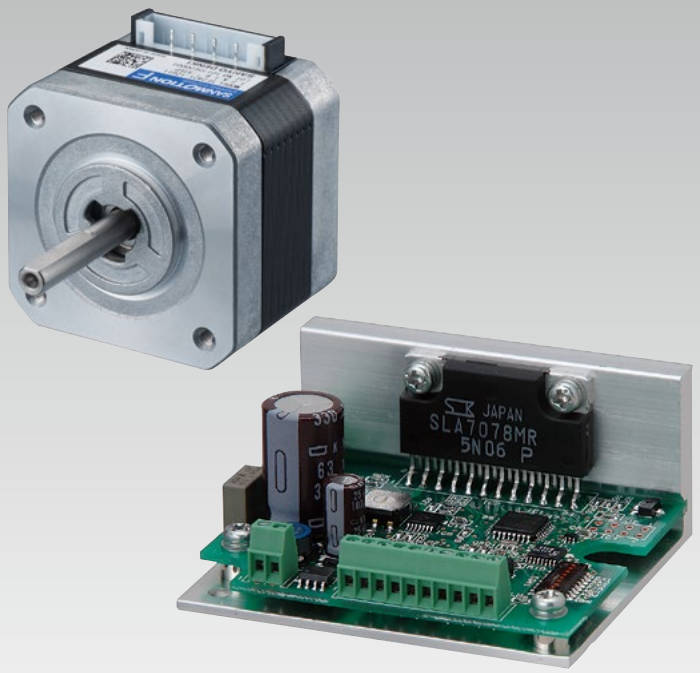
# SANMOTION

2-PHASE STEPPING SYSTEMS

# F2




Ver.8

SANYO DENKI

# SANMOTION F2

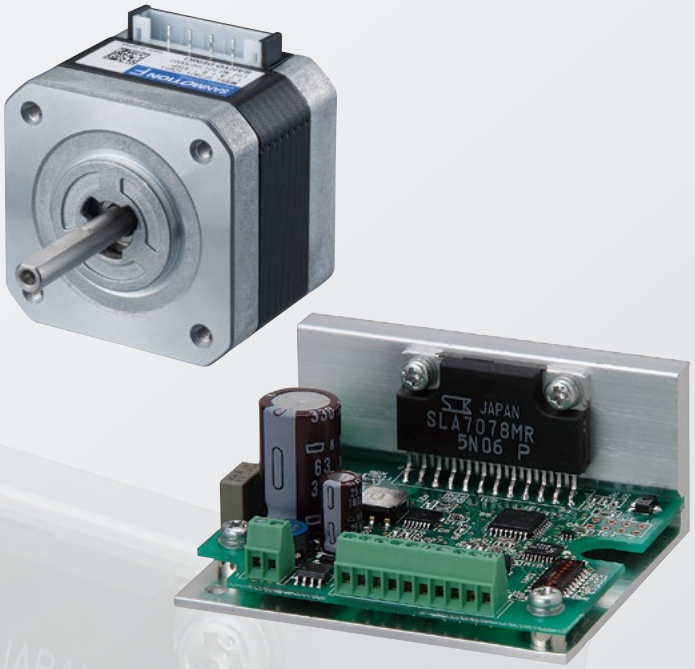
## 2-PHASE STEPPING SYSTEMS

DC Input Set Models

DC Input Drivers

Stepping Motors

Stepping Motors, IP65 Splash and Dust Proof Stepping Motors, Stepping Motors for Vacuum Environments, Synchronous Motors

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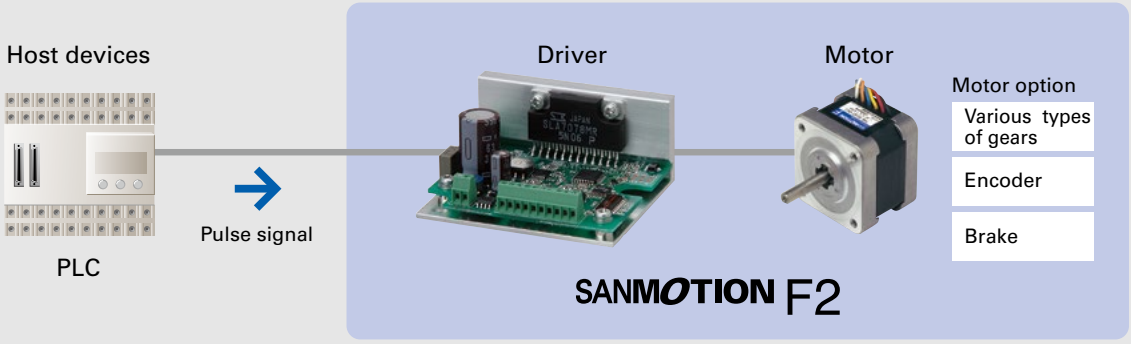
# SANMOTION F2
2-PHASE STEPPING SYSTEMS

The SANMOTION F2 is a 2-phase stepping system that provides precise positioning with easy control. The typical basic step angle is 1.8°, and accurate control is provided by pulse signals.




- **What is a stepping motor?**
  A stepping motor is a motor that rotates at a fixed angle for each pulse. The rotation speed is proportional to the speed of the command pulse (frequency). Also, the rotation angle can be controlled according to the number of command pulses. Stepping motors are able to make stable stops without vibrating, as they have holding power when the motor is stopped.

- **Bipolar and unipolar drive**
  The bipolar drive allows current to flow across both directions of the winding. The drive circuit is more complex, but it offers high torque.
  The unipolar drive allows current to flow across a single direction of the winding. The drive circuit is simpler than that of the bipolar drive.

## Application Examples

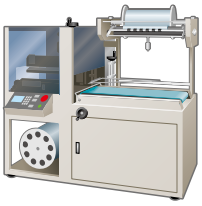
The SANMOTION F2 can be used in a wide variety of applications, including fixed-speed drive synchronized to a command pulse, accurate positioning, and stable stopping.

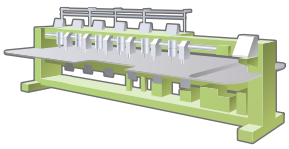
- Semiconductor devices, analytical and testing devices used in medical and environmental fields, ATMs, monitoring cameras and spotlights, packaging machines, embroidering machines, automatic ticket gates and more

ATMs

Blood analyzers

Wafer cleaners


Food packaging machines


Embroidering machines

All model numbers in this catalog are compliant with the tolerances for specified toxic substances (cadmium, lead, mercury, hexavalent chromium, PBB, and PBDE) found in supplement II of the EU RoHS directive (2011/65/EU), as of the October 2012 production lot. SANMOTION F2 drivers also feature standard specifications that are compliant with CE (European Norm) and UL standards.

# Lineup

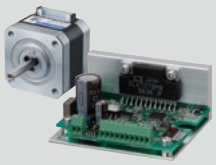
## Set Models ▶p. 9–

### DC input

#### Unipolar

These set models consist of a DC-powered driver and motor.
The input voltage range is from 24 to 36 VDC, and the motor winding is unipolar.

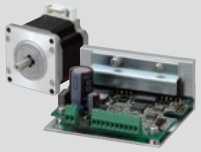
**Motor size:**
**28 mm sq./42 mm sq./56 mm sq.**



#### Bipolar

These set models consist of a DC-powered driver and motor.
The input voltage range is from 24 to 36 VDC, and the motor winding is bipolar.

**Motor size:**
**28 mm sq./42 mm sq./50 mm sq./56 mm sq./60 mm sq.**



## Stepping Motors ▶p. 33–

### Stepping Motors ▶p. 38–

High-torque stepping motors. Select from among a broad lineup of products from an ultra-compact 14 mm sq. motor size, to a thin 11.4 mm motor the shortest motor length.
Consult with us regarding customization. ▶p. 36
A separate driver is required.

**Motor size:**
**14 mm sq./28 mm sq./35 mm sq./42 mm sq./**
**50 mm sq./56 mm sq./60 mm sq./**
**86 mm sq. (CE and UL models are available.)/**
**ø106 mm**

### IP65 Splash and Dust Proof Stepping Motors Waterproof, dustproof ▶p. 74–

These IP65 rated motors* have superior water and dust resistance, and can be safely utilized in harsh or wet environments such as in food processing machines.
The input voltage range of the motors is up to 250 VAC.
*Except for the shaft and the cable end.
A separate driver is required.

**Motor size:**
**56 mm sq./86 mm sq.**

### Stepping Motors for Vacuum Environments Customized Products ▶p. 79

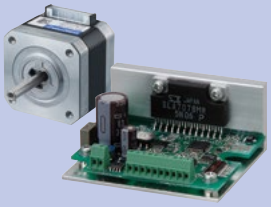
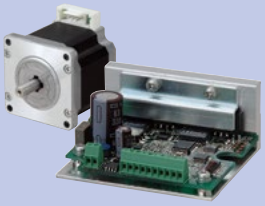
We can customize motors for use in low to ultra-high vacuum environments to suit your system requirements.
A separate driver is required.

### Synchronous Motors Customized Products ▶p. 79

Synchronous motors rotate at a constant speed in proportion to the AC power frequency. They operate on the commercial (AC) power supply.

# Lineup Details

## Set Models ▶p. 9–

| Series | | DC input set models<br>Unipolar | DC input set models<br>Bipolar |
|---|---|---|---|
| | |  |  |
| Input source | | 24 to 36 VDC | 24 to 36 VDC |
| Number of divisions | | 1, 2, 4, 8, 16 | 1, 2, 4, 8, 16 |
| Step-angle | Motors with 1.8° basic step angle | 1.8° to 0.1125°/pulse | 1.8° to 0.1125°/pulse |
| | Motors with 0.9° basic step angle | 0.9° to 0.05625°/pulse | 0.9° to 0.05625°/pulse |
| Corresponding motor sizes | | 28 mm sq./42 mm sq./56 mm sq. | 28 mm sq./42 mm sq./50 mm sq./<br>56 mm sq./60 mm sq. |
| Set configuration items | | Driver, Motor,<br>Cable with connector<br>(Supplied only with connector-type motors) | Driver, Motor,<br>Cable with connector<br>(Supplied only with connector-type motors) |
| Page | System Configuration Diagram | p. 12 | p. 12 |
| | Set Model Configuration | p. 14 | p. 14 |
| | Specifications/ Characteristics Diagram | pp. 15 to 17 | pp. 18 to 22 |
| | Dimensions | pp. 23 to 24, 27 | pp. 23 to 24, 27 |
| | Motor Specifications | p. 25 | p. 25 |
| | Driver Specifications/ Safety Standards | p. 28 | p. 28 |

## Stepping Motors ▶p. 33–

### Stepping Motors ▶p. 38–

| Basic step angle | Motor size | Holding torque (N·m) | Model no. | Page | |
|---|---|---|---|---|---|
| | | | | Specifications/ Characteristics diagram | Dimensions |
| 0.9° | 42 mm sq. | 0.2 to 0.48 | SH142 □ - □□□ 1 | pp. 42 to 43 | pp. 42 to 43 |
| 0.9° | 60 mm sq. | 0.57 to 2.15 | SH160 □ - □□□ 0 | pp. 56 to 57 | pp. 56 to 57 |
| 1.8° | 14 mm sq. Ultra-compact | 0.0065 to 0.01 | SH214 □ -5 □□ 1 | p. 38 | p. 38 |
| 1.8° | 28 mm sq. | 0.055 to 0.145 | SH228 □ -5 □□ 1 | pp. 39 to 40 | pp. 39 to 40 |
| 1.8° | 35 mm sq. | 0.12 to 0.23 | SH35 □□ -12U □ 0 | p. 41 | p. 41 |
| 1.8° | 42 mm sq. Slim form | 0.083 to 0.186 | SS242 □ -50 □ 1 | p. 44 | p. 44 |
| 1.8° | 42 mm sq. | 0.22 to 0.8 | SF242 □ - □□□□ 1 | pp. 45 to 46 | pp. 45, 47 |
| 1.8° | 50 mm sq. | 0.28 to 0.53 | 103H670 □ - □□□ 0 | pp. 48 to 50 | pp. 49 to 50 |
| 1.8° | 50 mm sq. Slim form | 0.1 to 0.215 | SS250 □ -80 □ 0 | p. 51 | p. 51 |
| 1.8° | 56 mm sq. | 0.39 to 2.0 | 103H712 □ - □□□ 0 | pp. 52 to 55 | pp. 53, 55 |
| 1.8° | 60 mm sq. | 0.78 to 2.7 | 103H782 □ - □□□ 0 | pp. 58 to 61 | pp. 59, 61 |
| 1.8° | 86 mm sq. (CE and UL models are available.) | 2.5 to 9 | SH286 □ - □□□ 1<br>SM286 □ - □□□□ | pp. 62, 64 to 65 | pp. 63, 66 |
| 1.8° | ø106 mm | 10.8 to 19 | 103H8922 □ - □□□ 1 | p. 67 | p. 67 |
| 1.8° | 56 mm sq. (CE Model) | 0.39 to 1.27 | 103H712 □ -6 □□ 0 | p. 68 | p. 68 |
| 1.8° | ø86 mm (CE Model) | 2.74 to 7.44 | 103H822 □ -6 □□ 0 | p. 69 | p. 69 |
| 1.8° | ø106 mm (CE Model) | 13.2 to 19 | 103H8922 □ -63 □ 1 | p. 70 | p. 70 |

・Contact us for available encoders, gears and motors with brakes.

### IP65 Splash and Dust Proof Stepping Motors Waterproof, dustproof ▶p. 74–

| Basic step angle | Motor size | Holding torque (N·m) | Safety standards | Model no. | Page | |
|---|---|---|---|---|---|---|
| | | | | | Specifications/ Characteristics diagram | Dimensions |
| 1.8° | 56 mm sq. | 1 to 1.7 | CE/UL Model | SP256 □ -5 □□ 0 | p. 75 | p. 76 |
| 1.8° | 86 mm sq. | 3.3 to 9 | CE/UL Model | SP286 □ -5 □□ 0 | pp. 77 to 78 | p. 78 |

### Stepping Motors for Vacuum Environments Customized Products ▶p. 79

We can customize motors for use in low to ultra-high vacuum environments to suit your system requirements.
The motors can handle a wide range of vacuum conditions, including low vacuum, high vacuum, and ultra-high vacuum.

### Synchronous Motors Customized Products ▶p. 79

Synchronous motors rotate at a constant speed in proportion to the AC power frequency. The motor can be directly driven using the AC power supply, so a driver is unnecessary.

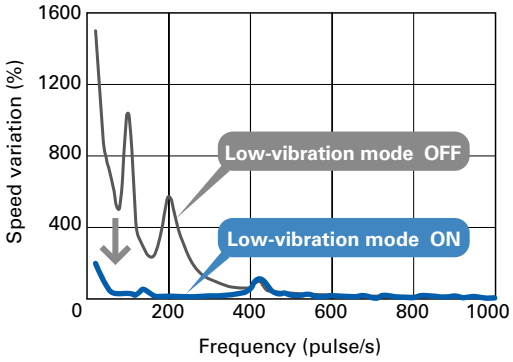
# Set Models

DC Input Set Models ▶p. 12

# Features

## Low vibration

SANMOTION F2 stepping drivers can smoothly operate stepping motors even at low resolution settings such as 1-division (full step) and 2-division (half step) thanks to its low-vibration mode. Vibrations can be suppressed regardless of the host controller.




## Micro-step drive

A resolution setting up to 16 divisions of the basic step angle 1.8° can be used, enabling smooth equipment operation with low vibration.

# How to Read the Specifications

## Unipolar

DC input driver (Model no.: US1D200P10) + Motor

RoHS

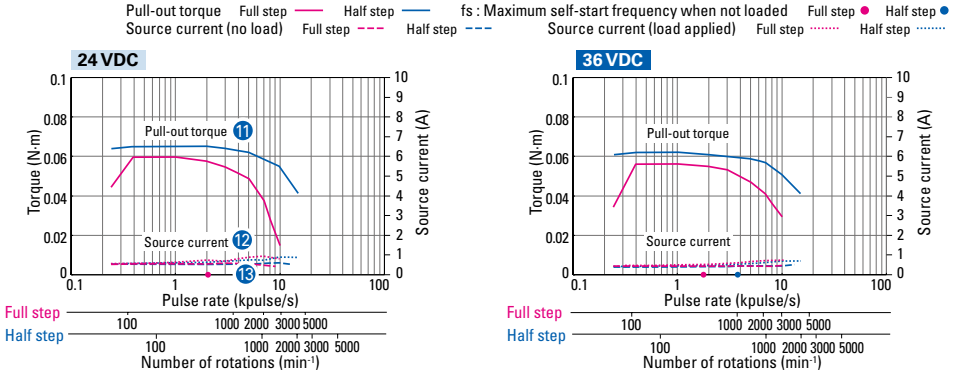
| | | | | | | |
|---|---|---|---|---|---|---|
| ② Size | Motor size | | 28 mm sq./Basic step angle 1.8° | | 42 mm sq./Basic step angle 1.8° | |
| | Motor length | | 32 mm | 51.5 mm | 33 mm | 39 mm |
| ③ Single shaft | Set model no. | | DU14S281S | DU14S285S | DU15S421S | DU15S422S |
| | Configuration item: motor model no. | | SH2281-5271 | SH2285-5271 | SF2421-12U41 | SF2422-12U41 |
| Dual shaft | Set model no. | | DU14S281D | DU14S285D | DU15S421D | DU15S422D |
| | Configuration item: motor model no. | | SH2281-5231 | SH2285-5231 | SF2421-12U11 | SF2422-12U11 |
| ④ Holding torque | | N·m | 0.055 | 0.115 | 0.22 | 0.33 |
| ⑤ Rotor inertia | | $\times10^{-4}$kg·m$^2$ | 0.01 | 0.022 | 0.031 | 0.046 |
| ⑥ Rated current | | A/phase | 1 | 1 | 1.2 | 1.2 |
| ⑦ Motor mass *1 | | kg | 0.11 | 0.2 | 0.23 | 0.3 |
| ⑧ Allowable thrust load | | N | 3 | 3 | 10 | 10 |
| ⑨ Allowable radial load *2 | | N | 42 | 49 | 39 | 37 |

*1 Driver mass ▶ p. 28 *2 The load point is at the tip of the output shaft.

### ⑩ Characteristics diagram

With rubber coupling

**DU14S281S**
**DU14S281D**




① Model number of the driver included in the set.

② Size and length of the stepping motor included in the set. When driving in full step mode, the basic step angle is the rotation angle with each pulse. When driving in half step mode, the motor rotates at half of the basic step angle.

③ The set model number and the model number of the stepping motor included in the set. The model number for the stepping motor shaft varies for single shaft and dual shaft.

④ This is the maximum torque that occurs when using 2-phase excitation at rated current, causing the shaft to rotate from the outside.

⑤ This is the moment of inertia of the rotor.

⑥ This is the rated current that flows to the motor winding.

⑦ This is the mass of the stepping motor.

⑧ This is the allowable load when applying a load to the shaft in the axial direction. Do not exceed this value when using this product.

⑨ This is the allowable load when applying a load to the shaft perpendicular to the axial direction. Do not exceed this value when using this product.

⑩ This graph shows the relationship between the pulse rate (frequency), speed, and torque. The driver source current is shown in addition to the torque. Full step is shown in red, and half step is shown in blue.

⑪ The pull-out torque is the maximum torque in which synchronized operation is possible for a certain command pulse. If a torque that exceeds this value is applied to the stepping motor, it will be unable to synchronize with the command pulse. Thus, when selecting a motor, you should allow for a torque margin of 1.4 to 2 times, in order to avoid step-out.

⑫ This graph shows the current value for the power supply that supplies the driver.

- The red and blue dashed lines show the source current value when there is no load (motor by itself).
- The red and blue dotted lines show the source current value when the maximum torque is applied to the stepping motor (during load).

The required power supply capacity (W) is calculated from this graph.

⑬ The red- and blue-colored dots in the lower part of the graph show the upper limit for the self-start frequency (maximum self-start frequency: fs) of the stepping motor by itself (no load). Full step is shown in red, and half step is shown in blue. The stepping motor will not operate normally if it is started using frequencies that exceed these values. For this reason, it is necessary to start the stepping motor using frequencies that are lower than these values. The maximum self-start frequency ($f_L$) which includes the load can be determined using the relational expression below.

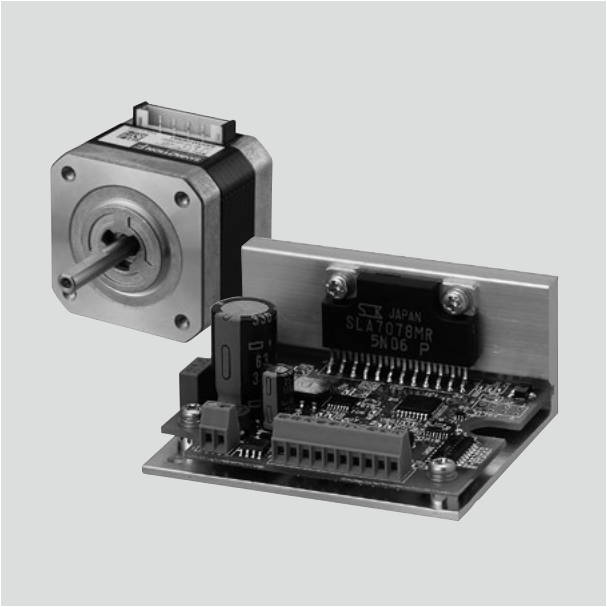
$$f_L = \frac{fs}{\sqrt{1 + \frac{J_L}{J_M}}}$$

$J_M$: Rotor inertia
$J_L$ : Load inertia
fs : Maximum self-start frequency when not loaded

# DC Input Set Models

## Unipolar, Bipolar

Set Model Configuration ▶ p. 14
Specifications/Characteristics Diagram ▶ pp. 15 to 22
Motor Dimensions ▶ pp. 23 to 24 Motor Specifications ▶ p. 25
Driver Dimensions ▶ p. 27 Driver Specifications ▶ p. 28



### Set configuration items RoHS

#### Driver Terminal block type

Unipolar Model no.: US1D200P10 Input source: 24/36 VDC
Bipolar Model no.: BS1D200P10 Input source: 24/36 VDC
・The operation manual can be downloaded from our website.
・Drivers are available for separate purchase.
Connector-type drivers are also available. Contact us for details.

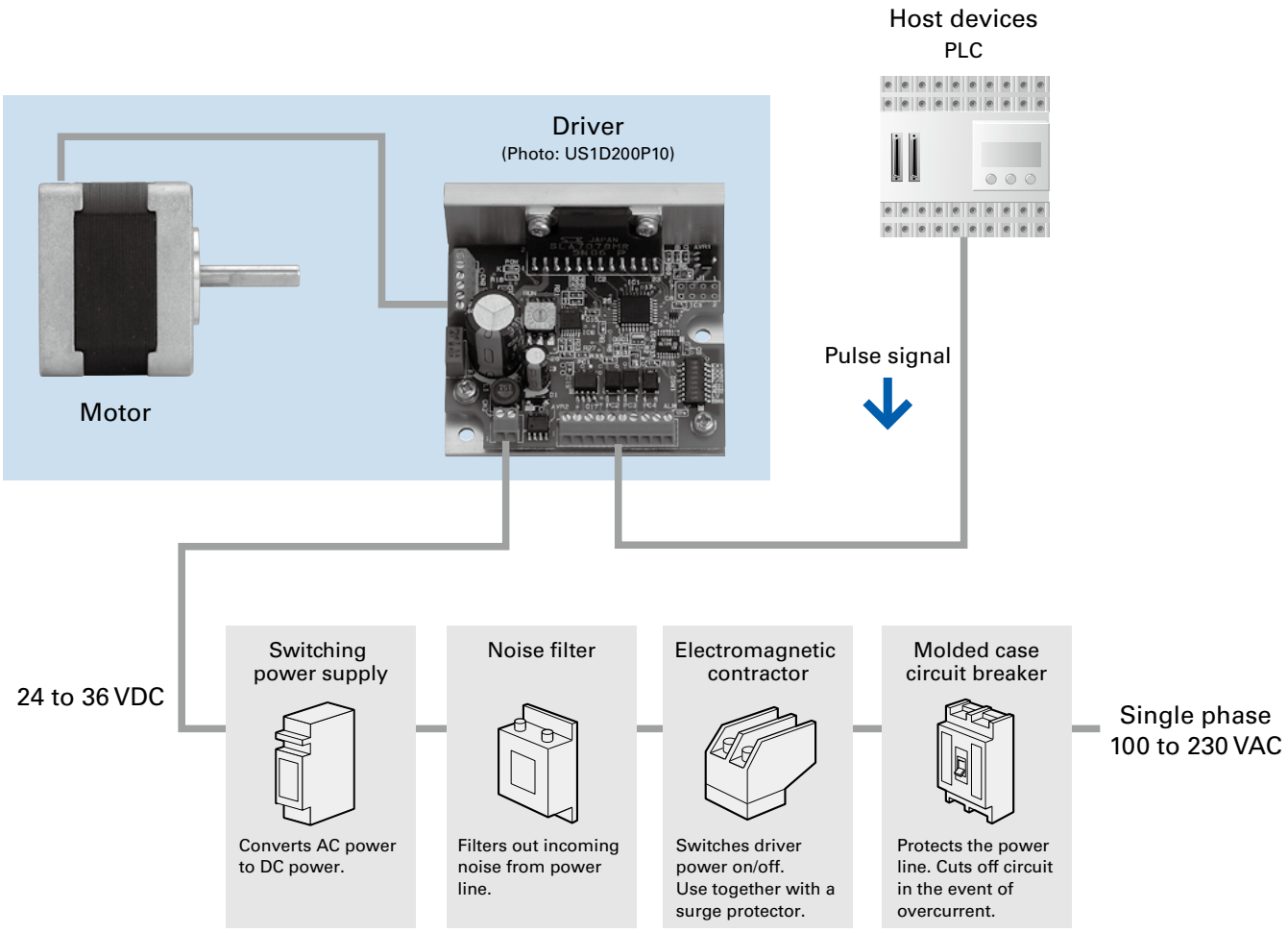
#### Motor

Unipolar Motor size: 28 mm sq., 42 mm sq., 56 mm sq.
Bipolar Motor size: 28 mm sq., 42 mm sq., 50 mm sq., 56 mm sq., 60 mm sq.

#### Cable with connector

Supplied only with connector-type motors

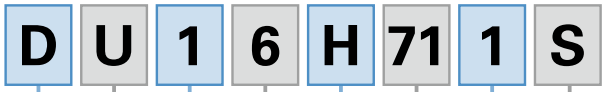
## System Configuration Diagram



# Set Model Numbering Convention

Not every combination of the following codes or characters is available. Check the set model component details on the p. 14 for the model number combinations, or contact us.

Example: This is a set model number for the DC input driver (Model no. US1D200P10) and motor (Model no. 103H7121-0440).
The motor specifications are motor size: 56 mm sq., motor length: 41.8 mm, single shaft.




Stepping motor shaft specification
S: Single shaft
D: Dual shaft

Stepping motor total length

| Code | Stepping motor size | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 28 mm sq. | | 42 mm sq. | | | | 50 mm sq. | | 56 mm sq. | | 60 mm sq. | | | |
| | Type code | Motor length: mm | Type code | Motor length: mm | Type code | Motor length: mm | Type code | Motor length: mm | Type code | Motor length: mm | Type code | Motor length: mm | Type code | Motor length: mm |
| 1 | SH2281 | 32 | SF2421 | 33 | SH1421 | 33 | 103H6701 | 39.8 | 103H7121 | 41.8 | 103H7821 | 44.8 | SH1601 | 42 |
| 2 | | | SF2422 | 39 | SH1422 | 39 | | | | | 103H7822 | 53.8 | SH1602 | 54 |
| 3 | | | SF2423 | 48 | | | 103H6703 | 51.3 | 103H7123 | 53.8 | 103H7823 | 85.8 | | |
| 4 | | | SF2424 | 59.5 | SH1424 | 48 | | | | | | | | |
| 5 | SH2285 | 51.5 | | | | | | | | | | | | |
| 6 | | | | | | | | | 103H7126 | 75.8 | | | | |

Motor size / Basic step angle
28: 28 mm sq. 1.8°
42: 42 mm sq. 1.8°
14: 42 mm sq. 0.9°
67: 50 mm sq. 1.8°
71: 56 mm sq. 1.8°
78: 60 mm sq. 1.8°
16: 60 mm sq. 0.9°

Stepping motor series name
H: H series
S: SH, SF series

Rated current specification
4: 1 A/phase 5: 1.2 A/phase 6: 2 A/phase

Model

Driver specification
U: Unipolar B: Bipolar

D: DC input

# Set Model Configuration

**This set includes the driver, motor and cable with motor connector.**

## Unipolar Bundled driver model no.: US1D200P10

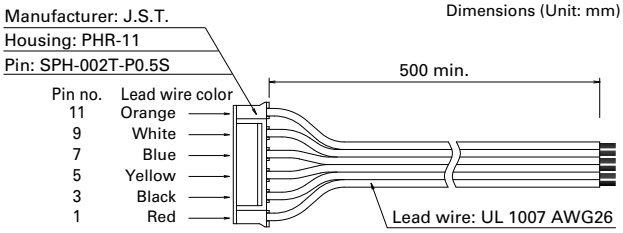
| Motor size | Single shaft | | | | Dual shaft | | | | Basic step angle | Rated current (A/phase) | Page | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Set model no. | Set configuration items | | | Set model no. | Set configuration items | | | | | | |
| | | Motor model no. | | Cable with motor connector model no. | | Motor model no. | | Cable with motor connector model no. | | | Specifications | Dimensions |
| 28 mm sq. | DU14S281S | SH2281-5271 | L | — | DU14S281D | SH2281-5231 | L | — | 1.8° | 1 | p. 15 | p. 23 |
| | DU14S285S | SH2285-5271 | L | — | DU14S285D | SH2285-5231 | L | — | 1.8° | 1 | p. 15 | p. 23 |
| 42 mm sq. | DU15S421S | SF2421-12U41 | C | 4835774-1 | DU15S421D | SF2421-12U11 | C | 4835774-1 | 1.8° | 1.2 | p. 15 | p. 23 |
| | DU15S422S | SF2422-12U41 | C | 4835774-1 | DU15S422D | SF2422-12U11 | C | 4835774-1 | 1.8° | 1.2 | p. 15 | p. 23 |
| | DU15S423S | SF2423-12U41 | C | 4835774-1 | DU15S423D | SF2423-12U11 | C | 4835774-1 | 1.8° | 1.2 | p. 16 | p. 23 |
| | DU15S424S | SF2424-12U41 | C | 4835774-1 | DU15S424D | SF2424-12U11 | C | 4835774-1 | 1.8° | 1.2 | p. 16 | p. 23 |
| | DU15S141S | SH1421-0441 | L | — | DU15S141D | SH1421-0411 | L | — | 0.9° | 1.2 | p. 16 | p. 23 |
| | DU15S142S | SH1422-0441 | L | — | DU15S142D | SH1422-0411 | L | — | 0.9° | 1.2 | p. 16 | p. 23 |
| | DU15S144S | SH1424-0441 | L | — | DU15S144D | SH1424-0411 | L | — | 0.9° | 1.2 | p. 17 | p. 23 |
| 56 mm sq. | DU16H711S | 103H7121-0440 | L | — | DU16H711D | 103H7121-0410 | L | — | 1.8° | 2 | p. 17 | p. 24 |
| | DU16H713S | 103H7123-0440 | L | — | DU16H713D | 103H7123-0410 | L | — | 1.8° | 2 | p. 17 | p. 24 |
| | DU16H716S | 103H7126-0440 | L | — | DU16H716D | 103H7126-0410 | L | — | 1.8° | 2 | p. 17 | p. 24 |

Motors marked with an Ⓛ are lead wire types. Either a 300 mm or a 305 mm or greater lead wire is attached to the motor.
Motors marked with a Ⓒ are connector types. Cables with connectors for motors as shown below are included.

### ● Cable with motor connector (Supplied only with connector-type motors)

**Bundled cable (Unipolar 42 mm sq. motors only, model no.: 4835774-1)**

Dimensions (Unit: mm)




## Bipolar Bundled driver model no.: BS1D200P10

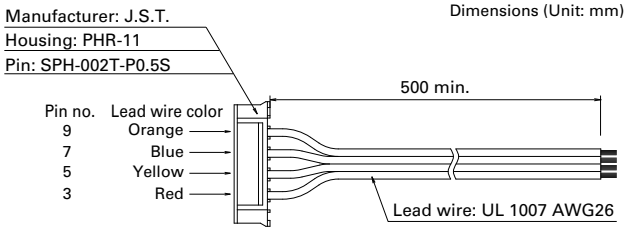
| Motor size | Single shaft | | | | Dual shaft | | | | Basic step angle | Rated current (A/phase) | Page | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Set model no. | Set configuration items | | | Set model no. | Set configuration items | | | | | | |
| | | Motor model no. | | Cable with motor connector model no. | | Motor model no. | | Cable with motor connector model no. | | | Specifications | Dimensions |
| 28 mm sq. | DB14S281S | SH2281-5771 | L | — | DB14S281D | SH2281-5731 | L | — | 1.8° | 1 | p. 18 | p. 23 |
| | DB14S285S | SH2285-5771 | L | — | DB14S285D | SH2285-5731 | L | — | 1.8° | 1 | p. 18 | p. 23 |
| 42 mm sq. | DB14S421S | SF2421-10B41 | C | 4835775-1 | DB14S421D | SF2421-10B11 | C | 4835775-1 | 1.8° | 1 | p. 18 | p. 23 |
| | DB14S422S | SF2422-10B41 | C | 4835775-1 | DB14S422D | SF2422-10B11 | C | 4835775-1 | 1.8° | 1 | p. 18 | p. 23 |
| | DB14S423S | SF2423-10B41 | C | 4835775-1 | DB14S423D | SF2423-10B11 | C | 4835775-1 | 1.8° | 1 | p. 19 | p. 23 |
| | DB14S424S | SF2424-10B41 | C | 4835775-1 | DB14S424D | SF2424-10B11 | C | 4835775-1 | 1.8° | 1 | p. 19 | p. 23 |
| | DB16S141S | SH1421-5241 | L | — | DB16S141D | SH1421-5211 | L | — | 0.9° | 2 | p. 19 | p. 23 |
| | DB16S142S | SH1422-5241 | L | — | DB16S142D | SH1422-5211 | L | — | 0.9° | 2 | p. 19 | p. 23 |
| | DB16S144S | SH1424-5241 | L | — | DB16S144D | SH1424-5211 | L | — | 0.9° | 2 | p. 20 | p. 23 |
| 50 mm sq. | DB16H671S | 103H6701-5040 | L | — | DB16H671D | 103H6701-5010 | L | — | 1.8° | 2 | p. 20 | p. 24 |
| | DB16H673S | 103H6703-5040 | L | — | DB16H673D | 103H6703-5010 | L | — | 1.8° | 2 | p. 20 | p. 24 |
| 56 mm sq. | DB16H711S | 103H7121-5740 | L | — | DB16H711D | 103H7121-5710 | L | — | 1.8° | 2 | p. 20 | p. 24 |
| | DB16H713S | 103H7123-5740 | L | — | DB16H713D | 103H7123-5710 | L | — | 1.8° | 2 | p. 21 | p. 24 |
| | DB16H716S | 103H7126-5740 | L | — | DB16H716D | 103H7126-5710 | L | — | 1.8° | 2 | p. 21 | p. 24 |
| 60 mm sq. | DB16H781S | 103H7821-5740 | C | 4837961-1 | DB16H781D | 103H7821-5710 | C | 4837961-1 | 1.8° | 2 | p. 21 | p. 24 |
| | DB16H782S | 103H7822-5740 | C | 4837961-1 | DB16H782D | 103H7822-5710 | C | 4837961-1 | 1.8° | 2 | p. 21 | p. 24 |
| | DB16H783S | 103H7823-5740 | C | 4837961-1 | DB16H783D | 103H7823-5710 | C | 4837961-1 | 1.8° | 2 | p. 22 | p. 24 |
| | DB16S161S | SH1601-5240 | L | — | DB16S161D | SH1601-5210 | L | — | 0.9° | 2 | p. 22 | p. 24 |
| | DB16S162S | SH1602-5240 | L | — | DB16S162D | SH1602-5210 | L | — | 0.9° | 2 | p. 22 | p. 24 |

Motors marked with an Ⓛ are lead wire types. Either a 300 mm or a 305 mm or greater lead wire is attached to the motor.
Motors marked with a Ⓒ are connector types. Cables with connectors for motors as shown below are included.

### ● Cable with motor connector (Supplied only with connector-type motors)

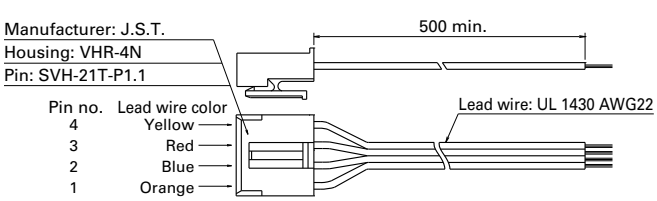
**Bundled cable (Bipolar 42 mm sq. motors only, model no.: 4835775-1)**

Dimensions (Unit: mm)




**Bundled cable (Bipolar 60 mm sq. motors only, model no.: 4837961-1)**

Dimensions (Unit: mm)



# Unipolar DC input driver (Model no.: US1D200P10) + Motor

RoHS

| Size | | | 28 mm sq./Basic step angle 1.8° | | 42 mm sq./Basic step angle 1.8° | |
|---|---|---|---|---|---|---|
| | Motor size | | 32 mm | 51.5 mm | 33 mm | 39 mm |
| | Motor length | | | | | |
| Single shaft | Set model no. | | DU14S281S | DU14S285S | DU15S421S | DU15S422S |
| | Configuration item: motor model no. | | SH2281-5271 | SH2285-5271 | SF2421-12U41 | SF2422-12U41 |
| Dual shaft | Set model no. | | DU14S281D | DU14S285D | DU15S421D | DU15S422D |
| | Configuration item: motor model no. | | SH2281-5231 | SH2285-5231 | SF2421-12U11 | SF2422-12U11 |
| Holding torque | | N·m | 0.055 | 0.115 | 0.22 | 0.33 |
| Rotor inertia | | $\times 10^{-4}$kg·m$^2$ | 0.01 | 0.022 | 0.031 | 0.046 |
| Rated current | | A/phase | 1 | 1 | 1.2 | 1.2 |
| Motor mass *1 | | kg | 0.11 | 0.2 | 0.23 | 0.3 |
| Allowable thrust load | | N | 3 | 3 | 10 | 10 |
| Allowable radial load *2 | | N | 42 | 49 | 39 | 37 |

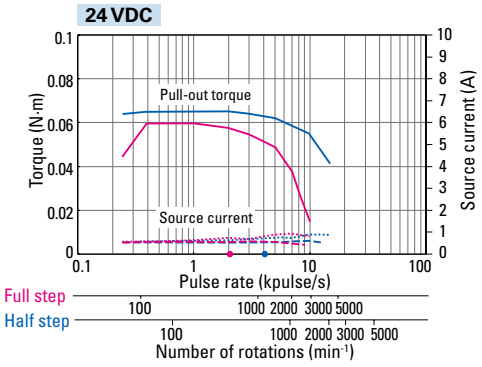
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

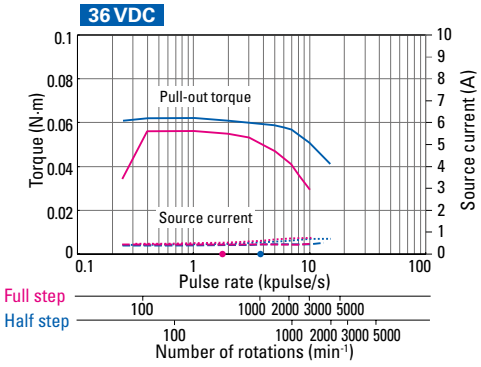
## Characteristics diagram

With rubber coupling

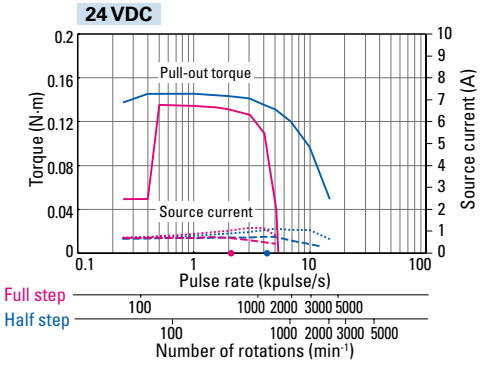
Pull-out torque Full step —— Half step ——
Source current (no load) Full step - - - Half step - - -
fs : Maximum self-start frequency when not loaded Full step ● Half step ●
Source current (load applied) Full step ····· Half step ·····

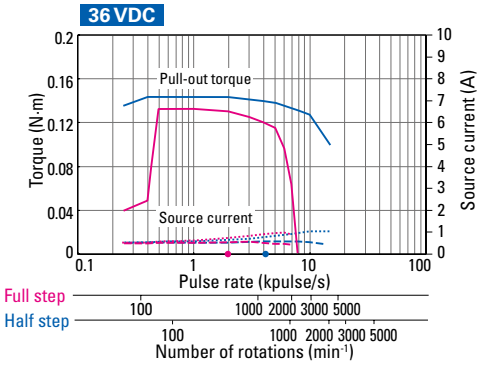
### DU14S281S DU14S281D



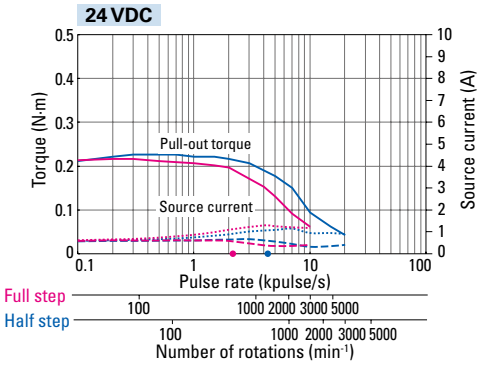



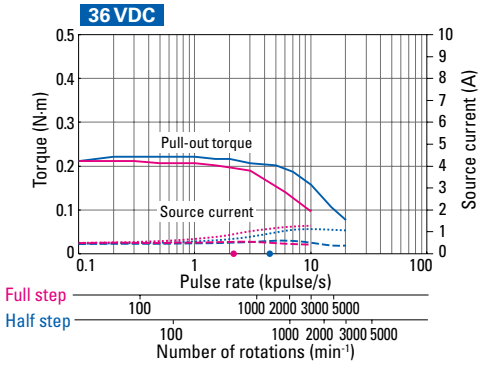

### DU14S285S DU14S285D



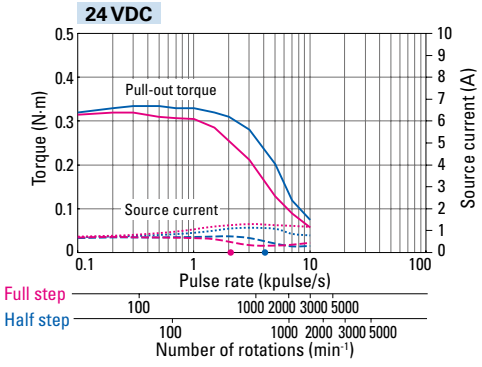



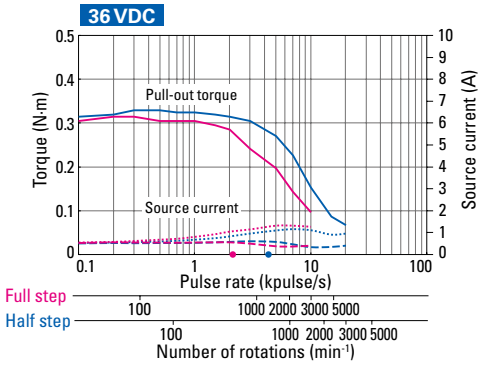

### DU15S421S DU15S421D




### DU15S422S DU15S422D




System Configuration Diagram ▶p. 12 Set Model Configuration ▶p. 14 Motor Dimensions ▶pp. 23 to 24 Driver Dimensions ▶p. 27

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Unipolar DC input driver (Model no.: US1D200P10) + Motor

RoHS

| Size | | | 42 mm sq./Basic step angle 1.8° | | 42 mm sq./Basic step angle 0.9° | |
|---|---|---|---|---|---|---|
| | Motor size | | 48 mm | 59.5 mm | 33 mm | 39 mm |
| Single shaft | Set model no. | | DU15S423S | DU15S424S | DU15S141S | DU15S142S |
| | Configuration item: motor model no. | | SF2423-12U41 | SF2424-12U41 | SH1421-0441 | SH1422-0441 |
| Dual shaft | Set model no. | | DU15S423D | DU15S424D | DU15S141D | DU15S142D |
| | Configuration item: motor model no. | | SF2423-12U11 | SF2424-12U11 | SH1421-0411 | SH1422-0411 |
| Holding torque | | N·m | 0.4 | 0.58 | 0.2 | 0.29 |
| Rotor inertia | | $\times 10^{-4}$kg·m² | 0.063 | 0.094 | 0.044 | 0.066 |
| Rated current | | A/phase | 1.2 | 1.2 | 1.2 | 1.2 |
| Motor mass *1 | | kg | 0.38 | 0.51 | 0.24 | 0.29 |
| Allowable thrust load | | N | 10 | 10 | 10 | 10 |
| Allowable radial load *2 | | N | 35 | 29 | 25 | 24 |

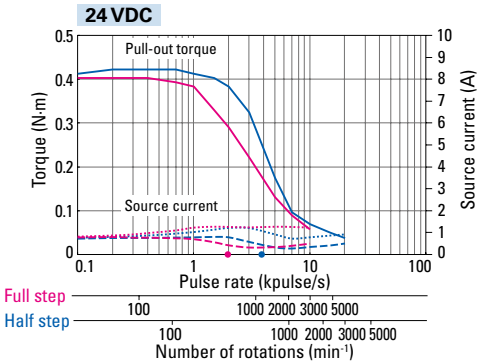
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

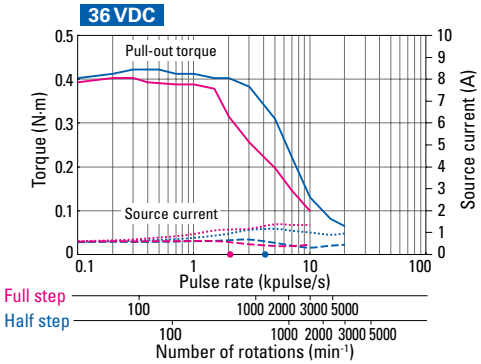
## Characteristics diagram

With rubber coupling

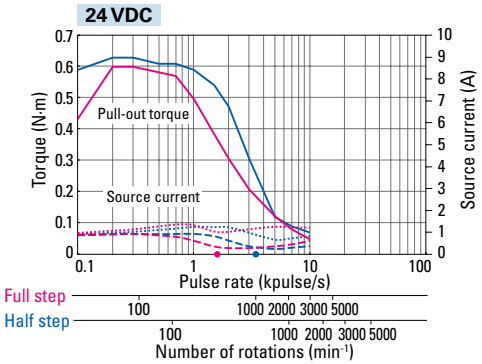
Pull-out torque Full step —— Half step ——
Source current (no load) Full step - - - Half step - - -
fs : Maximum self-start frequency when not loaded Full step ● Half step ●
Source current (load applied) Full step ····· Half step ·····

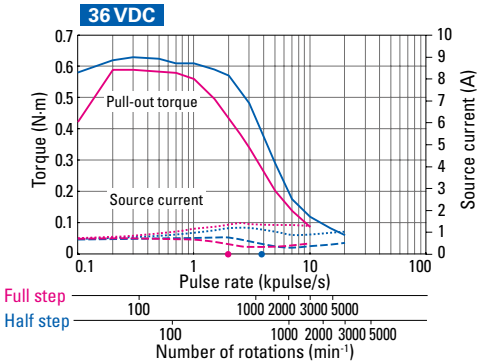
### DU15S423S DU15S423D



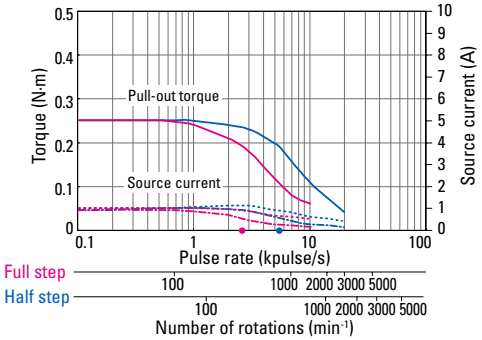



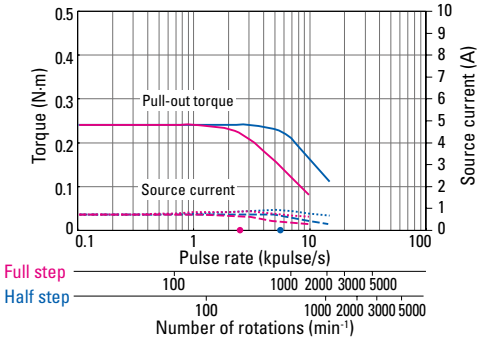

### DU15S424S DU15S424D



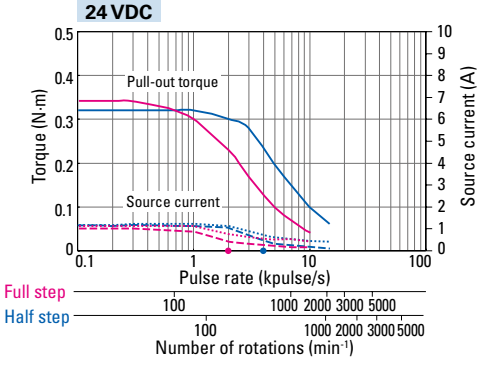



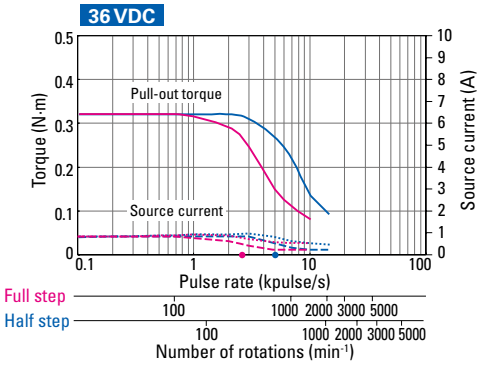

### DU15S141S DU15S141D




### DU15S142S DU15S142D






System Configuration Diagram▶p. 12 Set Model Configuration▶p. 14 Motor Dimensions▶pp. 23 to 24 Driver Dimensions▶p. 27

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# Unipolar DC input driver (Model no.: US1D200P10) + Motor

RoHS

| Size | | | 42 mm sq./Basic step angle 0.9° | 56 mm sq./Basic step angle 1.8° | | |
|---|---|---|---|---|---|---|
| | Motor length | | 48 mm | 41.8 mm | 53.8 mm | 75.8 mm |
| Single shaft | Set model no. | | DU15S144S | DU16H711S | DU16H713S | DU16H716S |
| | Configuration item: motor model no. | | SH1424-0441 | 103H7121-0440 | 103H7123-0440 | 103H7126-0440 |
| Dual shaft | Set model no. | | DU15S144D | DU16H711D | DU16H713D | DU16H716D |
| | Configuration item: motor model no. | | SH1424-0411 | 103H7121-0410 | 103H7123-0410 | 103H7126-0410 |
| Holding torque | | N·m | 0.39 | 0.39 | 0.83 | 1.27 |
| Rotor inertia | | $\times 10^{-4}$kg·m² | 0.089 | 0.1 | 0.21 | 0.36 |
| Rated current | | A/phase | 1.2 | 2 | 2 | 2 |
| Motor mass *1 | | kg | 0.38 | 0.47 | 0.65 | 0.98 |
| Allowable thrust load | | N | 10 | 15 | 15 | 15 |
| Allowable radial load *2 | | N | 20 | 78 | 71 | 62 |

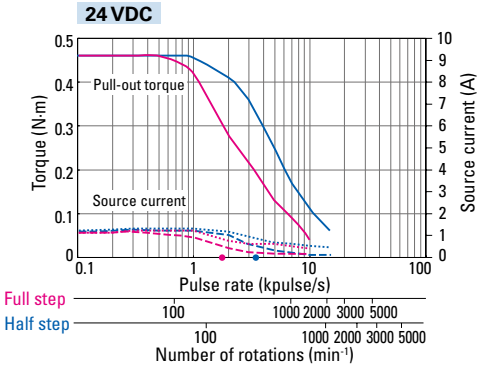
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

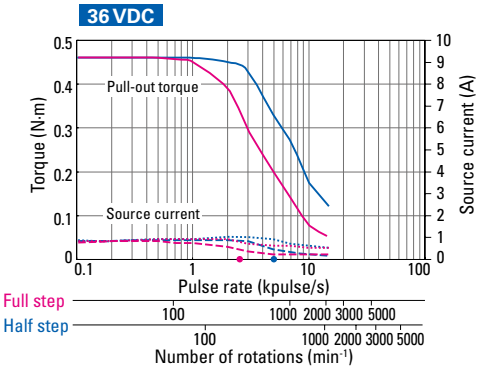
## Characteristics diagram

With rubber coupling

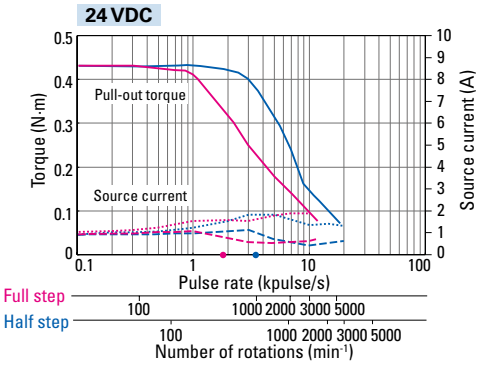
Pull-out torque Full step —— Half step ——
Source current (no load) Full step - - - Half step - - -
fs : Maximum self-start frequency when not loaded Full step ● Half step ●
Source current (load applied) Full step ····· Half step ·····

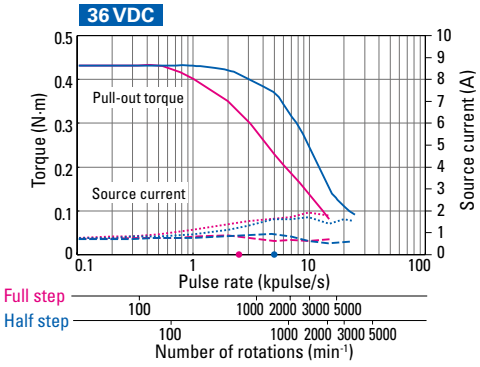
### DU15S144S DU15S144D



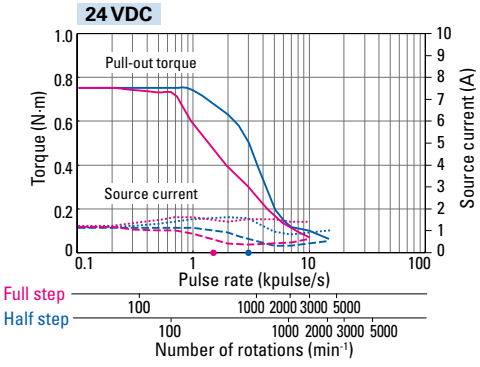



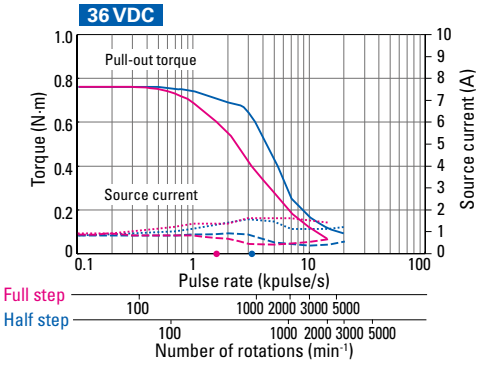

### DU16H711S DU16H711D



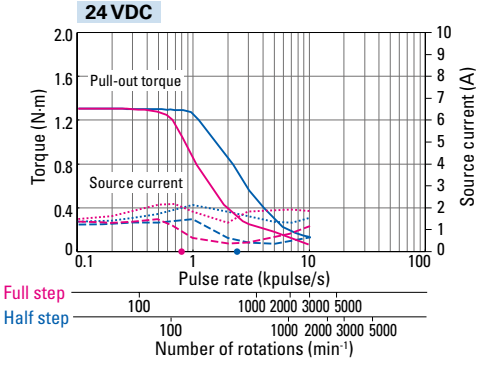



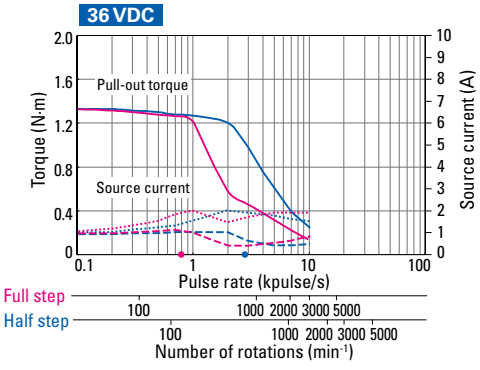

### DU16H713S DU16H713D




### DU16H716S DU16H716D




System Configuration Diagram ▶p. 12 Set Model Configuration ▶p. 14 Motor Dimensions ▶pp. 23 to 24 Driver Dimensions ▶p. 27

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Bipolar DC input driver (Model no.: BS1D200P10) + Motor

RoHS

| Size | | | 28 mm sq./Basic step angle1.8° | | 42 mm sq./Basic step angle 1.8° | |
|---|---|---|---|---|---|---|
| | Motor length | | 32 mm | 51.5 mm | 33 mm | 39 mm |
| Single shaft | Set model no. | | DB14S281S | DB14S285S | DB14S421S | DB14S422S |
| | Configuration item: motor model no. | | SH2281-5771 | SH2285-5771 | SF2421-10B41 | SF2422-10B41 |
| Dual shaft | Set model no. | | DB14S281D | DB14S285D | DB14S421D | DB14S422D |
| | Configuration item: motor model no. | | SH2281-5731 | SH2285-5731 | SF2421-10B11 | SF2422-10B11 |
| Holding torque | | N·m | 0.07 | 0.145 | 0.29 | 0.43 |
| Rotor inertia | | $\times 10^{-4}$kg·m² | 0.01 | 0.022 | 0.031 | 0.046 |
| Rated current | | A/phase | 1 | 1 | 1 | 1 |
| Motor mass *1 | | kg | 0.11 | 0.2 | 0.23 | 0.3 |
| Allowable thrust load | | N | 3 | 3 | 10 | 10 |
| Allowable radial load *2 | | N | 42 | 49 | 38 | 34 |

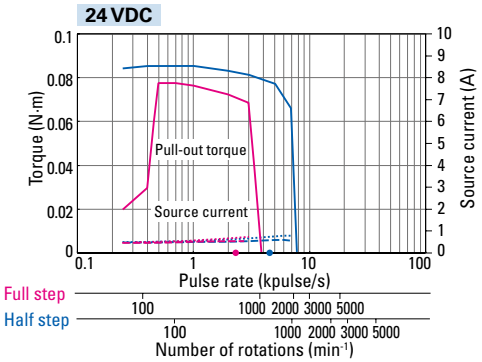
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

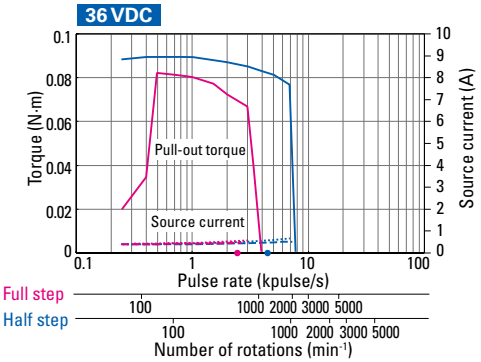
## Characteristics diagram

With rubber coupling

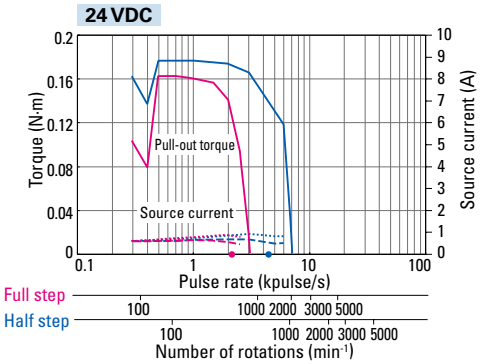
Pull-out torque Full step —— Half step ——
Source current (no load) Full step - - - Half step - - -
fs : Maximum self-start frequency when not loaded Full step ● Half step ●
Source current (load applied) Full step ····· Half step ·····

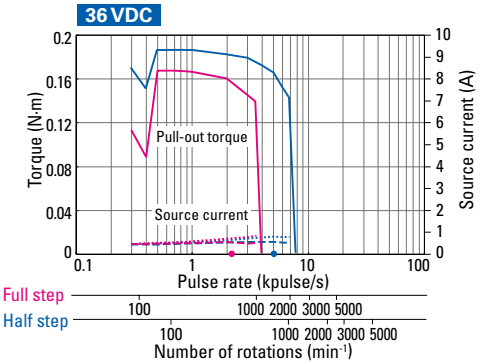
### DB14S281S DB14S281D



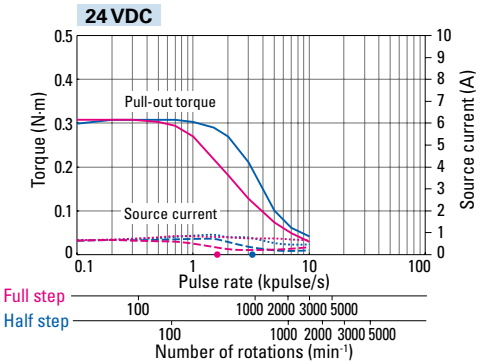



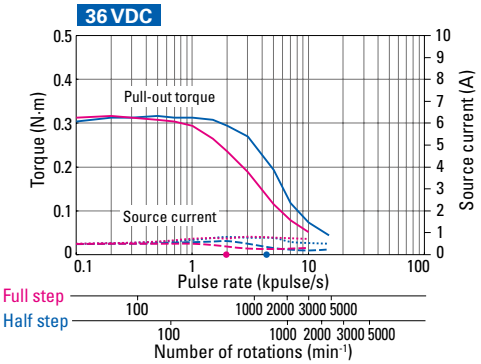

### DB14S285S DB14S285D



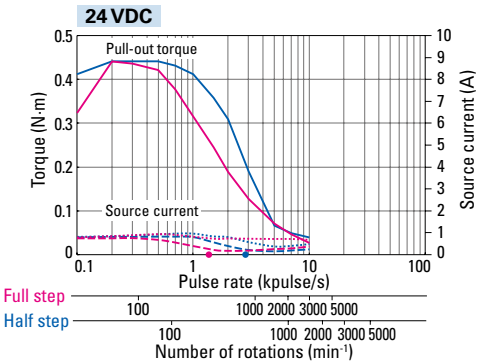



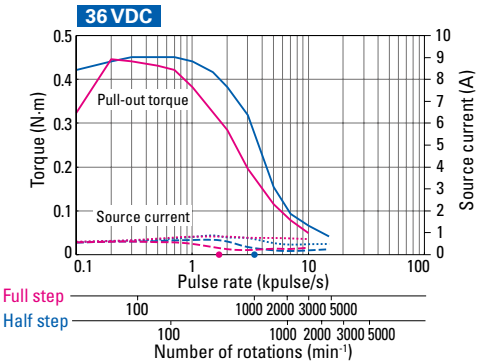

### DB14S421S DB14S421D




### DB14S422S DB14S422D






System Configuration Diagram▶p. 12 Set Model Configuration▶p. 14 Motor Dimensions▶pp. 23 to 24 Driver Dimensions▶p. 27

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# Bipolar DC input driver (Model no.: BS1D200P10) + Motor

RoHS

| Size | Motor size | 42 mm sq./Basic step angle 1.8° | | 42 mm sq./Basic step angle 0.9° | |
|---|---|---|---|---|---|
| | Motor length | 48 mm | 59.5 mm | 33 mm | 39 mm |
| Single shaft | Set model no. | DB14S423S | DB14S424S | DB16S141S | DB16S142S |
| | Configuration item: motor model no. | SF2423-10B41 | SF2424-10B41 | SH1421-5241 | SH1422-5241 |
| Dual shaft | Set model no. | DB14S423D | DB14S424D | DB16S141D | DB16S142D |
| | Configuration item: motor model no. | SF2423-10B11 | SF2424-10B11 | SH1421-5211 | SH1422-5211 |
| Holding torque | N·m | 0.56 | 0.8 | 0.23 | 0.34 |
| Rotor inertia | $\times 10^{-4}$kg·m² | 0.063 | 0.094 | 0.044 | 0.066 |
| Rated current | A/phase | 1 | 1 | 2 | 2 |
| Motor mass *1 | kg | 0.38 | 0.51 | 0.24 | 0.29 |
| Allowable thrust load | N | 10 | 10 | 10 | 10 |
| Allowable radial load *2 | N | 30 | 20 | 25 | 24 |

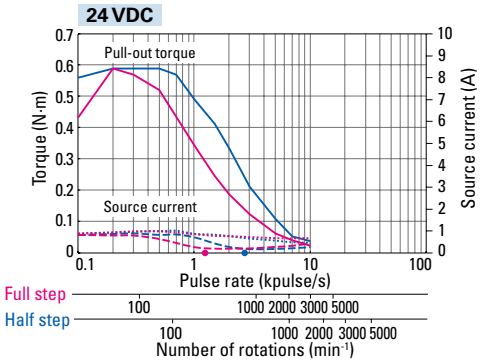
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

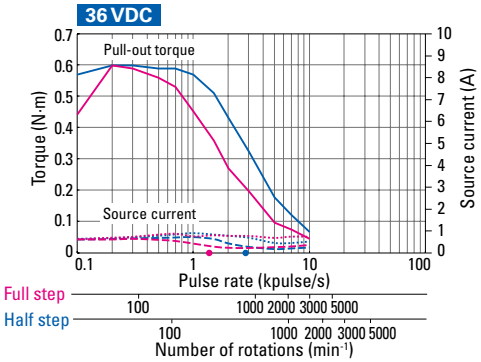
## Characteristics diagram

With rubber coupling

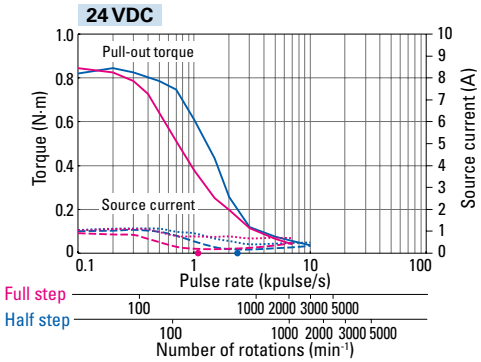
Pull-out torque Full step Half step — fs : Maximum self-start frequency when not loaded Full step Half step
Source current (no load) Full step Half step — Source current (load applied) Full step Half step

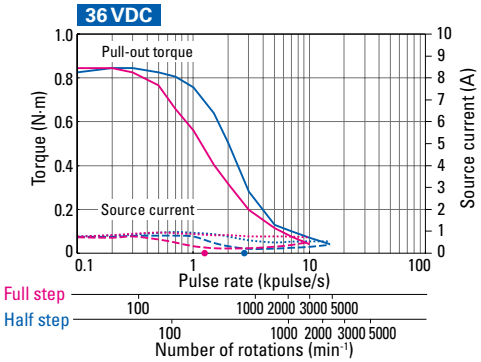
### DB14S423S DB14S423D



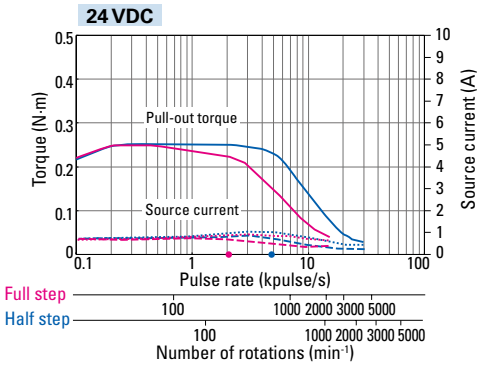



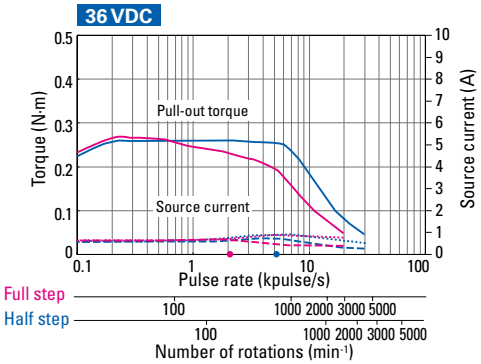

### DB14S424S DB14S424D



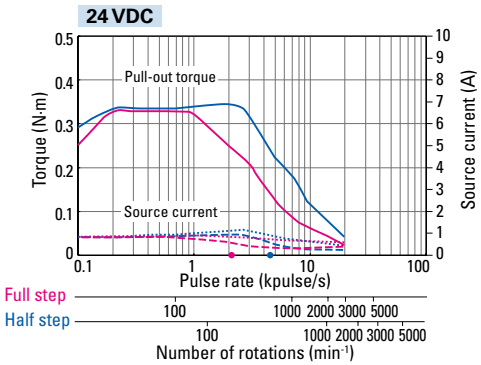



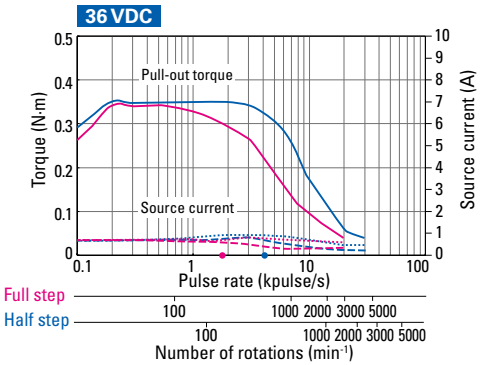

### DB16S141S DB16S141D




### DB16S142S DB16S142D




System Configuration Diagram ▶p. 12 Set Model Configuration ▶p. 14 Motor Dimensions ▶pp. 23 to 24 Driver Dimensions ▶p. 27

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Bipolar DC input driver (Model no.: BS1D200P10) + Motor

RoHS

| Size | | | 42 mm sq./Basic step angle 0.9° | 50 mm sq./Basic step angle 1.8° | | 56 mm sq./Basic step angle 1.8° |
|---|---|---|---|---|---|---|
| | Motor length | | 48 mm | 39.8 mm | 51.3 mm | 41.8 mm |
| Single shaft | Set model no. | | DB16S144S | DB16H671S | DB16H673S | DB16H711S |
| | Configuration item: motor model no. | | SH1424-5241 | 103H6701-5040 | 103H6703-5040 | 103H7121-5740 |
| Dual shaft | Set model no. | | DB16S144D | DB16H671D | DB16H673D | DB16H711D |
| | Configuration item: motor model no. | | SH1424-5211 | 103H6701-5010 | 103H6703-5010 | 103H7121-5710 |
| Holding torque | | N·m | 0.48 | 0.28 | 0.49 | 0.55 |
| Rotor inertia | | $\times 10^{-4}$kg·m² | 0.089 | 0.057 | 0.118 | 0.1 |
| Rated current | | A/phase | 2 | 2 | 2 | 2 |
| Motor mass *1 | | kg | 0.38 | 0.35 | 0.5 | 0.47 |
| Allowable thrust load | | N | 10 | 15 | 15 | 15 |
| Allowable radial load *2 | | N | 20 | 79 | 75 | 70 |

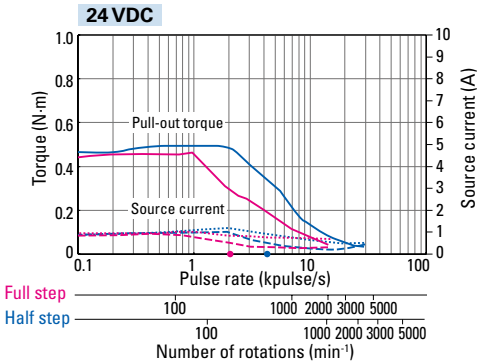
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

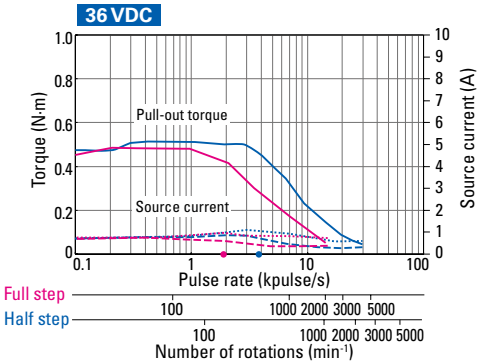
## Characteristics diagram

With rubber coupling

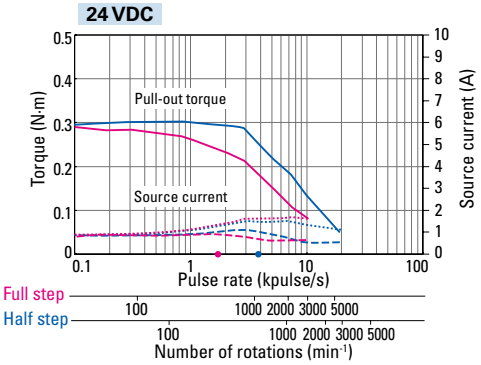
Pull-out torque Full step —— Half step ——
Source current (no load) Full step - - - Half step - - -
fs : Maximum self-start frequency when not loaded Full step ● Half step ●
Source current (load applied) Full step ····· Half step ·····

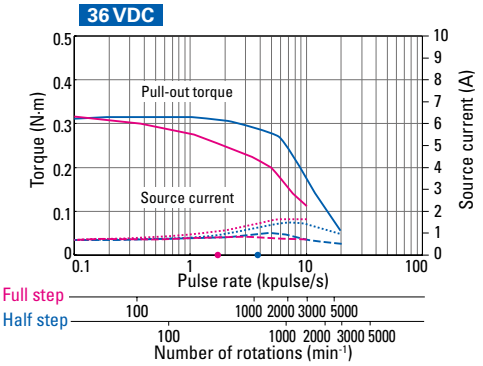
### DB16S144S DB16S144D



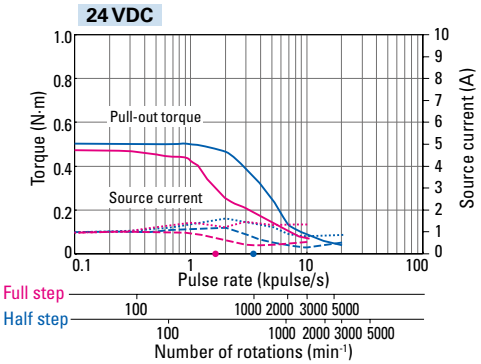



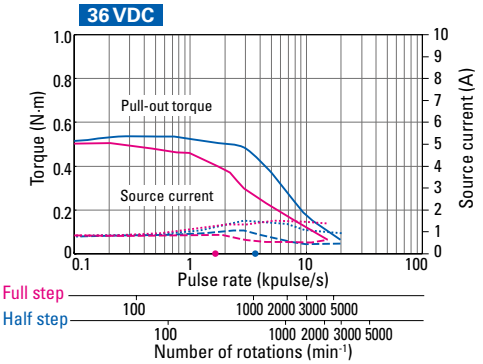

### DB16H671S DB16H671D



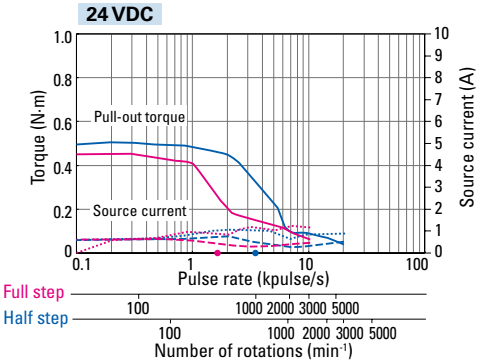



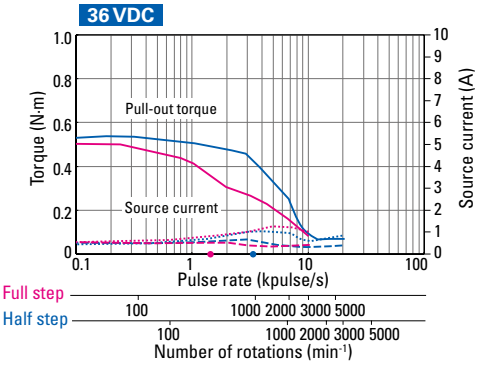

### DB16H673S DB16H673D




### DB16H711S DB16H711D






System Configuration Diagram▶p. 12 Set Model Configuration▶p. 14 Motor Dimensions▶pp. 23 to 24 Driver Dimensions▶p. 27

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# Bipolar DC input driver (Model no.: BS1D200P10) + Motor

RoHS

| Size | Motor size | 56 mm sq./Basic step angle 1.8° | | 60 mm sq./Basic step angle 1.8° | |
|---|---|---|---|---|---|
| | Motor length | 53.8 mm | 75.8 mm | 44.8 mm | 53.8 mm |
| Single shaft | Set model no. | DB16H713S | DB16H716S | DB16H781S | DB16H782S |
| | Configuration item: motor model no. | 103H7123-5740 | 103H7126-5740 | 103H7821-5740 | 103H7822-5740 |
| Dual shaft | Set model no. | DB16H713D | DB16H716D | DB16H781D | DB16H782D |
| | Configuration item: motor model no. | 103H7123-5710 | 103H7126-5710 | 103H7821-5710 | 103H7822-5710 |
| Holding torque | N·m | 1.0 | 1.6 | 0.88 | 1.37 |
| Rotor inertia | $\times 10^{-4}$kg·m² | 0.21 | 0.36 | 0.275 | 0.4 |
| Rated current | A/phase | 2 | 2 | 2 | 2 |
| Motor mass *1 | kg | 0.65 | 0.98 | 0.6 | 0.77 |
| Allowable thrust load | N | 15 | 15 | 20 | 20 |
| Allowable radial load *2 | N | 56 | 33 | 109 | 101 |

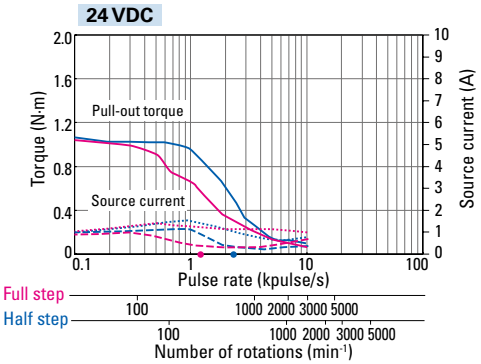
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

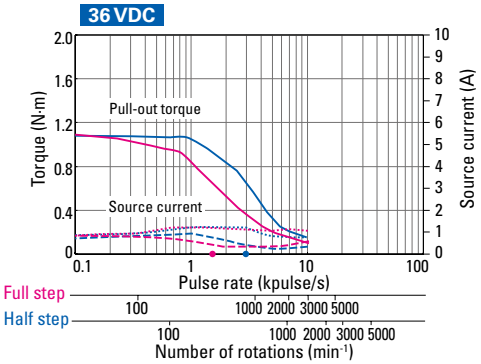
## Characteristics diagram

With rubber coupling

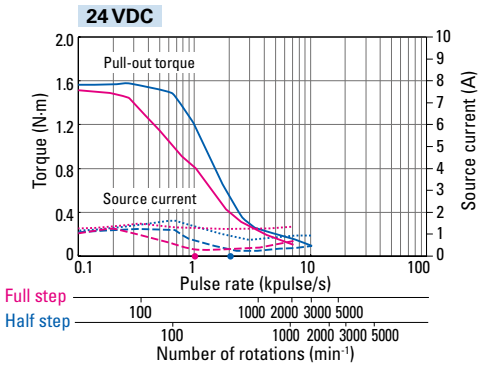
Pull-out torque Full step —— Half step ——
Source current (no load) Full step - - - Half step - - -
fs : Maximum self-start frequency when not loaded Full step ● Half step ●
Source current (load applied) Full step ····· Half step ·····

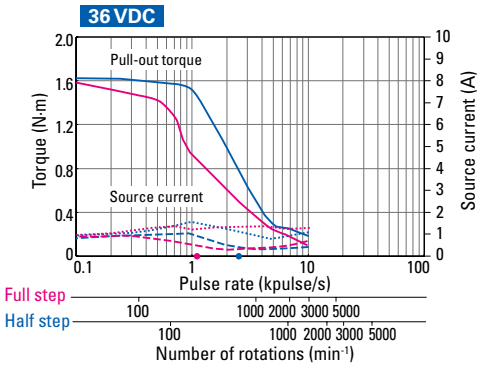
### DB16H713S DB16H713D



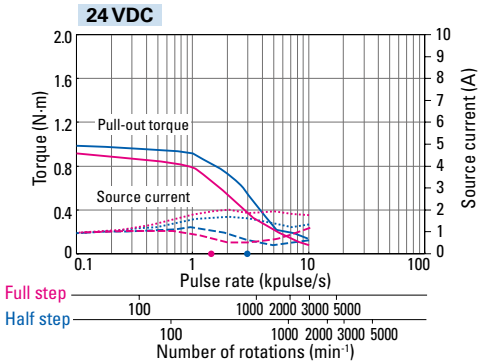



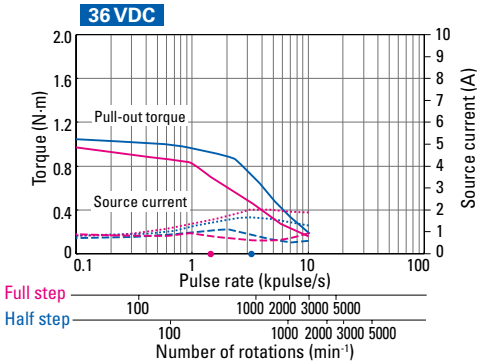

### DB16H716S DB16H716D



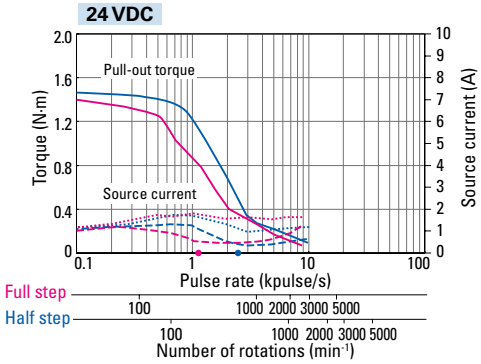



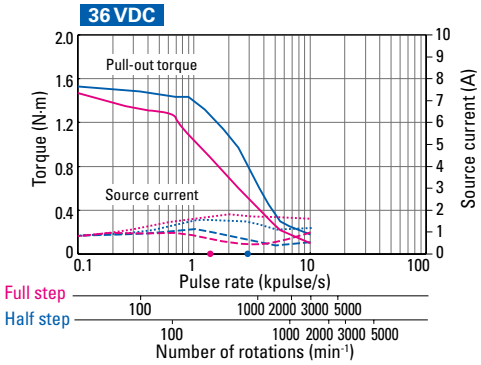

### DB16H781S DB16H781D




### DB16H782S DB16H782D




System Configuration Diagram ▶p. 12 Set Model Configuration ▶p. 14 Motor Dimensions ▶pp. 23 to 24 Driver Dimensions ▶p. 27

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Bipolar DC input driver (Model no.: BS1D200P10) + Motor

RoHS

| Size | Motor size | | 60 mm sq./Basic step angle 1.8° | 60 mm sq./Basic step angle 0.9° | |
|---|---|---|---|---|---|
| | Motor length | | 85.8 mm | 42 mm | 54 mm |
| Single shaft | Set model no. | | DB16H783S | DB16S161S | DB16S162S |
| | Configuration item: motor model no. | | 103H7823-5740 | SH1601-5240 | SH1602-5240 |
| Dual shaft | Set model no. | | DB16H783D | DB16S161D | DB16S162D |
| | Configuration item: motor model no. | | 103H7823-5710 | SH1601-5210 | SH1602-5210 |
| Holding torque | | N·m | 2.7 | 0.69 | 1.28 |
| Rotor inertia | | ×10⁻⁴kg·m² | 0.84 | 0.24 | 0.4 |
| Rated current | | A/phase | 2 | 2 | 2 |
| Motor mass *1 | | kg | 1.34 | 0.55 | 0.8 |
| Allowable thrust load | | N | 20 | 15 | 15 |
| Allowable radial load *2 | | N | 71 | 78 | 65 |

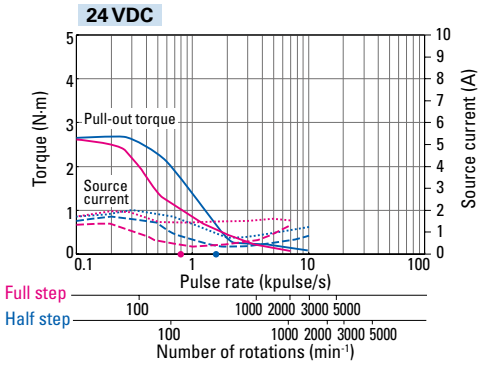
*1 Driver mass ▶p. 28 *2 The load point is at the tip of the output shaft.

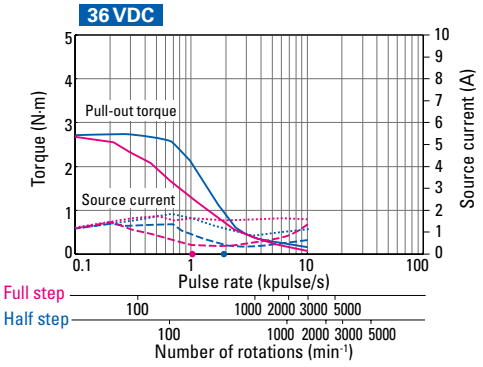
## Characteristics diagram

With rubber coupling

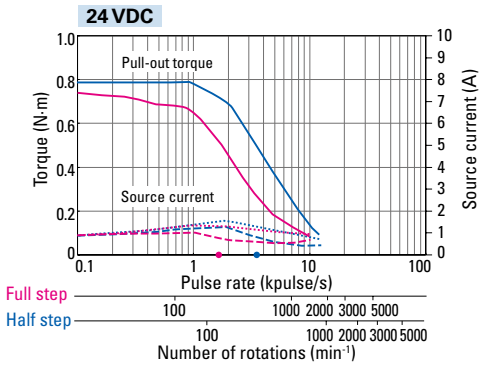
Pull-out torque Full step —— Half step ——  fs : Maximum self-start frequency when not loaded Full step ● Half step ●
Source current (no load) Full step - - - Half step - - -  Source current (load applied) Full step ····· Half step ·····

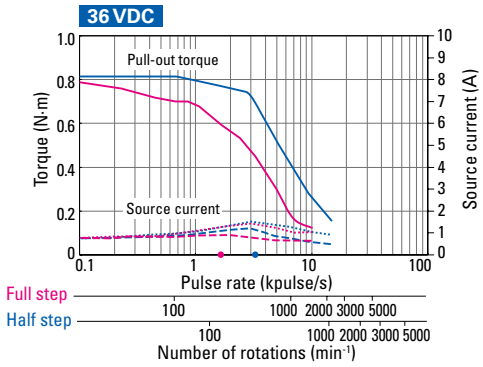
### DB16H783S DB16H783D



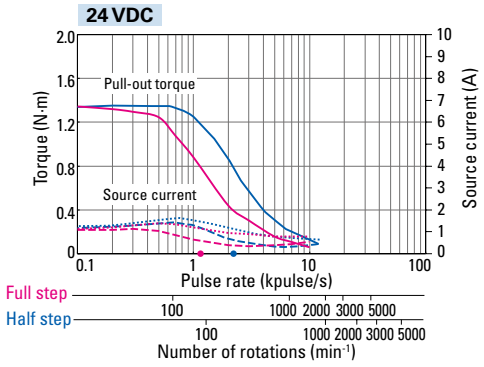



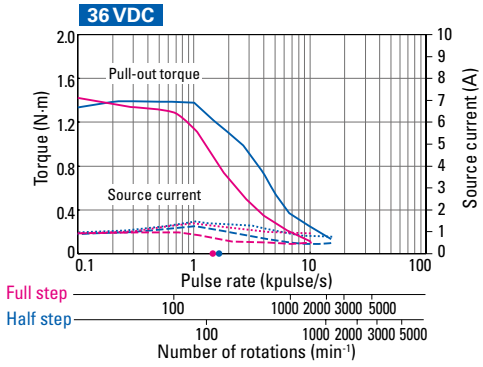

### DB16S161S DB16S161D




### DB16S162S DB16S162D



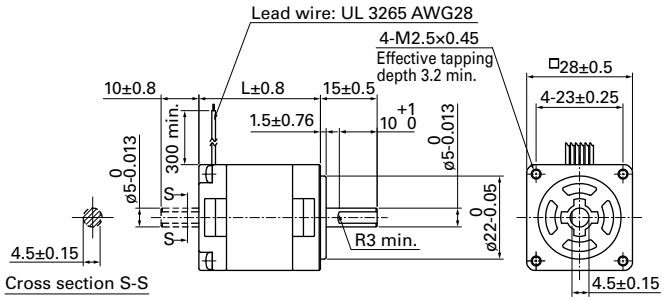






Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# Stepping Motor: Dimensions (Unit: mm)

## 28 mm sq.




Note: A unipolar motor is illustrated; bipolar motors have four lead wires.

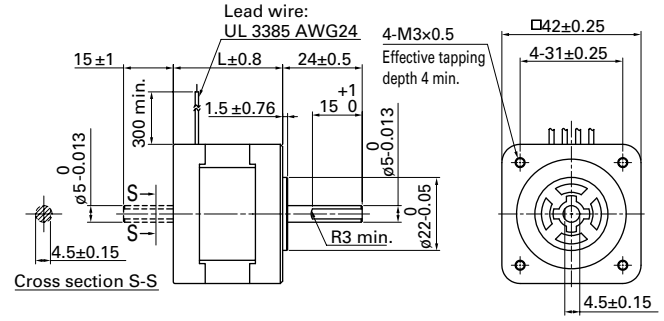
### Unipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DU14S281S | DU14S281D | SH2281-5271 | SH2281-5231 | 32 |
| DU14S285S | DU14S285D | SH2285-5271 | SH2285-5231 | 51.5 |

### Bipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DB14S281S | DB14S281D | SH2281-5771 | SH2281-5731 | 32 |
| DB14S285S | DB14S285D | SH2285-5771 | SH2285-5731 | 51.5 |

## 42 mm sq.




Note: A bipolar motor is illustrated; unipolar motors have six lead wires.

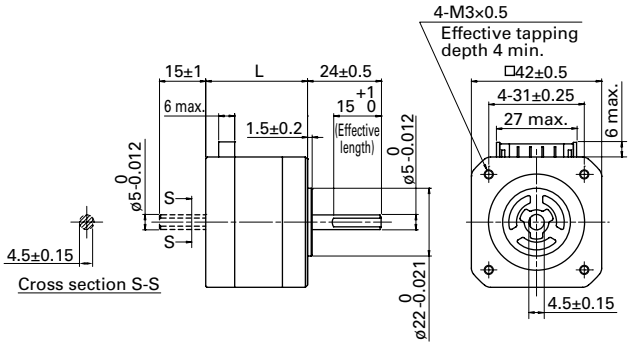
### Unipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DU15S141S | DU15S141D | SH1421-0441 | SH1421-0411 | 33 |
| DU15S142S | DU15S142D | SH1422-0441 | SH1422-0411 | 39 |
| DU15S144S | DU15S144D | SH1424-0441 | SH1424-0411 | 48 |

### Bipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DB16S141S | DB16S141D | SH1421-5241 | SH1421-5211 | 33 |
| DB16S142S | DB16S142D | SH1422-5241 | SH1422-5211 | 39 |
| DB16S144S | DB16S144D | SH1424-5241 | SH1424-5211 | 48 |

## 42 mm sq.



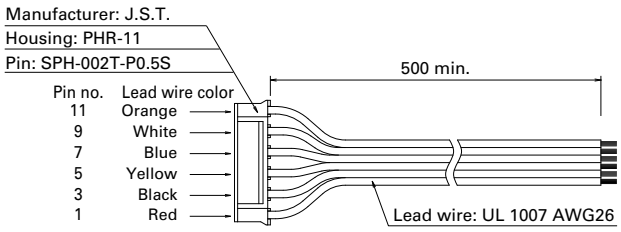

### Unipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DU15S421S | DU15S421D | SF2421-12U41 | SF2421-12U11 | 33±0.5 |
| DU15S422S | DU15S422D | SF2422-12U41 | SF2422-12U11 | 39±0.5 |
| DU15S423S | DU15S423D | SF2423-12U41 | SF2423-12U11 | 48±0.5 |
| DU15S424S | DU15S424D | SF2424-12U41 | SF2424-12U11 | 59.5±1 |

### Bipolar

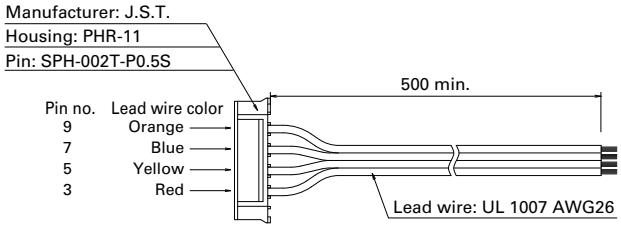
| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DB14S421S | DB14S421D | SF2421-10B41 | SF2421-10B11 | 33±0.5 |
| DB14S422S | DB14S422D | SF2422-10B41 | SF2422-10B11 | 39±0.5 |
| DB14S423S | DB14S423D | SF2423-10B41 | SF2423-10B11 | 48±0.5 |
| DB14S424S | DB14S424D | SF2424-10B41 | SF2424-10B11 | 59.5±1 |

### Motor cable Unipolar model no.: 4835774-1




This driver-motor cable is for motor model no. SF242□-12U□1.

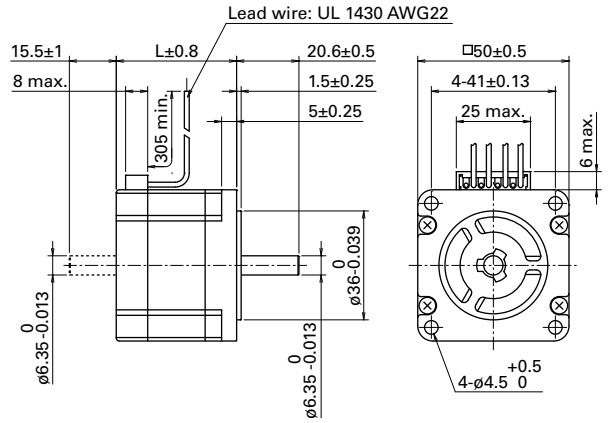
### Motor cable Bipolar model no.: 4835775-1




This driver-motor cable is for motor model no. SF242□-10B□1.

# Stepping Motor: Dimensions (Unit: mm)

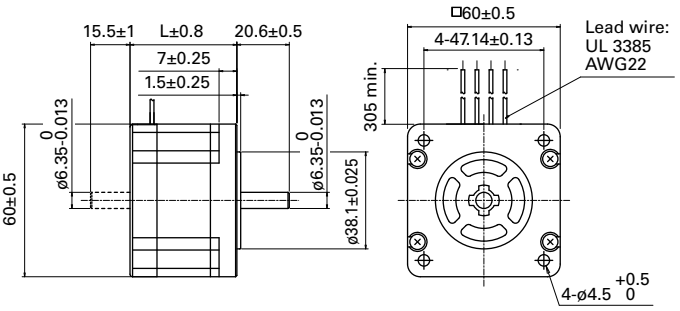
## 50 mm sq.




Bipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DB16H671S | DB16H671D | 103H6701-5040 | 103H6701-5010 | 39.8 |
| DB16H673S | DB16H673D | 103H6703-5040 | 103H6703-5010 | 51.3 |

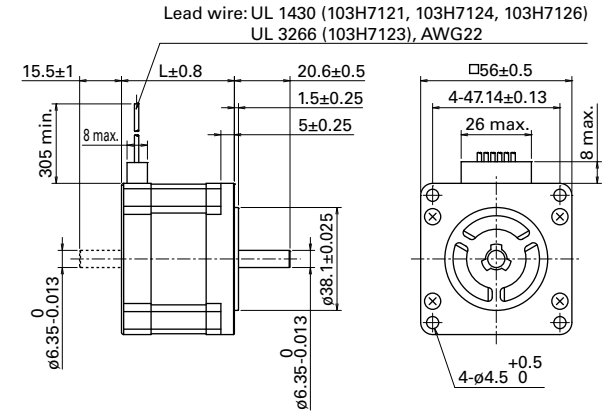
## 60 mm sq.




Bipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DB16S161S | DB16S161D | SH1601-5240 | SH1601-5210 | 42 |
| DB16S162S | DB16S162D | SH1602-5240 | SH1602-5210 | 54 |

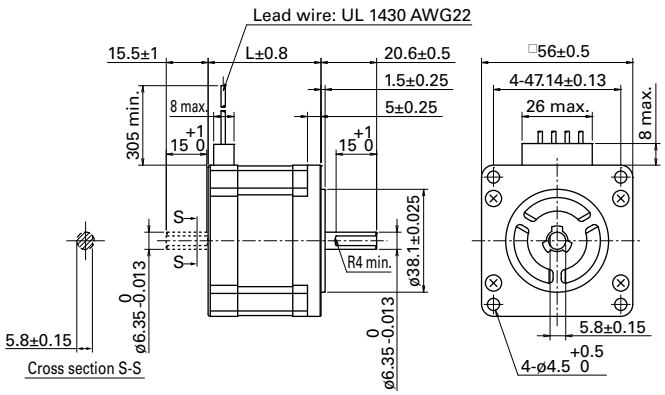
## 56 mm sq.




Unipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DU16H711S | DU16H711D | 103H7121-0440 | 103H7121-0410 | 41.8 |
| DU16H713S | DU16H713D | 103H7123-0440 | 103H7123-0410 | 53.8 |
| DU16H716S | DU16H716D | 103H7126-0440 | 103H7126-0410 | 75.8 |

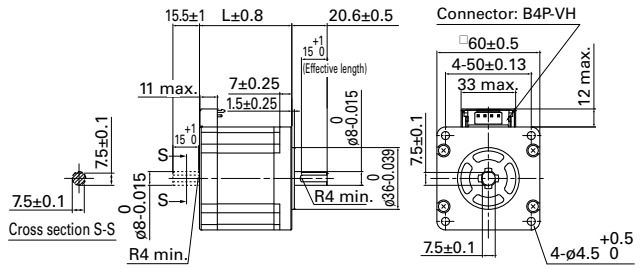
## 56 mm sq.




Bipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DB16H711S | DB16H711D | 103H7121-5740 | 103H7121-5710 | 41.8 |
| DB16H713S | DB16H713D | 103H7123-5740 | 103H7123-5710 | 53.8 |
| DB16H716S | DB16H716D | 103H7126-5740 | 103H7126-5710 | 75.8 |

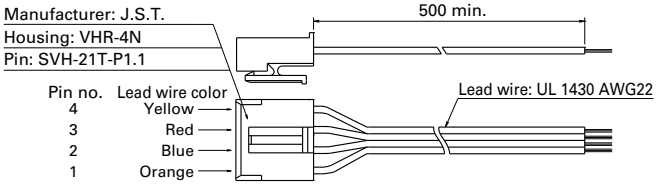
## 60 mm sq.




Bipolar

| Set model no. | | Motor model no. | | Motor length (L) |
|---|---|---|---|---|
| Single shaft | Dual shaft | Single shaft | Dual shaft | |
| DB16H781S | DB16H781D | 103H7821-5740 | 103H7821-5710 | 44.8 |
| DB16H782S | DB16H782D | 103H7822-5740 | 103H7822-5710 | 53.8 |
| DB16H783S | DB16H783D | 103H7823-5740 | 103H7823-5710 | 85.8 |

Motor cable Bipolar model no.: 4837961-1



# Stepping Motor: General Specifications

| Motor model no. | SH228 □ | SH142 □ | SF242 □ | 103H670 □ | 103H712 □ | SH160 □ | 103H782 □ |
|---|---|---|---|---|---|---|---|
| Type | — | | | | | | |
| Operating ambient temperature | -10 to +50°C | | | | | | |
| Storage temperature | -20 to +65°C | | | | | | |
| Operating ambient humidity | 20 to 90% RH (no condensation) | | | | | | |
| Storage humidity | 5 to 95% RH (no condensation) | | | | | | |
| Operation altitude | 1000 m max. above sea level | | | | | | |
| Vibration resistance | Vibration frequency 10 to 500 Hz, total amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction. | | | | | | |
| Impact resistance | 500 m/s² of acceleration for 11 ms with half-sine wave applying three times for X, Y, and Z axes each, 18 times in total. | | | | | | |
| Thermal class | Class B (+130°C) | | | | | | |
| Withstandable voltage | At normal temperature and humidity, no failure with 500 VAC @50/60 Hz applied for one minute between motor winding and frame. | | | At normal temperature and humidity, no failure with 1000 VAC @50/60 Hz applied for one minute between motor winding and frame. | | | |
| Insulation resistance | At normal temperature and humidity, not less then 100 MΩ between winding and frame by 500 VDC megger. | | | | | | |
| Protection grade | — | | | | | | |
| Winding temperature rise | 80 K max. (Based on SANYO DENKI standard) | | | | | | |
| Static angle error | ±0.09° | ±0.054° | ±0.09° | | ±0.054° | ±0.054° | ±0.09° |
| Thrust play *1 | 0.075 mm max. (load: 1.5 N) | 0.075 mm max. (load: 5 N) | 0.075 mm (load: 5 N) | 0.075 mm (load: 10 N) | 0.075 mm (load: 10 N) | 0.075 mm (load: 10 N) | 0.075 mm (load: 10 N) |
| Radial play *2 | 0.025 mm max. (load: 5 N) | | | | | | |
| Shaft runout | 0.025 mm | | | | | | |
| Concentricity of mounting pilot relative to shaft | ø0.05 mm | ø0.05 mm | ø0.05 mm | ø0.075 mm | ø0.075 mm | ø0.075 mm | ø0.075 mm |
| Squareness of mounting surface relative to shaft | 0.1 mm | 0.1 mm | 0.1 mm | 0.075 mm | 0.075 mm | 0.1 mm | 0.075 mm |
| Direction of motor mounting | Can be freely mounted vertically or horizontally | | | | | | |

*1 Thrust play: Shaft displacement under axial load.
*2 Radial play: Shaft displacement under radial load applied one-third of the length from the end of the shaft.

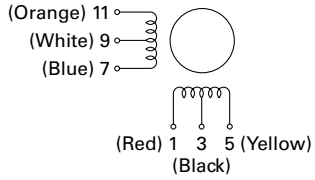
# Internal Wiring and Rotation Direction

## Unipolar winding

**Connector type**

### Internal wire connection

(Supplied cable lead wire color)



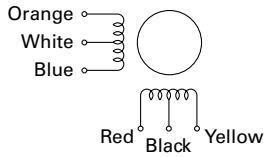

### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Connector pin no. | | | | |
|---|---|---|---|---|---|---|
| | | 3, 9 | 1 | 7 | 5 | 11 |
| Exciting order | 1 | + | − | − | | |
| | 2 | + | | − | − | |
| | 3 | + | | | − | − |
| | 4 | + | − | | | − |

**Lead wire type**

### Internal wire connection




### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

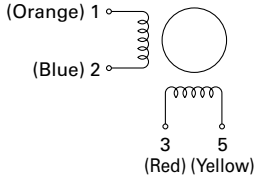
| | | Lead wire color | | | | |
|---|---|---|---|---|---|---|
| | | White, black | Red | Blue | Yellow | Orange |
| Exciting order | 1 | + | − | − | | |
| | 2 | + | | − | − | |
| | 3 | + | | | − | − |
| | 4 | + | − | | | − |

## Bipolar winding

**Connector type model no.: SF242 □**

### Internal wire connection

(Supplied cable lead wire color)




### Direction of motor rotation

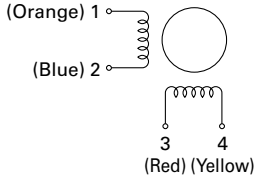
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Connector pin no. | | | |
|---|---|---|---|---|---|
| | | 3 | 7 | 5 | 9 |
| Exciting order | 1 | − | − | + | + |
| | 2 | + | − | − | + |
| | 3 | + | + | − | − |
| | 4 | − | + | + | − |

**Connector type model no.: 103H782 □**

### Internal wire connection

(Supplied cable lead wire color)



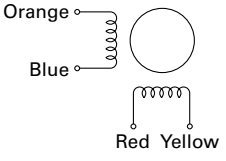

### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Connector pin no. | | | |
|---|---|---|---|---|---|
| | | 3 | 2 | 4 | 1 |
| Exciting order | 1 | − | − | + | + |
| | 2 | + | − | − | + |
| | 3 | + | + | − | − |
| | 4 | − | + | + | − |

**Lead wire type**

### Internal wire connection

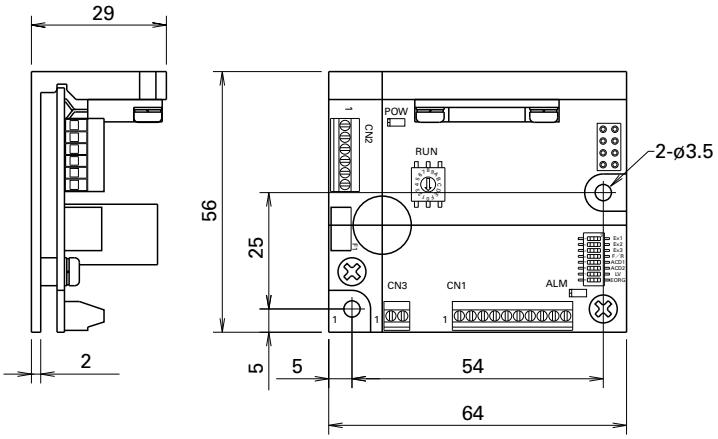



### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Lead wire color | | | |
|---|---|---|---|---|---|
| | | Red | Blue | Yellow | Orange |
| Exciting order | 1 | − | − | + | + |
| | 2 | + | − | − | + |
| | 3 | + | + | − | − |
| | 4 | − | + | + | − |

# Driver Dimensions (Unit: mm)



# Driver Specifications

## General specifications

| | | | Unipolar | Bipolar |
|---|---|---|---|---|
| Basic specifications | Model no. | | **US1D200P10** | **BS1D200P10** |
| | Input source | | 24/36 VDC ±10% | |
| | Source current | | 3 A | |
| | Environment | Protection class | Class Ⅲ | |
| | | Operation environment | Installation category (over-voltage category): Ⅰ, pollution degree: 2 | |
| | | Ambient operation temperature | 0 to +50°C | |
| | | Storage temperature | -20 to +70°C | |
| | | Operating ambient humidity | 35 to 85% RH (no condensation) | |
| | | Storage humidity | 10 to 90% RH (no condensation) | |
| | | Operation altitude | 1000 m (3281 feet) or less above sea level | |
| | | Vibration resistance | Tested under the following conditions: 5 m/s² frequency range 10 to 55 Hz, direction along X, Y and Z axes, for 2 hours each | |
| | | Impact resistance | Not influenced at NDS-C-0110 standard section 3.2.2 division "C". | |
| | | Withstandable voltage | Not influenced when 0.5 kVAC is applied between power input terminal and cabinet for one minute. | |
| | | Insulation resistance | 10 MΩ min. when measured with 500 VDC megohmmeter between input terminal and cabinet. | |
| | Mass | | 0.09 kg | |
| Functions | Selection functions | | Step angle, pulse input mode, low vibration mode, step current, operating current, original excitation phase | |
| | Protection functions | | Open phase protection, Main circuit power source voltage decrease | |
| | LED indication | | Power monitor, alarm display | |
| I/O signals | Command pulse input signal | | Photocoupler input system, input resistance: 220 Ω<br>input-signal "H" level: 4.0 to 5.5 V, input-signal "L" level: 0 to 0.5 V<br>Maximum input frequency: 150 kpulse/s | |
| | Power down input signal | | Photocoupler input system, input resistance: 220 Ω<br>input-signal "H" level: 4.0 to 5.5V, input-signal "L" level: 0 to 0.5 V | |
| | Phase origin monitor output signal | | From the photocoupler by the open collector output<br>Output specification: Vceo = 40 V max., Ic = 10 mA max. | |
| | Alarm output signal | | From the photocoupler by the open collector output<br>Output specification: Vceo = 40 V max., Ic = 10 mA max. | |

## Safety standards

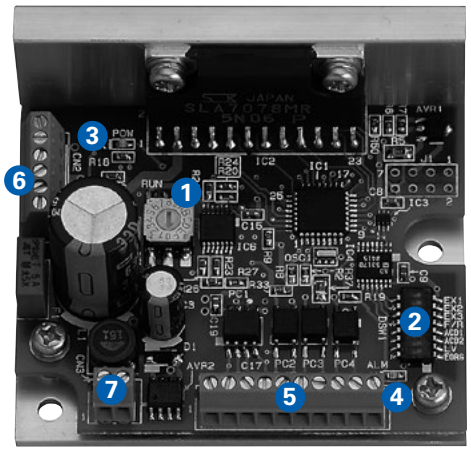
| | Directives | Category | Standard | Name |
|---|---|---|---|---|
| CE (TÜV) | Low-voltage directives | — | EN 61010-1 | — |
| | EMC directives | Emission | EN 55011-A | Terminal disturbance voltage |
| | | | EN 55011-A | Electromagnetic radiation disturbance |
| | | Immunity | EN 61000-4-2 | ESD (Electrostatic discharge) |
| | | | EN 61000-4-3 | RS (Radio-frequency amplitude modulated electromagnetic field) |
| | | | EN 61000-4-4 | Fast transients/burst |
| | | | EN 61000-4-6 | Conducted disturbances |
| UL | Acquired standards | | Applicable standard | File no. |
| | UL | | UL 508C | E179775 |
| | UL for Canada | | | |

- EMC characteristics may vary depending on the configuration of the users' control panel, which contains the driver or stepping motor, or the arrangement and wiring of other electrical devices.
  Parts for EMC noise suppression like noise filters and toroidal type ferrite cores may be required depending on circumstances.
- Validation test of driver has been performed for low-voltage EMC directives at TÜV (TÜV product service) for self-declaration of CE marking.

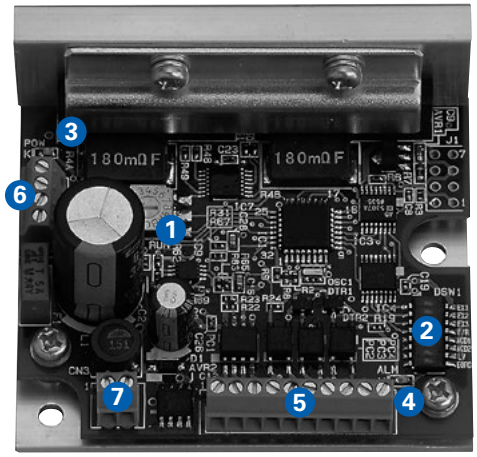
- Drivers are available for separate purchase. Connector-type drivers are also available. Contact us for details.

# Driver Controls and Connectors

**Unipolar**




**Bipolar**




### ❶ Operating current selection switch (RUN)

The value of the motor current can be set when operating.

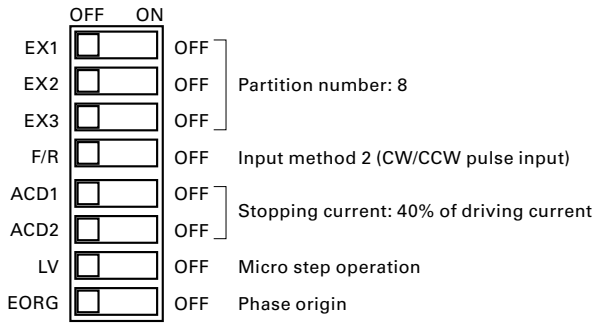
| Dial | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Stepping motor current (A) | 2.0 | 1.9 | 1.8 | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 |
| Dial | 8 | 9 | A | B | C | D | E | F |
| Stepping motor current (A) | 1.2 | 1.1 | 1.0 | 0.9 | 0.8 | 0.7 | 0.6 | 0.5 |

- The factory setting is F (0.5 A).
  Select the current after checking the rated current of the combination motor.

### ❷ Function selection DIP switchpack

Select the function depending on your specification.

Factory settings




#### 1. Step angle select (EX1, EX2, EX3)

Select the partition number of the basic step angle.

| EX1 | EX2 | EX3 | Partition no. |
|---|---|---|---|
| ON | ON | ON | 1-division |
| OFF | ON | OFF | 2-division |
| ON | OFF | OFF | 4-division |
| OFF | OFF | OFF | 8-division |
| OFF | OFF | ON | 16-division |

#### 2. Input method select (F/R)

Select input pulse type.

| F/R | Input pulse type |
|---|---|
| ON | 1 input (CK, U/D) |
| OFF | 2 input (CW, CCW) |

#### 3. Current selection when stopping (ACD1, ACD2)

Select the current value of the motor when stopping.

| ACD2 | ACD1 | Current value of the motor |
|---|---|---|
| ON | ON | 100% of driving current |
| ON | OFF | 60% of driving current |
| OFF | ON | 50% of driving current |
| OFF | OFF | 40% of driving current |

- Initial configuration of factory shipment is set to 40% of rated value. Driver and motor should be operated at around 50% of rated value to reduce heat.

#### 4. Low-vibration mode select (LV)

Provides low-vibration, smooth operation even if resolution is coarse (1-division, 2-division, etc).

| LV | Operation |
|---|---|
| ON | Auto-micro function |
| OFF | Micro-step |

#### 5. Excitation select (EORG)

The excitation phase when the power supply is engaged is selected.

| EORG | Original excitation phase |
|---|---|
| ON | Excitation phase at power shut off |
| OFF | Phase origin |

- By turning on the EORG, the excitation phase during power OFF will be saved. Therefore, there will be no shaft displacement when turning the power ON.

### ❸ LED for power supply monitor (POW)

Lit up when the main circuit power supply is connected.

### ❹ LED for alarm display (ALM)

Lights in the following conditions:

- Motor cable is broken.
- Switching element in driver is faulty.
- The main circuit voltage is out of specifications range (19 VDC max.).

When "ALM" is displayed, the winding current of the stepping motor is cut off and it is in a "non-excitation" state. At the same time, an output signal (photocoupler ON) is transmitted from the alarm output terminal (AL) to an external source. When the alarm circuit is operating, this state is maintained until it is reset by switching on the power supply again. When an alarm condition has occurred, please take corrective actions to rectify the cause of the alarm before switching on the power supply again.

### ❺ I/O signal terminal block (CN1)

Connect the I/O signal.

### ❻ Motor terminal block (CN2)

Connect the motor's power line.

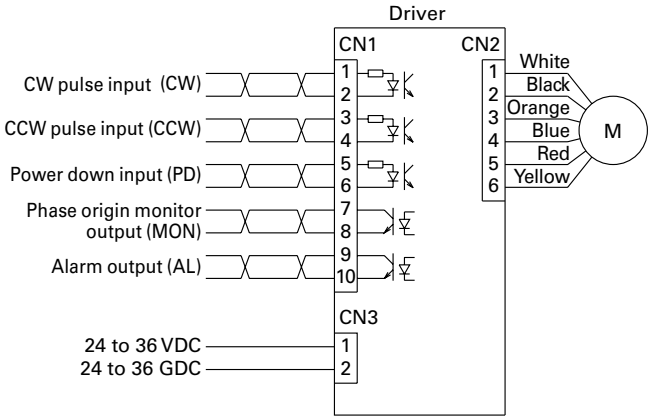
### ❼ Power supply terminal block (CN3)

Connect the main circuit power supply.

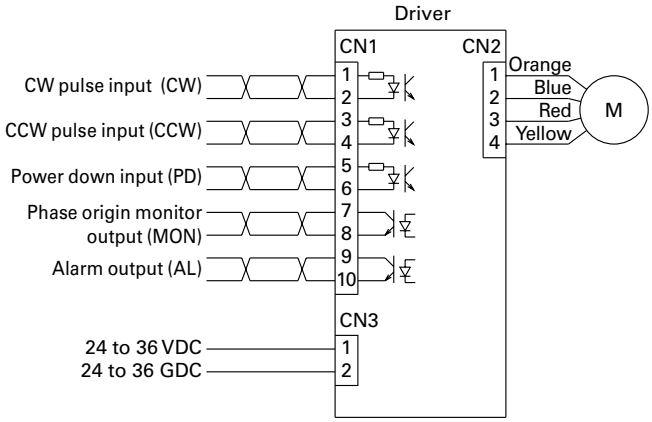
# Connections and Signals

## External wiring diagram

**Unipolar**




**Bipolar**




## Applicable wire sizes

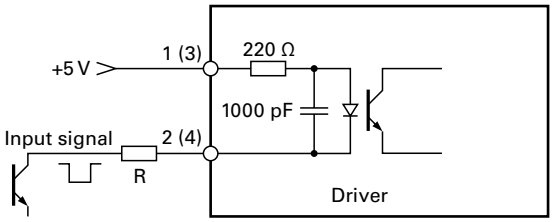
| Part | Wire sizes | Allowable wire length |
|---|---|---|
| For power supply | AWG22 (0.3 mm²) | 2 m max. |
| For input/output signal | AWG24 (0.2 mm²) to AWG22 (0.3 mm²) | 2 m max. |
| For motor | AWG22 (0.3 mm²) | Under 3 m |

## Specification summary of input/output signals

| Signal | CN1 Pin no. | Function summary |
|---|---|---|
| CW pulse input (CW) (Standard) | 1<br>2 | When in "2 input type",<br>input the drive pulse that rotates in a CW direction. |
| Pulse train input (CK) | 1<br>2 | When in "1 input type",<br>input the drive pulse train for motor rotation. |
| CCW pulse input (CCW) (Standard) | 3<br>4 | When in "2 input type",<br>input the drive pulse train that rotates in a CCW direction. |
| Rotational direction input (U/D) | 3<br>4 | When in "1 input type",<br>input the motor rotational direction signal.<br>Internal photocoupler ON ··· CW direction<br>Internal photocoupler OFF ··· CCW direction |
| Power down input (PD) | 5<br>6 | Inputting PD signal will cut off (power off) the current flowing to the motor (With DIP switch select, change to the Power low function is possible).<br>PD input signal on (internal photocoupler on) ··· PD function is valid.<br>PD input signal off (internal photocoupler off) ··· PD function is invalid. |
| Phase origin monitor output (MON) | 7<br>8 | When the excitation phase is at the origin (during power on) this function turns on.<br>When FULL step, ON once for 4 pulses;<br>when HALF step, ON once for 8 pulses. |
| Alarm output (AL) | 9<br>10 | When alarm circuits are actuated inside the driver, outputs signals to outside, after which the stepping motor changes to unexcited status. |

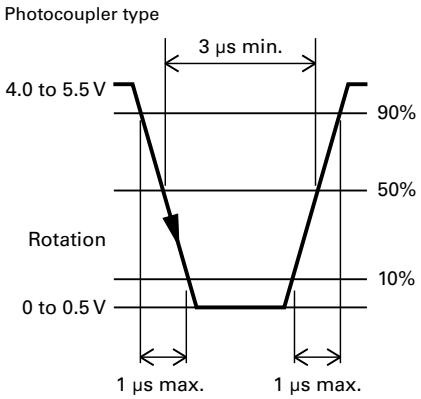
· As for the motor rotational direction, CW direction is regarded as the clockwise rotation, and CCW direction is regarded as the counterclockwise rotation by viewing the motor from output shaft side.

# Circuit Configuration of Pulse Input CW (CK), CCW (U/D)



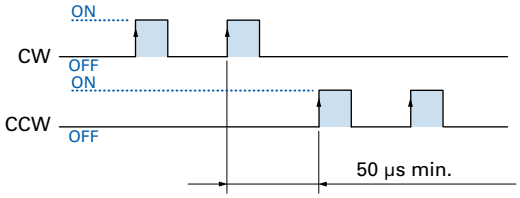

- Pulse duty 50% max.
- Maximum input frequency: 150 kpulse/s
- If the peak voltage of the input signal exceeds 5.5 V, please add an external current-limiting resistor R to limit the input current to around 15 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

## Input signal specifications



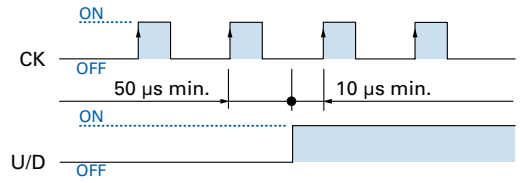

## Timing of the command pulse

**2 input mode (CW, CCW)**



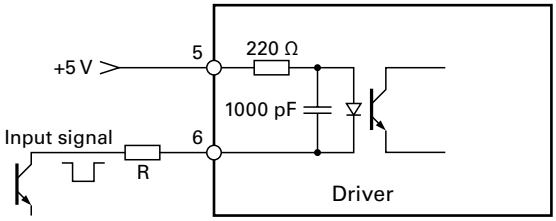

- Shaded area indicates internal photocoupler ON. Internal circuit (motor) starts operating at leading edge of the photocoupler ON.
- To apply pulse to CW, set CCW side internal photocoupler to OFF.
- To apply pulse to CCW, set CW side internal photocoupler to OFF.

**1 input mode (CK, U/D)**



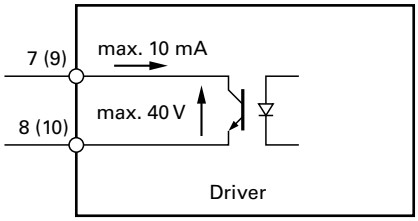

- Shaded area indicates internal photocoupler ON. Internal circuit (motor) starts operating at leading edge of CK side photocoupler ON.
- Switching of U/D input signal must be done while CK side internal photocoupler is OFF.

# Input Circuit Configuration of Power Down Input (PD)

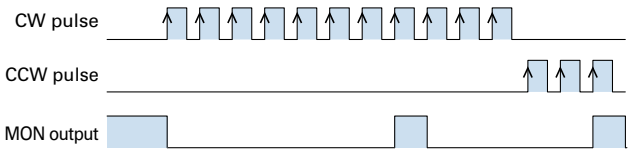



- If the peak voltage of the input signal exceeds 5.5 V, please add an external current-limiting resistor R to limit the input current to around 15 mA. (Take the photocoupler forward voltage of 1.5 V into consideration.)

# Output Signal Configuration of Phase Origin Monitor Output (MON) and Alarm Output (AL)




**MON output**




- Photocoupler is set to ON at phase origin of motor excitation (setting when number of divisions is 2).
- MON output is taken at every 7.2 degrees of motor output shaft from phase origin.

# Stepping Motors


Stepping Motors ▶p. 38–

IP65 Splash and Dust Proof Stepping Motors Waterproof, dustproof ▶p. 74–

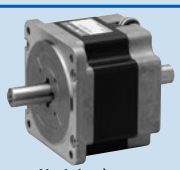
Stepping Motors for Vacuum Environments Customized Products ▶p. 79

Synchronous Motors Customized Products ▶p. 79

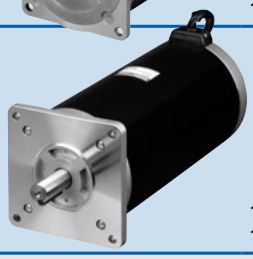
# Lineup

## Stepping Motors RoHS

These motors can be purchased as separate units.

| Basic step angle | Motor size | Holding torque (N·m) Model no. | Customizing* | Page |
|---|---|---|---|---|
| 1.8° | 14 mm sq. **Ultra-compact** | 0.0065 to 0.01 SH214□-5□□1 | Hollow Shaft modification | p. 38 |
| | 28 mm sq. | 0.055 to 0.145 SH228□-5□□1 | Hollow Shaft modification Decelerator Encoder | pp. 39 to 40 |
| | 35 mm sq. | 0.12 to 0.23 SH35□□-12U□0 | Hollow Shaft modification | p. 41 |
| 0.9° | 42 mm sq. | 0.2 to 0.48 SH142□-□□□1 | Hollow Shaft modification Decelerator Encoder | pp. 42 to 43 |
| 1.8° | 42 mm sq. **Slim form** | 0.083 to 0.186 SS242□-50□1 | Hollow Shaft modification | p. 44 |
| | 42 mm sq. | 0.22 to 0.8 SF242□-□□□□1 | Shaft length Shaft shape | pp. 45 to 47 |
| | 50 mm sq. | 0.28 to 0.53 103H670□-□□□0 | Hollow Shaft modification | pp. 48 to 50 |
| | 50 mm sq. **Slim form** | 0.1 to 0.215 SS250□-80□0 | Hollow Shaft modification | p. 51 |
| | 56 mm sq. | 0.39 to 2.0 103H712□-□□□0 | Hollow Shaft modification Decelerator Encoder | pp. 52 to 55 |
| 0.9° | 60 mm sq. | 0.57 to 2.15 SH160□-□□□0 | Hollow Shaft modification Decelerator Encoder | pp. 56 to 57 |
| 1.8° | 60 mm sq. | 0.78 to 2.7 103H782□-□□□0 | Hollow Shaft modification Decelerator Encoder Brake | pp. 58 to 61 |
| | 86 mm sq. (CE and UL models are available.)  | 2.5 to 9 S□286□-□□□□ | Hollow Shaft modification Encoder | pp. 62 to 66 |

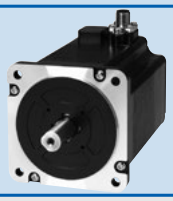
*Specifications can be customized, depending on the model number and quantity. Contact us for details.

| Basic step angle | Motor size | Holding torque (N·m) Model no. | Customizing* | Page |
|---|---|---|---|---|
| 1.8° | ø106 mm | 10.8 to 19<br>103H8922□-□□□1 | Hollow Shaft modification Brake | p. 67 |
| | 56 mm sq. CE Model | 0.39 to 1.27<br>103H712□-6□□0 | Hollow Shaft modification | p. 68 |
| | ø86 mm CE Model | 2.74 to 7.44<br>103H822□-6□□0 | Hollow Shaft modification | p. 69 |
| | ø106 mm CE Model  | 13.2 to 19<br>103H8922□-63□1 | Hollow Shaft modification | p. 70 |

*Specifications can be customized, depending on the model number and quantity. Contact us for details.

## IP65 Splash and Dust Proof Stepping Motors

Waterproof, dustproof RoHS

| Basic step angle | Motor size | | Page |
|---|---|---|---|
| 1.8° | 56 mm sq. CE/UL Model | 1 to 1.7 N·m<br>SP256□-5□□0 | p. 75 |
| | 86 mm sq. CE/UL Model  | 3.3 to 9 N·m<br>SP286□-5□□0 | p. 77 |

## Stepping Motors for Vacuum Environments

Customized Products

| | Motor size | | Page |
|---|---|---|---|
| | 42 mm sq. to ø106 mm | | p. 79 |

## Synchronous Motors

Customized Products

| | Motor size | | Page |
|---|---|---|---|
| | 56 mm sq. to ø106 mm | | p. 79 |

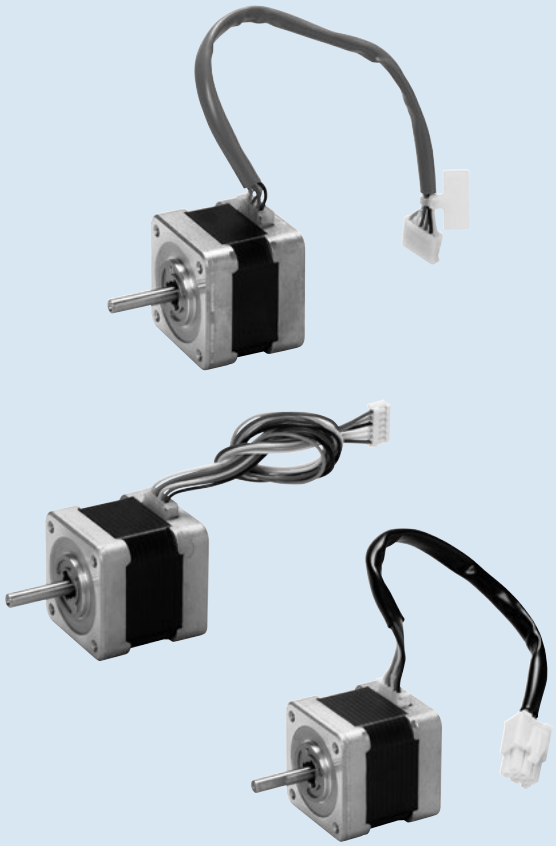
# Customization

Different types of customization are possible, depending on the request and quantity. Contact us for details.

## Manufacturing example

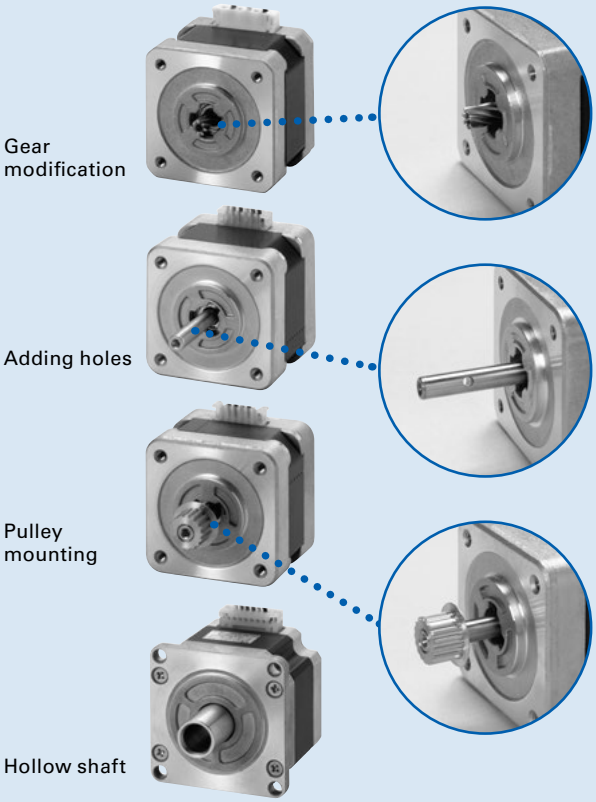
### Harness modification

Connectors, cable ties, and plastic tubing can be added.



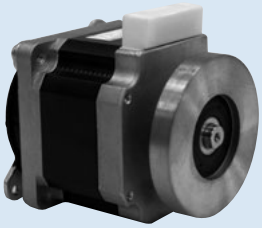
### Shaft modification

D-cuts, key grooves, and through holes can be added; and gears and pulleys can be mounted. The shaft can also be hollowed to allow airflow or to pass lead wires through.




### Rotating damper, mounting-side damper

A damper can be added to reduce vibrations when rotating.



Rotating damper

Mounting-side damper

### Decelerator, encoder, brake

- A decelerator can be added when a large high-load torque is required at low speeds.
- An encoder can be added in order to detect position and speed.
- A brake can be added to hold the position when the motor is stopped.

With brake+encoder

With decelerator+encoder



Specifications can be customized, depending on the model number and quantity. Contact us for details.

# How to Read the Specifications

**Bipolar winding, Lead wire type**

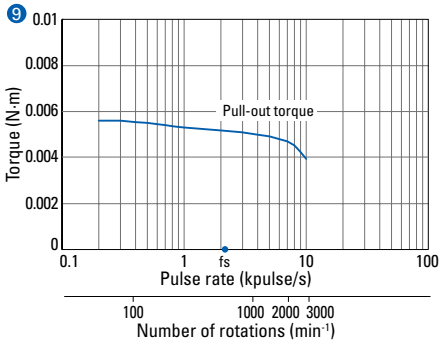
| ❶ Model no. | | ❷ Holding torque at 2-phase energization | ❸ Rated current | ❹ Wiring resistance | ❺ Winding inductance | ❻ Rotor inertia | ❼ Mass | ❽ Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | $\times10^{-4}$kg·m$^2$ | kg | mm |
| **SH2141-5541** | **SH2141-5511** | 0.0065 | 0.3 | 21 | 4.2 | 0.00058 | 0.03 | 30 |
| **SH2145-5641** | **SH2145-5611** | 0.01 | 0.4 | 19 | 4 | 0.0011 | 0.042 | 43.8 |

## Characteristics diagram

**SH2141-5541**
**SH2141-5511**

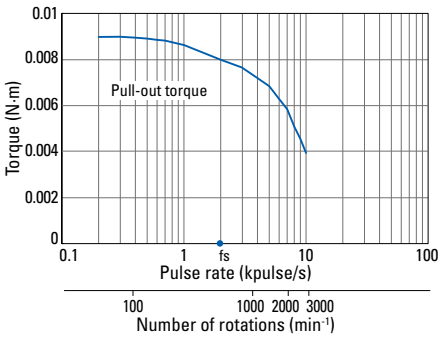
Constant current circuit
Source voltage: 24 VDC
Operating current:
0.3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10$^{-4}$kg·m$^2$ (pulley balancer method)
fs: Maximum self-start frequency when not loaded

❾




**SH2145-5641**
**SH2145-5611**

Constant current circuit
Source voltage: 24 VDC
Operating current:
0.4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10$^{-4}$kg·m$^2$ (pulley balancer method)
fs: Maximum self-start frequency when not loaded




❶ This is the stepping motor model number.

❷ This is the maximum torque that occurs with 2-phase excitation of the stepping motor at rated current, causing the shaft to rotate from the outside.

❸ This is the rated current that flows to the motor winding. Allowing this amount of current to flow to the motor will create torque equal to the holding torque value.

❹ This is the resistance for one phase of the stepping motor winding.

❺ This is the inductance for one phase of the stepping motor winding.

❻ This is the moment of inertia of the rotor, which shows how much torque is required to cause the rotor to accelerate or decelerate.

❼ This is the mass of the stepping motor.

❽ This is the length of the stepping motor.

❾ This graph shows the relationship between the full step pulse rate (frequency), speed, and pull-out torque.

# Stepping Motors

Allowable Load▶p. 71 Internal Wiring, Rotation Direction▶p. 72
General Specifications▶p. 73

## 14 mm sq.

1.8°/step **Ultra-compact** **RoHS**

Bipolar winding, Lead wire type

**Customizing**

Hollow Shaft modification

Varies depending on the model number and quantity. Contact us for details.

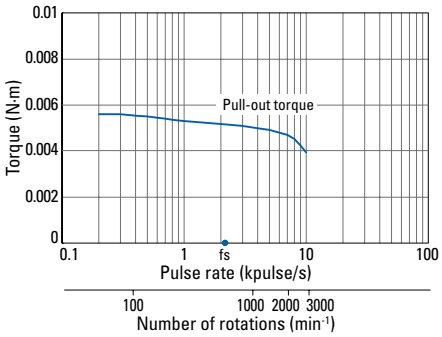
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | $\times10^{-4}$kg·m² | kg | mm |
| **SH2141-5541** | **SH2141-5511** | 0.0065 | 0.3 | 21 | 4.2 | 0.00058 | 0.03 | 30 |
| **SH2145-5641** | **SH2145-5611** | 0.01 | 0.4 | 19 | 4 | 0.0011 | 0.042 | 43.8 |

## Characteristics diagram

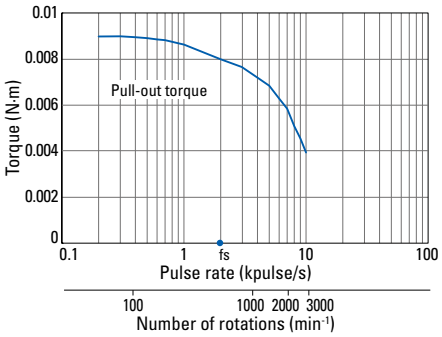
**SH2141-5541**
**SH2141-5511**

Constant current circuit
Source voltage: 24 VDC
Operating current:
0.3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded

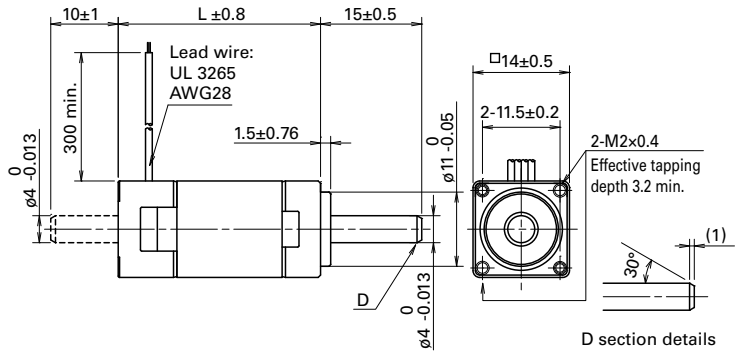



**SH2145-5641**
**SH2145-5611**

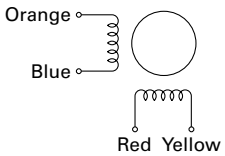
Constant current circuit
Source voltage: 24 VDC
Operating current:
0.4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

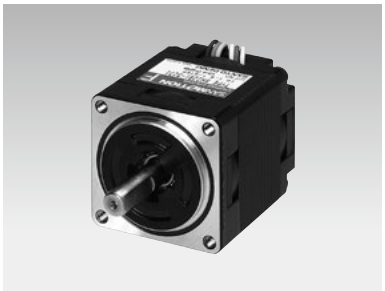
Driver is not included.

If you require assistance finding a driver, contact us for details.



Allowable Load▶p. 71 Rotation Direction▶p. 72 General Specifications▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 28 mm sq.

1.8°/step RoHS

Unipolar winding, Lead wire type

Bipolar winding, Lead wire type ▶p. 40

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder

Varies depending on the model number and quantity. Contact us for details.

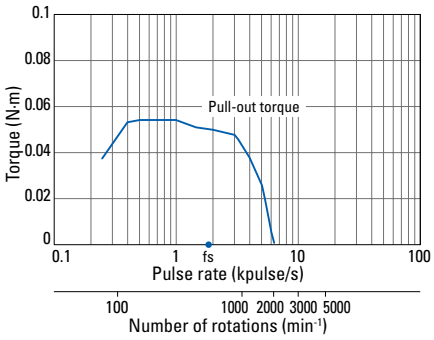
**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SH2281-5171** | **SH2281-5131** | 0.055 | 0.5 | 10.5 | 3.7 | 0.01 | 0.11 | 32 |
| **SH2281-5271** | **SH2281-5231** | 0.055 | 1 | 2.85 | 1 | 0.01 | 0.11 | 32 |
| **SH2285-5171** | **SH2285-5131** | 0.115 | 0.5 | 17 | 7 | 0.022 | 0.2 | 51.5 |
| **SH2285-5271** | **SH2285-5231** | 0.115 | 1 | 4.1 | 1.9 | 0.022 | 0.2 | 51.5 |

## Characteristics diagram

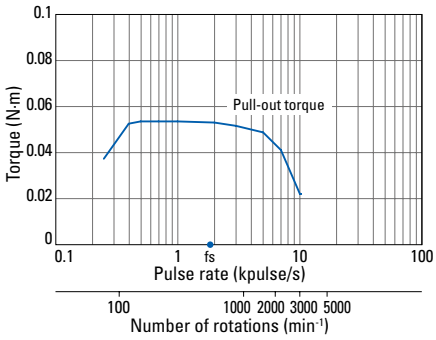
### SH2281-5171 SH2281-5131

Constant current circuit
Source voltage: 24 VDC
Operating current:
0.5 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded



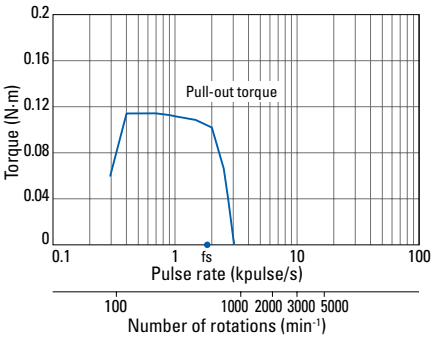

### SH2281-5271 SH2281-5231

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded



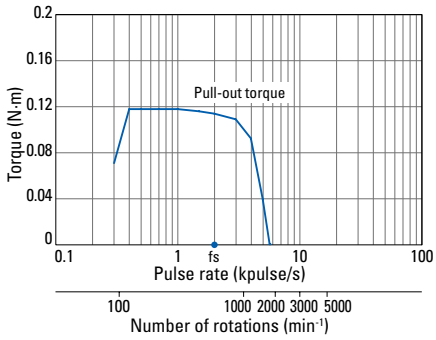

### SH2285-5171 SH2285-5131

Constant current circuit
Source voltage: 24 VDC
Operating current:
0.5 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded

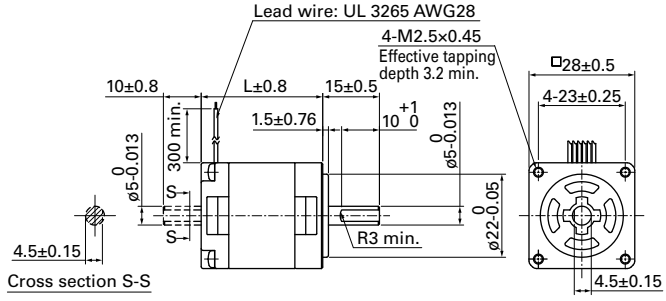



### SH2285-5271 SH2285-5231

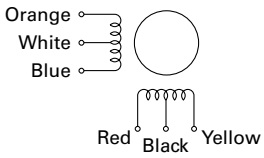
Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

- For motor model no. SH228 □ -51 □ 1 (0.5 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For model no. SH228 □ -52 □ 1 (1 A/phase)
  Model no.: BS1D200P10 (DC input)
  Operating current select switch setting: A

*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 28 mm sq.

1.8°/step RoHS

Bipolar winding, Lead wire type

Unipolar winding, Lead wire type ▶p. 39

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder

Varies depending on the model number and quantity. Contact us for details.

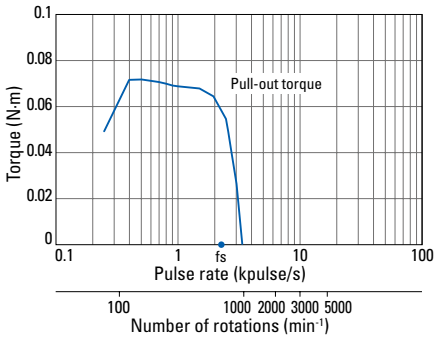
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SH2281-5671** | **SH2281-5631** | 0.07 | 0.5 | 10.5 | 7.2 | 0.01 | 0.11 | 32 |
| **SH2281-5771** | **SH2281-5731** | 0.07 | 1 | 2.6 | 1.85 | 0.01 | 0.11 | 32 |
| **SH2285-5671** | **SH2285-5631** | 0.145 | 0.5 | 15 | 13.5 | 0.022 | 0.2 | 51.5 |
| **SH2285-5771** | **SH2285-5731** | 0.145 | 1 | 3.75 | 3.4 | 0.022 | 0.2 | 51.5 |

## Characteristics diagram

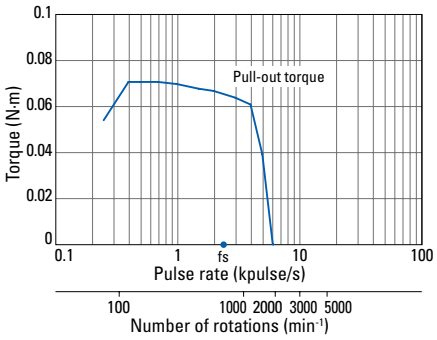
### SH2281-5671 SH2281-5631

Constant current circuit
Source voltage: 24 VDC
Operating current:
0.5 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded



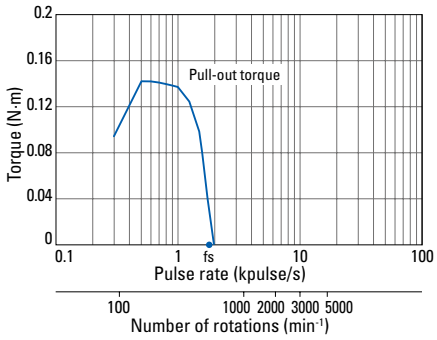

### SH2281-5771 SH2281-5731

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded



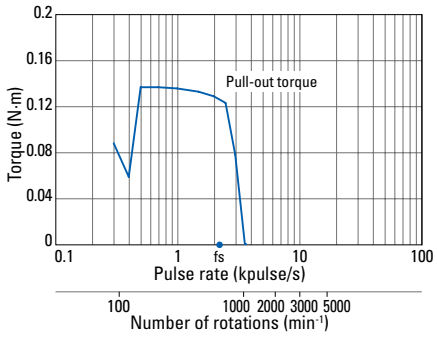

### SH2285-5671 SH2285-5631

Constant current circuit
Source voltage: 24 VDC
Operating current:
0.5 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded

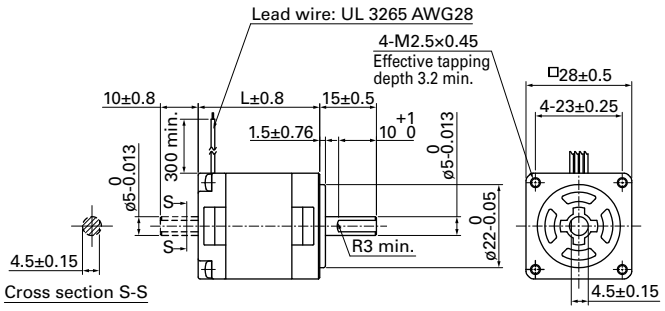



### SH2285-5771 SH2285-5731

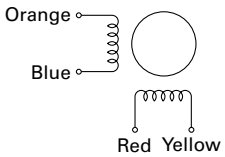
Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10⁻⁴kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

- For motor model no. SH228 □ -56 □ 1 (0.5 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For model no. SH228 □ -57 □ 1 (1 A/phase)
  Model no.: BS1D200P10 (DC input)
  Operating current select switch setting: A

*The characteristics diagram shown above is from our experimental circuit.*



Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 35 mm sq.

1.8°/step RoHS

Unipolar winding, Lead wire type

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

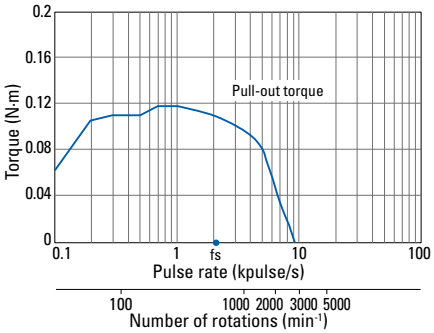
**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SH3533-12U40** | **SH3533-12U10** | 0.12 | 1.2 | 2.4 | 1.3 | 0.02 | 0.17 | 33 |
| **SH3537-12U40** | **SH3537-12U10** | 0.15 | 1.2 | 2.7 | 2 | 0.025 | 0.2 | 37 |
| **SH3552-12U40** | **SH3552-12U10** | 0.23 | 1.2 | 3.4 | 2.8 | 0.043 | 0.3 | 52 |

## Characteristics diagram

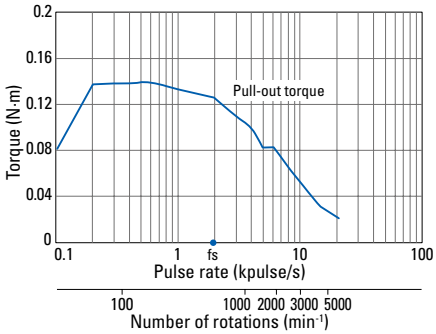
### SH3533-12U40 SH3533-12U10

Constant current circuit
Source voltage: 24 VDC
Operating current:
1.2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.33×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



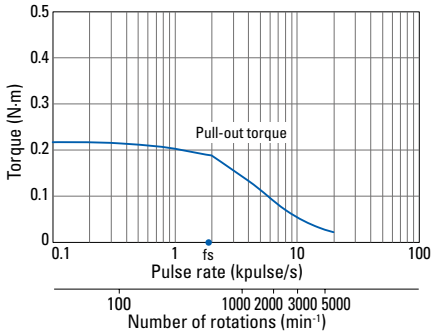

### SH3537-12U40 SH3537-12U10

Constant current circuit
Source voltage: 24 VDC
Operating current:
1.2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.33×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

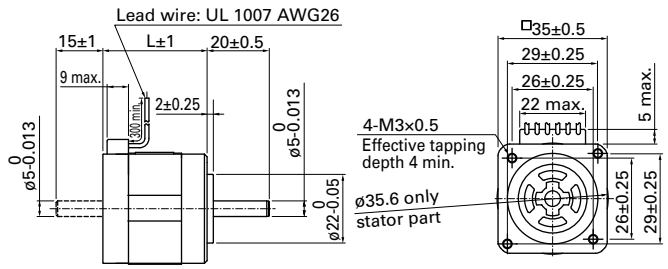



### SH3552-12U40 SH3552-12U10

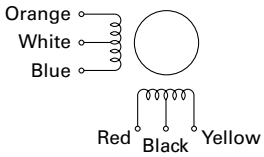
Constant current circuit
Source voltage: 24 VDC
Operating current:
1.2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

Model no.: US1D200P10 (DC input)
Operating current select switch setting: 8
*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 42 mm sq.

0.9°/step RoHS

Unipolar winding, Lead wire type
Bipolar winding, Lead wire type

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder

Varies depending on the model number and quantity. Contact us for details.

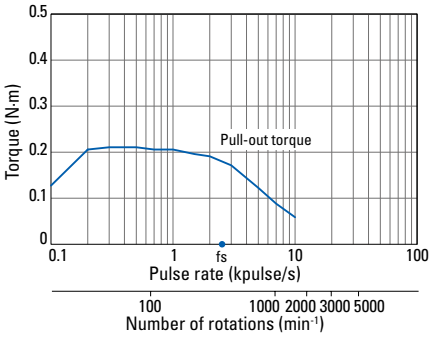
**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SH1421-0441** | **SH1421-0411** | 0.2 | 1.2 | 2.7 | 3.2 | 0.044 | 0.24 | 33 |
| **SH1422-0441** | **SH1422-0411** | 0.29 | 1.2 | 3.1 | 5.3 | 0.066 | 0.29 | 39 |
| **SH1424-0441** | **SH1424-0411** | 0.39 | 1.2 | 3.5 | 5.3 | 0.089 | 0.38 | 48 |

## Characteristics diagram

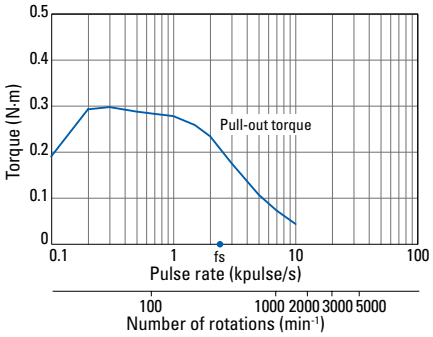
**SH1421-0441**
**SH1421-0411**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1.2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



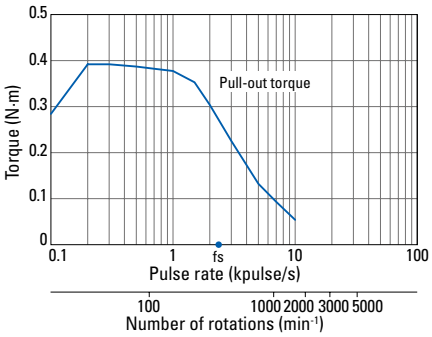

**SH1422-0441**
**SH1422-0411**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1.2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

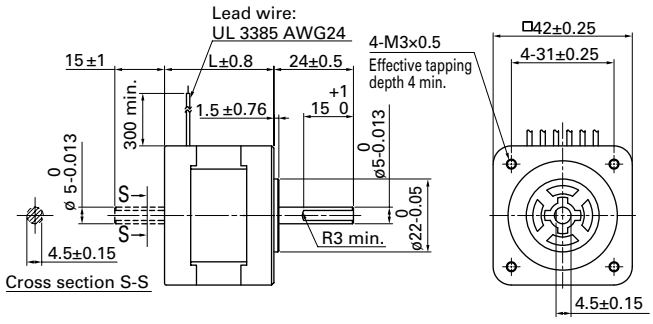



**SH1424-0441**
**SH1424-0411**

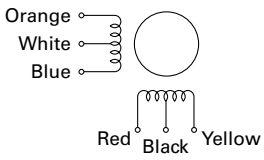
Constant current circuit
Source voltage: 24 VDC
Operating current:
1.2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

Model no.: US1D200P10 (DC input)
Operating current select switch setting: 8
*The characteristics diagram shown above is from our experimental circuit.*


Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

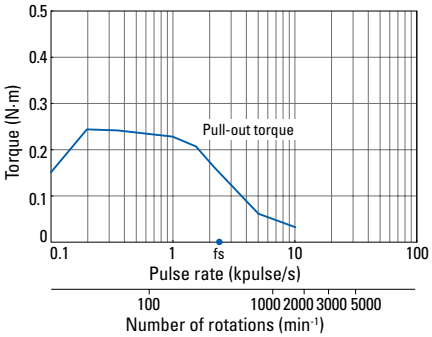
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SH1421-5041** | **SH1421-5011** | 0.23 | 1 | 3.3 | 8.0 | 0.044 | 0.24 | 33 |
| **SH1421-5241** | **SH1421-5211** | 0.23 | 2 | 0.85 | 2.1 | 0.044 | 0.24 | 33 |
| **SH1422-5041** | **SH1422-5011** | 0.34 | 1 | 4.0 | 14.0 | 0.066 | 0.29 | 39 |
| **SH1422-5241** | **SH1422-5211** | 0.34 | 2 | 1.05 | 3.6 | 0.066 | 0.29 | 39 |
| **SH1424-5041** | **SH1424-5011** | 0.48 | 1 | 4.7 | 15.0 | 0.089 | 0.38 | 48 |
| **SH1424-5241** | **SH1424-5211** | 0.48 | 2 | 1.25 | 3.75 | 0.089 | 0.38 | 48 |

## Characteristics diagram

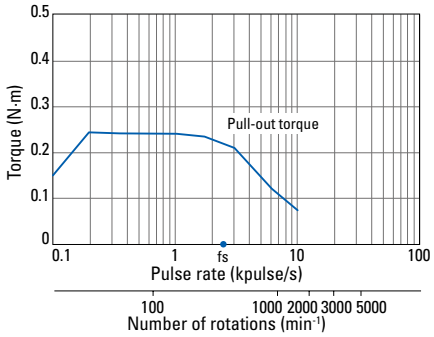
### SH1421-5041 SH1421-5011

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



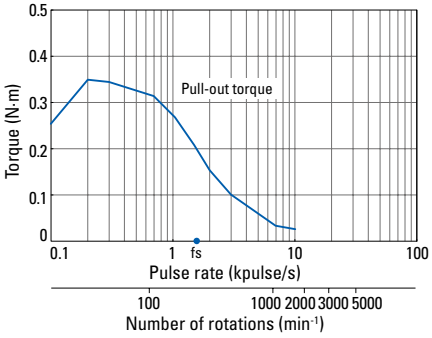

### SH1421-5241 SH1421-5211

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



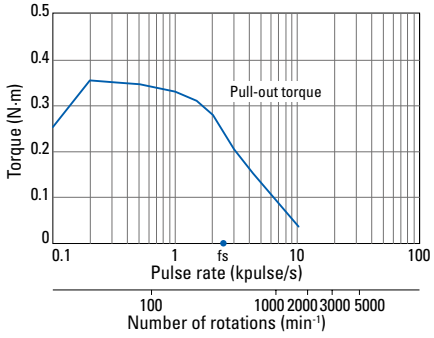

### SH1422-5041 SH1422-5011

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



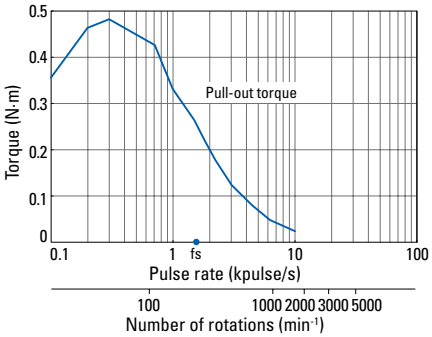

### SH1422-5241 SH1422-5211

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



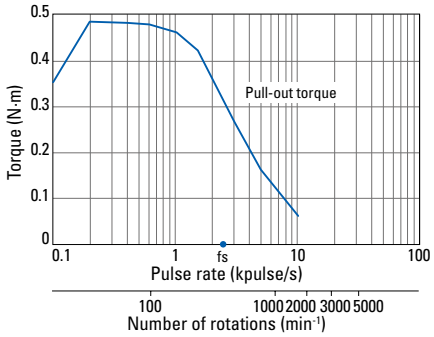

### SH1424-5041 SH1424-5011

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

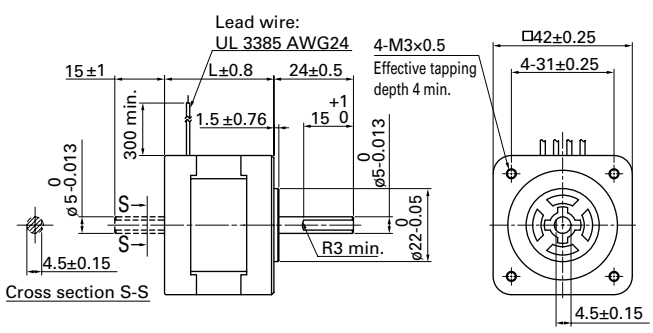



### SH1424-5241 SH1424-5211

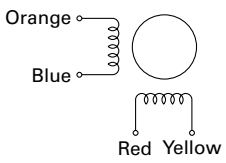
Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

- For motor model no. SH142 □ -50 □ 1 (1 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For model no. SH142 □ -52 □ 1 (2 A/phase)
  Model no.: BS1D200P10 (DC input)
  Operating current select switch setting: 0

*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 42 mm sq.

1.8°/step **Slim form** **RoHS**

Bipolar winding, Lead wire type

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

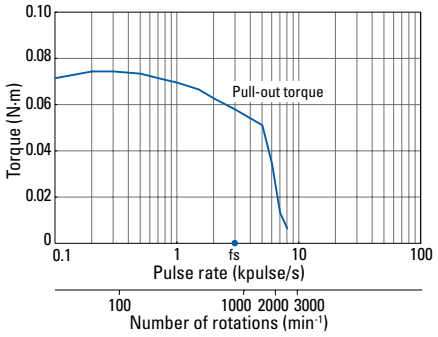
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | $\times10^{-4}$kg·m² | kg | mm |
| **SS2421-5041** | **SS2421-5011** | 0.083 | 1 | 3.5 | 1.2 | 0.015 | 0.07 | 11.6 |
| **SS2422-5041** | **SS2422-5011** | 0.186 | 1 | 5.4 | 2.9 | 0.028 | 0.14 | 18.6 |

## Characteristics diagram

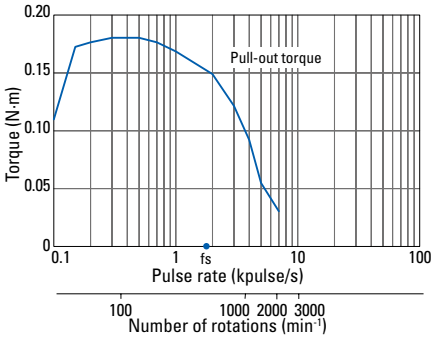
**SS2421-5041**
**SS2421-5011**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.33×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

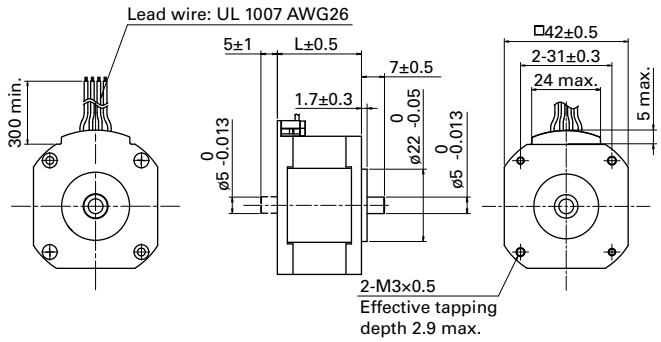



**SS2422-5041**
**SS2422-5011**

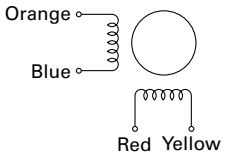
Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.33×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

Driver is not included.

If you require assistance finding a driver, contact us for details.



Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 42 mm sq.

1.8°/step RoHS

Unipolar winding, Connector type

Bipolar winding, Connector type ▶p. 46

**Customizing**

Shaft length | Shaft shape

Varies depending on the model number and quantity. Contact us for details.

**Unipolar winding, Connector type**

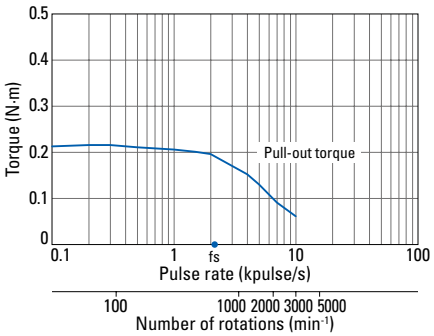
| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| SF2421-12U41 | SF2421-12U11 | 0.22 | 1.2 | 2.4 | 2.4 | 0.031 | 0.23 | 33±0.5 |
| SF2422-12U41 | SF2422-12U11 | 0.33 | 1.2 | 3 | 3.3 | 0.046 | 0.3 | 39±0.5 |
| SF2423-12U41 | SF2423-12U11 | 0.4 | 1.2 | 3.4 | 3.9 | 0.063 | 0.38 | 48±0.5 |
| SF2424-12U41 | SF2424-12U11 | 0.58 | 1.2 | 4.4 | 5.4 | 0.094 | 0.51 | 59.5±1 |

Motor cable: model no. 4835710-1

## Characteristics diagram

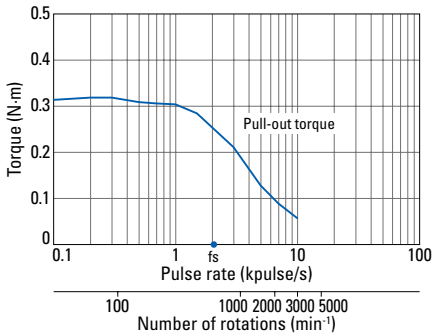
**SF2421-12U41 SF2421-12U11**

Constant current circuit
Source voltage: 24 VDC
Operating current: 1.2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



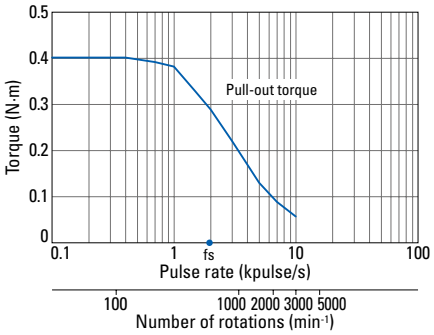

**SF2422-12U41 SF2422-12U11**

Constant current circuit
Source voltage: 24 VDC
Operating current: 1.2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



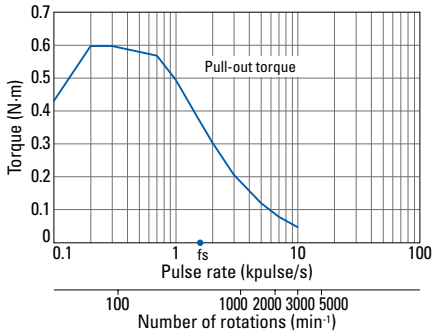

**SF2423-12U41 SF2423-12U11**

Constant current circuit
Source voltage: 24 VDC
Operating current: 1.2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

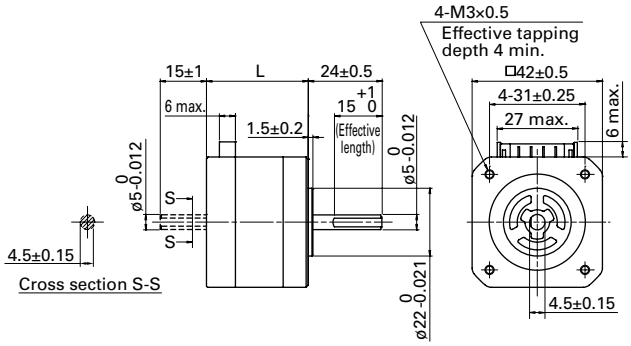



**SF2424-12U41 SF2424-12U11**

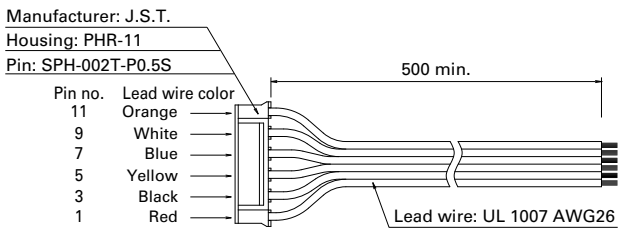
Constant current circuit
Source voltage: 24 VDC
Operating current: 1.2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)

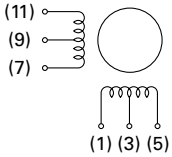



Option (sold separately): Motor cable model no. 4835774-1




This motor cable is for model no. SF242□-12U□1.

## Internal wiring ( ) connector pin number




## Compatible drivers

Model no.: US1D200P10

Operating current select switch setting: 8

*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 42 mm sq.

1.8°/step RoHS

Bipolar winding, Connector type

Unipolar winding, Connector type ▶p. 45

**Customizing**

Shaft length Shaft shape

Varies depending on the model number and quantity. Contact us for details.

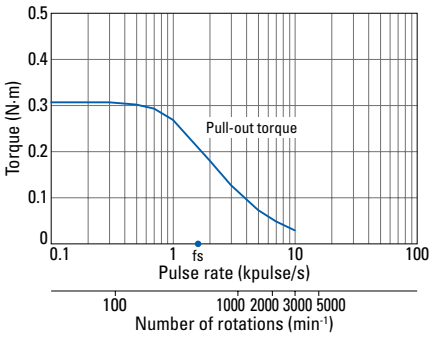
**Bipolar winding, Connector type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SF2421-10B41** | **SF2421-10B11** | 0.29 | 1 | 3.6 | 7 | 0.031 | 0.23 | 33±0.5 |
| **SF2422-10B41** | **SF2422-10B11** | 0.43 | 1 | 4.6 | 9.6 | 0.046 | 0.3 | 39±0.5 |
| **SF2423-10B41** | **SF2423-10B11** | 0.56 | 1 | 5.3 | 12.5 | 0.063 | 0.38 | 48±0.5 |
| **SF2424-10B41** | **SF2424-10B11** | 0.8 | 1 | 6.5 | 16 | 0.094 | 0.51 | 59.5±1 |

## Characteristics diagram

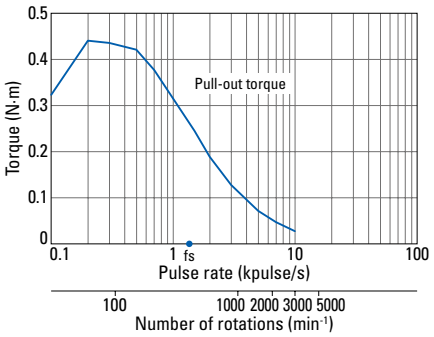
### SF2421-10B41 SF2421-10B11

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



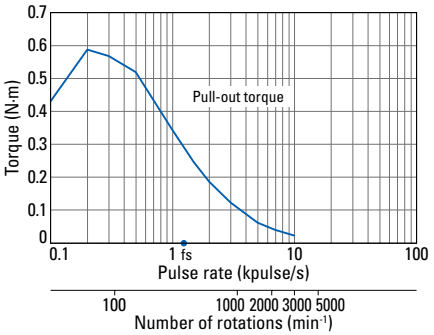

### SF2422-10B41 SF2422-10B11

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



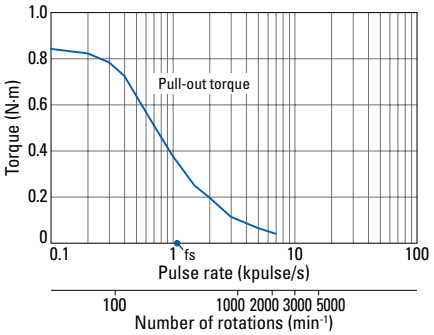

### SF2423-10B41 SF2423-10B11

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




### SF2424-10B41 SF2424-10B11

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

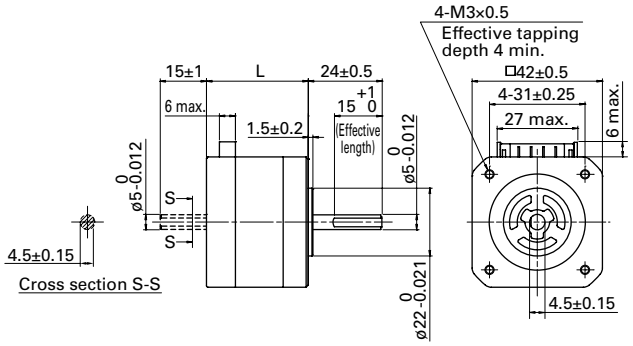




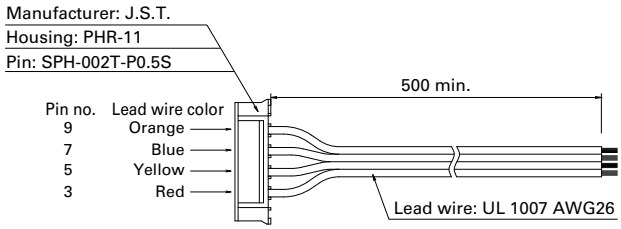

Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Dimensions (Unit: mm)

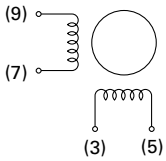



Option (sold separately): Motor cable model no. 4835775-1




This motor cable is for model no. SF242□-10B□1.

## Internal wiring ( ) connector pin number




## Compatible drivers

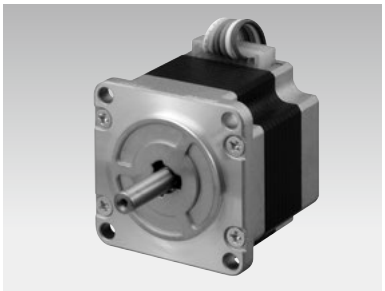
Model no.: BS1D200P10

Operating current select switch setting: A

*The characteristics diagram shown above is from our experimental circuit.*


Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73


Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 50 mm sq.

1.8°/step RoHS

Unipolar winding, Lead wire type

Bipolar winding, Lead wire type ▶p. 50

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

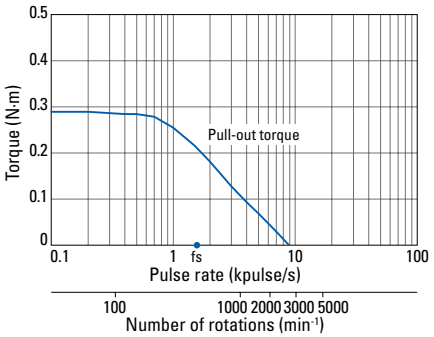
**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H6701-0140** | **103H6701-0110** | 0.28 | 1 | 4.3 | 6.8 | 0.057 | 0.35 | 39.8 |
| **103H6701-0440** | **103H6701-0410** | 0.28 | 2 | 1.1 | 1.6 | 0.057 | 0.35 | 39.8 |
| **103H6701-0740** | **103H6701-0710** | 0.28 | 3 | 0.6 | 0.7 | 0.057 | 0.35 | 39.8 |
| **103H6703-0140** | **103H6703-0110** | 0.49 | 1 | 6 | 13 | 0.118 | 0.5 | 51.3 |
| **103H6703-0440** | **103H6703-0410** | 0.49 | 2 | 1.6 | 3.2 | 0.118 | 0.5 | 51.3 |
| **103H6703-0740** | **103H6703-0710** | 0.49 | 3 | 0.83 | 1.4 | 0.118 | 0.5 | 51.3 |
| **103H6704-0140** | **103H6704-0110** | 0.52 | 1 | 6.5 | 16.5 | 0.14 | 0.55 | 55.8 |
| **103H6704-0440** | **103H6704-0410** | 0.52 | 2 | 1.7 | 3.8 | 0.14 | 0.55 | 55.8 |
| **103H6704-0740** | **103H6704-0710** | 0.53 | 3 | 0.9 | 1.7 | 0.14 | 0.55 | 55.8 |

## Characteristics diagram

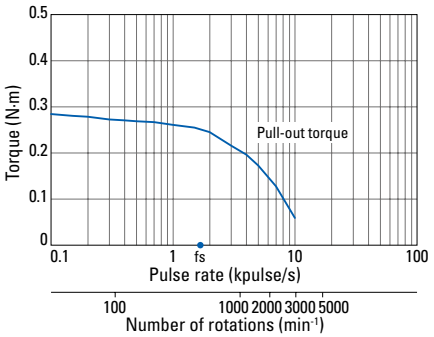
**103H6701-0140**
**103H6701-0110**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



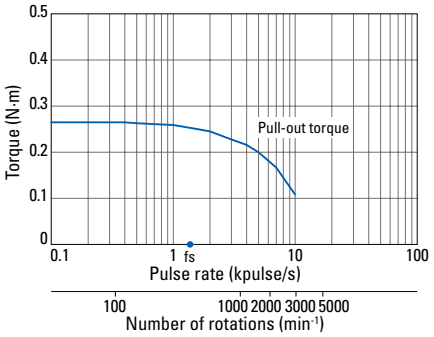

**103H6701-0440**
**103H6701-0410**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



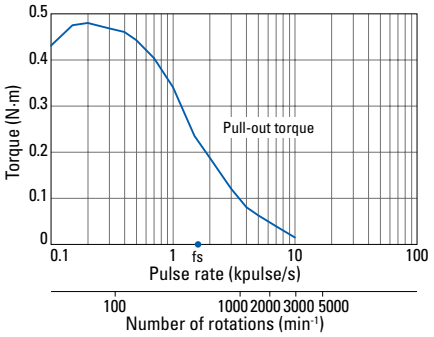

**103H6701-0740**
**103H6701-0710**

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



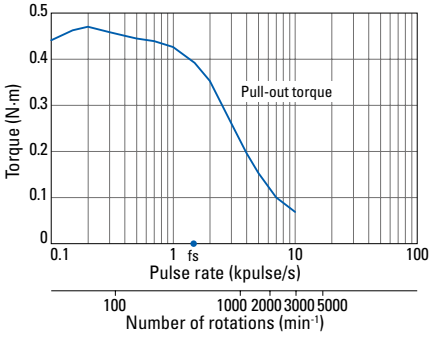

**103H6703-0140**
**103H6703-0110**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



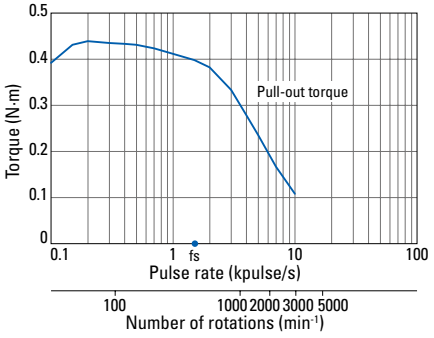

**103H6703-0440**
**103H6703-0410**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




**103H6703-0740**
**103H6703-0710**

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded





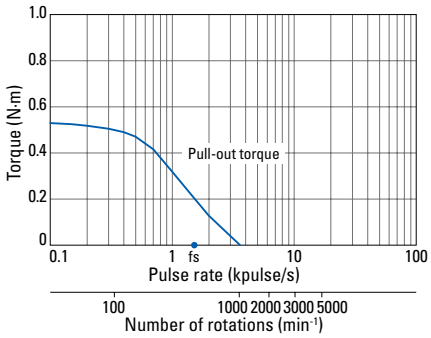

Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Characteristics diagram

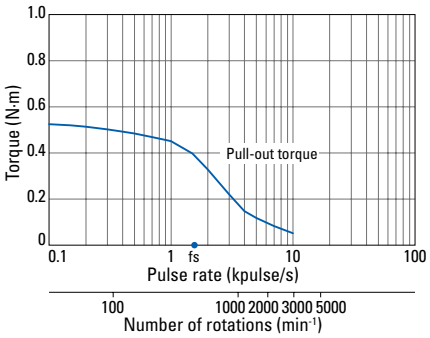
### 103H6704-0140 103H6704-0110

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



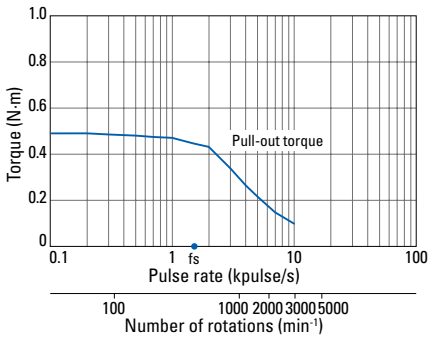

### 103H6704-0440 103H6704-0410

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

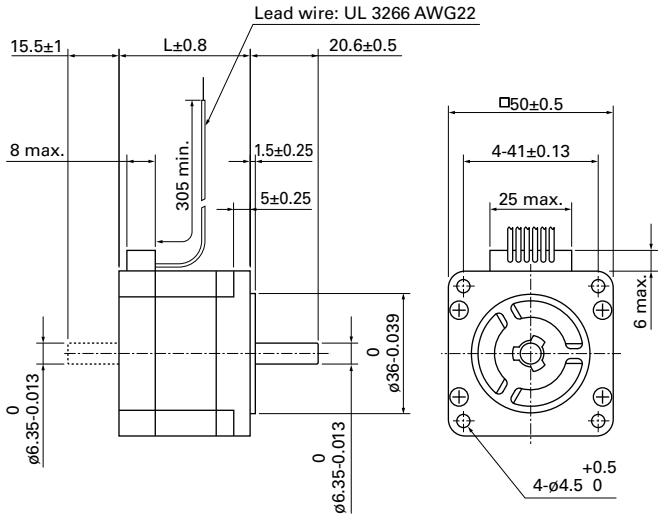



### 103H6704-0740 103H6704-0710

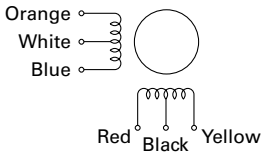
Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring



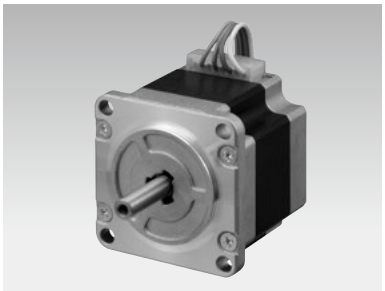

## Compatible drivers

- For motor model no. 103H670 □ -01 □ 0 (1 A/phase), 103H670 □ -07 □ 0 (3 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For model no. 103H670 □ -04 □ 0 (2 A/phase)
  Model no.: US1D200P10 (DC input)
  Operating current select switch setting: 0

*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 50 mm sq.

1.8°/step RoHS

Bipolar winding, Lead wire type

Unipolar winding, Lead wire type ▶p. 48

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

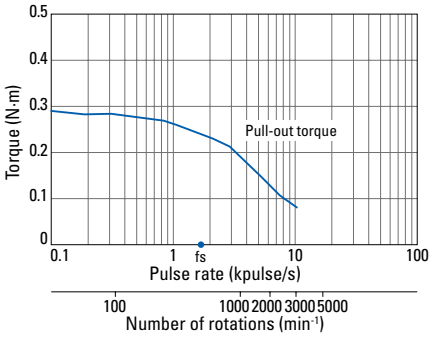
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H6701-5040** | **103H6701-5010** | 0.28 | 2 | 0.6 | 1.6 | 0.057 | 0.35 | 39.8 |
| **103H6703-5040** | **103H6703-5010** | 0.49 | 2 | 0.8 | 3.2 | 0.118 | 0.5 | 51.3 |
| **103H6704-5040** | **103H6704-5010** | 0.52 | 2 | 0.9 | 3.8 | 0.14 | 0.55 | 55.8 |

## Characteristics diagram

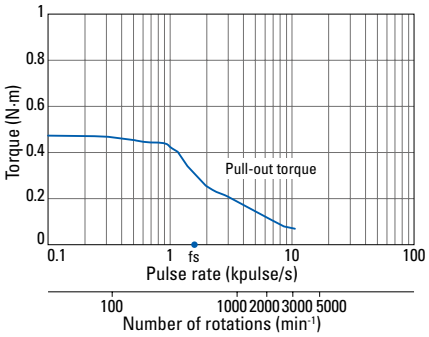
**103H6701-5040**
**103H6701-5010**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



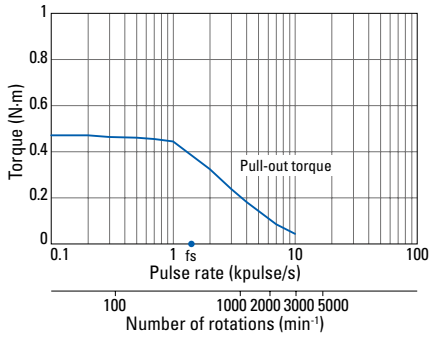

**103H6703-5040**
**103H6703-5010**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

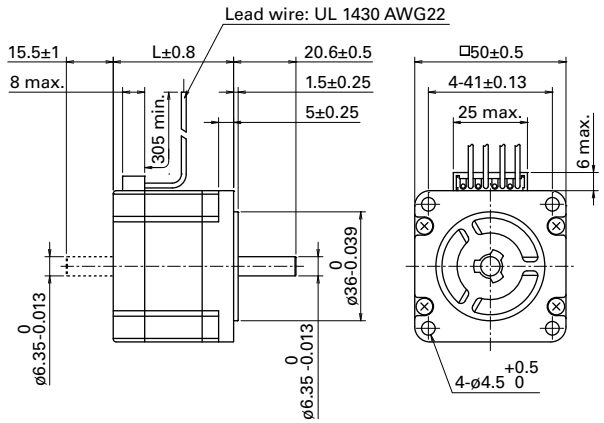



**103H6704-5040**
**103H6704-5010**

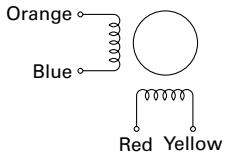
Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

Model no.: BS1D200P10 (DC input)

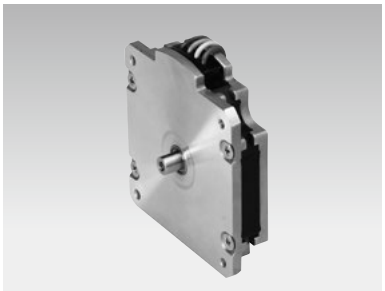
Operating current select switch setting: 0

*The characteristics diagram shown above is from our experimental circuit.*



Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 50 mm sq.

1.8°/step **Slim form** **RoHS**

Bipolar winding, Lead wire type

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

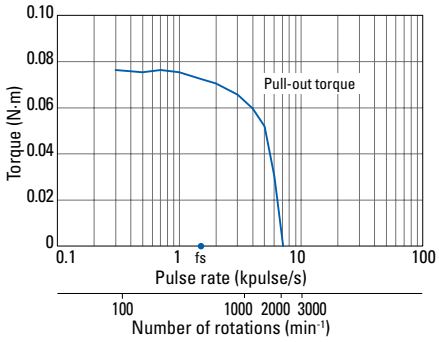
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | $\times 10^{-4}$kg·m² | kg | mm |
| **SS2501-8040** | **SS2501-8010** | 0.1 | 1 | 4.5 | 2 | 0.026 | 0.09 | 11.4 |
| **SS2502-8040** | **SS2502-8010** | 0.215 | 1 | 5.9 | 3.2 | 0.049 | 0.15 | 16.4 |

## Characteristics diagram

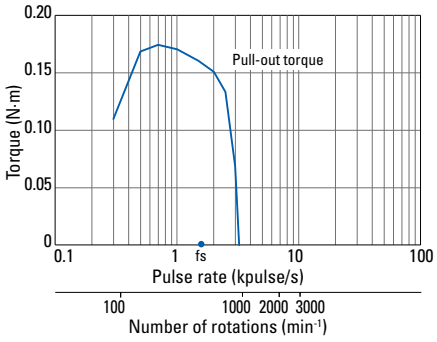
**SS2501-8040**
**SS2501-8010**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10$^{-4}$kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded

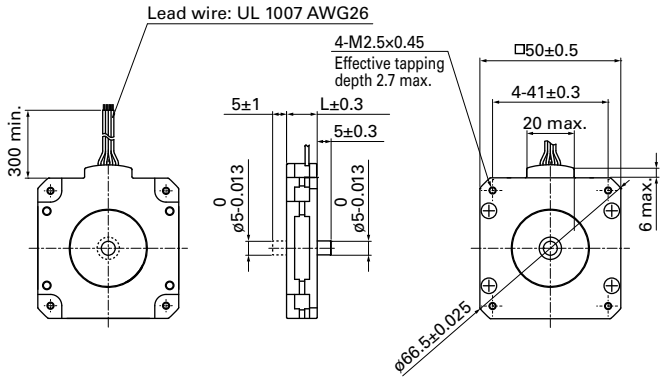



**SS2502-8040**
**SS2502-8010**

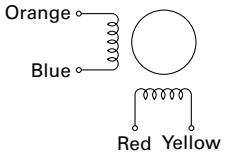
Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.01×10$^{-4}$kg·m² (pulley balancer method)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

Driver is not included.

If you require assistance finding a driver, contact us for details.

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 56 mm sq.

1.8°/step RoHS

Unipolar winding, Lead wire type

Bipolar winding, Lead wire type ▶p. 54

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder

Varies depending on the model number and quantity. Contact us for details.

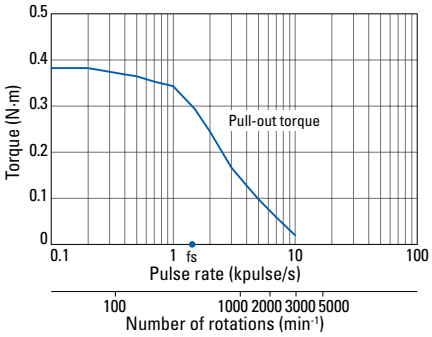
**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H7121-0140** | **103H7121-0110** | 0.39 | 1 | 4.8 | 8 | 0.1 | 0.47 | 41.8 |
| **103H7121-0440** | **103H7121-0410** | 0.39 | 2 | 1.25 | 1.9 | 0.1 | 0.47 | 41.8 |
| **103H7121-0740** | **103H7121-0710** | 0.39 | 3 | 0.6 | 0.8 | 0.1 | 0.47 | 41.8 |
| **103H7123-0140** | **103H7123-0110** | 0.83 | 1 | 6.7 | 15 | 0.21 | 0.65 | 53.8 |
| **103H7123-0440** | **103H7123-0410** | 0.83 | 2 | 1.6 | 3.8 | 0.21 | 0.65 | 53.8 |
| **103H7123-0740** | **103H7123-0710** | 0.78 | 3 | 0.77 | 1.58 | 0.21 | 0.65 | 53.8 |
| **103H7124-0140** | **103H7124-0110** | 0.98 | 1 | 7 | 14.5 | 0.245 | 0.8 | 63.8 |
| **103H7124-0440** | **103H7124-0410** | 0.98 | 2 | 1.7 | 3.1 | 0.245 | 0.8 | 63.8 |
| **103H7124-0740** | **103H7124-0710** | 0.98 | 3 | 0.74 | 1.4 | 0.245 | 0.8 | 63.8 |
| **103H7126-0140** | **103H7126-0110** | 1.27 | 1 | 8.6 | 19 | 0.36 | 0.98 | 75.8 |
| **103H7126-0440** | **103H7126-0410** | 1.27 | 2 | 2 | 4.5 | 0.36 | 0.98 | 75.8 |
| **103H7126-0740** | **103H7126-0710** | 1.27 | 3 | 0.9 | 2.2 | 0.36 | 0.98 | 75.8 |

## Characteristics diagram

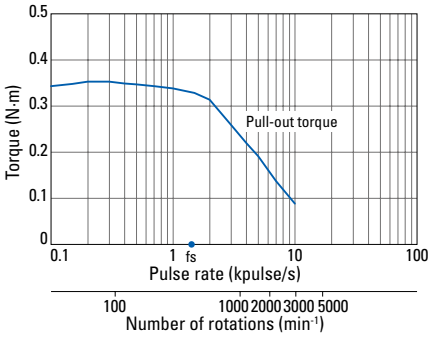
**103H7121-0140**
**103H7121-0110**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



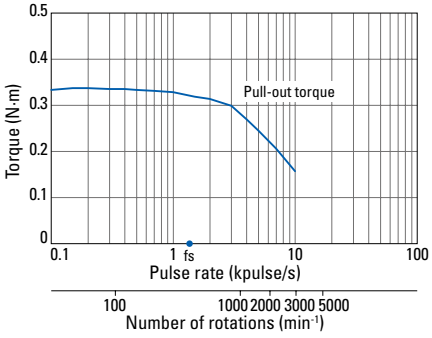

**103H7121-0440**
**103H7121-0410**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



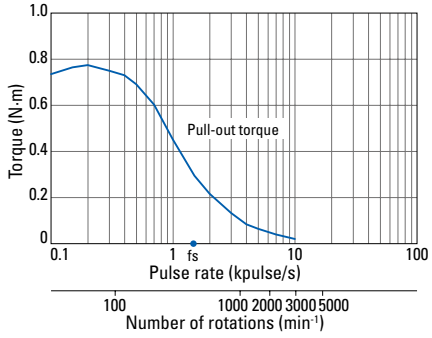

**103H7121-0740**
**103H7121-0710**

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



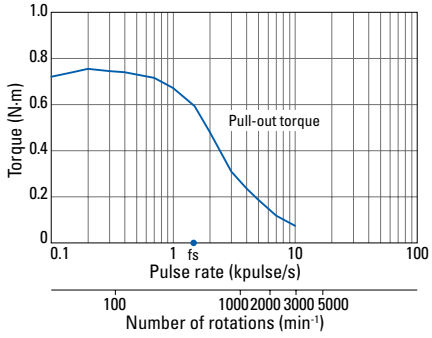

**103H7123-0140**
**103H7123-0110**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



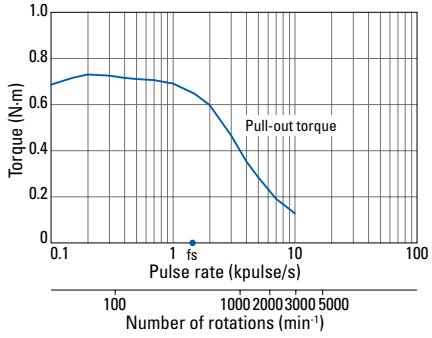

**103H7123-0440**
**103H7123-0410**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




**103H7123-0740**
**103H7123-0710**

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded





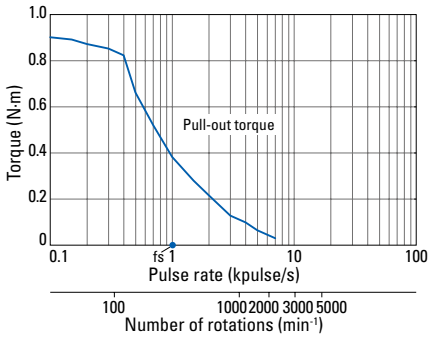

Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Characteristics diagram

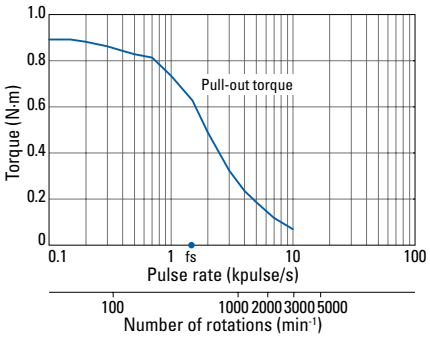
### 103H7124-0140 103H7124-0110

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



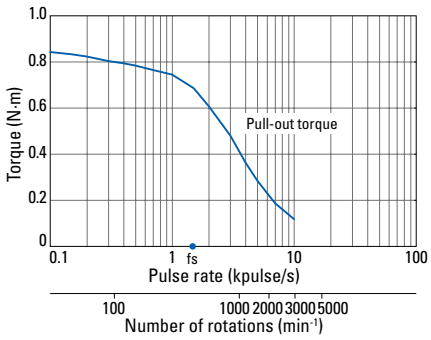

### 103H7124-0440 103H7124-0410

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



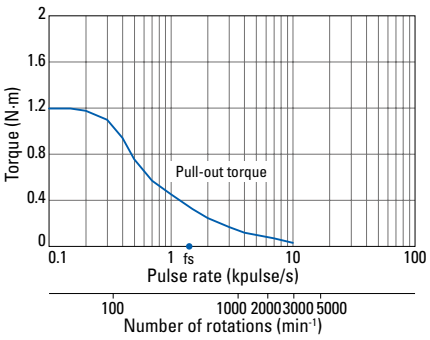

### 103H7124-0740 103H7124-0710

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



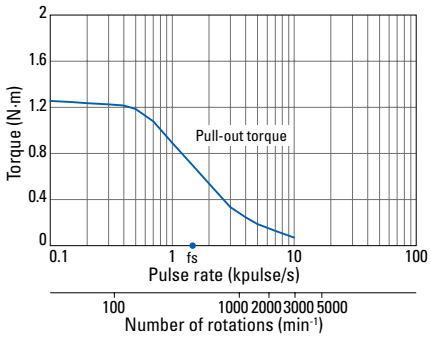

### 103H7126-0140 103H7126-0110

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



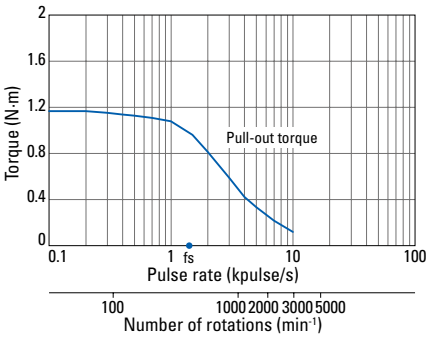

### 103H7126-0440 103H7126-0410

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

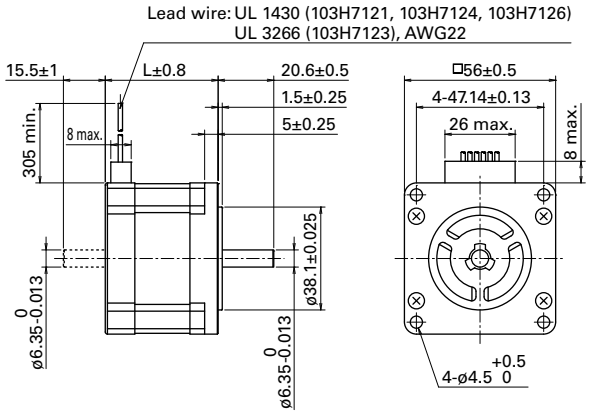



### 103H7126-0740 103H7126-0710

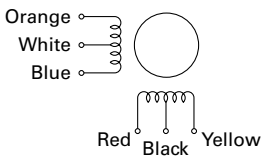
Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring



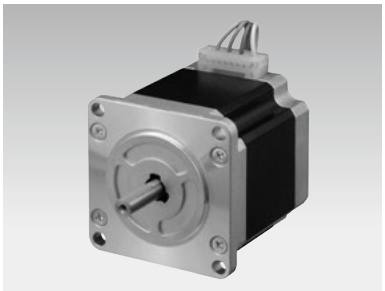

## Compatible drivers

- For motor model no. 103H712 □ -01 □ 0 (1 A/phase), 103H712 □ -07 □ 0 (3 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For model no. 103H712 □ -04 □ 0 (2 A/phase)
  Model no.: US1D200P10 (DC input)
  Operating current select switch setting: 0

*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 56 mm sq.

1.8°/step RoHS

Bipolar winding, Lead wire type

Unipolar winding, Lead wire type ▶p. 52

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder

Varies depending on the model number and quantity. Contact us for details.

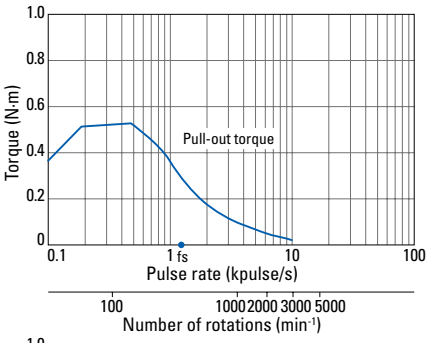
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) | Shaft diameter (D) | Dcut thickness (T) |
|---|---|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm | mm | mm |
| **103H7121-5640** | **103H7121-5610** | 0.55 | 1 | 4.3 | 14.5 | 0.1 | 0.47 | 41.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7121-5740** | **103H7121-5710** | 0.55 | 2 | 1.1 | 3.7 | 0.1 | 0.47 | 41.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7121-5840** | **103H7121-5810** | 0.55 | 3 | 0.54 | 1.74 | 0.1 | 0.47 | 41.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7123-5640** | **103H7123-5610** | 1.0 | 1 | 5.7 | 29.4 | 0.21 | 0.65 | 53.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7123-5740** | **103H7123-5710** | 1.0 | 2 | 1.5 | 7.5 | 0.21 | 0.65 | 53.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7123-5840** | **103H7123-5810** | 1.0 | 3 | 0.7 | 3.5 | 0.21 | 0.65 | 53.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7126-5640** | **103H7126-5610** | 1.6 | 1 | 7.7 | 34.6 | 0.36 | 0.98 | 75.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7126-5740** | **103H7126-5710** | 1.6 | 2 | 2 | 9.1 | 0.36 | 0.98 | 75.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7126-5840** | **103H7126-5810** | 1.6 | 3 | 0.94 | 4 | 0.36 | 0.98 | 75.8 | 0 ø6.35-0.013 | 5.8 |
| **103H7128-5640** | **103H7128-5610** | 2.0 | 1 | 8.9 | 40.1 | 0.49 | 1.3 | 94.8 | 0 ø8-0.015 | 7.5 |
| **103H7128-5740** | **103H7128-5710** | 2.0 | 2 | 2.3 | 10.4 | 0.49 | 1.3 | 94.8 | 0 ø8-0.015 | 7.5 |
| **103H7128-5840** | **103H7128-5810** | 2.0 | 3 | 1.03 | 4.3 | 0.49 | 1.3 | 94.8 | 0 ø8-0.015 | 7.5 |

## Characteristics diagram

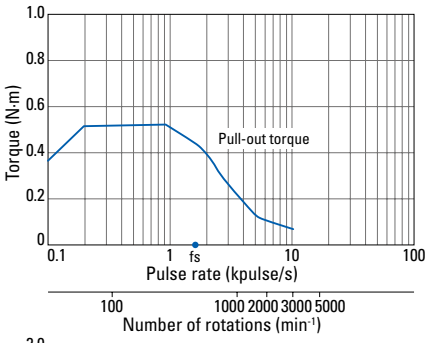
### 103H7121-5640 / 103H7121-5610

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



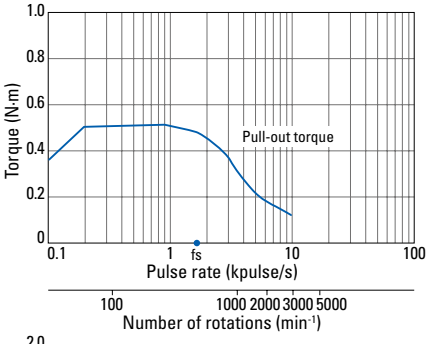

### 103H7121-5740 / 103H7121-5710

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



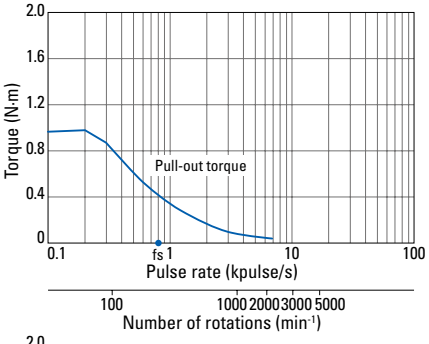

### 103H7121-5840 / 103H7121-5810

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



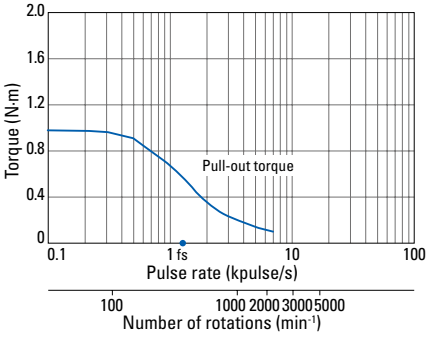

### 103H7123-5640 / 103H7123-5610

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



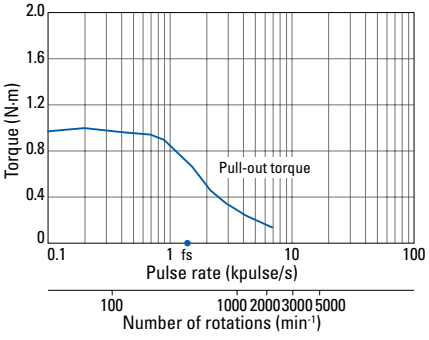

### 103H7123-5740 / 103H7123-5710

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




### 103H7123-5840 / 103H7123-5810

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded





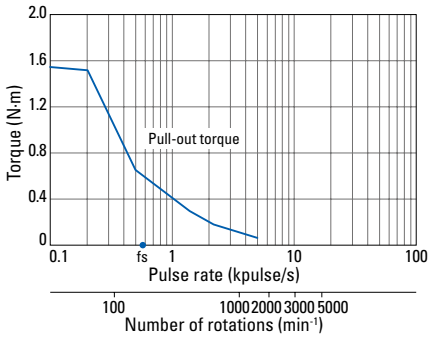

Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Characteristics diagram

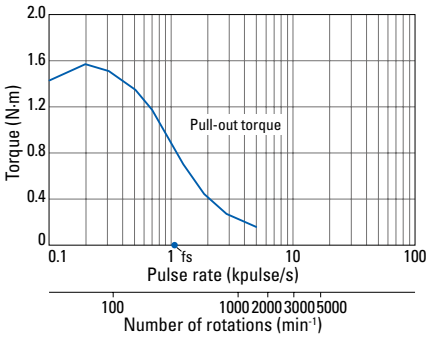
### 103H7126-5640 103H7126-5610

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



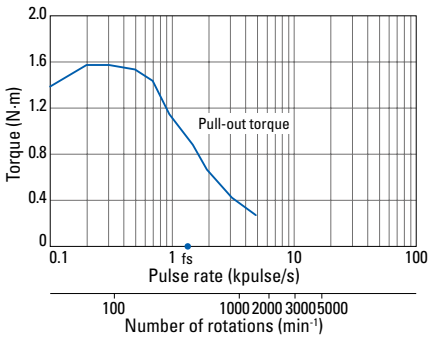

### 103H7126-5740 103H7126-5710

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



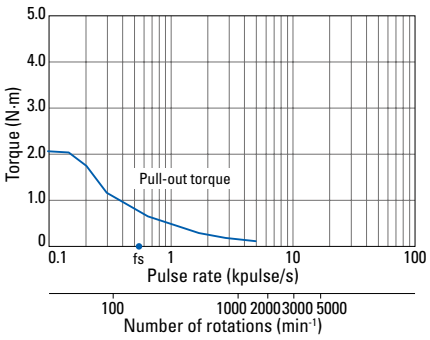

### 103H7126-5840 103H7126-5810

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



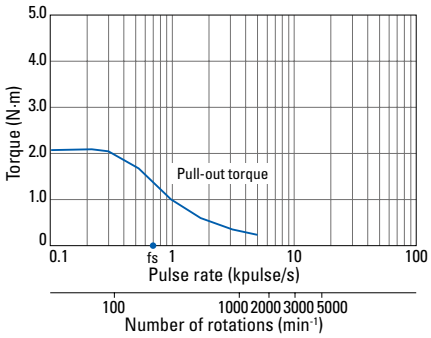

### 103H7128-5640 103H7128-5610

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



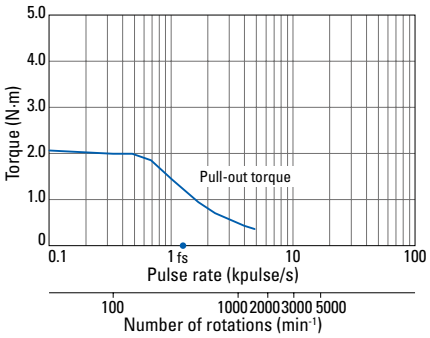

### 103H7128-5740 103H7128-5710

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

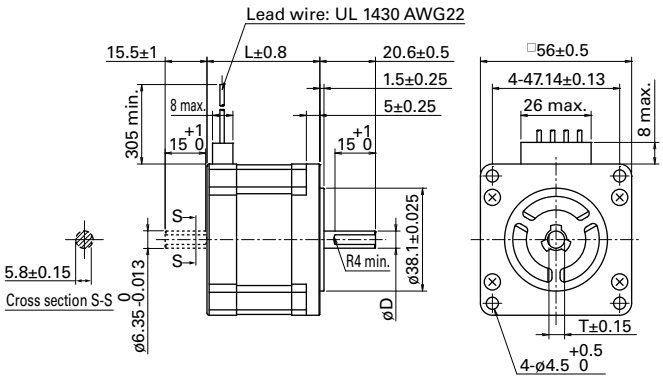



### 103H7128-5840 103H7128-5810

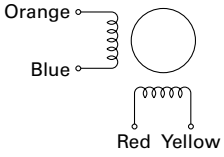
Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

- For Motor model no. 103H7121-57 □ 0 (2 A/phase), 103H7123-57 □ 0 (2 A/phase), 103H7126-57 □ 0 (2 A/phase)
  Model no.: BS1D200P10 (DC input)
  Operating current select switch setting: 0
- Driver is not included for other motor model nos.
  If you require assistance finding a driver, contact us for details.

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 60 mm sq.

0.9°/step RoHS

Unipolar winding, Lead wire type
Bipolar winding, Lead wire type

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder

Varies depending on the model number and quantity. Contact us for details.

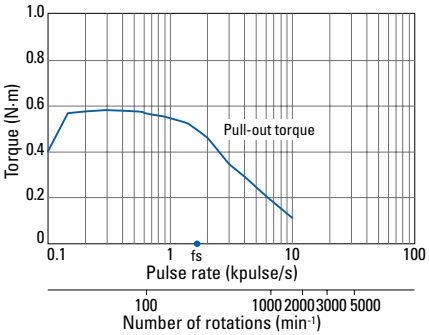
**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) | Shaft diameter (D) |
|---|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm | mm |
| **SH1601-0440** | **SH1601-0410** | 0.57 | 2 | 1.35 | 2 | 0.24 | 0.55 | 42 | 0 ø6.35 -0.013 |
| **SH1602-0440** | **SH1602-0410** | 1.1 | 2 | 1.8 | 3.5 | 0.4 | 0.8 | 54 | 0 ø6.35 -0.013 |
| **SH1603-0440** | **SH1603-0410** | 1.7 | 2 | 2.3 | 4.5 | 0.75 | 1.2 | 76 | 0 ø8 -0.015 |

## Characteristics diagram

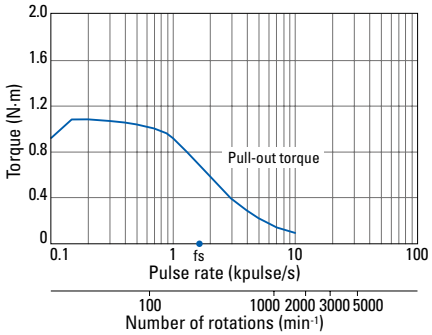
**SH1601-0440**
**SH1601-0410**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



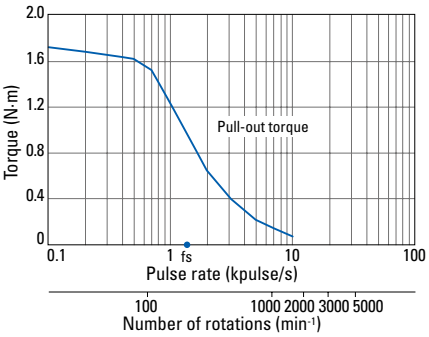

**SH1602-0440**
**SH1602-0410**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

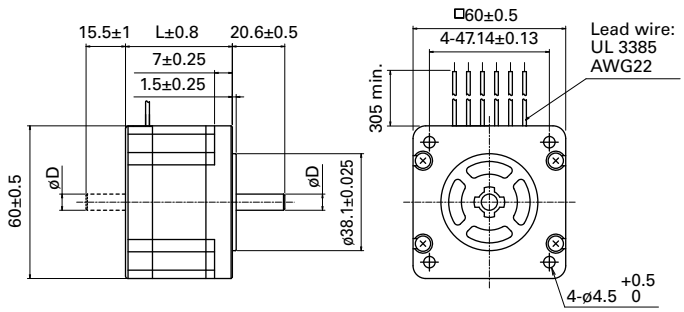



**SH1603-0440**
**SH1603-0410**

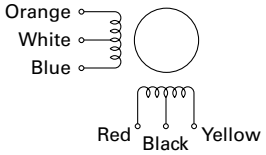
Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

Driver is not included.

If you require assistance finding a driver, contact us for details.



Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

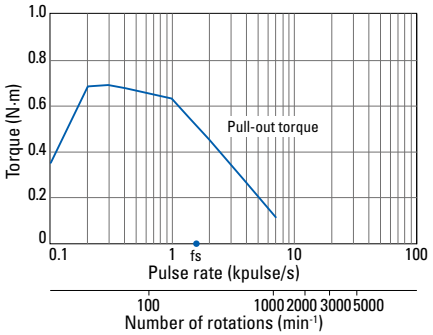
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) | Shaft diameter (D) |
|---|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm | mm |
| **SH1601-5240** | **SH1601-5210** | 0.69 | 2 | 1.2 | 3.5 | 0.24 | 0.55 | 42 | 0 ø6.35 -0.013 |
| **SH1602-5240** | **SH1602-5210** | 1.28 | 2 | 1.65 | 6.1 | 0.4 | 0.8 | 54 | 0 ø6.35 -0.013 |
| **SH1603-5240** | **SH1603-5210** | 2.15 | 2 | 2.3 | 8.8 | 0.75 | 1.2 | 76 | 0 ø8 -0.015 |

## Characteristics diagram

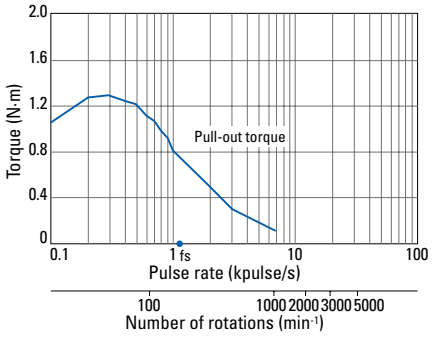
### SH1601-5240 SH1601-5210

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



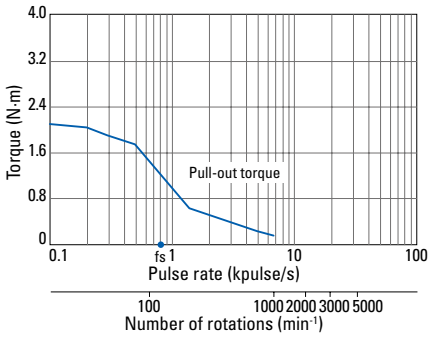

### SH1602-5240 SH1602-5210

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

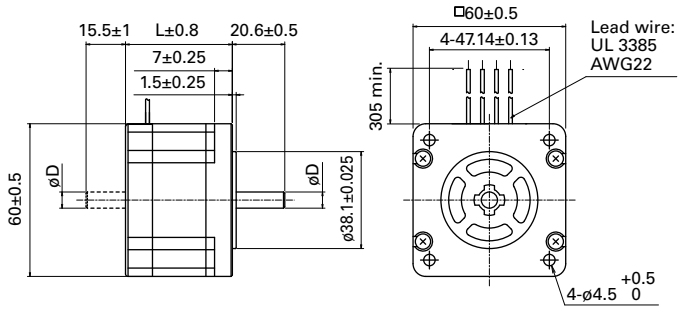



### SH1603-5240 SH1603-5210

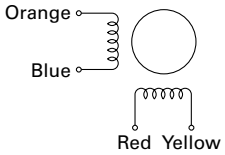
Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring

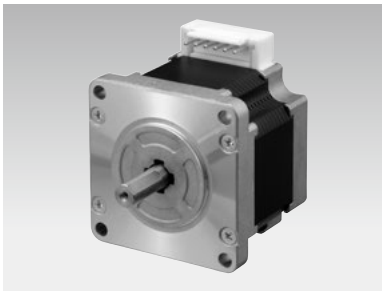



## Compatible drivers

Model no.: BS1D200P10 (DC input)
Operating current select switch setting: 0
*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 60 mm sq.

1.8°/step RoHS

Unipolar winding, Connector type
Unipolar winding, Lead wire type
Dimensions for attaching NEMA23 are interchangeable (47.14 mm-pitch)
Bipolar winding, Connector type ▶p. 60
Bipolar winding, Lead wire type
Dimensions for attaching NEMA23 are interchangeable (47.14 mm-pitch) ▶p. 60

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder | Brake

Varies depending on the model number and quantity. Contact us for details.

**Unipolar winding, Connector type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H7821-0140** | **103H7821-0110** | 0.78 | 1 | 5.7 | 8.3 | 0.275 | 0.6 | 44.8 |
| **103H7821-0440** | **103H7821-0410** | 0.78 | 2 | 1.5 | 2 | 0.275 | 0.6 | 44.8 |
| **103H7821-0740** | **103H7821-0710** | 0.78 | 3 | 0.68 | 0.8 | 0.275 | 0.6 | 44.8 |
| **103H7822-0140** | **103H7822-0110** | 1.17 | 1 | 6.9 | 14 | 0.4 | 0.77 | 53.8 |
| **103H7822-0440** | **103H7822-0410** | 1.17 | 2 | 1.8 | 3.6 | 0.4 | 0.77 | 53.8 |
| **103H7822-0740** | **103H7822-0710** | 1.17 | 3 | 0.8 | 1.38 | 0.4 | 0.77 | 53.8 |
| **103H7823-0140** | **103H7823-0110** | 2.1 | 1 | 10 | 21.7 | 0.84 | 1.34 | 85.8 |
| **103H7823-0440** | **103H7823-0410** | 2.1 | 2 | 2.7 | 5.6 | 0.84 | 1.34 | 85.8 |
| **103H7823-0740** | **103H7823-0710** | 2.1 | 3 | 1.25 | 2.4 | 0.84 | 1.34 | 85.8 |

Motor cable: model no. 4837798-1

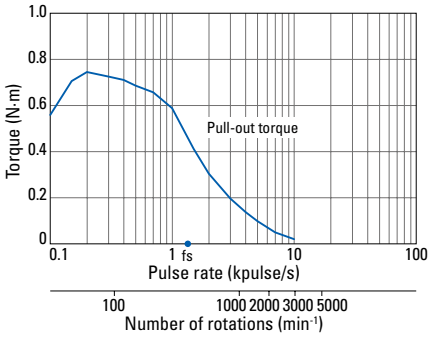
**Unipolar winding, Lead wire type Dimensions for attaching NEMA23 are interchangeable (47.14 mm-pitch)**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H7821-0160** | **103H7821-0130** | 0.78 | 1 | 5.7 | 8.3 | 0.275 | 0.6 | 43.5 |
| **103H7821-0460** | **103H7821-0430** | 0.78 | 2 | 1.5 | 2 | 0.275 | 0.6 | 43.5 |
| **103H7821-0760** | **103H7821-0730** | 0.78 | 3 | 0.68 | 0.8 | 0.275 | 0.6 | 43.5 |
| **103H7822-0160** | **103H7822-0130** | 1.17 | 1 | 6.9 | 14 | 0.4 | 0.77 | 52.5 |
| **103H7822-0460** | **103H7822-0430** | 1.17 | 2 | 1.8 | 3.6 | 0.4 | 0.77 | 52.5 |
| **103H7822-0760** | **103H7822-0730** | 1.17 | 3 | 0.8 | 1.38 | 0.4 | 0.77 | 52.5 |
| **103H7823-0160** | **103H7823-0130** | 2.1 | 1 | 10 | 21.7 | 0.84 | 1.34 | 84.5 |
| **103H7823-0460** | **103H7823-0430** | 2.1 | 2 | 2.7 | 5.6 | 0.84 | 1.34 | 84.5 |
| **103H7823-0760** | **103H7823-0730** | 2.1 | 3 | 1.25 | 2.4 | 0.84 | 1.34 | 84.5 |

## Characteristics diagram

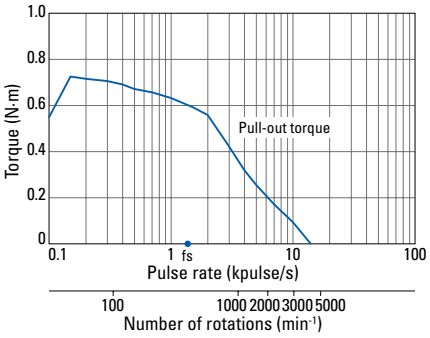
**103H7821-0140**
**103H7821-0110**
**103H7821-0160**
**103H7821-0130**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



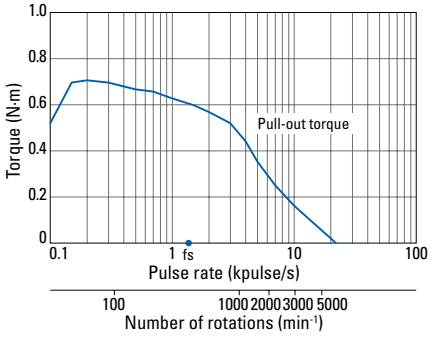

**103H7821-0440**
**103H7821-0410**
**103H7821-0460**
**103H7821-0430**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



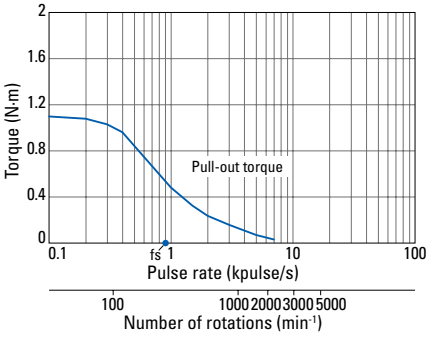

**103H7821-0740**
**103H7821-0710**
**103H7821-0760**
**103H7821-0730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




**103H7822-0140**
**103H7822-0110**
**103H7822-0160**
**103H7822-0130**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded





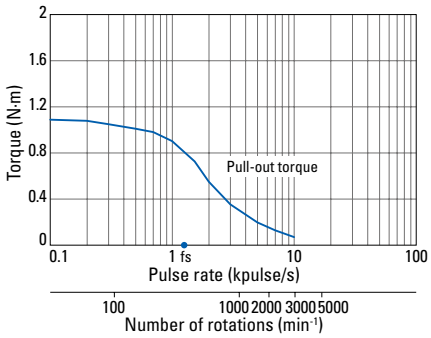

Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Characteristics diagram

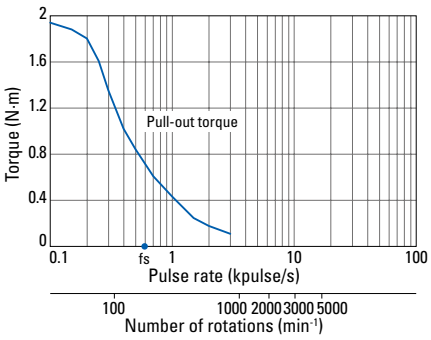
**103H7822-0440**
**103H7822-0410**
**103H7822-0460**
**103H7822-0430**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



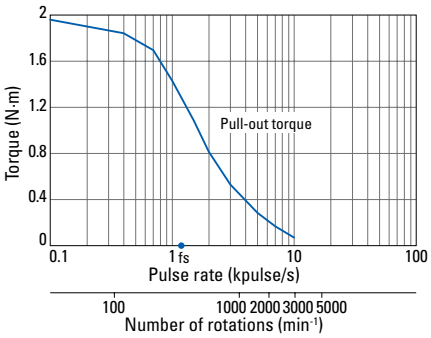

**103H7823-0140**
**103H7823-0110**
**103H7823-0160**
**103H7823-0130**

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



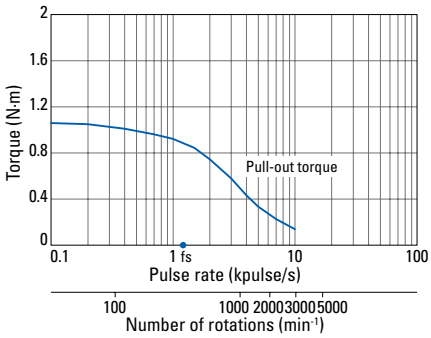

**103H7823-0740**
**103H7823-0710**
**103H7823-0760**
**103H7823-0730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



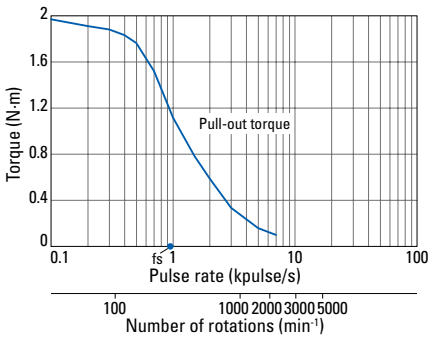

**103H7822-0740**
**103H7822-0710**
**103H7822-0760**
**103H7822-0730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



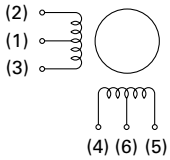

**103H7823-0440**
**103H7823-0410**
**103H7823-0460**
**103H7823-0430**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

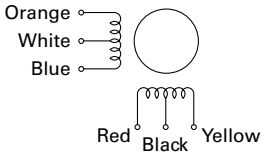



## Internal wiring

**Connector type**
( ) connector pin number

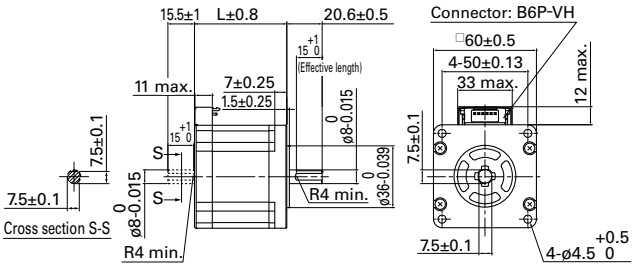



**Lead wire type**

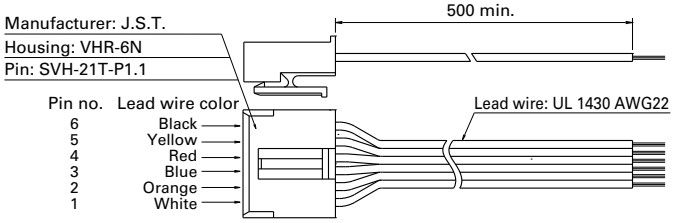



## Dimensions (Unit: mm)

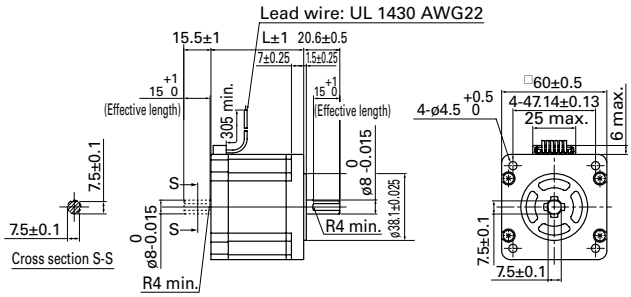
**Connector type**




Motor cable Unipolar Model no.: 4837798-1




**Lead wire type**



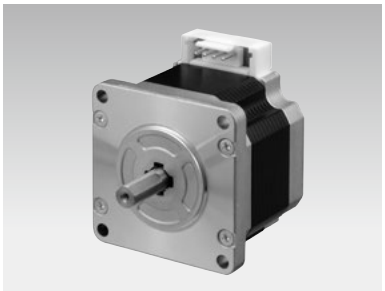

## Compatible drivers

- For motor model no. 103H782 □ -01 □ 0 (1 A/phase), 103H782 □ -07 □ 0 (3 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For model no. 103H782 □ -04 □ 0 (2 A/phase)
  Model no.: US1D200P10 (DC input)
  Operating current select switch setting: 0

*The characteristics diagram shown above is from our experimental circuit.*

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 60 mm sq.

1.8°/step RoHS

Bipolar winding, Connector type
Bipolar winding, Lead wire type
Dimensions for attaching NEMA23 are interchangeable (47.14 mm-pitch)
Unipolar winding, Connector type ▶p. 58
Unipolar winding, Lead wire type
Dimensions for attaching NEMA23 are interchangeable (47.14 mm-pitch) ▶p. 58

**Customizing**

Hollow | Shaft modification | Decelerator | Encoder | Brake

Varies depending on the model number and quantity. Contact us for details.

**Bipolar winding, Connector type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H7821-5740** | **103H7821-5710** | 0.88 | 2 | 1.27 | 3.3 | 0.275 | 0.6 | 44.8 |
| **103H7821-1740** | **103H7821-1710** | 0.88 | 4 | 0.35 | 0.8 | 0.275 | 0.6 | 44.8 |
| **103H7822-5740** | **103H7822-5710** | 1.37 | 2 | 1.55 | 5.5 | 0.4 | 0.77 | 53.8 |
| **103H7822-1740** | **103H7822-1710** | 1.37 | 4 | 0.43 | 1.38 | 0.4 | 0.77 | 53.8 |
| **103H7823-5740** | **103H7823-5710** | 2.7 | 2 | 2.4 | 9.5 | 0.84 | 1.34 | 85.8 |
| **103H7823-1740** | **103H7823-1710** | 2.7 | 4 | 0.65 | 2.4 | 0.84 | 1.34 | 85.8 |

Motor cable: model no. 4837961-1

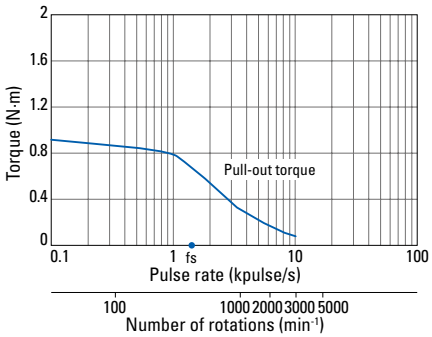
**Bipolar winding, Lead wire type Dimensions for attaching NEMA23 are interchangeable (47.14 mm-pitch)**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H7821-5760** | **103H7821-5730** | 0.88 | 2 | 1.27 | 3.3 | 0.275 | 0.6 | 43.5 |
| **103H7821-1760** | **103H7821-1730** | 0.88 | 4 | 0.35 | 0.8 | 0.275 | 0.6 | 43.5 |
| **103H7822-5760** | **103H7822-5730** | 1.37 | 2 | 1.55 | 5.5 | 0.4 | 0.77 | 52.5 |
| **103H7822-1760** | **103H7822-1730** | 1.37 | 4 | 0.43 | 1.38 | 0.4 | 0.77 | 52.5 |
| **103H7823-5760** | **103H7823-5730** | 2.7 | 2 | 2.4 | 9.5 | 0.84 | 1.34 | 84.5 |
| **103H7823-1760** | **103H7823-1730** | 2.7 | 4 | 0.65 | 2.4 | 0.84 | 1.34 | 84.5 |

## Characteristics diagram

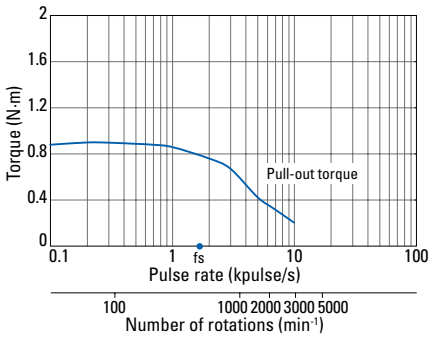
**103H7821-5740**
**103H7821-5710**
**103H7821-5760**
**103H7821-5730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



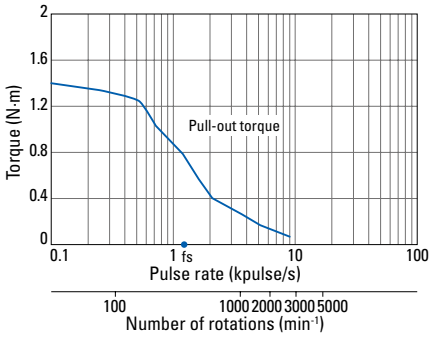

**103H7821-1740**
**103H7821-1710**
**103H7821-1760**
**103H7821-1730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



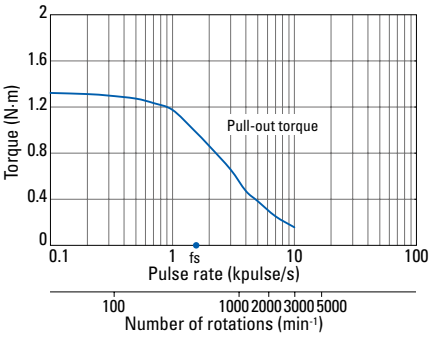

**103H7822-5740**
**103H7822-5710**
**103H7822-5760**
**103H7822-5730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




**103H7822-1740**
**103H7822-1710**
**103H7822-1760**
**103H7822-1730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



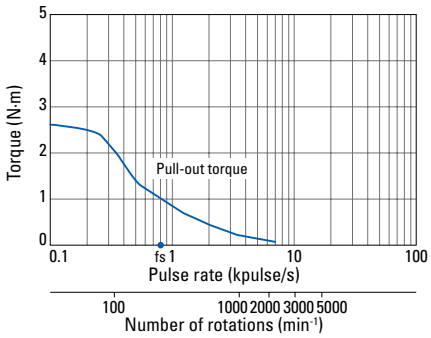


Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73
Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Characteristics diagram

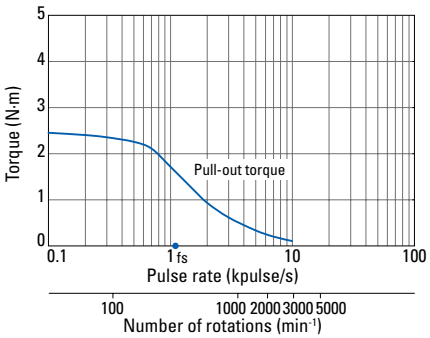
**103H7823-5740**
**103H7823-5710**
**103H7823-5760**
**103H7823-5730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



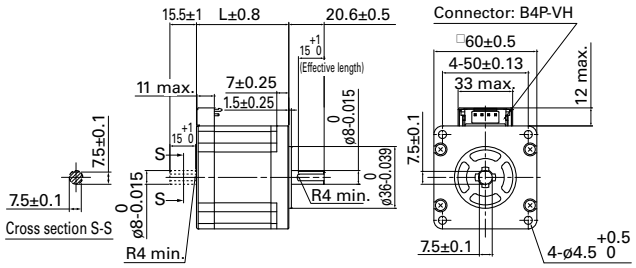

**103H7823-1740**
**103H7823-1710**
**103H7823-1760**
**103H7823-1730**

Constant current circuit
Source voltage: 24 VDC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

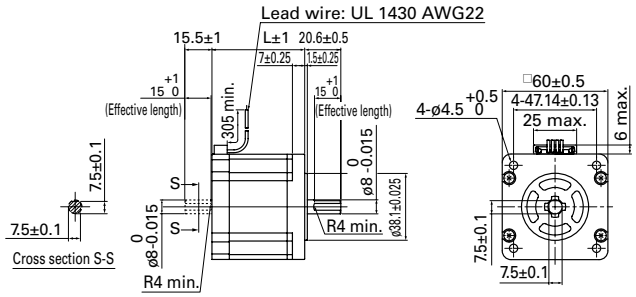



## Dimensions (Unit: mm)

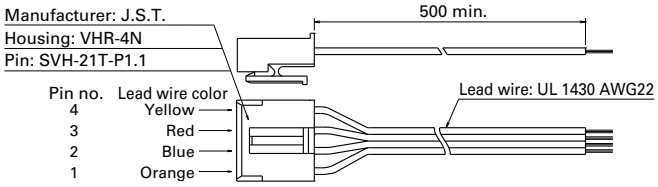
**Connector type**




**Lead wire type**

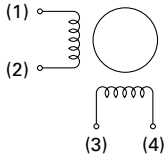



Motor cable Bipolar model no.: 4837961-1

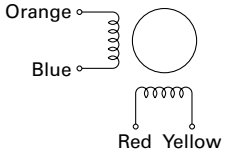



## Internal wiring

**Connector type**
( ) connector pin number, terminal block number




**Lead wire type**

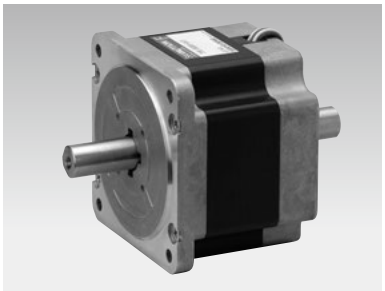



## Compatible drivers

- For motor model no. 103H782 □ -17 □ 0 (4 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For motors not listed above (2 A/phase)
  Model no.: BS1D200P10 (DC input)
  Operating current select switch setting: 0

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 86 mm sq.

1.8°/step RoHS

Unipolar winding, Lead wire type
Unipolar winding, Lead wire type CE/UL model
Bipolar winding, Lead wire type ▶p. 64
Bipolar winding, Lead wire type CE/UL model ▶p. 64
Bipolar winding, Terminal block type CE/UL model ▶p. 64

**Customizing**

Hollow | Shaft modification | Encoder

Varies depending on the model number and quantity. Contact us for details.

**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SH2861-0441** | **SH2861-0411** | 2.5 | 2 | 2.3 | 8.0 | 1.48 | 1.75 | 66 |
| **SH2861-0941** | **SH2861-0911** | 2.5 | 4 | 0.6 | 2.0 | 1.48 | 1.75 | 66 |
| **SH2862-0441** | **SH2862-0411** | 4.7 | 2 | 3.2 | 13.0 | 3.0 | 2.9 | 96.5 |
| **SH2862-0941** | **SH2862-0911** | 4.7 | 4 | 0.85 | 3.4 | 3.0 | 2.9 | 96.5 |
| **SH2863-0441** | **SH2863-0411** | 6.7 | 2 | 4.0 | 17.0 | 4.5 | 4.0 | 127 |
| **SH2863-0941** | **SH2863-0911** | 6.7 | 4 | 0.9 | 4.2 | 4.5 | 4.0 | 127 |

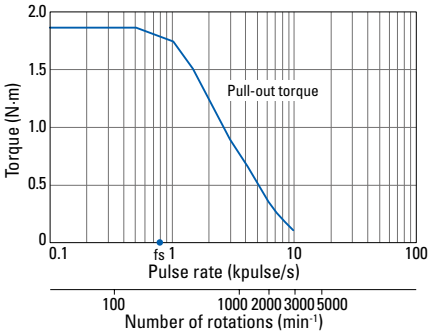
**Unipolar winding, Lead wire type CE/UL model**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SM2861-0451** | **SM2861-0421** | 2.5 | 2 | 2.3 | 8.0 | 1.48 | 1.75 | 66 |
| **SM2861-0951** | **SM2861-0921** | 2.5 | 4 | 0.6 | 2.0 | 1.48 | 1.75 | 66 |
| **SM2862-0451** | **SM2862-0421** | 4.7 | 2 | 3.2 | 13.0 | 3.0 | 2.9 | 96.5 |
| **SM2862-0951** | **SM2862-0921** | 4.7 | 4 | 0.85 | 3.4 | 3.0 | 2.9 | 96.5 |
| **SM2863-0451** | **SM2863-0421** | 6.7 | 2 | 4.0 | 17.0 | 4.5 | 4.0 | 127 |
| **SM2863-0951** | **SM2863-0921** | 6.7 | 4 | 0.9 | 4.2 | 4.5 | 4.0 | 127 |

## Characteristics diagram

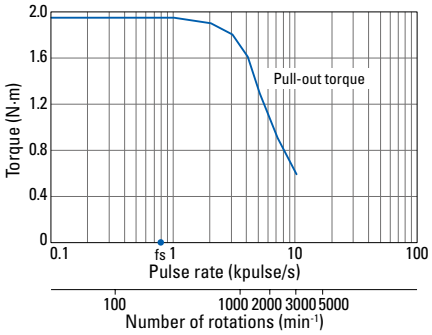
**SH2861-0441**
**SH2861-0411**
**SM2861-0451**
**SM2861-0421**

Constant current circuit
Source voltage: 100 VAC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



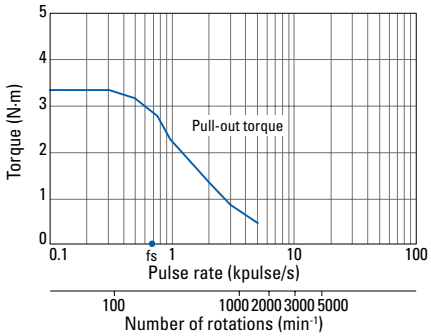

**SH2861-0941**
**SH2861-0911**
**SM2861-0951**
**SM2861-0921**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



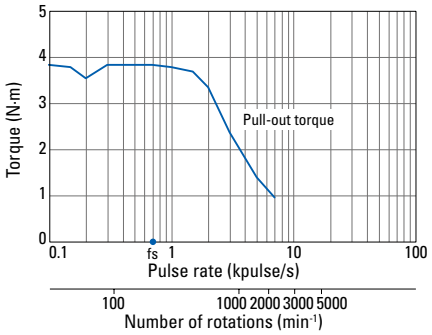

**SH2862-0441**
**SH2862-0411**
**SM2862-0451**
**SM2862-0421**

Constant current circuit
Source voltage: 100 VAC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



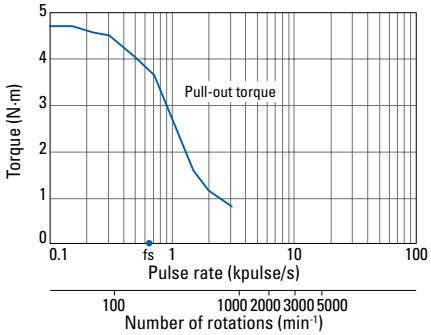

**SH2862-0941**
**SH2862-0911**
**SM2862-0951**
**SM2862-0921**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



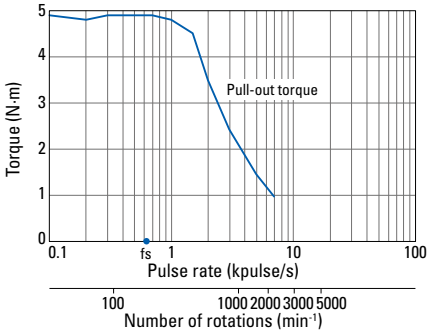

**SH2863-0441**
**SH2863-0411**
**SM2863-0451**
**SM2863-0421**

Constant current circuit
Source voltage: 100 VAC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




**SH2863-0941**
**SH2863-0911**
**SM2863-0951**
**SM2863-0921**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



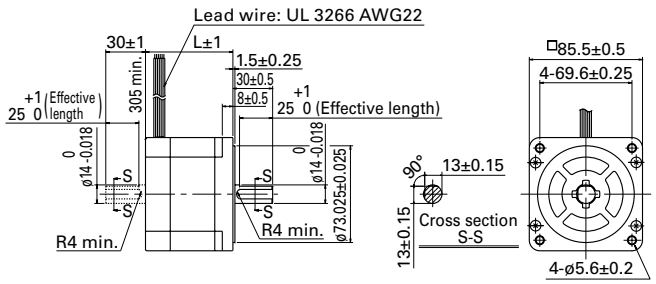


Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73

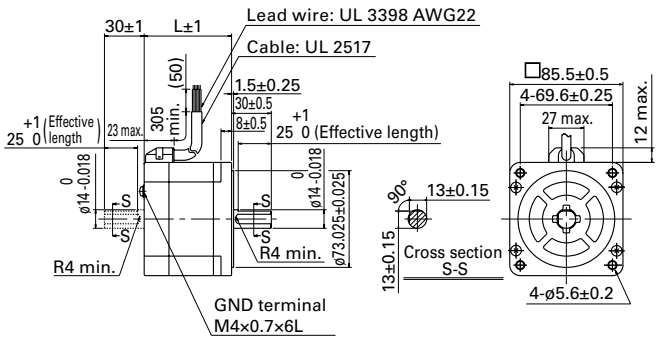
Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Dimensions (Unit: mm)

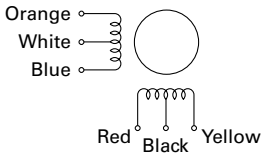
**Lead wire type**




**Lead wire type CE/UL model**




## Internal wiring




## Compatible drivers

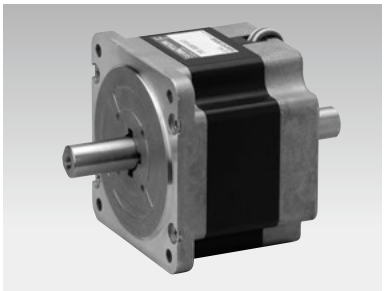
Driver is not included.

If you require assistance finding a driver, contact us for details.




Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73


Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.



# 86 mm sq.

1.8°/step RoHS

Bipolar winding, Lead wire type
Bipolar winding, Lead wire type CE/UL model
Bipolar winding, Terminal block type CE/UL model
Unipolar winding, Lead wire type ▶p. 62
Unipolar winding, Lead wire type CE/UL model ▶p. 62

**Customizing**
Hollow | Shaft modification
Encoder
Varies depending on the model number and quantity. Contact us for details.

**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SH2861-5041** | **SH2861-5011** | 3.3 | 2 | 2.2 | 15 | 1.48 | 1.75 | 66 |
| **SH2861-5141** | **SH2861-5111** | 3.3 | 4 | 0.56 | 3.7 | 1.48 | 1.75 | 66 |
| **SH2861-5241** | **SH2861-5211** | 3.3 | 6 | 0.29 | 1.7 | 1.48 | 1.75 | 66 |
| **SH2862-5041** | **SH2862-5011** | 6.4 | 2 | 3.2 | 25 | 3.0 | 2.9 | 96.5 |
| **SH2862-5141** | **SH2862-5111** | 6.4 | 4 | 0.83 | 6.4 | 3.0 | 2.9 | 96.5 |
| **SH2862-5241** | **SH2862-5211** | 6.4 | 6 | 0.36 | 2.8 | 3.0 | 2.9 | 96.5 |
| **SH2863-5041** | **SH2863-5011** | 9 | 2 | 4.0 | 32 | 4.5 | 4.0 | 127 |
| **SH2863-5141** | **SH2863-5111** | 9 | 4 | 1.0 | 7.9 | 4.5 | 4.0 | 127 |
| **SH2863-5241** | **SH2863-5211** | 9 | 6 | 0.46 | 3.8 | 4.5 | 4.0 | 127 |

**Bipolar winding, Lead wire type CE/UL model**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SM2861-5051** | **SM2861-5021** | 3.3 | 2 | 2.2 | 15 | 1.48 | 1.75 | 66 |
| **SM2861-5151** | **SM2861-5121** | 3.3 | 4 | 0.56 | 3.7 | 1.48 | 1.75 | 66 |
| **SM2861-5251** | **SM2861-5221** | 3.3 | 6 | 0.29 | 1.7 | 1.48 | 1.75 | 66 |
| **SM2862-5051** | **SM2862-5021** | 6.4 | 2 | 3.2 | 25 | 3.0 | 2.9 | 96.5 |
| **SM2862-5151** | **SM2862-5121** | 6.4 | 4 | 0.83 | 6.4 | 3.0 | 2.9 | 96.5 |
| **SM2862-5251** | **SM2862-5221** | 6.4 | 6 | 0.36 | 2.8 | 3.0 | 2.9 | 96.5 |
| **SM2863-5051** | **SM2863-5021** | 9 | 2 | 4.0 | 32 | 4.5 | 4.0 | 127 |
| **SM2863-5151** | **SM2863-5121** | 9 | 4 | 1.0 | 7.9 | 4.5 | 4.0 | 127 |
| **SM2863-5251** | **SM2863-5221** | 9 | 6 | 0.46 | 3.8 | 4.5 | 4.0 | 127 |

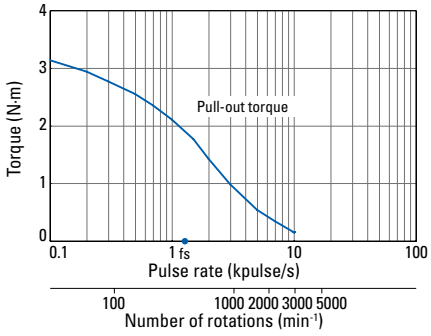
**Bipolar winding, Terminal block type CE/UL model**

| Model no. | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|
| Single shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **SM2861-5066** | 3.3 | 2 | 2.03 | 15 | 1.48 | 1.9 | 97.9 |
| **SM2861-5166** | 3.3 | 4 | 0.52 | 3.7 | 1.48 | 1.9 | 97.9 |
| **SM2861-5266** | 3.3 | 6 | 0.27 | 1.7 | 1.48 | 1.9 | 97.9 |
| **SM2862-5066** | 6.4 | 2 | 3.08 | 25 | 3.0 | 3.05 | 128.4 |
| **SM2862-5166** | 6.4 | 4 | 0.79 | 6.4 | 3.0 | 3.05 | 128.4 |
| **SM2862-5266** | 6.4 | 6 | 0.33 | 2.8 | 3.0 | 3.05 | 128.4 |
| **SM2863-5066** | 9 | 2 | 3.83 | 32 | 4.5 | 4.15 | 158.8 |
| **SM2863-5166** | 9 | 4 | 0.96 | 7.9 | 4.5 | 4.15 | 158.8 |
| **SM2863-5266** | 9 | 6 | 0.48 | 3.8 | 4.5 | 4.15 | 158.8 |

## Characteristics diagram

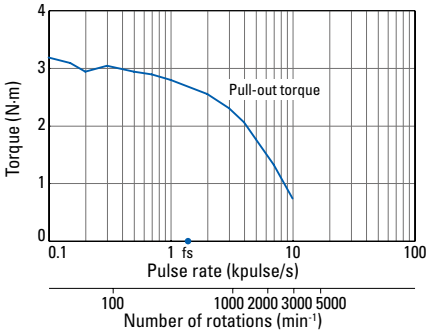
**SH2861-5041**
**SH2861-5011**
**SM2861-5051**
**SM2861-5021**
**SM2861-5066**

Constant current circuit
Source voltage: 100 VAC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




**SH2861-5141**
**SH2861-5111**
**SM2861-5151**
**SM2861-5121**
**SM2861-5166**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



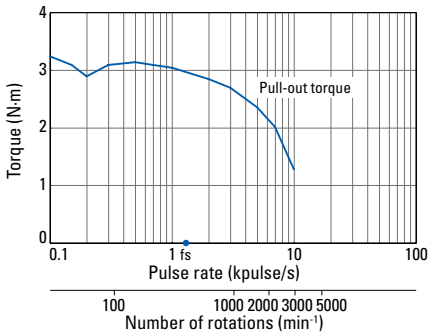


Allowable Load ▶p. 71 Rotation Direction ▶p. 72 General Specifications ▶p. 73
Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Characteristics diagram

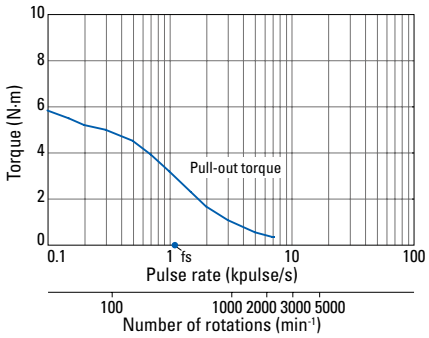
**SH2861-5241**
**SH2861-5211**
**SM2861-5251**
**SM2861-5221**
**SM2861-5266**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



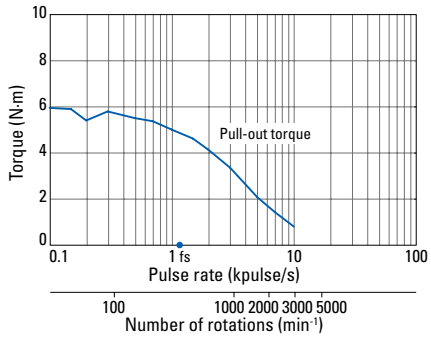

**SH2862-5041**
**SH2862-5011**
**SM2862-5051**
**SM2862-5021**
**SM2862-5066**

Constant current circuit
Source voltage: 100 VAC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



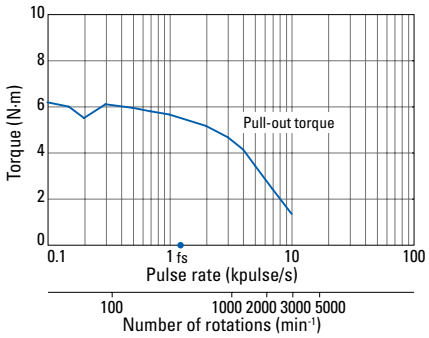

**SH2862-5141**
**SH2862-5111**
**SM2862-5151**
**SM2862-5121**
**SM2862-5166**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



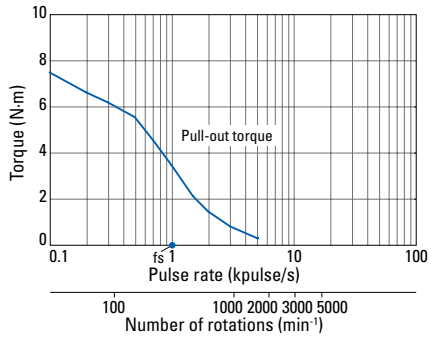

**SH2862-5241**
**SH2862-5211**
**SM2862-5251**
**SM2862-5221**
**SM2862-5266**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



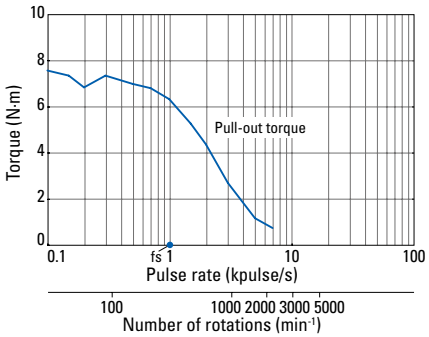

**SH2863-5041**
**SH2863-5011**
**SM2863-5051**
**SM2863-5021**
**SM2863-5066**

Constant current circuit
Source voltage: 100 VAC
Operating current:
2 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



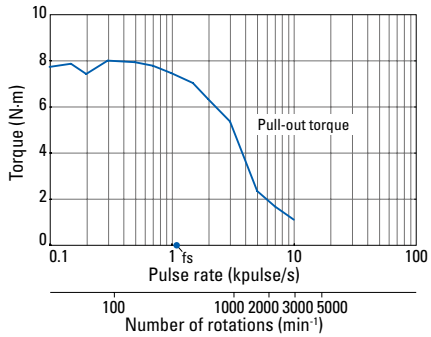

**SH2863-5141**
**SH2863-5111**
**SM2863-5151**
**SM2863-5121**
**SM2863-5166**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




**SH2863-5241**
**SH2863-5211**
**SM2863-5251**
**SM2863-5221**
**SM2863-5266**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

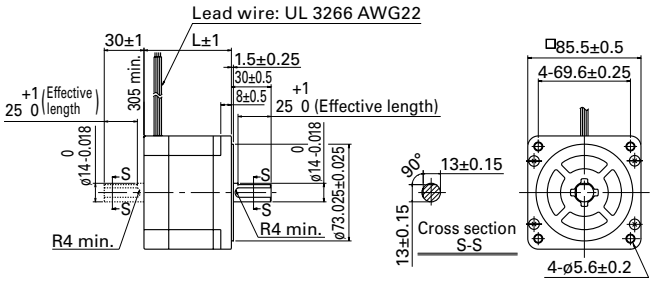



Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

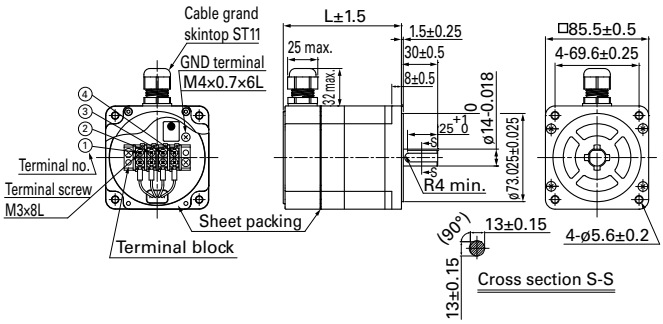
Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

## Dimensions (Unit: mm)

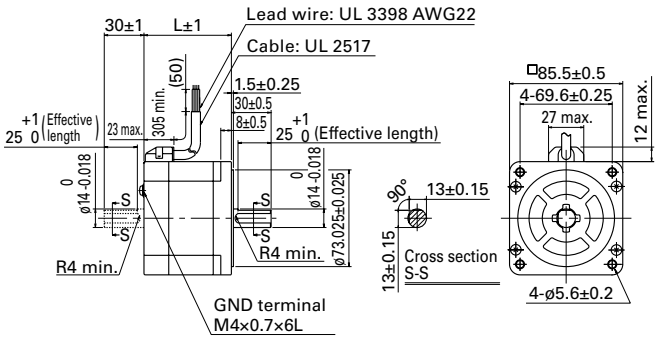
**Lead wire type**




**Terminal block type CE/UL model**

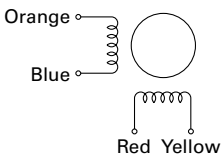



**Lead wire type CE/UL model**



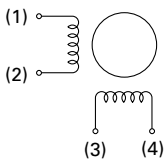

## Internal wiring

**Lead wire type**




**Terminal block type**

( ) terminal block number




## Compatible drivers

Driver is not included.

If you require assistance finding a driver, contact us for details.



Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# ø106 mm

1.8°/step RoHS

Unipolar winding, Lead wire type
Bipolar winding, Lead wire type

**Customizing**

Hollow | Shaft modification | Brake

Varies depending on the model number and quantity. Contact us for details.

**Unipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H89222-0941** | **103H89222-0911** | 10.8 | 4 | 0.98 | 6.3 | 14.6 | 7.5 | 163.3 |
| **103H89223-0941** | **103H89223-0911** | 15.5 | 4 | 1.4 | 9.7 | 22 | 10.5 | 221.3 |

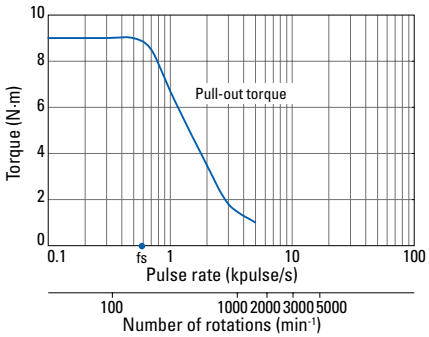
**Bipolar winding, Lead wire type**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H89222-5241** | **103H89222-5211** | 13.2 | 6 | 0.45 | 5.4 | 14.6 | 7.5 | 163.3 |
| **103H89223-5241** | **103H89223-5211** | 19 | 6 | 0.63 | 8 | 22 | 10.5 | 221.3 |

## Characteristics diagram

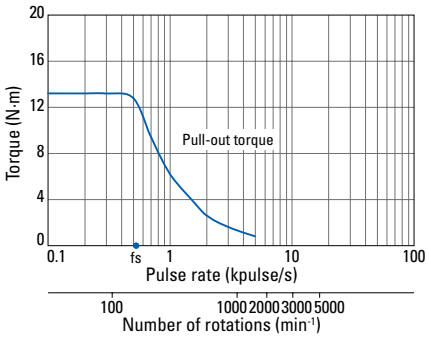
**103H89222-0941**
**103H89222-0911**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



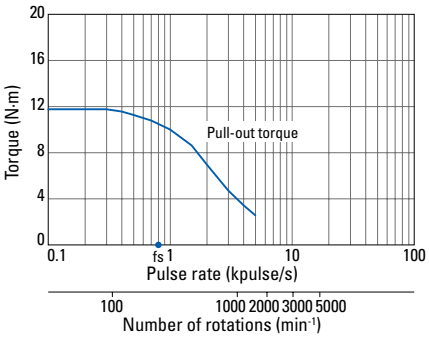

**103H89223-0941**
**103H89223-0911**

Constant current circuit
Source voltage: 100 VAC
Operating current:
4 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



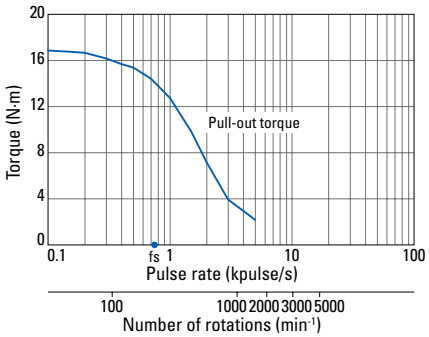

**103H89222-5241**
**103H89222-5211**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

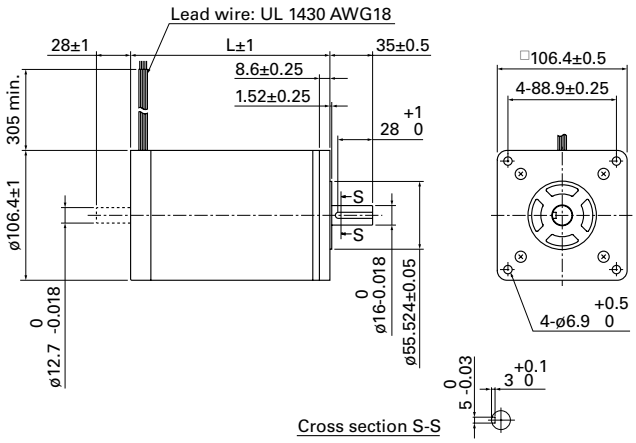



**103H89223-5241**
**103H89223-5211**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

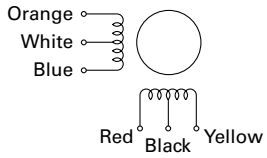



## Dimensions (Unit: mm)

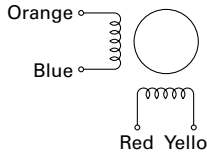



## Internal wiring

**Unipolar**




**Bipolar**




## Compatible drivers

Driver is not included.
If you require assistance finding a driver, contact us for details.

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# 56 mm sq.

1.8°/step RoHS

Unipolar winding, Lead wire type CE model

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

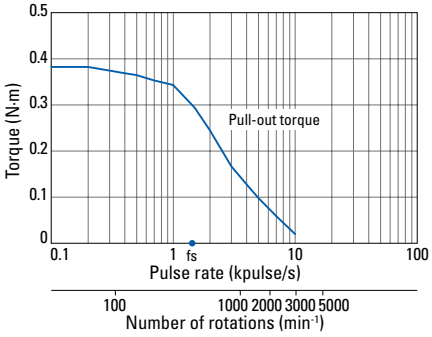
**Unipolar winding, Lead wire type CE model**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H7121-6140** | **103H7121-6110** | 0.39 | 1 | 4.8 | 8 | 0.1 | 0.47 | 41.8 |
| **103H7121-6740** | **103H7121-6710** | 0.39 | 3 | 0.6 | 0.8 | 0.1 | 0.47 | 41.8 |
| **103H7123-6140** | **103H7123-6110** | 0.83 | 1 | 6.7 | 15 | 0.21 | 0.65 | 53.8 |
| **103H7123-6740** | **103H7123-6710** | 0.78 | 3 | 0.77 | 1.58 | 0.21 | 0.65 | 53.8 |
| **103H7126-6140** | **103H7126-6110** | 1.27 | 1 | 8.6 | 19 | 0.36 | 0.98 | 75.8 |
| **103H7126-6740** | **103H7126-6710** | 1.27 | 3 | 0.9 | 2.2 | 0.36 | 0.98 | 75.8 |

## Characteristics diagram

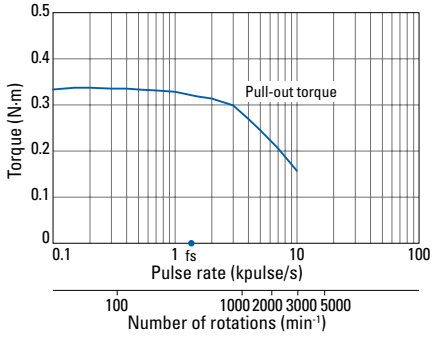
### 103H7121-6140 / 103H7121-6110

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



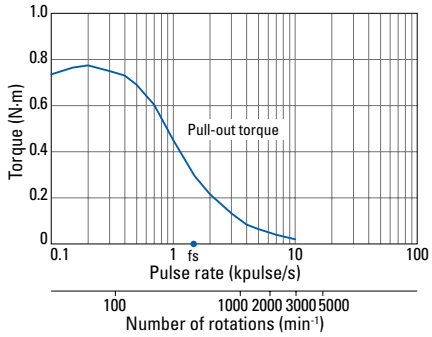

### 103H7121-6740 / 103H7121-6710

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



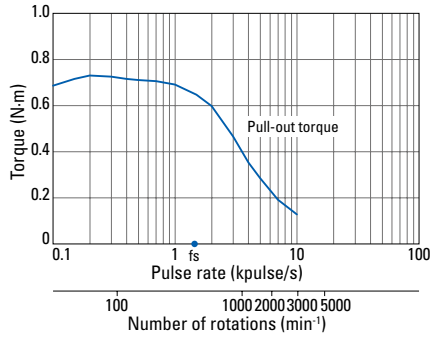

### 103H7123-6140 / 103H7123-6110

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



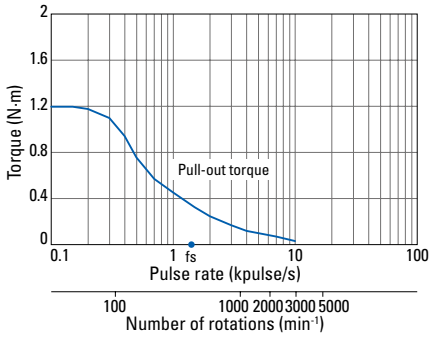

### 103H7123-6740 / 103H7123-6710

Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=0.94×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



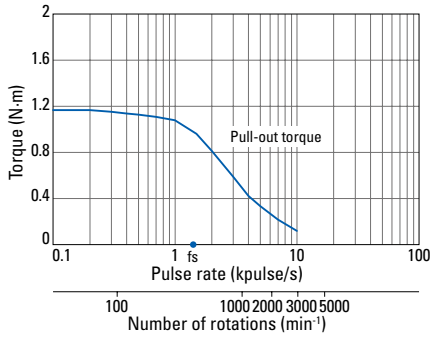

### 103H7126-6140 / 103H7126-6110

Constant current circuit
Source voltage: 24 VDC
Operating current:
1 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

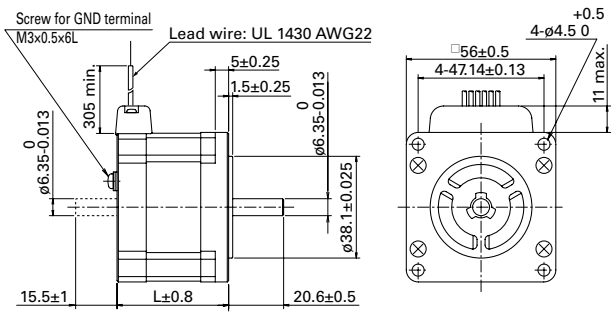



### 103H7126-6740 / 103H7126-6710

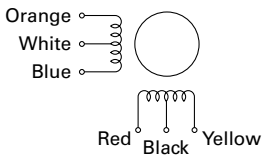
Constant current circuit
Source voltage: 24 VDC
Operating current:
3 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

- For motor model no. 103H712 □ -67 □ 0 (3 A/phase)
  Driver is not included.
  If you require assistance finding a driver, contact us for details.
- For motors not listed above (1 A/phase)
  Model no.: US1D200P10 (DC input)
  Operating current select switch setting: A



Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# ø86 mm

1.8°/step RoHS

Bipolar winding, Lead wire type CE model

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

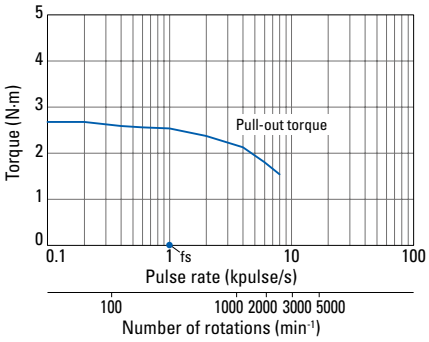
**Bipolar winding, Lead wire type CE model**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H8221-6240** | **103H8221-6210** | 2.74 | 6 | 0.3 | 1.65 | 1.45 | 1.5 | 62 |
| **103H8222-6340** | **103H8222-6310** | 5.09 | 6 | 0.35 | 2.7 | 2.9 | 2.5 | 92.2 |
| **103H8223-6340** | **103H8223-6310** | 7.44 | 6 | 0.45 | 3.4 | 4.4 | 3.5 | 125.9 |

## Characteristics diagram

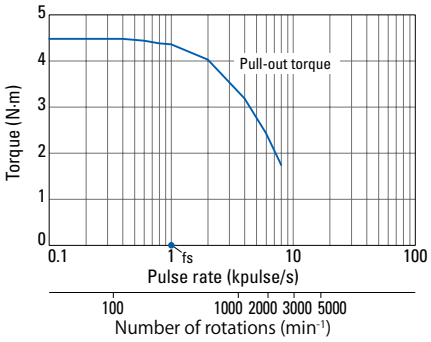
**103H8221-6240**
**103H8221-6210**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded



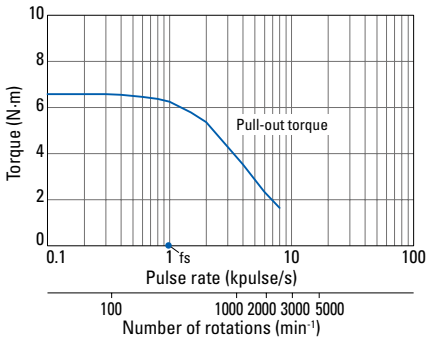

**103H8222-6340**
**103H8222-6310**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

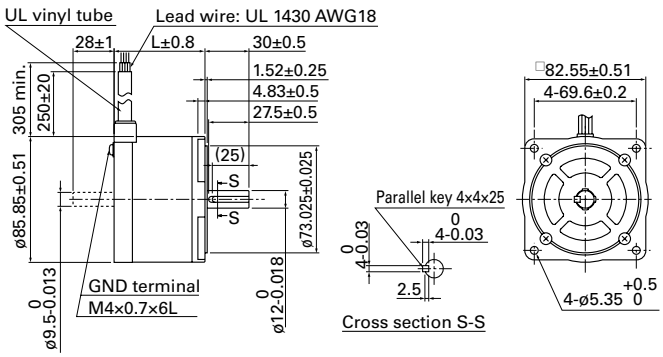



**103H8223-6340**
**103H8223-6310**

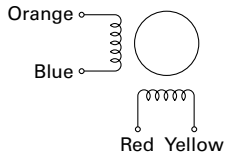
Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

Driver is not included.

If you require assistance finding a driver, contact us for details.

Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# ø106 mm

1.8°/step RoHS

Bipolar winding, Lead wire type CE model

**Customizing**

Hollow | Shaft modification

Varies depending on the model number and quantity. Contact us for details.

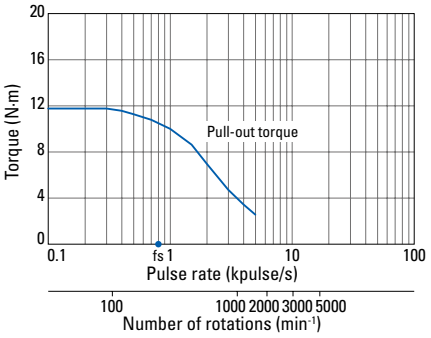
**Bipolar winding, Lead wire type CE model**

| Model no. | | Holding torque at 2-phase energization | Rated current | Wiring resistance | Winding inductance | Rotor inertia | Mass | Motor length (L) |
|---|---|---|---|---|---|---|---|---|
| Single shaft | Dual shaft | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | mm |
| **103H89222-6341** | **103H89222-6311** | 13.2 | 6 | 0.45 | 5.4 | 14.6 | 7.5 | 163.3 |
| **103H89223-6341** | **103H89223-6311** | 19 | 6 | 0.63 | 8 | 22 | 10.5 | 221.3 |

## Characteristics diagram

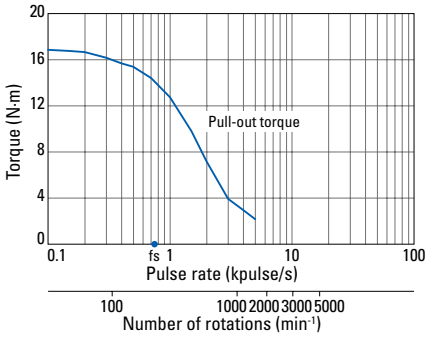
**103H89222-6341**
**103H89222-6311**

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

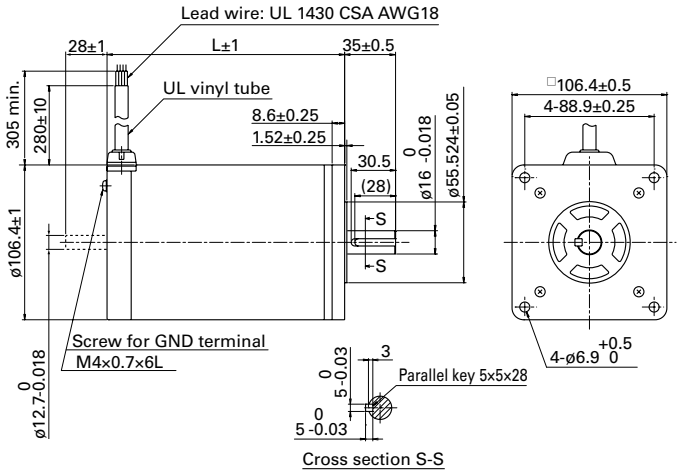



**103H89223-6341**
**103H89223-6311**

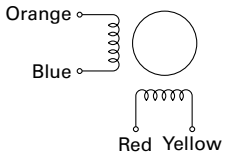
Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
Pull-out torque:
$J_L$=44×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded




## Dimensions (Unit: mm)




## Internal wiring




## Compatible drivers

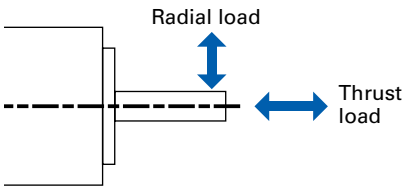
Driver is not included.
If you require assistance finding a driver, contact us for details.



Allowable Load ▶ p. 71 Rotation Direction ▶ p. 72 General Specifications ▶ p. 73

Data is measured under the trial conditions of SANYO DENKI. Driving torque may vary according to actual machine precision.

# Allowable Radial/Thrust Load




| Motor size | Model no. | Distance from end of shaft: mm | | | | Thrust load N |
|---|---|---|---|---|---|---|
| | | 0 | 5 | 10 | 15 | |
| | | Radial load: N | | | | |
| **14 mm sq.** | SH214 □ | 10 | 11 | 13 | — | 0.7 |
| **28 mm sq.** | SH228 □ | 42 | 48 | 56 | 66 | 3 |
| **35 mm sq.** | SH353 □ | 40 | 50 | 67 | 98 | 10 |
| **42 mm sq.** | SF242 □ | 20 | 29 | 49 | 68 | 10 |
| | SH142 □ | 22 | 26 | 33 | 46 | |
| | SS242 □ | 10 | — | — | — | 4.9 |
| **50 mm sq.** | 103H670 □ | 71 | 87 | 115 | 167 | 15 |
| | SS250 □ | 8.5 | — | — | — | 4.9 |
| **56 mm sq.** | 103H712 □ | 52 | 65 | 85 | 123 | 15 |
| | 103H7128 | 85 | 105 | 138 | 200 | 15 |
| **60 mm sq.** | 103H782 □ | 70 | 87 | 114 | 165 | 20 |
| | SH160 □ | | | | | 15 |
| **86 mm sq.** | SM286 □<br>SH286 □ | 167 | 193 | 229 | 280 | 60 |
| **ø86 mm** | 103H822 □ | 191 | 234 | 301 | 421 | 60 |
| **ø106 mm** | 103H8922 □ | 321 | 356 | 401 | 457 | 100 |

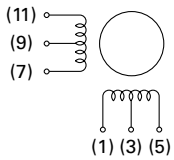
# Internal Wiring and Rotation Direction

## Unipolar winding

**Connector type model no.: SF242 □**

### Internal wire connection

( ) connector pin number




### Direction of motor rotation

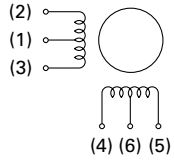
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Connector pin no. | | | | |
|---|---|---|---|---|---|---|
| | | (3, 9) | (1) | (7) | (5) | (11) |
| Exciting order | 1 | + | − | − | | |
| | 2 | + | | − | − | |
| | 3 | + | | | − | − |
| | 4 | + | − | | | − |

**Connector type model no.: 103H782 □□**

### Internal wire connection

( ) connector pin number



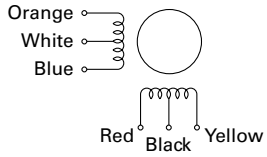

### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Connector pin no. | | | | |
|---|---|---|---|---|---|---|
| | | (1, 6) | (4) | (3) | (5) | (2) |
| Exciting order | 1 | + | − | − | | |
| | 2 | + | | − | − | |
| | 3 | + | | | − | − |
| | 4 | + | − | | | − |

**Lead wire type**

### Internal wire connection




### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

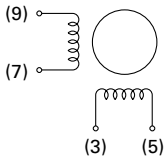
| | | Lead wire color | | | | |
|---|---|---|---|---|---|---|
| | | White, black | Red | Blue | Yellow | Orange |
| Exciting order | 1 | + | − | − | | |
| | 2 | + | | − | − | |
| | 3 | + | | | − | − |
| | 4 | + | − | | | − |

## Bipolar winding

**Connector type model no.: SF242 □**

### Internal wire connection

( ) connector pin number




### Direction of motor rotation

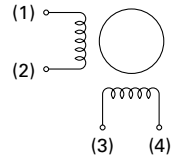
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Connector pin no. | | | |
|---|---|---|---|---|---|
| | | (3) | (7) | (5) | (9) |
| Exciting order | 1 | − | − | + | + |
| | 2 | + | − | − | + |
| | 3 | + | + | − | − |
| | 4 | − | + | + | − |

**Connector type model no.: 103H782 □**

### Internal wire connection

( ) connector pin number



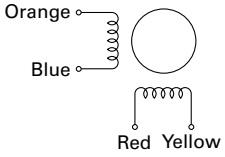

### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Connector pin no. | | | |
|---|---|---|---|---|---|
| | | (3) | (2) | (4) | (1) |
| Exciting order | 1 | − | − | + | + |
| | 2 | + | − | − | + |
| | 3 | + | + | − | − |
| | 4 | − | + | + | − |

**Lead wire type**

### Internal wire connection




### Direction of motor rotation

When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

| | | Lead wire color | | | |
|---|---|---|---|---|---|
| | | Red | Blue | Yellow | Orange |
| Exciting order | 1 | − | − | + | + |
| | 2 | + | − | − | + |
| | 3 | + | + | − | − |
| | 4 | − | + | + | − |

# General Specifications

| Motor model no. | SH214 □ | SH228 □ | SH353 □ | SS242 □ | SH142 □ | SF242 □ | SS250 □ | 103H670 □ | 103H712 □ |
|---|---|---|---|---|---|---|---|---|---|
| Type | — | | | | | | | | |
| Operating ambient temperature | -10 to +50°C | | | | | | | | |
| Storage temperature | -20 to +65°C | | | | | | | | |
| Operating ambient humidity | 20 to 90% RH (no condensation) | | | | | | | | |
| Storage humidity | 5 to 95% RH (no condensation) | | | | | | | | |
| Operation altitude | 1000 m max. above sea level | | | | | | | | |
| Vibration resistance | Vibration frequency 10 to 500 Hz, total amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction. | | | | | | | | |
| Impact resistance | 500 m/s² of acceleration for 11 ms with half-sine wave applying three times for X, Y, and Z axes each, 18 times in total. | | | | | | | | |
| Thermal class | Class B (+130°C) | | | | | | | | |
| Withstandable voltage | At normal temperature and humidity, no failure with 500 VAC @50/60 Hz applied for one minute between motor winding and frame. | | | | | | | At normal temperature and humidity, no failure with 1000 VAC @50/60 Hz applied for one minute between motor winding and frame. | |
| Insulation resistance | At normal temperature and humidity, not less than 100 MΩ between winding and frame by 500 VDC megger. | | | | | | | | |
| Protection grade | — | | | | | | | | |
| Winding temperature rise | 80 K max. (Based on SANYO DENKI standard) | | | | | | | | |
| Static angle error | ±0.09° | | | | ±0.054° | ±0.09° | | | ±0.054° |
| Thrust play *1 | 0.075 mm max. (load: 0.35 N) | 0.075 mm max. (load: 1.5 N) | 0.075 mm max. (load: 5 N) | 0.075 mm max. (load: 4 N) | 0.075 mm max. (load: 5 N) | 0.075 mm (load: 5 N) | 0.075 mm max. (load: 4 N) | 0.075 mm (load: 10 N) | 0.075 mm (load: 10 N) |
| Radial play *2 | 0.025 mm max. (load: 5 N) | | | | | | | | |
| Shaft runout | 0.025 mm | | | | | | | | |
| Concentricity of mounting pilot relative to shaft | ø0.05 mm | ø0.05 mm | ø0.075 mm | ø0.075 mm | ø0.05 mm | ø0.05 mm | ø0.075 mm | ø0.075 mm | ø0.075 mm |
| Squareness of mounting surface relative to shaft | 0.1 mm | 0.1 mm | 0.1 mm | 0.1 mm | 0.1 mm | 0.1 mm | 0.1 mm | 0.075 mm | 0.075 mm |
| Direction of motor mounting | Can be freely mounted vertically or horizontally | | | | | | | | |

| Motor model no. | SH160 □ | 103H782 □ | SH286 □ | 103H8922 □ | SM286 □ | 103H712 □ -6 □□ 0 CE Model | 103H822 □ -6 □□ 0 CE Model | 103H8922 □ -63 □ 1 CE Model |
|---|---|---|---|---|---|---|---|---|
| Type | — | | | | S1 (continuous operation) | | | |
| Operating ambient temperature | -10 to +50°C | | | | -10 to +40°C | | | |
| Storage temperature | -20 to +65°C | | | | -20 to +60°C | | | |
| Operating ambient humidity | 20 to 90% RH (no condensation) | | | | 95% RH max. at 40°C or less (no condensation) | | | |
| Storage humidity | 5 to 95% RH (no condensation) | | | | 95% RH max. at 40°C or less, 57% RH max. at 50°C or less, 35% RH max. at 60°C or less (no condensation) | | | |
| Operation altitude | 1000 m max. above sea level | | | | | | | |
| Vibration resistance | Vibration frequency 10 to 500 Hz, total amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction. | | | | | | | |
| Impact resistance | 500 m/s² of acceleration for 11 ms with half-sine wave applying three times for X, Y and Z axes each, 18 times in total. | | | | | | | |
| Thermal class | Class B (+130°C) | | | | Class F (+155°C) | Class B (+130°C) | | |
| Withstandable voltage | At normal temperature and humidity, no failure with 1000 VAC @50/60 Hz applied for one minute between motor winding and frame. | | | At normal temperature and humidity, no failure with 1500 VAC @50/60 Hz applied for one minute between motor winding and frame. | | | | |
| Insulation resistance | At normal temperature and humidity, not less then 100 MΩ between winding and frame by 500 VDC megger. | | | | | | | |
| Protection grade | — | | | | IP43 | | | |
| Winding temperature rise | 80 K max. (Based on SANYO DENKI standard) | | | | | | | |
| Static angle error | ±0.054° | ±0.09° | | | | ±0.054° | ±0.09° | |
| Thrust play *1 | 0.075 mm max. (load: 10 N) | | | | | | | |
| Radial play *2 | 0.025 mm (load: 5 N) | 0.025 mm (load: 5 N) | 0.025 mm (load: 5 N) | 0.025 mm (load: 10 N) | 0.025 mm (load: 5 N) | 0.025 mm (load: 5 N) | 0.025 mm (load: 5 N) | 0.025 mm (load: 10 N) |
| Shaft runout | 0.025 mm | | | | | | | |
| Concentricity of mounting pilot relative to shaft | ø0.075 mm | | | | | | | |
| Squareness of mounting surface relative to shaft | 0.1 mm | 0.075 mm | 0.15 mm | 0.1 mm | 0.15 mm | 0.075 mm | 0.1 mm | 0.1 mm |
| Direction of motor mounting | Can be freely mounted vertically or horizontally | | | | | | | |

*1 Thrust play: Shaft displacement under axial load.
*2 Radial play: Shaft displacement under radial load applied 1/3rd of the length from the end of the shaft.

## Safety standards

**Model no.: SM286 □ CE/UL marked models**

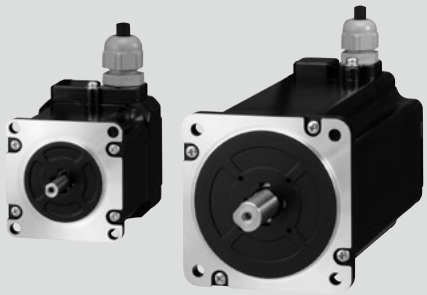
| | | | |
|---|---|---|---|
| CE (TÜV) | Standard category | | Applicable standard |
| | Low-voltage directives | | EN 60034-1, EN 60034-5 |
| UL | Acquired standards | Applicable standard | File no. |
| | UL | UL 1004-1, UL 1004-6 | E179832 |
| | UL for Canada | CSA C22.2 No.100 | |

**Model no.: 103H712 □ -6 □□ 0, 103H822 □ -6 □□ 0, 103H8922 □ -63 □ 1 CE marked model**

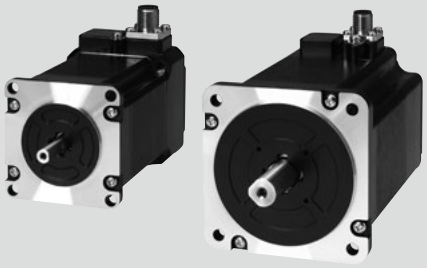
| | | |
|---|---|---|
| CE (TÜV) | Standard category | Applicable standard |
| | Low-voltage directives | EN 60034-1, EN 60034-5 |

# IP65 Splash and Dust Proof Stepping Motors

Waterproof, dustproof



Cable type



Connector type

## Features

- These IP65 rated motors* have superior water and dust resistance, and can be safely utilized in harsh or wet environments such as in food processing machines.
  *Except for the shaft and the cable end.
- The input voltage range of the motors is up to 250 VAC.
- Brake, encoder, and oil seal can be combined.

## Safety standards

CE/UL-certified.

# Specifications

| | 56 mm sq. | 86 mm sq. |
|---|---|---|
| Motor model no. | SP256 □ -5 □□ 0 | SP286 □ -5 □□ 0 |
| Type | S1 (continuous operation) | |
| Operating ambient temperature | -10 to +40°C | |
| Storage temperature | -20 to +60°C | |
| Operating ambient humidity | 95% RH max. at 40°C or less (no condensation) | |
| Storage humidity | 95% RH max. at 40°C or less, 57% RH max. at 50°C or less, 35% RH max. at 60°C or less (no condensation) | |
| Operation altitude | 1000 m max. above sea level | |
| Vibration resistance | Vibration frequency 10 to 500 Hz, total amplitude 1.52 mm (10 to 70 Hz), vibration acceleration 150 m/s² (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction. | |
| Impact resistance | 500 m/s² of acceleration for 11 ms with half-sine wave applying three times for X, Y and Z axes each, 18 times in total. | |
| Thermal class | Class F (+155°C) | |
| Withstandable voltage | At normal temperature and humidity, no failure with 1500 VAC @50/60 Hz applied for one minute between motor winding and frame. | |
| Insulation resistance | At normal temperature and humidity, not less than 100 MΩ between winding and frame by 500 VDC megger. | |
| Protection grade | IP65 (Except for the shaft and the cable end) | |
| Winding temperature rise | 100 K max. (Based on SANYO DENKI standard) | |
| Static angle error | ±0.054° | ±0.09° |
| Thrust play | 0.075 mm max. (load: 10 N) | |
| Radial play | 0.025 mm max. (load: 5 N) | |
| Shaft runout | 0.025 mm | |
| Concentricity of mounting pilot relative to shaft | ø0.075 mm | |
| Squareness of mounting surface relative to shaft | 0.1 mm | 0.15 mm |
| Direction of motor mounting | Can be freely mounted vertically or horizontally | |

## Safety standards

| | | | |
|---|---|---|---|
| CE | Standard category | Applicable standard | |
| | Low-voltage directives | EN 60034-1, EN 60034-5 | |
| UL | Acquired standards | Applicable standard | File no. |
| | UL | UL 1004-1, UL 1004-6 | E179832 |
| | UL for Canada (c-UL) | CSA C22.2 No.100 | |

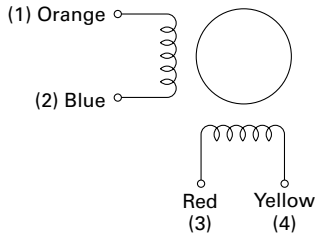
Model no. differs when the motor is equipped with a brake or oil seal.
Model no. and vibration resistence levels differ when the motor is equipped with a brake or oil seal.

## Internal wiring and rotation direction

Bipolar winding

Internal wire connection

( ) connector pin number




## Compatible drivers

Driver is not included.
If you require assistance finding a driver, contact us for details.

## Direction of motor rotation

The output shaft rotates clockwise as seen from the shaft side, when excited by DC in the following order.

| Lead wire color | | Red | Blue | Yellow | Orange |
|---|---|---|---|---|---|
| Connector pin no. | | 3 | 2 | 4 | 1 |
| Exciting order | 1 | – | – | + | + |
| | 2 | + | – | – | + |
| | 3 | + | + | – | – |
| | 4 | – | + | + | – |

# 56 mm sq.

1.8°/step RoHS

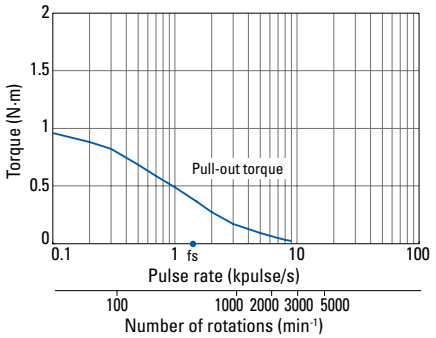
Bipolar winding

| Model no. | | Holding torque at 2-phase energization | Rated current | Winding resistance | Winding inductance | Rotor inertia | Mass | Allowable thrust load | Allowable radial load |
|---|---|---|---|---|---|---|---|---|---|
| Cable type | Connector type | N·m min. | A/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | N | N |
| **SP2563-5060** | **SP2563-5000** | 1 | 1 | 5.8 | 29 | 0.21 | 0.9 | 15 | 52 |
| **SP2563-5160** | **SP2563-5100** | 1 | 2 | 1.5 | 7.3 | 0.21 | 0.9 | 15 | 52 |
| **SP2563-5260** | **SP2563-5200** | 1 | 3 | 0.75 | 3.4 | 0.21 | 0.9 | 15 | 52 |
| **SP2566-5060** | **SP2566-5000** | 1.7 | 1 | 7.8 | 35.4 | 0.36 | 1.2 | 15 | 23 |
| **SP2566-5160** | **SP2566-5100** | 1.7 | 2 | 2 | 9.2 | 0.36 | 1.2 | 15 | 23 |
| **SP2566-5260** | **SP2566-5200** | 1.7 | 3 | 1 | 4.4 | 0.36 | 1.2 | 15 | 23 |

・The model no., rotor inertia and mass differ when the motor is equipped with brake, encoder or oil seal.

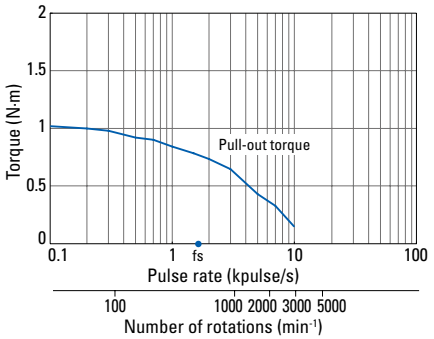
## Characteristics diagram

**SP2563-5000**
**SP2563-5060**



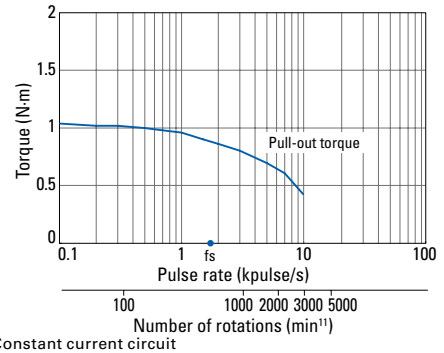

Constant current circuit
Source voltage: 100 VAC
Operating current: 1 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2563-5100**
**SP2563-5160**



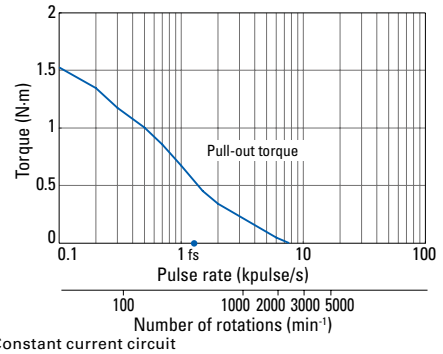

Constant current circuit
Source voltage: 100 VAC
Operating current: 2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2563-5200**
**SP2563-5260**



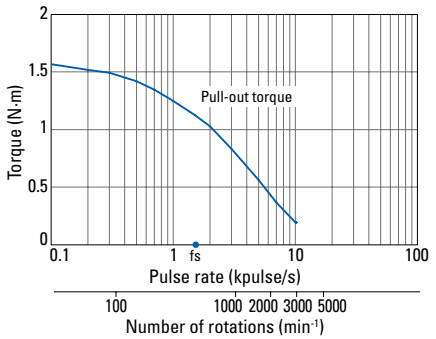

Constant current circuit
Source voltage: 100 VAC
Operating current: 3 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=2.6×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2566-5000**
**SP2566-5060**



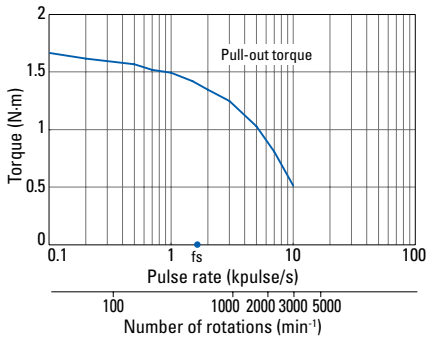

Constant current circuit
Source voltage: 100 VAC
Operating current: 1 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2566-5100**
**SP2566-5160**




Constant current circuit
Source voltage: 100 VAC
Operating current: 2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2566-5200**
**SP2566-5260**

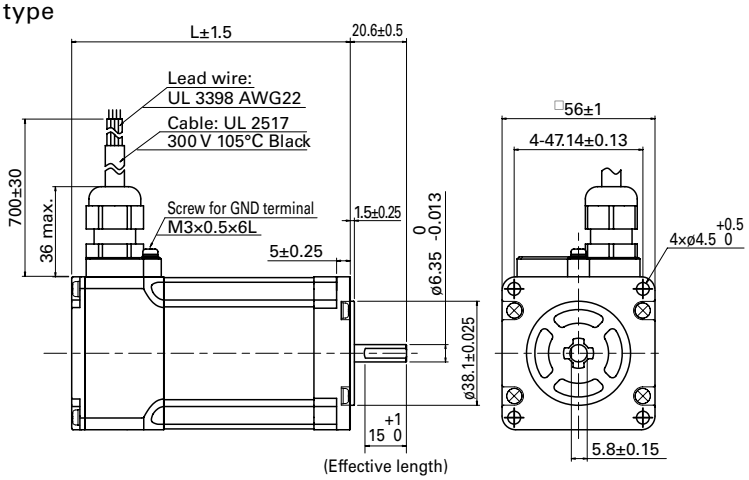



Constant current circuit
Source voltage: 100 VAC
Operating current: 3 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=7.4×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

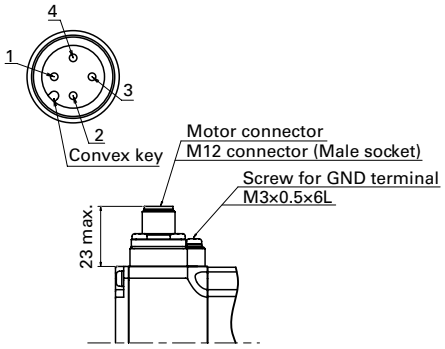
# Dimensions (Unit: mm)

## 56 mm sq.

Cable type




Connector type




| Model no. | | Motor length (L) |
|---|---|---|
| Cable type | Connector type | |
| SP2563-5 □ 60 | SP2563-5 □ 00 | 80 |
| SP2566-5 □ 60 | SP2566-5 □ 00 | 102 |

# 86 mm sq.

1.8°/step RoHS

Bipolar winding

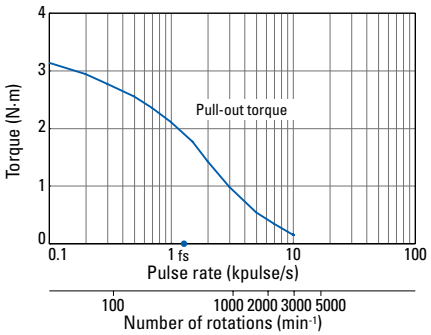
| Model no. | | Holding torque at 2-phase energization | Rated current | Winding resistance | | Winding inductance | Rotor inertia | Mass | Allowable thrust load | Allowable radial load |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Cable type | Connector type | | | | | |
| Cable type | Connector type | N·m min. | A/phase | Ω/phase | Ω/phase | mH/phase | ×10⁻⁴kg·m² | kg | N | N |
| **SP2861-5060** | **SP2861-5000** | 3.3 | 2 | 2.1 | 2.05 | 15 | 1.48 | 1.95 | 60 | 200 |
| **SP2861-5160** | **SP2861-5100** | 3.3 | 4 | 0.61 | 0.56 | 3.7 | 1.48 | 1.95 | 60 | 200 |
| **SP2861-5260** | — | 3.3 | 6 | 0.36 | — | 1.7 | 1.48 | 1.95 | 60 | 200 |
| **SP2862-5060** | **SP2862-5000** | 6.4 | 2 | 3.2 | 3.2 | 25 | 3 | 3.1 | 60 | 200 |
| **SP2862-5160** | **SP2862-5100** | 6.4 | 4 | 0.85 | 0.83 | 6.4 | 3 | 3.1 | 60 | 200 |
| **SP2862-5260** | — | 6.4 | 6 | 0.41 | — | 2.8 | 3 | 3.1 | 60 | 200 |
| **SP2863-5060** | **SP2863-5000** | 9 | 2 | 4 | 4 | 32 | 4.5 | 4.2 | 60 | 200 |
| **SP2863-5160** | **SP2863-5100** | 9 | 4 | 1.05 | 1 | 7.9 | 4.5 | 4.2 | 60 | 200 |
| **SP2863-5260** | — | 9 | 6 | 0.53 | — | 3.8 | 4.5 | 4.2 | 60 | 200 |

・The model no., rotor inertia and mass differ when the motor is equipped with brake, encoder or oil seal.

・The rated current of the motor with the connector is 4 A or less.

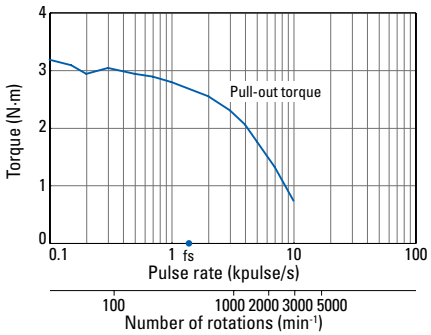
## Characteristics diagram

**SP2861-5000**
**SP2861-5060**



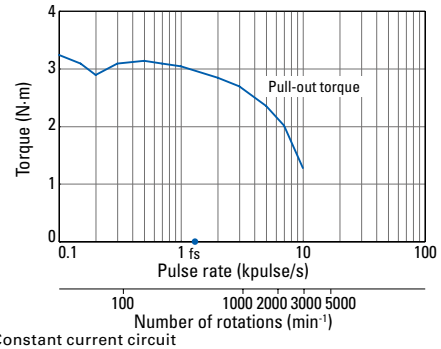

Constant current circuit
Source voltage: 100 VAC
Operating current: 2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2861-5100**
**SP2861-5160**



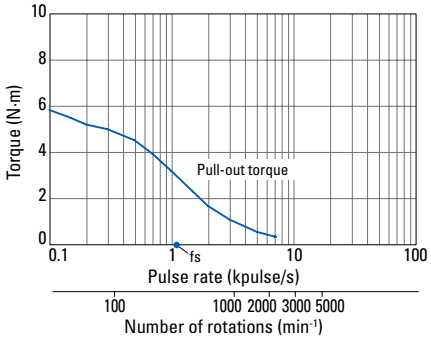

Constant current circuit
Source voltage: 100 VAC
Operating current: 4 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2861-5260**



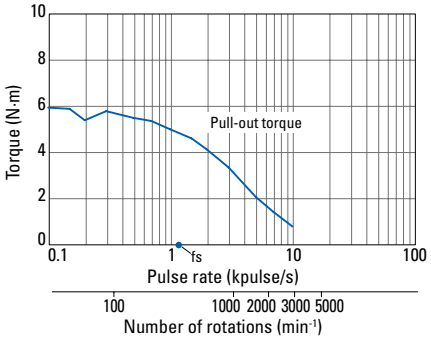

Constant current circuit
Source voltage: 100 VAC
Operating current: 6 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2862-5000**
**SP2862-5060**



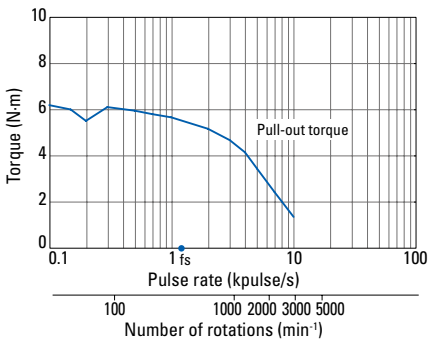

Constant current circuit
Source voltage: 100 VAC
Operating current: 2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2862-5100**
**SP2862-5160**




Constant current circuit
Source voltage: 100 VAC
Operating current: 4 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

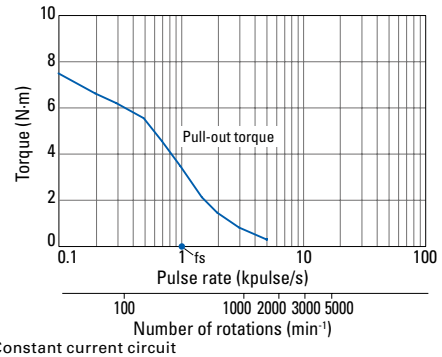
**SP2862-5260**




Constant current circuit
Source voltage: 100 VAC
Operating current: 6 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=15.3×10⁻⁴kg·m² (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

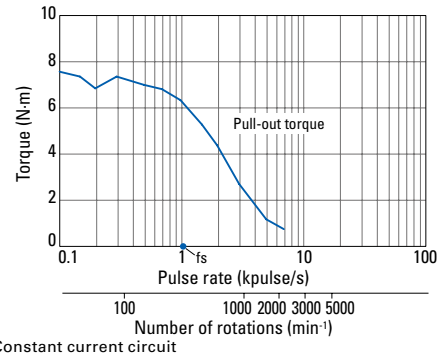
## Characteristics diagram

**SP2863-5000**
**SP2863-5060**



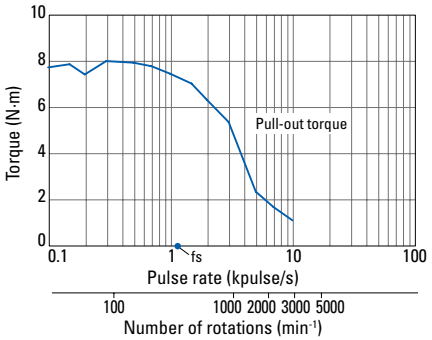

Constant current circuit
Source voltage: 100 VAC
Operating current: 2 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=44×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2863-5100**
**SP2863-5160**




Constant current circuit
Source voltage: 100 VAC
Operating current: 4 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=44×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

**SP2863-5260**

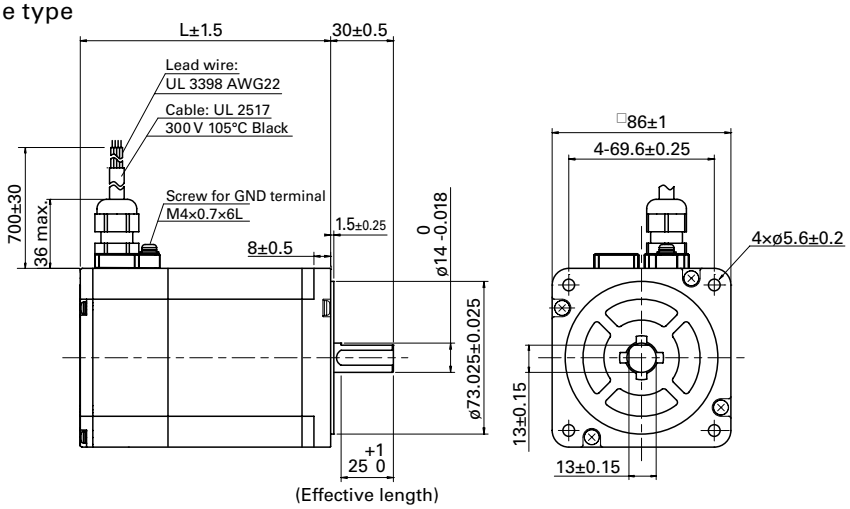



Constant current circuit
Source voltage: 100 VAC
Operating current: 6 A/phase, 2-phase energization (full-step)
Pull-out torque: $J_L$=44×10$^{-4}$kg·m$^2$ (use the rubber coupling)
fs: Maximum self-start frequency when not loaded

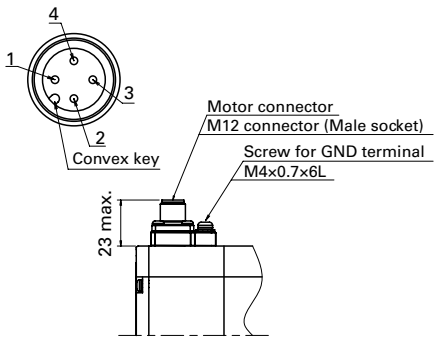
# Dimensions (Unit: mm)

### 86 mm sq.

Cable type

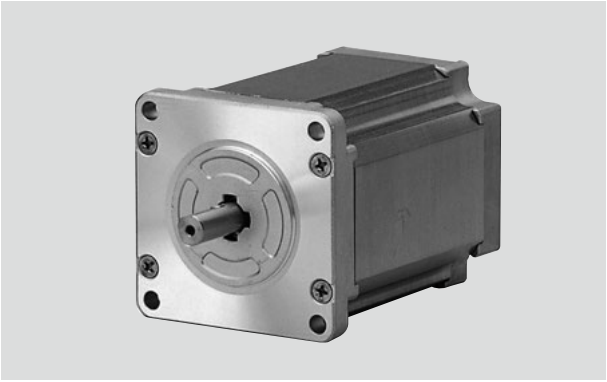



Connector type




| Model no. | | Motor length (L) |
|---|---|---|
| Cable type | Connector type | |
| SP2861-5 □ 60 | SP2861-5 □ 00 | 89.5 |
| SP2862-5 □ 60 | SP2862-5 □ 00 | 120 |
| SP2863-5 □ 60 | SP2863-5 □ 00 | 150 |

# Stepping Motors for Vacuum Environments Customized Products



## Features

- These stepping motors can be driven in a vacuum environment without requiring a vacuum feedthrough. Use as vacuum-compatible actuators while retaining the stepping motor benefits of easy high-precision open-loop control.
- We can customize for a wide range of environment pressures, from low to ultra-high vacuums.
- Available baked at 200°C.
- Size is similar to that of typical stepping motors.

## Intended operating pressure

| Low vacuum | | | Medium vacuum | | | High vacuum | | | | Ultra-High vacuum | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $10^5$ | $10^4$ | $10^3$ | $10^2$ | $10^1$ | 1 | $10^{-1}$ | $10^{-2}$ | $10^{-3}$ | $10^{-4}$ | $10^{-5}$ | $10^{-6}$ | $10^{-7}$ | $10^{-8}$ | [Pa] |

## Applications

Ideal for the following applications. Contact us to discuss your particular application environment needs.

- Semiconductor manufacturing equipment
- Satellite robotics
- Electron microscopes
- Large-scale research facilities such as accelerators, synchrotron radiation analysis equipment, etc.

## Motor size

42 mm sq. to ø106 mm

# Synchronous Motors Customized Products

## Features

- These motors always maintain a constant speed under variable load and voltage conditions, rotating in step with the frequency of the power supply. This eliminates motor slip.
- Provides high torque at ultraslow speeds with gearless construction.
- Allows for simplification by connecting directly to the commercial (AC) power supply, eliminating the need for a driver circuit.

## Applications

Ideal for the following applications. Contact us to discuss your particular application environment needs.

- Conveyor drives
- Printers
- Cryopumps
- Cryocoolers
- Switchgears

## Motor size

56 mm sq. to ø106 mm

# Safety Precautions

The products in this catalog are designed to be used with general industrial devices. When using them, pay sufficient attention to the following points.

- Read the Operation Manual thoroughly prior to placement, assembly and/or operation in order to use the product properly.
- Refrain from modifying or processing the product in any way.
- Contact us or your point of sale for placement or maintenance services of the product.
- Regarding the following uses of the product, contact us or your point of sale for the special care required for operation, maintenance and management such as multiplexing the system, installing an emergency electric generator set, and so forth.

**❶ Use in medical equipment that may have an effect on human life or the human body**
**❷ Use in transportation systems or transport-related equipment such as trains or elevators, that may have an effect on human life or the human body**
**❸ Use in computer systems that may have an impact on society or on the public**
**❹ Use in other devices that have a major impact on human safety or on maintaining public operations**

- In addition to the above, contact us or your point of sale for use in an environment where vibrations occur, such as in automobiles or transport.
- For use in space, aviation, or nuclear power-related applications, contact us or your point of sale.
- The products shown in this catalog are subject to Japanese Export Control Law. Diversion contrary to the law of exporting country is prohibited.

# Indication by (Warning Label) on the Product

Either or all of the following indications are expressed by the Warning Labels depending on the type of driver or stepping motor.

This label is affixed near high voltage parts such as the electrically charged or cover-protected section, warning of the places where it is likely to cause an electric shock.

This label is affixed near the GND terminals of the driver for which grounding is required, recommending that the terminals should be well grounded.

This label is affixed for the driver to which the power source is applied in the voltage exceeding the safety standard, drawing attention to the risk of the electric shock.

Indicates that the stepping motor may get hot, resulting in burns.

Indicates that the stepping motor should be grounded.

## Safety Ranks of the Cautions

Following four ranks are provided.

⚠ DANGER Improper operations or use is most likely to result in serious injury or death.

⚠ CAUTION Improper operations or use is likely to result in average or minor injury, or in property damage.

> In spite of the cautions with the ⚠ CAUTION label, it may cause serious results.
> Either the contents or the labels is describing important cautions to be followed inevitably.

PROHIBITED Indicates what must not be done.

COMPULSORY Indicates what must be done.

## ⚠ DANGER

### General matters

1. Do not use the product in an explosive, flammable or corrosive atmosphere, watery place or near a combustible material. Doing so may cause injury or fire.
2. Have a person with expert knowledge on hand for performing the transportation, placement, wiring, operation, maintenance or inspection of the product. Without such knowledge, it may cause an electric shock, injury or fire.
3. Do not work on wiring, maintenance servicing or inspection with the electric power on. Perform either of those five minutes after turning the power off. Failure to do so may cause an electric shock.
4. When the protective functions of the product is activated, turn the power off immediately and eliminate the cause. If continuing the operation without eliminating the cause, the product may operate improperly and cause injury or a breakdown of the system devices.
5. Stepping motor may run out of order when operating and stopping depending on the magnitude of the load. Put the product into use after confirming with the adequate trial test operation in the maximum load conditions that the product operates reliably. Doing otherwise may cause a breakdown of the system. (Should the product run out of order in the use to drive upward/downward, it may cause a fall of the load.)
6. Do not touch the internal parts of the driver. Doing so may cause an electric shock.

### Wiring

7. Do not connect the stepping motor directly to a commercial power outlet. Doing so may cause an electric shock, injury or fire. Power should be supplied to the stepping motor through the driving circuit (except for synchronous motors).
8. Use an electric power source within the rated input voltage. Using otherwise may cause fire or an electric shock.
9. Connect the driver and stepping motor to the ground. Using without grounding may cause an electric shock.
10. Do not harm, forcibly put a stress, or load a heavy article on the cable or get it caught between the articles. Doing so may cause an electric shock.
11. Perform wiring with the power cable as instructed by the wiring diagram or the Operation Manual. Doing otherwise may cause an electric shock or fire.
12. Do not move the stepping motor cable, as it is not a movable cable. Doing so may result in electric shock, injury, or fire.

### Operation

13. Be sure not to touch the rotating part of the stepping motor during its operation. Touching it may cause injury.
14. Do not reach or touch the electric terminals while electric power is on. Doing so may cause an electric shock.
15. Never disconnect any of the connectors while electric power is on. Doing so may cause an electric shock and corruption.
16. Do not operate this product with live parts exposed. Doing so may result in electric shock.
17. If smoke, fire, unusual smells, or unusual sounds are produced from the driver or stepping motor, turn off the power and stop using this product immediately. Not doing so may result in electric shock, injury, or fire.

## ⚠ CAUTION

### General matters

1. Prior to placement, operation, maintenance servicing or inspection, be sure to read the Operation Manual and follow the instructions to perform. Failure to follow the instructions may cause an electric shock, injury or fire.
2. Do not use the driver or the stepping motor in conditions that exceed the specification values. Doing so may cause an electric shock, injury or fire.
3. Do not insert a finger or an object into the opening of the product. Doing so may cause an electric shock, injury or fire.
4. Do not use a damaged driver or stepping motor. Doing so may cause injury, fire or the like.
5. Use the driver and stepping motor in the designated combination. Using otherwise may cause fire or a trouble.
6. Be careful when the temperature rises in the operating driver, stepping motor or peripheral devices. Failure to be careful may cause a burn.
7. Never disassemble, repair, modify, or remanufacture this product. Doing so may result in electric shock, injury, or fire.
8. Do not remove the rating plate. Using this product with an incorrect rating may result in fire.
9. Be careful that this product does not fall or tip over when handling, as this can be dangerous.

### Unpacking

10. Confirm that the bottom and top of the box are facing correctly while unpacking. Failure to do so may cause injury.
11. Confirm that the product is the one that you have ordered. Installing an incorrect product may cause a breakdown.

### Wiring

12. Do not measure the insulation resistance or dielectric voltage of the product. Doing so may cause a breakdown. Contact us or your point of sale instead, if such a measurement is required.
13. Perform wiring conforming to the technical standards of electric facility or the internal rule. Doing otherwise may cause burning or fire.
14. Ensure that wiring has been correctly done. Incorrect wiring may cause the stepping motor to run out of control, resulting in injury.
15. Insulate the attached condenser and external resistance connection terminals. Failure to do so may cause an electric shock.

### Placement

16. Do not climb or attach a heavy article on the product. Doing so may cause injury.
17. Make sure that the intake and exhaust ports are not blocked or stuffed by foreign particles. Doing so may cause fire.
18. Make sure to use the specified driver mounting direction. Failure to do so will result in product failure.
19. Keep a distance as instructed by the Operation Manual for the driver from the inner surface of the control console or other devices. Failure to do so may cause trouble.
20. Place the product with great care so as to prevent from danger such as a tumble or a turnover.
21. Mount the product on an incombustible material such as metal. Failure to do so may cause fire, injury, or device breakdown.
22. Do not place combustible material around this product. Failure to do so may result in fire or burns.
23. Be sure to provide an adequate ventilation path when installing this product, and do not block the intake and exhaust ports. Failure to do so may result in electric shock, fire, or device breakdown.
24. Confirm the rotating direction before connecting with the mechanical device. Failure to do so may cause injury or a breakdown.
25. Do not touch the motor output spindle (including the key slot and gears) with your bare hand. Doing so may cause injury.
26. Make sure not to apply force to the lead wire or cables.

### Operation

27. The stepping motor is not equipped with any protective device. Take protective measures using an over-current protective relay, a ground fault interrupter, a protective device from excess temperature, and an emergency stopping device. Failure to do so may cause injury or fire.
28. Do not touch the product for a period after the power is on or has been turned off, since the driver and stepping motor remain at a high temperature. Doing so may cause burns. In particular, the temperature rises considerably of the stepping motor depending on the operating conditions.
    Do not allow the motor surface to exceed the following temperatures:
    - Thermal class F (+155°C) stepping motors: 125°C
    - Thermal class B (+130°C) stepping motors: 100°C
    - Regardless of thermal class, encoder equipped stepping motors: 85°C, stepping motors with built in drivers: 70°C, stepping

motors for vacuum environments: 150°C

29. Stop operations immediately when an emergency occurs. Failure to do so may cause an electric shock, injury or fire.
30. Do not change adjustment to an extreme, for such a change results in unstable operation. Doing so may cause injury.
31. During trial operations, firmly stabilize the stepping motor, and confirm operations by disconnecting from the mechanical system before connecting with it. Failure to do so may cause injury.
32. When the alarm has been activated, eliminate the cause and ensure safety before resuming operations. Failure to do so may cause injury.
33. When the electric power recovers after a momentary interruption, do not approach the devices because the system may restart operation by itself. (Set the system so as to secure the safety even when it restarts on such occasions.) Failure to do so may cause injury.
34. Confirm that the electric power supply properly conforms to the product specifications. Failure to do so may cause a breakdown.
35. The brake mechanism of the motor with the electro-magnetic brake is used to hold the movable section and the motor position. Do not use it as a safety measure. Doing so may cause the breakdown of the system.
36. Firmly stabilize the key when operating the motor with the key individually. Failure to do so may cause injury.

**Maintenance**

37. Be careful when performing maintenance services or inspection regarding the temperature which rises highly in the driver and stepping motor frame. Failure to do so may cause burns.
38. It is recommended to replace the electrolytic condenser of the driver with a new one for securing the preventive measure after using for 5 years (the expected life in an average operating environment of 40°C). The expected life of the fuse is 10 years in an average operating environment of 40°C. Thus, periodical replacement is recommended.
39. Contact us or your point of sale for repair. If the product is disassembled by the user, it may become inoperable.

**Transportation**

40. Handle the product with care during transportation so as to prevent from dangers such as tumbling or overturning.
41. Do not hold with the cable or the motor spindle. Doing so may cause trouble or injury.

**Retirement**

42. When scrapping the driver or stepping motor, handle it as general industrial waste.

## PROHIBITED

**Storage**

1. Avoid storing this product in places exposed to rain or water drops, or in an environment with hazardous gas or liquid. Failure to do so may cause trouble.

**Maintenance**

2. Do not disassemble or repair the product. Doing so may cause fire or an electric shock.

**General matters**

3. Do not remove the rating plate. Using this product with the incorrect rating may result in fire.

## COMPULSORY

**Storage**

1. Store the product in a location that is not exposed to sunlight, at a temperature and humidity within the product specifications.
2. If the driver has been stored for a long period (3 years or longer as a general guide), contact us. The capacitance may have decreased with the electrolytic condenser due to the long period storage, which may cause trouble.

**Operation**

3. Install an external emergency stop circuit to turn the power off in the event that operation must be instantly halted.
4. Operate this product within the specified ambient temperature and humidity.

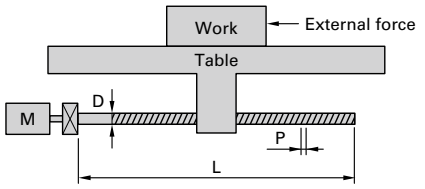
**Transportation**

5. Excess loading of the product on the carrier may cause the load to fall in pieces. Follow the instructions given outside the package.

## ■Selection materials for each mechanism

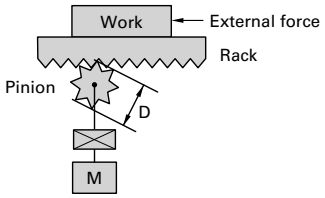
The diagrams below depict representative mechanisms and the points used in their selection. Notify us of the information shown here when requesting us to make a selection.

### Ball screw



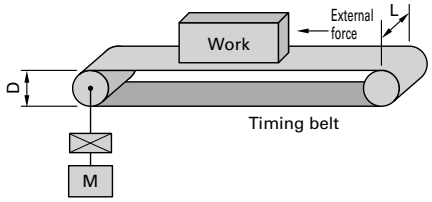

| | | |
|---|---|---|
| External force | F | N |
| Weight of work+table | W | kg |
| Ball screw diameter | D | m |
| Ball screw length | L | m |
| Ball screw lead | P | m |
| Ball screw material specific gravity | $\rho$ | kg/m$^3$ |
| Friction coefficient | $\mu$ | |
| Gear ratio* | G | |
| Mechanical efficiency | $\eta$ | |

### Rack and pinion



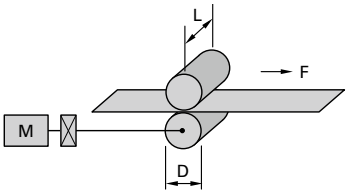

| | | |
|---|---|---|
| External force | F | N |
| Work+rack weight | W | kg |
| Pinion diameter | D | m |
| Pinion thickness | L | m |
| Pinion material specific gravity | $\rho$ | kg/m$^3$ |
| Friction coefficient | $\mu$ | |
| Gear ratio* | G | |
| Mechanical efficiency | $\eta$ | |

### Belt drive



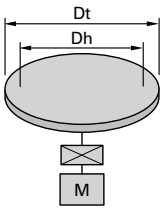

| | | |
|---|---|---|
| External force | F | N |
| Work+belt weight | W | kg |
| Pulley diameter | D | m |
| Pulley width | L | m |
| Pulley material specific gravity | $\rho$ | kg/m$^3$ |
| Pulley moment of inertia | J | kg·m$^2$ |
| Gear ratio* | G | |
| Mechanical efficiency | $\eta$ | |

### Roll feed



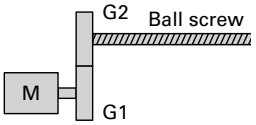

| | | |
|---|---|---|
| Sheet tension | F | N |
| Roll diameter | D | m |
| Roll width | L | m |
| Roll material specific gravity | $\rho$ | kg/m$^3$ |
| Roll moment of inertia | J | kg·m$^2$ |
| Gear ratio* | G | |
| Mechanical efficiency | $\eta$ | |

### Rotary table




| | | |
|---|---|---|
| Table weight | W | kg |
| Table diameter | Dt | m |
| Table support diameter | Dh | m |
| Table moment of inertia | J | kg·m$^2$ |
| Support area friction coefficient | $\mu$ | |
| Gear ratio* | G | |
| Mechanical efficiency | $\eta$ | |

*How to find the gear ratio (G)




$$G = \frac{\text{Number of ball screw gears (G2)}}{\text{Number of motor gears (G1)}}$$

## Notes before Purchase

The products in this catalog are designed to be used with general industrial devices.
Always follow the following precautions.

- Read the accompanying Instruction Manual carefully prior to using the product.
- If applying to medical devices and other equipment affecting people's lives, please contact us beforehand and take appropriate safety measures.
- If applying to equipment that can have significant effects on society and the general public, please contact us beforehand.
- Do not use this product in an environment where vibration is present, such as in a moving vehicle or shipping vessel.
- Do not perform any retrofitting, re-engineering, or modification to this equipment.
- The products presented in this catalog are meant to be used for general industrial applications. If using for special applications related to aviation and space, nuclear power, electric power, submarine repeaters, and the like, please contact us beforehand.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