

## Fast Recovery Diodes (Stud Version), 40 A, 70 A, 85 A



DO-5 (DO-203AB)

### FEATURES

- Short reverse recovery time
- Low stored charge
- Wide current range
- Excellent surge capabilities
- Stud cathode and stud anode versions
- Types up to 100 V<sub>RRM</sub>
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

### TYPICAL APPLICATIONS

- DC power supplies
- Inverters
- Converters
- Choppers
- Ultrasonic systems
- Freewheeling diodes

### PRIMARY CHARACTERISTICS

|                       |                  |
|-----------------------|------------------|
| $I_{F(AV)}$           | 40 A, 70 A, 85 A |
| Package               | DO-5 (DO-203AB)  |
| Circuit Configuration | Single           |

### MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER     | TEST CONDITIONS | 40HFL                              | 70HFL                              | 85HFL                              | UNITS            |
|---------------|-----------------|------------------------------------|------------------------------------|------------------------------------|------------------|
| $I_{F(AV)}$   |                 | 40                                 | 70                                 | 85                                 | A                |
|               | $T_C$ maximum   | 85                                 | 85                                 | 85                                 | °C               |
| $I_{FSM}$     | 50 Hz           | 400                                | 700                                | 1100                               | A                |
|               | 60 Hz           | 420                                | 730                                | 1151                               |                  |
| $I^2t$        | 50 Hz           | 800                                | 2450                               | 6050                               | A <sup>2</sup> s |
|               | 60 Hz           | 730                                | 2240                               | 5523                               |                  |
| $I^2\sqrt{t}$ |                 | 11 300                             | 34 650                             | 85 560                             | $I^2\sqrt{s}$    |
| $V_{RRM}$     | Range           | 100 to 1000                        | 100 to 1000                        | 100 to 1000                        | V                |
| $t_{rr}$      |                 | See Recovery Characteristics table | See Recovery Characteristics table | See Recovery Characteristics table | ns               |
| $T_J$         | Range           | -40 to +125                        | -40 to +125                        | -40 to +125                        | °C               |



## ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS              |                                                                                                                                      |                                                                                                                                         |                                                                     |                                     |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|-------------------------------------|
| TYPE NUMBER <sup>(1)</sup>   | $V_{RRM}$ , MAXIMUM<br>PEAK REPETITIVE<br>REVERSE VOLTAGE<br>$T_J = -40\text{ }^{\circ}\text{C TO }125\text{ }^{\circ}\text{C}$<br>V | $V_{RSM}$ , MAXIMUM PEAK<br>NON-REPETITIVE<br>REVERSE VOLTAGE<br>$T_J = 25\text{ }^{\circ}\text{C TO }125\text{ }^{\circ}\text{C}$<br>V | $I_{FM}$ , MAXIMUM PEAK REVERSE<br>CURRENT AT RATED $V_{RRM}$<br>mA |                                     |
|                              |                                                                                                                                      |                                                                                                                                         | $T_J = 25\text{ }^{\circ}\text{C}$                                  | $T_J = 125\text{ }^{\circ}\text{C}$ |
| VS-40HFL10S02, VS-40HFL10S05 | 100                                                                                                                                  | 150                                                                                                                                     | 0.1                                                                 | 10                                  |
| VS-40HFL20S02, VS-40HFL20S05 | 200                                                                                                                                  | 300                                                                                                                                     |                                                                     |                                     |
| VS-40HFL40S02, VS-40HFL40S05 | 400                                                                                                                                  | 500                                                                                                                                     |                                                                     |                                     |
| VS-40HFL60S02, VS-40HFL60S05 | 600                                                                                                                                  | 700                                                                                                                                     |                                                                     |                                     |
| VS-40HFL80S05                | 800                                                                                                                                  | 900                                                                                                                                     |                                                                     |                                     |
| VS-40HFL100S05               | 1000                                                                                                                                 | 1100                                                                                                                                    |                                                                     |                                     |
| VS-70HFL10S02, VS-70HFL10S05 | 100                                                                                                                                  | 150                                                                                                                                     | 0.1                                                                 | 15                                  |
| VS-70HFL20S02, VS-70HFL20S05 | 200                                                                                                                                  | 300                                                                                                                                     |                                                                     |                                     |
| VS-70HFL40S02, VS-70HFL40S05 | 400                                                                                                                                  | 500                                                                                                                                     |                                                                     |                                     |
| VS-70HFL60S02, VS-70HFL60S05 | 600                                                                                                                                  | 700                                                                                                                                     |                                                                     |                                     |
| VS-70HFL80S05                | 800                                                                                                                                  | 900                                                                                                                                     |                                                                     |                                     |
| VS-70HFL100S05               | 1000                                                                                                                                 | 1100                                                                                                                                    |                                                                     |                                     |
| VS-85HFL10S02, VS-85HFL10S05 | 100                                                                                                                                  | 150                                                                                                                                     | 0.1                                                                 | 20                                  |
| VS-85HFL20S02, VS-85HFL20S05 | 200                                                                                                                                  | 300                                                                                                                                     |                                                                     |                                     |
| VS-85HFL40S02, VS-85HFL40S05 | 400                                                                                                                                  | 500                                                                                                                                     |                                                                     |                                     |
| VS-85HFL60S02, VS-85HFL60S05 | 600                                                                                                                                  | 700                                                                                                                                     |                                                                     |                                     |
| VS-85HFL80S05                | 800                                                                                                                                  | 900                                                                                                                                     |                                                                     |                                     |
| VS-85HFL100S05               | 1000                                                                                                                                 | 1100                                                                                                                                    |                                                                     |                                     |

## Note

<sup>(1)</sup> Types listed are cathode case, for anode case add "R" to code, i.e. 40HFLR20S02, 85HFLR100S05 etc.

| FORWARD CONDUCTION                                          |               |                                                                      |        |        |        |                   |
|-------------------------------------------------------------|---------------|----------------------------------------------------------------------|--------|--------|--------|-------------------|
| PARAMETER                                                   | SYMBOL        | TEST CONDITIONS                                                      | 40HFL  | 70HFL  | 85HFL  | UNITS             |
| Maximum average forward current at maximum case temperature | $I_{F(AV)}$   | 180° conduction, half sine wave                                      | 40     | 70     | 85     | A                 |
|                                                             |               |                                                                      | 75     |        |        | °C                |
| Maximum RMS forward current                                 | $I_{F(RMS)}$  |                                                                      | 63     | 110    | 134    | A                 |
| Maximum peak repetitive forward current                     | $I_{FRM}$     | Sinusoidal half wave, 30° conduction                                 | 220    | 380    | 470    | A                 |
| Maximum peak, one-cycle non-repetitive forward current      | $I_{FSM}$     | t = 10 ms                                                            | 400    | 700    | 1100   | A                 |
|                                                             |               | t = 8.3 ms                                                           | 420    | 730    | 1151   |                   |
|                                                             |               | t = 10 ms                                                            | 475    | 830    | 1308   |                   |
|                                                             |               | t = 8.3 ms                                                           | 500    | 870    | 1369   |                   |
| Maximum $I^2t$ for fusing                                   | $I^2t$        | t = 10 ms                                                            | 800    | 2450   | 6050   | A <sup>2</sup> s  |
|                                                             |               | t = 8.3 ms                                                           | 730    | 2240   | 5523   |                   |
|                                                             |               | t = 10 ms                                                            | 1130   | 3460   | 8556   |                   |
|                                                             |               | t = 8.3 ms                                                           | 1030   | 3160   | 7810   |                   |
| Maximum $I^2\sqrt{t}$ for fusing <sup>(1)</sup>             | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reapplied                            | 11 300 | 34 650 | 85 560 | A <sup>2</sup> √s |
| Maximum value of threshold voltage                          | $V_{F(TO)}$   | $T_J = 125\text{ }^{\circ}\text{C}$                                  | 1.081  | 1.085  | 1.128  | V                 |
| Maximum value of forward slope resistance                   | $r_F$         |                                                                      | 6.33   | 3.40   | 2.11   | mΩ                |
| Maximum forward voltage drop                                | $V_{FM}$      | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_{FM} = \pi \times I_{F(AV)}$ | 1.95   | 1.85   | 1.75   | V                 |

## Note

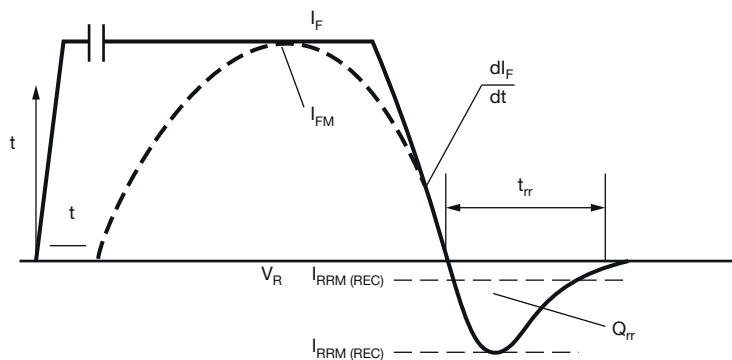
<sup>(1)</sup>  $I^2t$  for time  $t_x = I^2\sqrt{t} \times \sqrt{t_x}$

| RECOVERY CHARACTERISTICS         |          |                                                                                                                           |          |      |          |      |          |      |       |
|----------------------------------|----------|---------------------------------------------------------------------------------------------------------------------------|----------|------|----------|------|----------|------|-------|
| PARAMETER                        | SYMBOL   | TEST CONDITIONS                                                                                                           | 40HFL... |      | 70HFL... |      | 85HFL... |      | UNITS |
|                                  |          |                                                                                                                           | S02      | S05  | S02      | S05  | S02      | S05  |       |
| Typical reverse recovery time    | $t_{rr}$ | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_F = 1\text{ A}$ to $V_R = 30\text{ V}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$     | 70       | 180  | 60       | 150  | 50       | 120  | ns    |
|                                  |          | $T_J = 25\text{ }^{\circ}\text{C}$ , $-di_F/dt = 25\text{ A}/\mu\text{s}$ , $I_{FM} = \pi \times \text{rated } I_{F(AV)}$ | 200      | 500  | 200      | 500  | 200      | 500  |       |
| Typical reverse recovered charge | $Q_{rr}$ | $T_J = 25\text{ }^{\circ}\text{C}$ , $I_F = 1\text{ A}$ to $V_R = 30\text{ V}$ , $di_F/dt = 100\text{ A}/\mu\text{s}$     | 160      | 750  | 90       | 500  | 70       | 340  | nC    |
|                                  |          | $T_J = 25\text{ }^{\circ}\text{C}$ , $-di_F/dt = 25\text{ A}/\mu\text{s}$ , $I_{FM} = \pi \times \text{rated } I_{F(AV)}$ | 240      | 1300 | 240      | 1300 | 240      | 1300 |       |

| THERMAL AND MECHANICAL SPECIFICATIONS                |                   |                                                             |                 |       |       |                     |
|------------------------------------------------------|-------------------|-------------------------------------------------------------|-----------------|-------|-------|---------------------|
| PARAMETER                                            | SYMBOL            | TEST CONDITIONS                                             | 40HFL           | 70HFL | 85HFL | UNITS               |
| Junction operating temperature range                 | T <sub>J</sub>    |                                                             | -40 to 125      |       |       | °C                  |
| Storage temperature range                            | T <sub>Stg</sub>  |                                                             | -40 to 150      |       |       |                     |
| Maximum thermal resistance, junction to case         | R <sub>thJC</sub> | DC operation                                                | 0.60            | 0.36  | 0.30  | K/W                 |
| Maximum thermal resistance, case to heatsink         | R <sub>thCS</sub> | Mounting surface, smooth, flat and greased                  | 0.25            |       |       |                     |
| Maximum allowable mounting torque<br>(+ 0 %, - 10 %) |                   | Not lubricated thread, tightening on nut <sup>(1)</sup>     | 3.4 (30)        |       |       | N · m<br>(lbf · in) |
|                                                      |                   | Lubricated thread, tightening on nut <sup>(1)</sup>         | 2.3 (20)        |       |       |                     |
|                                                      |                   | Not lubricated thread, tightening on hexagon <sup>(2)</sup> | 4.2 (37)        |       |       |                     |
|                                                      |                   | Lubricated thread, tightening on hexagon <sup>(2)</sup>     | 3.2 (28)        |       |       |                     |
| Approximate weight                                   |                   |                                                             | 25              |       |       |                     |
|                                                      |                   |                                                             | 0.88            |       |       |                     |
| Case style                                           |                   | JEDEC®                                                      | DO-5 (DO-203AB) |       |       |                     |

**Notes**

- (1) Recommended for pass-through holes  
(2) Recommended for holed threaded heatsinks



$I_F, I_{FM}$  - Peak forward current prior to commutation  
 $-di_F/dt$  - Rate of fall forward current  
 $I_{RRM(REC)}$  - Peak reverse recovery current  
 $t_{rr}$  - Reverse recovery time  
 $Q_{rr}$  - Reverse recovered charge

Fig. 1 - Reverse Recovery Time Test Waveform

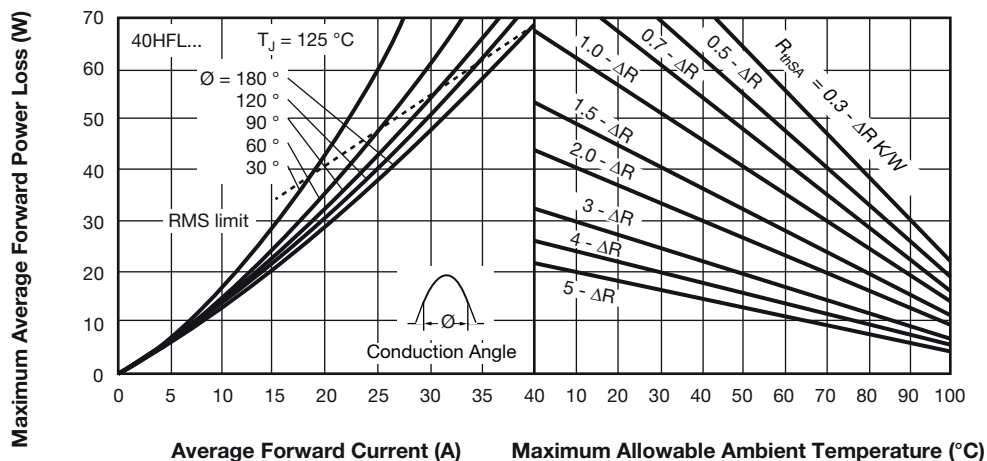


Fig. 2 - Current Rating Nomogram (Sinusoidal Waveforms), 40HFL Series

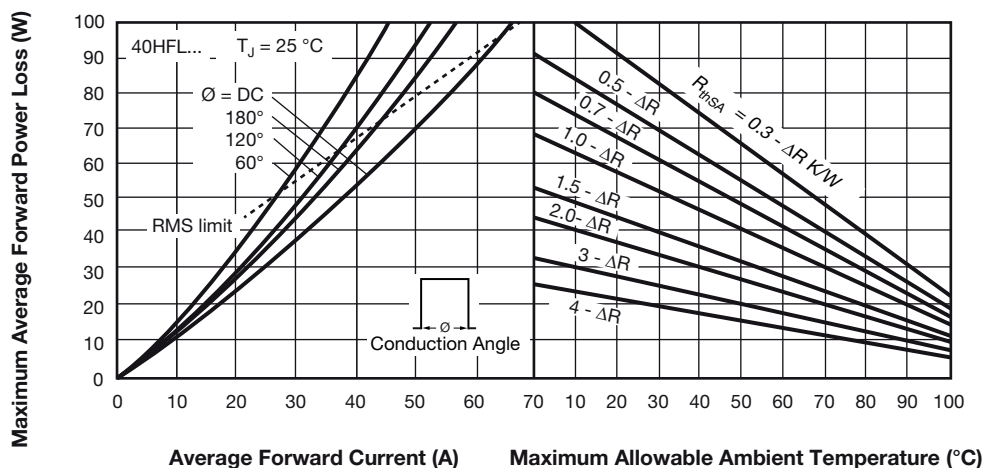


Fig. 3 - Current Rating Nomogram (Rectangular Waveforms), 40HFL Series

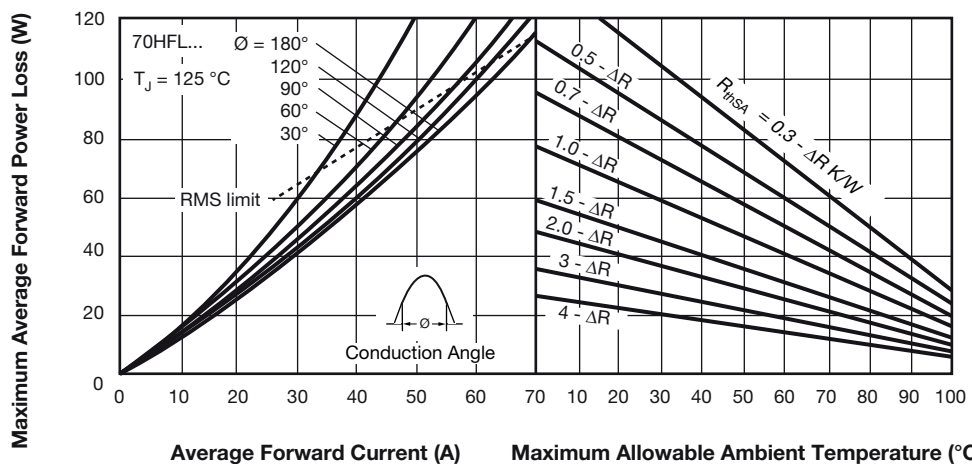


Fig. 4 - Current Rating Nomogram (Sinusoidal Waveforms), 70HFL Series

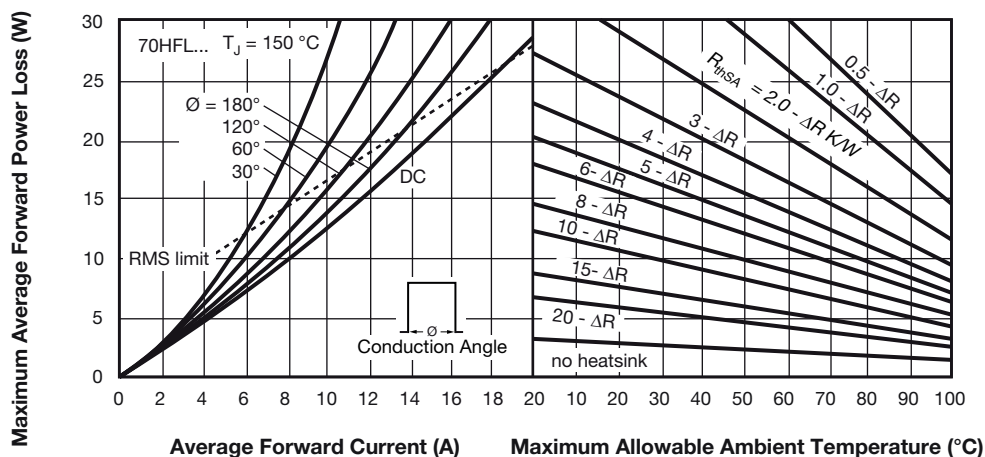


Fig. 5 - Current Rating Nomogram (Rectangular Waveforms), 70HFL Series

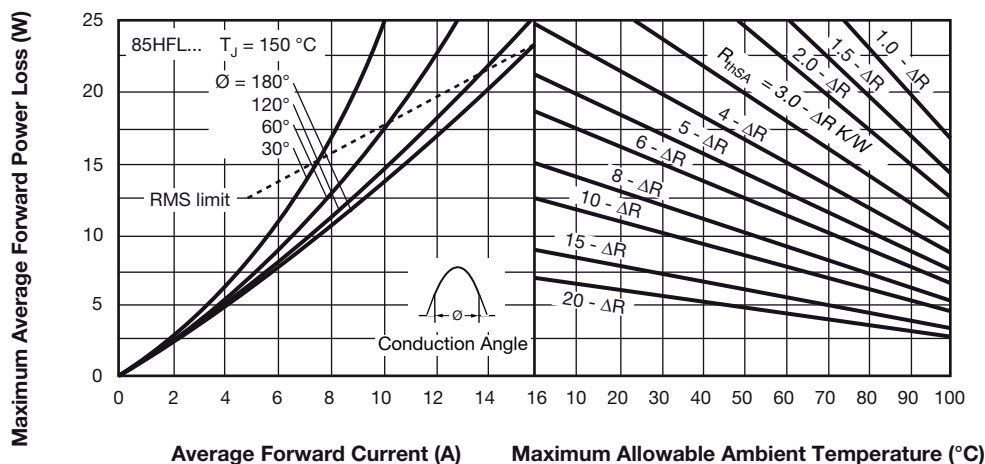


Fig. 6 - Current Rating Nomogram (Sinusoidal Waveforms), 85HFL Series

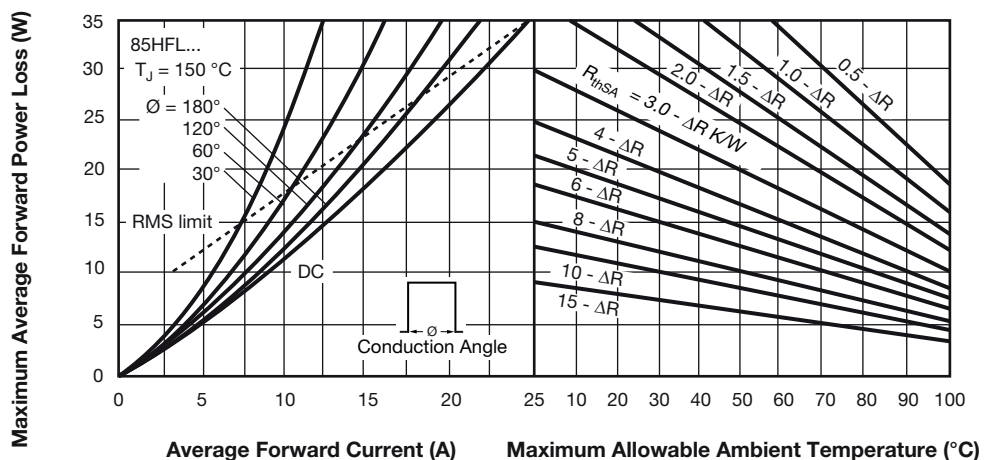


Fig. 7 - Current Rating Nomogram (Rectangular Waveforms), 85HFL Series

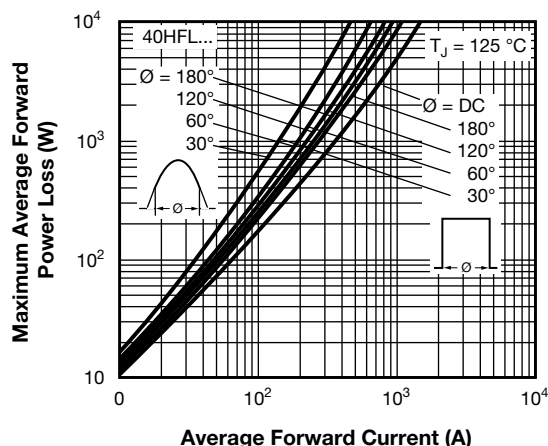


Fig. 8 - Maximum High Level Forward Power Loss vs. Average Forward Current, 40HFL Series

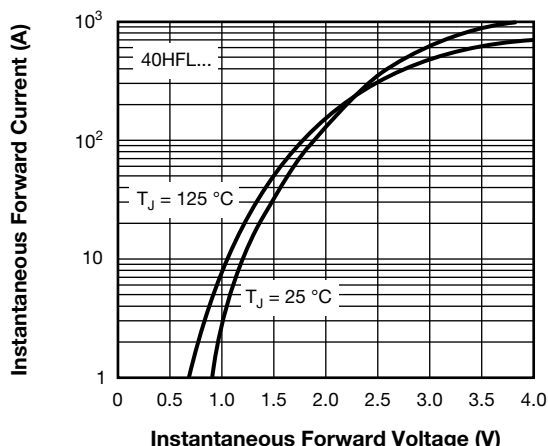


Fig. 11 - Maximum Forward Voltage vs. Forward Current, 40HFL Series

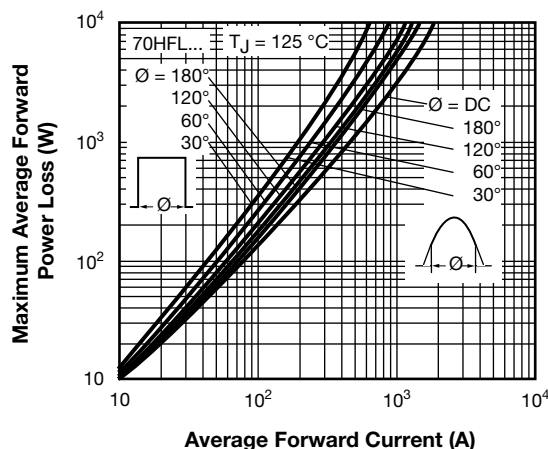


Fig. 9 - Maximum High Level Forward Power Loss vs. Average Forward Current, 70HFL Series

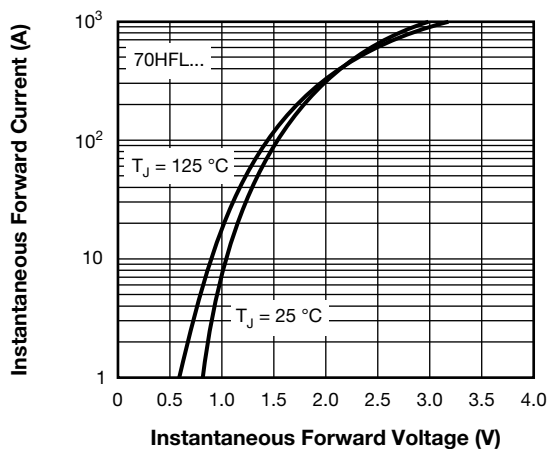


Fig. 12 - Maximum Forward Voltage vs. Forward Current, 70HFL Series

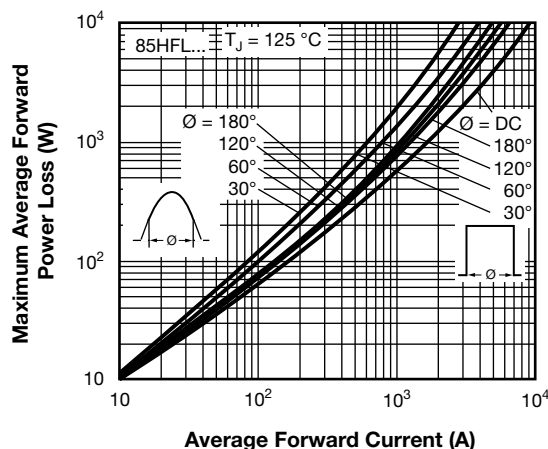


Fig. 10 - Maximum High Level Forward Power Loss vs. Average Forward Current, 85HFL Series

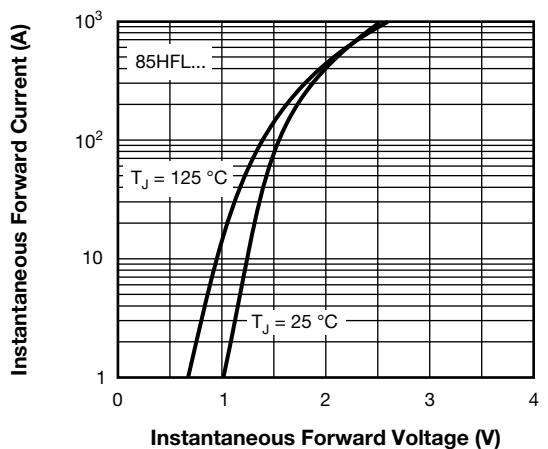


Fig. 13 - Maximum Forward Voltage vs. Forward Current, 85HFL Series

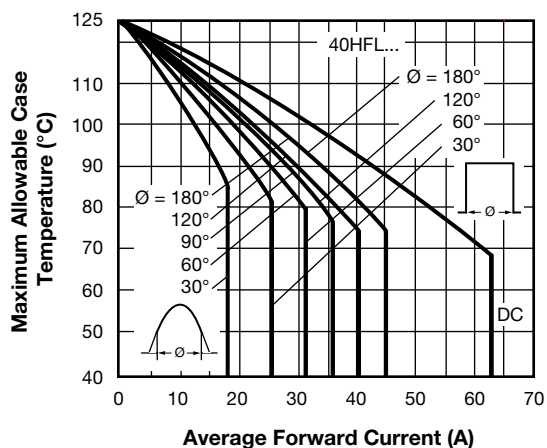


Fig. 14 - Average Forward Current vs. Maximum Allowable Case Temperature, 40HFL Series

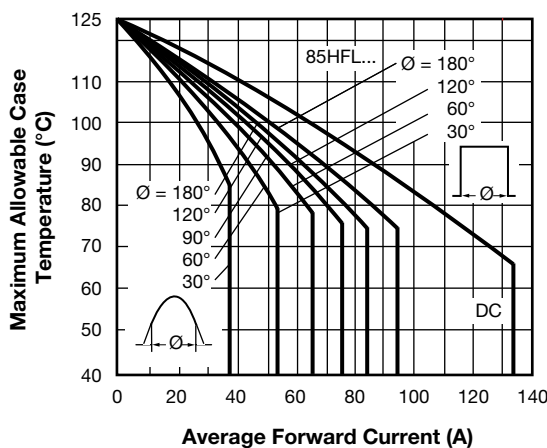


Fig. 16 - Average Forward Current vs. Maximum Allowable Case Temperature, 85HFL Series

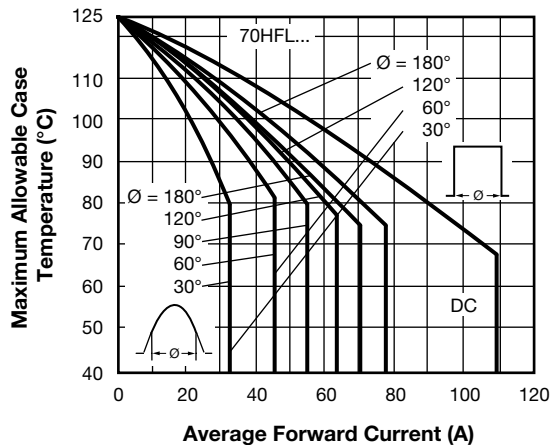


Fig. 15 - Average Forward Current vs. Maximum Allowable Case Temperature, 70HFL Series

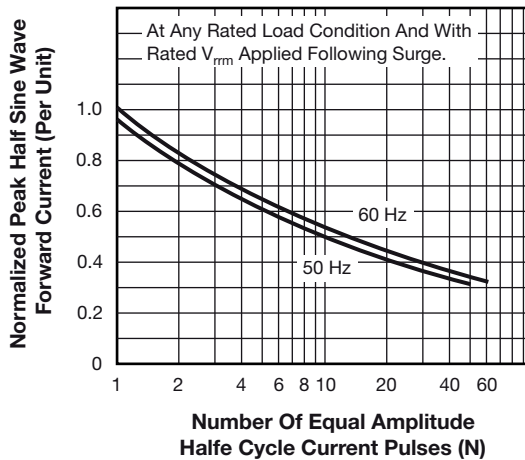


Fig. 17 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, All Series

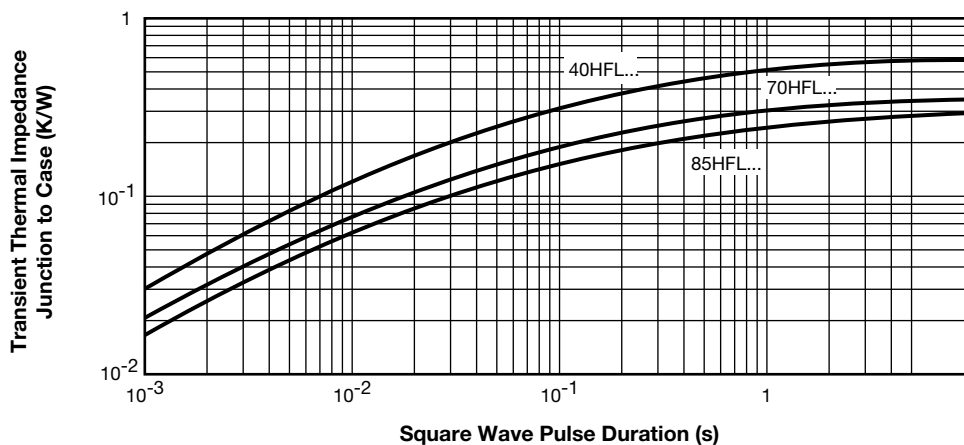


Fig. 18 - Maximum Transient Thermal Impedance, Junction to Case vs. Pulse Duration, All Series

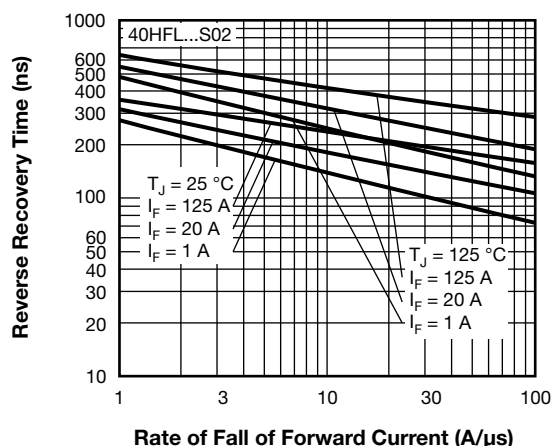


Fig. 19 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 40HFL...S02 Series

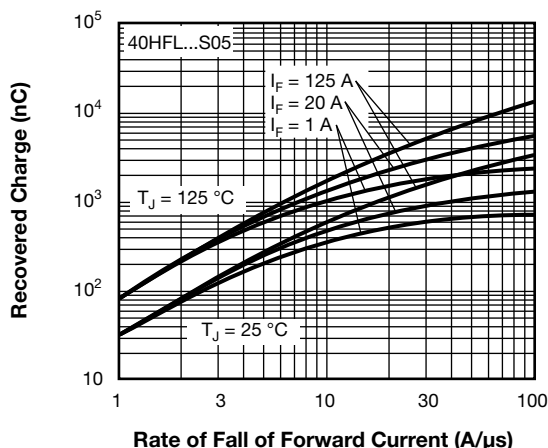


Fig. 22 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 40HFL...S05 Series

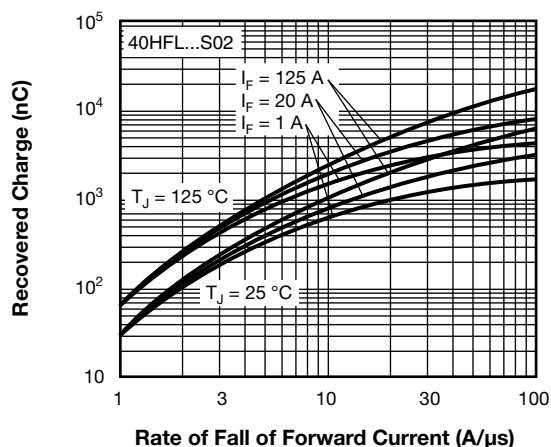


Fig. 20 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 40HFL...S02 Series

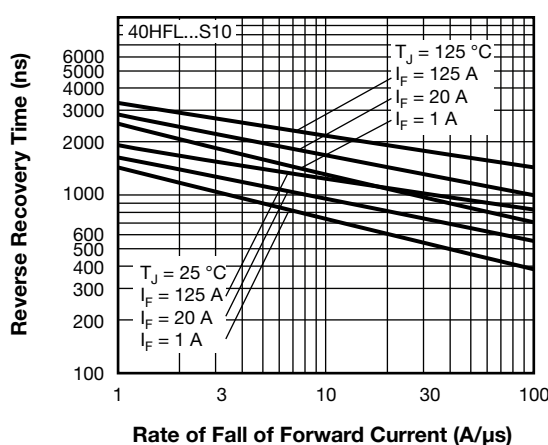


Fig. 23 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 40HFL...Series

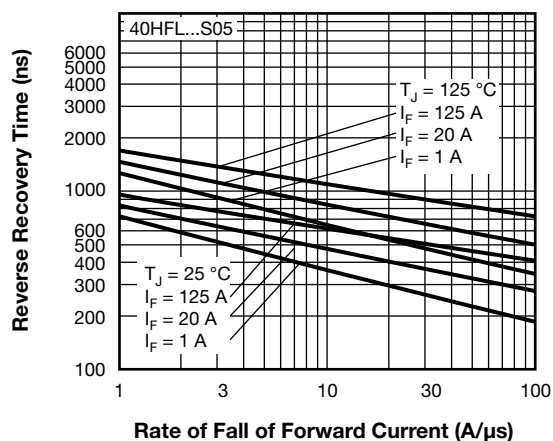


Fig. 21 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 40HFL...S05 Series

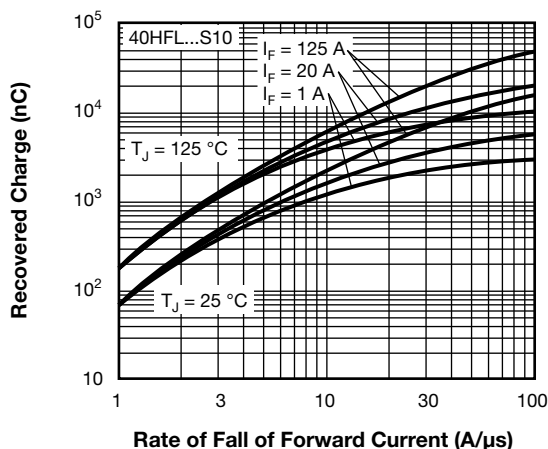


Fig. 24 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 40HFL...Series

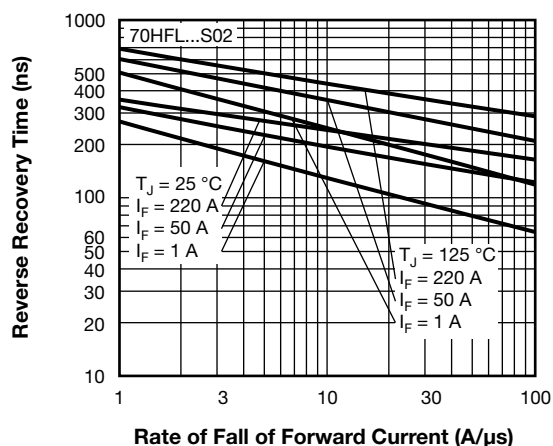


Fig. 25 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 70HFL...S02 Series

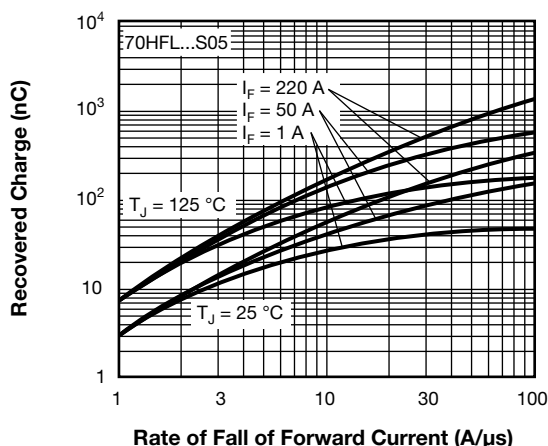


Fig. 28 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 70HFL...S05 Series

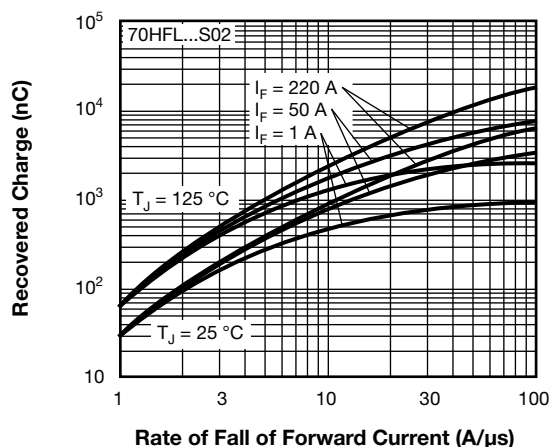


Fig. 26 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 70HFL...S02 Series

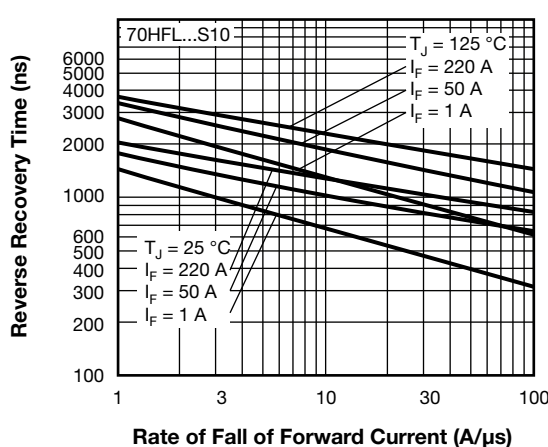


Fig. 29 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 70HFL... Series

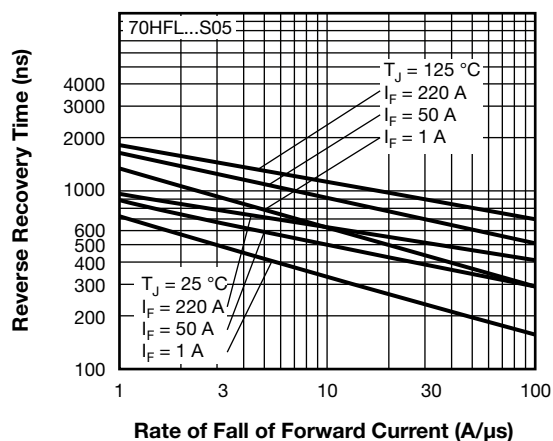


Fig. 27 - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, 70HFL...S05 Series

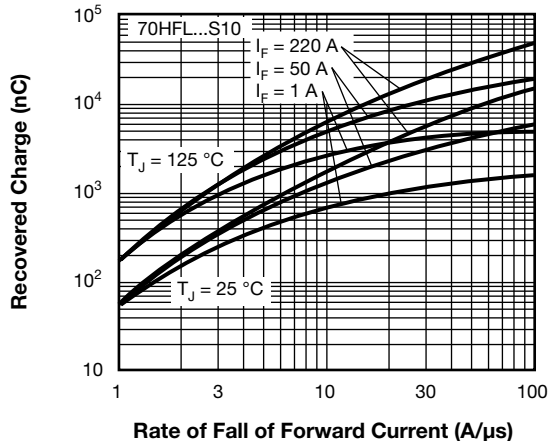
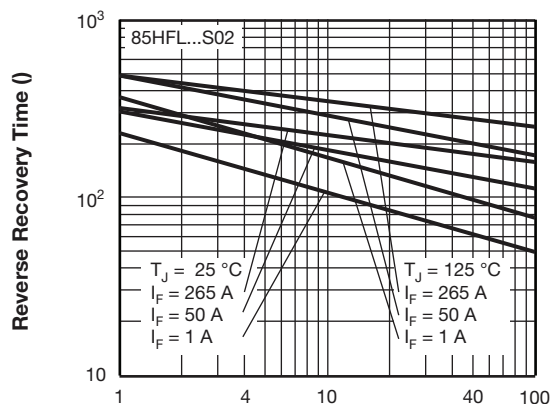
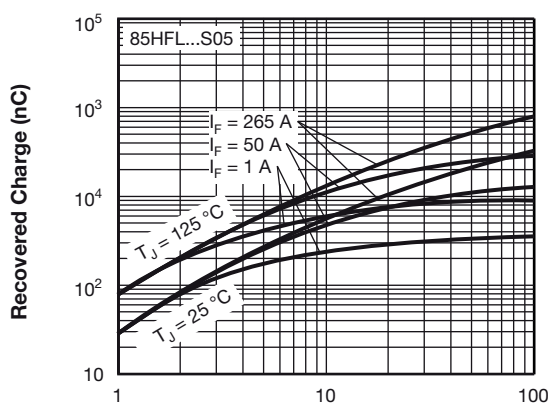


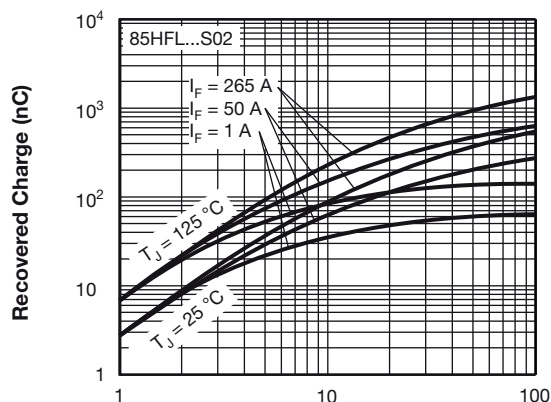
Fig. 30 - Typical Recovered Charge vs. Rate of Fall of Forward Current, 70HFL... Series



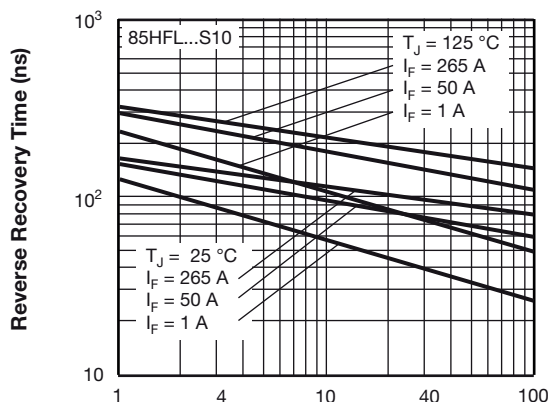
**Rate of Fall of Forward Current (A/μs)**  
Fig. 31 - Typical Reverse Recovery Time vs.  
Rate of Fall of Forward Current, 85HFL...S02 Series



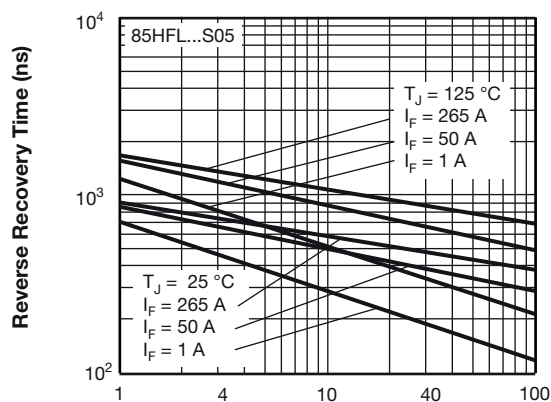
**Rate of Fall of Forward Current (A/μs)**  
Fig. 34 - Typical Recovered Charge vs.  
Rate of Fall of Forward Current, 85HFL...S05 Series



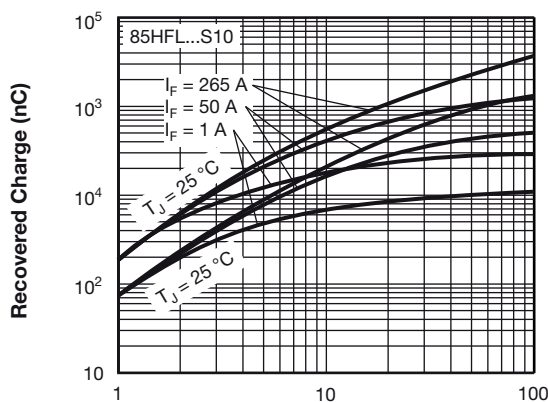
**Rate of Fall of Forward Current (A/μs)**  
Fig. 32 - Typical Recovered Charge vs.  
Rate of Fall of Forward Current, 85HFL...S02 Series



**Rate of Fall of Forward Current (A/μs)**  
Fig. 35 - Typical Reverse Recovery Time vs.  
Rate of Fall of Forward Current, 85HFL... Series



**Rate of Fall of Forward Current (A/μs)**  
Fig. 33 - Typical Reverse Recovery Time vs.  
Rate of Fall of Forward Current, 85HFL...S05 Series



**Rate of Fall of Forward Current (A/μs)**  
Fig. 36 - Typical Recovered Charge vs.  
Rate of Fall of Forward Current, 85HFL... Series



## ORDERING INFORMATION TABLE

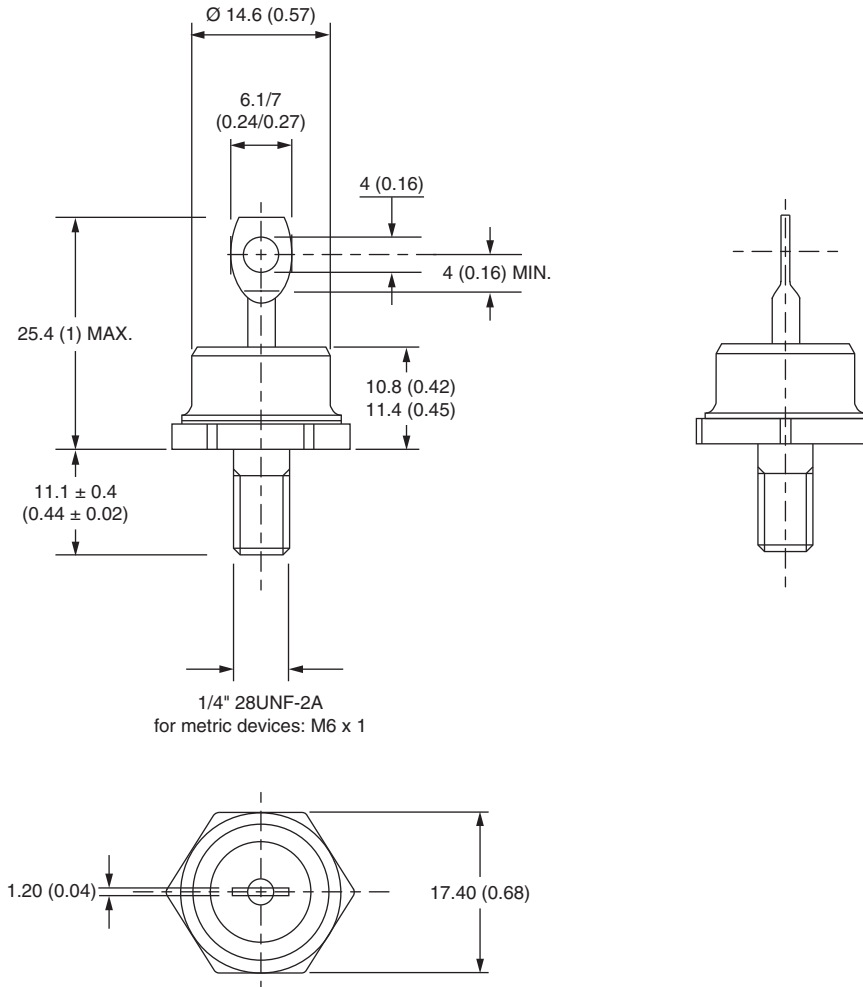
|             |            |           |            |          |            |            |          |
|-------------|------------|-----------|------------|----------|------------|------------|----------|
| Device code | <b>VS-</b> | <b>70</b> | <b>HFL</b> | <b>R</b> | <b>100</b> | <b>S02</b> | <b>M</b> |
|             | ①          | ②         | ③          | ④        | ⑤          | ⑥          | ⑦        |

- 1** - Vishay Semiconductors product
- 2** -
  - 70 = standard device (current rating: 40 = 40 A, 70 = 70 A, 85 = 85 A)
  - 71 = not isolated lead
  - 72, 87 = isolated lead with silicone sleeve  
(red = reverse polarity)  
(blue = normal polarity)
- 3** - HFL = fast recovery diode
- 4** -
  - None = stud normal polarity (cathode to stud)
  - R = stud reverse polarity (anode to stud)
- 5** - Voltage code x 10 =  $V_{RRM}$  (see "Voltage Ratings" table)
- 6** - Refer to "Recovery Characteristics" table
- 7** -
  - None = stud base DO-5 (DO-203AB) 1/4" 28UNF-2A
  - M = stud base DO-5 (DO-203AB) M6 x 1

| LINKS TO RELATED DOCUMENTS |                                                                        |
|----------------------------|------------------------------------------------------------------------|
| Dimensions                 | <a href="http://www.vishay.com/doc?95312">www.vishay.com/doc?95312</a> |

## DO-203AB (DO-5) for 40HFL, 70HFL and 85HFL

### DIMENSIONS FOR 40HFL/70HFL in millimeters (inches)



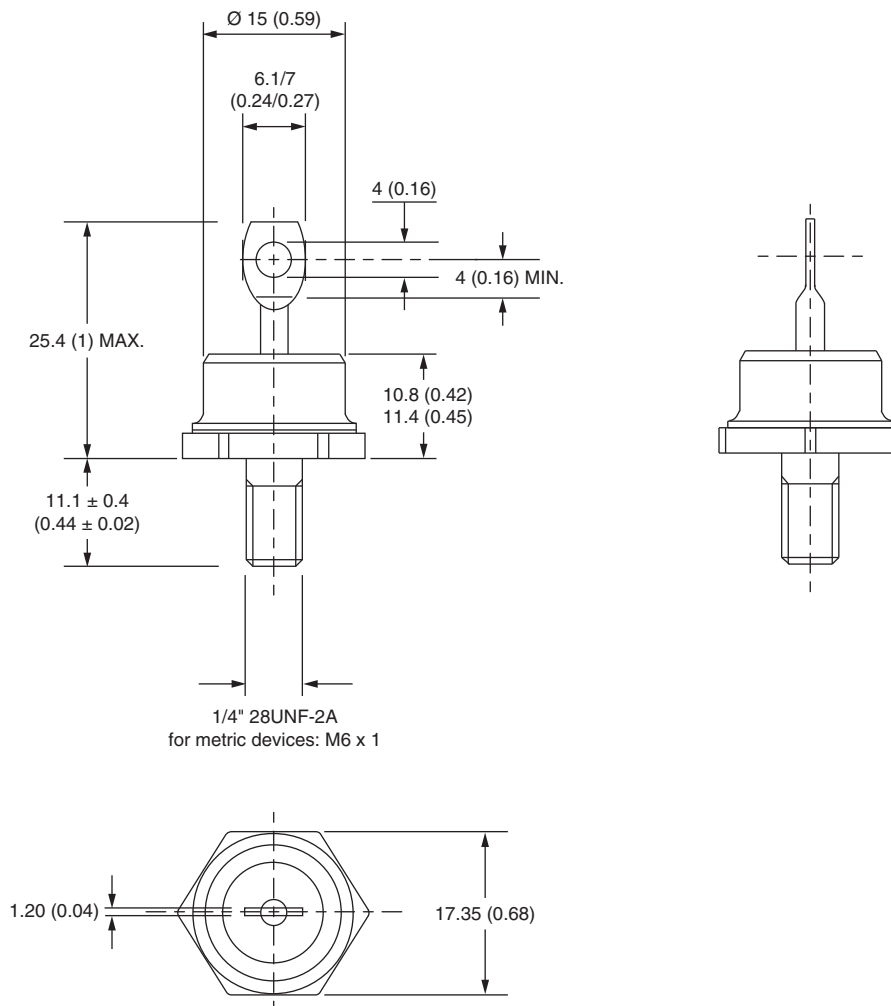
# Outline Dimensions

Vishay Semiconductors

DO-203AB (DO-5) for  
40HFL, 70HFL and 85HFL



## DIMENSIONS FOR 85HFL in millimeters (inches)





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