

### FAST RECOVERY DIODES

### Stud Version

#### Features

- High power FAST recovery diode series
- 2.0 to 3.0  $\mu$ s recovery time
- High voltage ratings up to 2500V
- 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 150°C

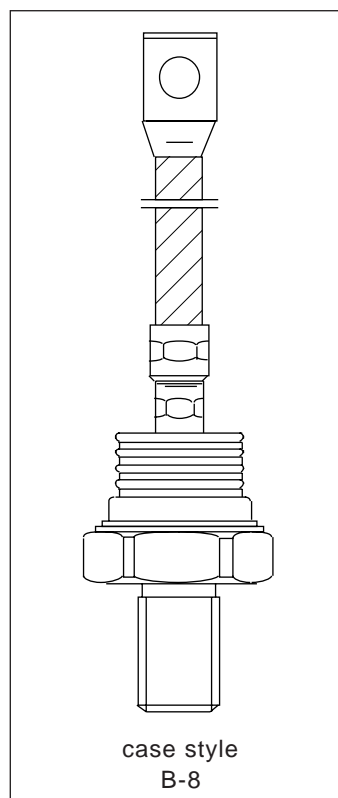
400A  
450A

#### Typical Applications

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

#### Major Ratings and Characteristics

| Parameters       | SD453N/R     |              | Units   |
|------------------|--------------|--------------|---------|
|                  | S20          | S30          |         |
| $I_{F(AV)}$      | 400          | 450          | A       |
| @ $T_C$          | 70           | 70           | °C      |
| $I_{F(RMS)}$     | 630          | 710          | A       |
| $I_{FSM}$ @ 50Hz | 9300         | 9600         | A       |
| @ 60Hz           | 9730         | 10050        | A       |
| $V_{RRM}$ range  | 1200 to 2500 | 1200 to 2500 | V       |
| $t_{rr}$         | 2.0          | 3.0          | $\mu$ s |
| @ $T_J$          | 25           | 25           | °C      |
| $T_J$            | - 40 to 150  |              | °C      |



## SD453N/R Series

Bulletin I2076 rev. A 09/94

International  
**IR** Rectifier

### ELECTRICAL SPECIFICATIONS

#### Voltage Ratings

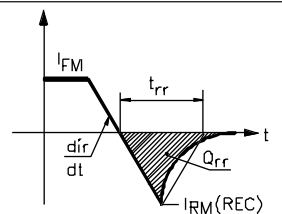
| Type number | Voltage Code | $V_{RRM}$ , maximum repetitive peak reverse voltage<br>V | $V_{RSM}$ , maximum non-repetitive peak rev. voltage<br>V | $I_{RRM}$ max.<br>@ $T_J = T_J$ max.<br>mA |
|-------------|--------------|--|---|--|
| SD453N/R    | 12           | 1200   | 1300  | 50   |
|             | 16           | 1600   | 1700  |  |
|             | 20           | 2000   | 2100  |  |
|             | 25           | 2500   | 2600  |  |

#### Forward Conduction

| Parameter  | SD453N/R |       | Units              | Conditions  |
|--|----------|-------|--------------------|---|
|  | S20      | S30   |                    |   |
| $I_{F(AV)}$ Max. average forward current @ case temperature          | 400      | 450   | A                  | 180° conduction, half sine wave   |
|  | 70       | 70    | °C                 |   |
| $I_{F(RMS)}$ Max. RMS forward current @ case temperature             | 630      | 710   | A                  |   |
|  | 55       | 52    | °C                 |   |
| $I_{FSM}$ Max. peak, one-cycle forward, non-repetitive surge current | 9300     | 9600  | A                  | t = 10ms No voltage reappplied  |
|  | 9730     | 10050 |                    | t = 8.3ms reappplied  |
|  | 7820     | 8070  |                    | t = 10ms 100% $V_{RRM}$ reappplied  |
|  | 8190     | 8450  |                    | t = 8.3ms reappplied  |
| $I^2t$ Maximum $I^2t$ for fusing                                     | 432      | 460   | KA <sup>2</sup> s  | t = 10ms No voltage reappplied  |
|  | 395      | 420   |                    | t = 8.3ms reappplied  |
|  | 306      | 326   |                    | t = 10ms 100% $V_{RRM}$ reappplied  |
|  | 279      | 297   |                    | t = 8.3ms reappplied  |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing                       | 4320     | 4600  | KA <sup>2</sup> √s | t = 0.1 to 10ms, no voltage reappplied                                      |
| $V_{F(TO)1}$ Low level value of threshold voltage                    | 1.00     | 0.95  | V                  | (16.7% x $\pi$ x $I_{F(AV)}$ ) < I < $\pi$ x $I_{F(AV)}$ , $T_J = T_J$ max. |
| $V_{F(TO)2}$ High level value of threshold voltage                   | 1.09     | 1.04  |                    | (I > $\pi$ x $I_{F(AV)}$ ), $T_J = T_J$ max.                                |
| $r_{f1}$ Low level value of forward slope resistance                 | 0.80     | 0.60  | mΩ                 | (16.7% x $\pi$ x $I_{F(AV)}$ ) < I < $\pi$ x $I_{F(AV)}$ , $T_J = T_J$ max. |
| $r_{f2}$ High level value of forward slope resistance                | 0.74     | 0.54  |                    | (I > $\pi$ x $I_{F(AV)}$ ), $T_J = T_J$ max.                                |
| $V_{FM}$ Max. forward voltage drop                                   | 2.20     | 1.85  | V                  | $I_{pk} = 1500A$ , $T_J = T_J$ max, $t_p = 10ms$ sinusoidal wave            |

#### Recovery Characteristics

| Code | $T_J = 25^\circ C$<br>typical $t_{rr}$<br>@ 25% $I_{RRM}$<br>(μs) | Test conditions                 |                 |              | Max. values @ $T_J = 150^\circ C$   |                  |                 |
|------|---|---------------------------------|-----------------|--------------|-------------------------------------|------------------|-----------------|
|      |   | $I_{pk}$<br>Square Pulse<br>(A) | di/dt<br>(A/μs) | $V_r$<br>(V) | $t_{rr}$<br>@ 25% $I_{RRM}$<br>(μs) | $Q_{rr}$<br>(μC) | $I_{rr}$<br>(A) |
| S20  | 2.0   | 1000                            | 50              | -50          | 3.5                                 | 250              | 120             |
| S30  | 3.0   | 1000                            | 50              | -50          | 5.0                                 | 380              | 150             |



**Thermal and Mechanical Specifications**

| Parameter   | SD453N/R   |     | Units | Conditions                                 |
|---|------------|-----|-------|--|
|   | S20        | S30 |       |  |
| T <sub>J</sub> Max. junction operating temperature range    | -40 to 150 |     | °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         |     | Nm    | Not lubricated threads                     |
| wt Approximate weight                                       | 454        |     | g     |  |
| Case style  | B-8        |     |       | See Outline Table                          |

**ΔR<sub>thJ-hs</sub> Conduction**

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

| Conduction angle | Sinusoidal conduction |       | Rectangular conduction |       | Units | Conditions                           |
|------------------|-----------------------|-------|------------------------|-------|-------|--------------------------------------|
|                  | S20                   | S30   | S20                    | S30   |       |                                      |
| 180°             | 0.010                 | 0.010 | 0.008                  | 0.008 | K/W   | T <sub>J</sub> = T <sub>J</sub> max. |
| 120°             | 0.014                 | 0.014 | 0.014                  | 0.014 |       |                                      |
| 90°              | 0.017                 | 0.017 | 0.019                  | 0.019 |       |                                      |
| 60°              | 0.025                 | 0.025 | 0.026                  | 0.026 |       |                                      |
| 30°              | 0.042                 | 0.042 | 0.042                  | 0.042 |       |                                      |

**Ordering Information Table**

**Device Code**

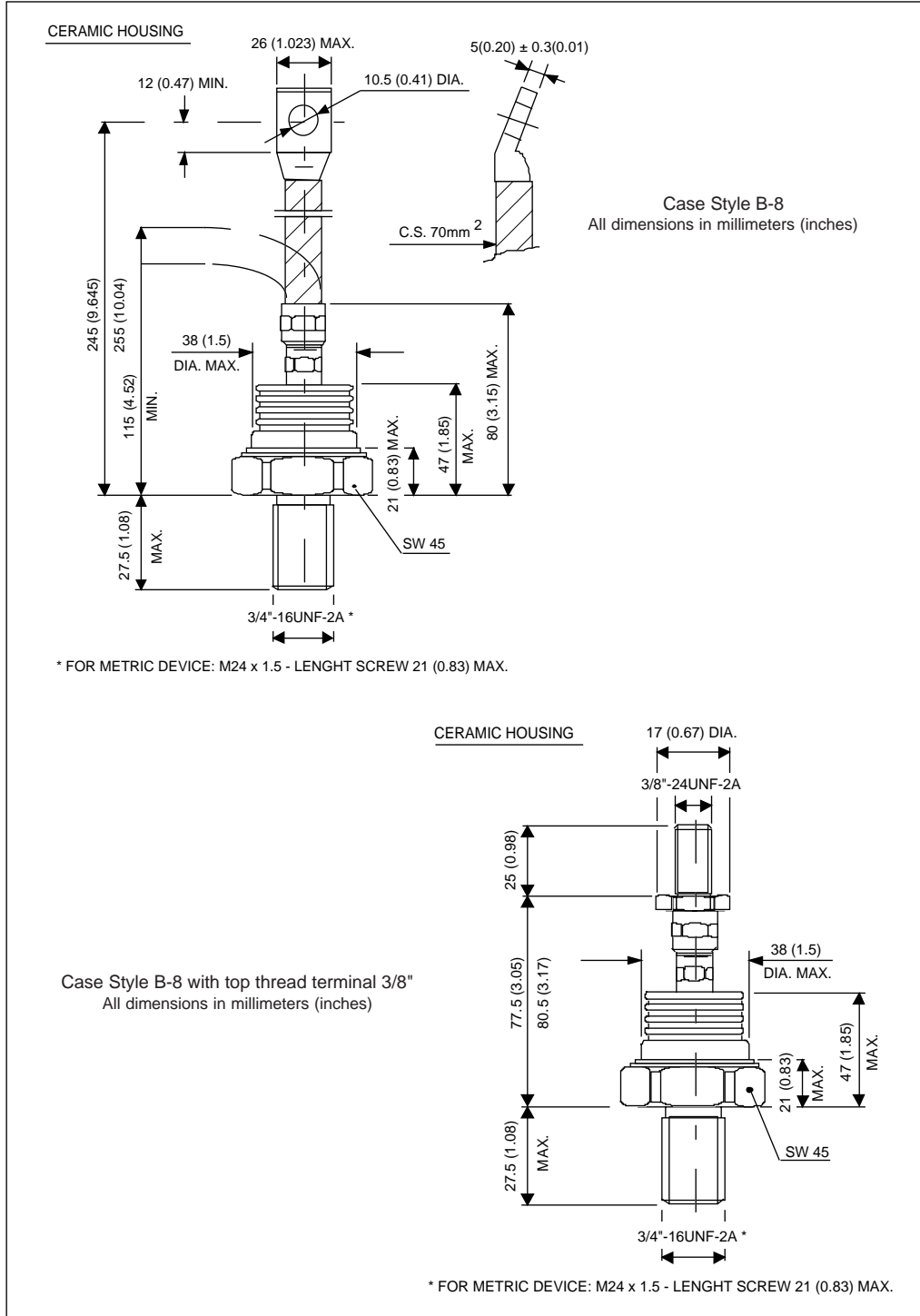
|           |           |          |          |           |            |          |          |          |
|-----------|-----------|----------|----------|-----------|------------|----------|----------|----------|
| <b>SD</b> | <b>45</b> | <b>3</b> | <b>N</b> | <b>25</b> | <b>S30</b> | <b>P</b> | <b>S</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)  
None = Not isolated lead  
T = Threaded Top Terminal 3/8" 24UNF-2A
- 9** - C = Ceramic housing

**SD453N/R Series**

Bulletin I2076 rev. A 09/94

**Outlines Table**



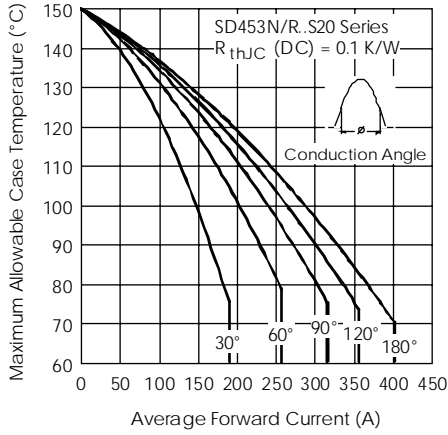


Fig. 1 - Current Ratings Characteristics

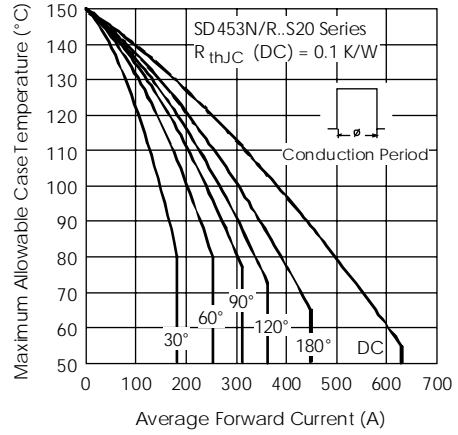


Fig. 2 - Current Ratings Characteristics

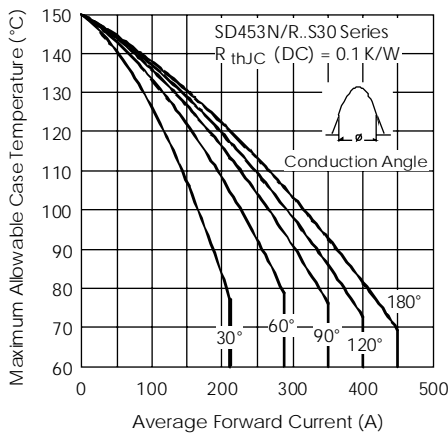


Fig. 3 - Current Ratings Characteristics

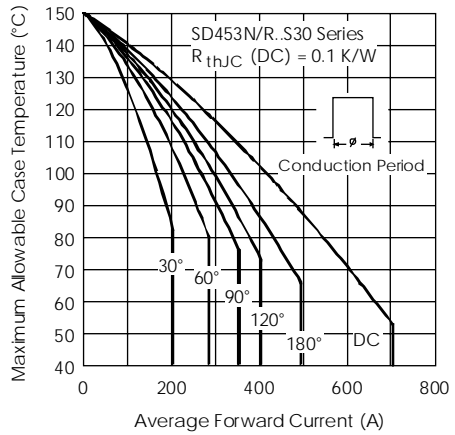


Fig. 4 - Current Ratings Characteristics

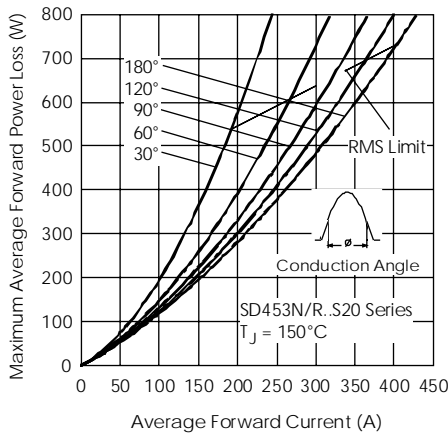


Fig. 5 - Forward Power Loss Characteristics

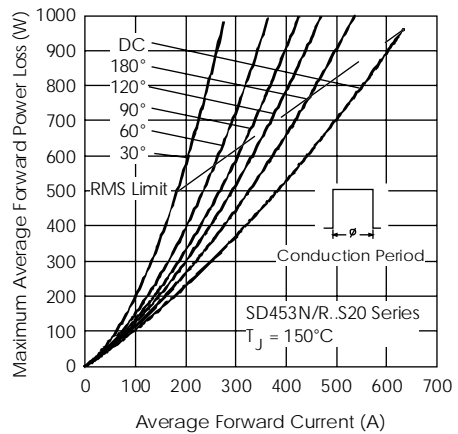


Fig. 6 - Forward Power Loss Characteristics

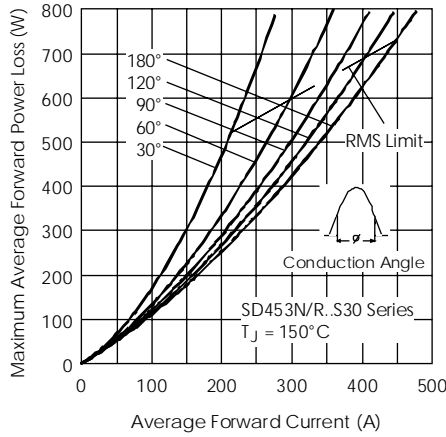


Fig. 7 - Forward Power Loss Characteristics

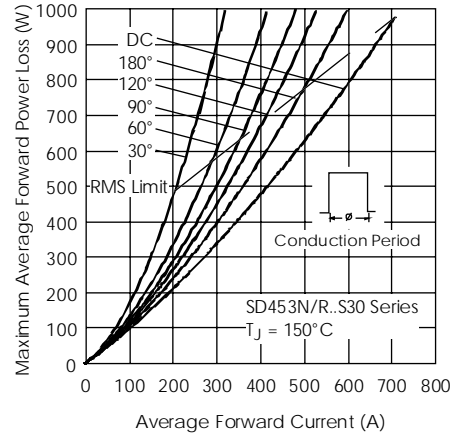


Fig. 8 - Forward Power Loss Characteristics

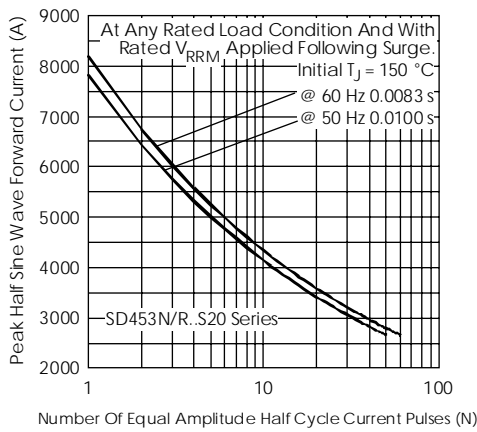


Fig. 9 - Maximum Non-repetitive Surge Current

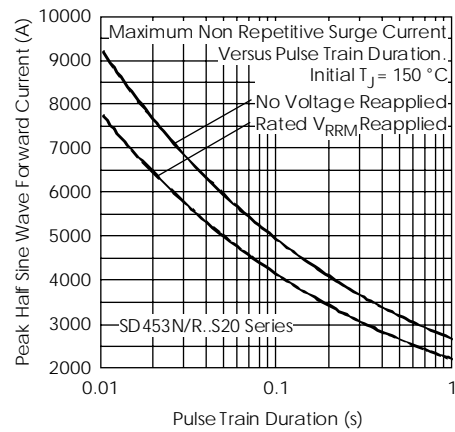


Fig. 10 - Maximum Non-repetitive Surge Current

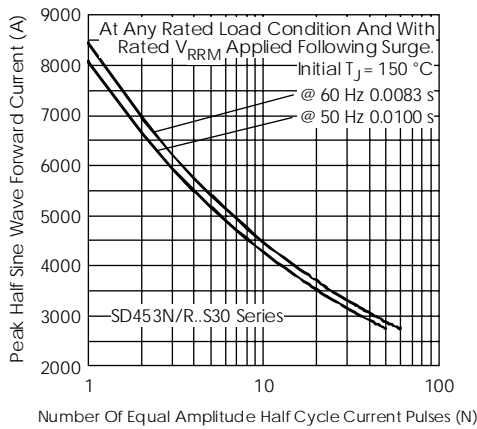


Fig. 11 - Maximum Non-repetitive Surge Current

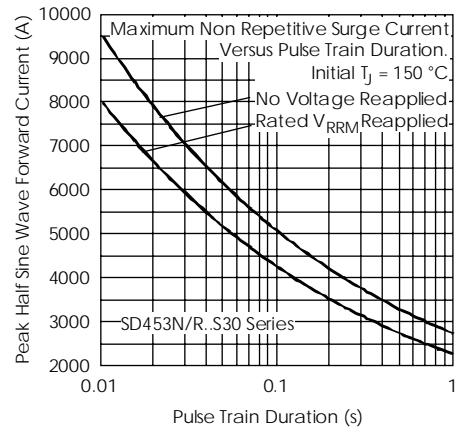


Fig. 12 - Maximum Non-repetitive Surge Current

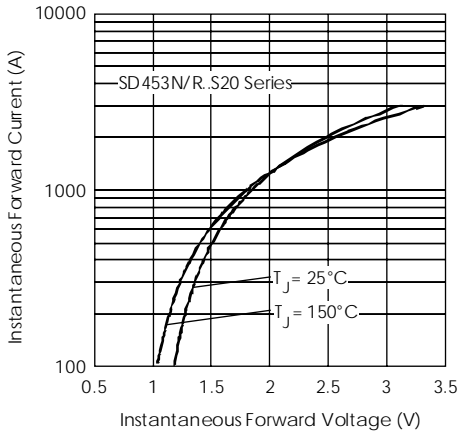


Fig. 13 - Forward Voltage Drop Characteristics

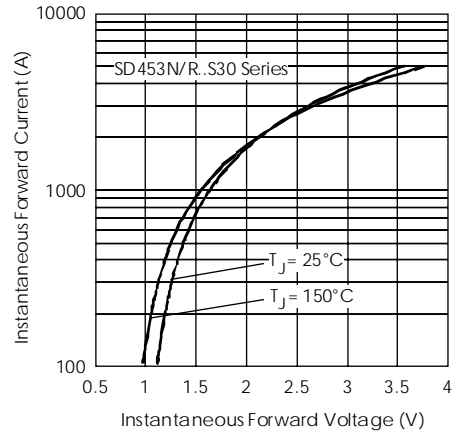


Fig. 14 - Forward Voltage Drop Characteristics

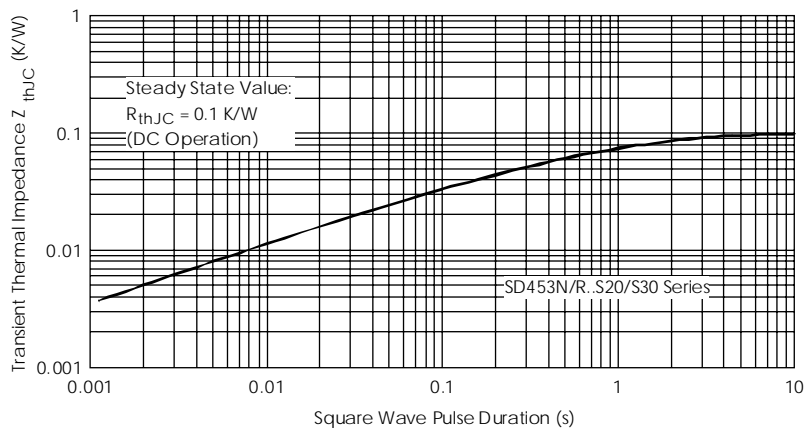


Fig. 15 - Thermal Impedance  $Z_{thJC}$  Characteristic

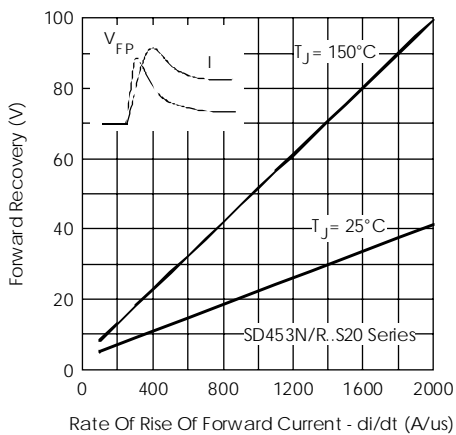


Fig. 16 - Typical Forward Recovery Characteristics

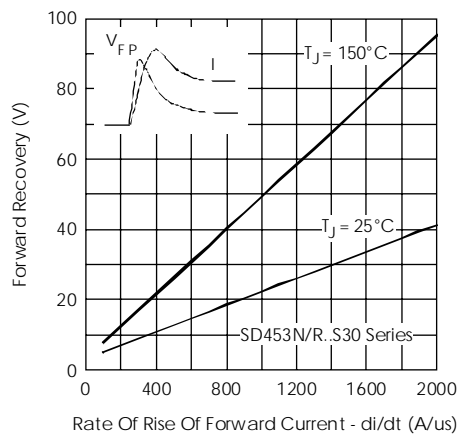


Fig. 17 - Typical Forward Recovery Characteristics

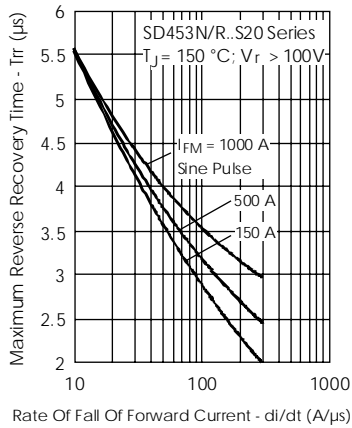


Fig. 18 - Recovery Time Characteristics

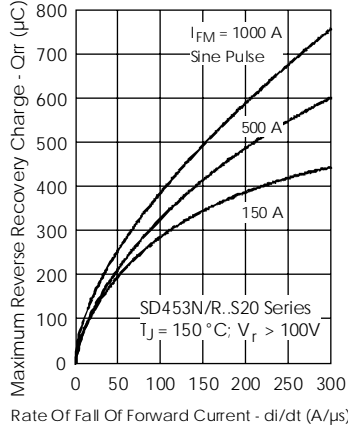


Fig. 19 - Recovery Charge Characteristics

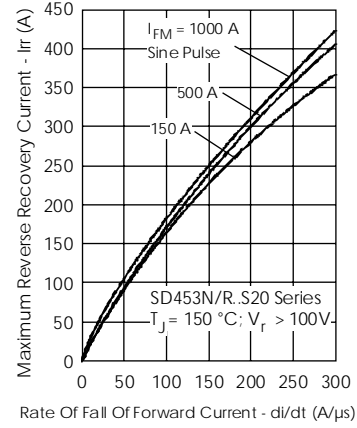


Fig. 20 - Recovery Current Characteristics

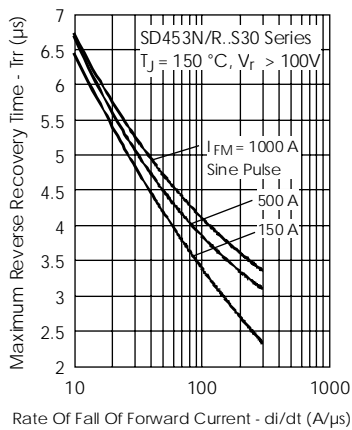


Fig. 21 - Recovery Time Characteristics

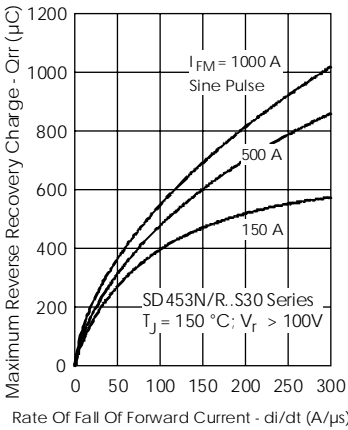


Fig. 22 - Recovery Charge Characteristics

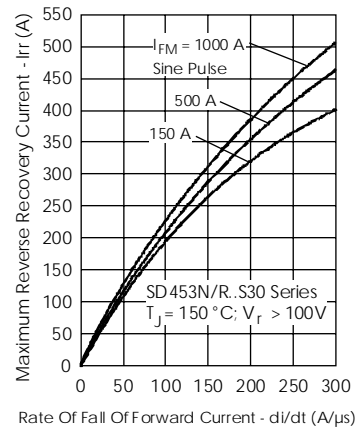


Fig. 23 - Recovery Current Characteristics

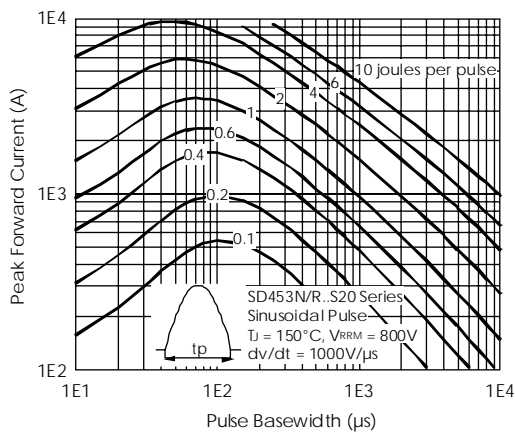


Fig. 24 - Maximum Total Energy Loss Per Pulse Characteristics

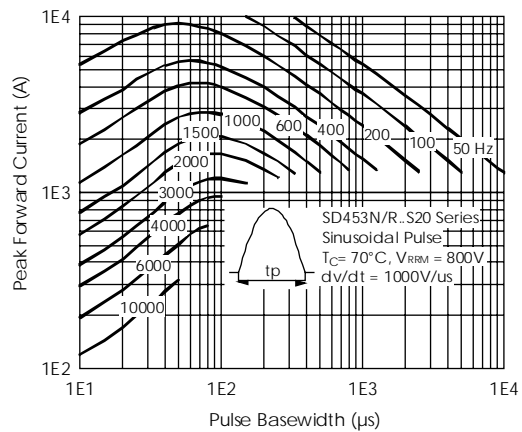


Fig. 25 - Frequency Characteristics



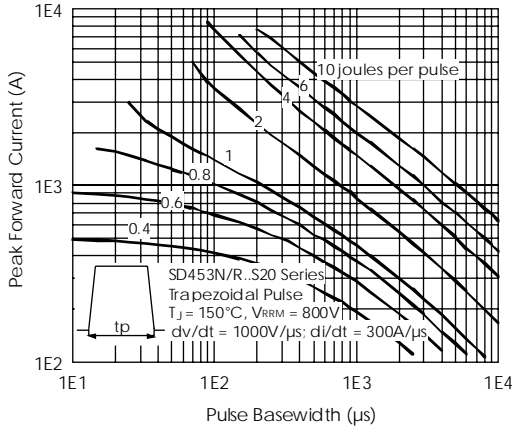


Fig. 26 - Maximum Total Energy Loss Per Pulse Characteristics

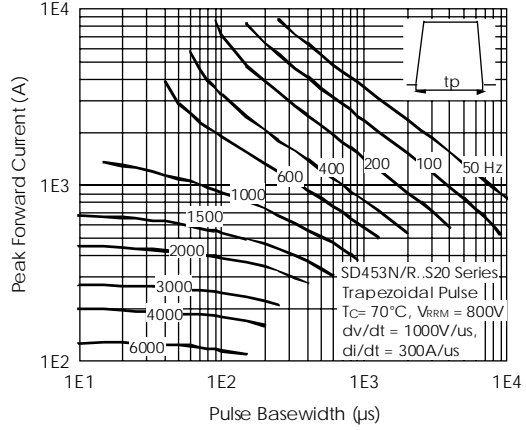


Fig. 27 - Frequency Characteristics

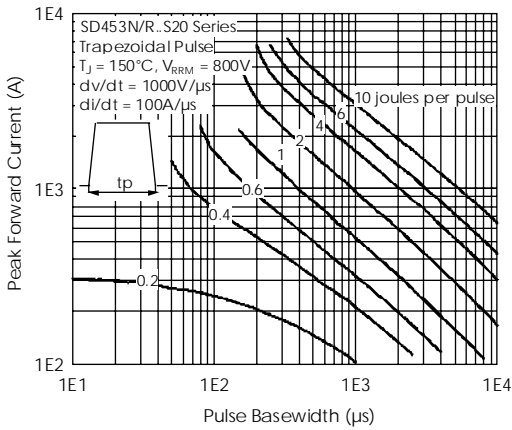


Fig. 28 - Maximum Total Energy Loss Per Pulse Characteristics

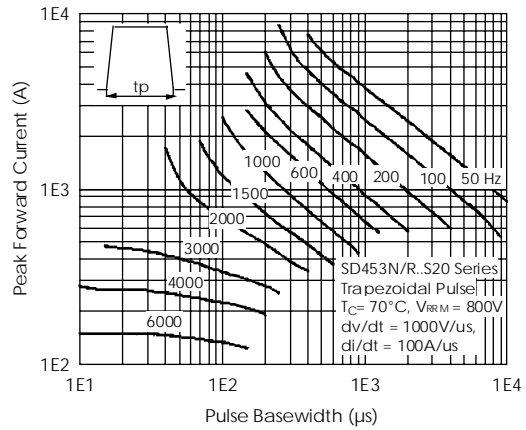


Fig. 29 - Frequency Characteristics

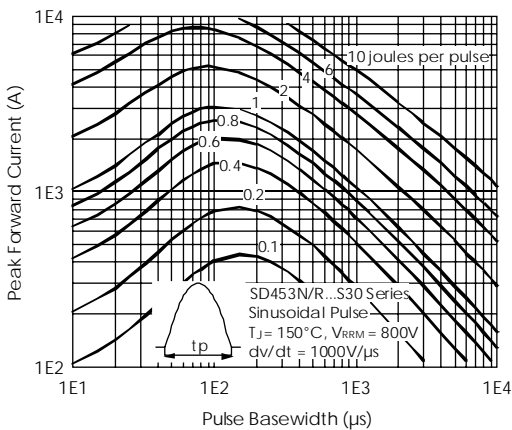


Fig. 30 - Maximum Total Energy Loss Per Pulse Characteristics

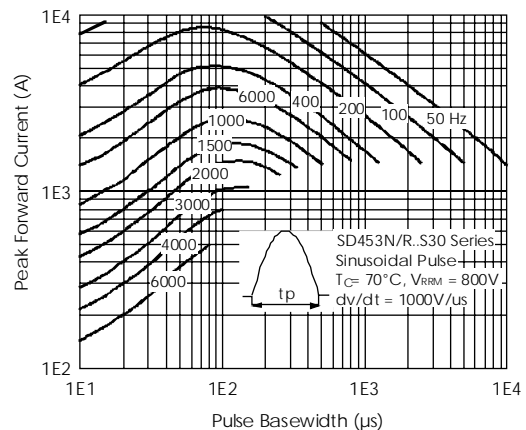


Fig. 31 - Frequency Characteristics

**SD453N/R Series**

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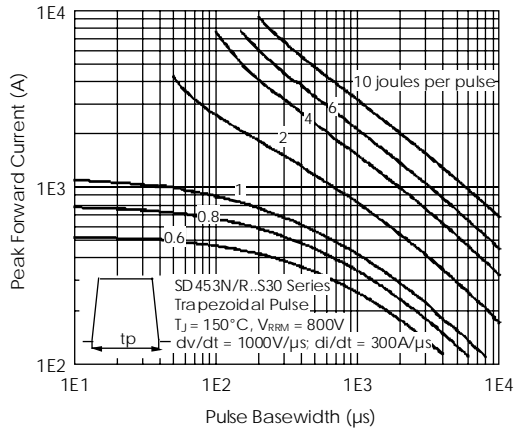


Fig. 32 - Maximum Total Energy Loss Per Pulse Characteristics

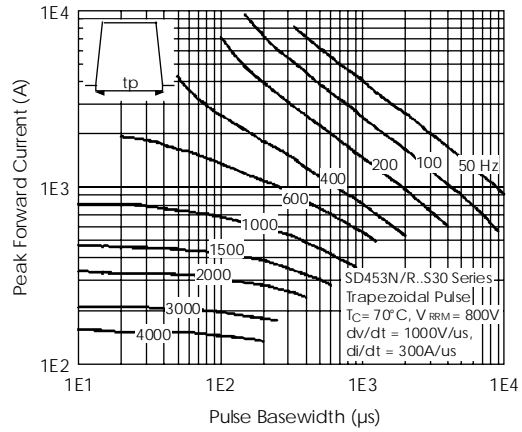


Fig. 33 - Frequency Characteristics

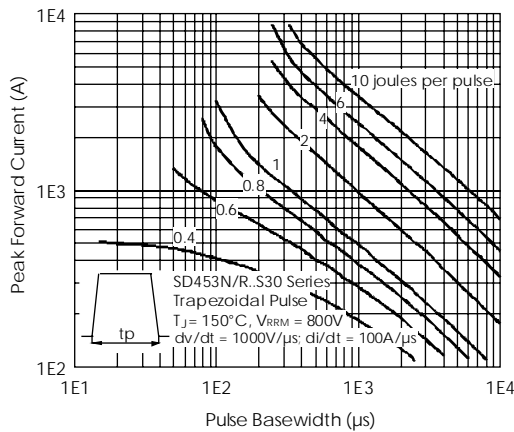


Fig. 34 - Maximum Total Energy Loss Per Pulse Characteristics

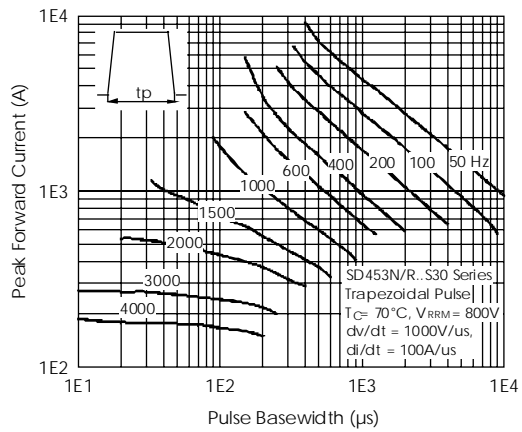


Fig. 35 - Frequency Characteristics