ϕ86 mm (ϕ3.39 inch)

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.

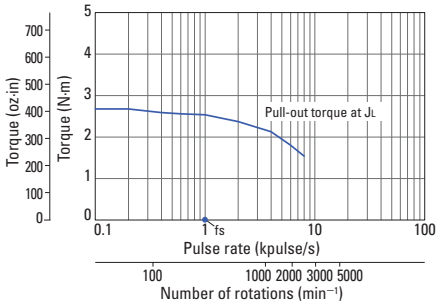
Bipolar winding, Lead wire type CE model

Model 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	[×10⁻⁴kg·m² (oz·in²)]	[kg (lbs)]	mm (in)
103H8221-6240	**103H8221-6210**	2.74 (388)	6	0.3	1.65	1.45 (7.93)	1.5 (3.31)	62 (3.31)
103H8222-6340	**103H8222-6310**	5.09 (720.8)	6	0.35	2.7	2.9 (15.86)	2.5 (5.51)	92.2 (5.51)
103H8223-6340	**103H8223-6310**	7.44 (1053.6)	6	0.45	3.4	4.4 (24.06)	3.5 (7.72)	125.9 (7.72)

Characteristics diagram

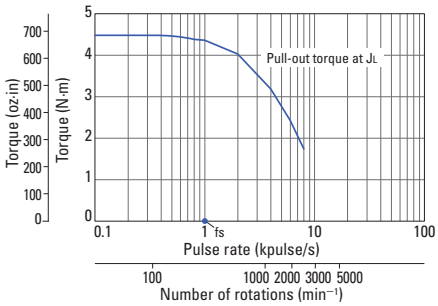
103H8221-6240
103H8221-6210

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
JL=[7.4 × 10⁻⁴kg·m² (40.46 oz·in²) use the rubber coupling]
fs: Maximum self-start frequency when not loaded



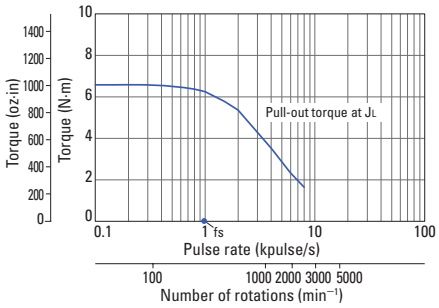
103H8222-6340
103H8222-6310

Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
JL=[15.3 × 10⁻⁴kg·m² (83.65 oz·in²) use the rubber coupling]
fs: Maximum self-start frequency when not loaded

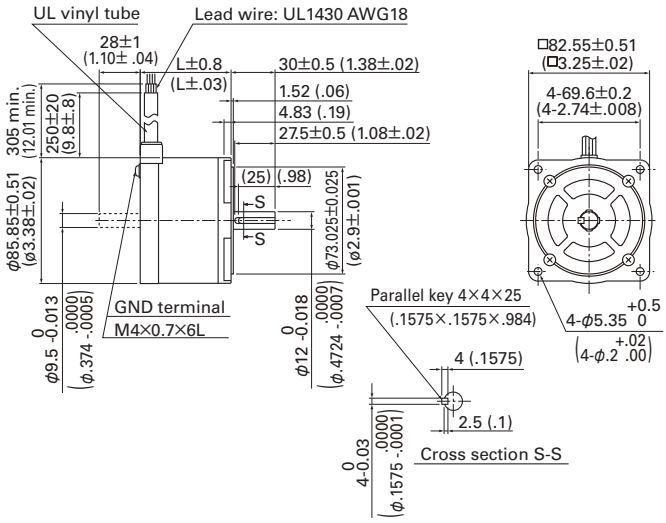


103H8223-6340
103H8223-6310

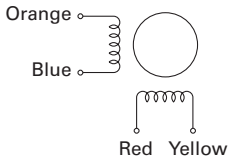
Constant current circuit
Source voltage: 100 VAC
Operating current:
6 A/phase, 2-phase energization (full-step)
JL=[44 × 10⁻⁴kg·m² (240.56 oz·in²) use the rubber coupling]
fs: Maximum self-start frequency when not loaded



Dimensions [Unit: mm (inch)]



Internal wiring



Compatible drivers

Driver is not included.

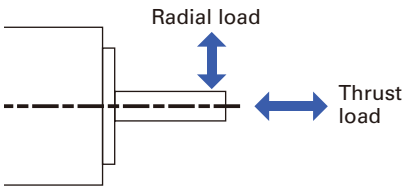
If you require assistance finding a driver, contact us for details.

AC Input Set Models/ Drivers
DC Input Set Models/ Drivers
Stepping Motors
IP65 Splash and Dust Proof Stepping Motors
Stepping Motors for Vacuum Environments
Synchronous Motors
Stepping Motors with Integrated Drivers

Allowable Load, Rotation Direction ▶p. 87 General Specifications ▶p. 88

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

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)
86 mm sq. (3.39 in sq.)	103H822 □	191 (43)	234 (53)	301 (68)	421 (95)	60 (13.488)
ϕ106 mm (ϕ4.17 in)	103H8922 □	321 (72)	356 (79)	401 (90)	457 (101)	100 (22.48)

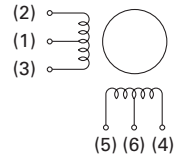
Internal Wiring and Rotation Direction

Unipolar winding

Connector type Model number: 103H52 □□

Internal wire connection

( ) connector pin number



Direction of motor rotation

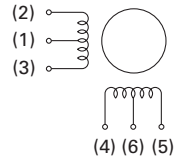
When excited by a direct current in the order shown below, the direction of rotation is clockwise as viewed from the output shaft side.

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

Connector type Model number: 103H782 □□

Internal wire connection

( ) connector pin number



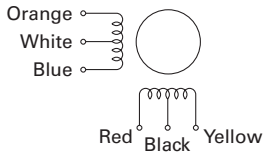
Direction of motor rotation

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 number				
		(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.

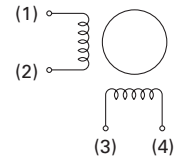
		Lead wire color				
		White & black	Red	Blue	Yellow	Orange
Exciting order	1	+	–	–		
	2	+		–	–	
	3	+			–	–
	4	+	–			–

Bipolar winding

Connector type

Internal wire connection

( ) connector pin number, terminal block number



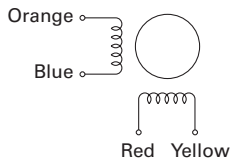
Direction of motor rotation

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 number, terminal block number			
		(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 number	SH2141	SH228 □	SH353 □	SS242 □	SH142 □	103H52 □□	SS250 □	103H67 □□	103H712 □
Type	—								
Operating ambient temperature	− 10℃ to + 50℃								
Conversation temperature	− 20℃ to + 65℃								
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/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.								
Insulation class	Class B (+130℃)								
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) (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) (load: 10 N (2.25 lbs))	0.075 mm (0.003 in) (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)	0.075 mm (0.003 in)	0.075 mm (0.003 in)
Direction of motor mounting	Can be freely mounted vertically or horizontally								

Motor model number	SH160 □	103H78 □□	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℃				− 10℃ to + 40℃			
Conversation temperature	− 20℃ to + 65℃				− 20℃ to + 60℃			
Operating ambient humidity	20 to 90% RH (no condensation)				95% max.: 40℃ max., 57% max.: 50℃ max., 35% max.: 60℃ 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/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.							
Insulation class	Class B (+130℃)				Class F (+155℃)	Class B (+130℃)		
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	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

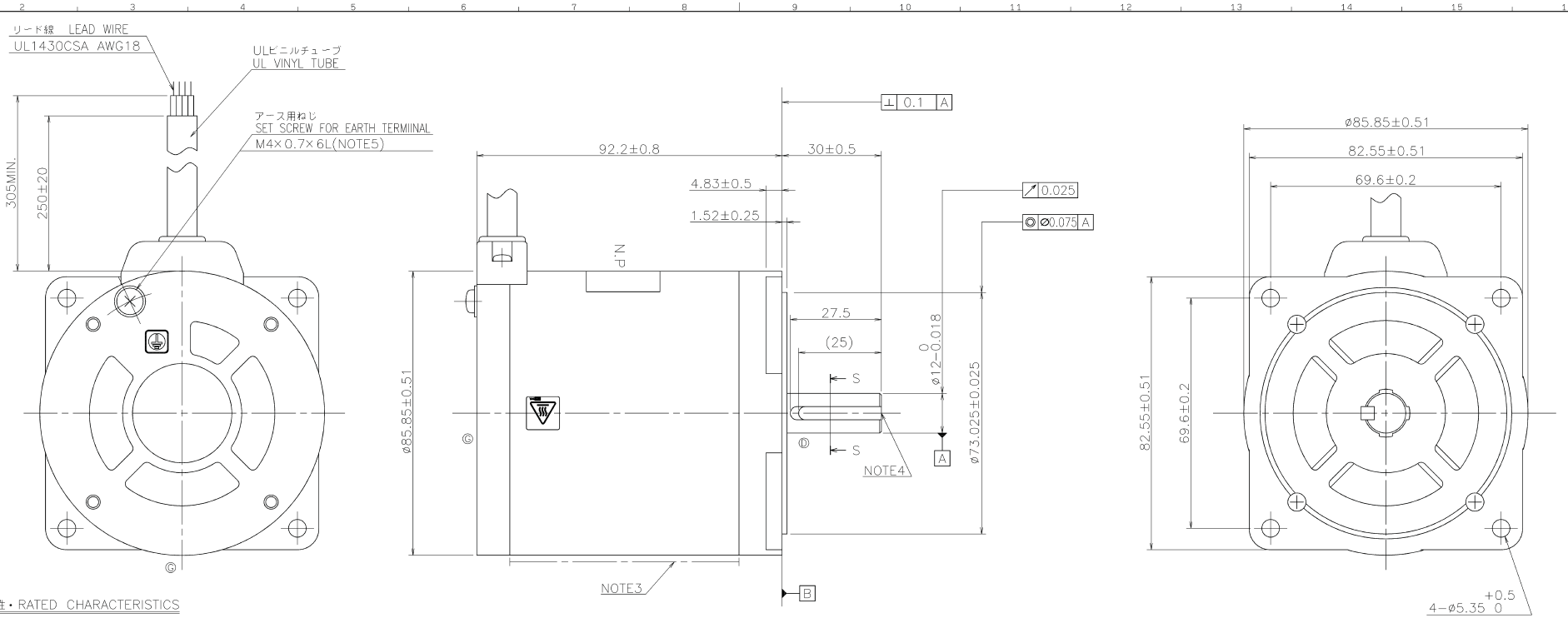
Model Number: SM286 □ CE/UL marked models

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

RoHS Ⓔ



Ⓔ 定格特性・RATED CHARACTERISTICS

	相数 PHASES	2	
	基本ステップ角度 FUNDAMENTAL STEP ANGLE	1.8	°
	定格電圧 RATED VOLTAGE	2.1	V(DC)
	定格電流 RATED CURRENT	6	A/PHASE
Ⓒ	巻線抵抗 WINDING RESISTANCE	0.35	Ω±15% at 25℃
	巻線インダクタンス WINDING INDUCTANCE	2.7	mH±20% at 1 kHz, 1 V(rms)
Ⓔ	ホールディングトルク HOLDING TORQUE	5.09	2相励磁 N・m MIN. at I=6 A/PHASE, 2 PHASE EXCITATION
Ⓔ NOTE 1.	脱出トルク PULL−OUT TORQUE	3.52	N・m MIN. at 300 pulse/s 負荷イナーシャ INERTIAL LOAD 15.3×10^{-4} kg・m^2 (ラバーカップリングイナーシャを含む) (INCLUDING RUBBER COUPLING INERTIA)
NOTE 1.	最大自起動周波数 MAXIMUM STARTING PULSE RATE	830	無負荷時 pulse/s MIN. at NO LOAD
NOTE 1.	最大連続応答周波数 MAXIMUM SLEWING PULSE RATE	2900	無負荷時 pulse/s MIN. at NO LOAD
	静止角度誤差 POSITIONAL ACCURACY	±0.09	2相励磁 °(0.18° SPREAD MAX.) 2 PHASE EXCITATION
Ⓔ NOTE 2.	温度上昇値 TEMPERATURE RISE	80	K MAX.
	ロータイナーシャ ROTOR INERTIA	2.9×10^{-4}	kg・m^2 NOMINAL
Ⓒ	耐熱クラス THERMAL CLASS	B	
	許容スラスト荷重 INSULATION CLASS	60	N
	許容ラジアル荷重 INSULATION CLASS	125	N 軸先端荷重 (LOAD TO SHAFT END)
Ⓒ	保護等級 IP RATING	IP43	EN60034−5 (但し、ビニールチューブ上端部は除く) (EXCEPT FOR THE VINYL TUBE TOP.)

NOTE1. 山洋標準2相励磁駆動回路による。
SANYO STANDARD 2 PHASE EXCITATION DRIVE CIRCUIT WAS USED.

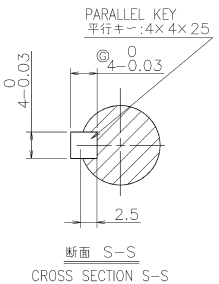
2. 200×200×6t アルミ放熱板に取付け、2相励磁 I=6 A/相を連続通電し、抵抗法にて測定した時の値。
MOUNT A MOTOR ON 200X200X6t ALUMINUM HEAT SINK AND CONTINUOUSLY ENERGIZE THE COIL AT 2 PHASE, I=6 A/PHASE.
MEASURED BY THE CHANGE OF RESISTANCE METHOD.

3. 塗装はステータハウジングのみ黒色塗装のこと。
COAT WITH BLACK PAINT ONLY TO THE STATOR HOUSING.

Ⓒ4. 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.

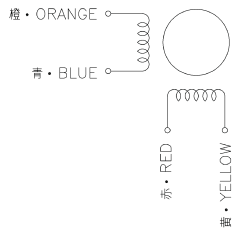
Ⓔ5. アース用ねじ部の防滴処理は、ユーザにて行って下さい。ねじの締付トルクは1±0.1N・mのこと。
WATER PROOF TREATMENT OF AN EARTH TERMINAL SHALL BE DONE BY THE USER.
THE FASTENING TORQUE SHALL BE 1±0.1N・m.

Ⓒ6. IP43はEN60034−5の試験条件により、水に対して保証するものです。
IP43 IS FOR WATER PROTECTION ACCORDING TO THE TEST CONDITION OF EN60034−5.



断面 S−S
CROSS SECTION S−S

内部結線 CONNECTION



Ⓔ 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側より見て時計方向回転のこと。
WHEN MOTOR IS SEQUENCED AS SHOWN IN THE TABLE BELOW, THE SHAFT ROTATION MUST BE CLOCKWISE WHEN YOU SEE FROM SURFACE "B" SIDE.

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

REV.				
G	E0129901	12−10−04		
F	E0105075	10−05−24		
E	E0031439	00−01−31	単位 UNIT	mm
D	E0006395	97−04−14	尺度 SCALE	
A	NEW DESIGN	96−08−26		
記号 REV.	記事 DESCRIPTION	日付 DATE		

承認 APPROVED BY K.UCHIYAMA 12−10−09
審査 CHECKED BY I.TAKESHITA 12−10−09
設計 DESIGNED BY J.SHIMIZU 12−10−04

品目分類記号 35080
名称 TITLE STEPPING MOTOR ステッピングモータ
図番 DWG NO. 103H8222−6340 REV. G

山洋電気株式会社 SANYO DENKI CO.,LTD.

CA Ⓒ

Ⓔ Change to Japanese−English drawing.

A1G−F1 16 00246991