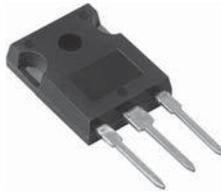
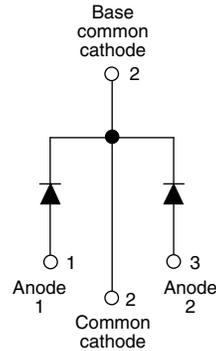


## HEXFRED®

### Ultrafast Soft Recovery Diode, 2 x 25 A


**TO-247AC**

**FEATURES**

- Ultrafast and ultrasoft recovery
- Very low  $I_{RRM}$  and  $Q_{rr}$
- Compliant to RoHS Directive 2002/95/EC
- Designed and qualified for industrial level


**RoHS**  
COMPLIANT

**BENEFITS**

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

**DESCRIPTION**

VS-HFA50PA60CPbF 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 25 A per leg continuous current, the VS-HFA50PA60CPbF 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-HFA50PA60CPbF 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
$I_{F(AV)}$	2 x 25 A
$V_R$	600 V
$V_F$ at $I_F$	1.7 V
$t_{rr}$ (typ.)	23 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	$I_F$	$T_C = 100\text{ °C}$	per leg	25
			per device	50
Single pulse forward current	$I_{FSM}$		225	A
Maximum repetitive forward current	$I_{FRM}$		100	
Maximum power dissipation	$P_D$	$T_C = 25\text{ °C}$	150	W
		$T_C = 100\text{ °C}$	60	
Operating junction and storage temperature range	$T_J, T_{Stg}$		- 55 to + 150	°C

ELECTRICAL SPECIFICATIONS PER LEG (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Cathode to anode breakdown voltage	V <sub>BR</sub>	I <sub>R</sub> = 100 μA	600	-	-	V
Maximum forward voltage	V <sub>FM</sub>	I <sub>F</sub> = 25 A	-	1.3	1.7	
		I <sub>F</sub> = 50 A	-	1.5	2.0	
		I <sub>F</sub> = 25 A, T <sub>J</sub> = 125 °C	-	1.3	1.7	
Maximum reverse leakage current	I <sub>RM</sub>	V <sub>R</sub> = V <sub>R</sub> rated	-	1.5	20	μA
		T <sub>J</sub> = 125 °C, V <sub>R</sub> = 0.8 x V <sub>R</sub> rated	-	600	2000	
Junction capacitance	C <sub>T</sub>	V <sub>R</sub> = 200 V	-	55	100	pF
Series inductance	L <sub>S</sub>	Measured lead to lead 5 mm from package body	-	12	-	nH

DYNAMIC RECOVERY CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time See fig. 5, 10	t <sub>rr</sub>	I <sub>F</sub> = 1.0 A, di <sub>F</sub> /dt = 200 A/μs, V <sub>R</sub> = 30 V	-	23	-	ns
	t <sub>rr1</sub>	T <sub>J</sub> = 25 °C	-	50	75	
	t <sub>rr2</sub>	T <sub>J</sub> = 125 °C	-	105	160	
Peak recovery current See fig. 6	I <sub>RRM1</sub>	T <sub>J</sub> = 25 °C	-	4.5	10	A
	I <sub>RRM2</sub>	T <sub>J</sub> = 125 °C	-	8.0	15	
Reverse recovery charge See fig. 7	Q <sub>rr1</sub>	T <sub>J</sub> = 25 °C	-	112	375	nC
	Q <sub>rr2</sub>	T <sub>J</sub> = 125 °C	-	420	1200	
Peak rate of fall of recovery current during t <sub>b</sub> See fig. 8	di <sub>(rec)M</sub> /dt1	T <sub>J</sub> = 25 °C	-	250	-	A/μs
	di <sub>(rec)M</sub> /dt2	T <sub>J</sub> = 125 °C	-	160	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Lead temperature	T <sub>lead</sub>	0.063" from case (1.6 mm) for 10 s	-	-	300	°C
Junction to case, single leg conducting	R <sub>thJC</sub>		-	-	0.83	K/W
Junction to case, both legs conducting			-	-	0.42	
Thermal resistance, junction to ambient	R <sub>thJA</sub>	Typical socket mount	-	-	40	
Thermal resistance, case to heatsink	R <sub>thCS</sub>	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	HFA50PA60C			

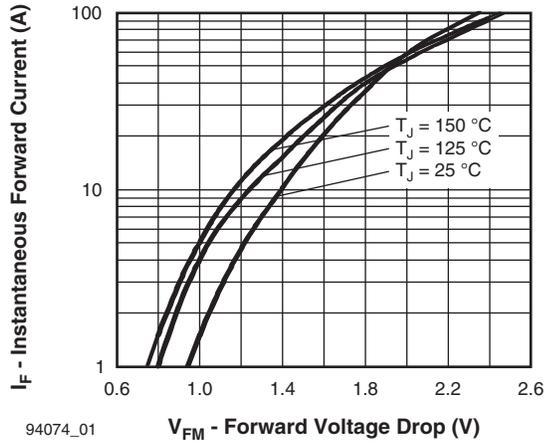


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

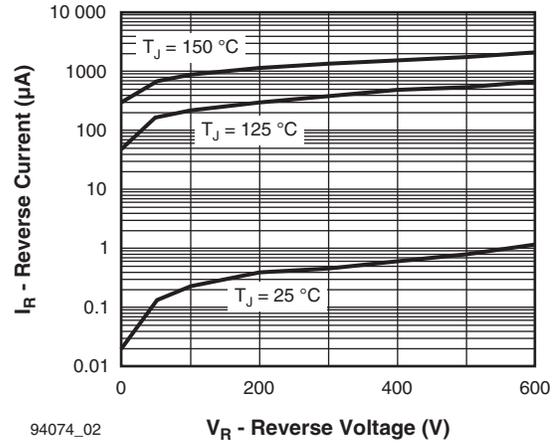


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

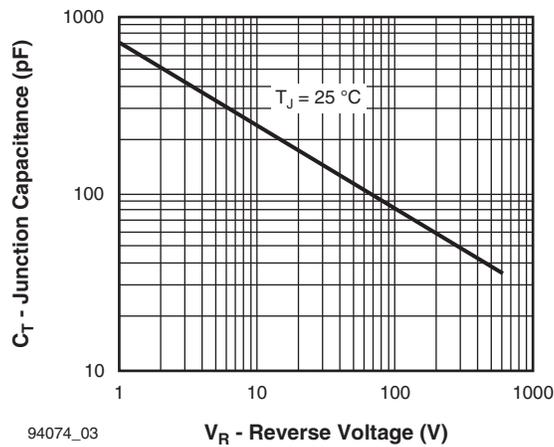
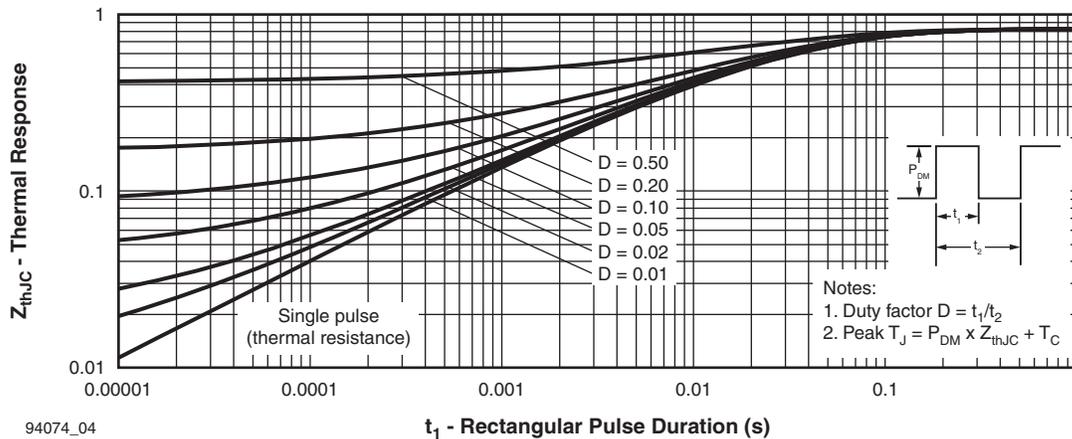
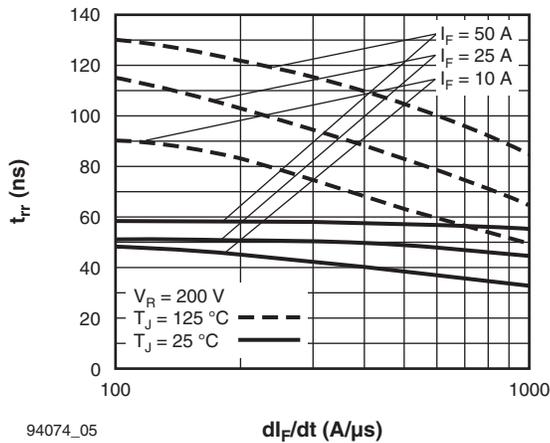


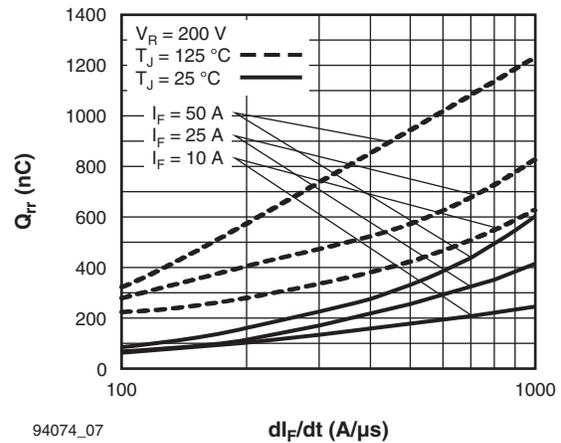
Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)


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



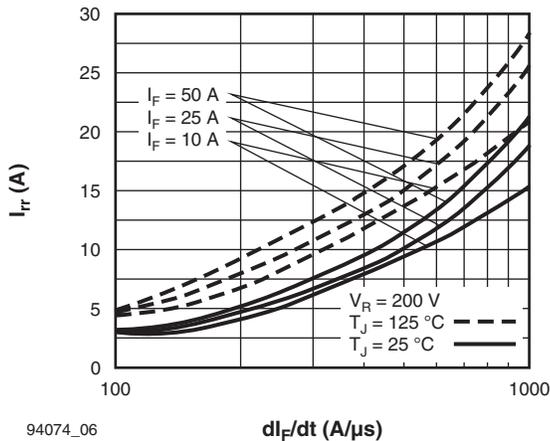
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Fig. 5 - Typical Reverse Recovery Time vs.  $dI_F/dt$  (Per Leg)



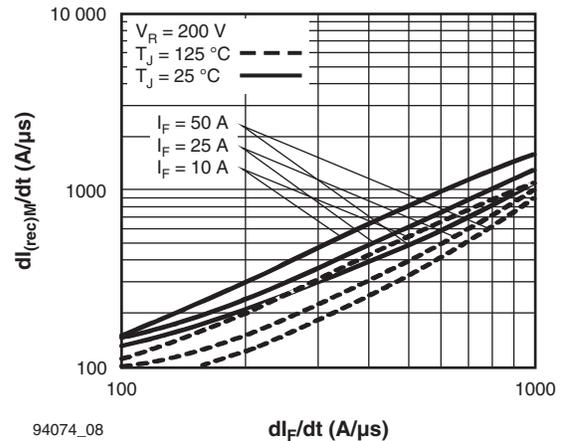
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Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$  (Per Leg)



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



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

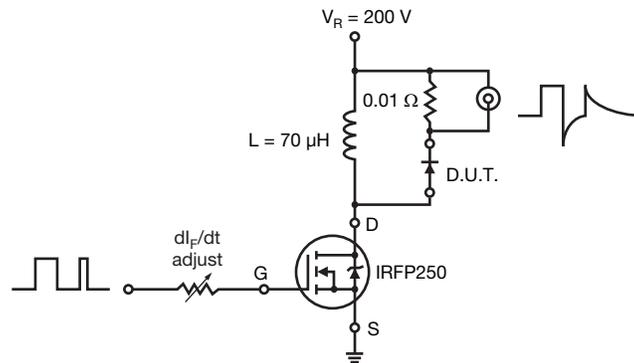
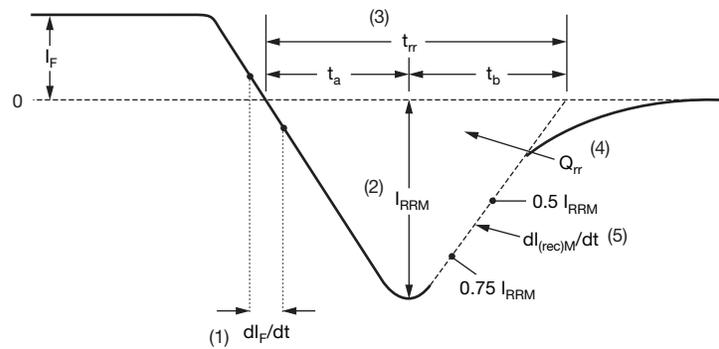


Fig. 9 - Reverse Recovery Parameter Test Circuit



(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

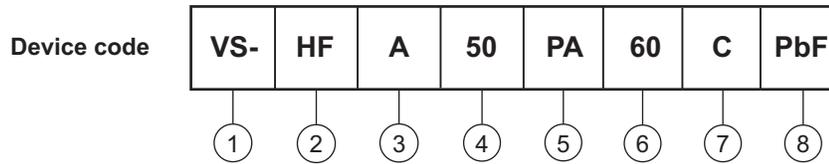
# VS-HFA50PA60CPbF

Vishay Semiconductors

HEXFRED®  
Ultrafast Soft Recovery Diode, 2 x 25 A



## ORDERING INFORMATION TABLE

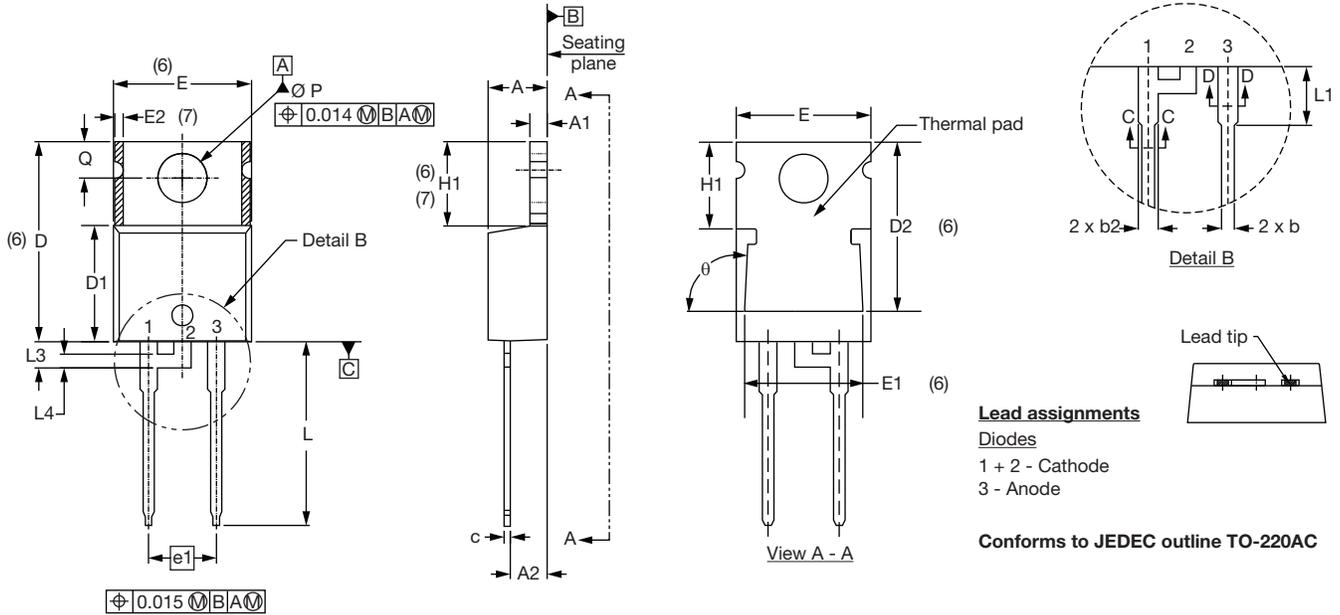


- 1** - Vishay Semiconductors product
- 2** - HEXFRED® family
- 3** - Electron irradiated
- 4** - Current rating (50 = 50 A)
- 5** - PA = TO-247AC
- 6** - Voltage rating: (60 = 600 V)
- 7** - Circuit configuration  
C = Common cathode
- 8** - PbF = Lead (Pb)-free

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95223">www.vishay.com/doc?95223</a>
Part marking information	<a href="http://www.vishay.com/doc?95226">www.vishay.com/doc?95226</a>

## TO-220AC

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.25	4.65	0.167	0.183		E1	6.86	8.89	0.270	0.350	6
A1	1.14	1.40	0.045	0.055		E2	-	0.76	-	0.030	7
A2	2.56	2.92	0.101	0.115		e	2.41	2.67	0.095	0.105	
b	0.69	1.01	0.027	0.040		e1	4.88	5.28	0.192	0.208	
b1	0.38	0.97	0.015	0.038	4	H1	6.09	6.48	0.240	0.255	6, 7
b2	1.20	1.73	0.047	0.068		L	13.52	14.02	0.532	0.552	
b3	1.14	1.73	0.045	0.068	4	L1	3.32	3.82	0.131	0.150	2
c	0.36	0.61	0.014	0.024		L3	1.78	2.13	0.070	0.084	
c1	0.36	0.56	0.014	0.022	4	L4	0.76	1.27	0.030	0.050	2
D	14.85	15.25	0.585	0.600	3	Ø P	3.54	3.73	0.139	0.147	
D1	8.38	9.02	0.330	0.355		Q	2.60	3.00	0.102	0.118	
D2	11.68	12.88	0.460	0.507	6	θ	90° to 93°		90° to 93°		
E	10.11	10.51	0.398	0.414	3, 6						

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1 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) Dimension b1, b3 and c1 apply to base metal only
- (5) Controlling dimension: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2 and E1
- (7) Dimension E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC TO-220, D2 (minimum) where dimensions are derived from the actual package outline





## Disclaimer

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