

# Stepping Motors

Allowable Load · Internal Wiring · Rotation Direction ▶ P.56

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Motor Dimensions ▶ P.69 to 74



## 14 mm sq. (0.55 inch sq.)

1.8° /step

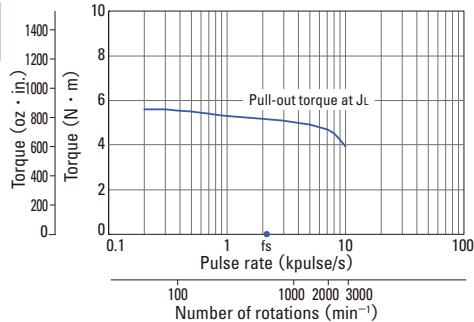
Bipolar winding · Lead wire type

### Bipolar winding · Lead wire type

Model number		Holding torque at 2-phase energization	Rated current	Wiring resistance	Winding inductance	Rotor inertia	Mass (Weight)
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)]
SH2141-5541	SH2141-5511	0.0065 (0.92)	0.3	21	4.2	0.00058 (0.0032)	0.028 (0.062)

### Characteristics diagram

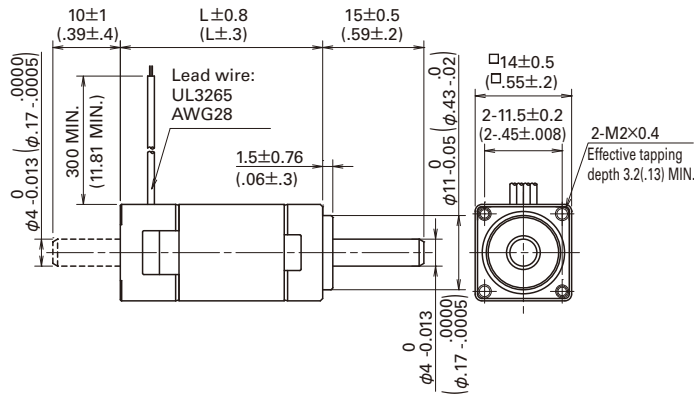
SH2141-5541  
SH2141-5511



Constant current circuit  
Source voltage : DC24V · Operating current : 0.3A/phase,  
2-phase energization (full-step)  
 $J_L = [0.01 \times 10^{-4} \text{kg} \cdot \text{m}^2 (1.80 \text{oz} \cdot \text{in}^2) \text{ pulley balancer method}]$   
fs: Maximum self-start frequency when not loaded

# Stepping motors [Unit: mm (inch)]

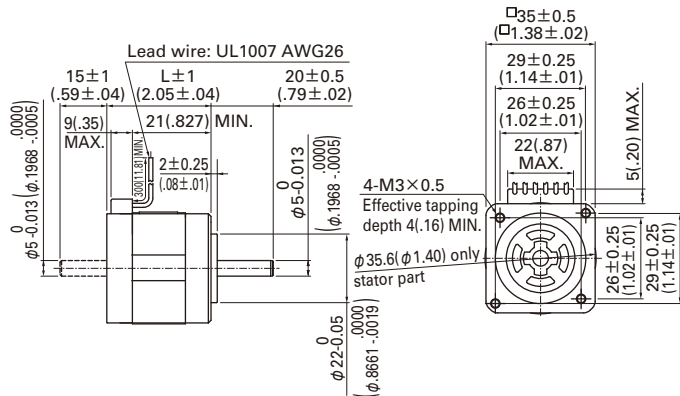
## 14 mm sq. (0.55 inch sq.)



### Bipolar

Set model number		Motor model number		Motor length (L)
Single shaft	Dual shaft	Single shaft	Dual shaft	
-	-	SH2141-5541	SH2141-5511	30 (1.18)

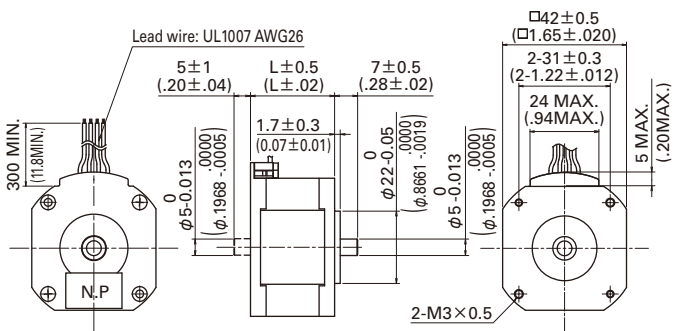
## 35 mm sq. (1.65 inch sq.)



### Unipolar

Set model number		Motor model number		Motor length (L)
Single shaft	Dual shaft	Single shaft	Dual shaft	
-	-	SH3533-12U40	SH3533-12U10	33 (1.25)
-	-	SH3537-12U40	SH3537-12U10	37 (1.54)
-	-	SH3552-12U40	SH3552-12U10	52 (1.89)

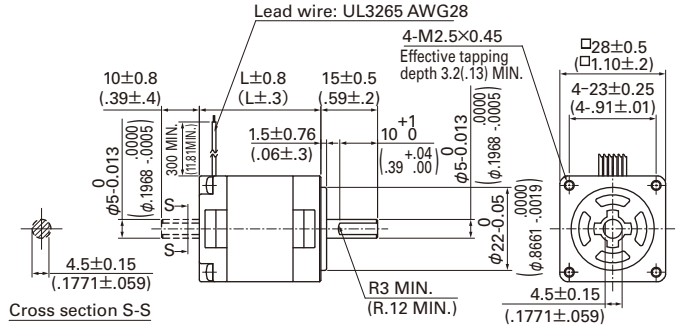
## 42 mm sq. (1.65 inch sq.)



### Bipolar

Set model number		Motor model number		Motor length (L)
Single shaft	Dual shaft	Single shaft	Dual shaft	
-	-	SS2421-5041	SS2421-5011	11.6 (.457)
-	-	SS2422-5041	SS2422-5011	18.6 (.732)

## 28 mm sq. (1.10 inch sq.)



### Cross section S-S

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

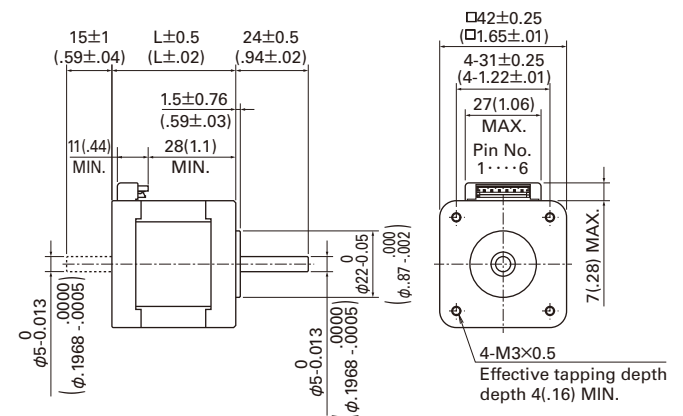
### Unipolar

Set model number		Motor model number		Motor length (L)
Single shaft	Dual shaft	Single shaft	Dual shaft	
-	-	SH2281-5171	SH2281-5131	32 (1.26)
DU14S281S	DU14S281D	SH2281-5271	SH2281-5231	32 (1.26)
-	-	SH2285-5171	SH2285-5131	51.5 (2.03)
DU14S285S	DU14S285D	SH2285-5271	SH2285-5231	51.5 (2.03)

### Bipolar

Set model number		Motor model number		Motor length (L)
Single shaft	Dual shaft	Single shaft	Dual shaft	
-	-	SH2281-5671	SH2281-5631	32 (1.26)
DB14S281S	DB14S281D	SH2281-5771	SH2281-5731	32 (1.26)
-	-	SH2285-5671	SH2285-5631	51.5 (2.03)
DB14S285S	DB14S285D	SH2285-5771	SH2285-5731	51.5 (2.03)

## 42 mm sq. (1.65 inch sq.)

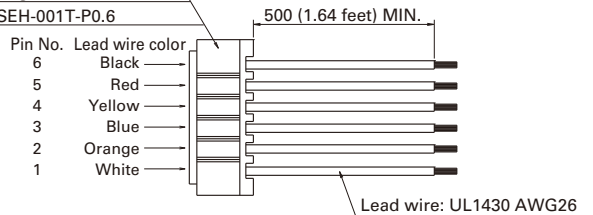


### Unipolar

Set model number		Motor model number		Motor length (L)
Single shaft	Dual shaft	Single shaft	Dual shaft	
DU15H521S	DU15H521D	103H5205-0440	103H5205-0410	33 (1.25)
DU15H522S	DU15H522D	103H5208-0440	103H5208-0410	39 (1.54)
-	-	103H5209-0440	103H5209-0410	41 (1.61)
DU15H524S	DU15H524D	103H5210-0440	103H5210-0410	48 (1.89)

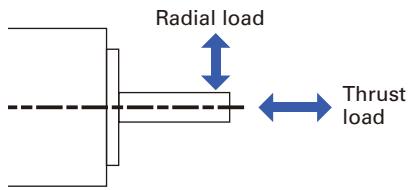
### Motor cable Model number: 4835710-1

Maker: J.S.T Mfg.Co.,Ltd  
Housing: EHR-6 Black  
Pin: SEH-001T-P0.6



This driver-motor cable is for motor model numbers 103H52□□-04□□.

## 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 □	167 (37)	193 (43)	229 (51)	280 (62)	60 (13.488)
	SH286 □					
86 mm sq. (3.39 in sq.)	103H822 □	191 (43)	234 (53)	301 (68)	421 (95)	60 (13.488)
φ 106 mm (φ 4.17 in)	103H8922 □	321 (72)	356 (79)	401 (90)	457 (101)	100 (22.48)

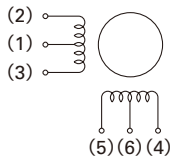
## Internal Wiring and Rotation Direction

### Unipolar winding

103H52 □□ Connector type

#### Internal wire connection

( ) connector pin number



#### Direction of motor rotation

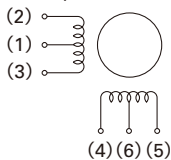
The output shaft shall rotate clockwise as seen from the shaft side, when excited by DC in the following order.

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

103H782 □□ Connector type

#### Internal wire connection

( ) connector pin number



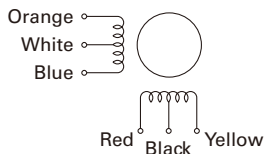
#### Direction of motor rotation

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

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

Lead wire type

#### Internal wire connection



#### Direction of motor rotation

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

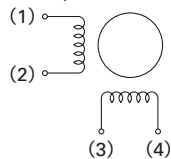
Exciting order	Lead wire color				
	White & black	Red	Blue	Yellow	Orange
1	+	-	-	-	-
2	+	-	-	-	-
3	+	-	-	-	-
4	+	-	-	-	-

### Bipolar winding

Connector type

#### Internal wire connection

( ) connector pin number, terminal block number



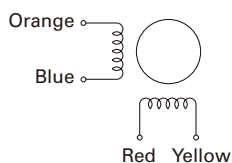
#### Direction of motor rotation

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

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

Lead wire type

#### Internal wire connection



#### Direction of motor rotation

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

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

# General Specifications

Motor model number	<b>SH2141</b>	<b>SH228</b> <input type="checkbox"/>	<b>SH353</b> <input type="checkbox"/>	<b>SS242</b> <input type="checkbox"/>	<b>SH142</b> <input type="checkbox"/>	<b>103H52</b> <input type="checkbox"/>	<b>SS250</b> <input type="checkbox"/>	<b>103H67</b> <input type="checkbox"/>	<b>103H712</b> <input type="checkbox"/>
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	1000m (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 147m/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction.								
Impact resistance	490m/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)								
Withstand voltage	At normal temperature and humidity, no failure with 500 V AC @50/60 Hz applied for one minute between motor winding and frame.						At normal temperature and humidity, no failure with 1000 V AC @50/60 Hz applied for one minute between motor winding and frame.		
Insulation resistance	At normal temperature and humidity, not less than 100MΩ between winding and frame by DC500V megger.								
Protection grade	IP40								
Winding temperature rise	80K MAX. (Based on Sanyo Denki standard)								
Static angle error	± 0.09°				± 0.054°		± 0.09°		
Axial play *1	0.075 mm (0.003 in) MAX. (load: 0.35N (0.08 lbs))	0.075 mm (0.003 in) MAX. (load: 1.5N (0.34 lbs))	0.075 mm (0.003 in) MAX. (load: 5N (1.12 lbs))	0.075 mm (0.003 in) MAX. (load: 4N (0.9 lbs))	0.075 mm (0.003 in) MAX. (load: 5N (1.12 lbs))	0.075 mm (0.003 in) MAX. (load: 5N (1.12 lbs))	0.075 mm (0.003 in) MAX. (load: 4N (0.9 lbs))	0.075 mm (0.003 in) MAX. (load: 10N (2.25 lbs))	0.075 mm (0.003 in) MAX. (load: 10N (2.25 lbs))
Radial play *2	0.025 mm (0.001 in) MAX. (load: 5N (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)	0.075 mm (0.003 in)	0.075 mm (0.003 in)

Motor model number	<b>SH160</b> <input type="checkbox"/>	<b>103H78</b> <input type="checkbox"/>	<b>SH286</b> <input type="checkbox"/>	<b>103H8922</b> <input type="checkbox"/>	<b>SM286</b> <input type="checkbox"/>	<b>103H712</b> <input type="checkbox"/> -6 <input type="checkbox"/> 0 <input type="checkbox"/> <b>CE Model</b>	<b>103H822</b> <input type="checkbox"/> -6 <input type="checkbox"/> 0 <input type="checkbox"/> <b>CE Model</b>	<b>103H8922</b> <input type="checkbox"/> -63 <input type="checkbox"/> 1 <input type="checkbox"/> <b>CE Model</b>
Type	-							
Operating ambient temperature	- 10°C to + 50°C				S1 (continuous operation)			
Conversation temperature	- 20°C to + 65°C				- 10°C to + 40°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	1000m (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 147m/s <sup>2</sup> (70 to 500 Hz), sweep time 15 min/cycle, 12 sweeps in each X, Y and Z direction.							
Impact resistance	490m/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)	
Withstand voltage	At normal temperature and humidity, no failure with 1000 V AC @50/60 Hz applied for one minute between motor winding and frame.				At normal temperature and humidity, no failure with 1500 V AC @50/60 Hz applied for one minute between motor winding and frame.			
Insulation resistance	At normal temperature and humidity, not less than 100MΩ between winding and frame by DC500V megger.							
Protection grade	IP40				IP43			
Winding temperature rise	80K MAX. (Based on Sanyo Denki standard)							
Static angle error	± 0.054°		± 0.09°					
Axial play *1	0.075 mm (0.003 in) MAX. (load: 10N (2.25 lbs))							
Radial play *2	0.025 mm (0.001 in) (load: 5N (1.12 lbs))	0.025 mm (0.001 in) (load: 5N (1.12 lbs))	0.025 mm (0.001 in) (load: 5N (1.12 lbs))	0.025 mm (0.001 in) (load: 10N (2.25 lbs))	0.025 mm (0.001 in) (load: 5N (1.12 lbs))	0.025 mm (0.001 in) (load: 5N (1.12 lbs))	0.025 mm (0.001 in) (load: 5N (1.12 lbs))	0.025 mm (0.001 in) (load: 10N (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)

\*1 Axial 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.

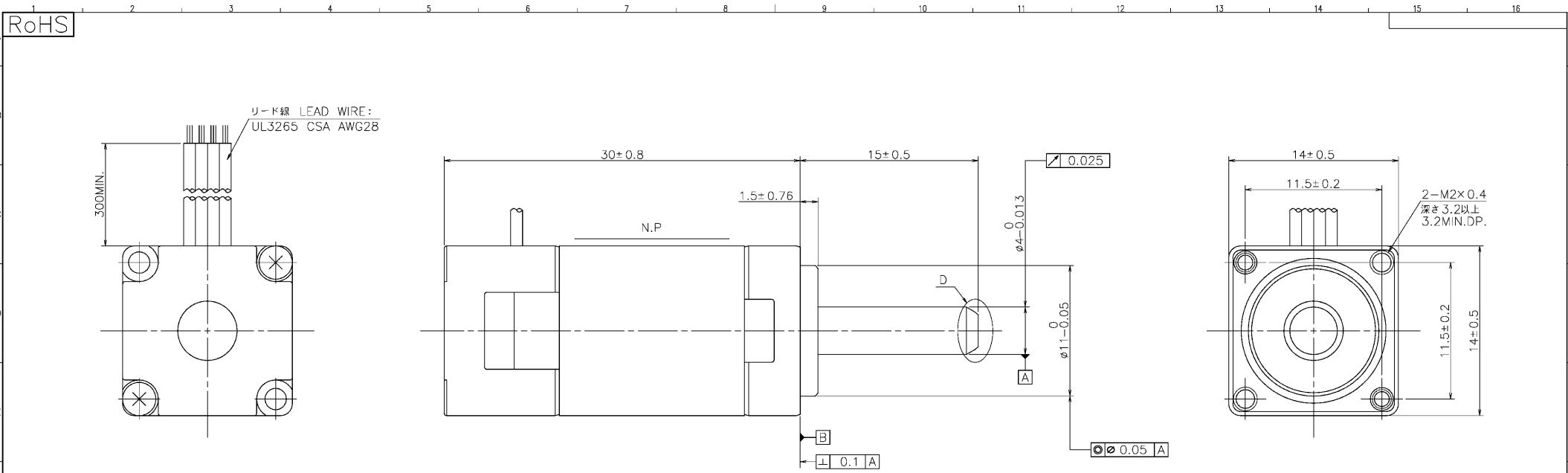
## Safety standards

Model Number: **SM286**  **CE** • **UL** marked models

CE (TÜV)	Standard category	Standard part	
	Low-voltage directives	EN60034-1, EN60034-5	
UL	Acquired standards	Standard part	File No.
	UL for Canada	UL1004-1	E179832

Model Number: **103H712**  -6  0  **CE** marked model

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



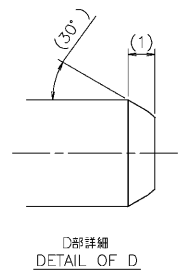
定格特性・CHARACTERISTICS

相数 PHASES	2
基本ステップ角 FUNDAMENTAL STEP ANGLE	1.8°
定格電圧 VOLTS	6.3 V[DC]
定格電流 AMPS	0.3 A/PHASE
巻線抵抗 WINDING RESISTANCE	21 Ω±10% at 25℃
巻線インダクタンス WINDING INDUCTANCE	4.2 mH±20% at 1 kHz, 1 V[rms]
ホールディンクトルク HOLDING TORQUE	0.0065 N·m MIN. at I=0.3 A/PHASE 2 PHASE EXCITATION
注1. 脱出トルク NOTE1. PULL OUT TORQUE	0.0045 N·m MIN. at 500 pulse/s
	負荷イナーシャ INERTIAL LOAD 0.01×10 <sup>-4</sup> kg·m <sup>2</sup> (プーリバランス方式) (PULLEY BALANCER SYSTEM)
注1. 最大自起動周波数 NOTE1. MAX STARTING RATE	1600 pulse/s MIN. at NO LOAD
注1. 最大連続応答周波数 NOTE1. MAX SLEWING RATE	10000 pulse/s MIN. at NO LOAD
静止角度誤差 POSITIONAL ACCURACY	±0.09° (0.18° SPREAD MAX.)
注2. 温度上昇値 NOTE2. COIL TEMPERATURE RISE	80 K MAX.
ロータイナーシャ ROTOR INERTIA	0.00058×10 <sup>-4</sup> kg·m <sup>2</sup> NOMINAL
絶縁階級 INSULATION CLASS	B
許容スラスト荷重 ALLOWABLE THRUST LOAD	0.7 N
許容ラジアル荷重 ALLOWABLE RADIAL LOAD	10 N
	軸先端荷重 LOAD TO SHAFT END.

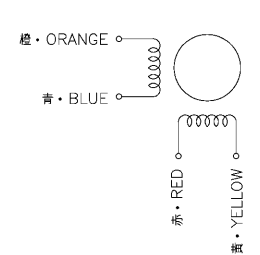
- 注1. 山洋標準駆動回路による。E=24 V[DC] I=0.3 A/相 2相励磁  
NOTE) SANYO STANDARD DRIVE CIRCUIT WAS USED. E=24 V[DC] I=0.3 A/PHASE 2 PHASE EXCITATION.
2. 100×100×2t SPCC放熱板に取付け、2相励磁E=6.3 V/相を連続通電し、抵抗法にて測定した時の値。  
MOUNT A MOTOR ON 100×100×2t SPCC HEAT SINK AND CONTINUOUSLY ENERGIZE A COIL AT 2 PHASE EXCITATION, E=6.3 V/PHASE. MEASURED BY THE CHANGE OF RESISTANCE METHOD.
3. シャフトセンター穴の有無及び形状は、製造上の都合により任意とする。  
CENTER HOLE ON THE SHAFT END IS NOT ALWAYS MADE.
4. モータのリード線口出し部の配色は任意とする。  
A COLOR SCHEME OF MOTOR'S LEAD WIRE EXIT IS DISCRETION.

回転方向・DIRECTION OF ROTATION

下記の順に直流励磁した場合、回転方向は面Bより見て時計方向回転のこと。  
WHEN A MOTOR IS SEQUENCED AS SHOWN IN THE TABLE BELOW, THE SHAFT ROTATION MUST BE CLOCKWISE WHEN YOU SEE FROM SURFACE "B" SIDE.



内部結線・CONNECTION



励磁順序 ENERGIZE ORDER	リード線色 LEADS COLOR			
	赤・RED	青・BLUE	黄・YELLOW	橙・ORANGE
1	⊖	⊖	⊕	⊕
2	⊕	⊖	⊖	⊕
3	⊖	⊕	⊕	⊖
4	⊕	⊕	⊖	⊖

承認 APPROVED BY Y. MIURA 12-01-17	高付分類記号 35030
検査 CHECKED BY M. OOHASHI 12-01-17	名称 TITLE STEPPING MOTOR
設計 DESIGNER K. NAKATAKE 12-01-17	製品名 PRODUCT NAME ステッピングモータ
山洋電気株式会社 SANYO DENKI CO., LTD.	
SH2141-5541	