

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.

## 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  $C_{iss}$ :  $C_{iss} = 4520 \text{ pF TYP.}$
- 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 ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 64$	A
Drain Current (pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 256$	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 to +150	$^\circ\text{C}$
Single Avalanche Current <sup>Note2</sup>	$I_{AS}$	70	A
Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	490	mJ

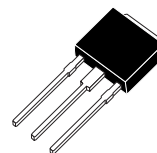
**Notes 1.**  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

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

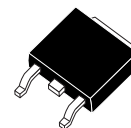
## ORDERING INFORMATION

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

(TO-251)



(TO-252)



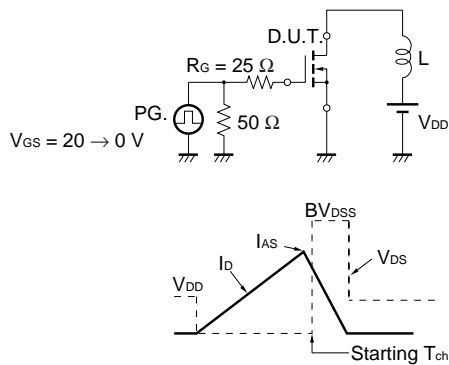
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★ ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C)

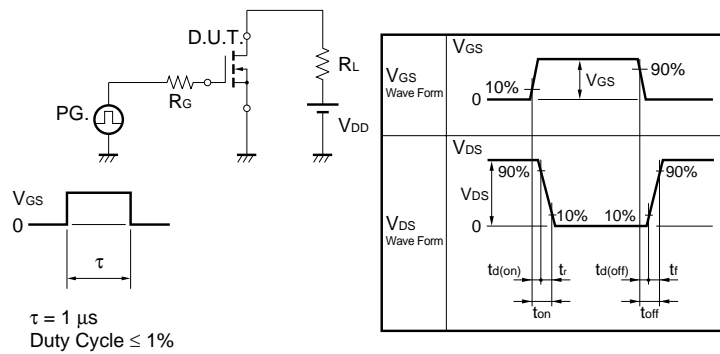
CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 25 V, V <sub>GS</sub> = 0 V			10	μA
Gate Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±100	nA
Gate Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.0	2.5	3.0	V
Forward Transfer Admittance <sup>Note</sup>	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 32 A	15			S
Drain to Source On-state Resistance <sup>Note</sup>	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 32 A		3.3	3.8	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 5.0 V, I <sub>D</sub> = 32 A		4.7	7.8	mΩ
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		4520		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		1080		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		770		pF
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> = 12.5 V, I <sub>D</sub> = 32 A		21		ns
Rise Time	t <sub>r</sub>	V <sub>GS</sub> = 10 V		23		ns
Turn-off Delay Time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		140		ns
Fall Time	t <sub>f</sub>			50		ns
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> = 20 V		100		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		17		nC
Gate to Drain Charge	Q <sub>GD</sub>	I <sub>D</sub> = 64 A		35		nC
Body Diode Forward Voltage <sup>Note</sup>	V <sub>F(S-D)</sub>	I <sub>F</sub> = 64 A, V <sub>GS</sub> = 0 V		0.9		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 64 A, V <sub>GS</sub> = 0 V		23		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		11		nC

Note Pulsed

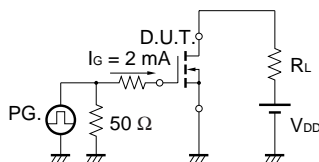
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

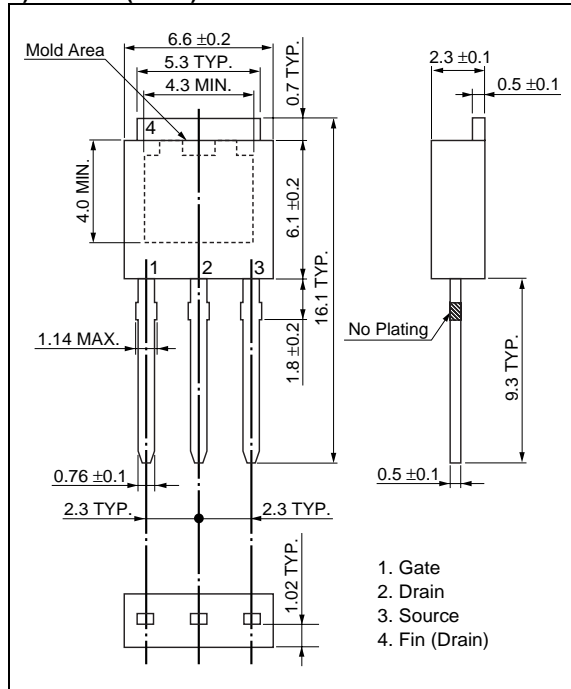


TEST CIRCUIT 3 GATE CHARGE

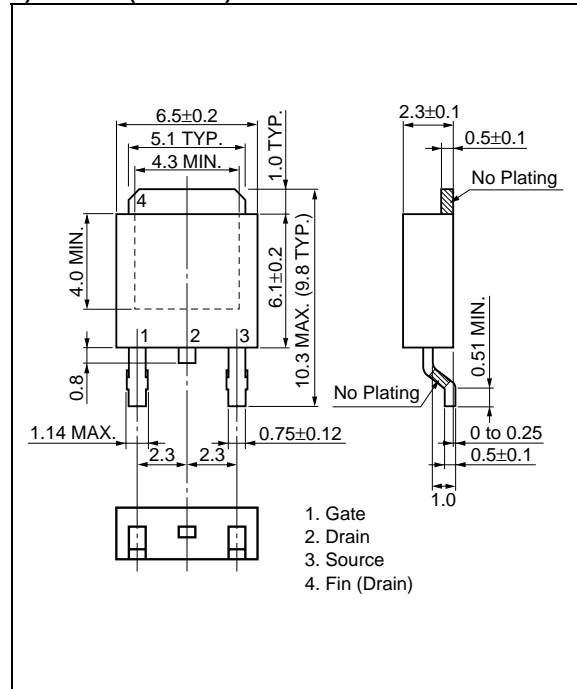


PACKAGE DRAWINGS (Unit: mm)

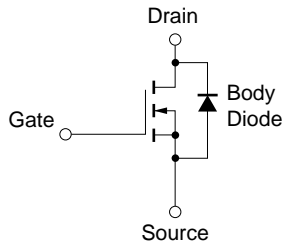
1) TO-251 (MP-3)



★ 2) TO-252 (MP-3ZK)



EQUIVALENT CIRCUIT



**Remark** Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

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