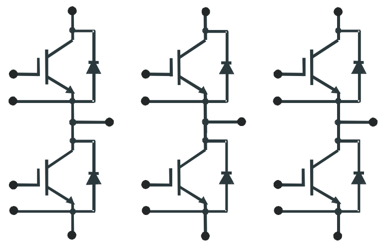
V_{CE} = 1200 V
I_C = 300 A

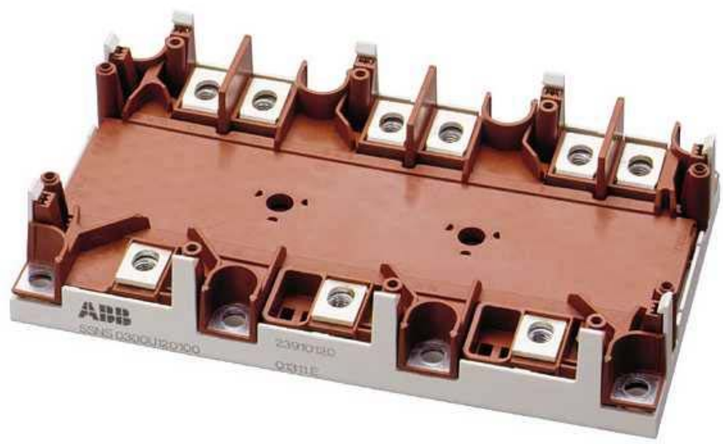


IGBT Module LoPak5 SPT

5SNS 0300U120100

Doc. No. 5SYA1528-02 July 03

- **Low-loss, rugged SPT chip-set**
- **Smooth switching SPT chip-set for good EMC**
- **Low profile compact baseless package for high power cycling capability**
- **Snap-on PCB assembly**
- **Integrated PTC substrate temperature sensor**



Maximum rated values 1)

Parameter	Symbol	Conditions	min	max	Unit
Collector-emitter voltage	V_{CES}	V_{GE} = 0 V, $T_{vj} \geq$ 25 °C	1200		V
DC collector current	I_C	T_h = 60 °C		300	A
Peak collector current	I_{CM}	t_p = 1 ms, T_h = 60 °C		600	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	T_h = 25 °C, per switch (IGBT)		960	W
DC forward current	I_F			300	A
Peak forward current	I_{FM}			600	A
Surge current	I_{FSM}	V_R = 0 V, T_{vj} = 125 °C, t_p = 10 ms, half-sinewave		3600	A
IGBT short circuit SOA	t_{psc}	V_{CC} = 900 V, $V_{CEM\,CHIP} \leq$ 1200 V $V_{GE} \leq$ 15 V, $T_{vj} \leq$ 125 °C		10	µs
Isolation voltage	V_{isol}	1 min, f = 50 Hz		2500	V
Junction temperature	T_{vj}			150	°C
Case operating temperature	$T_{c(op)}$		-40	125	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques	M_1	Base-heatsink, M5 screws	2	3	Nm
	M_2	Main terminals, M6 screws	4	5	

1) Maximum rated values indicate limits beyond which damage to the device may occur

IGBT characteristic values

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		1200			V
Collector-emitter saturation voltage 2)	$V_{CE\ sat}$	I_C = 300 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.9	2.3	V
			T_{vj} = 125 °C		2.1		V
Collector cut-off current	I_{CES}	V_{CE} = 1200 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
			T_{vj} = 125 °C		15		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 = 12 mA, V_{CE} = V_{GE}, T_{vj} = 25 °C		4.5		6.5	V
Gate charge	Q_{ge}	I_C = 300 A, V_{CE} = 600 V, V_{GE} = -15 V .. 15 V			4000		nC
Input capacitance	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 1 MHz, T_{vj} = 25 °C			27		nF
Output capacitance	C_{oes}				3.0		
Reverse transfer capacitance	C_{res}				1.3		
Turn-on delay time	$t_{d(on)}$	V_{CC} = 600 V, I_C = 300 A, R_G = 3.3 Ω, V_{GE} = ±15 V, L_σ = 55 nH, inductive load	T_{vj} = 25 °C		150		ns
			T_{vj} = 125 °C		180		
Rise time	t_r		T_{vj} = 25 °C		80		ns
			T_{vj} = 125 °C		80		
Turn-off delay time	$t_{d(off)}$	V_{CC} = 600 V, I_C = 300 A, R_G = 3.3 Ω, V_{GE} = ±15 V, L_σ = 55 nH, inductive load	T_{vj} = 25 °C		770		ns
			T_{vj} = 125 °C		750		
Fall time	t_f		T_{vj} = 25 °C		60		ns
			T_{vj} = 125 °C		70		
Turn-on switching energy	E_{on}	V_{CC} = 600 V, I_C = 300 A, V_{GE} = ±15, R_G = 3.3 Ω, L_σ = 55 nH, inductive load	T_{vj} = 25 °C		19		mJ
			T_{vj} = 125 °C		28		
Turn-off switching energy	E_{off}	V_{CC} = 600 V, I_C = 300 A, V_{GE} = ±15, R_G = 3.3 Ω, L_σ = 55 nH, inductive load	T_{vj} = 25 °C		24		mJ
			T_{vj} = 125 °C		34		
Short circuit current	I_{SC}	t_{psc} ≤ 10 μs, V_{GE} = 15 V, T_{vj} = 125 °C, V_{CC} = 900 V, $V_{CEM\ CHIP}$ ≤ 1200 V			1650		A
Module stray inductance plus to minus	$L_{\sigma\ DC}$				20		nH
Resistance, terminal-chip	$R_{CC'+EE'}$		T_h = 25 °C		0.9		mΩ
			T_h = 125 °C		1.0		

2) Collector emitter saturation voltage is given at chip level

Diode characteristic values

Parameter	Symbol	Conditions		min	typ	max	Unit
Continous forward voltage 3)	V_F	I_F = 300 A	T_{vj} = 25 °C		1.9	2.1	V
			T_{vj} = 125 °C		1.9		
Peak reverse recovery current	I_{RM}	V_{CC} = 600 V, I_F = 300 A, V_{GE} = ±15 V, R_G = 3.3 Ω L_σ = 55 nH inductive load	T_{vj} = 25 °C		250		A
			T_{vj} = 125 °C		340		
Recovered charge	Q_{RR}		T_{vj} = 25 °C		27		μC
			T_{vj} = 125 °C		58		
Reverse recovery time	t_{rr}		T_{vj} = 25 °C		120		ns
			T_{vj} = 125 °C		180		
Reverse recovery energy	E_{rec}		T_{vj} = 25 °C		13		mJ
			T_{vj} = 125 °C		27		

3) Forward voltage is given at chip level

Thermal properties

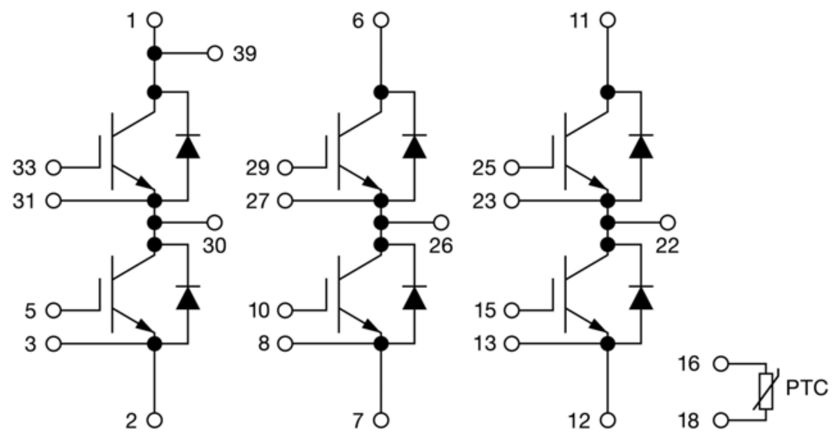
Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance 4) junction to heatsink	$R_{th(j-h)IGBT}$	Heatsink: flatness < ±50 μm, roughness < 6 μm without ridge			0.13	K/W
Diode thermal resistance 4) junction to heatsink	$R_{th(j-h)DIODE}$	Thermal grease: conductivity ≥ 0.8 W/mK, thickness 30 μm < t < 50 μm			0.19	K/W
Temperature sensor	PTC	$R_T = R_{T0} \exp [B (1/T - 1/T_0)]$ R_{T0} = 1kΩ (±3%), B = -760 K (±2%), T_0 = 298 K				

Mechanical properties

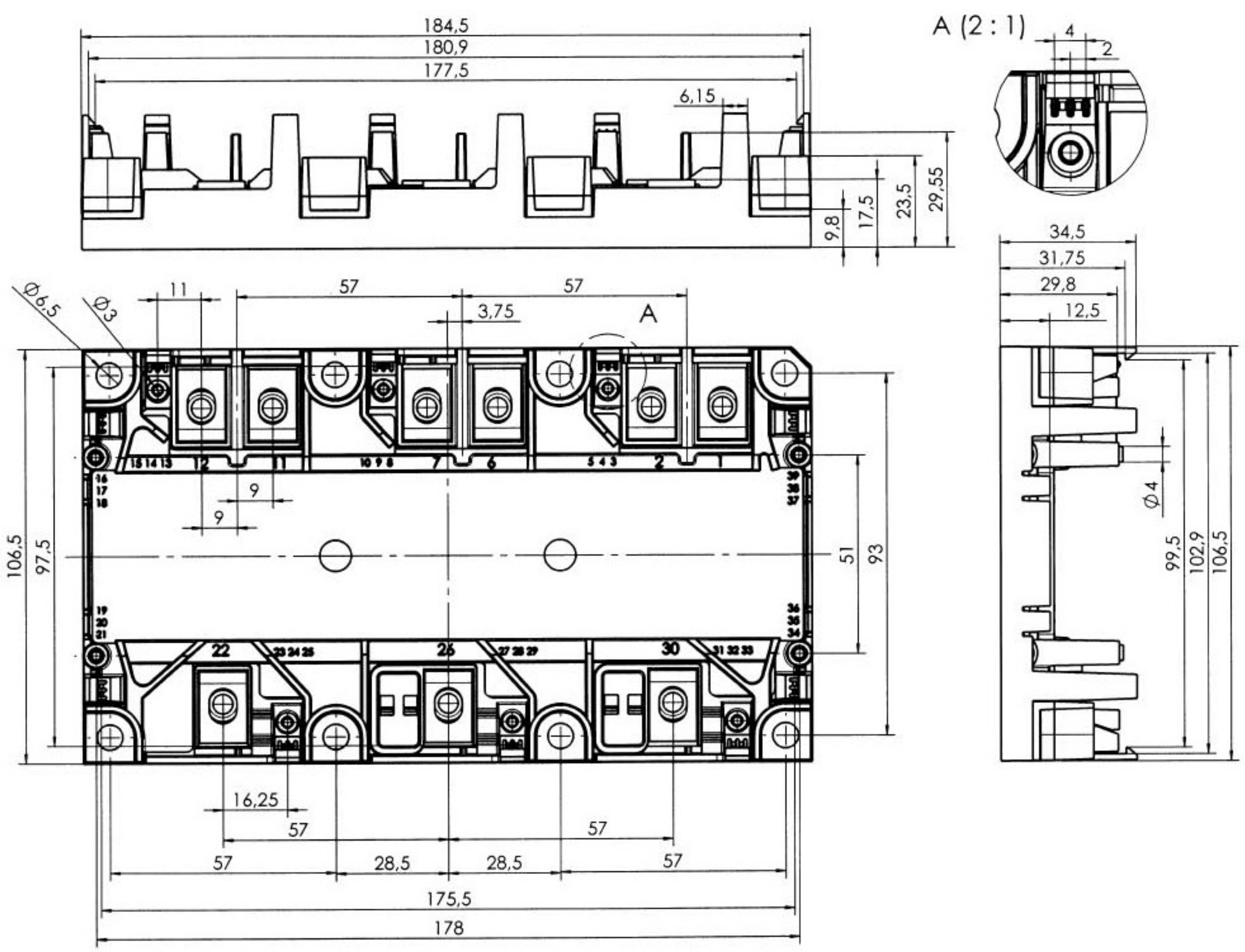
Parameter	Symbol	Conditions		min	typ	max	Unit
Dimensions	L x W x H	Typical , see outline drawing		184.5 x 106.5 x 34.5			mm
Clearance distance	D_C	according to IEC 60664-1 and EN 50124-1	Term. to base:	9.5			mm
			Term. to term:	11			
Surface creepage distance	D_{SC}	according to IEC 60664-1 and EN 50124-1	Term. to base:	9.5			mm
			Term. to term:	12.5			
Weight					460		gr
Mounting 4)	PCB mounting	Hole for selftapping screw: 2.5 mm diameter, 6.0 mm deep					
	Control terminal	Spring pins, pitch of pins = 4 mm, PCB thickness = 1.6 mm					

4) For detailed mounting instructions refer to ABB Document No. 5SYA 2017

Electrical configuration



Outline drawing



For mounting instructions refer to ABB document No. 5SYA 2017

This is an electrostatic sensitive device, please observe the international standard IEC 60747-1, chap. IX.

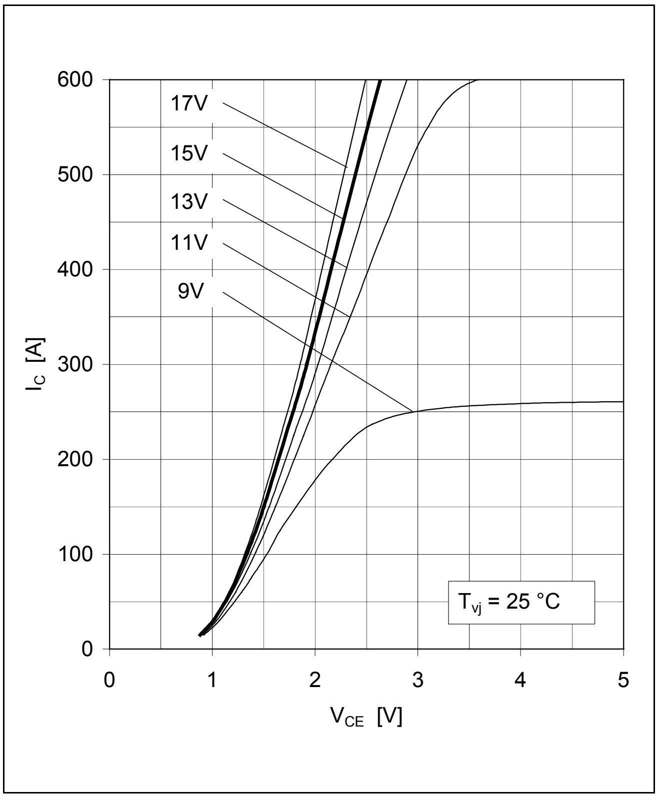


Fig. 1 Typical output characteristics, chip level

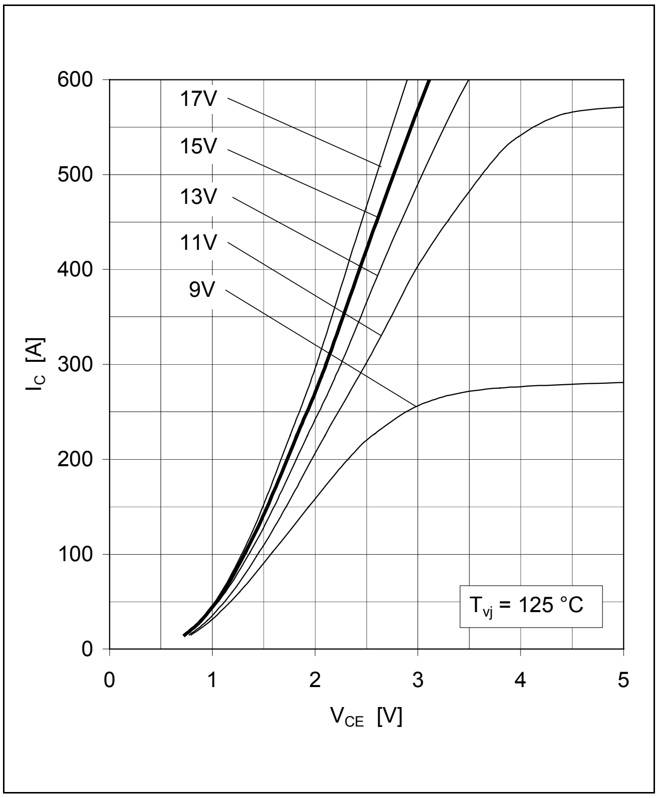


Fig. 2 Typical output characteristics, chip level

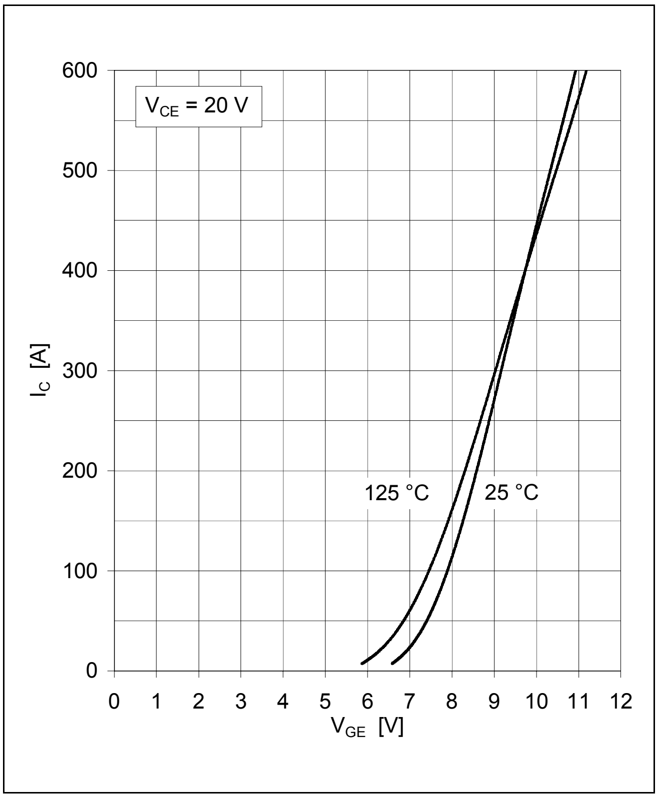


Fig. 3 Typical transfer characteristics, chip level

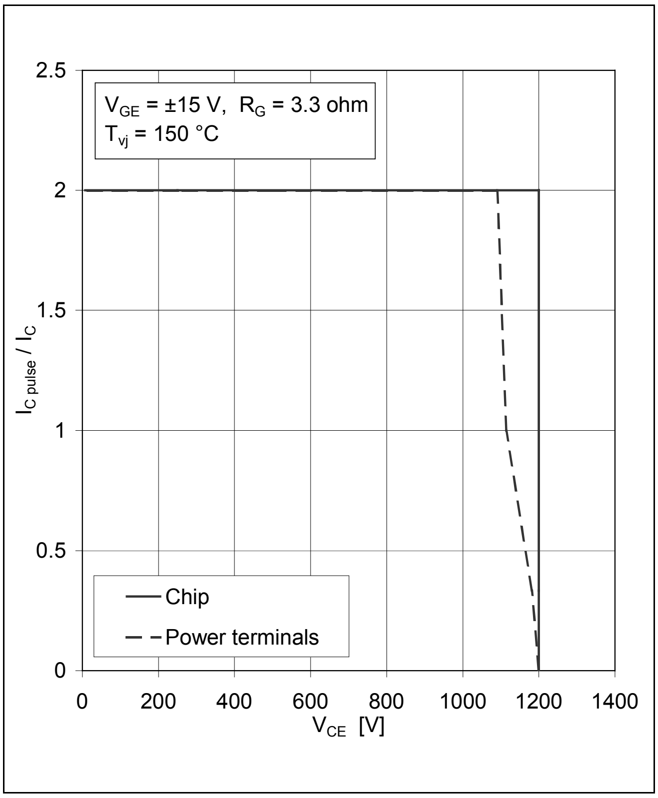


Fig. 4 Turn-off safe operating area (RBSOA)

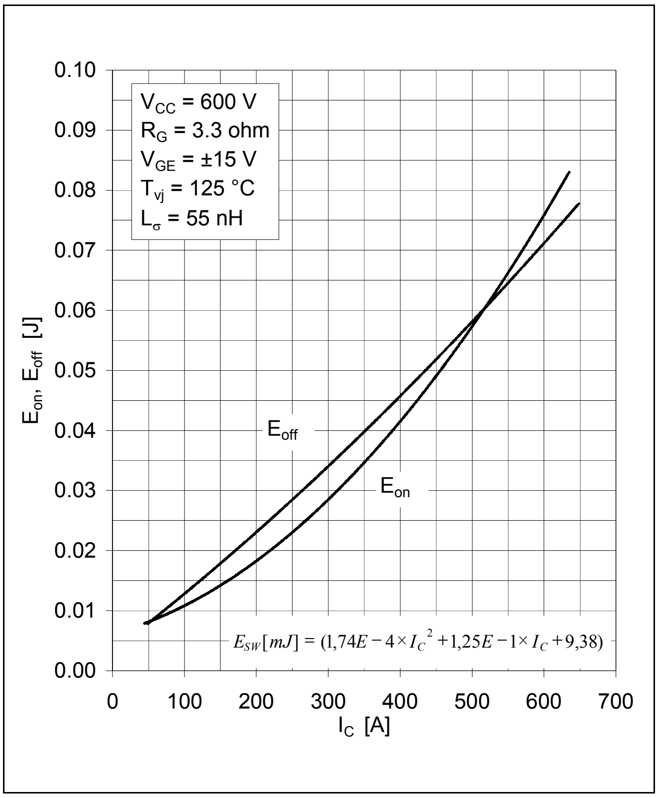


Fig. 5 Typical switching energies per pulse vs collector current

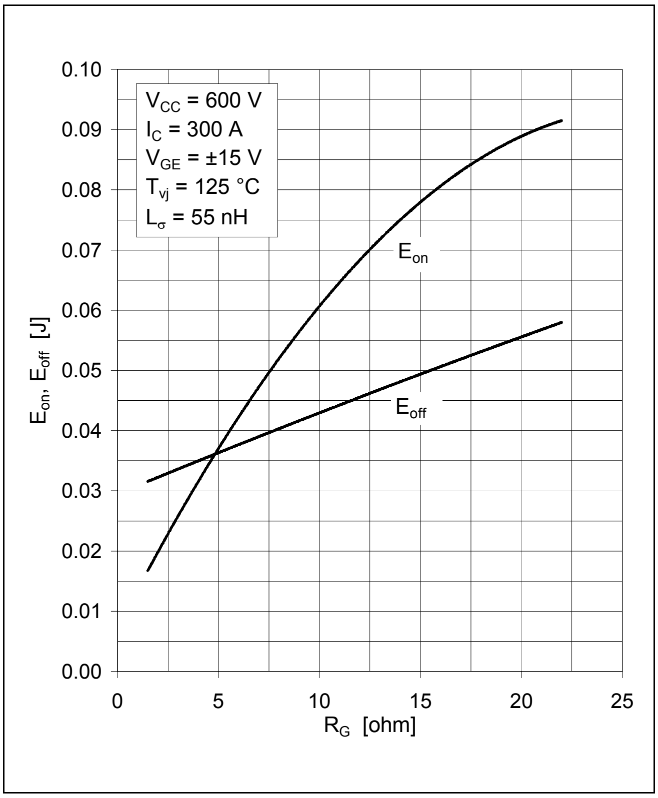


Fig. 6 Typical switching energies per pulse vs gate resistor

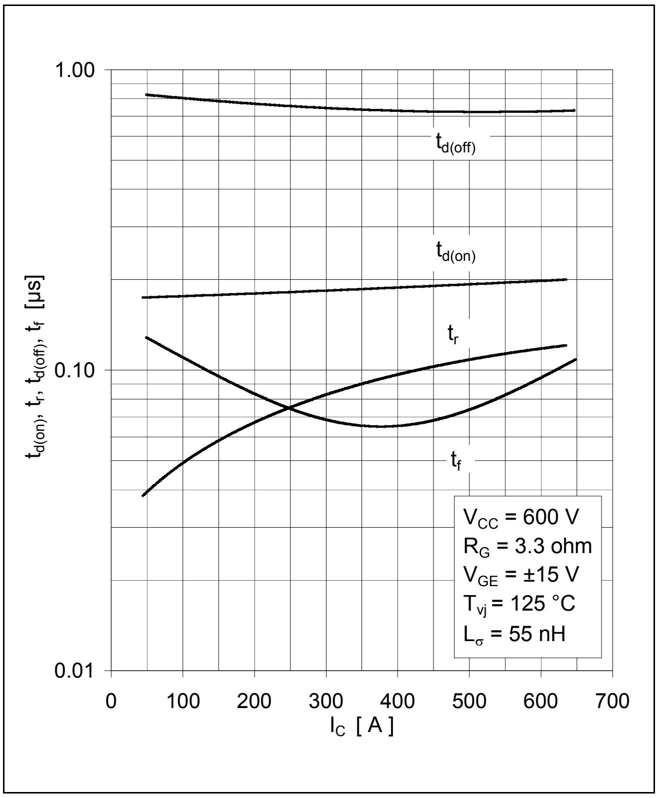


Fig. 7 Typical switching times vs collector current

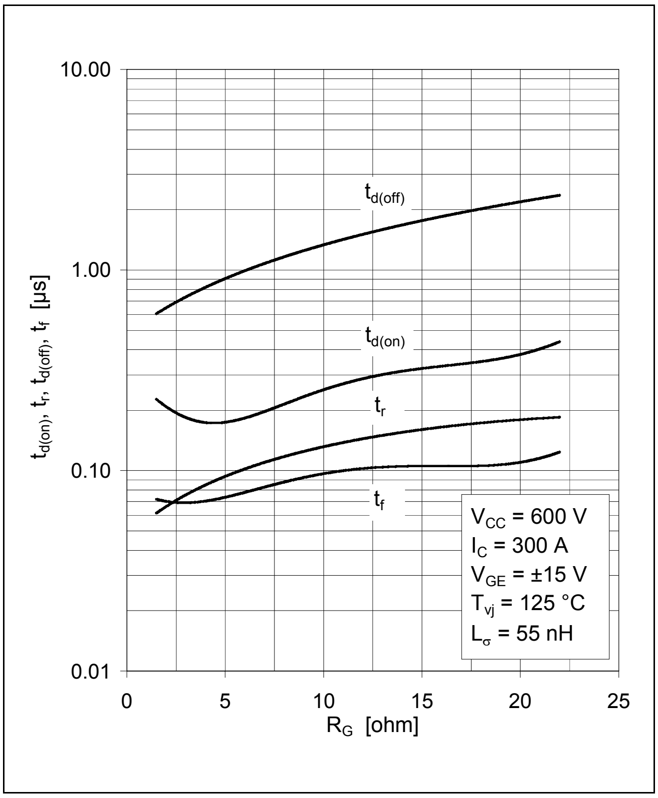


Fig. 8 Typical switching times vs gate resistor

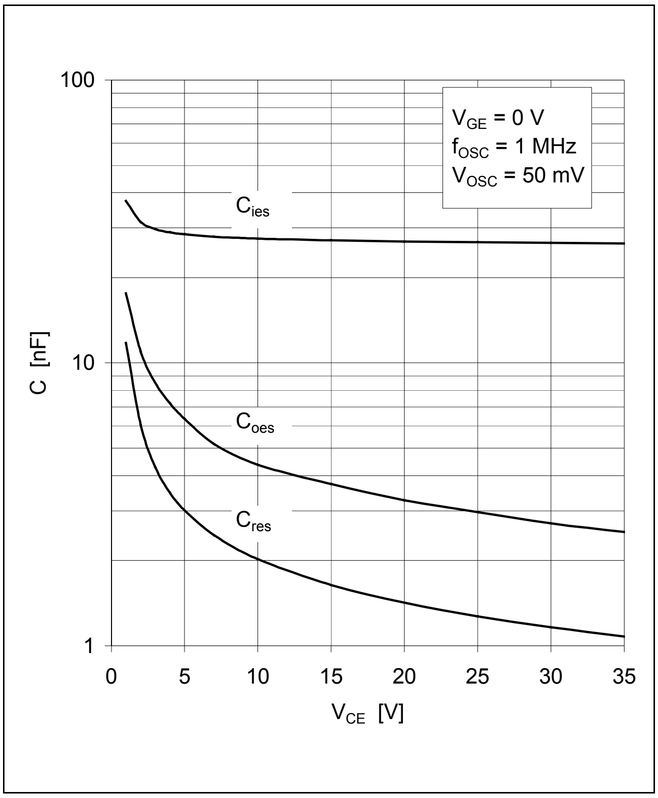


Fig. 9 Typical capacitances vs collector-emitter voltage

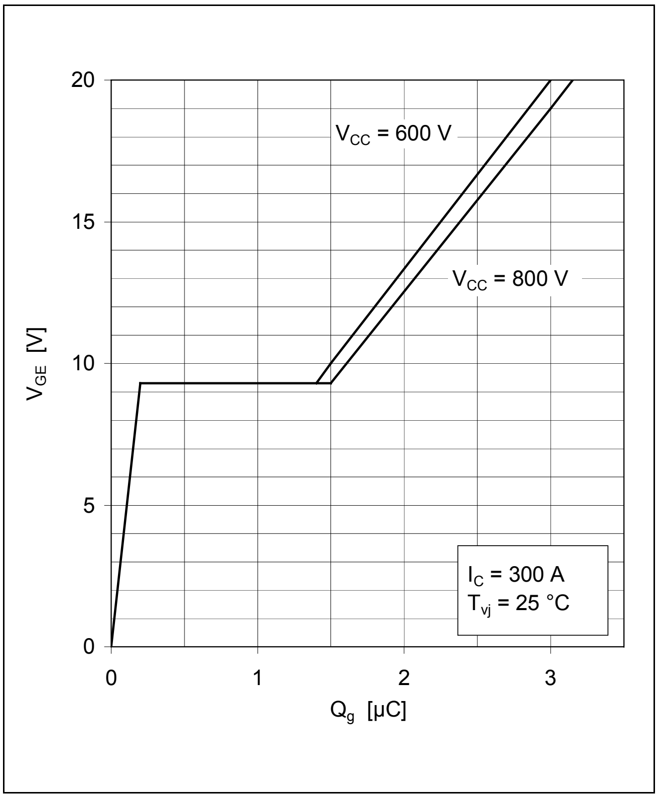


Fig. 10 Typical gate charge characteristics

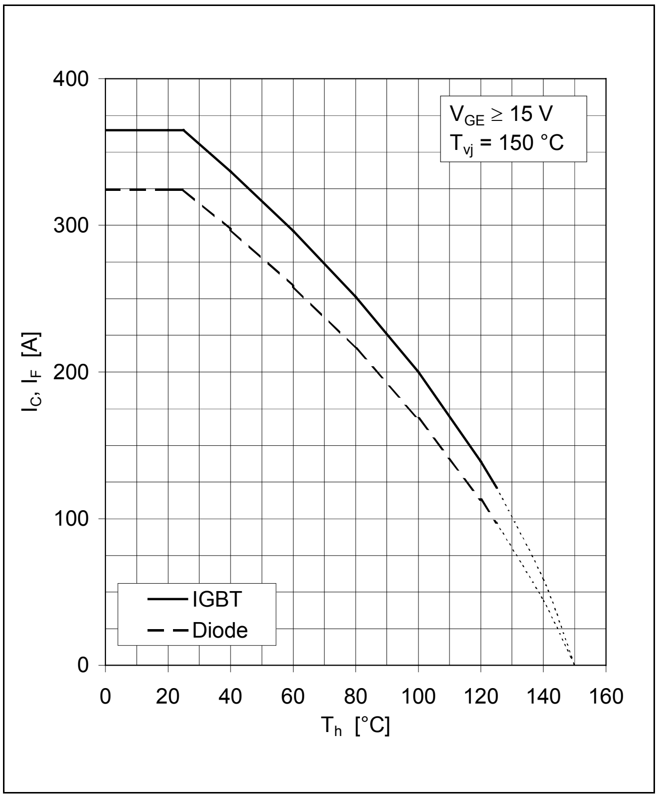


Fig. 11 Rated current vs temperature

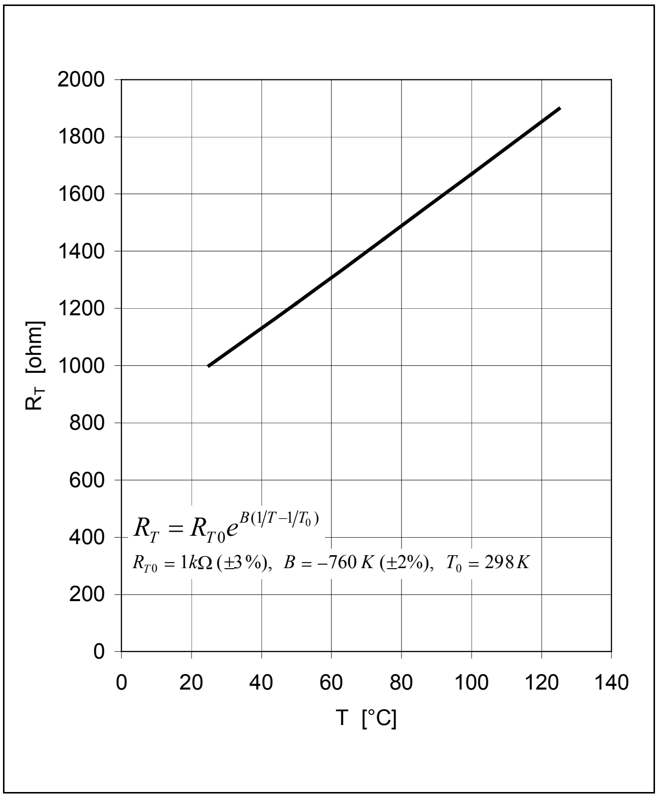


Fig. 12 PTC temperature sensor

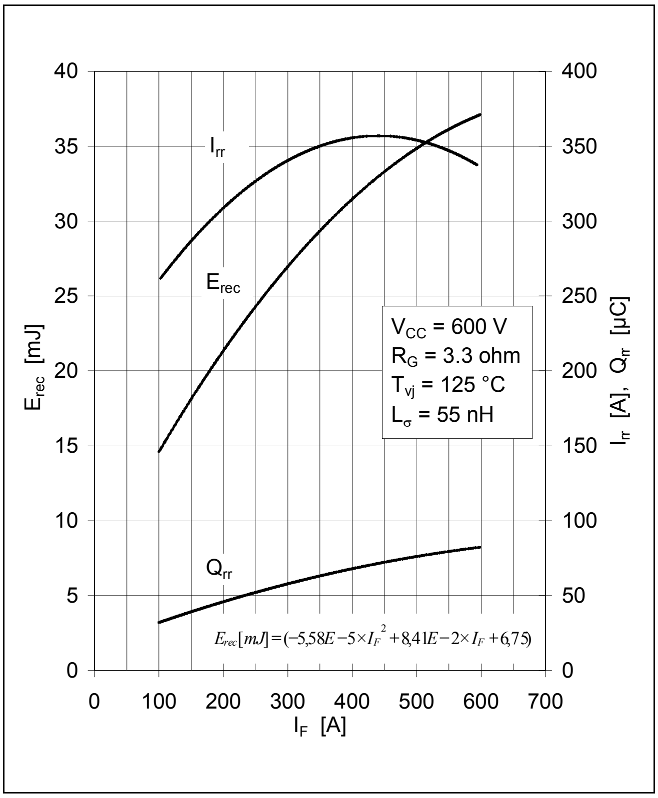


Fig. 13 Typical reverse recovery characteristics vs forward current

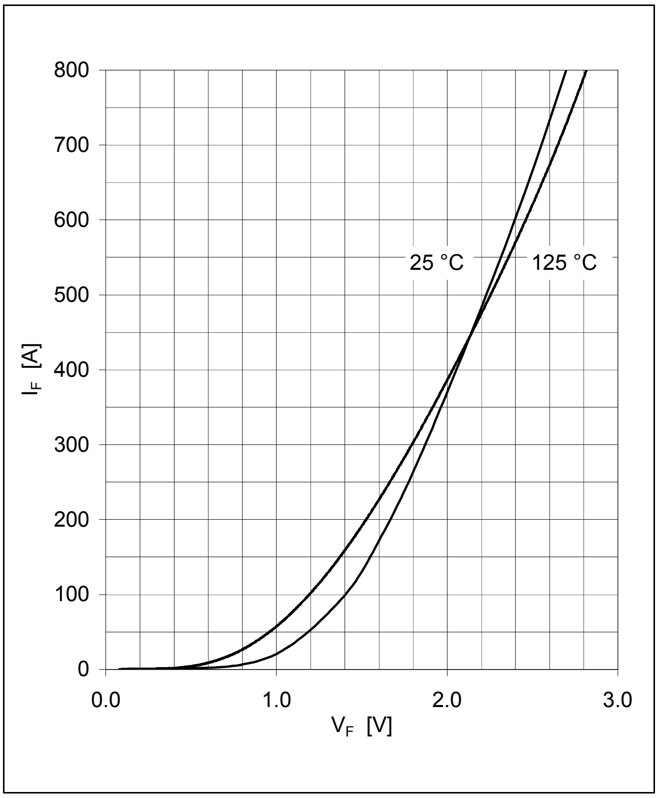


Fig. 14 Typical diode forward characteristics, chip level

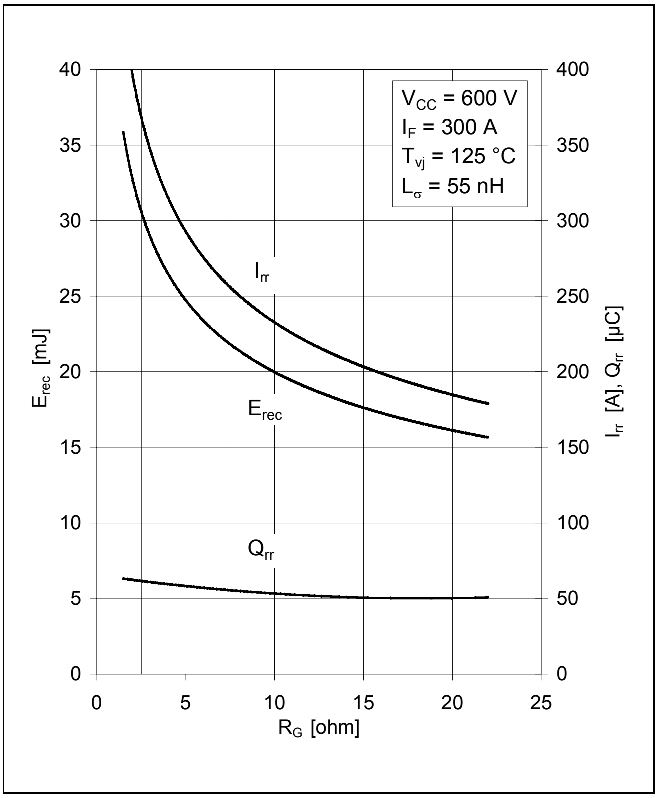


Fig. 15 Typical reverse recovery characteristics vs gate resistor

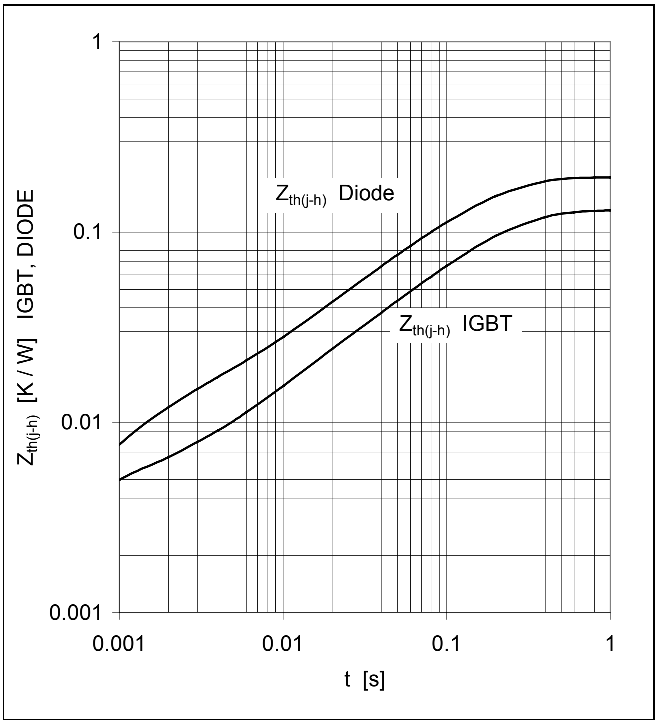


Fig. 16 Typical thermal impedance vs time

Analytical function for transient thermal impedance:

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

	i	1	2	3	4	5
IGBT	Ri(K/kW)	117	9	2.4	1.6	
	τ_i(ms)	164	14	0.5	0.2	
DIODE	Ri(K/kW)	167	17	10		
	τ_i(ms)	139	21	1.2		

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