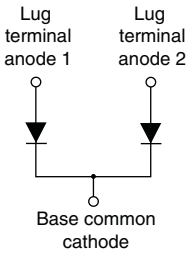
# FRED Pt®
# Ultrafast Soft Recovery Diode Module, 360 A

TO-244




## FEATURES

- Very low $Q_{rr}$ and $t_{rr}$
- UL approved file E222165
- Designed and qualified for industrial level
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

## BENEFITS

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

## DESCRIPTION / APPLICATIONS

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 a significant portion of the total losses.

| PRIMARY CHARACTERISTICS | |
|---|---|
| $I_{F(AV)}$ | 360 A |
| $V_R$ | 400 V |
| $Q_{rr}$ (typical) | 243 nC |
| $t_{rr}$ | 74 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 | $V_R$ | | 400 | V |
| Continuous forward current per diode | $I_{F(AV)}$ | $T_C$ = 25 °C | 510 | A |
| | | $T_C$ = 85 °C | 305 | |
| | | $T_C$ = 116 °C | 180 | |
| Single pulse forward current per diode | $I_{FSM}$ | $T_C$ = 25 °C | 2880 | |
| Maximum power dissipation | $P_D$ | $T_C$ = 25 °C | 570 | W |
| | | $T_C$ = 110 °C | 180 | |
| Operating junction and storage temperatures | $T_J$, $T_{Stg}$ | | -40 to +150 | °C |

| ELECTRICAL SPECIFICATIONS PER LEG ($T_J$ = 25 °C unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Breakdown voltage | $V_{BR}$ | $I_R$ = 100 µA | 400 | - | - | V |
| Forward voltage | $V_{FM}$ | $I_F$ = 180 A | - | 1.09 | 1.27 | |
| | | $I_F$ = 360 A | - | 1.23 | 1.50 | |
| | | $I_F$ = 180 A, $T_J$ = 150 °C | - | 0.88 | 0.96 | |
| | | $I_F$ = 360 A, $T_J$ = 150 °C | - | 1.04 | 1.18 | |
| Reverse leakage current | $I_{RM}$ | $T_J$ = 150 °C, $V_R$ = $V_R$ rated | - | 0.26 | 1.28 | mA |
| Series inductance | $L_S$ | From top of terminal hole to mounting plane | - | 5 | - | nH |

| DYNAMIC RECOVERY CHARACTERISTICS ($T_J$ = 25 °C unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time | $t_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 30 V | | - | 40 | 69 | ns |
| | | $T_J$ = 25 °C | $I_F$ = 180 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 200 V | - | 74 | - | |
| | | $T_J$ = 150 °C | | - | 171 | - | |
| Peak recovery current | $I_{RRM}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 30 V | | - | 5.1 | - | A |
| | | $I_F$ = 180 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 200 V | | - | 6.6 | - | |
| | | $I_F$ = 180 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 200 V, $T_J$ = 150 °C | | - | 15.2 | - | |
| Reverse recovery charge | $Q_{rr}$ | $I_F$ = 1.0 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 30 V | | - | 125 | - | nC |
| | | $I_F$ = 180 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 200 V | | - | 243 | - | |
| | | $I_F$ = 180 A, $dI_F/dt$ = 200 A/μs, $V_R$ = 200 V, $T_J$ = 150 °C | | - | 1295 | - | |

| THERMAL - MECHANICAL SPECIFICATIONS | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNITS |
| Thermal resistance, junction-to-case per leg | $R_{thJC}$ | | - | - | 0.19 | °C/W |
| Thermal resistance, junction-to-case per module | | | - | - | 0.095 | |
| Thermal resistance, case-to-heatsink (flag greased surface) | $R_{thCS}$ | | - | 0.10 | - | |
| Weight | | | - | 68 | - | g |
| | | | - | 2.4 | - | oz. |
| Mounting torque | | | 30 (3.4) | - | 40 (4.6) | lbf · in (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 | | | |

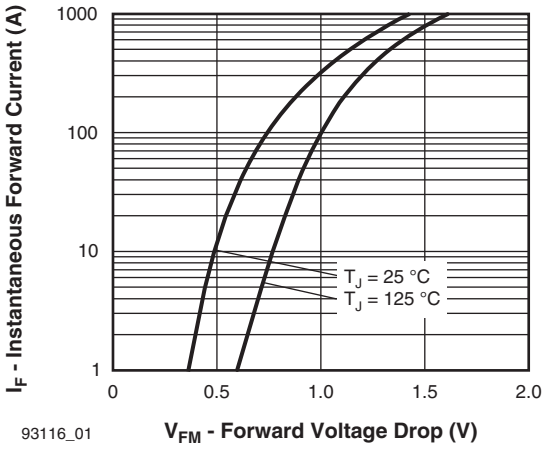



Fig. 1 - Typical Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

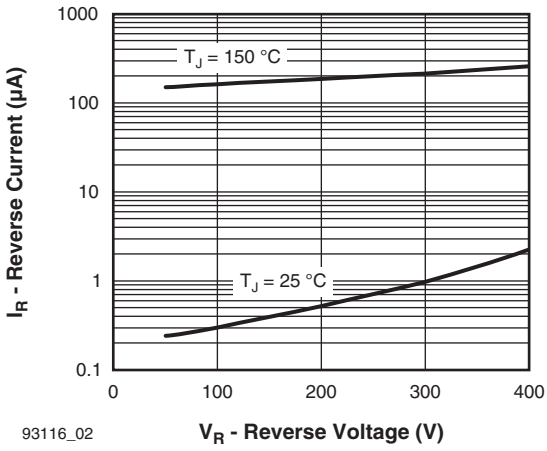



Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

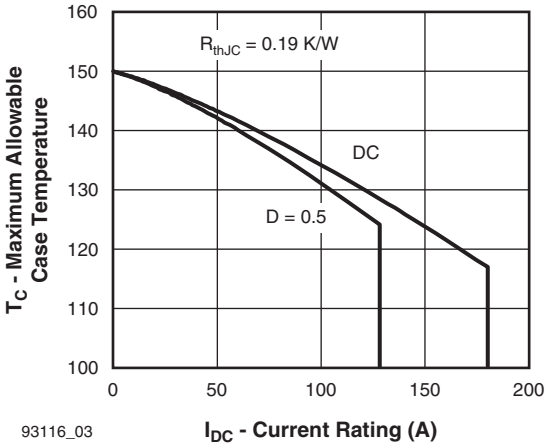



Fig. 3 - Maximum Current Rating Capability (Per Leg)

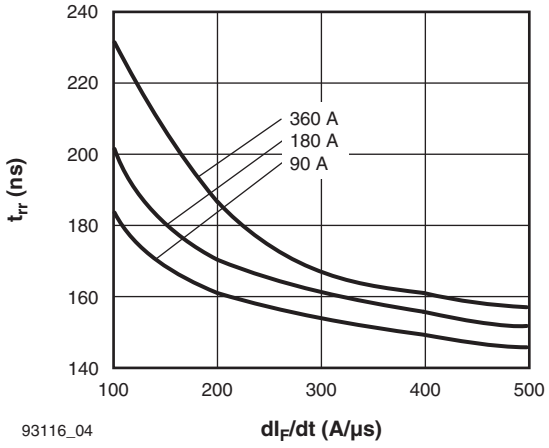



Fig. 4 - Typical Reverse Recovery Time vs. $dI_F/dt$
$T_J$ = 125 °C (Per Leg)

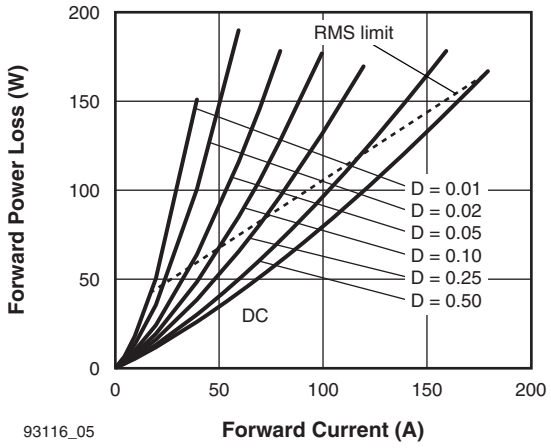



Fig. 5 - Forward Power Loss Characteristics

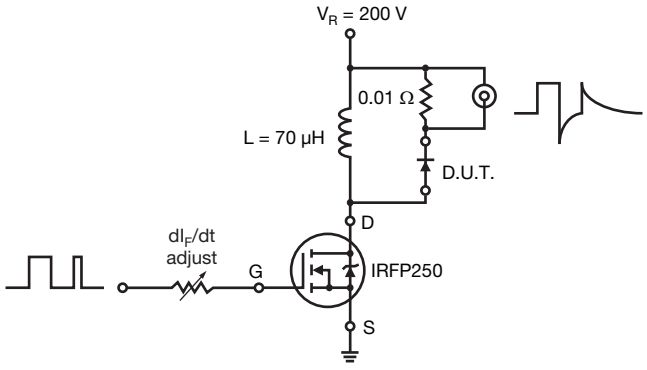
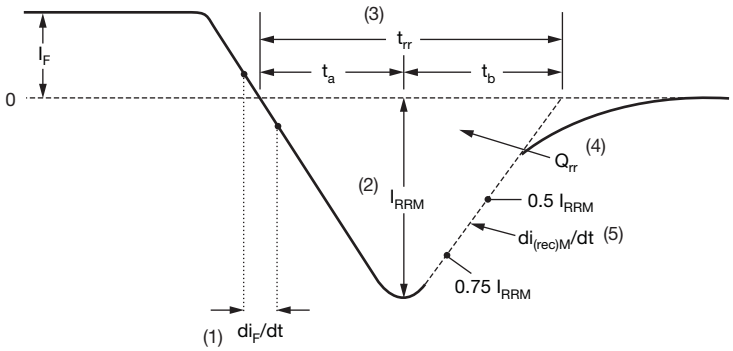



Fig. 6 - Reverse Recovery Parameter Test Circuit




(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 $t_{rr}$

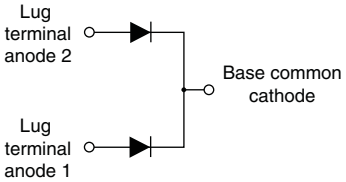
Fig. 7 - Reverse Recovery Waveform and Definitions

## ORDERING INFORMATION TABLE

**Device code**

| VS-VS | UD | 360 | C | W | 40 |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |

- 1 - Vishay Semiconductors product
- 2 - Type of device: UD = FRED Pt®
- 3 - Current rating (360 = 360 A)
- 4 - Circuit configuration:
  C = two diodes common cathode
- 5 - Type of device:
  W = TO-244 wire bondable not insulated
- 6 - Voltage rating (40 = 400 V)

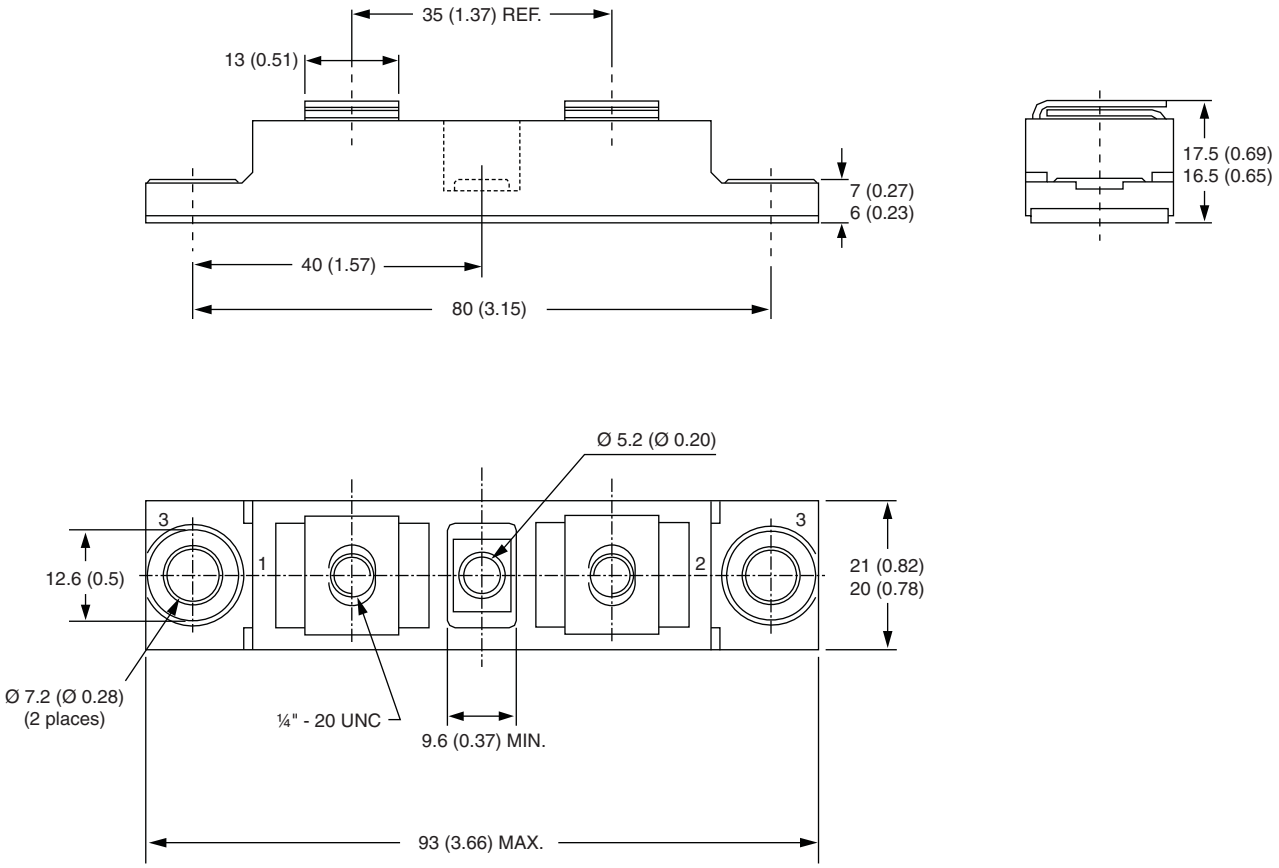
| CIRCUIT CONFIGURATION | | |
|---|---|---|
| **CIRCUIT** | **CIRCUIT CONFIGURATION CODE** | **CIRCUIT DRAWING** |
| Two diodes common cathode | C |  |



| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95021 |

# TO-244

**DIMENSIONS** in millimeters (inches)



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