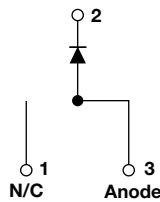


# HEXFRED®

## Ultrafast Soft Recovery Diode, 16 A


**D²PAK (TO-263AB)**

**FEATURES**

- Ultrafast and ultrasoft recovery
- Very low  $I_{RRM}$  and  $Q_{rr}$
- Specified at operating conditions
- Meets MSL level 1, per J-STD-020, LF maximum peak of 245 °C
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
 COMPLIANT  
 HALOGEN  
 FREE

**BENEFITS**

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

**DESCRIPTION**

VS-HFA16TB120S 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-HFA16TB120S 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-HFA16TB120S 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.

**PRIMARY CHARACTERISTICS**

$I_{F(AV)}$	16 A
$V_R$	1200 V
$V_F$ at $I_F$	2.3 V
$t_{rr}$ (typ.)	30 ns
$T_J$ max.	150 °C
Package	D²PAK (TO-263AB)
Circuit configuration	Single

**ABSOLUTE MAXIMUM RATINGS**

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



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

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

<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	$^\circ\text{C}$
Thermal resistance, junction-to-case	$R_{thJC}$		-	-	0.83	K/W
Thermal resistance, junction-to-ambient	$R_{thJA}$	Typical socket mount	-	-	80	
Weight			-	2.0	-	g
			-	0.07	-	oz.
Marking device		Case style D <sup>2</sup> PAK (TO-263AB)	HFA16TB120S			

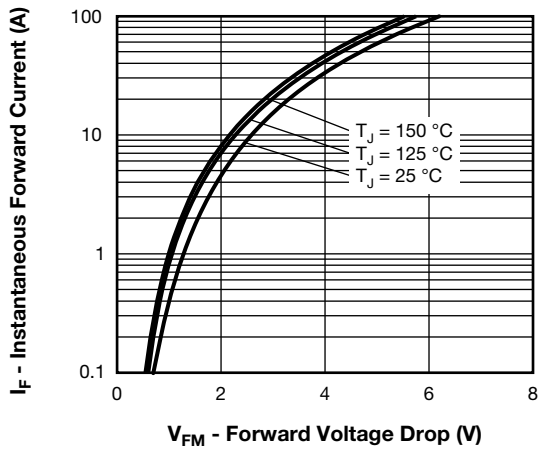


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

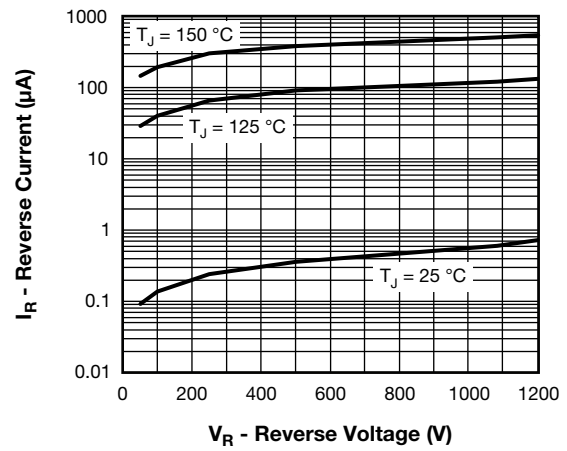


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

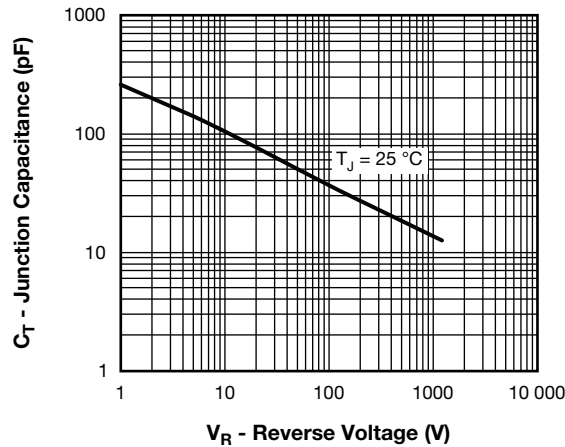


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

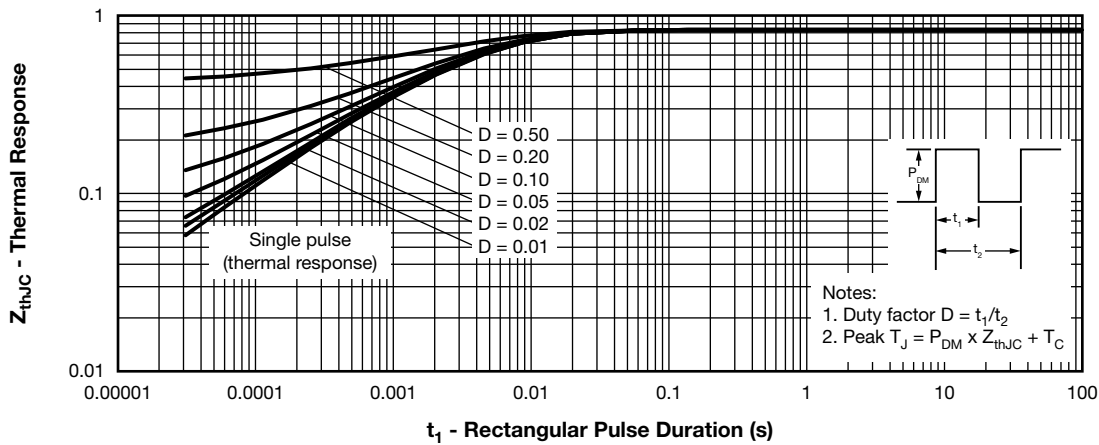


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

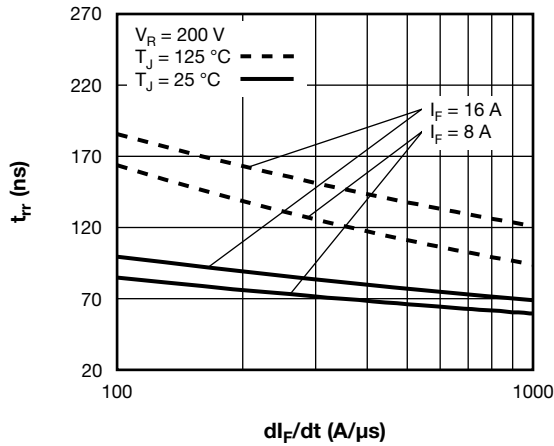


Fig. 5 - Typical Reverse Recovery Time vs.  $di_F/dt$  (Per Leg)

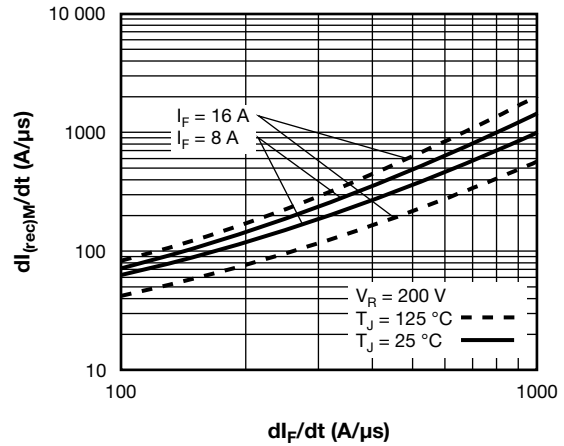


Fig. 8 - Typical  $di_{(rec)M}/dt$  vs.  $di_F/dt$  (Per Leg)

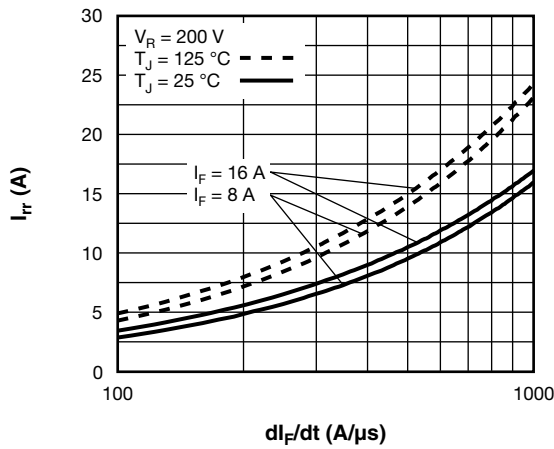


Fig. 6 - Typical Recovery Current vs.  $di_F/dt$  (Per Leg)

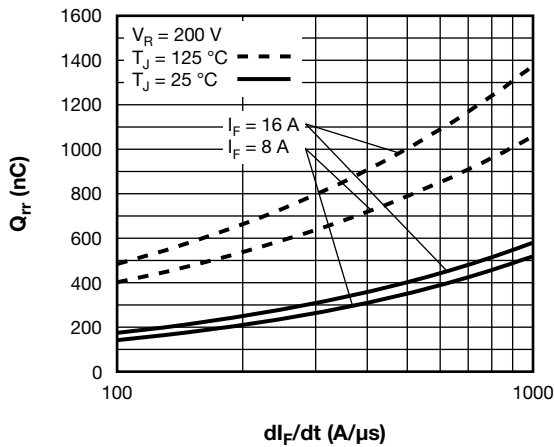
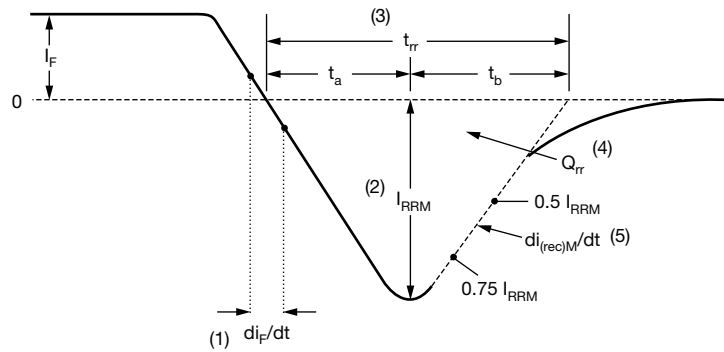


Fig. 7 - Typical Stored Charge vs.  $di_F/dt$  (Per Leg)



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

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

Fig. 9 - Reverse Recovery Waveform and Definitions

**ORDERING INFORMATION TABLE**

Device code	<b>VS-</b>	<b>HF</b>	<b>A</b>	<b>16</b>	<b>TB</b>	<b>120</b>	<b>S</b>	<b>L</b>	<b>-M3</b>
	①	②	③	④	⑤	⑥	⑦	⑧	⑨

- 1** - Vishay Semiconductors product
- 2** - HEXFRED® family
- 3** - Process designator: A = electron irradiated
- 4** - Current rating (16 = 16 A)
- 5** - Package outline (TB = TO-220, 2 leads)
- 6** - Voltage rating (120 = 1200 V)
- 7** - S = D<sup>2</sup>PAK (TO-263AB)
- 8** -
  - None = tube
  - L = tape and reel (left oriented)
  - R = tape and reel (right oriented)
- 9** - Environmental digit:
  - M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free



<b>ORDERING INFORMATION</b> (Example)		
<b>PREFERRED P/N</b>	<b>BASE QUANTITY</b>	<b>PACKAGING DESCRIPTION</b>
VS-HFA16TB120S-M3	50	Antistatic plastic tube
VS-HFA16TB120SR-M3	800	13" diameter reel
VS-HFA16TB120SL-M3	800	13" diameter reel

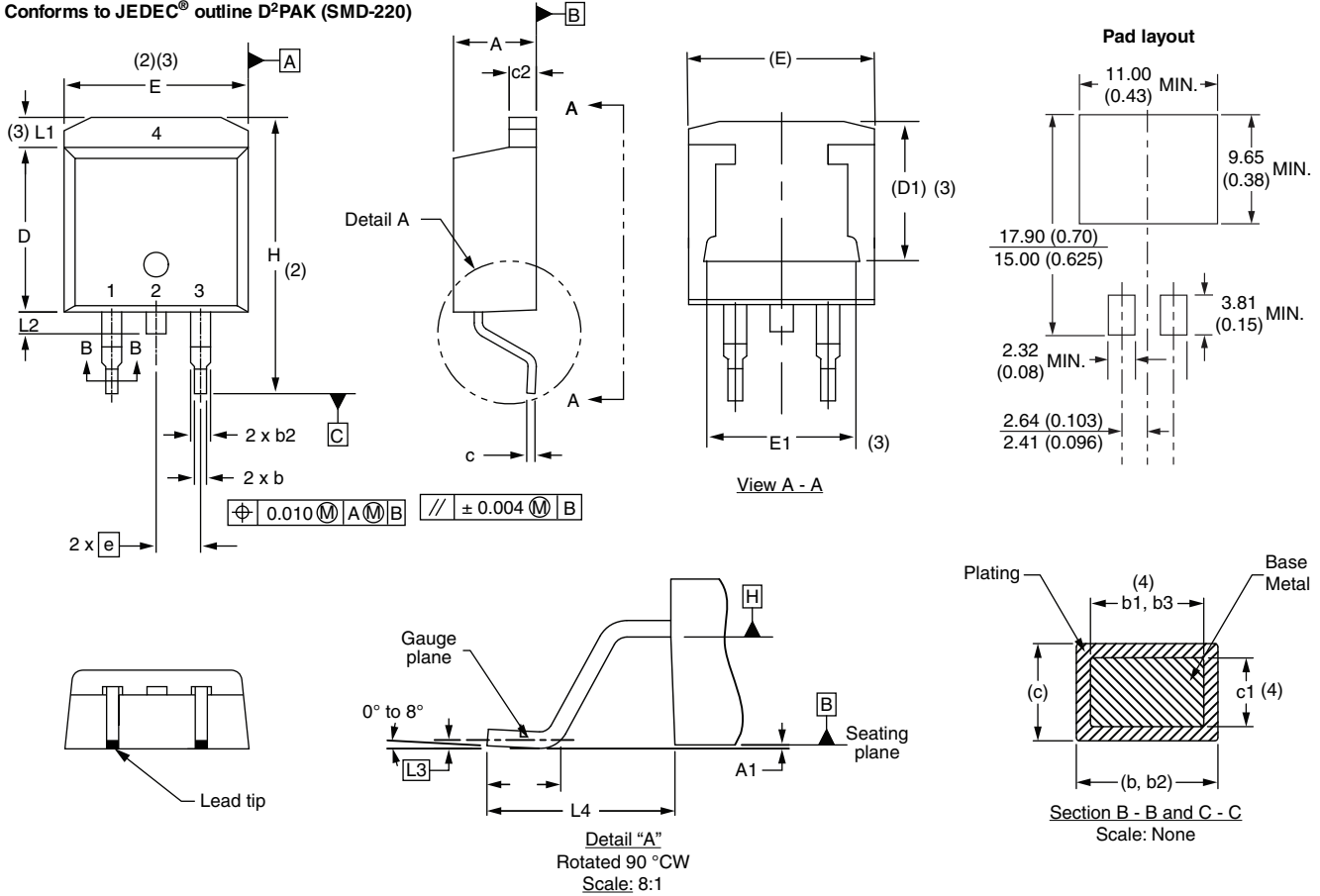
<b>LINKS TO RELATED DOCUMENTS</b>	
Dimensions	<a href="http://www.vishay.com/doc?96164">www.vishay.com/doc?96164</a>
Part marking information	<a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a>
Packaging information	<a href="http://www.vishay.com/doc?96424">www.vishay.com/doc?96424</a>



# D<sup>2</sup>PAK

**DIMENSIONS** in millimeters and inches

Conforms to JEDEC® outline D<sup>2</sup>PAK (SMD-220)



SYMBOL	MILLIMETERS		INCHES		NOTES	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.			MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190		D1	6.86	8.00	0.270	0.315	3
A1	0.00	0.254	0.000	0.010		E	9.65	10.67	0.380	0.420	2, 3
b	0.51	0.99	0.020	0.039		E1	7.90	8.80	0.311	0.346	3
b1	0.51	0.89	0.020	0.035	4	e	2.54 BSC		0.100 BSC		
b2	1.14	1.78	0.045	0.070		H	14.61	15.88	0.575	0.625	
b3	1.14	1.73	0.045	0.068	4	L	1.78	2.79	0.070	0.110	
c	0.38	0.74	0.015	0.029		L1	-	1.65	-	0.066	3
c1	0.38	0.58	0.015	0.023	4	L2	1.27	1.78	0.050	0.070	
c2	1.14	1.65	0.045	0.065		L3	0.25 BSC		0.010 BSC		
D	8.51	9.65	0.335	0.380	2	L4	4.78	5.28	0.188	0.208	

**Notes**

- (1) Dimensioning and tolerancing per ASME Y14.5 M-1994
- (2) 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 outmost extremes of the plastic body
- (3) Thermal pad contour optional within dimension E, L1, D1 and E1
- (4) Dimension b1 and c1 apply to base metal only
- (5) Datum A and B to be determined at datum plane H
- (6) Controlling dimension: inches
- (7) Outline conforms to JEDEC® outline TO-263AB



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