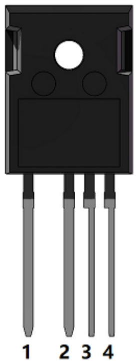
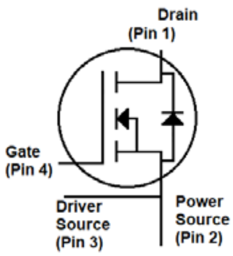
PRELIMINARY DATASHEET 规格书

SCS027HG065M22E

m22 650V Silicon Carbide Power MOSFET（N Channel Enhancement）
第二代 650V 碳化硅功率 MOSFET（N 沟道增强型）
Package Type：TO-247-4LB





V_{DS} = 650 V
I_D(25 °C) = 93 A
$R_{(DS)on}$(25 °C) = 27 mΩ

- High blocking voltage with low on-resistance
  兼具高击穿电压和低导通电阻
- Very low switching losses
  低开关损耗
- High-Reliability Qualification
  高可靠性认证

Maximum ratings 最大额定值[1 2]

PARAMETER 参数	SYMBOL 符号	TEST CONDITIONS 测试条件	MIN 最小值	MAX 最大值	UNIT 单位
Drain-source voltage 漏源电压	V_{DSmax}	V_{GS} = 0 V, T_{vj} = 25 °C		650	V
Continuos DC drain current 连续直流漏电流	I_D	V_{GS} = 18 V, T_C = 25 °C		93	A
		V_{GS} = 18 V, T_C = 100 °C		66	A
Peak drain current 漏极和源极峰值电流	I_{DM}	Pulse width t_p limited by T_{jmax}		232	A
Gate-source voltage (DC) 栅源电压（静态）	V_{GSS}		-10	22	V
Gate-source surge voltage 栅源浪涌电压	$V_{GS\ surge}$	t_p ≤ 0.5 µs, D ＜ 1%	-11	25	V
DC reverse drain current 直流反向漏极电流	I_S	T_c = 25 °C,		93	A
Peak reverse drain current 峰值反向漏极电流	I_{SM}	V_{GS} = -5 V, limited by T_{jmax}		232	A
Total power dissipation 最大功率损耗	P_{tot}	T_C = 25 °C, T_{vj} = 175 °C		357	W
Junction operating temperature 运行结温	$T_{vj(op)}$		-55	175	°C
Storage temperature 存储温度范围	T_{stg}		-55	175	°C

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[1] Maximum rated values indicate limits beyond which damage to the device may occur per IEC 60747
[1] 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} = 25 ℃, unless otherwise specified / 除非另有规定, T_{vj} = 25 ℃

MOSFET[3] [4]

Recommended values 推荐值

PARAMETER 参数	SYMBOL 符号	TEST CONDITIONS 测试条件	VALUE 值	UNIT 单位
Gate-source turn-on voltage 栅源导通电压	$V_{GS(on)}$		18	V
Gate-source turn-off voltage 栅源关断电压	$V_{GS(off)}$		-5	V

Characteristic values 特征值

PARAMETER 参数	SYMBOL 符号	TEST CONDITIONS 测试条件		MIN 最小	TYP 典型	MAX 最大	UNIT 单位
Drain-source breakdown voltage 漏极-源极击穿电压	$V_{(BR)DSS}$	V_{GS} ≤ 0 V, I_D = 100 μA, T_{vj} = 25 °C		650			V
Drain-source on-state resistance 静态漏极-源极导通电阻	$R_{DS(on)}$	I_D = 30 A, V_{GS} = 18 V	T_{vj} = 25 °C		27	35	mΩ
			T_{vj} = 175 °C		32		mΩ
Drain leakage current 漏源漏电流	I_{DSS}	V_{DS} = 650 V, V_{GS} = 0 V	T_{vj} = 25 °C		1	50	μA
Gate leakage current 栅极漏电流	I_{GSS}	V_{GS} = 18 V, V_{DS} = 0 V, T_{vj} = 25 °C			1	250	nA
Gate-source threshold voltage 栅极-源极阈值电压	$V_{GS(th)}$	I_D = 8 mA, V_{DS} = V_{GS}	T_{vj} = 25 °C	1.8	3.1	4.2	V
			T_{vj} = 175 °C		2.1		V
Transconductance 跨导	g_{fs}	V_{DS} = 20 V, I_D = 30 A, T_{vj} = 25 °C			20		S
		V_{DS} = 20 V, I_D = 30 A, T_{vj} = 175 °C			21		S
Input capacitance 输入电容	C_{iss}	V_{DS} = 600 V, V_{GS} = 0 V, f = 100 kHz, V_{AC} = 25 mV T_{vj} = 25 °C			1946		nF
Output capacitance 输出电容	C_{oss}				161		pF
Reverse tansfer capacitance 反向传输电容	C_{rss}				8		pF
C_{oss} stored energy 输出电容损耗	E_{OSS}	(E_{OSS} = ∫Q(V)dV)			33		μJ
Internal gate resistor 栅极内阻	R_{Gint}	f= 1 MHz， V_{AC} = 25 mV, V_{GS} = V_{DS} = 0 V			3.6		Ω
Total gate charge 栅极电荷量	Q_G	I_D = 30 A, V_{DD} = 400 V, V_{GS} = -5 V ... 18 V			80		nC
Gate to source charge 栅极-源极电荷量	Q_{GS}				30		nC
Gate to drain charge 栅极-漏极电荷量	Q_{GD}				16		nC

[3] Characteristic values according to IEC 60747-8
[4] T_{vj} = 25 °C, unless otherwise specified / 除非另有规定, T_{vj} = 25 °C

Characteristic values (continued) 特征值（续）

PARAMETER 参数	SYMBOL 符号	TEST CONDITIONS 测试条件		MIN 最小	TYP 典型	MAX 最大	UNIT 单位
Turn-on delay time 开通延迟	$t_{d(on)}$	V_{CC} = 400 V, I_D = 30 A, R_G = 2.4 Ω, V_{GS} = -5 / +18 V	T_{vj} = 25 °C		14		ns
			T_{vj} = 175 °C		12		ns
Rise time 上升时间	t_r		T_{vj} = 25 °C		16		ns
			T_{vj} = 175 °C		17		ns
Turn-off delay time 关断延迟	$t_{d(off)}$		T_{vj} = 25 °C		30		ns
			T_{vj} = 175 °C		36		ns
Fall time 下降时间	t_f		T_{vj} = 25 °C		6		ns
			T_{vj} = 175 °C		7		ns
Turn-on switching energy 开通损耗	E_{on}		T_{vj} = 25 °C		95		µJ
			T_{vj} = 175 °C		100		µJ
Turn-off switching energy 关断损耗	E_{off}		T_{vj} = 25 °C		17		µJ
			T_{vj} = 175 °C		24		µJ

Body Diode (MOSFET)[5]

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
Drain-source reverse voltage 漏源反向电压	V_{SD}	V_{GS} = -5 V, I_S = 30 A	T_{vj} = 25 °C		3.8		V
			T_{vj} = 175 °C		3.4		V
MOSFET peak forward recovery current 峰值正向恢复电流	I_{frm}	V_{DS} = 400 V, I_S = 30 A, V_{GS} = -5V dI/dt =1070 A/µs (25 °C), dI/dt =1110 A/µs (175 °C)	T_{vj} = 25 °C		17		A
			T_{vj} = 175 °C		23		A
MOSFET forward recovery charge 正向恢复电荷	Q_f		T_{vj} = 25 °C		0.19		µC
			T_{vj} = 175 °C		0.33		µC
MOSFET forward recovery time 正向恢复时间	t_{fr}		T_{vj} = 25 °C		19		ns
			T_{vj} = 175 °C		25		ns

Package properties 封装特性

PARAMETER 参数	SYMBOL 符号	TEST CONDITIONS 测试条件	MIN 最小值	TYP 典型值	MAX 最大值	UNIT 单位
Thermal resistance from junction to case 结到壳热阻	$R_{th(j-c)}$			0.42		K/W

[5] Characteristic values according to IEC 60747-8

Characteristics 特性曲线

Figure 1: Output characteristics (typical)
图 1. MOSFET 输出特性（典型值）
$I_D = f(V_{DS})$
$T_{vj} = -55\ °C$

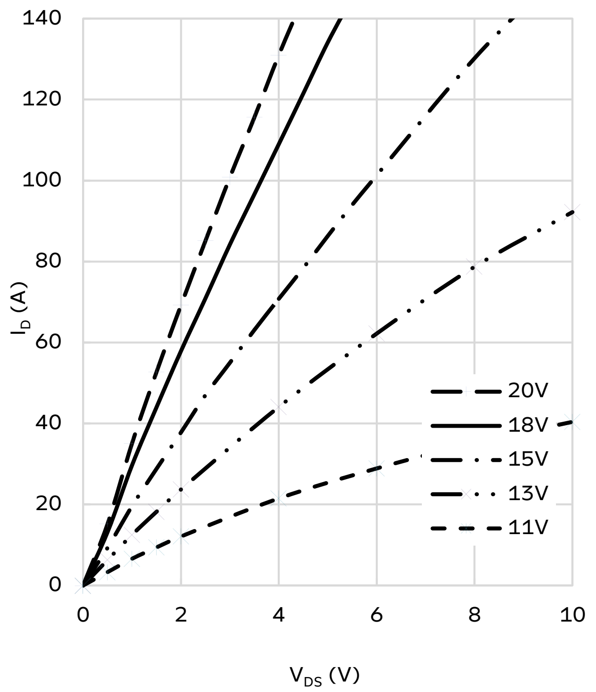


Figure 2: Output characteristics (typical)
图 2. MOSFET 输出特性（典型值）
$I_D = f(V_{DS})$
$T_{vj} = 25\ °C$

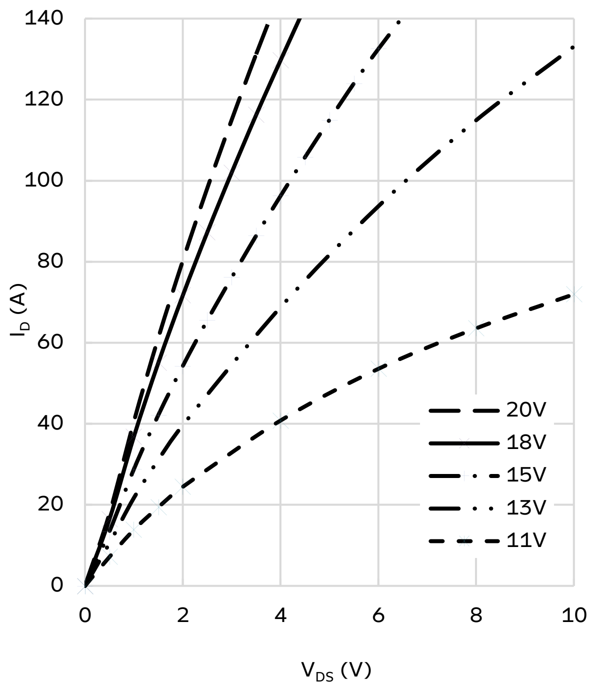


Figure 3: Output characteristics (typical)
图 3. MOSFET 输出特性（典型值）
$I_D = f(V_{DS})$
$T_{vj} = 175\ °C$

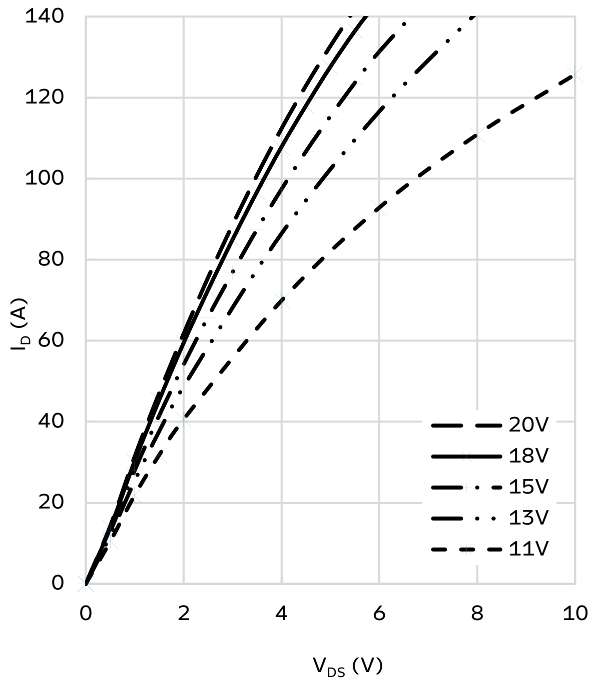


Figure 4: Drain-source on-state resistance vs. temperature
图 4. 导通电阻 vs 结温
$R_{DS(on)} = f(T_{vj})$

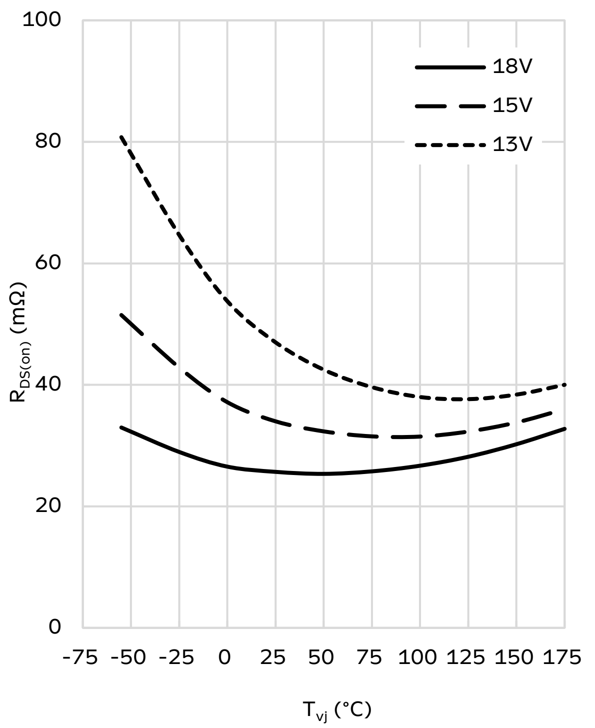


Figure 5: Drain-source on-state resistance vs. drain current
图 5. 导通电阻 vs 漏极电流
$R_{DS(on)} = f(I_{DS})$

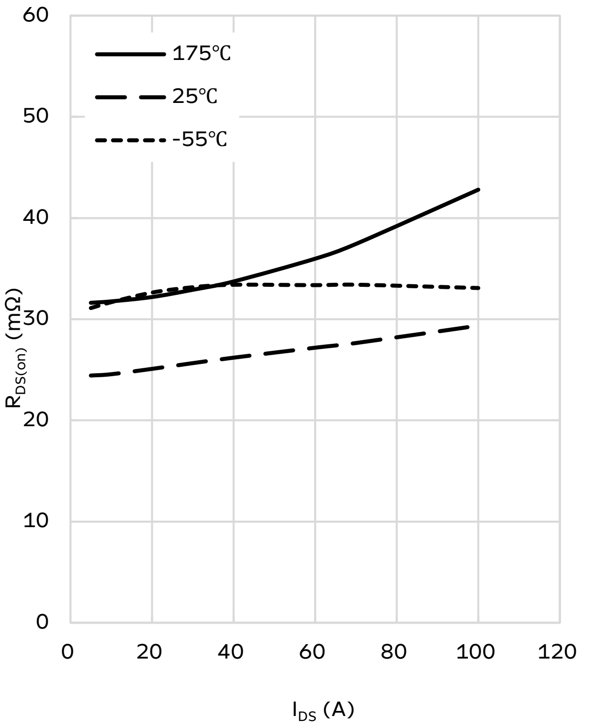


Figure 6: Transfer characteristic (typical)
图 6. 传输特性
$I_D = f(V_{GS})$
V_{DS} = 20 V

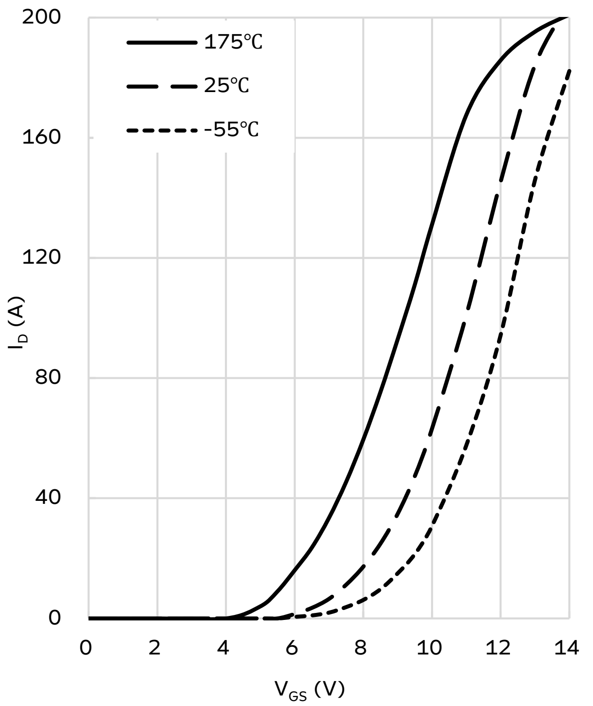


Figure 7: Gate-source threshold voltage vs. temperature
图 7. 开启电压 vs 温度特性
$V_{GS} = f(T_{vj})$
I_D = 8 mA, $V_{GS} = V_{DS}$

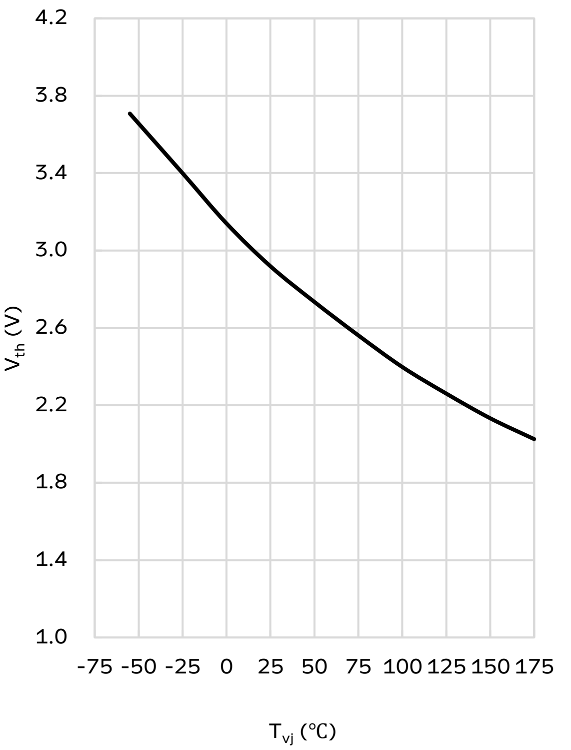


Figure 8: Body diode characteristic (typical)
图 8. 体二极管特性（典型值）
$I_S = f(V_{SD})$
T_{vj} = -55 °C

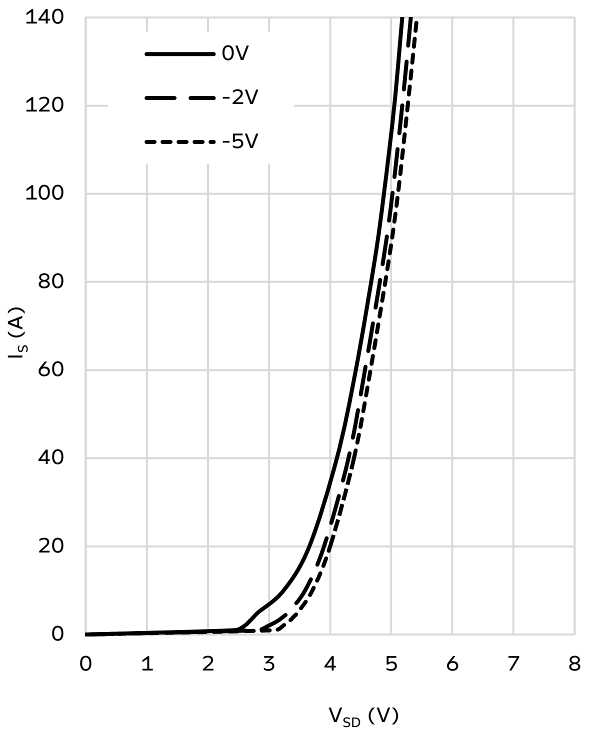


Figure 9: Body diode characteristic (typical)
图 9. 体二极管特性（典型值）
$I_S = f(V_{SD})$
T_{vj} = 25 °C

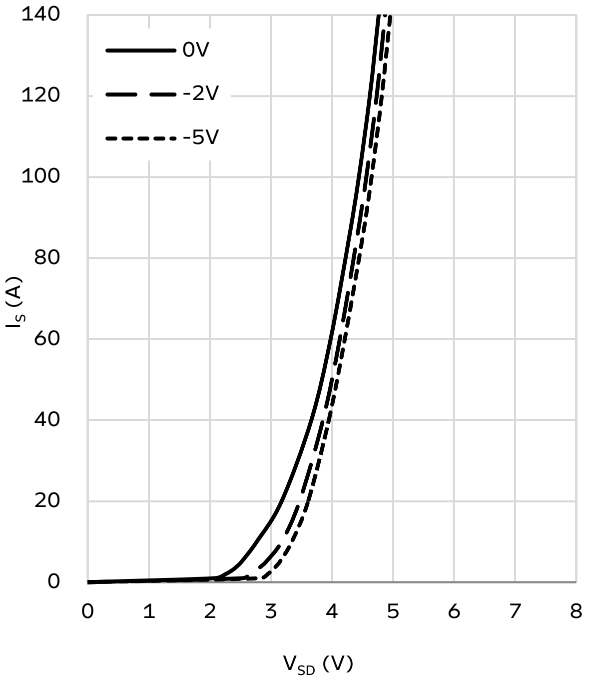


Figure 10: Body diode characteristic (typical)
图 10. 体二极管特性（典型值）
$I_S = f(V_{SD})$
T_{vj} = 175 °C

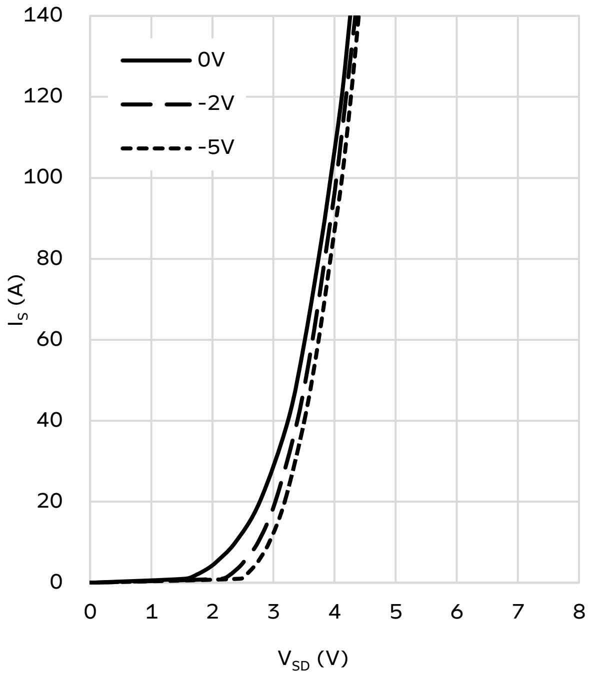


Figure 11: 3rd quadrant characteristics (typical)
图 11. 三象限特性（典型值）
$I_D = f(V_{DS})$
T_{vj} = -55 °C

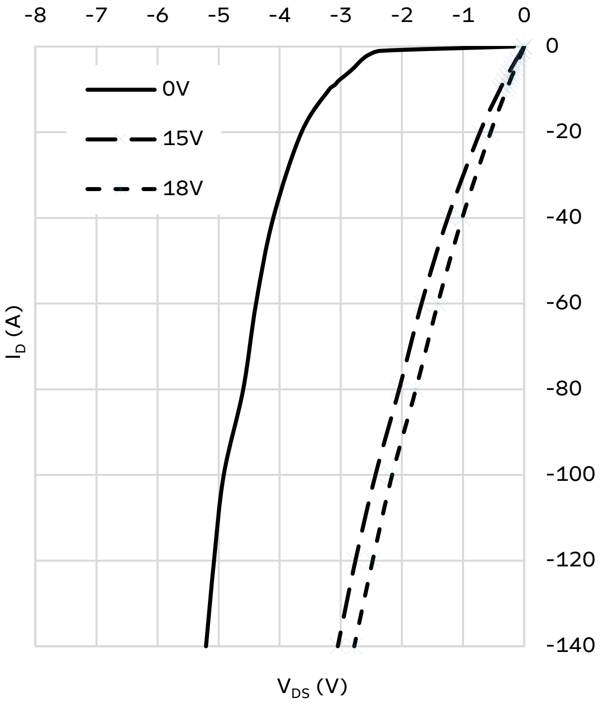


Figure 12: 3rd quadrant characteristics (typical)
图 12. 三象限特性（典型值）
$I_D = f(V_{DS})$
T_{vj} = 25 °C

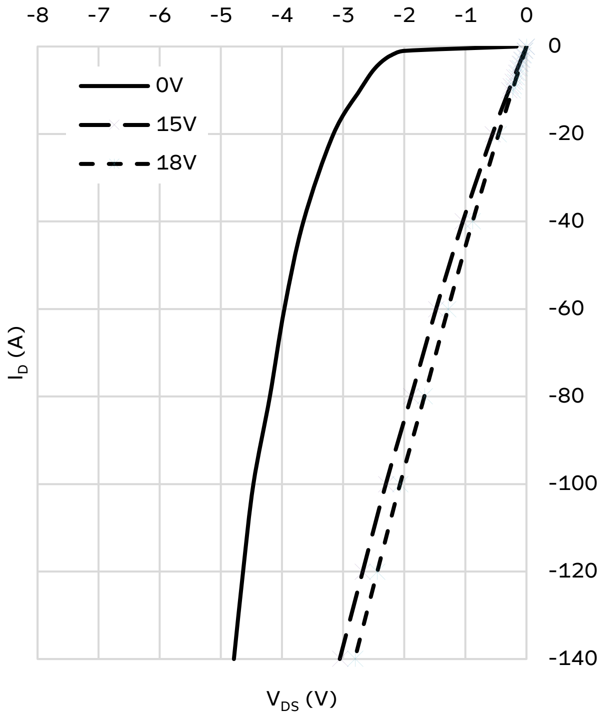


Figure 13: 3rd quadrant characteristics (typical)
图 13. 三象限特性（典型值）
$I_D = f(V_{DS})$
$T_{vj} = 175\ °C$

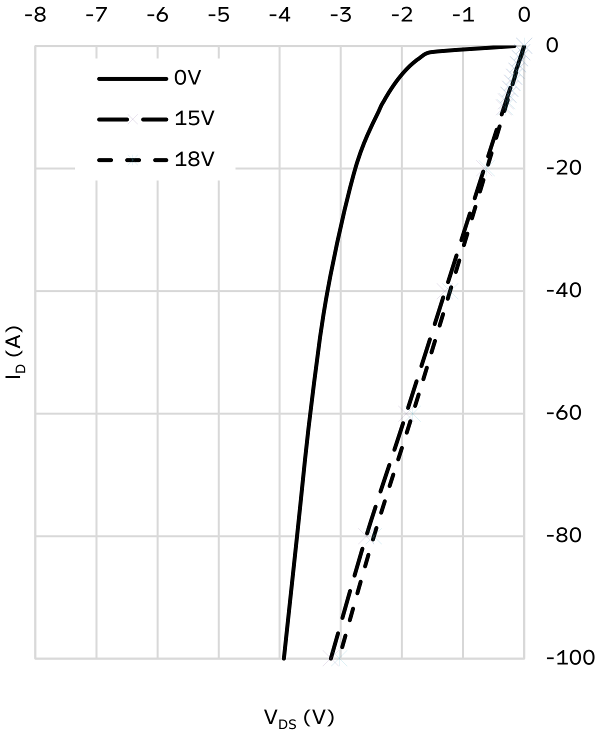


Figure 14: Total gate charge characteristics (typical)
图 14. 栅电荷特性（典型值）
$V_{GS} = f(Q_G)$

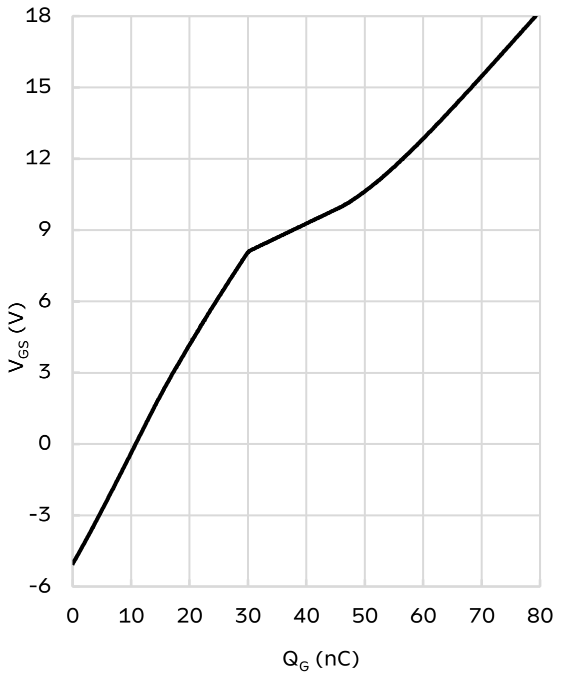


Figure 15: Capacitance vs. drain-source voltage (typical)
图 15. 电容 vs 漏源电压（典型值）
$C = f(V_{DS})$

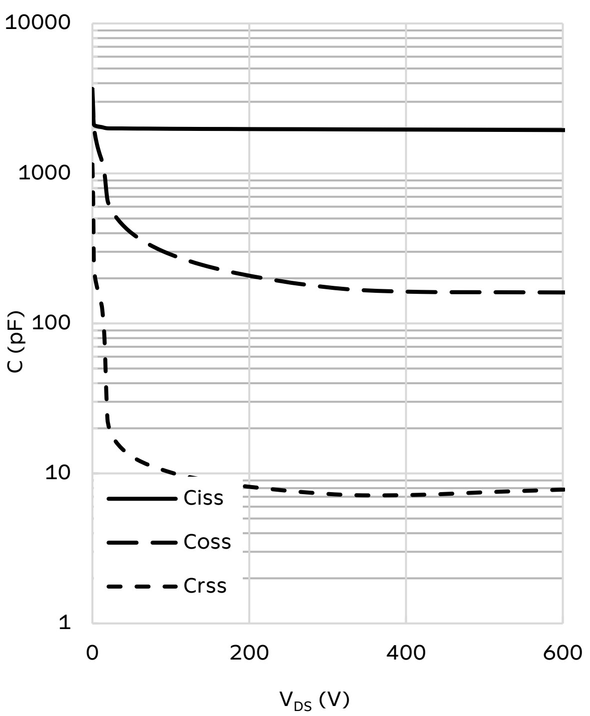


Figure 16: Output capacitor stored energy
图 16. 输出电容储存能量
$E_{OSS} = f(V_{DS})$

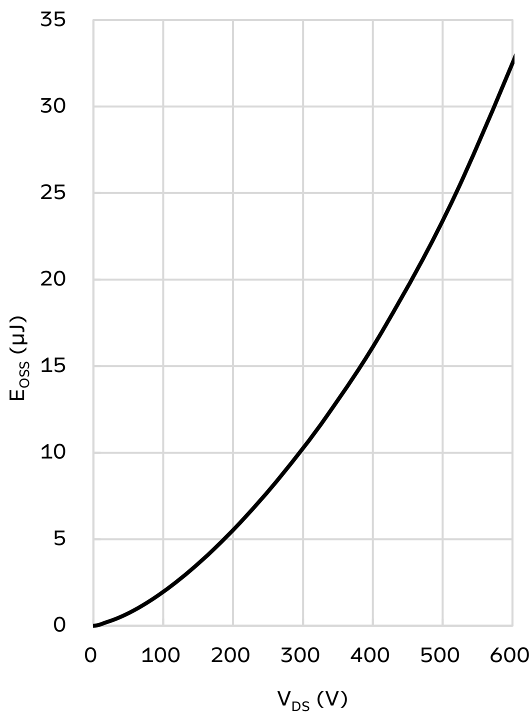


Figure 17: Continuous drain current derating vs. temperature
图 17. 漏极电流 vs 壳温
$I_D = f(T_C)$

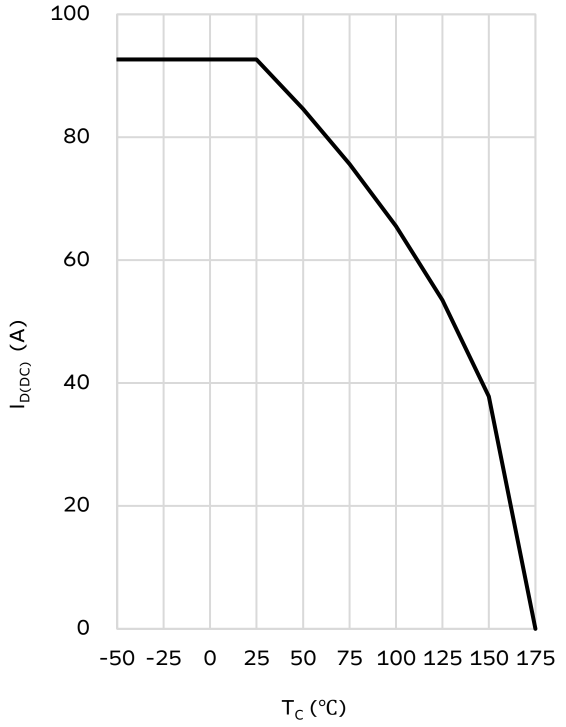


Figure 18: Maximum power dissipation derating vs. temperature
图 18. 耗散功率 vs 壳温
$P_D = f(T_C)$

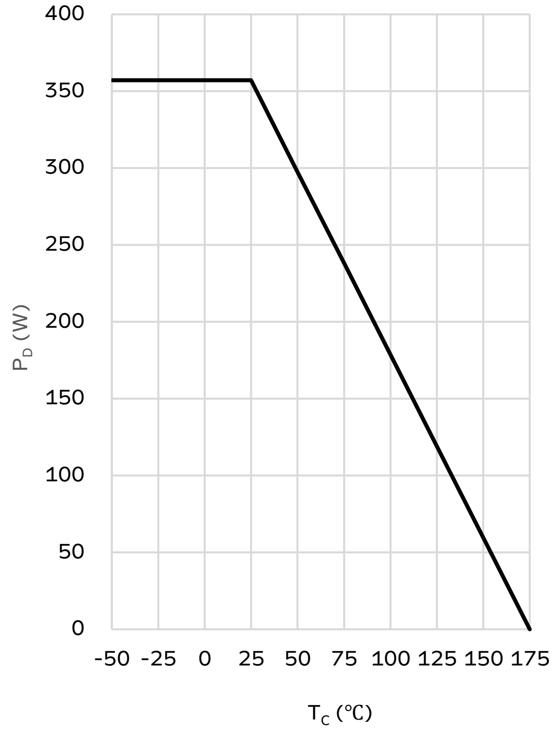


Figure 19: Switching energy vs. Drain current
图 19. 钳位电感开关能量 vs 漏极电流
$E = f(I_{DS})$
$V_{DS} = 400$ V, $V_{GS} = -5/18$ V, $T_{vj} = 175$ °C

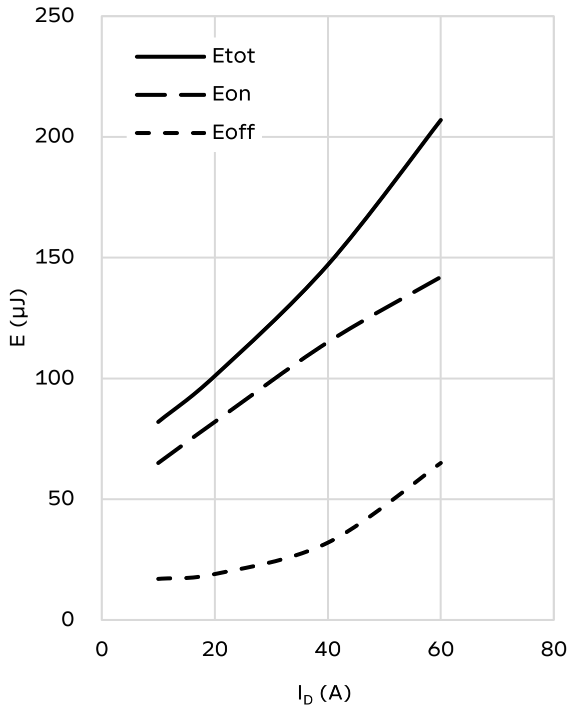


Figure 20: Switching energy vs. temperature
图 20. 钳位电感开关能量 vs 结温
$E = f(T_{vj})$
$V_{DS} = 400$ V, $V_{GS} = -5/18$ V, $I_{DS} = 30$ A

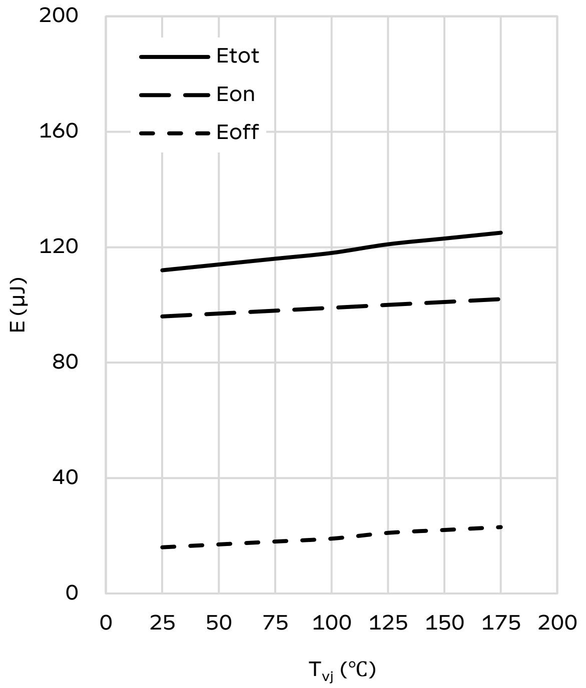


Figure 21: Switching energy vs. $R_{G\ (ext)}$
图 21. 钳位电感开关能量 vs $R_{G\ (ext)}$
$E = f(R_{G\ (ext)})$
$V_{DS} = 400$ V, $V_{GS} = -5/18$ V, $I_D = 30$ A, $T_{vj} = 25$ °C

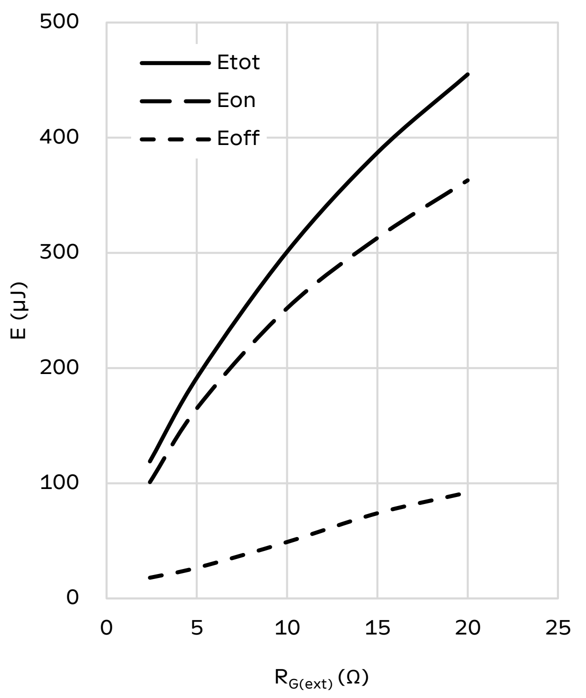


Figure 22: Reverse recovery charge vs. di_f/dt
图 22. 反向恢复电荷 vs di_f/dt
$Q_f = f(di_f/dt)$
$V_{DS} = 400$ V, $V_{GS} = -5/18$ V, $I_D = 30$ A

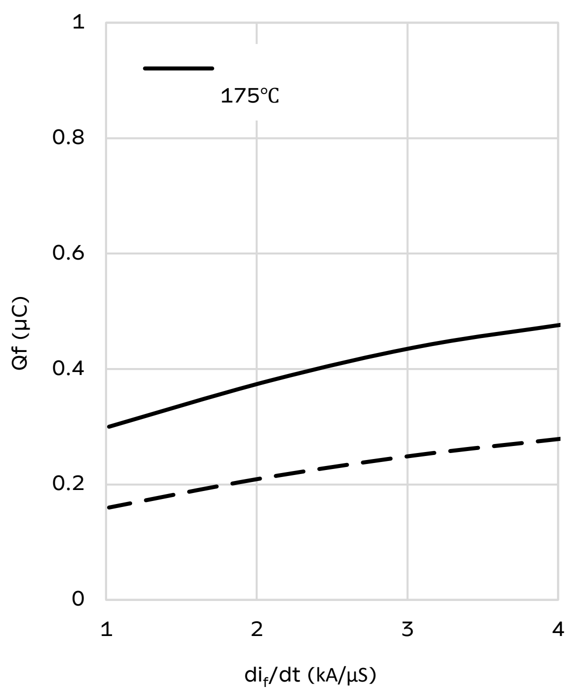


Figure 23: Reverse recovery current vs. di_f/dt
图 23. 反向恢复电流 vs di_f/dt
$I_{frm} = f(di_f/dt)$
$V_{DS} = 400$ V, $V_{GS} = -5/18$ V, $I_D = 30$ A

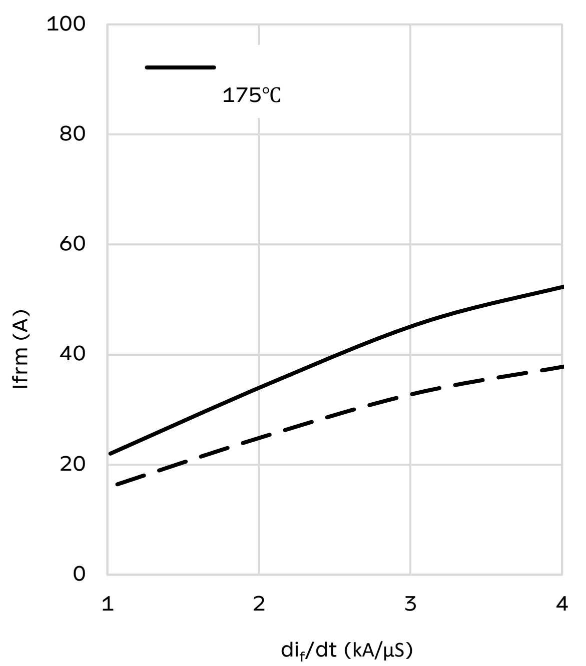


Figure 24: Safe Operating Area
图 24. 安全工作区
$I_D = f(V_{DS})$

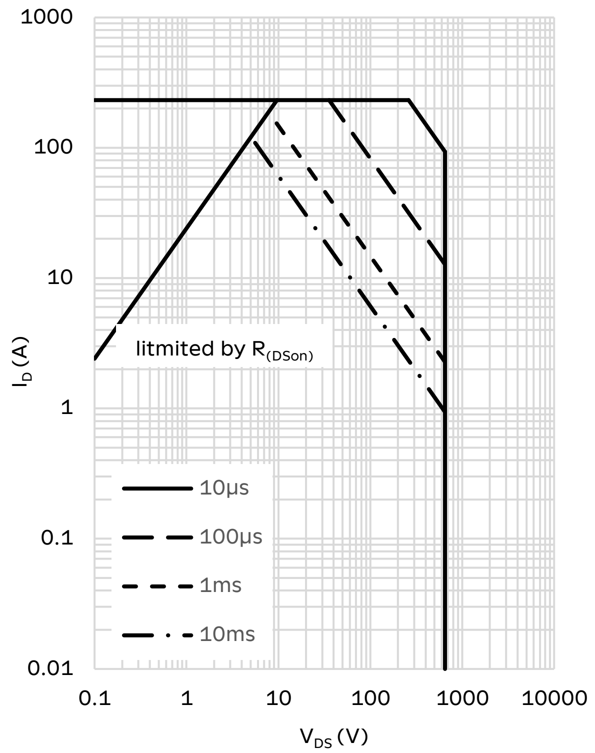
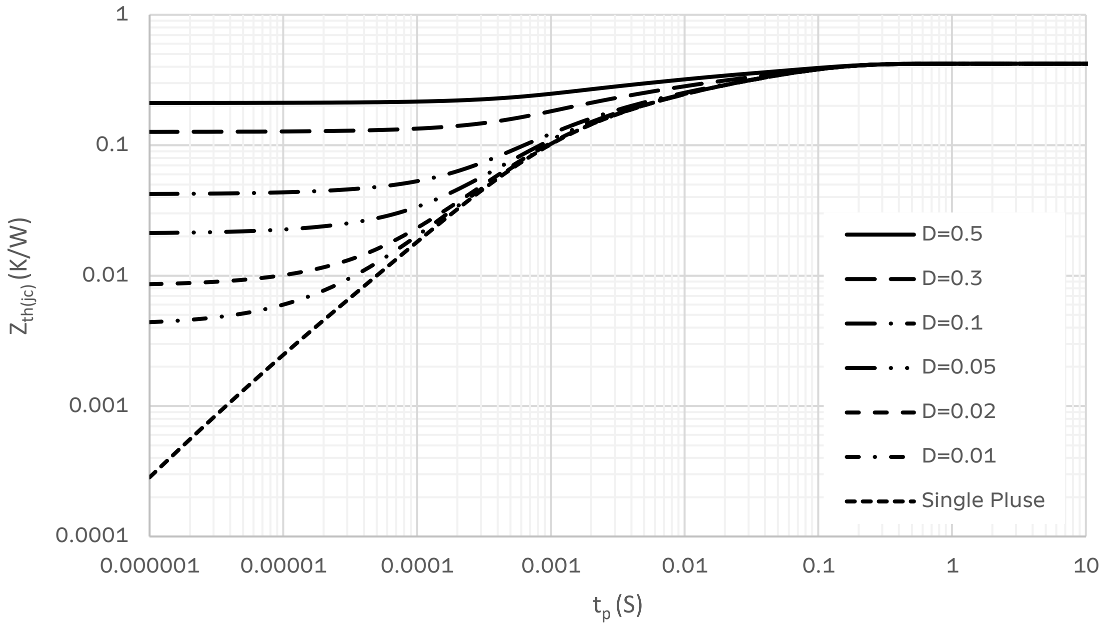
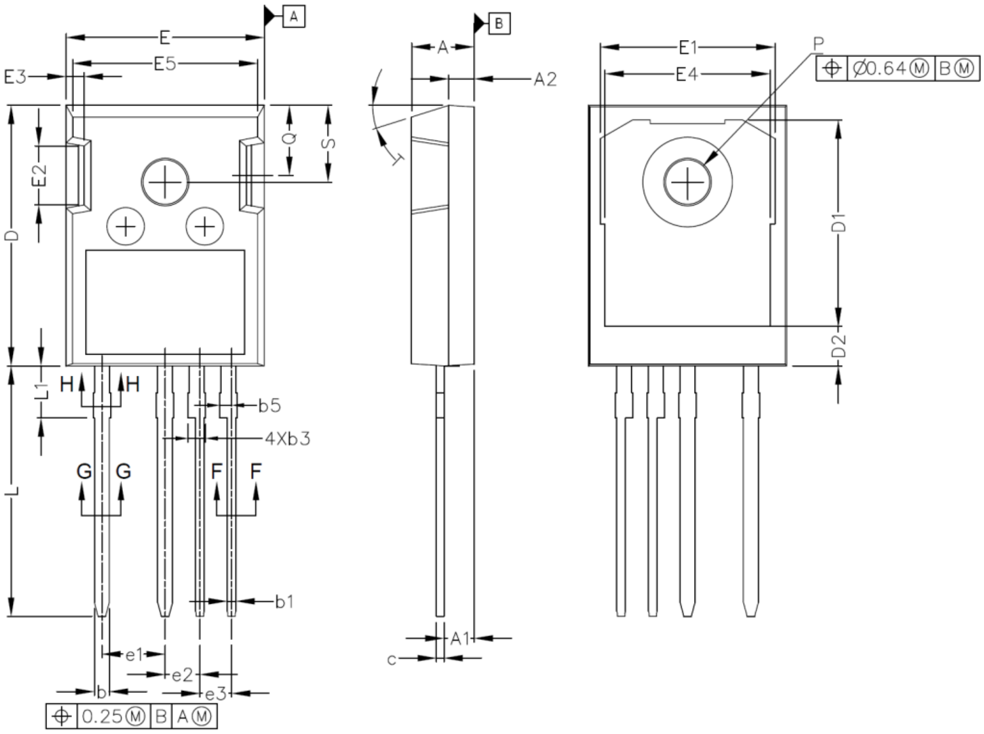


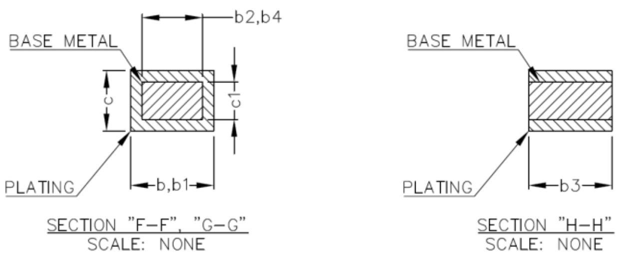
Figure 25: Transient thermal impedance (Junction - Case)
图 25. 瞬态热阻
$Z_{th(jc)} = f(t_p)$



Outline drawing 外形图

Marking SCSM22E027HG065





Symbol	Dimensions In Millimeters Min.	Max.
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b	1.10	1.30
b1	0.65	0.79
b2	1.10	1.25
b3	1.34	1.44
b4	0.65	0.74
b5	0.74	1.14
c	0.55	0.68

Symbol	Dimensions In Millimeters Min.	Max.
c1	0.55	0.65
D	20.80	21.10
D1	16.25	17.65
D2	2.95	3.35
E	15.75	16.13
E1	13.10	14.15
E2	4.32	5.10
E3	1.00	1.90
E4	12.38	13.43
E5	14.65	15.05

Symbol	Dimensions In Millimeters Min.	Max.
e1	5.08 BSC	
e2	2.79 BSC	
e3	2.54 BSC	
L	19.72	20.32
L1	3.97	4.37
ΦP	3.51	3.65
Q	5.49	6.00
S	6.04	6.30
T	17.5° REF	

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.
Note: All dimensions are in mm

Ordering Information 订购信息

OPTION 选项		ARTICLE NUMBER 商品编号
Qualification grade 资质等级	High-Reliability Industrial (E)	SCS027HG065M22**E**
Packaging Method 包装方式	Tube (_P20)	SCS027HG065M22**E _P20**

Revision History 修订历史

Release 发布	**Version 版本**	**Description 描述**
2026-08-12	v1.0	Preliminary Datasheet 初始规格书