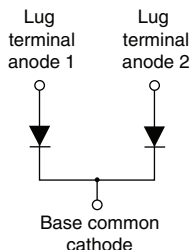


# **FRED Pt® Gen 5, Ultrafast Rectifier Diode, 600 V, 600 A**


**TO-244**


## **FEATURES**

- Ultrafast and optimized  $Q_{rr}$
- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operation junction temperature
- UL approved file E222165 
- 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 / APPLICATIONS**

Featuring a unique combination of low conduction and switching losses the FRED Pt® Gen 5 is the right choice for soft switched and resonant converters, as well as medium frequency hard switching converters.

These devices are also ideally suited for HF welding, power converters, and other applications where switching losses are significant portion of the total losses.

## **PRIMARY CHARACTERISTICS**

|                                   |                           |
|-----------------------------------|---------------------------|
| $I_{F(AV)}$ at 77 °C (per module) | 600 A                     |
| $V_R$                             | 600 V                     |
| $Q_{rr}$ (typical)                | 800 nC                    |
| $t_{rr}$                          | 78 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                              | $V_R$       |                       | 600         | V     |
| Continuous forward current per diode                  | $I_{F(DC)}$ | $T_C = 25\text{ °C}$  | 505         | A     |
|                                                       |             | $T_C = 85\text{ °C}$  | 359         |       |
|                                                       |             | $T_C = 106\text{ °C}$ | 271         |       |
| Non-repetitive single pulse forward current per diode | $I_{FSM}$   | $T_C = 25\text{ °C}$  | 2200        |       |
| Maximum power dissipation per diode                   | $P_D$       | $T_C = 25\text{ °C}$  | 938         | W     |
|                                                       |             | $T_C = 106\text{ °C}$ | 431         |       |
| Storage temperature range                             | $T_{Stg}$   |                       | -40 to +150 | °C    |
| Operating junction temperature range                  | $T_J$       |                       | -40 to +175 | °C    |

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

| PARAMETER                            | SYMBOL   | TEST CONDITIONS                                       | MIN. | TYP. | MAX. | UNITS |
|--------------------------------------|----------|-------------------------------------------------------|------|------|------|-------|
| Breakdown voltage                    | $V_{BR}$ | $I_R = 400\text{ }\mu\text{A}$                        | 600  | -    | -    | V     |
| Forward voltage                      | $V_{FM}$ | $I_F = 300\text{ A}$                                  | -    | 1.34 | 1.70 |       |
|                                      |          | $I_F = 600\text{ A}$                                  | -    | 1.52 | 2.25 |       |
|                                      |          | $I_F = 300\text{ A}, T_J = 150\text{ °C}$             | -    | 1.11 | -    |       |
|                                      |          | $I_F = 600\text{ A}, T_J = 150\text{ °C}$             | -    | 1.35 | -    |       |
| Reverse leakage current              | $I_{RM}$ | $T_J = 150\text{ °C}, V_R = 600\text{ V}$             | -    | 0.4  | 1.0  | mA    |
| Series inductance                    | $L_S$    | From top of terminal hole to mounting plane           | -    | 5    | -    | nH    |
| Maximum junction capacitance per leg | $C_T$    | $V_{DC} = 5\text{ V}, f = 1\text{ MHz}, 25\text{ °C}$ | -    | -    | 1.8  | nF    |

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

| PARAMETER               | SYMBOL    | TEST CONDITIONS                     | MIN. | TYP. | MAX. | UNITS |
|-------------------------|-----------|-------------------------------------|------|------|------|-------|
| Reverse recovery time   | $t_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$  | -    | 78   | -    | ns    |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$ | -    | 193  | -    |       |
| Peak recovery current   | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$  | -    | 9.0  | -    | A     |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$ | -    | 25   | -    |       |
| Reverse recovery charge | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$  | -    | 880  | -    | nC    |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$ | -    | 4000 | -    |       |

 $I_F = 50\text{ A}$ ,  
 $di_F/dt = 200\text{ A}/\mu\text{s}$ ,  
 $V_R = 300\text{ V}$ 
**THERMAL - MECHANICAL SPECIFICATIONS**

| THERMAL MECHANICAL SPECIFICATIONS       |            |            |          |      |          |                     |
|-----------------------------------------|------------|------------|----------|------|----------|---------------------|
| PARAMETER                               |            | SYMBOL     | MIN.     | TYP. | MAX.     | UNITS               |
| Thermal resistance,<br>junction to case | per leg    | $R_{thJC}$ | -        | -    | 0.16     | °C/W                |
|                                         | per module |            | -        | -    | 0.08     |                     |
| Thermal resistance, case to heatsink    |            | $R_{thCS}$ | -        | 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   |      |          |                     |

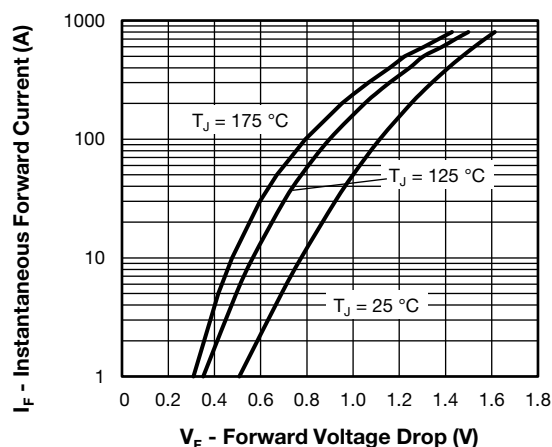


Fig. 1 - Typical Forward Voltage Drop vs. Instantaneous Forward Current (Per Diode)

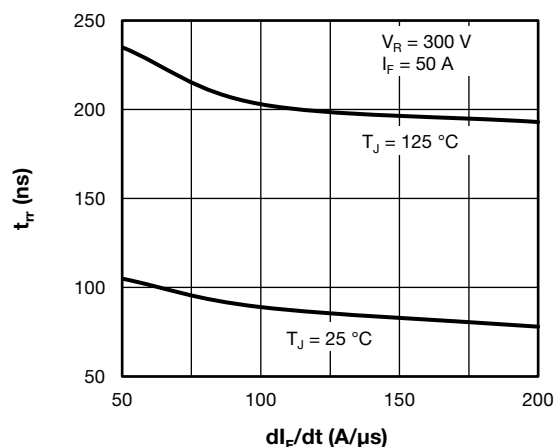


Fig. 4 - Typical Reverse Recovery Time vs  $dI_F/dt$  (Per Diode)

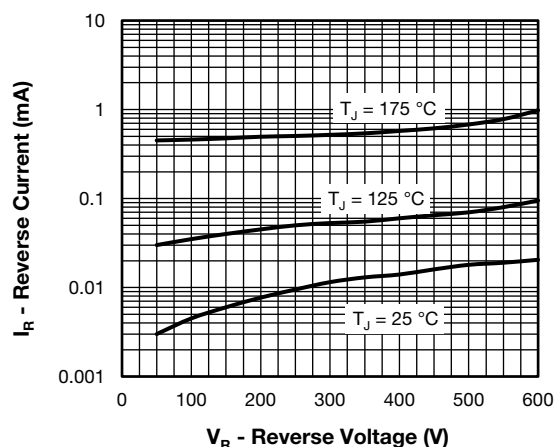


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Diode)

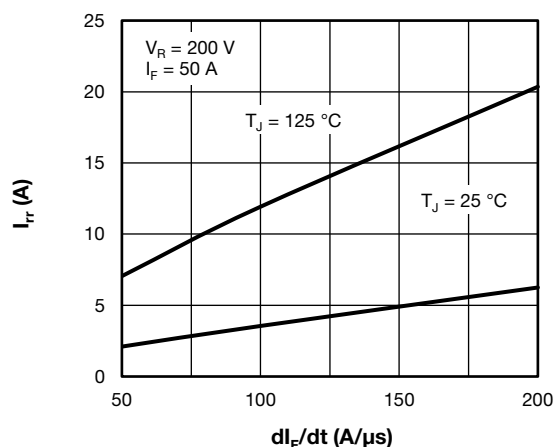


Fig. 5 - Typical Reverse Recovery Current vs  $dI_F/dt$  (Per Diode)

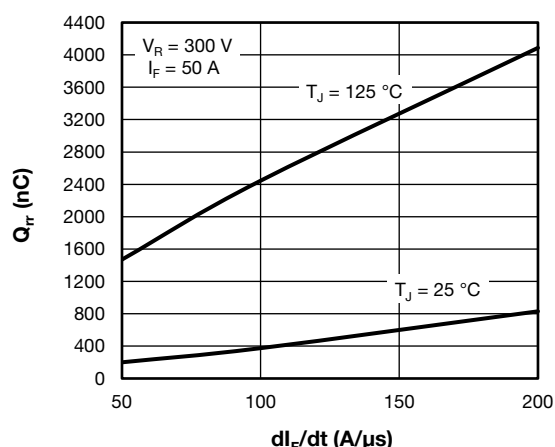


Fig. 3 - Typical Reverse Recovery Charge vs  $dI_F/dt$  (Per Diode)

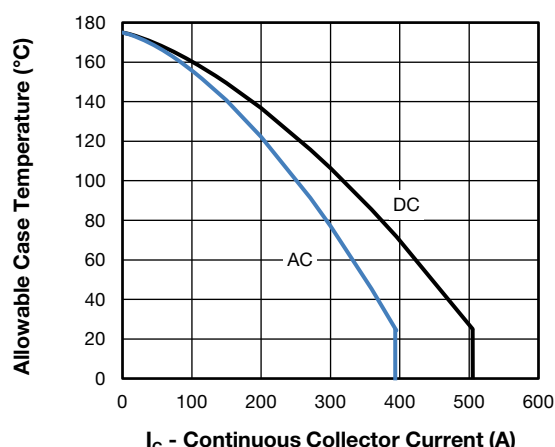


Fig. 6 - Maximum Continuous Forward Current vs. Case Temperature

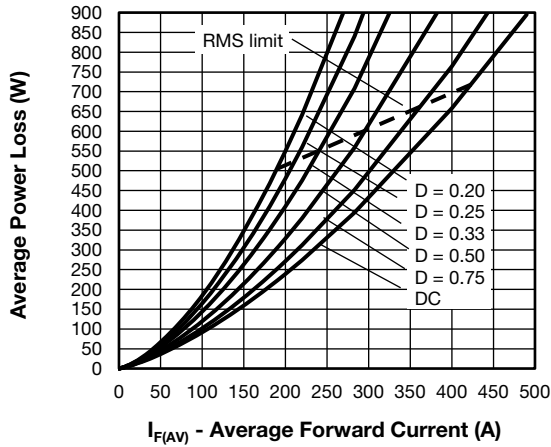


Fig. 7 - Average Power Loss vs. Average Forward Current  
(Forward Power Loss Characteristics)

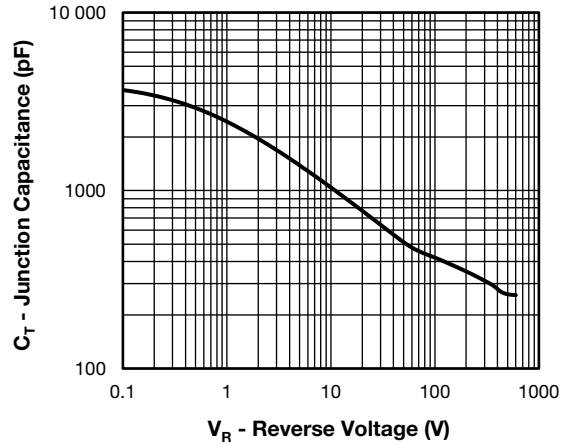


Fig. 8 - Typical Junction Capacitance vs. Reverse Voltage

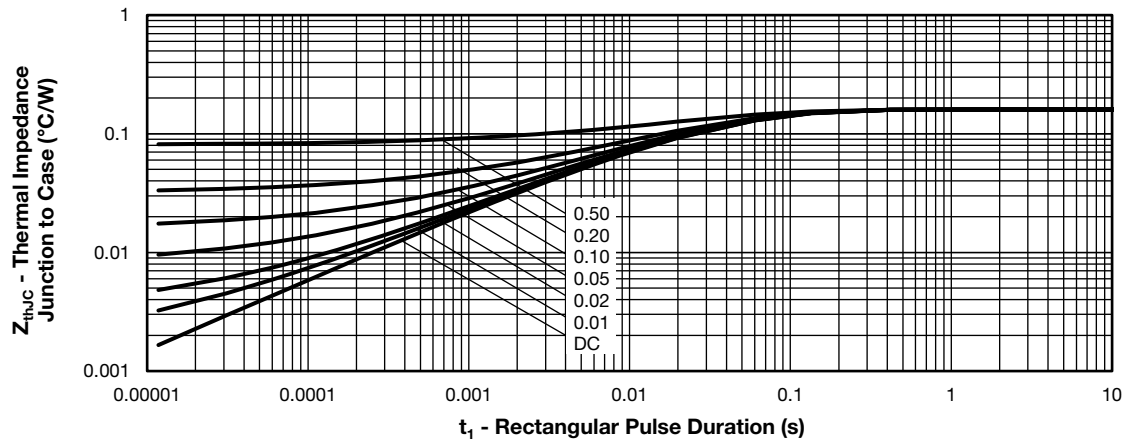
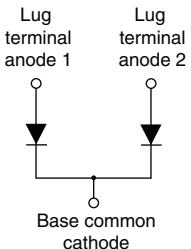


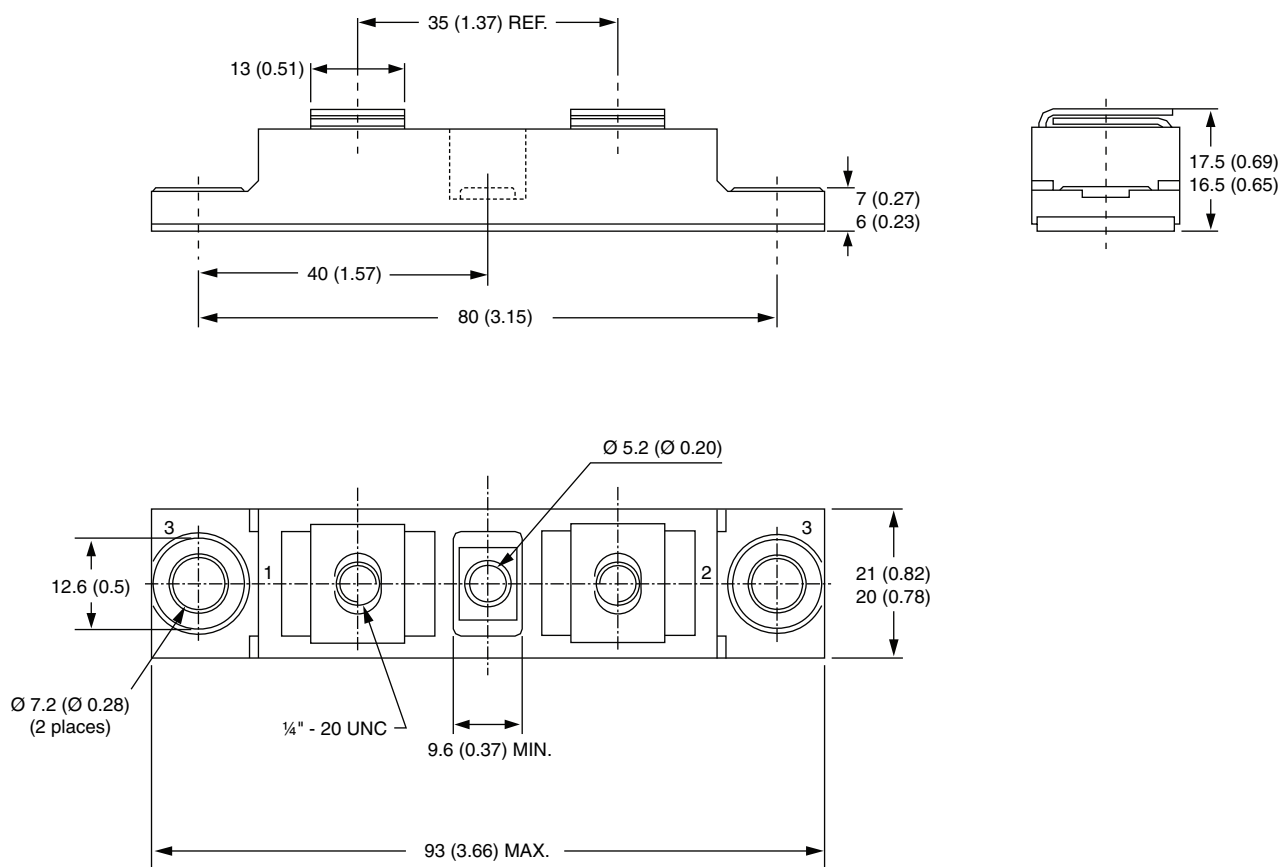
Fig. 9 -  $Z_{thJC}$  Maximum Thermal Impedance Junction to Case vs.  $t_1$  Rectangular Pulse Duration

## ORDERING INFORMATION TABLE

| Device code | VS-VS | 5HD                                   | 600 | C | W | 60 |
|-------------|-------|---------------------------------------|-----|---|---|----|
|             | ①     | ②                                     | ③   | ④ | ⑤ | ⑥  |
| ①           | -     | Vishay Semiconductors product         |     |   |   |    |
| ②           | -     | 5HD = high speed FRED Pt® Gen 5       |     |   |   |    |
| ③           | -     | Current rating (600 = 600 A)          |     |   |   |    |
| ④           | -     | Circuit configuration:                |     |   |   |    |
|             |       | C = two diodes common cathode         |     |   |   |    |
| ⑤           | -     | W = TO-244 wire bondable not isolated |     |   |   |    |
| ⑥           | -     | Voltage rating (60 = 600 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> |

**DIMENSIONS** in millimeters (inches)




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