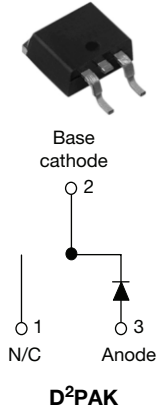
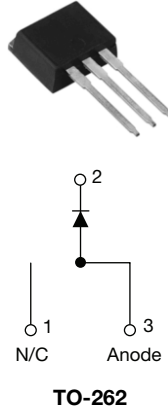


## Ultralow $V_F$ Hyperfast Rectifier for Discontinuous Mode PFC, 8 A FRED Pt<sup>®</sup>

VS-8ETL06SPbF



VS-8ETL06-1PbF



### FEATURES

- Benchmark ultralow forward voltage drop
- Hyperfast recovery time
- Low leakage current
- 175 °C operating junction temperature
- Meets MSL level 1, per J-STD-020, LF maximum peak of 260 °C
- Halogen-free according to IEC 61249-2-21 definition
- Compliant to RoHS directive 2002/95/EC
- AEC-Q101 qualified



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

### DESCRIPTION

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.

### APPLICATIONS

AC/DC SMPS 70 W to 400 W

e.g. laptop and printer AC adaptors, desktop PC, TV and monitor, games units and DVD ac-to-dc power supplies.

### PRODUCT SUMMARY

|                 |        |
|-----------------|--------|
| $V_F$ (typical) | 0.96 V |
| $I_{F(AV)}$     | 8 A    |
| $V_R$           | 600 V  |

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL         | TEST CONDITIONS       | MAX.        | UNITS |
|---|----------------|-----------------------|-------------|-------|
| Peak repetitive reverse voltage             | $V_{RRM}$      |                       | 600         | V     |
| Average rectified forward current           | $I_{F(AV)}$    | $T_C = 160\text{ °C}$ | 8           | A     |
| Non-repetitive peak surge current           | $I_{FSM}$      | $T_J = 25\text{ °C}$  | 175         |       |
| Peak repetitive forward current             | $I_{FM}$       |                       | 16          |       |
| 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                     | $V_F$         | $I_F = 8\text{ A}$<br>$I_F = 8\text{ A}, T_J = 150\text{ °C}$             | -    | 0.96<br>0.81 | 1.05<br>0.86 |               |
| Reverse leakage current             | $I_R$         | $V_R = V_R\text{ rated}$<br>$T_J = 150\text{ °C}, V_R = V_R\text{ rated}$ | -    | 0.05<br>20   | 5<br>100     | $\mu\text{A}$ |
| Junction capacitance                | $C_T$         | $V_R = 600\text{ V}$  | -    | 17           | -            | pF            |
| Series inductance                   | $L_S$         | Measured lead to lead 5 mm from package body                              | -    | 8.0          | -            | nH            |

# VS-8ETL06SPbF, VS-8ETL06-1PbF



Vishay High Power Products Ultralow  $V_F$  Hyperfast Rectifier for  
Discontinuous Mode PFC, 8 A FRED Pt®

| DYNAMIC RECOVERY CHARACTERISTICS ( $T_C = 25\text{ }^\circ\text{C}$ unless otherwise specified) |           |   |      |      |      |               |
|---|-----------|---|------|------|------|---------------|
| PARAMETER   | SYMBOL    | TEST CONDITIONS   | MIN. | TYP. | MAX. | UNITS         |
| Reverse recovery time   | $t_{rr}$  | $I_F = 1\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | 60   | 100  | ns            |
|   |           | $I_F = 8\text{ A}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | 150  | 250  |               |
|   |           | $T_J = 25\text{ }^\circ\text{C}$  | -    | 170  | -    |               |
|   |           | $T_J = 125\text{ }^\circ\text{C}$   | -    | 250  | -    |               |
| Peak recovery current   | $I_{RRM}$ | $T_J = 25\text{ }^\circ\text{C}$  | -    | 15   | -    | A             |
|   |           | $T_J = 125\text{ }^\circ\text{C}$   | -    | 20   | -    |               |
| Reverse recovery charge   | $Q_{rr}$  | $T_J = 25\text{ }^\circ\text{C}$  | -    | 1.3  | -    | $\mu\text{C}$ |
|   |           | $T_J = 125\text{ }^\circ\text{C}$   | -    | 2.6  | -    |               |

| 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  | 2          | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, junction to ambient per leg | $R_{thJA}$        | Typical socket mount                       | -            | -    | 70         |                           |
| Thermal resistance, case to heatsink            | $R_{thCS}$        | Mounting surface, flat, smooth and greased | -            | 0.5  | -          |                           |
| Weight  |                   |  | -            | 2.0  | -          | g                         |
|   |                   |  | -            | 0.07 | -          | oz.                       |
| Mounting torque                                 |                   |  | 6.0<br>(5.0) | -    | 12<br>(10) | kgf · cm<br>(lbf · in)    |
| Marking device                                  |                   | Case style D <sup>2</sup> PAK              | 8ETL06S      |      |            |                           |
|   |                   | Case style TO-262                          | 8ETL06-1     |      |            |                           |

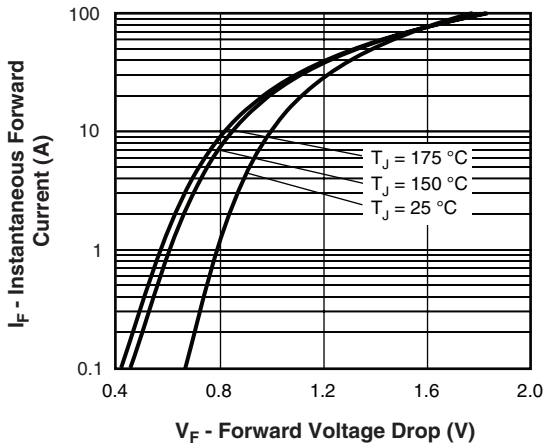


Fig. 1 - Typical Forward Voltage Drop Characteristics

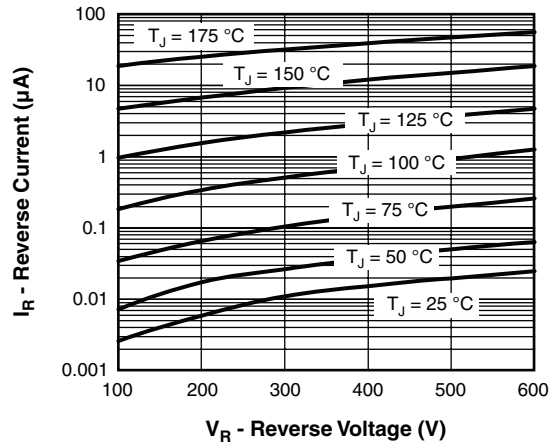


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

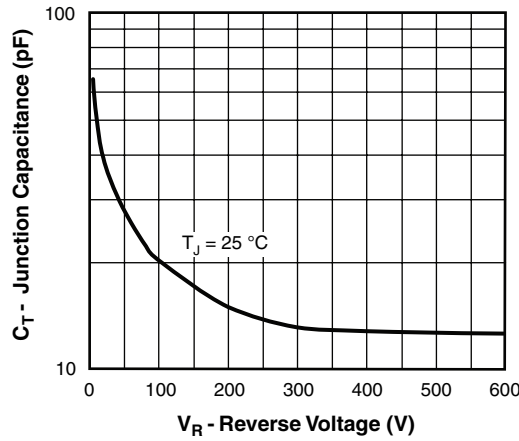


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

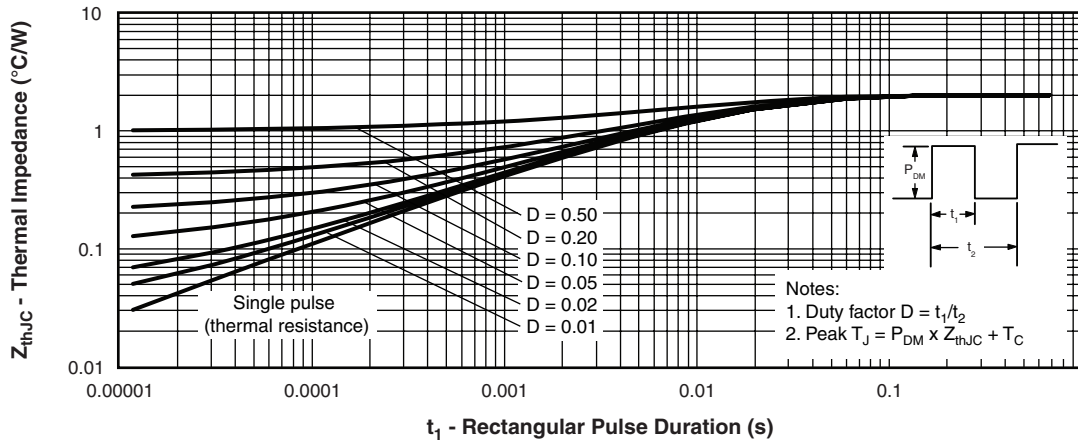


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

# VS-8ETL06SPbF, VS-8ETL06-1PbF



Vishay High Power Products

Ultralow  $V_F$  Hyperfast Rectifier for  
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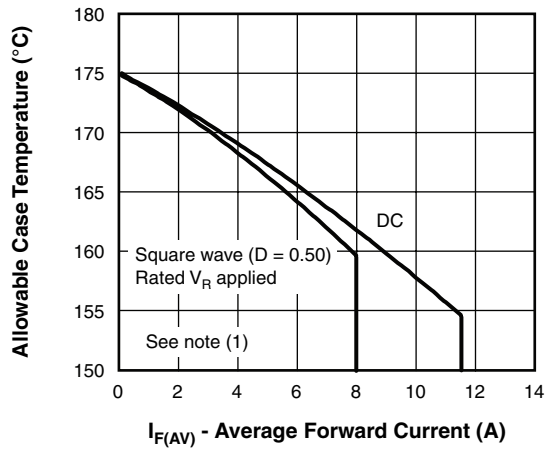


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

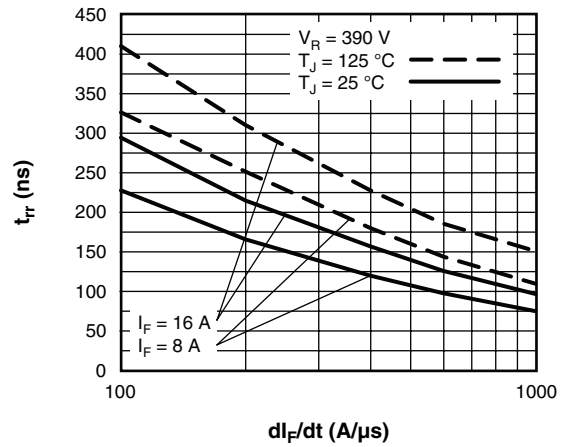


Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$

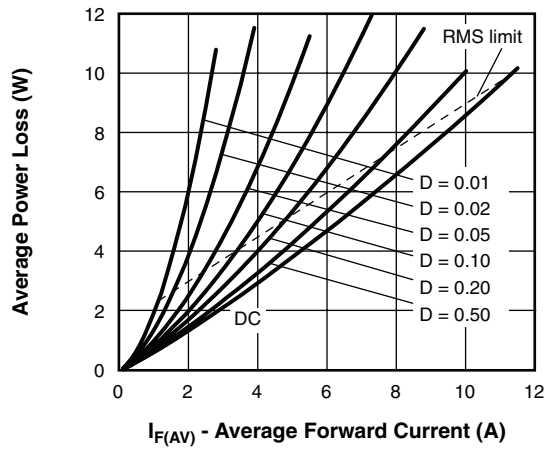


Fig. 6 - Forward Power Loss Characteristics

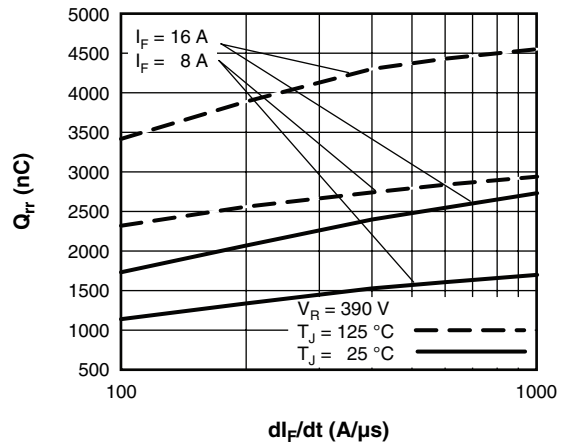


Fig. 8 - Typical Stored Charge vs.  $di_F/dt$

## 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  $V_R$

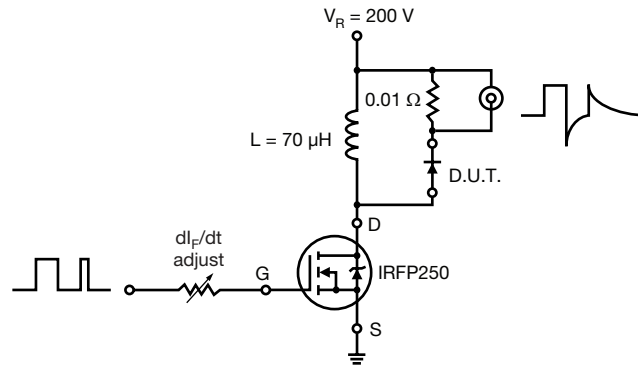
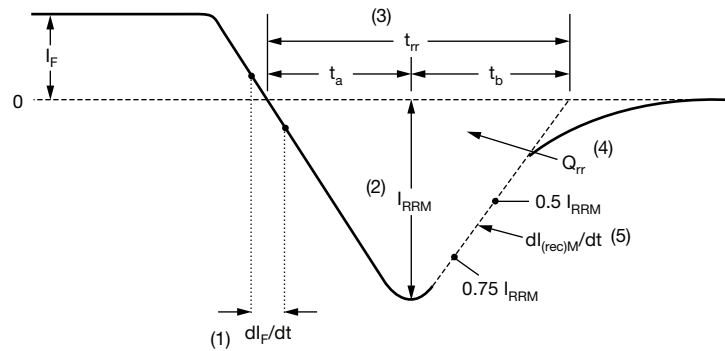


Fig. 9 - Reverse Recovery Parameter Test Circuit



(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  $I_{RRM}$

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

(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

# VS-8ETL06SPbF, VS-8ETL06-1PbF



Vishay High Power Products Ultralow  $V_F$  Hyperfast Rectifier for  
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## ORDERING INFORMATION TABLE

|             |     |   |   |   |   |    |   |     |     |
|-------------|-----|---|---|---|---|----|---|-----|-----|
| Device code | VS- | 8 | E | T | L | 06 | S | TRL | PbF |
|             | ①   | ② | ③ | ④ | ⑤ | ⑥  | ⑦ | ⑧   | ⑨   |

- 1** - HPP product suffix
- 2** - Current rating (8 A)
- 3** - E = Single diode
- 4** - T = TO-220, D<sup>2</sup>PAK
- 5** - L = Ultralow  $V_F$  hyperfast recovery
- 6** - Voltage rating (06 = 600 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** - PbF = Lead (Pb)-free

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95014">www.vishay.com/doc?95014</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95008">www.vishay.com/doc?95008</a> |
| Packaging information      | <a href="http://www.vishay.com/doc?95032">www.vishay.com/doc?95032</a> |

## D<sup>2</sup>PAK, TO-262

### DIMENSIONS FOR D<sup>2</sup>PAK in millimeters and inches

Conforms to JEDEC 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     |

| SYMBOL | MILLIMETERS |       | INCHES    |       | NOTES |
|--------|-------------|-------|-----------|-------|-------|
|        | MIN.        | MAX.  | MIN.      | MAX.  |       |
| 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

- (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: inch

- (7) Outline conforms to JEDEC outline TO-263AB

## DIMENSIONS FOR TO-262 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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**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**