

5SNA 2000K450300

StakPak IGBT Module

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

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}	$V_{GE} = 0 \text{ V}$, $T_{vj} \geq 25 \text{ °C}$		4500	V
DC collector current	I_C	$T_C = 95 \text{ °C}$, $T_{vj} = 125 \text{ °C}$		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}	$T_C = 25 \text{ °C}$, $T_{vj} = 125 \text{ °C}$		25000	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		32000	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	°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	$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}$, $I_C = 10 \text{ mA}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$	4500			V
Collector-emitter ⁵⁾ saturation voltage	$V_{CE \text{ sat}}$	$I_C = 2000 \text{ A}$, $V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	2.7	3.0	V
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	3.4	3.7	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
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	80	120	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	$V_{GE(th)}$	$I_C = 360 \text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$	5.3		7.3	V
Gate charge	Q_G	$I_C = 2000 \text{ A}$, $V_{CE} = 2800 \text{ V}$, $V_{GE} = -15 \text{ V} \dots 15 \text{ V}$		10.7		μC
Input capacitance	C_{ies}	$V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$		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	$t_{d(on)}$	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 1.8 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 200 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	800		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	720		ns
Rise time	t_r		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	500		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	600		ns
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 8.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 200 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	4500		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	5000		ns
Fall time	t_f		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	700		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	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	8000		mJ
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	11000		mJ
Turn-off switching energy	E_{off}	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 8.2 \text{ } \Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 200 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	8000		mJ
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	10500		mJ
Short circuit current	I_{SC}	$t_{psc} \leq 10 \text{ } \mu\text{s}$, $V_{GE} = 15 \text{ V}$, $V_{CC} = 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 4500 \text{ V}$	$T_{vj} = 125 \text{ }^{\circ}\text{C}$	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

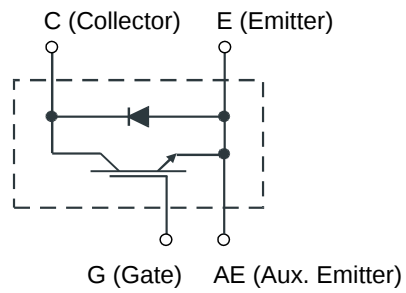
Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				0.004	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.004	K/W
IGBT thermal resistance ²⁾ case to heatsink	$R_{th(c-h)IGBT}$	Heatsink flatness : Complete module area < 100 μm 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

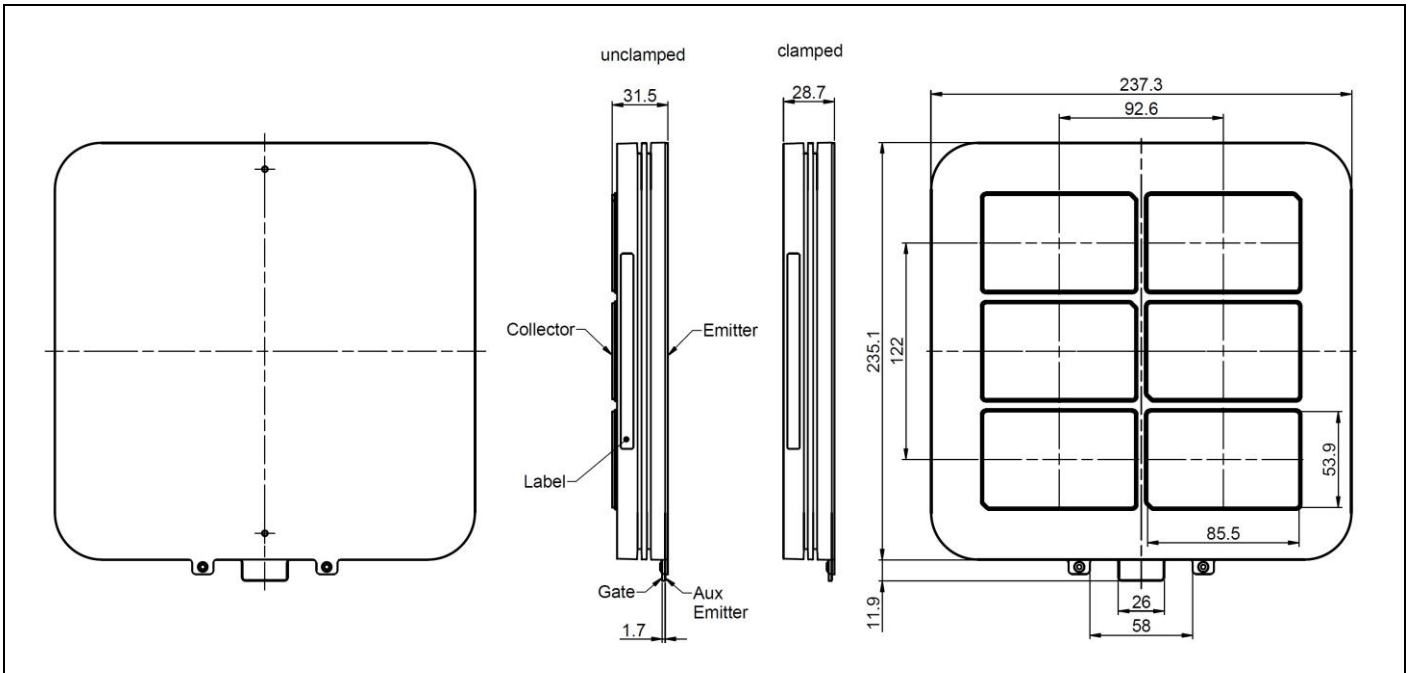
Mechanical properties

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.

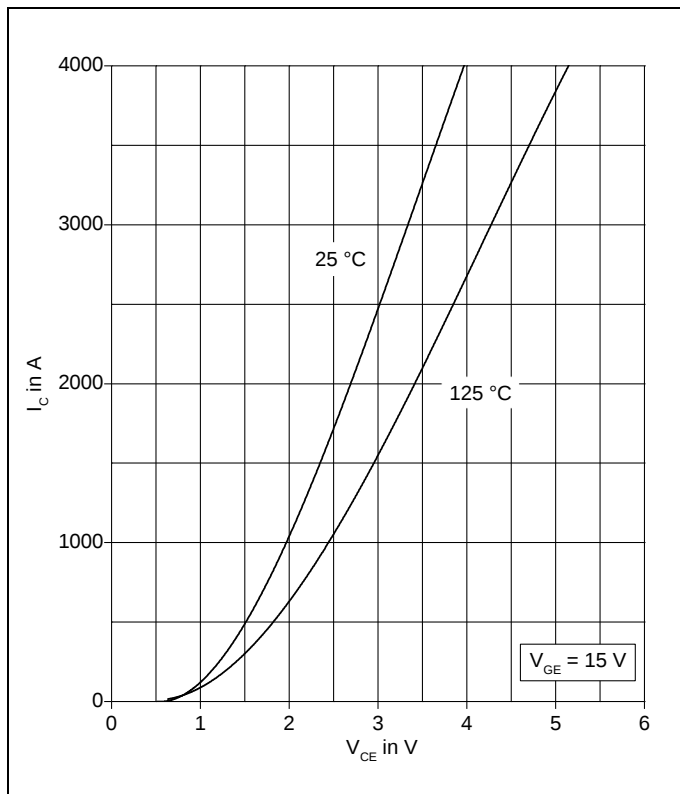


Fig. 1 Typical on-state characteristics, chip level

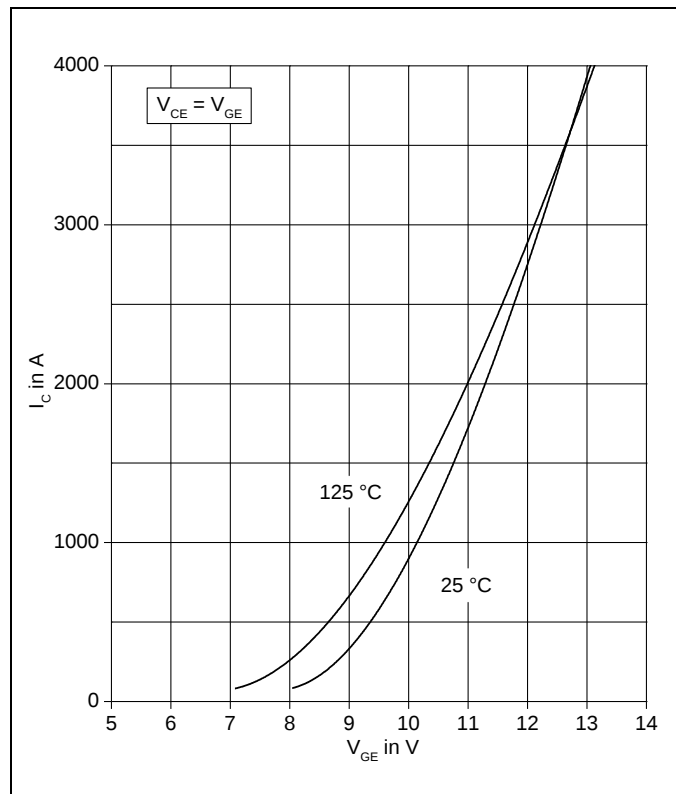


Fig. 2 Typical transfer characteristics, chip level

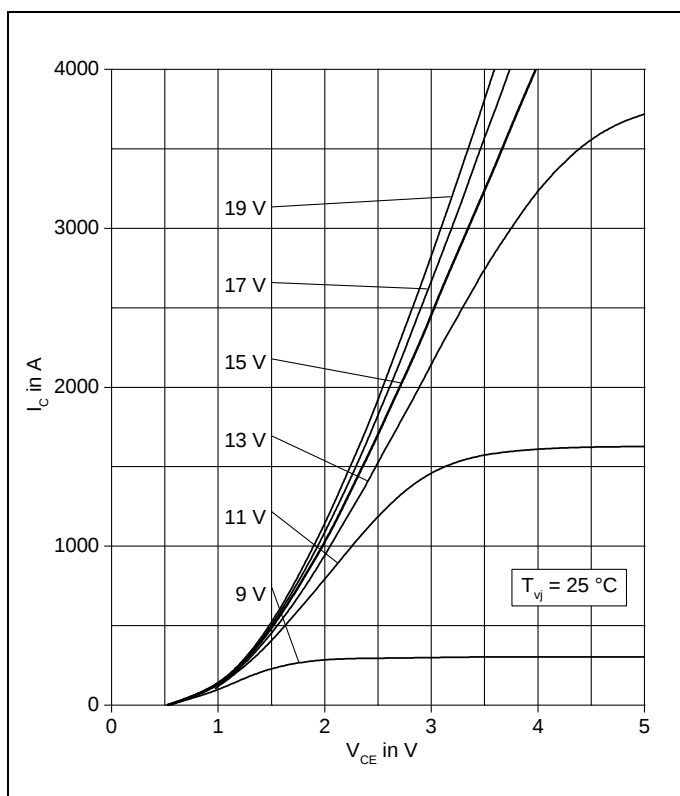


Fig. 3 Typical output characteristics, chip level

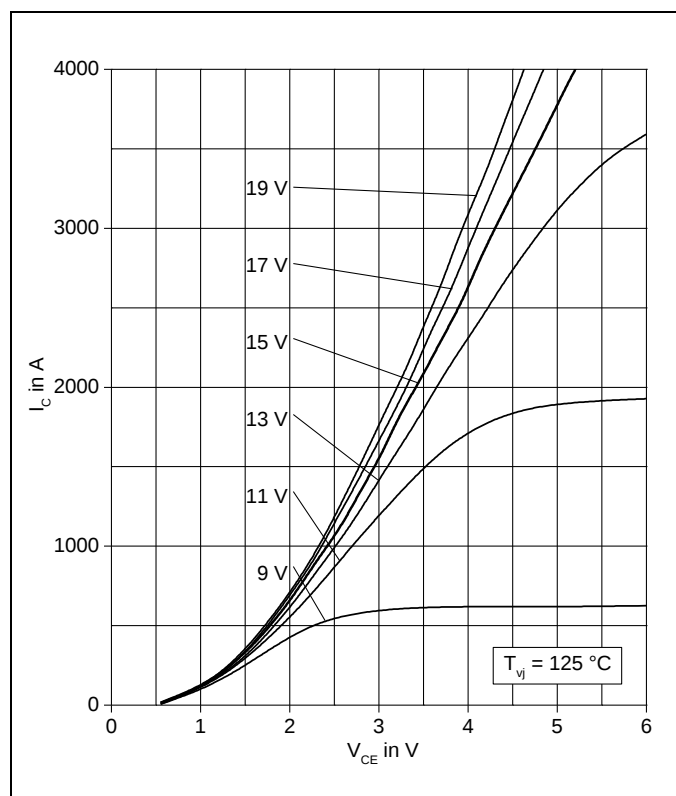


Fig. 4 Typical output characteristics, chip level

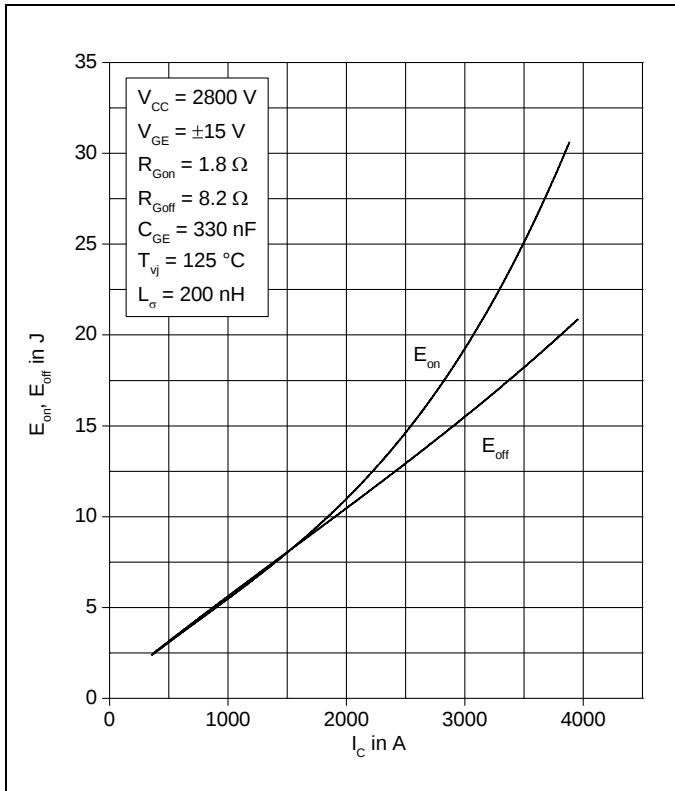


Fig. 5 Typical switching energies per pulse vs. collector current

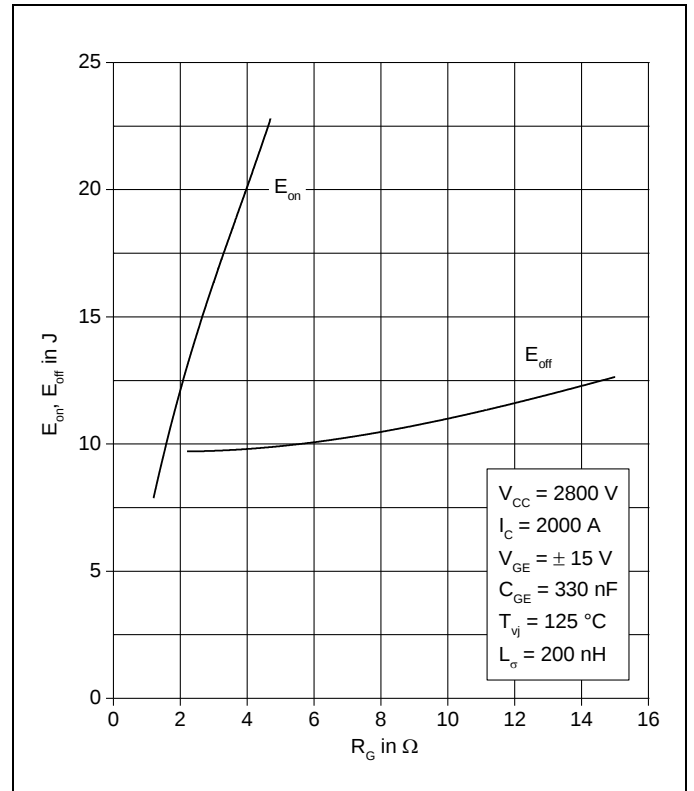


Fig. 6 Typical switching energies per pulse vs. gate resistor

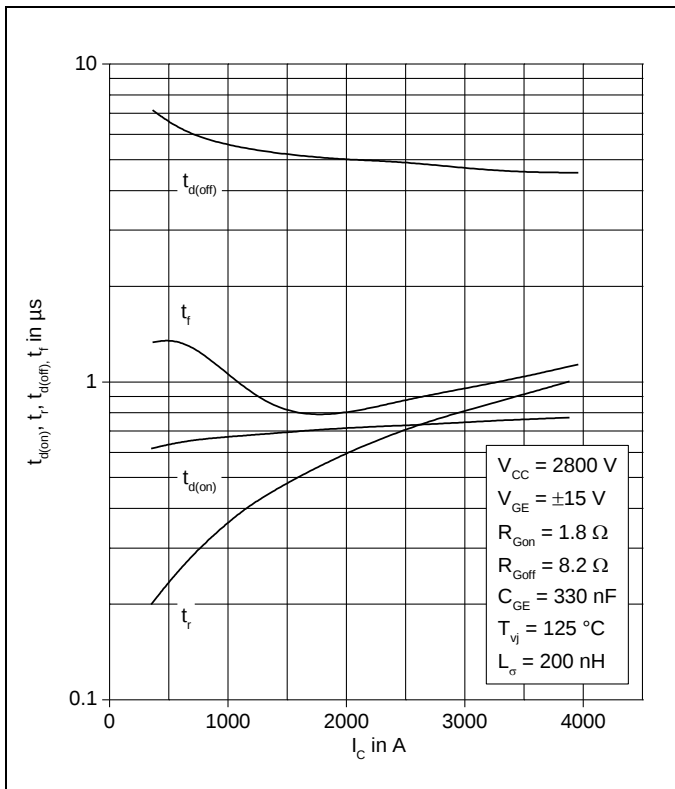


Fig. 7 Typical switching times vs. collector current

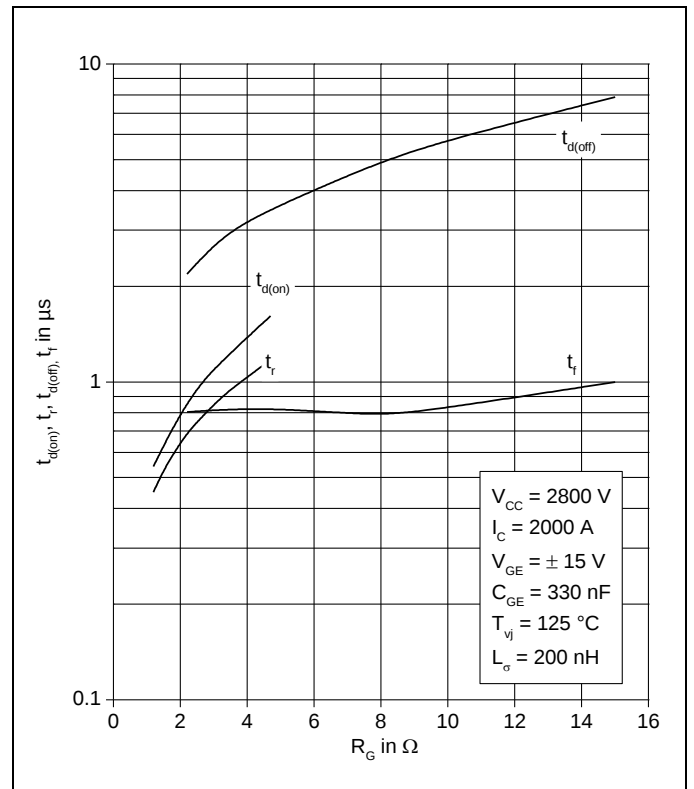


Fig. 8 Typical switching times vs. gate resistor

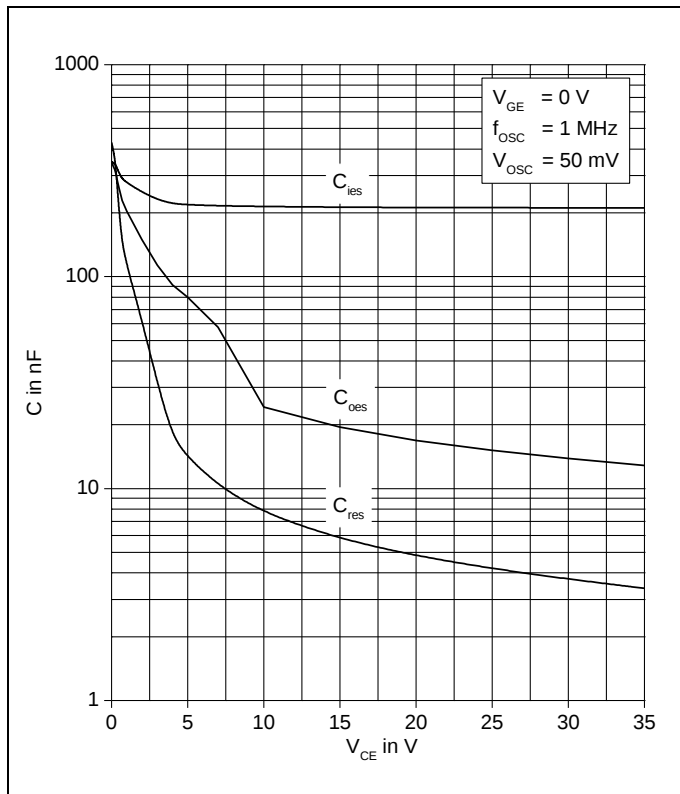


Fig. 9 Typical capacitances vs. collector-emitter voltage

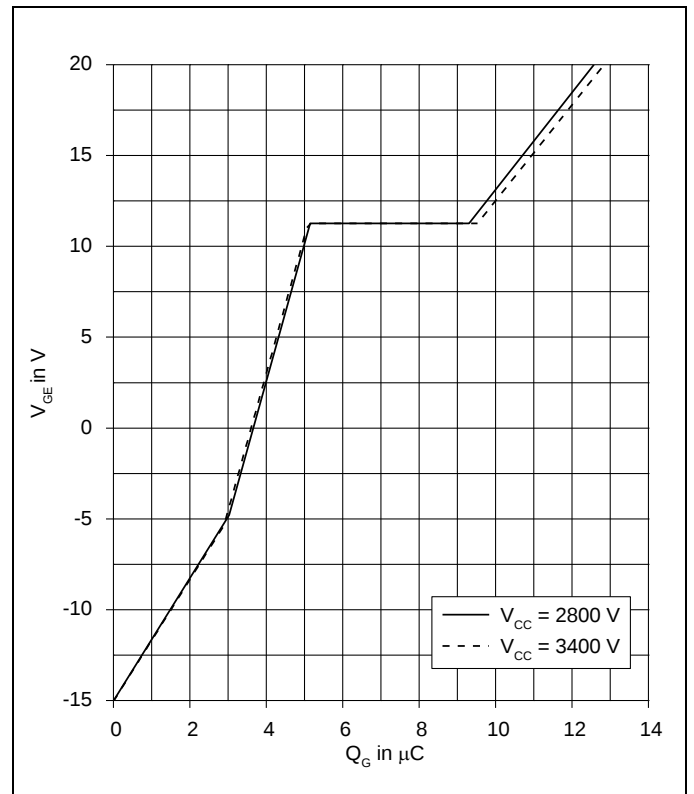


Fig. 10 Typical gate charge characteristics

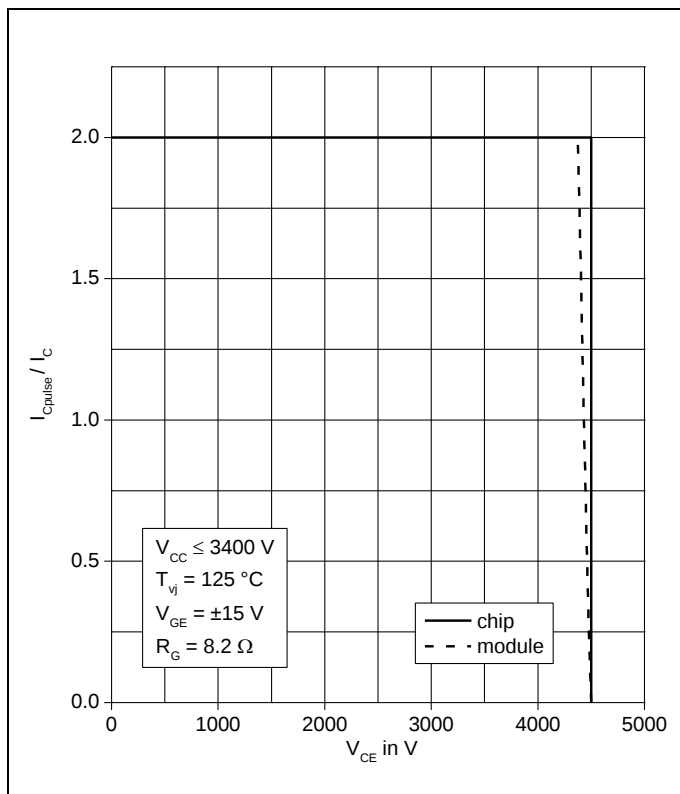


Fig. 11 Turn-off safe operating area (RBSOA)

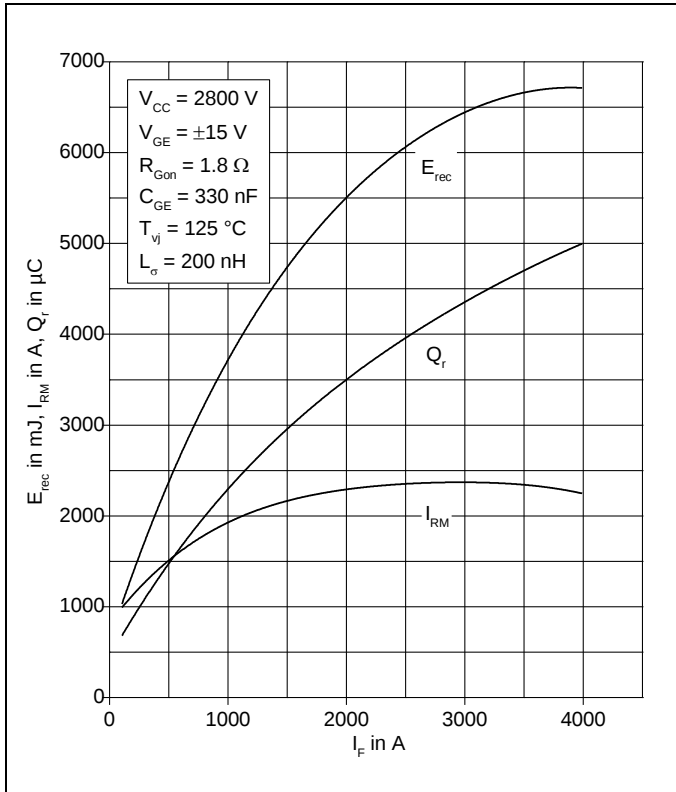


Fig. 12 Typical reverse recovery characteristics vs. forward current

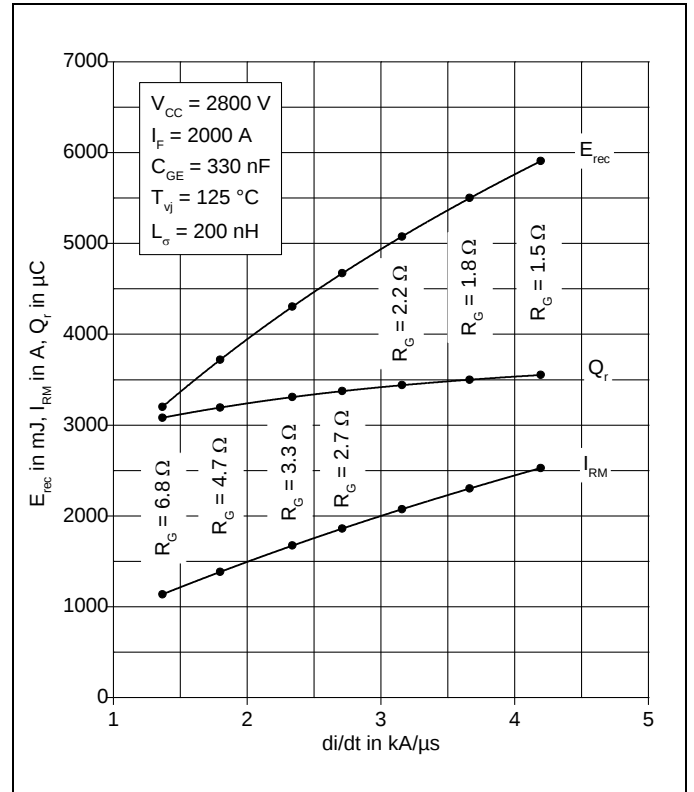


Fig. 13 Typical reverse recovery characteristics vs. di/dt

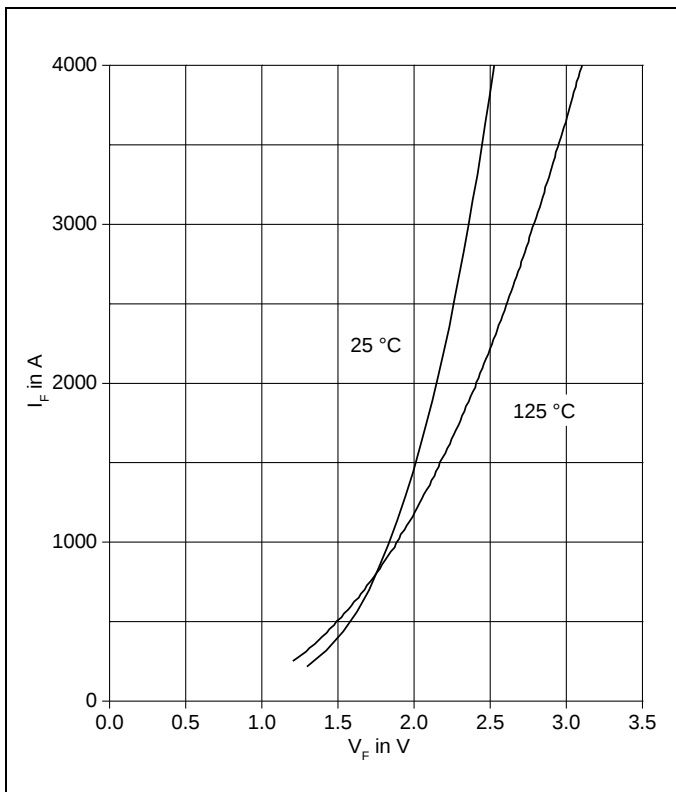


Fig. 14 Typical diode forward characteristics chip level

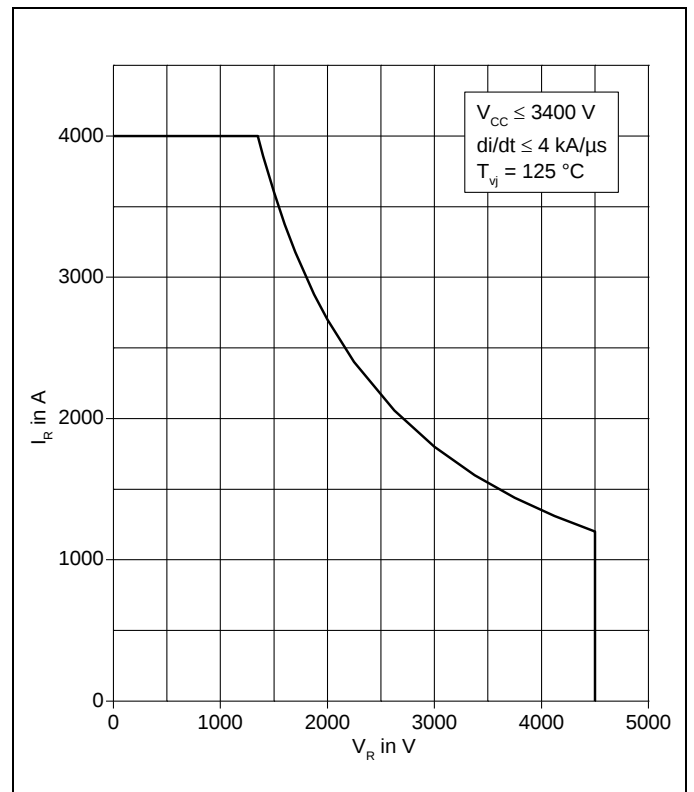


Fig. 15 Safe operating area diode (SOA)

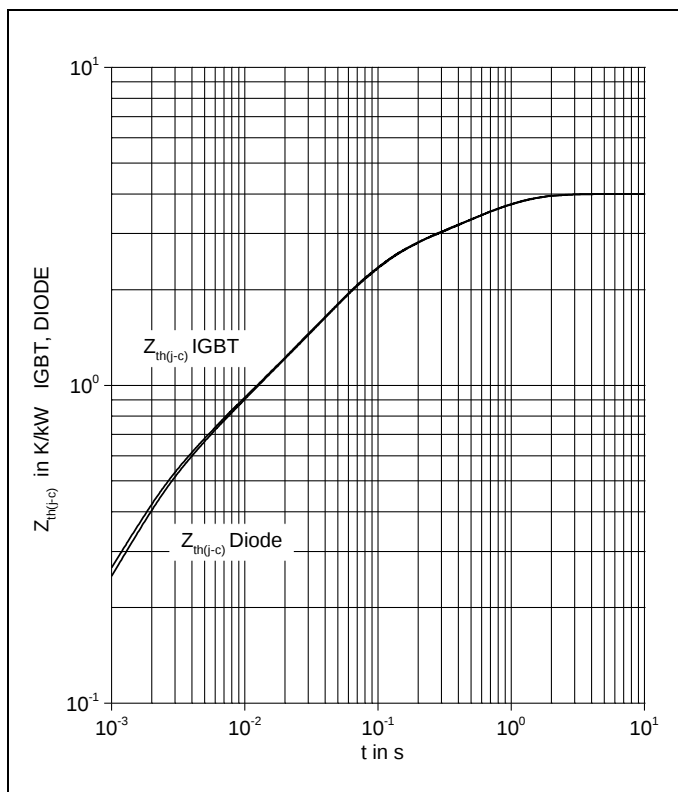


Fig. 16 Thermal impedance vs. time

Analytical function for transient thermal impedance:

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

	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

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