

## Insulated Single Phase Hyperfast Bridge (Power Modules), 60 A



SOT-227

### FEATURES

- Hyperfast and soft recovery characteristic
- Electrically isolated base plate
- Simplified mechanical designs, rapid assembly
- High operation junction temperature ( $T_J$  max. = 175 °C)
- Designed and qualified for industrial and consumer level
- UL approved file E78996 
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

| PRIMARY CHARACTERISTICS |                             |
|-------------------------|-----------------------------|
| $V_{RRM}$               | 650 V                       |
| $I_O$ at $T_C = 123$ °C | 60 A                        |
| $t_{rr}$                | 63 ns                       |
| Type                    | Modules - Bridge, Hyperfast |
| Package                 | SOT-227                     |
| Circuit configuration   | Single phase bridge         |

### DESCRIPTION

The semiconductor in the SOT-227 package is isolated from the copper base plate, allowing for common heatsinks and compact assemblies to be built.

| MAJOR RATINGS AND CHARACTERISTICS |                 |             |                  |
|-----------------------------------|-----------------|-------------|------------------|
| SYMBOL                            | CHARACTERISTICS | VALUES      | UNITS            |
| $I_O$                             |                 | 60          | A                |
|                                   | $T_C$           | 123         | °C               |
| $I_{FSM}$                         | 50 Hz           | 360         | A                |
|                                   | 60 Hz           | 377         |                  |
| $I^2t$                            | 50 Hz           | 648         | A <sup>2</sup> s |
|                                   | 60 Hz           | 589         |                  |
| $V_{RRM}$                         |                 | 650         | V                |
| $T_J$                             |                 | -55 to +175 | °C               |

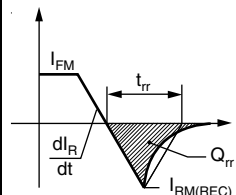
### ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS |              |                                                          |                                                              |                                          |
|-----------------|--------------|----------------------------------------------------------|--------------------------------------------------------------|------------------------------------------|
| TYPE NUMBER     | VOLTAGE CODE | $V_{RRM}$ , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE<br>V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | $I_{RRM}$ MAXIMUM AT $T_J$ MAXIMUM<br>mA |
| UFH60BA65       | 65           | 650                                                      | 700                                                          | 2                                        |

| ELECTRICAL SPECIFICATIONS ( $T_J = 25$ °C unless otherwise specified) |            |                                                |      |      |      |         |
|-----------------------------------------------------------------------|------------|------------------------------------------------|------|------|------|---------|
| PARAMETER                                                             | SYMBOL     | TEST CONDITIONS                                | MIN. | TYP. | MAX. | UNITS   |
| Cathode to anode breakdown voltage                                    | $V_{BR}$   | $I_R = 250$ $\mu$ A                            | 650  | -    | -    | V       |
| Forward voltage, per diode                                            | $V_{FM}$   | $I_F = 60$ A                                   | -    | 1.7  | 2.35 |         |
| Reverse leakage current, per leg                                      | $I_{RM}$   | $V_R = 650$ V                                  | -    | 1.0  | 100  | $\mu$ A |
|                                                                       |            | $V_R = 650$ V, $T_J = 150$ °C                  | -    | 250  | -    |         |
| RMS isolation voltage base plate                                      | $V_{ISOL}$ | $f = 50$ Hz, any terminal to case, $t = 1$ min | 2500 | -    | -    | V       |

| FORWARD CONDUCTION                                     |                     |                                                                                                                                       |                                  |                                |        |                    |
|--------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|--------------------------------|--------|--------------------|
| PARAMETER                                              | SYMBOL              | TEST CONDITIONS                                                                                                                       |                                  |                                | VALUES | UNITS              |
| Maximum DC output current at case temperature          | I <sub>O</sub>      | Resistive or inductive load                                                                                                           |                                  |                                | 60     | A                  |
|                                                        |                     |                                                                                                                                       |                                  |                                | 123    | °C                 |
| Maximum peak, one-cycle non-repetitive forward current | I <sub>FSM</sub>    | t = 10 ms                                                                                                                             | No voltage reapplied             | Initial T <sub>J</sub> = 25 °C | 360    | A                  |
|                                                        |                     | t = 8.3 ms                                                                                                                            |                                  |                                | 377    |                    |
|                                                        |                     | t = 10 ms                                                                                                                             | 100 % V <sub>RRM</sub> reapplied |                                | 303    |                    |
|                                                        |                     | t = 8.3 ms                                                                                                                            |                                  |                                | 317    |                    |
| Maximum I <sup>2</sup> t for fusing                    | I <sup>2</sup> t    | t = 10 ms                                                                                                                             | No voltage reapplied             |                                | 648    | A <sup>2</sup> s   |
|                                                        |                     | t = 8.3 ms                                                                                                                            |                                  |                                | 589    |                    |
|                                                        |                     | t = 10 ms                                                                                                                             | 100 % V <sub>RRM</sub> reapplied |                                | 458    |                    |
|                                                        |                     | t = 8.3 ms                                                                                                                            |                                  |                                | 417    |                    |
| Maximum I <sup>2</sup> √t for fusing                   | I <sup>2</sup> √t   | I <sup>2</sup> t for time t <sub>x</sub> = I <sub>2</sub> √t x √t <sub>x</sub> ; 0.1 ≤ t <sub>x</sub> ≤ 10 ms, V <sub>RRM</sub> = 0 V |                                  |                                | 6.4    | kA <sup>2</sup> √s |
| Low level of threshold voltage, per leg                | V <sub>F(T0)1</sub> | (16.7 % x π x I <sub>F(AV)</sub> ) < I < π x I <sub>F(AV)</sub> , T <sub>J</sub> = T <sub>J</sub> maximum                             |                                  |                                | 0.88   | V                  |
| Low level value of forward slope resistance            | r <sub>f1</sub>     |                                                                                                                                       |                                  |                                | 16.49  | mΩ                 |
| High level of threshold voltage, per leg               | V <sub>F(T0)2</sub> | (I > π x I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> maximum                                                                |                                  |                                | 1.16   | V                  |
| High level value of forward slope resistance           | r <sub>f2</sub>     |                                                                                                                                       |                                  |                                | 15.87  | mΩ                 |
| Maximum forward voltage, per diode                     | V <sub>FM</sub>     | I <sub>F</sub> = 60 A                                                                                                                 |                                  |                                | 2.35   | V                  |

| RECOVERY CHARACTERISTICS                    |          |                                                                   |        |       |
|---------------------------------------------|----------|-------------------------------------------------------------------|--------|-------|
| PARAMETER                                   | SYMBOL   | TEST CONDITIONS                                                   | VALUES | UNITS |
| Typical reverse recovery time, per diode    | $t_{rr}$ | $T_J = 25$ °C, $I_F = 50$ A, $V_R = 200$ V, $dI_F/dt = 200$ A/μs  | 63     | ns    |
|                                             |          | $T_J = 125$ °C, $I_F = 50$ A, $V_R = 200$ V, $dI_F/dt = 200$ A/μs | 134    |       |
| Typical reverse recovery current, per diode | $I_{rr}$ | $T_J = 25$ °C, $I_F = 50$ A, $V_R = 200$ V, $dI_F/dt = 200$ A/μs  | 4.1    | A     |
|                                             |          | $T_J = 125$ °C, $I_F = 50$ A, $V_R = 200$ V, $dI_F/dt = 200$ A/μs | 11.4   |       |
| Typical reverse recovery charge, per diode  | $Q_{rr}$ | $T_J = 25$ °C, $I_F = 50$ A, $V_R = 200$ V, $dI_F/dt = 200$ A/μs  | 130    | nC    |
|                                             |          | $T_J = 125$ °C, $I_F = 50$ A, $V_R = 200$ V, $dI_F/dt = 200$ A/μs | 765    |       |
| Typical junction capacitance                | $C_T$    | $V_R = 650$ V                                                     | 77     | pF    |



| THERMAL AND MECHANICAL SPECIFICATIONS          |                |                       |         |      |            |             |
|------------------------------------------------|----------------|-----------------------|---------|------|------------|-------------|
| PARAMETER                                      | SYMBOL         | TEST CONDITIONS       | MIN.    | TYP. | MAX.       | UNITS       |
| Junction and storage temperature range         | $T_J, T_{Stg}$ |                       | -55     | -    | 175        | °C          |
| Thermal resistance junction to case, per diode | $R_{thJC}$     |                       | -       | -    | 0.91       | °C/W        |
| Thermal resistance case to heatsink            | $R_{thCS}$     | Flat, greased surface | -       | 0.1  | -          |             |
| Weight                                         |                |                       | -       | 30   | -          | g           |
| Mounting torque                                |                | Torque to terminal    | -       | -    | 1.1 (9.7)  | Nm (lbf.in) |
|                                                |                | Torque to heatsink    | -       | -    | 1.3 (11.5) | Nm (lbf.in) |
| Case style                                     |                |                       | SOT-227 |      |            |             |

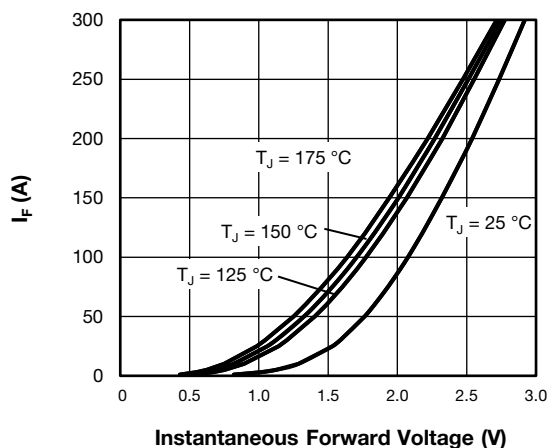


Fig. 1 - Typical Forward Voltage Characteristics

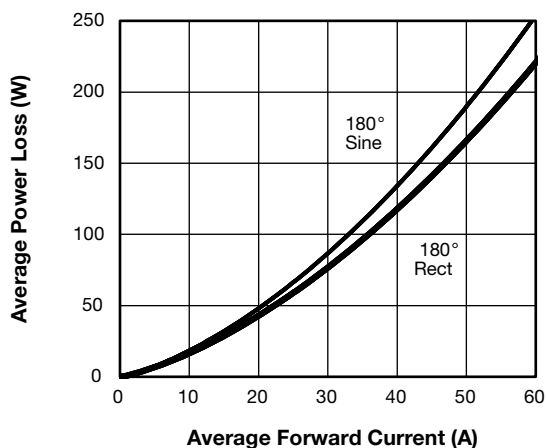


Fig. 4 - Forward Power Loss Characteristics

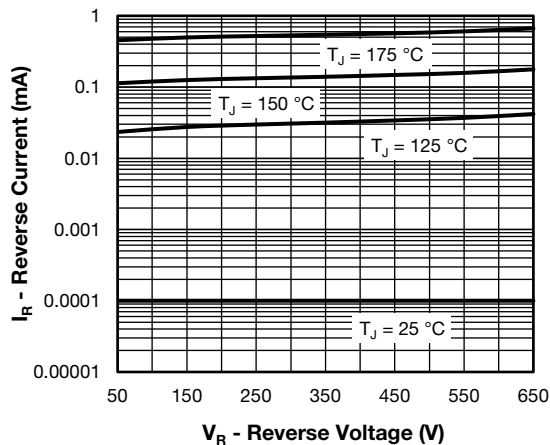


Fig. 2 - Typical Reverse Current vs. Reverse Voltage (Per Diode)

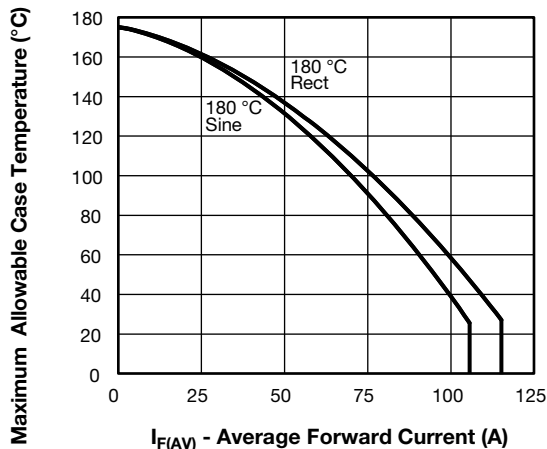


Fig. 5 - Current Rating Characteristics (A)

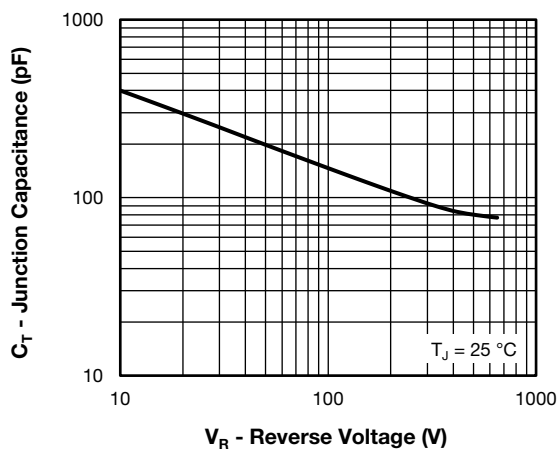
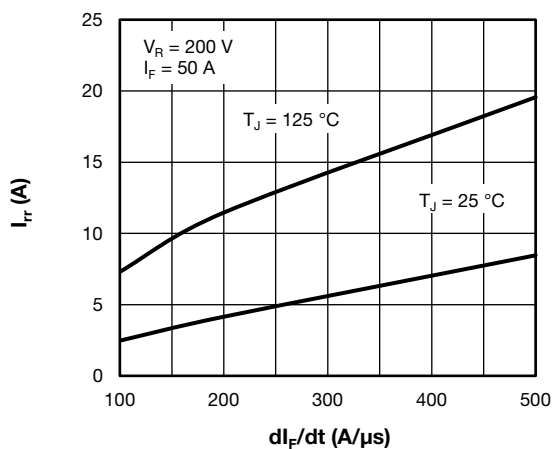


Fig. 3 - Typical Junction Capacitance vs. Reverse Voltage (Per Diode)


Fig. 6 - Typical Reverse Recovery Current vs.  $dI_F/dt$

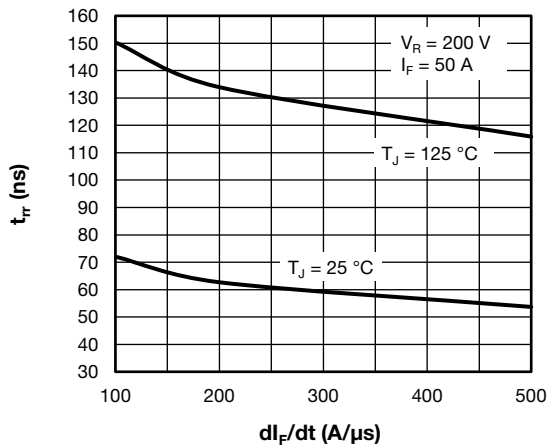
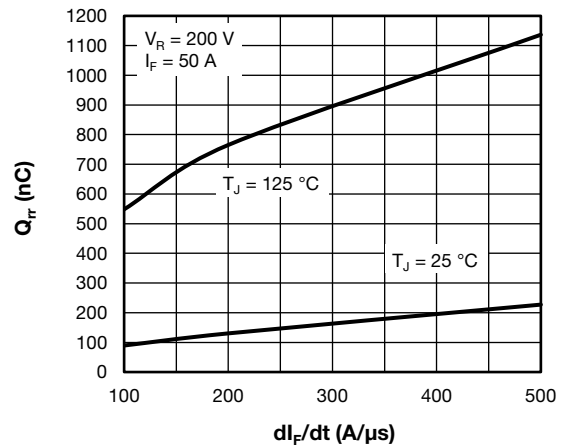
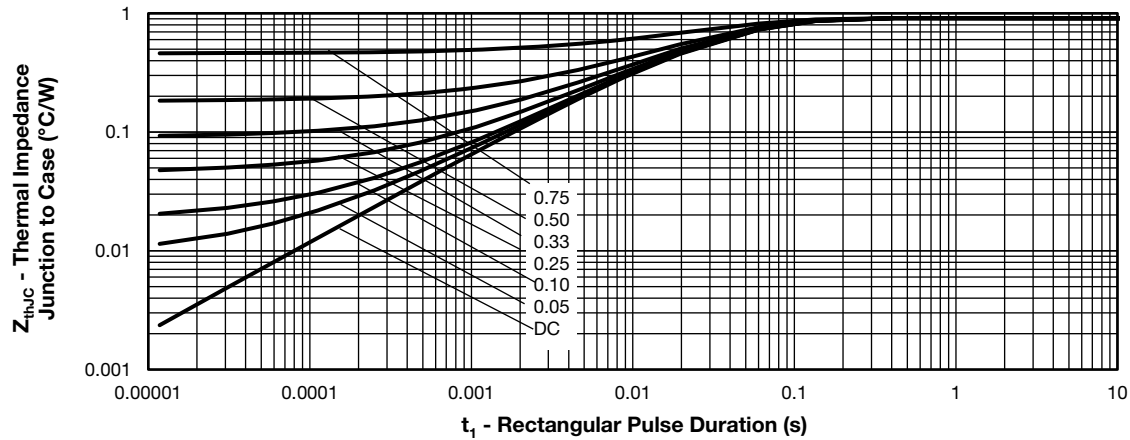

Fig. 7 - Typical Reverse Recovery Time vs.  $di_F/dt$ 

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


Fig. 9 - Maximum Thermal Impedance Junction-to-Case Characteristics (Per Diode)

**ORDERING INFORMATION TABLE**

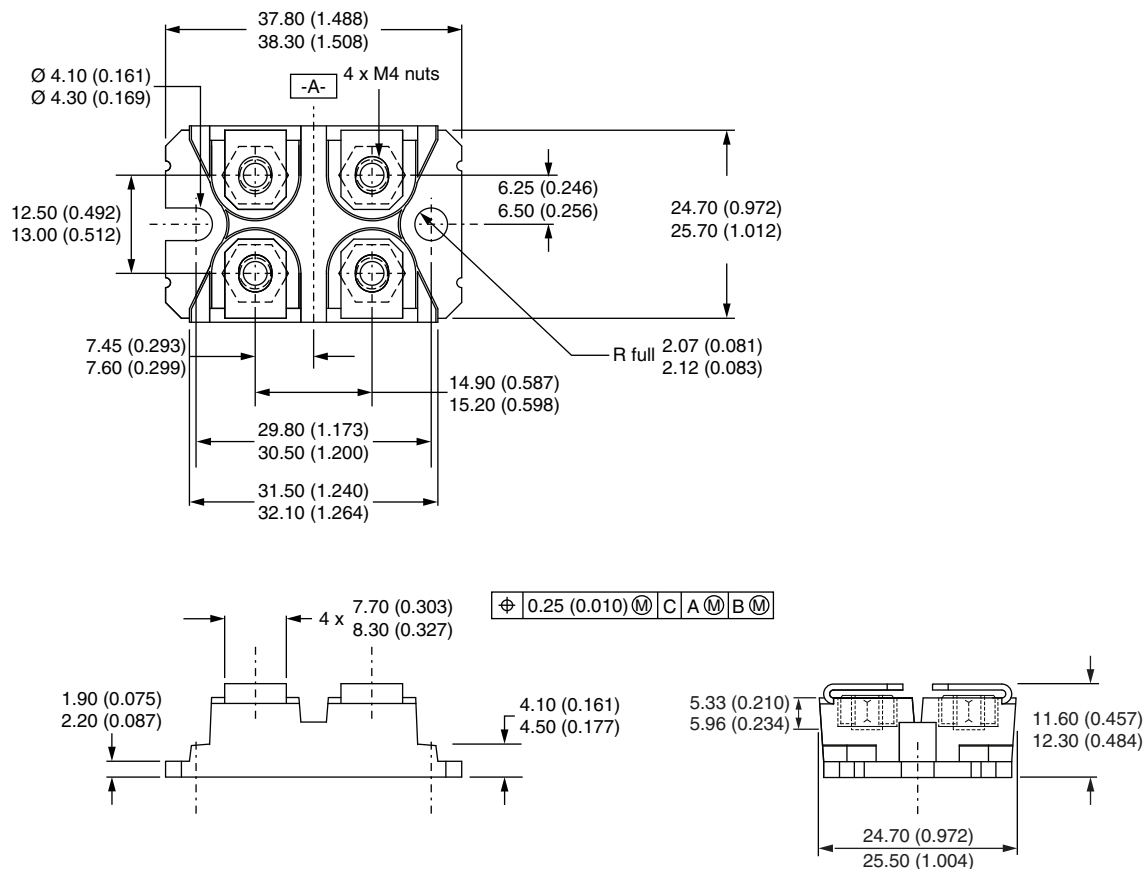
| Device code | VS-                                      | UF | H | 60 | B | A | 65 |
|-------------|------------------------------------------|----|---|----|---|---|----|
|             | 1                                        | 2  | 3 | 4  | 5 | 6 | 7  |
| 1           | Vishay Semiconductors product            |    |   |    |   |   |    |
| 2           | Ultra fast rectifier                     |    |   |    |   |   |    |
| 3           | Hyper fast FRED Pt <sup>®</sup> diffused |    |   |    |   |   |    |
| 4           | Current rating (60 = 60 A)               |    |   |    |   |   |    |
| 5           | Circuit configuration:                   |    |   |    |   |   |    |
|             | B = Single phase bridge                  |    |   |    |   |   |    |
| 6           | Package indicator:                       |    |   |    |   |   |    |
|             | A = SOT-227, standard insulated base     |    |   |    |   |   |    |
| 7           | Voltage rating (65 = 650 V)              |    |   |    |   |   |    |

| CIRCUIT CONFIGURATION |                            |                        |
|-----------------------|----------------------------|------------------------|
| CIRCUIT               | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING        |
| Single phase bridge   | B                          | <p>Lead Assignment</p> |

| 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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