

## FRED Pt<sup>®</sup> Gen 5 Hyperfast Rectifier Diode, 600 V, 60 A



SOT-227

| PRIMARY CHARACTERISTICS                         |                                       |
|---|---------------------------------------|
| $V_R$   | 600 V                                 |
| $V_F$ (typical) at 30 A, per diode              | 1.6 V                                 |
| $t_{rr}$ (typical) at 30 A, per diode           | 57 ns                                 |
| $I_{F(DC)}$ per module at $T_C = 128\text{ °C}$ | 60 A                                  |
| Type  | Modules - diode, FRED Pt <sup>®</sup> |
| Package   | SOT-227                               |
| Circuit configuration                           | Two separate diodes, parallel pin-out |

### FEATURES

- Hyperfast and optimized  $Q_{rr}$
- Best in class forward voltage drop and switching losses trade off
- Optimized for high speed operation
- 175 °C maximum operating junction temperature
- Electrically isolated base plate
- Large creepage distance between terminal
- Simplified mechanical designs, rapid assembly
- Designed and qualified for industrial level
- UL approved file E78996
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTION / APPLICATIONS

Featuring a unique combination of low conduction and switching losses, the VS-U5FX60FA60 is the right choice for high frequency converters, both soft switched / resonant. The semiconductor in the SOT-227 package is isolated from the copper base plate, allowing for common heatsinks and compact assemblies to be built.

These modules are specifically designed to improve efficiency of PFC and output rectification stages of EV / HEV battery charging stations, booster stage of solar inverters, and UPS applications, these devices are perfectly matched to operate with MOSFETs or high speed IGBTs.

| ABSOLUTE MAXIMUM RATINGS                         |                |  |             |       |
|--|----------------|--|-------------|-------|
| PARAMETER  | SYMBOL         | TEST CONDITIONS                          | MAX.        | UNITS |
| Cathode to anode voltage                         | $V_R$          |  | 600         | V     |
| Continuous forward current per diode             | $I_F$          | $T_C = 128\text{ °C}$                    | 30          | A     |
| Single pulse forward current per diode           | $I_{FSM}$      | $T_J = 25\text{ °C}$                     | 290         |       |
| Maximum power dissipation per module             | $P_D$          | $T_C = 128\text{ °C}$                    | 99          | W     |
| RMS isolation voltage                            | $V_{ISOL}$     | Any terminal to case, $t = 1\text{ min}$ | 2500        | V     |
| Operating junction and storage temperature range | $T_J, T_{Stg}$ |  | -55 to +175 | °C    |

| ELECTRICAL SPECIFICATIONS ( $T_J = 25\text{ °C}$ unless otherwise specified) |          |   |      |      |      |               |
|--|----------|---|------|------|------|---------------|
| PARAMETER  | SYMBOL   | TEST CONDITIONS                           | MIN. | TYP. | MAX. | UNITS         |
| Cathode to anode breakdown voltage   | $V_{BR}$ | $I_R = 100\text{ }\mu\text{A}$            | 600  | -    | -    | V             |
| Forward voltage  | $V_{FM}$ | $I_F = 30\text{ A}$                       | -    | 1.6  | 2.1  |               |
|  |          | $I_F = 30\text{ A}, T_J = 150\text{ °C}$  | -    | 1.26 | -    |               |
| Reverse leakage current  | $I_{RM}$ | $V_R = 600\text{ V}$                      | -    | 0.1  | 30   | $\mu\text{A}$ |
|  |          | $T_J = 125\text{ °C}, V_R = 600\text{ V}$ | -    | 14   | -    |               |
|  |          | $T_J = 150\text{ °C}, V_R = 600\text{ V}$ | -    | 53   | -    |               |



| DYNAMIC RECOVERY CHARACTERISTICS (T <sub>J</sub> = 25 °C unless otherwise specified) |                  |                                   |      |      |      |       |
|--|------------------|-----------------------------------|------|------|------|-------|
| PARAMETER  | SYMBOL           | TEST CONDITIONS                   | MIN. | TYP. | MAX. | UNITS |
| Reverse recovery time  | t <sub>rr</sub>  | T <sub>J</sub> = 25 °C            | -    | 57   | -    | ns    |
|  |                  | T <sub>J</sub> = 125 °C           | -    | 62   | -    |       |
| Peak recovery current  | I <sub>RRM</sub> | T <sub>J</sub> = 25 °C            | -    | 12   | -    | A     |
|  |                  | T <sub>J</sub> = 125 °C           | -    | 25   | -    |       |
| Reverse recovery charge  | Q <sub>rr</sub>  | T <sub>J</sub> = 25 °C            | -    | 0.3  | -    | μC    |
|  |                  | T <sub>J</sub> = 125 °C           | -    | 0.9  | -    |       |
| Junction capacitance   | C <sub>T</sub>   | V <sub>R</sub> = 600 V, f = 1 MHz | -    | 29   | -    | pF    |

| THERMAL - MECHANICAL SPECIFICATIONS             |                   |                       |         |      |            |              |
|---|-------------------|-----------------------|---------|------|------------|--------------|
| PARAMETER                                       | SYMBOL            | TEST CONDITIONS       | MIN.    | TYP. | MAX.       | UNITS        |
| Thermal resistance junction to case, per diode  | R <sub>thJC</sub> |                       | -       | -    | 0.95       | °C/W         |
| Thermal resistance junction to case, per module |                   |                       |         | -    | -          |              |
| Thermal resistance case to heatsink, per module | R <sub>thCS</sub> | Flat, greased surface | -       | 0.05 | -          |              |
| Weight  |                   |                       | -       | 30   | -          | g            |
| Mounting torque                                 |                   | Torque per diode      | -       | -    | 1.1 (9.7)  | Nm (lb.f.in) |
|   |                   | Torque to heatsink    | -       | -    | 1.8 (15.9) | Nm (lb.f.in) |
| Case style                                      |                   |                       | SOT-227 |      |            |              |

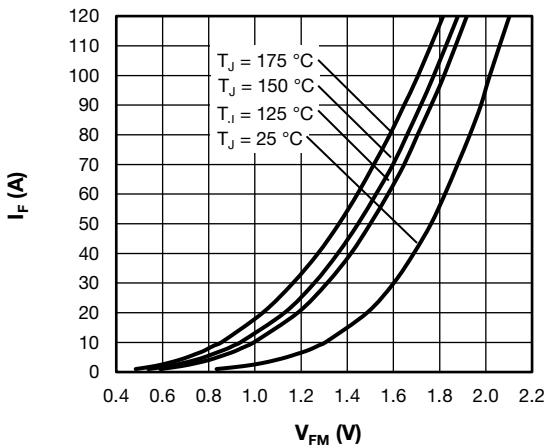


Fig. 1 - Typical Forward Voltage Drop Characteristics

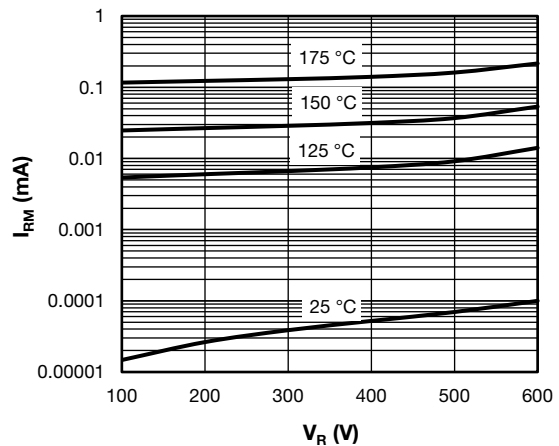


Fig. 2 - Typical Values of Reverse Current

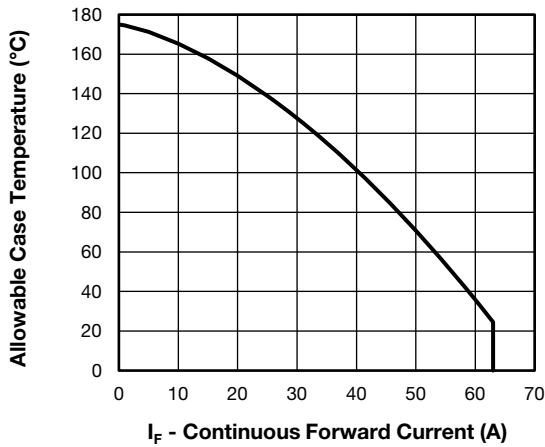


Fig. 3 - Maximum Allowable Case Temperature vs. Average Forward Current (Per Diode)

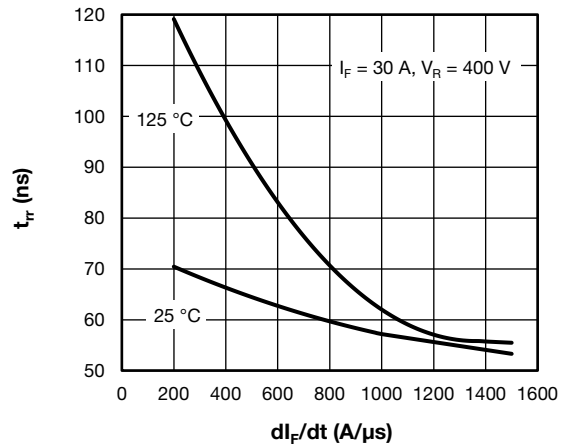


Fig. 6 - Diode Reverse Recovery Time vs.  $di_F/dt$

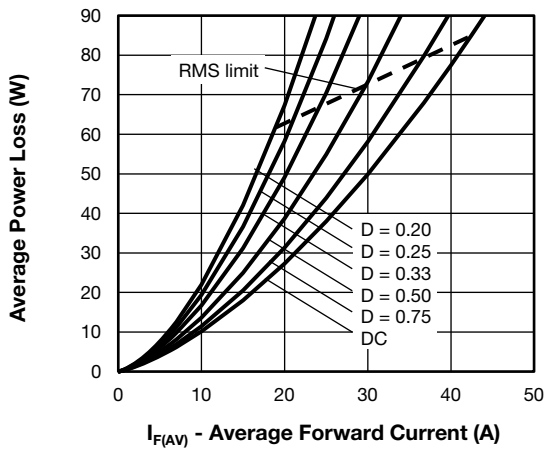


Fig. 4 - Average Power Loss vs. Average Forward Current

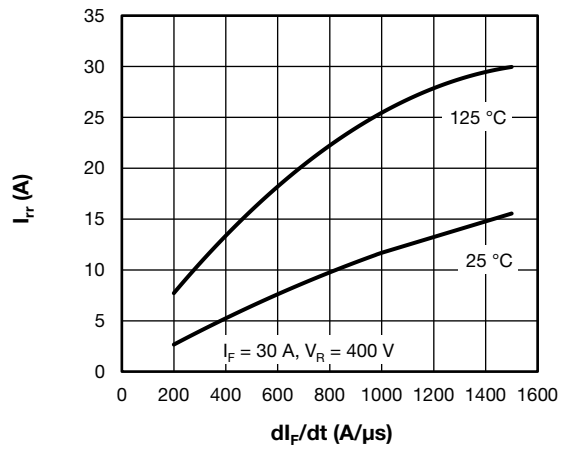


Fig. 7 - Diode Reverse Recovery Current vs.  $di_F/dt$

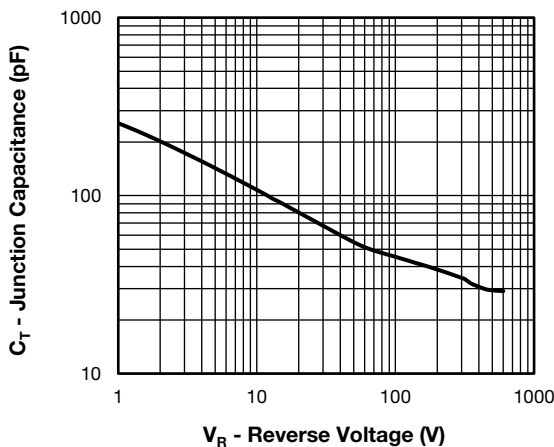


Fig. 5 - Junction Capacitance

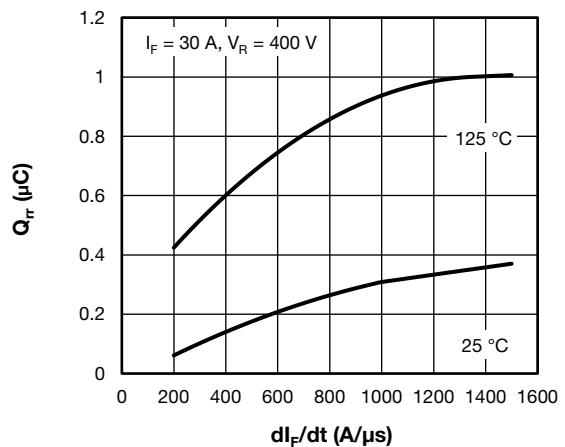


Fig. 8 - Diode Reverse Recovery Charge vs.  $di_F/dt$

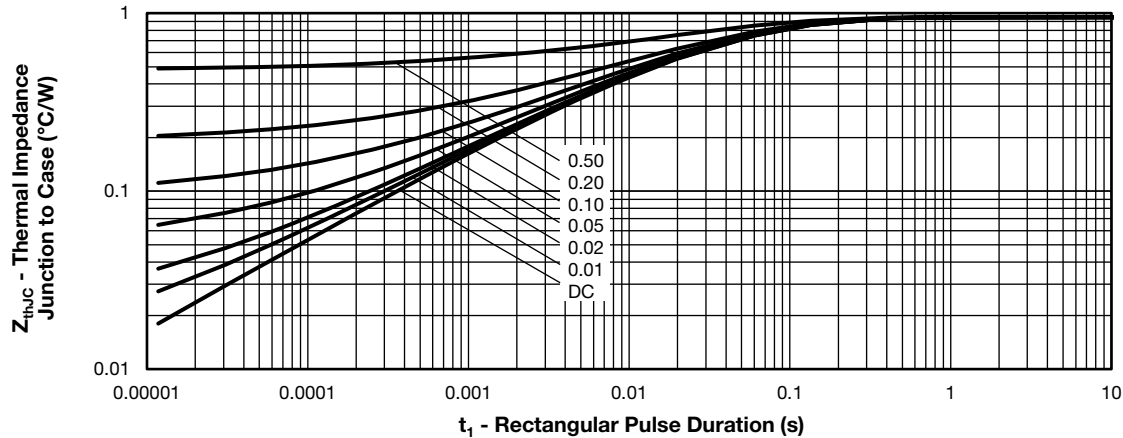


Fig. 9 - Maximum Thermal Impedance Junction to Case

**ORDERING INFORMATION TABLE**

|             |            |            |          |           |          |          |           |
|-------------|------------|------------|----------|-----------|----------|----------|-----------|
| Device code | <b>VS-</b> | <b>U5F</b> | <b>X</b> | <b>60</b> | <b>F</b> | <b>A</b> | <b>60</b> |
|             | ①          | ②          | ③        | ④         | ⑤        | ⑥        | ⑦         |

- 1** - Vishay Semiconductors product
- 2** - U5F = Gen 5 FRED Pt<sup>®</sup> family
- 3** - X = Hyperfast FRED Pt<sup>®</sup> diode
- 4** - Current rating per module (60 = 60 A)
- 5** - F = circuit configuration (two separate diodes, parallel pin-out)
- 6** - Package indicator (SOT-227 standard insulated base)
- 7** - Voltage rating (60 = 600 V)

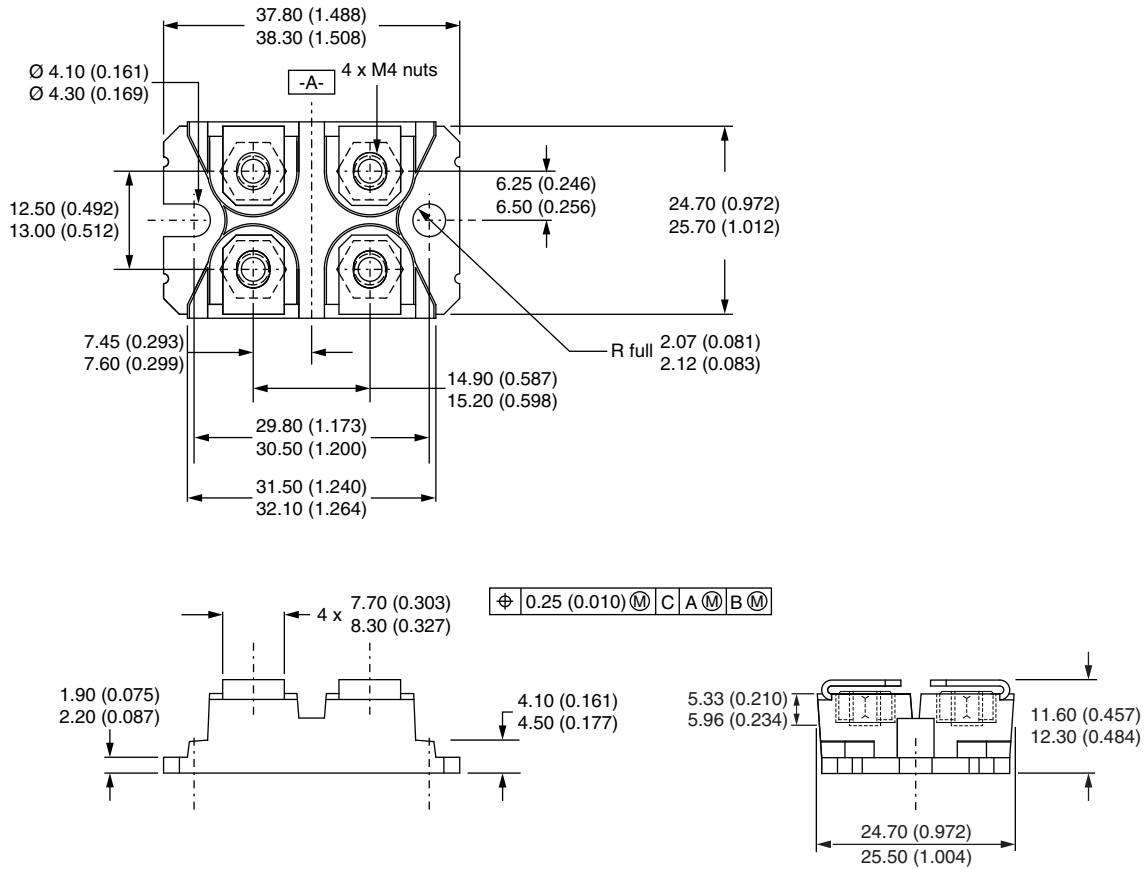
| CIRCUIT CONFIGURATION                 |                            |                 |
|---------------------------------------|----------------------------|-----------------|
| CIRCUIT                               | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| Two separate diodes, parallel pin-out | F                          |                 |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95423">www.vishay.com/doc?95423</a> |
| Packaging information      | <a href="http://www.vishay.com/doc?95425">www.vishay.com/doc?95425</a> |



### SOT-227 Generation 2

**DIMENSIONS** in millimeters (inches)



**Note**

- Controlling dimension: millimeter



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