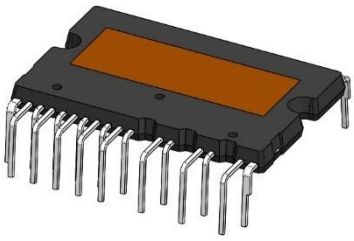
Description:

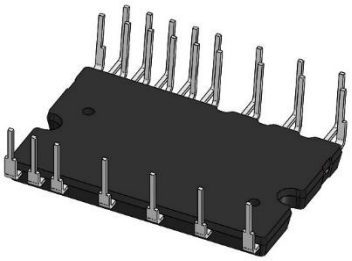
描述:

- 6HP30N120A9C offers the chance for integrating various power and control components to increase reliability, optimize PCB size and system costs.
  6HP30N120A9C 通过集成化功率和控制器件，以提高产品可靠性、优化PCB布局尺寸和系统成本
- It is designed to operate as high-performance inverter for demanding motor drive applications and active power factor correction.
  这是一款为实现电机驱动与有源功率校正(APFC)电路的高效逆变平台而设计的个性化产品。
- The product concept is specially adapted to power applications, which need good thermal performance and electrical isolation as well as EMI save control and overload protection.
  该产品是为大功率应用场合定制开发的，具有良好热性能和充足的电气隔离等级以及EMI保护限制和过载保护功能。
- Three phase inverter with 1200V SiC MOSFETs are combined with an optimized 6-channel SOI gate driver for excellent electrical performance.
  1200V SiC-MOSFETS的三相逆变桥与优化的SOI工艺6通道栅极驱动相结合，实现了高效的电气性能。
- The bodydiodes of SiC MOSFETs can be used as free-wheeling diode, and turning on the MOSFET during bodydiode conduction (synchronous rectification) can be used to reduce losses further.
  SiC-MOSFETS的体二极管可用作续流二极管，并且在体二极管导通（同步整流）期间通过使SiC-MOSFETS导通可以用于进一步降低损耗。

Features:

特点:





- Fully isolated Dual In-Line molded module
  全隔离双列直插模封模块
- Rugged 1200V SOI gate driver technology with stability against transient and negative voltage
  1200V SOI栅极驱动技术，具备稳定抗击瞬间负电压的能力
- Allowable negative VS potential up to -11 V for signal transmission at VBS = 15 V
  在VBS = 15 V 的信号传输中，允许负VS最高可达 - 11 V
- Integrated bootstrap functionality and over durrent shutdown
  集成自举和过流关断功能
- Built-in NTC thermistor for temperature monitor
  内置 NTC 热敏电阻，用于温度监测
- Under-voltage lockout at all channels
  所有通道均具备欠压锁定功能
- Low side source pins accessible for phase current monitoring (open source)
  低端源极引脚可用于相电流监测（开环源极）

- Anti cross-conduction prevention
  防直通保护功能
- All of 6 switches turn off during protection
  保护期间，6个开关都关闭
- Programmable fault clear timing and enable input
  可编程故障清除时序和使能输入
- Lead-free terminal plating; RoHS compliant
  无铅端子镀层；符合 RoHS 标准

Applications:

应用:

- Fan drives
  风扇驱动
- Active power factor correction
  有源功率因数校正
- High-performance motor drives
  高性能电机驱动

Package parameters封装参数

Type型号	Package封装	Marking标识	Packaging method 包装方式
6HP30N120A9C	SDIP24	6HP30N120A9C	Tube 管

1. Internal electrical schematic
内部电路原理图

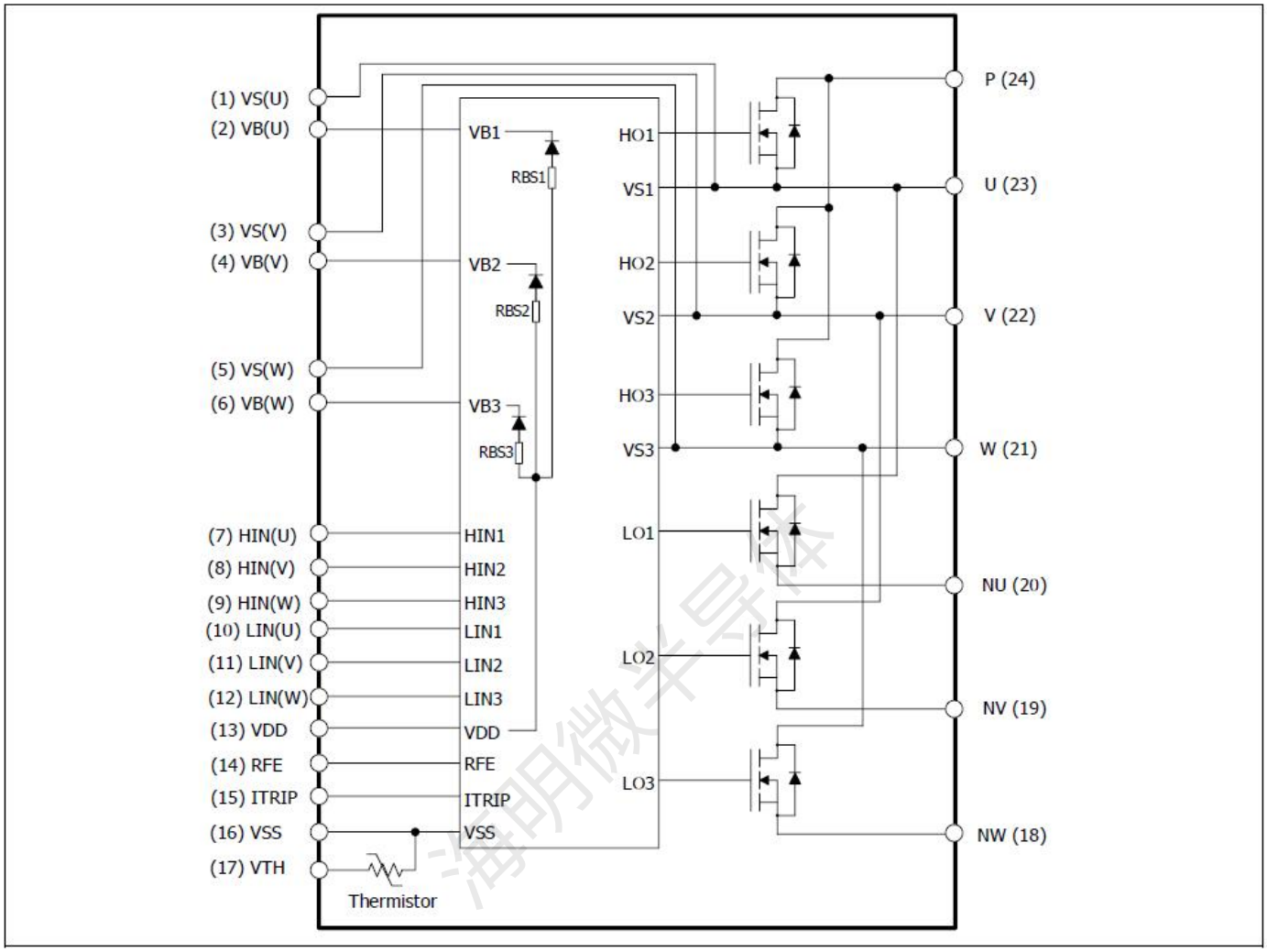


Figure 1　Internal electrical schematic　内部电路原理图

2. Pin configuration
引脚配置

2.1. Pin assignment
引脚分布

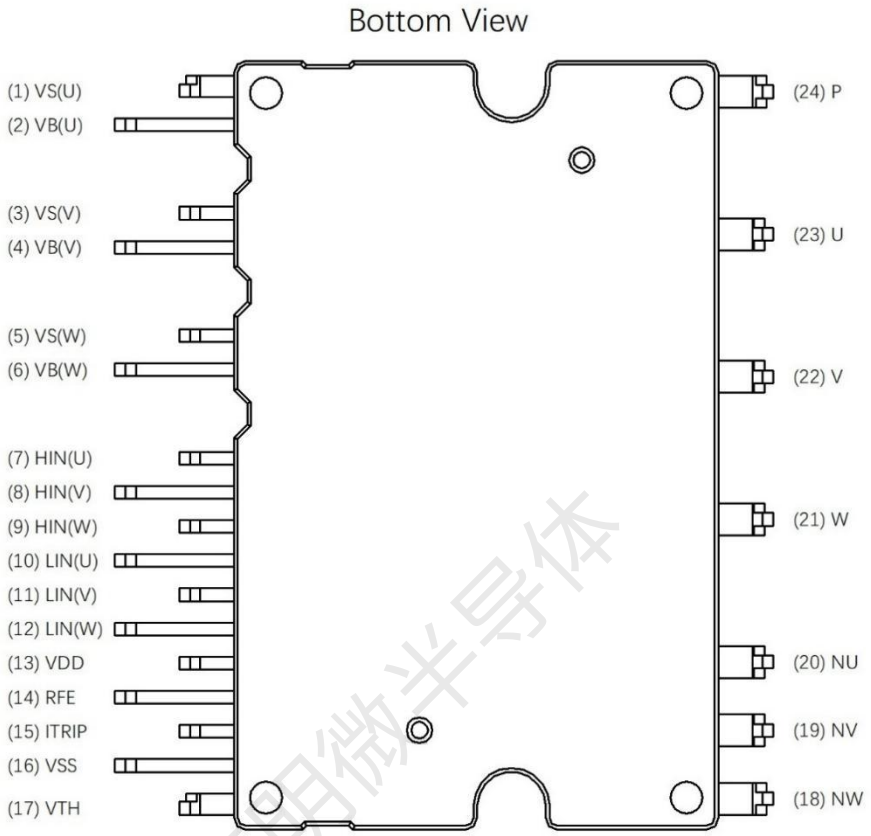


Figure 2 Module pinout 模块引脚分布

Pin number 引脚编号	Pin name 引脚名称	Pin description 引脚描述
1	VS(U)	U-phase high side floating IC supply offset voltage U 相高边驱动 IC 浮点偏置电压
2	VB(U)	U-phase high side floating IC supply voltage U 相高边驱动 IC 浮点供电电压
3	VS(V)	V-phase high side floating IC supply offset voltage V 相高边驱动 IC 浮点偏置电压
4	VB(V)	V-phase high side floating IC supply voltage V 相高边驱动 IC 浮点供电电压
5	VS(W)	W-phase high side floating IC supply offset voltage W 相高边驱动 IC 浮点偏置电压
6	VB(W)	W-phase high side floating IC supply voltage W 相高边驱动 IC 浮点供电电压
7	HIN(U)	U-phase high side gate driver input U 相高边栅极驱动输入端

8	HIN(V)	V-phase high side gate driver input V 相高边栅极驱动输入端
9	HIN(W)	W-phase high side gate driver input W 相高边栅极驱动输入端
10	LIN(U)	U-phase low side gate driver input U 相低边栅极驱动输入端
11	LIN(V)	V-phase low side gate driver input V 相低边栅极驱动输入端
12	LIN(W)	W-phase low side gate driver input W 相低边栅极驱动输入端
13	VDD	Low side control supply 低边控制电源
14	RFE	Programmable fault clear time, fault output, enable input 可编程故障清除时间、故障输出、使能输入端
15	ITRIP	Over current shutdown input 过流关断输入端
16	VSS	Low side control negative supply 低边控制负电源
17	VTH	Thermistor therminal 热敏电阻
18	NW	W-phase low side source W 相低边源极
19	NV	V-phase low side source V 相低边源极
20	NU	U-phase low side source U 相低边源极
21	W	Motor W-phase output 电机 W 相输出
22	V	Motor V-phase output 电机 V 相输出
23	U	Motor U-phase output 电机 U 相输出
24	P	Positive bus input voltage 母线电压输入正极

3. Maximum ratings 最大额定值

(V_{DD} = 15 V and T_J = 25°C, if not stated otherwise 除非另有说明)

3.1. Module section 模块部分

Symbol 符号	Description 描述	Condition 条件	Value 值	Unit 单位
T_{STG}	Storage temperature range 存储温度范围		-40~125	℃
T_C	Operating case temperature 外壳工作温度	Refer to Figure 4 参考图 4	-40~125	℃
T_J	Operating junction temperature 工作结温		-40~150	℃
Viso	Isolation test voltage 绝缘耐压	1min, RMS, f=60Hz	2500	V

3.2. Inverter section 逆变器

Symbol 符号	Description 描述	Condition 条件	Value 值	Unit 单位
V_{DSS}	Max. blocking voltage 最大阻断电压		1200	V
V_{PN}	DC link supply voltage of P-N P-N 间直流供电电压	Applied between P-N	900	V
$V_{PN(surge)}$	DC link supply voltage (surge) of P-N P-N 间直流供电电压（浪涌）	Applied between P-N	1000	V
I_D	DC drain current 漏极直流电流	T_C=25°C, T_J<150°C	±45	A
		T_C=80°C, T_J<150°C	±30	
I_{DP}	Pulse drain current 漏极脉冲电流		±90	A
P_{tot}	Power dissipation per MOSFET 每颗 MOS 管耗散功率		89	W
t_{sc}	Short circuit withstand time 短路耐受时间	VDC≤800 V, T_J≤150°C	2	μs

3.3. Control section 控制部分

Symbol 符号	Description 描述	Condition 条件	Value 值	Unit 单位
Vs	High Side offset voltage 高边偏置电压		1200	V
V_{RRM}	Repetitive peak reverse voltage of bootstrap diode 自举二极管反向重复峰值电压		1200	V
V_{DD}	Module control supply voltage 模块控制电源电压		-1~20	V

V_{BS}	High side floating supply voltage(V_B reference to Vs) 高边浮点供电电压（V_B 与 V_S 之间）		-1~20	V
V_{IN}	Input voltage (LIN, HIN, ITRIP, RFE) 输入电压(LIN, HIN, ITRIP, RFE)		-1~Vop+ 0.3	V

4. Thermal characteristics 热特性

Symbol 符号	Description 描述	Condition 条件	Value 值			Unit 单位
			Min. 最小	Typ. 典型	Max. 最大	
R_{thJC}	Single MOSFET thermal resistance, junction-case 单 MOS 芯片结壳热阻				1.49	K/W

5. Recommended operation conditions 推荐工作条件

Symbol 符号	Description 描述	Value 值			Unit 单位
		Min.最小	Typ.典型	Max.最大	
V_{PN}	DC link supply voltage of P-N P-N 间直流供电电压	350	600	800	V
V_{DD}	Low side supply voltage 低边供电电压	13.5	15	18.5	V
V_{BS}	High side floating supply voltage (V_B vs. V_S) 高边浮点供电电压（V_B 与 V_S 之间）	12.5		18.5	V
V_{IN}	Logic input voltages LIN, HIN, ITRIP, RFE 逻辑输入电压 LIN, HIN, ITRIP, RFE	0		5	V
F_{PWM}	PWM carrier frequency at V_{DD} = 15 V V_{DD} = 15 V 时的 PWM 载波频率			80	kHz
DT	External dead time between HIN & LIN HIN 与 LIN 之间的外部死区时间	0.5			μs
V_{COMP}	Voltage between VSS - N (including surge) VSS 与 N 之间的电压（包括浪涌）	-5		5	V
$PW_{IN(ON)}$ $PW_{IN(OFF)}$	Minimum input pulse width 最小输入脉冲宽度	1			μs
ΔV_{BS}, ΔV_{DD}	Control supply variation 控制电源波动	-1 -1		1 1	V/μs

6. Static parameters 静态参数

(V_{DD} = 15 V and T_J = 25°C, if not stated otherwise 除非另有说明)

6.1. Inverter section 逆变部分

Symbol 符号	Description 描述	Condition 条件	Value 值			Unit 单位
			Min. 最小	Typ. 典型	Max. 最大	

$R_{DS(on)}$	Drain-source on-state resistance 漏源极导通电阻	I_D = 30A, V_{IN} = 5V T_J = 25℃ 150℃		32 50	40 -	mΩ
I_{DSS}	Drain-source leakage current 漏源极漏电流	V_{DS}=1200V			1	mA
V_{SD}	Diode forward voltage 二极管正向压降	I_{SD} = 30A, V_{IN} = 0V T_J = 25℃ 150℃		4.0 3.9	5.9	V

6.2. Control section 控制部分

Symbol 符号	Description 描述	Condition 条件	Value 值			Unit 单位
			Min. 最小	Typ. 典型	Max. 最大	
V_{IH}	Logic "1" input voltage (LIN, HIN) 逻辑“1”输入电压			1.9	2.3	V
V_{IL}	Logic "0" input voltage (LIN, HIN) 逻辑“0”输入电压		0.7	0.9		V
$V_{IT, TH+}$	ITRIP positive going threshold ITRIP 正向阈值		475	500	525	mV
$V_{IT, HYS}$	ITRIP input hysteresis ITRIP 输入滞后			55		mV
V_{DDUV+} V_{BSUV+}	V_{DD} and V_{BS} supply under voltage positive going threshold V_{DD} 和 V_{BS} 电源欠压正向阈值		11.5 10.5	12.2 11.2	13.0 12.0	V
V_{DDUV-} V_{BSUV-}	V_{DD}/V_{BS} supply under voltage negative going threshold V_{DD}/V_{BS} 电源欠压反向阈值		10.5 9.5	11.2 10.2	12.0 11.0	V
V_{DDUVH} V_{BSUVH}	V_{DD}/V_{BS} supply under voltage lockout hysteresis V_{DD}/V_{BS} 电源欠压锁定滞后			1		V
I_{QBS}	Quiescent V_{BX} supply current (V_{BX} only) 静态 V_{BX} 电源电流（仅 V_{BX}）	H_{IN} = 0V		175		μA
I_{QDD}	Quiescent V_{DD} supply current (V_{DD} only) 静态 V_{DD} 电源电流（仅 V_{DD}）	L_{INX} = 0V H_{INX} = 5V		1		mA
I_{IN+}	Input bias current for LIN, HIN LIN、HIN 的输入偏置电流	V_{IN} = 5V		1		mA
I_{ITRIP+}	Input bias current for ITRIP ITRIP 的输入偏置电流	V_{ITRIP} = 5 V		30	100	μA

I_{RFE}	Input bias current for RFE RFE 的输入偏置电流	V_{RFE} = 5V, V_{ITRIP} = 0V			5	μA
V_{RFE}	RFE output voltage RFE 输出电压	I_{RFE} = 10 mA, V_{ITRIP} = 1V		0.4		V
$V_{RFE, TH+}$	V_{RFE} positive going threshold V_{RFE} 正向阈值			1.9	2.3	V
$V_{RFE, TH-}$	V_{RFE} negative going threshold V_{RFE} 反向阈值		0.7	0.9		V
V_{F_BSD}	Bootstrap diode forward voltage 自举二极管正向电压	I_F = 0.3 mA		0.9		V
R_{BSD}	Bootstrap diode resistance 自举二极管电阻	Between V_F = 4 V and V_F = 5 V		120		Ω

7. Dynamic parameters 动态参数

(V_{DD} = 15 V and T_J = 25°C, if not stated otherwise 除非另有说明)

7.1. Inverter section 逆变部分

Symbol 符号	Description 描述		Condition 条件	Value 值			Unit 单位
				Min. 最小	Typ. 典型	Max. 最大	
t_{on}	High side	Turn-on propagation delay time 开通传输延迟时间	V_{HIN} = 5V, I_D = 30A, V_{DC} = 600V		880		ns
t_r		Turn-on rise time 开通上升时间			47		ns
$t_{c(on)}$		Turn-on switching time 开通时间			142		ns
t_{rr}		Reverse recovery time 反向恢复时间			65		ns
t_{off}		Turn-off propagation delay time 关断传输延迟时间	V_{HIN} = 0V, I_D = 30A, V_{DC} = 600V		970		ns
t_f		Turn-off fall time 关断下降时间			75		ns
$t_{c(off)}$		Turn-off switching time 关断时间			105		ns
E_{on}		MOSFET turn-on energy (includes reverse recovery of diode) MOSFET 开通能量（包含二极管反向恢复）	V_{DC} = 600V, I_D = 30A T_J =25°C 150°C		0.95 1.08		mJ
E_{off}		MOSFET turn-off energy MOSFET 关断能量	V_{DC} = 600V, I_D = 30A T_J =25°C 150°C		0.50 0.73		mJ
E_{rec}		Body diode recovery energy 体二极管反向恢复能量	V_{DC} = 600V, I_D = 30A T_J =25°C 150°C		0.10 0.13		mJ
t_{on}	Low side	Turn-on propagation delay time 开通传输延迟时间	V_{HIN} = 5V, I_D = 30A, V_{DC} = 600V		970		ns
t_r		Turn-on rise time 开通上升时间			87		ns
$t_{c(on)}$		Turn-on switching time 开通时间			235		ns
t_{rr}		Reverse recovery time 反向恢复时间			95		ns
t_{off}		Turn-off propagation delay time 关断传输延迟时间	V_{HIN} = 0V, I_D = 30A, V_{DC} = 600V		890		ns
t_f		Turn-off fall time			55		ns

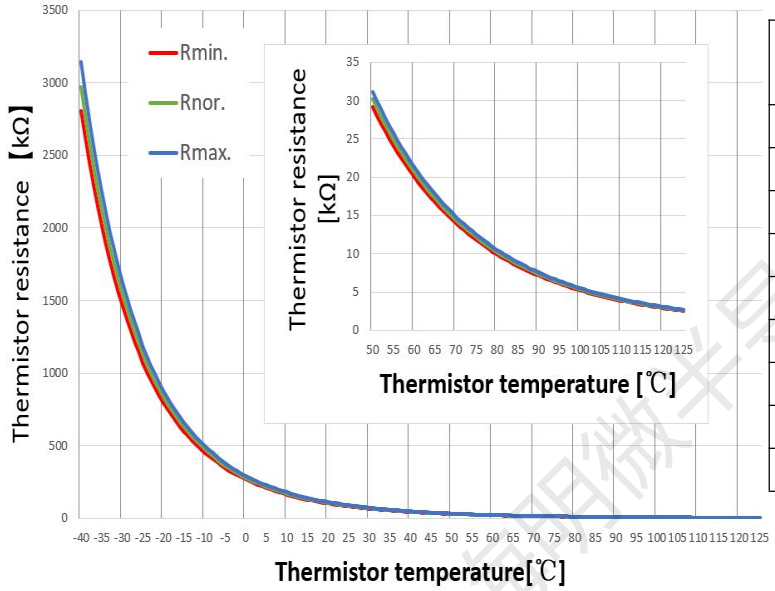
		关断下降时间					
$t_{c(off)}$		Turn-off switching time 关断时间			70		ns
E_{on}		MOSFET turn-on energy (includes reverse recovery of diode) MOSFET 开通能量（包含二极管反向恢复）	V_{DC} = 600V, I_D = 30A T_J =25℃ 150℃		1.53 1.65		mJ
E_{off}		MOSFET turn-off energy MOSFET 关断能量	V_{DC} = 600V, I_D = 30A T_J =25℃ 150℃		0.30 0.38		mJ
E_{rec}		Body diode recovery energy 体二极管反向恢复能量	V_{DC} = 600V, I_D = 30A T_J =25℃ 150℃		0.09 0.10		mJ
t_{scp}	Short circuit propagation delay time 短路传输延迟时间		From $V_{IT,\,TH+}$ to 10% I_{SC}		2		μS

7.2. Control section 控制部分

Symbol 符号	Description 描述	Condition 条件	Value 值			Unit 单位
			Min. 最小	Typ. 典型	Max. 最大	
t_{ITRIP}	Input filter time ITRIP ITRIP 输入滤波时间	V_{ITRIP} = 1V		500		ns
$T_{FIL,\,IN}$	Input filter time at LIN, HIN for turn on and off LIN、HIN 引脚的导通与关断输入滤波时间	$V_{LIN,\,HIN}$ = 0 V or 5 V		350		ns
$t_{FLT,\,CLR}$	Fault clear time after ITRIP-fault ITRIP 故障后的故障清除时间	V_{ITRIP} = 1V, $V_{pull\text{-}up}$ = 5V, (R_{RFE} = 1 MΩ, C_{RFE} = 2 nF)		1.1		ms
t_{FLT}	ITRIP to Fault propagation delay ITRIP 至故障的传输延迟	$V_{LIN,\,HIN}$ = 0 or 5 V, V_{ITRIP} = 1V		650	900	ns
DT_{IC}	Internal deadtime 内部死区时间	V_{IN} = 0 or V_{IN} = 5 V	300			ns
M_T	Matching propagation delay time (On & Off) all channels 所有通道的匹配传输延迟时间（导通与关断）	External dead time > 500ns			130	ns

8. Thermistor characteristics 热敏电阻特性

Symbol 符号	Description 描述	Condition 条件	Value 值			Unit 单位
			Min. 最小	Typ. 典型	Max. 最大	
R_{NTC}	Resistance，电阻	T_{NTC} = 25℃		85		kΩ
$B_{(25/100)}$	B-constant of NTC NTC 的 B 常数 (Negative Temperature Coefficient) （负温度系数）			4092		K



T (°C)	Rmin.(KΩ)	Rnor.(KΩ)	Rmax.(KΩ)
50	29.151	30.157	31.178
60	20.018	20.669	21.329
70	13.994	14.424	14.858
80	9.946	10.234	10.523
90	7.177	7.373	7.569
100	5.253	5.388	5.523
110	3.884	3.990	4.096
120	2.908	2.991	3.075
125	2.527	2.601	2.676

Figure 3 Thermistor resistance – temperature curve and table
热敏电阻-温度曲线和表格

9. Mechanical characteristics and ratings 机械特性与额定值

Description 描述	Condition 条件	Value 值			Unit 单位
		Min. 最小	Typ. 典型	Max. 最大	
Comparative Tracking Index (CTI) 相比漏电起痕指数（CTI）		600			
Mounting torque 安装扭矩	M3 screw and washer M3 螺丝和垫片	0.49		0.78	Nm
Backside curvature 背面曲率	Refer to Figure 8	0		150	μm
Weight 重量			6.85		g

10. Diagrams and tables 图表

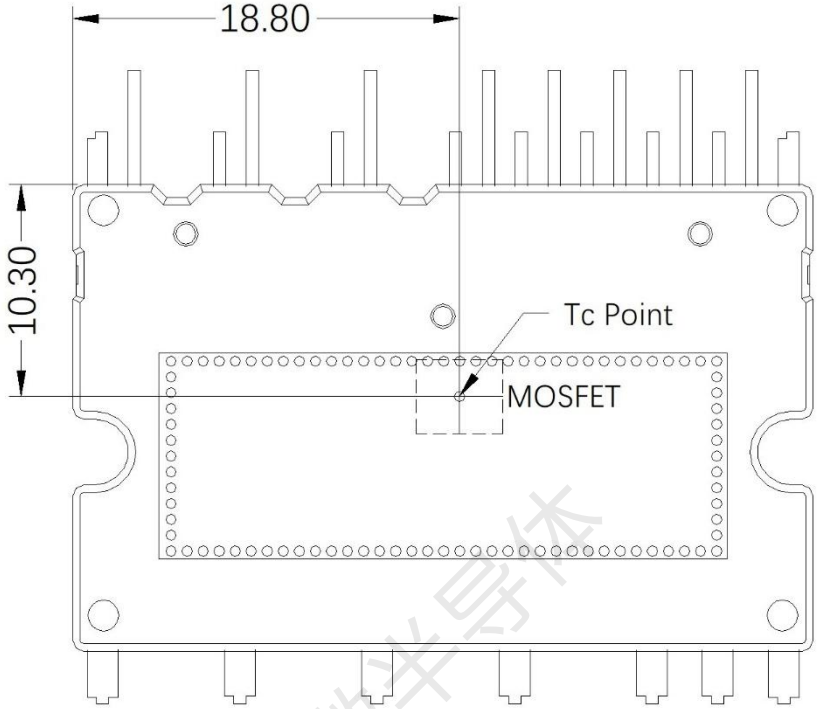


Figure 4 T_C measurement point 壳温测试点

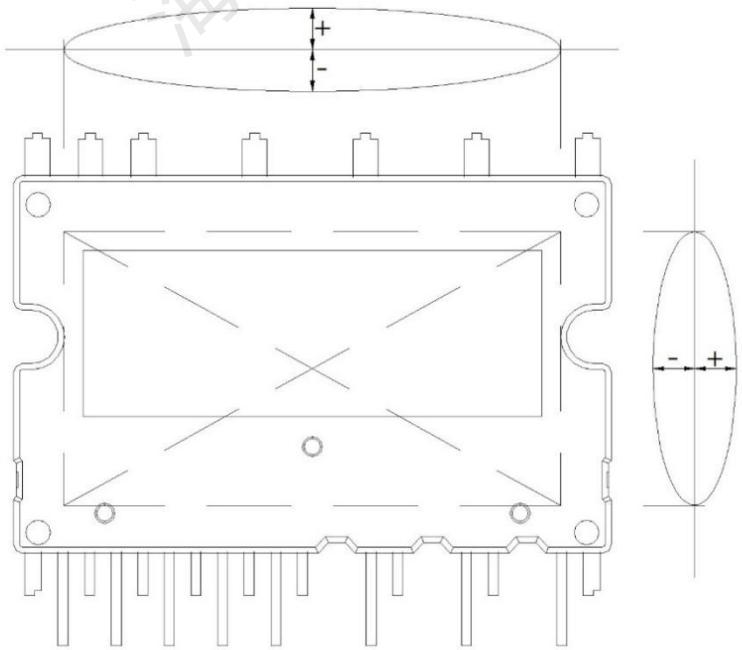


Figure 5 Backside curvature measurement position
背面曲度测试点

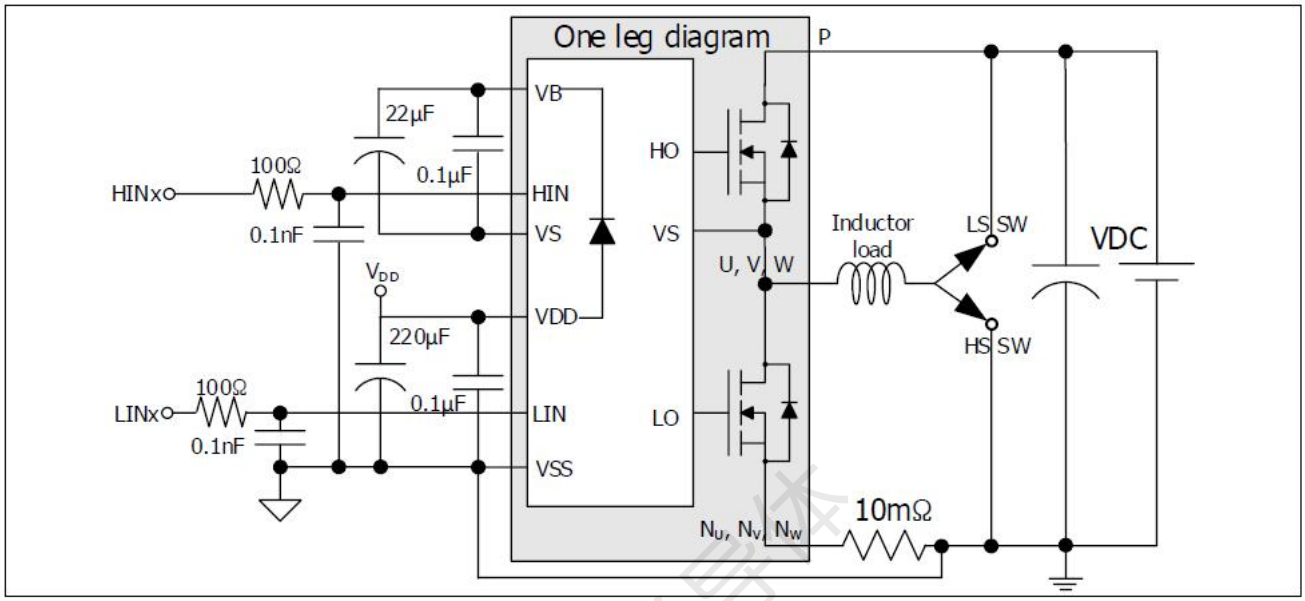


Figure 6 Switching test circuit
开关测试电路

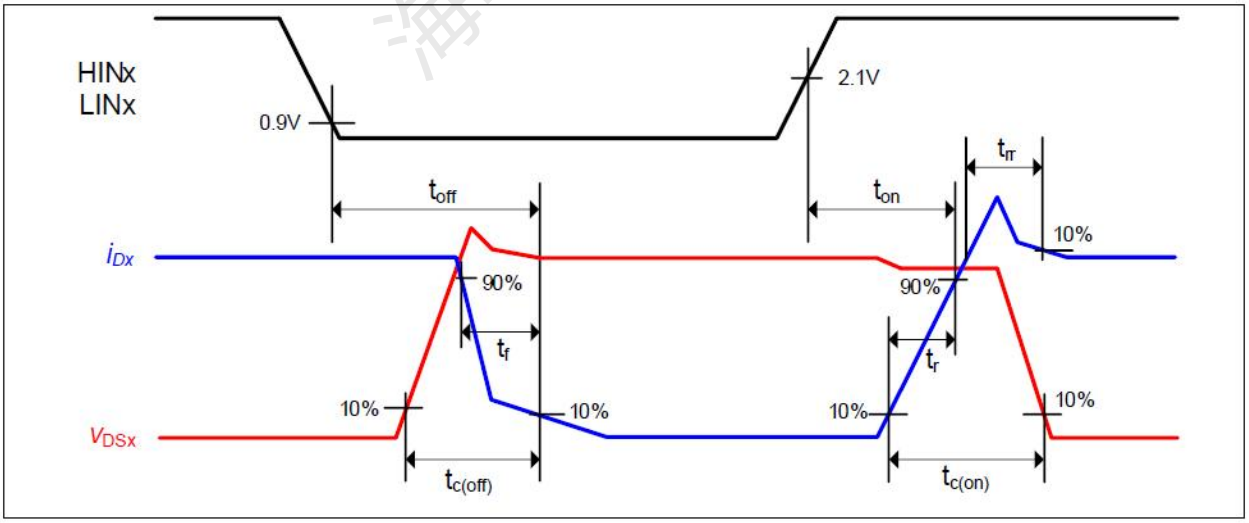


Figure 7 Switching times definition
开关时间定义

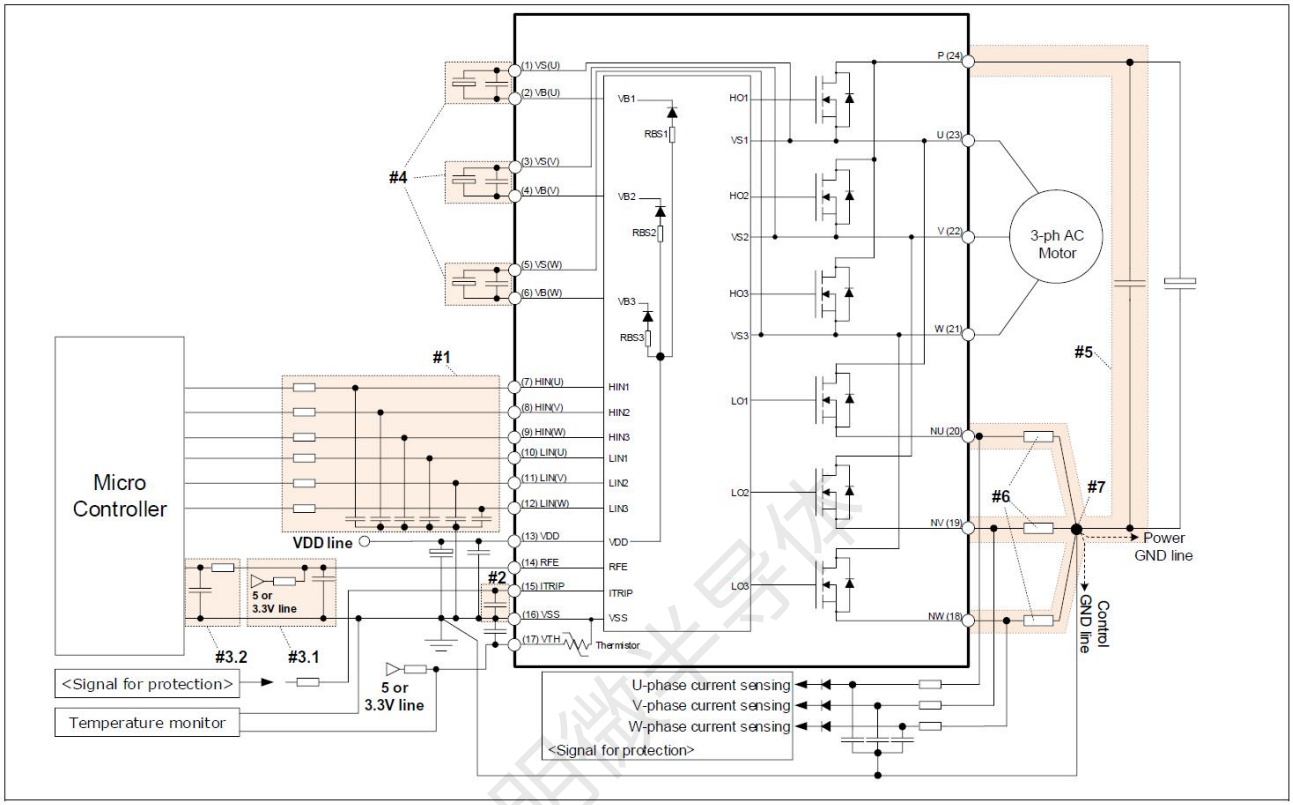


Figure 8 Typical application circuit
典型应用电路

1. Input circuit 输入电路

- To reduce input signal noise by high speed switching, the R_{IN} and C_{IN} filter circuit should be mounted. (100Ω, 1nF)

-为降低高速开关输入信号噪声，应安装 R_{IN} 和 C_{IN} 滤波电路（100Ω，1nF）

- C_{IN} should be placed as close to V_{SS} pin as possible.

- C_{IN}就尽量放置在离VSS引脚近的位置

2. Itrip circuit Itrip 电路

To prevent protection function errors, C_{ITRIP} should be placed as close to Itrip and V_{SS} pins as possible.

为防止保护功能出现错误，C_{ITRIP} 应尽可能靠近 Itrip 引脚和 V_{SS} 引脚放置

3. RFE circuit RFE 电路

3.1. Pull-up resistor (R_{RFE}) and pull-down capacitor (C_{RFE}) 上拉电阻（R_{RFE}）和下拉电容（C_{RFE}）

-RFE output is an open drain output. This signal line should be pulled up to the positive side of the 5 V / 3.3 V control power supply voltage (V_{CTR}) with a proper resistor RFE.

-RFE 输出为漏极开路输出。该信号线应通过合适的电阻 RFE 上拉至 5 V / 3.3 V 控制电源电压（VCTR）的正极侧。

-The fault-clear time is adjusted by RC network of R_{RFE} and C_{RFE} and pull-up voltage.

-故障清除时间由R_{RFE}和C_{RFE}的RC网络以及上拉电压调节。

- $t_{FLTCLR} = -R_{RFE} \cdot C_{RFE} \cdot \ln(1- V_{RFE,TH+}/V_{CTR}) +$ internal fault-clear time 160 µs
- $t_{FLTCLR} = -1M\Omega \times 2nF \times \ln(1 - 1.9 / 5\ V) + 160\mu s \approx$ 1.1ms at $R_{RFE} = 1\ M\Omega$, $C_{RFE} = 2$ nF and $V_{CTR} = 5$ V

- A pull-up resistor is limited to max. 2 MΩ 上拉电阻最大限制为2MΩ
- In case of V_{CTR} is higher than 5 V, the R_{RFE} needs to be at least 200 kΩ to limit the IC power dissipation
- 若V_{CTR}高于5V，为限制集成电路的功耗，R_{RFE}至少需要为200 kΩ

3.2. RC filter RC滤波

It is recommended that RC filter be placed as close to the controller as possible.
建议将 RC 滤波器放置在尽可能靠近控制器的位置。

4. VB-VS circuit VB-VS 电路

- Capacitor for Low side floating supply voltage should be placed as close to VB and VS pins as possible.
-低压侧悬浮电源电压的电容应尽可能靠近 VB 引脚和 VS 引脚放置

5. Snubber capacitor 缓冲电容器

-The wiring between IM828 and snubber capacitor including shunt resistor should be as short as possible.
- 6HP30N120A9C与缓冲电容器（包括分流电阻器）之间的布线应尽可能短。

6. Shunt resistor 分流电阻器

The shunt resistor of SMD type should be used for reducing its stray inductance.
应使用表面贴装（SMD）型分流电阻器，以降低其杂散电感。

7. Ground pattern

Ground pattern should be separated at only one point of shunt resistor as short as possible.
接地图形应仅在分流电阻器的一个点处分离，且分离部分要尽可能短。

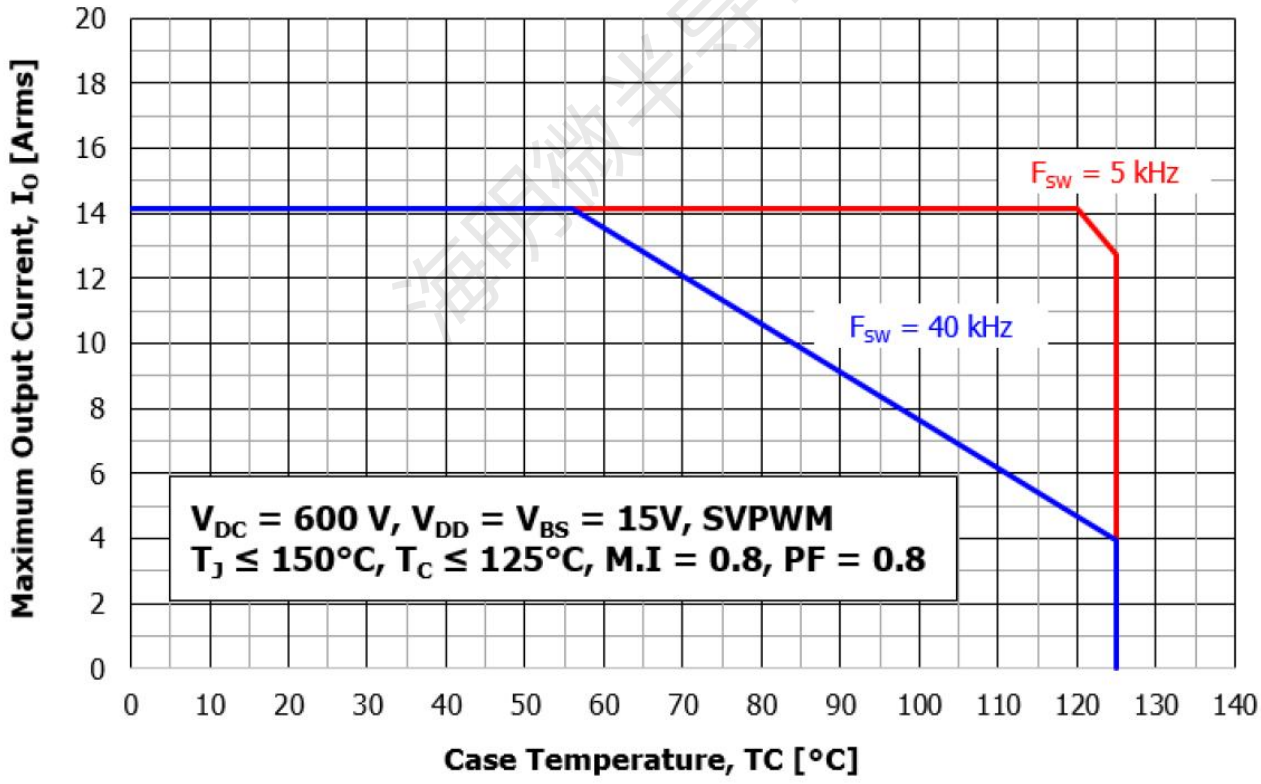
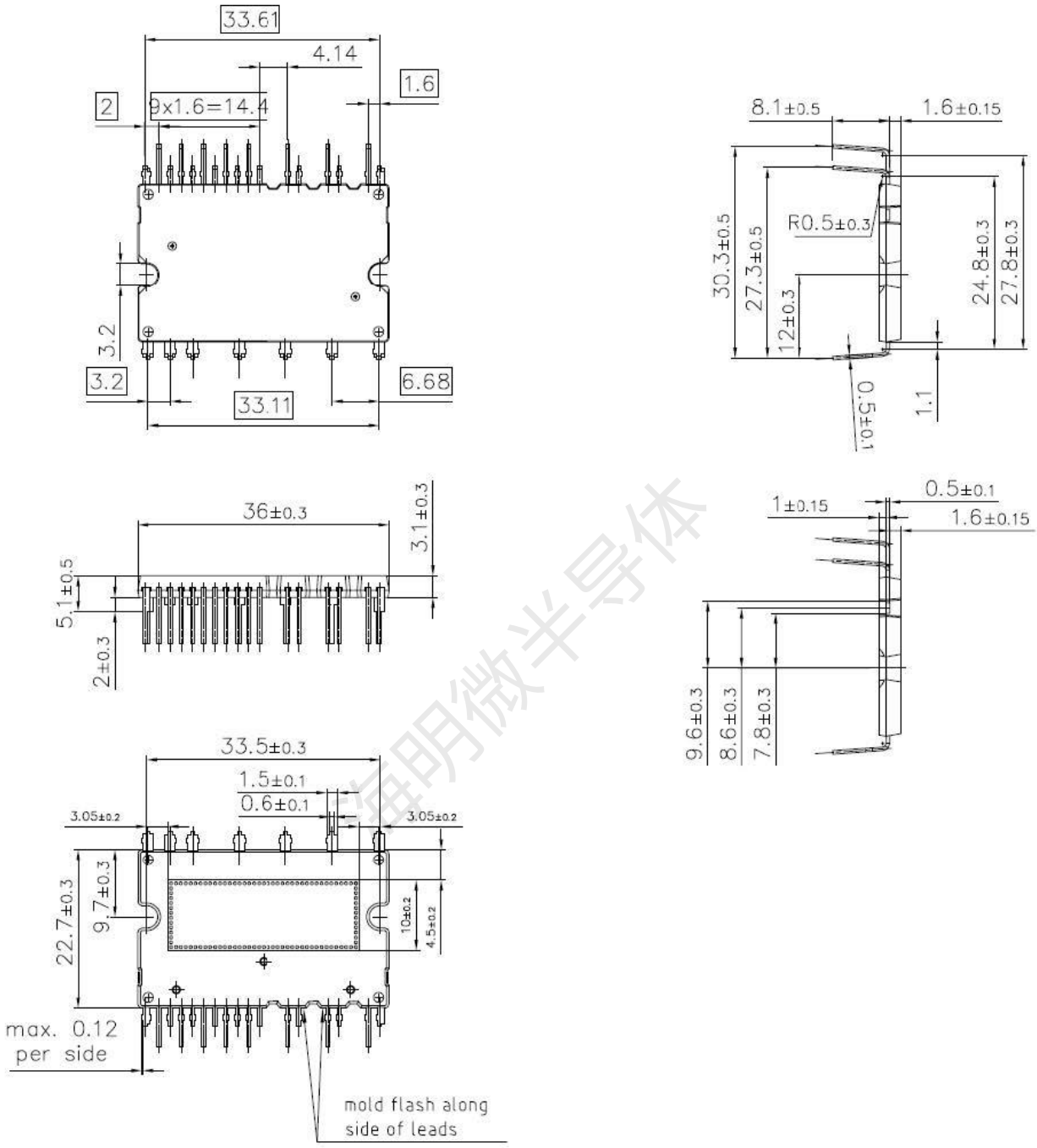


Figure 9 Operating current SOA (Based on multi-chip heating RthJC)
工作电流安全工作区（基于多芯片加热的结壳热阻）

11. Package Outline 封装外形图



12. Revision history历史版本

Date日期	Revision版本	Changes更改内容
2025-07-19	Rev. G 1.0	Target Datasheet（目标规格书）