

International
IRF Rectifier

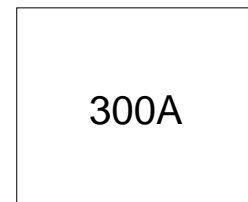
ST303S SERIES

INVERTER GRADE THYRISTORS

Stud Version

Features

- Center amplifying gate
- High surge current capability
- Low thermal impedance
- High speed performance

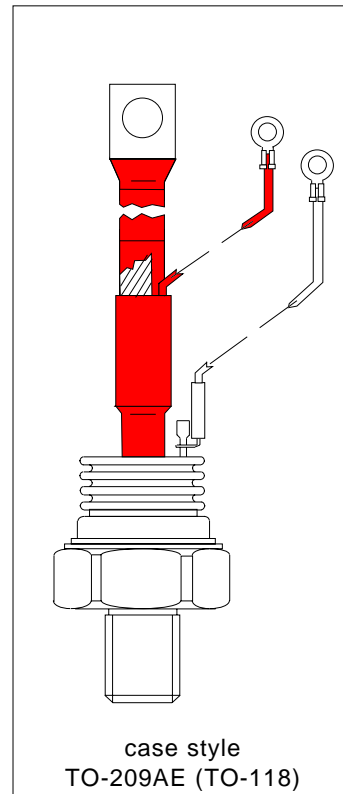


Typical Applications

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

Major Ratings and Characteristics

Parameters	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 ² s
@ 60Hz	288	KA ² s
V_{DRM}/V_{RRM}	400 to 1200	V
t_q	10 - 20	μs
T_J	- 40 to 125	°C



ST303S Series

Bulletin I25173 rev. C 03/03

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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	
	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	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 ² 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 ² /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 Ω	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}), T_J = T_J \text{ max.}$
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/ μs	$T_J = T_J \text{ max}, V_{DRM} = \text{rated } V_{DRM}$ $I_{TM} = 2 \times \text{di/dt}$
t_d Typical delay time	0.80	μs	$T_J = 25^\circ\text{C}, V_{DM} = \text{rated } V_{DRM}, I_{TM} = 50A \text{ DC}, t_p = 1\mu\text{s}$ Resistive load, Gate pulse: 10V, 5 Ω source
t_q Max. turn-off time	10 - 20		$T_J = T_J \text{ max}, I_{TM} = 550A, \text{commutating di/dt} = 40A/\mu\text{s}$ $V_R = 50V, t_p = 500\mu\text{s}, dv/dt = 200V/\mu\text{s}$

Blocking

Parameter	ST303S	Units	Conditions
dv/dt Maximum critical rate of rise of off-state voltage	500	V/ μs	$T_J = T_J \text{ max}, \text{linear to } 80\% V_{DRM}, \text{higher value available on request}$
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	V	
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		

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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

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°	0.011	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	K	0
1	2	3	4	5	6	7	8	9

- 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
- 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)

dv/dt - t_q combinations available		
	dv/dt (V/ μ s)	200
t_q (μ s) up to 800V	10	FN
	20	FK
t_q (μ s) only for 1000/1200V	20	FK

Outline Table

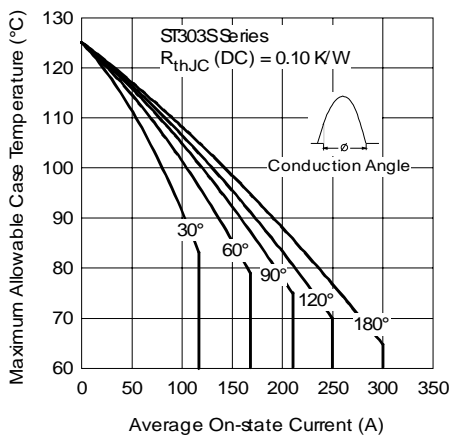
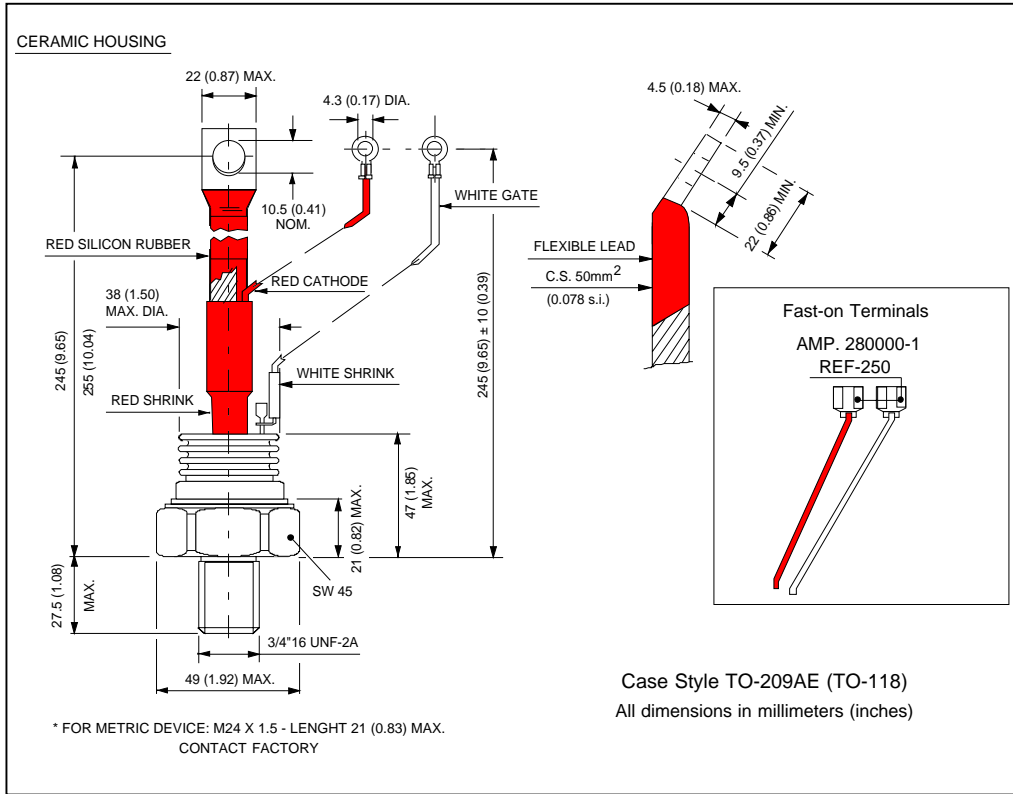


Fig. 1 - Current Ratings Characteristics

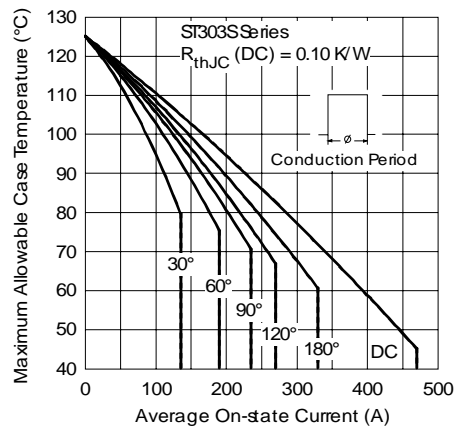


Fig. 2 - Current Ratings Characteristics

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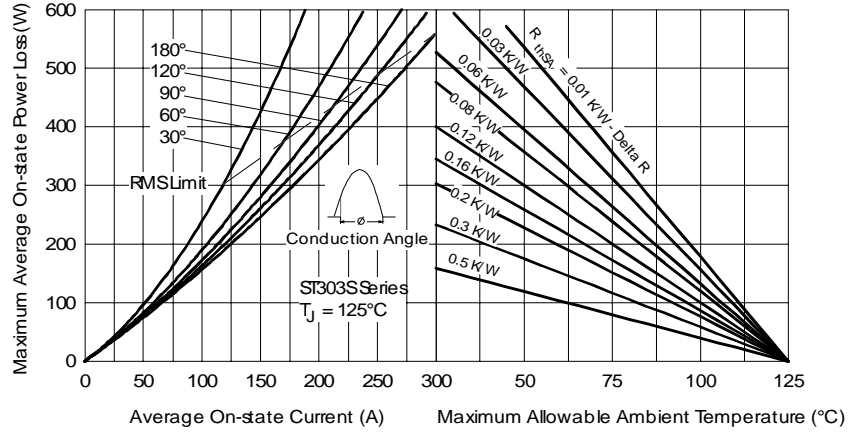


Fig. 3 - On-state Power Loss Characteristics

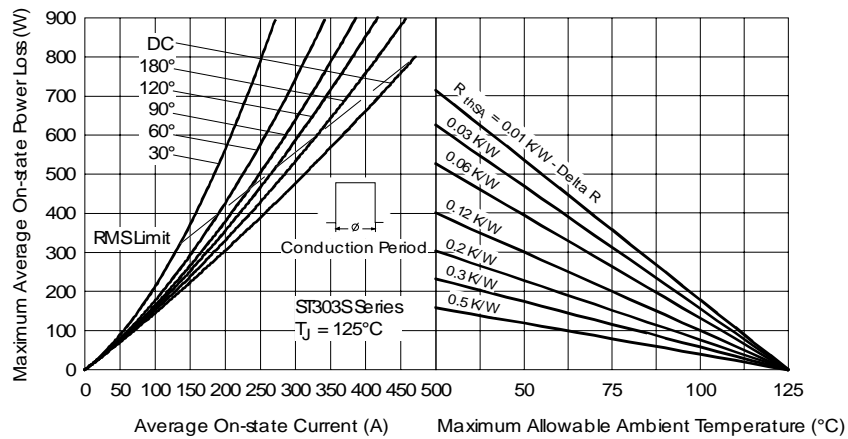


Fig. 4 - On-state Power Loss Characteristics

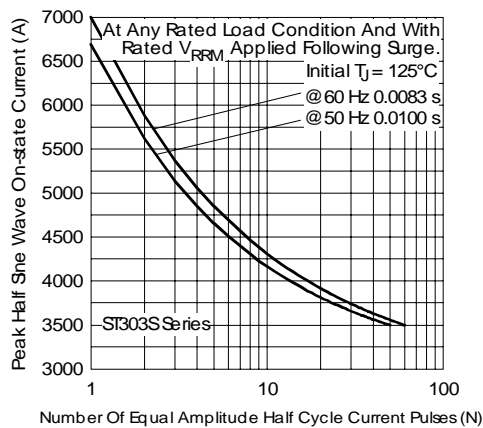


Fig. 5 - Maximum Non-repetitive Surge Current

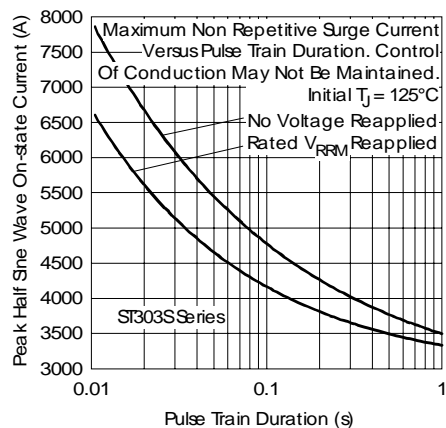


Fig. 6 - Maximum Non-repetitive Surge Current

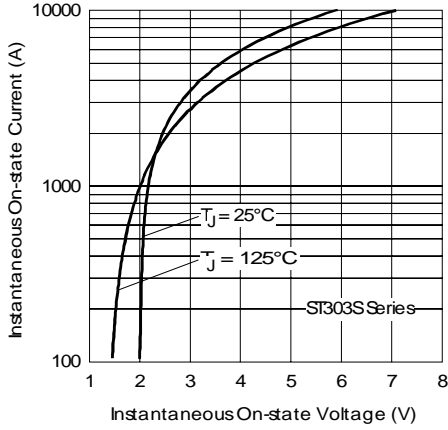


Fig. 7 - On-state Voltage Drop Characteristics

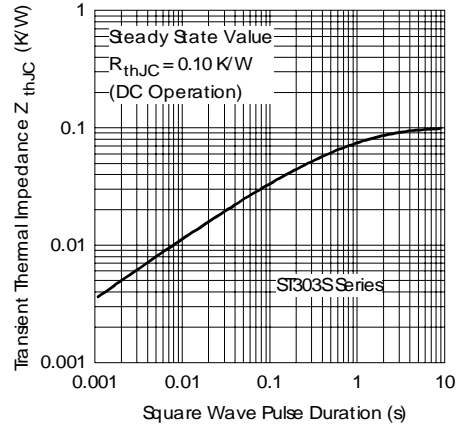


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

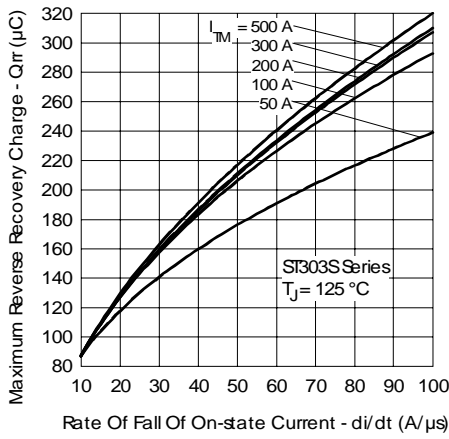


Fig. 9 - Reverse Recovered Charge Characteristics

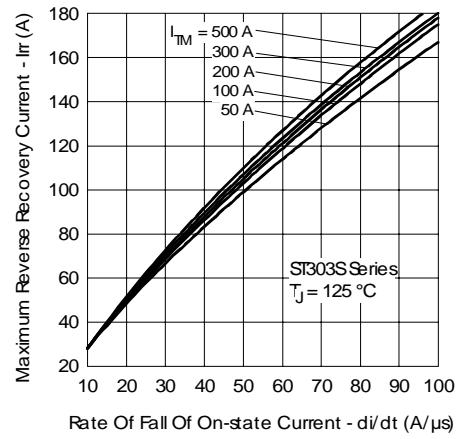


Fig. 10 - Reverse Recovery Current Characteristics

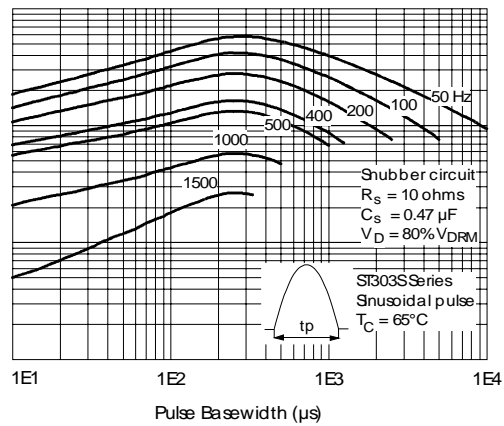
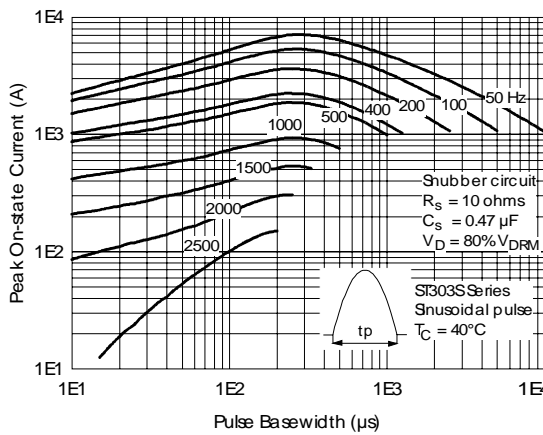


Fig. 11 - Frequency Characteristics

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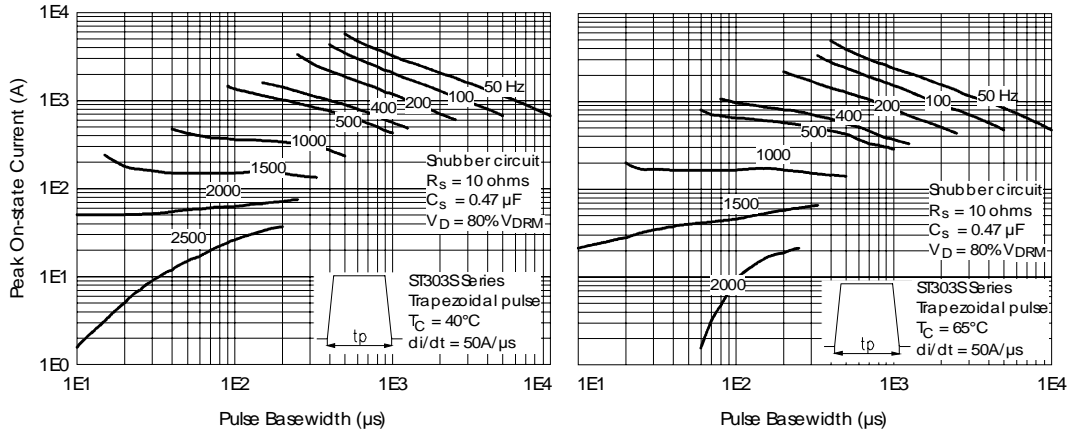


Fig. 12 - Frequency Characteristics

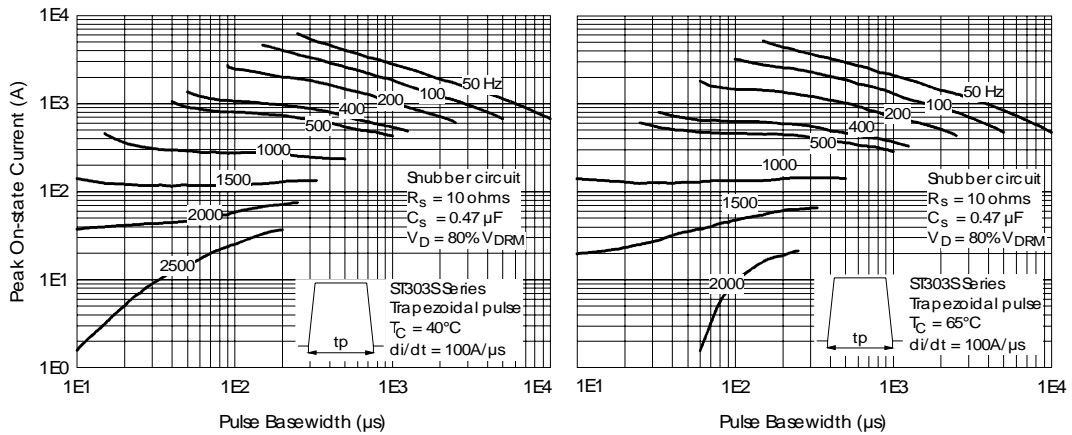


Fig. 13 - Frequency Characteristics

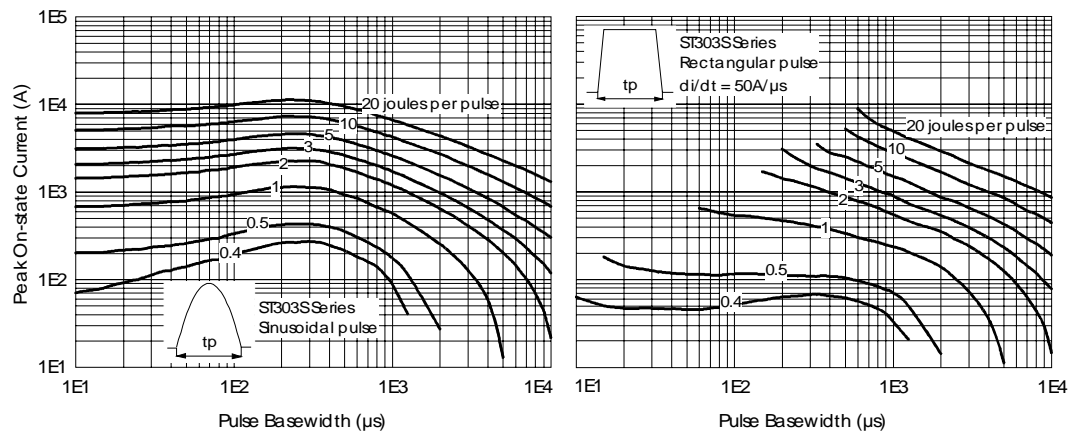


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

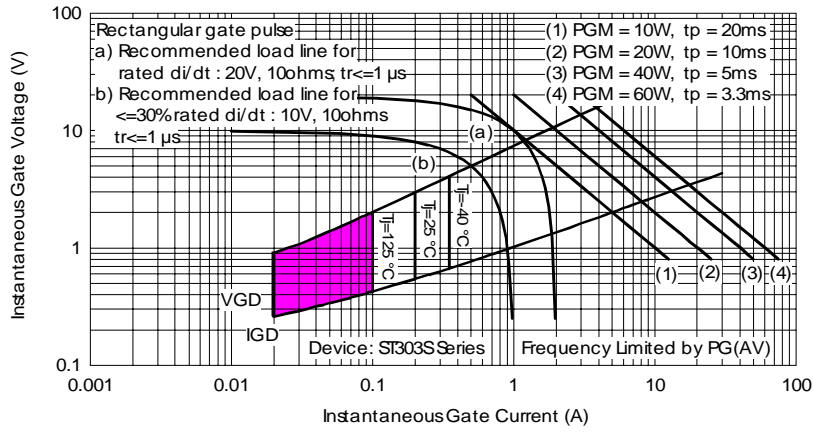


Fig. 15 - Gate Characteristics

Data and specifications subject to change without notice.
 This product has been designed and qualified for Industrial Level.
 Qualification Standards can be found on IR's Web site.