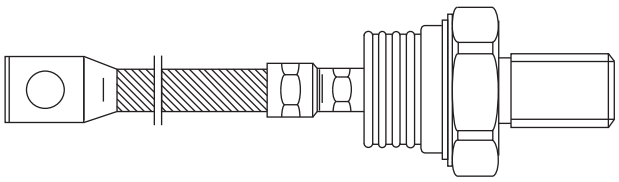
# Fast Recovery Diodes (Stud Version), 400 A, 450 A



B-8

## FEATURES

- High power fast recovery diode series
- 2.0 µs to 3.0 µs recovery time
- High voltage ratings up to 2500 V
- 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
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free

RoHS COMPLIANT

| PRODUCT SUMMARY | |
|---|---|
| $I_{F(AV)}$ | 400 A, 450 A |
| Package | B-8 |
| Circuit configuration | Single diode |

## TYPICAL APPLICATIONS

- Snubber diode for GTO
- High voltage freewheeling diode
- Fast recovery rectifier applications

| MAJOR RATINGS AND CHARACTERISTICS | | | | |
|---|---|---|---|---|
| PARAMETER | TEST CONDITIONS | SD453N/R | | UNITS |
| | | S20 | S30 | |
| $I_{F(AV)}$ | | 400 | 450 | A |
| | $T_C$ | 70 | 70 | °C |
| $I_{F(RMS)}$ | | 630 | 710 | A |
| $I_{FSM}$ | 50 Hz | 9300 | 9600 | |
| | 60 Hz | 9730 | 10 050 | |
| $V_{RRM}$ | Range | 1200 to 2500 | 1200 to 2500 | V |
| $t_{rr}$ | | 2.0 | 3.0 | µs |
| | $T_J$ | 25 | 25 | °C |
| $T_J$ | | - 40 to 150 | - 40 to 150 | |

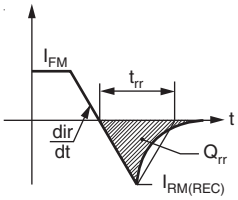
## ELECTRICAL SPECIFICATIONS

| VOLTAGE RATINGS | | | | |
|---|---|---|---|---|
| TYPE NUMBER | VOLTAGE CODE | $V_{RRM}$, MAXIMUM REPETITIVE PEAK REVERSE VOLTAGE V | $V_{RSM}$, MAXIMUM NON-REPETITIVE PEAK REVERSE VOLTAGE V | $I_{RRM}$ MAXIMUM AT $T_J = T_J$ MAXIMUM mA |
| VS-SD453N/R | 12 | 1200 | 1300 | 50 |
| | 16 | 1600 | 1700 | |
| | 20 | 2000 | 2100 | |
| | 25 | 2500 | 2600 | |

## FORWARD CONDUCTION

| PARAMETER | SYMBOL | TEST CONDITIONS | | | SD453N/R S20 | SD453N/R S30 | UNITS |
|---|---|---|---|---|---|---|---|
| Maximum average forward current at case temperature | $I_{F(AV)}$ | 180° conduction, half sine wave | | | 400 | 450 | A |
| | | | | | 70 | 70 | °C |
| Maximum RMS forward current at case temperature | $I_{F(RMS)}$ | | | | 630 | 710 | A |
| | | | | | 55 | 52 | °C |
| Maximum peak, one-cycle forward, non-repetitive surge current | $I_{FSM}$ | t = 10 ms | No voltage reapplied | Sinusoidal half wave, initial $T_J = T_J$ maximum | 9300 | 9600 | A |
| | | t = 8.3 ms | | | 9730 | 10 050 | |
| | | t = 10 ms | 100 % $V_{RRM}$ reapplied | | 7820 | 8070 | |
| | | t = 8.3 ms | | | 8190 | 8450 | |
| Maximum $I^2t$ for fusing | $I^2t$ | t = 10 ms | No voltage reapplied | | 432 | 460 | $kA^2s$ |
| | | t = 8.3 ms | | | 395 | 420 | |
| | | t = 10 ms | 100 % $V_{RRM}$ reapplied | | 306 | 326 | |
| | | t = 8.3 ms | | | 279 | 297 | |
| Maximum $I^2\sqrt{t}$ for fusing | $I^2\sqrt{t}$ | t = 0.1 to 10 ms, no voltage reapplied | | | 4320 | 4600 | $kA^2\sqrt{s}$ |
| Low level value of threshold voltage | $V_{F(TO)1}$ | (16.7 % x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$), $T_J = T_J$ maximum | | | 1.00 | 0.95 | V |
| High level value of threshold voltage | $V_{F(TO)2}$ | (I > π x $I_{F(AV)}$), $T_J = T_J$ maximum | | | 1.09 | 1.04 | |
| Low level value of forward slope resistance | $r_{f1}$ | (16.7 % x π x $I_{F(AV)}$ < I < π x $I_{F(AV)}$), $T_J = T_J$ maximum | | | 0.80 | 0.60 | mW |
| High level value of forward slope resistance | $r_{f2}$ | (I > π x $I_{F(AV)}$), $T_J = T_J$ maximum | | | 0.74 | 0.54 | |
| Maximum forward voltage drop | $V_{FM}$ | $I_{pk}$ = 1500 A, $T_J = T_J$ maximum, $t_p$ = 10 ms sinusoidal wave | | | 2.20 | 1.85 | V |

## RECOVERY CHARACTERISTICS

| CODE | MAXIMUM VALUE AT $T_J$ = 25 °C | TEST CONDITIONS | | | TYPICAL VALUES AT $T_J$ = 150 °C | | | |
|---|---|---|---|---|---|---|---|---|
| | $t_{rr}$ AT 25 % $I_{RRM}$ (µs) | $I_{pk}$ SQUARE PULSE (A) | dI/dt (A/µs) | $V_r$ (V) | $t_{rr}$ AT 25 % $I_{RRM}$ (µs) | $Q_{rr}$ (µC) | $I_{rr}$ (A) |  |
| S20 | 2.0 | 1000 | 50 | - 50 | 3.5 | 250 | 120 | |
| S30 | 3.0 | | | | 5.0 | 380 | 150 | |



## THERMAL AND MECHANICAL SPECIFICATIONS

| PARAMETER | SYMBOL | TEST CONDITIONS | VALUES | UNITS |
|---|---|---|---|---|
| Maximum junction operating and storage temperature range | $T_J$, $T_{Stg}$ | | - 40 to 150 | °C |
| Maximum thermal resistance, junction to case | $R_{thJC}$ | DC operation | 0.1 | K/W |
| Maximum thermal resistance, case to heatsink | $R_{thCS}$ | Mounting surface, smooth, flat and greased | 0.04 | |
| Mounting torque ± 10 % | | Not-lubricated threads | 50 | Nm |
| Approximate weight | | | 454 | g |
| Case style | | See dimensions (link at the end of datasheet) | B-8 | |

## $\Delta R_{thJC}$ CONDUCTION

| CONDUCTION ANGLE | SINUSOIDAL CONDUCTION | RECTANGULAR CONDUCTION | TEST CONDITIONS | UNITS |
|---|---|---|---|---|
| 180° | 0.010 | 0.008 | $T_J = T_J$ maximum | K/W |
| 120° | 0.014 | 0.014 | | |
| 90° | 0.017 | 0.019 | | |
| 60° | 0.025 | 0.026 | | |
| 30° | 0.042 | 0.042 | | |

**Note**

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

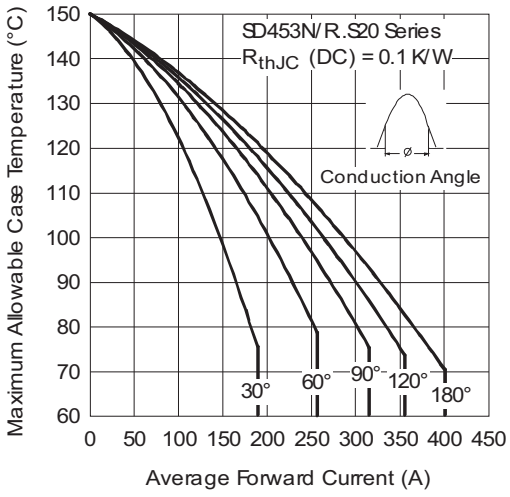



Fig. 1 - Current Ratings Characteristics

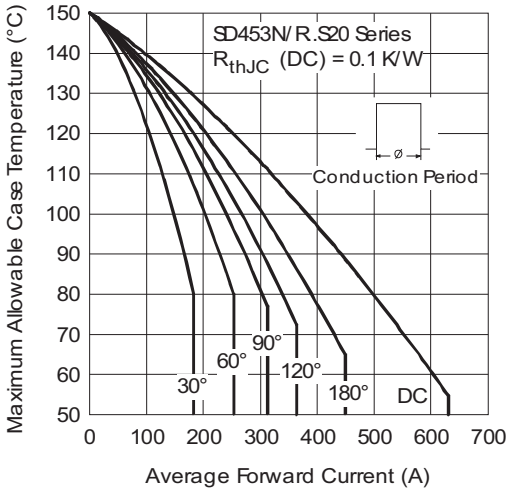



Fig. 2 - Current Ratings Characteristics

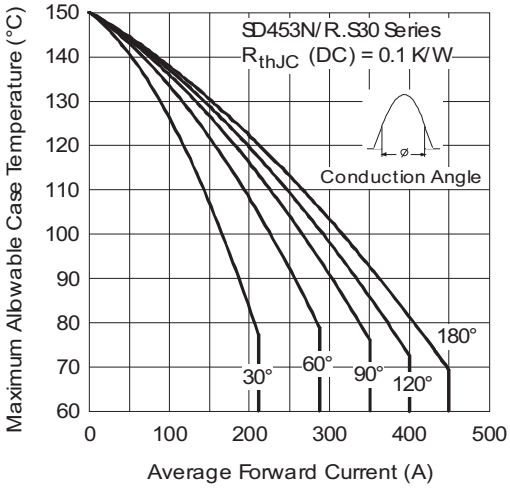



Fig. 3 - Current Ratings Characteristics

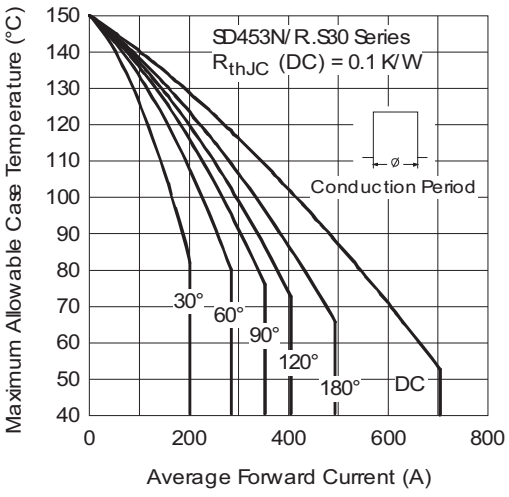



Fig. 4 - Current Ratings Characteristics

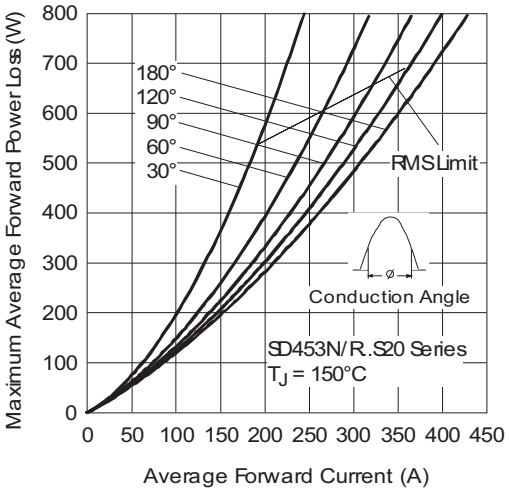



Fig. 5 - Forward Power Loss Characteristics

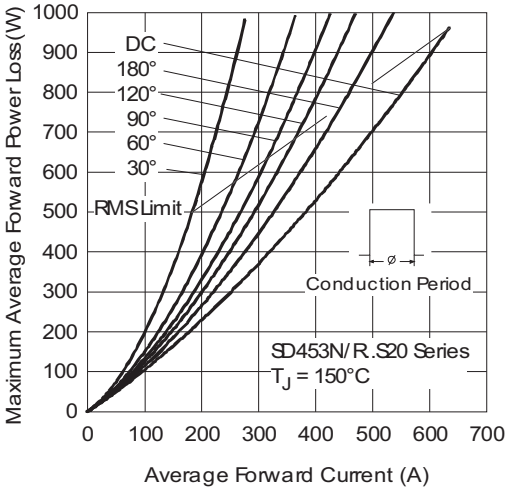



Fig. 6 - Forward Power Loss Characteristics

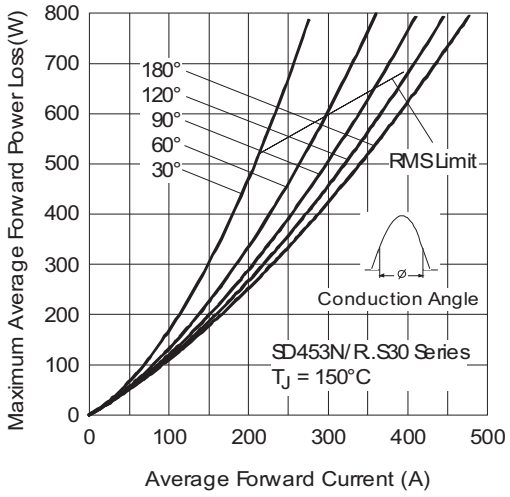



Fig. 7 - Forward Power Loss Characteristics

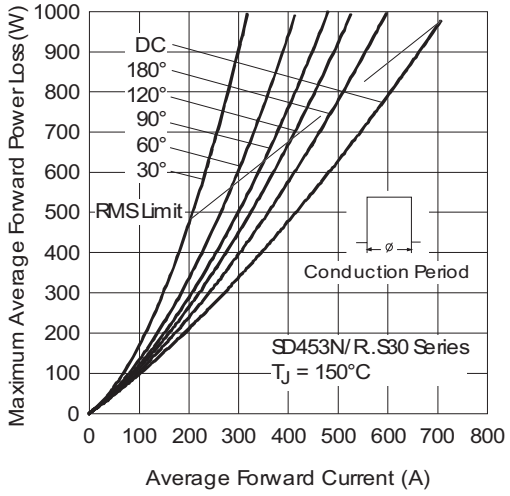



Fig. 8 - Forward Power Loss Characteristics

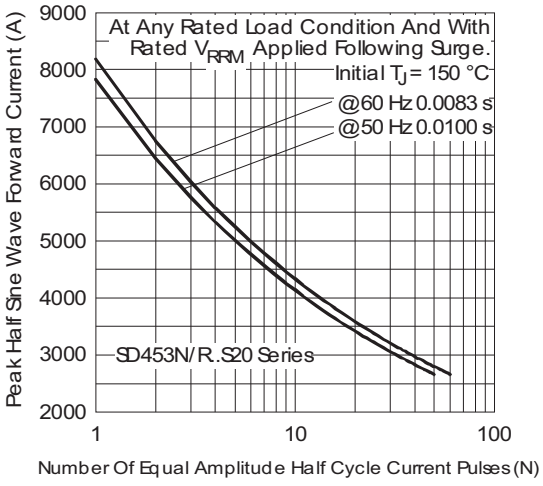



Fig. 9 - Maximum Non-Repetitive Surge Current




Fig. 10 - Maximum Non-Repetitive Surge Current

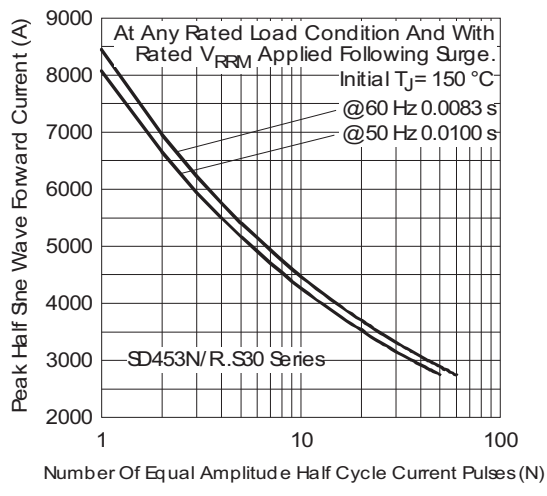



Fig. 11 - Maximum Non-Repetitive Surge Current




Fig. 12 - Maximum Non-Repetitive Surge Current

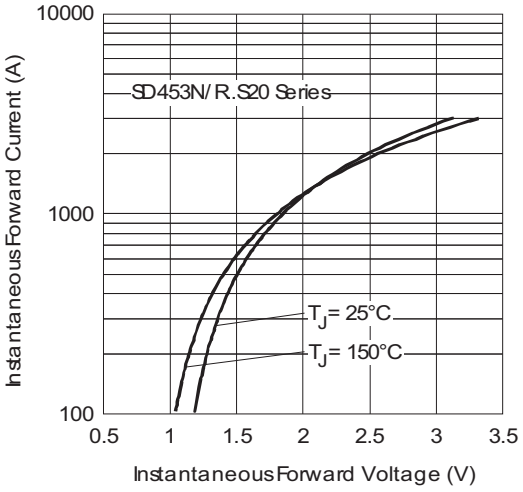



Fig. 13 - Forward Voltage Drop Characteristics

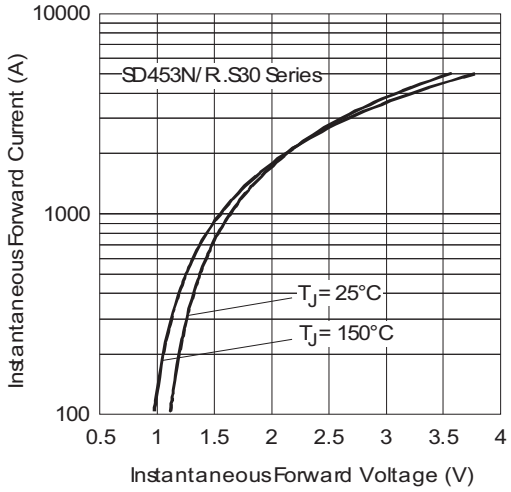



Fig. 14 - Forward Voltage Drop Characteristics

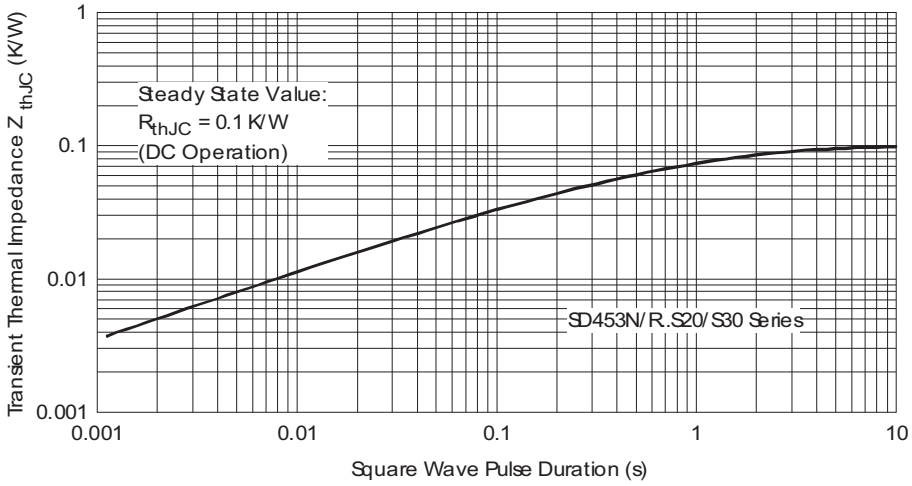



Fig. 15 - Thermal Impedance $Z_{thJC}$ Characteristic

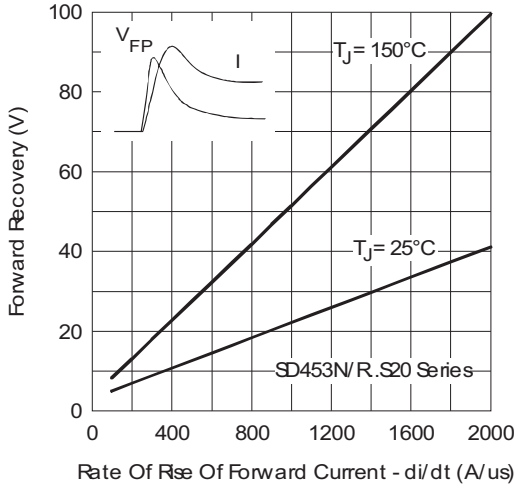



Fig. 16 - Typical Forward Recovery Characteristics

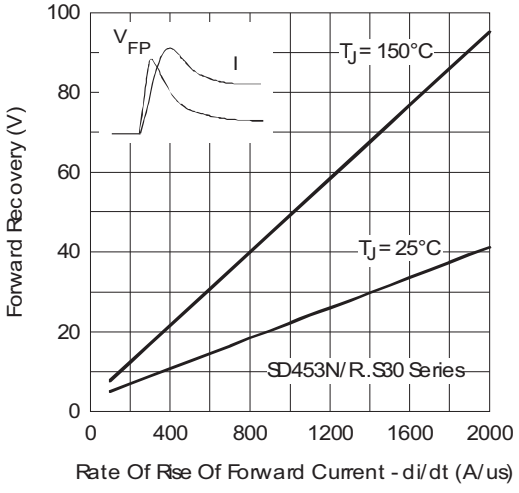



Fig. 17 - Typical Forward Recovery Characteristics

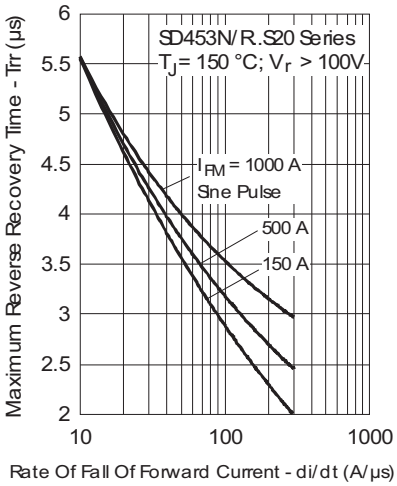



Fig. 18 - Recovery Time Characteristics

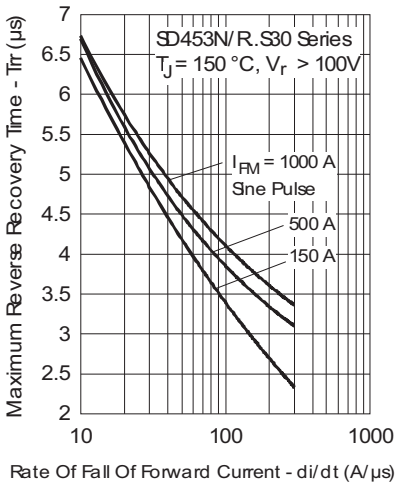



Fig. 21 - Recovery Time Characteristics

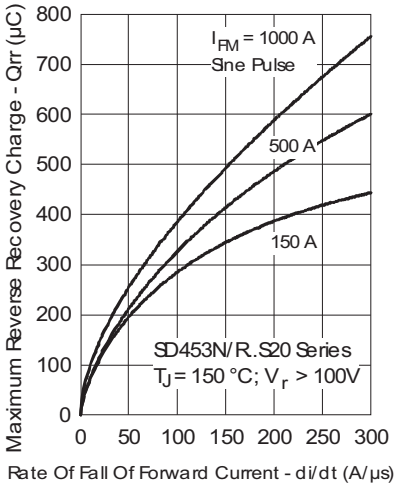



Fig. 19 - Recovery Charge Characteristics

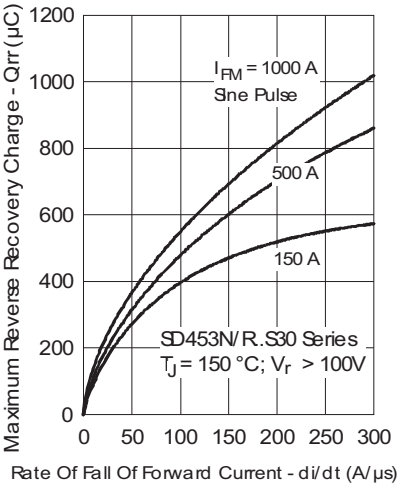



Fig. 22 - Recovery Charge Characteristics

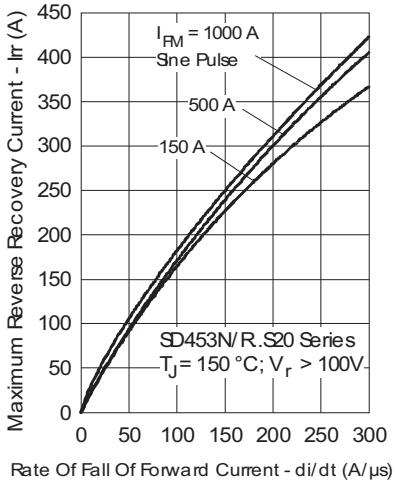



Fig. 20 - Recovery Current Characteristics

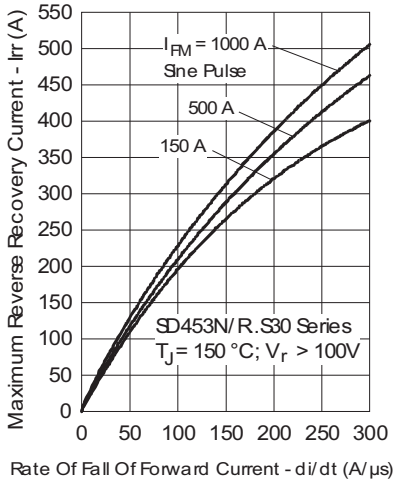



Fig. 23 - Recovery Current Characteristics

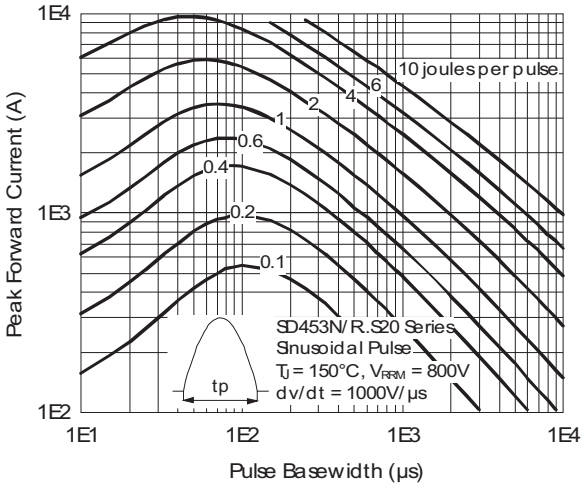



Fig. 24 - Maximum Total Energy Loss Per Pulse Characteristics

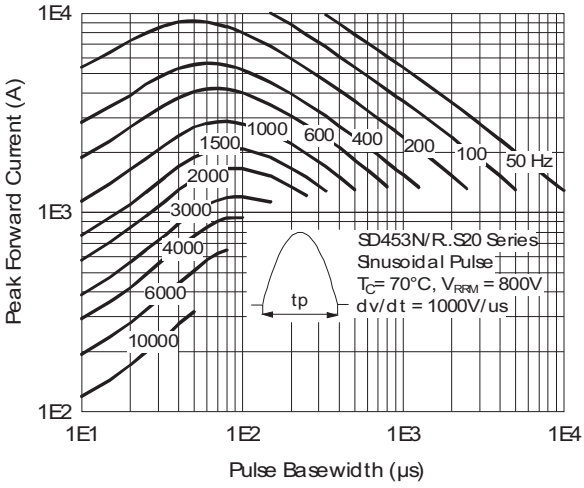



Fig. 25 - Frequency Characteristics

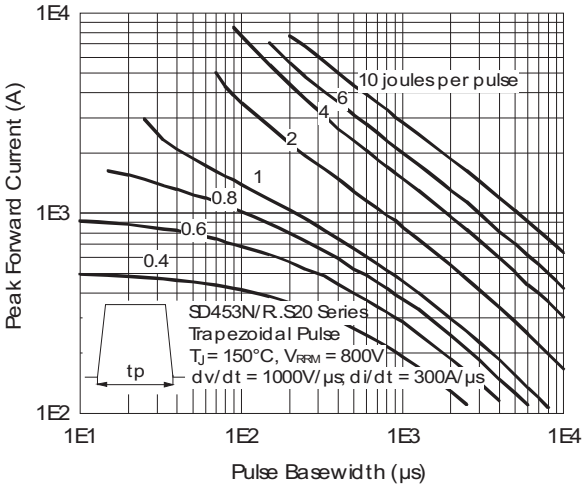



Fig. 26 - Maximum Total Energy Loss Per Pulse Characteristics

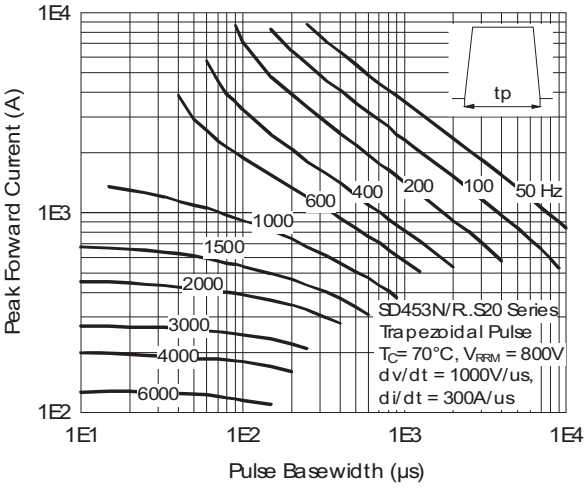



Fig. 27 - Frequency Characteristics

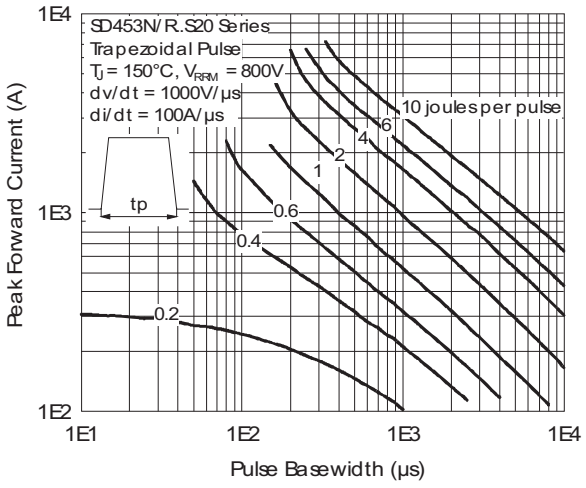



Fig. 28 - Maximum Total Energy Loss Per Pulse Characteristics

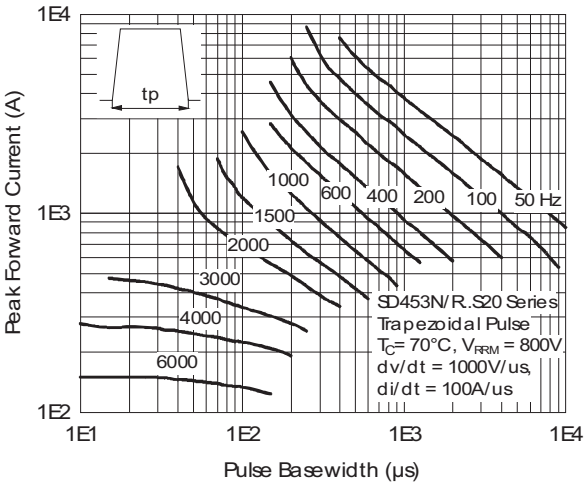



Fig. 29 - Frequency Characteristics

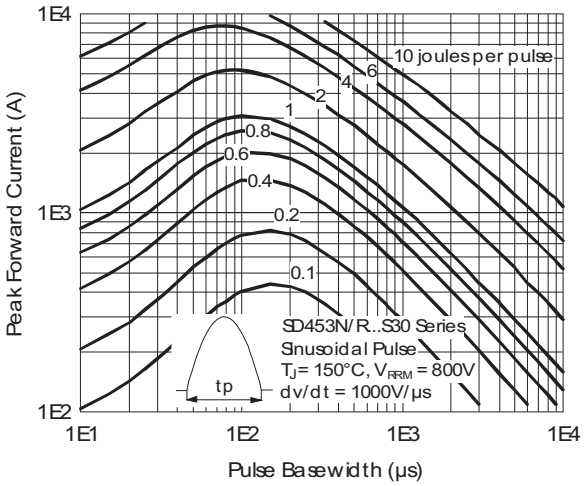



Fig. 30 - Maximum Total Energy Loss Per Pulse Characteristics

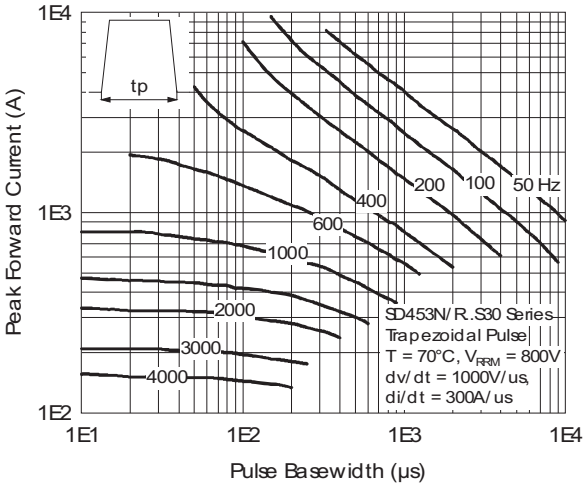



Fig. 33 - Frequency Characteristics

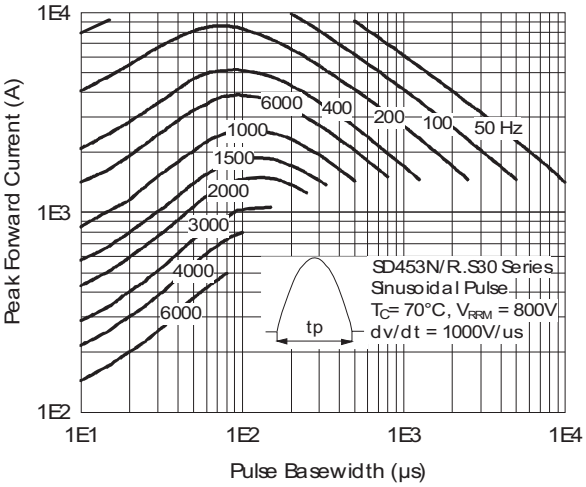



Fig. 31 - Frequency Characteristics

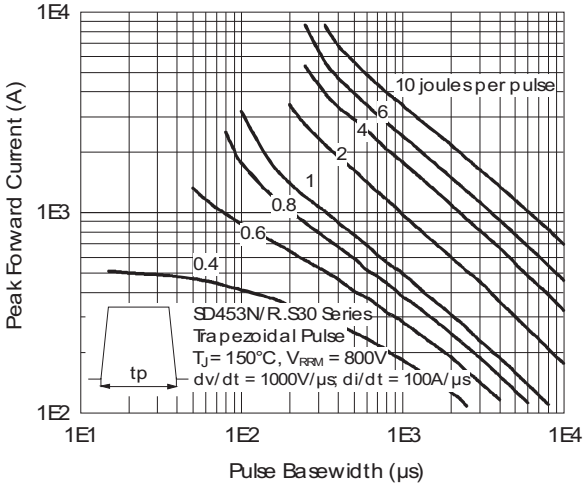



Fig. 34 - Maximum Total Energy Loss Per Pulse Characteristics

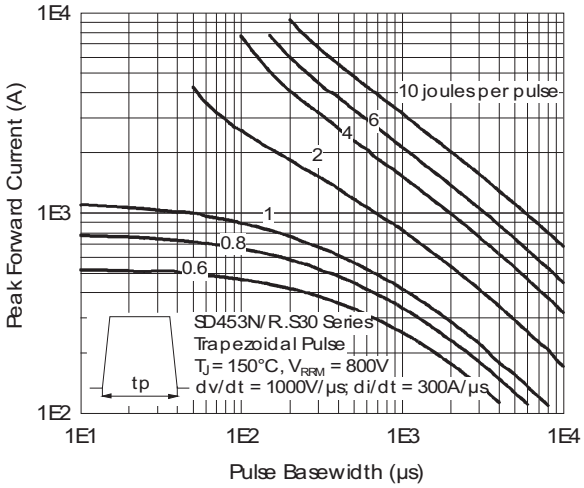



Fig. 32 - Maximum Total Energy Loss Per Pulse Characteristics

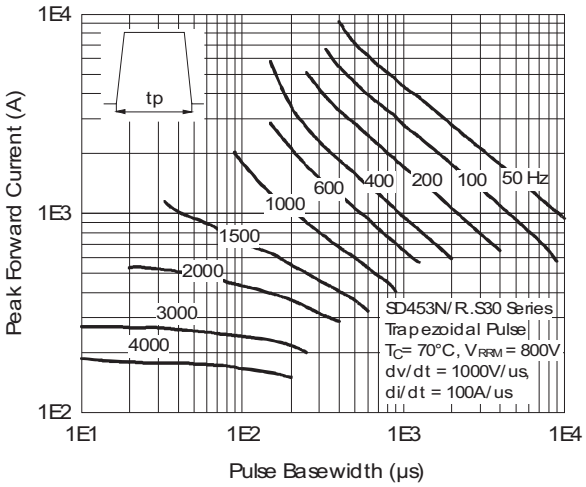



Fig. 35 - Frequency Characteristics

## ORDERING INFORMATION TABLE

**Device code**

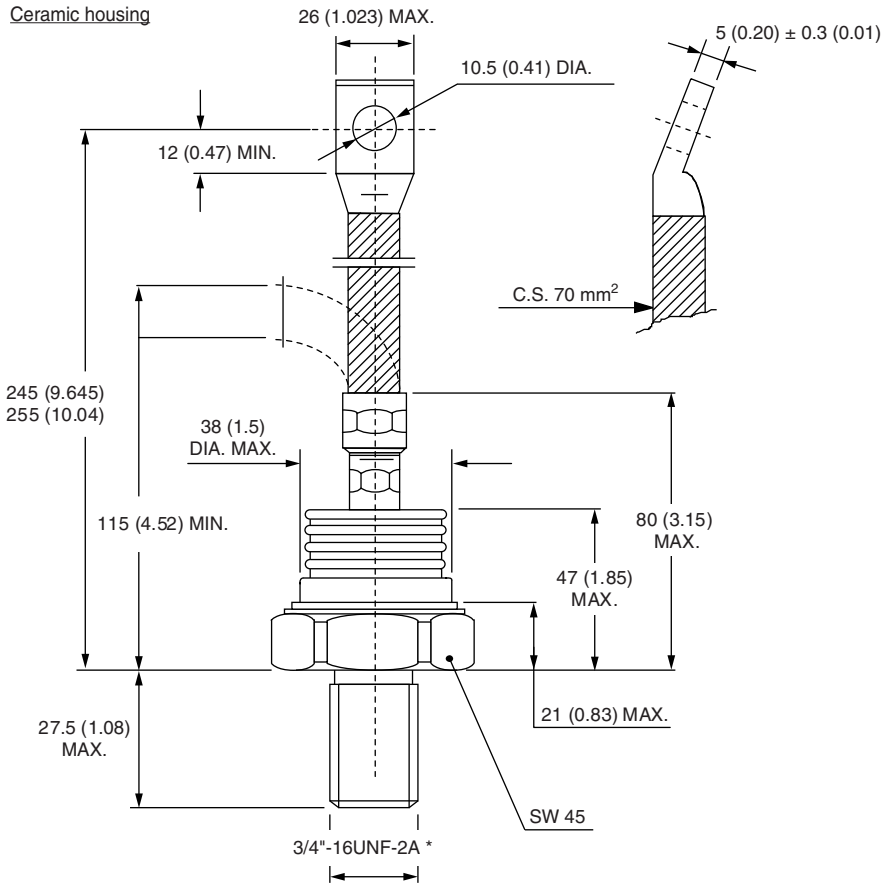
| VS- | SD | 45 | 3 | N | 25 | S30 | P | S | C |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

- 1 - Vishay Semiconductors product
- 2 - Diode
- 3 - Essential part number
- 4 - 3 = Fast recovery
- 5 - • N = Stud normal polarity (cathode to stud)
  • R = Stud reverse polarity (anode to stud)
- 6 - Voltage code x 100 = $V_{RRM}$ (see Voltage Ratings table)
- 7 - $t_{rr}$ code (see Recovery Characteristics table)
- 8 - • P = Stud base B-8 3/4" 16UNF-2A
  • M = Stud base B-8 M24 x 1.5
- 9 - • S = Isolated lead with silicon sleeve
  (red = Reverse polarity; blue = Normal polarity)
  • None = Not isolated lead
  • T = Threaded top terminal 3/8" 24UNF-2A
- 10 - C = Ceramic housing

| LINKS TO RELATED DOCUMENTS | |
|---|---|
| Dimensions | www.vishay.com/doc?95303 |

# B-8

**DIMENSIONS** in millimeters (inches)




*For metric device: M24 x 1.5 - length 21 (0.83) MAX.
contact factory

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