Inverter Grade Thyristors (PUK Version), 620 A

TO-200AB (E-PUK)

PRODUCT SUMMARY	
Package	TO-200AB (E-PUK)
Diode variation	Single SCR
$I_{T(AV)}$	620 A
V_{DRM}/V_{RRM}	400 V, 800 V, 1000 V, 1200 V
V_{TM}	2.16 V
I_{TSM} at 50 Hz	7950 A
I_{TSM} at 60 Hz	8320 A
I_{GT}	200 mA
T_C/T_{hs}	55 °C

FEATURES

- Metal case with ceramic insulator
- All diffused design
- Center amplifying gate
- Guaranteed high dV/dt
- Guaranteed high dI/dt
- International standard case TO-200AB (E-PUK)
- High surge current capability
- Low thermal impedance
- High speed performance
- Designed and qualified for industrial level
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT

TYPICAL APPLICATIONS

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

MAJOR RATINGS AND CHARACTERISTICS			
PARAMETER	TEST CONDITIONS	VALUES	UNITS
$I_{T(AV)}$		620	A
	T_{hs}	55	°C
$I_{T(RMS)}$		1180	A
	T_{hs}	25	°C
I_{TSM}	50 Hz	7950	A
	60 Hz	8320	
I^2t	50 Hz	316	kA^2s
	60 Hz	289	
V_{DRM}/V_{RRM}		400 to 1200	V
t_q	Range	10 to 30	µs
T_J		-40 to 125	°C

Note

- t_q = 10 µs to 20 µs for 400 V to 800 V devices
  t_q = 15 µs to 30 µs for 1000 V to 1200 V devices

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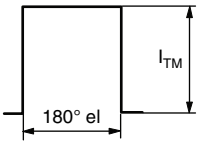
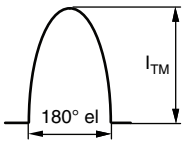
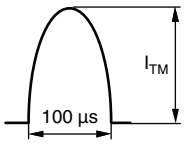
ELECTRICAL SPECIFICATIONS

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} MAXIMUM AT $T_J = T_J$ MAXIMUM mA
VS-ST303C..C	04	400	500	50
	08	800	900	
	10	1000	1100	
	12	1200	1300	

CURRENT CARRYING CAPABILITY

FREQUENCY							UNITS
50 Hz	1314	1130	2070	1940	6930	6270	A
400 Hz	1260	1040	2190	1880	3440	2960	
1000 Hz	900	700	1900	1590	1850	1540	
2500 Hz	340	230	910	710	740	560	
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
Heatsink temperature	40	55	40	55	40	55	°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 heatsink temperature	$I_{T(AV)}$	180° conduction, half sine wave double side (single side) cooled			620 (230)	A
					55 (85)	°C
Maximum RMS on-state current	$I_{T(RMS)}$	DC at 25 °C heatsink temperature double side cooled			1180	A
Maximum peak, one half cycle, non-repetitive surge current	I_{TSM}	t = 10 ms	No voltage reapplied	Sinusoidal half wave, initial $T_J = T_J$ maximum	7950	
		t = 8.3 ms			8320	
		t = 10 ms	100 % V_{RRM} reapplied		6690	
		t = 8.3 ms			7000	
Maximum I^2t for fusing	I^2t	t = 10 ms	No voltage reapplied		316	kA^2s
		t = 8.3 ms			289	
		t = 10 ms	100 % V_{RRM} reapplied		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 reapplied			3160	$kIA^2\sqrt{s}$
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 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			1.44	
High level value of threshold voltage	$V_{T(TO)2}$	(I > π x $I_{T(AV)}$), $T_J = T_J$ maximum			1.48	
Low level value of forward slope resistance	r_{t1}	(16.7 % x π x $I_{T(AV)}$ < I < π x $I_{T(AV)}$), $T_J = T_J$ maximum			0.57	mΩ
High level value of forward slope resistance	r_{t2}	(I > π x $I_{T(AV)}$), $T_J = T_J$ 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	

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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} = Rated V_{DRM} I_{TM} = 2 x dI/dt	1000	A/µs
Typical delay time	t_d	T_J = 25 °C, V_{DM} = Rated V_{DRM}, I_{TM} = 50 A DC, t_p = 1 µs Resistive load, gate pulse: 10 V, 5 Ω source	0.83	µs
Maximum turn-off time (1) minimum	t_q	$T_J = T_J$ maximum, I_{TM} = 550 A, commutating dI/dt = 40 A/µs V_R = 50 V, t_p = 500 µs, dV/dt: See table in device code	10	µs
Maximum turn-off time (1) maximum	t_q		30	µs

Note

(1) t_q = 10 µs to 20 µs for 400 V to 800 V devices; t_q = 15 µs to 30 µs for 1000 V to 1200 V devices

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/µs
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	W
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	V
Maximum peak negative gate voltage	- V_{GM}		5	V
Maximum DC gate currrent required to trigger	I_{GT}	T_J = 25 °C, V_A = 12 V, R_a = 6 Ω	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	°C
Maximum storage temperature range	T_{Stg}		-40 to 150	°C
Maximum thermal resistance, junction to heatsink	R_{thJ-hs}	DC operation single side cooled	0.09	K/W
		DC operation double side cooled	0.04	K/W
Maximum thermal resistance, case to heatsink	R_{thC-hs}	DC operation single side cooled	0.020	K/W
		DC operation double side cooled	0.010	K/W
Mounting force, ± 10 %			9800 (1000)	N (kg)
Approximate weight			83	g
Case style		See dimensions - link at the end of datasheet	TO-200AB (E-PUK)	

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$\Delta R_{thJ\text{-}hs}$ CONDUCTION						
CONDUCTION ANGLE	SINUSOIDAL CONDUCTION		RECTANGULAR CONDUCTION		TEST CONDITIONS	UNITS
	SINGLE SIDE	DOUBLE SIDE	SINGLE SIDE	DOUBLE SIDE		
180°	0.010	0.010	0.007	0.007	$T_J = T_J$ max.	K/W
120°	0.012	0.012	0.012	0.013		
90°	0.015	0.015	0.016	0.017		
60°	0.022	0.022	0.023	0.023		
30°	0.036	0.036	0.036	0.037		

Note

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

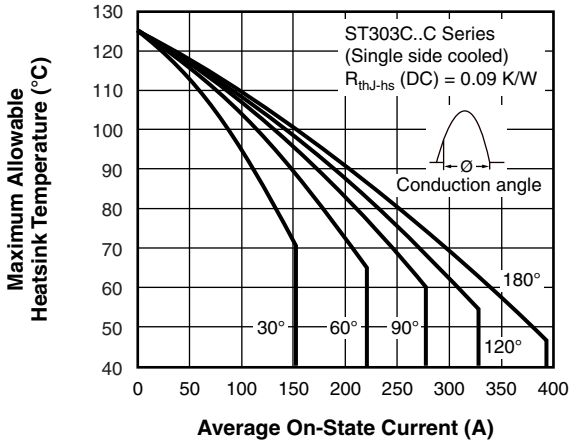

Fig. 1 - Current Ratings Characteristics

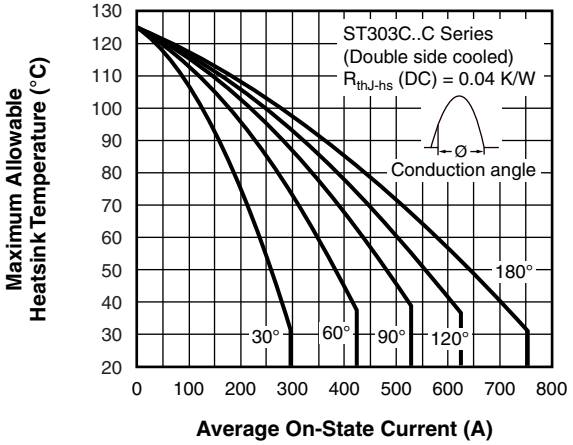

Fig. 3 - Current Ratings Characteristics

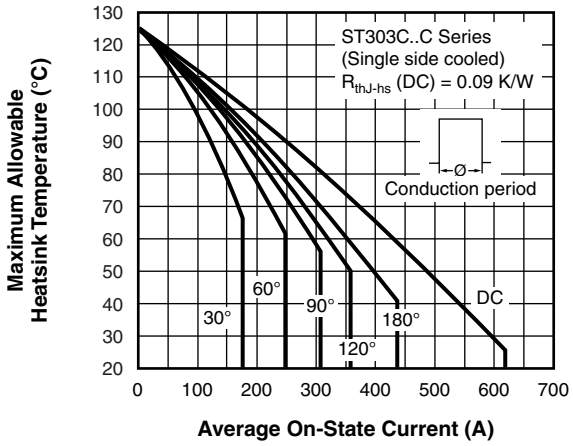

Fig. 2 - Current Ratings Characteristics

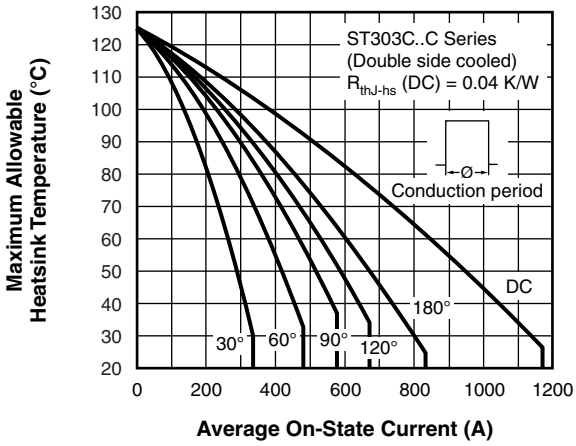

Fig. 4 - Current Ratings Characteristics

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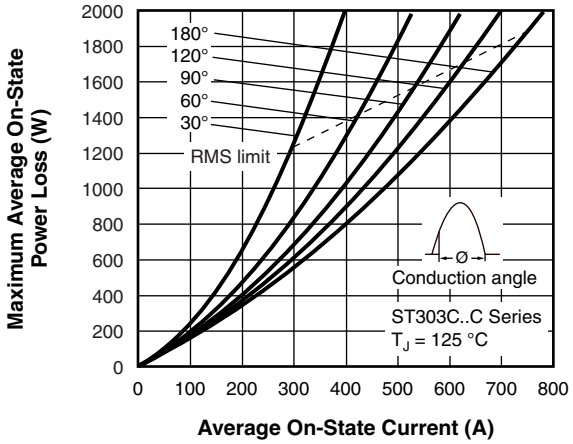

Fig. 5 - On-State Power Loss Characteristics

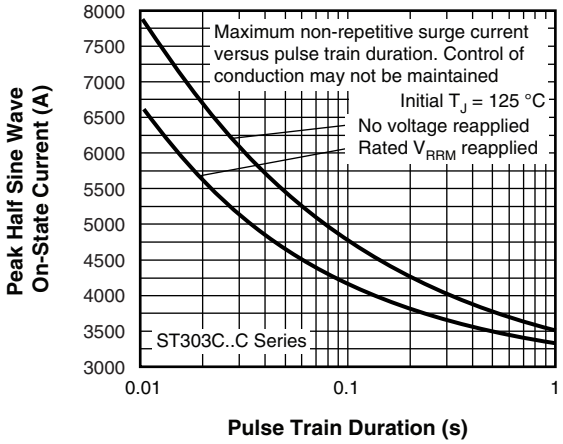

Fig. 8 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

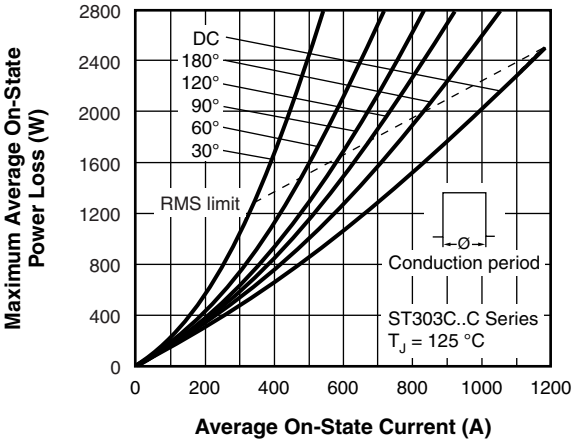

Fig. 6 - On-State Power Loss Characteristics

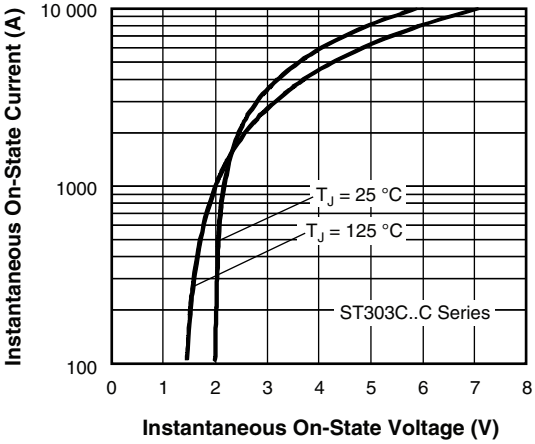

Fig. 9 - On-State Voltage Drop Characteristics

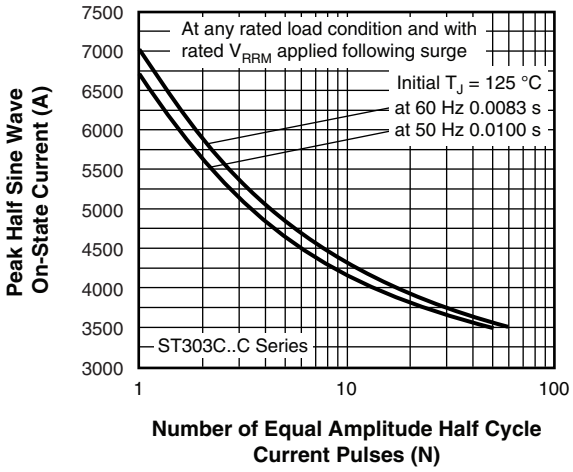

Fig. 7 - Maximum Non-Repetitive Surge Current Single and Double Side Cooled

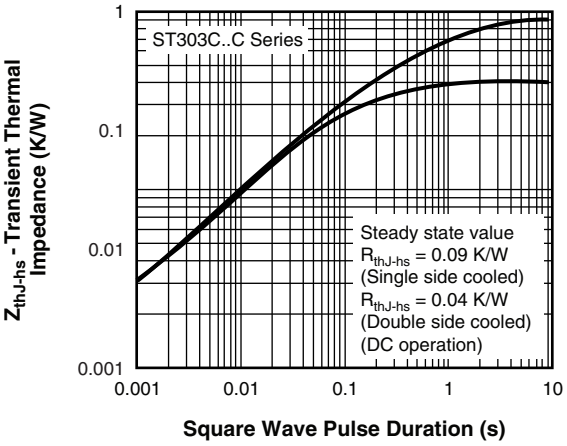

Fig. 10 - Thermal Impedance Z_{thJ-hs} Characteristics

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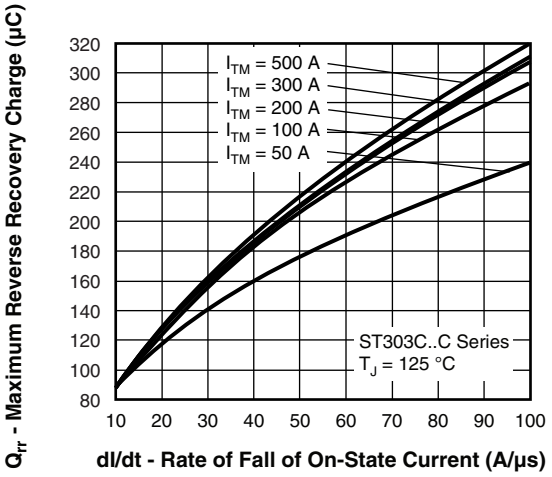


Fig. 11 - Reverse Recovered Charge Characteristics

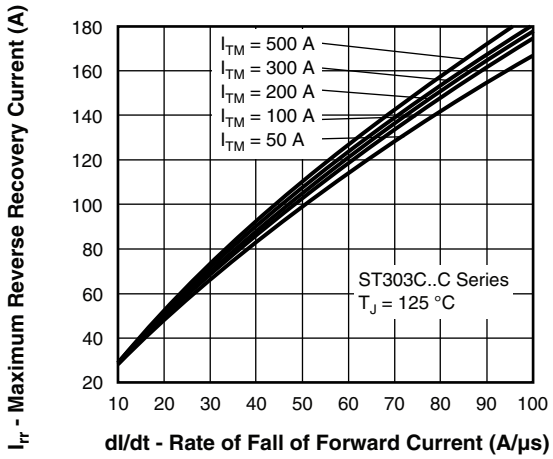
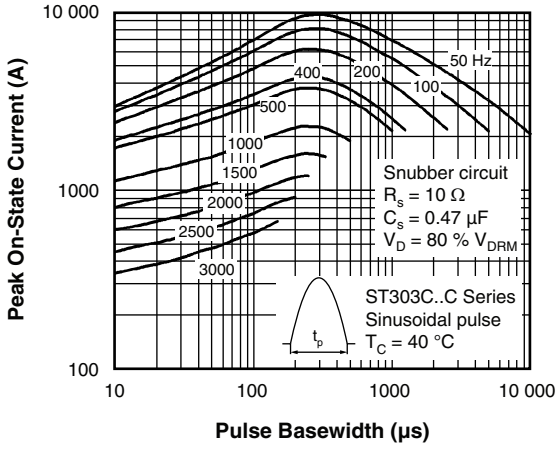


Fig. 12 - Reverse Recovered Current Characteristics



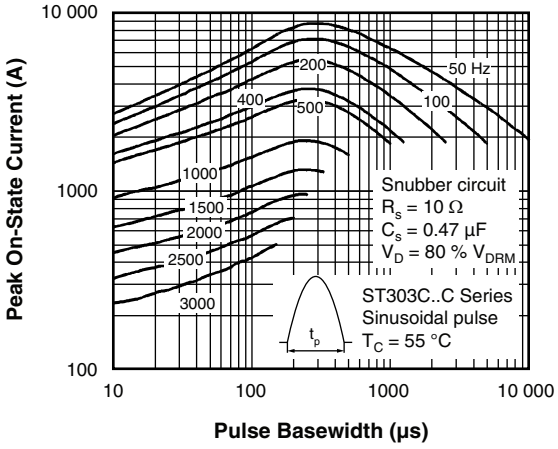
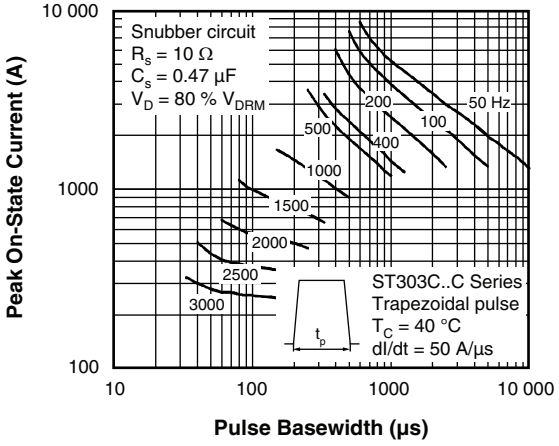


Fig. 13 - Frequency Characteristics



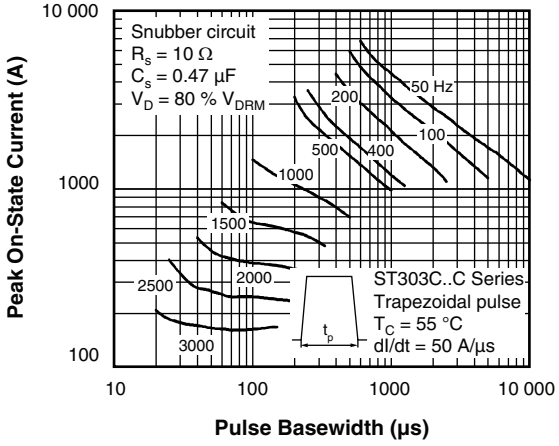


Fig. 14 - Frequency Characteristics

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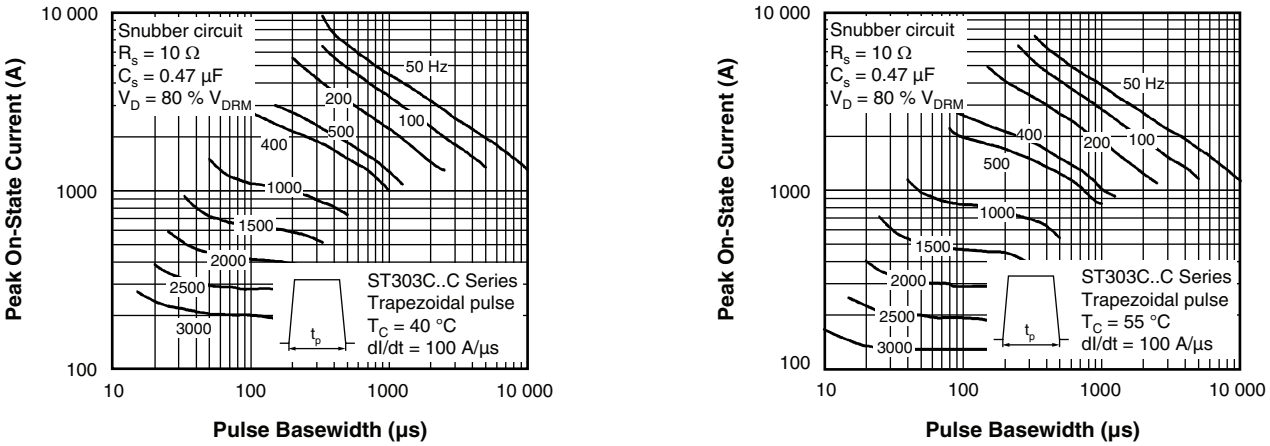

Fig. 15 - Frequency Characteristics

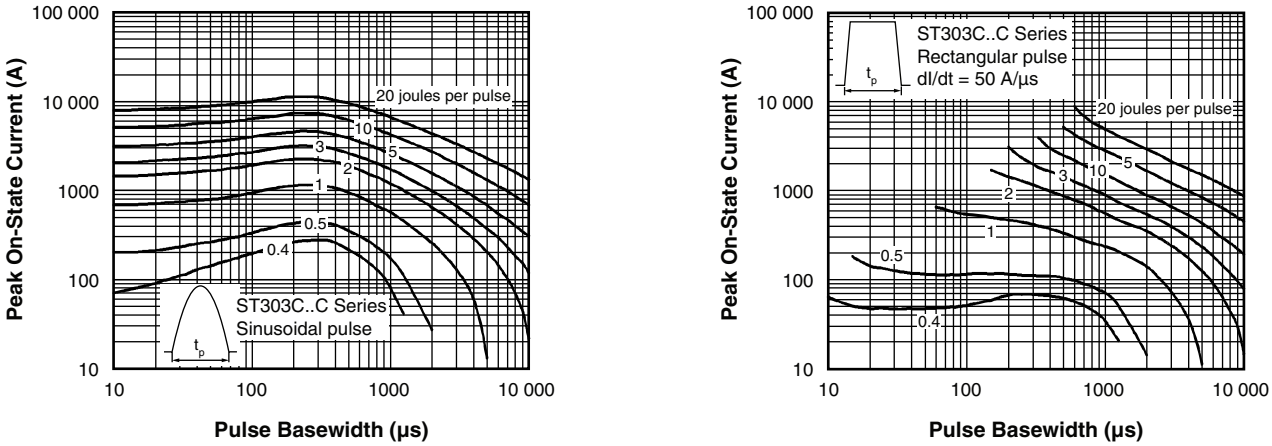

Fig. 16 - Maximum On-State Energy Power Loss Characteristics

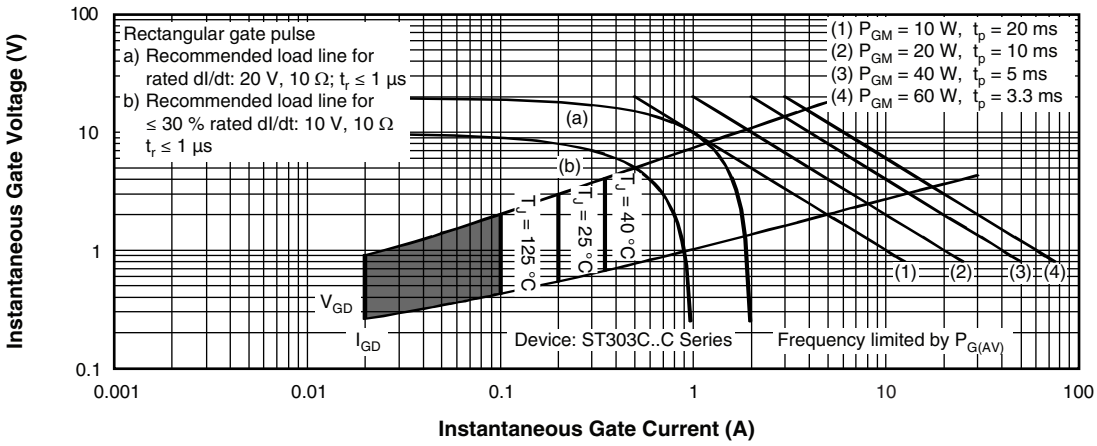

Fig. 17 - Gate Characteristics

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ORDERING INFORMATION TABLE

Device code

VS-	ST	30	3	C	12	C	H	K	1	-
1	2	3	4	5	6	7	8	9	10	11

1 - Vishay Semiconductors product
2 - Thyristor
3 - Essential part number
4 - 3 = Fast turn-off
5 - C = Ceramic PUK
6 - Voltage code x 100 = V_{RRM} (see Voltage Ratings table)
7 - C = PUK case TO-200AB (E-PUK)
8 - Reapplied dV/dt code (for t_q test condition)
9 - t_q code
10 - 0 = Eyelet terminals (gate and aux. cathode unsoldered leads)
1 = Fast-on terminals (gate and aux. cathode unsoldered leads)
2 = Eyelet terminals (gate and aux. cathode soldered leads)
3 = Fast-on terminals (gate and aux. cathode soldered leads)
11 - Critical dV/dt:
- None = 500 V/μs (standard value)
- L = 1000 V/μs (special selection)

dV/dt - t_q combinations available						
	dV/dt (V/μs)	20	50	100	**200**	400
t_q (μs) up to 800 V	10	CN	DN	EN	**FN***	HN
	12	CM	DM	EM	FM	HM
	15	CL	DL	EL	**FL***	HL
	20	CK	DK	EK	**FK***	HK
t_q (μs) only for 1000 V/1200 V	15	CL	-	-	-	-
	18	CP	DP	-	-	-
	20	CK	DK	EK	**FK***	HK
	25	CJ	DJ	EJ	**FJ***	HJ
	30	-	DH	EH	FH	HH

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

LINKS TO RELATED DOCUMENTS	
Dimensions	http://www.vishay.com/doc?95075

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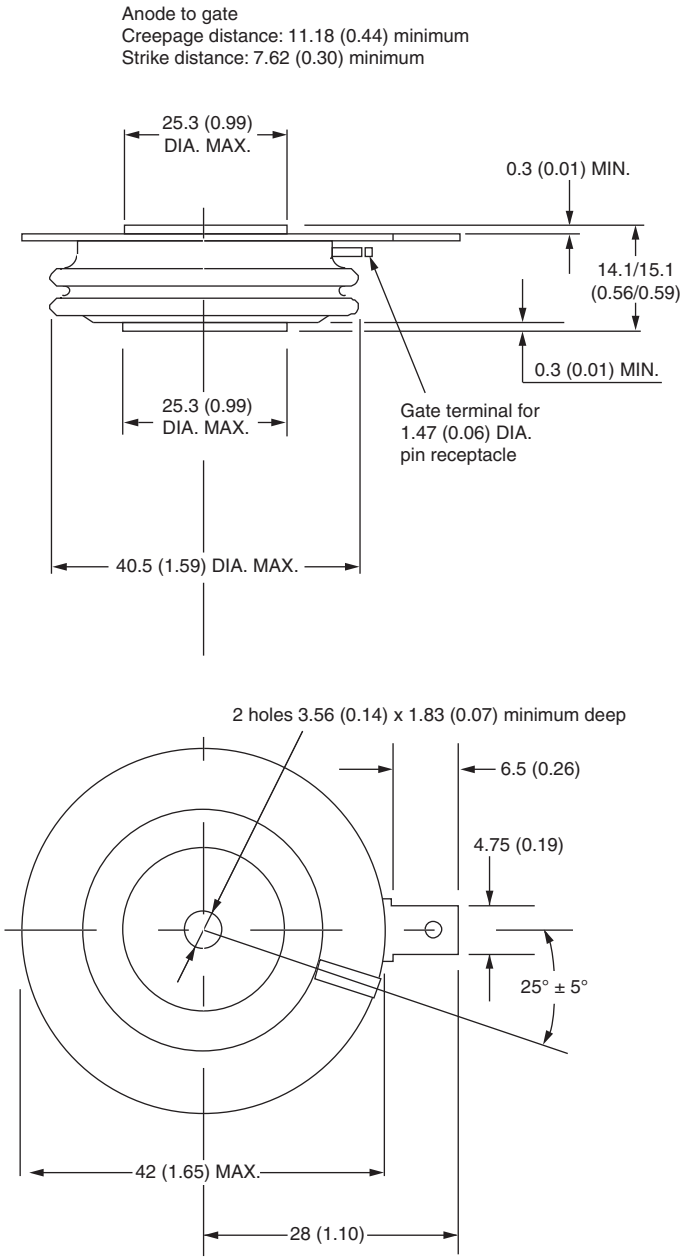
TO-200AB (E-PUK)

DIMENSIONS in millimeters (inches)



Quote between upper and lower pole pieces has to be considered after application of mounting force (see thermal and mechanical specification)

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