Data Sheet, Doc. No. 5SYA 1454-02 Dez 18

5SNG 1000X170300
LinPak phase leg IGBT module

V_{CE} = 1700 V
I_C = 2 x 1000 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 V, $T_{vj} \geq 25$ °C		1700	V
DC collector current	I_C	T_C = 100 °C, T_{vj} = 175 °C		1000	A
Peak collector current	I_{CM}	t_p = 1 ms		2000	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_C = 25 °C, T_{vj} = 175 °C		5500	W
DC forward current	I_F			1000	A
Peak forward current	I_{FRM}	t_p = 1 ms		2000	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 175 °C, t_p = 10 ms, half-sinewave		5400	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 1300 V, $V_{CEM\ CHIP} \leq 1700$ V $V_{GE} \leq 15$ V, $T_{vj\ start} \leq 150$ °C		10	µs
Isolation voltage	V_{isol}	1 min, f = 50 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	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 60747

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		1700			V
Collector-emitter [4)] saturation voltage	$V_{CE\,sat}$	I_C = 1000 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.25	2.5	V
			T_{vj} = 125 °C		2.55	2.8	V
			T_{vj} = 175 °C		2.75		V
Collector cut-off current	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C		0.003		mA
			T_{vj} = 125 °C		2.55		mA
			T_{vj} = 175 °C		55		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	$V_{GE(TO)}$	I_C = 40 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C			5.9		V
Gate charge	Q_{ge}	I_C = 1000 A, V_{CE} = 900 V, V_{GE} = -15 V ..15 V			6.4		μC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °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 V, I_C = 1000 A, R_G = 0.39 Ω, C_{GE} = 0 nF, V_{GE} = ±15 V, L_σ = 20 nH, inductive load	T_{vj} = 25 °C		270		ns
			T_{vj} = 125 °C		290		ns
			T_{vj} = 175 °C		300		ns
Rise time	t_r		T_{vj} = 25 °C		80		ns
			T_{vj} = 125 °C		90		ns
			T_{vj} = 175 °C		100		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 900 V, I_C = 1000 A, R_G = 0.56 Ω, C_{GE} = 0 nF, V_{GE} = ±15 V, L_σ = 20 nH, inductive load	T_{vj} = 25 °C		570		ns
			T_{vj} = 125 °C		680		ns
			T_{vj} = 175 °C		730		ns
Fall time	t_f		T_{vj} = 25 °C		90		ns
			T_{vj} = 125 °C		120		ns
			T_{vj} = 175 °C		140		ns
Turn-on switching energy	E_{on}	V_{CC} = 900 V, I_C = 1000 A, R_G = 0.39 Ω, C_{GE} = 0 nF, V_{GE} = ±15 V, L_σ = 20 nH, inductive load	T_{vj} = 25 °C		250		mJ
			T_{vj} = 125 °C		410		mJ
			T_{vj} = 175 °C		500		mJ
Turn-off switching energy	E_{off}	V_{CC} = 900 V, I_C = 1000 A, R_G = 0.56 Ω, C_{GE} = 0 nF, V_{GE} = ±15 V, L_σ = 20 nH, inductive load	T_{vj} = 25 °C		190		mJ
			T_{vj} = 125 °C		280		mJ
			T_{vj} = 175 °C		350		mJ
Short circuit current	I_{SC}	V_{CC} = 1300 V, V_{GE} = 15 V	$T_{vj\,start}$ = 150 °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		kΩ
B-value	$B_{25/85}$	R2 = R25 exp [B25/85(1/T2 - 1/(298.15K))]		3371		K
	$B_{25/100}$	R2 = R25 exp [B25/100(1/T2 - 1/(298.15K))]		3435		K

Package properties [7]

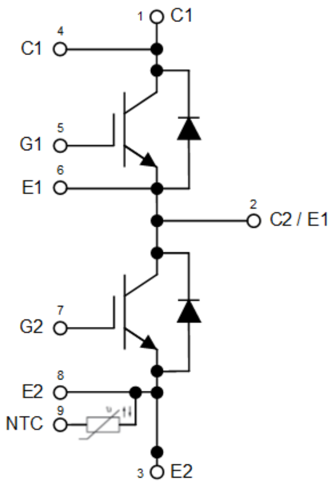
Parameter	Symbol	Conditions		min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$					27	K/kW
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$					45	K/kW
IGBT thermal resistance case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 1W/m x K			27		K/kW
Diode thermal resistance 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	$R_{C1E1\ IGBT\ /\ Diode}$		T_C = 25 °C		0.25 / 0.34		mΩ
			T_C = 125 °C		0.35 / 0.47		mΩ
			T_C = 175 °C		0.40 / 0.54		mΩ
	$R_{C2E2\ IGBT\ /\ Diode}$		T_C = 25 °C		0.35 / 0.45		mΩ
			T_C = 125 °C		0.49 / 0.62		mΩ
			T_C = 175 °C		0.56 / 0.71		mΩ

Mechanical properties [7]

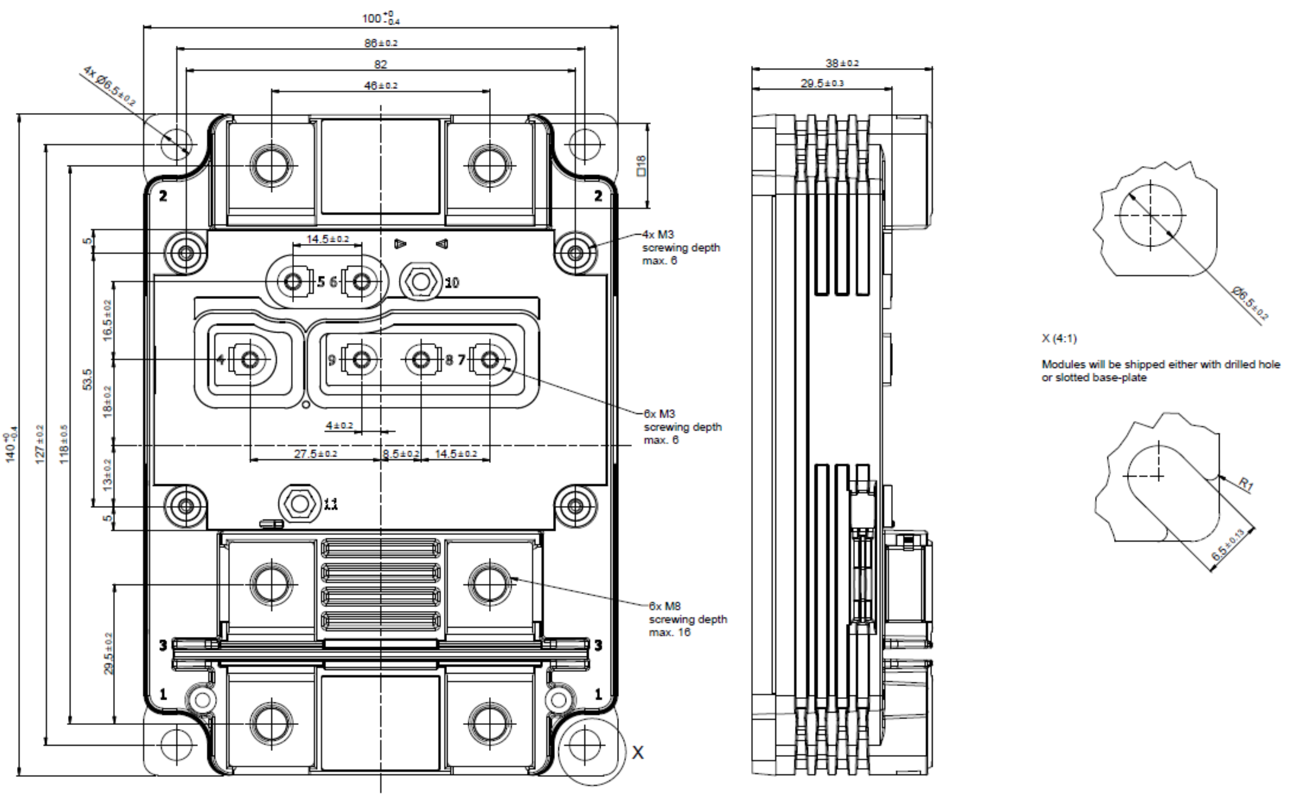
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical			140 x 100 x 38		mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	20			mm
			Term. to term:	8			mm
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	30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

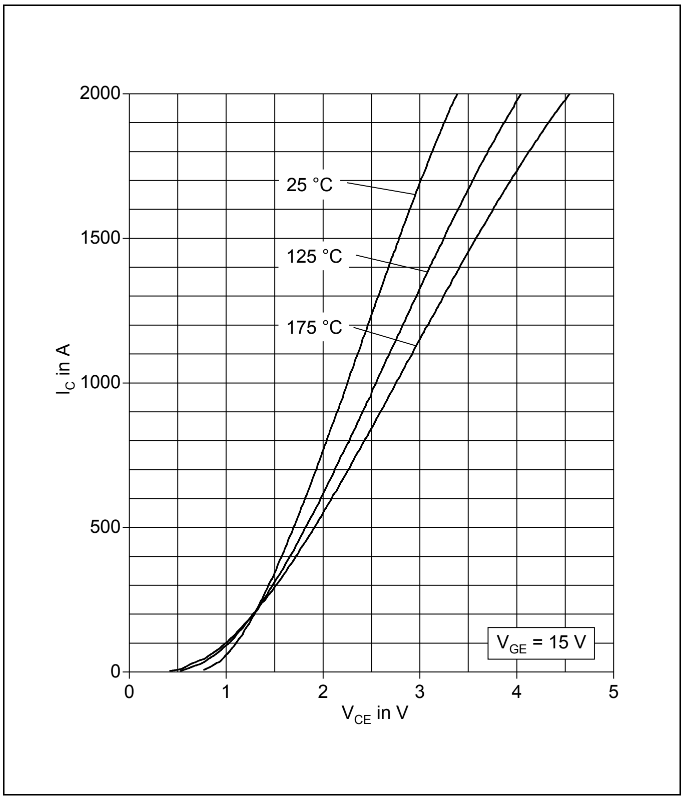


Fig. 1 Typical on-state characteristics, chip level

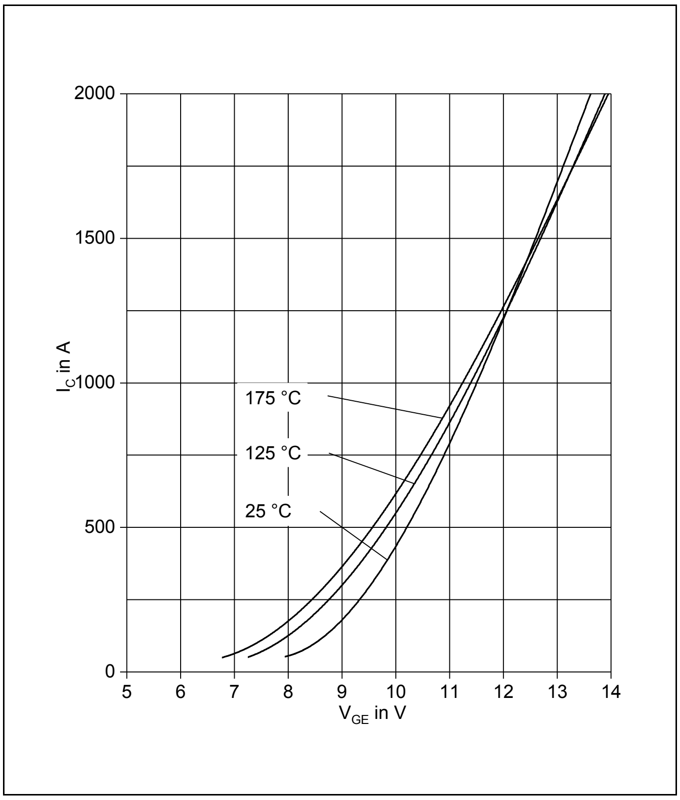


Fig. 2 Typical transfer characteristics, chip level

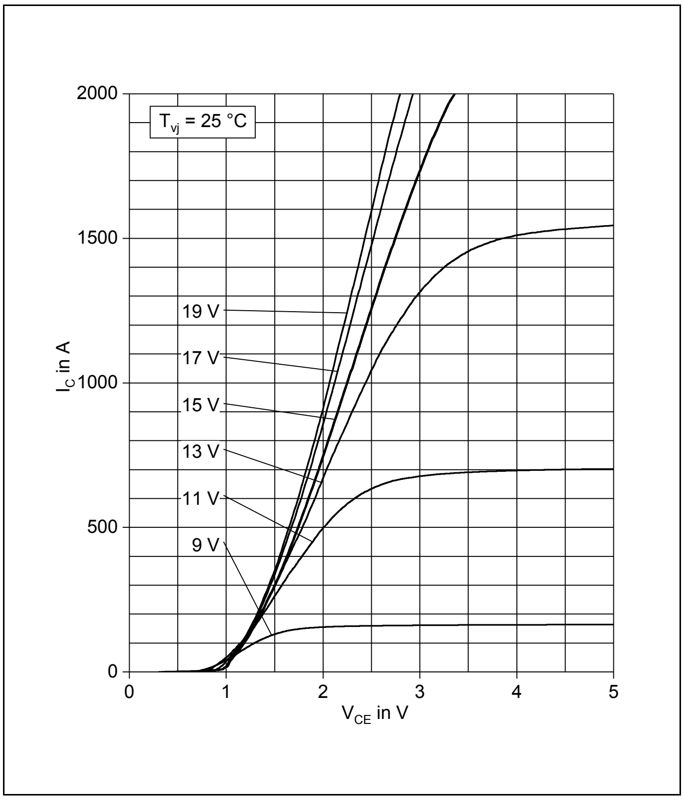


Fig. 3 Typical output characteristics, chip level

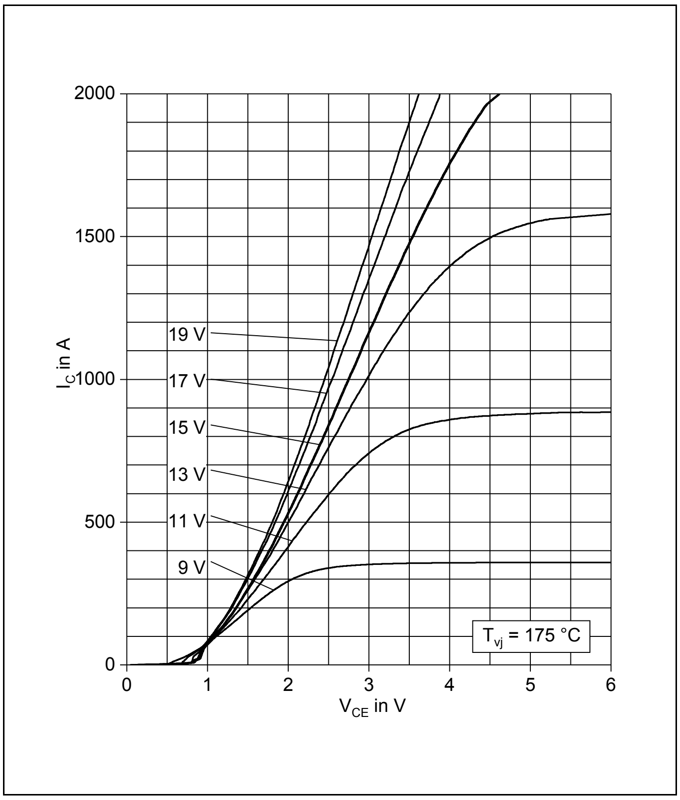


Fig. 4 Typical output characteristics, chip level

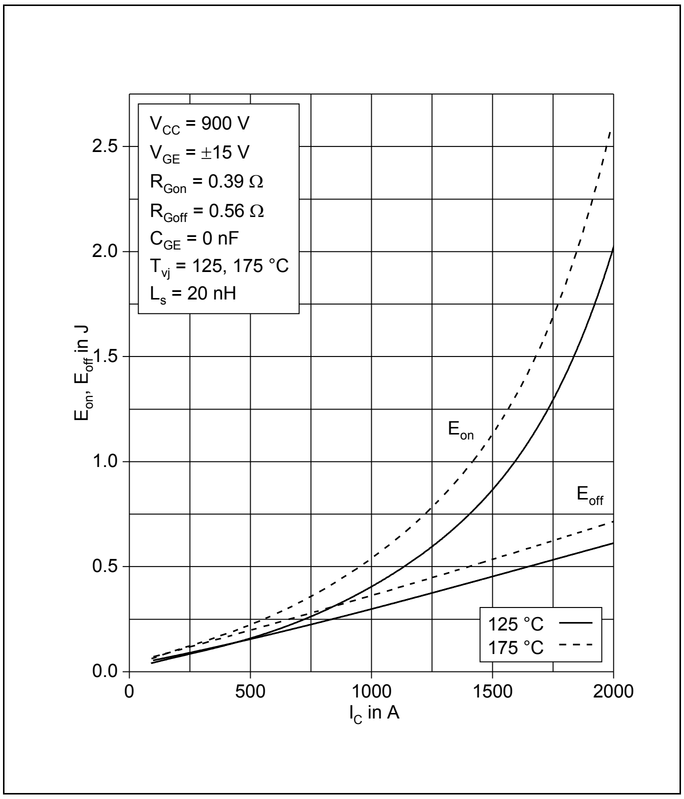


Fig. 5 Typical switching energies per pulse vs. collector current

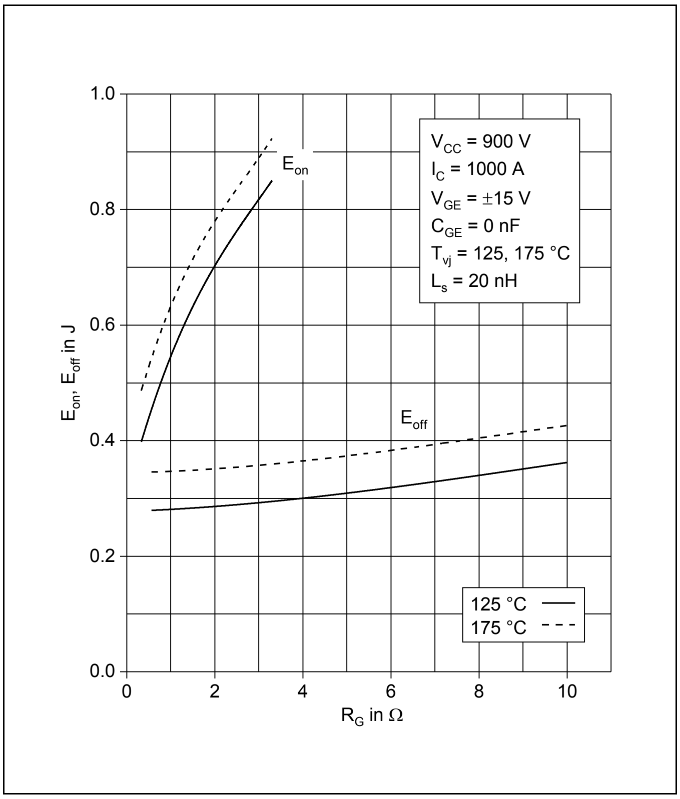


Fig. 6 Typical switching energies per pulse vs. gate resistor

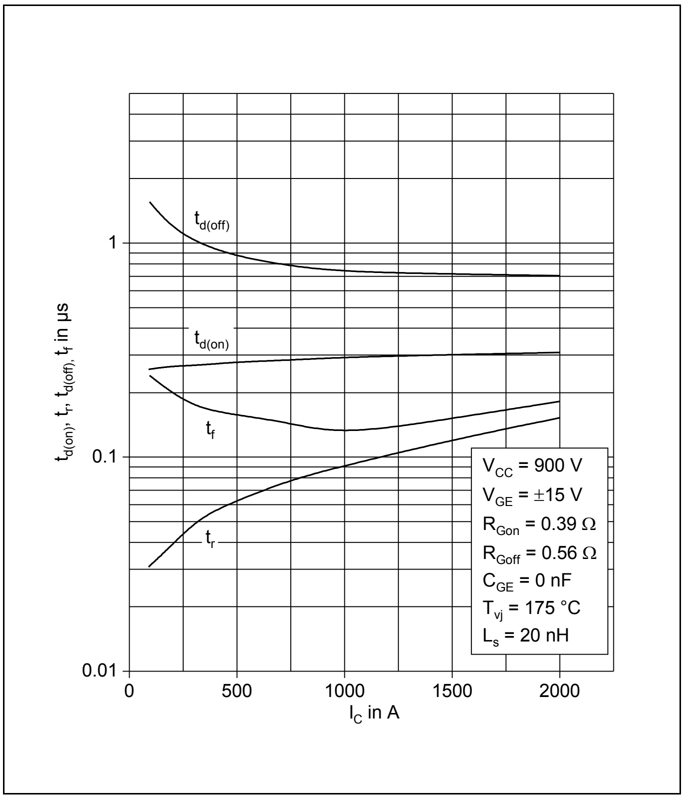


Fig. 7 Typical switching times vs. collector current

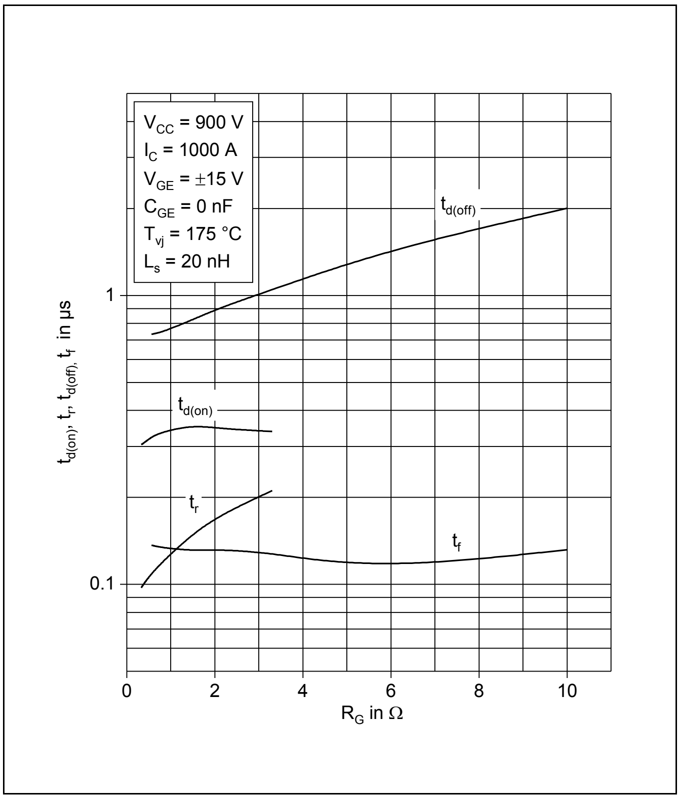


Fig. 8 Typical switching times vs. gate resistor

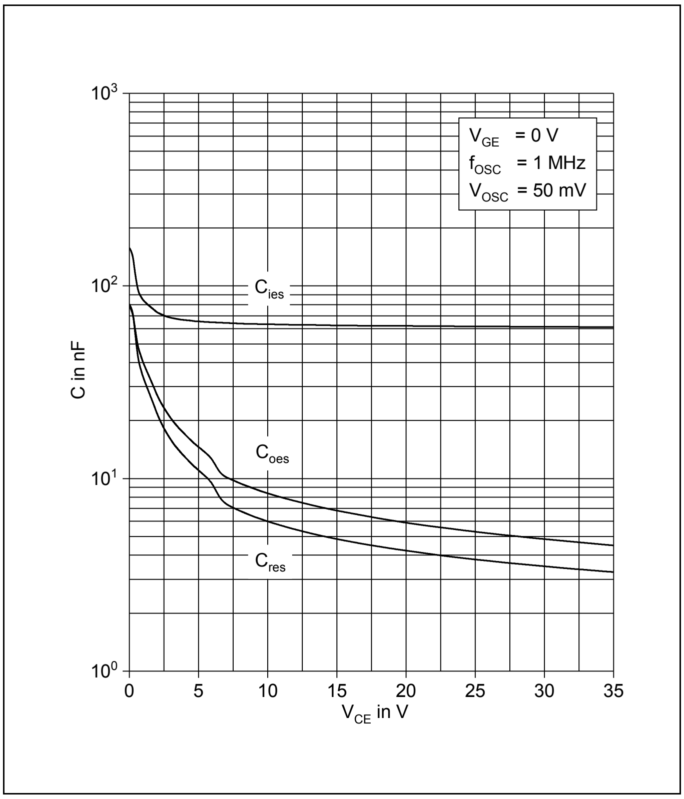


Fig. 9 Typical capacitances vs. collector-emitter voltage

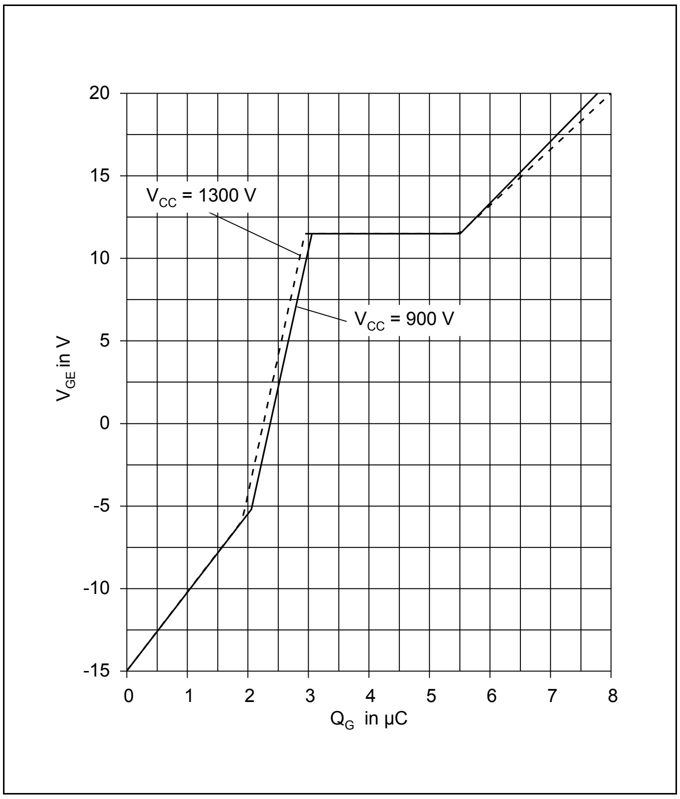


Fig. 10 Typical gate charge characteristics

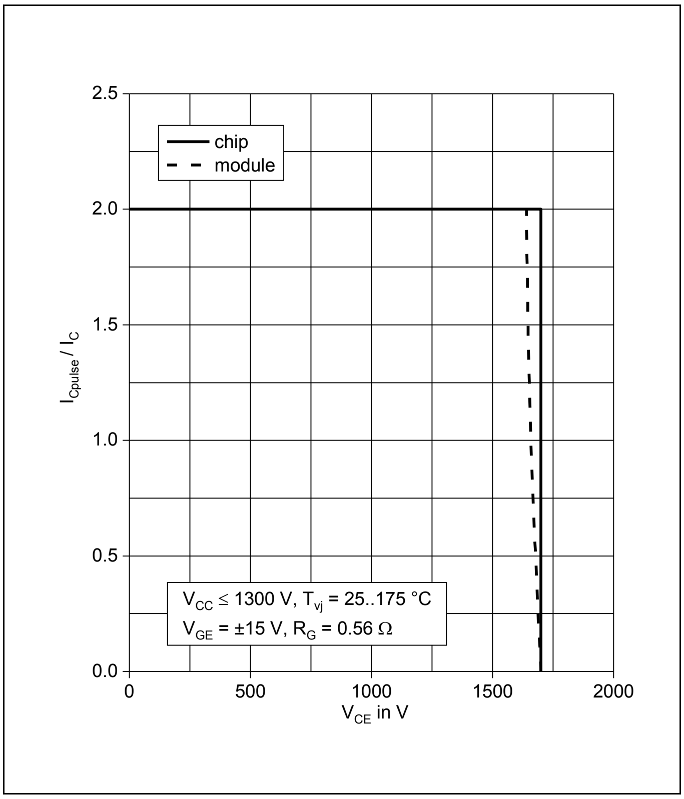


Fig. 11 Turn-off safe operating area (RBSOA)

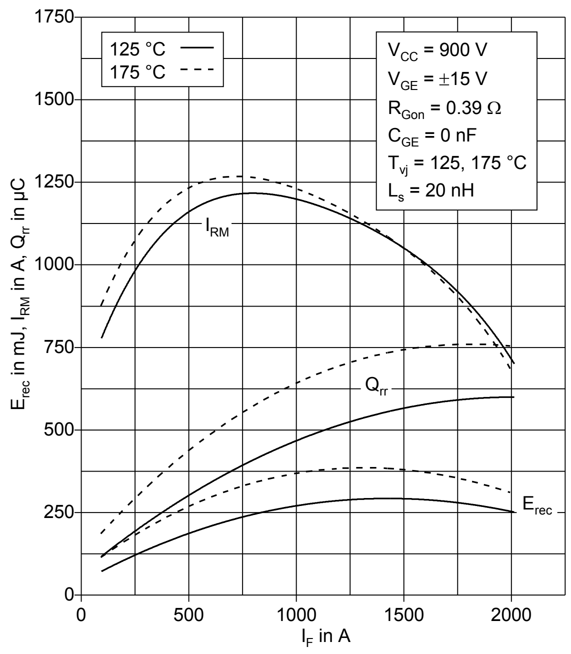


Fig. 12 Typical reverse recovery characteristics vs. forward current

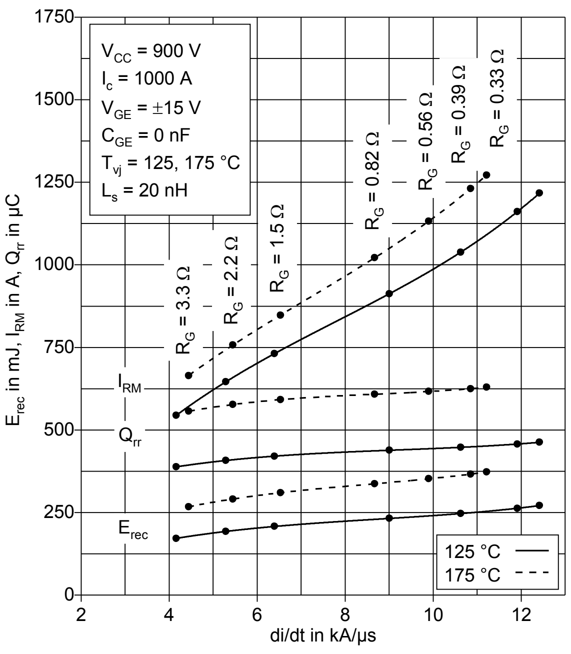


Fig. 13 Typical reverse recovery characteristics vs. di/dt

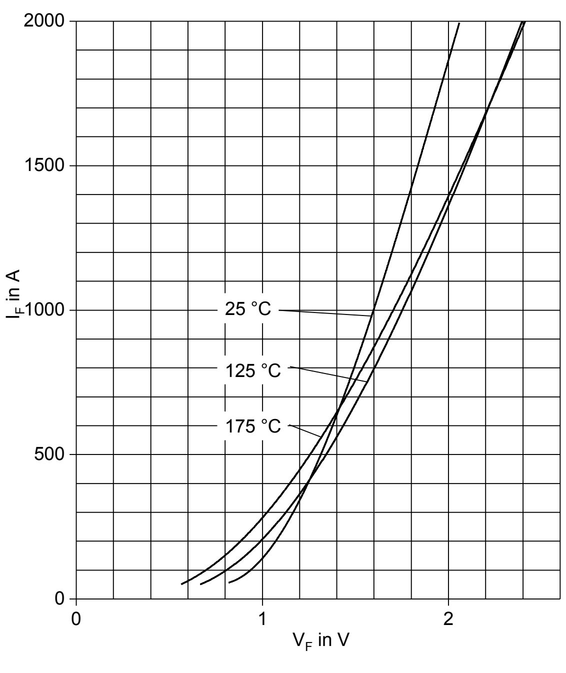


Fig. 14 Typical diode forward characteristics chip level

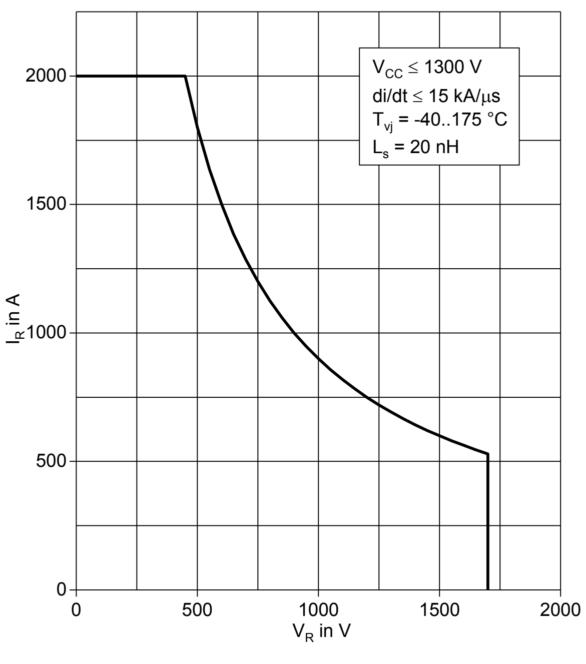


Fig. 15 Safe operating area diode (SOA)

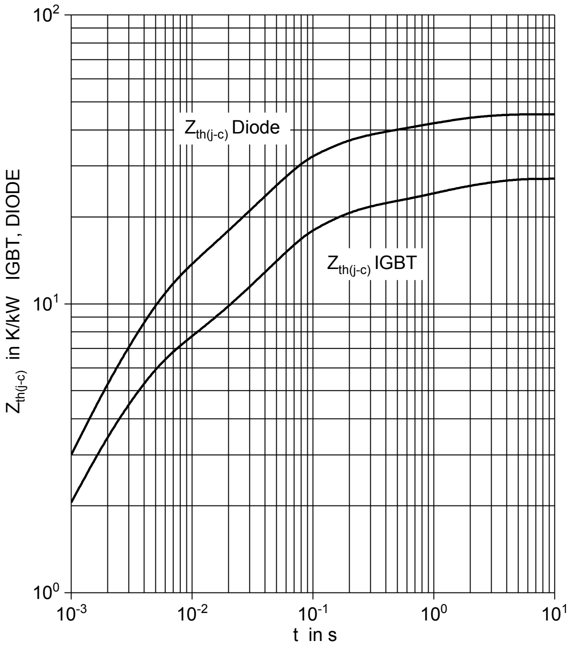


Fig. 16 Thermal impedance vs. time

Analytical function for transient thermal impedance:

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

	i	1	2	3	4	5
IGBT	Ri(K/kW)	15.0	6.48	5.58		
	τi(ms)	62.9	1280	2.55		
DIODE	Ri(K/kW)	26.3	10.0	8.96		
	τi(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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