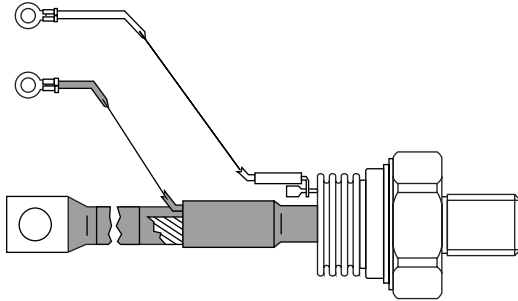


Inverter Grade Thyristors (Stud Version), 300 A



TO-209AE (TO-118)

FEATURES

- Center amplifying gate
- High surge current capability
- Low thermal impedance
- High speed performance
- Compression bonding
- Lead (Pb)-free
- Designed and qualified for industrial level


**RoHS
COMPLIANT**
TYPICAL APPLICATIONS

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

PRODUCT SUMMARY

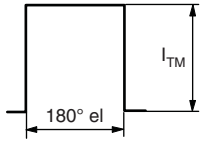
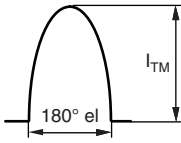
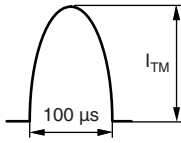
$I_{T(AV)}$	300 A
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MAJOR RATINGS AND CHARACTERISTICS

PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		300	A
	T_C	65	°C
$I_{T(RMS)}$		471	A
I_{TSM}	50 Hz	7950	
	60 Hz	8320	
I^2t	50 Hz	316	kA ² s
	60 Hz	288	
V_{DRM}/V_{RRM}		400 to 1200	V
t_q		10/20	μs
T_J		- 40 to 125	°C

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} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
ST303S	04	400	500	50
	08	800	900	
	12	1200	1300	

CURRENT CARRYING CAPABILITY							
FREQUENCY							UNITS
50 Hz	670	470	1050	940	5240	4300	A
400 Hz	480	330	1021	710	1800	1270	
1000 Hz	230	140	760	470	730	430	
2500 Hz	35	-	150	-	90	-	
Recovery voltage V_R	50		50		50		V
Voltage before turn-on V_D	V_{DRM}		V_{DRM}		V_{DRM}		
Rise of on-state current di/dt	50		-		-		A/ μ s
Case temperature	40	65	40	65	40	65	$^{\circ}$ C
Equivalent values for RC circuit	10/0.47		10/0.47		10/0.47		Ω/μ F

ON-STATE CONDUCTION						
PARAMETER	SYMBOL	TEST CONDITIONS			VALUES	UNITS
Maximum average on-state current at case temperature	$I_{T(AV)}$	180° conduction, half sine wave			300	A
					65	$^{\circ}$ C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 45 $^{\circ}$ C case temperature			471	A
Maximum peak, one half cycle, non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reappplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	7950	
		t = 8.3 ms			8320	
		t = 10 ms	100 % V_{RRM} reappplied		6690	
		t = 8.3 ms			7000	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reappplied		316	kA 2 s
		t = 8.3 ms			288	
		t = 10 ms	100 % V_{RRM} reappplied		224	
		t = 8.3 ms			204	
Maximum $I^2\sqrt{t}$ for fusing	$I^2\sqrt{t}$	t = 0.1 to 10 ms, no voltage reappplied			3160	kA $^2\sqrt{s}$
Maximum peak on-state voltage	V_{TM}	$I_{TM} = 1255$ A, $T_J = T_J$ maximum, $t_p = 10$ ms sine wave pulse			2.16	V
Low level value of threshold voltage	$V_{T(TO)1}$	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			1.44	
High level value of threshold voltage	$V_{T(TO)2}$	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			1.46	
Low level value of forward slope resistance	r_{f1}	$(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			0.57	m Ω
High level value of forward slope resistance	r_{f2}	$(I > \pi \times I_{T(AV)})$, $T_J = T_J$ maximum			0.56	
Maximum holding current	I_H	$T_J = 25$ $^{\circ}$ C, $I_T > 30$ A			600	mA
Typical latching current	I_L	$T_J = 25$ $^{\circ}$ C, $V_A = 12$ V, $R_a = 6$ Ω , $I_G = 1$ A			1000	



SWITCHING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum non-repetitive rate of rise of turned-on current	di/dt	$T_J = T_J$ maximum, $V_{DRM} = \text{Rated } V_{DRM}$ $I_{TM} = 2 \times di/dt$	1000	A/ μ s
Typical delay time	t_d	$T_J = 25 \text{ }^\circ\text{C}$, $V_{DM} = \text{Rated } V_{DRM}$, $I_{TM} = 50 \text{ A DC}$, $t_p = 1 \text{ } \mu\text{s}$ Resistive load, gate pulse: 10 V, 5 Ω source	0.80	μ s
Maximum turn-off time	minimum	$T_J = T_J$ maximum, $I_{TM} = 550 \text{ A}$, commutating $di/dt = 40 \text{ A}/\mu\text{s}$ $V_R = 50 \text{ V}$, $t_p = 500 \text{ } \mu\text{s}$, $dV/dt = 200 \text{ V}/\mu\text{s}$	10	
	maximum		20	

BLOCKING				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum critical rate of rise of off-state voltage	dV/dt	$T_J = T_J$ maximum, linear to 80 % V_{DRM} , higher value available on request	500	V/ μ s
Maximum peak reverse and off-state leakage current	I_{RRM} I_{DRM}	$T_J = T_J$ maximum, rated V_{DRM}/V_{RRM} applied	50	mA

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

THERMAL AND MECHANICAL SPECIFICATIONS				
PARAMETER	SYMBOL	TEST CONDITIONS	VALUES	UNITS
Maximum operating junction temperature range	T_J		- 40 to 125	$^\circ\text{C}$
Maximum storage temperature range	T_{Stg}		- 40 to 150	
Maximum thermal resistance, junction to case	R_{thJC}	DC operation	0.10	K/W
Maximum thermal resistance, case to heatsink	R_{thCS}	Mounting surface, smooth, flat and greased	0.03	
Mounting force, $\pm 10 \%$		Non-lubricated threads	48.5 (425)	N · m (lbf · in)
Approximate weight			535	g
Case style		See dimensions - link at the end of datasheet	TO-209AE (TO-118)	

ΔR_{thJ-hs} CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.011	0.008	T _J = T _J maximum	K/W
120°	0.013	0.014		
90°	0.017	0.018		
60°	0.025	0.026		
30°	0.041	0.042		

Note

- The table above shows the increment of thermal resistance R_{thJ-hs} when devices operate at different conduction angles than DC

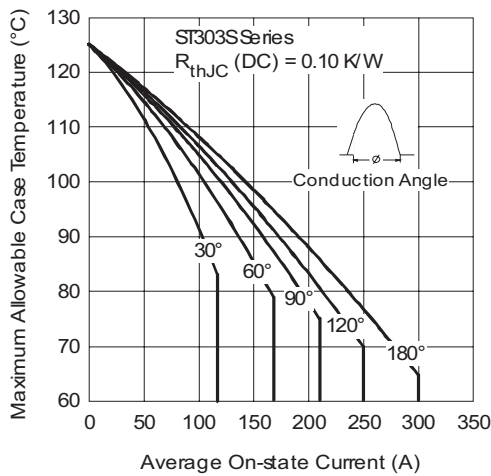


Fig. 1 - Current Ratings Characteristics

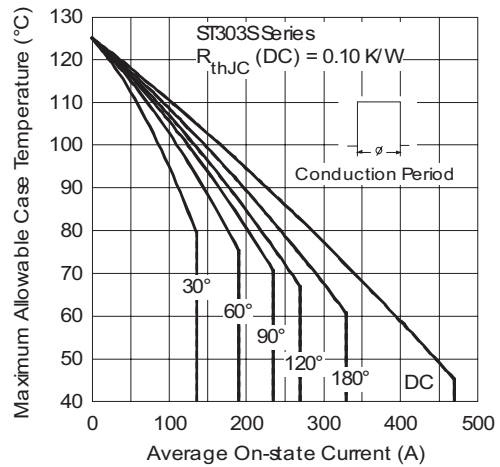


Fig. 2 - Current Ratings Characteristics

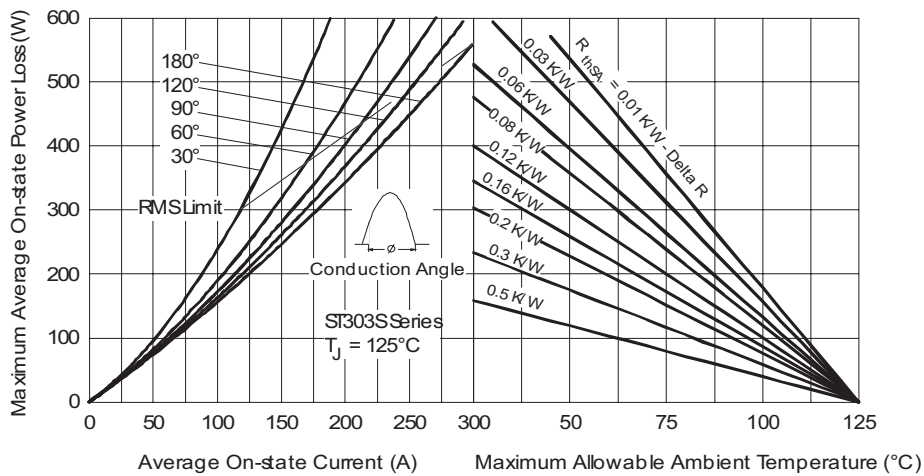


Fig. 3 - On-State Power Loss Characteristics

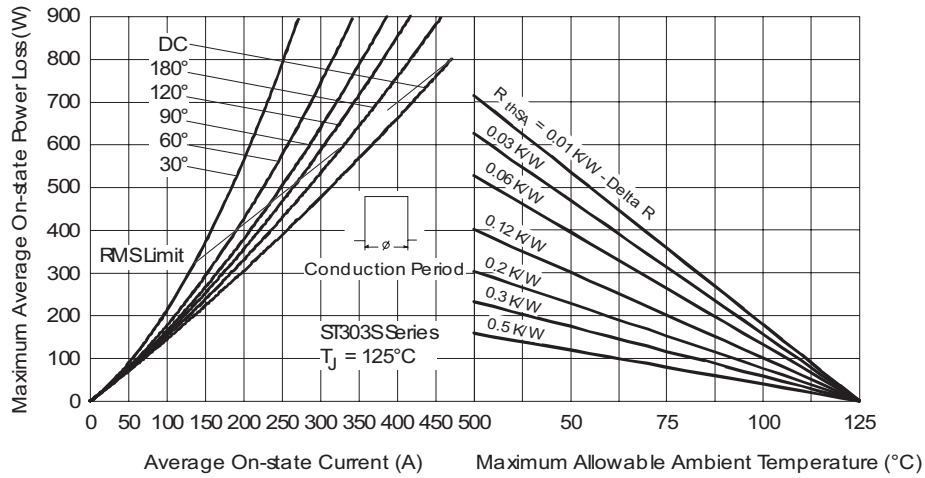


Fig. 4 - On-State Power Loss Characteristics

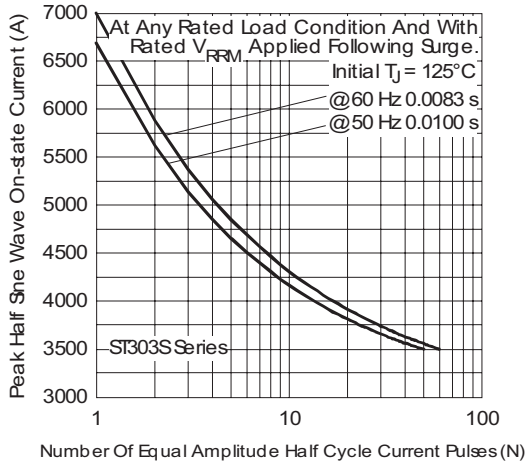


Fig. 5 - Maximum Non-Repetitive Surge Current

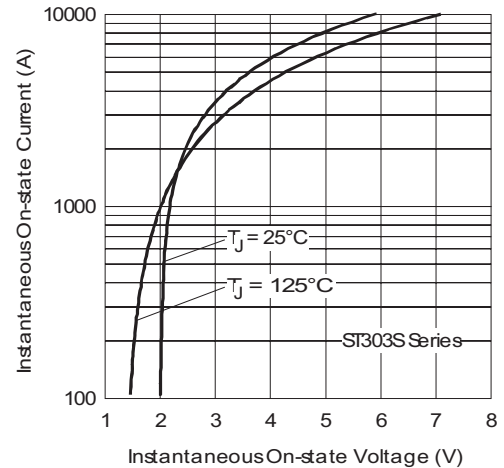


Fig. 7 - On-State Voltage Drop Characteristics

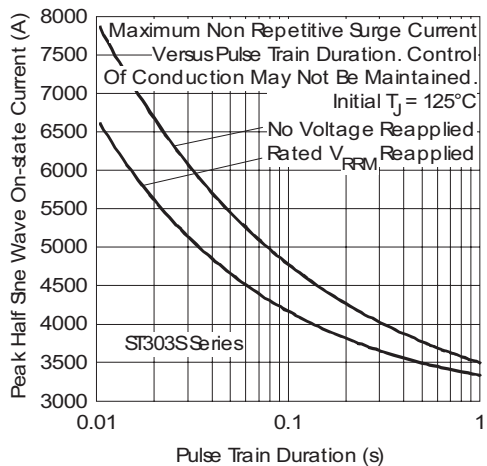


Fig. 6 - Maximum Non-Repetitive Surge Current

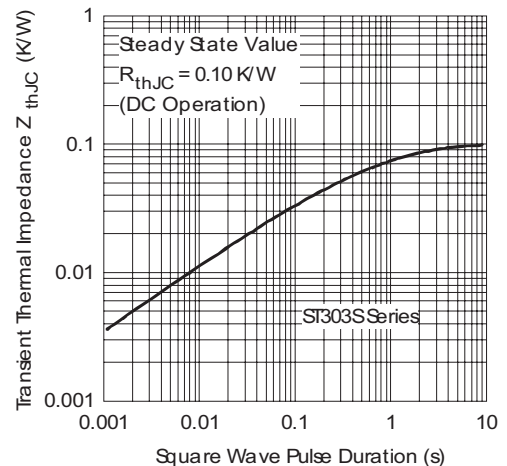


Fig. 8 - Thermal Impedance Z_{thJC} Characteristics

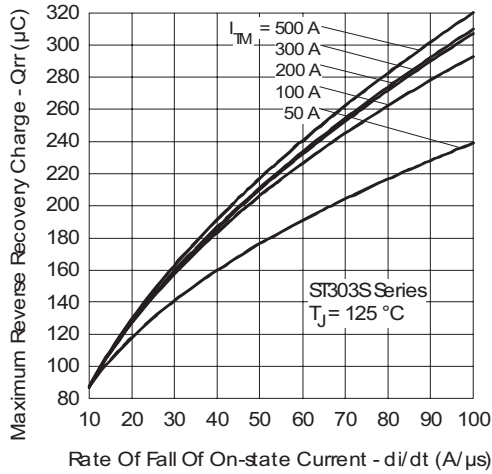


Fig. 9 - Reverse Recovered Charge Characteristics

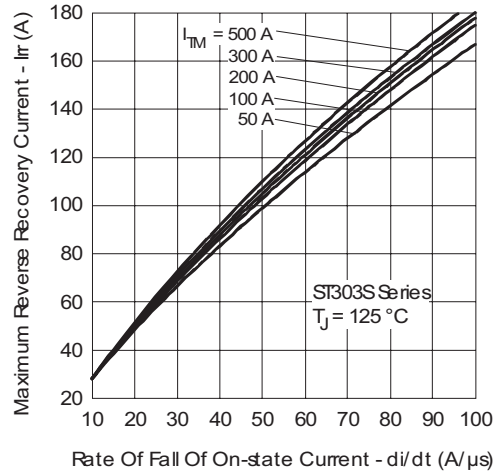


Fig. 10 - Reverse Recovery Current Characteristics

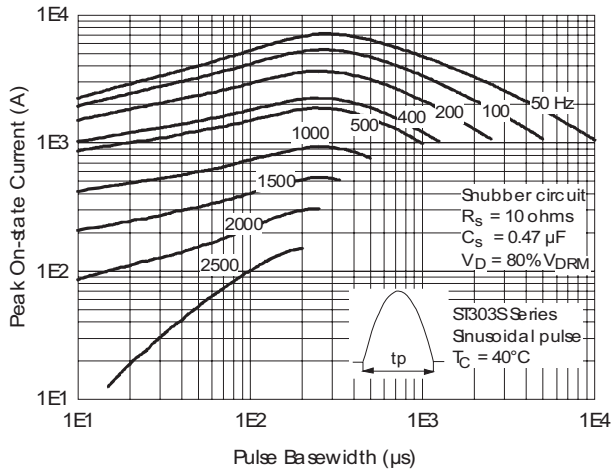


Fig. 11 - Frequency Characteristics

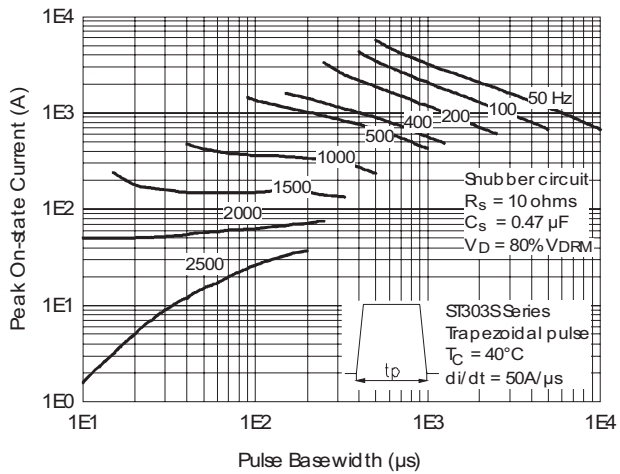
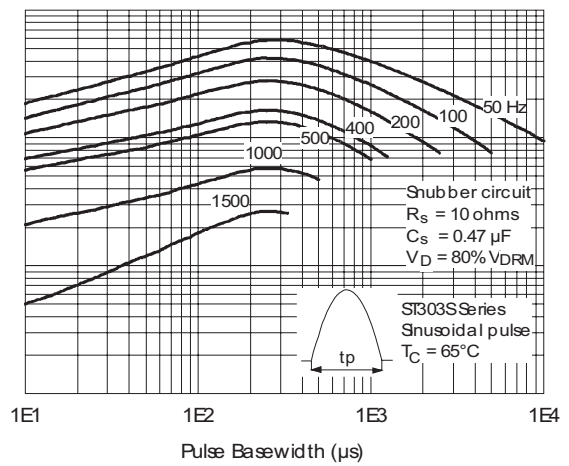
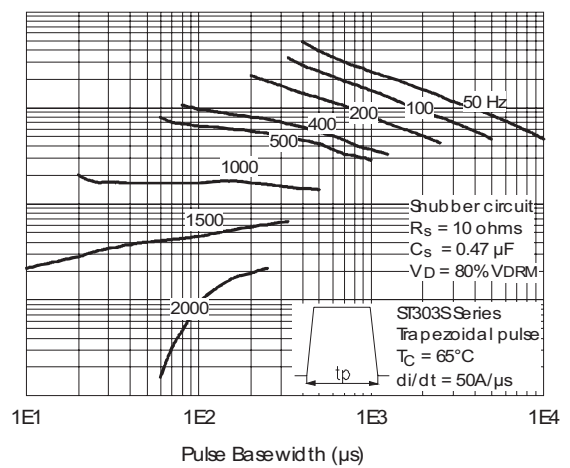


Fig. 12 - Frequency Characteristics



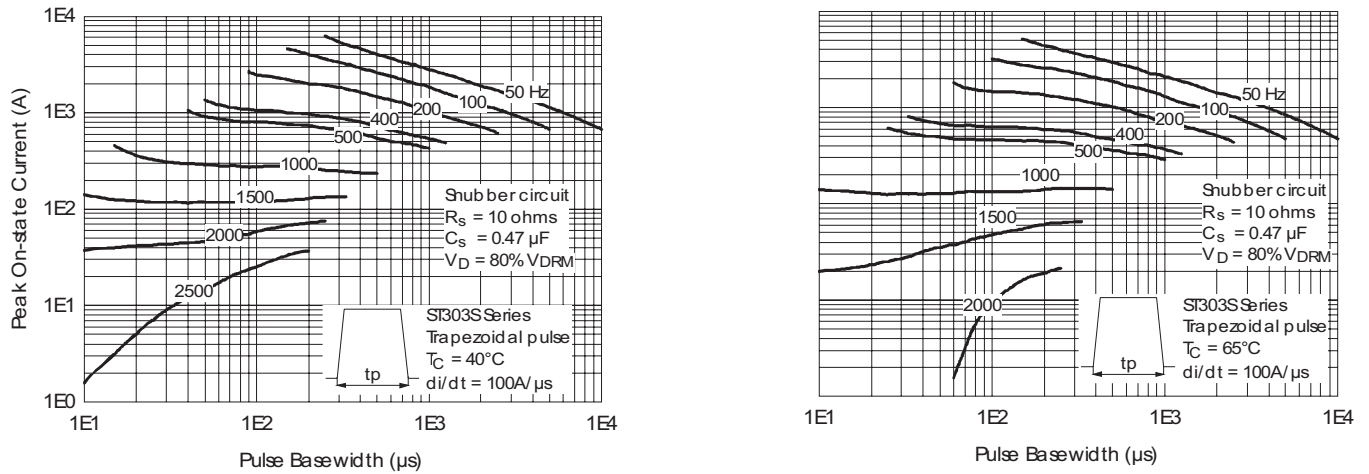


Fig. 13 - Frequency Characteristics

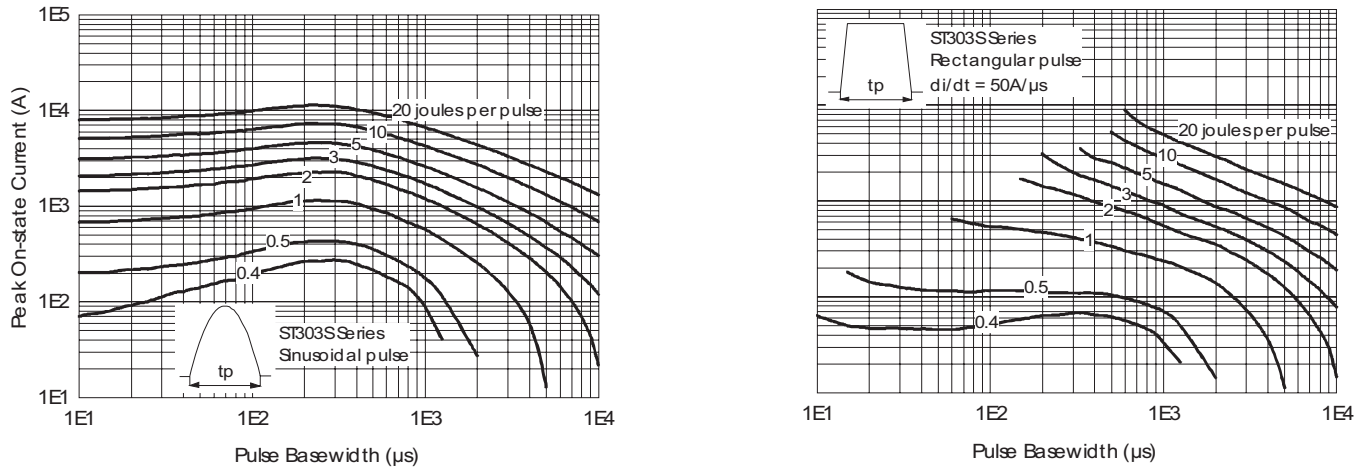


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

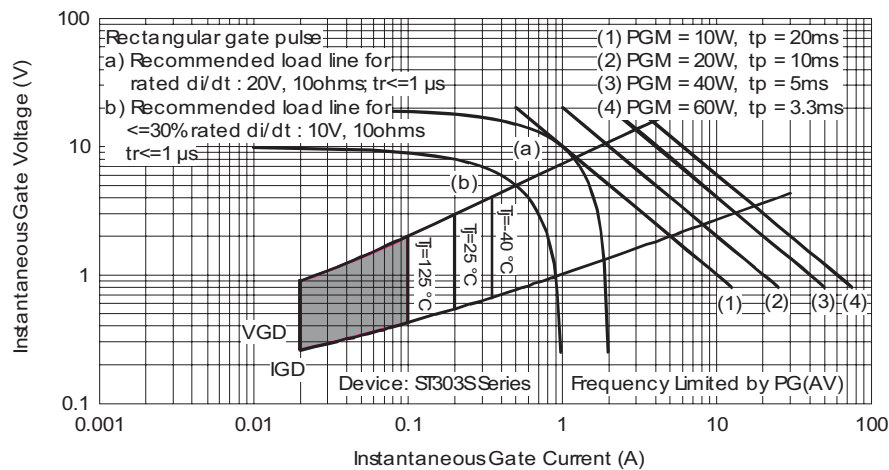


Fig. 15 - Gate Characteristics

ST303SPbF Series



Vishay High Power Products Inverter Grade Thyristors
(Stud Version), 300 A

ORDERING INFORMATION TABLE

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

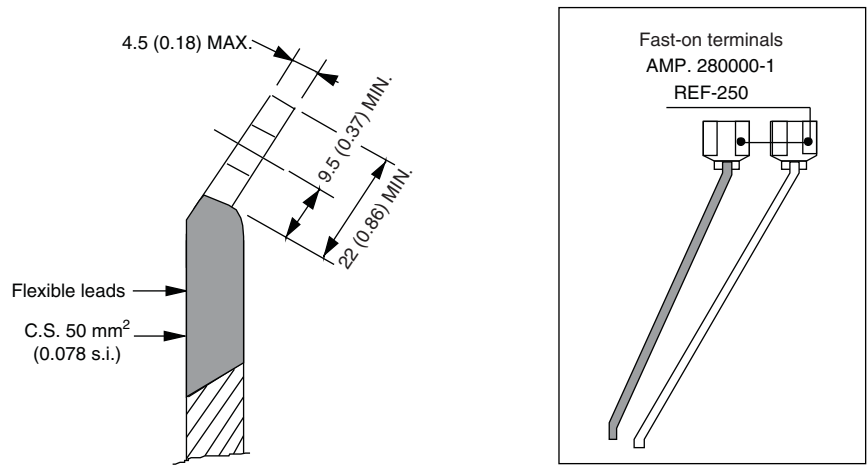
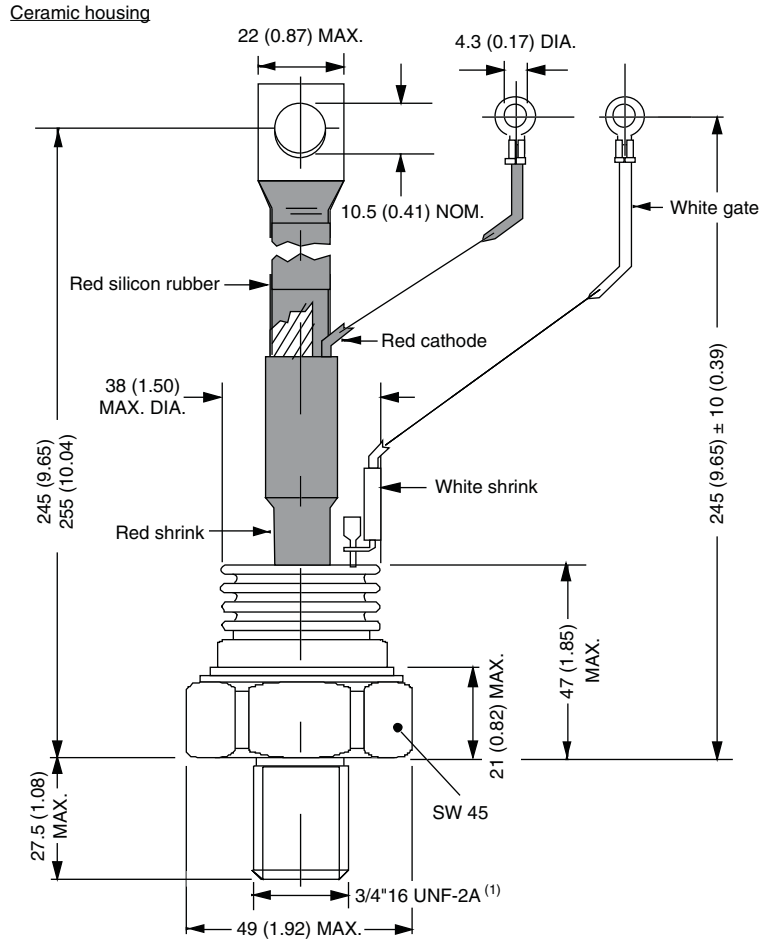
- 1** - Thyristor
- 2** - Essential part number
- 3** - 3 = Fast turn-off
- 4** - S = Compression bonding stud
- 5** - Voltage code x 100 = V_{RRM}
(see Voltage Ratings table)
- 6** - P = Stud base 3/4" 16UNF-2A
- 7** - Reapplied dV/dt code (for t_q test condition)
- 8** - t_q code
- 9** - 0 = Eyelet terminals
(gate and auxiliary cathode leads)
1 = Fast-on terminals
(gate and auxiliary cathode leads)
- 10** - Lead (Pb)-free

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

LINKS TO RELATED DOCUMENTS	
Dimensions	http://www.vishay.com/doc?95080

TO-209AE (TO-118)

DIMENSIONS in millimeters (inches)



Note

⁽¹⁾ For metric device: M24 x 1.5 - length 21 (0.83) maximum



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Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru

moschip.ru_4

moschip.ru_6

moschip.ru_9