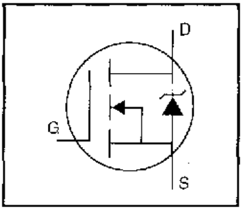
International Rectifier

IRL510S

HEXFET® Power MOSFET

- Surface Mount
- Available in Tape & Reel
- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Logic-Level Gate Drive
- $R_{DS(on)}$ Specified at V_{GS}=4V & 5V
- 175°C Operating Temperature



V_{DSS} = 100V

$R_{DS(on)}$ = 0.54Ω

I_D = 5.6A

Description

Third Generation HEXFETs from International Rectifier provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The SMD-220 is a surface mount power package capable of accommodating die sizes up to HEX-4. It provides the highest power capability and the lowest possible on-resistance in any existing surface mount package. The SMD-220 is suitable for high current applications because of its low internal connection resistance and can dissipate up to 2.0W in a typical surface mount application.

SMD-220

DATA SHEETS

Absolute Maximum Ratings

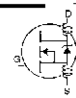
	Parameter	Max.	Units
I_D @ T_C = 25°C	Continuous Drain Current, V_{GS} @ 5.0 V	5.6	A
I_D @ T_C = 100°C	Continuous Drain Current, V_{GS} @ 5.0 V	4.0	
I_{DM}	Pulsed Drain Current ①	18	
P_D @ T_C = 25°C	Power Dissipation	43	W
P_D @ T_A = 25°C	Power Dissipation (PCB Mount)**	3.7	
	Linear Derating Factor	0.29	W/°C
	Linear Derating Factor (PCB Mount)**	0.025	
V_{GS}	Gate-to-Source Voltage	±10	V
E_{AS}	Single Pulse Avalanche Energy ②	100	mJ
I_{AR}	Avalanche Current ①	5.6	A
E_{AR}	Repetitive Avalanche Energy ①	4.3	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.5	V/ns
T_J, T_{STG}	Junction and Storage Temperature Range	-55 to +175	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

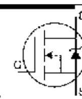
	Parameter	Min.	Typ.	Max.	Units
$R_{θJC}$	Junction-to-Case	—	—	3.5	°C/W
$R_{θJA}$	Junction-to-Ambient (PCB mount)**	—	—	40	
$R_{θJA}$	Junction-to-Ambient	—	—	62	

** When mounted on 1" square PCB (FR-4 or G-10 Material).
For recommended footprint and soldering techniques refer to application note #AN-994.

Electrical Characteristics @ $T_J = 25°C$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	100	—	—	V	V_{GS}=0V, I_D= 250μA
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.12	—	V/°C	Reference to 25°C, I_D= 1mA
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.54	Ω	V_{GS}=5.0V, I_D=3.4A ④
		—	—	0.76		V_{GS}=4.0V, I_D=2.8A ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS}=V_{GS}$, I_D= 250μA
g_{fs}	Forward Transconductance	1.9	—	—	S	V_{DS}=50V, I_D=3.4A ④
I_{DSS}	Drain-to-Source Leakage Current	—	—	25	μA	V_{DS}=100V, V_{GS}=0V
		—	—	250		V_{DS}=80V, V_{GS}=0V, T_J=150°C
I_{GSS}	Gate-to-Source Forward Leakage	—	—	100	nA	V_{GS}=10V
	Gate-to-Source Reverse Leakage	—	—	-100		V_{GS}=-10V
Q_g	Total Gate Charge	—	—	6.1	nC	I_D=5.6A
Q_{gs}	Gate-to-Source Charge	—	—	2.6		V_{DS}=80V
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	3.3		V_{GS}=5.0V See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	9.3	—	ns	V_{DD}=50V
t_r	Rise Time	—	47	—		I_D=5.6A
$t_{d(off)}$	Turn-Off Delay Time	—	16	—		R_G=12Ω
t_f	Fall Time	—	18	—		R_D=8.4Ω See Figure 10 ④
L_D	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6 mm (0.25in.) from package and center of die contact 
L_S	Internal Source Inductance	—	7.5	—		
C_{iss}	Input Capacitance	—	250	—	pF	V_{GS}=0V
C_{oss}	Output Capacitance	—	80	—		V_{DS}= 15V
C_{rss}	Reverse Transfer Capacitance	—	15	—		f=1.0MHz See Figure 5

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Test Conditions
I_S	Continuous Source Current (Body Diode)	—	—	5.6	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	18		
V_{SD}	Diode Forward Voltage	—	—	2.5	V	T_J=25°C, I_S=5.6A, V_{GS}=0V ④
t_{rr}	Reverse Recovery Time	—	110	130	ns	T_J=25°C, I_F=5.6A
Q_{rr}	Reverse Recovery Charge	—	0.50	0.65	uC	di/dt=100A/μs ④
t_{on}	Forward Turn-On Time	Intrinsic turn-on time is neglegible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature (See Figure 11)

② V_{DD}=25V, starting T_J=25°C, L=4.8mH R_G=25Ω, I_{AS}=5.6A (See Figure 12)

③ $I_{SD}\le$5.6A, di/dt$\le$75A/μs, $V_{DD}\le V_{(BR)DSS}$, $T_J\le$175°C

④ Pulse width ≤ 300 μs; duty cycle ≤2%.

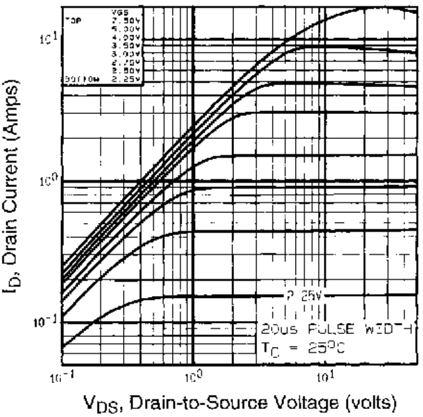


Fig 1. Typical Output Characteristics, T_C=25°C

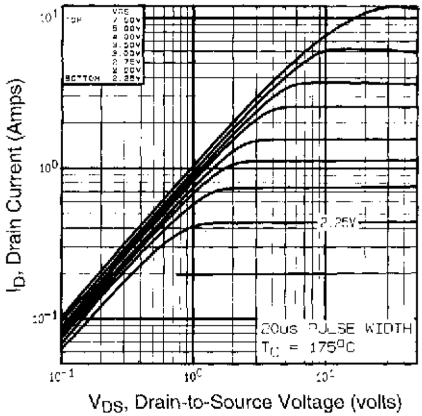


Fig 2. Typical Output Characteristics, T_C=175°C

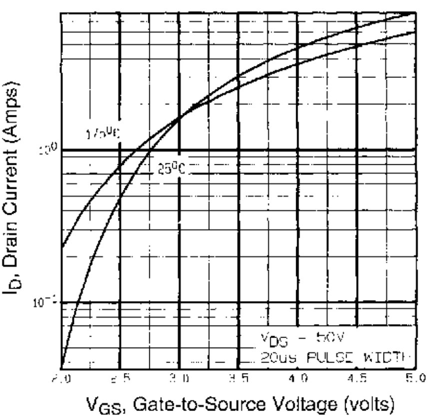


Fig 3. Typical Transfer Characteristics

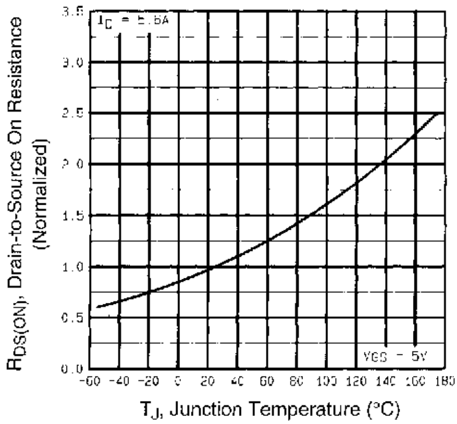


Fig 4. Normalized On-Resistance Vs. Temperature

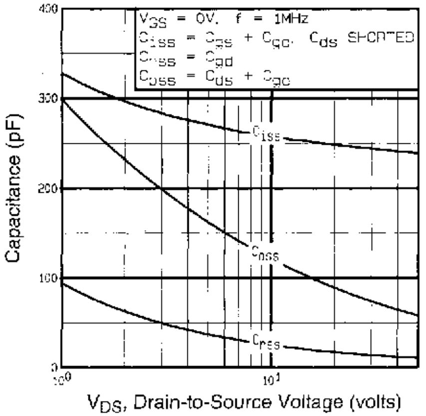


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

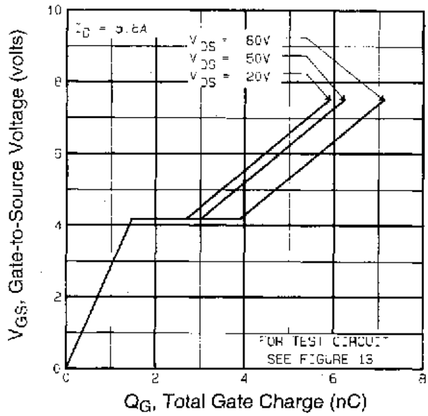


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

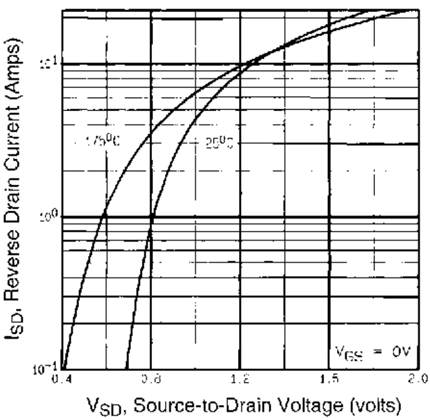


Fig 7. Typical Source-Drain Diode Forward Voltage

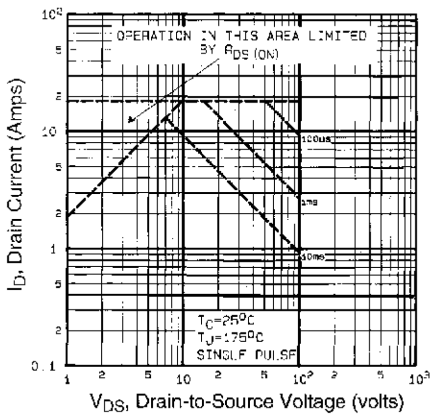


Fig 8. Maximum Safe Operating Area

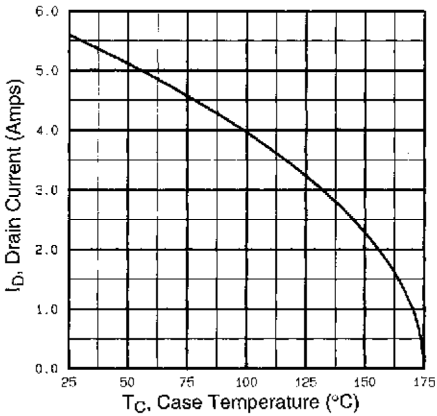


Fig 9. Maximum Drain Current Vs. Case Temperature

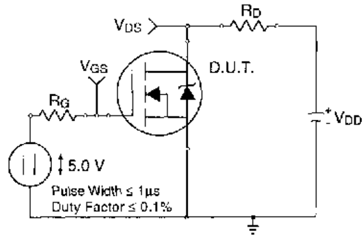


Fig 10a. Switching Time Test Circuit

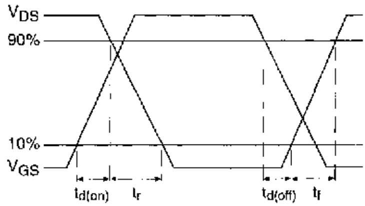


Fig 10b. Switching Time Waveforms

DATA SHEETS

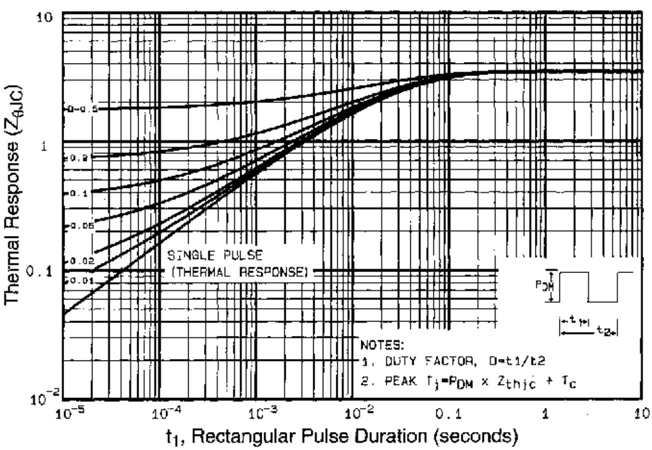


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

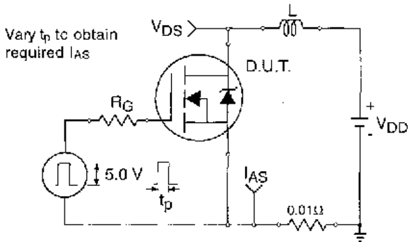


Fig 12a. Unclamped Inductive Test Circuit

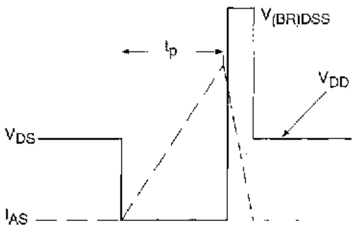


Fig 12b. Unclamped Inductive Waveforms

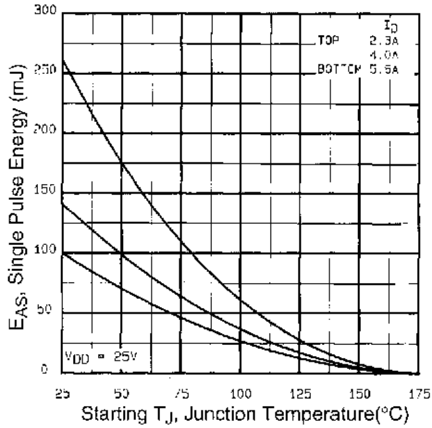


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

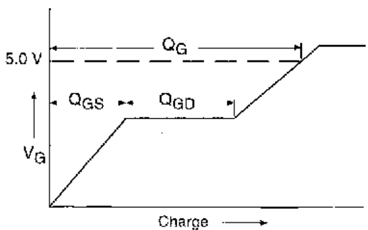


Fig 13a. Basic Gate Charge Waveform

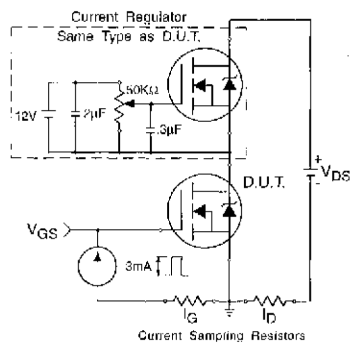


Fig 13b. Gate Charge Test Circuit

Appendix A: Figure 14, Peak Diode Recovery dv/dt Test Circuit – See page 1505

Appendix B: Package Outline Mechanical Drawing – See page 1507

Appendix C: Part Marking Information – See page 1515

Appendix D: Tape & Reel Information – See page 1519

International Rectifier

Notice

The products described herein were acquired by Vishay Intertechnology, Inc., as part of its acquisition of International Rectifier's Power Control Systems (PCS) business, which closed in April 2007. Specifications of the products displayed herein are pending review by Vishay and are subject to the terms and conditions shown below.

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.

International Rectifier®, IR®, the IR logo, HEXFET®, HEXSense®, HEXDIP®, DOL®, INTERO®, and POWIRTRAIN® are registered trademarks of International Rectifier Corporation in the U.S. and other countries. All other product names noted herein may be trademarks of their respective owners.