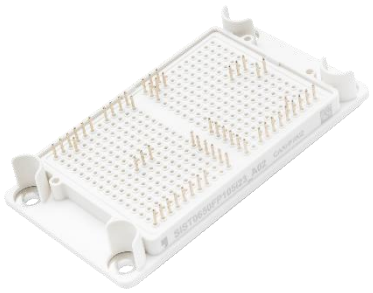
DATASHEET 规格书

SIST0650FP105i23_A02(_A03)

FP-Type three-level IGBT module

FP 封装三电平 IGBT 模块



V_{CE} = 1050 V

I_C = 650 A

- *i23* ultra-low loss micro pattern Trench IGBT chipset
  i23 超低损耗精细沟槽栅型 IGBT 芯片组
- Cu baseplate for low thermal resistance
  低热阻铜底板
- For solar power and Energy storage applications
  用于太阳能发电和储能应用
- 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		1050	V
Implemented DC collector current T1-T4 集电极直流电流	I_{CN}			650	A
Collector current T1-T4	I_C	T_C = 110 °C, T_{vj} = 175°C		450	A
Peak collector current 集电极峰值电流	I_{CM}	t_p = 1 ms		1300	A
Gate-emitter voltage 栅极-发射极驱动电压	V_{GES}		-20	20	V
Peak Repetitive Reverse Voltage D1-D6	V_{RRM}			1200	V
Implemented DC forward current (D2, D3) 二极管直流正向电流	I_{FN}			400	A
Continuous forward current (D2, D3)	I_F			400	A
Peak forward current (D2, D3) 二极管最大脉冲正向电流	I_{FRM}	t_p = 1 ms		800	A
Continuous Forward Current (D1, D4)	I_F			280	A
Repetitive Peak Forward Current (D1, D4)	I_{FRM}	t_p = 10 ms		840	A
Continuous Forward Current (D5, D6)	I_F			210	A
Repetitive Peak Forward Current (D5, D6)	I_{FRM}	t_p = 10 ms		630	A
Isolation voltage 绝缘电压	V_{isol}	1 min, f = 50 Hz		3200	V
Junction operating temperature 运行结温	$T_{vj(op)}$		-40	175	°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[2]	M_S	Base-heatsink, M5 screws	3	5	Nm

Scan for latest download 扫描最新下载

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

IGBT³ T1, T4

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		1050			V
Collector-emitter saturation voltage [4] 集电极-发射极饱和电压	V_{CEsat}	I_c = 600 A, V_{GE} = 15 V	T_{vj} = 25°C		1.65	2	V
			T_{vj} = 150°C		2.05		V
			T_{vj} = 175°C		2.15		V
Collector cut-off current 集电极截止电流	I_{CES}	V_{CE} = 1050 V, V_{GE} = 0 V	T_{vj} = 25°C			1	mA
			T_{vj} = 125°C		1		mA
			T_{vj} = 175°C		15		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 = 12 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		3.5		6	V
Gate charge 栅极电荷	Q_G	I_C = 450 A, V_{CE} = 650 V, V_{GE} = -15 V .. 15 V			3.1		µC
Input capacitance 输入电容	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25°C			46		nF
Output capacitance 输出电容	C_{oes}				1.12		nF
Reverse tansfer capacitance 反向传输电容	C_{res}				0.46		nF
Internal gate resistor 栅极内阻	R_{Gint}	Per switch			0.8		Ω
Turn-on delay time 开通延迟	$t_{d(on)}$	V_{CC} = 650 V, I_C = 200 A, R_G = 2.5 Ω, V_{GE} = -6/+15 V, c_{GE} = 10 nF, L_s = 17 nH, inductive load	T_{vj} = 25°C		106		ns
			T_{vj} = 150°C		114		ns
			T_{vj} = 175 °C		115		ns
Rise time 上升时间	t_r		T_{vj} = 25°C		22		ns
			T_{vj} = 150 °C		24		ns
			T_{vj} = 175 °C		24		ns
Turn-off delay time 关断延迟	$t_{d(off)}$	V_{CC} = 650 V, I_C = 200 A, R_G = 8.2 Ω, V_{GE} = -6/+15 V, c_{GE} = 10 nF, L_s = 17 nH, inductive load	T_{vj} = 25°C		1050		ns
			T_{vj} = 150 °C		1210		ns
			T_{vj} = 175 °C		1250		ns
Fall time 下降时间	t_f		T_{vj} = 25°C		52		ns
			T_{vj} = 150°C		109		ns
			T_{vj} = 175°C		110		ns
Turn-on switching energy 开通损耗	E_{on}	V_{CC} = 650 V, I_C = 200 A, R_G = 2.5 Ω, V_{GE} =-6/+15 V, c_{GE} = 10 nF, L_s = 17 nH, inductive load	T_{vj} = 25°C		3.5		mJ
			T_{vj} = 150°C		4.4		mJ
			T_{vj} = 175°C		4.55		mJ
Turn-off switching energy 关断损耗	E_{off}	V_{CC} = 650 V, I_C = 200 A, R_G = 2.5 Ω, V_{GE} = -6/+15 V, c_{GE} = 10 nF, L_s = 17 nH, inductive load	T_{vj} = 25°C		17.5		mJ
			T_{vj} = 150°C		21.6		mJ
			T_{vj} = 175°C		23		mJ

[3] Characteristic values according to IEC 60747-9
[4] Collector-emitter saturation voltage is given at chip-level 集电极-发射极饱和电压

IGBT[5] T2, T3

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		1050			V
Collector-emitter saturation voltage [6] 集电极-发射极饱和电压	V_{CEsat}	I_c = 600 A, V_{GE} = 15 V	T_{vj} = 25°C		1.65	2	V
			T_{vj} = 150°C		2.05		V
			T_{vj} = 175°C		2.15		V
Collector cut-off current 集电极截止电流	I_{CES}	V_{CE} = 1050 V, V_{GE} = 0 V	T_{vj} = 25°C			1	mA
			T_{vj} = 125°C		1		mA
			T_{vj} = 175°C		15		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 = 12 mA, V_{CE} = V_{GE}, T_{vj} = 25°C		3.5		6	V
Gate charge 栅极电荷	Q_G	I_C = 450 A, V_{CE} = 650 V, V_{GE} = -15 V .. 15 V			3.1		µC
Input capacitance 输入电容	C_{ies}	V_{CE} = 25 V, V_{GE} = 0 V, f = 100 kHz, T_{vj} = 25°C			46		nF
Output capacitance 输出电容	C_{oes}				1.12		nF
Reverse tansfer capacitance 反向传输电容	C_{res}				0.46		nF
Internal gate resistor 栅极内阻	R_{Gint}	Per switch			0.8		Ω
Turn-on delay time 开通延迟	$t_{d(on)}$	V_{CC} = 650 V, I_C = 200 A, R_G = 2.5 Ω, V_{GE} =-6/+15 V, c_{GE} = 10 nF, L_s = 27 nH, inductive load	T_{vj} = 25°C		114		ns
			T_{vj} = 150°C		119		ns
			T_{vj} = 175°C		119		ns
Rise time 上升时间	t_r		T_{vj} = 25°C		23		ns
			T_{vj} = 150°C		25		ns
			T_{vj} = 175°C		27		ns
Turn-off delay time 关断延迟	$t_{d(off)}$	V_{CC} = 650 V, I_C = 200 A, R_G = 10 Ω, V_{GE} =-6/+15 V, c_{GE} = 10 nF, L_s = 27 nH, inductive load	T_{vj} = 25°C		1240		ns
			T_{vj} = 150°C		1410		ns
			T_{vj} = 175°C		1450		ns
Fall time 下降时间	t_f		T_{vj} = 25°C		40		ns
			T_{vj} = 150°C		72		ns
			T_{vj} = 175°C		83		ns
Turn-on switching energy 开通损耗	E_{on}	V_{CC} = 650 V, I_C = 200 A, R_G = 2.5 Ω, V_{GE} =-6/+15 V, c_{GE} = 10 nF, L_s = 27 nH, inductive load	T_{vj} = 25°C		5		mJ
			T_{vj} = 150°C		5.4		mJ
			T_{vj} = 175°C		5.7		mJ
Turn-off switching energy 关断损耗	E_{off}	V_{CC} = 650 V, I_C = 200 A, R_G = 10 Ω, V_{GE} =-6/+15 V, c_{GE} = 10 nF, L_s = 27 nH, inductive load	T_{vj} = 25°C		18.6		mJ
			T_{vj} = 150°C		23.5		mJ
			T_{vj} = 175°C		25.1		mJ

[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

Diode[7] D2, D3

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		2.3		V
			T_{vj} = 150°C		2.4		V
			T_{vj} = 175°C		2.35		V

SiC inverse Diode[9] D1, D4

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[10] 正向压降	V_F	I_F = 300 A	T_{vj} = 25°C		1.55		V
			T_{vj} = 150°C		2.15		V
			T_{vj} = 175°C		2.3		V
Peak reverse recovery current 反向恢复电流峰值	I_{RM}	V_R = 650 V, I_F = 200 A, dI/dt = 5100 A/µs (175°C), R_G = 2.5 Ω, V_{GE} =-6/+15 V, c_{GE} = 10 nF, L_s = 27 nH, inductive load	T_{vj} = 25°C		60		A
			T_{vj} = 150°C		60		A
			T_{vj} = 175°C		60		A
Recovery charge 恢复电荷	Q_{rr}		T_{vj} = 25°C		0.85		µC
			T_{vj} = 150°C		0.84		µC
			T_{vj} = 175°C		1.25		µC
Reverse recovery time 反向恢复时间	t_{rr}		T_{vj} = 25°C		23		ns
			T_{vj} = 150°C		24		ns
			T_{vj} = 175°C		26		ns
Reverse recovery energy 反向恢复能量	E_{rec}		T_{vj} = 25°C		0.34		mJ
			T_{vj} = 150°C		0.35		mJ
			T_{vj} = 175°C		0.37		mJ

[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。

SiC neutral point Diode[9] D5, D6

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[10] 正向压降	V_F	I_F = 200 A	T_{vj} = 25°C		1.5		V
			T_{vj} = 150°C		2.0		V
			T_{vj} = 175°C		2.15		V
Peak reverse recovery current 反向恢复电流峰值	I_{RM}	V_R = 650 V, I_F = 200 A, dI/dt = 6200 A/µs (175°C), R_G = 2.5 Ω, V_{GE} = -6/+15 V, C_{GE} = 10 nF, L_s = 17 nH, inductive load	T_{vj} = 25°C		83		A
			T_{vj} = 150°C		75		A
			T_{vj} = 175°C		75		A
Recovery charge 恢复电荷	Q_{rr}		T_{vj} = 25°C		0.74		µC
			T_{vj} = 150°C		0.58		µC
			T_{vj} = 175°C		0.59		µC
Reverse recovery time 反向恢复时间	t_{rr}		T_{vj} = 25°C		12		ns
			T_{vj} = 150°C		30		ns
			T_{vj} = 175°C		30		ns
Reverse recovery energy 反向恢复能量	E_{rec}		T_{vj} = 25°C		0.23		mJ
			T_{vj} = 150°C		0.34		mJ
			T_{vj} = 175°C		0.35		mJ

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[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 结-壳热阻	$R_{th(j-c)IGBT}$	Per switch 每一个开关	T1, T4				0.074	K/W
			T2, T3				0.074	
Diode thermal resistance junction to case 二极管结-壳热阻	$R_{th(j-c)Diode}$		D1, D4				0.145	K/W
			D2, D3				0.132	
			D5, D6				0.193	
IGBT thermal resistance case to heatsink IGBT 壳到散热器热阻	$R_{th(c-s)IGBT}$	IGBT per switch IGBT 每一个开关	T1, T4			0.030		K/W
			T2, T3			0.030		
Diode thermal resistance case to heatsink 二极管壳到散热器热阻	$R_{th(c-s)Diode}$	diode per switch 二极管每一个开关	D1, D4			0.045		K/W
			D2, D3			0.045		
			D5, D6			0.065		
Comparative tracking index 相对漏电起痕指数	CTI				600			
Module stray inductance 模块自身杂散电感	$L_{s\ CIn}$	Inner commutation loop				7.7		nH
	$L_{s\ COut}$	Outer commutation loop				4.5		nH
Resistance, terminal chip 端子到芯片之间的阻抗	$R_{CC'+EE'}$ $R_{AA'+CC'}$	Per leg, T_C = 25°C		T1+T2			0.245	mΩ
				D5+T2			0.425	mΩ
				T3+D6			0.345	mΩ
				T3+T4			0.255	mΩ
				D1+D2			0.475	mΩ
				D3+D4			0.450	mΩ
Maximum RMS current per pin 最大端子电流	$I_{Term\ RMS}$					50		A

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

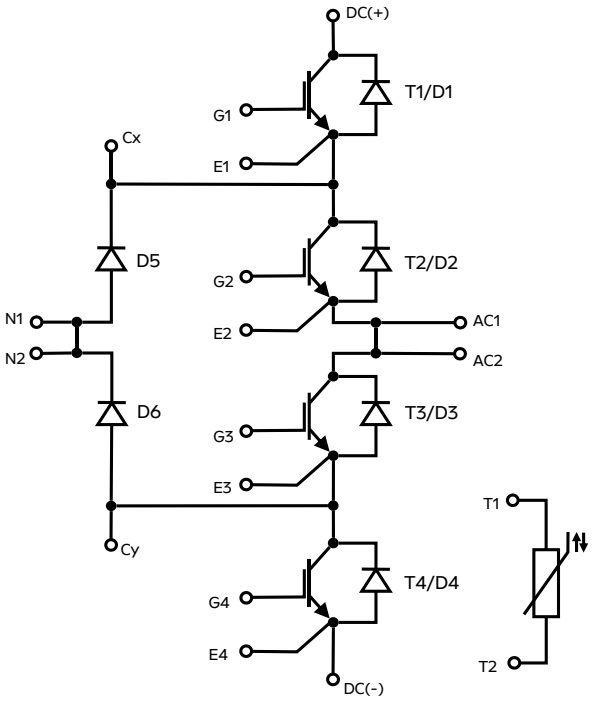
Mechanical properties 机械特性

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			113 x 62 x 17.3		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		15.7		mm
			Terminal to terminal: 端子到端子		5.4		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		17.5		mm
			Terminal to terminal: 端子到端子		5.4		mm
Mass 重量	m				250		g

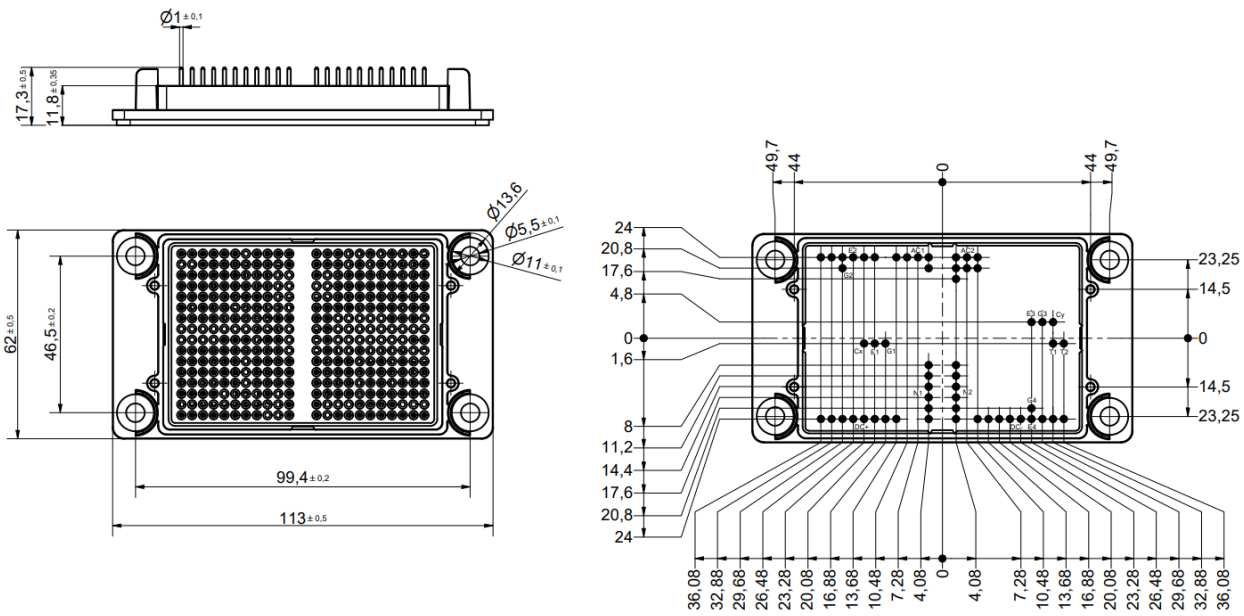
Ordering Information 订购信息

OPTION 选项	ARTICLE NUMBER 商品编号
Welded straight pins	SIST0650FP105i23_A02
Soldered flexible pins	SIST0650FP105i23_A03

Electrical configuration 电气图



Outline drawing 外形图

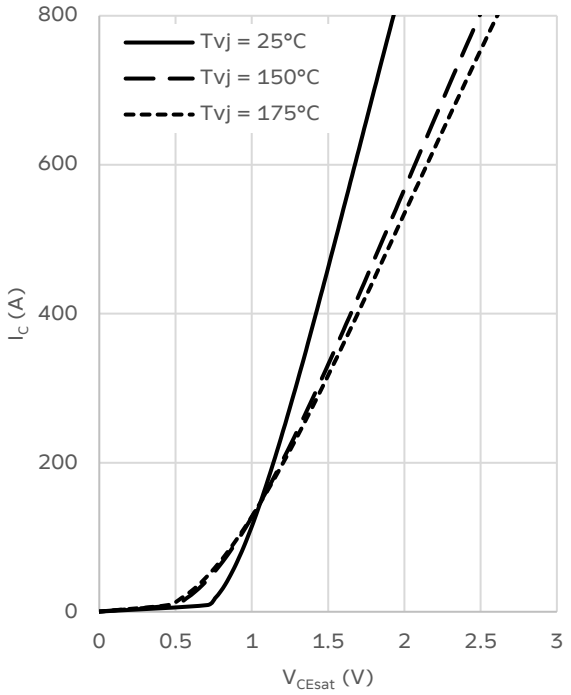


This is an electrostatic sensitive device. 本产品对静电特别敏感.
This product has been designed and qualified for Industrial Level. 本产品的设计符合工业级标准.

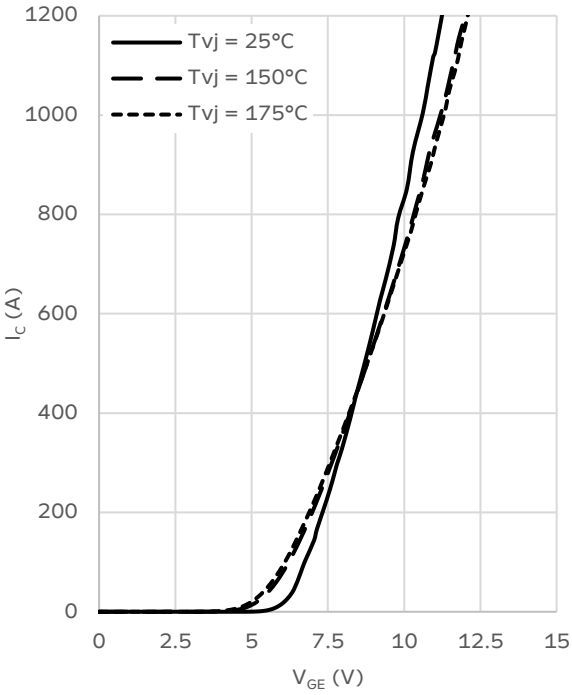
Characteristics 特性曲线

IGBT 1, 2, 3, 4

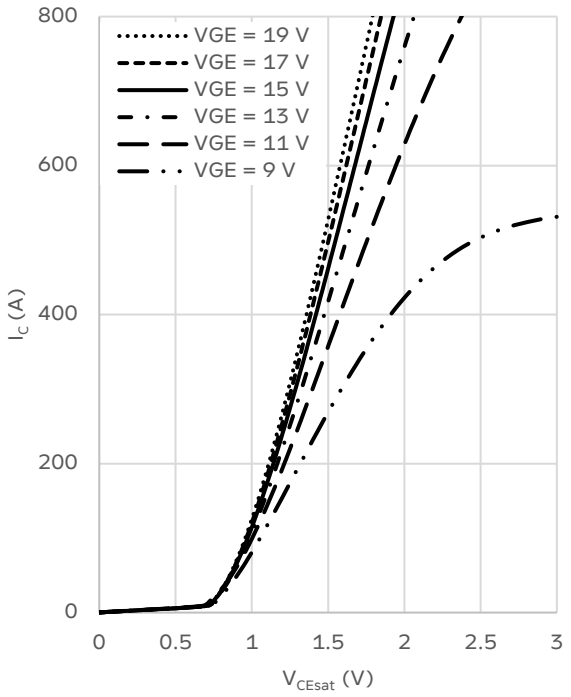
IGBT on-state characteristics T1 - T4 (typical)
IGBT 通态特性曲线（典型）
$I_C = f(V_{CE})$
V_{GE} = 15 V



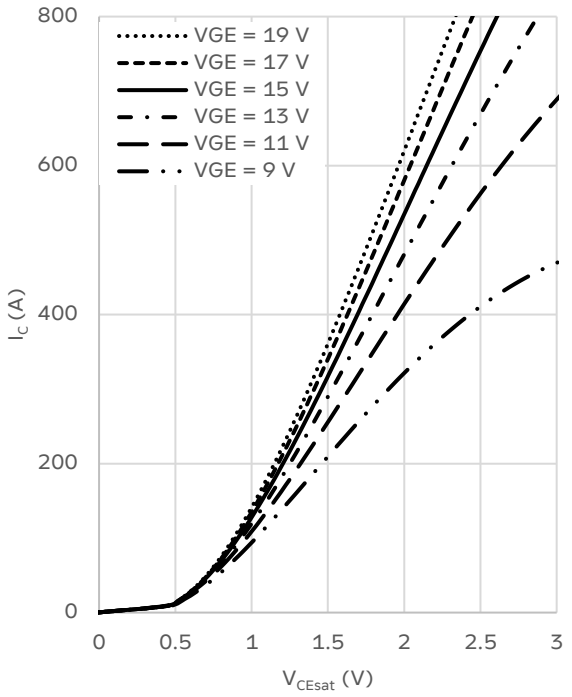
IGBT transfer characteristics T1 - T4 (typical)
IGBT 转移特性曲线（典型）
$I_C = f(V_{GE})$
V_{CE} = 20V



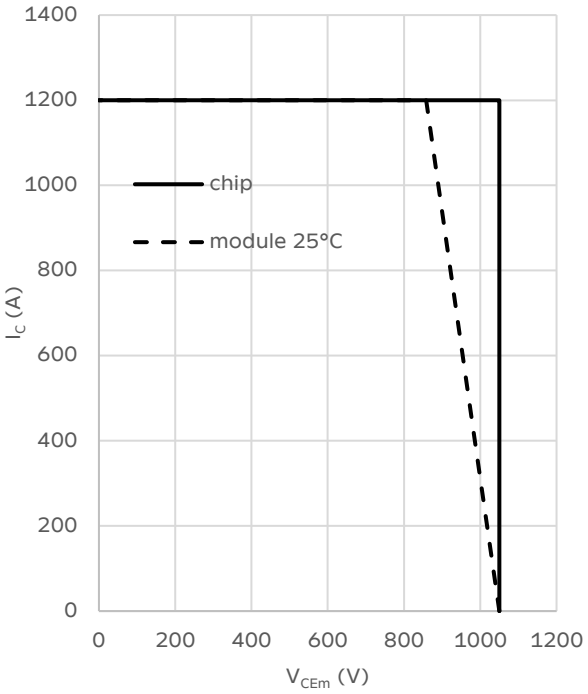
IGBT output characteristics T1 - T4 (typical)
IGBT 输出特性曲线（典型）
$I_C = f(V_{CE})$
T_{vj} = 25 °C



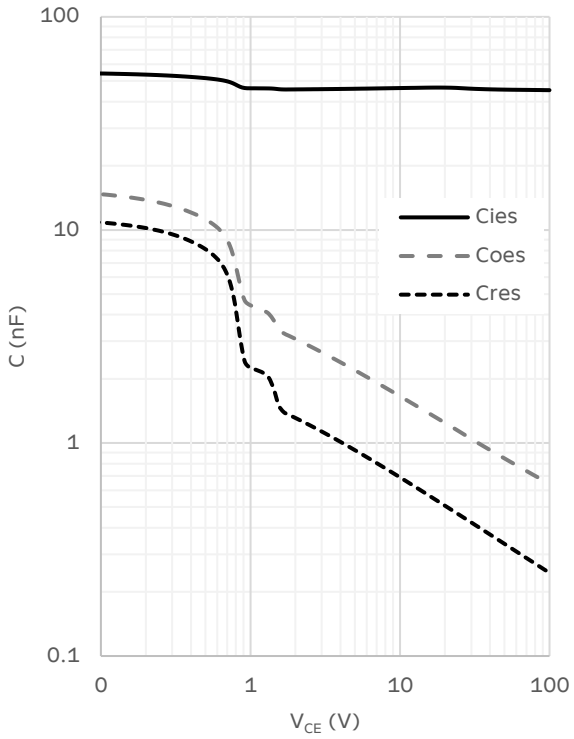
IGBT output characteristics T1 - T4 (typical)
IGBT 输出特性曲线（典型）
$I_C = f(V_{CE})$
T_{vj} = 175 °C



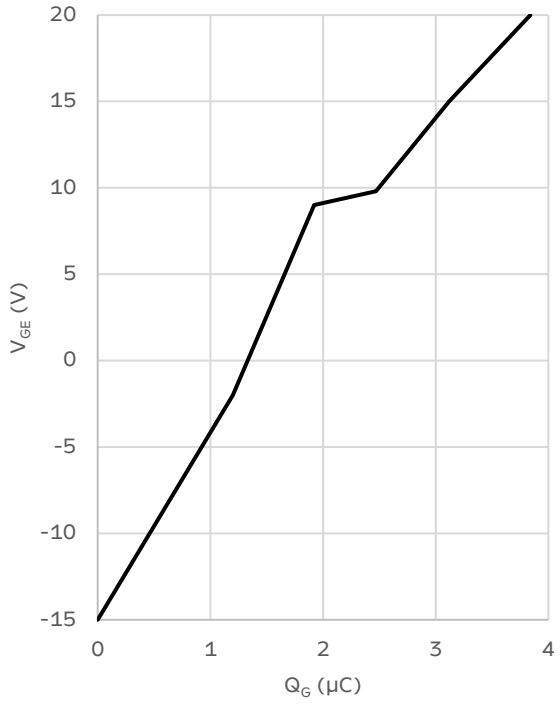
IGBT RBSOA
IGBT 反偏安全工作区域
$I_C = f(V_{CEm})$
$R_{Goff} > 10\ \Omega$, $V_{GE} = -6/+15$ V



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

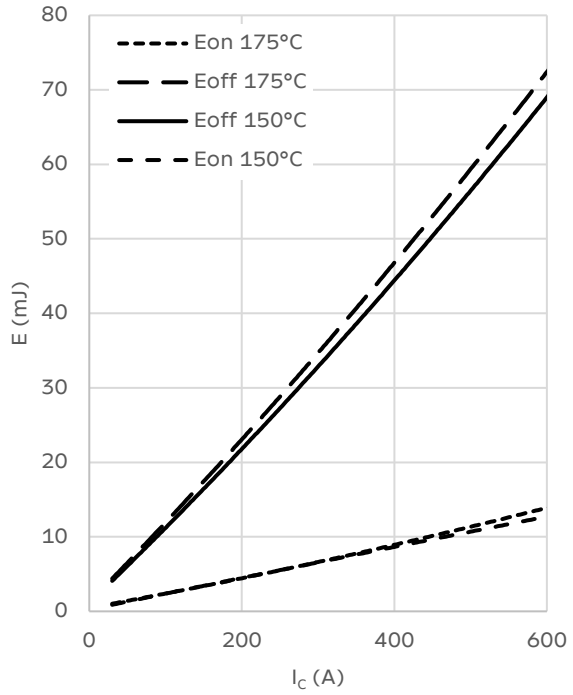


IGBT gate charge (typical)
$V_{GE} = f(Q_G)$, $T_{vj} = 25$°C
$V_{CE} = 650$ V, $I_C = 450$ A

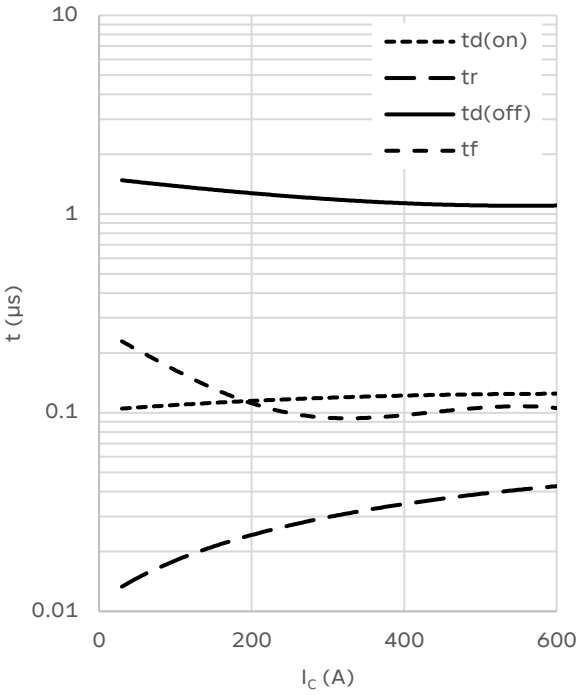


IGBT 1 / 4

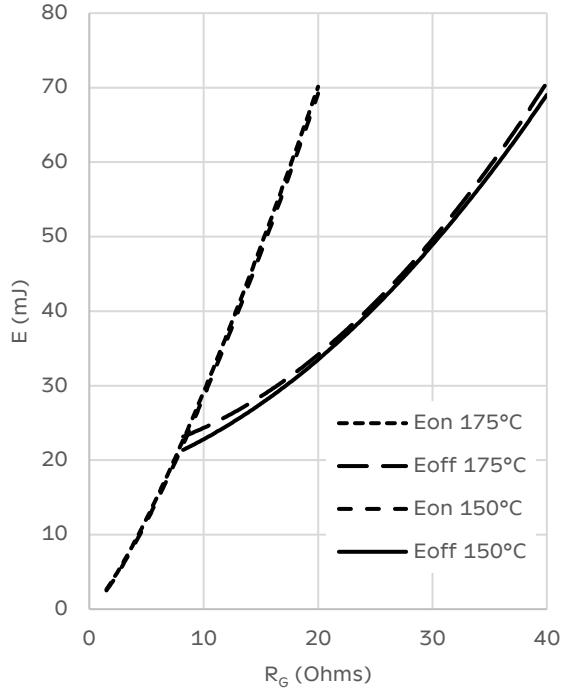
IGBT switching losses T1, T4 (typical)
IGBT 开关损耗曲线（典型）
$E = f(I_{CE})$
V_{CE} = 650 V, R_{Gon} = 2.5 Ω, R_{Goff} = 8.2 Ω, C_{GE} = 10 nF,
V_{GE} = -6/+15 V



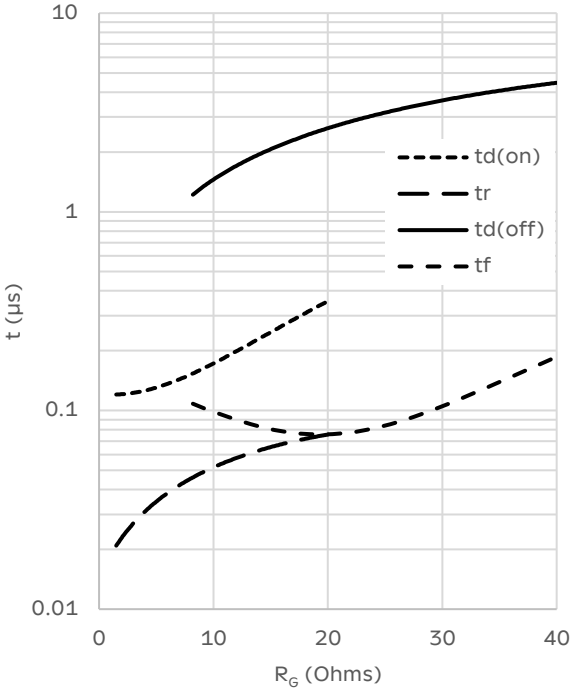
IGBT switching times T1, T4 (typical)
IGBT 开关时间曲线（典型）
$t = f(I_{CE})$, T_{vj} = 175 °C
V_{CE} = 650 V, R_{Gon} = 2.5 Ω, R_{Goff} = 8.2 Ω, C_{GE} = 10 nF,
V_{GE} = -6/+15 V



IGBT switching losses T1, T4 (typical)
IGBT 开关损耗曲线（典型）
$E = f(R_G)$
V_{CE} = 650 V, I_C = 200 A, V_{GE} = -6/+15 V, C_{GE} = 10 nF

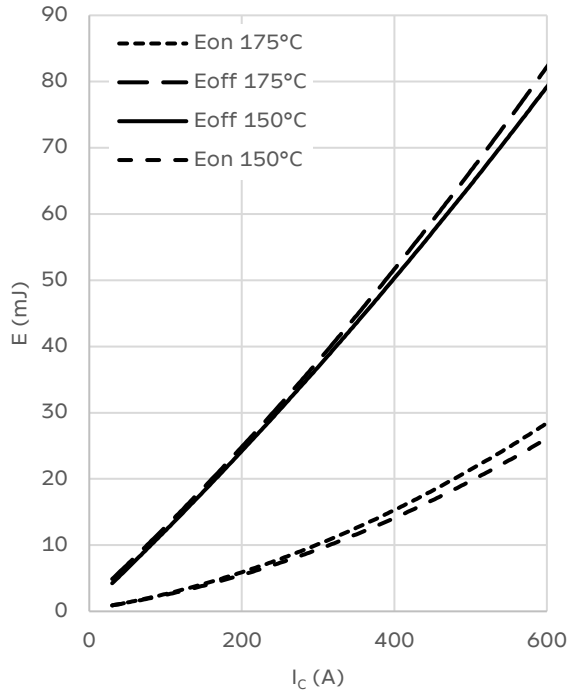


IGBT switching times T1, T4 (typical)
IGBT 开关时间曲线（典型）
$t = f(R_G)$, T_{vj} = 175 °C
V_{CE} = 650 V, I_C = 200 A, V_{GE} = -6/+15 V, C_{GE} = 10 nF

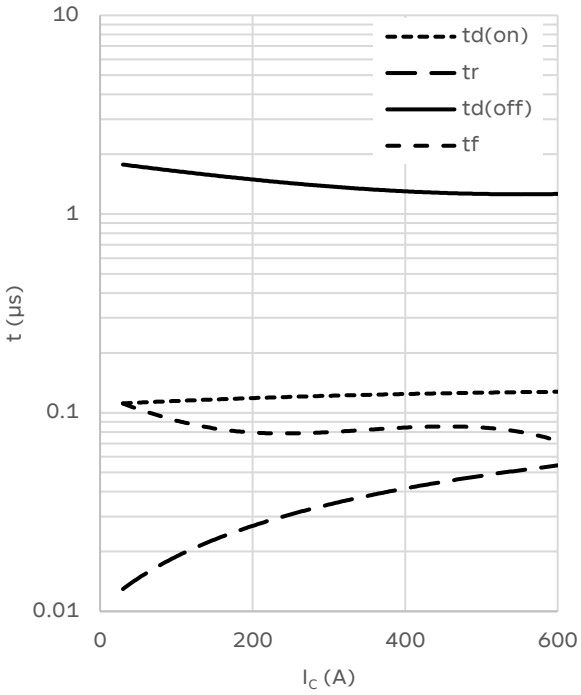


IGBT 2 / 3

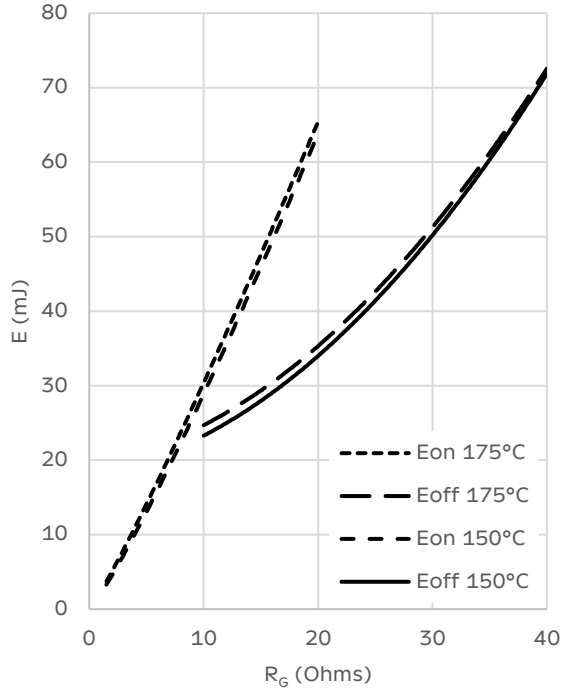
IGBT switching losses T2, T3 (typical)
IGBT 开关损耗曲线（典型）
$E = f(I_{CE})$
V_{CE} = 650 V, R_{Gon} = 2.5 Ω, R_{Goff} = 10 Ω, C_{GE} = 10 nF,
V_{GE} = -6/+15 V



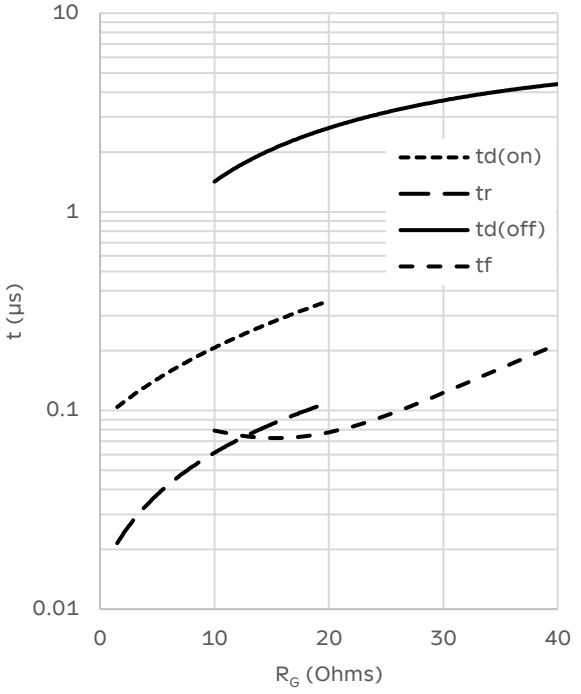
IGBT switching times T2, T3 (typical)
IGBT 开关时间曲线（典型）
$t = f(I_{CE})$, T_{vj} = 175 °C
V_{CE} = 650 V, R_{Gon} = 2.5 Ω, R_{Goff} = 10 Ω, C_{GE} = 10 nF,
V_{GE} = -6/+15 V



IGBT switching losses T2, T3 (typical)
IGBT 开关损耗曲线（典型）
$E = f(R_G)$
V_{CE} = 650 V, I_C = 200 A, V_{GE} = -6/+15 V, C_{GE} = 10 nF

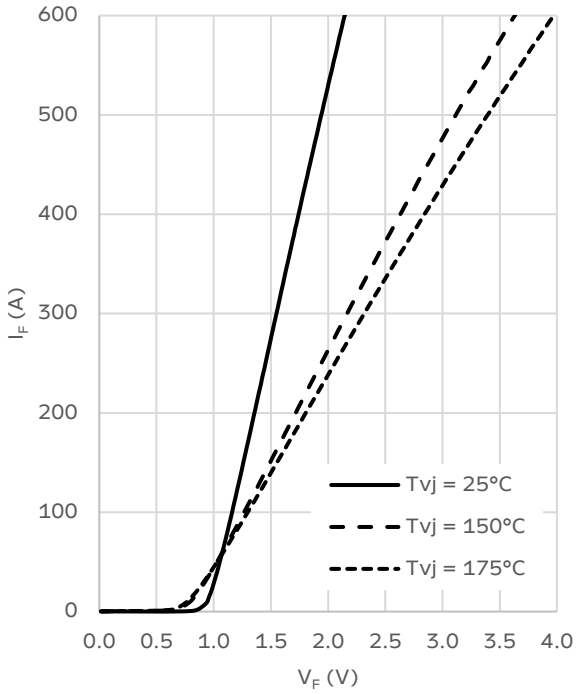


IGBT switching times T2, T3 (typical)
IGBT 开关时间曲线（典型）
$t = f(R_G)$, T_{vj} = 175 °C
V_{CE} = 650 V, I_C = 200 A, V_{GE} = -6/+15 V, C_{GE} = 10 nF

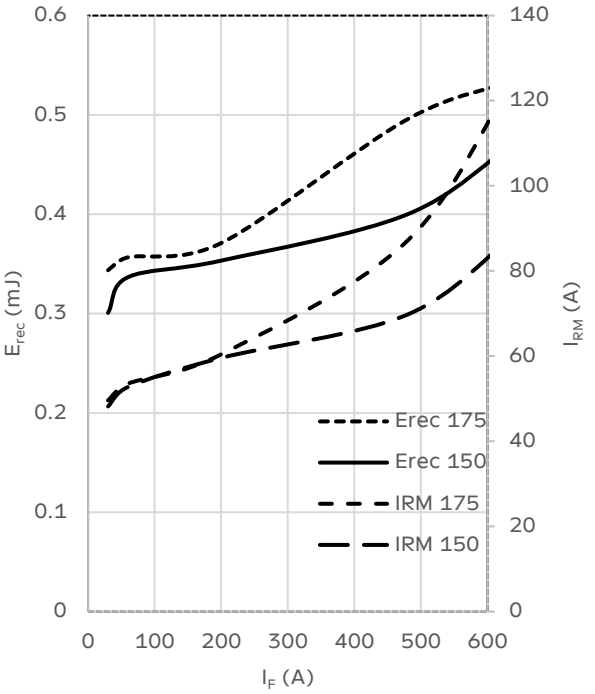


Diode 1 / 4

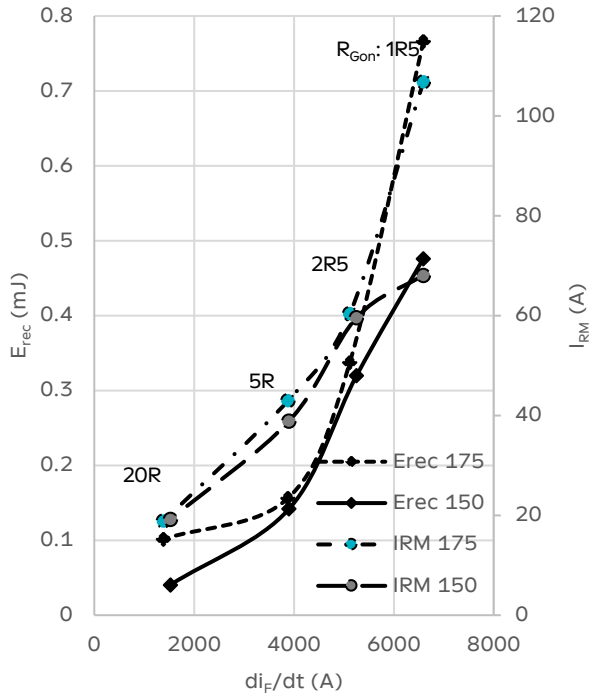
Diode forward characteristic D1, D4 (typical)
二极管正向特性（典型）
$I_F = f(V_F)$



Diode switching characteristics D1, D4 (typical)
二极管开关特性（典型）
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
V_{CE} = 650 V, R_{Gon} = 2.5 Ω, C_{GE} = 10 nF, V_{GE} = -6/+15 V

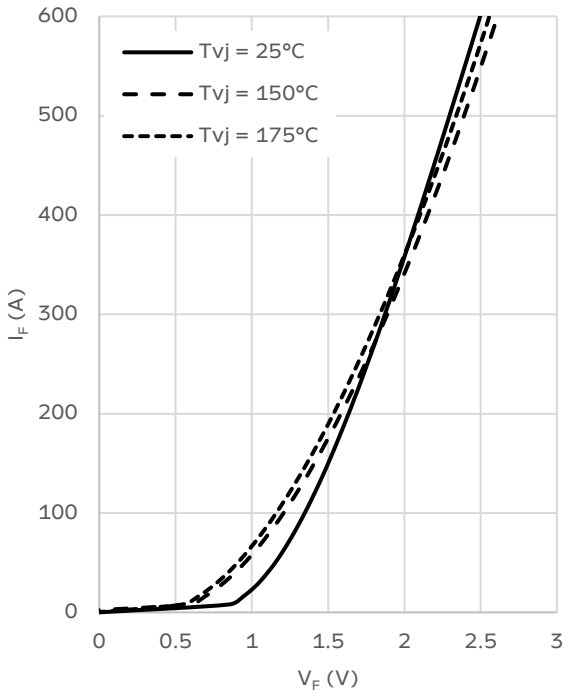


Diode switching characteristics D1, D4 (typical)
二极管开关特性（典型）
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
V_{CE} = 650 V, I_C = 200 A, V_{GE} = -6/+15 V, C_{GE} = 10 nF



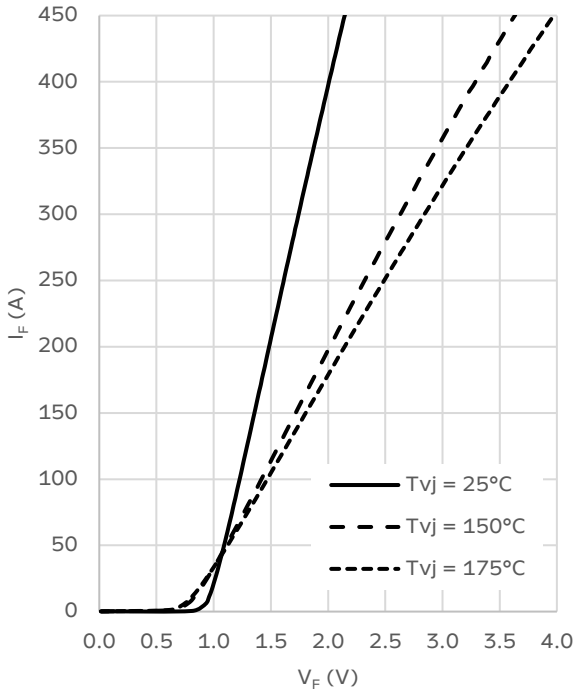
Diode 2 / 3

Diode forward characteristic D2, D3 (typical)
二极管正向特性（典型）
$I_F = f(V_F)$

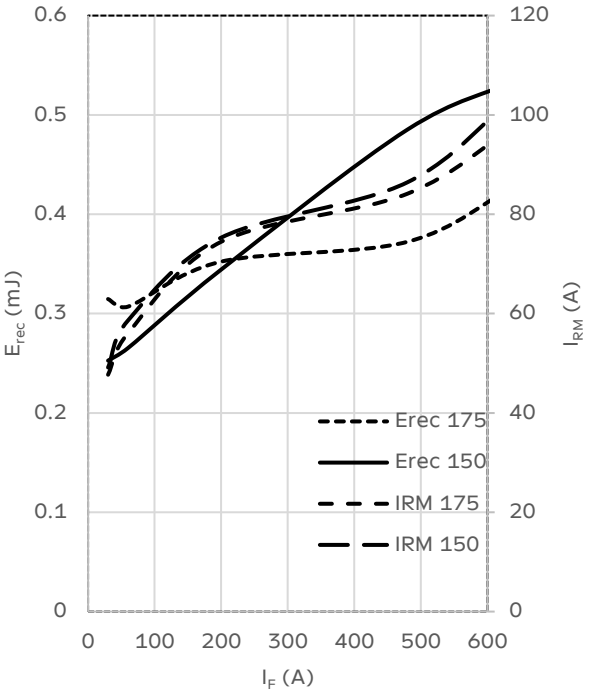


Diode 5 / 6

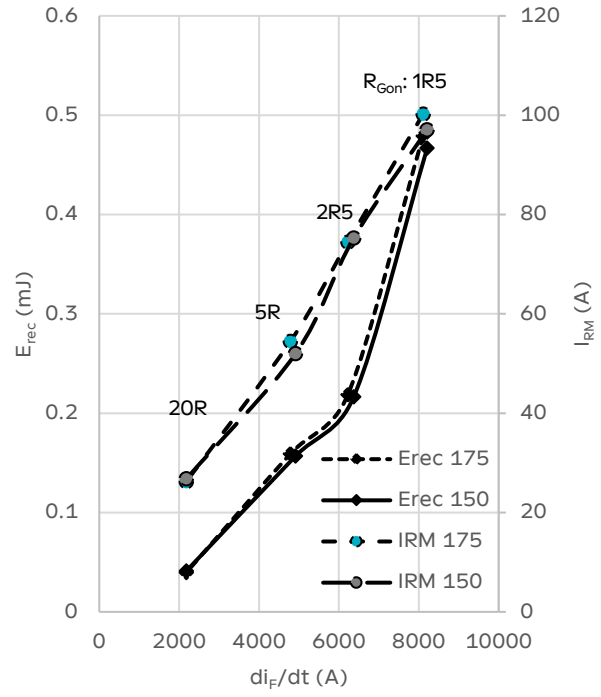
Diode forward characteristic D5, D6 (typical)
二极管正向特性（典型）
$I_F = f(V_F)$



Diode switching characteristics D5, D6 (typical)
二极管开关特性（典型）
$E_{rec} = f(I_F)$, $I_{RM} = f(I_F)$
V_{CE} = 650 V, R_{Gon} = 2.5 Ω, C_{GE} = 10 nF, V_{GE} = -6/+15 V

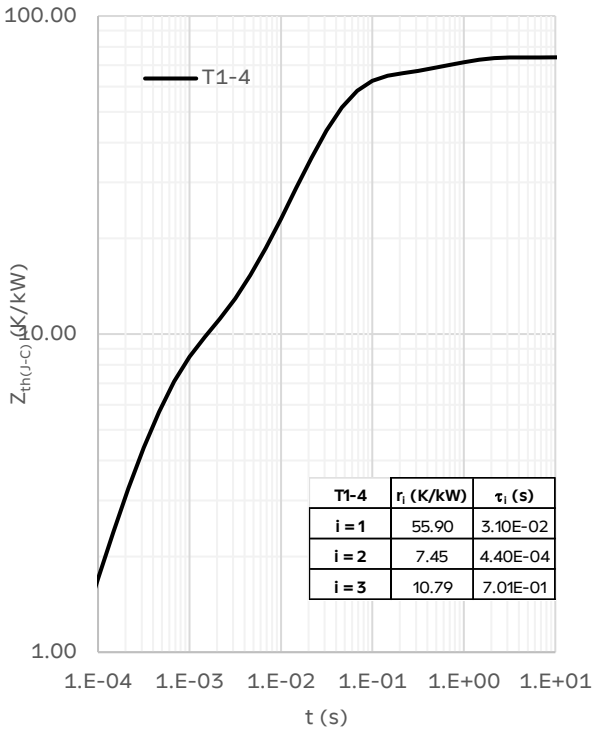


Diode switching characteristics D5, D6 (typical)
二极管开关特性（典型）
$E_{rec} = f(di/dt)$, $I_{RM} = f(di/dt)$
V_{CE} = 650 V, I_C = 200 A, V_{GE} = -6/+15 V, C_{GE} = 10 nF



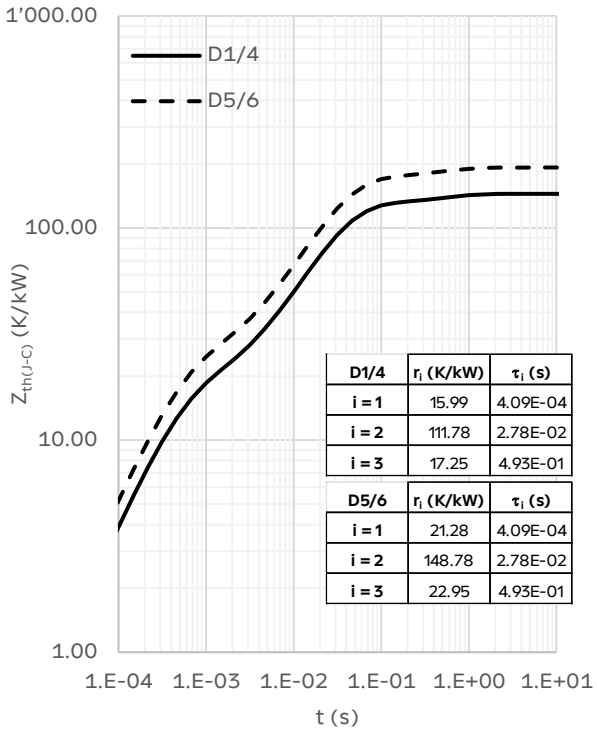
Thermal Impedance

Thermal impedance IGBT 1-4
热阻抗（典型）
$Z_{th(j-c)} = f(t)$



T1-4	r_i (K/kW)	τ_i (s)
i = 1	55.90	3.10E-02
i = 2	7.45	4.40E-04
i = 3	10.79	7.01E-01

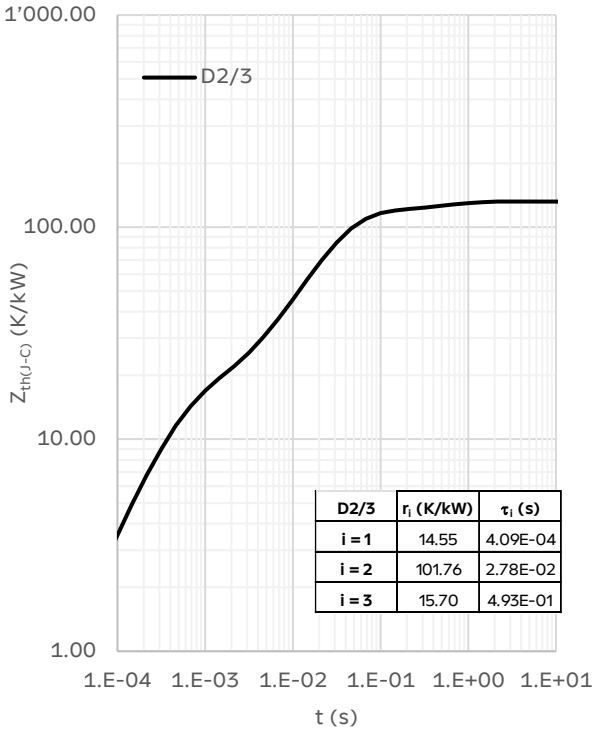
Thermal impedance SiC SBD D1/4 & D5/6
热阻抗（典型）
$Z_{th(j-c)} = f(t)$



D1/4	r_i (K/kW)	τ_i (s)
i = 1	15.99	4.09E-04
i = 2	111.78	2.78E-02
i = 3	17.25	4.93E-01

D5/6	r_i (K/kW)	τ_i (s)
i = 1	21.28	4.09E-04
i = 2	148.78	2.78E-02
i = 3	22.95	4.93E-01

Thermal impedance Si Diode D2/3
热阻抗（典型）
$Z_{th(j-c)} = f(t)$



D2/3	r_i (K/kW)	τ_i (s)
i = 1	14.55	4.09E-04
i = 2	101.76	2.78E-02
i = 3	15.70	4.93E-01

Revision History 修订历史

Release 发布	Version 版本	Description 描述
2026-07-30	v5.0	Final Datasheet
2026-09-01	V6.0	QG graph added