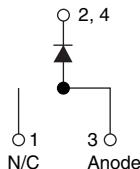


## Hyperfast Rectifier, 12 A FRED Pt®


**D-PAK (TO-252AA)**

**RoHS**  
COMPLIANT  
HALOGEN  
FREE

### FEATURES

- Hyperfast recovery time, reduced  $Q_{rr}$  and soft recovery
- 175 °C maximum operating junction temperature
- For PFC CRM/CCM operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

PRODUCT SUMMARY	
Package	D-PAK (TO-252AA)
$I_{F(AV)}$	12 A
$V_R$	600 V
$V_F$ at $I_F$	2.5 V
$t_{rr}$ (typ.)	18 ns
$T_J$ max.	175 °C
Diode variation	Single die

### DESCRIPTION/APPLICATIONS

State of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop, hyperfast recovery time, and soft recovery.

The planar structure and the platinum doped life time control guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in PFC boost stage in the AC/DC section of SMPS inverters or as freewheeling diodes. Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

ABSOLUTE MAXIMUM RATINGS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Peak repetitive reverse voltage	$V_{RRM}$		600	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 132$ °C	12	A
Non-repetitive peak surge current	$I_{FSM}$	$T_J = 25$ °C	110	
Peak repetitive forward current	$I_{FM}$	$T_C = 132$ °C, $f = 20$ kHz, $d = 50$ %	24	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-65 to 175	°C

ELECTRICAL SPECIFICATIONS ( $T_J = 25$ °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100$ µA	600	-	-	V
Forward voltage	$V_F$	$I_F = 12$ A	-	1.73	2.5	
		$I_F = 12$ A, $T_J = 125$ °C	-	1.34	1.8	
Reverse leakage current	$I_R$	$V_R = V_R$ rated	-	-	10	µA
		$T_J = 125$ °C, $V_R = V_R$ rated	-	-	100	
Junction capacitance	$C_T$	$V_R = 600$ V	-	8	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8	-	nH

DYNAMIC RECOVERY CHARACTERISTICS ( $T_J = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	$t_{rr}$	$I_F = 1 \text{ A}$ , $dI_F/dt = 100 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$	-	18	22	ns
		$I_F = 1 \text{ A}$ , $dI_F/dt = 50 \text{ A}/\mu\text{s}$ , $V_R = 30 \text{ V}$	-	22	-	
		$T_J = 25^\circ\text{C}$	-	26	-	
		$T_J = 125^\circ\text{C}$	-	47	-	
Peak recovery current	$I_{RRM}$	$T_J = 25^\circ\text{C}$	-	3.5	-	A
		$T_J = 125^\circ\text{C}$	-	5.4	-	
Reverse recovery charge	$Q_{rr}$	$T_J = 25^\circ\text{C}$	-	48	-	nC
		$T_J = 125^\circ\text{C}$	-	137	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	$T_J$ , $T_{Stg}$		-65	-	+175	°C
Thermal resistance, junction to case per leg	$R_{thJC}$		-	1.3	1.7	°C/W
Approximate weight			0.3			g
			0.01			oz.
Marking device		Case style D-PAK (TO-252AA)	12EWH06FN			

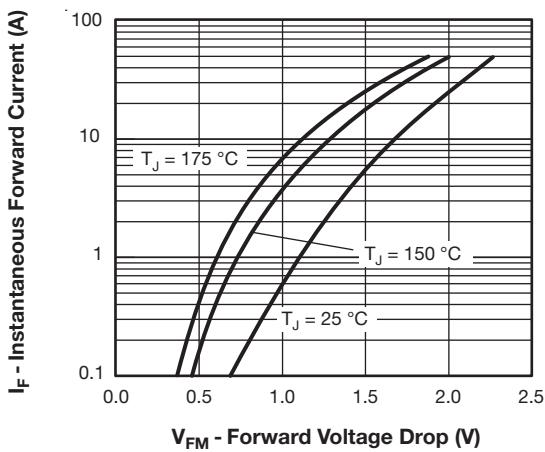


Fig. 1 - Typical Forward Voltage Drop Characteristics

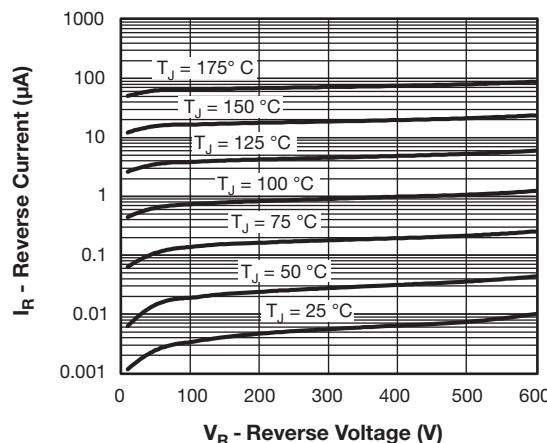


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

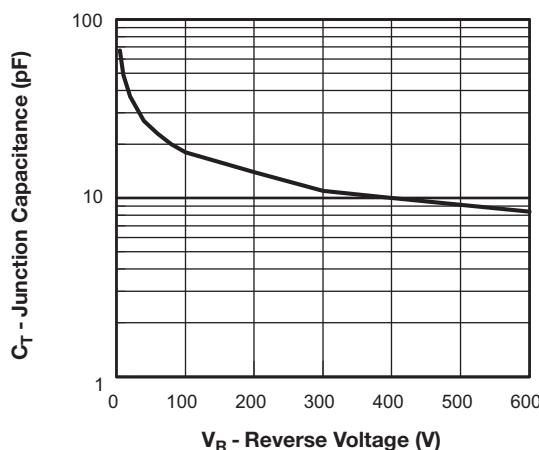


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

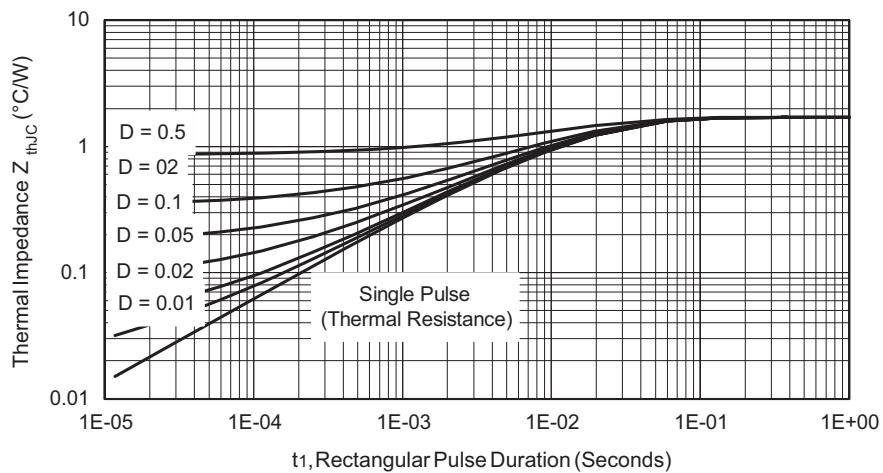


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

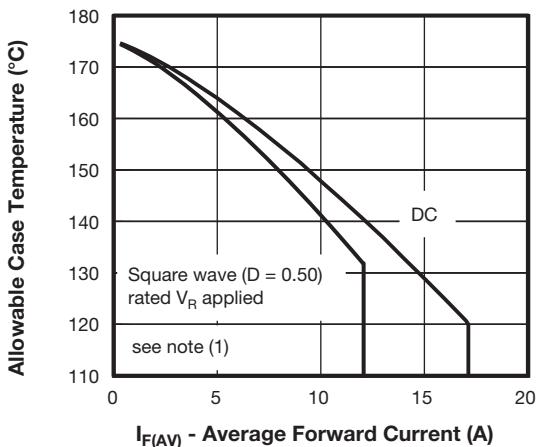


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

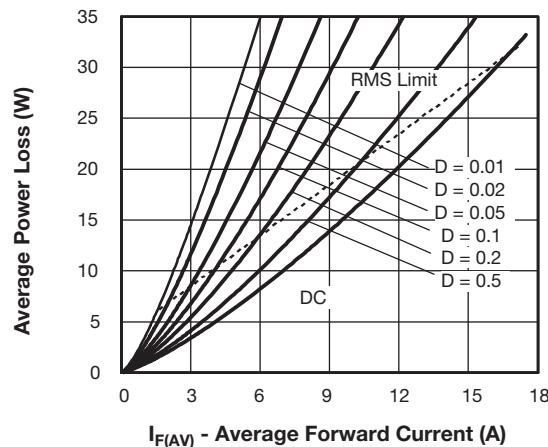


Fig. 6 - Forward Power Loss Characteristics

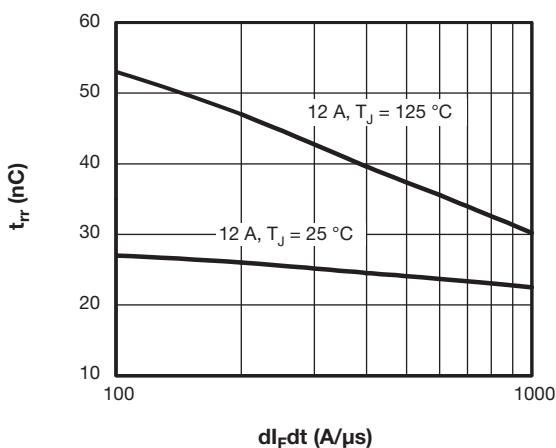


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$

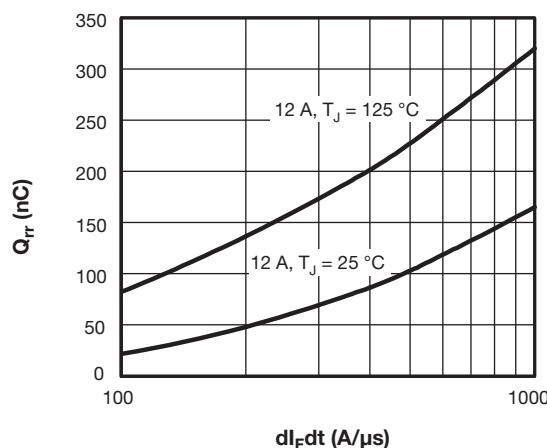


Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d = \text{Forward power loss} = I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 6);  
 $P_{dREV} = \text{Inverse power loss} = V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = Rated  $V_R$

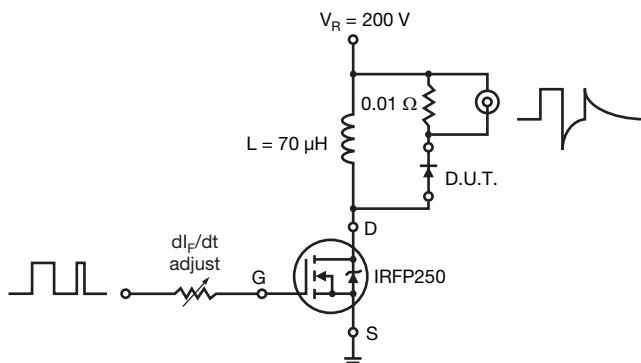
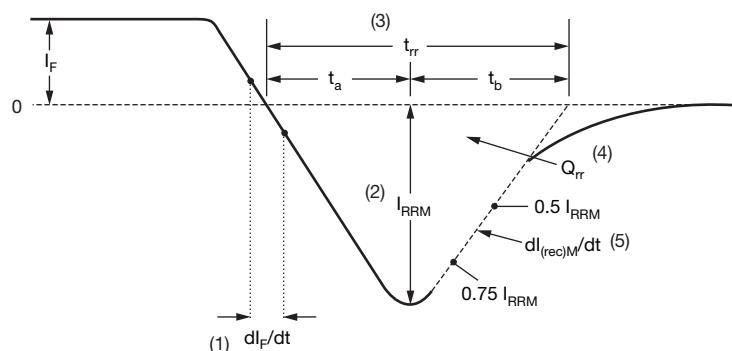


Fig. 9 - Reverse Recovery Parameter Test Circuit



(1)  $dI_F/dt$  - 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-	12	E	W	H	06	FN	TRL	-M3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

- [1]** - Vishay Semiconductors product
- [2]** - Current rating (12 = 12 A)
- [3]** - Circuit configuration:  
E = Single diode
- [4]** - Package identifier:  
W = D-PAK
- [5]** - H = Hyperfast recovery
- [6]** - Voltage rating (06 = 600 V)
- [7]** - FN = TO-252AA
- [8]** - • None = Tube  
• TR = Tape and reel  
• TRL = Tape and reel (left oriented)  
• TRR = Tape and reel (right oriented)
- [9]** - Environmental digit:  
-M3 = Halogen-free, RoHS compliant and terminations lead (Pb)-free

**ORDERING INFORMATION (Example)**

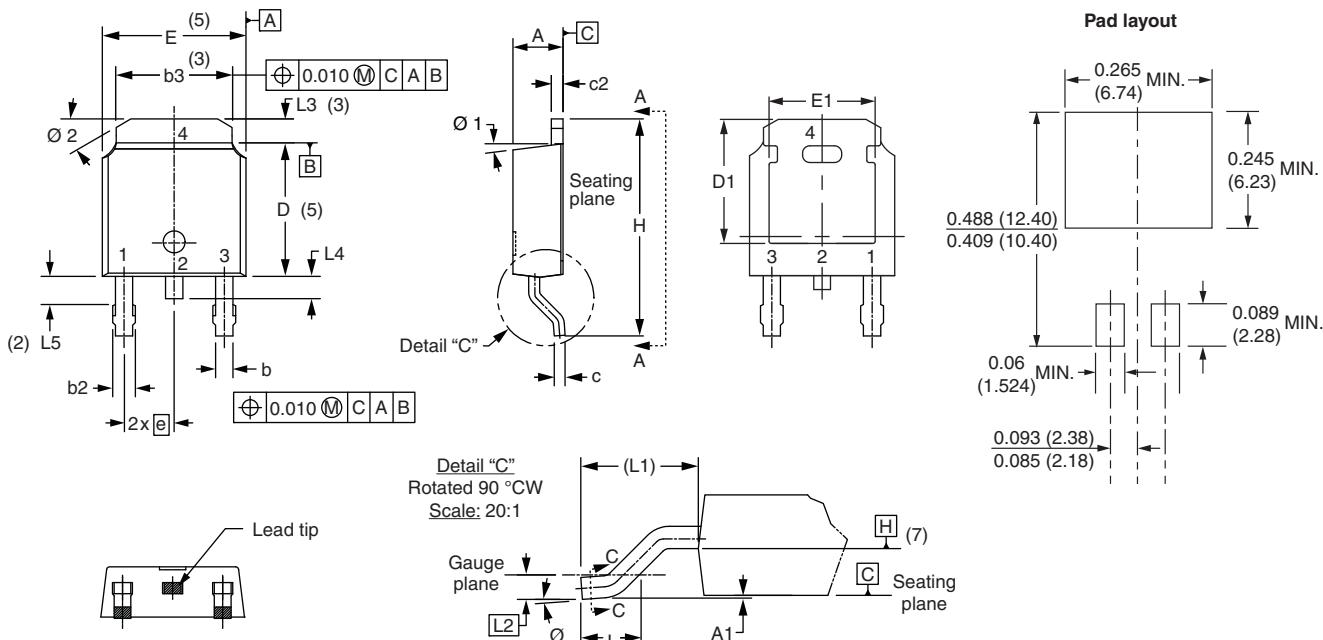
PREFERRED P/N	QUANTITY PER T/R	MINIMUM ORDER QUANTITY	PACKAGING DESCRIPTION
VS-12EWH06FN-M3	75	3000	Antistatic plastic tube
VS-12EWH06FNTR-M3	2000	2000	13" diameter reel
VS-12EWH06FNTRL-M3	3000	3000	13" diameter reel
VS-12EWH06FNTRR-M3	3000	3000	13" diameter reel

**LINKS TO RELATED DOCUMENTS**

Dimensions	<a href="http://www.vishay.com/doc?95016">www.vishay.com/doc?95016</a>
Part marking information	<a href="http://www.vishay.com/doc?95176">www.vishay.com/doc?95176</a>
Packaging information	<a href="http://www.vishay.com/doc?95033">www.vishay.com/doc?95033</a>
SPICE model	<a href="http://www.vishay.com/doc?95220">www.vishay.com/doc?95220</a>

## D-PAK (TO-252AA)

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES	Detail "C" Rotated 90 °CW Scale: 20:1	SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.				MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	0.094			e	2.29	BSC	0.090	BSC	
A1	-	0.13	-	0.005			H	9.40	10.41	0.370	0.410	
b	0.64	0.89	0.025	0.035			L	1.40	1.78	0.055	0.070	
b2	0.76	1.14	0.030	0.045			L1	2.74 BSC		0.108 REF.		
b3	4.95	5.46	0.195	0.215	3		L2	0.51 BSC		0.020 BSC		
c	0.46	0.61	0.018	0.024			L3	0.89	1.27	0.035	0.050	3
c2	0.46	0.89	0.018	0.035			L4	-	1.02	-	0.040	
D	5.97	6.22	0.235	0.245	5		L5	1.14	1.52	0.045	0.060	2
D1	5.21	-	0.205	-	3		Ø	0°	10°	0°	10°	
E	6.35	6.73	0.250	0.265	5		Ø1	0°	15°	0°	15°	
E1	4.32	-	0.170	-	3		Ø2	25°		25°		

### Notes

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension uncontrolled in L5
- (3) Dimension D1, E1, L3 and b3 establish a minimum mounting surface for thermal pad
- (4) Section C - C dimension apply to the flat section of the lead between 0.13 and 0.25 mm (0.005 and 0.010") from the lead tip
- (5) 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
- (6) Dimension b1 and c1 applied to base metal only
- (7) Datum A and B to be determined at datum plane H
- (8) Outline conforms to JEDEC outline TO-252AA

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