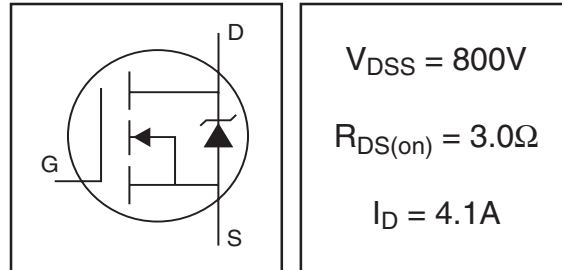


# IRFBE30SPbF IRFBE30LPbF

HEXFET® Power MOSFET

- Dynamic dv/dt Rating
- Repetitive Avalanche Rated
- Fast Switching
- Ease of Paralleling
- Simple Drive Requirements
- Lead-Free



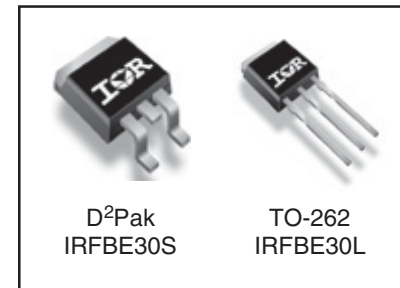
$$V_{DS} = 800V$$

$$R_{DS(on)} = 3.0\Omega$$

$$I_D = 4.1A$$

## 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.



D<sup>2</sup>Pak  
IRFBE30S

TO-262  
IRFBE30L

## Absolute Maximum Ratings

	Parameter	Max.	Units
$I_D @ T_C = 25^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	4.1	A
$I_D @ T_C = 100^\circ C$	Continuous Drain Current, $V_{GS} @ 10V$	2.6	
$I_{DM}$	Pulsed Drain Current ①	16	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	125	W
	Linear Derating Factor	1.0	W/°C
$V_{GS}$	Gate-to-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy (Thermally Limited) ②	260	mJ
$I_{AR}$	Avalanche Current ③	4.1	A
$E_{AR}$	Repetitive Avalanche Energy ①	13	mJ
dv/dt	Peak Diode Recovery dv/dt ③	2.0	V/ns
$T_J$	Operating Junction and	-55 to + 150	°C
$T_{STG}$	Storage Temperature Range		
	Soldering Temperature, for 10 seconds	300 (1.6mm from case )	
	Mounting torque, 6-32 or M3 screw	10 lbf•in (1.1N•m)	

## Thermal Resistance

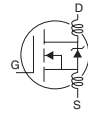
	Parameter	Min.	Typ.	Max.	Units
$R_{\theta JC}$	Junction-to-Case	—	—	1.0	°C/W
$R_{\theta CS}$	Case-to-Sink, Flat, Greased Surface	—	0.50	—	
$R_{\theta JA}$	Junction-to-Ambient	—	—	62	

# IRFBE30S/LPbF

International  
IR Rectifier

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

	Parameter	Min.	Typ.	Max.	Units	Conditions
$V_{(BR)DSS}$	Drain-to-Source Breakdown Voltage	800	—	—	V	$V_{GS} = 0V, I_D = 250\mu A$
$\Delta BV_{DSS}/\Delta T_J$	Breakdown Voltage Temp. Coefficient	—	0.90	—	$V/^\circ C$	Reference to $25^\circ C, I_D = 1mA$
$R_{DS(on)}$	Static Drain-to-Source On-Resistance	—	—	3.0	$\Omega$	$V_{GS} = 10V, I_D = 2.5A$ ④
$V_{GS(th)}$	Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
gfs	Forward Transconductance	2.5	—	—	S	$V_{DS} = 100V, I_D = 2.5A$
$I_{DSS}$	Drain-to-Source Leakage Current	—	—	100	$\mu A$	$V_{DS} = 800V, V_{GS} = 0V$
		—	—	500		$V_{DS} = 640V, V_{GS} = 0V, T_J = 125^\circ C$
$I_{GSS}$	Gate-to-Source Forward Leakage	—	—	100	nA	$V_{GS} = 20V$
	Gate-to-Source Reverse Leakage	—	—	-100		$V_{GS} = -20V$
$Q_g$	Total Gate Charge	—	—	78	nC	$I_D = 4.1A$
$Q_{gs}$	Gate-to-Source Charge	—	—	9.6		$V_{DS} = 400V$
$Q_{gd}$	Gate-to-Drain ("Miller") Charge	—	—	45		$V_{GS} = 10V$ , See Fig. 6 & 13 ④
$t_{d(on)}$	Turn-On Delay Time	—	12	—		$V_{DD} = 400V$
$t_r$	Rise Time	—	33	—	ns	$I_D = 4.1A$
$t_{d(off)}$	Turn-Off Delay Time	—	82	—		$R_G = 12\Omega$
$t_f$	Fall Time	—	30	—		$R_D = 95\Omega$ , 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	—	1300	—		$V_{GS} = 0V$
$C_{oss}$	Output Capacitance	—	310	—	pF	$V_{DS} = 25V$
$C_{rss}$	Reverse Transfer Capacitance	—	190	—		$f = 1.0MHz$ , See Fig. 5

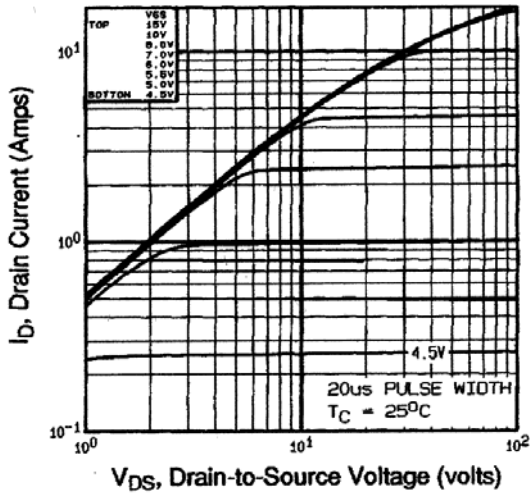


## Diode Characteristics

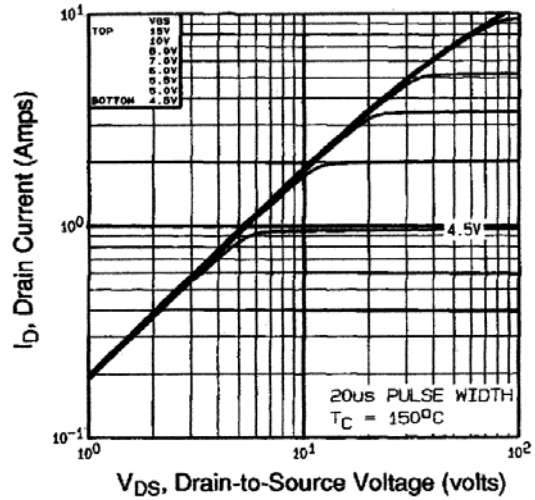
	Parameter	Min.	Typ.	Max.	Units	Conditions
$I_S$	Continuous Source Current (Body Diode)	—	—	4.1	A	MOSFET symbol showing the integral reverse p-n junction diode.
$I_{SM}$	Pulsed Source Current (Body Diode) ①	—	—	16		
$V_{SD}$	Diode Forward Voltage	—	—	1.8	V	$T_J = 25^\circ C, I_S = 4.1A, V_{GS} = 0V$ ④
$t_{rr}$	Reverse Recovery Time	—	480	720	ns	$T_J = 25^\circ C, I_F = 4.1A$
$Q_{rr}$	Reverse Recovery Charge	—	1.8	2.7	nC	$di/dt = 100A/\mu s$ ④
$t_{on}$	Forward Turn-On Time	Intrinsic turn-on time is negligible (turn-on is dominated by $L_S+L_D$ )				

### Notes:

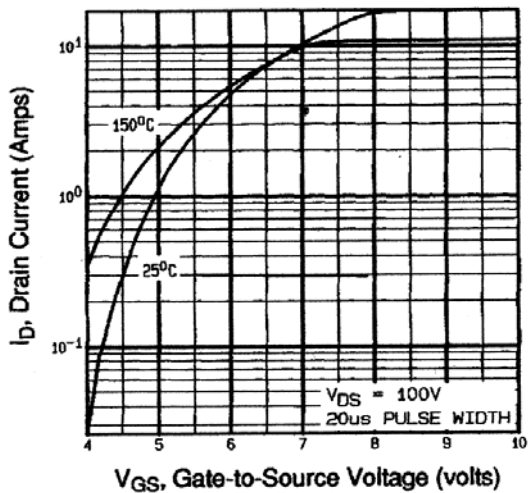
- ① Repetitive rating; pulse width limited by max. junction temperature. (See fig. 11).
- ②  $V_{DD}=50V$ , starting  $T_J = 25^\circ C$ ,  $L=29mH$ ,  $R_G=25\Omega$ ,  $I_{AS} = 4.1A$ . (See Figure 12).
- ③  $I_{SD} \leq 4.1A$ ,  $di/dt \leq 100A/\mu s$ ,  $V_{DD} \leq 600$ ,  $T_J \leq 150^\circ C$ .
- ④ Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$ .



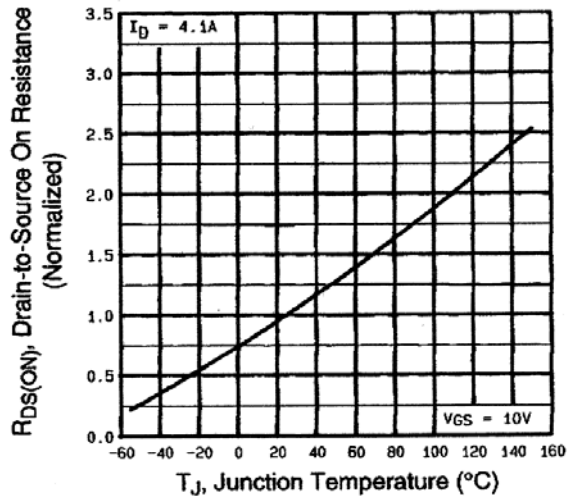
**Fig 1.** Typical Output Characteristics,  
 $T_C=25^\circ\text{C}$



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



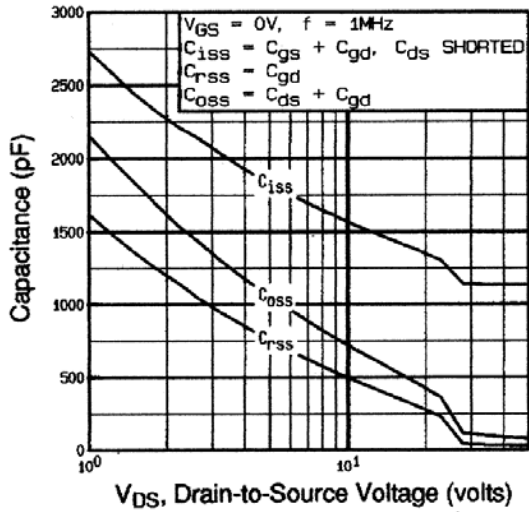
**Fig 3.** Typical Transfer Characteristics



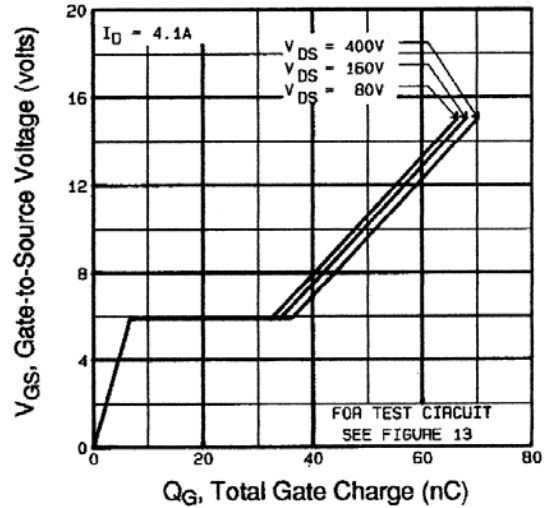
**Fig 4.** Normalized On-Resistance  
Vs. Temperature

# IRFBE30S/LPbF

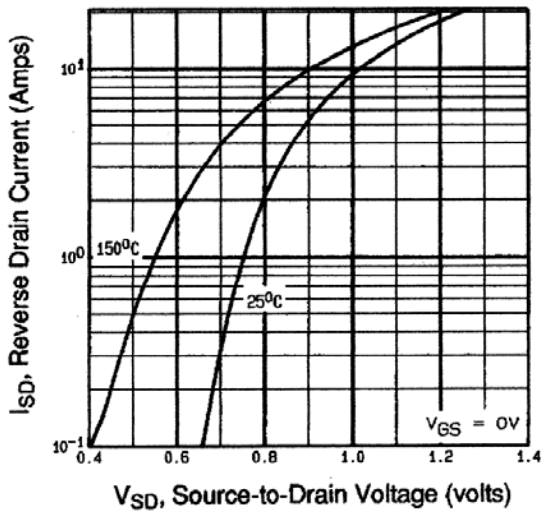
International  
IR Rectifier



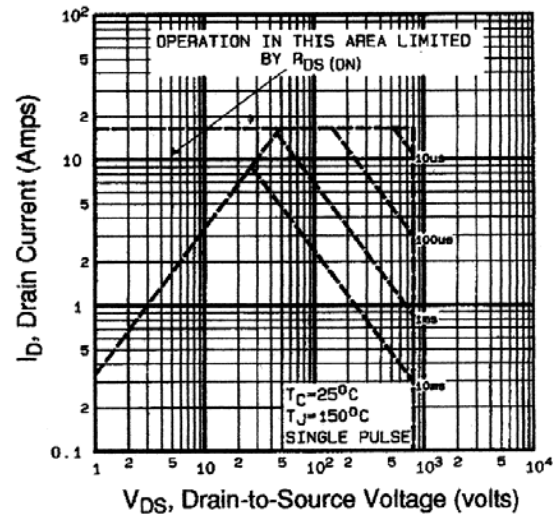
**Fig 5. Typical Capacitance Vs. Drain-to-Source Voltage**



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

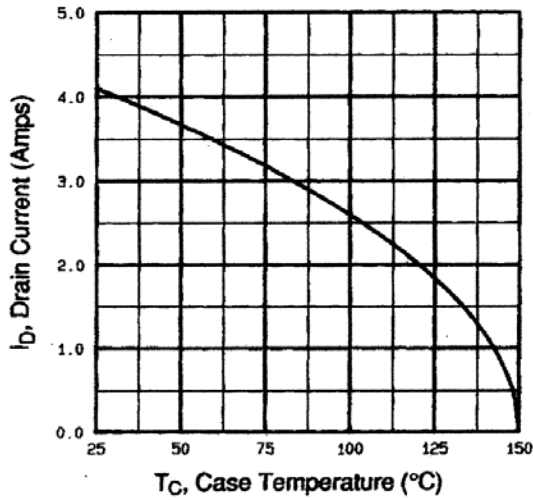


**Fig 7. Typical Source-Drain Diode Forward Voltage**

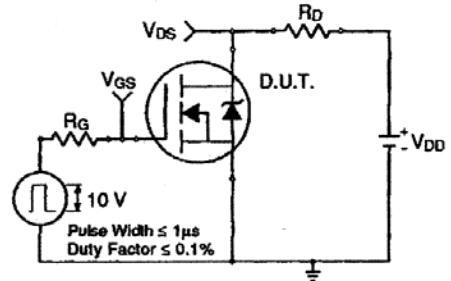


**Fig 8. Maximum Safe Operating Area**

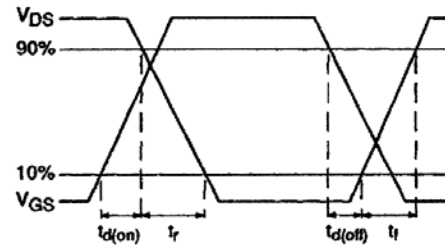
# IRFBE30S/LPbF



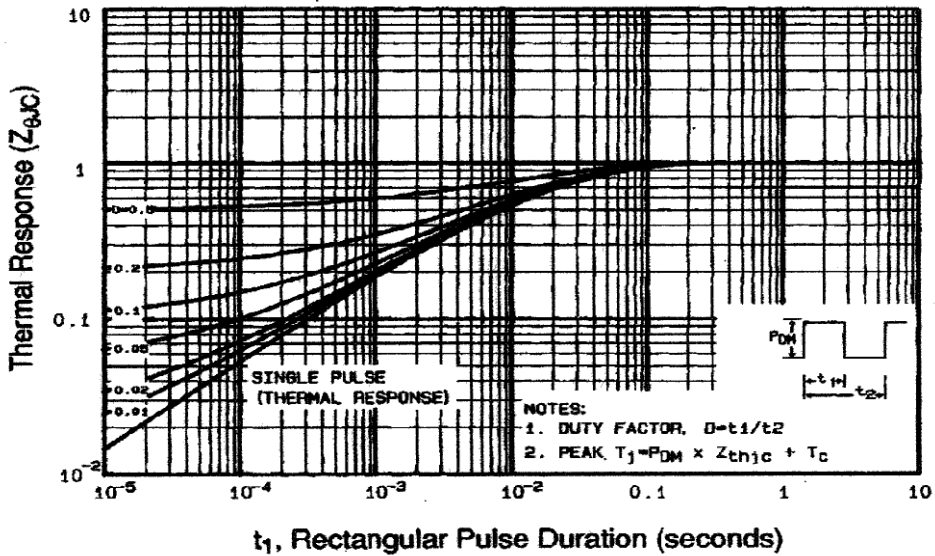
**Fig 9.** Maximum Drain Current Vs. Case Temperature



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

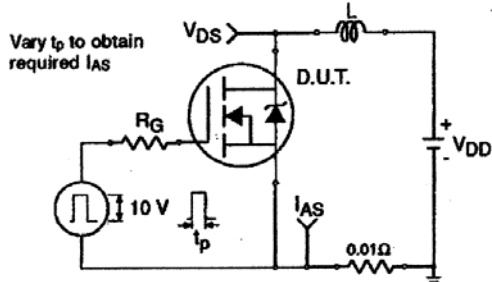


**Fig 10b.** Switching Time Waveforms

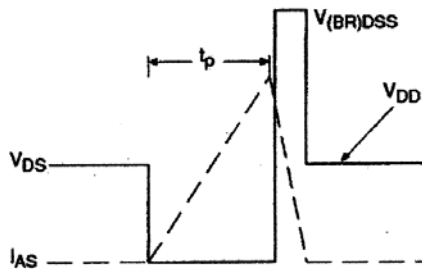


**Fig 11.** Maximum Effective Transient Thermal Impedance, Junction-to-Case

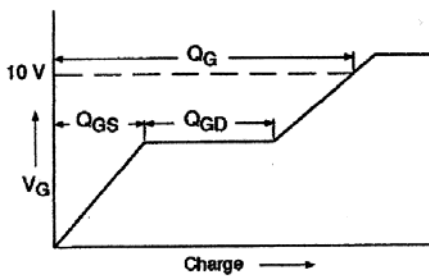
# IRFBE30S/LPbF



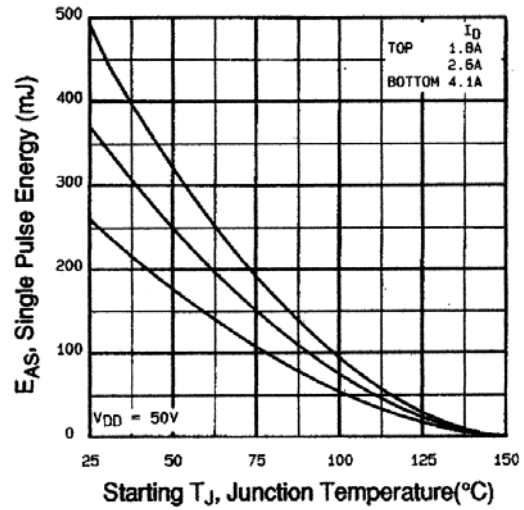
**Fig 12a. Unclamped Inductive Test Circuit**



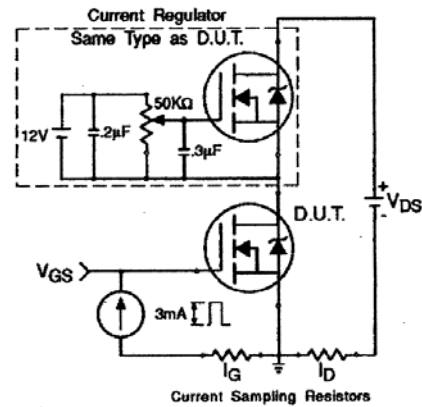
**Fig 12b. Unclamped Inductive Waveforms**



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

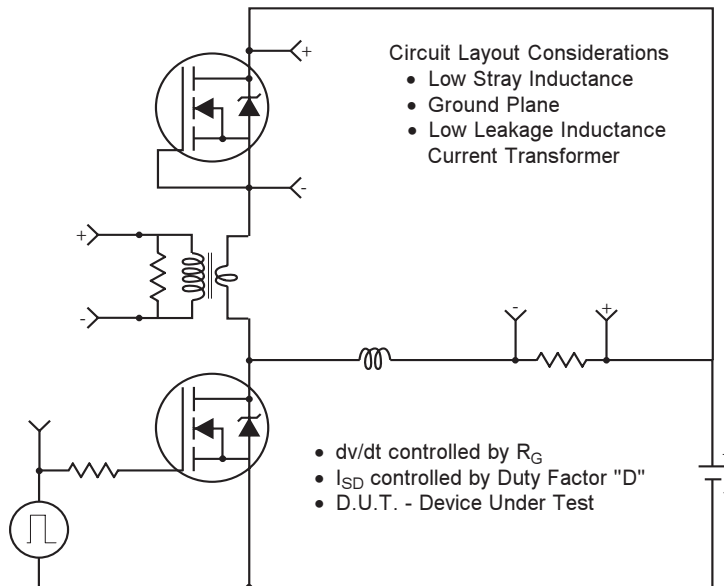


**Fig 12c. Maximum Avalanche Energy Vs. Drain Current**



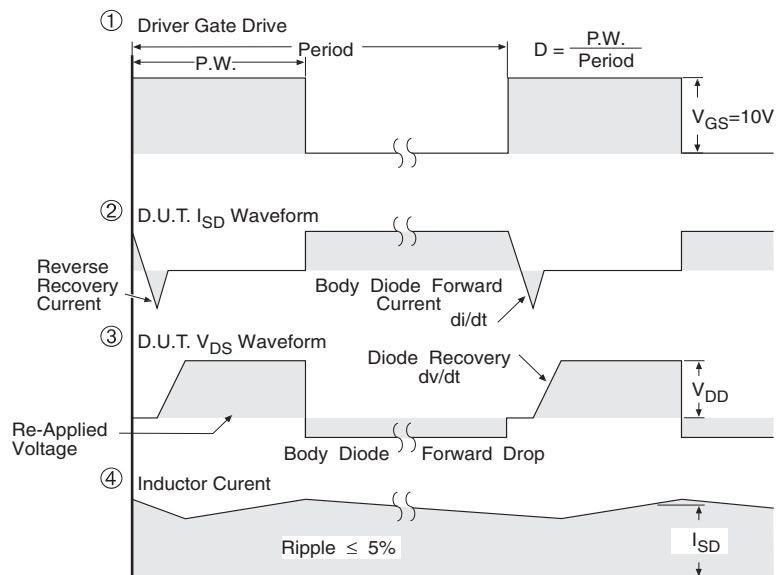
**Fig 13b. Gate Charge Test Circuit**

## Peak Diode Recovery dv/dt Test Circuit



\* Reverse Polarity for P-Channel

\*\* Use P-Channel Driver for P-Channel Measurements



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

**Fig-14** For N-Channel HEXFETS

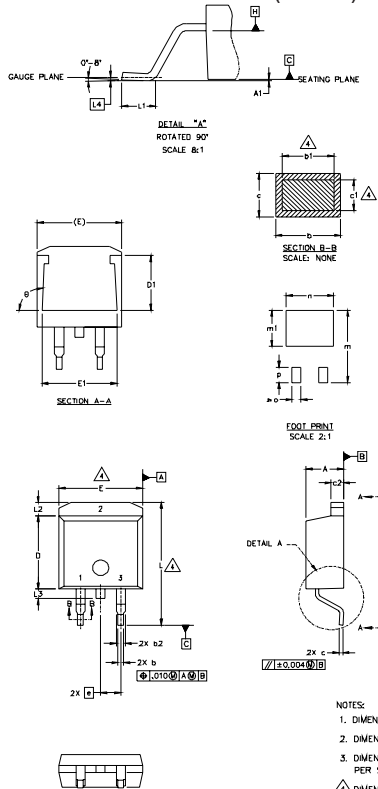


# IRFBE30S/LPbF



## 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	4
b1	0.51	0.89	.020	.035	
b2	1.14	1.40	.045	.055	
c	0.43	0.63	.017	.025	4
c1	0.38	0.74	.015	.029	
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.

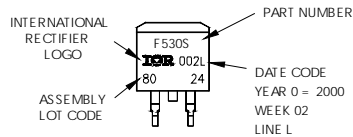
### NOTES:

- 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 [.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.

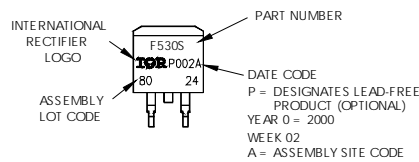
## D<sup>2</sup>Pak Part Marking Information

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"



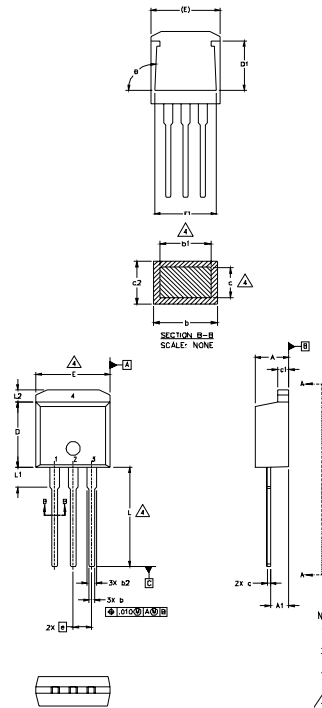
**OR**





## 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	
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	

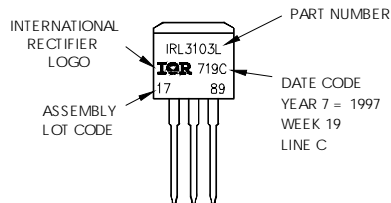
### LEAD ASSIGNMENTS

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

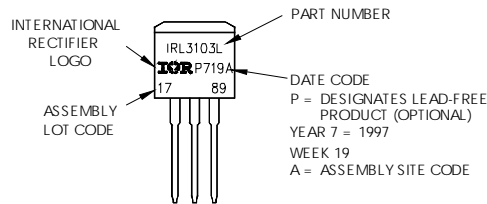
- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994
  2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES]
  3. DIMENSION D & E DO NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.127 [0.005] PER SIDE. THESE DIMENSIONS ARE MEASURED AT THE OUTMOST EXTREMES OF THE PLASTIC BODY.
  4. DIMENSION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

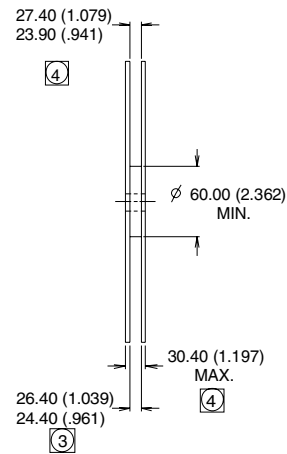
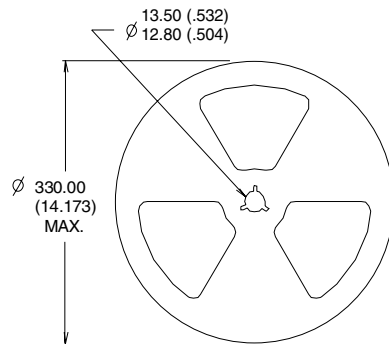
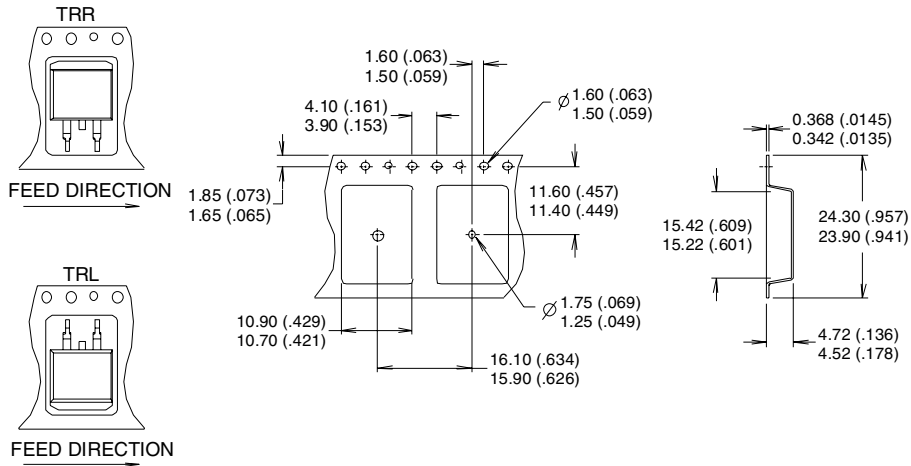


# IRFBE30S/LPbF

International  
**IOR** Rectifier

## 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.

International  
**IOR** Rectifier

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

07/04



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