Data Sheet, Doc. No. 5SYA 1431-02 01-2018

5SNA 2000K450300
StakPak IGBT Module

V_{CE} = 4500 V
I_C = 2000 A

Fails into stable shorted state
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 V, T_{vj} ≥ 25 °C		4500	V
DC collector current	I_C	T_C = 95 °C, T_{vj} = 125 °C		2000	A
Peak collector current	I_{CM}	t_p = 1 ms		4000	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_C = 25 °C, T_{vj} = 125 °C		25000	W
DC forward current	I_F			2000	A
Peak forward current	I_{FRM}	t_p = 1 ms		4000	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 125 °C, t_p = 10 ms, half-sinewave		32000	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 3400 V, $V_{CEM\ CHIP}$ ≤ 4500 V V_{GE} ≤ 15 V, T_{vj} ≤ 125 °C		10	µs
Junction temperature	T_{vj}		-50	150	°C
Junction operating temperature	$T_{vj(op)}$		-50	125	°C
Case temperature	T_C		-50	125	°C
Storage temperature	T_{stg}		-50	70	°C
Mounting force [2)3)]	F_M		90	130	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 V, I_C = 10 mA, T_{vj} = 25 °C		4500			V
Collector-emitter [5)] saturation voltage	$V_{CE\ sat}$	I_C = 2000 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.7	3.0	V
			T_{vj} = 125 °C		3.4	3.7	V
Collector cut-off current	I_{CES}	V_{CE} = 4500 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
			T_{vj} = 125 °C		80	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	$V_{GE(th)}$	I_C = 360 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.3		7.3	V
Gate charge	Q_G	I_C = 2000 A, V_{CE} = 2800 V, V_{GE} = -15 V ..15 V			10.7		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			211		nF
Output capacitance	C_{oes}				15		nF
Reverse transfer capacitance	C_{res}				4.2		nF
Internal gate resistor	R_{Gint}				0.16		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 2800 V, I_C = 2000 A, R_G = 1.8 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 200 nH, inductive load	T_{vj} = 25 °C		800		ns
			T_{vj} = 125 °C		720		ns
Rise time	t_r		T_{vj} = 25 °C		500		ns
			T_{vj} = 125 °C		600		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 2800 V, I_C = 2000 A, R_G = 8.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 200 nH, inductive load	T_{vj} = 25 °C		4500		ns
			T_{vj} = 125 °C		5000		ns
Fall time	t_f		T_{vj} = 25 °C		700		ns
			T_{vj} = 125 °C		800		ns
Turn-on switching energy	E_{on}	V_{CC} = 2800 V, I_C = 2000 A, R_G = 1.8 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 200 nH, inductive load	T_{vj} = 25 °C		8000		mJ
			T_{vj} = 125 °C		11000		mJ
Turn-off switching energy	E_{off}	V_{CC} = 2800 V, I_C = 2000 A, R_G = 8.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 200 nH, inductive load	Tvj = 25 °C		8000		mJ
			Tvj = 125 °C		10500		mJ
Short circuit current	I_{SC}	t_{psc} ≤ 10 µs, V_{GE} = 15 V, V_{CC} = 3400 V, $V_{CEM\ CHIP}$ ≤ 4500 V	Tvj = 125 °C		9000		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		2.2	2.4	V
			T_{vj} = 125 °C		2.4	2.6	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		1900		A
			T_{vj} = 125 °C		2300		A
Recovered charge	Q_r		T_{vj} = 25 °C		1800		µC
			T_{vj} = 125 °C		3500		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		2000		ns
			T_{vj} = 125 °C		3200		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		2800		mJ
			T_{vj} = 125 °C		5500		mJ

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

Package properties

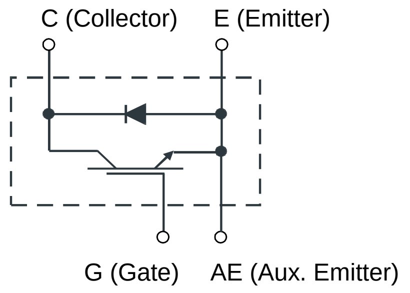
Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				0.004	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.004	K/W
IGBT thermal resistance [2)] case to heatsink	$R_{th(c-h)IGBT}$	Heatsink flatness : Complete module area < 100 µm Each submodule area < 20 µm Roughness : < 1.6 µm		0.001		K/W
Diode thermal resistance [2)] case to heatsink	$R_{th(c-h)DIODE}$			0.001		K/W
Comparative tracking index	CTI		600			

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

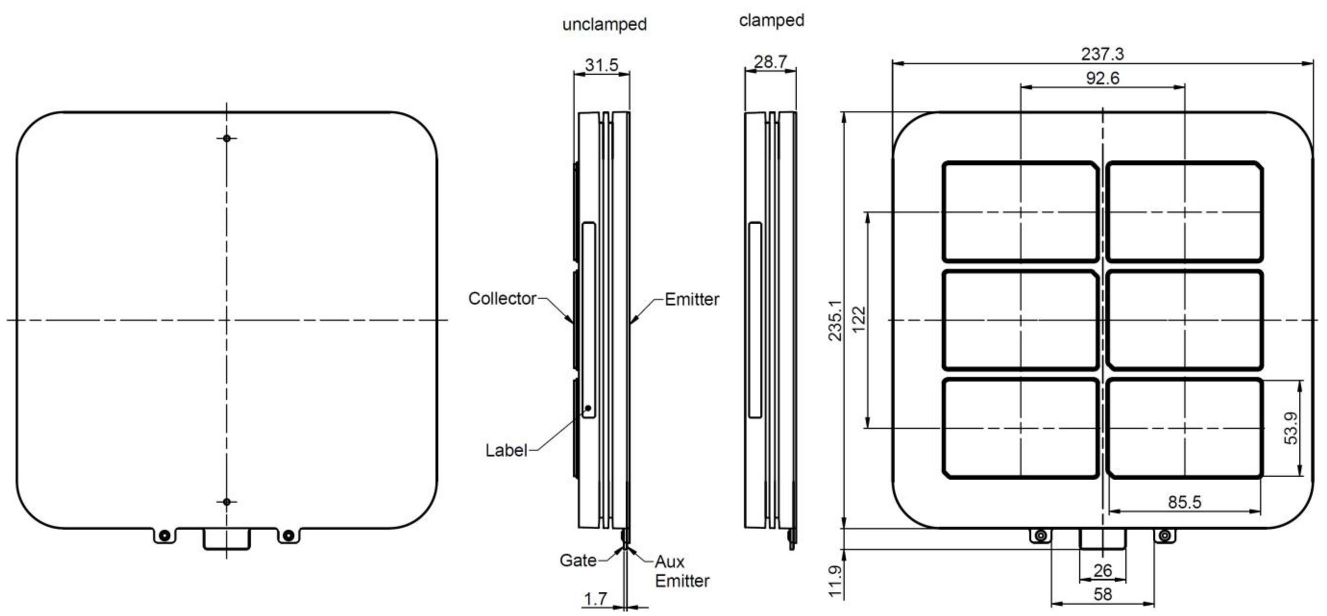
Mechanical properties

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				4300		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.

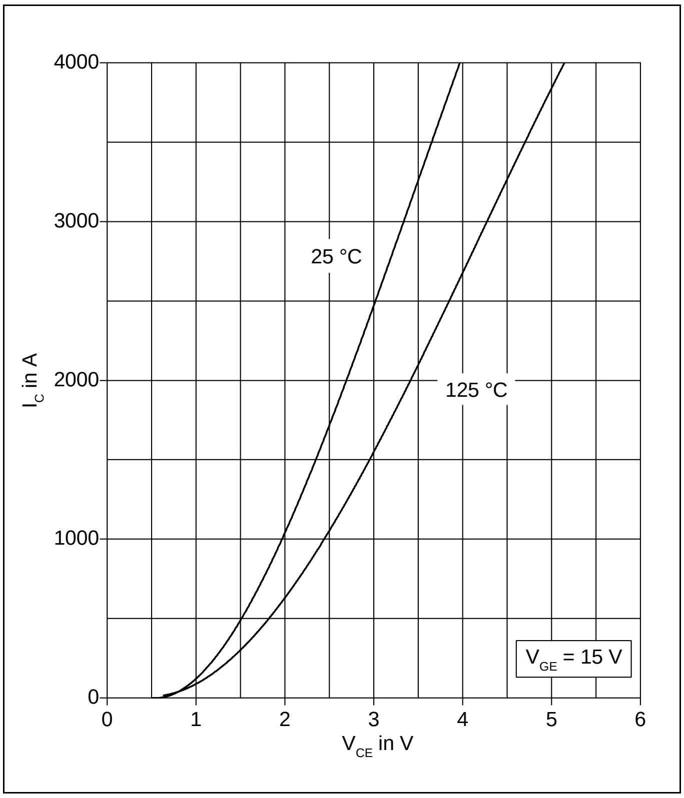


Fig. 1 Typical on-state characteristics, chip level

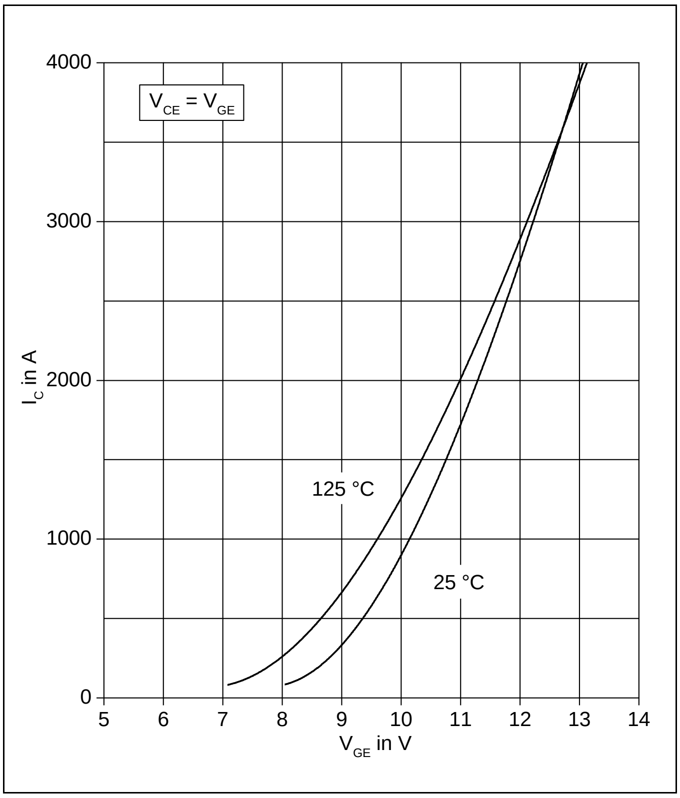


Fig. 2 Typical transfer characteristics, chip level

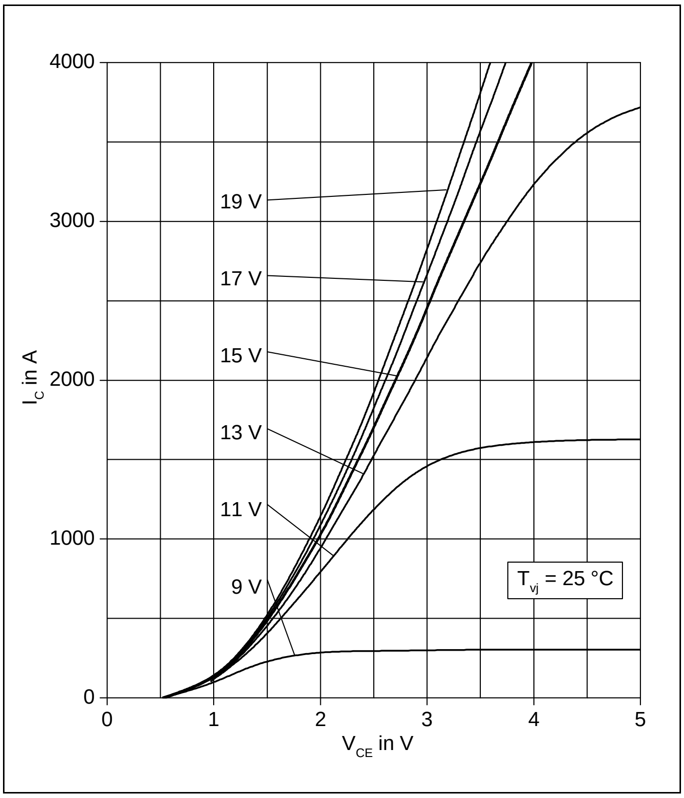


Fig. 3 Typical output characteristics, chip level

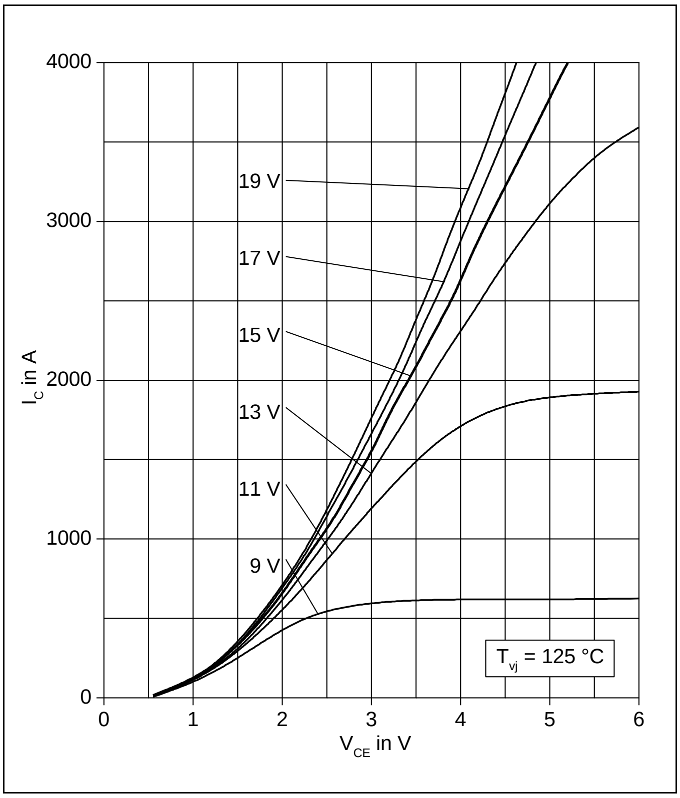


Fig. 4 Typical output characteristics, chip level

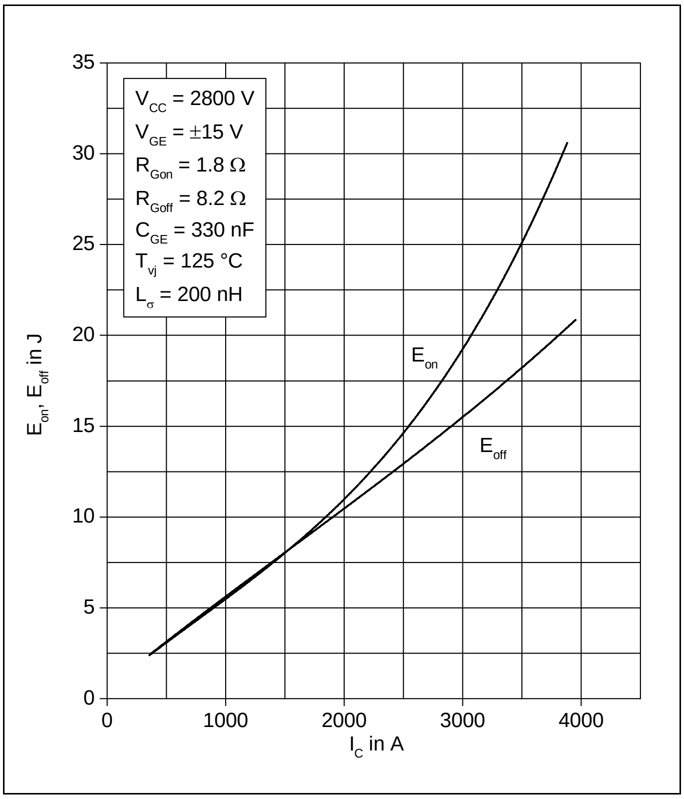


Fig. 5 Typical switching energies per pulse vs. collector current

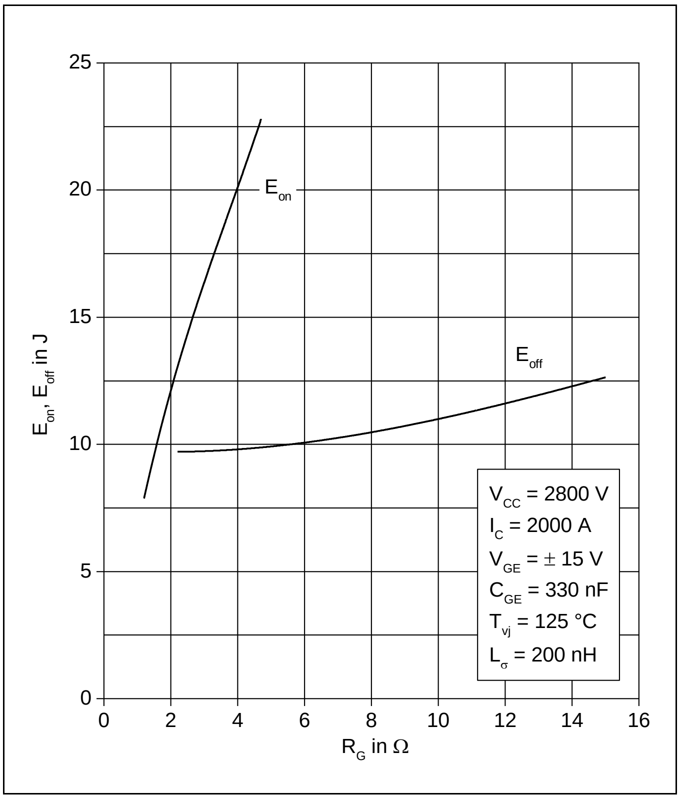


Fig. 6 Typical switching energies per pulse vs. gate resistor

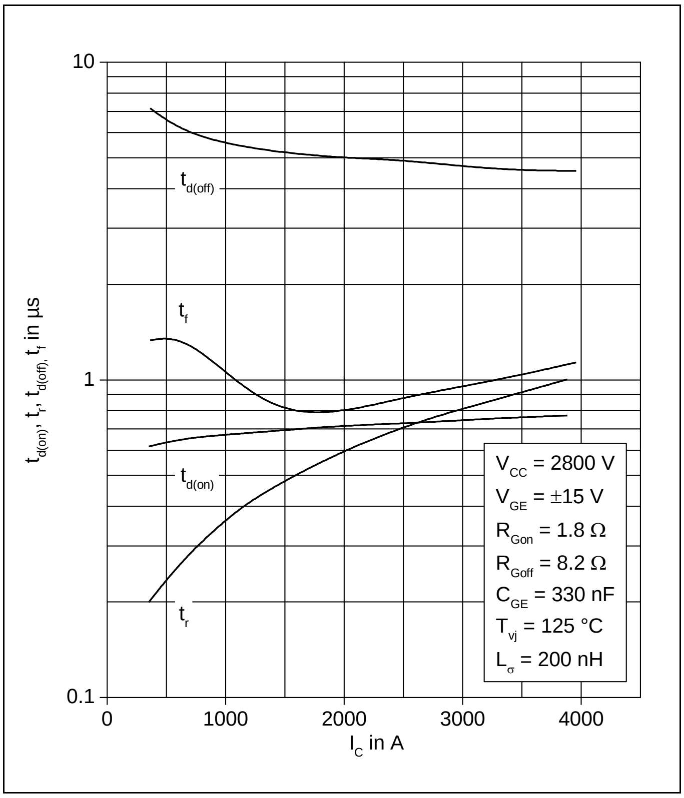


Fig. 7 Typical switching times vs. collector current

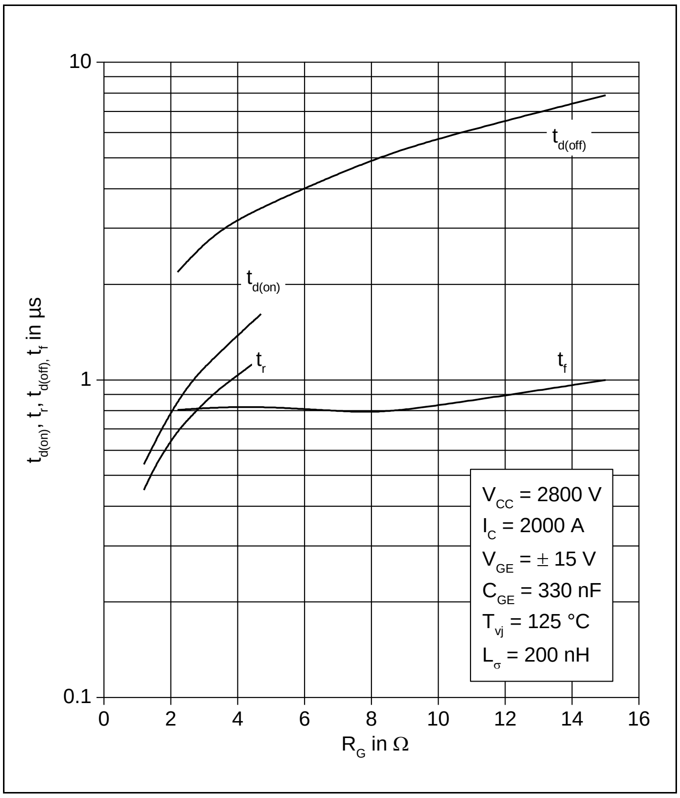


Fig. 8 Typical switching times vs. gate resistor

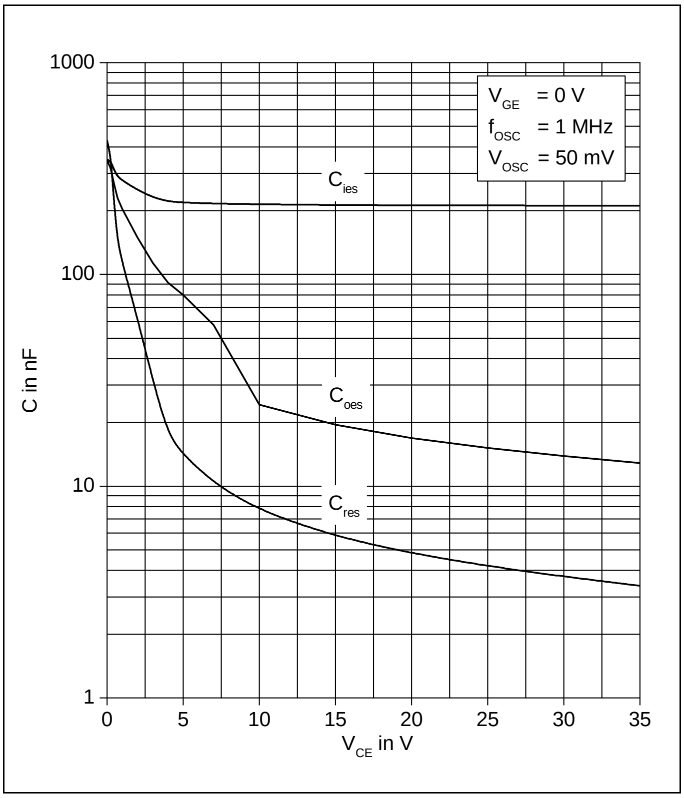


Fig. 9 Typical capacitances vs. collector-emitter voltage

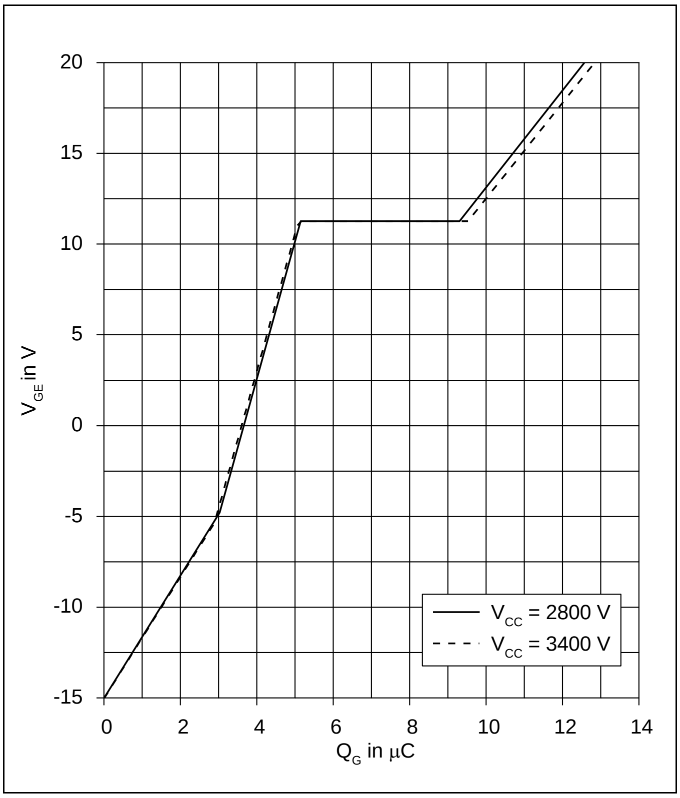


Fig. 10 Typical gate charge characteristics

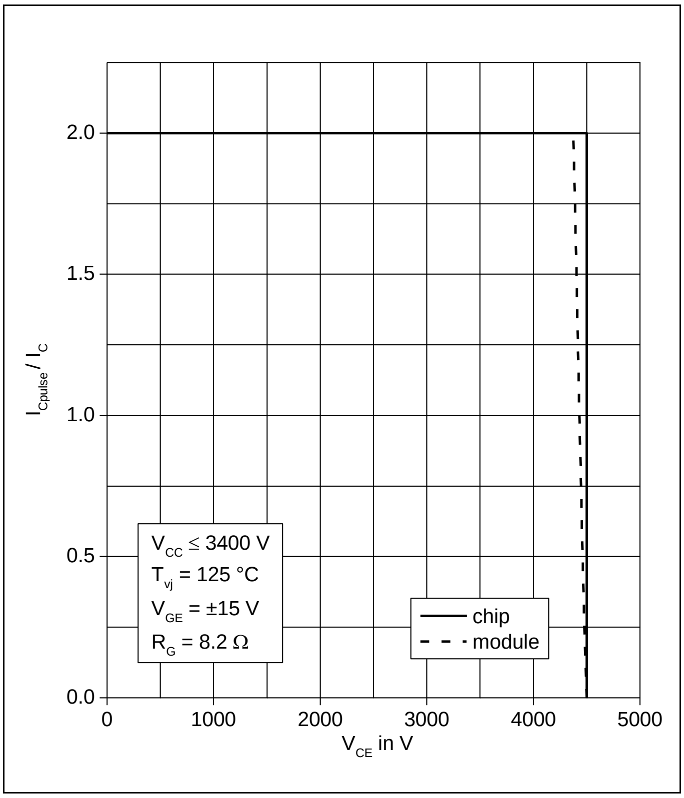


Fig. 11 Turn-off safe operating area (RBSOA)

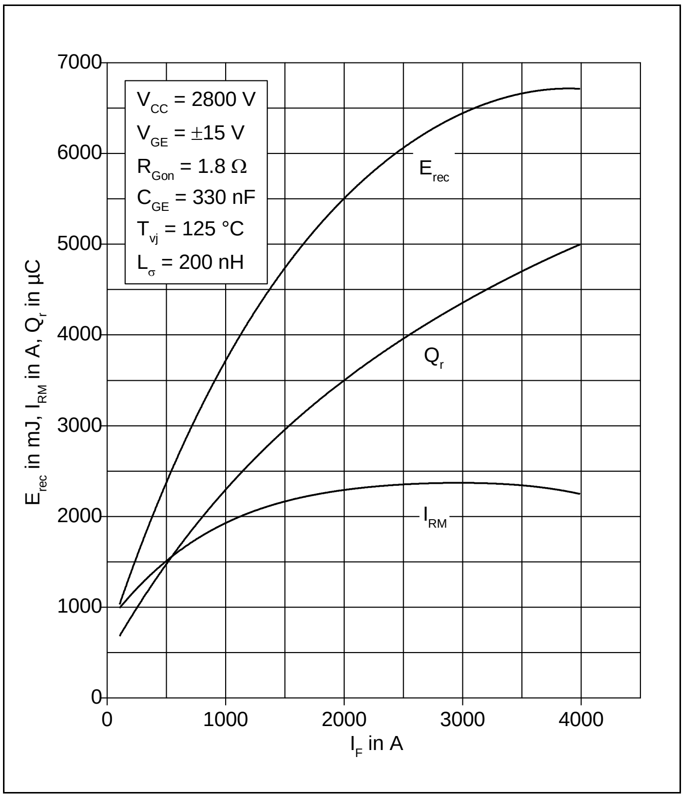


Fig. 12 Typical reverse recovery characteristics vs. forward current

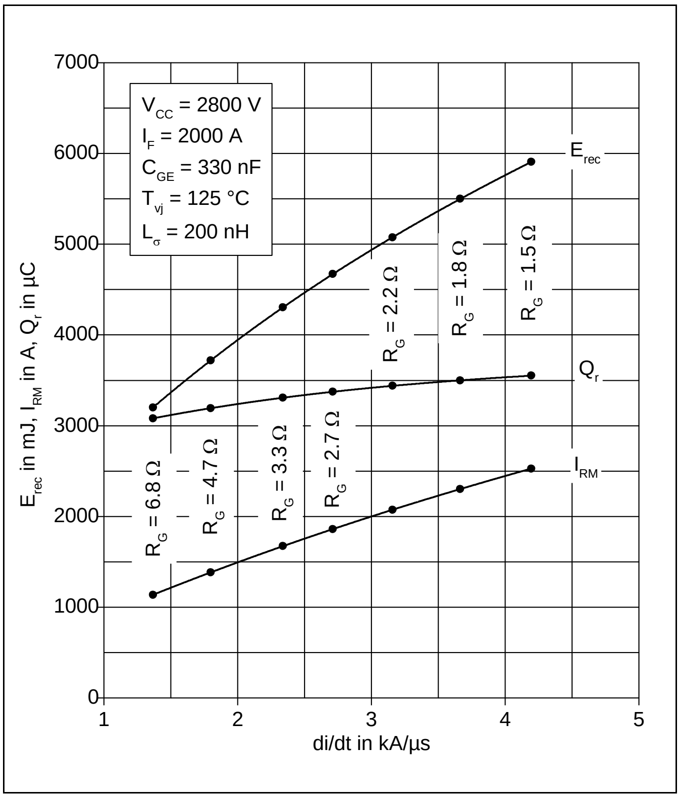


Fig. 13 Typical reverse recovery characteristics vs. di/dt

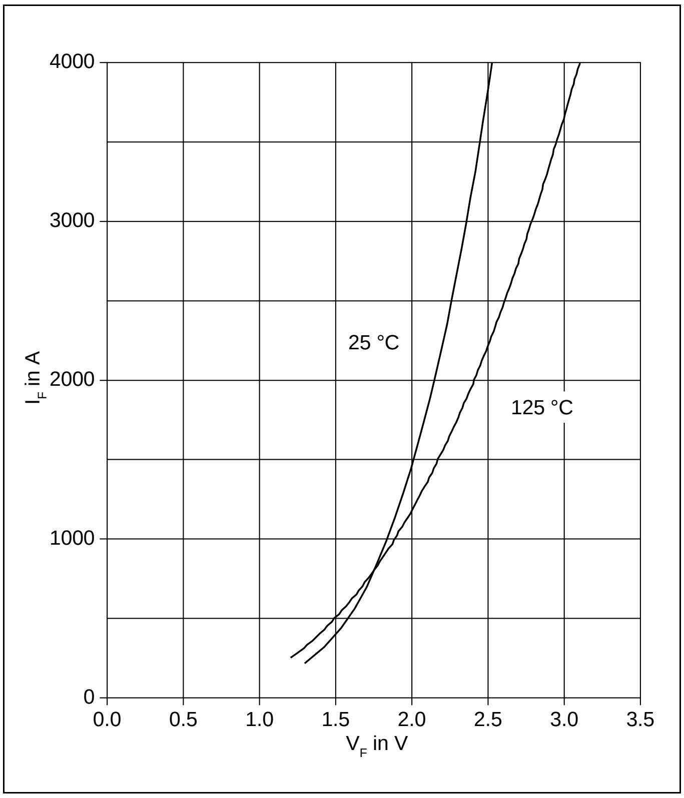


Fig. 14 Typical diode forward characteristics chip level

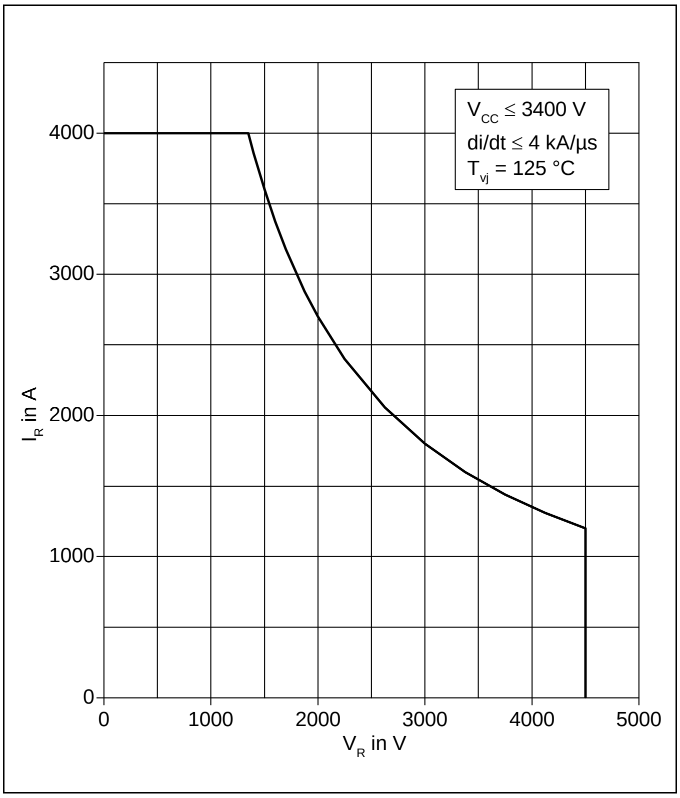


Fig. 15 Safe operating area diode (SOA)

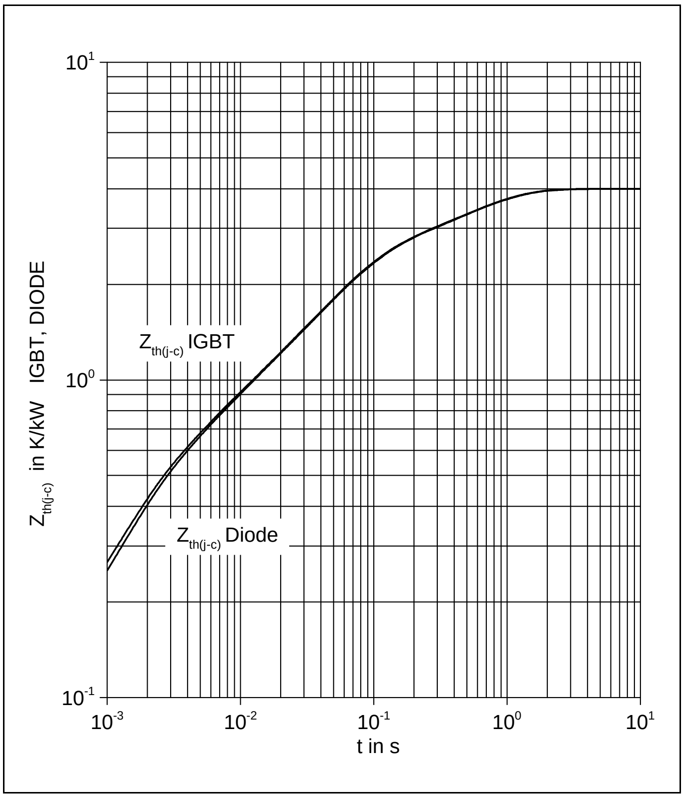


Fig. 16 Thermal impedance vs. time

Analytical function for transient thermal impedance:

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

	i	1	2	3	4	5
IGBT	R_i in K/kW	1.601	1.765	0.358	0.328	
	τ_i in s	0.581	0.059	0.006	0.001	
DIODE	R_i in K/kW	1.606	1.759	0.357	0.323	
	τ_i in s	0.584	0.059	0.006	0.001	

Related documents:

5SYA 2045 Thermal runaway during blocking
5SYA 2053 Applying IGBT
5SYA 2093 Thermal design of IGBT modules

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