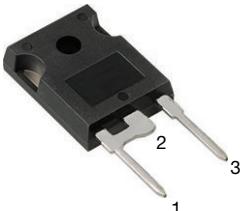
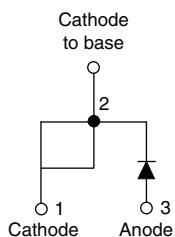


## HEXFRED®

### Ultrafast Soft Recovery Diode, 16 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](http://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-HFA16PB120... 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 1200 V and 16 A continuous current, the VS-HFA16PB120... 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-HFA16PB120... 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.

<b>PRODUCT SUMMARY</b>	
Package	TO-247AC modified (2 pins)
$I_{F(AV)}$	16 A
$V_R$	1200 V
$V_F$ at $I_F$	2.3 V
$t_{rr}$ typ.	30 ns
$T_J$ max.	150 °C
Diode variation	Single die

<b>ABSOLUTE MAXIMUM RATINGS</b>				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	$V_R$		1200	V
Maximum continuous forward current	$I_F$	$T_C = 100$ °C	16	A
Single pulse forward current	$I_{FSM}$		190	
Maximum repetitive forward current	$I_{FRM}$		64	
Maximum power dissipation	$P_D$	$T_C = 25$ °C	151	W
		$T_C = 100$ °C	60	
Operating junction and storage temperature range	$T_J, T_{Stg}$		-55 to +150	°C

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_J = 25^\circ\text{C}$ unless otherwise specified)								
PARAMETER	SYMBOL	TEST CONDITIONS			MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	$V_{BR}$	$I_R = 100 \mu\text{A}$			1200	-	-	V
Maximum forward voltage	$V_{FM}$	$I_F = 16 \text{ A}$	See fig. 1		-	2.5	3.0	
		$I_F = 32 \text{ A}$			-	3.2	3.93	
		$I_F = 16 \text{ A}, T_J = 125^\circ\text{C}$			-	2.3	2.7	
Maximum reverse leakage current	$I_{RM}$	$V_R = V_R \text{ rated}$	See fig. 2		-	0.75	20	$\mu\text{A}$
		$T_J = 125^\circ\text{C}, V_R = 0.8 \times V_R \text{ rated}$			-	375	2000	
Junction capacitance	$C_T$	$V_R = 200 \text{ V}$	See fig. 3		-	27	40	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body			-	8.0	-	nH

<b>DYNAMIC RECOVERY CHARACTERISTICS</b> ( $T_J = 25^\circ\text{C}$ unless otherwise specified)								
PARAMETER	SYMBOL	TEST CONDITIONS			MIN.	TYP.	MAX.	UNITS
Reverse recovery time See fig. 5, 10	$t_{rr}$	$I_F = 1.0 \text{ A}, dI_F/dt = 200 \text{ A}/\mu\text{s}, V_R = 30 \text{ V}$			-	30	-	ns
	$t_{rr1}$	$T_J = 25^\circ\text{C}$	$I_F = 16 \text{ A}$ $dI_F/dt = 200 \text{ A}/\mu\text{s}$ $V_R = 200 \text{ V}$		-	90	135	
	$t_{rr2}$	$T_J = 125^\circ\text{C}$			-	164	245	
Peak recovery current See fig. 6	$I_{RRM1}$	$T_J = 25^\circ\text{C}$			-	5.8	10	A
	$I_{RRM2}$	$T_J = 125^\circ\text{C}$			-	8.3	15	
Reverse recovery charge See fig. 7	$Q_{rr1}$	$T_J = 25^\circ\text{C}$			-	260	675	nC
	$Q_{rr2}$	$T_J = 125^\circ\text{C}$			-	680	1838	
Peak rate of fall of recovery current during $t_b$ See fig. 8	$dI_{(rec)M}/dt1$	$T_J = 25^\circ\text{C}$			-	120	-	$\text{A}/\mu\text{s}$
	$dI_{(rec)M}/dt2$	$T_J = 125^\circ\text{C}$			-	76	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>								
PARAMETER	SYMBOL	TEST CONDITIONS			MIN.	TYP.	MAX.	UNITS
Lead temperature	$T_{\text{lead}}$	0.063" from case (1.6 mm) for 10 s			-	-	300	$^\circ\text{C}$
Thermal resistance, junction to case	$R_{\text{thJC}}$				-	-	0.83	K/W
Thermal resistance, junction to ambient	$R_{\text{thJA}}$	Typical socket mount			-	-	80	
Thermal resistance, case to heatsink	$R_{\text{thCS}}$	Mounting surface, flat, smooth and greased			-	0.50	-	
Weight					-	2.0	-	g
					-	0.07	-	oz.
Mounting torque					6.0 (5.0)	-	12 (10)	$\text{kgf} \cdot \text{cm}$ (lbf · in)
Marking device		Case style TO-247AC modified (JEDEC)			HFA16PB120			

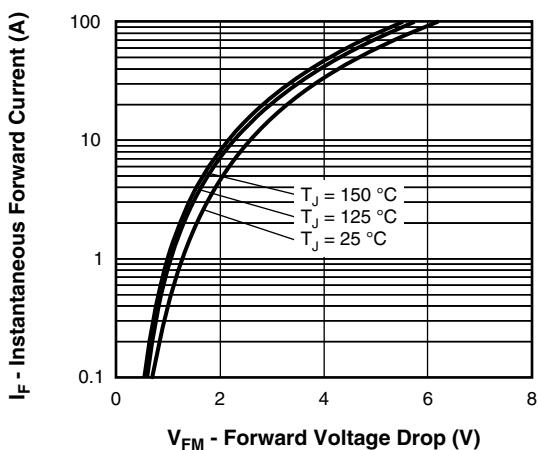


Fig. 1 - Maximum Forward Voltage Drop vs.  
Instantaneous Forward Current

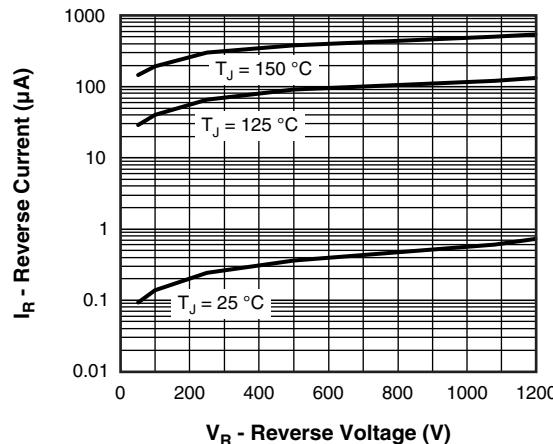


Fig. 2 - Typical Values of Reverse Current vs.  
Reverse Voltage

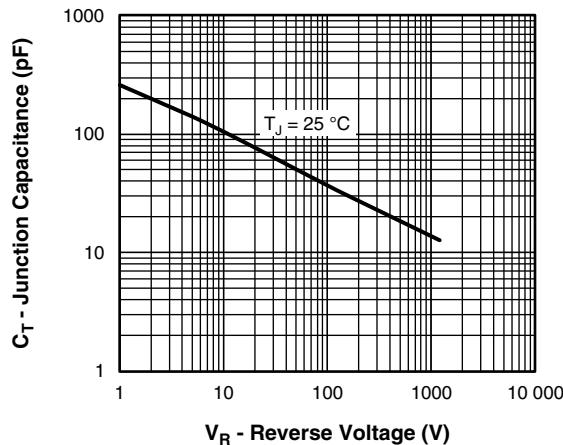


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

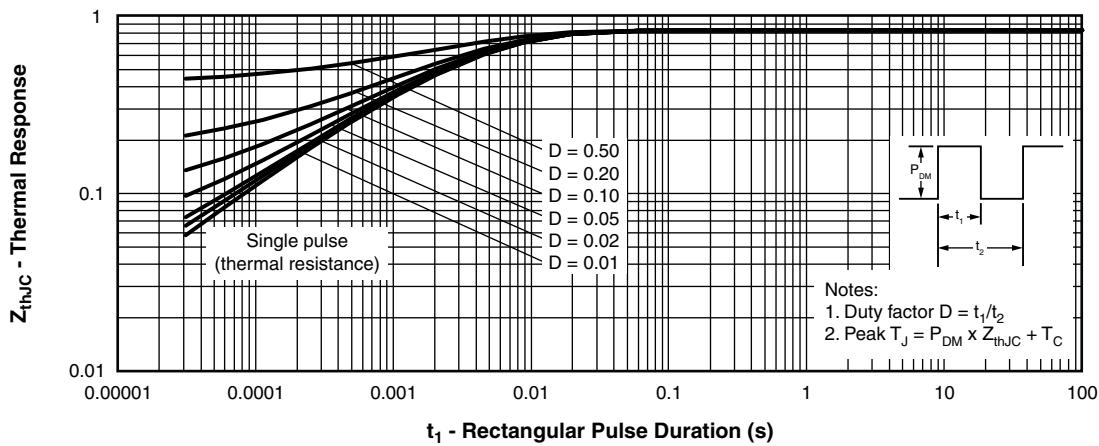


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

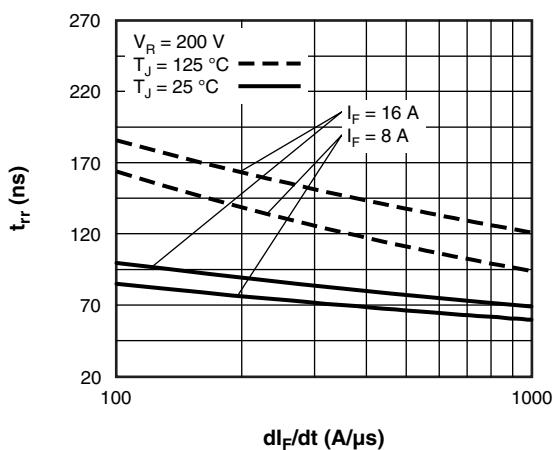


Fig. 5 - Typical Reverse Recovery Time vs.  
 $dI_F/dt$  (Per Leg)

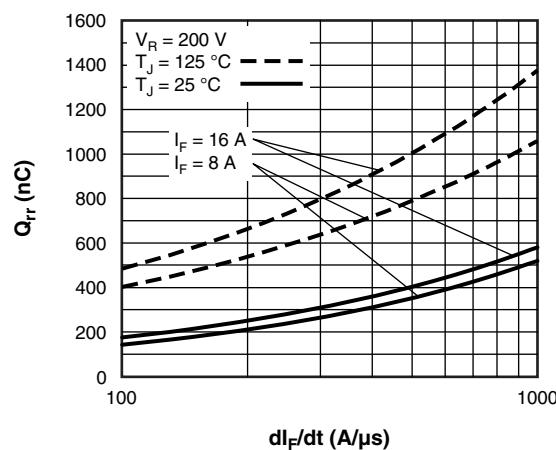


Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$  (Per Leg)

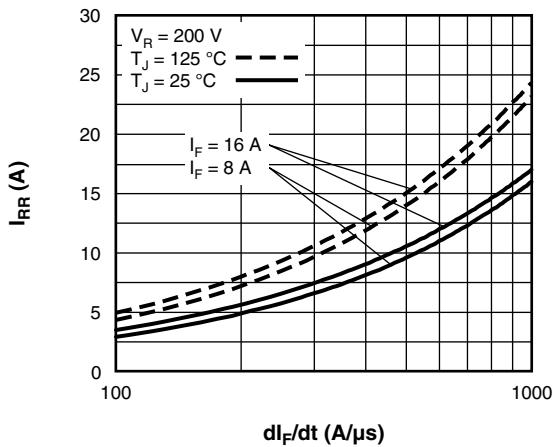


Fig. 6 - Typical Recovery Current vs.  $dI_F/dt$  (Per Leg)

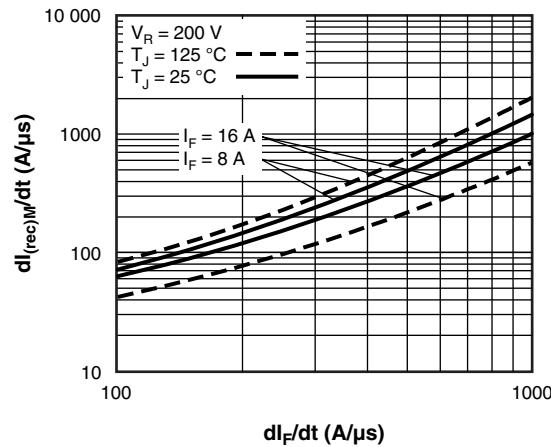


Fig. 8 - Typical  $dI_{rr}/dt$  vs.  $dI_F/dt$  (Per Leg)

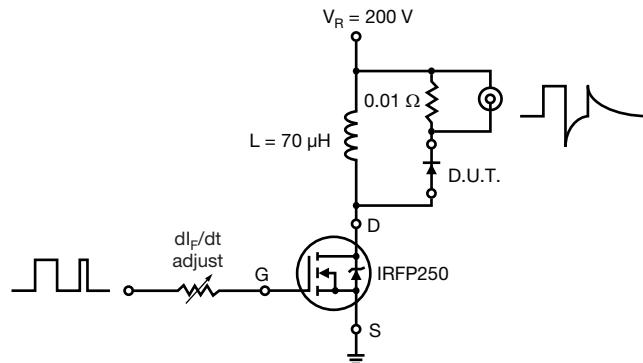
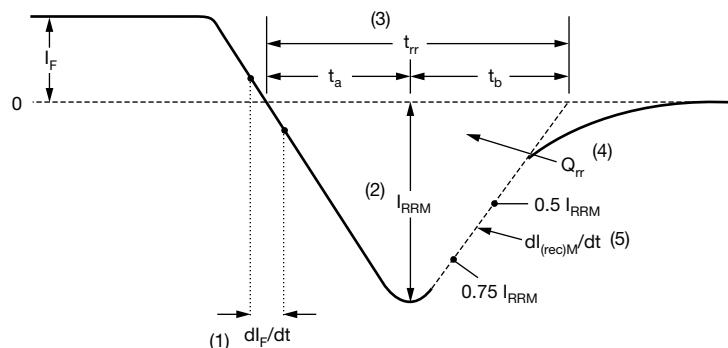


Fig. 9 - Reverse Recovery Parameter Test Circuit



(1)  $dl_F/dt$  - rate of change of current through zero crossing

(4)  $Q_{rr}$  - area under curve defined by  $t_{rr}$  and  $I_{RRM}$

(2)  $I_{RRM}$  - peak reverse recovery current

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

(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.

(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

## ORDERING INFORMATION TABLE

Device code	VS-	HF	A	16	PB	120	PbF
	1	2	3	4	5	6	7

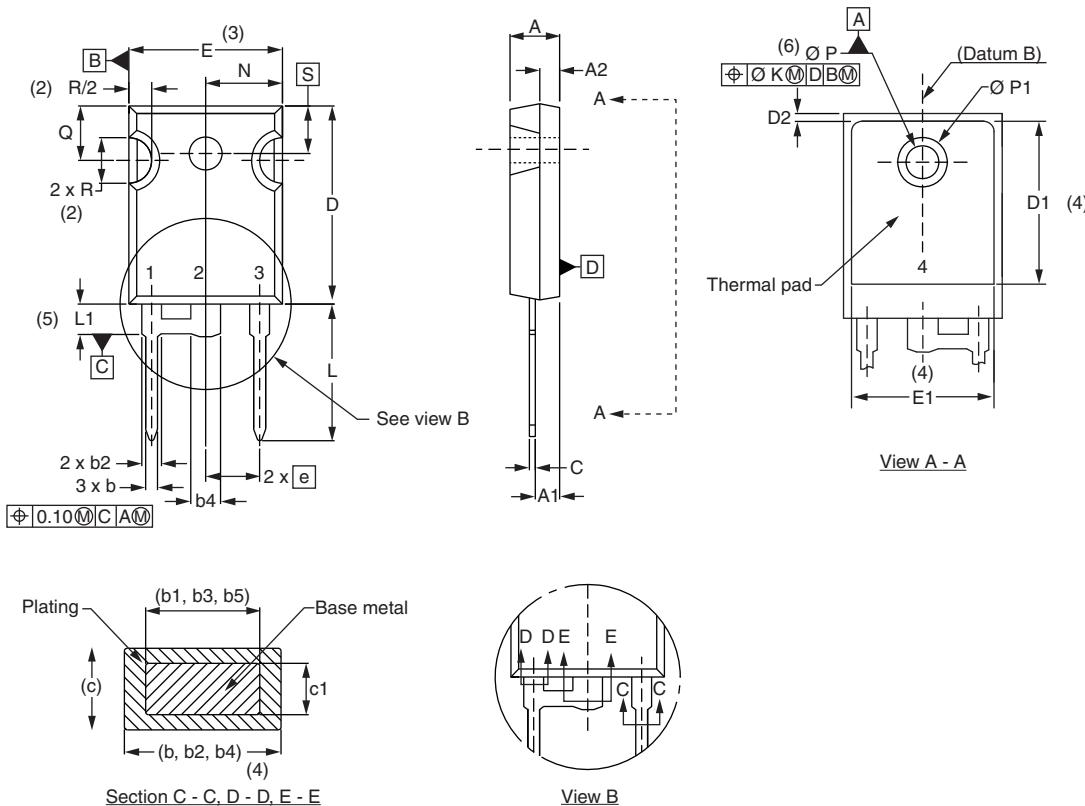
1	- Vishay Semiconductors product
2	- HEXFRED® family
3	- Electron irradiated
4	- Current rating (16 = 16 A)
5	- PB = TO-247AC modified
6	- Voltage rating: (120 = 1200 V)
7	- Environmental digit: PbF = lead (Pb)-free and RoHS-compliant -N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-HFA16PB120PbF	25	500	Antistatic plastic tube
VS-HFA16PB120-N3	25	500	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95541">www.vishay.com/doc?95541</a>
Part marking information	<a href="http://www.vishay.com/doc?95255">www.vishay.com/doc?95255</a>
	<a href="http://www.vishay.com/doc?95442">www.vishay.com/doc?95442</a>

## TO-247 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	1.30	0.020	0.051	
A1	2.21	2.59	0.087	0.102			E	15.29	15.87	0.602	0.625	3
A2	1.50	2.49	0.059	0.098			E1	13.72	-	0.540	-	
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	2.54		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	-	6.98	-	0.275	
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

- (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

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