

Hyperfast Rectifier, 15 A FRED Pt[®]

D-PAK (TO-252AA)



FEATURES

- Hyperfast recovery time, extremely low Q_{rr}
- 175 °C maximum operating junction temperature
- For PFC CCM operation
- Low forward voltage drop
- Low leakage current
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Compliant to RoHS Directive 2002/95/EC
- Halogen-free according to IEC 61249-2-21 definition



RoHS
COMPLIANT
HALOGEN
FREE

PRODUCT SUMMARY

Package	D-PAK (TO-252AA)
$I_{F(AV)}$	15 A
V_R	600 V
V_F at I_F	3.2 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	$I_{F(AV)}$	$T_C = 117\text{ °C}$	15	A
Non-repetitive peak surge current	I_{FSM}	$T_J = 25\text{ °C}$	120	
Peak repetitive forward current	I_{FM}	$T_C = 117\text{ °C}$, $f = 20\text{ kHz}$, $d = 50\%$	30	
Operating junction and storage temperatures	T_J, T_{Stg}		- 65 to 175	°C

ELECTRICAL SPECIFICATIONS ($T_J = 25\text{ °C}$ unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	V_{BR}, V_R	$I_R = 100\ \mu\text{A}$	600	-	-	V
Forward voltage	V_F	$I_F = 15\text{ A}$	-	2.3	3.2	
		$I_F = 15\text{ A}, T_J = 125\text{ °C}$	-	1.6	1.9	
		$I_F = 15\text{ A}, T_J = 150\text{ °C}$	-	1.5	1.8	
Reverse leakage current	I_R	$V_R = V_R$ rated	-	-	50	μA
		$T_J = 125\text{ °C}, V_R = V_R$ rated	-	-	200	
		$T_J = 150\text{ °C}, V_R = V_R$ rated	-	-	300	
Junction capacitance	C_T	$V_R = 600\text{ V}$	-	11	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	8	-	nH

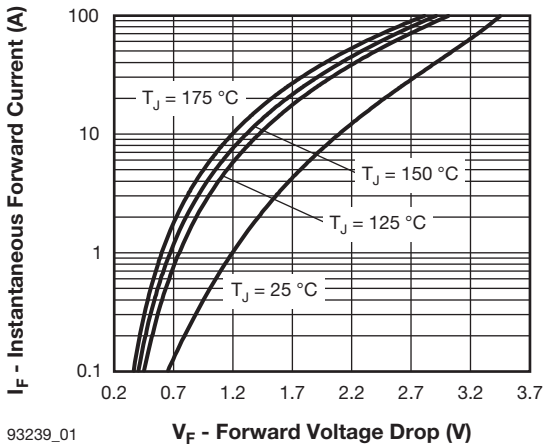
VS-15EWX06FN-M3



Vishay Semiconductors Hyperfast Rectifier, 15 A FRED Pt®

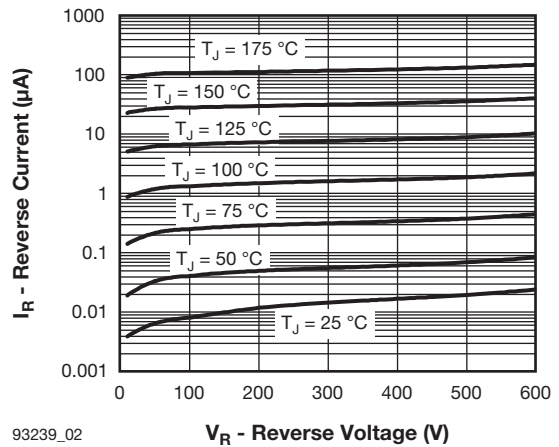
DYNAMIC RECOVERY CHARACTERISTICS ($T_J = 25\text{ }^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t_{rr}	$I_F = 1\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	18	22	ns
		$I_F = 1\text{ A}$, $di_F/dt = 50\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	22	-	
		$I_F = 15\text{ A}$, $di_F/dt = 100\text{ A}/\mu\text{s}$, $V_R = 30\text{ V}$	-	17	32	
		$T_J = 25\text{ }^\circ\text{C}$	-	22	-	
		$T_J = 125\text{ }^\circ\text{C}$	-	38	-	
Peak recovery current	I_{RRM}	$T_J = 25\text{ }^\circ\text{C}$	-	3.1	-	A
		$T_J = 125\text{ }^\circ\text{C}$	-	4.6	-	
Reverse recovery charge	Q_{rr}	$T_J = 25\text{ }^\circ\text{C}$	-	37	-	nC
		$T_J = 125\text{ }^\circ\text{C}$	-	92	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T_J , T_{Stg}		- 65	-	175	$^\circ\text{C}$
Thermal resistance, junction to case per leg	R_{thJC}		-	1.4	1.8	$^\circ\text{C}/\text{W}$
Thermal resistance, junction to ambient per leg	R_{thJA}		-	-	70	
Approximate weight			0.3			g
			0.01			oz.
Marking device		Case style D-PAK (TO-252AA)	15EWX06FN			



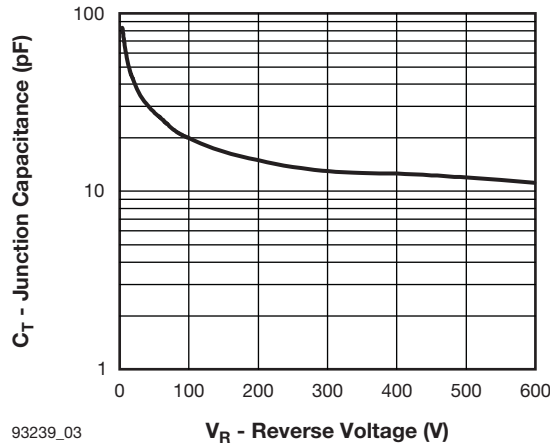
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Fig. 1 - Typical Forward Voltage Drop Characteristics



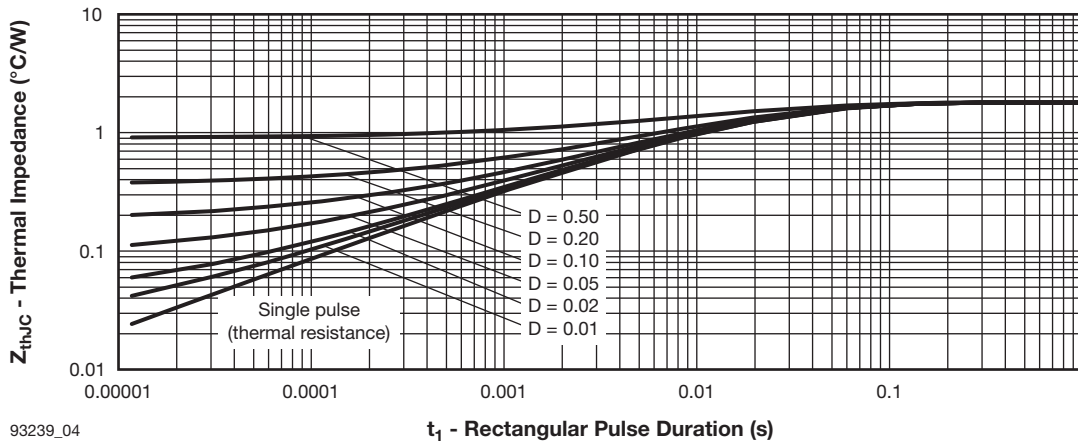
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Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage



93239_03

Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage



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

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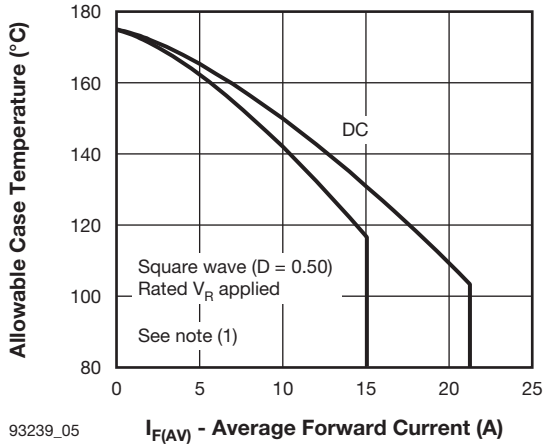


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

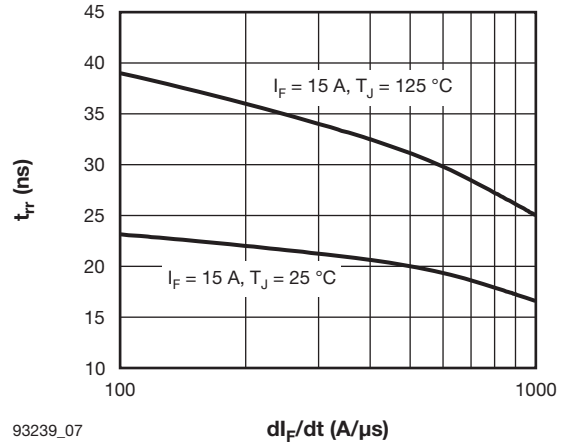


Fig. 7 - Typical Reverse Recovery Time vs. di_F/dt

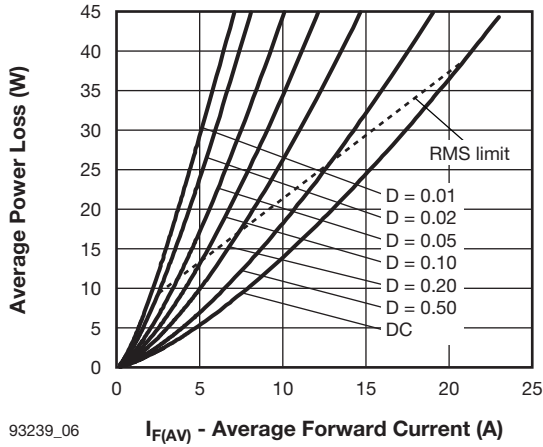


Fig. 6 - Forward Power Loss Characteristics

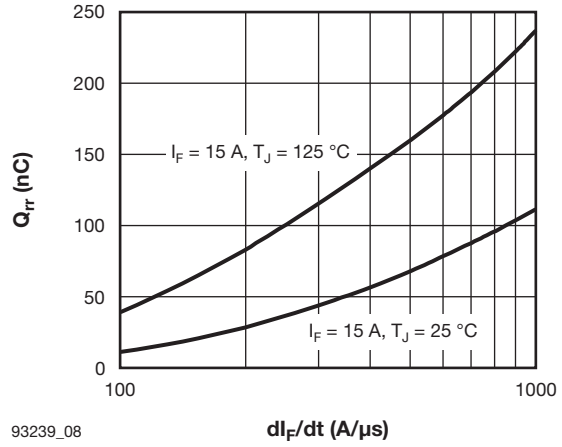


Fig. 8 - Typical Stored Charge vs. di_F/dt

Note

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

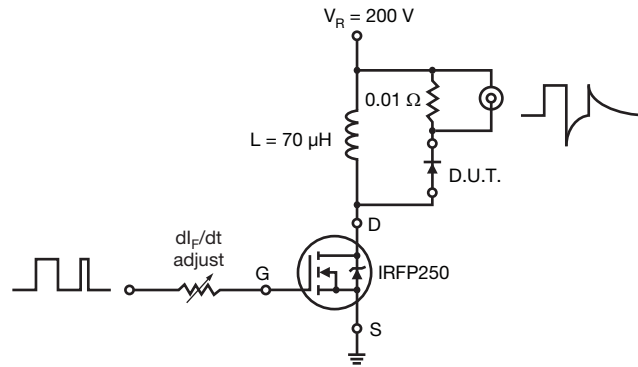
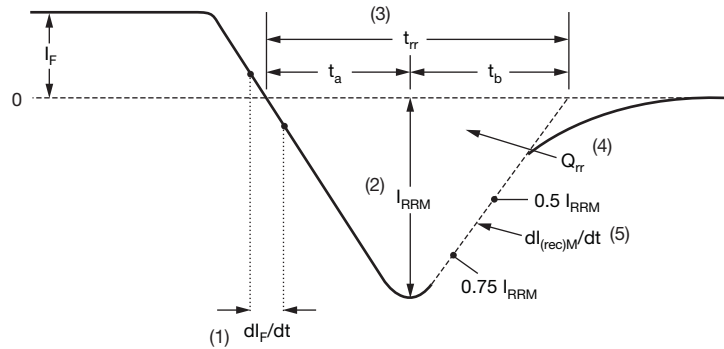


Fig. 9 - Reverse Recovery Parameter Test Circuit



- (1) di_F/dt - rate of change of current through zero crossing
- (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}

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

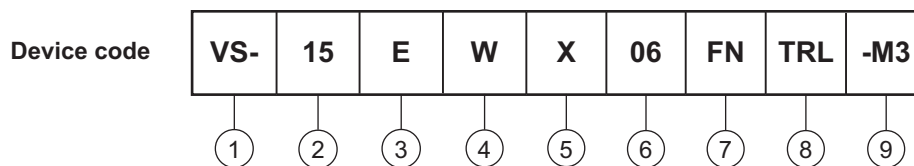
Fig. 10 - Reverse Recovery Waveform and Definitions

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ORDERING INFORMATION TABLE

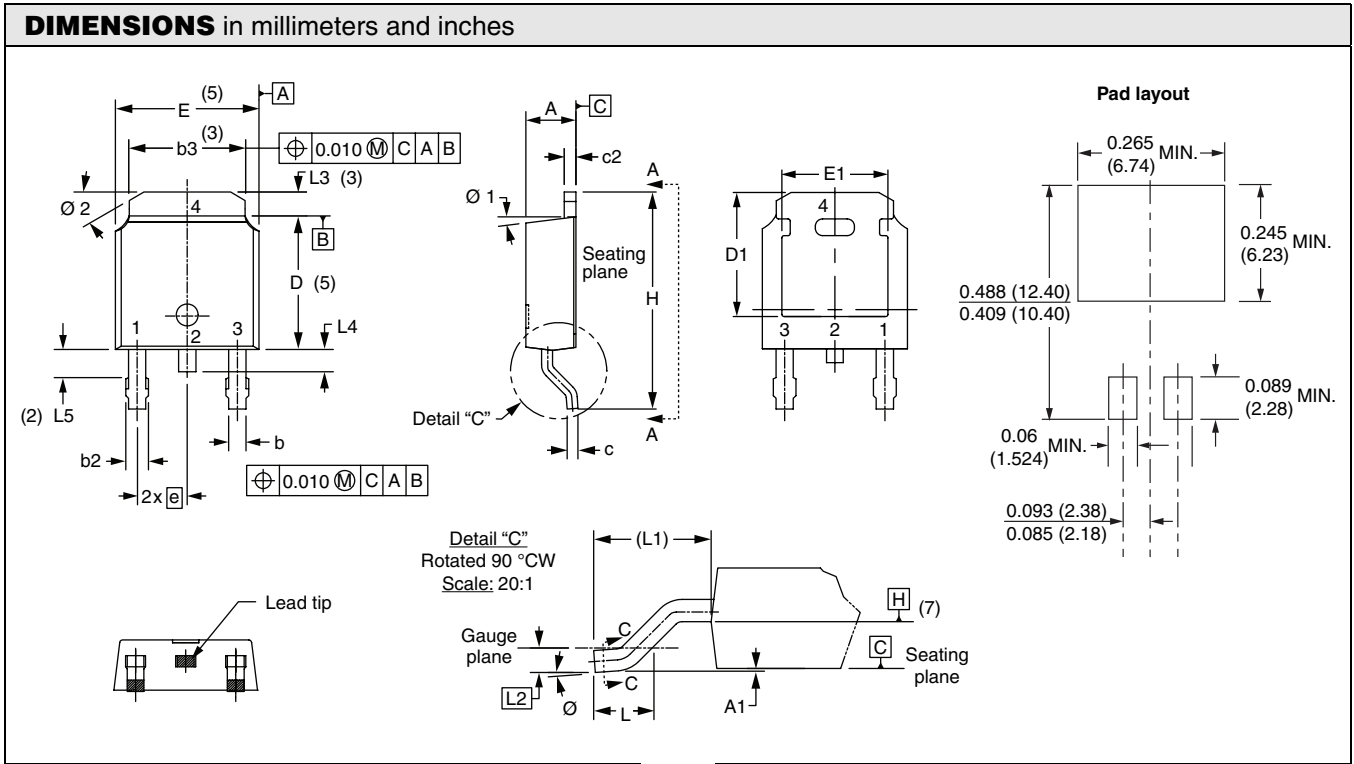


- 1** - Vishay Semiconductors product
- 2** - Current rating (15 = 15 A)
- 3** - Circuit configuration:
E = Single diode
- 4** - Package identifier:
W = D-PAK
- 5** - X = Hyperfast recovery time
- 6** - Voltage rating (06 = 600 V)
- 7** - FN = TO-252AA
- 8** -
 - None = Tube
 - TR = Tape and reel
 - 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-15EWX06FN-M3	75	3000	Antistatic plastic tube
VS-15EWX06FNTR-M3	2000	2000	13" diameter reel
VS-15EWX06FNTRL-M3	3000	3000	13" diameter reel
VS-15EWX06FNTRR-M3	3000	3000	13" diameter reel

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95016
Part marking information	www.vishay.com/doc?95176
Packaging information	www.vishay.com/doc?95033
SPIICE model	www.vishay.com/doc?95387

D-PAK (TO-252AA)



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	2.18	2.39	0.086	0.094	
A1	-	0.13	-	0.005	
b	0.64	0.89	0.025	0.035	
b2	0.76	1.14	0.030	0.045	
b3	4.95	5.46	0.195	0.215	3
c	0.46	0.61	0.018	0.024	
c2	0.46	0.89	0.018	0.035	
D	5.97	6.22	0.235	0.245	5
D1	5.21	-	0.205	-	3
E	6.35	6.73	0.250	0.265	5
E1	4.32	-	0.170	-	3

SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
e	2.29 BSC		0.090 BSC		
H	9.40	10.41	0.370	0.410	
L	1.40	1.78	0.055	0.070	
L1	2.74 BSC		0.108 REF.		
L2	0.51 BSC		0.020 BSC		
L3	0.89	1.27	0.035	0.050	3
L4	-	1.02	-	0.040	
L5	1.14	1.52	0.045	0.060	2
Ø	0°	10°	0°	10°	
Ø1	0°	15°	0°	15°	
Ø2	25°	35°	25°	35°	

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 0.10") 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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