

### FAST RECOVERY DIODES

Stud Version

#### Features

- High power FAST recovery diode series
- 4.5  $\mu$ s recovery time
- High voltage ratings up to 4500V
- High current capability
- Optimized turn on and turn off characteristics
- Low forward recovery
- Fast and soft reverse recovery
- Compression bonded encapsulation
- Stud version case style B-8
- Maximum junction temperature 125°C
- RoHS Compliant

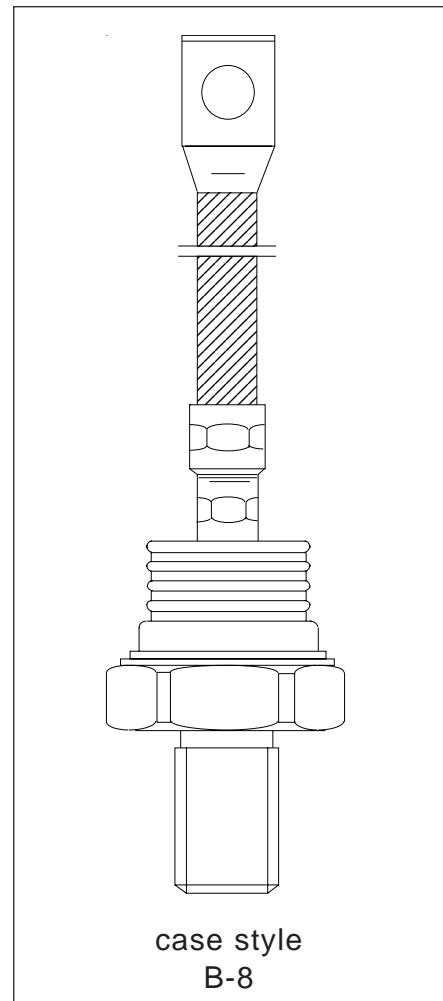
235A

#### Typical Applications

- Snubber diode for GTO
- High voltage free-wheeling diode
- Fast recovery rectifier applications

#### Major Ratings and Characteristics

| Parameters       | SD233N/R     | Units             |
|------------------|--------------|-------------------|
| $I_{F(AV)}$      | 235          | A                 |
| @ $T_C$          | 60           | °C                |
| $I_{F(RMS)}$     | 370          | A                 |
| $I_{FSM}$ @ 50Hz | 5500         | A                 |
| @ 60Hz           | 5760         | A                 |
| $I^2t$ @ 50Hz    | 151          | KA <sup>2</sup> s |
| @ 60Hz           | 138          | KA <sup>2</sup> s |
| $V_{RRM}$ range  | 3000 to 4500 | V                 |
| $t_{rr}$         | 4.5          | $\mu$ s           |
| @ $T_J$          | 125          | °C                |
| $T_J$            | -40 to 125   | °C                |



**ELECTRICAL SPECIFICATIONS**

Voltage Ratings

| Type number | Voltage Code | V <sub>RRM</sub> max. repetitive peak and off-state voltage V | V <sub>RSM</sub> , maximum non-repetitive peak voltage V | I <sub>RRM</sub> max. T <sub>J</sub> = 125°C mA |
|-------------|--------------|---------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------|
| SD233N/R    | 30           | 3000                                                          | 3100                                                     | 50                                              |
|             | 36           | 3600                                                          | 3700                                                     |                                                 |
|             | 40           | 4000                                                          | 4100                                                     |                                                 |
|             | 45           | 4500                                                          | 4600                                                     |                                                 |

Forward Conduction

| Parameter                                                            | SD233N/R                                              | Units                                                               | Conditions                                                                            |    |                                                                                                      |
|----------------------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------|
| I <sub>F(AV)</sub> Max. average forward current @ Case temperature   | 235                                                   | A                                                                   | 180° conduction, half sine wave.                                                      |    |                                                                                                      |
|                                                                      | 60                                                    | °C                                                                  |                                                                                       |    |                                                                                                      |
| I <sub>F(RMS)</sub> Max. RMS current                                 | 370                                                   | A                                                                   | @ 45°C case temperature                                                               |    |                                                                                                      |
| I <sub>FSM</sub> Max. peak, one-cycle non-repetitive forward current | 5500                                                  | A                                                                   | t = 10ms No voltage                                                                   |    |                                                                                                      |
|                                                                      | 5760                                                  |                                                                     | t = 8.3ms reappplied                                                                  |    |                                                                                                      |
|                                                                      | 4630                                                  |                                                                     | t = 10ms 50% V <sub>RRM</sub>                                                         |    |                                                                                                      |
|                                                                      | 4840                                                  |                                                                     | t = 8.3ms reappplied                                                                  |    |                                                                                                      |
| I <sup>2</sup> t Maximum I <sup>2</sup> t for fusing                 | 151                                                   | KA <sup>2</sup> s                                                   | t = 10ms No voltage                                                                   |    |                                                                                                      |
|                                                                      | 138                                                   |                                                                     | t = 8.3ms reappplied                                                                  |    |                                                                                                      |
|                                                                      | 107                                                   |                                                                     | t = 10ms 50% V <sub>RRM</sub>                                                         |    |                                                                                                      |
|                                                                      | 98                                                    |                                                                     | t = 8.3ms reappplied                                                                  |    |                                                                                                      |
| I <sup>2</sup> √t Maximum I <sup>2</sup> √t for fusing               | 1510                                                  | KA <sup>2</sup> √s                                                  | t = 0.1 to 10ms, no voltage reappplied                                                |    |                                                                                                      |
|                                                                      | V <sub>F(TO)1</sub> Low level of threshold voltage    |                                                                     | 1.56                                                                                  | V  | (16.7% x π x I <sub>F(AV)</sub> < I < π x I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> max. |
|                                                                      | V <sub>F(TO)2</sub> High level of threshold voltage   |                                                                     | 1.68                                                                                  |    | (I > π x I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> max.                                  |
|                                                                      | r <sub>f1</sub> Low level of forward slope resistance |                                                                     | 1.64                                                                                  | mΩ | (16.7% x π x I <sub>F(AV)</sub> < I < π x I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> max. |
| r <sub>f2</sub> High level of forward slope resistance               | 1.53                                                  | (I > π x I <sub>F(AV)</sub> ), T <sub>J</sub> = T <sub>J</sub> max. |                                                                                       |    |                                                                                                      |
| V <sub>FM</sub> Max. forward voltage                                 | 3.2                                                   | V                                                                   | I <sub>pk</sub> = 1000A, T <sub>J</sub> = 125°C, t <sub>p</sub> = 400 μs square pulse |    |                                                                                                      |

Recovery Characteristics

| Code | T <sub>J</sub> = 25°C<br>typical t <sub>rr</sub><br>@ 25% I <sub>RRM</sub><br>(μs) | Test conditions                        |                     |                       | Max. values @ T <sub>J</sub> = 125°C              |                         |                        |  |
|------|------------------------------------------------------------------------------------|----------------------------------------|---------------------|-----------------------|---------------------------------------------------|-------------------------|------------------------|--|
|      |                                                                                    | I <sub>pk</sub><br>Square Pulse<br>(A) | di/dt (*)<br>(A/μs) | V <sub>r</sub><br>(V) | t <sub>rr</sub><br>@ 25% I <sub>RRM</sub><br>(μs) | Q <sub>rr</sub><br>(μC) | I <sub>rr</sub><br>(A) |  |
| S50  | 5.0                                                                                | 1000                                   | 100                 | -50                   | 4.5                                               | 680                     | 240                    |  |

(\*) di/dt = 25A/μs @ T<sub>J</sub> = 25°C

**Thermal and Mechanical Specification**

| Parameter                                                   | SD233N/R   | Units | Conditions                                 |
|-------------------------------------------------------------|------------|-------|--------------------------------------------|
| T <sub>J</sub> Max. operating temperature range             | -40 to 125 | °C    |                                            |
| T <sub>stg</sub> Max. storage temperature range             | -40 to 150 |       |                                            |
| R <sub>thJC</sub> Max. thermal resistance, junction to case | 0.1        | K/W   | DC operation                               |
| R <sub>thCS</sub> Max. thermal resistance, case to heatsink | 0.04       |       | Mounting surface, smooth, flat and greased |
| T Mounting torque ± 10%                                     | 50         | N m   | Not lubricated threads                     |
| wt Approximate weight                                       | 454        | g     |                                            |
| Case style                                                  | B-8        |       | See Outline Table                          |

**ΔR<sub>thJC</sub> Conduction**

(The following table shows the increment of thermal resistance R<sub>thJC</sub> when devices operate at different conduction angles than DC)

| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions                           |
|------------------|-----------------------|------------------------|-------|--------------------------------------|
| 180°             | 0.010                 | 0.008                  | K/W   | T <sub>J</sub> = T <sub>J</sub> max. |
| 120°             | 0.013                 | 0.014                  |       |                                      |
| 90°              | 0.017                 | 0.018                  |       |                                      |
| 60°              | 0.025                 | 0.026                  |       |                                      |
| 30°              | 0.041                 | 0.042                  |       |                                      |

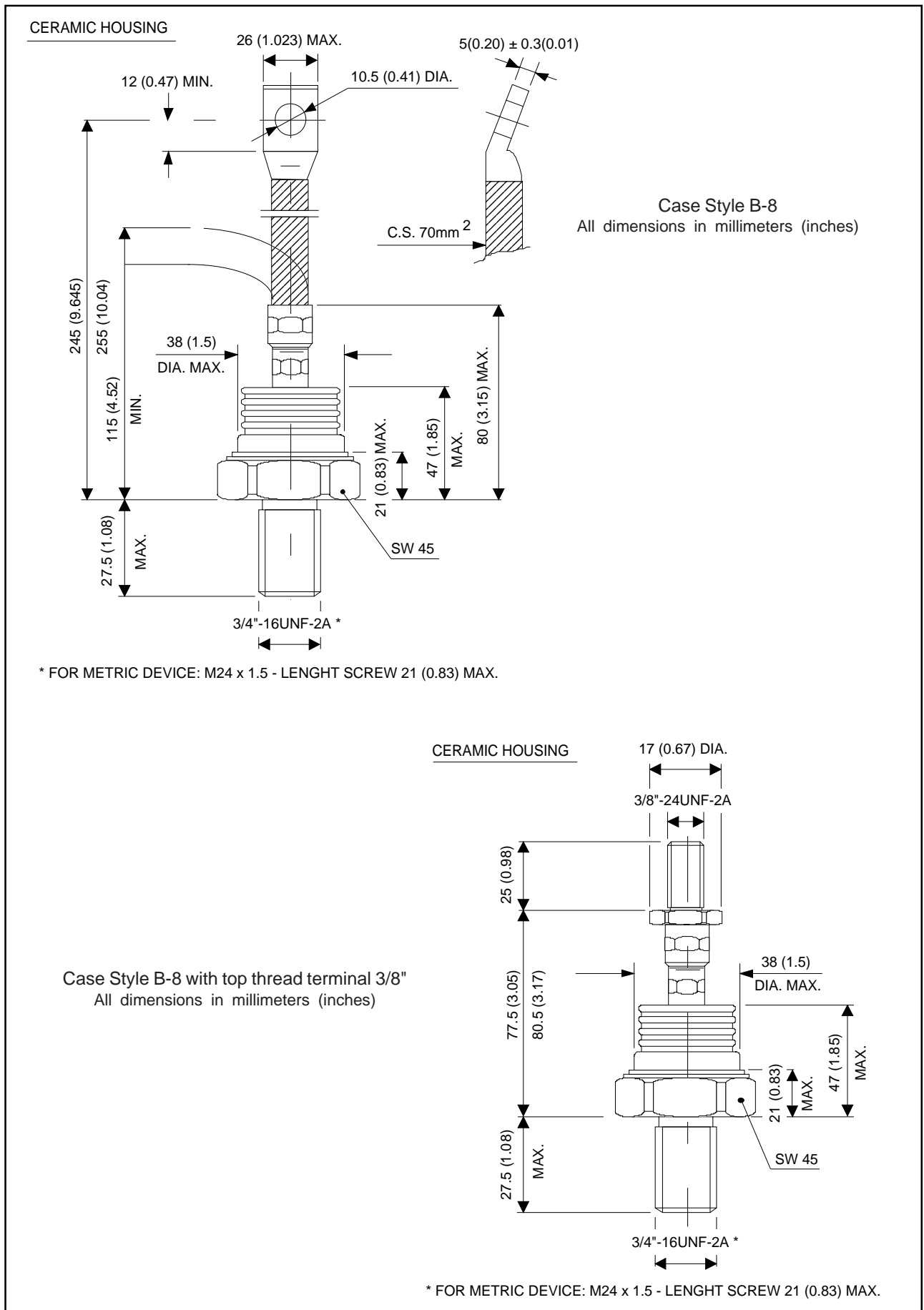
**Ordering Information Table**

**Device Code**

|           |           |          |          |           |            |          |          |          |
|-----------|-----------|----------|----------|-----------|------------|----------|----------|----------|
| <b>SD</b> | <b>23</b> | <b>3</b> | <b>N</b> | <b>45</b> | <b>S50</b> | <b>P</b> | <b>S</b> | <b>C</b> |
| ①         | ②         | ③        | ④        | ⑤         | ⑥          | ⑦        | ⑧        | ⑨        |

- 1** - Diode
- 2** - Essential part number
- 3** - 3 = Fast recovery
- 4** - N = Stud Normal Polarity (Cathode to Stud)  
R = Stud Reverse Polarity (Anode to Stud)
- 5** - Voltage code: Code x 100 = V<sub>RRM</sub> (see Voltage Ratings table)
- 6** - t<sub>rr</sub> code (see Recovery Characteristics table)
- 7** - P = Stud base B-8 3/4" 16UNF-2A  
M = Stud base B-8 M24 X 1.5
- 8** - S = Isolated lead with silicone sleeve  
( Red = Reverse Polarity; Blue = Normal Polarity)  
T = Threaded Top Terminal 3/8" 24UNF-2A  
None = Not isolated lead
- 9** - C = Ceramic housing

**Outlines Table**



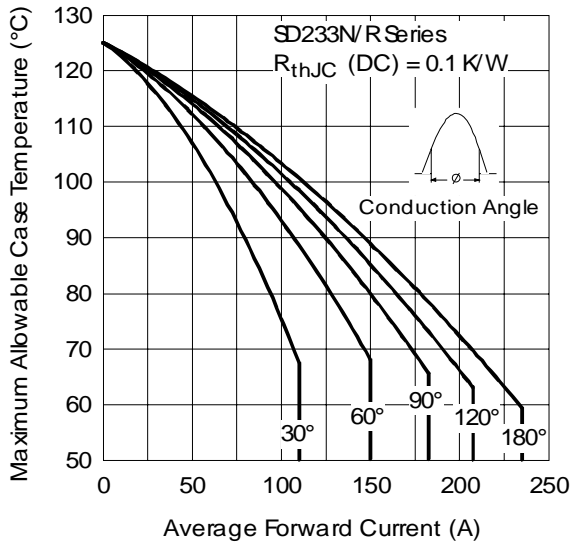


Fig. 1 - Current Ratings Characteristics

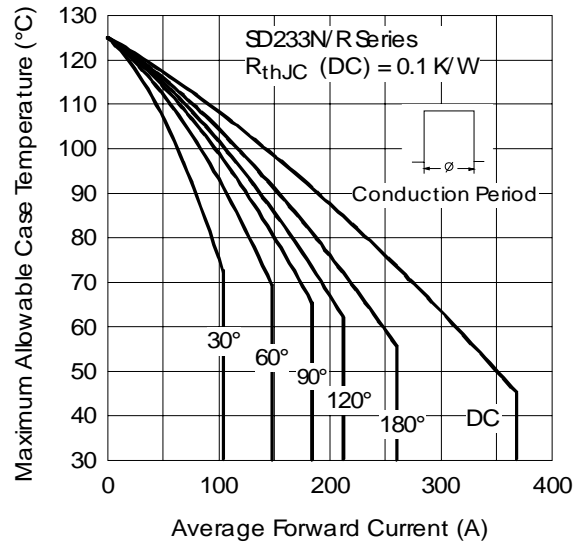


Fig. 2 - Current Ratings Characteristics

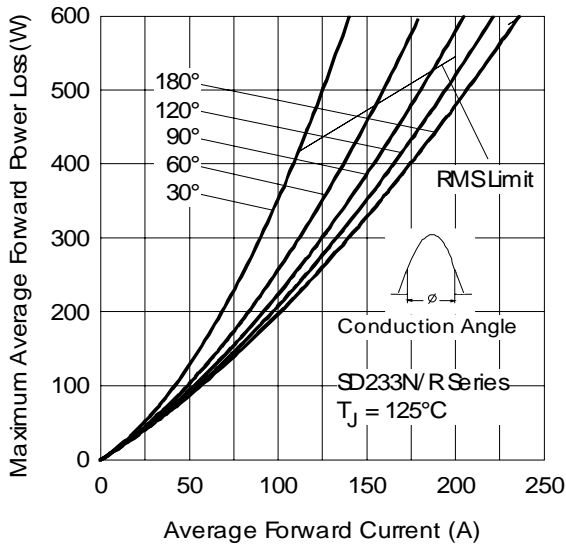


Fig. 3 - Forward Power Loss Characteristics

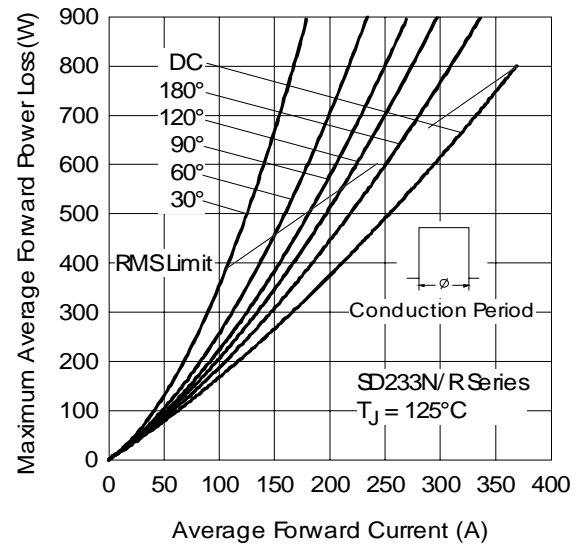


Fig. 4 - Forward Power Loss Characteristics

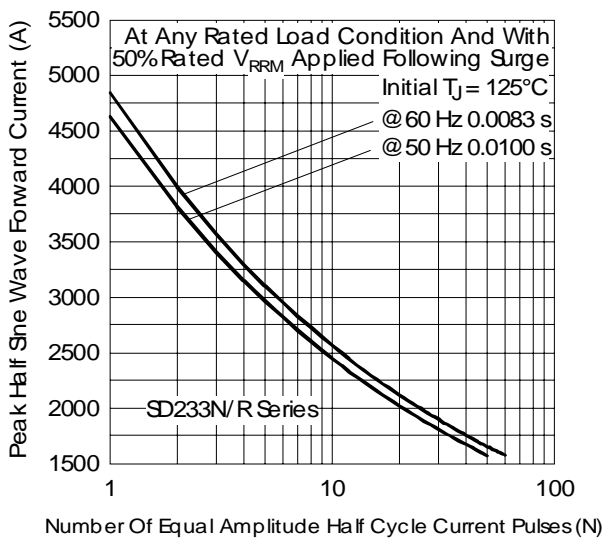


Fig. 5 - Maximum Non-repetitive Surge Current

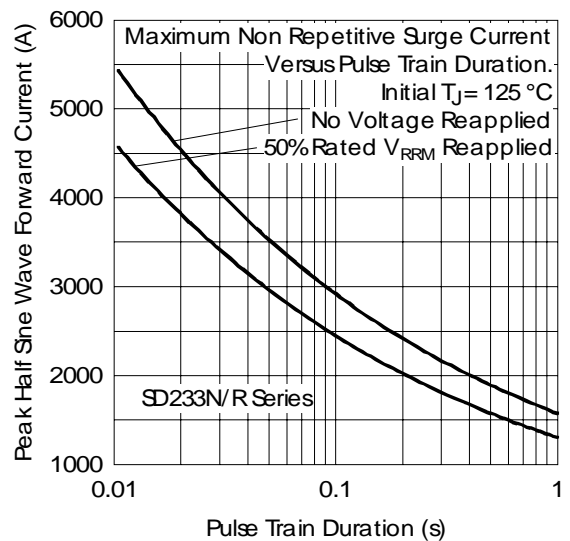


Fig. 6 - Maximum Non-repetitive Surge Current

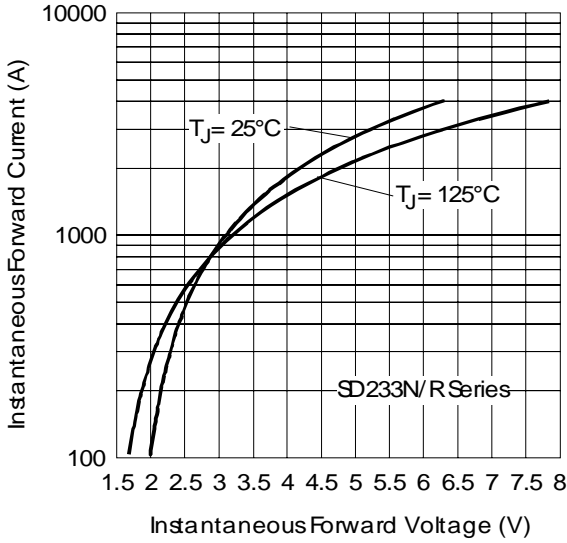


Fig. 7 - Forward Voltage Drop Characteristics

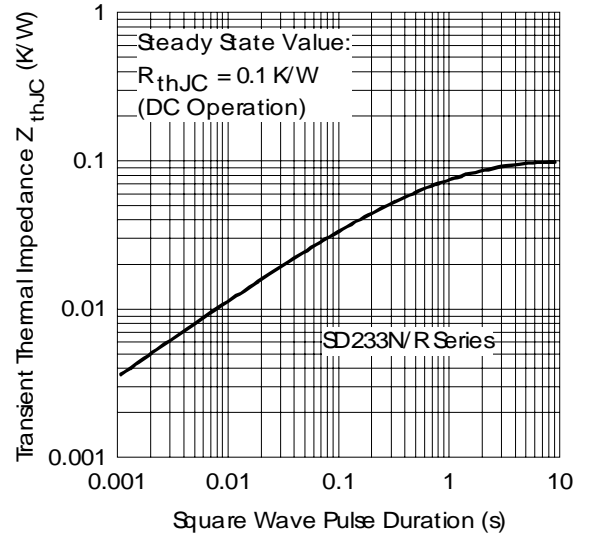


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

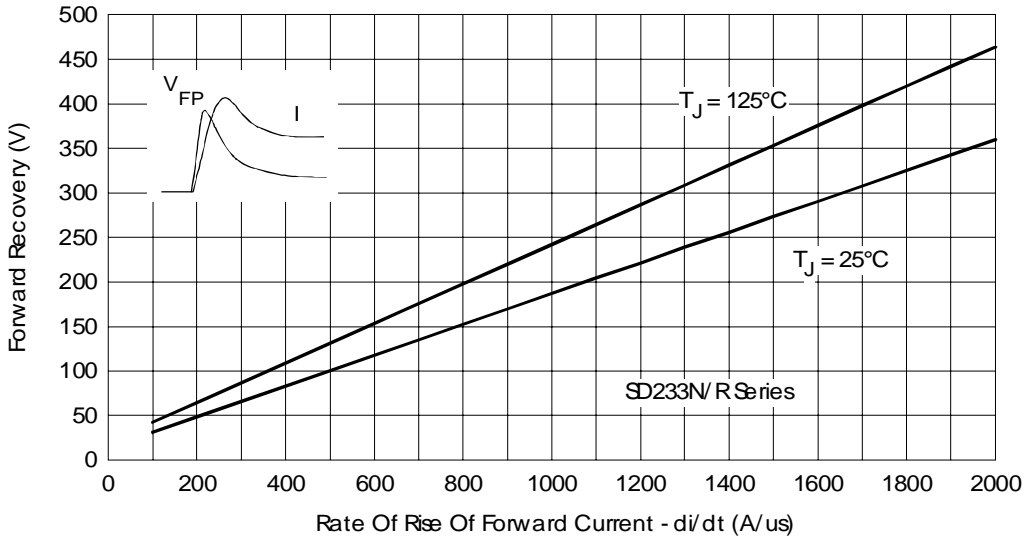


Fig. 9 - Typical Forward Recovery Characteristics

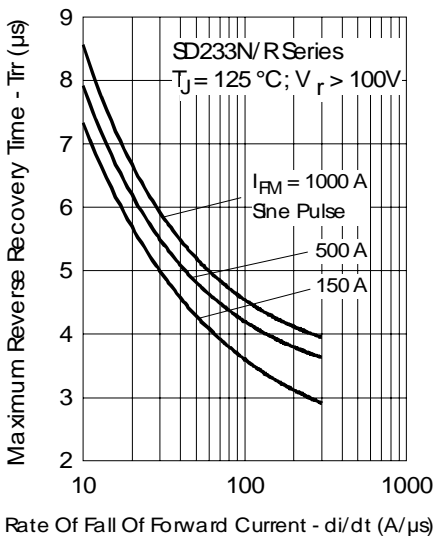


Fig. 10 - Recovery Time Characteristics

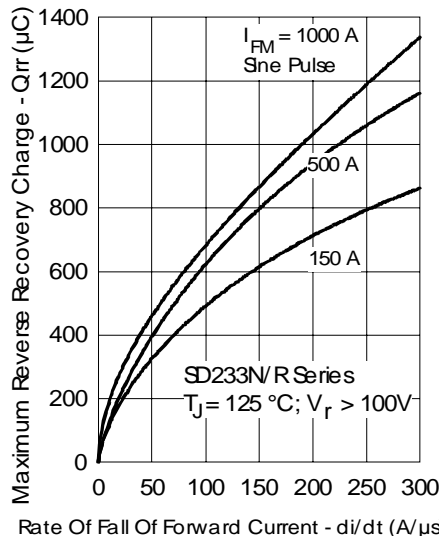


Fig. 11 - Recovery Charge Characteristics

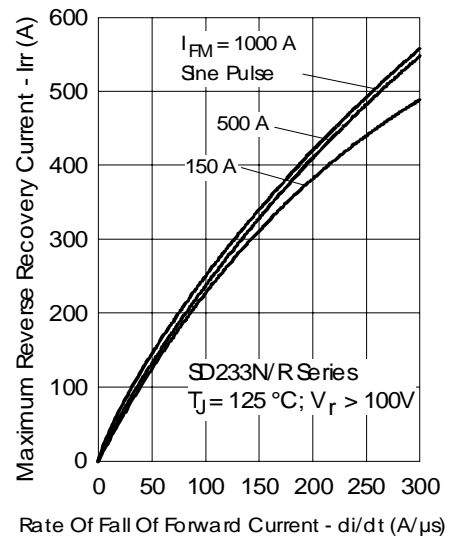


Fig. 12 - Recovery Current Characteristics

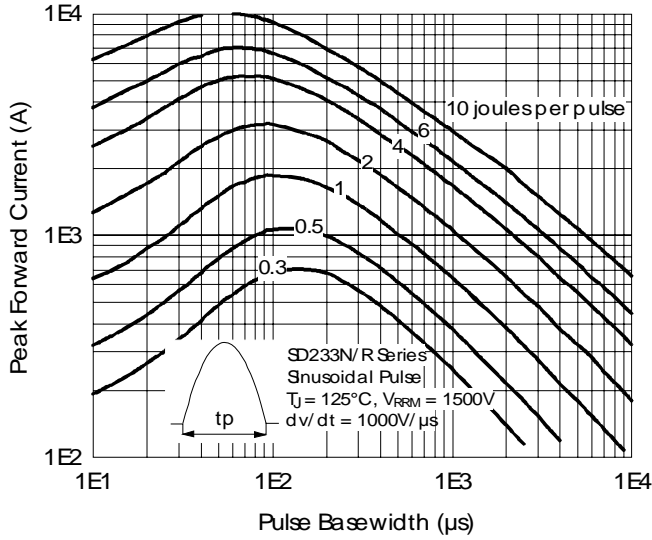


Fig. 13 - Maximum Total Energy Loss Per Pulse Characteristics

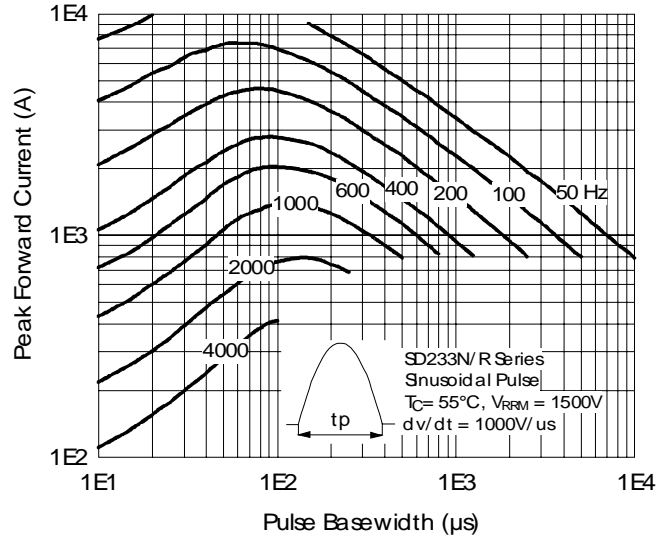


Fig. 14 - Frequency Characteristics

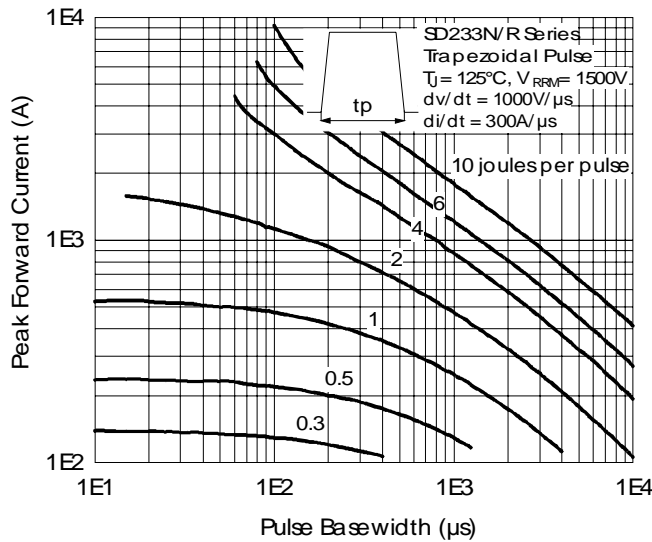


Fig. 15 - Maximum Total Energy Loss Per Pulse Characteristics

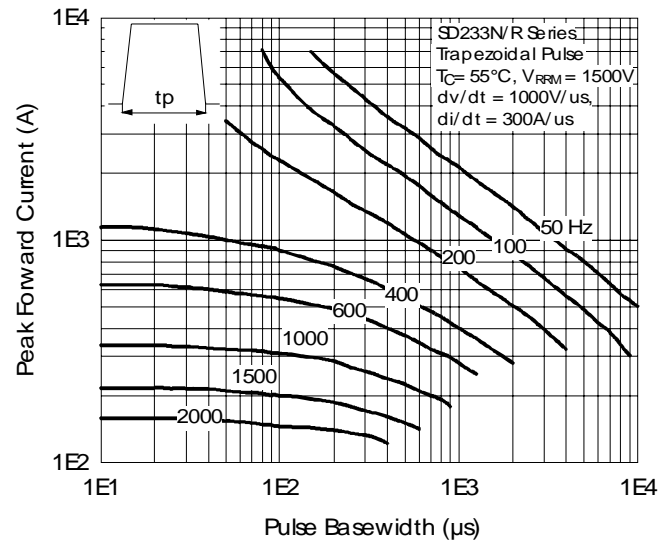


Fig. 16 - Frequency Characteristics

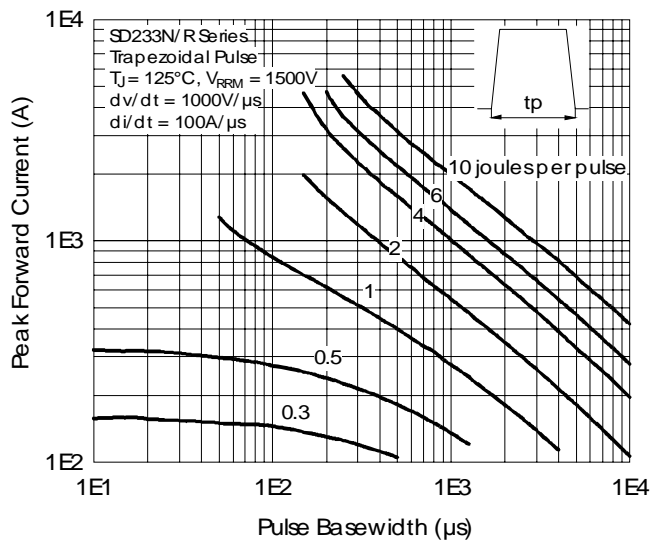


Fig. 17 - Maximum Total Energy Loss Per Pulse Characteristics

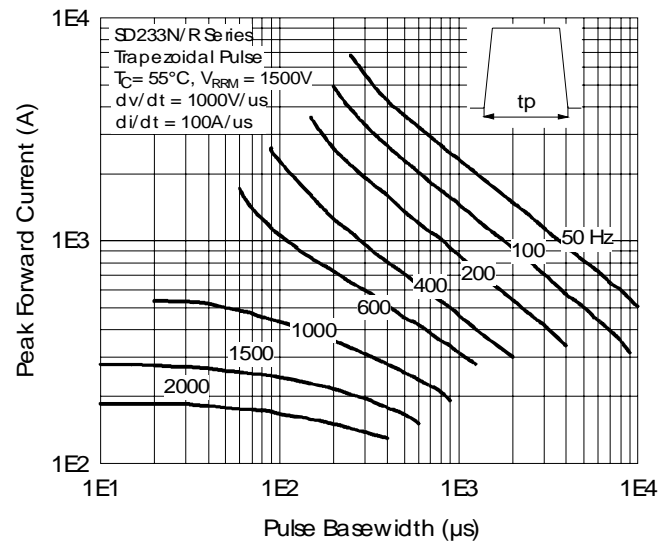


Fig. 18 - Frequency Characteristics

Data and specifications subject to change without notice.  
This product has been designed and qualified for Industrial Level.  
Qualification Standards can be found on IR's Web site.

International  
**IOR** Rectifier

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