Data Sheet, Doc. No. 5SYA 1471-00 11-2019

5SNA 1800G330400
HiPak IGBT module

- V_{CE} = 3300 V
- I_C = 1800 A
- Ultra-low loss TSPT+ technology
- Very soft switching FCE diode with increased diode area
- Exceptional ruggedness and highest current rating
- High insulation package
- AlSiC base-plate for high power cycling capability
- AlN substrate for low thermal resistance
- Recognized under UL1557, File E 196689

Maximum rated values [1]

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V, T_{vj} ≥ 25 °C		3300	V
		V_{GE} = 0 V, T_{vj} = -40 °C		3000	
DC collector current	I_C	T_C = 98 °C, T_{vj} = 150 °C		1800	A
Peak collector current	I_{CM}	t_p = 1 ms		3600	A
Gate-emitter voltage	V_{GES}		-20	20	V
DC forward current	I_F			1800	A
Peak forward current	I_{FRM}	t_p = 1 ms		3600	A
Surge current	I_{FSM}	V_R = 0 V, $T_{vj\,start}$ = 150 °C, t_p = 10 ms, half-sinewave		14300	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 2500 V, $V_{CEM\,CHIP}$ ≤ 3300 V V_{GE} ≤ 15 V, $T_{vj\,start}$ ≤ 150 °C		10	µs
Isolation voltage	V_{isol}	1 min, f = 50 Hz		10200	V
Junction temperature	T_{vj}			175	°C
Junction operating temperature	$T_{vj(op)}$		-40	150	°C
Case temperature	T_C		-40	125	°C
Storage temperature	T_{stg}		-50	125	°C
Mounting torques [2]	M_s	Base-heatsink, M6 screws	4	6	Nm
	M_{t1}	Main terminals, M8 screws	8	10	
	M_{t2}	Auxiliary terminals, M4 screws	2	3	

[1] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747
[2] For detailed mounting instructions refer to ABB Document No. 5SYA 2039

IGBT characteristic values [3)]

Parameter	Symbol	Conditions		min	typ	max	Unit
Collector (-emitter) breakdown voltage	$V_{(BR)CES}$	V_{GE} = 0 V, I_C = 10 mA	T_{vj} = 150 °C	3300			V
			T_{vj} = 25 °C	3300			
			T_{vj} = -40 °C	3000			
Collector-emitter [4)] saturation voltage	$V_{CE\ sat}$	I_C = 1800 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.3	2.7	V
			T_{vj} = 125 °C		2.75	3.2	
			T_{vj} = 150 °C		2.9		
Collector cut-off current	I_{CES}	V_{CE} = 3300 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
			T_{vj} = 125 °C		22		
			T_{vj} = 150 °C		120		
Gate leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ± 20 V, T_{vj} = 125 °C		-500		500	nA
Gate-emitter threshold voltage	$V_{GE(TO)}$	I_C = 240 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		6.7		8.7	V
Gate charge	Q_{ge}	I_C = 1800 A, V_{CE} = 1800 V, V_{GE} = -15 V ..15 V			18		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			239		nF
Internal gate resistance	R_{Gint}				0.83		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 1800 V, I_C = 1800 A, R_G = 1.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		1030		ns
			T_{vj} = 150 °C		1035		
Rise time	t_r		T_{vj} = 25 °C		320		ns
			T_{vj} = 150 °C		340		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 1800 V, I_C = 1800 A, R_G = 4.7 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		2930		ns
			T_{vj} = 150 °C		3500		
Fall time	t_f		T_{vj} = 25 °C		390		ns
			T_{vj} = 150 °C		490		
Turn-on switching energy	E_{on}	V_{CC} = 1800 V, I_C = 1800 A, R_G = 1.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		3.35		J
			T_{vj} = 125 °C		4.00		
			T_{vj} = 150 °C		4.55		
Turn-off switching energy	E_{off}	V_{CC} = 1800 V, I_C = 1800 A, R_G = 4.7 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		3.00		J
			T_{vj} = 125 °C		4.05		
			T_{vj} = 150 °C		4.35		
Short circuit current	I_{SC}	V_{CC} = 2500 V, V_{GE} = 15 V	$T_{vj\ start}$ = 150 °C		6600		A

[3)] Characteristic values according to IEC 60747 – 9
[4)] Collector-emitter saturation voltage is given at chip level

Diode characteristic values [5)]

Parameter	Symbol	Conditions		min	typ	max	Unit
Forward voltage [6)]	V_F	I_F = 1800 A	T_{vj} = 25 °C		2.0	2.45	V
			T_{vj} = 125 °C		2.2	2.65	
			T_{vj} = 150 °C		2.15		
Peak reverse recovery current	I_{RM}	V_{CC} = 1800 V, I_F = 1800 A, V_{GE} = ±15 V, R_G = 1.2 Ω, C_{GE} = 330 nF, di/dt = 5.0 kA/µs, L_σ = 100 nH, inductive load	T_{vj} = 25 °C		1940		A
			T_{vj} = 125 °C		2230		
			T_{vj} = 150 °C		2300		
Recovered charge	Q_{rr}		T_{vj} = 25 °C		1110		µC
			T_{vj} = 125 °C		1740		
			T_{vj} = 150 °C		1920		
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		1000		ns
			T_{vj} = 125 °C		1260		
			T_{vj} = 150 °C		1380		
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		1.25		J
			T_{vj} = 125 °C		2.00		
			T_{vj} = 150 °C		2.25		

[5)] Characteristic values according to IEC 60747 – 2
[6)] Forward voltage is given at chip level

Package properties [7)]

Parameter	Symbol	Conditions		min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$					0.009	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$					0.014	K/W
IGBT thermal resistance [2)] case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 1W/m x K			0.007		K/W
Diode thermal resistance [2)] case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = 1W/m x K			0.010		K/W
Partial discharge extinction voltage	V_e	f = 50 Hz, Q_{PD} ≤ 10 pC (acc. To IEC 61287)		5100			V
Comparative tracking index	CTI			600			
Module stray inductance	$L_{\sigma CE}$				18		nH
Resistance, terminal-chip	$R_{CC'+EE'}$		T_C = 25 °C		0.07		mΩ
			T_C = 125 °C		0.10		
			T_C = 150 °C		0.11		

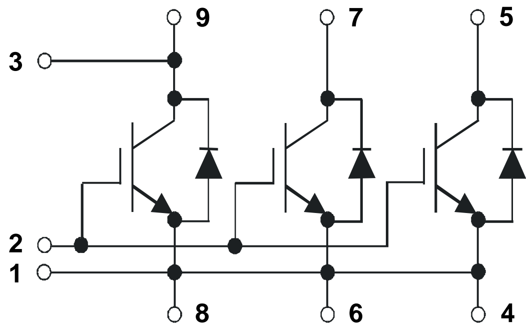
[2)] For detailed mounting instructions refer to ABB Document No. 5SYA 2039

Mechanical properties [7)]

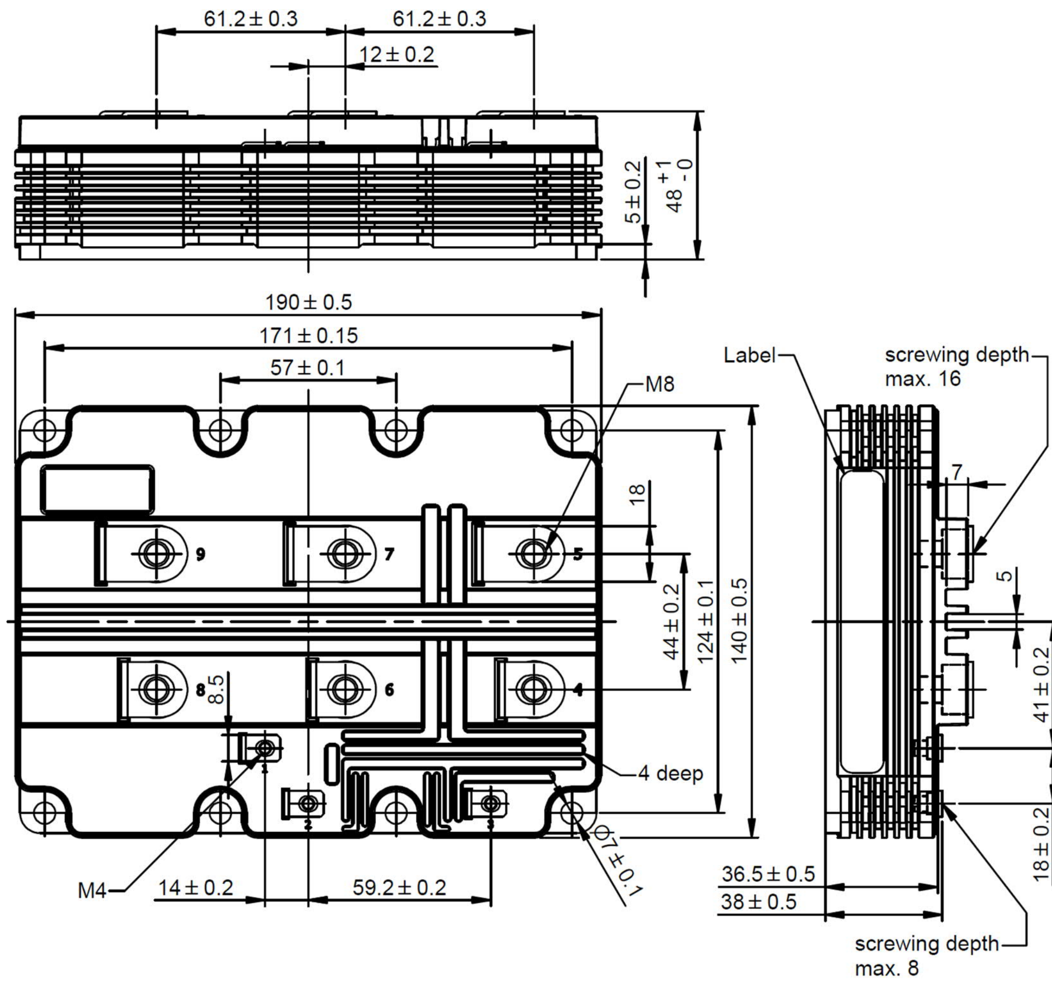
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical			190 x 140 x 48		mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	40			mm
			Term. to term:	26			
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	64			mm
			Term. to term:	56			
Mass	m				1330		g

[7)] Package and mechanical properties according to IEC 60747 – 15

Electrical configuration



Outline drawing (mm)



Note: This is an electrostatic sensitive device, please observe the international standard IEC 60747-1, chap. VIII. This product has been designed and qualified for Industrial Level.

Fig. 1 Typical on-state characteristics, chip level

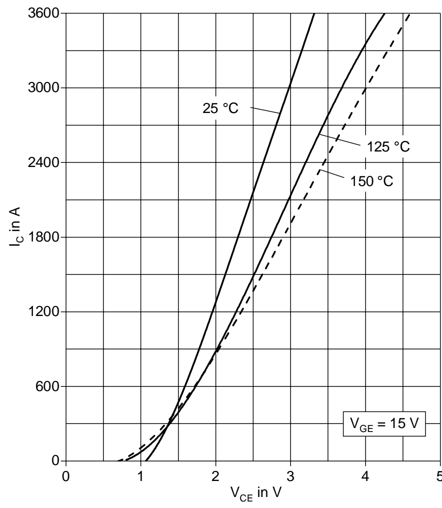


Fig. 2 Typical transfer characteristics, chip level

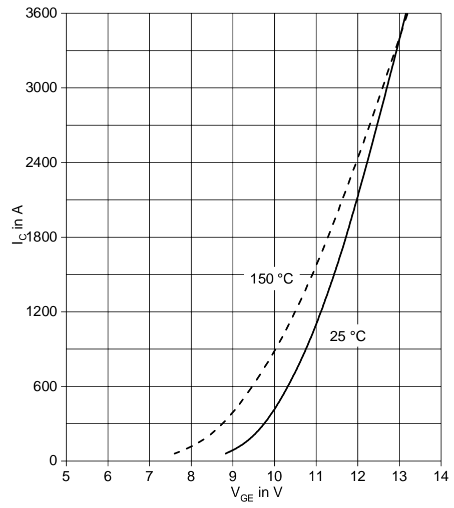


Fig. 3 Typical output characteristics, chip level

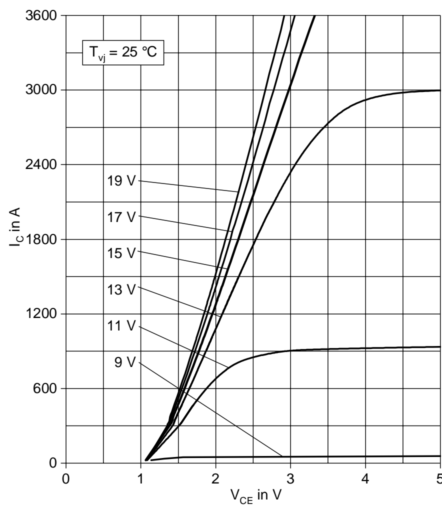


Fig. 4 Typical output characteristics, chip level

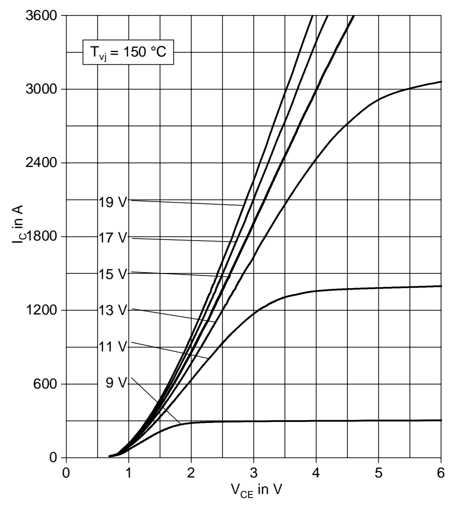


Fig. 5 Typical switching energies per pulse vs. collector current

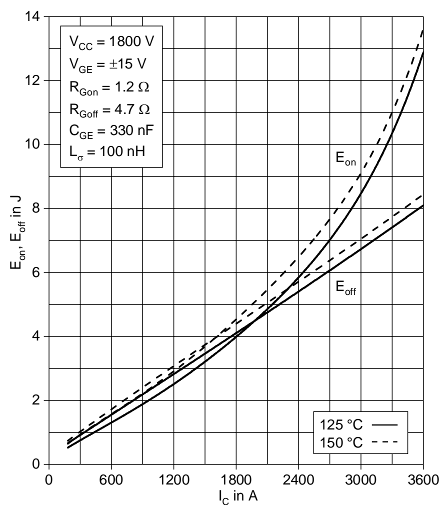


Fig. 6 Typical switching energies per pulse vs. gate resistor

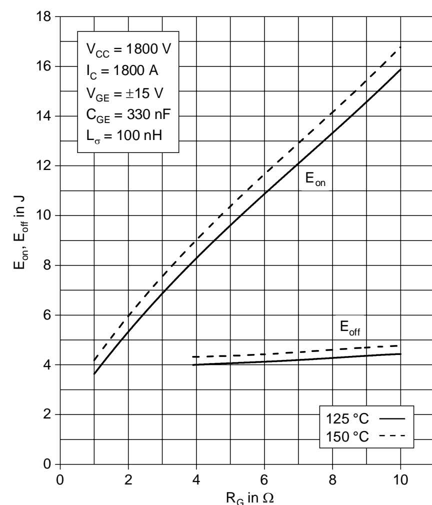


Fig. 7 Typical switching times vs. collector current

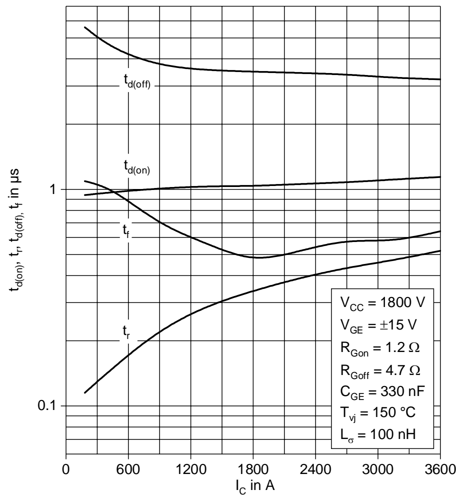


Fig. 8 Typical switching times vs. gate resistor

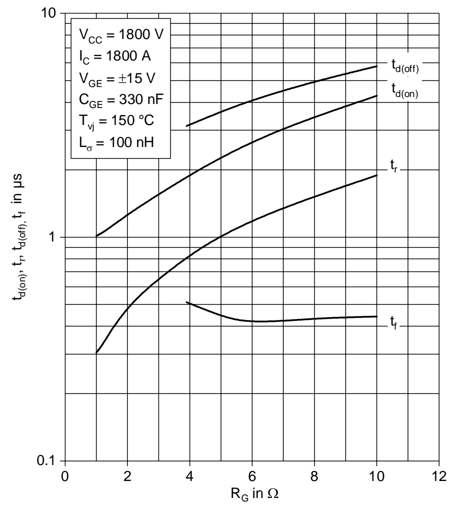


Fig. 9 Typical gate charge characteristics

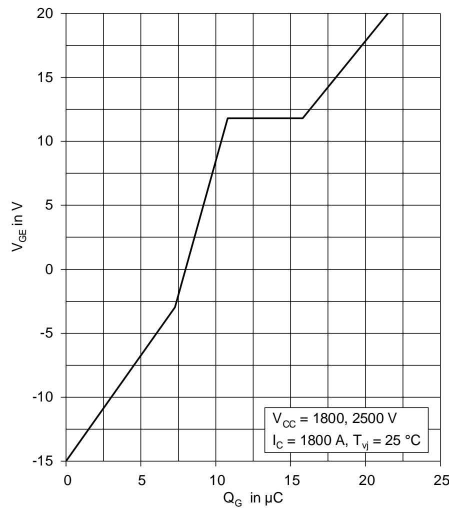


Fig. 10 Turn-off safe operating area (RBSOA)

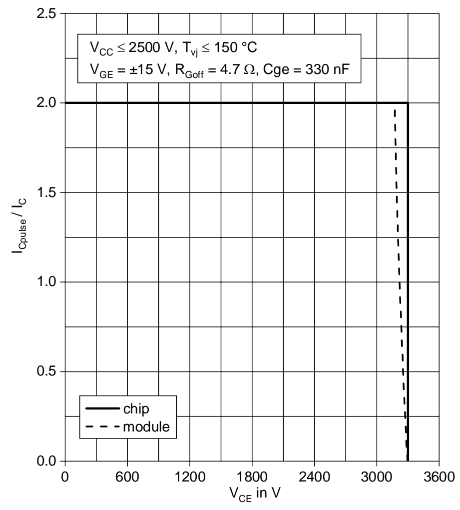


Fig. 11 Typical diode forward characteristics chip level

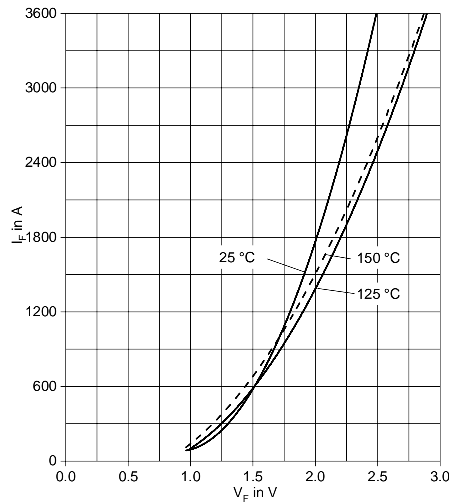


Fig. 12 Typical reverse recovery characteristics vs. forward current

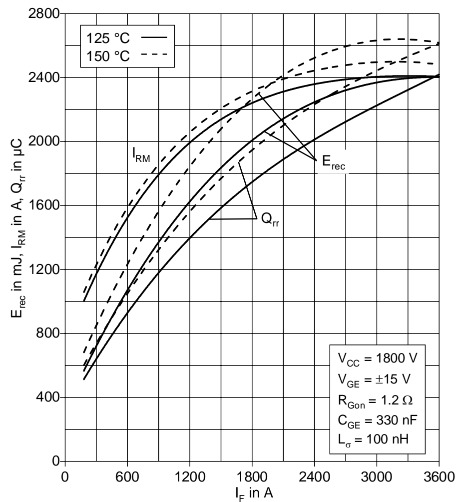


Fig. 13 Typical reverse recovery characteristics vs. di/dt

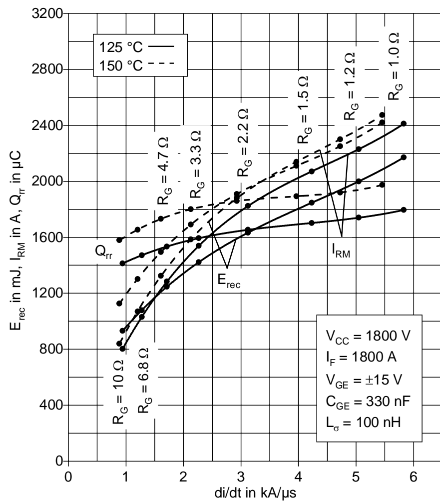


Fig. 14 Safe operating area diode (SOA)

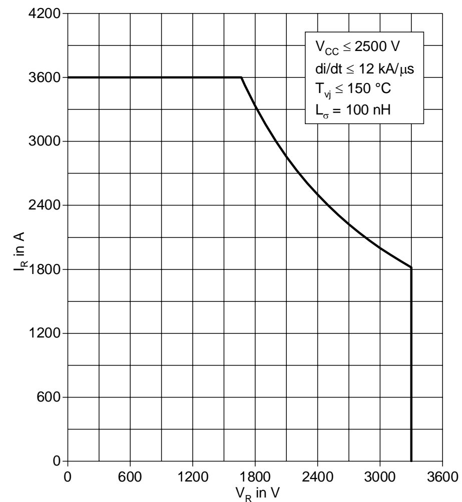
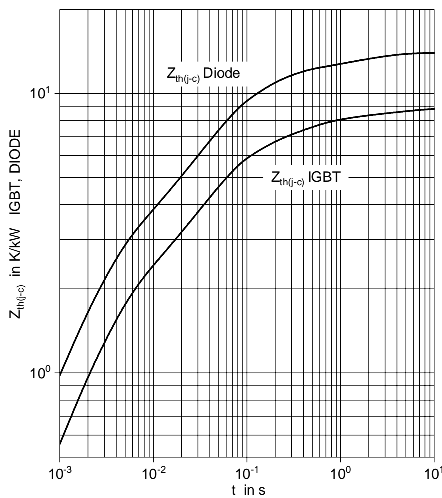


Fig. 15 Thermal impedance vs. time



Analytical function of the transient thermal resistance

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

	i	1	2	3	4	5
IGBT	Ri(K/kW)	1.631	4.286	2.089	0.855	
	τi(ms)	2.986	48.79	364.8	3593	
DIODE	Ri(K/kW)	2.441	4.230	5.055	2.253	
	τi(ms)	2.434	36.51	116.2	1641	

Related documents:

- 5SYA 2039 Mounting Instructions for HiPak modules
- 5SYA 2042 Failure rates of IGBT modules due to cosmic rays
- 5SYA 2043 Load – cycle capability of HiPaks
- 5SYA 2045 Thermal runaway during blocking
- 5SYA 2053 Applying IGBT
- 5SYA 2057 IGBT diode safe operating area (SOA)
- 5SYA 2058 Surge currents for IGBT diodes
- 5SYA 2093 Thermal design of IGBT modules
- 5SYA 2098 Paralleling of IGBT modules

ABB Power Grids Ltd
Semiconductors
Fabrikstrasse 3
CH-5600 Lenzburg
Switzerland

abb.com/semiconductors

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB AG does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB Ltd.
Copyright© 2018 ABB
All rights reserved