Rotary Position Sensors

SMD/Lead Dust-proof Type 12mm Size SV01 Series

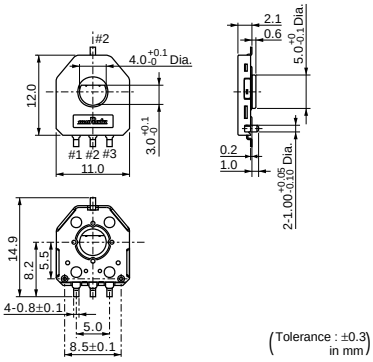
■ Features

1. Dust-proof construction protects the interior from dust, which maintains stable characteristics.
2. Compliant to high peak temperature lead free soldering.
3. Excellent resistance materials and high reliability wiper achieves 1M cycles.
4. D formation thru-hole rotor enables selection of any kind of gear shape.
5. Both D formation thru-hole rotor and T formation thru-hole rotor are available.
6. Leaded terminal type is available.
7. Ultra-thin size (2.1mm height)
8. Au plated terminals without Lead.
9. Complies with RoHS directive.

■ Applications

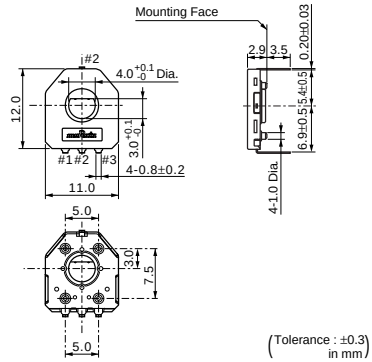
1. Animal robot
2. Switch for automotive
3. Motor drive unit
4. Radio control equipment
5. Car audio (navigation system, changer)

SV01A



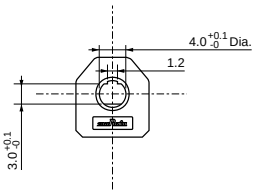
(Tolerance : ±0.3 in mm)

SV01L



(Tolerance : ±0.3 in mm)

■ T formation Thru-hole rotor



(Tolerance : ±0.3 in mm)

Part Number	Total Resistance Value (k ohm)	Linearity (%)	Effective Rotational Angle	Rotational Torque	Rotational Life
SV01A103□EA01	10 ±30%	±2	333.3° (Ref.)	2mN·m (Ref.; 21gf·cm) max.	1M cycles
SV01L103□EA11	10 ±30%	±2	333.3° (Ref.)	2mN·m (Ref.; 21gf·cm) max.	1M cycles

A blank column is filled with Rotor Formation Codes. (A: D formation thru-hole rotor C: T formation thru-hole rotor)

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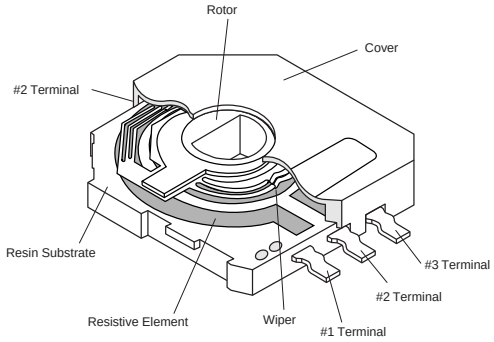
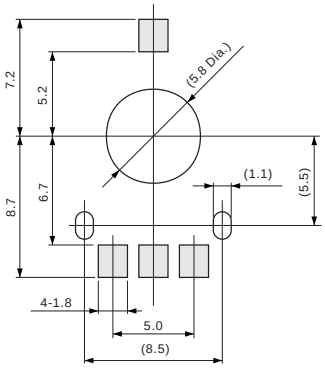
■ Construction



■ Standard Land Pattern

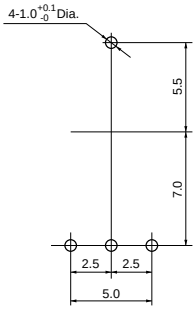
SV01A



(Tolerance: ±0.1 in mm)

■ Standard Mounting Holes

SV01L



(Tolerance: ±0.1 in mm)

■ Characteristics

Temperature Cycle (Thermal Shock)	ΔTR : ±20% Linearity: ±3%
Humidity	ΔTR : ±20% Linearity: ±3%
Vibration	ΔTR : ±10% Linearity: ±3%
Shock (20G)	ΔTR : ±10% Linearity: ±3%
Humidity Load Life	ΔTR : ±20% Linearity: ±3%
High Temperature Exposure	ΔTR : +5/-30% Linearity: ±3%
Low Temperature Exposure	ΔTR : ±20% Linearity: ±3%
Rotational Life	ΔTR : ±20% Linearity: ±3% (1M cycles)

ΔTR: Total Resistance Change

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SV01 Series Notice

■ Notice (Operating and Storage Conditions)

1. Store in temperatures of -10 to +40deg. C and relative humidity of 30-85%.
2. Do not store in or near corrosive gases.
3. Use within six months after delivery.
4. Open the package just before using.
5. Do not store under direct sunlight.
6. Do not use the rotary position sensor under the following environmental conditions. If you use the rotary position sensor in an environment other than listed below, please consult a Murata factory representative prior to using.
   (1) Corrosive gasses atmosphere
   (Ex. Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.)
   (2) In liquid
   (Ex. Water, Oil, Medical liquid, Organic solvent, etc.)
   (3) Dusty / dirty atmosphere
   (4) Direct sunlight
   (5) Static voltage nor electric/magnetic fields
   (6) Direct sea breeze
   (7) Other variations of the above

■ Notice (Soldering and Mounting)

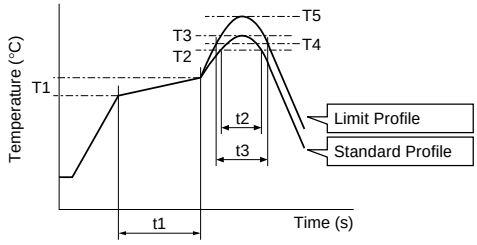
1. Soldering
   (1) SV01 series can be soldered by reflow soldering method and soldering iron. Do not use flow soldering method (dipping).
   (2) The dimension of land pattern used should be Murata's standard land pattern at reflow soldering. Excessive land area may cause displacement due to the effect of the surface tension of the solder. Insufficient land area may cause insufficient soldering strength on PCB (SMD Type).
   (3) Soldering conditions
   Refer to the temperature profile.
   If the soldering conditions are not suitable, e.g., excessive time and/or excessive temperature, the rotary position sensor may deviate from the specified characteristics.
   (4) The amount of solder is critical. Insufficient amounts of solder can lead to insufficient soldering strength on PCB. Excessive amounts of solder may cause bridging between the terminals.
   (5) The soldering iron should not come in contact with the cover of the rotary position sensor. If such contact does occur, the rotary position sensor may be damaged.
2. Mounting
   (1) Use PCB hole to meet the pin of the rotary position sensor. If the rotary position sensor is inserted into insufficient PCB hole, the rotary position sensor may be damaged by mechanical stress. (Lead type)
   (2) Do not apply excessive force, preferable 9.8N max. (Ref. 1kgf) when the rotary position sensor is mounted to the PCB.
   (3) Do not warp and/or bend PCB to prevent the rotary position sensor from breakage.
3. Cleaning
   Cannot be cleaned because of open construction.

SV01 Series Notice

■ Soldering Profile

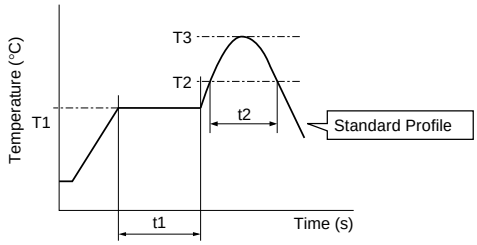
● Reflow Soldering Profile

1. Soldering profile for Lead-free solder (96.5Sn/3.0Ag/0.5Cu)



Series	Standard Profile						Limit Profile					
	Pre-heating		Heating		Peak Temperature (T3)	Cycle of Reflow	Pre-heating		Heating		Peak Temperature (T5)	Cycle of Reflow
	Temp. (T1)	Time (t1)	Temp. (T2)	Time (t2)			Temp. (T1)	Time (t1)	Temp. (T4)	Time (t3)		
	°C	sec.	°C	sec.	°C	Time	°C	sec.	°C	sec.	°C	Time
SV01A	150 to 180	60 to 120	220	30 to 60	245±3	2	150 to 180	60 to 120	230	30 to 50	260 +5/-0	2

2. Soldering profile for Eutectic solder (63Sn/37Pb)
(Limit profile: refer to 1)



Series	Standard Profile					
	Pre-heating		Heating		Peak Temperature (T3)	Cycle of Reflow
	Temp. (T1)	Time (t1)	Temp. (T2)	Time (t2)		
	°C	sec.	°C	sec.	°C	Time
SV01A	150	60 to 120	183	30	230	1

● Soldering Iron

Series	Standard Condition			
	Temperature of Soldering Iron Tip	Soldering Time	Soldering Iron Power Output	Cycle of Soldering Iron
	°C	sec.	W	Time
SV01	350±10	3 max.	30 max.	1

■ Notice (Handling)

Uncontrolled mechanical force (except usual rotation on the hollow rotor of product) may cause a change of electrical characteristics, an increase of rotational torque or mechanical damage of the product. Therefore, please consider the following points for your design.

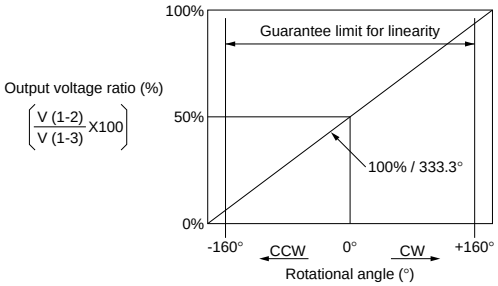
1. The product must be soldered by the terminals. Do not affix by screw clamping to support board as this could cause mechanical deformation.
2. The connecting shaft must be sustained by the bearing. No uncontrolled force should be applied to the hollow rotor.

■ Notice (Other)

1. Please make sure the connecting impedance is not less than 10M ohm. The rotary position sensor is designed to connect the output terminal and A/D port of the microprocessor directly. Therefore, connecting impedance presupposes certain M ohm and the contact resistance is set high.
2. To minimize processing errors and rare cases of noise influence when data is installed, please consider the following when programming your software.
   (1) Data install should be done plural times and applied the mean value.
   (2) Data considered as error should be invalid.
   (3) If suspicious data is found, the data should be re-installed.
3. Before using rotary position sensor, please test after assembly in your particular mass production system.
4. MURATA cannot guarantee rotary position sensor integrity when used under conditions other than those specified in this document.

Rotary Position Sensors SMD/Lead Dust-proof Type (SV01) Specifications and Test Methods

The tests and measurements should be conducted under the condition of 15 to 35°C of temperature 25 to 75% of relative humidity and 86 to 106 kpa of atmospheric pressure unless otherwise specified. If questionable results occur that have been measured in accordance with the above mentioned conditions, the tests and measurements should be conducted under the condition of 25±2°C of temperature, 45 to 55% of relative humidity and 86 to 106 kpa of atmospheric pressure. When the potentiometer is tested after soldering on PCB, it should be tested after being kept in a room (15 to 35°C, 25 to 75%RH) over 24 hours except "Resistance to soldering heat".

<table>
<tr><th>No.</th><th>Item</th><th>Test Methods</th></tr>
<tr><td>1</td><td>Linearity</td><td>Independent linearity should vary no more than ±2% within ±160° to 50% voltage ratio.
Taper : linear, 100%/333.3° Measured with the circuit as below (Figure 1).
 

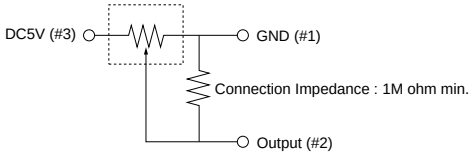


Figure-1</td></tr>
<tr><td>2</td><td>Temperature Coefficient of Resistance</td><td>The rotary position sensor should be subjected to each of the following temperatures (see Table 1) for 30-45 minutes.
Temperature coefficient of resistance should be applied to the following formula.
$TCR=\frac{R_2 - R_1}{R_1 (t_2 - t_1)} \times 10^6$ (ppm/°C)
t_1 : Reference temperature in degrees celsius
t_2 : Test temperature in degrees celsius
R_1 : Resistance at reference temperature in ohm
R_2 : Resistance at test temperature in ohm
<table>
<tr><th>Sequence</th><th>*1</th><th>2</th><th>*3</th><th>4</th></tr>
<tr><td>Temperature (°C)</td><td>+25</td><td>-40</td><td>+25</td><td>+85</td></tr>
</table>
Note * : Reference temperature
Table 1: Test temperatures</td></tr>
<tr><td>3</td><td>Temperature Cycle (Thermal Shock)</td><td>The rotary position sensor should be subjected to Table 2 temperature for 5 cycles.
Then, the rotary position sensor should be kept in the dry box for 24 +8/-0 hrs.
<table>
<tr><th>Sequence</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>Temperature (°C)</td><td>-40±3</td><td>+25±2</td><td>+85±3</td><td>+25±2</td></tr>
<tr><td>Time (min.)</td><td>30</td><td>5 max.</td><td>30</td><td>5 max.</td></tr>
</table>
Table 2: One cycle of temperature cycle</td></tr>
<tr><td>4</td><td>Humidity</td><td>The rotary position sensor should be stored in a chamber at temperature of +60±2°C and relative humidity of 90-95% for 250±8 hrs. After removing from the chamber, the rotary position sensor should be kept in the dry box for 24 +8/-0 hours.</td></tr>
<tr><td>5</td><td>Vibration</td><td>The rotary position sensor should be tested under the condition of the amplitude of 1.5mm, the frequency range from 10 to 55Hz (should be traversed in approximately one minute) and 2 hours in each of 3 mutually perpendicular directions (total 6 hours). Then, the rotary position sensor should be kept in the dry box for 1-2 hrs.</td></tr>
<tr><td>6</td><td>Shock</td><td>The rotary position sensor should be tested under the condition of the peak acceleration 20G max. in half-sine wave and 5 shocks in each of 3 mutually perpendicular directions (total 15 shocks). Then, the rotary position sensor should be kept in the dry box for 1-2 hrs.</td></tr>
<tr><td>7</td><td>Humidity Load Life</td><td>Full rated continuous working voltage not exceeding 5Vdc should be applied intermittently between terminal #1 and terminal #3 of the rotary position sensor, 1.5 hours on and 0.5 hours off, for 96±4 hours in total in a chamber at a temperature of +40±2°C and relative humidity of 90-95%. After removing from the chamber, the rotary position sensor should be kept in the dry box for 24 +8/-0 hours.</td></tr>
<tr><td>8</td><td>High Temp. Exposure</td><td>The rotary position sensor should be stored in a chamber at the temperature of +85±3°C without loading for 250±8 hours. After removing from the chamber, the rotary position sensor should be kept in the dry box for 24 +8/-0 hours.</td></tr>
<tr><td>9</td><td>Low Temp. Exposure</td><td>The rotary position sensor should be stored in a chamber at the temperature of -40±3°C without loading for 168±4 hours. After removing from the chamber, the rotary position sensor should be kept in the dry box for 24 +8/-0 hours.</td></tr>
<tr><td>10</td><td>Rotational Life</td><td>The adjustment rotor should be continuously rotated within ±160° of effective electrical rotational angle, at the rate of one cycle for 6 seconds for 1 Million cycles under the condition of +25±2°C of temperature without loading.</td></tr>
</table>

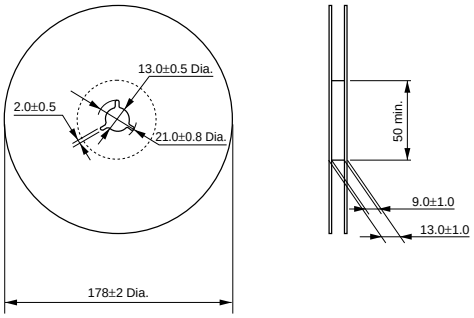
Packaging

■ Minimum Quantity

Part Number	Minimum Quantity (pcs.)					
	ø180mm reel	ø330mm reel	Ammo Pack	Magazine	Bulk	Tray
PVZ2A	3000	12000	—	—	1000	—
PVZ2K/R	3000	—	—	—	1000	—
PVA2	3000	—	—	—	1000	—
PVZ3A	2000	8000	—	—	1000	—
PVZ3G	2500	—	—	—	1000	—
PVZ3K/R	1500	—	—	—	1000	—
PVG3A/G	1000	—	—	—	500	—
PVG3K	500	—	—	—	—	—
PVM4	500	3000	—	—	500	—
PVF2A	500	—	—	—	100	—
PVG5A	250	—	—	—	50	—
PVG5H	500	—	—	—	50	—
PV32	—	—	—	—	100	—
PV12	—	—	—	—	50	—
PV36W	—	—	1000	50	50	—
PV36Y	—	—	—	50	50	—
PV36X	—	—	1000	40	50	—
PV36Z/P	—	—	—	40	50	—
PV37Y/Z	—	—	1000	—	50	—
PV37W/X/P	—	—	—	—	50	—
SV01A	—	1000	—	—	50	—
SV01L	—	—	—	—	—	1000
SV21	—	—	—	—	10	—

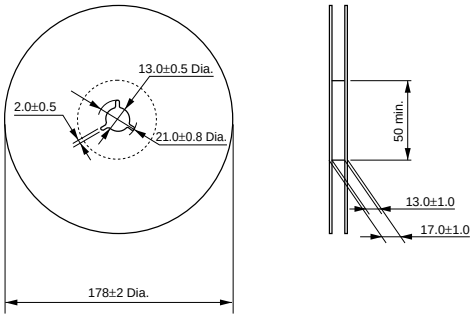
■ Dimensions of Reel

PVZ2A/PVA2/PVZ3A/PVZ3G/PVF2



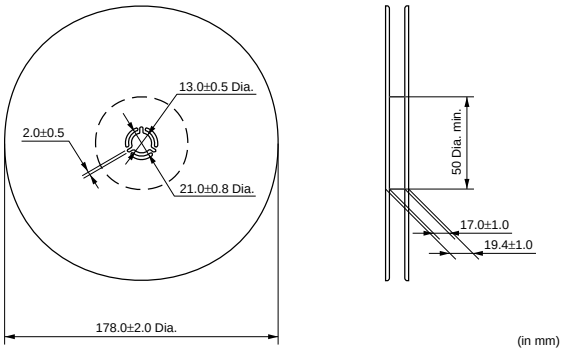
(in mm)

PVZ2K/PVZ2R/PVZ3K/PVZ3R/PVM4/PVG3/PVG5H



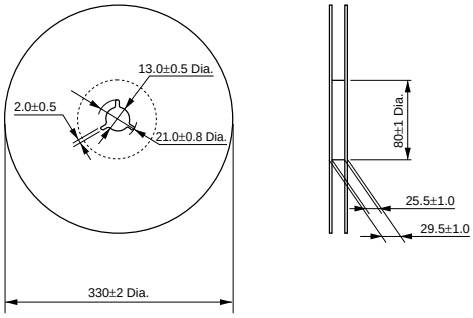
(in mm)

PVG5A



(in mm)

SV01



(in mm)

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Packaging

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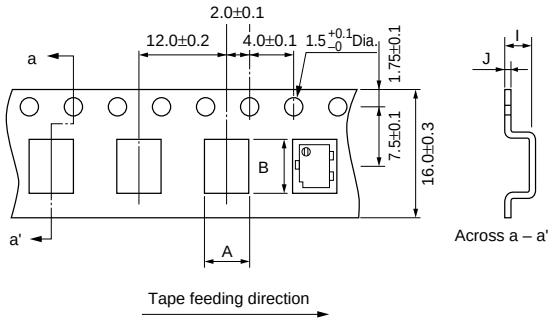
■ Dimensions of Plastic Tape

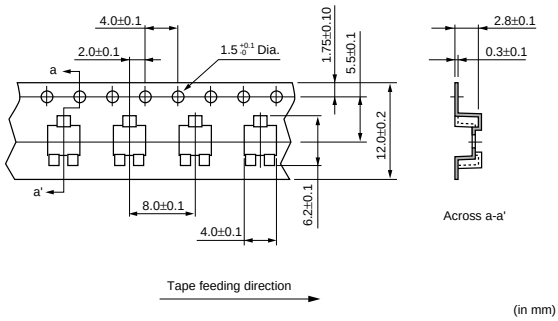
PVG5A



Part Number	A	B	I	J
PVG5A	4.3±0.2	5.4±0.2	5.4±0.1	0.4±0.1

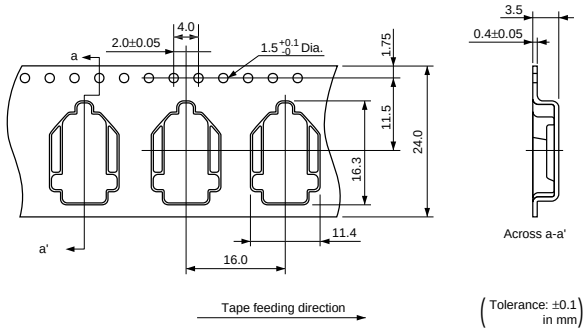
(in mm)

PVG3K



(in mm)

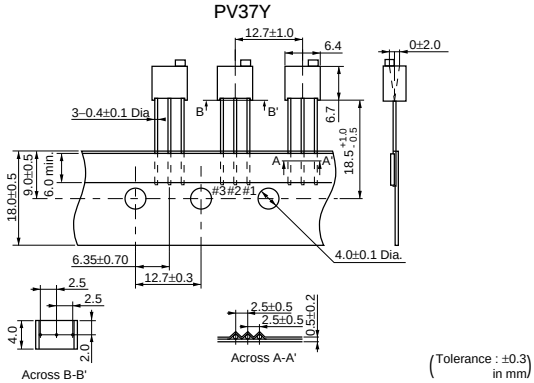
SV01



(Tolerance: ±0.1 in mm)

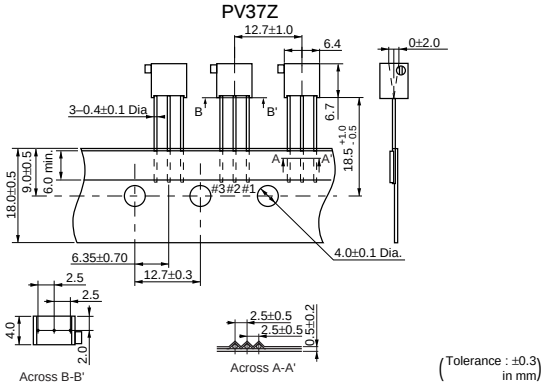
■ Dimensions of Radial Taping

PV37Y



(Tolerance : ±0.3 in mm)

PV37Z



(Tolerance : ±0.3 in mm)

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