

Trimmer Potentiometers

muRata

SMD Sealed Type Multi-turns PVG5/PV01 Series

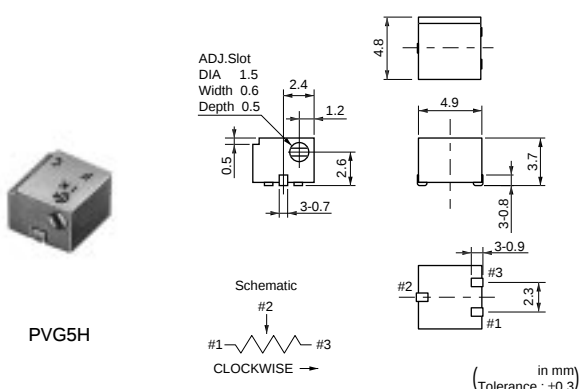
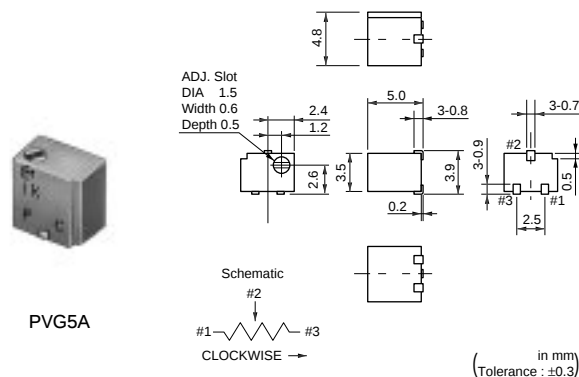
PVG5 Series

■ Features

1. Sealed construction protects the interior from dust and liquid, which achieves stable performance.
2. Available with reflow soldering method
3. Available for ultrasonic cleaning after soldering
4. Clutch mechanism prevents excessive wiper rotation.
5. Both Top and side adjustment directions
6. Ultra smaller volume (1/5-1/2) than leaded multi-turn potentiometer.
7. To be complied with RoHS directive by new Cd free cermet resistive material. Pb free terminals with Sn plating.

■ Applications

1. Measuring instruments
2. OA equipment
3. Medical equipment
4. Power supply
5. Sensors
6. Base station for cellular phone

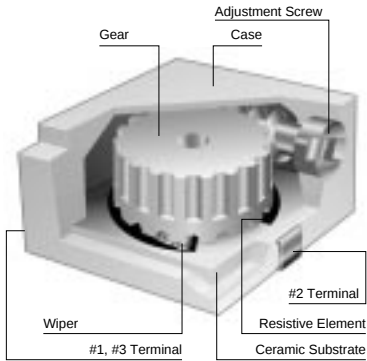


Part Number	Power Rating	Soldering Method	Number of Turns (Effective Rotation Angle)	Total Resistance Value	TCR
PVG5□100C01	0.25W(70°C)	Reflow/Soldering Iron	11	10ohm ±10%	±150ppm/°C
PVG5□200C01	0.25W(70°C)	Reflow/Soldering Iron	11	20ohm ±10%	±150ppm/°C
PVG5□500C01	0.25W(70°C)	Reflow/Soldering Iron	11	50ohm ±10%	±150ppm/°C
PVG5□101C01	0.25W(70°C)	Reflow/Soldering Iron	11	100ohm ±10%	±150ppm/°C
PVG5□201C01	0.25W(70°C)	Reflow/Soldering Iron	11	200ohm ±10%	±150ppm/°C
PVG5□501C01	0.25W(70°C)	Reflow/Soldering Iron	11	500ohm ±10%	±150ppm/°C
PVG5□102C01	0.25W(70°C)	Reflow/Soldering Iron	11	1k ohm ±10%	±150ppm/°C
PVG5□202C01	0.25W(70°C)	Reflow/Soldering Iron	11	2k ohm ±10%	±150ppm/°C
PVG5□502C01	0.25W(70°C)	Reflow/Soldering Iron	11	5k ohm ±10%	±150ppm/°C
PVG5□103C01	0.25W(70°C)	Reflow/Soldering Iron	11	10k ohm ±10%	±150ppm/°C
PVG5□203C01	0.25W(70°C)	Reflow/Soldering Iron	11	20k ohm ±10%	±150ppm/°C
PVG5□503C01	0.25W(70°C)	Reflow/Soldering Iron	11	50k ohm ±10%	±150ppm/°C
PVG5□104C01	0.25W(70°C)	Reflow/Soldering Iron	11	100k ohm ±10%	±150ppm/°C
PVG5□204C01	0.25W(70°C)	Reflow/Soldering Iron	11	200k ohm ±10%	±150ppm/°C
PVG5□504C01	0.25W(70°C)	Reflow/Soldering Iron	11	500k ohm ±10%	±150ppm/°C
PVG5□105C01	0.25W(70°C)	Reflow/Soldering Iron	11	1M ohm ±10%	±150ppm/°C
PVG5□205C01	0.25W(70°C)	Reflow/Soldering Iron	11	2M ohm ±10%	±150ppm/°C

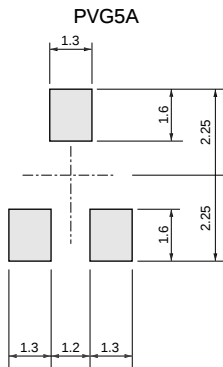
The blank column is filled with the code of adjustment direction A (top) or H (side).

Part Number	Power Rating (W)	Soldering Method	Number of Turns (Effective Rotation Angle)	Total Resistance Value	TCR (ppm/°C)	Remarks
PVG5□100A01	0.25(70°C)	Reflow/Soldering Iron	11	10 ohm±10%	±200	Non Standard Product (Cd included)
PVG5□200A01	0.25(70°C)	Reflow/Soldering Iron	11	20 ohm±10%	±200	
PVG5□500A01	0.25(70°C)	Reflow/Soldering Iron	11	50 ohm±10%	±200	
PVG5□101A01	0.25(70°C)	Reflow/Soldering Iron	11	100 ohm±10%	±200	
PVG5□201A01	0.25(70°C)	Reflow/Soldering Iron	11	200 ohm±10%	±100	
PVG5□501A01	0.25(70°C)	Reflow/Soldering Iron	11	500 ohm±10%	±100	
PVG5□102A01	0.25(70°C)	Reflow/Soldering Iron	11	1k ohm±10%	±100	
PVG5□202A01	0.25(70°C)	Reflow/Soldering Iron	11	2k ohm±10%	±100	
PVG5□502A01	0.25(70°C)	Reflow/Soldering Iron	11	5k ohm±10%	±100	
PVG5□103A01	0.25(70°C)	Reflow/Soldering Iron	11	10k ohm±10%	±100	
PVG5□203A01	0.25(70°C)	Reflow/Soldering Iron	11	20k ohm±10%	±100	
PVG5□503A01	0.25(70°C)	Reflow/Soldering Iron	11	50k ohm±10%	±100	
PVG5□104A01	0.25(70°C)	Reflow/Soldering Iron	11	100k ohm±10%	±100	
PVG5□204A01	0.25(70°C)	Reflow/Soldering Iron	11	200k ohm±10%	±100	
PVG5□504A01	0.25(70°C)	Reflow/Soldering Iron	11	500k ohm±10%	±100	
PVG5□105A01	0.25(70°C)	Reflow/Soldering Iron	11	1M ohm±10%	±100	
PVG5□205A01	0.25(70°C)	Reflow/Soldering Iron	11	2M ohm±10%	±100	

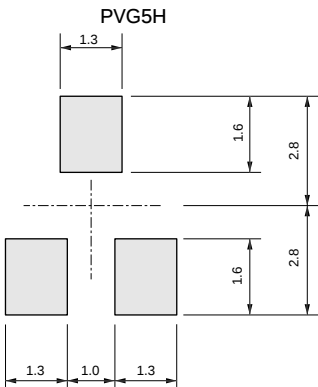
Construction



Standard Land Pattern



(in mm)
(Tolerance : ±0.1)



(in mm)
(Tolerance : ±0.1)

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■ Characteristics

Temperature Cycle	ΔTR	$\pm 2\%$
	$\Delta V.S.S.$	$\pm 1\%$
Humidity	ΔTR	$\pm 2\%$
	IR	10Mohm min.
Vibration	ΔTR	$\pm 1\%$
	$\Delta V.S.S.$	$\pm 1\%$
Shock	ΔTR	$\pm 1\%$
	$\Delta V.S.S.$	$\pm 1\%$
Temperature Load Life	ΔTR	$\pm 3\%$ or 3ohm max., whichever is greater
	$\Delta V.S.S.$	$\pm 1\%$
Low Temperature Exposure	ΔTR	$\pm 1\%$
	$\Delta V.S.S.$	$\pm 1\%$
High Temperature Exposure	ΔTR	$\pm 2\%$
	$\Delta V.S.S.$	$\pm 1\%$
Rotational Life (100 cycles)	ΔTR	$\pm 3\%$ or 3ohm max., whichever is greater

ΔTR : Total Resistance Change

$\Delta V.S.S.$: Voltage Setting Stability

IR : Insulation Resistance

PV01 Series

■ Features

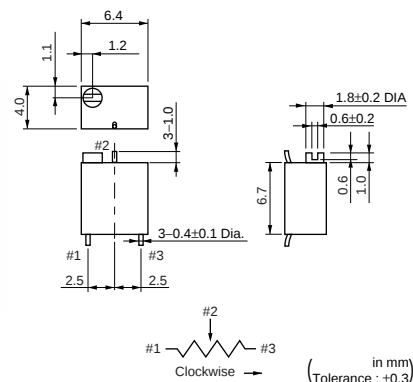
1. Small size (6.35x6.35x4.3mm)
2. Sealed construction protects the interior from dust and liquid, which achieves stable performance.
3. Available with reflow soldering method
4. Available for ultrasonic cleaning after soldering
5. Clutch mechanism prevents excessive wiper rotation.
6. To be complied with RoHS directive by new Cd free cermet resistive material. Pb free terminals with Sn plating.

■ Applications

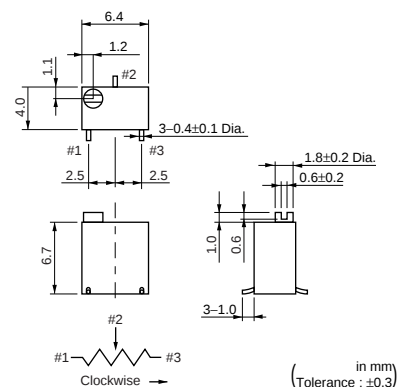
1. Measuring instruments
2. FAX
3. PPCs
4. Printers
5. Sensors



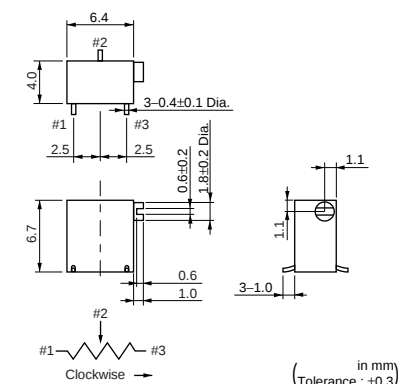
PV01P



PV01W



PV01X



Part Number	Power Rating	Soldering Method	Number of Turns (Effective Rotation Angle)	Total Resistance Value	TCR
PV01□100C01	0.25W(85°C)	Reflow/Soldering Iron	12	10ohm ±10%	±150ppm/°C
PV01□200C01	0.25W(85°C)	Reflow/Soldering Iron	12	20ohm ±10%	±150ppm/°C
PV01□500C01	0.25W(85°C)	Reflow/Soldering Iron	12	50ohm ±10%	±150ppm/°C
PV01□101C01	0.25W(85°C)	Reflow/Soldering Iron	12	100ohm ±10%	±150ppm/°C
PV01□201C01	0.25W(85°C)	Reflow/Soldering Iron	12	200ohm ±10%	±150ppm/°C
PV01□501C01	0.25W(85°C)	Reflow/Soldering Iron	12	500ohm ±10%	±150ppm/°C
PV01□102C01	0.25W(85°C)	Reflow/Soldering Iron	12	1k ohm ±10%	±150ppm/°C
PV01□202C01	0.25W(85°C)	Reflow/Soldering Iron	12	2k ohm ±10%	±150ppm/°C
PV01□502C01	0.25W(85°C)	Reflow/Soldering Iron	12	5k ohm ±10%	±150ppm/°C
PV01□103C01	0.25W(85°C)	Reflow/Soldering Iron	12	10k ohm ±10%	±150ppm/°C
PV01□203C01	0.25W(85°C)	Reflow/Soldering Iron	12	20k ohm ±10%	±150ppm/°C
PV01□253C01	0.25W(85°C)	Reflow/Soldering Iron	12	25k ohm ±10%	±150ppm/°C
PV01□503C01	0.25W(85°C)	Reflow/Soldering Iron	12	50k ohm ±10%	±150ppm/°C
PV01□104C01	0.25W(85°C)	Reflow/Soldering Iron	12	100k ohm ±10%	±150ppm/°C
PV01□204C01	0.25W(85°C)	Reflow/Soldering Iron	12	200k ohm ±10%	±150ppm/°C
PV01□254C01	0.25W(85°C)	Reflow/Soldering Iron	12	250k ohm ±10%	±150ppm/°C

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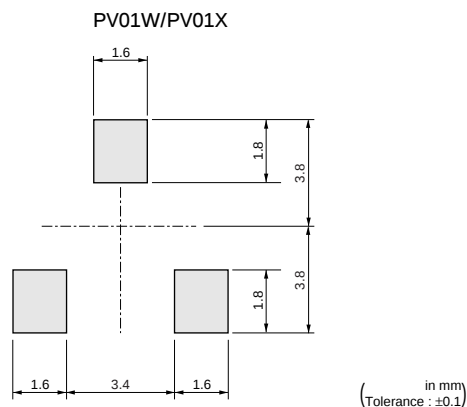
Part Number	Power Rating	Soldering Method	Number of Turns (Effective Rotation Angle)	Total Resistance Value	TCR
PV01□504C01	0.25W(85°C)	Reflow/Soldering Iron	12	500k ohm ±10%	±150ppm/°C
PV01□105C01	0.25W(85°C)	Reflow/Soldering Iron	12	1M ohm ±10%	±150ppm/°C

Part Number	Power Rating (W)	Soldering Method	Number of Turns (Effective Rotation Angle)	Total Resistance Value	TCR (ppm/°C)	Remarks
PV01□100A01	0.25(85°C)	Reflow/Soldering Iron	12	10 ohm±10%	±100	Non Standard Product (Cd included)
PV01□200A01	0.25(85°C)	Reflow/Soldering Iron	12	20 ohm±10%	±100	
PV01□500A01	0.25(85°C)	Reflow/Soldering Iron	12	50 ohm±10%	±100	
PV01□101A01	0.25(85°C)	Reflow/Soldering Iron	12	100 ohm±10%	±100	
PV01□201A01	0.25(85°C)	Reflow/Soldering Iron	12	200 ohm±10%	±100	
PV01□501A01	0.25(85°C)	Reflow/Soldering Iron	12	500 ohm±10%	±100	
PV01□102A01	0.25(85°C)	Reflow/Soldering Iron	12	1k ohm±10%	±100	
PV01□202A01	0.25(85°C)	Reflow/Soldering Iron	12	2k ohm±10%	±100	
PV01□502A01	0.25(85°C)	Reflow/Soldering Iron	12	5k ohm±10%	±100	
PV01□103A01	0.25(85°C)	Reflow/Soldering Iron	12	10k ohm±10%	±100	
PV01□203A01	0.25(85°C)	Reflow/Soldering Iron	12	20k ohm±10%	±100	
PV01□253A01	0.25(85°C)	Reflow/Soldering Iron	12	25k ohm±10%	±100	
PV01□503A01	0.25(85°C)	Reflow/Soldering Iron	12	50k ohm±10%	±100	
PV01□104A01	0.25(85°C)	Reflow/Soldering Iron	12	100k ohm±10%	±100	
PV01□204A01	0.25(85°C)	Reflow/Soldering Iron	12	200k ohm±10%	±100	
PV01□254A01	0.25(85°C)	Reflow/Soldering Iron	12	250k ohm±10%	±100	
PV01□504A01	0.25(85°C)	Reflow/Soldering Iron	12	500k ohm±10%	±100	
PV01□105A01	0.25(85°C)	Reflow/Soldering Iron	12	1M ohm±10%	±100	

Diagram illustrating the components of a microactuator assembly:

- Case
- Gear
- Adjustment Screw
- Washer
- Terminal
- Cermet Resistive Element
- Wiper
- Alumina Substrate

Technical drawing of a PV01P part. The drawing shows a top view and a side view. The top view is a rectangle with a width of 1.6 and a height of 1.8. The side view shows a total height of 4.85 and a width of 1.8. The drawing includes a dashed line indicating a centerline. The dimensions are given in mm, and the tolerance is ± 0.1 .



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■ Characteristics

Temperature Cycle	ΔTR	$\pm 1\%$
	$\Delta V.S.S.$	$\pm 1\%$
Humidity	ΔTR	$\pm 2\%$
	IR	100Mohm min.
Vibration (20G)	ΔTR	$\pm 1\%$
	$\Delta V.S.S.$	$\pm 1\%$
Shock (100G)	ΔTR	$\pm 1\%$
	$\Delta V.S.S.$	$\pm 1\%$
Temperature Load Life	ΔTR	$\pm 2\%$
	$\Delta V.S.S.$	$\pm 1\%$
Low Temperature Exposure	ΔTR	$\pm 1\%$
	$\Delta V.S.S.$	$\pm 1\%$
High Temperature Exposure	ΔTR	$\pm 2\%$
	$\Delta V.S.S.$	$\pm 1\%$
Rotational Life (200 cycles)	ΔTR	$R \leq 100\text{ohm} \cdots \pm 3\%$
		$R > 100\text{ohm} \cdots \pm 2\%$

ΔTR : Total Resistance Change
 $\Delta V.S.S.$: Voltage Setting Stability
 IR : Insulation Resistance
 R : Standard Total Resistance

PVG5/PV01 Series Notice

■ Notice (Operating and Storage Conditions)

1. Store in temperatures of -10 to +40 deg. C and relative humidity of 30-85%RH.
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. If you use the trimmer potentiometer in an environment other than listed below, please consult with a Murata factory representative prior to using.
The trimmer potentiometer should not be used under

the following environmental conditions:

- (1) Corrosive gaseous atmosphere
(Ex. Chlorine gas, Hydrogen sulfide gas, Ammonia gas, Sulfuric acid gas, Nitric oxide gas, etc.)
- (2) In liquid
(Ex. 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 (Rating)

1. When using with partial load (rheostat), minimize the power depending on the resistance value.
2. The maximum input voltage to a trimmer potentiometer should not exceed $(P \cdot R)^{1/2}$ or the maximum operating voltage, whichever is smaller.
3. The maximum input current to a trimmer potentiometer should not exceed $(P/R)^{1/2}$ or the allowable wiper current, whichever is smaller.

■ Notice (Soldering and Mounting)

1. Soldering

(1) Standard soldering condition

(a) Reflow and flow soldering:

Refer to the standard temperature profile.

(b) Soldering iron:

- >Temperature of tip 260 deg.C max.
- >Soldering time 3 sec. max.
- >Diameter 2mm dia. max.
- >Wattage of iron 30W max.

Before using other soldering conditions than those listed above, please consult with a Murata factory representative prior to using. If the soldering conditions are not suitable, e.g., excessive time and/or excessive temperature, the trimmer capacitor may deviate from the specified characteristics.

- (2) Cannot be soldered using the flow soldering method. If you use the flow soldering method, the trimmer potentiometer may not function.
- (3) The soldering iron should not come in contact with the case of the trimmer potentiometer. If such contact does occur, the trimmer potentiometer may be damaged.
- (4) Insufficient amounts of solder can lead to insufficient soldering strength on PCB.
Excessive amounts of solder may cause bridging between the terminals.

2. Mounting

- (1) Use our standard land dimension. Excessive land area causes displacement due to the effect of the

surface tension of the solder. Insufficient land area leads to insufficient soldering strength of the chip.

- (2) Do not apply excessive force (preferably 9.8N (Ref.; 1kgf) max.), when the trimmer potentiometer is mounted to the PCB.
- (3) Do not warp and/or bend PC board to prevent trimmer potentiometer from breakage.
- (4) In chip placers, the recommended size of the cylindrical pick-up nozzle should be outer dimension 4.0mm dia. and inner dimension 2.0mm dia.

3. Cleaning

- (1) Isopropyl-alcohol and Ethyl-alcohol are applicable solvents for cleaning. If you use any other types of solvents, please consult with a Murata factory representative prior to using.
- (2) The total cleaning time by cold dipping, vapor and ultrasonic washing (conditions as below) method should be less than 3 minutes.
- (3) For ultra-sonic cleaning, the available condition is as follows.

>Power: 600W (67 liter) max.

>Frequency: 28kHz

>Temperature: Ambient temperature

Due to the ultra-sonic cleaning equipment's peculiar self-resonance point and that the cleaning compatibility usually depends on the jig construction and/or the cleaning condition such as the depth of immersion, please check the

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PVG5/PV01 Series Notice

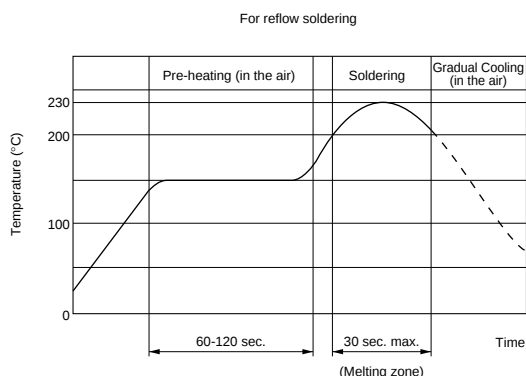
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cleaning equipment to determine the suitable conditions.

If the trimmer potentiometer is cleaned by other

conditions, the trimmer potentiometer may be damaged.

Reflow Soldering Standard Profile



Notice (Handling)

1. Use suitable screwdrivers that fit comfortably in driver slot. We recommend the screwdrivers below.

* Recommended screwdrivers for manual adjustment

<PVG5 series>

VESSEL MFG. : NO.9000-1.3x30

(Murata P/N : KMDR130)

<PV01 series>

ENGINEER INC. : DA-40

(Murata P/N : KMDR180)

We can supply the screwdrivers above.

If you place order, please specify Murata P/N.

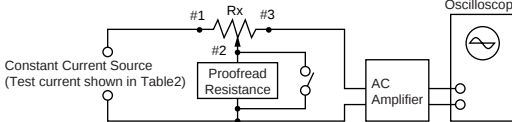
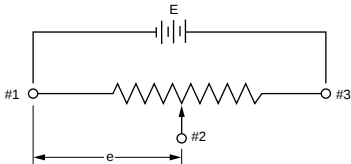
2. Don't apply more than 9.8N (Ref.; 1kgf) of twist and stress after mounting onto PCB to prevent contact intermittence. If excessive force is applied, the trimmer potentiometer may not function.
3. When adjusting with a screwdriver, do not apply excessive force (preferable 4.9N (Ref; 500gf) max.)
4. When using a lock paint to fix slot position, please use adhesive resin without chlorine or sulfur (Three-bond "1401 series").

Notice (Other)

1. Please make sure that your product has been evaluated and confirmed against your specifications when our product is mounted to your product.
2. Murata cannot guarantee trimmer potentiometer integrity when used under conditions other than those specified in this document.

SMD Sealed Type/Lead Sealed Type Specifications and Test Methods

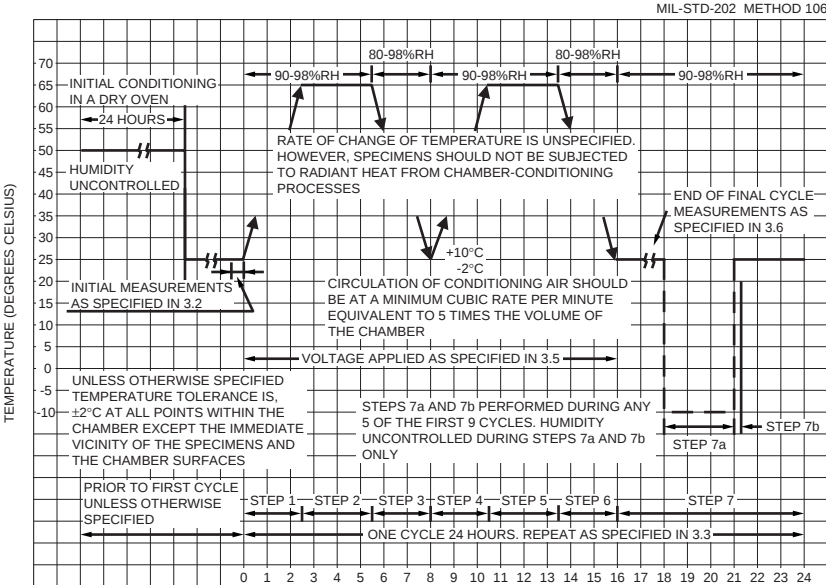
The following describes trimmer potentiometer testing conducted by Murata Manufacturing Co., Ltd. in accordance with MIL-R-22097 (Military specification for variable resistors, non-wirewound) and MIL-STD-202 (Test methods for electronic and electrical component parts).

No.	Item	Test Methods																				
1	Total Resistance	Measure total resistance between the resistance element and terminals (#1 and #3) with the contact arm positioned against a stop. The positioning of the contact arm and terminal should be the same for subsequent total resistance measurements on the same device. Use the test voltage specified in Table 1 for total resistance measurements. This voltage should be used for all subsequent total resistance measurements. <table><tr><th>Total Resistance, Nominal (ohm)</th><th>Maximum Test Voltage (V)</th></tr><tr><td>$10 \leq R \leq 100$</td><td>1.0</td></tr><tr><td>$100 < R \leq 1k$</td><td>3.0</td></tr><tr><td>$1k < R \leq 10k$</td><td>10.0</td></tr><tr><td>$10k < R \leq 100k$</td><td>30.0</td></tr><tr><td>$100k < R$</td><td>100.0</td></tr></table> Table 1: Total resistance test voltage	Total Resistance, Nominal (ohm)	Maximum Test Voltage (V)	$10 \leq R \leq 100$	1.0	$100 < R \leq 1k$	3.0	$1k < R \leq 10k$	10.0	$10k < R \leq 100k$	30.0	$100k < R$	100.0								
Total Resistance, Nominal (ohm)	Maximum Test Voltage (V)																					
$10 \leq R \leq 100$	1.0																					
$100 < R \leq 1k$	3.0																					
$1k < R \leq 10k$	10.0																					
$10k < R \leq 100k$	30.0																					
$100k < R$	100.0																					
2	Residual Resistance	Position the contact arm at the extreme counterclockwise limit of mechanical travel and measure the resistance between the contact arm and the corresponding end terminal. Then, position the contact arm at the extreme clockwise limit of mechanical travel and measure the resistance between the contact arm and the corresponding end terminal. During this test, take suitable precautions to ensure that the rated current of the resistance element is not exceeded.																				
3	Contact Resistance Variation	Contact resistance variation should be measured with the measuring circuit shown in Figure 1, or its equivalent. The adjustment rotor (screw) should be rotated in both directions through 90% of the actual effective-electrical rotational angle (number of turns) for a total of 6 cycles. Only the last 3 cycles should count in determining whether or not a contact resistance variation is observed at least twice in the same location, exclusive of the roll-on or roll-off points where the contact arm moves from the termination, on or off, the resistance element. The rate of rotation of the adjustment rotor (screw) should be such that the adjustment rotor (screw) completes 1 cycle for 5 seconds minimum to 2 minutes maximum. The test current used should follow the value given in Table 2 unless otherwise limited by power rating. <table><tr><th>Standard Total Resistance R (ohm)</th><th>Test Current</th></tr><tr><td>$R \leq 100$</td><td>20mA</td></tr><tr><td>$100 < R < 500$</td><td>10mA</td></tr><tr><td>$500 \leq R < 1k$</td><td>4mA</td></tr><tr><td>$1k \leq R < 2k$</td><td>2mA</td></tr><tr><td>$2k \leq R < 50k$</td><td>1mA</td></tr><tr><td>$50k \leq R < 200k$</td><td>200μA</td></tr><tr><td>$200k \leq R < 1M$</td><td>100μA</td></tr><tr><td>$1M \leq R < 2M$</td><td>50μA</td></tr><tr><td>$2M \leq R$</td><td>30μA</td></tr></table> Table 2: Test current for CRV  Rx : Trimmer Potentiometer Oscilloscope bandwidth :100Hz to 50kHz Figure 1: CRV measuring circuit	Standard Total Resistance R (ohm)	Test Current	$R \leq 100$	20mA	$100 < R < 500$	10mA	$500 \leq R < 1k$	4mA	$1k \leq R < 2k$	2mA	$2k \leq R < 50k$	1mA	$50k \leq R < 200k$	200μA	$200k \leq R < 1M$	100μA	$1M \leq R < 2M$	50μA	$2M \leq R$	30μA
Standard Total Resistance R (ohm)	Test Current																					
$R \leq 100$	20mA																					
$100 < R < 500$	10mA																					
$500 \leq R < 1k$	4mA																					
$1k \leq R < 2k$	2mA																					
$2k \leq R < 50k$	1mA																					
$50k \leq R < 200k$	200μA																					
$200k \leq R < 1M$	100μA																					
$1M \leq R < 2M$	50μA																					
$2M \leq R$	30μA																					
4	Temperature Coefficient of Resistance	The trimmer potentiometer should be subjected to each of the following temperatures (see Table 3) for 30-45 minutes. Temperature coefficient of resistance should be applied to the following formula. $TCR = \frac{R_2 - R_1}{R_1 (T_2 - T_1)} \times 10^6 \text{ (ppm/}^\circ\text{C)}$ T_1 : Reference temperature in degrees celsius T_2 : Test temperature in degrees celsius R_1 : Resistance at reference temperature 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><th>5</th><th>6</th></tr><tr><td>Temperature (°C)</td><td>+25</td><td>-15</td><td>Min. operating Temperature</td><td>+25</td><td>+65</td><td>Max. operating Temperature</td></tr></table> Note*: Reference temperature Table 3: Test temperatures	Sequence	1*	2	3	4*	5	6	Temperature (°C)	+25	-15	Min. operating Temperature	+25	+65	Max. operating Temperature						
Sequence	1*	2	3	4*	5	6																
Temperature (°C)	+25	-15	Min. operating Temperature	+25	+65	Max. operating Temperature																
5	Voltage Setting Stability	The wiper should be set at approximately 40% of the actual effective-electrical rotational angle (number of turns). An adequate DC test potential should be applied between terminal #1 and terminal #3. The voltage between terminal #1 and terminal #3, and the voltage between terminal #1 and terminal #2, should be measured and applied to the following formula. $\text{Voltage setting stability} = \left(\frac{e'}{E} - \frac{e}{E} \right) \times 100 \text{ (\%)}$ e : Before test (The voltage between terminal #1 and terminal #2) e' : After test (The voltage between terminal #1 and terminal #2) E : The voltage between terminal #1 and terminal #3  Figure 2																				

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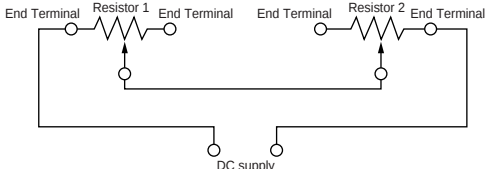
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No.	Item	Test Methods															
6	Temperature Cycle	The trimmer potentiometer should be subjected to Table 4 temperature for 5 cycles. The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of 25±5°C for 1~2 hours. <table><tr><th>Sequence</th><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>Temp. (°C)</td><td>PV□□ series PV22 series PVF2 series</td><td>-55±3 +25±2 -25±3</td><td>+125±3 +150±3 +60±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 4: One cycle of temperature cycle.	Sequence	1	2	3	4	Temp. (°C)	PV□□ series PV22 series PVF2 series	-55±3 +25±2 -25±3	+125±3 +150±3 +60±3	+25±2	Time (min.)	30	5 max.	30	5 max.
Sequence	1	2	3	4													
Temp. (°C)	PV□□ series PV22 series PVF2 series	-55±3 +25±2 -25±3	+125±3 +150±3 +60±3	+25±2													
Time (min.)	30	5 max.	30	5 max.													
7	Humidity	1) PVC6, PV12, PV32, PV34 PVM4A□□□D01 series The trimmer potentiometer should be placed in a chamber at a temperature of 40±2°C and a humidity of 90~95% without loading for 250±8 hours (500±12 hours for PVM4A□□□D01 series). The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of 25±5°C for 5±1/6 hours. 2) PVF2 series The trimmer potentiometer should be placed in a chamber at 60±2°C and 90~95% without loading for 1000±12 hours. The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of 25±5°C for 5±1/6 hours 2) PVG3, PVG5, PV01, PV22, PV23, PV36, PV37 series The trimmer potentiometer should be subjected Figure-3 the programmed humidity environment for 10 cycle. The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of 25±5°C for 1.5±1/2 hours.  Figure 3															
8	Vibration	1) PV□□ series The trimmer potentiometer should be vibrated throughout the frequency range at the 20G level. A complete frequency range, 10Hz to 2000Hz and back, should be made within 15 minutes for a total of 4 sweeps in each of the three axis direction for a total of 12 sweeps. 2) PVF2 series The trimmer potentiometer should be subjected to vibration at 0.3 inch amplitude. The frequency should be varied uniformly between the approximate limits of 10Hz and 55Hz. This motion should be applied for period of 2 hours in each of 3 mutually perpendicular directions (total of 6 hours).															
9	Shock	1) PV□□ series The trimmer potentiometer should be shocked at the 100G (50G for PV22 and PV23 series) level and should be subjected to 4 shocks in each of the three axis directions for a total of 12 shocks. 2) PVM4A□□□D01 series The trimmer potentiometer should be shocked at the 100G level and should be subjected to 3 shocks in each of the six axis directions for a total of 18 shocks.															
10	Temperature Road Life	Full rated continuous working voltage not exceeding the maximum rated voltage should be applied intermittently between terminal #1 and terminal #3 of the trimmer potentiometer, 1.5 hours on and 0.5 hours off, for a total of 1000±12 hours, at a temperature of 70±2°C (85±2°C for PV01 and PV37 series, 50±2°C for PVF2 series). The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of 25±5°C for 1 to 2 hours.															
11	High Temperature Exposure (Except for PVF2)	The trimmer potentiometer should be placed in a chamber at a temperature of 125±3°C (150±3°C for PV22 series) 250±8 hours without loading. The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of 25±5°C for 1 to 2 hours.															
12	Low Temperature Exposure (Except for PVF2 and PVM4A□□□D01)	The trimmer potentiometer should be placed in a chamber at a temperature of -55±3°C for 1 hours without loading. Full rated continuous working voltage not exceeding the maximum rated voltage should be applied for 45 minutes. The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of 25±5°C for approximately 24 hours.															

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No.	Item	Test Methods
13	Low Temperature Operation (Only for PVF2 and PVM4A□□□D01)	The trimmer potentiometer should be placed in a chamber at a temperature of $-25\pm 3^{\circ}\text{C}$ ($-55\pm 3^{\circ}\text{C}$ for PVM4A□□□D01 series) 48±4 hours without loading. The trimmer potentiometer should be removed from the chamber, and maintained at a temperature of $25\pm 5^{\circ}\text{C}$ for 1-2 hours
14	Rotational Life	1) PV□□ series Full rated continuous working voltage not exceeding the maximum rated voltage should be applied with the circuit shown in the figure. The adjustment rotor (screw) should be continuously cycled through not less than 90% of effective-electrical rotational angle (number of turns), at the rate of 1 cycle for 5 seconds minimum to 2.5 minutes maximum for total of 200 cycles.  Figure 4 2) PVG3, PVG5 series The adjustment rotor (screw) should be continuously cycled though not less than 90% of effective-electrical rotational angle (number of turns), at the rate of 1 cycle for 5 seconds minimum to 2.5 minutes maximum for a total of 50 (100 for PVG5) cycles, without loading. 3) PVF2, PVM4A□□□D01 series The wiper should be rotated over 90% of the effective rotational angle without loading at a speed of 10 cycles per minute, for 100 cycles continuously.