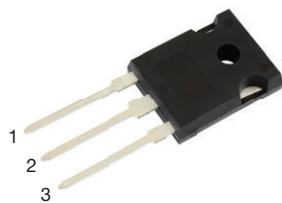
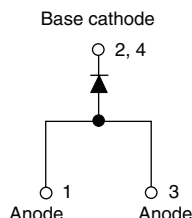


# **FRED Pt® Ultrafast Rectifier, 30 A**


**TO-247AD 3L**


## **FEATURES**

- Low forward voltage drop
- Ultrafast recovery time
- 175 °C operating junction temperature
- Designed and qualified according to commercial qualification
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


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

## **DESCRIPTION**

Ultralow  $V_F$ , soft-switching ultrafast rectifiers optimized for Discontinuous (Critical) Mode (DCM) Power Factor Correction (PFC).

The minimized conduction loss, optimized stored charge and low recovery current minimized 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 adapters, desktop PC, TV and monitor, games units, and DVD AC/DC power supplies.

## **PRODUCT SUMMARY**

|                 |             |
|-----------------|-------------|
| Package         | TO-247AD 3L |
| $I_{F(AV)}$     | 30 A        |
| $V_R$           | 600 V       |
| $V_F$ at $I_F$  | 1.15 V      |
| $t_{rr}$ typ.   | 30 ns       |
| $T_J$ max.      | 175 °C      |
| Diode variation | Single die  |

## **ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                                   | SYMBOL            | TEST CONDITIONS  | MAX.        | UNITS |
|---|-------------------|--|-------------|-------|
| Repetitive peak reverse voltage             | $V_{RRM}$         |  | 600         | V     |
| Average rectified forward current           | $I_{F(AV)}$       | $T_C = 127\text{ °C}$  | 30          | A     |
| Non-repetitive peak surge current           | $I_{FSM}$         | $T_C = 25\text{ °C}$ , $t_p = 8.3\text{ ms}$ ; half sine wave, connecting two anode pins | 250         |       |
| Operating junction and storage temperatures | $T_J$ , $T_{Stg}$ |  | -55 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 | $V_{BR}$ , $V_R$ | $I_R = 100\text{ }\mu\text{A}$               | 600  | -    | -    | V             |
| Forward voltage                     | $V_F$            | $I_F = 30\text{ A}$                          | -    | 1.4  | 2    |               |
|                                     |                  | $I_F = 30\text{ A}$ , $T_J = 150\text{ °C}$  | -    | 1.15 | 1.35 |               |
| Reverse leakage current             | $I_R$            | $V_R = V_R$ rated                            | -    | 0.2  | 30   | $\mu\text{A}$ |
|                                     |                  | $T_J = 150\text{ °C}$ , $V_R = V_R$ rated    | -    | -    | 250  |               |
| Junction capacitance                | $C_T$            | $V_R = 600\text{ V}$                         | -    | 20   | -    | pF            |
| Series inductance                   | $L_S$            | Measured lead to lead 5 mm from package body | -    | 8.0  | -    | nH            |

**DYNAMIC RECOVERY CHARACTERISTICS** ( $T_J = 25\text{ }^{\circ}\text{C}$  unless otherwise specified)

| PARAMETER               | SYMBOL    | TEST CONDITIONS  | MIN. | TYP. | MAX. | UNITS |
|-------------------------|-----------|--|------|------|------|-------|
| Reverse recovery time   | $t_{rr}$  | $I_F = 1\text{ A}$ , $dI_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | 30   | -    | ns    |
|                         |           | $T_J = 25\text{ }^{\circ}\text{C}$   | -    | 45   | -    |       |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$  | -    | 100  | -    |       |
| Peak recovery current   | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$   | -    | 5.6  | -    | A     |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$  | -    | 10   | -    |       |
| Reverse recovery charge | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$   | -    | 127  | -    | nC    |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$  | -    | 580  | -    |       |

**THERMAL - MECHANICAL SPECIFICATIONS**

| PARAMETER                                       | SYMBOL            | TEST CONDITIONS                            | MIN.        | TYP. | MAX.        | UNITS                       |
|---|-------------------|--|-------------|------|-------------|-----------------------------|
| Maximum junction and storage temperature range  | $T_J$ , $T_{Stg}$ |  | -55         | -    | 175         | $^{\circ}\text{C}$          |
| Thermal resistance, junction to case            | $R_{thJC}$        |  | -           | 0.7  | 1.1         | $^{\circ}\text{C}/\text{W}$ |
| Thermal resistance, junction to ambient per leg | $R_{thJA}$        | Typical socket mount                       | -           | -    | 70          |                             |
| Thermal resistance, case to heat sink           | $R_{thCS}$        | Mounting surface, flat, smooth and greased | -           | 0.5  | -           |                             |
| Weight  |                   |  | -           | 2.0  | -           | g                           |
|   |                   |  | -           | 0.07 | -           | oz.                         |
| Mounting torque                                 |                   |  | 1.2<br>(10) | -    | 2.4<br>(20) | kgf · cm<br>(lbf · in)      |
|   |                   | Case style: TO-247AD 3L                    | APU3006L    |      |             |                             |

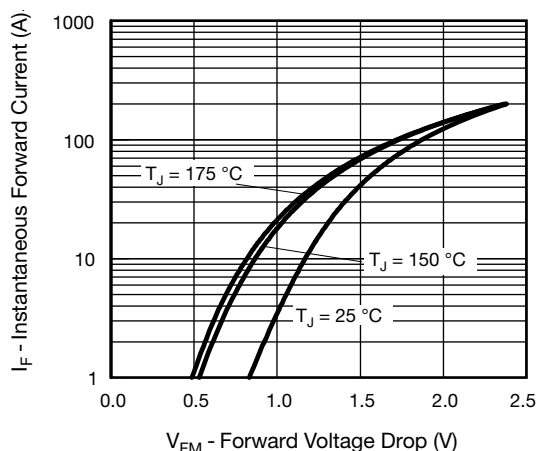


Fig. 1 - Typical Forward Voltage Drop Characteristics

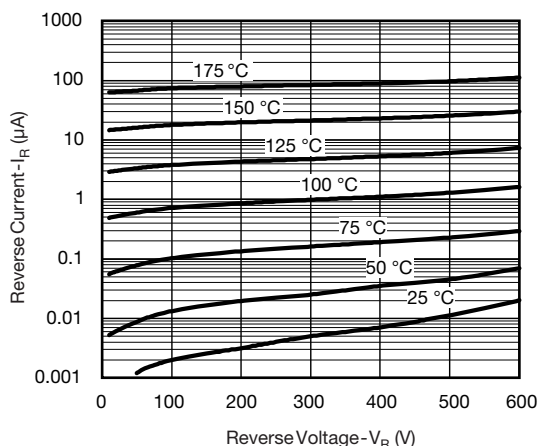


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

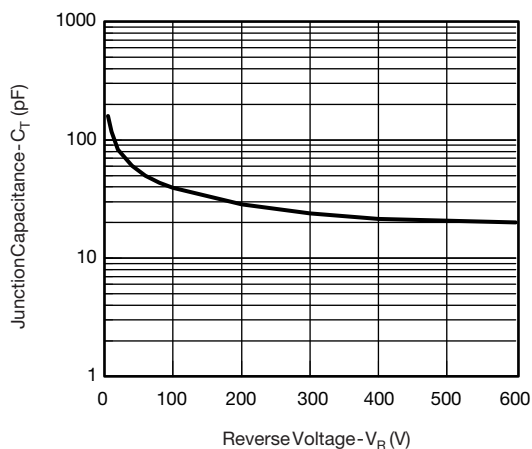
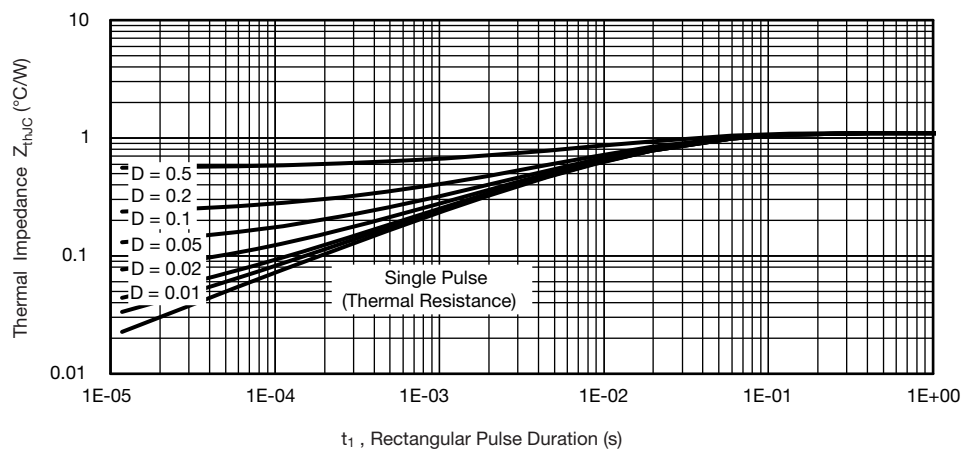


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage


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

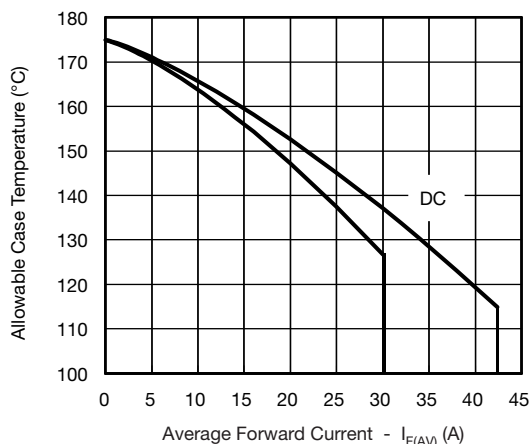


Fig. 5 - Maximum Allowable Case Temperature vs. Average Forward Current

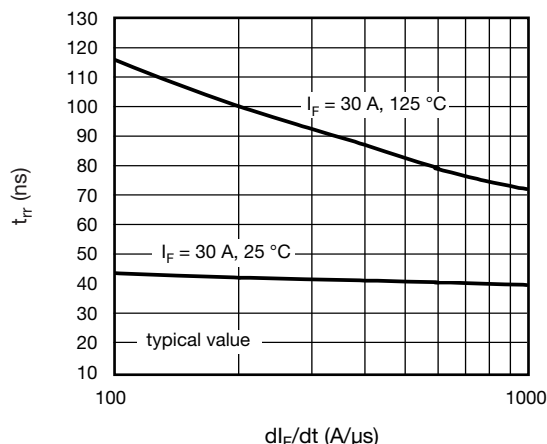


Fig. 7 - Typical Reverse Recovery Time vs.  $dI_F/dt$

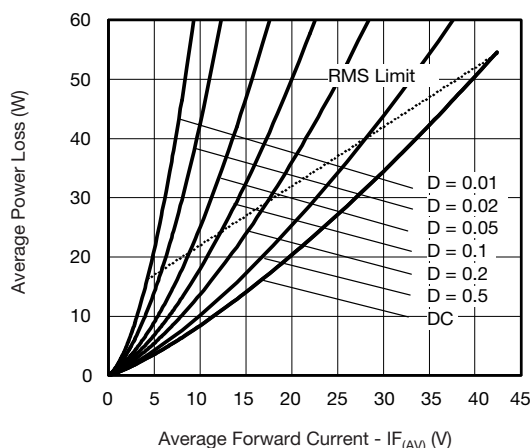


Fig. 6 - Forward Power Loss Characteristics

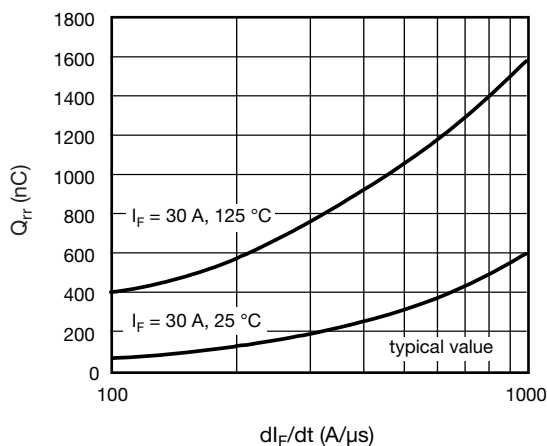
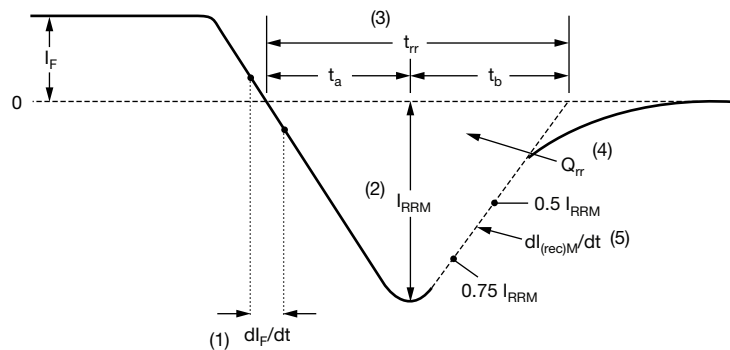


Fig. 8 - Typical Stored Charge vs.  $dI_F/dt$



- (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)  $dl_{(rec)M}/dt$  - peak rate of change of current during  $t_b$  portion of  $t_{rr}$

Fig. 9 - Reverse Recovery Waveform and Definitions



ORDERING INFORMATION TABLE

| Device code | VS-  | A | P | U | 30 | 06 | L | -N3 |
|-------------|--|---|---|---|----|----|---|-----|
|             | 1  | 2 | 3 | 4 | 5  | 6  | 7 | 8   |
| 1           | Vishay Semiconductors product  |   |   |   |    |    |   |     |
| 2           | Ultrafast<br>A = single diode, 3 pin   |   |   |   |    |    |   |     |
| 3           | P = TO-247   |   |   |   |    |    |   |     |
| 4           | U = ultrafast recovery time  |   |   |   |    |    |   |     |
| 5           | Current code (30 = 30 A)   |   |   |   |    |    |   |     |
| 6           | Voltage code (06 = 600 V)  |   |   |   |    |    |   |     |
| 7           | L = long lead  |   |   |   |    |    |   |     |
| 8           | Environmental digit:<br>-N3 = halogen-free, RoHS-compliant, and totally lead (Pb)-free |   |   |   |    |    |   |     |

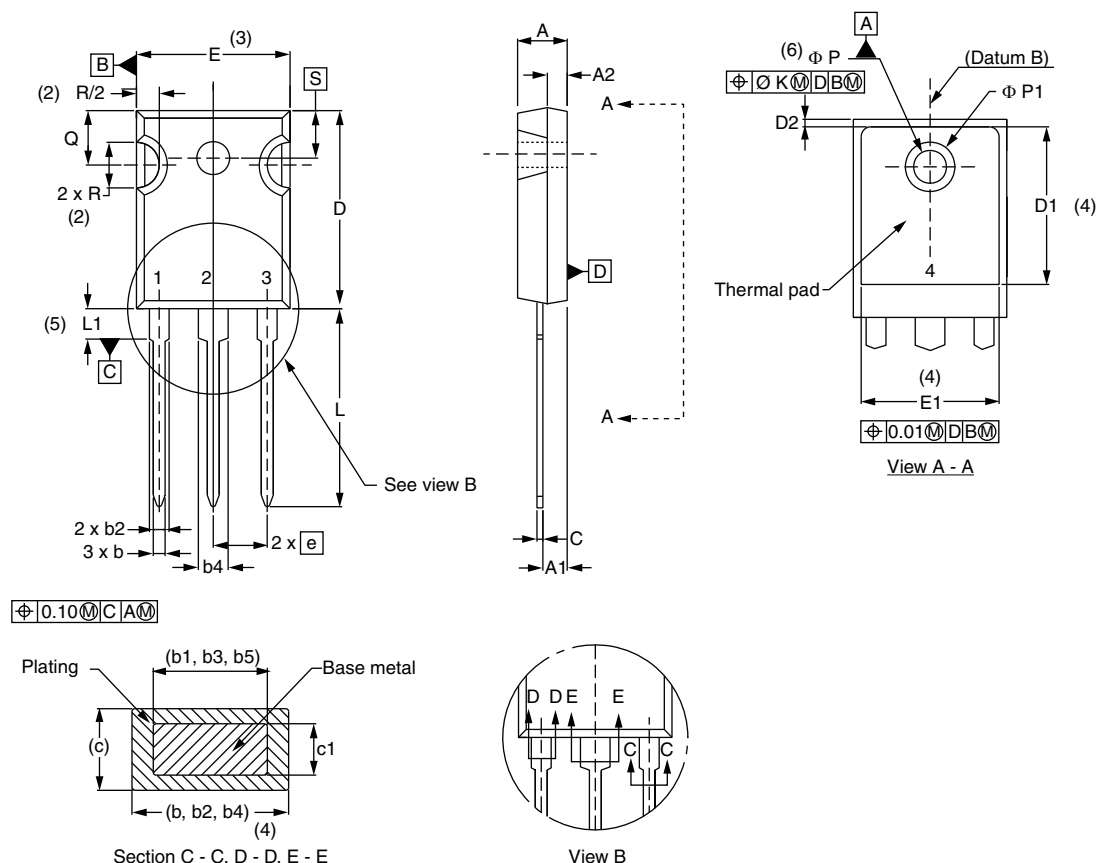
| ORDERING INFORMATION (Example) |                   |                        |                         |
|--------------------------------|-------------------|------------------------|-------------------------|
| PREFERRED P/N                  | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION   |
| VS-APU3006L-N3                 | 25                | 500                    | Antistatic plastic tube |

| LINKS TO RELATED DOCUMENTS |             |  |
|----------------------------|-------------|--|
| Dimensions                 | TO-247AD 3L | <a href="http://www.vishay.com/doc?95626">www.vishay.com/doc?95626</a> |
| Part marking information   | TO-247AD 3L | <a href="http://www.vishay.com/doc?95007">www.vishay.com/doc?95007</a> |



### TO-247AD 3L

**DIMENSIONS** in millimeters and inches



| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.65        | 5.31  | 0.183  | 0.209 |       |
| A1     | 2.21        | 2.59  | 0.087  | 0.102 |       |
| A2     | 1.50        | 2.49  | 0.059  | 0.098 |       |
| b      | 0.99        | 1.40  | 0.039  | 0.055 |       |
| b1     | 0.99        | 1.35  | 0.039  | 0.053 |       |
| b2     | 1.65        | 2.39  | 0.065  | 0.094 |       |
| b3     | 1.65        | 2.34  | 0.065  | 0.092 |       |
| b4     | 2.59        | 3.43  | 0.102  | 0.135 |       |
| b5     | 2.59        | 3.38  | 0.102  | 0.133 |       |
| c      | 0.38        | 0.89  | 0.015  | 0.035 |       |
| c1     | 0.38        | 0.84  | 0.015  | 0.033 |       |
| D      | 19.71       | 20.70 | 0.776  | 0.815 | 3     |
| D1     | 13.08       | -     | 0.515  | -     | 4     |

| SYMBOL    | MILLIMETERS |       | INCHES    |       | NOTES |
|-----------|-------------|-------|-----------|-------|-------|
|           | MIN.        | MAX.  | MIN.      | MAX.  |       |
| D2        | 0.51        | 1.30  | 0.020     | 0.051 |       |
| E         | 15.29       | 15.87 | 0.602     | 0.625 | 3     |
| E1        | 13.46       | -     | 0.53      | -     |       |
| e         | 5.46 BSC    |       | 0.215 BSC |       |       |
| $\phi K$  | 0.254       |       | 0.010     |       |       |
| L         | 19.81       | 20.32 | 0.780     | 0.800 |       |
| L1        | 3.71        | 4.29  | 0.146     | 0.169 |       |
| $\phi P$  | 3.56        | 3.66  | 0.14      | 0.144 |       |
| $\phi P1$ | -           | 6.98  | -         | 0.275 |       |
| Q         | 5.31        | 5.69  | 0.209     | 0.224 |       |
| R         | 4.52        | 5.49  | 0.178     | 0.216 |       |
| S         | 5.51 BSC    |       | 0.217 BSC |       |       |

#### Notes

- Dimensioning and tolerancing per ASME Y14.5M-1994
- Contour of slot optional
- Dimension D and E do not include mold flash. These dimensions are measured at the outermost extremes of the plastic body
- Thermal pad contour optional with dimensions D1 and E1
- Lead finish uncontrolled in L1
- $\phi P$  to have a maximum draft angle of 1.5 to the top of the part with a maximum hole diameter of 3.91 mm (0.154")
- Outline conforms to JEDEC® outline TO-247 with exception of dimension A min., D, E min., Q min., S, and note 4



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