Data Sheet, Doc. No. 5SYA 1433-00 12-2013

5SND 0500N330300
HiPak IGBT Module

V_{CE} = 3300 V
I_C = 500 A

Ultra low-loss, rugged SPT+ chip-set
Smooth switching SPT+ chip-set for good EMC
AlSiC base-plate for high power cycling capability
AlN substrate for low thermal resistance
2 switches in one package



Maximum rated values [1)]

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V, $T_{vj} \geq 25$ °C		3300	V
DC collector current	I_C	T_C = 100 °C, T_{vj} = 150 °C		500	A
Peak collector current	I_{CM}	t_p = 1 ms		1000	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_C = 25 °C, T_{vj} = 150 °C, per switch		4800	W
DC forward current	I_F			500	A
Peak forward current	I_{FRM}	t_p = 1 ms		1000	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 150 °C, t_p = 10 ms, half-sinewave		4500	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 2500 V, $V_{CEM\ CHIP} \leq$ 3300 V $V_{GE} \leq$ 15 V, $T_{vj} \leq$ 150 °C		10	µs
Isolation voltage	V_{isol}	1 min, f = 50 Hz		6000	V
Junction temperature	T_{vj}			175	°C
Junction operating temperature	$T_{vj(op)}$		-50	150	°C
Case temperature	T_C		-50	150	°C
Storage temperature	T_{stg}		-50	125	°C
Mounting torques [2)]	M_s	Base-heatsink, M6 screws	4	6	Nm
	M_{t1}	Main terminals, M8 screws	8	10	
	M_{t2}	Auxiliary terminals, M4 screws	2	3	

[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

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IGBT characteristic values [3)]

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		3300			V
Collector-emitter [4)] saturation voltage	$V_{CE\ sat}$	I_C = 500 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.5	2.9	V
			T_{vj} = 125 °C		3.1		V
			T_{vj} = 150 °C		3.25	3.4	V
Collector cut-off current	I_{CES}	V_{CE} = 3300 V, V_{GE} = 0 V	T_{vj} = 25 °C			0.3	mA
			T_{vj} = 125 °C		6.5	13	mA
			T_{vj} = 150 °C		30		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 = 80 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5		7	V
Gate charge	Q_G	I_C = 500 A, V_{CE} = 1800 V, V_{GE} = -15 V ..15 V			3.7		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			50		nF
Output capacitance	C_{oes}				4.2		nF
Reverse transfer capacitance	C_{res}				1.28		nF
Internal gate resistance	R_{Gint}	per switch			1.8		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 1800 V, I_C = 500 A, R_G = 3.9 Ω, V_{GE} = ±15 V, L_σ = 125 nH, inductive load	T_{vj} = 25 °C		380		ns
			T_{vj} = 125 °C		400		ns
			T_{vj} = 150 °C		400		ns
Rise time	t_r		T_{vj} = 25 °C		135		ns
			T_{vj} = 125 °C		140		ns
			T_{vj} = 150 °C		145		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 1800 V, I_C = 500 A, R_G = 3.9 Ω, V_{GE} = ±15 V, L_σ = 125 nH, inductive load	T_{vj} = 25 °C		1250		ns
			T_{vj} = 125 °C		1450		ns
			T_{vj} = 150 °C		1460		ns
Fall time	t_f		T_{vj} = 25 °C		255		ns
			T_{vj} = 125 °C		340		ns
			T_{vj} = 150 °C		360		ns
Turn-on switching energy	E_{on}	V_{CC} = 1800 V, I_C = 500 A, R_G = 3.9 Ω, V_{GE} = ±15 V, L_σ = 125 nH, inductive load	T_{vj} = 25 °C		660		mJ
			T_{vj} = 125 °C		860		mJ
			T_{vj} = 150 °C		960		mJ
Turn-off switching energy	E_{off}	V_{CC} = 1800 V, I_C = 500 A, R_G = 3.9 Ω, V_{GE} = ±15 V, L_σ = 125 nH, inductive load	T_{vj} = 25 °C		620		mJ
			T_{vj} = 125 °C		850		mJ
			T_{vj} = 150 °C		920		mJ
Short circuit current	I_{SC}	t_{psc} ≤ 10 µs, V_{GE} = 15 V, V_{CC} = 2500 V, $V_{CEM\ CHIP}$ ≤ 3300 V	T_{vj} = 150 °C		2170		A

[3)] Characteristic values according to IEC 60747 - 9
[4)] 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 = 500 A	T_{vj} = 25 °C		2.05		V
			T_{vj} = 125 °C		2.25		V
			T_{vj} = 150 °C		2.20		V
Peak reverse recovery current	I_{RM}	V_{CC} = 1800 V, I_F = 500 A, V_{GE} = ±15 V, R_G = 3.9 Ω, di/dt = 3.8 kA/µs L_σ = 125 nH, inductive load	T_{vj} = 25 °C		690		A
			T_{vj} = 125 °C		810		A
			T_{vj} = 150 °C		830		A
Recovered charge	Q_r		T_{vj} = 25 °C		360		µC
			T_{vj} = 125 °C		585		µC
			T_{vj} = 150 °C		680		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		930		ns
			T_{vj} = 125 °C		1250		ns
			T_{vj} = 150 °C		1410		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		400		mJ
			T_{vj} = 125 °C		680		mJ
			T_{vj} = 150 °C		800		mJ

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

Package properties [7)]

Parameter	Symbol	Conditions		min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$	per switch				0.026	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$					0.05	K/W
IGBT thermal resistance [2)] case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 1W/m x K			0.024		K/W
Diode thermal resistance [2)] case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = 1W/m x K			0.048		K/W
Partial discharge extinction voltage	V_e	f = 50 Hz, $Q_{PD} \leq$ 10 pC (acc. To IEC 61287)		3500			V
Comparative tracking index	CTI			600			
Module stray inductance	$L_{\sigma CE}$	per switch			24		nH
Resistance, terminal-chip	$R_{CC'+EE'}$	per switch	T_C = 25 °C		0.180		mΩ
			T_C = 125 °C		0.245		
			T_C = 150 °C		0.260		

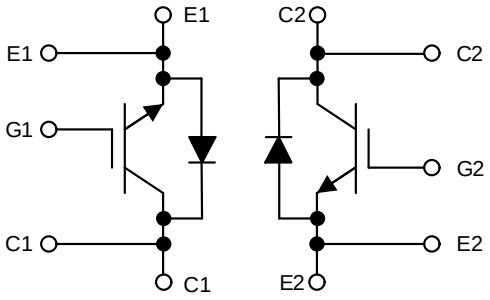
[2)] For detailed mounting instructions refer to ABB Document No. 5SYA 2039

Mechanical properties [7)]

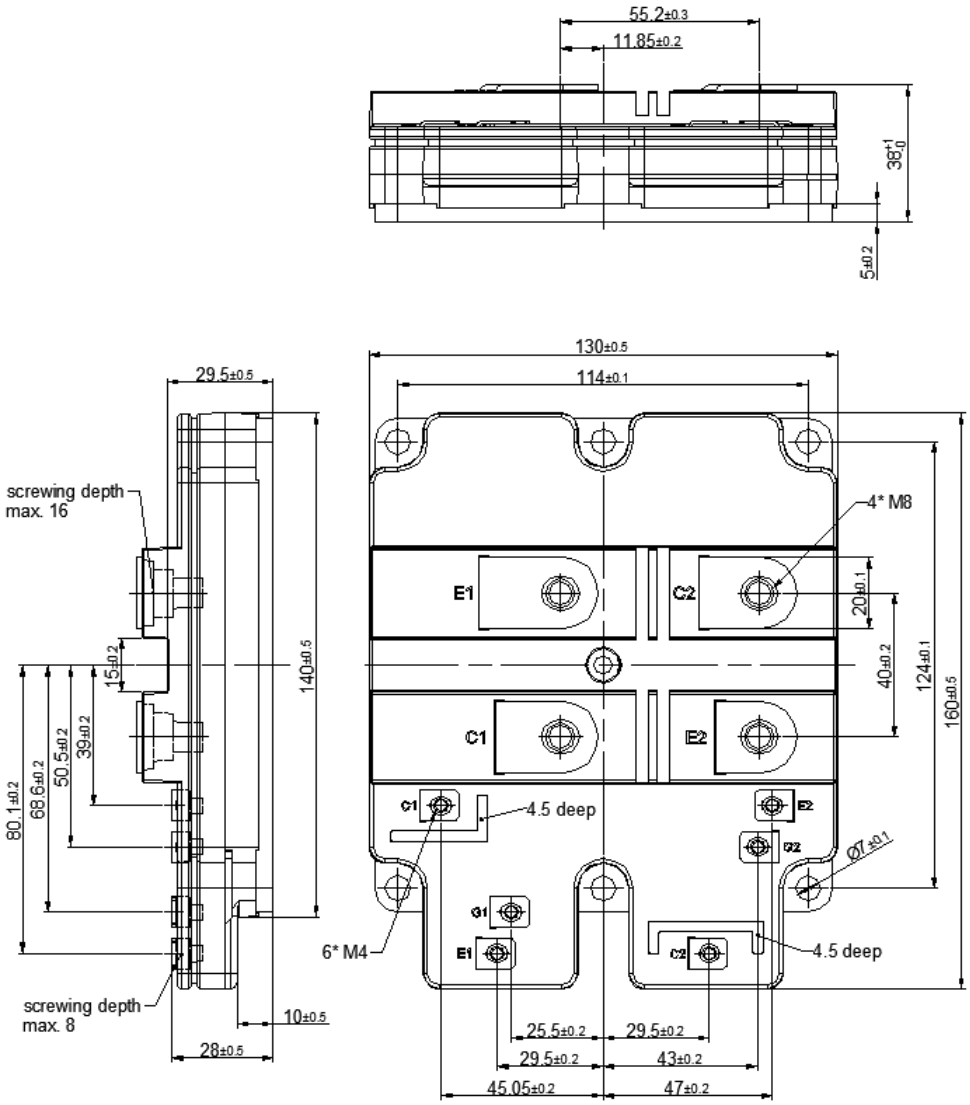
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical		130 x 160 x 38			mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	19			mm
			Term. to term:	19			
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	28.2			mm
			Term. to term:	28.2			
Mass	m				850		g

[7)] Package and mechanical properties according to IEC 60747 - 15

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. IX.
This product has been designed and qualified for Industrial Level.

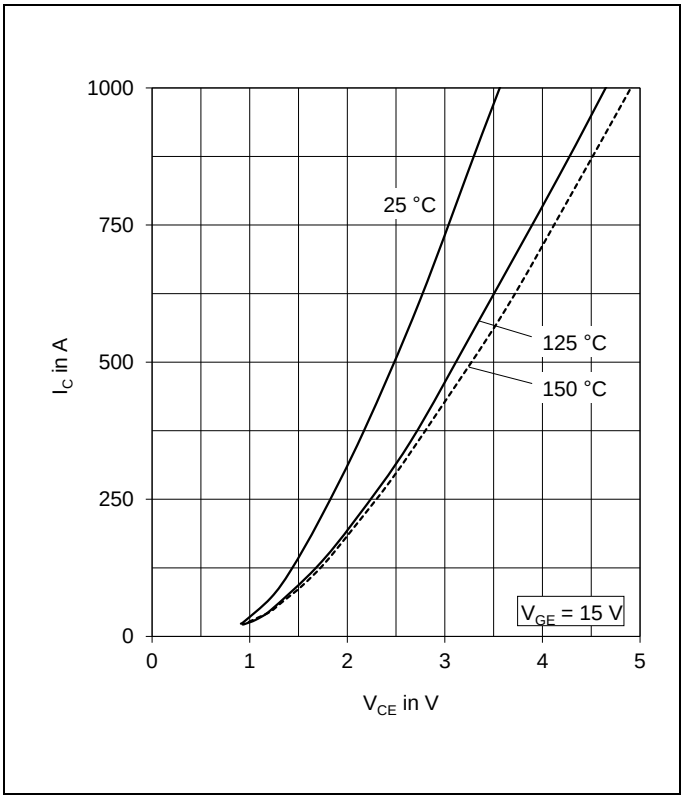


Fig. 1 Typical on-state characteristics, chip level

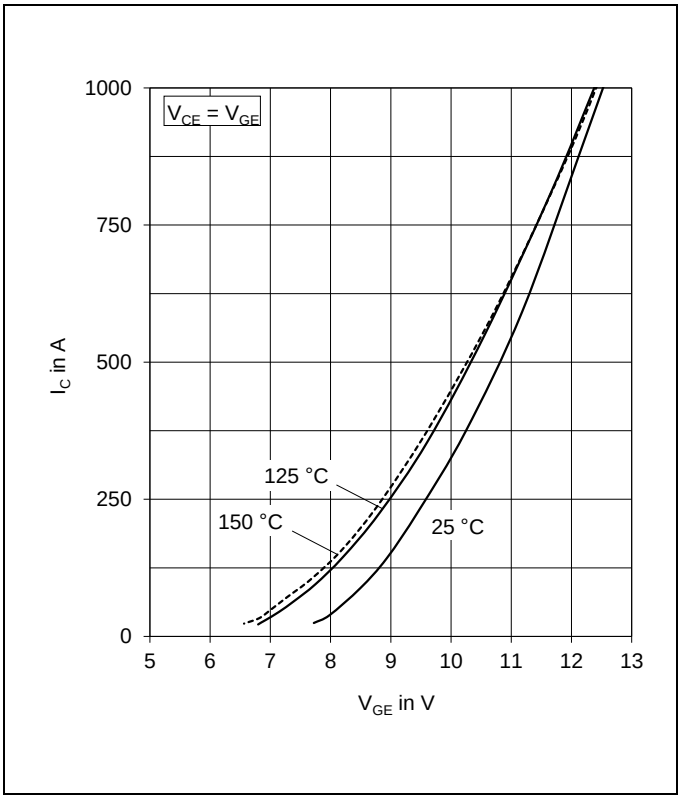


Fig. 2 Typical transfer characteristics, chip level

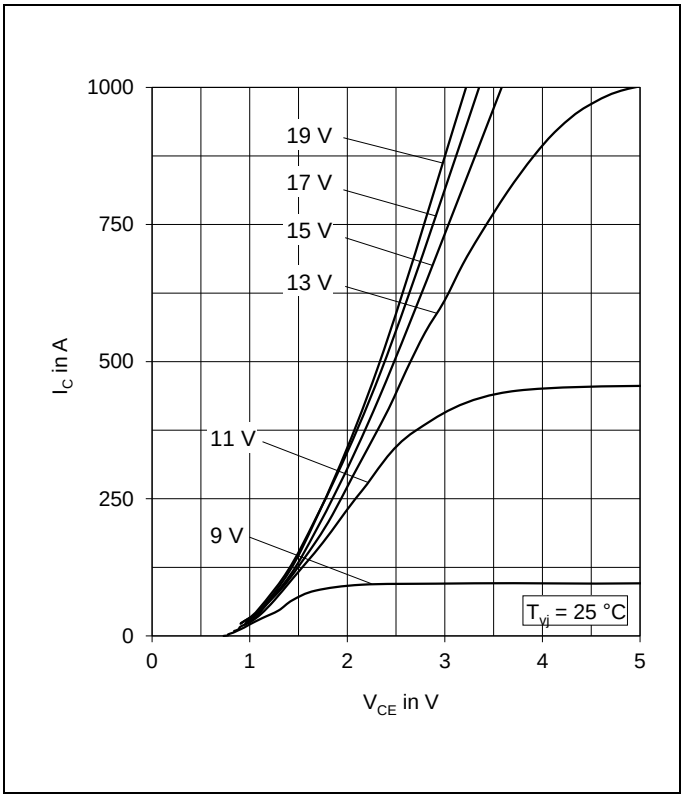


Fig. 3 Typical output characteristics, chip level

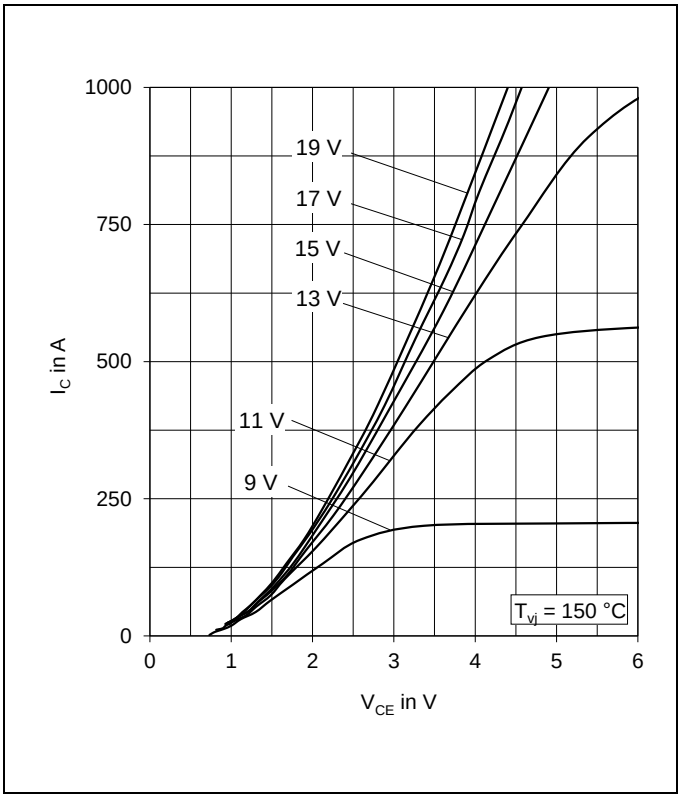


Fig. 4 Typical output characteristics, chip level

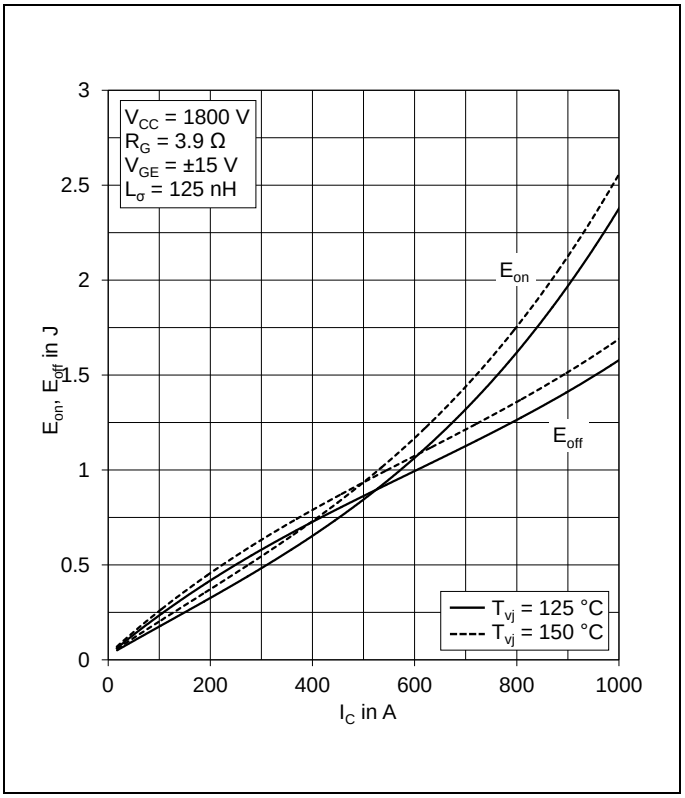


Fig. 5 Typical switching energies per pulse vs. collector current

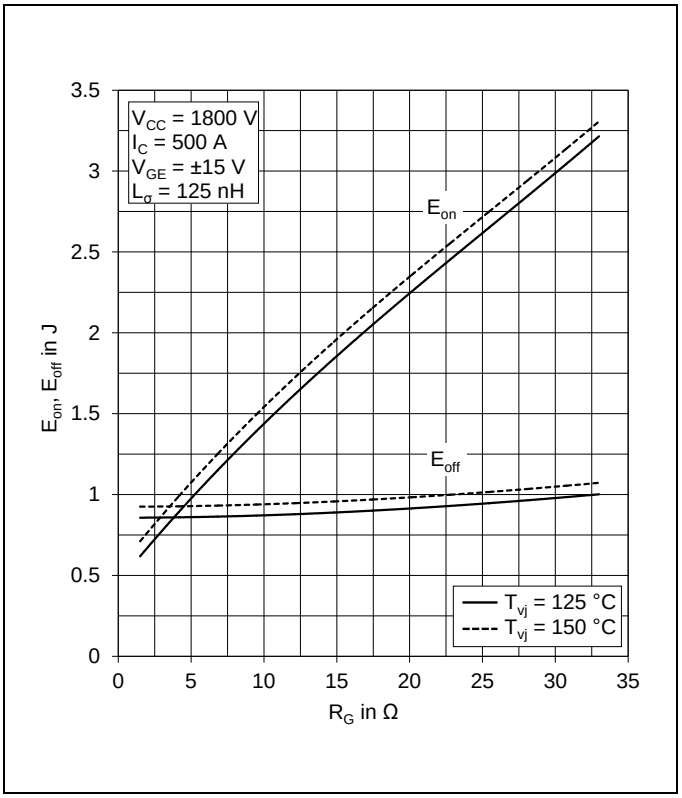


Fig. 6 Typical switching energies per pulse vs. gate resistor

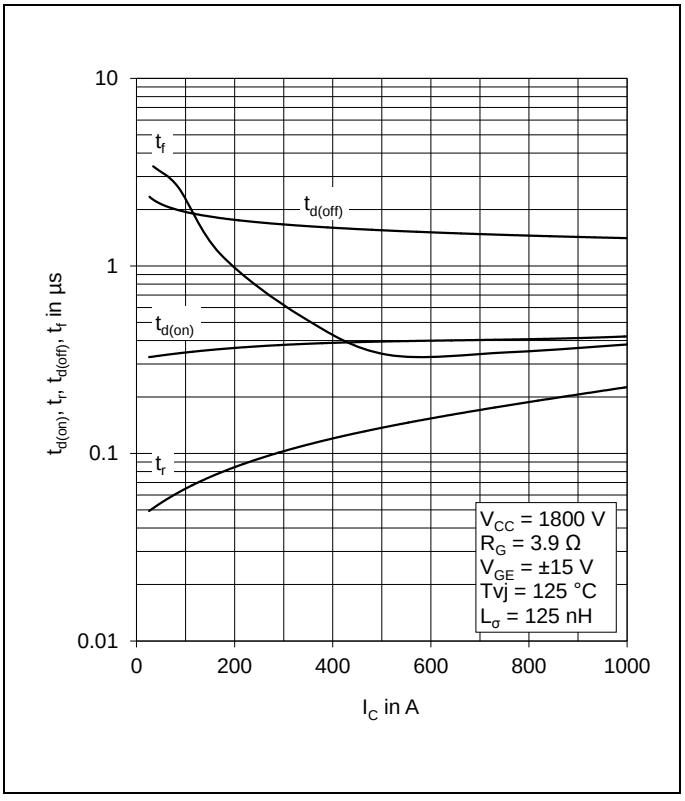


Fig. 7 Typical switching times vs. collector current

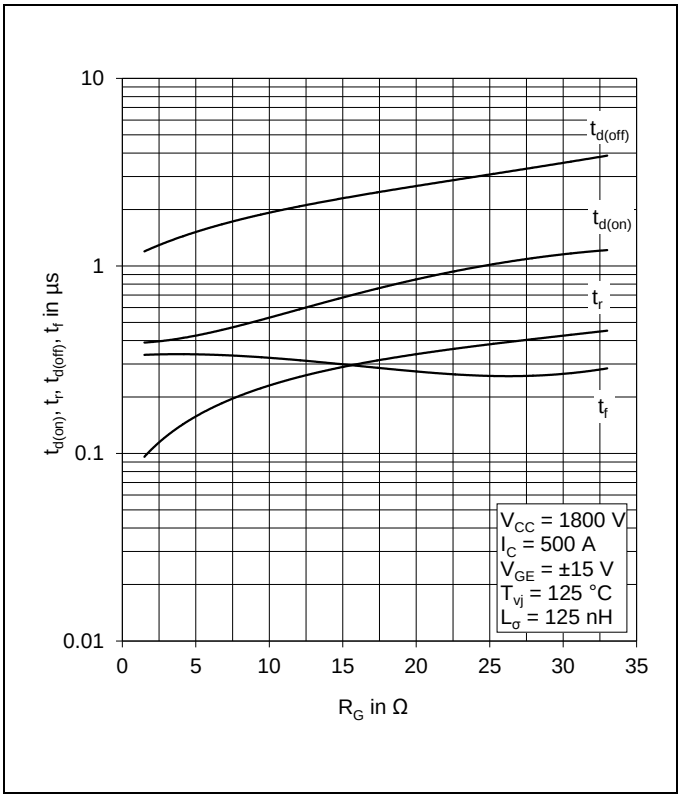


Fig. 8 Typical switching times vs. gate resistor

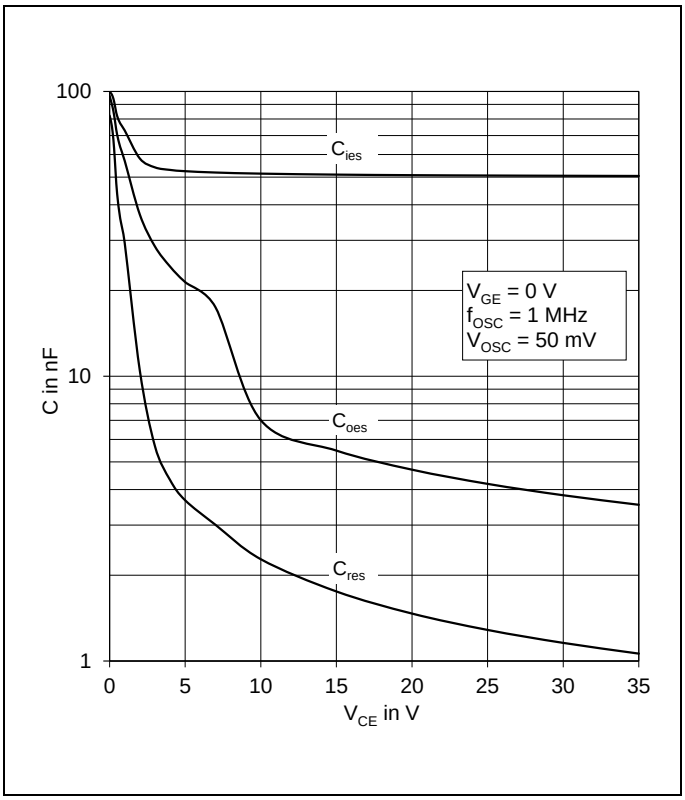


Fig. 9 Typical capacitances vs. collector-emitter voltage

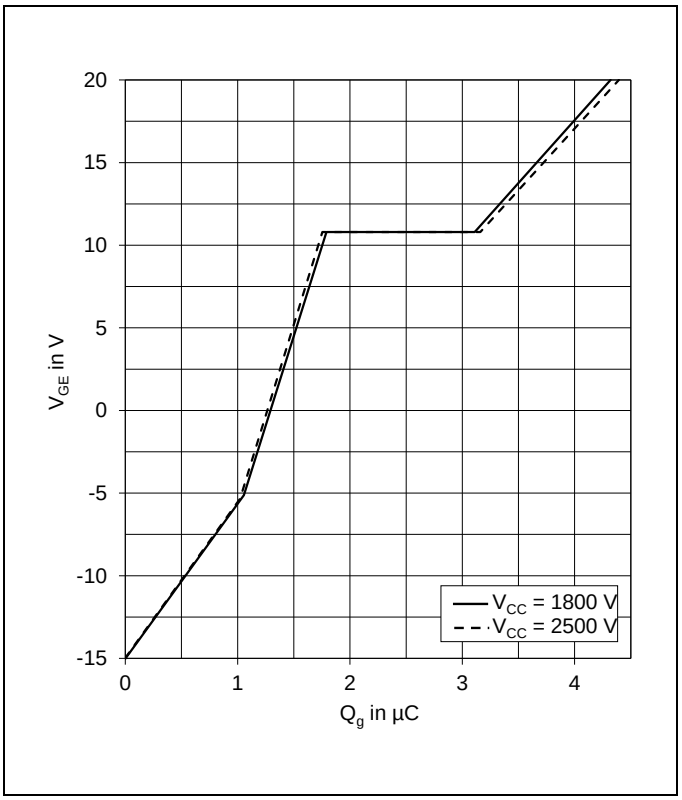


Fig. 10 Typical gate charge characteristics

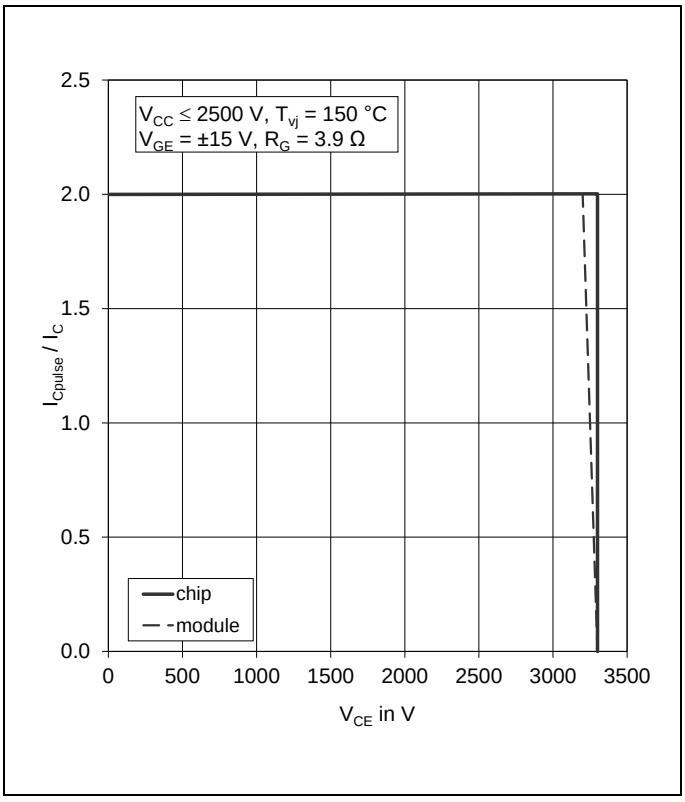


Fig. 11 Turn-off safe operating area (RBSOA)

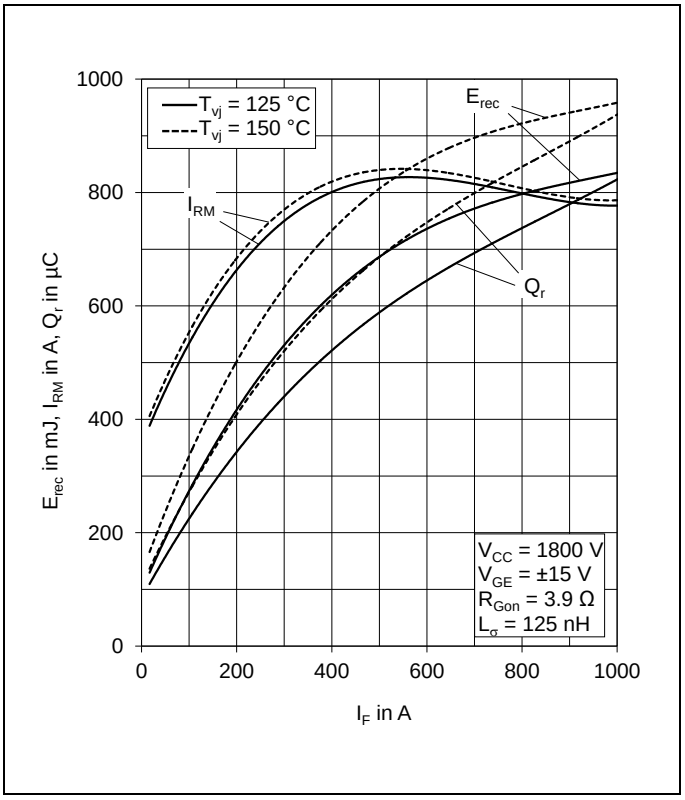


Fig. 12 Typical reverse recovery characteristics vs. forward current

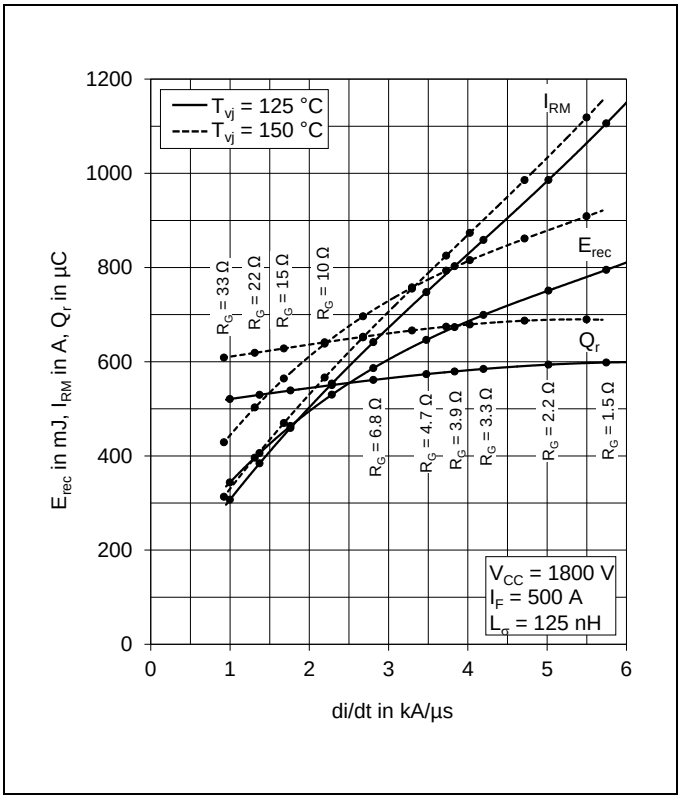


Fig. 13 Typical reverse recovery characteristics vs. di/dt

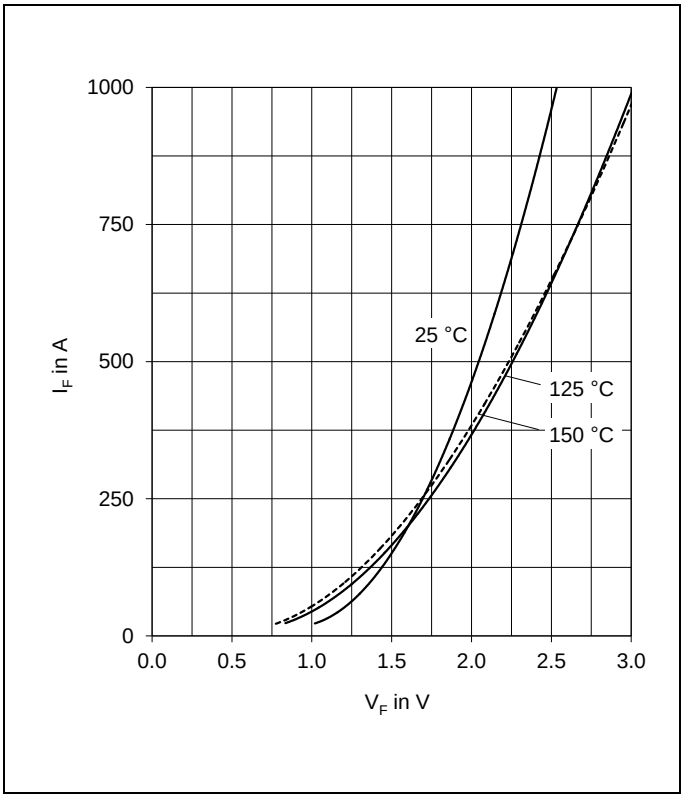


Fig. 14 Typicial diode forward characteristics chip level

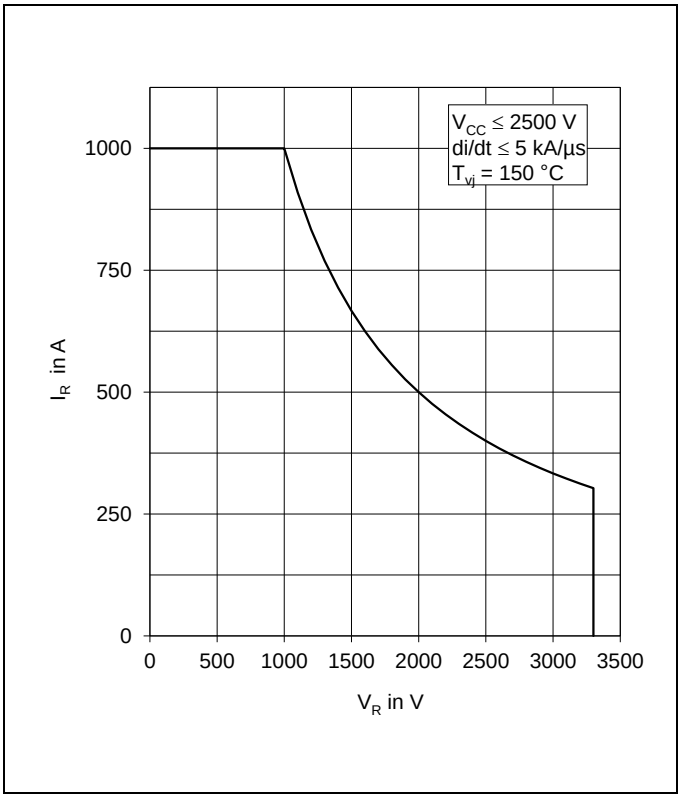
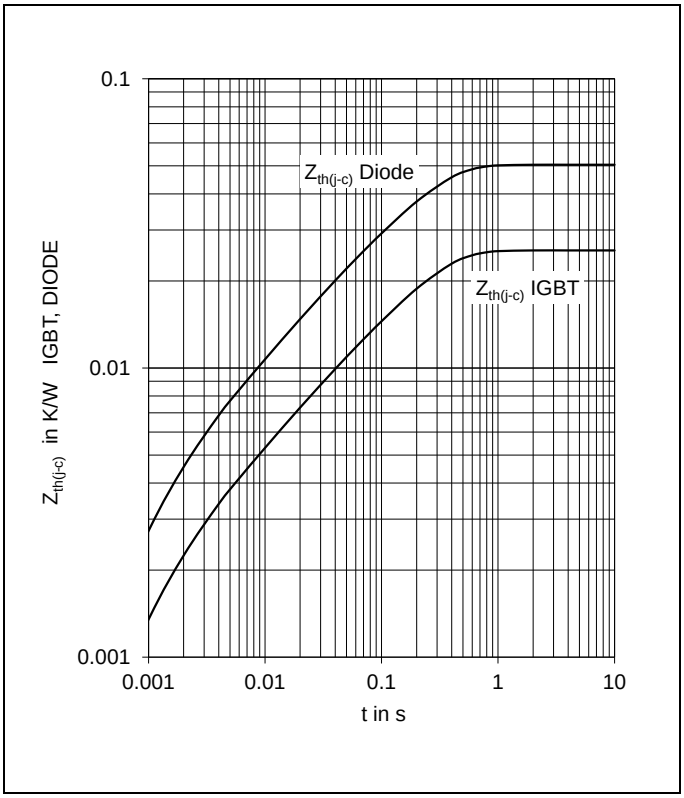


Fig. 15 Safe operating area diode (SOA)



Analytical function for transient thermal impedance:

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

	i	1	2	3	4	5
IGBT	R_i(K/kW)	17.56	4.12	1.922	1.896	
	τ_i(ms)	207.4	30.1	7.55	1.57	
DIODE	R_i(K/kW)	34.2	8.56	3.84	3.84	
	τ_i(ms)	203.6	30.1	7.53	1.57	

Fig. 16 Thermal impedance vs. time

Related documents:

5SYA 2042 Failure rates of HiPak modules due to cosmic rays
5SYA 2043 Load – cycle capability of HiPaks
5SYA 2045 Thermal runaway during blocking
5SYA 2053 Applying IGBT
5SYA 2058 Surge currents for IGBT diodes
5SYA 2093 Thermal design and temperature ratings of IGBT modules
5SYA 2098 Paralleling of IGBT modules
5SZK 9111 Specification of environmental class for HiPak Storage
5SZK 9112 Specification of environmental class for HiPak Transportation
5SZK 9113 Specification of environmental class for HiPak Operation (Industry)
5SZK 9120 Specification of environmental class for HiPak

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