



## Power Rectifiers Diodes (T-modules), 40 A to 110 A



D-55 (T-module)

### FEATURES

- Electrically isolated base plate
- Types up to 1200 V<sub>RRM</sub>
- 3500 V<sub>RMS</sub> isolating voltage
- Simplified mechanical designs, rapid assembly
- High surge capability
- Large creepage distances
- UL E78996 approved 
- 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

### PRIMARY CHARACTERISTICS

|                       |                               |
|-----------------------|-------------------------------|
| I <sub>F(AV)</sub>    | 40 A to 110 A                 |
| Type                  | Modules - diode, high voltage |
| V <sub>RRM</sub>      | 100 V to 1200 V               |
| Package               | D-55 (T-module)               |
| Circuit configuration | Single diode                  |

### DESCRIPTION / APPLICATIONS

These series of T-modules use standard recovery power rectifier diodes. The semiconductors are electrically isolated from the metal base, allowing common heatsink and compact assembly to be built.

Applications include power supplies, battery charges, welders, motor controls and general industrial current rectification.

### MAJOR RATINGS AND CHARACTERISTICS

| SYMBOL                      | CHARACTERISTICS | T40HF       | T70HF  | T85HF   | T110HF  | UNITS             |
|-----------------------------|-----------------|-------------|--------|---------|---------|-------------------|
| I <sub>F(AV)</sub>          |                 | 40          | 70     | 85      | 110     | A                 |
|                             | T <sub>C</sub>  | 85          | 85     | 85      | 85      | °C                |
| I <sub>F(RMS)</sub>         |                 | 63          | 110    | 134     | 173     | A                 |
| I <sub>FSM</sub>            | 50 Hz           | 570         | 1200   | 1700    | 2000    | A                 |
|                             | 60 Hz           | 600         | 1250   | 1800    | 2100    |                   |
| I <sup>2</sup> <sub>t</sub> | 50 Hz           | 1630        | 7100   | 14 500  | 20 500  | A <sup>2</sup> s  |
|                             | 60 Hz           | 1500        | 6450   | 13 500  | 18 600  |                   |
| I <sup>2</sup> √t           |                 | 16 300      | 70 700 | 148 700 | 204 300 | A <sup>2</sup> √s |
| V <sub>RRM</sub>            |                 | 100 to 1200 |        |         |         | V                 |
| T <sub>J</sub>              |                 | -40 to +150 |        |         |         | °C                |

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

| TYPE NUMBER                                               | VOLTAGE CODE | V <sub>RRM</sub> , MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE<br>V | V <sub>RSM</sub> , MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE<br>V | I <sub>RRM</sub> MAXIMUM AT T <sub>J</sub> = 25 °C<br>μA |
|-----------------------------------------------------------|--------------|-----------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------|
| VS-T40HF...<br>VS-T70HF...<br>VS-T85HF...<br>VS-T110HF... | 10           | 100                                                             | 150                                                                 | 100                                                      |
|                                                           | 20           | 200                                                             | 300                                                                 |                                                          |
|                                                           | 40           | 400                                                             | 500                                                                 |                                                          |
|                                                           | 60           | 600                                                             | 700                                                                 |                                                          |
|                                                           | 80           | 800                                                             | 900                                                                 |                                                          |
|                                                           | 100          | 1000                                                            | 1100                                                                |                                                          |
|                                                           | 120          | 1200                                                            | 1300                                                                |                                                          |



| FORWARD CONDUCTION                                            |                     |                                                                                                                                                                                                                           |                                  |                                                                       |        |        |         |         |                   |
|---------------------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-----------------------------------------------------------------------|--------|--------|---------|---------|-------------------|
| PARAMETER                                                     | SYMBOL              | TEST CONDITIONS                                                                                                                                                                                                           |                                  |                                                                       | VALUES |        |         |         | UNITS             |
|                                                               |                     |                                                                                                                                                                                                                           |                                  |                                                                       | T40HF  | T70HF  | T85HF   | T110HF  |                   |
| Maximum average forward current at case temperature           | I <sub>F(AV)</sub>  | 180° conduction, half sine wave                                                                                                                                                                                           |                                  |                                                                       | 40     | 70     | 85      | 110     | A                 |
|                                                               |                     |                                                                                                                                                                                                                           |                                  |                                                                       | 85     | 85     | 85      | 85      | °C                |
| Maximum RMS forward current                                   | I <sub>F(RMS)</sub> |                                                                                                                                                                                                                           |                                  |                                                                       | 63     | 110    | 134     | 173     | A                 |
| Maximum peak, one-cycle forward, non-repetitive surge current | I <sub>FSM</sub>    | t = 10 ms                                                                                                                                                                                                                 | No voltage reapplied             | Sinusoidal half wave, initial T <sub>J</sub> = T <sub>J</sub> maximum | 570    | 1200   | 1700    | 2000    | A                 |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                                |                                  |                                                                       | 600    | 1250   | 1800    | 2100    |                   |
|                                                               |                     | t = 10 ms                                                                                                                                                                                                                 | 100 % V <sub>RRM</sub> reapplied |                                                                       | 480    | 1000   | 1450    | 1700    |                   |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                                |                                  |                                                                       | 500    | 1050   | 1500    | 1780    |                   |
| Maximum I <sup>2</sup> t for fusing                           | I <sup>2</sup> t    | t = 10 ms                                                                                                                                                                                                                 | No voltage reapplied             |                                                                       | 1630   | 7100   | 14 500  | 20 500  | A <sup>2</sup> s  |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                                |                                  |                                                                       | 1500   | 6450   | 13 500  | 18 600  |                   |
|                                                               |                     | t = 10 ms                                                                                                                                                                                                                 | 100 % V <sub>RRM</sub> reapplied |                                                                       | 1150   | 5000   | 10 500  | 14 500  |                   |
|                                                               |                     | t = 8.3 ms                                                                                                                                                                                                                |                                  |                                                                       | 1050   | 4570   | 9600    | 13 200  |                   |
| Maximum I <sup>2</sup> √t for fusing                          | I <sup>2</sup> √t   | t = 0.1 ms to 10 ms, no voltage reapplied                                                                                                                                                                                 |                                  |                                                                       | 16 300 | 70 700 | 148 700 | 204 300 | A <sup>2</sup> √s |
| Low level value of threshold voltage                          | V <sub>F(TO)1</sub> | (16.7 % × π × I <sub>F(AV)</sub> ) < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> maximum                                                                                                                                 |                                  |                                                                       | 0.66   | 0.76   | 0.68    | 0.68    | V                 |
| High level value of threshold voltage                         | V <sub>F(TO)2</sub> | (I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> maximum                                                                                                                                                                     |                                  |                                                                       | 0.84   | 0.95   | 0.90    | 0.86    |                   |
| Low level value of forward slope resistance                   | r <sub>f1</sub>     | (16.7 % × π × I <sub>F(AV)</sub> ) < I < π × I <sub>F(AV)</sub> ), T <sub>J</sub> maximum                                                                                                                                 |                                  |                                                                       | 4.3    | 2.4    | 1.76    | 1.56    | mΩ                |
| High level value of forward slope resistance                  | r <sub>f2</sub>     | (I > π × I <sub>F(AV)</sub> ), T <sub>J</sub> maximum                                                                                                                                                                     |                                  |                                                                       | 3.1    | 1.7    | 1.08    | 1.12    |                   |
| Maximum forward voltage drop                                  | V <sub>FM</sub>     | I <sub>FM</sub> = π × I <sub>F(AV)</sub> , T <sub>J</sub> = 25 °C, t <sub>p</sub> = 400 μs square pulse<br>Average power = V <sub>F(TO)</sub> × I <sub>F(AV)</sub> + r <sub>f</sub> × (I <sub>F(RMS)</sub> ) <sup>2</sup> |                                  |                                                                       | 1.30   | 1.35   | 1.27    | 1.35    | V                 |

| BLOCKING                             |            |                                                                                 |       |       |       |        |       |
|--------------------------------------|------------|---------------------------------------------------------------------------------|-------|-------|-------|--------|-------|
| PARAMETER                            | SYMBOL     | TEST CONDITIONS                                                                 | T40HF | T70HF | T85HF | T110HF | UNITS |
| Maximum peak reverse leakage current | $I_{RRM}$  | $T_J = 150\text{ °C}$                                                           | 15    | 15    | 20    | 20     | mA    |
| RMS isolation voltage                | $V_{ISOL}$ | 50 Hz, circuit to base, all terminals shorted<br>$T_J = 25\text{ °C}$ , t = 1 s | 3500  | 3500  | 3500  | 3500   | V     |

| THERMAL AND MECHANICAL SPECIFICATIONS                            |                                   |                                               |                                     |                 |       |       |        |       |
|------------------------------------------------------------------|-----------------------------------|-----------------------------------------------|-------------------------------------|-----------------|-------|-------|--------|-------|
| PARAMETER                                                        | SYMBOL                            | TEST CONDITIONS                               |                                     | VALUES          |       |       |        | UNITS |
|                                                                  |                                   |                                               |                                     | T40HF           | T70HF | T85HF | T110HF |       |
| Maximum junction operating and storage temperature range         | T <sub>J</sub> , T <sub>Stg</sub> |                                               |                                     | -40 to +150     |       |       |        | °C    |
| Maximum thermal resistance, junction to case per junction        | R <sub>thJC</sub>                 | DC operation                                  |                                     | 1.36            | 0.69  | 0.62  | 0.47   | K/W   |
| Maximum thermal resistance, case to heatsink                     | R <sub>thCS</sub>                 | Mounting surface smooth, flat and greased     |                                     | 0.2             |       |       |        |       |
| Mounting torque, <div>to heatsink<br/>± 10 %<br/>terminals</div> |                                   | Non-lubricated threads                        | M3.5 mounting screws <sup>(1)</sup> | 1.3 ± 10 %      |       |       |        | Nm    |
|                                                                  |                                   |                                               | M5 screw terminals                  | 3 ± 10 %        |       |       |        |       |
| Approximate weight                                               |                                   | See dimensions - link at the end of datasheet |                                     | 54              |       |       |        | g     |
| Case style                                                       |                                   |                                               |                                     | D-55 (T-module) |       |       |        |       |

## Note

<sup>(1)</sup> A mounting compound is recommended and the torque should be rechecked after a period of about 3 hours to allow for the spread of the compound



| ΔR CONDUCTION PER JUNCTION |                                                 |      |      |      |      |                                                  |      |      |      |      |       |
|----------------------------|-------------------------------------------------|------|------|------|------|--------------------------------------------------|------|------|------|------|-------|
| DEVICES                    | SINUSOIDAL CONDUCTION AT T <sub>J</sub> MAXIMUM |      |      |      |      | RECTANGULAR CONDUCTION AT T <sub>J</sub> MAXIMUM |      |      |      |      | UNITS |
|                            | 180°                                            | 120° | 90°  | 60°  | 30°  | 180°                                             | 120° | 90°  | 60°  | 30°  |       |
| T40HF...                   | 0.12                                            | 0.14 | 0.18 | 0.27 | 0.46 | 0.09                                             | 0.15 | 0.20 | 0.28 | 0.46 | K/W   |
| T70HF...                   | 0.09                                            | 0.11 | 0.14 | 0.20 | 0.35 | 0.07                                             | 0.11 | 0.15 | 0.21 | 0.35 |       |
| T85HF...                   | 0.08                                            | 0.09 | 0.12 | 0.18 | 0.31 | 0.06                                             | 0.10 | 0.13 | 0.19 | 0.31 |       |
| T110HF...                  | 0.05                                            | 0.07 | 0.09 | 0.14 | 0.23 | 0.05                                             | 0.08 | 0.10 | 0.15 | 0.24 |       |

## Note

- Table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC



Fig. 1 - Current Ratings Characteristics



Fig. 2 - Current Ratings Characteristics



Fig. 3 - Forward Power Loss Characteristics

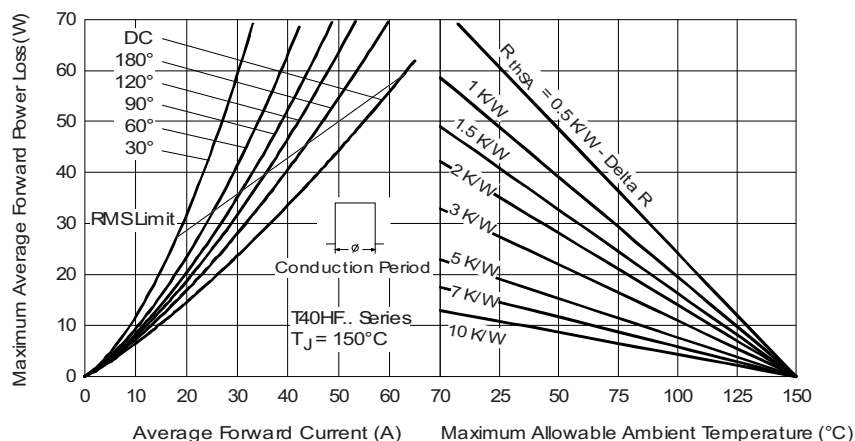


Fig. 4 - Forward Power Loss Characteristics

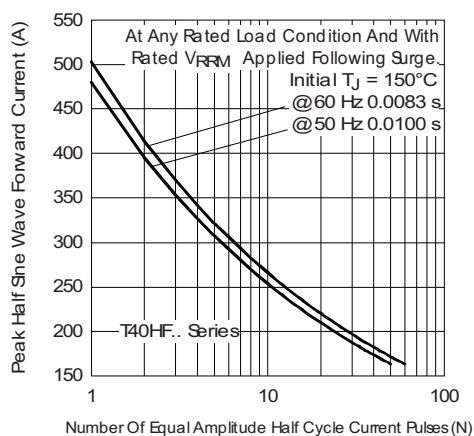


Fig. 5 - Maximum Non-Repetitive Surge Current

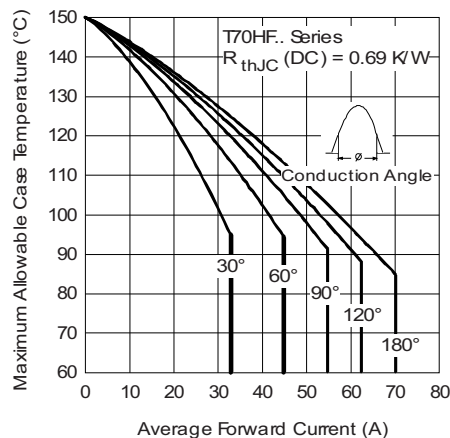


Fig. 7 - Current Ratings Characteristics

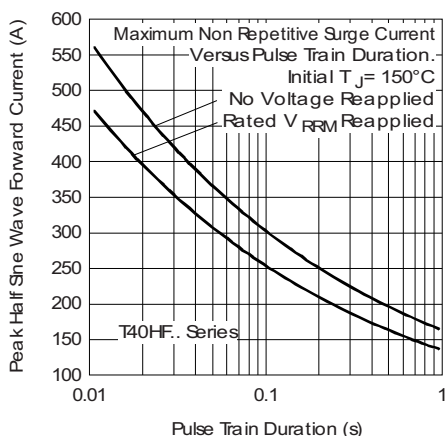


Fig. 6 - Maximum Non-Repetitive Surge Current



Fig. 8 - Current Ratings Characteristics



Fig. 9 - Forward Power Loss Characteristics



Fig. 10 - Forward Power Loss Characteristics



Fig. 11 - Maximum Non-Repetitive Surge Current



Fig. 12 - Maximum Non-Repetitive Surge Current



Fig. 13 - Current Ratings Characteristics



Fig. 14 - Current Ratings Characteristics



Fig. 15 - Forward Power Loss Characteristics



Fig. 16 - Forward Power Loss Characteristics



Fig. 17 - Maximum Non-Repetitive Surge Current

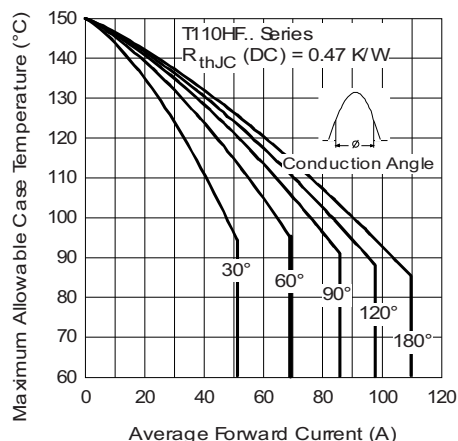


Fig. 19 - Current Ratings Characteristics



Fig. 18 - Maximum Non-Repetitive Surge Current



Fig. 20 - Current Ratings Characteristics

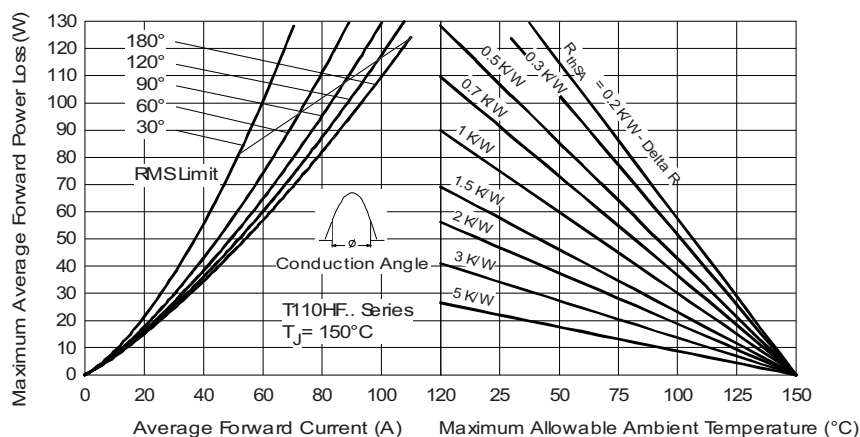


Fig. 21 - Forward Power Loss Characteristics

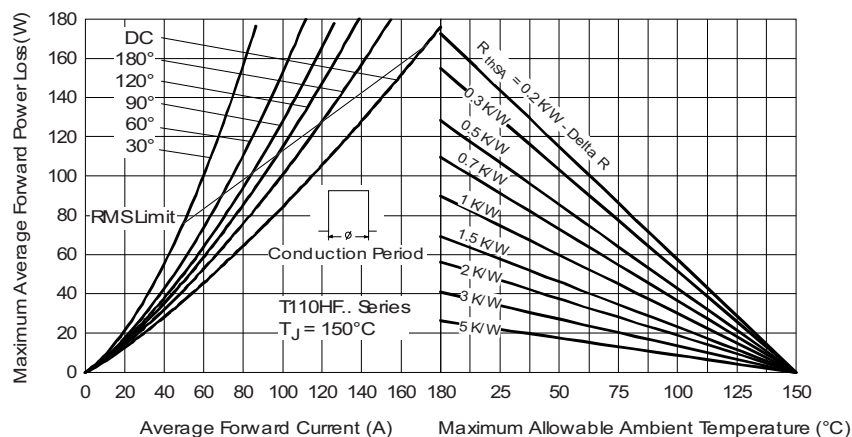


Fig. 22 - Forward Power Loss Characteristics

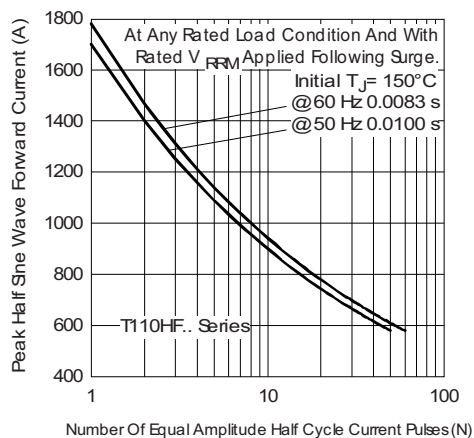


Fig. 23 - Maximum Non-Repetitive Surge Current

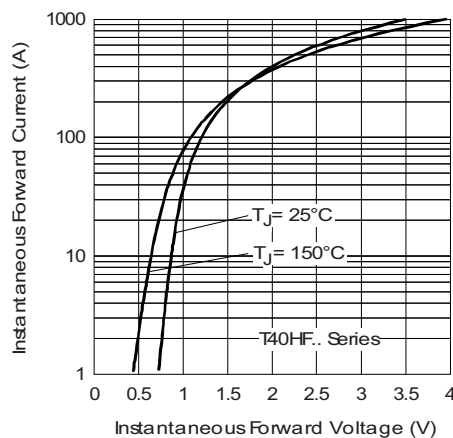


Fig. 25 - Forward Voltage Drop Characteristics

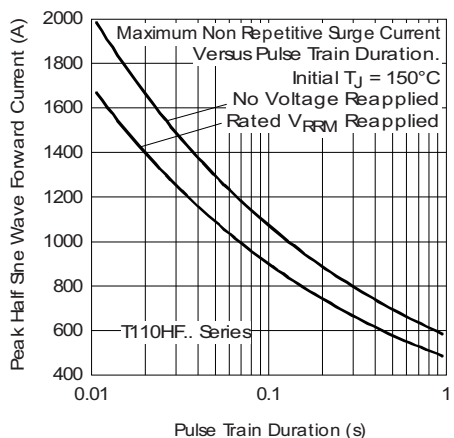


Fig. 24 - Maximum Non-Repetitive Surge Current

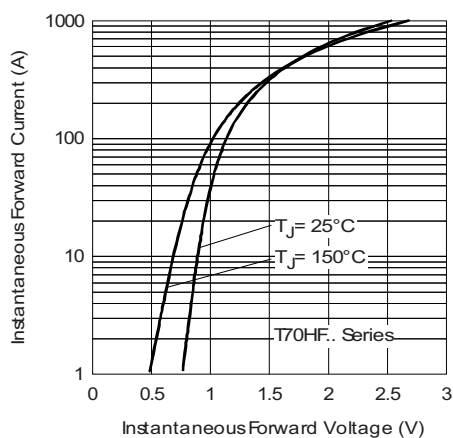


Fig. 26 - Forward Voltage Drop Characteristics



Fig. 27 - Forward Voltage Drop Characteristics



Fig. 28 - Forward Voltage Drop Characteristics

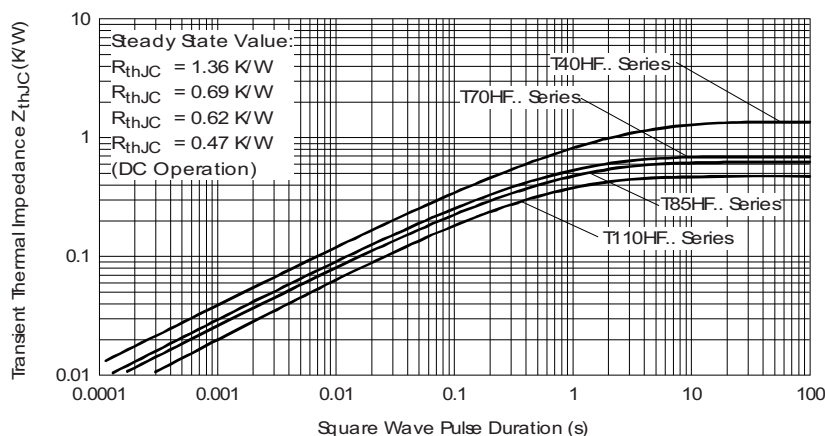


Fig. 29 - Thermal Impedance  $Z_{thJC}$  Characteristics

## ORDERING INFORMATION TABLE

| Device code | VS-                                                       | T | 110 | HF | 120 |
|-------------|-----------------------------------------------------------|---|-----|----|-----|
|             | ①                                                         | ② | ③   | ④  | ⑤   |
| ①           | - Vishay Semiconductors product                           |   |     |    |     |
| ②           | - Module type                                             |   |     |    |     |
| ③           | - Current rating                                          |   |     |    |     |
| ④           | - Circuit configuration (see Circuit Configuration table) |   |     |    |     |
| ⑤           | - Voltage code x 10 = $V_{RRM}$                           |   |     |    |     |

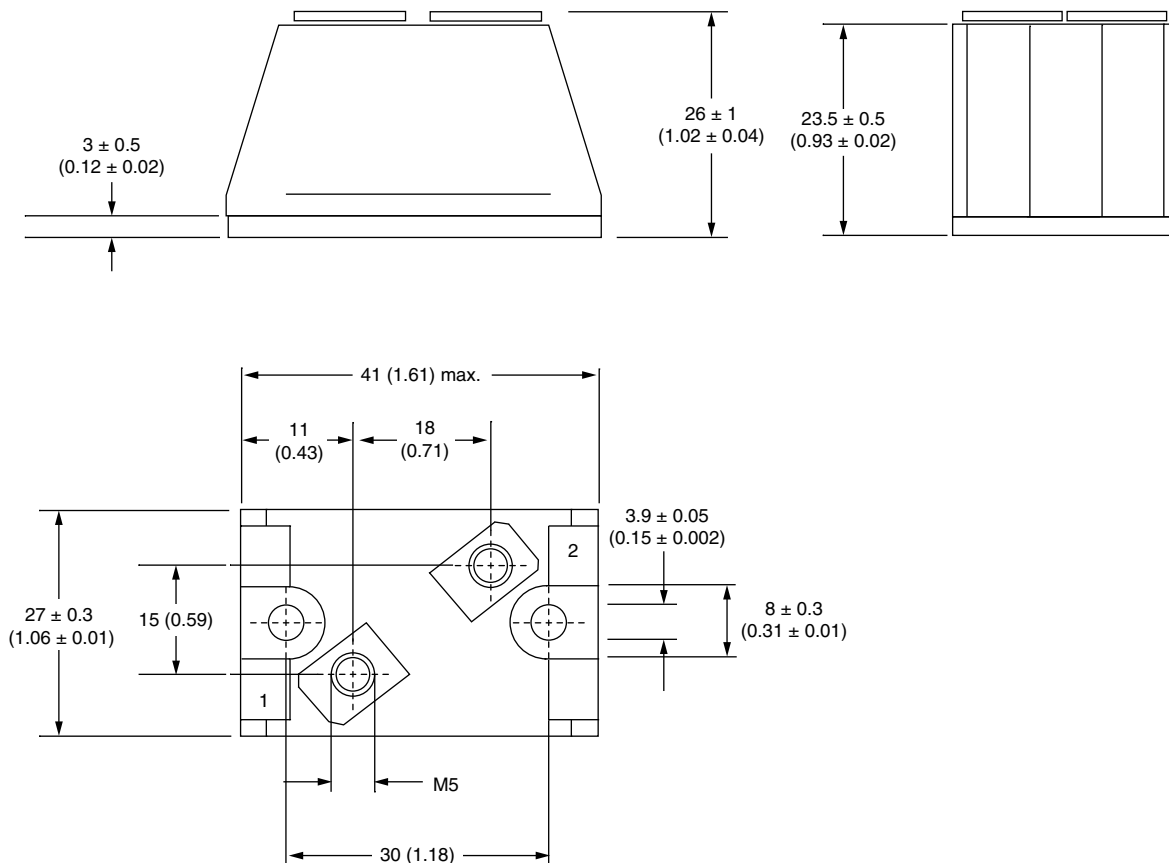
| CIRCUIT CONFIGURATION |                            |                 |
|-----------------------|----------------------------|-----------------|
| CIRCUIT DESCRIPTION   | CIRCUIT CONFIGURATION CODE | CIRCUIT DRAWING |
| Single diode          | HF                         |                 |

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95313">www.vishay.com/doc?95313</a> |



## D-55 T-Module Diode Standard and Fast Recovery

**DIMENSIONS** in millimeters (inches)



**Note**

- 1 = Anode
- 2 = Cathode



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