

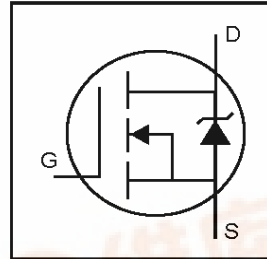
International
IR Rectifier

PD - 95543

IRFBC20S/LPbF

HEXFET® Power MOSFET

- Surface Mount (IRFBC20S)
- Low-profile through-hole (IRFBC20L)
- Available in Tape & Reel (IRFBC20S)
- Dynamic dv/dt Rating
- 150°C Operating Temperature
- Fast Switching
- Fully Avalanche Rated
- Lead-Free

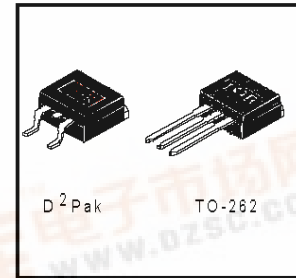


$V_{DSS} = 600V$
$R_{DS(on)} = 4.4\Omega$
$I_D = 2.2A$

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 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 (IRFBC20L) is available for low-profile applications.



Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ⑤	2.2	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$ ⑤	1.4	
I_{DM}	Pulsed Drain Current ①⑤	8.0	
$P_D @ T_A = 25^\circ C$	Power Dissipation	3.1	W
$P_D @ T_C = 25^\circ C$	Power Dissipation	50	W
	Linear Derating Factor	0.40	W/°C
V_{GS}	Gate-to-Source Voltage	± 20	V
E_{AS}	Single Pulse Avalanche Energy②⑤	84	mJ
I_{AR}	Avalanche Current①	2.2	A
E_{AR}	Repetitive Avalanche Energy①	5.0	mJ
dv/dt	Peak Diode Recovery dv/dt ③⑤	3.0	V/ns
T_J	Operating Junction and	-55 to + 150	°C
T_{STG}	Storage Temperature Range		
	Soldering Temperature, for 10 seconds		

Thermal Resistance

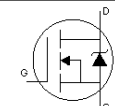
	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	---	2.5	°C/W
$R_{\theta JA}$	Junction-to-Ambient (PCB Mounted, steady-state)**	---	40	



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	600	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta V_{(BR)DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.88	—	$V/^\circ\text{C}$	Reference to $25^\circ\text{C}, I_D = 1\text{mA}$ ⑤
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	4.4	Ω	$V_{GS} = 10V, I_D = 1.3A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
g_{fs}	Forward Transconductance	1.4	—	—	S	$V_{DS} = 50V, I_D = 1.3A$ ⑤
I_{DSS}	Drain-to-Source Leakage Current	—	—	100	μA	$V_{DS} = 600V, V_{GS} = 0V$
		—	—	500		$V_{DS} = 480V, V_{GS} = 0V, T_J = 125^\circ\text{C}$
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	—	—	18	nC	$I_D = 2.0A$
Q_{gs}	Gate-to-Source Charge	—	—	3.0		$V_{DS} = 360V$
Q_{gd}	Gate-to-Drain ("Miller") Charge	—	—	8.9		$V_{GS} = 10V$, See Fig. 6 and 13 ④⑤
$t_{d(on)}$	Turn-On Delay Time	—	10	—	ns	$V_{DD} = 300V$
t_r	Rise Time	—	23	—		$I_D = 2.0A$
$t_{d(off)}$	Turn-Off Delay Time	—	30	—		$R_G = 18\Omega$
t_f	Fall Time	—	25	—		$R_D = 150\Omega$, See Fig. 10 ④⑤
L_S	Internal Source Inductance	—	7.5	—	nH	Between lead, and center of die contact
C_{iss}	Input Capacitance	—	350	—	pF	$V_{GS} = 0V$
C_{oss}	Output Capacitance	—	48	—		$V_{DS} = 25V$
C_{rss}	Reverse Transfer Capacitance	—	8.6	—		$f = 1.0\text{MHz}$, See Fig. 5⑤

Source-Drain Ratings and Characteristics

	Parameter	Min.	Typ.	Max.	Units	Conditions
I_S	Continuous Source Current (Body Diode)	—	—	2.2	A	MOSFET symbol showing the integral reverse p-n junction diode. 
I_{SM}	Pulsed Source Current (Body Diode) ①	—	—	8.0		
V_{SD}	Diode Forward Voltage	—	—	1.6	V	$T_J = 25^\circ\text{C}, I_S = 2.2A, V_{GS} = 0V$ ④
t_{rr}	Reverse Recovery Time	—	290	580	ns	$T_J = 25^\circ\text{C}, I_F = 2.0A$
Q_{rr}	Reverse Recovery Charge	—	0.67	1.3	μC	$di/dt = 100A/\mu s$ 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)
- ② $V_{DD} = 50V$, starting $T_J = 25^\circ\text{C}$, $L = 31\text{mH}$, $R_G = 25\Omega$, $I_{AS} = 2.2A$. (See Figure 12)
- ③ $I_{SD} \leq 2.2A$, $di/dt \leq 40A/\mu s$, $V_{DD} \leq V_{(BR)DSS}$, $T_J \leq 150^\circ\text{C}$
- ④ Pulse width $\leq 300\mu s$; duty cycle $\leq 2\%$.
- ⑤ Uses IRFBC20 data and test conditions

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

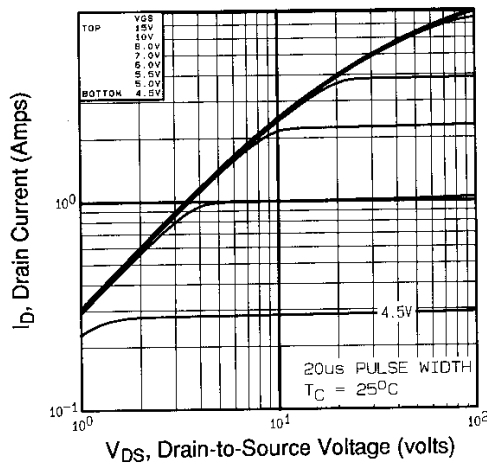


Fig 1. Typical Output Characteristics,

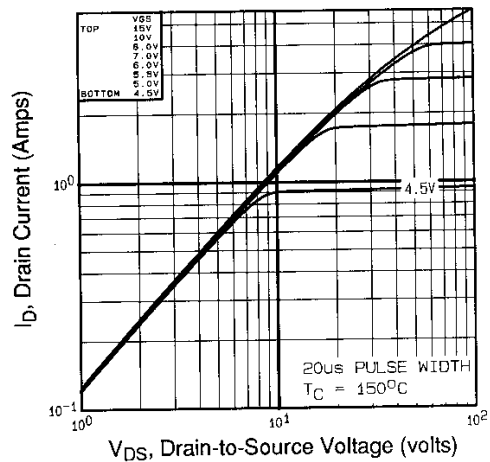


Fig 2. Typical Output Characteristics,

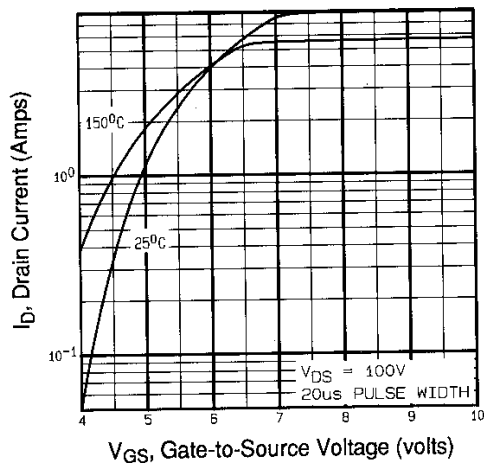


Fig 3. Typical Transfer Characteristics

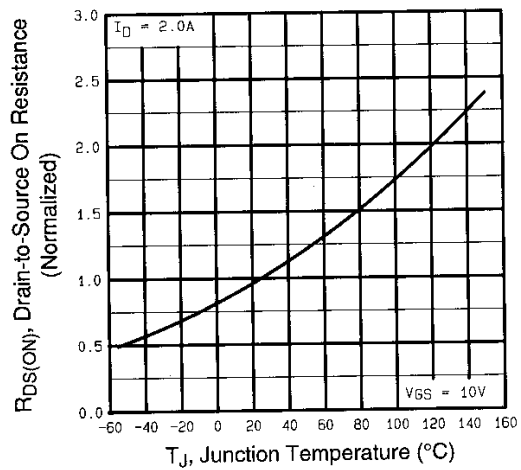


Fig 4. Normalized On-Resistance Vs. Temperature

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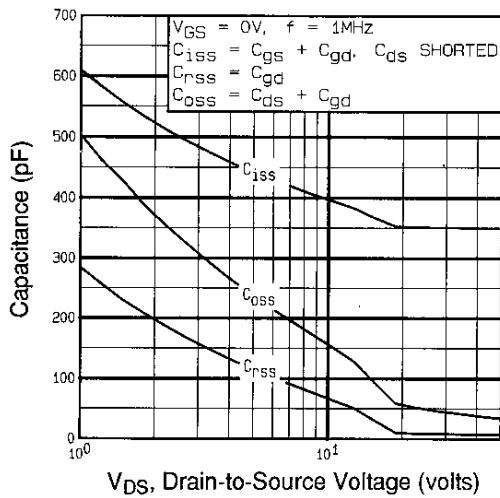


Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage

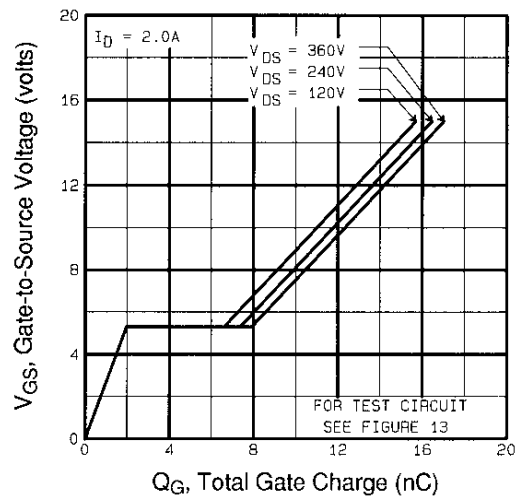


Fig 6. Typical Gate Charge Vs. Gate-to-Source Voltage

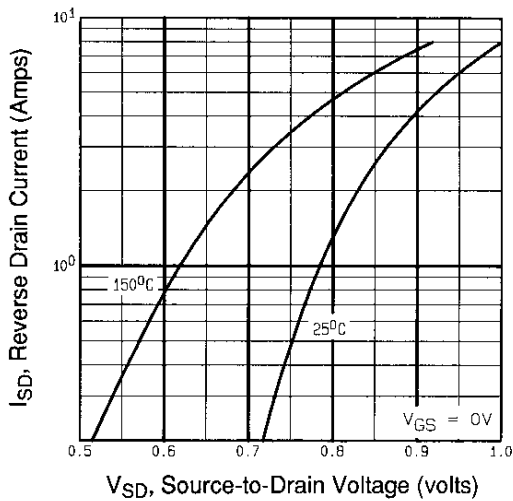


Fig 7. Typical Source-Drain Diode Forward Voltage

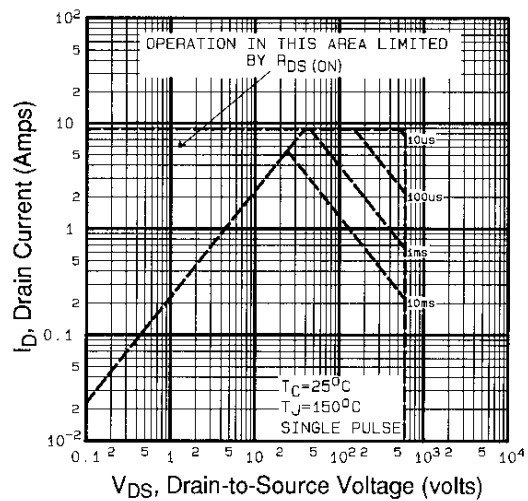


Fig 8. Maximum Safe Operating Area

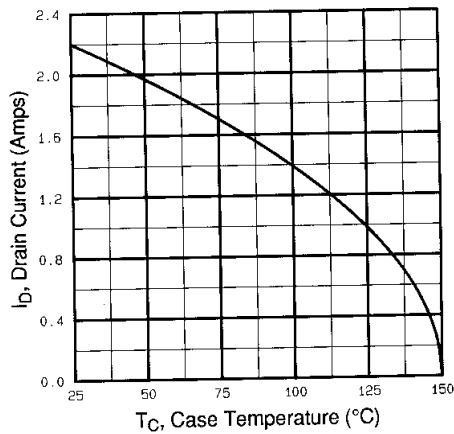


Fig 9. Maximum Drain Current Vs. Case Temperature

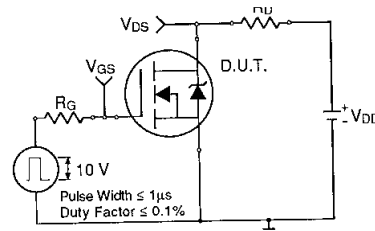


Fig 10a. Switching Time Test Circuit

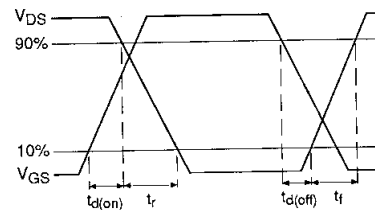


Fig 10b. Switching Time Waveforms

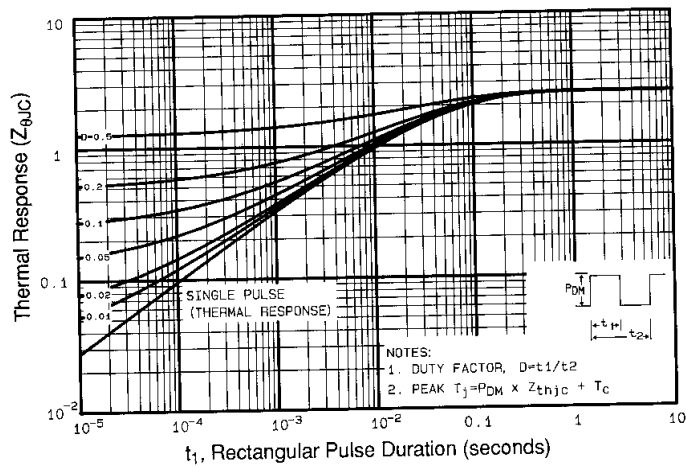


Fig 11. Maximum Effective Transient Thermal Impedance, Junction-to-Case

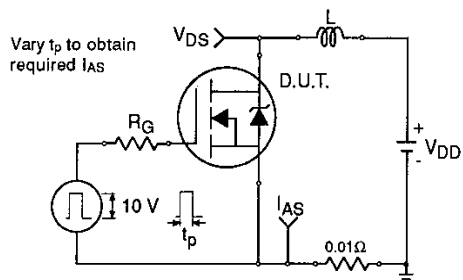


Fig 12a. Unclamped Inductive Test Circuit

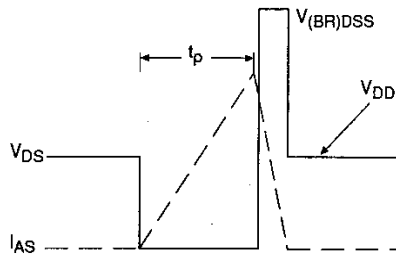


Fig 12b. Unclamped Inductive Waveforms

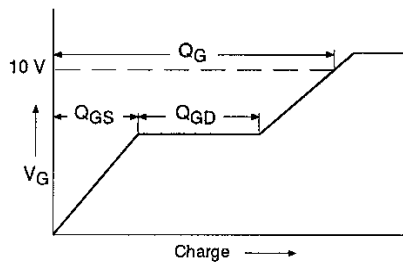


Fig 13a. Basic Gate Charge Waveform

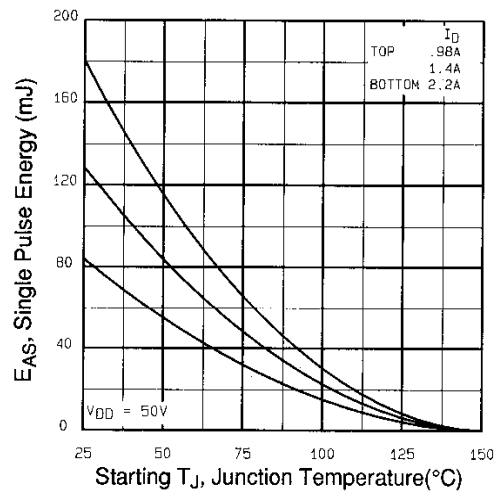


Fig 12c. Maximum Avalanche Energy Vs. Drain Current

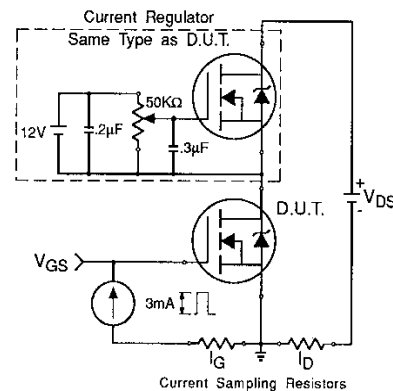


Fig 13b. Gate Charge Test Circuit

Peak Diode Recovery dv/dt Test Circuit

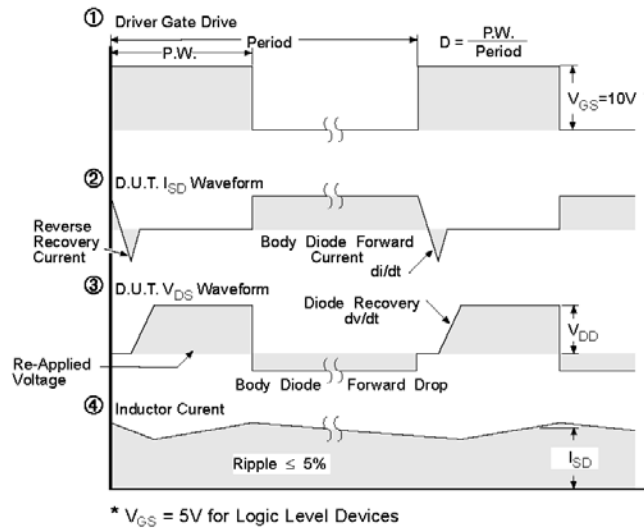
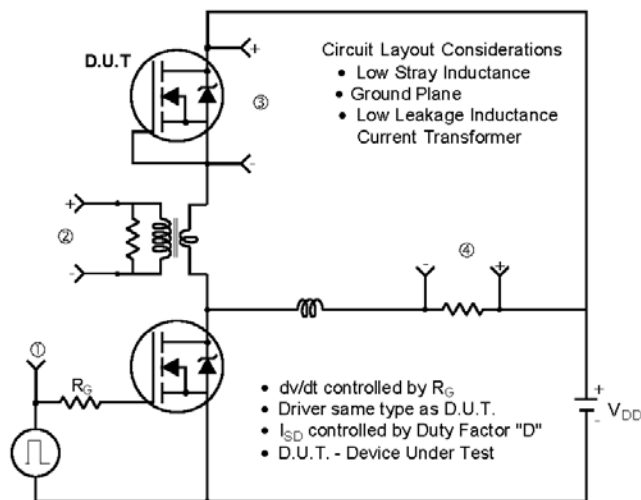


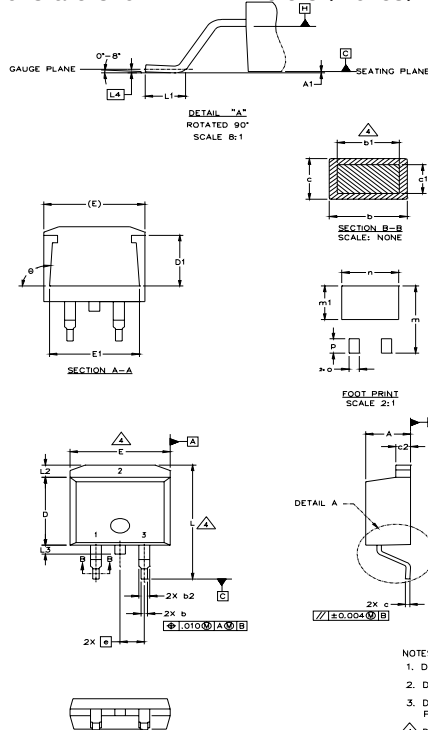
Fig 14. For N-Channel HEXFETS

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D²Pak Package Outline

Dimensions are shown in millimeters (inches)



SYMBOL	DIMENSIONS				NOTES
	MILLIMETERS		INCHES		
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	.160	.190	4
A1		0.127		.005	
b	0.51	0.99	.020	.039	4
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	4
c	0.43	0.63	.017	.025	
c1	0.38	0.74	.015	.029	3
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		
θ	90°	93°	90°	93°	

LEAD ASSIGNMENTS

HEXFET	IGBTs, CoPACK	DIODES
1.- GATE	1.- GATE	1.- ANODE *
2.- DRAIN	2.- COLLECTOR	2.- CATHODE
3.- SOURCE	3.- EMITTER	3.- ANODE

* PART DEPENDENT.

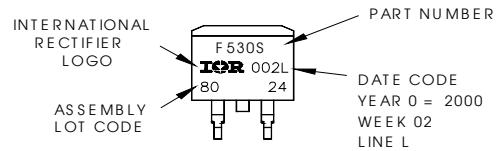
NOTES:

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.

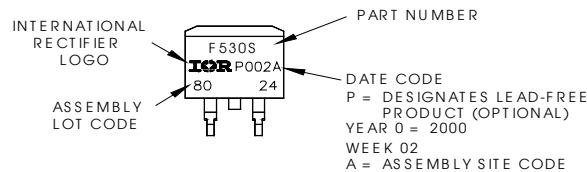
D²Pak Part Marking Information (Lead-Free)

EXAMPLE: THIS IS AN IRF530S WITH
LOT CODE 8024
ASSEMBLED ON WW 02, 2000
IN THE ASSEMBLY LINE "L"

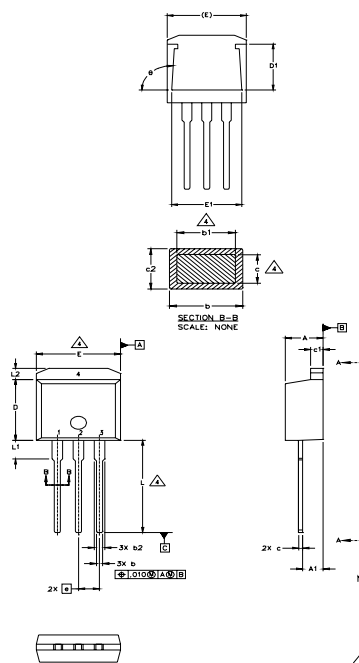
Note: "P" in assembly line
position indicates "Lead-Free"



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	
b	0.51	0.99	.020	.039	
b1	0.51	0.89	.020	.035	4
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

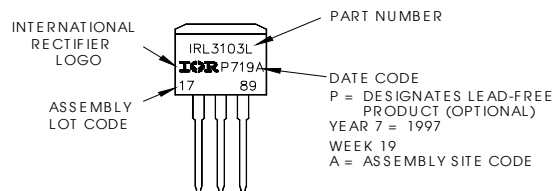
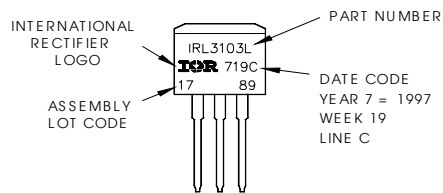
HEXFET	IGBT
1.- GATE	1 - GATE
2.- DRAIN	2 - COLLECTOR
3.- SOURCE	3 - EMITTER
4.- DRAIN	

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 2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].
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 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"

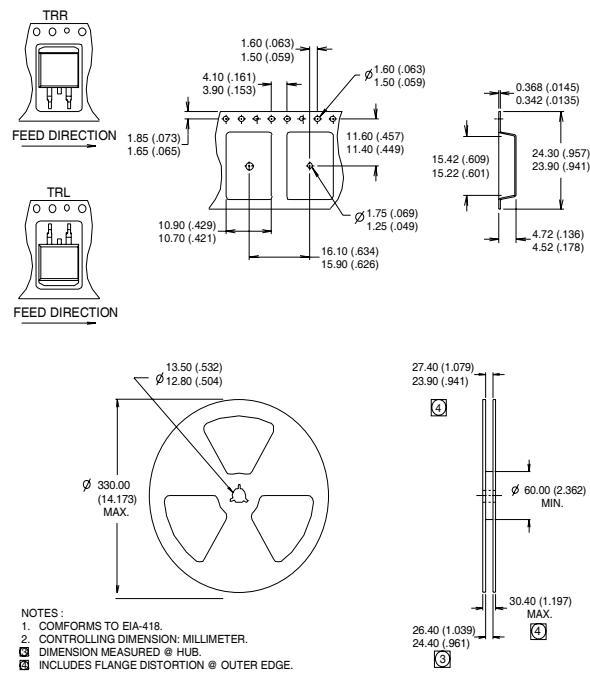
OR



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D²Pak Tape & Reel Information



Data and specifications subject to change without notice.

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