

# 42 mm sq. (1.65 inch sq.)

1.8° /step RoHS

Bipolar winding, Lead wire type  
Unipolar winding, Connector type ▶ p. 61

### Customizing

- Hollow Shaft modification
- Decelerator Encoder
- Brake

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

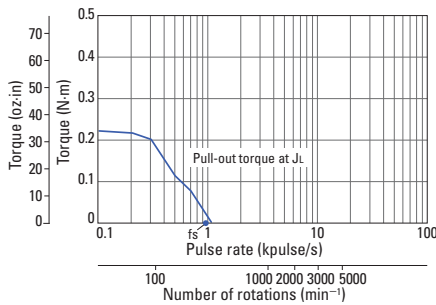
### Bipolar winding, Lead wire type

Model number		Holding torque at 2-phase energization	Rated current	Wiring resistance	Winding inductance	Rotor inertia	Mass (Weight)	Motor length (L)
Single shaft	Dual shaft	[N·m (oz-in) min.]	A/phase	Ω /phase	mH/phase	[× 10 <sup>-4</sup> kg·m <sup>2</sup> (oz-in <sup>2</sup> )]	[kg (lbs)]	mm (in)
<b>103H5205-5040</b>	<b>103H5205-5010</b>	0.23 (32.57)	0.25	54	78	0.036 (0.20)	0.23 (0.51)	33 (1.25)
<b>103H5205-5140</b>	<b>103H5205-5110</b>	0.25 (35.40)	0.5	13.4	23.4	0.036 (0.20)	0.23 (0.51)	33 (1.25)
<b>103H5205-5240</b>	<b>103H5205-5210</b>	0.265 (37.53)	1	3.4	6.5	0.036 (0.20)	0.23 (0.51)	33 (1.25)
<b>103H5208-5040</b>	<b>103H5208-5010</b>	0.35 (49.56)	0.25	66	116	0.056 (0.31)	0.29 (0.64)	39 (1.54)
<b>103H5208-5140</b>	<b>103H5208-5110</b>	0.38 (53.81)	0.5	16.5	34	0.056 (0.31)	0.29 (0.64)	39 (1.54)
<b>103H5208-5240</b>	<b>103H5208-5210</b>	0.39 (55.23)	1	4.1	9.5	0.056 (0.31)	0.29 (0.64)	39 (1.54)
<b>103H5209-5040</b>	<b>103H5209-5010</b>	0.38 (53.81)	0.25	71.4	133	0.062 (0.34)	0.31 (0.68)	41 (1.61)
<b>103H5209-5140</b>	<b>103H5209-5110</b>	0.41 (58.06)	0.5	18.2	39	0.062 (0.34)	0.31 (0.68)	41 (1.61)
<b>103H5209-5240</b>	<b>103H5209-5210</b>	0.425 (60.18)	1	4.4	11	0.062 (0.34)	0.31 (0.68)	41 (1.61)
<b>103H5210-5040</b>	<b>103H5210-5010</b>	0.465 (65.85)	0.25	80	123.3	0.074 (0.40)	0.37 (0.82)	48 (1.89)
<b>103H5210-5140</b>	<b>103H5210-5110</b>	0.49 (69.39)	0.5	20	35	0.074 (0.40)	0.37 (0.82)	48 (1.89)
<b>103H5210-5240</b>	<b>103H5210-5210</b>	0.51 (72.22)	1	4.8	9.5	0.074 (0.40)	0.37 (0.82)	48 (1.89)

## Characteristics diagram

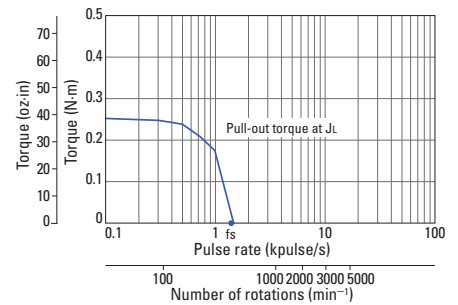
### 103H5205-5040 103H5205-5010

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.25 A/phase, 2-phase  
energization (full-step)  
 $J_L=[0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz-in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



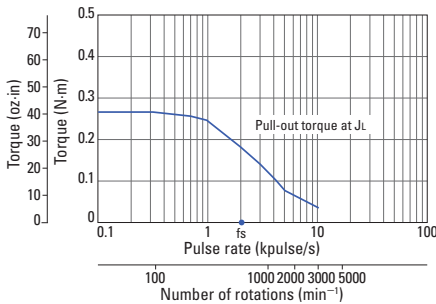
### 103H5205-5140 103H5205-5110

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.5 A/phase, 2-phase  
energization (full-step)  
 $J_L=[0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz-in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



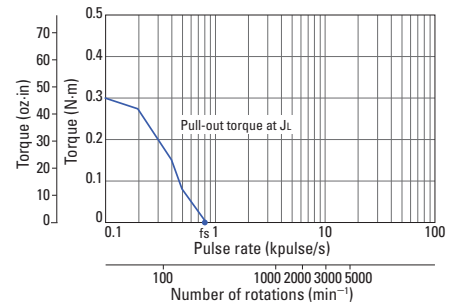
### 103H5205-5240 103H5205-5210

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
1 A/phase, 2-phase  
energization (full-step)  
 $J_L=[0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz-in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



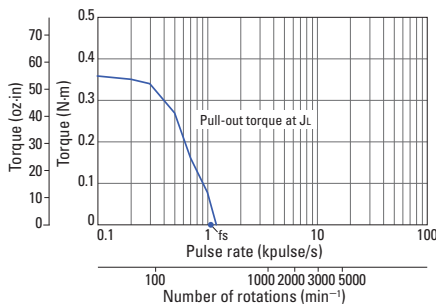
### 103H5208-5040 103H5208-5010

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.25 A/phase, 2-phase  
energization (full-step)  
 $J_L=[0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz-in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



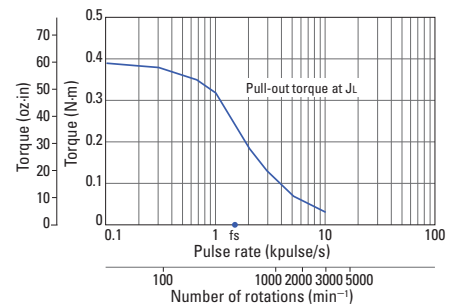
### 103H5208-5140 103H5208-5110

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.5 A/phase, 2-phase  
energization (full-step)  
 $J_L=[0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz-in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



### 103H5208-5240 103H5208-5210

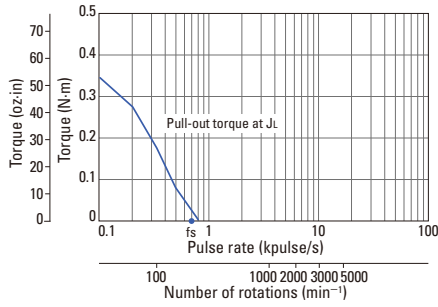
Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
1 A/phase, 2-phase  
energization (full-step)  
 $J_L=[0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz-in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



## Characteristics diagram

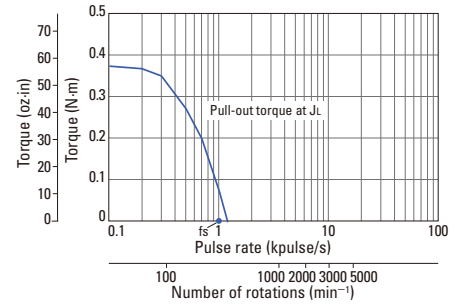
### 103H5209-5040 103H5209-5010

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.25 A/phase, 2-phase  
energization (full-step)  
 $J_L = [0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz·in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



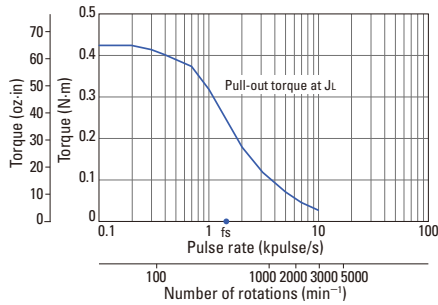
### 103H5209-5140 103H5209-5110

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.5 A/phase, 2-phase  
energization (full-step)  
 $J_L = [0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz·in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



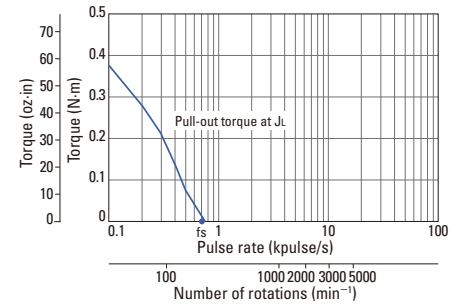
### 103H5209-5240 103H5209-5210

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
1 A/phase, 2-phase  
energization (full-step)  
 $J_L = [0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz·in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



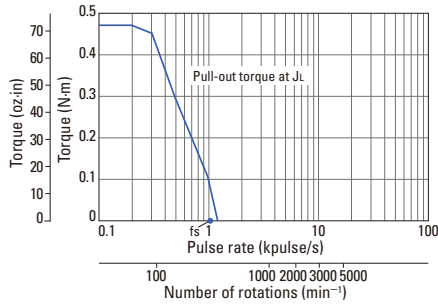
### 103H5210-5040 103H5210-5010

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.25 A/phase, 2-phase  
energization (full-step)  
 $J_L = [0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz·in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



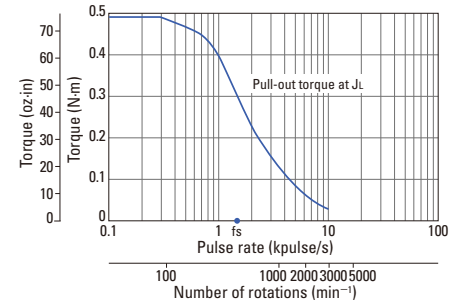
### 103H5210-5140 103H5210-5110

Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
0.5 A/phase, 2-phase  
energization (full-step)  
 $J_L = [0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz·in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded

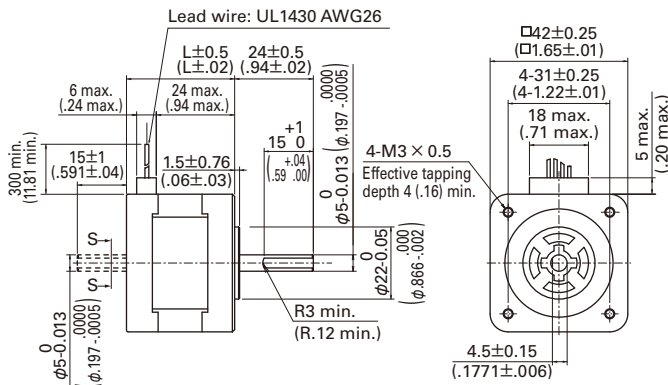


### 103H5210-5240 103H5210-5210

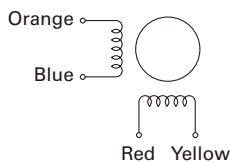
Constant current circuit  
Source voltage: 24 VDC  
Operating current:  
1 A/phase, 2-phase  
energization (full-step)  
 $J_L = [0.94 \times 10^{-4} \text{kg}\cdot\text{m}^2$  (5.14  
oz·in<sup>2</sup>) use the rubber  
coupling]  
fs: Maximum self-start  
frequency when not  
loaded



## Dimensions [Unit: mm (inch)]



## Internal wiring



## Compatible drivers

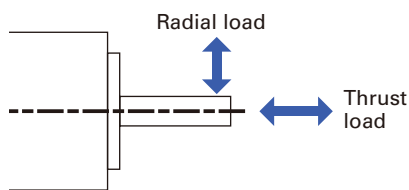
- For motor model number 103H52 □□ -50 □ 0 (0.25 A/phase), 103H52 □□ -51 □□ (0.5 A/phase)  
Driver is not included.

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

- For model number 103H52 □□ -52 □□ (1 A/phase)  
Model number: BS1D200P10 (DC input)  
Operating current select switch setting: A

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

# Allowable Radial/Thrust Load



Flange size	Model number	Distance from end of shaft : mm (in)				Thrust load N (lbs)
		0	5	10	15	
Radial load : N (lbs)						
14 mm sq. (0.55 in sq.)	SH2141	10 (2.25)	11 (2.47)	13 (2.92)	-	0.7 (0.16)
28 mm sq. (1.10 in sq.)	SH228 □	42 (9)	48 (10)	56 (12)	66 (14)	3 (0.67)
35 mm sq. (1.38 in sq.)	SH353 □	40 (8)	50 (11)	67 (15)	98 (22)	10 (2.25)
42 mm sq. (1.65 in sq.)	103H52 □□ SH142 □	22 (4)	26 (5)	33 (7)	46 (10)	10 (2.25)
50 mm sq. (1.97 in sq.)	103H670 □	71 (15)	87 (19)	115 (25)	167 (37)	15 (3.37)
56 mm sq. (2.20 in sq.)	103H712 □	52 (11)	65 (14)	85 (19)	123 (27)	15 (3.37)
	103H7128	85 (19)	105 (23)	138 (31)	200 (44)	15 (3.37)
60 mm sq. (2.36 in sq.)	103H782 □	70 (15)	87 (19)	114 (25)	165 (37)	20 (4.50)
	SH160 □					15 (3.37)
86 mm sq. (3.39 in sq.)	SM286 □ SH286 □	167 (37)	193 (43)	229 (51)	280 (62)	60 (13.488)
	103H822 □					191 (43)
φ 106 mm (φ 4.17 in)	103H8922 □	321 (72)	356 (79)	401 (90)	457 (101)	100 (22.48)

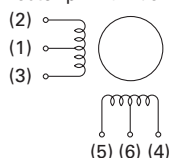
## Internal Wiring and Rotation Direction

### Unipolar winding

Connector type Model number: 103H52 □□

#### Internal wire connection

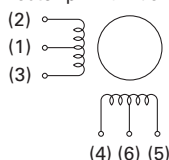
( ) connector pin number



Connector type Model number: 103H782 □□

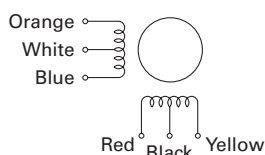
#### Internal wire connection

( ) connector pin number



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.

Exciting order	Connector pin number				
	(1.6)	(5)	(3)	(4)	(2)
1	+	-	-	-	-
2	+	-	-	-	-
3	+	-	-	-	-
4	+	-	-	-	-

#### 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.

Exciting order	Connector pin number				
	(1.6)	(4)	(3)	(5)	(2)
1	+	-	-	-	-
2	+	-	-	-	-
3	+	-	-	-	-
4	+	-	-	-	-

#### 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.

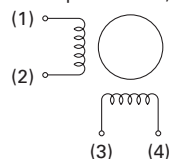
Exciting order	Lead wire color				
	White & black	Red	Blue	Yellow	Orange
1	+	-	-	-	-
2	+	-	-	-	-
3	+	-	-	-	-
4	+	-	-	-	-

### Bipolar winding

Connector type

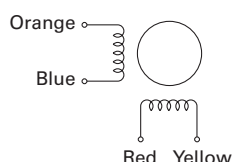
#### Internal wire connection

( ) connector pin number, terminal block number



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.

Exciting order	Connector pin number, terminal block number			
	(3)	(2)	(4)	(1)
1	-	-	+	+
2	+	-	-	+
3	+	+	-	-
4	-	+	+	-

#### 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.

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

## General Specifications

Motor model number	<b>SH2141</b>	<b>SH228</b> □	<b>SH353</b> □	<b>SS242</b> □	<b>SH142</b> □	<b>103H52</b> □□	<b>SS250</b> □	<b>103H67</b> □□	<b>103H712</b> □
Type	-								
Operating ambient temperature	- 10°C to + 50°C								
Conversation temperature	- 20°C to + 65°C								
Operating ambient humidity	20 to 90% RH (no condensation)								
Conversation humidity	5 to 95% RH (no condensation)								
Operation altitude	1000 m (3281 feet) 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/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction.								
Impact resistance	500 m/s <sup>2</sup> of acceleration for 11 ms with half-sine wave applying three times for X, Y, and Z axes each, 18 times in total.								
Insulation 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	IP40								
Winding temperature rise	80 K max. (Based on Sanyo Denki standard)								
Static angle error	± 0.09°				± 0.054°		± 0.09°		
Thrust play *1	0.075 mm (0.003 in) max. (load: 0.35 N (0.08 lbs))	0.075 mm (0.003 in) max. (load: 1.5 N (0.34 lbs))	0.075 mm (0.003 in) max. (load: 5 N (1.12 lbs))	0.075 mm (0.003 in) max. (load: 4 N (0.9 lbs))	0.075 mm (0.003 in) max. (load: 5 N (1.12 lbs))	0.075 mm (0.003 in) max. (load: 5 N (1.12 lbs))	0.075 mm (0.003 in) max. (load: 4 N (0.9 lbs))	0.075 mm (0.003 in) max. (load: 10 N (2.25 lbs))	0.075 mm (0.003 in) max. (load: 10 N (2.25 lbs))
Radial play *2	0.025 mm (0.001 in) max. (load: 5 N (1.12 lbs))								
Shaft runout	0.025 mm (0.001 in)								
Concentricity of mounting pilot relative to shaft	φ 0.05 mm (φ 0.002 in)	φ 0.05 mm (φ 0.002 in)	φ 0.075 mm (φ 0.003 in)	φ 0.075 mm (φ 0.003 in)	φ 0.05 mm (φ 0.002 in)	φ 0.05 mm (φ 0.002 in)	φ 0.075 mm (φ 0.003 in)	φ 0.075 mm (φ 0.003 in)	φ 0.075 mm (φ 0.003 in)
Squareness of mounting surface relative to shaft	0.1 mm (0.004 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)
Direction of motor mounting	Can be freely mounted vertically or horizontally								

Motor model number	<b>SH160</b> □	<b>103H78</b> □□	<b>SH286</b> □	<b>103H8922</b> □	<b>SM286</b> □	<b>103H712</b> □ -6 □□ 0 CE Model	<b>103H822</b> □ -6 □□ 0 CE Model	<b>103H8922</b> □ -63 □ 1 CE Model	
Type	-				S1 (continuous operation)				
Operating ambient temperature	- 10°C to + 50°C				- 10°C to + 40°C				
Conversation temperature	- 20°C to + 65°C				- 20°C to + 60°C				
Operating ambient humidity	20 to 90% RH (no condensation)				95% max.: 40°C max., 57% max.: 50°C max., 35% max.: 60°C max. (no condensation)				
Conversation humidity	5 to 95% RH (no condensation)								
Operation altitude	1000 m (3280 feet) 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/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction.								
Impact resistance	500 m/s <sup>2</sup> of acceleration for 11 ms with half-sine wave applying three times for X, Y and Z axes each, 18 times in total.								
Insulation 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 than 100 MΩ between winding and frame by 500 VDC megger.								
Protection grade	IP40				IP43				
Winding temperature rise	80 K max. (Based on Sanyo Denki standard)								
Static angle error	± 0.054°		± 0.09°						
Thrust play *1	0.075 mm (0.003 in) max. (load: 10 N (2.25 lbs))								
Radial play *2	0.025 mm (0.001 in) (load: 5 N (1.12 lbs))	0.025 mm (0.001 in) (load: 5 N (1.12 lbs))	0.025 mm (0.001 in) (load: 5 N (1.12 lbs))	0.025 mm (0.001 in) (load: 10 N (2.25 lbs))	0.025 mm (0.001 in) (load: 5 N (1.12 lbs))	0.025 mm (0.001 in) (load: 5 N (1.12 lbs))	0.025 mm (0.001 in) (load: 5 N (1.12 lbs))	0.025 mm (0.001 in) (load: 10 N (2.25 lbs))	
Shaft runout	0.025 mm (0.001 in)								
Concentricity of mounting pilot relative to shaft	φ 0.075 mm (φ 0.003 in)								
Squareness of mounting surface relative to shaft	0.1 mm (0.004 in)	0.075 mm (0.003 in)	0.15 mm (0.006 in)	0.1 mm (0.004 in)	0.15 mm (0.006 in)	0.075 mm (0.003 in)	0.1 mm (0.004 in)	0.1 mm (0.004 in)	
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

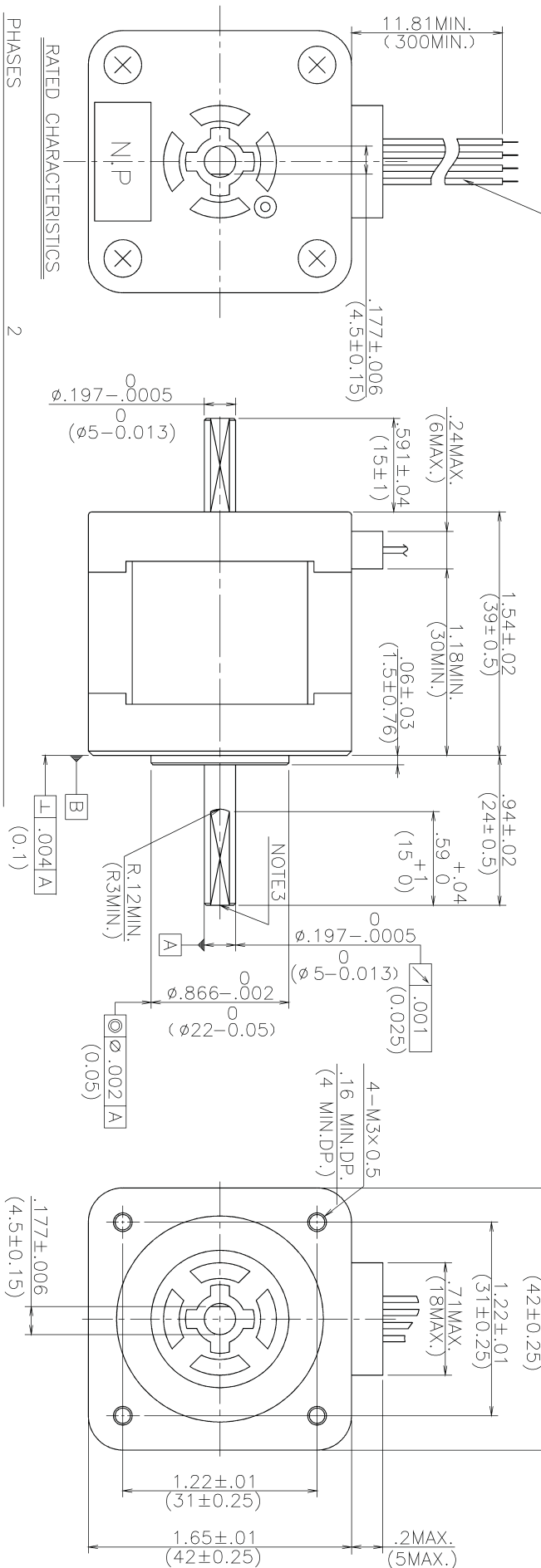
Model Number: **SM286** □ CE/UL marked models

CE (TÜV)	Standard category	Applicable standard	
	Low-voltage directives	EN60034-1, EN60034-5	
UL	Acquired standards	Applicable standard	File No.
	UL	UL1004-1, UL1004-6	E179832
	UL for Canada	CSA C22.2 No.100	

Model Number: **103H712** □ -6 □□ 0, **103H822** □ -6 □□ 0, **103H8922** □ -63 □ 1 CE marked model

CE (TÜV)	Standard category	Applicable standard	
	Low-voltage directives	EN60034-1, EN60034-5	

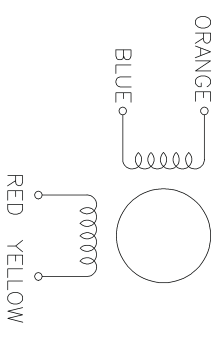
LEAD WIRE : UL1430 CSA.AWG26(7/0.16)



RATED CHARACTERISTICS

PHASES	2
STEP ANGLE	1.8 °
VOLTS	4.1 V[DC]
AMPS	1 A/PHASE
D.C. RESISTANCE	4.1 Ω±10% at 25 °C
COIL INDUCTANCE	9.5 mH±20% at 1 kHz, 1 V[rms]
HOLDING TORQUE	55.2 oz·in (0.39 N·m) MIN. at I=1 A/PHASE 2EX.
NOTE1. PULL OUT TORQUE	43.9 oz·in (0.31 N·m) MIN. at 200 pulse/s (INERTIA LOAD 5.14 oz·in <sup>2</sup> (0.94x10 <sup>-4</sup> kg·m <sup>2</sup> ))

CONNECTION



DIRECTION OF ROTATION

WHEN A MOTOR IS SEQUENCED AS SHOWN IN THE TABLE BELOW, THE SHAFT ROTATION MUST BE CLOCKWISE WHEN YOU SEE FROM SURFACE [B] SIDE.

STEP	1	2	3	4
RED	⊖	⊕	⊕	⊕
BLUE	⊖	⊖	⊖	⊖
YELLOW	⊕	⊕	⊕	⊕
ORANGE	⊕	⊕	⊕	⊕

- NOTE1. MAX. STARTING RATE 1300 pulse/s MIN. at NO LOAD
- NOTE1. MAX. SLEWING RATE 1300 pulse/s MIN. at NO LOAD
- NOTE2. POSITIONAL ACCURACY ±0.09 ° (0.18° SPREAD MAX.) 2EX.
- COIL TEMPERATURE RISE 80 K MAX.
- ROTOR INERTIA .31 oz·in<sup>2</sup> (0.056x10<sup>-4</sup>kg·m<sup>2</sup>) NOMINAL
- INSULATION CLASS B
- ◎ ALLOWABLE THRUST LOAD 36 oz(10 N)
- ◎ ALLOWABLE RADIAL LOAD 86.3 oz(24 N) LOAD TO SHAFT END.

NOTE1. SANYO PMM-BD-4502 DRIVE CIRCUIT. (2 PHASE EXCITATION )  
E=24 V[DC], I=1 A/PHASE. (AVERAGE VALUE)

NOTE2. MOUNTED A MOTOR ON 4.00x4.00x.08t (100x100x2t) SPCC HEAT SINK AND ENERGIZED A COIL AT 2 PHASE EXCITATION, I=1 A/PHASE CONSTANT. MEASURED BY THE CHANGE OF RESISTANCE METHOD.

NOTE3. CENTER HOLE ON THE SHAFT END IS NOT ALWAYS MADE.

REV.	DATE	DESCRIPTION	BY	CHKD	DATE	DESCRIPTION	BY	CHKD	DATE
C	E0070160	05-07-11			05-07-12	変更承認			
B	E0055049	03-05-27			05-07-12	変更承認			
A	NEW DESIGN	02-12-24							

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