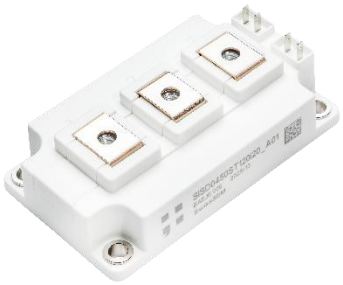
SwissSEM Technologies AG

PRELIMINARY DATASHEET 初版规格书

SISD01000ST120i23_A01

ST-Type phase leg IGBT module
ST 封装半桥 IGBT 模块



V_{CE} = 1200 V
I_C = 2 x 1000 A

- *i23* ultra-low loss fine pattern Trench IGBT chipset
  i23 超低损耗精细沟槽栅型 IGBT 芯片组
- Baseplate isolation with efficient Al_2O_3 ceramic
  高效 Al_2O_3 绝缘陶瓷基板
- Cu baseplate for low thermal resistance
  低热阻铜底板
- Industry standard package
  行业标准封装

Maximum ratings[1] 最大额定值 [1]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件	MIN 最小值	MAX 最大值	UNIT 单位
Collector-emitter voltage 集电极-发射极电压	V_{CES}	V_{GE} = 0 V, T_{vj} = 25 °C		1200	V
DC collector current 集电极直流电流	I_C	T_C = 100 °C, T_{vj} = 175 °C		1000	A
Peak collector current 集电极峰值电流	I_{CM}	t_p = 1 ms		2000	A
Gate-emitter voltage 栅极-发射极驱动电压	V_{GES}		-20	20	V
Total power dissipation 最大功率损耗	P_{tot}	T_C = 25 °C, T_{vj} = 175 °C, per switch		3800	W
DC forward current 二极管直流正向电流	I_F			1000	A
Peak forward current 二极管最大脉冲正向电流	I_{FRM}	t_p = 1 ms		2000	A
Surge current 二极管最大浪涌电流	I_{FSM}	V_R = 0 V, T_{vj} = 150 °C, t_p = 10 ms, half-sinewave		3000 45000	A A^2s
Isolation voltage 绝缘电压	V_{isol}	1 min, f = 50 Hz		4000	V
Junction operating temperature 运行结温	$T_{vj(op)}$		-40	175[2]	°C
Case temperature 壳温	T_C		-40	150	°C
Storage temperature 存储温度	T_{stg}		-40	125	°C
Mounting torques 紧固力矩[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; 根据标准 IEC 60747 要求，最大额定值表示超过该限值可能会对器件造成损坏
[2] Tvj(op) > 150°C allowed for overload conditions, in maximum for 60s and less than 20% of operation time 允许运行的时间不超过 60s，或者小于运行时间的 20%
[3] For details, please refer to the mounting instructions. 详细信息，请参考安装说明书

IGBT[4]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Collector(-emitter) breakdown voltage 集电极-发射极击穿电压	$V_{(BR)CES}$	V_{GE} = 0 V, I_C = 10 mA, T_{vj} = 25°C		1200			V
Collector-emitter saturation voltage [5] 集电极-发射极饱和电压	$V_{CE\ sat}$	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 集电极截止电流	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 栅极漏电流	I_{GES}	V_{CE} = 0 V, V_{GE} = ±20 V		-0.5		0.5	µA
Gate-emitter threshold voltage 栅极-发射极阈值电压	$V_{GE(th)}$	I_C = 50 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		5	6.3	7.0	V
Gate charge 栅极电荷	Q_G	I_C = 1000 A, V_{CE} = 600 V, V_{GE} = -15 V .. 15 V			8.5		µC
Input capacitance 输入电容	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100kHz, T_{vj} = 25 °C			129		nF
Output capacitance 输出电容	C_{oes}				2.8		
Reverse tansfer capacitance 反向传输电容	C_{res}				1.2		
Internal gate resistor 栅极内阻	R_{Gint}	Per switch, f = 1 MHz, V_{GE} = 0V, CE short			0.5		Ω
Turn-on delay time 开通延迟	$t_{d(on)}$	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 上升时间	t_r		T_{vj} = 25 °C		86		
			T_{vj} = 125 °C		96		
			T_{vj} = 175 °C		102		
Turn-off delay time 关断延迟	$t_{d(off)}$	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		398		ns
			T_{vj} = 125 °C		466		
			T_{vj} = 175 °C		497		
Fall time 下降时间	t_f		T_{vj} = 25 °C		190		
			T_{vj} = 125 °C		308		
			T_{vj} = 175 °C		362		
Turn-on switching energy 开通损耗	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 关断损耗	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 短路电流	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 集电极-发射极饱和电压

Diode[6]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Forward voltage[7] 正向压降	V_F	I_F = 1000 A	T_{vj} = 25 °C		1.65	2	V
			T_{vj} = 125 °C		1.7		V
			T_{vj} = 175 °C		1.65		V
Peak reverse recovery current 反向恢复电流峰值	I_{RM}	V_R = 600 V, I_F = 1000 A, dI/dt = 9355 A/µs (175 °C), R_G = 0.5 Ω, V_{GE} = ± 15 V, L_s = 35 nH, inductive load	T_{vj} = 25 °C		715		A
			T_{vj} = 125 °C		861		A
			T_{vj} = 175 °C		950		A
Recovery charge 恢复电荷	Q_{rr}		T_{vj} = 25 °C		120		µC
			T_{vj} = 125 °C		204		µC
			T_{vj} = 175 °C		258		µC
Reverse recovery time 反向恢复时间	t_{rr}		T_{vj} = 25 °C		721		ns
			T_{vj} = 125 °C		854		ns
			T_{vj} = 175 °C		1002		ns
Reverse recovery energy 反向恢复能量	E_{rec}		T_{vj} = 25 °C		61		mJ
			T_{vj} = 125 °C		97		mJ
			T_{vj} = 175 °C		118		mJ

Package properties 封装特性[8]

PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
IGBT thermal resistance junction to case IGBT 结-壳热阻	$R_{th(j-c)IGBT}$	Per switch				0.039	K/W
Diode thermal resistance junction to case 二极管结-壳热阻	$R_{th(j-c)Diode}$					0.065	K/W
IGBT thermal resistance case to heatsink IGBT 壳到散热器热阻	$R_{th(c-s)IGBT}$	IGBT per switch, lambda grease = 1 W/m x K			0.028		K/W
Diode thermal resistance case to heatsink 二极管壳到散热器热阻	$R_{th(c-s)Diode}$	diode per switch, lambda grease = 1 W/m x K			0.033		K/W
Comparative tracking index 相对漏电起痕指数	CTI			>400			
Module stray inductance 模块自身杂散电感	$L_{s\,CE}$	Per switch			20		nH
Resistance, terminal chip 端子到芯片之间的阻抗	$R_{CC'+EE'}$	Per switch	T_{vj} = 25 °C		0.7		mΩ
			T_{vj} = 125 °C				
			T_{vj} = 175 °C				

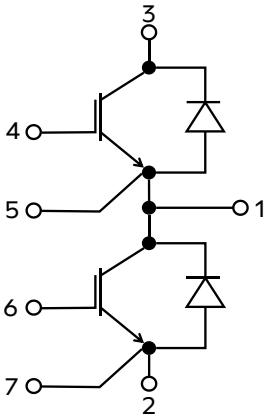
[6] Characteristic values according to IEC 60747-2
[7] Forward voltage is given at chip-level 正向压降是芯片两端的电压值。
[8] Package and mechanical properties according to IEC 60747-15

Mechanical properties 机械特性[9]

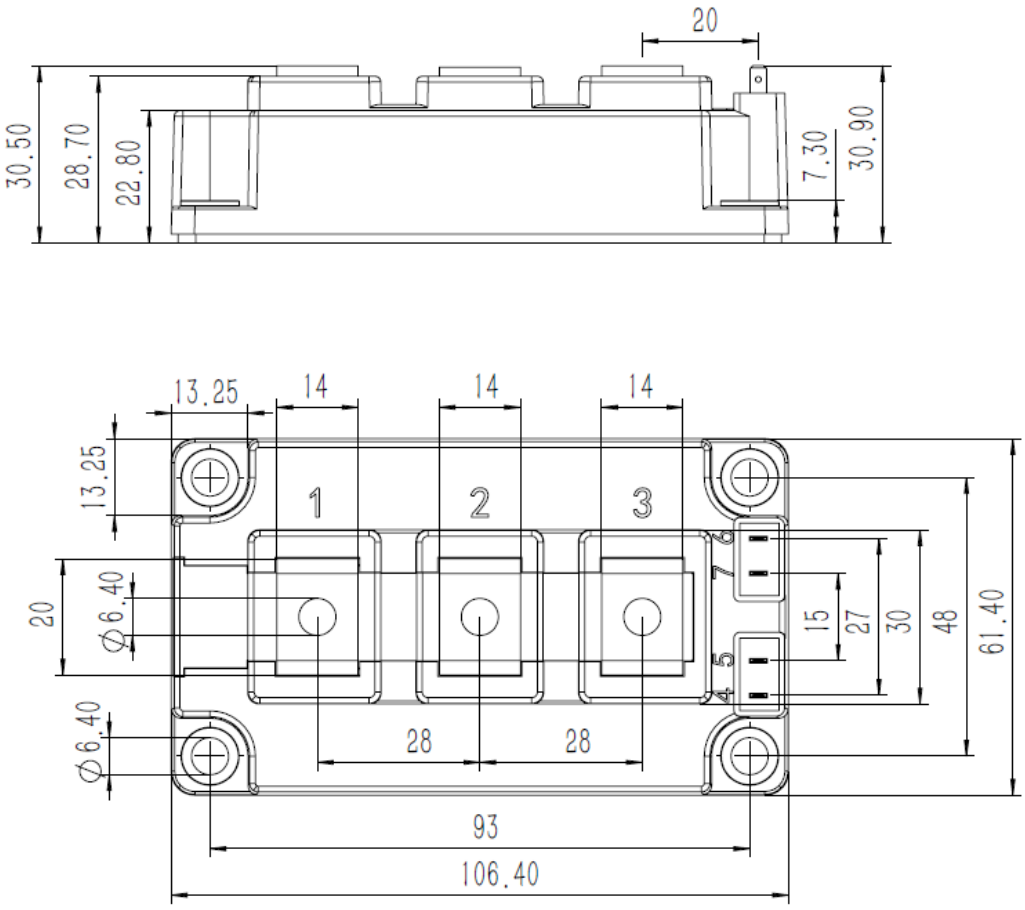
PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Dimensions	L x W x H	Typical			106 x 62 x 30.9		mm^3
Clearance distance in air 电气间隙	da	According to IEC 60664-1 and EN 50124-1 参考标准 IEC 60664-1 和 EN 50124-1	Terminal to base: 端子到基板		23		mm
			Terminal to terminal: 端子到端子		11		
Surface creepage distance 爬电距离	ds		Terminal to base: 端子到基板		29		mm
			Terminal to terminal: 端子到端子		23		
Mass 重量	m				310		g

[9] Package and mechanical properties according to IEC 60747-15

Electrical configuration 电气图



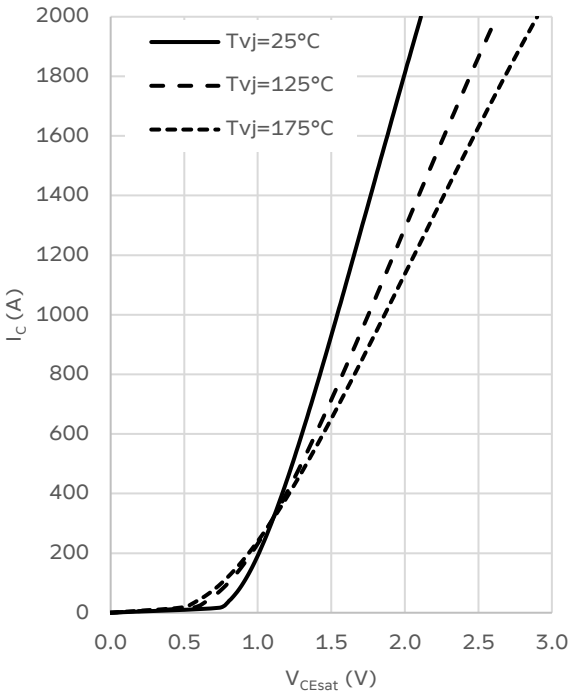
Outline drawing 外形图



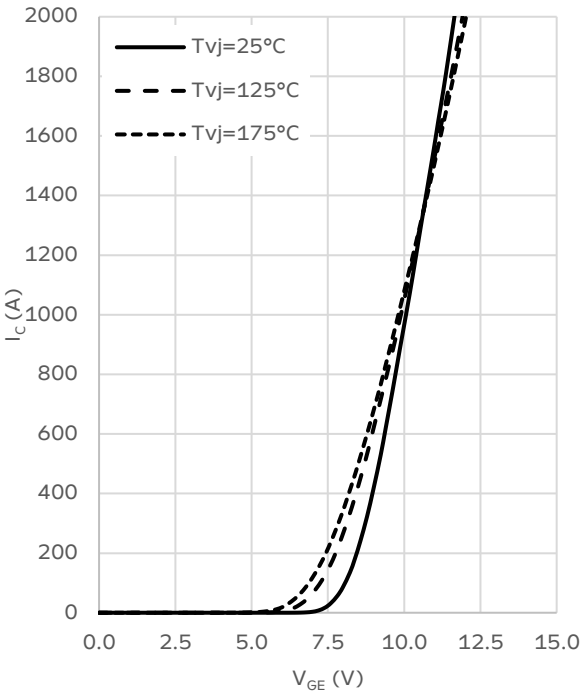
This is an electrostatic sensitive device, please observe the international standard. 本产品对静电特别敏感.
This product has been designed and qualified for Industrial Level. 本产品的设计符合工业级标准.

Characteristics 特性曲线

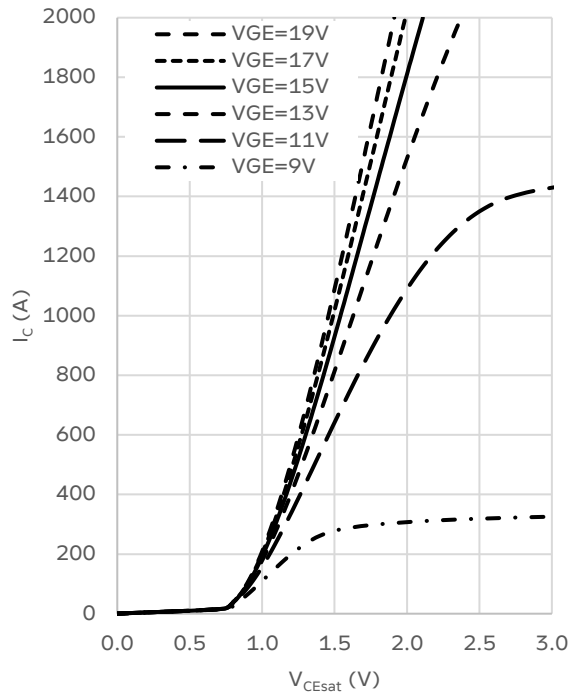
IGBT on-state characteristics (typical)
IGBT 通态特性曲线（典型）
$I_C = f(V_{CE})$
V_{GE} = 15 V



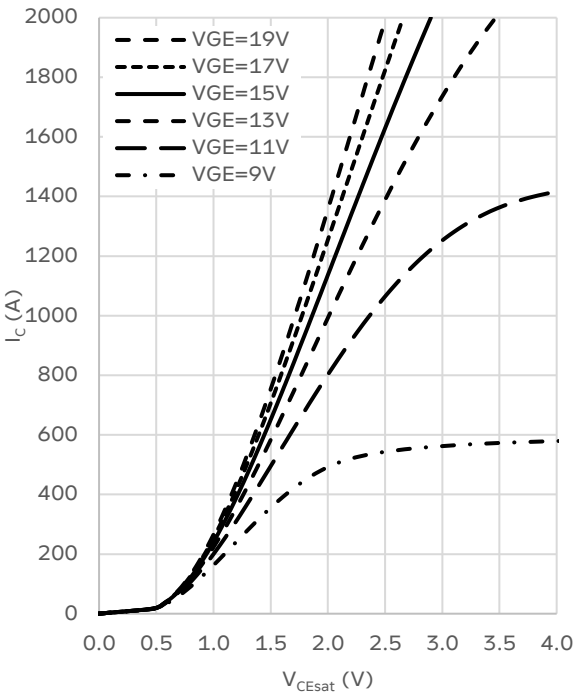
IGBT transfer characteristics (typical)
IGBT 转移特性曲线（典型）
$I_C = f(V_{GE})$
V_{CE} = 20 V



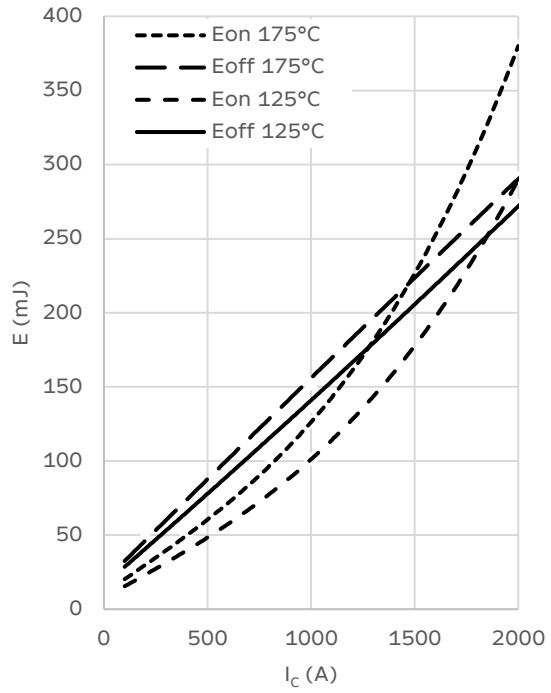
IGBT output characteristics (typical)
IGBT 输出特性曲线（典型）
$I_C = f(V_{CE})$
T_{vj} = 25 °C



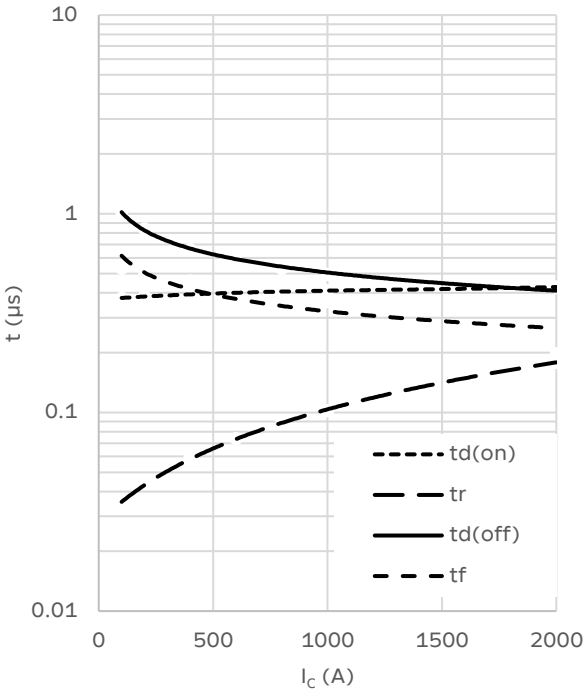
IGBT output characteristics (typical)
IGBT 输出特性曲线（典型）
$I_C = f(V_{CE})$
T_{vj} = 175 °C



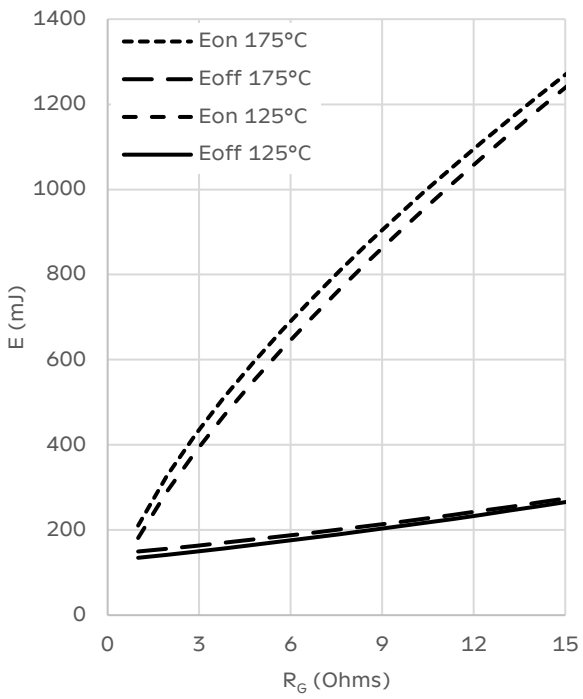
IGBT switching losses (typical)
IGBT 开关损耗曲线（典型）
$E = f(I_{CE})$
V_{CE} = 600 V, R_{Gon} = 0.5 Ω, R_{Goff} = 0.5 Ω, V_{GE} = -15/+15 V



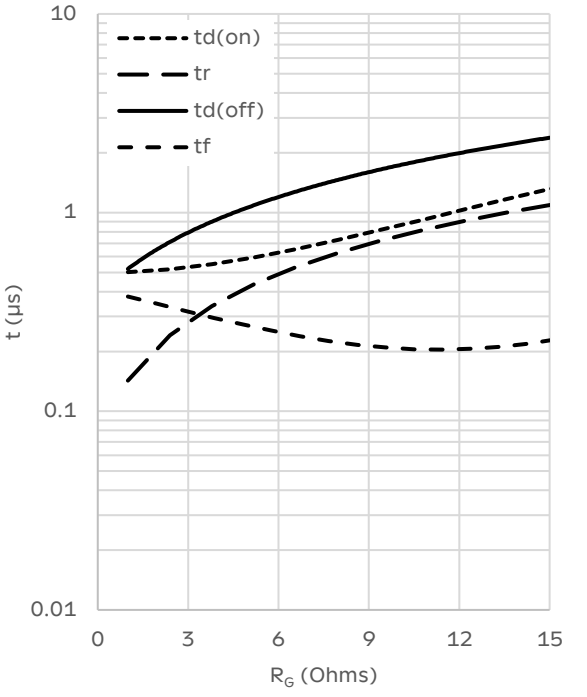
IGBT switching times (typical)
IGBT 开关时间曲线（典型）
$t = f(I_{CE})$, T_{vj} = 175 °C
V_{CE} = 600 V, R_{Gon} = 0.5 Ω, R_{Goff} = 0.5 Ω, V_{GE} =-15/+15 V



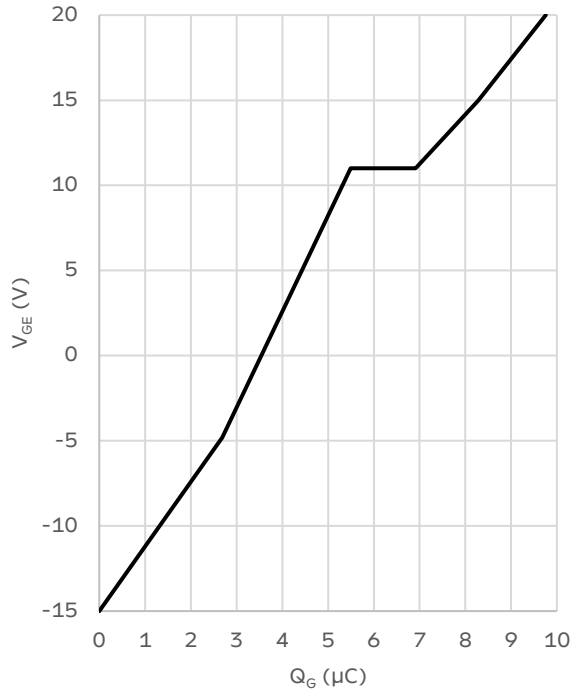
IGBT switching losses (typical)
IGBT 开关损耗曲线（典型）
$E = f(R_G)$
V_{CE} = 600 V, I_C = 1000 A, V_{GE} = -15/+15 V



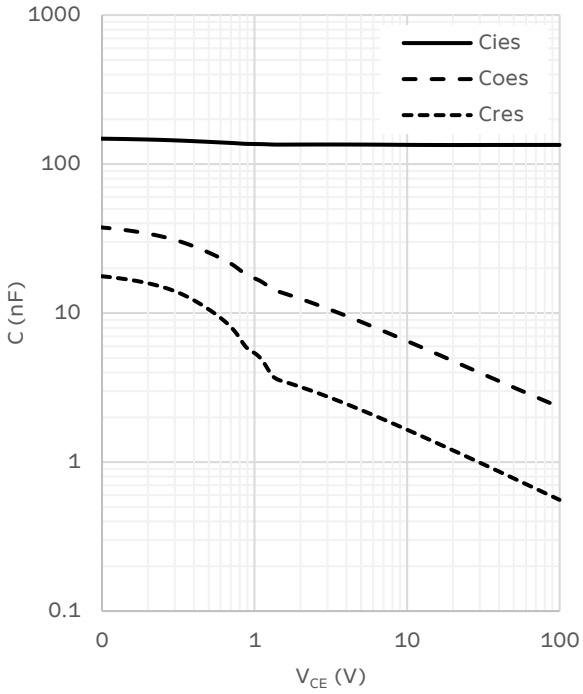
IGBT switching times (typical)
IGBT 开关时间曲线（典型）
$t = f(R_G)$, T_{vj} = 175 °C
V_{CE} = 600 V, I_C = 1000 A, V_{GE} = -15/+15 V



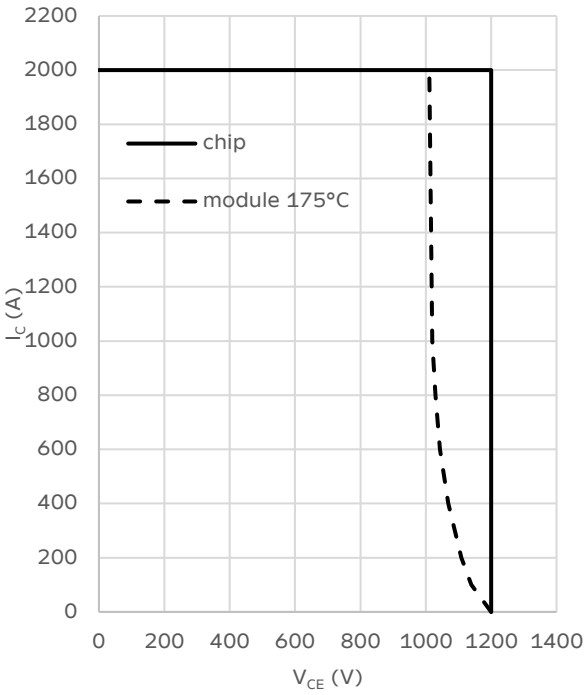
IGBT gate charge (typical)
IGBT 门极电荷（典型）
$V_{GE} = f(Q_G)$, $T_{vj} = 25$ °C
$V_{CE} = 600$ V, $I_C = 1000$ A



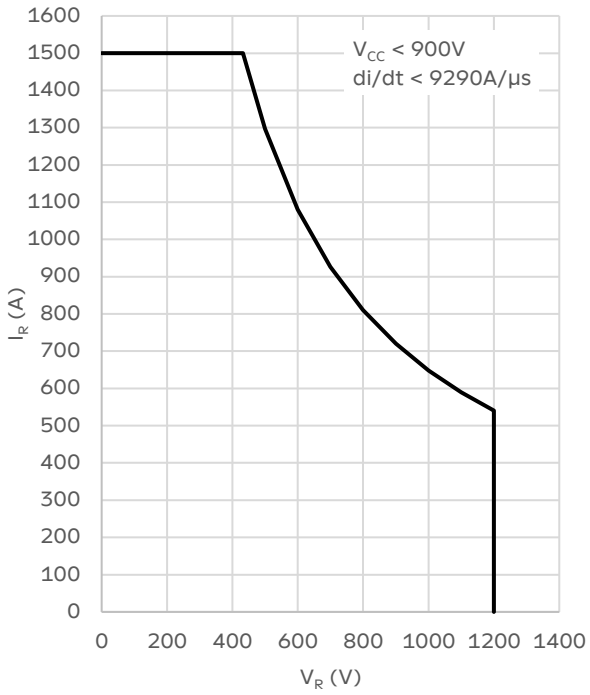
Capacitance characteristics (typical)
电容特性曲线（典型）
$C = f(V_{CE})$, $T_{vj} = 25$ °C
$f = 100$ kHz, $V_{GE} = 0$ V



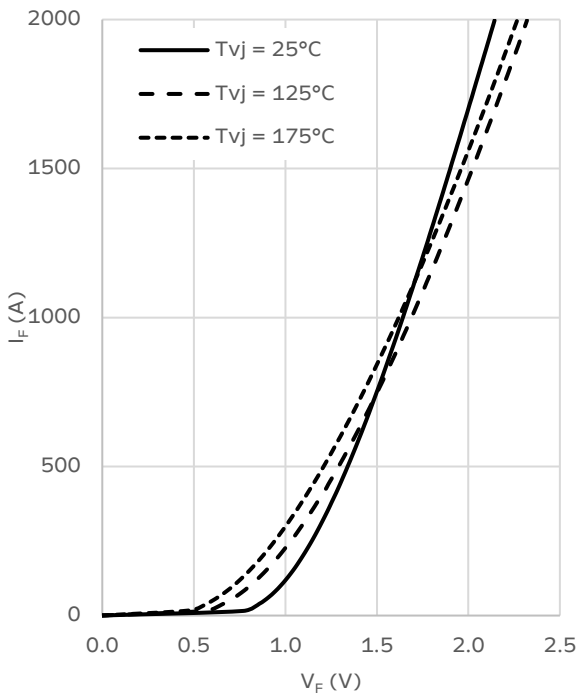
IGBT RBSOA
IGBT 反偏安全工作区域
$I_C = f(V_{CEm})$
$R_{Goff} = 0.5\ \Omega$, $V_{GE} = \pm 15$ V



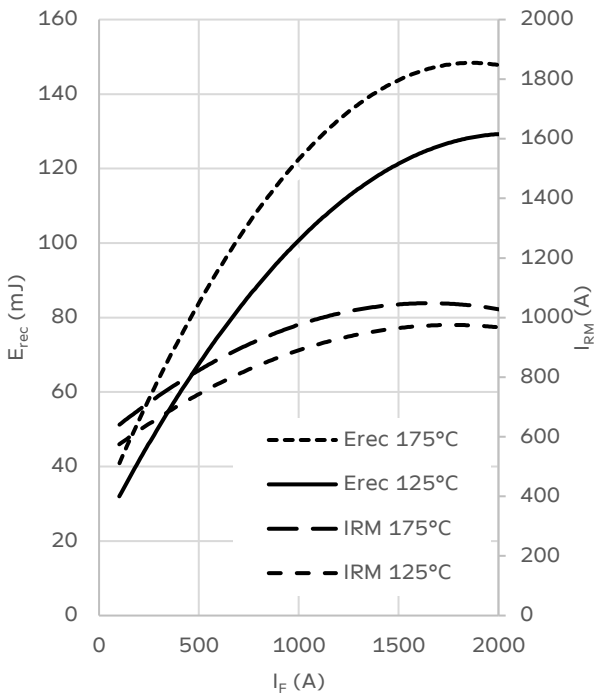
Diode SOA
Diode 反偏安全工作区域
$T_{vj} \leq 175$ °C



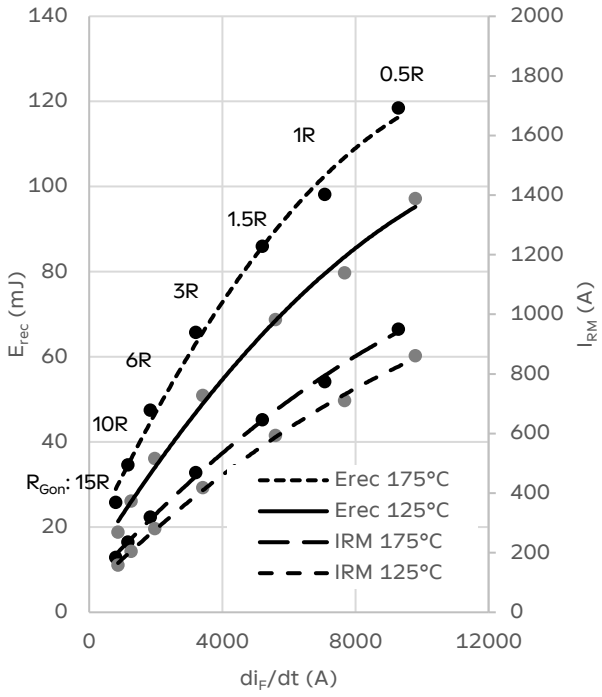
Diode forward characteristic (typical)
二极管正向特性（典型）
$I_F = f(V_F)$



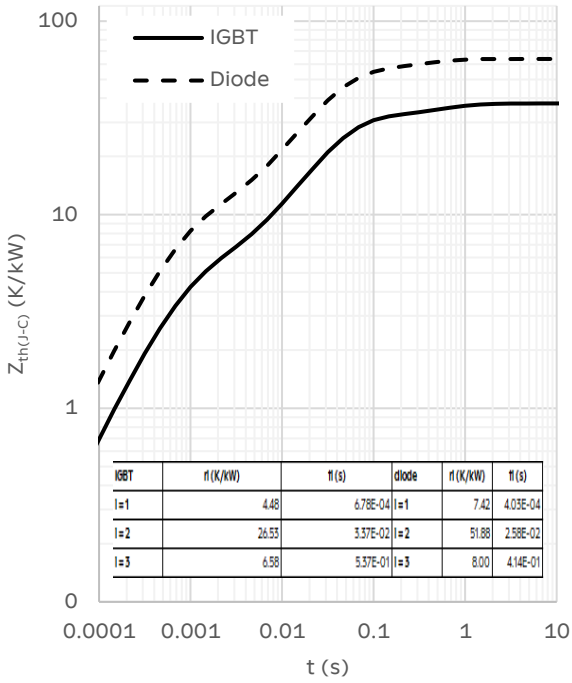
Diode switching characteristics (typical)
二极管开关特性（典型）
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
V_{DC} = 600 V, R_{Gon} =0.5 Ω (IGBT), V_{GE} =-15/+15 V (IGBT)



Diode switching characteristics (typical)
二极管开关特性（典型）
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
V_{DC} = 600 V, I_F = 1000 A, V_{GE} =-15/+15 V (IGBT)



Thermal impedance (typical)
热阻抗（典型）
$Z_{th(j-c)} = f(t)$



IGBT	ri (K/kW)	τi (s)	diode	ri (K/kW)	τi (s)
i=1	4.48	6.78E-04	i=1	7.42	4.03E-04
i=2	26.53	3.37E-02	i=2	51.88	2.58E-02
i=3	6.58	5.37E-01	i=3	8.00	4.14E-01