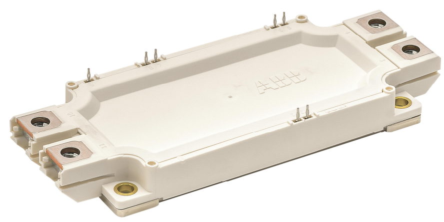
Data Sheet, Doc. No. 5SYA 1475-00 2020-07

5SNG 0225R170390
LoPak1 phase leg IGBT Module

V_{CE} = 1700 V
I_C = 2 x 225 A



Press-fit pins for reliable auxiliary contacts
Ultra low-loss, rugged SPT++ chip-set
NTC thermistor for temperature sensing
Cu base-plate for low thermal resistance
Pre-Applied Thermal Interface Material (TIM) to improve thermal conductivity between module and heat sink
Industry standard package

Maximum rated values [1)]

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V, T_{vj} ≥ 25 °C		1700	V
DC collector current	I_C	T_C = 125 °C, T_{vj} = 175 °C		225	A
Peak collector current	I_{CM}	t_p = 1 ms		450	A
Gate-emitter voltage	V_{GES}		-20	20	V
DC forward current	I_F			225	A
Peak forward current	I_{FRM}	t_p = 1 ms		450	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 175 °C, t_p = 10 ms, half-sinewave		1600	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 1300 V, $V_{CEM\ CHIP}$ ≤ 1700 V V_{GE} ≤ 15 V, T_{vj} ≤ 175 °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	125[2)] / 150	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques [3)]	M_s	Base-heatsink, M5 screws	3	6	Nm
	M_{t1}	Main terminals, M6 screws	3	6	Nm

[1)] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747
[2)] For UL1557 compliance T_{Cmax} must be limited to 125°C
[3)] For detailed mounting instructions refer to ABB Document No. 5SYA 2113

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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		1700			V
Collector-emitter [5)] saturation voltage	$V_{CE\,sat}$	I_C = 225 A, V_{GE} = 15 V	T_{vj} = 25 °C		2.25	2.6	V
			T_{vj} = 125 °C		2.55		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			0.1	mA
			T_{vj} = 125 °C		0.7		mA
			T_{vj} = 175 °C		13		mA
Gate leakage current	I_{GES}	V_{CE} = 0 V, V_{GE} = ± 20 V, T_{vj} = 175 °C		-500		500	nA
Gate-emitter threshold voltage	$V_{GE(th)}$	I_C = 6 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		4.5		6.5	V
Gate charge	Q_G	I_C = 225 A, V_{CE} = 900 V, V_{GE} = -15 V ..15 V			1.6		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			14.4		nF
Internal gate resistance	R_{Gint}	per switch			2.6		Ω
Turn-on delay time	$t_{d(on)}$	V_{CC} = 900 V, I_C = 225 A, R_G = 1.2 Ω, V_{GE} = ±15 V, L_σ = 40 nH, inductive load	T_{vj} = 25 °C		175		ns
			T_{vj} = 125 °C		185		ns
			T_{vj} = 175 °C		190		ns
Rise time	t_r		T_{vj} = 25 °C		46		ns
			T_{vj} = 125 °C		52		ns
			T_{vj} = 175 °C		58		ns
Turn-off delay time	$t_{d(off)}$	V_{CC} = 900 V, I_C = 225 A, R_G = 1.2 Ω, V_{GE} = ±15 V, L_σ = 40 nH, inductive load	T_{vj} = 25 °C		360		ns
			T_{vj} = 125 °C		450		ns
			T_{vj} = 175 °C		490		ns
Fall time	t_f		T_{vj} = 25 °C		100		ns
			T_{vj} = 125 °C		130		ns
			T_{vj} = 175 °C		175		ns
Turn-on switching energy	E_{on}	V_{CC} = 900 V, I_C = 225 A, R_G = 1.2 Ω, V_{GE} = ±15 V, L_σ = 40 nH, inductive load	T_{vj} = 25 °C		38		mJ
			T_{vj} = 125 °C		60		mJ
			T_{vj} = 175 °C		69		mJ
Turn-off switching energy	E_{off}	V_{CC} = 900 V, I_C = 225 A, R_G = 1.2 Ω, V_{GE} = ±15 V, L_σ = 40 nH, inductive load	T_{vj} = 25 °C		44		mJ
			T_{vj} = 125 °C		66		mJ
			T_{vj} = 175 °C		79		mJ
Short circuit current	I_{SC}	t_{psc} ≤ 10 µs, V_{GE} = 15 V, V_{CC} = 1300 V, $V_{CEM\,CHIP}$ ≤ 1700 V	T_{vj} = 175 °C		650		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 = 225 A	T_{vj} = 25 °C		1.6	2.2	V
			T_{vj} = 125 °C		1.75		V
			T_{vj} = 175 °C		1.7		V
Peak reverse recovery current	I_{RM}	V_{CC} = 900 V, I_F = 225 A, V_{GE} = ±15 V, R_G = 1.2 Ω, di/dt = 4.9 kA/µs L_σ = 40 nH, inductive load	T_{vj} = 25 °C		270		A
			T_{vj} = 125 °C		315		A
			T_{vj} = 175 °C		345		A
Recovered charge	Q_r		T_{vj} = 25 °C		60		µC
			T_{vj} = 125 °C		100		µC
			T_{vj} = 175 °C		135		µC
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		420		ns
			T_{vj} = 125 °C		520		ns
			T_{vj} = 175 °C		640		ns
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		38		mJ
			T_{vj} = 125 °C		65		mJ
			T_{vj} = 175 °C		86		mJ

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

NTC Thermistor

Parameter	Symbol	Conditions	min	typ	max	Unit
Rated resistance	R_{25}	T_C = 25 °C		5		kΩ
R100	R_{100}	T_C = 100 °C	468		517	Ω
B-value	$B_{25/50}$	$R_{25} = R_{25}$ exp $[B_{25/50}(1/T_2 - 1/(298.15K))]$		3375		K
B-value	$B_{25/100}$	$R_{25} = R_{25}$ exp $[B_{25/100}(1/T_2 - 1/(298.15K))]$		3433		K

Package properties [8]

Parameter	Symbol	Conditions		min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$	per switch				0.080	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$					0.140	K/W
IGBT thermal resistance [3] case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 5.2W/m x K			0.025		K/W
Diode thermal resistance [3] case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = 5.2W/m x K			0.041		K/W
Comparative tracking index	CTI			200			
Module stray inductance	$L_{\sigma CE}$	per switch			25		nH
Resistance, terminal-chip	$R_{CC'+EE'}$	per switch	T_C = 25 °C		0.95		mΩ
			T_C = 125 °C		1.35		
			T_C = 175 °C		1.55		

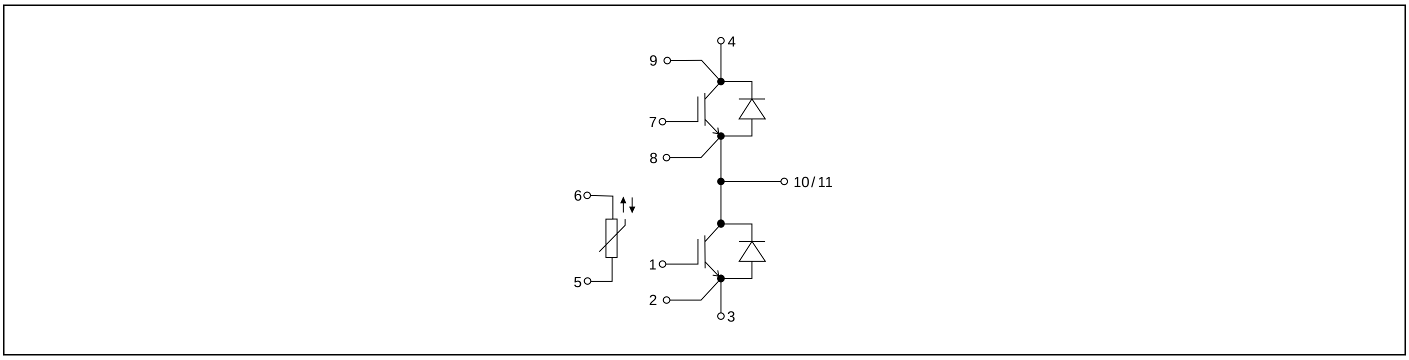
[3] For detailed mounting instructions refer to ABB Document No. 5SYA 2113

Mechanical properties [8]

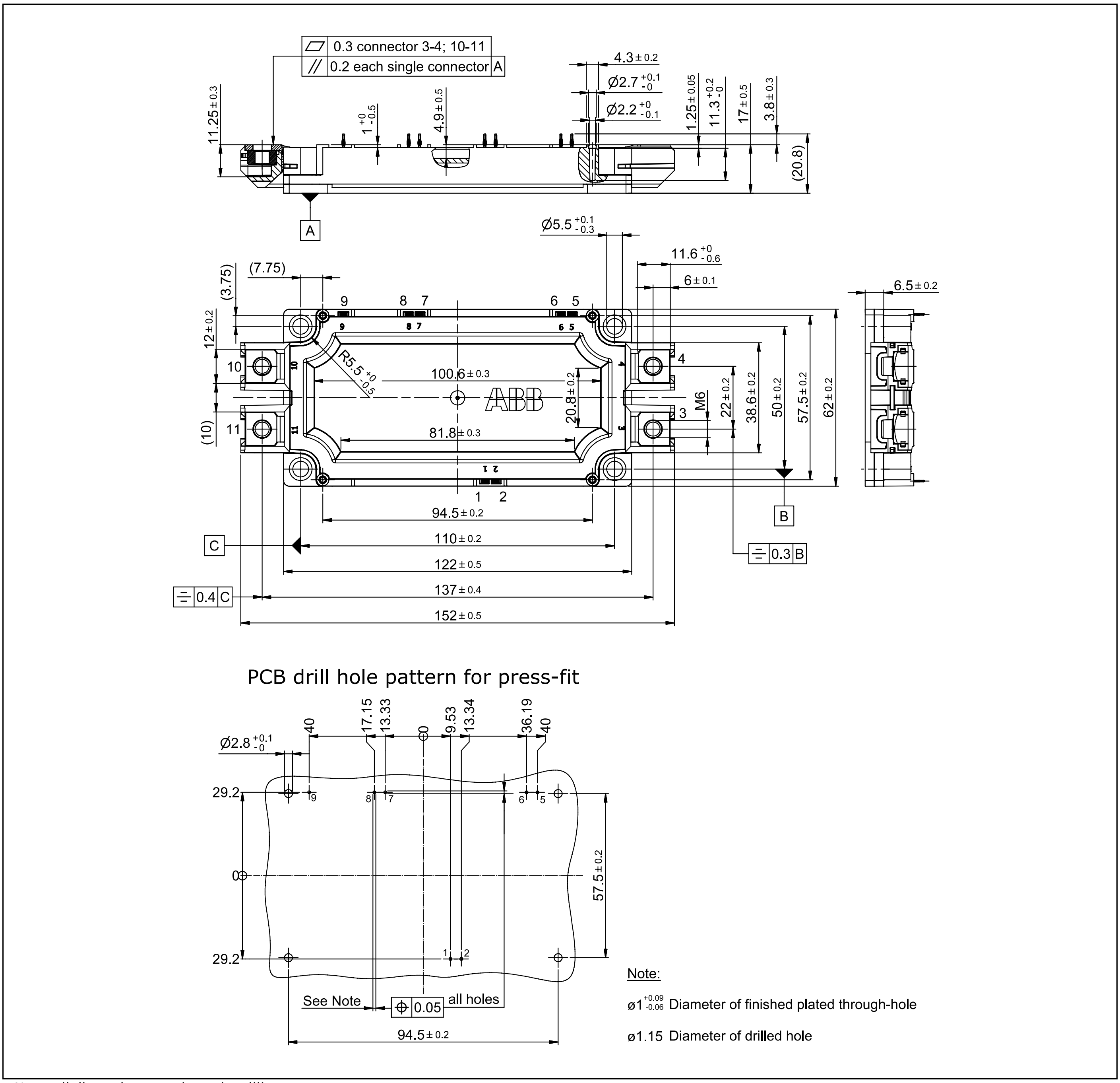
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical			152 x 62 x 17		mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	12.5			mm
			Term. to term:	10			
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	14.5			mm
			Term. to term:	13			
Mass	m				350		g

[8] Package and mechanical properties according to IEC 60747 – 15

Electrical configuration



Outline drawing [3)]



Note: all dimensions are shown in millimeters
[3)] For detailed mounting instructions refer to ABB Document No. 5SYA 2113

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.

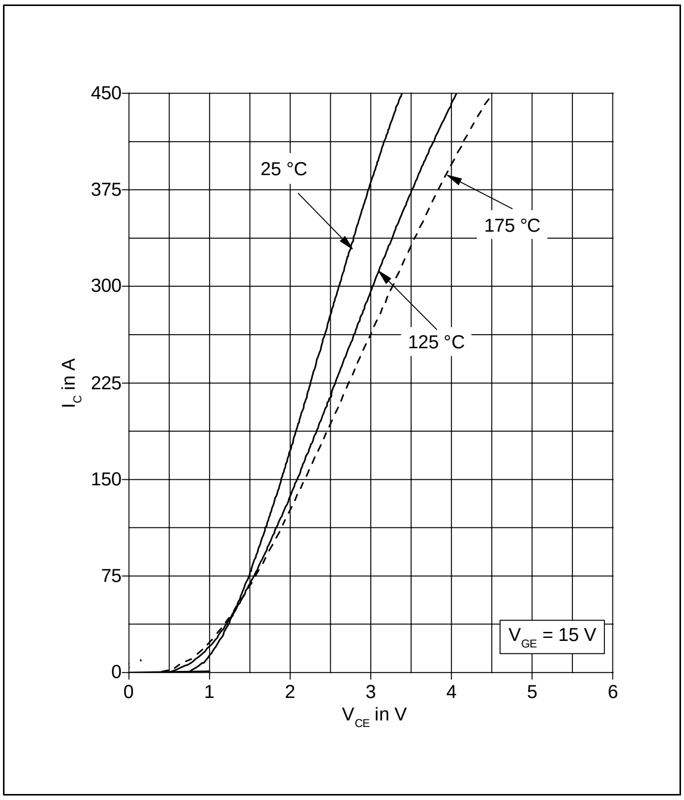


Fig. 1 Typical on-state characteristics, chip level

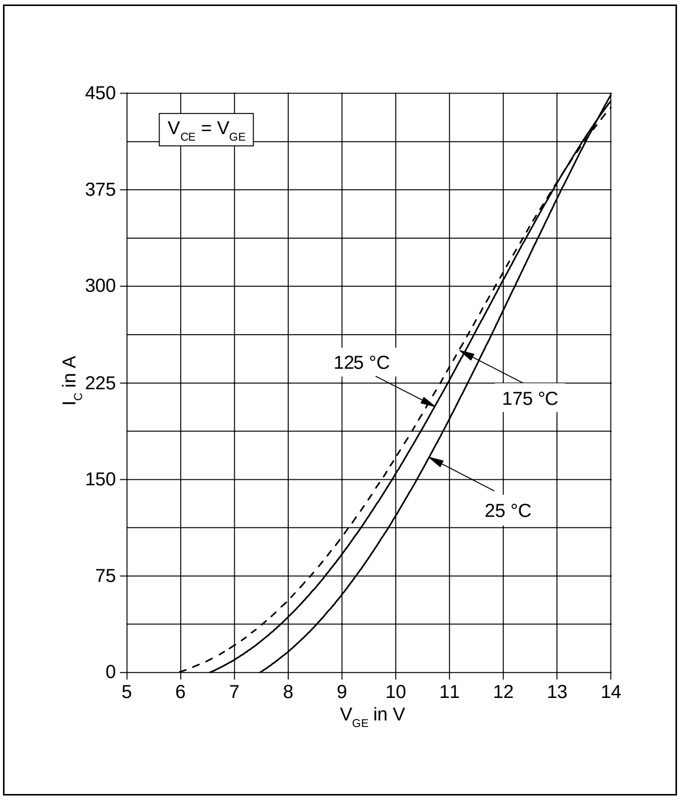


Fig. 2 Typical transfer characteristics, chip level

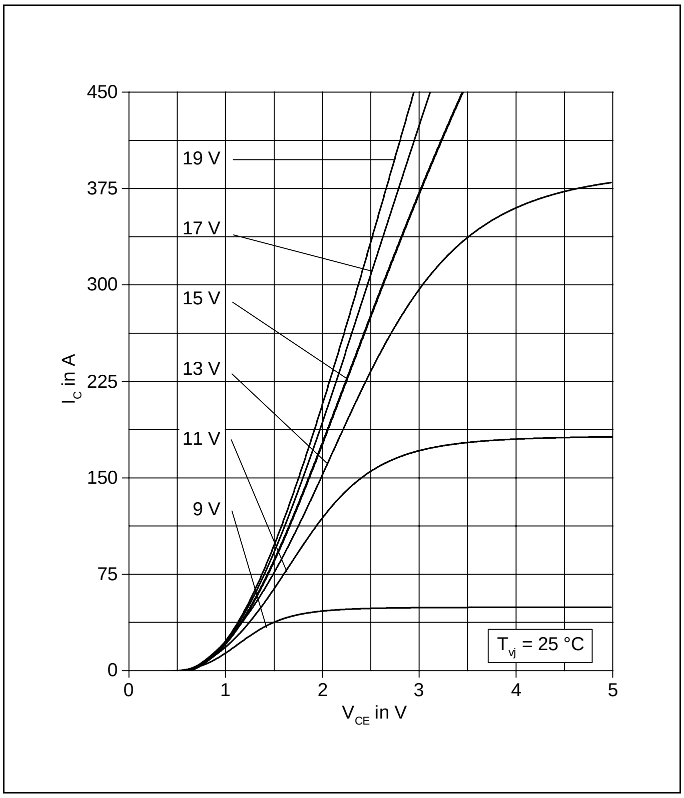


Fig. 3 Typical output characteristics, chip level

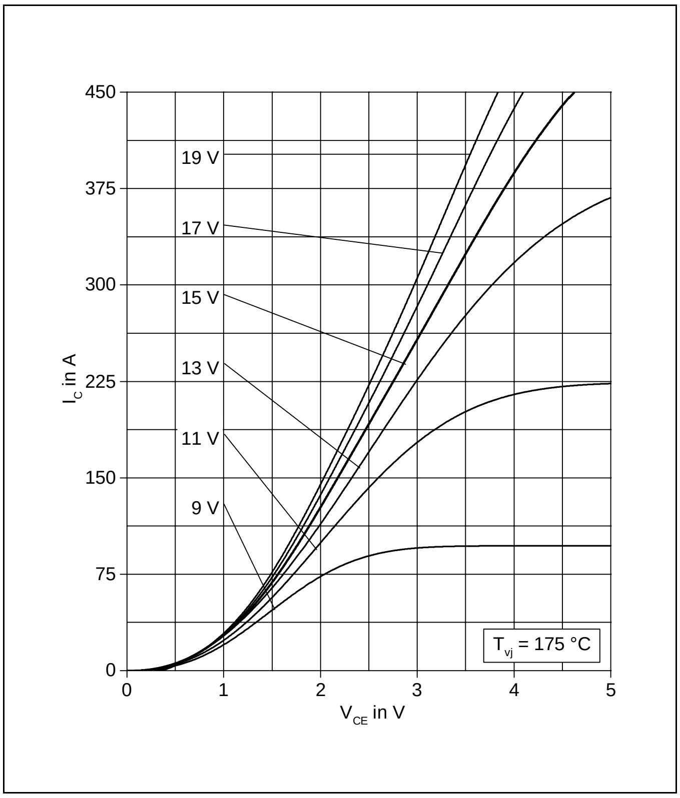


Fig. 4 Typical output characteristics, chip level

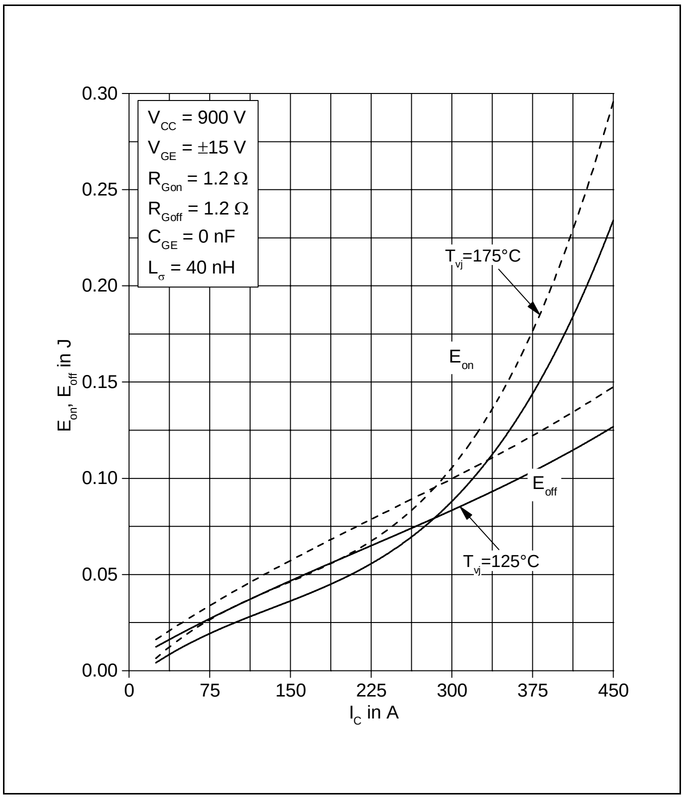


Fig. 5 Typical switching energies per pulse vs. collector current

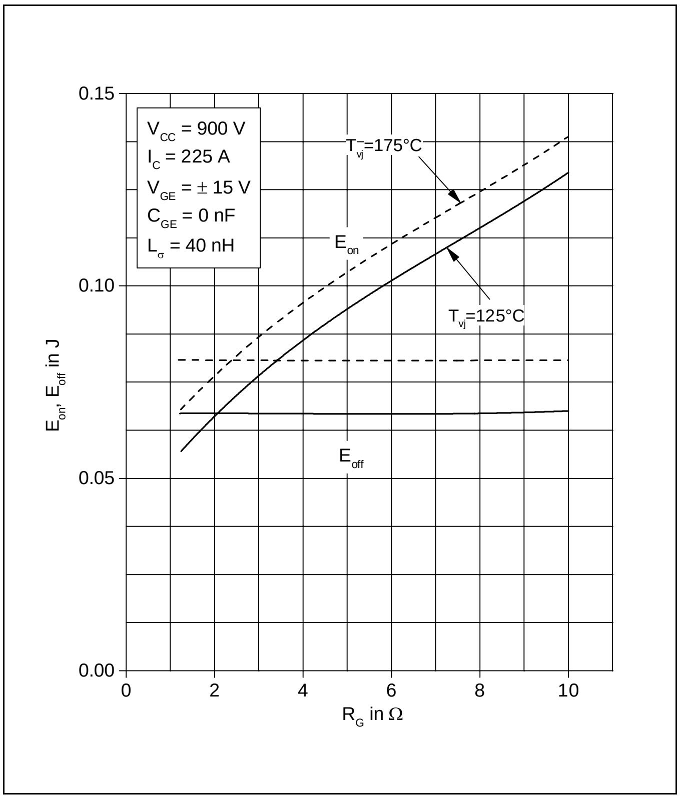


Fig. 6 Typical switching energies per pulse vs. gate resistor

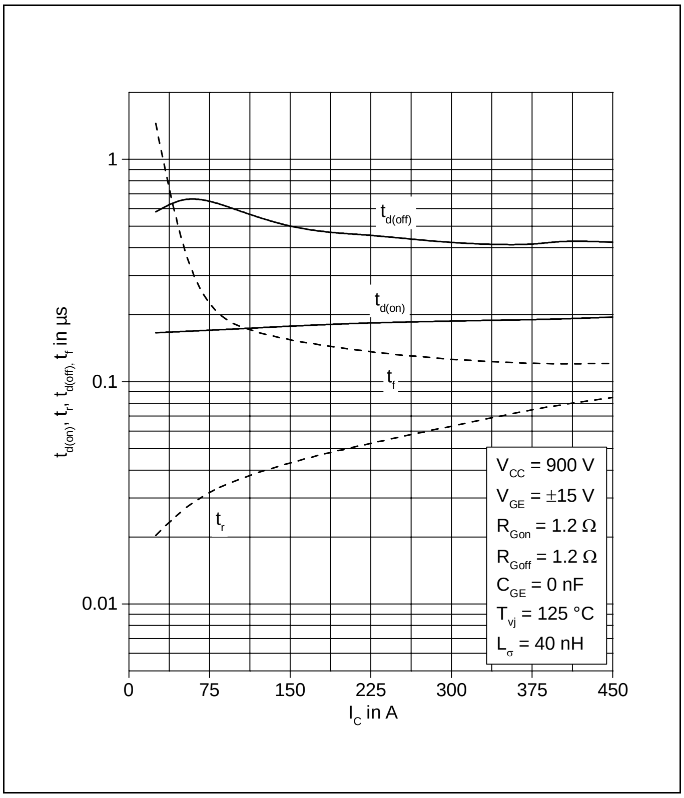


Fig. 7 Typical switching times vs. collector current

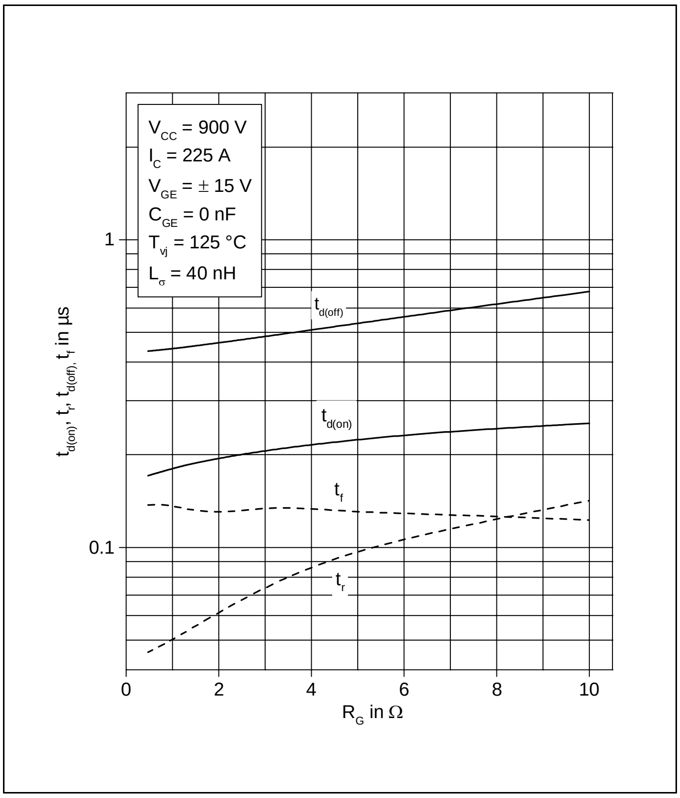


Fig. 8 Typical switching times vs. gate resistor

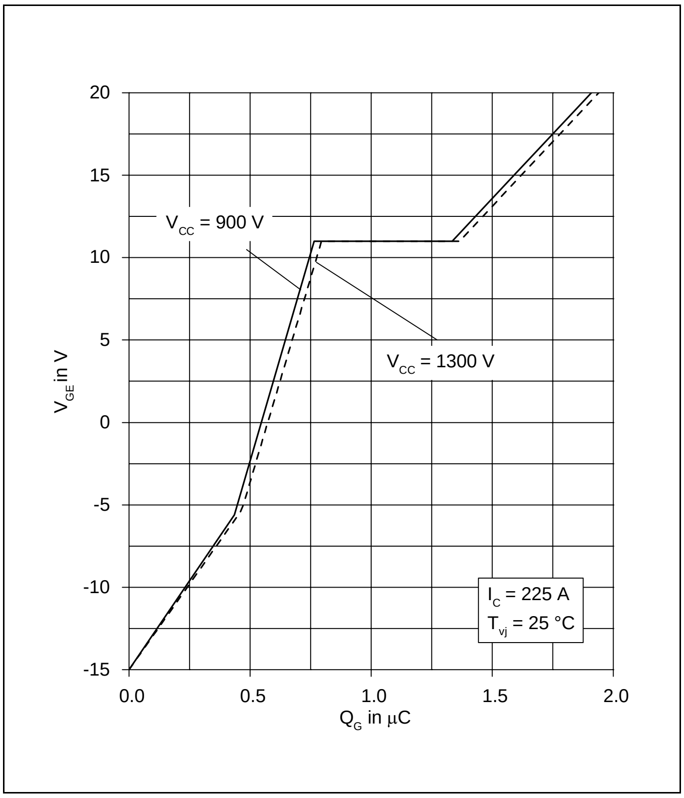


Fig. 9 Typical gate charge characteristics

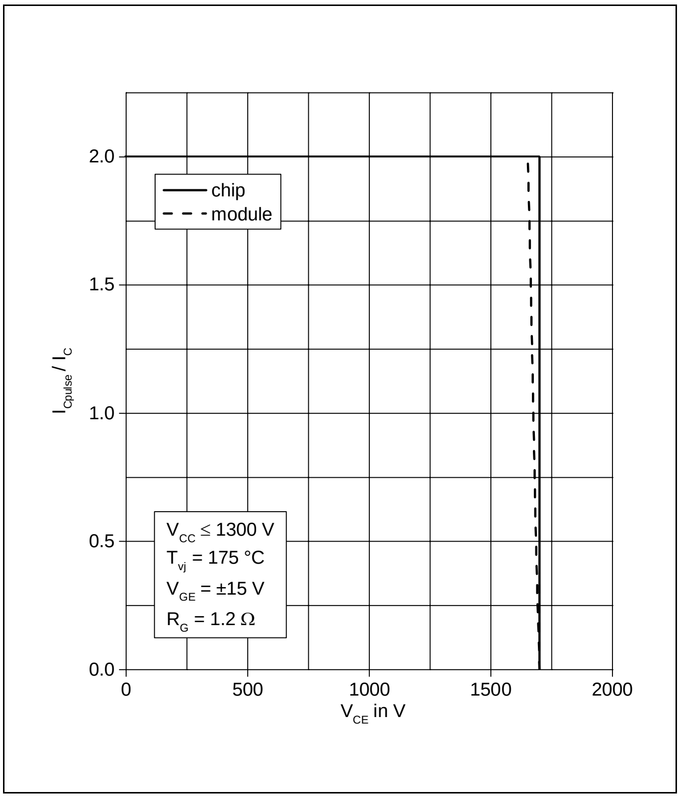


Fig. 10 Turn-off safe operating area (RBSOA)

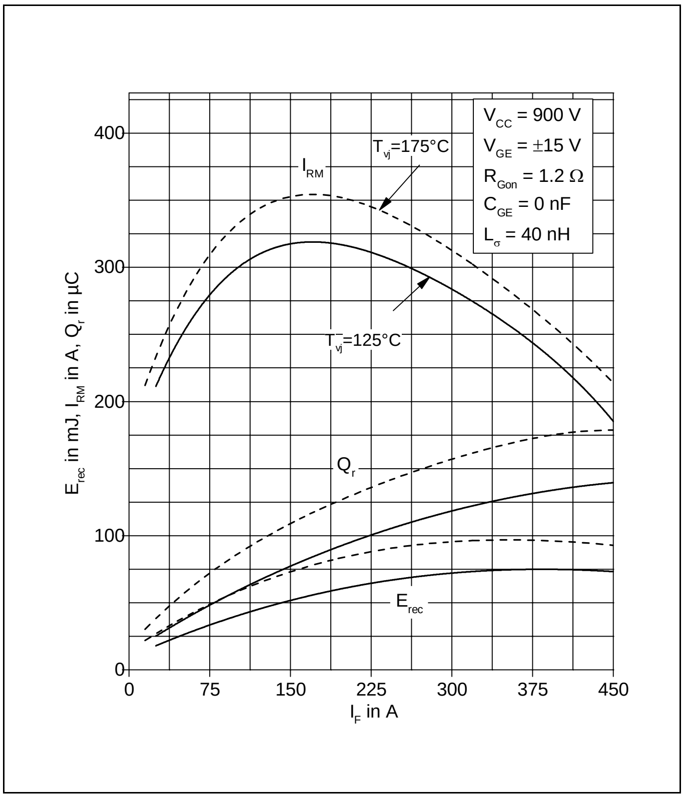


Fig. 11 Typical reverse recovery characteristics vs. forward current

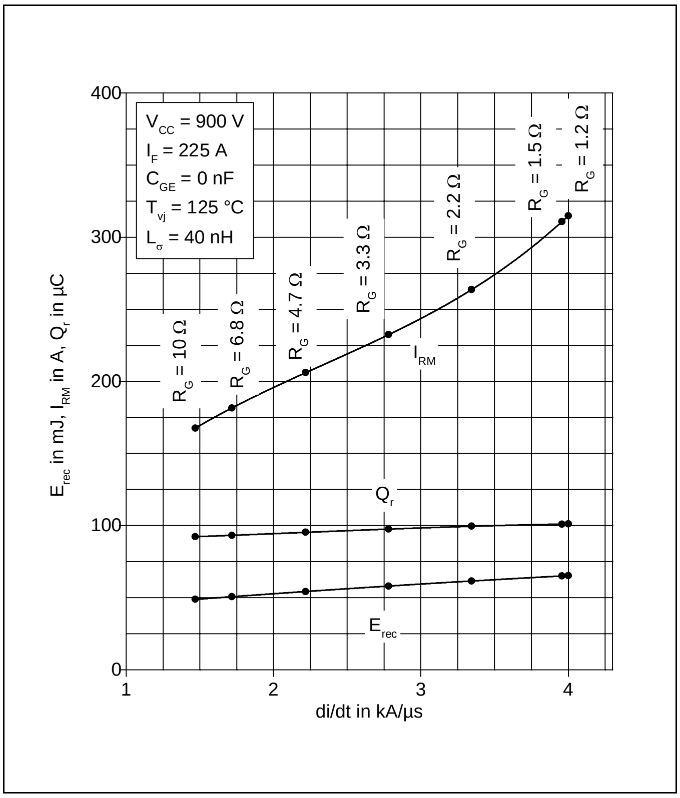


Fig. 12 Typical reverse recovery characteristics vs. di/dt

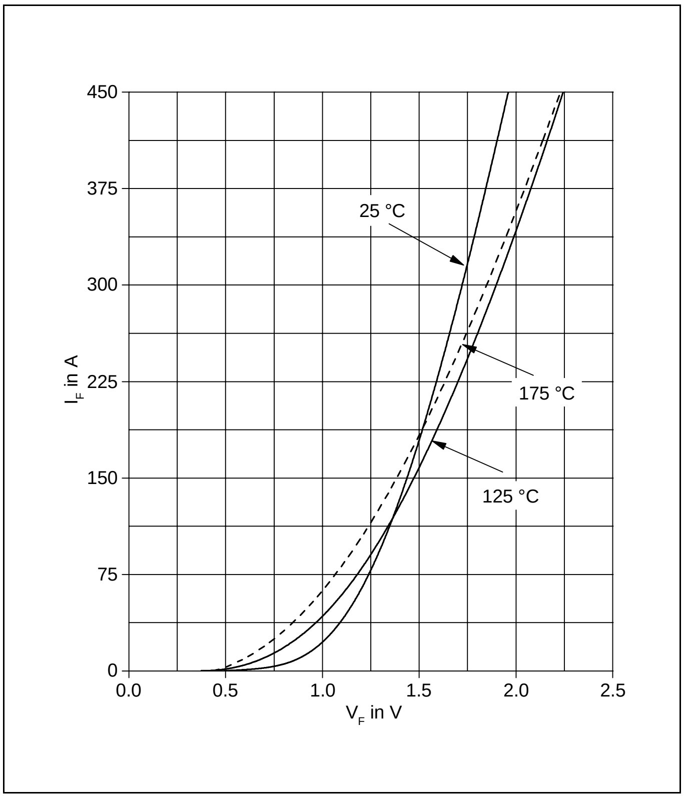


Fig. 13 Typicial diode forward characteristics chip level

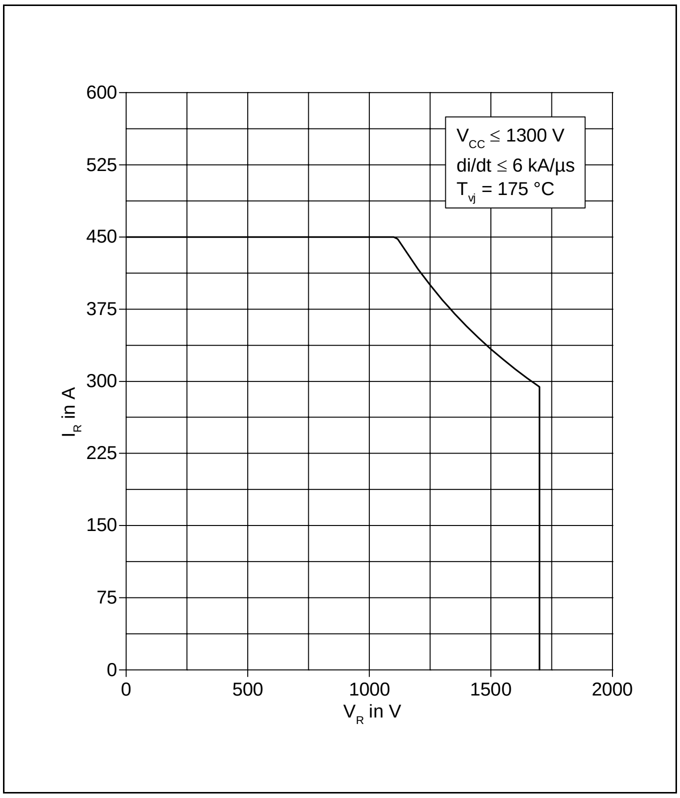


Fig. 14 Safe operating area diode (SOA)

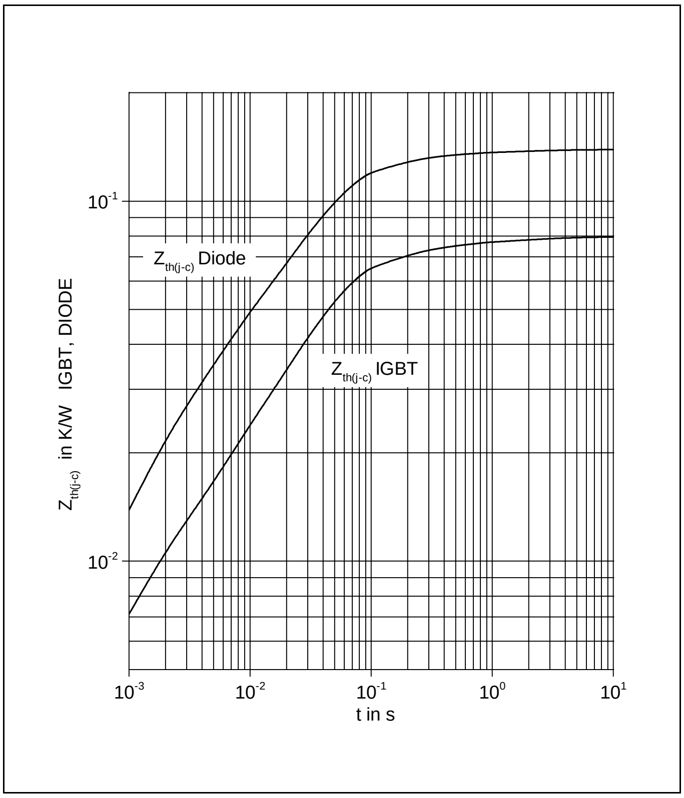


Fig. 15 Thermal impedance vs. time

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	R_i(K/kW)	10.3	55.2	10.2	2.3	1.97
	τ_i(ms)	1.3	37	240	1380	2800
DIODE	R_i(K/kW)	10	17.8	94.8	13.6	3.8
	τ_i(ms)	0.8	3.5	37.8	242.6	222.2

Related documents:

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
5SYA 2113 Mounting instructions for LoPak1 modules

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