Data Sheet, Doc. No. 5SYA 1469-00 10-2018

5SMA 3000L450300
StakPak IGBT Module

V_{CE} = 4500 V
I_C = 3000 A

Low-loss, rugged IGBT chip
Optimized for low switching frequency
Smooth switching for good EMC
High tolerance to uneven mounting pressure
Explosion resistant package
Remains in low impedance state for up to 1 minute after failure*

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V, $T_{vj} \geq 25$ °C		4500	V
DC collector current	I_C	T_C = 87 °C, T_{vj} = 125 °C		3000	A
Peak collector current	I_{CM}	t_p = 1 ms		6000	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_C = 25 °C, T_{vj} = 125 °C		26600	W
IGBT short circuit SOA	t_{psc}	V_{CC} = 3400 V, $V_{CEM\ CHIP} \leq$ 4500 V $V_{GE} \leq$ 15 V, $T_{vj} \leq$ 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		40	60	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
* Functionality is load profile dependent and is to be agreed upon

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 = 3000 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.45	2.75	V
			T_{vj} = 125 °C		3.1	3.4	V
Collector cut-off current	I_{CES}	V_{CE} = 4500 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.1	mA
			T_{vj} = 125 °C		50	100	mA
Gate leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ± 20 V, T_{vj} = 25 °C		-500		500	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 320 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.0		7.0	V
Gate charge	Q_G	I_C = 3000 A, V_{CE} = 2800 V, V_{GE} = -15 V ..15 V			14.4		µC
Input capacitance	Cies	VCE = 25 V, VGE = 0 V, f = 1 MHz, Tvj = 25 °C			279		nF
Internal gate resistor	R_{Gint}				0.16		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 2800 V, I_C = 3000 A, R_G = 1.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 130 nH, inductive load, Aux: 5SNA 3000K452300	T_{vj} = 25 °C		780		ns
			T_{vj} = 125 °C		700		ns
Rise time	t_r		T_{vj} = 25 °C		430		ns
			T_{vj} = 125 °C		435		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 2800 V, I_C = 3000 A, R_G = 6.8 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 130 nH, inductive load	T_{vj} = 25 °C		5510		ns
			T_{vj} = 125 °C		5980		ns
Fall time	t_f		T_{vj} = 25 °C		945		ns
			T_{vj} = 125 °C		950		ns
Turn-on switching energy	E_{on}	V_{CC} = 2800 V, I_C = 3000 A, R_G = 1.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 130 nH, inductive load, Aux: 5SNA 3000K452300	T_{vj} = 25 °C		10500		mJ
			T_{vj} = 125 °C		12500		mJ
Turn-off switching energy	E_{off}	V_{CC} = 2800 V, I_C = 3000 A, R_G = 6.8 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 130 nH, inductive load	Tvj = 25 °C		16500		mJ
			Tvj = 125 °C		20000		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		11500		A

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

Package properties

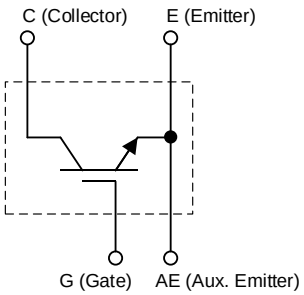
Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				3.75	K/kW
IGBT thermal resistance [2] case to heatsink	$R_{th(c-h)IGBT}$	Heatsink flatness : Complete module area < 100 µm Each submodule area < 20 µm Roughness : < 1.6 µm		0.83		K/kW
Comparative tracking index	CTI		600			

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

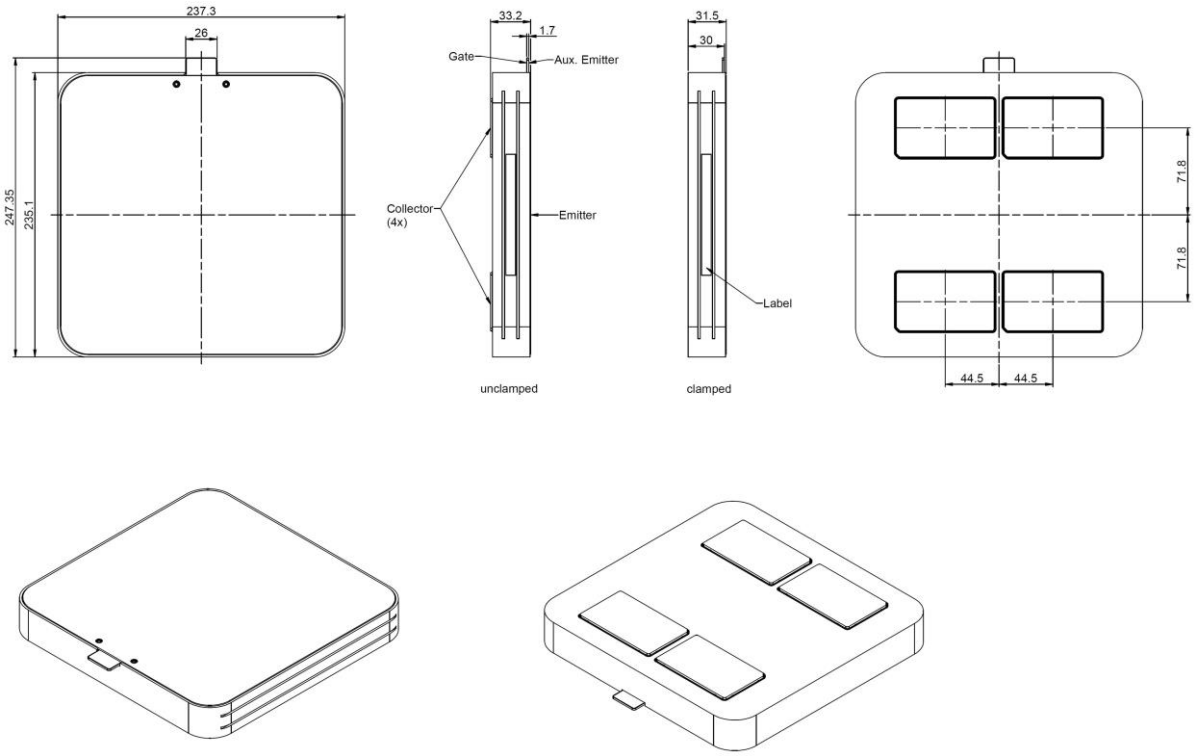
Mechanical properties

Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical	device clamped	247.4 x 237.3 x 31.5			mm
			device unclamped	247.4 x 237.3 x 33.2			
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		30			mm
Mass	m				3620		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.

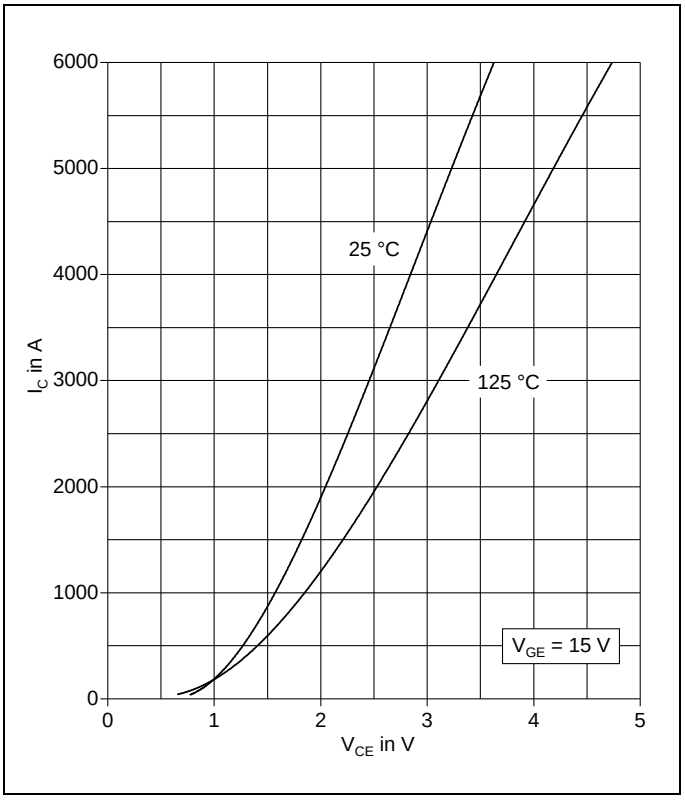


Fig. 1 Typical on-state characteristics, chip level

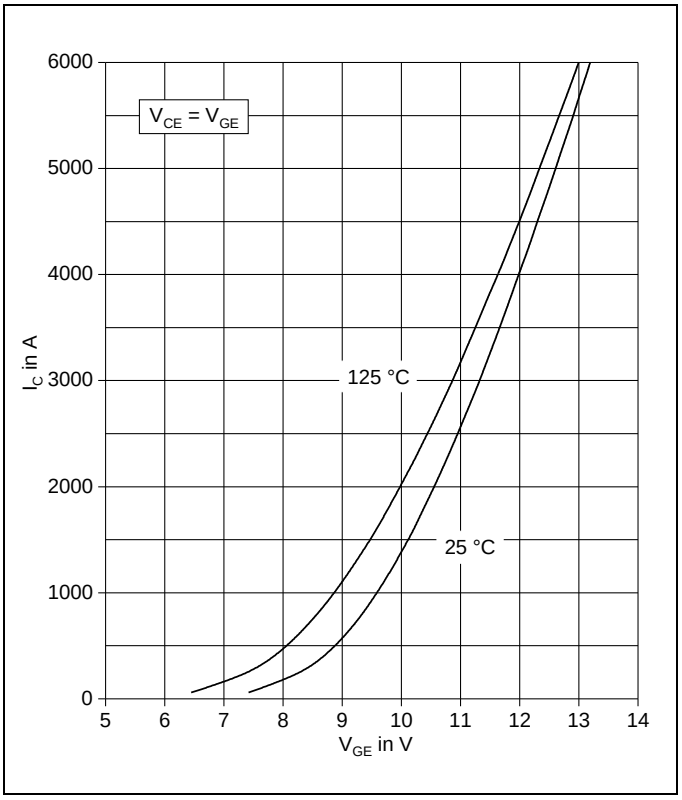


Fig. 2 Typical transfer characteristics, chip level

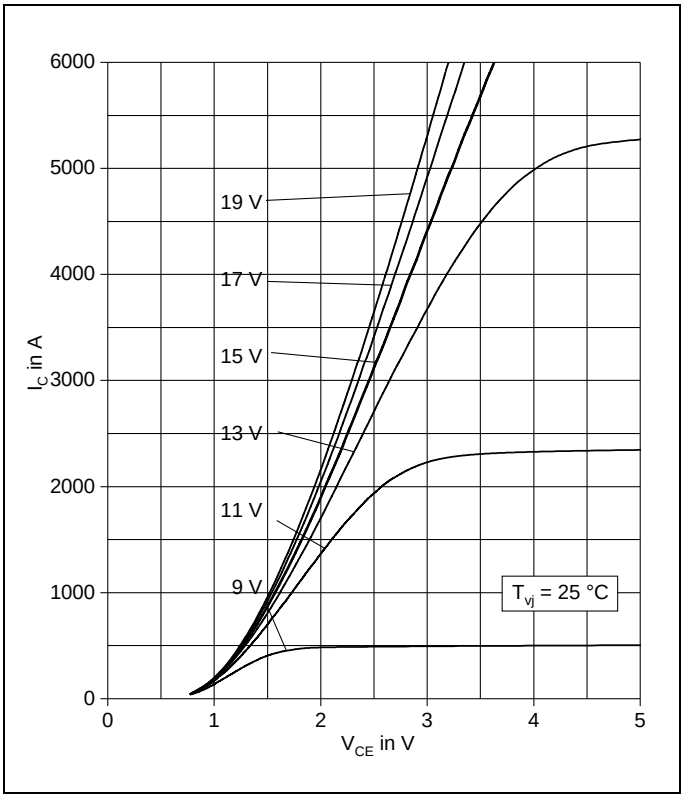


Fig. 3 Typical output characteristics, chip level

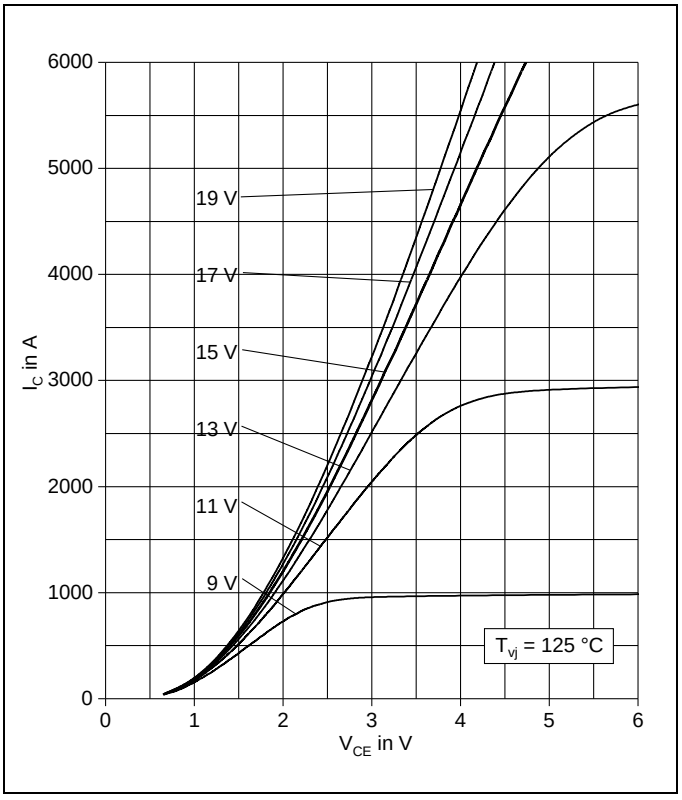


Fig. 4 Typical output characteristics, chip level

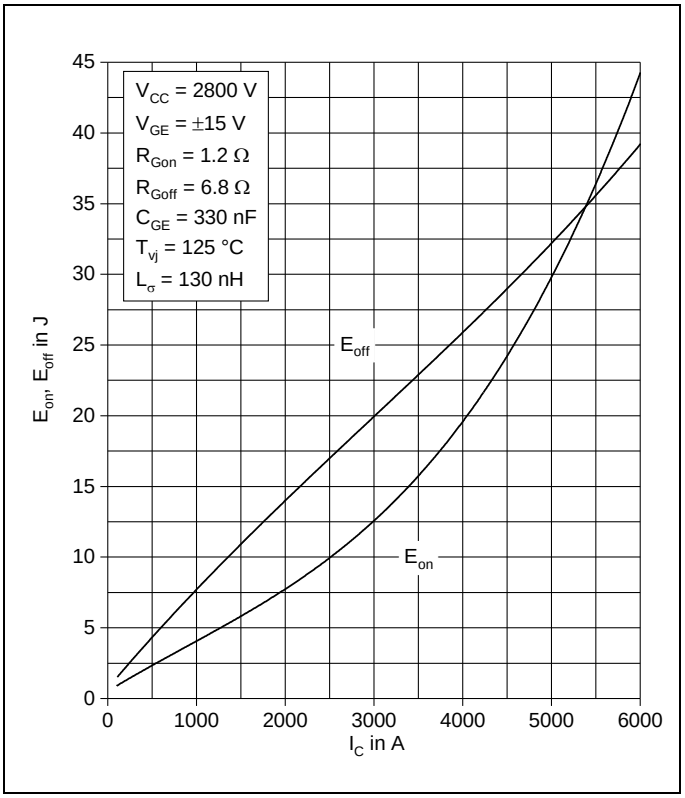


Fig. 5 Typical switching energies per pulse vs. collector current

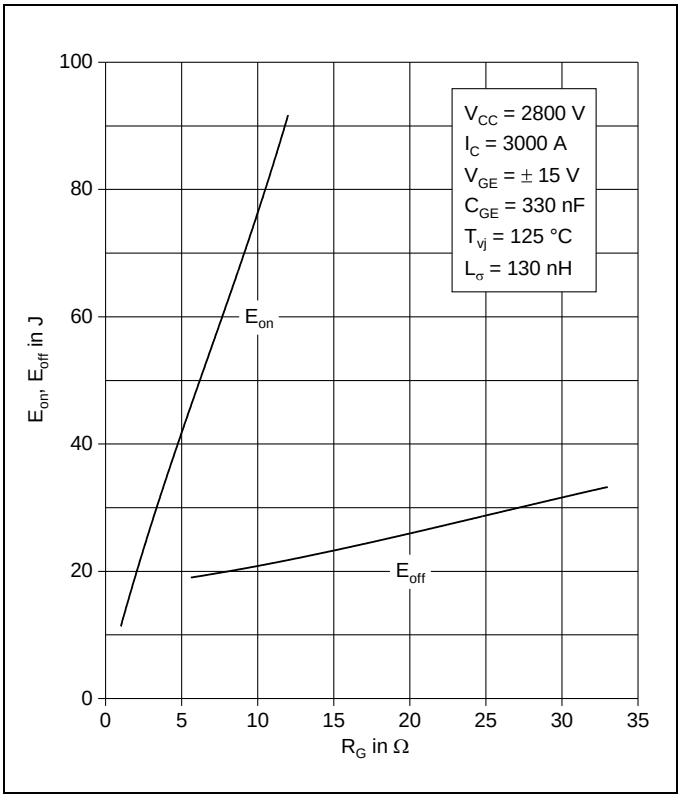


Fig. 6 Typical switching energies per pulse vs. gate resistor

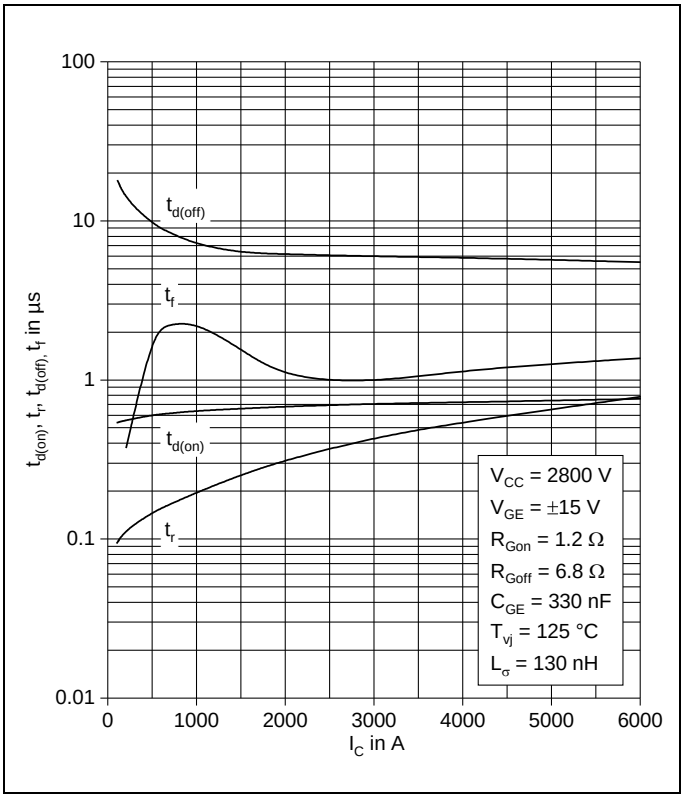


Fig. 7 Typical switching times vs. collector current

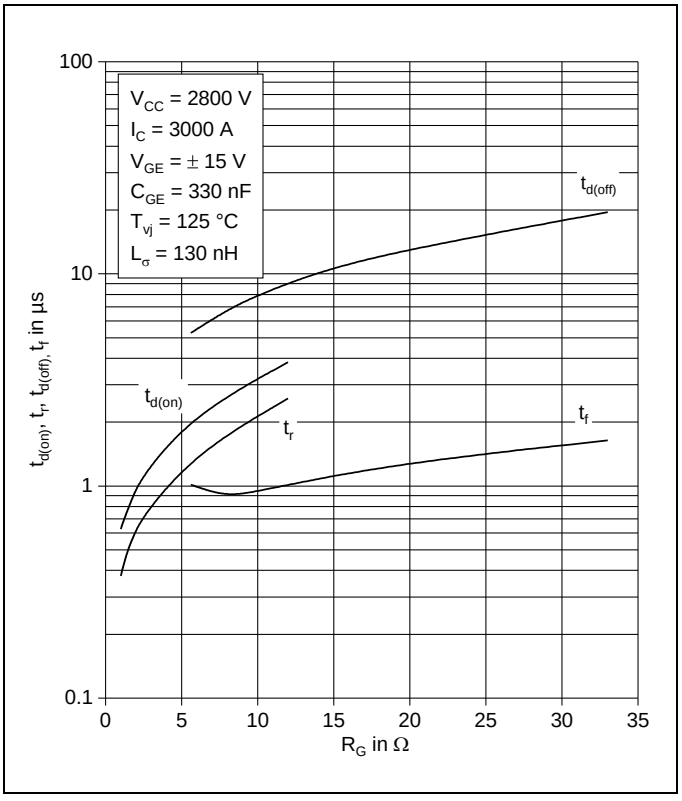


Fig. 8 Typical switching times vs. gate resistor

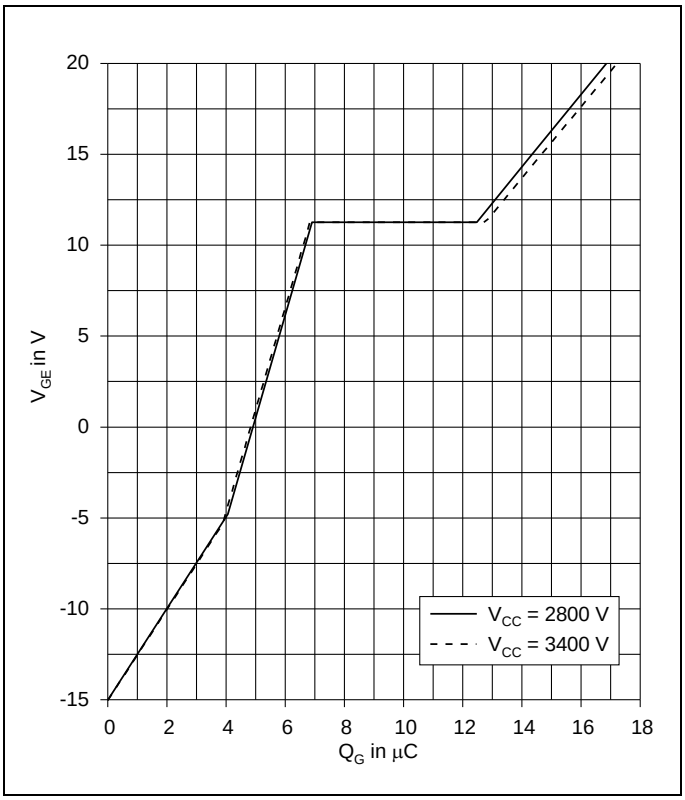


Fig. 9 Typical gate charge characteristics

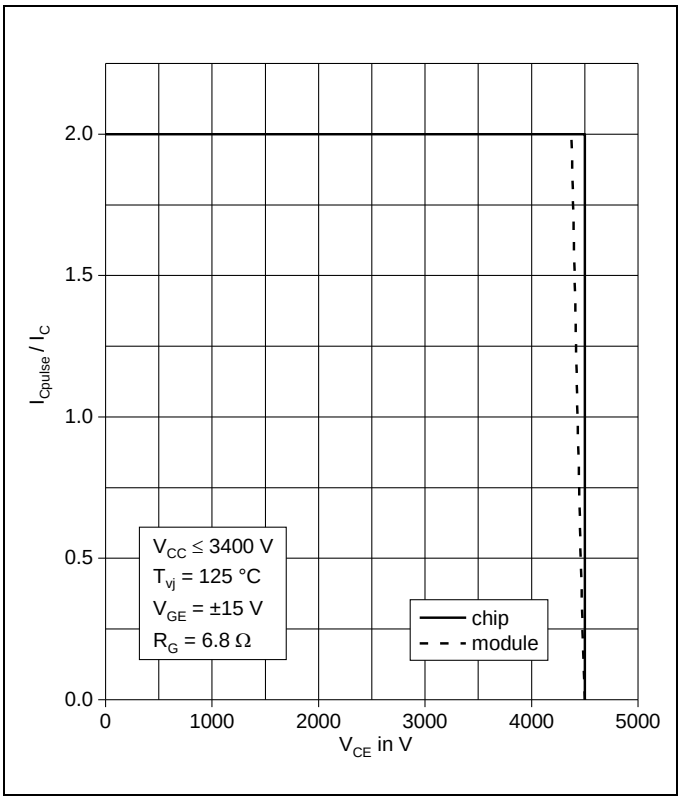


Fig. 10 Turn-off safe operating area (RBSOA)

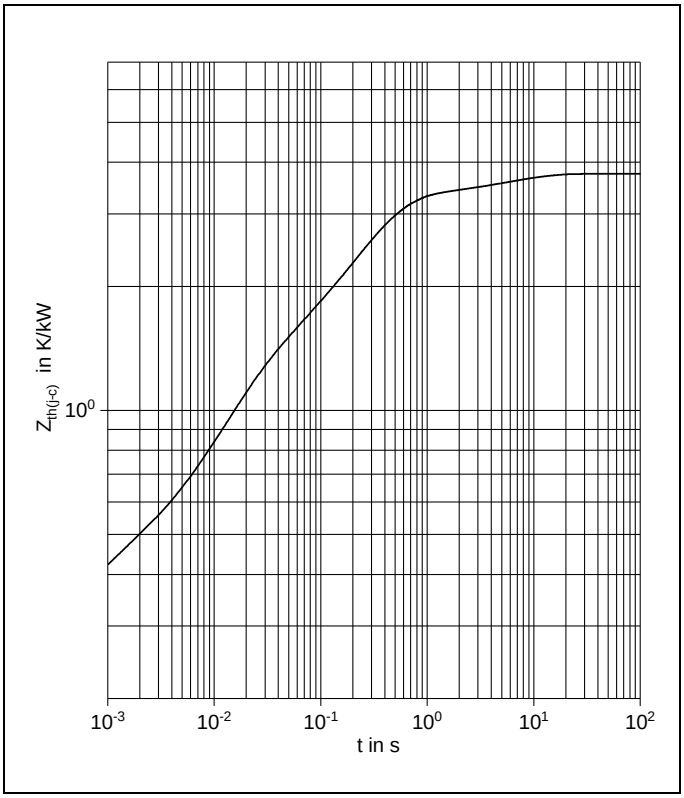


Fig. 11 Thermal impedance vs. time

Analytical function for transient thermal impedance:

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

IGBT

i	1	2	3	4	5
R_i in K/kW	2.089	0.819	0.449	0.397	
τ_i in s	0.2862	0.0168	6.0189	0.0004	

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