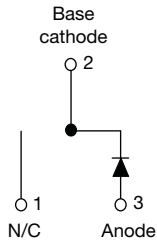
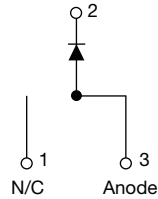


## Ultrafast Rectifier, 8 A FRED Pt<sup>®</sup>

 TO-263AB (D<sup>2</sup>PAK)


VS-8ETU04SHM3

TO-262AA



VS-8ETU04-1HM3

### FEATURES

- Ultrafast recovery time
- Low forward voltage drop
- Low leakage current
- 175 °C operating junction temperature
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- AEC-Q101 qualified, meets JESD 201, class 1 whisker test
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**

### DESCRIPTION / APPLICATIONS

Vishay Semiconductors FRED Pt<sup>®</sup> series are the state of the art ultrafast recovery rectifiers specifically designed with optimized performance of forward voltage drop and ultrafast recovery time.

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 the output rectification stage of SMPS, UPS, DC/DC converters as well as freewheeling diode in low voltage inverters and chopper motor drives.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

### PRODUCT SUMMARY

Package	TO-263AB (D <sup>2</sup> PAK), TO-262AA
$I_{F(AV)}$	8 A
$V_R$	400 V
$V_F$ at $I_F$	0.94 V
$t_{rr}$ typ.	35 ns
$T_J$ max.	175 °C
Diode variation	Single die

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	TEST CONDITIONS	MAX.	UNITS
Repetitive peak reverse voltage	$V_{RRM}$		400	V
Average rectified forward current	$I_{F(AV)}$	$T_C = 155$ °C	8	A
Non-repetitive peak surge current	$I_{FSM}$	$T_C = 25$ °C	100	
Repetitive peak forward current	$I_{FRM}$		16	
Operating junction and storage temperatures	$T_J, T_{Stg}$		-55 to +175	°C

### ELECTRICAL SPECIFICATIONS ( $T_J = 25$ °C unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Breakdown voltage, blocking voltage	$V_{BR}, V_R$	$I_R = 100$ $\mu$ A	400	-	-	V
Forward voltage	$V_F$	$I_F = 8$ A $I_F = 8$ A, $T_J = 150$ °C	-	1.19 0.94	- 1.3 1.0	
Reverse leakage current	$I_R$	$V_R = V_R$ rated $T_J = 150$ °C, $V_R = V_R$ rated	-	0.2 20	10 500	$\mu$ A
Junction capacitance	$C_T$	$V_R = 400$ V	-	14	-	pF
Series inductance	$L_S$	Measured lead to lead 5 mm from package body	-	8.0	-	nH



DYNAMIC RECOVERY CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 1.0 A, di <sub>F</sub> /dt = 50 A/μs, V <sub>R</sub> = 30 V	-	35	60	ns
		T <sub>J</sub> = 25 °C	-	43	-	
		T <sub>J</sub> = 125 °C	-	67	-	
Peak recovery current	I <sub>RRM</sub>	T <sub>J</sub> = 25 °C	-	2.8	-	A
		T <sub>J</sub> = 125 °C	-	6.3	-	
Reverse recovery charge	Q <sub>rr</sub>	T <sub>J</sub> = 25 °C	-	60	-	nC
		T <sub>J</sub> = 125 °C	-	210	-	

THERMAL - MECHANICAL SPECIFICATIONS						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNITS
Maximum junction and storage temperature range	T <sub>J</sub> , T <sub>Stg</sub>		-55	-	175	°C
Thermal resistance, junction to case	R <sub>thJC</sub>		-	1.8	2.0	°C/W
Thermal resistance, junction to ambient	R <sub>thJA</sub>	Typical socket mount	-	-	50	
Thermal resistance, case to heatsink	R <sub>thCS</sub>	Mounting surface, flat, smooth and greased	-	0.5	-	
Weight			-	2.0	-	g
			-	0.07	-	oz.
Mounting torque			6.0 (5.0)	-	12 (10)	kgf · cm (lbf · in)
Marking device		Case style TO-263AB (D <sup>2</sup> PAK)	8ETU04SH			
		Case style TO-262	8ETU04-1H			

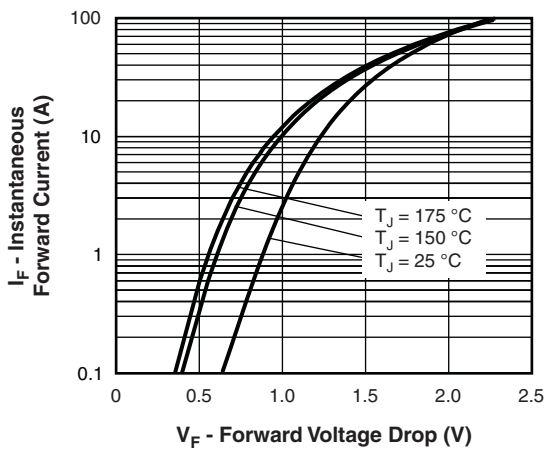


Fig. 1 - Typical Forward Voltage Drop Characteristics

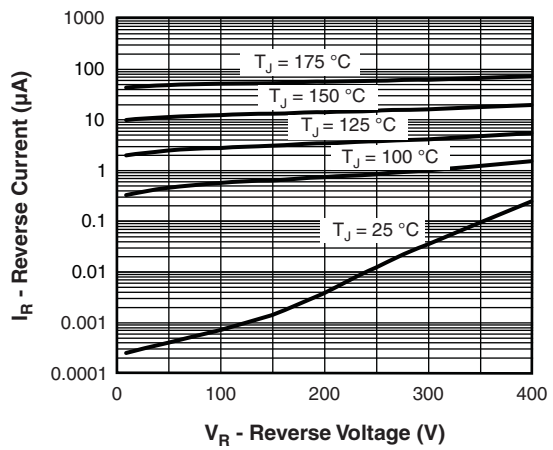


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

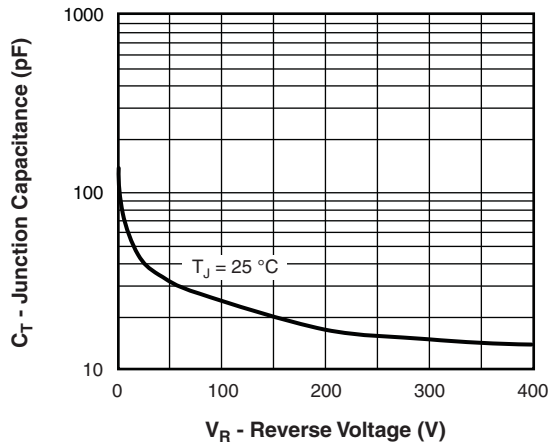


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

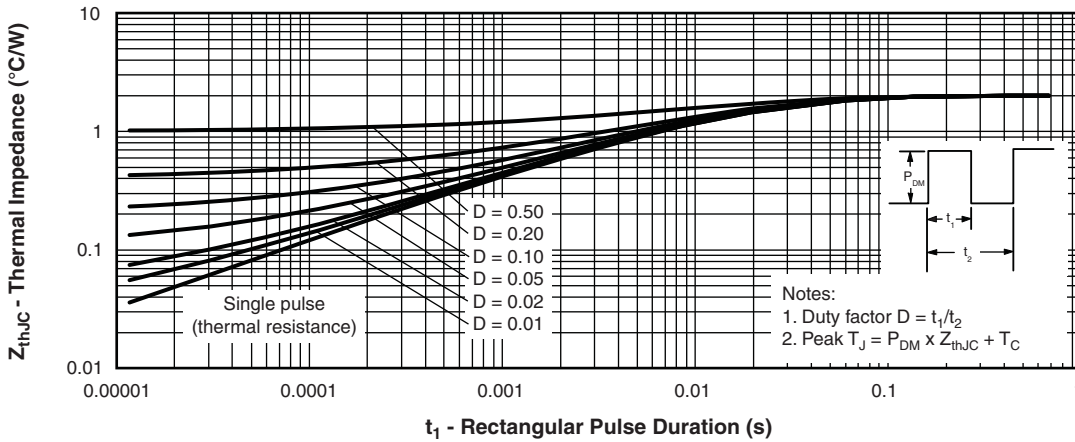


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

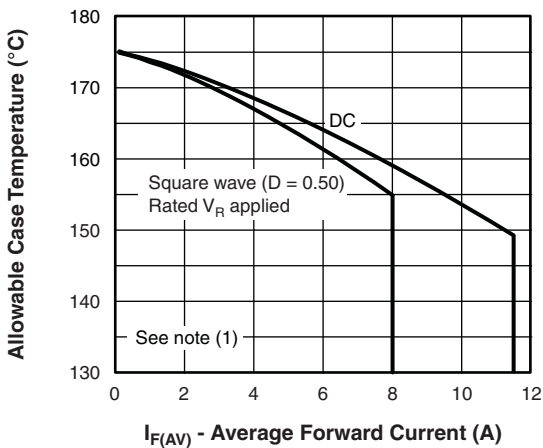


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

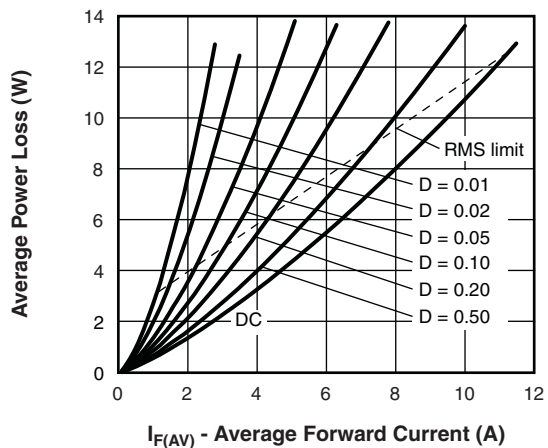


Fig. 6 - Forward Power Loss Characteristics

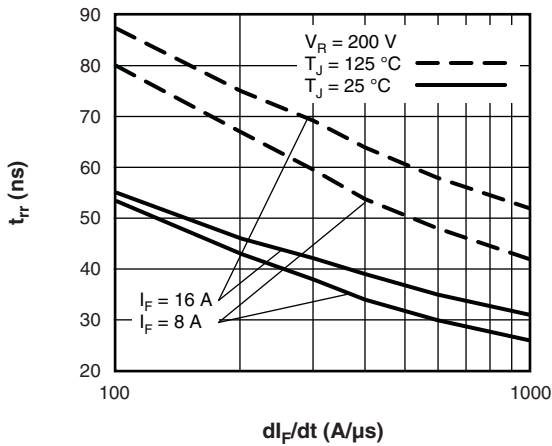


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

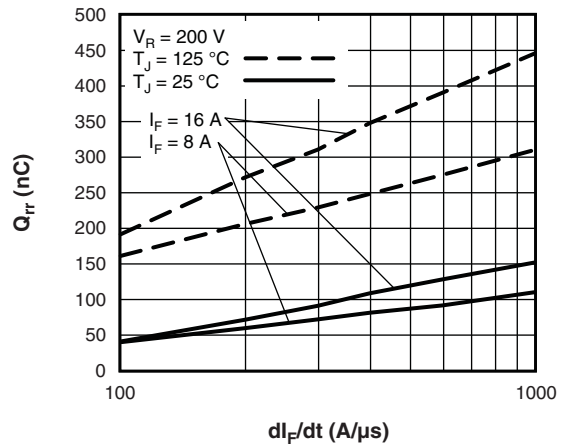
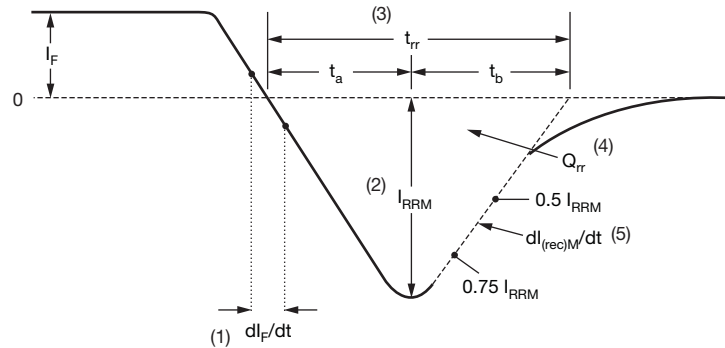


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$

**Note**

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



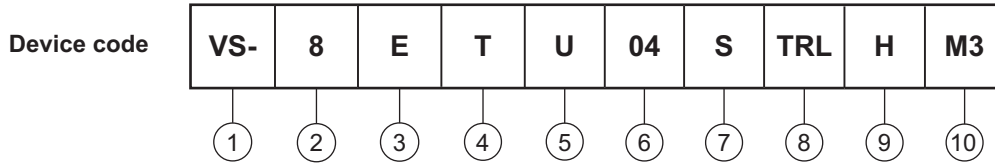
- (1)  $di_F/dt$  - rate of change of current through zero crossing
- (2)  $I_{RRM}$  - peak reverse recovery current
- (3)  $t_{rr}$  - reverse recovery time measured from zero crossing point of negative going  $I_F$  to point where a line passing through  $0.75 I_{RRM}$  and  $0.50 I_{RRM}$  extrapolated 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. 9 - Reverse Recovery Waveform and Definitions



## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating (8 A)
- 3** - E = single diode
- 4** - T = TO-220, D<sup>2</sup>PAK
- 5** - U = ultrafast recovery
- 6** - Voltage rating (04 = 400 V)
- 7** -
  - S = D<sup>2</sup>PAK
  - -1 = TO-262
- 8** -
  - None = tube (50 pieces)
  - TRL = tape and reel (left oriented, for D<sup>2</sup>PAK package)
  - TRR = tape and reel (right oriented, for D<sup>2</sup>PAK package)
- 9** - H = AEC-Q101 qualified
- 10** - 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-8ETU04SHM3	50	1000	Antistatic plastic tube
VS-8ETU04STRRHM3	800	800	13" diameter reel
VS-8ETU04STRLHM3	800	800	13" diameter plastic reel
VS-8ETU04-1HM3	50	1000	Antistatic plastic tube

LINKS TO RELATED DOCUMENTS		
Dimensions	TO-263AB (D <sup>2</sup> PAK)	<a href="http://www.vishay.com/doc?95046">www.vishay.com/doc?95046</a>
	TO-262AA	<a href="http://www.vishay.com/doc?95419">www.vishay.com/doc?95419</a>
Part marking information	TO-263AB (D <sup>2</sup> PAK)	<a href="http://www.vishay.com/doc?95444">www.vishay.com/doc?95444</a>
	TO-262AA	<a href="http://www.vishay.com/doc?95443">www.vishay.com/doc?95443</a>
Packaging information	TO-263AB (D <sup>2</sup> PAK)	<a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a>

## D<sup>2</sup>PAK

### DIMENSIONS in millimeters and inches

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



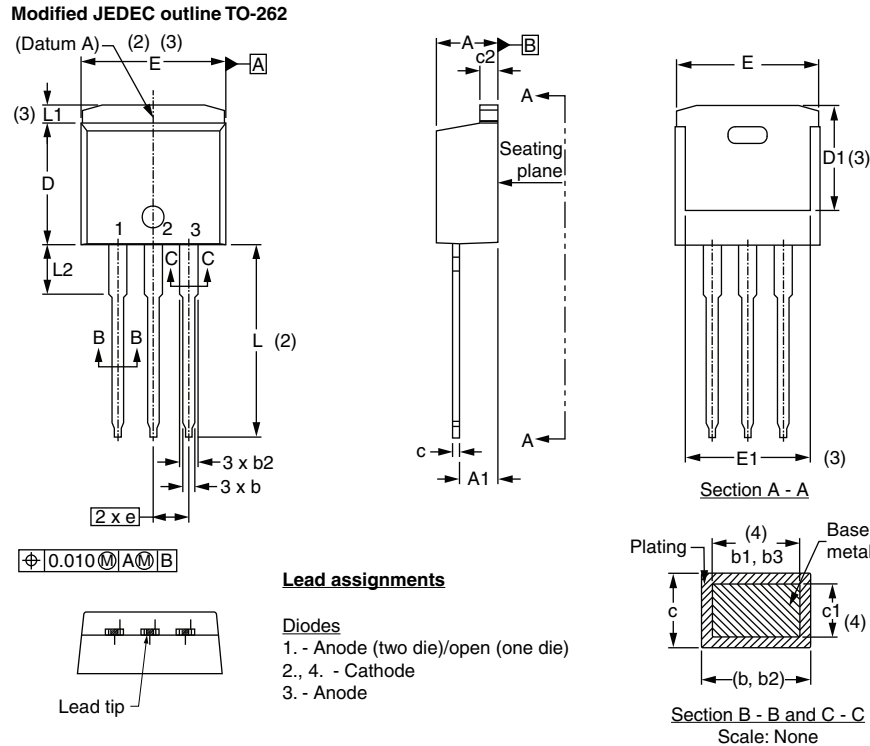
SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	0.00	0.254	0.000	0.010	
b	0.51	0.99	0.020	0.039	
b1	0.51	0.89	0.020	0.035	4
b2	1.14	1.78	0.045	0.070	
b3	1.14	1.73	0.045	0.068	4
c	0.38	0.74	0.015	0.029	
c1	0.38	0.58	0.015	0.023	4
c2	1.14	1.65	0.045	0.065	
D	8.51	9.65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

#### Notes

- Dimensioning and tolerancing per ASME Y14.5 M-1994
- 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
- Thermal pad contour optional within dimension E, L1, D1 and E1
- Dimension b1 and c1 apply to base metal only
- Datum A and B to be determined at datum plane H
- Controlling dimension: inch
- Outline conforms to JEDEC<sup>®</sup> outline TO-263AB

### TO-262

**DIMENSIONS** in millimeters and inches



SYMBOL	MILLIMETERS		INCHES		NOTES
	MIN.	MAX.	MIN.	MAX.	
A	4.06	4.83	0.160	0.190	
A1	2.03	3.02	0.080	0.119	
b	0.51	0.99	0.020	0.039	
b1	0.51	0.89	0.020	0.035	4
b2	1.14	1.78	0.045	0.070	
b3	1.14	1.73	0.045	0.068	4
c	0.38	0.74	0.015	0.029	
c1	0.38	0.58	0.015	0.023	4
c2	1.14	1.65	0.045	0.065	
D	8.51	9.65	0.335	0.380	2
D1	6.86	8.00	0.270	0.315	3
E	9.65	10.67	0.380	0.420	2, 3
E1	7.90	8.80	0.311	0.346	3
e	2.54 BSC		0.100 BSC		
L	13.46	14.10	0.530	0.555	
L1	-	1.65	-	0.065	3
L2	3.56	3.71	0.140	0.146	

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-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) Controlling dimension: inches
- (6) Outline conform to JEDEC TO-262 except A1 (maximum), b (minimum) and D1 (minimum) where dimensions derived the actual package outline



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