

$V_{DSM}$	=	2800 V
$I_{TAVM}$	=	1400 A
$I_{TRMS}$	=	2210 A
$I_{TSM}$	=	18000 A
$V_{T0}$	=	0.82 V
$r_T$	=	0.370 mW

# Phase Control Thyristor

## 5STP 16F2800

Doc. No. 5SYA1022-03 Aug.00

- Patented free-floating silicon technology
- Low on-state and switching losses
- Designed for traction, energy and industrial applications
- Optimum power handling capability

### Blocking

Part Number	5STP 16F2800	5STP 16F2600	5STP 16F2200	Conditions
$V_{DRM}$ $V_{RRM}$	2800 V	2600 V	2200 V	$f = 50 \text{ Hz}$ , $t_p = 10\text{ms}$
$V_{RSM1}$	3000 V	2800 V	2400 V	$t_p = 5 \text{ ms}$ , single pulse
$I_{DRM}$	$\leq 200 \text{ mA}$			$V_{DRM}$
$I_{RRM}$	$\leq 200 \text{ mA}$			$V_{RRM}$
$dV/dt_{crit}$	1000 V/ $\mu\text{s}$			@ Exp. to $0.67 \times V_{DRM}$
$T_j = 125^\circ\text{C}$				

### Mechanical data

$F_M$	Mounting force	nom.	22 kN
		min.	14 kN
		max.	24 kN
a	Acceleration		
	Device unclamped		50 $\text{m/s}^2$
	Device clamped		100 $\text{m/s}^2$
m	Weight		0.6 kg
$D_S$	Surface creepage distance		25 mm
$D_a$	Air strike distance		14 mm

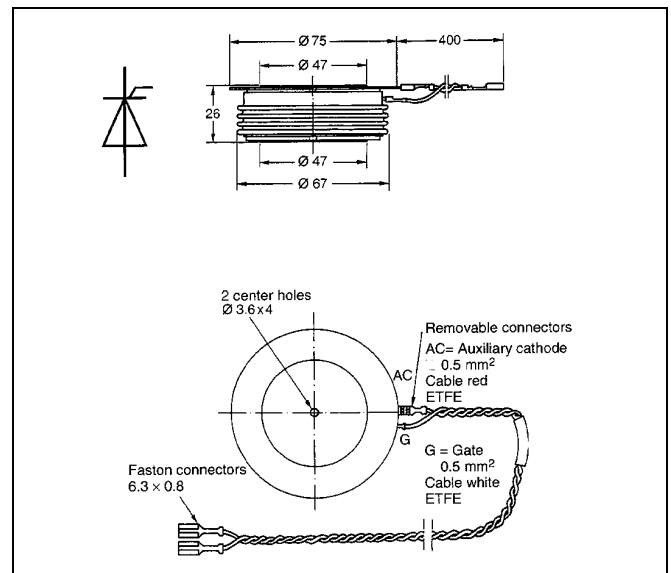


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## On-state

$I_{TAVM}$	Max. average on-state current	1400 A	Half sine wave, $T_C = 70^\circ\text{C}$	
$I_{TRMS}$	Max. RMS on-state current	2210 A		
$I_{TSM}$	Max. peak non-repetitive surge current	18000 A	$t_p = 10 \text{ ms}$	$T_j = 125^\circ\text{C}$ After surge: $V_D = V_R = 0\text{V}$
		19000 A	$t_p = 8.3 \text{ ms}$	
$I^2t$	Limiting load integral	1620 $\text{kA}^2\text{s}$	$t_p = 10 \text{ ms}$	
		1498 $\text{kA}^2\text{s}$	$t_p = 8.3 \text{ ms}$	
$V_T$	On-state voltage	1.55 V	$I_T = 2000 \text{ A}$	$T_j = 125^\circ\text{C}$
$V_{T0}$	Threshold voltage	0.82 V	$I_T = 800 - 2400 \text{ A}$	
$r_T$	Slope resistance	0.370 $\text{m}\Omega$		
$I_H$	Holding current	25-75 mA	$T_j = 25^\circ\text{C}$	
		15-60 mA	$T_j = 125^\circ\text{C}$	
$I_L$	Latching current	100-500 mA	$T_j = 25^\circ\text{C}$	
		50-200 mA	$T_j = 125^\circ\text{C}$	

## Switching

$di/dt_{crit}$	Critical rate of rise of on-state current	150 $\text{A}/\mu\text{s}$	Cont.	$V_D \leq 0.67 \cdot V_{DRM}$ $T_j = 125^\circ\text{C}$ $I_{TRM} = 2000 \text{ A}$ $f = 50 \text{ Hz}$ $I_{FG} = 2.0 \text{ A}$ $t_r = 0.5 \mu\text{s}$
		300 $\text{A}/\mu\text{s}$	60 sec.	
$t_d$	Delay time	$\leq 3.0 \mu\text{s}$	$V_D = 0.4 \cdot V_{DRM}$	$I_{FG} = 2.0 \text{ A}$ $t_r = 0.5 \mu\text{s}$
$t_q$	Turn-off time	$\leq 400 \mu\text{s}$	$V_D \leq 0.67 \cdot V_{DRM}$ $dv_D/dt = 20\text{V}/\mu\text{s}$	$I_{TRM} = 2000 \text{ A}$ $T_j = 125^\circ\text{C}$ $V_R > 200 \text{ V}$
$Q_{rr}$	Recovery charge	min	3000 $\mu\text{As}$	$di_T/dt = -20 \text{ A}/\mu\text{s}$
		max	6000 $\mu\text{As}$	

## Triggering

$V_{GT}$	Gate trigger voltage	2.6 V	$T_j = 25^\circ\text{C}$
$I_{GT}$	Gate trigger current	400 mA	$T_j = 25^\circ\text{C}$
$V_{GD}$	Gate non-trigger voltage	0.3 V	$V_D = 0.4 \cdot V_{DRM}$
$I_{GD}$	Gate non-trigger current	10 mA	$V_D = 0.4 \cdot V_{DRM}$
$V_{FGM}$	Peak forward gate voltage	12 V	
$I_{FGM}$	Peak forward gate current	10 A	
$V_{RGM}$	Peak reverse gate voltage	10 V	
$P_G$	Maximum gate power loss	3 W	

### Thermal

$T_{j\max}$	Max. junction temperature	125°C	
$T_{j\text{stg}}$	Storage temperature range	-40...150°C	
$R_{\text{thJC}}$	Thermal resistance junction to case	33 K/kW	Anode side cooled
		35 K/kW	Cathode side cooled
		17 K/kW	Double side cooled
$R_{\text{thCH}}$	Thermal resistance case to heat sink	8 K/kW	Single side cooled
		4 K/kW	Double side cooled

Analytical function for transient thermal impedance:

$$Z_{\text{thJC}}(t) = \sum_{i=1}^n R_i(1 - e^{-t/\tau_i})$$

i	1	2	3	4
$R_i$ (K/kW)	10.35	3.76	2.29	0.67
$\tau_i$ (s)	0.3723	0.0525	0.0057	0.0023

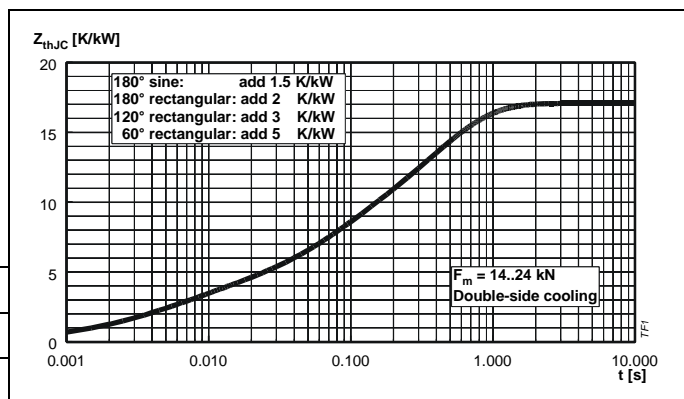


Fig. 1 Transient thermal impedance junction to case.

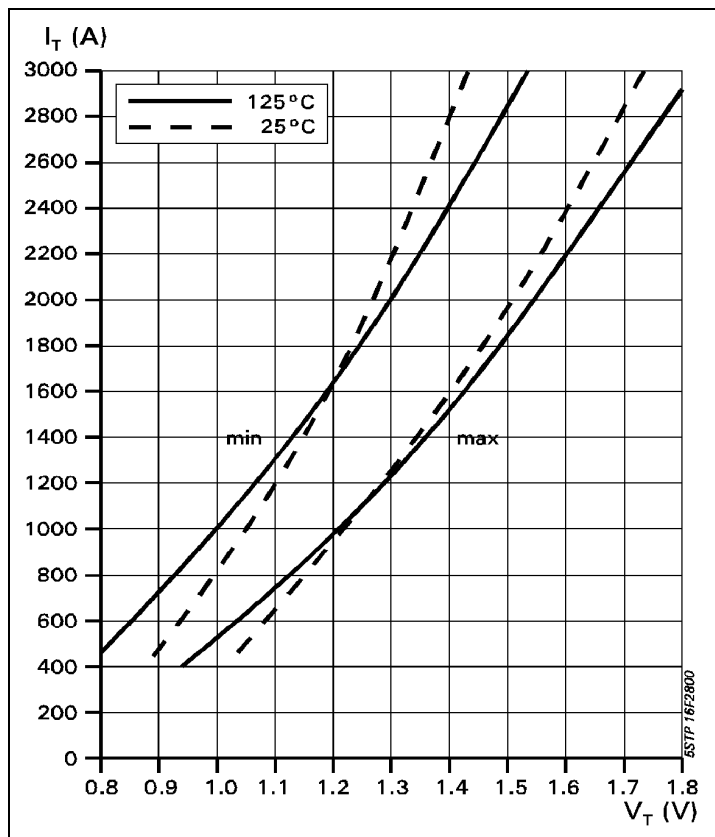


Fig. 2. On-state characteristics.

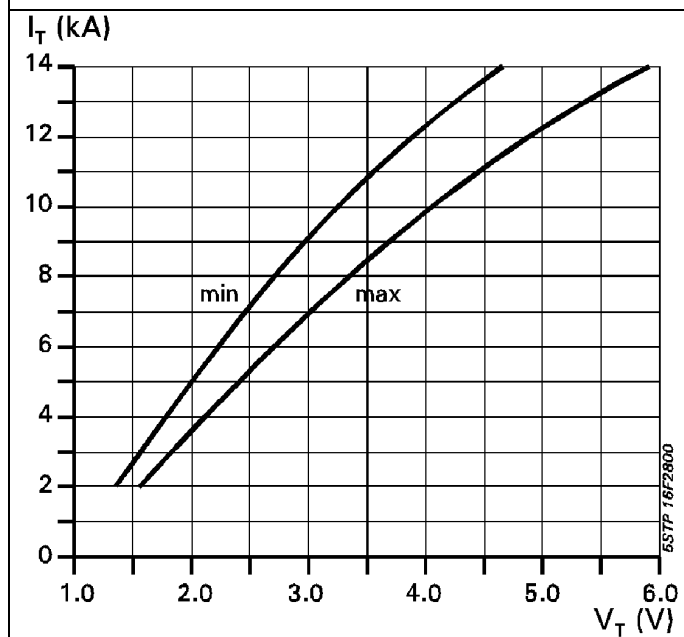
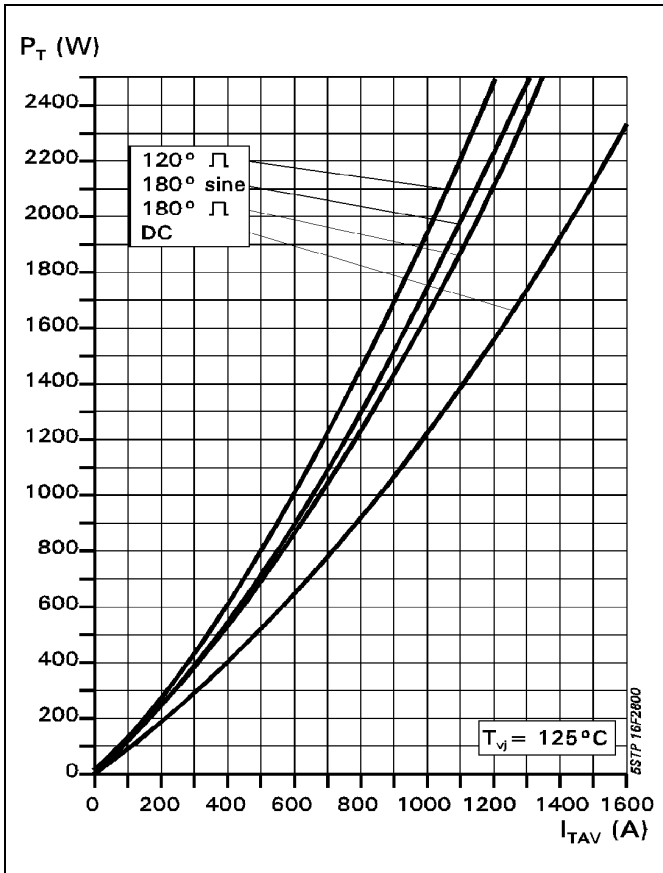
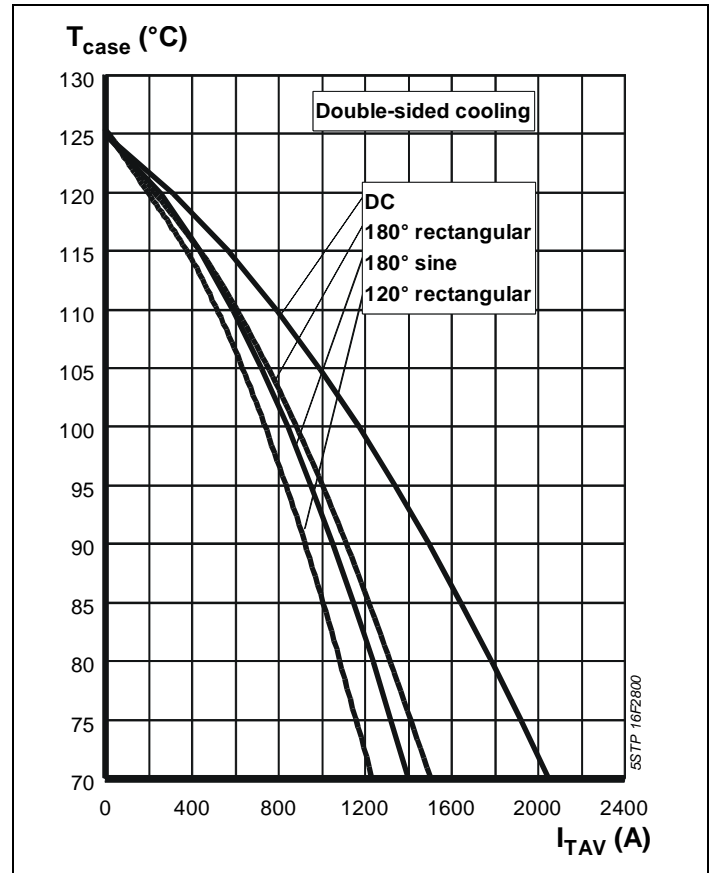


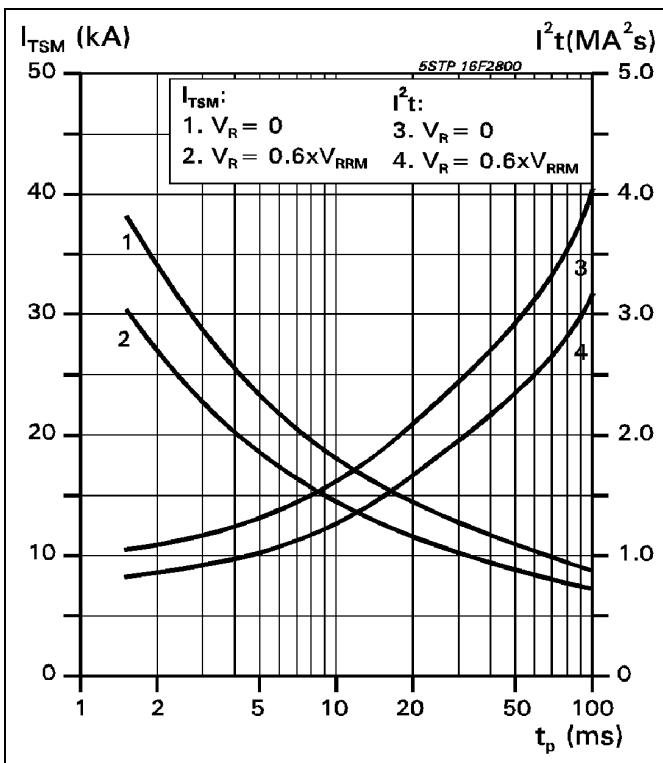
Fig. 3 On state characteristics.



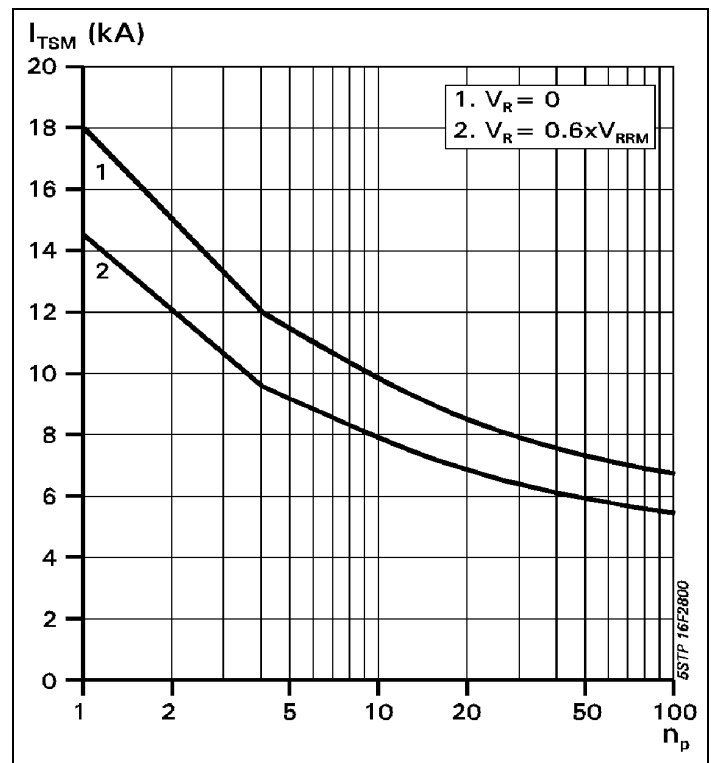
**Fig. 4** On-state power dissipation vs. mean on-state current. Turn-on losses excluded.



**Fig. 5** Max. permissible case temperature vs. mean on-state current.



**Fig. 6** Surge on-state current vs. pulse length. Half-sine wave.



**Fig. 7** Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

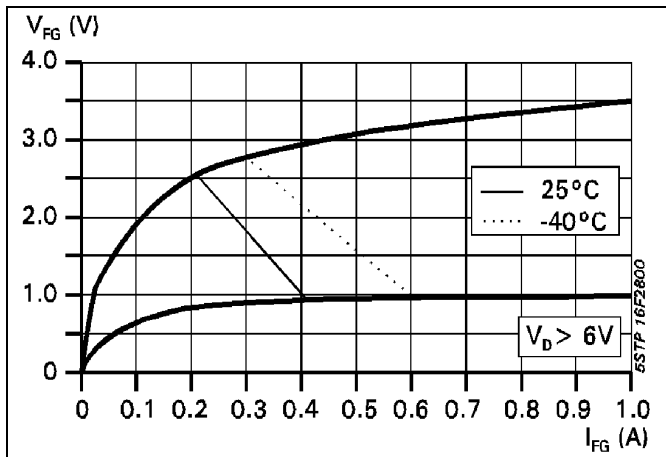


Fig. 8 Gate trigger characteristics.

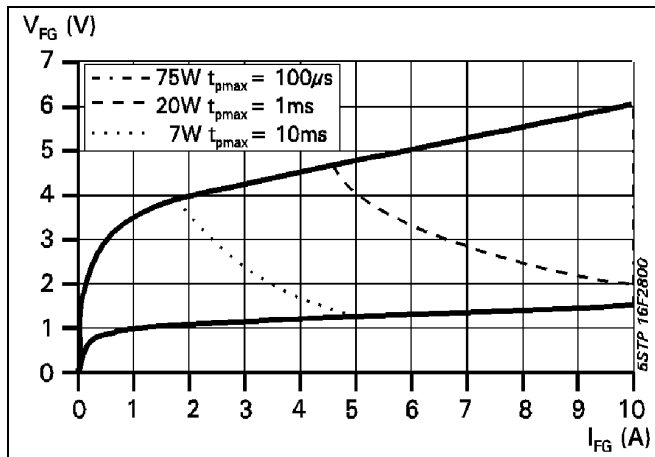


Fig. 9 Max. peak gate power loss.

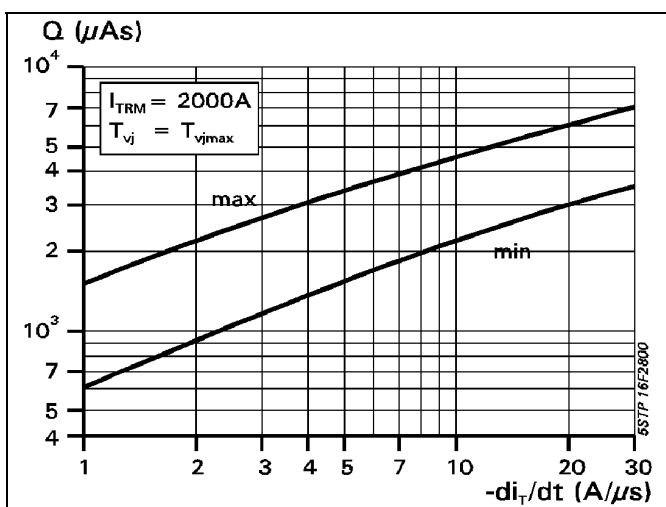


Fig. 10 Recovery charge vs. decay rate of on-state current.

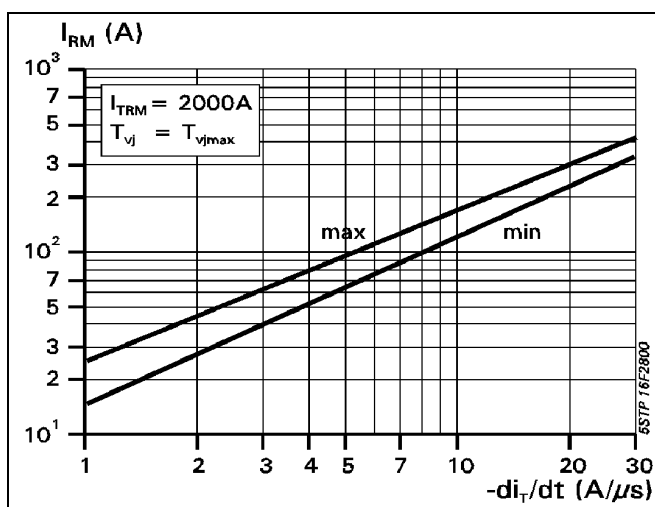


Fig. 11 Peak reverse recovery current vs. decay rate of on-state current.

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ABB Semiconductors AG  
 Fabrikstrasse 3  
 CH-5600 Lenzburg, Switzerland

Telephone +41 62 888 6419  
 Fax +41 62 888 6306  
 E-mail info@ch.abb.com  
 Internet www.abbsem.com