# 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
- Compliant to RoHS directive 2002/95/EC

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 |

| MAJOR RATINGS AND CHARACTERISTICS | | | | | |
|---|---|---|---|---|---|
| SYMBOL | CHARACTERISTICS | 6FL.. | 12FL.. | 16FL.. | UNITS |
| $I_{F(AV)}$ | $T_C$ = 100 °C | 6 | 12 | 16 | A |
| $I_{F(RMS)}$ | | 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 | $A^2s$ |
| | 60 Hz | 55 | 94 | 150 | |
| $I^2\sqrt{t}$ | | 1452 | 1452 | 2290 | $I^2\sqrt{s}$ |
| $V_{RRM}$ | Range | 50 to 1000 | | | V |
| $t_{rr}$ | | See Recovery Characteristics table | | | ns |
| $T_J$ | Range | - 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 °C µA | $I_{RRM}$ MAXIMUM AT $T_J$ = 100 °C mA | $I_{RRM}$ MAXIMUM AT $T_J$ = 150 °C mA |
|---|---|---|---|---|---|---|
| 6FL..<br>12FL..<br>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 | | | |

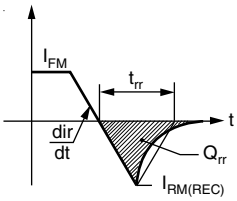
### FORWARD CONDUCTION

| PARAMETER | SYMBOL | TEST CONDITIONS | | | 6FL.. | 12FL.. | 16FL.. | UNITS |
|---|---|---|---|---|---|---|---|---|
| Maximum average forward current at case temperature | $I_{F(AV)}$ | 180° conduction, half sine wave | | | 6 | 12 (1) | 16 | A |
| | | DC | | | 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 °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 (1) | 190 | |
| Maximum $I^2t$ for fusing | $I^2t$ | t = 10 ms | No voltage reapplied | | 86 | 145 | 230 | $A^2s$ |
| | | 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 °C; $I_F$ = Rated $I_{F(AV)}$ (DC) | | | 1.4 | 1.4 (1) | 1.4 | V |
| | | $T_C$ = 100 °C; $I_{FM}$ = π x rated $I_{F(AV)}$ | | | 1.5 | 1.5 (1) | 1.5 | |

**Note**

(1) JEDEC registered values

## RECOVERY CHARACTERISTICS

| PARAMETER | SYMBOL | TEST CONDITIONS | 6FL..<br>12FL..<br>16FL.. | | UNITS | |
|---|---|---|---|---|---|---|
| | | | S02 | S05 | | |
| Maximum reverse recovery time | $t_{rr}$ | $T_J$ = 25 °C, $I_F$ = 1 A to $V_R$ = 30 V, $dI_F/dt$ = 100 A/µs | - | - | ns |  |
| | | $T_J$ = 25 °C, $dI_F/dt$ = 25 A/µs, $I_{FM}$ = π x rated $I_{F(AV)}$ | 200 | 500 | | |
| Maximum peak recovery current | $I_{RM(REC)}$ | $I_{FM}$ = π x rated $I_{F(AV)}$ | - | | - | |
| Maximum reverse recovery charge | $Q_{rr}$ | $T_J$ = 25 °C, $I_F$ = 1 A to $V_R$ = 30 V, $dI_F/dt$ = 100 A/µs | - | - | nC | |
| | | $T_J$ = 25 °C, $dI_F/dt$ = 25 A/µs, $I_{FM}$ = π x 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 °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

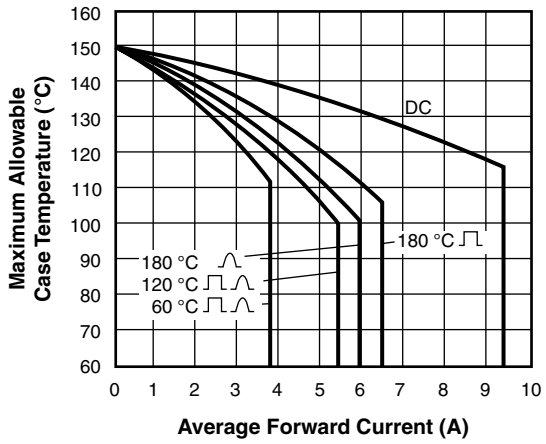



Fig. 1 - Average Forward Current vs.
Maximum Allowable Case Temperature, 6FL Series

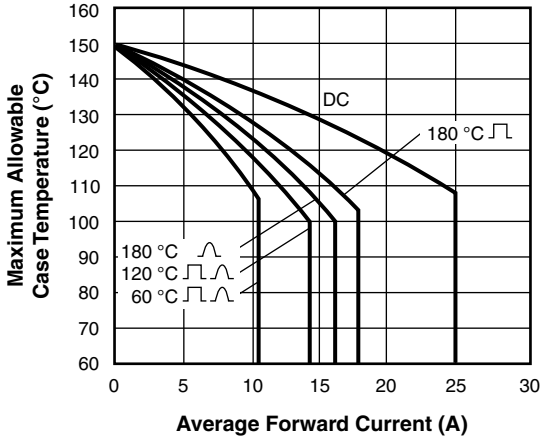



Fig. 3 - Average Forward Current vs.
Maximum Allowable Case Temperature, 16FL Series

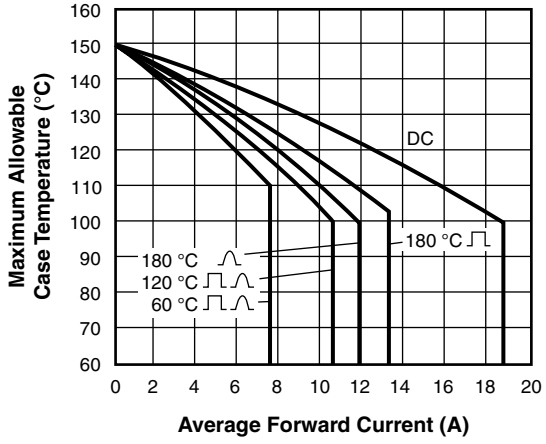
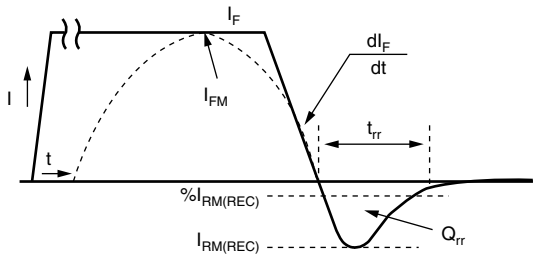
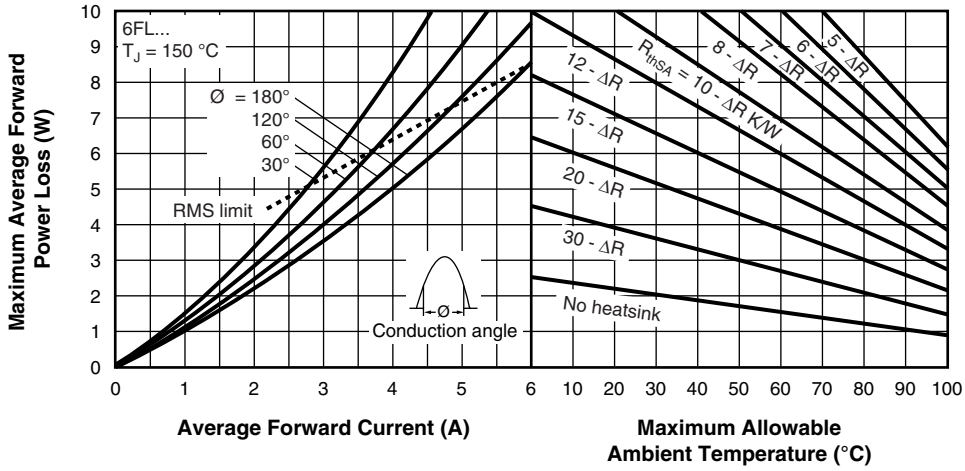



Fig. 2 - Average Forward Current vs.
Maximum Allowable Case Temperature, 12FL Series



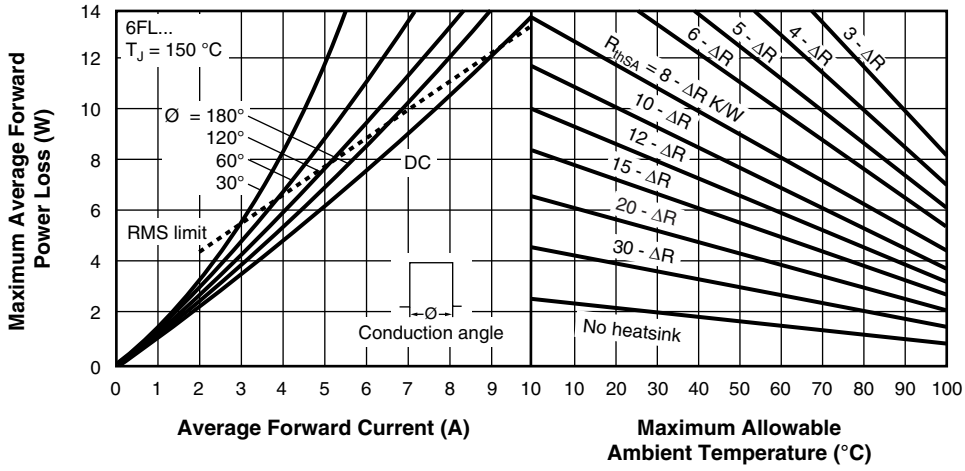

$I_F$, $I_{FM}$ - Peak forward current prior to commutation
$-dI_F/dt$ - Rate of fall of forward current
$I_{RM(REC)}$ - Peak reverse recovery current
$t_{rr}$ - Reverse recovery time
$Q_{rr}$ - Reverse recovered charge

Fig. 4 - Reverse Recovery Time Test Waveform



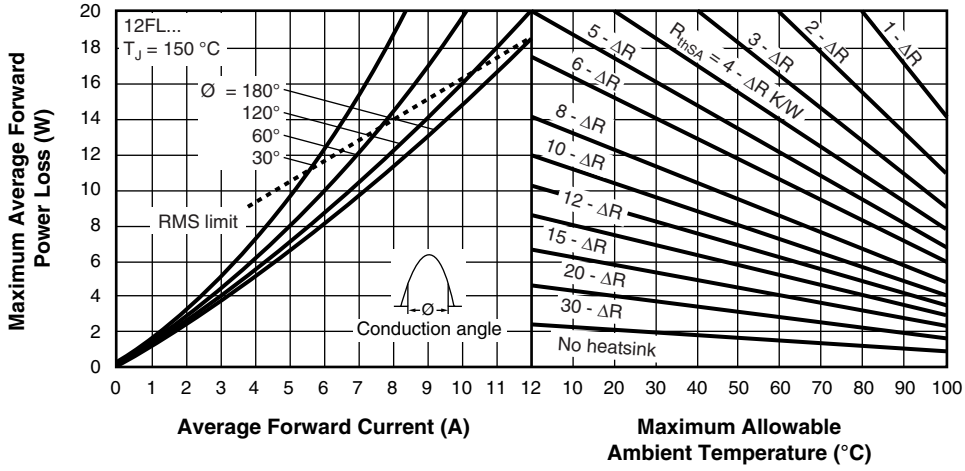

| Conduction angle - Ø | ΔR - K/W |
|---|---|
| 180° | 0.58 |
| 120° | 0.60 |
| 60° | 1.28 |
| 30° | 2.20 |

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



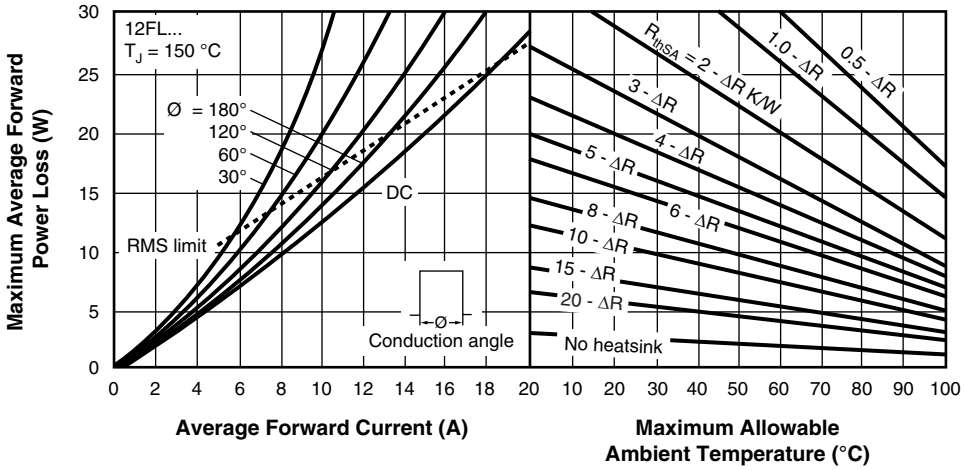

| Conduction angle - Ø | ΔR - K/W |
|---|---|
| DC | 0 |
| 180° | 0.33 |
| 120° | 0.58 |
| 60° | 1.28 |
| 30° | 2.20 |

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



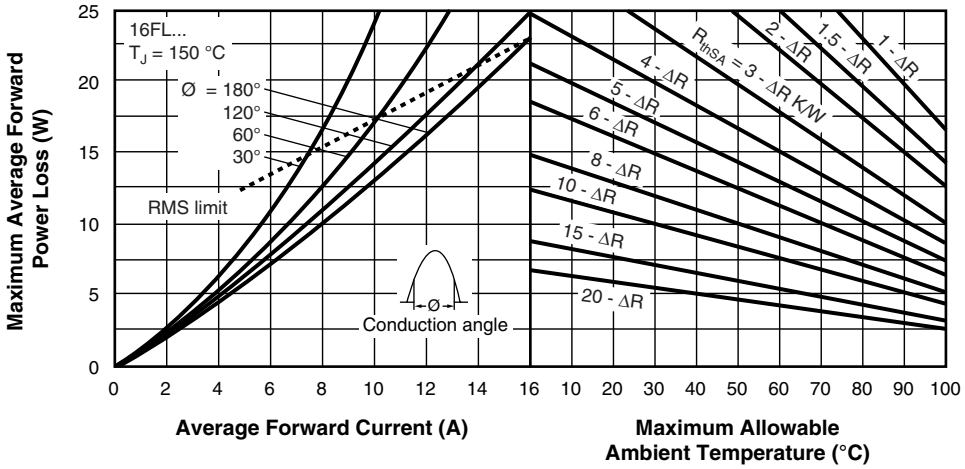

| Conduction angle - Ø | ΔR - K/W |
|---|---|
| 180° | 0.46 |
| 120° | 0.48 |
| 60° | 1.02 |
| 30° | 1.76 |

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



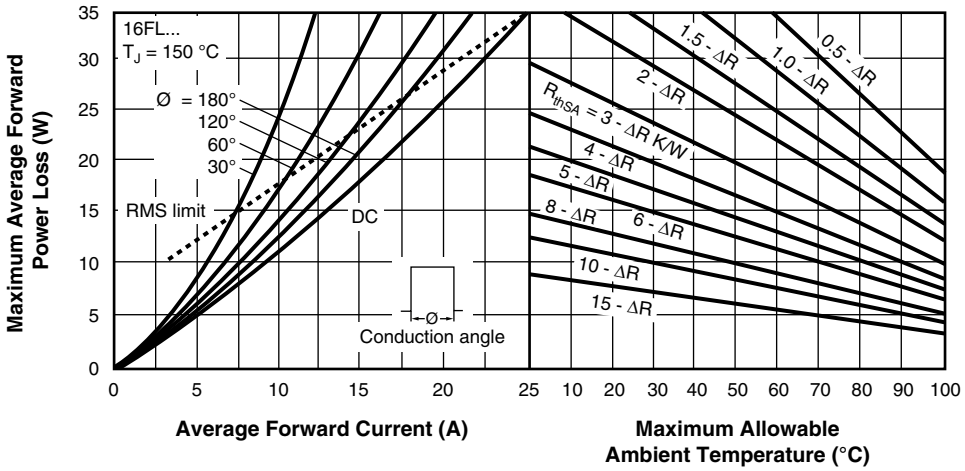

| Conduction angle - Ø | ΔR - K/W |
|---|---|
| DC | 0 |
| 180° | 0.26 |
| 120° | 0.46 |
| 60° | 1.02 |
| 30° | 1.76 |

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




| Conduction angle - Ø | ΔR - K/W |
|---|---|
| 180° | 0.37 |
| 120° | 0.39 |
| 60° | 0.82 |
| 30° | 1.41 |

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




| Conduction angle - Ø | ΔR - K/W |
|---|---|
| DC | 0 |
| 180° | 0.21 |
| 120° | 0.37 |
| 60° | 0.82 |
| 30° | 1.41 |

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

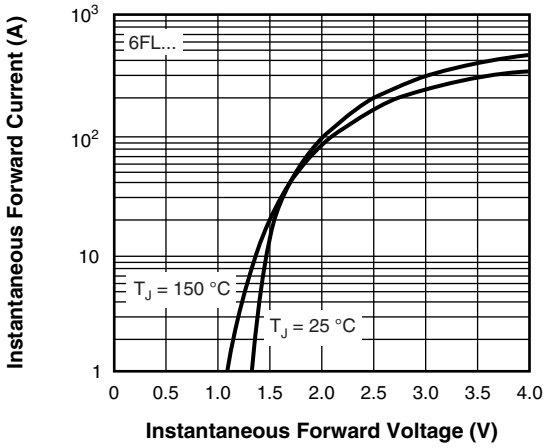



Fig. 11 - Maximum Forward Voltage vs. Forward Current, 6FL Series

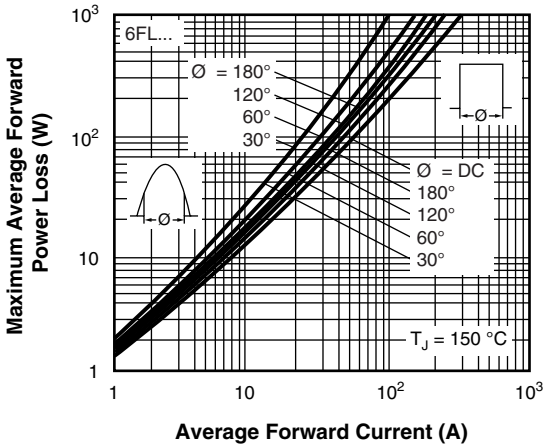



Fig. 12 - Maximum High Level Forward Power Loss vs. Average Forward Current, 6FL Series

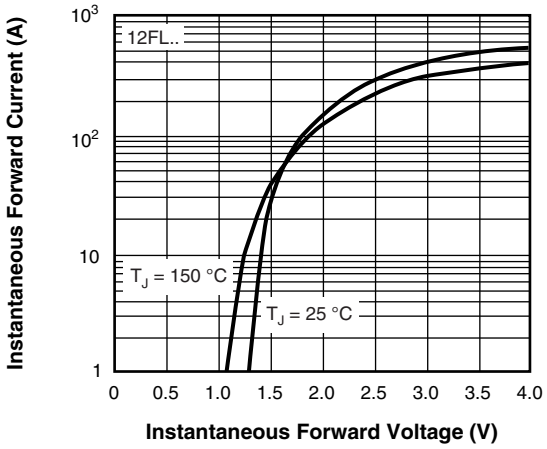



Fig. 13 - Maximum Forward Voltage vs. Forward Current, 12FL Series

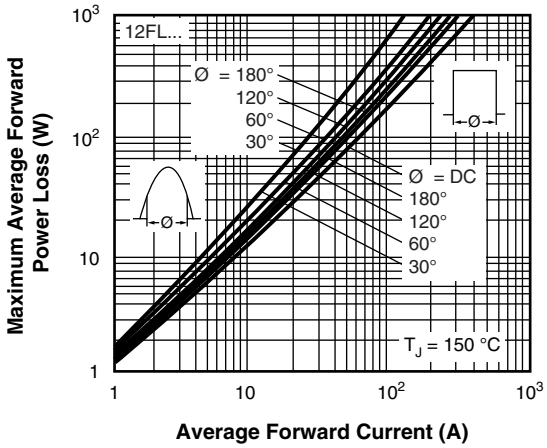



Fig. 14 - Maximum High Level Forward Power Loss vs. Average Forward Current, 12FL Series

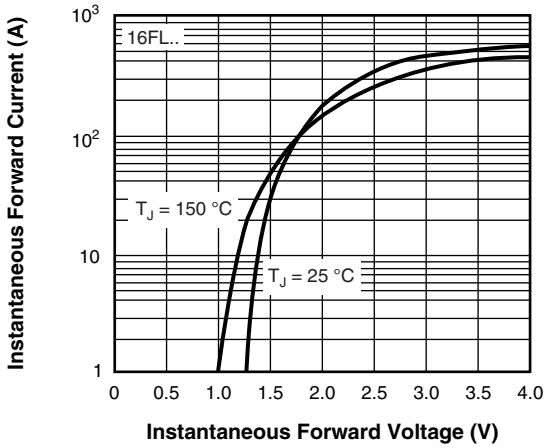



Fig. 15 - Maximum Forward Voltage vs. Forward Current, 16FL Series

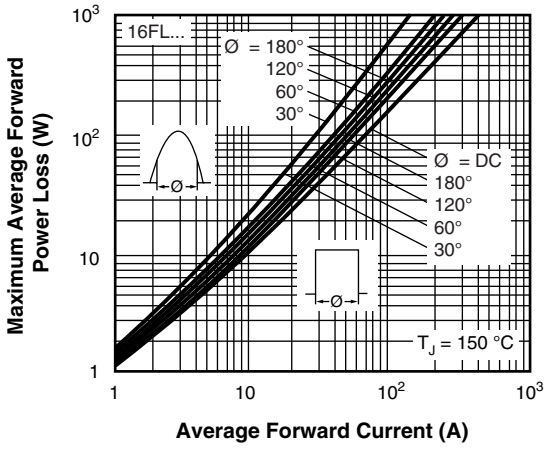



Fig. 16 - Maximum High Level Forward Power Loss vs. Average Forward Current, 16FL Series

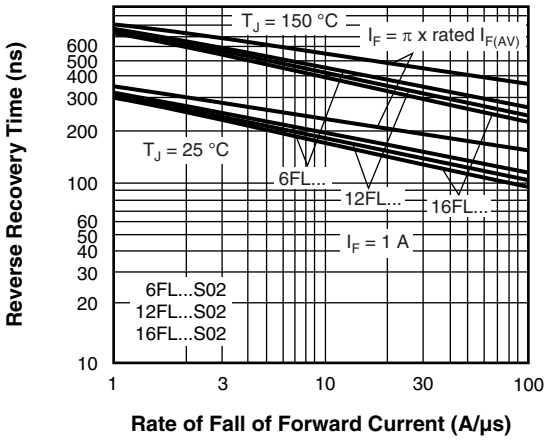



Fig. 17a - Typical Reverse Recovery Time vs.
Rate of Fall of Forward Current, All Series ...S02

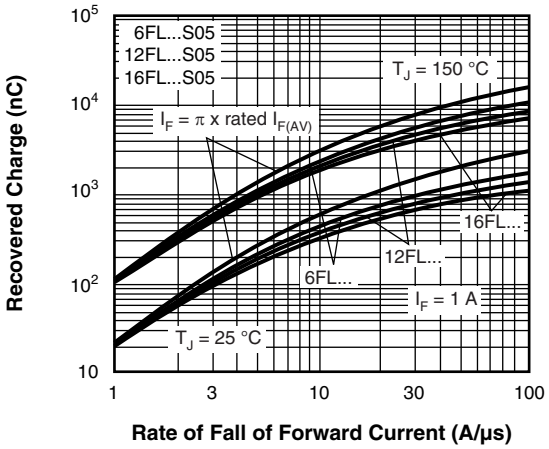



Fig. 18b - Typical Recovered Charge vs.
Rate of Fall of Forward Current, All Series ...S05

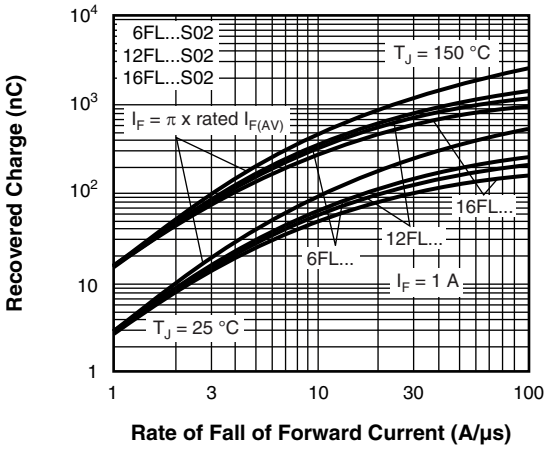



Fig. 17b - Typical Recovered Charge vs.
Rate of Fall of Forward Current, All Series ...S02

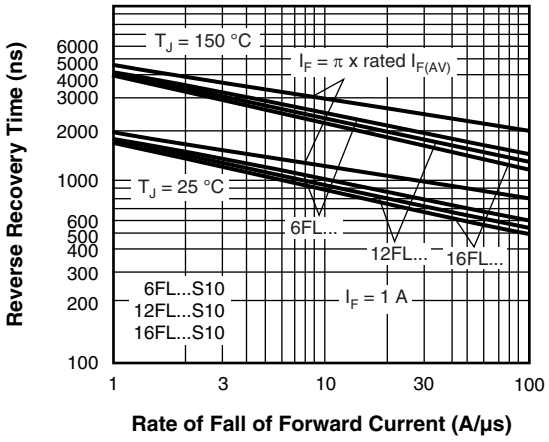



Fig. 19a - Typical Reverse Recovery Time vs.
Rate of Fall of Forward Current, All Series ...S10

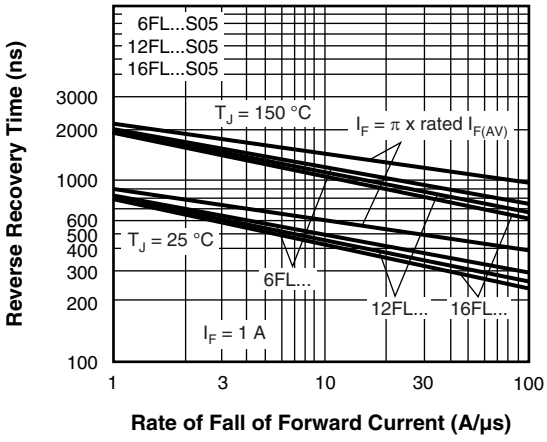



Fig. 18a - Typical Reverse Recovery Time vs.
Rate of Fall of Forward Current, All Series ...S05

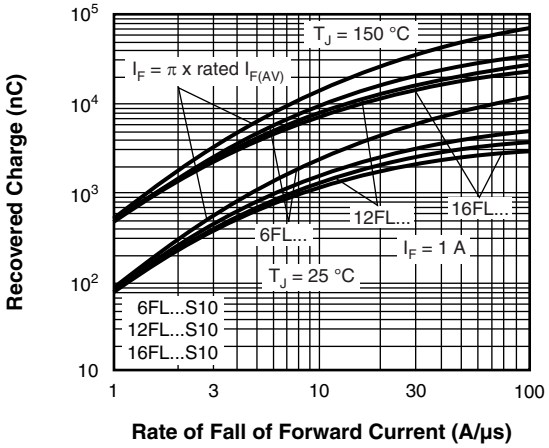



Fig. 19b - Typical Recovered Charge vs.
Rate of Fall of Forward Current, All Series ...S10

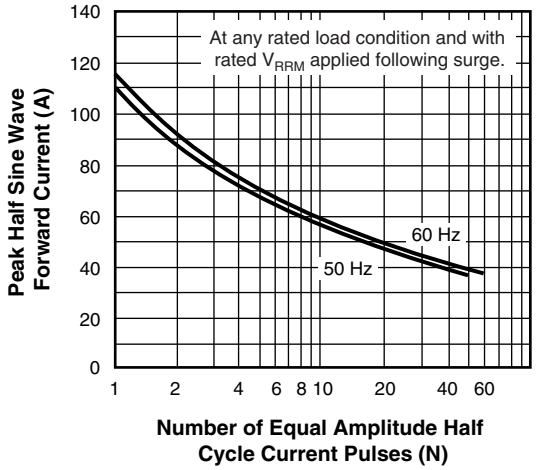



Fig. 20 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 6FL Series

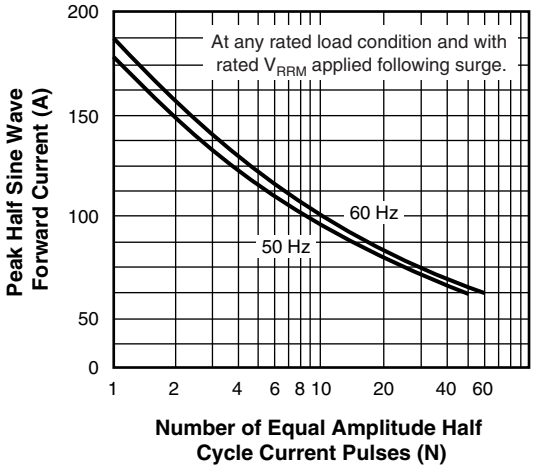



Fig. 22 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 16FL Series

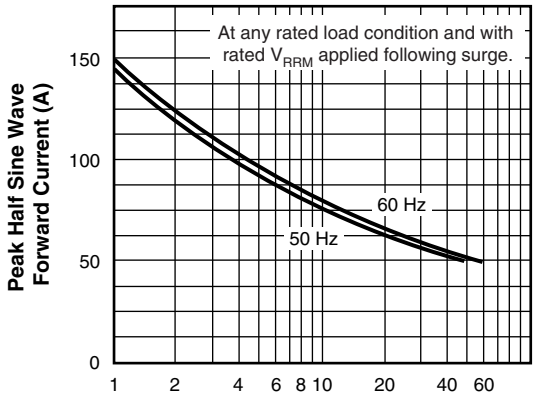



Fig. 21 - Maximum Non-Repetitive Surge Current vs. Number of Current Pulses, 12FL Series

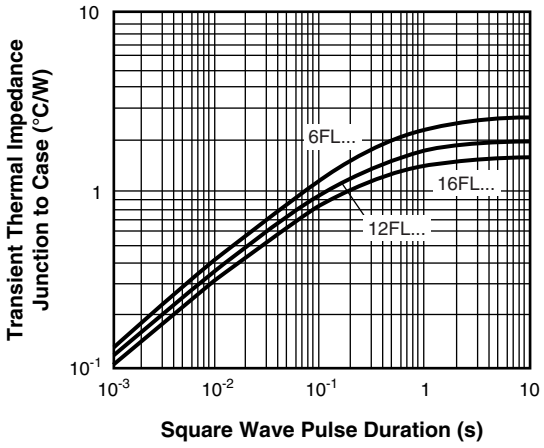
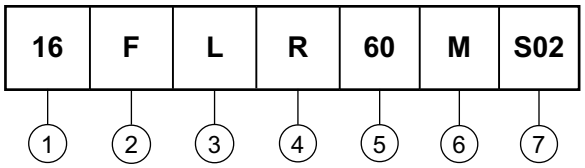



Fig. 23 - Maximum Transient Thermal Impedance, Junction to Case vs. Pulse Duration, All Series

## ORDERING INFORMATION TABLE

**Device code**




1 - Current code $I_{(AVG)}$ = Exact current rating

2 - F = Diode

3 - Omit = Standard recovery diode
L = Only for fast diode

4 - Omit = Stud forward polarity
R = Stud reverse polarity

5 - Voltage code x 10 = $V_{RRM}$ (see Voltage Ratings table)

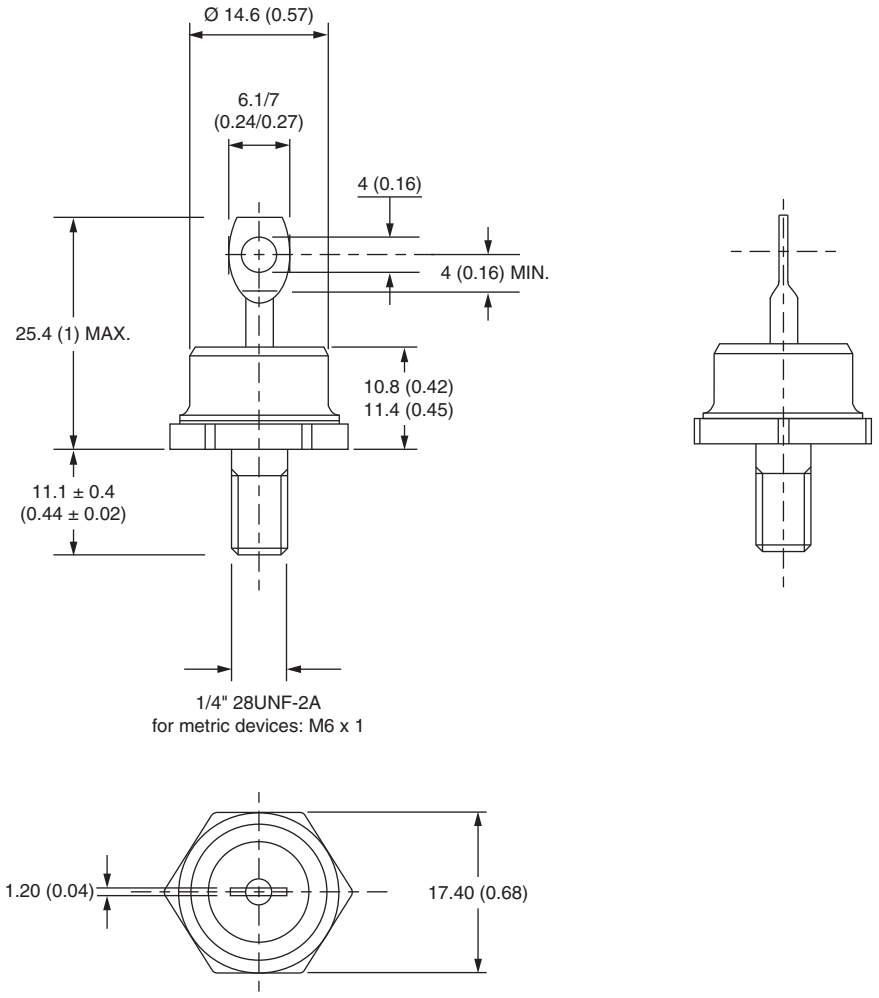
6 - Outlines:
Omit = Stud base UNF thread
M = Stud base metric thread

7 - $t_{rr}$ code only for fast diode (see Recovery Characteristics table)

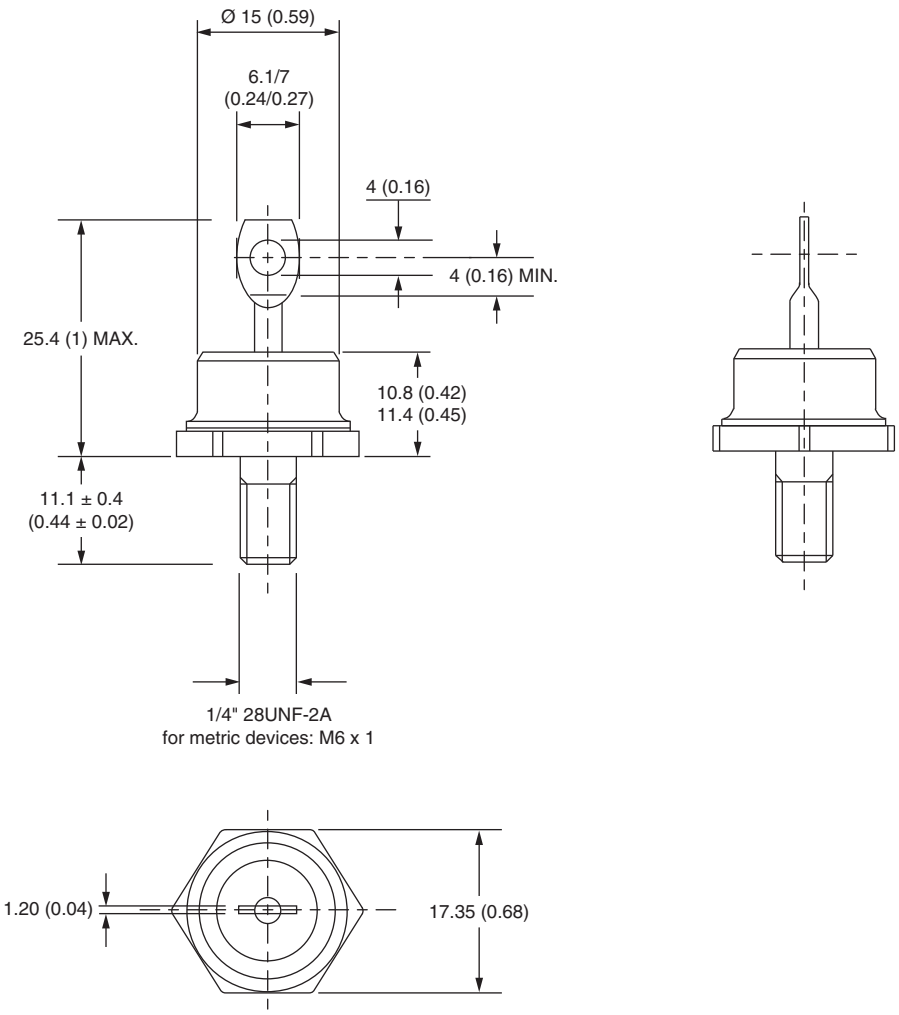
| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95311 |

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

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



**DIMENSIONS FOR 85HFL** in millimeters (inches)



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# Material Category Policy

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as RoHS-Compliant fulfill the definitions and restrictions defined under Directive 2011/65/EU of The European Parliament and of the Council of June 8, 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (EEE) - recast, unless otherwise specified as non-compliant.**

**Please note that some Vishay documentation may still make reference to RoHS Directive 2002/95/EC. We confirm that all the products identified as being compliant to Directive 2002/95/EC conform to Directive 2011/65/EU.**

**Vishay Intertechnology, Inc. hereby certifies that all its products that are identified as Halogen-Free follow Halogen-Free requirements as per JEDEC JS709A standards. Please note that some Vishay documentation may still make reference to the IEC 61249-2-21 definition. We confirm that all the products identified as being compliant to IEC 61249-2-21 conform to JEDEC JS709A standards.**

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001
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Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

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