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[Vishay Semiconductor/Diodes Division](#)
[VS-HFA15PB60PBF](#)

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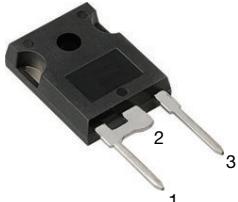
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VS-HFA15PB60PbF, VS-HFA15PB60-N3

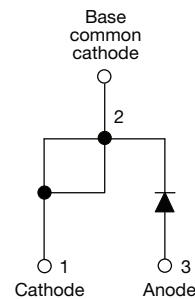
Vishay Semiconductors

HEXFRED®

Ultrafast Soft Recovery Diode, 15 A



TO-247AC modified



FEATURES

- Ultrafast and ultrasoft recovery
- Very low I_{RRM} and Q_{rr}
- Designed and qualified according to JEDEC®-JESD47
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
Available

BENEFITS

- Reduced RFI and EMI
- Reduced power loss in diode and switching transistor
- Higher frequency operation
- Reduced snubbing
- Reduced parts count

DESCRIPTION

VS-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 V and 15 A continuous current, the VS-HFA15PB60... is especially well suited for use as the companion diode for IGBTs and MOSFETs. In addition to ultrafast recovery time, the HEXFRED® 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 HEXFRED features combine to offer designers a rectifier with lower noise and significantly lower switching losses in both the diode and the switching transistor. These HEXFRED advantages can help to significantly reduce snubbing, component count and heatsink sizes. The HEXFRED VS-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.

PRODUCT SUMMARY

Package	TO-247AC modified (2 pins)
$I_{F(AV)}$	15 A
V_R	600 V
V_F at I_F	1.2 V
t_r typ.	19 ns
T_J max.	150 °C
Diode variation	Single die

ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	V_R		600	V
Maximum continuous forward current	I_F	$T_C = 100$ °C	15	A
Single pulse forward current	I_{FSM}		150	
Maximum repetitive forward current	I_{FRM}		60	W
Maximum power dissipation	P_D	$T_C = 25$ °C	74	
Operating junction and storage temperature range	T_J, T_{Stg}	$T_C = 100$ °C	29	
			-55 to +150	°C



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ELECTRICAL SPECIFICATIONS ($T_J = 25^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	V_{BR}	$I_R = 100 \mu\text{A}$		600	-	-	V
Maximum forward voltage	V_{FM}	$I_F = 15 \text{ A}$	See fig. 1	-	1.3	1.7	V
		$I_F = 30 \text{ A}$		-	1.5	2.0	
		$I_F = 15 \text{ A}, T_J = 125^\circ\text{C}$		-	1.2	1.6	
Maximum reverse leakage current	I_{RM}	$V_R = V_R \text{ rated}$ $T_J = 125^\circ\text{C}, V_R = 0.8 \times V_R \text{ rated}$	See fig. 2	-	1.0	10	μA
				-	400	1000	
Junction capacitance	C_J	$V_R = 200 \text{ V}$	See fig. 3	-	25	50	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body		-	12	-	nH

DYNAMIC RECOVERY CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise specified)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Reverse recovery time See fig. 5, 10	t_{rr}	$I_F = 1.0 \text{ A}, dI_F/dt = 200 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}$		-	19	-	ns
	t_{rr1}	$T_J = 25^\circ\text{C}$		-	42	60	
	t_{rr2}	$T_J = 125^\circ\text{C}$		-	74	120	
Peak recovery current See fig. 6	I_{RRM1}	$T_J = 25^\circ\text{C}$		-	4.0	6.0	A
	I_{RRM2}	$T_J = 125^\circ\text{C}$		-	6.5	10	
Reverse recovery charge See fig. 7	Q_{rr1}	$T_J = 25^\circ\text{C}$		-	80	180	nC
	Q_{rr2}	$T_J = 125^\circ\text{C}$		-	220	600	
Peak rate of fall of recovery current during t_b See fig. 8	$dl_{(rec)M}/dt1$	$T_J = 25^\circ\text{C}$		-	188	-	$\text{A}/\mu\text{s}$
	$dl_{(rec)M}/dt2$	$T_J = 125^\circ\text{C}$		-	160	-	

THERMAL - MECHANICAL SPECIFICATIONS							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS
Lead temperature	T_{lead}	0.063" from case (1.6 mm) for 10 s		-	-	300	$^\circ\text{C}$
Thermal resistance, junction to case	R_{thJC}			-	-	1.7	K/W
Thermal resistance, junction to ambient	R_{thJA}	Typical socket mount		-	-	40	
Thermal resistance, case to heatsink	R_{thCS}	Mounting surface, flat, smooth and greased		-	0.25	-	
Weight				-	6.0	-	g
				-	0.21	-	oz.
Mounting torque				6.0 (5.0)	-	12 (10)	$\text{kgf} \cdot \text{cm}$ (lbf · in)
Marking device		Case style TO-247AC modified (JEDEC)		HFA15PB60			



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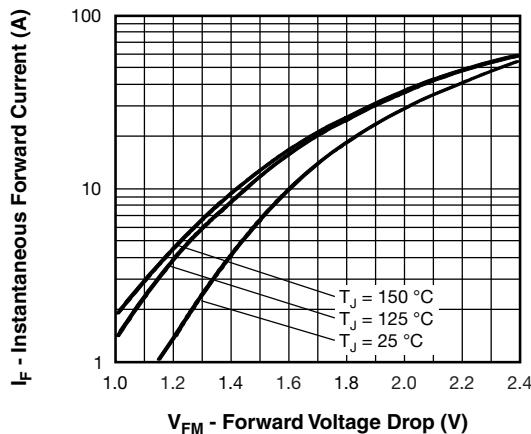


Fig. 1 - Maximum Forward Voltage Drop vs.
Instantaneous Forward Current

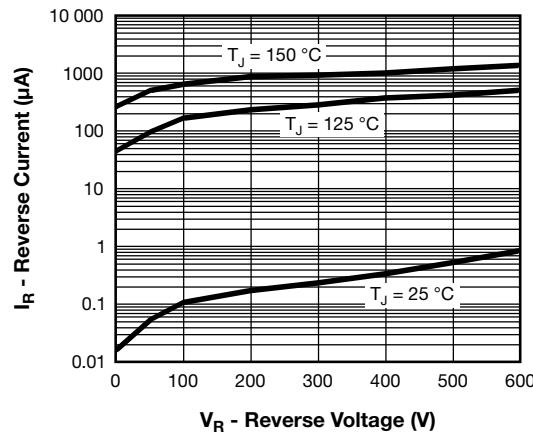


Fig. 2 - Typical Reverse Current vs. Reverse Voltage

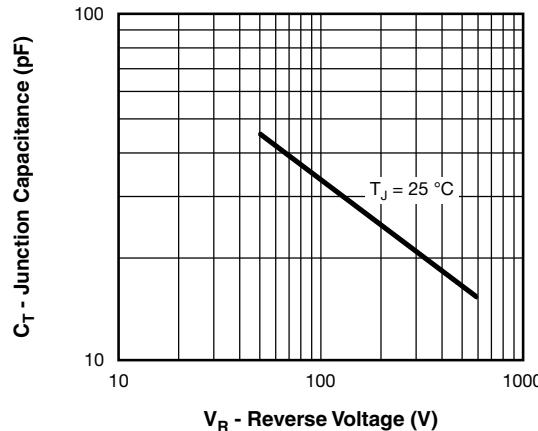


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

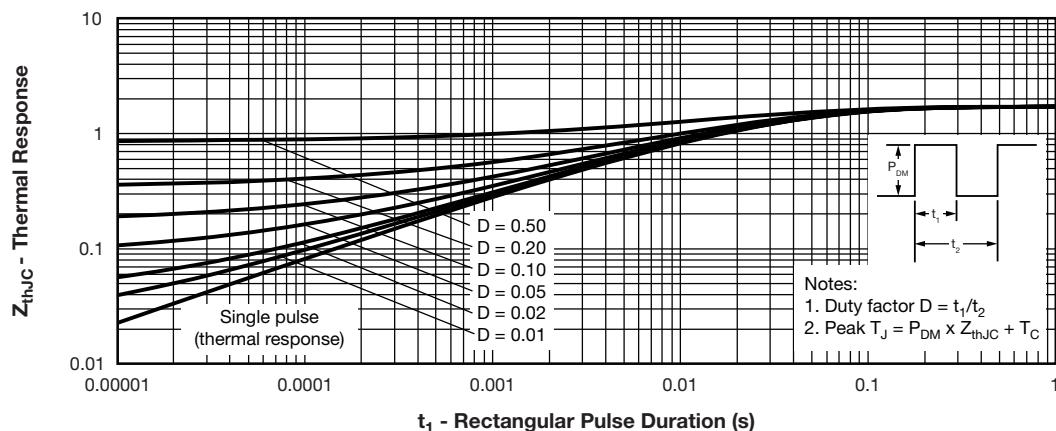


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics



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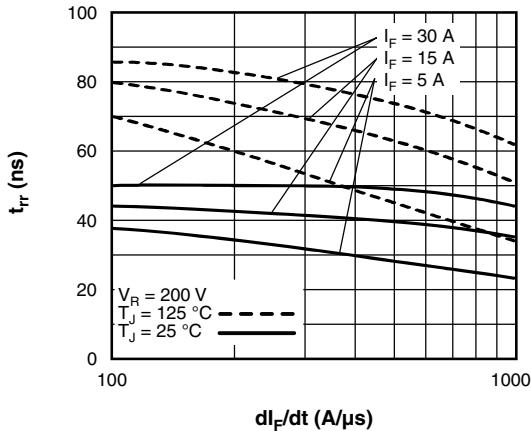


Fig. 5 - Typical Reverse Recovery Time vs. dI_F/dt

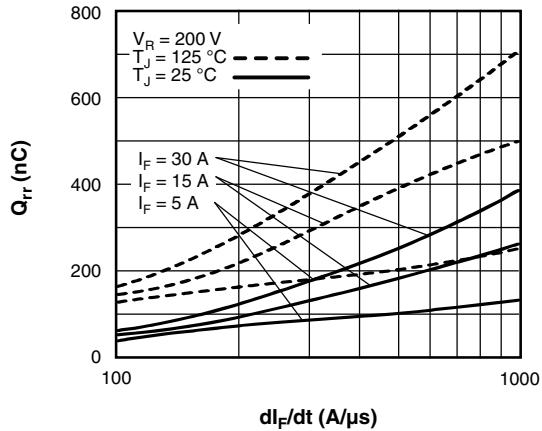


Fig. 7 - Typical Stored Charge vs. dI_F/dt

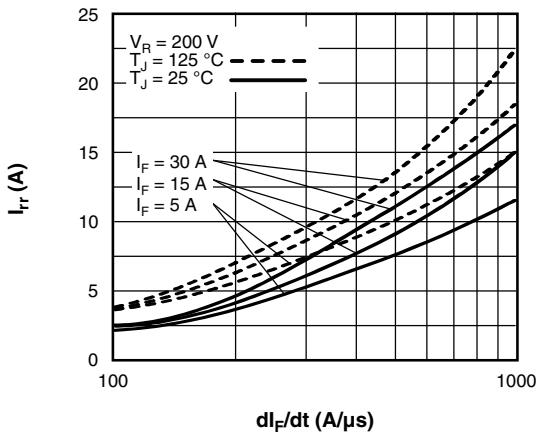


Fig. 6 - Typical Recovery Current vs. dI_F/dt

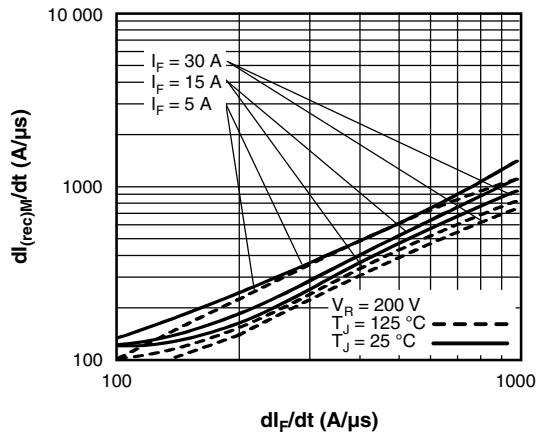


Fig. 8 - Typical $dI_{(rec)M}/dt$ vs. dI_F/dt

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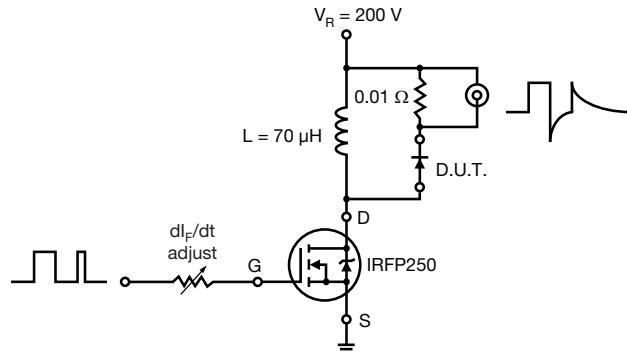
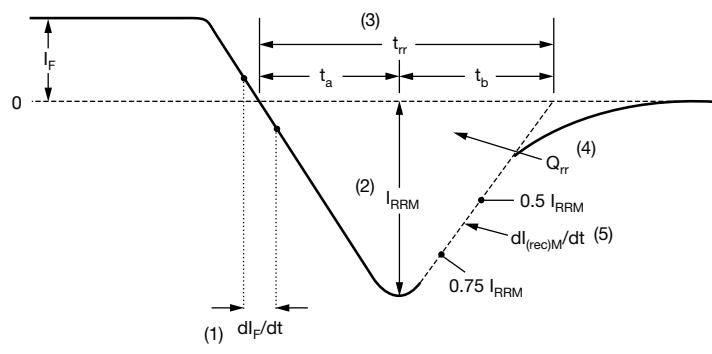


Fig. 9 - Reverse Recovery Parameter Test Circuit



(1) dl_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) $dl_{(rec)M}/dt$ - peak rate of change of current during t_b portion of t_{rr}

Fig. 10 - Reverse Recovery Waveform and Definitions



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ORDERING INFORMATION TABLE

Device code	VS-	HF	A	15	PB	60	PbF
	1	2	3	4	5	6	7

1	- Vishay Semiconductors product
2	- HEXFRED® family
3	- Electron irradiated
4	- Current rating (15 = 15 A)
5	- PB = TO-247AC modified
6	- Voltage rating: (60 = 600 V)
7	<p>- Environmental digit: PbF = lead (Pb)-free and RoHS-compliant -N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free</p>

ORDERING INFORMATION (Example)

PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-HFA15PB60PbF	25	500	Antistatic plastic tube
VS-HFA15PB60-N3	25	500	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS

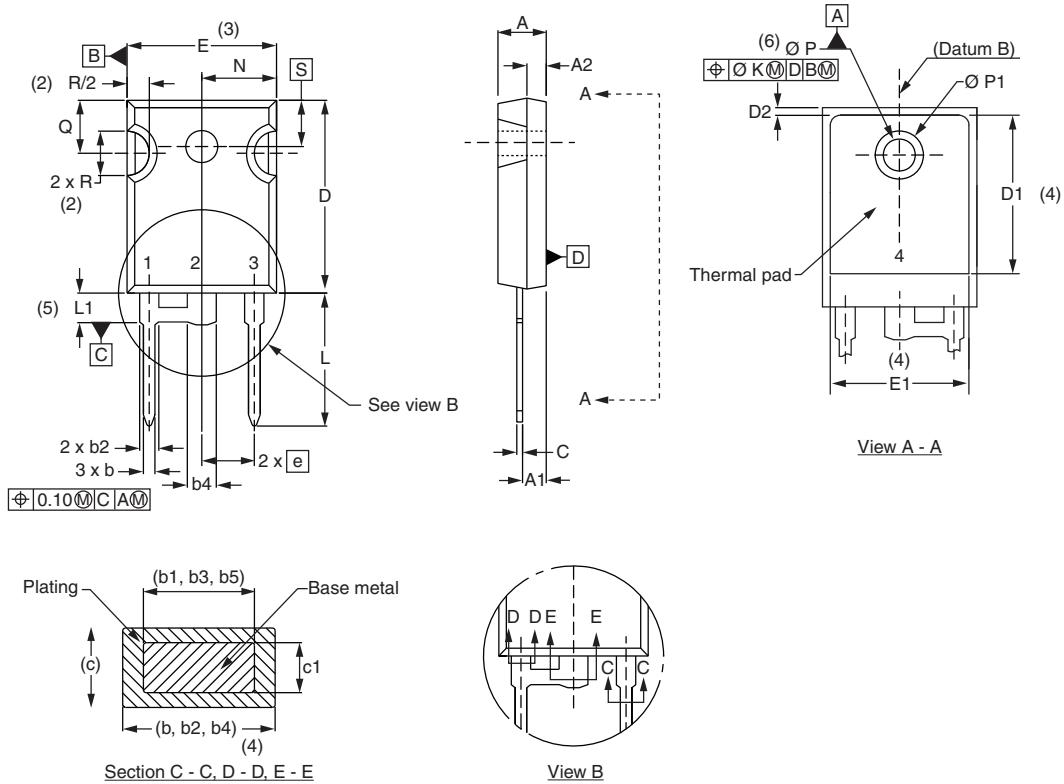
Dimensions	www.vishay.com/doc?95541
Part marking information	www.vishay.com/doc?95225
	www.vishay.com/doc?95442

Outline Dimensions

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TO-247 - 50 mils L/F modified

DIMENSIONS in millimeters and inches



Symbol	Millimeters		Inches		Notes	Symbol	Millimeters		Inches		Notes
	Min.	Max.	Min.	Max.			Min.	Max.	Min.	Max.	
A	4.65	5.31	0.183	0.209		D2	0.51	1.35	0.020	0.053	
A1	2.21	2.59	0.087	0.102		E	15.29	15.87	0.602	0.625	3
A2	1.17	1.37	0.046	0.054		E1	13.46	-	0.53	-	
b	0.99	1.40	0.039	0.055		e	5.46 BSC		0.215 BSC		
b1	0.99	1.35	0.039	0.053		Ø K	0.254		0.010		
b2	1.65	2.39	0.065	0.094		L	14.20	16.10	0.559	0.634	
b3	1.65	2.34	0.065	0.092		L1	3.71	4.29	0.146	0.169	
b4	2.59	3.43	0.102	0.135		N	7.62 BSC		0.3		
b5	2.59	3.38	0.102	0.133		Ø P	3.56	3.66	0.14	0.144	
c	0.38	0.89	0.015	0.035		Ø P1	-	7.39	-	0.291	
c1	0.38	0.84	0.015	0.033		Q	5.31	5.69	0.209	0.224	
D	19.71	20.70	0.776	0.815	3	R	4.52	5.49	0.178	0.216	
D1	13.08	-	0.515	-	4	S	5.51 BSC		0.217 BSC		

Notes

Notes

- (1) Dimensioning and tolerance per ASME Y14.5M-1994
- (2) Contour of slot optional
- (3) Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Thermal pad contour optional with dimensions D1 and E1
- (5) Lead finish uncontrolled in L1
- (6) Ø P to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- (7) Outline conforms to JEDEC® outline TO-247 with exception of dimension c and Q



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