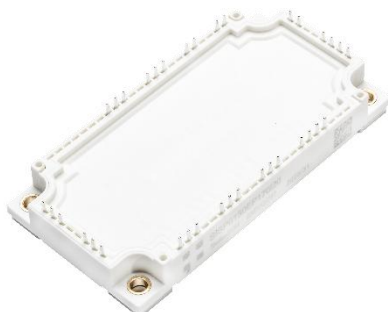


DATASHEET 规格书

SISP0100EP170i20

EP-Type H-bridge IGBT module with input rectifier

带输入整流器的 EP 型 H 桥 IGBT 模块



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

$I_C = 4 \times 100\text{ A}$

- 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 ratings¹ 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}	$V_{GE} = 0\text{ V}$, $T_{vj} = 25\text{ }^\circ\text{C}$		1700	V
DC collector current 集电极直流电流	I_C	$T_C = 125\text{ }^\circ\text{C}$, $T_{vj} = 175\text{ }^\circ\text{C}$		100	A
Peak collector current 集电极峰值电流	I_{CM}	$t_p = 1\text{ ms}$		200	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}	$T_C = 25\text{ }^\circ\text{C}$, $T_{vj} = 175\text{ }^\circ\text{C}$, per IGBT		750	W
DC forward current 二极管直流正向电流	I_F			100	A
Peak forward current 二极管最大脉冲正向电流	I_{FRM}	$t_p = 1\text{ ms}$		200	A
Surge current FWD 二极管最大浪涌电流浪	I_{FSM} I^2t	$V_R = 0\text{ V}$, $T_{vj} = 150\text{ }^\circ\text{C}$, $t_p = 10\text{ ms}$, half-sinewave		450 1000	A A^2s
Surge current Rectifier 浪涌电流整流器	I_{FSM} I^2t	$V_R = 0\text{ V}$, $T_{vj} = 150\text{ }^\circ\text{C}$, $t_p = 10\text{ ms}$, half-sinewave		1050 5500	A A^2s
Isolation voltage 绝缘电压	V_{isol}	1 min, $f = 50\text{ Hz}$		3400	V
Junction operating temperature 运行结温	$T_{vj(op)}$		-40	175 ²	$^\circ\text{C}$
Case temperature 壳温	T_C		-40	125	$^\circ\text{C}$
Storage temperature 存储温度	T_{stg}		-40	125	$^\circ\text{C}$
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 $T_{vj(op)} > 150\text{ }^\circ\text{C}$ allowed for overload conditions, less than 20% of operation time

³ For details, please refer to the mounting instructions. 详细信息, 请参考安装说明书

**IGBT⁴**

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	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$, $I_C = 1\text{ mA}$, $T_{vj} = 25^\circ\text{C}$	1700			V
Collector-emitter saturation voltage⁵ 集电极-发射极饱和电压	V_{CESat}	$I_C = 100\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25^\circ\text{C}$	1.65	2.0	V
			$T_{vj} = 125^\circ\text{C}$	1.85		V
			$T_{vj} = 175^\circ\text{C}$	2.05		V
Collector cut-off current 集电极截止电流	I_{CES}	$V_{CE} = 1700\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25^\circ\text{C}$		1	mA
			$T_{vj} = 125^\circ\text{C}$	0.3		mA
			$T_{vj} = 175^\circ\text{C}$	4.5		mA
Gate leakage current 栅极漏电流	I_{GES}	$V_{CE} = 0\text{ V}$, $V_{GE} = \pm 20\text{ V}$	-0.5		0.5	μA
Gate-emitter threshold voltage 栅极-发射极阈值电压	$V_{GE(th)}$	$I_C = 5\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^\circ\text{C}$	5	6.15	7.5	V
Gate charge 栅极电荷	Q_G	$I_C = 100\text{ A}$, $V_{CE} = 900\text{ V}$, $V_{GE} = -15\text{ V} \dots 15\text{ V}$		0.73		μC
Input capacitance 输入电容	C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$, $T_{vj} = 25^\circ\text{C}$		8		nF
Output capacitance 输出电容	C_{oes}			0.32		nF
Reverse transfer capacitance 反向传输电容	C_{res}			0.23		nF
Internal gate resistor 栅极内阻	R_{Gint}	Per switch, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$, CE short		5		Ω
Turn-on delay time 开通延迟	$t_{d(on)}$	$V_{CC} = 900\text{ V}$, $I_C = 100\text{ A}$, $V_{GE} = \pm 15\text{ V}$, $R_G = 11\text{ }\Omega$ (A1 switch), $R_G = 6.5\text{ }\Omega$ (A2 switch), $L_s = 90\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	168		ns
			$T_{vj} = 125^\circ\text{C}$	177		ns
			$T_{vj} = 175^\circ\text{C}$	178		ns
Rise time 上升时间	t_r		$T_{vj} = 25^\circ\text{C}$	27		ns
			$T_{vj} = 125^\circ\text{C}$	30		ns
			$T_{vj} = 175^\circ\text{C}$	33		ns
Turn-off delay time 关断延迟	$t_{d(off)}$	$V_{CC} = 900\text{ V}$, $I_C = 100\text{ A}$, $R_G = 4.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_s = 90\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	377		ns
			$T_{vj} = 125^\circ\text{C}$	475		ns
			$T_{vj} = 175^\circ\text{C}$	510		ns
Fall time 下降时间	t_f		$T_{vj} = 25^\circ\text{C}$	415		ns
			$T_{vj} = 125^\circ\text{C}$	562		ns
			$T_{vj} = 175^\circ\text{C}$	650		ns
Turn-on switching energy 开通损耗	E_{on}	$V_{CC} = 900\text{ V}$, $I_C = 100\text{ A}$, $R_G = 11\text{ }\Omega$ (A1 switch), $R_G = 6.5\text{ }\Omega$ (A2 switch), $L_s = 90\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	32		mJ
			$T_{vj} = 125^\circ\text{C}$	39		mJ
			$T_{vj} = 175^\circ\text{C}$	44		mJ
Turn-off switching energy 关断损耗	E_{off}	$V_{CC} = 900\text{ V}$, $I_C = 100\text{ A}$, $R_G = 4.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_s = 90\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	18		mJ
			$T_{vj} = 125^\circ\text{C}$	25		mJ
			$T_{vj} = 175^\circ\text{C}$	28		mJ
Short circuit current 短路电流	I_{SC}	$t_{pCS} \leq 10\text{ }\mu\text{s}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 175^\circ\text{C}$, $V_{CC} = 1200\text{ V}$, $V_{CEM\text{ Chip}} \leq 1700\text{ V}$		496		A

⁴ Characteristic values according to IEC 60747-9⁵ Collector-emitter saturation voltage is given at chip-level 集电极-发射极饱和电压



Diode FWD⁶

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 = 100 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 = 100 A, R _G = 11 Ω(A1 switch), R _G = 6.5 Ω(A2 switch), L _S = 90 nH, inductive load	T _{VJ} = 25 °C		117		A
			T _{VJ} = 125 °C		119		A
			T _{VJ} = 175 °C		119		A
Recovery charge 恢复电荷	Q _{rr}		T _{VJ} = 25 °C		26		μC
			T _{VJ} = 125 °C		40		μC
			T _{VJ} = 175 °C		49		μC
Reverse recovery time 反向恢复时间	t _{rr}		T _{VJ} = 25 °C		712		ns
			T _{VJ} = 125 °C		1156		ns
			T _{VJ} = 175 °C		1453		ns
Reverse recovery energy 反向恢复能量	E _{rec}		T _{VJ} = 25 °C		14		mJ
			T _{VJ} = 125 °C		23		mJ
			T _{VJ} = 175 °C		29		mJ

Diode Rectifier⁸

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}	$T_{vj}=25\text{ °C}$, $I_R = 1\text{ mA}$		1700			V
Maximum RMS forward current 最大均方根正向电流	I_{FRMSM}	$T_C=95\text{ °C}$				125	A
Forward voltage⁹ 正向压降	V_F	$I_F=125\text{ A}$	$T_{vj} = 25\text{ °C}$		1.08		V
			$T_{vj} = 125\text{ °C}$		1.02		V
			$T_{vj} = 150\text{ °C}$		1.0		V
Forward threshold voltage 正向阈值电压	$V_{(FO)}$	$T_{vj}=150\text{ °C}$, $I_F=50 - 125\text{ A}$			0.7		V
Forward slope resistance 前坡阻力	r_F	$T_{vj}=150\text{ °C}$, $I_F=50 - 125\text{ A}$			2		$\text{m}\Omega$
Junction operating temperature 运行结温	$T_{vj(op)}$			-40		150	$^{\circ}\text{C}$

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 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}	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15K))]$		3375		K
B-value B 值	B _{25/100}	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15K))]$		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			0.20	K/W
FWD thermal resistance junction to case 二极管结-壳热阻	R _{th(j-c)Diode}				0.32	K/W
Rectifier thermal resistance junction to case 整流器热阻结到外壳	R _{th(j-c)rectifier Diode}				0.28	K/W
IGBT thermal resistance case to heatsink 壳到散热器热阻	R _{th(c-h)IGBT}			0.089		K/W
FWD thermal resistance case to heatsink 二极管壳到散热器热阻	R _{th(c-h)Diode}			0.099		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}			0.159		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

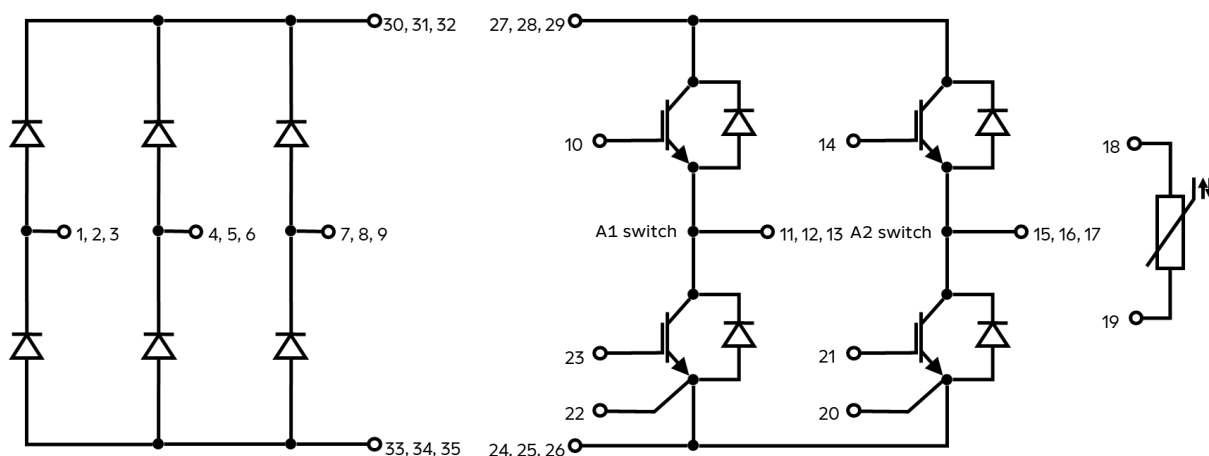
¹⁰ Package and mechanical properties according to IEC 60747-15



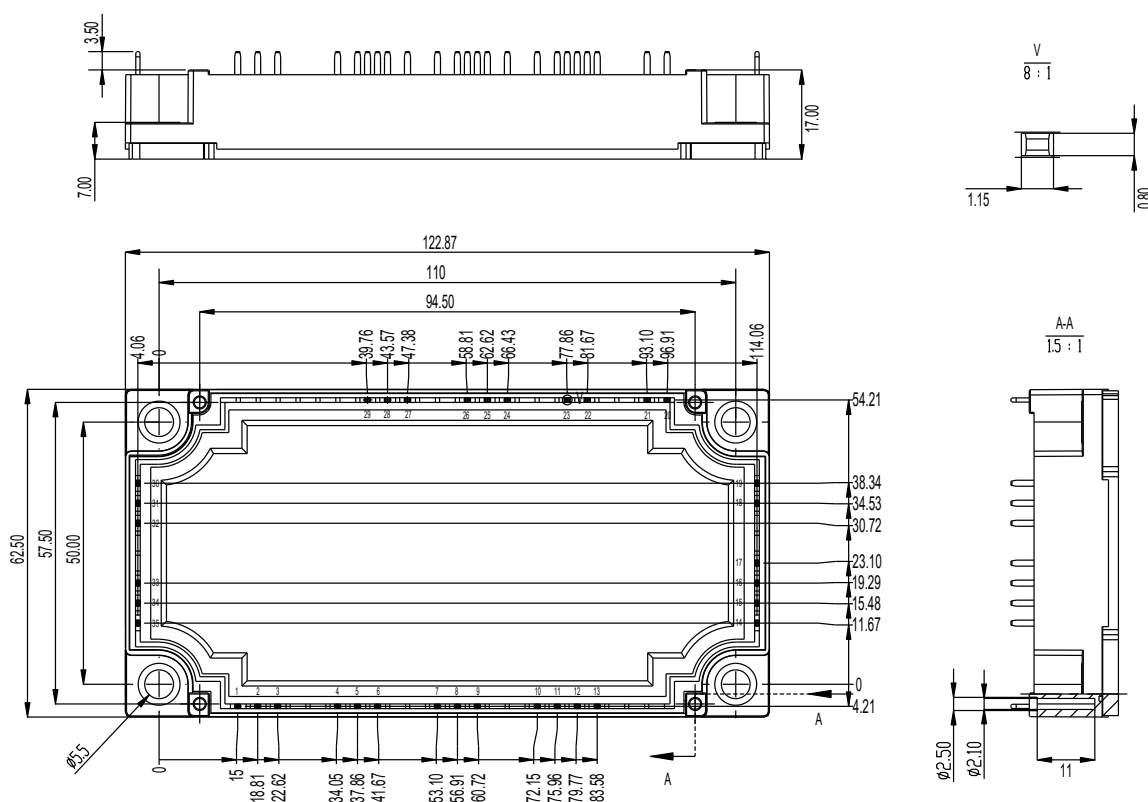
Mechanical properties 机械特性

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。



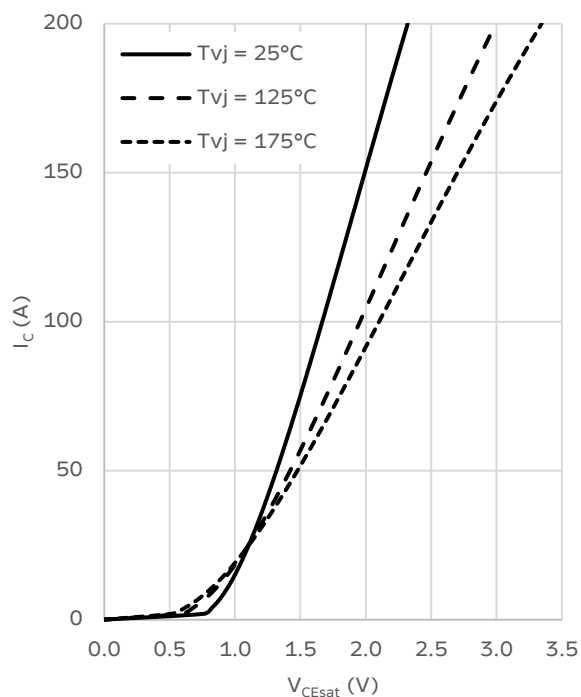
Characteristics 特性曲线

IGBT on-state characteristics (typical)

IGBT 通态特性曲线 (典型)

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

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

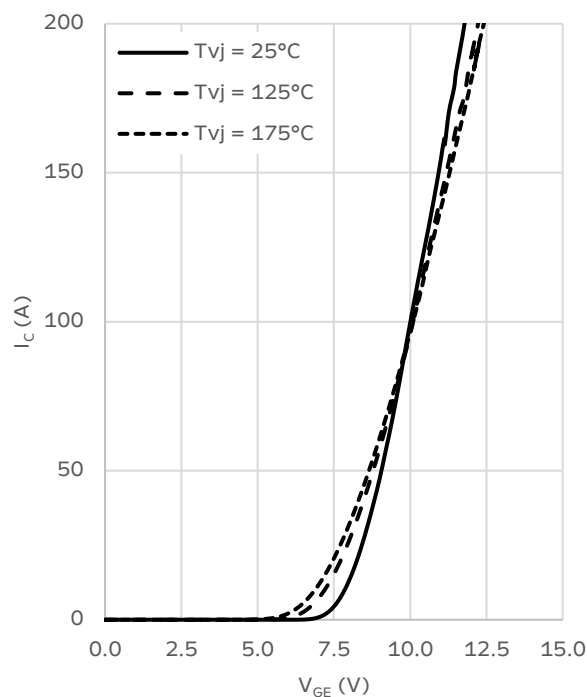


IGBT transfer characteristics (typical)

IGBT 转移特性曲线 (典型)

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

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

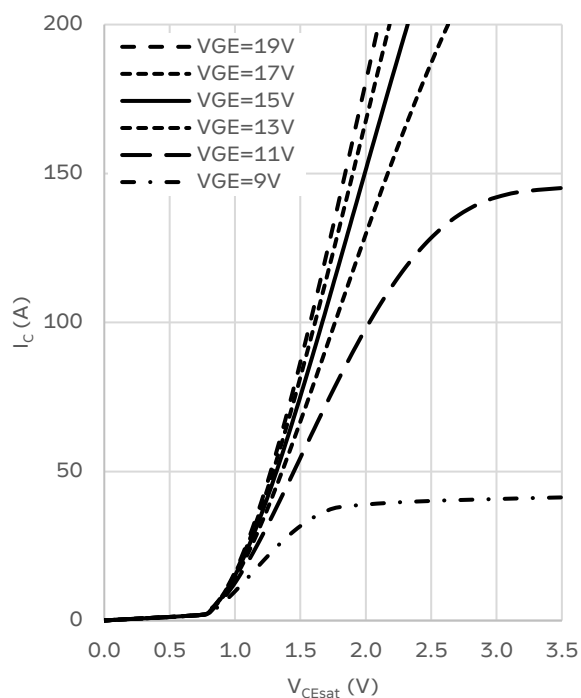


IGBT output characteristics (typical)

IGBT 输出特性曲线 (典型)

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

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

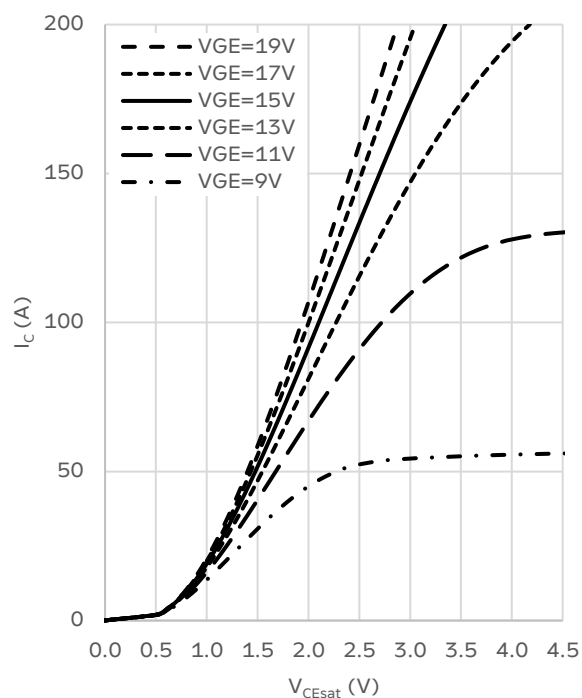


IGBT output characteristics (typical)

IGBT 输出特性曲线 (典型)

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

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



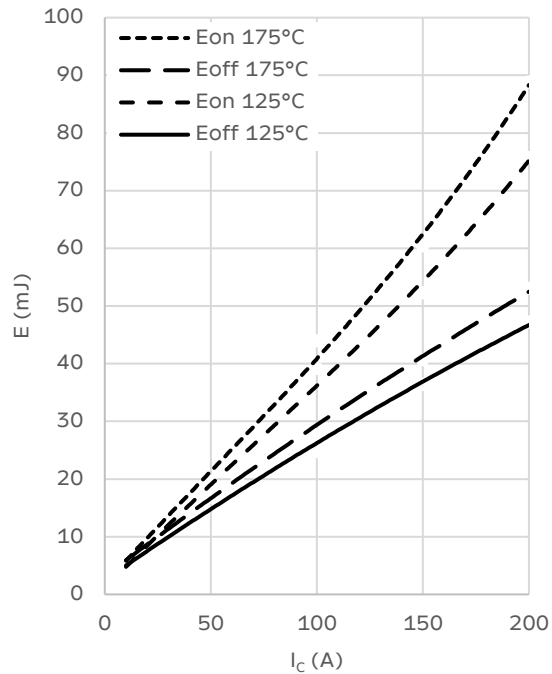


IGBT switching losses (typical)

IGBT 开关损耗曲线 (典型)

$E = f(I_{CE})$

$V_{CE} = 900 \text{ V}$, $R_{Gon} = 11 / 6.5 \Omega$, $R_{Goff} = 4.5 \Omega$, $V_{GE} = -15/+15 \text{ V}$

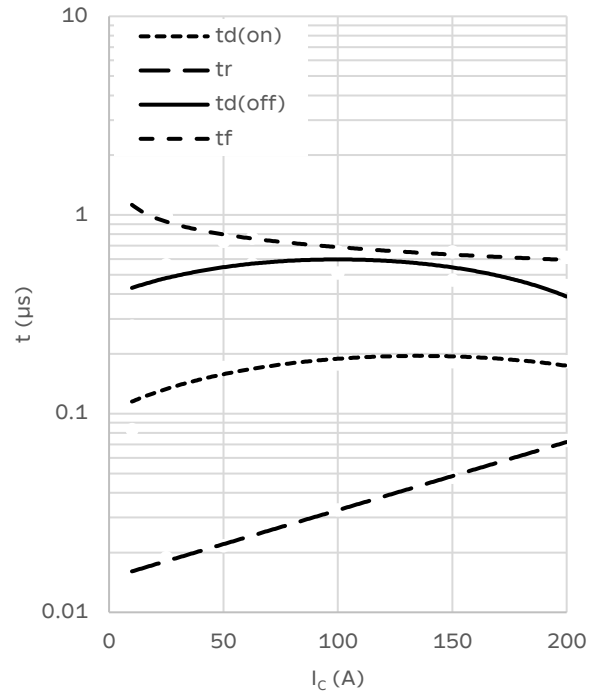


IGBT switching times (typical)

IGBT 开关时间曲线 (典型)

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

$V_{CE} = 900 \text{ V}$, $R_{Gon} = 11 / 6.5 \Omega$, $R_{Goff} = 4.5 \Omega$, $V_{GE} = -15/+15 \text{ V}$

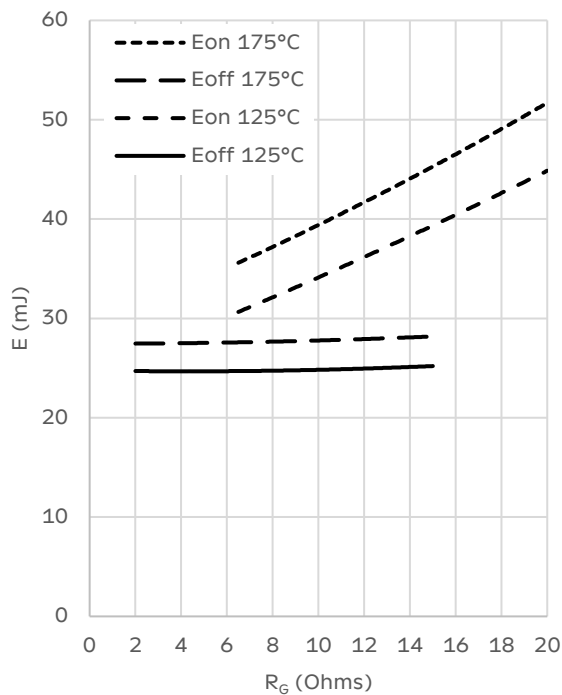


IGBT switching losses (typical)

IGBT 开关损耗曲线 (典型)

$E = f(R_G)$

$V_{CE} = 900 \text{ V}$, $I_C = 100 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$

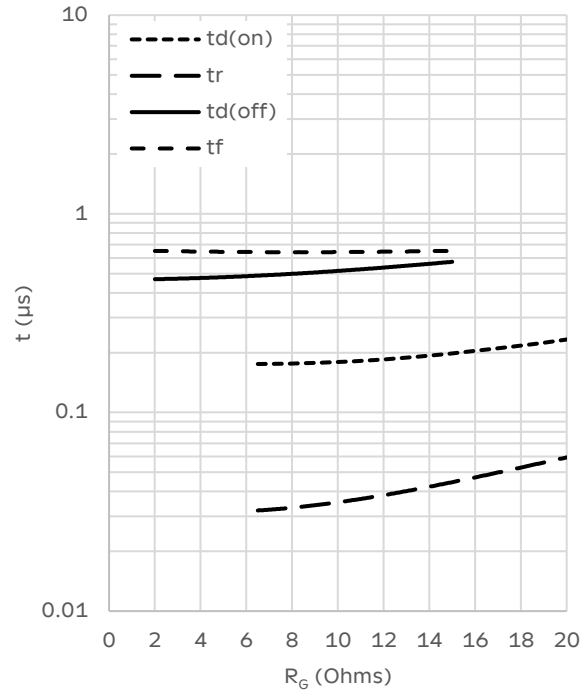


IGBT switching times (typical)

IGBT 开关时间曲线 (典型)

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

$V_{CE} = 900 \text{ V}$, $I_C = 100 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$



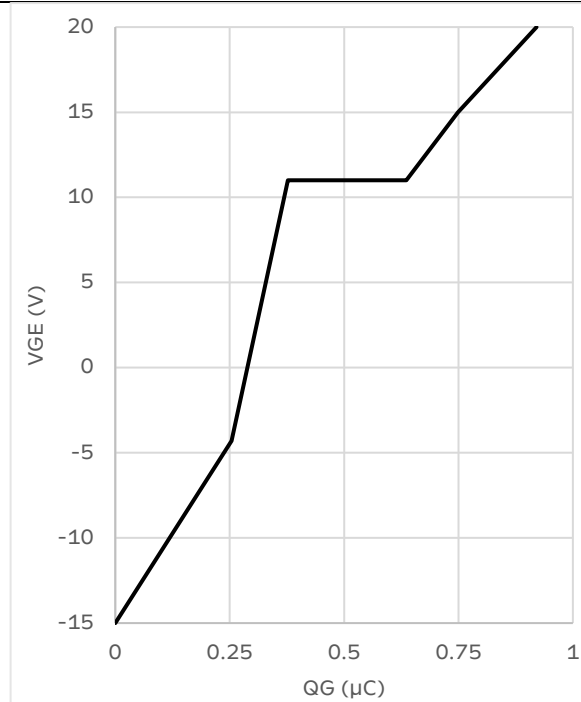


IGBT gate charge (typical)

IGBT 门极电荷 (典型)

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

$V_{CE} = 900\text{ V}$, $I_C = 100\text{ A}$

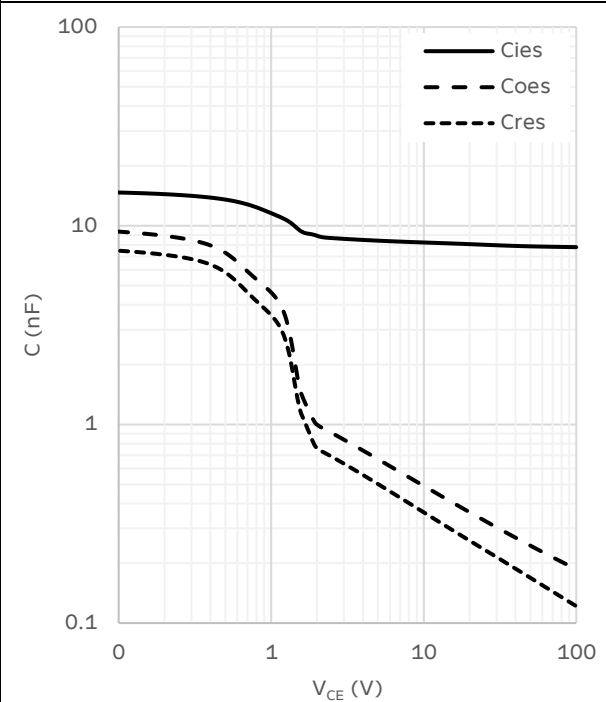


Capacitance characteristics (typical)

电容特性曲线 (典型)

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

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

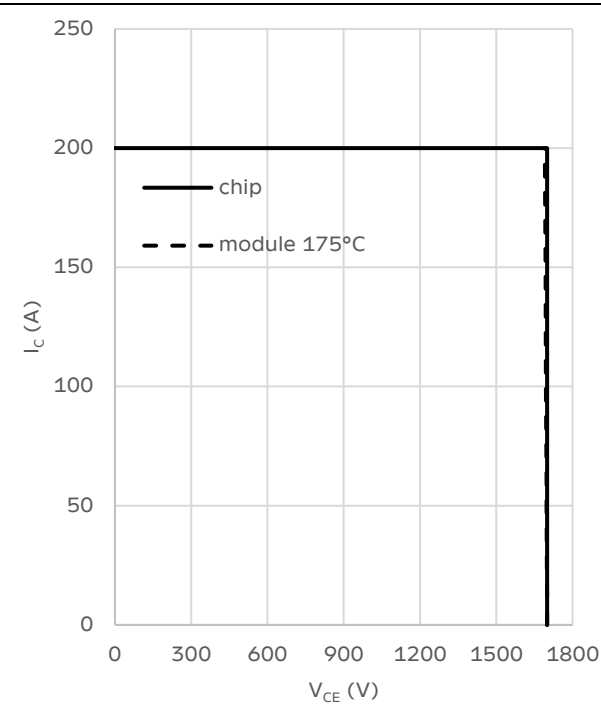


IGBT RBSOA

IGBT 反偏安全工作区域

$I_C = f(V_{CEM})$

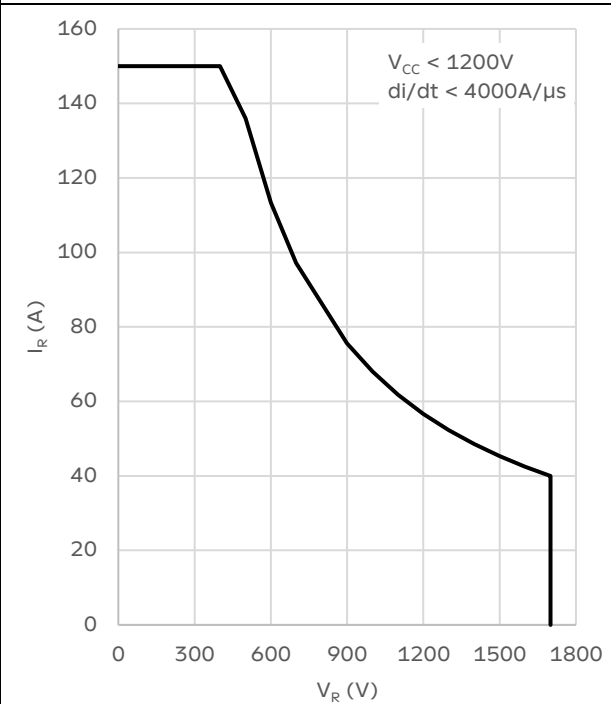
$R_{Goff} = 4.5\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$



Diode SOA

Diode 反偏安全工作区域

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

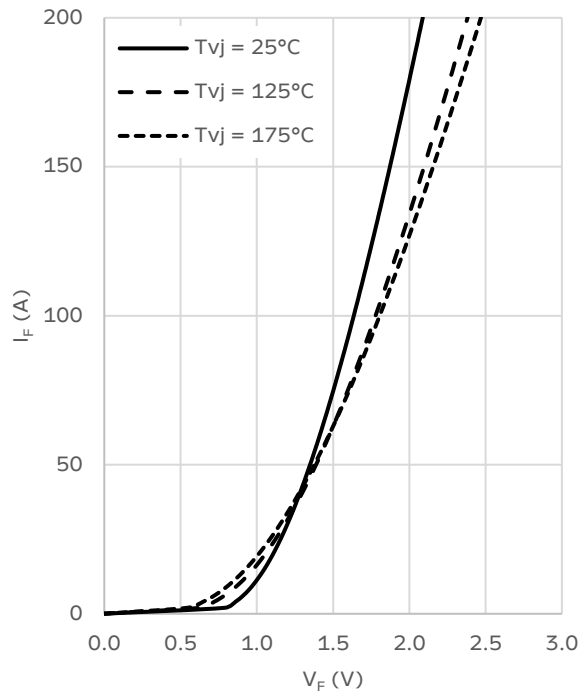




Diode forward characteristic (typical)

二极管正向特性 (典型)

$I_F = f(V_F)$

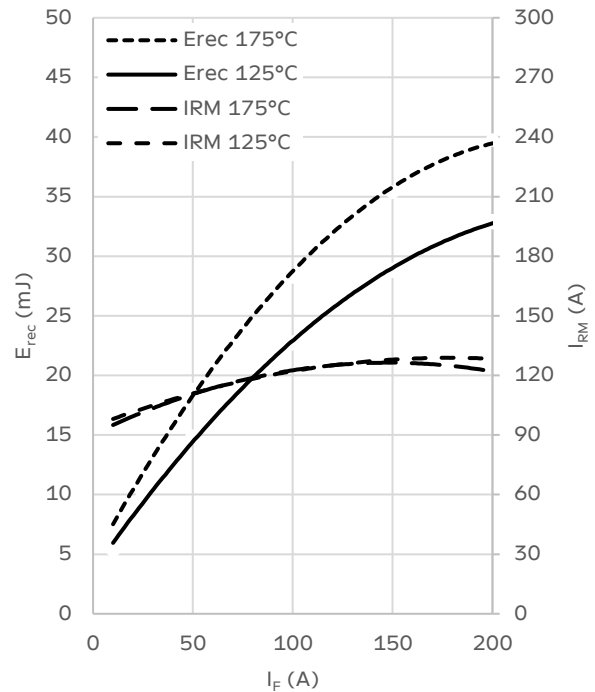


Diode switching characteristics (typical)

二极管开关特性 (典型)

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

$V_{DC} = 900\text{ V}$, $R_{Gon} = 11 / 6.5\ \Omega$ (IGBT), $V_{GE} = -15/+15\text{ V}$ (IGBT)

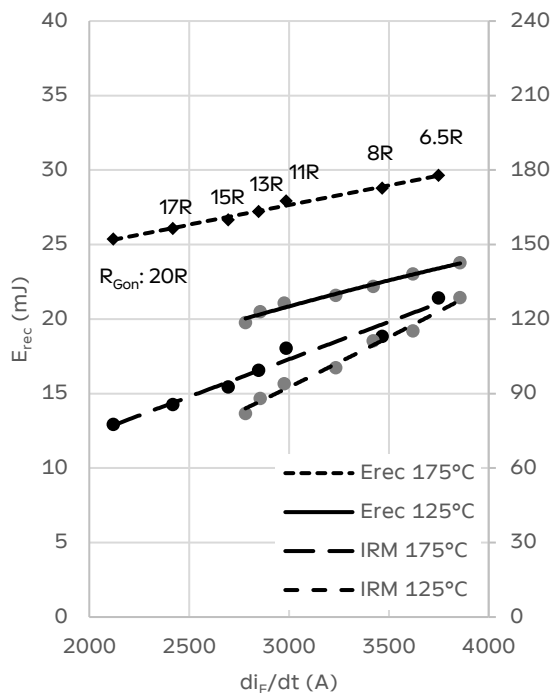


Diode switching characteristics (typical)

二极管开关特性 (典型)

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

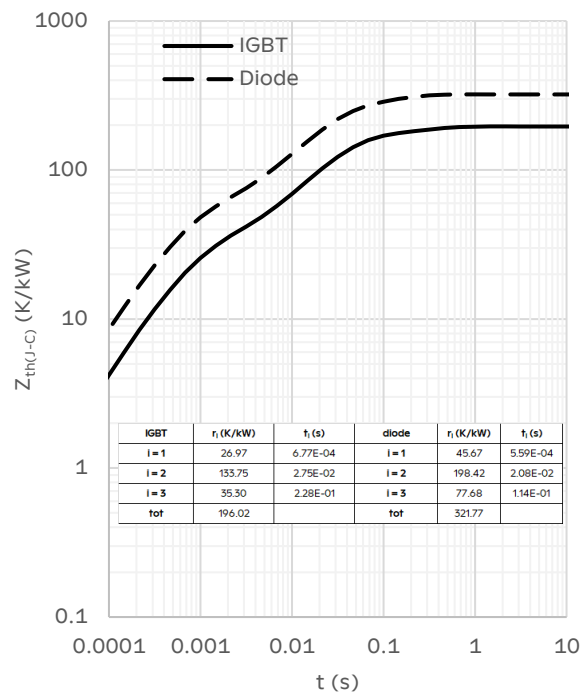
$V_{DC} = 900\text{ V}$, $I_F = 100\text{ A}$, $V_{GE} = -15/+15\text{ V}$ (IGBT)



Thermal impedance Inverter

热阻逆变器

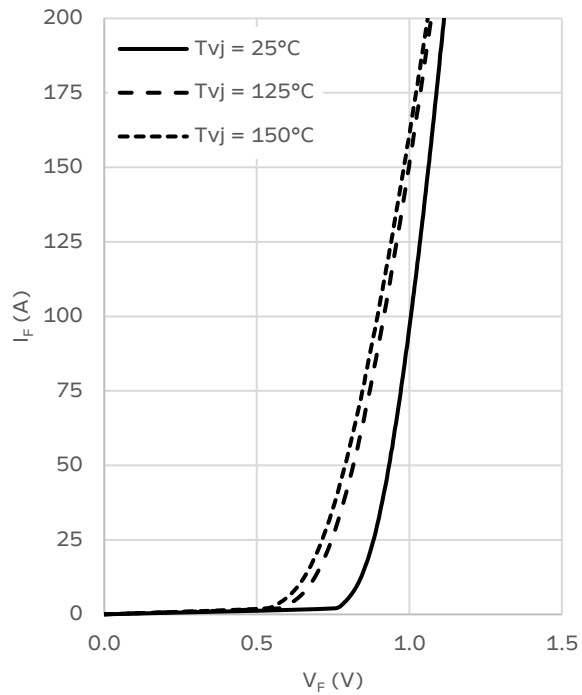
$Z_{th(j-c)} = f(t)$



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

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

