
DISCRETE POWER DIODES and THYRISTORS
DATA BOOK

PHASE CONTROL THYRISTORS

Stud Version

Features

- Hermetic glass-metal seal
- $dv/dt = 1000V/\mu s$ option
- International standard case TO-209AB (TO-93)
- Threaded studs UNF 3/4 - 16UNF2A

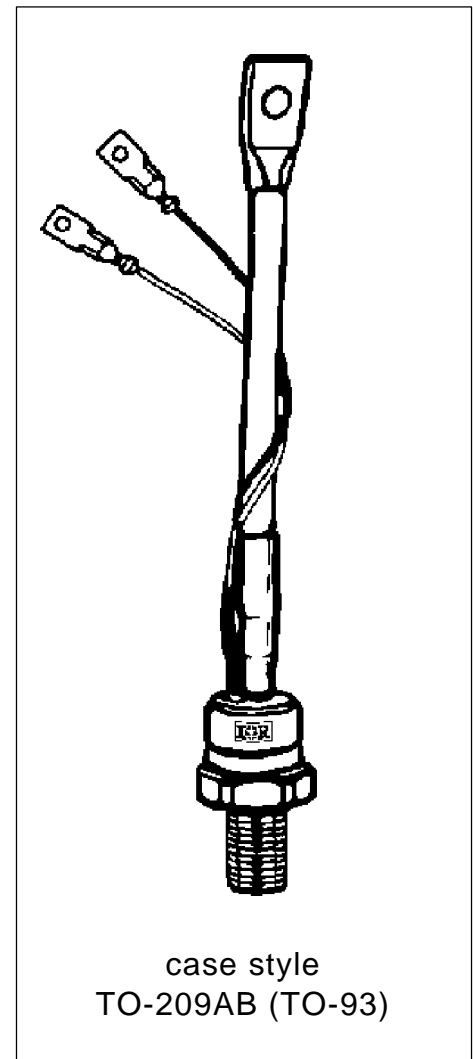
180A

Typical Applications

- DC motor controls
- Controlled DC power supplies
- AC controllers

Major Ratings and Characteristics

Parameters	181RKI	Units
$I_{T(AV)}$	180	A
@ T_C	80	$^{\circ}C$
$I_{T(RMS)}$	285	A
I_{TSM} @ 50Hz	3800	A
@ 60Hz	4000	A
I^2t @ 50Hz	72	KA^2s
@ 60Hz	66	KA^2s
V_{DRM}/V_{RRM}	400 to 1000	V
t_q typical	100	μs
T_J	- 40 to 125	$^{\circ}C$



ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	V_{DRM}/V_{RRM} , max. repetitive peak and off-state voltage V	V_{RSM} , maximum non-repetitive peak voltage V	I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA
181RKI	40	400	500	30
	80	800	900	
	100	1000	1100	

On-state Conduction

Parameter	181RKI	Units	Conditions		
$I_{T(AV)}$ Max. average on-state current @ Case temperature	180	A	180° conduction, half sine wave		
	80	°C			
$I_{T(RMS)}$ Max. RMS on-state current	285	A	DC @ 79°C case temperature		
I_{TSM} Max. peak, one-cycle non-repetitive surge current	3800		t = 10ms	No voltage	
	4000		t = 8.3ms	reapplied	
	3500		t = 10ms	100% V_{RRM}	
	3660	t = 8.3ms	reapplied		
I^2t Maximum I^2t for fusing	72	KA ² s	t = 10ms	No voltage	Sinusoidal half wave, Initial $T_J = T_J$ max.
	66		t = 8.3ms	reapplied	
	61		t = 10ms	100% V_{RRM}	
	56		t = 8.3ms	reapplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	720	KA ² √s	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$ Low level value of threshold voltage	0.83	V	(16.7% × π × $I_{T(AV)}$ < I < π × $I_{T(AV)}$), $T_J = T_J$ max.		
$V_{T(TO)2}$ High level value of threshold voltage	0.89		(I > π × $I_{T(AV)}$), $T_J = T_J$ max.		
r_{t1} Low level value of on-state slope resistance	0.92	mΩ	(16.7% × π × $I_{T(AV)}$ < I < π × $I_{T(AV)}$), $T_J = T_J$ max.		
r_{t2} High level value of on-state slope resistance	0.81		(I > π × $I_{T(AV)}$), $T_J = T_J$ max.		
V_{TM} Max. on-state voltage	1.35	V	$I_{pk} = 570A$, $T_J = T_J$ max, $t_p = 10ms$ sine pulse		
I_H Maximum holding current	600	mA	$T_J = 25°C$, anode supply 12V resistive load		
I_L Typical latching current	1000				

Switching

Parameter	181RKI	Units	Conditions
di/dt Max. non-repetitive rate of rise of turned-on current	300	A/μs	Gate drive 20V, 20Ω, $t_r \leq 1\mu s$ $T_J = T_J$ max, anode voltage ≤ 80% V_{DRM}
t_d Typical delay time	1.0	μs	Gate current 1A, $di_g/dt = 1A/\mu s$ $V_d = 0.67\% V_{DRM}$, $T_J = 25°C$
t_q Typical turn-off time	100		$I_{TM} = 50A$, $T_J = T_J$ max, di/dt = 10A/μs, $V_R = 100V$ dv/dt = 20V/μs

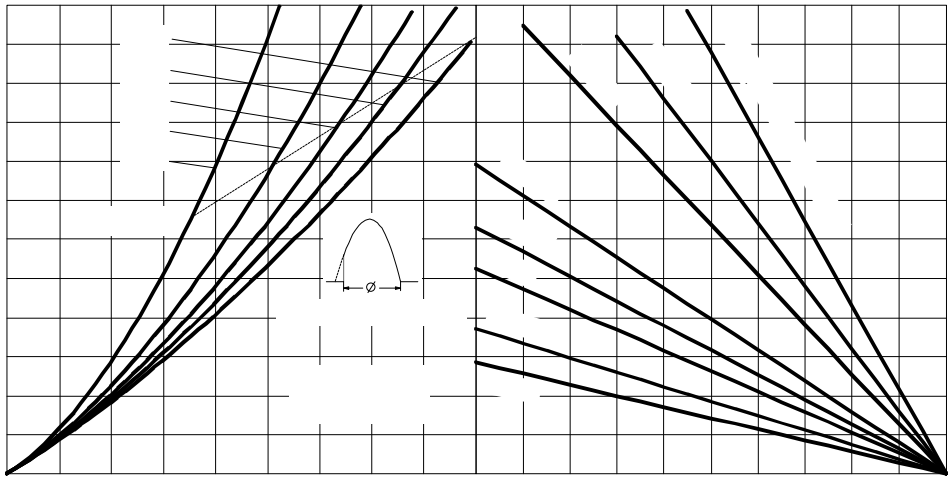


Fig. 3 - On-state Power Loss Characteristics

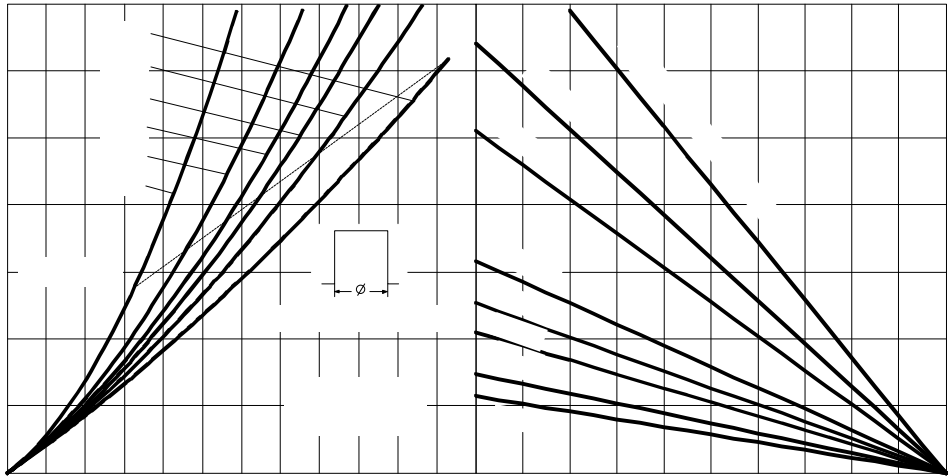


Fig. 4 - On-state Power Loss Characteristics

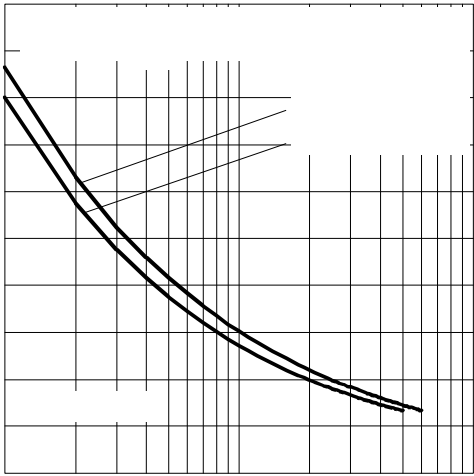


Fig. 5 - Maximum Non-Repetitive Surge Current

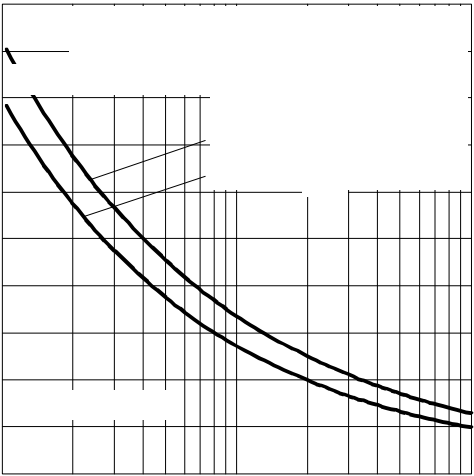


Fig. 6 - Maximum Non-Repetitive Surge Current

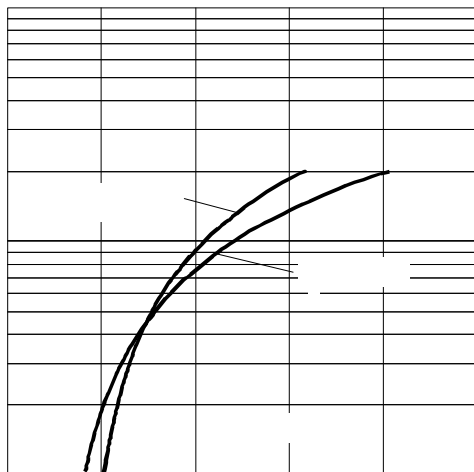


Fig. 7 - On-state Voltage Drop Characteristics

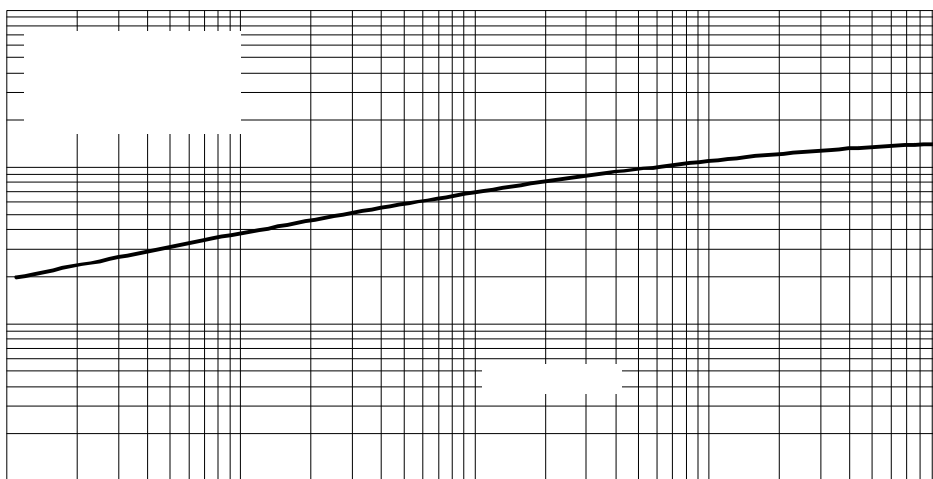


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

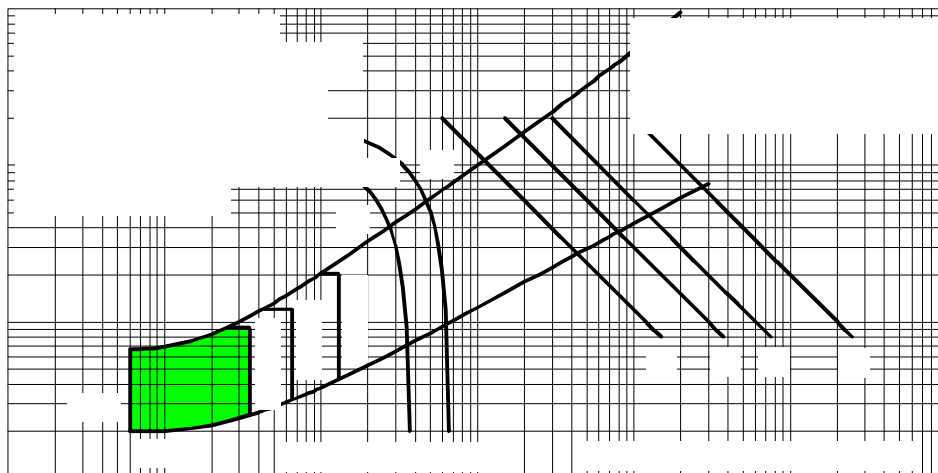


Fig. 9 - Gate Characteristics

Blocking

Parameter	181RKI	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ μ s	$T_J = T_J$ max. linear to 80% rated V_{DRM}
I_{RRM} I_{DRM} Max. peak reverse and off-state leakage current	30	mA	$T_J = T_J$ max, rated V_{DRM}/V_{RRM} applied

Triggering

Parameter	181RKI	Units	Conditions
P_{GM} Maximum peak gate power	10	W	$T_J = T_J$ max, $t_p \leq 5$ ms
$P_{G(AV)}$ Maximum average gate power	2.0		$T_J = T_J$ max, $f = 50$ Hz, $d\% = 50$
I_{GM} Max. peak positive gate current	3.0	A	$T_J = T_J$ max, $t_p \leq 5$ ms
$+V_{GM}$ Maximum peak positive gate voltage	20	V	$T_J = T_J$ max., $t_p \leq 5$ ms
$-V_{GM}$ Maximum peak negative gate voltage	5.0		
I_{GT} DC gate current required to trigger	TYP.	MAX.	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$ Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
	130	-	
	65	150	
V_{GT} DC gate voltage required to trigger	2.0	-	$T_J = -40^\circ\text{C}$ $T_J = 25^\circ\text{C}$ $T_J = 125^\circ\text{C}$
	1.2	2.5	
	0.9	-	
I_{GD} DC gate current not to trigger	10	mA	$T_J = T_J$ max. Max. gate current/ voltage not to trigger is the max. value which will not trigger any unit with rated V_{DRM} anode-to-cathode applied
V_{GD} DC gate voltage not to trigger	0.25	V	

Thermal and Mechanical Specification

Parameter	181RKI	Units	Conditions
T_J Max. operating temperature range	-40 to 125	$^\circ\text{C}$	
T_{stg} Max. storage temperature range	-40 to 150		
R_{thJC} Max. thermal resistance, junction to case	0.15	K/W	DC operation
R_{thCS} Max. thermal resistance, case to heatsink	0.04		Mounting surface, smooth, flat and greased
T Mounting torque, $\pm 10\%$	31	Nm (lbf-in)	Non lubricated threads
	(275)		
	24.5		Lubricated threads
(210)			
wt Approximate weight	280	g	
Case style	TO - 209AB (TO-93)		See Outline Table

181RKI Series

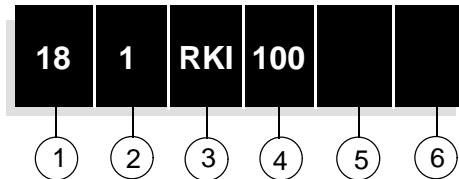
ΔR_{thJC} Conduction

(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°	0.050	0.032	K/W	$T_J = T_{J \text{ max.}}$
120°	0.063	0.059		
90°	0.080	0.082		
60°	0.118	0.124		
30°	0.225	0.228		

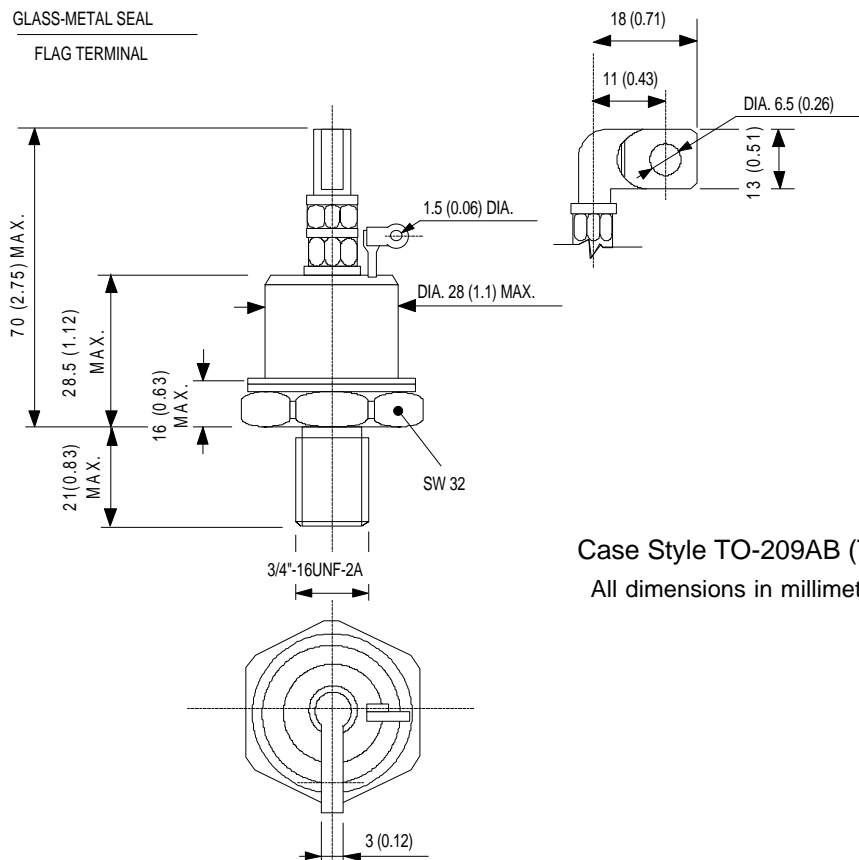
Ordering Information Table

Device Code



- 1** - $I_{T(AV)}$ rated average output current (rounded/10)
- 2** - 0 = Eyelet terminals (Gate and Auxiliary Cathode Leads)
1 = Fast - on terminals (Gate and Auxiliary Cathode Leads)
2 = Flag terminals (For Cathode and Gate Terminals)
- 3** - Thyristor
- 4** - Voltage code: Code x 10 = V_{RRM} (See Voltage Rating Table)
- 5** - None = Stud base UNF 3/4 - 16UNF threads
- 6** - Critical dv/dt: None = 500V/ μ sec
S90 = 1000V/ μ sec

Outline Table



Case Style TO-209AB (TO-93) Flag
All dimensions in millimeters (inches)

Outline Table

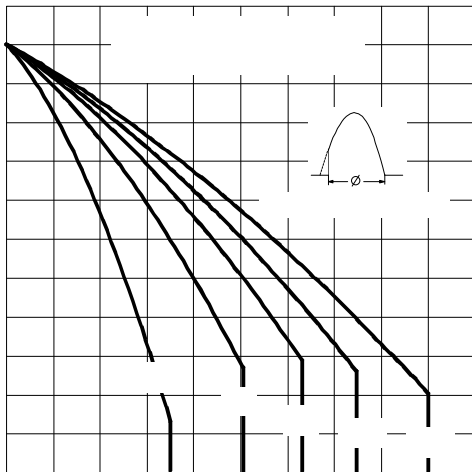
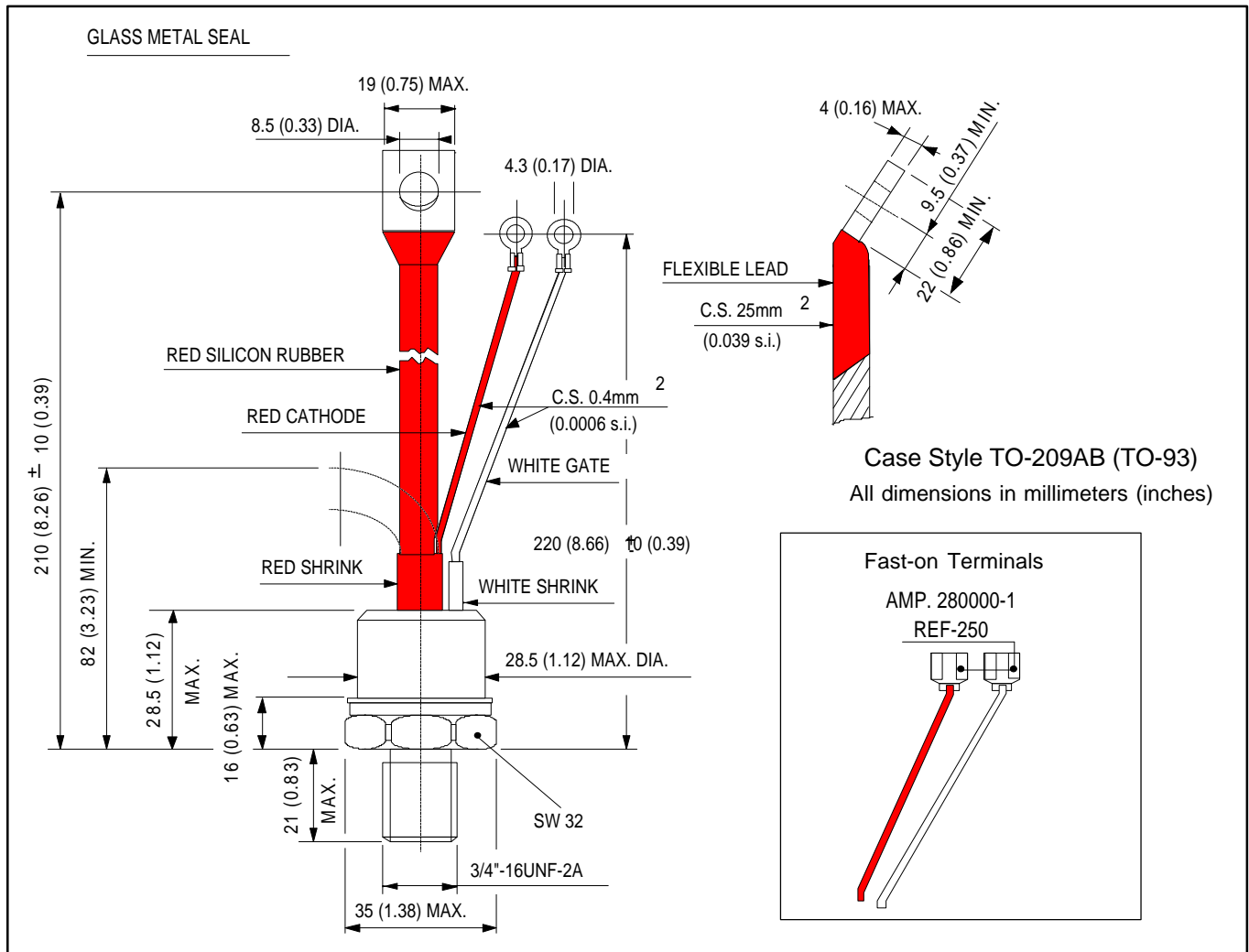


Fig. 1 - Current Ratings Characteristics

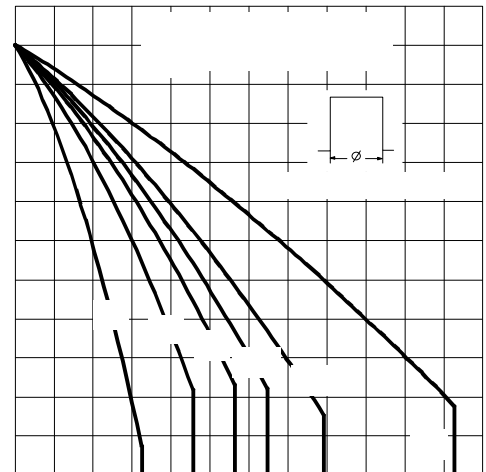


Fig. 2 - Current Ratings Characteristics