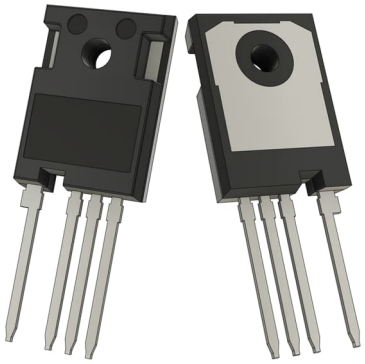
DATA SHEET

海明微半导体
HIMINGWAY

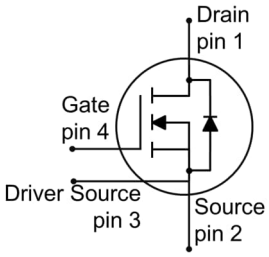
HC040N120F7Y

1200V N-Channel SiC MOSFET



Product features/产品特点

- High Efficiency & Low Loss Performance
  高效率与低损耗性能
- Low Capacitance with High speed switching speed
  低电容实现的快速开关特性
- Low reverse recovery Q_{rr}
  低反向恢复电荷Q_{rr}
- Excellent thermal performance for reduced cooling infrastructure
  优异的热性能可降低散热需求
- Enhanced Drive Stability (Kelvin Source)
  增强的驱动稳定性（开尔文源极）
- Simplification & Cost Reduction
  系统简化与成本降低
- The device is RoHS Compliant
  符合 RoHS 标准



Applications/应用领域

- EV DC Fast Charging Stations
  电动汽车直流快充桩
- Solar Inverters and Energy Storage Systems (ESS)
  光伏逆变器与储能系统
- Switch Mode Power Supplies (SMPS)
  开关电源
- High Voltage DC/DC Converters
  高压 DC/DC 转换器
- Uninterruptible Power Supplies (UPS)
  不间断电源

Key performance parameters/关键性能参数

Parameter	Value	Unit
V_{DSS}	1200	V
$R_{DS(on)}$,typ	40	mΩ
I_{DM}	142	A

Package parameters/封装信息

Type/型号	Package/封装	Marking/标识	Packaging method/包装方式
HC040N120F7Y	TO247-4L	HC040N120Y	Tube/管装

1. Maximum ratings at T_{vj}= 25°C, unless otherwise specified.

最大额定值默认T_{vj}= 25°C除非另有说明

Table 1 Maximum ratings/最大额定值

Parameter 参数	Symbol 符号	Test conditions 测试条件	Value 值	Unit 单位
Drain-source voltage 漏极-源极电压	V_{DSS}	T_{vj}≥25°C	1200	V
Drain current[1] 连续漏极电流	I_D	T_C=25°C,V_{GS}=18V	57	A
		T_C=100°C,V_{GS}=18V	40	
Peak drain current[2] 峰值漏极电流	I_{DM}		142	A
Continuous diode current[1] 连续二极管电流	I_S	T_C=25°C,V_{GS}=-3V	57	A
Peak diode current[2] 峰值二极管电流	I_{SM}	T_C=25°C,V_{GS}=-3V	142	A
Maximum gate source voltage 栅源最大电压	$V_{GS.MAX}$		-10~22	V
Recommend gate source voltage 推荐的栅源电压	$V_{GS.op}$		-5 - -3~18	V
Power dissipation[1] 总耗散功率	P_{tot}	T_C=25°C	288	W
Mounting torque 安装扭矩	M_d	M3 and M3.5 screw M3或者M3.5螺钉	0.6	Nm

1. Limited by T_{vj}(max)/受限于最大结温
2. Pulse width t_p limited by $T_{vj(max)}$ /脉宽受限于最大结温

2. Thermal characteristics
热特性

Table 2 Thermal characteristics/热特性

Parameter 参数	Symbol 符号	Test conditions 测试条件	Value/值			Unit 单位
			Min.	Typ.	Max.	
Storage Temperature 存储温度	T_{stg}		-55		175	°C
Operating junction Temperature 工作结温	T_{vj}		-55		175	°C
Thermal resistance, junction-case 结-壳热阻	$R_{th(j-c)}$				0.52	°C/W
Thermal resistance, junction-ambient 结-环境热阻	$R_{th(j-a)}$			40		°C/W
Soldering temperature 焊接温度	T_{sold}				260	°C

3. Electrical characteristics at T_{vj}= 25°C, unless otherwise specified.

电气特性默认T_{vj}= 25°C除非另有说明

Table 3 Static characteristics/静态特性

Parameter 参数	Symbol 符号	Test conditions 测试条件		Value/值			Unit 单位
				Min.	Typ.	Max.	
Drain-source breakdown voltage 漏源击穿电压	$V_{(BR)DSS}$	I_D=1mA,V_{GS}=0V		1200			V
Gate threshold voltage 门极开启阀值电压	$V_{GS(th)}$	I_D=10mA,V_{DS}=V_{GS}	T_{vj}=25°C	2.0	3.0	4.5	V
			T_{vj}=175°C		2.0		
Drain-source on-state resistance 漏极-源极导通电阻	$R_{DS(on)}$	I_D=28A,$V_{GS(on)}$=15V			55.5		mΩ
		I_D=28A,$V_{GS(on)}$=18V	T_{vj}=25°C		40	56	
			T_{vj}=175°C		64		
Zero gate voltage drain current 集电极-发射极漏电	I_{DSS}	V_{DS}=1200V,V_{GS}=0V			0.4	50	μA
Gate to source Leakage current 门极-源极漏电流	I_{GSS}	V_{DS}=0V,V_{GS}=18V				100	nA
		V_{DS}=0V,V_{GS}=-3V				100	
Forward transconductance 正向跨导	g_{fs}	I_D=28A,V_{DS}=20V			11		S
Integrated gate resistor 内部门极电阻	$R_{G.int}$	f=1MHz			3		Ω

Table 4 Dynamic characteristics/动态特性

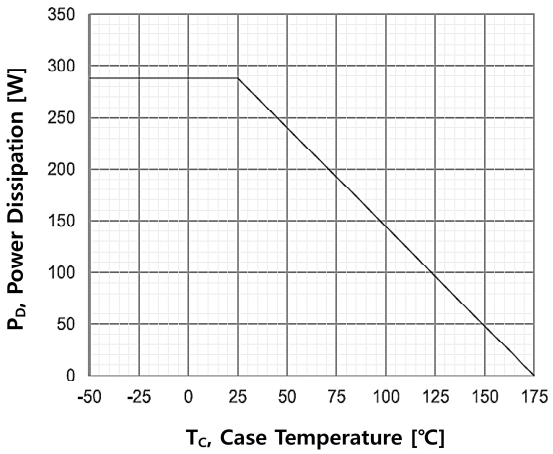
Parameter 参数	Symbol 符号	Test conditions 测试条件	Value/值			Unit 单位
			Min.	Typ.	Max.	
Input capacitance 输入电容	C_{iss}	V_{GS}=0V, V_{DS}=800V, f=250kHz		1668		pF
Output capacitance 输出电容	C_{oss}			105		
Reverse transfer capacitance 反向传输电容	C_{rss}			4		
Coss stored energy 输出电容存储能量	E_{oss}	Calculated based on C_{oss}		42		μJ
Total gate charge 总栅极电荷	$Q_{G(tot)}$	V_{GS}=-3/18V, I_D=28A, V_{DD}=800V		62		nC
Gate source charge 栅-源极电荷	Q_{GS}			20		
Gate-drain charge 栅-漏极电荷	Q_{GD}			14		
Turn-on delay time 开启延迟时间	$t_{d(on)}$	V_{GS}=-3/18V, I_D=28A, V_{DD}=800V, $R_{G(ext)}$=6.8Ω		19		ns
Rise time 上升时间	t_r			15		
Turn-off delay time 关闭延迟时间	$t_{d(off)}$			35		
Fall time 下降时间	t_f			8		
Turn-on switching loss 单次开启损耗	E_{on}			158		μJ
Turn-off switching loss 单次关闭损耗	E_{off}			100		
Total switching energy 总开关损耗	E_{tot}			258		

Table 5 Reverse diode characteristics/体二极管反向特性

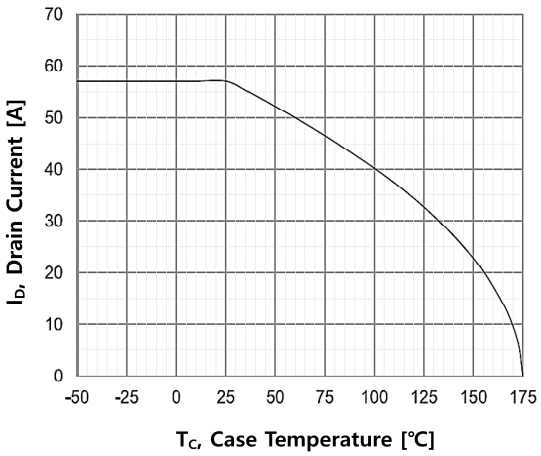
Parameter 参数	Symbol 符号	Test conditions 测试条件		Value/值			Unit 单位
				Min.	Typ.	Max.	
Drain-source reverse voltage 体二极管正向压降	V_{SD}	V_{GS}=0V,I_S=28A	T_{vj}=25°C		3.9		V
			T_{vj}=175°C		3.3		
		V_{GS}=-3V,I_S=28A	T_{vj}=25°C		4.3		
			T_{vj}=175°C		3.6		
MOSFET forward recovery time MOSFET正向恢复时间	t_{fr}	I_S=28A, V_{DS}=800V, di_S/dt=-3000A/μs			15		ns
MOSFET forward recovery charge MOSFET正向恢复电荷	Q_{fr}				219		nC
MOSFET peak forward recovery current MOSFET正向恢复峰值电流	I_{frm}				24		A

4. Electrical characteristics diagrams
电气特性图表

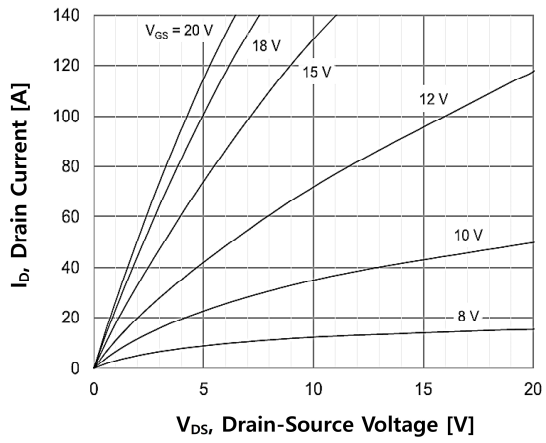
Power dissipation/耗散功率
P_D=f(T_C); T_{vj}≤175℃



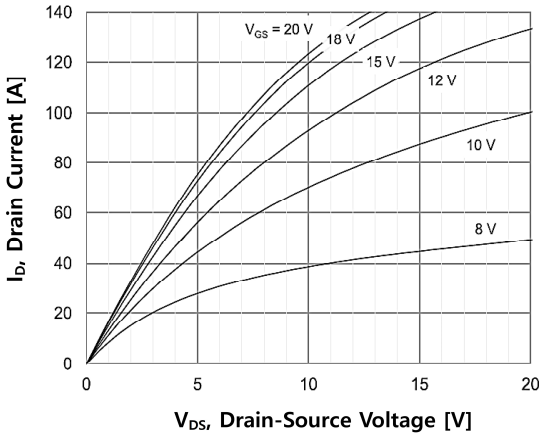
Continuous drain current/连续漏电与壳温
I_{DS}=f(T_C); T_{vj}≤175℃



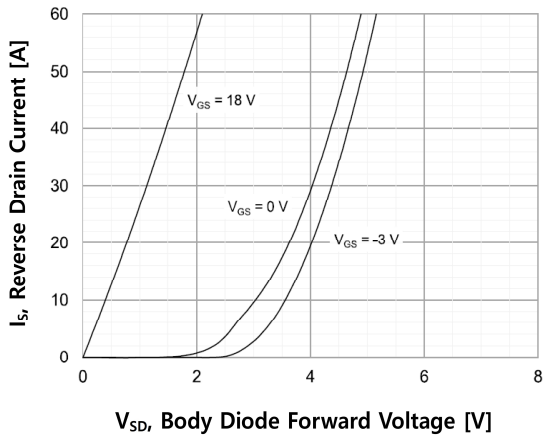
Typ.Output characteristic/典型输出特性
I_{DS}=f(V_{DS}); T_{vj}=25℃



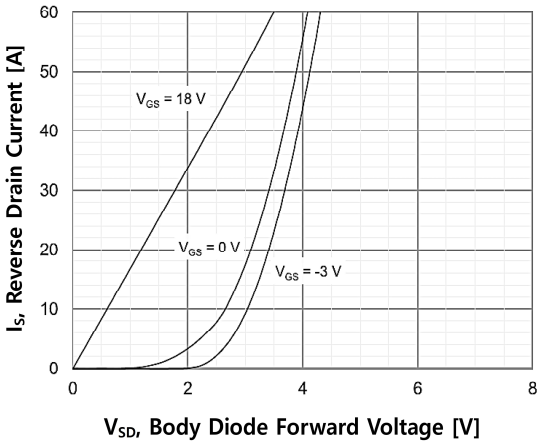
Typ.Output characteristic/典型输出特性
I_{DS}=f(V_{DS}); T_{vj}=175℃



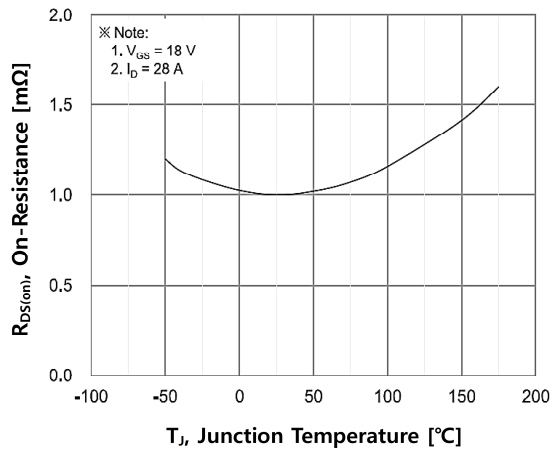
Typ.3rd Quadrant characteristics/典型第三象限特性
$I_{SD}=f(V_{SD})$; $T_{vj}=25℃$



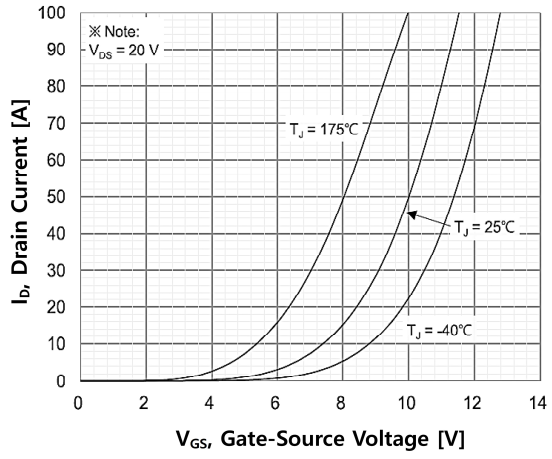
Typ.3rd Quadrant characteristics/典型第三象限特性
$I_{SD}=f(V_{SD})$; $T_{vj}=175℃$



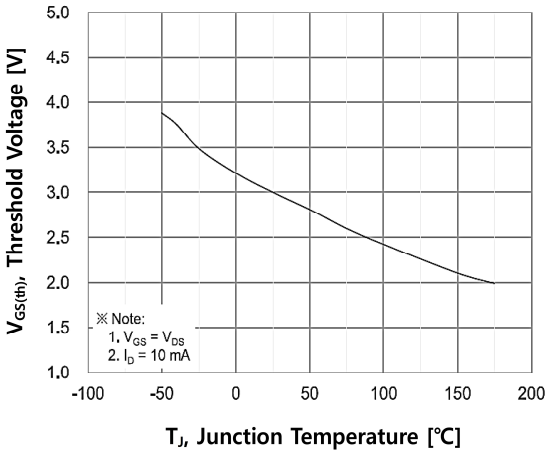
Typ.Drain-source on-state resistance/漏源导通电阻
$R_{DS(on)}=f(T_{vj})$;



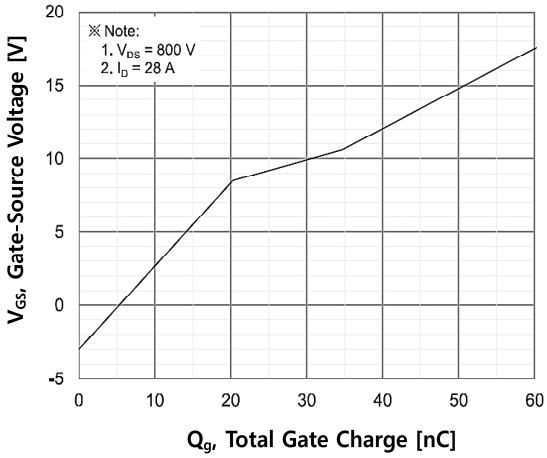
Typ.Transfer characteristics/传输特性
$I_{DS}=f(V_{GS})$;



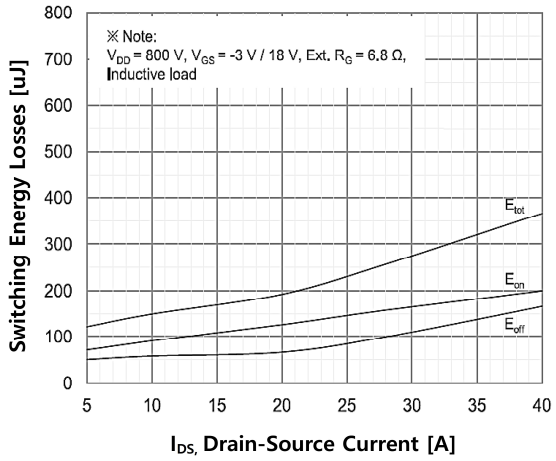
Typ.Gate threshold voltage/门级阈值电压结温特性
$V_{GS}=f(T_{vj})$;



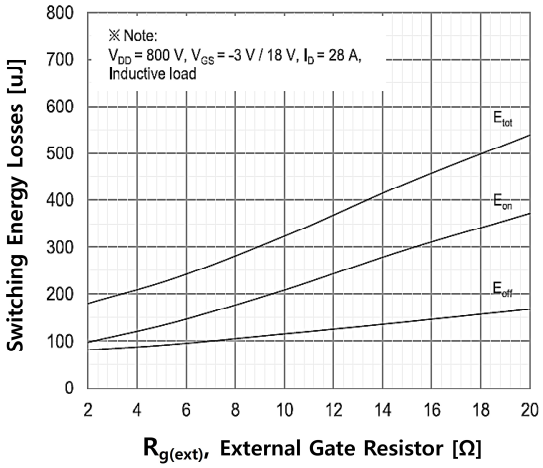
Typ.Gate charge/典型门级电荷
$V_{GS}=f(Q_G)$; T_{vj}=25℃



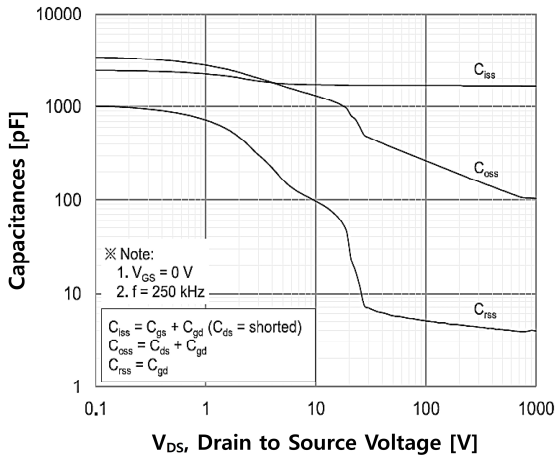
Typ.Switching losses vs current /动态损耗与电流特性
$E=f(I_C)$; T_{vj}=25°C



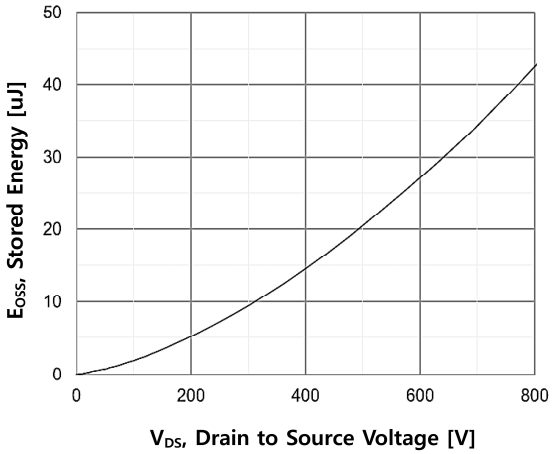
Typ.Switching losses vs resistance/动态损耗与门级电阻特性
$E=f(R_G)$; T_{vj}=25°C



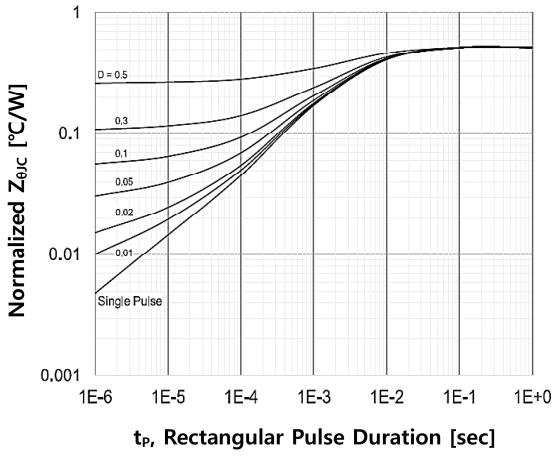
Typ.Capacitances/典型电容特性
C=f(V_{DS}); T_{vj}=25℃



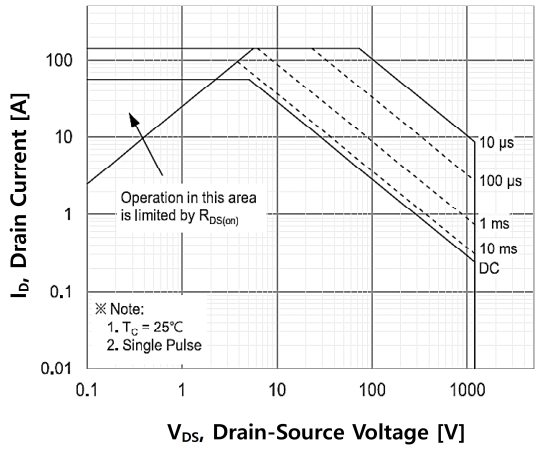
Typ.Coss stored energy/典型Coss存储能量
E_{OSS}=f(V_{DS}); T_{vj}=25℃



Transient Thermal impedance/瞬态热阻抗
$Z_{th(j-c)}$=f(t_p);

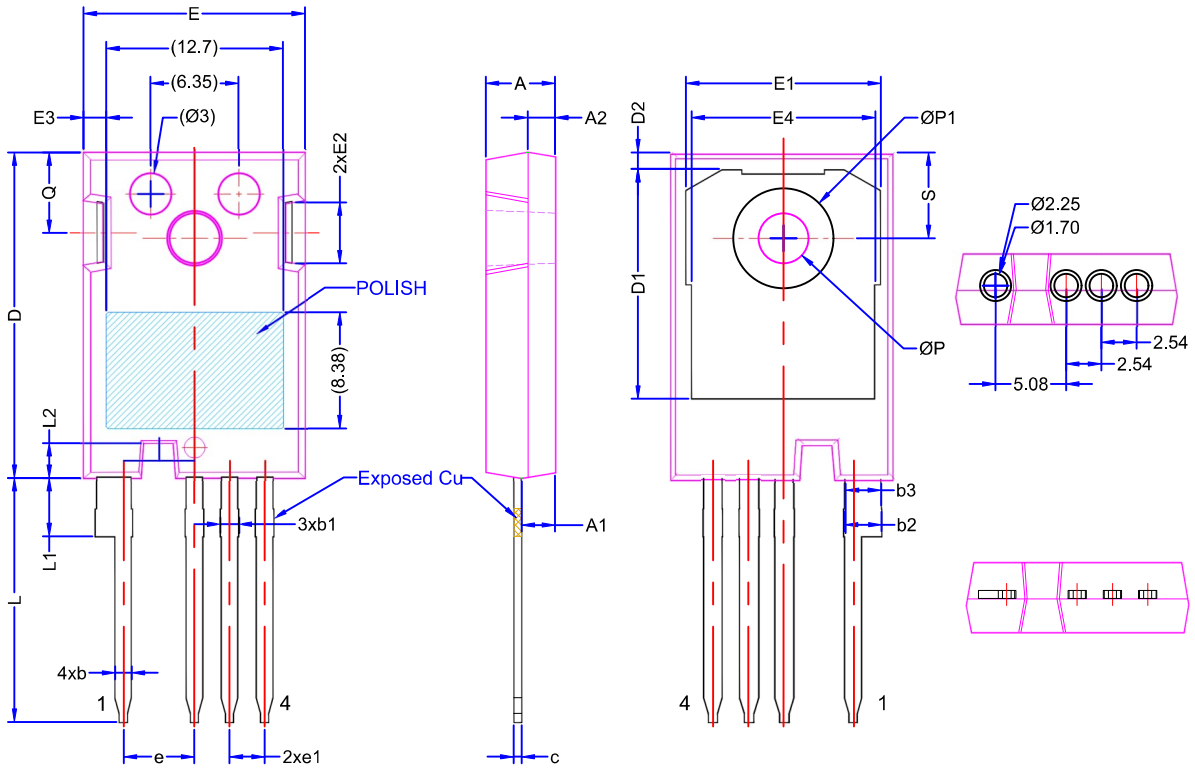


Forward bias safe operating area/安全工作区
I_D=f(V_{DS}); T_C=25℃,D=0



5. Package outline
封装外形

Figure 1. Outline TO247-4L, dimensions in mm/TO247-4L外形尺寸（毫米）



SYMBOL	DIMENSIONS			SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.		MIN.	NOM.	MAX.
A	4.83	5.02	5.21	E2	3.68	4.40	5.10
A1	2.29	2.41	2.54	E3	1.00	1.45	1.90
A2	1.91	2.00	2.16	E4	12.38	13.26	13.43
b	1.10	1.20	1.30	e	5.08 BSC		
b1	1.07	1.30	1.60	e1	2.54 BSC		
b2	2.39	2.67	2.94	L	17.31	17.57	17.82
b3	2.39	2.53	2.69	L1	3.97	4.19	4.37
c	0.55	0.60	0.68	L2	2.35	2.50	2.65
c1	0.55	0.60	0.65	ΦP	3.51	3.61	3.65
D	23.30	23.45	23.60	ΦP1	7.19 REF		
D1	16.25	16.55	17.65	Q	5.49	5.79	6.00
D2	0.95	1.19	1.25	S	6.04	6.17	6.30
E	15.75	15.94	16.13				
E1	13.10	14.02	14.15				

NOTES\注:
- Slot required, notch may be rounded
- 槽口是必需的，缺口（或凹槽）可以倒圆（或圆角化）
- Dimension D & E do not include mold flash, Mold flash shall not exceed 0.127mm per side, These dimensions are measured at the outermost extreme of the plastic body
- 尺寸 D 和 E 不包含溢边（模具飞边）。溢边每侧不得超过0.127mm。这些尺寸测量于塑料本体的最外极限。
- Thermal pad contour optional within dimension D1 & E1.
- 散热焊盘的轮廓在尺寸 D1 和 E1 定义的范围内可选。
- Lead finish uncontrolled in L1
- 引脚镀层在 L1 区域不作控制。
- ΦP to have A draft angle of 1.5°(REF.) to the top of the part with hole diameter of 3.91mm(REF.)
- ΦP孔具有一个1.5°（参考值）的拔模斜度（至器件顶部），孔径为 3.91 mm（参考值）

6. Revision history
修订历史

Table 6 Date and version number/日期与版本号

Date日期	Revision版本	Changes更改内容
2025-02-16	Rev. G 1.0	Target Datasheet（目标规格书）

7. Matters needing attention
注意事项

Appendix 1. Important Technical Guidance, Application Policy, and Copyright Notice/重要技术指南、应用规范与版权声明

[Data and Design Guidance]

The information provided herein, including typical values and application examples, serves as technical guidance only and should not be construed as a formal guarantee of product characteristics. This documentation is intended for qualified engineering personnel, who bear the ultimate responsibility for evaluating the product's suitability for their specific application and compliance with all industry standards.

【数据与设计指引】

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