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

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**INVERTER GRADE THYRISTORS**
**Stud Version**
**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

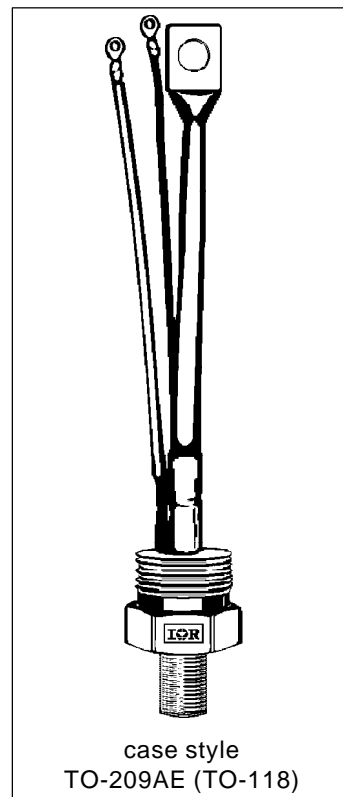
**300A**
**Typical Applications**

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

**Major Ratings and Characteristics**

Parameters	ST303S	Units
$I_{T(AV)}$	300	A
	@ $T_C$	65 °C
$I_{T(RMS)}$	471	A
$I_{TSM}$	@ 50Hz	7950 A
	@ 60Hz	8320 A
$I^2t$	@ 50Hz	316 KA <sup>2</sup> s
	@ 60Hz	288 KA <sup>2</sup> s
$V_{DRM}/V_{RRM}$	400 to 1200	V
$t_q$ range (*)	10 to 30	μs
$T_J$	- 40 to 125	°C

(\*)  $t_q = 10$  to  $20\mu s$  for 400 to 800V devices  
 $t_q = 15$  to  $30\mu s$  for 1000 to 1200V devices



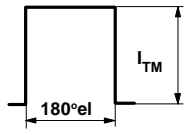
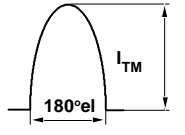
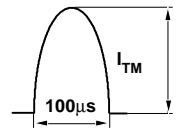
## ST303S Series

### 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
ST303S	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	

#### Current Carrying Capability

Frequency							Units
50Hz	670	470	1050	940	5240	4300	A
400Hz	480	330	1021	710	1800	1270	
1000Hz	230	140	760	470	730	430	
2500Hz	35	-	150	-	90	-	
Recovery voltage Vr	50	50	50	50	50	50	
Voltage before turn-on Vd	$V_{DRM}$		$V_{DRM}$		$V_{DRM}$		
Rise of on-state current di/dt	50	50	-	-	-	-	A/µs
Case temperature	40	65	40	65	40	65	°C
Equivalent values for RC circuit	10Ω / 0.47µF		10Ω / 0.47µF		10Ω / 0.47µF		

#### On-state Conduction

Parameter	ST303S	Units	Conditions	
$I_{T(AV)}$ Max. average on-state current @ Case temperature	300	A	180° conduction, half sine wave	
	65	°C		
$I_{T(RMS)}$ Max. RMS on-state current	471	A	DC @ 45°C case temperature	
$I_{TSM}$ Max. peak, one half cycle, non-repetitive surge current	7950		t = 10ms	No voltage reappplied
	8320		t = 8.3ms	reappplied
	6690		t = 10ms	100% $V_{RRM}$
$I^2t$ Maximum $I^2t$ for fusing	7000	t = 8.3ms	reappplied	
	316	t = 10ms	No voltage reappplied	
		t = 8.3ms	reappplied	
		t = 10ms	100% $V_{RRM}$	
288	t = 8.3ms	reappplied		
224	KA <sup>2</sup> s	t = 10ms	100% $V_{RRM}$	
204		t = 8.3ms	reappplied	
$I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing	3160	KA <sup>2</sup> /s	t = 0.1 to 10ms, no voltage reappplied	

ST303S Series

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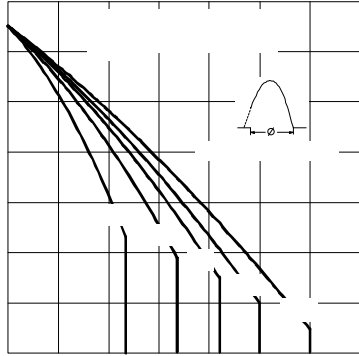


Fig. 1 - Current Ratings Characteristics

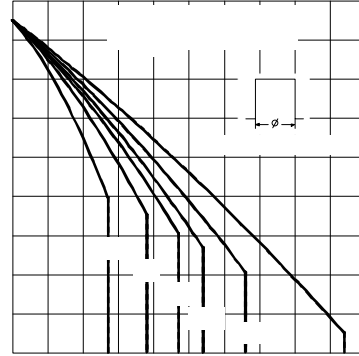


Fig. 2 - Current Ratings Characteristics

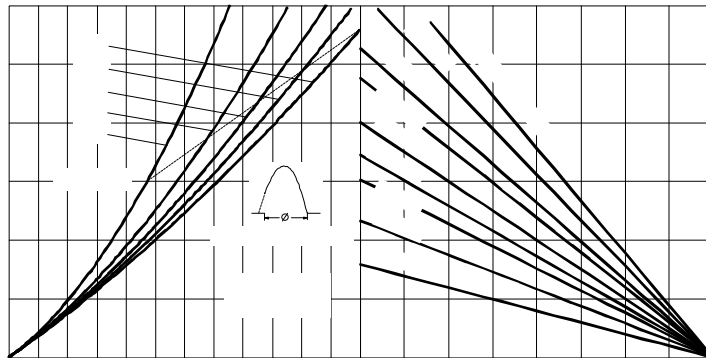


Fig. 3 - On-state Power Loss Characteristics

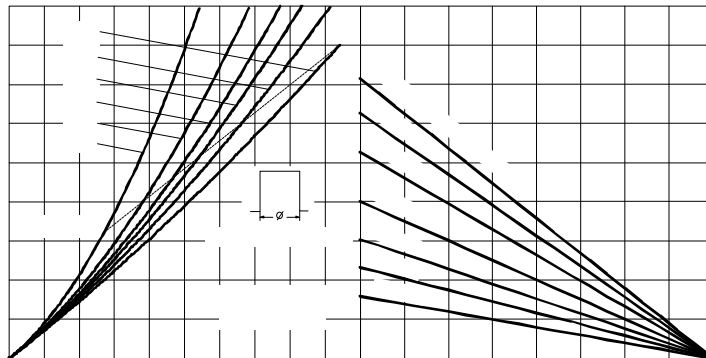


Fig. 4 - On-state Power Loss Characteristics

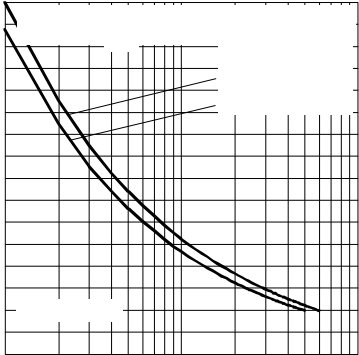


Fig. 5 - Maximum Non-repetitive Surge Current

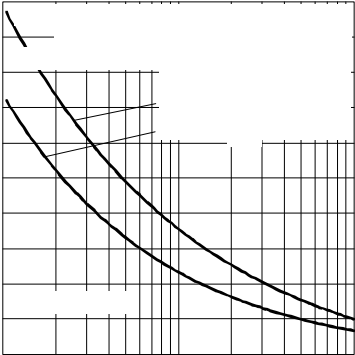


Fig. 6 - Maximum Non-repetitive Surge Current

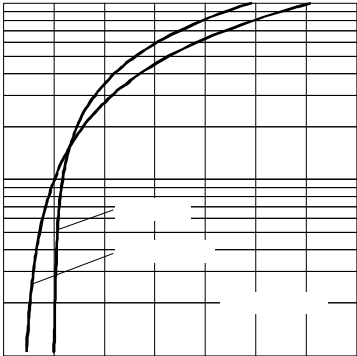


Fig. 7 - On-state Voltage Drop Characteristics

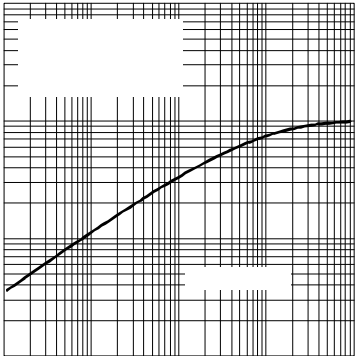


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

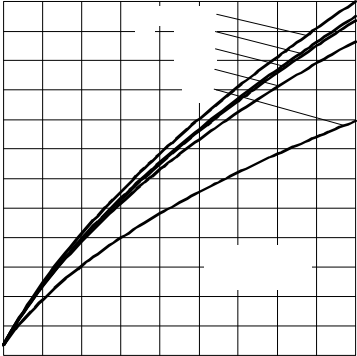


Fig. 9 - Reverse Recovered Charge Characteristics

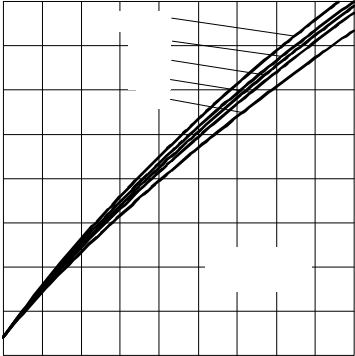


Fig. 10 - Reverse Recovery Current Characteristics

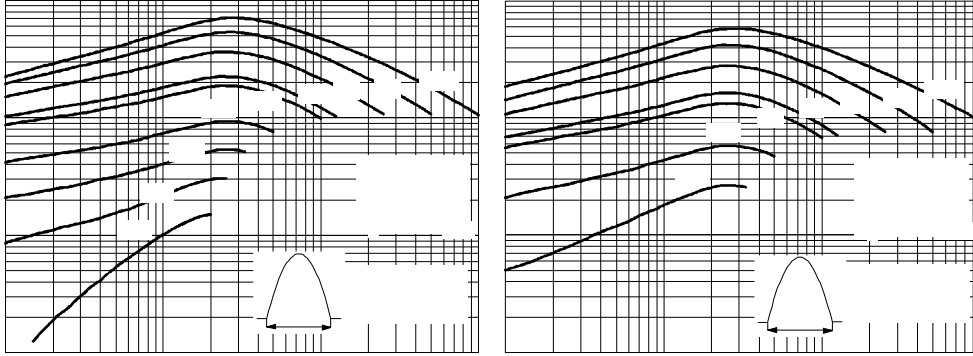


Fig. 11 - Frequency Characteristics

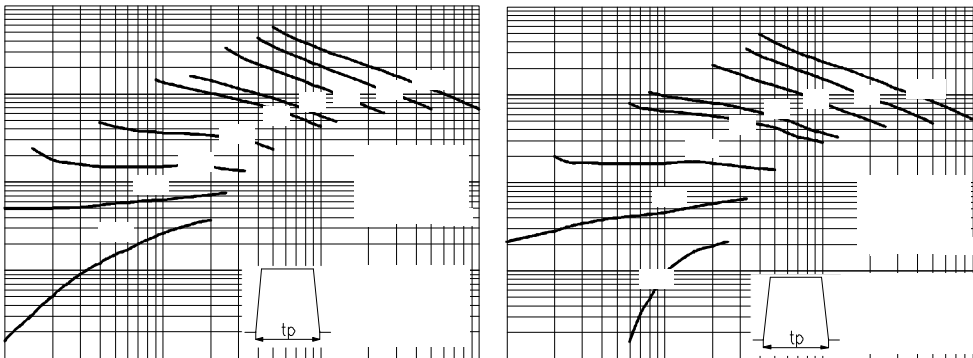


Fig. 12 - Frequency Characteristics

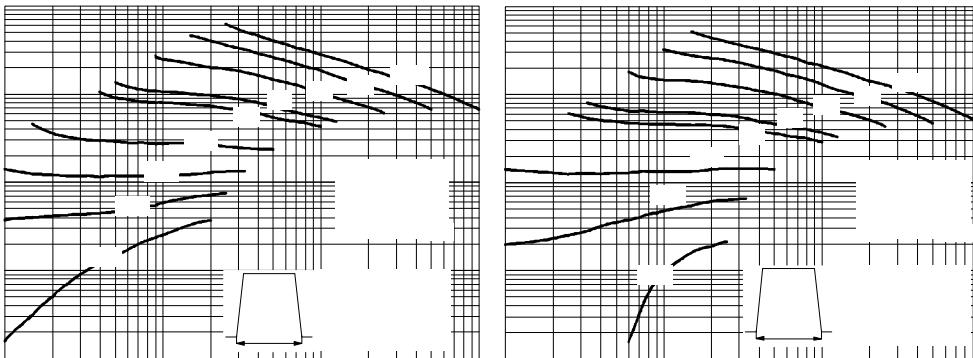


Fig. 13 - Frequency Characteristics

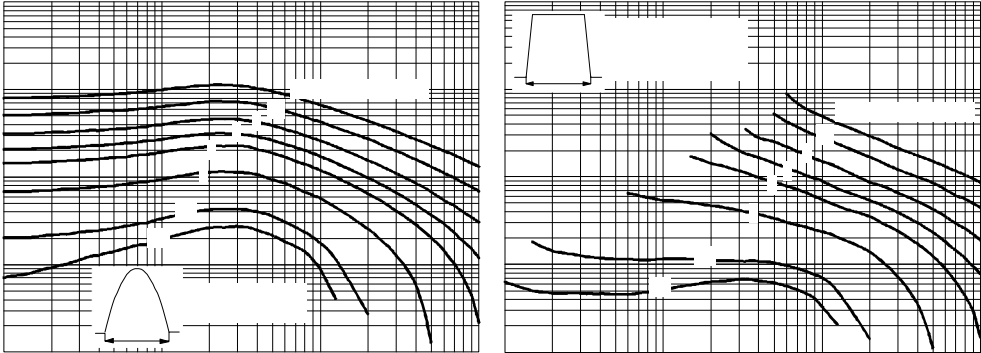


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

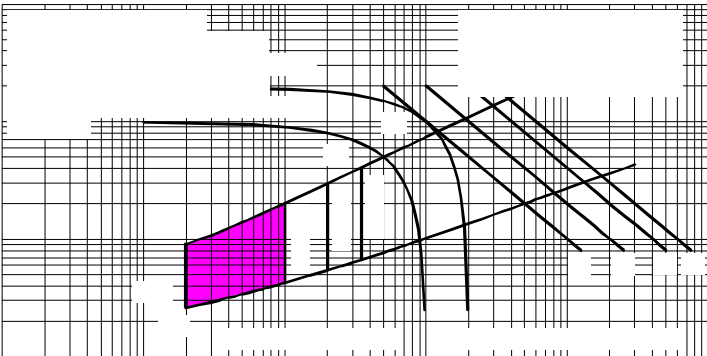


Fig. 15 - Gate Characteristics

## On-state Conduction

Parameter	ST303S	Units	Conditions
$V_{TM}$ Max. peak on-state voltage	2.16	V	$I_{TM} = 1255A$ , $T_J = T_J \text{ max}$ , $t_p = 10\text{ms}$ sine wave pulse
$V_{T(TO)1}$ Low level value of threshold voltage	1.44		$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max}$ .
$V_{T(TO)2}$ High level value of threshold voltage	1.46		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max}$ .
$r_{t1}$ Low level value of forward slope resistance	0.57	m $\Omega$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max}$ .
$r_{t2}$ High level value of forward slope resistance	0.56		$(I > \pi \times I_{T(AV)})$ , $T_J = T_J \text{ max}$ .
$I_H$ Maximum holding current	600	mA	$T_J = 25^\circ\text{C}$ , $I_T > 30A$
$I_L$ Typical latching current	1000		$T_J = 25^\circ\text{C}$ , $V_A = 12V$ , $R_a = 6\Omega$ , $I_G = 1A$

## Switching

Parameter	ST303S	Units	Conditions
$di/dt$ Max. non-repetitive rate of rise of turned-on current	1000	A/ $\mu\text{s}$	$T_J = T_J \text{ max}$ , $V_{DRM} = \text{rated } V_{DRM}$ $I_{TM} = 2 \times di/dt$
$t_d$ Typical delay time	0.80	$\mu\text{s}$	$T_J = 25^\circ\text{C}$ , $V_{DM} = \text{rated } V_{DRM}$ , $I_{TM} = 50A$ DC, $t_p = 1\mu\text{s}$ Resistive load, Gate pulse: 10V, 5 $\Omega$ source
$t_q$ Max. turn-off time (*)	Min 10 Max 30		$T_J = T_J \text{ max}$ , $I_{TM} = 550A$ , commutating $di/dt = 40A/\mu\text{s}$ $V_R = 50V$ , $t_p = 500\mu\text{s}$ , $dv/dt$ : see table in device code

(\*)  $t_q = 10$  to  $20\mu\text{s}$  for 400 to 800V devices;  $t_q = 15$  to  $30\mu\text{s}$  for 1000 to 1200V devices.

## Blocking

Parameter	ST303S	Units	Conditions
$dv/dt$ Maximum critical rate of rise of off-state voltage	500	V/ $\mu\text{s}$	$T_J = T_J \text{ max}$ , linear to 80% $V_{DRM}$ , higher value available on request
$I_{RRM}$ $I_{DRM}$ Max. peak reverse and off-state leakage current	50	mA	$T_J = T_J \text{ max}$ , rated $V_{DRM}/V_{RRM}$ applied

## Triggering

Parameter	ST303S	Units	Conditions
$P_{GM}$ Maximum peak gate power	60	W	$T_J = T_J \text{ max}$ , $f = 50\text{Hz}$ , $d\% = 50$
$P_{G(AV)}$ Maximum average gate power	10		
$I_{GM}$ Max. peak positive gate current	10	A	$T_J = T_J \text{ max}$ , $t_p \leq 5\text{ms}$
$+V_{GM}$ Maximum peak positive gate voltage	20	V	$T_J = T_J \text{ max}$ , $t_p \leq 5\text{ms}$
$-V_{GM}$ Maximum peak negative gate voltage	5		
$I_{GT}$ Max. DC gate current required to trigger	200	mA	$T_J = 25^\circ\text{C}$ , $V_A = 12V$ , $R_a = 6\Omega$
$V_{GT}$ Max. DC gate voltage required to trigger	3		
$I_{GD}$ Max. DC gate current not to trigger	20	mA	$T_J = T_J \text{ max}$ , rated $V_{DRM}$ applied
$V_{GD}$ Max. DC gate voltage not to trigger	0.25		



## ST303S Series

### Thermal and Mechanical Specifications

Parameter	ST303S	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	0.10	K/W	DC operation
$R_{thCS}$ Max. thermal resistance, case to heatsink	0.03		Mounting surface, smooth, flat and greased
T Mounting torque, $\pm 10\%$	48.5 (425)	Nm (lbf-in)	Non lubricated threads
wt Approximate weight	535	g	
Case style	TO-209AE (TO-118)		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°	0.011	0.008	K/W	$T_J = T_{J \text{ max.}}$
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**

ST	30	3	S	12	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 3/4" 16UNF-2A  
M = Stud base metric threads M24 x 1.5
- 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)  
3 = Threaded top terminal 3/8" 24UNF-2A
- 10** - Critical dv/dt:  
None = 500V/ $\mu$ sec (Standard value)  
L = 1000V/ $\mu$ sec (Special selection)

dv/dt - $t_q$ combinations available						
	dv/dt (V/ $\mu$ s)	20	50	100	200	400
$t_q$ ( $\mu$ s)	10	CN	DN	EN	<b>FN</b> *	HN
	12	CM	DM	EM	FM	HM
	15	CL	DL	EL	<b>FL</b> *	HL
	20	CK	DK	EK	<b>FK</b> *	HK
$t_q$ ( $\mu$ s)	15	CL	--	--	--	--
	18	CP	DP	--	--	--
	20	CK	DK	EK	<b>FK</b> *	HK
	25	CJ	DJ	EJ	<b>FJ</b> *	HJ
	30	--	DH	EH	FH	HH

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

Outline Table

