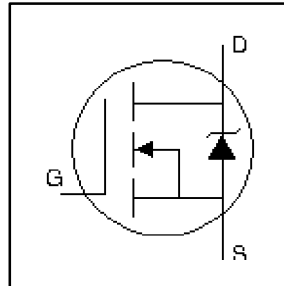


HEXFET® Power MOSFET

- Advanced Process Technology
- Ultra Low On-Resistance
- Surface Mount
- Available in Tape & Reel
- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- 175°C Operating Temperature



$$V_{DSS} = 100V$$

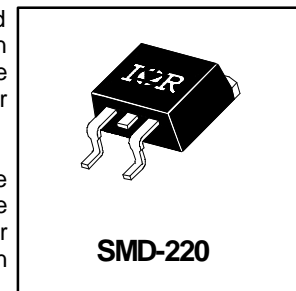
$$R_{DS(on)} = 0.04\Omega$$

$$I_D = 41A$$

**Description**

Fourth Generation HEXFETs from International Rectifier utilize advanced processing techniques to achieve the lowest possible on-resistance per silicon area. This benefit, combined with the fast switching speed and ruggedized device design that HEXFET Power MOSFETs are well known for, provides the designer with an extremely efficient device for use in a wide variety of applications.

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.



**Absolute Maximum Ratings**

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	41	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	29	
$I_{DM}$	Pulsed Drain Current ①	160	
$P_D @ T_C = 25^\circ C$	Power Dissipation	170	W
$P_D @ T_C = 25^\circ C$	Power Dissipation (PCB Mount)**	3.8	
	Linear Derating Factor	1.1	W/°C
	Linear Derating Factor (PCB Mount)**	0.025	
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy ②	230	mJ
$I_{AR}$	Avalanche Current ①	41	A
$E_{AR}$	Repetitive Avalanche Energy ①	17	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
$R_{\theta JC}$	Junction-to-Case	—	—	0.90	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mount)**	—	—	40	
$R_{\theta JA}$	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.

# IRF1310S



## 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	100	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.10	—	V/°C	Reference to $25^\circ\text{C}, I_D = 1mA$
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	—	—	0.04	$\Omega$	$V_{GS} = 10V, I_D = 25A$ ①
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
$g_{fs}$	Forward Transconductance	12	—	—	S	$V_{DS} = 50V, I_D = 25A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	25	$\mu A$	$V_{DS} = 100V, V_{GS} = 0V$
		—	—	250		$V_{DS} = 80V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$Q_g$	Total Gate Charge	—	—	110	nC	$I_D = 25A$
$Q_{gs}$	Gate-to-Source Charge	—	—	18		$V_{DS} = 80V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	42		$V_{GS} = 10V$ , See Fig. 6 and 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	13	—	ns	$V_{DD} = 50V$
$t_r$	Rise Time	—	77	—		$I_D = 25A$
$t_{d(off)}$	Turn-Off Delay Time	—	82	—		$R_G = 9.1\Omega$
$t_f$	Fall Time	—	64	—		$R_D = 2.0\Omega$ , 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	—	2500	—	pF	$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	630	—		$V_{DS} = 25V$
$C_{riss}$	Reverse Transfer Capacitance	—	130	—		$f = 1.0MHz$ , See Fig. 5

## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	41	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	160		
$V_{SD}$	Diode Forward Voltage	—	—	2.5	V	$T_J = 25^\circ\text{C}, I_S = 25A, V_{GS} = 0V$ ②
$t_{rr}$	Reverse Recovery Time	—	140	210	ns	$T_J = 25^\circ\text{C}, I_F = 25A$
$Q_{rr}$	Reverse Recovery Charge	—	0.79	1.2	$\mu C$	$di/dt = 100A/\mu s$ ③
$t_{on}$	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 )

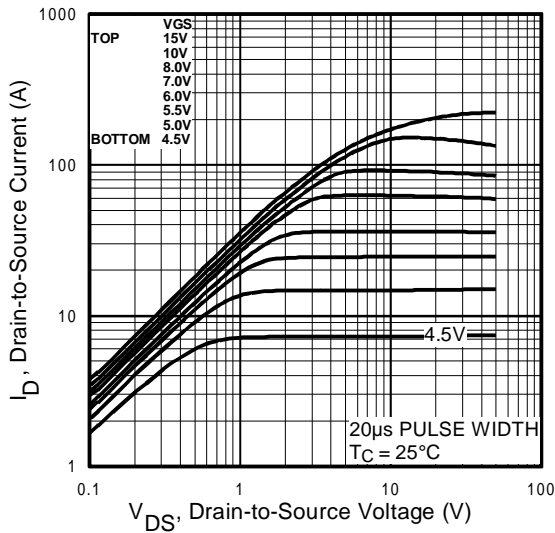
③  $I_{SD} \leq 25A, di/dt \leq 170A/\mu s, V_{DD} \leq V_{(BR)DSS}, T_J \leq 175^\circ\text{C}$

②  $V_{DD} = 25V, \text{ starting } T_J = 25^\circ\text{C}, L = 3.1mH, R_G = 25\Omega, I_{AS} = 25A.$  (See Figure 12)

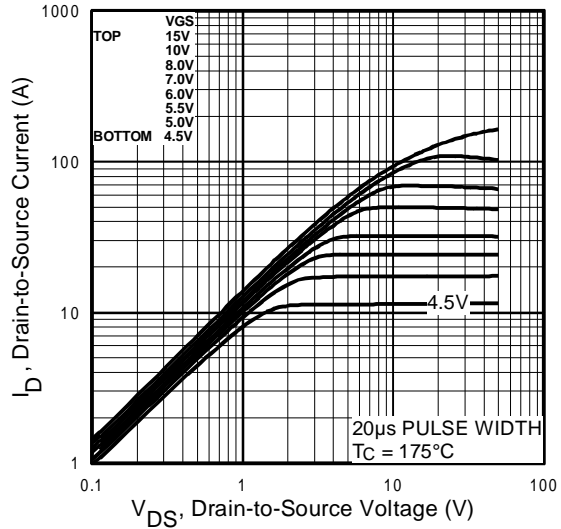
④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



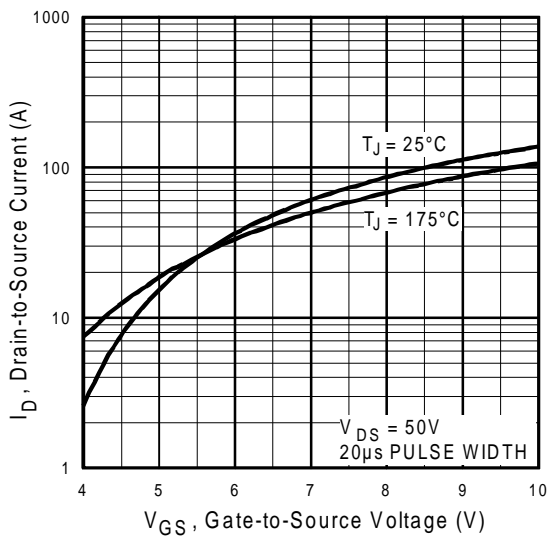
# IRF1310S



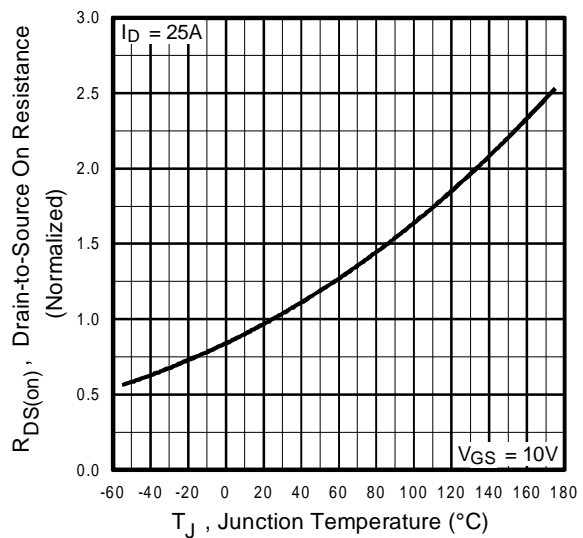
**Fig 1.** Typical Output Characteristics,  
 $T_C = 25^\circ C$



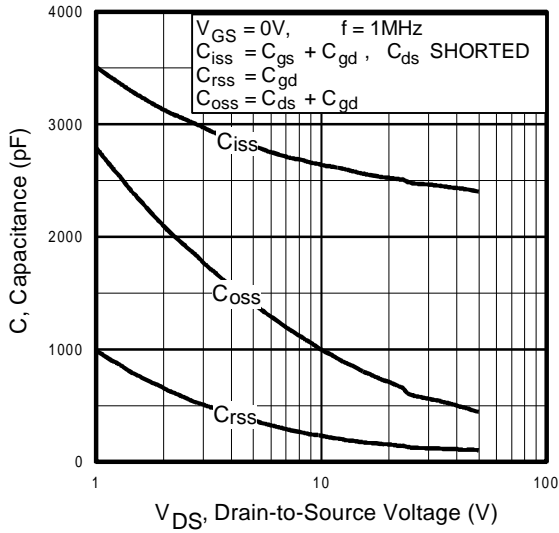
**Fig 2.** Typical Output Characteristics,  
 $T_C = 175^\circ C$



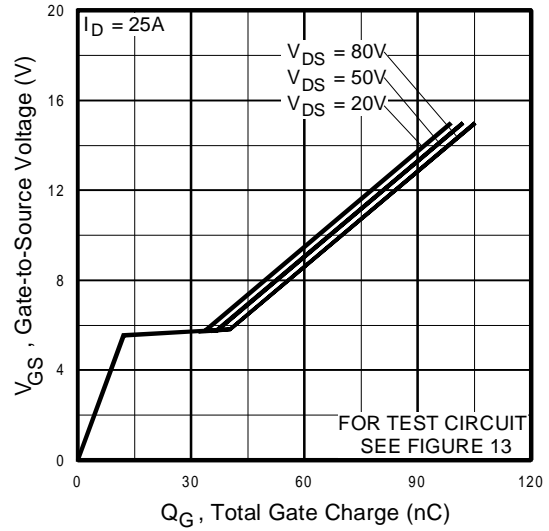
**Fig 3.** Typical Transfer Characteristics



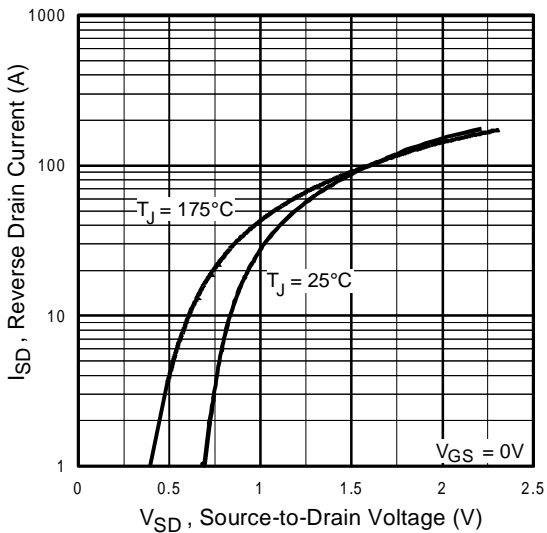
**Fig 4.** Normalized On-Resistance  
Vs. Temperature



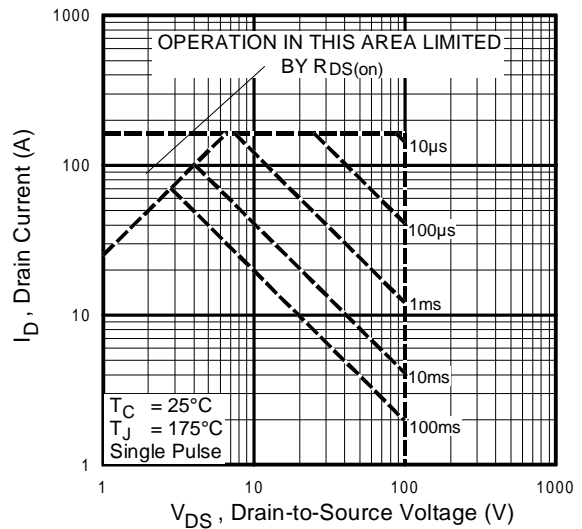
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



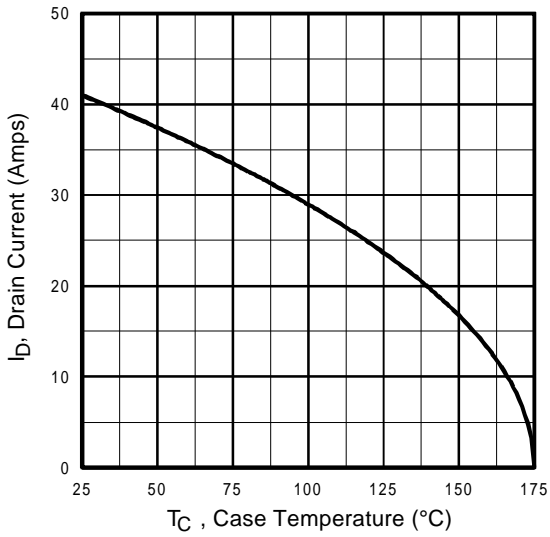
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



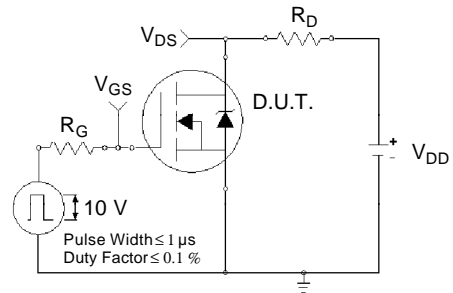
**Fig 7.** Typical Source-Drain Diode Forward Voltage



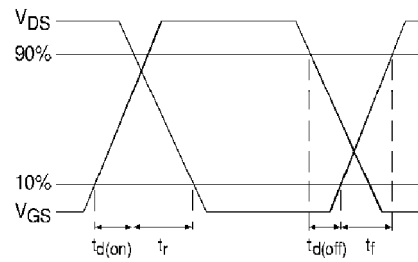
**Fig 8.** Maximum Safe Operating Area



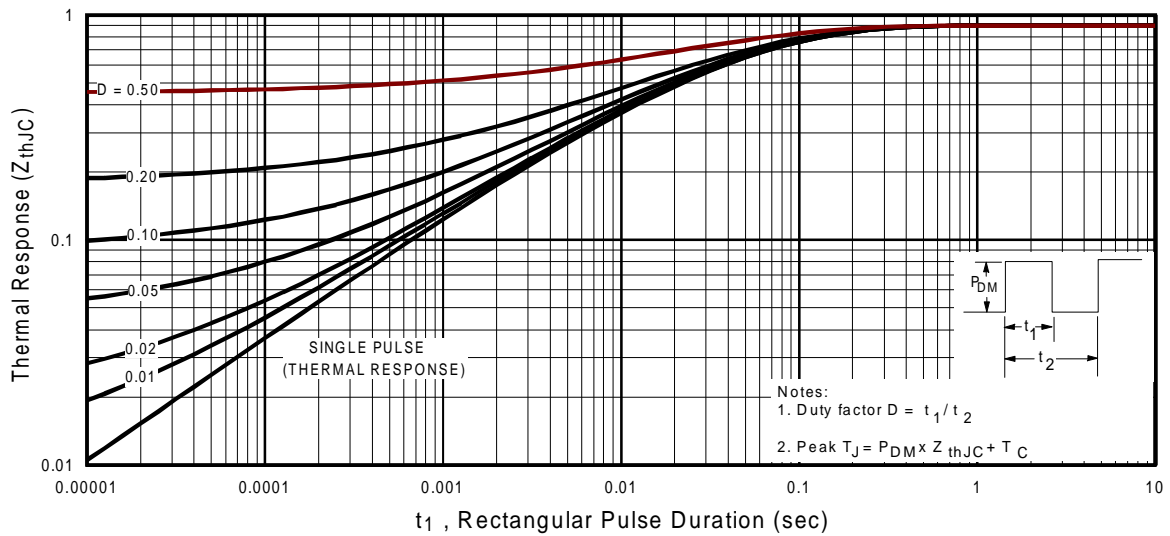
**Fig 9.** Maximum Drain Current Vs. Case Temperature



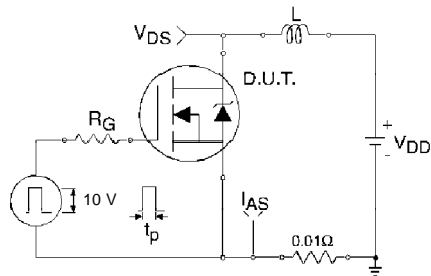
**Fig 10a.** Switching Time Test Circuit



**Fig 10b.** Switching Time Waveforms



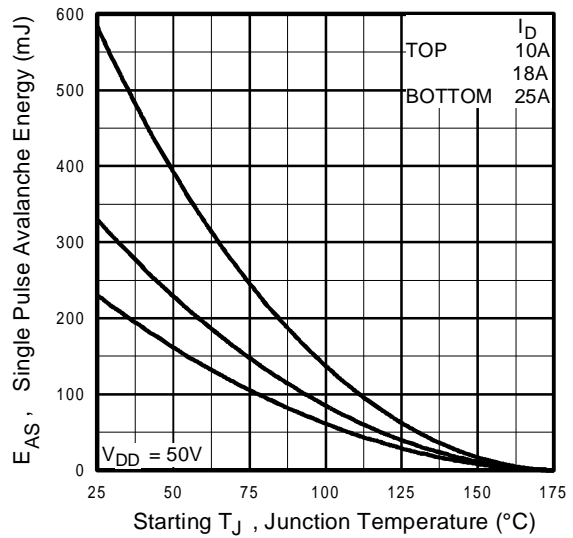
**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case



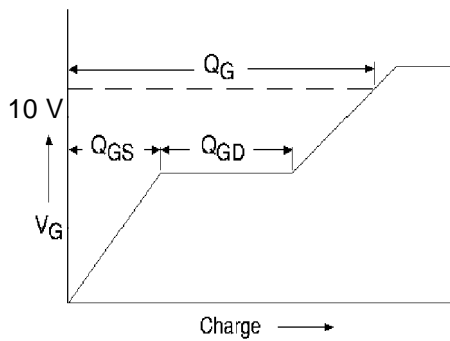
**Fig 12a.** Unclamped Inductive Test Circuit



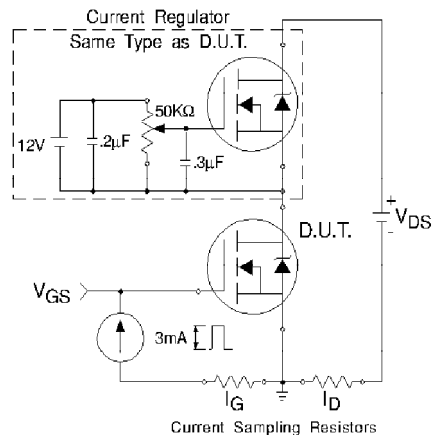
**Fig 12b.** Unclamped Inductive Waveforms



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



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



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

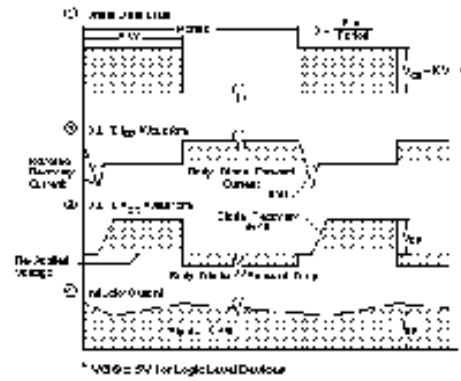
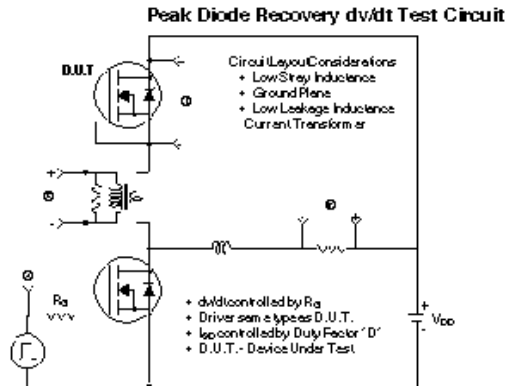
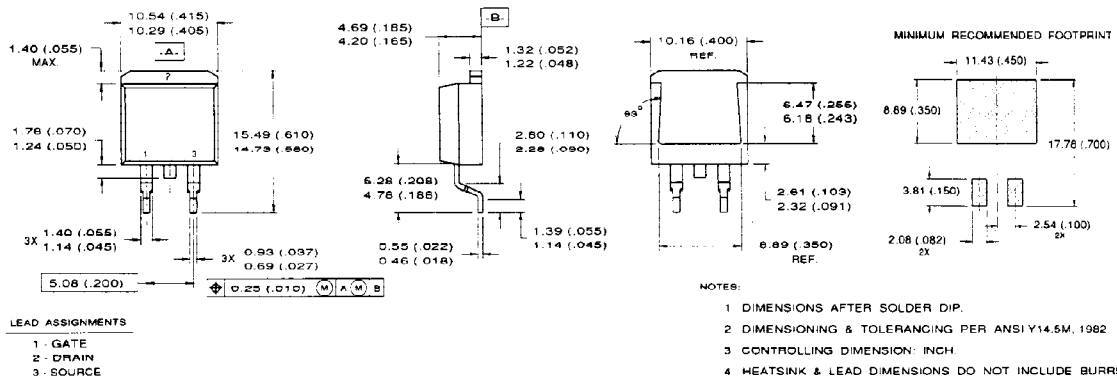


Fig 14. For N-Channel HEXFETS

## Package Outline

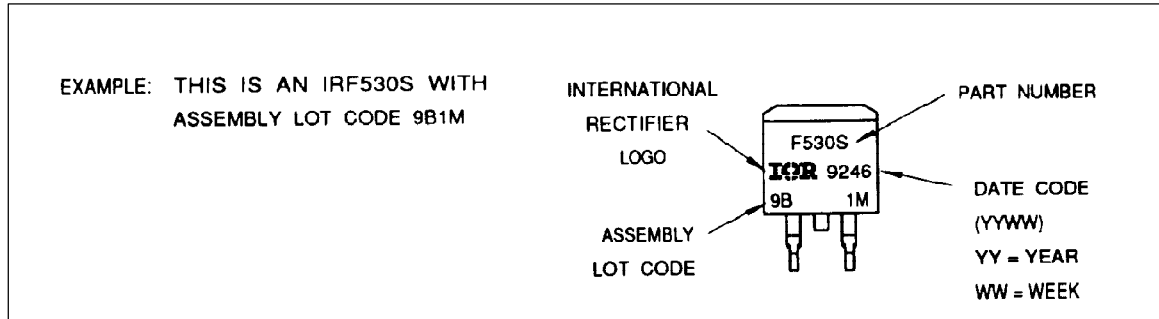
### SMD-220 Outline



# IRF1310S

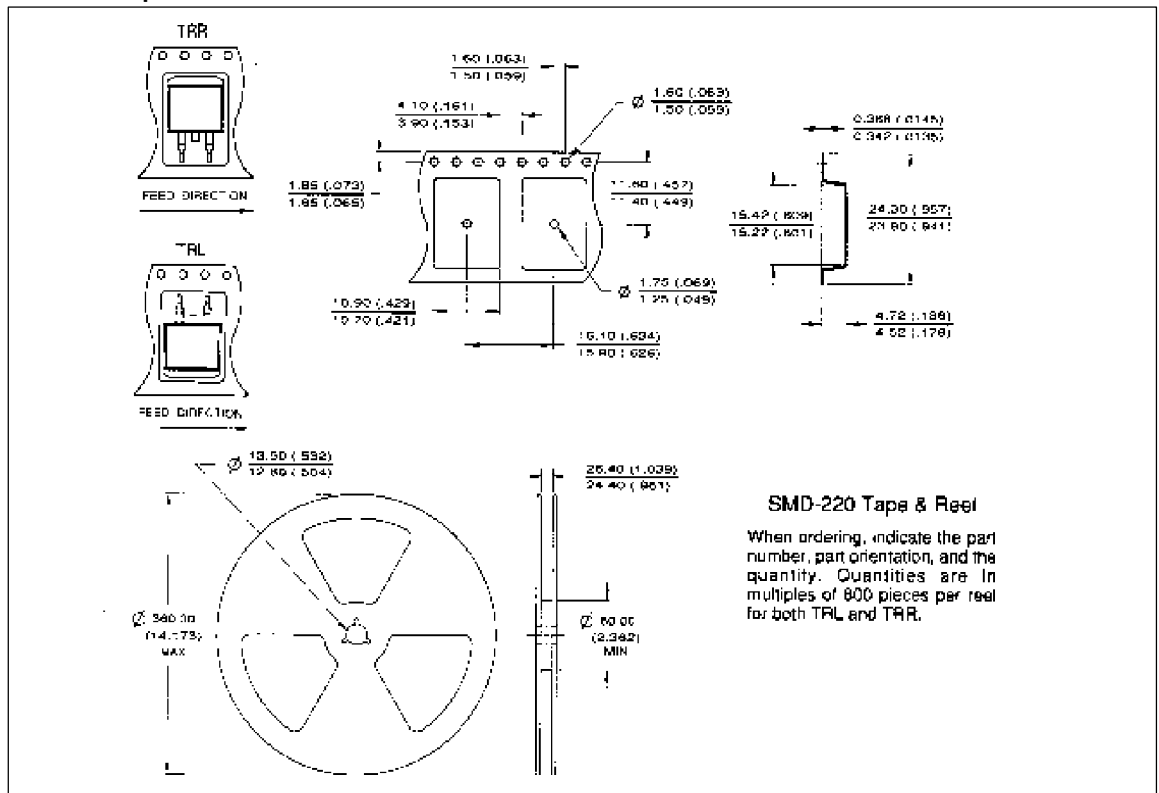


## Part Marking Information



## Package Outline

### SMD-220 Tape and Reel



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**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.*