V_{CE} = 3300 V
I_C = 800 A

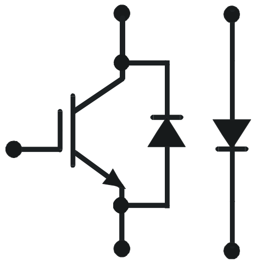


ABB HiPak™

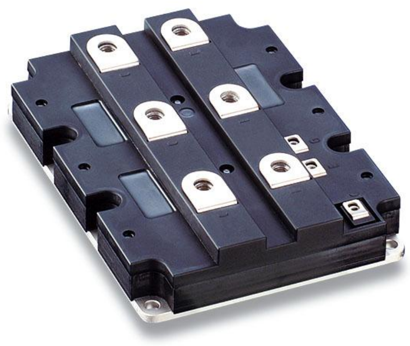
IGBT Module

5SNE 0800E330100

PRELIMINARY

Doc. No. 5SYA1562-01 July 07

- **Low-loss, rugged SPT chip-set**
- **Smooth switching SPT chip-set for good EMC**
- **Industry standard package**
- **High power density**
- **AlSiC base-plate for high power cycling capability**
- **AlN substrate for low thermal resistance**



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 = 80 °C		800	A
Peak collector current	I_{CM}	t_p = 1 ms, T_c = 80 °C		1600	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_c = 25 °C, per switch (IGBT)		7700	W
DC forward current	I_F	Either diode		800	A
Peak forward current	I_{FRM}			1600	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 125 °C, t_p = 10 ms, half-sinewave, either diode		8000	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 2500 V, $V_{CEM\,CHIP} \leq$ 3300 V $V_{GE} \leq$ 15 V, $T_{vj} \leq$ 125 °C		10	µs
Isolation voltage	V_{isol}	t = 1 min, f = 50 Hz		6000	V
Junction temperature	T_{vj}			150	°C
Junction operating temperature	$T_{vj(op)}$		-40	125	°C
Case temperature	T_c		-40	125	°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, 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. 5SYA2039

ABB Switzerland Ltd, Semiconductors reserves the right to change specifications without notice.

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 = 800 A, V_{GE} = 15 V	T_{vj} = 25 °C	2.7	3.1	3.4	V
			T_{vj} = 125 °C	3.5	3.8	4.3	V
Collector cut-off current	I_{CES}	V_{CE} = 3300 V, V_{GE} = 0 V	T_{vj} = 25 °C			8	mA
			T_{vj} = 125 °C			80	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 = 160 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		5.5		7.5	V
Gate charge	Q_{ge}	I_C = 800 A, V_{CE} = 1800 V, V_{GE} = -15 V .. 15 V			8.07		µC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			125		nF
Output capacitance	C_{oes}				7.71		
Reverse transfer capacitance	C_{res}				1.48		
Turn-on delay time	$t_{d(on)}$	V_{CC} = 1800 V, I_C = 800 A, R_G = 2.2 Ω, V_{GE} = ±15 V, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		525		ns
			T_{vj} = 125 °C		525		
Rise time	t_r		T_{vj} = 25 °C		190		ns
			T_{vj} = 125 °C		200		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 1800 V, I_C = 800 A, R_G = 2.2 Ω, V_{GE} = ±15 V, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		1060		ns
			T_{vj} = 125 °C		1210		
Fall time	t_f		T_{vj} = 25 °C		340		ns
			T_{vj} = 125 °C		460		
Turn-on switching energy	E_{on}	V_{CC} = 1800 V, I_C = 800 A, V_{GE} = ±15 V, R_G = 2.2 Ω, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		1000		mJ
			T_{vj} = 125 °C		1380		
Turn-off switching energy	E_{off}	V_{CC} = 1800 V, I_C = 800 A, V_{GE} = ±15 V, R_G = 2.2 Ω, $L_σ$ = 100 nH, inductive load	T_{vj} = 25 °C		880		mJ
			T_{vj} = 125 °C		1250		
Short circuit current	I_{SC}	t_{psc} ≤ 10 µs, V_{GE} = 15 V, T_{vj} = 125 °C, V_{CC} = 2500 V, $V_{CEM\ CHIP}$ ≤ 3300 V			3300		A
Module stray inductance	$L_{σ\ CE}$	Leg 1 + 2 parallel			15		nH
Resistance, terminal-chip	$R_{CC'+EE'}$	Leg 1 + 2 parallel	T_C = 25 °C		0.09		mΩ
			T_C = 125 °C		0.13		

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 = 800 A	T_{vj} = 25 °C	2.0	2.3	2.6	V
			T_{vj} = 125 °C	2.0	2.35	2.6	
Reverse recovery current	I_{rr}	V_{CC} = 1800 V, I_F = 800 A, V_{GE} = ±15 V, R_G = 2.2 Ω, L_σ = 100 nH, inductive load	T_{vj} = 25 °C		710		A
			T_{vj} = 125 °C		950		
Recovered charge	Q_{rr}		T_{vj} = 25 °C		500		µC
			T_{vj} = 125 °C		930		
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		850		ns
			T_{vj} = 125 °C		1550		
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		620		mJ
			T_{vj} = 125 °C		1180		
Stray inductance	$L_{\sigma AC}$	Leg 3			30		nH
Resistance, terminal-chip	$R_{AA'+CC'}$	Leg 3	T_C = 25 °C		0.18		mΩ
			T_C = 125 °C		0.26		

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

Thermal properties [7)]

Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				0.013	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.025	K/W
IGBT thermal resistance [2)] case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = 1W/m x K		0.012		K/W
Diode thermal resistance [2)] case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = 1W/m x K		0.024		K/W

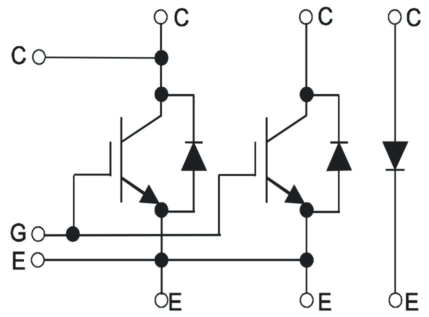
2) For detailed mounting instructions refer to ABB Document No. 5SYA2039

Mechanical properties [7)]

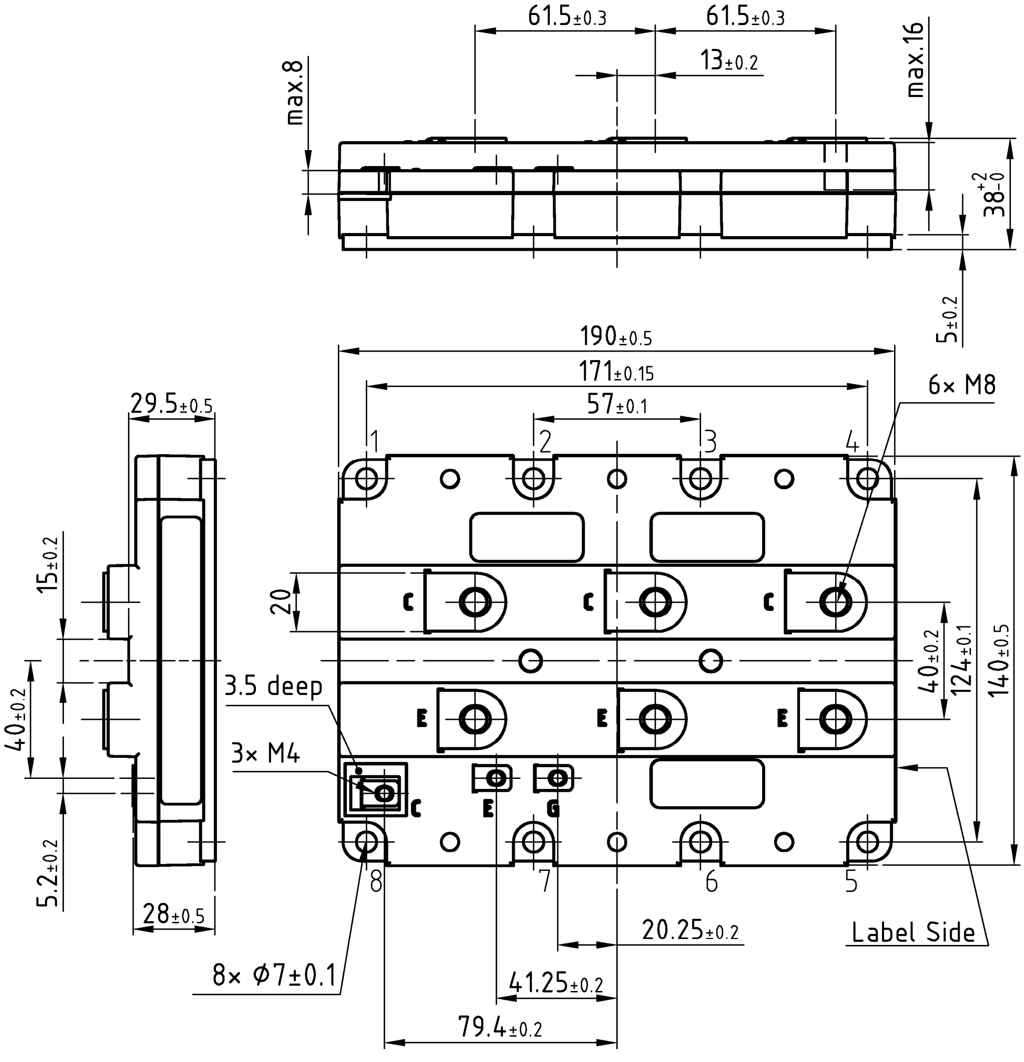
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical , see outline drawing		190 x 140 x 38			mm
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	23			mm
			Term. to term:	19			
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	33			mm
			Term. to term:	32			
Mass	m				1380		g

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

Electrical configuration



Outline drawing [2)]



Note: all dimensions are shown in mm

[2)] For detailed mounting instructions refer to ABB Document No. 5SYA2039

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.

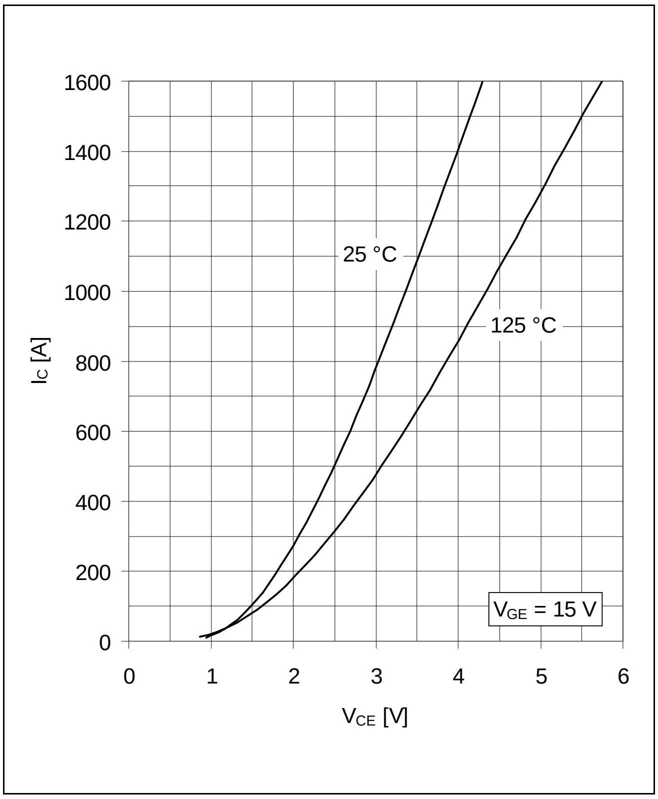


Fig. 1 Typical on-state characteristics, chip level

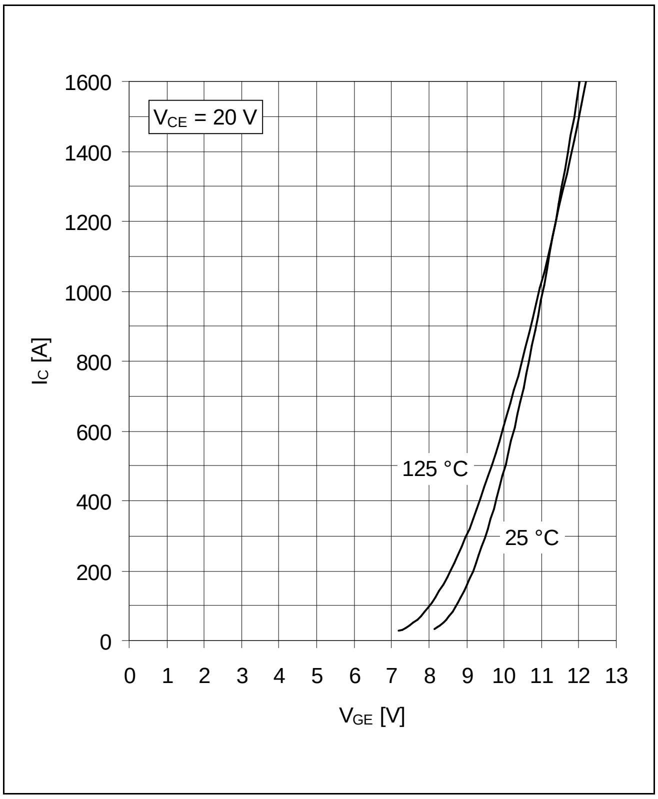


Fig. 2 Typical transfer characteristics, chip level

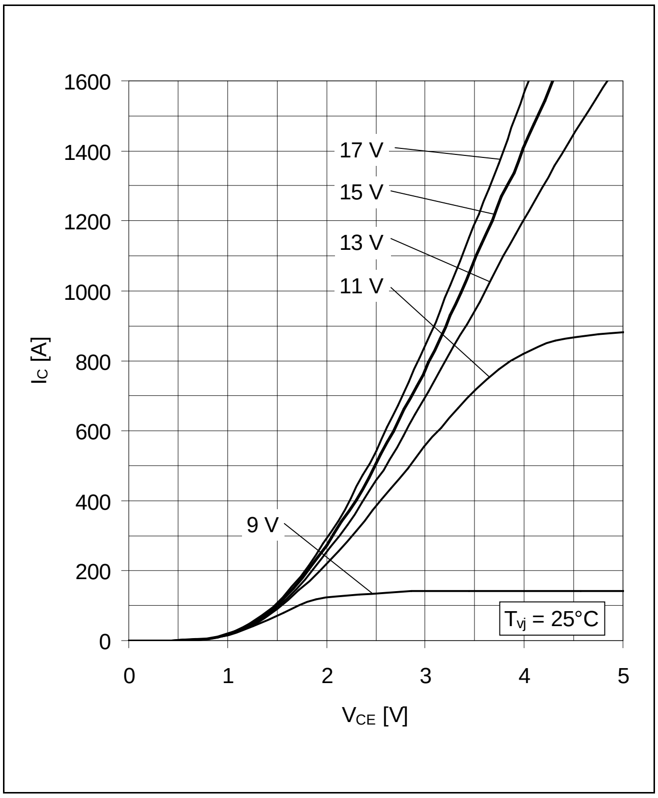


Fig. 3 Typical output characteristics, chip level

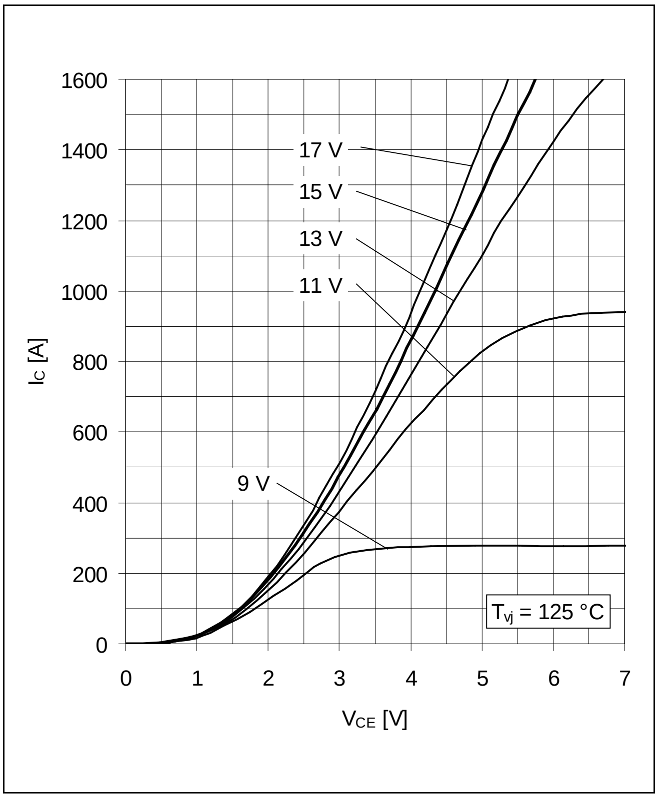


Fig. 4 Typical output characteristics, chip level

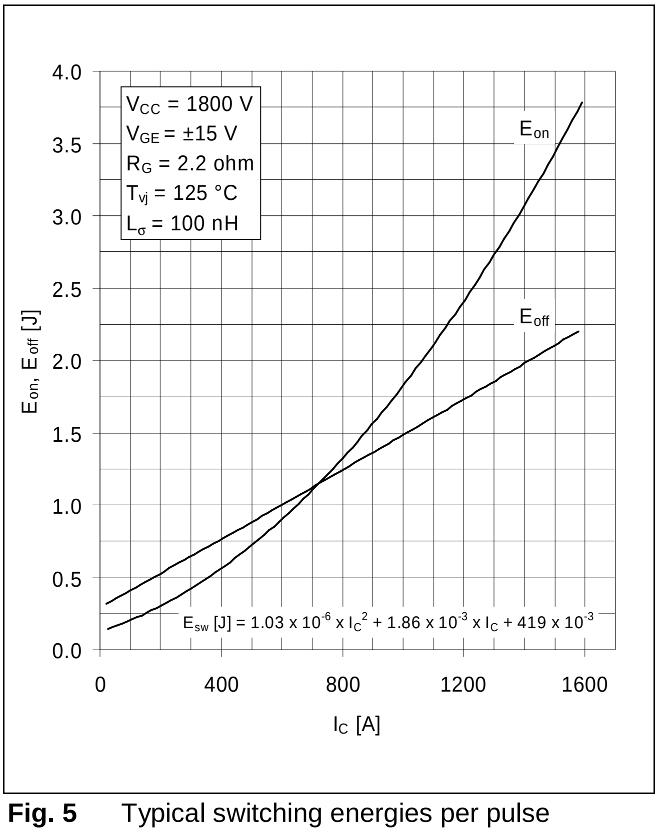


Fig. 5 Typical switching energies per pulse vs collector current

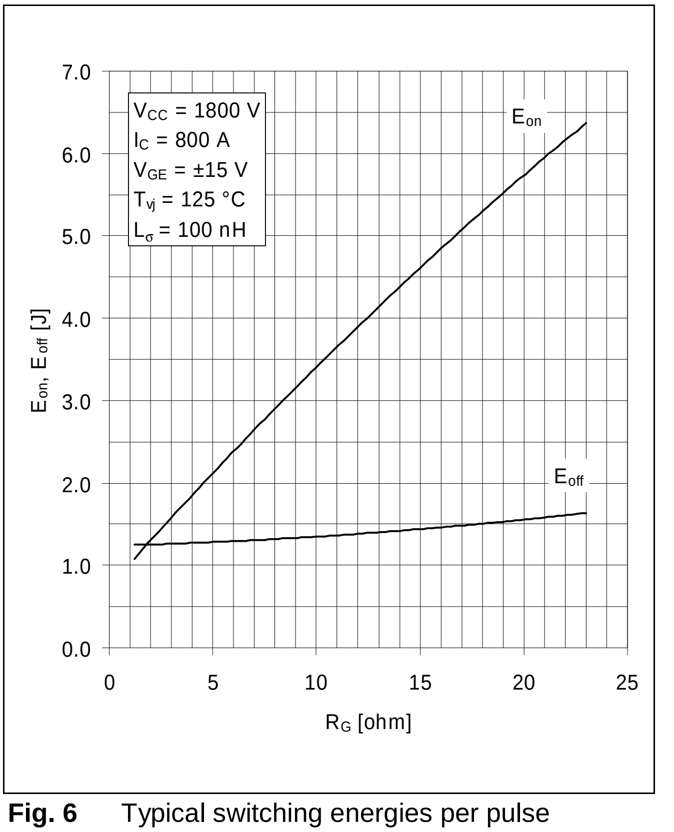


Fig. 6 Typical switching energies per pulse vs gate resistor

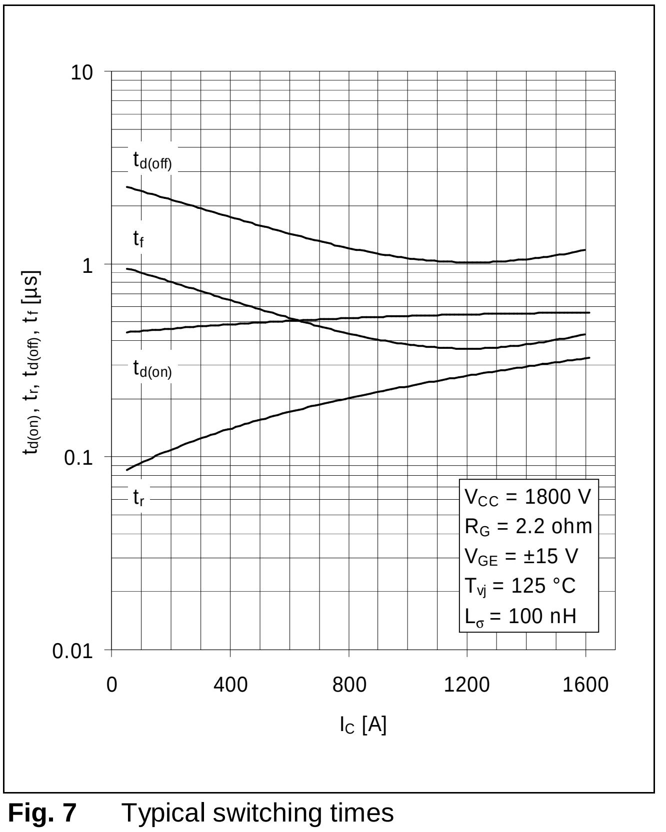


Fig. 7 Typical switching times vs collector current

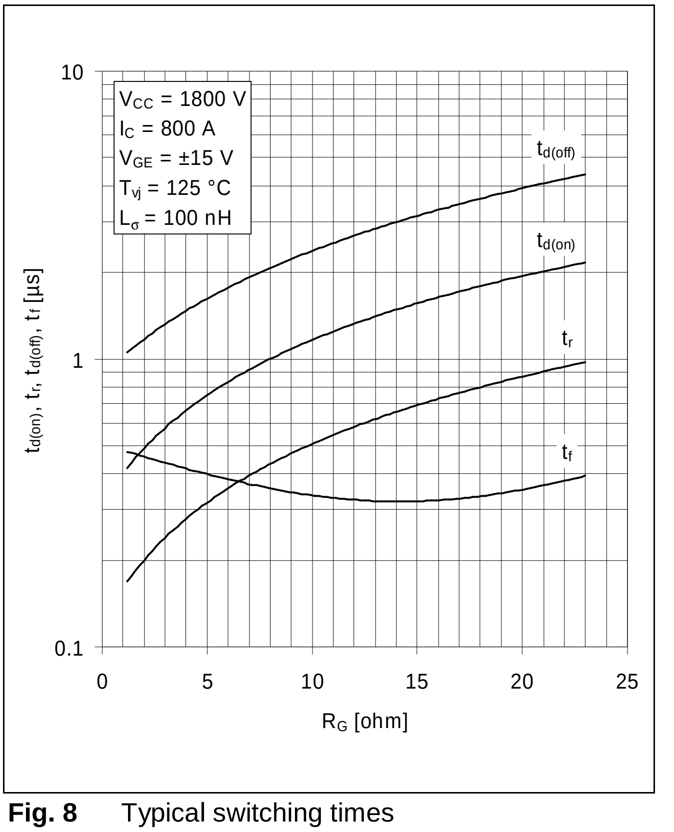


Fig. 8 Typical switching times vs gate resistor

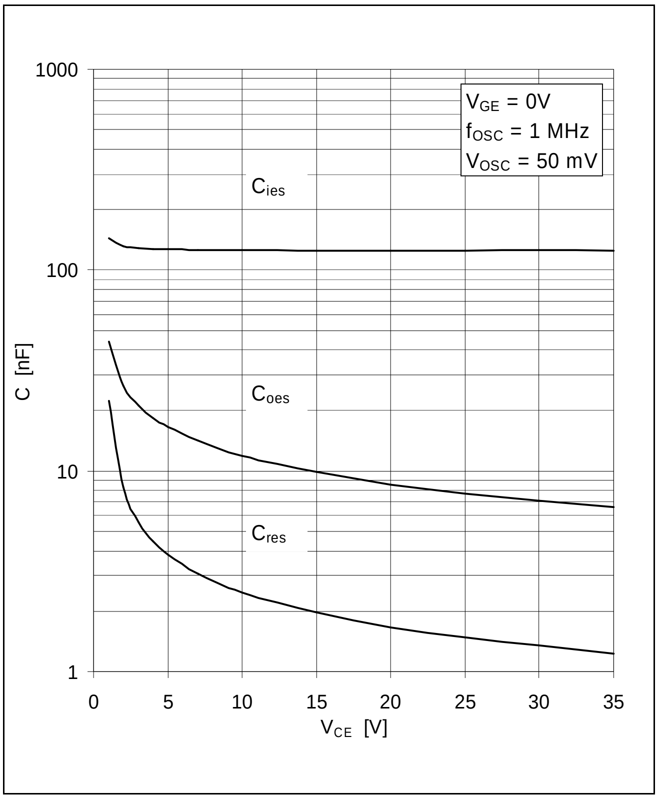


Fig. 9 Typical capacitances vs collector-emitter voltage

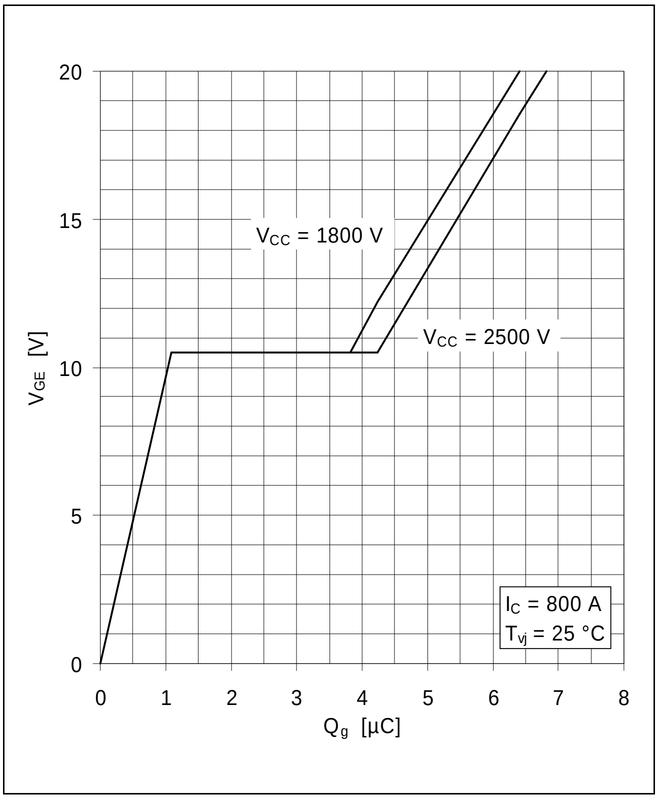


Fig. 10 Typical gate charge characteristics

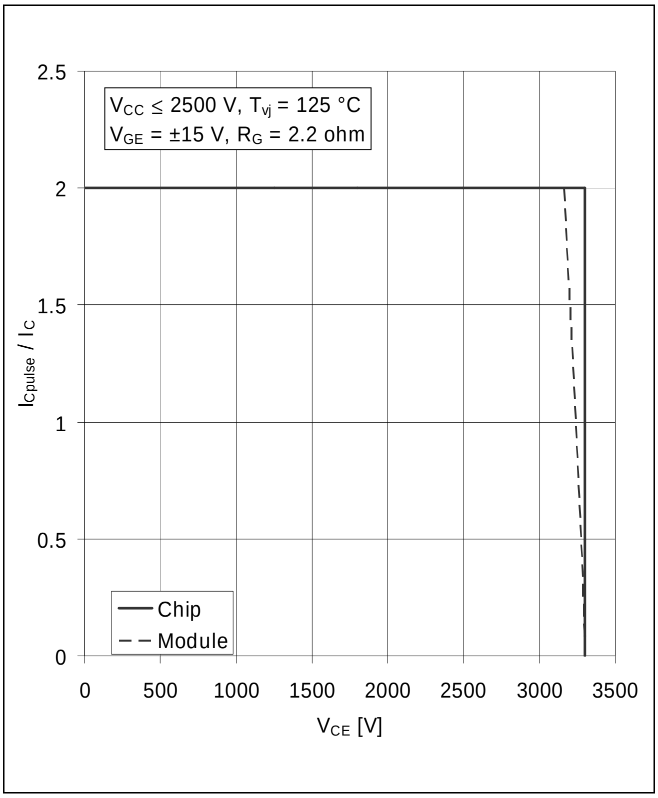


Fig. 11 Turn-off safe operating area (RBSOA)

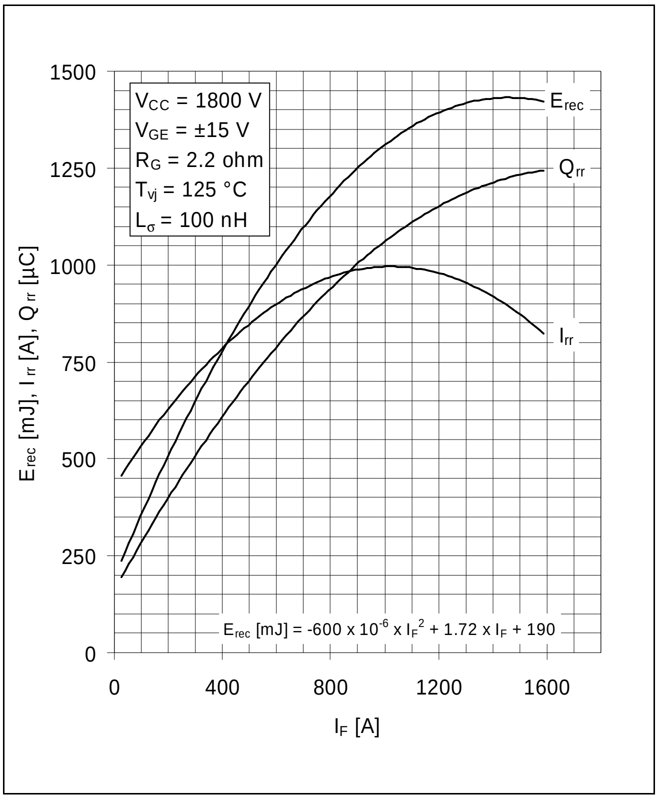


Fig. 12 Typical reverse recovery characteristics vs forward current

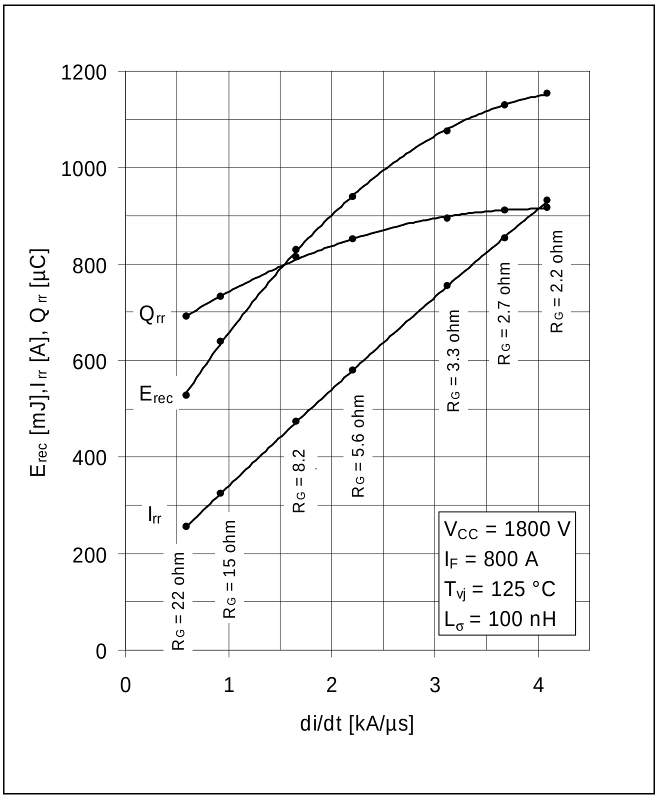


Fig. 13 Typical reverse recovery characteristics vs di/dt

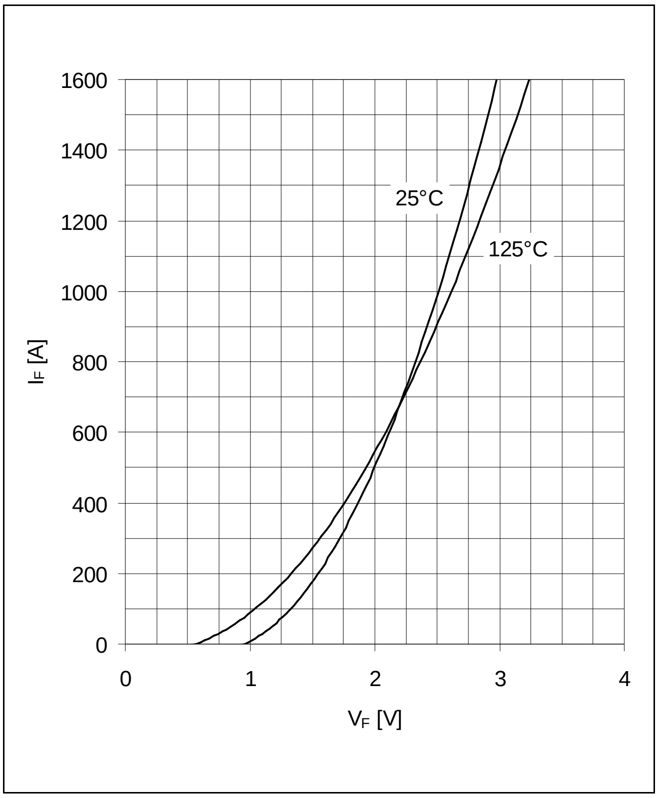


Fig. 14 Typical diode forward characteristics, chip level

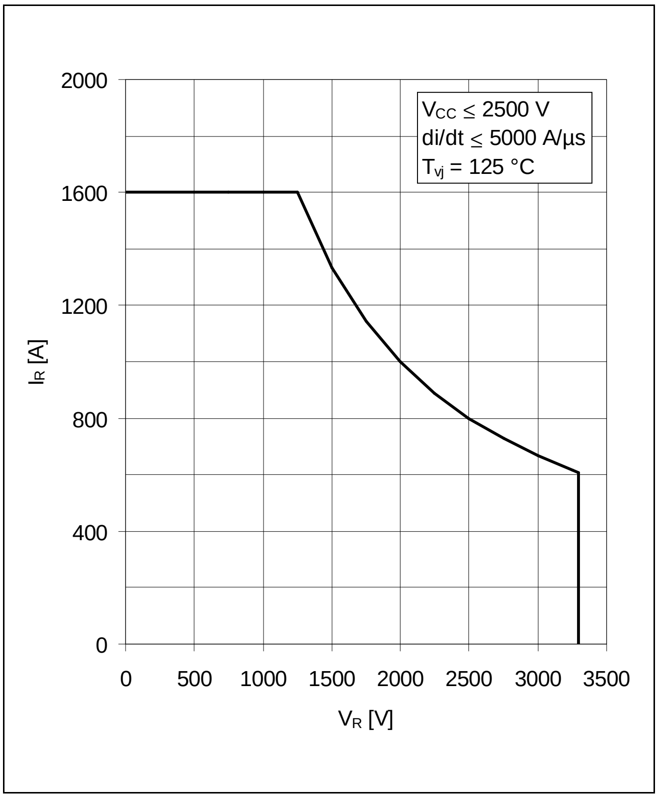


Fig. 15 Safe operating area diode (SOA)

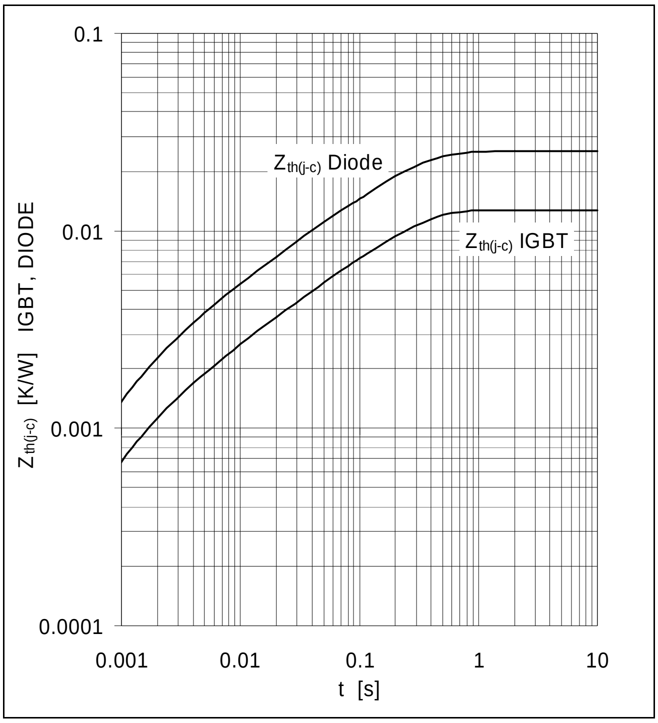


Fig. 16 Thermal impedance vs time

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	R_i(K/kW)	8.78	2.06	0.961	0.948	
	τ_i(ms)	207.4	30.1	7.55	1.57	
DIODE	R_i(K/kW)	17.3	4.28	1.92	1.92	
	τ_i(ms)	203.6	30.1	7.53	1.57	

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