Development of "SANMOTION" Stepping System 2-phase 35mm sq. 1.8°

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1. Introduction

The stepping motor is used as a positioning actuator and a power source of various devices due to the ease of the opening loop and economic system cost. As the demand for device miniaturization has increased, customers are requesting a small stepping motor with the best size for each device and driving system while considering the motor arrangement in a more limited mechanism space.

We developed the 2 phase stepping motor of 35mm sq. size to reinforce the lineup of the product and improve product competitiveness, thinking that the choices of the motor selection would be expanded for customers. Also, with this motor, we believe that we can satisfy customer demands for the miniaturization of devices, if there is a middle size product in between the 28mm sq. size and the 42mm sq. size, which we have been offering to the market so far as a 2 phase 1.8° / step small size motor.

The outline of the product of the 35mm sq. 2 phase stepping motor is introduced below.

2. Overview of Product

2.1 Exterior of the Motor

The exterior of the developed product is shown in Fig. 1 and the exterior dimensions of the motor are shown in Fig. 2. Three types of total length, 33mm, 37mm, and 52mm, are prepared for this motor (shown in L in Fig. 2).

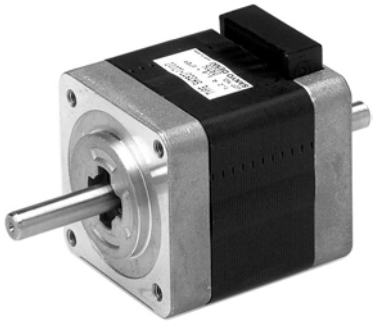


Fig. 1 Motor

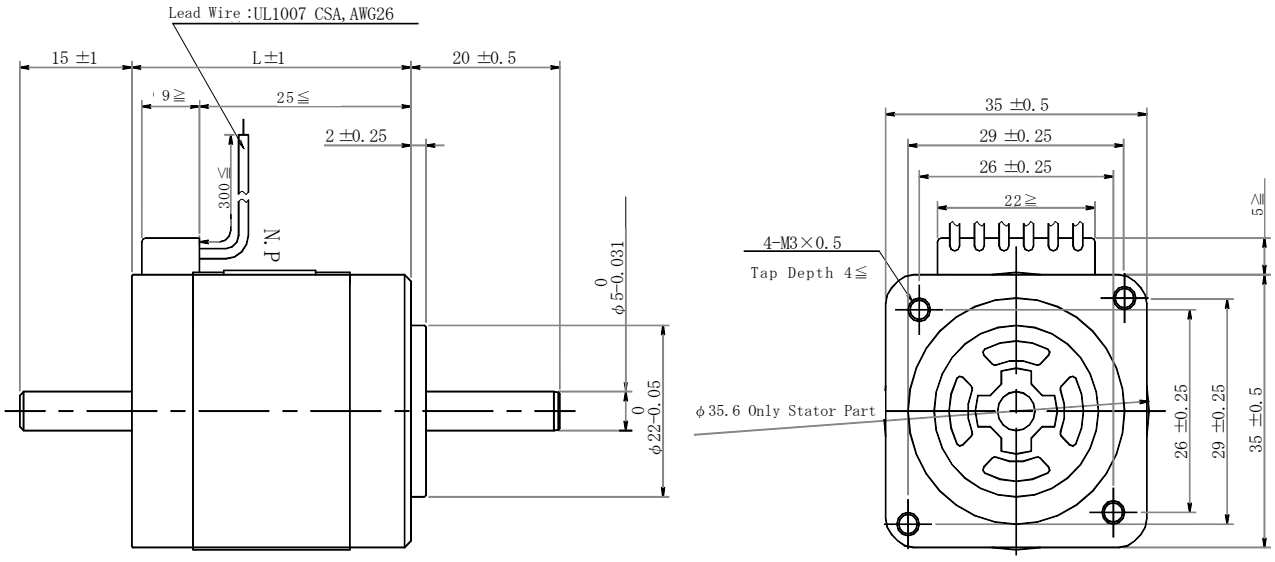


Fig. 2 Exterior Dimensions of the Product

2.2 Structure of the Motor

We carefully reconsidered the necessities of parts when composing the motor to reduce the number of parts.

In the conventional motor structure, as shown in Fig. 3, the printed wiring board was used to connect by soldering an edge of the electric wire winded on the stator and the lead line for the power supply. The connected processing part was composed of three parts: the resin molding part for insulation, the printed wiring board, and the exit resin cover.

In the developed product shown in Fig. 4, we decided to fix the lead line on the resin molding part for insulation after examining the method to delete this printed wiring board.

For example, a fixed part of the lead line is composed on the resin molding part for insulation, and the wire is wrapped directly with the lead wire and soldered. Results of the new structure are as follows:

- The material cost of the printed wiring board has been reduced.
- The labor for mounting the printed wiring board is no longer necessary.
- The time for connection processing has been shortened.

In addition, lead-free soldering has been promoted since the start of development to support the reduction of the environmental burden.

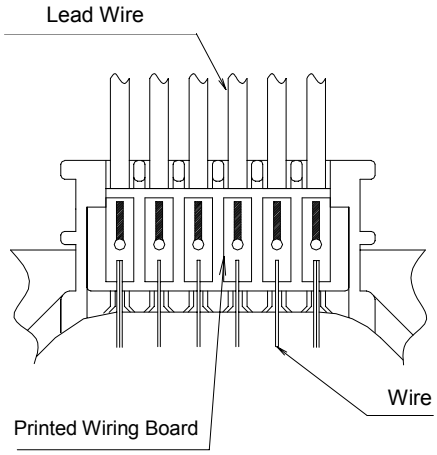


Fig. 3 Conventional Lead Wire Connection

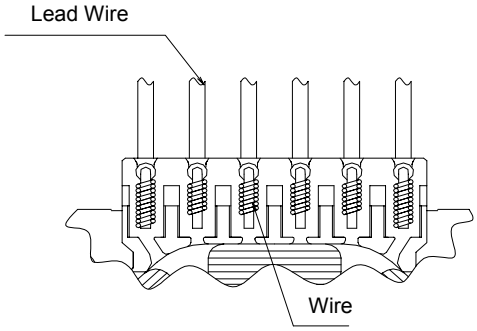


Fig. 4 Lead Connection of the Developed Product

3. Product Specifications and Features

The list of the product specifications is shown in Table 1 and driving frequency-torque characteristics are shown in Fig. 5.

The 35mm sq. 2 phase stepping motor is a model placed in the middle of the conventional 28mm sq. size and 42mm sq. size regarding torque and size.

This motor is able to expand the motor selection in cases where the torque is insufficient using the conventional 28mm sq. size or the 42mm sq. size is too large and does not fit in a device.

This matches our driver for unipolar winding (1.2A/phase specification product) as a driving driver.

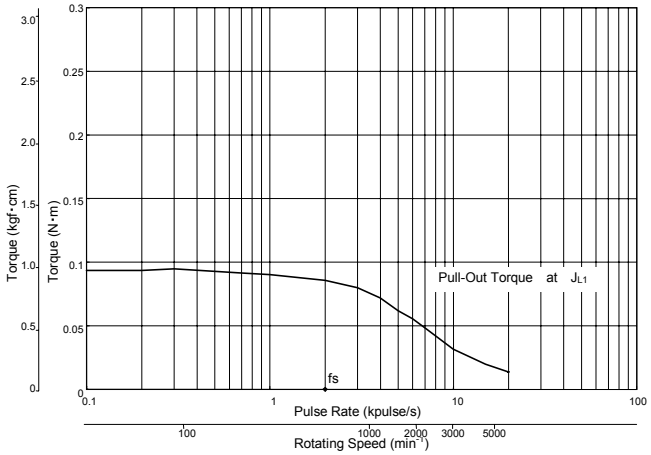
Table 1 Product Spec.: Unipolar Winding

Model		Holding Torque on 2 Phase Exciting	Rated Current	Winding Resistance	Winding Inductance	Rotor Inertia	Mass
Single Ended Spindle	Dual Ended Spindle	N·m≦	A/Phase	Ω/Phase	mH/Phase	$\times 10^{-4}$ kg·m^2	kg
SH3533-12U40	-12U10	0.12	1.2	2.4	1.3	0.020	0.17
SH3537-12U40	-12U10	0.15	1.2	2.7	2	0.025	0.2
SH3552-12U40	-12U10	0.23	1.2	3.4	2.8	0. 043	0.3

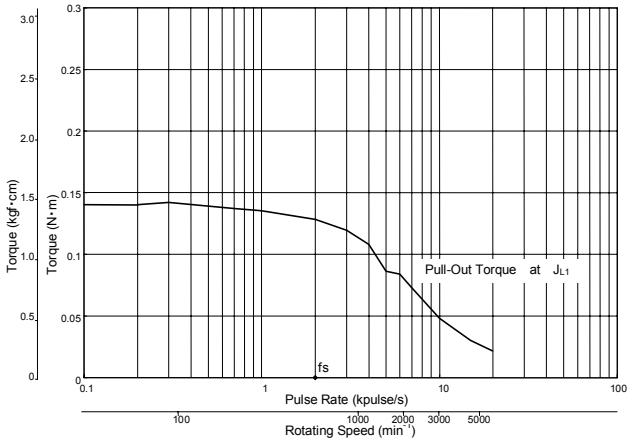
Fig. 5 Driving Frequency - Torque

*Driving Conditions
Driving Circuit: PMM-MD-23221
Power Supply Voltage: 24VDC
Winding Currency: 1.2A/phase
Exciting Method: 2 phase exciting (full step)
JL1=0.94×10^{-4} kg・m^2 (using rubber coupling)

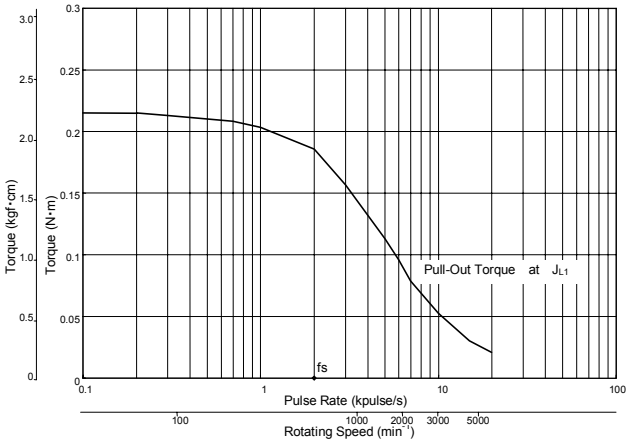
SH3533-12U40 / -12U10



SH3537-12U40 / -12U10



SH3552-12U40 / -12U10



For a reference, the relationship between the holding torque and rotor inertia regarding the series of our 2 phase 1.8°/step small size stepping motor is shown in Fig. 6.

We think that the commercialization of the 35mm sq. size buried the blank of the model between the conventional 28mm sq. size and 42mm sq. size, and completed the variation of the easy-to-use, small size, stepping motor.

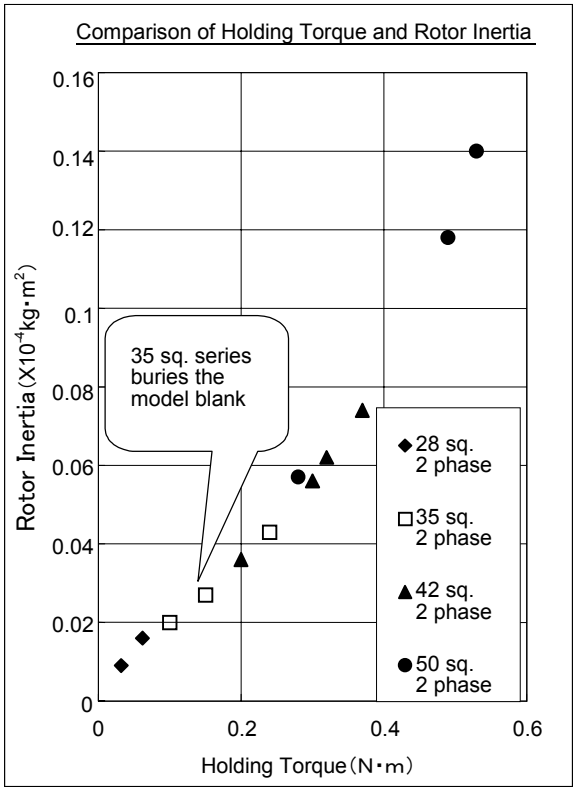


Fig. 6 Holding Torque – Rotor Inertia Chart

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