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***DISCRETE POWER DIODES and THYRISTORS***  
***DATA BOOK***

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## 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

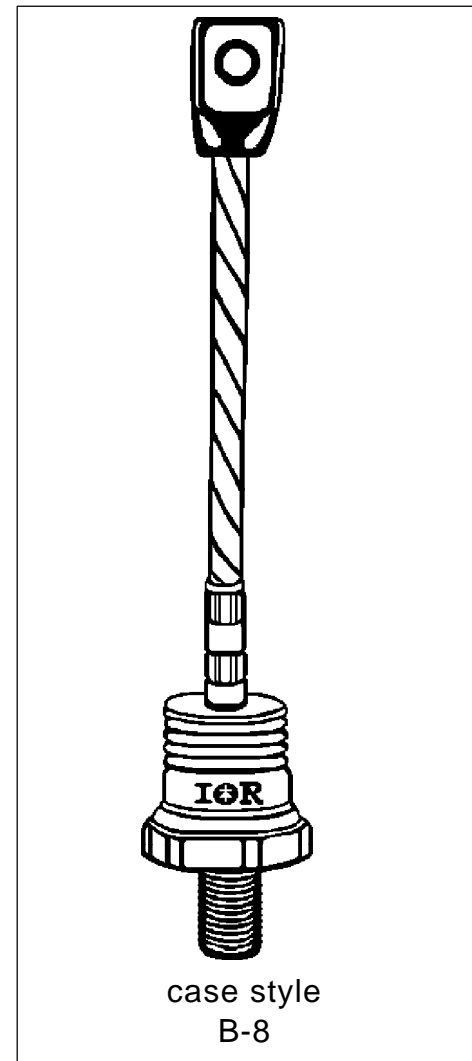
235A

### 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 V	$V_{RSM}$ , maximum non-repetitive peak voltage V	$I_{RRM}$ max. $T_J = 125^\circ\text{C}$ mA
SD233N/R	30	3000	3100	50
	36	3600	3700	
	40	4000	4100	
	45	4500	4600	

## Forward Conduction

Parameter	SD233N/R	Units	Conditions
$I_{F(AV)}$ Max. average forward current @ 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 reappplied
	5760		t = 8.3ms
	4630		t = 10ms 50% $V_{RRM}$ reappplied
	4840		t = 8.3ms
$I^2t$ Maximum $I^2t$ for fusing	151	KA <sup>2</sup> s	t = 10ms No voltage reappplied
	138		t = 8.3ms
	107		t = 10ms 50% $V_{RRM}$ reappplied
	98		t = 8.3ms
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	1510	KA <sup>2</sup> /s	t = 0.1 to 10ms, no voltage reappplied
$V_{F(TO)1}$ Low level of threshold voltage	1.56	V	(16.7% $\times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)}$ ), $T_J = T_J$ max.
$V_{F(TO)2}$ High level of threshold voltage	1.68		( $I > \pi \times I_{F(AV)}$ ), $T_J = T_J$ max.
$r_{f1}$ Low level of forward slope resistance	1.64	mΩ	(16.7% $\times \pi \times I_{F(AV)} < I < \pi \times I_{F(AV)}$ ), $T_J = T_J$ max.
$r_{f2}$ High level of forward slope resistance	1.53		( $I > \pi \times I_{F(AV)}$ ), $T_J = T_J$ 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	$T_J = 25^\circ\text{C}$ typical $t_{rr}$ @ 25% $I_{RRM}$ ( $\mu\text{s}$ )	Test conditions			Max. values @ $T_J = 125^\circ\text{C}$			
		$I_{pk}$ Square Pulse (A)	$di/dt$ (*) (A/ $\mu\text{s}$ )	$V_r$ (V)	$t_{rr}$ @ 25% $I_{RRM}$ ( $\mu\text{s}$ )	$Q_{rr}$ ( $\mu\text{C}$ )	$I_{rr}$ (A)	
S50	5.0	1000	100	-50	4.5	680	240	

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

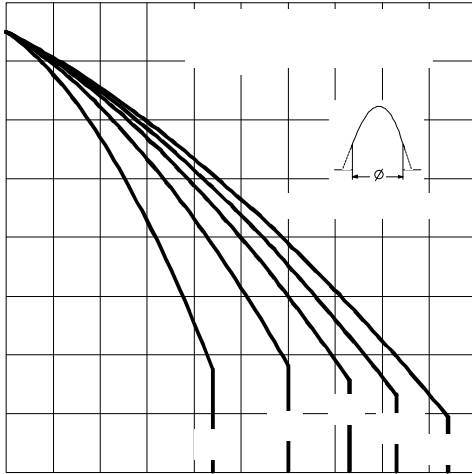


Fig. 1 - Current Ratings Characteristics

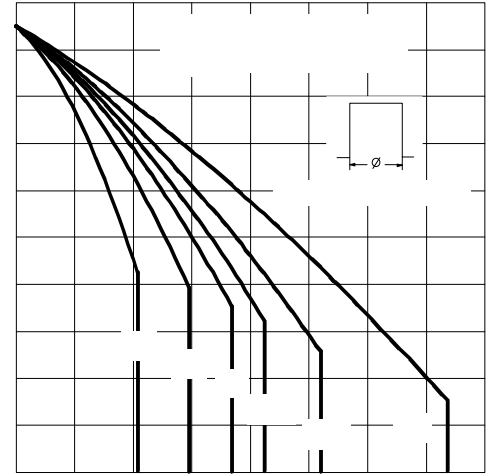


Fig. 2 - Current Ratings Characteristics

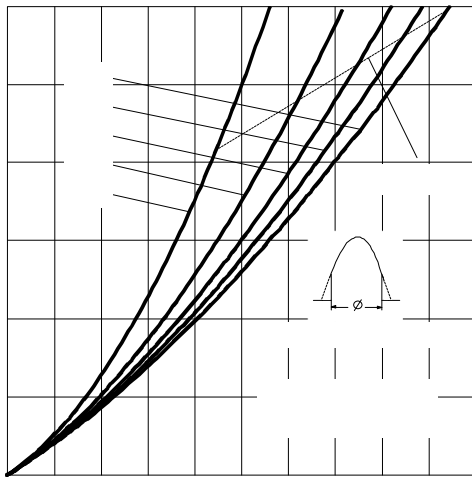


Fig. 3 - Forward Power Loss Characteristics

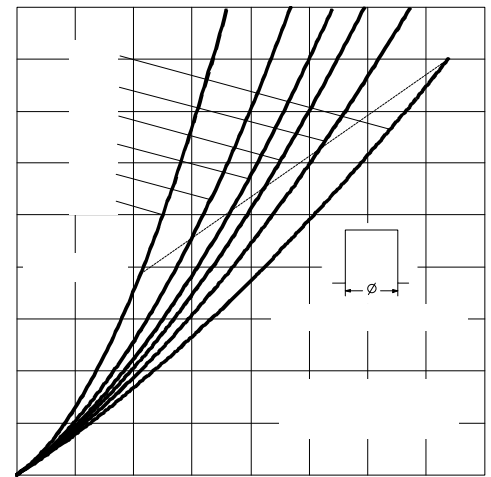


Fig. 4 - Forward Power Loss Characteristics

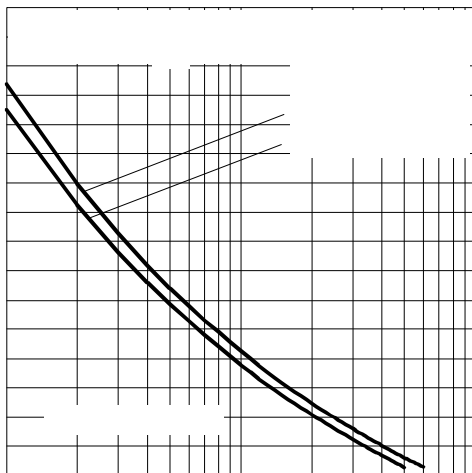


Fig. 5 - Maximum Non-repetitive Surge Current

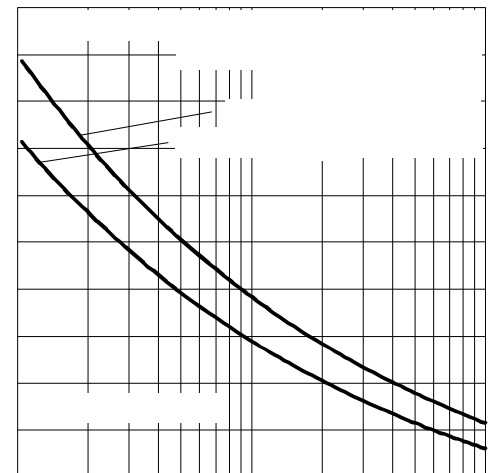


Fig. 6 - Maximum Non-repetitive Surge Current

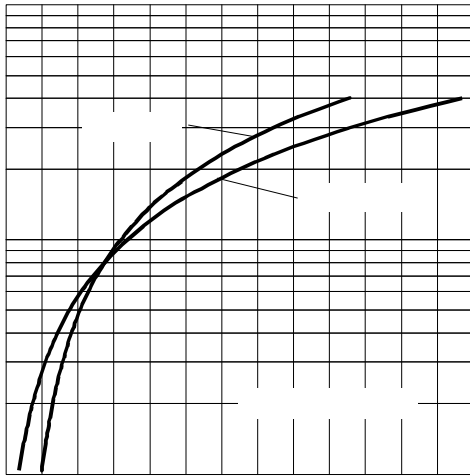


Fig. 7 - Forward Voltage Drop Characteristics

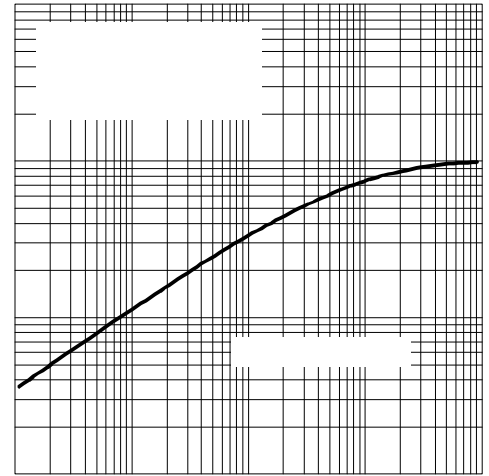


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

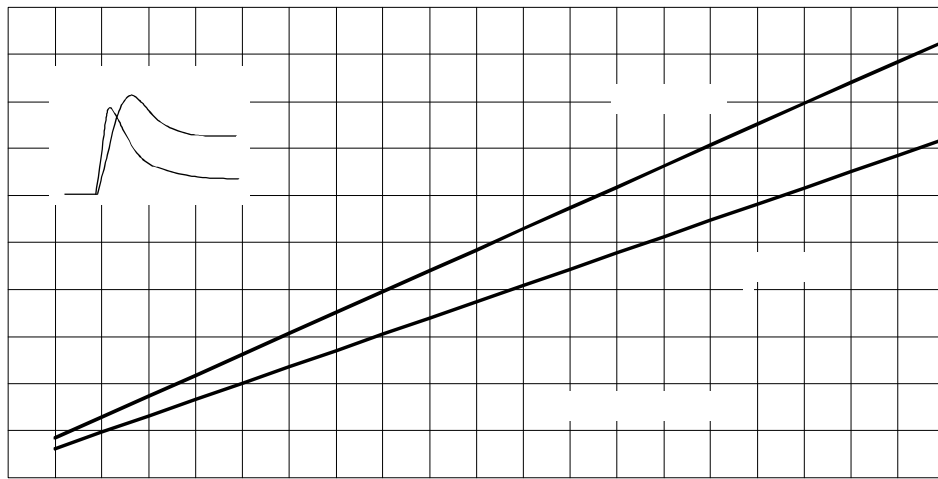


Fig. 9 - Typical Forward Recovery Characteristics

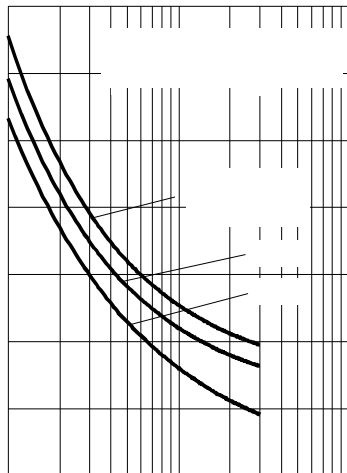


Fig. 10 - Recovery Time Characteristics

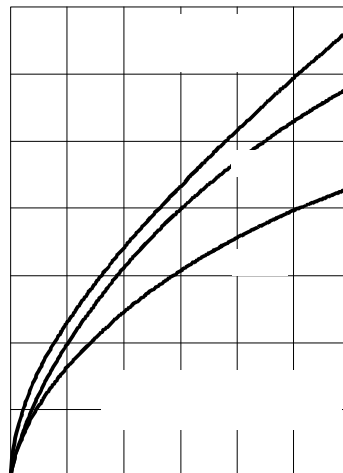


Fig. 11 - Recovery Charge Characteristics

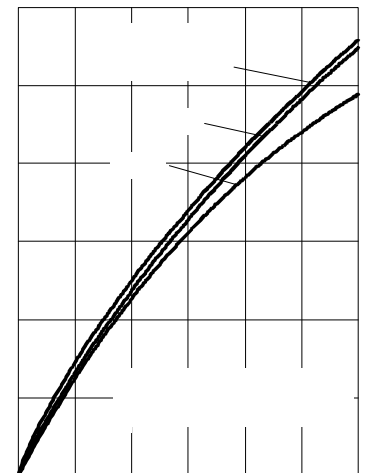


Fig. 12 - Recovery Current Characteristics

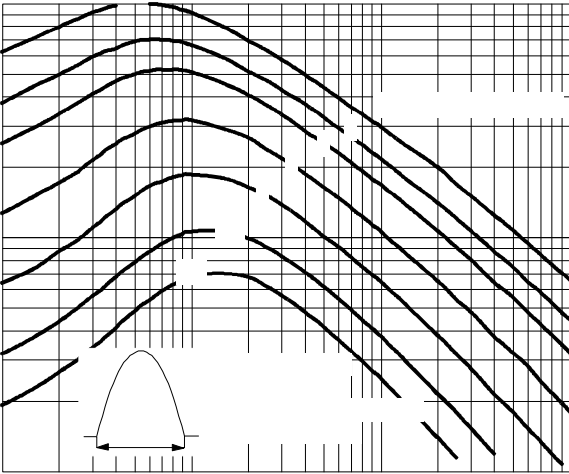


Fig. 13 - Maximum Total Energy Loss Per Pulse Characteristics

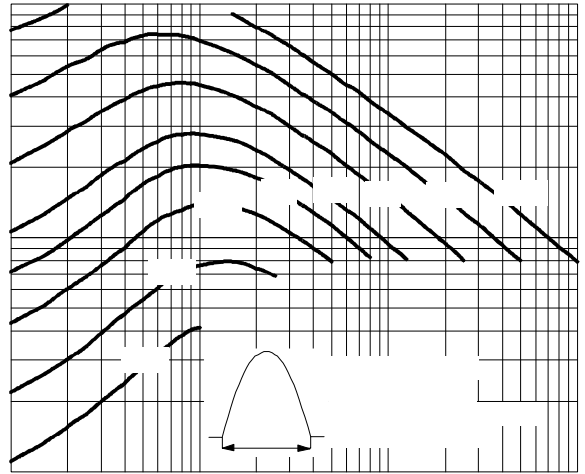


Fig. 14 - Frequency Characteristics

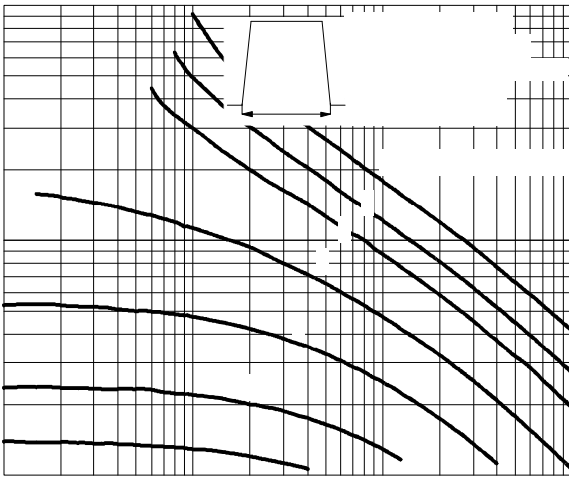


Fig. 15 - Maximum Total Energy Loss Per Pulse Characteristics

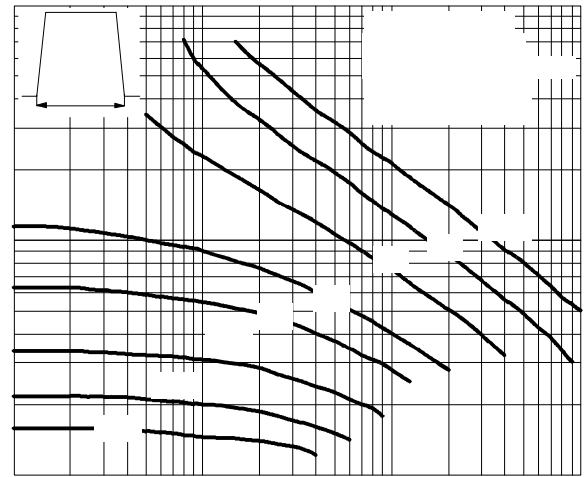


Fig. 16 - Frequency Characteristics

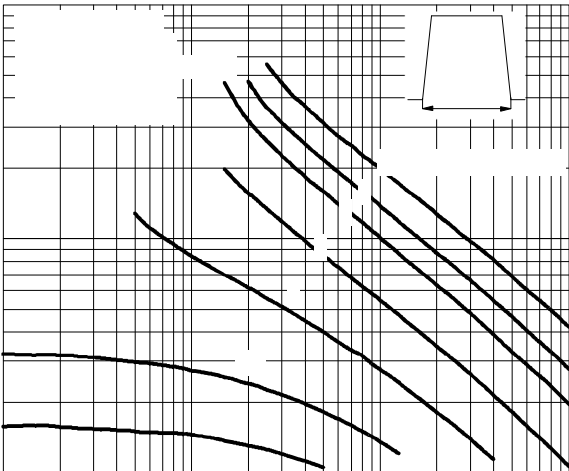


Fig. 17 - Maximum Total Energy Loss Per Pulse Characteristics

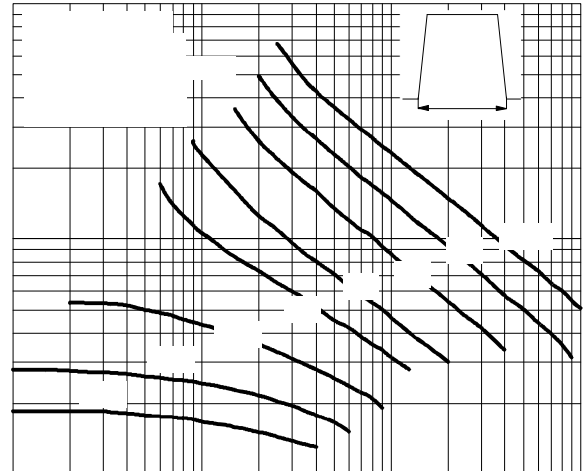


Fig. 18 - Frequency Characteristics

## 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	Nm	Not lubricated threads
wt Approximate weight	454	g	
Case style	B-8		See Outline Table

 $\Delta R_{thJC}$  Conduction

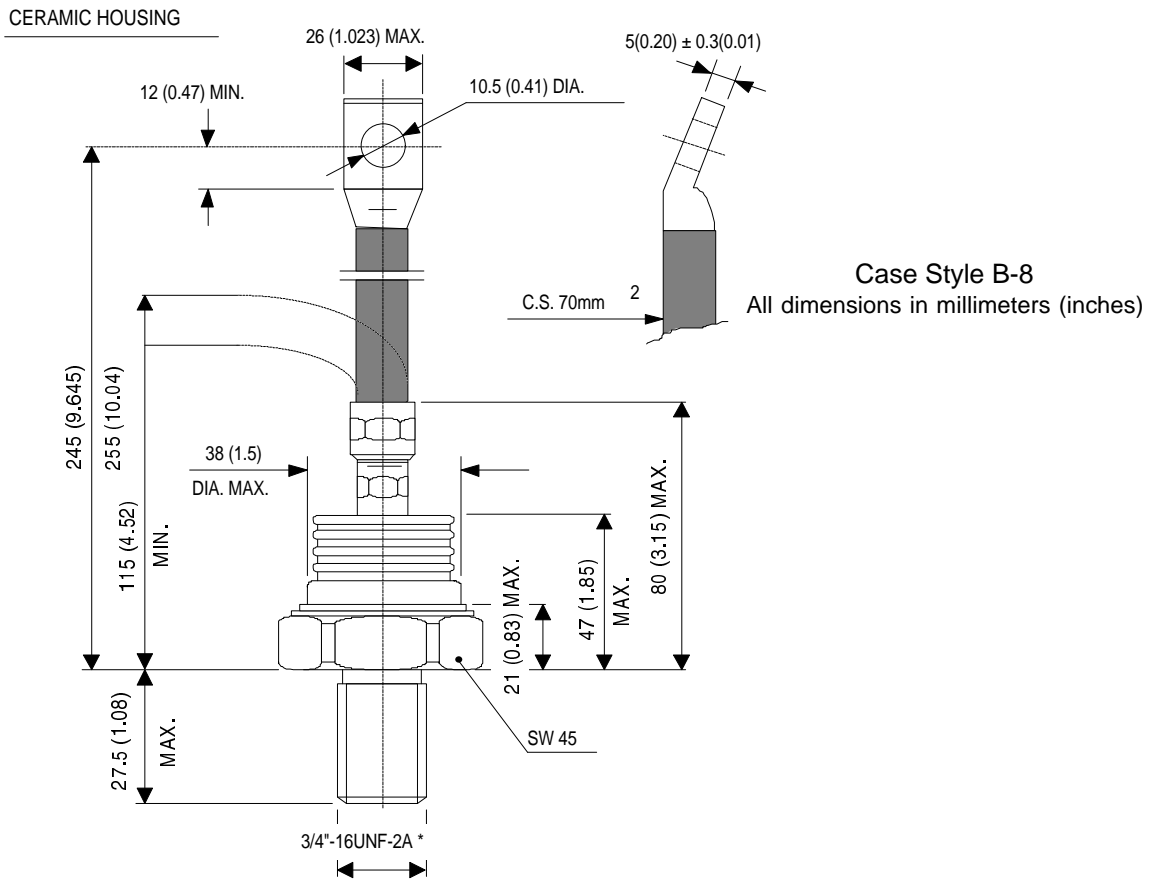
(The following table shows the increment of thermal resistance  $R_{thJC}$  when devices operate at different conduction angles than DC)

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.010	0.008	K/W	T <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		

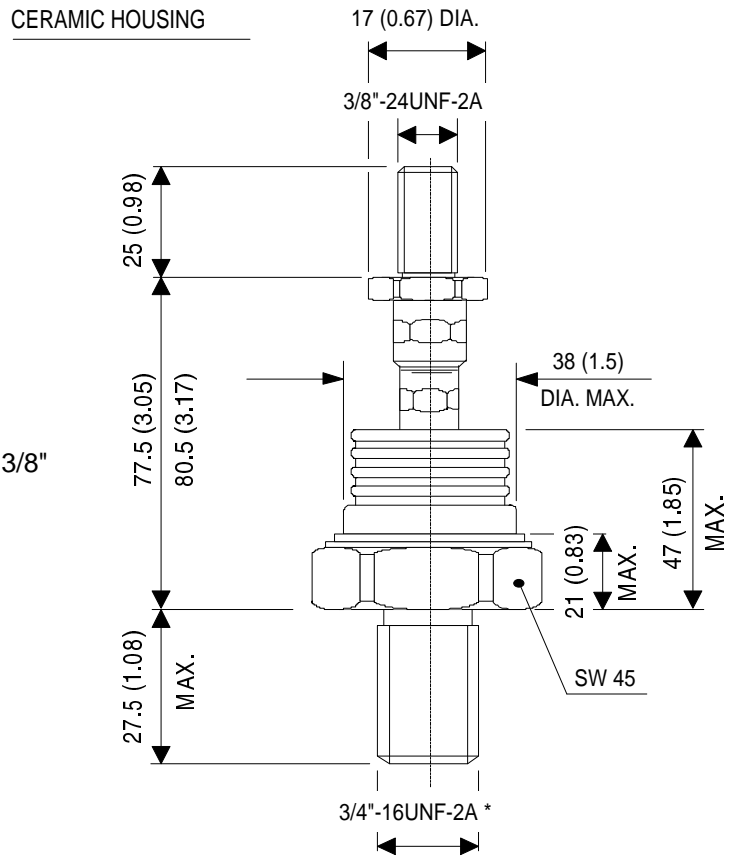
## Ordering Information Table

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

## Outlines Table



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



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