



Detector

Slide

Push

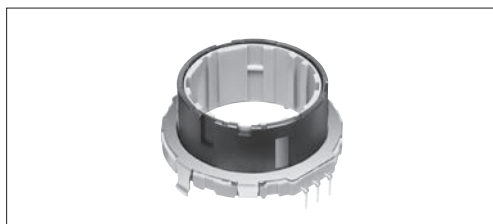
Rotary

Encoders

Power

Dual-in-line  
Package Type

TACT Switch™

Metal  
ShaftInsulated  
ShaftHollow  
ShaftRing  
Type

## ■ Typical Specifications

| Items                       | Specifications            |
|-----------------------------|---------------------------|
| Output signal               | Three phase of A, B and C |
| Rating                      | 10mA 5V DC                |
| Operating life              | 50,000 cycles             |
| Operating temperature range | − 40°C to + 85°C          |

## ■ Product Line

| Actuator length | Detent torque<br>(mN · m) | Number of detents | Number of pulse | Minimum order unit (pcs.) |        | Products No. | Drawing No. |
|-----------------|---------------------------|-------------------|-----------------|---------------------------|--------|--------------|-------------|
|                 |                           |                   |                 | Japan                     | Export |              |             |
| 15              | 12 ± 5                    | 30                | 10              | 800                       | 800    | EC35AH240403 | 1           |
|                 | 18 ± 7                    |                   |                 |                           |        | EC35AH220403 |             |
| 25              | 30 ± 15                   | 18                | 6               | 700                       | 700    | EC35AH220502 | 2           |
|                 | 18 ± 7                    |                   |                 |                           |        | EC35AH260502 |             |
| 15              | 18 ± 7                    | 18                | 6               | 800                       | 800    | EC35AH120401 | 3           |

## ■ Packing Specifications

## Tray

| Length of operating<br>section (mm) | Number of packages (pcs.) |                         | Export package<br>measurements<br>(mm) |
|-------------------------------------|---------------------------|-------------------------|----------------------------------------|
|                                     | 1 case / Japan            | 1 case / export packing |                                        |
| 15                                  | 800                       | 800                     | 360 × 540 × 290                        |
| 25                                  | 350                       | 700                     | 360 × 540 × 380                        |

## ■ Dimensions

Unit:mm

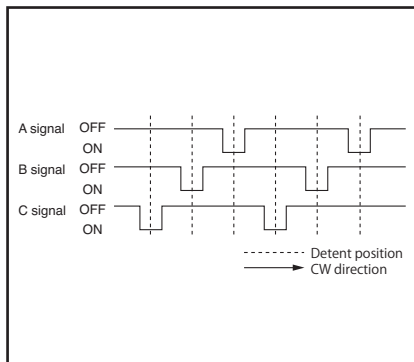
| No. | Style | PC board mounting hole dimensions<br>(Viewed from mounting side) |
|-----|-------|------------------------------------------------------------------|
| 1   |       |                                                                  |
| 2   |       |                                                                  |

## ■ Dimensions

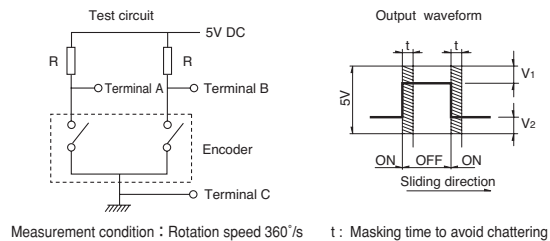
Unit:mm

| No. | Style | PC board mounting hole dimensions<br>(Viewed from mounting side) |
|-----|-------|------------------------------------------------------------------|
| 3   |       |                                                                  |

## Output Wave



## ■ Sliding Noise

 $V_1 = V_2 = 2.5V \text{ max.}$ 

At  $R = 10k\Omega$   
Chattering : 5ms max.    Bounce : 5ms max.

## Detector

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Package Type

TACT Switch™

### Metal Shaft

### Insulated Shaft

## Hollow Shaft

Ring Type

## List of Varieties

| Type                                  |                                                 | Ring Type                                                                         |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                          |
|---------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|------------------------------------------|
|                                       |                                                 | 21mm size                                                                         | 28mm size                                                                         | 35mm size                                                                         |                                                                                     |                                                                                     |                                          |
| Series                                |                                                 | EC21A                                                                             | EC28A                                                                             | EC35A                                                                             | EC35AH                                                                              | EC35B                                                                               |                                          |
| Photo                                 |                                                 |  |  |  |  |  |                                          |
| Output                                |                                                 | Incremental<br>(Two phase A and B )                                               |                                                                                   |                                                                                   | Incremental<br>( Three phase A, B and C)                                            | Incremental<br>(Two phase A and B ) /<br>Self-return switch                         |                                          |
| Shaft types                           |                                                 | Ring type                                                                         |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                          |
| Number of pulse /<br>Number of detent |                                                 | 9 / 18<br>15 / 30                                                                 | 15 / 30                                                                           |                                                                                   | 6×ABC / 18<br>10×ABC / 30                                                           | 15 / 30                                                                             |                                          |
| Dimensions<br>(mm)                    | W                                               | 21.6                                                                              | 28                                                                                | 35                                                                                |                                                                                     | 35                                                                                  |                                          |
|                                       | D                                               |                                                                                   | 29                                                                                |                                                                                   |                                                                                     | 37                                                                                  |                                          |
|                                       | H                                               | 4                                                                                 |                                                                                   | 4.5                                                                               |                                                                                     | 12.1                                                                                |                                          |
| Operating temperature range           |                                                 | -40℃ to + 85℃                                                                     |                                                                                   |                                                                                   |                                                                                     |                                                                                     |                                          |
| Operating life                        |                                                 | 50,000 cycles                                                                     |                                                                                   |                                                                                   |                                                                                     | 30,000 cycles                                                                       |                                          |
| Automotive use                        |                                                 |  |  |  |  |  |                                          |
| Life cycle (availability)             |                                                 |  |  |  |  |  |                                          |
| Electrical<br>performance             | Rating                                          |                                                                                   | 10mA 5V DC                                                                        |                                                                                   |                                                                                     |                                                                                     |                                          |
|                                       | Max./min. operating current<br>(Resistive load) |                                                                                   | 10mA / 1mA                                                                        |                                                                                   |                                                                                     |                                                                                     |                                          |
|                                       | Insulation resistance                           |                                                                                   | 100M Ω min. 250V DC                                                               |                                                                                   |                                                                                     |                                                                                     |                                          |
|                                       | Voltage proof                                   |                                                                                   | 300V AC for 1minute or 360V AC for 2s                                             |                                                                                   |                                                                                     |                                                                                     | 300V AC for 1minute or<br>360V AC for 1s |
| Mechanical<br>performance             | Detent torque                                   |                                                                                   | 7±5mN·m<br>16±7mN·m                                                               | 7±5mN·m<br>12±7mN·m<br>20±10mN·m                                                  | 18±7mN·m                                                                            | 12±5mN·m<br>18±7mN·m<br>30±15mN·m                                                   | 20±10mN·m                                |
|                                       | Push-pull<br>strength                           | Push                                                                              | 100N                                                                              |                                                                                   |                                                                                     |                                                                                     |                                          |
|                                       |                                                 | Pull                                                                              | 100N                                                                              |                                                                                   |                                                                                     |                                                                                     |                                          |
| Shaft configuration                   |                                                 |                                                                                   | Ring type                                                                         |                                                                                   |                                                                                     |                                                                                     |                                          |
| Terminal type                         |                                                 |                                                                                   | Insertion                                                                         |                                                                                   |                                                                                     |                                                                                     |                                          |
| Switch<br>Specifications              | Switch type                                     |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | Self-return switch                       |
|                                       | Contact arrangement                             |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | Single pole and<br>double throw          |
|                                       | Travel (mm)                                     |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | 2.8 ± 0.5                                |
|                                       | Operating force (N)                             |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | 3.8 ± 1.5                                |
|                                       | Switch ON position                              |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | 15 ± 5°                                  |
|                                       | Ratational torque                               |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | 40 ± 25mN·m                              |
|                                       | Rating                                          |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | 10mA 5V DC                               |
|                                       | Contact resistance                              |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | 200m Ω max.                              |
|                                       | Operating life                                  |                                                                                   | —                                                                                 | —                                                                                 | —                                                                                   | —                                                                                   | 15,000cycles                             |
| Page                                  |                                                 | 182                                                                               | 184                                                                               | 185                                                                               | 186                                                                                 | 188                                                                                 |                                          |

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**Note** ● indicates applicability to all products in the series.

## Reference for Hand Soldering

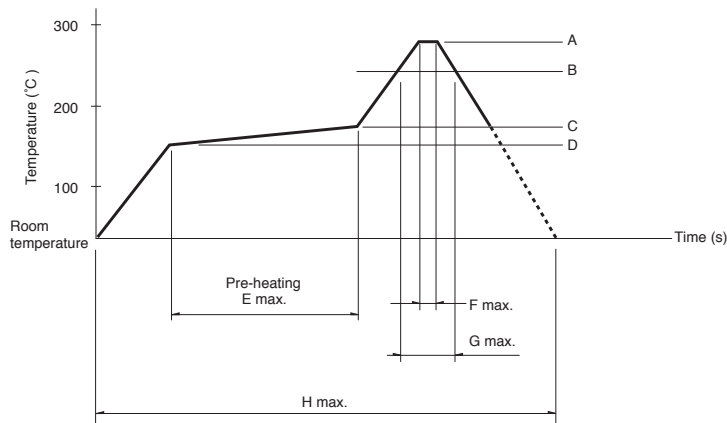
| Series                                                                                                                                                    | Tip temperature | Soldering time                 | No. of solders |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------|----------------|
| EC05E, EC09E, EC10E, EC111, EC11B, EC11E, EC11G, EC11K, EC12D, EC12E, EC18A, EC20A, EC21A, EC28A, EC35A, EC35AH, EC35B, EC40A, EC45A, EC50A, EC60A, EM20B | 350°C max.      | 3s max.                        | 1 time         |
| EC11J                                                                                                                                                     | 350±10°C        | 3 <sup>+1</sup> <sub>0</sub> s | 2 time         |

## Reference for Dip Soldering

| Series                                                                                            | Preheating                    |              | Dip soldering         |                | No. of solders |
|---------------------------------------------------------------------------------------------------|-------------------------------|--------------|-----------------------|----------------|----------------|
|                                                                                                   | Soldering surface temperature | Heating time | Soldering temperature | Soldering time |                |
| EC09E, EC11B, EC111, EC11E, EC11G, EC11K, EC18A, EC20A, EC21A, EC28A, EC35A, EC35AH, EC35B, EC50A | 100°C max.                    | 2 min. max.  | 260±5°C               | 5±1s           | 2 time max.    |
| EC10E, EC12D, EC12E                                                                               | 100°C max.                    | 1 min. max.  | 260±5°C               | 3±1s           | 2 time max.    |
| EC40A                                                                                             | 110°C max.                    | 1 min. max.  | 260°C max.            | 10s max.       | 1 time         |
| EC45A, EC60A                                                                                      | 100°C max.                    | 2 min. max.  | 260°C max.            | 5s max.        | 2 time max.    |
| EM20B                                                                                             | 80°C max.                     | 1 min. max.  | 260°C max.            | 3s max.        | 2 time max.    |

## Condition for Reflow

### Temperature profile



| Series | A          | B          | C     | D     | E           | F  | G          | H          | No. of reflows |
|--------|------------|------------|-------|-------|-------------|----|------------|------------|----------------|
| EC11J  | 260°C      | 230°C      | 180°C | 150°C | 2 min.max.  | 3s | 40s        | 4 min. max | 2 time max.    |
| EC05E  | 250°C min. | 230°C min. | 180°C | 150°C | 60s to 120s | —  | 30s to 40s | —          | 2 time max.    |

## Notes

- When using an infrared reflow oven, solder may sometimes not be applied. Be sure to use a hot air reflow oven or a type that uses infrared rays in combination with hot air.
- The temperatures given above are the maximum temperatures at the terminals of the potentiometer when employing a hot air reflow method. The temperature of the PC board and the surface temperature of the potentiometer may vary greatly depending on the PC board material, its size and thickness. Ensure that the surface temperature of the potentiometer does not rise to 250°C or greater.
- Conditions vary to some extent depending on the type of reflow bath used. Be sure to give due consideration to this prior to use.