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DISCRETE POWER DIODES and THYRISTORS
DATA BOOK

International Rectifier

ST103S SERIES

INVERTER GRADE THYRISTORS

Stud Version

105A

Features

■ All diffused design
■ Center amplifying gate
■ Guaranteed high dv/dt
■ Guaranteed high di/dt
■ High surge current capability
■ Low thermal impedance
■ High speed performance

Typical Applications

■ Inverters
■ Choppers
■ Induction heating
■ All types of force-commutated converters

Major Ratings and Characteristics

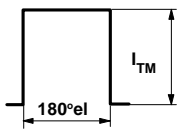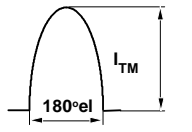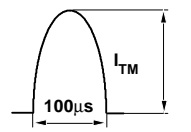| Parameters		ST103S	Units
$I_{T(AV)}$		105	A
	@ T_C	85	°C
$I_{T(RMS)}$		165	A
I_{TSM}	@ 50Hz	3000	A
	@ 60Hz	3150	A
I^2t	@ 50Hz	45	KA^2s
	@ 60Hz	41	KA^2s
V_{DRM}/V_{RRM}		400 to 800	V
t_q range		10 to 25	μs
T_J		- 40 to 125	°C

case style
TO-209AC (TO-94)
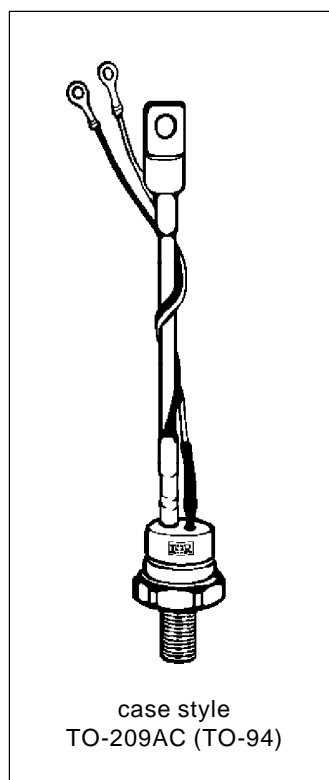
ELECTRICAL SPECIFICATIONS

Voltage Ratings

Type number	Voltage Code	V_{DRM}/V_{RRM}, maximum repetitive peak voltage V	V_{RSM}, maximum non-repetitive peak voltage V	I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA
ST103S	04	400	500	30
	08	800	900	

Current Carrying Capability

Frequency	180°el I_{TM}		180°el I_{TM}		100µs I_{TM}		Units
50Hz	280	180	440	330	4730	3630	
400Hz	310	200	470	300	2500	1850	
1000Hz	320	200	480	310	1530	1090	A
2500Hz	340	210	490	320	840	580	
Recovery voltage Vr	50	50	50	50	50	50	V
Voltage before turn-on Vd	V_{DRM}		V_{DRM}		V_{DRM}		
Rise of on-state current di/dt	50	50	-	-	-	-	A/µs
Case temperature	60	85	60	85	60	85	°C
Equivalent values for RC circuit	22Ω / 0.15µF		22Ω / 0.15µF		22Ω / 0.15µF		

On-state Conduction

|	Parameter	ST103S	Units	Conditions		
$I_{T(AV)}$	Max. average on-state current	105	A	180° conduction, half sine wave		
	@ Case temperature	85	°C			
$I_{T(RMS)}$	Max. RMS on-state current	165		DC @ 76°C case temperature		
I_{TSM}	Max. peak, one half cycle,	3000	A	t = 10ms	No voltage	
	non-repetitive surge current	3150		t = 8.3ms	reapplied	
		2530		t = 10ms	100% V_{RRM}	
		2650		t = 8.3ms	reapplied	Sinusoidal half wave,
I^2t	Maximum I^2t for fusing	45		t = 10ms	No voltage	Initial $T_J = T_J$ max
		41	KA²s	t = 8.3ms	reapplied	
		32		t = 10ms	100% V_{RRM}	
		29		t = 8.3ms	reapplied	
$I^2\sqrt{t}$	Maximum $I^2\sqrt{t}$ for fusing	450	KA²√s	t = 0.1 to 10ms, no voltage reapplied		
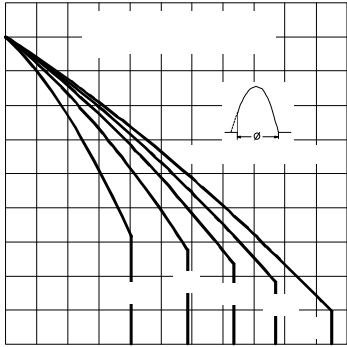
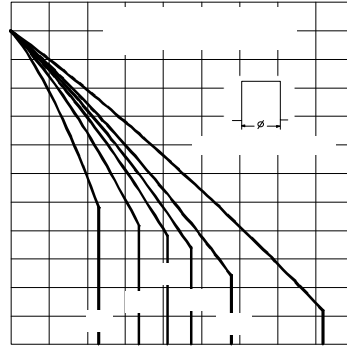Fig. 1 - Current Ratings Characteristics

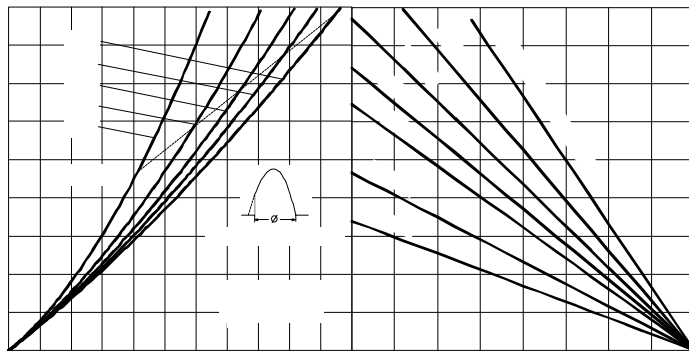Fig. 2 - Current Ratings Characteristics
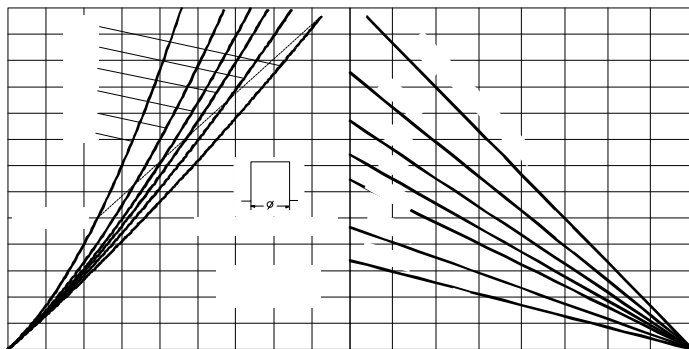

Fig. 3 - On-state Power Loss Characteristics

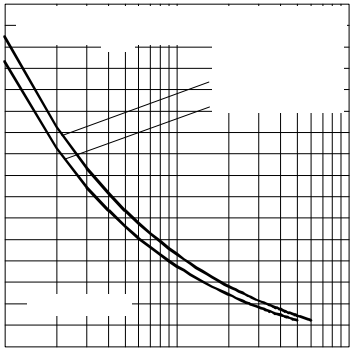Fig. 4 - On-state Power Loss Characteristics

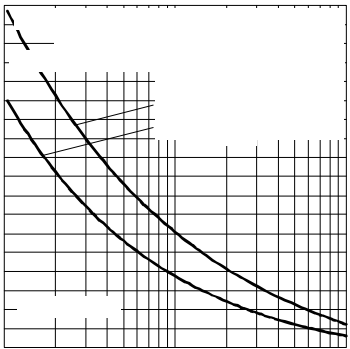Fig. 5 - Maximum Non-repetitive Surge Current

Fig. 6 - Maximum Non-repetitive Surge Current

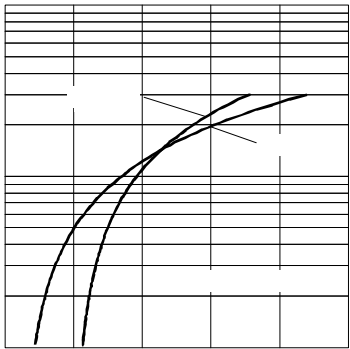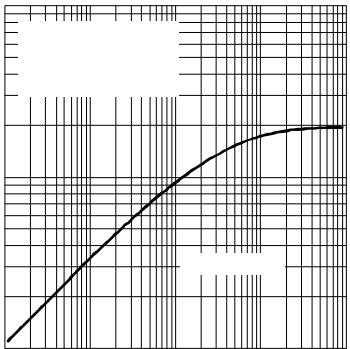Fig. 7 - On-state Voltage Drop Characteristics

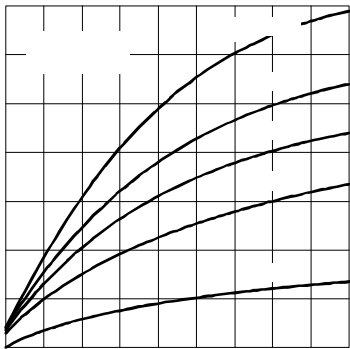Fig. 8 - Thermal Impedance Z_{thJC} Characteristic
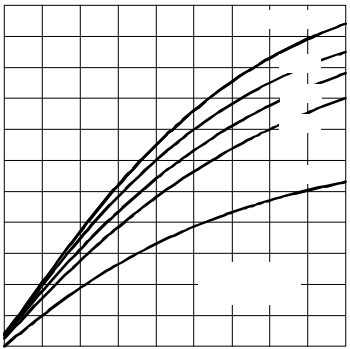
Fig. 9 - Reverse Recovered Charge Characteristics

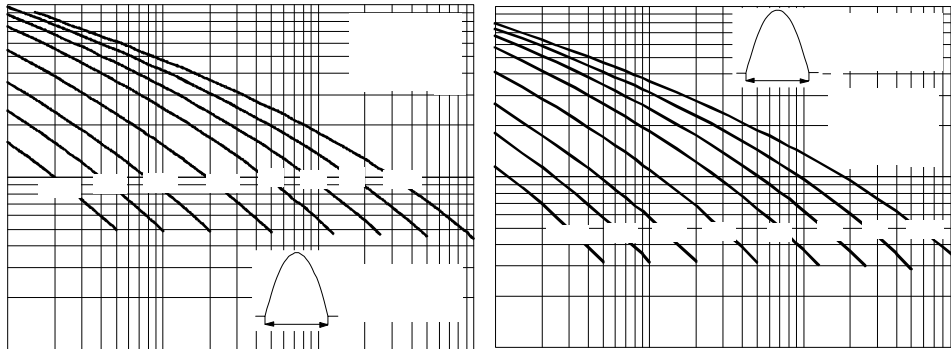Fig. 10 - Reverse Recovery Current Characteristics
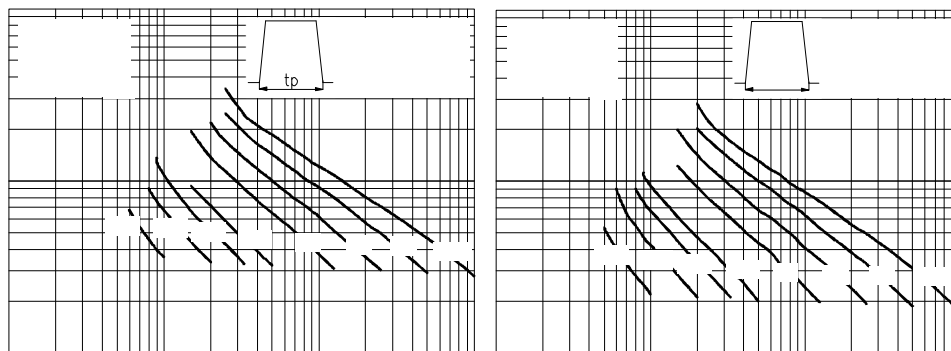
Fig. 11 - Frequency Characteristics

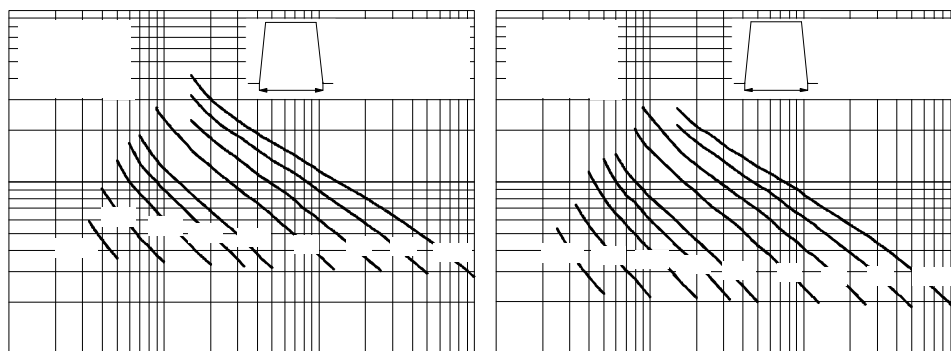Fig. 12 - Frequency Characteristics

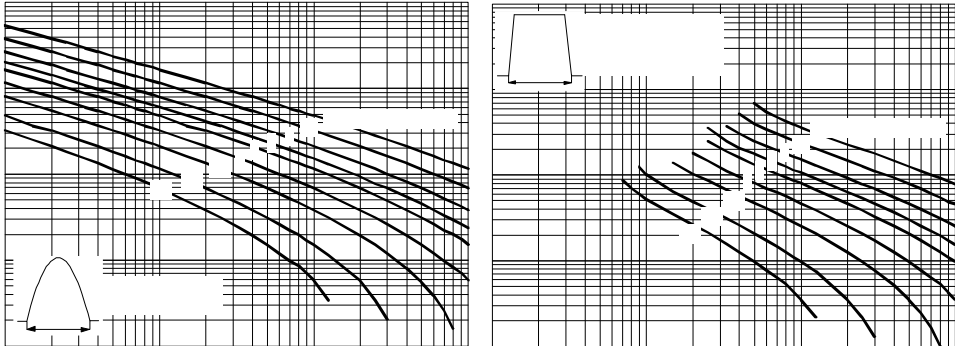Fig. 13 - Frequency Characteristics

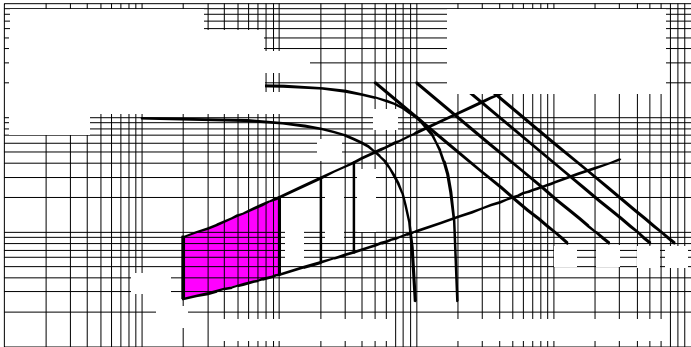Fig. 14 - Maximum On-state Energy Power Loss Characteristics

Fig. 15 - Gate Characteristics

On-state Conduction

	Parameter	ST103S	Units	Conditions
V_{TM}	Max. peak on-state voltage	1.73		$I_{TM} = 300A$, $T_J = T_J$ max, $t_p = 10ms$ sine wave pulse
$V_{T(TO)1}$	Low level value of threshold voltage	1.32	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	1.35		$(I > \times \pi \times I_{T(AV)})$, $T_J = T_J$ max.
r_{t1}	Low level value of forward slope resistance	1.40	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 forward slope resistance	1.30		$(I > \times \pi \times I_{T(AV)})$, $T_J = T_J$ max.
I_H	Maximum holding current	600	mA	$T_J = 25°C$, $I_T > 30A$
I_L	Typical latching current	1000		$T_J = 25°C$, $V_A = 12V$, $Ra = 6\Omega$, $I_G = 1A$

Switching

	Parameter	ST103S		Units	Conditions
di/dt	Max. non-repetitive rate of rise of turned-on current	1000		A/µs	$T_J = T_J$ max, V_{DRM} = rated V_{DRM} $I_{TM} = 2 \times$ di/dt
t_d	Typical delay time	0.80			$T_J = 25°C$, V_{DM} = rated V_{DRM}, $I_{TM} = 50A$ DC, $t_p = 1µs$ Resistive load, Gate pulse: 10V, 5Ω source
		Min	Max	µs	$T_J = T_J$ max, $I_{TM} = 100A$, commutating di/dt = 10A/µs
t_q	Max. turn-off time	10	25		$V_R = 50V$, $t_p = 200µs$, dv/dt: see table in device code

Blocking

	Parameter	ST103S	Units	Conditions
dv/dt	Maximum critical rate of rise of off-state voltage	500	V/µs	$T_J = T_J$ max., linear to 80% V_{DRM}, higher value available on request
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	ST103S	Units	Conditions
P_{GM}	Maximum peak gate power	40	W	$T_J = T_J$ max, f = 50Hz, d% = 50
$P_{G(AV)}$	Maximum average gate power	5		
I_{GM}	Max. peak positive gate current	5	A	$T_J = T_J$ max, $t_p \leq 5ms$
$+V_{GM}$	Maximum peak positive gate voltage	20	V	$T_J = T_J$ max, $t_p \leq 5ms$
$-V_{GM}$	Maximum peak negative gate voltage	5		
I_{GT}	Max. DC gate current required to trigger	200	mA	$T_J = 25°C$, $V_A = 12V$, $Ra = 6\Omega$
V_{GT}	Max. DC gate voltage required to trigger	3	V	
I_{GD}	Max DC gate current not to trigger	20	mA	$T_J = T_J$ max, rated V_{DRM} applied
V_{GD}	Max. DC gate voltage not to trigger	0.25	V	

ST103S Series

Thermal and Mechanical Specifications

	Parameter	ST103S	Units	Conditions
T_J	Max. junction operating temperature range	-40 to 125	°C	
T_{stg}	Max. storage temperature range	-40 to 150		
R_{thJC}	Max. thermal resistance, junction to case	0.195	K/W	DC operation
R_{thCS}	Max. thermal resistance, case to heatsink	0.08		Mounting surface, smooth, flat and greased
T	Mounting torque, ± 10%	15.5 (137)	Nm (lbf-in)	Non lubricated threads
		14 (120)	Nm (lbf-in)	Lubricated threads
wt	Approximate weight	130	g	
	Case style	TO-209AC (TO-94)		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°	0.034	0.025	K/W	$T_J = T_J$ max.
120°	0.040	0.042		
90°	0.052	0.056		
60°	0.076	0.079		
30°	0.126	0.127		

Ordering Information Table

Device Code	ST	10	3	S	08	P	F	N	0	
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

1 - Thyristor
2 - Essential part number
3 - 3 = Fast turn off
4 - S = Compression bonding Stud
5 - Voltage code: Code x 100 = V_{RRM} (See Voltage Ratings table)
6 - P = Stud Base 1/2" 20UNF
7 - Reapplied dv/dt code (for t_q test condition)
8 - t_q code
9 - 0 = Eyelet terminals (Gate and Aux. Cathode Leads)
　　　1 = Fast-on terminals (Gate and Aux. Cathode Leads)
　　　2 = Flag terminals (For Cathode and Gate Terminals)
10 - Critical dv/dt:
　　　None = 500V/µsec (Standard value)
　　　L = 1000V/µsec (Special selection)

dv/dt - t_q combinations available					
dv/dt (V/µs)	20	50	100	**200**	400
t_q (µs) 10	CN	DN	EN	**FN** *	--
12	CM	DM	EM	FM	HM
15	CL	DL	EL	**FL** *	HL
18	CP	DP	EP	FP	HP
20	CK	DK	EK	FK	HK
25	--	--	--	--	HJ

*Standard part number.
All other types available only on request.

Outline Table

CERAMIC HOUSING

16.5 (0.65) MAX.

8.5 (0.33) DIA.

4.3 (0.17) DIA

2.6 (0.10) MAX.

9.5 (0.37) MIN.

20 (0.79) MIN.

FLEXIBLE LEAD

C.S. 16mm
(.025 s.i.)

RED SILICON RUBBER

C.S. 0.4 mm
(.0006 s.i.)

RED CATHODE

WHITE GATE

157 (6.18)

170 (6.69)

215 (8.46)   ± 10 (0.39)

RED SHRINK

WHITE SHRINK

70 (2.75) MIN.

29 (1.14) MAX.

22.5 (0.88) MAX. DIA.

12.5 (0.49) MAX.

21 (0.83) MAX.

SW 27

1/2"-20UNF-2A

29.5 (1.16) MAX.

Fast-on Terminals

AMP. 280000-1
REF-250

Case Style TO-209AC (TO-94)

All dimensions in millimeters (inches)

CERAMIC HOUSING

FLAG TERMINALS

22.5 DIA.
(0.89) MAX.

1.5 (0.06) DIA.

5.2 (0.20) DIA.

10 (0.39)

46 (1.81)

49 (1.93)

10 (0.39)

29 (1.14) MAX.

7.5 (0.30)

12.5 (0.49) MAX.

21 (0.83) MAX.

1/2"-20UNF-2A

Case Style TO-208AD (TO-83)

All dimensions in millimeters (inches)

SW 27

16.5 (0.65)

2.4 (0.09)

29.5 (1.16)