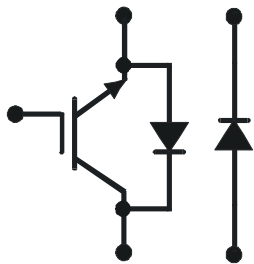


$V_{CE} = 1700\text{ V}$

$I_C = 800\text{ A}$



HiPak

IGBT Module

5SNE 0800M170100

Doc. No. 5SYA1590-01 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	$T_c = 80\text{ °C}$		800	A
Peak collector current	I_{CM}	$t_p = 1\text{ ms}$, $T_c = 80\text{ °C}$		1600	A
Gate-emitter voltage	V_{GES}		-20	20	V
Total power dissipation	P_{tot}	$T_c = 25\text{ °C}$, per switch (IGBT)		4800	W
DC forward current	I_F			800	A
Peak forward current	I_{FRM}			1600	A
Surge current	I_{FSM}	$V_R = 0\text{ V}$, $T_{vj} = 125\text{ °C}$, $t_p = 10\text{ ms}$, half-sinewave		6600	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	$T_{vj(op)}$		-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 document no. 5SYA 2039 - 01

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 = 800 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			4	mA
			T _{vj} = 125 °C			40	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 = 80 mA, V _{CE} = V _{GE} , T _{vj} = 25 °C	4.5		6.5	V	
Gate charge	Q _{ge}	I _C = 800 A, V _{CE} = 900 V, V _{GE} = -15 V .. 15 V		7.3		μC	
Input capacitance	C _{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 1 MHz, T _{vj} = 25 °C		76		nF	
Output capacitance	C _{oes}			7.3			
Reverse transfer capacitance	C _{res}			3.2			
Turn-on delay time	t _{d(on)}	V _{CC} = 900 V, I _C = 800 A, R _G = 1.2 Ω, V _{GE} = ±15 V, L _σ = 80 nH, inductive load	T _{vj} = 25 °C		485		ns
			T _{vj} = 125 °C		485		
Rise time	t _r	V _{GE} = ±15 V, L _σ = 80 nH, inductive load	T _{vj} = 25 °C		165		ns
			T _{vj} = 125 °C		170		
Turn-off delay time	t _{d(off)}	V _{CC} = 900 V, I _C = 800 A, R _G = 1.8 Ω, V _{GE} = ±15 V, L _σ = 80 nH, inductive load	T _{vj} = 25 °C		790		ns
			T _{vj} = 125 °C		875		
Fall time	t _f	V _{GE} = ±15 V, L _σ = 80 nH, inductive load	T _{vj} = 25 °C		160		ns
			T _{vj} = 125 °C		185		
Turn-on switching energy	E _{on}	V _{CC} = 900 V, I _C = 800 A, V _{GE} = ±15 V, R _G = 1.2 Ω, L _σ = 80 nH, inductive load	T _{vj} = 25 °C		160		mJ
			T _{vj} = 125 °C		250		
Turn-off switching energy	E _{off}	V _{CC} = 900 V, I _C = 800 A, V _{GE} = ±15 V, R _G = 1.8 Ω, L _σ = 80 nH, inductive load	T _{vj} = 25 °C		220		mJ
			T _{vj} = 125 °C		300		
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		3600		A	
Module stray inductance	L _{σ CE}	Leg 1		24		nH	
Resistance, terminal-chip	R _{CC'+EE'}	Leg 1	T _C = 25 °C		0.18		mΩ
			T _C = 125 °C		0.255		

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	$I_F = 800 \text{ A}$	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	1.65	2.0	V
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	1.7	2.0	
Reverse recovery current	I_{rr}	$V_{CC} = 900 \text{ V},$ $I_F = 800 \text{ A},$ $V_{GE} = \pm 15 \text{ V},$ $R_G = 1.2 \text{ } \Omega$ $L_{\sigma} = 80 \text{ nH}$ inductive load	$T_{vj} = 25 \text{ }^{\circ}\text{C}$	560		A
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	730		
Recovered charge	Q_{rr}		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	210		μC
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	385		
Reverse recovery time	t_{rr}		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	690		ns
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	975		
Reverse recovery energy	E_{rec}		$T_{vj} = 25 \text{ }^{\circ}\text{C}$	150		mJ
			$T_{vj} = 125 \text{ }^{\circ}\text{C}$	270		
Module stray inductance	$L_{\sigma \text{ AE}}$	Leg 2		24		nH
Resistance, terminal-chip	$R_{AA'+CC'}$	Leg 2	$T_C = 25 \text{ }^{\circ}\text{C}$	0.18		m Ω
			$T_C = 125 \text{ }^{\circ}\text{C}$	0.255		

⁵⁾ Characteristic values according to IEC 60747 – 2⁶⁾ Forward voltage is given at chip level**Thermal properties** ⁷⁾

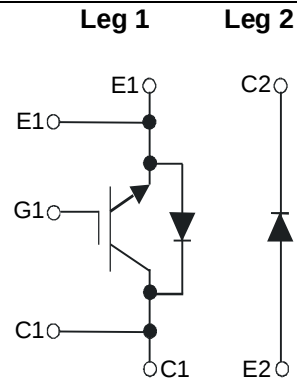
Parameter	Symbol	Conditions	min	typ	max	Unit
IGBT thermal resistance junction to case	$R_{th(j-c)IGBT}$	per switch			0.021	K/W
Diode thermal resistance junction to case	$R_{th(j-c)DIODE}$				0.036	K/W
IGBT thermal resistance ²⁾ case to heatsink	$R_{th(c-s)IGBT}$	IGBT per switch, λ grease = $1\text{W/m} \times \text{K}$		0.024		K/W
Diode thermal resistance ⁷⁾ case to heatsink	$R_{th(c-s)DIODE}$	Diode per switch, λ grease = $1\text{W/m} \times \text{K}$		0.048		K/W

²⁾ For detailed mounting instructions refer to document no. 5SYA 2039 - 01**Mechanical properties** ⁷⁾

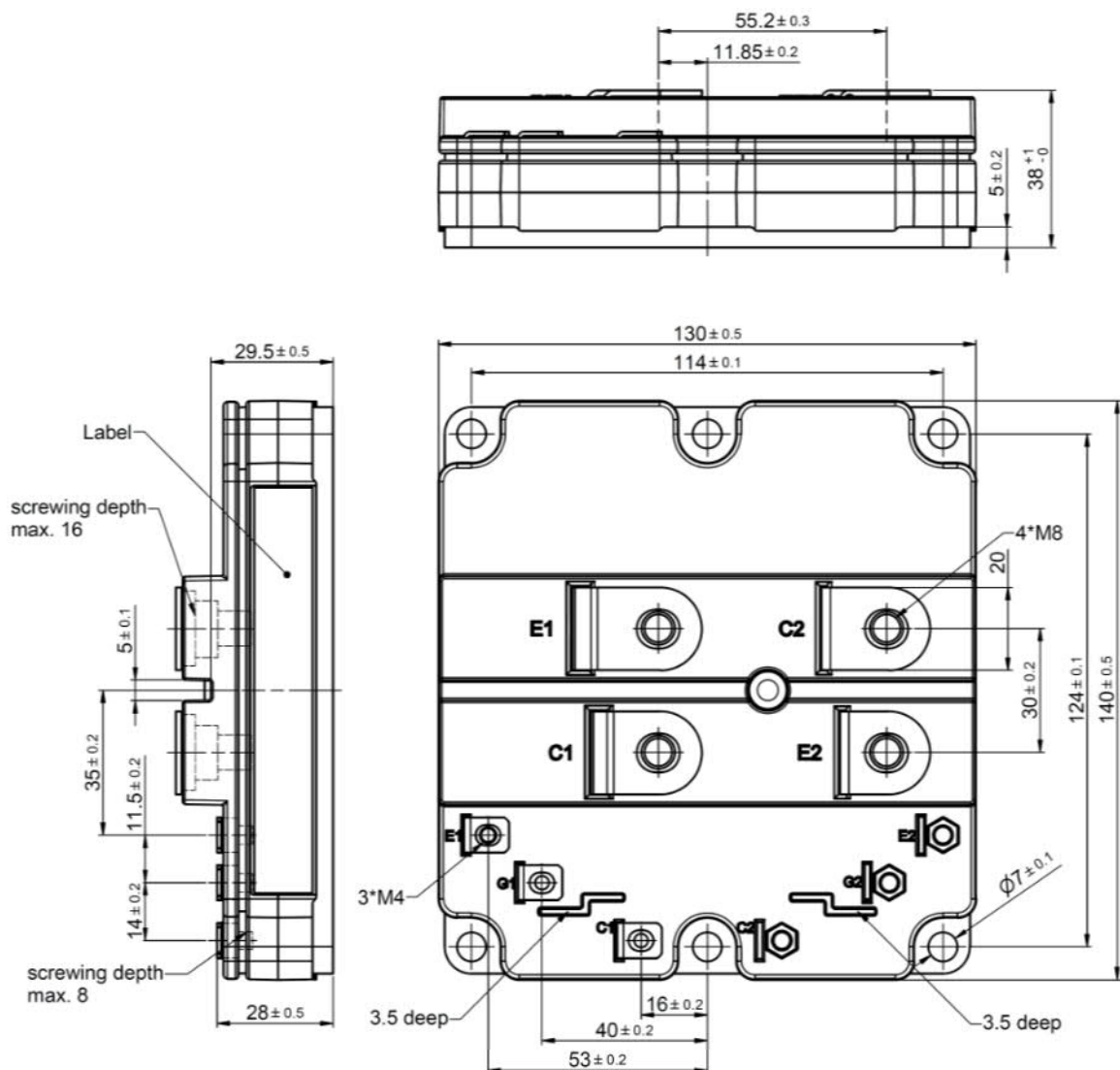
Parameter	Symbol	Conditions	min	typ	max	Unit
Dimensions	$L \times W \times H$	Typical , see outline drawing	130 × 140 × 38			mm
Comparative tracking index	CTI		600			
Clearance distance in air	d_a	according to IEC 60664-1 and EN 50124-1	Term. to base:	10		mm
			Term. to term:	10		
Surface creepage distance	d_s	according to IEC 60664-1 and EN 50124-1	Term. to base:	15		mm
			Term. to term:	15		
Mass	m			800		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 document no. 5SYA 2039 - 01

**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.**

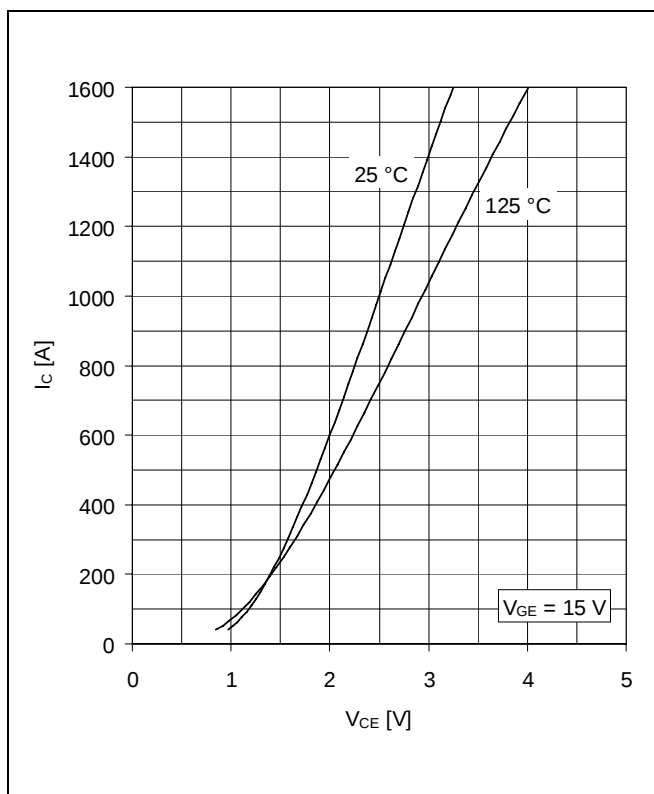


Fig. 1 Typical on-state characteristics, chip level

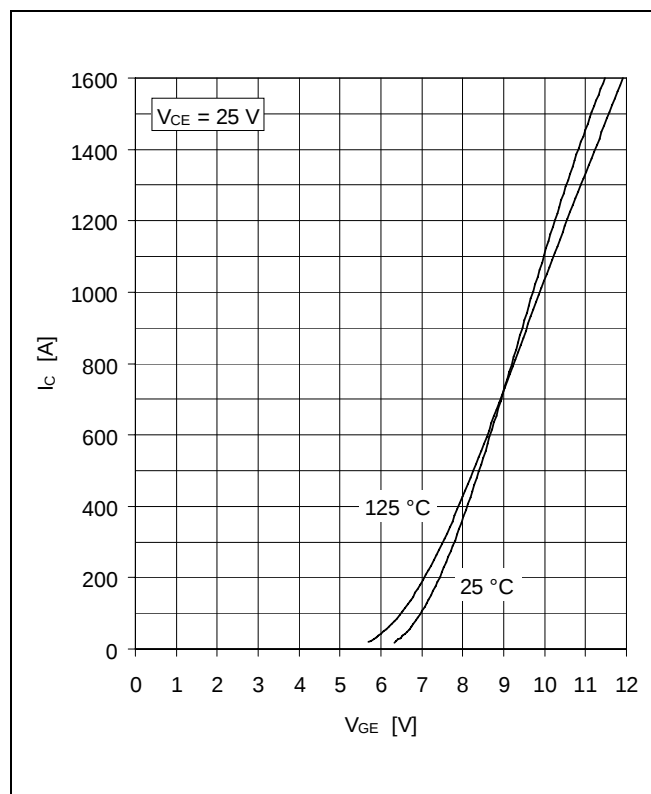


Fig. 2 Typical transfer characteristics, chip level

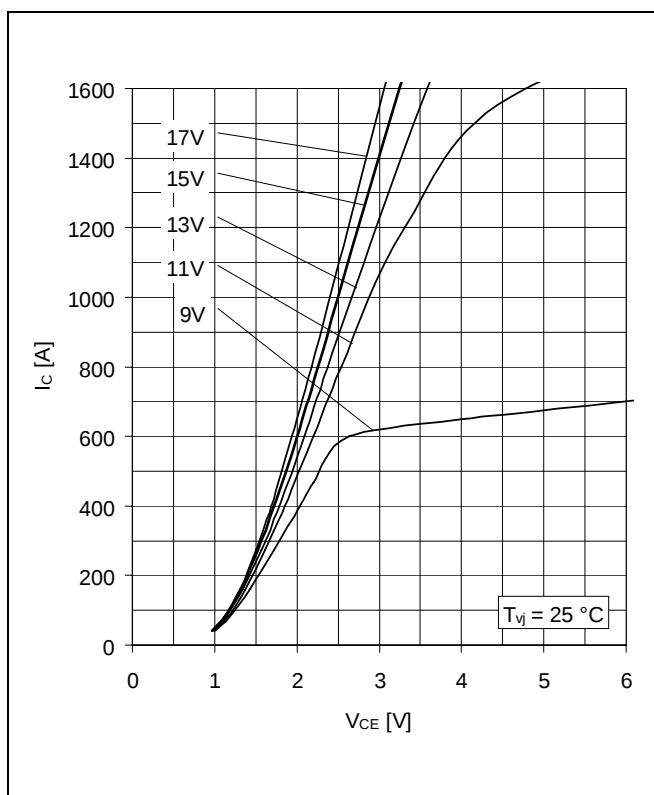


Fig. 3 Typical output characteristics, chip level

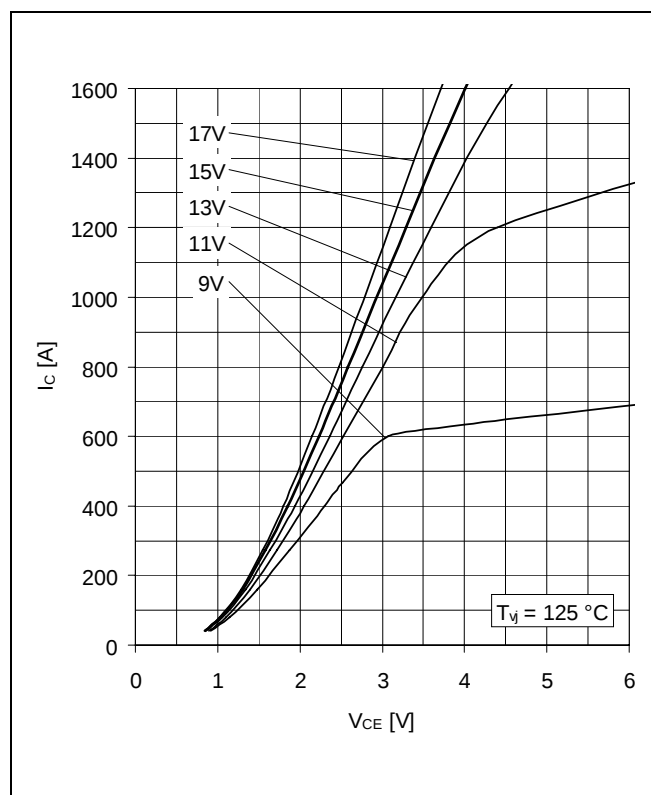


Fig. 4 Typical output characteristics, chip level

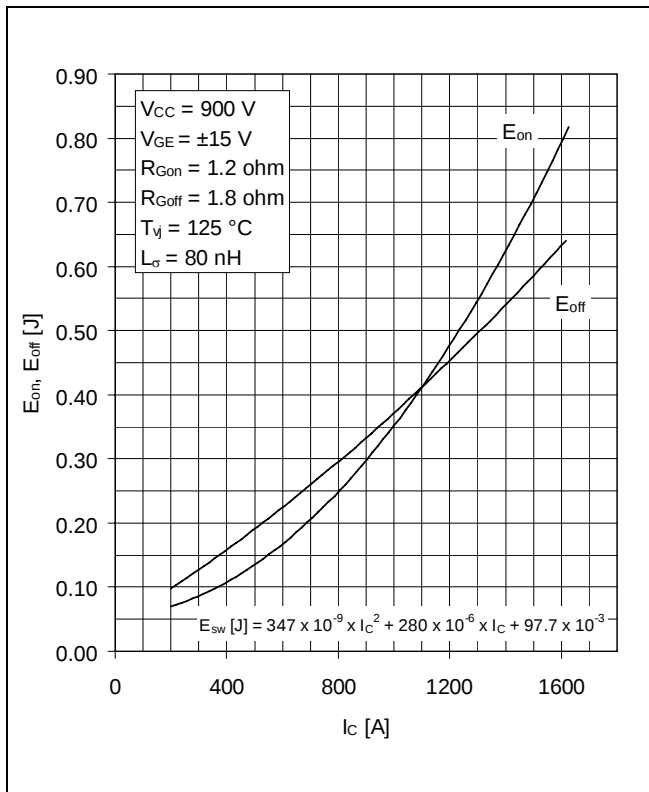


Fig. 5 Typical switching energies per pulse vs collector current

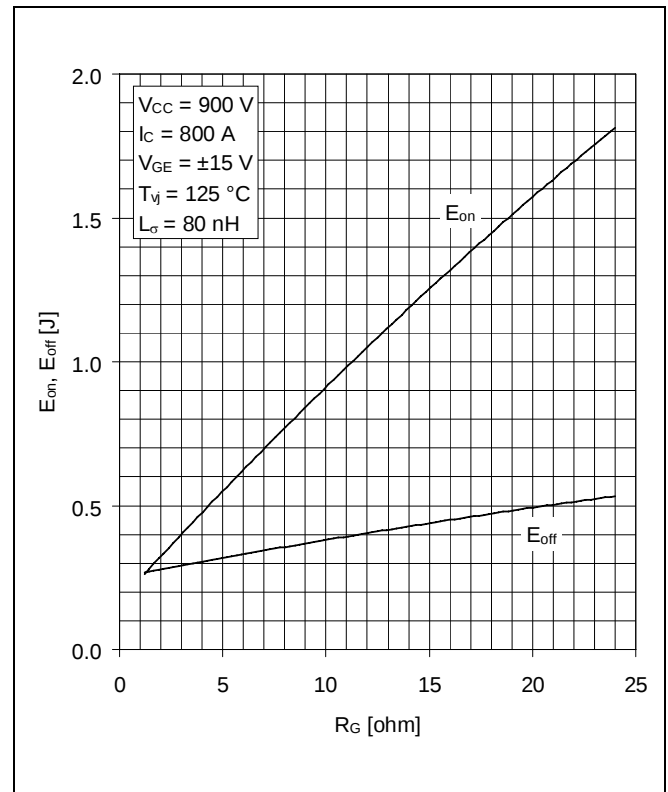


Fig. 6 Typical switching energies per pulse vs gate resistor

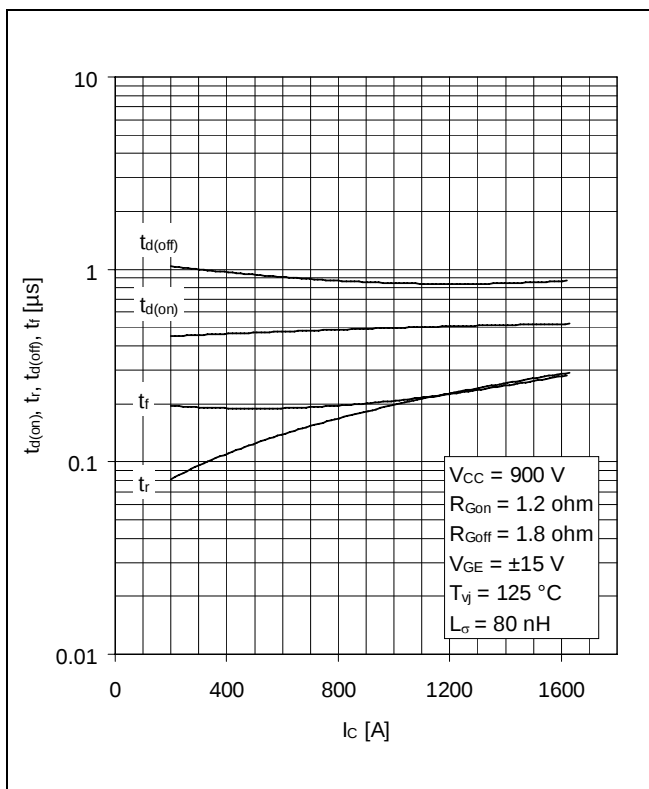


Fig. 7 Typical switching times vs collector current

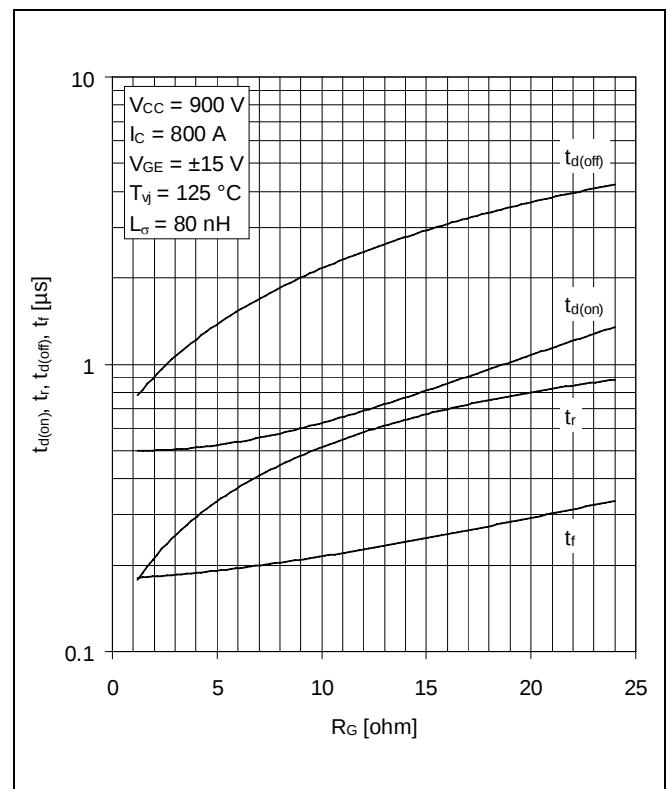


Fig. 8 Typical switching times vs gate resistor

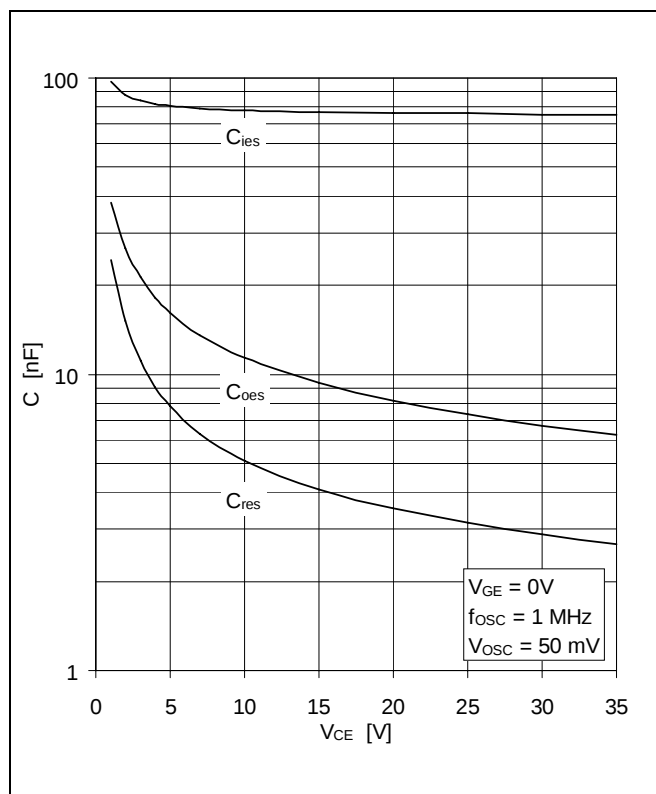


Fig. 9 Typical capacitances vs collector-emitter voltage

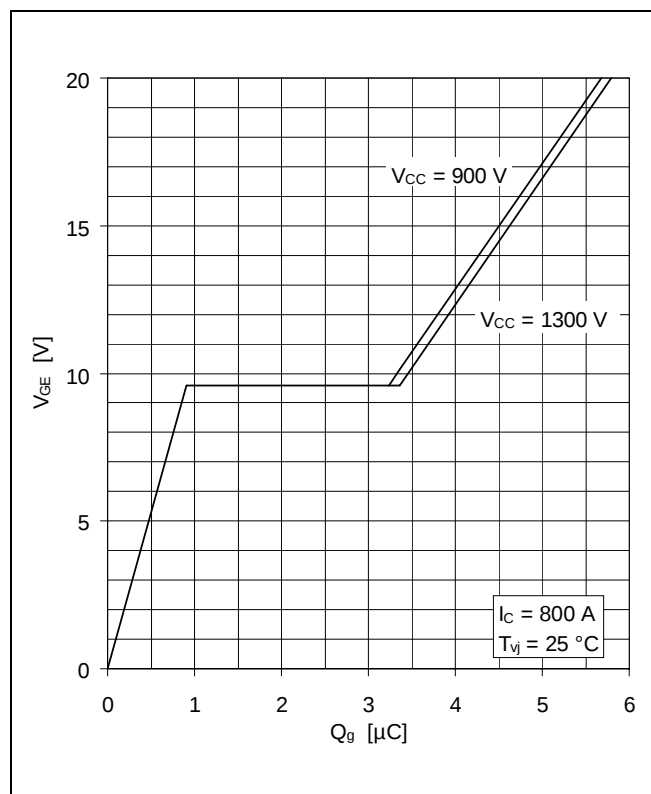


Fig. 10 Typical gate charge characteristics

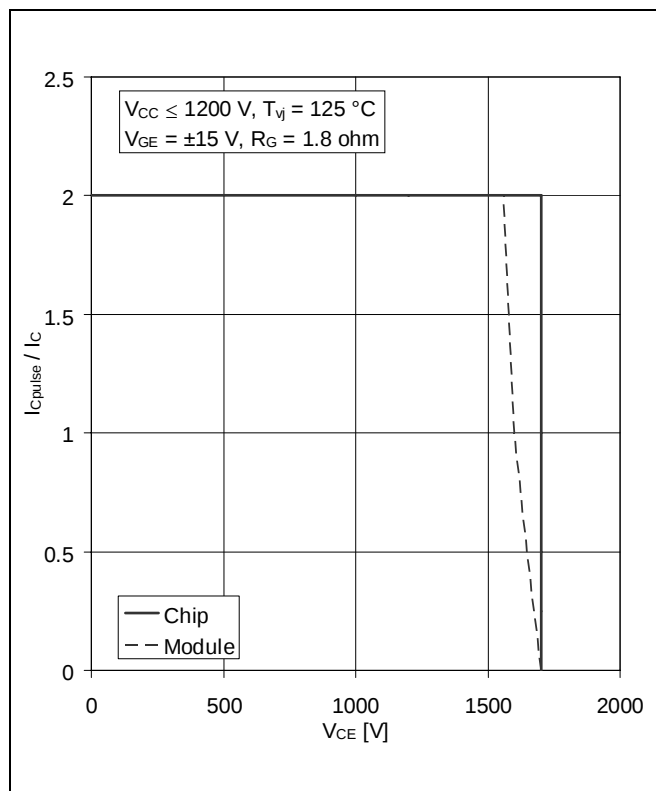


Fig. 11 Turn-off safe operating area (RBSOA)

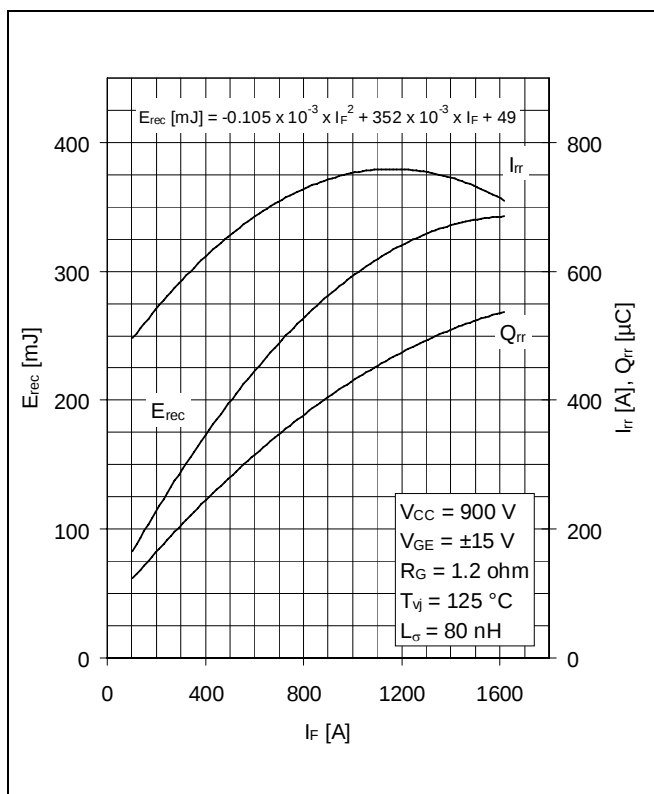


Fig. 12 Typical reverse recovery characteristics vs forward current

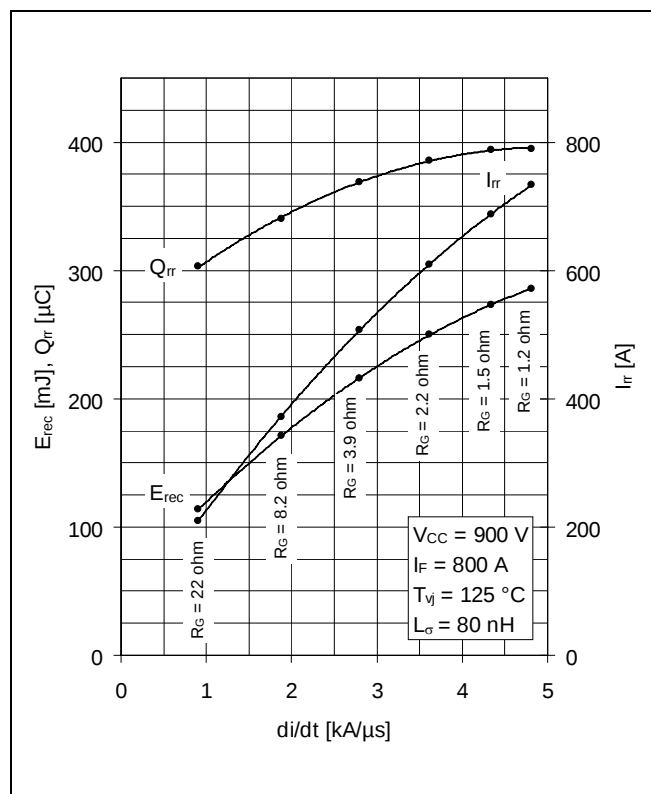


Fig. 13 Typical reverse recovery characteristics vs di/dt

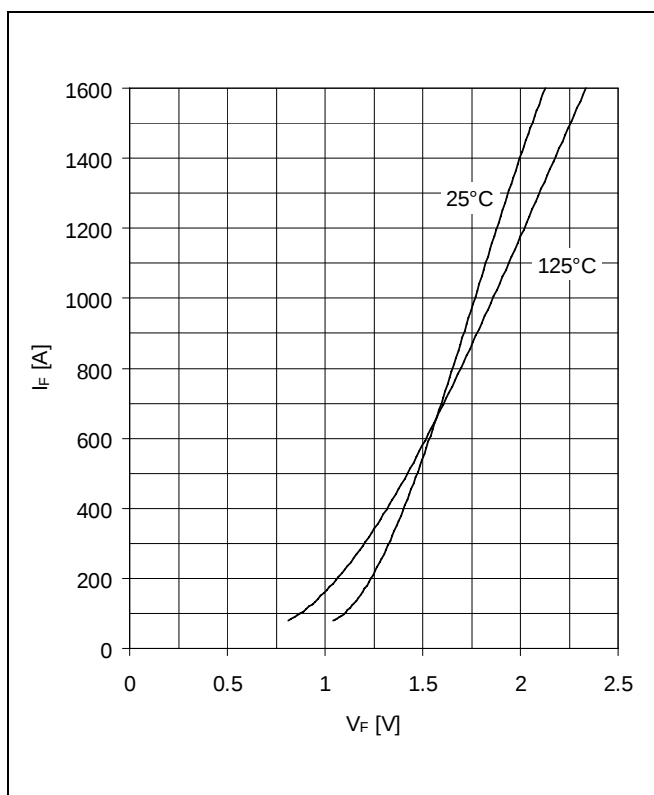


Fig. 14 Typical diode forward characteristics, chip level

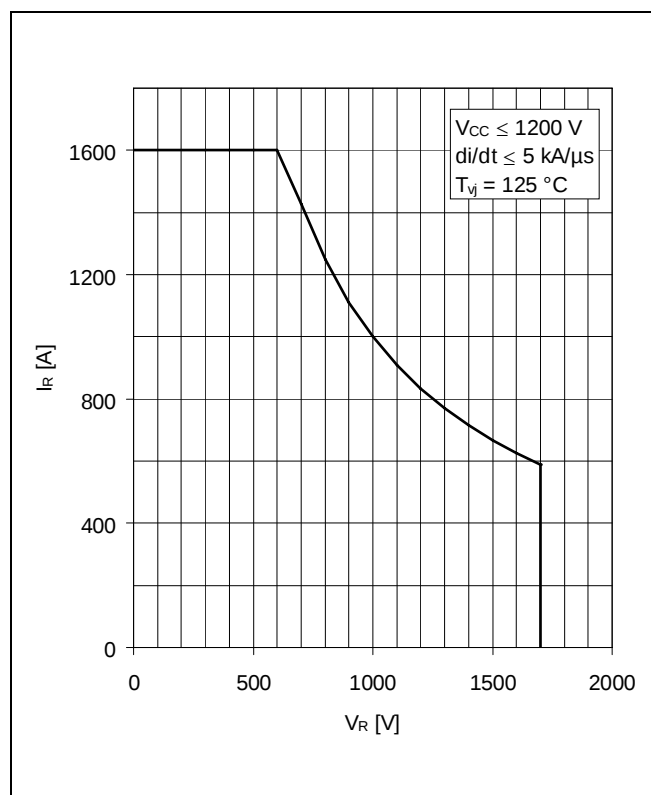


Fig. 15 Safe operating area diode (SOA)

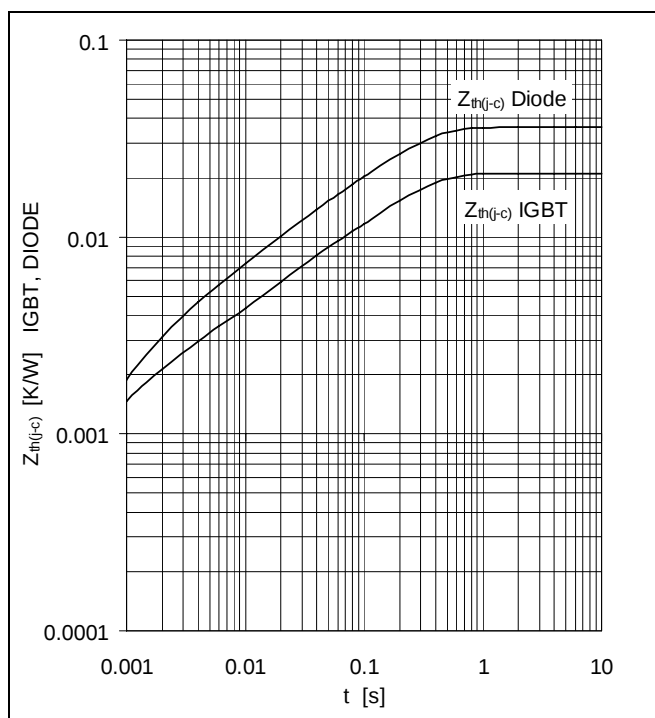


Fig. 16 Thermal impedance vs time

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	
IGBT	$R_i(K/kW)$	15.2	3.6	1.49	0.74	
	$\tau_i(ms)$	202	20.3	2.01	0.52	
DIODE	$R_i(K/kW)$	25.3	5.78	2.6	2.52	
	$\tau_i(ms)$	210	29.6	7.01	1.49	

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

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent. Copyright 2020 Hitachi Powergrids. All rights reserved.