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DISCRETE POWER DIODES and THYRISTORS

DATA BOOK

International Rectifier

181RKI SERIES

PHASE CONTROL THYRISTORS

Stud Version

180A

Features

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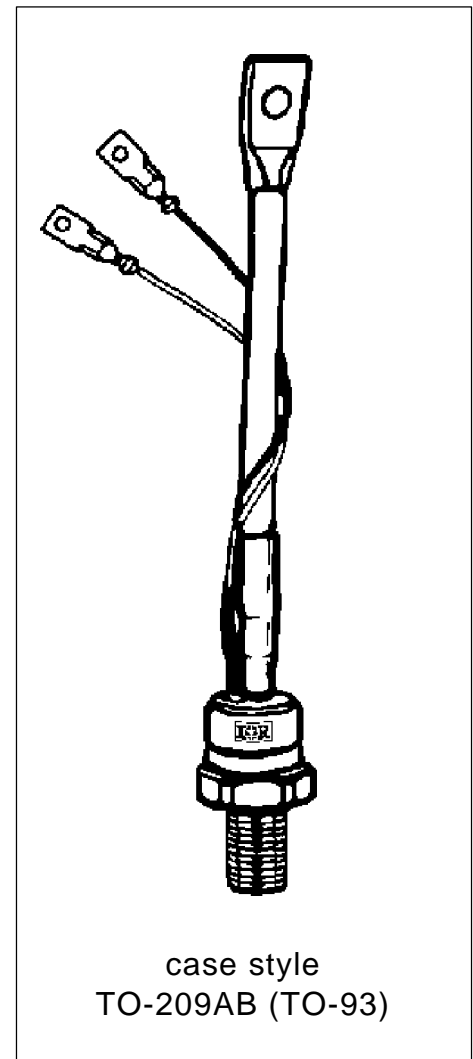■ International standard case TO-209AB (TO-93)
■ Threaded studs UNF 3/4 - 16UNF2A

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	°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	°C

case style
TO-209AB (TO-93)

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	
	80	800	900	30
	100	1000	1100	

On-state Conduction

	Parameter	181RKI	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	180	A	180° conduction, half sine wave		
	@ Case temperature	80	°C			
$I_{T(RMS)}$	Max. RMS on-state current	285		DC @ 79°C case temperature		
I_{TSM}	Max. peak, one-cycle	3800	A	t = 10ms	No voltage	
	non-repetitive surge current	4000		t = 8.3ms	reapplied	
		3500		t = 10ms	100% V_{RRM}	
		3660		t = 8.3ms	reapplied	Sinusoidal half wave,
I^2t	Maximum I^2t for fusing	72		t = 10ms	No voltage	Initial $T_J = T_J$ max.
		66	KA^2s	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	$KA^2\sqrt{s}$	t = 0.1 to 10ms, no voltage reapplied		
$V_{T(TO)1}$	Low level value of threshold voltage	0.83	V	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
$V_{T(TO)2}$	High level value of threshold voltage	0.89		$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
r_{t1}	Low level value of on-state slope resistance	0.92	mΩ	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ max.		
r_{t2}	High level value of on-state slope resistance	0.81		$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ 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

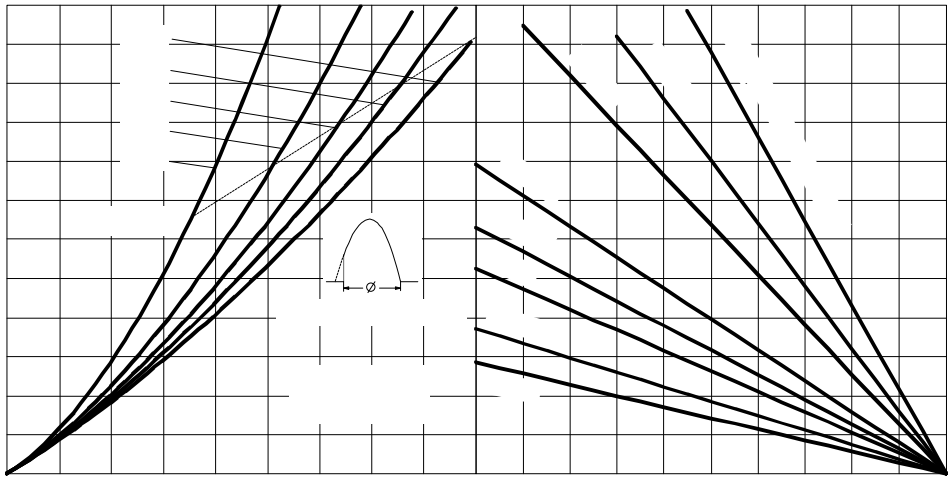|	Parameter	181RKI	Units	Conditions
di/dt	Max. non-repetitive rate of rise of turned-on current	300	A/µs	Gate drive 20V, 20Ω, $t_r \leq$1µs $T_J = T_J$ max, anode voltage $\leq$ 80% V_{DRM}
t_d	Typical delay time	1.0	µs	Gate current 1A, di_g/dt = 1A/µs V_d = 0.67% V_{DRM}, T_J = 25°C
t_q	Typical turn-off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

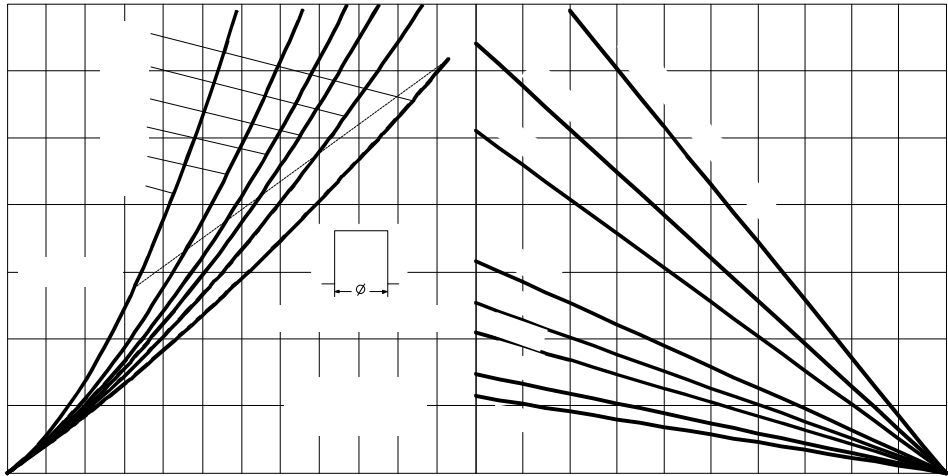Fig. 3 - On-state Power Loss Characteristics

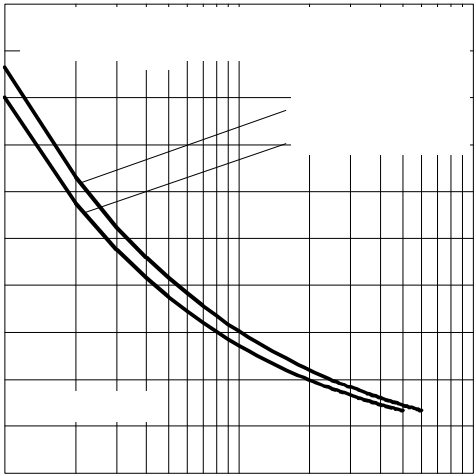Fig. 4 - On-state Power Loss Characteristics

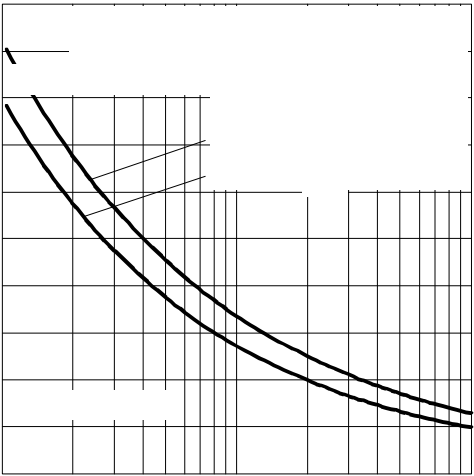Fig. 5 - Maximum Non-Repetitive Surge Current
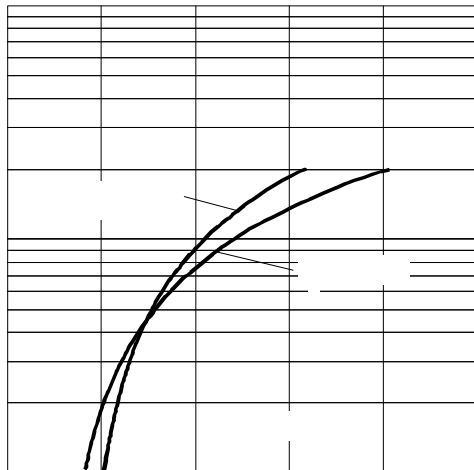

Fig. 6 - Maximum Non-Repetitive Surge Current
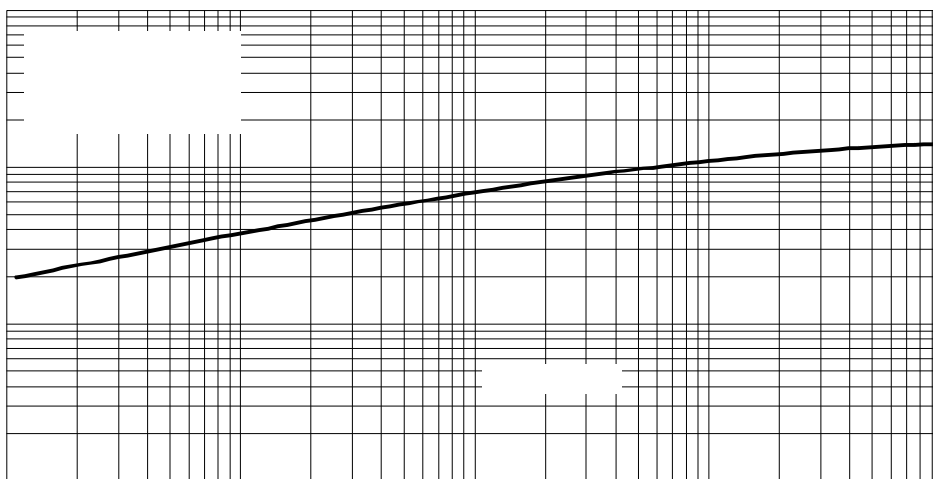
Fig. 7 - On-state Voltage Drop Characteristics
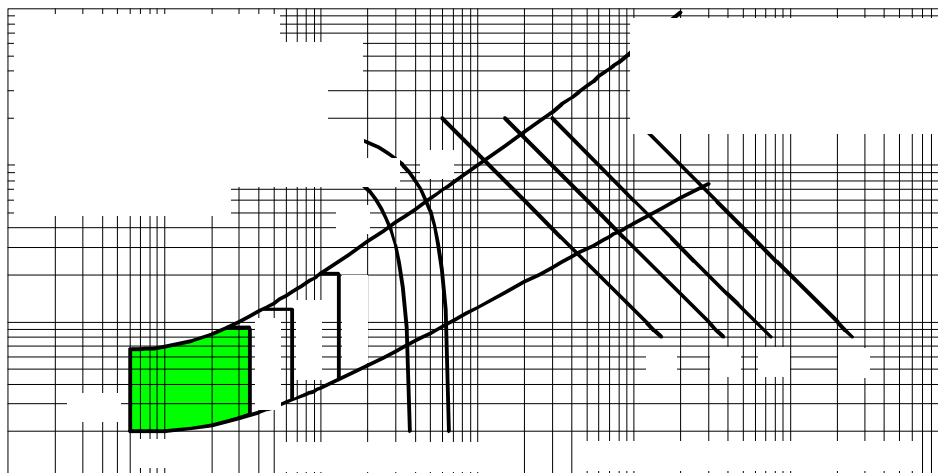
Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

Fig. 9 - Gate Characteristics

Blocking

	Parameter	181RKI	Units	Conditions
dv/dt	Maximum critical rate of rise of off-state voltage	500	V/µs	$T_J = T_J$ 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 = 50Hz, 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				
		TYP.	MAX.			
I_{GT}	DC gate current required to trigger	130 / 65 / 35	- / 150 / -	mA	$T_J = -40°C$ / $T_J = 25°C$ / $T_J = 125°C$	Max. required gate trigger/ current/ voltage are the lowest value which will trigger all units 12V anode-to-cathode applied
V_{GT}	DC gate voltage required to trigger	2.0 / 1.2 / 0.9	- / 2.5 / -	V	$T_J = -40°C$ / $T_J = 25°C$ / $T_J = 125°C$	
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	°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, ± 10%	31 (275)	Nm (lbf-in)	Non lubricated threads
		24.5 (210)		Lubricated threads
wt	Approximate weight	280	g	
	Case style	TO - 209AB (TO-93)		See Outline Table

ΔR_{thJC} Conduction

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

Conduction angle	Sinusoidal conduction	Rectangular conduction	Units	Conditions
180°	0.050	0.032		$T_J = T_J$ max.
120°	0.063	0.059		
90°	0.080	0.082	K/W	
60°	0.118	0.124		
30°	0.225	0.228		

Ordering Information Table

Device Code | **18** | **1** | **RKI** | **100** | | |

(1) (2) (3) (4) (5) (6)

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/µsec

S90 = 1000V/µsec

Outline Table

GLASS-METAL SEAL

FLAG TERMINAL

18 (0.71)

11 (0.43)

DIA. 6.5 (0.26)

13 (0.51)

1.5 (0.06) DIA.

70 (2.75) MAX.

28.5 (1.12) MAX.

16 (0.63) MAX.

21 (0.83) MAX.

DIA. 28 (1.1) MAX.

SW 32

3/4"-16UNF-2A

3 (0.12)

Case Style TO-209AB (TO-93) Flag

All dimensions in millimeters (inches)

Outline Table

GLASS METAL SEAL

19 (0.75) MAX.

8.5 (0.33) DIA.

4.3 (0.17) DIA.

4 (0.16) MAX.

9.5 (0.37) MIN.

22 (0.86) MIN.

210 (8.26) ± 10 (0.39)

RED SILICON RUBBER

RED CATHODE

C.S. 0.4mm 2
(0.0006 s.i.)

WHITE GATE

FLEXIBLE LEAD

C.S. 25mm 2
(0.039 s.i.)

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

82 (3.23) MIN.

220 (8.66) ±0 (0.39)

RED SHRINK

WHITE SHRINK

28.5 (1.12) MAX.

28.5 (1.12) MAX. DIA.

16 (0.63) MAX.

21 (0.83) MAX.

SW 32

3/4"-16UNF-2A

35 (1.38) MAX.

Fast-on Terminals
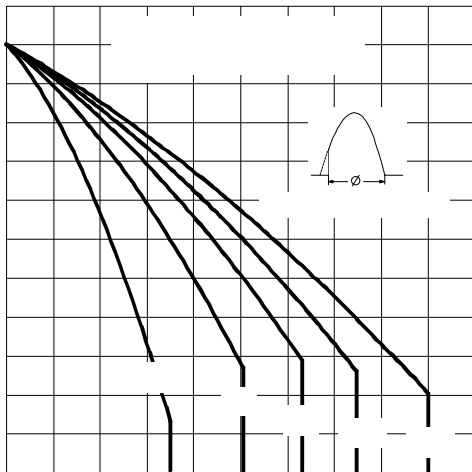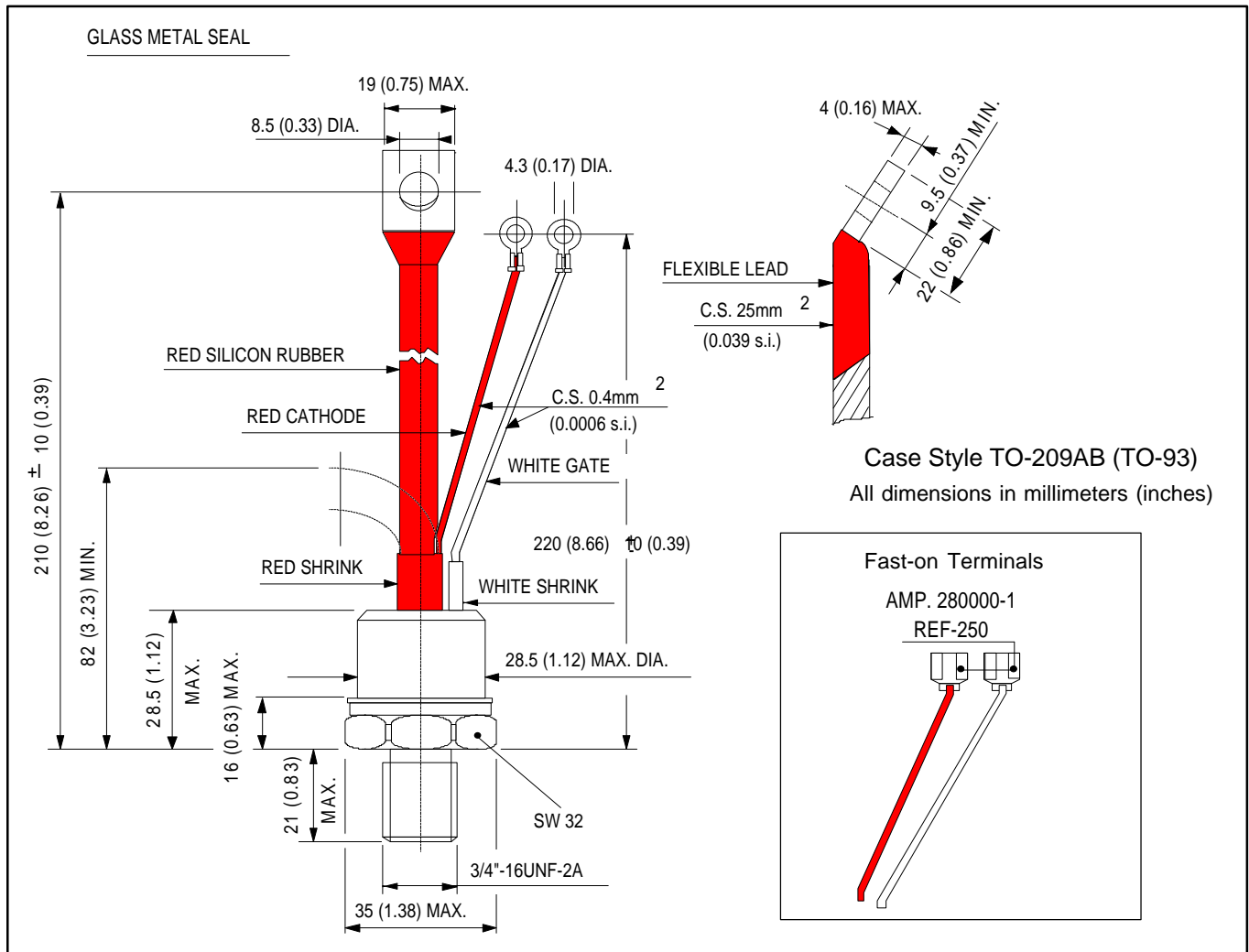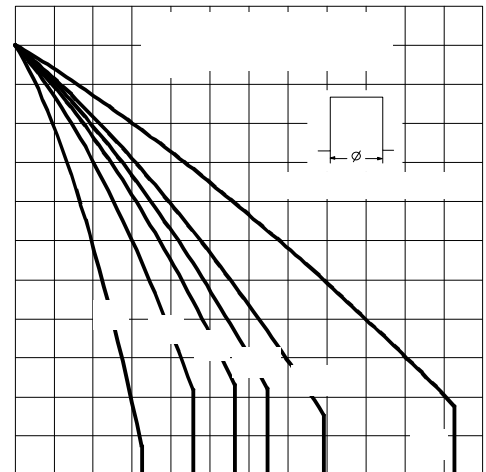AMP. 280000-1
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Fig. 1 - Current Ratings Characteristics

Fig. 2 - Current Ratings Characteristics