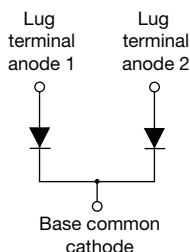


# HEXFRED® Ultrafast Soft Recovery Diode, 210 A



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](http://www.vishay.com/doc?99912)


RoHS  
COMPLIANT

## BENEFITS

- Reduced RFI and EMI
- Reduced snubbing

## DESCRIPTION

HEXFRED® diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems. An extensive characterization of the recovery behavior for different values of current, temperature and  $di_F/dt$  simplifies the calculations of losses in the operating conditions. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for power converters, motors drives and other applications where switching losses are significant portion of the total losses.

| PRODUCT SUMMARY      |                           |
|----------------------|---------------------------|
| $I_{F(AV)}$          | 210 A                     |
| $V_R$                | 600 V                     |
| $I_{F(DC)}$ at $T_C$ | 120 A at 100 °C           |
| Package              | TO-244 (TO-244AB)         |
| Circuit              | Two diodes common cathode |

| ABSOLUTE MAXIMUM RATINGS                         |                |                                                                    |             |       |
|--------------------------------------------------|----------------|--------------------------------------------------------------------|-------------|-------|
| PARAMETER                                        | SYMBOL         | TEST CONDITIONS                                                    | MAX.        | UNITS |
| Cathode to anode voltage                         | $V_R$          |                                                                    | 600         | V     |
| Continuous forward current                       | $I_F$          | $T_C = 25\text{ °C}$                                               | 235         | A     |
|                                                  |                | $T_C = 100\text{ °C}$                                              | 120         |       |
| Single pulse forward current                     | $I_{FSM}$      | Limited by junction temperature                                    | 600         |       |
| Non-repetitive avalanche energy                  | $E_{AS}$       | $L = 100\text{ }\mu\text{H}$ , duty cycle limited by maximum $T_J$ | 2.2         | mJ    |
| Maximum power dissipation                        | $P_D$          | $T_C = 25\text{ °C}$                                               | 463         | W     |
|                                                  |                | $T_C = 100\text{ °C}$                                              | 185         |       |
| Operating junction and storage temperature range | $T_J, T_{Stg}$ |                                                                    | -55 to +150 | °C    |

| ELECTRICAL SPECIFICATIONS PER LEG ( $T_J = 25\text{ °C}$ unless otherwise specified) |          |                                             |            |      |      |      |
|--------------------------------------------------------------------------------------|----------|---------------------------------------------|------------|------|------|------|
| PARAMETER                                                                            | SYMBOL   | TEST CONDITIONS                             |            | MIN. | TYP. | MAX. |
| Cathode to anode breakdown voltage                                                   | $V_{BR}$ | $I_R = 100\text{ }\mu\text{A}$              |            | 600  | -    | -    |
| Maximum forward voltage                                                              | $V_{FM}$ | $I_F = 105\text{ A}$                        | See fig. 1 | -    | 1.38 | 1.9  |
|                                                                                      |          | $I_F = 210\text{ A}$                        |            | -    | 1.6  | 2.25 |
|                                                                                      |          | $I_F = 105\text{ A}, T_J = 125\text{ °C}$   |            | -    | 1.3  | 1.56 |
| Maximum reverse leakage current                                                      | $I_{RM}$ | $T_J = 125\text{ °C}, V_R = 480\text{ V}$   | See fig. 2 | -    | 1.8  | 6.0  |
| Junction capacitance                                                                 | $C_T$    | $V_R = 200\text{ V}$                        | See fig. 3 | -    | 200  | 300  |
| Series inductance                                                                    | $L_S$    | From top of terminal hole to mounting plane |            | -    | 6.0  | -    |



| DYNAMIC RECOVERY CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified) |                          |                                                                               |                                                                                    |      |      |      |       |
|--------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------|------|------|-------|
| PARAMETER                                                                            | SYMBOL                   | TEST CONDITIONS                                                               |                                                                                    | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time (fig. 5)                                                       | t <sub>rr</sub>          | I <sub>F</sub> = 1.0 A, dI <sub>F</sub> /dt = 200 A/μs, V <sub>R</sub> = 30 V |                                                                                    | -    | 35   | -    | ns    |
|                                                                                      |                          | T <sub>J</sub> = 25 °C                                                        | I <sub>F</sub> = 105 A<br>dI <sub>F</sub> /dt = 200 A/μs<br>V <sub>R</sub> = 200 V | -    | 90   | 140  |       |
|                                                                                      |                          | T <sub>J</sub> = 125 °C                                                       |                                                                                    | -    | 160  | 240  |       |
| Peak recovery current (fig. 6)                                                       | I <sub>RRM</sub>         | T <sub>J</sub> = 25 °C                                                        |                                                                                    | -    | 10   | 18   | A     |
|                                                                                      |                          | T <sub>J</sub> = 125 °C                                                       |                                                                                    | -    | 15   | 30   |       |
| Reverse recovery charge (fig. 7)                                                     | Q <sub>rr</sub>          | T <sub>J</sub> = 25 °C                                                        |                                                                                    | -    | 450  | 1300 | nC    |
|                                                                                      |                          | T <sub>J</sub> = 125 °C                                                       |                                                                                    | -    | 1200 | 3600 |       |
| Peak rate of recovery current (fig. 8)                                               | dI <sub>(rec)</sub> M/dt | T <sub>J</sub> = 25 °C                                                        | -                                                                                  | 310  | -    | A/μs |       |
|                                                                                      |                          | T <sub>J</sub> = 125 °C                                                       | -                                                                                  | 240  | -    |      |       |

| THERMAL - MECHANICAL SPECIFICATIONS            |            |                                   |          |      |          |                     |
|------------------------------------------------|------------|-----------------------------------|----------|------|----------|---------------------|
| PARAMETER                                      |            | SYMBOL                            | MIN.     | TYP. | MAX.     | UNITS               |
| Maximum junction and storage temperature range |            | T <sub>J</sub> , T <sub>Stg</sub> | -55      | -    | 150      | °C                  |
| Thermal resistance, junction to case           | per leg    | R <sub>thJC</sub>                 | -        | -    | 0.27     | °C/W<br>K/W         |
|                                                | per module |                                   | -        | -    | 0.135    |                     |
| Typical thermal resistance, case to heatsink   |            | R <sub>thCS</sub>                 | -        | 0.10 | -        |                     |
| Weight                                         |            |                                   | -        | 68   | -        | g                   |
|                                                |            |                                   | -        | 2.4  | -        | oz.                 |
| Mounting torque <sup>(1)</sup>                 |            |                                   | 30 (3.4) | -    | 40 (4.6) | N · m<br>(lbf · in) |
| 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       |                     |

**Note**

- <sup>(1)</sup> Mounting surface must be smooth, flat, free of burrs or other protrusions. Apply a thin even film of thermal grease to mounting surface. Gradually tighten each mounting bolt in 5 to 10 lbf · in steps until desired or maximum torque limits are reached

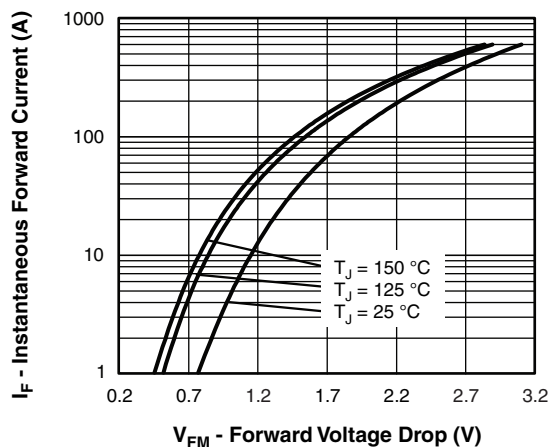


Fig. 1 - Maximum Forward Voltage Drop vs. Instantaneous Forward Current (Per Leg)

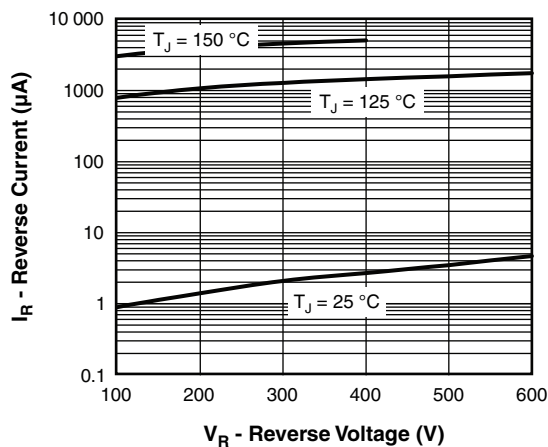


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Leg)

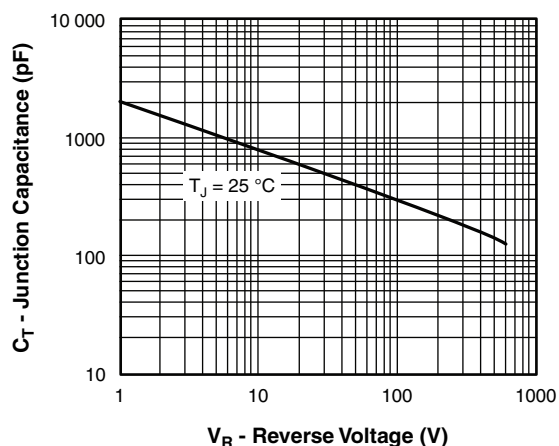


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Leg)

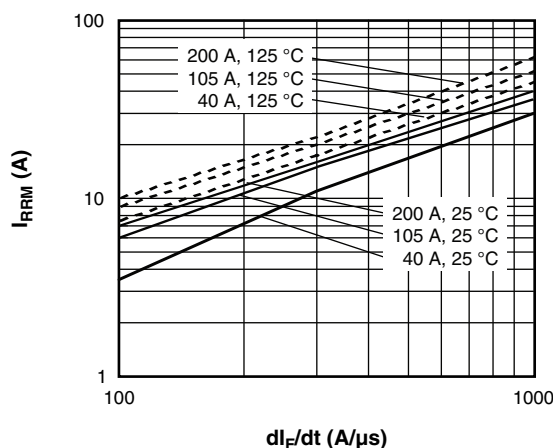


Fig. 6 - Typical Recovery Current vs.  $dI_F/dt$  (Per Leg)

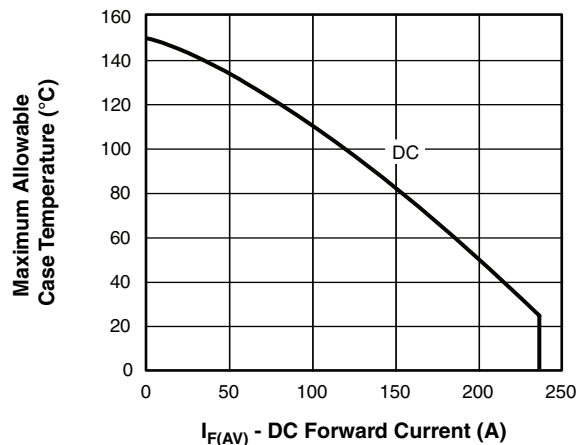


Fig. 4 - Maximum Allowable Case Temperature vs. DC Forward Current (Per Leg)

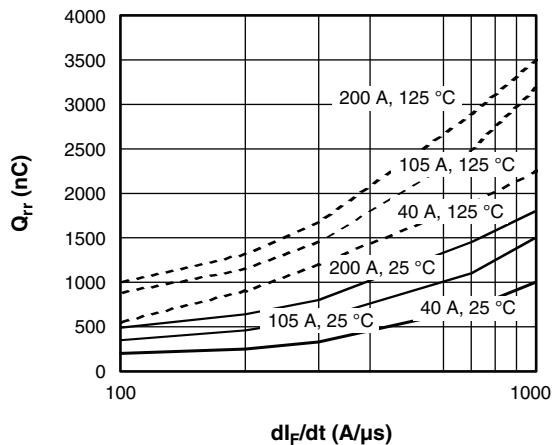


Fig. 7 - Typical Stored Charge vs.  $dI_F/dt$  (Per Leg)

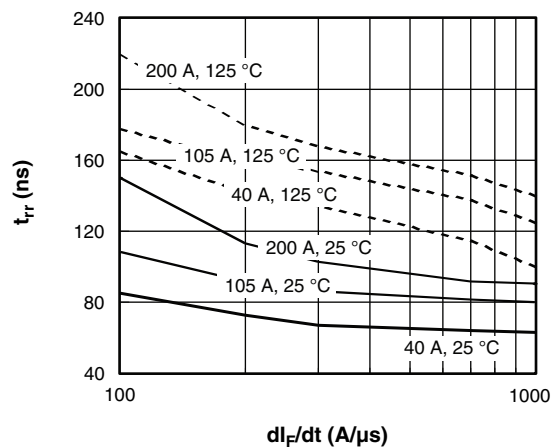


Fig. 5 - Typical Reverse Recovery Time vs.  $dI_F/dt$  (Per Leg)

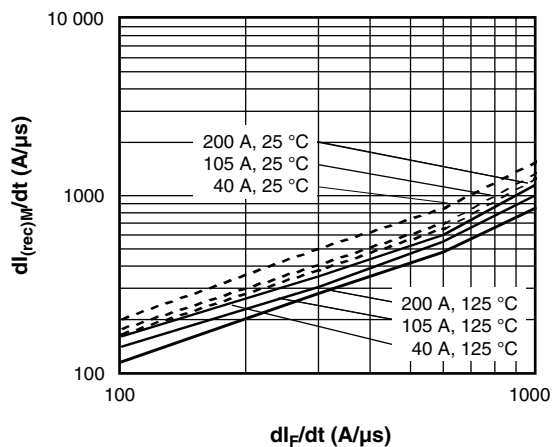


Fig. 8 - Typical  $dI_{(rec)M}/dt$  vs.  $dI_F/dt$  (Per Leg)

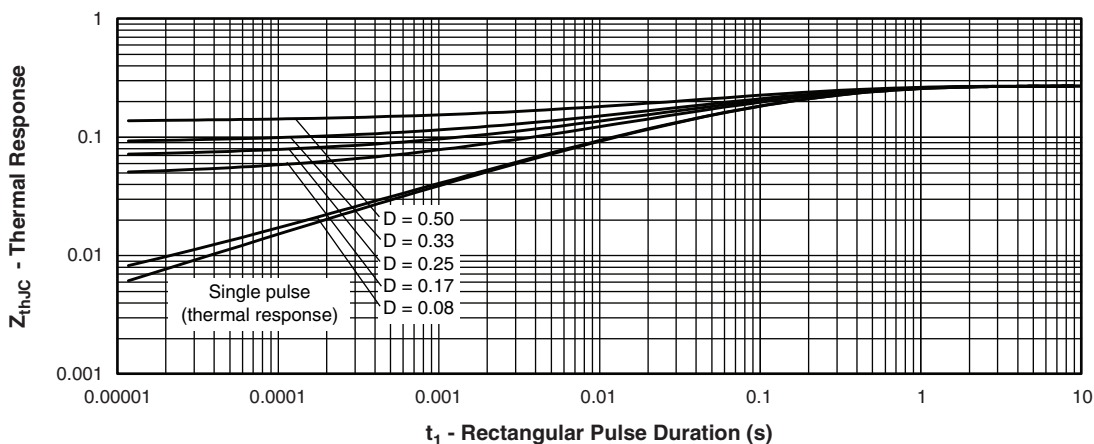


Fig. 9 - - Maximum Thermal Impedance  $Z_{thJC}$  Characteristics (Per Leg)

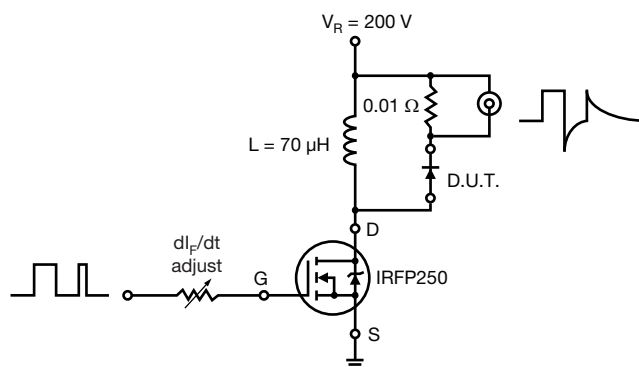


Fig. 10 - - Reverse Recovery Parameter Test Circuit

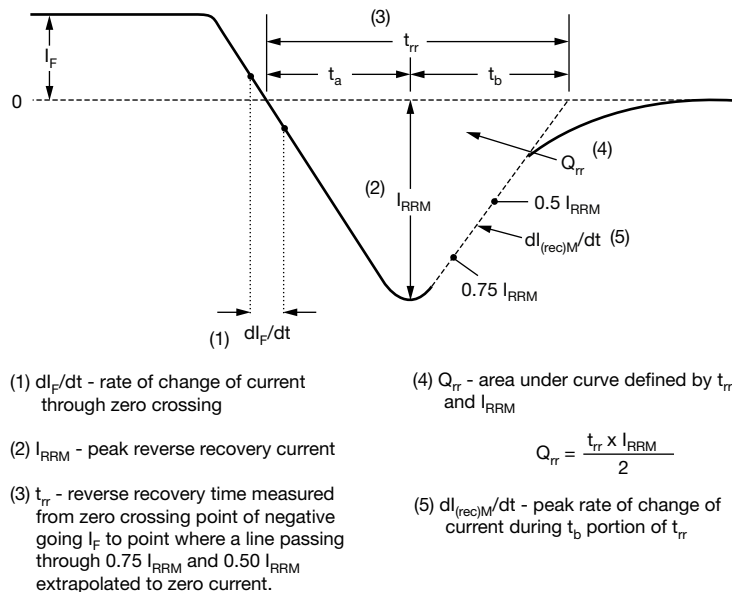


Fig. 11 - Reverse Recovery Waveform and Definitions

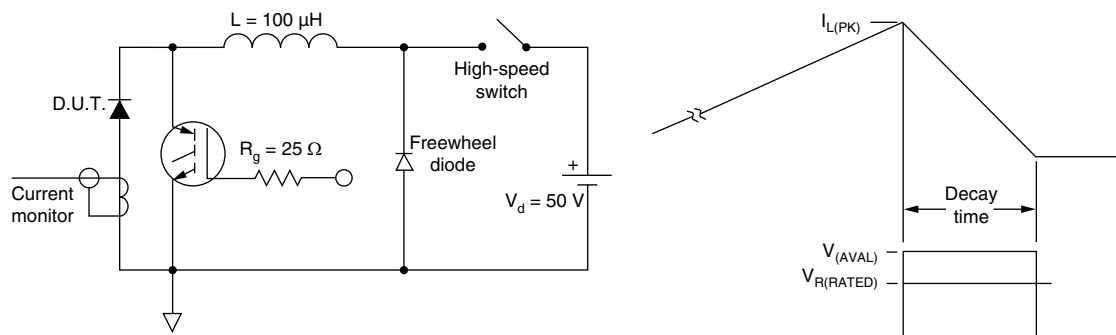


Fig. 12 - Avalanche Test Circuit and Waveforms

## ORDERING INFORMATION TABLE

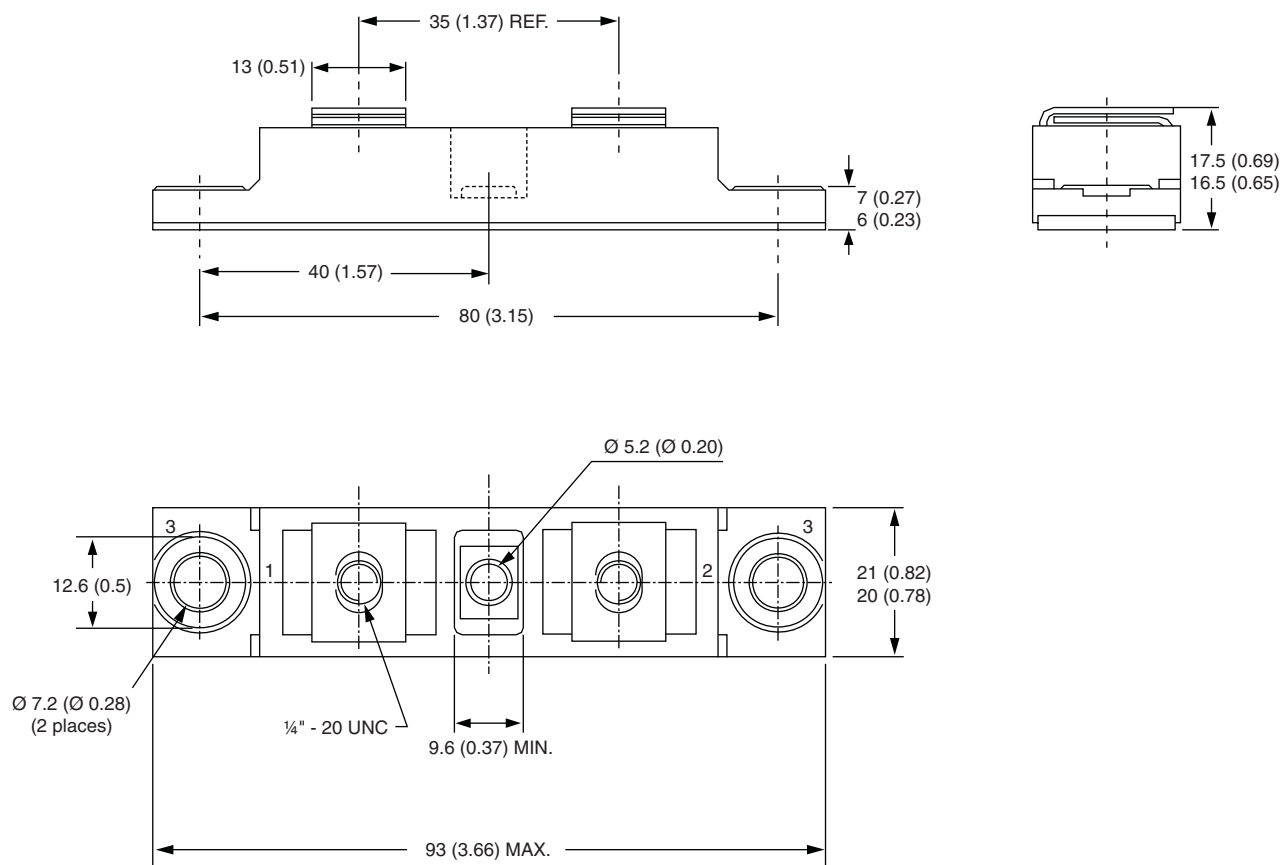
| Device code | VS-                                  | HFA | 210 | NJ | 60 | C | PbF |
|-------------|--------------------------------------|-----|-----|----|----|---|-----|
|             | 1                                    | 2   | 3   | 4  | 5  | 6 | 7   |
| 1           | Vishay Semiconductors product        |     |     |    |    |   |     |
| 2           | HEXFRED® family, electron irradiated |     |     |    |    |   |     |
| 3           | Average current rating               |     |     |    |    |   |     |
| 4           | NJ = TO-244                          |     |     |    |    |   |     |
| 5           | Voltage rating (60 = 600 V)          |     |     |    |    |   |     |
| 6           | C = Common cathode                   |     |     |    |    |   |     |
| 7           | Lead (Pb)-free                       |     |     |    |    |   |     |

| 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)





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