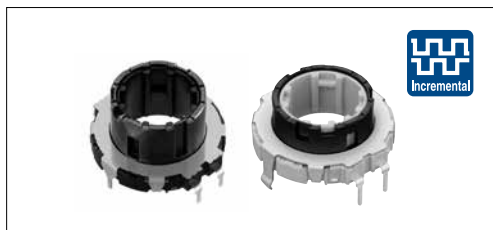


Ring encoder with 4mm height contribute to space saving and multifunctioning



## Typical Specifications



| Items                       | Specifications |
|-----------------------------|----------------|
| Rating                      | 10mA 5V DC     |
| Operating life              | 50,000 cycles  |
| Operating temperature range | -40°C to +85°C |

## Product Line

| Structure | Actuator length (mm) | Detent torque (mN·m) | Number of detent | Number of pulse                                               | Minimum order unit (pcs.) |              | Product No.  | No. |
|-----------|----------------------|----------------------|------------------|---------------------------------------------------------------|---------------------------|--------------|--------------|-----|
|           |                      |                      |                  |                                                               | Japan                     | Export       |              |     |
| Dip       | 9                    | 7±5                  | 30               | 15                                                            | 600                       | 1,200        | EC21A1540401 | 1   |
|           |                      | 16±7                 |                  |                                                               |                           |              | EC21A1520401 |     |
|           |                      |                      | 18               | 9                                                             | 240                       | 480          | EC21A0920401 | 2   |
|           | 15                   | 30                   | 15               | 600                                                           | 1,200                     | EC21A1520407 | 3            |     |
|           |                      | 12±5                 | 18               |                                                               |                           | 9            | EC21A0950402 | 4   |
|           |                      | Reflow               | 12               | 17±8 (Initial), 12 <sup>+7</sup> <sub>-4</sub> (After reflow) | 30                        | 15           | 640          | 640 |

## Packing Specifications

Tray

| Product No.                  | Number of packages (pcs.) |                         | Export package measurements (mm) |
|------------------------------|---------------------------|-------------------------|----------------------------------|
|                              | 1 case / Japan            | 1 case / export packing |                                  |
| EC21A0920401                 | 240                       | 480                     | 375×285×223                      |
| EC21A1520401<br>EC21A1540401 | 600                       | 1,200                   | 508×364×192                      |
| EC21A1520407<br>EC21A0950402 | 600                       | 1,200                   | 540×360×290                      |
| EC21C                        | 640                       | 640                     | 400×310×185                      |

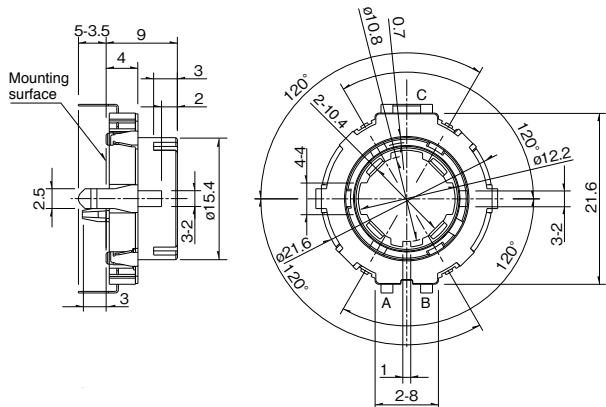
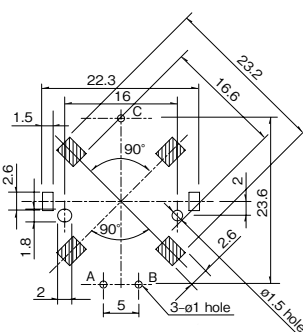
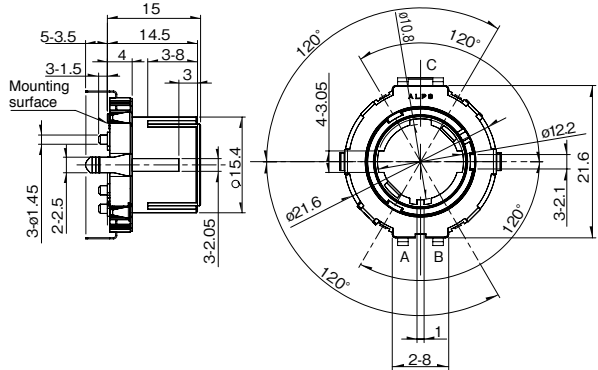
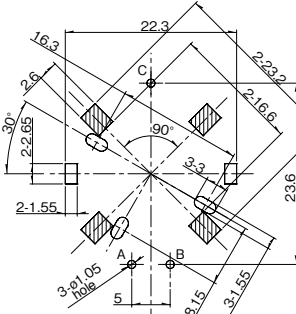
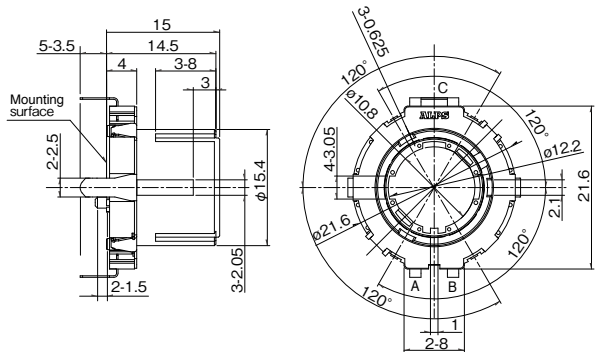
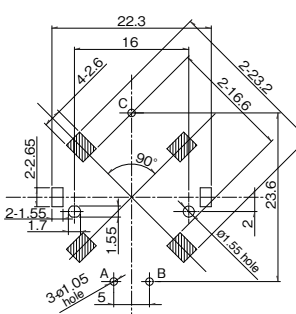
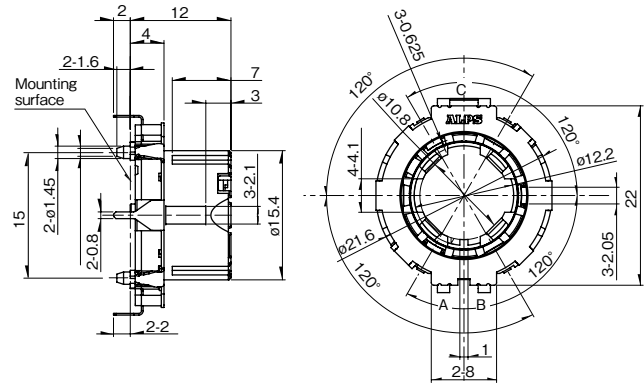
## Dimensions

Unit:mm

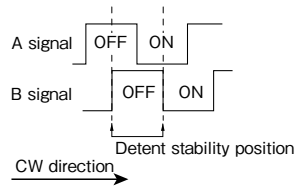
| No. | Photo                                                       | Style | PC board mounting hole dimensions (Viewed from mounting side) |
|-----|-------------------------------------------------------------|-------|---------------------------------------------------------------|
| 1   | <p>EC21A<br/>Actuator length 9mm<br/>15 pulse/30 detent</p> |       | <p>Shaded area: Wiring prohibited area</p>                    |

## Dimensions

Unit:mm

| No. | Photo                                                                                                                                                         | Style                                                                                | PC board mounting hole dimensions<br>(Viewed from mounting side)                                                                 |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| 2   | <b>EC21A</b><br>Actuator length 9mm<br>9 pulse/18 detent                     |    |  <p>Shaded area: Wiring prohibited area</p>   |
| 3   | <b>EC21A</b><br>Actuator length 15mm<br>15 pulse/30 detent                  |   |  <p>Shaded area: Wiring prohibited area</p>  |
| 4   | <b>EC21A</b><br>Actuator length 15mm<br>9 pulse/18 detent                  |  |  <p>Shaded area: Wiring prohibited area</p> |
| 5   | <b>EC21C</b><br>Reflow type<br>Actuator length 12mm<br>15 pulse/30 detent  |  |                                                                                                                                  |

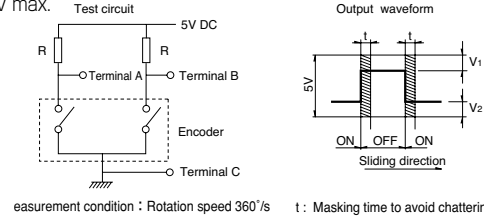
## Output Wave



※Detent position cannot be specified for B signal.

## Sliding Noise

$V_1 = V_2 = 2.5V$  max.



At  $R = 5k\Omega$

Chattering : 5ms max. Bounce : 5ms max.

Encoders

Metal Shaft

Insulated Shaft

Through Shaft Type

Ring Type

# Encoders

## List of Varieties

| Type                               |                                              | Through shaft type                                                                |            |                                                                                   | Ring type                                                                           |                                                                                     |
|------------------------------------|----------------------------------------------|-----------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                    |                                              | 5mm size                                                                          |            | 10mm size                                                                         | 21mm size                                                                           |                                                                                     |
| Series                             |                                              | EC05E                                                                             |            | EC10E                                                                             | EC21A                                                                               | EC21C                                                                               |
| Photo                              |                                              |  |            |  |  |  |
| Output                             |                                              | Incremental (Two phase A and B)                                                   |            |                                                                                   |                                                                                     |                                                                                     |
| Shaft types                        |                                              | Through shaft                                                                     |            |                                                                                   | Ring type                                                                           |                                                                                     |
| Operating direction                |                                              | Vertical                                                                          | Horizontal | Horizontal                                                                        | —                                                                                   | —                                                                                   |
| Number of pulse / Number of detent |                                              | 12/12                                                                             |            | 12/24<br>12/12                                                                    | 9/18<br>15/30                                                                       | 15/30                                                                               |
| Features                           |                                              | Surface mount type                                                                |            |                                                                                   | —                                                                                   | —                                                                                   |
| Dimensions (mm)                    | W                                            | 5.7                                                                               | 7.5        | 9.8                                                                               | 21.6                                                                                | 22                                                                                  |
|                                    | D                                            | 6                                                                                 | 3.3        | 4.4                                                                               |                                                                                     | 21.6                                                                                |
|                                    | H                                            | 2.7                                                                               | 7.25       | 10.6/12.6/14.6                                                                    | 4                                                                                   |                                                                                     |
| Operating temperature range        |                                              | -30°C to +85°C                                                                    |            | -5°C to +45°C<br>-40°C to +85°C (For Automotive)                                  | -40°C to +85°C                                                                      |                                                                                     |
| Operating life                     |                                              | 100,000 cycles                                                                    |            |                                                                                   | 50,000 cycles                                                                       |                                                                                     |
| Automotive use                     |                                              | —                                                                                 |            | ○                                                                                 | ●                                                                                   | ●                                                                                   |
| Life cycle (availability)          |                                              |  |            |  |  |  |
| Electrical performance             | Rating                                       | 0.55mA 5.5V DC                                                                    |            | 1mA 5V DC                                                                         | 10mA 5V DC                                                                          |                                                                                     |
|                                    | Max./min. operating current (Resistive load) | 0.55mA / —                                                                        |            | —                                                                                 | 10mA / 1mA                                                                          |                                                                                     |
|                                    | Insulation resistance                        | 50MΩ min. 50V DC                                                                  |            |                                                                                   | 100MΩ min. 250V DC                                                                  |                                                                                     |
|                                    | Voltage proof                                | 50V AC for 1 minute                                                               |            |                                                                                   | 300V AC for 1minute<br>or 360V AC for 2s                                            | 300V AC for 1minute<br>or 360V AC for 1s                                            |
| Mechanical performance             | Rotational torque (Without detent)           | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
|                                    | Detent torque                                | 1.6±1.3mN·m                                                                       |            | 5±3mN·m<br>6±3mN·m                                                                | 7±5mN·m<br>12±5mN·m<br>16±7mN·m                                                     | 17±8mN·m (Initial)<br>12±4mN·m (After reflow)                                       |
|                                    | Push-pull strength                           | —                                                                                 |            | —                                                                                 | 100N                                                                                |                                                                                     |
| Shaft configuration                |                                              | Through shaft                                                                     |            |                                                                                   | Ring type                                                                           |                                                                                     |
| Terminal type                      |                                              | Reflow                                                                            |            | Insertion                                                                         | Insertion                                                                           |                                                                                     |
| Switch Specifications              | Switch type                                  | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
|                                    | Contact arrangement                          | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
|                                    | Travel (mm)                                  | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
|                                    | Operating force (N)                          | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
|                                    | Rating                                       | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
|                                    | Contact resistance                           | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
|                                    | Operating life                               | —                                                                                 |            | —                                                                                 | —                                                                                   | —                                                                                   |
| Page                               |                                              | 282                                                                               |            | 284                                                                               | 285                                                                                 |                                                                                     |

|                               |     |
|-------------------------------|-----|
| Encoders Soldering Conditions | 299 |
| Encoders Cautions             | 300 |

### Notes

- The operating temperature range for automotive applications can be raised upon Request. Please contact us for details.
- Indicates applicability to all products in the series, while ○ indicates applicability to some products in the series.

## Reference for Manual Soldering

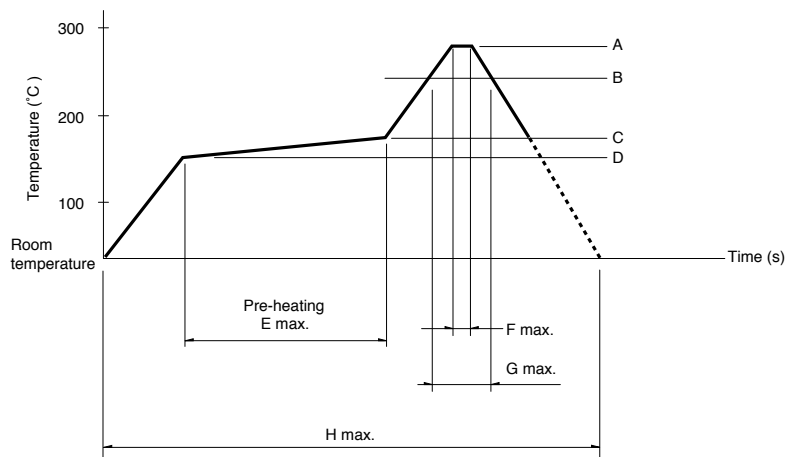
| Series                                                                                                                                                                          | Tip temperature | Soldering time                 | No. of solders |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------|----------------|
| EC05E, EC09E, EC10E, EC111, EC11B, EC11E, EC11G, EC11K, EC11M, EC11N, EC12D, EC12E, EC18A, EC21A, EC28A, EC35A, EC35AH, EC40A, EC45A, EC50A, EC60B, EM11B, EC21C, EC28C, EC35CH | 350°C max.      | 3s max.                        | 1 time         |
| EC11J                                                                                                                                                                           | 350±10°C        | 3 <sup>+1</sup> <sub>0</sub> s | 2 times        |

## 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, EC11M, EC11N, EC18A, EC21A, EC28A, EC35A, EC35AH, EC50A, EC60B | 100°C max.                    | 2 min. max.  | 260±5°C               | 5±1s           | 2 times max.   |
| EM11B                                                                                                    | 100°C max.                    | 1 min. max.  | 260°C max.            | 3s max.        | 2 times max.   |
| EC10E, EC12D, EC12E                                                                                      | 100°C max.                    | 1 min. max.  | 260±5°C               | 3±1s           | 2 times max.   |
| EC40A                                                                                                    | 110°C max.                    | 1 min. max.  | 260°C max.            | 10s max.       | 1 time         |
| EC45A                                                                                                    | 100°C max.                    | 2 min. max.  | 260°C max.            | 5s max.        | 2 times max.   |

## Example of Reflow Soldering Condition

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 times max.   |
| EC05E         | 250°C min.     | 230°C min. | 180°C | 150°C | 60s to 120s | —  | 30s to 40s | —           | 2 times max.   |
| EC21C         | 230°C to 245°C | 220°C      | 200°C | 150°C | 60s to 120s | —  | 25s to 60s | 300s max.   | 1 time max.    |
| EC28C, EC35CH | 260°C          | 230°C      | 180°C | 150°C | 2 min. min. | 3s | 40s        | 230s max.   | 1 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 encoder when employing a hot air reflow method. The temperature of the PC board and the surface temperature of the encoder may vary greatly depending on the PC board material, its size and thickness. Ensure that the surface temperature of the encoder 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.

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