Data Sheet, Doc. No. 5SYA 1467-01 11-2018

5SJA 3000L520300
StakPak BIGT Module

V_{CE} = 5200 V
I_C = 3000 A

Low-loss, rugged BIGT 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		5200	V
DC collector current	I_C	T_C = 108 °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		55500	W
DC forward current	I_F			3000	A
Peak forward current	I_{FRM}	t_p = 1 ms		6000	A
Peak diode recovery power	P_{prec}	$V_{CC} \leq$ 3400 V, $V_{CEM\ CHIP} \leq$ 5200 V, T_{vj} = 125 °C, di/dt = 7.5 kA/µs, L_σ = 150 nH, inductive load		7.5	MW
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 125 °C, V_{GE} = 0 V, t_p = 10 ms, half-sinewave, 3 times during lifetime		42000	A
BIGT turn off SOA (IGBT mode)	RBSOA	$V_{CC} \leq$ 3400 V, $V_{CEM\ CHIP} \leq$ 5200 V, T_{vj} = 125 °C, V_{GE} = 15 V, R_G = 1.2 Ω, C_{GE} = 330 nF, L_σ = 150 nH, inductive load		6000	A
BIGT turn off SOA (IGBT mode)	RBSOA	$V_{CC} \leq$ 3800 V, $V_{CEM\ CHIP} \leq$ 5200 V, T_{vj} = 125 °C, V_{GE} = 15 V, R_G = 1.2 Ω, C_{GE} = 330 nF, L_σ = 150 nH, inductive load		3000	A
BIGT short circuit SOA	t_{psc}	V_{CC} = 3400 V, $V_{CEM\ CHIP} \leq$ 5200 V $V_{GE} \leq$ 15 V, $T_{vj} \leq$ 125 °C		10	µs
Junction temperature	T_{vj}		5	150	°C
Junction operating temperature	$T_{vj(op)}$		5	125	°C
Case temperature	T_C		5	70	°C
Storage temperature	T_{stg}		-40	70	°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
* Functionality is load profile dependent and needs 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		5200			V
Collector-emitter [5)] saturation voltage	$V_{CE\ sat}$	I_C = 3000 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.73		V
			T_{vj} = 125 °C		3.13		V
Collector cut-off current	I_{CES}	V_{CE} = 5200 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
			T_{vj} = 125 °C		60	120	mA
Gate leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ± 20 V, T_{vj} = 25 °C		-750		750	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 480 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.2		7.2	V
Gate charge	Q_G	I_C = 3000 A, V_{CE} = 2800 V, V_{GE} = -15 V ..15 V			25.5		μC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			439		nF
Output capacitance	C_{oes}				19.9		nF
Reverse transfer capacitance	C_{res}				30.0		nF
Internal gate resistor	R_{Gint}				0.104		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 = 150 nH, inductive load	T_{vj} = 25 °C		760		ns
			T_{vj} = 125 °C		880		ns
Rise time	t_r		T_{vj} = 25 °C		420		ns
			T_{vj} = 125 °C		420		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 2800 V, I_C = 3000 A, R_G = 1.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 150 nH, inductive load	T_{vj} = 25 °C		2760		ns
			T_{vj} = 125 °C		3040		ns
Fall time	t_f		T_{vj} = 25 °C		860		ns
			T_{vj} = 125 °C		980		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 = 150 nH, inductive load	T_{vj} = 25 °C		11100		mJ
			T_{vj} = 125 °C		14200		mJ
Turn-off switching energy	E_{off}	V_{CC} = 2800 V, I_C = 3000 A, R_G = 1.2 Ω, C_{GE} = 330 nF, V_{GE} = ±15 V, L_σ = 150 nH, inductive load	Tvj = 25 °C		14100		mJ
			Tvj = 125 °C		18500		mJ
Short circuit current	I_{SC}	t_{psc} ≤ 10 μs, V_{GE} = 15 V, V_{CC} = 3400 V, $V_{CEM\ CHIP}$ ≤ 5200 V	Tvj = 125 °C		18000		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 = 3000 A, V_{GE} = 0 V	T_{vj} = 25 °C		2.29		V
			T_{vj} = 125 °C		2.52		V
		I_F = 3000 A, V_{GE} = 15 V	T_{vj} = 25 °C		3.47		V
			T_{vj} = 125 °C		3.63		V
Peak reverse recovery current	I_{RM}	V_{CC} = 2800 V, I_F = 3000 A, V_{GE} = ±15 V, R_G = 1.2 Ω, C_{GE} = 330 nF, di/dt = 6.9 kA/µs L_σ = 150 nH, inductive load	T_{vj} = 25 °C		3800		A
			T_{vj} = 125 °C		4500		A
Recovered charge	Q_r		T_{vj} = 25 °C		5100		µC
			T_{vj} = 125 °C		7600		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		2680		ns
			T_{vj} = 125 °C		2840		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		9500		mJ
			T_{vj} = 125 °C		14500		mJ

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

Package properties

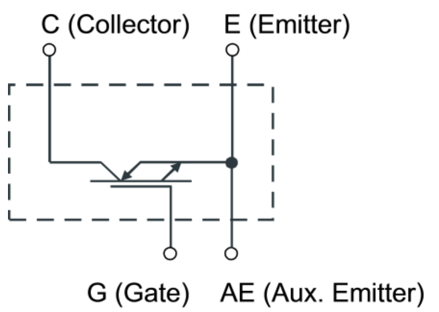
Parameter	Symbol	Conditions	min	typ	max	Unit
BIGT thermal resistance junction to case	$R_{th(j-c)IGBT}$				2.10	K/kW
BIGT thermal resistance [2)] case to heatsink	$R_{th(c-h)IGBT}$	Heatsink flatness : Complete module area < 100 µm Each submodule area < 20 µm Roughness : < 1.6 µm		0.55		K/kW
Comparative tracking index	CTI		600			

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

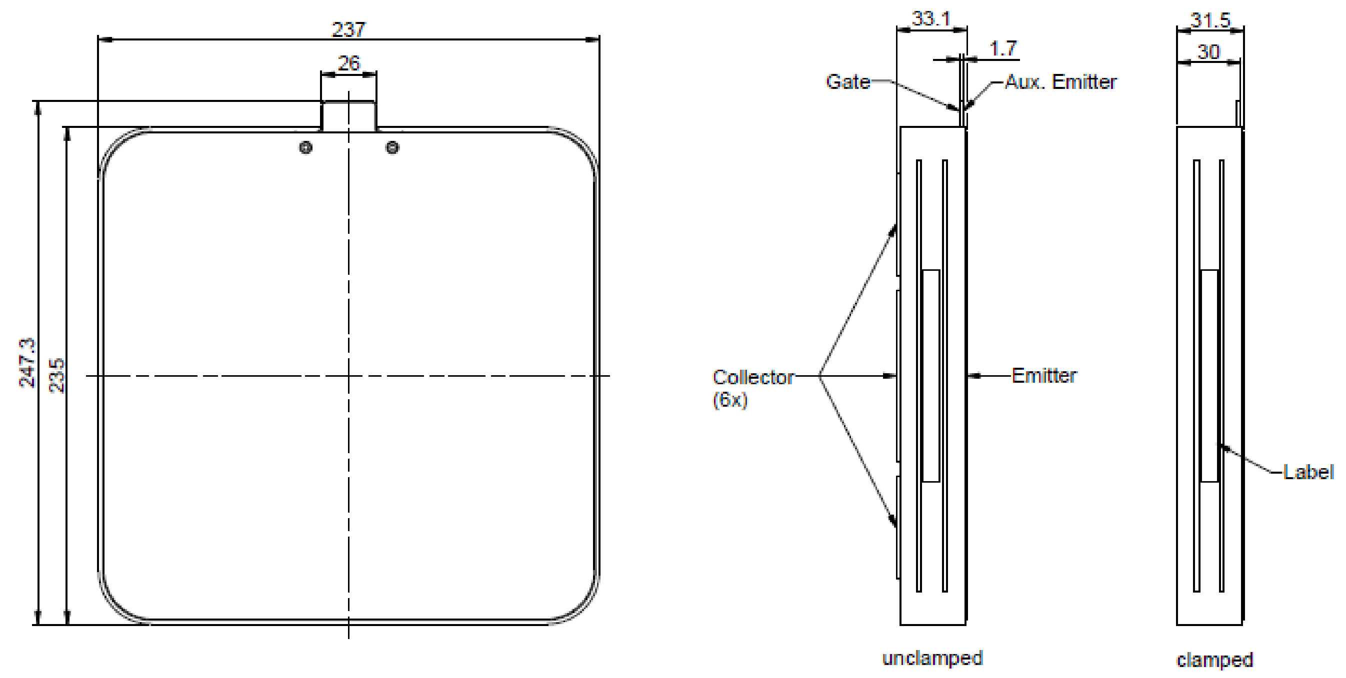
Mechanical properties

Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical	device clamped		237 x 250 x 31.5		mm
			device unclamped		237 x 250 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				4030		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.

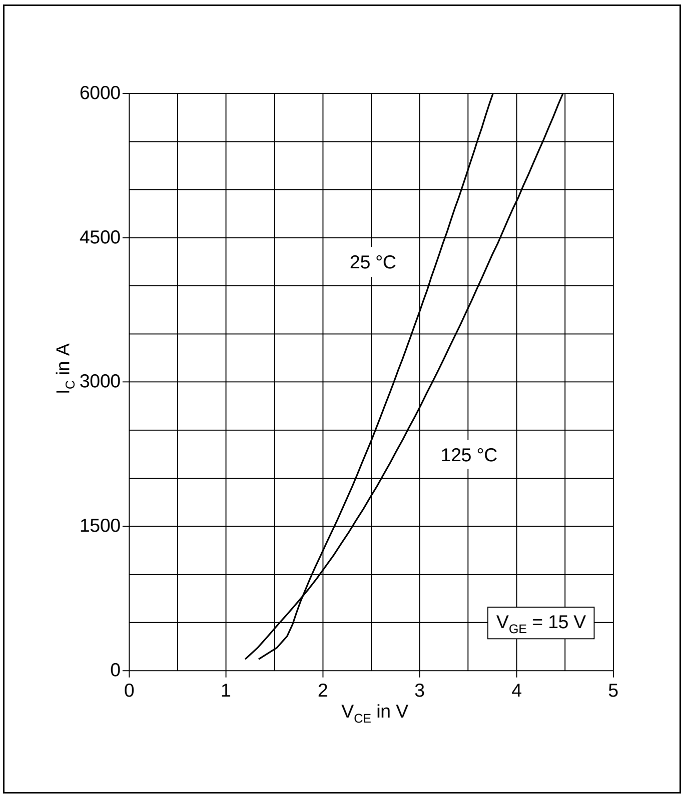


Fig. 1 Typical on-state characteristics, chip level

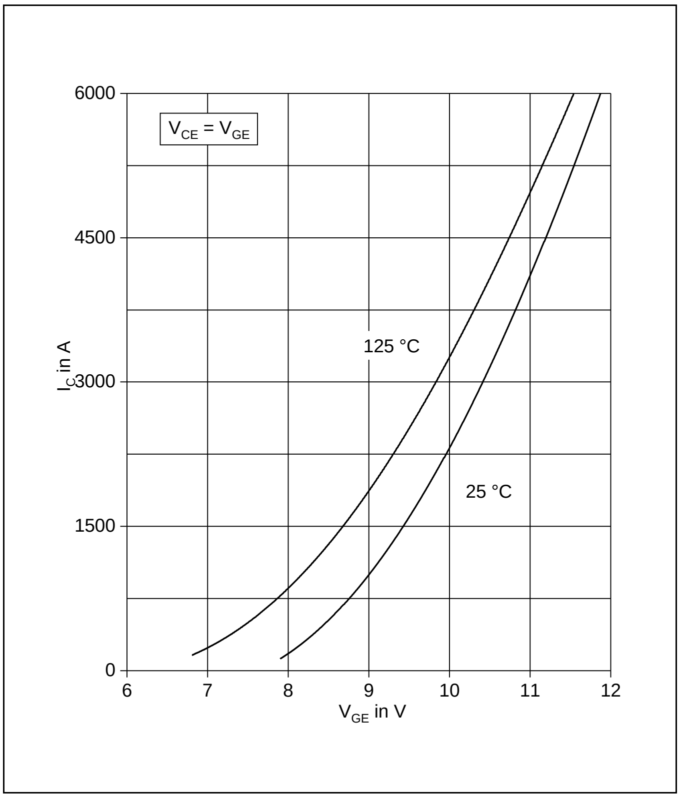


Fig. 2 Typical transfer characteristics, chip level

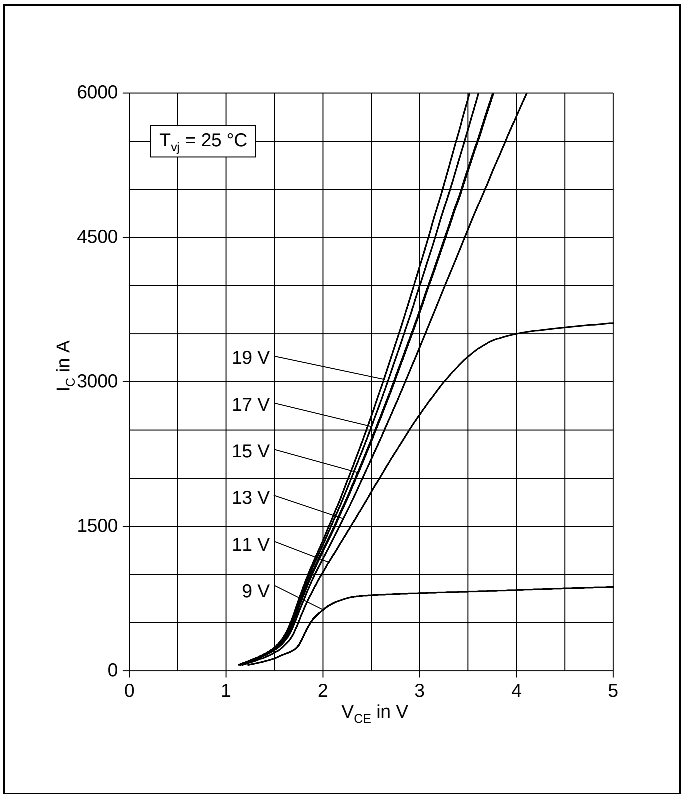


Fig. 3 Typical output characteristics, chip level

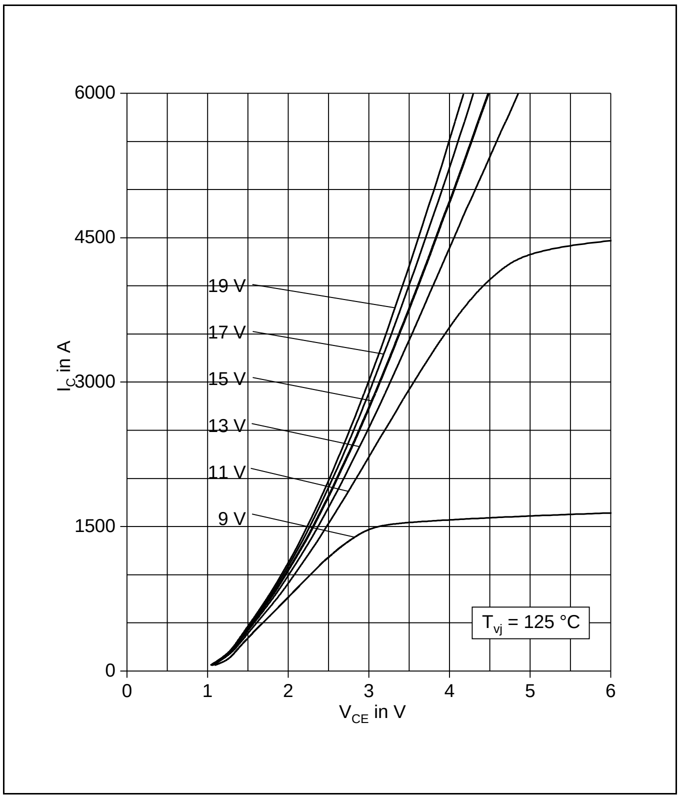


Fig. 4 Typical output characteristics, chip level

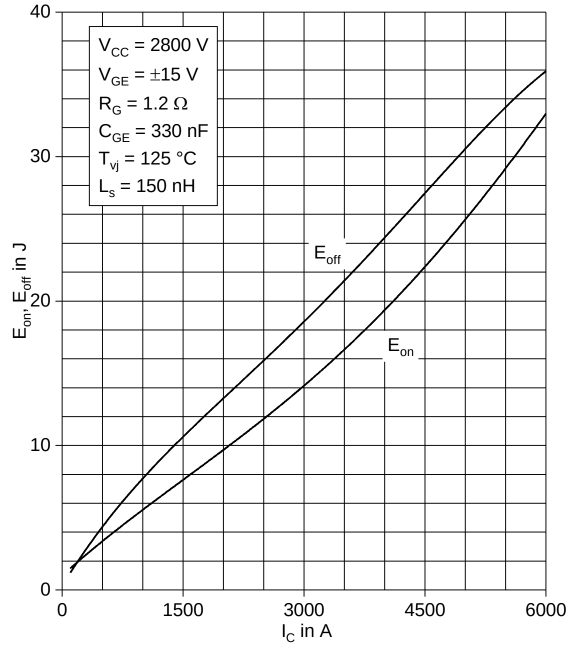


Fig. 5 Typical switching energies per pulse vs. collector current

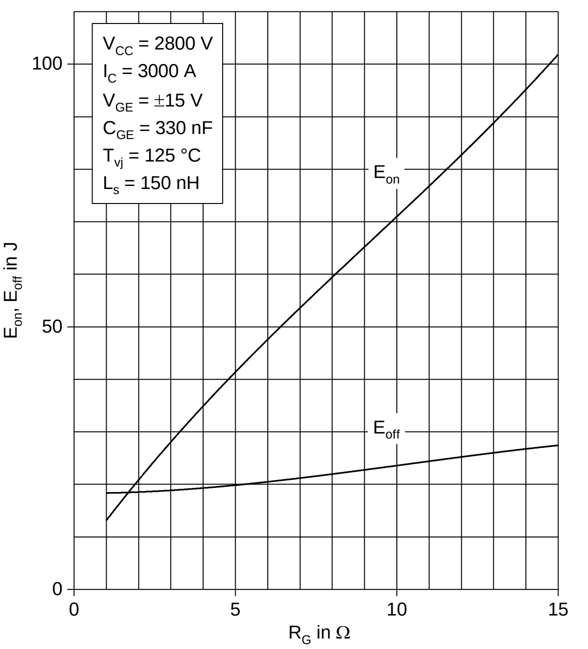


Fig. 6 Typical switching energies per pulse vs. gate resistor

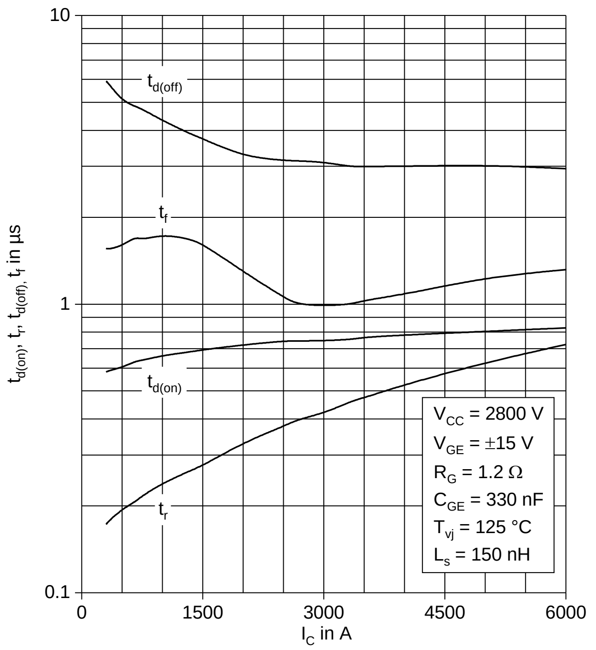


Fig. 7 Typical switching times vs. collector current

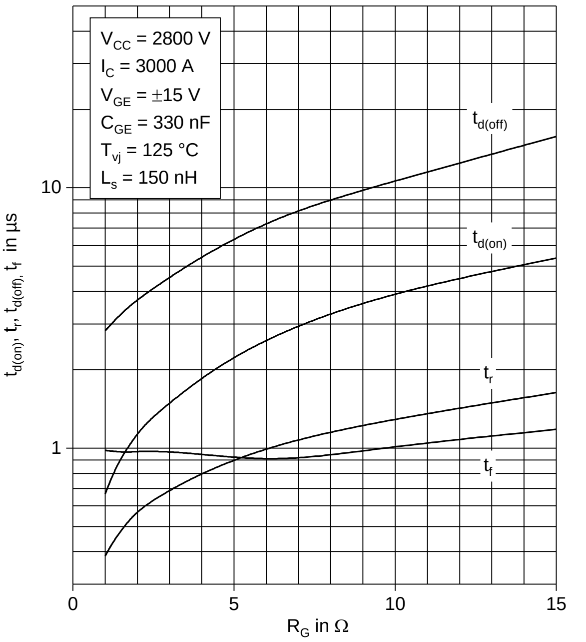


Fig. 8 Typical switching times vs. gate resistor

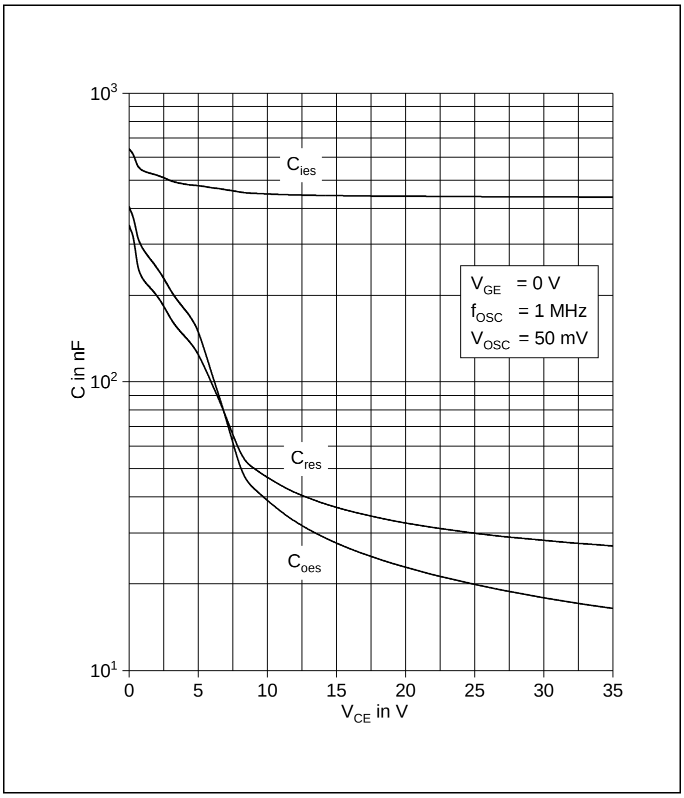


Fig. 9 Typical capacitances vs. collector-emitter voltage

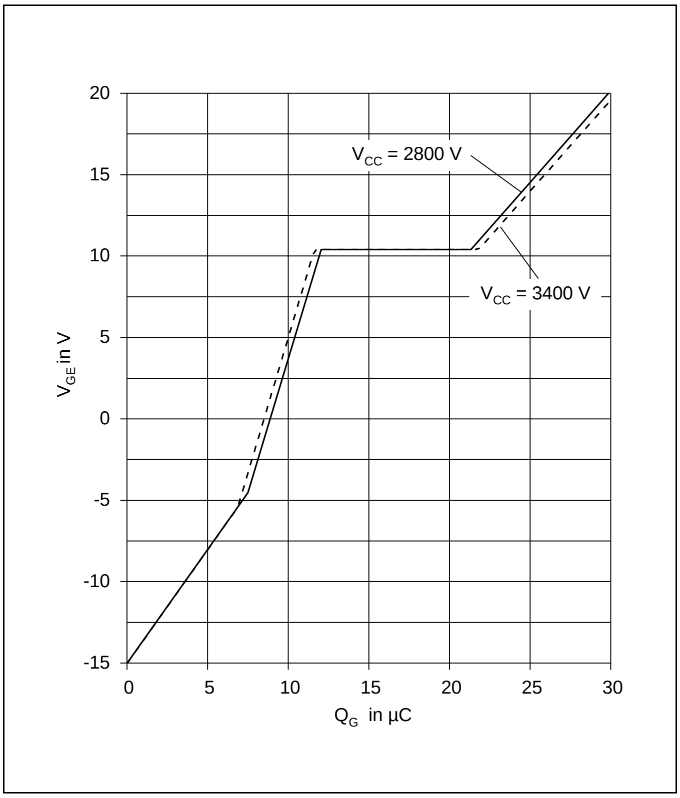


Fig. 10 Typical gate charge characteristics

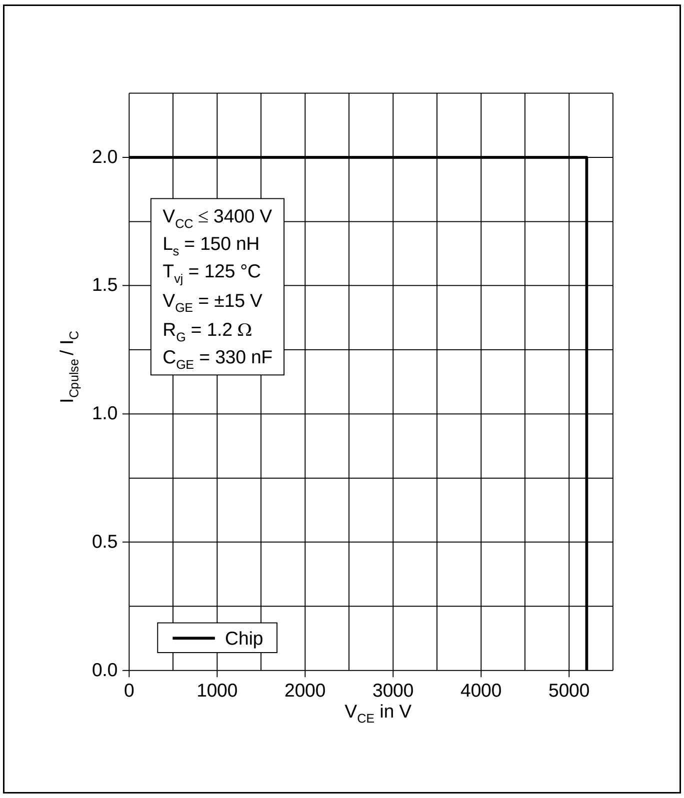


Fig. 11 Turn-off safe operating area (RBSOA)

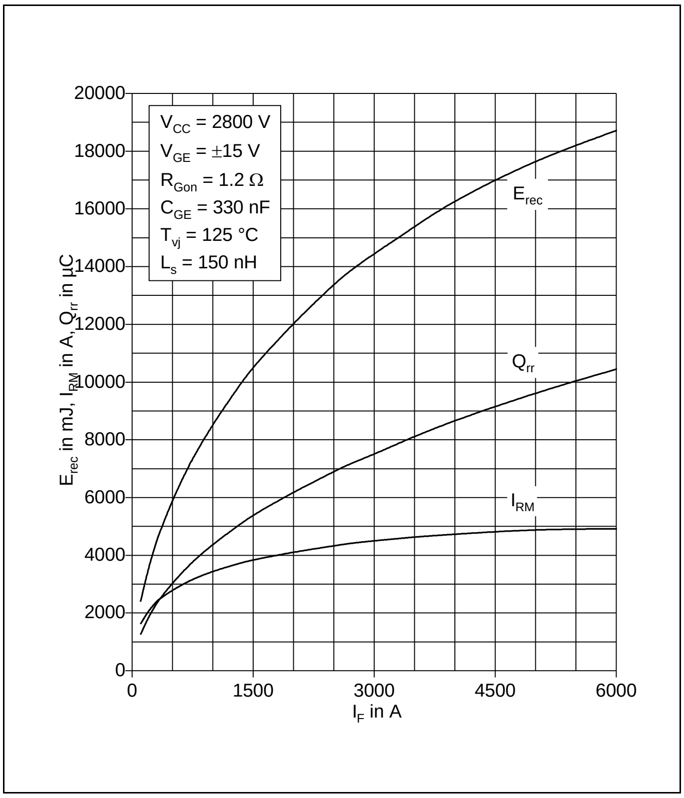


Fig. 12 Typical reverse recovery characteristics vs. forward current

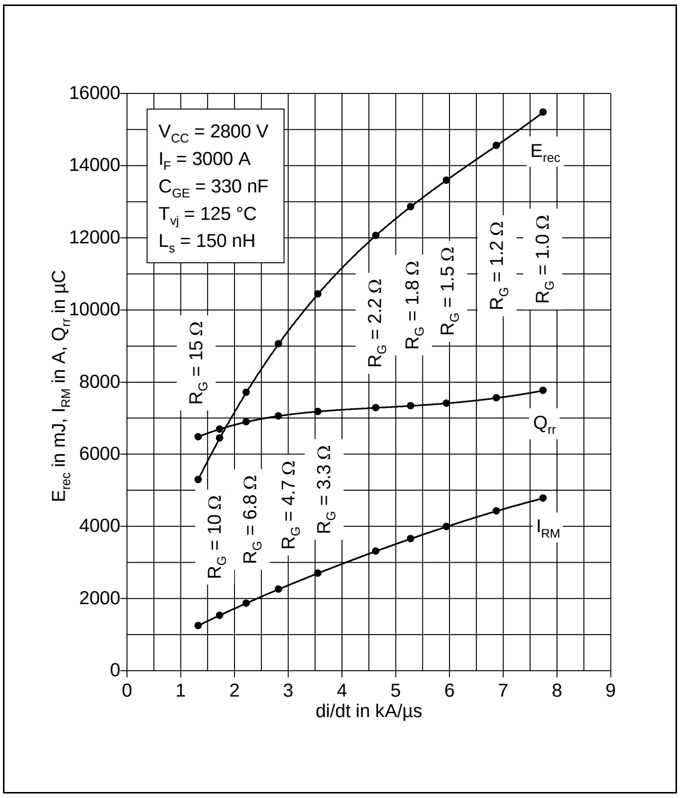


Fig. 13 Typical reverse recovery characteristics vs. di/dt

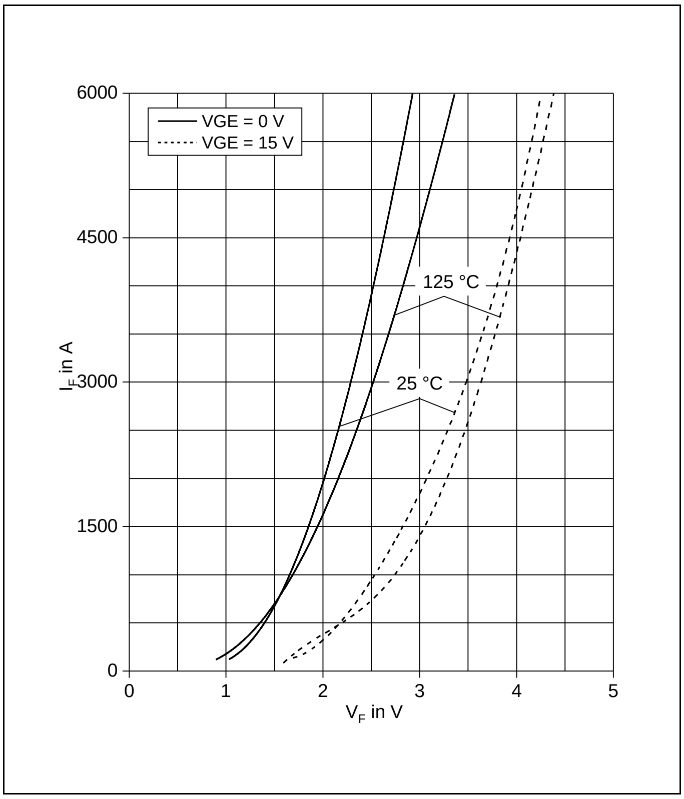


Fig. 14 Typical diode forward characteristics chip level

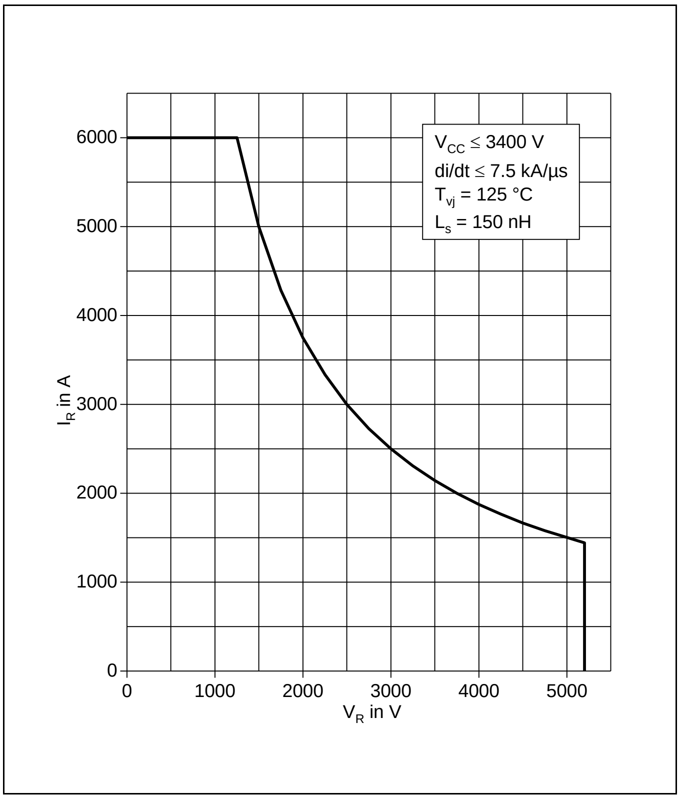
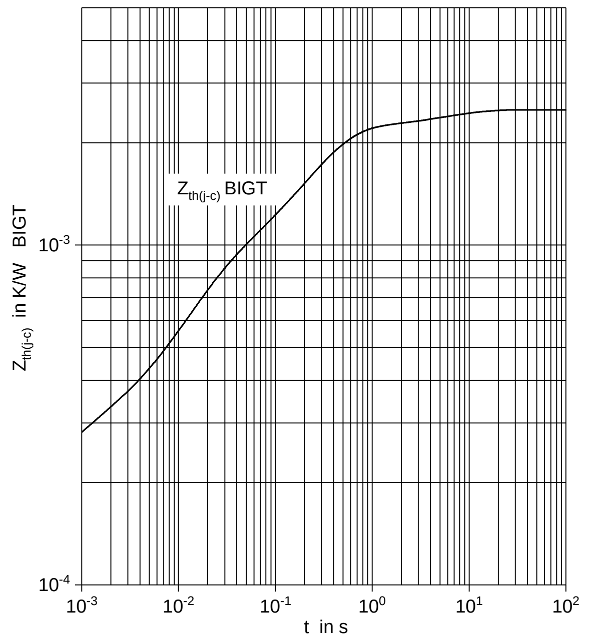


Fig. 15 Safe operating area diode (SOA)



Analytical function for transient thermal impedance:

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

	i	1	2	3	4
BIGT	R_i in K/kW	0.265	0.546	1.393	0.299
	τ_i in s	0.0004	0.0168	0.2862	6.0189

Fig. 16 Thermal impedance vs. time

Related documents:

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

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