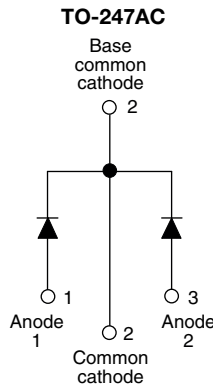
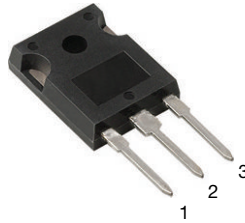


## HEXFRED® Ultrafast Soft Recovery Diode, 2 x 8 A



PRODUCT SUMMARY	
Package	TO-247AC
$I_{F(AV)}$	2 x 8 A
$V_R$	600 V
$V_F$ at $I_F$	1.4 V
$t_{rr}$ typ.	18 ns
$T_J$ max.	150 °C
Diode variation	Common cathode

### 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)



### BENEFITS

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

### DESCRIPTION

VS-HFA16PA60C... is a state of the art center tap 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 8 A per leg continuous current, the VS-HFA16PA60C... 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-HFA16PA60C... 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.

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Cathode to anode voltage	$V_R$		600	V
Maximum continuous forward current	$I_F$	$T_C = 100\text{ °C}$	per leg	8
			per device	16
Single pulse forward current	$I_{FSM}$		60	A
Maximum repetitive forward current	$I_{FRM}$		24	
Maximum power dissipation	$P_D$	$T_C = 25\text{ °C}$	36	
		$T_C = 100\text{ °C}$	14	
Operating junction and storage temperature range	$T_J, T_{Stg}$		-55 to +150	°C



<b>ELECTRICAL SPECIFICATIONS PER LEG</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	$V_{BR}$	$I_R = 100\text{ }\mu\text{A}$	600	-	-	V
Maximum forward voltage	$V_{FM}$	$I_F = 8.0\text{ A}$	-	1.4	1.7	
		$I_F = 16\text{ A}$	-	1.7	2.1	
		$I_F = 8.0\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	1.4	1.7	
Maximum reverse leakage current	$I_{RM}$	$V_R = V_R\text{ rated}$	-	0.3	5.0	$\mu\text{A}$
		$T_J = 125\text{ }^\circ\text{C}, V_R = 0.8 \times V_R\text{ rated}$	-	100	500	
Junction capacitance	$C_T$	$V_R = 200\text{ V}$	-	10	25	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8.0	-	nH

<b>DYNAMIC RECOVERY CHARACTERISTICS PER LEG</b> ( $T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time See fig. 5, 6 and 16	$t_{rr}$	$I_F = 1.0\text{ A}, di_F/dt = 200\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	-	18	-	ns
	$t_{rr1}$	$T_J = 25\text{ }^\circ\text{C}$	-	37	55	
	$t_{rr2}$	$T_J = 125\text{ }^\circ\text{C}$	-	55	90	
Peak recovery current See fig. 7 and 8	$I_{RRM1}$	$T_J = 25\text{ }^\circ\text{C}$	-	3.5	5.0	A
	$I_{RRM2}$	$T_J = 125\text{ }^\circ\text{C}$	-	4.5	8.0	
Reverse recovery charge See fig. 9 and 10	$Q_{rr1}$	$T_J = 25\text{ }^\circ\text{C}$	-	65	138	nC
	$Q_{rr2}$	$T_J = 125\text{ }^\circ\text{C}$	-	124	360	
Peak rate of fall recovery current during $t_b$ See fig. 11 and 12	$dI_{(rec)M}/dt1$	$T_J = 25\text{ }^\circ\text{C}$	-	240	-	$\text{A}/\mu\text{s}$
	$dI_{(rec)M}/dt2$	$T_J = 125\text{ }^\circ\text{C}$	-	210	-	

<b>THERMAL - MECHANICAL SPECIFICATIONS</b>						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Lead temperature	$T_{lead}$	0.063" from case (1.6 mm) for 10 s	-	-	300	$^\circ\text{C}$
Junction to case, single leg conducting	$R_{thJC}$		-	-	3.5	K/W
Junction to case, both leg conducting			-	-	1.75	
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)	kgf · cm (lbf · in)
Marking device		Case style TO-247AC (JEDEC)	HFA16PA60C			

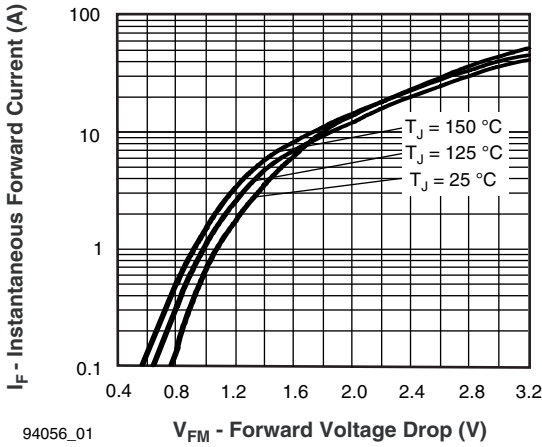


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

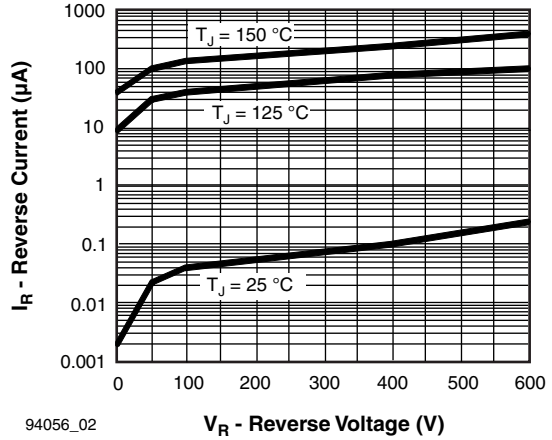


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

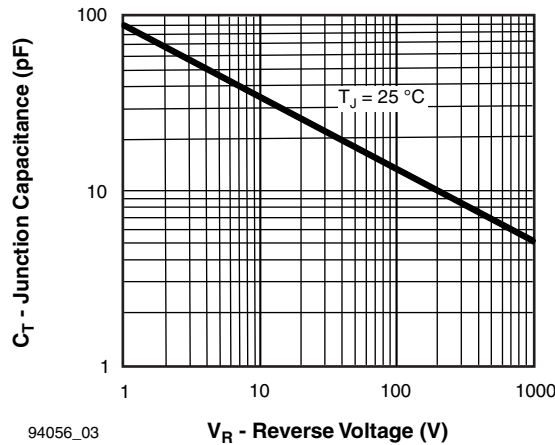


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

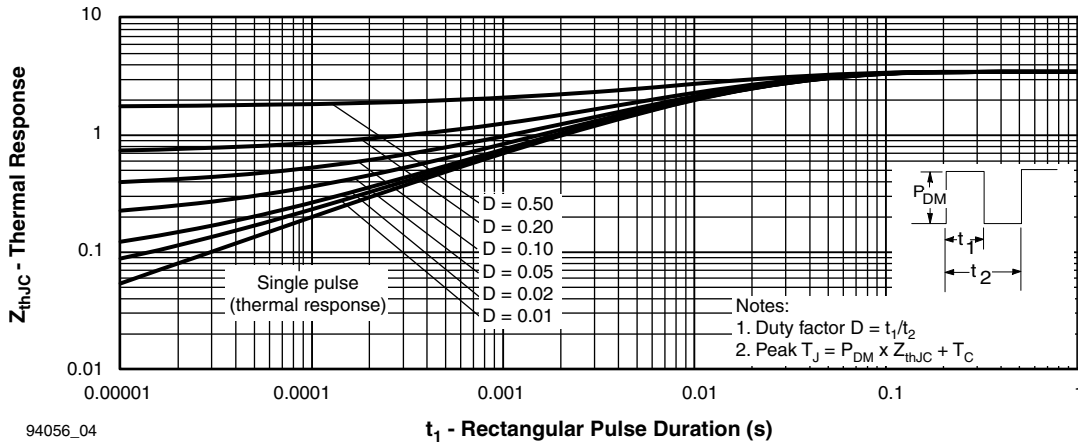
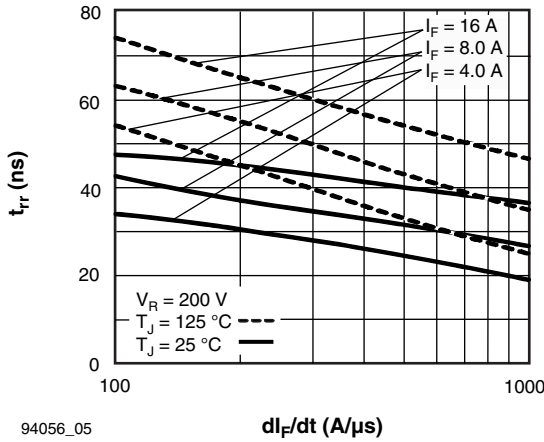
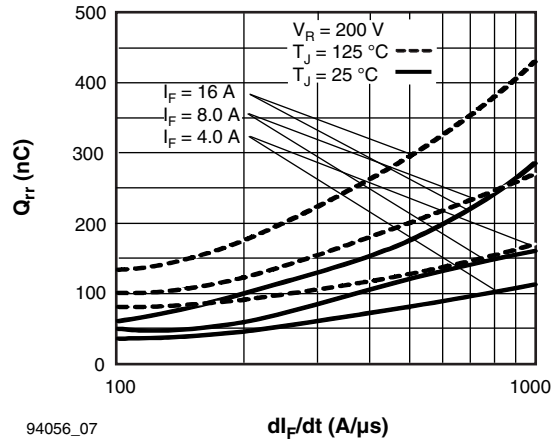


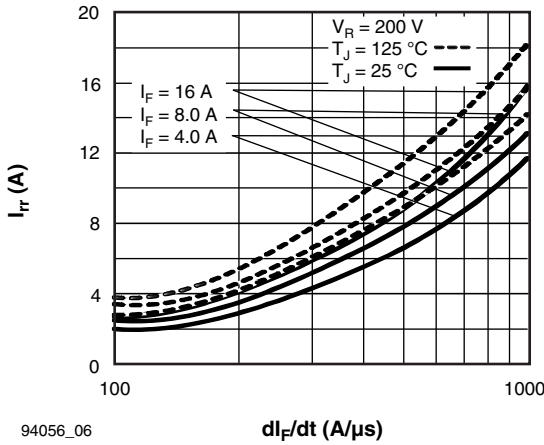
Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)



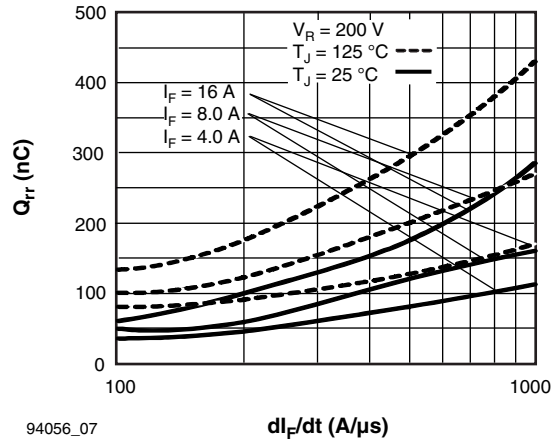
94056\_05  
Fig. 5 - Typical Reverse Recovery Time vs.  $di_F/dt$  (Per Leg)



94056\_07  
Fig. 7 - Typical Stored Charge vs.  $di_F/dt$  (Per Leg)



94056\_06  
Fig. 6 - Typical Recovery Current vs.  $di_F/dt$  (Per Leg)



94056\_07  
Fig. 8 - Typical  $di_{(rec)M}/dt$  vs.  $di_F/dt$  (Per Leg)

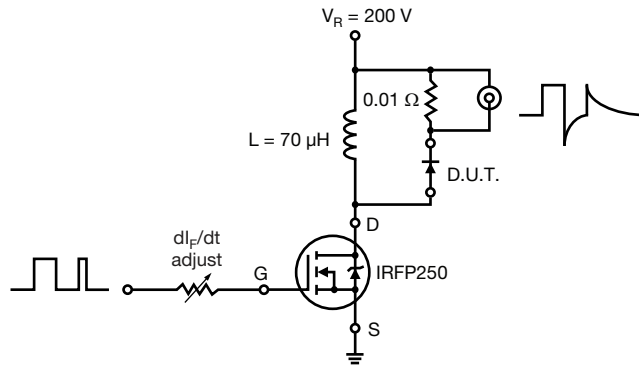
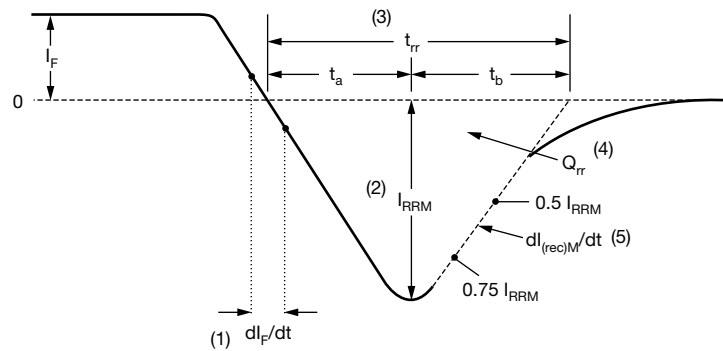


Fig. 9 - Reverse Recovery Parameter Test Circuit



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

(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

### ORDERING INFORMATION TABLE

Device code	<b>VS-</b>	<b>HF</b>	<b>A</b>	<b>16</b>	<b>PA</b>	<b>60</b>	<b>C</b>	<b>PbF</b>
	①	②	③	④	⑤	⑥	⑦	⑧

- 1** - Vishay Semiconductors product
- 2** - HEXFRED® family
- 3** - Electron irradiated
- 4** - Current rating (16 = 16 A)
- 5** - PA = TO-247AC
- 6** - Voltage rating: (60 = 600 V)
- 7** - Circuit configuration  
C = Common cathode
- 8** - Environmental digit:  
PbF = lead (Pb)-free and RoHS-compliant  
-N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free

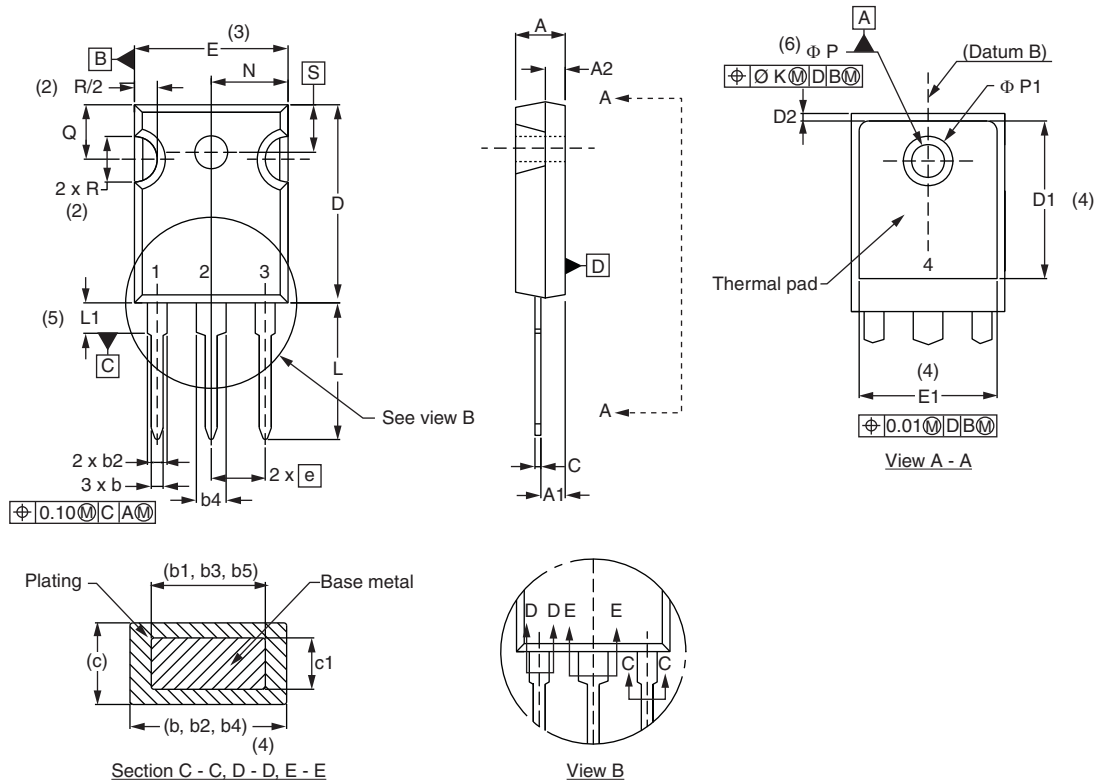
ORDERING INFORMATION (Example)			
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-HFA16PA60CPbF	25	500	Antistatic plastic tube
VS-HFA16PA60C-N3	25	500	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS		
Dimensions		<a href="http://www.vishay.com/doc?95542">www.vishay.com/doc?95542</a>
Part marking information	TO-247ACPbF	<a href="http://www.vishay.com/doc?95226">www.vishay.com/doc?95226</a>
	TO-247AC-N3	<a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a>



# TO-247 - 50 mils L/F

**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		$\phi K$	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		$\phi P$	3.56	3.66	0.14	0.144	
c	0.38	0.89	0.015	0.035		$\phi P1$	-	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**

- (1) Dimensioning and tolerancing 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)  $\phi P$  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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