

Data Sheet, Doc. No. 5SYA 1468-02 06-2019

5SJA 2000L520300

StakPak BIGT Module



- 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}	$V_{GE} = 0 \text{ V}$, $T_{vj} \geq 25 \text{ °C}$		5200	V
DC collector current	I_C	$T_C = 108 \text{ °C}$, $T_{vj} = 125 \text{ °C}$		2000	A
Peak collector current	I_{CM}	$t_p = 1 \text{ ms}$		4000	A
Gate-emitter voltage	V_{GES}		-20	20	V
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		28000	A
IGBT short circuit SOA	t_{psc}	$V_{CC} = 3400 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 5200 \text{ V}$ $V_{GE} \leq 15 \text{ V}$, $T_{vj \text{ start}} \leq 125 \text{ °C}$		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		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 2039

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

* Functionality is load profile dependent and needs to be agreed upon

IGBT characteristic values ³⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Collector (-emitter) breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}$, $I_C = 10 \text{ mA}$ $T_{vj} = 25 \text{ }^{\circ}\text{C}$	5200			V
Collector-emitter ⁴⁾ saturation voltage	$V_{CE sat}$	$I_C = 2000 \text{ A}$, $V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	2.73		V
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	3.14	3.44	V
Collector cut-off current	I_{CES}	$V_{CE} = 5200 \text{ V}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$		0.2	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	$V_{GE(TO)}$	$I_C = 320 \text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$	5.2		7.2	V
Gate charge	Q_{ge}	$I_C = 2000 \text{ A}$, $V_{CE} = 2800 \text{ V}$, $V_{GE} = -15 \text{ V} \dots 15 \text{ V}$		17.0		μC
Input capacitance	C_{ies}	$V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$		292		nF
Internal gate resistance	R_{Gint}			0.156		Ω
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 1.8 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 150 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	1050		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	880		ns
Rise time	t_r		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	440		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	430		ns
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 1.8 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 150 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	2750		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	3040		ns
Fall time	t_f		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	800		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	920		ns
Turn-on switching energy	E_{on}	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 1.8 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 150 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	8800		mJ
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	11100		mJ
Turn-off switching energy	E_{off}	$V_{CC} = 2800 \text{ V}$, $I_C = 2000 \text{ A}$, $R_G = 1.8 \text{ }\Omega$, $C_{GE} = 330 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_{\sigma} = 150 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	9200		mJ
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	12300		mJ
Short circuit current	I_{SC}	$V_{CC} = 3400 \text{ V}$, $V_{GE} = 15 \text{ V}$ $T_{vj start} = 125 \text{ }^{\circ}\text{C}$		12000		A

³⁾ Characteristic values according to IEC 60747 – 9⁴⁾ Collector-emitter saturation voltage is given at chip level

Diode characteristic values ⁵⁾

Parameter	Symbol	Conditions		min	typ	max	Unit	
Forward voltage ⁶⁾	V _F	I _F = 2000 A	T _{vj} = 25 °C		2.29		V	
			T _{vj} = 125 °C		2.51	2.81	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 = 4.7 kA/μs, L _σ = 150 nH, inductive load	T _{vj} = 25 °C		2400		A	
			T _{vj} = 125 °C		2800		A	
Recovered charge	Q _{rr}		T _{vj} = 25 °C		3300		μC	
			T _{vj} = 125 °C		5000		μC	
Reverse recovery time	t _{rr}		T _{vj} = 25 °C		2900		ns	
			T _{vj} = 125 °C		3300		ns	
Reverse recovery energy	E _{rec}		T _{vj} = 25 °C		5800		mJ	
			T _{vj} = 125 °C		9100		mJ	

⁵⁾ Characteristic values according to IEC 60747 – 2⁶⁾ Forward voltage is given at chip levelPackage properties ⁷⁾

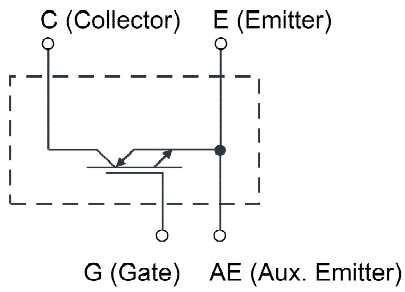
Parameter	Symbol	Conditions	min	typ	max	Unit
BIGT thermal resistance junction to case	$R_{th(j-c)BIGT}$				3.75	K/kW
BIGT thermal resistance ²⁾ case to heatsink	$R_{th(c-h)BIGT}$	Heatsink flatness: Complete module area: $< 100 \mu\text{m}$ Each submodule area: $< 20 \mu\text{m}$ Roughness: $< 1.6 \mu\text{m}$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

²⁾ For detailed mounting instructions refer to ABB Document No. 5SYA 2037-02Mechanical properties ⁷⁾

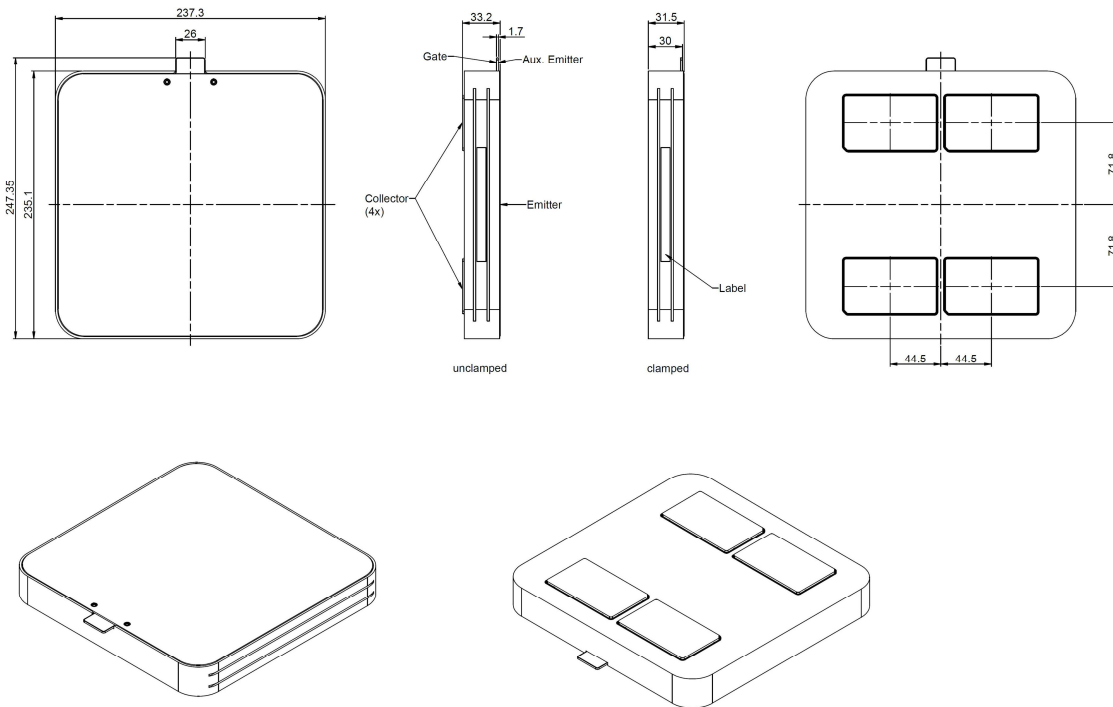
Parameter	Symbol	Conditions	min	typ	max	Unit
Dimensions	L x W x H	Typical	247.4 x 237.3 x 31.5			mm
			247.4 x 237.3 x 33.2			mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	23			mm
Surface creepage distance	d_s		30			mm
Mass	m			3350		g

⁷⁾ Package and mechanical properties according to IEC 60747 – 15

Electrical configuration



Outline drawing (mm)



Note: 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

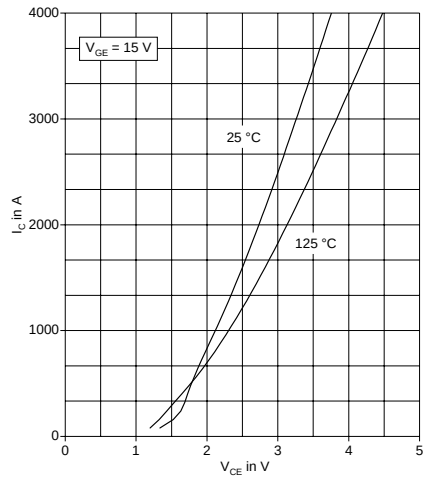


Fig. 2 Typical transfer characteristics, chip level

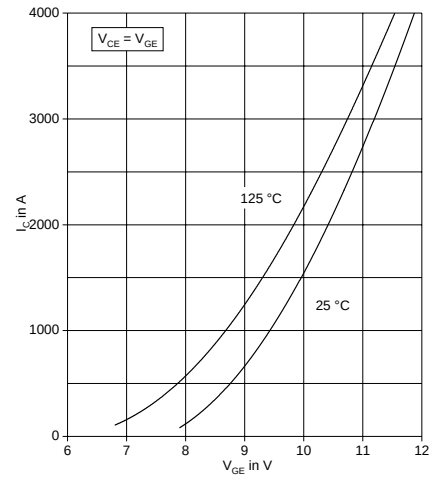


Fig. 3 Typical output characteristics, chip level

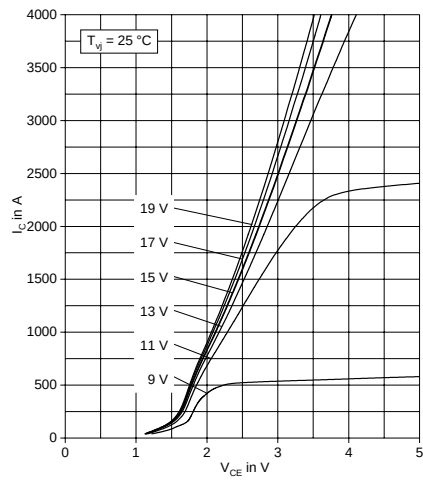


Fig. 4 Typical output characteristics, chip level

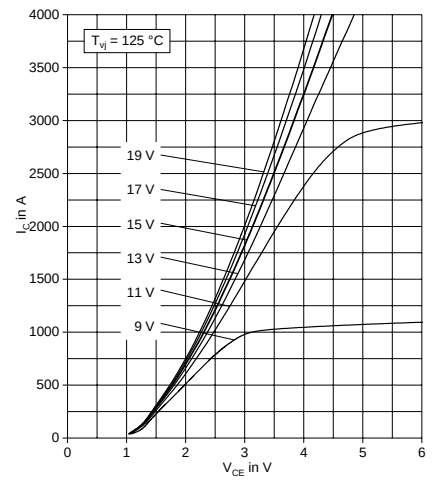


Fig. 5 Typical switching energies per pulse vs. collector current

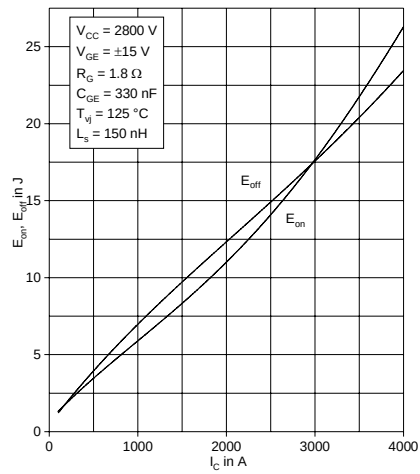


Fig. 6 Typical switching energies per pulse vs. gate resistor

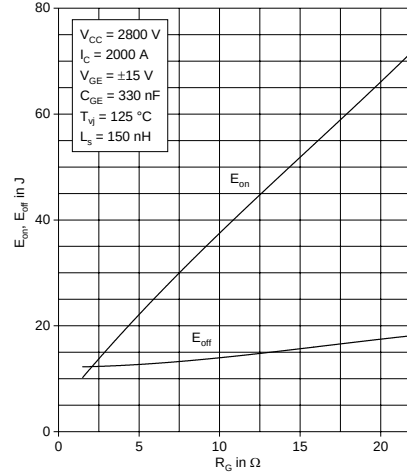


Fig. 7 Typical switching times vs. collector current

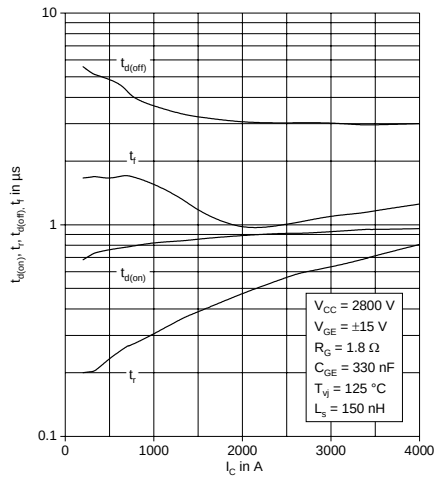


Fig. 9 Typical gate charge characteristics

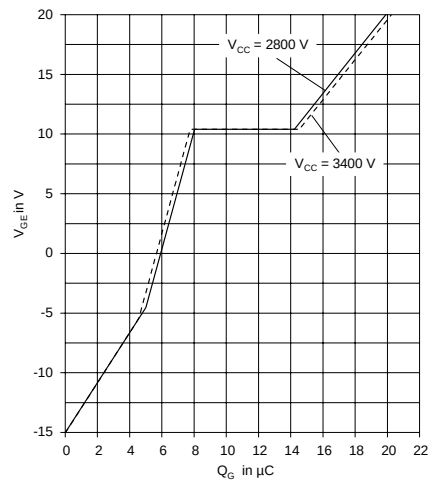


Fig. 11 Typical diode forward characteristics chip level

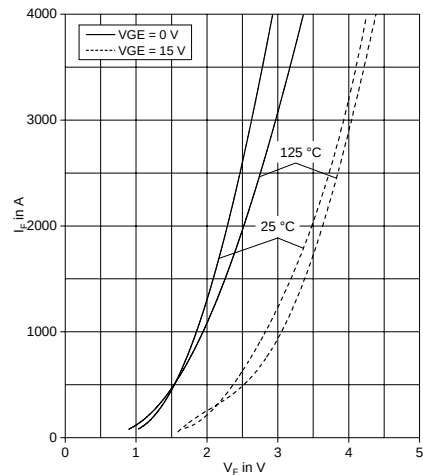


Fig. 8 Typical switching times vs. gate resistor

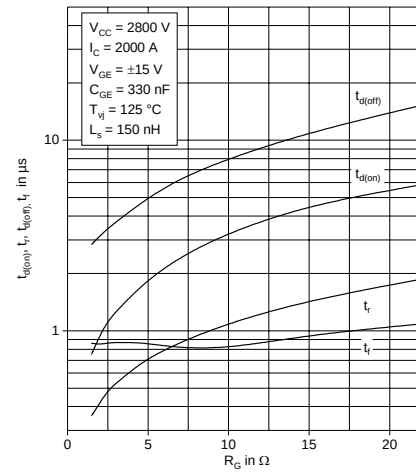


Fig. 10 Turn-off safe operating area (RBSOA)

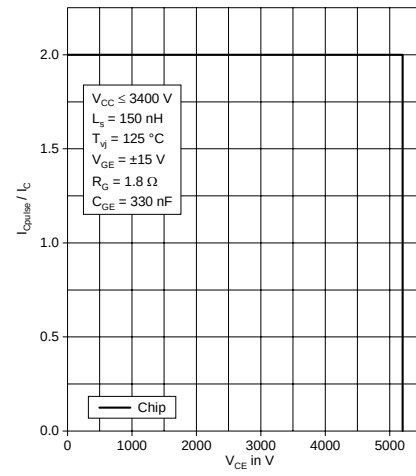


Fig. 12 Typical reverse recovery characteristics vs. forward current

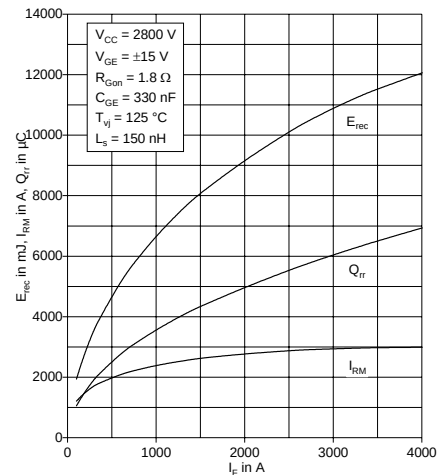


Fig. 13 Typical reverse recovery characteristics vs. di / dt

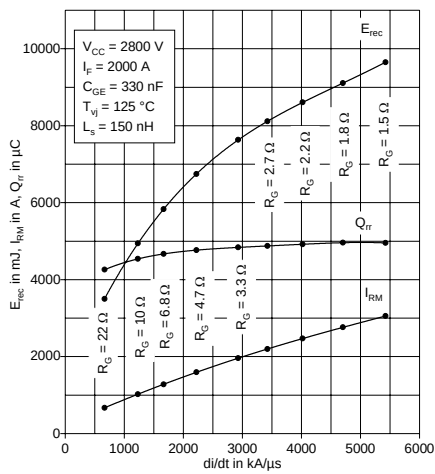


Fig. 14 Safe operating area diode (SOA)

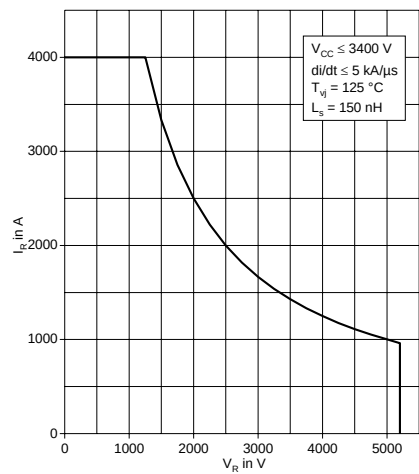
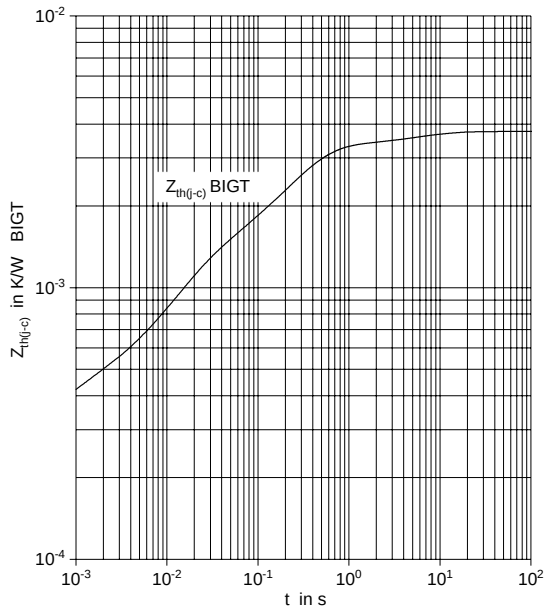


Fig. 15 Thermal impedance vs. time



Analytical function of the transient thermal resistance

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

i	1	2	3	4	5
Ri(K/kW)	0.397	0.819	2.089	0.449	
IGBT					
τi(s)	0.0004	0.0168	0.2862	6.0189	

Related documents:

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

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