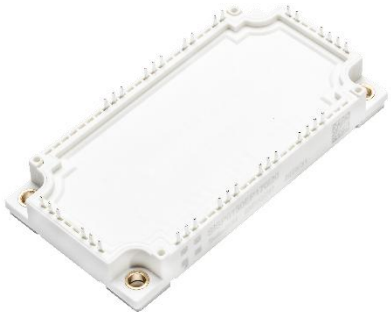
DATASHEET 规格书

SISP0200EP170i20

EP-Type H-bridge IGBT module with input rectifier

带输入整流器的 EP 型 H 桥 IGBT 模块



V_{CE} = 1700 V

I_C = 4 x 200 A

- *i20* ultra-low loss fine pattern Trench IGBT chipset
  i20 超低损耗精细沟槽栅型 IGBT 芯片组
- PIM with H-bridge and input rectifier
  带 H 桥和输入整流器的 PIM
- 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_{RRM}	V_{GE} = 0 V, T_{vj} = 25 °C		1700	V
DC collector current 集电极直流电流	I_C	T_C = 120 °C, T_{vj} = 175 °C		200	A
Peak collector current 集电极峰值电流	I_{CM}	t_p = 1 ms		400	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 IGBT		1250	W
DC forward current 二极管直流正向电流	I_F			200	A
Peak forward current 二极管最大脉冲正向电流	I_{FRM}	t_p = 1 ms		400	A
Surge current FWD 二极管最大浪涌电流浪	I_{FSM} I^2t	V_R = 0 V, T_{vj} = 150 °C, t_p = 10 ms, half-sinewave		915 4200	A A^2s
Surge current Rectifier 浪涌电流整流器	I_{FSM} I^2t	V_R = 0 V, T_{vj} = 150 °C, t_p = 10 ms, half-sinewave		1260 7940	A A^2s
Isolation voltage 绝缘电压	V_{isol}	1 min, f = 50 Hz		3400	V
Junction operating temperature 运行结温	$T_{vj(op)}$		-40	175[2]	°C
Case temperature 壳温	T_C		-40	125	°C
Storage temperature 存储温度	T_{stg}		-40	125	°C
Mounting torques 紧固力矩[3]	M_S	Base-heatsink, M5 screws	3	6	Nm

[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] $T_{vj(op)}$ > 150°C allowed for overload conditions, 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 = 1 mA, T_{vj} = 25°C		1700			V
Collector-emitter saturation voltage [5] 集电极-发射极饱和电压	V_{CEsat}	I_c = 200 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.65	2.0	V
			T_{vj} = 125 °C		1.85		V
			T_{vj} = 175 °C		2.05		V
Collector cut-off current 集电极截止电流	I_{CES}	V_{CE} = 1700 V, V_{GE} = 0 V	T_{vj} = 25 °C			1	mA
			T_{vj} = 125 °C		0.3		mA
			T_{vj} = 175 °C		4.5		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 = 10 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		5	6.15	7.5	V
Gate charge 栅极电荷	Q_G	I_C = 200 A, V_{CE} = 900 V, V_{GE} = -15 V .. 15 V			1.5		µC
Input capacitance 输入电容	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25 °C			15		nF
Output capacitance 输出电容	C_{oes}				0.9		nF
Reverse tansfer capacitance 反向传输电容	C_{res}				0.47		nF
Internal gate resistor 栅极内阻	R_{Gint}	Per switch, f = 1 MHz, V_{GE} = 0V, CE short			4.2		Ω
Turn-on delay time 开通延迟	$t_{d(on)}$	V_{CC} = 900 V, I_C = 200 A, V_{GE} = ± 15 V, R_G = 5 Ω(LS switch), R_G = 2 Ω(HS switch), L_s = 90 nH, inductive load	T_{vj} = 25 °C		142		ns
			T_{vj} = 125 °C		180		ns
			T_{vj} = 175 °C		203		ns
Rise time 上升时间	t_r		T_{vj} = 25 °C		37		ns
			T_{vj} = 125 °C		41		ns
			T_{vj} = 175 °C		44		ns
Turn-off delay time 关断延迟	$t_{d(off)}$	V_{CC} = 900 V, I_C = 200 A, R_G = 3 Ω, V_{GE} = ± 15 V, L_s = 90 nH, inductive load	T_{vj} = 25 °C		505		ns
			T_{vj} = 125 °C		614		ns
			T_{vj} = 175 °C		658		ns
Fall time 下降时间	t_f		T_{vj} = 25 °C		371		ns
			T_{vj} = 125 °C		589		ns
			T_{vj} = 175 °C		680		ns
Turn-on switching energy 开通损耗	E_{on}	V_{CC} = 900 V, I_C = 200 A, R_G = 5 Ω(LS switch), R_G = 2 Ω(HS switch), L_s = 90 nH, inductive load	T_{vj} = 25 °C		56		mJ
			T_{vj} = 125 °C		70		mJ
			T_{vj} = 175 °C		82		mJ
Turn-off switching energy 关断损耗	E_{off}	V_{CC} = 900 V, I_C = 200 A, R_G = 3 Ω, V_{GE} = ± 15 V, L_s = 90 nH, inductive load	T_{vj} = 25 °C		38		mJ
			T_{vj} = 125 °C		55		mJ
			T_{vj} = 175 °C		63		mJ
Short circuit current 短路电流	I_{SC}	t_{pcs} ≤ 10 µs, V_{GE} = 15 V, T_{vj} = 175 °C, V_{CC} = 1200V, $V_{CEM\ Chip}$ ≤ 1700 V			1250		A

[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 FWD[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 = 200 A	T_{vj} = 25 °C		1.7	2.15	V
			T_{vj} = 125 °C		1.85		V
			T_{vj} = 175 °C		1.95		V
Peak reverse recovery current 反向恢复电流峰值	I_{RM}	V_R = 900 V, I_F = 200 A, R_G = 5 Ω(LS switch), R_G = 2 Ω(HS switch), L_s = 90 nH, inductive load	T_{vj} = 25 °C		244		A
			T_{vj} = 125 °C		265		A
			T_{vj} = 175 °C		268		A
Recovery charge 恢复电荷	Q_{rr}		T_{vj} = 25 °C		49		µC
			T_{vj} = 125 °C		76		µC
			T_{vj} = 175 °C		94		µC
Reverse recovery time 反向恢复时间	t_{rr}		T_{vj} = 25 °C		712		ns
			T_{vj} = 125 °C		1098		ns
			T_{vj} = 175 °C		1395		ns
Reverse recovery energy 反向恢复能量	E_{rec}		T_{vj} = 25 °C		25		mJ
			T_{vj} = 125 °C		42		mJ
			T_{vj} = 175 °C		53		mJ

Diode Rectifier[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
Repetitive peak reverse voltage 重复峰值反向电压	V_{RRM}	T_{vj}=25°C, I_R = 1mA		1700			V
Maximum RMS forward current 最大均方根正向电流	I_{FRMSM}	T_C=95°C				150	A
Forward voltage[9] 正向压降	V_F	I_F=150 A	T_{vj} = 25 °C		1.08		V
			T_{vj} = 125 °C		1.02		V
			T_{vj} = 150 °C		1.0		V
Forward threshold voltage 正向阈值电压	$V_{(F0)}$	T_{vj}=150°C, I_F=50 – 150 A			0.7		V
Forward slope resistance 前坡阻力	r_F	T_{vj}=150°C, I_F=50 – 150 A			2		mΩ
Junction operating temperature 运行结温	$T_{vj(op)}$			-40		150	°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] Characteristic values according to IEC 60747-2
[9] Forward voltage is given at chip-level 正向压降是芯片两端的电压值。

NTC Thermistor

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
Rated resistance 额定电阻	R_{25}	T_C = 25 °C		5		kΩ
R100	R_{100}	T_C = 100 °C	468		518	Ω
B-value B 值	$B_{25/50}$	$R_2 = R_{25}\ \exp\ [B_{25/50}(1/T2 - 1/(298.15K))]$		3375		K
B-value B 值	$B_{25/100}$	$R_2 = R_{25}\ \exp\ [B_{25/100}(1/T2 - 1/(298.15K))]$		3433		K

Package properties 封装特性[10]

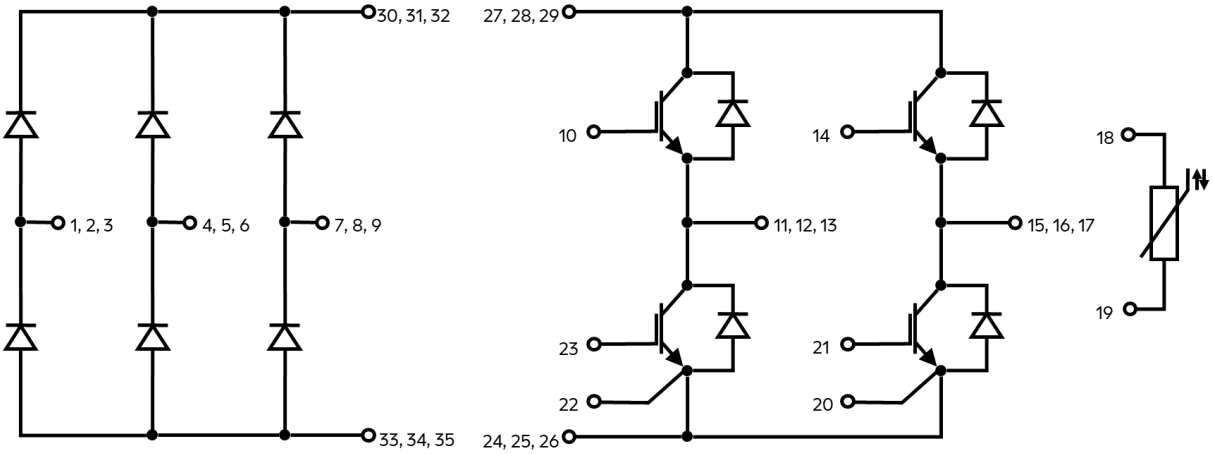
PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件		MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
IGBT thermal resistance junction to case 结-壳热阻	$R_{th(j-c)IGBT}$	Per switch 每一个开关				0.12	K/W
FWD thermal resistance junction to case 二极管结-壳热阻	$R_{th(j-c)Diode}$					0.21	K/W
Rectifier thermal resistance junction to case 整流器热阻结到外壳	$R_{th(j-c)rectifier\ Diode}$					0.25	K/W
IGBT thermal resistance case to heatsink 壳到散热器热阻	$R_{th(c-h)IGBT}$				0.073		K/W
FWD thermal resistance case to heatsink 二极管壳到散热器热阻	$R_{th(c-h)Diode}$				0.083		K/W
Rectifier thermal resistance case to heatsink 整流器热阻外壳至散热器	$R_{th(c-h)rectifier\ Diode}$				0.143		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 每一个开关			35		nH
Resistance, terminal chip 端子到芯片之间的阻抗	$R_{CC'+EE'}$	Per switch 每一个开关	T_{vj} = 25 °C		2		mΩ
			T_{vj} = 125 °C		2.8		mΩ
			T_{vj} = 175 °C		3.1		mΩ

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

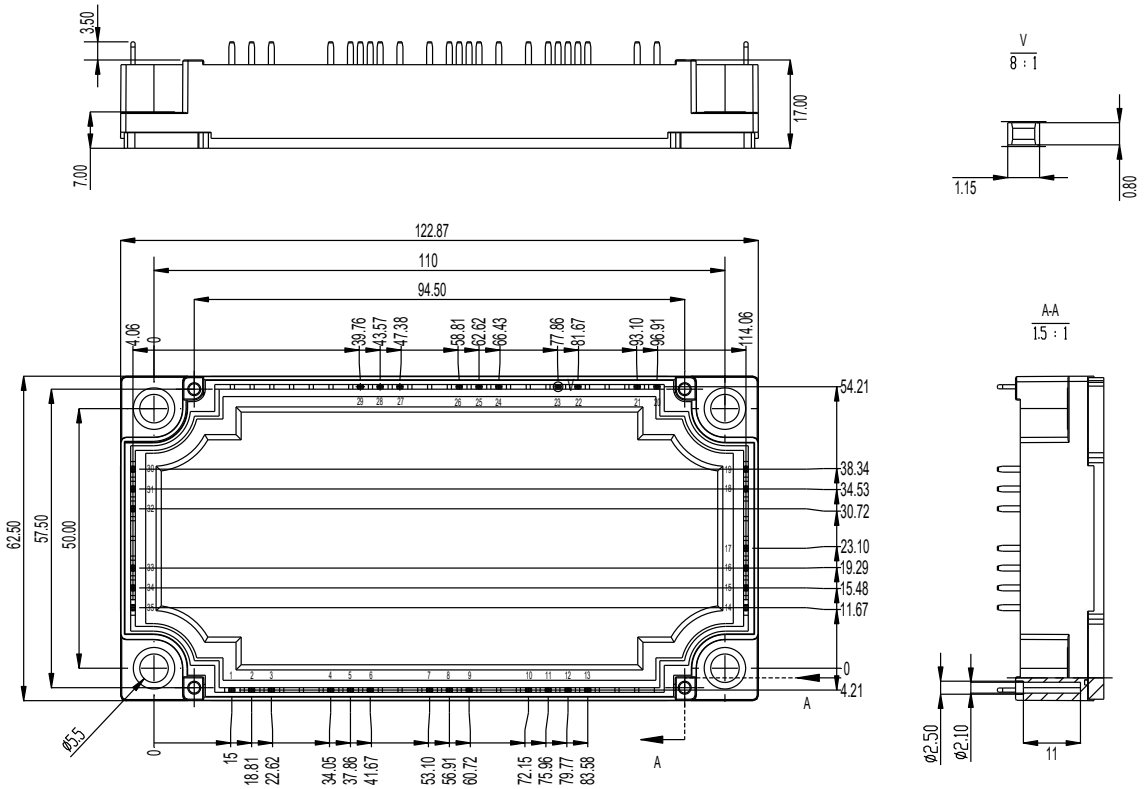
Mechanical properties 机械特性

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		122 x 62.5 x 17			mm^3
Clearance distance in air 电气间隙	d_a	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	10			mm
			Terminal to terminal: 端子到端子	10			mm
Surface creepage distance 爬电距离	d_s	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	7.5			mm
			Terminal to terminal: 端子到端子	10			mm
Mass 重量	m				300		g

Electrical configuration 电气图



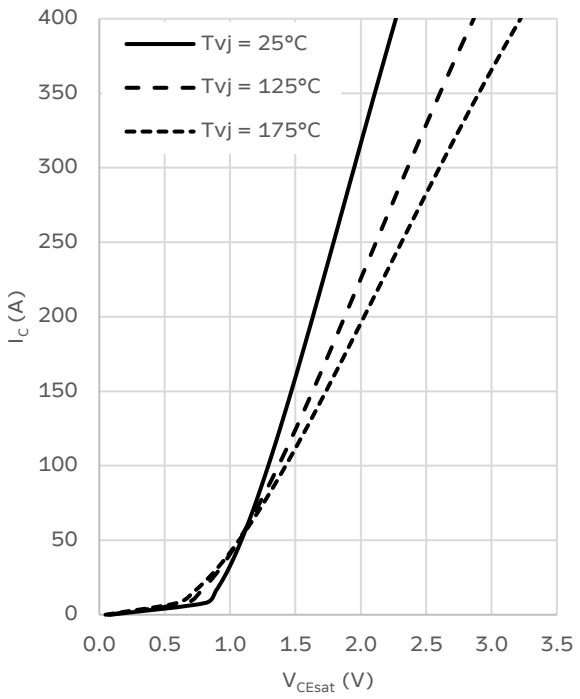
Outline drawing 外形图



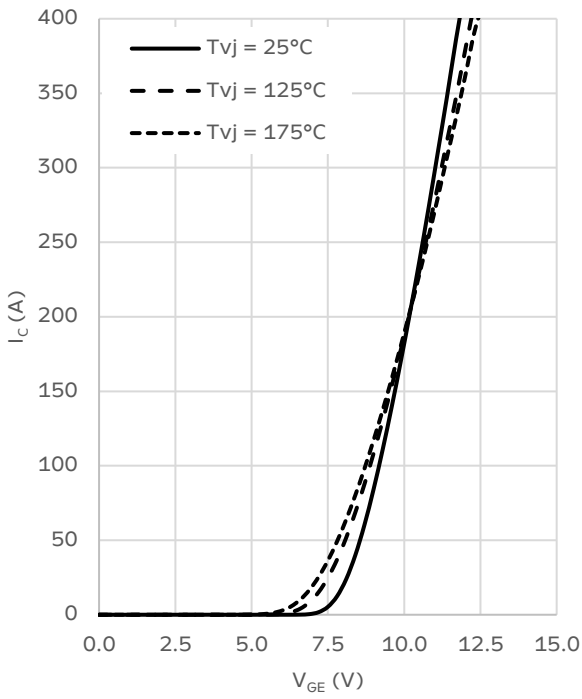
This is an electrostatic sensitive device. 本产品对静电特别敏感.
This product has been designed and qualified for Industrial Level. 本产品的设计符合工业级标准.

Characteristics 特性曲线

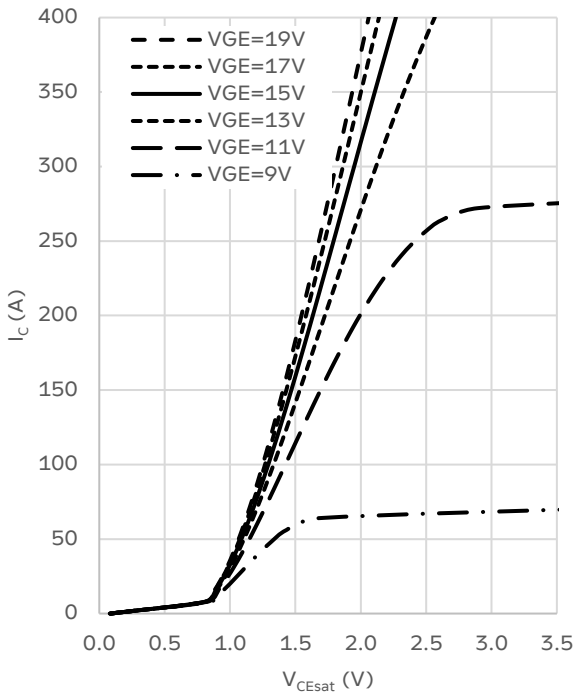
IGBT on-state characteristics (typical)
IGBT 通态特性曲线（典型）
$I_C = f(V_{CE})$
V_{GE} = 15 V



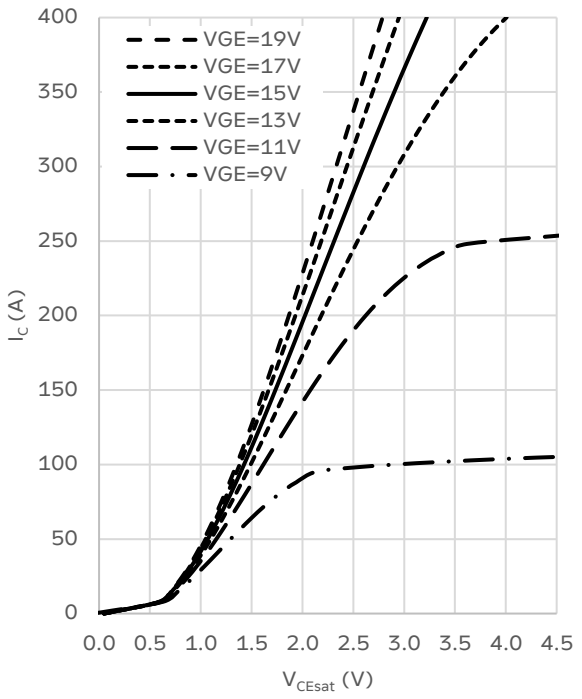
IGBT transfer characteristics (typical)
IGBT 转移特性曲线（典型）
$I_C = f(V_{GE})$
V_{CE} = 20V



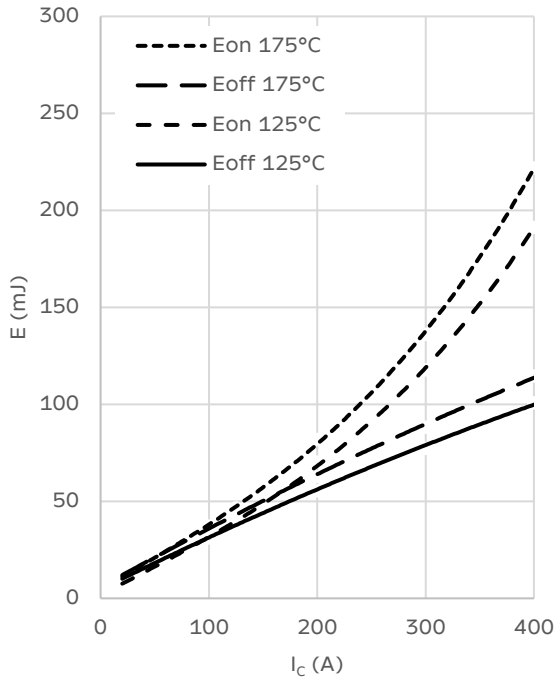
IGBT output characteristics (typical)
IGBT 输出特性曲线（典型）
$I_C = f(V_{CE})$
T_{vj} = 25 °C



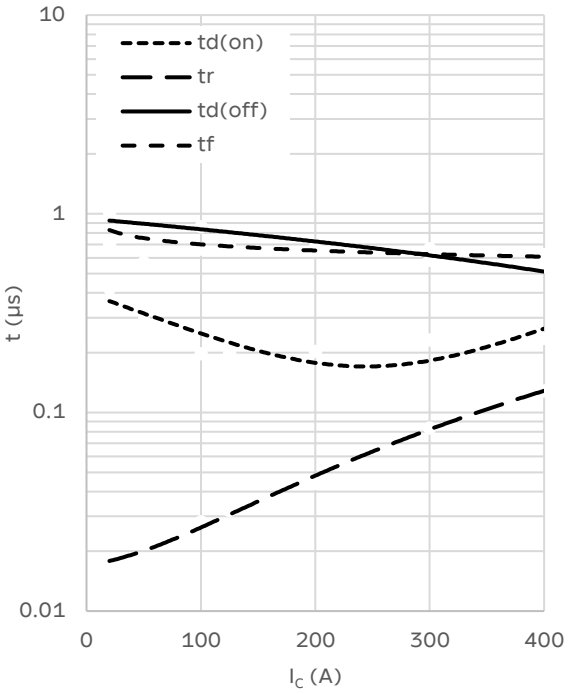
IGBT output characteristics (typical)
IGBT 输出特性曲线（典型）
$I_C = f(V_{CE})$
T_{vj} = 175 °C



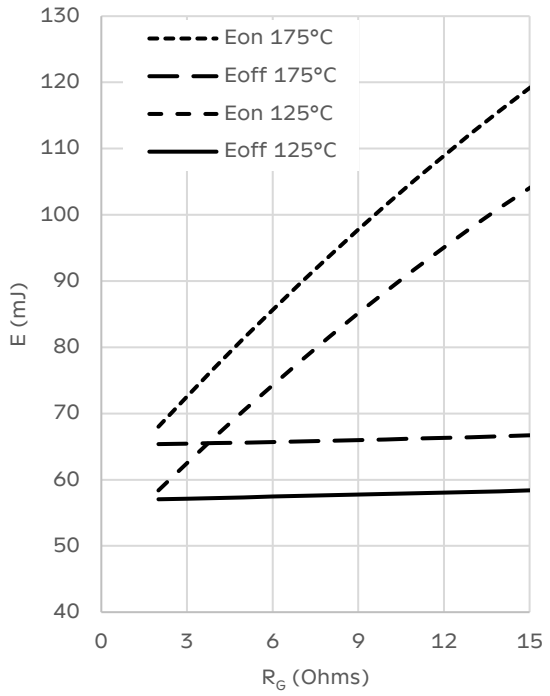
IGBT switching losses (typical)
IGBT 开关损耗曲线（典型）
$E = f(I_{CE})$
V_{CE} = 900 V, R_{Gon} = 2 / 5 Ω, R_{Goff} = 3 Ω, V_{GE} = -15/+15 V



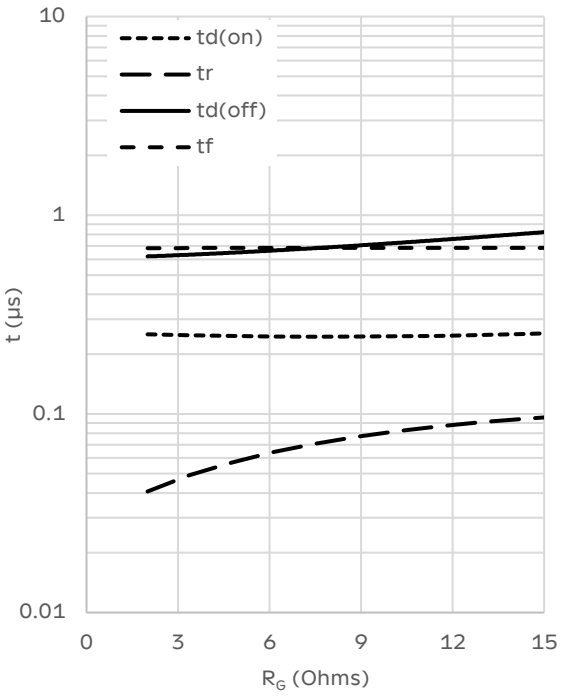
IGBT switching times (typical)
IGBT 开关时间曲线（典型）
$t = f(I_{CE})$, T_{vj} = 175 °C
V_{CE} = 900 V, R_{Gon} = 2 / 5 Ω, R_{Goff} = 3 Ω, V_{GE} = -15/+15 V



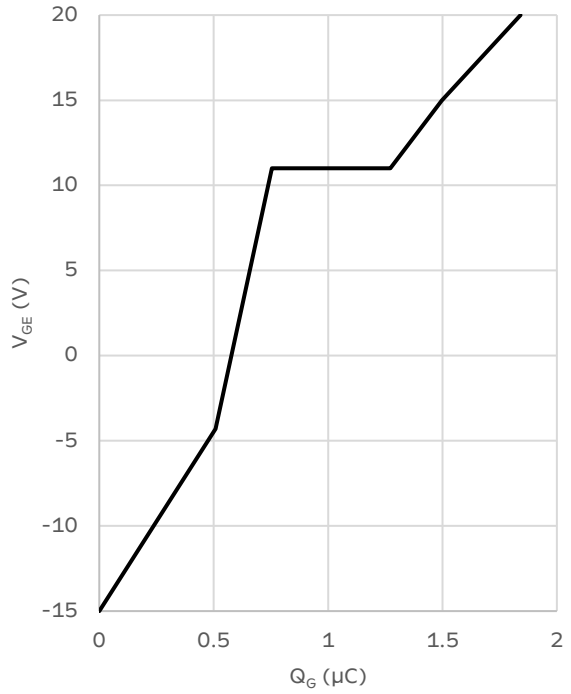
IGBT switching losses (typical)
IGBT 开关损耗曲线（典型）
$E = f(R_G)$
V_{CE} = 900 V, I_C = 200 A, V_{GE} = -15/+15 V



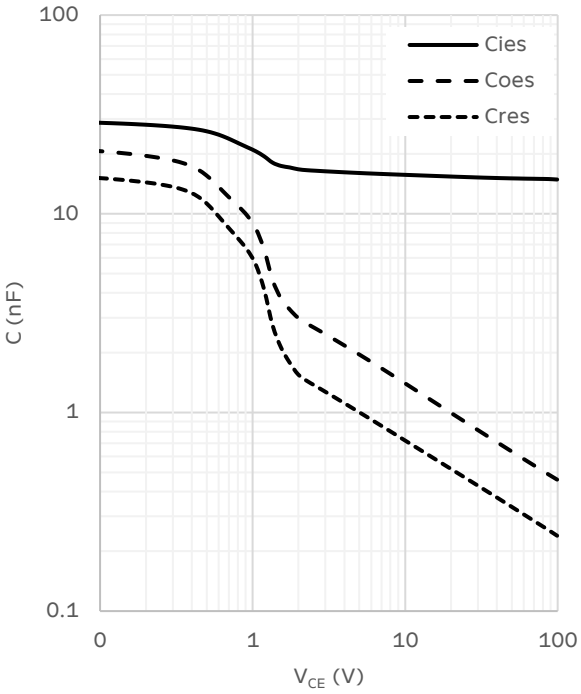
IGBT switching times (typical)
IGBT 开关时间曲线（典型）
$t = f(R_G)$, T_{vj} = 175 °C
V_{CE} = 900 V, I_C = 200 A, V_{GE} = -15/+15 V



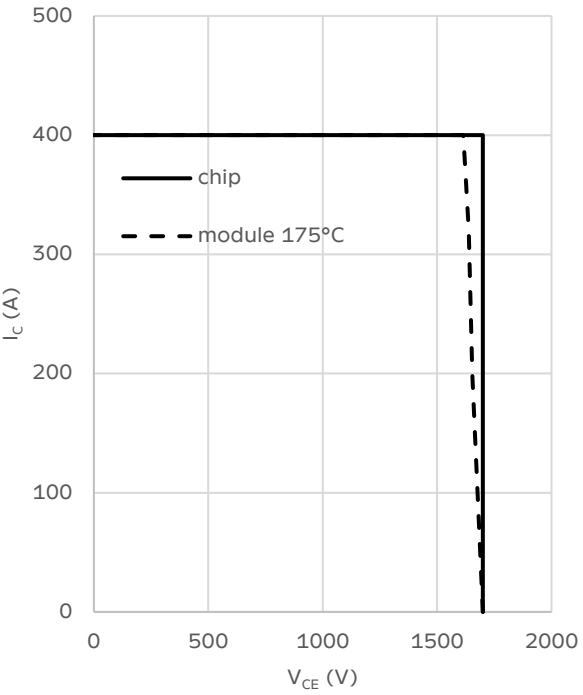
IGBT gate charge (typical)
IGBT 门极电荷（典型）
$V_{GE} = f(Q_G)$, $T_{vj} = 25$ °C
$V_{CE} = 900$ V, $I_C = 200$ A



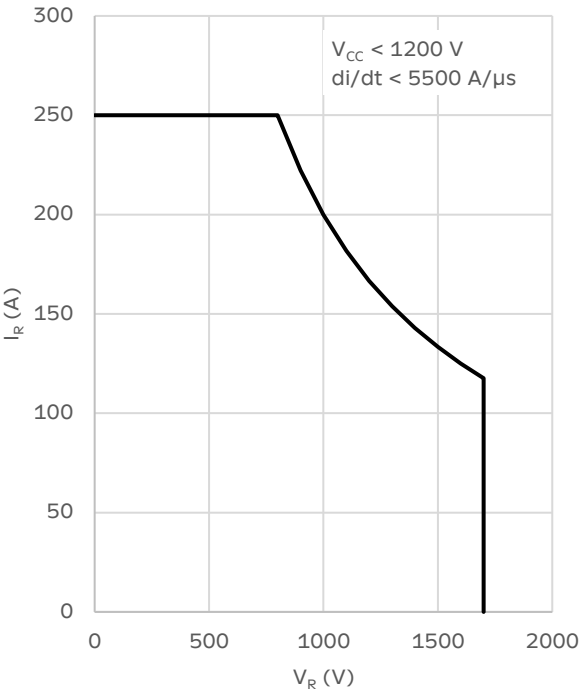
Capacitance characteristics (typical)
电容特性曲线（典型）
$C = f(V_{CE})$, $T_{vj} = 25$ °C
$f = 100$ kHz, $V_{GE} = 0$ V



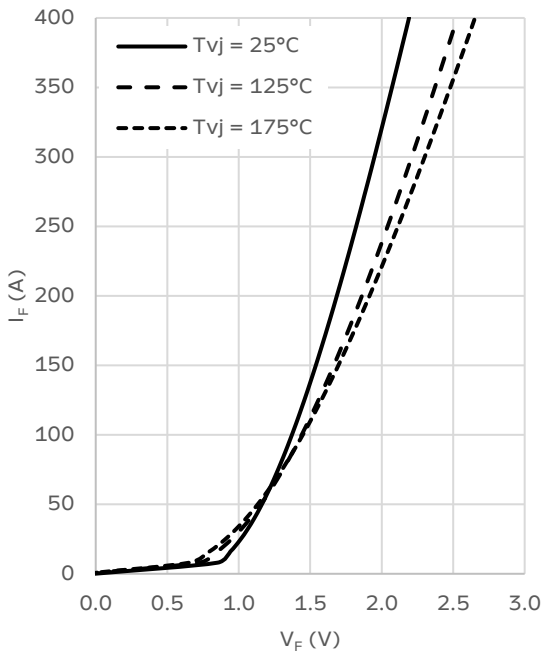
IGBT RBSOA
IGBT 反偏安全工作区域
$I_C = f(V_{CEm})$
$R_{Goff} = 3\ \Omega$, $V_{GE} = \pm 15$ V



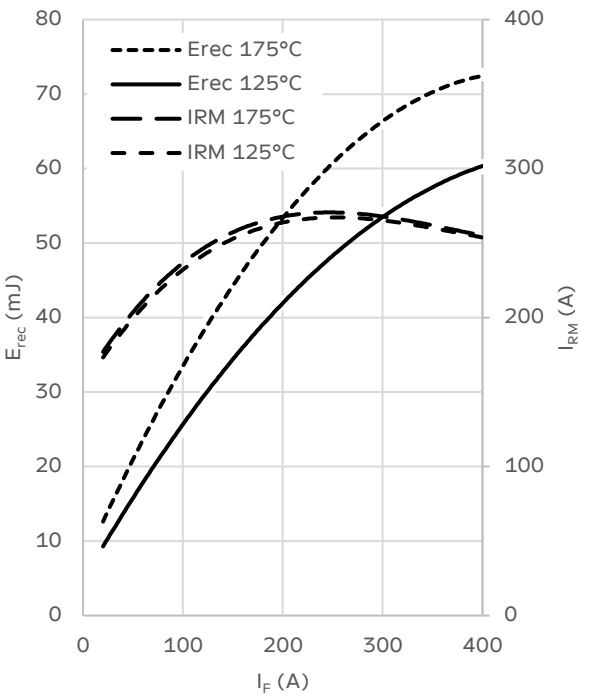
Diode SOA
Diode 反偏安全工作区域
$T_{vj} \leq 175$ °C



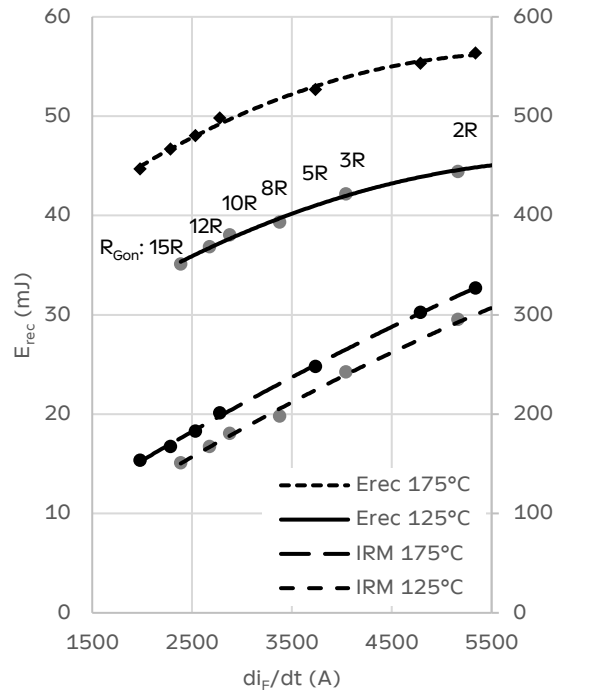
Diode forward characteristic (typical)
二极管正向特性（典型）
$I_F = f(V_F)$



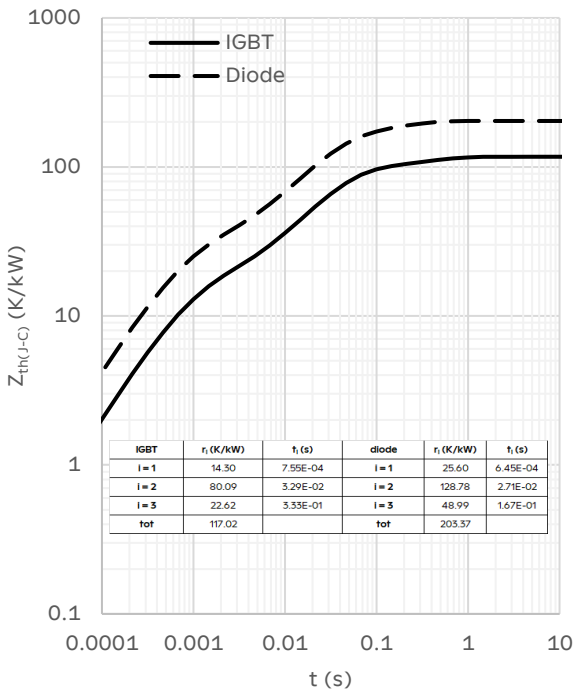
Diode switching characteristics (typical)
二极管开关特性（典型）
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
V_{DC} = 900 V, R_{Gon} = 2 / 5 Ω (IGBT), V_{GE} =-15/+15 V (IGBT)



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} = 900 V, I_F = 200 A, V_{GE} =-15/+15 V (IGBT)

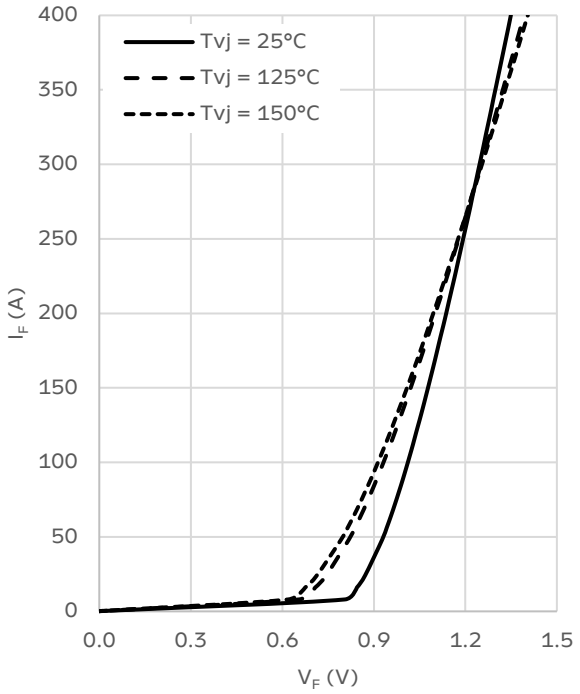


Thermal impedance Inverter
热阻逆变器
$Z_{th(j-c)} = f(t)$

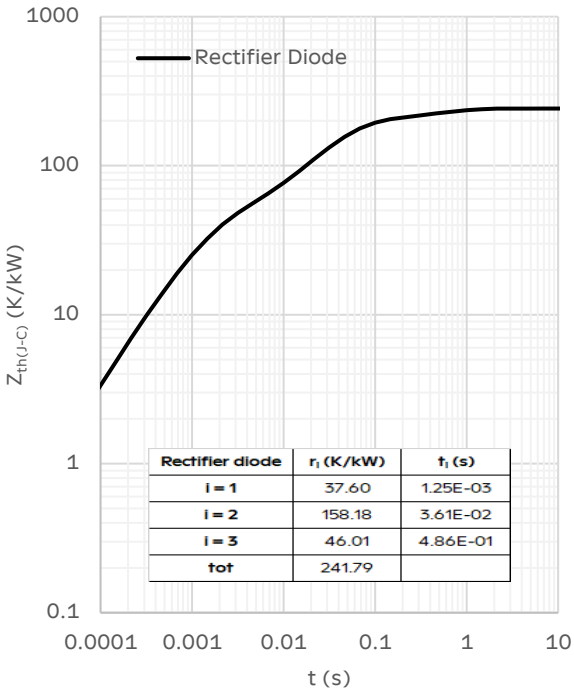


IGBT	r_i (K/kW)	τ_i (s)	diode	r_i (K/kW)	τ_i (s)
i = 1	14.30	7.55E-04	i = 1	25.60	6.45E-04
i = 2	80.09	3.29E-02	i = 2	128.78	2.71E-02
i = 3	22.62	3.33E-01	i = 3	48.99	1.67E-01
tot	117.02		tot	203.37	

Rectifier Diode forward characteristic (typical)
整流二极管正向特性（典型值）
$I_F = f(V_F)$



Thermal impedance Rectifier
热阻整流器
$Z_{th(j-c)} = f(t)$



Rectifier diode	r_i (K/kW)	t_i (s)
i = 1	37.60	1.25E-03
i = 2	158.18	3.61E-02
i = 3	46.01	4.86E-01
tot	241.79	