

VS-HFA04TB60PbF, VS-HFA04TB60-N3

Vishay Semiconductors

RoHS COMPLIANT

HALOGEN

FREE

HEXFRED® Ultrafast Soft Recovery Diode, 4 A



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Cathode		Anode

PRODUCT SUMMARY						
Package	TO-220AC					
I _{F(AV)}	4 A					
V _R	600 V					
V _F at I _F	1.4 V					
t _{rr} typ.	17 ns					
T _J max.	150 °C					
Diode variation	Single die					

FEATURES

· Ultrafast and ultrasoft recovery

Very low I_{RRM} and Q_{rr}

 Designed and qualified according JEDĚC®-JESD47

· Material categorization: for definitions of compliance please see 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-HFA04TB60... 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 4 A continuous current, the VS-HFA04TB60... 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-HFA04TB60... 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 °C	4				
Single pulse forward current	I _{FSM}		25	Α			
Maximum repetitive forward current	I _{FRM}		16				
Maximum naurar discination	В	T _C = 25 °C	25	10/			
Maximum power dissipation	P _D	T _C = 100 °C	10	W			
Operating junction and storage temperature range	T _J , T _{Stg}		-55 to +150	°C			



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ELECTRICAL SPECIFICATIONS (T _J = 25 °C unless otherwise specified)								
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNITS	
Cathode to anode breakdown voltage	V _{BR}	Ι _R = 100 μΑ		600	-	-		
	I _F = 4.0 A			-	1.5	1.8	V	
Maximum forward voltage	V_{FM}	I _F = 8.0 A	See fig. 1	-	1.8	2.2		
		I _F = 4.0 A, T _J = 125 °C		-	1.4	1.7		
Maximum reverse		V _R = V _R rated	Coo fig. 0	-	0.17	3.0		
leakage current	I _{RM}	T _J = 125 °C, V _R = 0.8 x V _R rated	See fig. 2	-	44	300	μΑ	
Junction capacitance	C _T	V _R = 200 V	See fig. 3	-	4.0	8.0	pF	
Series inductance	L _S	Measured lead to lead 5 mm from p	ackage body	-	8.0	-	nH	

DYNAMIC RECOVERY CHARACTERISTICS (T _J = 25 °C unless otherwise specified)								
PARAMETER	SYMBOL	TEST CO	NDITIONS	MIN.	TYP.	MAX.	UNITS	
	t _{rr}	$I_F = 1.0 \text{ A}, dI_F/dt = 200 \text{ A}$	A/μs, V _R = 30 V	-	17	-	ns	
Reverse recovery time See fig. 5, 6 and 16	t _{rr1}	T _J = 25 °C		-	28	42		
oos ng. o, o and ro	t _{rr2}	T _J = 125 °C		-	38	57		
Peak recovery current	I _{RRM1}	T _J = 25 °C	$I_F = 4 \text{ A}$ $dI_F/dt = 200 \text{ A/}\mu\text{s}$ $V_R = 200 \text{ V}$	-	2.9	5.2	A nC	
See fig. 7 and 8	I _{RRM2}	T _J = 125 °C		-	3.7	6.7		
Reverse recovery charge	Q _{rr1}	T _J = 25 °C		-	40	60		
See fig. 9 and 10	Q _{rr2}	T _J = 125 °C		-	70	105	iiC	
Peak rate of fall of recovery	dI _{(rec)M} /dt1	T _J = 25 °C		-	280	-	Λ/	
current during t _b See fig. 11 and 12	dI _{(rec)M} /dt2	T _J = 125 °C		-	235	-	- A/μs	

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	°C	
Thermal resistance, junction to case	R _{thJC}		-	-	5.0		
Thermal resistance, junction to ambient	R _{thA}	Typical socket mount	-	-	80	K/W	
Thermal resistance, case to heatsink	R _{thS}	Mounting surface, flat, smooth and greased	-	0.5	-		
Weight			-	2.0	-	g	
weignt			-	0.07	-	oz.	
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)	
Marking device		Case style TO-220AC	HFA04TB60				

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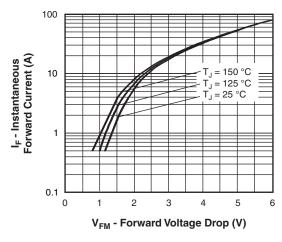


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current

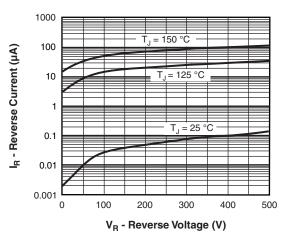


Fig. 2 - Typical Reverse Current vs. Reverse Voltage

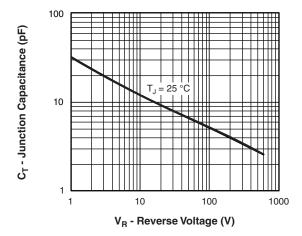


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

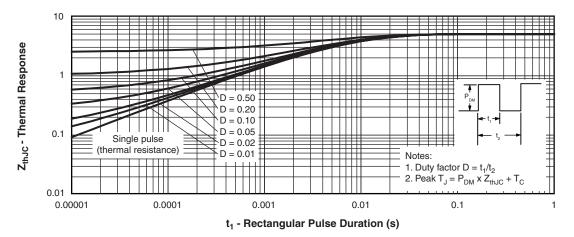


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

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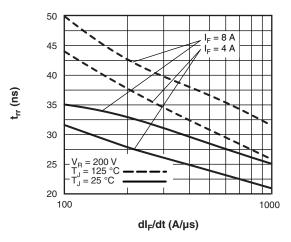


Fig. 5 - Typical Reverse Recovery Time vs. dl_E/dt

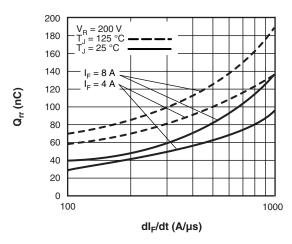


Fig. 7 - Typical Stored Charge vs. dl_F/dt

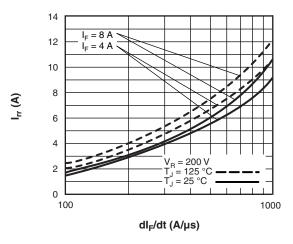


Fig. 6 - Typical Recovery Current vs. dl_F/dt

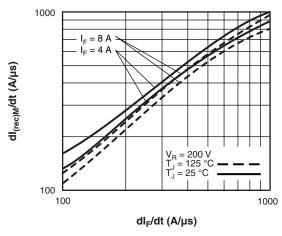


Fig. 8 - Typical $dI_{(rec)M}/dt$ vs. dI_F/dt

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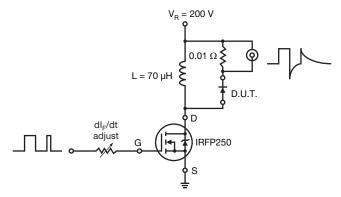
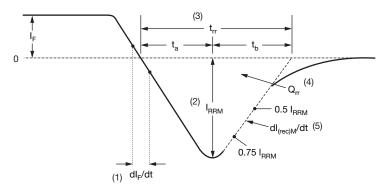


Fig. 9 - Reverse Recovery Parameter Test Circuit



- (1) dI_F/dt rate of change of current through zero crossing
- (2) I_{RRM} peak reverse recovery current
- (3) $\rm t_{rr}$ reverse recovery time measured from zero crossing point of negative going $\rm I_F$ to point where a line passing through 0.75 $\rm I_{RRM}$ and 0.50 $\rm I_{RRM}$ extrapolated to zero current.
- (4) $\mathbf{Q}_{\rm rr}$ area under curve defined by $\mathbf{t}_{\rm rr}$ and $\mathbf{I}_{\rm RRM}$

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

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

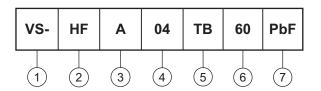
Fig. 10 - Reverse Recovery Waveform and Definitions

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ORDERING INFORMATION TABLE

Device code



1 - Vishay Semiconductors product

2 - HEXFRED® family

Electron irradiated

4 - Current rating (04 = 4 A)

5 - Package:

TB = TO-220AC

Voltage rating (60 = 600 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-HFA04TB60PbF	50	1000	Antistatic plastic tube					
VS-HFA04TB60-N3	50	1000	Antistatic plastic tube					

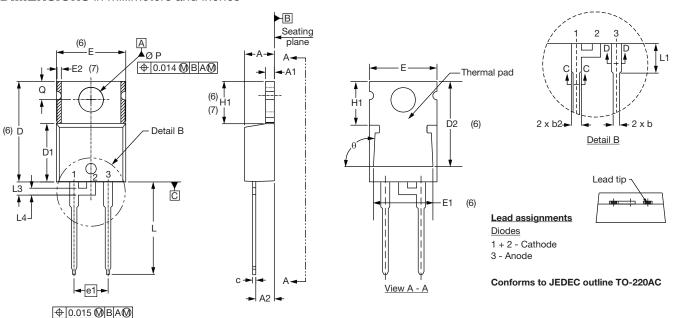
LINKS TO RELATED DOCUMENTS						
Dimensions <u>www.vishay.com/doc?95221</u>						
Dort marking information	TO-220ACPbF	www.vishay.com/doc?95224				
Part marking information	TO-220AC-N3	www.vishay.com/doc?95068				



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TO-220AC

DIMENSIONS in millimeters and inches



SYMBOL	MILLIM	IETERS	INC	INCHES	
STWIDOL	MIN.	MAX.	MIN.	MAX.	NOTES
А	4.25	4.65	0.167	0.183	
A1	1.14	1.40	0.045	0.055	
A2	2.56	2.92	0.101	0.115	
b	0.69	1.01	0.027	0.040	
b1	0.38	0.97	0.015	0.038	4
b2	1.20	1.73	0.047	0.068	
b3	1.14	1.73	0.045	0.068	4
С	0.36	0.61	0.014	0.024	
c1	0.36	0.56	0.014	0.022	4
D	14.85	15.25	0.585	0.600	3
D1	8.38	9.02	0.330	0.355	
D2	11.68	12.88	0.460	0.507	6
Е	10.11	10.51	0.398	0.414	3, 6

SYMBOL	MILLIM	IETERS	INCHES		NOTES
STINIBOL	MIN.	MAX.	MIN.	MAX.	NOTES
E1	6.86	8.89	0.270	0.350	6
E2	-	0.76	-	0.030	7
е	2.41	2.67	0.095	0.105	
e1	4.88	5.28	0.192	0.208	
H1	6.09	6.48	0.240	0.255	6, 7
L	13.52	14.02	0.532	0.552	
L1	3.32	3.82	0.131	0.150	2
L3	1.78	2.13	0.070	0.084	
L4	0.76	1.27	0.030	0.050	2
ØΡ	3.54	3.73	0.139	0.147	
Q	2.60	3.00	0.102	0.118	
θ	90° t	o 93°	90° to 93°		

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



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