

International Rectifier

PD - 95957

IRF5305S/LPbF

- Lead-Free
- Advanced Process Technology
- Surface Mount (IRF5305S)
- Low-profile through-hole (IRF5305L)
- 175°C Operating Temperature
- Fast Switching
- P-Channel
- Fully Avalanche Rated

Description

Fifth Generation HEXFETs 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 D²Pak 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 D²Pak 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.

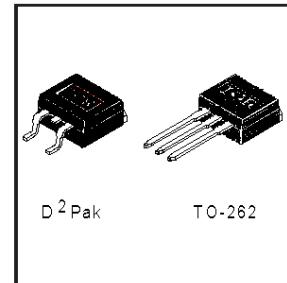
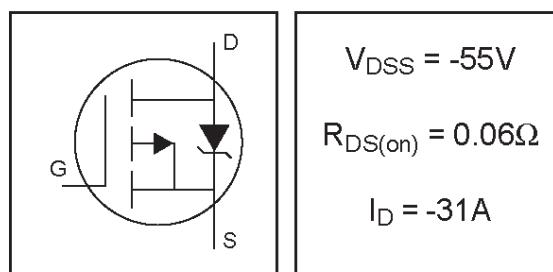
The through-hole version (IRF5305L) is available for low-profile applications.

Absolute Maximum Ratings

	Parameter	Max.	Units
I _D @ T _C = 25°C	Continuous Drain Current, V _{GS} @ -10V ^⑤	-31	
I _D @ T _C = 100°C	Continuous Drain Current, V _{GS} @ -10V ^⑤	-22	A
I _{DM}	Pulsed Drain Current ①②	-110	
P _D @T _A = 25°C	Power Dissipation	3.8	W
P _D @T _C = 25°C	Power Dissipation	110	W
	Linear Derating Factor	0.71	W/C
V _{GS}	Gate-to-Source Voltage	± 20	V
E _{AS}	Single Pulse Avalanche Energy ^{②⑤}	280	mJ
I _{AR}	Avalanche Current ^①	-16	A
E _{AR}	Repetitive Avalanche Energy ^①	11	mJ
dv/dt	Peak Diode Recovery dv/dt ^{③⑤}	-5.8	V/ns
T _J	Operating Junction and	-55 to + 175	
T _{STG}	Storage Temperature Range		°C
	Soldering Temperature, for 10 seconds	300 (1.6mm from case)	

Thermal Resistance

	Parameter	Typ.	Max.	Units
R _{θJC}	Junction-to-Case	—	1.4	°C/W
R _{θJA}	Junction-to-Ambient (PCB Mounted,steady-state)**	—	40	



IRF5305S/LPbF

International
IR Rectifier

Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise specified)

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(\text{BR})\text{DSS}}$	Drain-to-Source Breakdown Voltage	-55	—	—	V	$V_{GS} = 0V, I_D = -250\mu\text{A}$
$\Delta V_{(\text{BR})\text{DSS}/\Delta T_J}$	Breakdown Voltage Temp. Coefficient	—	-0.034	—	V°C	Reference to 25°C , $I_D = -1\text{mA}$ ⑤
$R_{DS(\text{on})}$	Static Drain-to-Source On-Resistance	—	—	0.06	Ω	$V_{GS} = -10V, I_D = -16\text{A}$ ④
$V_{GS(\text{th})}$	Gate Threshold Voltage	-2.0	—	-4.0	V	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$
g_{fs}	Forward Transconductance	8.0	—	—	S	$V_{DS} = -25V, I_D = -16\text{A}$ ⑤
I_{DSS}	Drain-to-Source Leakage Current	—	—	-25	μA	$V_{DS} = -55V, V_{GS} = 0V$
		—	—	-250		$V_{DS} = -44V, V_{GS} = 0V, T_J = 150^\circ\text{C}$
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	—	—	63	nC	$I_D = -16\text{A}$
Q_{gs}	Gate-to-Source Charge	—	—	13		$V_{DS} = -44V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	29		$V_{GS} = -10V$, See Fig. 6 and 13 ④⑤
$t_{d(on)}$	Turn-On Delay Time	—	14	—	ns	$V_{DD} = -28V$
t_r	Rise Time	—	66	—		$I_D = -16\text{A}$
$t_{d(off)}$	Turn-Off Delay Time	—	39	—		$R_G = 6.8\Omega$
t_f	Fall Time	—	63	—		$R_D = 1.6\Omega$, See Fig. 10 ④⑤
L_S	Internal Source Inductance	—	7.5	—	nH	Between lead, and center of die contact
C_{iss}	Input Capacitance	—	1200	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	520	—		$V_{DS} = -25V$
C_{rss}	Reverse Transfer Capacitance	—	250	—		$f = 1.0\text{MHz}$, See Fig. 5⑤

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	-31	A	MOSFET symbol showing the integral reverse p-n junction diode.
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	-110		
V_{SD}	Diode Forward Voltage	—	—	-1.3		$T_J = 25^\circ\text{C}, I_S = -16\text{A}, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	71	110		$T_J = 25^\circ\text{C}, I_F = -16\text{A}$
Q_{rr}	Reverse Recovery Charge	—	170	250	nC	$dI/dt = -100\text{A}/\mu\text{s}$ ④⑤
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)

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

② $V_{DD} = -25V$, Starting $T_J = 25^\circ\text{C}$, $L = 2.1\text{mH}$
 $R_G = 25\Omega$, $I_{AS} = -16\text{A}$. (See Figure 12)

⑤ Uses IRF5305 data and test conditions

③ $I_{SD} \leq -16\text{A}$, $dI/dt \leq -280\text{A}/\mu\text{s}$, $V_{DD} \leq V_{(\text{BR})\text{DSS}}$,
 $T_J \leq 175^\circ\text{C}$

** When mounted on 1" square PCB (FR-4 or G-10 Material).

For recommended footprint and soldering techniques refer to application note #AN-994.

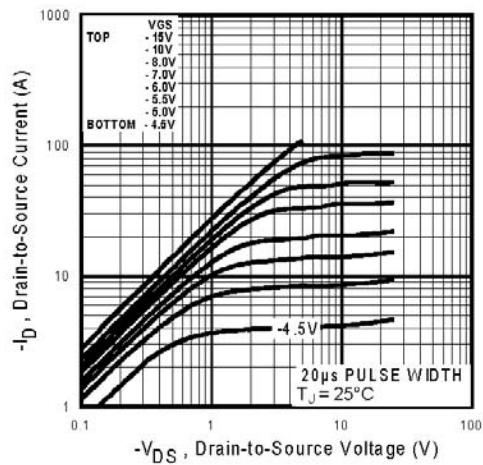


Fig 1. Typical Output Characteristics

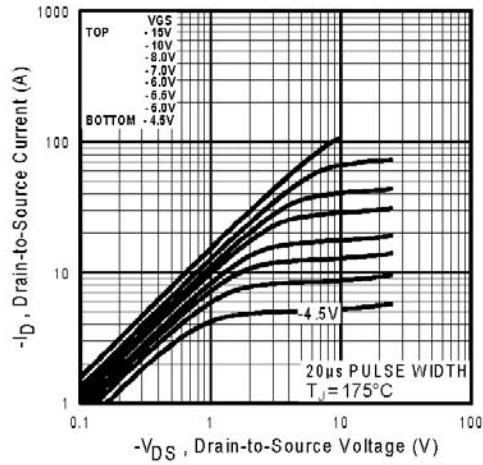


Fig 2. Typical Output Characteristics

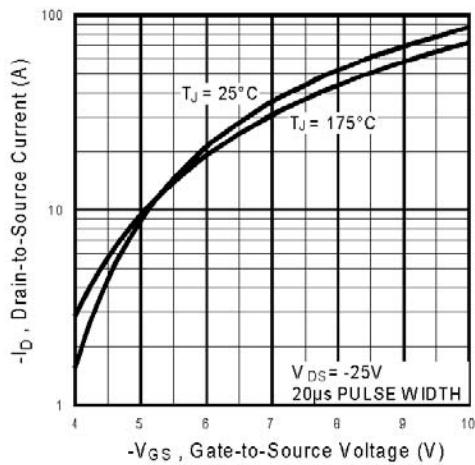


Fig 3. Typical Transfer Characteristics

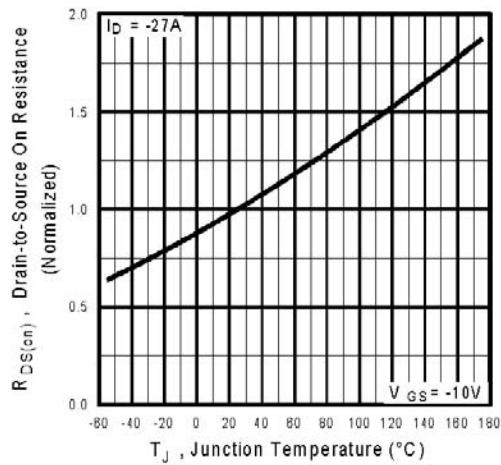


Fig 4. Normalized On-Resistance
Vs. Temperature

IRF5305S/LPbF

International
IR Rectifier

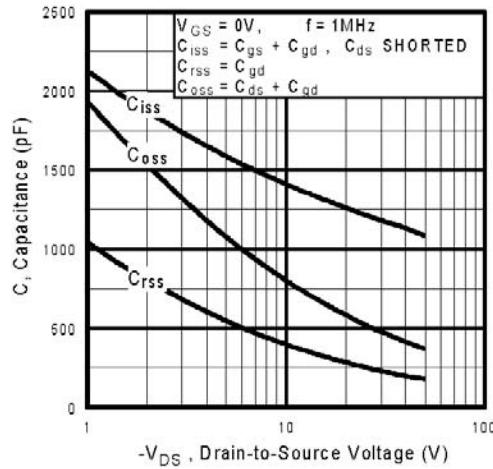


Fig 5. Typical Capacitance Vs.
Drain-to-Source Voltage

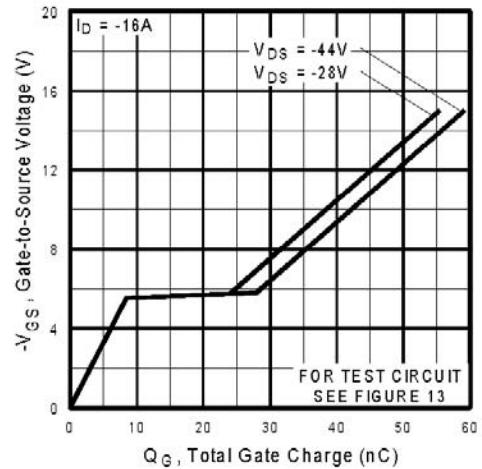


Fig 6. Typical Gate Charge Vs.
Gate-to-Source Voltage

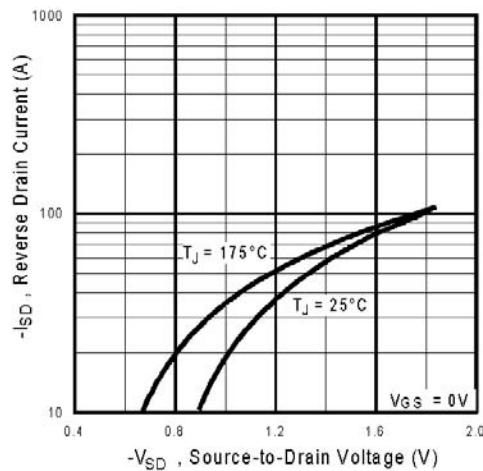


Fig 7. Typical Source-Drain Diode
Forward Voltage

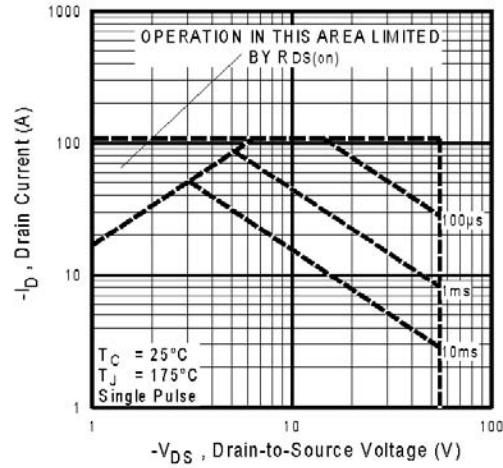


Fig 8. Maximum Safe Operating Area

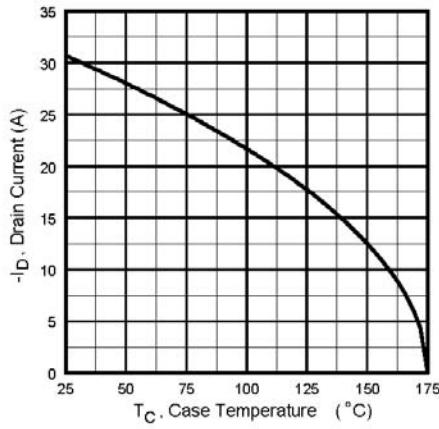


Fig 9. Maximum Drain Current Vs.
Case Temperature

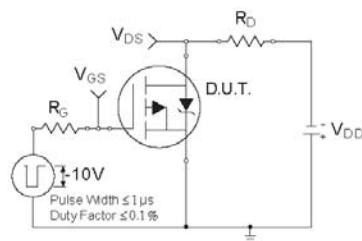


Fig 10a. Switching Time Test Circuit

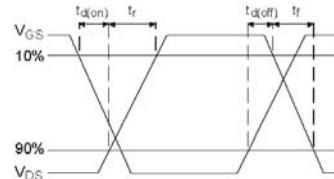


Fig 10b. Switching Time Waveforms

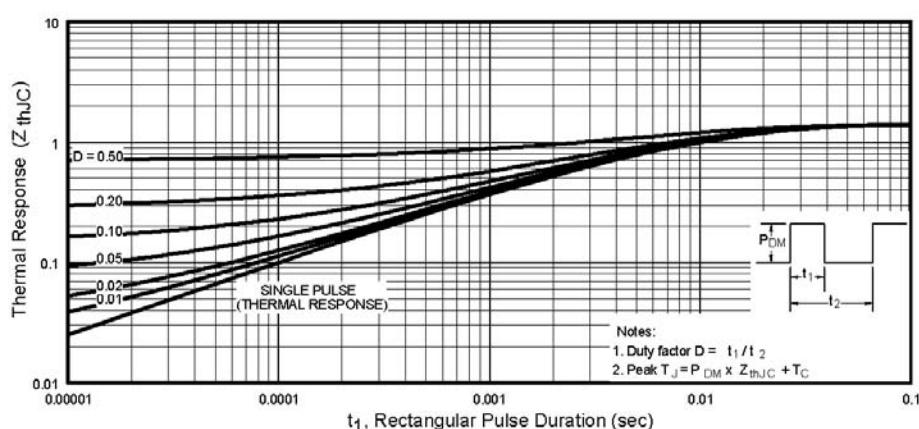


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

IRF5305S/LPbF

International
IR Rectifier

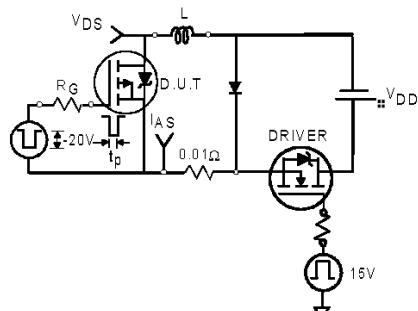


Fig 12a. Unclamped Inductive Test Circuit

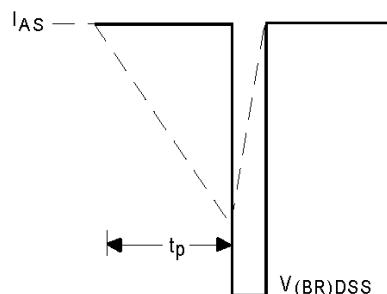


Fig 12b. Unclamped Inductive Waveforms

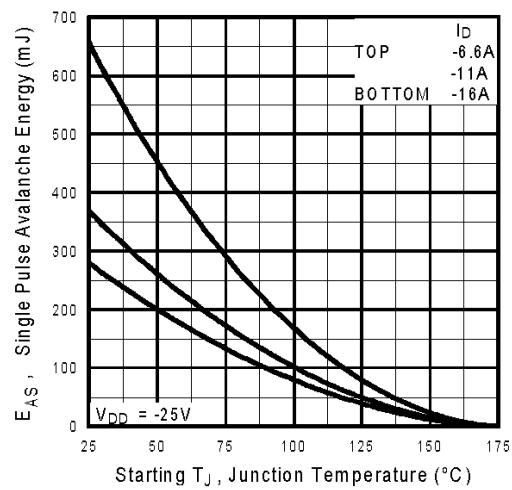


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

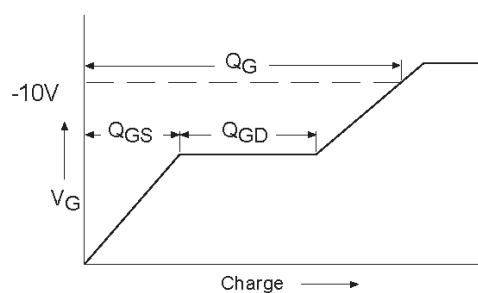


Fig 13a. Basic Gate Charge Waveform

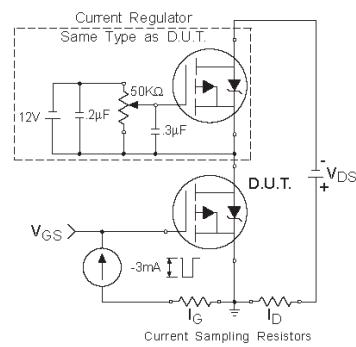


Fig 13b. Gate Charge Test Circuit

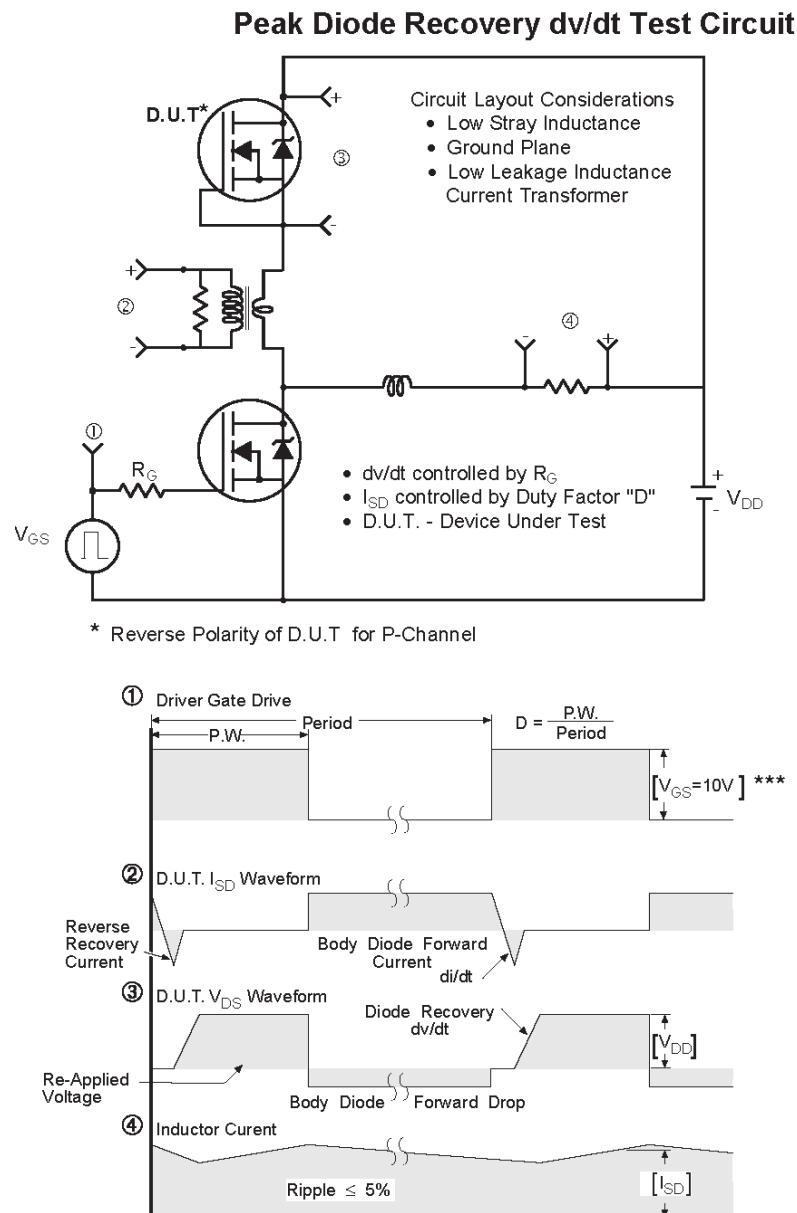
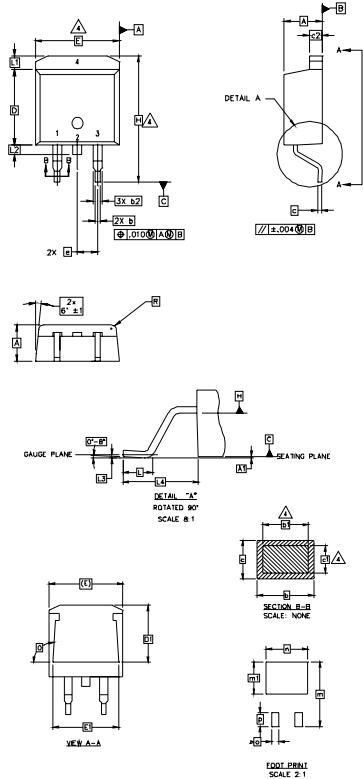


Fig 14. For P-Channel HEXFETS

IRF5305S/LPbF

International
IR Rectifier

D²Pak Package Outline



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 [.005"] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.

▲ DIMENSION b1 AND c1 APPLY TO BASE METAL ONLY.

5. CONTROLLING DIMENSION: INCH.

S Y M O	DIMENSIONS		N O T E S
	MILLIMETERS	INCHES	
L	MIN.	MAX.	
A	4.06	4.83	.160 .190
A1	0.00	0.254	.000 .010
b	0.51	0.99	.020 .039
b1	0.51	0.89	.020 .035
b2	1.14	1.78	.045 .070
c	0.38	0.74	.015 .029
c1	0.38	0.58	.015 .023
c2	1.14	1.65	.045 .065
D	8.51	9.65	.335 .380
D1	6.86		.270
E	9.65	10.67	.380 .420
E1	6.22		.245
e	2.54	BSC	.100 BSC
H	14.61	15.88	.575 .625
L	1.78	2.79	.070 .110
L1		1.65	.065
L2	1.27	1.78	.050 .070
L3		0.25 BSC	.010 BSC
L4	4.78	5.28	.188 .208
m	17.78		.700
m1	8.89		.350
n	11.43		.450
o	2.08		.082
p	3.81		.150
R	0.51	0.71	.020 .028
S	90°	93°	90° 93°

LEAD ASSIGNMENTS

HEXFET

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

IGBTs, CoPACK

1. GATE
- 2, 4. COLLECTOR
3. Emitter

DIODES

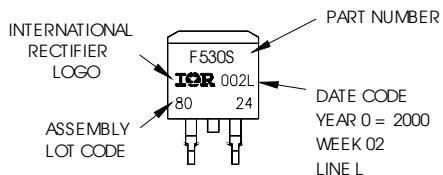
1. ANODE *
- 2, 4. CATHODE
3. ANODE

* PART DEPENDENT.

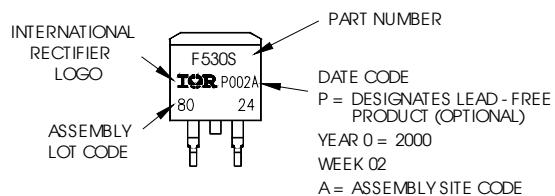
D²Pak Part Marking Information

EXAMPLE: THIS IS AN IRF5305 WITH
LOT CODE 8024
ASSEMBLED ON WW02, 2000
IN THE ASSEMBLY LINE "L"

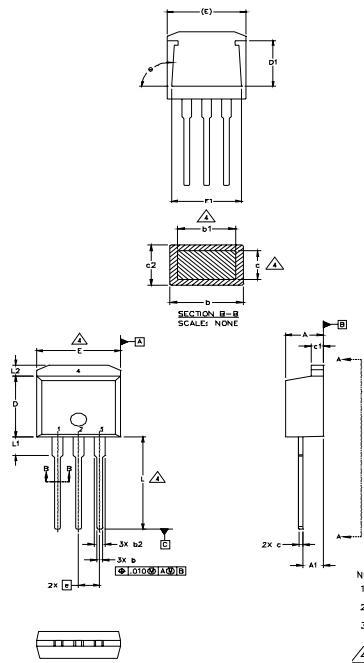
Note: "P" in assembly line position
indicates "Lead - Free"



OR



TO-262 Package Outline



SYMBOL	DIMENSIONS				NOTES	
	MILLIMETERS		INCHES			
	MIN.	MAX.	MIN.	MAX.		
A	4.06	4.83	.160	.190		
A1	2.03	2.92	.080	.115	4	
b	0.51	0.99	.020	.039		
b1	0.51	0.89	.020	.035		
b2	1.14	1.40	.045	.055		
c	0.38	0.63	.015	.025	4	
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

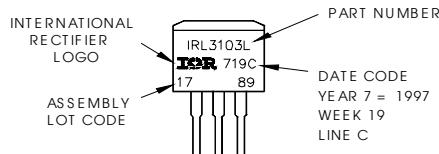
HEXFET	IGBT
1. - GATE	1 - GATE
2. - DRAIN	2 - COLLECTOR
3. - SOURCE	3 - Emitter
4. - DRAIN	

- 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 [.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.

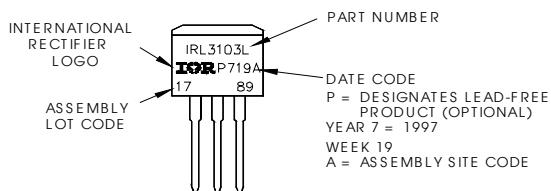
TO-262 Part Marking Information

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

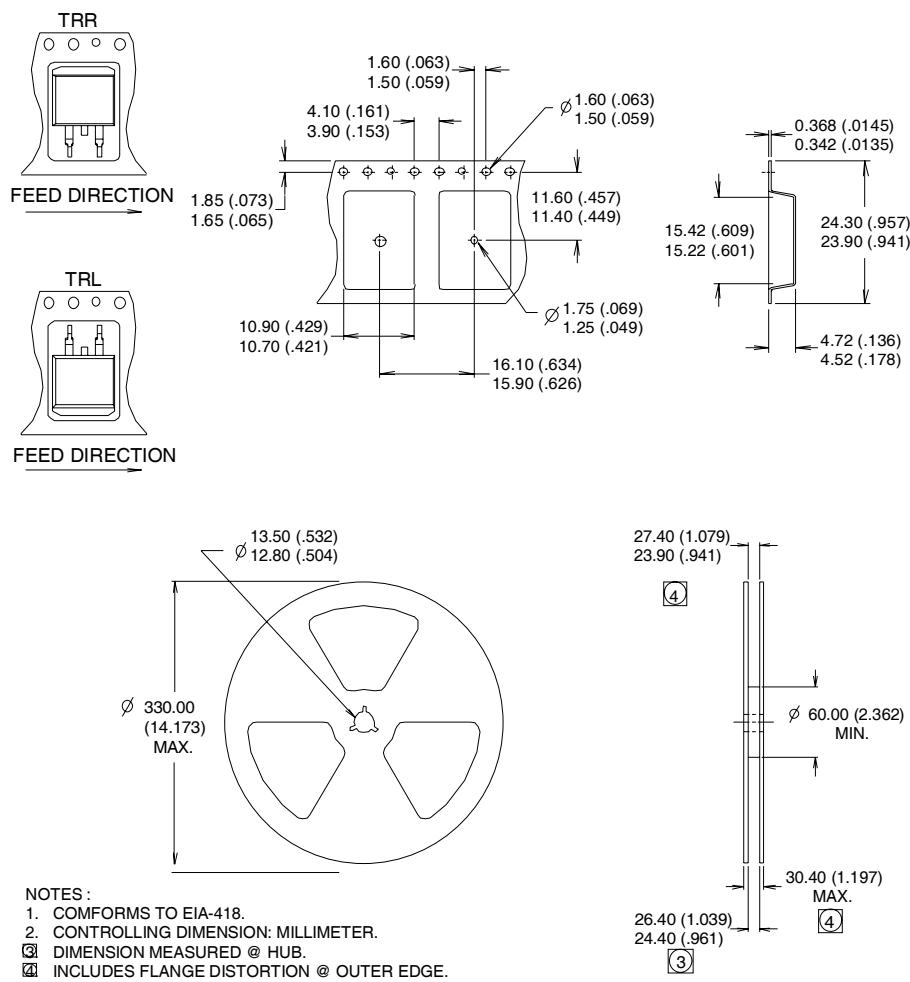


IRF5305S/LPbF

International
IR Rectifier

D²Pak Tape & Reel Information

Dimensions are shown in millimeters (inches)



Data and specifications subject to change without notice.

International
IR Rectifier

IR WORLD HEADQUARTERS: 233 Kansas St., El Segundo, California 90245, USA Tel: (310) 252-7105
TAC Fax: (310) 252-7903

Visit us at www.irf.com for sales contact information. 04/05
www.irf.com

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