

### 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

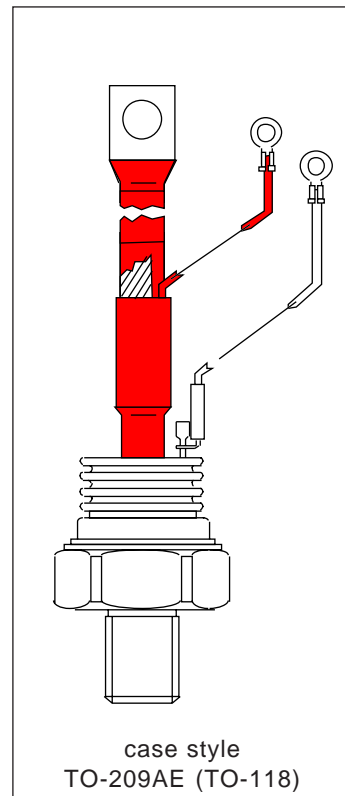
#### Typical Applications

- 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

Bulletin I25173 rev. B 03/94

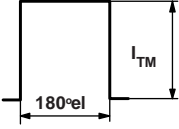
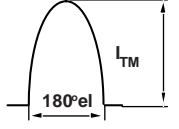
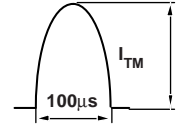
International  
IR Rectifier

### 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. @ $T_J = T_{J \text{ max.}}$ mA
ST303S	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	

#### Current Carrying Capability

Frequency							Units
	$I_{TM}$	$I_{TM}$	$I_{TM}$	$I_{TM}$	$I_{TM}$	$I_{TM}$	
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	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	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% $V_{RRM}$	
	7000		t = 8.3ms	reappplied	
$I^2t$ Maximum $I^2t$ for fusing	316		KA <sup>2</sup> s	t = 10ms	No voltage reappplied
	288			t = 8.3ms	reappplied
	224			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		

**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	$\mu\text{s}$	$T_J = 25^\circ\text{C}, V_{DM} = \text{rated } V_{DRM}, I_{TM} = 50A \text{ DC}, t_p = 1\mu\text{s}$ Resistive load, Gate pulse: 10V, 5 $\Omega$ source
$t_q$ Max. turn-off time (*)	Min 10 Max 30		$T_J = T_J \text{ max}, I_{TM} = 550A, \text{commutating } di/dt = 40A/\mu\text{s}$ $V_R = 50V, t_p = 500\mu\text{s}, dv/dt: \text{ see table in device code}$

(\*)  $t_q = 10$  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/ $\mu\text{s}$	$T_J = T_J \text{ max}, \text{ linear to } 80\% V_{DRM}, \text{ higher value available on request}$
$I_{RRM}$ $I_{DRM}$ Max. peak reverse and off-state leakage current	50	mA	$T_J = T_J \text{ max}, \text{ rated } V_{DRM}/V_{RRM} \text{ applied}$

**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	$T_J = T_J \text{ max}, \text{ rated } V_{DRM} \text{ applied}$
$V_{GD}$ Max. DC gate voltage not to trigger	0.25		

## ST303S Series

Bulletin I25173 rev. B 03/94

International  
IR Rectifier

### Thermal and Mechanical Specifications

Parameter	ST303S	Units	Conditions
T <sub>J</sub> Max. junction 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	0.10	K/W	DC operation
R <sub>thCS</sub> Max. thermal resistance, case to heatsink	0.03		Mounting surface, smooth, flat and greased
T Mounting torque, ± 10%	48.5 (425)	Nm (lbf-in)	Non lubricated threads
wt Approximate weight	535	g	
Case style	TO-209AE (TO-118)		See Outline Table

### ΔR<sub>thJC</sub> Conduction

(The following table shows the increment of thermal resistance R<sub>thJC</sub> 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 <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**

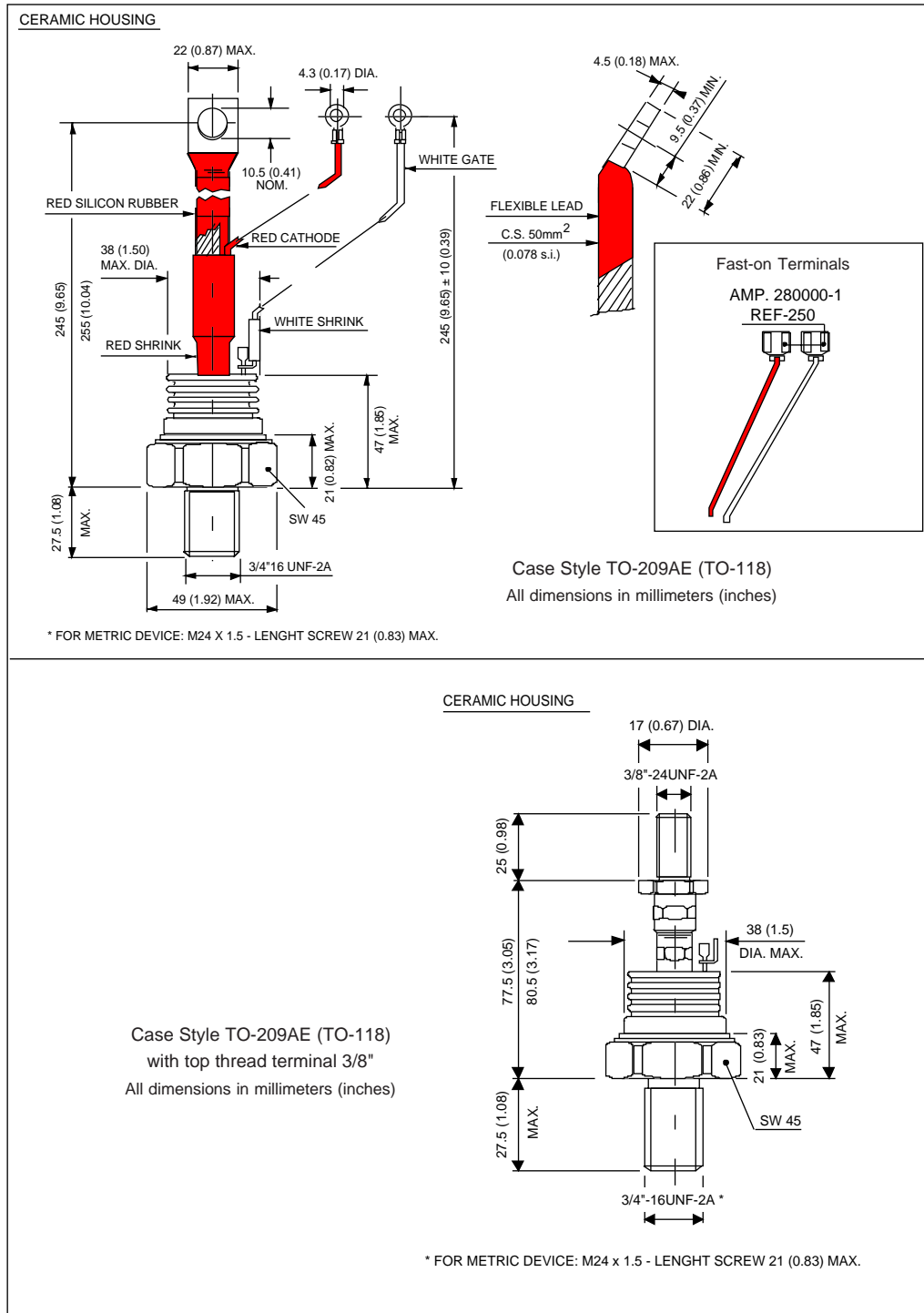
ST	30	3	S	12	P	F	N	0	
①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

- 1** - Thyristor
- 2** - Essential part number
- 3** - 3 = Fast turn off
- 4** - S = Compression bonding Stud
- 5** - Voltage code: Code x 100 = V<sub>RRM</sub> (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<sub>q</sub> test condition)
- 8** - t<sub>q</sub> 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/μsec (Standard value)  
L = 1000V/μsec (Special selection)

dv/dt - t <sub>q</sub> combinations available							
	dv/dt (V/μs)	20	50	100	200	400	
t <sub>q</sub> (μs)	10	CN	DN	EN	<b>FN</b> *	HN	
	12	CM	DM	EM	FM	HM	
	up to 800V	15	CL	DL	EL	<b>FL</b> *	HL
		20	CK	DK	EK	<b>FK</b> *	HK
t <sub>q</sub> (μs)	15	CL	--	--	--	--	
	18	CP	DP	--	--	--	
	only for 1000/1200V	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



# ST303S Series

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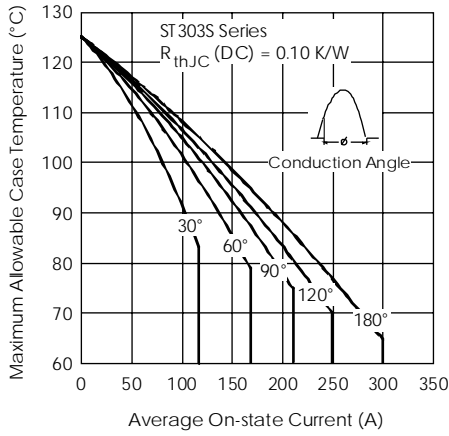


Fig. 1 - Current Ratings Characteristics

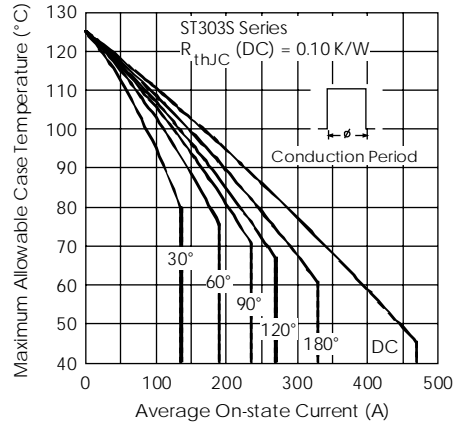


Fig. 2 - Current Ratings Characteristics

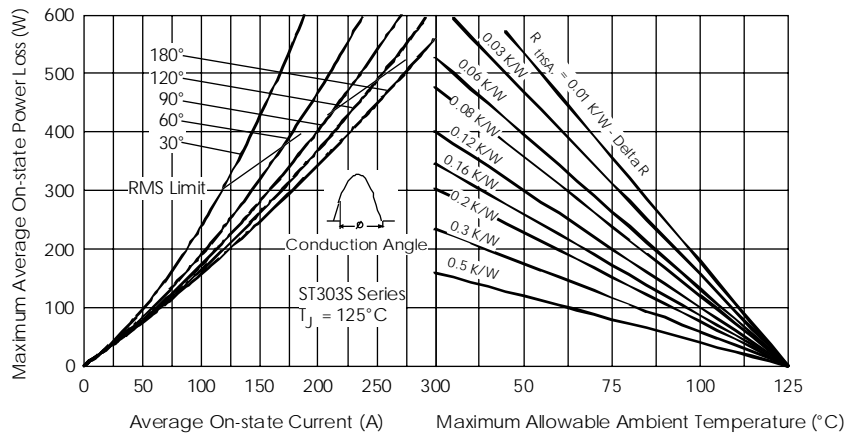


Fig. 3 - On-state Power Loss Characteristics

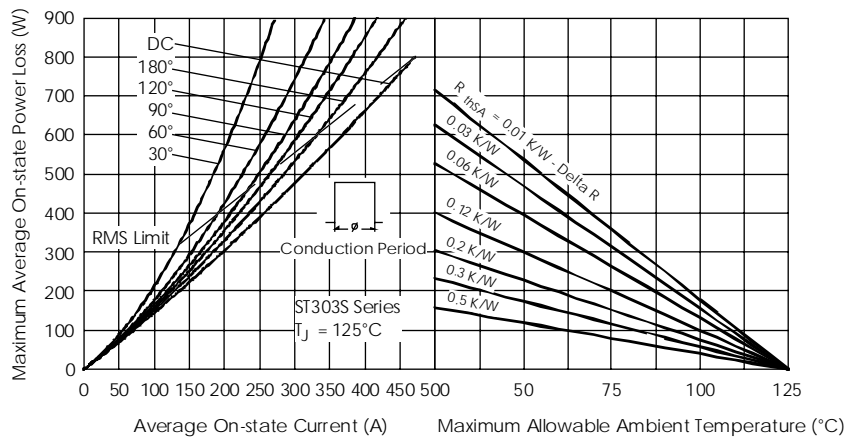


Fig. 4 - On-state Power Loss Characteristics

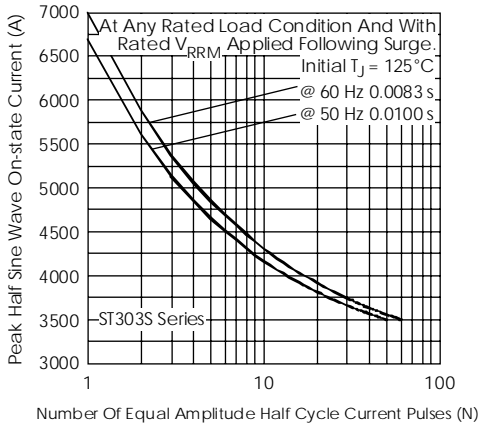


Fig. 5 - Maximum Non-repetitive Surge Current

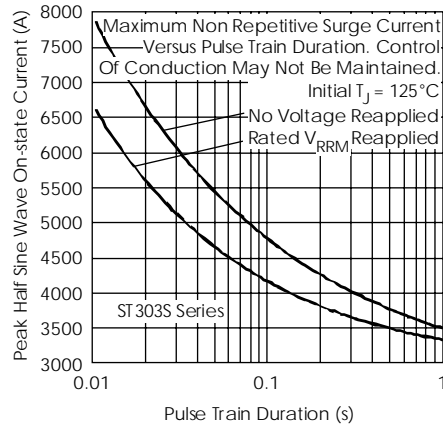


Fig. 6 - Maximum Non-repetitive Surge Current

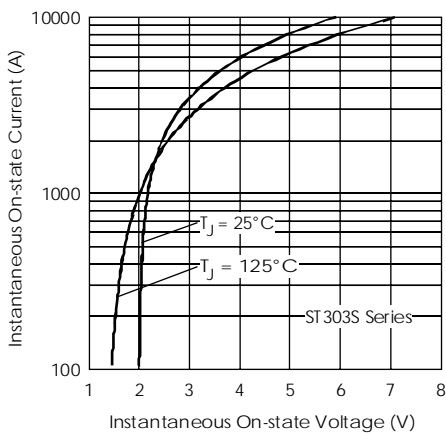


Fig. 7 - On-state Voltage Drop Characteristics

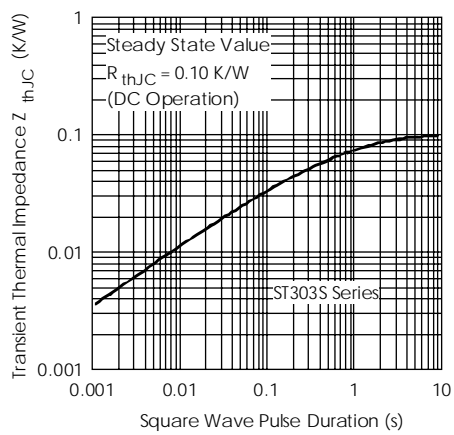


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristic

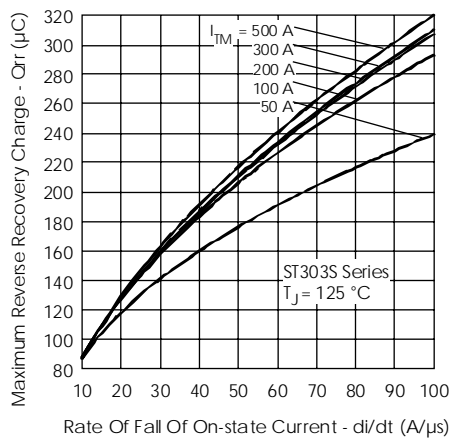


Fig. 9 - Reverse Recovered Charge Characteristics

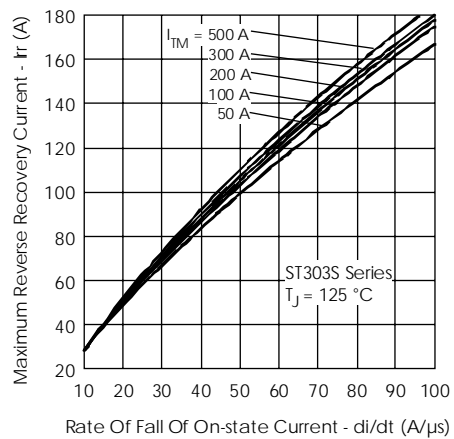


Fig. 10 - Reverse Recovery Current Characteristics

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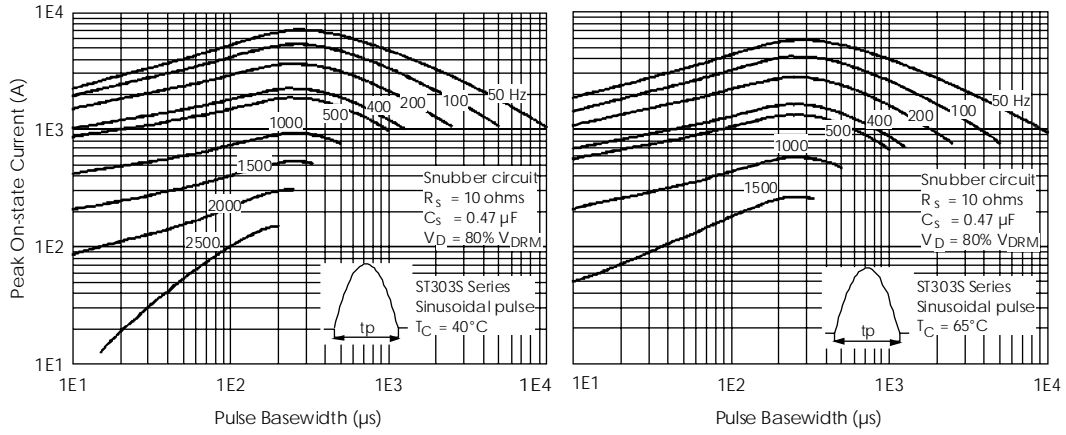


Fig. 11 - Frequency Characteristics

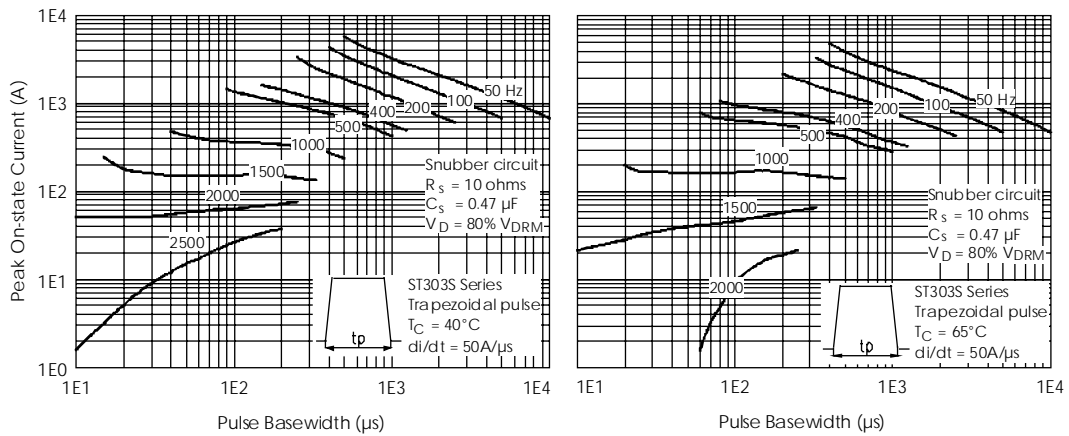


Fig. 12 - Frequency Characteristics

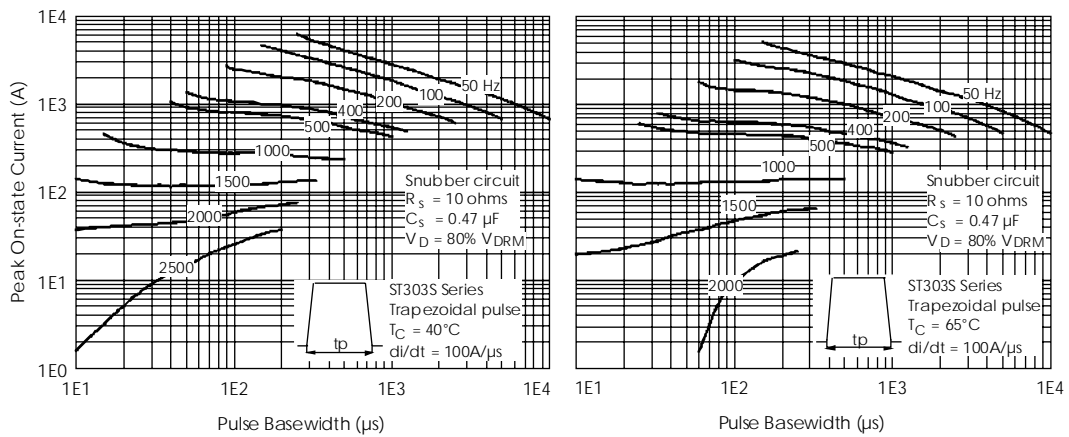


Fig. 13 - Frequency Characteristics



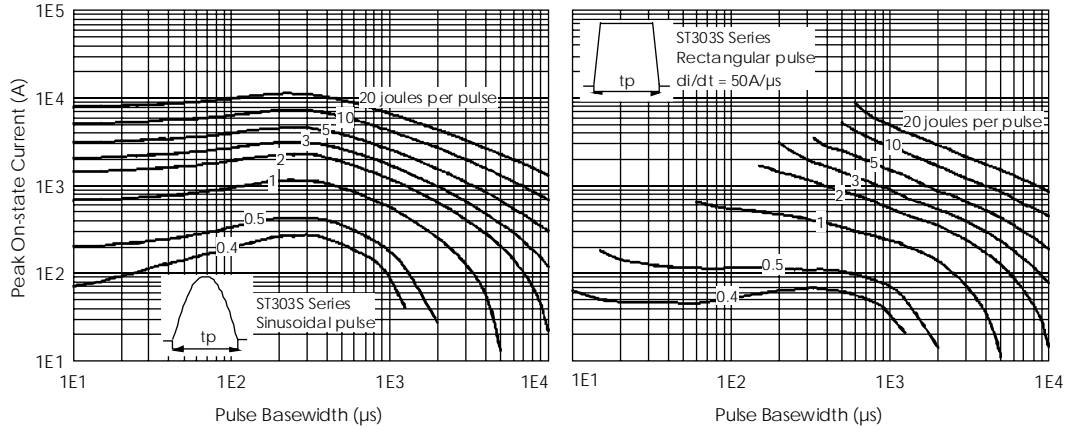


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

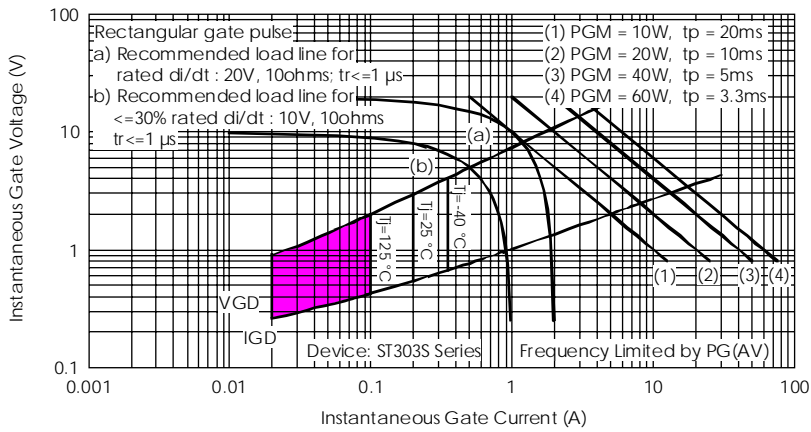


Fig. 15 - Gate Characteristics