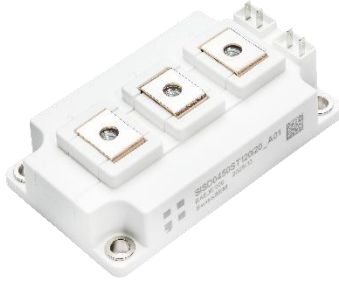


PRELIMINARY DATASHEET

SISD01000ST120i23_A01

ST-Type phase leg IGBT module



$V_{CE} = 1200 \text{ V}$

$I_C = 2 \times 1000 \text{ A}$

- *i23* ultra-low loss fine pattern Trench IGBT chipset
- Baseplate isolation with efficient Al_2O_3 ceramic
- Cu baseplate for low thermal resistance
- Industry standard package

Maximum ratings¹

PARAMETER	SYMBOL	CONDITIONS	MIN	MAX	UNIT
Collector-emitter voltage	V_{CES}	$V_{GE} = 0 \text{ V}$, $T_{vj} = 25 \text{ °C}$		1200	V
DC collector current	I_C	$T_C = 100 \text{ °C}$, $T_{vj} = 175 \text{ °C}$		1000	A
Peak collector current	I_{CM}	$t_p = 1 \text{ ms}$		2000	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		3800	W
DC forward current	I_F			1000	A
Peak forward current	I_{FRM}	$t_p = 1 \text{ ms}$		2000	A
Surge current	I_{FSM}	$V_R = 0 \text{ V}$, $T_{vj} = 150 \text{ °C}$, $t_p = 10 \text{ ms}$, half-sinewave		3000 45000	A A ² s
Isolation voltage	V_{isol}	1 min, $f = 50 \text{ Hz}$		4000	V
Junction operating temperature	$T_{vj(op)}$		-40	175 ²	°C
Case temperature	T_C		-40	150	°C
Storage temperature	T_{stg}		-40	125	°C
Mounting torques ³	M_S	Base-heatsink, M6 screws	3	6	Nm
	M_{t1}	Main terminals, M6 screws	2.5	5	Nm



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¹ Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747

² $T_{vj(op)} > 150 \text{ °C}$ allowed for overload conditions, in maximum for 60s and less than 20% of operation time

³ For details, please refer to the mounting instructions.



IGBT⁴

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 ⁵	V _{CE sat}	I _C = 1000 A, V _{GE} = 15 V	T _{vj} = 25 °C		1.55	1.75	V	
			T _{vj} = 125 °C		1.75		V	
			T _{vj} = 175 °C		1.85		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		4		mA	
			T _{vj} = 175 °C		24		mA	
Gate leakage current	I _{GES}	V _{CE} = 0 V, V _{GE} = ±20 V		-0.5		0.5	μA	
Gate-emitter threshold voltage	V _{GE(th)}	I _C = 50 mA, V _{CE} = V _{GE} , T _{vj} = 25°C		5	6.3	7.0	V	
Gate charge	Q _G	I _C = 1000 A, V _{CE} = 600 V, V _{GE} = -15 V .. 15 V			8.5		μC	
Input capacitance	C _{ies}	V _{CE} = 25 V, V _{GE} = 0 V, f = 100kHz, T _{vj} = 25 °C			129		nF	
Output capacitance	C _{oes}				2.8			
Reverse transfer capacitance	C _{res}				1.2			
Internal gate resistor	R _{Gint}	Per switch, f = 1 MHz, V _{GE} = 0V, CE short			0.5		Ω	
Turn-on delay time	t _{d(on)}	V _{CC} = 600 V, I _C = 1000 A, R _G = 0.5 Ω, V _{GE} = ± 15 V, L _S = 35 nH, inductive load	T _{vj} = 25 °C		394		ns	
			T _{vj} = 125 °C		404			
			T _{vj} = 175 °C		410			
Rise time	t _r		T _{vj} = 25 °C		86			
			T _{vj} = 125 °C		96			
			T _{vj} = 175 °C		102			
Turn-off delay time	t _{d(off)}		T _{vj} = 25 °C		398			ns
			T _{vj} = 125 °C		466			
			T _{vj} = 175 °C		497			
Fall time	t _f	T _{vj} = 25 °C		190				
		T _{vj} = 125 °C		308				
		T _{vj} = 175 °C		362				
Turn-on switching energy	E _{on}	V _{CC} = 600 V, I _C = 1000 A, R _G = 0.5 Ω, V _{GE} = ± 15 V, L _S = 35 nH, inductive load	T _{vj} = 25 °C		66		mJ	
		T _{vj} = 125 °C		101				
		T _{vj} = 175 °C		126				
Turn-off switching energy	E _{off}	V _{CC} = 600 V, I _C = 1000 A, R _G = 0.5 Ω, V _{GE} = ± 15 V, L _S = 35 nH, inductive load	T _{vj} = 25 °C		103			
			T _{vj} = 125 °C		137			
			T _{vj} = 175 °C		152			
Short circuit current	I _{SC}	t _{pCS} ≤ 8 μs, V _{GE} = 15 V, T _{vj} = 175 °C, V _{CC} = 800 V, V _{CEM Chip} ≤ 1200 V			4254			

⁴ Characteristic values according to IEC 60747-9

⁵ Collector-emitter saturation voltage is given at chip-level



Diode⁶

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
Forward voltage ⁷	V_F	$I_F = 1000 \text{ A}$	$T_{vj} = 25 \text{ }^\circ\text{C}$	1.65	2	V
			$T_{vj} = 125 \text{ }^\circ\text{C}$	1.7		V
			$T_{vj} = 175 \text{ }^\circ\text{C}$	1.65		V
Peak reverse recovery current	I_{RM}	$V_R = 600 \text{ V}$, $I_F = 1000 \text{ A}$, $di/dt = 9355 \text{ A}/\mu\text{s}$ (175 °C), $R_G = 0.5 \text{ } \Omega$, $V_{GE} = \pm 15 \text{ V}$, $L_S = 35 \text{ nH}$, inductive load	$T_{vj} = 25 \text{ }^\circ\text{C}$	715		A
			$T_{vj} = 125 \text{ }^\circ\text{C}$	861		A
			$T_{vj} = 175 \text{ }^\circ\text{C}$	950		A
Recovery charge	Q_{rr}		$T_{vj} = 25 \text{ }^\circ\text{C}$	120		μC
			$T_{vj} = 125 \text{ }^\circ\text{C}$	204		μC
			$T_{vj} = 175 \text{ }^\circ\text{C}$	258		μC
Reverse recovery time	t_{rr}		$T_{vj} = 25 \text{ }^\circ\text{C}$	721		ns
			$T_{vj} = 125 \text{ }^\circ\text{C}$	854		ns
			$T_{vj} = 175 \text{ }^\circ\text{C}$	1002		ns
Reverse recovery energy	E_{rec}		$T_{vj} = 25 \text{ }^\circ\text{C}$	61		mJ
			$T_{vj} = 125 \text{ }^\circ\text{C}$	97		mJ
			$T_{vj} = 175 \text{ }^\circ\text{C}$	118		mJ

Package properties⁸

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
IGBT thermal resistance junction to case IGBT	$R_{th(j-c)IGBT}$	Per switch			0.039	K/W
Diode thermal resistance junction to case	$R_{th(j-c)Diode}$				0.065	K/W
IGBT thermal resistance case to heatsink IGBT	$R_{th(c-s)IGBT}$	IGBT per switch, lambda grease = 1 W/m x K		0.028		K/W
Diode thermal resistance case to heatsink	$R_{th(c-s)Diode}$	diode per switch, lambda grease = 1 W/m x K		0.033		K/W
Comparative tracking index	CTI		>400			
Module stray inductance	L_{sCE}	Per switch		20		nH
Resistance, terminal chip	R_{CC+EE}	Per switch	$T_{vj} = 25 \text{ }^\circ\text{C}$	0.7		m Ω
			$T_{vj} = 125 \text{ }^\circ\text{C}$			
			$T_{vj} = 175 \text{ }^\circ\text{C}$			

⁶ Characteristic values according to IEC 60747-2

⁷ Forward voltage is given at chip-level 正向压降是芯片两端的电压值。

⁸ Package and mechanical properties according to IEC 60747-15

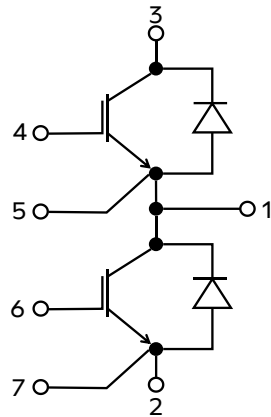


Mechanical properties ⁹

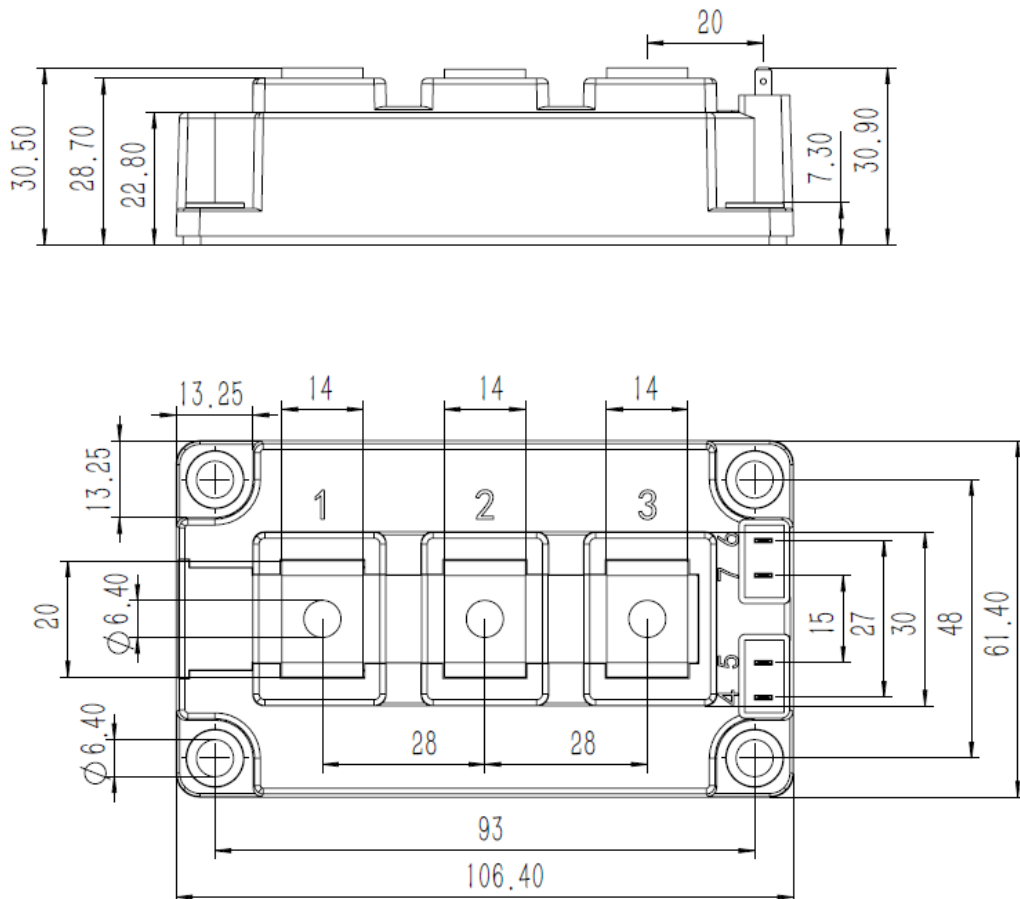
PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNIT
Dimensions	L x W x H	Typical		106 x 62 x 30.9			mm ³
Clearance distance in air	da	According to IEC 60664-1 and EN 50124-1 参考标准 IEC 60664-1EN 50124-1	Terminal to base:		23		mm
			Terminal to terminal:		11		
Surface creepage distance	ds		Terminal to base:		29		mm
			Terminal to terminal:		23		
Mass	m				310		g

⁹ Package and mechanical properties according to IEC 60747-15

Electrical configuration



Outline drawing



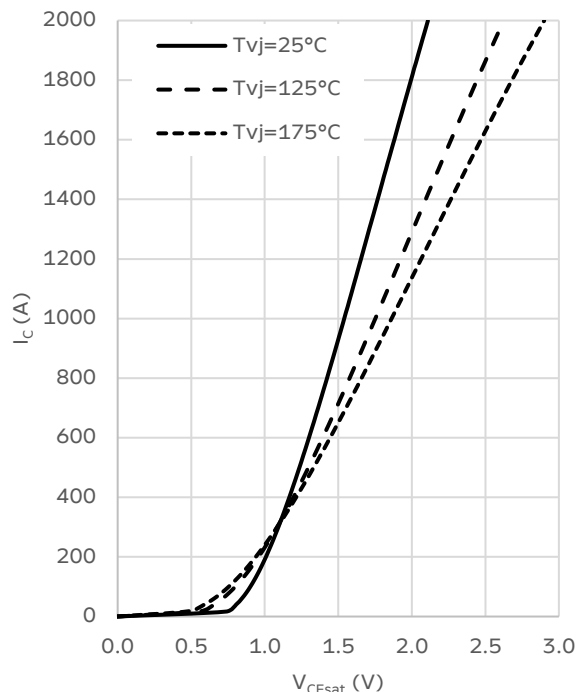
This is an electrostatic sensitive device, please observe the international standard.
This product has been designed and qualified for Industrial Level.

Characteristics

IGBT on-state characteristics (typical)

$$I_C = f(V_{CE})$$

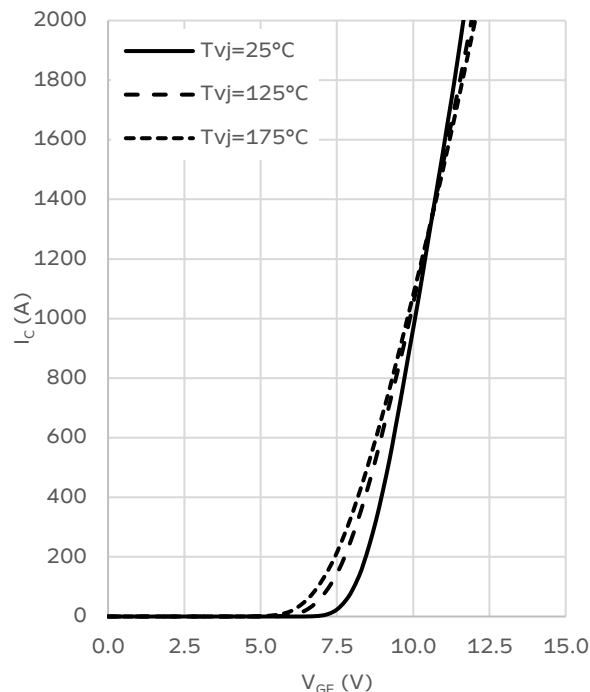
$$V_{GE} = 15 \text{ V}$$



IGBT transfer characteristics (typical)

$$I_C = f(V_{GE})$$

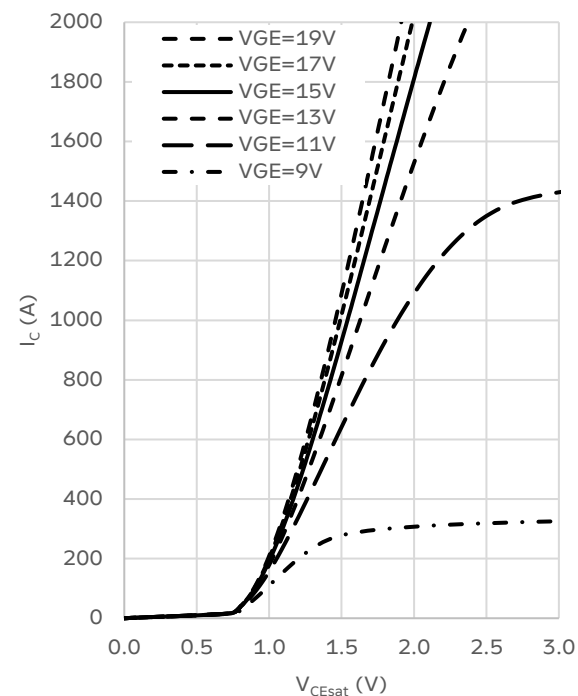
$$V_{CE} = 20 \text{ V}$$



IGBT output characteristics (typical)

$$I_C = f(V_{CE})$$

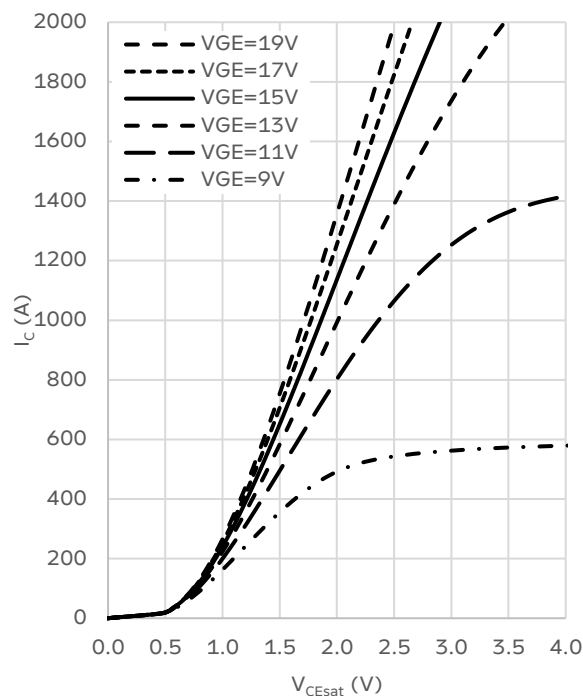
$$T_{vj} = 25^\circ\text{C}$$



IGBT output characteristics (typical)

$$I_C = f(V_{CE})$$

$$T_{vj} = 175^\circ\text{C}$$

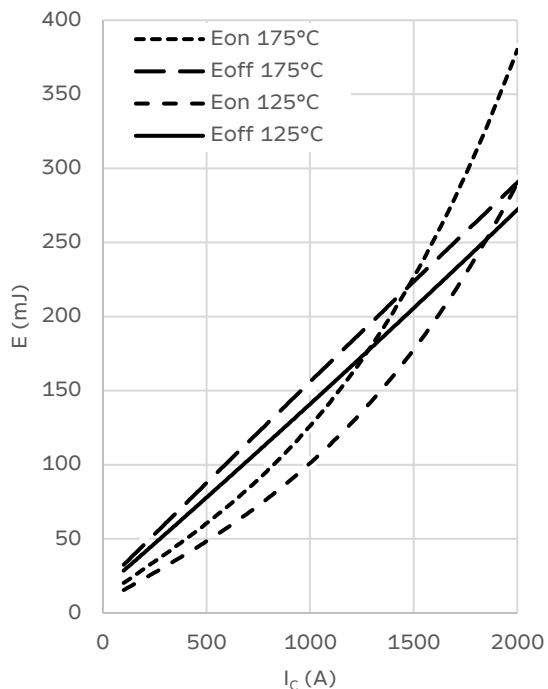




IGBT switching losses (typical)

$E = f(I_{CE})$

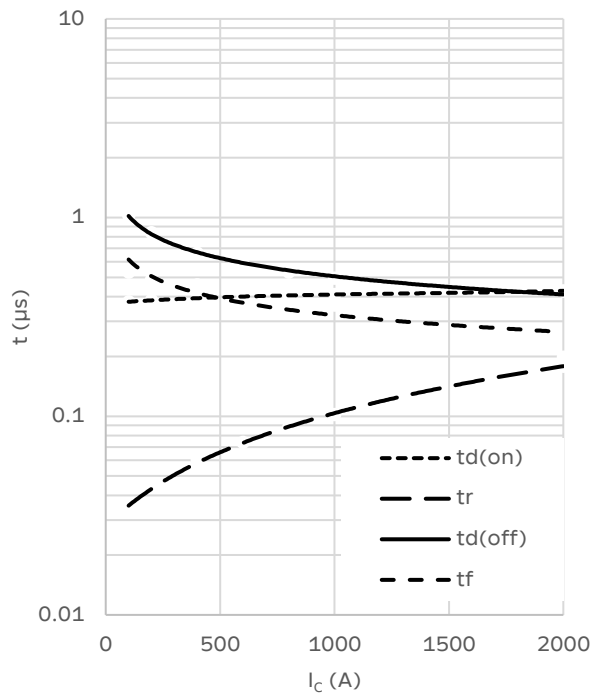
$V_{CE} = 600 \text{ V}$, $R_{Gon} = 0.5 \Omega$, $R_{Goff} = 0.5 \Omega$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching times (typical)

$t = f(I_{CE})$, $T_{vj} = 175 \text{ °C}$

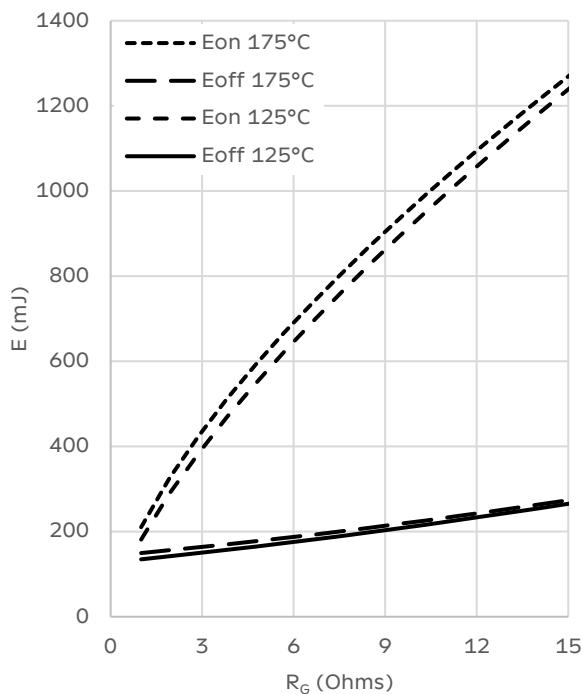
$V_{CE} = 600 \text{ V}$, $R_{Gon} = 0.5 \Omega$, $R_{Goff} = 0.5 \Omega$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching losses (typical)

$E = f(R_G)$

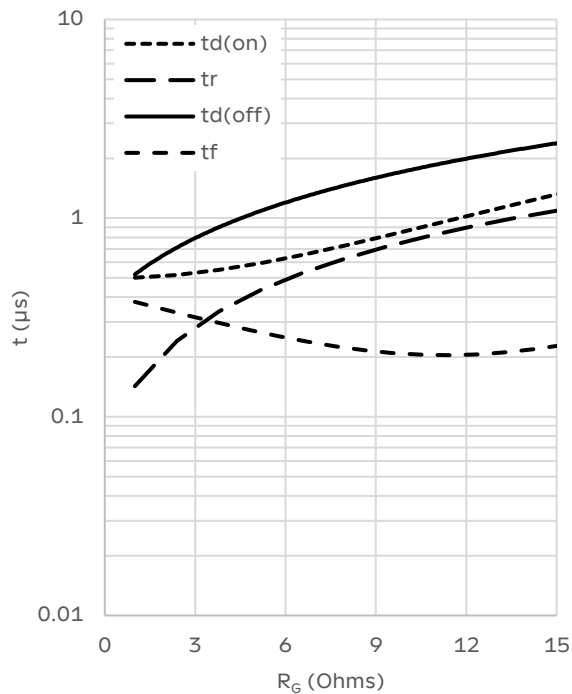
$V_{CE} = 600 \text{ V}$, $I_C = 1000 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$



IGBT switching times (typical)

$t = f(R_G)$, $T_{vj} = 175 \text{ °C}$

$V_{CE} = 600 \text{ V}$, $I_C = 1000 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$

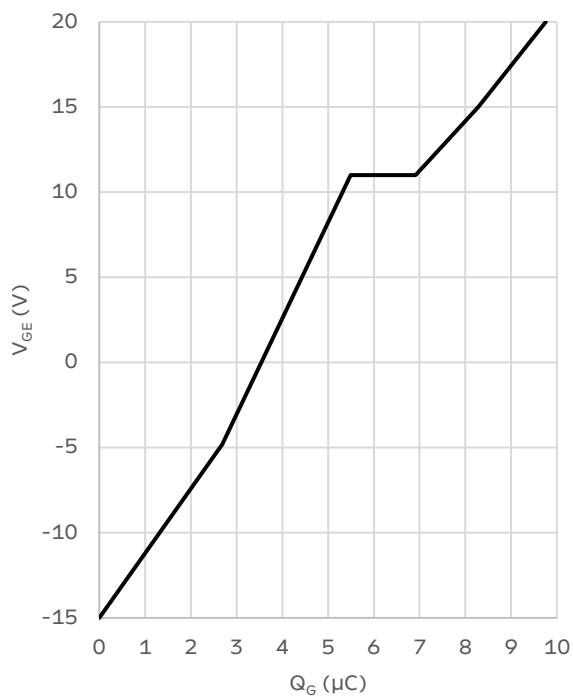




IGBT gate charge (typical)

$V_{GE} = f(Q_G)$, $T_{vj} = 25\text{ °C}$

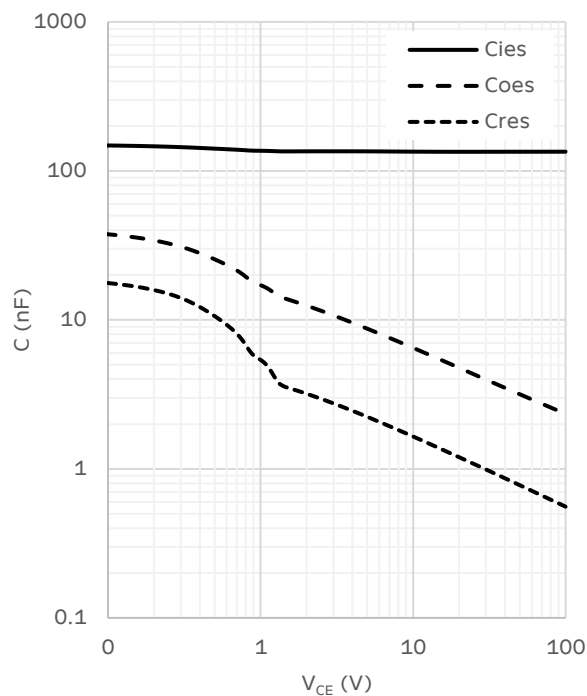
$V_{CE} = 600\text{ V}$, $I_C = 1000\text{ A}$



Capacitance characteristics (typical)

$C = f(V_{CE})$, $T_{vj} = 25\text{ °C}$

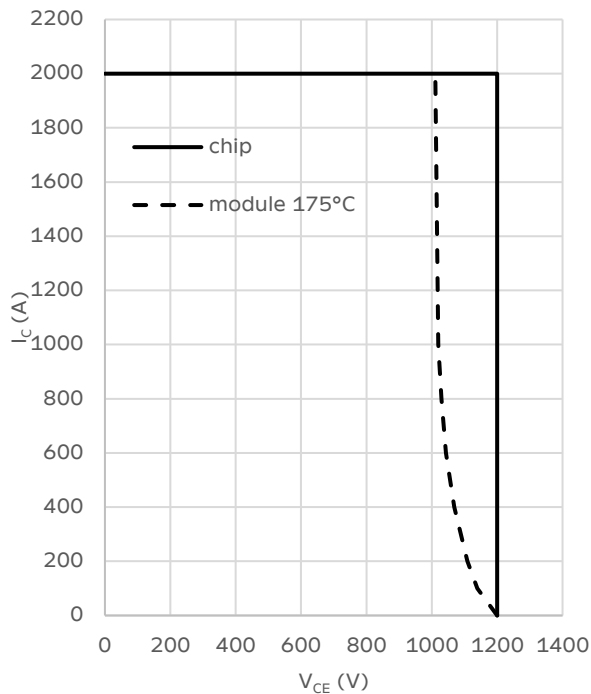
$f = 100\text{ kHz}$, $V_{GE} = 0\text{ V}$



IGBT RBSOA

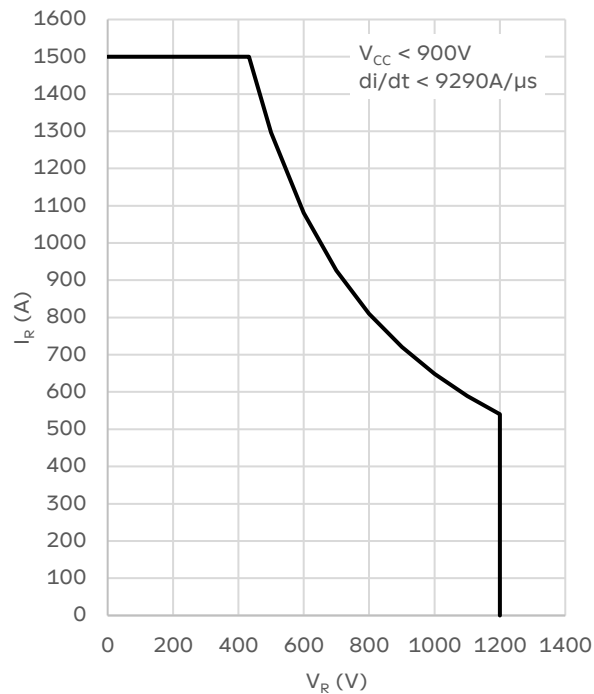
$I_C = f(V_{CEM})$

$R_{Goff} = 0.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$



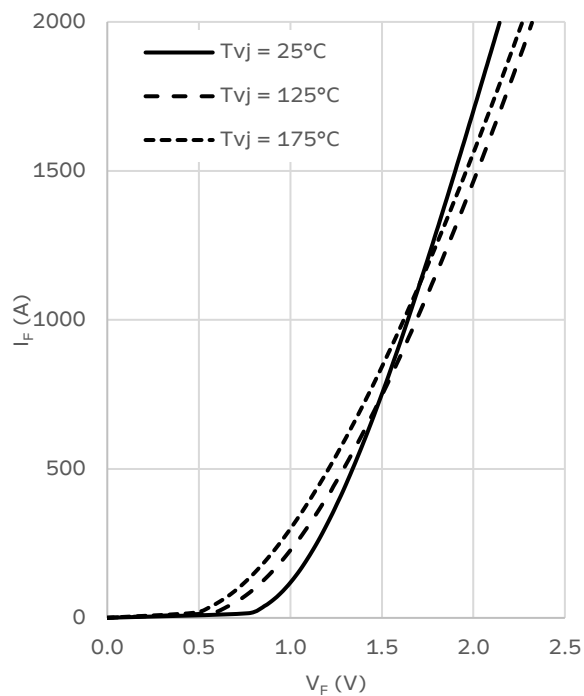
Diode SOA

$T_{vj} \leq 175\text{ °C}$



Diode forward characteristic (typical)

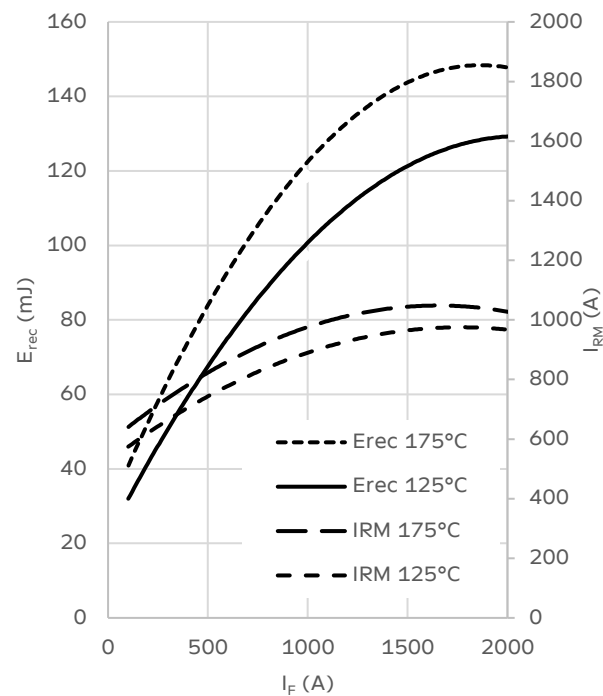
$$I_F = f(V_F)$$



Diode switching characteristics (typical)

$$E_{rec} = f(I_F), I_{RM} = f(I_F)$$

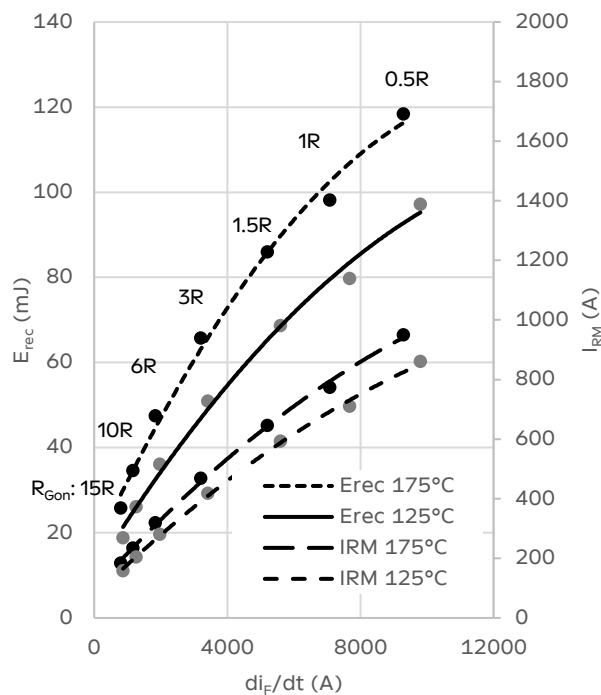
$$V_{DC} = 600 \text{ V}, R_{Gon} = 0.5 \Omega \text{ (IGBT)}, V_{GE} = -15/+15 \text{ V (IGBT)}$$



Diode switching characteristics (typical)

$$E_{rec} = f(di/dt), I_{RM} = f(di/dt)$$

$$V_{DC} = 600 \text{ V}, I_F = 1000 \text{ A}, V_{GE} = -15/+15 \text{ V (IGBT)}$$



Thermal impedance (typical)

$$Z_{th(j-c)} = f(t)$$

