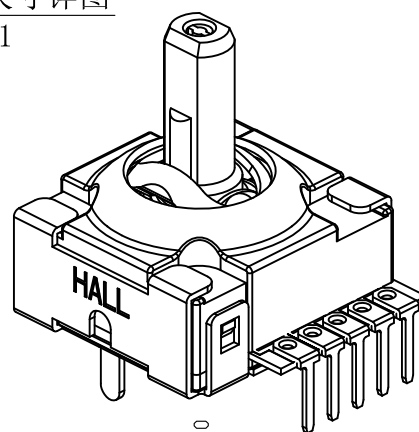
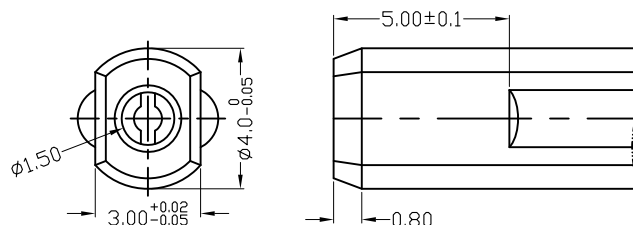
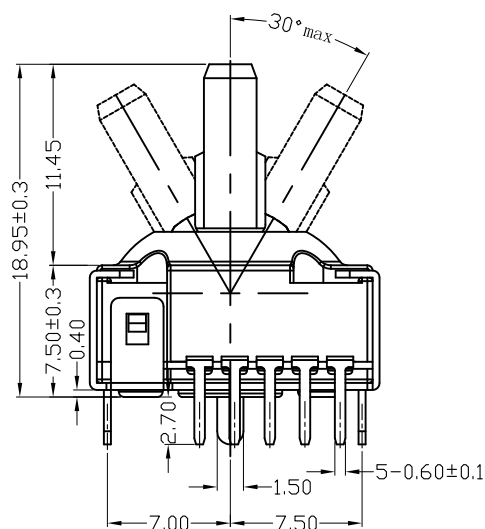
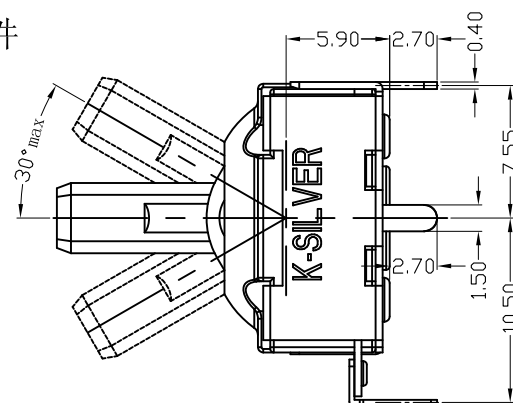
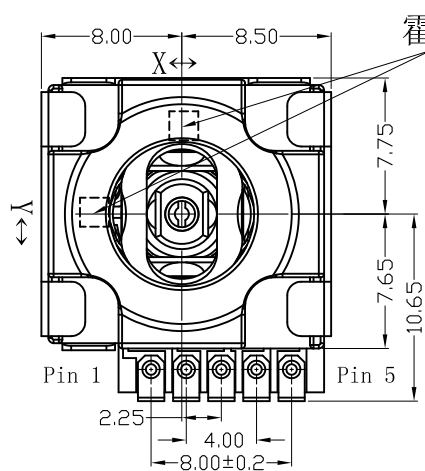




Pin 1 (VCC)
Pin 2 (Output1) X方向
Pin 3 (Output2) Y方向
Pin 4 (Switch)
Pin 5 (GND)

注意：1. 基板板厚=1.2
RECOMMENDATORY THICKNESS OF
P. W. B. IS 1.2mm
2. VR端子厚 t=0.3mm
POT. TERMINAL THICKNESS
3. 霍尔扳机磁铁远离霍尔IC元器件，
避免造成干扰

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2. VR端子厚 $t=0.3\text{mm}$
POT. TERMINAL THICKNESS

3. 霍尔扳机磁铁远离霍尔IC元器件，避免造成干扰

POT. TERMINAL THICKNESS

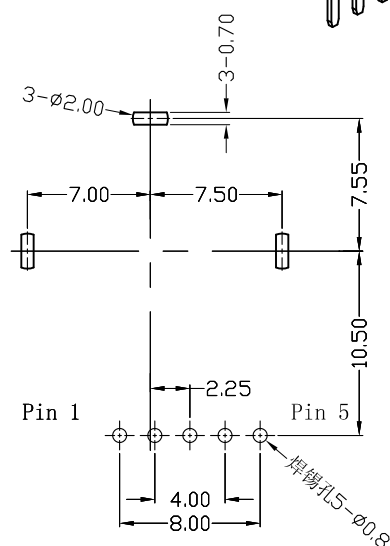
3. 霍尔扳机磁铁远离霍尔IC元器件，避免造成干扰

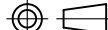
避免造成干扰

Hall trigger magnet away from
Hall IC components to
avoid interference

Hall IC components to
avoid interference

avoid interference



VERSION	 亚特联 YATELIAN		MODEL: YHE-YG16-001 SH1B166A1			DRAW	SCALE
A0			DRAWING NO: YHE-YG16-001 SH1B166A1			洪晓亮	
.ISSU.	DATE	REVISION	Design	TOL.UNLESS OTHERWISE SPEC.		CHKD	UNIT
00	2022.11.17	初始发行	洪晓亮	BASIC DIMENSIONS	TOL.	宋明士	
01				L≤10	±0.3	APPD	mm
02				10<L	±0.5		
03				100≤L	±0.8	严治银	
04				ANGLE	±5°		
							第 1 页

1. General 一般事项

1-1 Scope 适用范围

This specification is applicable to electromagnetic joystick used in electronic equipment. The device produces a linear response when the output voltage is within the specified voltage range. Outside this range, sensitivity is reduced and nonlinear

本规格书适用于电子设备使用之电磁摇杆。当输出电压在规定的电压范围内时,该装置产生线性响应。在这个范围之外,灵敏度会降低,并且是非线性的。

1-2 Standard atmospheric conditions 标准大气状态

Unless otherwise specified, the standard range of atmospheric conditions for making measurements

and tests is as follows:

除另有规定外,量测应在以下大气条件下进行:

Ambient temperature	温度	: 15°C ~ 35°C
Relative humidity	相对湿度	: 25% ~ 85%
Air pressure	气压	: 86 KPa~ 106 KPa

If there is any doubt about the results, measurements should be made within the following limits:

如有任何疑虑时,量测应在以下条件下进行:

Ambient temperature	温度	: 20°C ± 1°C
Relative humidity	相对湿度	: 63% ~ 67%
Air pressure	气压	: 86 KPa~ 106 KPa

1-3 Operating temperature range : -10°C ~ +70°C

适用温度范围

1-4 Storage temperature range : -30°C ~+80°C

保存温度范围

1-5 Operators shall wear electrostatic bracelets during operation

作业员操作时需戴静电手环

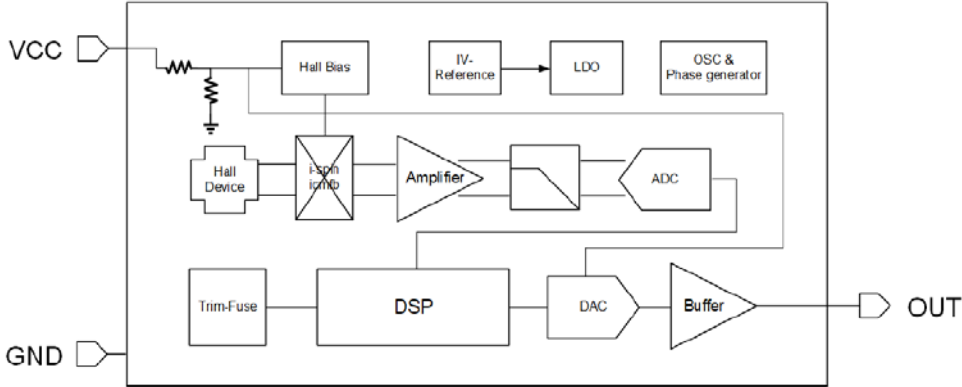
2. Construction 构造

2-1 Dimension 尺寸 : Refer to attached drawing 参见成品图

3. Mechanical characteristics 机械性能			
NO. 序号	ITEM 项 目	CONDITIONS 条 件	SPECIFICATION 规 格
1	Figure of lever operation 摇杆动作形式	/	Circular operating 圆形式
2	Operation angle of lever 摇杆使用有效角度	Add a fit force on the lever top to push it to max. angle of each direction when lever is released and reset position. 当摇杆处于自由复归位置时, 在摇杆顶部施加一定力将摇杆推向任意方向最大角度。	30° max 最大 30°
3	Operating force of lever 摇杆作用力	Test position is at more than 10 degrees deflection of lever. 摇杆偏斜 10 度以上之位置测定。	120±40gf
4	Accuracy of reset position of lever 摇杆复归垂直度	Measure the angle between the lever and the axial center line after the lever pushed to the direction of X-X(Y-Y) and resets. 摇杆推向 X-X(Y-Y) 方向自由复归后测量摇杆与垂直中心线的角度。	90° ±5°
5	Knob strength 摇杆扭曲强度	Apply force on the lever perpendicular to the lever's rotation direction. 旋转于摇杆的力作用于摇杆上。	More than 2.5Kgf.cm 3 seconds min 大于 2.5Kgf.cm, 至少 3 秒钟
6	Pull strength of lever 摇杆拉拔强度	Apply specified pull force on the lever upward. 作用于摇杆上, 沿摇杆方向向上。	More than 50N 3 seconds min 大于 50N, 至少 3 秒钟
7	Push Strength of lever 摇杆推强度	Apply specified push force on the lever downward. 作用于摇杆上, 沿摇杆方向向下。	More than 98N 3 seconds min 大于 98N, 至少 3 秒钟

4. Electrical characteristics 电气特性			
NO. 序号	ITEM 项 目	CONDITIONS 条 件	SPECIFICATION 规 格
1	Rated voltage 额定电压	$E = \sqrt{PR}$ E: 额定电压 Rated voltage (V) P: 额定功率 Rated power (W) R: 公称全阻值 Nominal total resistance (Ω) The rated voltage is calculated by above formula. When the rated voltage exceeds the maximum operating voltage, the maximum operating voltage should be the rated voltage. 额定电压按以上公式计算，当额定电压超过最大工作电压时，最大工作电压即为额定电压。	DC 1.8V & 3.3V
2	Temperature characteristic 阻抗温度特性	The without electrical load V.R should be stored at temperature of $70 \pm 3^{\circ}\text{C}$ for 5hrs and measure immediately. 将产品置于在 $70 \pm 3^{\circ}\text{C}$ 的恒温槽内以无负荷的条件下放置 5 小时后马上测量。	Without damage and lever deformation, Without the looseness and failing function of witch. 无不良性能产生, 无松动及开关性能损坏。
3	Voltage Divider Error 分压误差值	Voltage divider error is defined the ratio of the voltage terminals Output-GND to terminals VCC-GND after the drive arm rested. 1.8V & 3.3V D.C. shall be applied to the terminals between VCC and GND and then voltage divider error shall be measured with the drive arm operation on the line X-X and Y-Y. 分压误差值是摇杆自由复归后端子 Output-GND 与端子 VCC-GND 电压比例. 将 1.8V & 3.3V D.C 电压加在端子 VCC-GND 之间，分压误差值在摇杆运作于 X-X 和 Y-Y 方向到底复归后测试。	40.3%~59.7%

4	Limit voltage value 极限电压值	The limit voltage value is the voltage ratio between terminals Output-GND and VCC-GND after the rocker reaches the bottom. Add 1.8V & 3.3V D.C voltage between terminals VCC-GND, and the limit voltage rocker operates in the x-x and Y-Y directions to the bottom 极限电压值是摇杆到底后端子 Output-GND 与端子 VCC-GND 电压比例. 将 1.8V & 3.3V D.C 电压加在端子 VCC-GND 之间, 极限电压摇杆运作于 X-X 和 Y-Y 方向到底测试.	At 23° Minimum value < 26% and maximum value > 74%. (value from the straight line to the edge in the up, down, left and right directions) 在 23° 时最小值<26%, 最大值>74%。 (上、下、左、右四个方向直线到边的值)
5	VALUE OF RESET POSITION 复归值	The absolute value of difference between the partial voltage error value measured after the free reset of the rocker in the upward direction and the partial voltage error value measured after the free reset of the rocker in the downward direction. The absolute value of difference between the partial voltage error value measured after the free reset of the rocker in the left direction and the partial voltage error value measured after the free reset of the rocker in the right direction 摇杆推向上方向自由复位后测得分压误差值与摇杆推向下方向自由复位后测得分压误差值之差的绝对值。摇杆推向左方向自由复位后测得分压误差值与摇杆推向右方向自由复位后测得分压误差值之差的绝对值.	Within 6.3%. 6.3%以内
6	Insulation resistance 绝缘阻抗值	/	More than 10 MΩ. 10 MΩ 以上。

7	Functional Block Diagram 功能图							
8	Electrical Specifications 电气规格	SYMBOL 符号	PARAMETERS 参数	TEST CONDITION 实验条件	MIN 最小值	TYP 标准值	MAX 最大值	UNIT 单位
		Vcc	Supply Voltage 电源电压		1.7	-	3.6	V
		Icc	Supply Current 供电电流	Ta=25℃	1.5	2	2.5	mA
		Tpo	Power on Time 开机时间	Ta=25℃	-	3.0	3.8	MS
		Bw	Bandwidth 带宽	-3dB, CL=1nF	-	800	-	Hz
		Rout	Output Resistance 输出电阻	Iout<1.5mA Vcc=3V B=0Gs	-	5	10	Ω
		RI	Output Loading Resistance 输出负载电阻	Pull to GND 下拉到 GND	4.7	-	-	KΩ
				Pull to VCC 上拉到 VCC	4.7	-	-	KΩ
		CI	Output Loading Capacitance 输出负载电容	Output to GND	-	-	10	nF
		RI	Output Loading Resistance 输出负载电阻	Iout<=1.5mA Output to GND or to Vcc	4.7	-	-	kohm
		VOL	Linear output low voltage 线性输出低电压	VCC=3V, RL>=4.7 KΩ	-	-	0.1	V
		VOH	Linear output high voltage 线性输出高电压	VCC=3V, RL>=4.7 KΩ	VCC-0.1	-	-	V

9	Magnetic Characteristics 磁特性	SYMBOL 符号	PARAMETERS 参数	TEST CONDITION 实验条件	MIN 最小值	TYP 标准值	MAX 最大值	UNIT 单位
		ELin	Nonlinear error 非线性误差	Ta=25℃	-1.5	-	1.5	%
		VOE	Zero field output voltage error 零磁场输出电压误差	Vcc=1.8V;B=0 Ta=25℃	0.882	0.9	0.918	V
				Vcc=3V;B=0 Ta=25℃	1.455	1.5	1.545	V
		SNST	Magnetic sensitivity 磁灵敏度	Ta=25℃, Vcc=1.8V	1.1628	1.224	1.2852	mV/Gs
				Ta=25℃, Vcc=3V	1.9176	2.04	2.1624	mV/Gs
		VOQ_TC	Zero field voltage output drift in temperature range 温度范围内零磁场电压输出漂移	-	-2	-	2	%
		SNST_TC	Magnetic sensitivity drift in temperature range 温度范围内磁灵敏度漂移	-	-	1100	-	ppm/℃
		ERAT_VOQ	Zero field output voltage proportional error 零磁场输出电压比例误差	Ta=25℃	-1.5	-	1.5	%
				Ta=25℃	-1.5	-	1.5	%
		ERAT_SNST	Proportional error of magnetic sensitivity 磁灵敏度比例误差	Ta=25℃	-2	-	2	%
				Ta=25℃	-2	-	2	%
		VN	Noise 噪声	Ta=25℃, Vcc=1.8V, BW=800Hz	-	0.5	-	mVpp

10	V ESD 耐静电	TYPE 类型	REFERENCE 参考	Grade 等级
		HUMAN-BODY MODEL (HBM) 人体模型	AEC-Q100-002	Class II
		CHARGED-DEVICE MODEL (CDM) 带电器件模型	AEC-Q100-011	Class C3
		sealing effect (Latch up) 闭锁效应	AEC-Q100-004	Class IA

5. Endurance characteristics

耐久性能

NO. 序号	ITEM 项 目	CONDITIONS 条件	SPECIFICATION 规格
1	Resistance to soldering heat 焊锡耐热性	Soldering test shall be using below materials. 使用以下材料进行焊锡试验。 Using printed: single sided Wiring board copper clad laminate 使用板子 t=1.2mm 单面铜箔玻纤板 Solder: Sn-Ag solder (Pb free) 半田:: Sn-Ag 材料 无 Pb Flux : specific gravity 0.82min. 助焊剂 : 比重 0.82 以上 Soldering condition is in this below. 如下焊锡条件进行试验。 Preheating: The surface of the solder side shall be heated 90°C to 100°C, for 45 seconds or less. 预热温度: 基板表面温度 90°C~100°C, 45 秒以内。 Solder : The board shall be solderd up to the mounting side surface (but solder shall not come into the mounting side surface) for within 5seconds at 255°C to 260°C. 焊锡: 温度 255~260°C、5 秒以下。 焊锡面最大为 PCB 板的上面。PCB 板表面无沾锡流动。 Flux :The foaming method shall be applied. Flux shall not come into the mounting side surface and fluxing time shall be 3seconds or less. 助焊剂: 3 秒以内在 PCB 表面喷撒, PCB 板上助焊剂流动。 Soldering time: One time with above condition. 焊锡次数: 按上記条件 1 次。	terminals shall not work loose to injure electric performance after test. Be satisfied with 4.3 to 4.6. 试后无端子松动, 不会损坏电气性能 (符合第 4.3~4.6 条)。

2	Dry heat 耐热性	Temperature: $80 \pm 2^{\circ}\text{C}$ Time: 96 hours The controller shall be subjected to standard atmospheric conditions for 2 hours , after which measurement shall be made. 在温度 $80 \pm 2^{\circ}\text{C}$ 恒温槽中放置 96 小时, 取出后在正常状态下放置 2 小时后测试。	Without damage and lever deformation, Without the looseness and failing function of witch. 无不良性能产生, 无松动及开关性能损坏。
3	Cold 耐寒性	Temperature: $-30 \pm 2^{\circ}\text{C}$ Time: 96 hours Surface moisture shall be removed, and then the controller shall be subjected to standard atmospheric conditions for 2 hours, after which measurement shall be made. 在温度 $-30 \pm 2^{\circ}\text{C}$ 恒温槽中放置 96 小时, 表面水份摄取后在正常状态下放置 2 小时后测试。	Without damage and lever deformation, Without the looseness and failing function of witch. 无不良性能产生, 无松动及开关性能损坏。
4	Damp heat 耐湿性	Temperature: $60 \pm 2^{\circ}\text{C}$ Humidity: 90~95%RH Time: 96 hours Surface moisture shall be removed And then the controller shall be subjected to standard atmospheric conditions for 2hours, after which measurement shall be made. 在温度 $60 \pm 2^{\circ}\text{C}$ 90%~95%RH 恒温槽中放置 96 小时, 表面水份摄取后在正常状态下放置 2 小时后测试。	Without damage and lever deformation, Without the looseness and failing function of witch. 无不良性能产生, 无松动及开关性能损坏。

5	Temperature cycling test 温度循环测试	Low temperature : $-20\pm 3^{\circ}\text{C}$ 30 minutes High temperature: $+60\pm 3^{\circ}\text{C}$ 30 minutes Number of cycles: 5 Surface moisture shall be removed, and then the controller shall be subjected to standard atmospheric conditions for 2 hours , after which measurement shall be made. 在低温为$-20\pm 3^{\circ}\text{C}$恒温槽放置 30 分钟, 高温 $60\pm 3^{\circ}\text{C}$放置 30 分钟, 测试 5 次, 表面水份摄取后在正常状态下放置 2 小时后测试。	Without damage and lever deformation, Without the looseness and failing function of witch. 无不良性能产生, 无松动及开关性能损坏。
6	Free falling 自由落下试验	Height: 75cm. Number of falls: 3 times 从高度为 75 厘米落下测试 3 次后。	Without damage and lever deformation, Without the looseness and failing function of witch. 无不良性能产生, 无松动及开关性能损坏。
7	Number of cycles 耐久寿命	Mechanical life should be tested 5,000,000 cycles at the speed of one cycle per second without electrical load when joystick rotate 360° at 30° position. 无负载状态下以 1 圈/秒速度将摇杆推至 30.0° 位置进行 360° 旋转测试, 寿命 5,000,000 圈。	Voltage divider error be 40~60%. Accuracy of reset position should be within 8%.without mechanical malfunction. Be satisfied with 分压误差为 40~60%, 复归值为 8% 以内, 机械性能无异常

6. Switch characteristics (FOR WITH-SWITCH TYPE)

开关规格 (适用于带开关机种)

NO. 序号	ITEM 项 目	CONDITIONS 条 件	SPECIFICATION 规 格
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1	Operating force 作动力	Apply side force perpendicular to the lever' s axial direction on the lever until the lever stops, measure the max force value. 将一个轴向力施加于摇杆上直到其不动为止, 量取施力期间之最大值。	7.0±3N
2	Travel 移动量	Put the switch lever upward, apply 2 times of the static operating force over the lever' s axial direction of the lever, measure the variance of the switch stroke. 将开关操作部位(摇杆)置于静止位置, 并在操作柄中央施加两倍于作动力之静负荷测量柄被压到不动时之移动距离。	0.4 ^{+0.5} _{-0.3} mm
3	Maximum Ratings 最大定格电压	Within 70°C 70°C以内。	DC 1.7V & 3.6V
4	Contact resistance 接触阻抗	Apply 2 times of the operating force of the static load on the vertical direction of the lever, measure the resistance by using the Contact Resistance Tester with 1KHZ, 20mV, 5~50mA of current. 将两倍于作动力之静负荷加于操作柄之中央以(1KHZ, 20mV, 5~50mA)微电流接触阻抗计测定。	Less than 200 Ω 低于 200 Ω

5	Switch number of cycles 开关寿命	UNDER ELECTRICAL LOAD DC 1.7V & 3.6V /5mA, COMPRESS 10N FORCE TO THE LEVER WHICH IS RELEASED AND RESET TO VERTICAL POSITION. SWITCH LIFE SHOULD BE TESTED MORE THAN 1,000,000 CYCLES AT THE SPEED OF 2 CYCLES PER SECOND. 负载状态下 (DC 1.7V & 3.6V /5mA), 在摇杆自由复归后的垂直方 向施加 10N (1Kgf) 的按压力, 以 2 次/秒的速度对开关进行测试, 寿命 1,000,000 次以上。	Contact resistance 200 Ω Max, No mechanical malfunction Be satisfied with 6.1 and 6.2 接触阻抗最大 200Ω, 机械方面能动作 (符合第 6.1 条和第 6.2 条)。
Approved 核准		Check 审查	Design dept. 经办者
严治银		宋明士	洪晓亮