

# 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  $C_{iss}$   $C_{iss} = 2100 \text{ pF TYP.}$
- Built-in G-S Protection Diode

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

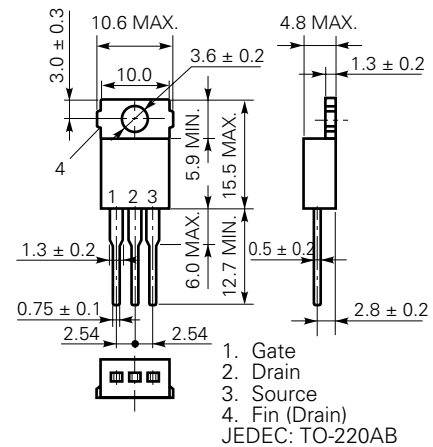
Drain to Source Voltage	$V_{bss}$	60	V
Gate to Source Voltage	$V_{GSS}$	$\pm 20$	V
Drain Current (DC)	$I_{D(DC)}$	$\pm 45$	A
Drain Current (pulse)*	$I_{D(pulse)}$	$\pm 180$	A
Total Power Dissipation ( $T_c = 25 \text{ }^\circ\text{C}$ )	$P_{T1}$	75	W
Total Power Dissipation ( $T_A = 25 \text{ }^\circ\text{C}$ )	$P_{T2}$	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  $\leq 1 \%$

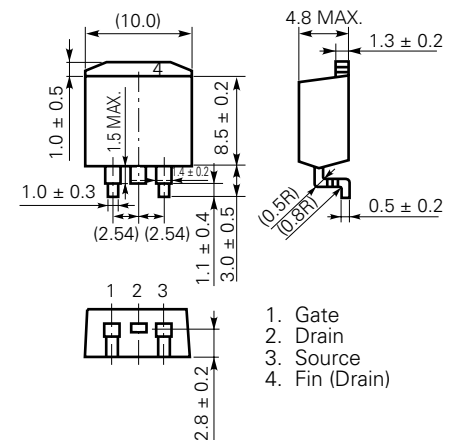
The diode connected between the gate and source of the transistor serves as a protector against ESD. When this device is actually used, an additional protection circuit is externally required if a voltage exceeding the rated voltage may be applied to this device.

### PACKAGE DIMENSIONS

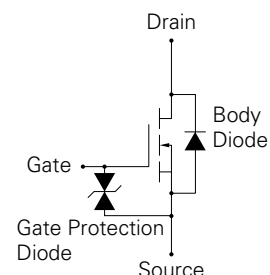
(in millimeters)



### MP-25 (TO-220)



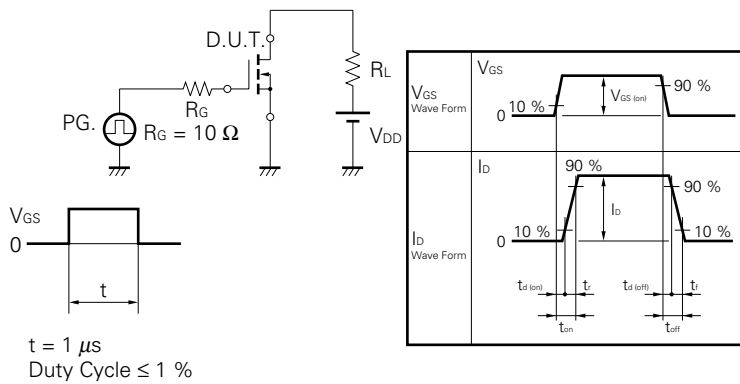
### MP-25Z (SURFACE MOUNT TYPE)



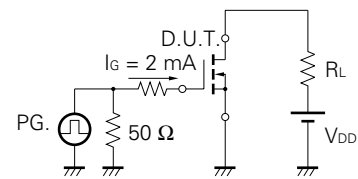
**ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)**

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**



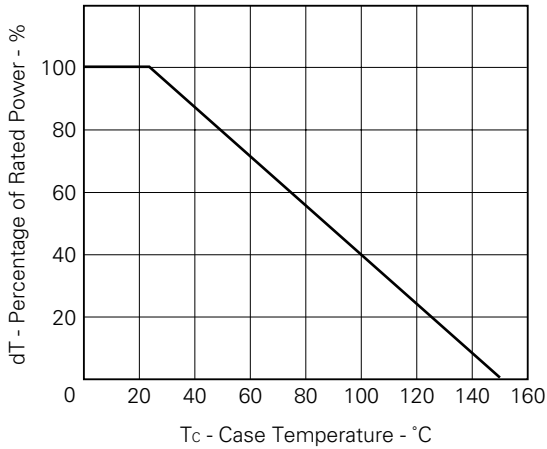
**Test Circuit 2 Gate Charge**



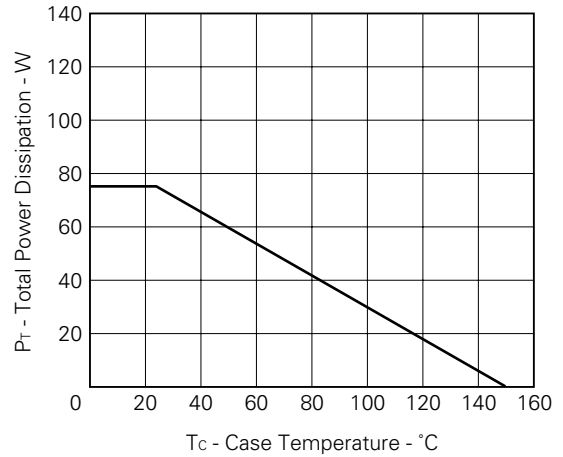
The application circuits and their parameters are for references only and are not intended for use in actual design-in's.

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

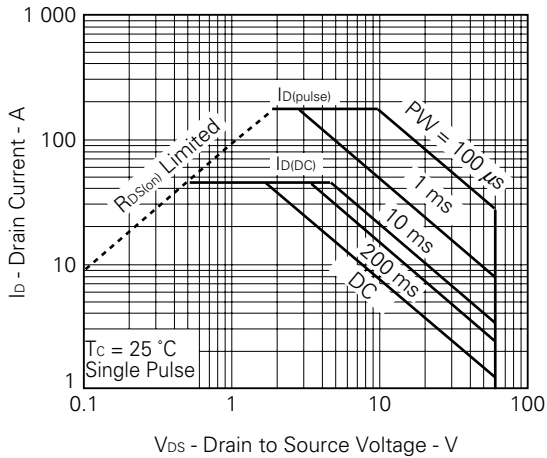
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



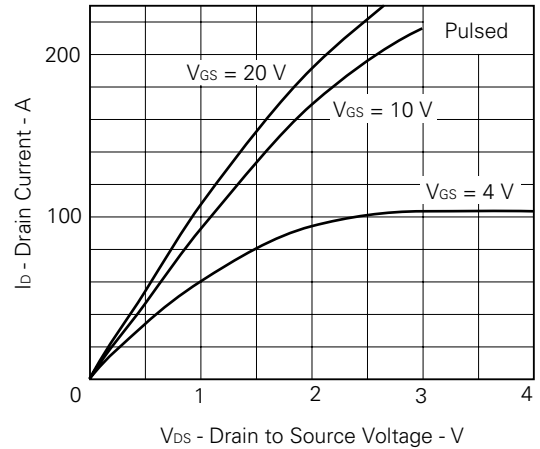
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



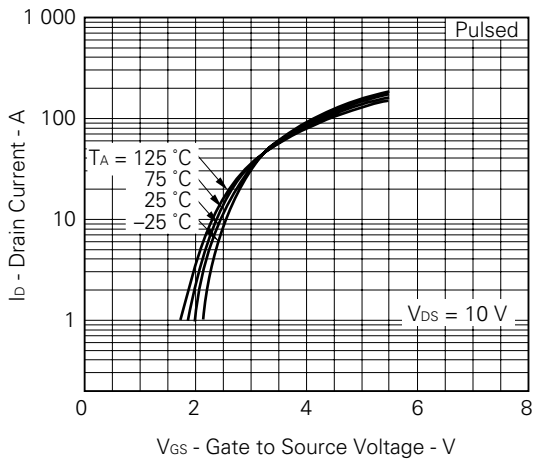
FORWARD BIAS SAFE OPERATING AREA



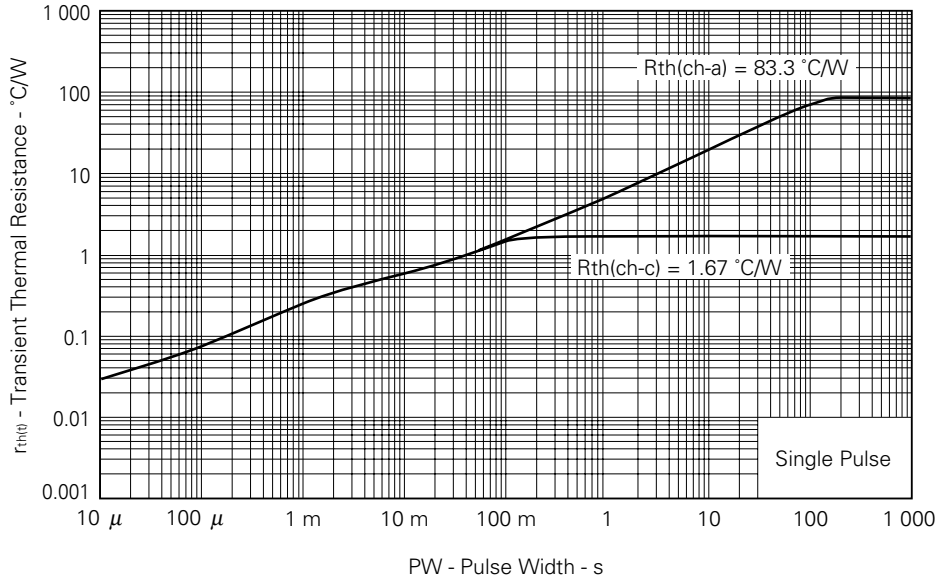
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



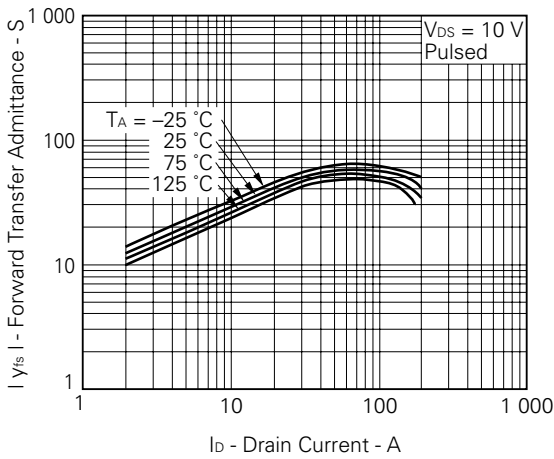
FORWARD TRANSFER CHARACTERISTICS



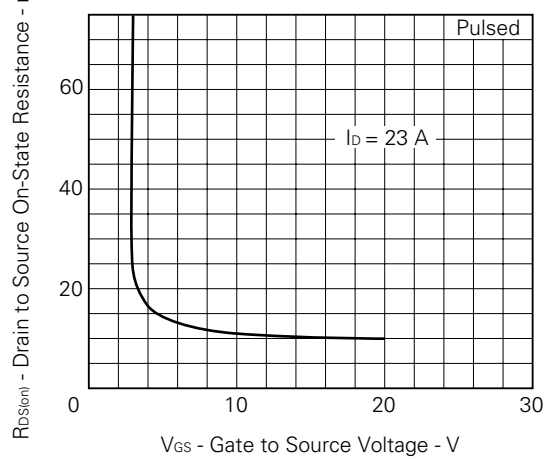
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



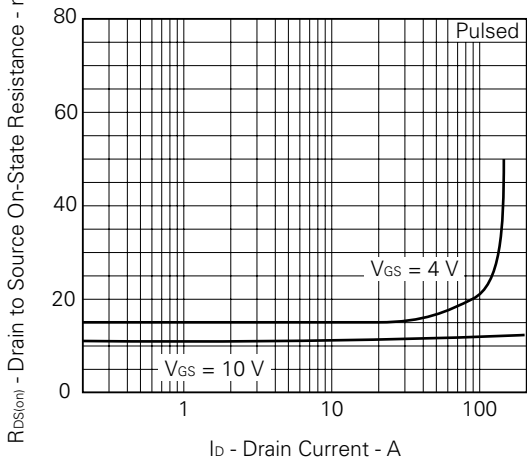
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



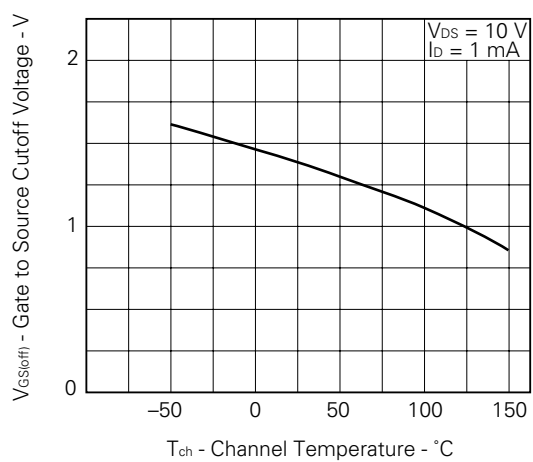
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE

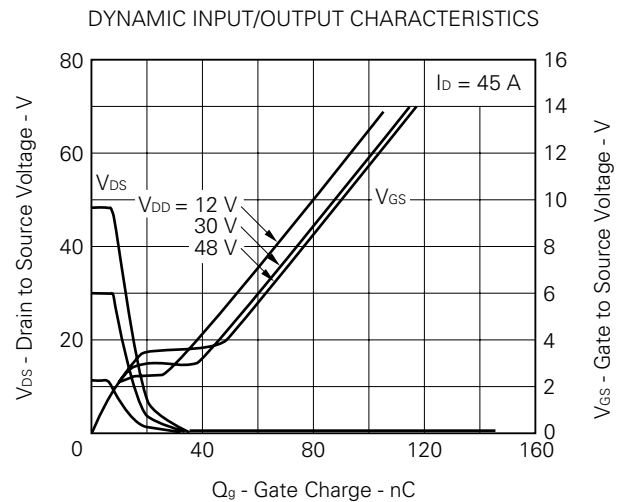
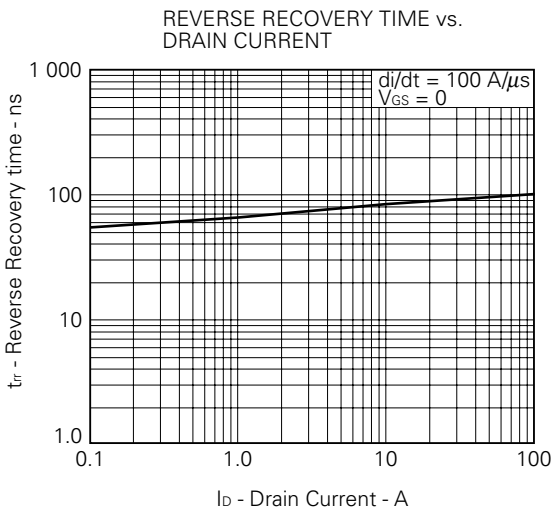
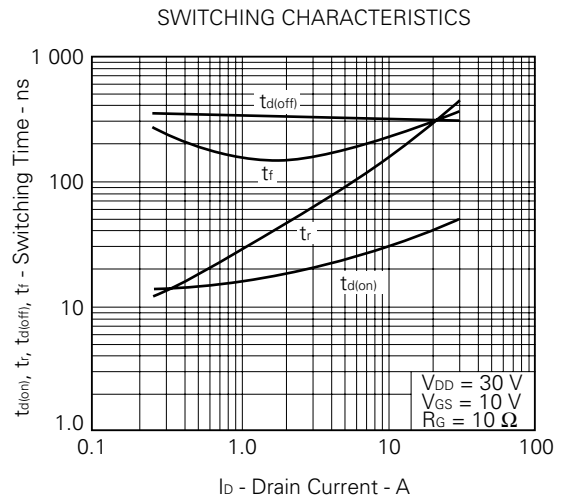
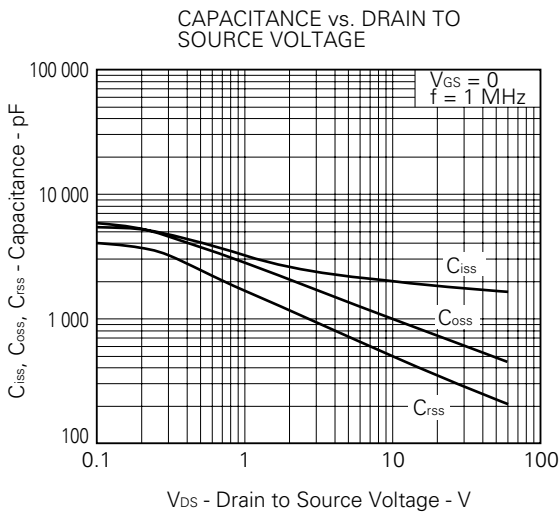
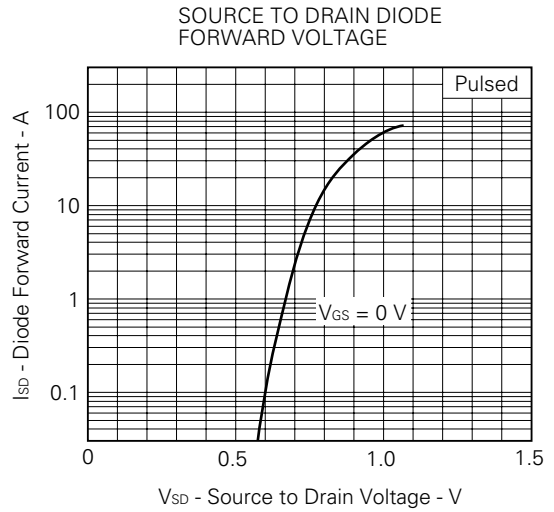
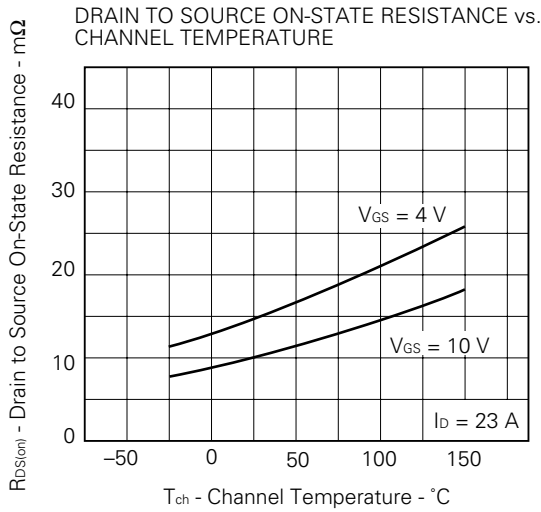


DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



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.