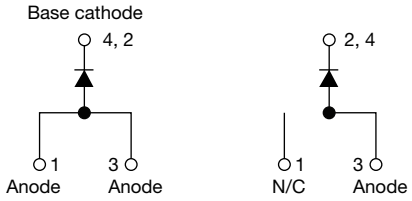
Ultralow V_F Ultrafast Rectifier, 15 A FRED Pt®

TO-252AA (D-PAK)



VS-15AWL06FN-M3 **VS-15EWL06FN-M3**

FEATURES

- Ultrafast recovery time, extremely low V_F and soft recovery
- 175 °C maximum operating junction temperature
- For PFC DCM operation
- 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

RoHS COMPLIANT

HALOGEN FREE

DESCRIPTION / APPLICATIONS

State of the art, ultralow V_F, soft-switching hyperfast rectifiers optimized for Discontinuous (Critical) Mode (DCM) Power Factor Correction (PFC).

The minimized conduction loss, optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

The device is also intended for use as a freewheeling diode in power supplies and other power switching applications.

PRODUCT SUMMARY	
Package	TO-252AA (D-PAK)
$I_{F(AV)}$	15 A
V_R	600 V
V_F at I_F	0.85 V
t_{rr} (typ.)	60 ns
T_J max.	175 °C
Diode variation	Single die

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 = 148 °C	15	A
Non-repetitive peak surge current	I_{FSM}	T_J = 25 °C	180	
Peak repetitive forward current	I_{FM}	T_C = 148 °C, f = 20 kHz, d = 50 %	30	
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 = 15 A	-	0.99	1.05	
		I_F = 15 A, T_J = 150 °C	-	0.85	0.92	
Reverse leakage current	I_R	V_R = V_R rated	-	-	10	µA
		T_J = 150 °C, V_R = V_R rated	-	-	120	
Junction capacitance	C_T	V_R = 600 V	-	11	-	pF
Series inductance	L_S	Measured lead to lead 5 mm from package body	-	8	-	nH

DYNAMIC RECOVERY CHARACTERISTICS (T_J = 25 °C unless otherwise specified)							
PARAMETER	**SYMBOL**	**TEST CONDITIONS**		**MIN.**	**TYP.**	**MAX.**	**UNITS**
Reverse recovery time	t_{rr}	I_F = 1 A, dI_F/dt = 100 A/µs, V_R = 30 V		-	60	120	ns
		I_F = 15 A, dI_F/dt = 100 A/µs, V_R = 30 V		-	190	-	
		T_J = 25 °C	I_F = 15 A dI_F/dt = 200 A/µs V_R = 390 V	-	220	-	
		T_J = 125 °C		-	290	-	
Peak recovery current	I_{RRM}	T_J = 25 °C		-	21	-	A
		T_J = 125 °C		-	25	-	
Reverse recovery charge	Q_{rr}	T_J = 25 °C		-	2.6	-	µC
		T_J = 125 °C		-	4	-	

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}		-	1.4	1.8	°C/W
Thermal resistance, junction to ambient per leg	R_{thJA}		-	-	70	
Approximate weight			0.3			g
			0.01			oz.
Marking device		Case style TO-252AA (D-PAK)	15AWL06FN			
			15EWL06FN			

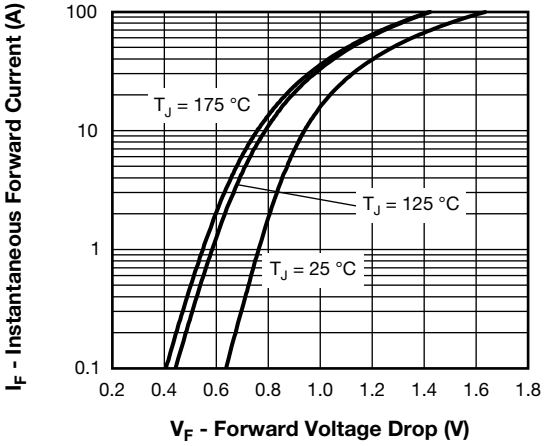


Fig. 1 - Typical Forward Voltage Drop Characteristics

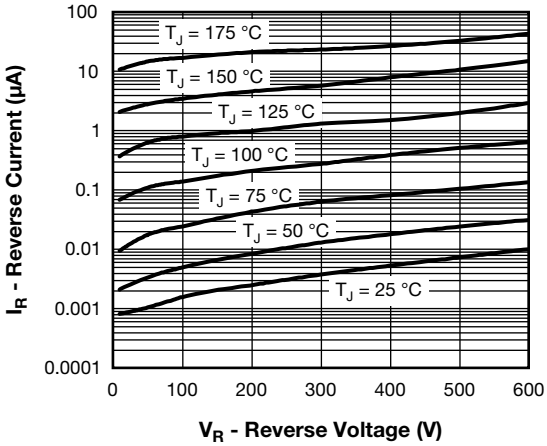


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

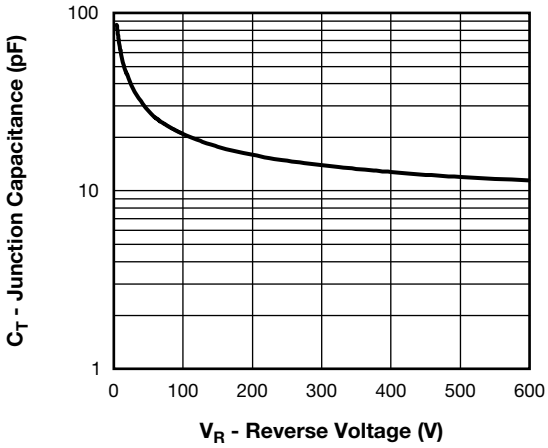


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

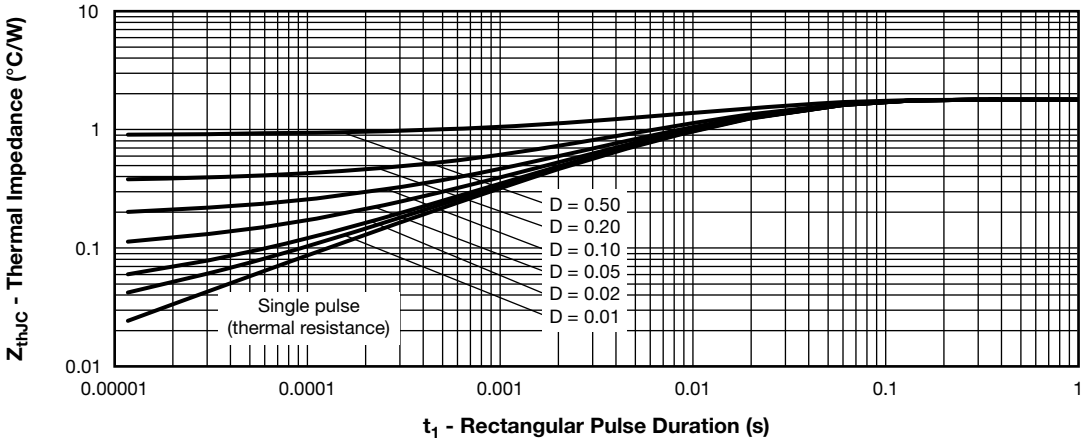


Fig. 4 - Maximum Thermal Impedance Z_{thJC} Characteristics

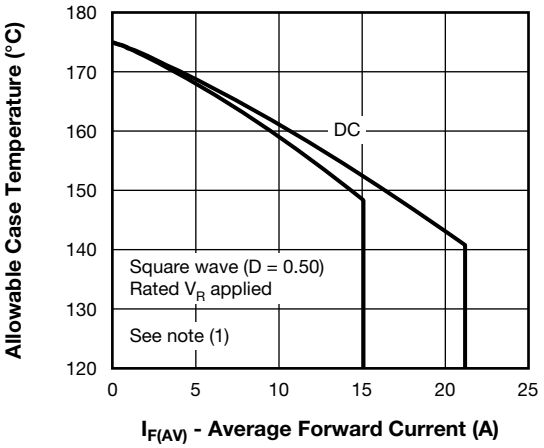


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

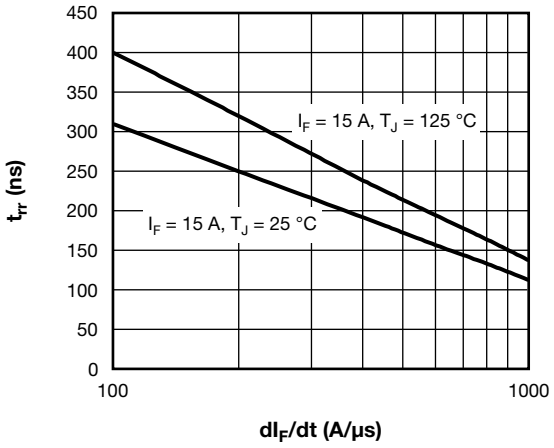


Fig. 7 - Typical Reverse Recovery Time vs. dI_F/dt

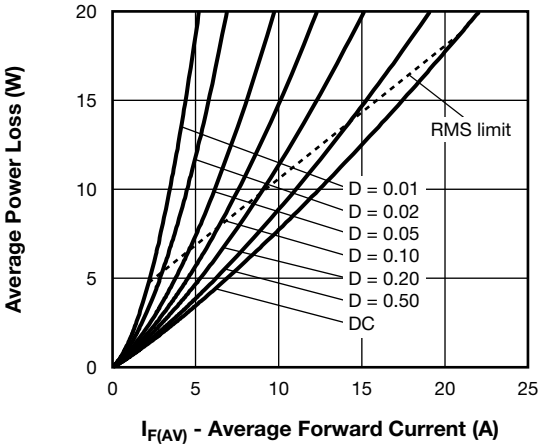


Fig. 6 - Forward Power Loss Characteristics

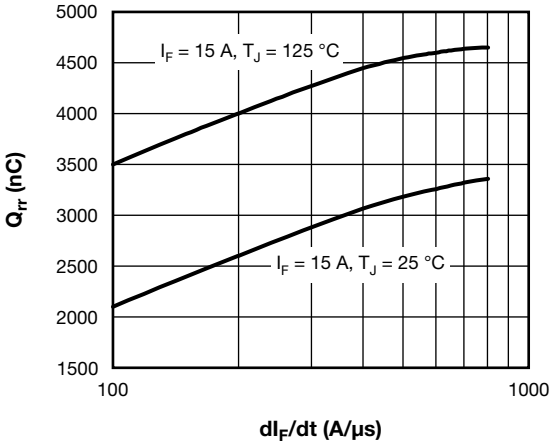


Fig. 8 - Typical Stored Charge vs. dI_F/dt

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

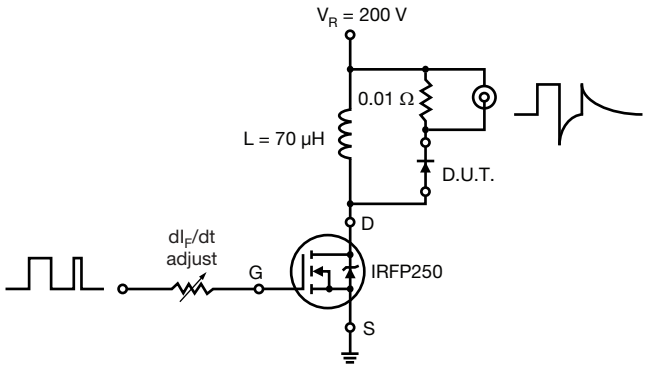
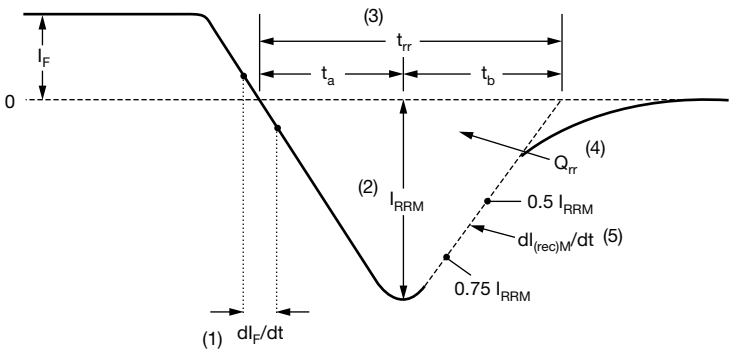


Fig. 9 - Reverse Recovery Parameter Test Circuit



(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}

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

(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

ORDERING INFORMATION TABLE

Device code

VS-	15	A	W	L	06	FN	TRL	-M3
1	2	3	4	5	6	7	8	9

1 - Vishay Semiconductors product

2 - Current rating (15 = 15 A)

3 - Circuit configuration:
- A = single diode (2 anodes)
- E = single diode

4 - Package identifier:
W = D-PAK

5 - L = hyperfast rectifier

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)

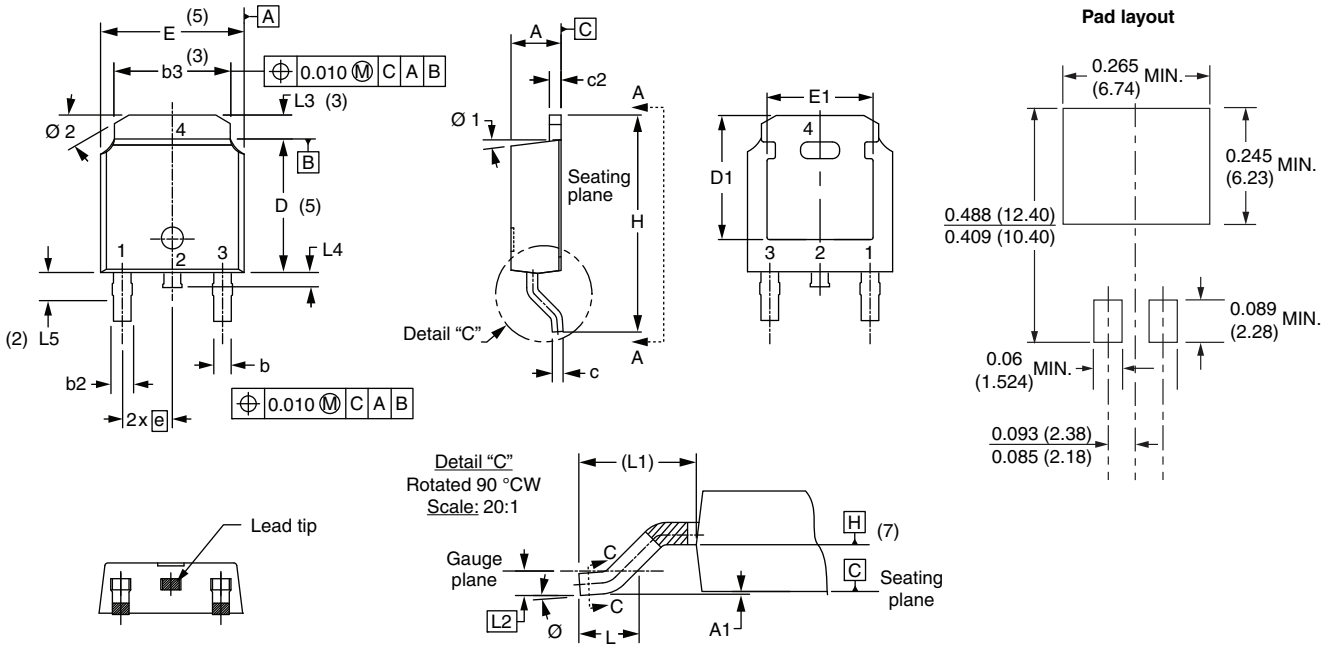
9 - Environmental digit:
-M3 = halogen-free, RoHS-compliant and terminations lead (Pb)-free

ORDERING INFORMATION (Example)			
PREFERRED P/N	**QUANTITY PER T/R**	**MINIMUM ORDER QUANTITY**	**PACKAGING DESCRIPTION**
VS-15AWL06FN-M3	75	3000	Antistatic plastic tube
VS-15EWL06FN-M3			
VS-15AWL06FNTR-M3	2000	2000	13" diameter reel
VS-15EWL06FNTR-M3			
VS-15AWL06FNTRL-M3	3000	3000	13" diameter reel
VS-15EWL06FNTRL-M3			
VS-15AWL06FNTRR-M3	3000	3000	13" diameter reel
VS-15EWL06FNTRR-M3			

LINKS TO RELATED DOCUMENTS	
Dimensions	www.vishay.com/doc?95627
Part marking information	www.vishay.com/doc?95176
Packaging information	www.vishay.com/doc?95033
SPICE model	www.vishay.com/doc?95372

D-PAK (TO-252AA) "M"

DIMENSIONS in millimeters and inches



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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