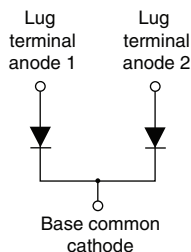



# **FRED Pt®** **Ultrafast Soft Recovery Diode Module, 480 A**


**TO-244**


## **FEATURES**

- Ultrafast recovery
- UL approved file E222165 
- Designed for industrial level
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

## **BENEFITS**

- Reduced RFI and EMI
- Higher frequency operation
- Reduced snubbing
- Reduced parts count

## **DESCRIPTION**

FRED Pt® diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for HF welding, power converters and other applications where switching losses are significant portion of the total losses.

## **PRIMARY CHARACTERISTICS**

|                       |                           |
|-----------------------|---------------------------|
| $I_{F(AV)}$           | 480 A                     |
| $V_R$                 | 200 V                     |
| $Q_{rr}$ (typical)    | 249 nC                    |
| $t_{rr}$              | 87 ns                     |
| Type                  | Modules - diode, FRED Pt® |
| Package               | TO-244                    |
| Circuit configuration | Two diodes common cathode |

## **ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                            | SYMBOL      | TEST CONDITIONS           | MAX.        | UNITS            |
|--------------------------------------|-------------|---------------------------|-------------|------------------|
| Cathode to anode voltage             | $V_R$       |                           | 200         | V                |
| Continuous forward current           | $I_{F(AV)}$ | $T_C = 127^\circ\text{C}$ | 240         | A                |
| Single pulse forward current         | $I_{FSM}$   | $T_C = 25^\circ\text{C}$  | 2300        |                  |
| Storage temperature range            | $T_{Stg}$   |                           | -40 to +150 | $^\circ\text{C}$ |
| Operating junction temperature range | $T_J$       |                           | -40 to +175 | $^\circ\text{C}$ |

## **ELECTRICAL SPECIFICATIONS PER LEG ( $T_J = 25^\circ\text{C}$ unless otherwise specified)**

| PARAMETER               | SYMBOL    | TEST CONDITIONS                                | MIN. | TYP. | MAX. | UNITS |
|-------------------------|-----------|--|------|------|------|-------|
| Breakdown voltage       | $V_{BR}$  | $I_R = 100\ \mu\text{A}$                       | 200  | -    | -    | V     |
| Forward voltage         | $V_{FM}$  | $I_F = 200\ \text{A}$                          | -    | 0.94 | 1.0  |       |
|                         |           | $I_F = 400\ \text{A}$                          | -    | 1.06 | 1.14 |       |
|                         |           | $I_F = 200\ \text{A}, T_J = 175^\circ\text{C}$ | -    | 0.73 | 0.80 |       |
|                         |           | $I_F = 400\ \text{A}, T_J = 175^\circ\text{C}$ | -    | 0.88 | 0.99 |       |
| Reverse leakage current | $I_{RRM}$ | $T_J = 175^\circ\text{C}, V_R = V_R$ rated     | -    | 0.67 | 1.5  | mA    |
| Series inductance       | $L_S$     | From top of terminal hole to mounting plane    | -    | 5    | -    | nH    |

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

| PARAMETER               | SYMBOL   | TEST CONDITIONS   | MIN. | TYP.  | MAX. | UNITS |
|-------------------------|----------|---|------|-------|------|-------|
| Reverse recovery time   | $t_{rr}$ | $I_F = 50\ \text{A}, dI_F/dt = 200\ \text{A}/\mu\text{s}, V_R = 200\ \text{V}, T_J = 25^\circ\text{C}$  | -    | 87    | 130  | ns    |
|                         |          | $I_F = 50\ \text{A}, dI_F/dt = 200\ \text{A}/\mu\text{s}, V_R = 100\ \text{V}, T_J = 125^\circ\text{C}$ | -    | 95    | 155  |       |
| Peak recovery current   | $I_{RR}$ | $I_F = 50\ \text{A}, dI_F/dt = 200\ \text{A}/\mu\text{s}, V_R = 200\ \text{V}, T_J = 25^\circ\text{C}$  | -    | 6     | 11.5 | A     |
|                         |          | $I_F = 50\ \text{A}, dI_F/dt = 200\ \text{A}/\mu\text{s}, V_R = 100\ \text{V}, T_J = 125^\circ\text{C}$ | -    | 10.62 | 16.5 |       |
| Reverse recovery charge | $Q_{rr}$ | $I_F = 50\ \text{A}, dI_F/dt = 200\ \text{A}/\mu\text{s}, V_R = 200\ \text{V}, T_J = 25^\circ\text{C}$  | -    | 249   | 420  | nC    |
|                         |          | $I_F = 50\ \text{A}, dI_F/dt = 200\ \text{A}/\mu\text{s}, V_R = 100\ \text{V}, T_J = 125^\circ\text{C}$ | -    | 493   | 980  |       |



| 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> |                        | -        | -    | -40 to +175 | °C                  |
| Thermal resistance, junction-to-case per leg                | R <sub>thJC</sub>                 | DC operation           | -        | -    | 0.19        | °C/W                |
| Thermal resistance, junction-to-case per module             |                                   |                        | -        | -    | 0.095       |                     |
| Thermal resistance, case-to-heatsink (flag greased surface) | R <sub>thCS</sub>                 | Flag, greased, surface | -        | 0.10 | -           |                     |
| Weight  |                                   |                        | -        | 68   | -           | g                   |
|   |                                   |                        | -        | 2.4  | -           | oz.                 |
| Mounting torque   |                                   |                        | 30 (3.4) | -    | 40 (4.6)    | lbf · in<br>(N · m) |
| Mounting torque center hole                                 |                                   |                        | 12 (1.4) | -    | 18 (2.1)    |                     |
| Terminal torque   |                                   |                        | 30 (3.4) | -    | 40 (4.6)    |                     |
| Vertical pull   |                                   |                        | -        | -    | 80          | lbf · in            |
| 2" lever pull   |                                   |                        | -        | -    | 35          |                     |
| Case style  |                                   |                        | TO-244   |      |             |                     |

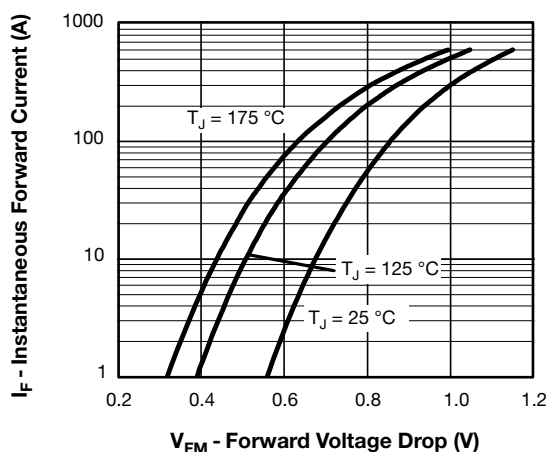


Fig. 1 - Typical Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

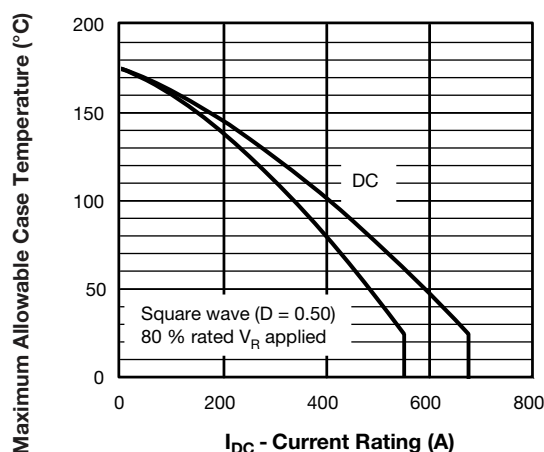


Fig. 3 - Maximum Current Rating Capability (Per Leg)

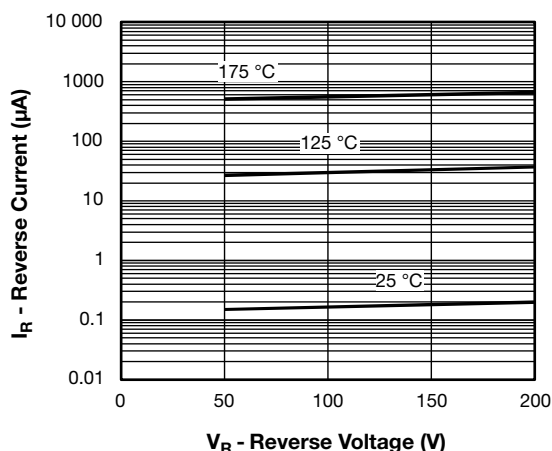
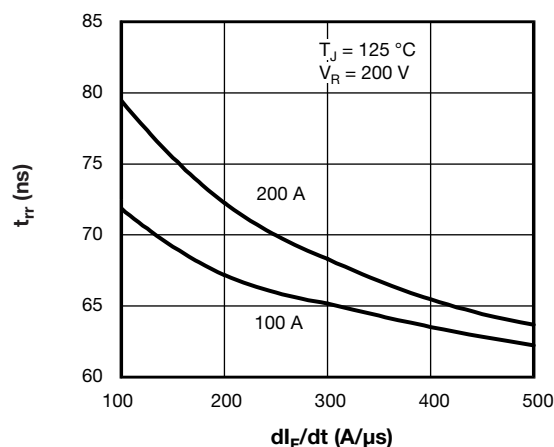


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

Fig. 4 - Typical Recovery Time vs.  $dI_F/dt$  (Per Leg)

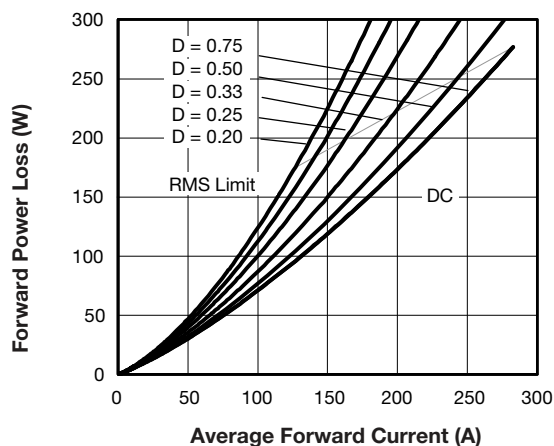
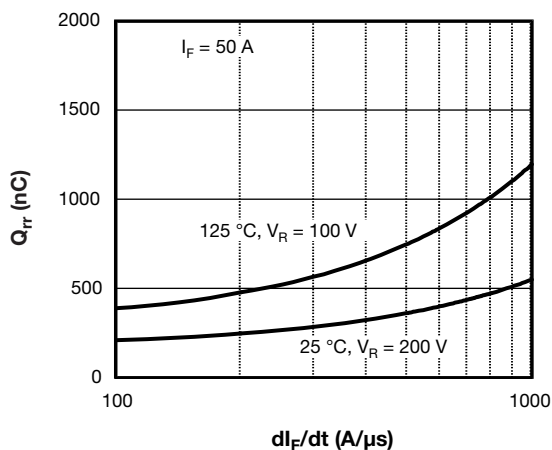
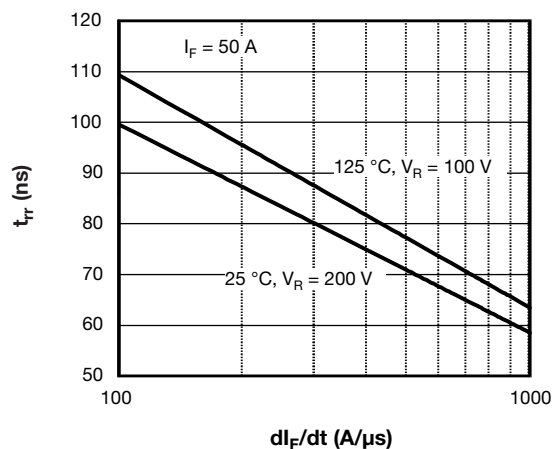
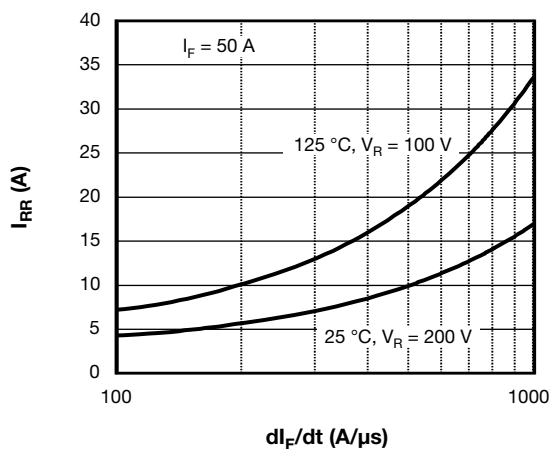
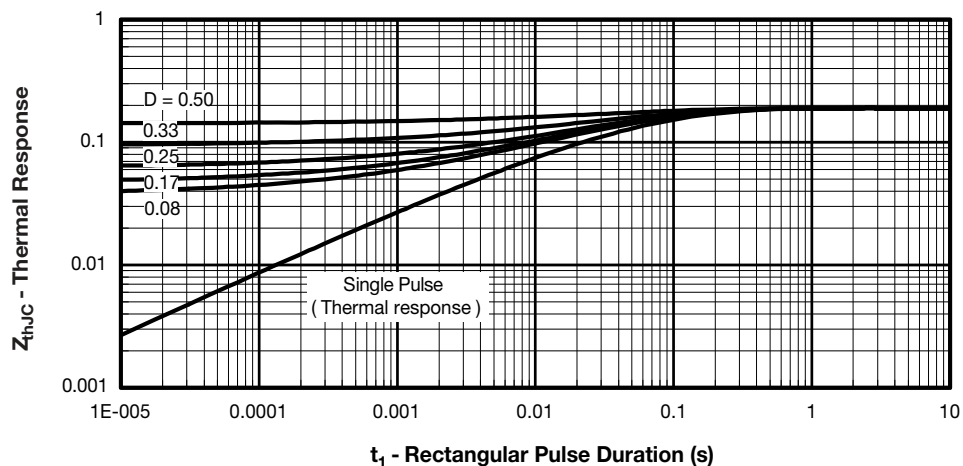


Fig. 5 - Forward Power Loss Characteristics (Per Leg)


Fig. 7 - Typical Reverse Recovery Charge vs.  $dI_F/dt$  (Per Leg)

Fig. 6 - Typical Reverse Recovery Time vs.  $dI_F/dt$  (Per Leg)

Fig. 8 - Typical Reverse Recovery Current vs.  $dI_F/dt$  (Per Leg)

Fig. 9 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

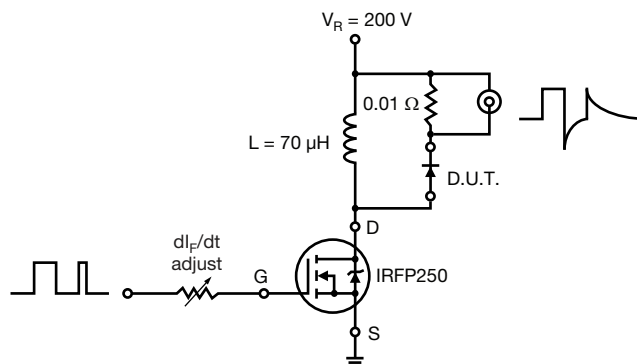


Fig. 10 - Reverse Recovery Parameter Test Circuit  
(All recovery characteristics have been determined using test circuit shown)

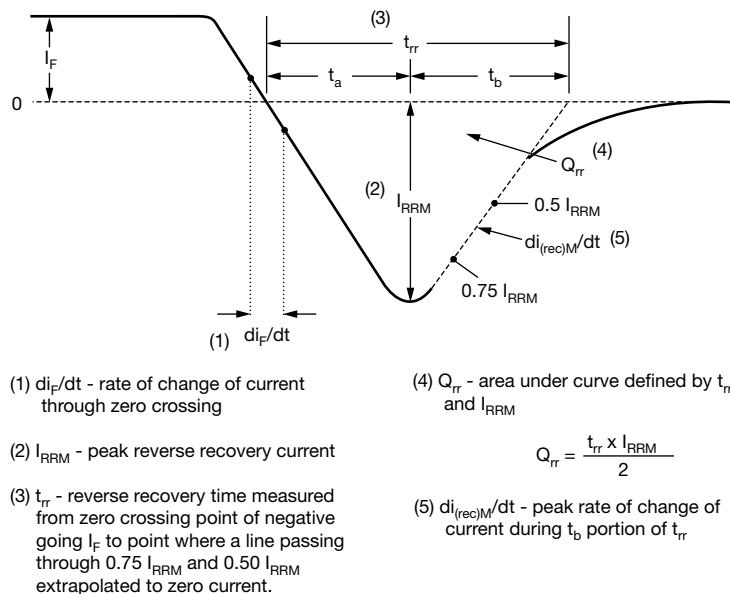
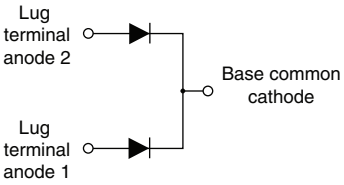


Fig. 11 - Reverse Recovery Waveform and Definitions



ORDERING INFORMATION TABLE

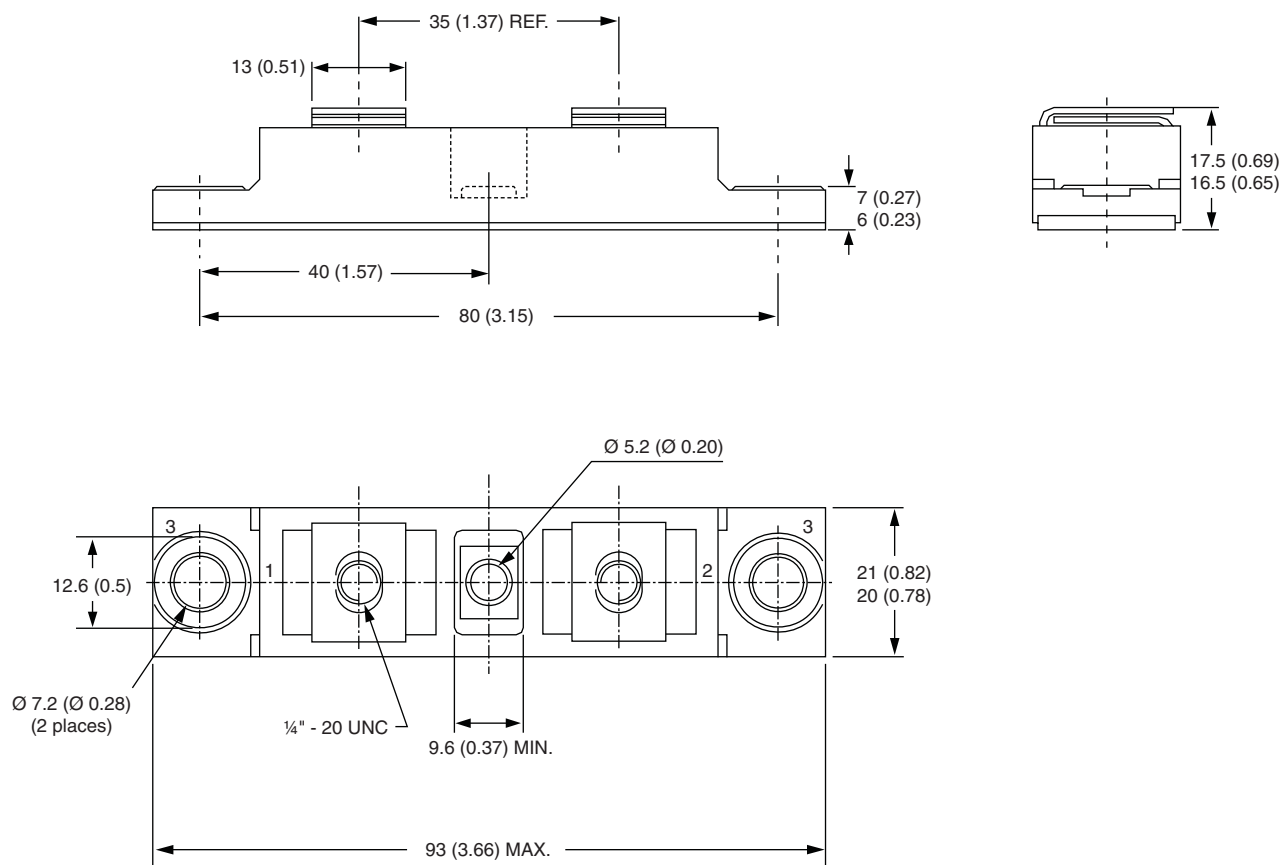
|             |       |    |  |   |   |    |
|-------------|-------|----|--|---|---|----|
| Device code | VS-VS | UD | 400  | C | W | 20 |
|             | 1     | 2  | 3  | 4 | 5 | 6  |
|             | 1     | -  | VS-VS = Vishay Semiconductors product                    |   |   |    |
|             | 2     | -  | Ultrafast diode  |   |   |    |
|             | 3     | -  | Current rating (400 = 400 A)                             |   |   |    |
|             | 4     | -  | Circuit configuration:<br>C = not isolated               |   |   |    |
|             | 5     | -  | Type of device:<br>W = TO-244 wire bondable not isolated |   |   |    |
|             | 6     | -  | Voltage rating (20 = 200 V)                              |   |   |    |

| CIRCUIT CONFIGURATION     |                            |  |
|---------------------------|----------------------------|--|
| CIRCUIT                   | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING  |
| Two diodes common cathode | C                          |  |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95021">www.vishay.com/doc?95021</a> |

## TO-244

**DIMENSIONS** in millimeters (inches)





## Disclaimer

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