Total Gate Charge	Q _G	V _{DD} = 20 V		88		nC
Gate to Source Charge	Q _{GS}	V _{GS} = 10 V		16		nC
Gate to Drain Charge	Q _{GD}	I _D = 64 A		30		nC
Body Diode Forward Voltage ^{Note}	V _{F(S-D)}	I _F = 64 A, V _{GS} = 0 V		0.91		V
Reverse Recovery Time	t _{rr}	I _F = 64 A, V _{GS} = 0 V		43		ns
Reverse Recovery Charge	Q _{rr}	di/dt = 100 A/μs		52		nC

Note Pulsed

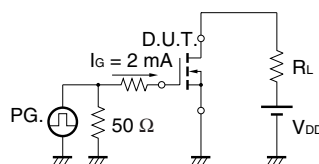
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

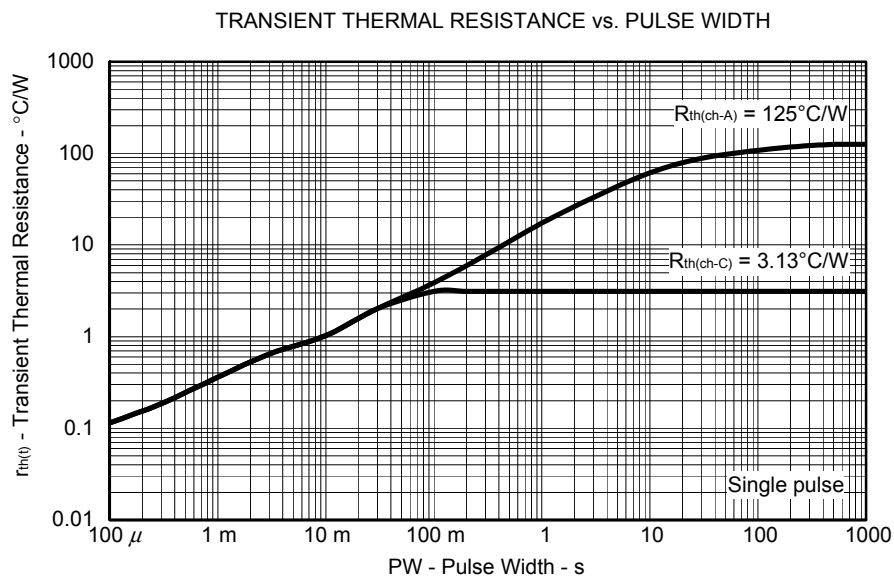
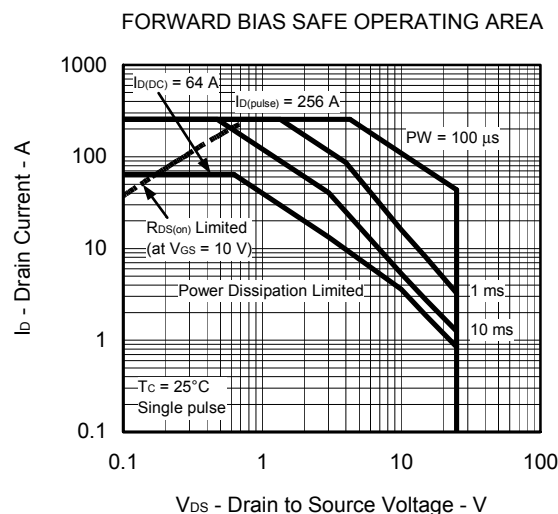
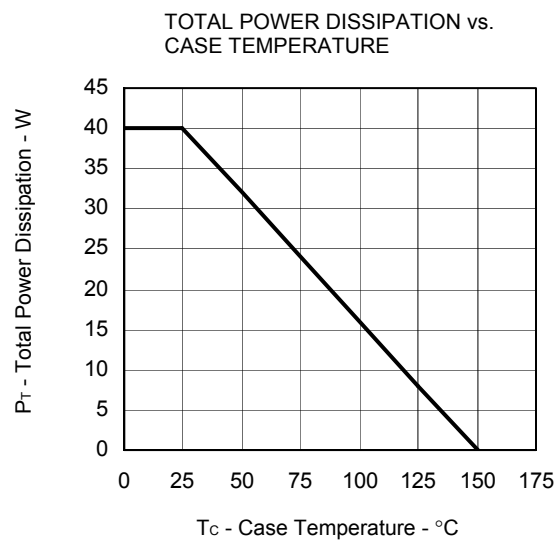
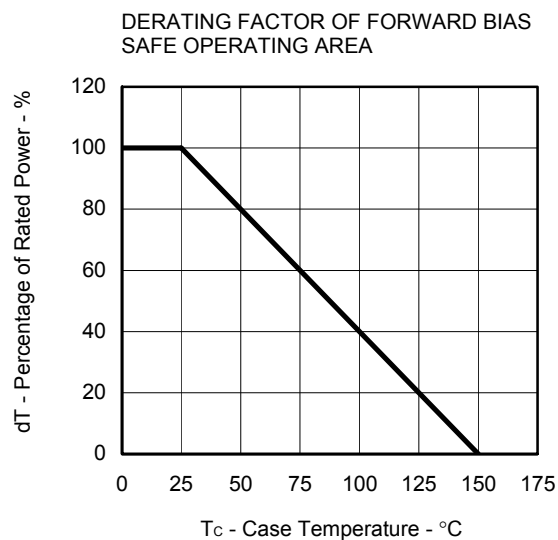


TEST CIRCUIT 3 GATE CHARGE



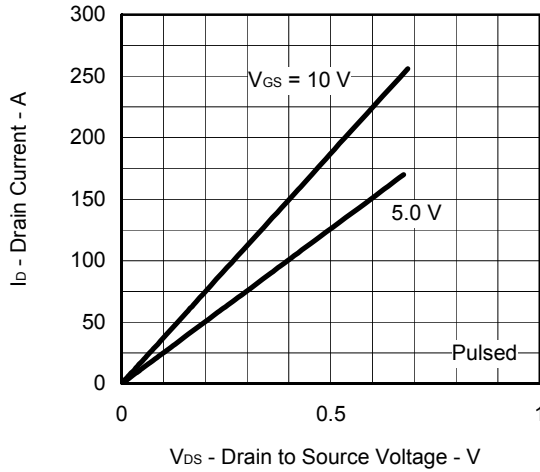
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TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$)

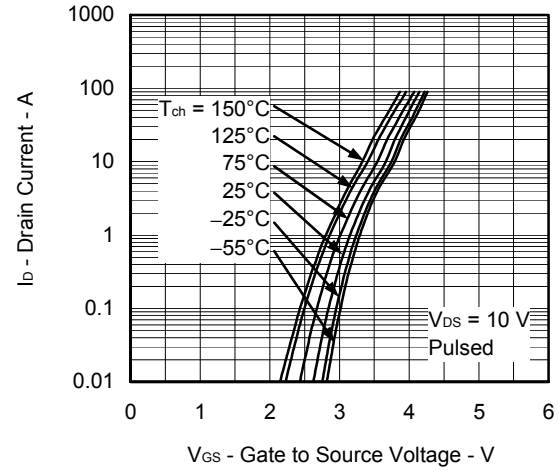


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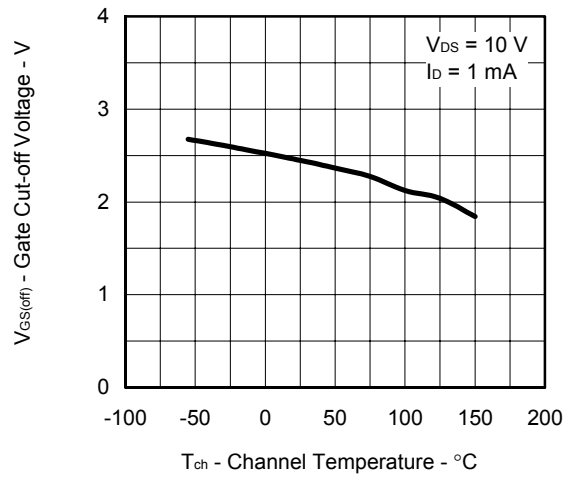
DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE



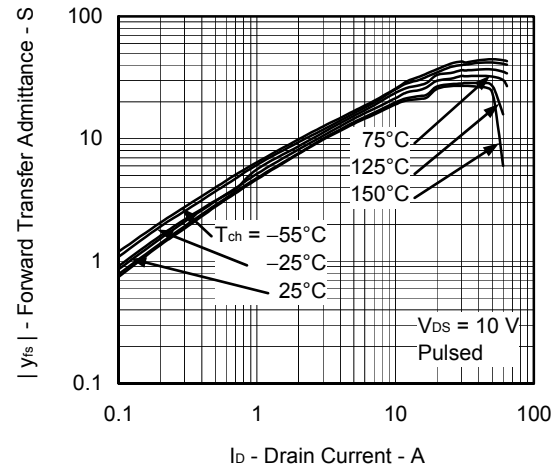
FORWARD TRANSFER CHARACTERISTICS



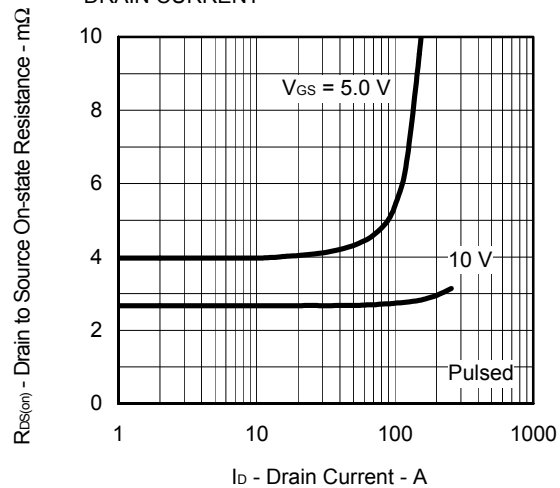
GATE CUT-OFF VOLTAGE vs.
CHANNEL TEMPERATURE



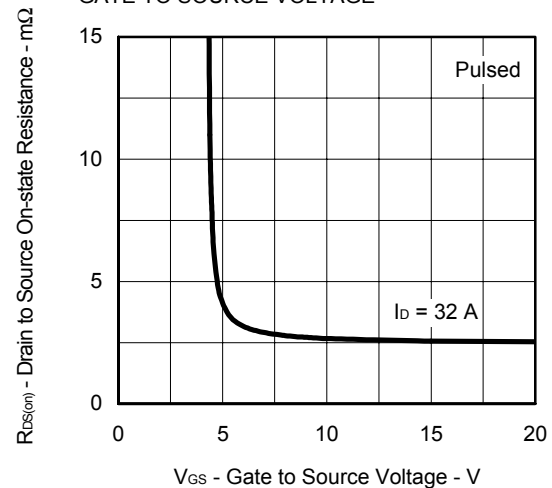
FORWARD TRANSFER ADMITTANCE vs.
DRAIN CURRENT



DRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENT

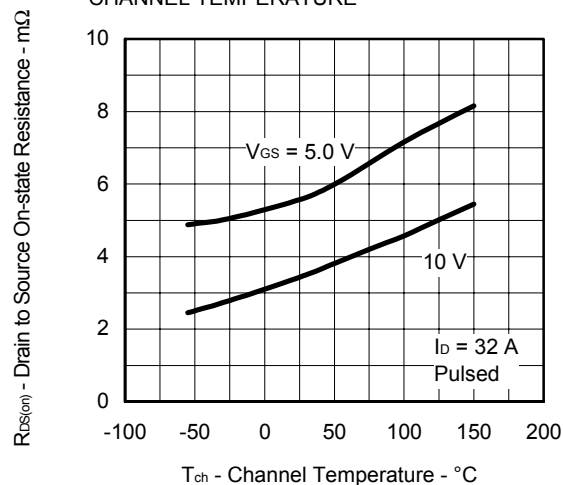


DRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE

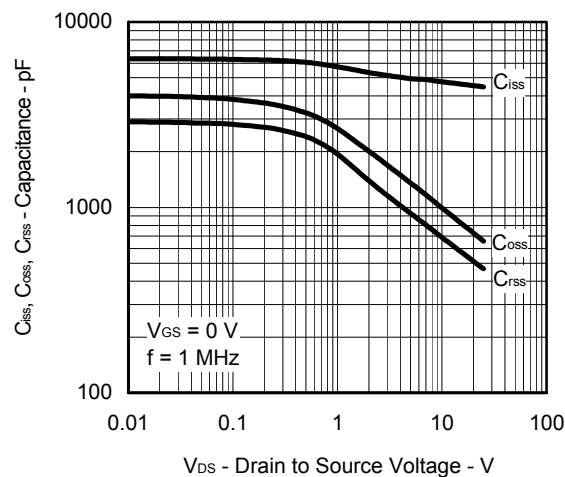


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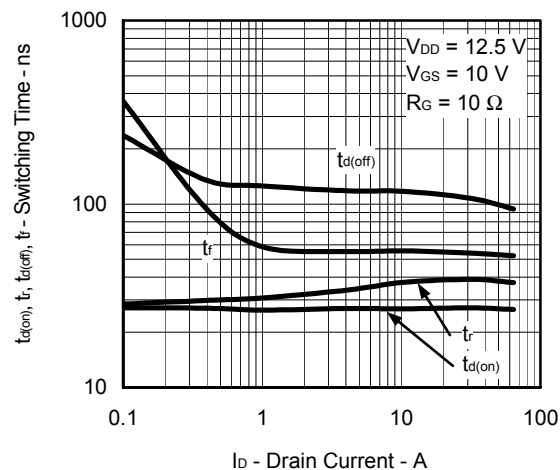
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



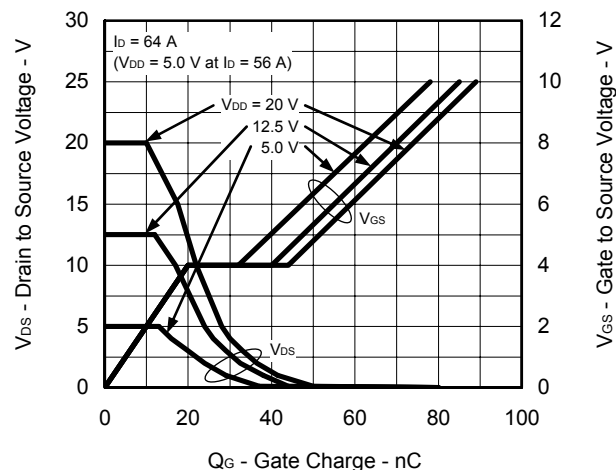
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



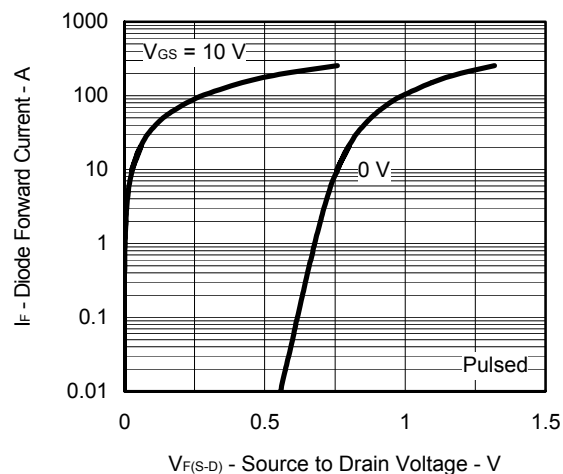
SWITCHING CHARACTERISTICS



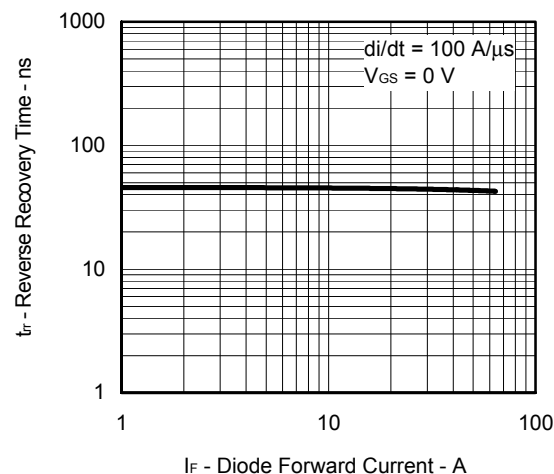
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

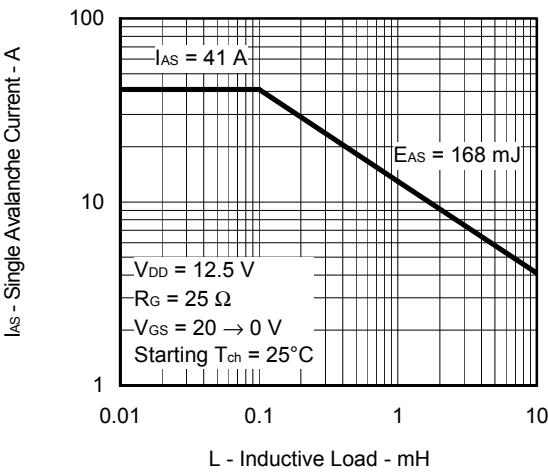


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

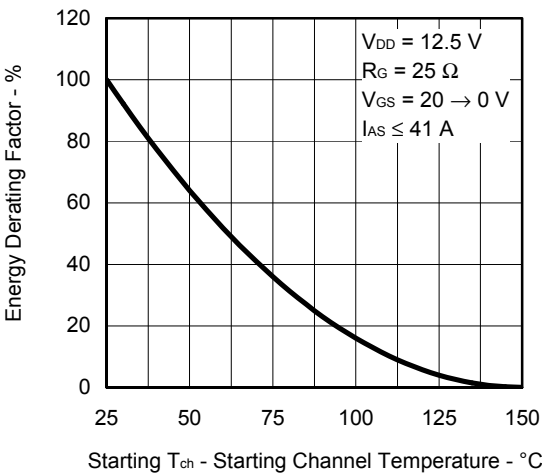


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SINGLE AVALANCHE CURRENT vs.
INDUCTIVE LOAD

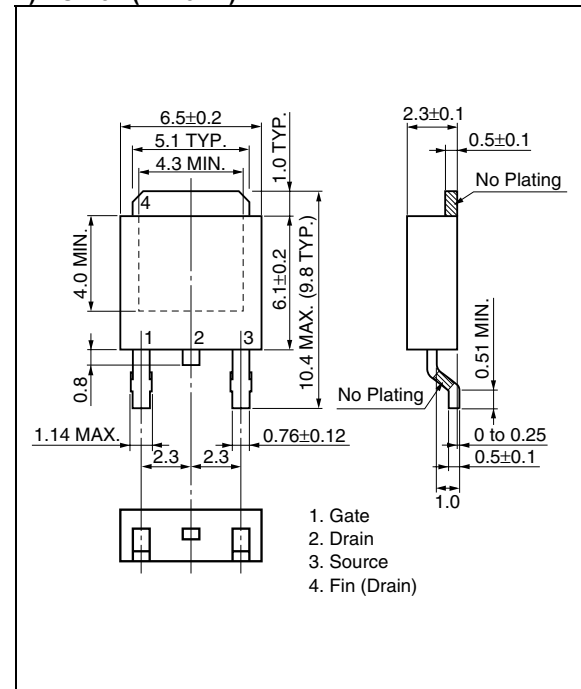


SINGLE AVALANCHE ENERGY
DERATING FACTOR



PACKAGE DRAWINGS (Unit: mm)

2) TO-252 (MP-3ZK)



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