V_{CE} = 1700 V
I_C = 1600 A

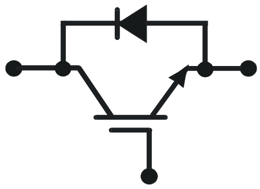


ABB HiPak

IGBT Module
5SNA 1600N170100

Doc. No. 5SYA1564-02 Apr 14

- **Low-loss, rugged SPT chip-set**
- **Smooth switching SPT chip-set for good EMC**
- **Industry standard package**
- **High power density**
- **AlSiC base-plate for high power cycling capability**
- **AlN substrate for low thermal resistance**
- **Improved high reliability package**

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V, T_{vj} ≥ 25 °C		1700	V
DC collector current	I_C	T_c = 80 °C		1600	A
Peak collector current	I_{CM}	t_p = 1 ms, T_c = 80 °C		3200	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_c = 25 °C, per switch (IGBT)		9100	W
DC forward current	I_F			1600	A
Peak forward current	I_{FRM}			3200	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 125 °C, t_p = 10 ms, half-sinewave		13200	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 1200 V, $V_{CEM\ CHIP}$ ≤ 1700 V V_{GE} ≤ 15 V, T_{vj} ≤ 125 °C		10	µs
Isolation voltage	V_{isol}	1 min, f = 50 Hz		4000	V
Junction temperature	T_{vj}			150	°C
Junction operating temperature	$T_{vj(op)}$		-40	125	°C
Case temperature	T_c		-40	125	°C
Storage temperature	T_{stg}		-40	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 - 01

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} = 25 °C		1700			V
Collector-emitter [4)] saturation voltage	$V_{CE\,sat}$	I_C = 1600 A, V_{GE} = 15 V	T_{vj} = 25 °C	2.0	2.3	2.6	V
			T_{vj} = 125 °C	2.3	2.6	2.9	V
Collector cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			8	mA
			T_{vj} = 125 °C			80	mA
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 = 160 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		4.5		6.5	V
Gate charge	Q_{ge}	I_C = 1600 A, V_{CE} = 900 V, V_{GE} = -15 V .. 15 V			14.6		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			152		nF
Output capacitance	C_{oes}				14.6		
Reverse transfer capacitance	C_{res}				6.4		
Turn-on delay time	$t_{d(on)}$	V_{CC} = 900 V, I_C = 1600 A, R_G = 0.82 Ω, V_{GE} = ±15 V, L_σ = 50 nH, inductive load	T_{vj} = 25 °C		290		ns
			T_{vj} = 125 °C		300		
Rise time	t_r		T_{vj} = 25 °C		175		ns
			T_{vj} = 125 °C		190		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 900 V, I_C = 1600 A, R_G = 0.82 Ω, V_{GE} = ±15 V, L_σ = 50 nH, inductive load	T_{vj} = 25 °C		1050		ns
			T_{vj} = 125 °C		1140		
Fall time	t_f		T_{vj} = 25 °C		150		ns
			T_{vj} = 125 °C		170		
Turn-on switching energy	E_{on}	V_{CC} = 900 V, I_C = 1600 A, V_{GE} = ±15 V, R_G = 0.82 Ω, L_σ = 50 nH, inductive load	T_{vj} = 25 °C		380		mJ
			T_{vj} = 125 °C		530		
Turn-off switching energy	E_{off}	V_{CC} = 900 V, I_C = 1600 A, V_{GE} = ±15 V, R_G = 0.82 Ω, L_σ = 50 nH, inductive load	T_{vj} = 25 °C		460		mJ
			T_{vj} = 125 °C		590		
Short circuit current	I_{SC}	t_{psc} ≤ 10 µs, V_{GE} = 15 V, T_{vj} = 125 °C, V_{CC} = 1200 V, $V_{CEM\,CHIP}$ ≤ 1700 V			7200		A
Module stray inductance	$L_{\sigma\,CE}$				15		nH
Resistance, terminal-chip	$R_{CC'+EE'}$		T_C = 25 °C		0.10		mΩ
			T_C = 125 °C		0.13		

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 = 1600 A	T_{vj} = 25 °C		1.65	2.0	V
			T_{vj} = 125 °C		1.7	2.0	
Reverse recovery current	I_{rr}	V_{CC} = 900 V, I_F = 1600 A, V_{GE} = ±15 V, R_G = 0.82 Ω, L_σ = 50 nH, inductive load	T_{vj} = 25 °C		1090		A
			T_{vj} = 125 °C		1400		
Recovered charge	Q_{rr}		T_{vj} = 25 °C		390		µC
			T_{vj} = 125 °C		690		
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		620		ns
			T_{vj} = 125 °C		830		
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		280		mJ
			T_{vj} = 125 °C		480		

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

Thermal properties [7)]

Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				0.011	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.018	K/W
IGBT thermal resistance [2)] case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 1W/m × K		0.012		K/W
Diode thermal resistance [7)] case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = 1W/m × K		0.024		K/W

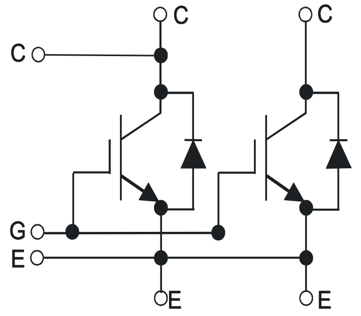
2) For detailed mounting instructions refer to ABB document no. 5SYA 2039 - 01

Mechanical properties [7)]

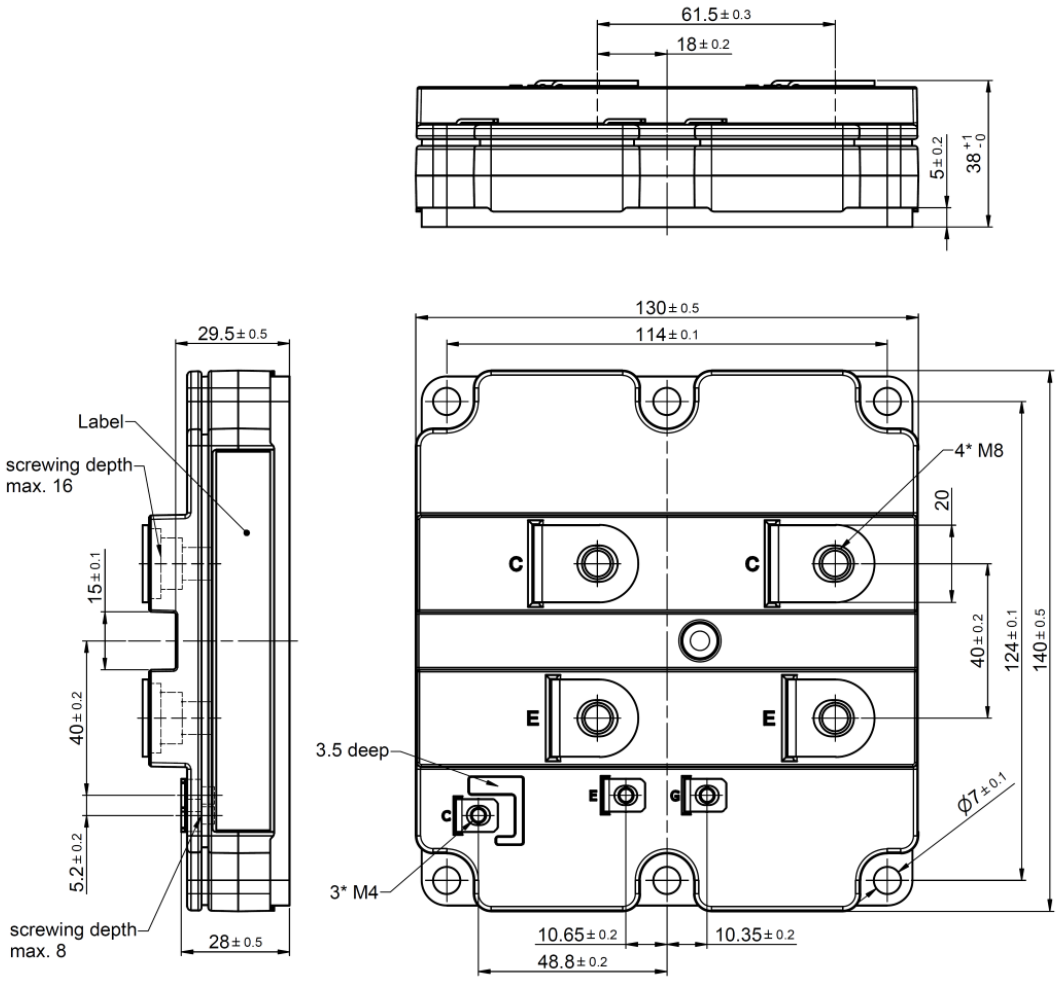
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L × W × H	Typical , see outline drawing		130 × 140 × 38			mm
Comparative tracking index	CTI			600			
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	19			mm
			Term. to term:	19			
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	28.2			mm
			Term. to term:	28.2			
Mass	m				820		g

7) Thermal and mechanical properties according to IEC 60747 – 15

Electrical configuration



Outline drawing [2]



Note: all dimensions are shown in mm

[2] For detailed mounting instructions refer to ABB document no. 5SYA 2039 - 01

This is an electrostatic sensitive device, please observe the international standard IEC 60747-1, chap. IX. This product has been designed and qualified for industrial level.

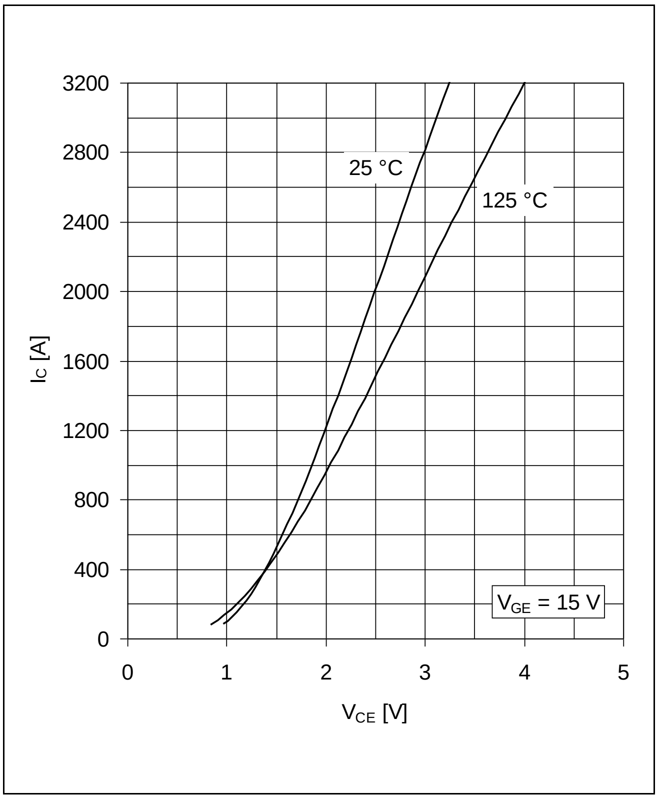


Fig. 1 Typical on-state characteristics, chip level

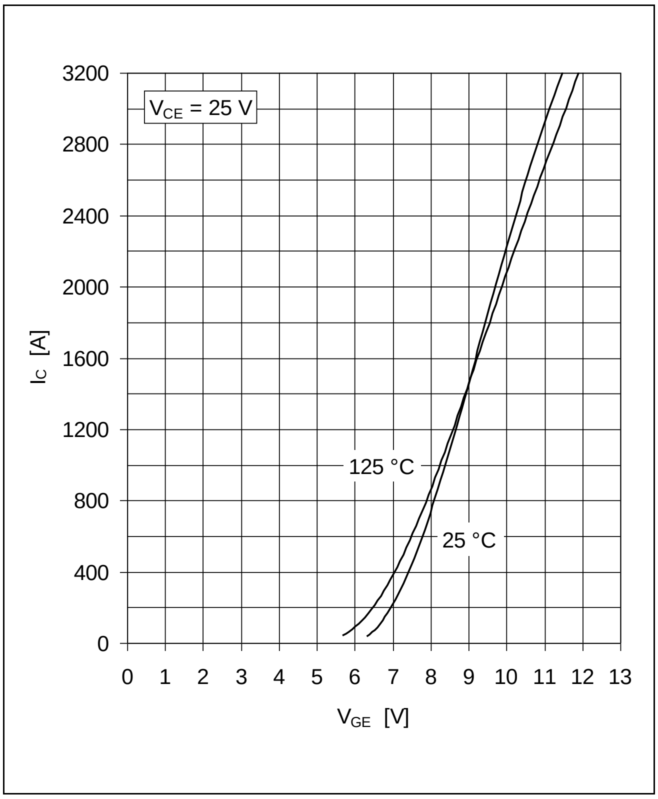


Fig. 2 Typical transfer characteristics, chip level

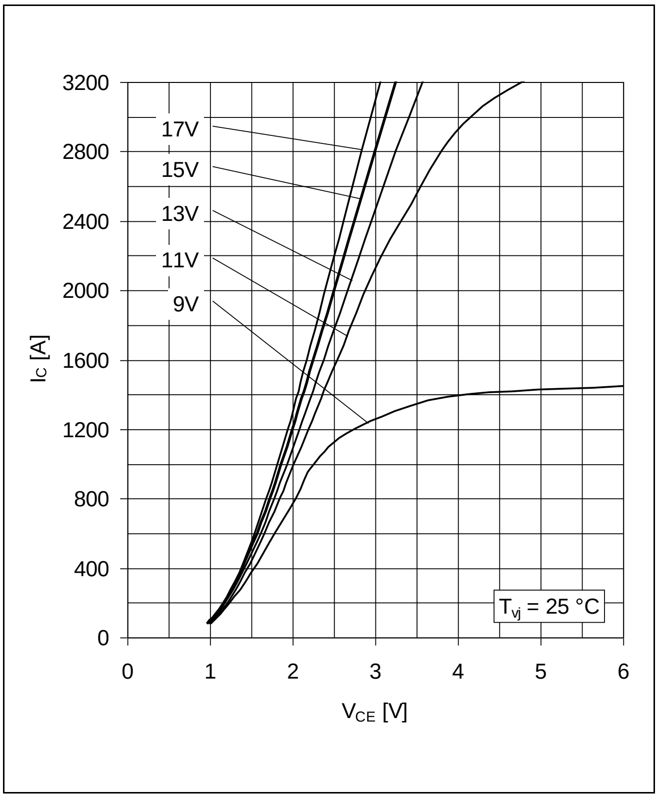


Fig. 3 Typical output characteristics, chip level

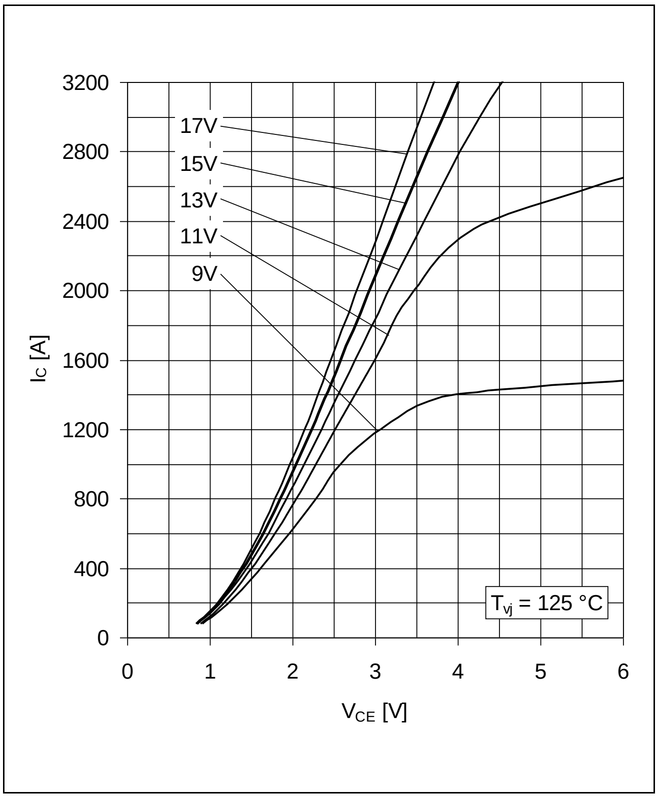


Fig. 4 Typical output characteristics, chip level

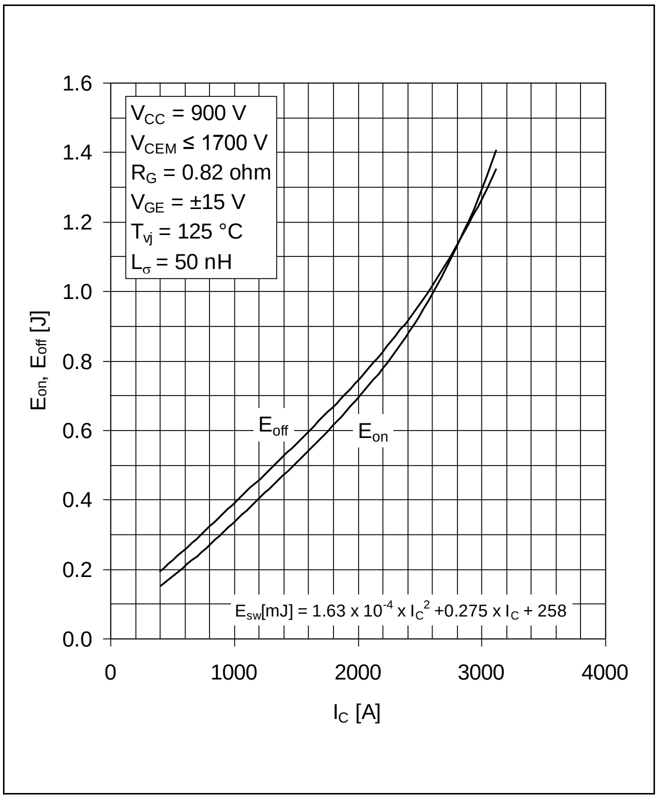


Fig. 5 Typical switching energies per pulse vs collector current

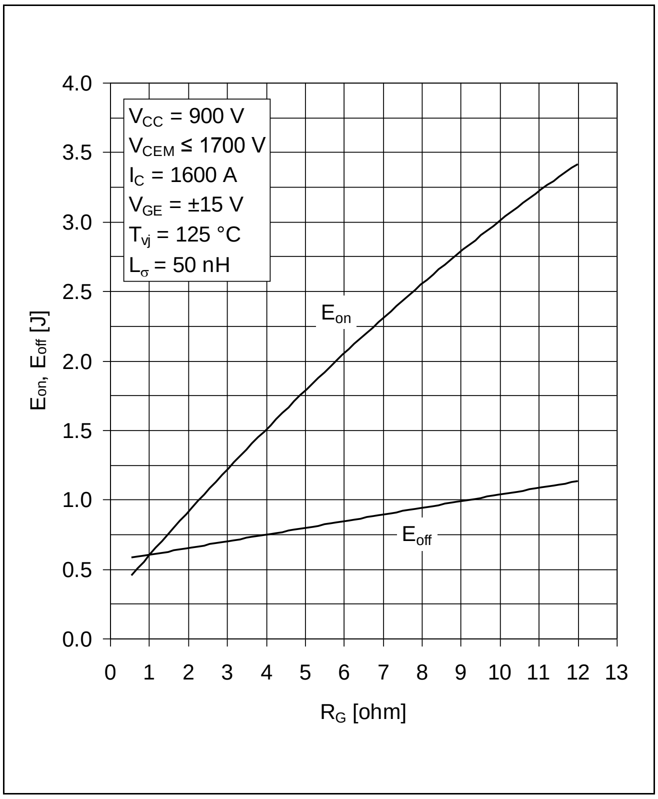


Fig. 6 Typical switching energies per pulse vs gate resistor

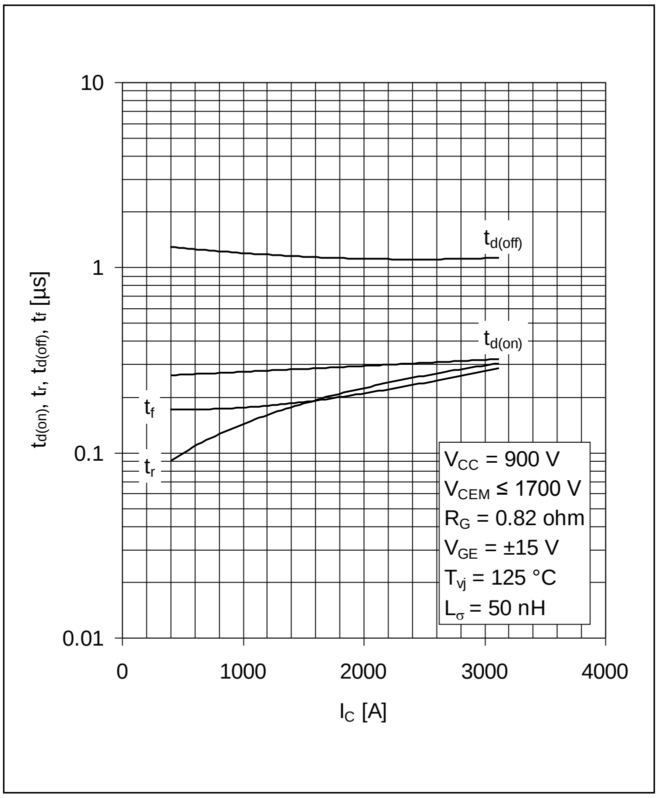


Fig. 7 Typical switching times vs collector current

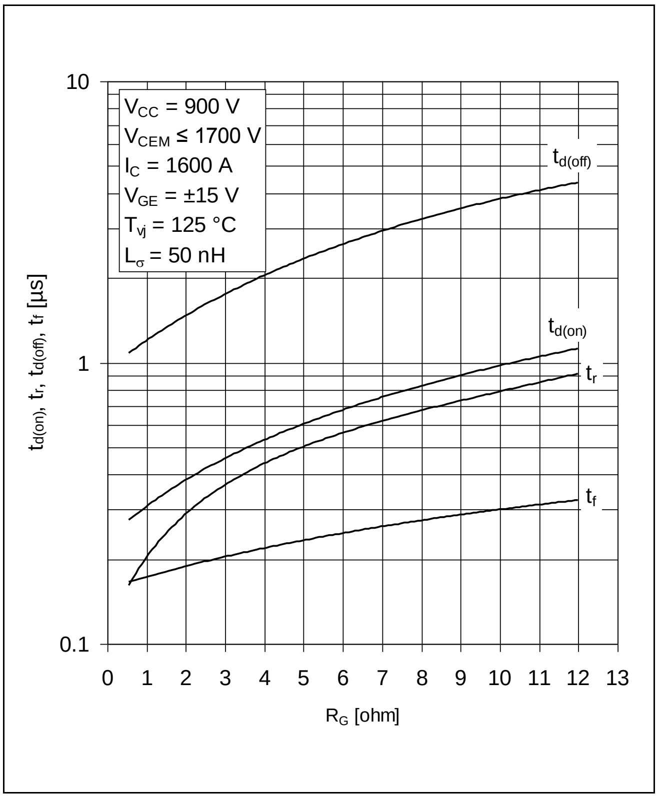


Fig. 8 Typical switching times vs gate resistor

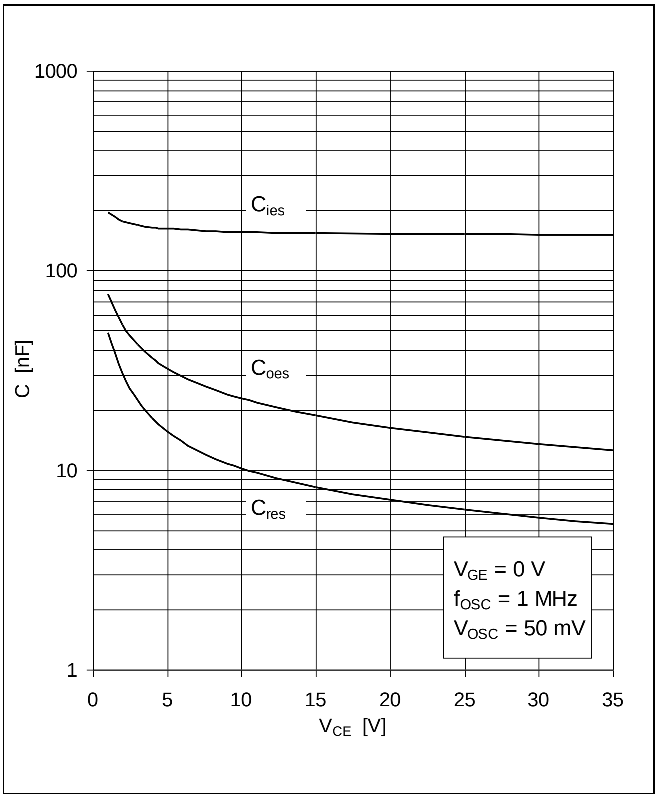


Fig. 9 Typical capacitances vs collector-emitter voltage

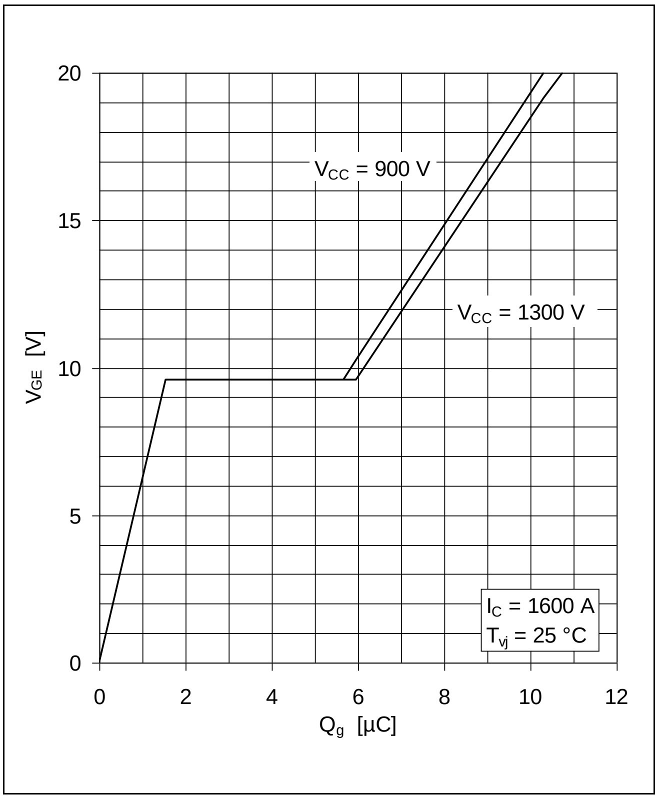


Fig. 10 Typical gate charge characteristics

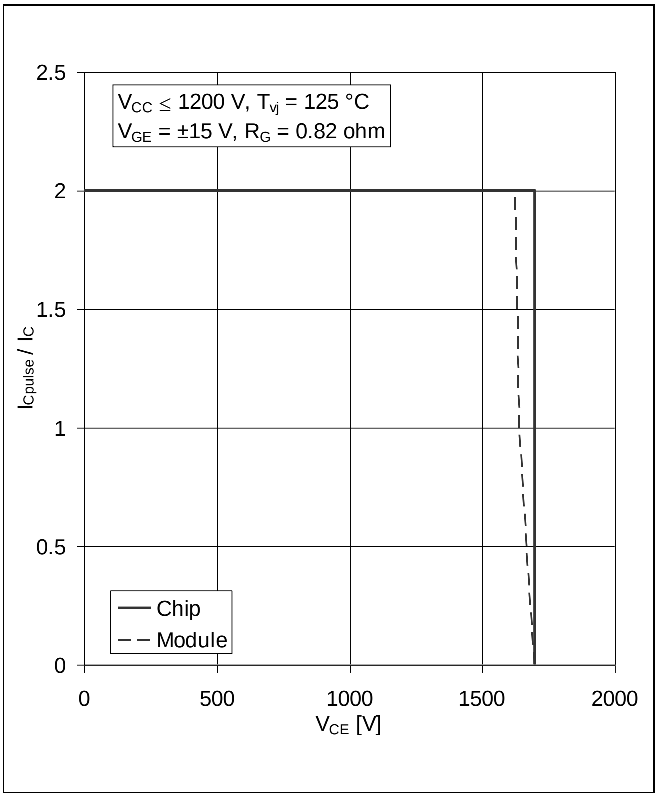


Fig. 11 Turn-off safe operating area (RBSOA)

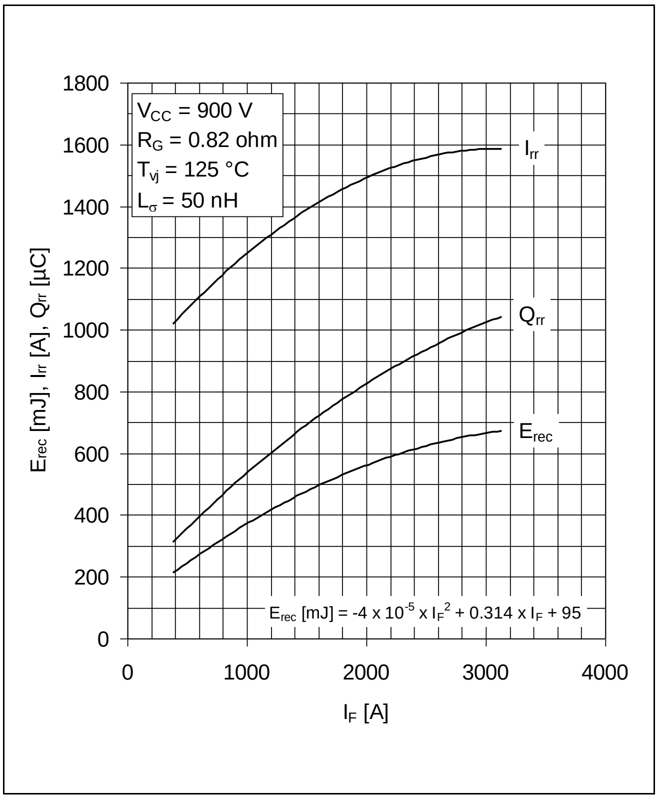


Fig. 12 Typical reverse recovery characteristics vs forward current

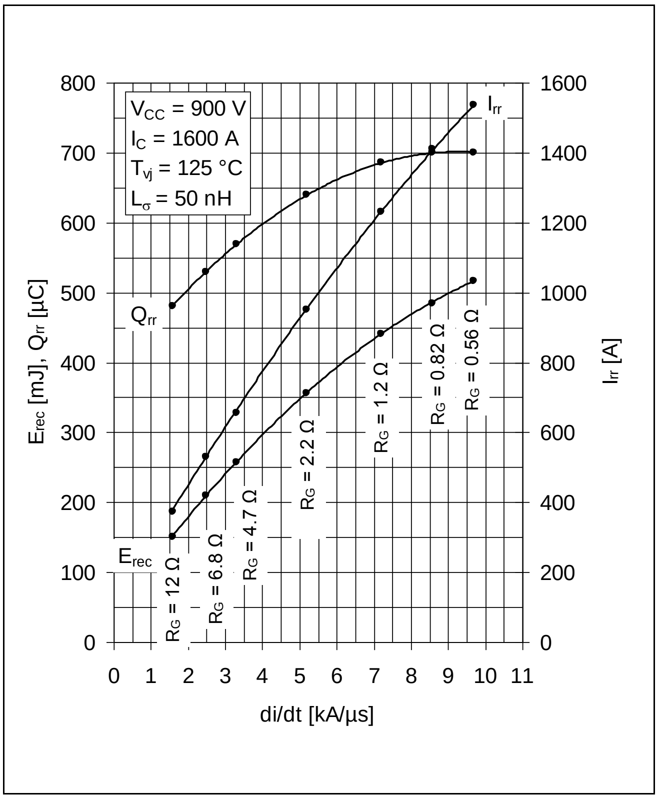


Fig. 13 Typical reverse recovery characteristics vs di/dt

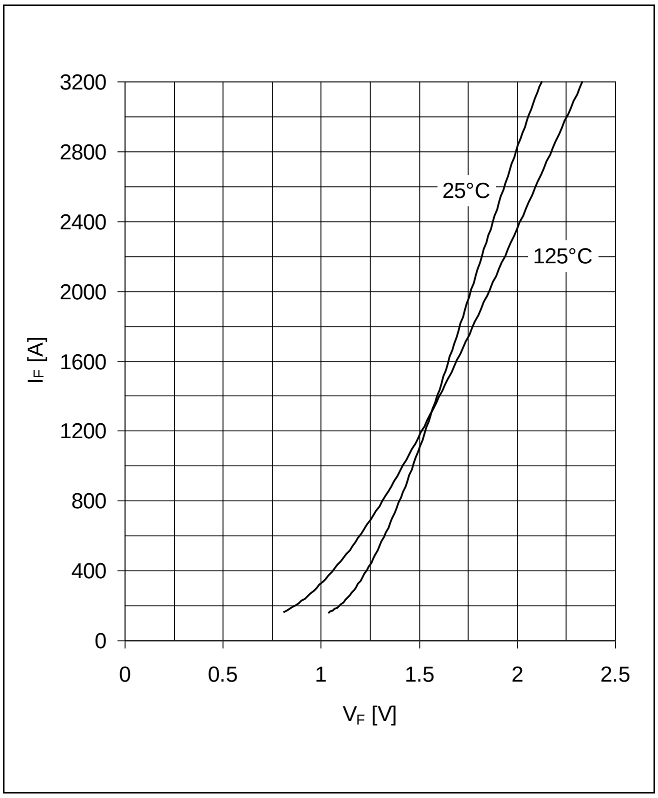


Fig. 14 Typical diode forward characteristics, chip level

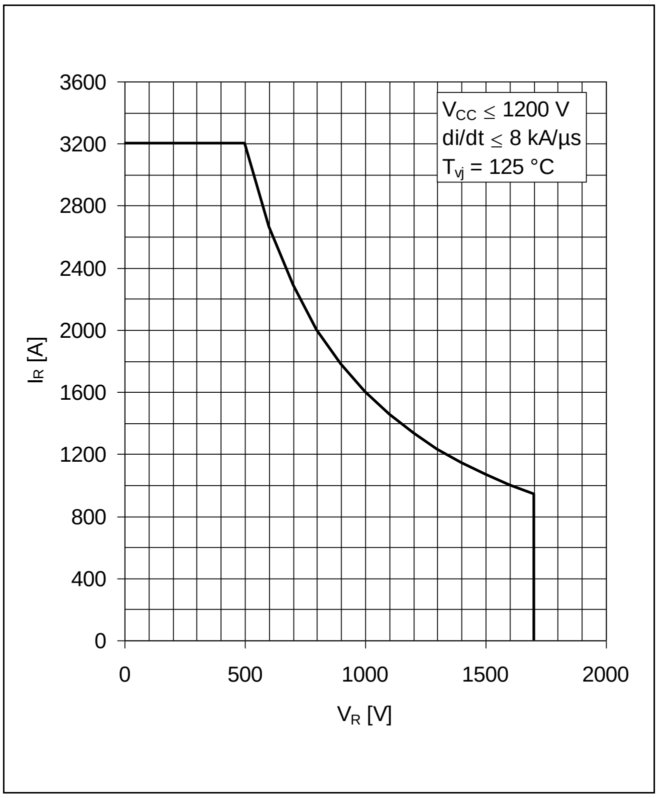


Fig. 15 Safe operating area diode (SOA)

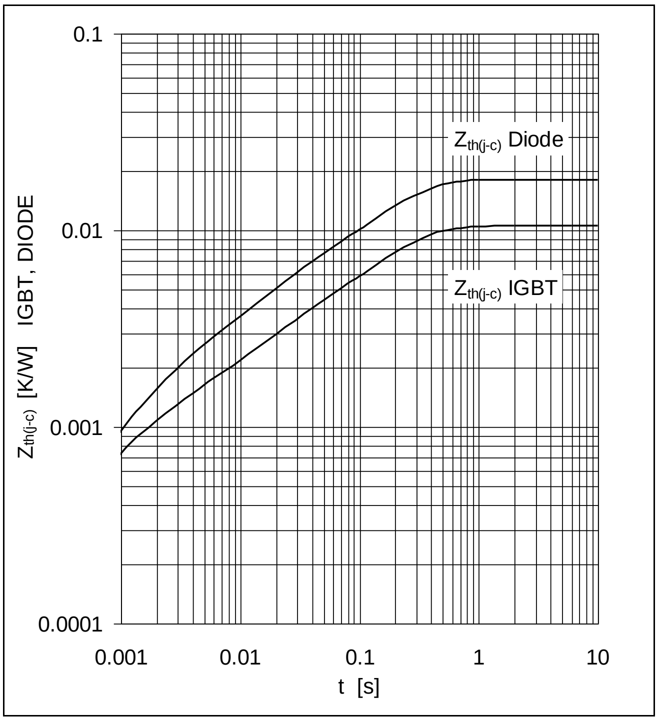


Fig. 16 Thermal impedance vs time

Analytical function for transient thermal impedance:

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

	i	1	2	3	4	
IGBT	R_i(K/kW)	7.59	1.8	0.743	0.369	
IGBT	τ_i(ms)	202	20.3	2.01	0.52	
DIODE	R_i(K/kW)	12.6	2.89	1.3	1.26	
DIODE	τ_i(ms)	210	29.6	7.01	1.49	

Related documents:

5SYA 2042 Failure rates of HiPak modules due to cosmic rays
5SYA 2043 Load - cycle capability of HiPaks
5SYA 2045 Thermal runaway during blocking
5SYA 2053 Applying IGBT
5SYA 2058 Surge currents for IGBT diodes
5SYA 2093 Thermal design of IGBT modules
5SYA 2098 Paralleling of IGBT modules
5SZK 9111 Specification of environmental class for HiPak Storage
5SZK 9112 Specification of environmental class for HiPak Transportation
5SZK 9113 Specification of environmental class for HiPak Operation (Industry)
5SZK 9120 Specification of environmental class for HiPak

ABB

ABB Switzerland Ltd
Semiconductors
Fabrikstrasse 3
CH-5600 Lenzburg, Switzerland

Telephone +41 (0)58 586 1419
Fax +41 (0)58 586 1306
Email abbsem@ch.abb.com
Internet www.abb.com/semiconductors

Doc. No. 5SYA1564-02 Apr 14