**VS-T40HFL, VS-T70HFL, VS-T85HFL Series**

**Fast Recovery Diodes (T-Modules), 40 A, 70 A, 85 A**

**FEATURES**
- Fast recovery time characteristics
- Electrically isolated base plate
- 3500 $V_{RMS}$ isolating voltage
- Standard JEDEC® package
- Simplified mechanical designs, rapid assembly
- Large creepage distances
- UL E78996 approved
- Designed and qualified for industrial level

**DESCRIPTION**

The series of T-modules uses fast recovery power diodes in a single diode configuration. The semiconductors are electrically isolated from the metal base, allowing common heatsink and compact assemblies to be built. These single diode modules can be used in conjunction with the thyristor modules as a freewheel diode. Application includes self-commutated inverters, DC choppers, motor control, inductive heating and electronic welders. These modules are intended for those applications where very fast recovery characteristics are required and for general power switching applications.

### PRIMARY CHARACTERISTICS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>T40HFL</th>
<th>T70HFL</th>
<th>T85HFL</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{F(AV)}$</td>
<td>40 A</td>
<td>70 A</td>
<td>85 A</td>
</tr>
<tr>
<td>$T_C$</td>
<td>70 A</td>
<td>70 A</td>
<td>70 A</td>
</tr>
<tr>
<td>$I_{F(RMS)}$</td>
<td>63 A</td>
<td>110 A</td>
<td>133 A</td>
</tr>
<tr>
<td>$I_{FSM}$</td>
<td>475 A</td>
<td>830 A</td>
<td>1300 A</td>
</tr>
<tr>
<td>$I_{Pt}$</td>
<td>1130 A</td>
<td>3460 A</td>
<td>8550 A</td>
</tr>
<tr>
<td>$V_{RRM}$</td>
<td>Range</td>
<td>100 to 1000 V</td>
<td></td>
</tr>
<tr>
<td>$t_{tr}$</td>
<td>Range</td>
<td>200 to 1000 ns</td>
<td></td>
</tr>
<tr>
<td>$T_J$</td>
<td>Range</td>
<td>-40 to +125 °C</td>
<td></td>
</tr>
</tbody>
</table>

### ELECTRICAL SPECIFICATIONS

#### VOLTAGE RATINGS

<table>
<thead>
<tr>
<th>TYPE NUMBER</th>
<th>VOLTAGE CODE</th>
<th>$t_{tr}$ CODE</th>
<th>$V_{RMM, MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE}$</th>
<th>$V_{RSM, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE}$</th>
<th>$I_{FMM, MAXIMUM AT T_J = 25 °C}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>VS_T40HFL..</td>
<td>S02, S05, S10</td>
<td>200</td>
<td>150</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>VS_T70HFL..</td>
<td>S02, S05, S10</td>
<td>400</td>
<td>500</td>
<td>700</td>
<td></td>
</tr>
<tr>
<td>VS_T85HFL..</td>
<td>S05, S10</td>
<td>800</td>
<td>900</td>
<td>1100</td>
<td></td>
</tr>
</tbody>
</table>
### FORWARD CONDUCTION

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS</th>
<th>VALUES</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum average forward current at case temperature</td>
<td>$I_{F(AV)}$</td>
<td>180° conduction, half sine wave</td>
<td>T40HFL: 40°C, 70°C, 85°C; T70HFL: 70°C, T85HFL</td>
<td>A</td>
</tr>
<tr>
<td>Maximum RMS forward current</td>
<td>$I_{(RMS)}$</td>
<td></td>
<td>T40HFL: 63 A, 110 A, 133 A; T70HFL: 70 A, 110 A, 133 A; T85HFL: 70 A, 110 A, 133 A</td>
<td>A</td>
</tr>
<tr>
<td>Maximum peak, one-cycle forward, non-repetitive surge current</td>
<td>$I_{FSM}$</td>
<td>t = 10 ms, t = 8.3 ms, No voltage reapplied</td>
<td>T40HFL: 475 A, 500 A, 400 A; T70HFL: 830 A, 870 A, 700 A; T85HFL: 1300 A, 1370 A, 1100 A</td>
<td>A</td>
</tr>
<tr>
<td>Maximum $I^2t$ for fusing</td>
<td>$I^2t_1$</td>
<td>t = 10 ms, No voltage reapplied</td>
<td>T40HFL: 1130 A, 1030 A, 800 A; T70HFL: 3460 A, 3160 A, 2450 A; T85HFL: 8550 A, 7810 A, 6050 A</td>
<td>A²s</td>
</tr>
<tr>
<td>Maximum $I^2t$ for fusing</td>
<td>$I^2t_2$</td>
<td>t = 0.1 ms to 10 ms, no voltage reapplied</td>
<td>T40HFL: 11300 A, 10300 A, 8000 A; T70HFL: 34600 A, 31600 A, 24500 A; T85HFL: 85500 A, 78100 A, 60500 A</td>
<td>A²s</td>
</tr>
<tr>
<td>Low level value of threshold voltage</td>
<td>$V_{F(TOH1)}$</td>
<td>TJ = 25 °C, (16.7 % x π x $I_{F(AV)}$ x I &lt; π x $I_{F(AV)}$</td>
<td>T40HFL: 0.82 V, 0.87 V, 0.84 V; T70HFL: 0.82 V, 0.87 V, 0.84 V; T85HFL: 0.82 V, 0.87 V, 0.84 V</td>
<td>V</td>
</tr>
<tr>
<td>High level value of threshold voltage</td>
<td>$V_{F(TOH2)}$</td>
<td>TJ = 25 °C, (I &gt; π x $I_{F(AV)}$</td>
<td>T40HFL: 0.84 mΩ, 0.90 mΩ, 0.86 mΩ; T70HFL: 0.84 mΩ, 0.90 mΩ, 0.86 mΩ; T85HFL: 0.84 mΩ, 0.90 mΩ, 0.86 mΩ</td>
<td>mΩ</td>
</tr>
<tr>
<td>Low level value of forward slope resistance</td>
<td>$r_{1f}$</td>
<td>TJ = 25 °C, (16.7 % x π x $I_{F(AV)}$ x I &lt; π x $I_{F(AV)}$</td>
<td>T40HFL: 7.0 mΩ, 2.77 mΩ, 2.15 mΩ; T70HFL: 7.0 mΩ, 2.77 mΩ, 2.15 mΩ; T85HFL: 7.0 mΩ, 2.77 mΩ, 2.15 mΩ</td>
<td>mΩ</td>
</tr>
<tr>
<td>High level value of forward slope resistance</td>
<td>$r_{2f}$</td>
<td>TJ = 25 °C, (I &gt; π x $I_{F(AV)}$</td>
<td>T40HFL: 6.8 mΩ, 2.67 mΩ, 2.07 mΩ; T70HFL: 6.8 mΩ, 2.67 mΩ, 2.07 mΩ; T85HFL: 6.8 mΩ, 2.67 mΩ, 2.07 mΩ</td>
<td>mΩ</td>
</tr>
<tr>
<td>Maximum forward voltage drop</td>
<td>$V_{FM}$</td>
<td>$I_{FM} = \pi x I_{F(AV)}$, TJ = 25 °C, $t_p = 400 \mu s$ square wave, Average power = $V_{F(TOH1)} x I_{F(AV)} + r_{1f} x (I_{F(RMS)})^2$</td>
<td>T40HFL: 1.60 V, 1.73 V, 1.55 V; T70HFL: 1.60 V, 1.73 V, 1.55 V; T85HFL: 1.60 V, 1.73 V, 1.55 V</td>
<td>V</td>
</tr>
</tbody>
</table>

### REVERSE RECOVERY CHARACTERISTICS

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS (1)</th>
<th>T40HFL</th>
<th>T70HFL</th>
<th>T85HFL</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum reverse recovery time</td>
<td>$t_{rr}$</td>
<td>TJ = 25 °C, $-\frac{dl_{F}}{dt} = 100 A/\mu s$</td>
<td>S02: 70 ns, 110 ns, 270 ns; S05: 70 ns, 110 ns, 270 ns; S10: 80 ns, 120 ns, 290 ns</td>
<td>ns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum reverse recovery charge</td>
<td>$Q_{rr}$</td>
<td>TJ = 25 °C, $-\frac{dl_{F}}{dt} = 100 A/\mu s$</td>
<td>S02: 0.25 μC, 0.4 μC, 1.35 μC; S05: 0.25 μC, 0.4 μC, 1.35 μC; S10: 0.3 μC, 0.6 μC, 1.6 μC</td>
<td>μC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note

(1) Tested on LEM 300 A diodometer tester

### BLOCKING

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>SYMBOL</th>
<th>TEST CONDITIONS</th>
<th>T40HFL</th>
<th>T70HFL</th>
<th>T85HFL</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum peak reverse leakage current</td>
<td>$I_{BRM}$</td>
<td>TJ = 125 °C</td>
<td>20 mA</td>
<td>mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RMS isolation voltage</td>
<td>$V_{ISOL}$</td>
<td>50 Hz, circuit to base, all terminals shorted, TJ = 25 °C, t = 1 s</td>
<td>3500 V</td>
<td>V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
THERMAL AND MECHANICAL SPECIFICATIONS

PARAMETER SYMBOL TEST CONDITIONS VALUES UNITS

Junction operating temperature range $T_J$ -40 to +125 °C

Storage temperature range $T_{Stg}$ -40 to +150 °C

Maximum internal thermal resistance, junction to case per module

- T40HFL $R_{thJC}$ DC operation 0.85 K/W
- T70HFL 0.53
- T85HFL 0.46

Thermal resistance, case to heatsink per module

- $R_{thCS}$ Mounting surface, flat, smooth and greased 0.2

Mounting torque ± 10 %

- base to heatsink Non-lubricated threads M3.5 mounting screws 1.3 ± 10 % N
- busbar to terminal MS screws terminals 3 ± 10 %

Approximate weight

- See dimensions - link at the end of datasheet 54 g
- 19 oz.

Case style

- D-55 (T-module)

Note

(1) 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

<table>
<thead>
<tr>
<th>DEVICES</th>
<th>SINUSOIDAL CONDUCTION AT $T_J$ MAXIMUM</th>
<th>RECTANGULAR CONDUCTION AT $T_J$ MAXIMUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>T40HFL</td>
<td>0.06 0.08 0.10 0.14 0.24 0.05 0.08 0.10 0.15 0.24</td>
<td>K/W</td>
</tr>
<tr>
<td>T70HFL</td>
<td>0.05 0.06 0.08 0.11 0.19 0.04 0.06 0.08 0.12 0.19</td>
<td></td>
</tr>
<tr>
<td>T85HFL</td>
<td>0.04 0.05 0.06 0.09 0.15 0.03 0.05 0.07 0.09 0.015</td>
<td></td>
</tr>
</tbody>
</table>

Note

- The table above shows the increment of thermal resistance $R_{thJC}$ when devices operate at different conduction angles than DC.
Fig. 9 - Forward Power Loss Characteristics

Fig. 10 - Forward Power Loss Characteristics

Fig. 11 - Forward Power Loss Characteristics

Fig. 12 - Forward Power Loss Characteristics

Fig. 13 - Maximum Non-Repetitive Surge Current

Fig. 14 - Maximum Non-Repetitive Surge Current
Fig. 15 - Maximum Non-Repetitive Surge Current

Fig. 16 - Maximum Non-Repetitive Surge Current

Fig. 17 - Maximum Non-Repetitive Surge Current

Fig. 18 - Maximum Non-Repetitive Surge Current

Fig. 19 - Recovery Time Characteristics

Fig. 20 - Recovery Charge Characteristics
Fig. 21 - Recovery Current Characteristics

Fig. 22 - Recovery Time Characteristics

Fig. 23 - Recovery Charge Characteristics

Fig. 24 - Recovery Current Characteristics

Fig. 25 - Recovery Time Characteristics

Fig. 26 - Recovery Charge Characteristics
Fig. 27 - Recovery Current Characteristics

Fig. 28 - Recovery Time Characteristics

Fig. 29 - Recovery Charge Characteristics

Fig. 30 - Recovery Current Characteristics

Fig. 31 - Recovery Time Characteristics

Fig. 32 - Recovery Charge Characteristics
Fig. 33 - Recovery Current Characteristics

Fig. 34 - Recovery Time Characteristics

Fig. 35 - Recovery Charge Characteristics

Fig. 36 - Recovery Current Characteristics

Fig. 37 - Frequency Characteristics
Fig. 38 - Frequency Characteristics

Fig. 39 - Maximum Forward Energy Power Loss Characteristics

Fig. 40 - Frequency Characteristics
Fig. 41 - Frequency Characteristics

Fig. 42 - Maximum Forward Energy Power Loss Characteristics

Fig. 43 - Frequency Characteristics
Fig. 44 - Frequency Characteristics

Fig. 45 - Maximum Forward Energy Power Loss Characteristics

Fig. 46 - Forward Voltage Drop Characteristics

Fig. 47 - Forward Voltage Drop Characteristics
**VS-T40HFL, VS-T70HFL, VS-T85HFL Series**

Vishay Semiconductors

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**Fig. 48 - Forward Voltage Drop Characteristics**

**Fig. 49 - Thermal Impedance $Z_{thJC}$ Characteristics**

**ORDERING INFORMATION TABLE**

<table>
<thead>
<tr>
<th>Device code</th>
<th>VS-</th>
<th>T</th>
<th>40</th>
<th>HFL</th>
<th>100</th>
<th>S10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
</tbody>
</table>

1. Vishay Semiconductors product
2. Module type
3. Current rating
4. Fast recovery diode
5. Voltage code x 10 = $V_{RRM}$
6. $t_{rr}$ code

<p>| | | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>40 = 40 A (average)</td>
<td>70 = 70 A (average)</td>
<td>85 = 85 A (average)</td>
<td>S02 = 200 ns</td>
<td>S05 = 500 ns</td>
<td>S10 = 1000 ns</td>
<td></td>
</tr>
</tbody>
</table>

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For technical questions within your region: DiodesAmericas@vishay.com, DiodesAsia@vishay.com, DiodesEurope@vishay.com

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### CIRCUIT CONFIGURATION

<table>
<thead>
<tr>
<th>CIRCUIT</th>
<th>CIRCUIT CONFIGURATION CODE</th>
<th>CIRCUIT DRAWING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>HFL</td>
<td><img src="image" alt="Circuit Diagram" /></td>
</tr>
</tbody>
</table>

### LINKS TO RELATED DOCUMENTS

D-55 T-Module Diode Standard and Fast Recovery

DIMENSIONS in millimeters (inches)

Note
• 1 = Anode
• 2 = Cathode
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