

**Ultrafast, Soft Recovery Diode**

**Features**

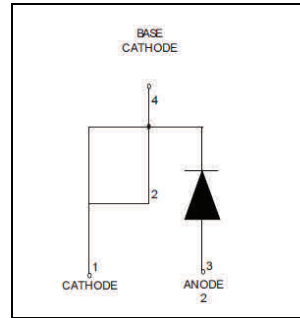
- Ultrafast Recovery
- Ultra soft Recovery
- Very Low  $I_{RRM}$
- Very Low  $Q_{rr}$
- Specified at Operating Conditions
- Lead-Free

**Benefits**

- Reduced RFI and EMI
- Reduced Power Loss in Diode and Switching Transistor
- Higher Frequency Operation
- Reduced Snubbing
- Reduced Parts Count

**Description**

International Rectifier's HFA15PB60 is a state of the art ultrafast recovery diode. Employing the latest in epitaxial construction and advanced processing techniques it features a superb combination of characteristics which result in performance which is unsurpassed by any rectifier previously available. With basic ratings of 600 volts and 15 amps continuous current, the HFA15PB60 is especially well suited for use as the companion diode for IGBTs and MOSFETs. In addition to ultra fast recovery time, the ultrafast recovery diode product line features extremely low values of peak recovery current ( $I_{RRM}$ ) and does not exhibit any tendency to "snap-off" during the  $t_b$  portion of recovery. The ultrafast recovery diode features combine to offer designers a rectifier with lower noise and significantly lower switching losses in both the diode and the switching transistor. These ultrafast advantages can help to significantly reduce snubbing, component count and heat sink sizes. The HFA15PB60 is ideally suited for applications in power supplies and power conversion systems (such as inverters), motor drives, and many other similar applications where high speed, high efficiency is needed.



$V_R = 600V$
$V_{F(TYP)}^* = 1.3V$
$I_{F(AV)} = 15A$
$Q_{rr}(typ.) = 80nC$
$I_{RRM}(typ.) = 4.0A$
$t_{rr}(typ.) = 19ns$
$D_{I(rec)M/dt}(typ.)^* = 160A/\mu s$



TO-247AC (Modified)

Base part number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
HFA15PB60PbF	TO-247AC	Tube	25	HFA15PB60PbF

**Absolute Maximum Ratings**

	Parameter	Max.	Units
$V_R$	Cathode -to – Anode Voltage	600	V
$I_F @ T_C = 100^\circ C$	Continuous Forward Current	15	A
$I_{FSM}$	Single Pulse Forward Current	150	
$I_{FRM}$	Maximum Repetitive Forward Current	60	
$P_D @ T_C = 25^\circ C$	Maximum Power Dissipation	74	W
$P_D @ T_C = 100^\circ C$	Maximum Power Dissipation	29	
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to + 150	$^\circ C$

\* 125°C

**Electrical Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions	
V <sub>BR</sub>	Cathode Anode Breakdown Voltage	600	—	—	V	I <sub>R</sub> = 100μA	
V <sub>FM</sub>	Max Forward Voltage	—	1.3	1.7		I <sub>F</sub> = 15A	See Fig. 1
		—	1.5	2.0		I <sub>F</sub> = 30A	
		—	1.2	1.6		I <sub>F</sub> = 30A, T <sub>J</sub> = 125°C	
I <sub>RM</sub>	Max Reverse Leakage Current	—	1.0	10	μA	V <sub>R</sub> = V <sub>R</sub> Rated See Fig. 2	
		—	400	1000		T <sub>J</sub> = 125°C, V <sub>R</sub> = 0.8 x V <sub>R</sub> Rated	
C <sub>T</sub>	Junction Capacitance	—	25	50	pF	V <sub>R</sub> = 200V See Fig. 3	
L <sub>S</sub>	Series Inductance	—	12	—	nH	Measured lead to lead 5mm from package body	

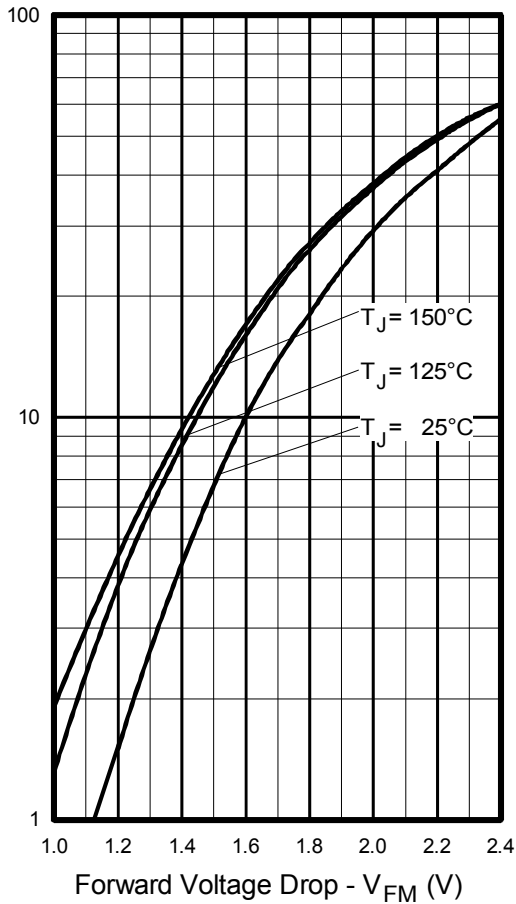
**Dynamic Recovery Characteristics @ T<sub>J</sub> = 25°C (unless otherwise specified)**

	Parameter	Min.	Typ.	Max.	Units	Conditions
t <sub>rr</sub>	Reverse Recovery Time See Fig. 5,10	—	19	—	ns	I <sub>F</sub> = 1.0A, dif/dt = 200A/μs, V <sub>R</sub> = 30V
t <sub>rr1</sub>		—	42	60		T <sub>J</sub> = 25°C
t <sub>rr2</sub>		—	74	120		T <sub>J</sub> = 125°C
I <sub>RRM1</sub>	Peak Recovery Current See Fig. 6	—	4.0	6.0	A	T <sub>J</sub> = 25°C
I <sub>RRM2</sub>		—	6.5	10		T <sub>J</sub> = 125°C
Q <sub>rr1</sub>	Reverse Recovery Charge See Fig.7	—	80	180	nC	T <sub>J</sub> = 25°C
Q <sub>rr2</sub>		—	220	600		T <sub>J</sub> = 125°C
di <sub>(rec)M</sub> /dt1	Peak Rate of Fall of Recovery Current	—	188	—	A/μs	T <sub>J</sub> = 25°C
di <sub>(rec)M</sub> /dt2	During t <sub>b</sub> See Fig.8	—	160	—		T <sub>J</sub> = 125°C

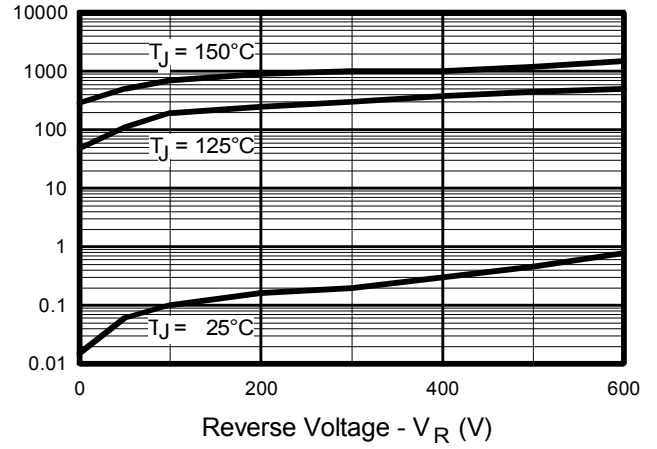
**Thermal –Mechanical Characteristics**

	Parameter	Min.	Typ.	Max.	Units
T <sub>lead</sub> ①	Lead Temperature	—	—	300	°C
R <sub>θJC</sub>	Thermal Resistance, Junction to Case	—	—	1.7	K/W
R <sub>θJA</sub> ②	Thermal Resistance, Junction to Ambient	—	—	40	
R <sub>θCS</sub> ③	Thermal Resistance, Case to Heat Sink	—	0.25	—	
Wt	Weight	—	6.0	—	g
		—	0.21	—	(oz)
T	Mounting Torque	6.0	—	12	Kg-cm
		5.0	—	10	lbf•in

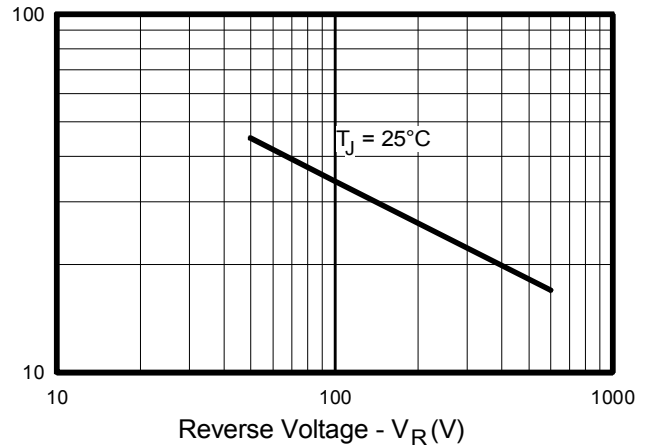
- ① 0.063 in. from Case (1.6mm) for 10 sec
- ② Typical Socket Mount
- ③ Mounting Surface, Flat, Smooth and Greased



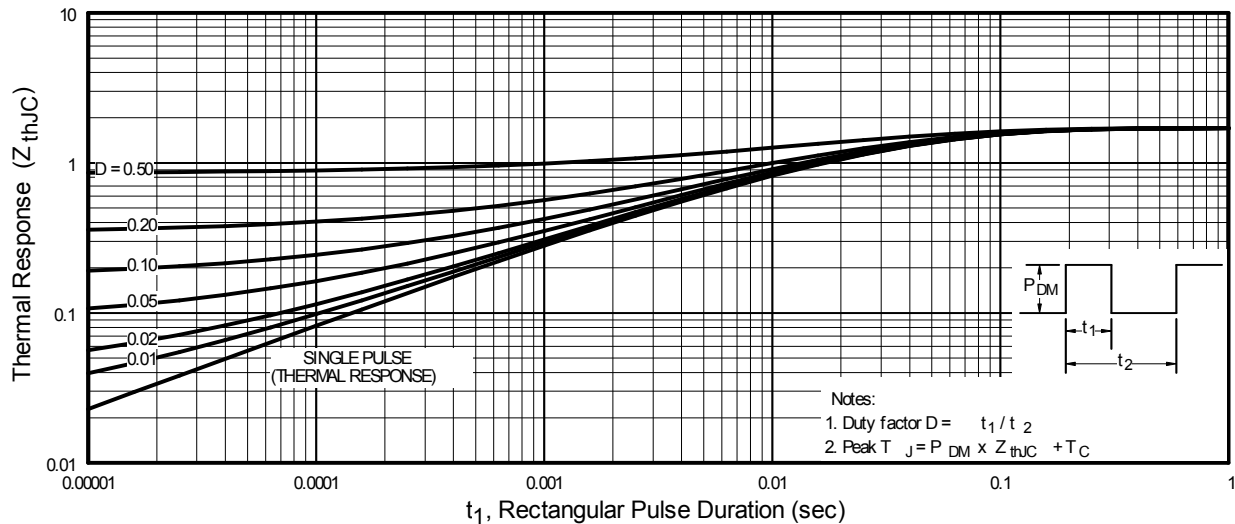
**Fig. 1** - Maximum Forward Voltage Drop vs. Instantaneous Forward Current



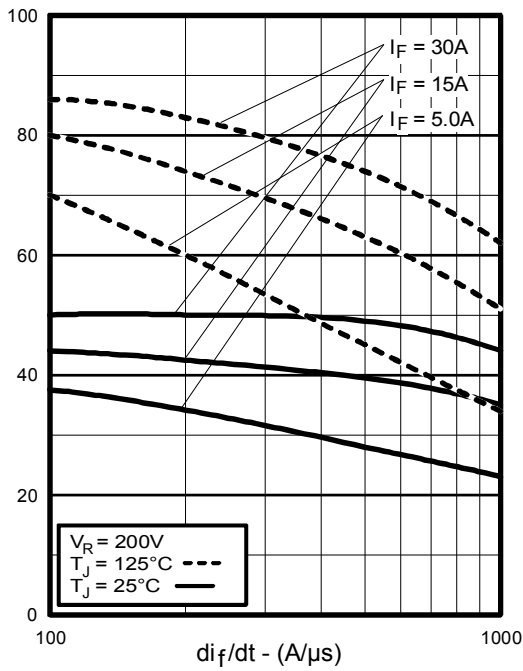
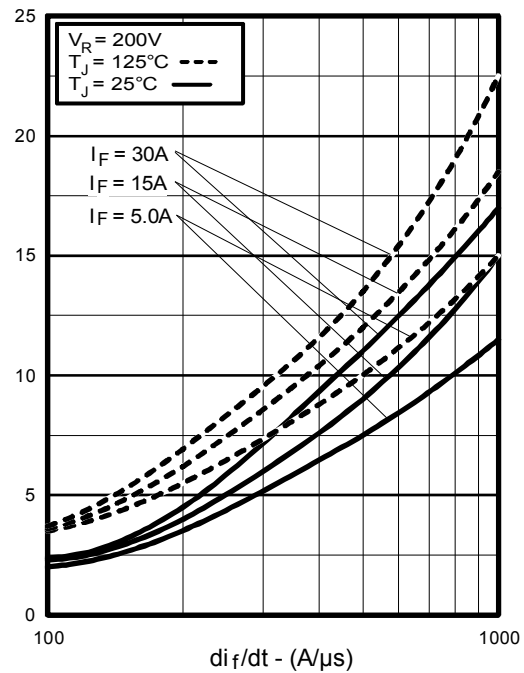
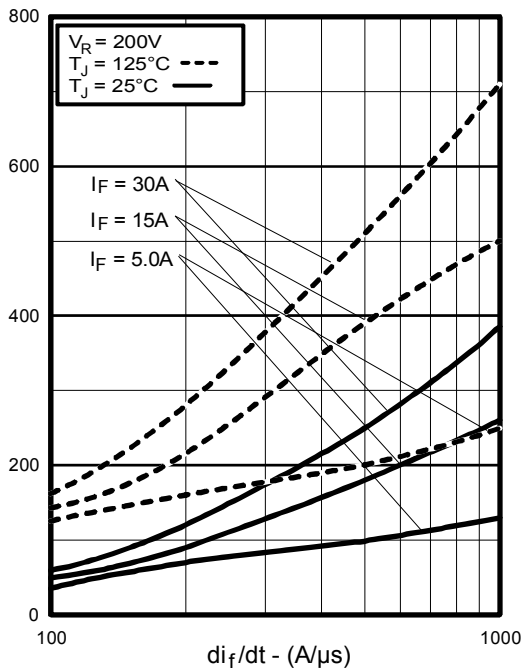
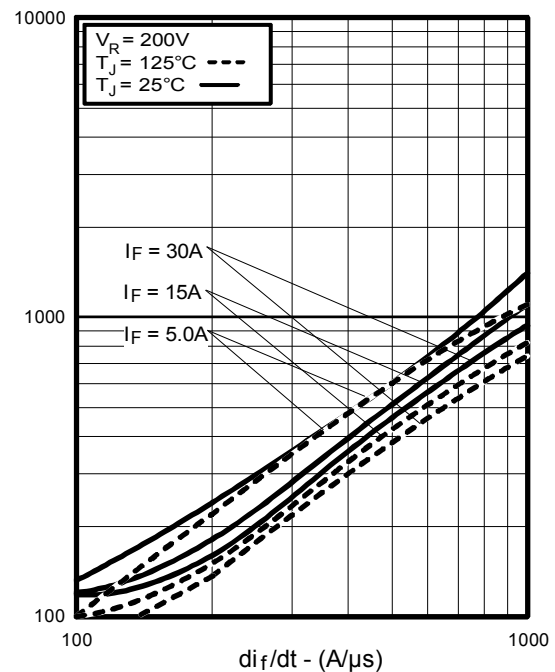
**Fig. 2** - Typical Reverse Current vs. Reverse Voltage

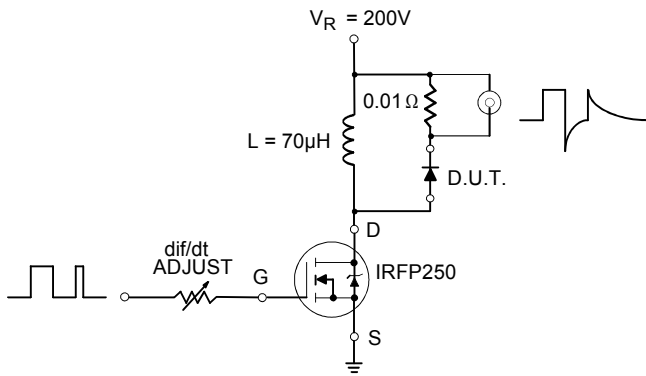
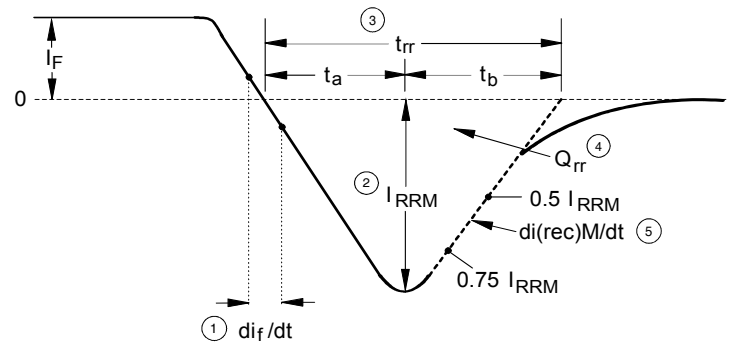


**Fig. 3** - Typical Junction Capacitance vs. Reverse Voltage



**Fig. 4** - Maximum Thermal Impedance  $Z_{thjC}$  Characteristics


**Fig. 5 - Typical Reverse Recovery vs.  $di_f/dt$** 

**Fig. 6 - Typical Recovery Current vs.  $di_f/dt$** 

**Fig. 7 - Typical Stored Charge vs.  $di_f/dt$** 

**Fig. 8 - Typical  $di_{(rec)M}/dt$  vs.  $di_f/dt$**

**REVERSE RECOVERY CIRCUIT**

**Fig. 9 - Reverse Recovery Parameter Test Circuit**


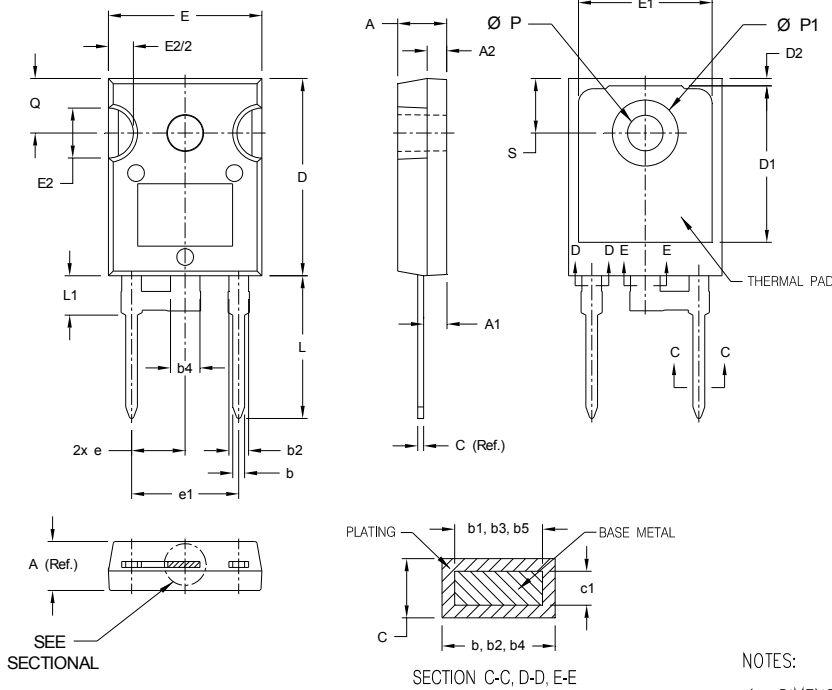
1.  $di_f/dt$  - Rate of change of current through zero crossing
2.  $I_{RRM}$  - Peak reverse recovery current
3.  $t_{rr}$  - Reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through  $0.75 I_{RRM}$  and  $0.50 I_{RRM}$  extrapolated to zero current

4.  $Q_{rr}$  - Area under curve defined by  $t_{rr}$  and  $I_{RRM}$

$$Q_{rr} = \frac{t_{rr} \times I_{RRM}}{2}$$

5.  $di_{(rec)M}/dt$  - Peak rate of change of current during  $t_b$  portion of  $t_{rr}$

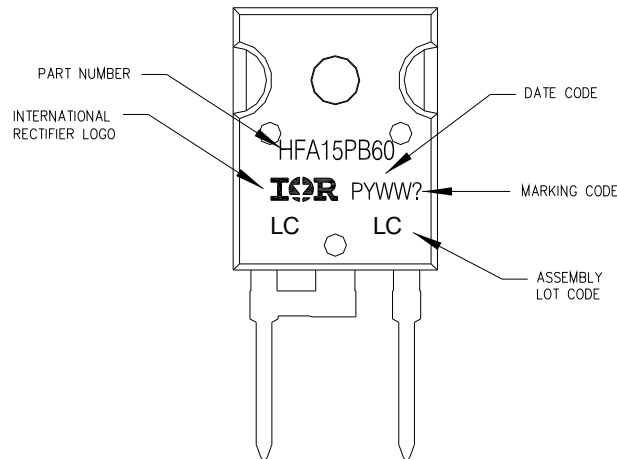
**Fig. 10 - Reverse Recovery Waveform and Definitions**

**TO-247AC Package Outline (Dimensions are shown in millimeters (inches))**


SYMBOL	MILLIMETERS		INCHES	
	MIN.	MAX.	MIN.	MAX.
A	4.65	5.31	.1831	.2091
A1	2.21	2.59	.0870	.1020
A2	1.50	2.49	.0591	.0980
b	0.99	1.40	.0390	.0551
b1	0.99	1.35	.0390	.0531
b2	1.65	2.39	.0650	.0941
b3	1.65	2.34	.0650	.0921
b4	2.59	3.43	.1020	.1350
b5	2.59	3.38	.1020	.1331
c	0.38	0.89	.0150	.0350
c1	0.38	0.84	.0150	.0331
D	19.71	20.70	.7760	.8150
D1	13.08	--	.5150	--
D2	0.51	1.35	.0201	.0531
E	15.29	15.87	.6020	.6248
E1	13.46	--	.5299	--
E2	4.52	5.49	.1780	.2161
e	5.46 BASIC		.2150 BASIC	
L	14.20	16.10	.5591	.6339
L1	3.71	4.29	.1461	.1689
Q	5.31	5.69	.2091	.2240
S	5.51 BASIC		.2169 BASIC	
ØP	3.56	3.66	.1402	.1441
ØP1	--	7.39	--	.2909

**NOTES:**

1. DIMENSIONING AND TOLERANCING AS PER ASME Y14.5M 1994.
2. DIMENSIONS ARE SHOWN IN MILLIMETERS [INCHES].

**TO-247AC Part Marking Information**


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

**Qualification Information<sup>†</sup>**

<b>Qualification Level</b>	Industrial (per JEDEC JESD47F) <sup>††</sup>	
<b>Moisture Sensitivity Level</b>	TO-247AC	N/A
<b>RoHS Compliant</b>	Yes	

† Qualification standards can be found at International Rectifier’s web site: <http://www.irf.com/product-info/reliability/>

†† Applicable version of JEDEC standard at the time of product release.

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