V_{CE} = 1700 V
I_C = 1800 A

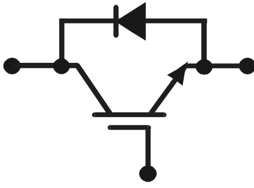

ABB HiPak™

IGBT Module

5SNA 1800E170100

PRELIMINARY

Doc. No. 5SYA 1554-01 Oct 03

- **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**

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V		1700	V
DC collector current	I_C	T_c = 80 °C		1800	A
Peak collector current	I_{CM}	t_p = 1 ms, T_c = 80 °C		3600	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_c = 25 °C, per switch (IGBT)		13900	W
DC forward current	I_F			1800	A
Peak forward current	I_{FM}			3600	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 125 °C, t_p = 10 ms, half-sinewave		16500	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 1000 V, $V_{CEM\,CHIP} \le$ 1700 V $V_{GE} \le$ 15 V, $T_{vj} \le$ 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
Storage temperature	T_{stg}		-40	125	°C
Mounting torques	M_1	Base-heatsink, M6 screws	4	6	Nm
	M_2	Main terminals, M8 screws	8	10	

1) Maximum rated values indicate limits beyond which damage to the device may occur

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IGBT characteristic values

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 [2] saturation voltage	$V_{CE\ sat}$	I_C = 1800 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.3	2.6	V
			T_{vj} = 125 °C		2.6	2.9	V
Collector cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			12	mA
			T_{vj} = 125 °C			120	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 = 240 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		4.5		6.5	V
Gate charge	Q_{ge}	I_C = 1800 A, V_{CE} = 900 V, V_{GE} = -15 V .. 15 V			15.1		μC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			166		nF
Output capacitance	C_{oes}				16.5		
Reverse transfer capacitance	C_{res}				6.98		
Turn-on delay time	$t_{d(on)}$	V_{CC} = 900 V, I_C = 1800 A, R_G = 0.82 Ω, V_{GE} = ±15 V, $L_σ$ = 60 nH, inductive load	T_{vj} = 25 °C		270		ns
			T_{vj} = 125 °C		285		
Rise time	t_r		T_{vj} = 25 °C		220		ns
			T_{vj} = 125 °C		230		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 900 V, I_C = 1800 A, R_G = 0.82 Ω, V_{GE} = ±15 V, $L_σ$ = 60 nH, inductive load	T_{vj} = 25 °C		855		ns
			T_{vj} = 125 °C		950		
Fall time	t_f		T_{vj} = 25 °C		230		ns
			T_{vj} = 125 °C		240		
Turn-on switching energy	E_{on}	V_{CC} = 900 V, I_C = 1800 A, V_{GE} = ±15, R_G = 0.82 Ω, $L_σ$ = 60 nH, inductive load	T_{vj} = 25 °C		360		mJ
			T_{vj} = 125 °C		530		
Turn-off switching energy	E_{off}	V_{CC} = 900 V, I_C = 1800 A, V_{GE} = ±15, R_G = 0.82 Ω, $L_σ$ = 60 nH, inductive load	T_{vj} = 25 °C		530		mJ
			T_{vj} = 125 °C		670		
Short circuit current	I_{SC}	t_{psc} ≤ 10 μs, V_{GE} = 15 V, T_{vj} = 125 °C, V_{CC} = 1000 V, $V_{CEM\ CHIP}$ ≤ 1700 V			8500		A
Module stray inductance	$L_{σ\ CE}$				10		nH
Resistance, terminal-chip	$R_{CC'+EE'}$		T_C = 25 °C		0.06		mΩ
			T_C = 125 °C		0.085		

2) Collector emitter saturation voltage is given at chip level

Diode characteristic values

Parameter	Symbol	Conditions		min	typ	max	Unit
Continous forward voltage [3]	V_F	I_F = 1800 A	T_{vj} = 25 °C		1.65	2.0	V
			T_{vj} = 125 °C		1.7	2.0	
Peak reverse recovery current	I_{RM}	V_{CC} = 900 V, I_F = 1800 A, V_{GE} = ±15 V, R_G = 0.82 Ω, L_σ = 60 nH inductive load	T_{vj} = 25 °C		1170		A
			T_{vj} = 125 °C		1470		
Recovered charge	Q_{RR}		T_{vj} = 25 °C		435		µC
			T_{vj} = 125 °C		770		
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		550		ns
			T_{vj} = 125 °C		870		
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		300		mJ
			T_{vj} = 125 °C		530		

3) Forward voltage is given at chip level

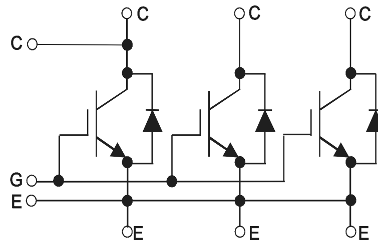
Thermal properties

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	$R_{th(j-c)DIODE}$				0.017	K/W
Thermal resistance case to heatsink	$R_{th(c-h)}$	per module, λ grease = 1W/m × K		0.006		K/W

Mechanical properties

Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L × W × H	Typical , see outline drawing			190 × 140 × 38		mm
Clearance distance	D_C	according to IEC 60664-1 and EN 50124-1	Term. to base:	23			mm
			Term. to term:	19			
Surface creepage distance	D_{SC}	according to IEC 60664-1 and EN 50124-1	Term. to base:	33			mm
			Term. to term:	32			
Weight					1500		gr

Electrical configuration



Outline drawing

Note: all dimensions are shown in mm

This is an electrostatic sensitive device, please observe the international standard IEC 60747-1, chap. IX.

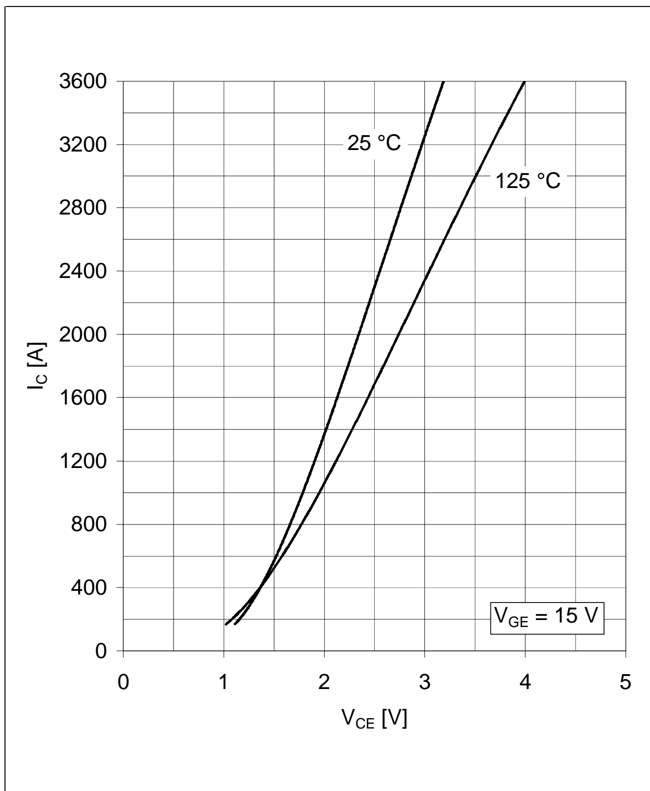


Fig. 1 Typical onstate characteristics, chip level

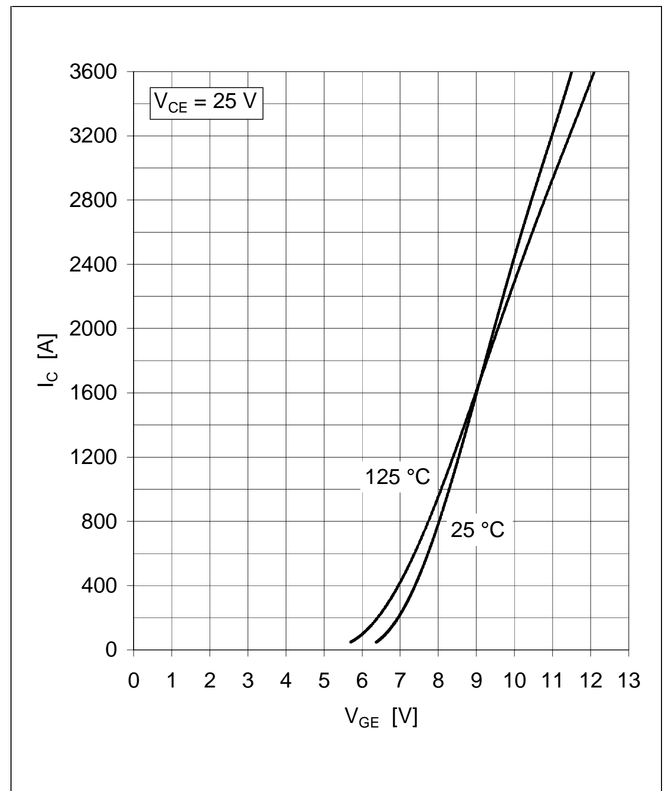


Fig. 2 Typical transfer characteristics, chip level

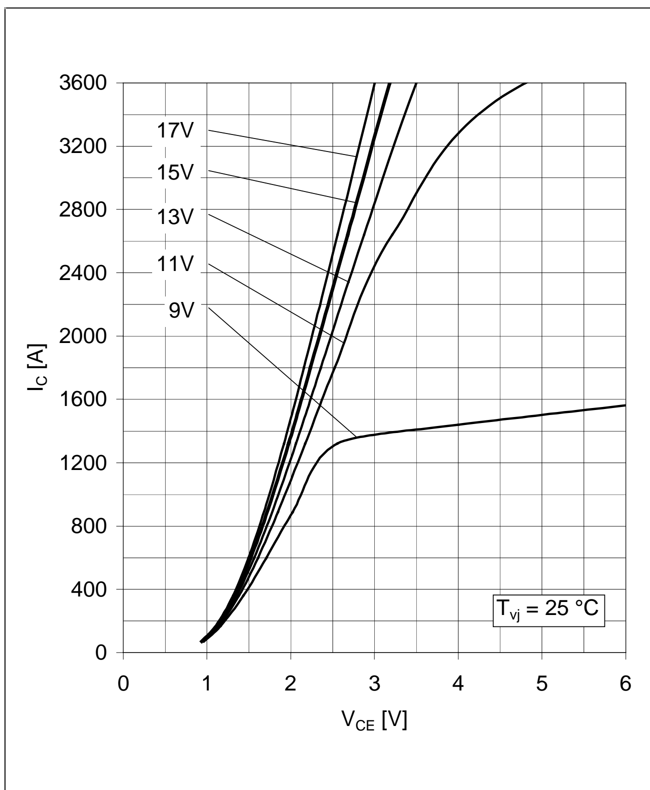


Fig. 3 Typical output characteristics, chip level

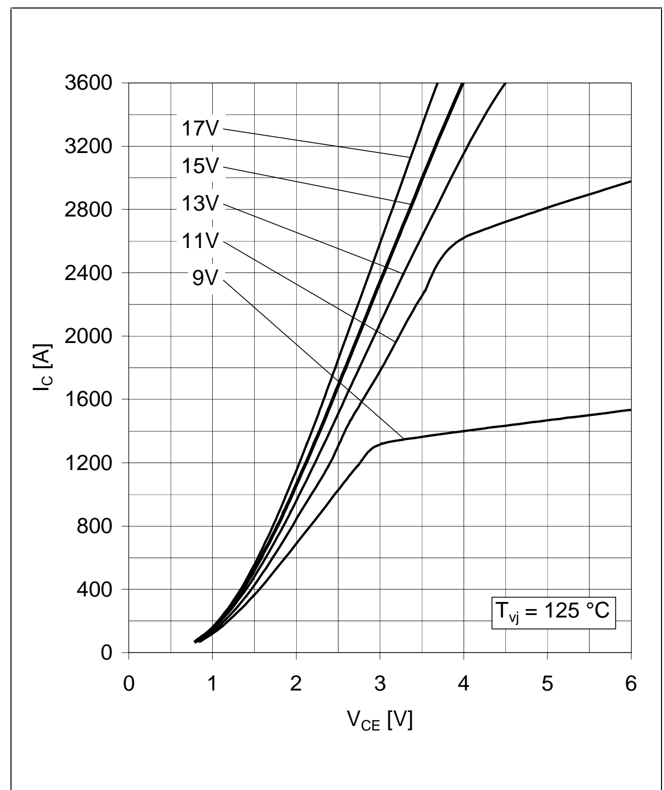


Fig. 4 Typical output characteristics, chip level

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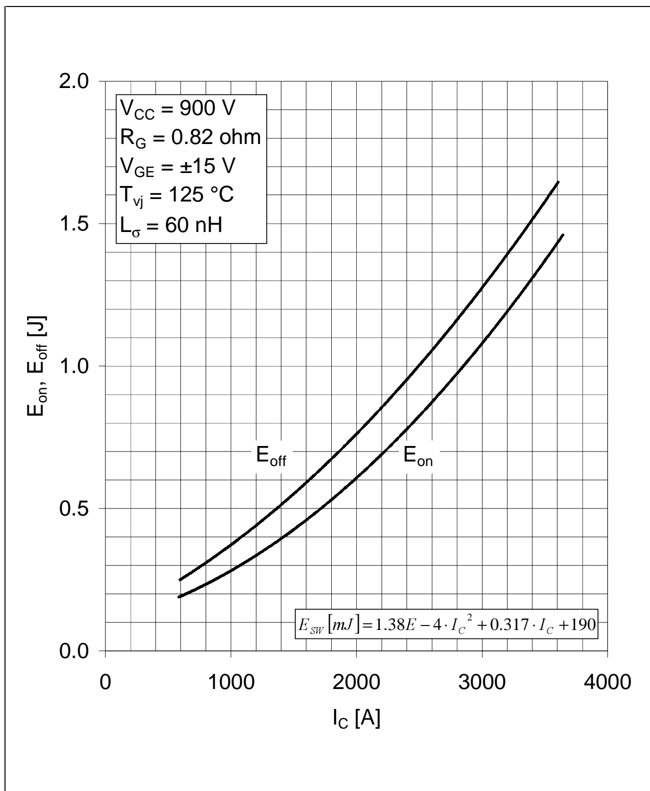

Fig. 5 Typical switching energies per pulse vs collector current

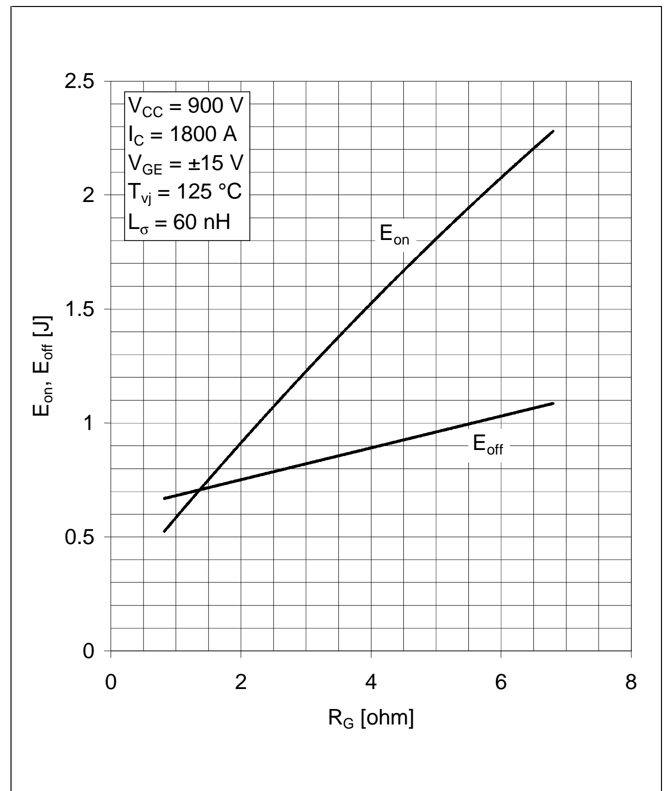

Fig. 6 Typical switching energies per pulse vs gate resistor

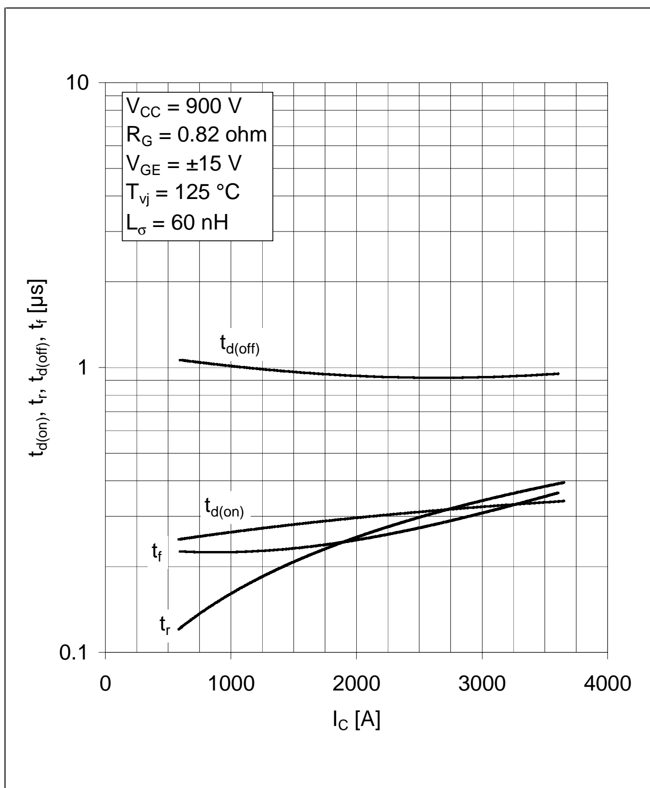

Fig. 7 Typical switching times vs collector current

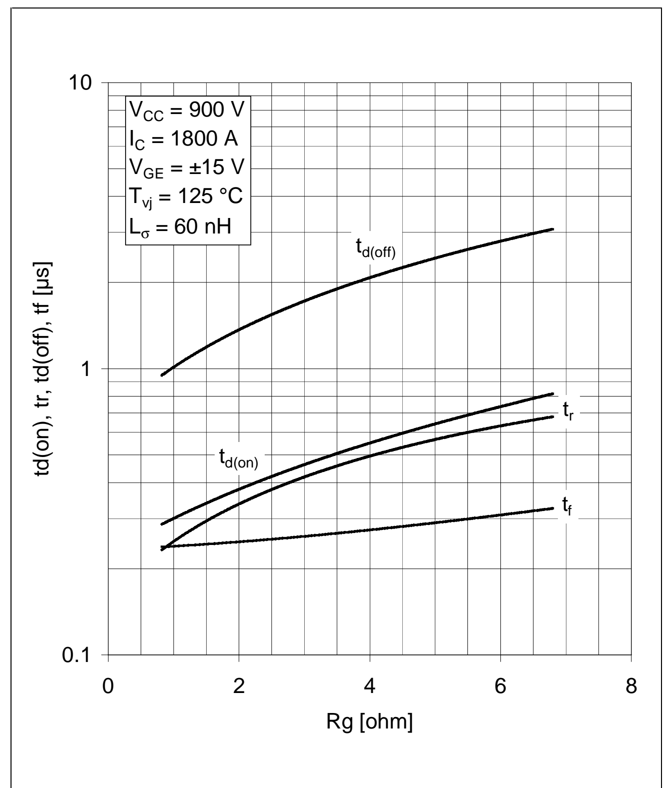

Fig. 8 Typical switching times vs gate resistor

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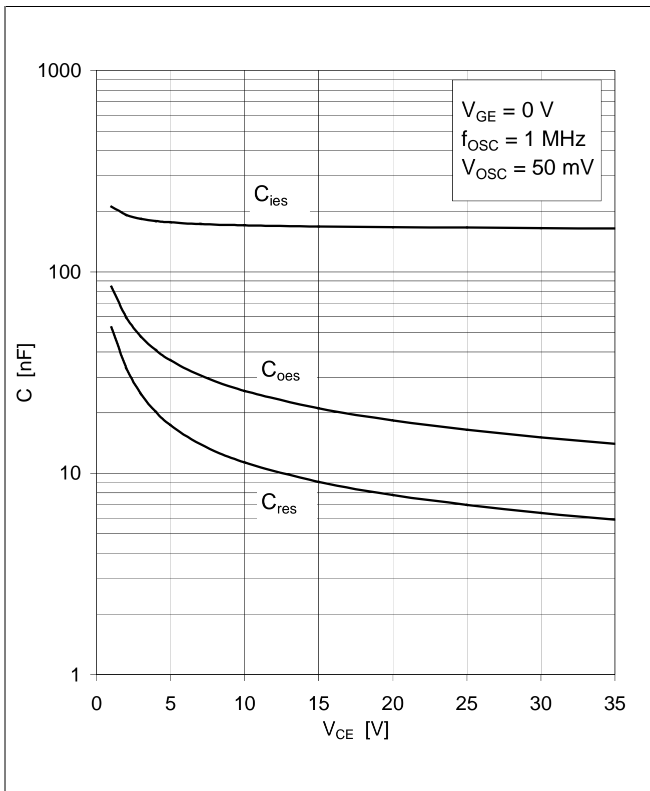

Fig. 9 Typical capacitances vs collector-emitter voltage

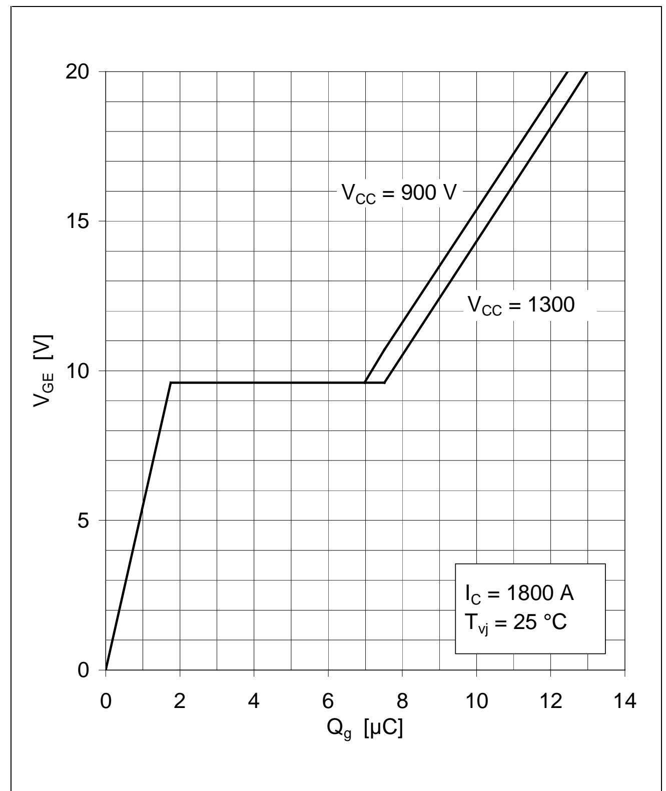

Fig. 10 Typical gate charge characteristics

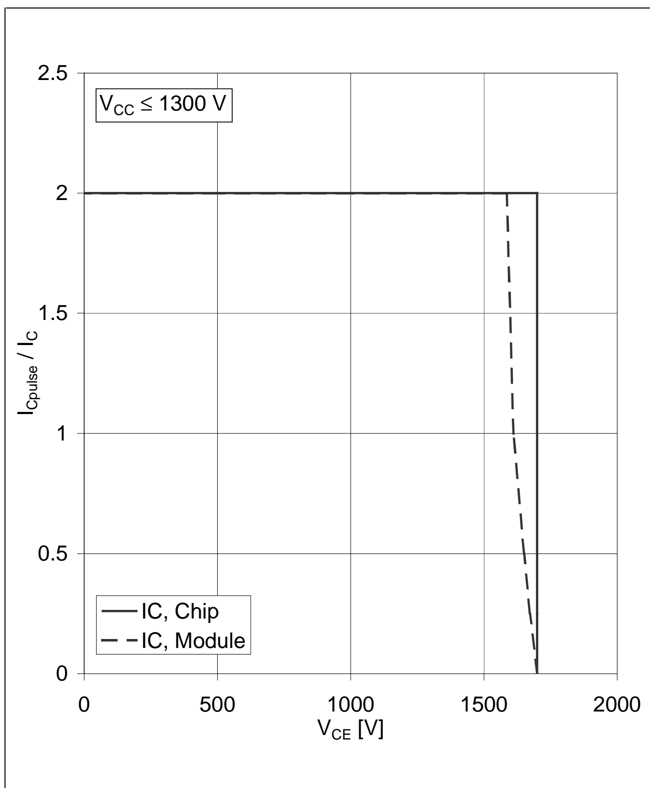

Fig. 11 Turn-off safe operating area (RBSOA)

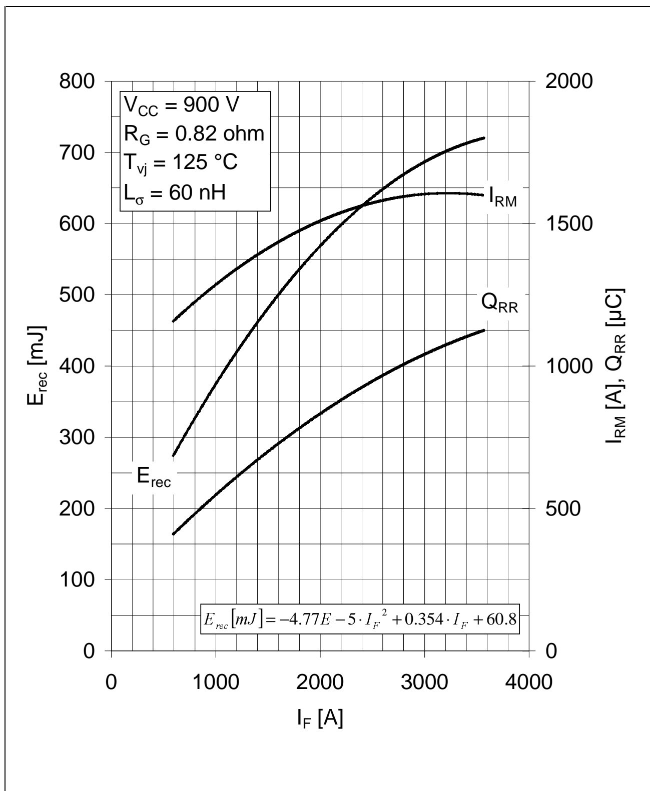

Fig. 12 Typical reverse recovery characteristics vs forward current

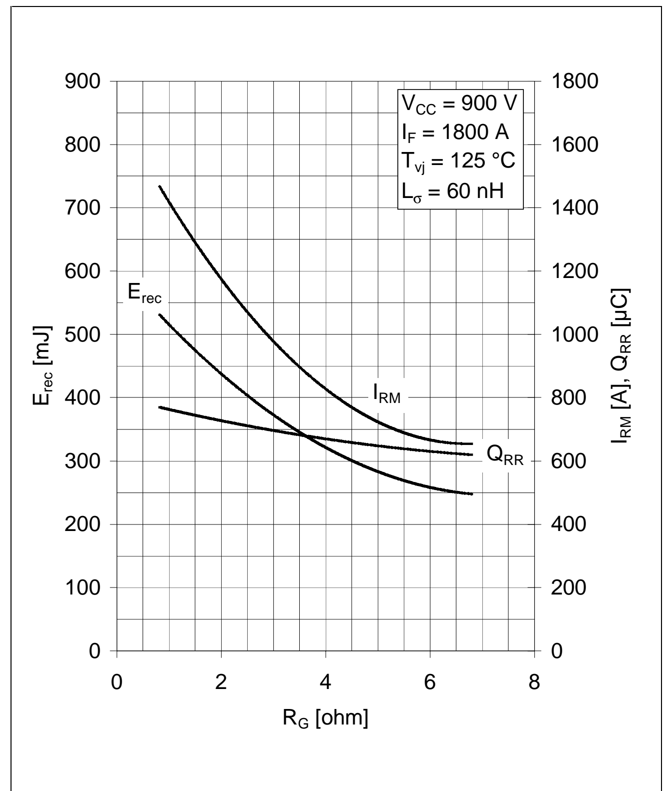

Fig. 13 Typical reverse recovery characteristics vs gate resistor

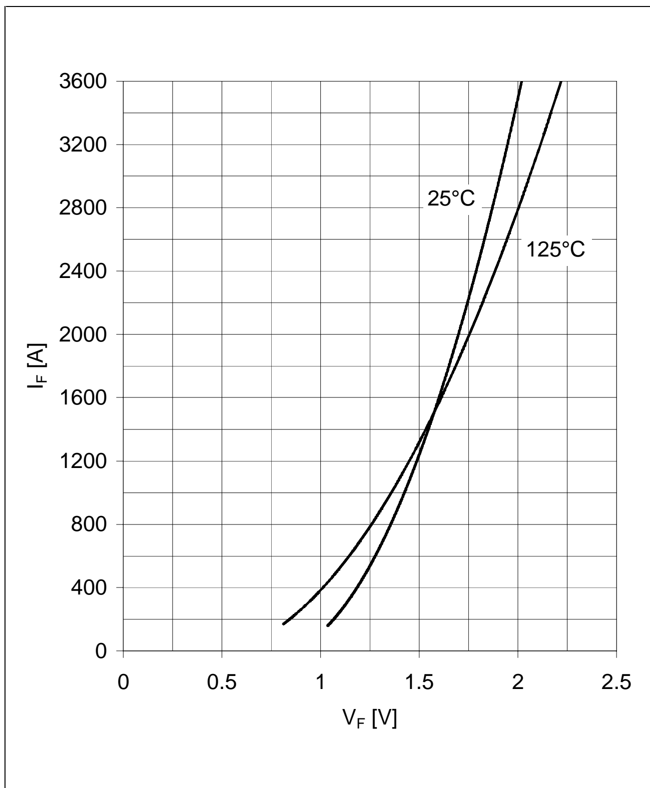

Fig. 14 Typical diode forward characteristics, chip level

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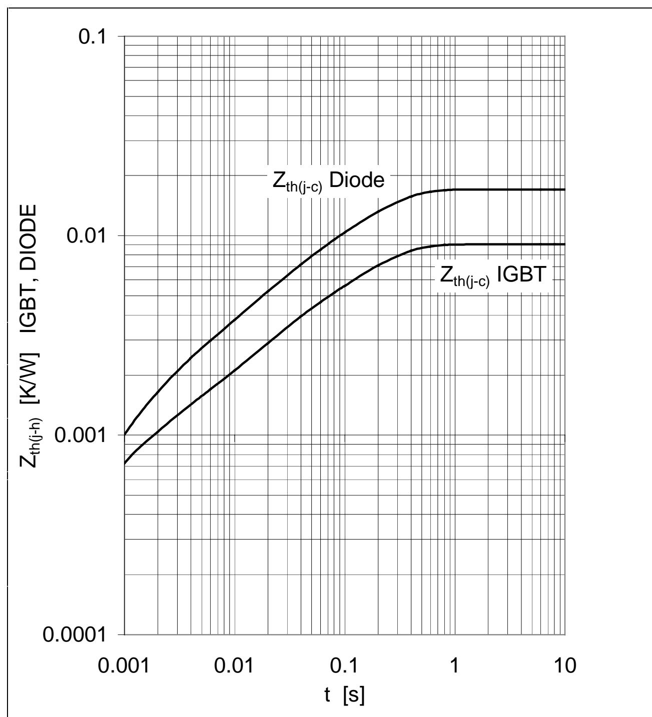

Fig. 15 Thermal impedance vs time

Analytical function for transient thermal impedance:

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

	i	1	2	3	4	5
IGBT	Ri(K/kW)	5.97	1.99	0.619	0.465	
	τ_i(ms)	179	22	2.4	0.54	
DIODE	Ri(K/kW)	11.1	3.36	1.27	1.34	
	τ_i(ms)	189	30	7.4	1.4	

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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

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