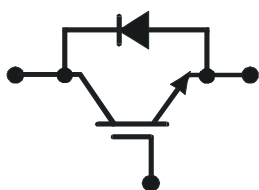


$V_{CE} = 1700\text{ V}$

$I_C = 1800\text{ A}$

HiPak

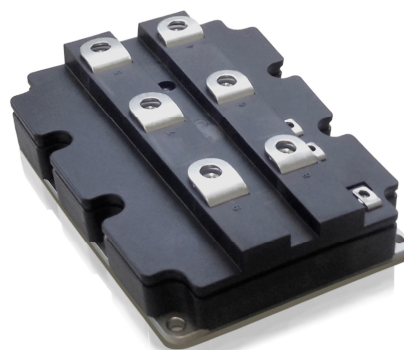


IGBT Module

5SNA 1800E170100

Doc. No. 5SYA 1554-04 10-2020

- 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
- Improved high reliability package
- Recognized under UL1557, File E196689



Maximum rated values ¹⁾

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	$T_c = 80\text{ °C}$		1800	A
Peak collector current	I_{CM}	$t_p = 1\text{ ms}$, $T_c = 80\text{ °C}$		3600	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	$T_c = 25\text{ °C}$, per switch (IGBT)		11000	W
DC forward current	I_F			1800	A
Peak forward current	I_{FRM}			3600	A
Surge current	I_{FSM}	$V_R = 0\text{ V}$, $T_{vj} = 125\text{ °C}$, $t_p = 10\text{ ms}$, half-sinewave		16500	A
IGBT short circuit SOA	t_{psc}	$V_{CC} = 1200\text{ V}$, $V_{CEMCHIP} \leq 1700\text{ V}$ $V_{GE} \leq 15\text{ V}$, $T_{vj} \leq 125\text{ °C}$		10	μs
Isolation voltage	V_{isol}	1 min, $f = 50\text{ Hz}$		4000	V
Junction temperature	T_{vj}			150	°C
Junction operating temperature	$T_{vj(op)}$		-50	125	°C
Case temperature	T_c		-50	125	°C
Storage temperature	T_{stg}		-50	125	°C
Mounting torques ²⁾	M_1	Base-heatsink, M6 screws	4	6	Nm
	M_2	Main terminals, M8 screws	8	10	
	M_3	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 Document No. 5SYA2039

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 = 1800 A, V _{GE} = 15 V	T _{vj} = 25 °C	2.0	2.3	2.6	V
			T _{vj} = 125 °C	2.3	2.6	2.9	V
Collector cut-off current	I _{CES}	V _{CE} = 1700 V, V _{GE} = 0 V	T _{vj} = 25 °C			12	mA
			T _{vj} = 125 °C		50	120	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 = 240 mA, V _{CE} = V _{GE} , T _{vj} = 25 °C	4.5		6.5	V	
Gate charge	Q _{ge}	I _C = 1800 A, V _{CE} = 900 V, V _{GE} = -15 V .. 15 V		15.1		μC	
Input capacitance	C _{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz, T _{vj} = 25 °C		166		nF	
Output capacitance	C _{oes}			16.5			
Reverse transfer capacitance	C _{res}			6.98			
Turn-on delay time	t _{d(on)}	V _{CC} = 900 V, I _C = 1800 A, R _G = 0.82 Ω, V _{GE} = ±15 V, L _σ = 60 nH, inductive load	T _{vj} = 25 °C	290		ns	
			T _{vj} = 125 °C	300			
Rise time	t _r	V _{GE} = ±15 V, L _σ = 60 nH, inductive load	T _{vj} = 25 °C	230		ns	
			T _{vj} = 125 °C	250			
Turn-off delay time	t _{d(off)}	V _{CC} = 900 V, I _C = 1800 A, R _G = 0.82 Ω, V _{GE} = ±15 V, L _σ = 60 nH, inductive load	T _{vj} = 25 °C	920		ns	
			T _{vj} = 125 °C	1000			
Fall time	t _f	V _{GE} = ±15 V, L _σ = 60 nH, inductive load	T _{vj} = 25 °C	215		ns	
			T _{vj} = 125 °C	230			
Turn-on switching energy	E _{on}	V _{CC} = 900 V, I _C = 1800 A, V _{GE} = ±15 V, R _G = 0.82 Ω, L _σ = 60 nH, inductive load	T _{vj} = 25 °C	380		mJ	
			T _{vj} = 125 °C	550			
Turn-off switching energy	E _{off}	V _{CC} = 900 V, I _C = 1800 A, V _{GE} = ±15 V, R _G = 0.82 Ω, L _σ = 60 nH, inductive load	T _{vj} = 25 °C	560		mJ	
			T _{vj} = 125 °C	700			
Short circuit current	I _{SC}	t _{pSC} ≤ 10 μs, V _{GE} = 15 V, T _{vj} = 125 °C, V _{CC} = 1200 V, V _{CEM CHIP} ≤ 1700 V		8500		A	
Module stray inductance	L _{σ CE}			10		nH	
Resistance, terminal-chip	R _{CC'+EE'}	T _C = 25 °C		0.06		mΩ	
		T _C = 125 °C		0.085			

³⁾ Characteristic values according to IEC 60747 – 9⁴⁾ 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 = 1800 A	T _{vj} = 25 °C	1.4	1.65	2.0	V
			T _{vj} = 125 °C	1.4	1.7	2.0	
Reverse recovery current	I _{rr}	V _{CC} = 900 V, I _F = 1800 A, V _{GE} = ±15 V, R _G = 0.82 Ω L _σ = 60 nH inductive load	T _{vj} = 25 °C		1140		A
			T _{vj} = 125 °C		1460		
Recovered charge	Q _{rr}		T _{vj} = 25 °C		440		μC
			T _{vj} = 125 °C		780		
Reverse recovery time	t _{rr}		T _{vj} = 25 °C		590		ns
			T _{vj} = 125 °C		890		
Reverse recovery energy	E _{rec}		T _{vj} = 25 °C		310		mJ
			T _{vj} = 125 °C		540		

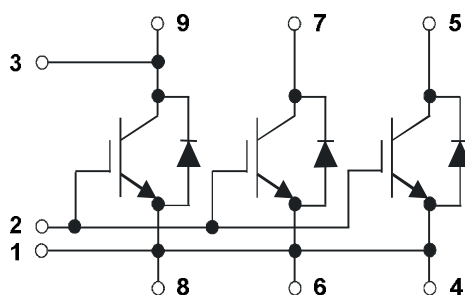
⁵⁾ Characteristic values according to IEC 60747 – 2⁶⁾ Forward voltage is given at chip level**Thermal properties**

Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$				0.009	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.017	K/W
Thermal resistance case ²⁾ to heatsink	$R_{th(c-h)}$	per module, λ grease = $1\text{ W/m} \times \text{K}$		0.006		K/W

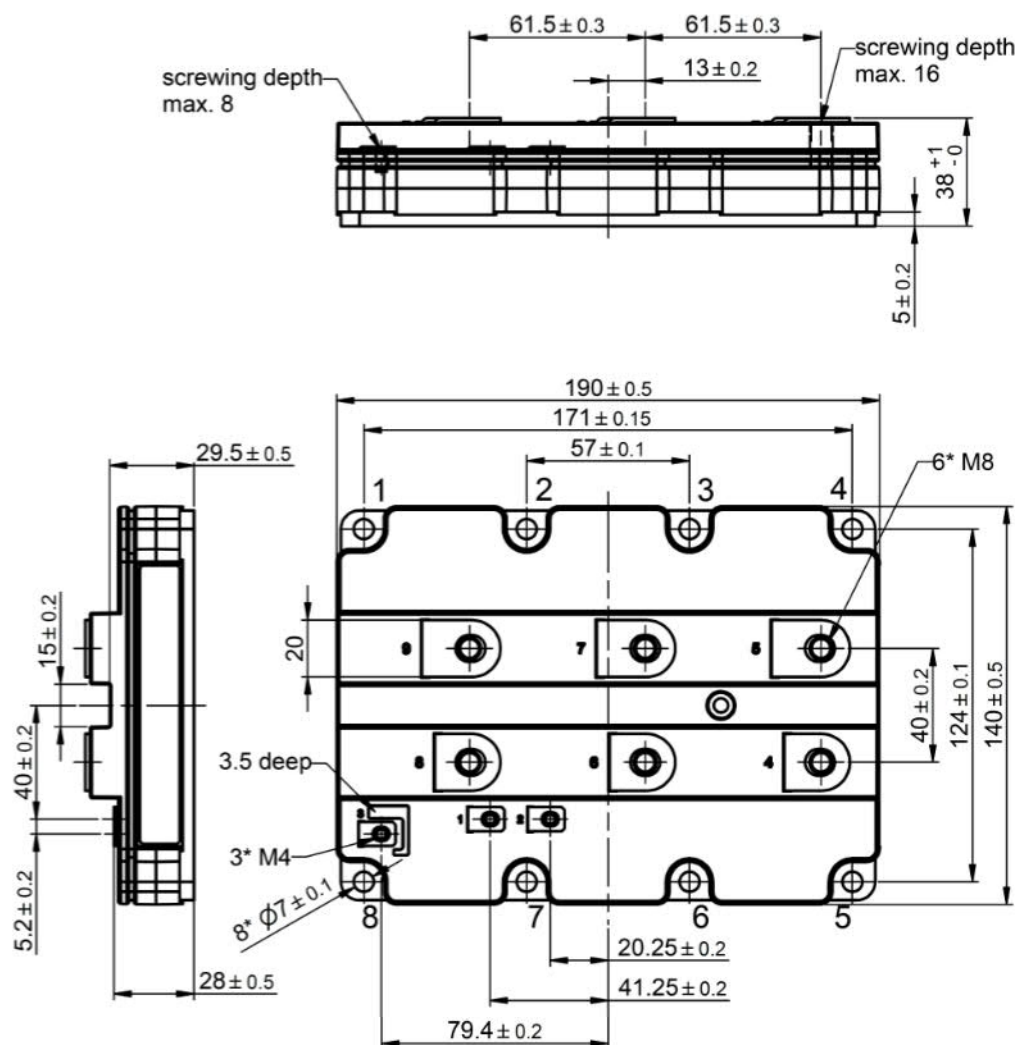
²⁾ For detailed mounting instructions refer to ABB Document No. 5SYA2039**Mechanical properties**

Parameter	Symbol	Conditions	min	typ	max	Unit
Dimensions	$L \times W \times H$	Typical , see outline drawing	190 × 140 × 38			mm
Comparative tracking index	CTI		600			
Clearance distance	D_c	according to IEC 60664-1 and EN 50124-1	Term. to base:	23		mm
			Term. to term:	19		
Surface creepage distance	D_{sc}	according to IEC 60664-1 and EN 50124-1	Term. to base:	28.2		mm
			Term. to term:	28.2		
Weight				1210		g

Electrical configuration



Outline drawing ²⁾



Note: all dimensions are shown in mm

²⁾ For detailed mounting instructions refer to 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.

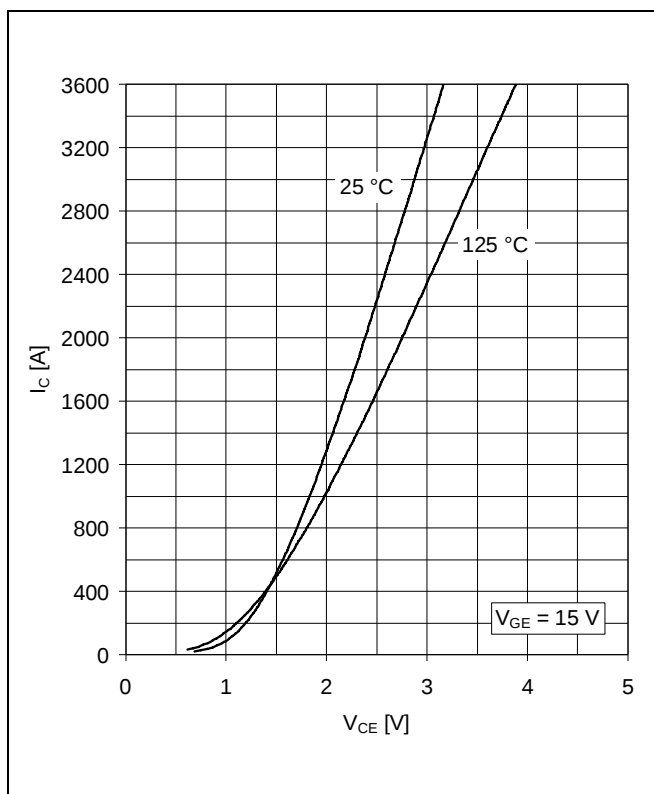


Fig. 1 Typical on-state characteristics, chip level

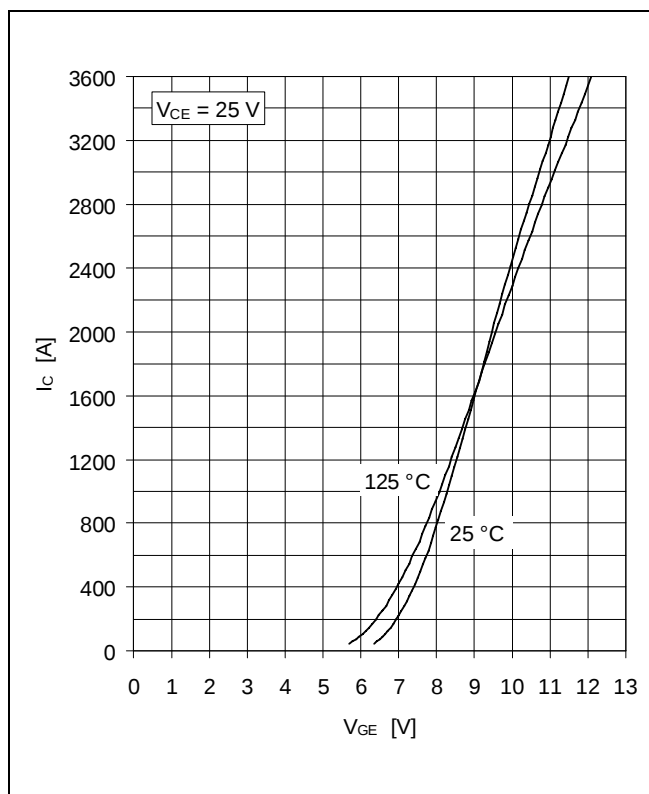


Fig. 2 Typical transfer characteristics, chip level

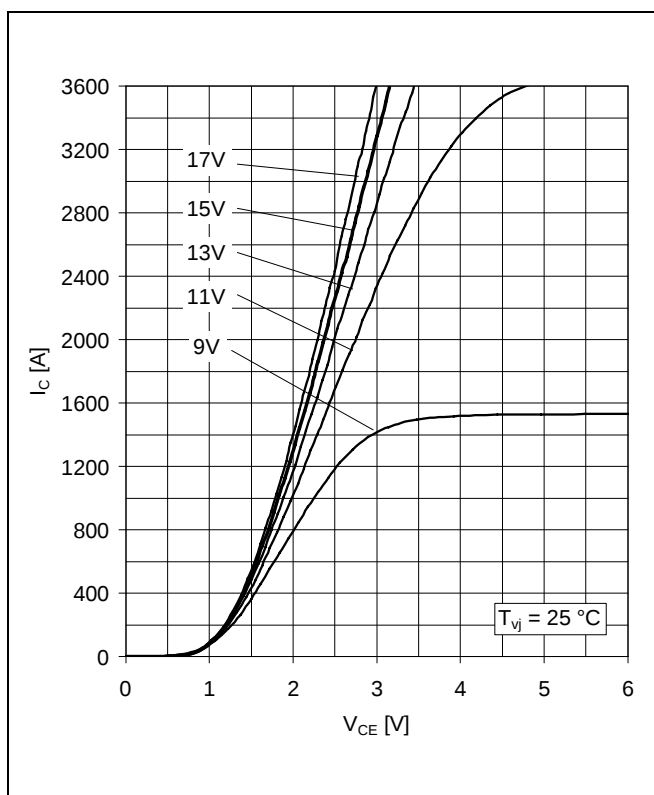


Fig. 3 Typical output characteristics, chip level

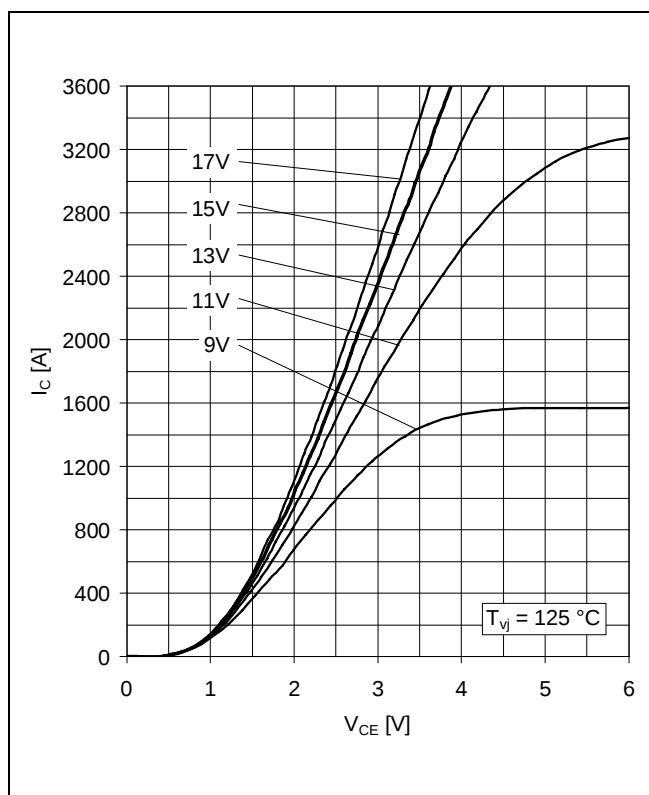


Fig. 4 Typical output characteristics, chip level

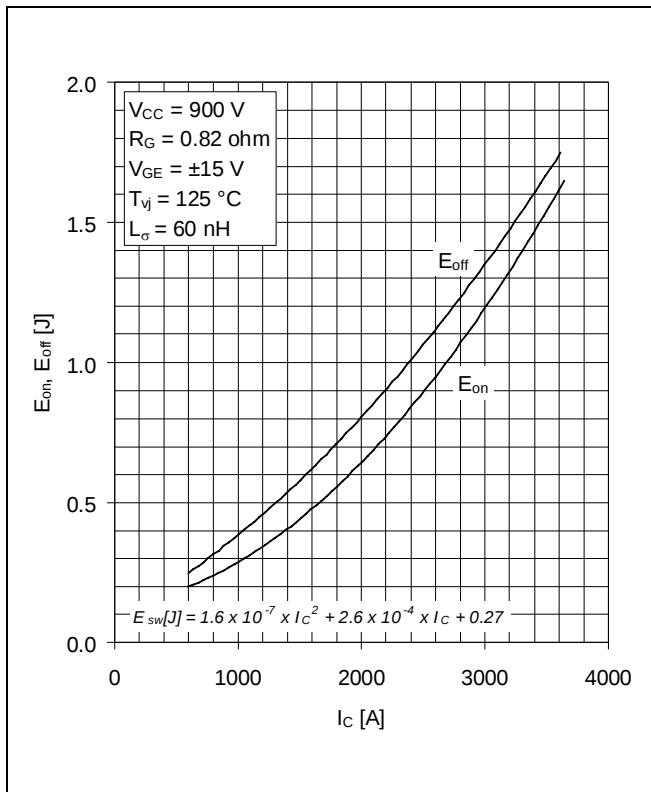


Fig. 5 Typical switching energies per pulse vs collector current

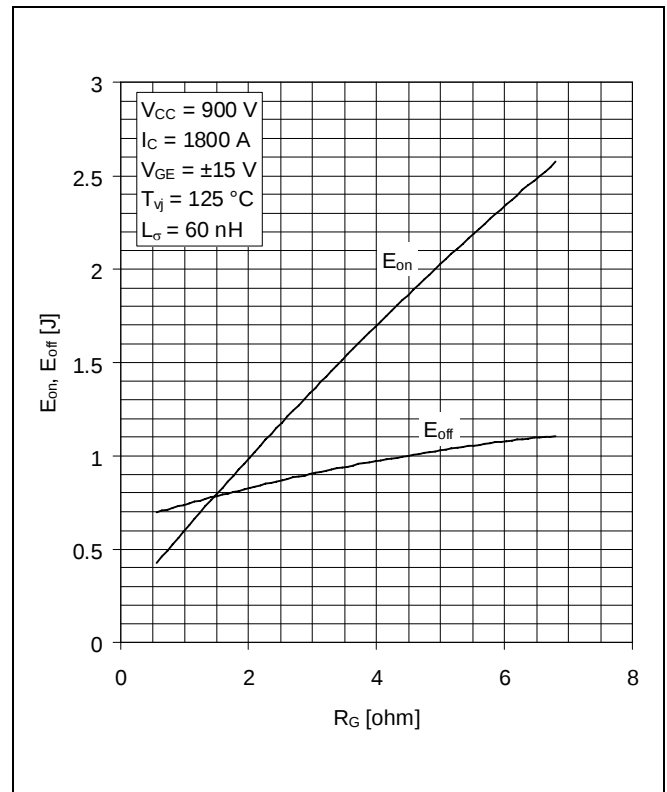


Fig. 6 Typical switching energies per pulse vs gate resistor

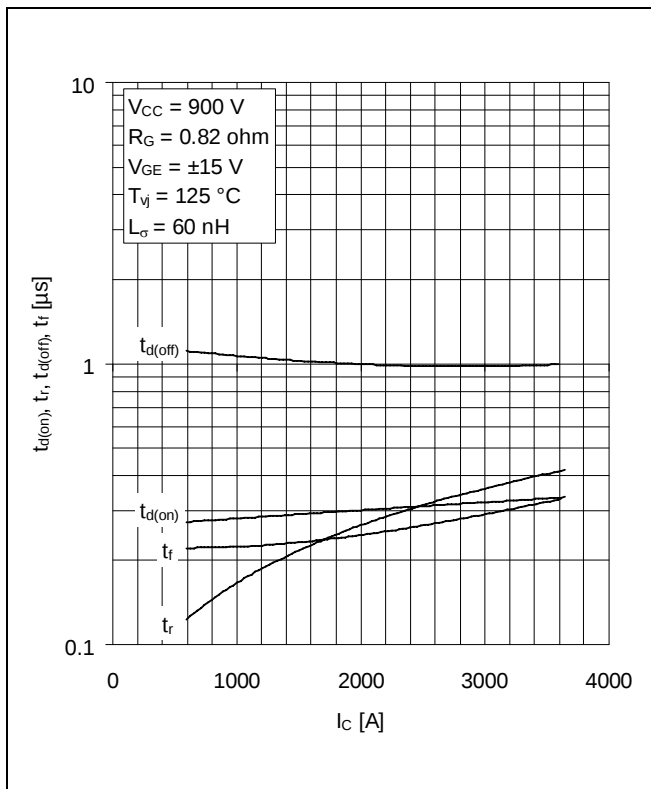


Fig. 7 Typical switching times vs collector current

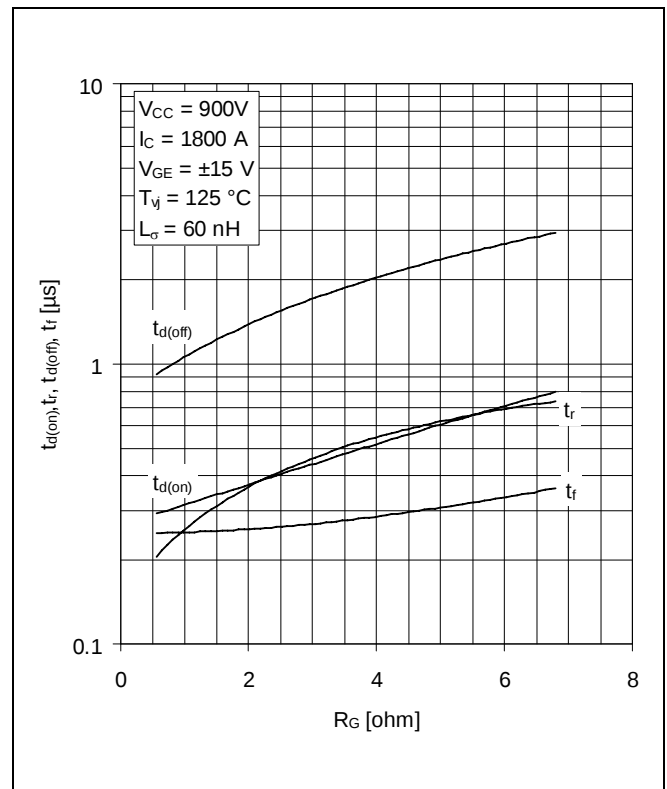


Fig. 8 Typical switching times vs gate resistor

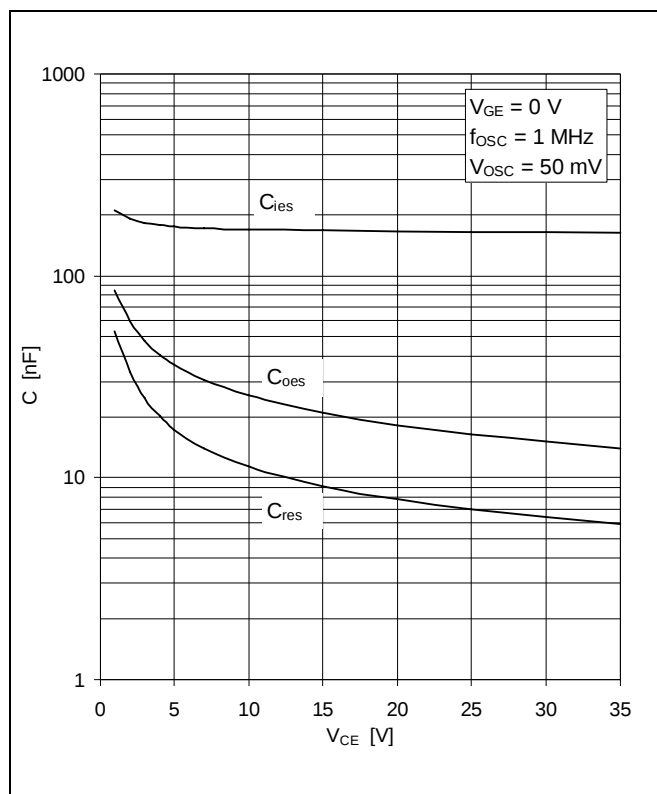


Fig. 9 Typical capacitances
vs collector-emitter voltage

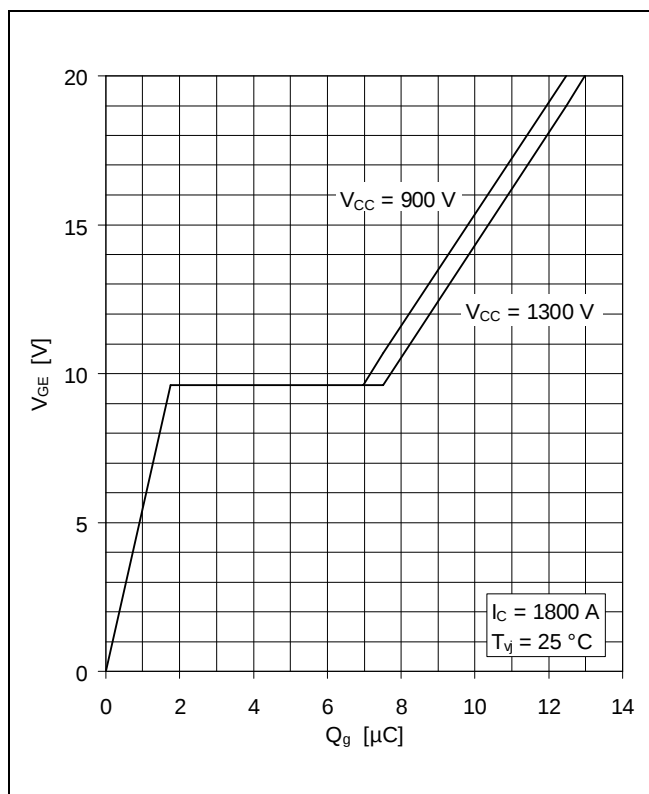


Fig. 10 Typical gate charge characteristics

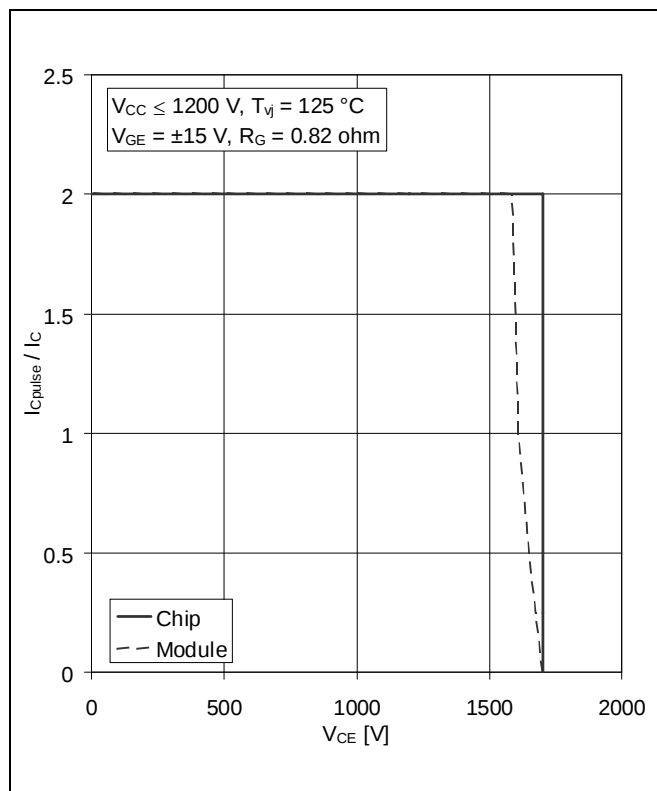


Fig. 11 Turn-off safe operating area (RBSOA)

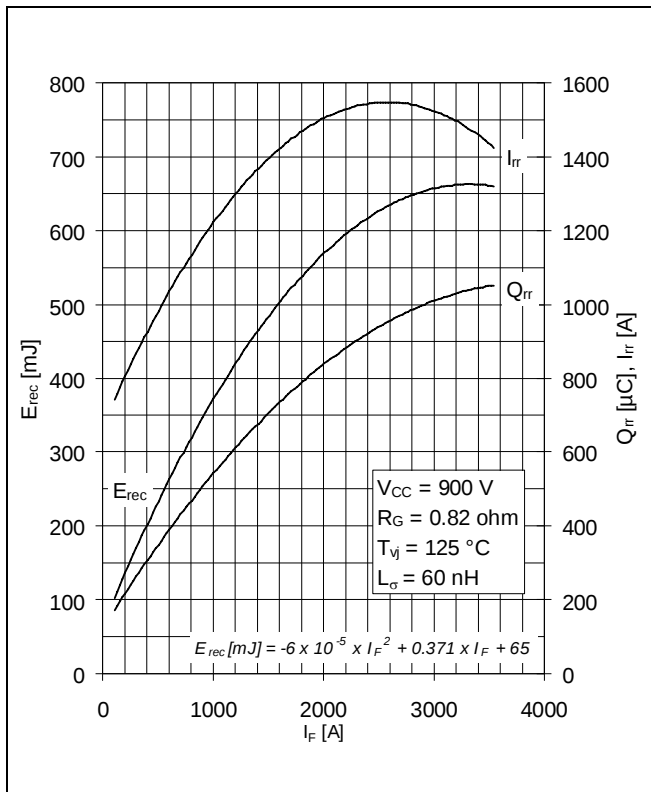


Fig. 12 Typical reverse recovery characteristics vs forward current

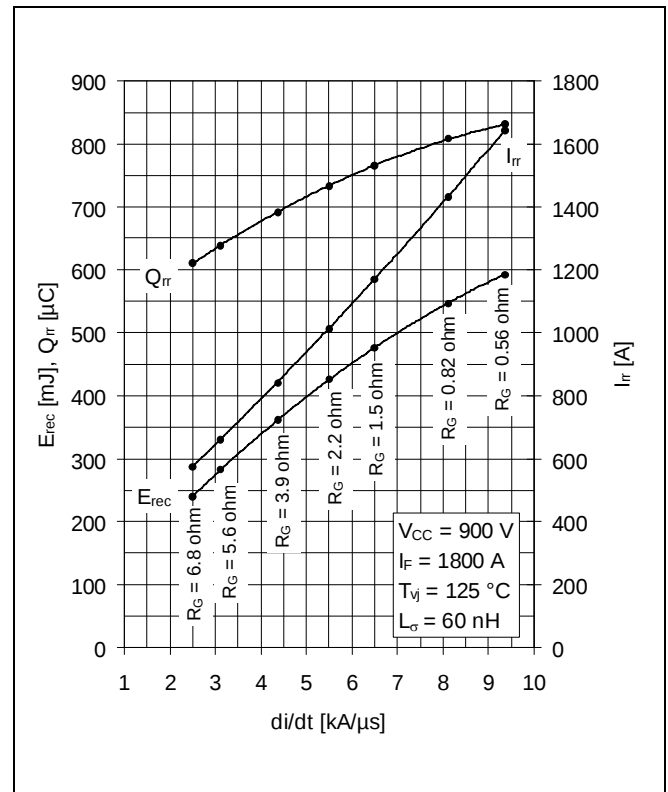


Fig. 13 Typical reverse recovery characteristics vs di/dt

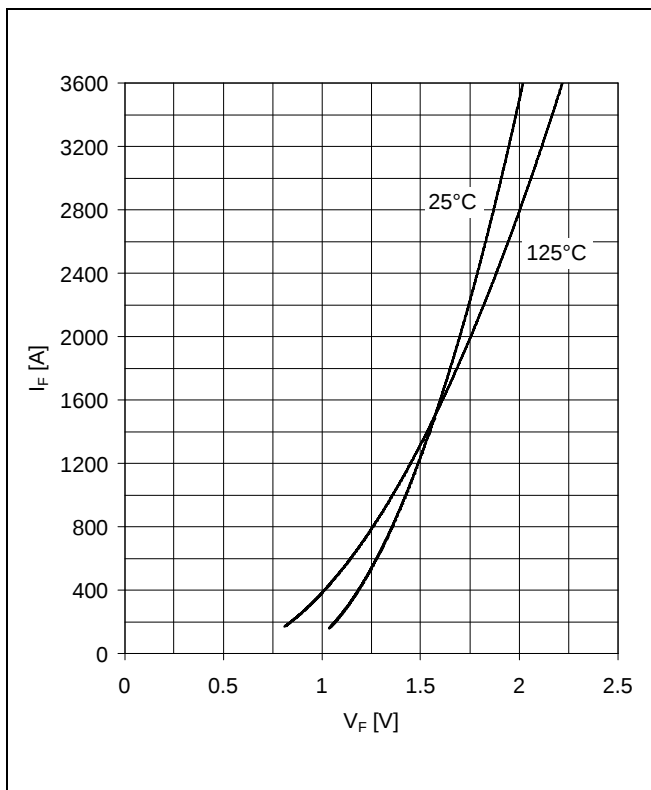


Fig. 14 Typical diode forward characteristics, chip level

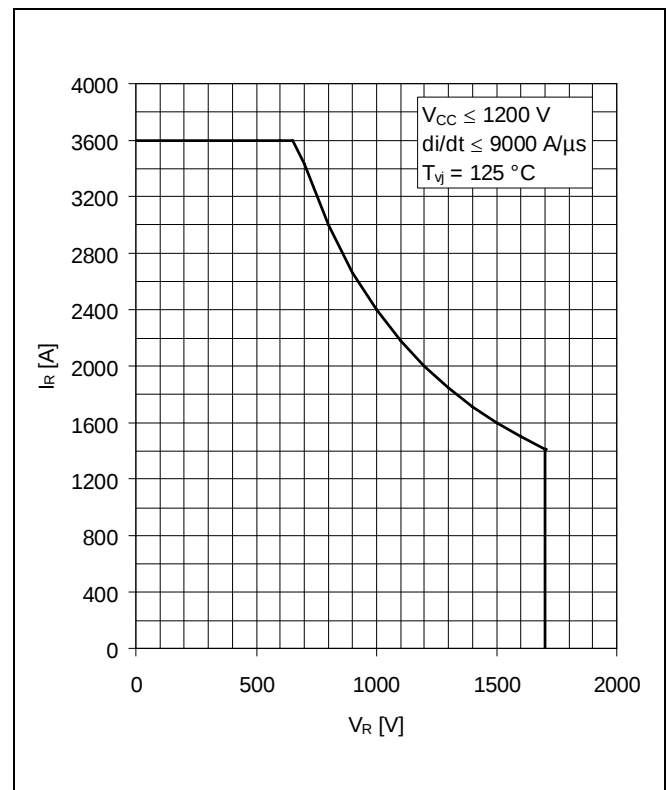


Fig. 15 Safe operating area diode (SOA)

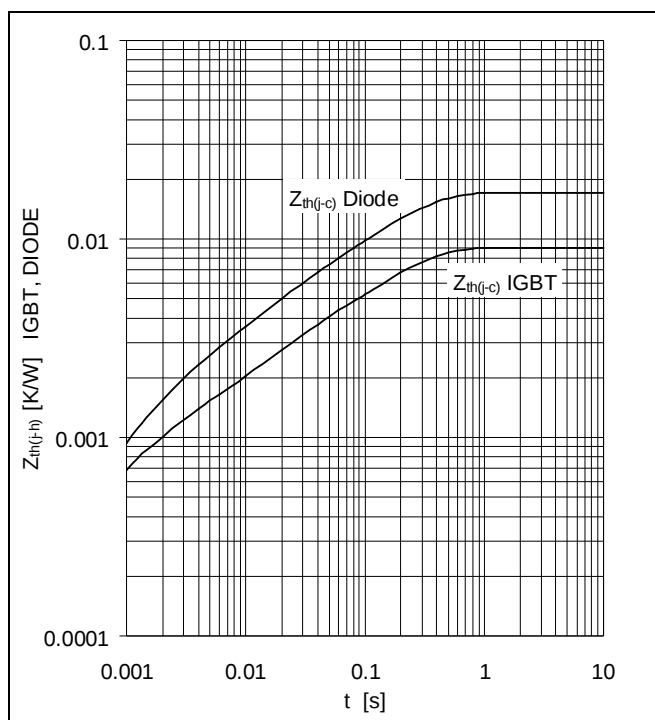


Fig. 16 Thermal impedance vs time

Analytical function for transient thermal impedance:

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

	i	1	2	3	4	5
IGBT	$R_i(K/kW)$	6.24	1.73	0.704	0.345	
	$\tau_i(ms)$	192	20.4	1.97	0.52	
DIODE	$R_i(K/kW)$	11.6	2.91	1.28	1.27	
	$\tau_i(ms)$	204	29.3	6.96	1.5	

Related documents:

5SYA 2042 Failure rates of HiPak modules due to cosmic rays
 5SYA 2043 Load – cycle capability of HiPaks
 5SYA 2045 Thermal runaway during blocking
 5SYA 2053 Applying IGBT
 5SYA 2058 Surge currents for IGBT diodes
 5SYA 2093 Thermal design of IGBT modules
 5SYA 2098 Paralleling of IGBT 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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