

5SNG 1000X170300**LinPak phase leg IGBT module**

$V_{CE} = 1700 \text{ V}$

$I_C = 2 \times 1000 \text{ A}$

Ultra low inductance phase-leg module

Compact design with very high current density

Paralleling without derating

AlSiC base-plate for high power cycling capability

AlN substrate for low thermal resistance

Low-loss, fast and rugged SPT++ chip-set

**Maximum rated values ¹⁾**

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	$V_{GE} = 0 \text{ V}$, $T_{vj} \geq 25 \text{ °C}$		1700	V
DC collector current	I_C	$T_C = 100 \text{ °C}$, $T_{vj} = 175 \text{ °C}$		1000	A
Peak collector current	I_{CM}	$t_p = 1 \text{ ms}$		2000	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	$T_C = 25 \text{ °C}$, $T_{vj} = 175 \text{ °C}$		5500	W
DC forward current	I_F			1000	A
Peak forward current	I_{FRM}	$t_p = 1 \text{ ms}$		2000	A
Surge current	I_{FSM}	$V_R = 0 \text{ V}$, $T_{vj} = 175 \text{ °C}$, $t_p = 10 \text{ ms}$, half-sinewave		5400	A
IGBT short circuit SOA	t_{psc}	$V_{CC} = 1300 \text{ V}$, $V_{CEM \text{ CHIP}} \leq 1700 \text{ V}$ $V_{GE} \leq 15 \text{ V}$, $T_{vj \text{ start}} \leq 150 \text{ °C}$		10	μs
Isolation voltage	V_{isol}	1 min, $f = 50 \text{ Hz}$		4000	V
Junction temperature	T_{vj}		-40	175	°C
Junction operating temperature	$T_{vj(op)}$		-40	175	°C
Case temperature	T_C		-40	150	°C
Storage temperature	T_{stg}		-40	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, M3 screws	0.9	1.1	

¹⁾ Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747²⁾ For detailed mounting instructions refer to ABB Document No. 5SYA 2039

IGBT characteristic values ³⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Collector (-emitter) breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}$, $I_C = 10 \text{ mA}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$	1700			V
Collector-emitter ⁴⁾ saturation voltage	$V_{CE \text{ sat}}$	$I_C = 1000 \text{ A}$, $V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	2.25	2.5	V
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	2.55	2.8	V
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	2.75		V
Collector cut-off current	I_{CES}	$V_{CE} = 1700 \text{ V}$, $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	0.003		mA
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	2.55		mA
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	55		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	$V_{GE(TO)}$	$I_C = 40 \text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$		5.9		V
Gate charge	Q_{ge}	$I_C = 1000 \text{ A}$, $V_{CE} = 900 \text{ V}$, $V_{GE} = -15 \text{ V} \dots 15 \text{ V}$		6.4		μC
Input capacitance	C_{ies}	$V_{CE} = 25 \text{ V}$, $V_{GE} = 0 \text{ V}$, $f = 1 \text{ MHz}$, $T_{vj} = 25 \text{ }^{\circ}\text{C}$		62		nF
Output capacitance	C_{oes}			5.3		nF
Reverse transfer capacitance	C_{res}			3.8		nF
Internal gate resistance	R_{Gint}	per switch		0.75		Ω
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 900 \text{ V}$, $I_C = 1000 \text{ A}$, $R_G = 0.39 \text{ }\Omega$, $C_{GE} = 0 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 20 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	270		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	290		ns
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	300		ns
Rise time	t_r		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	80		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	90		ns
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	100		ns
Turn-off delay time	$t_{d(off)}$		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	570		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	680		ns
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	730		ns
Fall time	t_f		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	90		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	120		ns
			$T_{vj} = 175 \text{ }^{\circ}\text{C}$	140		ns
Turn-on switching energy	E_{on}	$V_{CC} = 900 \text{ V}$, $I_C = 1000 \text{ A}$, $R_G = 0.39 \text{ }\Omega$, $C_{GE} = 0 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 20 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	250		mJ
		$T_{vj} = 125 \text{ }^{\circ}\text{C}$	410		mJ	
		$T_{vj} = 175 \text{ }^{\circ}\text{C}$	500		mJ	
Turn-off switching energy	E_{off}	$V_{CC} = 900 \text{ V}$, $I_C = 1000 \text{ A}$, $R_G = 0.56 \text{ }\Omega$, $C_{GE} = 0 \text{ nF}$, $V_{GE} = \pm 15 \text{ V}$, $L_\sigma = 20 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	190		mJ
		$T_{vj} = 125 \text{ }^{\circ}\text{C}$	280		mJ	
		$T_{vj} = 175 \text{ }^{\circ}\text{C}$	350		mJ	
Short circuit current	I_{SC}	$V_{CC} = 1300 \text{ V}$, $V_{GE} = 15 \text{ V}$	$T_{vj \text{ start}} = 150 \text{ }^{\circ}\text{C}$	3000		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 = 1000 A	T _{vj} = 25 °C	1.6	1.9	V
			T _{vj} = 125 °C	1.75	2.05	V
			T _{vj} = 175 °C	1.7		V
Peak reverse recovery current	I _{RM}	V _{CC} = 900 V, I _F = 1000 A, V _{GE} = ±15 V, R _G = 0.39 Ω, C _{GE} = 0 nF, L _σ = 20 nH, inductive load	T _{vj} = 25 °C	1130		A
			T _{vj} = 125 °C	1160		A
			T _{vj} = 175 °C	1230		A
Recovered charge	Q _{rr}		T _{vj} = 25 °C	290		μC
			T _{vj} = 125 °C	460		μC
			T _{vj} = 175 °C	630		μC
Reverse recovery time	t _{rr}		T _{vj} = 25 °C	520		ns
			T _{vj} = 125 °C	830		ns
			T _{vj} = 175 °C	1040		ns
Reverse recovery energy	E _{rec}	T _{vj} = 25 °C	170		mJ	
		T _{vj} = 125 °C	260		mJ	
		T _{vj} = 175 °C	370		mJ	

⁵⁾ Characteristic values according to IEC 60747 – 2

⁶⁾ Forward voltage is given at chip level

NTC Thermistor

Parameter	Symbol	Conditions	min	typ	max	Unit
Rated resistor	R_{25}			4.7		k Ω
B-value	$B_{25/85}$	$R_2 = R_{25} \exp [B_{25/85}(1/T_2 - 1/(298.15\text{K}))]$		3371		K
	$B_{25/100}$	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15\text{K}))]$		3435		K

Package properties ⁷⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				27	K/kW
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				45	K/kW
IGBT thermal resistance ²⁾ case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 1W/m x K		27		K/kW
Diode thermal resistance ²⁾ case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = 1W/m x K		33		K/kW
Comparative tracking index	CTI		600			
Module stray inductance	$L_{\sigma CE}$	total C1-E2		10		nH
Resistance, terminal-chip	$R_{C1E1\text{ IGBT / Diode}}$	$T_c = 25\text{ °C}$		0.25 / 0.34		m Ω
		$T_c = 125\text{ °C}$		0.35 / 0.47		
		$T_c = 175\text{ °C}$		0.40 / 0.54		
	$R_{C2E2\text{ IGBT / Diode}}$	$T_c = 25\text{ °C}$		0.35 / 0.45		
		$T_c = 125\text{ °C}$		0.49 / 0.62		
		$T_c = 175\text{ °C}$		0.56 / 0.71		

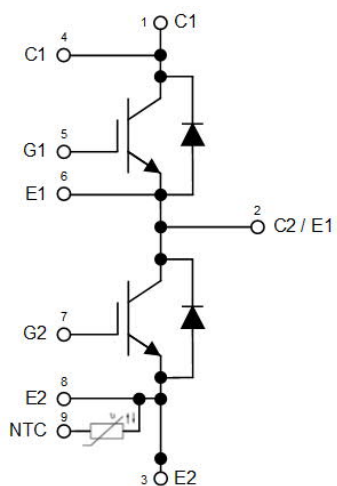
²⁾ For detailed mounting instructions refer to ABB Document No. 5SYA 2039

Mechanical properties ⁷⁾

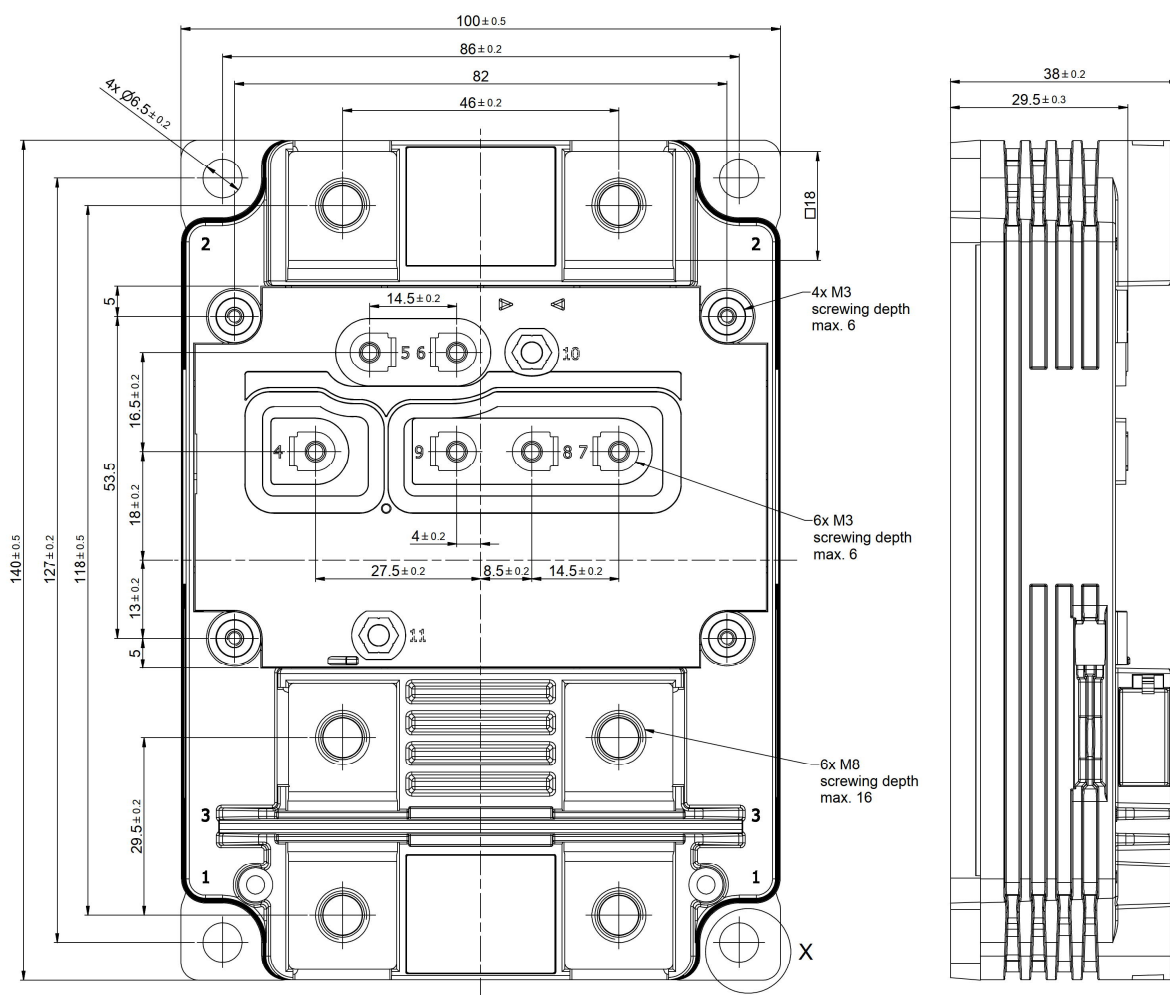
Parameter	Symbol	Conditions	min	typ	max	Unit
Dimensions	L x W x H	Typical		140 x 100 x 38		mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	20		mm
			Term. to term:	8		
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	30		mm
			Term. to term:	30		
Mass	m			820		g

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

Electrical configuration



Outline drawing



Note: all dimensions are shown in millimeters

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.

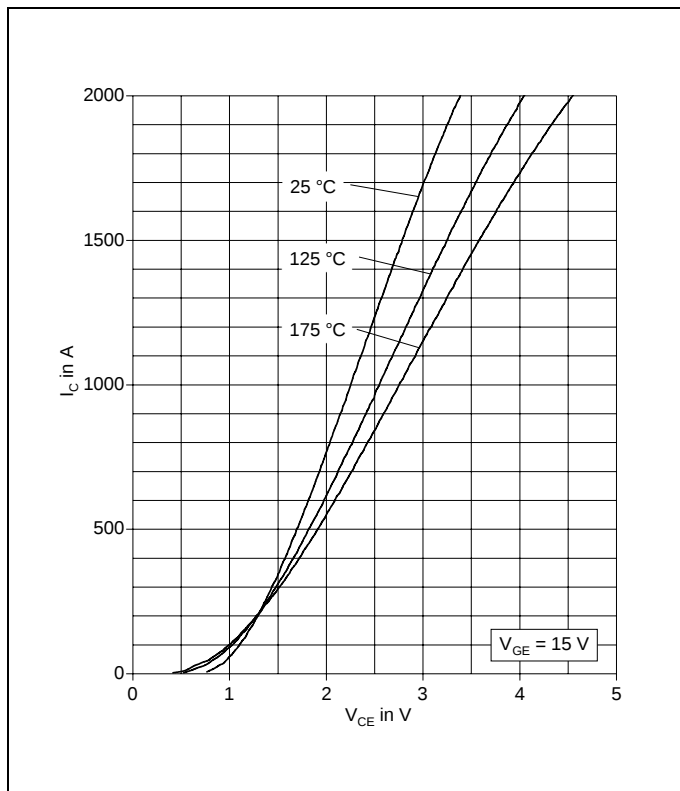


Fig. 1 Typical on-state characteristics, chip level

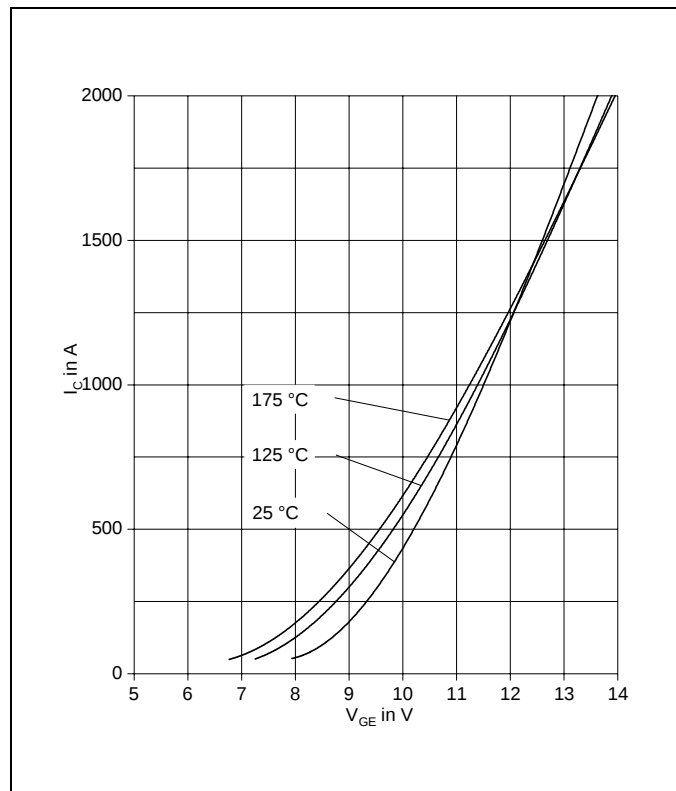


Fig. 2 Typical transfer characteristics, chip level

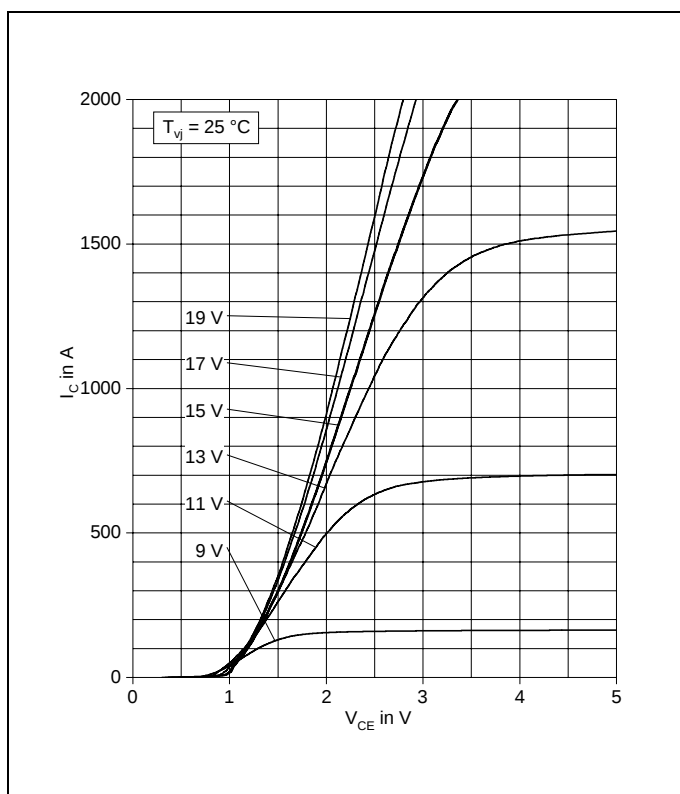


Fig. 3 Typical output characteristics, chip level

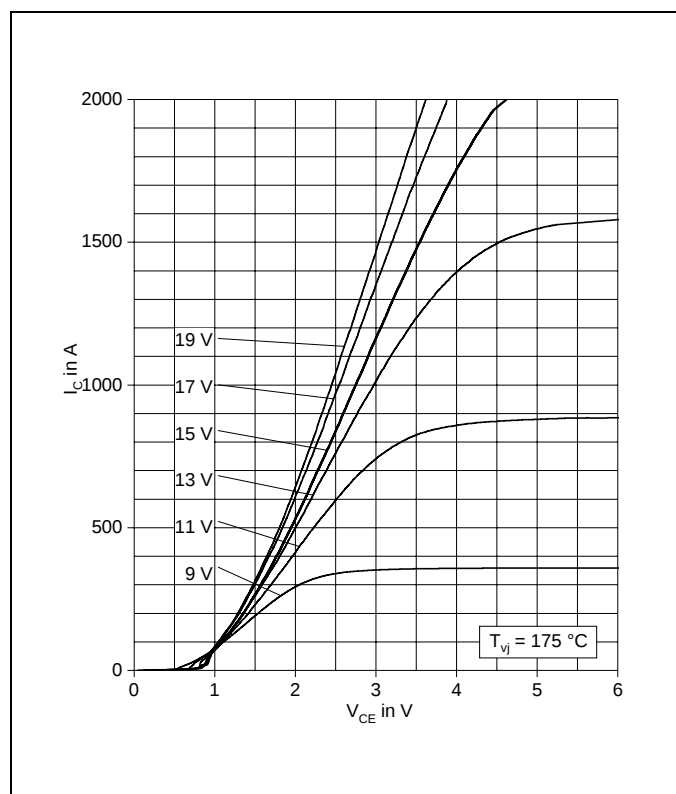


Fig. 4 Typical output characteristics, chip level

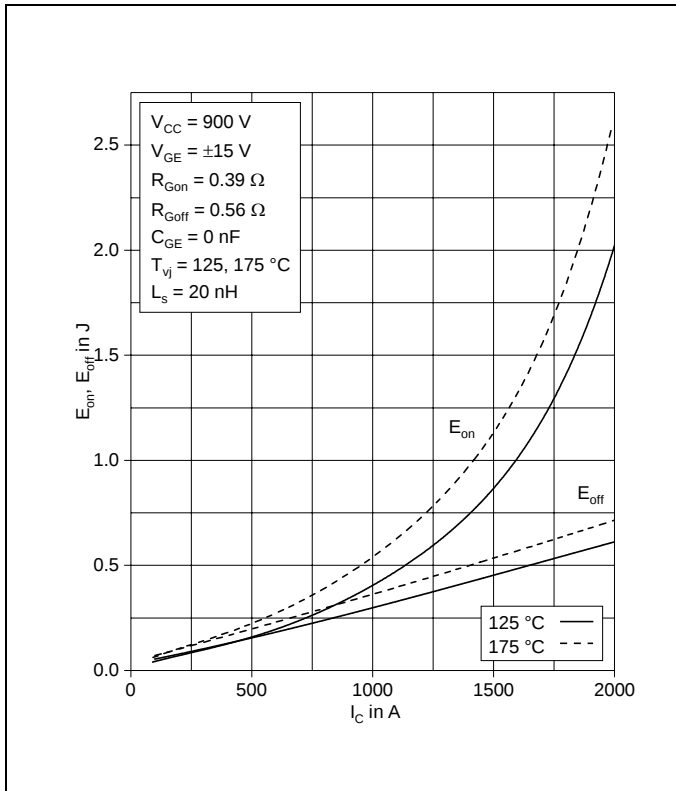


Fig. 5 Typical switching energies per pulse vs. collector current

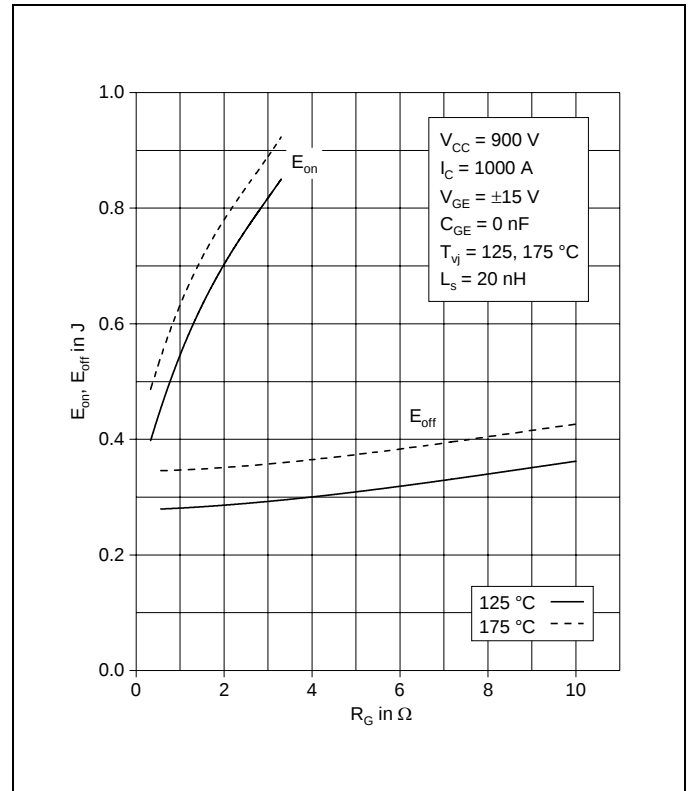


Fig. 6 Typical switching energies per pulse vs. gate resistor

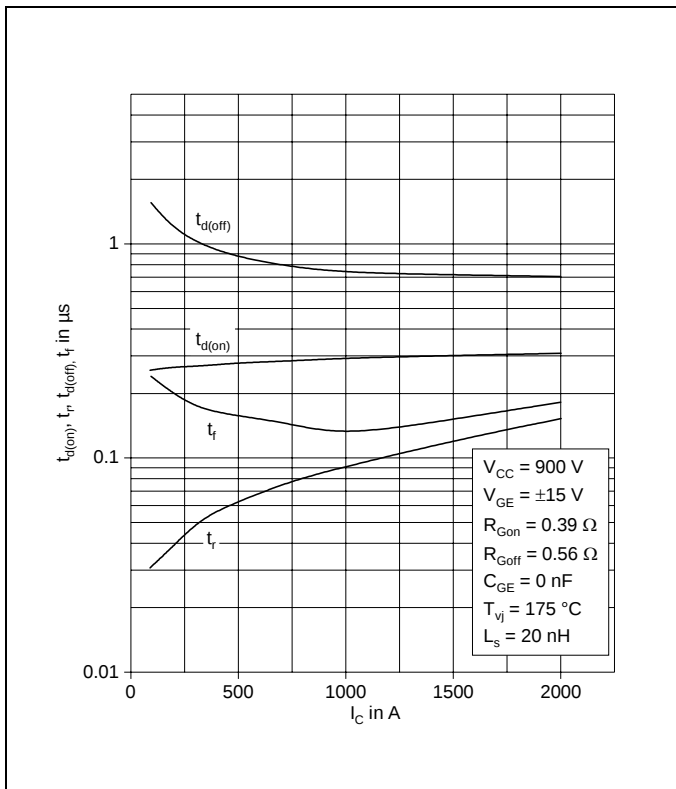


Fig. 7 Typical switching times vs. collector current

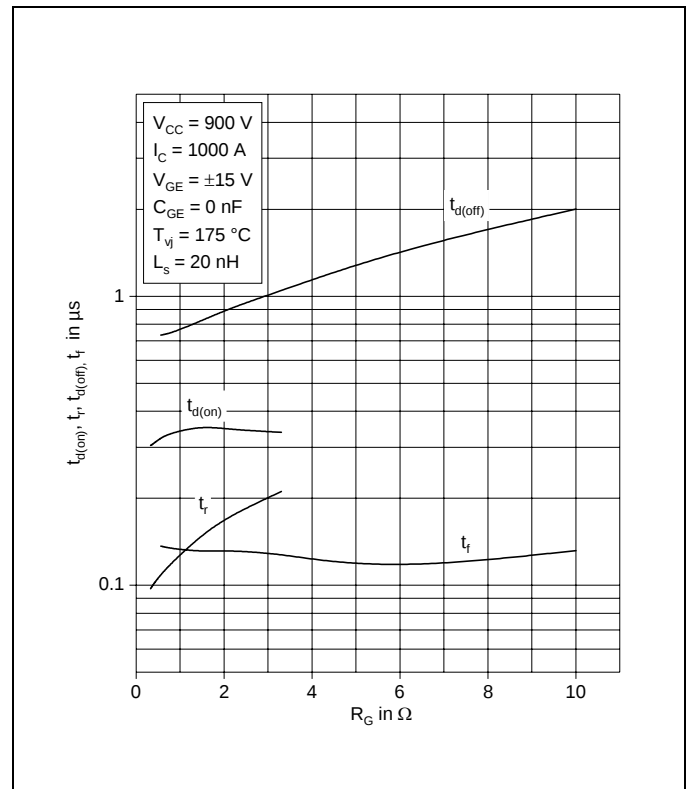


Fig. 8 Typical switching times vs. gate resistor

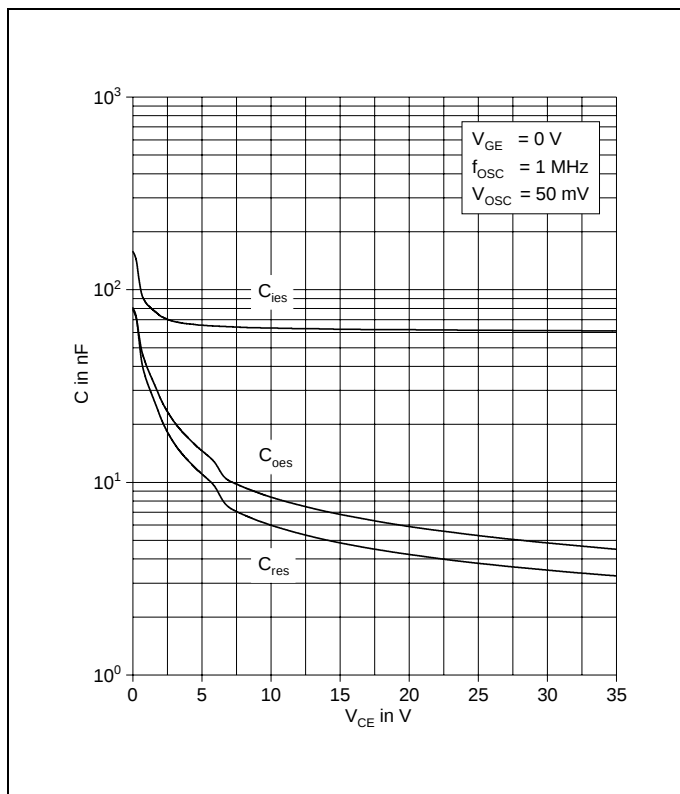


Fig. 9 Typical capacitances vs. collector-emitter voltage

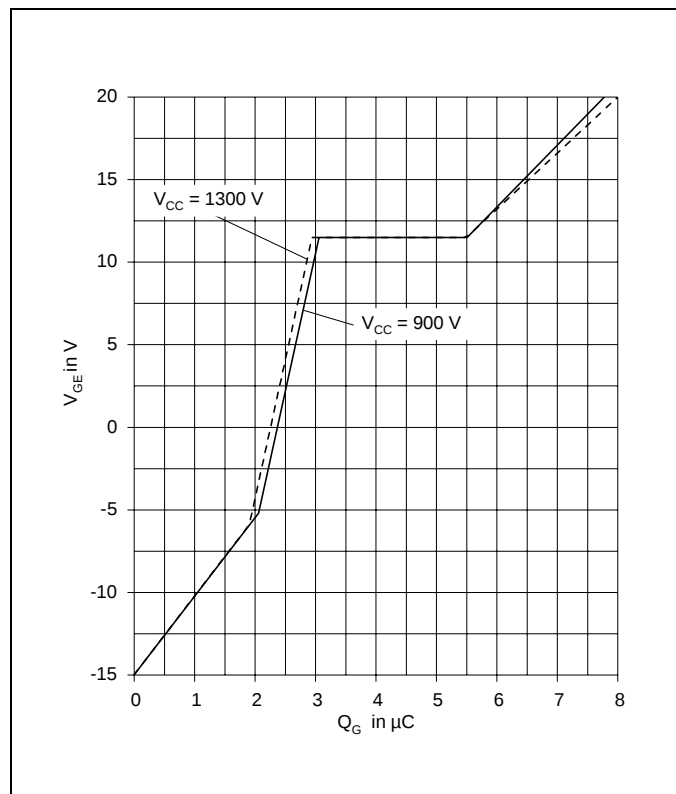


Fig. 10 Typical gate charge characteristics

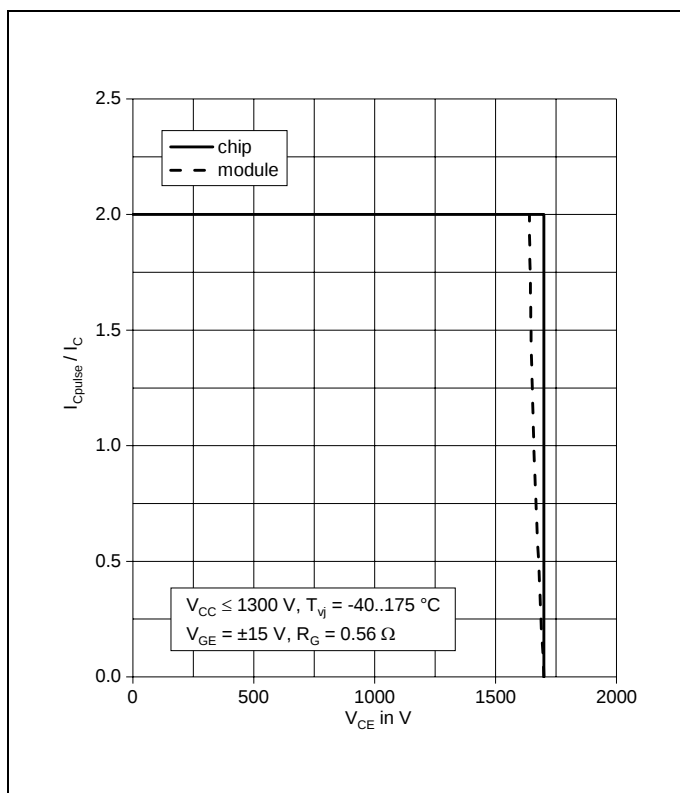


Fig. 11 Turn-off safe operating area (RBSOA)

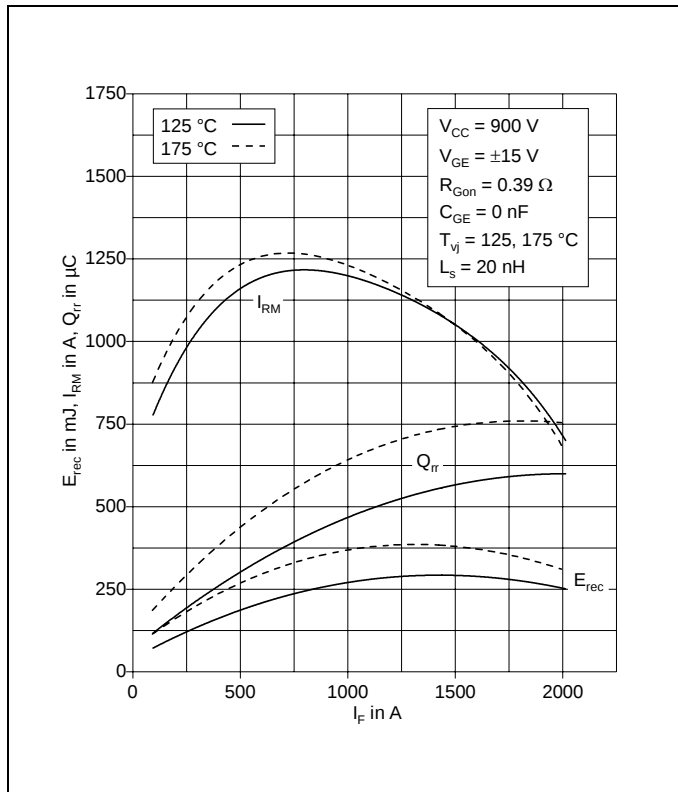


Fig. 12 Typical reverse recovery characteristics vs. forward current

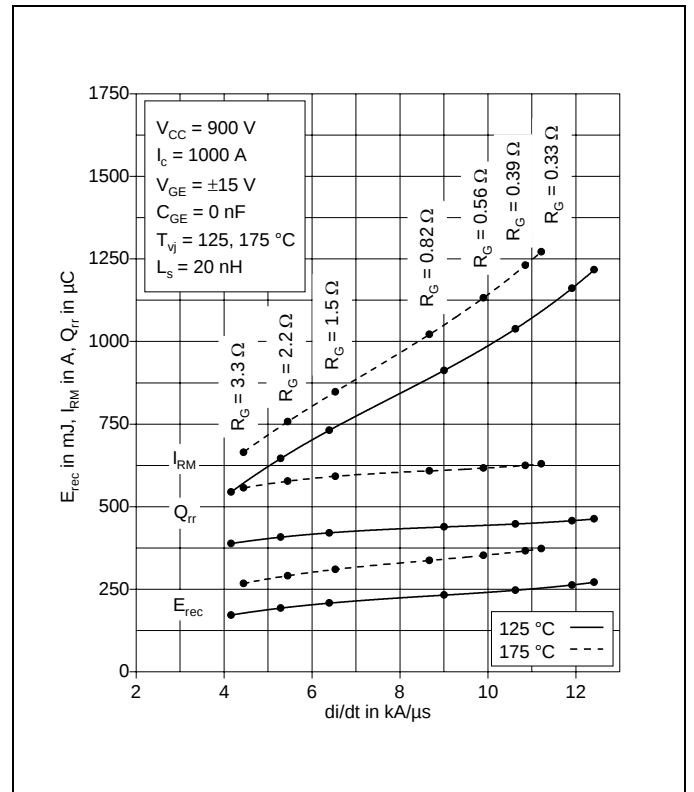


Fig. 13 Typical reverse recovery characteristics vs. di/dt

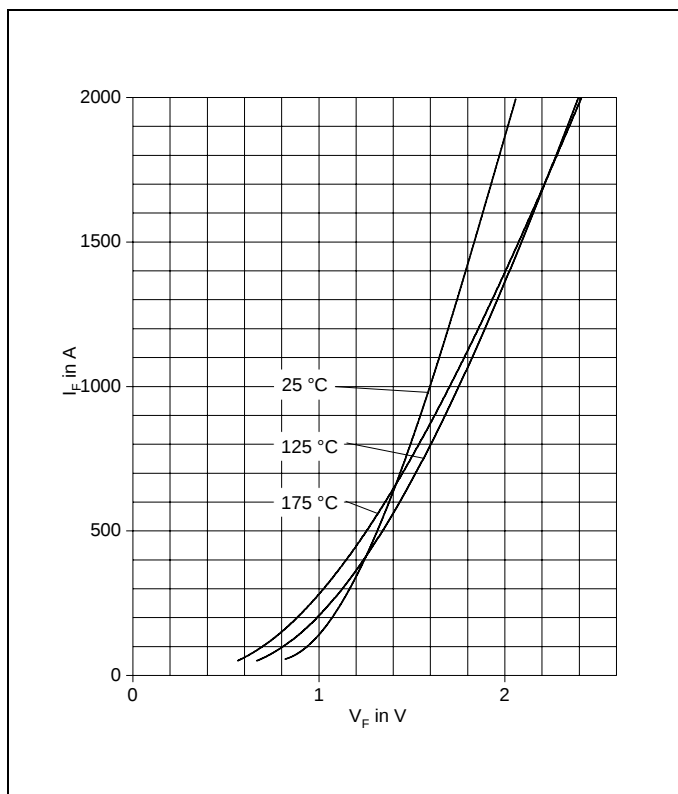


Fig. 14 Typical diode forward characteristics chip level

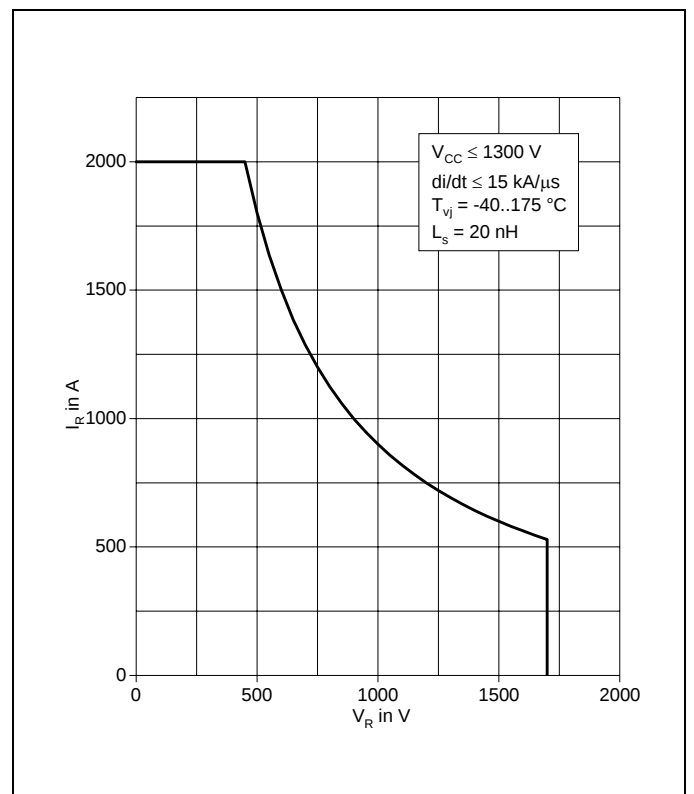


Fig. 15 Safe operating area diode (SOA)

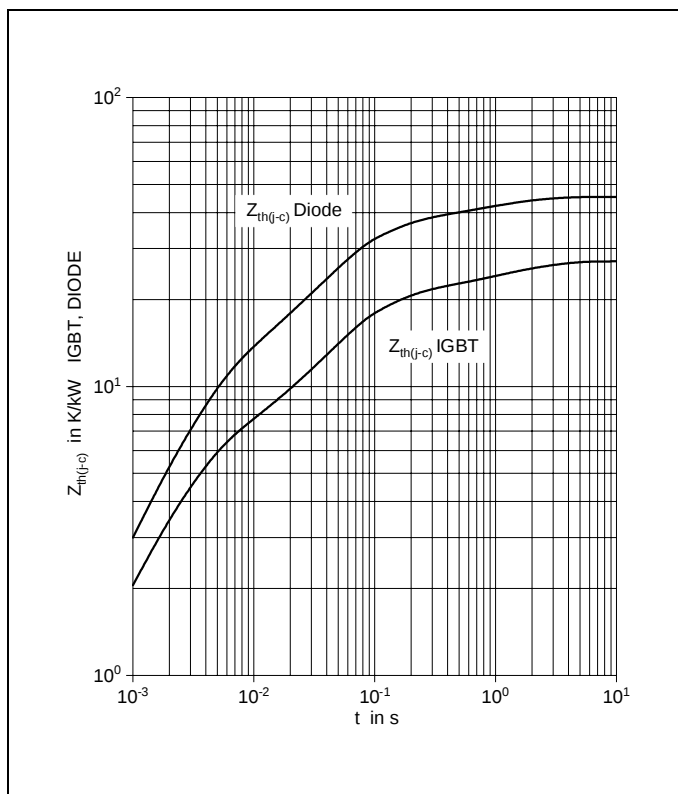


Fig. 16 Thermal impedance vs. time

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	Ri(K/kW)	15.0	6.48	5.58		
	τ_i (ms)	62.9	1280	2.55		
DIODE	Ri(K/kW)	26.3	10.0	8.96		
	τ_i (ms)	57.6	3.42	929		

Related documents:

5SYA 2042 Failure rates of IGBT modules due to cosmic rays
 5SYA 2043 Load – cycle capability of HiPaks
 5SYA 2045 Thermal runaway during blocking
 5SYA 2053 Applying IGBT
 5SYA 2057 IGBT diode safe operating area (SOA)
 5SYA 2058 Surge currents for IGBT diodes
 5SYA 2093 Thermal design of IGBT modules
 5SYA 2098 Paralleling of IGBT modules
 5SYA 2107 Mounting instructions for LinPak 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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