

### 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

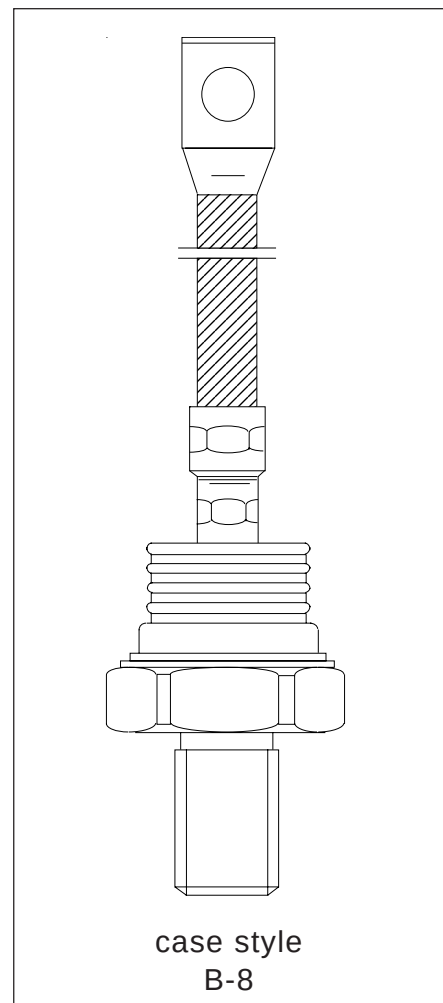
235A

#### 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

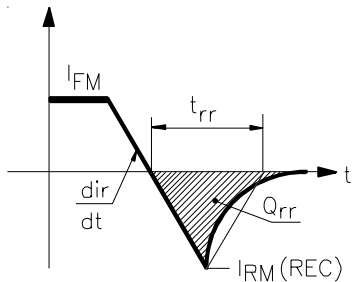
## Voltage Ratings

| Type number | Voltage Code | $V_{RRM}$ max. repetitive peak and off-state voltage<br>V | $V_{RSM}$ , maximum non-repetitive peak voltage<br>V | $I_{RRM}$ max.<br>$T_J = 125^\circ\text{C}$<br>mA |
|-------------|--------------|-----------------------------------------------------------|------------------------------------------------------|---------------------------------------------------|
| SD233N/R    | 30           | 3000                                                      | 3100                                                 | 50                                                |
|             | 36           | 3600                                                      | 3700                                                 |                                                   |
|             | 40           | 4000                                                      | 4100                                                 |                                                   |
|             | 45           | 4500                                                      | 4600                                                 |                                                   |

## Forward Conduction

| Parameter                                                      | SD233N/R | Units                        | Conditions                                                                                   |
|----------------------------------------------------------------|----------|------------------------------|----------------------------------------------------------------------------------------------|
| $I_{F(AV)}$ Max. average forward current<br>@ Case temperature | 235      | A                            | 180° conduction, half sine wave.                                                             |
|                                                                | 60       | °C                           |                                                                                              |
| $I_{F(RMS)}$ Max. RMS current                                  | 370      | A                            | @ 45°C case temperature                                                                      |
| $I_{FSM}$ Max. peak, one-cycle non-repetitive forward current  | 5500     | A                            | t = 10ms No voltage                                                                          |
|                                                                | 5760     |                              | t = 8.3ms reappplied                                                                         |
|                                                                | 4630     |                              | t = 10ms 50% $V_{RRM}$                                                                       |
|                                                                | 4840     |                              | t = 8.3ms reappplied                                                                         |
| $I^2t$ Maximum $I^2t$ for fusing                               | 151      | $\text{KA}^2\text{s}$        | t = 10ms No voltage                                                                          |
|                                                                | 138      |                              | t = 8.3ms reappplied                                                                         |
|                                                                | 107      |                              | t = 10ms 50% $V_{RRM}$                                                                       |
|                                                                | 98       |                              | t = 8.3ms reappplied                                                                         |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing                 | 1510     | $\text{KA}^2\sqrt{\text{s}}$ | t = 0.1 to 10ms, no voltage reappplied                                                       |
| $V_{F(TO)1}$ Low level of threshold voltage                    | 1.56     | V                            | $(16.7\% \times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)})$ , $T_J = T_J \text{ max.}$ |
| $V_{F(TO)2}$ High level of threshold voltage                   | 1.68     |                              | $(I > \pi \times I_{F(AV)})$ , $T_J = T_J \text{ max.}$                                      |
| $r_{f1}$ Low level of forward slope resistance                 | 1.64     | $\text{m}\Omega$             | $(16.7\% \times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)})$ , $T_J = T_J \text{ max.}$ |
| $r_{f2}$ High level of forward slope resistance                | 1.53     |                              | $(I > \pi \times I_{F(AV)})$ , $T_J = T_J \text{ max.}$                                      |
| $V_{FM}$ Max. forward voltage                                  | 3.2      | V                            | $I_{pk} = 1000\text{A}$ , $T_J = 125^\circ\text{C}$ , $t_p = 400 \mu\text{s}$ square pulse   |

## Recovery Characteristics

| Code | $T_J = 25^\circ\text{C}$<br>typical $t_{rr}$<br>@ 25% $I_{RRM}$<br>( $\mu\text{s}$ ) | Test conditions                 |                                    |              | Max. values @ $T_J = 125^\circ\text{C}$          |                               |                 |  |
|------|--------------------------------------------------------------------------------------|---------------------------------|------------------------------------|--------------|--------------------------------------------------|-------------------------------|-----------------|---------------------------------------------------------------------------------------|
|      |                                                                                      | $I_{pk}$<br>Square Pulse<br>(A) | $di/dt$ (*)<br>(A/ $\mu\text{s}$ ) | $V_r$<br>(V) | $t_{rr}$<br>@ 25% $I_{RRM}$<br>( $\mu\text{s}$ ) | $Q_{rr}$<br>( $\mu\text{C}$ ) | $I_{rr}$<br>(A) |                                                                                       |
| S50  | 5.0                                                                                  | 1000                            | 100                                | -50          | 4.5                                              | 680                           | 240             |                                                                                       |

(\*)  $di/dt = 25\text{A}/\mu\text{s}$  @  $T_J = 25^\circ\text{C}$

## Thermal and Mechanical Specification

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

## $\Delta R_{thJC}$ Conduction

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

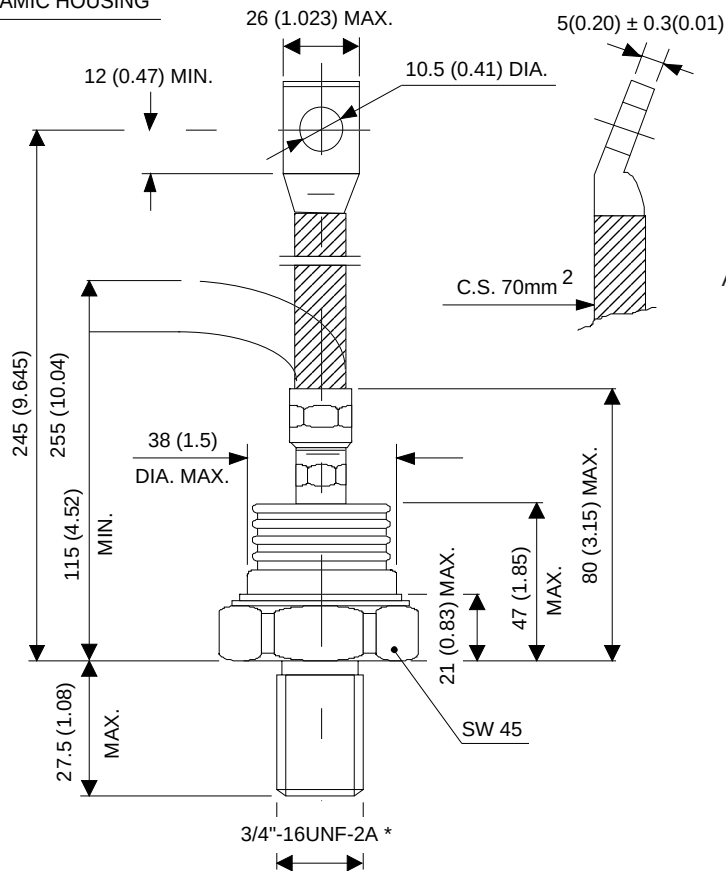
| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions               |
|------------------|-----------------------|------------------------|-------|--------------------------|
| 180°             | 0.010                 | 0.008                  | K/W   | $T_J = T_J \text{ max.}$ |
| 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                                                                                                                                                                                                                                              |   |                                                                                                                                                                   |  |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
| <div> <div>SD</div><div>23</div><div>3</div><div>N</div><div>45</div><div>S50</div><div>P</div><div>S</div><div>C</div> </div> <div> <div>1</div><div>2</div><div>3</div><div>4</div><div>5</div><div>6</div><div>7</div><div>8</div><div>9</div> </div> |   |                                                                                                                                                                   |  |  |  |  |  |  |
| <b>1</b>                                                                                                                                                                                                                                                 | - | Diode                                                                                                                                                             |  |  |  |  |  |  |
| <b>2</b>                                                                                                                                                                                                                                                 | - | Essential part number                                                                                                                                             |  |  |  |  |  |  |
| <b>3</b>                                                                                                                                                                                                                                                 | - | 3 = Fast recovery                                                                                                                                                 |  |  |  |  |  |  |
| <b>4</b>                                                                                                                                                                                                                                                 | - | N = Stud Normal Polarity (Cathode to Stud)<br>R = Stud Reverse Polarity (Anode to Stud)                                                                           |  |  |  |  |  |  |
| <b>5</b>                                                                                                                                                                                                                                                 | - | Voltage code: Code x 100 = $V_{RRM}$ (see Voltage Ratings table)                                                                                                  |  |  |  |  |  |  |
| <b>6</b>                                                                                                                                                                                                                                                 | - | $t_{rr}$ code (see Recovery Characteristics table)                                                                                                                |  |  |  |  |  |  |
| <b>7</b>                                                                                                                                                                                                                                                 | - | P = Stud base B-8 3/4" 16UNF-2A<br>M = Stud base B-8 M24 X 1.5                                                                                                    |  |  |  |  |  |  |
| <b>8</b>                                                                                                                                                                                                                                                 | - | S = Isolated lead with silicone sleeve<br>(Red = Reverse Polarity; Blue = Normal Polarity)<br>T = Threaded Top Terminal 3/8" 24UNF-2A<br>None = Not isolated lead |  |  |  |  |  |  |
| <b>9</b>                                                                                                                                                                                                                                                 | - | C = Ceramic housing                                                                                                                                               |  |  |  |  |  |  |

## Outlines Table

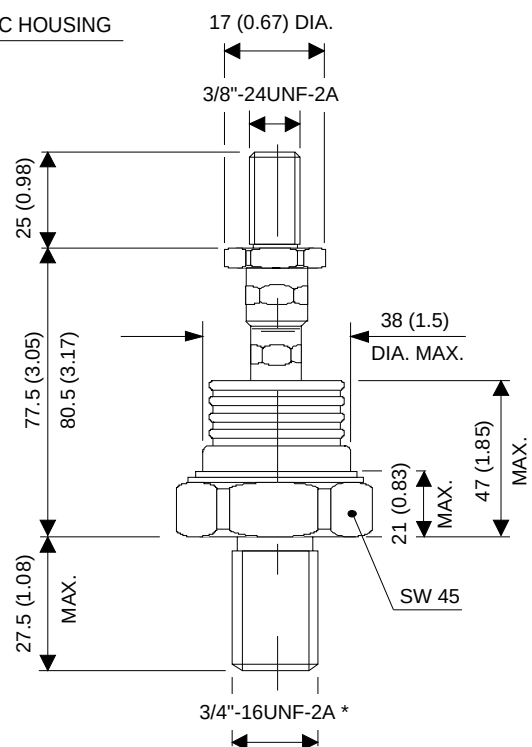
## CERAMIC HOUSING



\* FOR METRIC DEVICE: M24 x 1.5 - LENGTH SCREW 21 (0.83) MAX.

## CERAMIC HOUSING

Case Style B-8 with top thread terminal 3/8"  
All dimensions in millimeters (inches)



\* FOR METRIC DEVICE: M24 x 1.5 - LENGTH SCREW 21 (0.83) MAX.

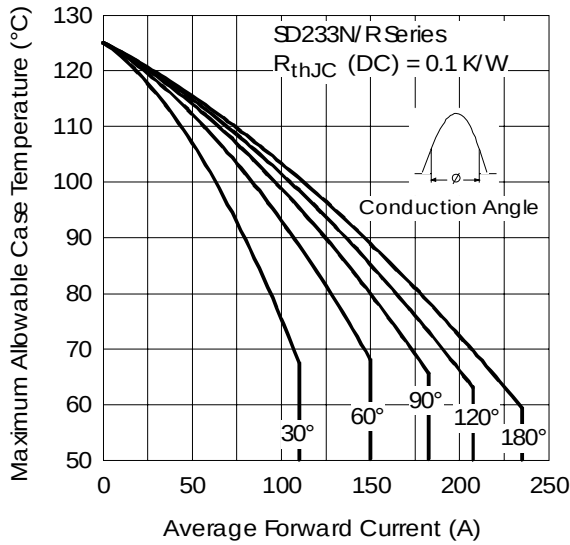


Fig. 1 - Current Ratings Characteristics

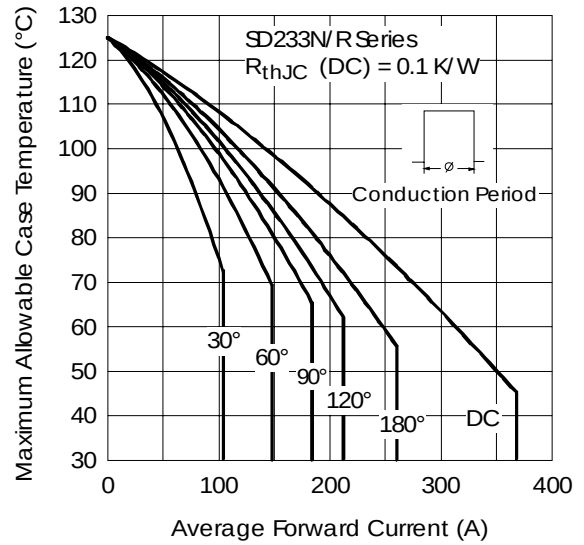


Fig. 2 - Current Ratings Characteristics

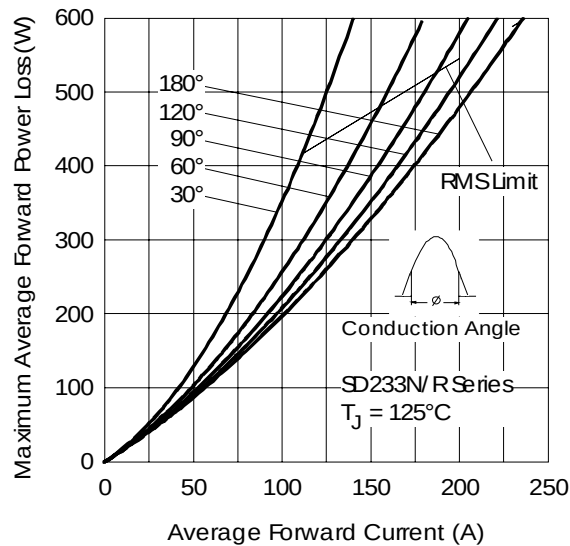


Fig. 3 - Forward Power Loss Characteristics

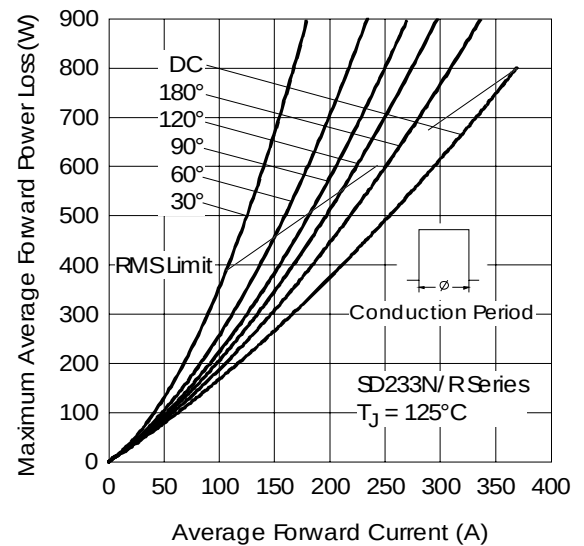


Fig. 4 - Forward Power Loss Characteristics

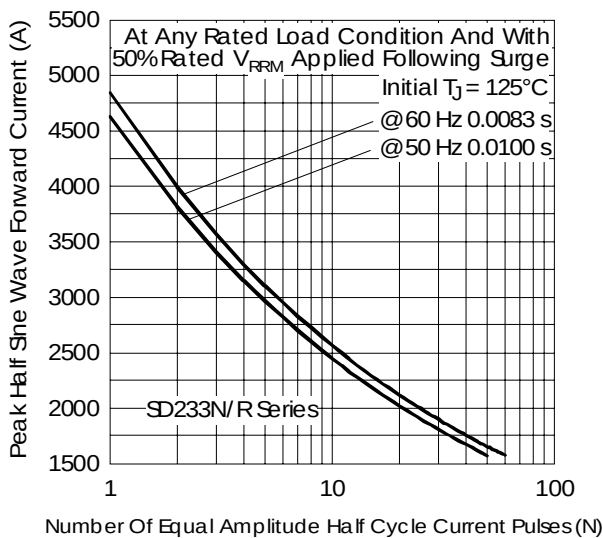


Fig. 5 - Maximum Non-repetitive Surge Current

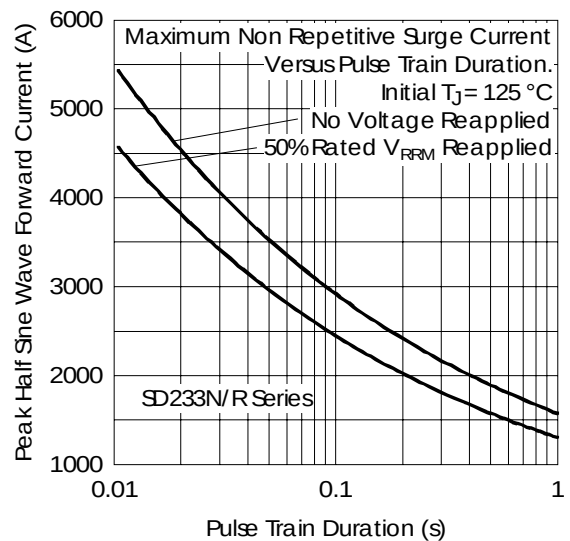


Fig. 6 - Maximum Non-repetitive Surge Current

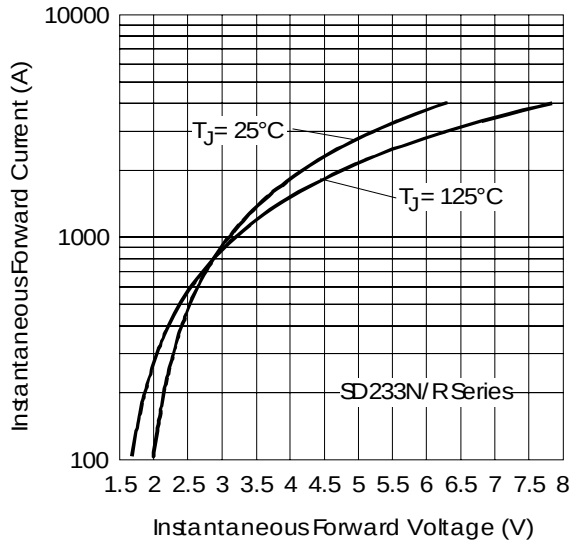


Fig. 7 - Forward Voltage Drop Characteristics

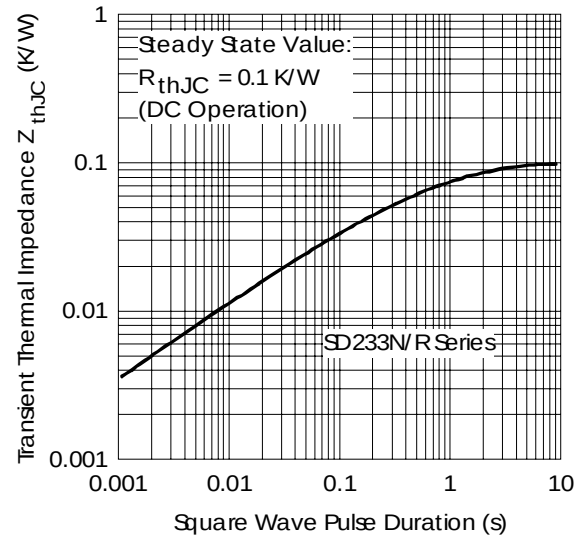
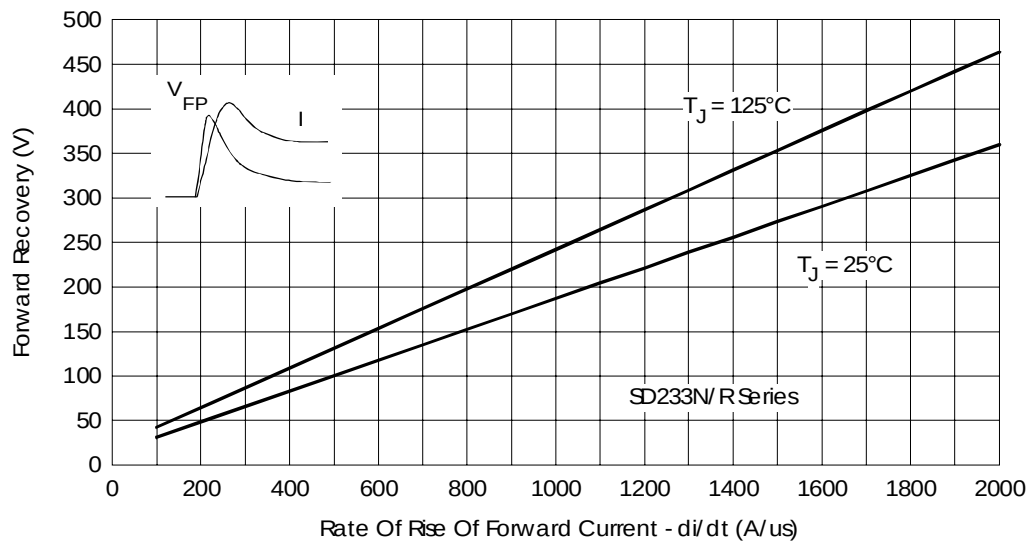
Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

Fig. 9 - Typical Forward Recovery Characteristics

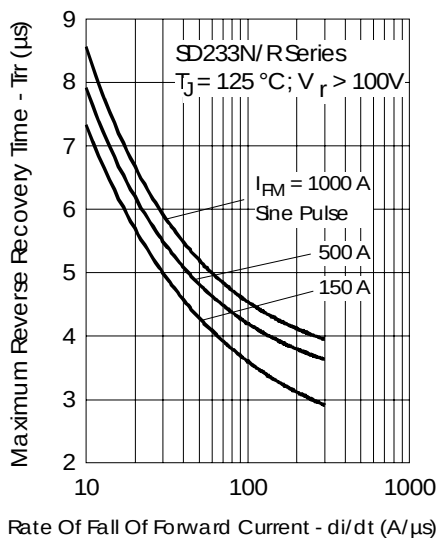


Fig. 10 - Recovery Time Characteristics

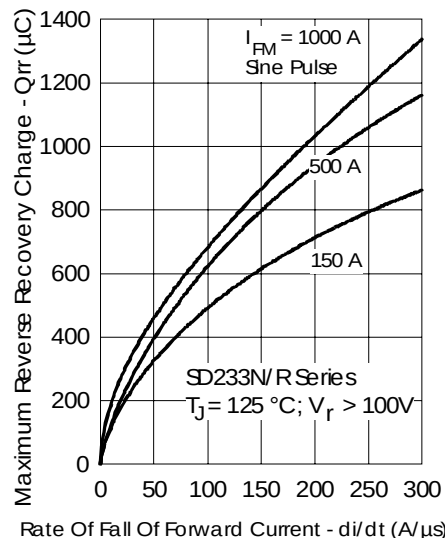


Fig. 11 - Recovery Charge Characteristics

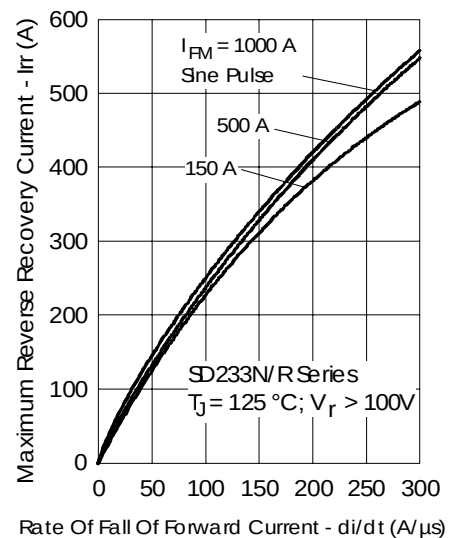


Fig. 12 - Recovery Current Characteristics

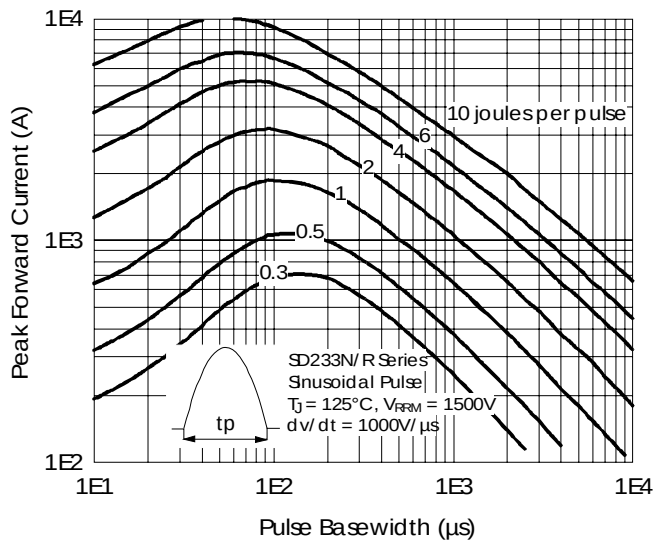


Fig. 13 - Maximum Total Energy Loss Per Pulse Characteristics

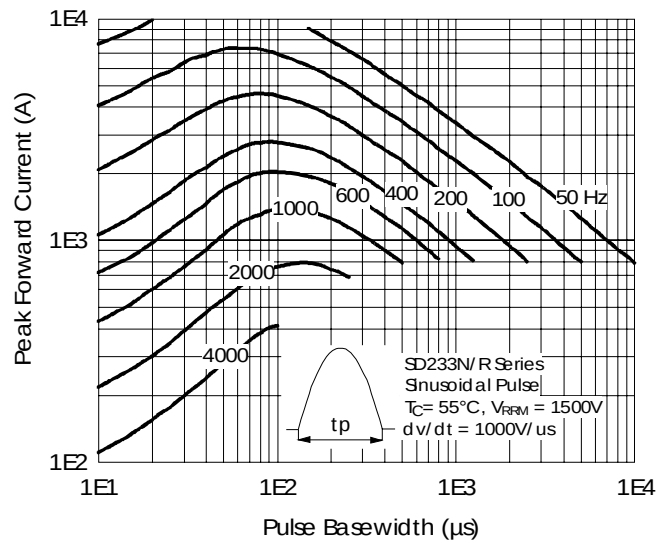


Fig. 14 - Frequency Characteristics

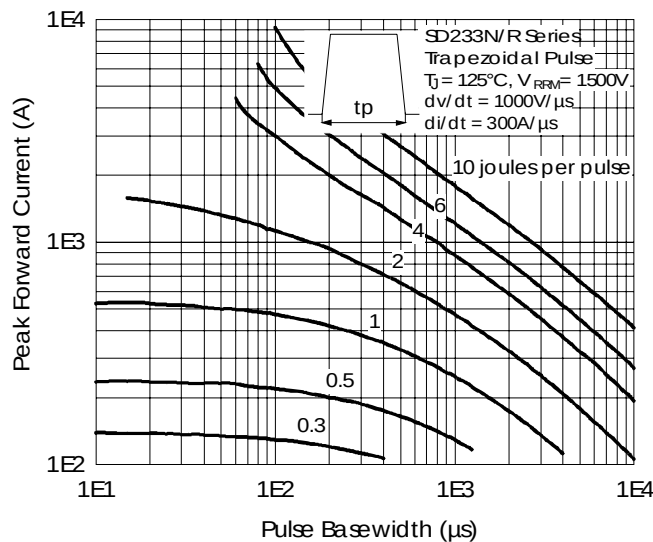


Fig. 15 - Maximum Total Energy Loss Per Pulse Characteristics

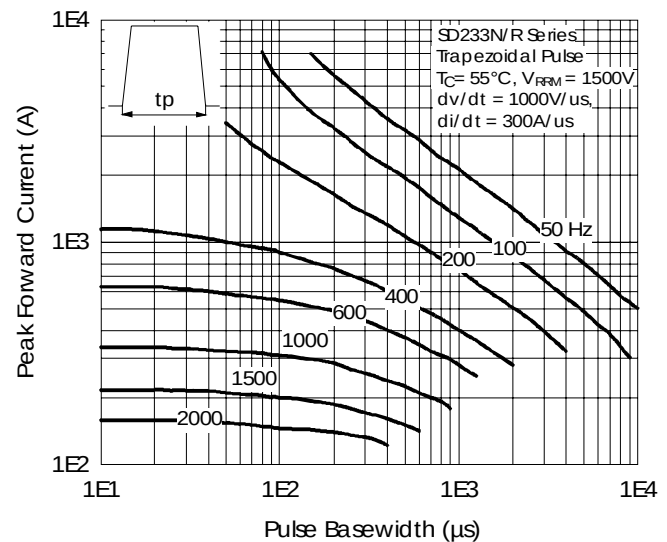


Fig. 16 - Frequency Characteristics

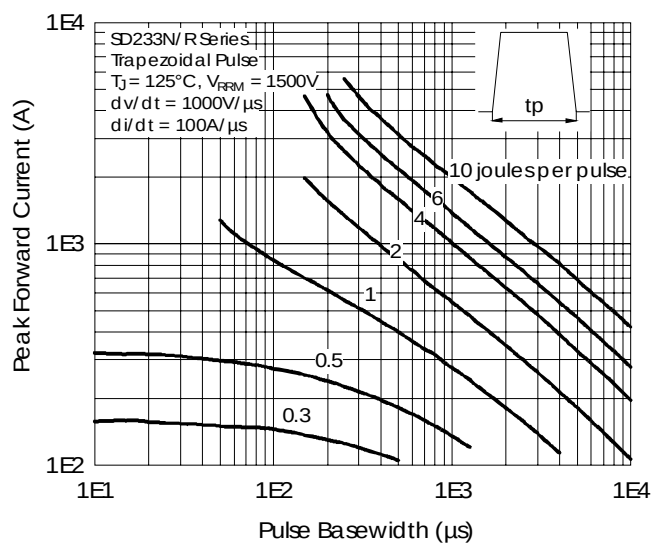


Fig. 17 - Maximum Total Energy Loss Per Pulse Characteristics

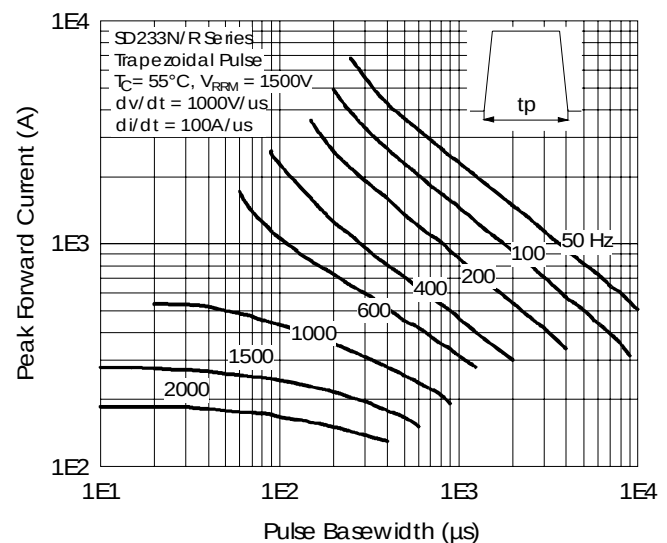


Fig. 18 - Frequency Characteristics

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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