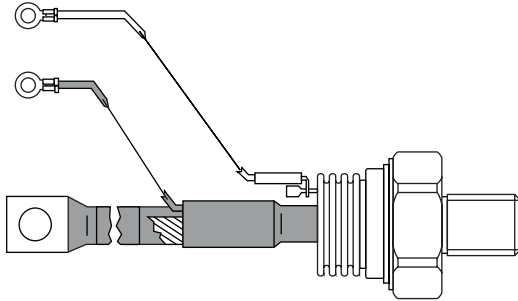


## Inverter Grade Thyristors (Stud Version), 300 A



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**

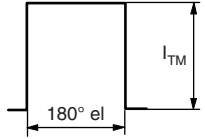
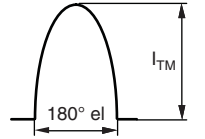
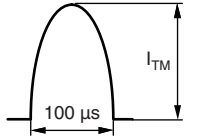
$I_{T(AV)}$	300 A
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**MAJOR RATINGS AND CHARACTERISTICS**

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 <sup>2</sup> 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/μs
Case temperature	40	65	40	65	40	65	°C
Equivalent values for RC circuit	10/0.47		10/0.47		10/0.47		Ω/μF

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	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 45 °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 <sup>2</sup> 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 <sup>2</sup> √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	mΩ
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	$I_H$	$T_J = 25$ °C, $I_T > 30$ A			600	mA
Typical latching current	$I_L$	$T_J = 25$ °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/ $\mu$ s
Typical delay time	$t_d$	$T_J = 25^\circ\text{C}$ , $V_{DM} = \text{Rated } V_{DRM}$ , $I_{TM} = 50$ A DC, $t_p = 1 \mu\text{s}$ Resistive load, gate pulse: 10 V, 5 $\Omega$ source	0.80	$\mu$ s
Maximum turn-off time	minimum	$T_J = T_J$ maximum, $I_{TM} = 550$ A, commutating $di/dt = 40$ A/ $\mu$ s $V_R = 50$ V, $t_p = 500 \mu\text{s}$ , $dV/dt = 200$ V/ $\mu$ 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/ $\mu$ 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, $f = 50$ 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, $t_p \leq 5$ 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	$I_{GT}$	$T_J = 25^\circ\text{C}$ , $V_A = 12$ V, $R_a = 6 \Omega$	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)	

$\Delta R_{thJ-hs}$ CONDUCTION				
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION	RECTANGULAR CONDUCTION	TEST CONDITIONS	UNITS
180°	0.011	0.008	T <sub>J</sub> = T <sub>J</sub> 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

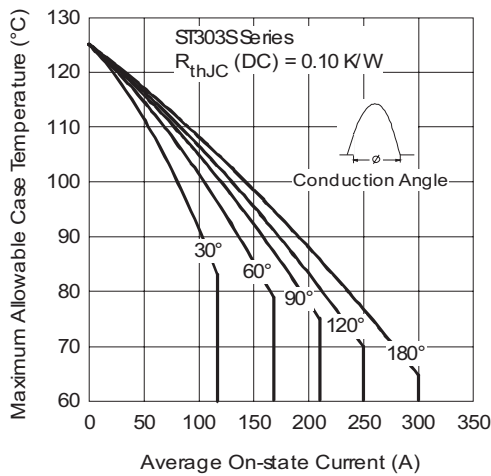


Fig. 1 - Current Ratings Characteristics

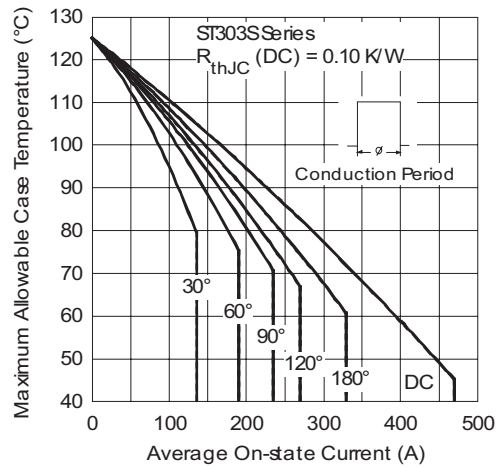


Fig. 2 - Current Ratings Characteristics

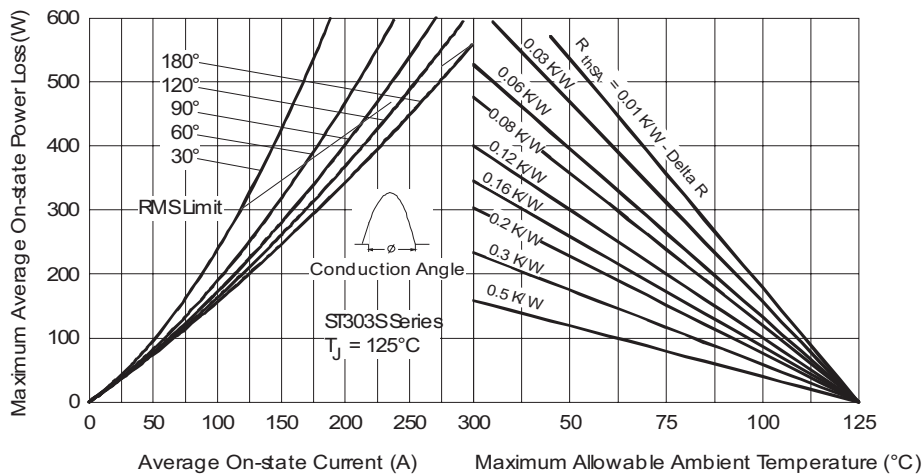


Fig. 3 - On-State Power Loss Characteristics

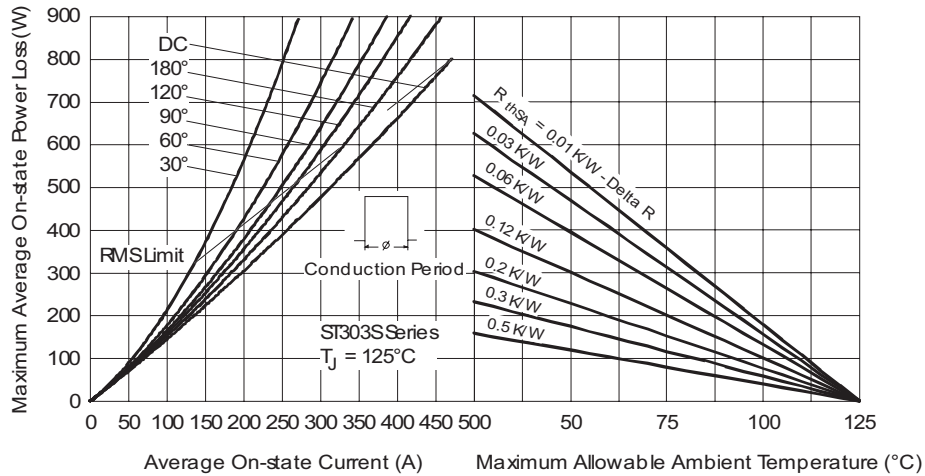


Fig. 4 - On-State Power Loss Characteristics

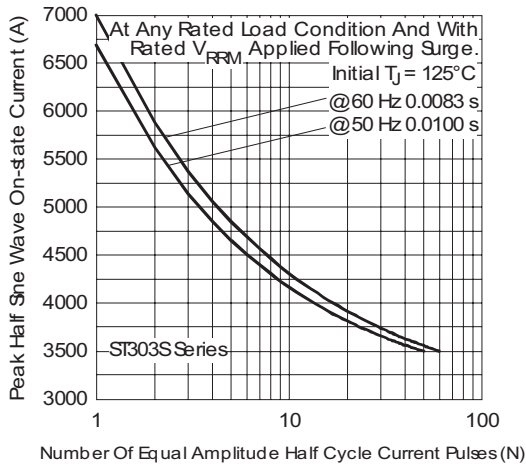


Fig. 5 - Maximum Non-Repetitive Surge Current

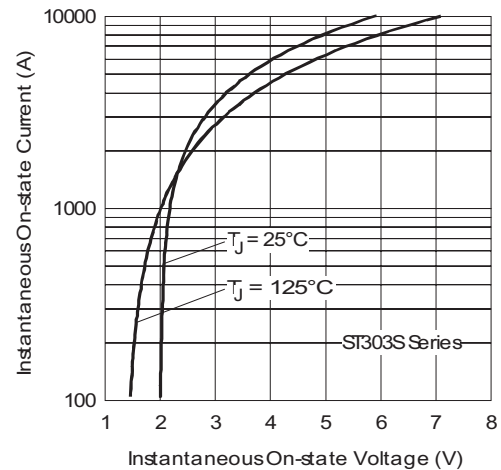


Fig. 7 - On-State Voltage Drop Characteristics

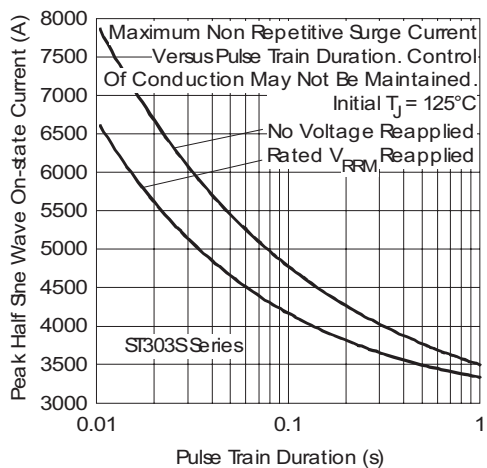


Fig. 6 - Maximum Non-Repetitive Surge Current

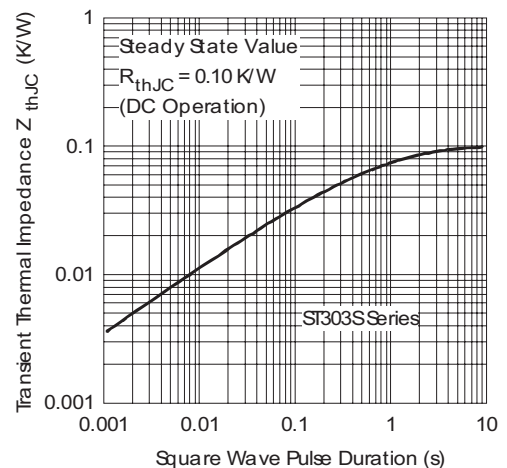


Fig. 8 - Thermal Impedance  $Z_{thJC}$  Characteristics

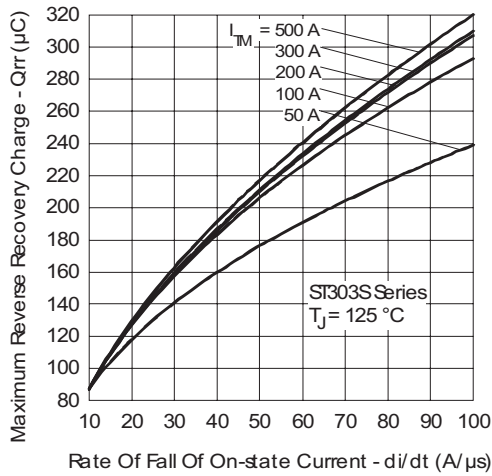


Fig. 9 - Reverse Recovered Charge Characteristics

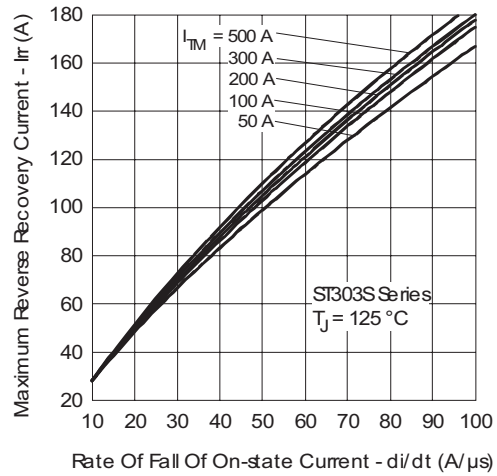


Fig. 10 - Reverse Recovery Current Characteristics

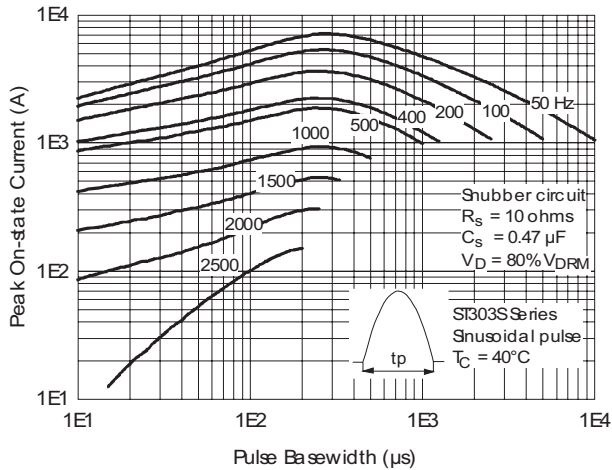


Fig. 11 - Frequency Characteristics

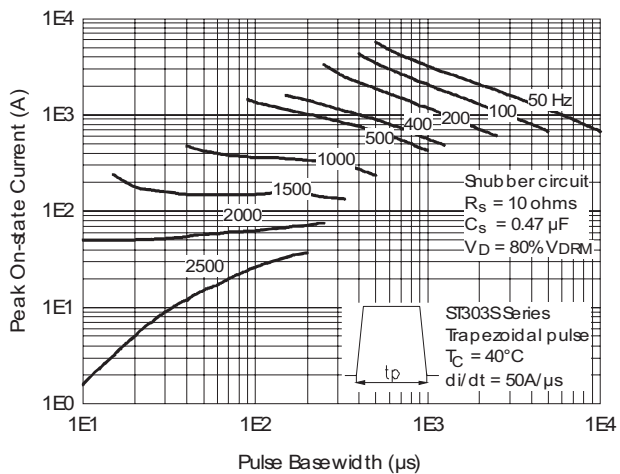
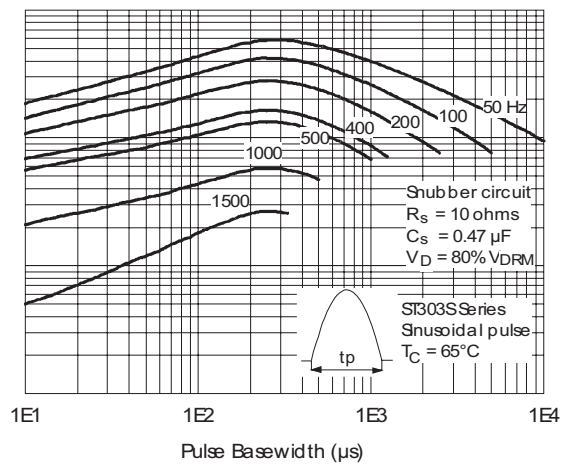
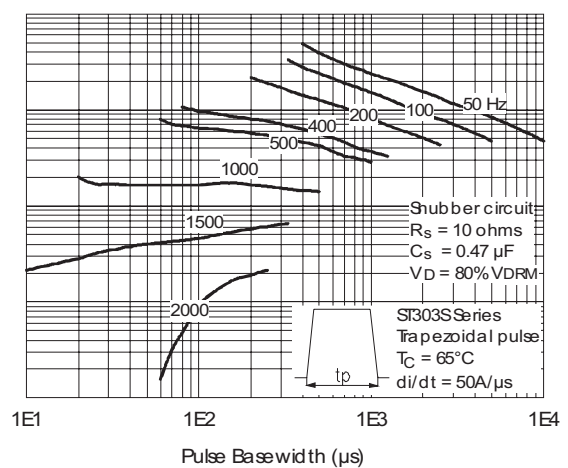


Fig. 12 - Frequency Characteristics



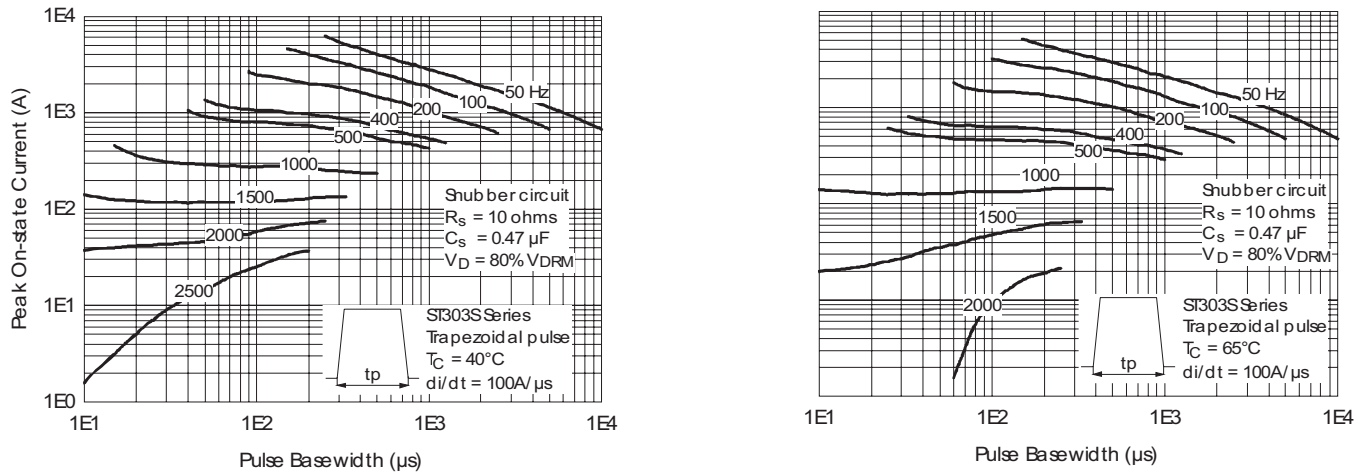


Fig. 13 - Frequency Characteristics

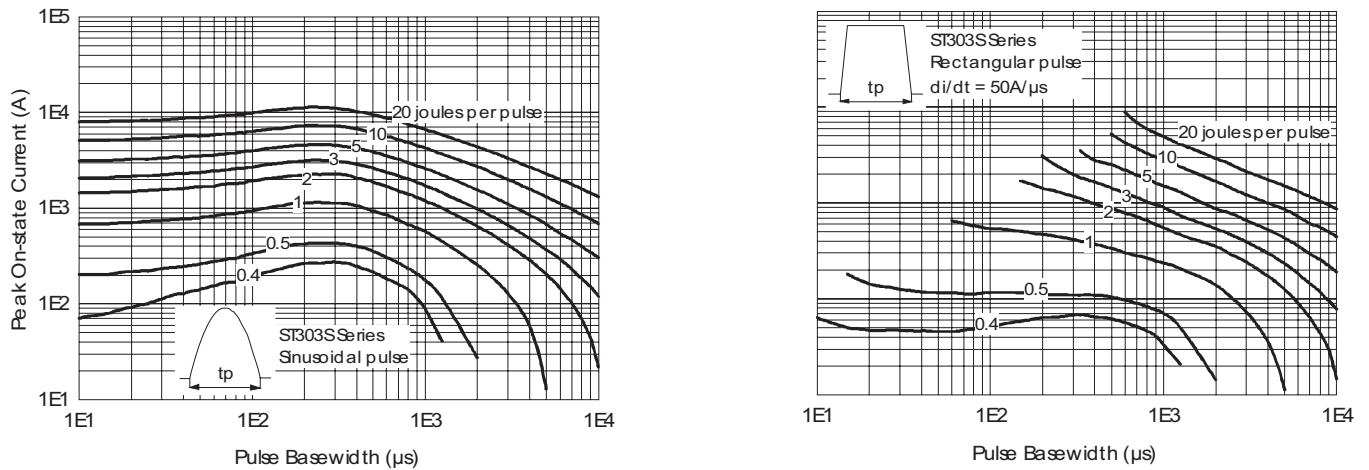


Fig. 14 - Maximum On-State Energy Power Loss Characteristics

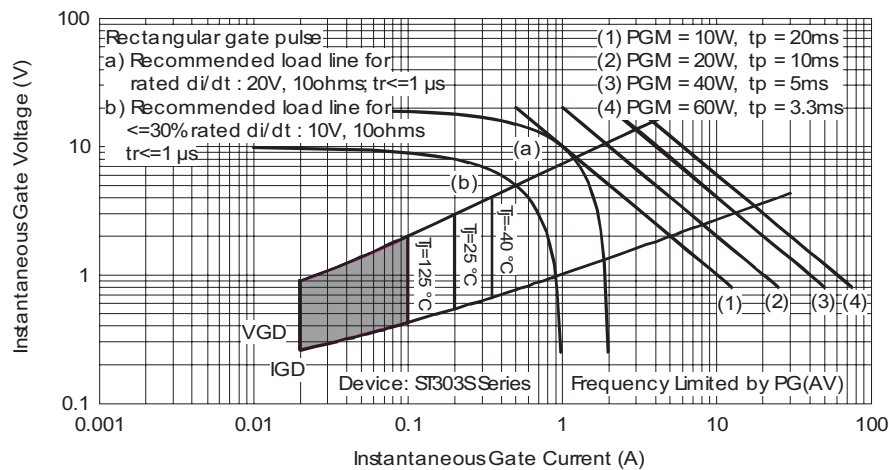


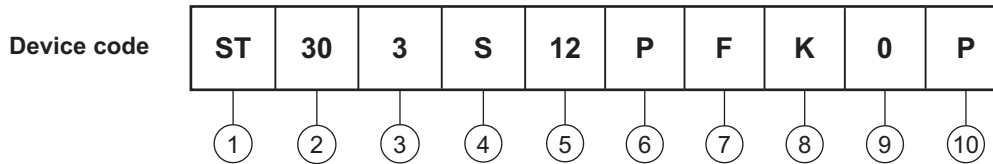
Fig. 15 - Gate Characteristics

# ST303SPbF Series



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

## ORDERING INFORMATION TABLE



- 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

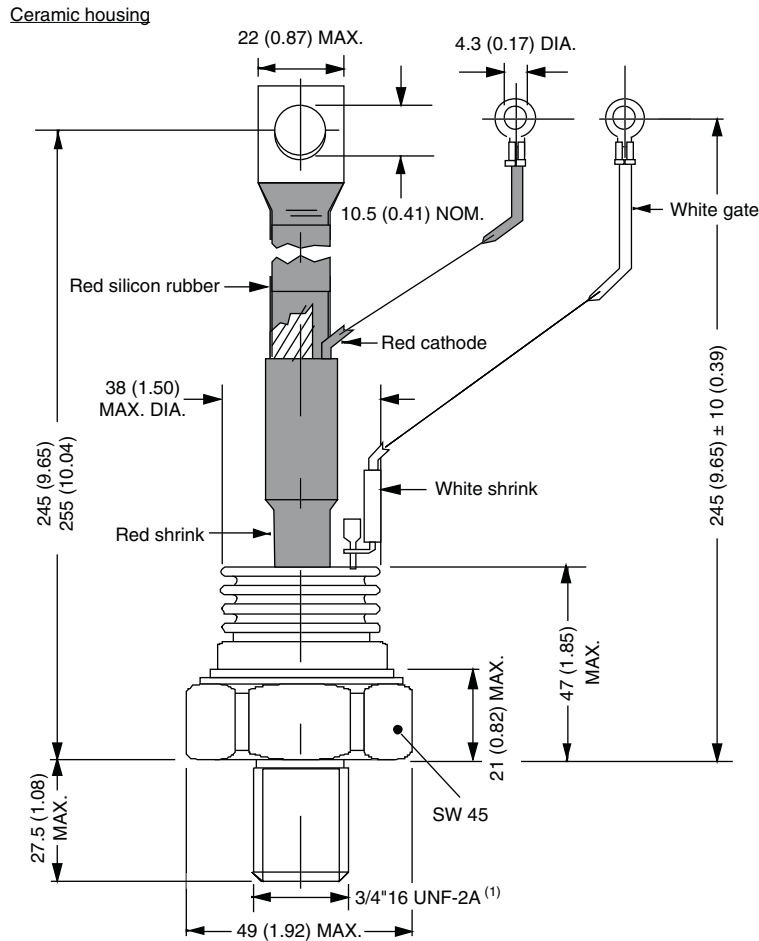
dV/dt - $t_q$ combinations available		
	dV/dt (V/ $\mu$ s)	200
$t_q$ ( $\mu$ s) up to 800 V	10	FN
	20	FK
$t_q$ ( $\mu$ s) only for 1000/1200 V	20	FK

LINKS TO RELATED DOCUMENTS	
Dimensions	<a href="http://www.vishay.com/doc?95080">http://www.vishay.com/doc?95080</a>



## TO-209AE (TO-118)

**DIMENSIONS** in millimeters (inches)



**Note**

<sup>(1)</sup> For metric device: M24 x 1.5 - length 21 (0.83) maximum



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