

SWITCHING  
N-CHANNEL POWER MOS FET  
INDUSTRIAL USE

## 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

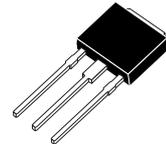
## ORDERING INFORMATION

PART NUMBER	PACKAGE
2SK3402	TO-251
2SK3402-Z	TO-252

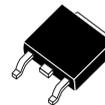
ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage	$V_{DSS}$	60	V
Gate to Source Voltage	$V_{GSS}$	$\pm 20$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 36$	A
Drain Current (Pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 144$	A
Total Power Dissipation ( $T_c = 25^\circ\text{C}$ )	$P_T$	40	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_T$	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>	$I_{AS}$	35	A
★ Single Avalanche Energy <sup>Note2</sup>	$E_{AS}$	123	mJ

(TO-251)



(TO-252)



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

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

## THERMAL RESISTANCE

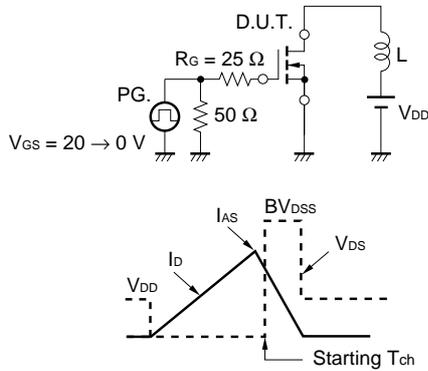
Channel to Case	$R_{th(ch-C)}$	3.13	$^\circ\text{C/W}$
Channel to Ambient	$R_{th(ch-A)}$	125	$^\circ\text{C/W}$

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Not all devices/types available in every country. Please check with local NEC representative for availability and additional information.

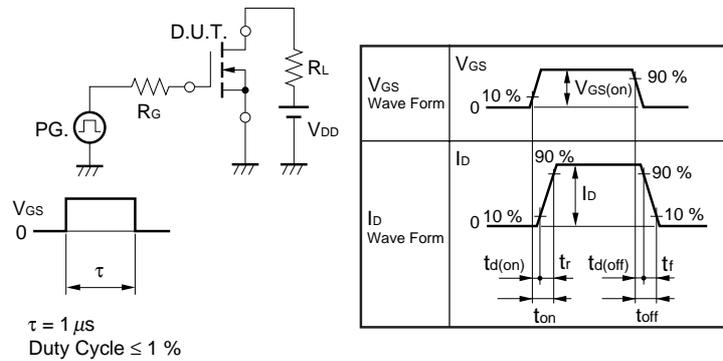
★ ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Drain to Source On-state Resistance	R <sub>DS(on)1</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 18 A		12	15	mΩ
	R <sub>DS(on)2</sub>	V <sub>GS</sub> = 4.0 V, I <sub>D</sub> = 18 A		15	22	mΩ
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	1.5	2.0	2.5	V
Forward Transfer Admittance	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 18 A	13	27		S
Drain Leakage Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V			10	μA
Gate to Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V			±10	μA
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		3200		pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		520		pF
Reverse Transfer Capacitance	C <sub>rss</sub>	f = 1 MHz		270		pF
Turn-on Delay Time	t <sub>d(on)</sub>	I <sub>D</sub> = 18 A		36		ns
Rise Time	t <sub>r</sub>	V <sub>GS(on)</sub> = 10 V		310		ns
Turn-off Delay Time	t <sub>d(off)</sub>	V <sub>DD</sub> = 30 V		170		ns
Fall Time	t <sub>f</sub>	R <sub>G</sub> = 10 Ω		180		ns
Total Gate Charge	Q <sub>G</sub>	I <sub>D</sub> = 36 A		61		nC
Gate to Source Charge	Q <sub>GS</sub>	V <sub>DD</sub> = 48 V		8.2		nC
Gate to Drain Charge	Q <sub>GD</sub>	V <sub>GS(on)</sub> = 10 V		17		nC
Body Diode Forward Voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 36 A, V <sub>GS</sub> = 0 V		1.0		V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> = 36 A, V <sub>GS</sub> = 0 V		48		ns
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100 A/μs		89		nC

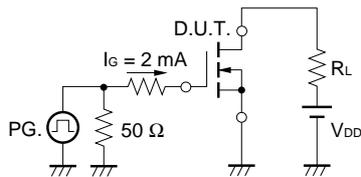
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

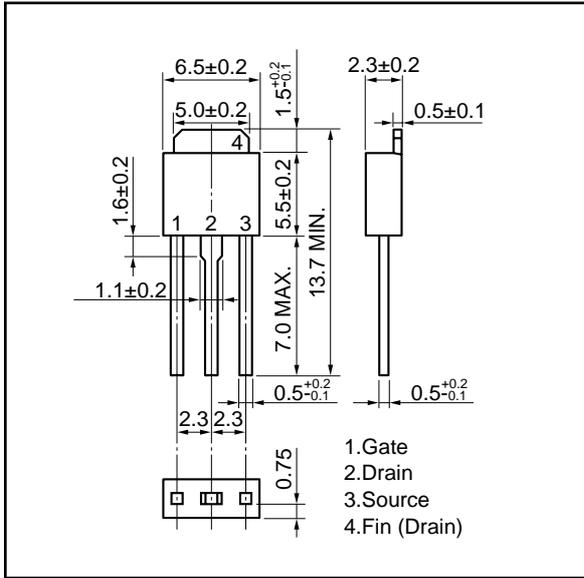


TEST CIRCUIT 3 GATE CHARGE

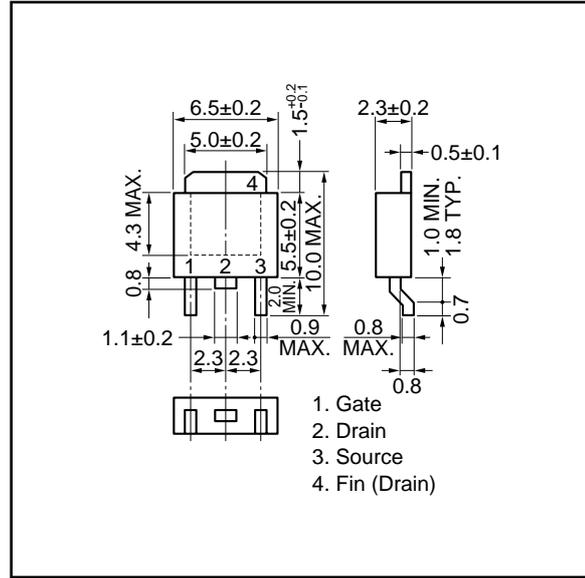


PACKAGE DRAWINGS (Unit : mm)

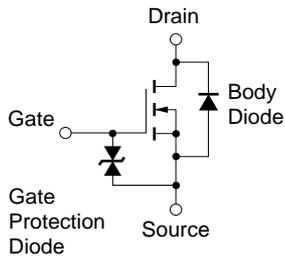
1) TO-251 (MP-3)



2) TO-252 (MP-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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