



SPE06S60B-C

主要参数 MAIN CHARACTERISTICS

600V/6A 半桥驱动	
V_{CES}	600V
I_C	6A

用途

- 空调室内风机
- 冰箱
- 水泵

APPLICATIONS

- Air conditioner fan
- Refrigerator
- Pump

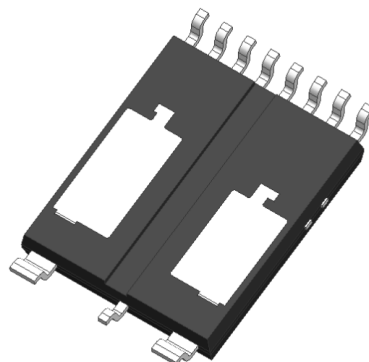
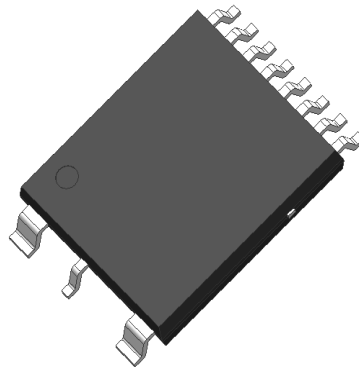
产品特性

- 信号高电平有效, 兼容 3.3V 和 5V 的 MCU
- 下臂 IGBT 发射极输出
- 内置自举二极管
- 内置防直通保护
- 内置欠压保护
- 绝缘耐压 1500V

FEATURES

- Signal high level valid, compatible with 3.3v and 5V MCU
- Lower arm IGBT emitter electrode output
- Built-in bootstrap diode
- Built-in straight through protection
- Built-in undervoltage protection
- Resistant to high voltage 1500V

封装 Package



SOP12B

订货信息 ORDER MESSAGE

订 货 料 号 Order number	产 品 信 息 Product information			
	无卤-条管 Halogen-Free-Tube	无卤-编带 Halogen-Free-Reel	印 记 Marking	封 装 Package
2A01-0991	SPE06S60B-C	N/A	06S60B-C	SOP12B



模块分布示意图 Module distribution diagram

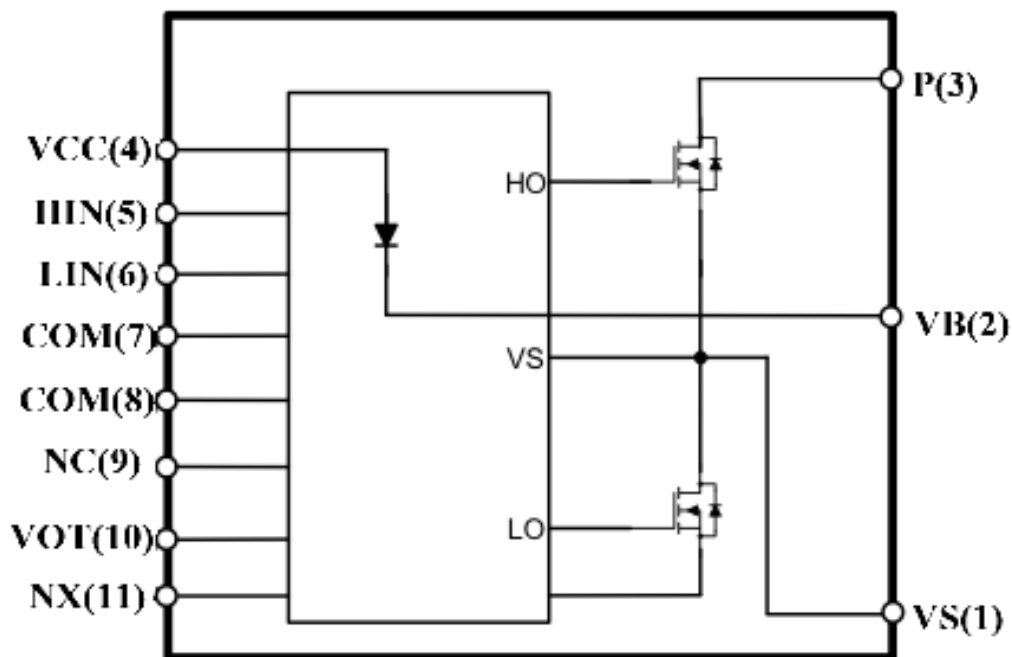


图 1: 模块内部电路示意图

Fig 1: Internal circuit

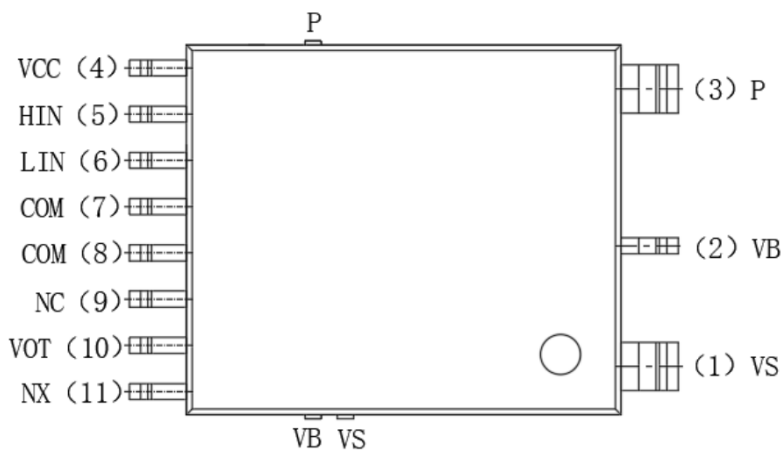


图 2: 模块正面引脚分布示意图

Fig 2: Distribution of pin

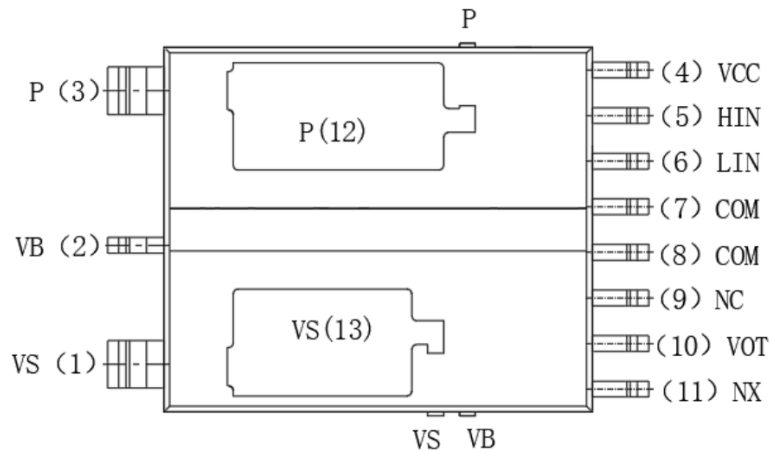


图 3：模块背面引脚分布示意图

Fig 3: Distribution of pin

引脚编号 Number	引脚名称 Name	引脚描述 Description
1	VS	控制电源 GND 端子 IC Common Supply Ground
2	VB	上桥臂驱动电源端子 upper arm drive power terminal
3	P	逆变器直流输入端子 Positive DC-Link Input
4	VCC	控制电源端子 Bias Voltage for V-Phase IC and Low Side MOSFET Driving
5	HIN	上臂控制信号输入端子 Signal Input for U-Phase High-Side
6	LIN	下臂控制信号输入端子 Signal Input for U-Phase Low-Side
7	COM	控制电源 GND 端子 IC Common Supply Ground
8	COM	控制电源 GND 端子 IC Common Supply Ground
9	NC	空端子
10	VOT	温度输出端子 Temperature Output
11	Nx	下臂 IGBT 发射极端子 Negative DC-Link
12	P	逆变器直流输入端子 Positive DC-Link Input
13	VS	控制电源 GND 端子 IC Common Supply Ground

图 4：模块引脚功能定义表

Fig 4: Pin function



最大额定值 ($T_j = 25^\circ\text{C}$, 除非特殊说明)

Absolute Maximum Ratings ($T_j = 25^\circ\text{C}$, Unless otherwise Specified)

逆变部分 Inverter Part

记号 Symbol	参数 Parameter	条件 Condition	额定值 Ratings	单位 Units
V_{CES}	集电极-发射极之间电压 Collector emitter Voltage of Each IGBT	备注 1	600	V
I_C	集电极电流 Each IGBT Current, Continuous	$T_c = 25^\circ\text{C}$ (T_c 测量参考图 5)	6	A
I_{CP}	集电极电流(峰值) Each IGBT Pulse Current, Peak	$T_c = 25^\circ\text{C}$, 脉冲宽度小于 1ms $T_c = 25^\circ\text{C}$, Less than 1mS	12	A
P_C	集电极功耗 Maximum Power Dissipation	$T_c = 25^\circ\text{C}$, 单晶片 $T_c = 25^\circ\text{C}$, Each IGBT	20	W
T_j	结温 Junction Temperature	见备注 2) Note1	-40~150	$^\circ\text{C}$

备注 1: V_{CES} 是单个 IGBT C-E 间最大电压。 V_{PN} 应小于该值, 考虑到杂散电感, V_{DS} 在任何情况下都不应超过 V_{CES} ;

备注 2: IPM 功率晶片最大额定结温为 150°C (@表面温度 $T_c \leq 100^\circ\text{C}$), 为确保 IPM 的安全运行, 其均结温应限制在 $T_{j(ave)} = 125^\circ\text{C}$ (@ $T_c = 100^\circ\text{C}$) 以内。

控制部分 Control Part

记号 Symbol	参数 Parameter	条件 Condition	额定值 Ratings	单位 Units
V_{CC}	控制电源电压 Control Supply Voltage	V_{CC} -COM 之间 Applied between V_{CC} and COM	20	V
V_{BS}	高侧控制电压 High-side Bias Voltage	VB-VS 之间 Applied between VB and VS	20	V
V_{IN}	输入信号电压 Input Signal Voltage	V_{IN} -COM 之间 Applied between V_{IN} and COM	-0.3~ $V_{CC}+0.3$	V

内部自举电路 Bootstrap Diode Part

记号 Symbol	参数 Parameter	条件 Condition	额定值 Ratings	单位 Units
V_{RRMB}	反向耐压 Control Supply Voltage	/	600	V

整个系统 Total System

记号 Symbol	参数 Parameter	条件 Condition	额定值 Ratings	单位 Units
$V_{PN(prot)}$	自我保护电源电压限制 Self-protecting power supply voltage limit	$V_{CC} = V_{BS} = 13.5\text{V} \sim 16.5\text{V}$, $T_j = 125^\circ\text{C}$, 非重复性, $< 2\mu\text{s}$	400	V
T_j	结温 Operating Junction Temperature	/	-40~150	$^\circ\text{C}$
T_{STG}	贮存温度 Storage Temperature	$T_c = 25^\circ\text{C}$	-40~125	$^\circ\text{C}$
V_{ISO}	绝缘耐压 Isolation Voltage	60Hz, 正弦, AC 1 分钟, 连接管脚到散热器 60Hz, Sinusoidal, AC 1 min, between pins and heat-sink plate	1500	V

热阻 Thermal Resistance

记号	参数	条件	典型值	单位
$R_{th(j-c)}$	结到外壳的热阻	每个 IGBT	6.0	$^\circ\text{C}/\text{W}$



电气特性 (T_J=25°C, 除非特殊说明)Electrical Characteristics (T_J=25°C, Unless Otherwise Specified)

逆变部分 Inverter Part

记 号	参 数	条 件		最小值	典型值	最大值	单位
V _{CE(SAT)}	集电极-发射极间饱和电压 Collector - emitter saturation voltage	V _{CC} =V _{BS} =15V, V _{IN} =5V	I _C =6A, T _J =25°C,	-	1.9	2.6	V
			I _C =6A, T _J =125°C,	-	2.0	-	
V _F	FRD正向电压 FRD Forward voltage	V _{IN} = 0V, I _C =-6A		-	2.0	2.6	V
I _{CES}	集电极-发射极间漏电流 Collector emitter leakage current	V _{CE} =V _{CES} , V _{IN} =0V		-	-	1	mA
t _{ON}	开关时间	V _{PN} = 300 V, V _{CC} = V _{BS} = 15 V, I _C = 6 A V _{IN} = 0 ↔ 5 V, 感性负载 (备注3)		-	680	-	nS
t _{CON}				-	200	-	nS
t _{off}				-	710	-	nS
T _{coff}				-	70	-	nS
t _{tr}				-	150	-	nS
E _{ON}				-	290	-	uJ
E _{OFF}				-	70	-	uJ

备注 3: t_{ON} 和 t_{OFF} 包含驱动 IC 传输延迟。列表值是在实验条件下测得, 不同的 PCB 及连线会改变数值。请参考图 4 的开关时间定义。

NOTE 3: t_{ON} and t_{OFF} include the propagation delay time of the internal drive IC. Listed values are measured at the laboratory test condition, and they can be different according to the field applications due to the effect of different printed circuit boards and wirings. Please see Fig 4 for the switching time definition.

控制部分 Control Part

记号 Symbol	参数 Parameter	条件 Condition		最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
I _{QCC}	V _{CC} 静态电流 Quiescent V _{CC} Supply Current	V _{CC} =15V V _{IN} =5V	V _{CC} -COM 之间 Applied between V _{CC} and COM	-	170	270	uA
I _{QB}	V _{BS} 静态电流 Quiescent V _{BS} Supply Current	V _{BS} =15V V _{IN} =5V	V _B -V _S 之间 Applied between V _B -V _S	-	85	120	uA
UV _{CCD}	低侧欠压保护 Low-Side Under-Voltage Protection	检测电平 V _{CC} Under-Voltage Protection Detection Level		7.4	8.2	8.9	V
UV _{CCR}		复位电平 V _{CC} Under-Voltage Protection Reset Level		8.0	8.8	9.5	V
UV _{BSD}	高侧欠压保护 High-Side Under-Voltage Protection	检测电平 V _{BS} Under-Voltage Protection Detection Level		7.7	8.3	8.8	V
UV _{BSR}		复位电平 V _{BS} Under-Voltage Protection Reset Level		8.2	9.0	9.5	V
V _{IH}	输入开启阈值电压 ON Threshold Voltage	逻辑高电平, 加在 V _{IN} 与 COM 之间 Logic HIGH Level, Applied between V _{IN} and COM		-	-	2.5	V
V _{IL}	输入关闭阈值电压 OFF Threshold Voltage	逻辑低电平, 加在 V _{IN} 与 COM 之间 Logic Low Level, Applied between V _{IN} and COM		0.8	-	-	V

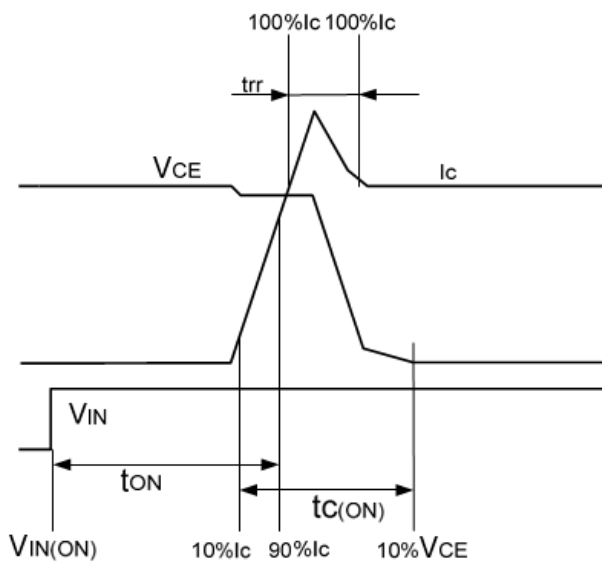




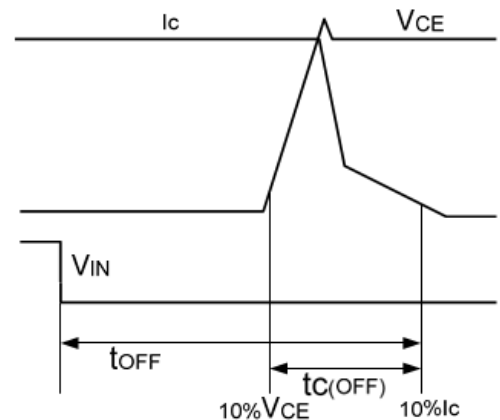
V _{OT}	温度检测输出 Temperature Sensing Voltage Output(note4)	Temperature sensing voltage@25°C	0.5	0.79	1.0	V
		Temperature sensing voltage@100°C	1.7	2.25	2.8	
R _{BSD}	自举二极管限流电阻 Bsd resistance		-	330	-	ohm

推荐工作条件 Recommended Operating Conditions

记号 Symbol	参数 Parameter	记号 Symbol	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
V _{PN}	电源电压 Supply Voltage	P-N 之间 Applied between P and N	-	300	400	V
V _{CC}	控制电源电压 Control Supply Voltage	V _{CC} -COM 之间 Applied between V _{CC} and COM	13.5	15.0	16.5	V
V _{BS}	高侧控制电源电压 High-Side Bias Voltage	V _B -V _S 之间 Applied between V _B and V _S	13.5	15.0	16.5	V
V _{IN(ON)}	输入开启阈值电压 Input ON Threshold Voltage	V _{IN} -COM 之间 Applied between V _{IN} and COM	3.0	-	V _{CC}	V
V _{IN(OFF)}	输入关闭阈值电压 Input OFF Threshold Voltage		0	-	0.6	V
t _{dead}	死区时间 Blanking Time for Preventing Arm-Shor	V _{CC} =V _{BS} =13.5~16.5V, T _j <150°C	1.0	-	-	us
PWM	最小输入信号脉冲宽度 Minimum input signal pulse width	ON	0.7	-	-	us
		OFF	0.7	-	-	us
FPWM	PWM 开关频率 PWM Switching Frequency	T _j <150°C	-	15	-	KHz



(a) 开启



(b) 关断

图 5: 开关时间定义

Fig 5: Switching Time Definition



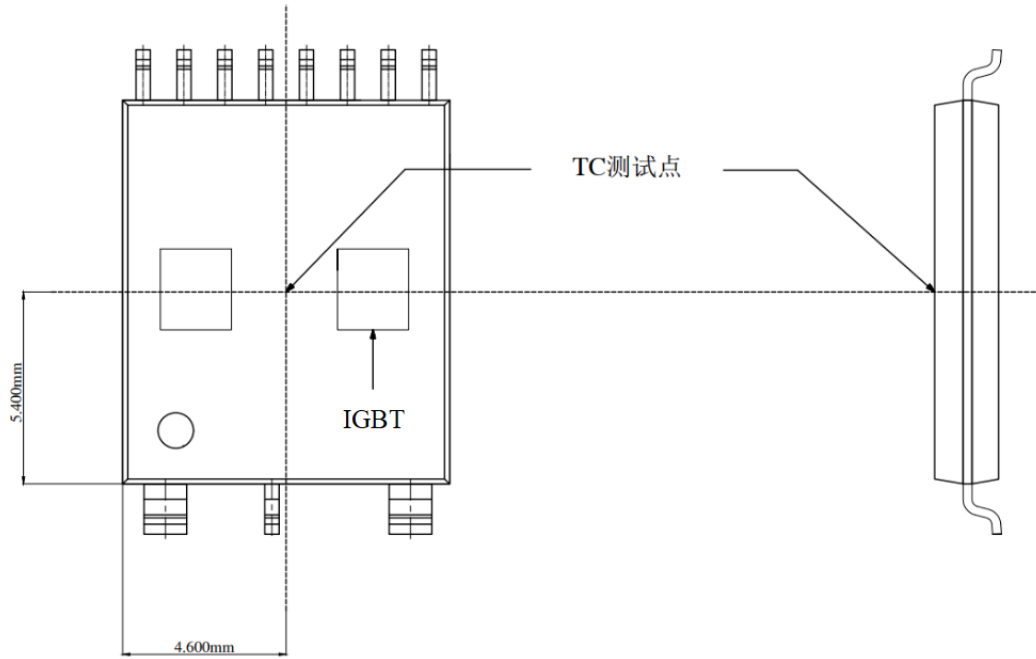


图 6: 壳温 T_c 测试点
Fig 6: Case Temperature Measurement

保护功能时序图 Time Charts of Protective Function

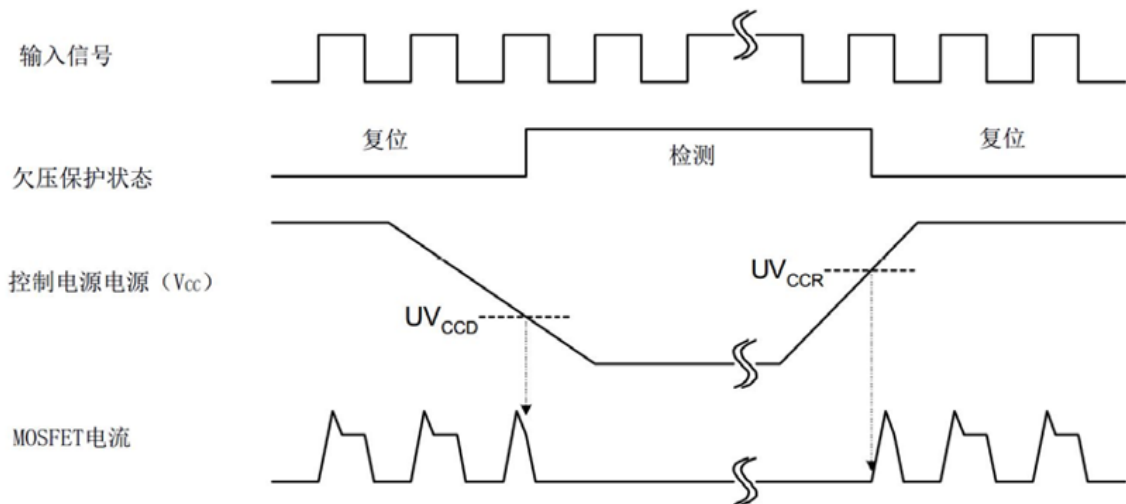


图 7: 欠压保护时序图(低侧)
Fig 7: Undervoltage protection sequence diagram (low side)

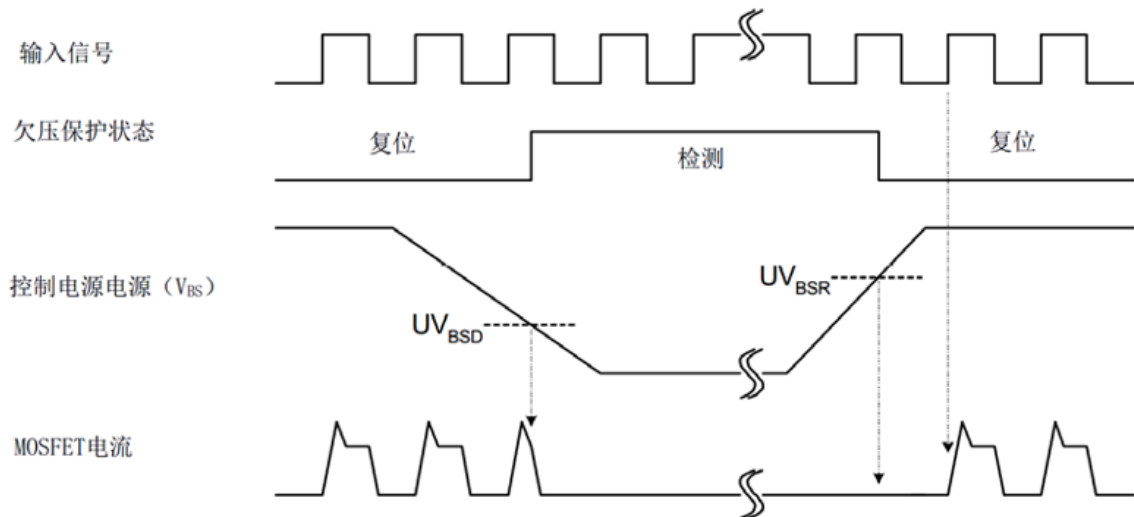


图 8: 欠压保护时序图(高侧)

Fig 8: Undervoltage protection sequence diagram (High side)

IC 温度输出的电流-温度曲线 I-T curve of temperature output of IC

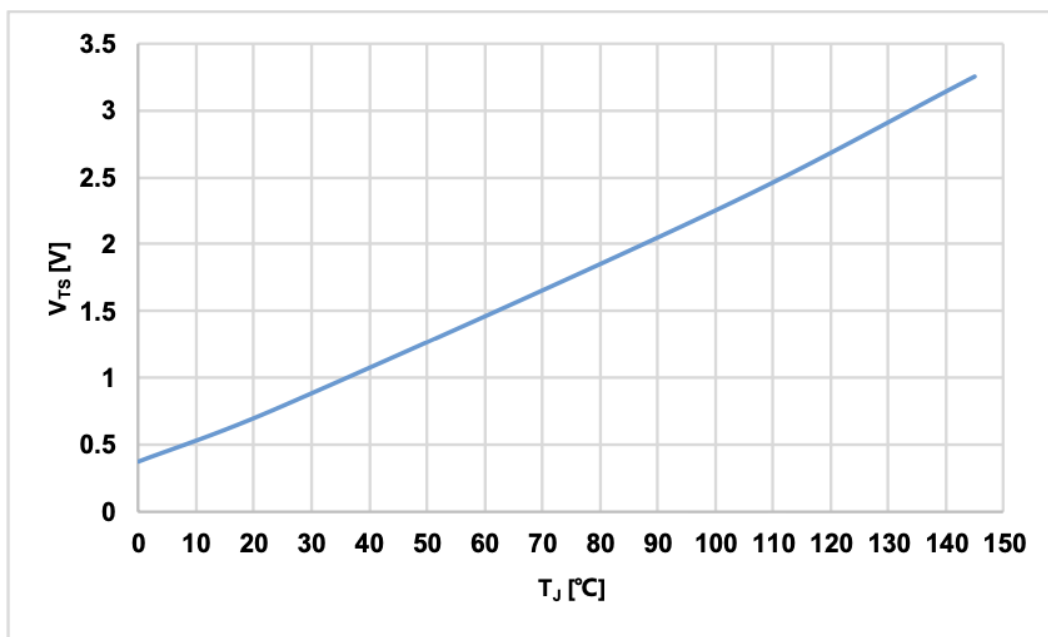


图 9: VOT 输出电压曲线

Figure 9 VOT output voltage curve

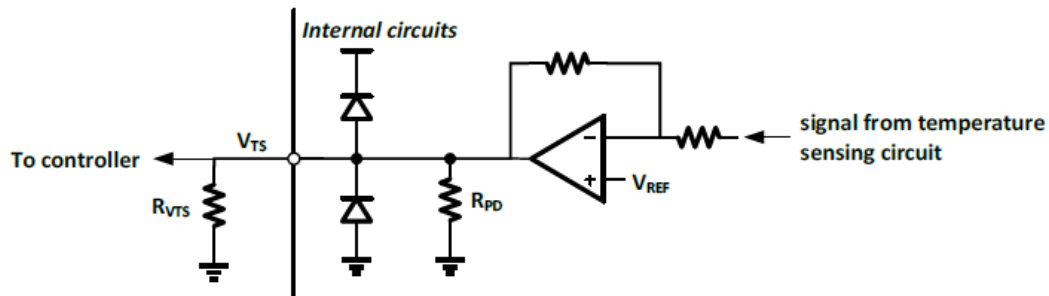


图 10:VOT 输出电路

Figure 10:VOT output circuit

- 1) 使用温度监测功能时，用户可以根据自己的实验进行 R_{VTS} 值的调整。
- 1) A pull down resistor R_{VTS} should be inserted when using the VOT function. Users can judge the R_{VTS} value through their experiments.
- 2) 不使用 VOT 功能时，保持 VOT 引脚悬空(无连接)。
- 2) In the case of not using VOT, leave the pin open without any connection.
- 3) 在 3.3V 单片机等低压控制器上使用 VOT 时，VOT 输出在温度上升过快时，可能超过控制电源电压 3.3V，如果系统使用低压控制器，建议在控制电源和 VOT 输出之间的加入钳位二极管，用于防止过电压损坏。
- 3) When using VOT on low-voltage controllers such as 3.3V single chip microcomputer, the VOT output may exceed the control power supply voltage by 3.3V when the temperature rises too fast. If the system uses low-voltage controller, it is recommended to add clamping diode between the control power supply and VOT output to prevent overvoltage damage.

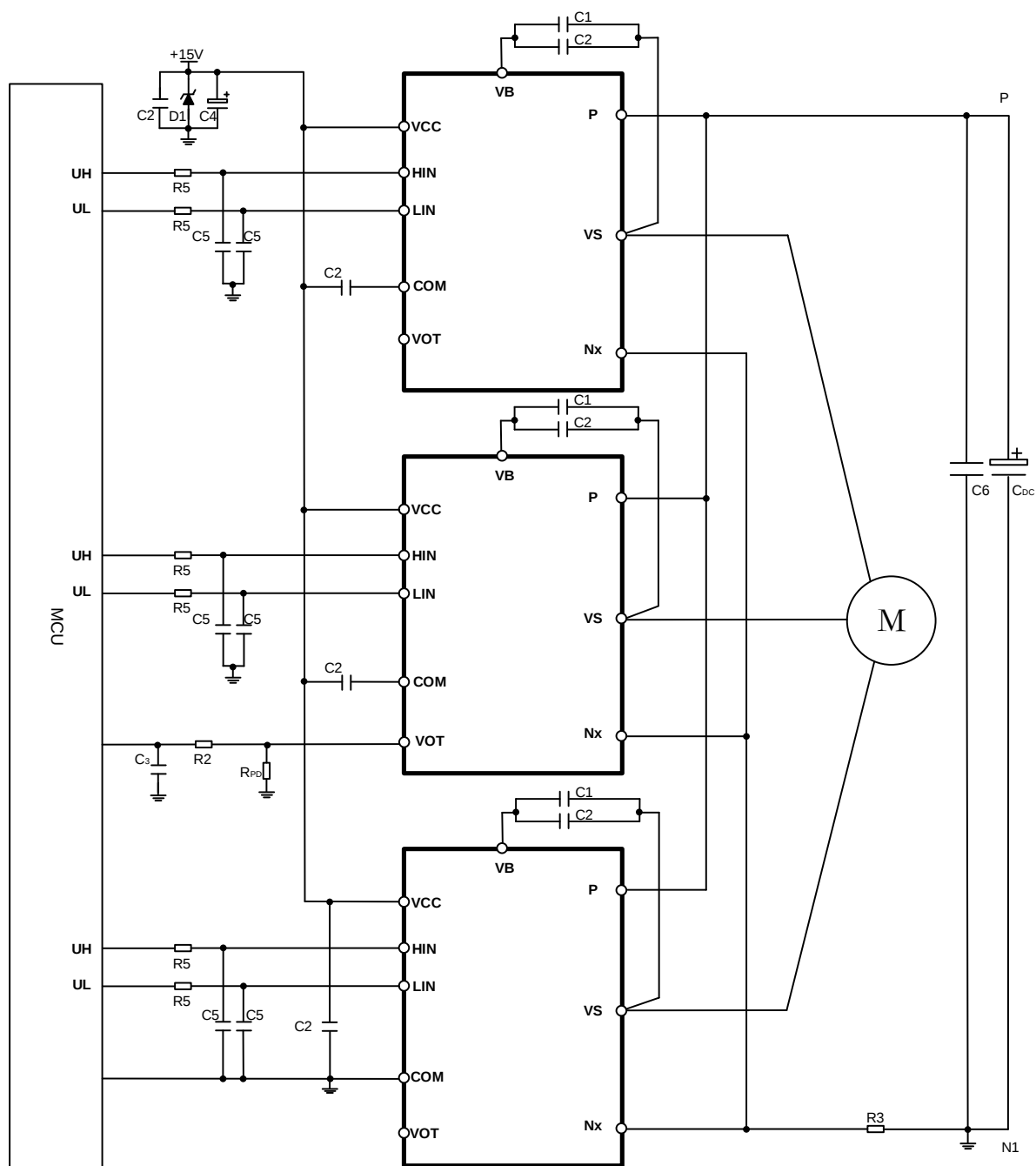


图 11: 典型应用电路图

Fig 11: Example of Application Circuit

备注 4: 自举电路的元器件参数要根据 PWM 周期而定, 以 15kHz 开关频率为例: $C1=4.7\mu\text{F}$, $C2=0.1\mu\text{F}$ 。

NOTE 4: Parameters for bootstrap circuit elements are dependent on PWM algorithm. For 15 kHz of switching frequency, typical example of parameters is an example of: $C1=4.7\mu\text{F}$, $C2=0.1\mu\text{F}$ 。

备注 5: 在模块的每个输入端和 MCU 输出端之间加入 RC 去耦电路, 如 R5、C5, 防止干扰噪声引起的信号失真。

NOTE 5: RC coupling(R5 and C5) input of IPM and MCU may be used to prevent improper signal due to surge noise. Signal input of IPM is compatible with standard CMOS or LSTTL outputs.





备注 6: 输入驱动高有效; IC 内部集成有一个 500K (典型值)下拉电阻; 为防止发生误动作, 输入布线应尽可能短; 当用 RC 去耦线路时, 须确保输入信号达到开启和关断阈值电压范围。

NOTE 6: Input drive is High-Active type. There is a 500k Ω (typ.) pull-down resistor integrated in the IC input circuit. To prevent malfunction, the wiring of each input should be as short as possible. When using RC coupling circuit, make sure the input signal level meet the turn-on and turn-off threshold voltage.

备注 7: 由于模块内置了专用 HVIC, 其控制端子可与 CPU 端子直接相连, 而不需要任何光耦或变压器等隔离电路。

NOTE 7: Thanks for HVIC inside modules, direct coupling to MCU without any opto-coupler or transformer isolation is possible.

备注 8: 自举电路负极应直接连接到 VS 端。

NOTE 8: Bootstrap negative electrodes should be connected to VS terminals directly and separated from the main output wires.

备注 9: 保护线路 R4、C3 的时间常数建议选取在 1~2 μ S。关断时间可能随着布线的不同而多少有些变化。建议 R4、C3 选择小容差, 温度补偿类型。

NOTE 9: The time constant R4、C3 of the protection circuit should be selected in the range of 1.0-2 μ s. SC interrupting time might vary with the wiring pattern. Tight tolerance, temp-compensated type is recommended for R4, C3.

备注 10: 所有电容的位置尽可能的靠近 IPM。

NOTE 10: All capacitors should be mounted as close to the terminals of the IPM as possible.

备注 11: 为了防止噪声干扰, 储能电容与 P&N1 之间的引线应尽可能的短, 推荐在 P&N1 端子之间加约 0.1~0.22 μ F 的 MLCC 低频滤波电容。

NOTE 11: To prevent surge destruction, the wiring between the smoothing capacitor and the P, N1 terminals should be as short as possible. Generally, a 0.1-0.22 μ F snubber between the P-N1 terminals is recommended.



外形封装图 Detailed Package Outline Drawings

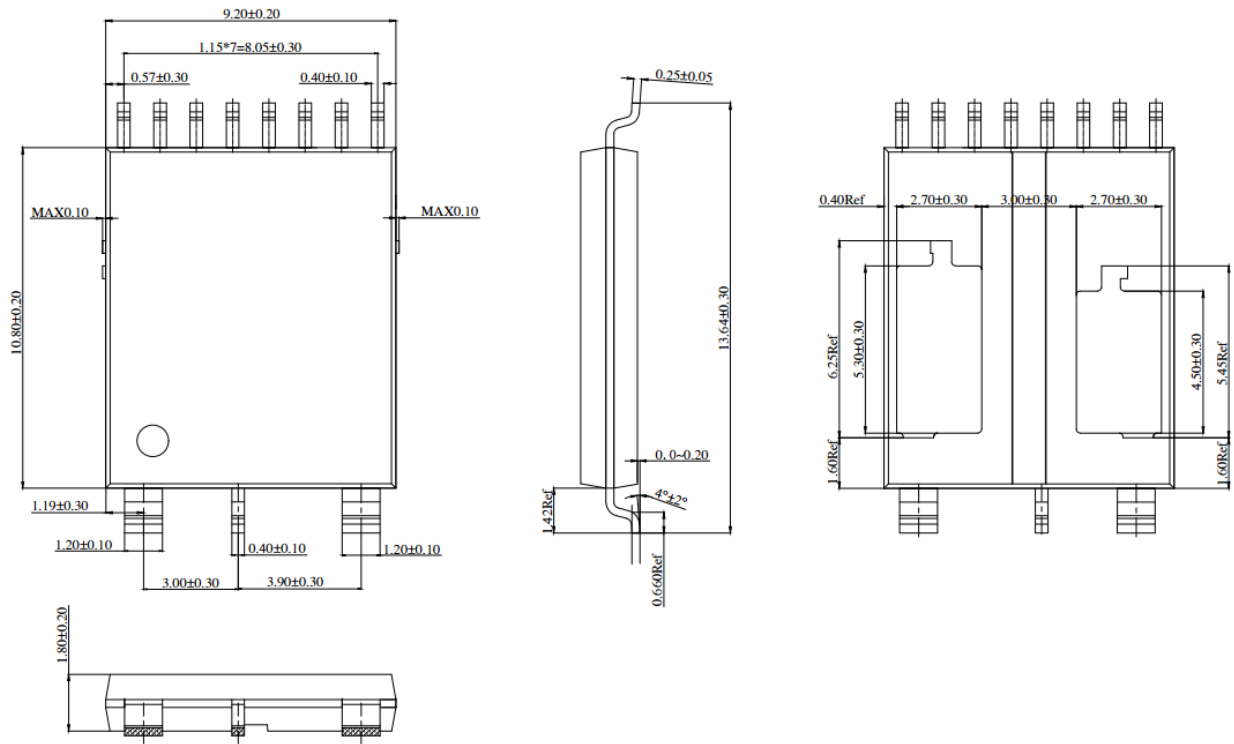


图 12: SPE06S60B-C 封装外形图

Fig12: SPE06S60B-C Package Outline Drawings



注意事项

1. 吉林华微电子股份有限公司的产品销售分为直销和销售代理，无论哪种方式，订货时请与公司核实。
2. 购买时请认清公司商标，如有疑问请与公司本部联系。
3. 在电路设计时请不要超过器件的绝对最大额定值，否则会影响整机的可靠性。
4. 本说明书如有版本变更不另外告知。

NOTE

1. Jilin Sino-microelectronics co., Ltd sales its product either through direct sales or sales agent , thus, for customers, when ordering , please check with our company.
2. We strongly recommend customers check carefully on the trademark when buying our product, if there is any question, please don't be hesitate to contact us.
3. Please do not exceed the absolute maximum ratings of the device when circuit designing.
4. Jilin Sino-microelectronics co., Ltd reserves the right to make changes in this. specification sheet and is subject to change without prior notice.

联系方式

吉林华微电子股份有限公司

公司地址：吉林省吉林市深圳街 99 号

邮编：132013

总机：86-432-64678411

传真：86-432-64665812

网址：www.hwdz.com.cn

CONTACT

JILIN SINO-MICROELECTRONICS CO., LTD.

ADD: No.99 Shenzhen Street, Jilin City, Jilin Province, China.

Post Code: 132013

Tel: 86-432-64678411

Fax: 86-432-64665812

Web Site: www.hwdz.com.cn