

SWITCHING  
N-CHANNEL POWER MOS FET

## DESCRIPTION

The 2SK3641 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.

## FEATURES

- Low on-state resistance  
 $R_{DS(on)1} = 14 \text{ m}\Omega \text{ MAX. (} V_{GS} = 10 \text{ V, } I_D = 18 \text{ A)}$   
 $R_{DS(on)2} = 25 \text{ m}\Omega \text{ MAX. (} V_{GS} = 4.5 \text{ V, } I_D = 15 \text{ A)}$
- Low  $C_{iss}$ :  $C_{iss} = 930 \text{ pF TYP.}$
- Built-in gate protection diode

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

Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	30	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 36$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 140$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	29	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 <sup>Note2</sup>	$I_{AS}$	19	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	36	mJ

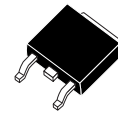
**Notes 1.**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

**2.** Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 15 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $L = 100 \mu\text{H}$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$

## ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3641-ZK	TO-252 (MP-3ZK)

(TO-252)



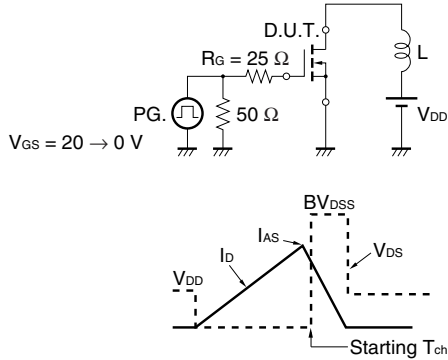
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**ELECTRICAL CHARACTERISTICS (Ta = 25°C)**

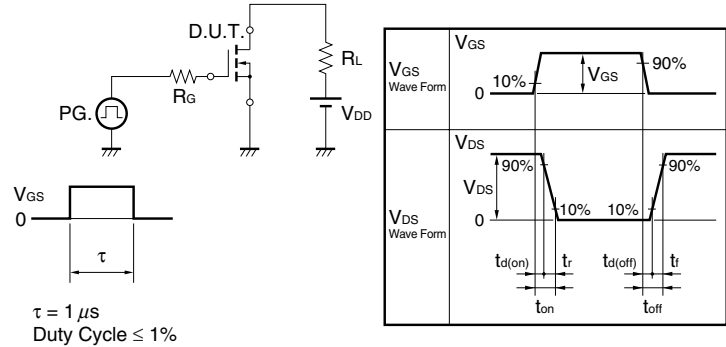
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$			10	$\mu\text{A}$
Gate Leakage Current	$I_{GSS}$	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$			$\pm 10$	$\mu\text{A}$
Gate Cut-off Voltage	$V_{GS(off)}$	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$	1.5		2.5	V
Forward Transfer Admittance <sup>Note</sup>	$ y_{fs} $	$V_{DS} = 10\text{ V}, I_D = 18\text{ A}$	5.5	11		S
Drain to Source On-state Resistance <sup>Note</sup>	$R_{DS(on)1}$	$V_{GS} = 10\text{ V}, I_D = 18\text{ A}$		11	14	$\text{m}\Omega$
	$R_{DS(on)2}$	$V_{GS} = 4.5\text{ V}, I_D = 15\text{ A}$		17	25	$\text{m}\Omega$
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}$		930		pF
Output Capacitance	$C_{oss}$	$V_{GS} = 0\text{ V}$		250		pF
Reverse Transfer Capacitance	$C_{rss}$	$f = 1\text{ MHz}$		160		pF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD} = 15\text{ V}, I_D = 18\text{ A}$		9.4		ns
Rise Time	$t_r$	$V_{GS} = 10\text{ V}$		8.6		ns
Turn-off Delay Time	$t_{d(off)}$	$R_G = 10\ \Omega$		34		ns
Fall Time	$t_f$			11		ns
Total Gate Charge	$Q_G$	$V_{DD} = 24\text{ V}$		22		nC
Gate to Source Charge	$Q_{GS}$	$V_{GS} = 10\text{ V}$		3.6		nC
Gate to Drain Charge	$Q_{GD}$	$I_D = 36\text{ A}$		7.4		nC
Body Diode Forward Voltage <sup>Note</sup>	$V_{F(S-D)}$	$I_F = 36\text{ A}, V_{GS} = 0\text{ V}$		1.0		V
Reverse Recovery Time	$t_{rr}$	$I_F = 36\text{ A}, V_{GS} = 0\text{ V}$		24		ns
Reverse Recovery Charge	$Q_{rr}$	$di/dt = 100\text{ A}/\mu\text{s}$		15		nC

**Note** Pulsed:  $PW \leq 350\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$

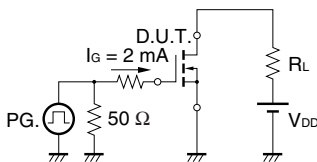
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



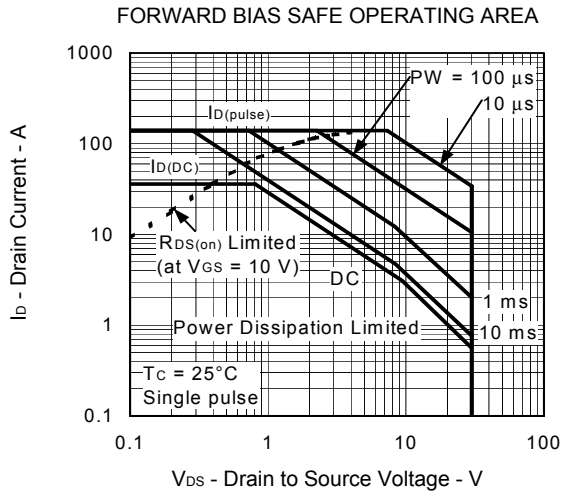
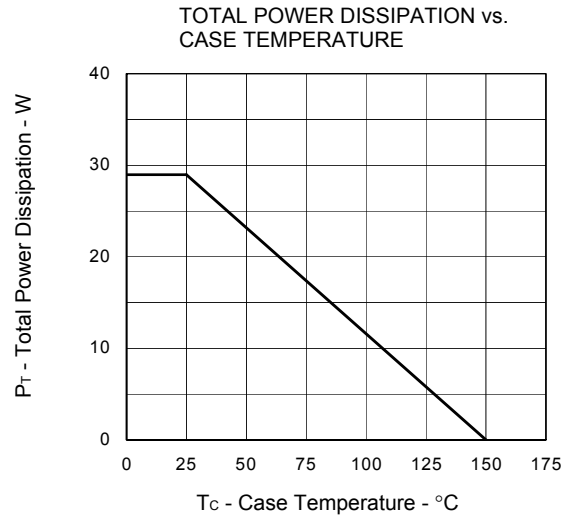
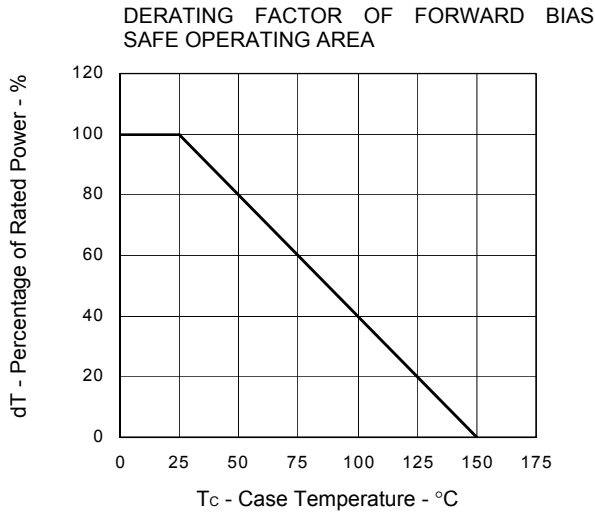
**TEST CIRCUIT 2 SWITCHING TIME**



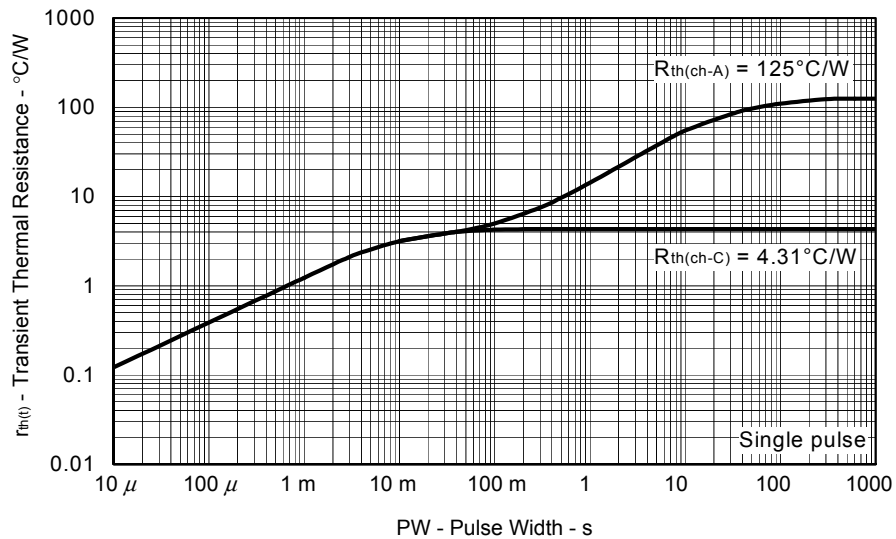
**TEST CIRCUIT 3 GATE CHARGE**



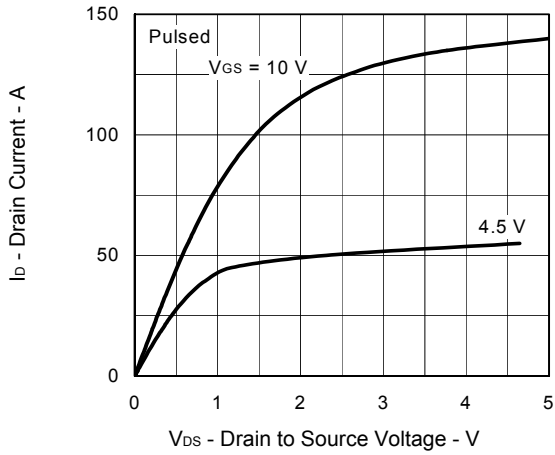
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)



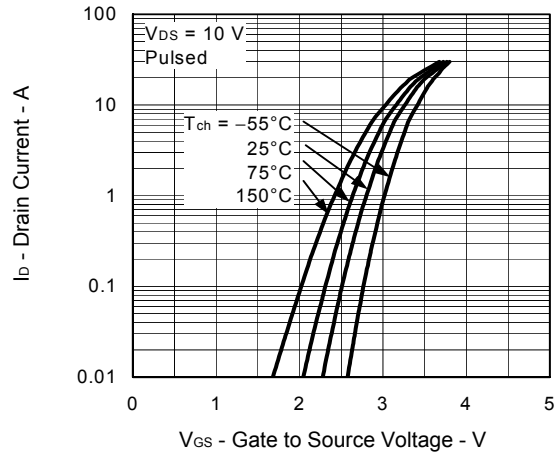
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



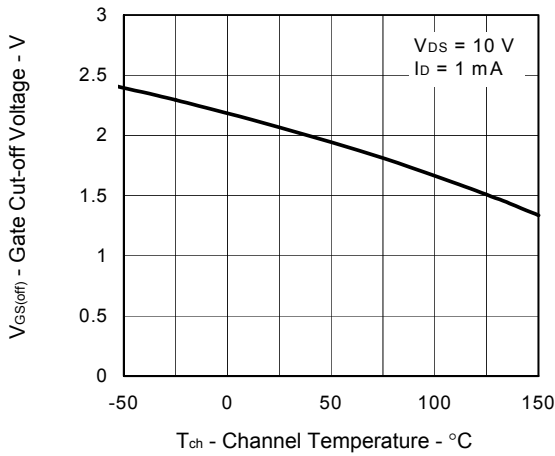
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



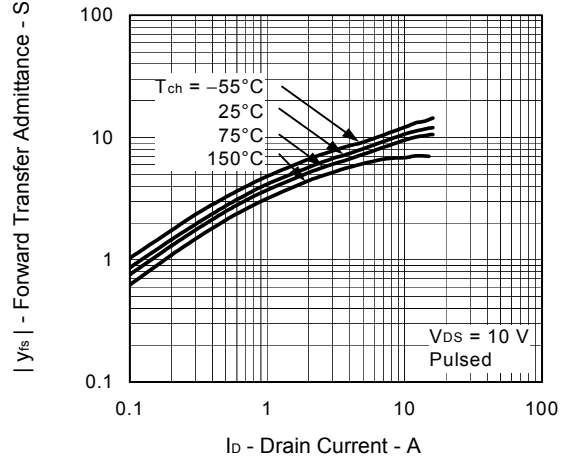
FORWARD TRANSFER CHARACTERISTICS



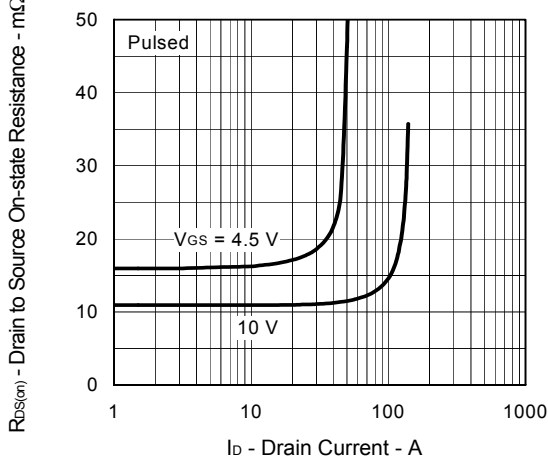
GATE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



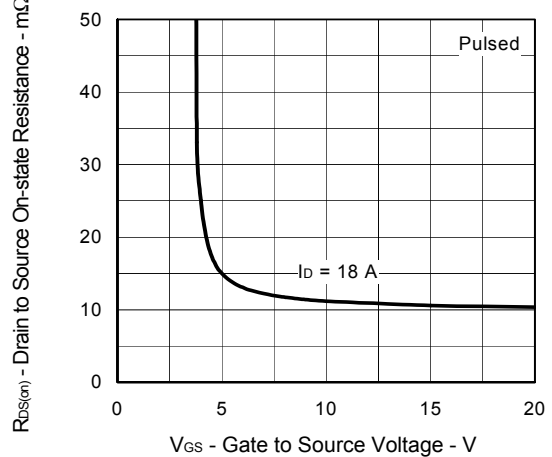
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



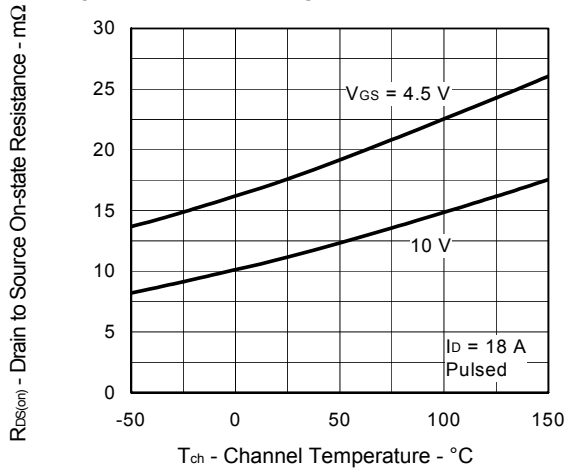
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



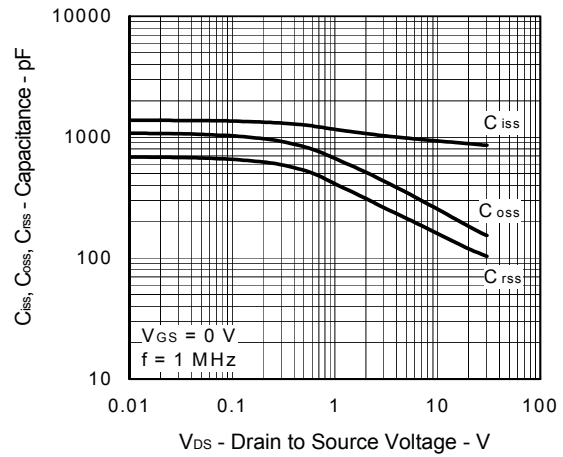
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



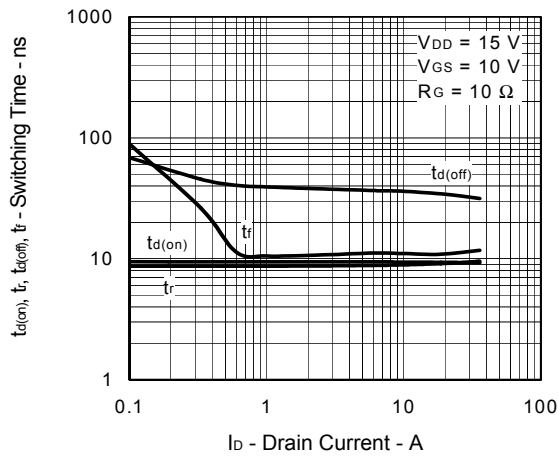
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



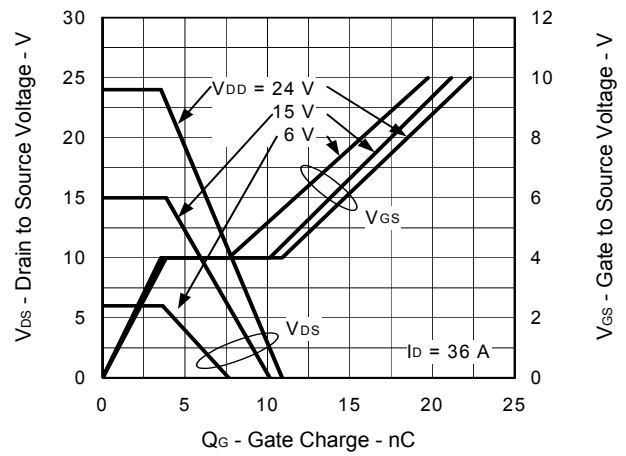
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



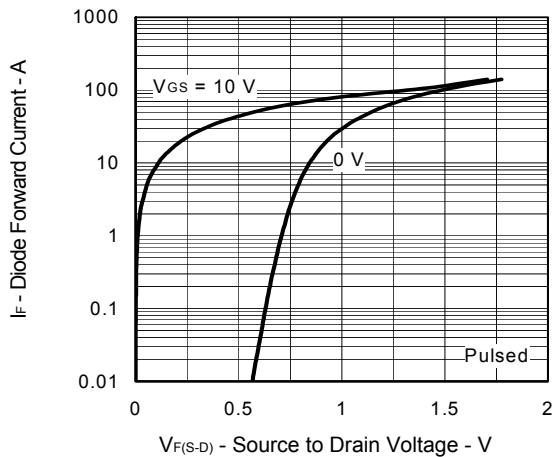
SWITCHING CHARACTERISTICS



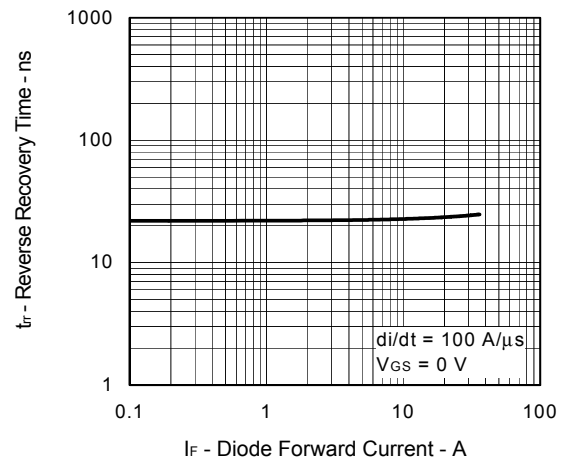
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



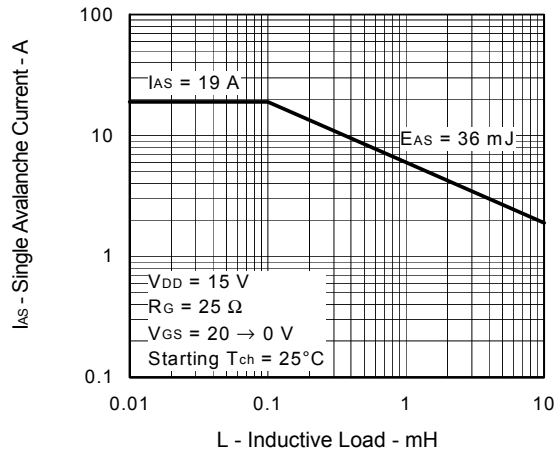
SOURCE TO DRAIN DIODE FORWARD VOLTAGE



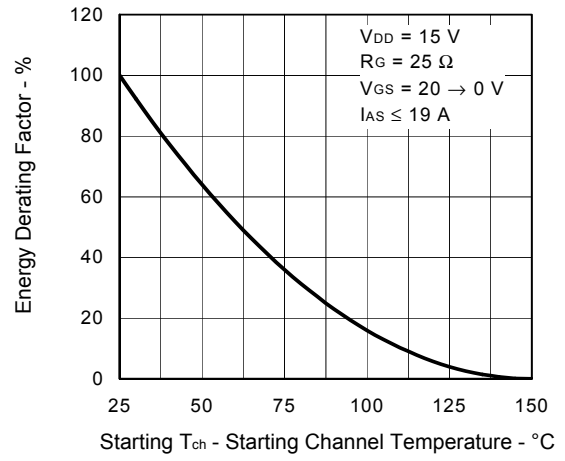
REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT



SINGLE AVALANCHE CURRENT vs. INDUCTIVE LOAD

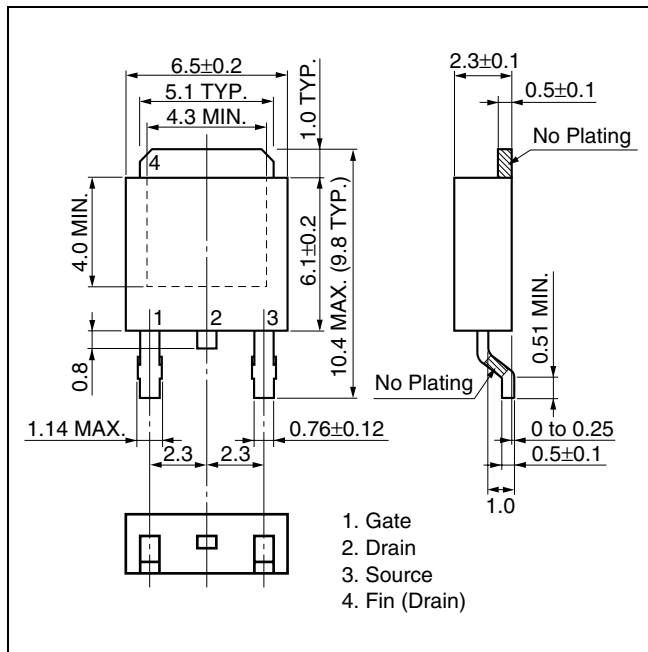


SINGLE AVALANCHE ENERGY DERATING FACTOR

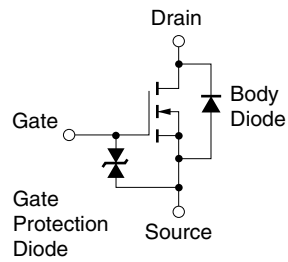


★ PACKAGE DRAWING (Unit: mm)

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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