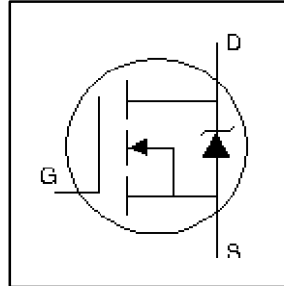


# HEXFET<sup>®</sup> Power MOSFET

- Surface Mount
- Available in Tape & Reel
- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Logic-Level Gate Drive
- R<sub>DS(on)</sub> Specified at V<sub>GS</sub>=4V & 5V
- Fast Switching



$$V_{DSS} = 200V$$

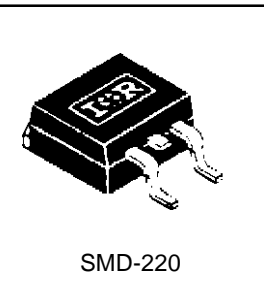
$$R_{DS(on)} = 0.80\Omega$$

$$I_D = 5.2A$$

## 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

## Absolute Maximum Ratings

	Parameter	Max.	Units
I <sub>D</sub> @ T <sub>C</sub> = 25°C	Continuous Drain Current, V <sub>GS</sub> @ 5.0 V	5.2	A
I <sub>D</sub> @ T <sub>C</sub> = 100°C	Continuous Drain Current, V <sub>GS</sub> @ 5.0 V	3.3	
I <sub>DM</sub>	Pulsed Drain Current ①	21	
P <sub>D</sub> @ T <sub>C</sub> = 25°C	Power Dissipation	50	W
P <sub>D</sub> @ T <sub>A</sub> = 25°C	Power Dissipation (PCB Mount)**	3.1	
	Linear Derating Factor	0.40	W/°C
	Linear Derating Factor (PCB Mount)**	0.025	
V <sub>GS</sub>	Gate-to-Source Voltage	±10	V
E <sub>AS</sub>	Single Pulse Avalanche Energy ②	125	mJ
I <sub>AR</sub>	Avalanche Current ①	5.2	A
E <sub>AR</sub>	Repetitive Avalanche Energy ①	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt ③	5.0	V/ns
T <sub>J</sub> , T <sub>STG</sub>	Junction and Storage Temperature Range	-55 to + 150	°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

## Thermal Resistance

	Parameter	Min.	Typ.	Max.	Units
R <sub>θJC</sub>	Junction-to-Case	—	—	2.5	°C/W
R <sub>θJA</sub>	Junction-to-Ambient (PCB Mount)**	—	—	40	
R <sub>θJA</sub>	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 @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	200	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.27	—	V/ $^\circ\text{C}$	Reference to $25^\circ\text{C}$ , $I_D = 1\text{mA}$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	0.80	$\Omega$	$V_{GS} = 10.0V, I_D = 3.1A$ ④
		—	—	1.0		$V_{GS} = 4.0V, I_D = 2.6A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	1.0	—	2.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	1.2	—	—	S	$V_{DS} = 50V, I_D = 3.1A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 200V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 320V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 10V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -10V$
$Q_g$	Total Gate Charge	—	—	16	nC	$I_D = 5.2A$
$Q_{gs}$	Gate-to-Source Charge	—	—	2.9		$V_{DS} = 160V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	9.6		$V_{GS} = 5.0V$ , See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	4.2	—		$V_{DD} = 100V$
$t_r$	Rise Time	—	31	—	ns	$I_D = 5.2A$
$t_{d(off)}$	Turn-Off Delay Time	—	18	—		$R_G = 9.0\Omega$
$t_f$	Fall Time	—	17	—		$R_D = 20\Omega$ , See Fig. 10 ④
$L_D$	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
$L_S$	Internal Source Inductance	—	7.5	—		
$C_{iss}$	Input Capacitance	—	360	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	91	—		$V_{DS} = 25V$
$C_{riss}$	Reverse Transfer Capacitance	—	27	—		$f = 1.0\text{MHz}$ , See Fig. 5

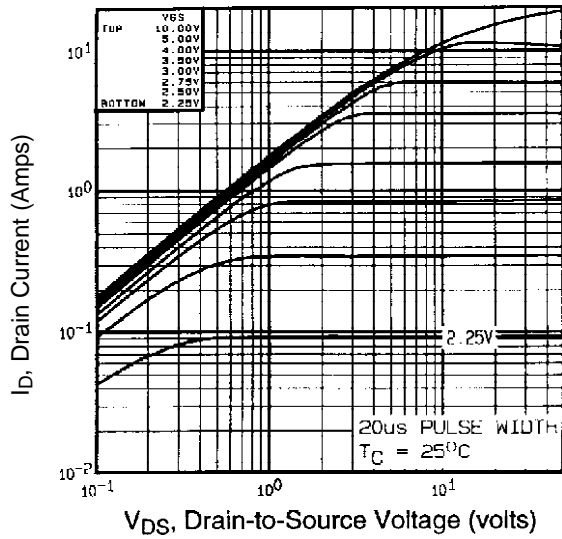


## Source-Drain Ratings and Characteristics

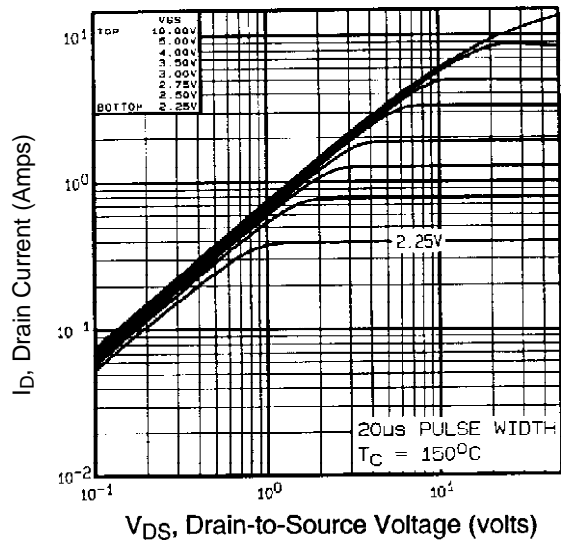
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	5.2	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	21		
$V_{SD}$	Diode Forward Voltage	—	—	1.8	V	$T_J = 25^\circ\text{C}, I_S = 5.2A, V_{GS} = 0V$ ②
$t_{rr}$	Reverse Recovery Time	—	180	270	ns	$T_J = 25^\circ\text{C}, I_F = 5.2A$
$Q_{rr}$	Reverse Recovery Charge	—	1.1	1.7	$\mu C$	$di/dt = 100A/\mu s$ ②
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

### Notes:

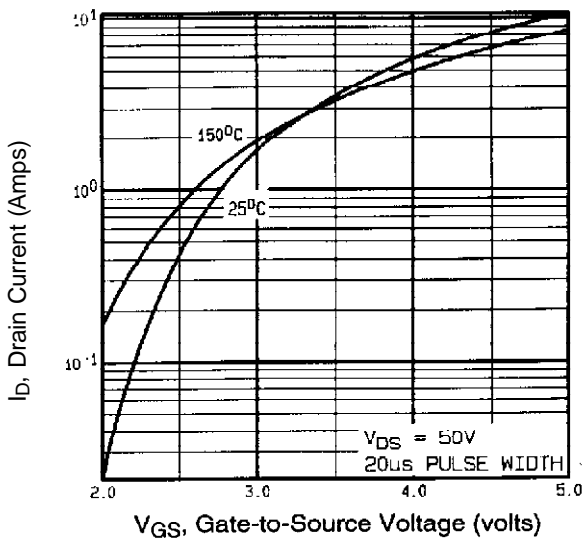
- ① Repetitive rating; pulse width limited by max. junction temperature. ( See fig. 11 )
- ②  $V_{DD} = 50V$ , starting  $T_J = 25^\circ\text{C}$ ,  $L = 6.9\text{mH}$ ,  $R_G = 25\Omega$ ,  $I_{AS} = 5.2A$ . (See Figure 12)
- ③  $I_{SD} \leq 5.2A$ ,  $di/dt \leq 95A/\mu s$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq 150^\circ\text{C}$
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



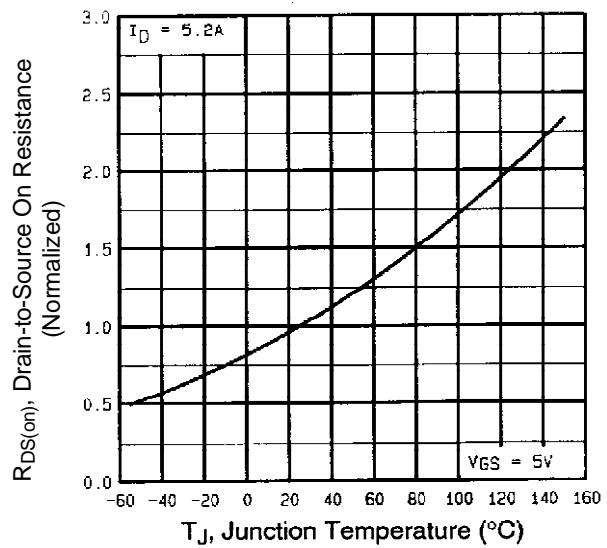
**Fig 1.** Typical Output Characteristics,  
 $T_C = 25^\circ\text{C}$



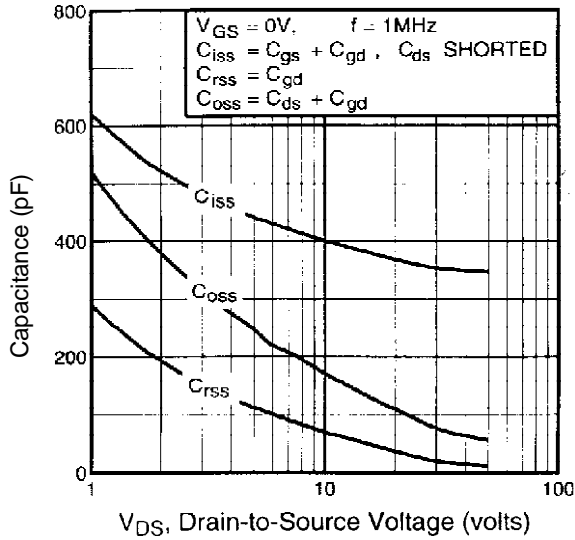
**Fig 2.** Typical Output Characteristics,  
 $T_C = 150^\circ\text{C}$



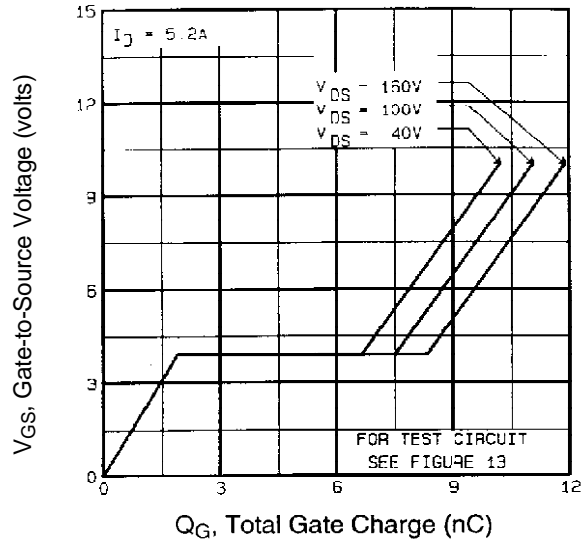
**Fig 3.** Typical Transfer Characteristics



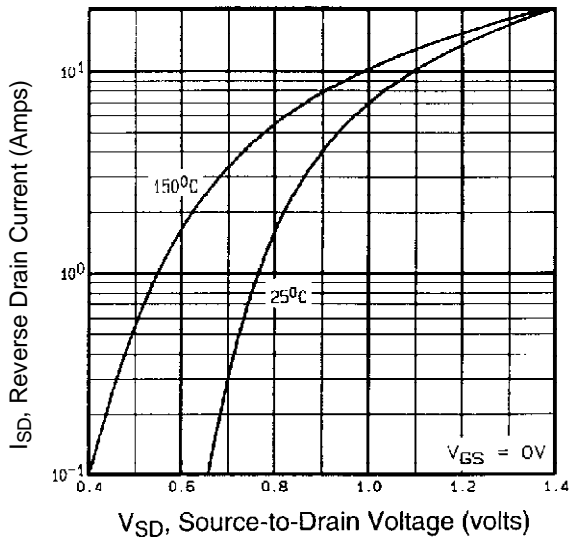
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



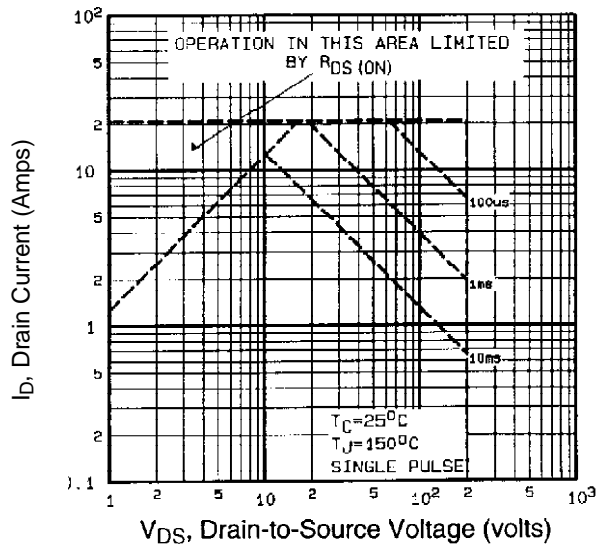
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



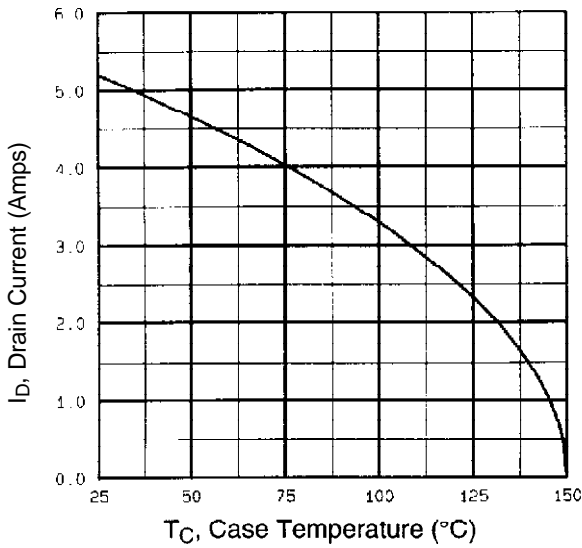
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



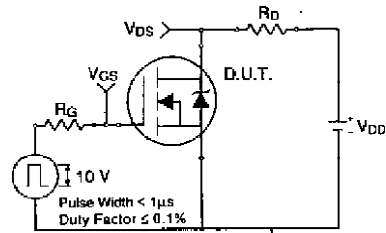
**Fig 7.** Typical Source-Drain Diode Forward Voltage



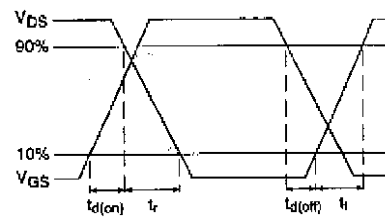
**Fig 8.** Maximum Safe Operating Area



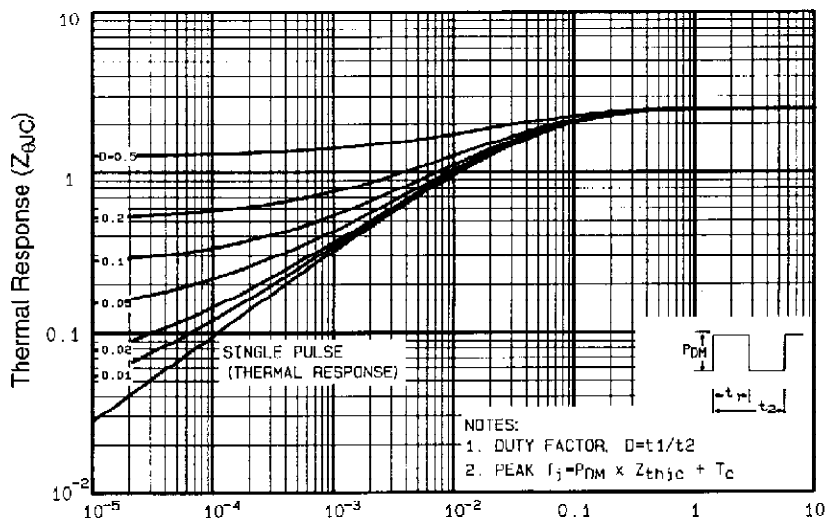
**Fig 9.** Maximum Drain Current Vs. Case Temperature



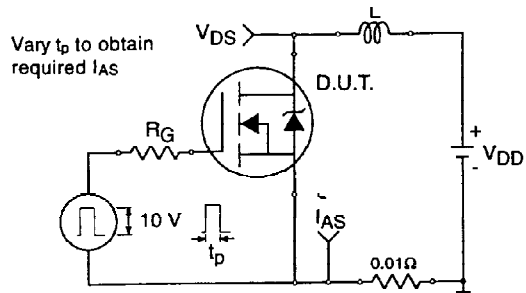
**Fig 10a.** Switching Time Test Circuit



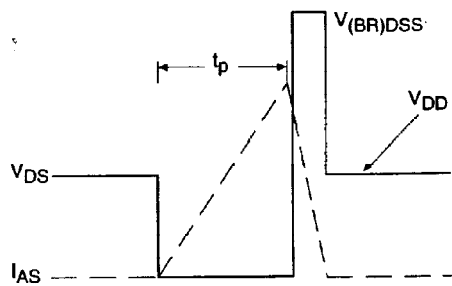
**Fig 10b.** Switching Time Waveforms



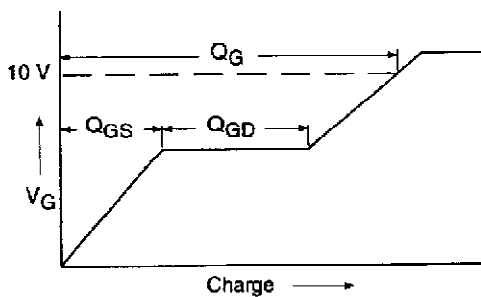
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



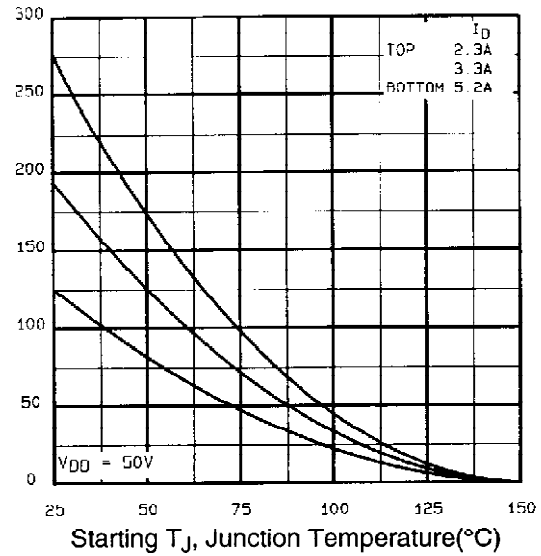
**Fig 12a.** Unclamped Inductive Test Circuit



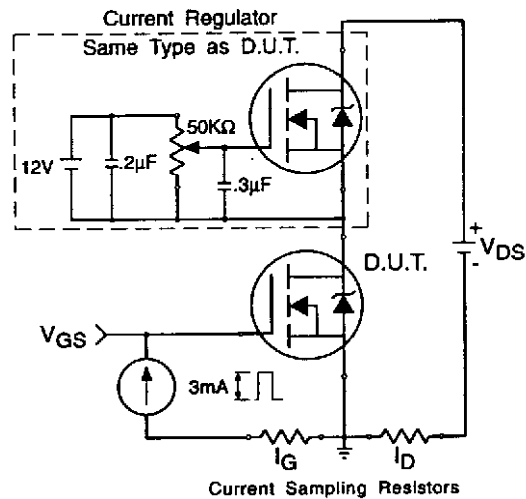
**Fig 12b.** Unclamped Inductive Waveforms



**Fig 13a.** Basic Gate Charge Waveform

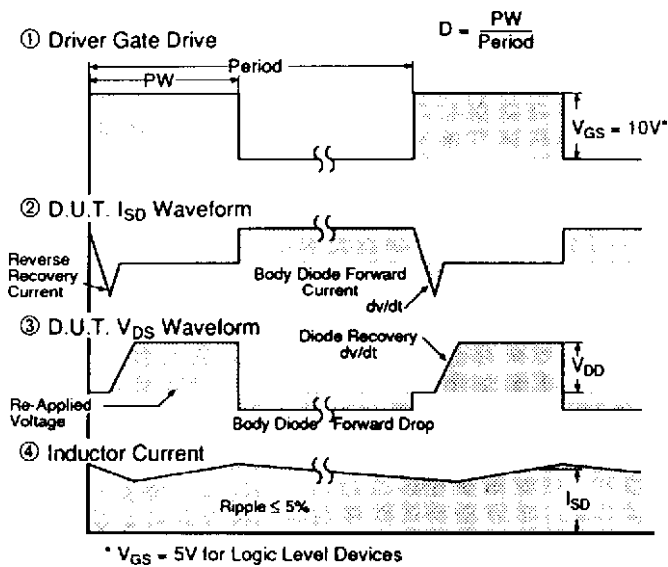
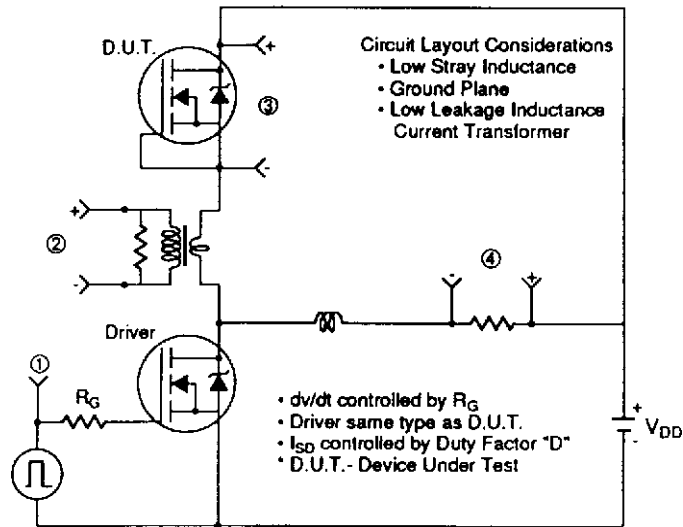


**Fig 12c.** Maximum Avalanche Energy Vs. Drain Current

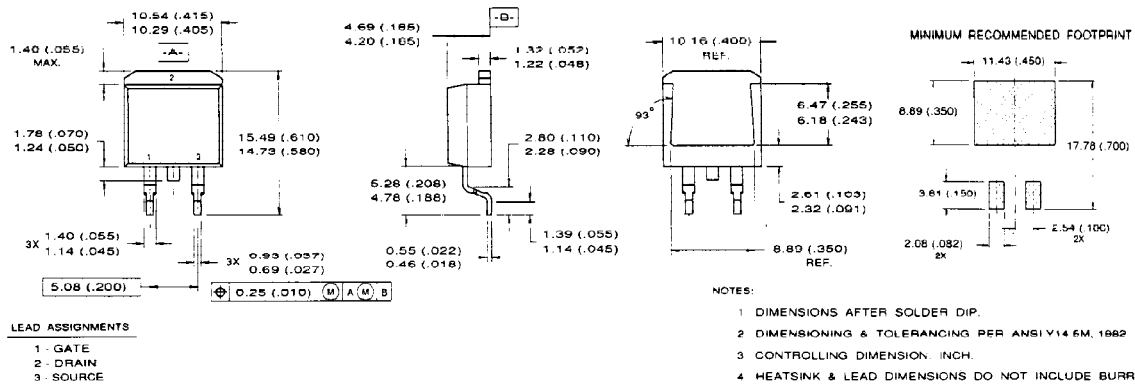


**Fig 13b.** Gate Charge Test Circuit

Fig 14. Peak Diode Recovery dv/dt Test Circuit

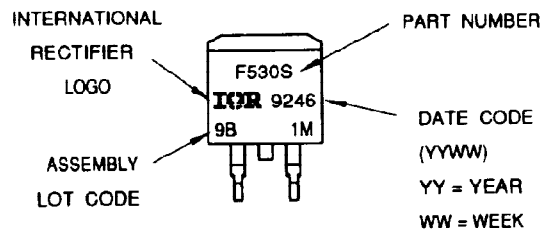


## Package Outline SMD-220



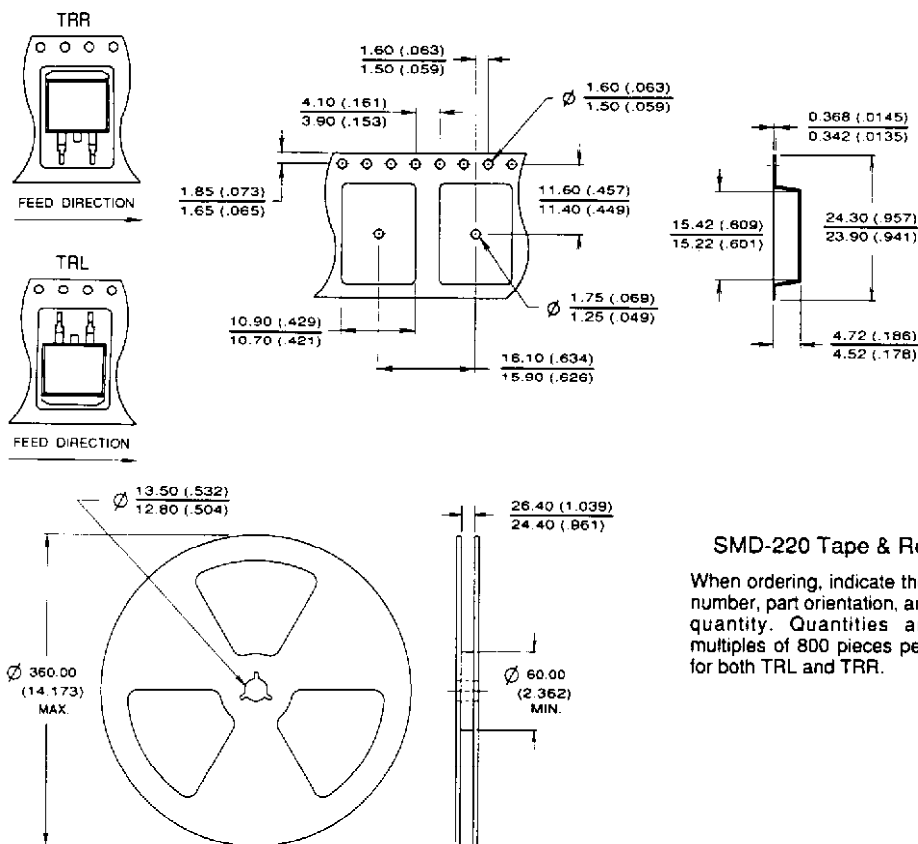
## Part Marking Information SMD-220

EXAMPLE: THIS IS AN IRF530S WITH  
ASSEMBLY LOT CODE 9B1M





## Package Outline SMD-220 Tape and Reel



### SMD-220 Tape & Reel

When ordering, indicate the part number, part orientation, and the quantity. Quantities are in multiples of 800 pieces per reel for both TRL and TRR.

**International**  
**Rectifier**

**WORLD HEADQUARTERS:** 233 Kansas St., El Segundo, California 90245, Tel: (310) 322 3331  
**EUROPEAN HEADQUARTERS:** Hurst Green, Oxted, Surrey RH8 9BB, UK Tel: (44) 0883 713215  
**IR CANADA:** 7321 Victoria Park Ave., Suite 201, Markham, Ontario L3R 3L1, Tel: (905) 475 1897 **IR GERMANY:** Saalburgstrasse 157, 61350 Bad Homburg Tel: 6172 37066 **IR ITALY:** Via Liguria 49, 10071 Borgaro, Torino Tel: (39) 1145 10111 **IR FAR EAST:** K&H Bldg., 2F, 3-30-4 Nishi-Ikeburo 3-Chome, Toshima-Ki, Tokyo 171 Tel: (03)3983 0641 **IR SOUTHEAST ASIA:** 315 Outram Road, #10-02 Tan Boon Liat Building, 0316 Tel: 65 221 8371

*Data and specifications subject to change without notice.*



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