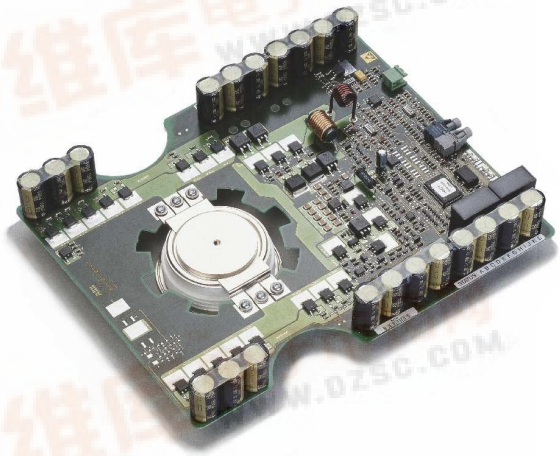
V_{DRM}	=	6000 V
V_{RRM}	=	6000 V
I_{TGQM}	=	800 A
V_{T0}	=	3.25 V
r_T	=	6.4 mΩ

Reverse Blocking Integrated Gate-Commutated Thyristor

5SHZ 08F6000

Doc. No. 5SYA1231-01 Sep. 01

- **Optimized for current source inverter (CSI)**
- **Fast response (t_{don} < 3 µs, t_{doff} < 7 µs)**
- **Precise timing (Δt_{doff} < 400 ns)**
- **Direct fiber optic control**
- **Status feedback**
- **Cosmic radiation withstand rating**
- **Very high EMI immunity**



Blocking

V_{DRM}	Repetitive peak off-state voltage		6000 V	
V_{RRM}	Reverse repetitive peak off-state voltage		6000 V	
I_{DRM}	Repetitive peak off-state current	≤	50 mA	$V_D = V_{DRM}$
I_{RRM}	Reverse repetitive peak off-state current	≤	50 mA	$V_R = V_{RRM}$
V_{AC}	Max. AC voltage for 100 FIT failure rate		3600 V	$0 \le T_{jop} \le 125$ °C. Ambient cosmic radiation at sea level in open air.

Mechanical data (see Fig. 8)

F_m	Mounting force	min.	12 kN	
		max.	16 kN	
D_p	Pole-piece diameter		47 mm	±0.1 mm
H	Housing thickness		26 mm	±0.5 mm
m	Weight IGCT		1.00 kg	
D_S	Surface creepage distance	≥	33 mm	
D_a	Air strike distance	≥	13 mm	
l	Length IGCT		250 mm	+0/-0.5 mm
h	Height IGCT		44 mm	±1.0 mm
w	Width IGCT		208 mm	+0/-0.5 mm

On-state (see Fig. 2)

I_{TAVM}	Max. average on-state current	290 A	Half sine wave, T_C = 85 °C		
I_{TRMS}	Max. RMS on-state current	450 A			
V_T	On-state voltage	≤ 8.40 V	I_T = 800 A		T_j = 125 °C
V_{T0}	Threshold voltage	3.25 V	I_T = 200 - 800 A		
r_T	Slope resistance	6.4 mΩ			

Self commutation (V_D > 0 V)

Turn-on switching (see Fig. 3, 10, 11)							
di/dt_{crit}	Max. rate of rise of on-state current	1300 A/µs	T_j = 0…125 °C				
$t_{on\ (min)}$	Min. on-time	10 µs					
t_{don}	Turn-on delay time	≤ 3 µs	V_D = 3000 V		T_j = 125 °C		
t_r	Rise time	≤ 1.5 µs	I_T = 800 A		di/dt = 500 A/µs		
E_{on}	Turn-on energy per pulse	≤ 0.8 J	R_S = 10 Ω		L_{comm} = 6 µH		
			C_S = 0.1 µF		L_S = 350 nH		
Turn-off switching (see Fig. 4, 6, 10, 11)							
I_{TGQM}	Max. contr. turn-off current	800 A	T_j = 0…125 °C				
$t_{off\ (min)}$	Min. off-time	10 µs					
t_f	Fall time	≤ 4.0 µs	V_D = 3000 V		T_j = 125 °C		
t_{doff}	Turn-off delay time	≤ 7.0 µs	I_{TGQ} = 800 A		V_{DM} ≤ V_{DRM}		
E_{off}	Turn-off energy per pulse	≤ 7.2 J	R_S = 10 Ω		L_{comm} = 6 µH		
			C_S = 0.1 µF		L_S = 350 nH		

Load commutation (V_D < 0 V)

Turn-off switching (see Fig. 5, 6, 10, 11)							
di/dt_{crit}	Max. rate of rise of on-state current	1300 A/µs	T_j = 0…125 °C				
I_{rr}	Reverse recovery current	≤ 750 A	V_D = -3000 V		T_j = 125 °C		
Q_{rr}	Reverse recovery charge	≤ 1500 µC	I_T = 800 A		di/dt = 500 A/µs		
E_{rr}	Turn off energy per pulse	≤ 6.0 J	R_S = 10 Ω		L_{comm} = 6 µH		
			C_S = 0.1 µF		L_S = 350 nH		
					V_{RM} ≤ V_{RRM}		

Gate Unit

Gate Unit

Power supply (see Fig. 7 to 10)			
V_{GDC}	Gate Unit supply voltage	20 ±0.5 V_{DC}	Without galvanic isolation to power circuit.
P_{Gin}	Gate Unit power consumption	≤ 58 W	f_S = 750 Hz, I_{TGQ} = 400 A, δ = 0.33
X1	Gate Unit power connector	Phoenix, Type MSTB 2.5/2-G-5.08 Au Note 1	
Optical control input/output (see Fig. 8 to 10)			
$P_{on\ CS}$	Optical input power	> -20 dBm	Valid for 1mm plastic optical fibre (POF)
$P_{off\ CS}$	Optical noise power	< -45 dBm	
$P_{on\ SF}$	Optical output power	> -15 dBm	
$P_{off\ SF}$	Optical noise power	< -50 dBm	
t_{GLITCH}	Pulse width threshold	≤ 400 ns	Max. pulse width without response
CS	Receiver for command signal	Agilent, Type HFBR-2528 Note 2	
SF	Transmitter for status feedback	Agilent, Type HFBR-1528 Note 2	
Visual feedback (see Fig. 8, 9)			
LED1 (green)	Power supply voltage ok	"Light" when power supply is within specified rang	
LED2 (green)	Gate-cathode interface ok	"Light" when no short circuit, no open and mouning force is applied.	
LED3 (yellow)	Off gated	"Light" when gate-current is flowing	
LED4 (red)	Off gated	"Light" when GCT is off	
LED5 (red)	Not ready (failure)	(optional)	

Note 1: Phoenix Contact, www.phoenixcontact.com
Note 2: Agilent Technologies, www.semiconductor.agilent.com

Thermal

T_j	Operating junction temperature range	0…125 °C	
T_{stg}	Storage temperature range	-40…60 °C	
T_{amb}	Ambient operational temperature range	0…60 °C	
R_{thJC}	Thermal resistance junction to case	≤ 23 K/kW	Double side cooled
R_{thCH}	Thermal resistance case to heatsink	≤ 7.5 K/kW	Double side cooled

Analytical function for transient thermal impedance:

$$Z_{thJC}(t) = \sum_{i=1}^{4} R_i(1 - e^{-t/\tau_i})$$

i	1	2	3	4
R_i (K/kW)	15.5	3.35	2.92	1.17
τ_i (s)	0.57	0.087	0.013	0.0035

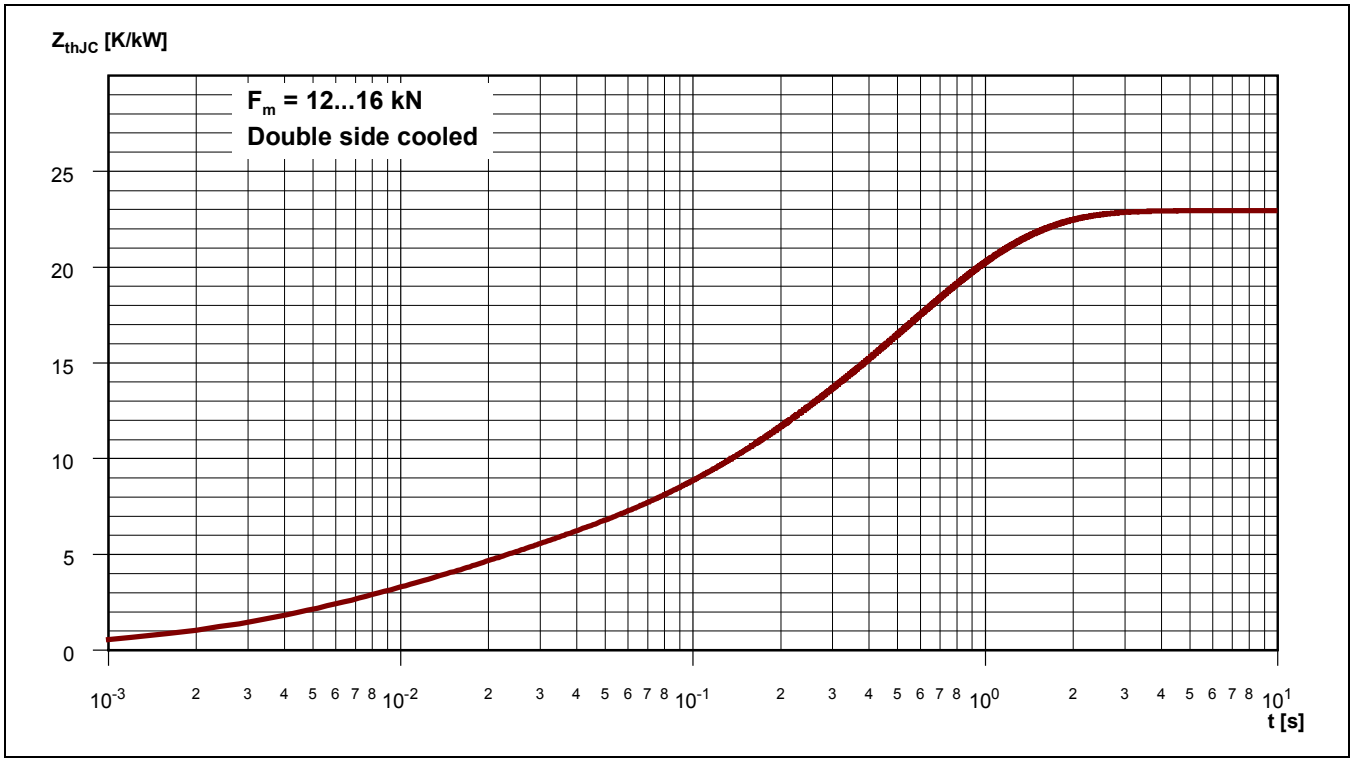


Fig. 1 Transient thermal impedance (junction-to-case) vs. time (max. values).

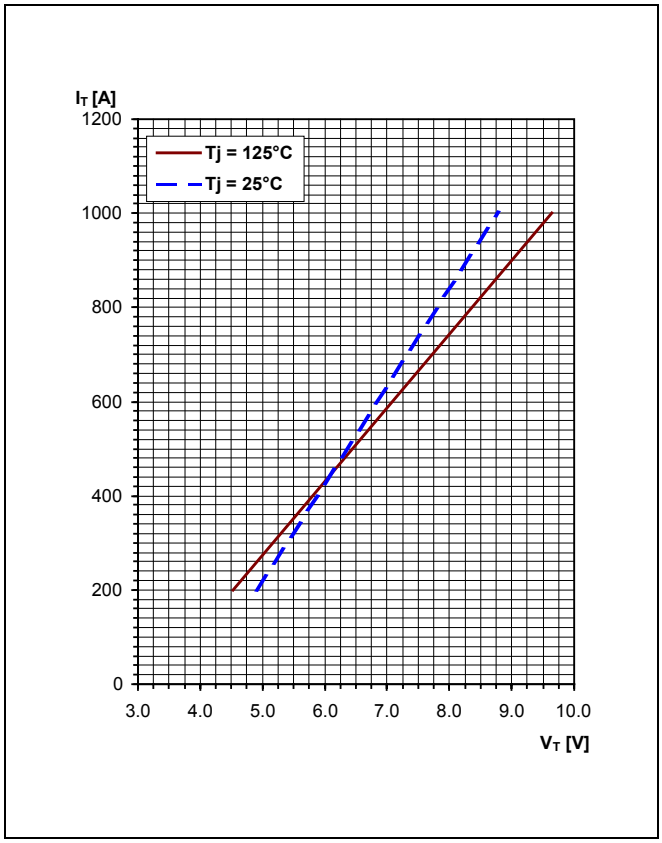


Fig. 2 On-state characteristics.

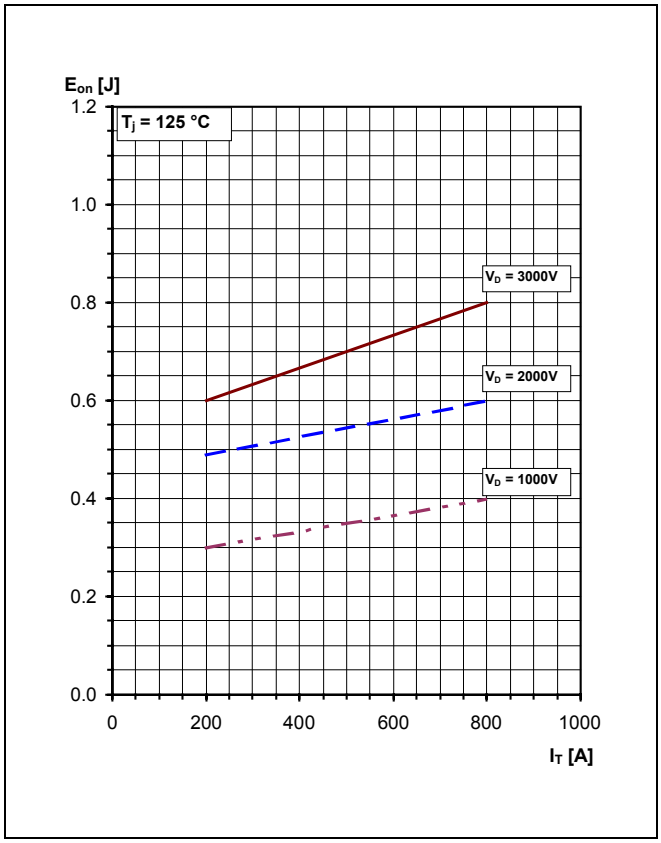


Fig. 3 Turn-on energy per pulse Self commutation (V_D > 0 V)

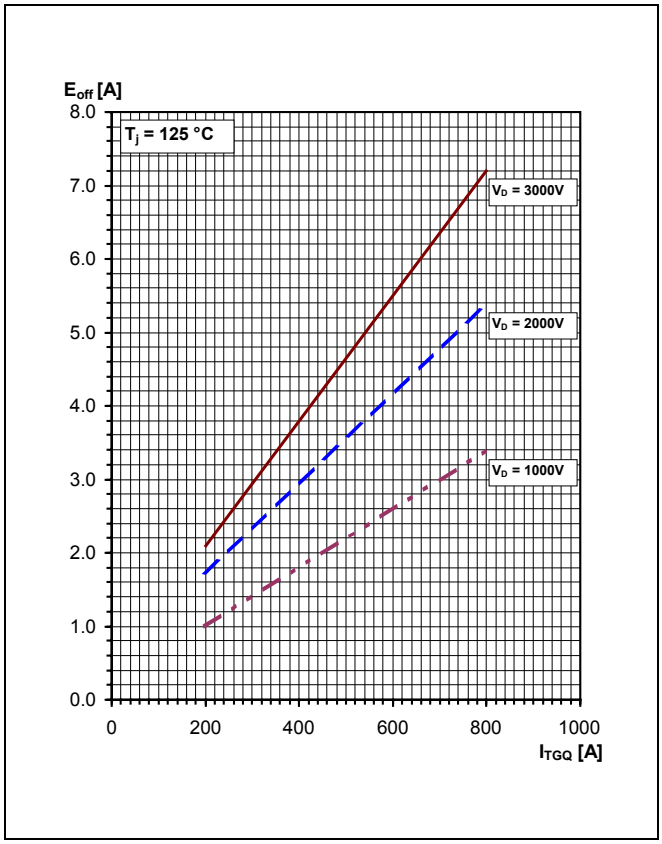


Fig. 4 Turn-off energy per pulse Self commutation (V_D > 0 V).

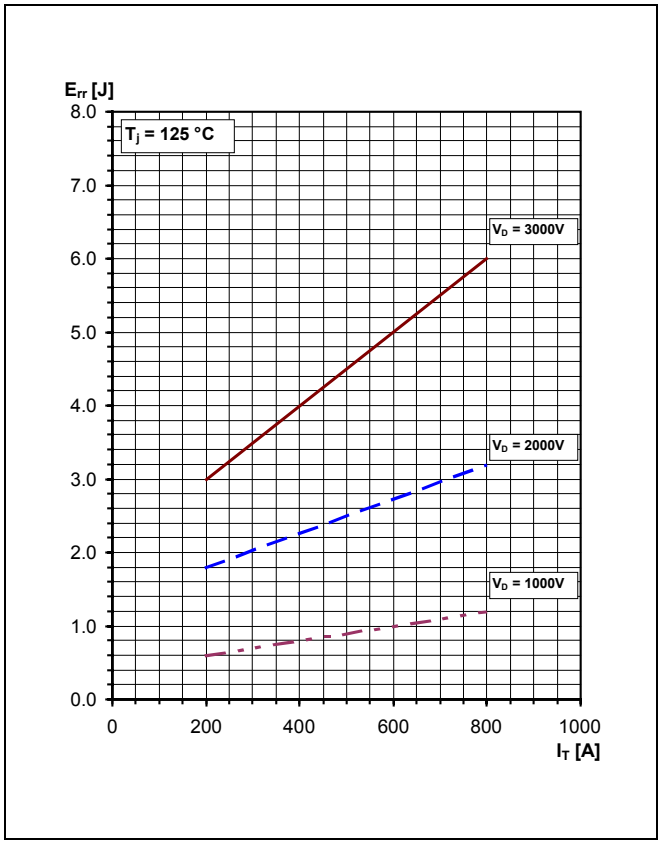


Fig. 5 Turn-off energy per pulse Load commutation (V_D < 0 V).

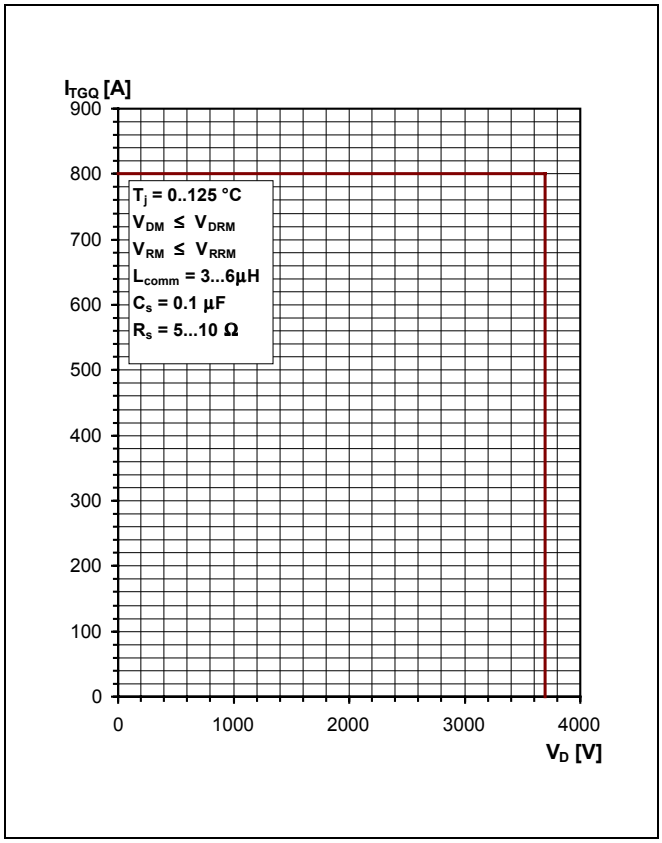


Fig. 6 Max. repetitive turn-off current.

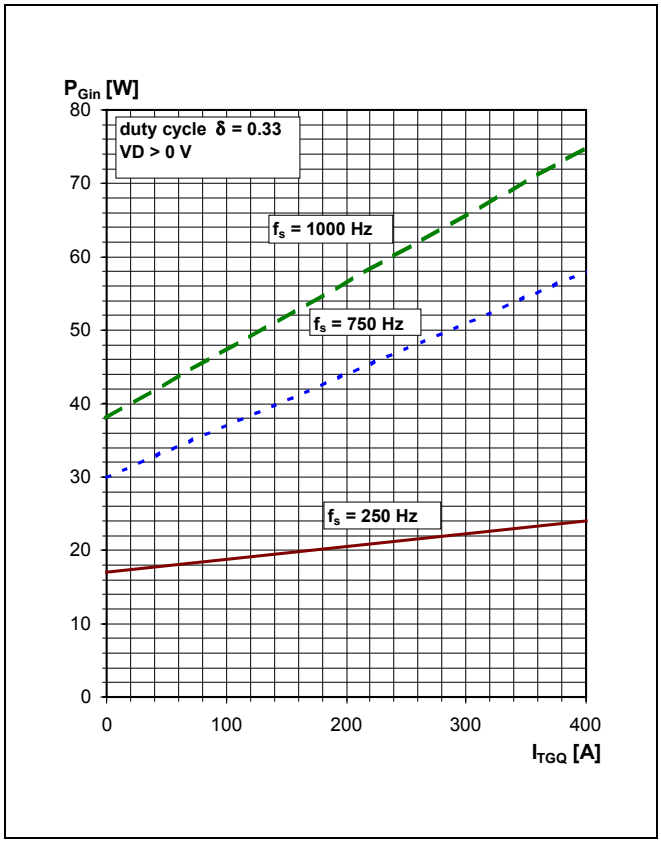


Fig. 7 Gate Unit power consumption.

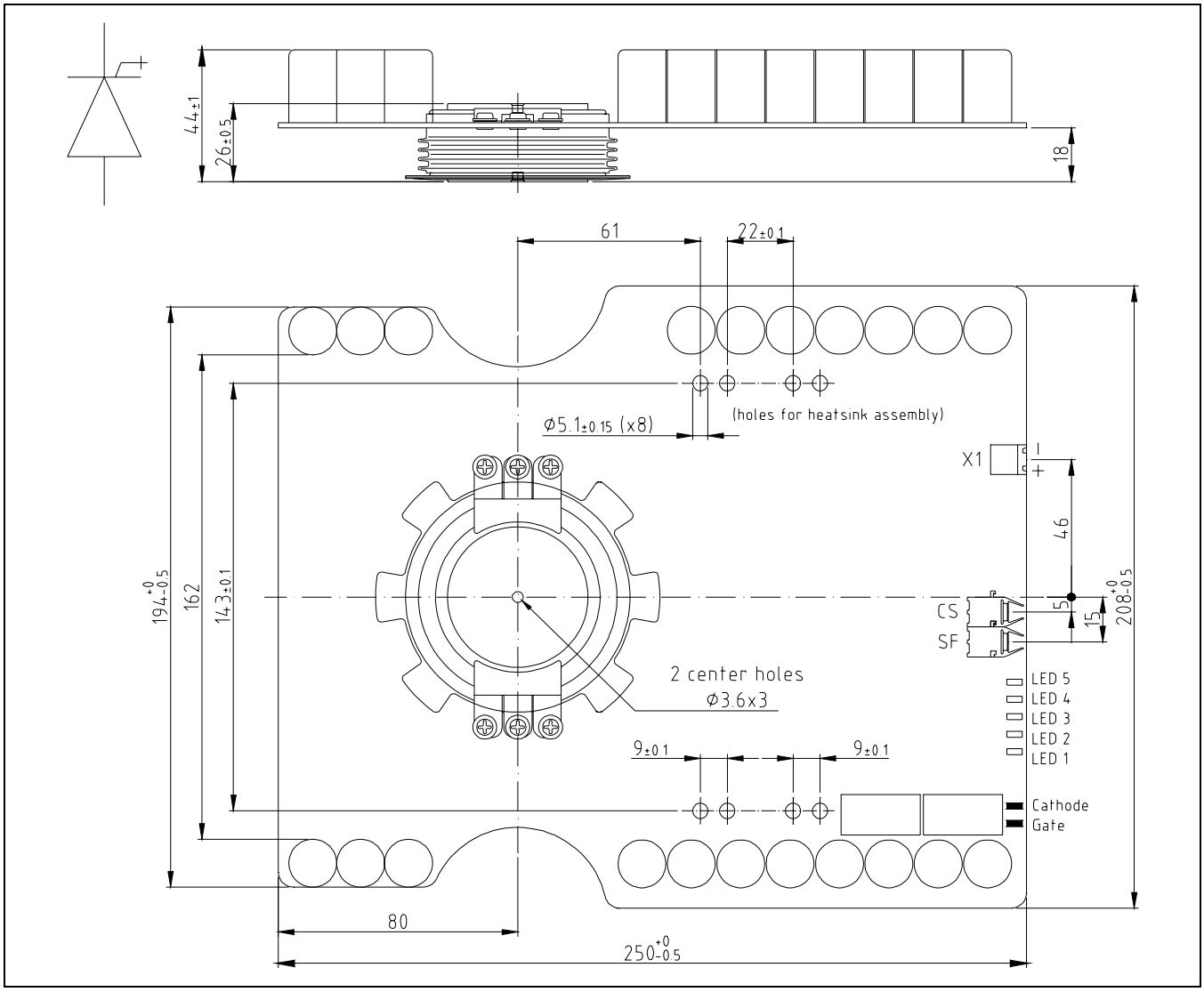


Fig. 8 Device Outline Drawing.

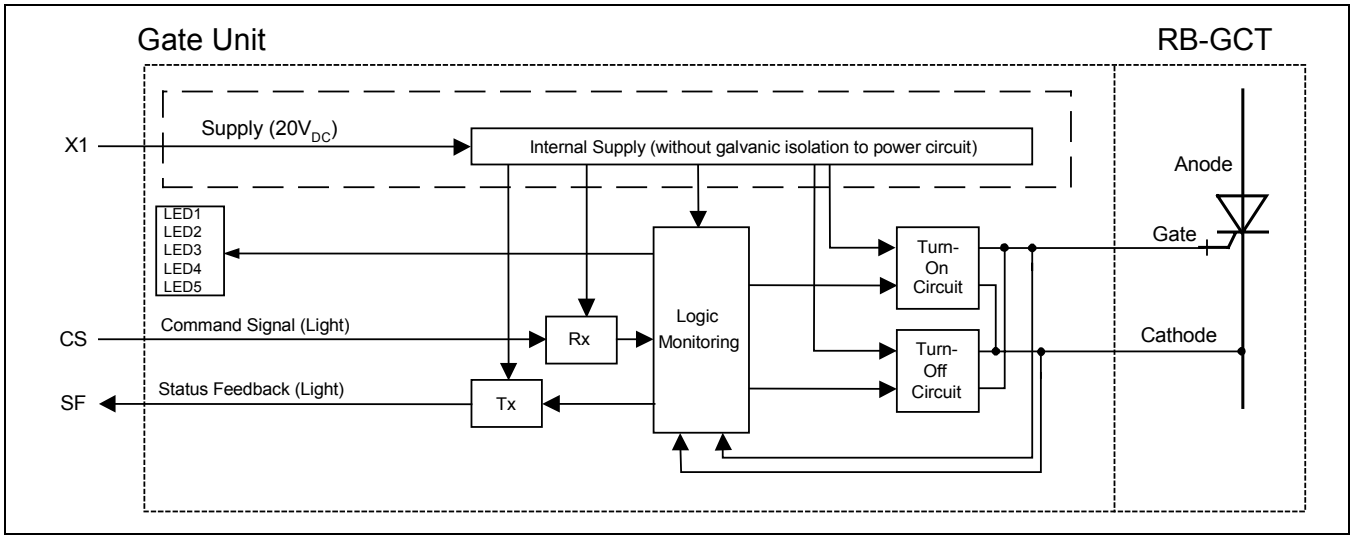


Fig. 9 Block diagram RB-IGCT.

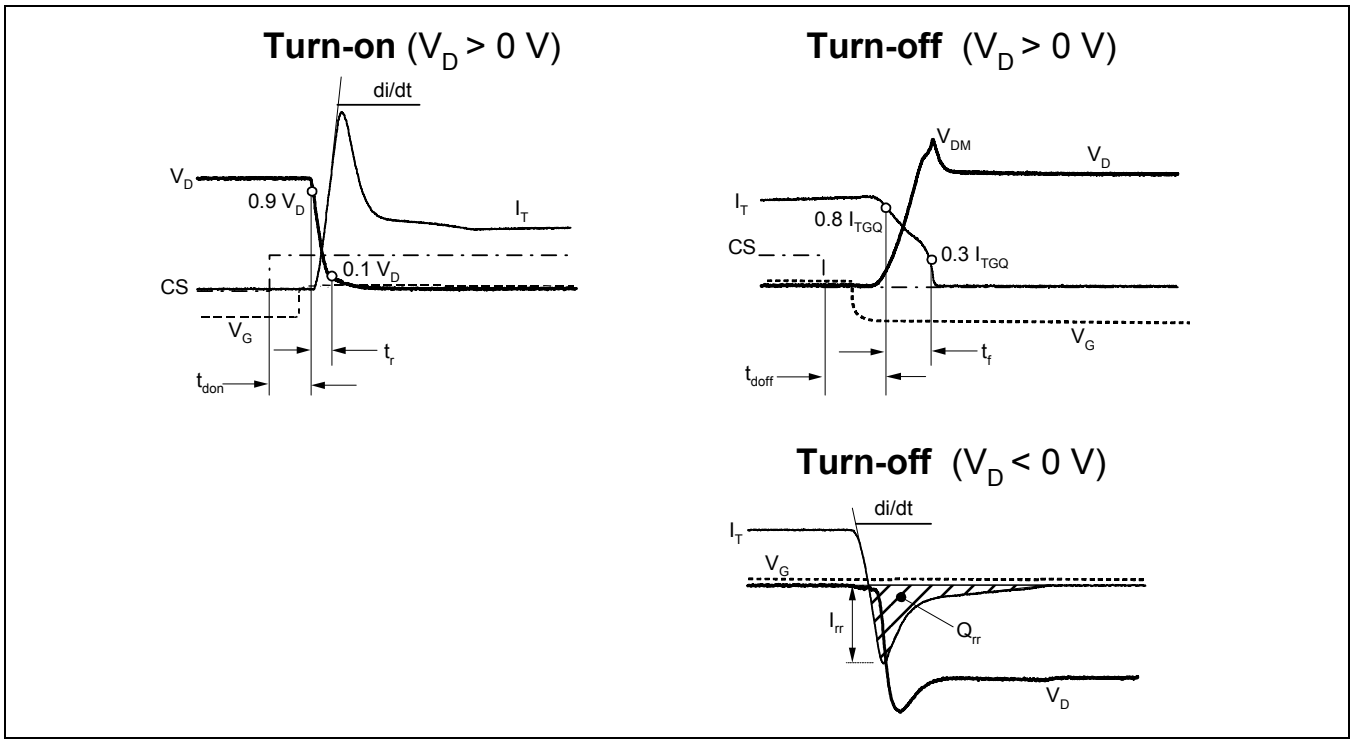


Fig. 10 General current and voltage waveforms with RB-IGCT specific symbols.

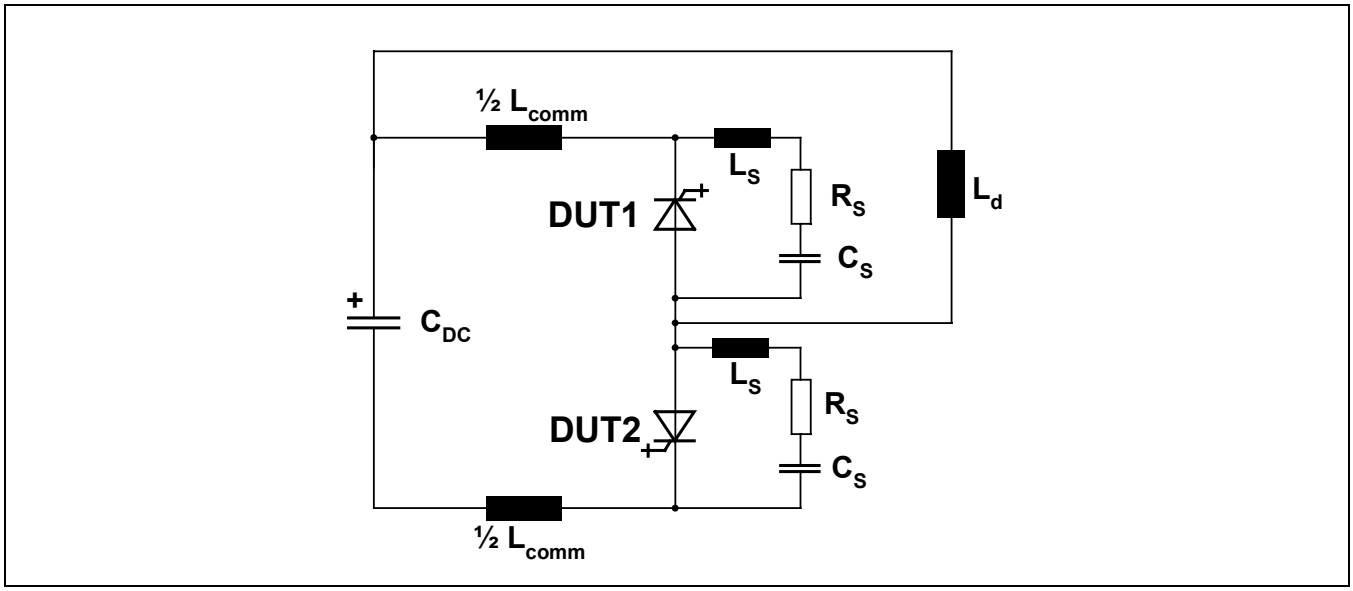


Fig. 11 Test circuit.

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