

5SNA 2000K451300

StakPak IGBT Module

$V_{CE} = 4500 \text{ V}$
 $I_C = 2000 \text{ A}$

Low-loss, rugged SPT+ chip-set
 Smooth switching SPT+ chip-set for good EMC
 High tolerance to uneven mounting pressure
 Explosion resistant package



Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	$V_{GE} = 0 \text{ V}$, $T_{vj} \geq 25 \text{ °C}$		4500	V
DC collector current	I_C	$T_C = 85 \text{ °C}$, $T_{vj} = 125 \text{ °C}$		2000	A
Peak collector current	I_{CM}	$t_p = 1 \text{ ms}$		4000	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	$T_C = 25 \text{ °C}$, $T_{vj} = 125 \text{ °C}$		20800	W
DC forward current	I_F			2000	A
Peak forward current	I_{FRM}	$t_p = 1 \text{ ms}$		4000	A
Surge current	I_{FSM}	$V_R = 0 \text{ V}$, $T_{vj} = 125 \text{ °C}$, $t_p = 10 \text{ ms}$, half-sinewave		14000	A
IGBT short circuit SOA	t_{psc}	$V_{CC} = 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 4500 \text{ V}$ $V_{GE} \leq 15 \text{ V}$, $T_{vj} \leq 125 \text{ °C}$		10	μs
Junction temperature	T_{vj}		-50	150	$^{\circ}\text{C}$
Junction operating temperature	$T_{vj(op)}$		-50	125	$^{\circ}\text{C}$
Case temperature	T_C		-50	125	$^{\circ}\text{C}$
Storage temperature	T_{stg}		-50	70	$^{\circ}\text{C}$
Mounting force ²⁾³⁾	F_M		60	90	kN

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 2037-02

³⁾ All electrical characteristics are valid only when the module is clamped

IGBT characteristic values ⁴⁾

Parameter	Symbol	Conditions	min	typ	max	Unit	
Collector (-emitter) breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}$, $I_C = 10 \text{ mA}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$	4500			V	
Collector-emitter ⁵⁾ saturation voltage	$V_{CE \text{ sat}}$	$I_C = 2000 \text{ A}$, $V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	2.55	2.85	3.15	V
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	3.35	3.65	3.95	V
Collector cut-off current	I_{CES}	$V_{CE} = 4500 \text{ V}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$			1	mA
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$		50	100	mA
Gate leakage current	I_{GES}	$V_{CE} = 0 \text{ V}$, $V_{GE} = \pm 20 \text{ V}$, $T_{vj} = 125 \text{ }^{\circ}\text{C}$	-500		500	nA	
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 320 \text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$	5.3		7.3	V	
Gate charge	Q_G	$I_C = 2000 \text{ A}$, $V_{CE} = 2800 \text{ V}$, $V_{GE} = -15 \text{ V} \dots 15 \text{ V}$		9.6		μC	
Input capacitance	C_{ies}	$V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$		186		nF	
Output capacitance	C_{oes}			13.4		nF	
Reverse transfer capacitance	C_{res}			3.7		nF	
Internal gate resistor	R_{Gint}			0.16		Ω	
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 1.8 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 200 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	820		ns	
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	690		ns	
Rise time	t_r		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	530		ns	
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	540		ns	
Turn-off delay time	$t_{d(off)}$		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	3990		ns	
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	4410		ns	
Fall time	t_f		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	710		ns	
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	800		ns	
Turn-on switching energy	E_{on}	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 1.8 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 200 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	8110		mJ	
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	9960		mJ	
Turn-off switching energy	E_{off}		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	7670		mJ	
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	9790		mJ	
Short circuit current	I_{SC}		$t_{psc} \leq 10 \text{ }\mu\text{s}$, $V_{GE} = 15 \text{ V}$, $V_{CC} = 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 4500 \text{ V}$	$T_{vj} = 125 \text{ }^{\circ}\text{C}$	7800		A

⁴⁾ Characteristic values according to IEC 60747 - 9

⁵⁾ Collector-emitter saturation voltage is given at chip level

Diode characteristic values ⁶⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Forward voltage ⁷⁾	V _F	I _F = 2000 A	T _{vj} = 25 °C	2.6	2.9	V
			T _{vj} = 125 °C	3.0	3.4	V
Peak reverse recovery current	I _{RM}	V _{CC} = 2800 V, I _F = 2000 A, V _{GE} = ±15 V, R _G = 1.8 Ω, C _{GE} = 330 nF, di/dt = 3.8 kA/μs L _σ = 200 nH, inductive load	T _{vj} = 25 °C	1670		A
			T _{vj} = 125 °C	1950		A
Recovered charge	Q _r		T _{vj} = 25 °C	1770		μC
			T _{vj} = 125 °C	2710		μC
Reverse recovery time	t _{rr}		T _{vj} = 25 °C	2030		ns
			T _{vj} = 125 °C	2340		ns
Reverse recovery energy	E _{rec}		T _{vj} = 25 °C	2930		mJ
			T _{vj} = 125 °C	4690		mJ

⁶⁾ Characteristic values according to IEC 60747 - 2

⁷⁾ Forward voltage is given at chip level

Package properties

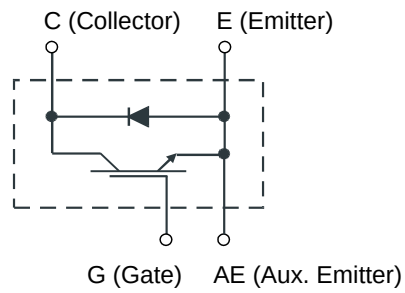
Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				0.0048	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.0091	K/W
IGBT thermal resistance ²⁾ case to heatsink	$R_{th(c-h)IGBT}$	Heatsink flatness : Complete module area < 100 μm Each submodule area < 20 μm Roughness : < 1.6 μm		0.0011		K/W
Diode thermal resistance ²⁾ case to heatsink	$R_{th(c-h)DIODE}$			0.0023		K/W
Comparative tracking index	CTI		600			

²⁾ for detailed mounting instructions refer to ABB Document No. 5SYA 2037-02

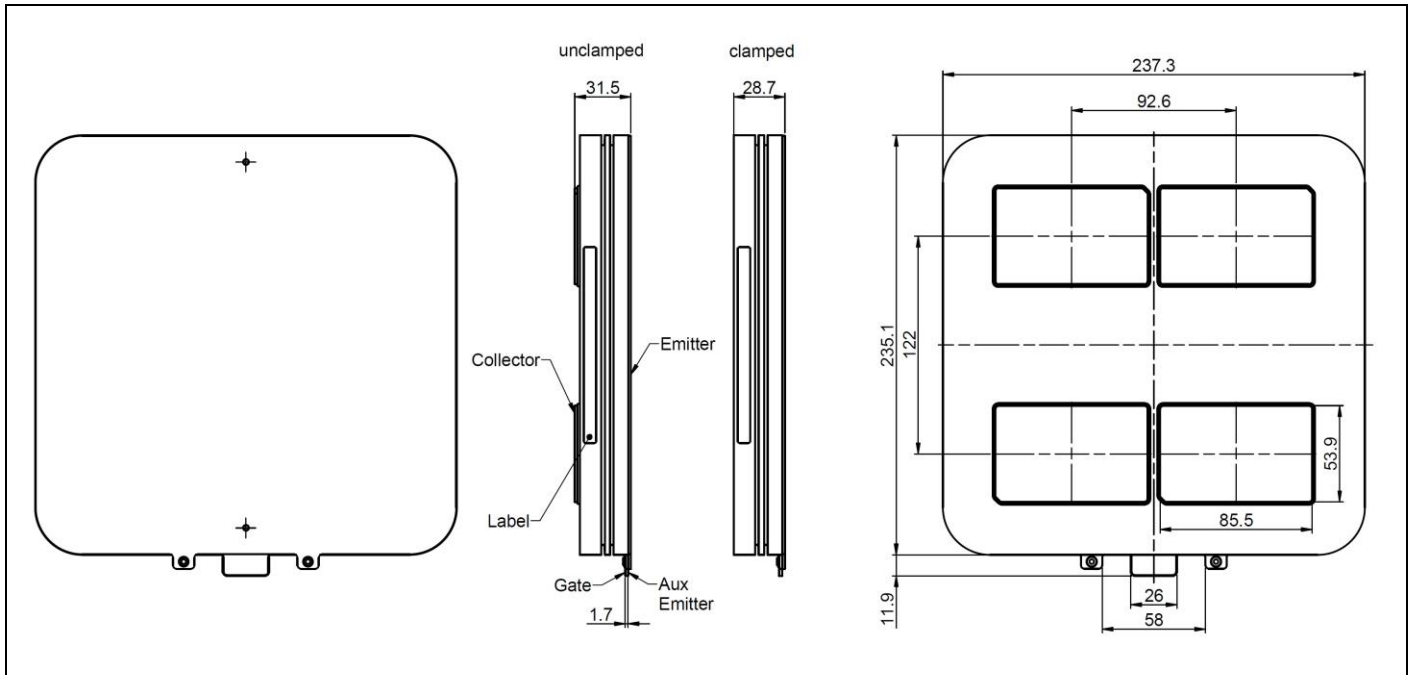
Mechanical properties

Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical	device clamped	246.95 x 237.3 x 28.75			mm
			device unclamped	246.95 x 237.3 x 31.5			
Clearance distance in air	d _a	according to IEC 60664-1 and EN 50124-1		23			mm
Surface creepage distance	d _s	according to IEC 60664-1 and EN 50124-1		40			mm
Mass	m				3745		g

Electrical configuration



Outline drawing ²⁾



Note: all dimensions are shown in millimeters

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

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.

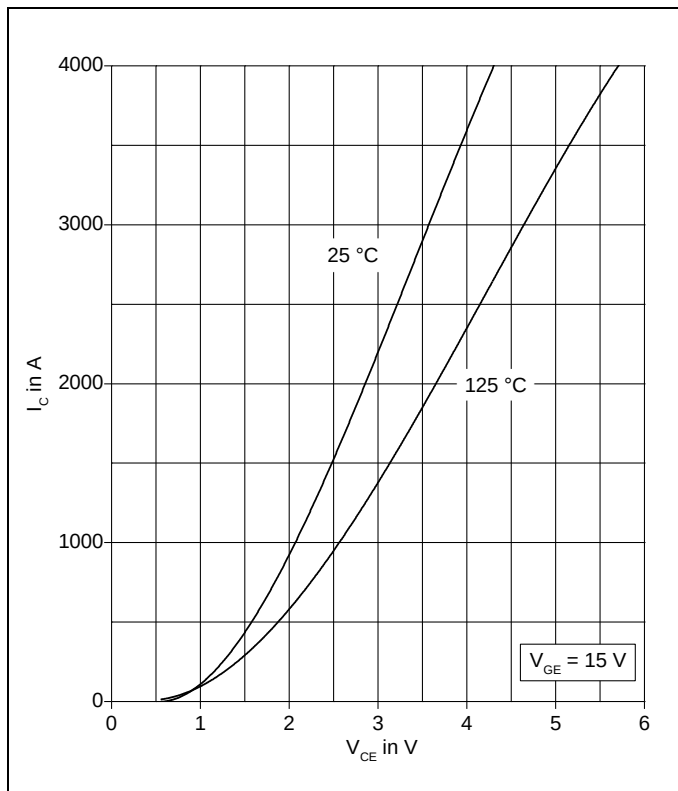


Fig. 1 Typical on-state characteristics, chip level

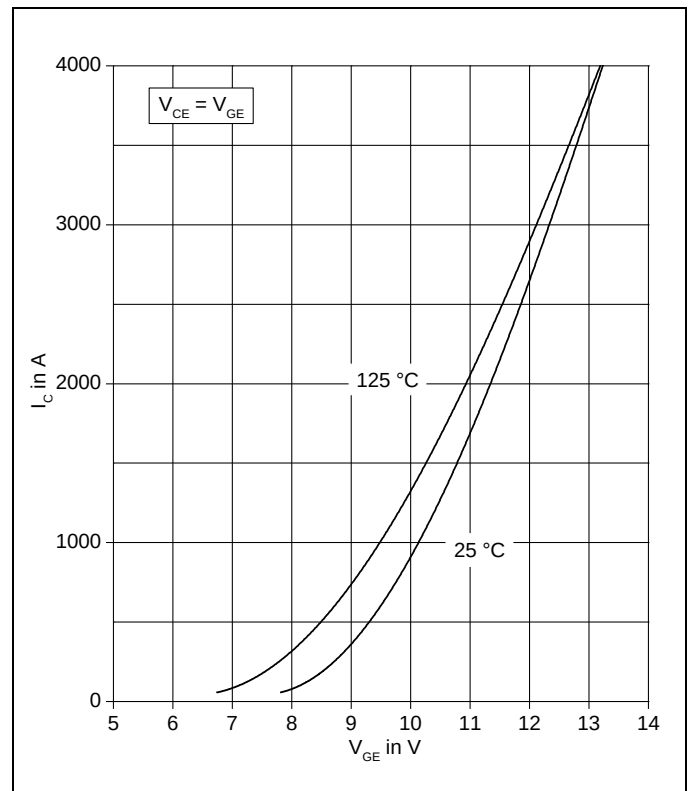


Fig. 2 Typical transfer characteristics, chip level

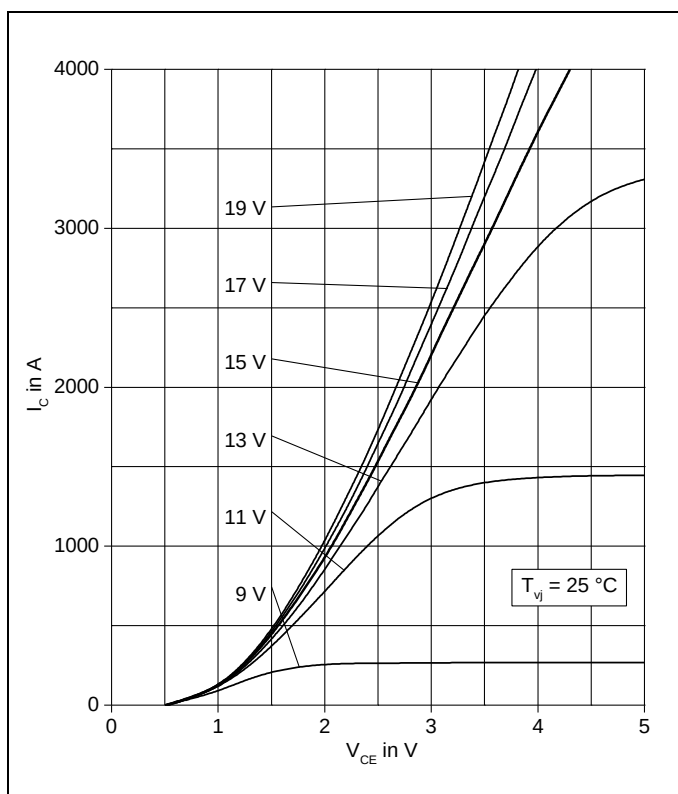


Fig. 3 Typical output characteristics, chip level

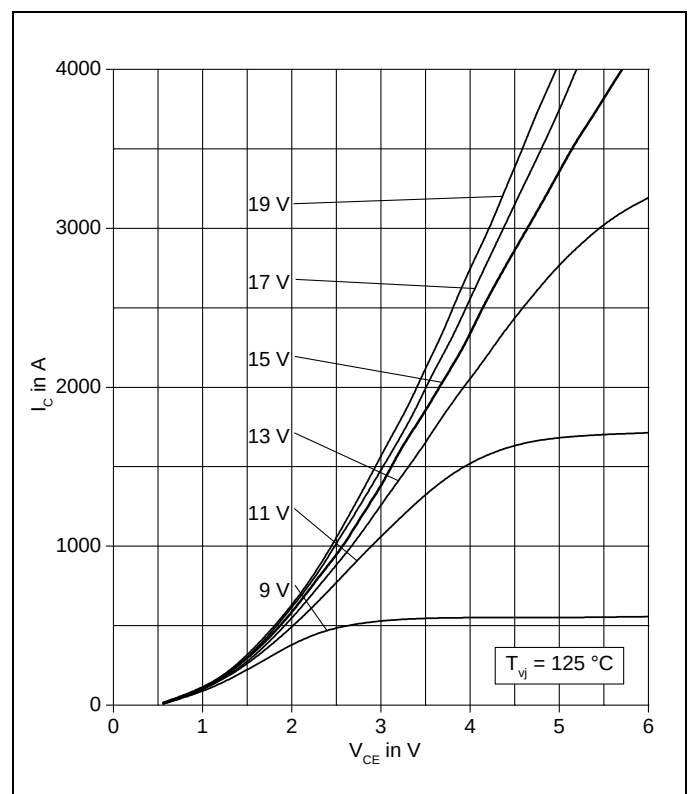


Fig. 4 Typical output characteristics, chip level

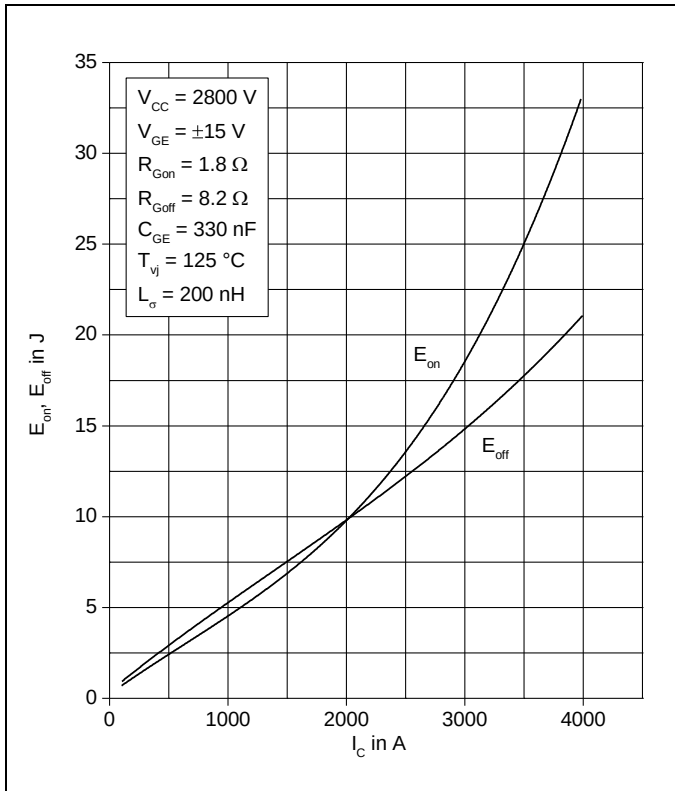


Fig. 5 Typical switching energies per pulse vs. collector current

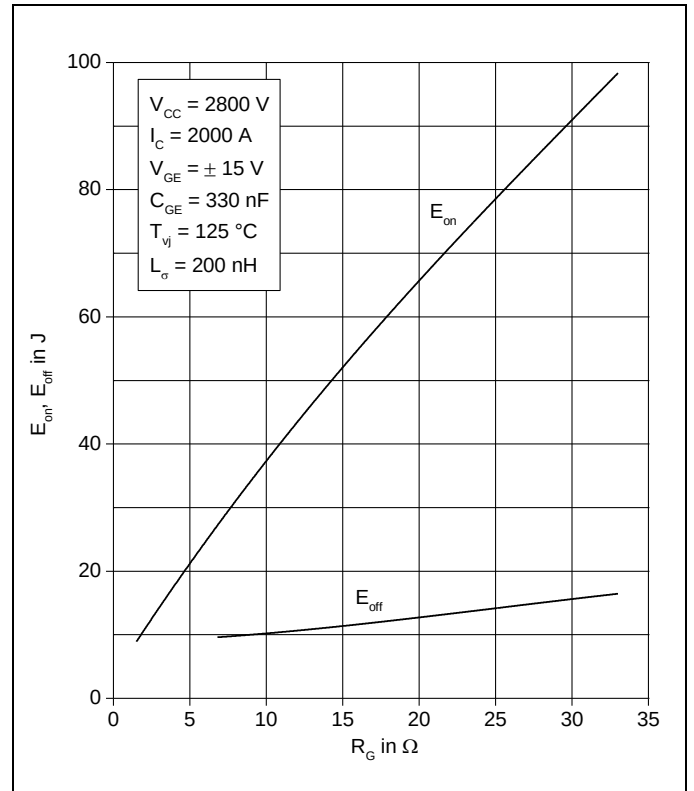


Fig. 6 Typical switching energies per pulse vs. gate resistor

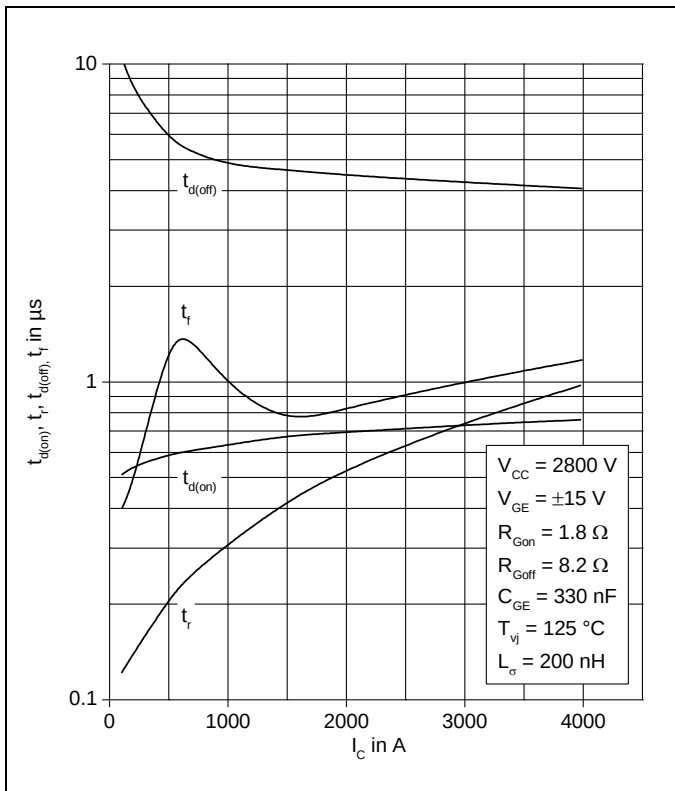


Fig. 7 Typical switching times vs. collector current

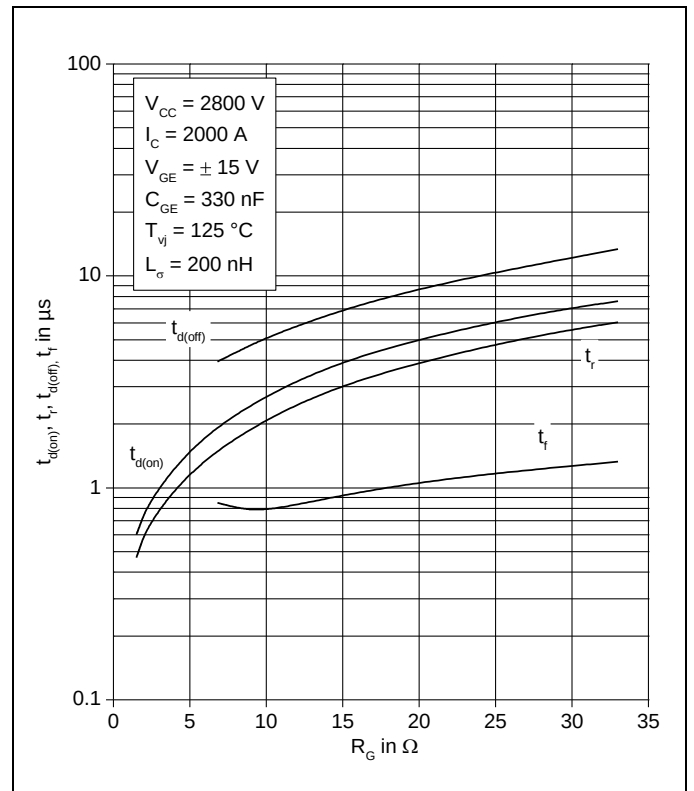


Fig. 8 Typical switching times vs. gate resistor

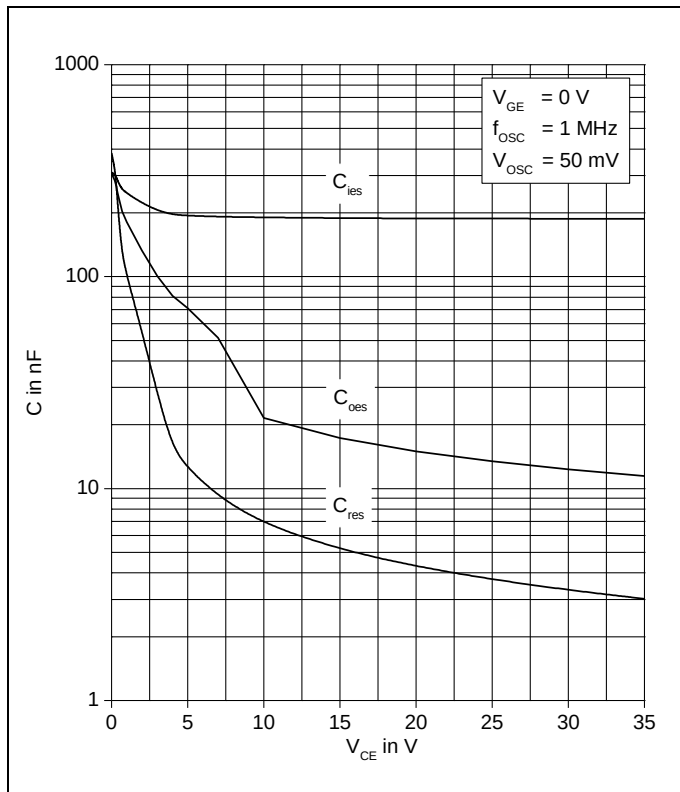


Fig. 9 Typical capacitances vs. collector-emitter voltage

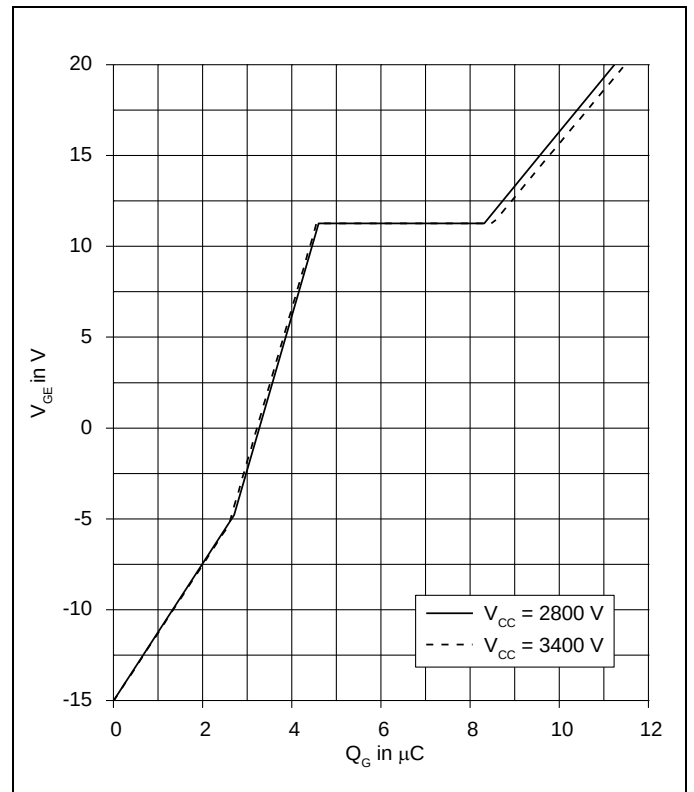


Fig. 10 Typical gate charge characteristics

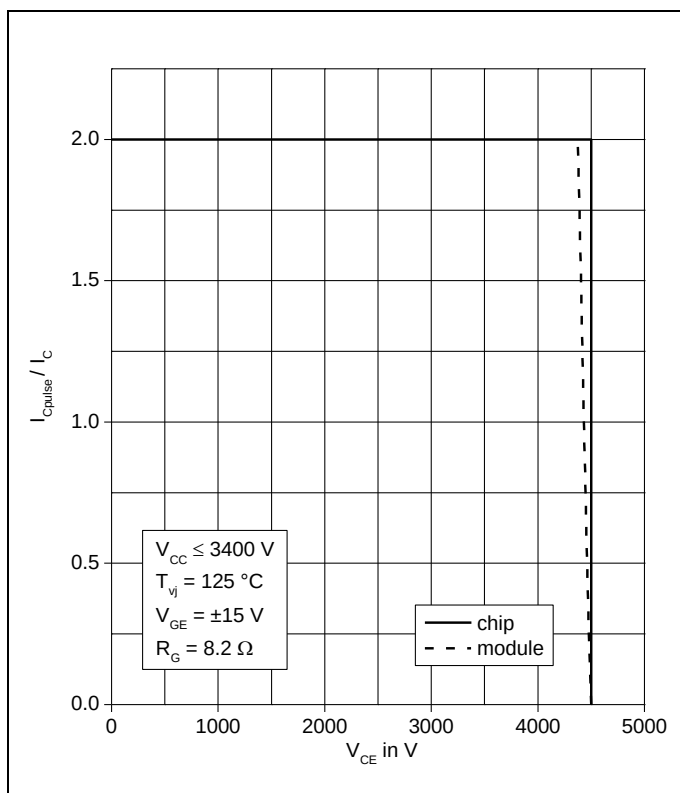


Fig. 11 Turn-off safe operating area (RBSOA)

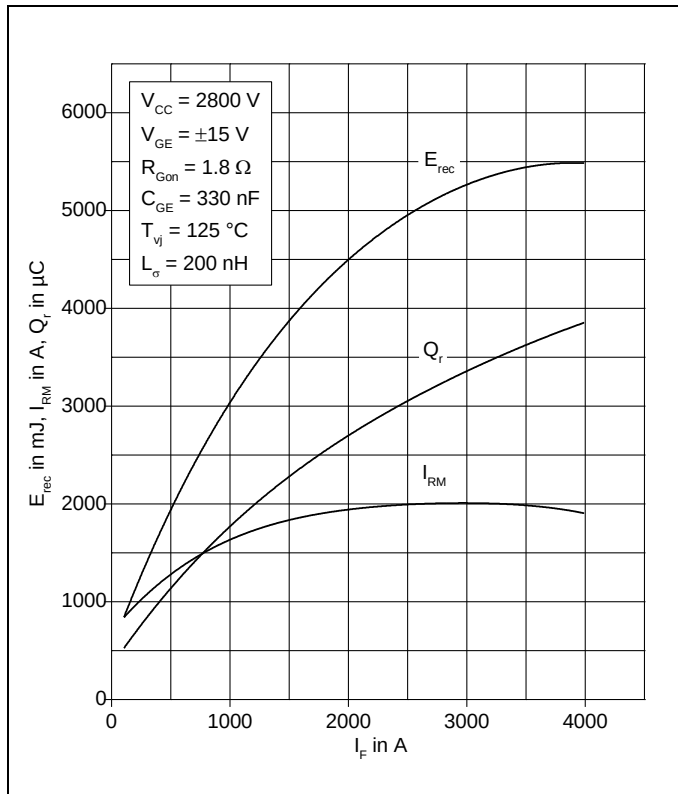


Fig. 12 Typical reverse recovery characteristics vs. forward current

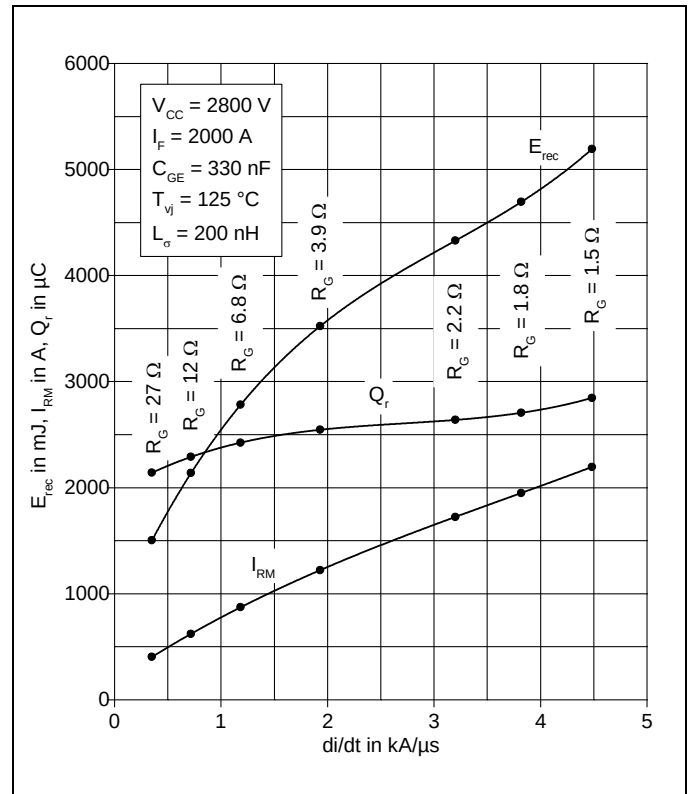


Fig. 13 Typical reverse recovery characteristics vs. di/dt

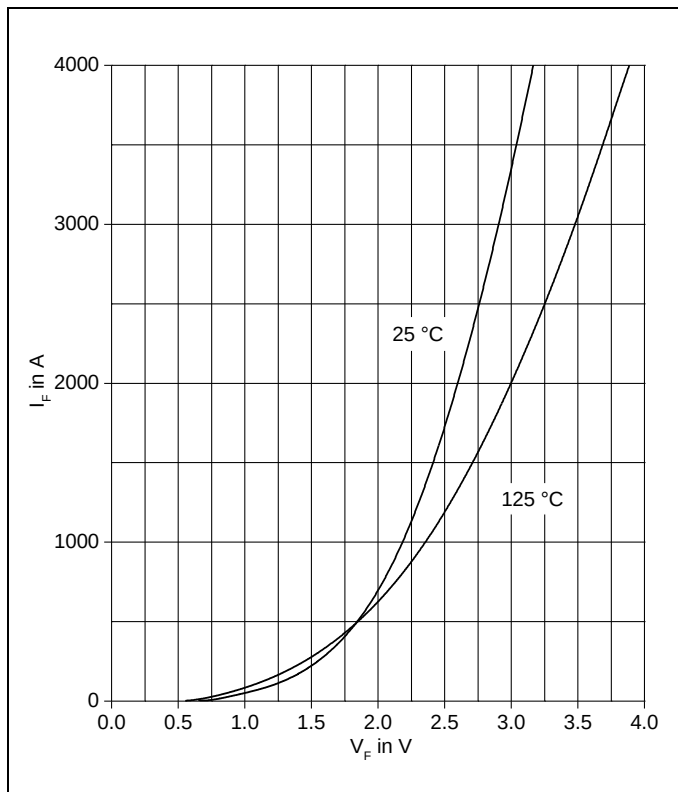


Fig. 14 Typical diode forward characteristics chip level

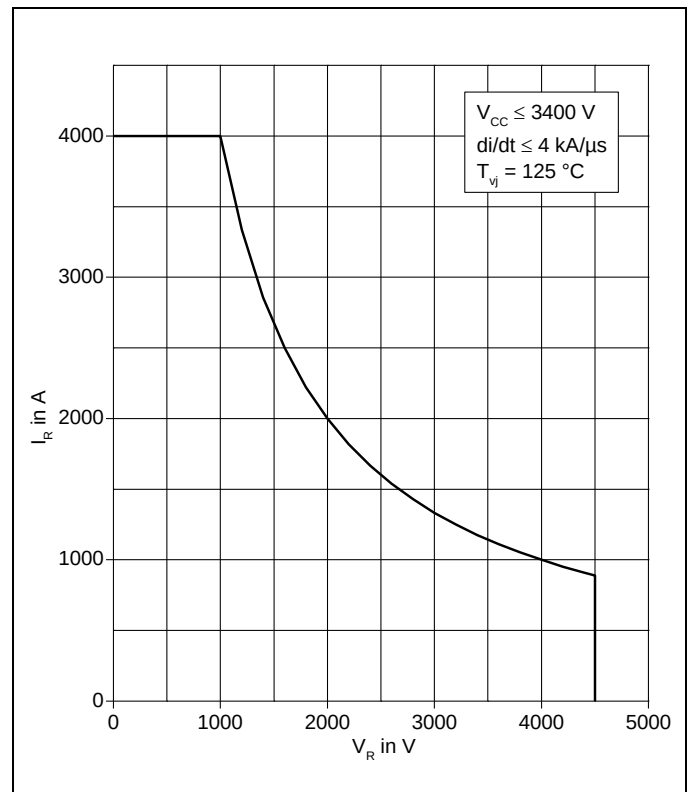


Fig. 15 Safe operating area diode (SOA)

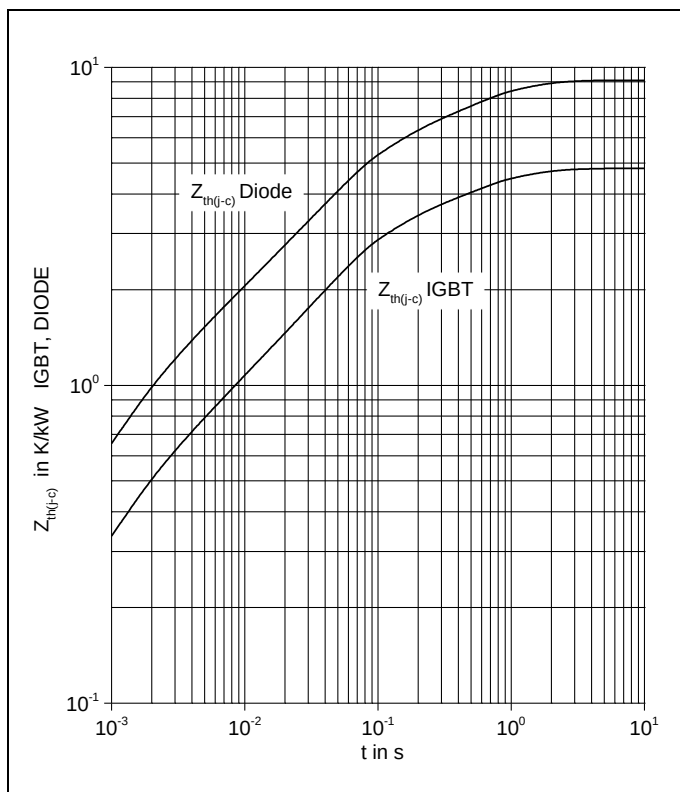


Fig. 16 Thermal impedance vs. time

Analytical function for transient thermal impedance:

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

	i	1	2	3	4	5
IGBT	R_i in K/kW	1.801	2.234	0.403	0.369	
	τ_i in s	0.581	0.059	0.006	0.001	
DIODE	R_i in K/kW	3.614	3.958	0.803	0.727	
	τ_i in s	0.584	0.059	0.006	0.001	

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

Phone: +41 58 586 1419
Fax: +41 58 586 1306
E-Mail: abbsem@ch.abb.com
Internet: www.abb.com/semiconductors

We reserve the right to make technical changes or to modify the contents of this document without prior notice.

We reserve all rights in this document and the information contained therein. Any reproduction or utilization of this document or parts thereof for commercial purposes without our prior written consent is forbidden.

Any liability for use of our products contrary to the instructions in this document is excluded.