IRHLNS87Y50

An Infineon Technologies Company

RADIATION HARDENED LOGIC POWER MOSFET SURFACE MOUNT (SupIR-SMD)

20V, N-CHANNEL
R8 TECHNOLOGY

Product Summary

Part Number	Radiation Level	$R_{DS(on)}$	I_D
IRHLNS87Y50	100 kRads (Si)	2.5mΩ	75A*

SupIR-SMD

Description

IR HiRel R8 Logic Level Power MOSFETs provide simple solution to interfacing CMOS and TTL control circuits to power devices in space and other radiation environments. The threshold voltage remains within acceptable operating limits over the full operating temperature and post radiation. This is achieved while maintaining single event gate rupture and single event burnout immunity.

The device is ideal when used to interface directly with most logic gates, linear IC's, micro-controllers, and other device types that operate from a 3.3-5V source. It may also be used to increase the output current of a PWM, voltage comparator or an operational amplifier where the logic level drive signal is available.

Features

- 5V CMOS and TTL Compatible
- Fast Switching
- Low RDS(on)
- Low Total Gate Charge
- Simple Drive Requirements
- Surface Mount
- Hermetically Sealed
- Light Weight
- ESD Rating: Class 2 per MIL-STD-750, Method 1020

Absolute Maximum Ratings

Pre-Irradiation

Symbol	Parameter	Value	Units
I_{D1} @ V_{GS} = 4.5V, T_C = 25°C	Continuous Drain Current	75*	A
I_{D2} @ V_{GS} = 4.5V, T_C = 100°C	Continuous Drain Current	75*	
I_{DM} @ T_C = 25°C	Pulsed Drain Current ①	300	
P_D @ T_C = 25°C	Maximum Power Dissipation	125	W
	Linear Derating Factor	1.0	W/°C
V_{GS}	Gate-to-Source Voltage	+12/-10	V
E_{AS}	Single Pulse Avalanche Energy ②	535	mJ
I_{AR}	Avalanche Current ①	75	A
E_{AR}	Repetitive Avalanche Energy ①	12.5	mJ
dv/dt	Peak Diode Recovery dv/dt ③	0.8	V/ns
T_J T_{STG}	Operating Junction and Storage Temperature Range	-55 to + 150	°C
	Package Mounting Surface Temperature	300 (for 5s)	
	Weight	3.3 (Typical)	g

* Current is limited by package

For Footnotes, refer to the page 2.

Electrical Characteristics @ Tj = 25°C (Unless Otherwise Specified)

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
BV_{DSS}	Drain-to-Source Breakdown Voltage	20	—	—	V	V_{GS} = 0V, I_D = 250µA
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.02	—	V/°C	Reference to 25°C, I_D = 250µA
$R_{DS(on)}$	Static Drain-to-Source On-State Resistance	—	—	2.5	mΩ	V_{GS} = 4.5V, I_{D2} = 75A* ④
		—	—	2.3	mΩ	V_{GS} = 7.0V, I_{D2} = 75A* ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.3	V	V_{DS} = V_{GS}, I_D = 1.8mA
$\Delta V_{GS(th)}/\Delta T_J$	Gate Threshold Voltage Coefficient	—	- 4.3	—	mV/°C	
Gfs	Forward Transconductance	75	—	—	S	V_{DS} = 15V, I_{D2} = 75A ④
I_{DSS}	Zero Gate Voltage Drain Current	—	—	1.0	µA	V_{DS} = 16V, V_{GS} = 0V
		—	—	50		V_{DS} = 16V,V_{GS} = 0V,T_J =125°C
I_{GSS}	Gate-to-Source Leakage Forward	—	—	100	nA	V_{GS} = 12V
	Gate-to-Source Leakage Reverse	—	—	-100		V_{GS} = -10V
Q_G	Total Gate Charge	—	—	130	nC	I_{D1} = 75A
Q_{GS}	Gate-to-Source Charge	—	—	50		V_{DS} = 10V
Q_{GD}	Gate-to-Drain ('Miller') Charge	—	—	35		V_{GS} = 4.5V
$t_{d(on)}$	Turn-On Delay Time	—	—	80	ns	V_{DD} = 10V
tr	Rise Time	—	—	130		I_{D1} = 75A
$t_{d(off)}$	Turn-Off Delay Time	—	—	100		R_G = 2.35Ω
t_f	Fall Time	—	—	55		V_{GS} = 4.5V
Ls +L_D	Total Inductance	—	12	—	nH	Measured from center of Drain pad to center of Source pad
C_{iss}	Input Capacitance	—	15330	—	pF	V_{GS} = 0V
C_{oss}	Output Capacitance	—	3140	—		V_{DS} = 20V
C_{rss}	Reverse Transfer Capacitance	—	610	—		f = 1.0MHz
R_G	Gate Resistance	—	0.4	—	Ω	f = 1.0MHz, open drain

Source-Drain Diode Ratings and Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	—	—	75*	A	
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	300		
V_{SD}	Diode Forward Voltage	—	—	1.0	V	T_J = 25°C,I_S = 75A, V_{GS} = 0V④
t_{rr}	Reverse Recovery Time	—	—	100	ns	T_J = 25°C, I_F = 75A, V_{DD} ≤ 20V
Q_{rr}	Reverse Recovery Charge	—	—	155	nC	di/dt = 100A/µs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

* Current is limited by package

Thermal Resistance

Symbol	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	1.0	°C/W

Footnotes:

① Repetitive Rating; Pulse width limited by maximum junction temperature.
② V_{DD} = 20V, starting T_J = 25°C, L = 0.19mH, Peak I_L =75A, V_{GS} = 10V
③ I_{SD} ≤ 75A, di/dt ≤ 450A/µs, V_{DD} ≤ 20V, T_J ≤ 150°C
④ Pulse width ≤ 300 µs; Duty Cycle ≤ 2%
⑤ Total Dose Irradiation with V_{GS} Bias. 12 volt VGS applied and VDS = 0 during irradiation per MIL-STD-750, Method 1019, condition A.
⑥ Total Dose Irradiation with V_{DS} Bias. 16 volt VDS applied and VGS = 0 during irradiation per MIL-STD-750, Method 1019, condition A.

Radiation Characteristics

IR HiRel Radiation Hardened MOSFETs are tested to verify their radiation hardness capability. The hardness assurance program at IR HiRel is comprised of two radiation environments. Every manufacturing lot is tested for total ionizing dose (per notes 5 and 6) using the TO-3 package. Both pre- and post-irradiation performance are tested and specified using the same drive circuitry and test conditions in order to provide a direct comparison.

Table1. Electrical Characteristics @ Tj = 25°C, Post Total Dose Irradiation ⑤⑥

Symbol	Parameter	Up to 100 kRads (Si)		Units	Test Conditions
		Min.	Max.		
BV_{DSS}	Drain-to-Source Breakdown Voltage	20	——	V	V_{GS} = 0V, I_D = 1.0mA
$V_{GS(th)}$	Gate Threshold Voltage	1.0	2.3	V	V_{DS} = V_{GS}, I_D = 1.8mA
I_{GSS}	Gate-to-Source Leakage Forward	——	100	nA	V_{GS} = 12V
I_{GSS}	Gate-to-Source Leakage Reverse	——	-100	nA	V_{GS} = -10V
I_{DSS}	Zero Gate Voltage Drain Current	——	1.0	µA	V_{DS} = 16V, V_{GS} = 0V
$R_{DS(on)}$	Static Drain-to-Source ④ On-State Resistance (TO-3)	——	3.0	mΩ	V_{GS} = 4.5V, I_{D2} = 75A
$R_{DS(on)}$	Static Drain-to-Source ④ On-State Resistance (SupIR-SMD)	——	2.5	mΩ	V_{GS} = 4.5V, I_{D2} = 75A
V_{SD}	Diode Forward Voltage	——	1.0	V	V_{GS} = 0V, I_S = 75A

IR HiRel radiation hardened MOSFETs have been characterized in heavy ion environment for Single Event Effects (SEE). Single Event Effects characterization is illustrated in Fig. a and Table 2.

Table 2. Worst Case Single Event Effect Safe Operating Area

Ion	LET (MeV/(mg/cm^2))	Energy (MeV)	Range (µm)	VDS (V)		
				@ VGS=0V	@ VGS=-1V	@ VGS=-2V
Kr	32.4	679	83.3	16	16	——
Xe	61.7	584	48.7	14	14	——
Au	92.3	1156	65.1	12	12	——

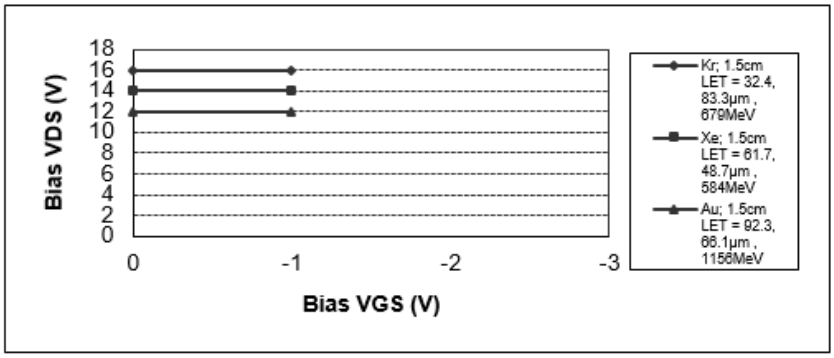


Fig a. Worst Case Single Event Effect, Safe Operating Area

For Footnotes, refer to the page 2.

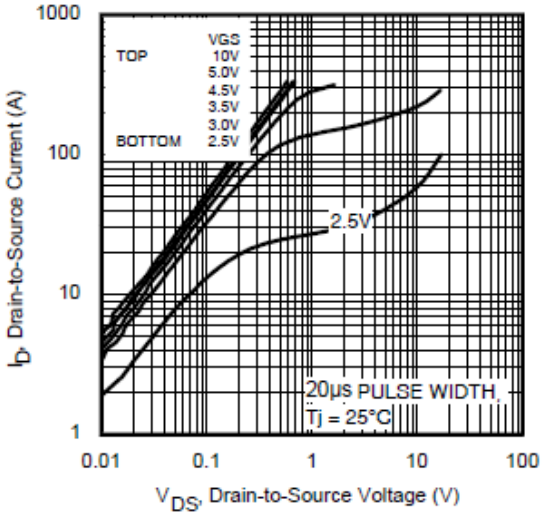


Fig 1. Typical Output Characteristics

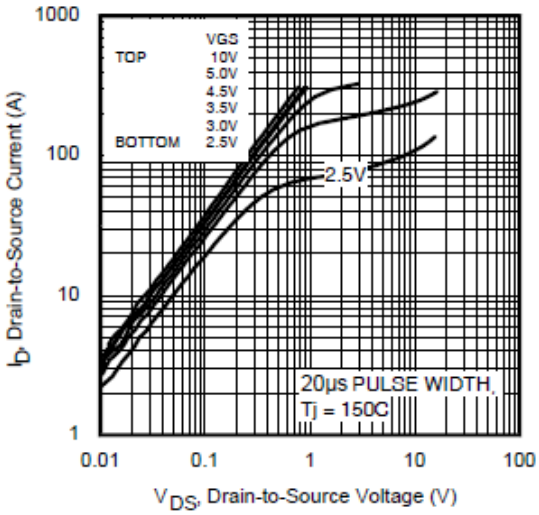


Fig 2. Typical Output Characteristics

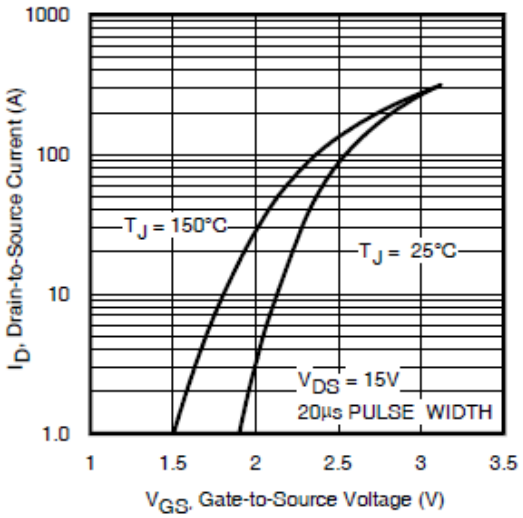


Fig 3. Typical Transfer Characteristics

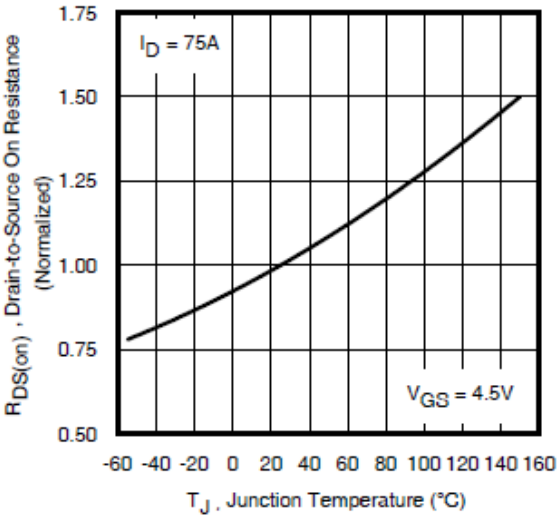


Fig 4. Normalized On-Resistance Vs. Temperature

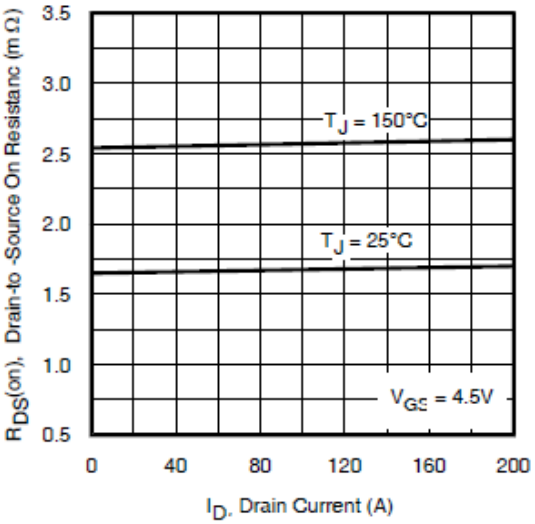


Fig 5. Typical On-Resistance Vs Gate Voltage

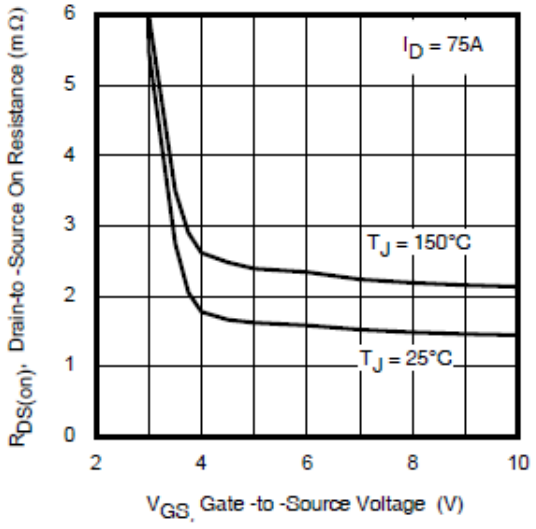


Fig 6. Typical On-Resistance Vs Drain Current

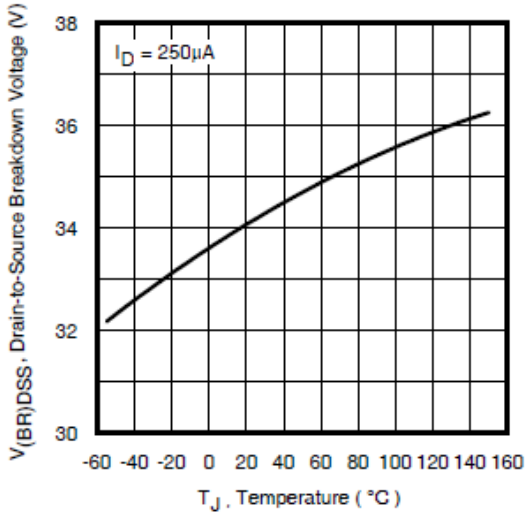


Fig 7. Typical Drain-to-Source Breakdown Voltage Vs Temperature

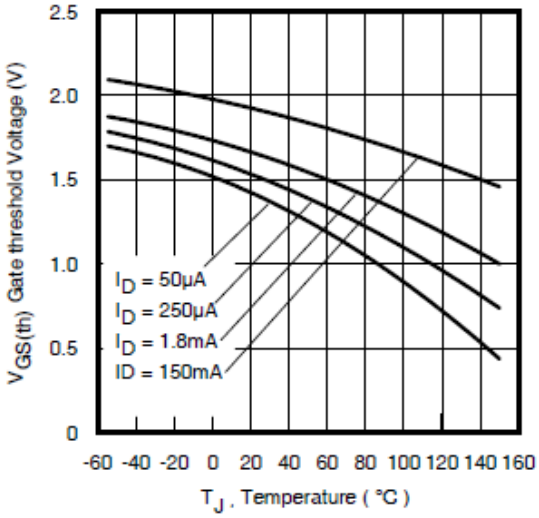


Fig 8. Typical Threshold Voltage Vs Temperature

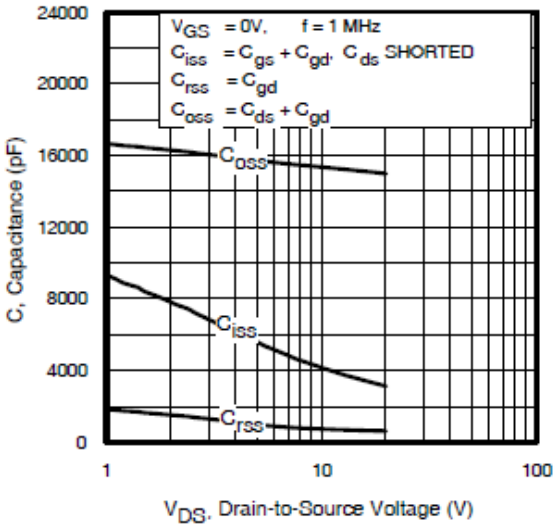


Fig 9. Typical Capacitance Vs. Drain-to-Source Voltage

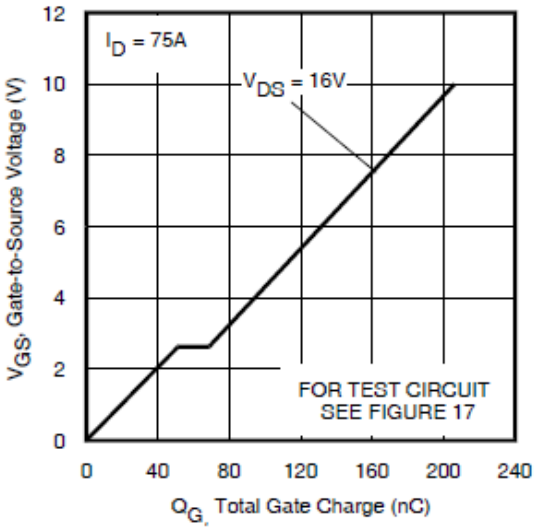


Fig 10. Typical Gate Charge Vs. Gate-to-Source Voltage

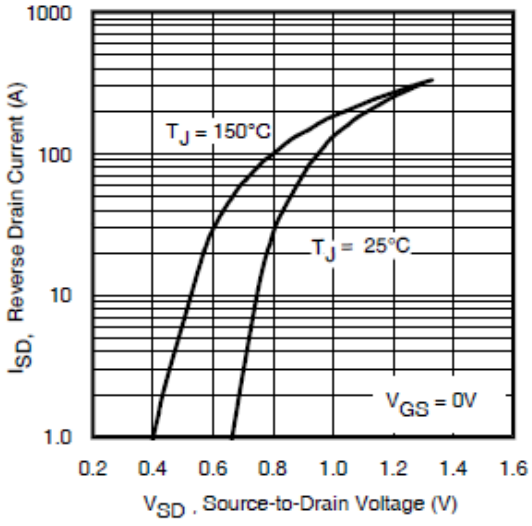


Fig 11. Typical Source-Drain Diode Forward Voltage

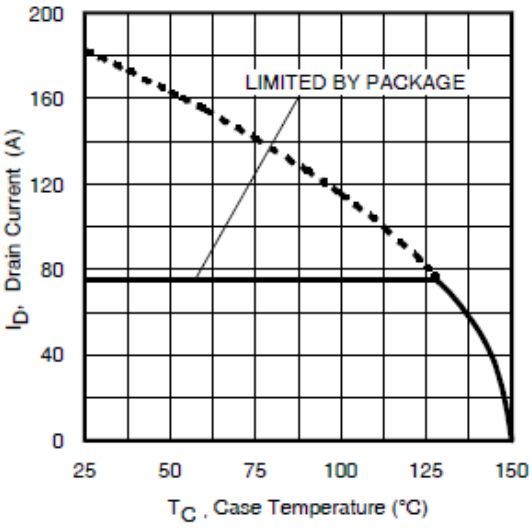


Fig 12. Maximum Drain Current Vs. Case Temperature

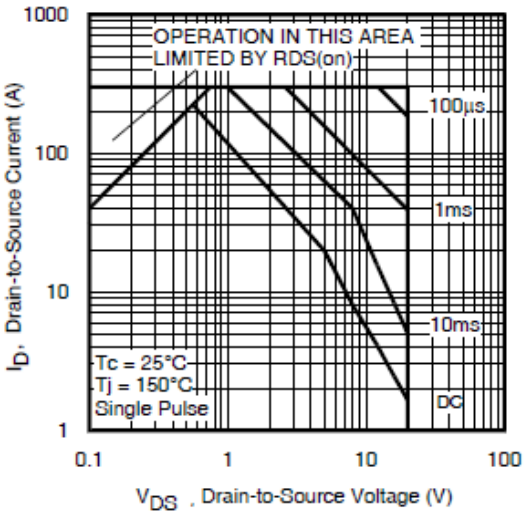


Fig 13. Maximum Safe Operating Area

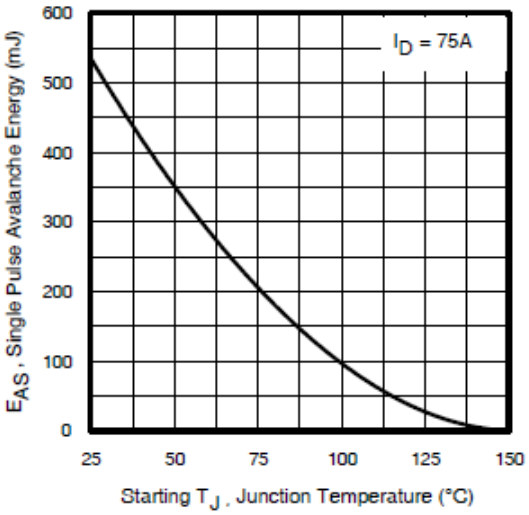


Fig 14. Maximum Avalanche Energy Vs. Drain Current

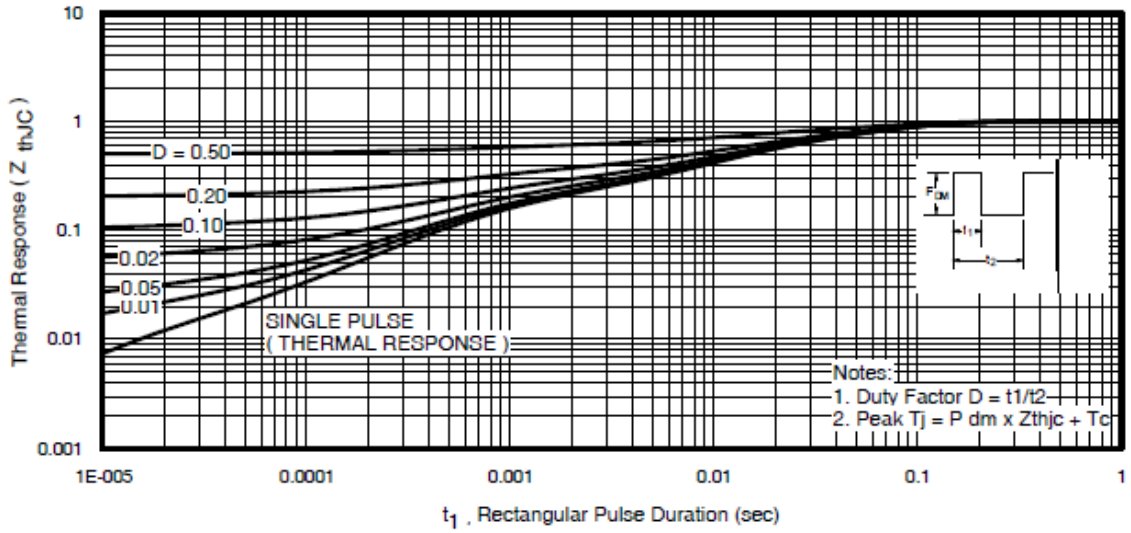


Fig 15. Maximum Effective Transient Thermal Impedance, Junction-to-Case

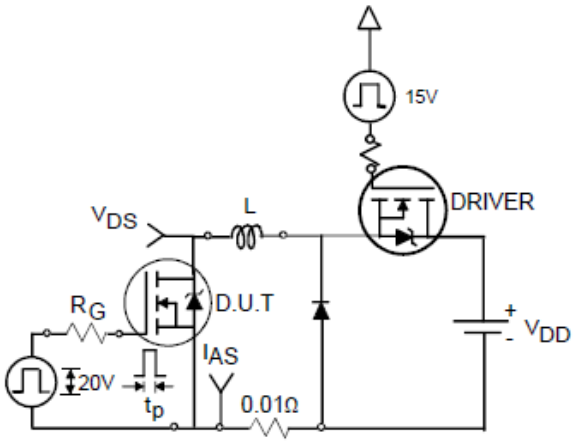


Fig 16a. Unclamped Inductive Test Circuit

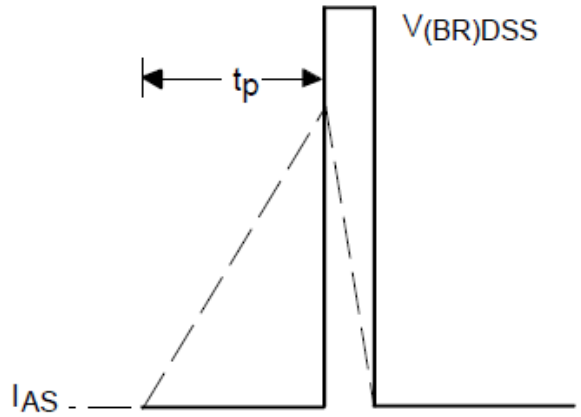


Fig 16b. Unclamped Inductive Wave-

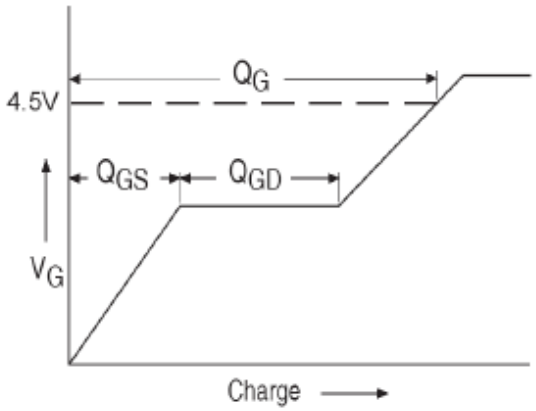


Fig 17a. Gate Charge Waveform

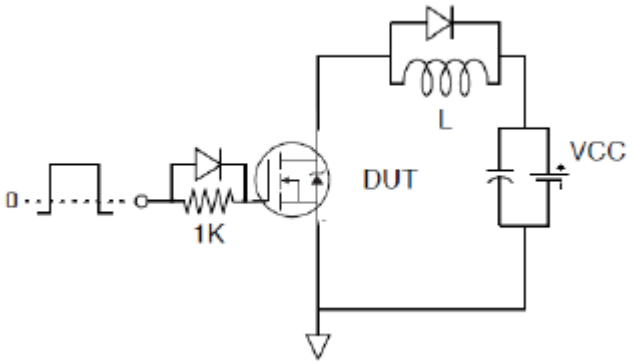


Fig 17b. Gate Charge Test Circuit

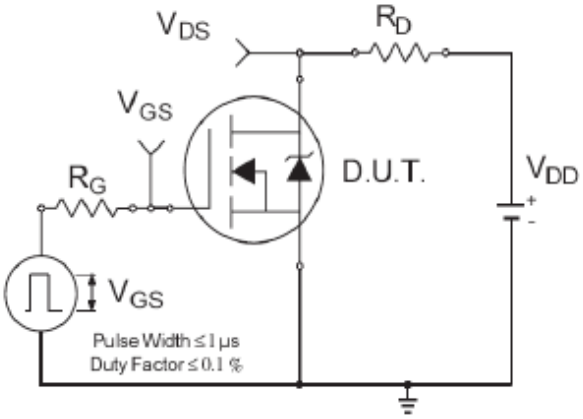


Fig 18a. Switching Time Test Circuit

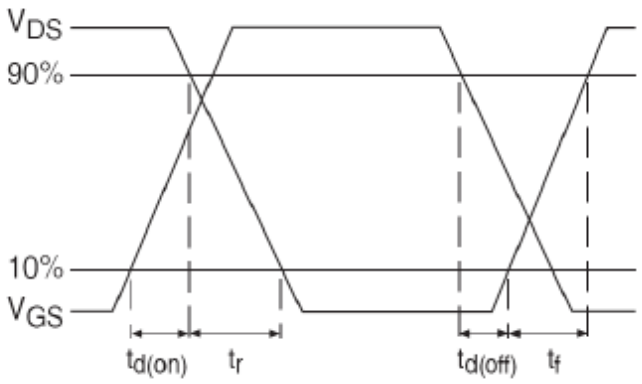
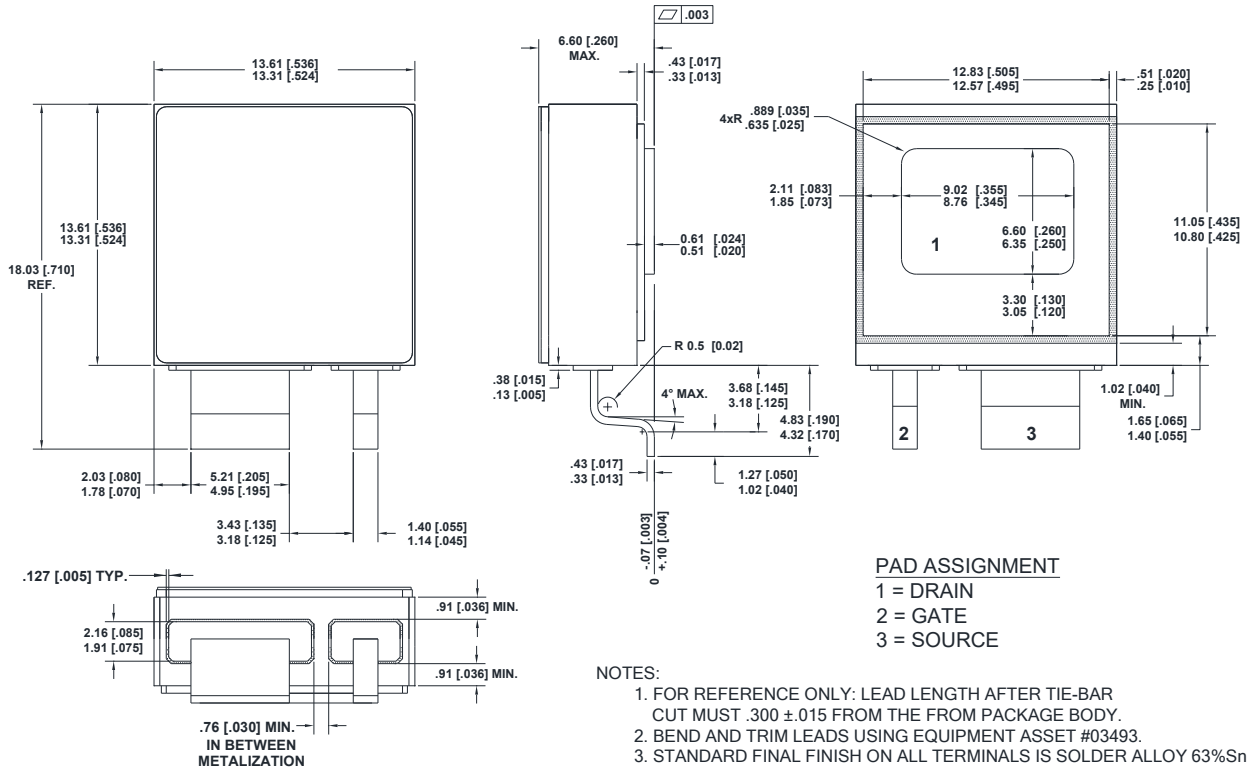


Fig 18b. Switching Time Waveforms

Note: For the most updated package outline, please see the website: SupIR-SMD

Case Outline and Dimensions — SupIR-SMD

REV.	DESCRIPTION	ECN	DATE
E	INITIAL RELEASE	1120_ER6904	4-3-20



PAD ASSIGNMENT
1 = DRAIN
2 = GATE
3 = SOURCE

NOTES:
1. FOR REFERENCE ONLY: LEAD LENGTH AFTER TIE-BAR CUT MUST .300 ±.015 FROM THE FROM PACKAGE BODY.
2. BEND AND TRIM LEADS USING EQUIPMENT ASSET #03493.
3. STANDARD FINAL FINISH ON ALL TERMINALS IS SOLDER ALLOY 63%Sn 37%Pb.

IOR HiRel
An Infineon Technologies Company

TITLE:
CASE OUTLINE STD SUPSMD2, LF

DRAWING NO.
D101003G–WEB

REV E

IOR HiRel
An Infineon Technologies Company
www.infineon.com/irhirel

Infineon Technologies Service Center: USA Tel: +1 (866) 951-9519 and International Tel: +49 89 234 65555
Leominster, Massachusetts 01453, USA Tel: +1 (978) 534-5776
San Jose, California 95134, USA Tel: +1 (408) 434-5000

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