

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 ^{*1}	Pure Sn (Tin)	50 pcs/tube	TO-220, S19 tube

Note: ^{*1}. 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}	± 20	V
Drain Current (DC) ($T_C = 25^\circ\text{C}$)	$I_{D(DC)}$	± 80	A
Drain Current (pulse) ^{*1}	$I_{D(pulse)}$	± 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 ^{*2}	I_{AR}	33	A
Repetitive Avalanche Energy ^{*2}	E_{AR}	109	mJ

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

^{*2}. 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

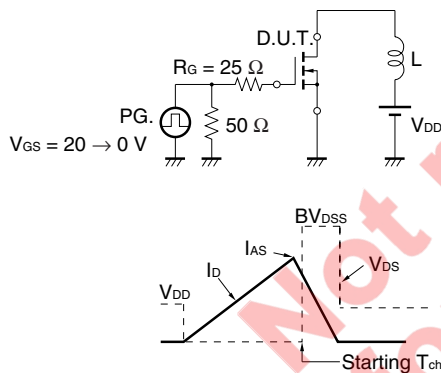
Channel to Case Thermal Resistance	$R_{th(ch-C)}$	1.49	$^\circ\text{C/W}$
Channel to Ambient Thermal Resistance	$R_{th(ch-A)}$	83.3	$^\circ\text{C/W}$

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

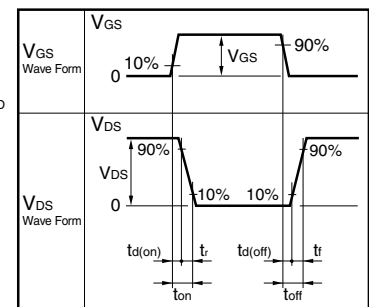
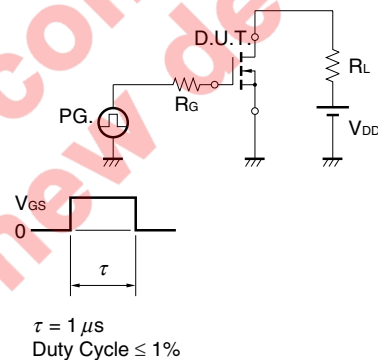
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Zero Gate Voltage Drain Current	I_{DSS}			10	μA	$V_{DS} = 75\text{ V}, V_{GS} = 0\text{ V}$
Gate Leakage Current	I_{GSS}			± 100	nA	$V_{GS} = \pm 20\text{ V}, V_{DS} = 0\text{ V}$
Gate to Source Cut-off Voltage	$V_{GS(off)}$	2.0	3.0	4.0	V	$V_{DS} = 10\text{ V}, I_D = 1\text{ mA}$
Forward Transfer Admittance ^{*1}	$ y_{fs} $	15	32		S	$V_{DS} = 10\text{ V}, I_D = 40\text{ A}$
Drain to Source On-state Resistance ^{*1}	$R_{DS(on)}$		7.8	10.1	m Ω	$V_{GS} = 10\text{ V}, I_D = 40\text{ A}$
Input Capacitance	C_{iss}		3500		pF	$V_{DS} = 10\text{ V},$ $V_{GS} = 0\text{ V},$ $f = 1\text{ MHz}$
Output Capacitance	C_{oss}		620		pF	
Reverse Transfer Capacitance	C_{rss}		160		pF	
Turn-on Delay Time	$t_{d(on)}$		26		ns	$V_{DD} = 38\text{ V}, I_D = 40\text{ A},$ $V_{GS} = 10\text{ V},$ $R_G = 0\text{ }\Omega$
Rise Time	t_r		20		ns	
Turn-off Delay Time	$t_{d(off)}$		85		ns	
Fall Time	t_f		17		ns	
Total Gate Charge	Q_G		61		nC	$V_{DD} = 60\text{ V},$ $V_{GS} = 10\text{ V},$ $I_D = 80\text{ A}$
Gate to Source Charge	Q_{GS}		16		nC	
Gate to Drain Charge	Q_{GD}		20		nC	
Body Diode Forward Voltage ^{*1}	$V_{F(S-D)}$		1.0	1.5	V	$I_F = 80\text{ A}, V_{GS} = 0\text{ V}$
Reverse Recovery Time	t_{rr}		58		ns	$I_F = 80\text{ A}, V_{GS} = 0\text{ V},$
Reverse Recovery Charge	Q_{rr}		125		nC	$di/dt = 100\text{ A}/\mu\text{s}$

Note: ^{*1}. Pulsed

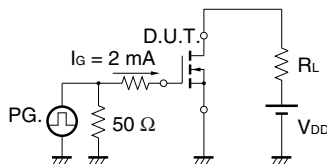
TEST CIRCUIT 1 AVALANCHE CAPABILITY



TEST CIRCUIT 2 SWITCHING TIME

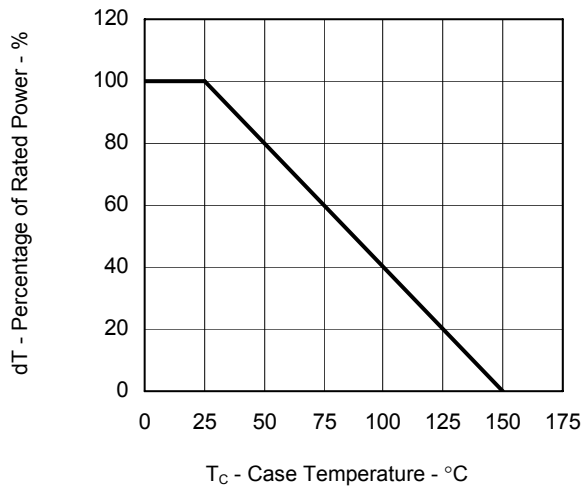


TEST CIRCUIT 3 GATE CHARGE

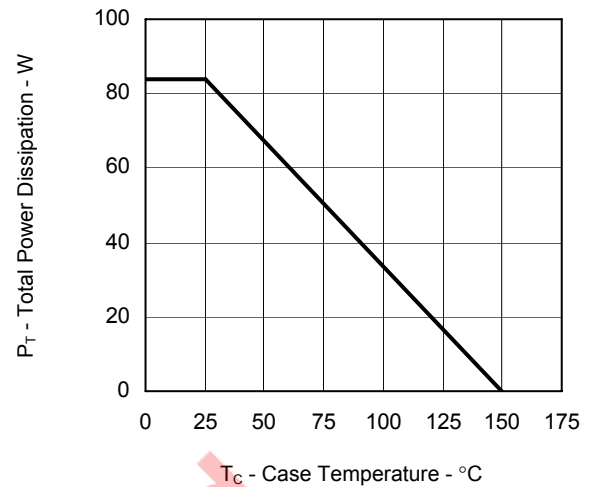


Typical Characteristics ($T_A = 25^\circ\text{C}$)

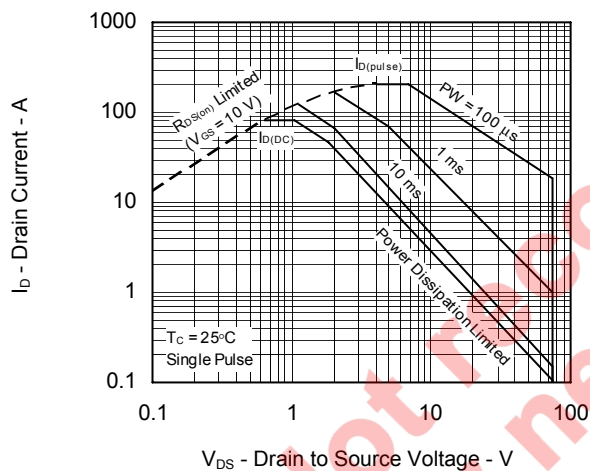
DERATING FACTOR OF FORWARD BIAS SAFE OPERATING AREA



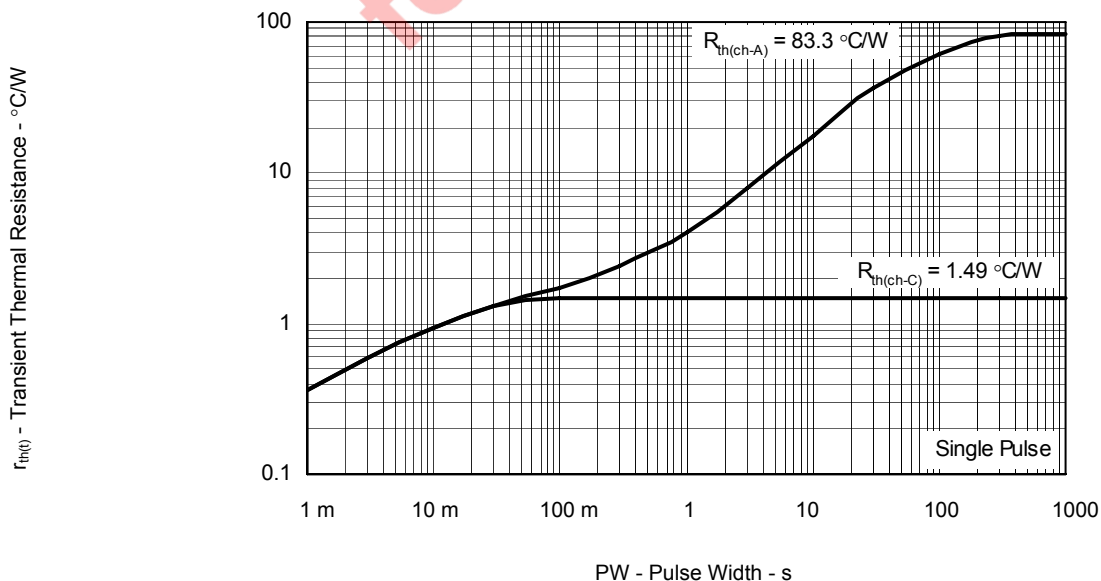
TOTAL POWER DISSIPATION vs. CASE TEMPERATURE

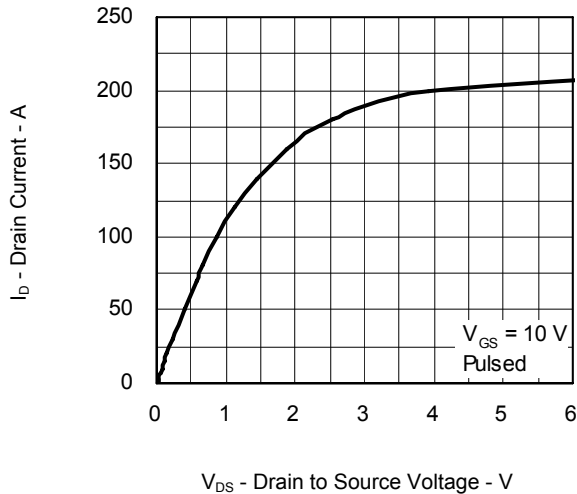


FORWARD BIAS SAFE OPERATING AREA

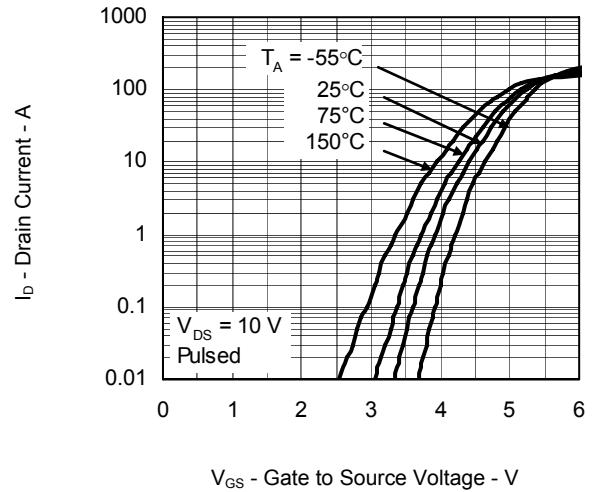
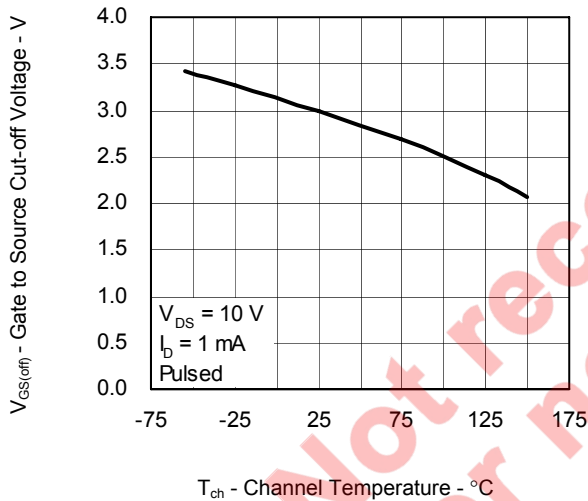
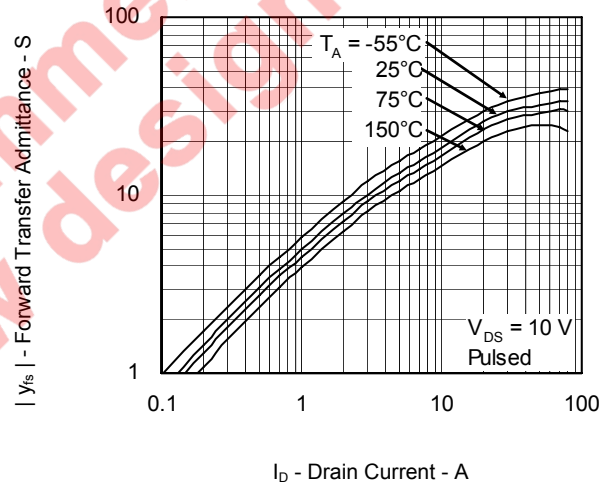
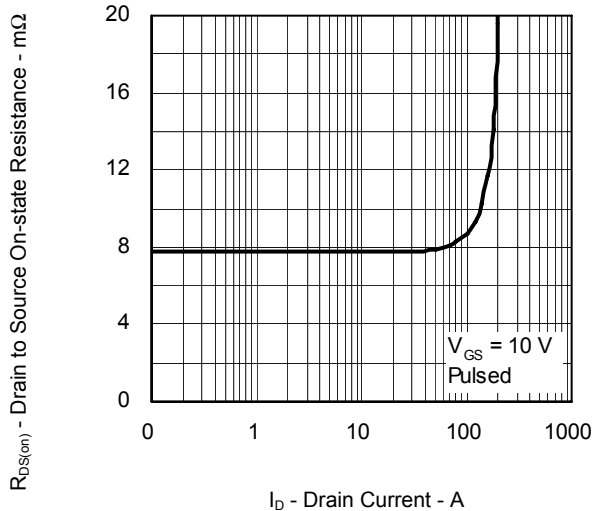
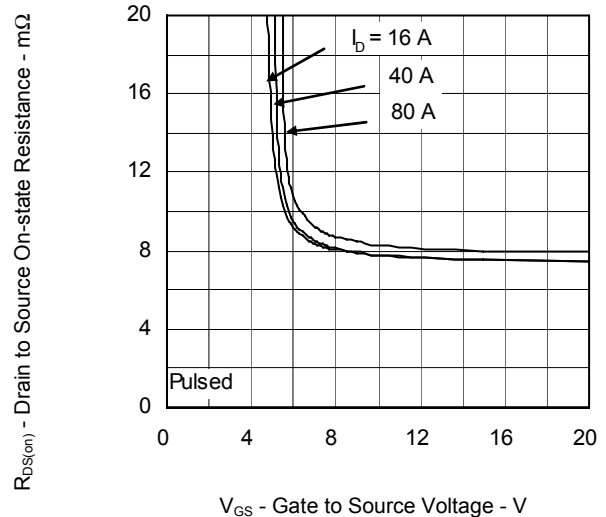


TRANSIENT THERMAL RESISTANCE vs. PULSE WIDTH

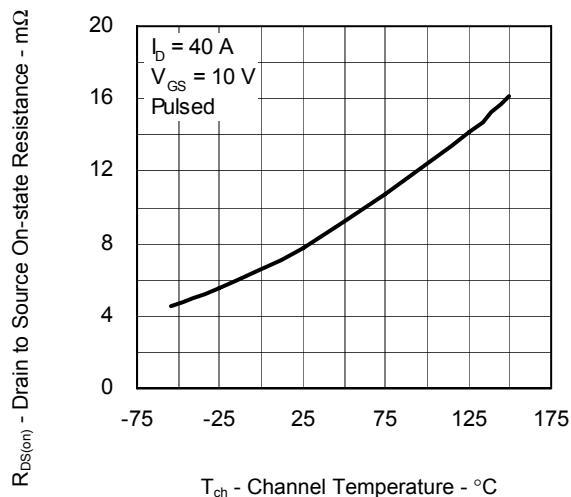


DRAIN CURRENT vs.
DRAIN TO SOURCE VOLTAGE

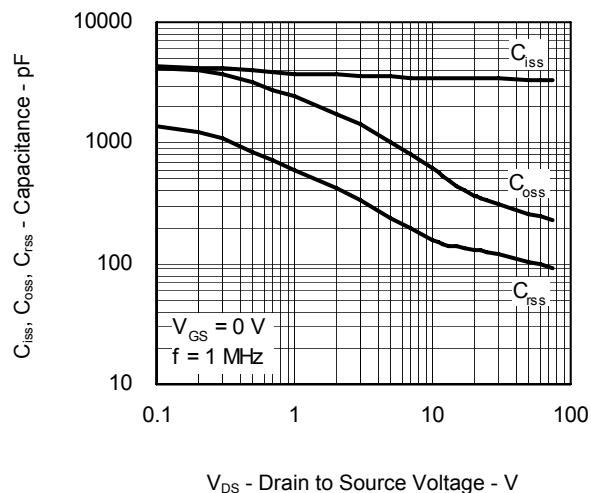
FORWARD TRANSFER CHARACTERISTICS

GATE TO SOURCE CUT-OFF VOLTAGE
vs. CHANNEL TEMPERATUREFORWARD TRANSFER ADMITTANCE vs. DRAIN
CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.
DRAIN CURRENTDRAIN TO SOURCE ON-STATE RESISTANCE vs.
GATE TO SOURCE VOLTAGE

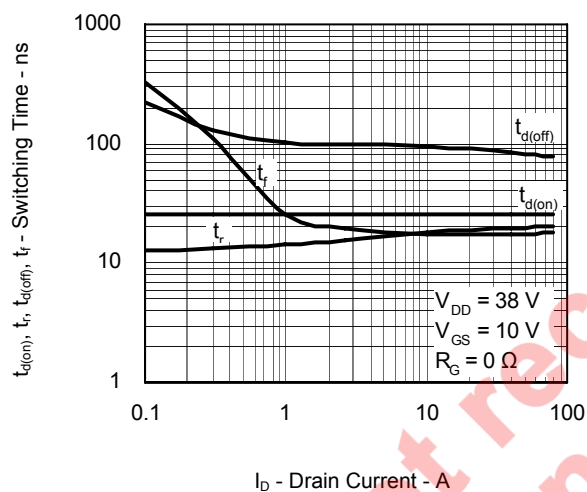
DRAIN TO SOURCE ON-STATE RESISTANCE vs. CHANNEL TEMPERATURE



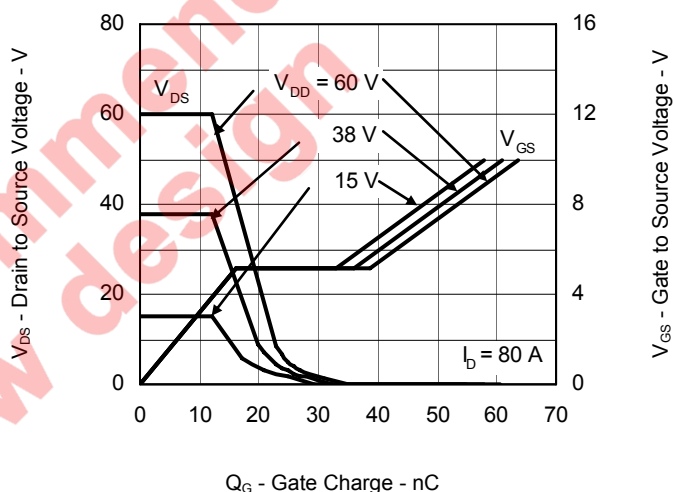
CAPACITANCE vs. DRAIN TO SOURCE VOLTAGE



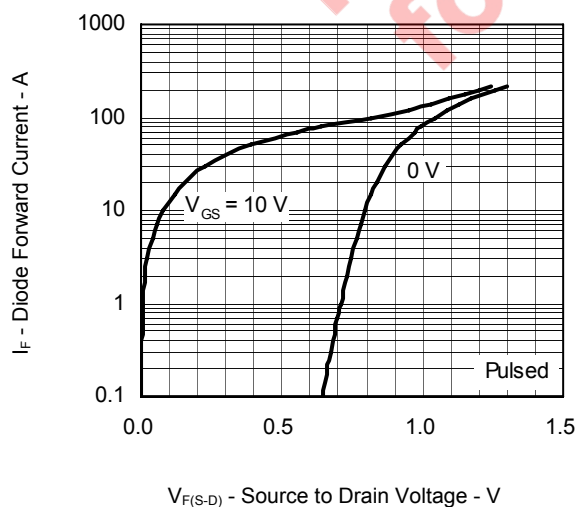
SWITCHING CHARACTERISTICS



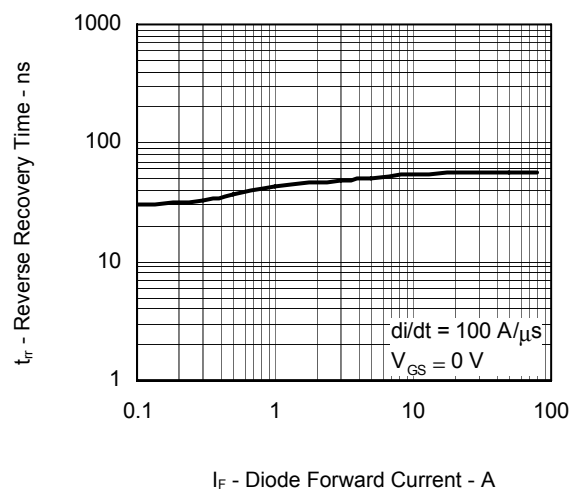
DYNAMIC INPUT/OUTPUT CHARACTERISTICS



SOURCE TO DRAIN DIODE FORWARD VOLTAGE

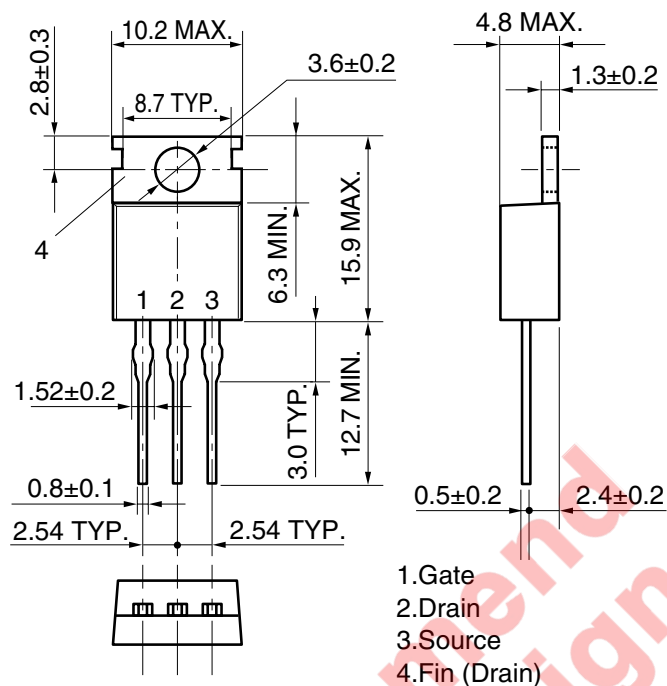


REVERSE RECOVERY TIME vs. DIODE FORWARD CURRENT

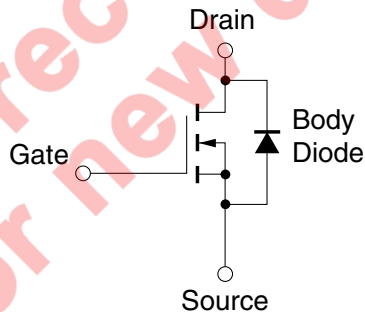


Package Drawings (Unit: mm)

TO-220 (Mass: 1.9 g TYP.)



Equivalent Circuit



Remark Strong electric field, when exposed to this device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it once, when it has occurred.

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