

# 5SNG 0200Q170300

## 62Pak phase leg IGBT Module

$V_{CE} = 1700 \text{ V}$   
 $I_C = 200 \text{ A}$

Ultra low-loss, rugged SPT++ chip-set  
 Smooth switching SPT++ chip-set for good EMC  
 Cu base-plate for low thermal resistance  
 Industry standard package  
 2 switches in one package



### Maximum rated values <sup>1)</sup>

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	$I_C$	$T_C = 100 \text{ °C}$ , $T_{vj} = 175 \text{ °C}$		200	A
Peak collector current	$I_{CM}$	$t_p = 1 \text{ ms}$		400	A
Gate-emitter voltage	$V_{GES}$		-20	20	V
Total power dissipation	$P_{tot}$	$T_C = 25 \text{ °C}$ , $T_{vj} = 175 \text{ °C}$ , per switch		1250	W
DC forward current	$I_F$			200	A
Peak forward current	$I_{FRM}$	$t_p = 1 \text{ ms}$		400	A
Surge current	$I_{FSM}$	$V_R = 0 \text{ V}$ , $T_{vj} = 175 \text{ °C}$ , $t_p = 10 \text{ ms}$ , half-sinewave		1200	A
IGBT short circuit SOA	$t_{psc}$	$V_{CC} = 1300 \text{ V}$ , $V_{CEM \text{ CHIP}} \leq 1700 \text{ V}$ $V_{GE} \leq 15 \text{ V}$ , $T_{vj} \leq 175 \text{ °C}$		10	$\mu\text{s}$
Isolation voltage	$V_{isol}$	1 min, $f = 50 \text{ Hz}$		4000	V
Junction temperature	$T_{vj}$			175	$^{\circ}\text{C}$
Junction operating temperature	$T_{vj(op)}$		-40	175	$^{\circ}\text{C}$
Case temperature	$T_C$		-40	125 <sup>2)</sup> /150	$^{\circ}\text{C}$
Storage temperature	$T_{stg}$		-40	125	$^{\circ}\text{C}$
Mounting torques <sup>3)</sup>	$M_s$	Base-heatsink, M6 screws	3	6	Nm
	$M_{t1}$	Main terminals, M6 screws	3	6	

<sup>1)</sup> Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

<sup>2)</sup> for UL1557 compliance  $T_{Cmax}$  must be limited to 125 $^{\circ}\text{C}$

<sup>3)</sup> for detailed mounting instructions refer to ABB Document No. 5SYA 2106

## IGBT characteristic values <sup>4)</sup>

Parameter	Symbol	Conditions	min	typ	max	Unit
Collector (-emitter) breakdown voltage	$V_{(BR)CES}$	$V_{GE} = 0 \text{ V}$ , $I_C = 10 \text{ mA}$ , $T_{vj} = 25 \text{ °C}$	1700			V
Collector-emitter <sup>5)</sup> saturation voltage	$V_{CE \text{ sat}}$	$I_C = 200 \text{ A}$ , $V_{GE} = 15 \text{ V}$	$T_{vj} = 25 \text{ °C}$	2.25	2.6	V
			$T_{vj} = 125 \text{ °C}$	2.55		V
			$T_{vj} = 175 \text{ °C}$	2.75		V
Collector cut-off current	$I_{CES}$	$V_{CE} = 1700 \text{ V}$ , $V_{GE} = 0 \text{ V}$	$T_{vj} = 25 \text{ °C}$		1	mA
			$T_{vj} = 125 \text{ °C}$		1	mA
			$T_{vj} = 175 \text{ °C}$		20	mA
Gate leakage current	$I_{GES}$	$V_{CE} = 0 \text{ V}$ , $V_{GE} = \pm 20 \text{ V}$ , $T_{vj} = 175 \text{ °C}$	-1		1	$\mu\text{A}$
Gate-emitter threshold voltage	$V_{GE(th)}$	$I_C = 8 \text{ mA}$ , $V_{CE} = V_{GE}$ , $T_{vj} = 25 \text{ °C}$	4.5		6.5	V
Gate charge	$Q_G$	$I_C = 200 \text{ A}$ , $V_{CE} = 900 \text{ V}$ , $V_{GE} = -15 \text{ V} \dots 15 \text{ V}$		1.4		$\mu\text{C}$
Input capacitance	$C_{ies}$	$V_{CE} = 25 \text{ V}$ , $V_{GE} = 0 \text{ V}$ , $f = 1 \text{ MHz}$ , $T_{vj} = 25 \text{ °C}$		12.8		nF
Output capacitance	$C_{oes}$			1.2		nF
Reverse transfer capacitance	$C_{res}$			1.1		nF
Internal gate resistance	$R_{Gint}$	per switch		2.95		$\Omega$
Turn-on delay time	$t_{d(on)}$	$V_{CC} = 900 \text{ V}$ , $I_C = 200 \text{ A}$ , $R_G = 2.2 \text{ }\Omega$ , $V_{GE} = \pm 15 \text{ V}$ , $L_\sigma = 60 \text{ nH}$ , inductive load	$T_{vj} = 25 \text{ °C}$	195		ns
			$T_{vj} = 125 \text{ °C}$	205		ns
			$T_{vj} = 175 \text{ °C}$	210		ns
Rise time	$t_r$	$V_{CC} = 900 \text{ V}$ , $I_C = 200 \text{ A}$ , $R_G = 2.2 \text{ }\Omega$ , $V_{GE} = \pm 15 \text{ V}$ , $L_\sigma = 60 \text{ nH}$ , inductive load	$T_{vj} = 25 \text{ °C}$	70		ns
			$T_{vj} = 125 \text{ °C}$	75		ns
			$T_{vj} = 175 \text{ °C}$	80		ns
Turn-off delay time	$t_{d(off)}$	$V_{CC} = 900 \text{ V}$ , $I_C = 200 \text{ A}$ , $R_G = 2.2 \text{ }\Omega$ , $V_{GE} = \pm 15 \text{ V}$ , $L_\sigma = 60 \text{ nH}$ , inductive load	$T_{vj} = 25 \text{ °C}$	250		ns
			$T_{vj} = 125 \text{ °C}$	380		ns
			$T_{vj} = 175 \text{ °C}$	320		ns
Fall time	$t_f$	$V_{CC} = 900 \text{ V}$ , $I_C = 200 \text{ A}$ , $R_G = 2.2 \text{ }\Omega$ , $V_{GE} = \pm 15 \text{ V}$ , $L_\sigma = 60 \text{ nH}$ , inductive load	$T_{vj} = 25 \text{ °C}$	160		ns
			$T_{vj} = 125 \text{ °C}$	175		ns
			$T_{vj} = 175 \text{ °C}$	200		ns
Turn-on switching energy	$E_{on}$	$V_{CC} = 900 \text{ V}$ , $I_C = 200 \text{ A}$ , $R_G = 2.2 \text{ }\Omega$ , $V_{GE} = \pm 15 \text{ V}$ , $L_\sigma = 60 \text{ nH}$ , inductive load	$T_{vj} = 25 \text{ °C}$	45		mJ
			$T_{vj} = 125 \text{ °C}$	60		mJ
			$T_{vj} = 175 \text{ °C}$	75		mJ
Turn-off switching energy	$E_{off}$	$V_{CC} = 900 \text{ V}$ , $I_C = 200 \text{ A}$ , $R_G = 2.2 \text{ }\Omega$ , $V_{GE} = \pm 15 \text{ V}$ , $L_\sigma = 60 \text{ nH}$ , inductive load	$T_{vj} = 25 \text{ °C}$	30		mJ
			$T_{vj} = 125 \text{ °C}$	50		mJ
			$T_{vj} = 175 \text{ °C}$	65		mJ
Short circuit current	$I_{SC}$	$t_{psc} \leq 10 \text{ }\mu\text{s}$ , $V_{GE} = 15 \text{ V}$ , $V_{CC} = 1300 \text{ V}$ , $V_{CEM \text{ CHIP}} \leq 1700 \text{ V}$	$T_{vj} = 175 \text{ °C}$	620		A

<sup>4)</sup> Characteristic values according to IEC 60747 - 9

<sup>5)</sup> Collector-emitter saturation voltage is given at chip level

## Diode characteristic values <sup>6)</sup>

Parameter	Symbol	Conditions	min	typ	max	Unit
Forward voltage <sup>7)</sup>	$V_F$	$I_F = 200 \text{ A}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1.6	2.2	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1.75		V
			$T_{vj} = 175 \text{ }^\circ\text{C}$	1.7		V
Peak reverse recovery current	$I_{RM}$		$T_{vj} = 25 \text{ }^\circ\text{C}$	250		A
			$T_{vj} = 125 \text{ }^\circ\text{C}$	300		A
			$T_{vj} = 175 \text{ }^\circ\text{C}$	340		A
Recovered charge	$Q_r$	$V_{CC} = 900 \text{ V}$ , $I_F = 200 \text{ A}$ , $V_{GE} = \pm 15 \text{ V}$ , $R_G = 2.2 \text{ } \Omega$ , $di/dt = 3.2 \text{ kA}/\mu\text{s}$ $L_\sigma = 60 \text{ nH}$ , inductive load	$T_{vj} = 25 \text{ }^\circ\text{C}$	56		$\mu\text{C}$
			$T_{vj} = 125 \text{ }^\circ\text{C}$	90		$\mu\text{C}$
			$T_{vj} = 175 \text{ }^\circ\text{C}$	140		$\mu\text{C}$
Reverse recovery time	$t_{rr}$		$T_{vj} = 25 \text{ }^\circ\text{C}$	410		ns
			$T_{vj} = 125 \text{ }^\circ\text{C}$	480		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	550		ns
Reverse recovery energy	$E_{rec}$		$T_{vj} = 25 \text{ }^\circ\text{C}$	35		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	55		mJ
			$T_{vj} = 175 \text{ }^\circ\text{C}$	75		mJ

<sup>6)</sup> Characteristic values according to IEC 60747 - 2

<sup>7)</sup> Forward voltage is given at chip level

## Package properties <sup>8)</sup>

Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$	per switch			0.12	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.15	K/W
IGBT thermal resistance <sup>3)</sup> case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, $\lambda$ grease = $1\text{W}/\text{m} \times \text{K}$		0.033		K/W
Diode thermal resistance <sup>3)</sup> case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, $\lambda$ grease = $1\text{W}/\text{m} \times \text{K}$		0.050		K/W
Comparative tracking index	CTI		200			
Module stray inductance	$L_{\sigma CE}$	per switch		20		nH
Resistance, terminal-chip	$R_{CC' \rightarrow EE'}$	per switch	$T_C = 25 \text{ }^\circ\text{C}$	0.7		m $\Omega$
			$T_C = 125 \text{ }^\circ\text{C}$	0.98		
			$T_C = 175 \text{ }^\circ\text{C}$	1.12		

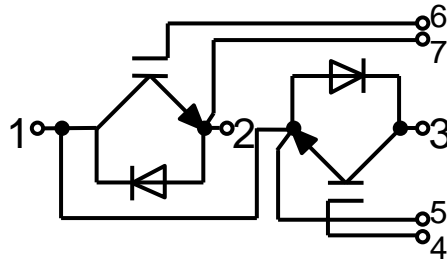
<sup>3)</sup> For detailed mounting instructions refer to ABB Document No. 5SYA 2106

## Mechanical properties <sup>8)</sup>

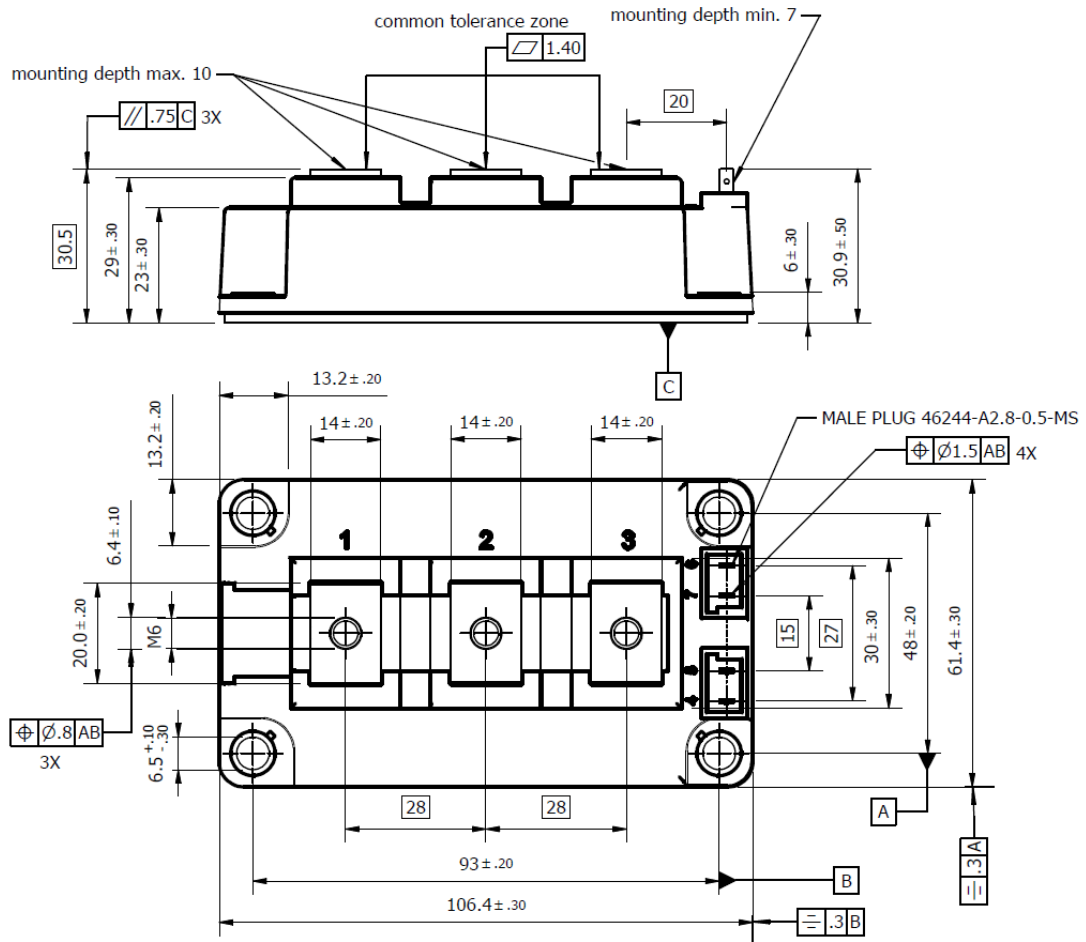
Parameter	Symbol	Conditions	min	typ	max	Unit
Dimensions	L x W x H	Typical	106.4 x 61.4 x 30.9			mm
Clearance distance in air	$d_a$	according to IEC 60664-1 and EN 50124-1	Term. to base:	23		mm
			Term. to term:	11		
Surface creepage distance	$d_s$	according to IEC 60664-1 and EN 50124-1	Term. to base:	29		mm
			Term. to term:	23		
Mass	m			330		g

<sup>8)</sup> Package and mechanical properties according to IEC 60747 - 15

## Electrical configuration



## Outline drawing <sup>3)</sup>



Note: all dimensions are shown in millimeters

<sup>3)</sup> For detailed mounting instructions refer to ABB Document No. 5SYA 2106

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.

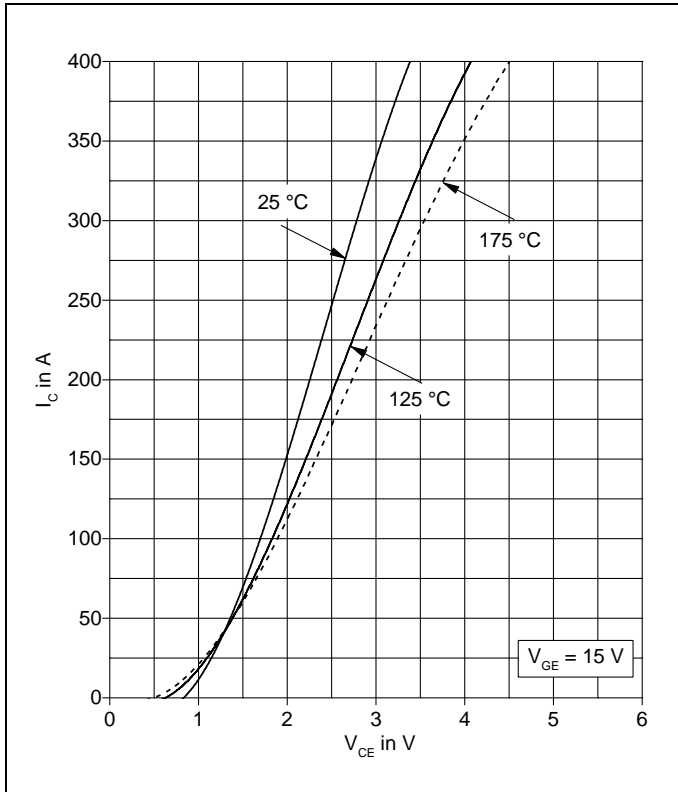


Fig. 1 Typical on-state characteristics, chip level

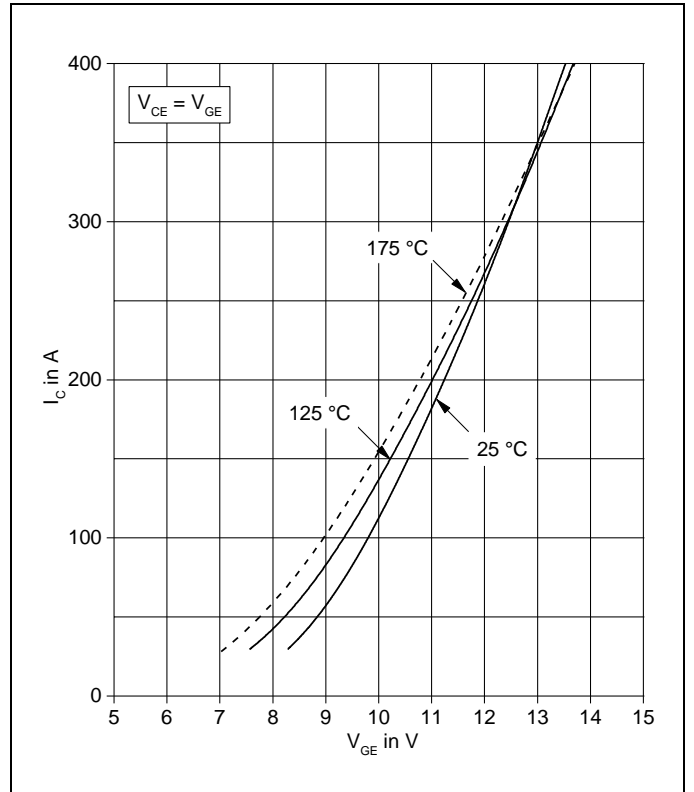


Fig. 2 Typical transfer characteristics, chip level

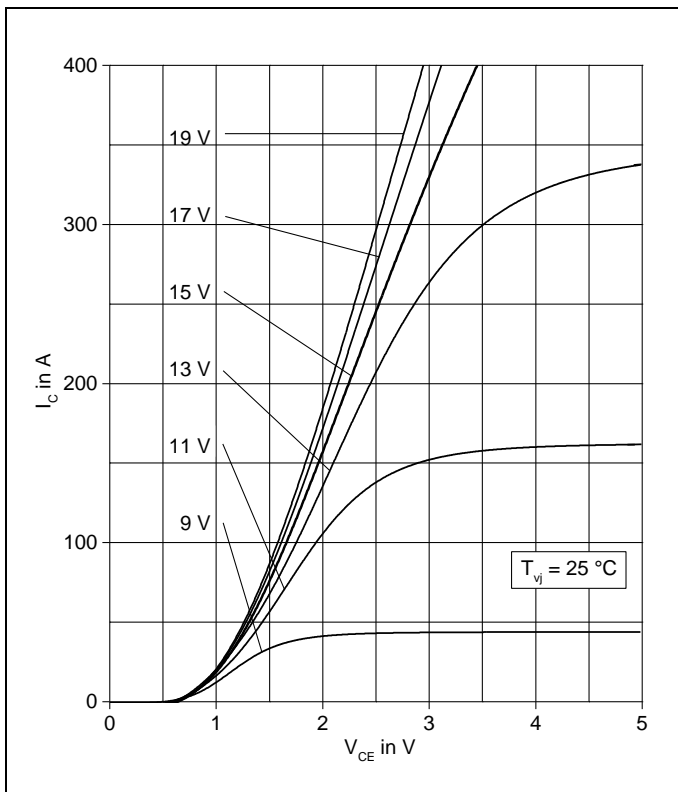


Fig. 3 Typical output characteristics, chip level

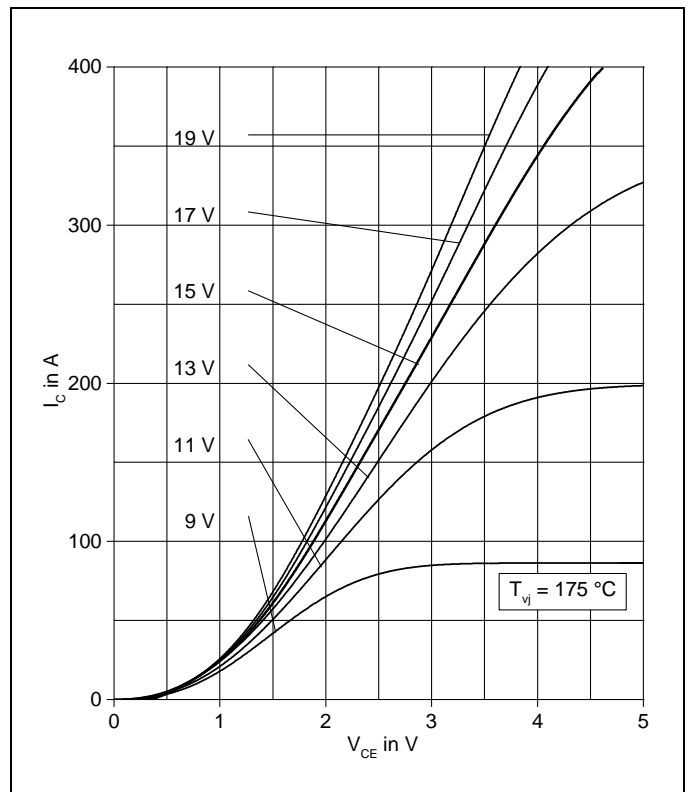


Fig. 4 Typical output characteristics, chip level

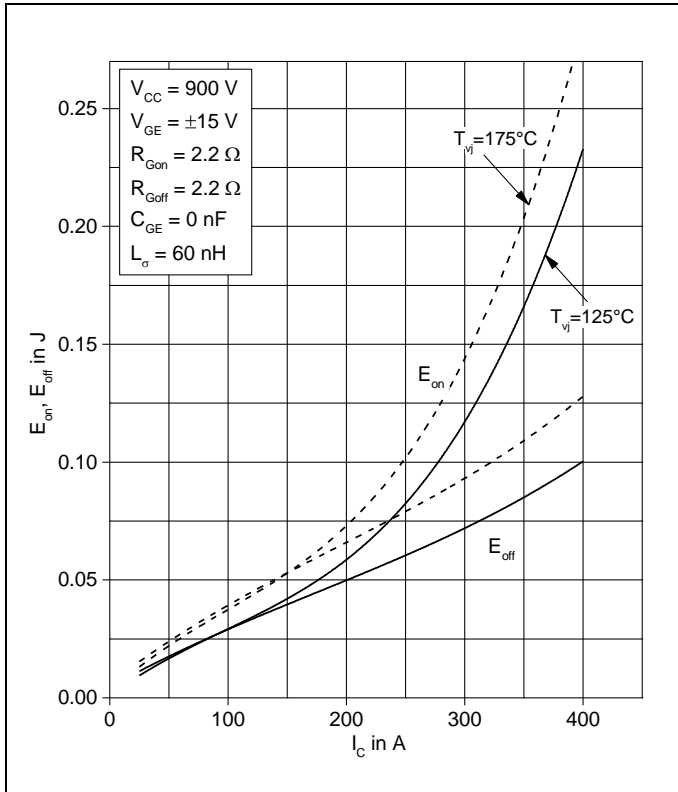


Fig. 5 Typical switching energies per pulse vs. collector current

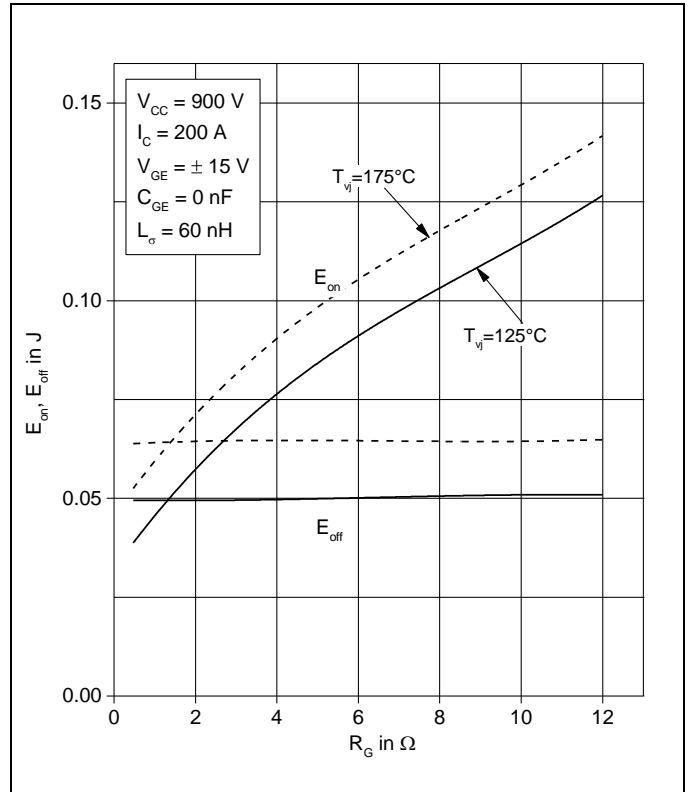


Fig. 6 Typical switching energies per pulse vs. gate resistor

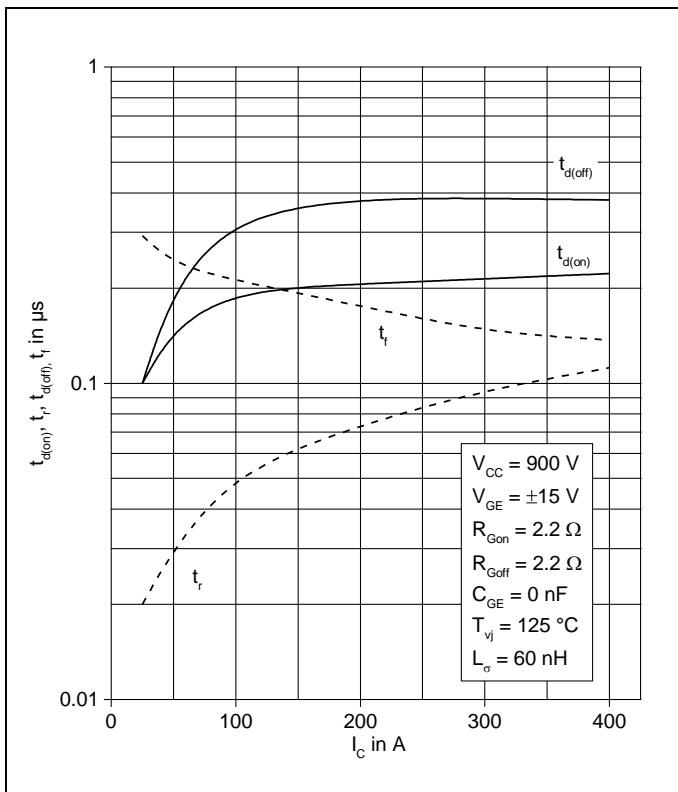


Fig. 7 Typical switching times vs. collector current

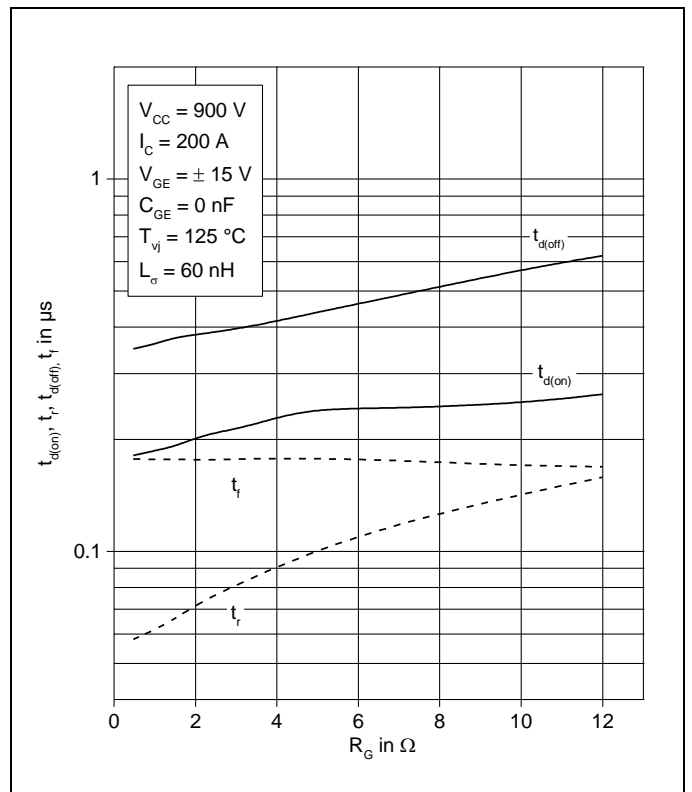


Fig. 8 Typical switching times vs. gate resistor

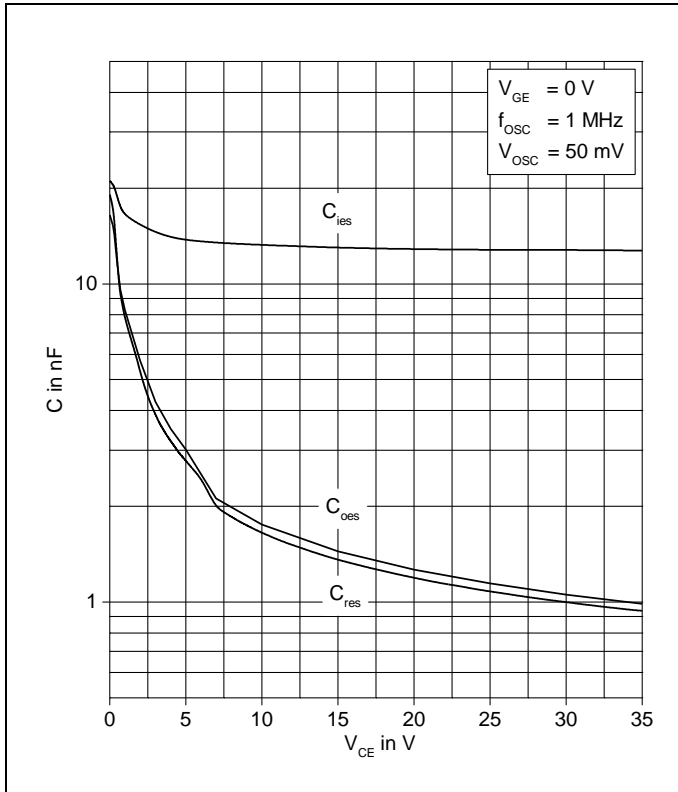


Fig. 9 Typical capacitances vs. collector-emitter voltage

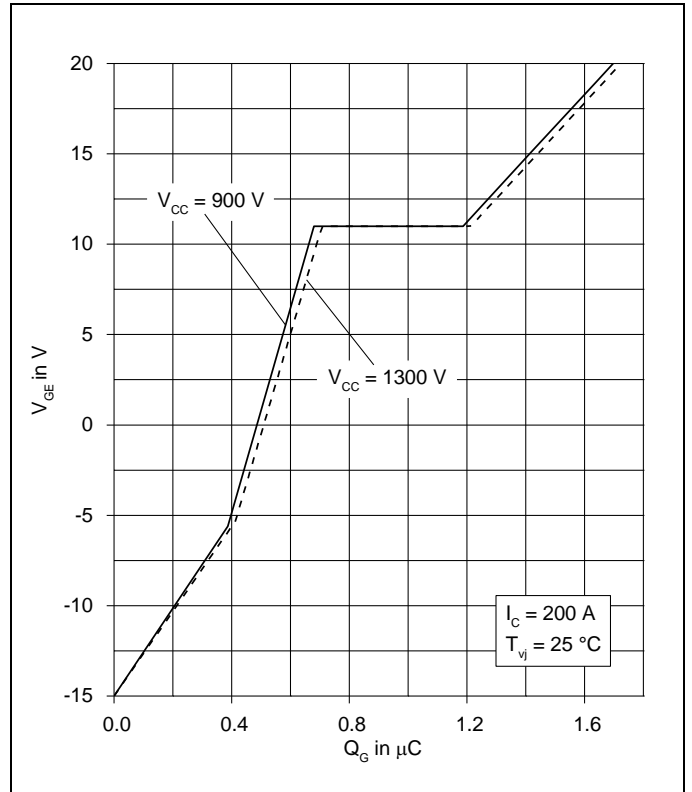


Fig. 10 Typical gate charge characteristics

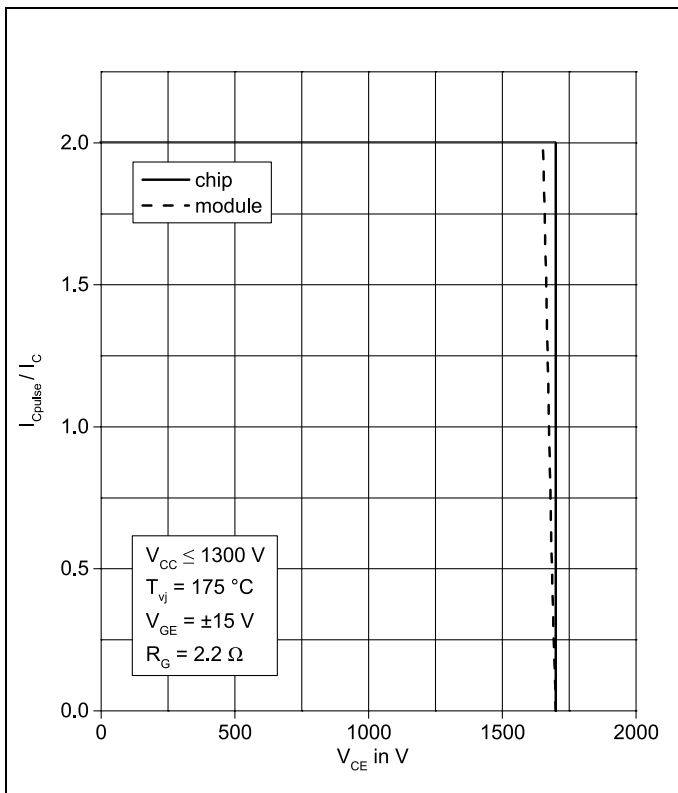


Fig. 11 Turn-off safe operating area (RBSOA)

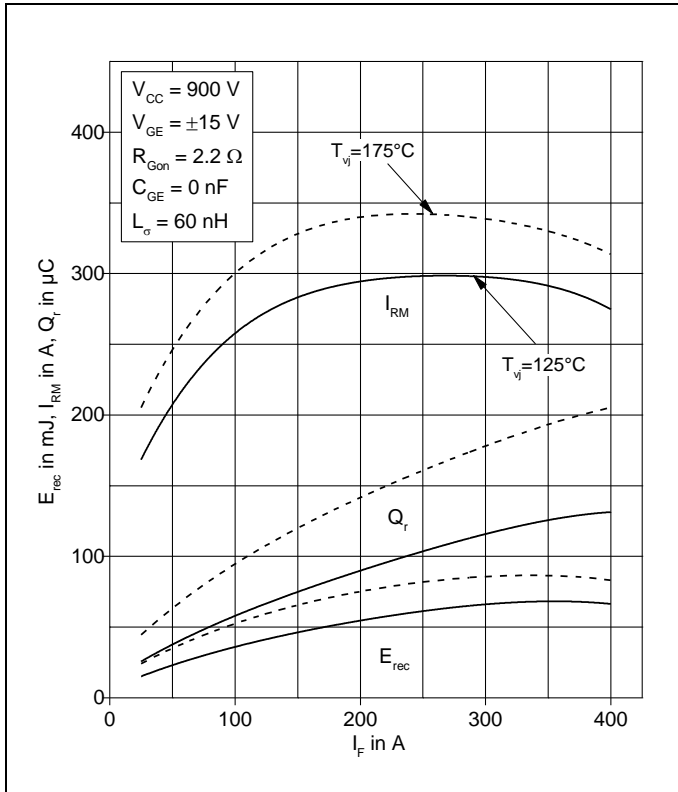


Fig. 12 Typical reverse recovery characteristics vs. forward current

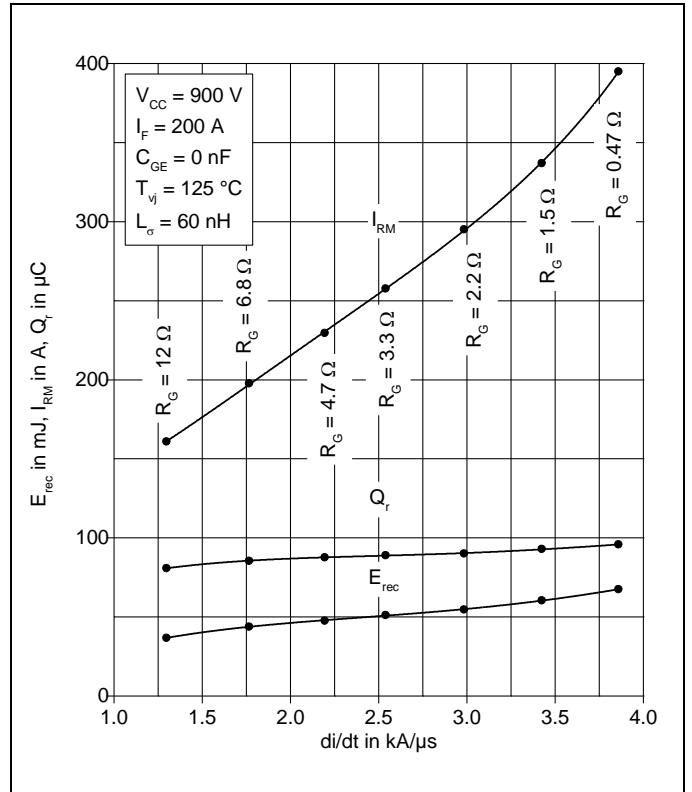


Fig. 13 Typical reverse recovery characteristics vs. di/dt

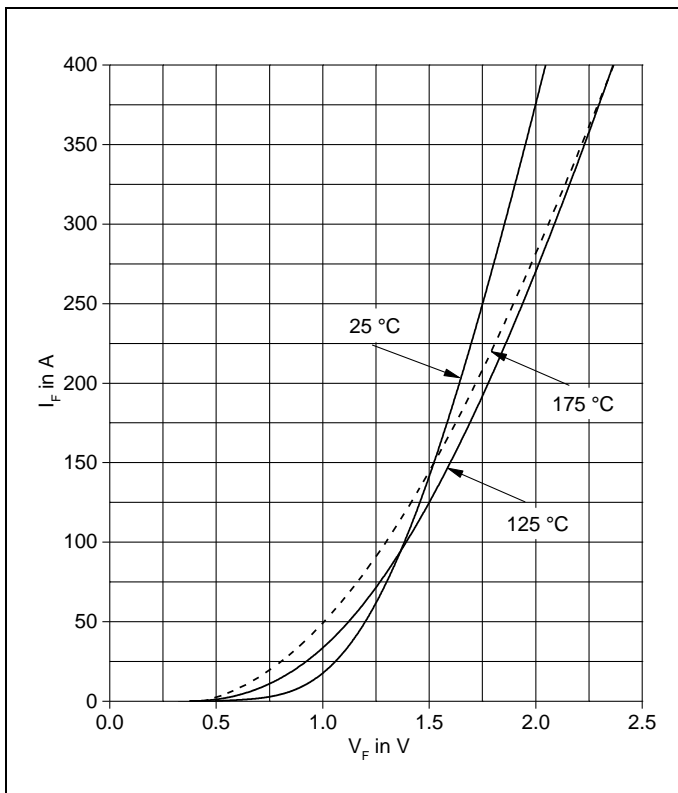


Fig. 14 Typical diode forward characteristics, chip level

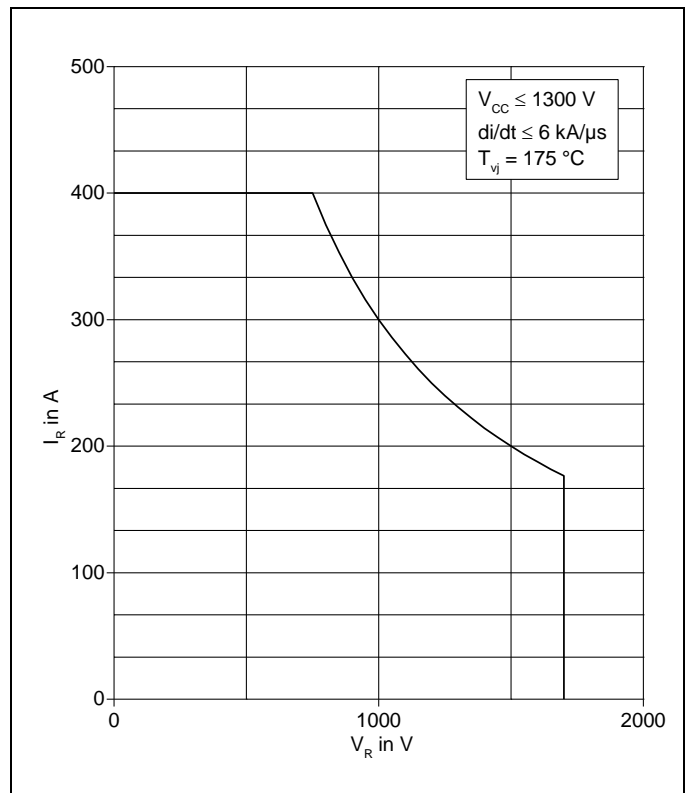


Fig. 15 Safe operating area diode (SOA)



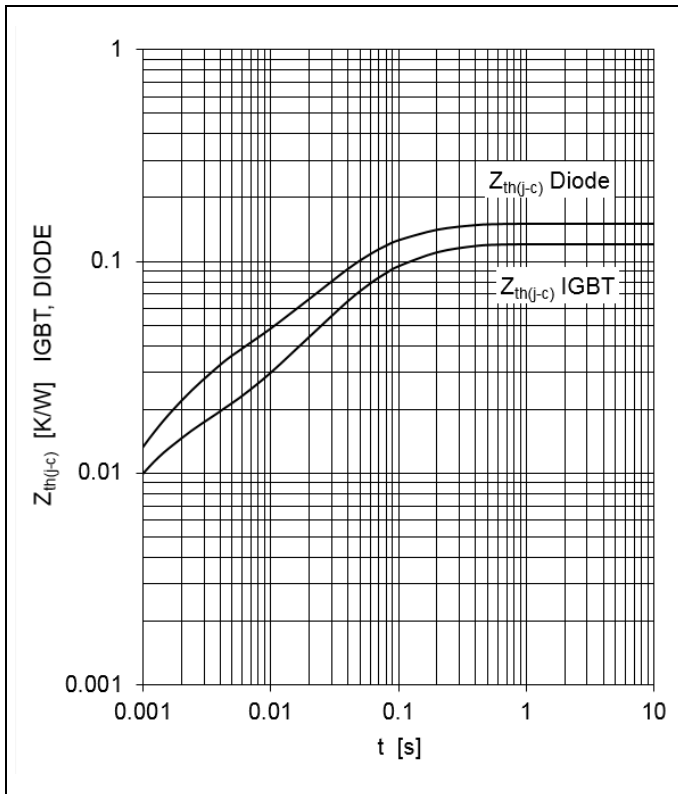


Fig. 16 Thermal impedance vs. time

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	R <sub>i</sub> (K/kW)	12.2	66.3	41.5		
	τ <sub>i</sub> (ms)	0.9	40.2	136		
DIODE	R <sub>i</sub> (K/kW)	25.2	38.7	86.1		
	τ <sub>i</sub> (ms)	1.8	137	37.2		

**Related documents:**

- 5SYA 2042 Failure rates of IGBT modules due to cosmic rays
- 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

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