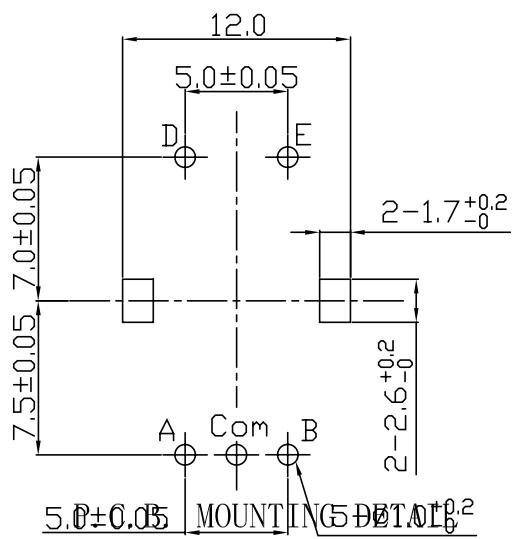


A向 (旋转90°)

注：重点管控尺寸 ① - ⑥。



EC111 SERIES SPECIFICATION

EC111 系列规格书

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1、 General 一般事项

1-1、 Scope 适用规格

This specification applies to 11mm size low-profile thin rotary encoder (incremental type) for microscopic current circuits , used in electronic equipment.

本规格书为11mm小型回转式编码器（增量型），适用于电子设备内微小电子电路。

1-2、 Standard atmospheric conditions 标准状态

Unless otherwise specified ,the standard range of atmospheric conditions for making measurements and test is as following limits:

除另有规定外，测量应在以下状态下进行：

Ambient temperature 温度：15°C to 35°C

Relative humidity 相对湿度：25% to 85%

Air pressure 气压 : 86kPa to 106kPa

1-3、 Operating temperature range

使用温度范围 : -40°C to 85°C

1-4、 Storage temperature range

保存温度范围 : -40°C to 85°C

2、 Construction 构造

2-1 Dimensions 尺寸

Refer to attached drawing 见所附成品图

3、 Rating 额定值

3-1、 Rated voltage 额定电压: DC 5V

3-2、 Maximum operating current (resistive load) 最大额定电流（阻抗负载）

Each lead 各相导线 : 0.5mA (Max 10mA; Min 0.5mA)

Common lead 公共导线: 1mA (Max 10mA; Min 0.5mA)

4、 Application Notes 使用上的事项

4-1. Avoid storing the products in a place at high temperature, high humidity and in Corrosive gases. Please use this product as soon as possible with 6 months limitation . If any remainder left after packing is opened, please store it with proper moistureproofing, gasproofing etc.

避免储藏于高温,潮湿及腐蚀的场所. 产品购入后尽可能在6个月内使用完. 拆包装后未使用完的剩余产品需储藏于防潮防毒的环境下.

4-2. The encoder pulses count method should be designed with taking operating speed ,sampling time and design software into cosideration.

编码器信号的计算方法应将操作的速度,信号的取样时间及电子回路中的微电脑软体等考虑进去.

4-3. With this products ,detent positon will always be aligned with A-OFF or ON phase. Therefore make the A phase of the microcomputer the reference at the soft ware design stage.

此产品在定位点状态时A相波形是处于OFF或ON状态,因此在设计软体时请留意此现象.

4-4. At design of the pulse count process. Using the C/R filter circuit is Recommended.

在设计时要考虑到杂讯,须使用C/R滤波电路.

4-5. Care must be taken not to expose this product to water or dew to prevent possible problem in pluses output waveform.
本产品请勿碰触到水,可能会导致输出波形的异常.

4-6. When encoder are used, the speed is suitable for controlling with 360°/s. The highest speed will lead that IC doesn't obtain signal.
Mean while,the slide contact in the inside of product can be divorced form in order to be poor conatct.

在使用编码品时速度宜控制在360°/s 内， 转速过快会导致IC抓取不到信号及产品内部的接触刷会瞬间脱离产生接触不良。

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5、ELECTRICAL CHARACTERISTICS 电气性能

ITEM 项目	CONDITIONS 条件	SPECIFICATIONS 规格													
	Note: Output signal is 1 pulse per 2 detents. And terminal A-C is pulse ON or OFF at detent position. No specified output of terminal B-C at detent position. 注意事项：输出信号方式是2个定位1个脉冲。在定位点位置时A-C端子处于ON或OFF状态，而B-C端子间不作特定要求。	2 Phase-different signals (signal A, signal B) Details shown in 〈fig.1〉 (The broken line shows detent position.) A、B两信号输出相位差,输出波形详见(图1)。虚线表示带卡点装置的卡点处位置。													
5-1、Output signal format 输出信号	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Shaft rotational direction 轴回转方向</td> <td style="width: 30%;">Signal 信号</td> <td style="width: 40%;">Output 输出波形</td> </tr> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">C .C.W. 逆时针方向</td> <td>A(Terminal A-C) A(A-C端子间)</td> <td>OFF ON</td> </tr> <tr> <td>B(Terminal B-C) B(B-C端子间)</td> <td>OFF ON</td> </tr> <tr> <td rowspan="2" style="text-align: center; vertical-align: middle;">C.W 顺时针方向</td> <td>A(Terminal A-C) A(A-C端子间)</td> <td>OFF ON</td> </tr> <tr> <td>B(Terminal B-C) B(B-C端子间)</td> <td>OFF ON</td> </tr> </table>	Shaft rotational direction 轴回转方向	Signal 信号	Output 输出波形	C .C.W. 逆时针方向	A(Terminal A-C) A(A-C端子间)	OFF ON	B(Terminal B-C) B(B-C端子间)	OFF ON	C.W 顺时针方向	A(Terminal A-C) A(A-C端子间)	OFF ON	B(Terminal B-C) B(B-C端子间)	OFF ON	〈fig.1〉 (图1)
Shaft rotational direction 轴回转方向	Signal 信号	Output 输出波形													
C .C.W. 逆时针方向	A(Terminal A-C) A(A-C端子间)	OFF ON													
	B(Terminal B-C) B(B-C端子间)	OFF ON													
C.W 顺时针方向	A(Terminal A-C) A(A-C端子间)	OFF ON													
	B(Terminal B-C) B(B-C端子间)	OFF ON													
5-2、Resolution 分解能力	Number of pulses in 360° rotation. 回转360°的输出脉冲数。	8 pulses/360° for each phase 8个脉冲/360°													
5-3、Switching characteristics 开关特性	<p>Measurement shall be made under the condition as follows.</p> <p>1)Shaft rotational speed : 360°/S</p> <p>2)Test circuit : (fig.2)</p> <p>下(图2)所示回路, 轴以360°/秒的速度回转测定。</p> <p>fig.2</p> <p>(Note) Code-OFF area :The area which the voltage is 3.5V or more. Code-ON area :The area which the voltage is 1.5V or less. (注) 编码器OFF指输出电压3.5V以上的状态。 编码器ON指输出电压1.5V以下的状态。</p>	<p>〈fig.3〉 图3</p>													
5-3-1、Chattering 振荡	Specified by the signal's passage time from 1.5V to 3.5V of each switching position (code OFF~ON or ON~OFF) (Fig.3) 编码从OFF → ON 或 ON → OFF时, 输出1.5V~3.5V通过的时间应符合规定。(图3)	On the case within detent, B signal will be irregular oscillation. 带卡点时, 在卡点位置上的B信号振荡无规定。 t1,t3 ≤ 3ms													
5-3-2、Sliding noise (Bounce) 滑动杂音(突跳)	Specified by the time of voltage change exceed 1.5V in code-ON area. When the bounce has code-ON time less than 1mS between chattering (t1 or t3).the voltage change shall be regarded as a part of chattering. When the code-ON time between 2 bounces is less than 1mS.they are regarded as 1 linked bounce. 编码ON部分的1.5V以上的电压变动时间在振荡t1,t3之间会产生1毫秒以上1.5V以下的ON部分. 另外, 如果各突跳间1.5V以下的范围在1毫秒以上时, 则判定为另一个突跳。	t2≤2ms													

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5、ELECTRICAL CHARACTERISTICS 电气性能

ITEM 项目	CONDITIONS 条件	SPECIFICATIONS 规格	
5-3-3、Sliding noise 滑动噪音	The voltage change in code - OFF area. 编码OFF部分的电压变动。	3.5V Min 3.5V 以上	
5-4、Phase difference 相位差	<p>Measurement shall be made under the condition which the shaft is rotated in $360^\circ \cdot S^{-1}$ (constant speed). 以$360^\circ / s$的速度测量。 (Fig.4)图4</p>	$\Delta T \geq 6 \text{ ms}$ In (fig.4) 见图4	
5-5、Insulation resistance 绝缘电阻	Measurement shall be made under the condition which a voltage of 250V DC 1min is applied between individual terminals and bushing. 在端子和安装板间施加电压 250V DC 1分钟。	Between individual terminals and bushing 100 MΩ Min 端子安装板间电阻100 MΩ以上。	
5-6、Dielectric strength 耐电压	A voltage of 300V AC shall be applied for 1 minute between individual terminals and bushing. 在端子和安装板间施加 AC 300V 电压1分钟。	Without arcing or breakdown. 不得有绝缘破坏。	
6、Mechanical characteristics 机械性能			
6-1、Total rotational angle 全回转角度		360°(Endless) 360°(无止挡点)	
6-2、Detent Torque 定位点力矩	Only suitable for C.C, equipment. 只适用于附卡点装置	40±20mNm (400±200 gf.cm)	
6-3、Number and position of detent 定位点数及位置	Only suitable for C.C, equipment. 只适用于附卡点装置	16 detents(Step angle: $22.5^\circ \pm 3^\circ$) 16点定位 (间隔角度 $22.5^\circ \pm 3^\circ$)	
6-4、Push-pull strength of shaft 轴推拉强度	Pull static load of 100 N(10 kgf) for 20s and push static load of 100 N (10 Kgf) for 10s shall be applied to the shaft in the axial direction . (After soldering of the PC board) 在轴端, 沿轴向施加100 N(10 kgf)的静负荷力拉力20秒钟和施加100 N (10 Kgf)推力10秒钟(焊锡固定在PCB上)。	Without damage or excessive play in shaft . No excessive abnormality in rotational feeling. And electrical characteristics shaft be satisfied. 轴无破损, 旋转、电气性能无异常。	
6-5、Terminal strength 端子强度	A static load of 3N(0.31kgf) shall be applied to the tip of terminals for 10 s in any direction. 端子前端的任意方向施加3N(0.31kgf)的静负荷力10秒钟.	Without excessive play in terminal or poor contact. 端子不得有明显松动及接触不良。	
6-6、Shaft wobble 轴摆动	A momentary load of 50mN.m(500 gf) shall be applied at the point 2mm from the tip of the shaft in a direction perpendicular to the axis of shaft. 在轴前端2mm处,沿径向瞬间施加50mN (500 gf)的力. L: Distance between mounting surface and measuring point on the shaft.	Bushing length Wobble 轴套长 (mm) 摆动 (mm-p less)	5 0.3*L/20 7 0.25*L/20 10以上 0.2*L/20

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6、 Mechanical characteristics 机械性能

ITEM 项 目	CONDITIONS 条件	SPECIFICATIONS 规 格
6-7、 Side thrust strength of shaft 轴的垂直押引强度	A load of 20N(2.04Kgf) shall be applied at the point 5mm from the tip of the shaft in a direction perpendicular to the axis of shaft for 10 s. 在轴前端5 mm处加20 N(2.04 Kgf)的静负荷力10 s.	Without excessive play of bending in shaft. No mechanical abnormally. 轴不得有明显松动及接触不良.
6-8、 Shaft play in rotational wobble 轴的回转方向摆动	Testing by angle board. 用角度板测定.	2° Max 2° 以下
6-9、 Shaft play in axial direction 轴向间隙	The pull / push load of 0.5N(51gf) shall be imposed on the shaft. 在轴上施加0.5N(51gf)的推力或拉力.	0.2mm Max. 0.2mm以下.

7、 Endurance characteristics 耐久性能

7-1、 Rotational life 回转寿命	<p>The shaft of encoder shall be rotated to 30,000 cycles at a speed of 600~800 cycles/H without electrical load, after which measurements shall be made. 在无负荷条件下轴以600~800周/小时速度回转30,000 周。</p> <p>1 cycle: rotate 360° CCW rotate 360° CW 1周指顺时针转360°逆时针转360°</p>	<p>Chattering t1,t3≤5ms Bounce t2≤3ms 振荡: t1,t3≤5ms; 突跳: t2≤3ms</p> <p>Detent torque: Relative to the previously specified value 50%. 定位力矩: 为原始规格值的50%</p> <p>Shaft wobble should be within 150% of the specifications. 轴摆动为原始规格值的150%以内</p> <p>Shaft play in rotational wobble: 4° Max. 轴的回转方向摆动: 4°以内</p>
7-2、 Damp heat 耐湿性	<p>The encoder shall be stored at temperature of 40±2°C with relative humidity of 90% to 95% for 240±10H in a thermostatic chamber .And the encoder shall be subjected to standard atmospheric conditions for 1.5H, After which measurements shall be made. 温度40±2°C,湿度90~95%的恒温恒湿槽中放置240±10小时后,在常温、常湿中放置1.5小时后测试.</p>	<p>Contact resistance: 100 Ω Max. SW Contact resistance: 200 mΩ max.</p> <p>Encoder characteristics item: 5-1、5-5、5-6、6-2</p> <p>Push switch characteristics item: 1-2-3、1-2-4、1-3-2、1-3-3</p> <p>The same as the initial specifications. 接触阻抗小于100 Ω。 开关接触阻抗小于200 mΩ。</p>
7-3、 Dry heat 耐热性	<p>The encoder shall be stored at a temperature of 85±3°C for 240±10H in a thermostatic chamber.And then the encoder shall be subjected to standard atmospheric conditions for 1.5H .After which measurement shall be made. 温度85±3°C的恒温箱中放置240±10小时,常温、常湿放置1.5小时后测试.</p>	<p>Push switch characteristics item: 1-2-3、1-2-4、1-3-2、1-3-3 The same as the initial specifications. 接触阻抗小于100 Ω。 开关接触阻抗小于200 mΩ。</p> <p>编码器特性项目: 5-1、5-5、5-6、6-2 按压开关特性项目: 1-2-3、1-2-4、1-3-2、1-3-3应同原规格值相同。</p>
7-4、 Cold 低温特性	<p>The encoder shall be stored at a temperature of -40±3°C for 240±10H in a thermostatic chamber.And then the encoder shall be subjected to standard atmospheric conditions for 1.5H .After which measurement shall be made. 温度-40±3°C的恒温箱中放置240±10小时,常温、常湿放置1.5小时后测试。</p>	
7-5、 Solder ability 焊锡性	<p>The terminals shall be immersed into solder bath at 260°C±5°C for 3s±1s in the same manner as para. 端子在260°C±5°C温度的焊锡槽内浸锡3秒±1秒。</p>	<p>A new uniform coating of solder shall cover 75% minimum of the surface being immersed. 浸渍面须有75%以上焊锡附着</p>
7-6、 Resistance to Soldering heat 耐焊接热	<p>■ Manual soldering 手工焊接 Bit temperature of soldering iron: 350°C less than Application time of soldering iron: within 3s 温度350°C以下, 时间3秒以内。</p> <p>■ Dip soldering 槽焊 Printed wiring board : copper clad laminate board with thickness of 1.6mm. 使用基板: t=1.6mm的覆铜板。 Preheating : 1、 Surface temperature of board: 100°C or less. 2、 Preheating time : within 1 min. 预热: 基板表面温度100°C以下, 时间1分钟以内。 Soldering : Solder temperature : 260±5°C or less Immersion time :within 3S 焊接: 温度260±5°C或以下, 时间3秒以内。</p>	<p>Electrical characteristics shall be satisfied No mechanical abnormality. 不得有绝缘体的破损、变形、接触无异常。</p>

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Push switch portion 推动开关部分

Note: The following specification is only suitable for the one type with switch construction of EC11 encoder series.
注：以下规格只适用于此EC11编码器系列带开关结构。

1-1、Rated capacity (Resistance load) : DC 5V 10mA (1mA Min)

额定容量（电阻负荷）：DC 5V 10mA (1mA 以上)

1-2 Electrical characteristics 电气性能

ITEM 项 目	CONDITIONS 条 件	SPECIFICATIONS 规 格
1-2-1、Contact resistance 接触电阻	Voltage step-down test at DC 5V 1mA 用DC 5V 1mA 电压降下法测定.	100 mΩ Max 100 mΩ 以下
1-2-2、Bouncing 振荡	Shaft shall be rotated at 1 cycles/S (OFF-ON-OFF) 以1秒钟1往返（OFF-ON-OFF）回转运转	10 ms Max 10 ms 以下
1-2-3、Insulation resistance 绝缘电阻	Measurement shall be made under the condition which a voltage 250V DC 1 min±5S is applied between individual terminals and tracked 在端子与安装板间施加电压DC 250V 1分钟±5秒。	Between individual terminals and bracket 100 MΩ Min. 在端子安装板间100 MΩ以上
1-2-4 Dielectric strength 耐电压	A voltage of 250V AC /min or300 V AC /2S(leak current 1mA) be applied between individual terminals and bracket.在端子与安装板间 施加AC 250V 1分钟或AC 300V 2秒钟（漏电流1mA）	Without arcing or breakdown. 不得有绝缘损坏。

1-3 Mechanical characteristics 机械性能

1-3-1、Switch circuit and number of pulse 开关电路、接点数		Single pole and single throw (push on) 单极单投（推ON）
1-3-2、Travel of switch 开关移动量		0.5 ^{+0.2} _{-0.3} mm
1-3-3、Operating force of switch 开关作动力		6±2N (600±200gf)

1-4 Endurance characteristics 耐久性能

Push operating life 寿命特性	The encoder's shall be pushed to 20,000 cycles at a speed of 1800±300/h without electrical load.(shaft push load: 1 kgf Max.) 在无负荷条件下,对轴以每小时1800±300次的速度推动20,000次,(轴按压力1 kgf以下).	Contact resistance : 200 mΩ Max. Specification in clause 1-2-2~4,1-3-1~2 shall be satisfied. Operating force: Before test 50%. 接触电阻 : 200 mΩ以下. 1-2-2~4,1-3-1~2 满足初期规格. 开关动作力为寿命前的50%.
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