

$V_{DRM}$	=	4500 V
$I_{TGQM}$	=	4000 A
$I_{TSM}$	=	32 kA
$V_{T0}$	=	1.40 V
$r_T$	=	0.325 m $\Omega$
$V_{DClink}$	=	2800 V

# Asymmetric Integrated Gate-Commutated Thyristor

## 5SHY 35L4510

### PRELIMINARY

Doc. No. 5SYA1232-00 Mai 01

- Highest snubberless turn off rating
- Optimized for medium frequency (<1kHz) and wide temperature range
- Suitable for series connection
- High reliability
- Very high EMI immunity
- Simple control interface with status feedback
- AC supply voltage



## Blocking

$V_{DRM}$	Repetitive peak off-state voltage	4500 V	$V_{GR} \geq 2V$
$I_{DRM}$	Repetitive peak off-state current	$\leq$ 50 mA	$V_D = V_{DRM}$ $V_{GR} \geq 2V$
$V_{DClink}$	Permanent DC voltage for 100 FIT failure rate	2800 V	Ambient cosmic radiation at sea level in open air.

## Mechanical data (see Fig. 6)

$F_m$	Mounting force	min.	36 kN	
		max.	44 kN	
$D_p$	Pole-piece diameter		85 mm	$\pm 0.1$ mm
H	Housing thickness		26 mm	$\pm 0.5$ mm
m	Weight IGCT		2.90 kg	
$D_s$	Surface creepage distance	$\geq$	33 mm	Anode to Gate
$D_a$	Air strike distance	$\geq$	10 mm	Anode to Gate
l	Length IGCT		439 mm	$\pm 1.0$ mm
h	Height IGCT		40 mm	$\pm 1.0$ mm
w	Width IGCT		172.5 mm	$\pm 1.0$ mm

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## GCT Data

### On-state (see Fig. 2)

$I_{TAVM}$	Max. average on-state current	1700 A	Half sine wave, $T_C = 85\text{ °C}$		
$I_{TRMS}$	Max. RMS on-state current	2700 A			
$I_{TSM}$	Max. peak non-repetitive surge current	32 kA	$t_p =$	10 ms	$T_j = 125\text{ °C}$ After surge: $V_D = V_R = 0V$
		12 kA	$t_p =$	100 ms	
$I^2t$	Limiting load integral	$5.1 \cdot 10^6\text{ A}^2\text{s}$	$t_p =$	10 ms	
		$7.2 \cdot 10^6\text{ A}^2\text{s}$	$t_p =$	100 ms	
$V_T$	On-state voltage	$\leq 2.70\text{ V}$	$I_T =$	4000 A	$T_j = 125\text{ °C}$
$V_{T0}$	Threshold voltage	1.40 V	$I_T =$	1000 - 4000 A	
$r_T$	Slope resistance	0.325 m $\Omega$			

### Turn-on switching (see Fig. 8, 9)

$di/dt_{crit}$	Max. rate of rise of on-state current	1000 A/ $\mu\text{s}$	$f =$	0..500 Hz	$T_j =$	125 °C
			$I_T =$	4000 A	$V_D =$	2800 V
$t_{don}$	Turn-on delay time	$\leq 3\text{ }\mu\text{s}$	$V_D =$	2800 V	$T_j =$	125 °C
$t_r$	Rise time	$\leq 1\text{ }\mu\text{s}$	$I_T =$	3300 A		
$t_{on(min)}$	Min. on-time	10 $\mu\text{s}$	$R_s =$	0.65 $\Omega$	$L_i =$	5.0 $\mu\text{H}$
$E_{on}$	Turn-on energy per pulse	$\leq 1.5\text{ J}$	$C_{CL} =$	10.0 $\mu\text{F}$	$L_{CL} =$	0.3 $\mu\text{H}$

### Turn-off switching (see Fig. 3, 4, 8, 9)

$I_{TGQM}$	Max. controllable turn-off current	4000 A	$V_{DM} \leq$	$V_{DRM}$	$T_j =$	125 °C
			$V_D =$	2800 V	$L_{CL} =$	0.3 $\mu\text{H}$
$t_{doff}$	Turn-off delay time	$\leq 7.0\text{ }\mu\text{s}$	$V_D =$	2800 V	$V_{DM} \leq$	$V_{DRM}$
$t_f$	Fall time	$\leq 1.0\text{ }\mu\text{s}$	$T_j =$	125 °C	$R_s =$	0.65 $\Omega$
$t_{off(min)}$	Min. off-time	10 $\mu\text{s}$	$I_{TGQ} =$	3300 A	$L_i =$	5.0 $\mu\text{H}$
$E_{off}$	Turn-off energy per pulse	$\leq 18\text{ J}$	$C_{CL} =$	10.0 $\mu\text{F}$	$L_{CL} =$	0.3 $\mu\text{H}$

## Gate Unit

<b>Power supply</b> (see Fig. 5, 6, 7)			
$V_{GAC}$	Gate supply voltage	24..40 V <sub>AC</sub>	AC square wave. Without galvanic isolation to power circuit.
$P_{Gin}$	Gate Unit power consumption	≤ 100 W	$f_S = 500$ Hz, $I_{TGQ} = 1500$ A, $\delta = 0.5$
X1	Gate Unit power connector	WAGO, Part Number 231-533/001-000 <sup>Note 1</sup>	
<b>Optical control input/output</b> (see Fig. 8)			
$P_{on CS}$	Optical input power	> -21 dBm	Valid for 1mm plastic optical fibre (POF)
$P_{off CS}$	Optical noise power	< -40 dBm	
$P_{on SF}$	Optical output power	> -19 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 <sup>Note 2</sup>	
SF	Transmitter for status feedback	Agilent, Type HFBR-1528 <sup>Note 2</sup>	
<b>Visual feedback</b> (see Fig. 8, 9)			
LED1 (green)	Gate OFF	"Light" when GCT is off	
LED2 (yellow)	Gate ON	"Light" when gate-current is flowing	
LED3 (red)	Fault	"Light" when not ready / Failure	
LED4 (green)	Power supply voltage OK	"Light" when power supply is within specified range	

Note 1: WAGO, [www.wago.com](http://www.wago.com)

Note 2: Agilent Technologies, [www.semiconductor.agilent.com](http://www.semiconductor.agilent.com)

## Thermal

$T_j$	Operating junction temperature range	-40...125 °C	
$T_{stg}$	Storage temperature range	-40...60 °C	
$T_{amb}$	Ambient operational temperature range	-40...60 °C	
$T_{amb}$	Ambient operational and storage temperature range	-40...70 °C	IGCT operation with lifetime reduction
$R_{thJC}$	Thermal resistance junction to case	≤ 8.5 K/kW	Double side cooled
$R_{thCH}$	Thermal resistance case to heatsink	≤ 3 K/kW	Double side cooled

Analytical function for transient thermal impedance.

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

i	1	2	3	4
$R_i$ (K/kW)	5.625	1.486	0.849	0.527
$\tau_i$ (s)	0.52748	0.08969	0.00905	0.00244
$F_M = 36... 44$ kN Double side cooled				

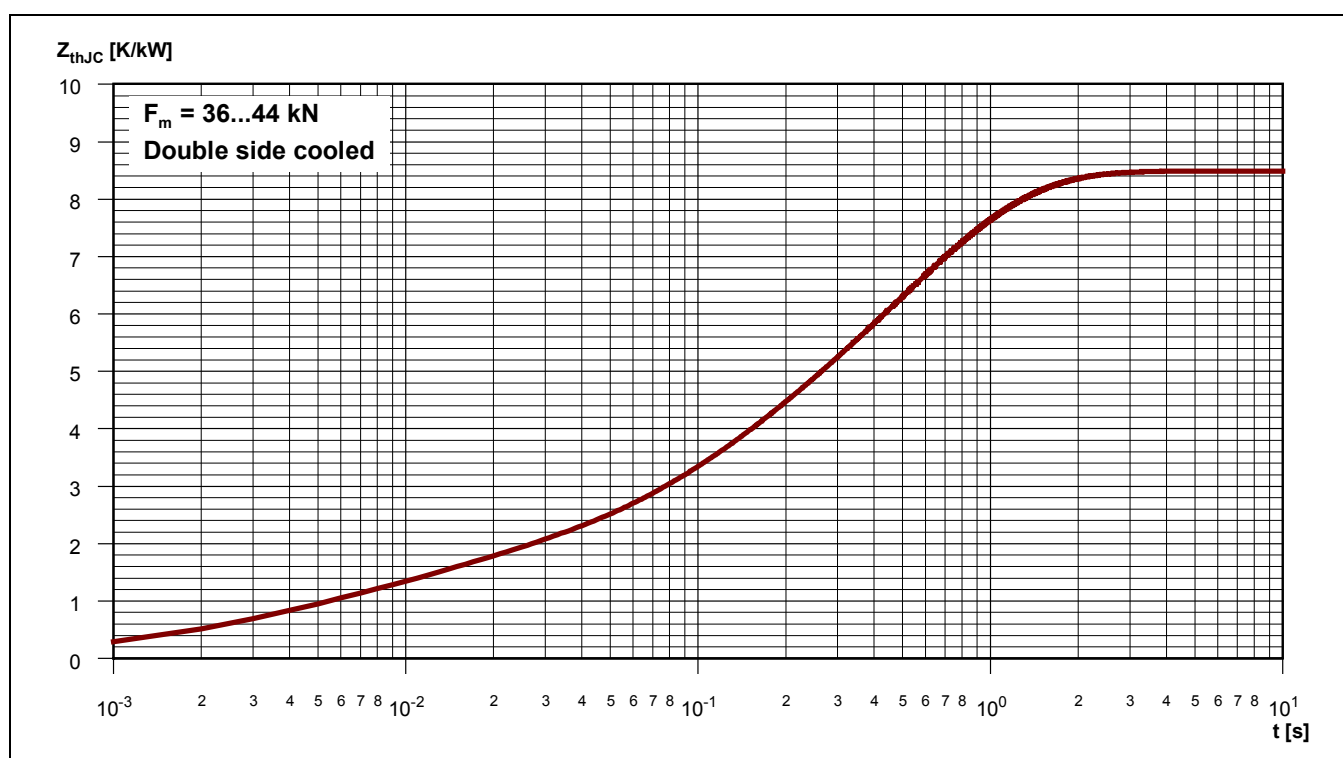
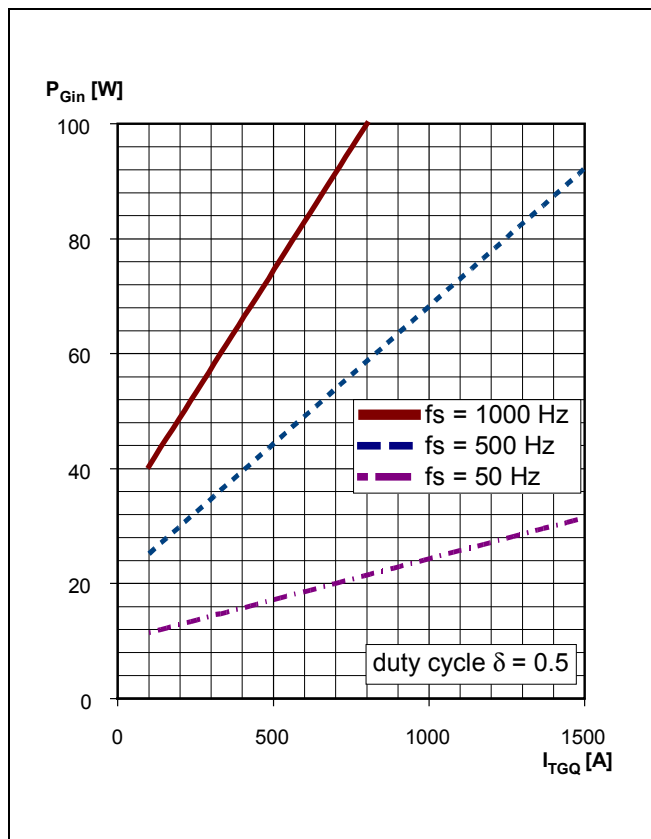
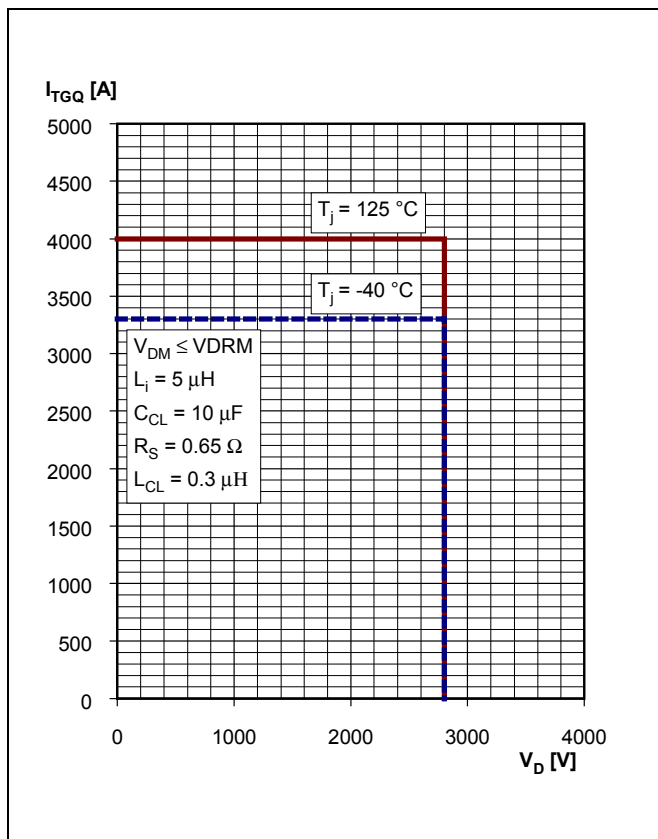
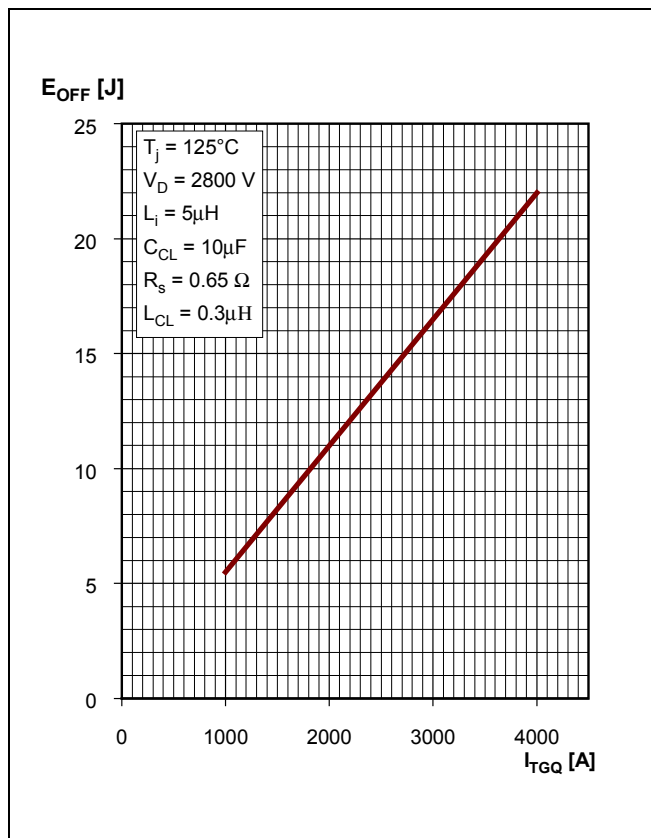
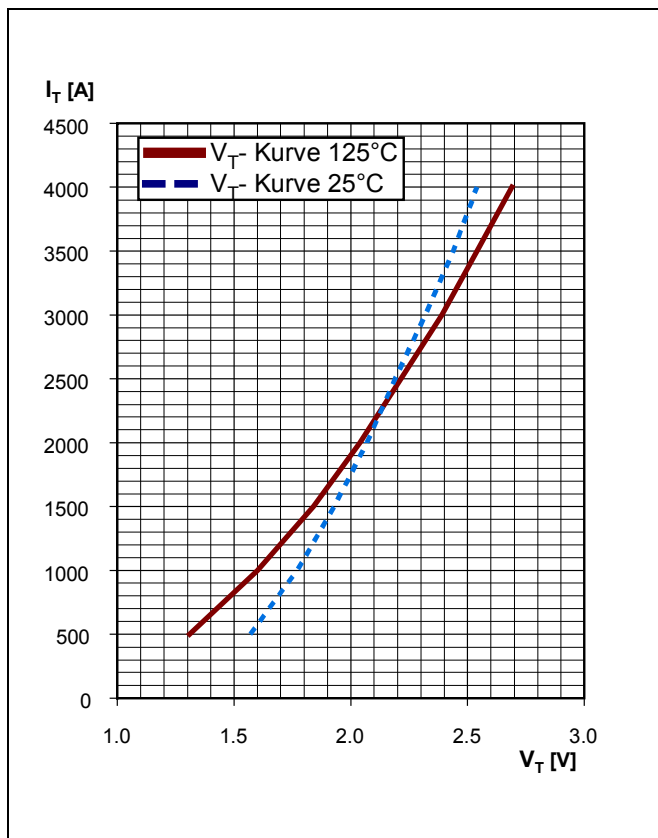


Fig. 1 Transient thermal impedance (junction-to-case) vs. time (max. values).

# GCT Part





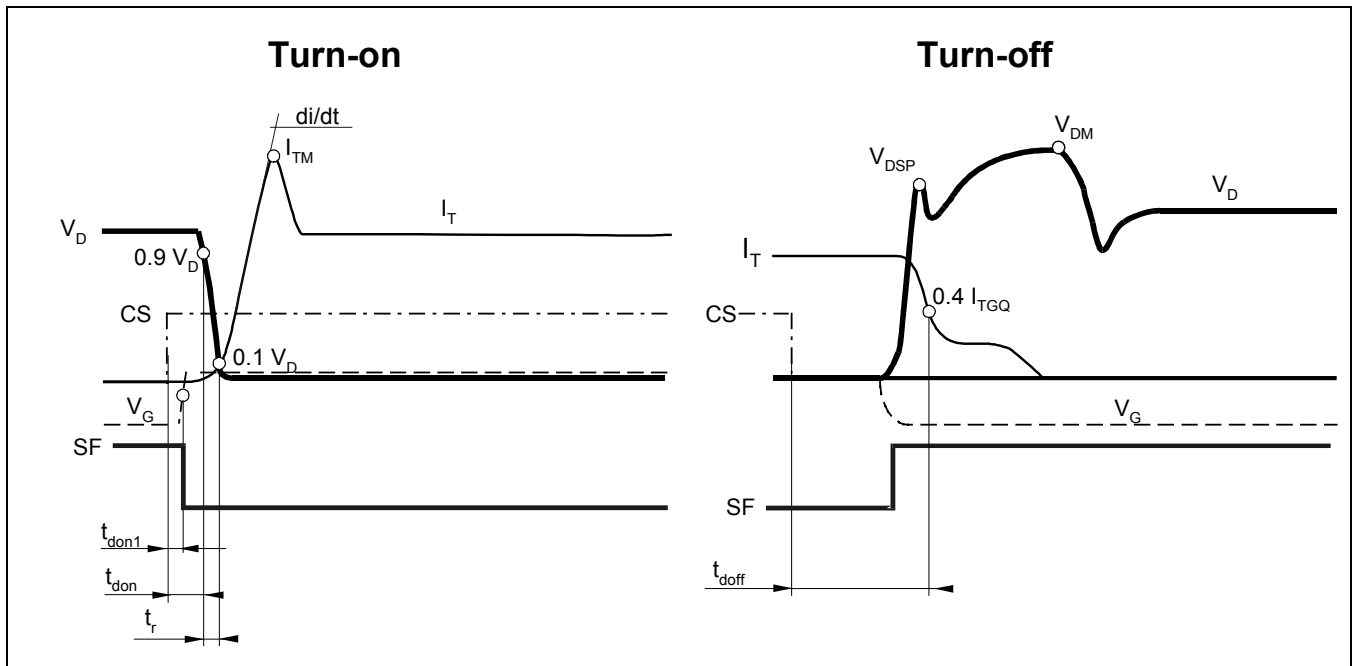


Fig. 8 General current and voltage waveforms with IGCT - specific symbols.

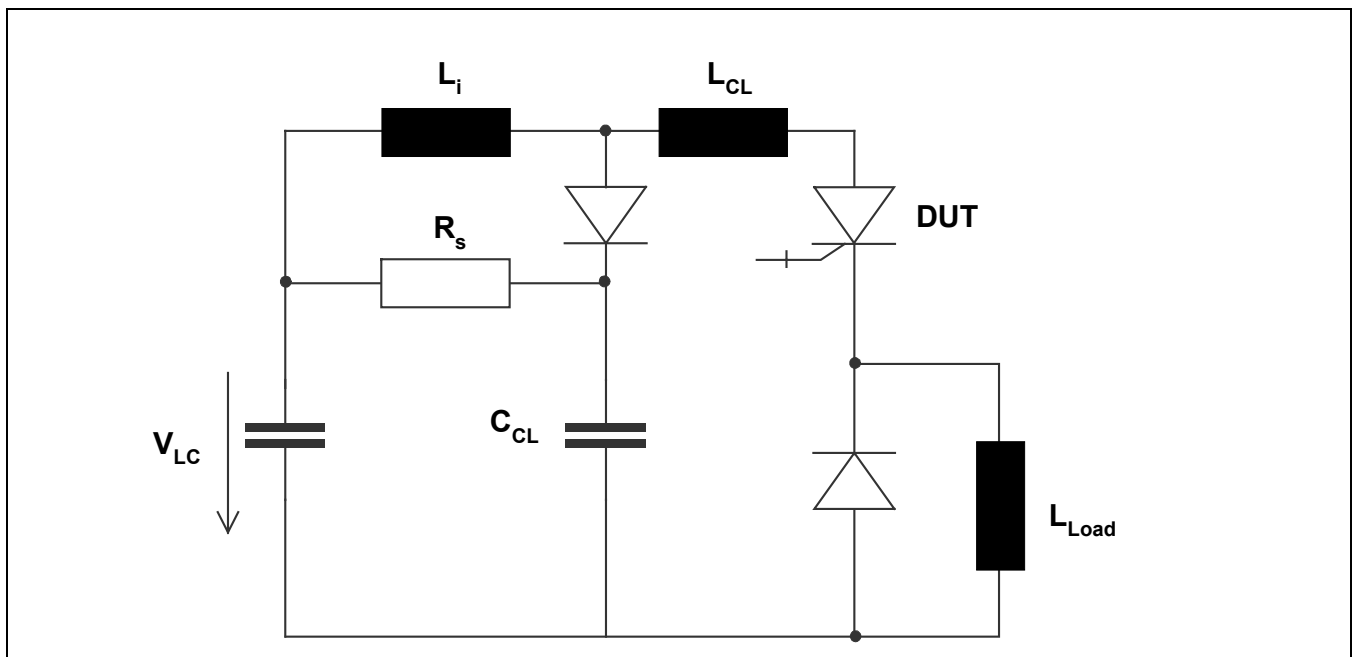


Fig. 9 Test circuit.

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