

# MOS FIELD EFFECT TRANSISTOR 2SK3221

## SWITCHING N-CHANNEL POWER MOS FET INDUSTRIAL USE

### DESCRIPTION

The 2SK3221 is N channel DMOS FET device that features a low gate charge and excellent switching characteristics, and designed for high voltage applications such as switching power supply, AC adapter.

### ORDERING INFORMATION

Part number	Package
2SK3221	Isolated TO-220

### FEATURES

- Low gate charge  
 $Q_G = 9 \text{ nC TYP. (} V_{DD} = 450 \text{ V, } V_{GS} = 10 \text{ V, } I_D = 2.0 \text{ A)}$
- Gate voltage rating  $\pm 30 \text{ V}$
- Low oN-state resistance  
 $R_{DS(on)} = 4.4 \ \Omega \text{ (MAX.) (} V_{GS} = 10 \text{ V, } I_D = 1.0 \text{ A)}$
- Avalanche capability ratings
- Isolated TO-220 package

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

Drain to source voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	600	V
Gate to source voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 30$	V
Drain current(DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 2.0$	A
Drain current(pulse) <sup>Note1</sup>	$I_{D(pulse)}$	$\pm 8.0$	A
Total power dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T1}$	2.0	W
Total power dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T2}$	25	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>	IAS	2.0	A
Single avalanche energy <sup>Note2</sup>	EAS	2.7	mJ
Diode recovery $dv/dt$ <sup>Note3</sup>	$dv/dt$	3.5	V/ns

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

**2.** Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 150 \text{ V}$ ,  $R_G = 25 \ \Omega$ ,  $V_{GS} = 20 \text{ V} \rightarrow 0 \text{ V}$

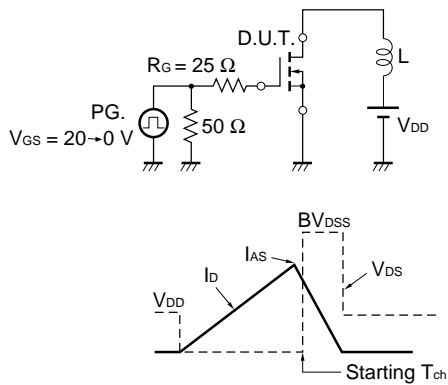
**3.**  $I_F \leq 1.0 \text{ A}$ ,  $V_{clamp} = 600 \text{ V}$ ,  $di/dt \leq 100 \text{ A}/\mu\text{s}$ ,  $T_A = 25^\circ\text{C}$

The information contained in this document is being issued in advance of the production cycle for the device. The parameters for the device may change before final production or NEC Corporation, at its own discretion, may withdraw the device prior to its production.

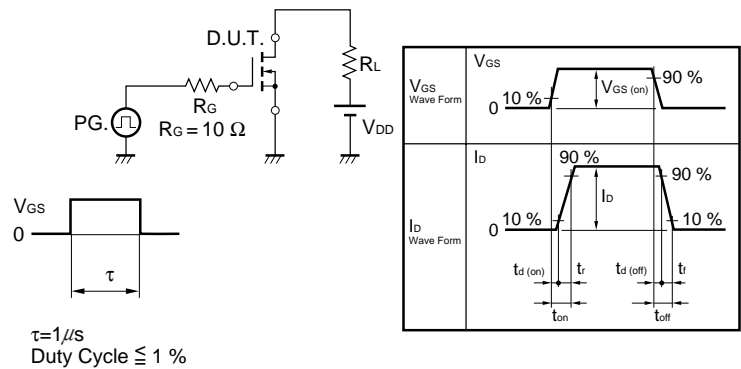
**ELECTRICAL CHARACTERISTICS(T<sub>A</sub> = 25°C)**

Characteristics	Symbol	Test Conditions	MIN.	TYP.	MAX.	Unit
Drain leakage current	I <sub>DSS</sub>	V <sub>DS</sub> = 600 V, V <sub>GS</sub> = 0 V			100	μA
Gate leakage current	I <sub>GSS</sub>	V <sub>GS</sub> = ±30 V, V <sub>DS</sub> = 0 V			±10	μA
Gate cut-off voltage	V <sub>GS(off)</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA	2.5		3.5	V
Forward transfer admittance	y <sub>fs</sub>	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1.0 A	0.5			S
Drain to source on-state resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 1.0 A		3.3	4.4	Ω
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 10 V		290		pF
Output capacitance	C <sub>oss</sub>	V <sub>GS</sub> = 0 V		60		pF
Reverse transfer capacitance	C <sub>rss</sub>	f = 1 MHz		5		pF
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 150 V, I <sub>D</sub> = 1.0 A		7		ns
Rise time	t <sub>r</sub>	V <sub>GS(on)</sub> = 10 V		2		ns
Turn-off delay time	t <sub>d(off)</sub>	R <sub>G</sub> = 10 Ω		20		ns
Fall time	t <sub>f</sub>			10		ns
Total gate charge	Q <sub>G</sub>	V <sub>DD</sub> = 450 V		9		nC
Gate to source charge	Q <sub>GS</sub>	V <sub>GS</sub> = 10 V		2.4		nC
Gate to drain charge	Q <sub>GD</sub>	I <sub>D</sub> = 2.0 A		2		nC
Diode forward voltage	V <sub>F(S-D)</sub>	I <sub>F</sub> = 2.0 A, V <sub>GS</sub> = 0 V		0.9		V
Reverse recovery time	T <sub>rr</sub>	I <sub>F</sub> = 2.0 A, V <sub>GS</sub> = 0 V		0.9		μs
Reverse recovery charge	Q <sub>rr</sub>	di/dt = 50 A/μs		2.0		μC

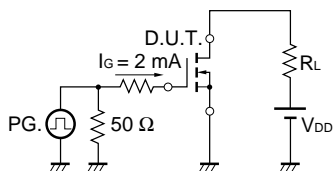
Test circuit 1 Avalanche capability



Test circuit 2 Switching time

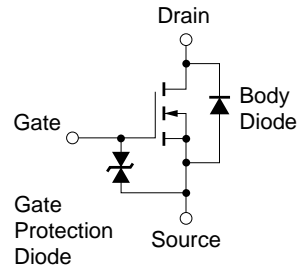
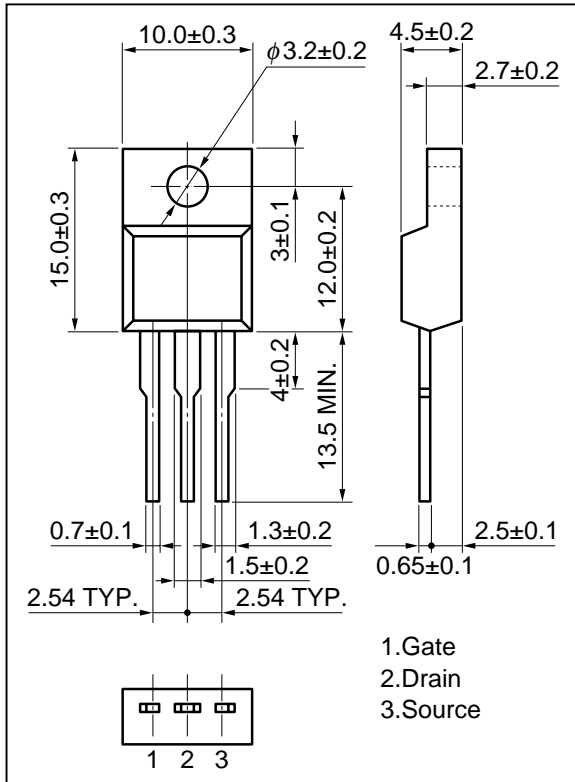


Test circuit 3 Gate charge



Package Drawing(Unit : mm)

Isolated TO-220 (MP-45F)



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.

No part of this document may be copied or reproduced in any form or by any means without the prior written consent of NEC Corporation. NEC Corporation assumes no responsibility for any errors which may appear in this document.

NEC Corporation does not assume any liability for infringement of patents, copyrights or other intellectual property rights of third parties by or arising from use of a device described herein or any other liability arising from use of such device. No license, either express, implied or otherwise, is granted under any patents, copyrights or other intellectual property rights of NEC Corporation or others.

While NEC Corporation has been making continuous effort to enhance the reliability of its semiconductor devices, the possibility of defects cannot be eliminated entirely. To minimize risks of damage or injury to persons or property arising from a defect in an NEC semiconductor device, customers must incorporate sufficient safety measures in its design, such as redundancy, fire-containment, and anti-failure features.

NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

Special: Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices is "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact an NEC sales representative in advance.

Anti-radioactive design is not implemented in this product.