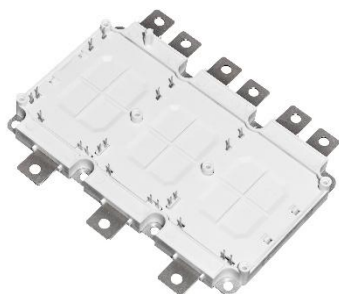


PRELIMINARY DATASHEET 初版规格书

SISS0500BEVD120i20

BEVD-Type three-phase IGBT module

BEVD 封装三相桥 IGBT 模块



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

$I_C = 6 \times 500\text{ A}$

- *i20* ultra-low loss fine pattern Trench IGBT chipset
i20 超低损耗精细沟槽栅型 IGBT 芯片组
- Baseplate isolation with efficient Si_3N_4 AMB
高效 Si_3N_4 活性金属钎焊绝缘陶瓷基板
- Cu baseplate for low thermal resistance
低热阻铜底板
- Automotive package
汽车行业标准封装

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}	$V_{GE} = 0\text{ V}$, $T_{vj} = 25\text{ °C}$		1200	V
DC collector current 集电极直流电流	I_C	$T_C = 120\text{ °C}$, $T_{vj} = 175\text{ °C}$		500	A
Peak collector current 集电极峰值电流	I_{CM}	$t_p = 1\text{ ms}$		1000	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}	$T_F = 75\text{ °C}$, $T_{vj} = 175\text{ °C}$, per switch		1100	W
DC forward current 二极管直流正向电流	I_F			500	A
Peak forward current 二极管最大脉冲正向电流	I_{FRM}	$t_p = 1\text{ ms}$		1000	A
Surge current 二极管最大浪涌电流	I_{FSM}	$V_R = 0\text{ V}$, $T_{vj} = 150\text{ °C}$, $t_p = 10\text{ ms}$, half-sinewave		1830 16750	A A ² s
Isolation voltage 绝缘电压	V_{isol}	1 min, $f = 50\text{ Hz}$		3800	V
Junction operating temperature 运行结温	$T_{vj(op)}$		-40	175 ²	°C
Case temperature 壳温	T_C		-40	125 ³⁾ / 150	°C
Storage temperature 存储温度	T_{stg}		-40	125	°C
Mounting torques 紧固力矩 ⁴	M_S	Base-heatsink, M4 screws	1.8	2.2	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 $T_{vj(op)} > 150\text{ °C}$ 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 UL1557 compliance T_{Cmax} must be limited to 125°C; UL1557 标准中要求，最大壳温不能超过 125°C

⁴ For details, please refer to the mounting instructions. 详细信息，请参考安装说明书



IGBT⁵

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	$V_{(BR)CES}$	$V_{GE} = 0\text{ V}$, $I_C = 10\text{ mA}$, $T_{vj} = 25^\circ\text{C}$	1200			V
Collector-emitter saturation voltage ⁶ 集电极-发射极饱和电压	$V_{CE\text{ sat}}$	$I_C = 500\text{ A}$, $V_{GE} = 15\text{ V}$	$T_{vj} = 25^\circ\text{C}$	1.65	2	V
			$T_{vj} = 125^\circ\text{C}$	1.95		V
			$T_{vj} = 175^\circ\text{C}$	2.1		V
Collector cut-off current 集电极截止电流	I_{CES}	$V_{CE} = 1200\text{ V}$, $V_{GE} = 0\text{ V}$	$T_{vj} = 25^\circ\text{C}$		1	mA
			$T_{vj} = 125^\circ\text{C}$	0.7		mA
			$T_{vj} = 175^\circ\text{C}$	15		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	$V_{GE(th)}$	$I_C = 25\text{ mA}$, $V_{CE} = V_{GE}$, $T_{vj} = 25^\circ\text{C}$	5	5.8	7.0	V
Gate charge 栅极电荷	Q_G	$I_C = 500\text{ A}$, $V_{CE} = 600\text{ V}$, $V_{GE} = -15\text{ V} \dots 15\text{ V}$		3.5		μC
Input capacitance 输入电容	C_{ies}	$V_{CE} = 25\text{ V}$, $V_{GE} = 0\text{ V}$, $f = 100\text{ kHz}$, $T_{vj} = 25^\circ\text{C}$		30		nF
Reverse transfer capacitance 反向传输电容	C_{res}			1.7		
Internal gate resistor 栅极内阻	R_{Gint}	Per switch, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$, CE short		1.8		Ω
Turn-on delay time 开通延迟	$t_{d(on)}$	$V_{CC} = 600\text{ V}$, $I_C = 500\text{ A}$, $R_G = 1\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 30\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	169		ns
			$T_{vj} = 125^\circ\text{C}$	200		
			$T_{vj} = 175^\circ\text{C}$	208		
Rise time 上升时间	t_r		$T_{vj} = 25^\circ\text{C}$	48		
			$T_{vj} = 125^\circ\text{C}$	55		
			$T_{vj} = 175^\circ\text{C}$	58		
Turn-off delay time 关断延迟	$t_{d(off)}$	$V_{CC} = 600\text{ V}$, $I_C = 500\text{ A}$, $R_G = 2\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 30\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	531		ns
			$T_{vj} = 125^\circ\text{C}$	627		
			$T_{vj} = 175^\circ\text{C}$	655		
Fall time 下降时间	t_f		$T_{vj} = 25^\circ\text{C}$	219		
			$T_{vj} = 125^\circ\text{C}$	332		
			$T_{vj} = 175^\circ\text{C}$	369		
Turn-on switching energy 开通损耗	E_{on}	$V_{CC} = 600\text{ V}$, $I_C = 500\text{ A}$, $R_G = 1\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 30\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	35		mJ
			$T_{vj} = 125^\circ\text{C}$	56		
			$T_{vj} = 175^\circ\text{C}$	69		
Turn-off switching energy 关断损耗	E_{off}	$V_{CC} = 600\text{ V}$, $I_C = 500\text{ A}$, $R_G = 2\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$, $L_S = 30\text{ nH}$, inductive load	$T_{vj} = 25^\circ\text{C}$	51		
			$T_{vj} = 125^\circ\text{C}$	70		
			$T_{vj} = 175^\circ\text{C}$	76		
Short circuit current 短路电流	I_{SC}	$t_{pCS} \leq 10\text{ }\mu\text{s}$, $V_{GE} = 15\text{ V}$, $T_{vj} = 175^\circ\text{C}$, $V_{CC} = 800\text{ V}$, $V_{CEM\text{ Chip}} \leq 1200\text{ V}$		2036		A

⁵ Characteristic values according to IEC 60747-9

⁶ Collector-emitter saturation voltage is given at chip-level 集电极-发射极饱和电压



Diode⁷

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 ⁸ 正向压降	V _F	I _F = 500 A	T _{Vj} = 25 °C	2.0	2.5	V
			T _{Vj} = 125 °C	2.15		V
			T _{Vj} = 175 °C	2.15		V
Peak reverse recovery current 反向恢复电流峰值	I _{RM}	V _R = 600 V, I _F = 500 A, di/dt = 8340A/μs (175 °C), R _G = 1 Ω, V _{GE} = ± 15 V, L _S = 30 nH, inductive load	T _{Vj} = 25 °C	479		A
			T _{Vj} = 125 °C	543		A
			T _{Vj} = 175 °C	561		A
Recovery charge 恢复电荷	Q _{rr}		T _{Vj} = 25 °C	48		μC
			T _{Vj} = 125 °C	90		μC
			T _{Vj} = 175 °C	109		μC
Reverse recovery time 反向恢复时间	t _{rr}		T _{Vj} = 25 °C	477		ns
			T _{Vj} = 125 °C	772		ns
			T _{Vj} = 175 °C	922		ns
Reverse recovery energy 反向恢复能量	E _{rec}		T _{Vj} = 25 °C	19		mJ
			T _{Vj} = 125 °C	37		mJ
			T _{Vj} = 175 °C	46		mJ

Package properties 封装特性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
IGBT thermal resistance junction to case IGBT 热阻	R _{th(j-f)IGBT}	冷却液: 50%乙二醇溶液; ΔV/Δt=10 dm ³ /min; TF = 75 ° C		0.06		K/W
Diode thermal resistance junction to case 二极管热阻	R _{th(j-f)Diode}	Cooling Fluid: 50% water / 50% ethylenglycol; ΔV/Δt=10 dm ³ /min; TF= 75 ° C		0.14		K/W
Pressure drop in cooling circuit 冷却过程中的压力下降 电路	ΔP	冷却液: 50%乙二醇溶液; ΔV/Δt=10 dm ³ /min; TF = 75 ° C Cooling Fluid: 50% water / 50% ethylenglycol; ΔV/Δt=10 dm ³ /min; TF= 75 ° C		~64		mbar
Comparative tracking index 相对漏电起痕指数	CTI		200			
Module stray inductance 模块自身杂散电感	L _{S CE}	Per switch		12		nH
Resistance, terminal chip 端子到芯片之间的阻抗	R _{CC'+EE'}	Per switch	T _{Vj} = 25 °C	0.5		mΩ
			T _{Vj} = 125 °C			
			T _{Vj} = 175 °C			
Material of module baseplate 模块底板材料		Ni + Cu Nickel plated Cu baseplate				

⁷ Characteristic values according to IEC 60747-2

⁸ Forward voltage is given at chip-level 正向压降是芯片两端的电压值。

⁹ Package and mechanical properties according to IEC 60747-15



NTC Thermistor 热敏电阻器

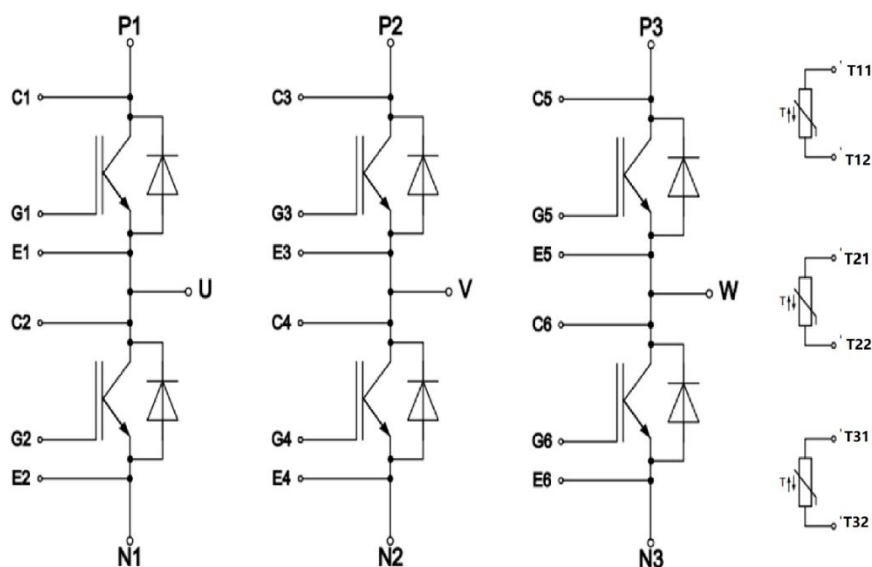
PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件	MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Rated resistance 额定电阻	R ₂₅	T _c = 25 °C		5		kΩ
R100	R ₁₀₀	T _c = 100 °C	468		518	Ω
B-value B 值	B _{25/50}	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15K))]$		3375		K
B-value B 值	B _{25/80}	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15K))]$		3411		K
Rated resistance 额定电阻	B _{25/100}	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15K))]$		3433		K

Mechanical properties 机械特性¹⁰

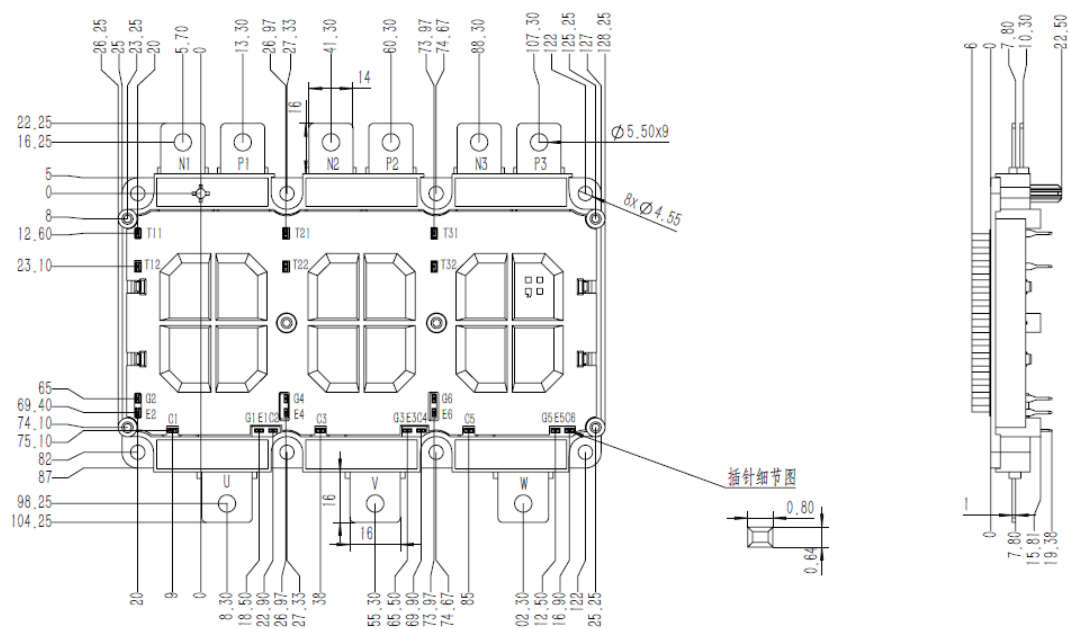
PARAMETER 参数	SYMBOL 符号	CONDITIONS 工作条件	MIN 最小值	TYP 典型	MAX 最大值	UNIT 单位
Dimensions	L x W x H	Typical	154.5x126.5x28.5			mm ³
Clearance distance in air 电气间隙	da	According to IEC 60664-1 and EN 50124-1 参考标准 IEC 60664-1 和 EN 50124-1	Terminal to base: 端子到基板	4.5		mm
			Terminal to terminal: 端子到端子	4.5		
Surface creepage distance 爬电距离	ds		Terminal to base: 端子到基板	9		mm
			Terminal to terminal: 端子到端子	9		
Mass 重量	m			700		g

¹⁰ 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 automotive Level. 本产品的设计和认证符合汽车级标准。



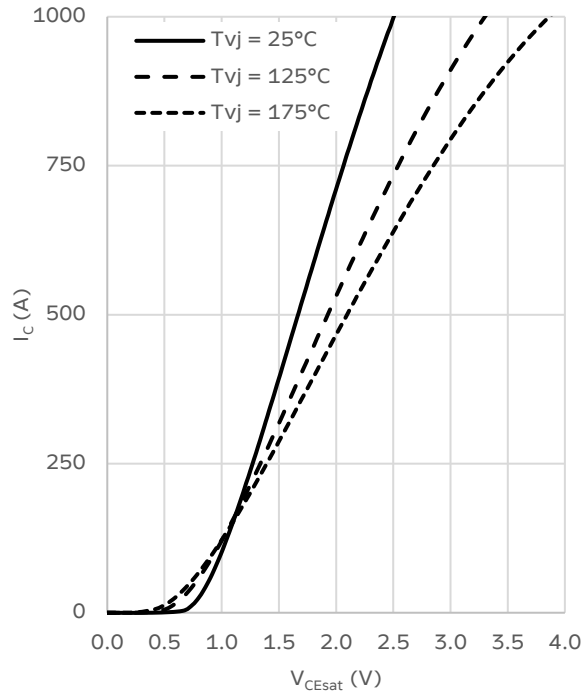
Characteristics 特性曲线

IGBT on-state characteristics (typical)

IGBT 通态特性曲线 (典型)

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

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

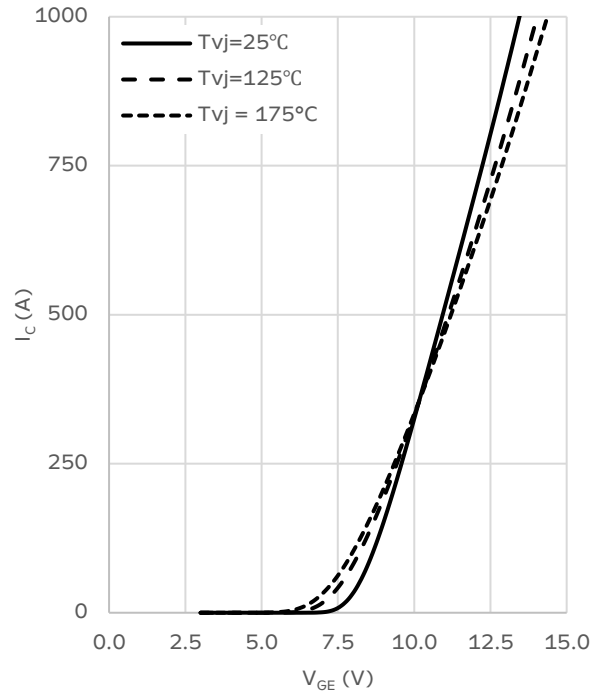


IGBT transfer characteristics (typical)

IGBT 转移特性曲线 (典型)

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

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

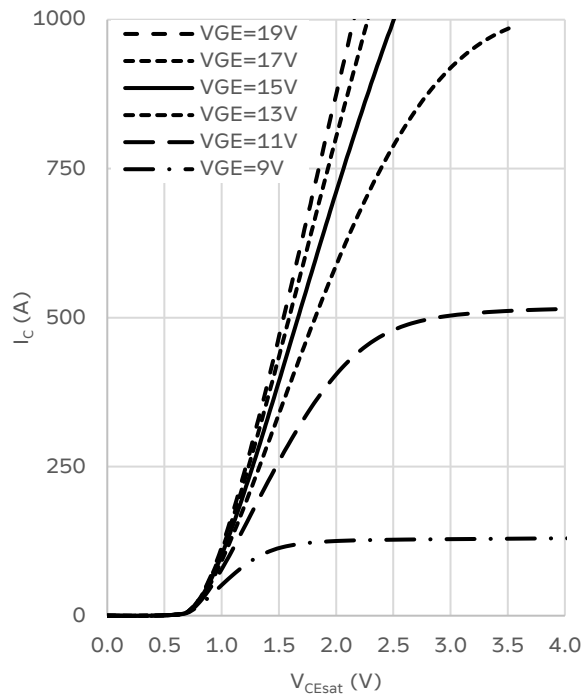


IGBT output characteristics (typical)

IGBT 输出特性曲线 (典型)

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

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

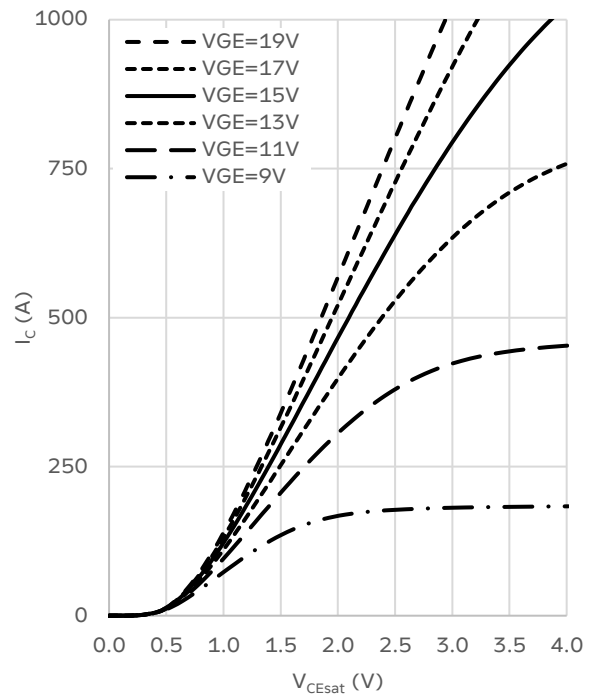


IGBT output characteristics (typical)

IGBT 输出特性曲线 (典型)

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

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



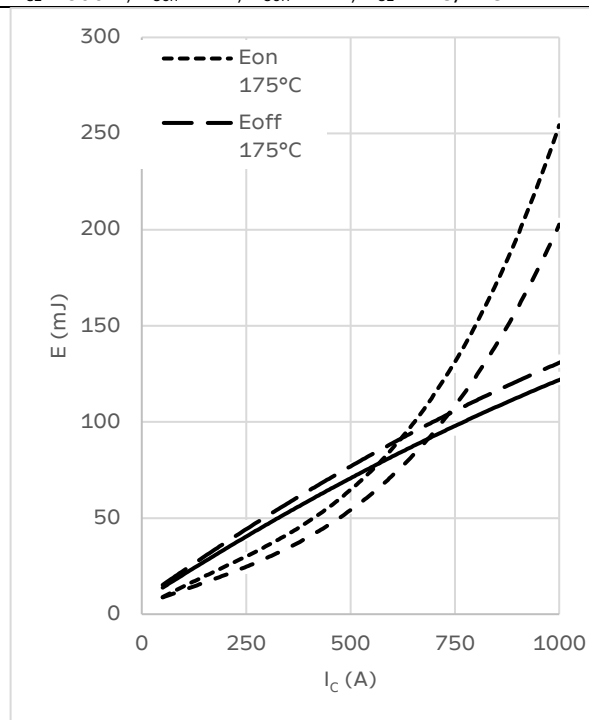


IGBT switching losses (typical)

IGBT 开关损耗曲线 (典型)

$E = f(I_{CE})$

$V_{CE} = 600 \text{ V}$, $R_{Gon} = 1 \Omega$, $R_{Goff} = 2 \Omega$, $V_{GE} = -15/+15 \text{ V}$

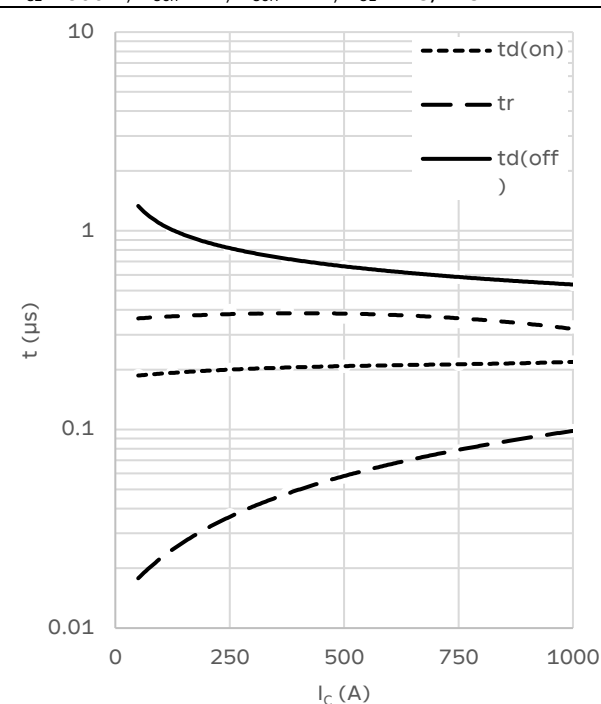


IGBT switching times (typical)

IGBT 开关时间曲线 (典型)

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

$V_{CE} = 600 \text{ V}$, $R_{Gon} = 1 \Omega$, $R_{Goff} = 2 \Omega$, $V_{GE} = -15/+15 \text{ V}$

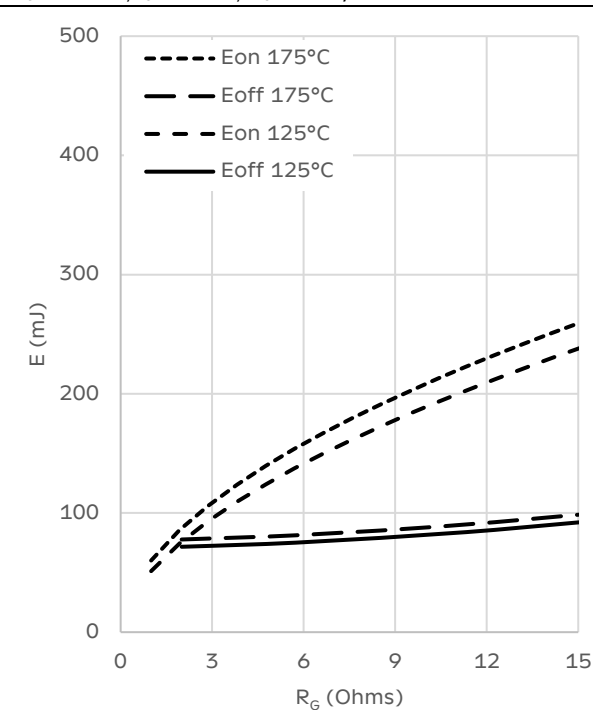


IGBT switching losses (typical)

IGBT 开关损耗曲线 (典型)

$E = f(R_G)$

$V_{CE} = 600 \text{ V}$, $I_C = 500 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$

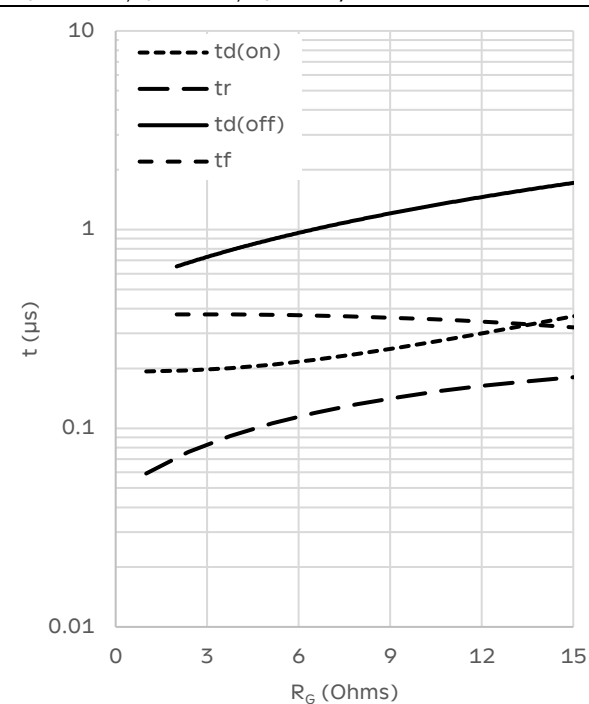


IGBT switching times (typical)

IGBT 开关时间曲线 (典型)

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

$V_{CE} = 600 \text{ V}$, $I_C = 500 \text{ A}$, $V_{GE} = -15/+15 \text{ V}$



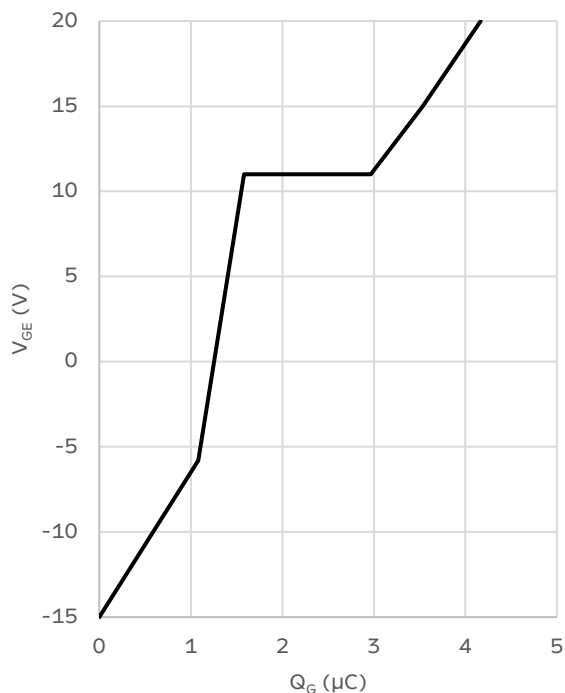


IGBT gate charge (typical)

IGBT 门极电荷 (典型)

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

$V_{CE} = 600\text{ V}$, $I_C = 500\text{ A}$

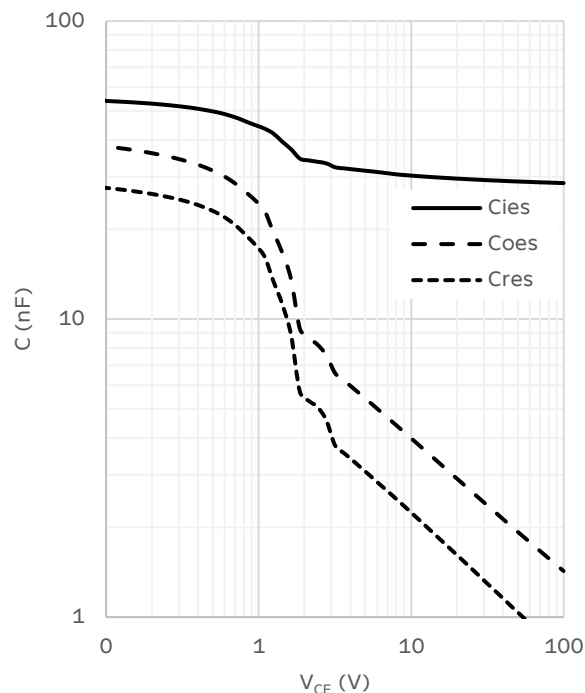


Capacitance characteristics (typical)

电容特性曲线 (典型)

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

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

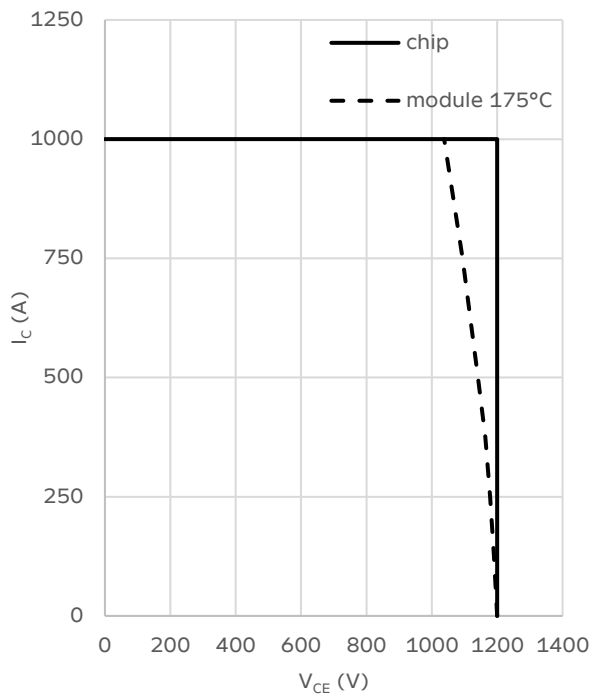


IGBT RBSOA

IGBT 反偏安全工作区域

$I_C = f(V_{CEm})$

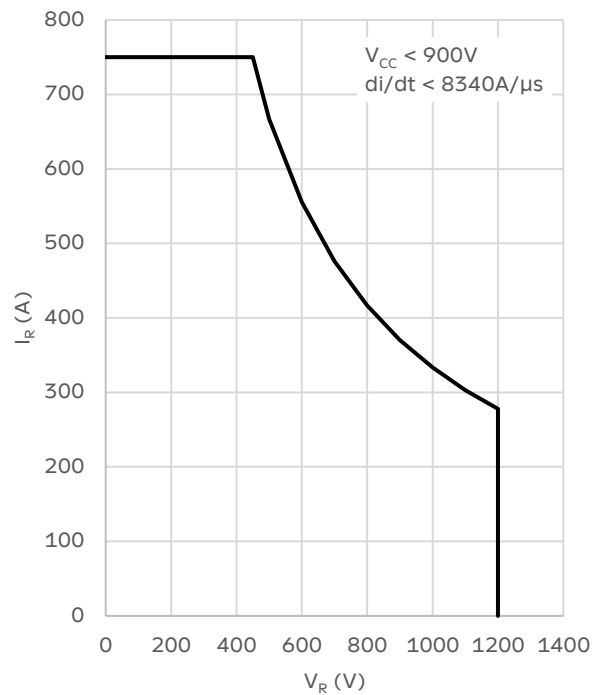
$R_{Goff} = 2\text{ }\Omega$, $V_{GE} = \pm 15\text{ V}$



Diode SOA

Diode 反偏安全工作区域

$T_{vj} \leq 175\text{ °C}$

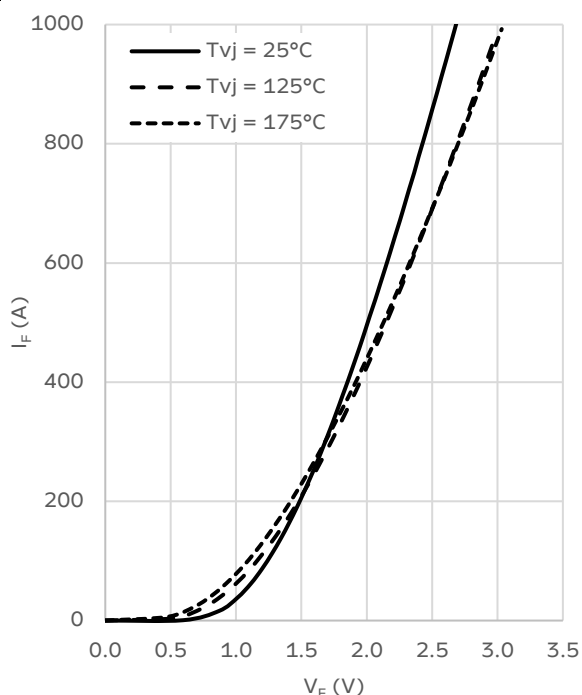




Diode forward characteristic (typical)

二极管正向特性 (典型)

$$I_F = f(V_F)$$

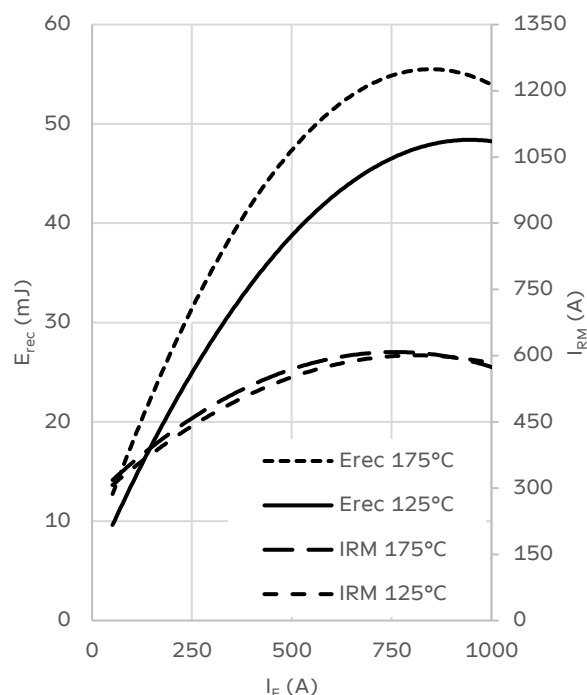


Diode switching characteristics (typical)

二极管开关特性 (典型)

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

$$V_{DC} = 600 \text{ V}, R_{Gon} = 1 \Omega \text{ (IGBT)}, V_{GE} = -15/+15 \text{ V (IGBT)}$$

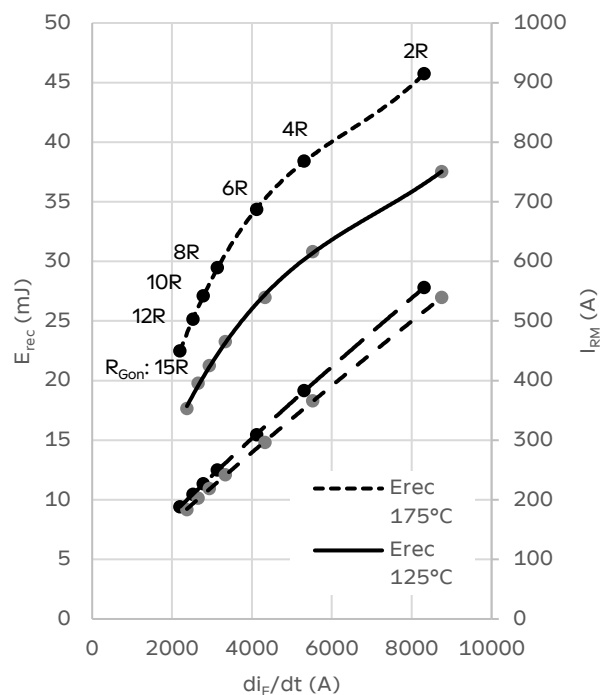


Diode switching characteristics (typical)

二极管开关特性 (典型)

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

$$V_{DC} = 600 \text{ V}, I_F = 500 \text{ A}, V_{GE} = -15/+15 \text{ V (IGBT)}$$



Thermal impedance (typical)

热阻抗 (典型)

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

Cooling Fluid: 50% water / 50% ethylenglycol

$$\Delta V/\Delta t = 10 \text{ dm}^3/\text{min}; T_F = 75^\circ\text{C}$$

TBD