

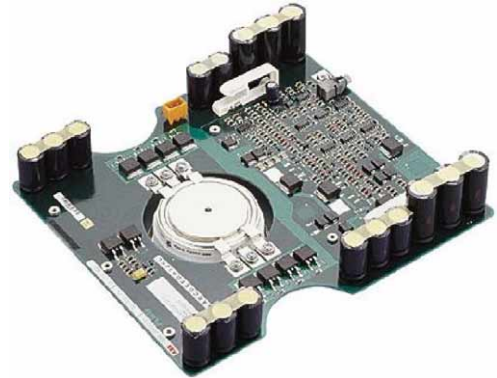
V_{DRM}	=	4500 V
I_{TGQM}	=	630 A
I_{TSM}	=	5 kA
V_{T0}	=	1.8 V
r_T	=	2 m Ω
V_{DClink}	=	2800 V

Reverse Conducting Integrated Gate-Commutated Thyristor

5SHX 08F4502

Doc. No. 5SYA1223-04 Jan. 02

- Direct fiber optic control
- Fast response ($t_{don} < 3 \mu s$, $t_{doff} < 6 \mu s$)
- Precise timing ($\Delta t_{doff} < 800 ns$)
- Patented free floating silicon technology
- Optimized low on-state and switching losses
- Very high EMI immunity
- Cosmic radiation withstand rating



Blocking

V_{DRM}	Repetitive peak off-state voltage	4500 V	$V_{GR} \geq 2V$
I_{DRM}	Repetitive peak off-state current	$\leq 20 mA$	$V_D = V_{DRM}$ $V_{GR} \geq 2V$
V_{DClink}	Permanent DC voltage for 100 FIT failure rate	2800 V	$0 \leq T_j \leq 115 \text{ }^\circ\text{C}$. Ambient cosmic radiation at sea level in open air.

Mechanical data (see Fig. 9)

F_m	Mounting force	min.	14 kN	
		max.	18 kN	
D_p	Pole-piece diameter		47 mm	$\pm 0.1 mm$
H	Housing thickness		26 mm	$\pm 0.5 mm$
m	Weight IGCT		1.01 kg	
D_s	Surface creepage distance	\geq	33 mm	
D_a	Air strike distance	\geq	13 mm	
l	Length IGCT		220 mm	+0/-0.5 mm
h	Height IGCT		57.5 mm	$\pm 1.0 mm$
w	Width IGCT		200 mm	+0/-0.5 mm

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GCT Data

On-state (see Fig. 1)

I_{TAVM}	Max. average on-state current	250 A	Half sine wave, $T_C = 85\text{ °C}$	
I_{TRMS}	Max. RMS on-state current	390 A		
I_{TSM}	Max. peak non-repetitive surge current	5 kA	$t_p =$	10 ms
		9 kA	$t_p =$	1 ms
I^2t	Limiting load integral	$128 \times 10^3\text{ A}^2\text{s}$	$t_p =$	10 ms
		$40 \times 10^3\text{ A}^2\text{s}$	$t_p =$	1 ms
V_T	On-state voltage	$\leq 3\text{ V}$	$I_T =$	630 A
V_{T0}	Threshold voltage	1.8 V	$I_T =$	100 - 1000 A
r_T	Slope resistance	2 m Ω		

$T_j = 115\text{ °C}$
After surge:
 $V_D = V_R = 0\text{ V}$

Turn-on switching

di/dt_{crit}	Max. rate of rise of on-state current	300 A/ μs	$f =$	500 Hz	$T_j =$	115 °C
t_{don}	Turn-on delay time	$\leq 3\text{ }\mu\text{s}$	$I_T =$	630 A	$V_D =$	V
t_r	Rise time	$\leq 1\text{ }\mu\text{s}$	$V_D =$	2700 V	$T_j =$	115 °C
$t_{on(min)}$	Min, on-time	10 μs	$I_T =$	630 A	$di/dt =$	250 A/ μs
E_{on}	Turn-on energy per pulse	$\leq 0.25\text{ J}$	$R_s =$	1.2 Ω	$L_i =$	10.7 μH
			$C_{CL} =$	2 μF	$L_{CL} =$	1 μH

Turn-off switching (see Fig. 2, 3)

I_{TGQM}	Max. controllable turn-off current	630 A	$V_{DM} \leq V_{DRM}$	$T_j =$	115 °C	
t_{doff}	Turn-off delay time	$\leq 6\text{ }\mu\text{s}$	$V_D =$	2700 V	$L_{CL} \leq$	1 μH
t_f	Fall time	$\leq 1\text{ }\mu\text{s}$	$V_D =$	2700 V	$V_{DM} \leq V_{DRM}$	
$t_{off(min)}$	Min. off-time	10 μs	$T_j =$	115 °C	$R_s =$	1.2 Ω
E_{off}	Turn-off energy per pulse	$\leq 2.9\text{ J}$	$I_{TGQ} =$	I_{TGQM}	$L_i =$	10.7 μH
			$C_{CL} =$	2 μF	$L_{CL} \leq$	1 μH

Diode Data

On-state (see Fig. 4)

I_{FAVM}	Max. average on-state current	130 A	Half sine wave, $T_C = 85\text{ °C}$		
I_{FRMS}	Max. RMS on-state current	205 A			
I_{FSM}	Max. peak non-repetitive surge current	6.1 kA	$t_p =$	10 ms	$T_j = 115\text{ °C}$ After surge: $V_F = V_R = 0V$
		15.6 kA	$t_p =$	1 ms	
I^2t	Limiting load integral	$191 \times 10^3\text{ A}^2\text{s}$	$t_p =$	10 ms	
		$122 \times 10^3\text{ A}^2\text{s}$	$t_p =$	1 ms	
V_F	On-state voltage	$\leq 5.7\text{ V}$	$I_F =$	630 A	$T_j = 115\text{ °C}$
V_{F0}	Threshold voltage	2.8 V	$I_F =$	100 - 1000 A	
r_F	Slope resistance	4.6 m Ω			

Turn-off switching (see Fig. 5, 6)

di/dt_{crit}	Max. rate of rise of on-state current	300 A/ μs	$I_F =$	630 A	$T_j =$	115 °C
I_{rr}	Reverse recovery current	$\leq 400\text{ A}$	$V_{CL} =$	V	$I_F =$	630 A
E_{rr}	Turn-off energy	$\leq 1.5\text{ J}$	$di/dt =$	250 A/ μs	$T_j =$	115 °C
			$R_s =$	1.2 Ω	$L_i =$	10.7 μH
			$C_{CL} =$	2 μF	$L_{CL} =$	1 μH

Gate Unit

Power supply (see Fig. 9 to 11)

V_{GDC}	Gate Unit voltage	$20 \pm 0.5\text{ V}_{DC}$	Without galvanic isolation to power circuit.
P_{Gin}	Gate Unit power consumption	$\leq 17\text{ W}$	$f_S = 500\text{ Hz}$, $I_{TGQ\text{ AV}} = 260\text{ A}$, $\delta = 0.9$
X1	Gate Unit power connector	WAGO, Part Number 231-532/001-000 ^{Note 1}	

Optical control input/output ^{Note 3} (see Fig. 9 to 11)

$P_{on\text{ CS}}$	Optical input power	$> -20\text{ dBm}$	Valid for 1mm plastic optical fibre (POF)
$P_{off\text{ CS}}$	Optical noise power	$< -45\text{ dBm}$	
t_{GLITCH}	Pulse width threshold	$\leq 500\text{ ns}$	Max. pulse width without response
CS	Receiver for command signal	Agilent, Type HFBR-2528 ^{Note 2}	

Note 1: WAGO, www.wago.com

Note 2: Agilent Technologies, www.semiconductor.agilent.com

Note 3: Do not disconnect or connect fiber optic cables while light is on.

Thermal

T_{jop}	Operating junction temperature range	0...115 °C	
T_{stg}	Storage temperature range	-40...60 °C	
T_{amb}	Ambient operational temperature range	0...60 °C	
Thermal resistance junction to case			
R_{thJC} GCT	Diode not dissipating	≤ 40 K/kW	Double side cooled
R_{thJC} Diode	GCT not dissipating	≤ 53 K/kW	
Thermal resistance case to heatsink			
R_{thCH} GCT	Diode not dissipating	≤ 16 K/kW	Double side cooled
R_{thCH} Diode	GCT not dissipating	≤ 17 K/kW	

GCT Part

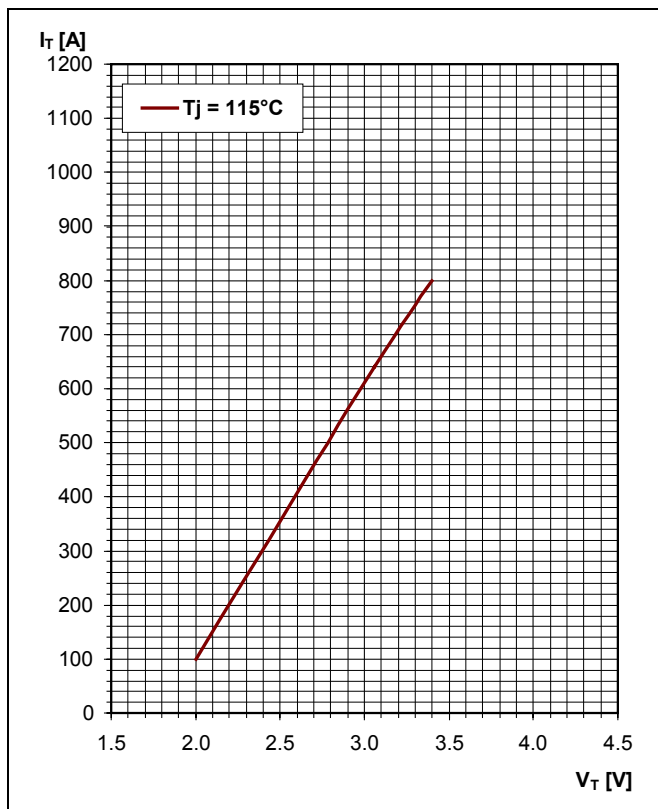


Fig. 1 GCT on-state characteristics.

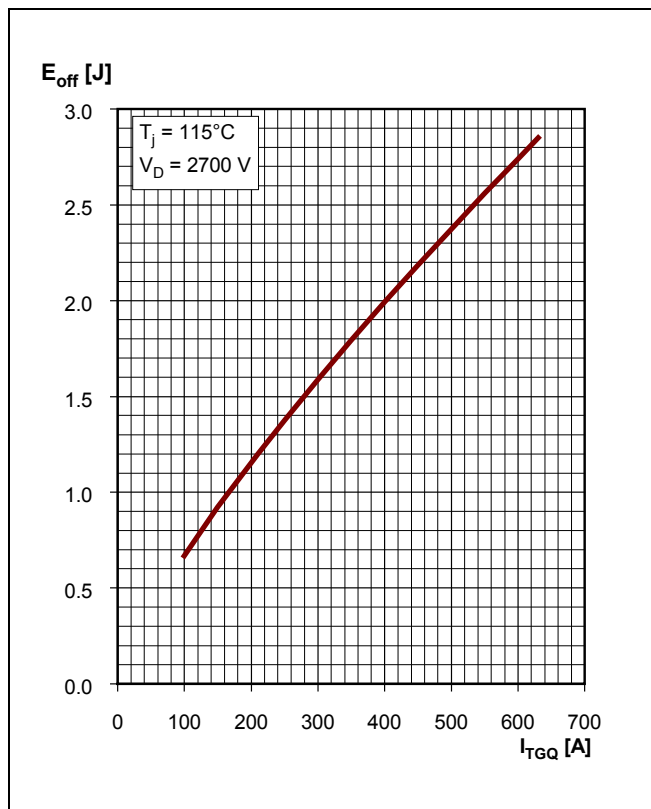


Fig. 2 GCT turn-off energy per pulse vs. turn-off current.

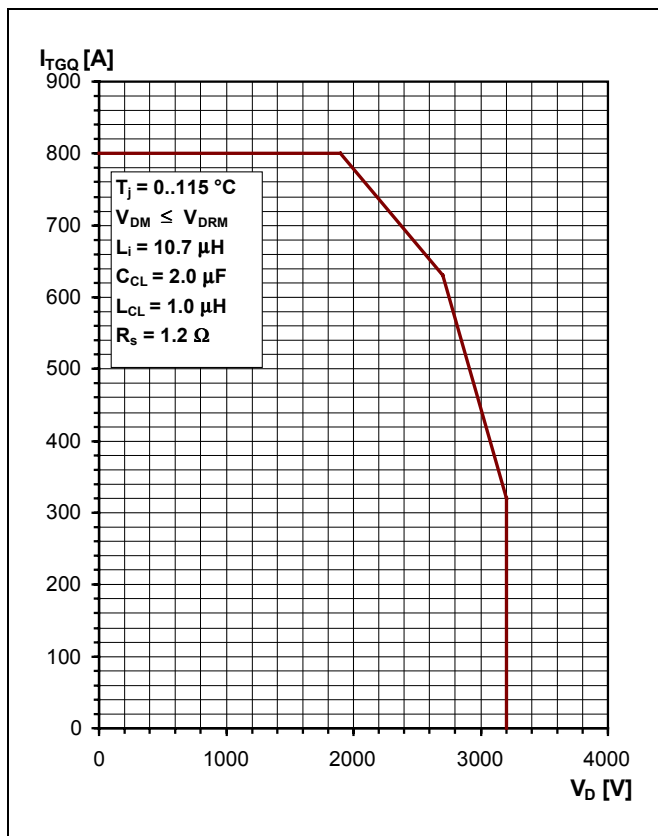


Fig. 3 Max. repetitive GCT turn-off current.

Diode Part

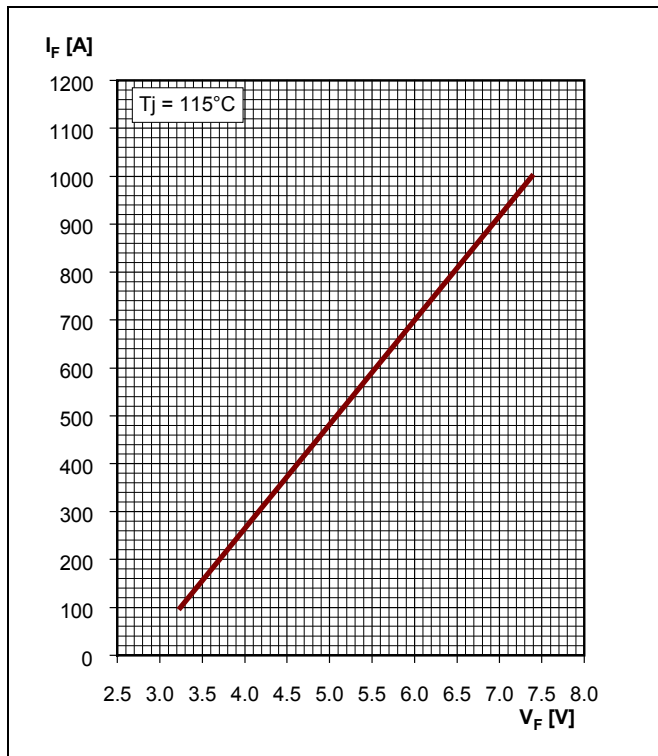


Fig. 4 Diode on-state characteristics.

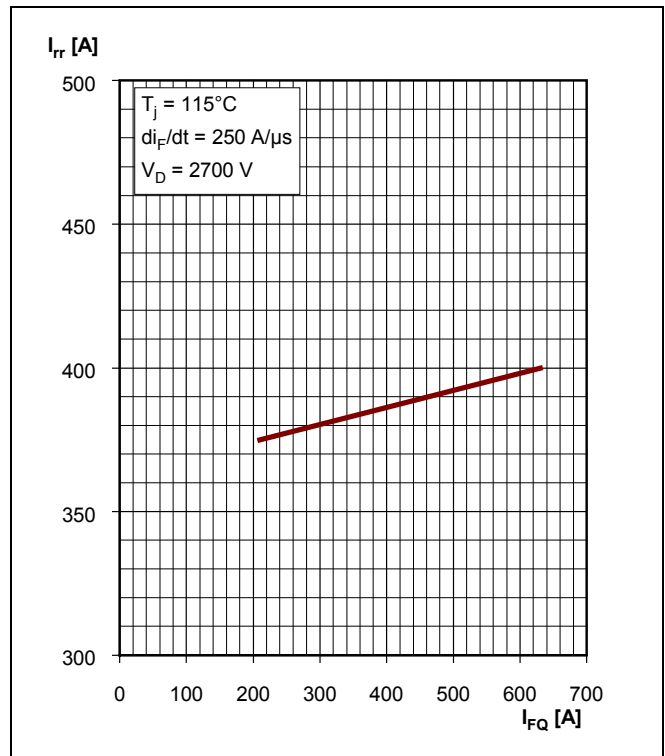


Fig. 5 Diode reverse recovery current vs. turn-off current.

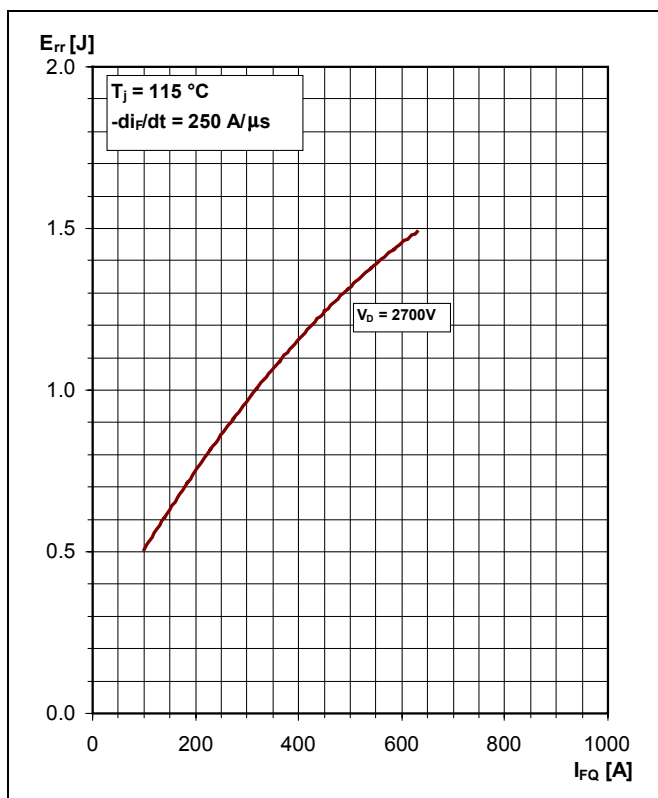


Fig. 6 Diode turn-off energy per pulse vs. turn-off current.

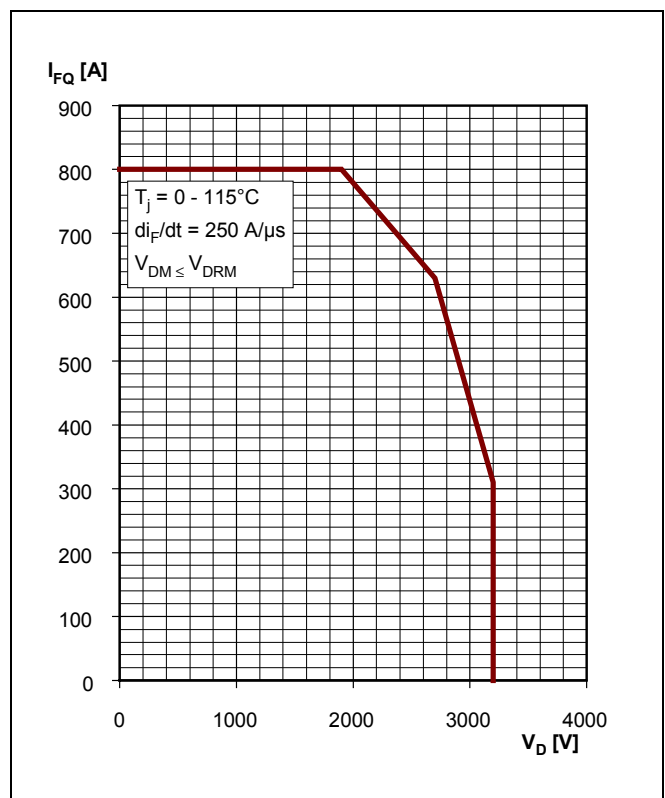


Fig. 7 Max. repetitive diode forward current.

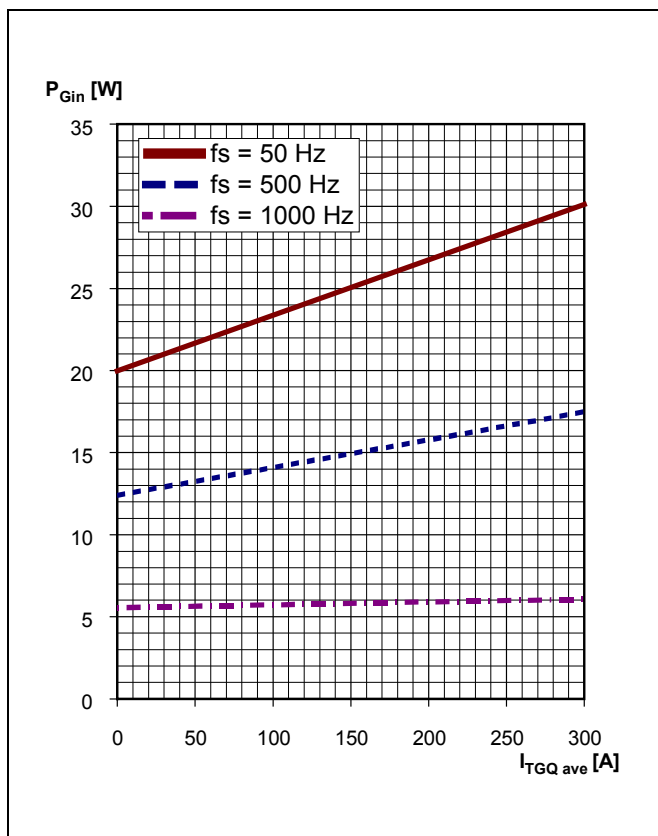


Fig. 8 Gate Unit power consumption.

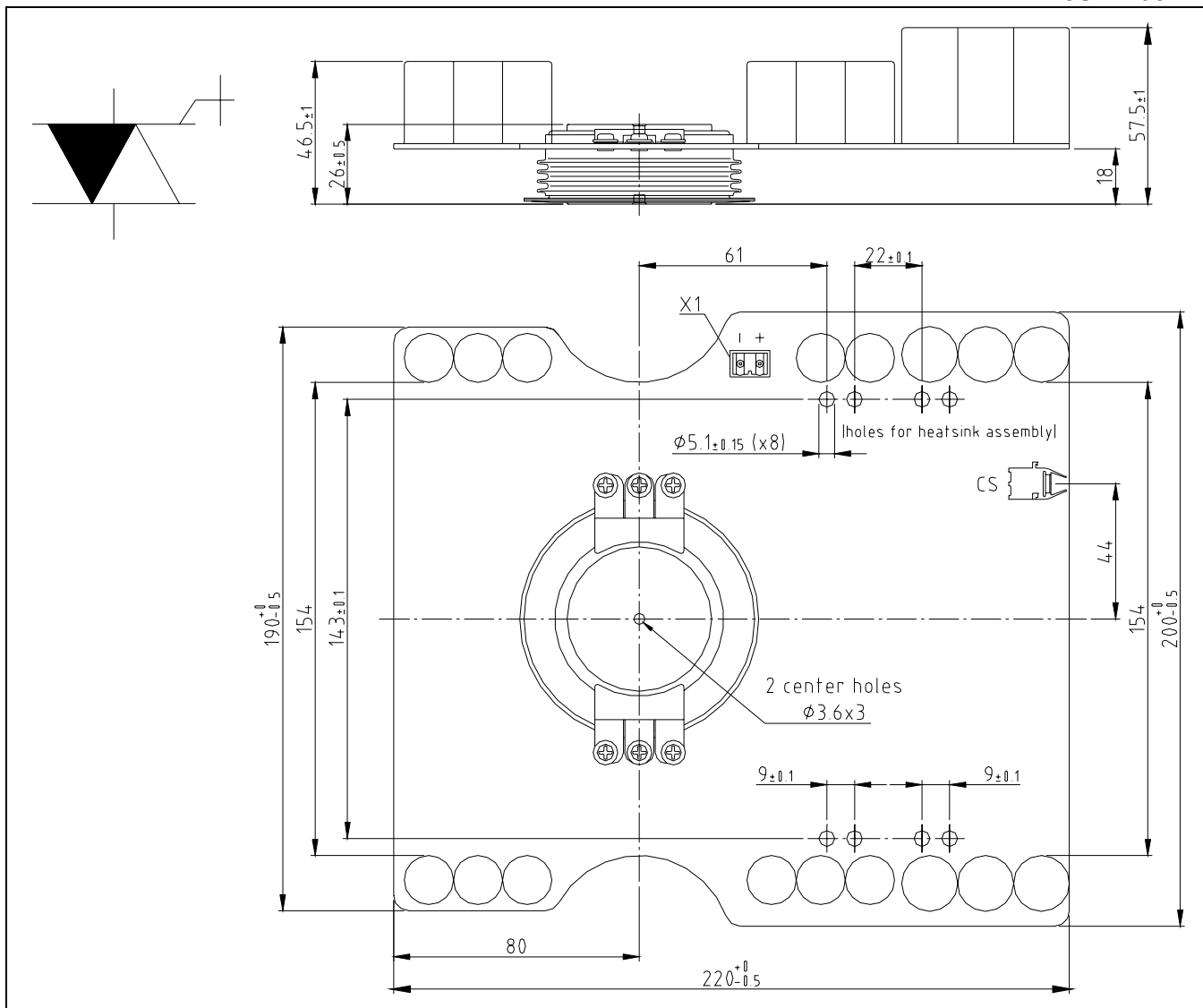


Fig. 9 Device Outline Drawing.

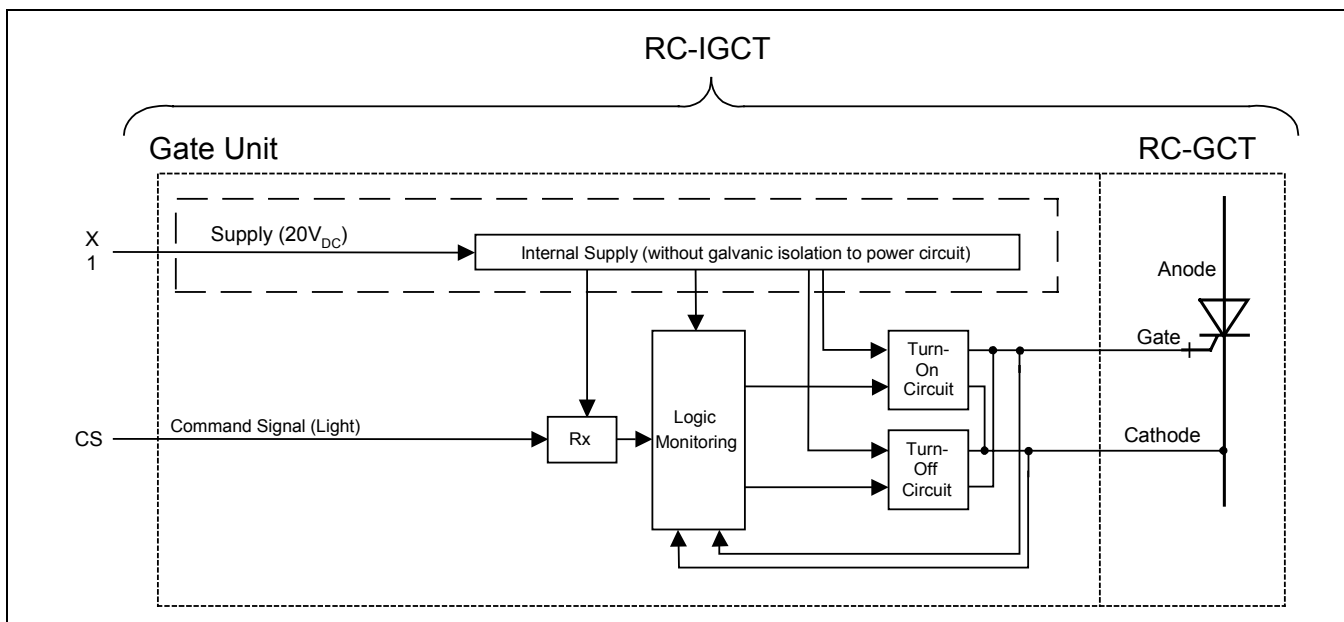


Fig. 10 Block diagram.

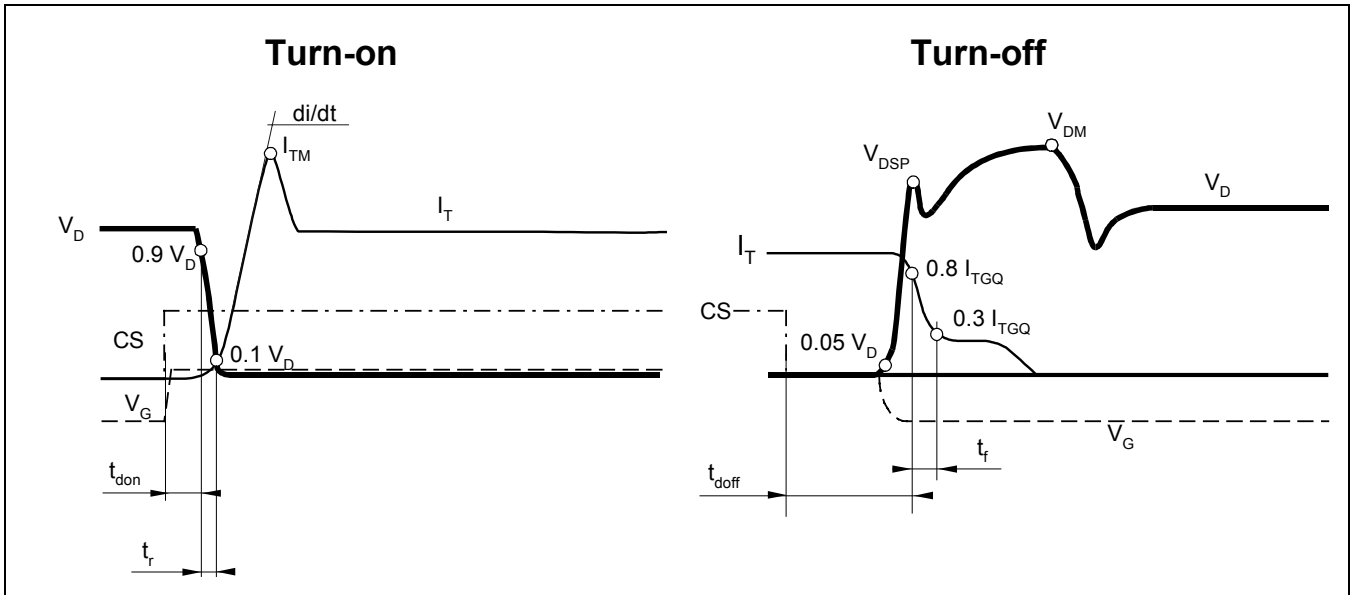


Fig. 11 General current and voltage waveforms with IGCT-specific symbols.

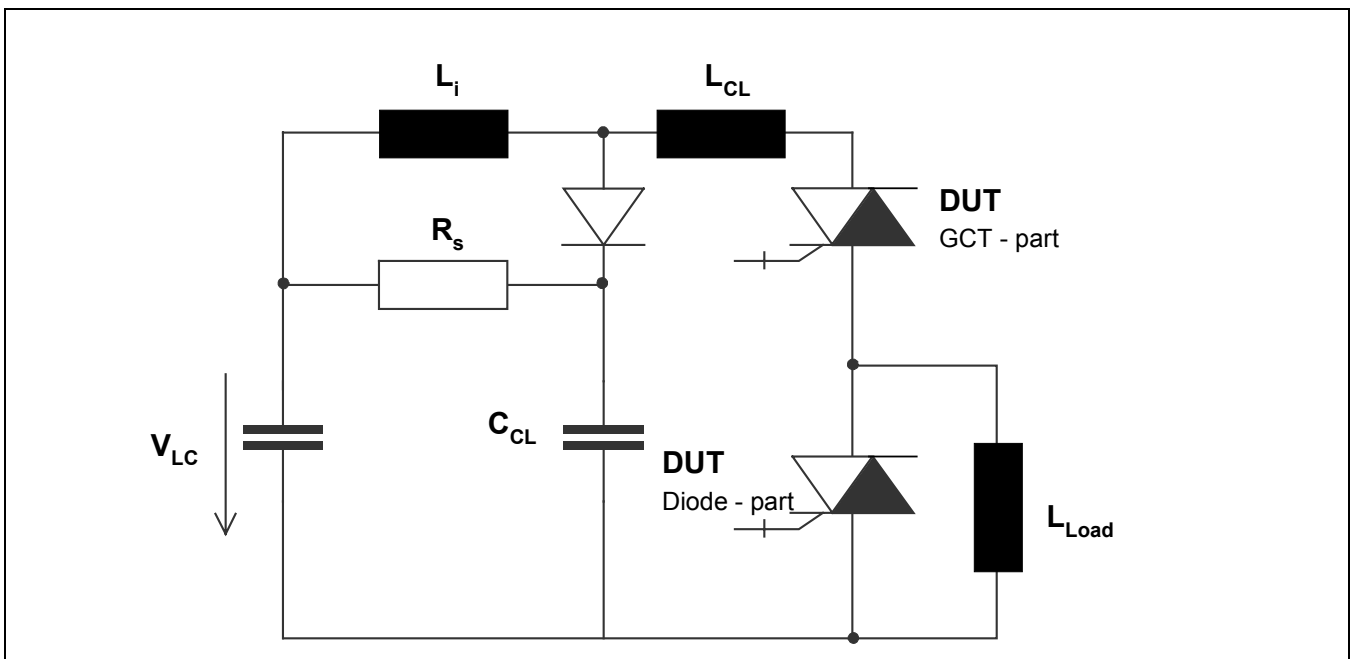


Fig. 12 Test circuit.

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