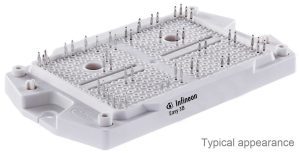
Final datasheet

EasyPACK™ 模块 采用 CoolSiC™ Trench MOSFET 带有 PressFIT 压接管脚和温度检测 NTC

特性


Typical appearance

- 电气特性
  - V_{CES} = 1200 V
  - $I_{C\,nom}$ = 200 A / I_{CRM} = 400 A
  - 增加直流母线电压
  - 高电流密度
  - 低开关损耗
  - 可以从下面链接寻找适合的英飞凌驱动 IC https://www.infineon.com/gdfinder
- 机械特性
  - 高电流压接管脚
  - 集成 NTC 温度传感器
  - PressFIT 压接技术
  - 集成的安装夹使安装坚固

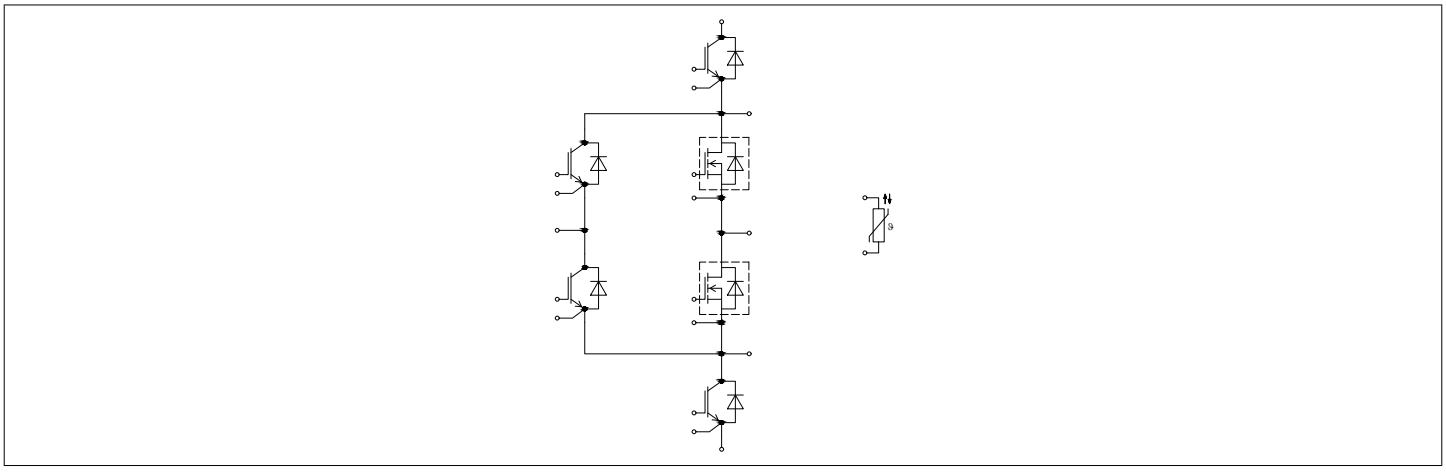
可选应用

- 三电平应用
- 高频开关应用
- 太阳能应用

产品认证

- 根据 IEC 60747、60749 和 60068 标准的相关测试，符合工业应用的要求。

描述



内容

1 封装

表 1 绝缘参数

特征参数	代号	标注或测试条件	数值	单位
绝缘测试电压	V_{ISOL}	RMS, f = 50 Hz, *t* = 1 min	3.2	kV
NTC 绝缘测试电压	$V_{ISOL(NTC)}$	RMS, f = 50 Hz, *t* = 1 min	3.2	kV
内部绝缘		基本绝缘 (class 1, IEC 61140)	Al_2O_3	
相对电痕指数	*CTI*		> 400	
相对温度指数 (电)	*RTI*	封装	140	°C

表 2 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
杂散电感,模块	L_{sCE}				39		nH
模块引线电阻,端子-芯片	$R_{CC'+EE'}$	T_H = 25 °C, 每个开关			2.4		mΩ
储存温度	T_{stg}			-40		125	°C
模块安装的安装扭距	*M*	根据相应的应用手册进行安装	M5, 螺丝	1.3		1.5	Nm
重量	*G*				78		g

注: The current under continuous operation is limited to 50A rms per connector pin.

2 IGBT, T1 / T4

表 3 最大标定值

特征参数	代号	标注或测试条件		数值	单位
集电极－发射极电压	V_{CES}		T_{vj} = 25 °C	950	V
集电极电流	I_{CN}			200	A
连续集电极直流电流	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 65 °C	180	A
集电极重复峰值电流	I_{CRM}	t_p 受限于 $T_{vj\,op}$		400	A
栅极－发射极峰值电压	V_{GES}			±20	V

表 4　　特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
集电极一发射极饱和电压	$V_{CE\,sat}$	I_C = 200 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.30	1.40	V
			T_{vj} = 125 °C		1.35		
			T_{vj} = 150 °C		1.35		
栅极阈值电压	V_{GEth}	I_C = 3.25 mA, V_{CE} = 20 V, T_{vj} = 25 °C		4.15	4.9	5.65	V
栅极电荷	Q_G	V_{GE} = ±15 V, V_{CC} = 600 V, T_{vj} = 25 °C			2.05		µC
内部栅极电阻	R_{Gint}	T_{vj} = 25 °C			1.5		Ω
输入电容	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			24.6		nF
反向传输电容	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.114		nF
集电极-发射极截止电流	I_{CES}	V_{CE} = 950 V, V_{GE} = 0 V	T_{vj} = 25 °C			37	µA
栅极-发射极漏电流	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA
开通延迟时间(感性负载)	t_{don}	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 18 Ω	T_{vj} = 25 °C		0.298		µs
			T_{vj} = 125 °C		0.268		
			T_{vj} = 150 °C		0.254		
上升时间(感性负载)	t_r	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 18 Ω	T_{vj} = 25 °C		0.045		µs
			T_{vj} = 125 °C		0.056		
			T_{vj} = 150 °C		0.059		
关断延迟时间(感性负载)	t_{doff}	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 82 Ω	T_{vj} = 25 °C		3.390		µs
			T_{vj} = 125 °C		3.580		
			T_{vj} = 150 °C		3.590		
下降时间(感性负载)	t_f	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 82 Ω	T_{vj} = 25 °C		0.212		µs
			T_{vj} = 125 °C		0.372		
			T_{vj} = 150 °C		0.443		
开通损耗能量 (每脉冲)	E_{on}	I_C = 200 A, V_{CC} = 600 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Gon} = 18 Ω, di/dt = 2800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		21.9		mJ
			T_{vj} = 125 °C		27		
			T_{vj} = 150 °C		28.5		
关断损耗能量 (每脉冲)	E_{off}	I_C = 200 A, V_{CC} = 600 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Goff} = 82 Ω, dv/dt = 1600 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		32		mJ
			T_{vj} = 125 °C		40.3		
			T_{vj} = 150 °C		42.8		
结一散热器热阻	R_{thJH}	每个 IGBT, λ_{grease} = 3.3 W/(m·K)			0.439		K/W
允许开关的温度范围	$T_{vj\,op}$			-40		150	°C

3 MOSFET, T2 / T3

表 5 最大标定值

特征参数	代号	标注或测试条件		数值	单位
漏源极电压	V_{DSS}		T_{vj} = 25 °C	1200	V
植入漏极电流	I_{DN}			240	A
连续漏极直流电流	I_{DDC}	T_{vj} = 175 °C, V_{GS} = 18 V	T_H = 65 °C	215	A
漏极重复峰值电流	I_{DRM}	verified by design, t_p limited by T_{vjmax}		530	A
栅-源瞬态最大电压	V_{GS}	D < 0.01		-10/23	V
栅-源稳态最大电压	V_{GS}			-7/20	V

表 6 推荐值

特征参数	代号	标注或测试条件	[ZH]Values	单位
通态栅极电压	$V_{GS(on)}$		15...18	V
断态栅极电压	$V_{GS(off)}$		-5...0	V

表 7 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
漏源通态电阻	$R_{DS(on)}$	I_D = 240 A	V_{GS}=18 V, T_{vj} = 25 °C		2.91	3.82	mΩ
			V_{GS}=18 V, T_{vj} = 125 °C		4.7		
			V_{GS}=18 V, T_{vj} = 175 °C		6.24		
			V_{GS}=15 V, T_{vj} = 25 °C		3.4		
栅极阈值电压	$V_{GS(th)}$	I_D = 112 mA, V_{DS} = V_{GS}, T_{vj} = 25 °C, (tested after 1ms pulse at V_{GS} = +20 V)		3.45	4.3	5.15	V
栅极电荷	Q_G	V_{DD}=800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			0.8		µC
内部栅极电阻	R_{Gint}	T_{vj}=25 °C			1.9		Ω
输入电容	C_{ISS}	f = 100 kHz, V_{DS}=800 V, V_{GS}=0 V	T_{vj}=25 °C		24.2		nF
输出电容	C_{OSS}	f = 100 kHz, V_{DS}=800 V, V_{GS}=0 V	T_{vj}=25 °C		1.2		nF
反向传输电容	C_{rss}	f = 100 kHz, V_{DS}=800 V, V_{GS}=0 V	T_{vj}=25 °C		0.079		nF
C_{OSS} 存储能量	E_{OSS}	V_{DS}=800 V, V_{GS} = -3/18 V, T_{vj} = 25 °C			473		µJ

(待续)

表 7　　(续) 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
漏源泄漏电流	I_{DSS}	V_{DS} = 1200 V, V_{GS} = -3 V	T_{vj} = 25 °C		0.16	378	µA
栅极漏电流	I_{GSS}	V_{DS} = 0 V, T_{vj} = 25 °C	V_{GS}=20 V			400	nA
开通延迟时间(感性负载)	$t_{d\,on}$	I_D = 240 A, R_{Gon} = 4.7 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 V_{GS} to 0.1 I_D	T_{vj} = 25 °C		78		ns
			T_{vj} = 125 °C		78		
			T_{vj} = 175 °C		78		
上升时间(感性负载)	t_r	I_D = 240 A, R_{Gon} = 4.7 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, t_{dead} = 1000 ns, 0.1 I_D to 0.9 I_D	T_{vj} = 25 °C		122		ns
			T_{vj} = 125 °C		115		
			T_{vj} = 175 °C		114		
关断延迟时间(感性负载)	$t_{d\,off}$	I_D = 240 A, R_{Goff} = 1 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, 0.9 V_{GS} to 0.9 I_D	T_{vj} = 25 °C		100		ns
			T_{vj} = 125 °C		111		
			T_{vj} = 175 °C		117		
下降时间(感性负载)	t_f	I_D = 240 A, R_{Goff} = 1 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V, 0.9 I_D to 0.1 I_D	T_{vj} = 25 °C		25		ns
			T_{vj} = 125 °C		26		
			T_{vj} = 175 °C		27		
开通损耗能量 (每脉冲)	E_{on}	I_D = 240 A, V_{DD} = 600 V, L_σ = 7 nH, V_{GS} = -3/18 V, R_{Gon} = 4.7 Ω, di/dt = 5.7 kA/µs (T_{vj} = 175 °C), t_{dead} = 1000 ns	T_{vj} = 25 °C		7.08		mJ
			T_{vj} = 125 °C		7.15		
			T_{vj} = 175 °C		7.16		
开通损耗能量 (每脉冲), 优化条件下	$E_{on,o}$	I_D = 240 A, V_{DD} = 600 V, L_σ = 7 nH, V_{GS} = -3/18 V, $R_{Gon,o}$ = 3 Ω, di/dt = 7.1 kA/µs (T_{vj} = 175 °C), t_{dead} = 100 ns	T_{vj} = 25 °C		4.51		mJ
			T_{vj} = 125 °C		4.54		
			T_{vj} = 175 °C		4.55		
关断损耗能量 (每脉冲）	E_{off}	I_D = 240 A, V_{DD} = 600 V, L_σ = 7 nH, V_{GS} = -3/18 V, R_{Goff} = 1 Ω, dv/dt = 17.5 kV/µs (T_{vj} = 175 °C)	T_{vj} = 25 °C		3.02		mJ
			T_{vj} = 125 °C		3.51		
			T_{vj} = 175 °C		3.68		
结－散热器热阻	R_{thJH}	每个 MOSFET, λ_{grease} = 3.3 W/(m·K)			0.283		K/W
允许开关的温度范围	$T_{vj\,op}$			-40		175	°C

注: *The selection of positive and negative gate-source voltages impacts losses and the long-term behavior of the MOSFET and body diode. The design guidelines described in Application Note AN 2018-09 and AN 2021-13 must be considered to ensure sound operation of the device over the planned lifetime.*

Tvj,op > 150°C is allowed for operation at overload conditions for MOSFET and body diode. For detailed specifications, please refer to AN 2021-13

4 Body diode (MOSFET, T2 / T3)

表 8 最大标定值

特征参数	代号	标注或测试条件		数值	单位
体二极管正向直流电流	I_{SD}	T_{vj} = 175 °C, V_{GS} = -3 V	T_H = 65 °C	95	A

表 9 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
正向电压	V_{SD}	I_{SD} = 240 A, V_{GS} = -3 V	T_{vj} = 25 °C		4.11	5.35	V
			T_{vj} = 125 °C		3.85		
			T_{vj} = 175 °C		3.75		
反向恢复峰值电流	I_{rrm}	I_{SD} = 240 A, di_s/dt = 5.5 kA/µs, V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		74		A
			T_{vj} = 125 °C		109		
			T_{vj} = 175 °C		134		
恢复电荷	Q_{rr}	I_{SD} = 240 A, di_s/dt = 5.5 kA/µs, V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		1.3		µC
			T_{vj} = 125 °C		2.7		
			T_{vj} = 175 °C		3.9		
反向恢复损耗（每脉冲）	E_{rec}	I_{SD} = 240 A, di_s/dt = 5.5 kA/µs (T_{vj} = 175 °C), V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 1000 ns	T_{vj} = 25 °C		0.38		mJ
			T_{vj} = 125 °C		0.89		
			T_{vj} = 175 °C		1.16		
反向恢复损耗（每脉冲），优化条件下	$E_{rec,o}$	I_{SD} = 240 A, di_s/dt = 6.9 kA/µs (T_{vj} = 175 °C), V_{DD} = 600 V, V_{GS} = -3 V, t_{dead} = 100 ns	T_{vj} = 25 °C		0.46		mJ
			T_{vj} = 125 °C		0.64		
			T_{vj} = 175 °C		0.91		

5 IGBT, T5 / T6

表 10 最大标定值

特征参数	代号	标注或测试条件		数值	单位
集电极－发射极电压	V_{CES}		T_{vj} = 25 °C	950	V
集电极电流	I_{CN}			200	A
连续集电极直流电流	I_{CDC}	$T_{vj\,max}$ = 175 °C	T_H = 65 °C	160	A
集电极重复峰值电流	I_{CRM}	t_p 受限于 $T_{vj\,op}$		400	A
栅极－发射极峰值电压	V_{GES}			±20	V

表 11　　特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
集电极一发射极饱和电压	$V_{CE\,sat}$	I_C = 200 A, V_{GE} = 15 V	T_{vj} = 25 °C		1.30	1.40	V
			T_{vj} = 125 °C		1.35		
			T_{vj} = 150 °C		1.35		
栅极阈值电压	V_{GEth}	I_C = 3.25 mA, V_{CE} = 20 V, T_{vj} = 25 °C		4.15	4.9	5.65	V
栅极电荷	Q_G	V_{GE} = ±15 V, V_{CC} = 600 V, T_{vj} = 25 °C			2.05		µC
内部栅极电阻	R_{Gint}	T_{vj} = 25 °C			1.5		Ω
输入电容	C_{ies}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			24.6		nF
反向传输电容	C_{res}	f = 100 kHz, T_{vj} = 25 °C, V_{CE} = 25 V, V_{GE} = 0 V			0.114		nF
集电极-发射极截止电流	I_{CES}	V_{CE} = 950 V, V_{GE} = 0 V	T_{vj} = 25 °C			32	µA
栅极-发射极漏电流	I_{GES}	V_{CE} = 0 V, V_{GE} = 20 V, T_{vj} = 25 °C				100	nA
开通延迟时间(感性负载)	t_{don}	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 18 Ω	T_{vj} = 25 °C		0.269		µs
			T_{vj} = 125 °C		0.255		
			T_{vj} = 150 °C		0.235		
上升时间(感性负载)	t_r	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Gon} = 18 Ω	T_{vj} = 25 °C		0.052		µs
			T_{vj} = 125 °C		0.065		
			T_{vj} = 150 °C		0.066		
关断延迟时间(感性负载)	t_{doff}	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 82 Ω	T_{vj} = 25 °C		3.420		µs
			T_{vj} = 125 °C		3.580		
			T_{vj} = 150 °C		3.590		
下降时间(感性负载)	t_f	I_C = 200 A, V_{CC} = 600 V, V_{GE} = ±15 V, R_{Goff} = 82 Ω	T_{vj} = 25 °C		0.174		µs
			T_{vj} = 125 °C		0.332		
			T_{vj} = 150 °C		0.363		
开通损耗能量 (每脉冲)	E_{on}	I_C = 200 A, V_{CC} = 600 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Gon} = 18 Ω, di/dt = 2500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		25.6		mJ
			T_{vj} = 125 °C		31.5		
			T_{vj} = 150 °C		34.2		
关断损耗能量 (每脉冲)	E_{off}	I_C = 200 A, V_{CC} = 600 V, L_σ = 7 nH, V_{GE} = ±15 V, R_{Goff} = 82 Ω, dv/dt = 1600 V/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		29.9		mJ
			T_{vj} = 125 °C		37.7		
			T_{vj} = 150 °C		40.1		
结一散热器热阻	R_{thJH}	每个 IGBT, λ_{grease} = 3.3 W/(m·K)			0.517		K/W
允许开关的温度范围	$T_{vj\,op}$			-40		150	°C

6 二极管, D1 / D4

表 12 最大标定值

特征参数	代号	标注或测试条件		数值	单位
反向重复峰值电压	V_{RRM}		T_{vj} = 25 °C	1200	V
连续正向直流电流	I_F			300	A
正向重复峰值电流	I_{FRM}	t_P = 1 ms		600	A
I2t-值	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	7380	A^2s
			T_{vj} = 150 °C	6320	

表 13 特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
正向电压	V_F	I_F = 160 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.41	1.64	V
			T_{vj} = 125 °C		1.28		
			T_{vj} = 150 °C		1.25		
反向恢复峰值电流	I_{RM}	V_{CC} = 600 V, I_F = 160 A, V_{GE} = -15 V, -di$_F$/dt = 2500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		99		A
			T_{vj} = 125 °C		143		
			T_{vj} = 150 °C		155		
恢复电荷	Q_r	V_{CC} = 600 V, I_F = 160 A, V_{GE} = -15 V, -di$_F$/dt = 2500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		15		µC
			T_{vj} = 125 °C		30		
			T_{vj} = 150 °C		35		
反向恢复损耗（每脉冲）	E_{rec}	V_{CC} = 600 V, I_F = 160 A, V_{GE} = -15 V, -di$_F$/dt = 2500 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		4.47		mJ
			T_{vj} = 125 °C		9.81		
			T_{vj} = 150 °C		11.8		
结－散热器热阻	R_{thJH}	每个二极管, λ_{grease} = 3.3 W/(m·K)			0.402		K/W
允许开关的温度范围	$T_{vj\,op}$			-40		150	°C

7 二极管, D5 / D6

表 14 最大标定值

特征参数	代号	标注或测试条件		数值	单位
反向重复峰值电压	V_{RRM}		T_{vj} = 25 °C	1200	V
连续正向直流电流	I_F			200	A
正向重复峰值电流	I_{FRM}	t_P = 1 ms		400	A

(待续)

表 14　　(续) 最大标定值

特征参数	代号	标注或测试条件		数值	单位
I2t-值	I^2t	t_P = 10 ms, V_R = 0 V	T_{vj} = 125 °C	5060	A^2s
			T_{vj} = 150 °C	4920	

表 15　　特征值

特征参数	代号	标注或测试条件		数值			单位
				最小值	典型值	最大值	
正向电压	V_F	I_F = 200 A, V_{GE} = 0 V	T_{vj} = 25 °C		1.72	2.10	V
			T_{vj} = 125 °C		1.59		
			T_{vj} = 150 °C		1.56		
反向恢复峰值电流	I_{RM}	V_{CC} = 600 V, I_F = 200 A, V_{GE} = -15 V, -di$_F$/dt = 2800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		101		A
			T_{vj} = 125 °C		126		
			T_{vj} = 150 °C		134		
恢复电荷	Q_r	V_{CC} = 600 V, I_F = 200 A, V_{GE} = -15 V, -di$_F$/dt = 2800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		12		µC
			T_{vj} = 125 °C		25		
			T_{vj} = 150 °C		30		
反向恢复损耗（每脉冲）	E_{rec}	V_{CC} = 600 V, I_F = 200 A, V_{GE} = -15 V, -di$_F$/dt = 2800 A/µs (T_{vj} = 150 °C)	T_{vj} = 25 °C		3.57		mJ
			T_{vj} = 125 °C		8.51		
			T_{vj} = 150 °C		10.3		
结－散热器热阻	R_{thJH}	每个二极管, λ_{grease} = 3.3 W/(m·K)			0.447		K/W
允许开关的温度范围	$T_{vj\,op}$			-40		150	°C

8　负温度系数热敏电阻

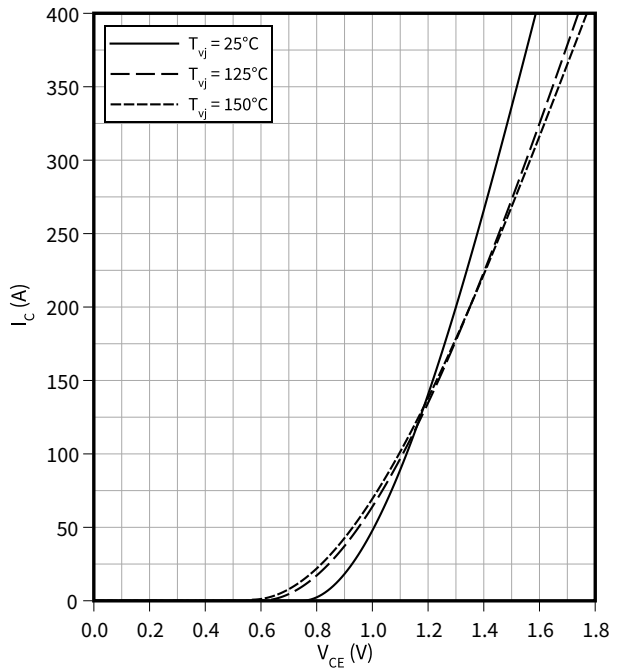
表 16　　特征值

特征参数	代号	标注或测试条件	数值			单位
			最小值	典型值	最大值	
额定电阻值	R_{25}	T_{NTC} = 25 °C		5		kΩ
R_{100} 偏差	$\Delta R/R$	T_{NTC} = 100 °C, R_{100} = 493 Ω	-5		5	%
耗散功率	P_{25}	T_{NTC} = 25 °C			20	mW
B-值	$B_{25/50}$	$R_2 = R_{25} \exp[B_{25/50}(1/T_2-1/(298{,}15\ K))]$		3375		K
B-值	$B_{25/80}$	$R_2 = R_{25} \exp[B_{25/80}(1/T_2-1/(298{,}15\ K))]$		3411		K
B-值	$B_{25/100}$	$R_2 = R_{25} \exp[B_{25/100}(1/T_2-1/(298{,}15\ K))]$		3433		K

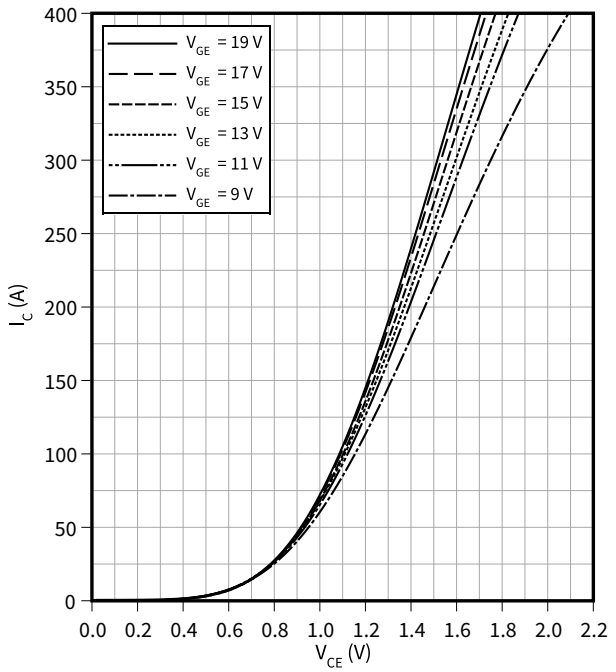
注:　NTC 的具体参数分析请见 AN2009-10, 第 4 章

9 特征参数图表

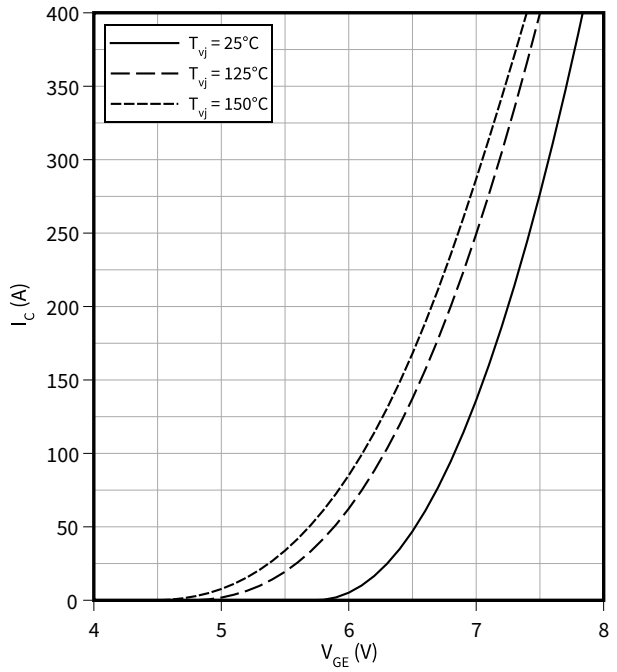
输出特性 （典型), IGBT, T1 / T4
$I_C = f(V_{CE})$
V_{GE} = 15 V



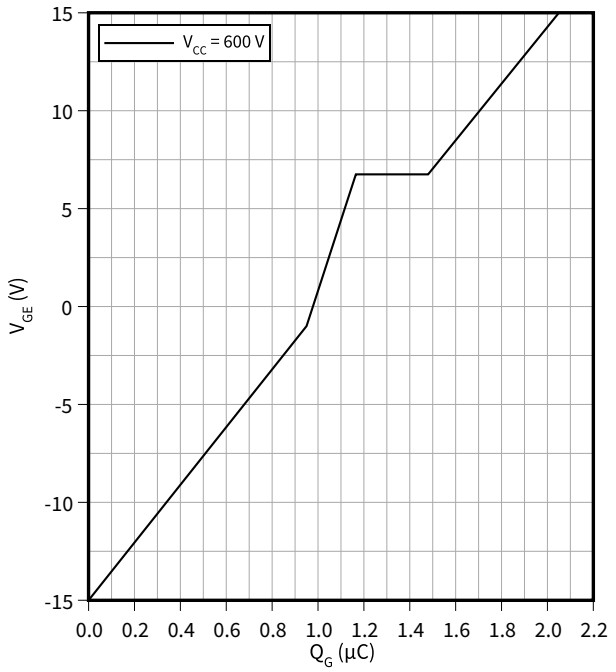
输出特性（典型), IGBT, T1 / T4
$I_C = f(V_{CE})$
T_{vj} = 150 °C



传输特性 （典型), IGBT, T1 / T4
$I_C = f(V_{GE})$
V_{CE} = 20 V



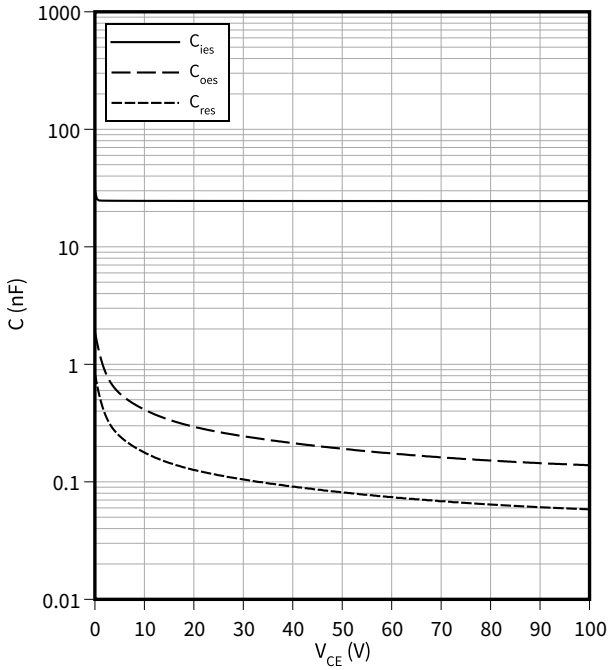
栅极电荷特性 （典型), IGBT, T1 / T4
$V_{GE} = f(Q_G)$
I_C = 200 A, T_{vj} = 25 °C



电容特性 （典型), IGBT, T1 / T4

$C = f(V_{CE})$

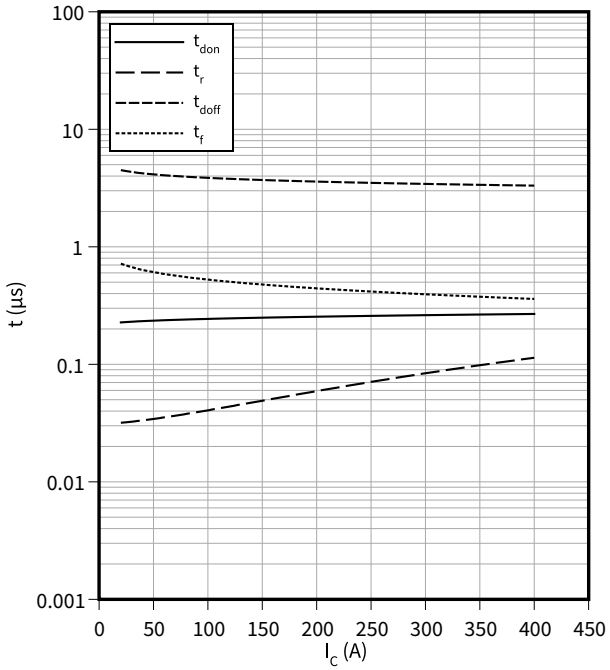
$f = 100\ kHz, V_{GE} = 0\ V, T_{vj} = 25\ °C$



开关时间 （典型), IGBT, T1 / T4

$t = f(I_C)$

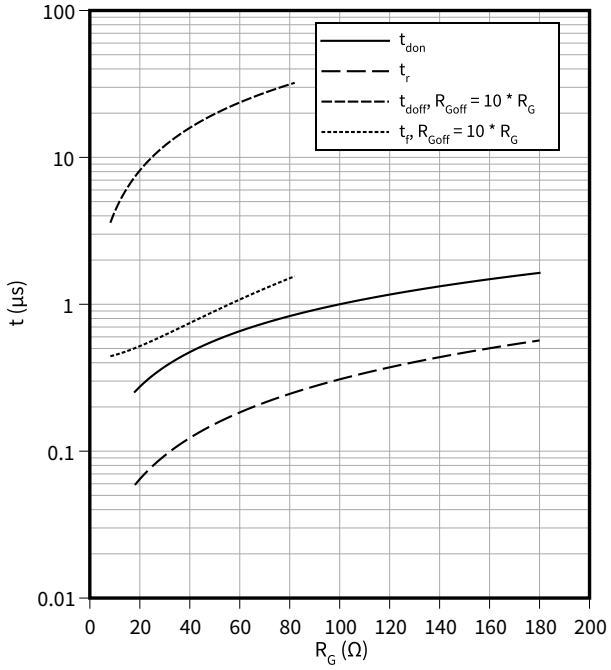
$V_{CC} = 600\ V, T_{vj} = 150\ °C, R_{Goff} = 82\ \Omega, R_{Gon} = 18\ \Omega, V_{GE} = \pm 15\ V$



开关时间 （典型), IGBT, T1 / T4

$t = f(R_G)$

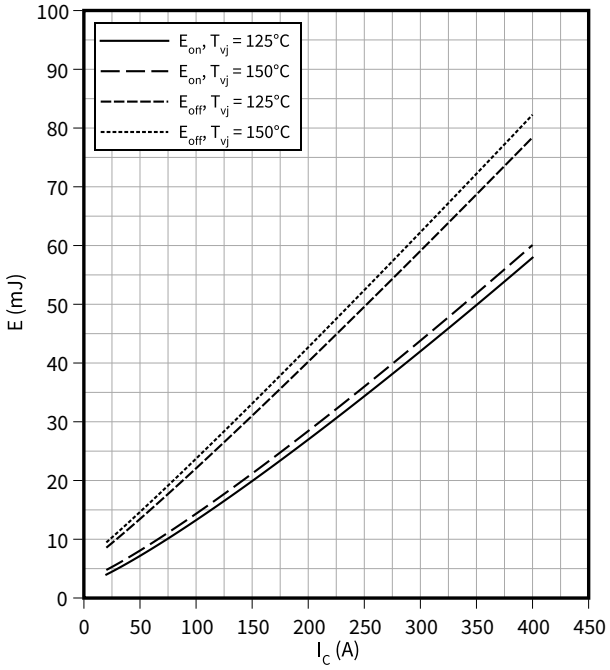
$V_{GE} = \pm 15\ V, I_C = 200\ A, V_{CC} = 600\ V, T_{vj} = 150\ °C$



开关损耗 （典型), IGBT, T1 / T4

$E = f(I_C)$

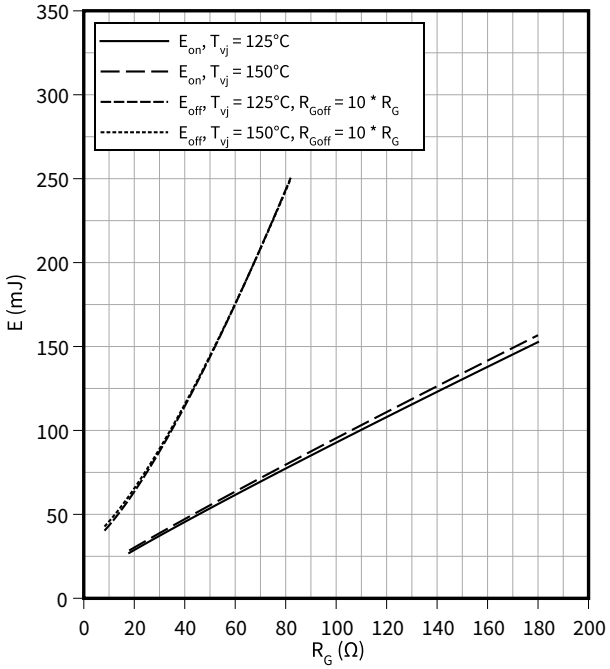
$R_{Goff} = 82\ \Omega, R_{Gon} = 18\ \Omega, V_{GE} = \pm 15\ V, V_{CC} = 600\ V$



开关损耗 （典型), IGBT, T1 / T4

$E = f(R_G)$

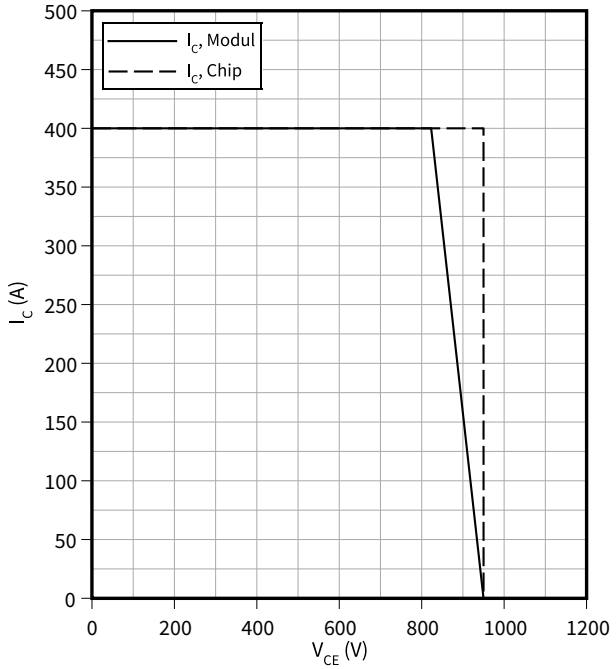
V_{GE} = ±15 V, I_C = 200 A, V_{CC} = 600 V



反偏安全工作区 （RBSOA）, IGBT, T1 / T4

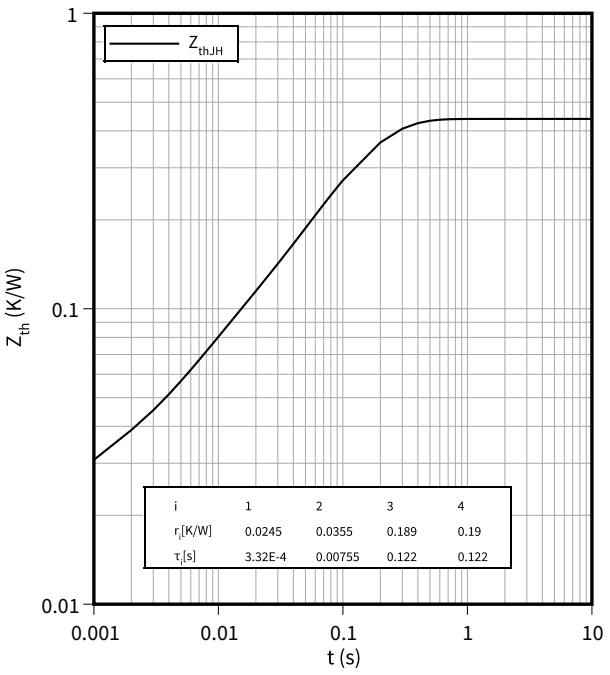
$I_C = f(V_{CE})$

R_{Goff} = 82 Ω, V_{GE} = ±15 V, T_{vj} = 150 °C



瞬态热阻抗, IGBT, T1 / T4

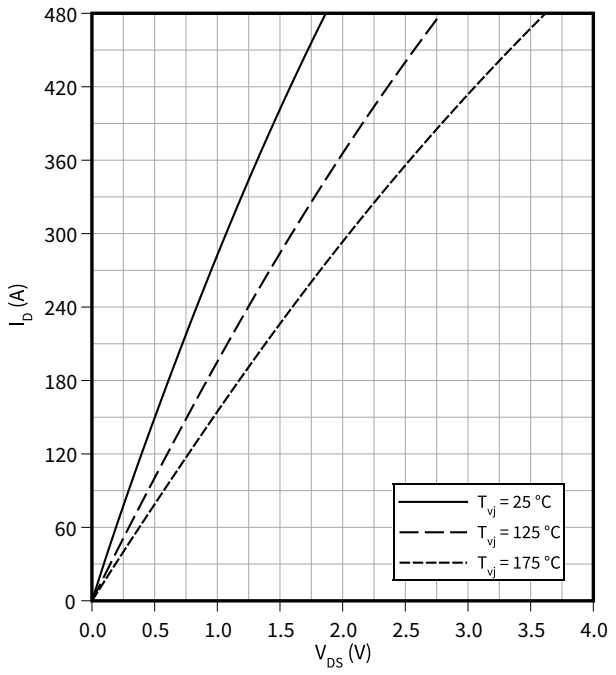
$Z_{th} = f(t)$



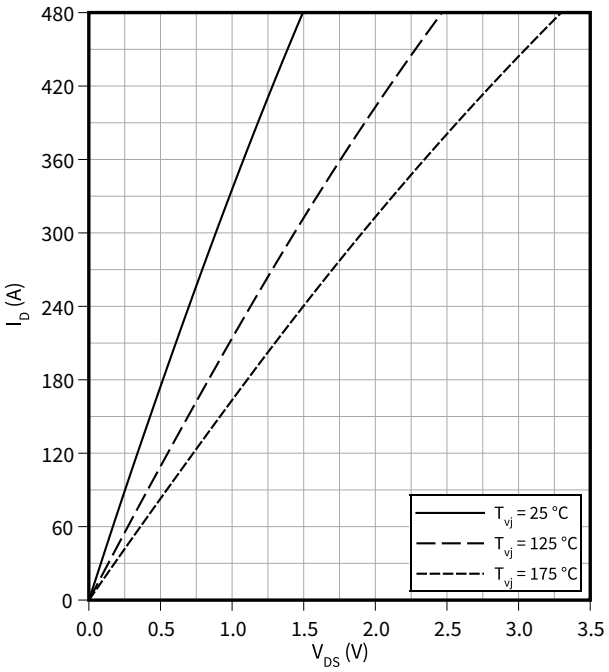
输出特性 （典型), MOSFET, T2 / T3

$I_D = f(V_{DS})$

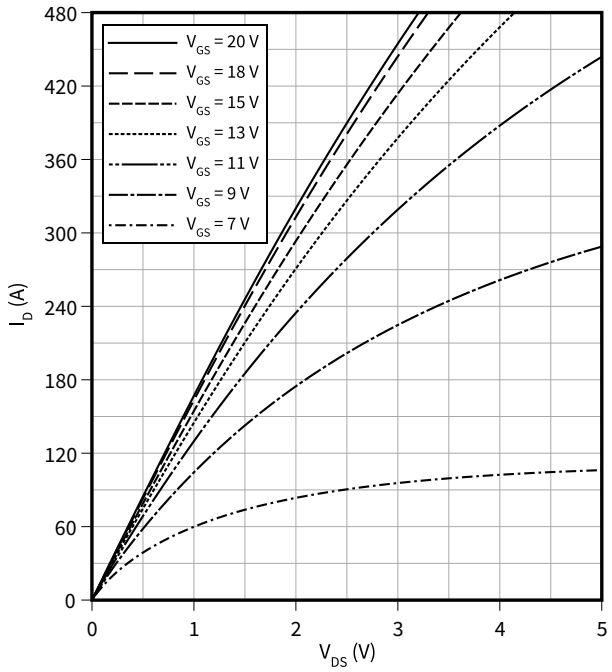
V_{GS} = 15 V



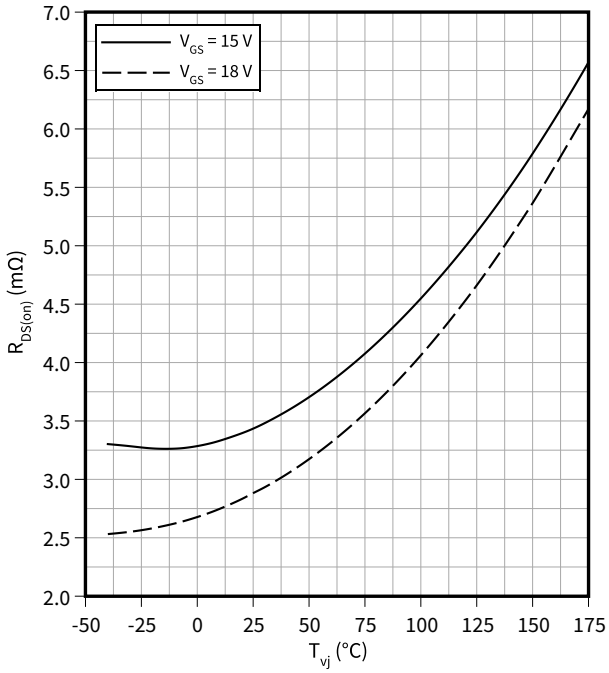
输出特性 （典型), MOSFET, T2 / T3
$I_D = f(V_{DS})$
$V_{GS} = 18\ V$



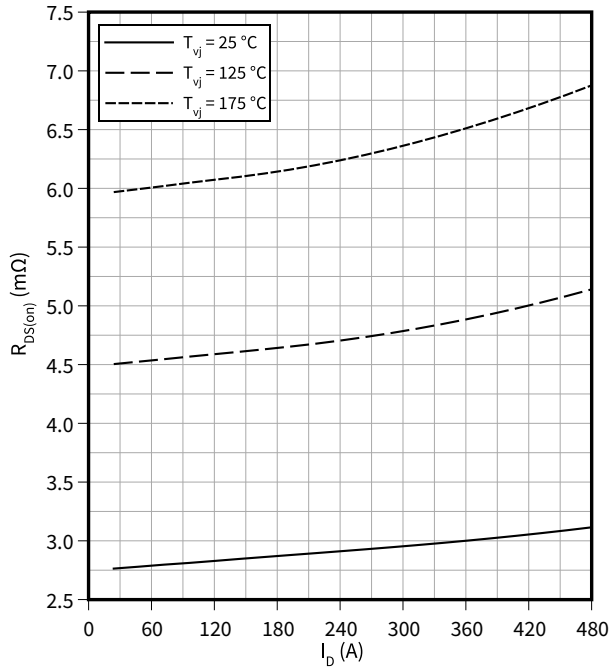
输出特性 （典型), MOSFET, T2 / T3
$I_D = f(V_{DS})$
$T_{vj} = 175\ °C$



漏源通态电阻 （典型), MOSFET, T2 / T3
$R_{DS(on)} = f(T_{vj})$
$I_D = 240\ A$

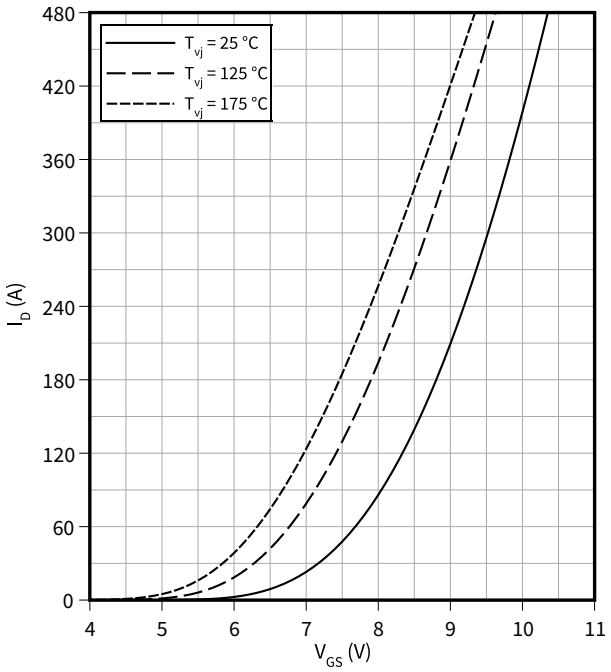


漏源通态电阻 （典型), MOSFET, T2 / T3
$R_{DS(on)} = f(I_D)$
$V_{GS} = 18\ V$



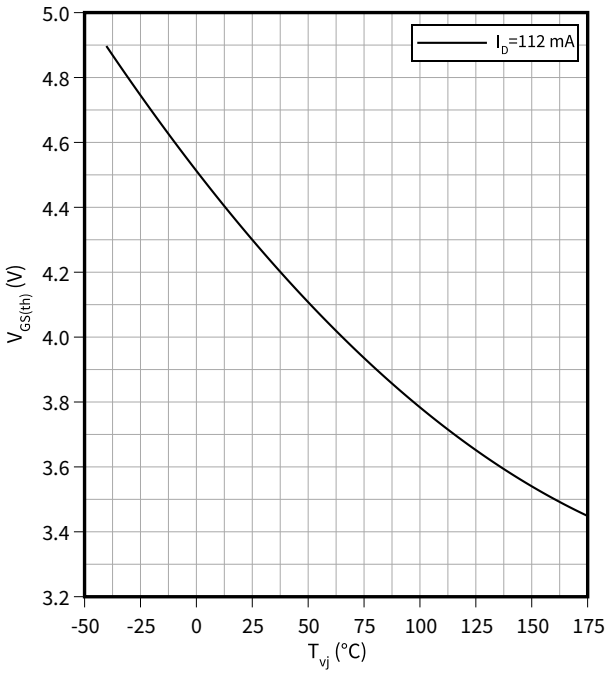
传输特性 （典型), MOSFET, T2 / T3

$I_D = f(V_{GS})$
V_{DS} = 20 V



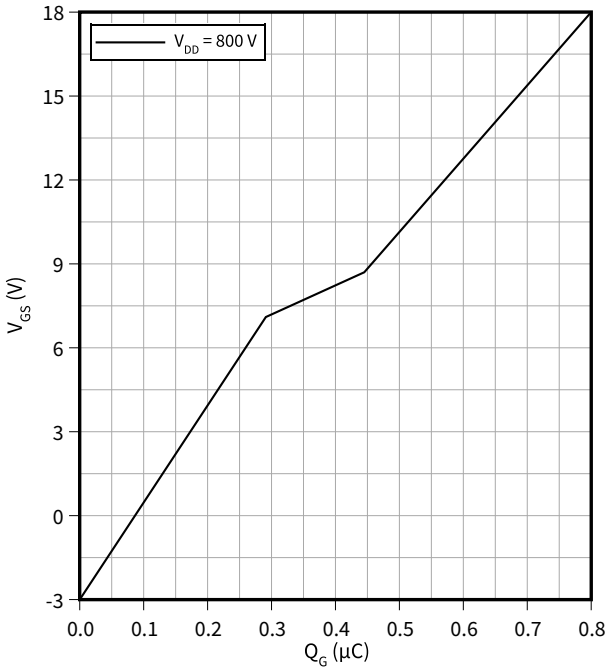
栅-源阀值电压（典型）, MOSFET, T2 / T3

$V_{GS(th)} = f(T_{vj})$
$V_{GS} = V_{DS}$, I_D = 112 mA



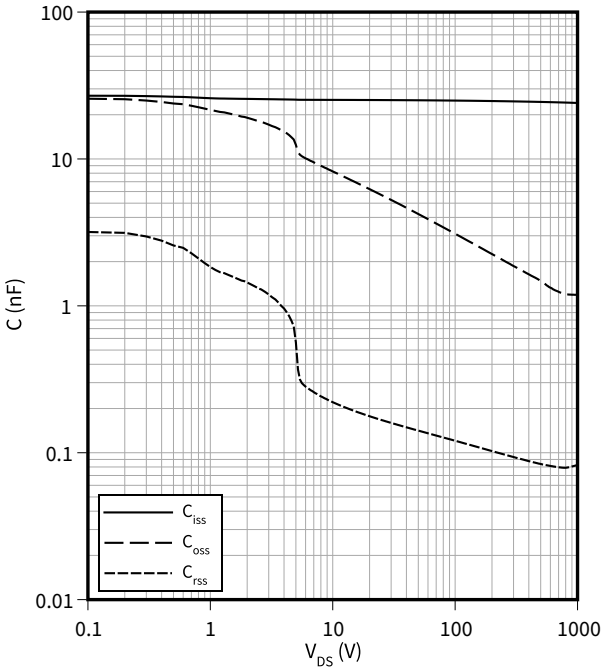
栅极电荷特性 （典型), MOSFET, T2 / T3

$V_{GS} = f(Q_G)$
I_D = 240 A, T_{vj} = 25 °C



电容特性 （典型), MOSFET, T2 / T3

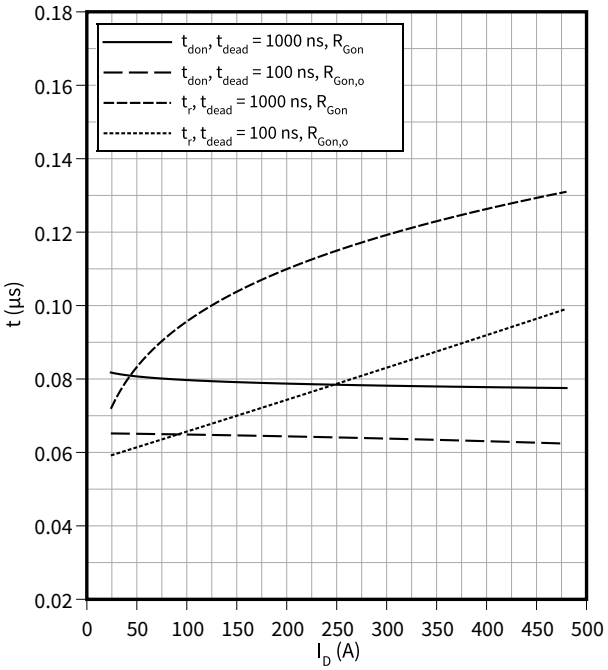
$C = f(V_{DS})$
f = 100 kHz, T_{vj} = 25 °C, V_{GS} = 0 V



开关时间 （典型), MOSFET, T2 / T3

$t = f(I_D)$

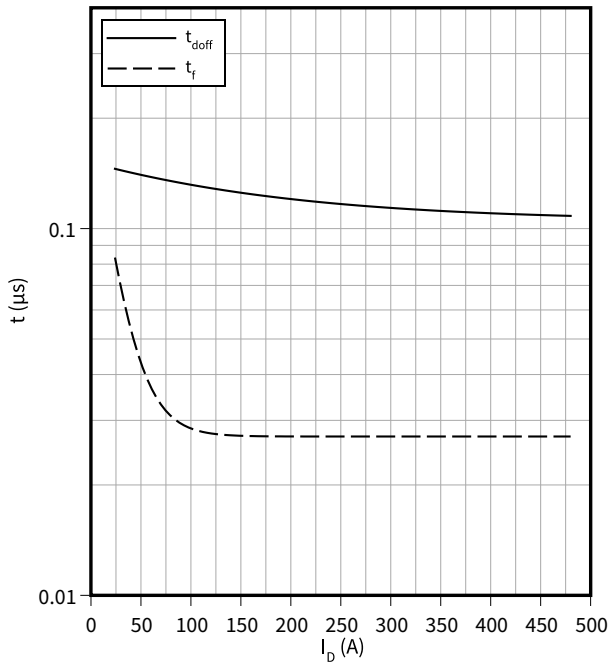
V_{DD} = 600 V, R_{Gon} = 4.7 Ω, $R_{Gon,o}$ = 3 Ω, T_{vj} = 175 °C, V_{GS} = -3/18 V



开关时间 （典型), MOSFET, T2 / T3

$t = f(I_D)$

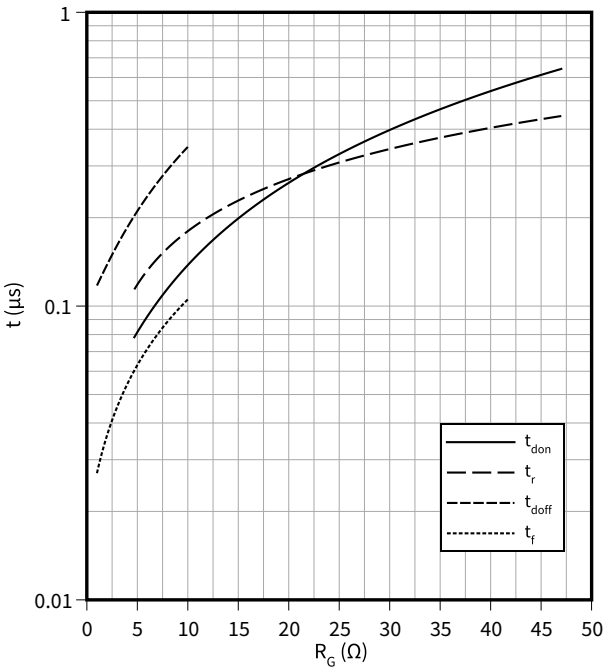
R_{Goff} = 1 Ω, V_{DD} = 600 V, T_{vj} = 175 °C, V_{GS} = -3/18 V



开关时间 （典型), MOSFET, T2 / T3

$t = f(R_G)$

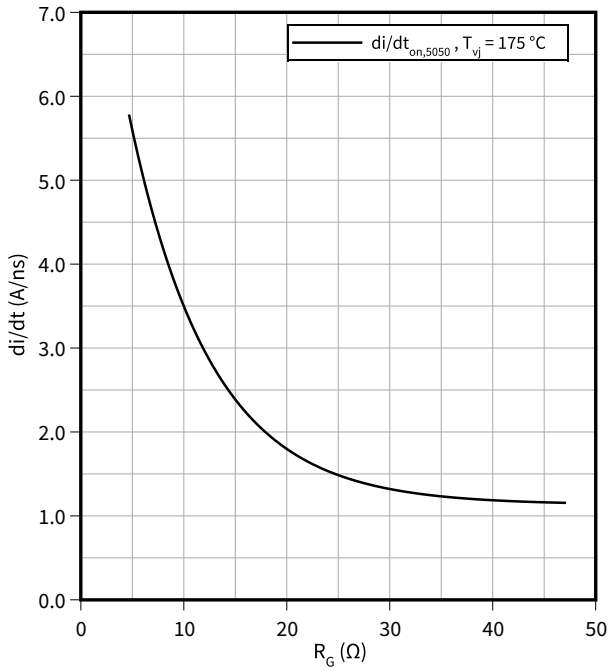
V_{DD} = 600 V, t_{dead} = 1000 ns, I_D = 240 A, T_{vj} = 175 °C, V_{GS} = -3/18 V



电流变化斜率 （典型), MOSFET, T2 / T3

$di/dt = f(R_G)$

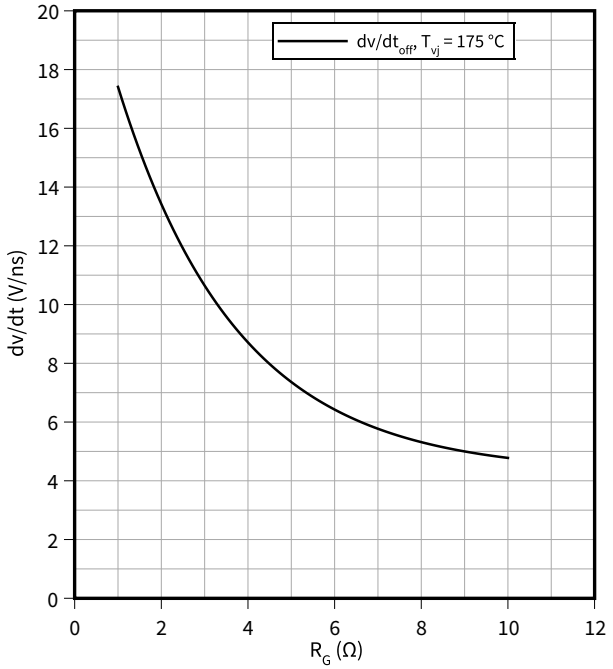
V_{DD} = 600 V, t_{dead} = 1000 ns, I_D = 240 A, V_{GS} = -3/18 V



电压变化斜率 （典型), MOSFET, T2 / T3

$dv/dt = f(R_G)$

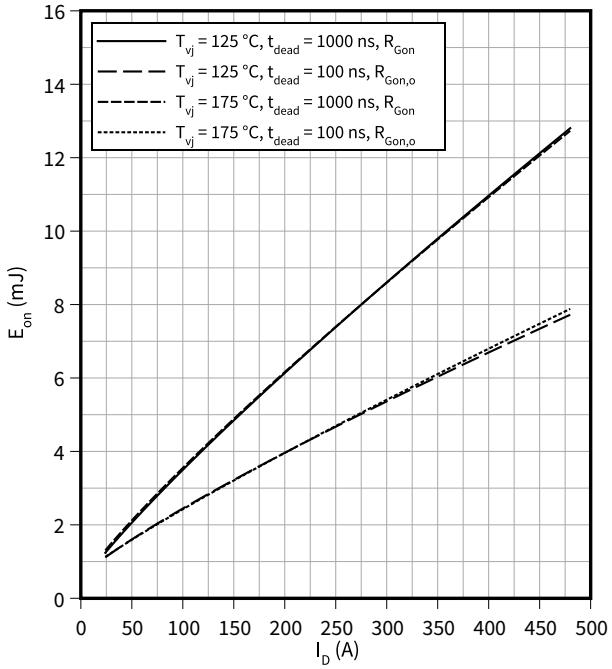
V_{DD} = 600 V, I_D = 240 A, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET, T2 / T3

$E_{on} = f(I_D)$

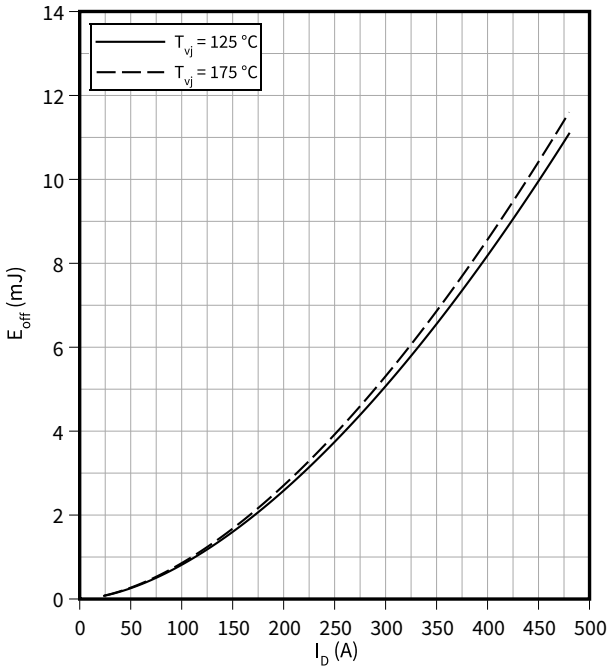
R_{Gon} = 4.7 Ω, V_{DD} = 600 V, $R_{Gon,o}$ = 3 Ω, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET, T2 / T3

$E_{off} = f(I_D)$

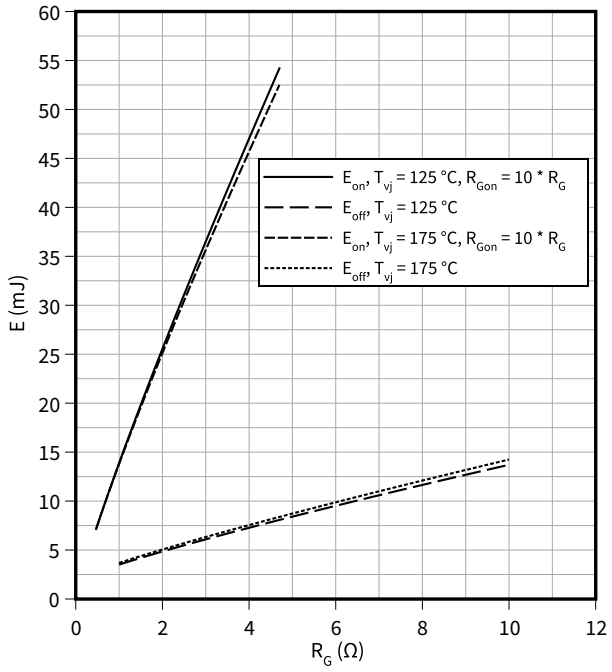
R_{Goff} = 1 Ω, V_{DD} = 600 V, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET, T2 / T3

$E = f(R_G)$

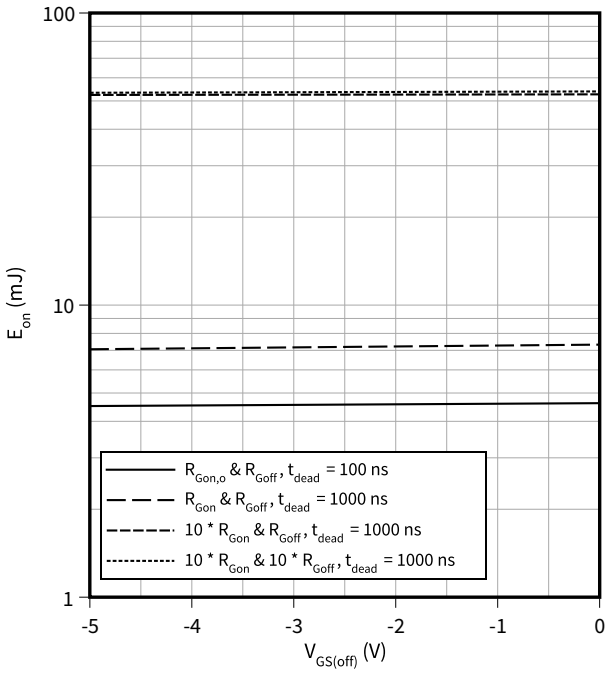
V_{DD} = 600 V, t_{dead} = 1000 ns, I_D = 240 A, V_{GS} = -3/18 V



开关损耗 （典型), MOSFET, T2 / T3

$E_{on} = f(V_{GS(off)})$

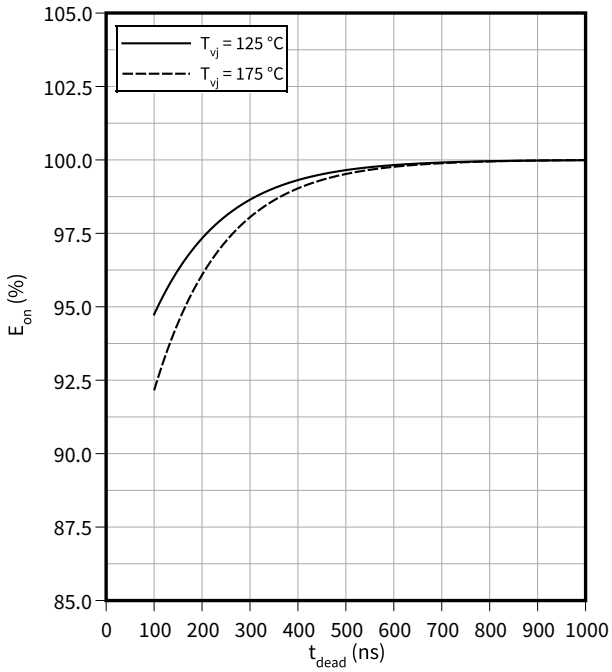
$R_{Goff} = 1\ \Omega$, $V_{DD} = 600$ V, $R_{Gon} = 4.7\ \Omega$, $V_{GS(on)} = 18$ V, $I_D = 240$ A, $R_{Gon,o} = 3\ \Omega$, $T_{vj} = 175$ °C



开关损耗 （典型), MOSFET, T2 / T3

$E_{on} = f(t_{dead})$

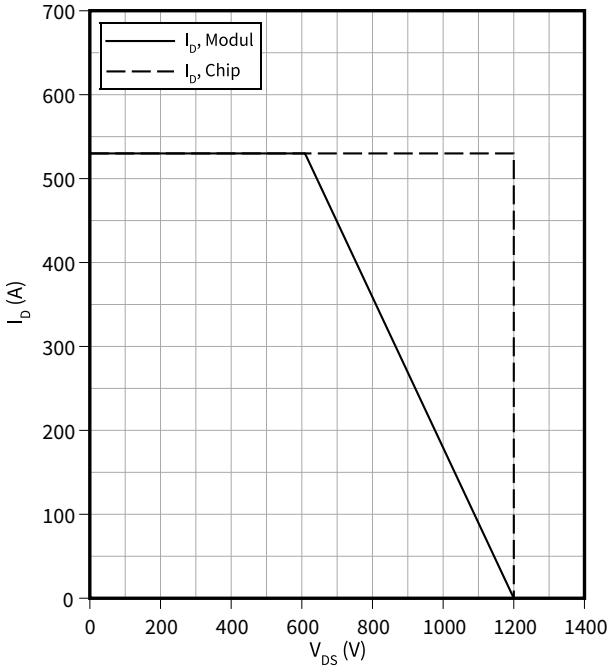
$R_{Gon} = 4.7\ \Omega$, $I_D = 240$ A, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V



反偏安全工作区 （RBSOA）, MOSFET, T2 / T3

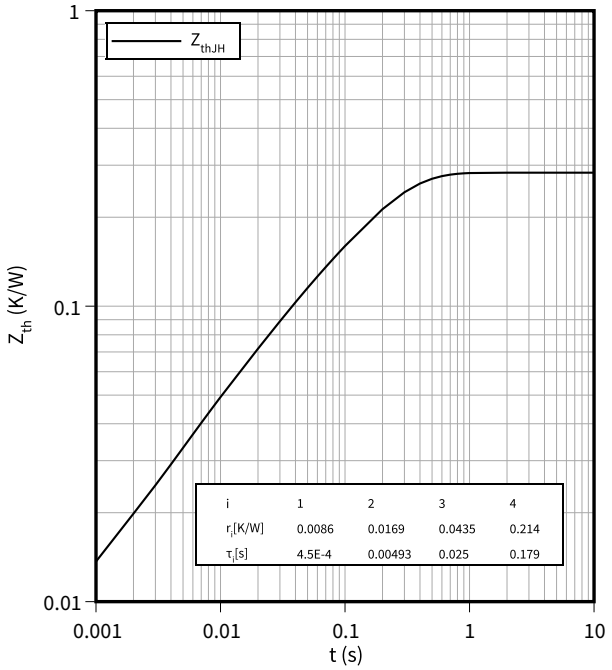
$I_D = f(V_{DS})$

$R_{Goff} = 1\ \Omega$, $T_{vj} = 175$ °C, $V_{GS} = -3/18$ V



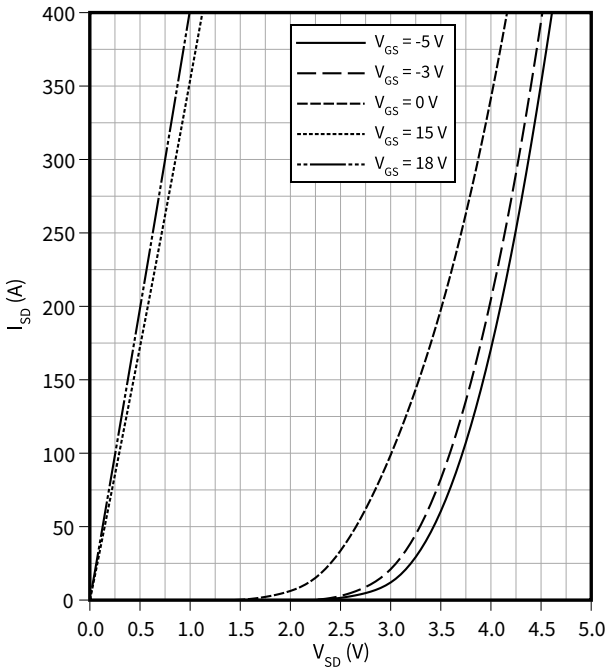
瞬态热阻抗, MOSFET, T2 / T3

$Z_{th} = f(t)$



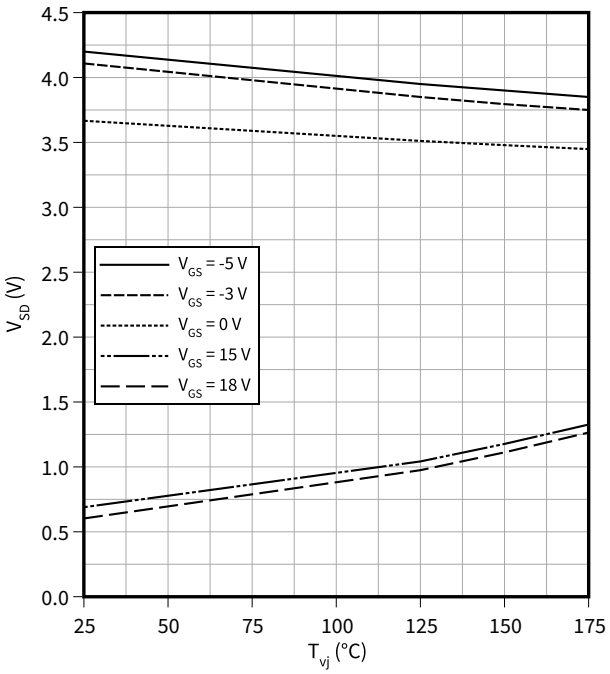
正向特性 体二极管（典型), MOSFET, T2 / T3

$I_{SD} = f(V_{SD})$
$T_{vj} = 25\ °C$



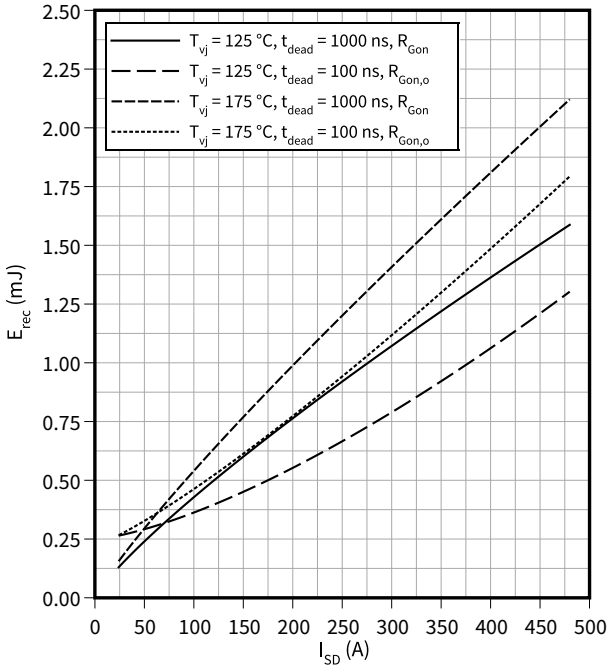
体二极管正向压降（典型), MOSFET, T2 / T3

$V_{SD} = f(T_{vj})$
$I_{SD} = 240\ A$



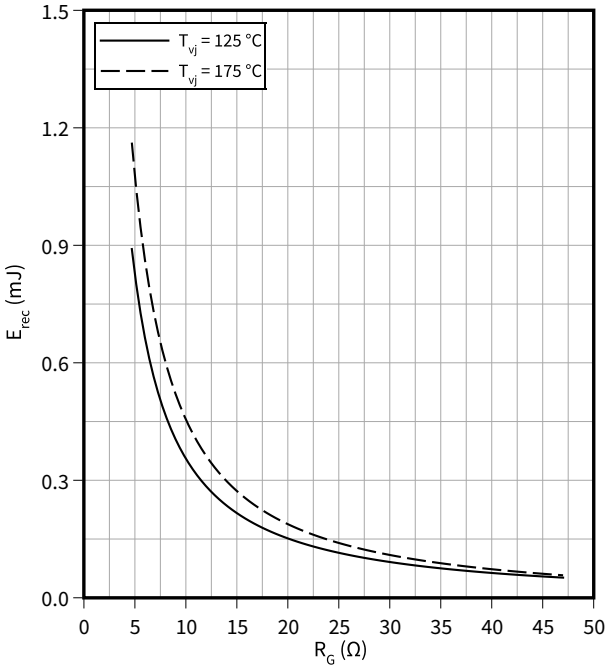
开关损耗 体二极管（典型), MOSFET, T2 / T3

$E_{rec} = f(I_{SD})$
$R_{Gon} = 4.7\ \Omega$, $R_{Gon,o} = 3\ \Omega$, $V_{DD} = 600\ V$



开关损耗 体二极管（典型), MOSFET, T2 / T3

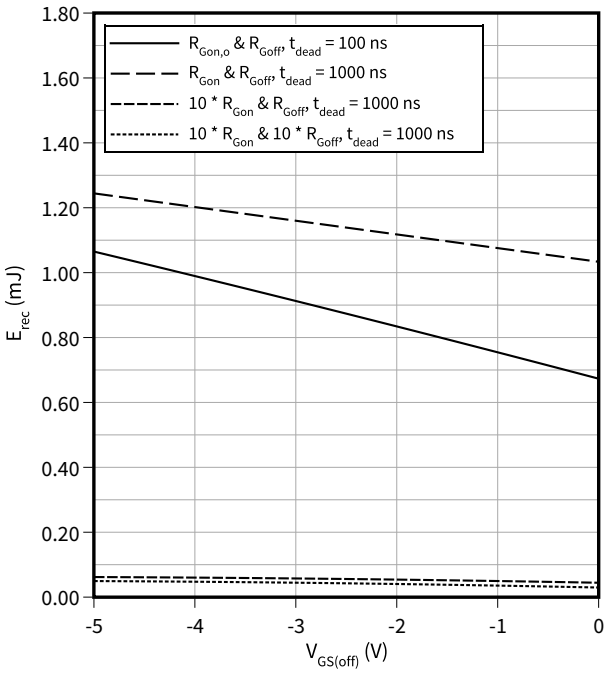
$E_{rec} = f(R_G)$
$t_{dead} = 1000\ ns$, $I_{SD} = 240\ A$, $V_{DD} = 600\ V$



开关损耗 体二极管（典型), MOSFET, T2 / T3

$E_{rec} = f(V_{GS(off)})$

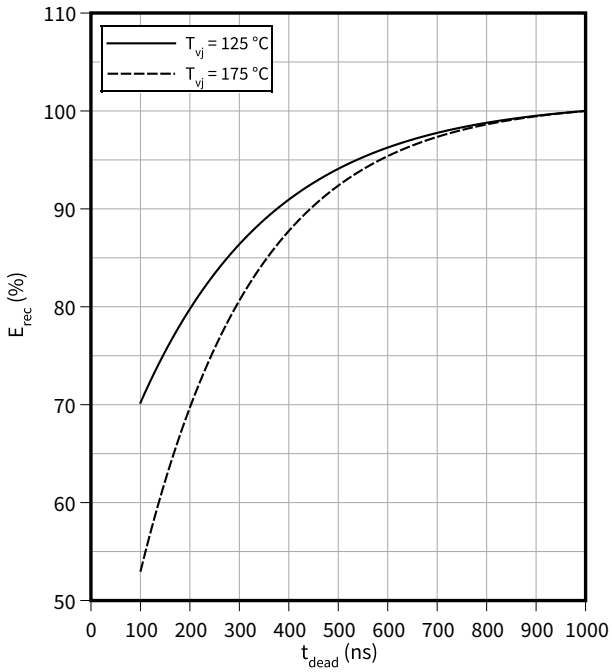
$R_{Goff} = 1\ \Omega$, $R_{Gon} = 4.7\ \Omega$, $V_{GS(on)} = 18$ V, $I_{SD} = 240$ A, $R_{Gon,o} = 3\ \Omega$, $V_{DD} = 600$ V, $T_{vj} = 175$ °C



开关损耗 体二极管（典型), MOSFET, T2 / T3

$E_{rec} = f(t_{dead})$

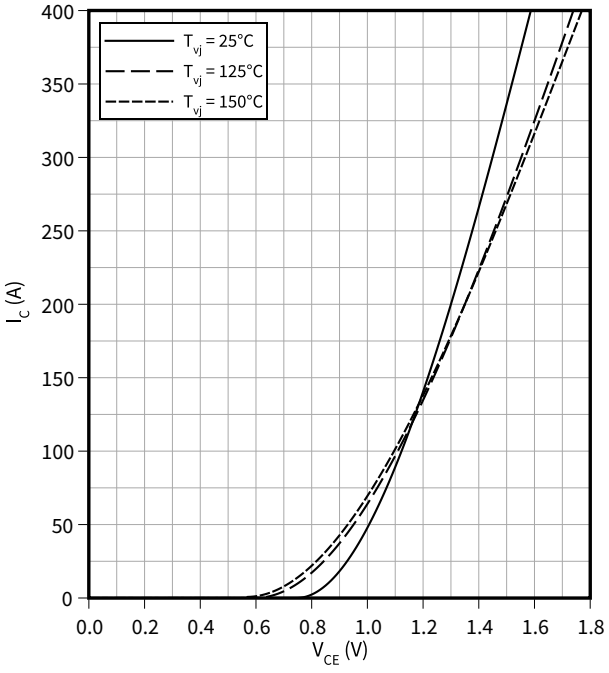
$R_{Gon} = 4.7\ \Omega$, $I_D = 240$ A, $V_{DD} = 600$ V, $V_{GS} = -3/18$ V



输出特性 （典型), IGBT, T5 / T6

$I_C = f(V_{CE})$

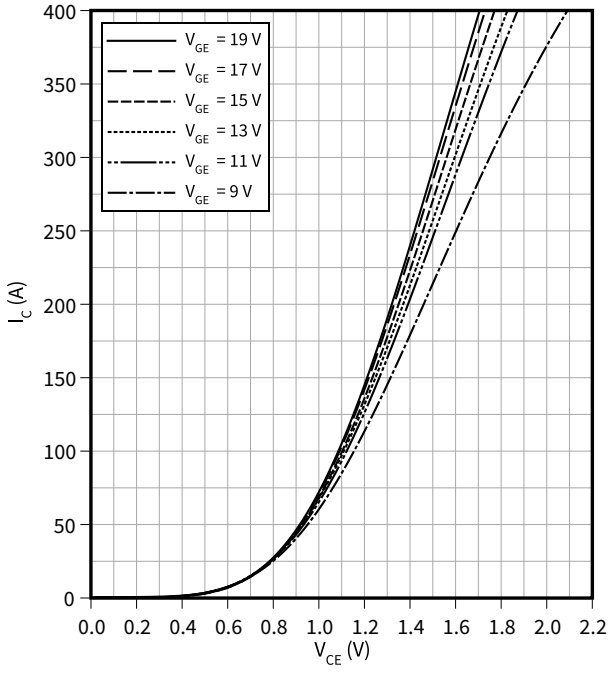
$V_{GE} = 15$ V



输出特性 （典型), IGBT, T5 / T6

$I_C = f(V_{CE})$

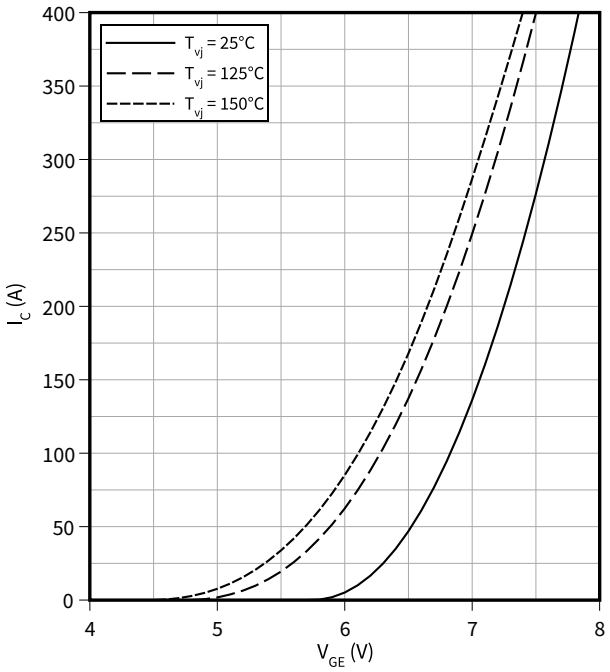
$T_{vj} = 150$ °C



传输特性 （典型), IGBT, T5 / T6

$I_C = f(V_{GE})$

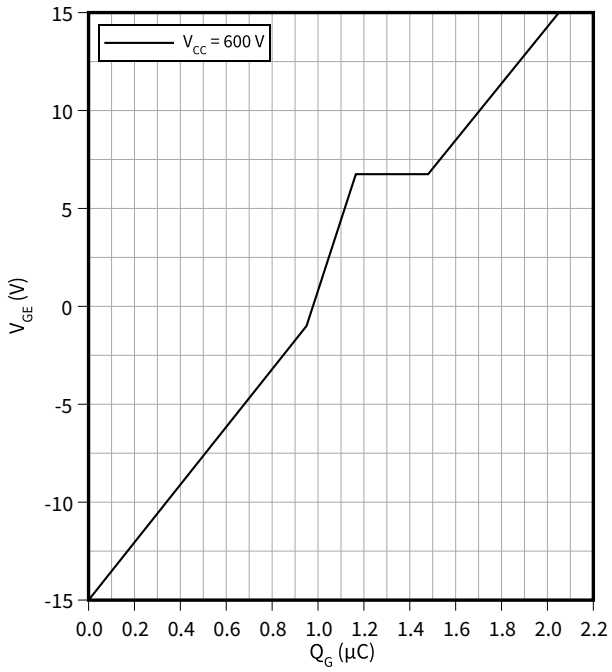
V_{CE} = 20 V



栅极电荷特性 （典型), IGBT, T5 / T6

$V_{GE} = f(Q_G)$

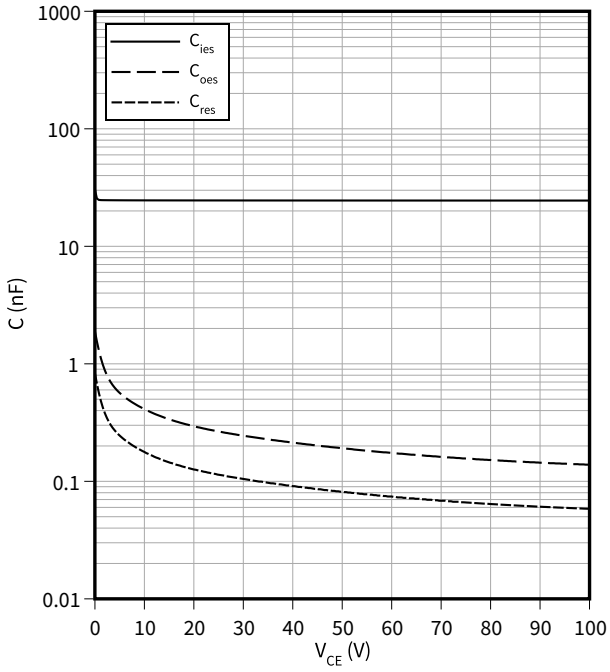
I_C = 200 A, T_{vj} = 25 °C



电容特性 （典型), IGBT, T5 / T6

$C = f(V_{CE})$

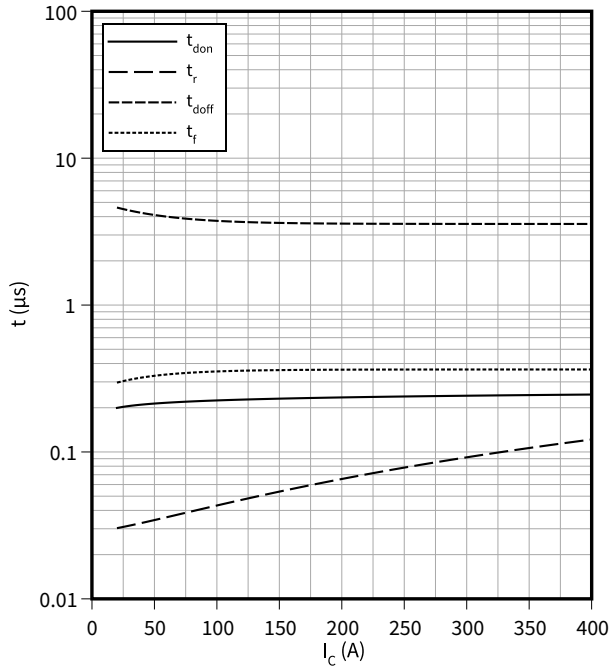
f = 100 kHz, V_{GE} = 0 V, T_{vj} = 25 °C



开关时间 （典型), IGBT, T5 / T6

$t = f(I_C)$

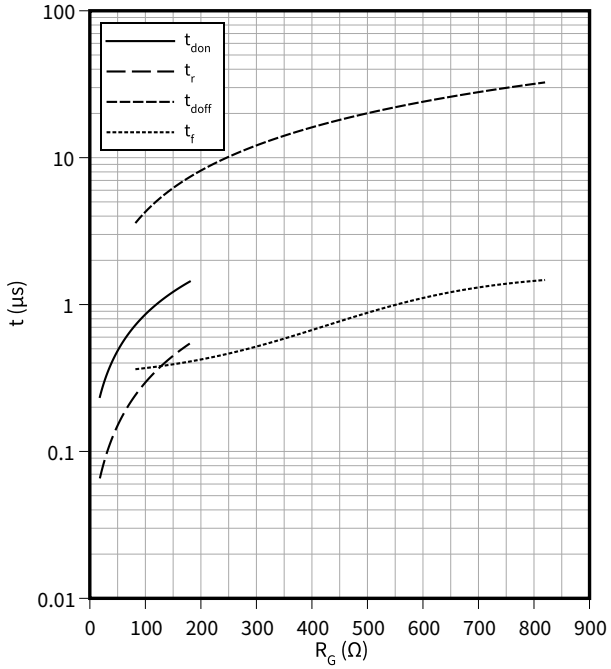
R_{Goff} = 82 Ω, R_{Gon} = 18 Ω, V_{GE} = ±15 V, V_{CC} = 600 V, T_{vj} = 150 °C



开关时间 （典型), IGBT, T5 / T6

$t = f(R_G)$

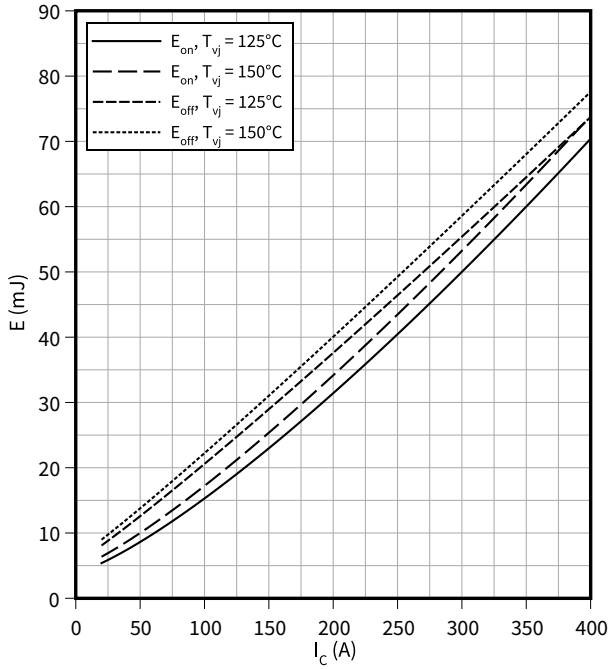
V_{GE} = ±15 V, I_C = 200 A, V_{CC} = 600 V, T_{vj} = 150 °C



开关损耗 （典型), IGBT, T5 / T6

$E = f(I_C)$

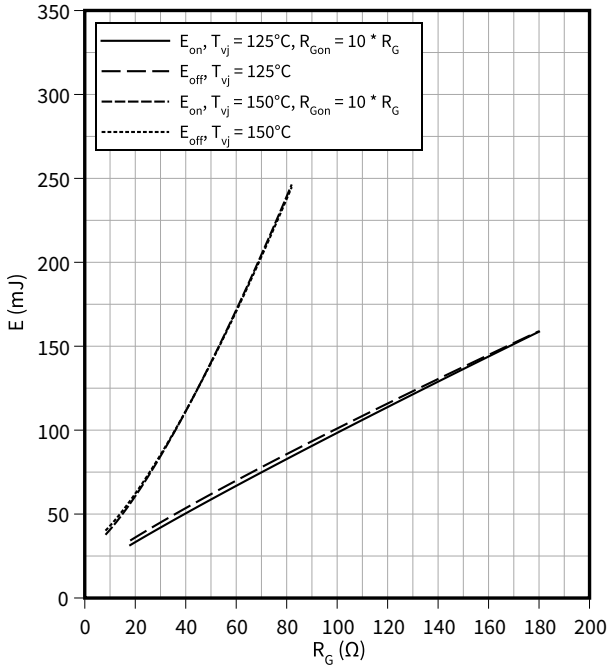
R_{Goff} = 82 Ω, R_{Gon} = 18 Ω, V_{GE} = ±15 V, V_{CC} = 600 V



开关损耗 （典型), IGBT, T5 / T6

$E = f(R_G)$

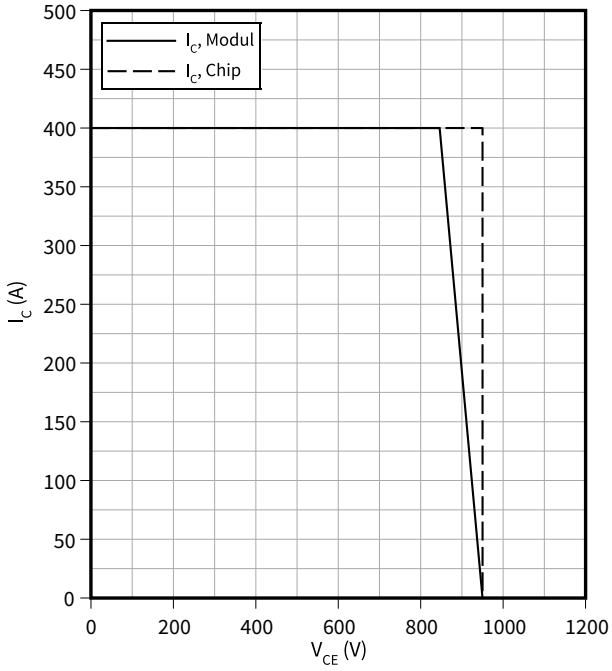
V_{GE} = ±15 V, I_C = 200 A, V_{CC} = 600 V



反偏安全工作区 （RBSOA）, IGBT, T5 / T6

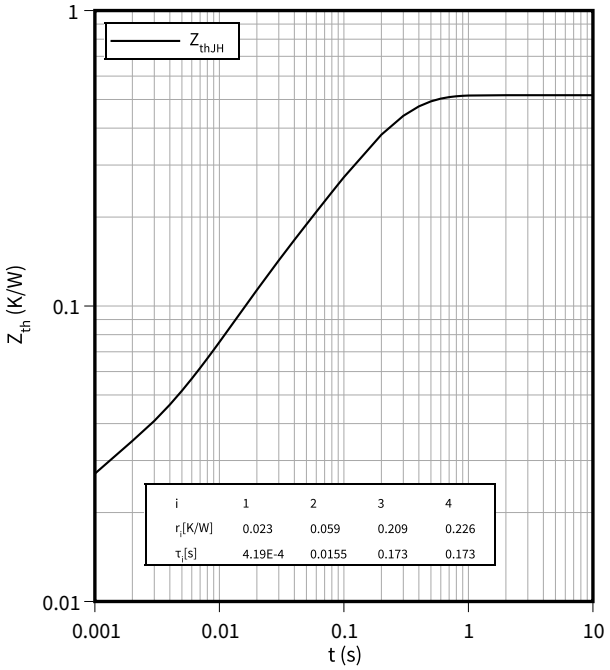
$I_C = f(V_{CE})$

R_{Goff} = 82 Ω, V_{GE} = ±15 V, T_{vj} = 150 °C



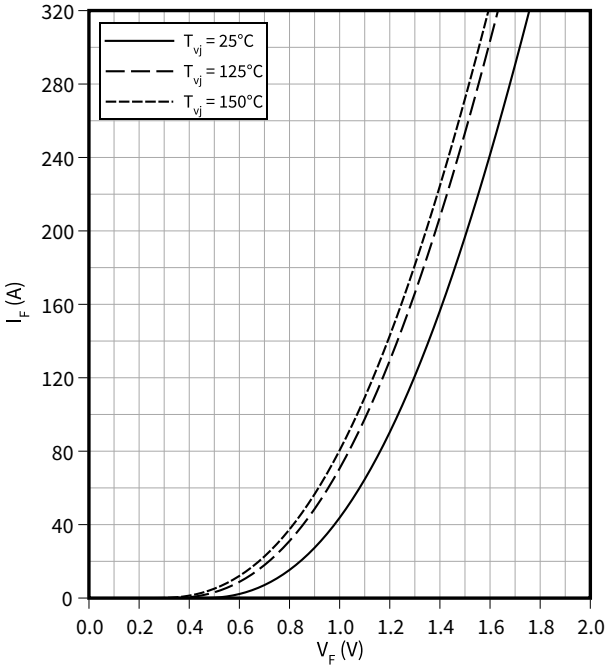
瞬态热阻抗, IGBT, T5 / T6

$Z_{th} = f(t)$



正向特性 （典型), 二极管, D1 / D4

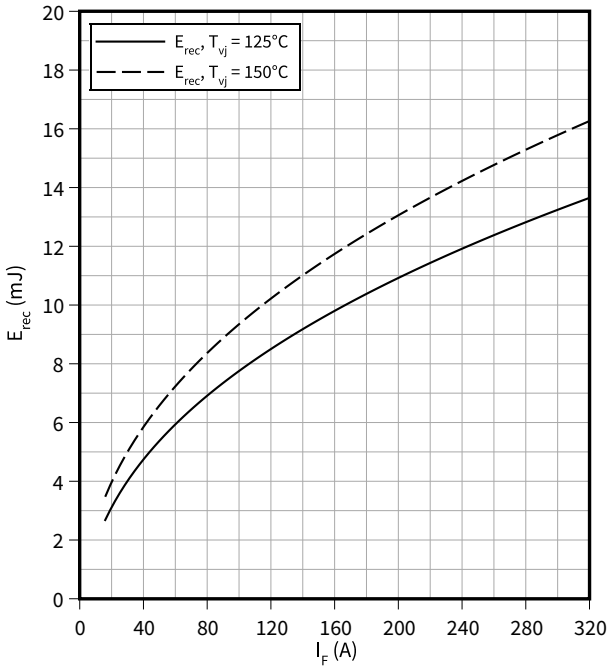
$I_F = f(V_F)$



开关损耗 （典型), 二极管, D1 / D4

$E_{rec} = f(I_F)$

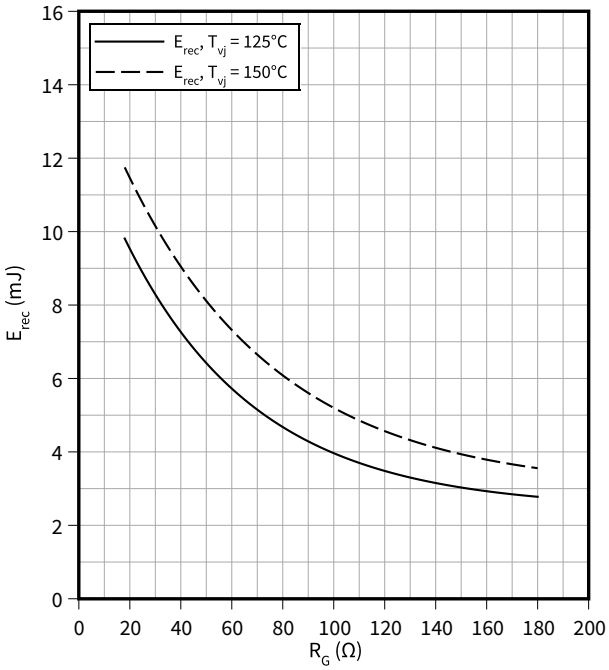
$R_G = 18\ \Omega$, $V_{CC} = 600$ V



开关损耗 （典型), 二极管, D1 / D4

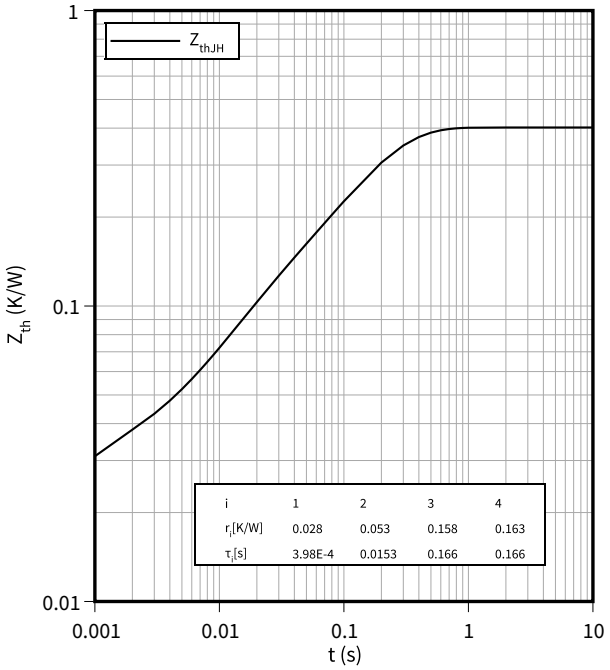
$E_{rec} = f(R_G)$

$I_F = 160$ A, $V_{CC} = 600$ V



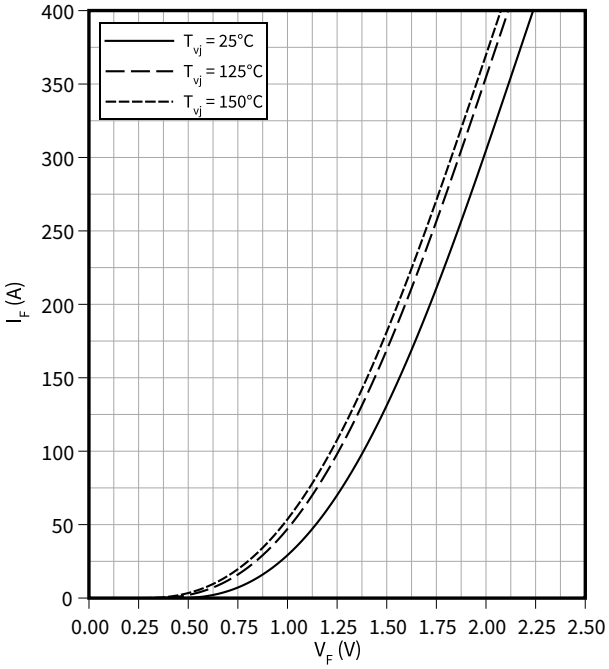
瞬态热阻抗, 二极管, D1 / D4

$Z_{th} = f(t)$



正向特性 （典型), 二极管, D5 / D6

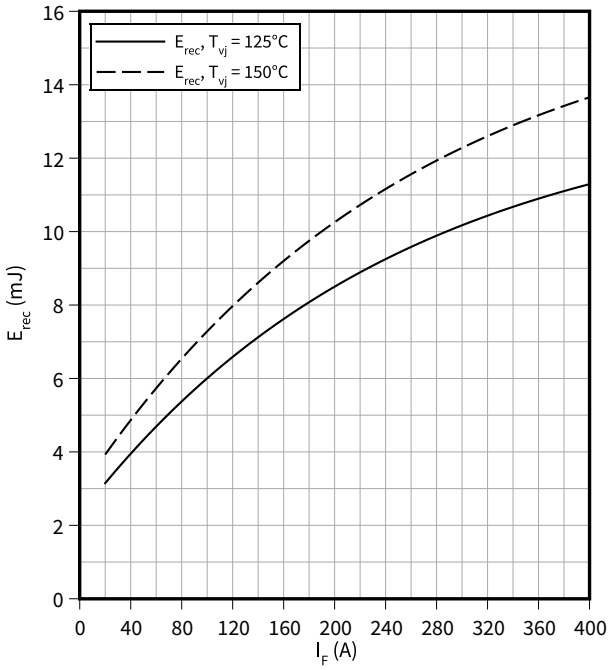
$I_F = f(V_F)$



开关损耗 （典型), 二极管, D5 / D6

$E_{rec} = f(I_F)$

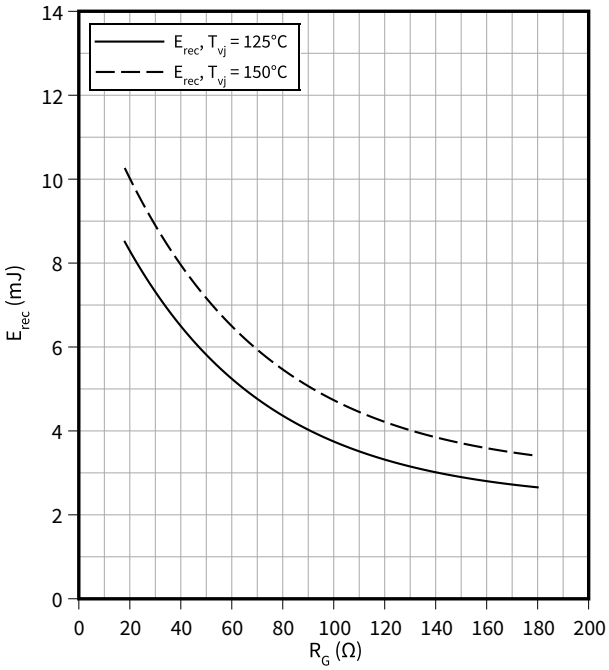
$R_{Gon} = 18\ \Omega$, $V_{CC} = 600$ V



开关损耗 （典型), 二极管, D5 / D6

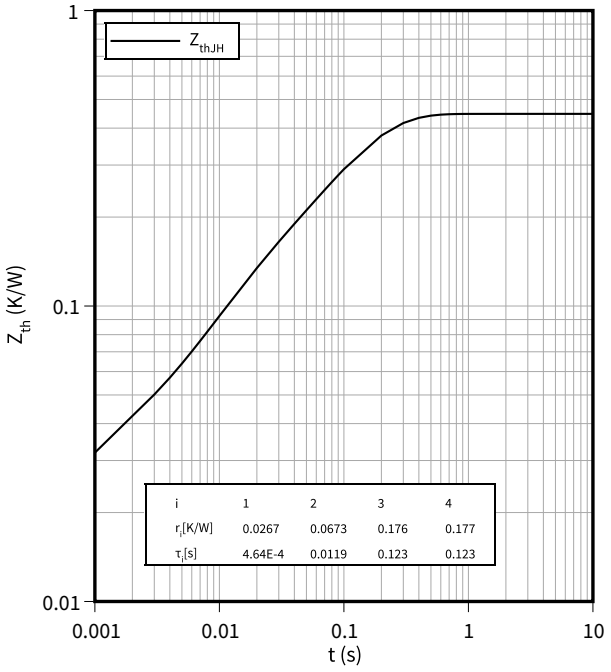
$E_{rec} = f(R_G)$

$I_F = 200$ A, $V_{CC} = 600$ V



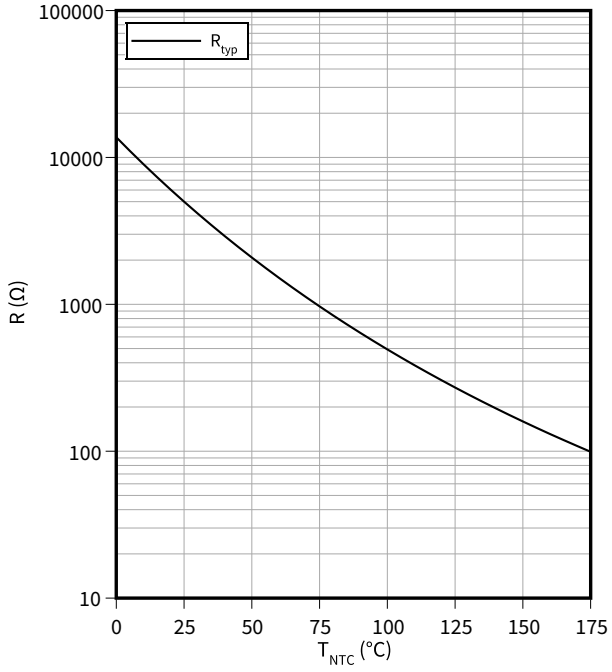
瞬态热阻抗, 二极管, D5 / D6

$Z_{th} = f(t)$



温度特性, 负温度系数热敏电阻

$R = f(T_{NTC})$



10 电路拓扑图

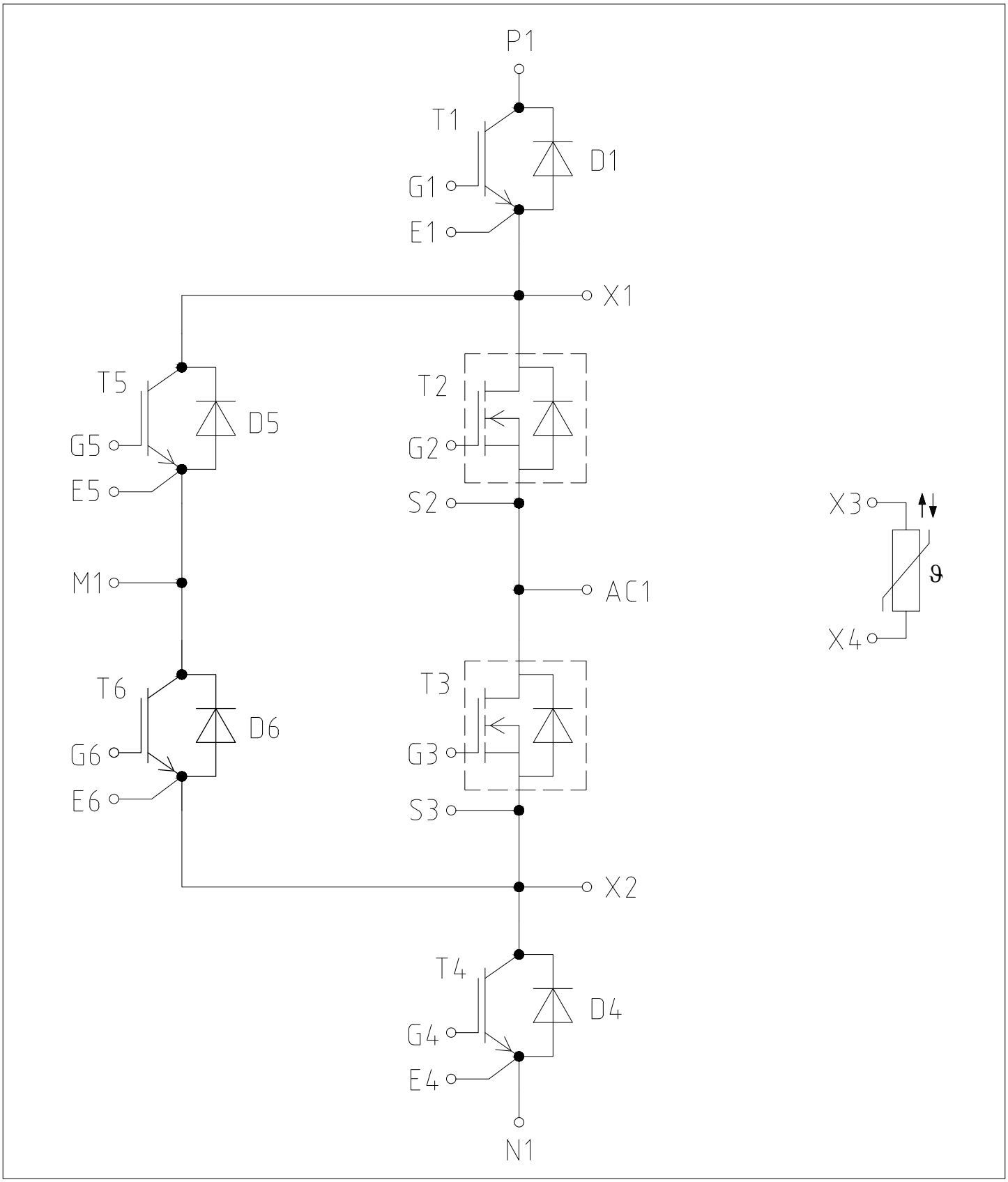

P1
T1
D1
G1
E1
X1
T5
D5
G5
E5
T2
G2
S2
X3
M1
AC1
ϑ
X4
T6
D6
G6
E6
T3
G3
S3
X2
T4
D4
G4
E4
N1

图 1

11 封装尺寸

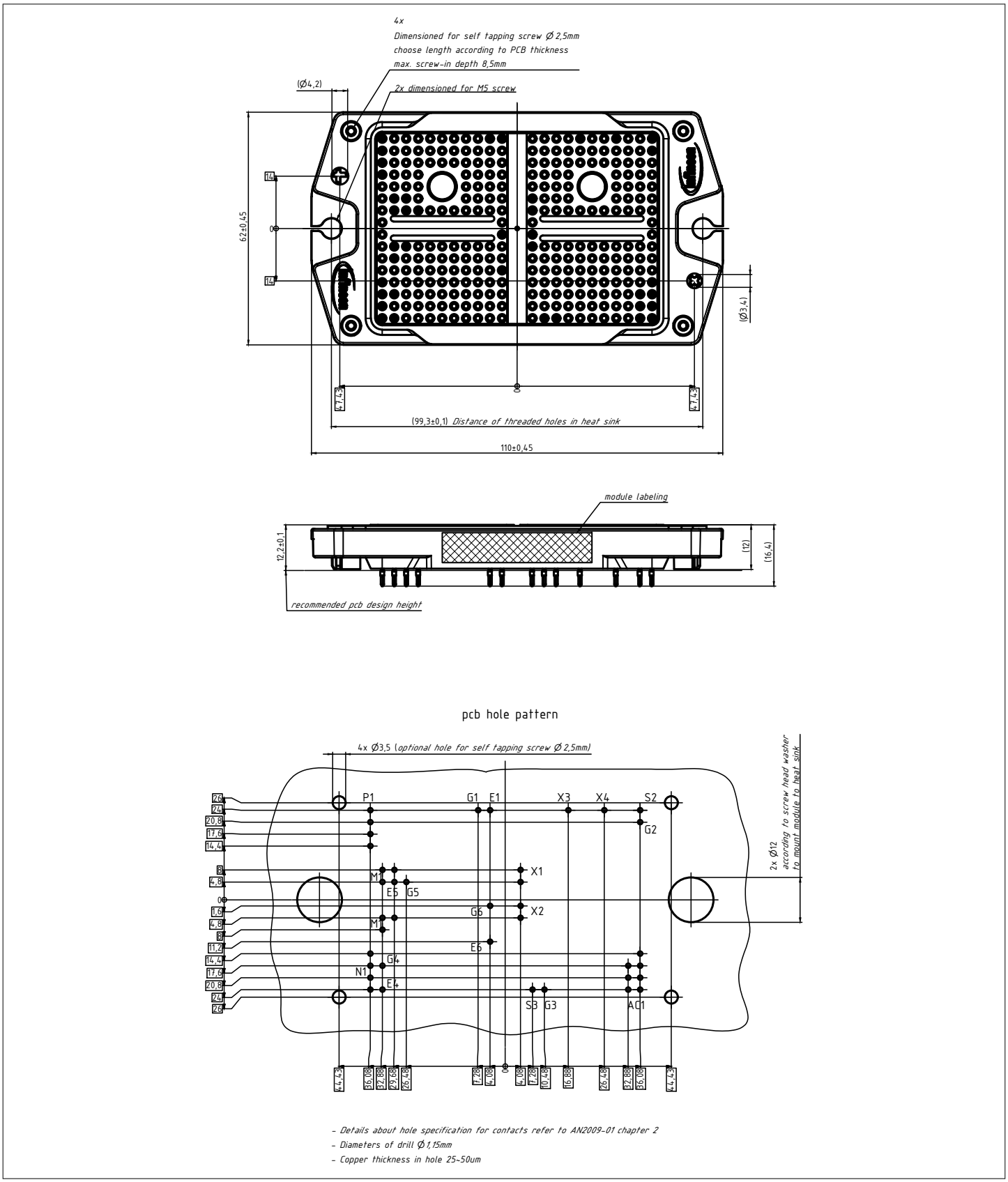

4x
Dimensioned for self tapping screw Ø 2,5mm
choose length according to PCB thickness
max. screw-in depth 8,5mm
2x dimensioned for M5 screw
(Ø4,2)
62±0,45
14
0
14
(Ø3,4)
6,7
6,7
(99,3±0,1) Distance of threaded holes in heat sink
110±0,45
module labeling
12,2±0,1
(12)
(16,4)
recommended pcb design height
pcb hole pattern
4x Ø3,5 (optional hole for self tapping screw Ø 2,5mm)
2x Ø12
according to screw head washer
to mount module to heat sink
P1
G1
E1
X3
X4
S2
G2
X1
X2
M1
E5
G5
G6
E6
G4
N1
E4
S3
G3
AC1
- Details about hole specification for contacts refer to AN2009-01 chapter 2
- Diameters of drill Ø 1,15mm
- Copper thickness in hole 25-50um

图 2

12 模块标签代码

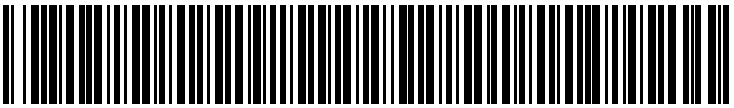
Module label code			
Code format	Data Matrix		Barcode Code128
Encoding	ASCII text		Code Set A
Symbol size	16x16		23 digits
Standard	IEC24720 and IEC16022		IEC8859-1
Code content	*Content* Module serial number Module material number Production order number Date code (production year) Date code (production week)	*Digit* 1 –5 6 - 11 12 - 19 20 –21 22 –23	*Example* 71549 142846 55054991 15 30
Example	 7154914284655054991530	 7154914284655054991530	

图 3

修订历史

修订版本	发布日期	变更说明
0.10	2023-12-20	Initial version
1.00	2024-11-12	Final datasheet
1.10	2024-11-18	Final datasheet
1.20	2025-04-01	Final datasheet

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