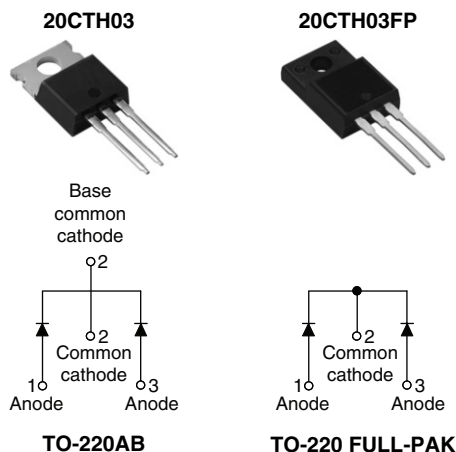


# Hyperfast Rectifier, 2 x 10 A FRED P<sub>t</sub><sup>TM</sup>



## FEATURES

- Hyperfast recovery time
- Low forward voltage drop
- Low leakage current
- 175 °C operating junction temperature
- Fully isolated package ( $V_{INS} = 2500 V_{RMS}$ )
- TO-220 designed and qualified for AEC Q101 level
- TO-220FP designed and qualified for industrial level

## DESCRIPTION/APPLICATIONS

300 V series are the state of the art hyperfast recovery rectifiers designed with optimized performance of forward voltage drop and hyperfast recovery time.

The planar structure and the platinum doped life time control, guarantee the best overall performance, ruggedness and reliability characteristics.

These devices are intended for use in the output rectification stage of SMPS, UPS, dc-to-dc converters as well as freewheeling diodes in low voltage inverters and chopper motor drives.

Their extremely optimized stored charge and low recovery current minimize the switching losses and reduce over dissipation in the switching element and snubbers.

## PRODUCT SUMMARY

|                    |          |
|--------------------|----------|
| $t_{rr}$ (maximum) | 35 ns    |
| $I_{F(AV)}$        | 2 x 10 A |
| $V_R$              | 300 V    |

## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                                   | SYMBOL         | TEST CONDITIONS      | VALUES      | UNITS |
|---------------------------------------------|----------------|----------------------|-------------|-------|
| Peak repetitive reverse voltage             | $V_{RRM}$      |                      | 300         | V     |
| Average rectified forward current           | $I_{F(AV)}$    | per diode            | 10          | A     |
|                                             |                | (FULL-PAK) per diode |             |       |
|                                             |                | per device           | 20          |       |
| Non-repetitive peak surge current           | $I_{FSM}$      | $T_J = 25\text{ °C}$ | 120         |       |
| 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 | $V_{BR}, V_R$ | $I_R = 100\text{ }\mu\text{A}$               | 300  | -    | -    | V             |
| Forward voltage                     | $V_F$         | $I_F = 10\text{ A}$                          | -    | 1.05 | 1.25 |               |
|                                     |               | $I_F = 10\text{ A}, T_J = 125\text{ °C}$     | -    | 0.85 | 0.95 |               |
| Reverse leakage current             | $I_R$         | $V_R = V_R$ rated                            | -    | -    | 20   | $\mu\text{A}$ |
|                                     |               | $T_J = 125\text{ °C}, V_R = V_R$ rated       | -    | 6    | 200  |               |
| Junction capacitance                | $C_T$         | $V_R = 300\text{ V}$                         | -    | 30   | -    | pF            |
| Series inductance                   | $L_S$         | Measured lead to lead 5 mm from package body | -    | 8    | -    | nH            |

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

| PARAMETER               | SYMBOL    | TEST CONDITIONS                                                                 | MIN. | TYP. | MAX. | UNITS |
|-------------------------|-----------|---------------------------------------------------------------------------------|------|------|------|-------|
| Reverse recovery time   | $t_{rr}$  | $I_F = 1\text{ A}$ , $dI_F/dt = 50\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$  | -    | -    | 35   | ns    |
|                         |           | $I_F = 1\text{ A}$ , $dI_F/dt = 100\text{ A}/\mu\text{s}$ , $V_R = 30\text{ V}$ | -    | -    | 30   |       |
|                         |           | $T_J = 25\text{ }^{\circ}\text{C}$                                              | -    | 31   | -    |       |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$                                             | -    | 42   | -    |       |
| Peak recovery current   | $I_{RRM}$ | $T_J = 25\text{ }^{\circ}\text{C}$                                              | -    | 2.4  | -    | A     |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$                                             | -    | 5.6  | -    |       |
| Reverse recovery charge | $Q_{rr}$  | $T_J = 25\text{ }^{\circ}\text{C}$                                              | -    | 36   | -    | nC    |
|                         |           | $T_J = 125\text{ }^{\circ}\text{C}$                                             | -    | 120  | -    |       |

**THERMAL - MECHANICAL SPECIFICATIONS**

| PARAMETER                                                                    | SYMBOL                            | TEST CONDITONS                             | MIN.      | TYP. | MAX. | UNITS |
|------------------------------------------------------------------------------|-----------------------------------|--------------------------------------------|-----------|------|------|-------|
| Maximum junction and storage temperature range                               | T <sub>J</sub> , T <sub>Stg</sub> |                                            | - 65      | -    | 175  | °C    |
| Thermal resistance, _____ per diode<br>junction to case (FULL-PAK) per diode | R <sub>thJC</sub>                 | Mounting surface, flat, smooth and greased | -         | -    | 1.5  | °C/W  |
|                                                                              |                                   |                                            | -         | -    | 3.9  |       |
| Marking device                                                               |                                   | Case style TO-220AB                        | 20CTH03   |      |      |       |
|                                                                              |                                   | Case style TO-220 FULL-PAK                 | 20CTH03FP |      |      |       |

# Hyperfast Rectifier, 2 x 10 A FRED Pt™

Vishay High Power Products

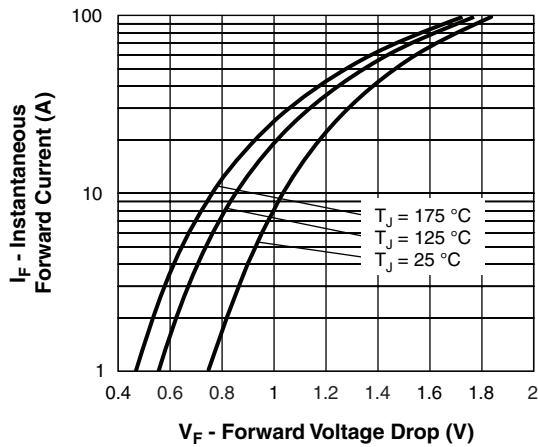


Fig. 1 - Typical Forward Voltage Drop Characteristics

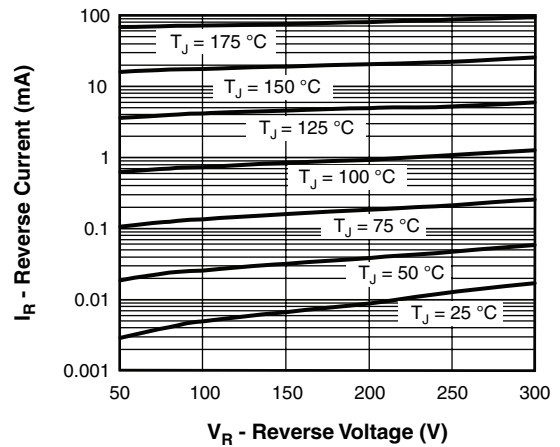


Fig. 2 - Typical Values of Reverse Current vs. Reverse Voltage

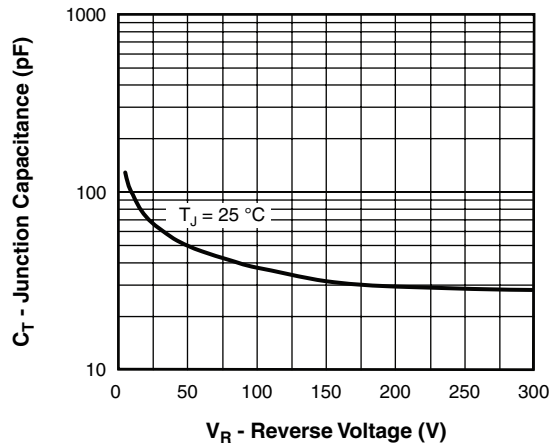


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage

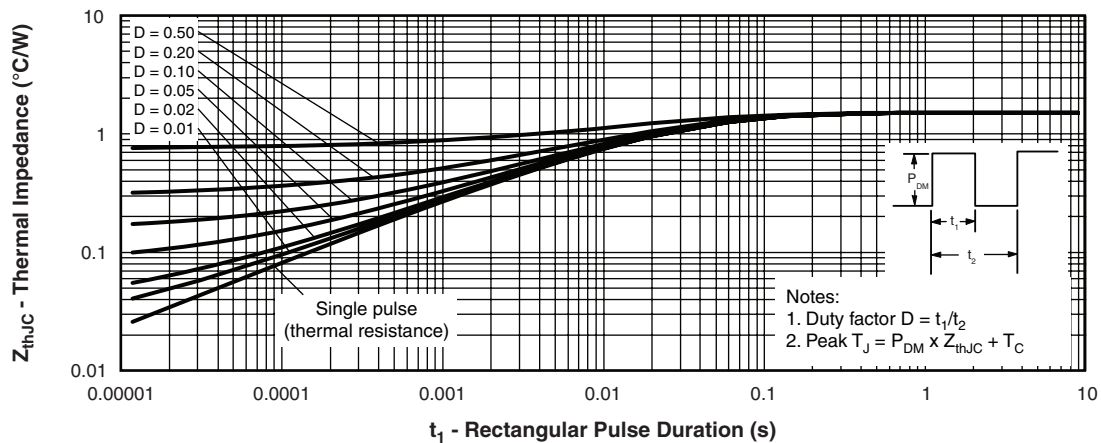


Fig. 4 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics

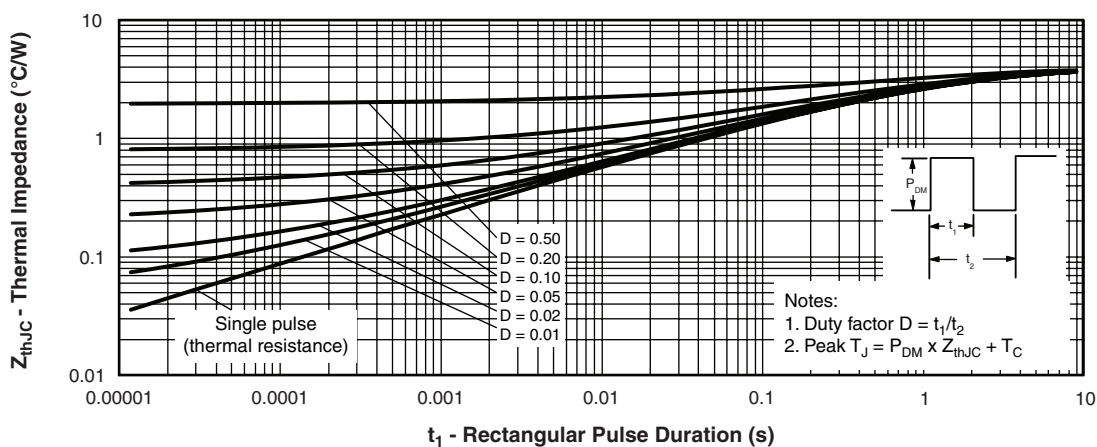
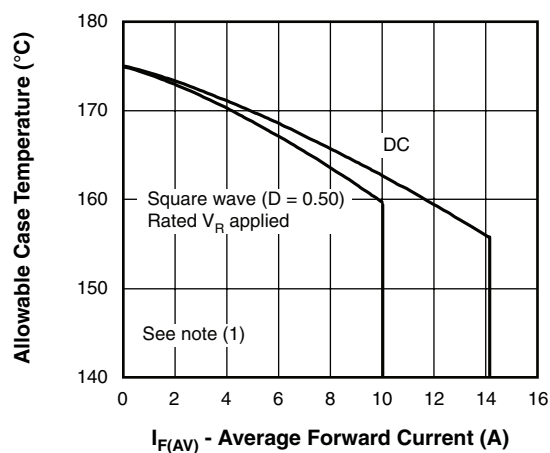
Fig. 5 - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (FULL-PAK)

Fig. 6 - Maximum Allowable Case Temperature vs. Average Forward Current

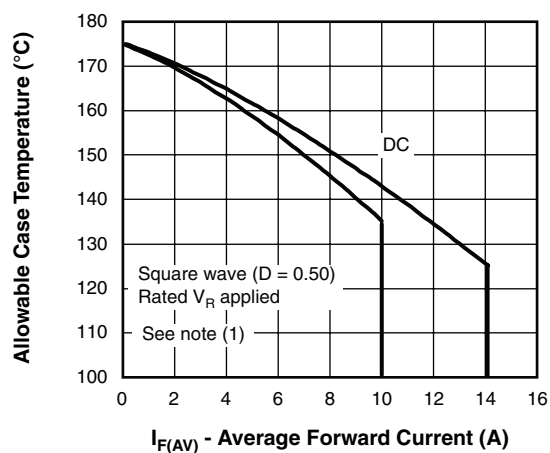


Fig. 7 - Maximum Allowable Case Temperature vs. Average Forward Current (FULL-PAK)

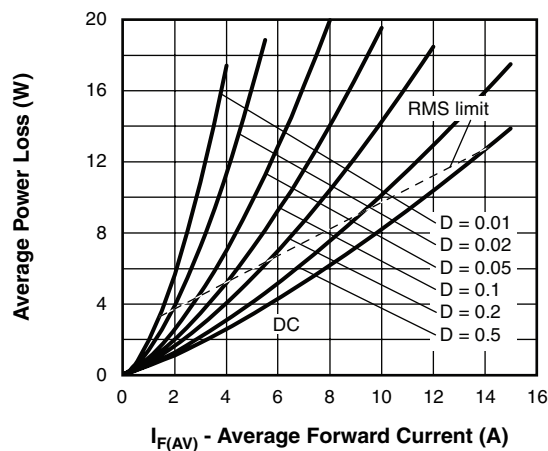


Fig. 8 - Forward Power Loss Characteristics

**Note**

- (1) Formula used:  $T_C = T_J - (P_d + P_{dREV}) \times R_{thJC}$ ;  
 $P_d$  = Forward power loss =  $I_{F(AV)} \times V_{FM}$  at  $(I_{F(AV)}/D)$  (see fig. 8);  
 $P_{dREV}$  = Inverse power loss =  $V_{R1} \times I_R (1 - D)$ ;  $I_R$  at  $V_{R1}$  = Rated  $V_R$

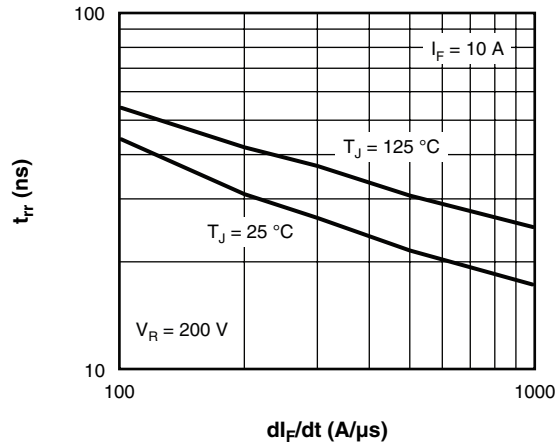
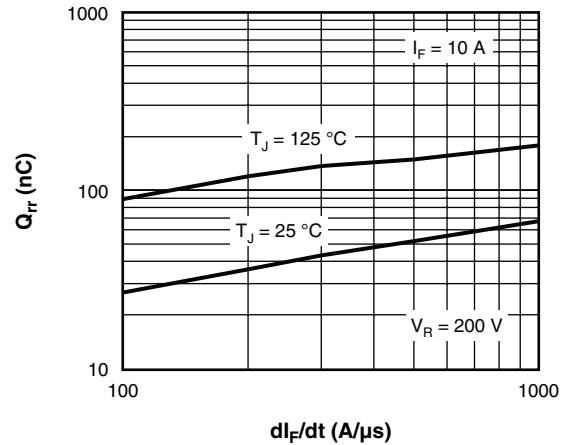
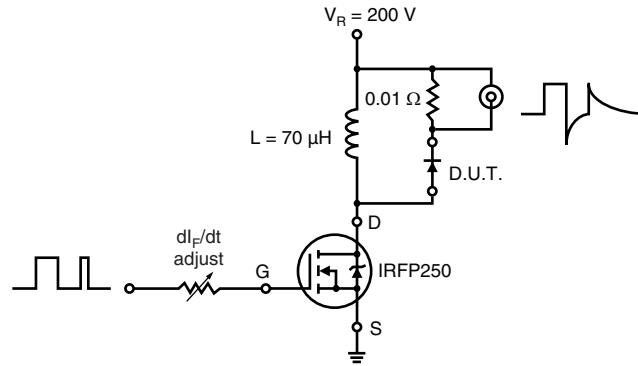

Fig. 9 - Typical Reverse Recovery Time vs.  $dI_F/dt$ 

Fig. 10 - Typical Stored Charge vs.  $dI_F/dt$ 


Fig. 11 - Reverse Recovery Parameter Test Circuit

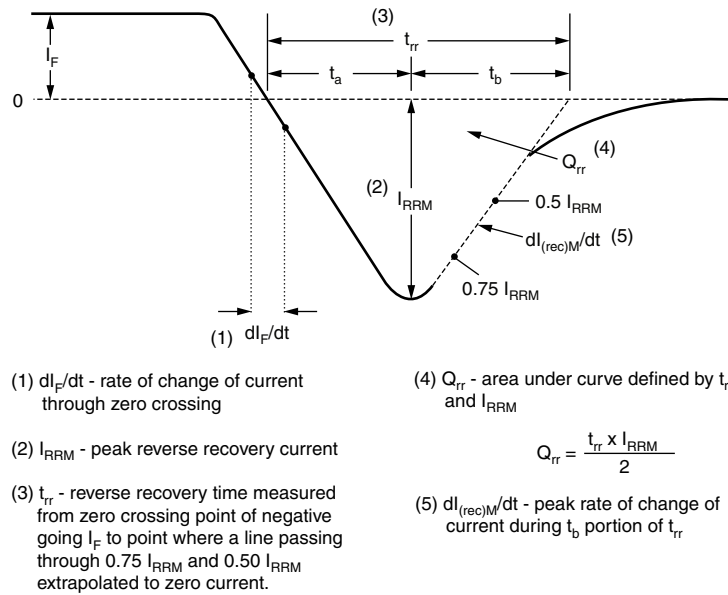


Fig. 12 - Reverse Recovery Waveform and Definitions

**ORDERING INFORMATION TABLE**

|             |    |   |   |   |    |    |   |
|-------------|----|---|---|---|----|----|---|
| Device code | 20 | C | T | H | 03 | FP | - |
|             | ①  | ② | ③ | ④ | ⑤  | ⑥  | ⑦ |

- |          |   |                                                                                                                |
|----------|---|----------------------------------------------------------------------------------------------------------------|
| <b>1</b> | - | Current rating (20 = 20 A)                                                                                     |
| <b>2</b> | - | C = Common cathode                                                                                             |
| <b>3</b> | - | T = TO-220, D <sup>2</sup> PAK                                                                                 |
| <b>4</b> | - | H = Hyperfast recovery                                                                                         |
| <b>5</b> | - | Voltage rating (03 = 300 V)                                                                                    |
| <b>6</b> | - | <ul style="list-style-type: none"> <li>• None = TO-220AB</li> <li>• FP = TO-220 FULL-PAK</li> </ul>            |
| <b>7</b> | - | <ul style="list-style-type: none"> <li>• None = Standard production</li> <li>• PbF = Lead (Pb)-free</li> </ul> |

Tube standard pack quantity: 50 pieces

| LINKS TO RELATED DOCUMENTS |                                                                               |
|----------------------------|-------------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95040">http://www.vishay.com/doc?95040</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95042">http://www.vishay.com/doc?95042</a> |



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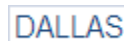
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