

# 2SK4146

R07DS0130EJ0100

Rev.1.00

Sep 24, 2010

## MOS FIELD EFFECT TRANSISTOR

### Description

The 2SK4146 is N-channel MOS Field Effect Transistor designed for high current switching applications.

### Features

- Low on-state resistance  
—  $R_{DS(on)} = 10.1 \text{ m}\Omega \text{ MAX.}$  ( $V_{GS} = 10 \text{ V}$ ,  $I_D = 40 \text{ A}$ )
- Low input capacitance  
—  $C_{iss} = 3500 \text{ pF TYP.}$  ( $V_{DS} = 10 \text{ V}$ )

### Ordering Information

Part No.	LEAD PLATING	PACKING	Package
2SK4146-S19-AY <sup>*1</sup>	Pure Sn (Tin)	50 pcs/tube	TO-220, S19 tube

Note: <sup>\*1</sup>. Pb-free (This product does not contain Pb in the external electrode.)

### Absolute Maximum Ratings ( $T_A = 25^\circ\text{C}$ )

Item	Symbol	Ratings	Unit
Drain to Source Voltage ( $V_{GS} = 0 \text{ V}$ )	$V_{DSS}$	75	V
Gate to Source Voltage ( $V_{DS} = 0 \text{ V}$ )	$V_{GSS}$	$\pm 20$	V
Drain Current (DC) ( $T_C = 25^\circ\text{C}$ )	$I_{D(DC)}$	$\pm 80$	A
Drain Current (pulse) <sup>*1</sup>	$I_{D(pulse)}$	$\pm 200$	A
Total Power Dissipation ( $T_C = 25^\circ\text{C}$ )	$P_{T1}$	84	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	$T_{stg}$	$-55 \text{ to } +150$	$^\circ\text{C}$
Repetitive Avalanche Current <sup>*2</sup>	$I_{AR}$	33	A
Repetitive Avalanche Energy <sup>*2</sup>	$E_{AR}$	109	mJ

Notes: <sup>\*1</sup>.  $PW \leq 10 \mu\text{s}$ , Duty Cycle  $\leq 1\%$

<sup>\*2</sup>. Starting  $T_{ch} = 25^\circ\text{C}$ ,  $V_{DD} = 38 \text{ V}$ ,  $R_G = 25 \Omega$ ,  $V_{GS} = 20 \rightarrow 0 \text{ V}$ ,  $L = 100 \mu\text{H}$

### Thermal Resistance

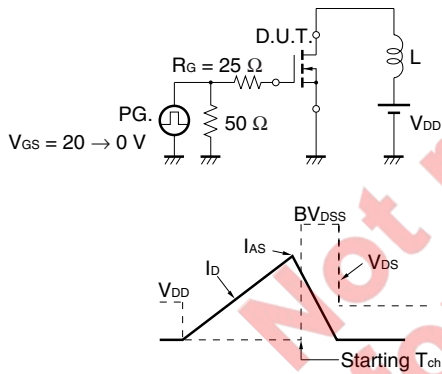
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.49	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

**Electrical Characteristics (T<sub>A</sub> = 25°C)**

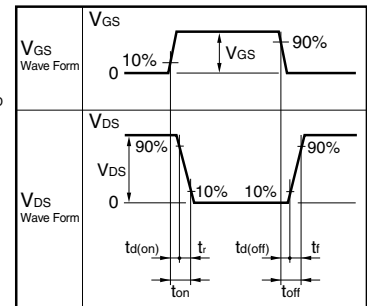
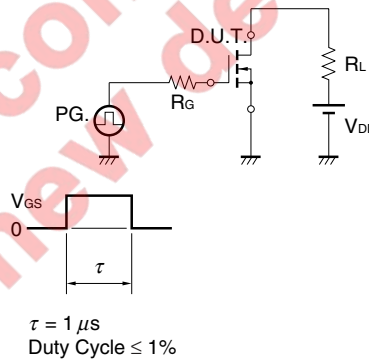
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Zero Gate Voltage Drain Current	I <sub>DSS</sub>			10	μA	V <sub>DS</sub> = 75 V, V <sub>GS</sub> = 0 V
Gate Leakage Current	I <sub>GSS</sub>			±100	nA	V <sub>GS</sub> = ±20 V, V <sub>DS</sub> = 0 V
Gate to Source Cut-off Voltage	V <sub>GS(off)</sub>	2.0	3.0	4.0	V	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 1 mA
Forward Transfer Admittance *1	y <sub>fs</sub>	15	32		S	V <sub>DS</sub> = 10 V, I <sub>D</sub> = 40 A
Drain to Source On-state Resistance *1	R <sub>DS(on)</sub>		7.8	10.1	mΩ	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 40 A
Input Capacitance	C <sub>iss</sub>		3500		pF	V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1 MHz
Output Capacitance	C <sub>oss</sub>		620		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>		160		pF	
Turn-on Delay Time	t <sub>d(on)</sub>		26		ns	V <sub>DD</sub> = 38 V, I <sub>D</sub> = 40 A, V <sub>GS</sub> = 10 V, R <sub>G</sub> = 0 Ω
Rise Time	t <sub>r</sub>		20		ns	
Turn-off Delay Time	t <sub>d(off)</sub>		85		ns	
Fall Time	t <sub>f</sub>		17		ns	
Total Gate Charge	Q <sub>G</sub>		61		nC	V <sub>DD</sub> = 60 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 80 A
Gate to Source Charge	Q <sub>GS</sub>		16		nC	
Gate to Drain Charge	Q <sub>GD</sub>		20		nC	
Body Diode Forward Voltage *1	V <sub>F(S-D)</sub>		1.0	1.5	V	I <sub>F</sub> = 80 A, V <sub>GS</sub> = 0 V
Reverse Recovery Time	t <sub>rr</sub>		58		ns	I <sub>F</sub> = 80 A, V <sub>GS</sub> = 0 V,
Reverse Recovery Charge	Q <sub>rr</sub>		125		nC	di/dt = 100 A/μs

Note: \*1. Pulsed

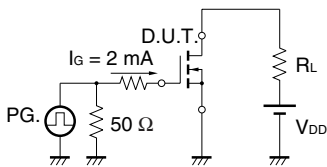
**TEST CIRCUIT 1 AVALANCHE CAPABILITY**



**TEST CIRCUIT 2 SWITCHING TIME**

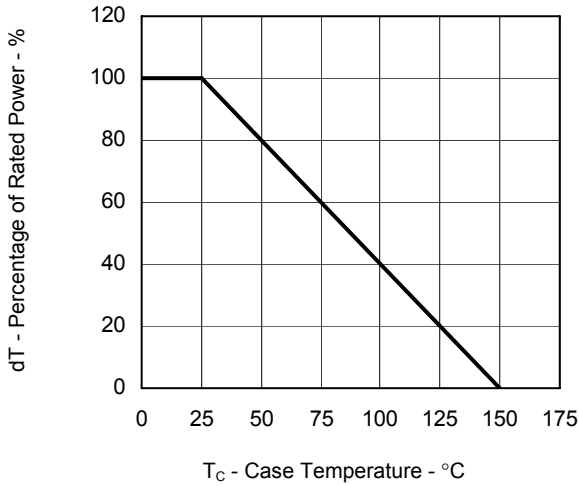


**TEST CIRCUIT 3 GATE CHARGE**

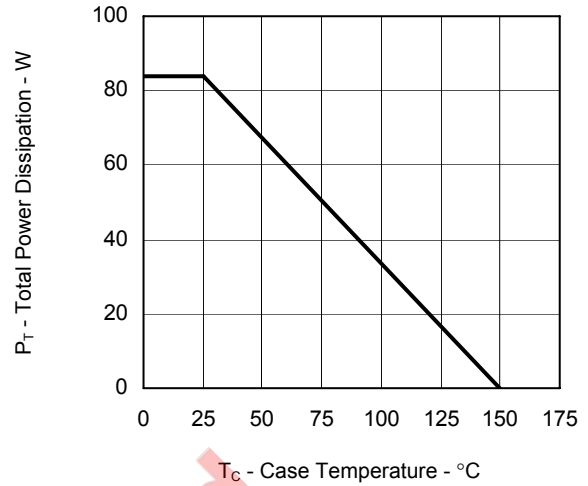


Typical Characteristics ( $T_A = 25^\circ\text{C}$ )

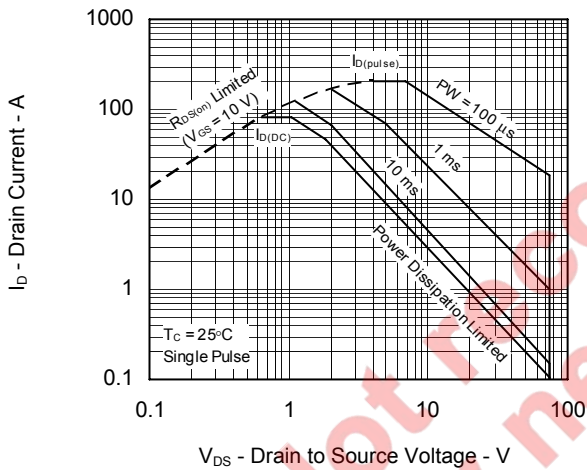
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



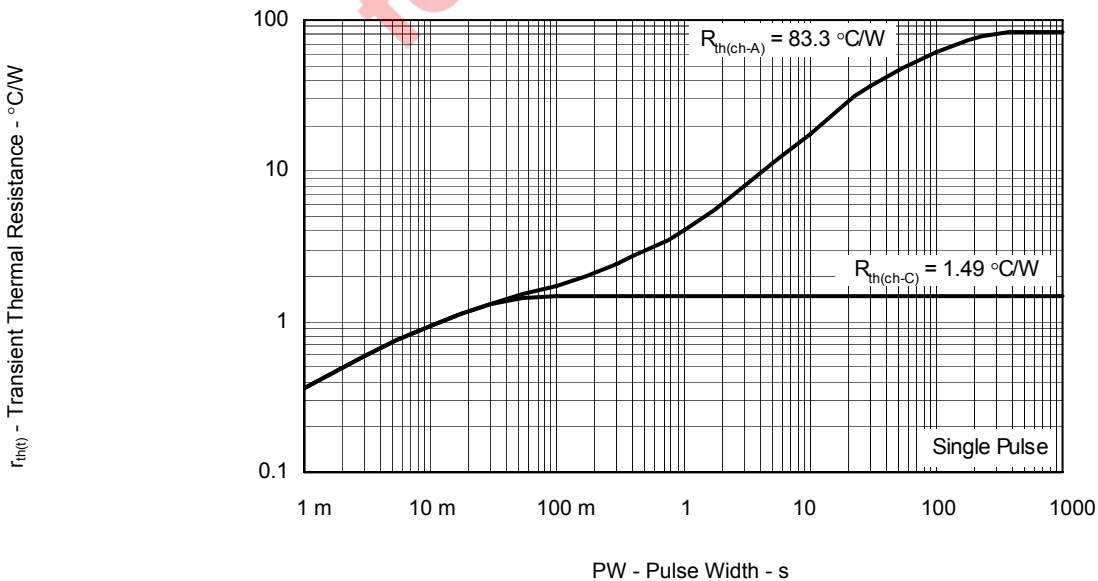
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE



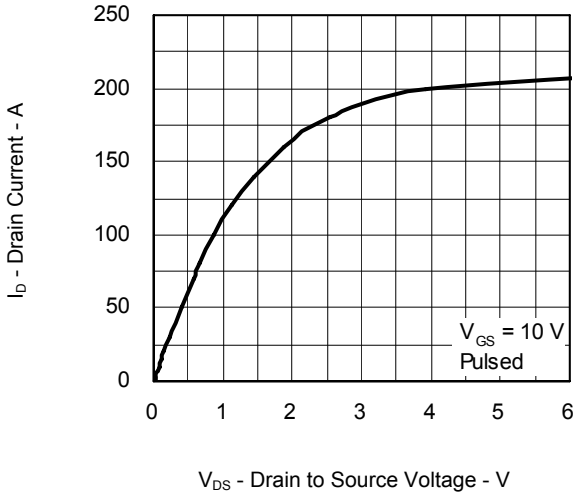
FORWARD BIAS SAFE OPERATING AREA



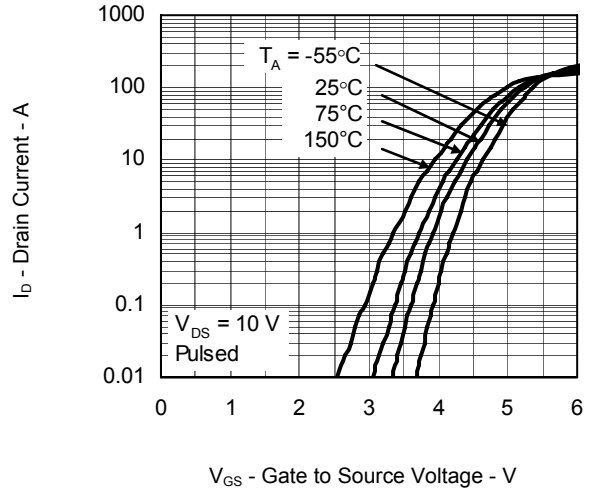
TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH



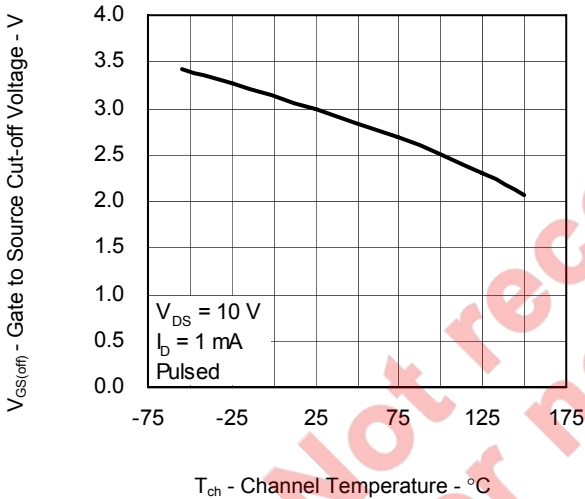
DRAIN CURRENT vs. DRAIN TO SOURCE VOLTAGE



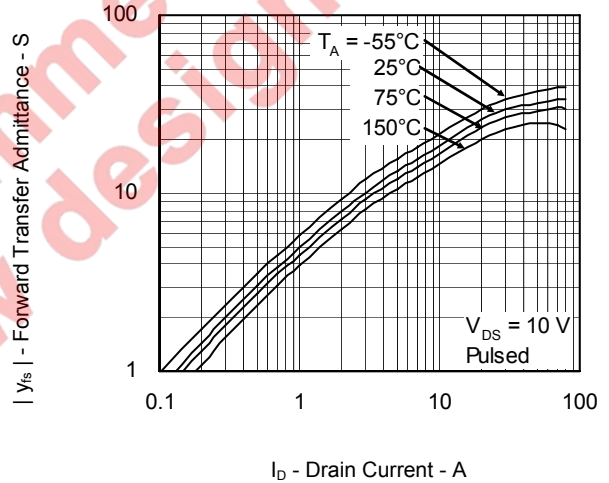
FORWARD TRANSFER CHARACTERISTICS



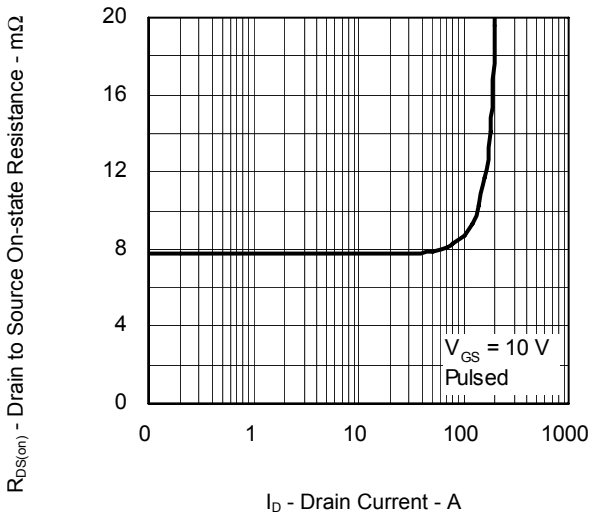
GATE TO SOURCE CUT-OFF VOLTAGE vs. CHANNEL TEMPERATURE



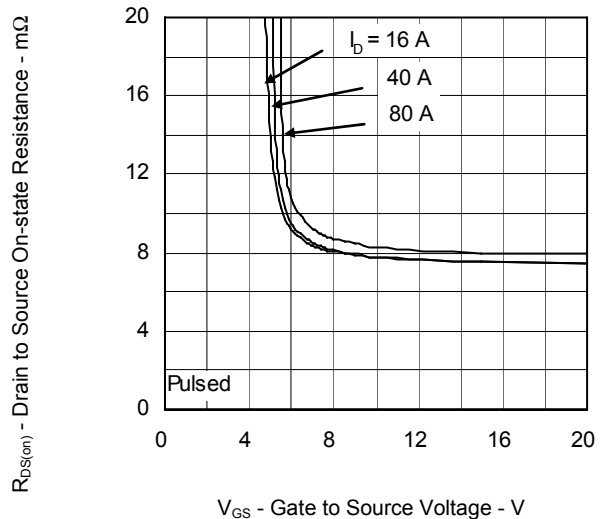
FORWARD TRANSFER ADMITTANCE vs. DRAIN CURRENT



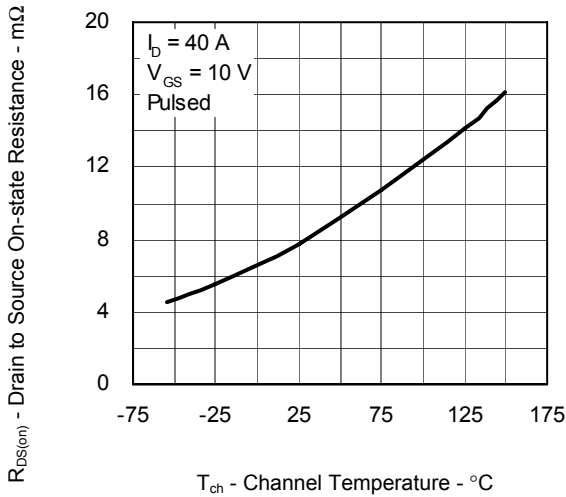
DRAIN TO SOURCE ON-STATE RESISTANCE vs. DRAIN CURRENT



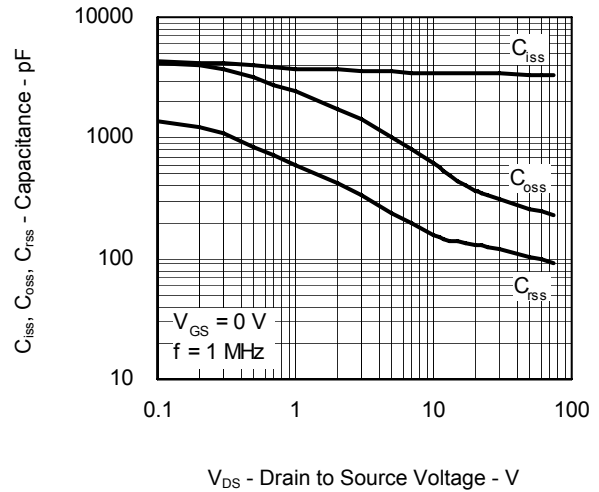
DRAIN TO SOURCE ON-STATE RESISTANCE vs. GATE TO SOURCE VOLTAGE



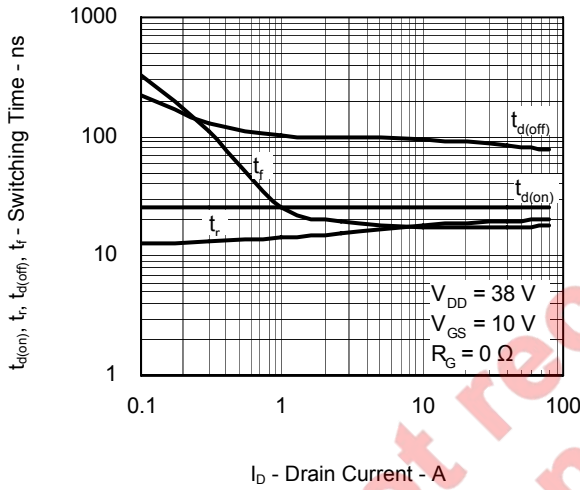
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



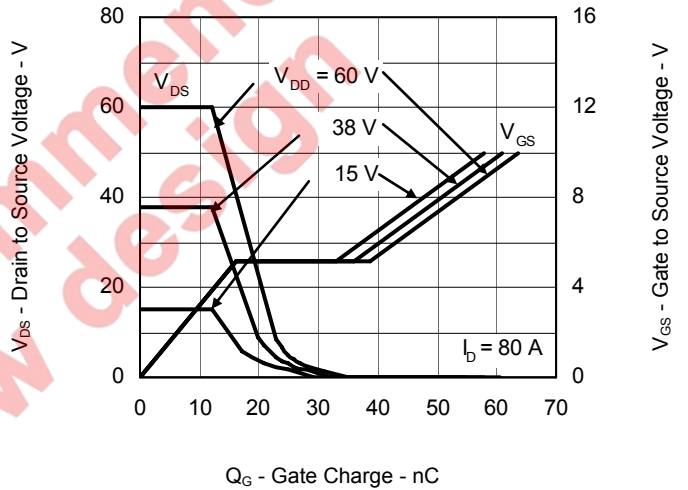
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



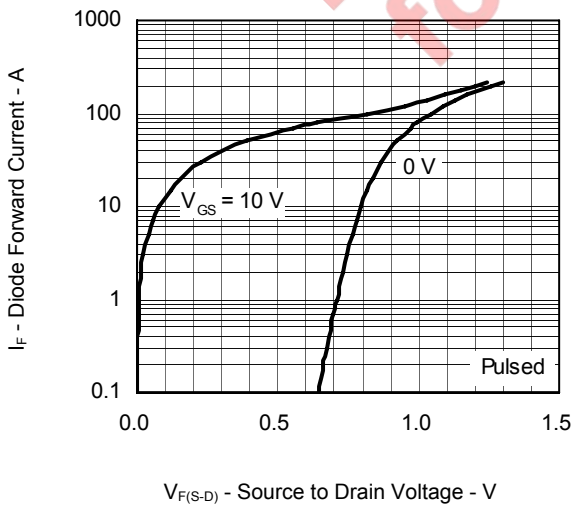
SWITCHING CHARACTERISTICS



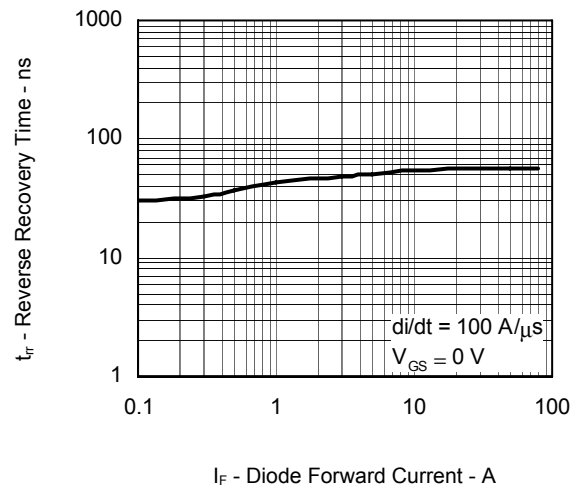
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

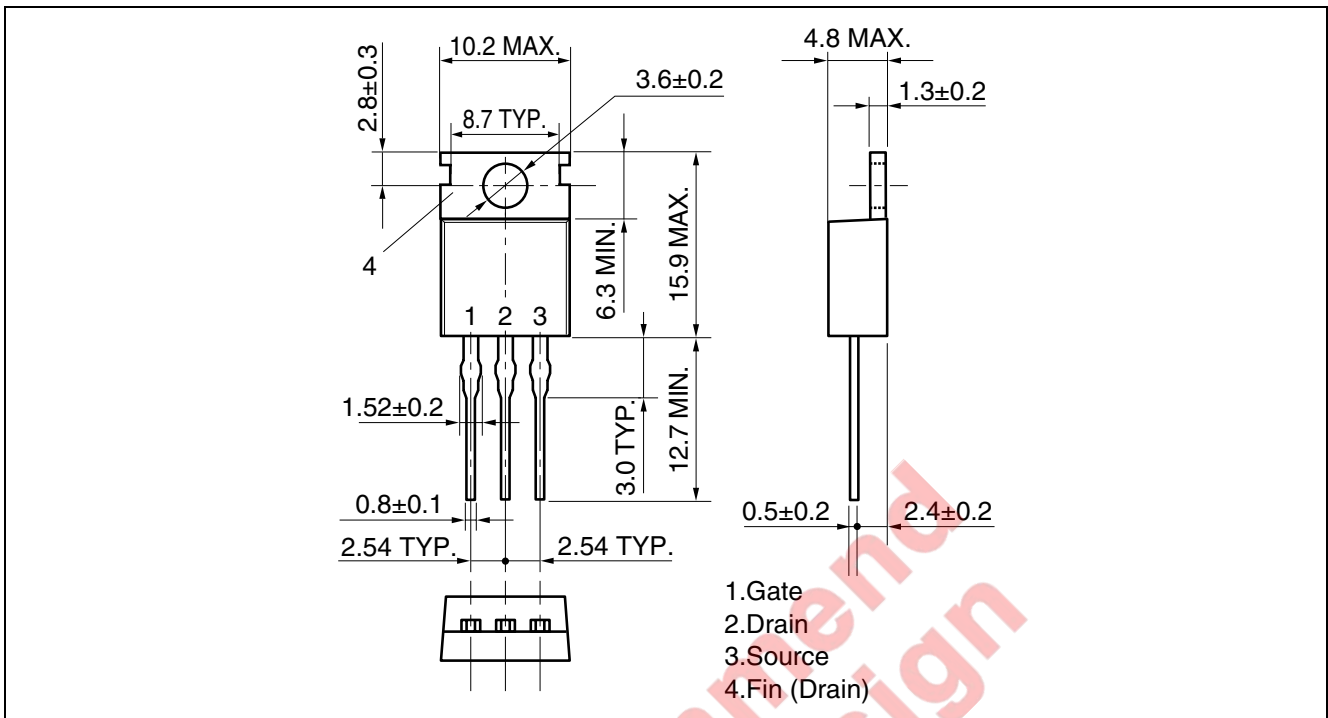


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

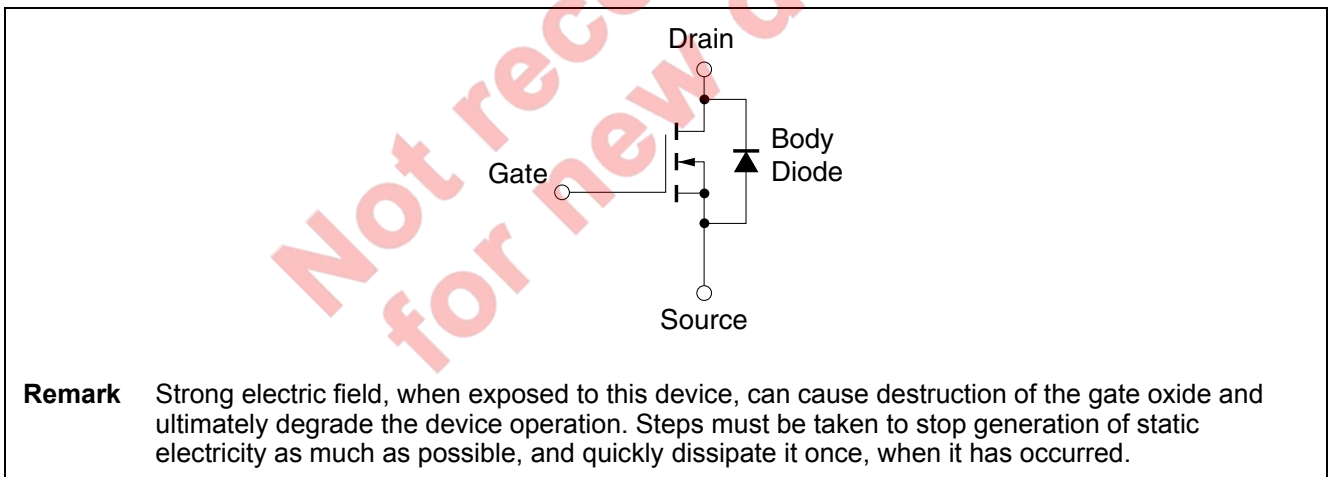


Package Drawings (Unit: mm)

TO-220 (Mass: 1.9 g TYP.)



Equivalent Circuit



<b>Revision History</b>	<b>2SK4146</b>
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Rev.	Date	Description	
		Page	Summary
1.00	Sep 24, 2010	-	First Edition Issued

**Not recommend  
for new design**

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