

**IRF1407SPbF**  
**IRF1407LPbF**

**Benefits**

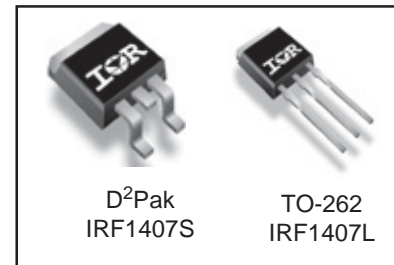
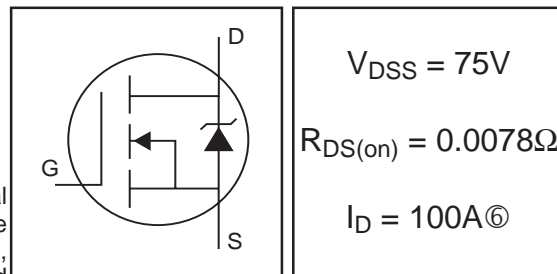
- Advanced Process Technology
- Ultra Low On-Resistance
- Dynamic dv/dt Rating
- 175°C Operating Temperature
- Fast Switching
- Repetitive Avalanche Allowed up to Tjmax
- Lead-Free

**Description**

Advanced HEXFET® Power MOSFETs from International Rectifier utilize advanced processing techniques to achieve extremely low 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 and reliable device for use in a wide variety of applications. The D<sup>2</sup>Pak 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 D<sup>2</sup>Pak 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.

The through-hole version (IRF1407L) is available for low-profile applications.

HEXFET® Power MOSFET



**Absolute Maximum Ratings**

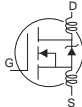
	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V\text{Ⓞ}$	100Ⓞ	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V\text{Ⓞ}$	70Ⓞ	
$I_{DM}$	Pulsed Drain Current ①Ⓞ	520	
$P_D @ T_A = 25^\circ C$	Power Dissipation	3.8	W
$P_D @ T_C = 25^\circ C$	Power Dissipation	200	W
	Linear Derating Factor	1.3	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy②Ⓞ	390	mJ
$I_{AR}$	Avalanche Current①	See Fig.12a, 12b, 15, 16	A
$E_{AR}$	Repetitive Avalanche Energy⑦		mJ
dv/dt	Peak Diode Recovery dv/dt ③Ⓞ	4.6	V/ns
$T_J$	Operating Junction and	-55 to + 175	°C
$T_{STG}$	Storage Temperature Range Soldering Temperature, for 10 seconds	300 (1.6mm from case )	

**Thermal Resistance**

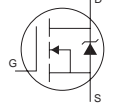
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	0.75	°C/W
$R_{\theta JA}$	Junction-to-Ambient(PCB Mounted, steady-state)**	—	40	

\*\*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<sub>J</sub> = 25°C (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
V <sub>(BR)DSS</sub>	Drain-to-Source Breakdown Voltage	75	—	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 250μA
ΔV <sub>(BR)DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	—	0.09	—	V/°C	Reference to 25°C, I <sub>D</sub> = 1mA ③
R <sub>DS(on)</sub>	Static Drain-to-Source On-Resistance	—	—	0.0078	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 78A ④
V <sub>GS(th)</sub>	Gate Threshold Voltage	2.0	—	4.0	V	V <sub>DS</sub> = 10V, I <sub>D</sub> = 250μA
g <sub>fs</sub>	Forward Transconductance	74	—	—	S	V <sub>DS</sub> = 25V, I <sub>D</sub> = 78A ③
I <sub>DSS</sub>	Drain-to-Source Leakage Current	—	—	20	μA	V <sub>DS</sub> = 75V, V <sub>GS</sub> = 0V
		—	—	250		V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V, T <sub>J</sub> = 150°C
I <sub>GSS</sub>	Gate-to-Source Forward Leakage	—	—	200	nA	V <sub>GS</sub> = 20V
	Gate-to-Source Reverse Leakage	—	—	-200		V <sub>GS</sub> = -20V
Q <sub>g</sub>	Total Gate Charge	—	160	250	nC	I <sub>D</sub> = 78A
Q <sub>gs</sub>	Gate-to-Source Charge	—	35	52		V <sub>DS</sub> = 60V
Q <sub>gd</sub>	Gate-to-Drain ("Miller") Charge	—	54	81		V <sub>GS</sub> = 10V ④ ⑤
t <sub>d(on)</sub>	Turn-On Delay Time	—	11	—	ns	V <sub>DD</sub> = 38V
t <sub>r</sub>	Rise Time	—	150	—		I <sub>D</sub> = 78A
t <sub>d(off)</sub>	Turn-Off Delay Time	—	150	—		R <sub>G</sub> = 2.5Ω
t <sub>f</sub>	Fall Time	—	140	—		V <sub>GS</sub> = 10V ④ ⑤
L <sub>D</sub>	Internal Drain Inductance	—	4.5	—	nH	Between lead, 6mm (0.25in.) from package and center of die contact
L <sub>S</sub>	Internal Source Inductance	—	7.5	—		
C <sub>iss</sub>	Input Capacitance	—	5600	—	pF	V <sub>GS</sub> = 0V
C <sub>oss</sub>	Output Capacitance	—	890	—		V <sub>DS</sub> = 25V
C <sub>rss</sub>	Reverse Transfer Capacitance	—	190	—		f = 1.0KHz, See Fig. 5 ③
C <sub>oss</sub>	Output Capacitance	—	5800	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 1.0V, f = 1.0KHz
C <sub>oss</sub>	Output Capacitance	—	560	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 60V, f = 1.0KHz
C <sub>oss eff.</sub>	Effective Output Capacitance ⑤	—	1100	—		V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 60V

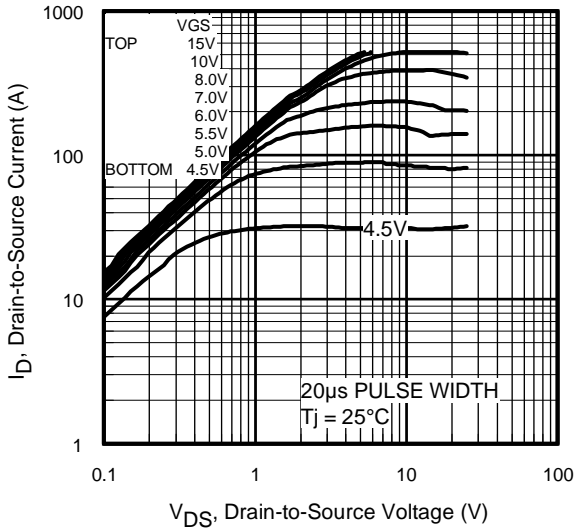
## Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I <sub>S</sub>	Continuous Source Current (Body Diode)	—	—	100 ⑥	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I <sub>SM</sub>	Pulsed Source Current (Body Diode) ①	—	—	520		
V <sub>SD</sub>	Diode Forward Voltage	—	—	1.3	V	T <sub>J</sub> = 25°C, I <sub>S</sub> = 78A, V <sub>GS</sub> = 0V ④
t <sub>rr</sub>	Reverse Recovery Time	—	110	170	ns	T <sub>J</sub> = 25°C, I <sub>F</sub> = 78A
Q <sub>rr</sub>	Reverse Recovery Charge	—	390	590	nC	di/dt = 100A/μs ④ ⑤
t <sub>on</sub>	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by L <sub>S</sub> +L <sub>D</sub> )				

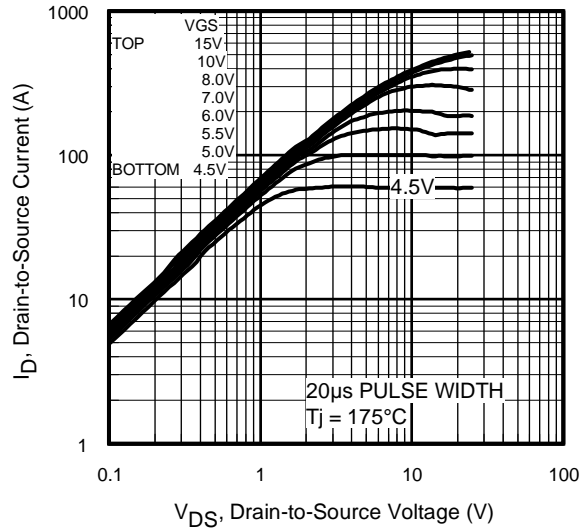
### Notes:

- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ② Starting T<sub>J</sub> = 25°C, L = 0.13mH  
R<sub>G</sub> = 25Ω, I<sub>AS</sub> = 78A. (See Figure 12).
- ③ I<sub>SD</sub> ≤ 78A, di/dt ≤ 320A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>,  
T<sub>J</sub> ≤ 175°C
- ④ Pulse width ≤ 400μs; duty cycle ≤ 2%.

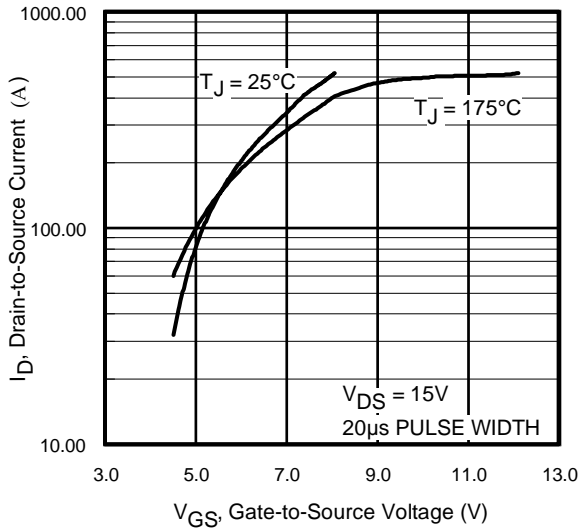
- ⑤ C<sub>oss eff.</sub> is a fixed capacitance that gives the same charging time as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% V<sub>DSS</sub>.
- ⑥ Calculated continuous current based on maximum allowable junction temperature. Package limitation current is 75A.
- ⑦ Limited by T<sub>Jmax</sub>, see Fig.12a, 12b, 15, 16 for typical repetitive avalanche performance.
- ⑧ Uses IRF1407 data and test conditions.



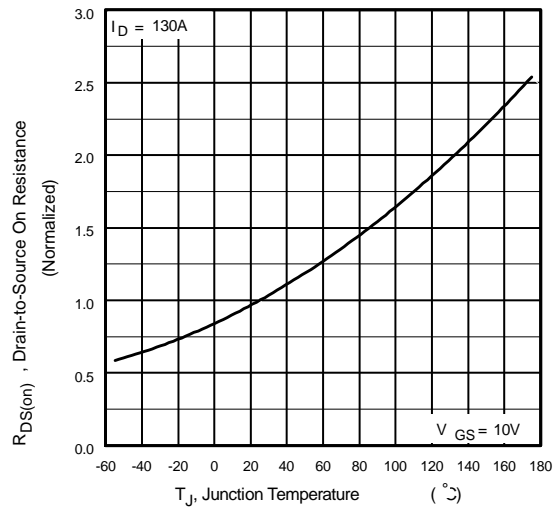
**Fig 1.** Typical Output Characteristics



**Fig 2.** Typical Output Characteristics

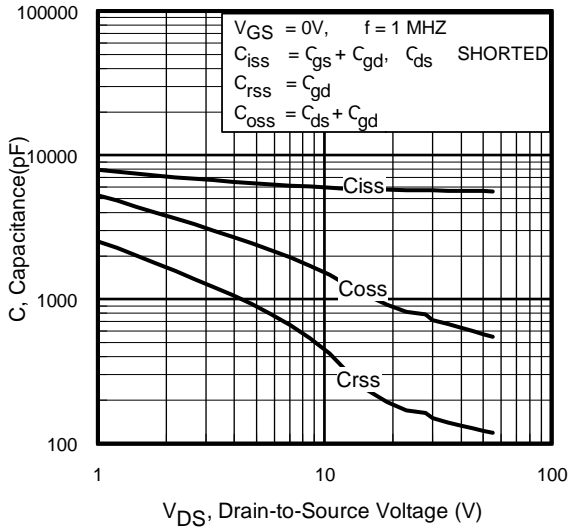


**Fig 3.** Typical Transfer Characteristics

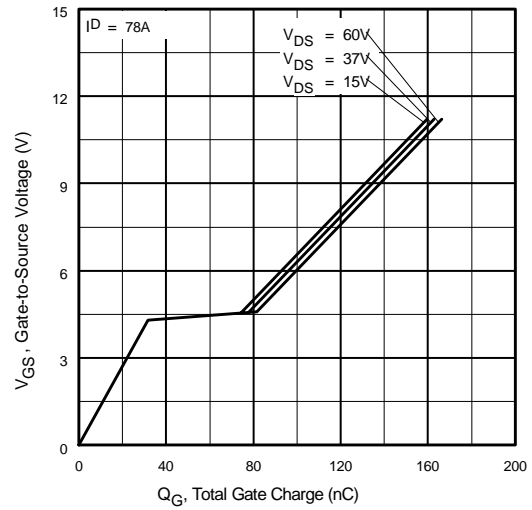


**Fig 4.** Normalized On-Resistance Vs. Temperature

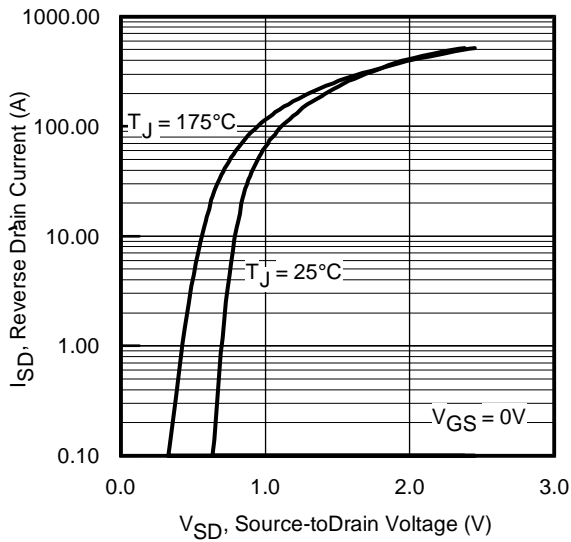
# IRF1407S/LPbF



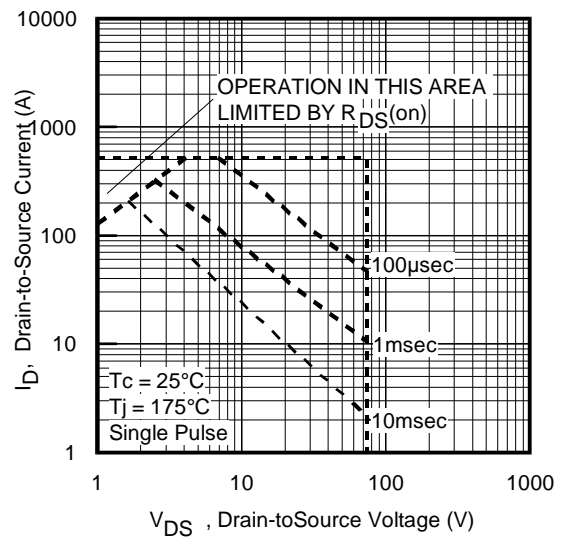
**Fig 5.** Typical Capacitance Vs. Drain-to-Source Voltage



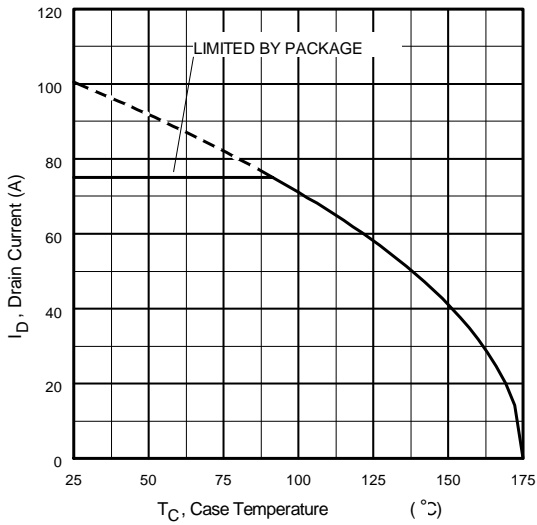
**Fig 6.** Typical Gate Charge Vs. Gate-to-Source Voltage



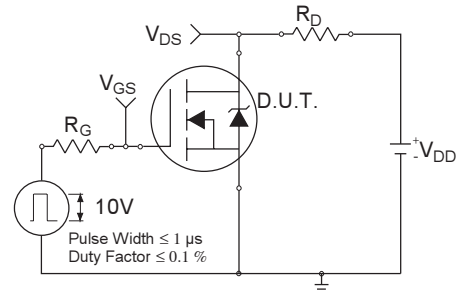
**Fig 7.** Typical Source-Drain Diode Forward Voltage



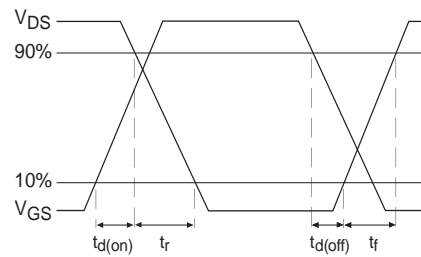
**Fig 8.** Maximum Safe Operating Area



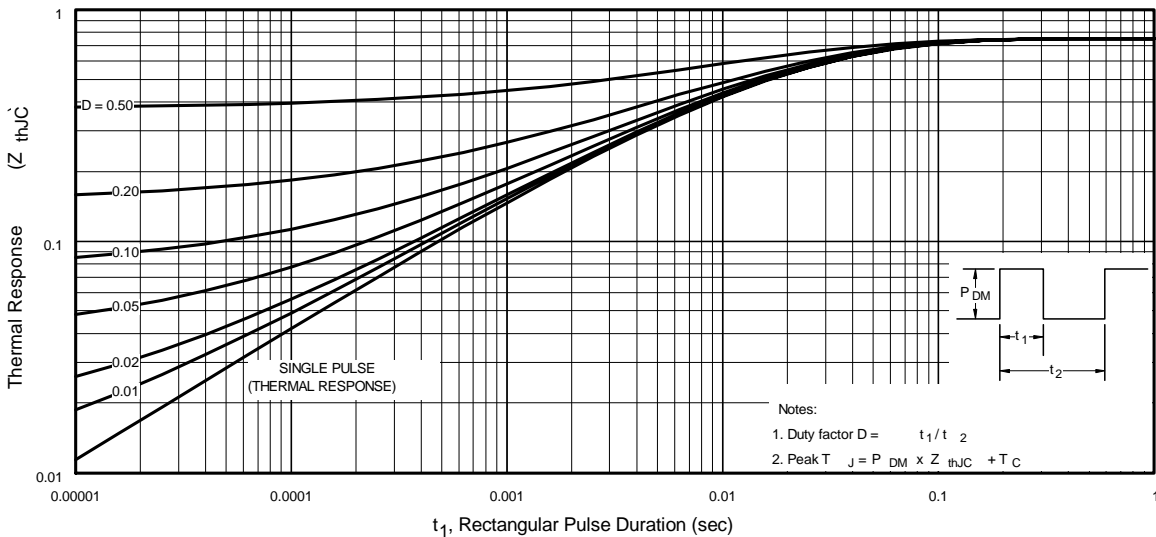
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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

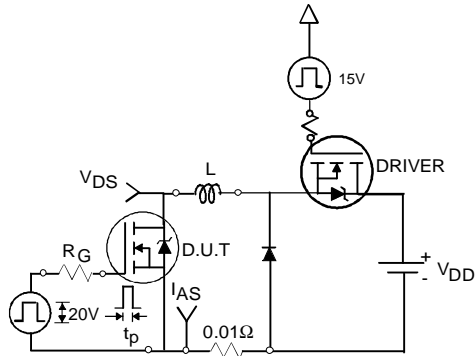


**Fig 10b.** Switching Time Waveforms

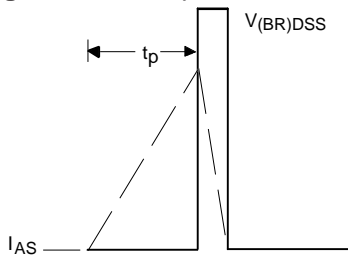


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

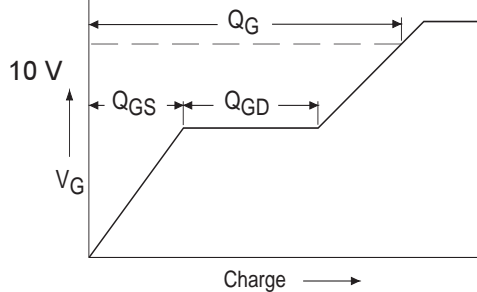
# IRF1407S/LPbF



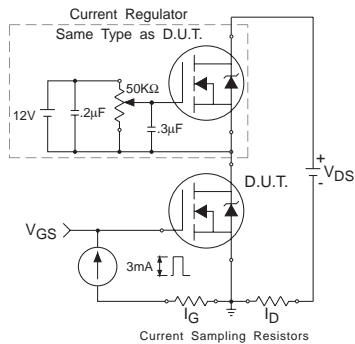
**Fig 12a.** Unclamped Inductive Test Circuit



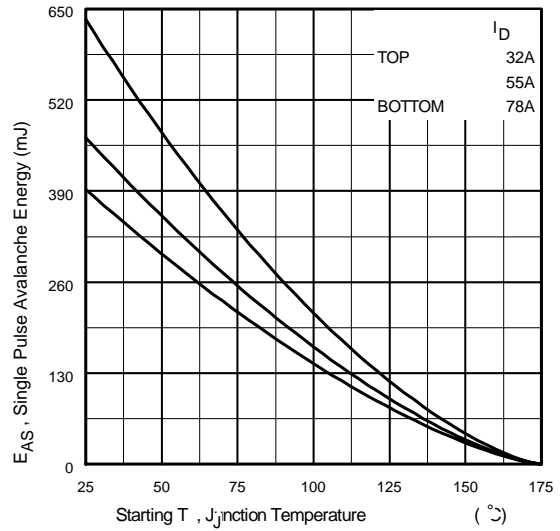
**Fig 12b.** Unclamped Inductive Waveforms



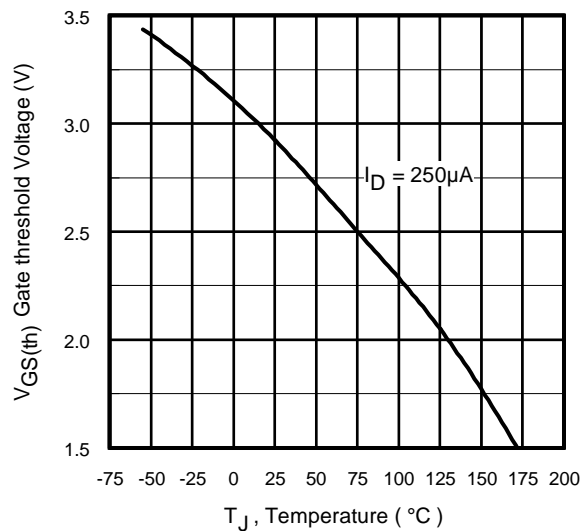
**Fig 13a.** Basic Gate Charge Waveform



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



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



**Fig 14.** Threshold Voltage Vs. Temperature

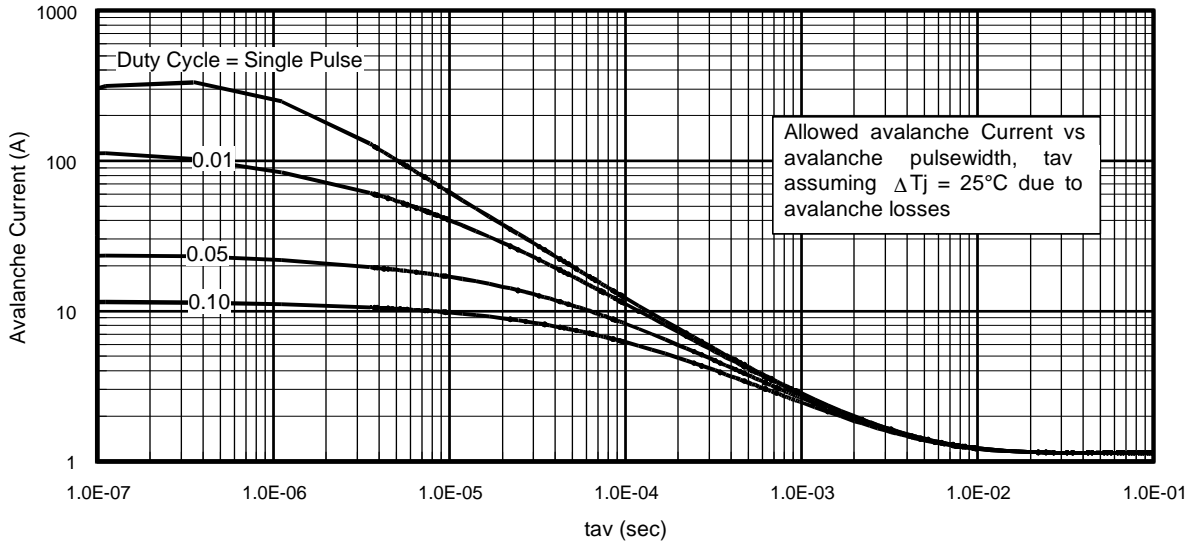


Fig 15. Typical Avalanche Current Vs.Pulsewidth

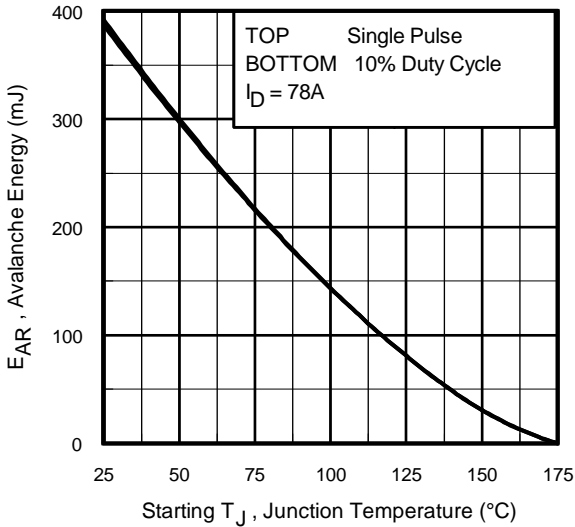


Fig 16. Maximum Avalanche Energy Vs. Temperature

**Notes on Repetitive Avalanche Curves , Figures 15, 16:  
(For further info, see AN-1005 at www.irf.com)**

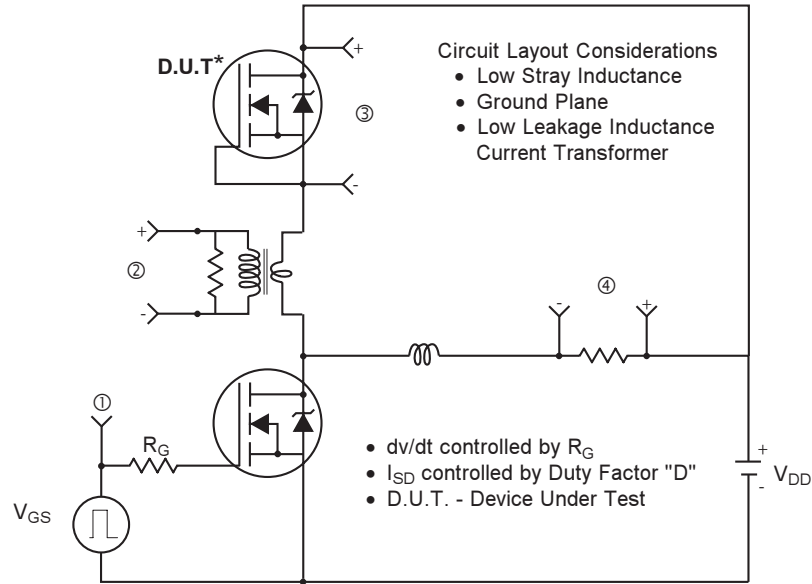
1. Avalanche failures assumption:  
Purely a thermal phenomenon and failure occurs at a temperature far in excess of  $T_{jmax}$ . This is validated for every part type.
2. Safe operation in Avalanche is allowed as long as  $T_{jmax}$  is not exceeded.
3. Equation below based on circuit and waveforms shown in Figures 12a, 12b.
4.  $P_{D(ave)}$  = Average power dissipation per single avalanche pulse.
5.  $BV$  = Rated breakdown voltage (1.3 factor accounts for voltage increase during avalanche).
6.  $I_{av}$  = Allowable avalanche current.
7.  $\Delta T$  = Allowable rise in junction temperature, not to exceed  $T_{jmax}$  (assumed as  $25^\circ\text{C}$  in Figure 15, 16).  
 $t_{av}$  = Average time in avalanche.  
 $D$  = Duty cycle in avalanche =  $t_{av} \cdot f$   
 $Z_{thJC}(D, t_{av})$  = Transient thermal resistance, see figure 11)

$$P_{D(ave)} = 1/2 ( 1.3 \cdot BV \cdot I_{av} ) = \Delta T / Z_{thJC}$$

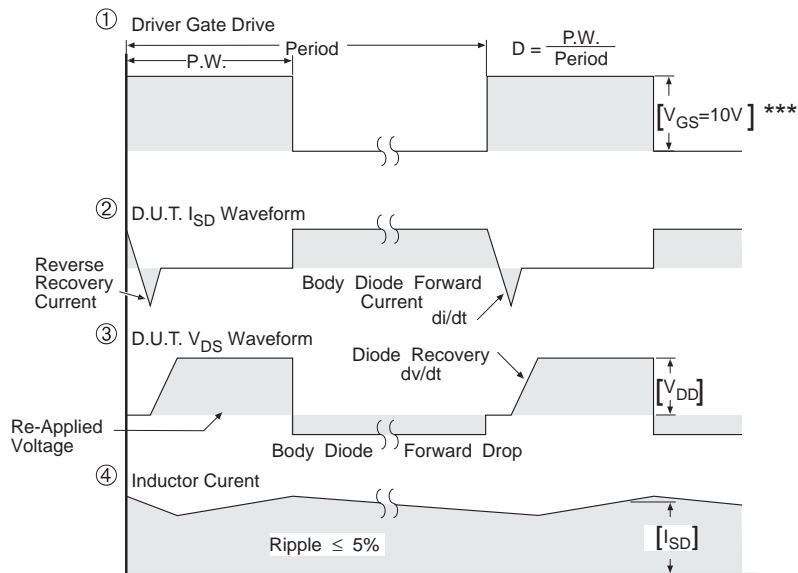
$$I_{av} = 2\Delta T / [1.3 \cdot BV \cdot Z_{th}]$$

$$E_{AS(AR)} = P_{D(ave)} \cdot t_{av}$$

## Peak Diode Recovery dv/dt Test Circuit



\* Reverse Polarity of D.U.T for P-Channel



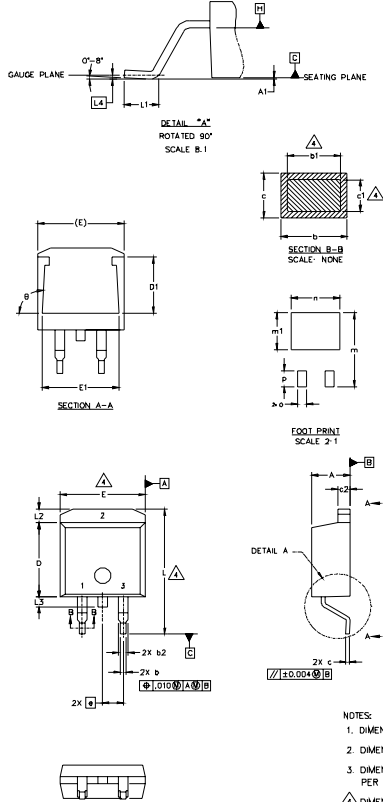
\*\*\*  $V_{GS} = 5.0V$  for Logic Level and 3V Drive Devices

**Fig 17.** For N-channel HEXFET® power MOSFETs



## D<sup>2</sup>Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1		0.127		.005	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	4
c2	1.14	1.40	.045	.055	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	14.61	15.88	.575	.625	
L1	1.78	2.79	.070	.110	
L2		1.65		.065	
L3	1.27	1.78	.050	.070	
L4	0.25 BSC		.010 BSC		
m	17.78		.700		
m1	8.89		.350		
n	11.43		.450		
o	2.08		.082		
p	3.81		.150		
g	90°	93°	90°	93°	

### LEAD ASSIGNMENTS

HEXFET	IGBT CoPACK	PIODES
1 - GATE	1 - GATE	1 - ANODE *
2 - DRAIN	2 - COLLECTOR	2 - CATHODE
3 - SOURCE	3 - EMITTER	3 - ANODE

\* PART DEPENDENT.

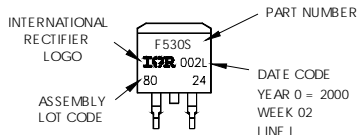
### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
- DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
- DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
- DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
- CONTROLLING DIMENSION: INCH.

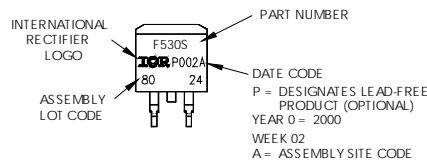
## D<sup>2</sup>Pak Part Marking Information

EXAMPLE: THIS IS AN IRF530S WITH  
LOT CODE 8024  
ASSEMBLED ON WW02, 2000  
IN THE ASSEMBLY LINE "L"

Note: "P" in assembly line  
position indicates "Lead-Free"



**OR**

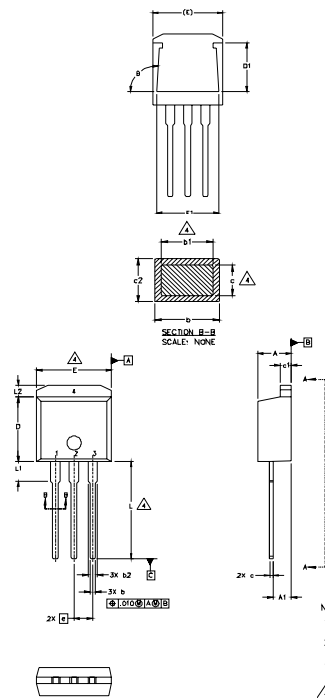


# IRF1407S/LPbF



## TO-262 Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	
A1	2.03	2.92	.080	.115	
b	0.51	0.99	.020	.039	4
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.38	0.63	.015	.025	
c1	1.14	1.40	.045	.055	
c2	0.43	.063	.017	.029	
D	8.51	9.65	.335	.380	3
D1	5.33		.210		
E	9.65	10.67	.380	.420	3
E1	6.22		.245		
e	2.54 BSC		.100 BSC		
L	13.46	14.09	.530	.555	
L1	3.56	3.71	.140	.146	
L2		1.65		.065	

### LEAD ASSIGNMENTS

#### HEXFET

- 1.- GATE
- 2.- DRAIN
- 3.- SOURCE
- 4.- DRAIN

#### IGBT

- 1 - GATE
- 2 - COLLECTOR
- 3 - EMITTER

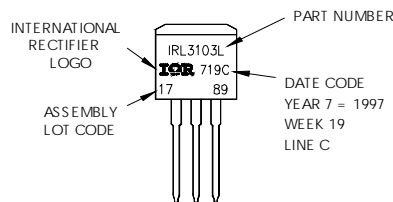
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
4. DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.
5. CONTROLLING DIMENSION: INCH.

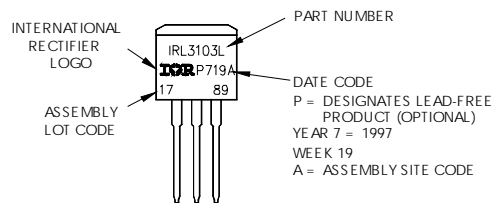
## TO-262 Part Marking Information

EXAMPLE: THIS IS AN IRL3103L  
 LOT CODE 1789  
 ASSEMBLED ON WW 19, 1997  
 IN THE ASSEMBLY LINE "C"

Note: "P" in assembly line position indicates "Lead-Free"

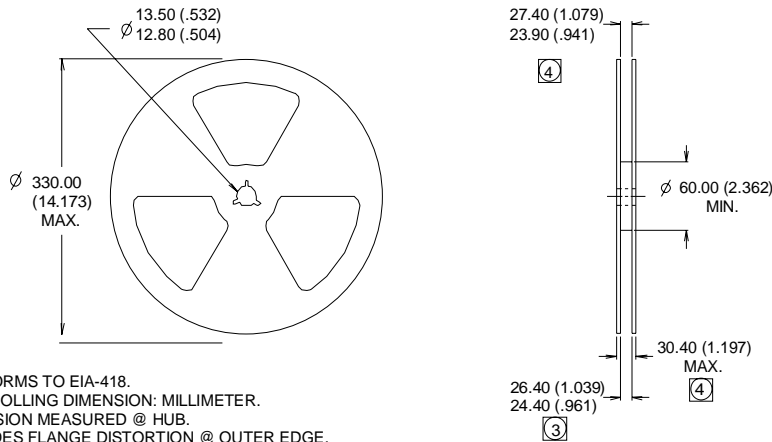
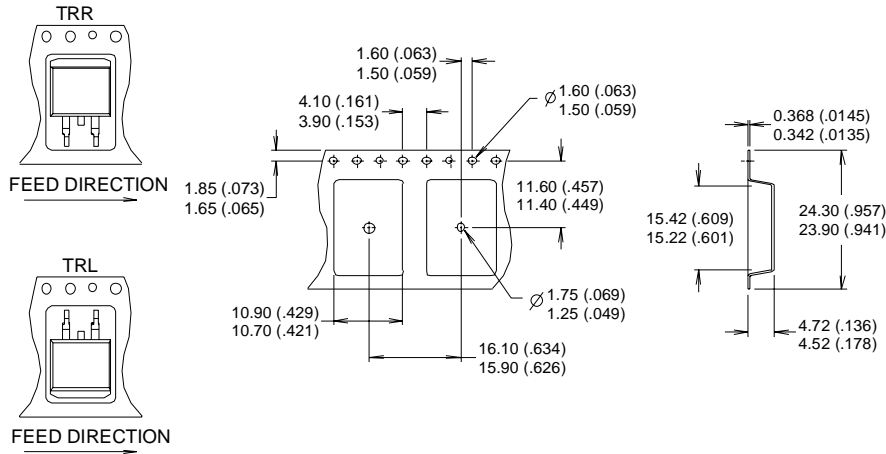


OR



## D<sup>2</sup>Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



- NOTES:
1. CONFORMS TO EIA-418.
  2. CONTROLLING DIMENSION: MILLIMETER.
  - ③ DIMENSION MEASURED @ HUB.
  - ④ INCLUDES FLANGE DISTORTION @ OUTER EDGE.

Data and specifications subject to change without notice.  
 This product has been designed and qualified for the Industrial market.  
 Qualification Standards can be found on IR's Web site.

Note: For the most current drawings please refer to the IR website at:  
<http://www.irf.com/package/>

# AMEYA360

## Components Supply Platform

Authorized Distribution Brand :



Website :

Welcome to visit [www.ameya360.com](http://www.ameya360.com)

Contact Us :

➤ Address :

401 Building No.5, JiuGe Business Center, Lane 2301, Yishan Rd  
Minhang District, Shanghai , China

➤ Sales :

Direct +86 (21) 6401-6692

Email [amall@ameya360.com](mailto:amall@ameya360.com)

QQ 800077892

Skype [ameyasales1](#) [ameyasales2](#)

➤ Customer Service :

Email [service@ameya360.com](mailto:service@ameya360.com)

➤ Partnership :

Tel +86 (21) 64016692-8333

Email [mkt@ameya360.com](mailto:mkt@ameya360.com)