

# MOS FIELD EFFECT TRANSISTOR

## 2SK2513, 2SK2513-Z

### SWITCHING N-CHANNEL POWER MOS FET INDUSTRIAL USE

#### DESCRIPTION

The 2SK2513, 2SK2513-Z is N-Channel MOS Field Effect Transistor designed for high current switching applications.

#### FEATURES

- Low On-Resistance  
 $R_{DS(on)1} = 15 \text{ m}\Omega$  ( $V_{GS} = 10 \text{ V}$ ,  $I_D = 23 \text{ A}$ )  
 $R_{DS(on)2} = 23 \text{ m}\Omega$  ( $V_{GS} = 4 \text{ V}$ ,  $I_D = 23 \text{ A}$ )
- Low  $C_{iss}$   $C_{iss} = 2.100 \text{ pF TYP.}$
- Built-in G-S Protection Diode

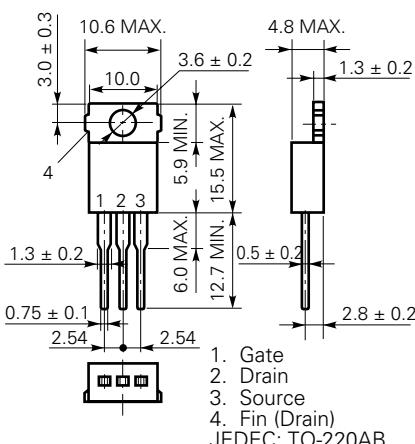
#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ )

Drain to Source Voltage	$V_{DSS}$	60	V
Gate to Source Voltage	$V_{GSS}$	$\pm 20$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 45$	A
Drain Current (pulse)*	$I_{D(pulse)}$	$\pm 180$	A
Total Power Dissipation ( $T_c = 25^\circ\text{C}$ )	$P_{T1}$	75	W
Total Power Dissipation ( $T_A = 25^\circ\text{C}$ )	$P_{T2}$	1.5	W
Channel Temperature	$T_{ch}$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

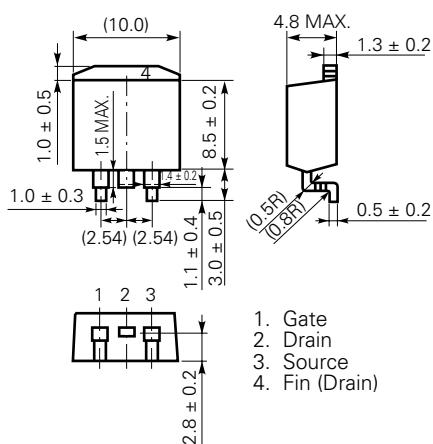
\*  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

#### PACKAGE DIMENSIONS

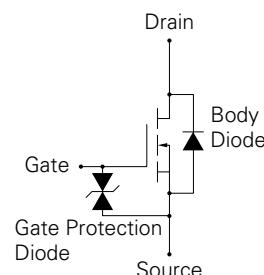
(in millimeters)



#### MP-25 (TO-220)



#### MP-25Z (SURFACE MOUNT TYPE)

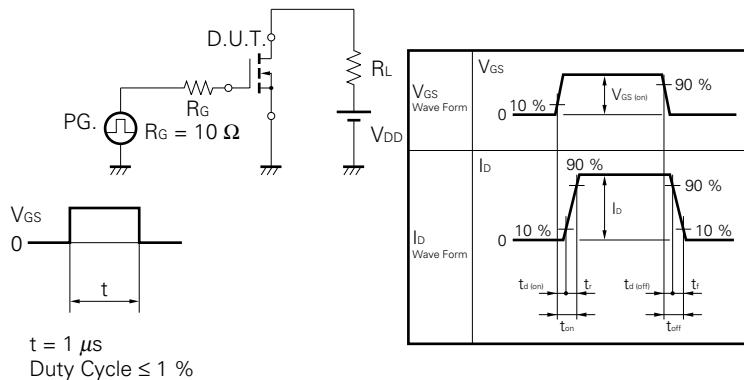


The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device is actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

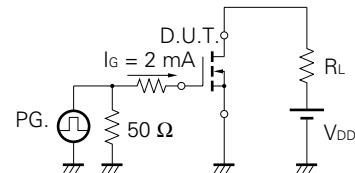
## ELECTRICAL CHARACTERISTICS (TA = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITIONS
Drain to Source On-State Resistance	R <sub>DS(on)1</sub>		11	15	mΩ	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 23 A
Drain to Source On-State Resistance	R <sub>DS(on)2</sub>		16	23	mΩ	V <sub>GS</sub> = 4 V, I <sub>D</sub> = 23 A
Gate to Source Cutoff Voltage	V <sub>GS(off)</sub>	1.0	1.5	2.0	V	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA
Forward Transfer Admittance	y <sub>fs</sub>	15	20		S	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 23 A
Drain Leakage Current	I <sub>DSS</sub>			10	μA	V <sub>DS</sub> = V <sub>DSS</sub> , V <sub>GS</sub> = 0
Gate to Source Leakage Current	I <sub>GSS</sub>			±10	μA	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0
Input Capacitance	C <sub>iss</sub>		2 100		pF	V <sub>DS</sub> = 10 V
Output Capacitance	C <sub>oss</sub>		1 100		pF	V <sub>GS</sub> = 0
Reverse Transfer Capacitance	C <sub>rss</sub>		500		pF	f = 1 MHz
Turn-On Delay Time	t <sub>d(on)</sub>		45		ns	I <sub>D</sub> = 23 A
Rise Time	t <sub>r</sub>		380		ns	V <sub>GS(on)</sub> = 10 V
Turn-Off Delay Time	t <sub>d(off)</sub>		320		ns	V <sub>DD</sub> = 30 V
Fall Time	t <sub>f</sub>		320		ns	R <sub>G</sub> = 10 Ω
Total Gate Charge	Q <sub>G</sub>		100		nC	I <sub>D</sub> = 45 A
Gate to Source Charge	Q <sub>GS</sub>		7		nC	V <sub>DD</sub> = 48 V
Gate to Drain Charge	Q <sub>GD</sub>		40		nC	V <sub>GS</sub> = 10 V
Body Diode Forward Voltage	V <sub>F(S-D)</sub>		1.0		V	I <sub>F</sub> = 45 A, V <sub>GS</sub> = 0
Reverse Recovery Time	t <sub>rr</sub>		100		ns	I <sub>F</sub> = 45 A, V <sub>GS</sub> = 0
Reverse Recovery Charge	Q <sub>rr</sub>		180		nC	di/dt = 100 A/μs

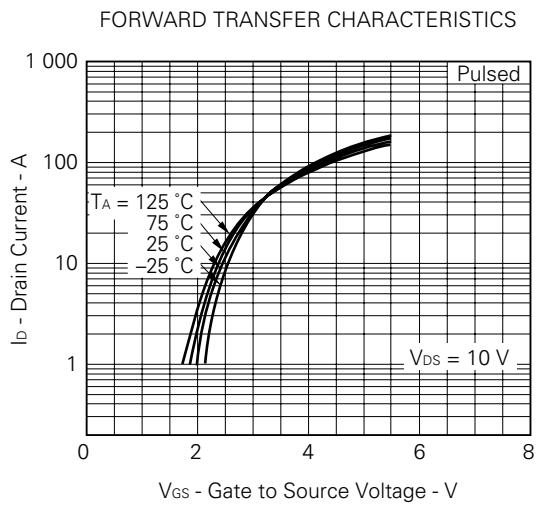
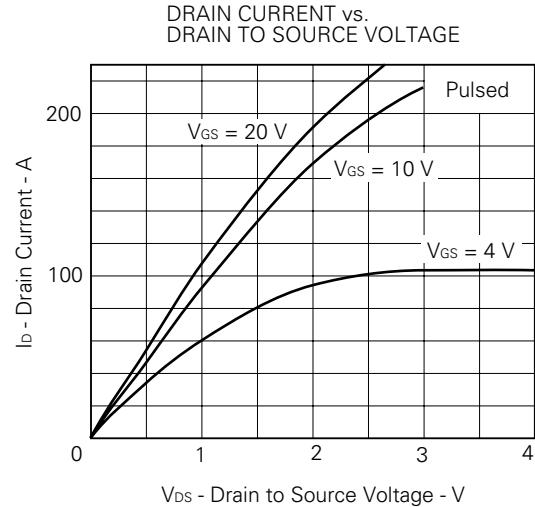
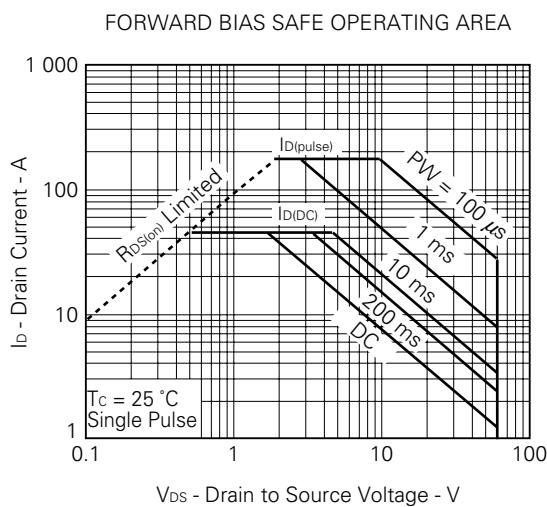
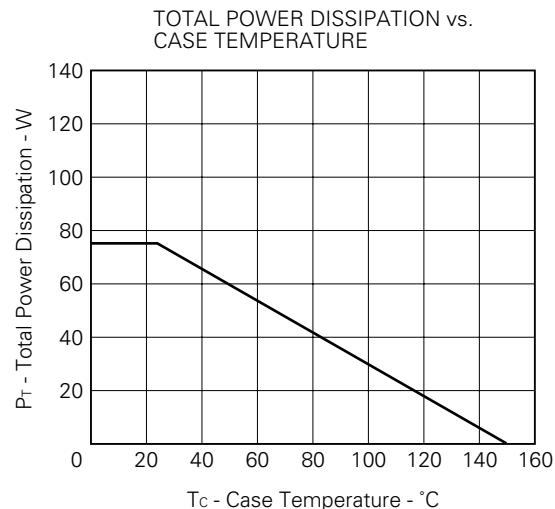
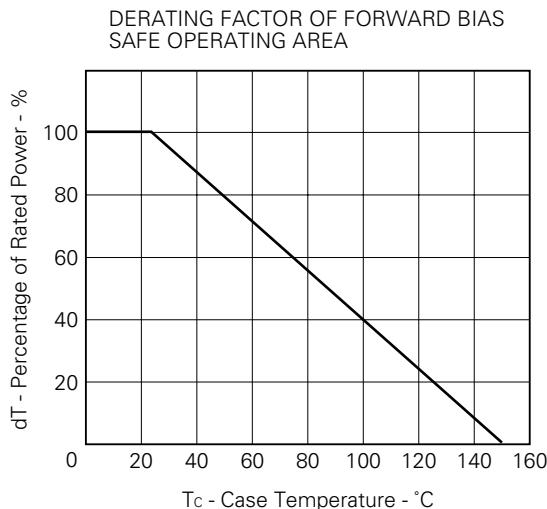
Test Circuit 1 Switching Time



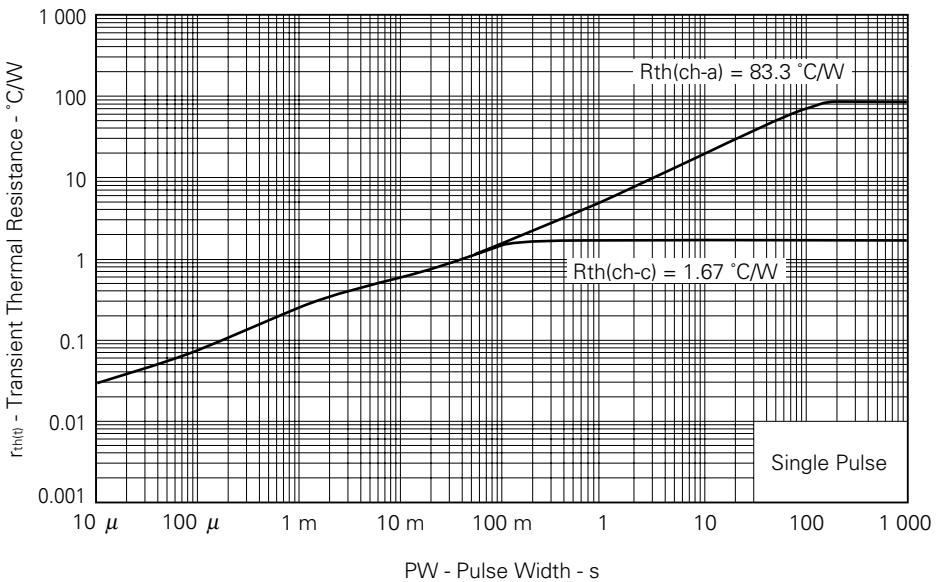
Test Circuit 2 Gate Charge



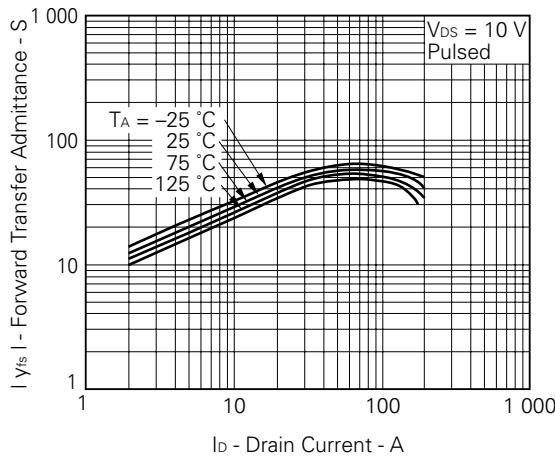
The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

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

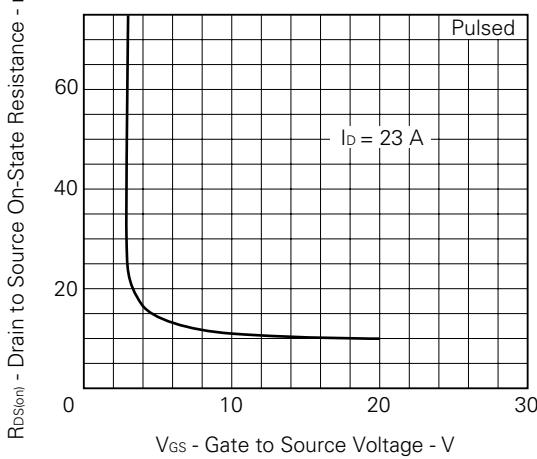
## TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



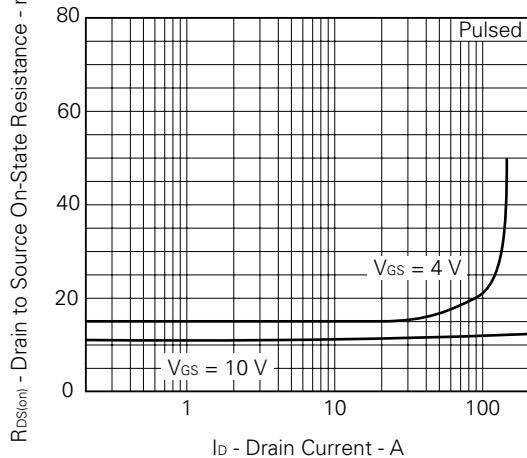
## FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



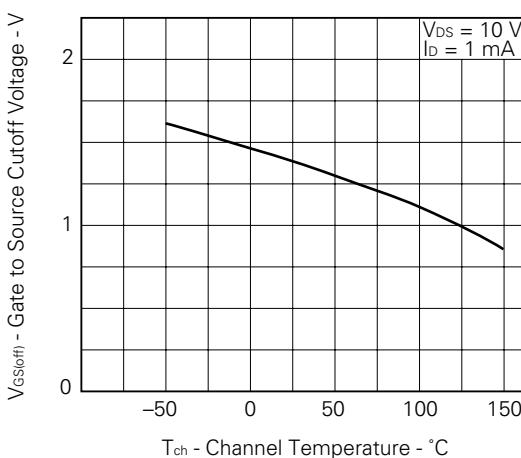
## DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

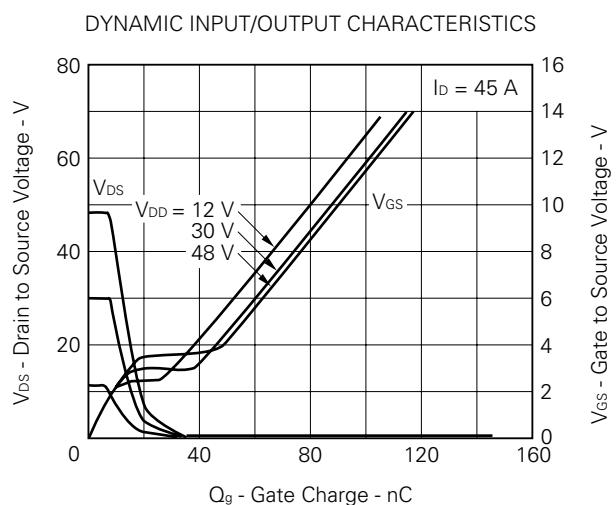
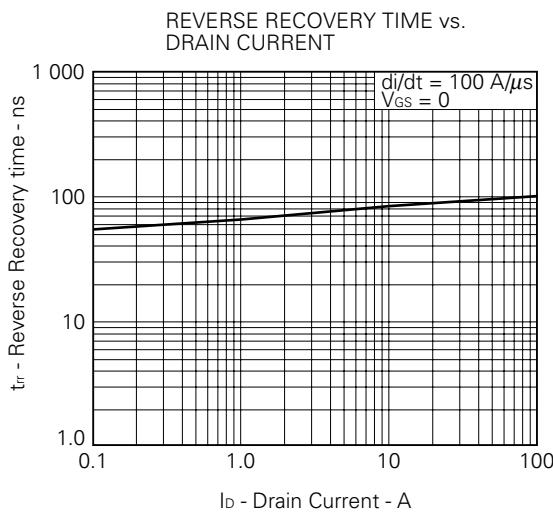
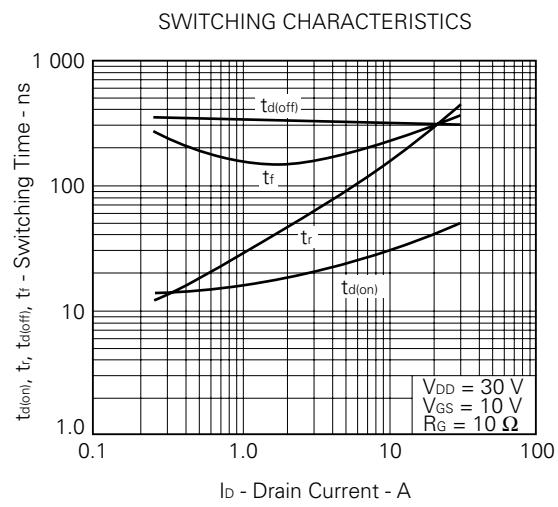
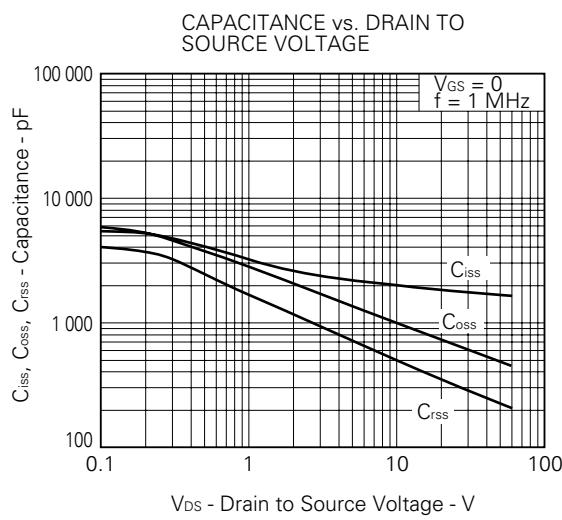
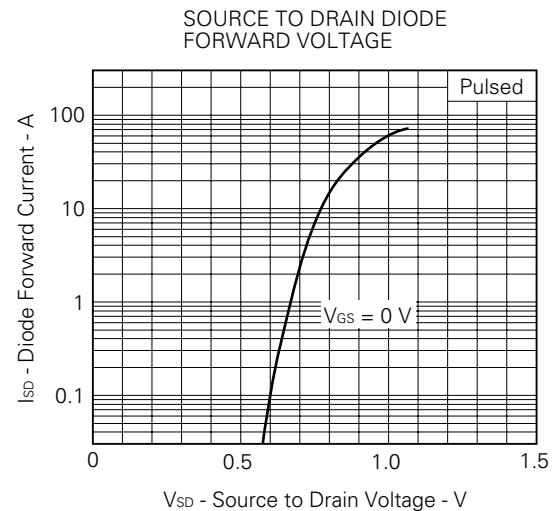
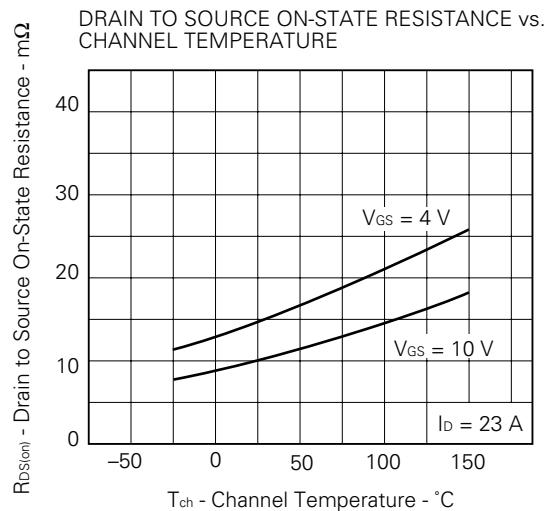


## DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



## GATE TO SOURCE CUTOFF VOLTAGE vs. CHANNEL TEMPERATURE





**REFERENCE**

Document Name	Document No.
NEC semiconductor device reliability/quality control system.	TEI-1202
Quality grade on NEC semiconductor devices.	IEI-1209
Semiconductor device mounting technology manual.	IEI-1207
Semiconductor device package manual.	IEI-1213
Guide to quality assurance for semiconductor devices.	MEI-1202
Semiconductor selection guide.	MF-1134
Power MOS FET features and application switching power supply.	TEA-1034
Application circuits using Power MOS FET.	TEA-1035
Safe operating area of Power MOS FET.	TEA-1037

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Anti-radioactive design is not implemented in this product.