



## Fast Recovery Diodes (Stud Version), 6 A, 12 A, 16 A



DO-203AA (DO-4)

### FEATURES

- Short reverse recovery time
- Low stored charge
- Wide current range
- Excellent surge capabilities
- Standard JEDEC® types
- Stud cathode and stud anode versions
- Fully characterized reverse recovery conditions
- 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

| PRODUCT SUMMARY       |                 |
|-----------------------|-----------------|
| $I_{F(AV)}$           | 6 A, 12 A, 16 A |
| Package               | DO-203AA (DO-4) |
| Circuit configuration | Single diode    |

| MAJOR RATINGS AND CHARACTERISTICS |                 |                                    |                                    |                                    |                   |
|-----------------------------------|-----------------|------------------------------------|------------------------------------|------------------------------------|-------------------|
| PARAMETER                         | TEST CONDITIONS | 6FL..                              | 12FL..                             | 16FL..                             | UNITS             |
| $I_{F(AV)}$                       |                 | 6                                  | 12                                 | 16                                 | A                 |
|                                   | $T_C$           | 100                                | 100                                | 100                                | °C                |
| $I_{F(RMS)}$                      |                 | 9.5                                | 19                                 | 25                                 | A                 |
| $I_{FSM}$                         | 50 Hz           | 110                                | 145                                | 180                                | A                 |
|                                   | 60 Hz           | 115                                | 150                                | 190                                |                   |
| $I^2t$                            | 50 Hz           | 60                                 | 103                                | 160                                | A <sup>2</sup> s  |
|                                   | 60 Hz           | 55                                 | 94                                 | 150                                |                   |
| $I^2\sqrt{t}$                     |                 | 1452                               | 1452                               | 2290                               | I <sup>2</sup> √s |
| $V_{RRM}$                         | Range           | 50 to 1000                         | 50 to 1000                         | 50 to 1000                         | V                 |
| $t_{rr}$                          |                 | See Recovery Characteristics table | See Recovery Characteristics table | See Recovery Characteristics table | ns                |
| $T_J$                             | Range           | -65 to 150                         | -65 to 150                         | -65 to 150                         | °C                |

### ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS                        |              |   |   |  |   |   |
|--|--------------|---|---|--|---|---|
| TYPE NUMBER                            | VOLTAGE CODE | $V_{RRM}$ , MAXIMUM REPETITIVE PEAK AND OFF-STATE VOLTAGE V | $V_{RSM}$ , MAXIMUM NON-REPETITIVE PEAK VOLTAGE V | $I_{RRM}$ MAXIMUM AT $T_J = 25\text{ °C}$ μA | $I_{RRM}$ MAXIMUM AT $T_J = 100\text{ °C}$ mA | $I_{RRM}$ MAXIMUM AT $T_J = 150\text{ °C}$ mA |
| VS-6FL...,<br>VS-12FL...,<br>VS-16FL.. | 5            | 50  | 75  | 50   | -   | 6.0   |
|  | 10           | 100   | 150   |  |   |   |
|  | 20           | 200   | 275   |  |   |   |
|  | 40           | 400   | 500   |  |   |   |
|  | 60           | 600   | 725   |  |   |   |
|  | 80           | 800   | 950   |  |   |   |
|  | 100          | 1000  | 1250  |  |   |   |



| FORWARD CONDUCTION                                     |               |  |                           |   |                   |                    |       |               |
|--|---------------|--|---------------------------|---|-------------------|--------------------|-------|---------------|
| PARAMETER  | SYMBOL        | TEST CONDITIONS  |                           | 6FL..   | 12FL..            | 16FL..             | UNITS |               |
| Maximum average forward current at case temperature    | $I_{F(AV)}$   | 180° conduction, half sine wave DC                                 |                           | 6   | 12 <sup>(1)</sup> | 16                 | A     |               |
|  |               |  |                           | 100   | 100               | 100                | °C    |               |
| Maximum RMS current                                    | $I_{F(RMS)}$  |  |                           | 9.5   | 19                | 25                 | A     |               |
| Maximum peak, one-cycle non-repetitive forward current | $I_{FSM}$     | t = 10 ms  | No voltage reapplied      | Sinusoidal half wave, initial $T_J = 150\text{ °C}$ | 130               | 170                |       | 215           |
|  |               | t = 8.3 ms   |                           |   | 135               | 180                |       | 225           |
|  |               | t = 10 ms  | 100 % $V_{RRM}$ reapplied |   | 110               | 145                |       | 180           |
|  |               | t = 8.3 ms   |                           |   | 115               | 150 <sup>(1)</sup> |       | 190           |
| Maximum $I^2t$ for fusing                              | $I^2t$        | t = 10 ms  | No voltage reapplied      |   | 86                | 145                | 230   |               |
|  |               | t = 8.3 ms   |                           |   | 78                | 130                | 210   |               |
|  |               | t = 10 ms  | 100 % $V_{RRM}$ reapplied |   | 60                | 103                | 160   |               |
|  |               | t = 8.3 ms   |                           |   | 55                | 94                 | 150   |               |
| Maximum $I^2\sqrt{t}$ for fusing                       | $I^2\sqrt{t}$ | t = 0.1 ms to 10 ms, no voltage reapplied                          |                           |   | 856               | 1452               | 2290  | $A^2\sqrt{s}$ |
| Maximum forward voltage drop                           | $V_{FM}$      | $T_J = 25\text{ °C}; I_F = \text{Rated } I_{F(AV)} \text{ (DC)}$   |                           |   | 1.4               | 1.4 <sup>(1)</sup> | 1.4   | V             |
|  |               | $T_C = 100\text{ °C}; I_{FM} = \pi \times \text{rated } I_{F(AV)}$ |                           |   | 1.5               | 1.5 <sup>(1)</sup> | 1.5   |               |

**Note**

(1) JEDEC registered values

| RECOVERY CHARACTERISTICS        |               |  |                       |     |       |  |
|---------------------------------|---------------|--|-----------------------|-----|-------|--|
| PARAMETER                       | SYMBOL        | TEST CONDITIONS  | 6FL.., 12FL.., 16FL.. |     | UNITS |  |
|                                 |               |  | S02                   | S05 |       |  |
| Maximum reverse recovery time   | $t_{rr}$      | $T_J = 25\text{ °C}, I_F = 1\text{ A to } V_R = 30\text{ V}, dl_F/dt = 100\text{ A}/\mu\text{s}$     | -                     | -   | ns    |  |
|                                 |               | $T_J = 25\text{ °C}, dl_F/dt = 25\text{ A}/\mu\text{s}, I_{FM} = \pi \times \text{rated } I_{F(AV)}$ | 200                   | 500 |       |  |
| Maximum peak recovery current   | $I_{RM(REC)}$ | $I_{FM} = \pi \times \text{rated } I_{F(AV)}$  | -                     |     | -     |  |
| Maximum reverse recovery charge | $Q_{rr}$      | $T_J = 25\text{ °C}, I_F = 1\text{ A to } V_R = 30\text{ V}, dl_F/dt = 100\text{ A}/\mu\text{s}$     | -                     | -   | nC    |  |
|                                 |               | $T_J = 25\text{ °C}, dl_F/dt = 25\text{ A}/\mu\text{s}, I_{FM} = \pi \times \text{rated } I_{F(AV)}$ | -                     | -   |       |  |

**Note**

(1) JEDEC registered values

| THERMAL AND MECHANICAL SPECIFICATIONS        |            |  |                   |        |        |                  |
|--|------------|--|-------------------|--------|--------|------------------|
| PARAMETER                                    | SYMBOL     | TEST CONDITIONS                            | 6FL..             | 12FL.. | 16FL.. | UNITS            |
| Maximum junction operating temperature range | $T_J$      |  | - 65 to 150       |        |        | °C               |
| Maximum storage temperature range            | $T_{Stg}$  |  | - 65 to 175       |        |        |                  |
| Maximum thermal resistance, junction to case | $R_{thJC}$ | DC operation                               | 2.5               | 2.0    | 1.6    | °C/W             |
| Maximum thermal resistance, case to heatsink | $R_{thCS}$ | Mounting surface, smooth, flat and greased | 0.5               |        |        |                  |
| Allowable mounting torque                    |            | Not lubricated threads                     | 1.5 +0 -10 % (13) |        |        | N · m (lbf · in) |
|  |            | Lubricated threads                         | 1.2 +0 -10 % (10) |        |        |                  |
| Approximate weight                           |            |  | 7                 |        |        | g                |
|  |            |  | 0.25              |        |        | oz.              |
| Case style                                   |            | JEDEC                                      | DO-203AA (DO-4)   |        |        |                  |

| $\Delta R_{thJC}$ CONDUCTION |                       |        |        |                        |        |        |                                   |       |
|------------------------------|-----------------------|--------|--------|------------------------|--------|--------|-----------------------------------|-------|
| CONDUCTION ANGLE             | 6FL..                 | 12FL.. | 16FL.. | 6FL..                  | 12FL.. | 16FL.. | TEST CONDITIONS                   | UNITS |
|                              | SINUSOIDAL CONDUCTION |        |        | RECTANGULAR CONDUCTION |        |        |                                   |       |
| 180°                         | 0.58                  | 0.46   | 0.37   | 0.33                   | 0.26   | 0.21   | $T_J = 150\text{ }^\circ\text{C}$ | K/W   |
| 120°                         | 0.60                  | 0.48   | 0.39   | 0.58                   | 0.46   | 0.37   |                                   |       |
| 60°                          | 1.28                  | 1.02   | 0.82   | 1.28                   | 1.02   | 0.82   |                                   |       |
| 30°                          | 2.20                  | 1.76   | 1.41   | 2.20                   | 1.76   | 1.41   |                                   |       |

**Note**

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

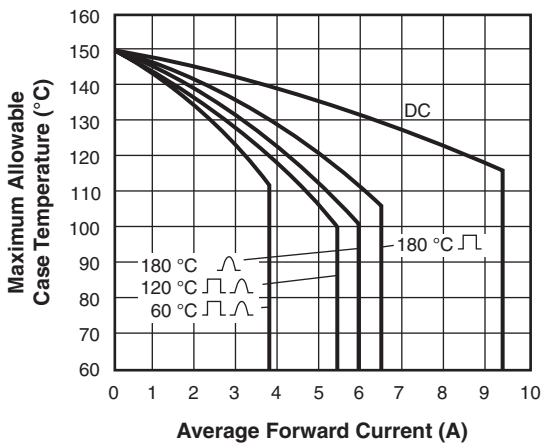


Fig. 1 - Average Forward Current vs. Maximum Allowable Case Temperature, 6FL Series

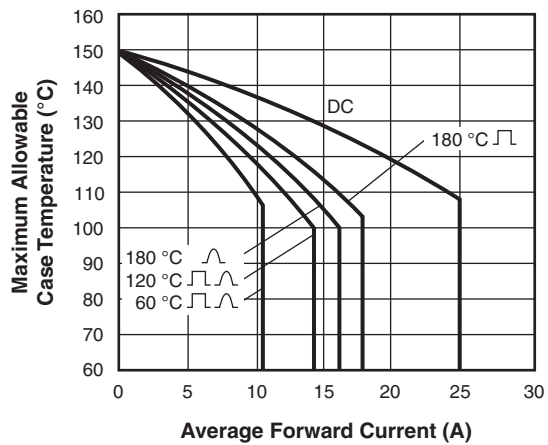


Fig. 3 - Average Forward Current vs. Maximum Allowable Case Temperature, 16FL Series

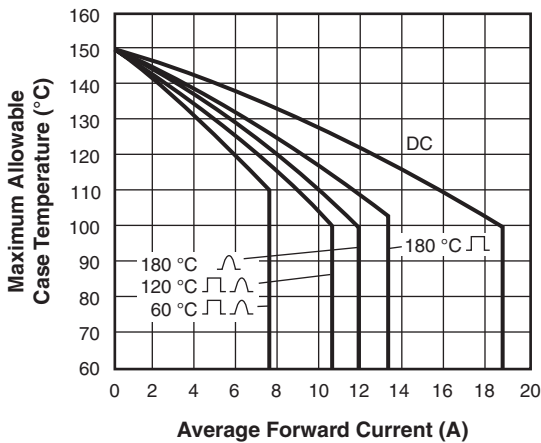
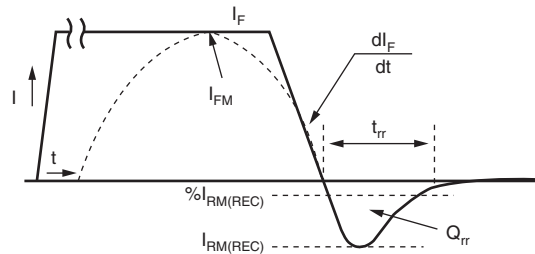


Fig. 2 - Average Forward Current vs. Maximum Allowable Case Temperature, 12FL Series



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

Fig. 4 - Reverse Recovery Time Test Waveform

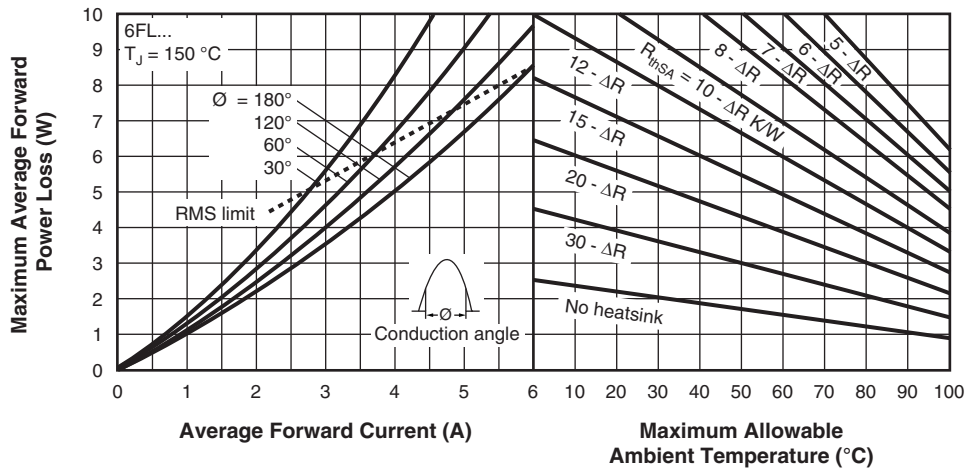


Fig. 5 - Current Rating Nomogram (Sinusoidal Waveforms), 6FL Series

| Conduction angle - $\Phi$ | $\Delta R$ - K/W |
|---------------------------|------------------|
| 180°                      | 0.58             |
| 120°                      | 0.60             |
| 60°                       | 1.28             |
| 30°                       | 2.20             |

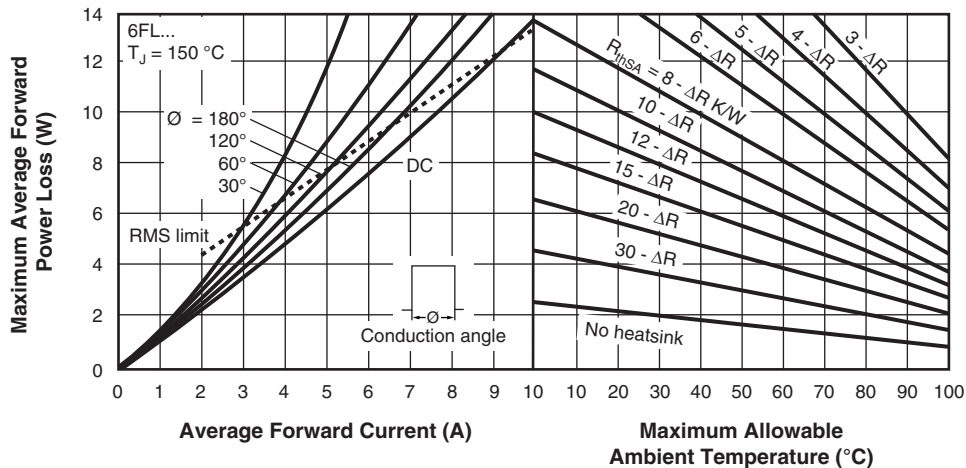


Fig. 6 - Current Rating Nomogram (Rectangular Waveforms), 6FL Series

| Conduction angle - $\Phi$ | $\Delta R$ - K/W |
|---------------------------|------------------|
| DC                        | 0                |
| 180°                      | 0.33             |
| 120°                      | 0.58             |
| 60°                       | 1.28             |
| 30°                       | 2.20             |

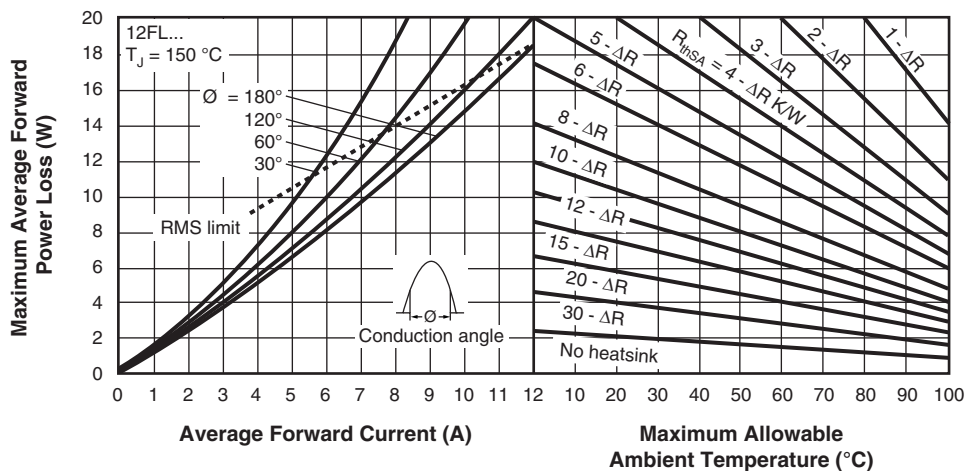
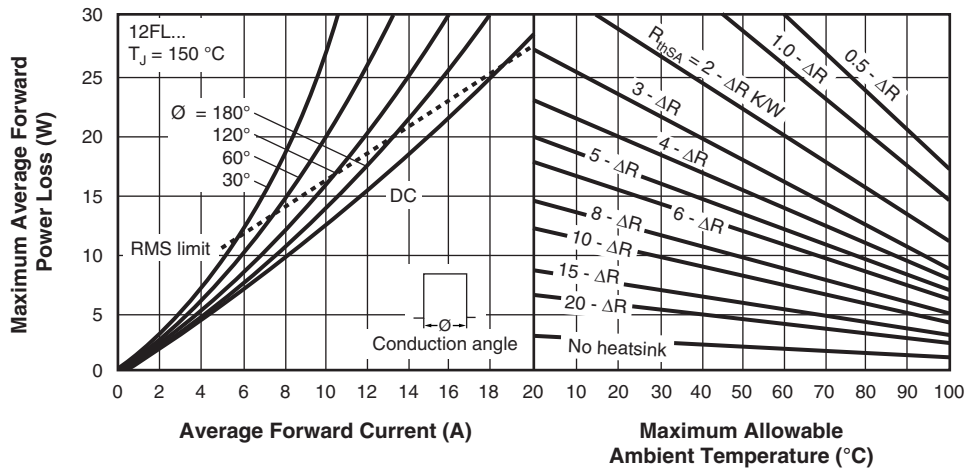


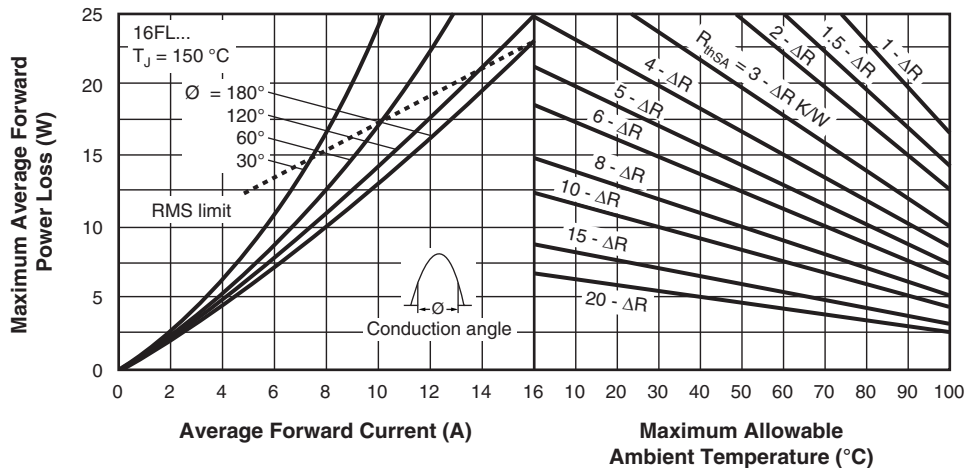
Fig. 7 - Current Rating Nomogram (Sinusoidal Waveforms), 12FL Series

| Conduction angle - $\Phi$ | $\Delta R$ - K/W |
|---------------------------|------------------|
| 180°                      | 0.46             |
| 120°                      | 0.48             |
| 60°                       | 1.02             |
| 30°                       | 1.76             |



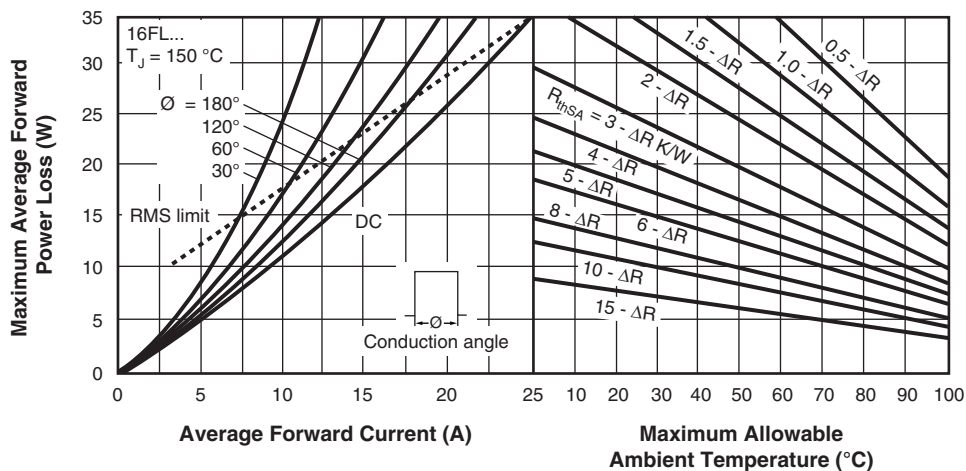
| Conduction angle - $\phi$ | $\Delta R$ - KW |
|---------------------------|-----------------|
| DC                        | 0               |
| 180°                      | 0.26            |
| 120°                      | 0.46            |
| 60°                       | 1.02            |
| 30°                       | 1.76            |

Fig. 8 - Current Rating Nomogram (Rectangular Waveforms), 12FL Series



| Conduction angle - $\phi$ | $\Delta R$ - KW |
|---------------------------|-----------------|
| 180°                      | 0.37            |
| 120°                      | 0.39            |
| 60°                       | 0.82            |
| 30°                       | 1.41            |

Fig. 9 - Current Rating Nomogram (Sinusoidal Waveforms), 16FL Series



| Conduction angle - $\phi$ | $\Delta R$ - KW |
|---------------------------|-----------------|
| DC                        | 0               |
| 180°                      | 0.21            |
| 120°                      | 0.37            |
| 60°                       | 0.82            |
| 30°                       | 1.41            |

Fig. 10 - Current Rating Nomogram (Rectangular Waveforms), 16FL Series

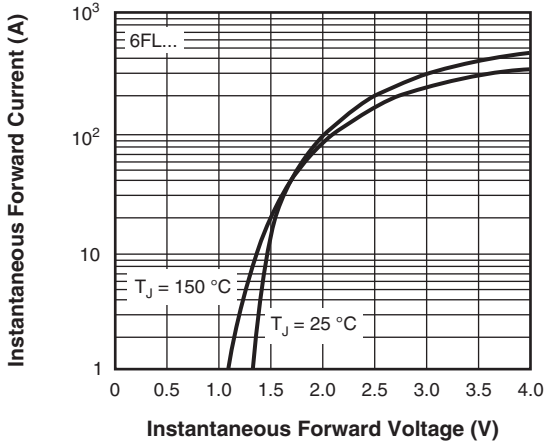


Fig. 11 - Maximum Forward Voltage vs. Forward Current, 6FL Series

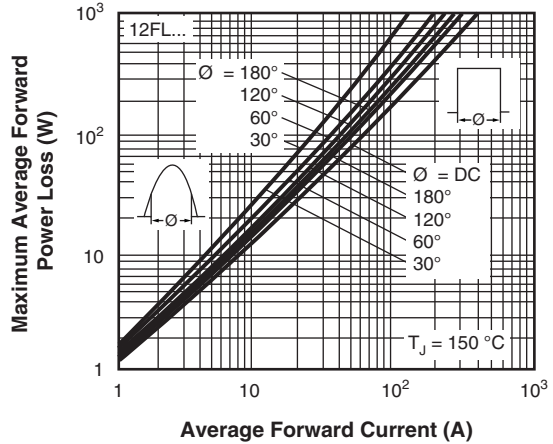


Fig. 14 - Maximum High Level Forward Power Loss vs. Average Forward Current, 12FL Series

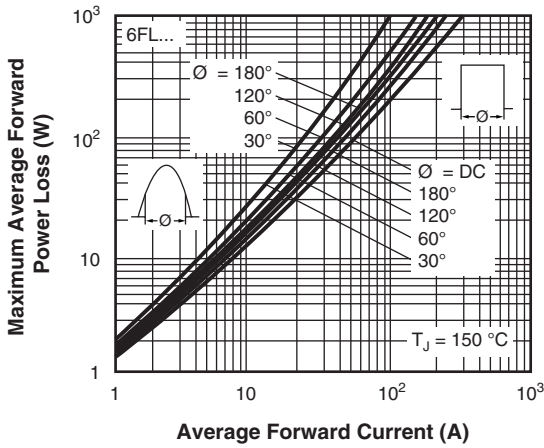


Fig. 12 - Maximum High Level Forward Power Loss vs. Average Forward Current, 6FL Series

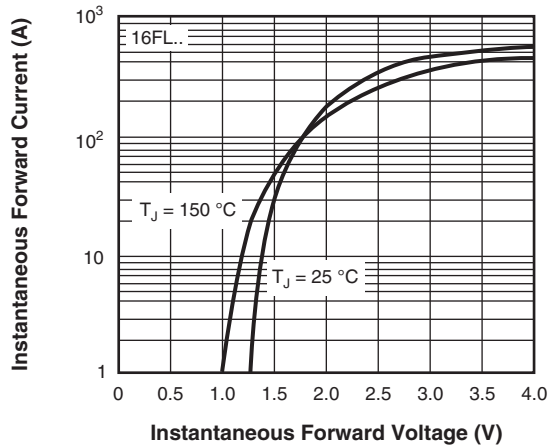


Fig. 15 - Maximum Forward Voltage vs. Forward Current, 16FL Series

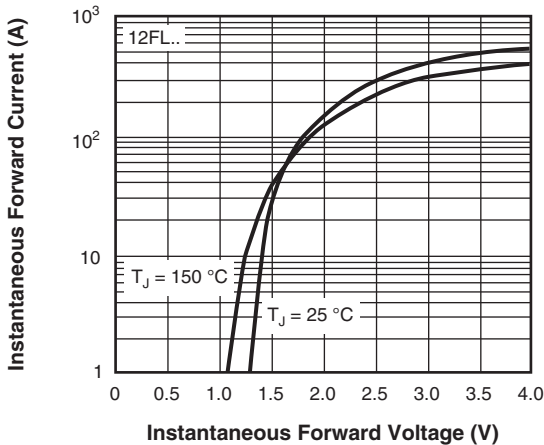


Fig. 13 - Maximum Forward Voltage vs. Forward Current, 12FL Series

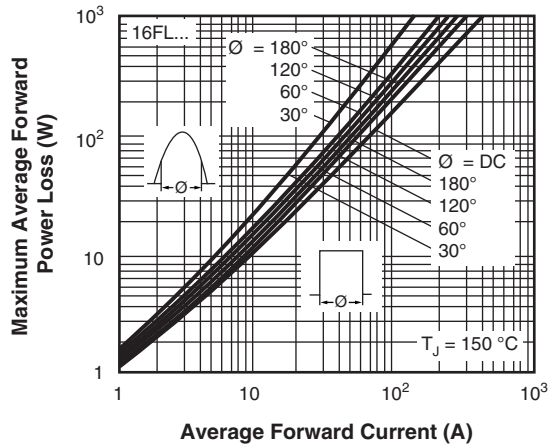


Fig. 16 - Maximum High Level Forward Power Loss vs. Average Forward Current, 16FL Series

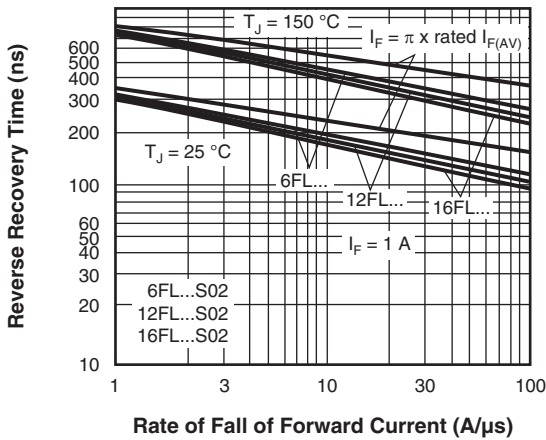


Fig. 17a - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, All Series ...S02

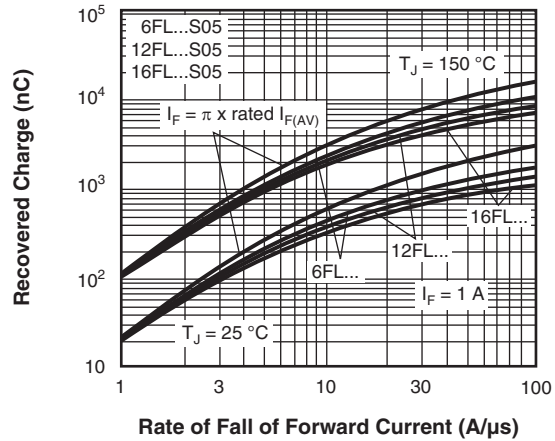


Fig. 18b - Typical Recovered Charge vs. Rate of Fall of Forward Current, All Series ...S05

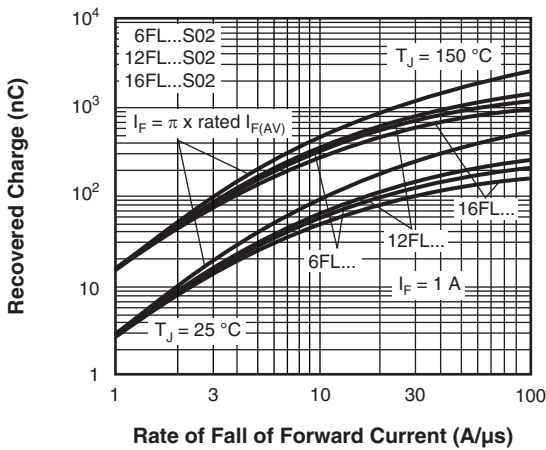


Fig. 17b - Typical Recovered Charge vs. Rate of Fall of Forward Current, All Series ...S02

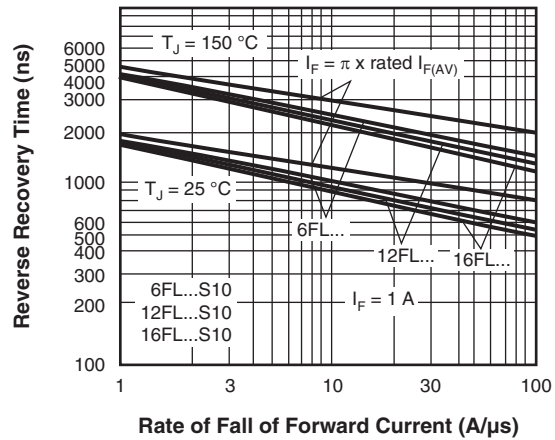


Fig. 19a - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, All Series ...S10

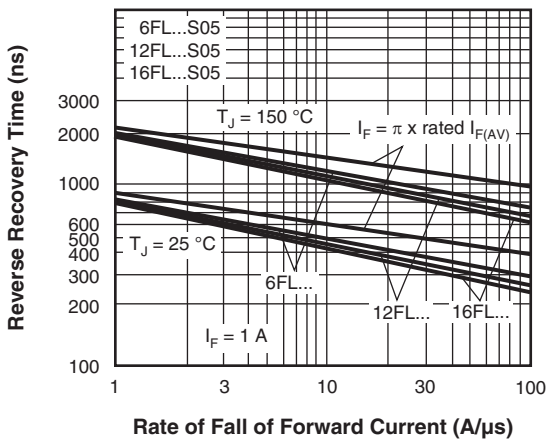


Fig. 18a - Typical Reverse Recovery Time vs. Rate of Fall of Forward Current, All Series ...S05

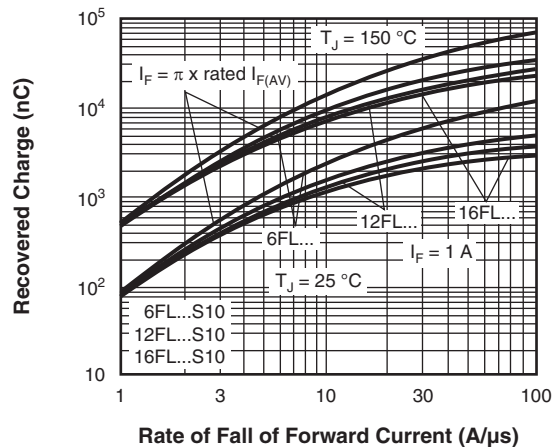


Fig. 19b - Typical Recovered Charge vs. Rate of Fall of Forward Current, All Series ...S10

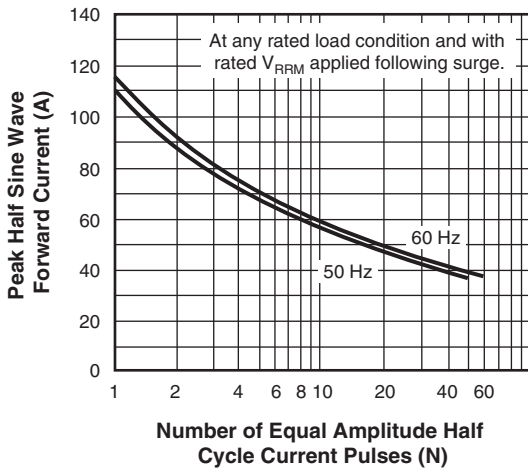


Fig. 20 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 6FL Series

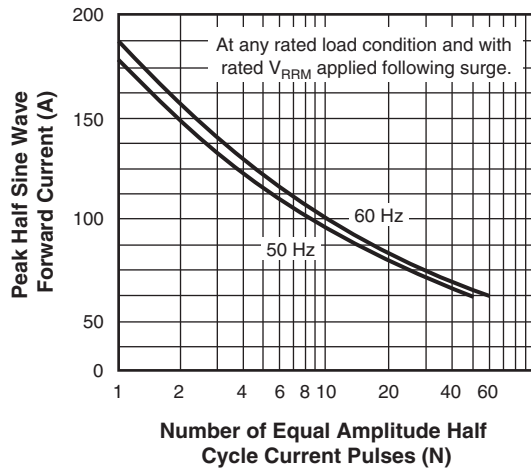


Fig. 22 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 16FL Series

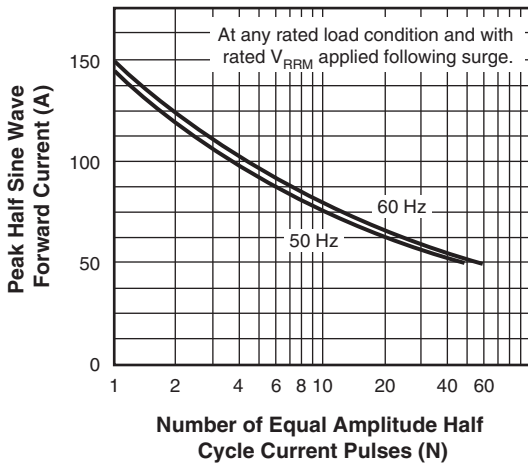


Fig. 21 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 12FL Series

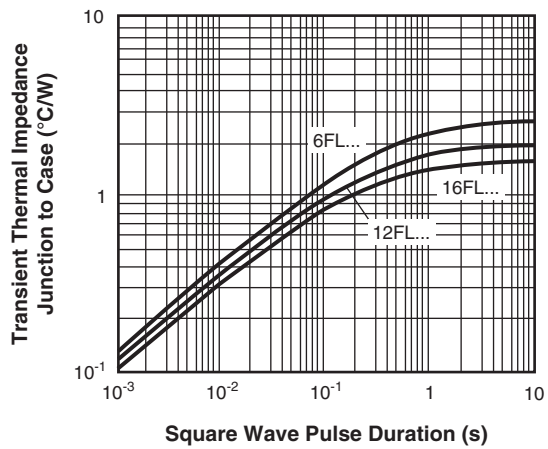
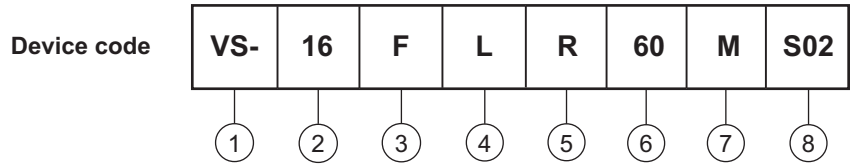


Fig. 23 - Maximum Transient Thermal Impedance, Junction to Case vs. Pulse Duration, All Series





## ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current code  $I_{(AVG)}$  = Exact current rating
- 3** - F = Diode
- 4** - Omit = Standard recovery diode  
L = Only for fast diode
- 5** - Omit = Stud forward polarity  
R = Stud reverse polarity
- 6** - Voltage code x 10 =  $V_{RRM}$  (see Voltage Ratings table)
- 7** - Outlines:  
Omit = Stud base UNF thread  
M = Stud base metric thread
- 8** -  $t_{rr}$  code only for fast diode (see Recovery Characteristics table)

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?95311">www.vishay.com/doc?95311</a> |





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