



VISHAY INTERTECHNOLOGY, INC.

INTERACTIVE

data book

POTENTIOMETERS AND TRIMMERS

VISHAY

VSE-DB0018-0609

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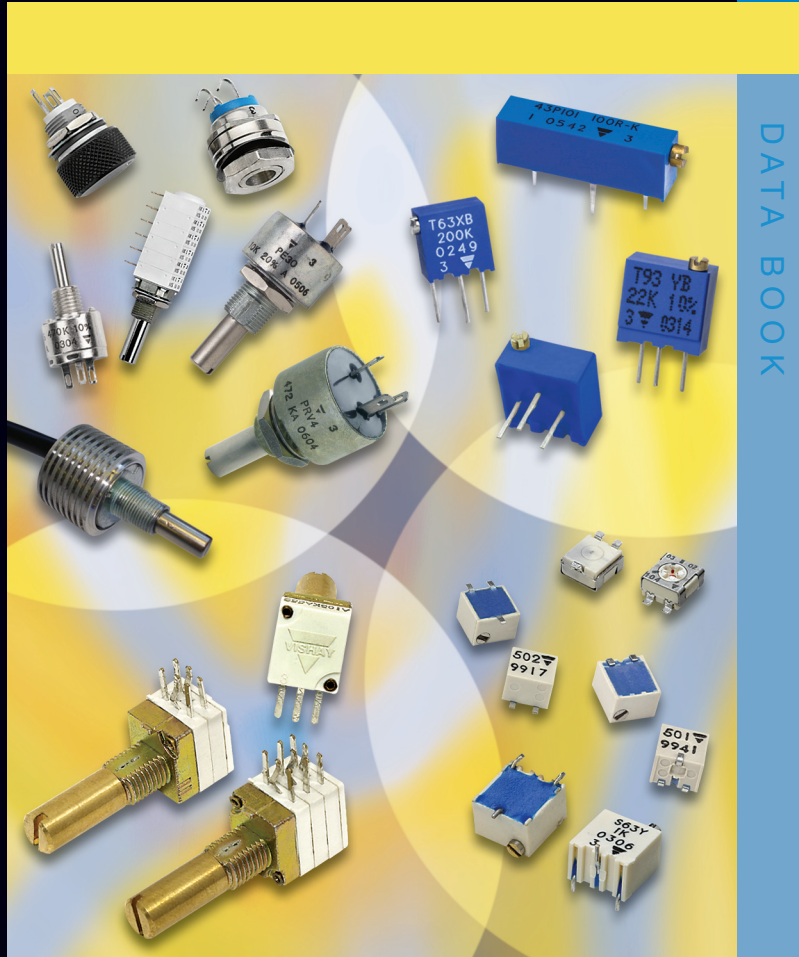
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One of the World's Largest Manufacturers of
Discrete Semiconductors and Passive Components



VISHAY INTERTECHNOLOGY, INC.



DATA BOOK

POTENTIOMETERS AND TRIMMERS

Cermet and Conductive Plastic Technologies

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Industrial Grade, Professional and Customs

Trimming Potentiometers:

Sealed SMD and Through-Hole

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 - Thick Film Resistors
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Potentiometers and Trimmers

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Potentiometers and Trimmers

These application notes are valid unless otherwise specified in the data sheets

1. GENERAL DEFINITIONS

1.1 - Potentiometer

A potentiometer is a mechanically actuated variable resistor with three terminals. Two of the terminals are linked to the ends of the resistive element and the third is connected to a mobile contact moving over the resistive track. The output voltage becomes a function of the position of this contact. Potentiometer is advised to be used as a voltage divider.

1.2 - Trimming potentiometer (trimmer)

A potentiometer designed for relatively infrequent adjustments

1.3 - Multi-ganged potentiometer

A potentiometer with two or more sections, each electrically independent, operated by a common spindle.

1.4 - Multi-turn potentiometer

A potentiometer with a shaft rotation of more than 360° from one end of the resistive element to the other. Multi-turn types are usually trimming or precision potentiometers.

1.5 - Sealed potentiometers

Two levels of sealing are usually recognized. The less severe one provides protection only against dust and cleaning processes (solvent splashes and vapors). For definition of sealing, see table "Protection Levels" at the end of these Application Notes. Hermetic sealing is more rigorous and protects the product against environmental pressure. (Not applicable for trimmers and potentiometers)

1.6 - Panel seal

This is used to seal the cut-out hole through which the potentiometer is mounted.

1.7 - Spindle seal

One or more O-rings are used to seal the spindle/case joint.

2. MECHANICAL DEFINITIONS

2.1 - Mechanical travel

The full extent of travel between the end stops of the spindle (Fig. 1). In potentiometers fitted with a slipping clutch, the position of the end stops is defined as those points where the clutch starts to slip at each end of the travel of the moving contact.

2.2 - Actual electrical travel

The angle of rotation of the spindle throughout which the resistance changes in the manner prescribed by the specified resistance law. (Fig. 1)

2.3 - End stop torque

The maximum torque that may be applied to the spindle when set against either end stop without causing any damage.

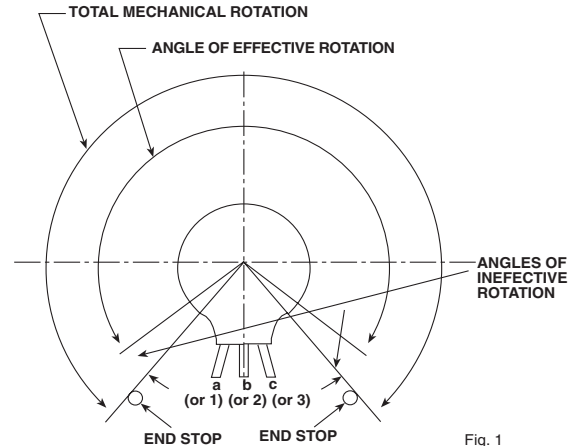


Fig. 1

2.4 - Operating torque

The necessary torque to move the contact in either direction from a random position away from end stops.

2.5 - Locking torque

The torque that may be applied to the shaft of a potentiometer fitted with a locking device without causing shaft rotation.

2.6 - Rotational life

The minimum number of cycles of operations obtainable under specified operating conditions while performance parameters (e.g., resistance rotational noise, torque, etc.) remain within specifications. A cycle is defined as the travel of the moving contact from end to end of the resistance element, and back.

2.7 - Direction of rotation

Rotation is defined as clockwise or counter-clockwise when viewing the surface of the potentiometer which, includes the means of actuation.

2.8 - Adjustment shaft

The mechanical input member of a potentiometer which, when rotated, causes the wiper to travel the resistance element resulting in a change in output voltage or resistance.

2.8.2 - Single-turn Adjustment

Requires 360° or less mechanical input to cause the wiper to travel the total resistance element.

2.8.2 - Multi-turn Adjustment

Requires more than 360° mechanical input to cause the wiper to travel the total resistance element.

2.9 - Terminal

An external contact that provides electrical connection to the resistance element and wiper.

2.9.1 - Printed Circuit Terminal

Rigid non-insulated electrical conductor suitable for printed circuit board

2.9.2 - Solder Lug Terminal

Rigid non-insulated electrical conductor suitable for external lead attachment

2.9.3 - Leadwire Type

Flexible insulated conductor

2.10 - Stop clutch

A device that allows the wiper to idle at the ends of the resistance element without damage while the adjustment shaft continues to be actuated in the same direction.

2.11 - Stop

A positive limit to mechanical and electrical adjustment.

3. INPUT AND OUTPUT TERMS

3.1 Input terms

3.1.1 - Total Applied Voltage

(E) The total voltage applied between the designated input terminals.

Note: When plus (+) and minus (-) voltages are applied to the potentiometer, the total applied voltage (commonly called peak-to-peak applied voltage) is equal to the sum of the two voltages. Each individual voltage is referred to as zero-to-peak applied voltage.

3.2 - Output terms

3.2.1 - Output Voltage

(e) The voltage between the wiper terminal and the designated reference points. Unless otherwise specified, the designated reference point is the counter-clockwise (CCW) terminal.

3.2.2 - Output Voltage Adjustment Ratio

(e/E) The ratio of the output voltage to the designated input reference voltage. Unless otherwise specified the reference voltage is the total applied voltage.

3.2.3 - Output Resistance

The resistance measured between the wiper terminal and the designated reference point. Unless otherwise specified, the designated reference point is the CCW terminal.

3.3 - Load terms

3.3.1 - Load Resistance

(R) The external resistance as seen by the output voltage (connected between the wiper terminal and the designated reference point).

Note: No load means an infinite load resistance.

4. ELECTRICAL DEFINITIONS

4.1 - Power rating

The maximum power that can be dissipated across the total resistance element, i.e., between terminals a (or 1) and c (or 3), at the specified ambient temperature. In practice this dissipation is modified by the following conditions:

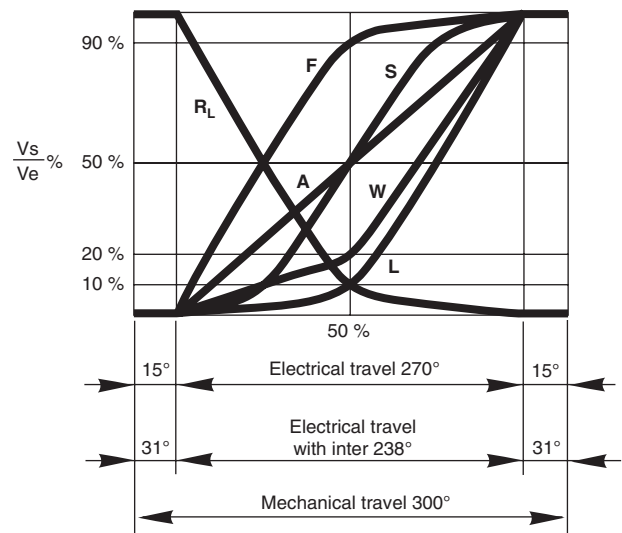
4.1.1 - For ambient temperatures higher than that specified, reference should be made to the derating curve.

4.1.2 - For high values of resistance, the limiting element voltage may prevent the maximum power rating from being obtained.

4.1.3 - For situations when the power is dissipated in only part of the resistance element, the maximum current capacity of the element will prohibit maximum total power dissipation.

4.2 - Resistance law

The relationship between the mechanical position of the moving contact and the resistance value across terminals a and b. (This may also be expressed as the relationship between the position of the moving contact and the ratio V_{ab}/V_{ac}). Typical available laws are indicated in Figure 2.



- A Linear (A law)
- L Clockwise logarithmic 10 % (L law) (audio taper)
- F Inverse, clockwise, logarithmic (F law)
- RL Counter-clockwise, logarithmic (RL law)
- W Clockwise logarithmic 20 % (W law)

4.3 - Conformity

This is a measure of the maximum deviation of the actual to the correspondant theoretical voltage expressed as percent of the total applied voltage.

4.4 - Linearity

The conformity where the theoretical resistance law is a straight line.

4.5 - Total resistance

The resistance value of the resistive element measured between connections a and c or 1 and 3 in conditions defined by CECC 41000:

Temperature: + 20 °C ± 1 °C

Relative humidity: 65 % ± 2 %

This value has to be included between limits of resistance nominal value according to tolerance.

4.5.1 - Minimum Effective Resistance

The resistance value at each end of the effective rotation between termination b (or 2) and the nearest end termination, a or c (1 or 3).

4.6 - Effective resistance

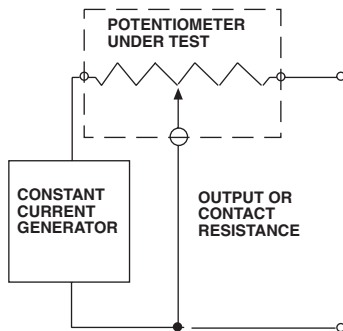
The portion of the total resistance over which the resistance changes in accordance with the declared resistance law. It is the total resistance minus the sum of the two minimum effective resistance values.

4.7 - End resistance

The resistance measured between termination a or c and termination b when the moving contact is positioned at the corresponding end of mechanical travel.

4.8 - Contact resistance

The resistance appearing between the contact and the resistive element when the shaft is rotated or translated. The wiper of the potentiometer is excited by a specific current and moved at a specified speed over a specified portion of the actual electrical travel.



4.9 - Continuity

Continuity is the maintenance of continuous electrical contact between the wiper and the resistive element over the total mechanical travel in both directions.

4.10 - Setting stability

For a fixed setting of the adjustment shaft, the amount of change in the output voltage due to the effects of an environmental condition, (expressed as a percentage of the total applied voltage).

4.11 - Setting ability

A measure of the ability for the user to adjust the wiper to any particular voltage ratio or resistance output.

4.12 - Resolution

This term is used in the description of wirewound potentiometers and is a measure of the sensitivity to which the output ratio of the potentiometer may be set. The theoretical resolution is the reciprocal of the number of turns of the resistance winding in the actual electrical travel multiplied by 100 i.e., (expressed as a percentage).

4.13 - Limiting element voltage

The maximum voltage that may be applied across the element of a potentiometer, provided that the power rating is not exceeded.

4.14 - Insulation voltage

The maximum voltage which may be applied under continuous operating conditions between any potentiometer termination and other external conductive parts connected together. The insulation voltage is not less than 1.4 times the limiting element voltage.

4.15 - Dielectric strength (voltage proof)

The maximum voltage which may be applied under 1 ATM pressure for 60 s between any potentiometer termination and any external conductive part without breakdown occurring. Dielectric strength is not less than 1.4 times the insulation voltage.

4.16 - Insulation resistance

The resistance measured between the terminals and other external conductive parts (e.g., shaft, housing, or mounting), when a specified D.C. voltage is applied.

4.17 - Temperature coefficient of resistance (TCR)

The unit change in resistance per °C change from a reference temperature, expressed in parts per million per °C as follows:

$$TC = \frac{R_2 - R_1}{(T_2 - T_1)R_1} \times 10^6$$

Where :

R₁ = Resistance in ohms, at reference temperature

R₂ = Resistance in ohms, at test temperature

T₁ = Reference temperature in °C

T₂ = Test temperature in °C

5. ENVIRONMENTAL DEFINITIONS

5.1 - Climatic category

The climatic category is defined in terms of the temperature extremes (hot and cold) and number of days exposure to dampness, heat, and steady-state conditions that the component is designed to withstand.

The category is indicated by a series of three sets of digits, separated by oblique strokes, as follows:

- First set: Two digits denoting the minimum ambient temperature of operation (cold test).
- Second set: Three digits denoting the upper category temperature (at that temperature the allowed dissipation is at least 25 %).
The maximum allowable temperature with zero dissipation is higher than the upper category temperature.
- Third set: Two digits denoting the number of days used for the "dampness, heat, and steady-state" test.

Example: P13: 55/100/56

Cold: - 55 °C

Upper category temperature: + 100 °C

(maximum allowable temperature: + 125 °C)

Damp heat: 56 days.

5.2 - Classify materials

Plastic materials used are UL94 class VO and/or our products are compliant with the flammability test of STD UL746C § 17 and 52.

6. STORAGE RECOMMENDATIONS

Careful attention must be paid when the components are stored. Because high and very low environmental temperature, high humidity, corrosive gases, etc. might affect the solderability of the terminals and the function of the package. Listed below are notes to be observed:

- The recommended storage conditions are in between + 10 °C and 25 °C (room temperature) at a relative humidity in between 35 % and 75 %.
- Do not store them within the vicinity of any corrosive gases such as hydrogen sulphide, sulphurous acid, chlorine or ammonium. The oxidation of the metals caused by such toxic gases may affect solderability as well as the electrical and mechanical performance of these products.
- Exposure to the direct sunlight and dust must be avoided
- Handle carefully to avoid deformation of terminals
- Keep parts in the original packages until just before use, and unpack only the quantity needed. Always seal any opened packages to protect them from oxidation and contaminants.
- Moisture Sensitive Level (MSL) for applicable SMD components, following storage conditions should be applied.

MSL LEVEL	FLOOR LIFE	
	TIME	CONDITIONS
1	Unlimited	≤ 30 °C/85 % RH
2	1 year	≤ 30 °C/60 % RH
2A	4 weeks	≤ 30 °C/60 % RH
3	168 hours	≤ 30 °C/60 % RH
4	72 hours	≤ 30 °C/60 % RH
5	48 hours	≤ 30 °C/60 % RH
5A	24 hours	≤ 30 °C/60 % RH
6	Time on label (TOL)	≤ 30 °C/60 % RH

If any special storage conditions are applied (outside those recommendations), it is the user's responsibility.

7. SMD AND THROUGH HOLE COMPONENTS, SOLDER AND CLEANING RECOMMENDATIONS

VISHAY Trimmers sealed surface mount components are designed to withstand the processes related to Infrared, Hot Air, Vapour Phase Reflow and Dual Wave soldering. They are sealed against flux by means of an O-ring seal or press fit and can withstand exposure to all commonly used defluxing solvents. It is important to note before pre-heating and soldering trimmers, make sure the position of the wiper is not in contact with the end terminals (beginning or end of the wiper mechanical travel) to avoid malfunction of trimmers.

7.1 - Adhesive application (for SMD only)

When an assembly has to be wave soldered, an adhesive is essential to bond the SMDs to the substrate. Under normal conditions reflow, soldered substrates do not need adhesive to maintain trimmer orientation, since the solder paste does it. The amount of adhesive, the curing time and temperature to use should be in accordance with adhesive manufacturer's recommendations. Otherwise, the adhesive polymerization time & temperature have to also respect trimmers soldering recommendations. (§3)

Caution: The height and the volume of adhesive dots applied are critical for two reasons: the dot must be high enough to reach the SMD, and there must not be any excess adhesive, since this can pollute the solder land and prevent the formation of a good soldered joint.

7.2 - Flux and solder recommendations

SMD & Through hole components can be used with R & RA (Rosin & Rosin Activated) type flux to OA (Organic Acid). It is always advisable not to use a flux of an activity level greater than that necessary to achieve optimum yields for solder wetting. Fluxes of RA and OA activity levels are corrosive and therefore must be removed. It is advisable that all types of fluxes be removed by cleaning due to the possibility of corrosion.

Caution: Avoid highly activated fluxes. Consult factory before using OA.

Suggested Solder composition is:

- Tin Lead solder: Sn63/Pb37
 - Lead (Pb)-free solder: Sn96.5/Ag3/Cu0.5
- Typical solder paste print thickness would be 0.8 to 1 mm thick

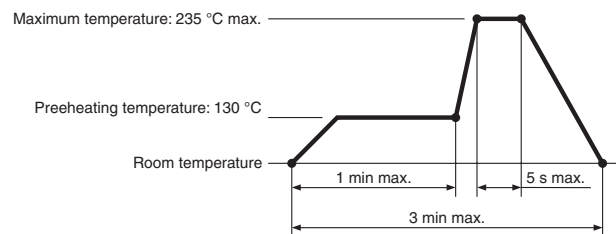
7.3 - Soldering recommendations

Normal preheating is required to activate flux and minimize thermal shock to components. The maximum recommended temperature for flow and reflow soldering profiles are specified below. It is important to note temperature of those profiles corresponds to parts temperature (and not PCB temperature). The use of leaded solder process or lead (Pb)-free solder process is specified under each series of SMD or through hole products.

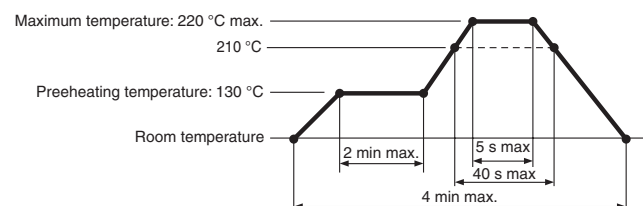
General Caution: User must always test and verify pre-heating and soldering processes as well as other production line assembly before final production.

Leaded solder process

Wave soldering (1 time max.)

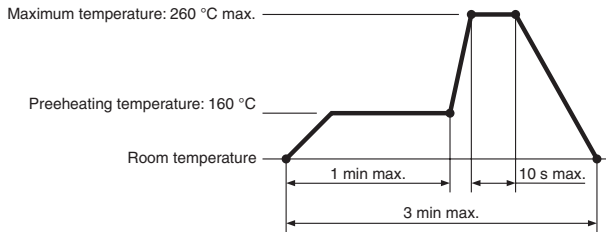


Infrared or Hot Air reflow soldering (2 times max.) (for SMD only)

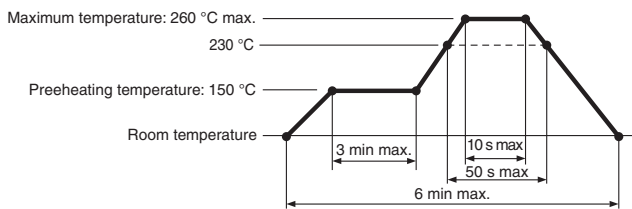


Lead (Pb)-free solder process

Wave soldering (1 time max.)



Infrared or Hot Air reflow soldering (2 times max.) (for SMD only)



Vapor phase reflow: Vapour with 215 °C condensation temperature for a period not more than 2 minutes

Soldering iron caution: Use the appropriate soldering iron size, shape and heat capacity for soldering SMD trimmers. Do not exceed the maximum time and temperature parameters specified: 3 s at 350 °C. Never touch the body of the trimmer or potentiometer with the soldering iron.

Infrared soldering caution: If the infrared radiation is the heat source, the temperature increase of the SMD trimmers should be carefully checked because the radiation absorption rate depends on the color and the structure of the material of trimmers.

7.4 - Washing recommendations (refer to protection level of the component)

Cooling down time after soldering and before exposure to defluxing solvents is required. The component body temperature when exposed to cleaning should not exceed 60 °C. Cleaning spray rinse is recommended with pressures of not greater than 60 psi (5.5 kg-cm²) for a period not to exceed 15 - 20 seconds.

Appropriate defluxing solvent/Aqueous:

- Aqueous detergent solutions
- Terpene based semiaqueous
- Ester/Ether based solvents
- Methanol
- HAS - HCFC

Caution:

- Avoid using cleaning solvents such as Trichloroethane or Freon which endanger the environment
- Ultrasonic may cause component damage or failure

7.5 - Reworking recommendations

- General: Excessive and/or repeated high temperature heat exposure may affect component performance and reliability
- Recommended: Hot air reflow technique is the safest method for SMD component
- Caution: Avoid use of a soldering iron or wave soldering as a rework technique

7.6 - Adjustment recommendations

Adjustment of components should be done only after part has reached ambient temperature and cleaning solvent has evaporated (10 minutes).

PROTECTION LEVELS



FIRST DIGIT PROTECTION AGAINST SOLID SUBSTANCES		SECOND DIGIT PROTECTION AGAINST LIQUIDS	
IP	Tests	IP	Tests
0	Without Protection	0	Without Protection
1	Protected against solid substances (size > 50 mm)	1	Protected against water drops (condensation)
2	Protected against solid substances (size > 12 mm)	2	Protected against water drops from up to 15 feet
3	Protected against solid substances (size > 2.5 mm)	3	Protected against water drops from up to 60 feet
4	Protected against solid substances (size > 1 mm)	4	Protected against water drops from above 60 feet
5	Protected against dust (> 0.1 mm < 1 mm)	5	Protected against splashes of water in all directions
6	Fully protected against dust	6	Protected against projections of water in all directions
		7	Protected against action of immersion < 15 cm and water jet pressure in all directions
		8	Protected against long time action of immersion < 1 meter and water jet pressure in all directions


Note: To symbolize the protection levels, we use IP letters followed by 2 digits.

Potentiometers and Trimming Potentiometers of Assessed Quality

NF - CECC HOMOLOGATIONS

Styles officially qualified are listed in this document. Between two editions modifications may occur. Up-to-date information can be obtained from VISHAY SFERNICE or official Qualified Parts List LCIE C 00-191.

TYPE OF COMPONENTS AND RELATED SPECIFICATIONS		RELEVANT SHEET	TYPE		QUALIFIED RANGE (MAIN CHARACTERISTICS)			
			CECC/UTE/NF	VISHAY SFERNICE				
 CECC 41 100	Lead screw actuated rotational preset trimmers	002	A (PC19) B (PC39)	P8PY P8PX	100 Ω to 100 Ω	1 MΩ to 1 MΩ	± 10 % to ± 10 %	± 20 % law A to ± 20 % law A
		004	A (PM81A) B (PM82A) C (PM81B) D (PM82B) E (PM83)	T9XA T9YA T9XB T9YB T9Z	100 Ω to 100 Ω	1 MΩ to 1 MΩ	± 10 % to ± 10 %	± 20 % law A to ± 20 % law A
		005	A PM84A B PM84B C PM84C D PM84D	T6XB T6YB T6XA T6YA	100 Ω to 100 Ω	470 kΩ to 470 kΩ	± 10 % to ± 10 %	law A to law A
 CECC 41 300	Low power single turn rotational potentiometers	001	A (PC32) B C (PC33)	P13T P13Q P13V	470 Ω to 470 Ω 470 Ω to 470 Ω 470 Ω to 470 Ω	1 MΩ to 1 MΩ 1 MΩ to 1 MΩ 1 MΩ to 1 MΩ	± 10 % to ± 10 % ± 10 % to ± 10 % ± 10 % to ± 10 %	± 20 % law A to ± 20 % law A ± 20 % law A to ± 20 % law A ± 20 % law A to ± 20 % law A

 Undergoes European Quality Assurance System (CECC)

MILITARY LIST GAM T1

Styles officially qualified are listed in this document

TYPE OF COMPONENTS AND RELATED SPECIFICATIONS	TYPE		PARTICULAR CHARACTERISTICS PREFERENTIAL VALUES	GAM T1 LIST	
	CECC/UTE/NF	VISHAY SFERNICE		PREFERENTIAL	GUIDE
Non wirewound potentiometer 1 turn 41301	PC32 PC33 (C) PC33 (3) -	P13T P13V P13Q P13H	22 Ω to 2.2 MΩ 1.5 W	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
	PC 6.	P11. all series	22 Ω to 4.7 MΩ 1 W	<input type="checkbox"/>	
Non wirewound potentiometer multiturn 41101	PM81A PM81B	T9XA T9XB	22 Ω to 1 MΩ 0.5 W	<input type="checkbox"/>	
	PM82A PM82B	T9YA T9YB	22 Ω to 1 MΩ 0.5 W	<input type="checkbox"/>	
	PM83	T9Z	22 Ω to 1 MΩ 0.5 W	<input type="checkbox"/>	
	PM84	T6	100 Ω to 1 MΩ 0.25 W	<input type="checkbox"/>	
SMD Trimming Potentiometers 41101	TS5	TS5	100 Ω to 1 MΩ 0.2 W	<input type="checkbox"/>	
	TS6	TS6 TS63	10 Ω to 2 MΩ 0.25 W	<input type="checkbox"/>	



Potentiometers and Trimming Potentiometers

PRODUCTS IN MAINTENANCE					
TRIMMING POTENTIOMETERS					
	NO LONGER MANUFACTURED	STILL MANUFACTURED	REPLACED BY	EXACT CROSS	EQUIVALENCE
36	X		T7		X
37	X		T7		X
38	X		T7		X
74	X		T63	X	
75	X		T7		X
76	X		T73	X	
80		X			
84		X			
3H	X		TS3		X
43 T040	X		43		X
4H/4M	X		TS3		X
4J/4G	X		TS53	X	
5W/5X	X		TSM4	X	
T10	X		63		X
T19P	X		T18		X
T20	X		63	X	
T4	X		TS53Y, T53Y		X
T70	X		T73	X	
T7R		X			
T7X		X	T73XX		X
TM6	X				
TXTY	X		T73		X
POTENTIOMETERS					
P14T	X		P12T		X
PE25/PX	X		PE30		X
P50 A6P	X		P11VYP/J41	X	X
174/175/176		X			
180	X		P9		X
185	X		P9		X
SWITCH					
87		X			
ENCODERS					
110E		X			



Trimming Potentiometers For Surface Mounting

Single Turn Industrial



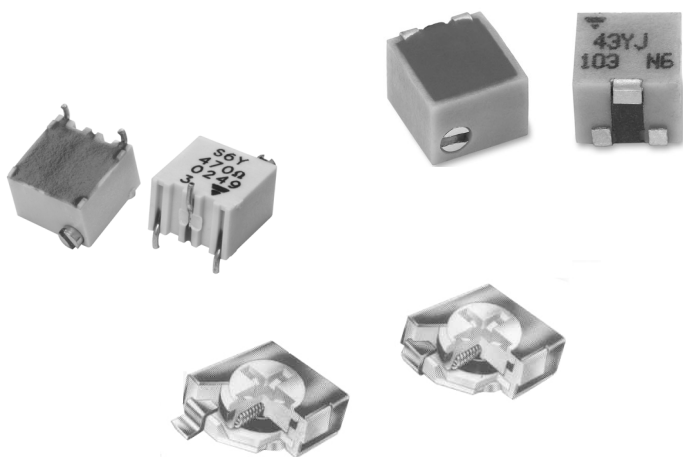
Multiturn Industrial



Multiturn Professional and Military


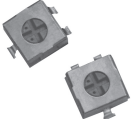






Model Numbers

TS3Y	11
TS4Y	13
TS5Y	15
TS53Y	18
TSM4	21
TSM43	24
TS6	27
TS63	30

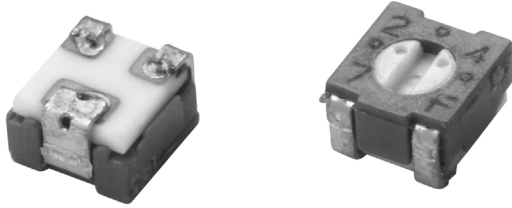


Surface Mount Trimmers

TRIMMING POTENTIOMETERS

	SERIES	SETTING	DOC NO.	MECHANICAL TRAVEL	STYLE	APPLICATIONS	POWER RATING	RESISTANCE RANGE	DIMENSIONS mm
	TS3Y cermet	single-turn	51041	250°	J	Industrial	0.125 W 70 °C	10 Ω - 2 MΩ	3.2 x 3.5 x 2.2
	TS4Y cermet	single-turn	51053	240°	J L	Industrial	0.25 W 70 °C	10 Ω - 2 MΩ	4.5 x 4.5 x 2.55
	TS5Y cermet	single-turn	51007	270°	L J	Professional	0.2 W 70 °C	10 Ω - 1 MΩ	5 x 5 x 2.7
	TS53Y cermet	single-turn	51008	270°	L J	Industrial	0.25 W 70 °C	10 Ω - 1 MΩ	5 x 5 x 2.7
	TSM4 cermet	multi-turn	51009	13 turns	YL YJ ZL ZJ	Professional	0.25 W 85 °C	10 Ω - 1 MΩ	4.8 x 5.1 x 3.7
	TSM43 cermet	multi-turn	51045	11 turns	YJ ZL ZJ	Industrial	0.25 W 85 °C	10 Ω - 2 MΩ	4.6 x 5.1 x 3.9
	TS6 cermet	multi-turn	51010	15 turns	X Y Z	Professional and military	0.25 W 85 °C	10 Ω - 2 MΩ	6.85 x 6.85 x 5
	TS63 cermet	multi-turn	51011	15 turns	X Y Z	Industrial	0.25 W 85 °C	10 Ω - 2 MΩ	6.85 x 6.85 x 5

Surface Mount Miniature Trimmers 3 mm Single-Turn Cermet Sealed



FEATURES

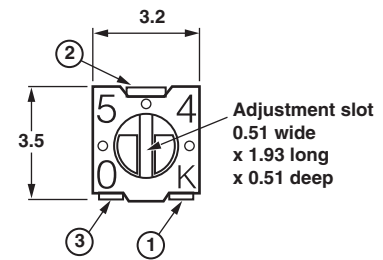
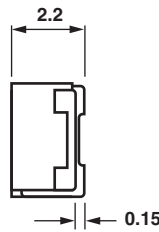
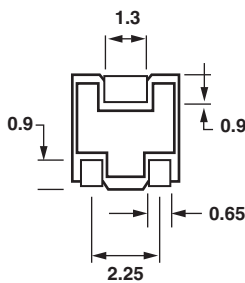
- 0.125 Watt at 70 °C
- Small Size for Optimum Packing Density
- Suitable for both manual and automatic operation



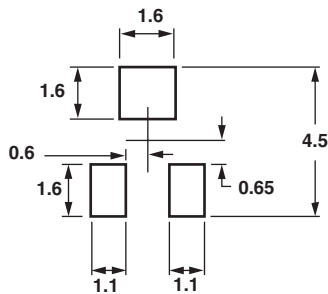
RoHS
COMPLIANT

DIMENSIONS in millimeters

TS3 YJ

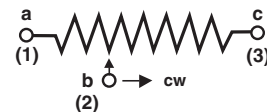


RECOMMENDED SOLDERING AREAS



General tolerance ± 0.25

CIRCUIT DIAGRAM



SOLDERING RECOMMENDATIONS

see Application notes

ELECTRICAL SPECIFICATIONS

Resistive Element	Cermet
Electrical Travel	220°
Resistance Range	10 Ω to 2 M Ω
Stocked Range	1 k Ω to 100 k Ω
Standard Series	1 - 2 - 5
Tolerance Standard	$\pm 20\%$
Power Rating	0.125 W at 70 °C
Temp. Coefficient (Max.)	± 150 ppm/°C
Limiting Element Voltage (Max.)	200 V
Contact Resistance Variation	3 % or 3 Ω
End Resistance	1 % or 3 Ω
Dielectric Strength (Rms)	500 V
Insulation Resistance	100 M Ω

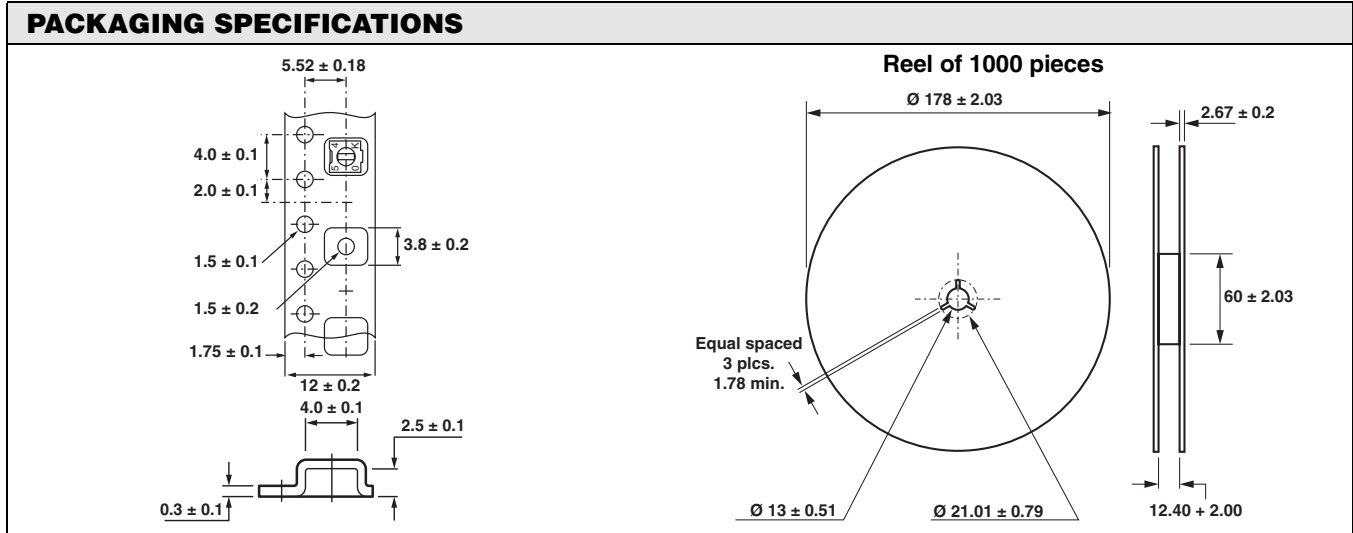
MECHANICAL SPECIFICATIONS

Mechanical Travel	250°
Operating Torque (max. Ncm)	0.5
End Stop Torque (min. Ncm)	2
Unit Weight (max. g)	0.1
Mechanical Life (Cycles)	50

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C + 125 °C
Sealing	sealed container IP 67
MSL Level	1

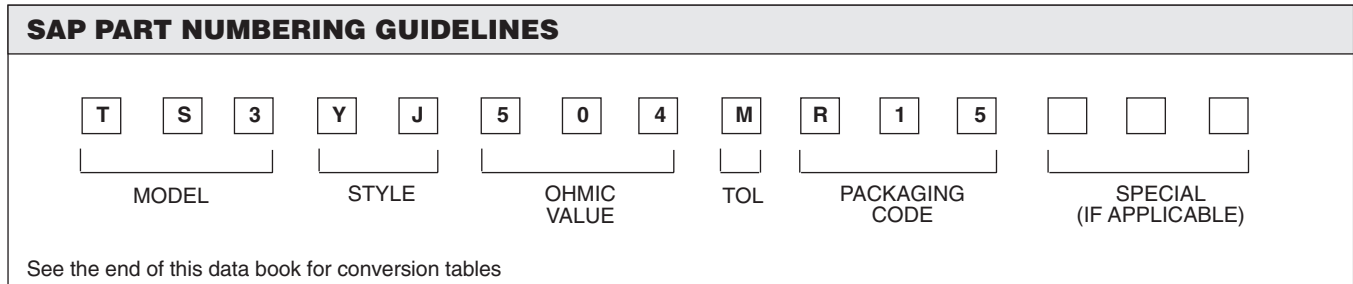
STANDARD RESISTANCE TABLE		
RESISTANCE	PART MARKING CODE	RESISTANCE CODE
10	A1	100
20	21	200
50	51	500
100	A2	101
200	22	201
500	52	501
1000	A3	102
2000	23	202
5000	53	502
10 000	A4	103
20 000	24	203
50 000	54	503
100 000	A5	104
200 000	25	204
500 000	55	504
1 000 000	A6	105
2 000 000	26	205



ORDERING INFORMATION

TS3 SERIES	YJ STYLE	500 kΩ OHMIC VALUE	± 20 % TOLERANCE	TR1000 PACKAGING
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TR1000 = tape and reel 1000 pcs



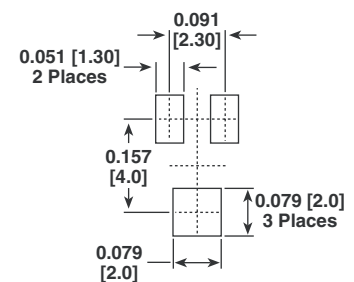
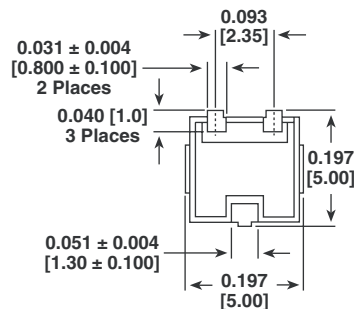
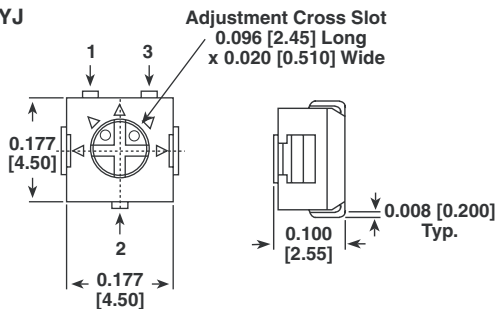
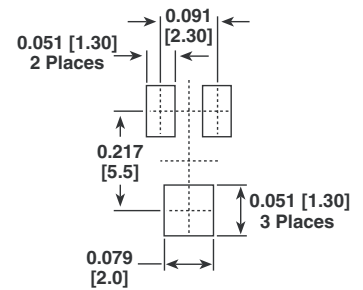
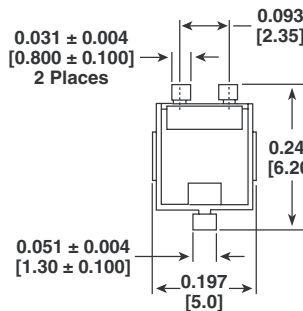
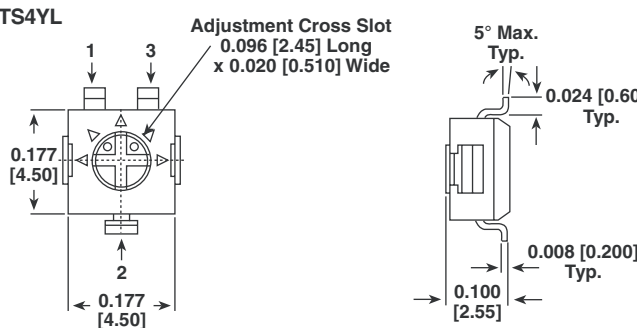
Cermet Trimmers

Surface Mount, 4.0 mm Square, Single Turn, Industrial Grade


FEATURES

- Fully sealed to withstand board washing
- Compatible with surface mount manufacturing processes
- Compatible with popular vacuum pick-and-place equipment
- J-hook and gull-wing configurations


DIMENSIONS in millimeters

TS4YJ

Recommended PCB Footprint
TS4YL

Recommended PCB Footprint

NOTE: All tolerances are ± 0.010 " [0.25 mm] unless otherwise specified.

MECHANICAL SPECIFICATIONS

Mechanical Angle: 240° nominal
Operating Torque: 1.8 Ncm typical
End Stop Torque: 3.0 Ncm typical
Weight: Approximately 0.01 ounce
Wiper: Positioned at 50 % nominal
Flammability: UL 94V-0

Vibration: 20 G (total resistance shift ± 1 %, voltage ratio shift ± 1 %)
Shock: 100 G (total resistance shift ± 1 %, voltage ratio shift ± 1 %)
Load Life: At + 70 °C rated power 1000 hours (total resistance shift ± 3 %)
Rotational Life: 100 cycles (total resistance shift ± 3 %)
Thermal Shock: 5 cycles (total resistance shift ± 2 %, voltage ratio shift ± 1 %)

ENVIRONMENTAL SPECIFICATIONS

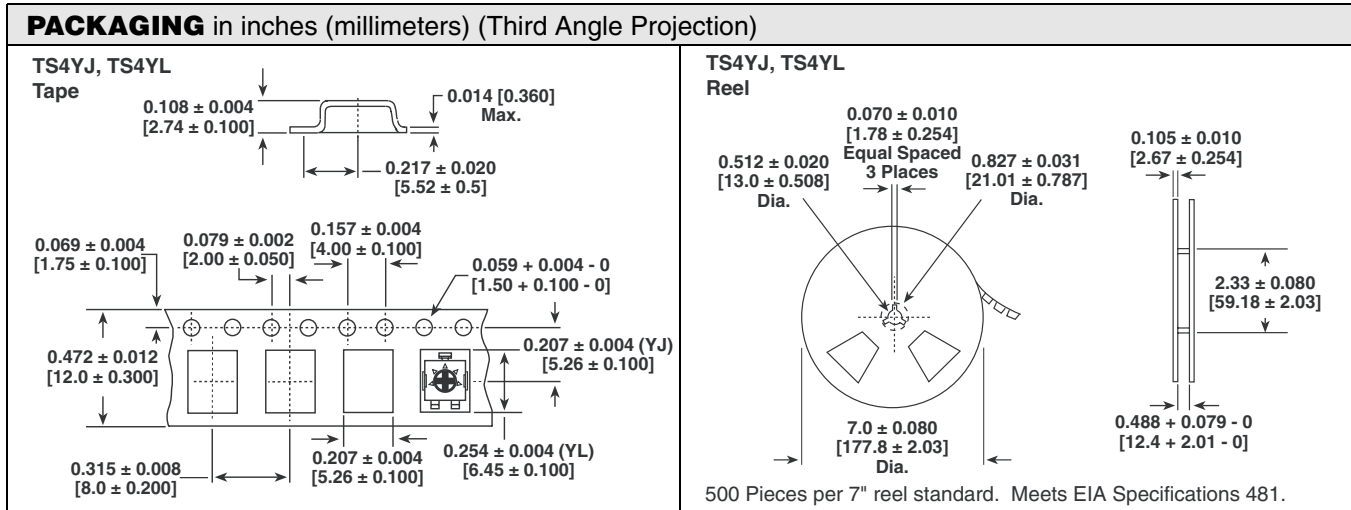
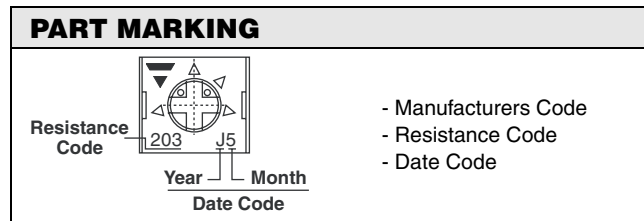
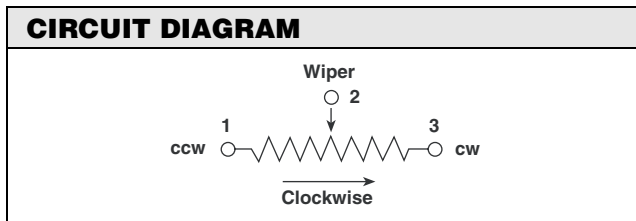
Temperature Range: - 55 °C to + 125 °C
Humidity: 90 - 98 % relative humidity 10 cycles, 240 hours, (total resistance shift ± 2 %, insulation resistance 10 M Ω)

ELECTRICAL SPECIFICATIONS	
Resistive Range	10 Ω to 2 M Ω (See Standard Resistance Table)
Tolerance	± 20 % standard
End Resistance	1 % or 2 Ω maximum, whichever is greater
Temperature Coefficient	± 100 ppm/°C
Power Rating	(300 volts maximum) 0.25 watt at + 70 °C, 0 watt at + 125 °C
Contact Resistance Variation (CRV)	1 % or 3 Ω
Resolution	Infinite
Insulation Resistance (500 VDC)	100 M Ω minimum
Dielectric Strength	Sea level 500 VAC (1 minute)
Adjustment Angle	210° nominal

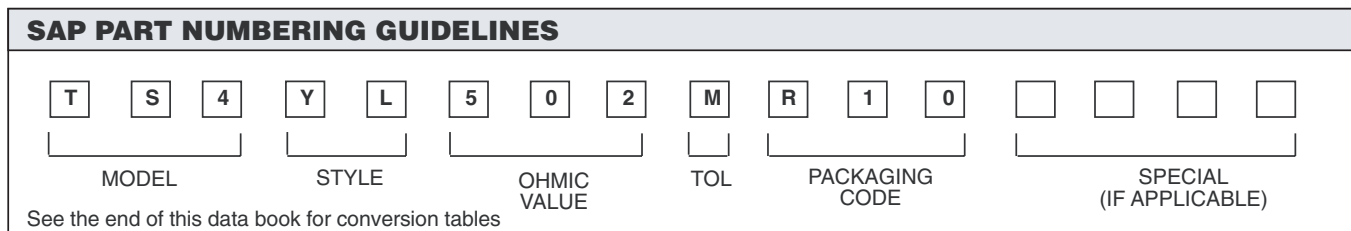
TWO DIGIT DATE CODE					
YEAR					
1980	M	1990	A	2000	M
1981	N	1991	B	2001	N
1982	P	1992	C	2002	P
1983	R	1993	D	2003	R
1984	S	1994	E	2004	S
1985	T	1995	F	2005	T
1986	U	1996	H	2006	U
1987	V	1997	J	2007	V
1988	W	1998	K	2008	W
1989	X	1999	L	2009	X
MONTH					
January	1	July	7		
February	2	August	8		
March	3	September	9		
April	4	October	0		
May	5	November	N		
June	6	December	D		

STANDARD RESISTANCE TABLE	
RESISTANCE (OHMS)	RESISTANCE CODE
10	100
20	200
50	500
100	101
200	201
500	501
1000	102
2000	202
5000	502
10 000	103
20 000	203
50 000	503
100 000	104
200 000	204
500 000	504
1 000 000	105
2 000 000	205

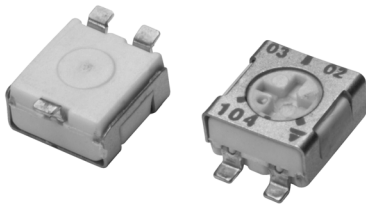
NOTE: Special resistance available



NOTE: Specifications are subject to change without notice



Surface Mount Miniature Trimmers Single-Turn Cermet Fully Sealed



The TS5 trimming potentiometer has been designed for surface mount applications and offers volumetric efficiency (5 x 5 x 2.7 mm) with high performance and stability.

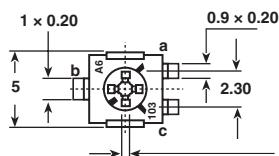
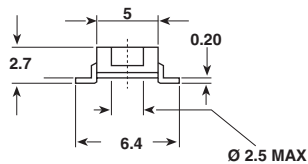
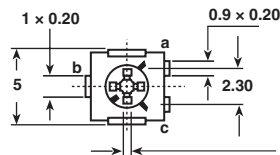
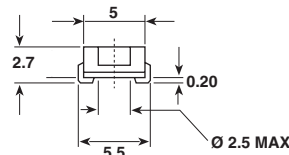
The TS5 design is suitable for both manual or automatic operation, and can withstand wave and reflow soldering techniques.

FEATURES

- 0.25 Watt at 70 °C
- CECC 41100
- GAM T1
- Professional grade
- Wide ohmic range (10 Ω to 1 MΩ)
- Full sealing
- Low contact resistance variation (1 % or 3 Ω)
- Small size for optimum packing density
- Suitable for both manual or automatic operation

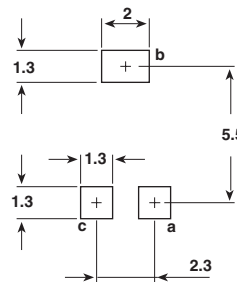
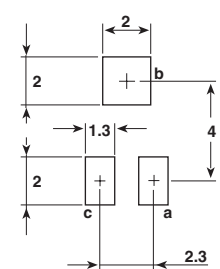


DIMENSIONS in millimeters

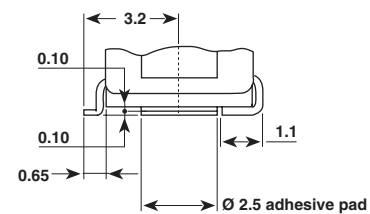
TS5YL

TS5YJ


cruciform screwdriver slot
 ø 2.5, width 0.5
 deep: 0.55
 max deep (center): 0.7

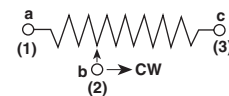
RECOMMENDED SOLDERING AREAS

TS5YL

TS5YJ


ADHESIVE PAD (detail)



CIRCUIT DIAGRAM



Tolerance unless otherwise specified ± 0.25 mm

ELECTRICAL SPECIFICATIONS		
Resistive Element		Cermet
Electrical Travel		220° ± 15°
Resistance Range		10 Ω to 1 MΩ
Standard Series		1 - 2 - 5
Tolerance Standard		± 10 %
Power Rating	Linear	0.25 W at 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		200 V
Contact Resistance Variation		1 % or 3 Ω
End Resistance (Typical)		0.1 % or 3 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance		10 ⁶ MΩ
Specification		in accordance with CECC 41100

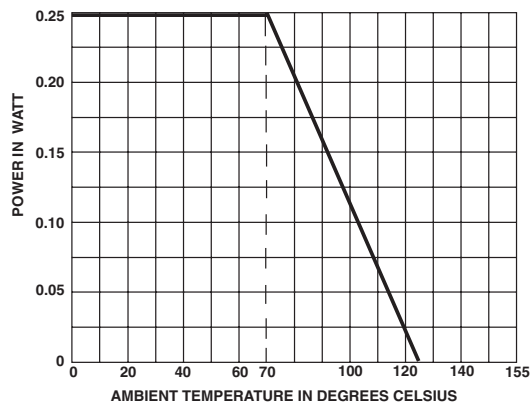
MECHANICAL SPECIFICATIONS

Mechanical Travel	270° ± 10°
Operating Torque (max. Ncm)	1.5
End Stop Torque (max. Ncm)	3.5
Unit Weight (max. g)	0.15

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56
Sealing	fully sealed container solder immersion IP67

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30° - ambient temperature + 70 °C	± 2 % Contact resistance variation: $\Delta R < 1 \% R_n$	± 3 %
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %	± 3 %
Long Term Damp Heat	Temperature 40 °C - RH 93 % 56 days	± 2 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 3 %
Thermal Shock	55 °C to + 125 °C - 5 cycles	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 2 \%$
Rotational Life (Electrical and Mechanical)	100 cycles - rated power	± 3 %	
Shock	50 g - 11 ms 3 successive shocks in 3 directions	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Vibration	10 - 55 Hz 0.75 mm or 10 g - 6 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C ppm/°C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH ELEMENT	
Ω	W	V	mA	
10	0.25	1.58	158	0 + 200
20		2.24	112	
50		3.54	71	
100	↓	5.00	50	± 100
200		7.07	35	
500		11.2	22	
1K		15.8	16	
2K		22.4	11	
5K		35.4	7	
10K		50.0	5	
20K		70.7	3.5	
50K		112	2.2	
100K		0.25	158	
200K	0.20	200	1.0	
500K	0.08	200	0.4	
1M	0.04	200	0.2	

MARKING (RED MARK)

VISHAY trademark, ohmic value, manufacturing date, red mark.

The ohmic value is indicated by a 3 figure code, the first two are significant figures, the third one is the multiplier.

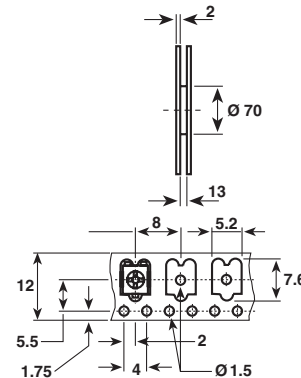
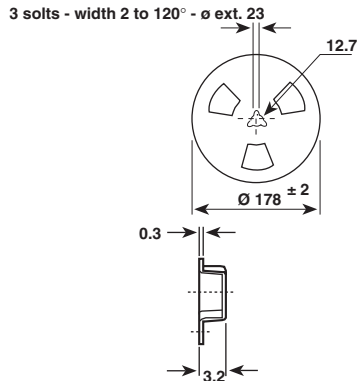
Example: 100 = 10 Ω
101 = 100 Ω
102 = 1000 Ω
503 = 50 000 Ω

SOLDERING RECOMMENDATIONS

see Application notes

PACKAGING

On tape and reel of 500 pieces, code TR and 2000 pieces, code TR1



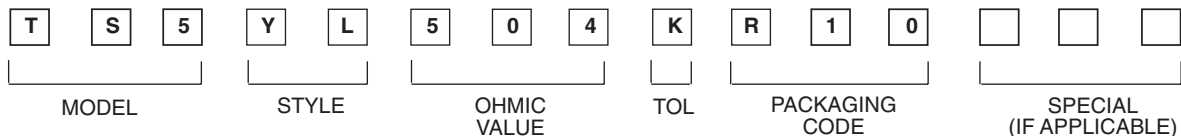
Cover tape panel strength specifications EIA 481 A and CEI 60286-3.

ORDERING INFORMATION

TS5 SERIES	YL STYLE	500 kΩ OHMIC VALUE	± 10 % TOLERANCE	TR500 PACKAGING	e3 LEAD FINISH
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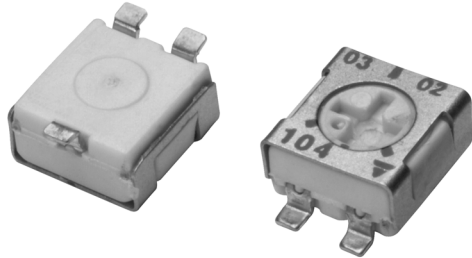
TR: Tape and reel 500 pcs
TR1: Tape and reel 2000 pcs
e3: pure Sn

SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

Surface Mount Miniature Trimmers Single-Turn Cermet Sealed



FEATURES

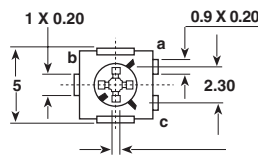
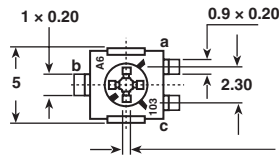
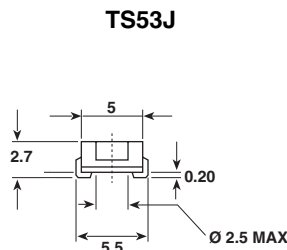
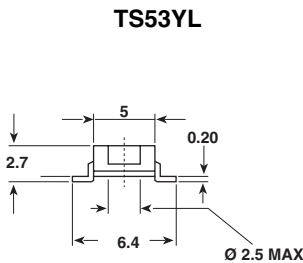
- 0.25 Watt at 70 °C
- For PCB version see T53Y series
- Wide ohmic range (10 Ω to 1 MΩ)
- Small size for optimum packing density
- Suitable for both manual or automatic operation



The TS53 trimming potentiometer has been designed for surface mount applications and offers volumetric efficiency (5 x 5 x 2.7 mm) with high performance and stability.

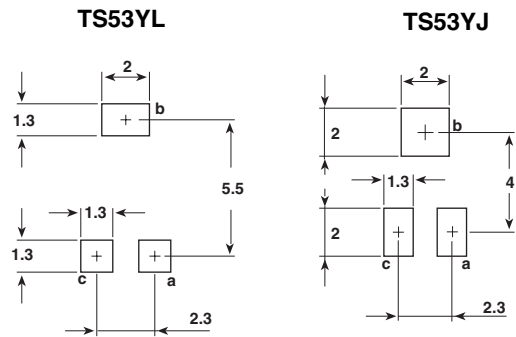
The TS53 design is suitable for both manual or automatic operation, and can withstand wave, and reflow soldering techniques.

DIMENSIONS in millimeters

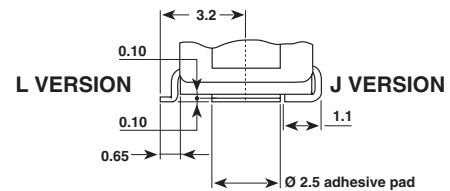


cruciform screwdriver slot
 ø 2.5, width 0.5
 deep: 0.55
 max deep (center): 0.7

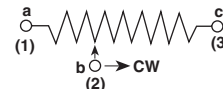
**RECOMMENDED
SOLDERING AREAS**



ADHESIVE PAD (detail)



CIRCUIT DIAGRAM



Tolerances unless otherwise specified ± 0.25 mm



ELECTRICAL SPECIFICATIONS		
Resistive Element		Cermet
Electrical Travel		220° ± 15°
Resistance Range		10 Ω to 1 MΩ
Standard Series		1 - 2 - 5
Tolerance Standard		± 20 %
Power Rating	Linear	0.25 W at 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		200 V
Contact Resistance Variation		1 % or 3 Ω
End Resistance (Typical)		0.1 % or 3 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance		10 ⁶ MΩ

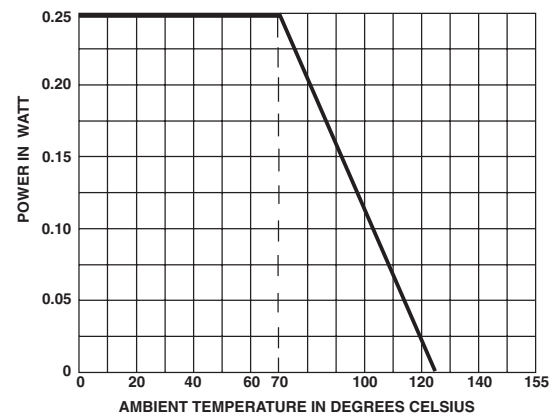
MECHANICAL SPECIFICATIONS

Mechanical Travel	270° ± 10°
Operating Torque (max. Ncm)	1.5
End Stop Torque (max. Ncm)	3.5
Unit Weight (max. g)	0.15

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56
Sealing	sealed container

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30' - ambient temperature + 70 °C	± 2 % Contact resistance variation: ΔR < 1 % Rn	± 3 %
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %	± 3 %
Long Term Damp Heat	Temperature 40 °C - RH 93 % 56 days	± 2 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 3 %
Thermal Shock	55 °C to + 125 °C - 5 cycles	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 2 \%$
Rotational Life (Electrical and Mechanical)	100 cycles - rated power	± 3 %	
Shock	50 g - 11 ms 3 successive shocks in 3 directions	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Vibration	10 - 55 Hz 0.75 mm or 10 g - 6 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$

STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C ppm/°C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH ELEMENT	
Ω	W	V	mA	
10	0.25	1.58	158	0 + 200
20		2.24	112	
50		3.54	71	
100	↓	5.00	50	± 100
200		7.07	35	
500		11.2	22	
1K		15.8	16	
2K		22.4	11	
5K		35.4	7	
10K		50.0	5	
20K		70.7	3.5	
50K		112	2.2	
100K		0.25	158	
200K	0.20	200	1.0	
500K	0.08	200	0.4	
1M	0.04	200	0.2	

MARKING

VISHAY trademark, ohmic value, manufacturing date.

The ohmic value is indicated by a 3 figure code, the first two are significant figures, the third one is the multiplier.

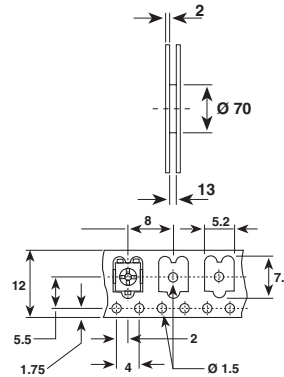
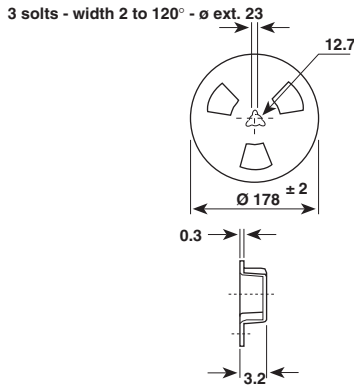
Example:
 100 = 10 Ω
 101 = 100 Ω
 102 = 1000 Ω
 503 = 50 000 Ω

SOLDERING RECOMMENDATIONS

see Application notes

PACKAGING

On tape and reel of 500 pieces, code TR and 2000 pieces, code TR1

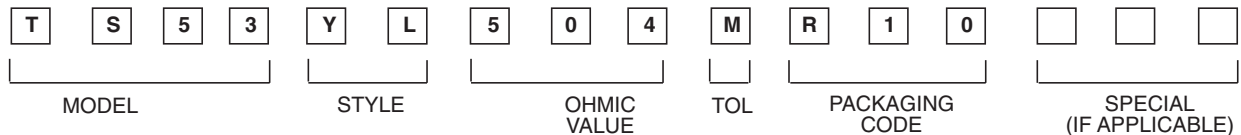


Cover tape panel strength specifications EIA 481 A and CEI 60286-3.

ORDERING INFORMATION

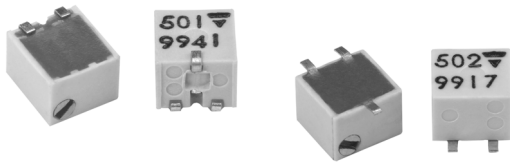
TS53 SERIES	YL STYLE	500 KΩ OHMIC VALUE	± 20 % TOLERANCE	TR500 PACKAGING	e3 LEAD FINISH
				TR: Tape and reel 500 pcs on request: TR1: Tape and reel 2000 pcs	e3: pure Sn

SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

Surface Mount Miniature Trimmers Multi-Turn Cermet Sealed



The TSM4 trimming potentiometer has been designed for surface mount applications and offers volumetric efficiency $5 \times 5 \times 3.7 \text{ mm}^3$ with high performance and stability.

The TSM4 design is suitable for both manual or automatic operation, and can withstand vapor phase and reflow soldering techniques.

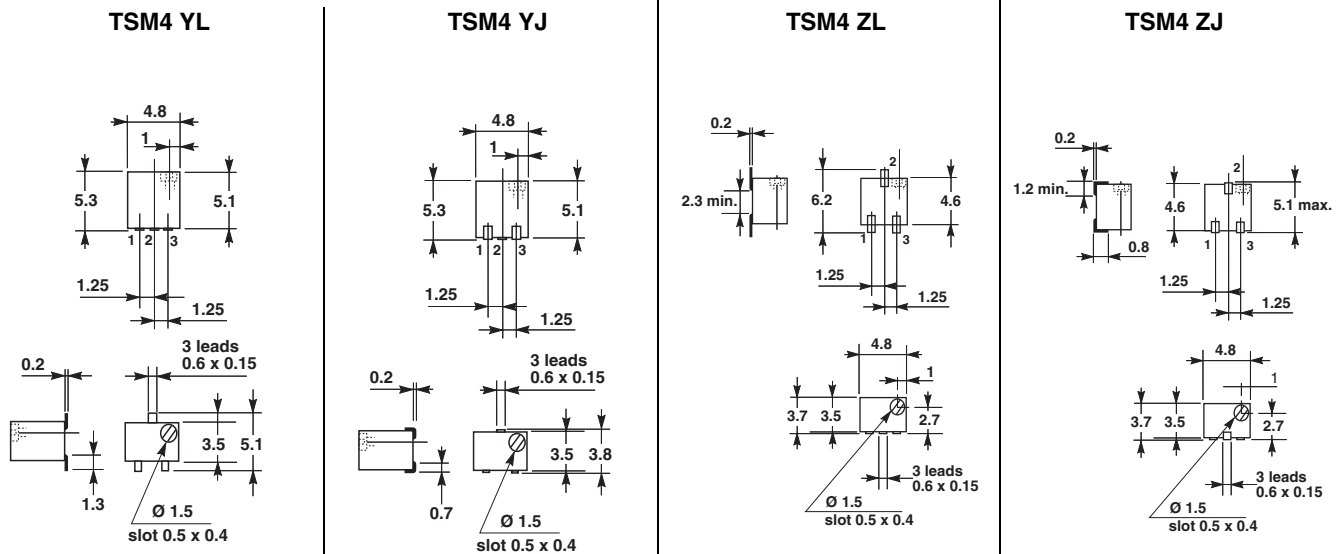
FEATURES

- 0.25 Watt at 85 °C
- Professional grade
- Wide ohmic range (10 Ω to 1 MΩ)
- Low contact resistance variation (2 % or 3 Ω)
- Small size for optimum packing density
- Suitable for both manual or automatic operation

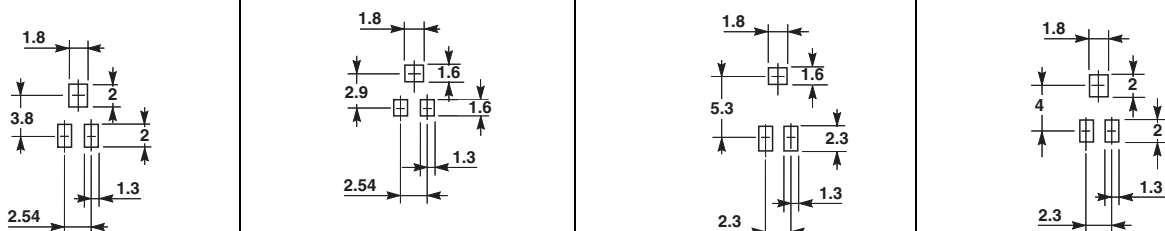


RoHS
COMPLIANT

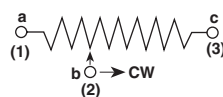
DIMENSIONS in millimeters



RECOMMENDED SOLDERING AREAS



CIRCUIT DIAGRAM



Tolerances unless otherwise specified ± 0.5



ELECTRICAL SPECIFICATIONS		
Resistive Element		Cermet
Electrical Travel		11 turns ± 2
Resistance Range		10 Ω to 1 MΩ
Standard Series		1 - 2 - 5
Tolerance Standard		± 10 %
Power Rating	Linear	0.25 W at + 85 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		200 V
Contact Resistance Variation (Typical)		2 % or 3 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		600 V
Insulation Resistance		10 ⁶ MΩ

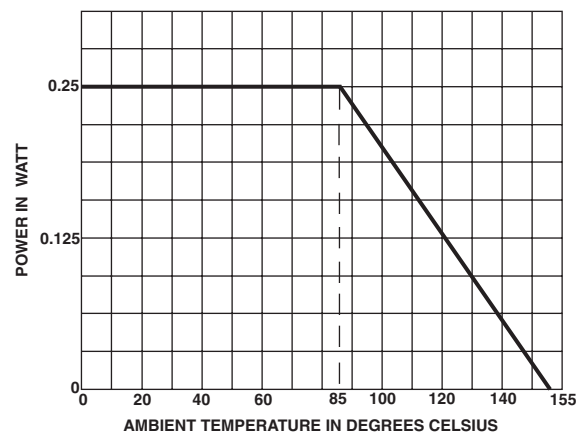
MECHANICAL SPECIFICATIONS

Mechanical Travel	13 turns ± 2
Operating Torque (max. Ncm)	1
End Stop Torque (Ncm)	clutch action (2 turns max)
Unit Weight (max. g)	0.15
Wiper (actual travel)	positioned at approx. 50 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56
Sealing	sealed container solder immersion IP67

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30' - ambient temperature + 85 °C	± 2 % Contact resistance variation: $\Delta > 1 \% R_n$	± 3 %
Moisture Resistance	MIL STD 202 Method 106 10 cycles of 24 hours constituted with damp heat - cold - vibrations	± 2 % Dielectric strength: 1000 V RMS Insulation resistance: $> 10^4 M\Omega$	± 3 %
Long Term Damp Heat	Temperature 40 °C - RH 93 % 56 days	± 2 % Dielectric strength: 1000 V RMS Insulation resistance: $> 10^4 M\Omega$	± 3 %
Thermal Shock	- 55 °C to + 125 °C - 5 cycles	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 2 \%$
Rotational Life (Electrical and Mechanical)	100 cycles - rated power	± 3 %	
Shock	MIL STD 202 Method 213/1 100 g - 6 ms 3 successive shocks in 3 directions	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Vibration	MIL STD 202 Method 204/D 20 g - 12 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 85 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH ELEMENT	
Ω	W	V	mA	ppm/°C
10 20 50	0.25	1.58 2.23 3.53	158 112 77	0 + 200
100 200 500 1K 2K 5K 10K 20K 50K 100K 200K 500K 1M	↓ 0.25 0.08 0.04	5.00 7.07 11.2 15.8 22.3 35.3 50.0 70.7 112 158 200 200 200	50 35 22 15.8 11.2 7.1 5.0 3.5 2.2 1.6 1.0 0.4 0.2	± 100

MARKING

VISHAY trademark, ohmic value, manufacturing date.

The ohmic value is indicated by a 3 figure code, the first two digits are significant figures, the third one is the multiplier.

Example: 100 = 10 Ω
101 = 100 Ω
102 = 1000 Ω
503 = 50 000 Ω

SOLDERING RECOMMENDATIONS

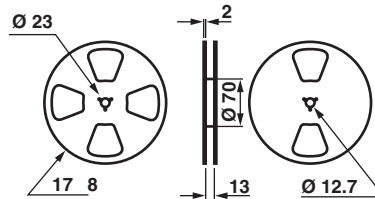
see Application notes

PACKAGING

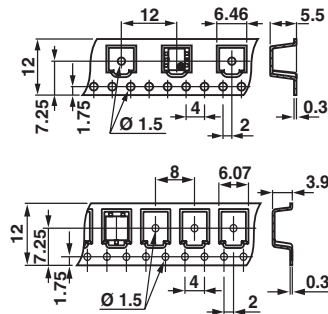
In bulk (plastic box of 50 pieces).

On tape and reel on request, by 500 pieces for Z version, or 250 pieces for Y version.

Version Y



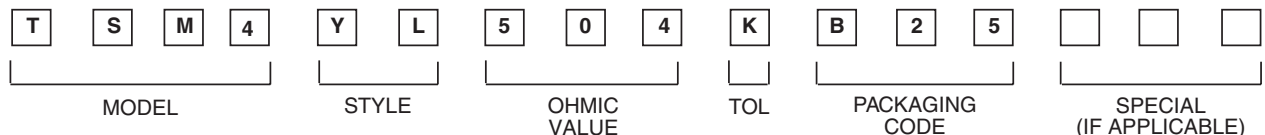
Version Z



ORDERING INFORMATION

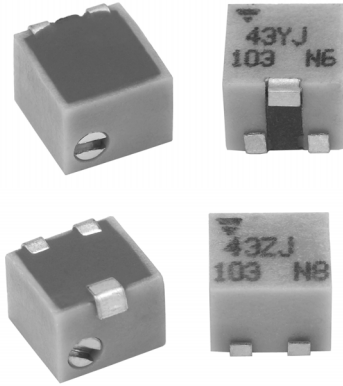
TSM4 SERIES	YL STYLE	500 kΩ OHMIC VALUE	± 10 % TOLERANCE	BO50 PACKAGING	e3 LEAD FINISH
				On request	BO50 Version Z: code TR500 Version Y: code TR250
					e3: pure Sn

SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

Surface Mount Cermet Trimmers Multi-turn Cermet Sealed, Industrial Grade



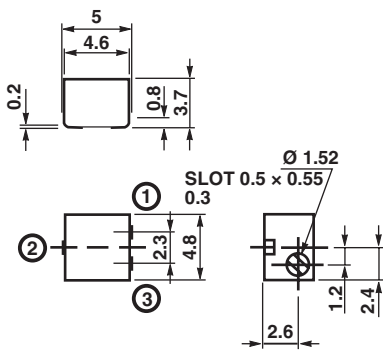
FEATURES

- Sealed to withstand board wash processing
- Pick and place centering design, with flush adjustment
- 4.0 mm design meets EIA SMD standard trimmer footprint
- Low CRV, 1 %
- Top and side adjust styles
- J-hook and gull-wing configurations

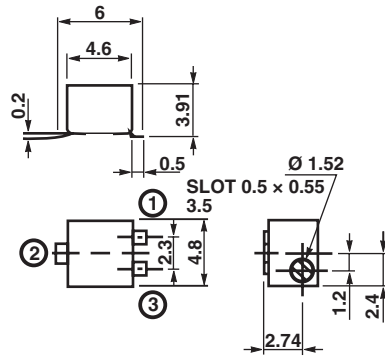


DIMENSIONS in millimeters

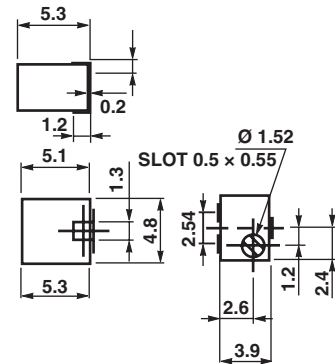
TSM43 ZJ



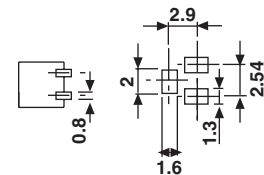
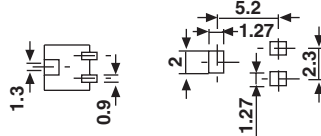
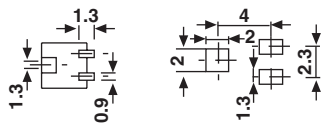
TSM43 ZL



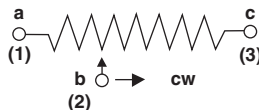
TSM43 YJ



RECOMMENDED SOLDERING AREAS



CIRCUIT DIAGRAM



Tolerances unless otherwise specified ± 0.5



Surface Mount Cermet Trimmers
Multi-turn Cermet Sealed, Industrial Grade

Vishay Sfernice

ELECTRICAL SPECIFICATIONS	
Resistive Element	Cermet
Resistance Range	10 Ω to 2 MΩ
Electrical Travel	11 turns nominal
Tolerance Standard	± 10 %
Power Rating	0.25 W at + 85 °C 0 W at + 150 °C
Limiting Element Voltage (Linear Law)	300 V
Resolution	infinite
Temperature Coefficient	± 100 ppm/°C
Contact Resistance Variation (CRV)	1 % or 3 Ω max
Minimum Resistance (absolute)	1 % or 2 Ω max (whichever is greater)
Sea Level Dielectric Strength (RMS)	600 Vac (1 minute)
Insulation Resistance (500 VDC)	100 MΩ min

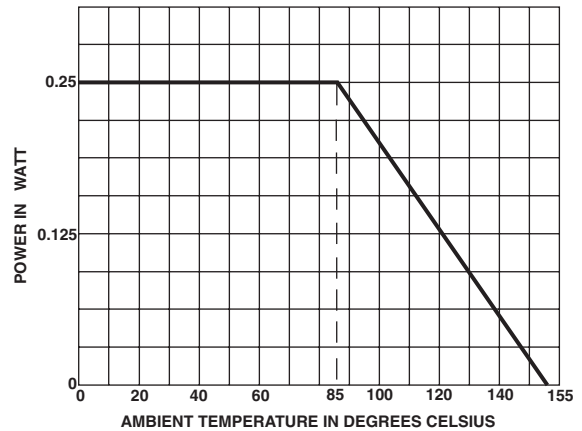
MECHANICAL SPECIFICATIONS

End Stop Torque	clutch action
Operating Torque	180 g.cm max
Unit Weight (approx.)	0.28 g.
Solderability	Per MIL-STD-202 Method 208
Wiper (actual travel)	positioned at approx. 50 %
Flammability	UL-94V-0

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 65 °C + 150 °C
-------------------	------------------

POWER RATING CHART



PERFORMANCE		
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS
Load Life	1000 hours at rated power 90'/30' - ambient temperature + 85 °C	Total resistance shift = ± 3 Ω or ± 3 % whichever is greater
Humidity Moisture Resistance	MIL STD 202 Method 106 10 cycles of 24 hours constituted with damp heat - cold - vibrations	Total resistance shift = ± 2 % insulation resistance: 10 MΩ
Thermal Shock	5 cycles	Total resistance shift = ± 2 % Voltage resistance shift = ± 1 %
Rotational Cycling	100 cycles - rated powers	± 3 %
Shock	MIL STD 202 Method 213/1 100 g - 6 ms 3 successive shocks in 3 directions	Total resistance shift = ± 1 % Voltage resistance shift = ± 1 %
Vibration	MIL STD 202 Method 204/D 20 g - 12 hours	Total resistance shift = ± 1 % Voltage resistance shift = ± 1 %

MARKING

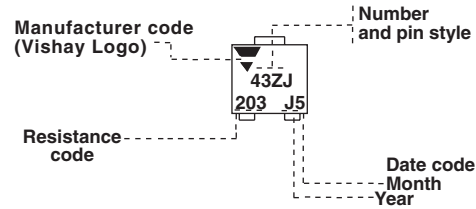
VISHAY SFERNICE trademark, ohmic value, manufacturing date.

The ohmic value is indicated by a 3 digit code, the first two are significant figures, the third one is the multiplier.

Example: 100 = 10 Ω
 101 = 100 Ω
 102 = 1 kΩ
 503 = 50 kΩ

SOLDERING RECOMMENDATIONS

Vapour phase: 215 °C/20 to 40 seconds
 Reflow: 230 °C/20 seconds
 Do not exceed peak 260 °C



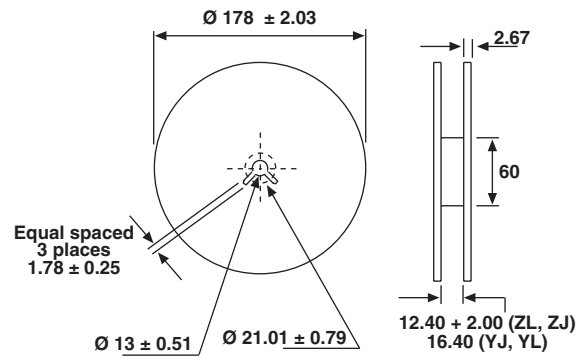
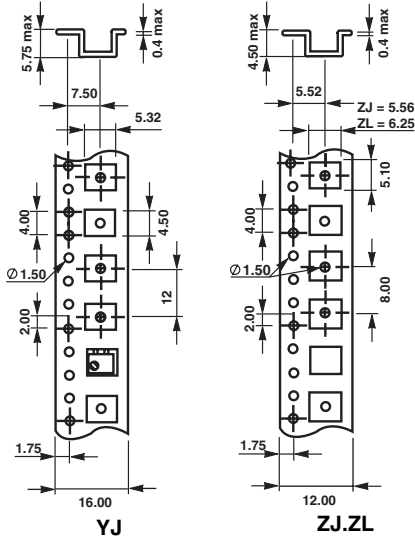
PACKAGING

Standard packaging: Tape and reel

Packaging quantities:

Pin style YJ = 250 pieces, order code TR250

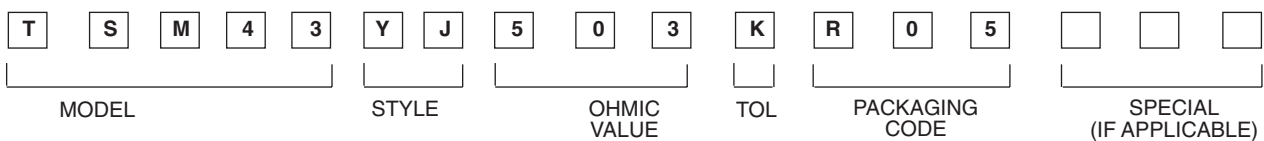
Pin style ZL, ZJ = 500 pieces, order code TR500



ORDERING INFORMATION

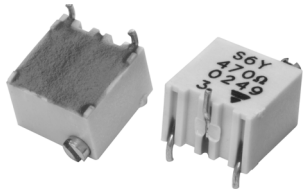
TSM43 SERIES	YJ PIN STYLE	50 kΩ RESISTANCE CODE	TR250 PACKAGING	e3 LEAD FINISH
	YJ ZJ ZL		YJ: code TR250 ZJ, ZL: code TR500	e3: pure Sn

SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

Multi-Turn Surface Mount Miniature 1/4" Square Cermet Trimmers, Fully Sealed



The TS6 multi-turn trimmer has been designed for use in PCB surface mounting applications.

Three variations are available according to the positioning of the control screw and contact positions.

The cermet track gives a high stability performance with an extended ohmic capacity of 10 Ω to 2 MΩ

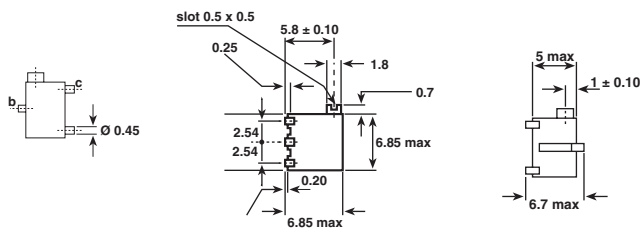
FEATURES

- 0.25 Watt at 85 °C
- GAM T1
- Military and professional grade
- Multi-turn operation
- A low contact resistance variation (down to 2 % Rn)
- Low end contact resistance (1 Ω typical)
- Full sealing
- Tests according to CECC 41 000

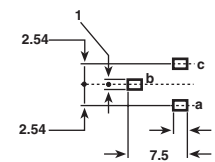


DIMENSIONS in millimeters

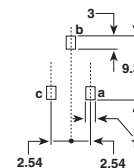
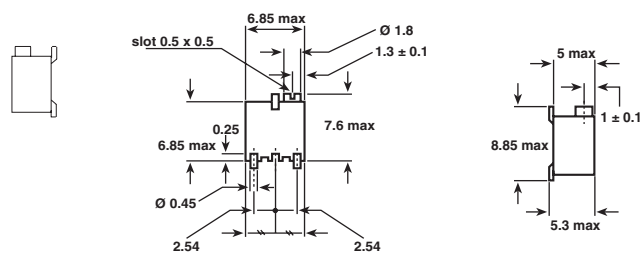
TS6X



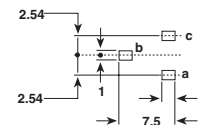
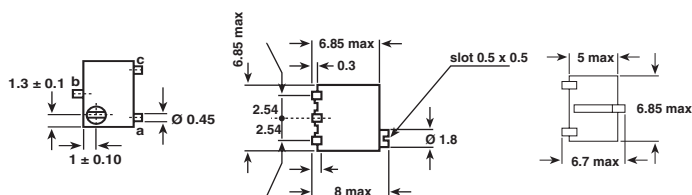
RECOMMENDED SOLDERING AREAS



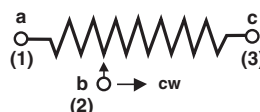
TS6Z



TS6Y



CIRCUIT DIAGRAM



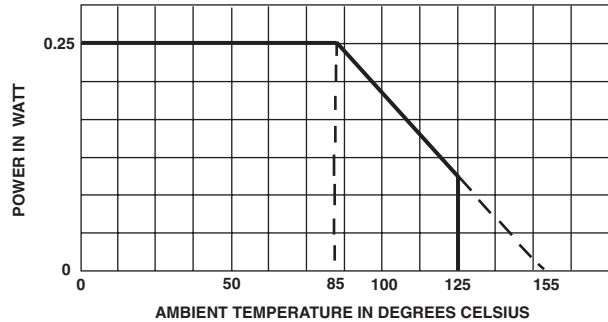
Tolerance unless otherwise specified ± 0.5

ELECTRICAL SPECIFICATIONS		
Resistive Element		Cermet
Electrical Travel		13 turns ± 2
Resistance Range		10 Ω to 2 MΩ
Standard Series E3 and Series		1 - 2.2 - 4.7 and 1 - 2 - 5
Tolerance	Standard	± 10 %
	On request	± 5 %
Power Rating Linear		0.25 W at 85 °C
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 2 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance		10 ⁶ MΩ

MECHANICAL SPECIFICATIONS

Mechanical Travel	15 turns ± 5
Operating Torque (max. Ncm)	1.5
End Stop Torque	clutch action
Unit Weight (max. g)	0.5
Wiper (actual travel)	positioned at approx. 50 %

POWER RATING CHART



ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/125/56
Sealing	fully sealed container solder immersion IP67

PERFORMANCE			
CECC 41100			TYPICAL VALUES AND DRIFTS
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%) REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %	± 3 %
Long Term Damp Heat	56 days 40 °C 93 % RH	± 2 % Dielectric strength: 250 V RMS Insulation resistance: > 100 MΩ	± 3 % Dielectric strength: 1000 V RMS Insulation resistance: > 104 MΩ
Rotational Life (Electrical, Mechanical)	200 cycles at rated power	± 2 % Contact res. variat.: < 3 % Rn	± 2 % Contact res. variat.: < 1 % Rn
Load Life	1000 h at rated power 90'/30' - ambient temp. 85 °C	± 2 % Contact res. variat.: < 3 % Rn	± 4 % Contact res. variat.: < 1 % Rn
Thermal Shock	5 cycles - 55 °C to + 125 °C	± 1.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ ± 1 %
Shock	50 g at 11m secs 3 successive shocks in 3 directions	± 1 %	± 2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g for 6 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ ± 2 %



**Multi-Turn Surface Mount
Miniature 1/4" Square Cermet Trimmers, Fully Sealed**

Vishay Sfernice

STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 85 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	ppm/°C
10	0.25	158	158	0 + 200
22		2.34	107	
47		3.43	73	
100	↓	5	50	± 100
220		7.42	34	
470		10.8	23	
1K		15.8	15.8	
2.2K		23.4	10.7	
4.7K		34.3	7.3	
10K		50	5	
22K		74.2	3.37	
47K		108.4	2.31	
100K		158	1.58	
220K	0.25	234	1.97	
470K	0.13	250	0.53	
1M	0.06	250	0.25	
2M	0.03	250	0.125	

MARKING

Printed: VISHAY trademark, model, style, ohmic value (in Ω, kΩ, MΩ), tolerance (in %) only if non standard, manufacturing date, marking of terminal 3.

SOLDERING RECOMMENDATION

Soldering cycle: 10 s at 220 °C max or with an 40 W iron; 3 s at 350 °C. Soldering is recommended by reflow or vapor phase.

PACKAGING
<p>- X, Y and Z types: on tape and reel (Dia. 330 mm) of 500 pieces: TR</p> <p>- In magazine pack by 50 pieces (Tube) code "TU"</p>

ORDERING INFORMATION					
TS6	Y	470 kΩ	± 10 %	TU50	e3
MODEL	STYLE	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD FINISH
				TU50: Tube On request - TR500: Tape and reel	e3: pure Sn

SAP PART NUMBERING GUIDELINES													
T	S	6	Y	4	7	4	K	T	2	0	□	□	□
MODEL			STYLE	OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables													

Multi-Turn Surface Mount Miniature 1/4" Square Cermet Trimmers, Fully Sealed



The TS63 multiturn trimmer has been designed for use in PCB surface mounting applications.

Three variations are available according to the positioning of the control screw and contact positions.

The cermet track gives a high stability performance with an extended ohmic capacity of 10 Ω to 2 MΩ.

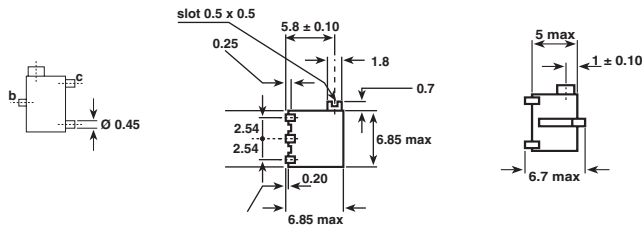
FEATURES

- 0.25 Watt at 85 °C
- Industrial grade
- Multi-turn operation
- A low contact resistance variation (down to 2 % Rn)
- Low end contact resistance (1 Ω typical)
- Full sealing
- Tests according to CECC 41 000

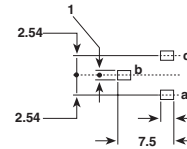


DIMENSIONS in millimeters

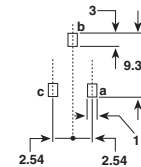
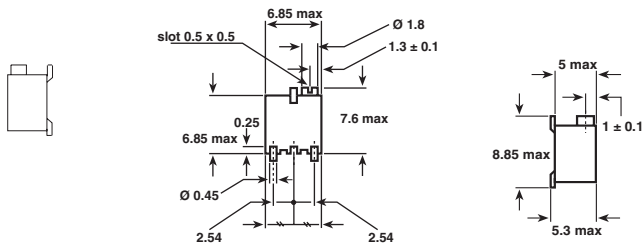
TS63X



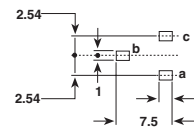
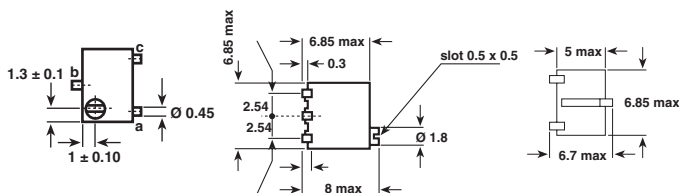
RECOMMENDED SOLDERING AREAS



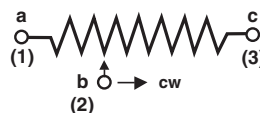
TS63Z



TS63Y



CIRCUIT DIAGRAM



Tolerance unless otherwise specified ± 0.5



Multi-Turn Surface Mount
Miniature 1/4" Square Cermet Trimmers, Fully Sealed

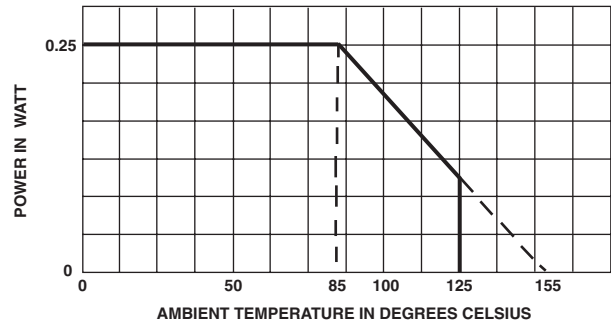
Vishay Sfernice

ELECTRICAL SPECIFICATIONS		
Resistive Element		Cermet
Electrical Travel		13 turns ± 2
Resistance Range		10 Ω to 2 MΩ
Standard Series		1 - 2 - 5
Tolerance	Standard	± 10 %
	On request	± 5 %
Power Rating	Linear	0.25 W at 85 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 2 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance		10 ⁶ MΩ

MECHANICAL SPECIFICATIONS

Mechanical Travel	15 turns ± 5
Operating Torque (max. Ncm)	1.5
End Stop Torque	clutch action
Unit Weight (max. g)	0.5
Wiper (actual travel)	Positioned at approx. 50 %

POWER RATING CHART



ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/125/56
Sealing	sealed container solder immersion IP67

PERFORMANCE						
CECC 41100					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %		± 3 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C 93 % RH	± 2 %		± 3 %	± 0.5 %	± 1 %
Rotational Life (Electrical, Mechanical)	200 cycles at rated power	± 2 %	Contact res. variat.: < 3 % Rn		± 2 %	Contact res. variat.: < 1 % Rn
Load Life	1000 h at rated power 90'/30' - ambient temp. 85 °C	± 2 %	Contact res. variat.: < 3 % Rn	± 4 %	± 1 %	± 2 %
Thermal Shock	5 cycles - 55 °C to + 125 °C	± 1.5 %		$\frac{\Delta V_{1-2}}{V_{1-3}}$ ± 1 %	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ < ± 1 %
Shock	50 g at 11 ms 3 successive shocks in 3 directions	± 1 %		± 2 %	± 0.1 %	± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g for 6 hours	± 1 %		$\frac{\Delta V_{1-2}}{V_{1-3}}$ ± 2 %	± 0.1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ < ± 0.2 %

STANDARD RESISTANCE ELEMENT DATA					
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C	
	MAX. POWER AT 85 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER		
Ω	W	V	mA	ppm/°C	
10	0.25	1.58	158	0 + 200	
20		2.23	112		
50		3.53	77		
100		5.00	50		
200		7.07	35		
500	↓	11.2	22	± 100	
1K		15.8	15.8		
2K		22.3	11.2		
5K		35.3	7.1		
10K		50.0	5.0		
20K		70.7	3.5		
25K		79.0	3.2		
50K		112	2.2		
100K		158	1.6		
200K		0.25	224		1.1
250K		0.25	250		1.1
500K		0.13	250		0.50
1M		0.06	250		0.25
2M		0.03	250		0.125

MARKING

Printed: VISHAY trademark, model, style, ohmic value (in Ω, kΩ, MΩ), tolerance (in %) only if non standard, manufacturing date, marking of terminal 3.

SOLDERING RECOMMENDATION

Soldering cycle: 10 s at 220 °C max or with an 40 W iron: 3 s at 350 °C

Soldering is recommended by reflow or vapour phase.

PACKAGING
- X, Y and Z types: on tape and reel (Dia. 330 mm) of 500 pieces, code TR500.
- On request in magazine pack by 50 pieces (Tube) code TU.

ORDERING INFORMATION					
TS63	Y	500 kΩ	± 10 %	TR500	e3
MODEL	STYLE	OHMIC VALUE	TOLERANCE	PACKAGING	LEAD FINISH
				TR500: Tape and reel On request: TU50: Tube	e3: pure Sn

SAP PART NUMBERING GUIDELINES														
T	S	6	3	Y	5	0	4	K	R	1	0			
MODEL				STYLE	OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables														

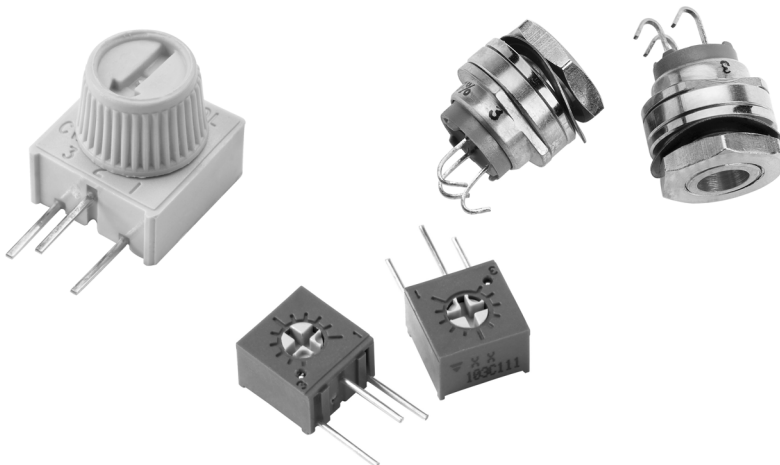


Trimmers Single-Turn Cermet

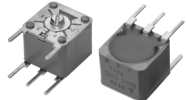
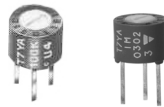
Industrial
•
Professional and Military

Model Numbers

T53Y	36
T7	39
T73	42
63	45
P8P	48
P8S	51
T11	54
T12, T13	56



Trimmers Single - Turn



SERIES	MECHANICAL TRAVEL NUMBER OF TURNS	APPLICATIONS	QUALIFIED STYLES	DIMENSIONS in millimeters
T53	270°	Industrial		5
T7	300°	Industrial		ø 7
T73	290°	Industrial		6.6 x 7.1 x 4.7
P8	300°	P Professional and Military S Industrial	P8PX B (PC39) P8PY A (PC19)	ø 8.5
T11	300°	Industrial		12.5
T12 T13	300°	Professional and Military	T12X (PM06X) T12Y (PM06Y)	12 x 13 x 10 ø 12.7
63	310°	Industrial		9.6 x 9.6 x 4.8

Undergoes European Quality Assurance System (CECC)



SEALINGS	DATA SHEET NO.	PN AT	RESISTANCE RANGE TOL.	CLIMATIC CATEGORY	MAX. TEMP.	P.C. BOARD LAYOUT
full sealed IP67	51014	0.20 W 85 °C	10 Ω to 1 MΩ ± 20 %	55/125/56	155 °C	
IP64	51015	0.5 W 85 °C	10 Ω to 2.2 MΩ ± 20 % - ± 10 %	55/100/56	125 °C	
full sealed IP67	51017	0.5 W 85 °C	10 Ω to 2 MΩ ± 10 % - ± 5 %	55/100/56	125 °C	
full sealed IP67	51020	0.5 W 70 °C	10 Ω to 2.2 MΩ ± 10 % - ± 5 %	P 55/125/56 S 55/100/56	125 °C	
IP64	51021	0.5 W 70 °C	22 Ω to 4.7 MΩ ± 20 % - ± 10 %	55/125/56	125 °C	
full sealed IP67	51022	1 W 70 °C	22 Ω to 10 MΩ ± 20 % - ± 10 %	55/100/56	125 °C	
full sealed IP67	57027	0.5 W 70 °C	10 Ω to 2 MΩ ± 10 %	55/100/56	125 °C	

Miniature Trimmer Single-Turn Cermet



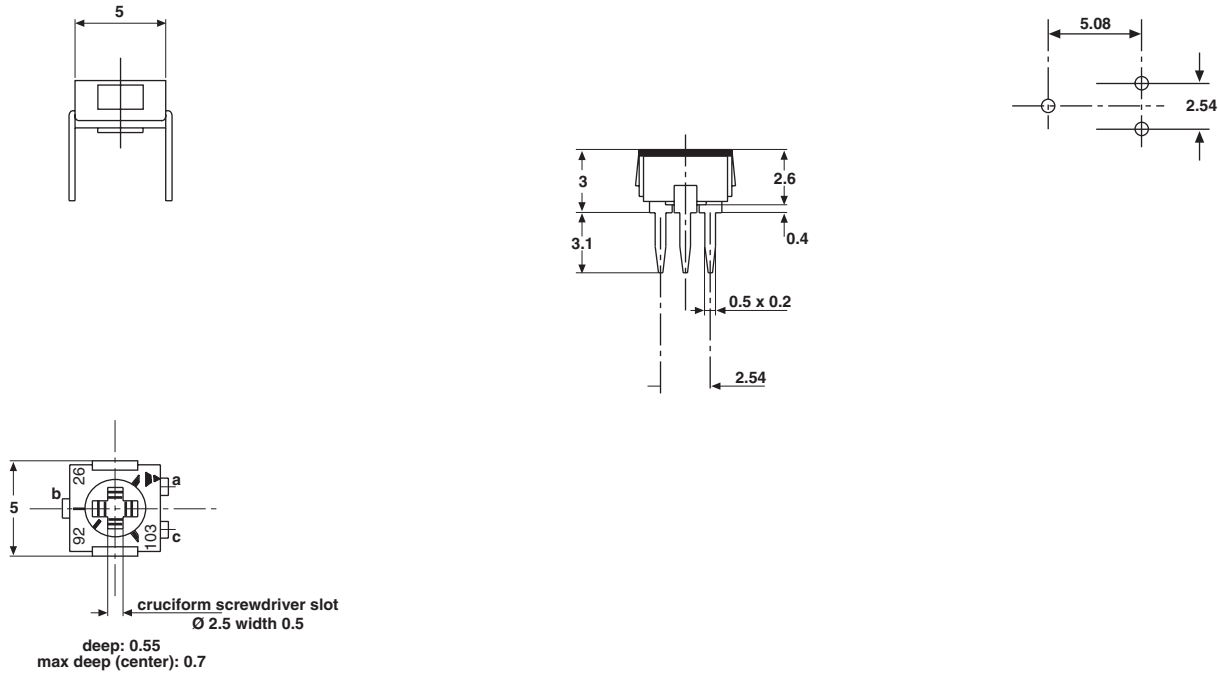
The T53 trimming potentiometer volumetric efficiency (5 x 5 x 2.7 mm) with high performance and stability. The T53 design is suitable for both manual or automatic operation.

FEATURES

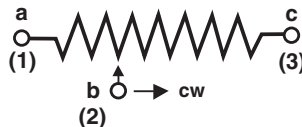
- Fully sealed
- 0.25 Watt at 70 °C
- Wide ohmic range (10 Ω to 1 MΩ)
- Low contact resistance variation (2 % or 3 Ω)
- Small size for optimum packing density
- Suitable for both manual or automatic operation
- For SMD version see TS53Y series



DIMENSIONS in millimeters



CIRCUIT DIAGRAM



Tolerances unless otherwise specified ± 0.25

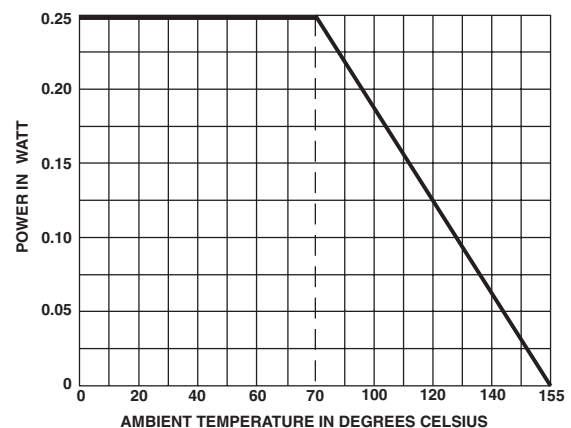
ELECTRICAL SPECIFICATIONS		
Resistive Element		Cermet
Electrical Travel		220° ± 15°
Resistance Range		10 Ω to 1 MΩ
Standard Series		1 - 2 - 5
Tolerance Standard		± 20 %
Power Rating	Linear	0.25 W at 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		200 V
Contact Resistance Variation		2 % or 3 Ω
End Resistance (Typical)		0.1 % or 3 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance		10 ⁶ MΩ
Specification		in accordance with CECC 41100

MECHANICAL SPECIFICATIONS

Mechanical Travel	270° ± 10°
Operating Torque (max. Ncm)	1.5
End Stop Torque (max. Ncm)	3.5
Unit Weight (max. g)	0.15

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/125/56
Sealing	enables cleaning IP67

POWER RATING CHART


PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90'/30' - ambient temperature + 70 °C	± 2 % Contact resistance variation: $\Delta R < 1 \% R_n$	± 3 %
Moisture Resistance	MIL STD 202 Method 106 10 cycles of 24 hours constituted with damp heat - cold - vibrations	± 2 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 3 %
Long Term Damp Heat	Temperature 40 °C - RH 93 % 56 days	± 2 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 3 %
Thermal Shock	- 55 °C to + 125 °C - 5 cycles	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 2 \%$
Rotational Life (Electrical and Mechanical)	100 cycles - rated power	± 3 %	
Shock	MIL STD 202 Method 213/1 100 g - 6 ms 3 successive shocks in 3 directions	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Vibration	MIL STD 202 Method 204/D 20 g - 12 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	ppm/°C
10	0.25	1.58	158	0 + 200
20	↓	2.24	112	
50		3.54	71	
100		5.00	50	
200		7.07	35	
500		11.2	22	
1K		15.8	16	
2K		22.4	11	
5K		35.4	7	
10K		50.0	5	
20K		70.7	3.5	± 100
50K	112	2.2		
100K	0.25	158	1.6	
200K	0.20	200	1.0	
500K	0.08	200	0.4	
1M	0.04	200	0.2	

MARKING

VISHAY trademark, ohmic value, manufacturing date.

The ohmic value is indicated by a 3 figure code, the first two are significant figures, the third one is the multiplier.

Example:
 100 = 10 Ω
 101 = 100 Ω
 102 = 1000 Ω
 503 = 50 000 Ω

The manufacturing date is indicated by four digits, the first two for the year, the last two for the week number.

SOLDERING RECOMMENDATIONS

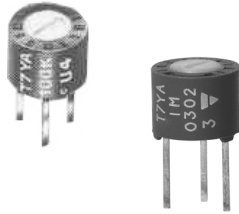
see Application notes

PACKAGING
- In bulk (plastic box of 250 pieces), code BO250

ORDERING INFORMATION					
T53 SERIES	Y STYLE	500 kΩ OHMIC VALUE	± 20 % TOLERANCE	BO250 PACKAGING	e3 LEAD FINISH
					e3: pure Sn

SAP PART NUMBERING GUIDELINES													
T	5	3	Y	5	0	4	M	B	4	1	□	□	□
MODEL			STYLE	OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables													

Miniature Cermet Trimmers



The T7 trimmer is only 7 mm (0.275") in diameter and fits almost anywhere.

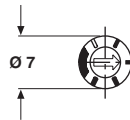
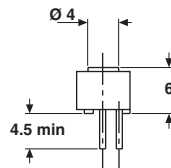
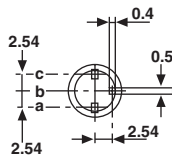
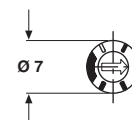
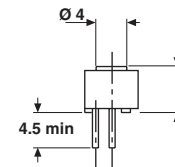
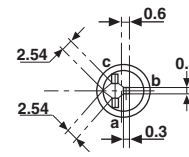
A dust sealed plastic case protecting a quality cermet track guarantees high performance and proven reliability. Adjustments are made easier by the clear scale readings. T7 is ideally suited to all industrial applications.

FEATURES

- Industrial grade
- 0.5 Watt at 85 °C
- Test according to CECC 41100
- Low temperature coefficient (100 ppm/K typical)
- Wide resistance range (10 Ω to 2.2 MΩ)
- Easy to read scale

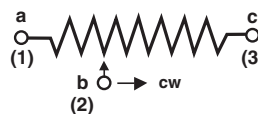


DIMENSIONS in millimeters

T7 YA

T7 YB


Tolerances unless otherwise specified ± 0.5 mm

CIRCUIT DIAGRAM



ELECTRICAL SPECIFICATIONS		
Resistive Element		Cermet
Electrical Travel		270° ± 15°
Resistance Range		10 Ω to 2.2 MΩ
Standard Series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance Standard	Standard	± 20 %
	On Request	± 10 %
Power Rating	Linear	0.5 W at 85 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		3 % or 3 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance		10 ⁶ MΩ

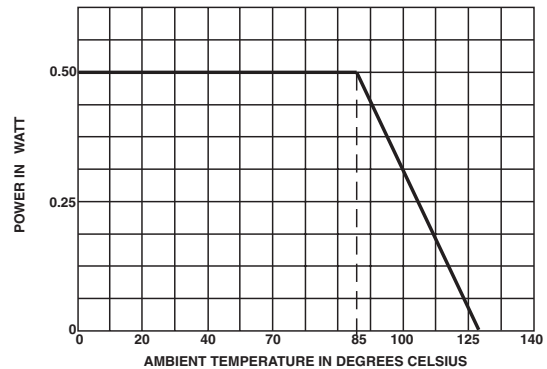
MECHANICAL SPECIFICATIONS

Mechanical Travel	300° ± 5°
Operating Torque (max. Ncm)	2
End Stop Torque (max. Ncm)	4
Unit Weight (max. g)	0.5

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/100/56
Sealing	IP64

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90/30' - ambient temperature 70 °C	± 3 % Contact resistance variation: < 3 % Rn	± 4 %
Climatic Sequence	Phase A dry heat 100 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %	± 3 %
Long Term Damp Heat	56 days	± 2 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 3 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 2 \%$
Shock	50 g 11 ms 3 successive shocks in 3 directions	± 0.5 %	± 1 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Rotational Life	200 cycles	± 3 % Contact resistance variation: < 3 % Rn	



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 85 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	ppm/°C
10	0.5	2.2	224	0 + 200
22	↓	3.3	150	
47		4.8	103	
100		7.0	70	
220		10.5	47	
470		15.3	32	
1K		22.4	22	
2.2K		33.2	15	
4.7K		48.5	10	
10K		70.7	7	
22K		105	4.8	± 100
47K	153	3.2		
100K	0.5	224	2.2	
220K	0.28	250	1.1	
470K	0.13	250	1.53	
1M	0.06	250	0.25	
2.2M	0.028	250	0.11	

MARKING

- Printed:
- VISHAY trademark
 - series
 - YA or YB style
 - ohmic value (in Ω, kΩ, MΩ)
 - manufacturing date
 - marking of terminal: 3.

SEALING

T7 is sealed against dust (IP64).
 For board cleaning, Vishay recommends testing before usage. Water immersion is forbidden. Ultrasonic may cause component damage or failure.

PACKAGING
- In bulk (box of 200 pieces), code BO200
- On request in Tube, code TU50

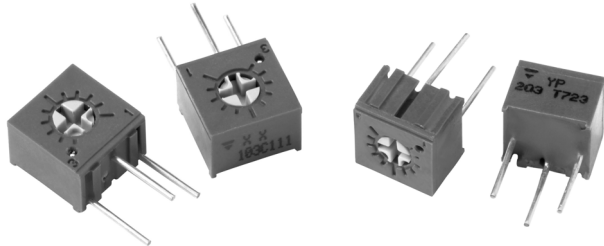
ORDERING INFORMATION					
T7 SERIES	YA STYLE	470 kΩ OHMIC VALUE	± 20 % TOLERANCE	BO200 PACKAGING	e2 LEAD FINISH
	YA - YB			BO200 On request: TU50	e2: SnAg alloy

SAP PART NUMBERING GUIDELINES													
T	7	Y	A	4	7	4	M	B	4	0	□	□	□
MODEL		STYLE		OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables													

1/4" Square Single-Turn Cermet Sealed Trimmers

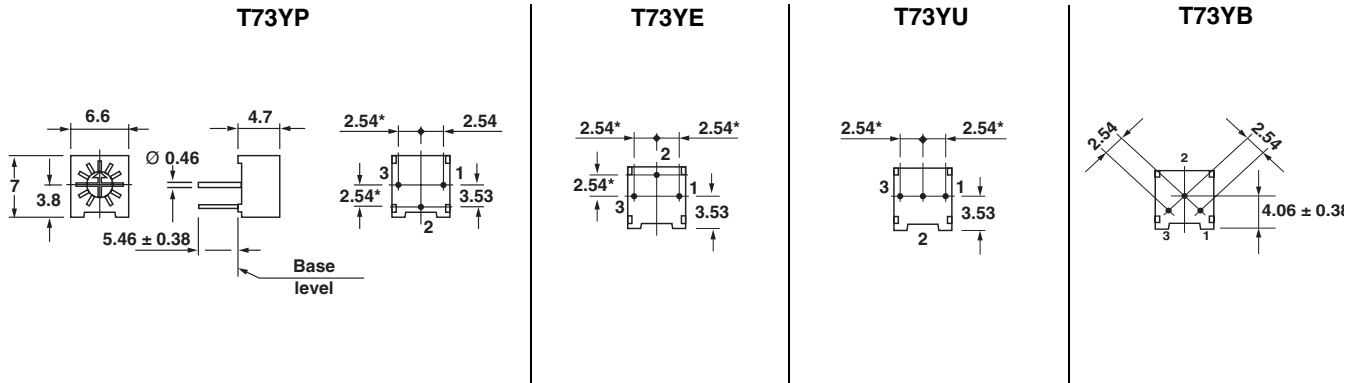
FEATURES

- Industrial grade
- Fully sealed
- Miniature package
- Rotor designed for automatic machine adjust interface
- Withstands harsh environments and immersion cleaning process

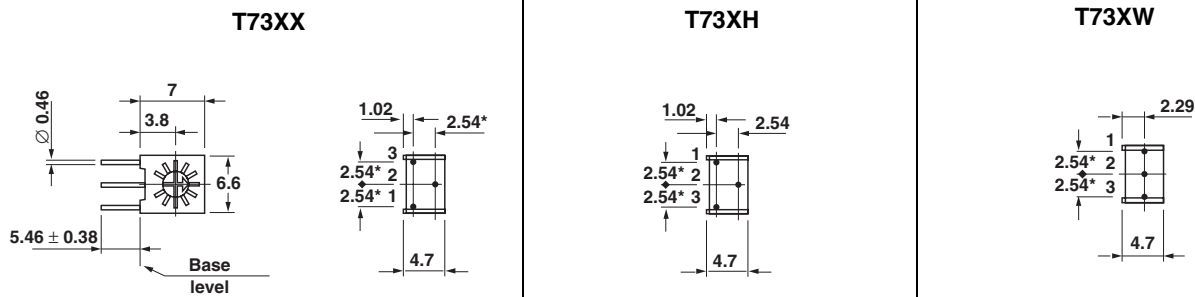


DIMENSIONS in millimeters

T73Y Top adjust



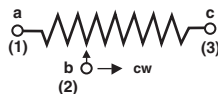
T73X Side adjust



Tolerances unless otherwise specified ± 0.25 mm

Cruciform slot $\varnothing 3$
long 2.77, wide 0.64 - deep 0.89

CIRCUIT DIAGRAM





1/4" Square Single-Turn
Cermet Sealed Trimmers

Vishay Sfernice

ELECTRICAL SPECIFICATIONS	
Resistive Element	Cermet
Electrical Travel	240° nominal
Resistance Range	10 Ω to 2 MΩ
Standard Series	1 - 2 - 5
Tolerance Standard	± 10 %
Power Rating	Linear Logarithmic
	0.5 W at 70 °C not applicable
Temperature Coefficient	± 100 ppm/°C
Limiting Element Voltage	300 V
Contact Resistance Variation	1 % or 3 Ω max. whichever is greater
Absolute Minimum Resistance	1 % or 2 Ω max. whichever is greater
Adjustability	± 0.05 % voltage ± 0.15 % resistance
Resolution	infinite
Insulation Resistance (500 V DC)	10 ³ MΩ minimum
Dielectric Strength	900 Vac sea level 350 Vac 80 000 feet

MECHANICAL SPECIFICATIONS

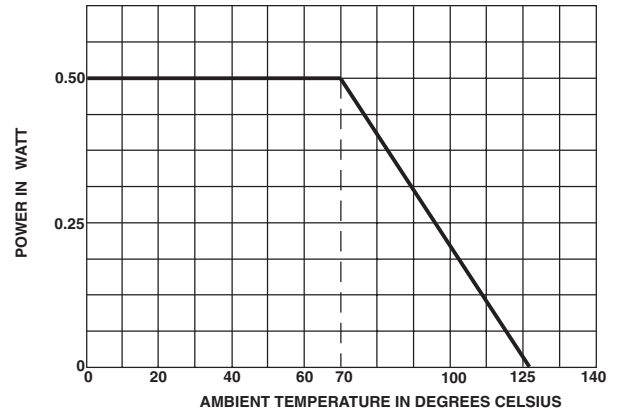
Mechanical Travel	270°
Operating Torque (max. Ncm)	2.1
End Stop Torque (max. Ncm)	4.9
Unit Weight (max. g)	0.6

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/100/56
Seal Test	85 °C Fluorinert**
Flammability	UL 94-VO

**Fluorinert is a registered trademark of 3M Co.

POWER RATING CHART



PERFORMANCE		
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS
Load Life	1000 hours - 0.5 W at + 70 °C	$\frac{\Delta R}{R} \leq 3\%$ CRV < 3 Ω or 3 % whichever is greater
Shock	100 g	$\frac{\Delta R}{R} < \pm 1\%$ $\frac{\Delta V}{V} < \pm 1\%$
Vibration	30 g	$\frac{\Delta R}{R} < \pm 1\%$ $\frac{\Delta V}{V} \leq \pm 1\%$
Humidity	Mil-STD202 method 103 - 96 hours	$\frac{\Delta R}{R} < \pm 2\%$ i.R. 10 MΩ
Rotational Life	200 cycles	$\frac{\Delta R}{R} < \pm 4\%$ CRV < 3 Ω or 3 % whichever is greater



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C ppm/°C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	
10	0.5	2.2	224	± 100
20	↓	3.2	160	
50		5	100	
100		7.1	70	
200		10	50	
500		15.8	32	
1K		22.4	22	
2K		31.6	16	
5K		50	10	
10K		70.7	7.1	
20K		100	5	
50K	158.1	3.2		
100K	0.50	223.6	2.2	
200K	0.45	300	1.5	
500K	0.18	300	0.60	
1M	0.09	300	0.30	
2M	0.05	300	0.15	

MARKING

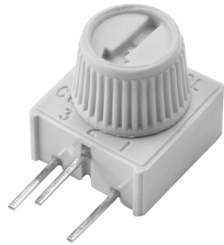
Printed: VISHAY trademark, resistance code, terminal numbers, date code, manufacturer's model number and style.

PACKAGING
- In tube by 50 pieces, code TU50
- Tape and reel for model YU, code TR750 and XW, code TR100

ORDERING INFORMATION					
T73 SERIES	YP STYLE	500 kΩ OHMIC VALUE	± 10 % TOLERANCE	TU50 PACKAGING	e3 LEAD FINISH
	XX XH XW	YP YE YU YM YB		TU50 On request: TR750 TR1000	e3: pure Sn

SAP PART NUMBERING GUIDELINES														
T	7	3	Y	P	5	0	4	K	T	2	0			
MODEL			STYLE		OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables														

3/8" Square (10 mm) Single-Turn Cermet Trimmer



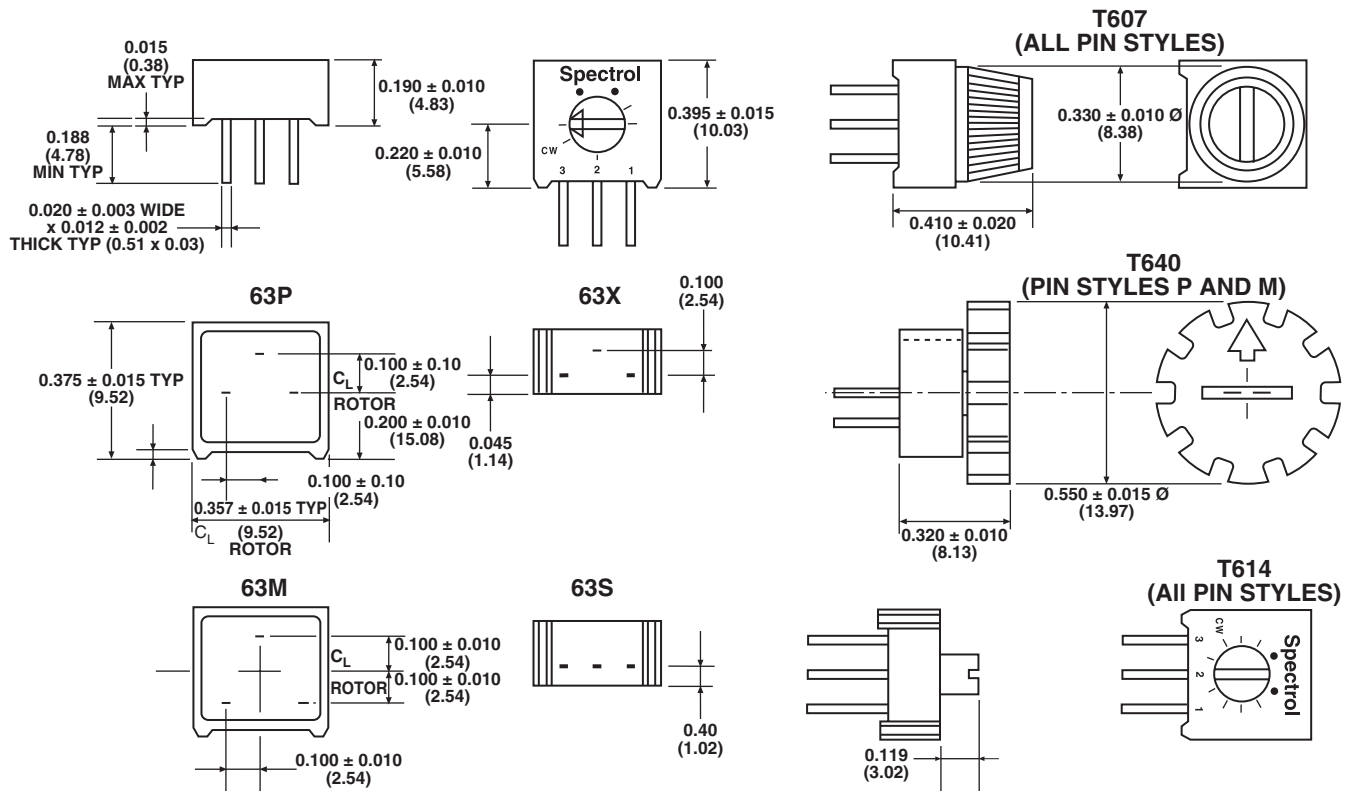
The Model 63 cermet trimmer manufactured in Europe is readily available in several pin configurations for top or side adjustment and with a choice of Knob styles for finger setting. Quick adjustment is achieved with multi finger wiper and the standard resistance range is between 10 Ω and 2 MΩ with a tolerance of ± 10 %. This sealed (IEC 68-2-17) single turn trimmer is continuing to provide excellent performance as the industry standard across a broad spectrum of applications.

FEATURES

- Arrow and graduations for repeatable settings
- "O" ring seal for solvent and aqueous washing
- I.C. style pins for easy PCB assembly
- Rigid board mounting achieved with pins secured in housing
- Solder plated terminals for good solderability
- High temperature soldered terminations for high reliability
- Multi-finger wiper for better contact resistance
- Solid end stop
- Flame retardant housing to U_L rated VO

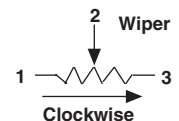


DIMENSIONS in inches (millimeters)



Tolerances unless otherwise specified ± 0.015 (0.38)

CIRCUIT DIAGRAM





ELECTRICAL SPECIFICATIONS	
Effective Travel	270° nominal
Resistance Range	10 Ω to 2 MΩ
Resistance Tolerance	± 10 %
End Resistance	2 Ω or 1 %, whichever is greater
Temperature Coefficient of Resistance	100 ppm/°C. 100 Ω thru to 2 MΩ 0 to + 250 ppm/°C below 100 Ω
Power Rating	0.5 watts at 70 °C derated linearly to zero watts at 125 °C Maximum voltage not to exceed 300 V
Dielectric Withstanding Voltage	1000 V _{AC} at sea level; 250 V _{AC} at 80 000 ft (24 000 meters)
Insulation Resistance (500 V _{DC})	1000 MΩ minimum
Contact Resistance Variation	1 % or 1 Ω, whichever is greater

MECHANICAL SPECIFICATIONS	
Stop Strength	Solid
Starting Torque	35 mNm maximum
Weight	0.03 oz (0.85 grams) maximum
Resistance Element	Cermet
2 Terminal Adjustability	± 0.15 % of RT
3 Terminal Adjustability	± 0.05 % of applied voltage

ENVIRONMENTAL SPECIFICATIONS						
		MAX (R)	CHANGE PER CECC		PER IEC 68.1 PART 1202F	PER MIL
			$\frac{V_{AB}}{V_{AC}}$	41 100		
Temperature Range	- 55 °C to + 125 °C	2 %	1 %	(PARA 2.3.6)	TEST NA (IEC 68 - 2 - 14)	METHOD 107
Bumps	390 m/s ² , 4000	1 %	-	(PARA 2.3.3)	TEST EB (IEC 68 - 2 - 29)	NO EQUIV
Vibration	98 m/s ² , 10 to 500 Hz	1 %	2 %	(PARA 2.3.2)	TEST FC (IEC 68 - 2 - 6)	METHOD 204
Electrical Endurance	1000 Hour	3 %	-	(PARA 2.5.16)	-	NO EQUIV
Soldering	-	-	-	(PARA 2.3.7)	TEST TB (IEC 68 - 2 - 20)	METHOD 208
Resistance to Heat	-	1 %	-	(PARA 2.3.7)	TEST TB (IEC 68 - 2 - 20A)	METHOD 210 METHOD 1A
Damp Heat Steady State	21 Days	3 %	-	(PARA 2.1)	TEST C (IEC 68 - 2 - 3)	METHOD 103
Sealing	85 °C for 1 minimum	-	-	AS IEC	TEST QC (IEC 68 - 2 - 17)	METHOD 112
Mechanical Life	200 Cycles	3 %	-	-	METHOD 2	-
Terminal Strength	2.2 lbs (1 kg)	min	-	-	-	-



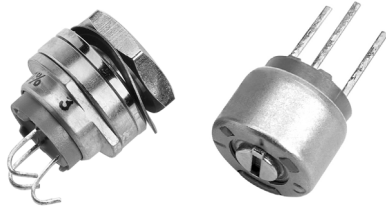
MARKING

Unit Identification: Manufacturer's name and model number, resistance value, tolerance, date code and terminal identification

ORDERING INFORMATION				
63	P	T607	201	e3
MODEL	PIN STYLE	SPECIAL (OMIT IF STANDARD)	EIA RESISTANCE VALUE	LEAD FINISH
	P, M, X, S	T607 - Knob adjust (see drawing) T640 - Knob adjust (see drawing) T614 - Extended rotor (see drawing)		e3: pure Sn

SAP PART NUMBERING GUIDELINES														
M	6	3	P	2	0	1	K	B	4	0	T	6	0	7
MODEL			STYLE	OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)			
See the end of this data book for conversion tables														

Fully Sealed Container Cermet Trimmers



Models P8PX and P8PY feature a TO-5 transistor type, rugged metal case housing.

The cermet track is printed to an alumina substrate allowing high dissipation and ensuring reliable performance under extreme environmental conditions.

Models P8PX and P8PY are qualified PC 39 and PC 19 respectively according to CECC 41 101-002 mod. A and B.

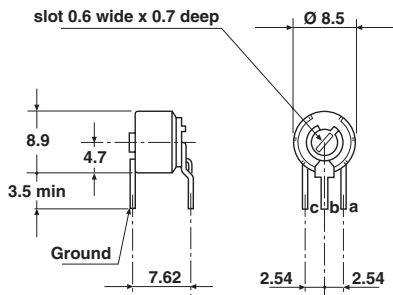
FEATURES

- Military and professional grade
- 1 Watt at 70 °C, P8PT
- 0.5 Watt at 70 °C, P8PX - P8PY
- CECC 41 101-002 (A, B)
- GAM T1
- Fully sealed
- P8P series are available in three mounting configurations:
 - P8PX, side adjust with pins } Outlets PCB mounting
 - P8PY, top adjust with pins }
 - P8PT, panel mount with solder lugs
- Multi-finger wiper contact in precious metal

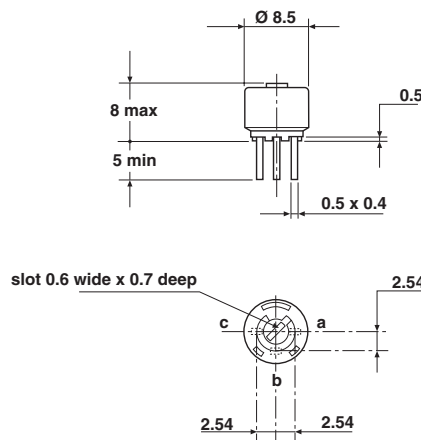


DIMENSIONS in millimeters

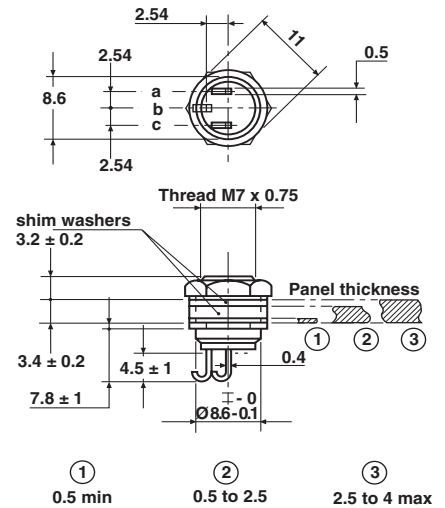
P8PX - (PC 39) B



P8PY - (PC 19) A



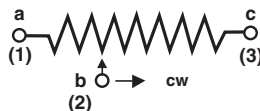
P8PT



• Tolerance unless otherwise specified: ± 0.5

Consult Vishay SFERNICE for panel sealed type

CIRCUIT DIAGRAM



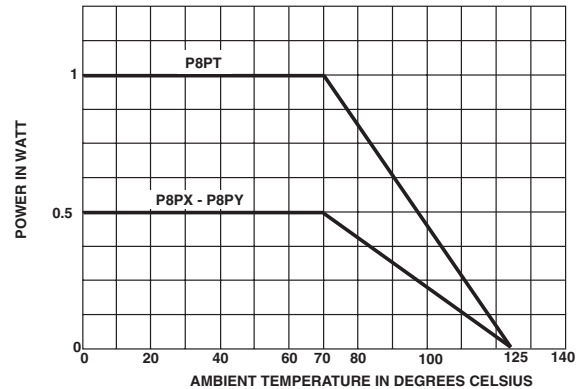
ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		270° ± 15°
Resistance Range		10 Ω to 2.2 MΩ
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	P8PX - P8PY	0.5 W at 70 °C
	P8PT	1 W at 70 °C
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 1 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

MECHANICAL SPECIFICATIONS

Mechanical Travel	300° ± 5°
Operating Torque (max. Ncm)	3
End Stop Torque (max. Ncm)	6
Unit Weight (max. g)	1... 3.1

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56
Sealing	fully sealed container IP67

POWER RATING CHART


PERFORMANCE						
CECC 41100					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %		± 3 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C, 93 % RH	± 2 %		± 3 %	± 0.5 %	± 1 %
Rotational Life	200 cycles	± 2 %	Contact res. variat.: < 5 % Rn		± 1 %	Contact res. variat.: < 2 % Rn
Load Life	1000 h at rated power 90°/30° - ambient temp. 70 °C	± 2 %	Contact res. variat.: < 5 % Rn	± 3 %	± 1 %	± 2 %
Rapid Temperature Change	5 cycles - 55 °C to + 125 °C	± 1.5 %		$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$	± 0.2 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.5 \%$
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 1 %		± 2 %	± 0.1 %	± 0.5 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 1 %		$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 2 \%$	± 0.2 %	$\frac{\Delta V_{1-2}}{V_6} \leq \pm 0.5 \%$



STANDARD RESISTANCE ELEMENT DATA									
STANDARD RESISTANCE VALUES	P8PX - P8PY			P8PT			TCR - 55 °C + 125 °C		
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER			
Ω	W	V	mA	W	V	mA	ppm/°C		
10	0.5	2.2	224	1	3.16	316	0 + 200		
22		3.3	150		4.69	213			
47		4.8	103		6.86	146			
100	↓	7	70	↓	10.0	100	± 100		
220		10.5	47		14.8	67			
470		15.3	32		21.7	46			
1K		22.4	22		31.6	32			
2.2K		33.2	15		46.9	21			
4.7K		48.5	10		68.6	15			
10K		7.7	7		100.0	10.0			
22K		105	4.8		148	6.7			
47K		153	3.2		217	4.6			
100K		0.5	224		2.2	0.63		250	2.5
220K		0.28	250		1.1	0.28		250	1.1
470K		0.13	250		1.53	0.13		250	0.5
1M		0.06	250		0.25	0.06		250	0.3
2.2M		0.028	250		0.11	0.03		250	0.1

MARKING

- Printed :
- VISHAY trademark
 - NF type if applicable
 - series
 - style
 - ohmic value (in Ω , kΩ, MΩ)
 - tolerance (in %)
 - manufacturing date
 - marking of terminal: 3

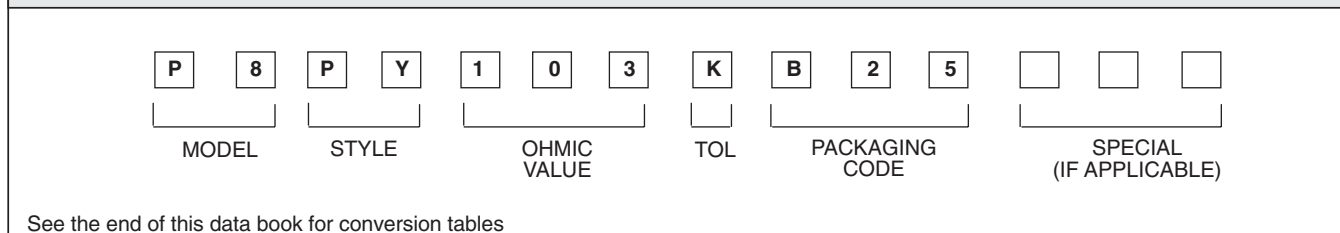
PACKAGING

- Plastic box of 50 pieces for P8PX and P8PY
- Plastic box of 24 pieces for P8PT

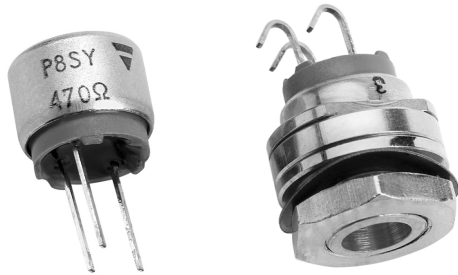
ORDERING INFORMATION

P8 MODEL	PY STYLE	10 kΩ OHMIC VALUE	± 10 % TOLERANCE	BL50 PACKAGING	e2 LEAD FINISH
				P8PX and P8PY: BL50 P8PT: BL24	e2: SnAg alloy

SAP PART NUMBERING GUIDELINES



Fully Sealed Container Cermet Trimmers



FEATURES

- Industrial grade
- High quality cermet resistive track:
- 1 Watt at 70 °C, P8ST
- 0.5 Watt at 70 °C, P8SX - P8SY
- CECC 41100
- Wide resistance range (10 Ω to 2.2 MΩ)



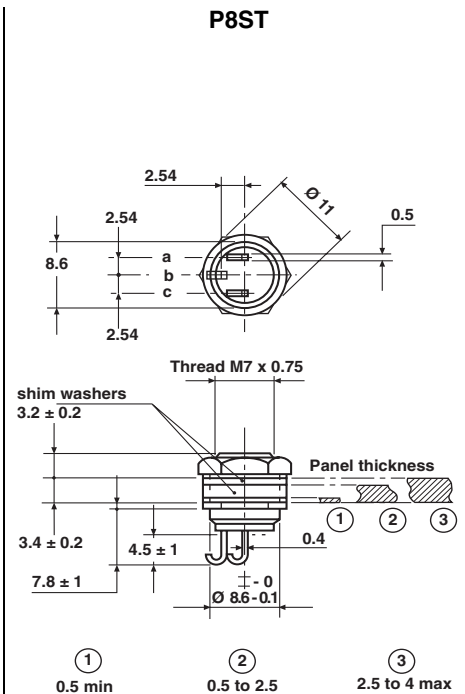
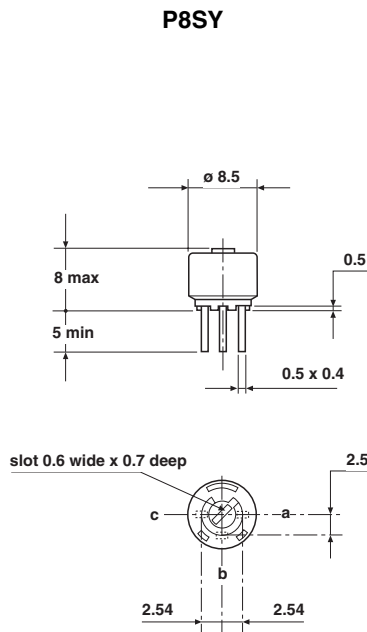
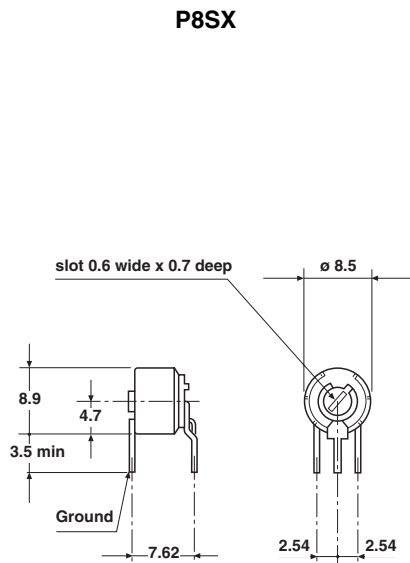
Three versions are available:

- P8SX, with shaft parallel to the PC board plane
 - P8SY, with shaft perpendicular to the PC board plane
 - P8ST, for front panel mounting
- } Outlets PCB mounting

The P8S series trimmers are extremely well adapted for all industrial applications as their maximum resistance contact variation is within 3 % of R_n and as they are fully sealed.

For more stringent requirements the P8P series is recommended.

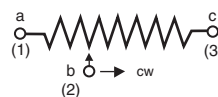
DIMENSIONS in millimeters



• Tolerance unless otherwise specified: ± 0.5

Consult Vishay Sfernice for panel sealed type

CIRCUIT DIAGRAM





ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		270° ± 15°
Resistance Range		10 Ω to 2.2 MΩ
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	P8SX - P8SY	0.5 W at 70 °C
	P8ST	1 W at 70 °C
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		3 % Rn or 3 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

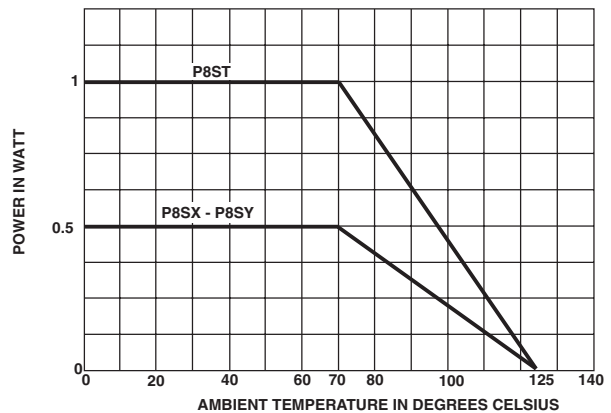
MECHANICAL SPECIFICATIONS

Mechanical Travel	300° ± 5°
Operating Torque (max. Ncm)	3
End Stop Torque (max. Ncm)	6
Unit Weight (max. g)	1... 3.1

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56
Sealing	fully sealed container IP67

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90'/30' - ambient temperature 70 °C	± 2 % Contact res. variation: < 3 % Rn	± 3 %
Climatic Sequence	Phase A dry heat 100 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C, 93 % RH	± 1 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 2 %
Rapid Temperature Change	5 cycles - 55 °C to + 125 °C	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 0.2 %	± 0.5 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.2 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.5 \%$
Rotational Life	200 cycles	± 3 % Contact res. variat.: < 3 % Rn	

STANDARD RESISTANCE ELEMENT DATA							
STANDARD RESISTANCE VALUES	P8SX - P8SY			P8ST			TCR - 55 °C +125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	W	V	mA	W	V	mA	ppm/°C
10	0.5	2.2	224	1	3.16	316	0 + 200
22	↓	3.3	150	↓	4.69	213	
47		4.8	103		6.86	146	
100		7	70		10.0	100	± 100
220	10.5	47	14.8	67			
470	15.3	32	21.7	46			
1K	22.4	22	31.6	32			
2.2K	33.2	15	46.9	21			
4.7K	48.5	10	68.6	15			
10K	70.7	7	100.0	10.0			
22K	105	4.8	148	6.7			
47K	153	3.2	217	4.6			
100K	0.5	224	2.2	0.63	250	2.5	
220K	0.28	250	1.1	0.28	250	1.1	
470K	0.13	250	1.53	0.13	250	0.5	
1M	0.06	250	0.25	0.06	250	0.3	
2.2M	0.028	250	0.11	0.03	250	0.1	

MARKING

- Printed:
- VISHAY trademark
 - series and grade of quality
 - style
 - ohmic value (in Ω , kΩ , MΩ)
 - tolerance (in %)
 - manufacturing date
 - marking of terminal: 3

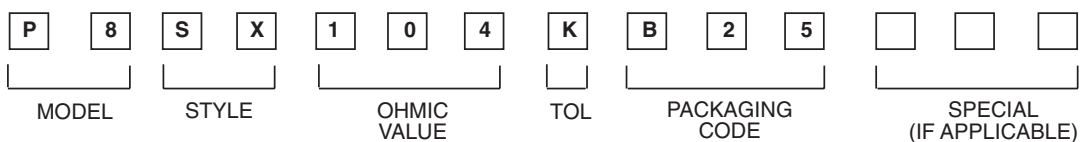
PACKAGING

- Plastic box of 50 pieces for P8SX and P8SY
- Plastic box of 24 pieces for P8ST

ORDERING INFORMATION

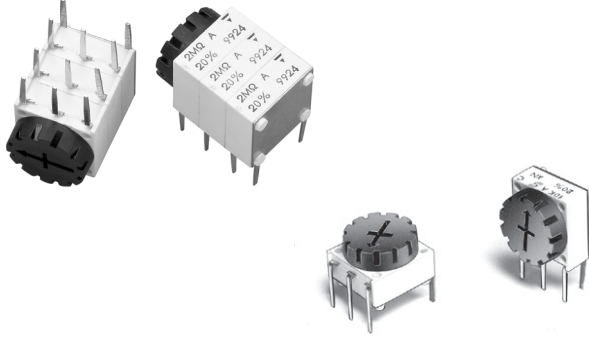
P8 MODEL	SX STYLE	100 kΩ OHMIC VALUE	± 10 % TOLERANCE	BL50 PACKAGING	e2 LEAD FINISH
				P8SX and P8SY: BL50 P8ST: BL24	e2: SnAg alloy

SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

Square Modular Cermet Trimmers



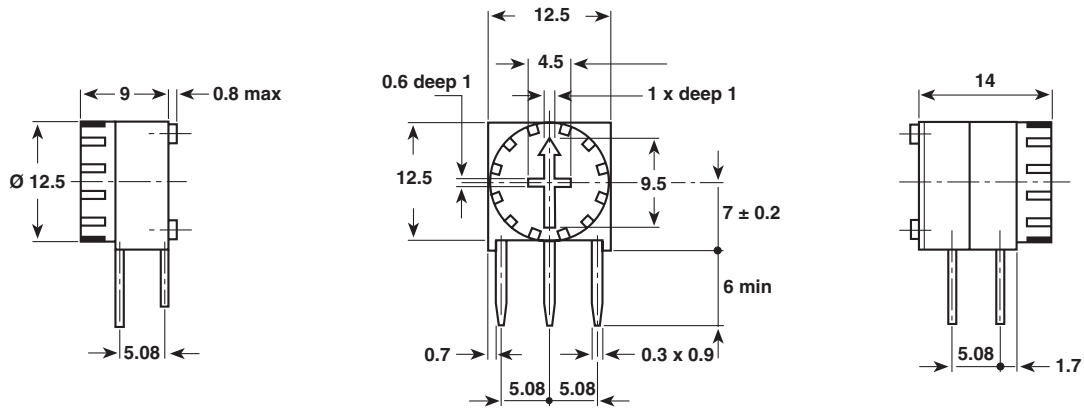
FEATURES

- 0.5 W at 70 °C
- Industrial grade
- Up to 5 modules
- Switches and detents available
- Available in conductive plastic
- High rotational life up to 2000 cycles
- X and Y styles

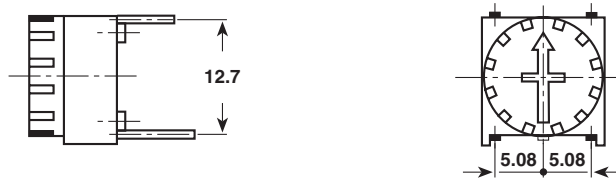


DIMENSIONS in millimeters

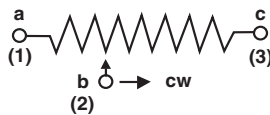
T11X



T11Y



CIRCUIT DIAGRAM



Tolerances unless otherwise specified ± 0.5 mm



ELECTRICAL SPECIFICATIONS		
Resistive Element	cermet	
Electrical Travel	270° ± 10°	
Resistance Range	22 Ω to 4.7 MΩ	
Standard series E3	1 - 2.2 - 4.7 and on request 1 - 2 - 5	
Tolerance	Standard	± 20 %
	On Request	± 5 % or ± 10 %
Power Rating	Linear	at 70 °C: 0.5 W
	Logarithmic Laws, L, F, or S and ganged elements	at 70 °C: 0.25 W
Temperature Coefficient (for R _n ≥ 100 Ω)	± 100 ppm/°C	
Limiting Element Voltage	350 V	
Contact Resistance Variation	2 % R _n or 3 Ω (linear law)	
End Resistance (Typical)	2 Ω	
Independant Linearity (Typical)	± 3 % (linear law)	
Middle Keying Point (C V1M Typical)	± 3 %	
Insulation Resistance	10 ⁶ MΩ (500 VDC)	
Dielectric Strength (RMS)	1500 V _{RMS}	

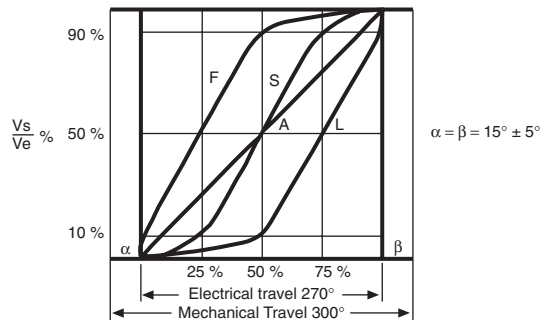
MECHANICAL SPECIFICATIONS

Mechanical Travel 300° ± 5°
 End Stop Torque (max. Ncm) 35
 Mechanical Life 2000 cycles

ENVIRONMENTAL SPECIFICATIONS

Temperature Range - 55 °C to + 125 °C
 Climatic Category 55/125/56
 Sealing enables cleaning IP64

POWER RATING CHART



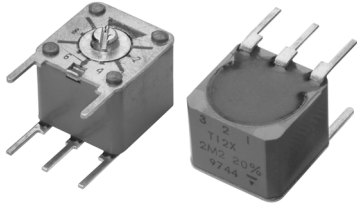
Further information see P11/PA11 Document number 51031

PACKAGING
- Carton box of 45 pieces, code BO45 for Y style (SAP code B24) and carton box of 80 pieces, code BO80 for X style (SAP code B28)

ORDERING INFORMATION						
T11	X	470 kΩ	± 20 %	A	BO80	e3
SERIES	STYLE	OHMIC VALUE	TOLERANCE	LAW	PACKAGING	LEAD FINISH
	Y				Y Style: BO45	
	X				X Style: BO80	e3: pure Sn

SAP PART NUMBERING GUIDELINES														
T	1	1	X	4	7	4	M	A	B	2	8			
MODEL		STYLE	OHMIC VALUE			TOL	LAW	PACKAGING CODE		SPECIAL (IF APPLICABLE)				
See the end of this data book for conversion tables														

Fully Sealed Container Square or Round Cermet Trimmers



The Vishay SFERNICE trimming potentiometers T12 and T13 fully meet the requirements of CECC 41 100.

The use of a cermet track combined with sealing of the case provides unique characteristics and performances.

T12 and T13 have been specially designed for mounting on printed circuit board.

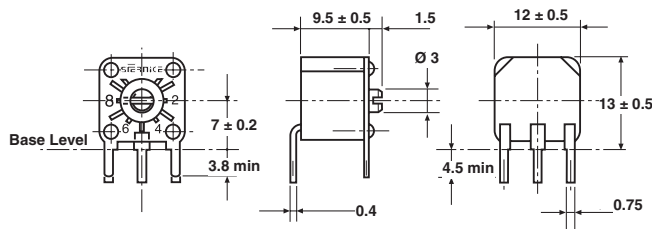
FEATURES

- Military and Professional Grade
- High power rating (1 Watt at 70 °C)
- CECC 41100
- High stability (1 % typical)
- Mechanical strength
- Hermetic sealing of the case
- Different mounting types

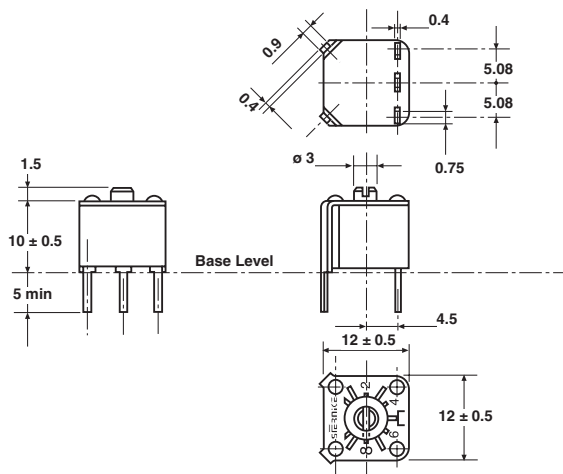


DIMENSIONS in millimeters

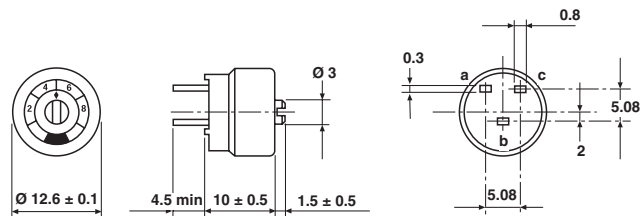
T12X - PM06X



T12Y - PM06Y

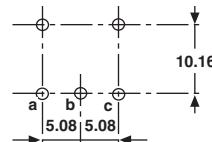


T13Y

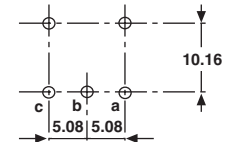


TERMINAL SPACING ON THE PCB Drilling diameter: 1.2 mm

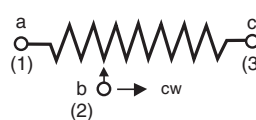
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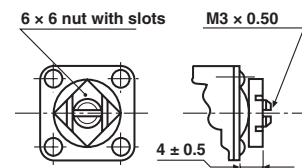
T12Y



CIRCUIT DIAGRAM



LOCKING DEVICE: T12 XB - YB



Tolerances unless otherwise specified ± 0.5



ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		270° ± 10°
Resistance Range		22 Ω to 10 MΩ
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	± 20 %
	On Request	± 10 %
Power Rating	Linear	1 W at 70 °C
	Logarithmic	0.5 W at 70 °C
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		350 V
Contact Resistance Variation		3 % Rn or 3 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500VDC)		10 ⁶ MΩ

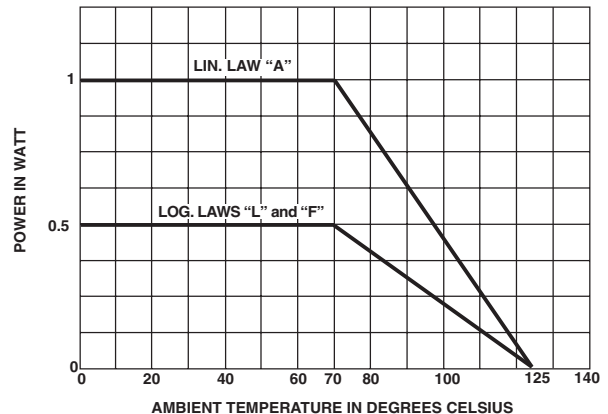
MECHANICAL SPECIFICATIONS

Mechanical Travel 300° ± 5°
 Operating Torque (max. Ncm) 3
 End Stop Torque (max. Ncm) 15
 Unit Weight (max. g) 4.7

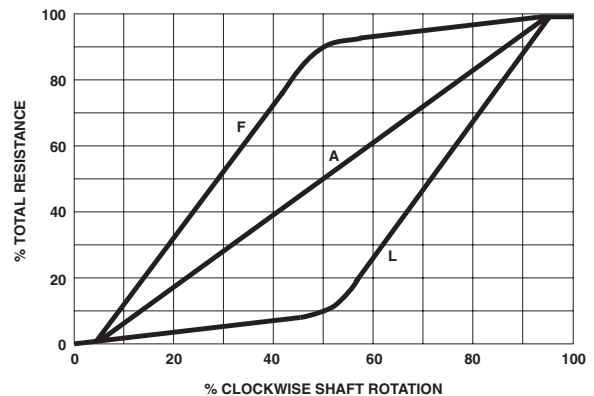
ENVIRONMENTAL SPECIFICATIONS

Temperature Range - 55 °C to + 125 °C
 Climatic Category 55/100/56
 Sealing fully sealed container IP67

POWER RATING CHART



RESISTANCE LAWS





PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30° - ambient temperature 70 °C	± 1 % Contact res. variation: < 2 % Rn	± 2 %
Climatic Sequence	Phase A dry heat 100 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C 93 % RH	± 0.5 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 1 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 0.5 %	$\frac{\Delta V_{1-2}}{\Delta V_{1-3}}$ ≤ ± 1 %
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 0.1 %	± 0.5 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.1 %	$\frac{\Delta V_{1-2}}{\Delta V_{1-3}}$ ≤ ± 0.5 %
Rotational Life	200 cycles	± 1 % Contact res. variation: < 2 % Rn	

STANDARD RESISTANCE ELEMENT DATA							
STANDARD RESISTANCE VALUES	LINEAR LAW			LOG LAWS			TCR - 55 °C + 125 °C ppm/°C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	W	V	mA	
22	1	4.69	213.2				0
47	↓	6.85	145.8				+ 200
100	↓	10	100				± 100
220	↓	14.8	67.4				
470	↓	21.6	46.1				
1K	↓	31.6	31.6	0.5	22.4	22.4	
2.2K	↓	46.9	21.3	↓	33.2	15.1	
4.7K	↓	68.5	14.5	↓	48.5	10.3	
10K	↓	100	10	↓	79.7	7.07	
22K	↓	148.3	6.7	↓	105	4.77	
47K	↓	216.7	4.6	↓	153	3.26	
100K	1	316.2	3.16	↓	224	2.24	
220K	0.56	350	1.59	0.5	332	1.51	
470K	0.26	350	0.75	0.26	350	0.74	
1M	0.12	350	0.35	0.12	350	0.35	
2.2M	0.05	350	0.16				
4.7M	0.02	350	0.07				
10M	0.01	350	0.03				

MARKING

Printed:

- VISHAY trademark
- series
- ohmic value (in Ω, kΩ, MΩ)
- tolerance (in %)
- manufacturing date
- marking of terminal: (1, 2, 3)



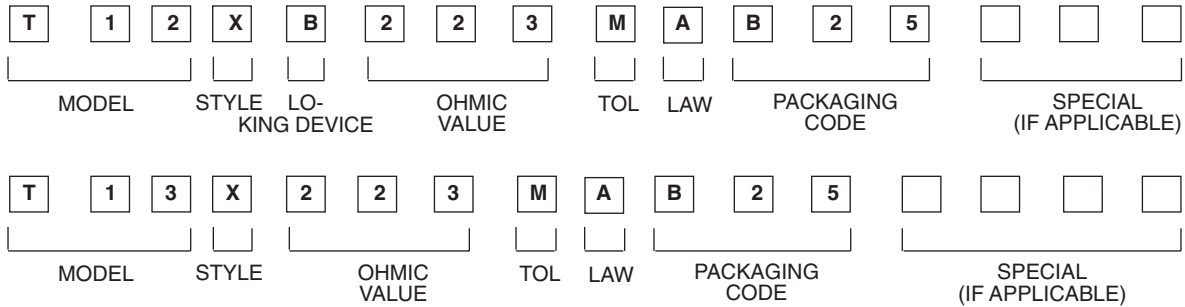
PACKAGING

- Plastic box of 50 pieces for T13Y and BL50
- Carton box of 50 pieces for T12Y and T12X, code BO50

ORDERING INFORMATION

T12 SERIES	X STYLE	B ON REQUEST	22 kΩ OHMIC VALUE	± 20 % TOLERANCE	A RESISTANC	BO50 PACKAGING	e3 LEAD FINISH
T12	X	LOCKING DEVICE			LAWS	Version T12X, Y: BO50	
T13	Y					Version T13Y: BL50	e3: pure Sn

SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

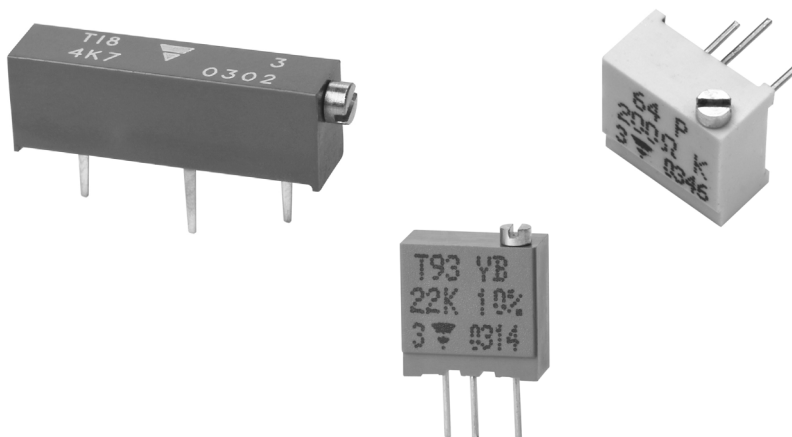


Trimmers Multi-Turn Cermet

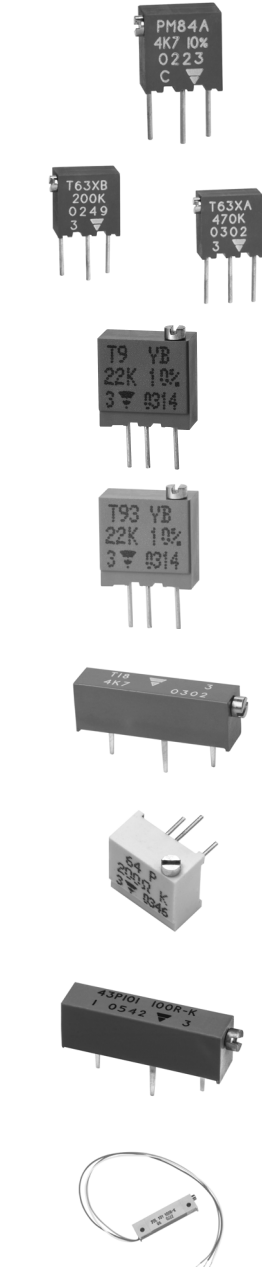
Industrial
•
Professional and Military

Model Numbers

T6.....	64
T63.....	67
T9.....	70
T93.....	73
64.....	76
T18.....	79
43.....	82
70.....	85



Trimmers Multi-Turn



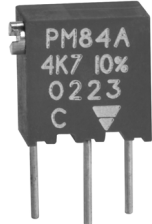
SERIES	MECHANICAL TRAVEL NUMBER OF TURNS	APPLICATIONS	QUALIFIED STYLES	DIMENSIONS in millimeters
T6	15	Professional and military	T6XA C (PM84C) T6XB A (PM84A) T6YA D (PM84D) T6YB B (PM84B)	6.8 x 6.8 x 5
T63	15	Industrial		6.8 x 6.8 x 5
T9	23	Professional and military	T9XA A (PM81A) T9XB C (PM81B) T9YA B (PM82A) T9YB D (PM82B) T9Z E (PM83)	9.7 x 9.7 x 4.8
T93	23	Industrial		9.7 x 9.7 x 4.8
T18	18	Industrial		19 x 6.4 x 4.7
64	23	Industrial		9.7 x 9.7 x 4.8
43	18	Industrial		19 x 6.4 x 4.7
70	22	Industrial		31.75 x 12.7 x 4.8

Undergoes European Quality Assurance System (CECC)



SEALING	DATA SHEET NO.	PN AT	RESISTANCE RANGE TOL.	CLIMATIC CATEGORY	MAX. TEMP.	P.C. BOARD LAYOUT
full sealed IP67	51023	0.25 W 85 °C	10 Ω to 2.2 MΩ ± 10 % - ± 5 %	55/125/56	155 °C	
full sealed IP67	51024	0.25 W 85 °C	10 Ω to 2.2 MΩ ± 10 % - ± 5 %	55/125/56	155 °C	
full sealed IP67	51025	0.5 W 70 °C	10 Ω to 2.2 MΩ ± 10 % - ± 5 %	55/125/56	155 °C	
full sealed IP67	51026	0.5 W 70 °C	10 Ω to 2.2 MΩ ± 10 % - ± 5 %	55/125/56	155 °C	
full sealed IP67	51027	0.50 W 70 °C	10 Ω to 2.2 MΩ ± 10 % - ± 5 %	55/125/56	125 °C	
full sealed IP67	57028	0.5 W 70 °C	10 Ω to 2.2 MΩ ± 10 %	55/125/56	155 °C	
full sealed IP67	57026	0.5 W 70 °C	10 Ω to 2.2 MΩ ± 10 %	55/125/56	125 °C	
full sealed IP67	57076	1 W 85 °C	10 Ω to 2 MΩ ± 10 %	55/150/21	150 °C	

1/4" Multi-Turn Fully Sealed Container Cermet Trimmers



Due to their square shape and small size (6.8 x 6.8 x 5 mm), the multi-turn trimmers of the T6 series are ideally suited for PCB use, enabling high density board mounting with reduced space requirement between cards.

Four versions are available differing by the top or side position of the adjustment screw and by PC pins configuration.

The use of cermet for the resistive track ensures an excellent stability of nominal specifications throughout life.

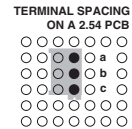
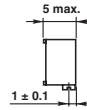
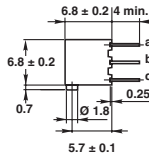
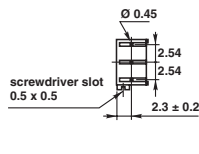
DIMENSIONS in millimeters

FEATURES

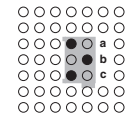
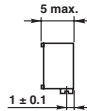
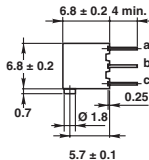
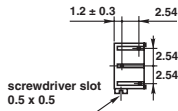
- Military and professional grade
- 0.25 Watt at 85 °C
- CECC 41 100-005 (A, B, C, D)
- Equivalent to MIL-R-22097 (RJ26)
- GAM T1
- Space saving
- Low contact resistance variation 1 % typical
- Fully sealed
- Wide range of ohmic values from 10 Ω to 2.2 MΩ
- Tests according to CECC 41 100



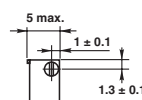
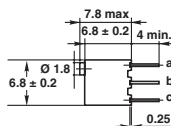
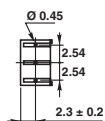
T6XA (PM 84) C



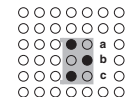
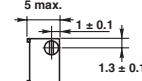
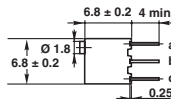
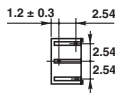
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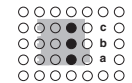
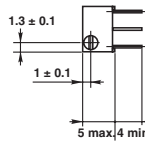
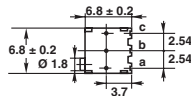
T6YA (PM 84) D



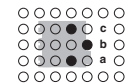
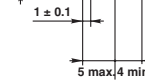
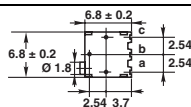
T6YB (PM 84) B



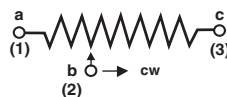
T6ZA



T6ZB



CIRCUIT DIAGRAM





1/4" Multi-Turn Fully Sealed Container
Cermet Trimmers

Vishay Sfernice

Undergoes European Quality Assurance System (CECC)

ELECTRICAL SPECIFICATIONS		
Resistive Element	cermet	
Electrical Travel	13 turns ± 2	
Resistance Range	10 Ω to 2.2 MΩ	
Standard series E3 and Series	1 - 2.2 - 4.7 and on request 1 - 2 - 5	
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating Linear	0.25 W at + 85 °C	
Temperature Coefficient	See Standard Resistance Element Table	
Limiting Element Voltage (Linear Law)	250 V	
Contact Resistance Variation	2 % Rn or 2 Ω	
End Resistance (Typical)	1 Ω	
Dielectric Strength (RMS)	1000 V	
Insulation Resistance (500VDC)	10 ⁶ MΩ	

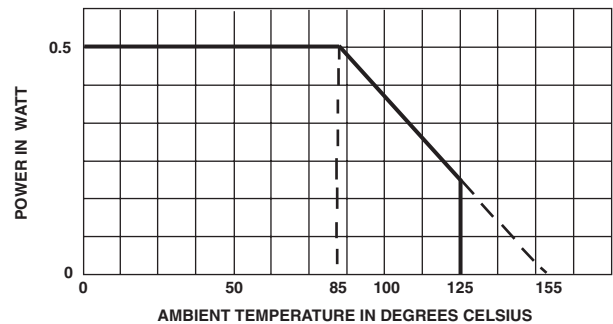
MECHANICAL SPECIFICATIONS

Mechanical Travel 15 turns
 Operating Torque (max. Ncm) 1
 End Stop Torque clutch action
 Unit Weight (max. g) 0.5
 Wiper (actual travel) positioned at approx. 50 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range - 55 °C to + 155 °C
 Climatic Category 55/125/56
 Sealing fully sealed container IP67

POWER RATING CHART



PERFORMANCE						
CECC 41100					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %		± 3 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C 93 % RH	± 2 %		± 3 %	± 0.5 %	± 1 %
Rotational Life	200 cycles	± 2 %			± 2 %	Contact res. variation: < 1 % Rn
Load Life	1000 h at rated power 90/30' - ambient temp. 85 °C	± 2 %		± 4 %	± 1 %	± 2 % Contact res. variation: < 1 % Rn
Rapid Temperature Change	5 cycles - 55 °C to + 125 °C	± 1.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$	± 1 %	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ < ± 1 %
Shocks	50 g at 11 m secs 3 successive shocks in 3 directions	± 1 %		± 2 %	± 0.1 %	± 0.2 %
Vibrations	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$	± 2 %	± 0.1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ < ± 0.2 %



STANDARD RESISTANCE ELEMENT DATA					
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C	
	MAX. POWER AT 85 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.		
Ω	W	V	mA	ppm/°C	
10	0.25	1.58	158	0	
22	↓	2.34	107	+ 200	
47		3.53	73		
100		5	50		
220		7.42	34		
470		10.8	23		
1K		15.8	15.8		
2.2K		23.4	10.7		
4.7K		34.3	7.3		
10K		50	5		
22K		74.2	3.37		
47K		108.4	2.31		
100K		158	1.58		
220K		0.25	234	0.97	± 100
470K		0.13	250	0.53	
1M		0.06	250	0.25	
2.2M	0.028	250	0.11		

MARKING

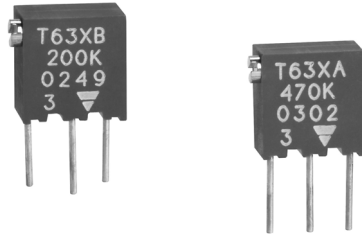
- Printed:
- VISHAY trademark
 - model
 - style
 - ohmic value (in Ω, kΩ, MΩ)
 - tolerance (in %)
 - manufacturing date
 - marking of terminal c

PACKAGING
- In magazine pack (tube) by 50 pieces code "TU50".

ORDERING INFORMATION					
T6 MODEL	XA VERSION	470 kΩ OHMIC VALUE	± 10 % TOLERANCE	TU50 PACKAGING	e3 LEAD FINISH
				TU50: Tube	e3: pure Sn

SAP PART NUMBERING GUIDELINES													
T	6	X	A	4	7	4	K	T	2	0	□	□	□
MODEL		STYLE		OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables													

1/4" Multi-Turn Sealed Container Cermet Trimmers



Due to their square shape and small size (6.8 x 6.8 x 5 mm), the multi-turn trimmers of the T63 series are ideally suited for PCB use, enabling high density board mounting with reduced space requirement between cards.

Four versions are available differing by the top or side position of the adjustment screw and by PC pins configuration.

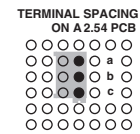
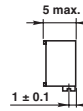
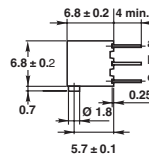
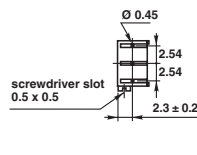
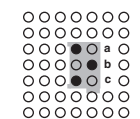
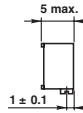
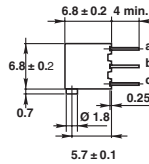
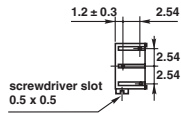
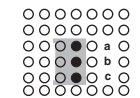
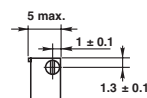
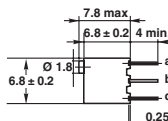
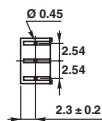
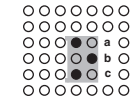
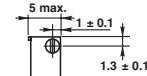
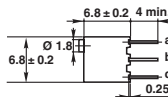
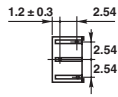
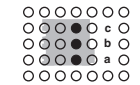
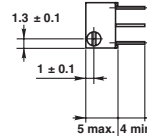
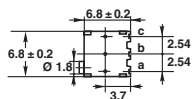
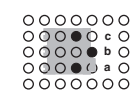
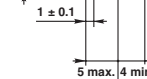
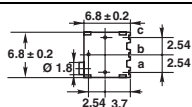
The use of cermet for the resistive track ensures an excellent stability of nominal specifications throughout life.

FEATURES

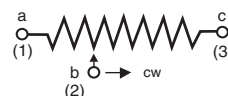
- 0.25 Watt at 85 °C
- Industrial grade
- Tests according to GECC 41 000
- Multi-turn operation
- Low contact resistance variation 1 % typical



DIMENSIONS in millimeters

T63XA

T63XB

T63YA

T63YB

T63ZA

T63ZB


CIRCUIT DIAGRAM



Tolerance unless otherwise specified ± 0.5

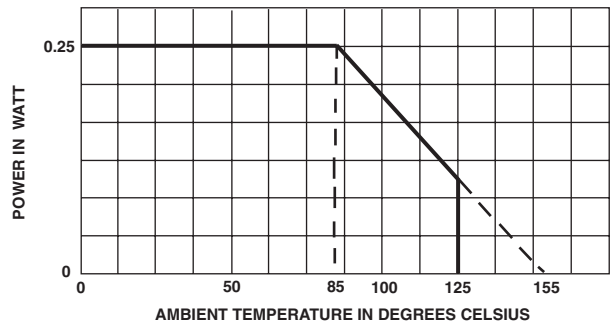


ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		13 turns ± 2
Resistance Range		10 Ω to 2.2 MΩ
Standard Series and on Request Series E3		1 - 2 - 5 (1 - 2.2 - 4.7)
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	Linear	0.25 W at + 85 °C
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 2 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500VDC)		10 ⁶ MΩ

MECHANICAL SPECIFICATIONS

Mechanical Travel	15 turns ± 5
Operating Torque (max. Ncm)	1.5
End Stop Torque	clutch action
Unit Weight (max. g)	0.5
Wiper (actual travel)	positioned at approx. 50 %

POWER RATING CHART



ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C + 155 °C
Climatic Category	55/125/56
Sealing	fully sealed container IP67

PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30' - ambient temp. 85 °C	± 1 % Contact res. variation: < 1 % Rn	± 2 %
Climatic Sequence	Phase A dry heat 125 °C - 30 % Pr Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C 93 % RH	± 0.5 % Dielectric strength : 1000V RMS Insulation resistance : > 10 ⁴ MΩ	± 1 %
Rapid Temperature Change	5 cycles - 55 °C to + 125 °C	± 0.5 %	$\frac{\Delta V_{1-2}}{\Delta V_{1-3}} \leq \pm 1 \%$
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 0.1 %	± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.1 %	$\frac{\Delta V_{1-2}}{\Delta V_{1-3}} \leq \pm 0.2 \%$
Rotational Life	200 cycles	± 2 % Contact res. variation: < 1 % Rn	



1/4" Multi-Turn Fully Sealed Container
Cermet Trimmers

Vishay Sfernice

STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 85 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	ppm/°C
10	0.25	1.58	158	0 + 200
20	↓	2.23	112	
50		3.53	77	
100		5	50	
200		7.07	35	
500		11.2	22	
1K		15.8	15.8	
2K		22.3	11.2	
5K		35.3	7.1	
10K		50	5	
20K		70.7	3.5	± 100
25K	79	3.2		
50K	112	2.2		
100K	158	1.6		
200K	0.25	224	1.1	
250K	0.25	250	1.1	
500K	0.13	250	0.50	
1M	0.06	250	0.25	
2.2M	0.03	250	0.125	

MARKING

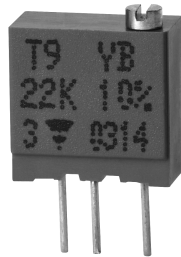
- Printed:
- VISHAY trademark
 - model
 - style
 - ohmic value (in Ω, kΩ, MΩ)
 - tolerance (in %)
 - only if non standard,
 - manufacturing date
 - marking of terminal 3

PACKAGING
- In magazine pack (tube) by 50 pieces code "TU50".

ORDERING INFORMATION					
T63 MODEL	XA VERSION	100 kΩ OHMIC VALUE	± 10 % TOLERANCE	TU50 PACKAGING	e3 LEAD FINISH
				TU50: Tube	e3: pure Sn

SAP PART NUMBERING GUIDELINES														
T	6	3	X	A	1	0	4	K	T	2	0	□	□	□
MODEL			STYLE		OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables														

3/8" Square Multi-Turn Fully Sealed Container Cermet Trimmers



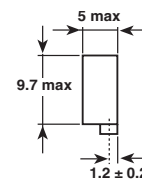
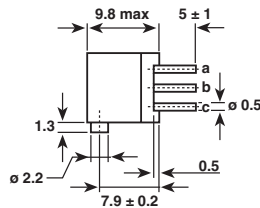
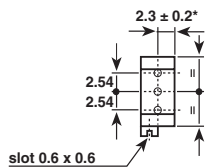
FEATURES

- Military and Professional Grade
- 0.5 Watt at 70 °C
- CECC 41 101-004 (A, B, C, D, E)
- Tests according to CECC 41 000
- GAM T1
- Fully sealed
- Operating temperature range - 55 °C to + 155 °C
- Wide ohmic range from 10 ohms to 2M2 ohms
- Lead (Pb)-free and RoHS compliant

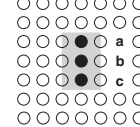


DIMENSIONS in millimeters

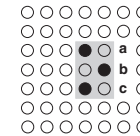
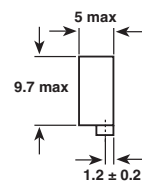
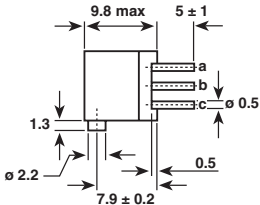
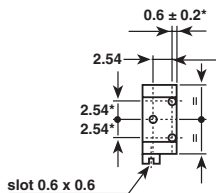
T9XA (PM81A) A



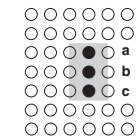
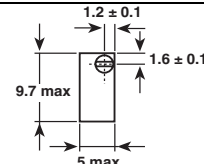
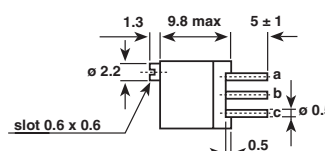
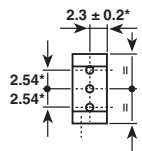
Terminal Spacing on a 2.54 PCB



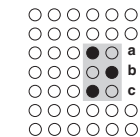
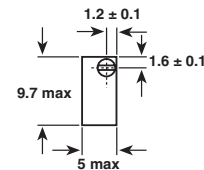
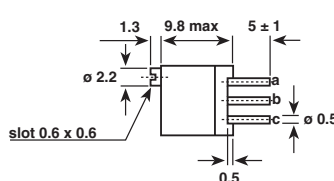
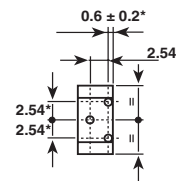
T9XB (PM81B) C



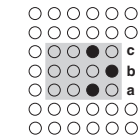
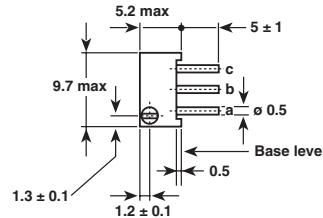
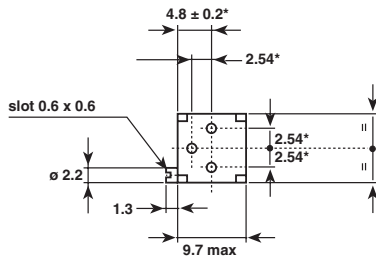
T9YA (PM82A) B



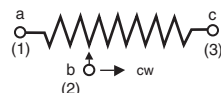
T9YB (PM82B) D



T9Z (PM83) E



CIRCUIT DIAGRAM



* to be measured at base level



3/8" Square Multi-Turn Fully Sealed Container
Cermet Trimmers

Vishay Sfernice

ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		21 turns ± 2
Resistance Range		10 Ω to 2.2 MΩ
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	Linear	0.5 W at + 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 1 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

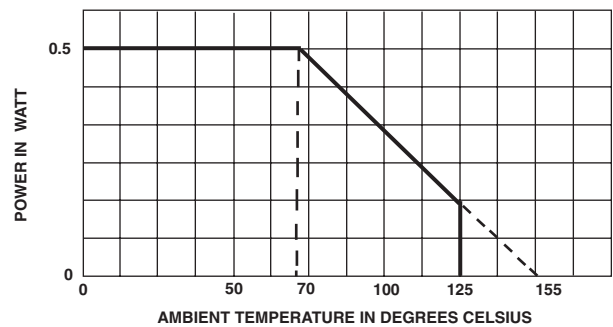
MECHANICAL SPECIFICATIONS

Mechanical Travel 23 turns ± 5
 Operating Torque (max. Ncm) 1.5
 End Stop Torque clutch action
 Net Weight Approx. 0.82 g
 Wiper (actual travel) Positioned at approx. 50 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range - 55 °C to + 155 °C
 Climatic Category 55/125/56
 Sealing fully sealed
 container IP67

POWER RATING CHART



PERFORMANCE						
CECC 41100					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 2 %		± 3 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C, 93 % RH	± 2 %	Dielectric strength: 700 V Insulation resistance: > 100 MΩ	± 3 %	± 0.5 %	± 1 %
Rotational Life	200 cycles	± 2 %	Contact res. variation: < 3 % Rn		± 2 %	Contact res. variation: < 1 % Rn
Load Life	1000 h at rated power 90'/30' - ambient temp. 70 °C	± 2 %	Contact res. variation: < 3 % Rn	± 3 %	± 1 %	± 2 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 1.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$	± 1 %	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ < ± 1 %
Shocks	50 g at 11m secs 3 successive shocks in 3 directions	± 1 %		± 2 %	± 0.1 %	± 0.2 %
Vibrations	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$	± 2 %	± 0.1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ < ± 0.2 %



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	W	V	mA	ppm/°C
10	0.5	2.2	224	0 + 200
22	↓	3.3	150	
47		4.8	103	
100		7	70	± 100
220		10.5	47	
470		15.3	32	
1K		22.4	22	
2.2K		33.2	15	
4.7K		48.5	10	
10K		70.7	7	
22K		105	4.8	
47K	153	3.2		
100K	0.5	224	2.2	
220K	0.28	250	1.1	
470K	0.13	250	0.53	
1M	0.06	250	0.25	
2.2M	0.028	250	0.11	

MARKING

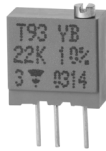
- Printed:
- VISHAY trademark
 - model
 - style
 - ohmic value (in Ω, kΩ, MΩ)
 - tolerance (in %)
 - manufacturing date
 - marking of terminal C

PACKAGING
- In magazine pack by 50 pieces (tube) code "TU50".

ORDERING INFORMATION					
T9 MODEL	XA VERSION	470 kΩ OHMIC VALUE	± 10 % TOLERANCE	TU50 PACKAGING	e3 LEAD FINISH
				TU50: Tube	e3: pure Sn

SAP PART NUMBERING GUIDELINES													
T	9	X	A	4	7	4	K	T	2	0	□	□	□
MODEL		STYLE		OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables													

3/8" Square Multi-Turn Cermet Trimmers



FEATURES

- Industrial Grade
- 0.5 Watt at 70 °C
- Tests according to CECC 41 000
- Contact resistance variation < 1 % typical
- Lead (Pb)-free and RoHS compliant

The T93 is a small size trimmer - 3/8" x 3/8" x 3/16" - answering PC board mounting requirements.

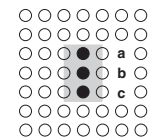
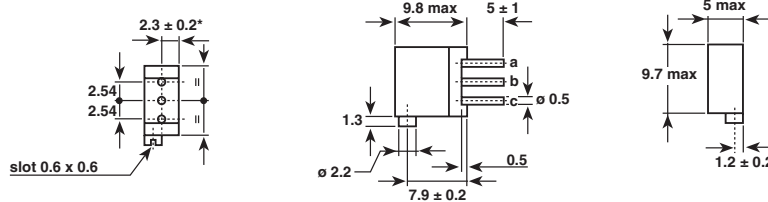
Five versions are available which differ by the position of the control screw in relation to the PC board plane and by the spacing of the terminals.

Excellent operational stability is provided by the use of a cermet element.

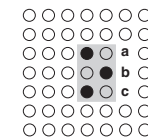
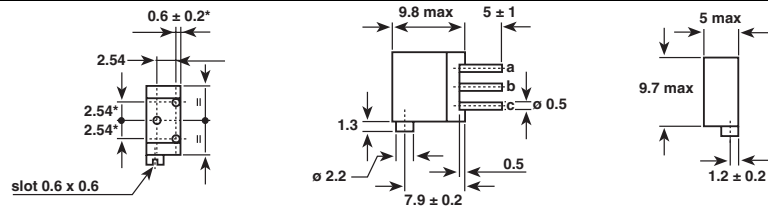
DIMENSIONS in millimeters

Terminal Spacing on a 2.54 PCB

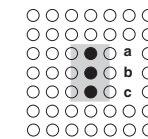
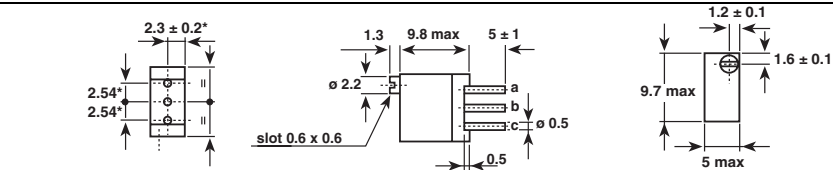
T93XA



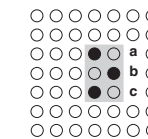
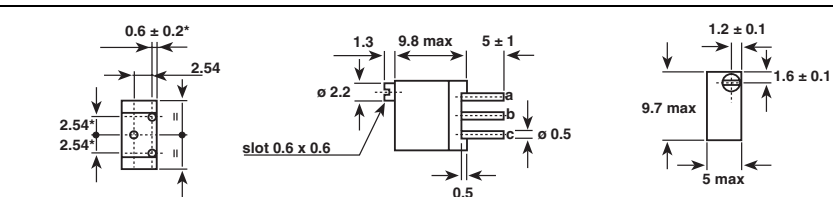
T93XB



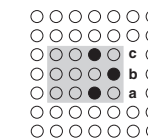
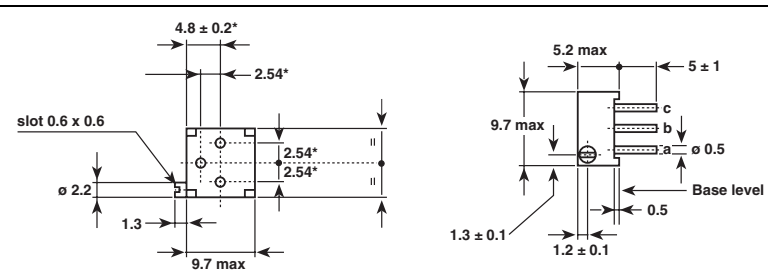
T93YA



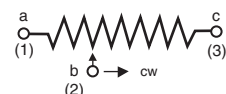
T93YB



T93Z



CIRCUIT DIAGRAM



* to be measured at base level

Tolerance unless otherwise specified ± 0.5



ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		21 turns ± 2
Resistance Range		10 Ω to 2.2 MΩ
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	Linear	0.5 W at + 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 2 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

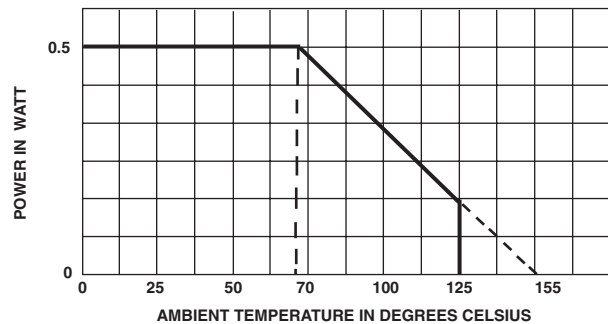
MECHANICAL SPECIFICATIONS

Mechanical Travel	23 turns ± 5
Operating Torque (max. Ncm)	1.5
End Stop Torque	clutch action
Net Weight	Approx. 0.82 g
Wiper (actual travel)	Positioned at approx. 50 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/125/56
Sealing	fully sealed container IP67

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30° - ambient temp. 70 °C	± 1 % Contact res. variation: < 1 % Rn	± 2 %
Climatic Sequence	Phase A dry heat 125 °C - 30 % Pr Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C, 93 % RH	± 0.5 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 1 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 0.1 %	± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.2 \%$
Rotational Life	200 cycles	± 4 % Contact res. variation: < 1 % Rn	



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	W	V	mA	ppm/°C
10	0.5	2.2	224	0 + 200
22	↓	3.3	150	
47		4.8	103	
100		7	70	
220		10.5	47	
470		15.3	32	
1K		22.4	22	
2.2K		33.2	15	
4.7K		48.5	10	
10K		70.7	7	
22K		105	4.8	± 100
47K	153	3.2		
100K	0.5	224	2.2	
220K	0.28	250	1.1	
470K	0.13	250	0.53	
1M	0.06	250	0.25	
2.2M	0.028	250	0.11	

MARKING

- Printed:
- VISHAY trademark
 - model
 - style
 - ohmic value (in Ω, kΩ, MΩ)
 - tolerance (in %)
 - manufacturing date
 - marking of terminal 3

PACKAGING
- In magazine pack by 50 pieces (tube) code "TU50".

ORDERING INFORMATION					
T93 MODEL	XA VERSION	220 kΩ OHMIC VALUE	± 10 % TOLERANCE	TU50 PACKAGING	e3 LEAD FINISH
				TU50 : Tube	e3: pure Sn

SAP PART NUMBERING GUIDELINES														
T	9	3	X	A	2	2	4	K	T	2	0			
MODEL			STYLE		OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables														

3/8" Square (10 mm) Multi-Turn Cermet Trimmer



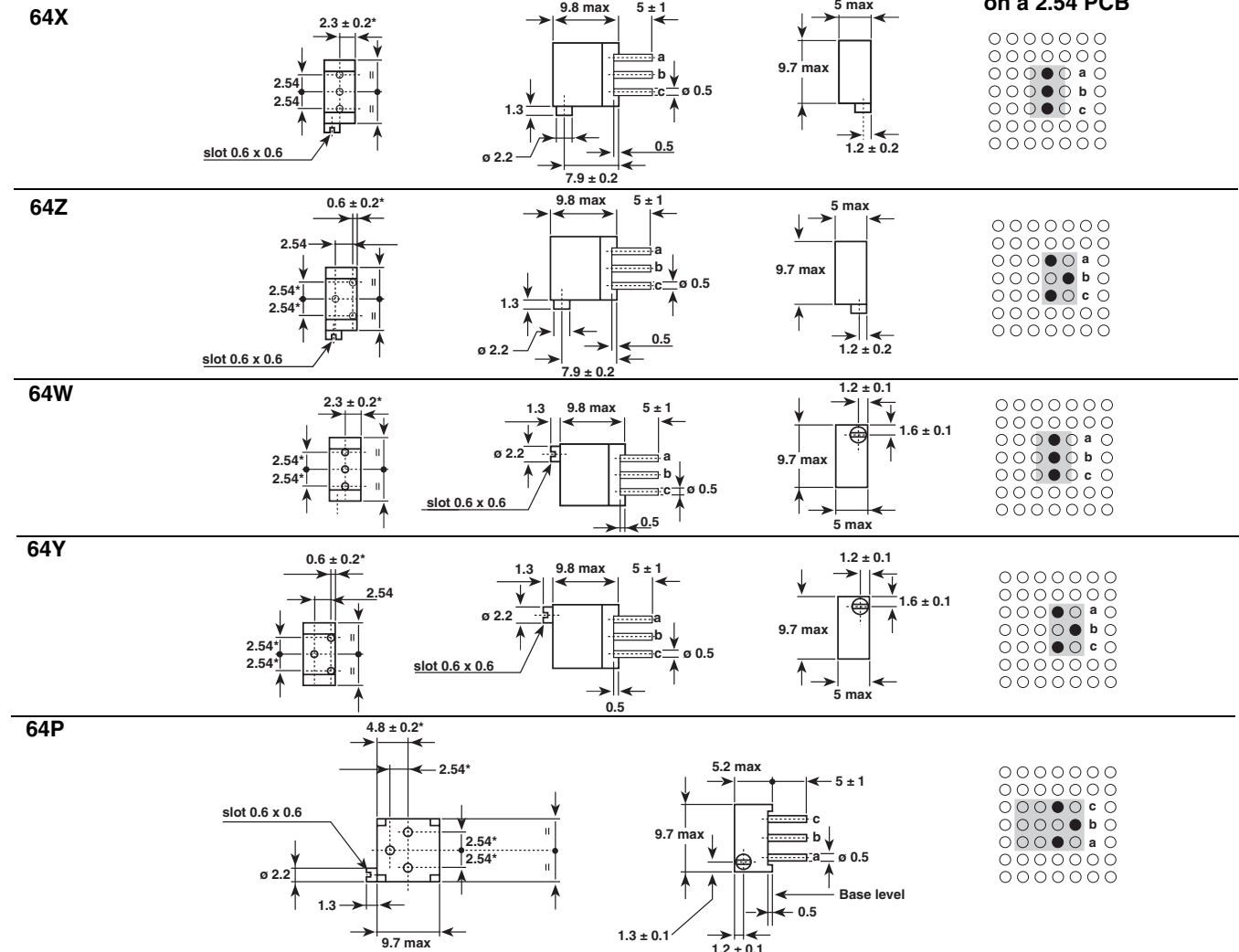
FEATURES

- Industrial Grade
- 0.5 Watt at 70 °C
- Tests according to CECC 41 000
- Contact resistance variation < 1 % typical

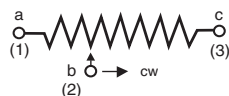


The Model 64 is a small size trimmer - 3/8" x 3/8" x 3/16" - answering PC board mounting requirements. Five versions are available which differ by the position of the control screw in relation to the PC board plane and by the spacing of the terminals. Excellent operational stability is provided by the use of a cermet element.

DIMENSIONS in millimeters



CIRCUIT DIAGRAM



* to be measured at base level

Tolerance unless otherwise specified ± 0.5

ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		21 turns ± 2
Resistance Range		10 Ω to 2.2 MΩ
Standard series e3		1 - 2 - 2.5 - 5
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	Linear	0.5 W at + 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 2 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

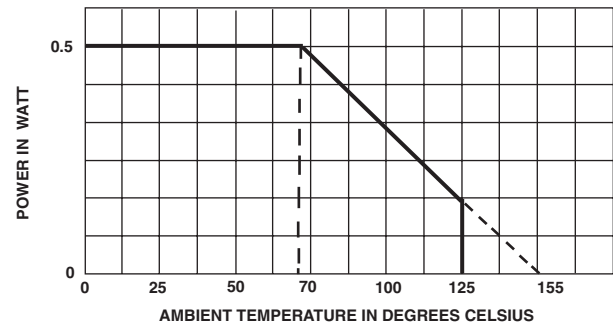
MECHANICAL SPECIFICATIONS

Mechanical Travel	23 turns ± 5
Operating Torque (max. Ncm)	1.5
End Stop Torque	clutch action
Net Weight	Approx. 0.82 g
Wiper (actual travel)	Positioned at approx. 50 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 155 °C
Climatic Category	55/125/56
Sealing	fully sealed container IP67

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30° - ambient temp. 70 °C	± 1 % Contact res. variation: < 1 % Rn	± 2 %
Climatic Sequence	Phase A dry heat 125°C - 30 % Pr Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40°C, 93 % RH	± 0.5 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 1 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ ≤ ± 1 %
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 0.1 %	± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ ≤ ± 0.2 %
Rotational Life	200 cycles	± 4 % Contact res. variation: < 1 % Rn	



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C +125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	W	V	mA	ppm/°C
10	0.5	2.2	224	0 + 200
20	↓	3.2	158	
50		5	100	
100		7.1	71	
200		10	50	
250		11.2	45	
500		15.8	32	
1K		22.4	22	
2K		31.6	16	
2.5K		35.4	14	
5K		50	10	
10K		70.7	7.1	
20K		100	5	± 100
25K		112	4.5	
50K		158	3.2	
100K		0.5	224	
200K	0.31	250	1.3	
250K	0.25	250	1	
500K	0.125	250	0.5	
1M	0.063	250	0.25	
2M	0.031	250	0.13	

MARKING

Printed:

- VISHAY trademark
- model
- style
- ohmic value (in Ω, kΩ, MΩ)
- tolerance (in %)
- manufacturing date
- marking of terminal 3

LEAD FINISH

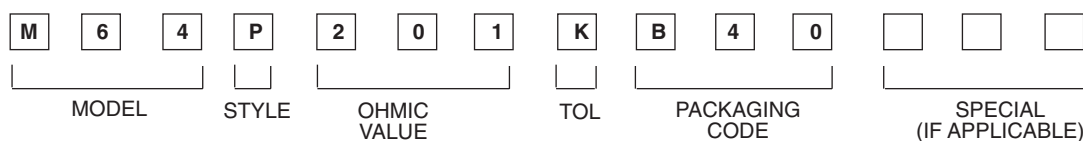
Pure Sn. Code e3

PACKAGING

- In bulk (box of 200 pieces), code B0200
- On request in tube

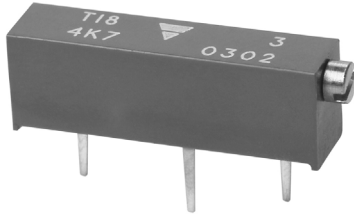
ORDERING INFORMATION64
MODELP
TERMINAL STYLE

P, W, X, Y or Z201
EIA
RESISTANCE CODEe3
LEAD FINISH

e3: pure Sn**SAP PART NUMBERING GUIDELINES**

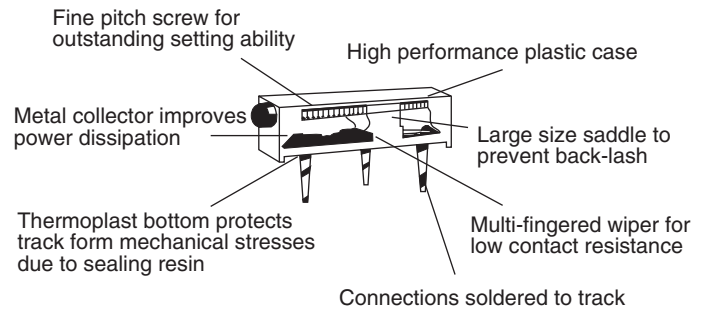
See the end of this data book for conversion tables

3/4" Rectangular Multi-Turn Cermet Trimmer



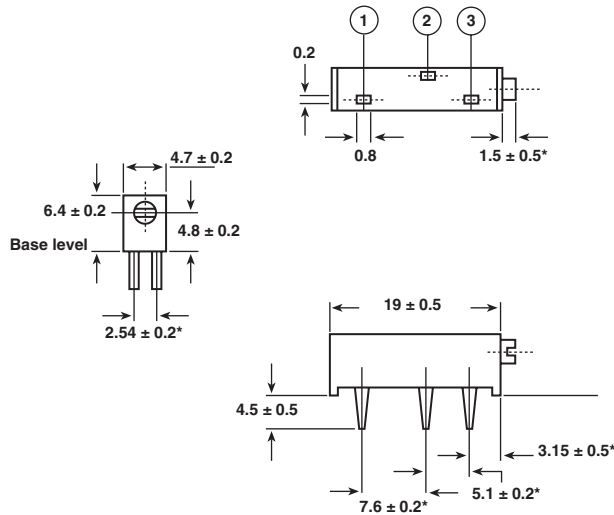
FEATURES

- Industrial Grade
- 0.50 Watt at 70 °C
- MIL-R-22097
- Tests according to CECC 41 000



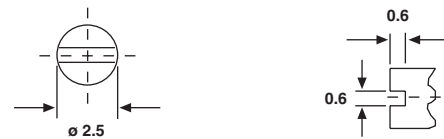
DIMENSIONS in millimeters

T18

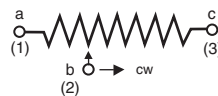


* to be measured at base level

SHAFT



CIRCUIT DIAGRAM



Tolerances unless otherwise specified ± 0.5

ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		15 turns \pm 1
Resistance Range		10 Ω to 2.2 M Ω
Standard series E3		1 - 2.2 - 4.7 and 1 - 2 - 5
Tolerance	Standard	\pm 10 %
	On Request	\pm 5 %
Power Rating	Linear	0.50 W at + 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % R _n or 1 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500VDC)		10 ⁶ M Ω

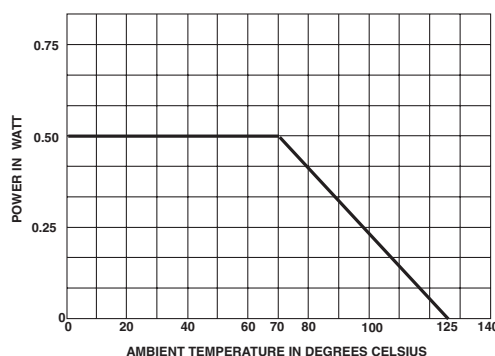
MECHANICAL SPECIFICATIONS

Mechanical Travel	18 turns \pm 5
Operating Torque (max. Ncm)	2
End Stop Torque	clutch action
Unit Weight (max. g)	1
Wiper (actual travel)	positioned at approx. 50 %

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56
Sealing	fully sealed container IP67

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30' - ambient temp. 70 °C	\pm 1 % Contact res. variation: < 3 % R _n	\pm (3 % + 5 %)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	\pm 0.5 %	\pm 1 %
Long Term Damp Heat	56 days	\pm 0.5 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ M Ω	\pm 1 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	\pm 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Shock	50 g at 11m secs 3 successive shocks in 3 directions	\pm 0.2 %	$\pm 0.3 \%$
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	\pm 0.2 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.3 \%$
Rotational Life	200 cycles	\pm 2 % Contact res. variation: < 2 % R _n	



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	ppm/°C
10	0.5	2.24	224	0 + 200
22	0.5	3.32	151	
47	0.5	4.85	103	
100	0.5	7.07	71	± 100
220	0.5	10.5	48	
470	0.5	15.3	33	
1K	0.5	22.4	22	
2K2	0.5	33.2	15	
4K7	0.5	48.5	10	
10K	0.5	70.7	7.1	
22K	0.5	105	4.8	
47K	0.5	153	3.3	
100K	0.5	224	2.2	
220K	0.28	250	1.1	
470K	0.13	250	0.5	
1M	0.06	250	0.3	

MARKING

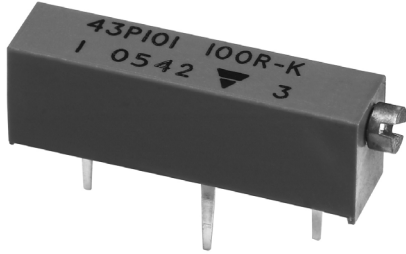
- Printed :
- VISHAY trademark
 - model
 - style
 - ohmic value (in Ω, kΩ, MΩ)
 - manufacturing date
 - marking of terminal 3

PACKAGING
- In tube of 25 pieces, code "TU25"

ORDERING INFORMATION				
T18 SERIES	10 kΩ OHMIC VALUE	± 10 % TOLERANCE	TU25 PACKAGING TU25: Tube	e3 LEAD FINISH e3: pure Sn

SAP PART NUMBERING GUIDELINES												
T	1	8	1	0	3	K	T	1	0			
MODEL			OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)		
See the end of this data book for conversion tables												

3/4" Rectangular (19 mm) Multi-Turn Cermet Trimmer



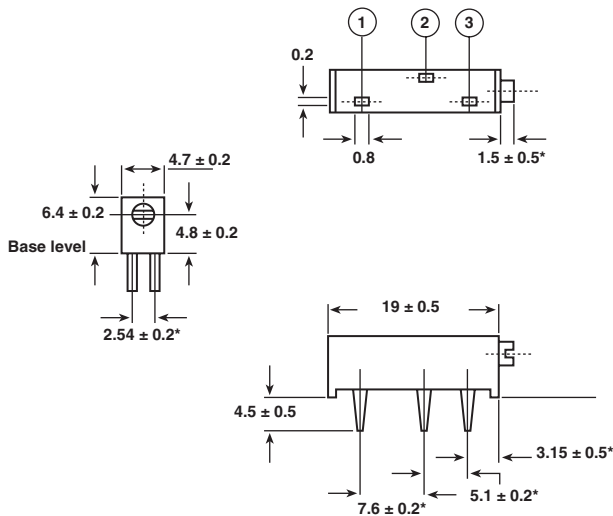
FEATURES

- Panel mount, clear lid versions available
- Chevron shaft for sealing and smooth consistent torque
- Solder terminations for improved reliability
- Multi-finger wiper for better C.R.V.

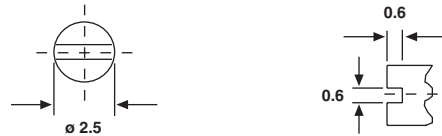


The Model 43 is manufactured to the highest international standards. This product, sealed to 85 °C for 1 minute (IEC. 68-2-17) has an effective travel of 18 turns nominal and a resistance range of 10 Ω to 2 MΩ.

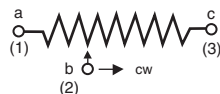
DIMENSIONS in inches (millimeters)



SHAFT



CIRCUIT DIAGRAM



Tolerance unless otherwise specified ± 0.5



3/4" Rectangular (19 mm)
Multi-Turn Cermet Trimmer

Vishay Spectrol

ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		15 turns ± 1
Resistance Range		10 Ω to 2.2 MΩ
Standard series E3		1 - 2.2 - 4.7 and 1 - 2 - 5
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	Linear	0.50 W at + 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		2 % Rn or 1 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

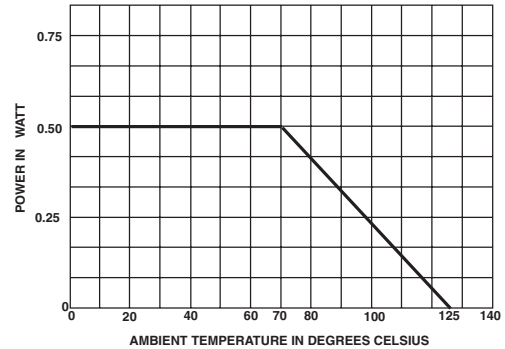
MECHANICAL SPECIFICATIONS

Mechanical Travel	18 turns ± 5
Operating Torque (max. Ncm)	2
End Stop Torque	clutch action
Unit Weight (max. g)	1
Wiper (actual travel)	positioned at approx. 50 %

Environmental specifications

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/125/56
Sealing	fully sealed container IP67

POWER RATING CHART



PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$
Load Life	1000 hours at rated power 90'/30' - ambient temp. 70 °C	± 1 % Contact res. variation: < 3 % Rn	± (3 % ± 5 %)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 %	± 1 %
Long Term Damp Heat	56 days	± 0.5 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 1 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 0.2 %	± 0.3 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.2 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.3 \%$
Rotational Life	200 cycles	± 2 % Contact res. variation: < 2 % Rn	



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C ppm/°C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	
10	0.5	2.24	224	0 + 200
22	0.5	3.32	151	
47	0.5	4.85	103	
100	0.5	7.07	71	± 100
220	0.5	10.5	48	
470	0.5	15.3	33	
1K	0.5	22.4	22	
2K2	0.5	33.2	15	
4K7	0.5	48.5	10	
10K	0.5	70.7	7.1	
22K	0.5	105	4.8	
47K	0.5	153	3.3	
100K	0.5	224	2.2	
220K	0.28	250	1.1	
470K	0.13	250	0.5	
1M	0.06	250	0.3	

MARKING

- Printed:
- VISHAY trademark
 - model
 - ohmic value
 - manufacturing date
 - marking of terminal 3

PACKAGING
<ul style="list-style-type: none"> - In box of 200 pieces, code BO200 - In tube by 25 pieces, code "TU25"

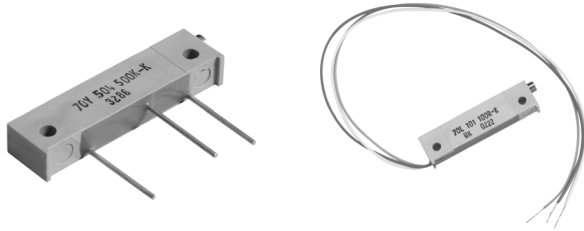
ORDERING INFORMATION				
43P MODEL AND PIN STYLE	SPECIAL (omit if standard) T601 - Panel mount	103 EIA RESISTANCE VALUE	BO200 PACKAGING on request: TU25	e3 LEAD FINISH e3: pure Sn

SAP PART NUMBERING GUIDELINES														
[M]	[7]	[0]	[L]	[1]	[0]	[3]	[K]	[B]	[2]	[5]	[]	[]	[]	[]
MODEL			STYLE	OHMIC VALUE			TOL	PACKAGING CODE			SPECIAL (IF APPLICABLE)			
See the end of this data book for conversion tables														

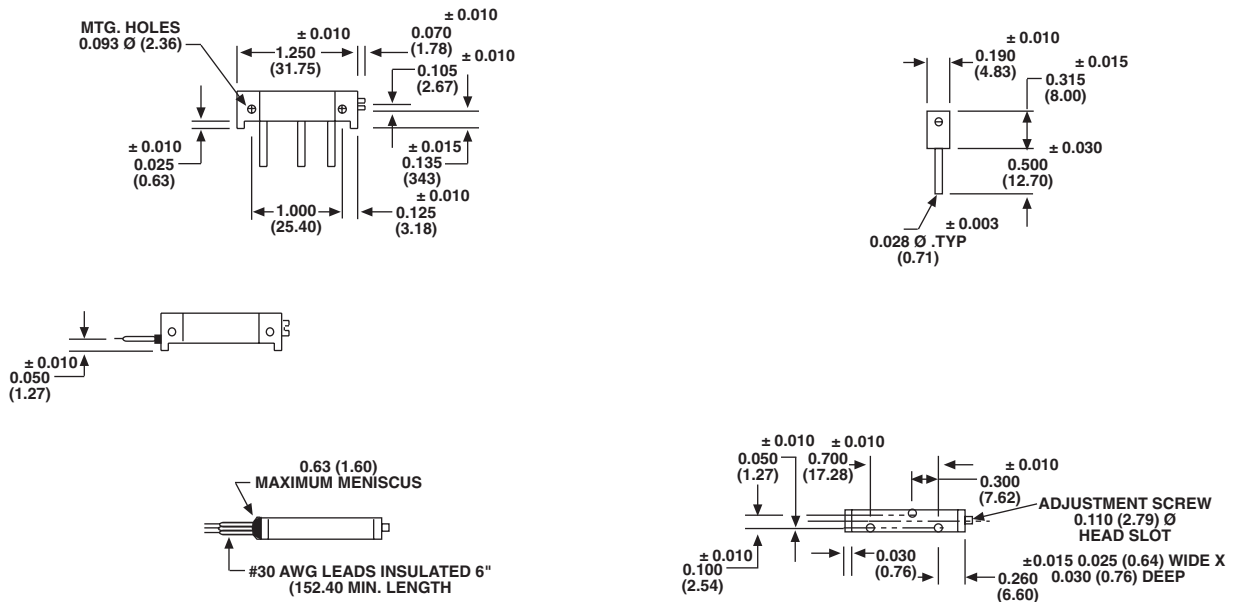
1 - 1/4" Rectangular Multi-Turn Cermet

FEATURES

- Unique "T" slider block design
- CRV of 3 % or 3 Ω
- Temperature coefficient of 100 ppm/°C
- RT Tolerance ± 10 % STD (± 5 % Available)



DIMENSIONS in inches (millimeters)



Tolerances unless otherwise specified ± 0.5

ELECTRICAL SPECIFICATIONS	
Resistance Range	10 Ω thru 2 MΩ
Standard Resistance Tolerance	10 %
End Resistance	2 % maximum
Actual Effective Electrical Travel	20 turns nominal
Contact Resistance Variation	3 % or 3 Ω, whichever is greater
Dielectric Withstanding Voltage	1000 VAC at sea level, 350 VAC at 80 000 feet (24.400 meters)
Insulation Resistance	1000 MΩ
Power Rating	1.0 watt at 85 °C derated linearly to zero watts at 150 °C maximum voltage not to exceed 400 volts
Temperature coefficient of resistance	± 100 ppm/°C 100 Ω to 2 MΩ - 100 to 200 ppm/°C 10 Ω, 20 Ω and 50 Ω



MECHANICAL SPECIFICATIONS

Operating Torque	5 oz-in (360 gm-cm) maximum
Rotational Life	200 cycles minimum with loaded circuit, maximum change in resistance 2 % or 500 cycles minimum without discontinuity unloaded
Weight	0.116 oz (3.3 grams) maximum

ENVIRONMENTAL SPECIFICATIONS

		MAXIMUM TOTAL RESISTANCE	CHANGE SETTING
Operating Temperature Range	- 55 °C to + 150 °C	-	-
Terminal Strength	2 lbs (900 gms) minimum push/pull	-	-
Sealed	All units sealed to permit cleaning in common solvents immersion	-	-
Thermal Shock	- 55 °C to + 125 °C, 5 cycles	2 %	1 %
Shock	50 g at 11 ms, 3 successive shocks in 3 directions	1 %	1 %
Vibration	10 - 55 Hz 0.75 mm or 10 g for 6 hours	1 %	1 %
Load Life	1000 hours at rater power 90'/30'	3 %	1 %
High Temperature Exposure	+ 150 °C	3 %	2 %
Resistance to Solder Heat	350 °C for 3 seconds	1 %	-

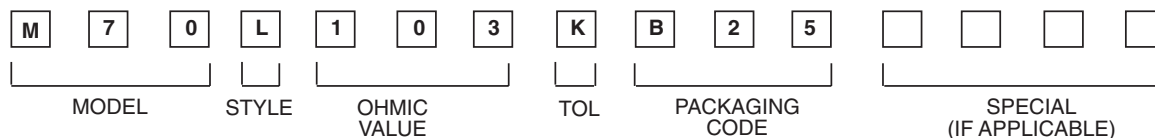
MARKING

Unit Identification: Manufacturer's name and part number including EIA resistance code, date code, circuit diagram and military style designation as applicable

ORDERING INFORMATION

70	L	103	T000	e3
MODEL	TERMINAL STYLE	EIA RESISTANCE CODE	SPECIAL (omit if standard)	LEAD FINISH
	L = Leadwire Y = Printed circuit pins		T601 Panel mount added to terminal style L	e3: pure Sn

SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables



Model Numbers

P9.....	90
P11, PA11.....	94
148, 149.....	102

Modular Panel Potentiometers

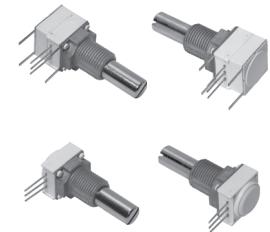
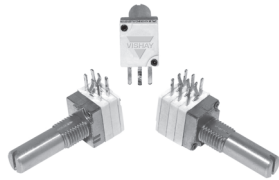
Industrial



Professional and Military



Modular Panel Potentiometers



SERIES	MECHANICAL TRAVEL	STYLE	APPLICATIONS	QUALIFIED STYLES	NF CECC	SHAFT DIA.	BUSH	SHAFT LENGTH ¹⁾	DIMENSIONS in millimeters [inch]
P9	300°	A	Industrial			3.5 6	7	15 20 25 30	9.52 × 11.35 [3/8" × 0.45]
PA11 conductive plastic	300°	T	Industrial	P11TY P11TZ	PC60 PC64	3	6	See data sheet	12.5 × 12.5 [0.492 × 0.492]
		Q		P11QY P11QZ	PC61 PC65	4	7		
		V		P11VY P11VZ	PC63 PC67	6	10		
P11 cermet		2				1/4"	3/8"		
		7				1/8"	1/4"		
148	300°		Industrial			1/4" 1/8"	1/4" 3/8"	1/2" 5/8" 3/4" 7/8" 1" 1.25"	12.5 × 12.5 [1/2" × 1/2"]
149									

(1) **SHAFT LENGTH**
The shaft length is measured from mounting face.
Special shaft on request.

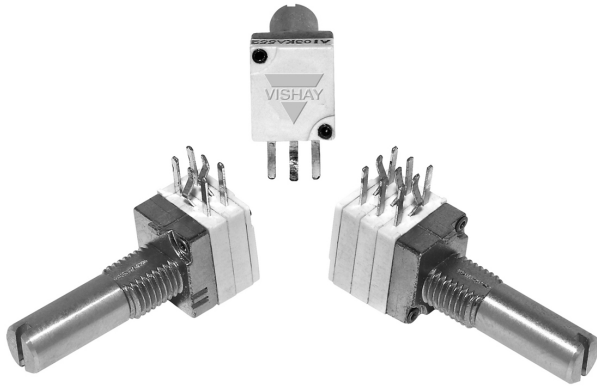


DATA SHEET NO.	SEALING	POWER RATING AT 70 °C	RESISTANCE RANGE (LINEAR LAW)	TOL.	CLIMATIC CATEGORY ⁽²⁾	MAX. TEMP.	SPECIAL FEATURES				
							SOLDER LUGS	"FASTON" TYPE	PC BOARD SIDE ADJ.	PC BOARD TOP ADJ.	PANEL SEALED
51047	IP64 or IP67	0.1 W	1 kΩ - 1 MΩ	± 20 % ± 10 %	55/100/21	100 °C			●	●	
51031	IP64	0.5 W	1 kΩ - 1 MΩ	± 20 % ± 10 %	25/100/21	125 °C	●		●	●	●
		1 W	10 Ω - 10 MΩ	± 20 % ± 10 % ± 5 %	25/125/56	150 °C					
57040		0.5 W	1 kΩ - 1 MΩ	± 20 % ± 10 %	55/120/21	120 °C	●		●		
		1 W	100 Ω - 2 MΩ		50/150/21	150 °C					

(2) CLIMATIC CATEGORY

The first figure states the minimum temperature, the second figure corresponds to the maximum temperature of the category (at the maximum temperature of the category, the power dissipation is at least 25 % of the power rating), the third figure corresponds to the number of days of the damp heat test.

9 mm Multi-Ganged Potentiometer



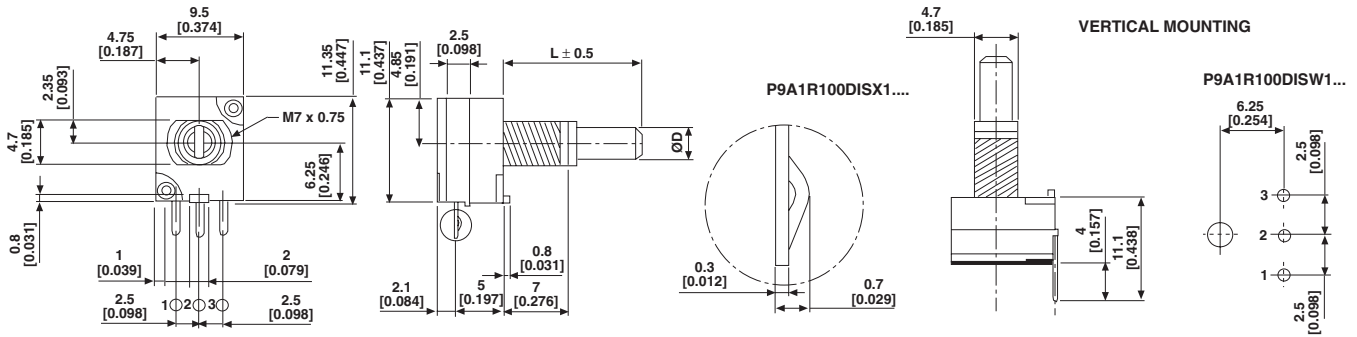
FEATURES

- Conductive plastic element
- Ultra compact (Extra miniature module size)
- Multiple assemblies (up to seven modules)
- Custom version available on request

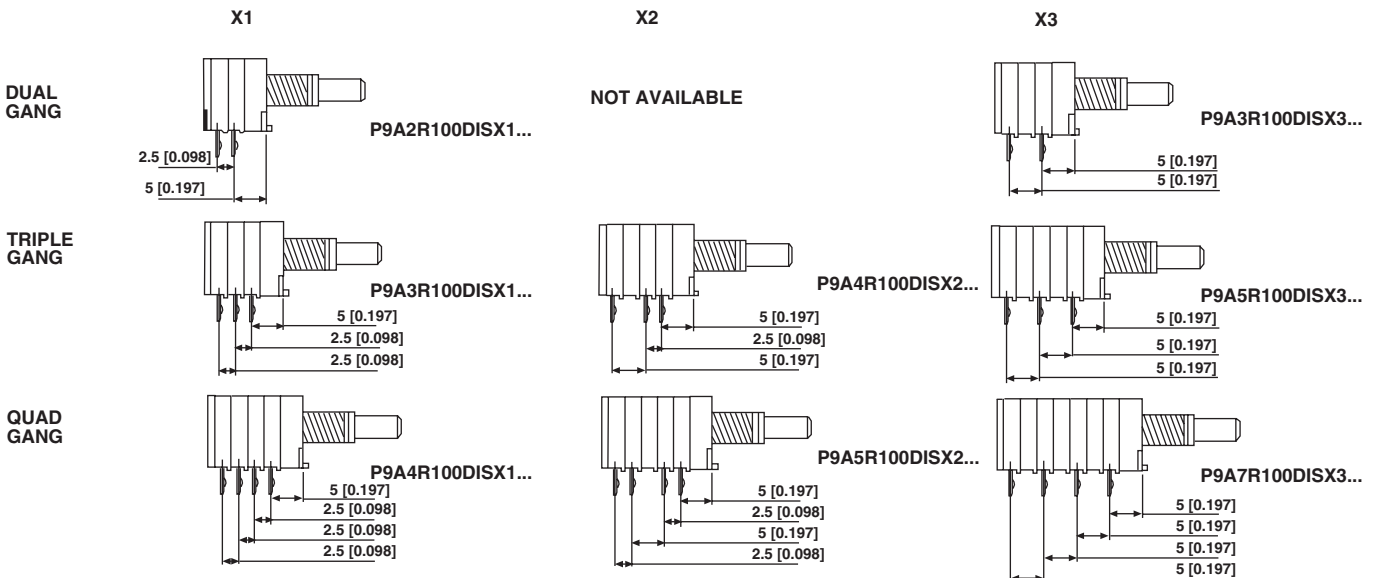


VERSATILE	MODULAR	ULTRA-COMPACT	ROBUST
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DIMENSIONS in millimeters [inches] - General tolerance: ± 0.5 mm **Note:** Shaft is shown in mid-travel

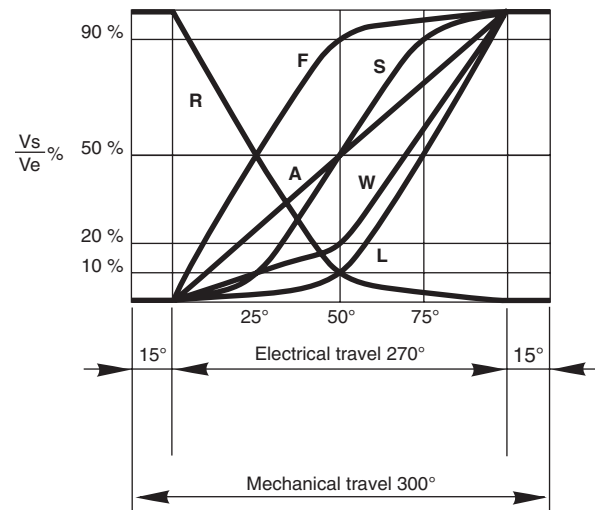


MOST COMMON PINS STYLES - OTHERS AVAILABLE ON REQUEST



ELECTRICAL SPECIFICATIONS		
Resistive Element		Conductive Plastic
Electrical Travel		270° ± 10°
Resistance Range	Linear Law	1 kΩ up to 1 MΩ
	Non-Linear Law	2K2 up to 500 kΩ
Tolerance	Standard	± 20 %
	On request	± 10 %
Power Rating at 70 °C	Linear Law	0.1 W
	Non linear Law	0.05 W
	Multiple assemblies Linear Law	0.05 W per module
	Multiple assemblies Non linear Law	0.025 W per module
Temperature Coefficient (typical)		± 500 ppm
Limiting Element Voltage		10 V (DC) 50 V (AC)
End Resistance (typical)		3 Ω
Contact Resistance Variation	Linear Law (typical)	2 % of nominal resistance
Independent Linearity (typical) Linear Law		± 5 %
Insulation Resistance		100 MΩ at 250 VDC
Dielectric Strength		300 V _{AC} during 1 min
Attenuation (typical)		90 dB max/0.05 dB min

MECHANICAL SPECIFICATIONS P9A	
Mechanical Travel	300 ± 5°
Mechanical Rotational Life	25 000 cycles
Operating Torque	0.2 N.cm up to 2.5 N.cm (0.3 to 3.5 oz inch)
End Stop Torque	50 N.cm (4.4 lb inch)
Nut Tightening Torque for M7 Bushing	120 N.cm max. (10.6 lb inch max.)
Shaft Push/Pull Force	7 DaN max. (15.7 lb f. max.)
Weight (one module)	6.25 g, 0.22 oz (without nut and washer)

VARIATION LAWS




ENVIRONMENTAL SPECIFICATIONS	
TEMPERATURE RANGE	- 55 °C up to + 100 °C
CLIMATIC CATEGORY	55/100/21

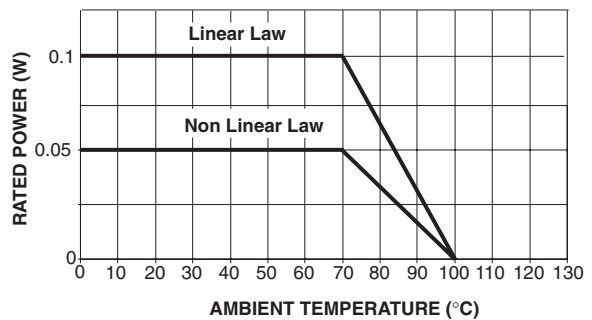
AVAILABLE OPTIONS

- Custom shafts or design on request
- Bushing with or without locating PEG (with as a standard at 6 o' clock position)
- Spacer module(s) to increase the distance between rows of pins (by step of 2.5 mm - 3 spacers max)
- Center tap
- Specific linearity/interlinearity on request

MARKING

- Type of element: A-conductive plastic
- Code for tolerance
- Code for ohmic value
- Taper
- Code for date code

POWER RATING CHART



PERFORMANCES				
TESTS	CONDITIONS	TYPICAL VALUE AND DRIFTS		
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	OTHER
Load Life	1000 hours under nominal power at 70 °C (90 on/30 off)	± 5 %	± 10 %	Contact resistance variation < 5 % Rn
Temperature Cycle	- 55 °C to + 100 °C 5 cycles	± 0.5 %	-	-
Moisture	21 days at 40 ± 2 °C and 90 - 95 % relative humidity	± 5 %	-	Insulation resistance > 10 MΩ
Rotational Life	25 000 cycles	± 6 %	± 12 %	Contact resistance variation < 2 % Rn
Shock	50 g 11 ms 3 shocks - 3 directions	± 0.2 %	± 0.5 %	-
Vibration	10 - 55 Hz 0.75 mm or 10 g 6 hours	± 0.2 %	-	$\frac{\Delta V_{1-2}}{V_{1-2}} \leq \pm 0.5 \%$

SHAFT STYLES													
DIAMETER (mm)	L (mm)	15			20			25			30		
	STYLE	ROUND	SLOTTED	FLAT	ROUND	SLOTTED	FLAT	ROUND	SLOTTED	FLAT	ROUND	SLOTTED	FLAT
	3.5	DFR	DFS	DFF	DIR	DIS	DIF	DLR	DLS	DLF	DMR	DMS	DMF
6	FFR	FFS	FFF	FIR	FIS	FIF	FLR	FLS	FLF	FMR	FMS	FMF	

Note: The grey shaded cells show the most common dimensions.

ORDERING INFORMATION										
P9	A	1	R	0	0	0	DIR	X1	470MA	e3
MODEL	STYLE	NUMBER OF MODULE	BUSHING	LOCATION PEG	SEALING	DETENT	SHAFTS	PIN STYLE	RESISTANCE CODE/TOL/TAPER OR SPECIAL	LEAD FINISH
General term for 9 mm potentiometer	A = Conductive Plastic element	1 = one module 2 = two modules 3 = three modules 4 = four modules 5 = five modules 6 = six modules 7 = seven modules	R = M7 x 0.75 Length = 7 mm X = M7 x 0.75 Length = 5 mm	1 = with 0 = without	0 = without	0 = without center detent	Dimensions Shafts: Standard shafts = See above (Example DI) Custom shafts = AP Style: R = Round S = Slotted F = Flat K = Knurled	X1 = PC pins for horizontal mounting (2.5 mm between gangs) X2 = PC pins for horizontal mounting (2.5 - 5 - 2.5 mm between gangs) X3 = PC pins for horizontal mounting (5 mm between gangs) W1 = PC pins for vertical mounting (only for one module potentiometer)	Given by VISHAY to determine ohmic value, tolerance, taper, custom design, etc OR Resistance code (see table below) in case of unique value, tolerance and taper for all modules	e3: pure Sn
								Note: pitch between pins = 2.5 mm (0.1 inch)		

SAP PART NUMBERING GUIDELINES																	
P	9	A	1	R	0	0	0	D	I	R	X	1	4	7	0	M	A
MODEL		STYLE	NO. OF MODULES	BUSHING LOCATING PEG	SEALING OPTION	DETENT OPTION	SHAFT			PIN STYLE		OHMIC VALUE/TOL/LAW OR SPECIAL					
See the end of this data book for conversion tables																	

Modular Potentiometers with Cermet (P11) or Conductive Plastic Elements (PA11)



FEATURES

- CECC 41300
- GAM T1
- P11 version for industrial and military applications
- PA11 version for professional audio applications
- Trimmer version T11/TA11 (see document No. 51021)
- Miniature module size: 12.5 mm square - low current compatibility
- Five shaft diameters and 12 terminal styles
- Multiple assemblies - up to seven modules
- Shaft and panel sealed version
- Up to twenty-one indent positions
- Switch modules
- Concentric shafts
- Motorized version
- Custom designs



VERSATILE	MODULAR	COMPACT	ROBUST
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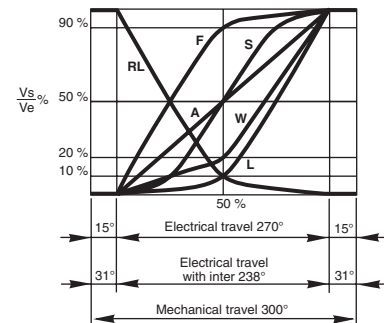
ELECTRICAL SPECIFICATIONS			PA11	P11
Resistive Element			Conductive plastic	Cermet
Electrical Travel			270° ± 10°	270° ± 10°
Resistance Range*	Linear Law		1 kΩ to 1 MΩ	10 Ω to 10 MΩ
	Non Linear Law		470 Ω to 500 kΩ	100 Ω to 2.2 MΩ
Tolerance	Standard		± 20 %	± 20 %
	On request		-	± 5 % or ± 10 %
Power Rating	Linear Law		0.5 W at + 70 °C	1 W at + 70 °C
	Non linear Laws		0.25 W at + 70 °C	0.5 W at + 70 °C
	Multiple Assemblies		0.25 W at + 70 °C per module	0.5 W at + 70 °C per module
Temperature Coefficient (Typical)			± 500 ppm/°C	± 100 ppm/°C (R ≥ 100 Ω)
Limiting Element Voltage			350 V	350 V
Contact Resistance Variation	Linear Law		1 %	2 % or 3 Ω
End Resistance (Typical)			2 Ω	2 Ω
Independent Linearity (Typical)	Linear Law		± 5 %	± 5 %
Insulation Resistance			10 ⁶ MΩ min.	10 ⁶ MΩ min.
Dielectric Strength			1500 V _{RMS} min.	1500 V _{RMS} min.
Attenuation			90 dB max. and 0.05 dB min.	-
Mechanical Rotational Life			50 000 cycles	50 000 cycles

* Consult Vishay Sfernice for other ohmic values

MECHANICAL SPECIFICATIONS PA11 AND P11

- Mechanical Travel:** 300° ± 5°
- Operating Torque, Single and Dual Assemblies:**
- 3 mm, 4 mm (1/8") dia. Shafts: 0.5 to 1.3 Ncm max. (0.7 to 1.8 oz-inch max.)
 - 6 mm (1/4") dia. Shafts: 0.7 to 1.5 Ncm max. (1 to 2.1 oz-inch max.)
- Three to Seven Modules (per module):** 0.2 to 0.3 Ncm max. (0.3 to 0.45 oz-inch max.)
- End Stop Torque:**
- 3 mm, 4 mm (1/8") dia. Shafts: 25 Ncm max. (2.1 lb-inch max.)
 - 6 mm (1/4") dia. Shafts: 80 Ncm max. (6.8 lb-inch max.)
- Tightening Torque:**
- 6 mm, 7 mm (1/4") dia. bushings: 150 Ncm max. (13 lb-inch max.)
 - 10 mm (3/8") dia. bushings: 250 Ncm max. (21 lb-inch max.)
- Weight:** 7 g to 9 g per module (0.25 to 0.32 oz)

VARIATION LAWS



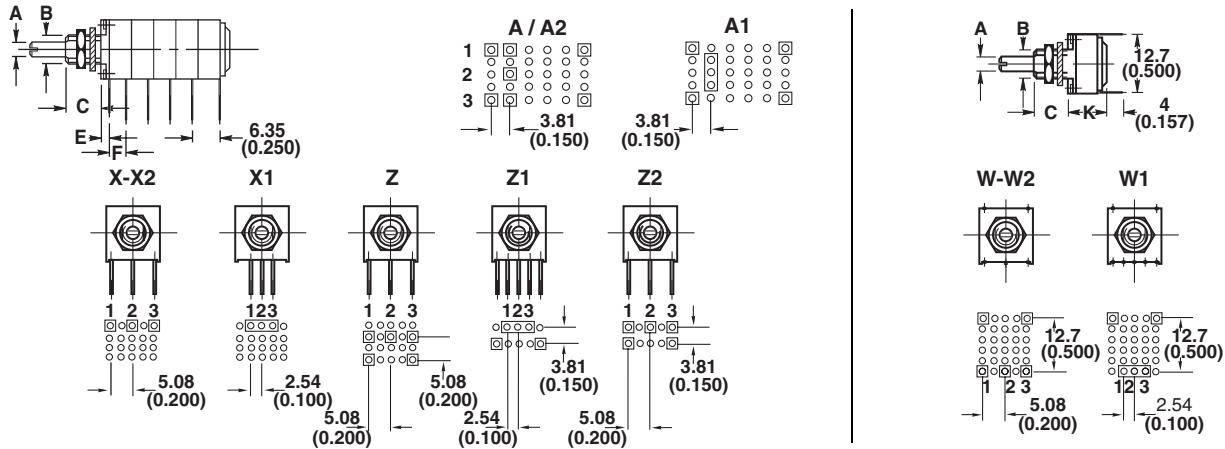


**Modular Potentiometers with Cermet (P11) or
Conductive Plastic Elements (PA11)**

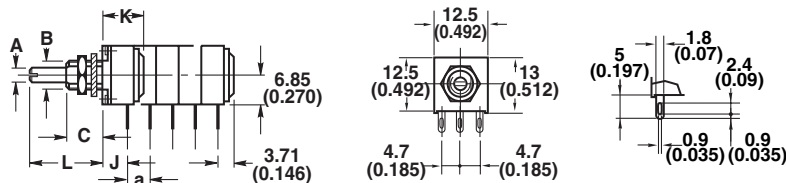
Vishay Sfernice

DIMENSIONS in millimeters [inches]

PCB PIN OUT A - A₁ - A₂/X - X₁ - X₂/Z - Z₁ - Z₂/W - W₁ - W₂

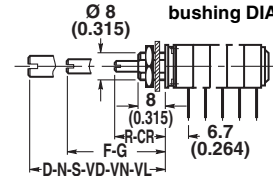


SOLDER LUGS Y

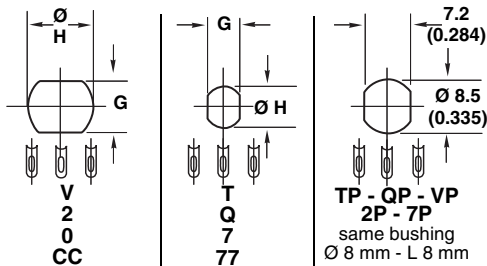


**PANEL AND SHAFT SEALED
TP/QP/VP/2P/7P**

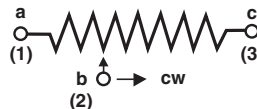
All models have to same bushing DIA 8 mm - L 8 mm



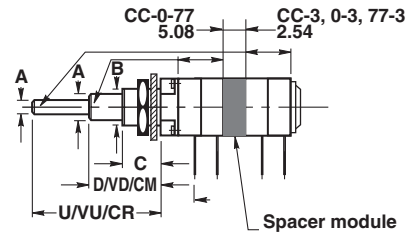
PANEL CUT OUT



CIRCUIT DIAGRAM

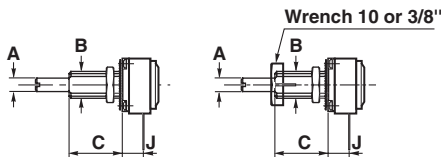


CONCENTRIC SHAFT

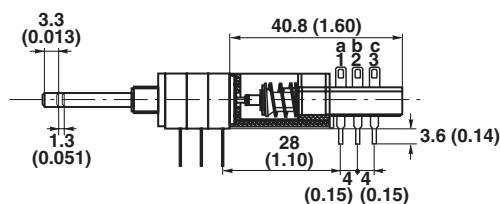


The position of each module is free

P11/PA11 71 **P11/PA11 71H**
P11/PA11 72 **P11/PA11 72H with spindle baking nut**



SWITCH: MOMENTARY PUSH OR PUSH-PUSH



Shafts	T	Q	V	CC	7	71	72	2	0	77		
	dimensions mm ± 0.5					dimensions inches ± (0.01)						
A Shafts Ø	3	4	6	3/6	1/8"	1/8"	1/8"	1/4"	1/8"	1/4"	0.07	1/8"
B Bushing Ø	6	7	10	10	1/4"	1/4"	1/4"	3/8"	3/8"	1/4"		
C L	8	8	9.5	9.5	1/4"	3/8"	1/2"	3/8"	3/8"	1/4"		
J version Y, X, X ₁ , X ₂	5	5	7	7	0.200	0.200	0.200	0.278	0.278	0.200		
K	9.1	9.1	11.1	-	0.357	0.357	0.357	0.436	-	-		
E version Z	1.8	1.8	3.8	3.8	0.071	0.071	0.071	0.150	0.150	0.071		
E version	1.6	1.6	3.6	3.6	0.063	0.063	0.063	0.14	0.14	0.063		
F	version Z : 5.08 (0.200)				versions A- A ₁ -A ₂ -Z ₁ -Z ₂ : 3.81 (0.150)							
G Panel	5.2	6.2	8.2	8.2	0.197	0.197	0.197	0.323	.323	0.197		
H Cutout Ø	6.5	7.5	10.5	10.5	0.268	0.268	0.268	0.394	0.394	0.268		
a	variable	5.08 (0.200)			7.62 (0.300)			10.16 (0.400)				
Thread	M 0.75				32 threads/inch							
Nut	8	10	12	12	0.313	0.313	0.313	0.500	0.500	0.313		
Shaft lengths L	Measurement from the mounting face, see ordering procedures											

P11, PA11



Vishay Sfernice

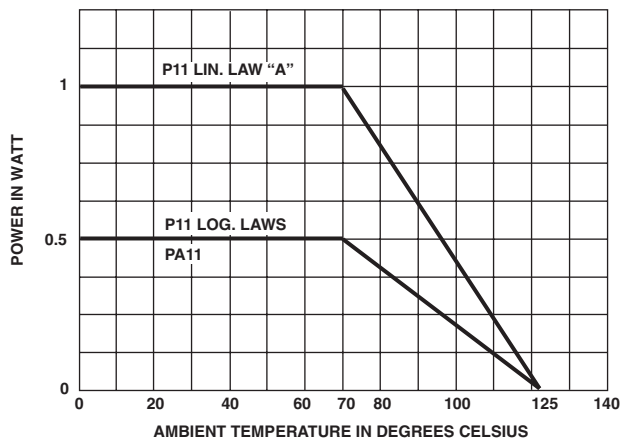
Modular Potentiometers with Cermet (P11) or
Conductive Plastic Elements (PA11)

ENVIRONMENTAL SPECIFICATIONS

	PA11	P11
Operating Temperature Range	- 55 °C + 125 °C	- 55 °C + 125 °C
Climatic Category	55/125/21	55/125/56
Sealing	IP64	IP64
Storage Temperature	- 55 °C + 125 °C	- 55 °C + 150 °C

STANDARD RESISTANCE ELEMENT DATA											
STANDARD RESISTANCE VALUES	P11 CERMET						PA11 CONDUCTIVE PLASTIC LINEAR LAW			TCR	
	LINEAR LAW			NON LINEAR LAW			MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	- 55 °C	+ 125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER				P11	PA11
Ω	W	V	mA	W	V	mA	W	V	mA	ppm/°C	
22 47	1	4.69 6.85	213.2 145.8							± 200	
100 200 470 1K 2.2K 4.7K 10K 22K 47K 100K 220K 470K 1M 2.2M 4.7M	↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	10 14.8 21.6 31.6 46.9 63.5 100 148.3 216.7 316.2 350 350 350 350 350	100 67.4 46.1 31.6 21.3 14.5 10 6.7 4.6 3.16 1.59 0.75 0.35 0.16 0.07	0.5 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	15.3 22.4 33.2 48.5 79.7 105 153 224 332 350 350	32.7 22.4 15.1 10.3 7.07 4.77 3.26 2.24 1.51 0.74 0.35	0.5 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	22.4 33.2 48.5 79.7 105 153 224 332 350	22.4 15.1 10.3 7.07 4.77 3.26 2.24 1.51 0.74	± 100	± 1000

POWER RATING CHART



MULTIPLE ASSEMBLIES

Standard assemblies can comprise up to 7 modules in addition to the shaft and bushing module.

Detents module (CV)

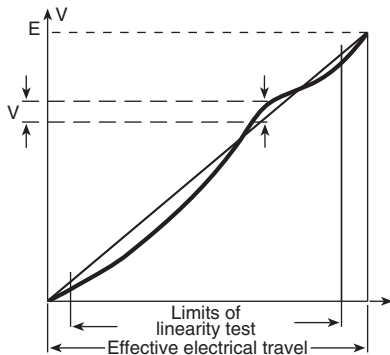
Switch modules (RS or RSI)

Potentiometer modules

Spacer module (EV) to increase the distance between rows of pins from 5.06 mm (0.200) to 10.16 mm (0.400).

Screening module, with ground terminal.

The position of each module is free except the push/push, momentary push and motor which has to be the last module.

LINEARITY - CONFORMITY


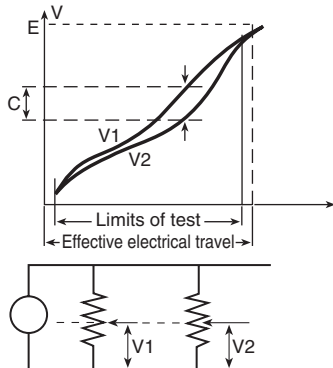
The independent linearity (conformity for the non linear laws) is the maximum gap ΔV between the actual variation curve and the theoretical variation curve the nearest to it. The linearity and the conformity are expressed in percentage of the total applied voltage E

$$\text{linearity conformity} = \frac{\pm \Delta V \text{ max}}{E}$$

They are measured over 90 % of actual electrical travel (centered).

On request linearity can be guaranteed in linear law.

For example: linearity $\pm 2\%$ + J 145 option (see ordering procedure).

INTERLINEARITY - INTERCONFORMITY


It is the maximum deviation between the actual voltage outputs of 2 or more pot modules in the same assembly. It is expressed as a percentage of the total applied voltage, or preferably in dB attenuation.

Interlinearity is measured between 2 pot modules, over 10 to 90 % of the attenuation.

The interlinearity or interconformity is expressed as a percentage of the total applied voltage :

$$I\% = \frac{|C|}{E}$$

Or in decibels by comparison between outputs V_1 and V_2

$$I \text{ dB} = 20 \log \frac{V_1}{V_2}$$

PERFORMANCE				
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS		
			P11 CERMET	PA11 CONDUCTIVE PLASTIC
Load Life	1000 h at + 70 °C (90'/30')	total resistance shift	$\pm 2\%$	$\pm 10\%$
		contact resistance variation	$\pm 4\%$	$\pm 5\%$
Temperature Cycle	5 cycles - 55 °C to 125 °C	total resistance shift	$\pm 0.2\%$	$\pm 0.5\%$ typical
Moisture	+ 40 °C 93 % relative humidity	total resistance shift insulation resistance	56 days $\pm 2\%$ > 1000 M Ω	21 days $\pm 5\%$ > 10 M Ω
Rotational Life	P11/PA11: 50 000 cycles	total resistance shift contact resistance variation	$\pm 5\%$ $\pm 5\%$	$\pm 6\%$ $\pm 2\%$
Climatic Sequence	Dry heat at + 125 °C/Damp heat Cold - 55 °C/Damp Heat 5 cycles	total resistance shift	$\pm 1\%$	-
Shock	50 G 11 ms 3 shocks - 3 directions	total resistance shift resistance setting change	$\pm 0.2\%$ $\pm 0.5\%$	$\pm 0.2\%$ $\pm 0.5\%$ typical
Vibration	10 - 55 Hz 0.75 mm or 10 G 6 hours	total resistance shift voltage setting change	$\pm 0.2\%$ $\pm 0.5\%$ typical	$\pm 0.2\%$ $\pm 0.5\%$ typical

OPTIONS MODULES : RS ON/OFF SWITCH RSI CHANGEOVER SWITCH

The position of each module is free.

RS and RSI rotary switches are housed in a standard P11 module size 12.7 x 12.7 x 5.08 mm (0.5" x 0.5" x 0.2"). They have the same terminal styles as the assembled electrical modules.

CAUTION: Because of the switch actuation travel, the potentiometer total electrical travel is reduced to $240^\circ \pm 10^\circ$

Switch actuation is described as seen from the shaft end.
D: means actuation in maximum CCW position
F: means actuation in maximum CW position
The switch actuation travel is 25° with a total mechanical travel of $300^\circ \pm 5^\circ$.

MODULES : PUSH/PUSH SWITCH RSPP MOMENTARY/PUSH SWITCH RSMP

The switches are manufactured by ITT, F.U. series (NE18 series available on request).

They have to be the last element of potentiometer and are linked to electrical module by an interface.

RSPP and RSMP switches are available only with P11/PA11 T-Q or 7 series not with P11/PA11 V or 2 series.

Options :

2 reversing switches F2 4 reversing switches F4
6 reversing switches F6 8 reversing switches F8
Available with shafts R (T), G (Q), CR (7) others shafts on request.

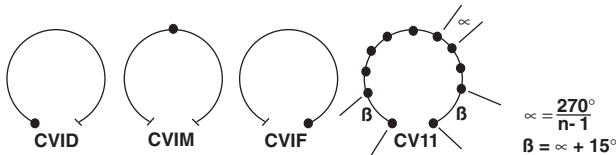
Not available with panel sealed option.

Number of modules before the switch limited to 3 modules.

VALLEY DETENTS

The valley detents mechanism is housed in a standard P11 module. Up to 21 detents position available.
Count detents as follows : 1 for CCW position, 1 for full CW position, plus the other positions forming **equal resistance increments** (linear taper) - **not equal angles**.

Available now : CVID - CVIF - CVIM
CV3 - CV11 - CV21



SWITCH MODULES

RSD SINGLE POLE SWITCH, NORMALLY OPEN

In full CCW position, the contact between 1 and 3 is open. It is made at the beginning of the travel in CW direction.

RSF SINGLE POLE SWITCH, NORMALLY OPEN

In full CW position, the contact between 1 and 3 is open. It is made at the beginning of the travel in CCW direction.

RSID SINGLE POLE CHANGEOVER

In full CCW position, the contact is made between 3 and 2 and open between 3 and 1. Switch actuation (CW direction) reverses these positions.

RSIF SINGLE POLE CHANGEOVER

In full CW position, the contact is made between 1 and 2 and open between 1 and 3. Switch actuation (CCW direction) reverses these positions.

RSPP F2 : PUSH/PUSH SWITCH WITH TWO REVERSING SWITCHES

Idle position : the contact is made between 1 and 2 and a and b. It is open between 2 and 3 and b and c.

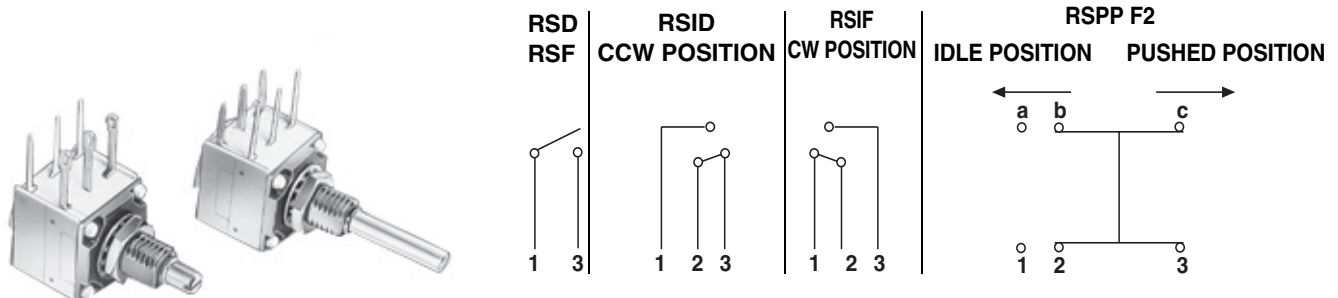
Pushed position: the contact is made between 2 and 3 and b and c. It is open between 1 and 2 and a and b.

Not available on P11V and P11-2.

On request for P11Q and P11-7.

SWITCH SPECIFICATIONS		
MODEL	RS - RSI	F2 to F8
Switching Power max.	62.5 VA \cup 15 VA =	50 VA \cup
Switching Current max.	0.25 A 250 V \cup 0.5 A 30 V =	0.5 A \cup
Max. Current Through Element	2 A	2 A
Contact Resistance	30 m Ω	100 m Ω
Dielectric Strength	Terminal to Terminal	1000 V _{RMS}
	Terminal to Bushing	2000 V _{RMS}
Max. Voltage Operation	250 V \cup 30 V =	250 V \cup
Insulation Resistance Between Contacts	10 ⁶ M Ω	10 ³ M Ω
Life at P max.	10 000 actuations	100 000 actuations
Minimal Travel	25 $^\circ$	3.3 mm to 4.7 mm
Operating Temperature	- 40 $^\circ$ C to + 85 $^\circ$ C	- 20 $^\circ$ C + 70 $^\circ$ C

ELECTRICAL DIAGRAM

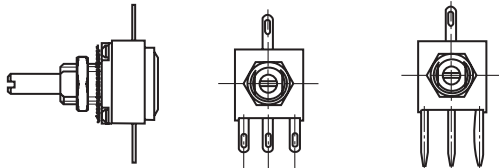




CENTER TAP "J"

The extra terminal is a solder lug connected at 50 % of electrical travel and situated in the potentiometer module opposite the terminals.

Center tap short circuit 11° of travel.



SHAFTS (see Ordering Information)

The shaft lengths are always measured from the mounting face.

Standard shafts are designed by a letter code (one or two digits). Shafts slots are aligned to ± 10° of the wiper position.

CONCENTRIC SHAFTS

The CC or 0 or 77 concentric shaft versions allies the total flexibility of the P11/PA11 modular system to the advantage of having two separate shafts.

The outer 6 mm or 1/4" or 1/8" dia. shaft drives the modules situated immediately behind the panel, before the spacer module.

The inner 3 mm or 1/8" or 0.07" dia. shaft drives the modules situated after the spacer module.

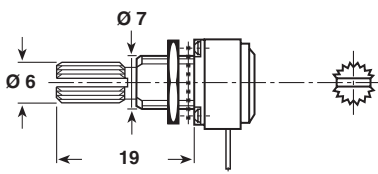
Spacer is available with a choice of two spacer thickness :
5.08 mm designations: CC, 0, 77

2.54 mm designations: CC-3, 0-3, and 77-3. See dimensional drawings on second page of this data sheet

CUSTOM SHAFTS

When special shafts are required - flat, threaded ends, special shaft lengths, etc. a drawing is required.

SPLINED SHAFT "I"



FLATTED SHAFT

PA11/P11 - 2 = VHM

PA11/P11 - 7 = CDM

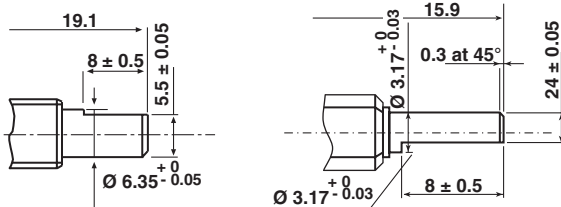


Fig. 9

NEUTRAL MODULE "EN"

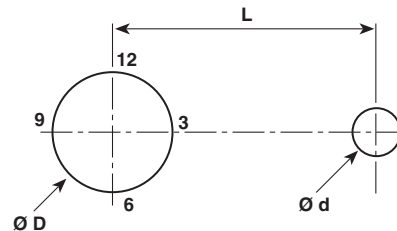
Neutral or screen module is housed in a standard P11 module. It is used as a screen between two electrical modules.

The leads can be connected to ground.

LOCATING PEGS (Anti-rotation lugs)

The locating peg is provided by a plate mounted on the bushing and positioned by the module sides. Four set positions are available, clock face orientation: 12, 3, 6, 9.

All P11 bushings have a double flat. When panel mounting holes have been punched accordingly, an anti-rotation log is not necessary.



CODE	P11 - PA11					EFFECTIVE HIGH PEG
	VERSION	T-7	V-CC	Q	2-0	
B24	Ø D mm	6.5	10.5	7.5	10	0.7
	Ø d mm	2	2	2	2	
	L mm	6.2	6.2	6.2	6.2	
B30	Ø d mm	2	2	2	2	0.7
	L mm	7.75	7.75	7.75	7.75	
B53	Ø d mm	-	3.5	-	3.5	1.1
	L mm	-	13.5	-	13.5	

TRIMMERS T11

See data sheet document No. 51021

MARKING

POTENTIOMETER MODULE

VISHAY logo, nominal ohmic value (Ω, kΩ, MΩ), two stars identify PA11 version, tolerance in % - variation law, manufacturing date (four digits), "3" for the lead 3.

SWITCH MODULE

Version, manufacturing date (four digits), "c" for common lead.

INDENT MODULE

Version, manufacturing date (four digits).

P11, PA11

Vishay Sfernice

Modular Potentiometers with Cermet (P11) or Conductive Plastic Elements (PA11)



ORDERING INFORMATION

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">P11 Cermet element</td> <td style="width: 50%;">PA11 Conductive plastic element</td> </tr> <tr> <td colspan="2" style="text-align: center;">SERIES</td> </tr> </table>	P11 Cermet element	PA11 Conductive plastic element	SERIES		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Y Solder lugs - radial 4.70 mm (.200") pin spacing</td> <td style="width: 50%;">B24 Distance from shaft center of 6.2 mm (.244") for all models. Plate thickness of 0.4 mm (.015").</td> </tr> <tr> <td>X PCB pins - radial</td> <td>B30 Distance from shaft center of 7.75 mm (.305") for all models. Plate thickness of 0.4 mm (.015").</td> </tr> <tr> <td>Z PCB pins - radial with front support plate</td> <td>B53 Distance from shaft center of 13.5 mm (.531") for V, 2, CC and O models. 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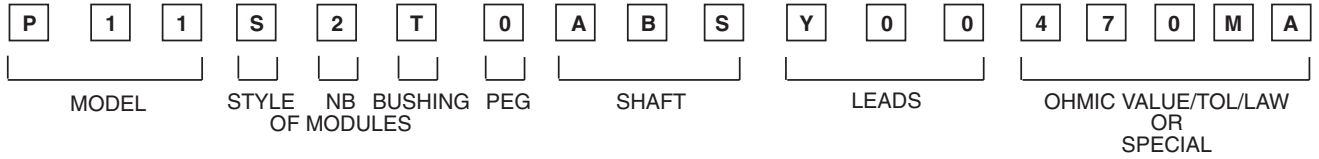
SHAFT AND BUSHING MODULE	OPTION INDENTS MODULE	OPTION SWITCH MODULE	1st POTENTIOMETER MODULE	2nd POTENTIOMETER MODULE	3rd POTENTIOMETER MODULE
PA11 7 X13 or B24 P	CR CV1M	RSD	100 k 20 % A J84	10 k 20 % A J + J84	100 k
Panel and shaft sealed					
Concentric shafts					
Locating peg					
SHAFT AND BUSHING MODULE					
PA11 7 X13 or B24 P	CR CV1M	RSD	100 k 20 % A J84	10 k 20 % A J + J84	100 k

OPTION INDENT MODULE	OPTION SWITCH MODULE	OHMIC VALUE	VARIATION LAW	OPTIONS
CV1M 1 indent at half travel	RSD Single pole open switch in CCW position - 2 pins	Quote clearly multipliers K - M	A Linear	J Center tap
CV1D 1 indent CCW position	RSF Single pole open switch in CW position - 2 pins	10 Ω to 10 MΩ A linear law - cermet	L CW log 10 %	J41 Panel sealed bushing 10 mm dia.
CV1F 1 indent CW position	RSID Single pole chargeover switch in CCW position - 3pins	100 Ω to 2.2 MΩ L, F, S non linear laws -cermet	F CW reverse log	J44 Interlinearity ± 2 % (linear law)
CV3 3 indents inc. CW & CCW	RSIF Single pole chargeover switch in CW position - 3 pins	Conductive plastic 1 kΩ to 1MΩ A linear law	S Audio S shape symmetrical log	J84 Accuracy of center point of CV1M to ± 2 % (except S law)
- -		470 Ω to 500 kΩ non-linear laws	W CW log 20 %	J123 Linearity ± 3 % (linear law)
- -			RL CCW log	J145 Linearity ± 2 % (linear law)
CV11 11 indents				J152 Marking part number
- -				EN Empty module with screen
- -				EV Spacer module without pin
- -				M Motorized assembly
CV21 21 indents etc.				RSPP Push Push switch
Former CRN version (N-1 equal mechanical angles) available on request.	An assembly can comprise 1 or more switch modules. Pin out RS and RSI is the print out as other assembled modules.			RSMP Momentary Push switch
				Servo Electrical travel 300°

TOLERANCE	
± 20 %	Standard
± 10 %	Optional
± 5 %	Optional (cermet only)

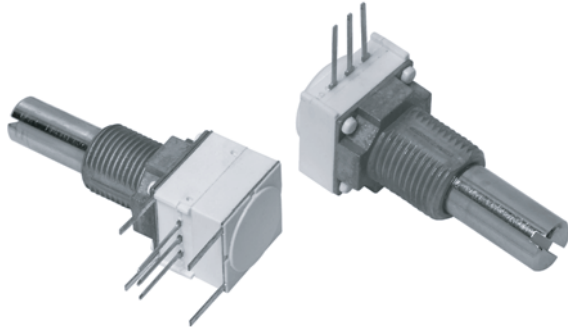


SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

1/2" (12.7 mm) Conductive Plastic and Cermet Potentiometers



148 FEATURES

- Conductive plastic element
- High rotational life (50 000 cycles)
- Quiet electrical output
- Robust construction

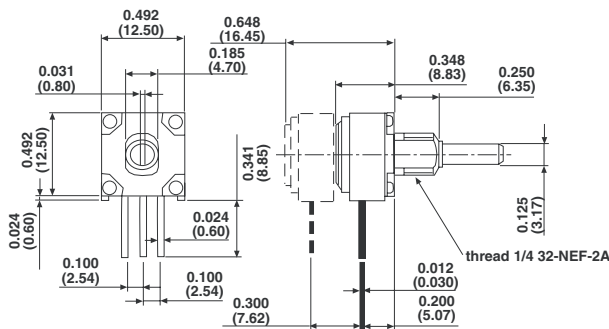


149 FEATURES

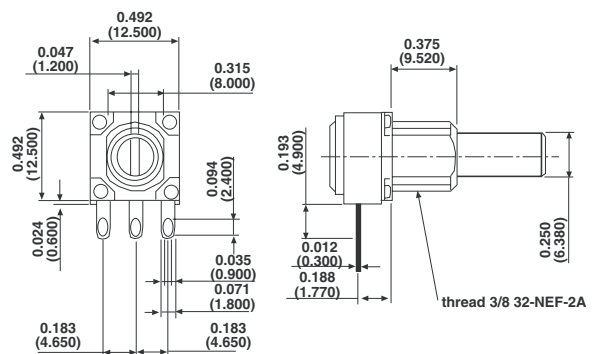
- Cermet element
- Low temperature coefficient (± 150 ppm/ $^{\circ}$ C)
- Robust construction

DIMENSIONS in inches (millimeters)

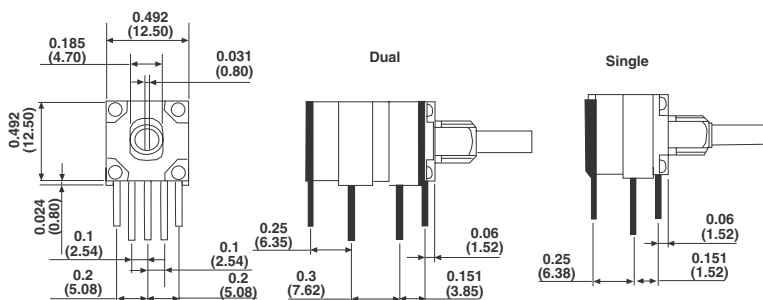
SINGLE, DUAL OR TRIPLE



SOLDER LUG TERMINALS



FRONT AND REAR SUPPORT PLATES
E = Flush with board surface



Tolerances unless otherwise specified ± 0.5

MOUNTING ACCESSORIES: PRODUCT IS SUPPLIED WITH A NUT & WASHER

OPTIONAL FEATURES

Up to three sections PC support plates
Rotary switches, detents, Solder lugs terminals

CONSTRUCTION MATERIALS

Housing - Molded thermoplastic white
Shaft - Brass, nickel plated



ELECTRICAL SPECIFICATIONS		
PARAMETER	148	149
Resistance Range	1 k Ω to 1 M Ω linear 500 Ω to 500 k Ω non-linear	100 Ω to 2.0 M Ω linear 250 Ω to 1 M Ω non-linear
Resistance Tolerance Linear Non-Linear	Standard $\pm 10\%$ to 500K, $\pm 20\%$ over 500K Standard $\pm 10\%$ to 100K, $\pm 20\%$ over 100K	
Taper Tolerance	20 % of the Nominal R at 50 % mechanical rotation	
Linearity (Typical)	$\pm 5\%$ Independent	
End Resistance	4 Ω maximum each end	
Power Rating	0.5 watts at 70 $^{\circ}$ C 0 watts at 120 $^{\circ}$ C	1 watt at 70 $^{\circ}$ C 0 watt at 150 $^{\circ}$ C
	Non-Linear or PC mount, derate 50 %	
Effective Rotation	270 $^{\circ}$ \pm 10 $^{\circ}$ without rotary switch 240 $^{\circ}$ \pm 10 $^{\circ}$ with rotary switch	
Contact Resistance Variation	1.5 % of total resistance	3 % of total resistance
Maximum Continuous Working Voltage	350 VAC across end terminals, but within power rating	
Dielectric Withstanding Voltage	Sea Level - 750 VAC 70 000 feet - 350 VAC	
Switch Specifications	Rotary (AL) switch: S.P.S.T and S.P.D.T 125 mA, 28 VDC CCW or CW, rotational life 10 000 cycles (rated load)	

MECHANICAL SPECIFICATIONS	
Mechanical Rotation	300 $^{\circ}$ \pm 5 $^{\circ}$
Torque	
Operating	Single section 0.2 to 3.0 oz - in Dual or triple section 0.3 to 4.5 oz - in
Center Detent	0.6 to 3.0 oz - in
Stop Strength	3 in - lbs min
Weight (approx)	
Single	0.19 oz
Dual	0.27 oz
Triple	0.35 oz

ENVIRONMENTAL SPECIFICATIONS		
	148	149
Operating Temperature	- 40 $^{\circ}$ C to + 120 $^{\circ}$ C	- 40 $^{\circ}$ C to + 150 $^{\circ}$ C
Storage Temperature	- 55 $^{\circ}$ C to + 120 $^{\circ}$ C	- 55 $^{\circ}$ C to + 150 $^{\circ}$ C
Temperature Cycling (5 Cycles)	- 40 $^{\circ}$ C to + 120 $^{\circ}$ C (4 % Δ Rt)	- 40 $^{\circ}$ C to + 150 $^{\circ}$ C (3 % Δ Rt)
Load Life (1000 hrs. Rated Load at 70 $^{\circ}$ C)	10 % Δ Rt	5 % Δ Rt
Rotational Load Life	50 000 cycles	25 000 cycles
TCR	± 1000 ppm/ $^{\circ}$ C	± 150 ppm/ $^{\circ}$ C



MARKING

Unit Identification: Ink stamp on periphery

ORDERING INFORMATION									
148 MODEL	S NUMBER OF SECTIONS	X MECHANICAL CONFIGURATION	G METRIC BUSHING SIZE & SHAFT	56 SHAFT LENGTH	S SHAFT STYLE	103 RESISTANCE CODE Ω	S TAPER	P TERMINAL CONFIGURATION	e3 LEAD FINISH
FROM THE MOUNTING SURFACE									
148 CP 149 Cer	S: Single D: Duals T: Triple	X: None (single shaft D, T sections) S: Single w/rotary switch P: Dual w/rotary switch	N: 1/4 Dia x 1/4 L J: 1/4 Dia x 3/8 L Shaft, 1/8 Dia G: 3/8 Dia x 3/8 L Shaft, 1/4 Dia	Shaft length code 32: 1/2 in 40: 5/8 in 48: 3/4 in 56: 7/8 in 64: 1 in 80: 1 1/4 in	S: Slotted F: Flatted P: Plain slotted in std. on request F and P	EIA code - first 2 significant digits 3rd is number of zeros 100 10K 500K 250 20K 750K 500 25K 1M 750 50K 2M 1K 75K 2.5K 100K 5K 250K	S: Linear ± 10 % Z: CW Log. ± 10 % to 500 kΩ ± 20 % over 500 kΩ R: CCW Log. ± 10 % to 500 kΩ ± 20 % over 500 kΩ	P: PC, 0.250 E: PC terminals with E support plate S: Solder lugs	e3: Pure Sn

SAP PART NUMBERING GUIDELINES																		
1	4	8	1	0	F	0	G	J	S	X	1	0	1	0	3	K	A	
MODEL			NB OF MOD.		SWITCH	BUSHING	LOCATING PEG		SHAFT			LEADS			OHMIC VALUE/TOL/LAW OR SPECIAL			
See the end of this data book for conversion tables																		



Panel Potentiometers

Industrial
•
Professional and Military



Model Numbers

P10.....	108
248, 249.....	111
P12.....	113
P13.....	117
PRV4.....	121
PRV6, PARV6.....	124
P16, PA16.....	127
PE30	131
PE60	134
Special Designs	137

Panel Potentiometers

SERIES	MECHANICAL TRAVEL	STYLE	APPLICATIONS	QUALIFIED STYLES AND/OR CONFORM	MIL NF CECC	SHAFT	BUSH	SHAFT LENGTH ⁽¹⁾	DIMENSIONS in millimeters [inches]			
P10 cermet	290°	X	Industrial			3	6	R: 20 D: 16	9.7 x 9.6 x 5.2			
		Y										
248 conductive plastic	295°		Industrial			1/4" 1/8"	1/4" 3/8"	3/4" 7/8"	12.7 x 12.7 [1/2" x 1/2"]			
249 cermet												
P12 cermet	300°	T	Professional and military			3	6	K: 19.5 M: 12.5 R: 22	12 x 12 x 10.2			
		Q						E: 19.5 F: 12.5 G: 22				
		H						L: 12.5				
P13 cermet	300°	T	Professional and military	P13T PC32 A		with spindle locking nut	3	6	K: 19.5 M: 12.5 R: 22			
		H							L: 12.5			
		Q							P13Q B	4	7	E: 9.5 F: 12.5 G: 22
		V							P13V PC33 C	6	10	AC: 16 AM: 25 AL: 50
PRV4 cermet	300°	L	Industrial			6.35	9.52	GBS: 1/2" GJS: 7/8" GRS: 2"	Ø 19.6 H 12			
		F										
PARV6 conductive plastic	300°		Professional and industrial	PRV6 MIL-R-94 RV6		1/8"	1/4"	CR: 7/8" CD: 5/8" CM: 1/2" CK: 3/8	Ø 12 H 9.5			
PRV6 cermet												
PA16 conductive plastic	300°		Professional and industrial					Command button P16 PA16 metal	bushing 10 Ø 16 H 8.5			
P16 cermet		P16P PA16P plastic										
PE30 cermet	300°		Industrial			6 6.35	10	AC: 16 AM: 25 AL: 50	Ø 19.4 H 11.5			
PE60 cermet	300°		Industrial and Professional			6 6.35	10 9.52	FG: 16 FL: 25 FR: 50	Ø 25 H 18			



Undergoes European Quality Assurance System CECC

(1) **SHAFT LENGTH**
The shaft length is measured from mounting face.
Special shaft on request.

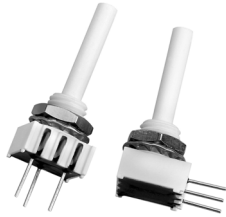


DATA SHEET NO.	SEALING	POWER RATING AT	RESISTANCE RANGE (A LAW)	TOL.	CLIMATIC CATEGORY ²⁾	MAX. TEMP.	SPECIAL FEATURES				
							SOLDER LUGS	"FASTON" TYPE	PC BOARD SIDE ADJ.	PC BOARD TOP ADJ.	PANEL SEALED
51030	fully sealed container IP67	0.5 W 70 °C	10 Ω ... 2 MΩ	± 10 % ± 5 %	55/100/56	125 °C			●	●	
57054	IP50	0.5 W 70 °C	500 Ω ... 500 kΩ	± 20 %	55/125/4	125 °C			●		
		1 W 70 °C		± 10 %							
51033	fully sealed container IP67	1 W 70 °C	22 Ω ... 10 MΩ	± 20 % ± 10 % ± 5 %	55/100/56	125 °C	●		●	●	●
51034	fully sealed container IP67	1.5 W 70 °C	22 Ω ... 10 MΩ	± 20 % ± 10 % ± 5 %	55/125/56	125 °C	●				●
50004	fully sealed container IP67	2 W 70 °C	20 Ω ... 10 MΩ	± 20 % ± 10 %	55/125/10	125 °C	●				
51035	fully sealed container and panel IP67	0.75 W 70 °C	100 Ω ... 500 kΩ	± 20 % ± 10 %	40/125/56	125 °C	●		●	●	●
		1.5 W 70 °C	20 Ω ... 10 kΩ	± 20 % ± 10 % ± 5 %	55/125/56						
51036	fully sealed container IP67	0.5 W 40 °C	1 kΩ ... 500 kΩ	± 20 % ± 10 %	PA16 40/85/56	85 °C	●				●
		1 W 40 °C	22 Ω ... 10 MΩ		P16 40/100/56	125 °C					
					P16P 40/85/56	85 °C					
51037	fully sealed container IP67	3 W 70 °C	22 Ω ... 10 MΩ	± 20 % ± 10 % ± 5 %	55/125/56	125 °C	●	●			●
51005	fully sealed container IP67	6 W 25 °C	1 Ω ... 1 MΩ	± 20 % ± 10 % ± 5 %	55/100/56	100 °C	Wire				●

(2) CLIMATIC CATEGORY

The first figure states the minimum temperature, the second figure corresponds to the maximum temperature of the category (at the maximum temperature of the category, the power dissipation is at least 25 % of the power rating), the third figure corresponds to the number of days of the damp heat test.

3/8" Square Potentiometers Cermet Fully Sealed



P10 panel potentiometer combines the very good setting stability offered by VISHAY SFERNICE trimmers (due to their proprietary multifinger wiper), with a mechanical life of 10 000 cycles.

It is an ideal choice to set and control parameters such as temperature, time, volume levels, etc.

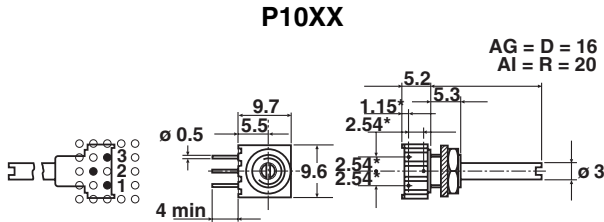
FEATURES

- Industrial Grade
- 0.5 Watt at 70 °C
- Miniature compact
- Plastic housing and shaft
- Fully sealed
- 7 standard pin styles
- 10 000 cycles rotational life

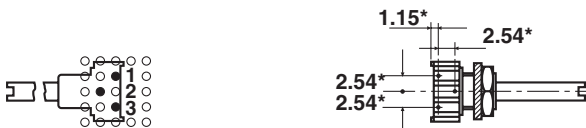


DIMENSIONS in millimeters

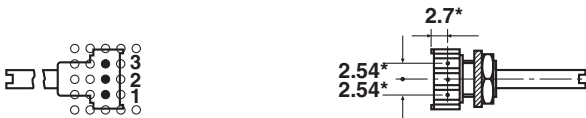
P10
side adjust



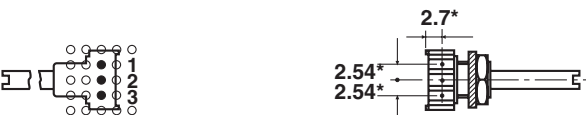
P10XH



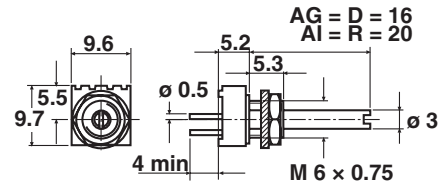
P10XC



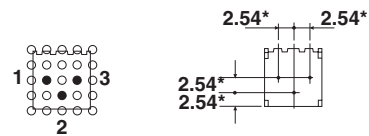
P10XW



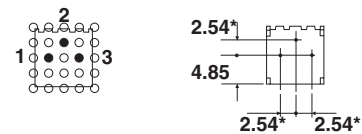
P10
top adjust



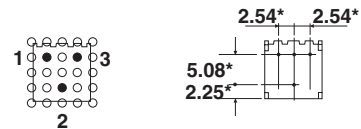
P10YP



P10YE

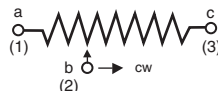


P10YM



* to be measured at base level

CIRCUIT DIAGRAM



Tolerance unless otherwise specified ± 0.5

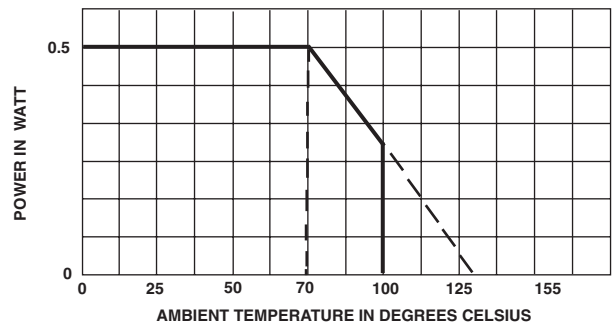


ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		250° ± 15°
Resistance Range		10 Ω to 2 MΩ
Standard series		1 - 2 - 5
Tolerance	Standard	± 10 %
	On Request	± 5 %
Power Rating	Linear	0.5 W at + 70 °C
	Logarithmic	not applicable
Temperature Coefficient		See Standard Resistance Element Table
Limiting Element Voltage (Linear Law)		250 V
Contact Resistance Variation		1 % Rn or 2 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		1000 V
Insulation Resistance		10 ⁶ MΩ

MECHANICAL SPECIFICATIONS

Mechanical Travel	290° ± 5°
Operating Torque (max. Ncm)	2
End Stop Torque (max. Ncm)	7
Tightening Torque (max. Ncm)	25
Unit Weight (max. g)	1

POWER RATING CHART



ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Climatic Category	55/100/56
Sealing	fully sealed container IP67

PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30° - ambient temperature 70 °C	± 1 % Contact res. variation: < 1 % Rn	± 2 %
Climatic Sequence	Phase A dry heat 100 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 1 %	± 2 %
Long Term Damp Heat	56 days 40 °C, 93 % RH	± 1 % Dielectric strength: 1000 V RMS Insulation resistance: > 10 ⁴ MΩ	± 2 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ ≤ ± 2 %
Shock	50 g at 11 m secs 3 successive shocks in 3 directions	± 0.5 %	± 1 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.5 %	$\frac{\Delta V_{1-2}}{V_{1-3}}$ ≤ ± 1 %
Rotational Life	10 000 cycles	± 3 % Contact res. variation: < 2 % Rn	



STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	W	V	mA	ppm/°C
10	0.5	2.2	224	± 200
20	↓	3.2	160	
50		5.0	1000	
100		7.0	70	± 100
200		10.0	50	
500		15.8	32	
1K		22.4	22	
2K		31.8	16	
5K		50.0	10	
10K		70.7	7.0	
20K		100	5.0	
50K	158	3.2		
100K	0.5	224	2.2	
200K	0.28	250	1.3	
500K	0.13	250	0.5	
1M	0.06	250	0.25	
2M	0.028	250	0.13	

MARKING

Printed:

- VISHAY trademark
- model
- ohmic value
- manufacturing date
- pin 3

The ohmic value is indicated by a 3 figures code: the first two digits are significant figures, the third digit is the multiplier:

- Example: 100 = 10 Ω
 101 = 100 Ω
 102 = 1000 Ω
 503 = 50 000 Ω

The manufacturing date is indicated by a 4 figures code. The first two digits are the year, the last two digits are the week.

SHAFTS

Standard shaft 20 mm length (R or AI code) and 16 mm length (D or AG code) is measured from the mounting face to the free end of the shaft.

Vishay guarantee is lost if the customer modifies the shaft himself.

HARDWARE

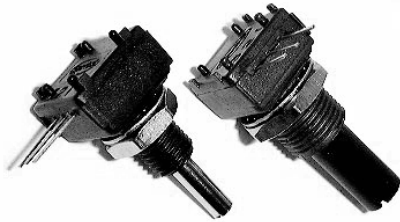
Nuts and washer are supplied separately (not mounted on the potentiometer) in a small bag placed in the packaging.

PACKAGING
- Carton boxes of 100 pieces

ORDERING INFORMATION						
P10 MODEL	XX VERSION	R AXE	500 kΩ OHMIC VALUE	± 10 % TOLERANCE	BO100 PACKAGING	e3 LEAD FINISH
	XX YP XH YE XC YM XW	R = AI = 20 mm D = AG = 16 mm				e3: pure Sn

SAP PART NUMBERING GUIDELINES																
P	1	0	X	X	A	I	5	0	4	K	B	3	0			
MODEL			STYLE		SHAFT		OHMIC VALUE			TOL	PACKAGING CODE		SPECIAL (IF APPLICABLE)			
See the end of this data book for conversion tables																

1/2" (12.7 mm) Conductive Plastic & Cermet Potentiometers

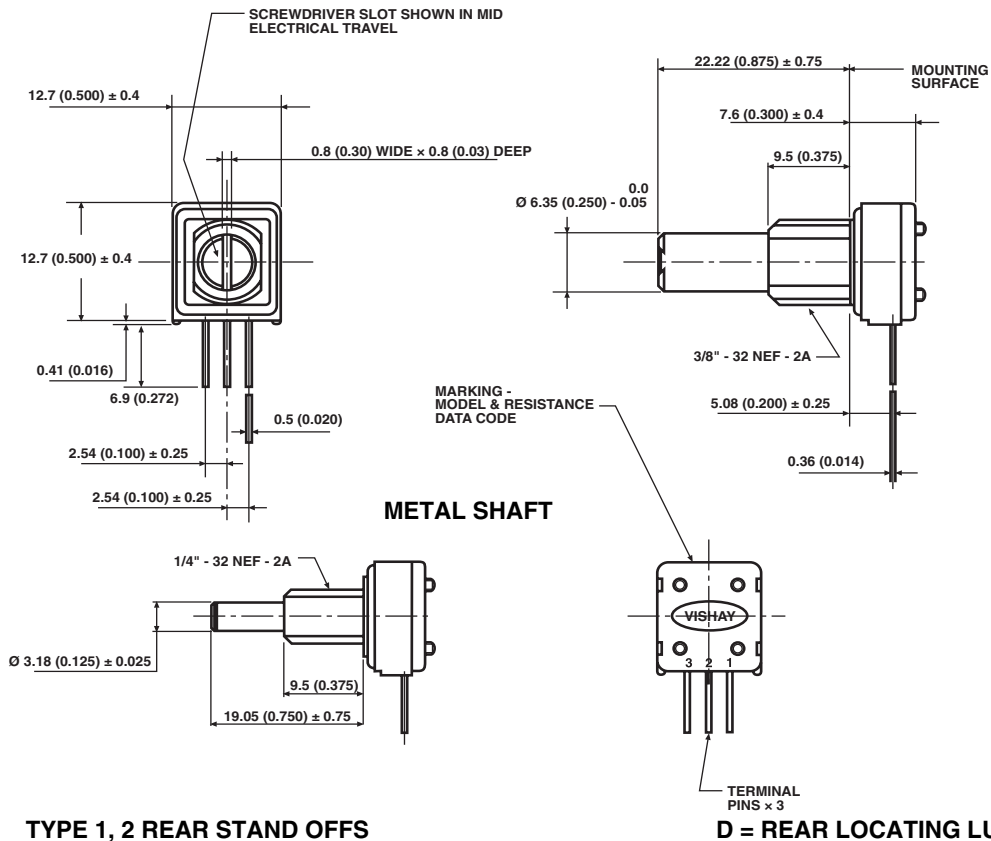


FEATURES

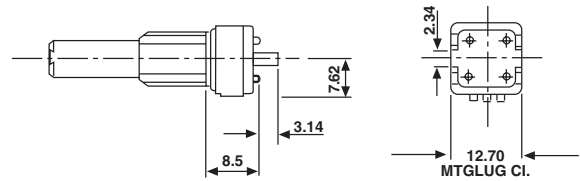
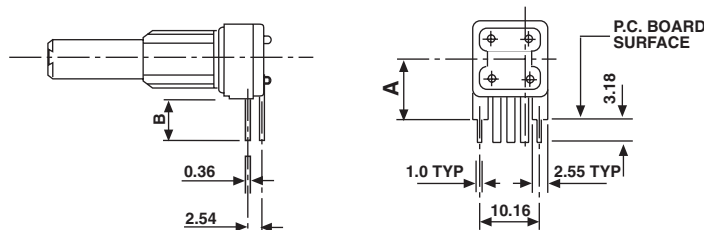
- Model 248/249 retains the proven high performance characteristics in a more cost effective package
- This model is destined to become the first choice when seeking high quality
- Cost effective panel potentiometers
- P.C.B. mounting potentiometers

DIMENSIONS in millimeters (inches)

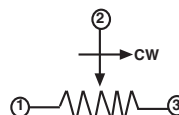
METAL OR PLASTIC SHAFTS



TYPE 1, 2 REAR STAND OFFS



MODEL	TYPE	A DIM SUPPORT PLATE	B DIM TERMINAL
E	1	6.76 (0.266")	3.18 (0.125")
F	2	9.52 (3.18")	6.35 (1/4")





ELECTRICAL SPECIFICATIONS		
PARAMETER	MODEL 248	MODEL 249
Element Type	conductive plastic	cermet
Total Resistance Range	500 Ω to 500 kΩ	
Resistance Tolerance	± 20 %	± 10 %
Power rating	0.5 watts at 70 °C	1.0 watts at 70 °C
	Both derated to zero at 125 °C	
Temperature Coefficient of Resistance	± 1000 ppm/°C	± 100 ppm/°C
Linearity Tolerance	± 5 % Independent	
Contact Resistance Variation	Both 3 % of the Total Resistance	
Insulation Resistance	1000 MΩ minimum, 500 VDC	
Dielectric Strength	750 V _{RMS} minimum 50/60 Hz	
End Resistance	2 Ω maximum each end	
Effective Electrical Angle	265° ± 5°	

MECHANICAL SPECIFICATIONS

Rotation	295° ± 5°
Torque	Starting and Running 1.5 to 18.75 mNm
End Stop Torque	0.35 Nm (50 oz-in)
Weight	8.3 g's (0.29 oz) (1/4" × 7/8" FMF metal shaft)
Max Tightening Torque	0.50 Nm (1/4" Bush) 0.70 Nm (3/8" Bush)

ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 °C to + 125 °C
Shock	390 meters/sec/sec. 1000 bumps
Vibrations	98 meters/sec/sec. 0.75 mm, 10 to 500 Hz
Rotational Life (Electrical)	
248:	50 000 cycles
249:	25 000 cycles
Load Life at 70 °C	1000 hours
Materials	
Shaft:	Plated brass or plastic
Housing & Rear Lid:	Plastic flame retardant
Terminals:	Phosphor bronze, solder plated
Mounting Hardware	Lockwasher: Steel, nickel plated Panel nut: Brass, nickel plated

STANDARD RESISTANCE ELEMENT DATA	
Ohms	500R, 1K, 2K, 5K, 10K, 25K, 50K, 100K, 250K,
248/249:	500K, 1M

MARKING

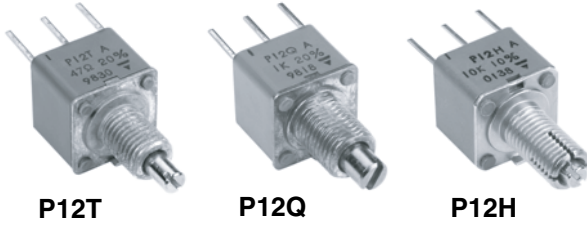
Unit identification: Manufacturer's name and model number, EIA resistance value coding, tolerance, data code and terminal identification.

PACKAGING
Carton box of 50, code: BO50

ORDERING INFORMATION						
248	JE	8	08	103	e3	
MODEL	SPECIAL FEATURES	SHAFT OPTIONS	FMF SHAFT OPTIONS	EIIA RESISTANCE CODE	LEAD FINISH	
248/249	D: Rear locating lugs E: Type 1 rear stand offs F: Type 2 rear stand offs J: CW audio taper	7: 6.35 (1/4") plastic 8: 3.18 (1/8") plated brass 9: 6.35 (1/4") plated brass	08: 19.05 (3/4") for 3.18 (1/8") plated brass 10: 22.22 (7/8") for 6.35 (1/4") plated brass or plastic versions		e3: pure Sn	
Example: 248 - JE - 8 - 08 - 103						

SAP PART NUMBERING GUIDELINES																
2	4	8	B	B	H	S	0	E	B	2	5	1	0	3	M	L
MODEL			BUSHING	SHAFT			SHAFT MATERIAL	LEADS	PACKAGING			OHMIC VALUE/TOL/LAW OR SPECIAL				
See the end of this data book for conversion tables																

Fully Sealed Container Cermet Potentiometers Military and Professional Grade



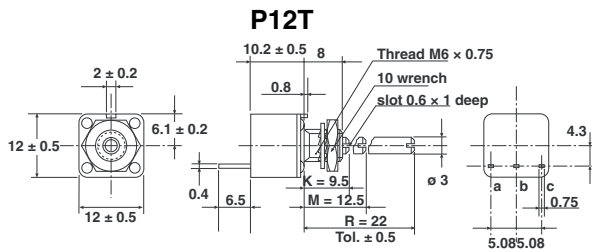
FEATURES

- 1 Watt at 70 °C
- CECC 41 300
- Full sealing
- Mechanical strength

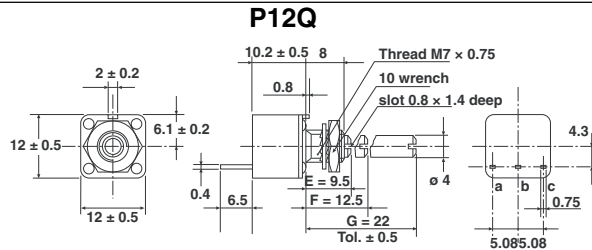
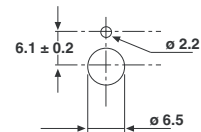


Model P12 potentiometers fully meet the requirements of CECC 41300

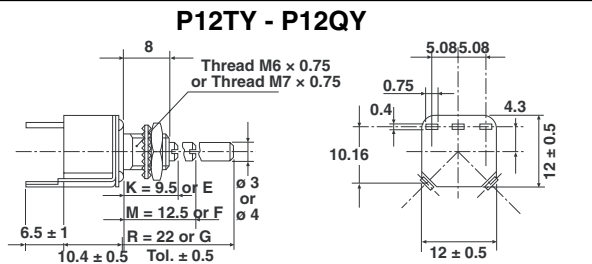
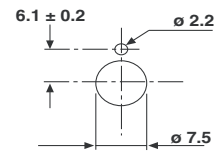
DIMENSIONS in millimeters



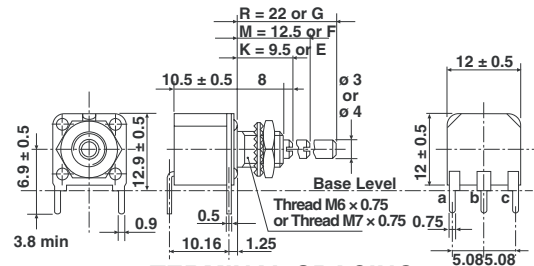
PANEL CUTOUT PANEL THICKNESS: 4 max



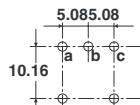
PANEL CUTOUT



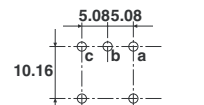
P12TX - P12QX



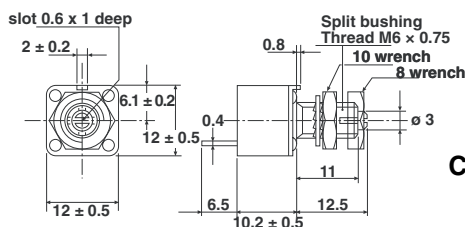
TERMINAL SPACING



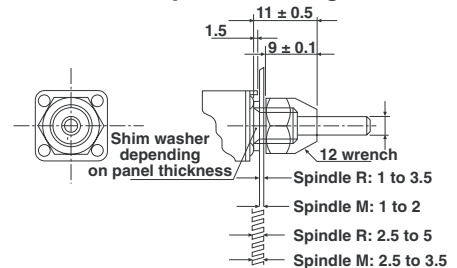
TERMINAL SPACING



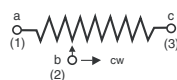
P12HL with spindle locking nut



DE Shaft and panel sealing hardware



CIRCUIT DIAGRAM



Tolerance unless otherwise specified ± 0.5



ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		270° ± 10°
Resistance Range	Linear Law	22 Ω to 10 MΩ
	Logarithmic Laws	100 Ω to 2.2 MΩ
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	± 20 %
	On Request	± 10 %
Power Rating	Linear	1 W at + 70 °C
	Logarithmic	0.5 W at + 70 °C
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		350 V
Contact Resistance Variation		3 % or 3 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		2000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

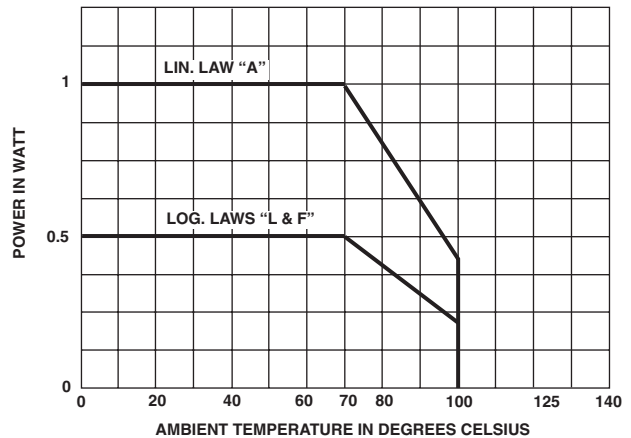
MECHANICAL SPECIFICATIONS

Mechanical Travel 300° ± 5°
 Operating Torque (max. Ncm) 2 typical
 End Stop Torque (max. Ncm) style H: 15 - T.Q.: 35
 Tightening Torque (max. Ncm) 150
 Unit Weight (max. g) 7.6 to 10

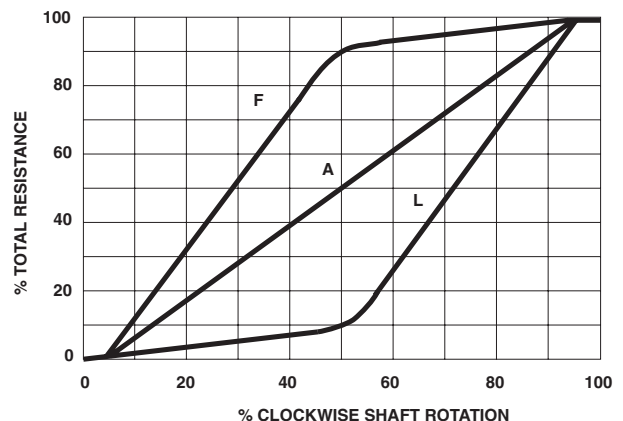
ENVIRONMENTAL SPECIFICATIONS

Temperature Range - 55 °C to + 125 °C
 Climatic Category 55/100/56
 Sealing fully sealed container IP67

POWER RATING CHART



RESISTANCE LAWS





Fully Sealed Container Cermet Potentiometers
Military and Professional Grade

Vishay Sfernice

PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours at rated power 90°/30° - ambient temp. 70 °C	± 1 % Contact res. variation: < 3 % Rn	
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C 93 % RH	± 0.5 %	± 1 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 0.5 %	
Shock	50 g at 11 ms 3 successive shocks in 3 directions	± 0.1 %	± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.2 \%$
Rotational Life	25 000 cycles	± 3 % Contact res. variation: < 2 % Rn	

STANDARD RESISTANCE ELEMENT DATA							
STANDARD RESISTANCE VALUES	LINEAR LAW			LOGS LAW			TCR -55 °C + 125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	W	V	mA	ppm/°C
22	1	4.69	213.2				0
47		6.85	145.8				+ 200
100		10	100				
220		14.8	67.4				
470		21.6	46.1				
1K		31.6	31.6	0.5	22.4	22.4	
2.2K		46.9	21.3		33.2	15.1	
4.7K		63.5	14.5		48.5	10.3	
10K		100	10		79.7	7.07	
22K		148.3	6.7		105	4.77	
47K		216.7	4.6		153	3.26	± 100
100K	1	316.2	3.16		224	2.24	
220K	0.56	350	1.59	0.5	332	1.51	
470K	0.26	350	0.75	0.26	350	0.74	
1M	0.12	350	0.35	0.12	350	0.35	
2.2M	0.05	350	0.16	0.05	350	0.16	
4.7M	0.02	350	0.07				
10M	0.01	350	0.01				

MARKING

- Printed:
- VISHAY trademark
 - series
 - ohmic value (in Ω)
 - tolerance (in %)
 - manufacturing date
 - marking of terminals 1 or a

SPECIAL FEATURES SHAFTS

Lengths are measured from the mounting surface to the free end of shaft. Shaft slot is aligned with the wiper within ± 10°. Special shafts are available, in accordance with drawings supplied by customers. We recommend customers not to machine shafts, in order to avoid damage. Bending or torsion of terminal should be avoided.

SHAFT AND PANEL SEALING HARDWARE

The type P12T with R or M shaft can be provided with an optional "DE" sealing hardware which ensures sealing of both the shaft and the mounting panel. "DE" sealing hardware can be supplied in a separate envelope.

SHAFT LOCKING

- The shaft locking bushing is available only with P12H potentiometers. Torque applied to locking nuts should not exceed 15 Ncm.



ORDERING INFORMATION							
P12 OR P12H	T	M	470 kΩ	20 %	A	DE	BO
SERIES OR SHAFT LOCKING	STYLE	SHAFT	OHMIC VALUE	TOLERANCE	RESISTANCE LAW	PANEL SEALING DEVICE	PACKAGING

SAP PART NUMBERING GUIDELINES																	
P	1	2	T	A	B	S	4	7	4	M	A	B	2	D	E		
MODEL			BUSHING	SHAFT	LEADS	OHMIC VALUE			TOL	LAW	PACKAGING	SPECIAL (IF APPLICABLE)					
See the end of this data book for conversion tables																	

Fully Sealed Container Cermet Potentiometers Military and Professional Grade


P13V

P13T

P13 potentiometers fully conform to CECC 41301-001 specification. Their excellent performances are due to the use of a cermet-track sealed in a large case.

P13 interchangeability with RV6, combined with the excellent stability of its rated characteristics make it fully acceptable for military and professional uses.

FEATURES

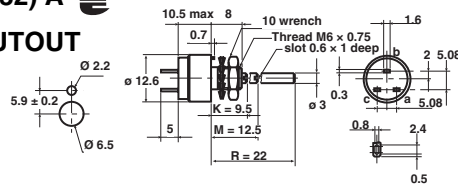
- High power rating 1.5 Watt at 70 °C
- CECC 41 301-001 (A, B, C)
- GAM T1
- Fully sealed case
- Tight temperature coefficient (± 75 ppm/°C typical)
- Mechanical strength



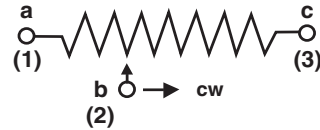
DIMENSIONS in millimeters

P13T - (PC32) A

PANEL CUTOUT

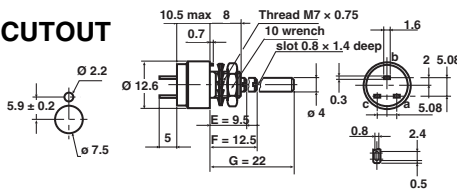


CIRCUIT DIAGRAM

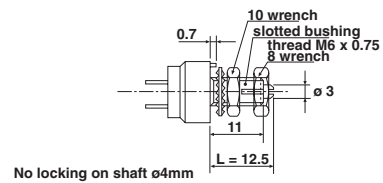


P13Q - B

PANEL CUTOUT

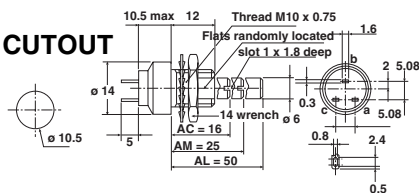


P13H

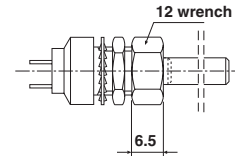


P13V - (PC33) C

PANEL CUTOUT



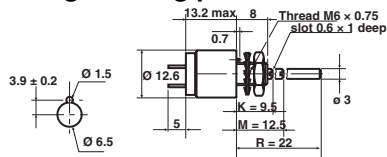
P13V DBAN



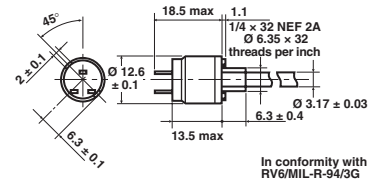
Panel sealed version

P13TP - P13TPE

TPE: Including locating ped



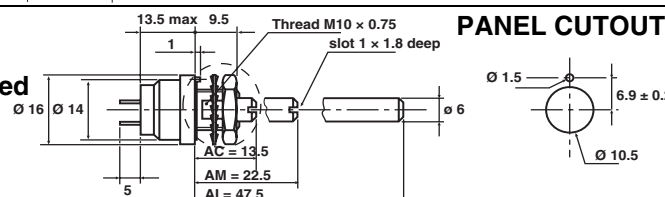
P13T - F55



Panel sealed version

P13VP - P13VPE

VPE: Including locating ped



Undergoes European Quality Insurance System



ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		270° ± 10°
Resistance Range	Linear Law	22 Ω to 10 MΩ
	Logarithmic Laws	100 Ω to 2.2 MΩ
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	± 20 %
	On Request	± 10 % - ± 5 %
Power Rating	Linear	1.5 W at + 70 °C
	Logarithmic	0.75 W at + 70 °C
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		350 V
Contact Resistance Variation		3 % Rn or 3 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength (RMS)		2000 V
Insulation Resistance (500 VDC)		10 ⁶ MΩ

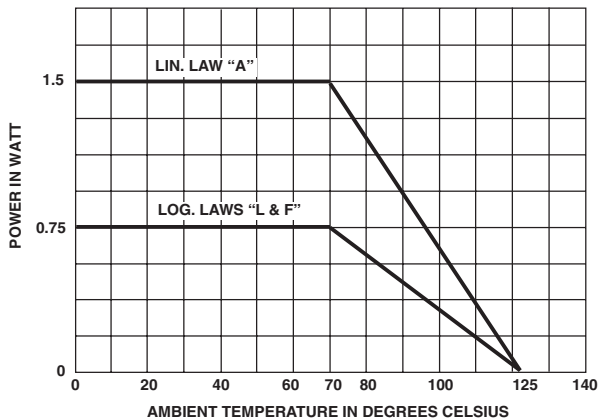
MECHANICAL SPECIFICATIONS

Mechanical Travel 300° ± 5°
 Operating Torque (max. Ncm) 2 typical
 End Stop Torque (max. Ncm) style T.Q.: 35 - V: 80
 Tightening Torque (max. Ncm) T.Q.: 150 - V: 250
 Unit Weight (max. g) 6 to 18

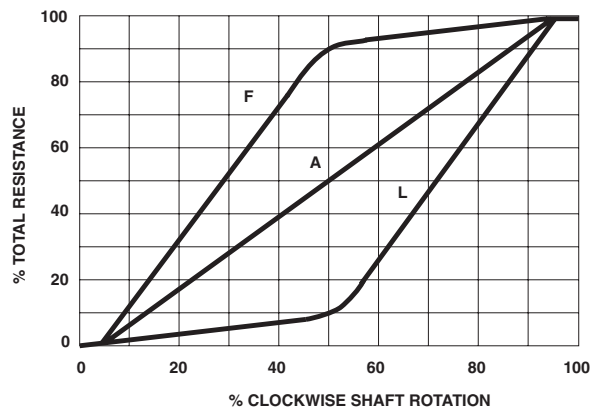
ENVIRONMENTAL SPECIFICATIONS

Temperature Range - 55 °C to + 125 °C
 Climatic Category 55/100/56
 Sealing fully sealed container IP67

POWER RATING CHART



RESISTANCE LAWS



TEMPERATURE COEFFICIENT

For values ≥ 100 ohms and in the temperature range + 20 °C to + 70 °C, the typical temperature coefficient is ± 75 ppm/°C.



Fully Sealed Container Cermet Potentiometers
Military and Professional Grade

Vishay Sfernice

PERFORMANCE						
NF C 83-253					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 10 %		± 10 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C 93 % RH	± 10 %		± 10 %	± 0.5 %	± 1 %
Rotational Life	25 000 cycles	± 10 %	Contact res. variation: < 7 % Rn		± 3 %	Contact res. variation: < 2 % Rn
Load Life	1000 h at rated power 90°/30° - ambient temp. 70 °C	± 10 %	Contact res. variation: < 7 % Rn		± 1 %	Contact res. variation: < 3 % Rn
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 3 %			± 0.5 %	
Shocks	50 g at 11 ms 3 successive shocks in 3 directions	± 2 %			± 0.1 %	± 0.2 %
Vibrations	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 2 %			± 0.1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} < \pm 0.2 \%$

STANDARD RESISTANCE ELEMENT DATA							
STANDARD RESISTANCE VALUES	LINEAR LAW			LOGS LAW			TCR -55 °C +125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	W	V	mA	ppm/°C
22	1.5	5.74	261				0
47		8.4	177				+200
100		12.2	122				
220		18.2	82.6				
470		26.5	56.5				
1K		38.7	38.7	0.75	27	27	
2.2K		57.5	26.1		40	18	
4.7K		84	17.9		59	12	
10K		122.5	12.2		87	8.7	
22K		182	8.26		128	5.8	
47K	1.5	265	5.65		187	3.9	± 100
100K	1.22	350	3.5	0.75	273	2.7	
220K	0.56	350	1.6	0.56	350	1.6	
470K	0.26	350	0.74	0.26	350	0.74	
1M	0.12	350	0.35	0.12	350	0.35	
2.2M	0.05	350	0.16	0.05	350	0.16	
4.7M	0.026	350	0.074				
10M	0.012	350	0.035				

MARKING

- Printed:
- VISHAY trademark
 - series
 - style
 - ohmic value (in Ω, kΩ or MΩ)
 - tolerance (in %)
 - resistance law
 - manufacturing date
 - marking of terminals a

**SPECIAL FEATURES
PANEL SEALING**

Potentiometers P13T and P13V can be fitted with a device providing sealing between the threaded bushing and the front panel. Their designation is P13TP and P13VP respectively or with a locating peg P13TPE and P13VPE.

SHAFT

Shaft lengths are measured from the mounting surface to the free end of the potentiometer. Special shafts are available, provided customer supplies a drawing.

The shaft slot is aligned to the wiper within ± 10°.

SHAFT LOCKING

On potentiometers equipped with a 3 mm Ø shaft, shaft locking can be obtained:

- either by a taper nut tightening a slotted bushing. Ask for P13H type. These devices are normally equipped with an L type shaft (12.5 mm with a slot),
 - or by a tightening nut locked by a screw. Ask for ES1 type.
- On potentiometers equipped with a Ø 6 mm shaft, locking can be obtained by a taper nut applying pressure on a slotted notched washer. This device is supplied in a box as an accessory. Ask for DBAN.

These devices are ordered separately. Please consult VISHAY SFERNICE.

ORDERING INFORMATION								
P13	T	P OR PE	M	22 kΩ	± 20 %	A	XX	BO
SERIES	STYLE	PANEL SEALING	SHAFT	OHMIC VALUE	TOLERANCE	LAW	SPECIAL FEATURES	PACKAGING
	T 6 mm dia, 3 mm dia. shaft		K 9.5 mm, slotted M 12.5 mm, slotted R 22 mm, plain		± 20 % standard ± 10 % on request	A Linear L clockwise logarithmic F inverse clockwise logarithmic	F55 DBAN F32 (PCB style)	
	Q 7 mm dia, 4 mm dia. shaft		E 9.5 mm, slotted F 12.5 mm, slotted G 22 mm, plain					
	V 10 mm dia, 6 mm dia. shaft		AC 16 mm, slotted AM 25 mm, slotted AL 50 mm, plain					
	locking H 6 mm dia, 3 mm dia. shaft		L 12.5 mm, slotted AP special shafts					
	VP 9.5 mm dia, 6 mm dia. shaft		AC 13 mm, slotted AM 22 mm, slotted AL 47 mm, plain					

SAP PART NUMBERING GUIDELINES																	
P	1	3	T	A	B	2	2	3	M	A	B	1	7				
MODEL			BUSHING	SHAFT		OHMIC VALUE			TOL	LAW	PACKAGING		SPECIAL (IF APPLICABLE)				

See the end of this data book for conversion tables

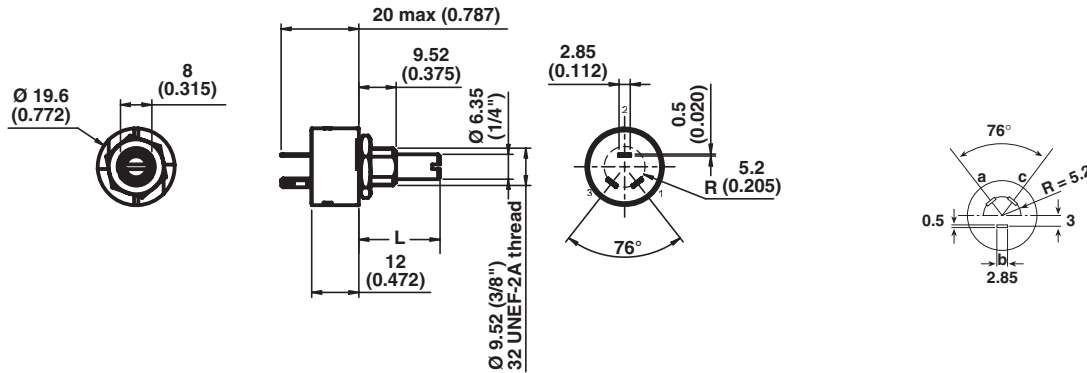
Industrial Potentiometer


FEATURES

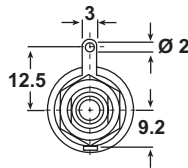
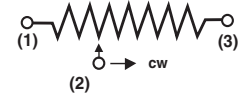
- High power rating 2 Watt at 70 °C
- Full sealing
- Low contact resistance variation (1 % typical)
- Robust nickel plated brass shaft
- Use of faston 2.86 connections
- Cermet element
- Electrical performance in accordance with MIL-PRF-94 standards


RoHS
COMPLIANT

DIMENSIONS in millimeters

PRV4F


LENGTH L	1/2"	7/8"	2"
SHAFT CODE	GBS	GJS	GRS

PRV4 LPRP - WITH LOCATING PEG

CIRCUIT DIAGRAM




**SPECIAL FEATURES
COMMAND SHAFT**

Length is measured from the mounting surface to the free end of the shaft. The screwdriver slot is aligned with the wiper within $\pm 10^\circ$. Special shafts are available, in accordance to drawings supplied by customers. We recommend that customers should not machine shafts, in order to avoid damage. Bending or torsion of terminals should also be avoided.

LINEARITY

The typical linearity of linear variation law potentiometers is $\pm 5\%$. Guaranteed linearity on request. Consult VISHAY.

ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		$270^\circ \pm 10^\circ$
Resistance Range	Linear Law	20Ω to $10 \text{ M}\Omega$
	Logarithmic Laws	100Ω to $2.5 \text{ M}\Omega$
Standard series		1 - 2 - 2.5 - 5
Tolerance	Standard	$\pm 20\%$
	On Request	$\pm 10\%$
Power Rating	Linear	2 W at $+ 70^\circ \text{C}$
	Logarithmic	1 W at $+ 70^\circ \text{C}$
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		500 V
Contact Resistance Variation (Typical)		1 % Rn or 3 Ω
End Resistance		4 Ω
Dielectric Strength (RMS)		1500 V
Insulation Resistance (500 VDC)		$10^4 \text{ M}\Omega$

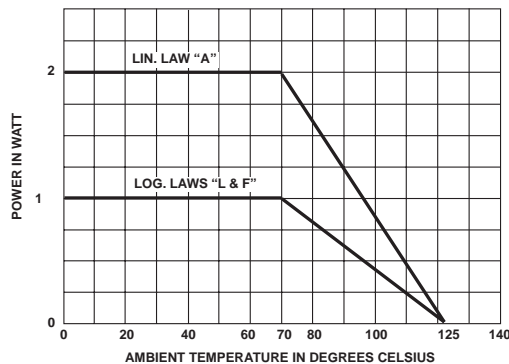
MECHANICAL SPECIFICATIONS

Mechanical Travel $300^\circ \pm 5^\circ$
 Operating Torque (max. Ncm) 3 typical [4.3 oz. inch]
 End Stop Torque (max. Ncm) 70 [6 lb. inch]
 Max Tightening Torque of Mounting Nut (Ncm) 200 [17.3 lb. inch]
 Unit Weight (max. g) 23 to 32 [0.82 oz to 1.14 oz]

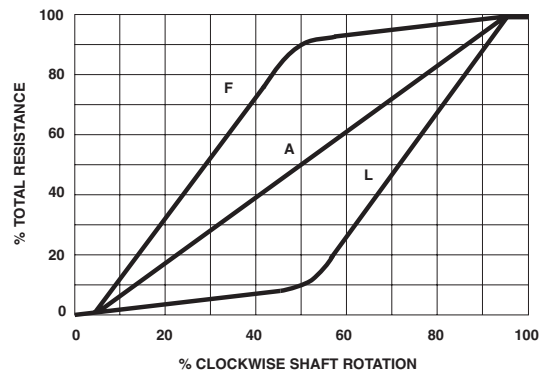
ENVIRONMENTAL SPECIFICATIONS

Temperature Range $- 55^\circ \text{C}$ to $+ 125^\circ \text{C}$
 Climatic Category 55/125/10
 Sealing fully sealed container IP67

POWER RATING CHART



RESISTANCE LAWS





PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta RT_{1-2}}{RT_{1-2}}$ (%)
Load Life	1000 h at rated power 90°/30° - ambient temp. 70 °C	± 3 % Contact resistance variation: < 5 %	± 5 %
Moisture Resistance	MIL STD 202 Method 105 10 cycles of 24 hours constituted with damp heat - cold - vibrations	± 2 % Dielectric strength: 100 V RMS Insulation resistance: > 10 ⁴ MΩ	± 3 %
Long Term Damp Heat	Temperature 40 °C - RH 93 % 10 days	± 2 % Dielectric strength: 100 V RMS Insulation resistance: > 10 ⁴ MΩ	± 3 %
Thermal Shock	55 °C to + 125 °C - 5 cycles	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 2 \%$
Rotational Life (Electrical and Mechanical)	25 000 cycles	± 5 %	
Shock	MIL STD 202 Method 213/1 100 g - 6 ms 3 successive shocks in 3 directions	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$
Vibration	MIL STD 202 Method 204/D 20 g - 12 hours	± 1 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 1 \%$

STANDARD RESISTANCE ELEMENT DATA							
STAN- DARD RESIS- TANCE VALUES	LINEAR LAW			LOGS LAW			TCR 55 °C + 125 °C ppm/°C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH ELEMENT/ WIPER	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH ELEMENT/ WIPER	
Ω	W	V	mA	W	V	mA	
20	2	6.32	316	1	4.47	224	0 + 400
25	↓	7.07	283	↓	5.00	200	
50	↓	10.0	200	↓	7.07	141	
100	↓	14.1	141	↓	10.0	100	± 200
200	↓	20.0	100.0	↓	14.1	70.7	
250	↓	22.4	89.4	↓	15.8	53.2	
500	↓	31.6	53.2	↓	22.4	44.7	
1K	↓	44.7	44.7	↓	31.5	31.6	
2K	↓	53.2	31.6	↓	44.7	22.4	
2.5K	↓	70.7	28.3	↓	50.0	20.0	
5K	↓	100	20.00	↓	70.7	14.1	
10K	↓	141	14.14	↓	100	10.0	
20K	↓	200	10.00	↓	141	7.07	
25K	↓	224	6.04	↓	158	6.32	
50K	↓	315	6.32	↓	224	4.47	
100K	2	447	4.47	↓	315	3.16	
200K	1	500	2.50	↓	447	2.24	
250K	1	500	2.00	↓	499	2.00	
500K	0.50	500	1.00	0.50	500	1.00	
1M	0.25	500	0.50	0.25	500	0.50	
2M	0.13	500	0.25	0.13	500	0.25	
2.5M	0.10	500	0.20	0.10	500	0.20	

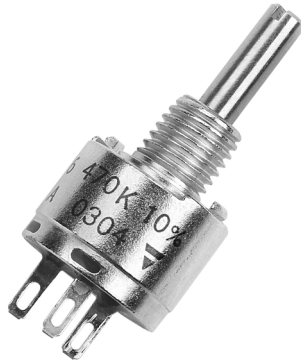
MARKING

- Printed:
- VISHAY trademark
 - series
 - NF types if applicable
 - ohmic value (in Ω, kΩ or MΩ)
 - tolerance (in %)
 - manufacturing date
 - marking of terminals 1, 2, 3 or a, b, c

ORDERING INFORMATION								
PRV4	F	Ø	GJS	200 KΩ	± 20 %	A	BO	e3
MODE	BUSHING	OPTION	SHAFT	OHMIC VALUE	TOLERANCE	LAW	PACKAGING	LEAD FINISH
		0: none L: LPRP			± 20 % standard ± 10 % on request	A Linear F clockwise reverse logarithmic L clockwise logarithmic	Box 10 pcs	e3: pure Sn

SAP PART NUMBERING GUIDELINES																	
P	R	V	4	F	0	G	J	S	2	0	4	M	A				
MODEL			BUSHING		OPTION	SHAFT		OHMIC VALUE			TOL	LAW	SPECIAL (IF APPLICABLE)				
See the end of this data book for conversion tables																	

Fully Sealed Potentiometers Cermet (PRV6) Conductive Plastic (PARV6)



FEATURES

- PRV6 high power rating 1.5 Watt at 70 °C
- PARV6 0.75 Watt at 70 °C
- CECC 41300
- Military performances
- Low cost
- Fully sealed and panel sealed
- Compatible RV6 (MIL R 94)
- Mechanical life 50 000 cycles



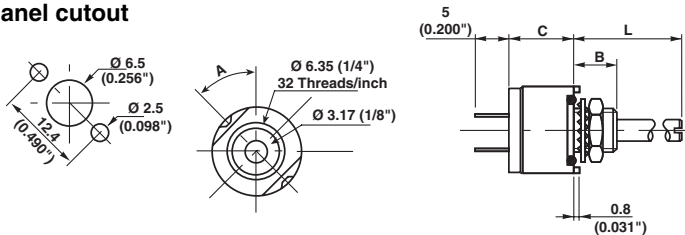
DIMENSIONS in millimeters

PRV cermet PRV6

PARV conductive plastic PARV6

Shafts and bushings: 6 - 61 - 62

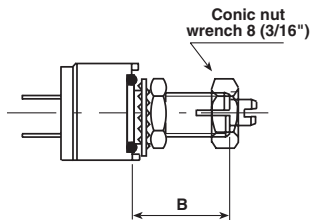
Panel cutout



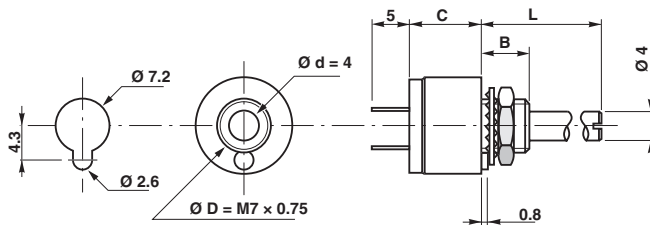
Locking shaft H option:

61H - 62H

61LCH - 62LCH



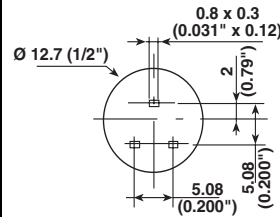
Shaft Dia 4 mm: 6Q - 61Q - 61QH



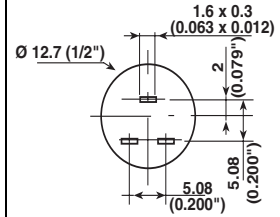
See ordering information for quotation

Terminal options available on all types

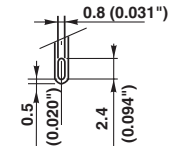
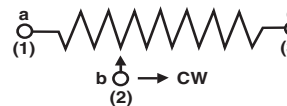
PCB pins W option



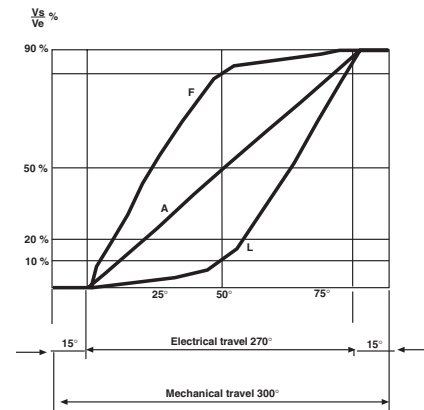
Solder lugs



CIRCUIT DIAGRAM



VARIATION LAWS



TAPERS

Tapers A - L - F - are measured between the wiper (2) and the ccw terminal (1).



ELECTRICAL SPECIFICATIONS		
Resistive Element		PRV6 cermet
Electrical Travel		PARV6 conductive plastic
Resistance Range	Linear Law (A)	20 Ω to 10 MΩ
	Non Linear Laws (F-L)	470 Ω to 1 MΩ
Tolerance	Standard	± 20 % ± 10 %
	On Request	± 5 %
Power Rating at + 70 °C	Linear	1.5 W
	Other Tapers	0.75 W
Temperature Coefficient		± 1000 ppm/°C
Limiting Element Voltage		350 V
Contact Resist. Variation CRV		2 % or 3 Ω
End Resistance (Typical)		1 Ω
Dielectric Strength		1750 VRMS (2000 VRMS on request)
Insulation Resistance (500 VDC)		10 ⁶ MΩ

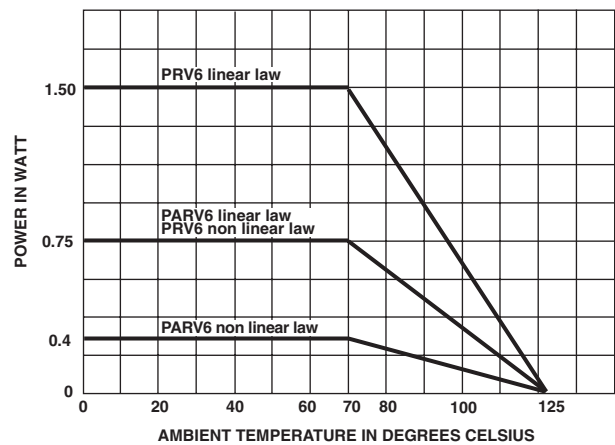
MECHANICAL SPECIFICATIONS

Mechanical Travel	300° ± 5°
Operating Torque	0.5 to 2 Ncm
	or 0.7 to 3 oz.in.
End Stop Torque max	35 Ncm
	or 3 lb.in.
Tightening Torque max	150 Ncm
	or 13 lb.in.

ENVIRONMENTAL SPECIFICATIONS

	PRV6	PARV6
Temperature Range	- 55 °C to + 125 °C	- 40 °C to + 125 °C
Climatic Category	55/125/56	40/125/56
Sealing	fully sealed container IP67 and panel sealed	

POWER RATING CHART



PERFORMANCE						
CECC 41 300 and/or MIL R 94					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 h at rated power 90/30' - temperature 70 °C	± 10 %	CRV < 7 % Rn		± 1 %	CRV < 3 % Rn
Climatic Sequence	Phase A dry heat 100 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 10 %		± 10 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days	± 10 %		± 10 %	± 0.5 %	± 1 %
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 3 %			± 0.5 %	
Vibration	10 g 55 to 2000 Hz 2 h each direction	± 2 %	no CUT > 0.1 ms ± 5 %		± 0.1 %	± 0.2 %
Shock	100 g 6 ms 20 shocks	± 2 %		± 5 %	± 0.1 %	± 0.2 %
Rotational Life	50 000 cycles	± 10 %	CRV < 7 % Rn		± 3 %	CRV < 2 % Rn

STANDARD RESISTANCE ELEMENT DATA							
STANDARD RESISTANCE VALUES	PRV6 LINEAR LAW			PRV6 NON-LINEAR LAWS			TCR -55 °C +125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. WIPER CUR.	
Ω	W	V	mA	W	V	mA	ppm/°C
20 50	1.5	5.48 8.66	274 173				0 +200
100 200 500 1K 2K 5K 10K 20K 50K 100K 200K 500K 1M 2M 5M 10M	↓ 1.5 1.22 0.61 0.25 0.12 0.06 0.025 0.012	12.2 17.3 27.4 38.7 54.8 86.6 122.5 173 274 350 350 350 350 350 350 350	122 87 55 38.7 27.4 17.3 12.2 8.26 5.65 3.5 1.75 0.7 0.35 0.17 0.07 0.035	0.75 ↓ 0.75 0.25	27.3 38.2 61.2 87 122 194 273 350 350	27.4 19.3 12.2 8.7 6.1 3.9 2.74 1.75 0.7	PRV6 ±100

PACKAGING

Carton box of 50, code: BO50

PANEL SEALING

Except for dia. 4 mm shaft, an O-ring is supplied with the potentiometer. This O-ring should be placed into the groove of the body and ensures the panel sealing.
For dia. 4 mm shaft please see note "P" in ordering information.

SHAFTS

Shaft lengths are measured from the mounting face to the free end of the shaft. Special shafts are available if the customer supplies a drawing. The shaft slot is aligned to the wiper within ± 10°.

HARDWARE

Nuts, washer and O-ring are **separately supplied** (not mounted on the potentiometer), in a small bag placed in the packaging.

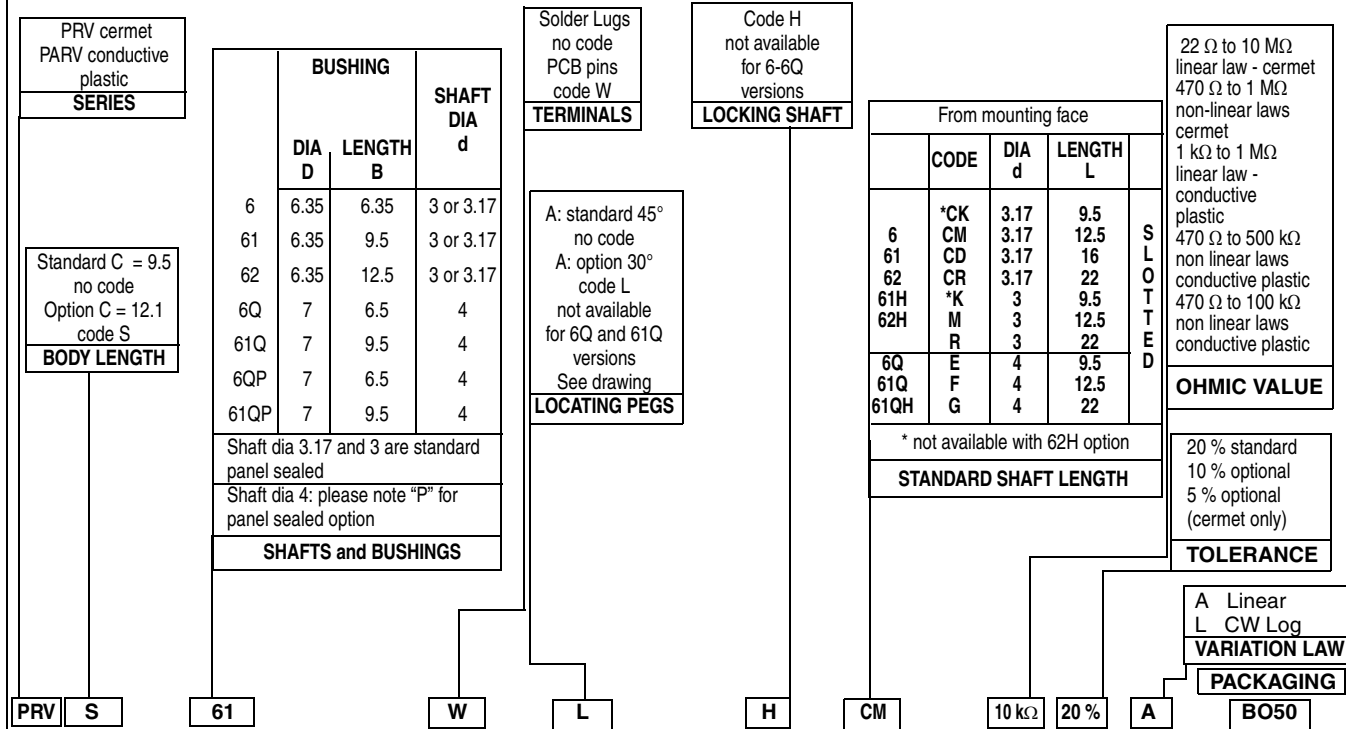
LOCATING PEG

Except for dia. 4 mm shaft, the potentiometers are delivered with 2 opposite locating pegs orientated at 45°. These 2 pegs can be easily broken-off by the customer. On request, the orientation of the pegs can be at 30° instead of 45°. Order Designation: PRV6 L (see ordering information)

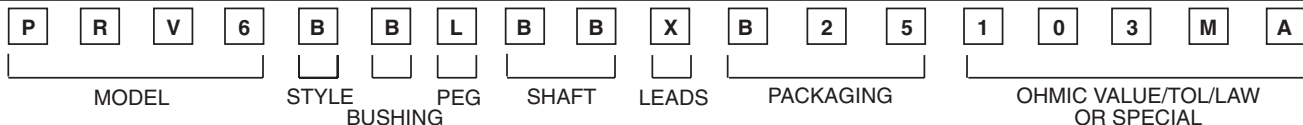
MARKING

VISHAY trademark, series, style, ohmic value (in Ω, kΩ or MΩ), tolerance in %, taper code, manufacturing date (4 digits: 2 for year, 2 for week), terminal 1.

ORDERING INFORMATION



SAP PART NUMBERING GUIDELINES



See the end of this data book for conversion tables

Knob Potentiometer



The P16 is a revolutionary concept in panel mounted potentiometers. This unique design consists of a knob driving and incorporating a cermet potentiometer. Only the mounting hardware and terminals are situated on the back side of the panel reducing to a minimum the required clearance.

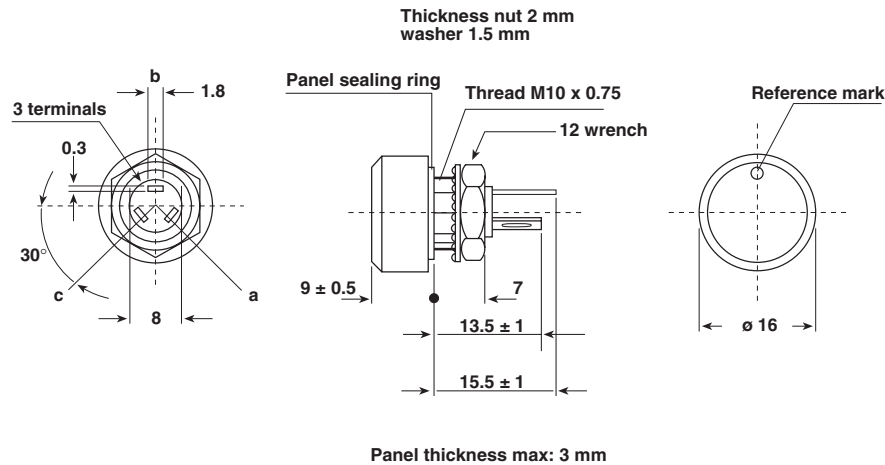
FEATURES

- 1 Watt at 40 °C
- Test according to CECC 41300
- **P16** - version for professional and industrial applications
- **PA16** - version for professional audio applications
- Compact (integrated)
- Minimum clearance required
- Safety in use due to good insulation: $> 10^4 \text{ M}\Omega$ 500 V_{DC}
- High dielectric strength: 2500 V_{RMS}
- Fully sealed and panel sealed
- Metallic or plastic knob options
- Cermet or conductive plastic

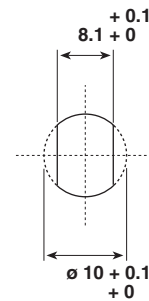


DIMENSIONS in millimeters

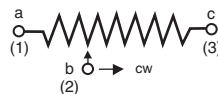
P16 - PA16



PANEL CUTOUT



CIRCUIT DIAGRAM





ELECTRICAL SPECIFICATIONS				
			P16	PA16
Resistive Element			cermet	conductive plastic
Electrical Travel			270° ± 10°	270° ± 10°
Resistance Range	Linear Law		22 Ω to 10 MΩ	1 kΩ to 1 MΩ
	Logarithmic Laws		100 Ω to 2.2 MΩ	470 Ω to 500 kΩ
Standard series E3			1 - 2.2 - 4.7 and on request 1 - 2 - 5	1 - 2.2 - 4.7
Tolerance	Standard		± 20 %	± 20 %
	On Request		± 10 %	± 10 % (1 kΩ to 100 kΩ)
Power Rating	Linear		1 W at + 40 °C	0.5 W at + 40 °C
	Logarithmic		0.5 W at + 40 °C	0.25 W at + 40 °C
Temperature Coefficient			See Standard Resistance Element Data	± 1000 ppm/°C
Dielectric Strength (RMS)			2500 V	2500 V
Limiting Element Voltage (Linear Law)			350 V	350 V
Insulation Resistance (500 VDC)			≥ 10 ⁴ MΩ	≥ 10 ⁴ MΩ
Contact Resistance Variation			3 % R _n or 3 Ω	2 % R _n or 3 Ω
End Resistance (Typical)			1 Ω	1 Ω
Insulation Resistance (500 VDC)			10 ⁶ MΩ	10 ⁶ MΩ

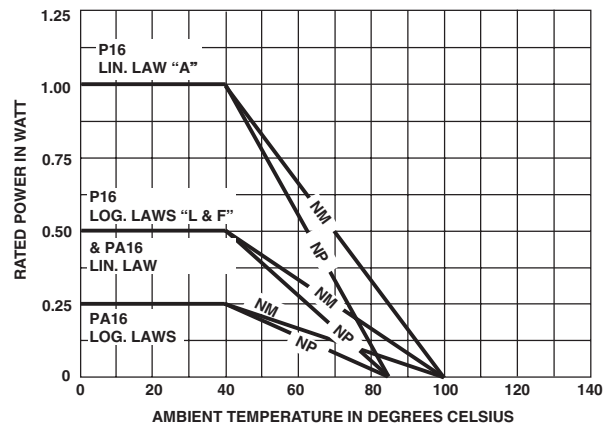
MECHANICAL SPECIFICATIONS

Mechanical Travel	300° ± 5°
Operating Torque (Ncm)	2 typical
End Stop Torque (max. Ncm)	25
Max Tightening Torque of Mounting Nut (max. Ncm)	250
Unit Weight	4.5 g typical

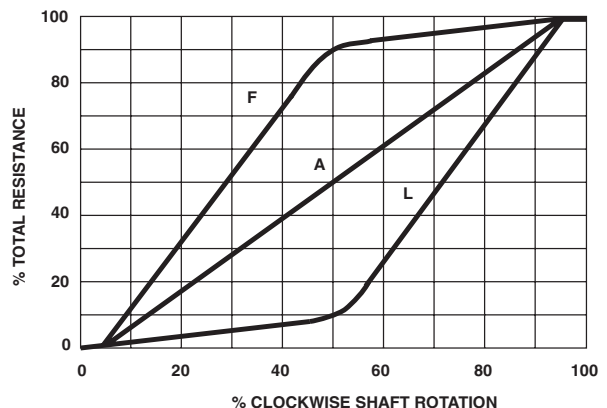
ENVIRONMENTAL SPECIFICATIONS

	METALLIC KNOB	PLASTIC KNOB
TEMPERATURE RANGE	- 40 °C to + 125 °C	- 40 °C to + 85 °C
CLIMATIC CATEGORY	40/100/56	40/85/56
SEALING	SEALED CONTAINER AND PANEL SEALED	
PROTECTION GRADES	IP67	

POWER RATING CHART



RESISTANCE LAWS





PERFORMANCE P16		
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS
		$\frac{\Delta R_T}{R_T}$ (%) $\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Load Life	1000 hours Pn 90°/30° at 40 °C	± 1 % Contact res. variation: < 3 % Rn
Climatic Sequence	Phase A dry heat 85 °C/125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 0.5 % ± 1 %
Long Term Damp Heat	56 days 40 °C 93 % HR	± 0.5 % Insulation resistance: > 10 ⁴ MΩ
Temperature Variations	5 cycles - 40 °C at + 85 °C/125 °C	± 0.5 %
Shock	50 g at 11 ms 3 successive shocks in 3 directions	± 0.1 % ± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.1 % $\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.2 \%$
Rotational Life	25 000 cycles	± 3 % Contact res. variation: < 2 % Rn

STANDARD RESISTANCE ELEMENT DATA							
STANDARD RESISTANCE VALUES	LINEAR LAW			LOG LAW			TCR - 40 °C + 85 °C
	MAX. POWER AT 40 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	MAX. POWER AT 40 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	P1 (W)	Um = $\frac{\sqrt{P1XRn}}{350 V_{DC}}$	Im (mA)	P1 (W)	Um = $\frac{\sqrt{P1XRn}}{350 V_{DC}}$	Im (mA)	10 ⁻⁶ /°C
22 47	1	4.69 6.85	213.2 145.8				- 50 + 200
100 220 470 1K 2.2K 4.7K 10K 22K 47K 100K 220K 470K 1M 2.2M 4.7M 10M	↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	10 14.83 21.67 31.62 46.90 68.55 100 148.32 216.7 316.23 350 350 350 350 350 350 350	100 67.4 46.1 31.6 21.32 14.58 10 6.74 4.61 3.16 1.59 0.75 0.35 0.16 0.07 0.012	0.5 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	22.4 33.2 48.5 70.7 105 153 224 332 350 350	22.4 15.1 10.3 7.07 4.77 3.26 2.24 1.51 0.74 0.35	± 100

MARKING

- Printed:
 - VISHAY trademark
 - ohmic value
 - tolerance (in %)
 - resistance law
 - manufacturing date

CONTROL KNOB

Black metallic knob (NM).
 Black plastic knob (NP).
 For white and blue color see ordering information.
 Other dimensions, shapes, colors of control knobs are manufactured on request - please consult VISHAY.
 Other reference marks (shapes, colours) and legends can be printed on plastic knob on request - please consult VISHAY.

PACKAGING

Carton box of 20 pieces

PA16 PARTICULAR CHARACTERISTICS				
NOMINAL RESISTANCE	LINEAR LAW			TCR - 40 °C + 85 °C
	MAX. DISSIPATION AT 40 °C	MAX. VOLTAGE	MAX. CUR. THROUGH THE WIPER	
Ω	W	V	mA	ppm/°C
1K 2.2K 4.7K 10K 22K 47K 100K 220K 470K 1M	0.5 ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓ ↓	22.4 33.2 48.5 79.7 105 153 224 332 350 350	22.4 15.1 10.3 7.07 4.77 3.26 2.24 1.51 0.74 0.35	± 1000

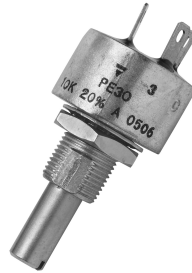


PERFORMANCE			
TESTS	CONDITIONS	TYPICAL VALUES AND DRIFTS	
		$\frac{\Delta R_T}{R_T}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-3}}$ (%)
Load Life	1000 hours at Pn 90°/30° cycle at + 40°C	± 5 % Insulation resistance: > 10 ⁴ MΩ Contact res. variatio: < 2 % Rn	
Long Term Damp Heat	56 days 40 °C 93 % HR	± 2 % Insulation resistance: > 10 ⁴ MΩ	± 1 %
Shock	50 g at 11 ms 3 successive shocks in 3 axes	± 0.2 %	± 0.5 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 0.2 %	$\frac{\Delta V_{1-2}}{V_{1-3}} \leq \pm 0.5 \%$
Rotational Life	50 000 cycles	± 5 % Contact res. variation: < 2 % Rn	

ORDERING INFORMATION					
PA, PA16	NP	22 kΩ	20 %	A	BO20
SERIES	CONTROL KNOB DESIGNATION	OHMIC VALUE	TOLERANCE	LAW	PACKAGING
	NM : metallic black color NP : plastic black color WM : metallic white color WP : plastic white color BP : plastic blue color			A : linear L : clockwise logarithmic F : inverse clockwise logarithmic	

SAP PART NUMBERING GUIDELINES																		
P	1	6	N	P	2	2	3	M	A	B	1	5						
MODEL			STYLE		OHMIC VALUE			TOL	LAW	PACKAGING CODE			SPECIAL (IF APPLICABLE)					
See the end of this data book for conversion tables																		

Fully Sealed Container Cermet Potentiometer Military and Professional Grade



FEATURES

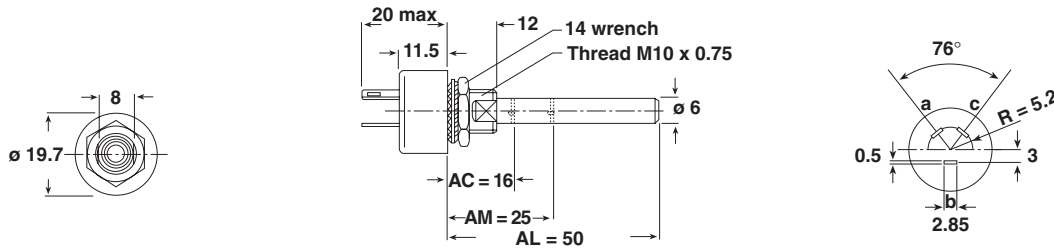
- 3 Watt at 70 °C
- High power rating
- Low temperature coefficient (100 ppm/°C typical)
- Full sealing
- Mechanical strength
- Use of faston 2.86 connections
- Tests according to CECC 41 000



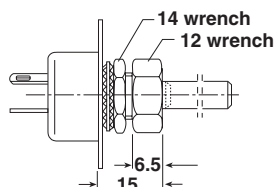
RoHS
COMPLIANT

DIMENSIONS in millimeters

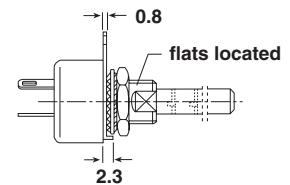
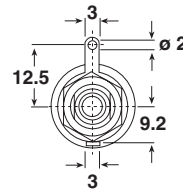
PE30



DBAN SHAFT LOCKING



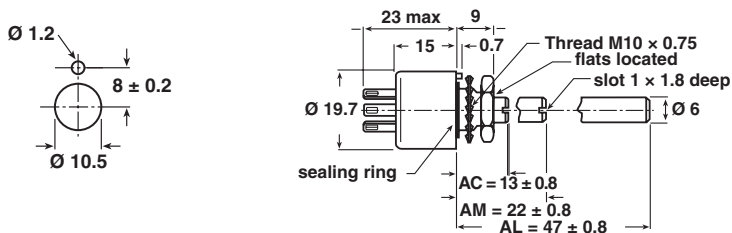
PE30 LPRP - WITH LOCATING PEG



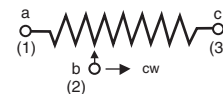
Panel sealed version

PE30P - PE30PE

PE: Including locating peg



CIRCUIT DIAGRAM



Tolerance unless otherwise specified ± 0.5

**SPECIAL FEATURES
COMMAND SHAFT**

Length is measured from the mounting surface to the free end of the shaft. The screwdriver slot is aligned with the wiper within $\pm 10^\circ$. Special shafts are available, in accordance to drawings supplied by customers. We recommend that customers should not machine shafts, in order to avoid damage. Bending or torsion of terminals should also be avoided.

PANEL SEALING: PE30P

The panel sealing device consists of a ring located in a slot on the potentiometer face. Sealing is obtained by tightening the ring against the panel when mounting the potentiometer.

LINEARITY

The typical linearity of linear variation law potentiometers is $\pm 5\%$. Guaranteed linearity on request. Consult VISHAY.

SHAFT LOCKING: DBAN

The shaft locking device consists of a tapered nut tightening a slotted notched washer against both bushing and shaft. DBAN tightening torque is 200 Ncm, shaft locking torque being 30 Ncm.

DBAN is also available with all special types.

This device is normally supplied in a separate bag. Can be pre-mounted on request.

LOCATING PEG: LPRP

Location is obtained by fitting a special washer in 2 holes drilled at 180° in the potentiometer face.

ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		$270^\circ \pm 10^\circ$
Resistance Range	Linear Law	22Ω to $10 \text{ M}\Omega$
	Logarithmic Laws	100Ω to $2.2 \text{ M}\Omega$
Standard series E3		1 - 2.2 - 4.7 and on request 1 - 2 - 5
Tolerance	Standard	$\pm 20\%$
	On Request	$\pm 10\% - \pm 5\%$
Power Rating	Linear	3 W at $+70^\circ\text{C}$
	Logarithmic	1.5 W at $+70^\circ\text{C}$
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		300 V
Contact Resistance Variation		3 % R_n or 3Ω
End Resistance (Typical)		1Ω
Dielectric Strength (RMS)		2500 V
Insulation Resistance (500VDC)		$10^6 \text{ M}\Omega$

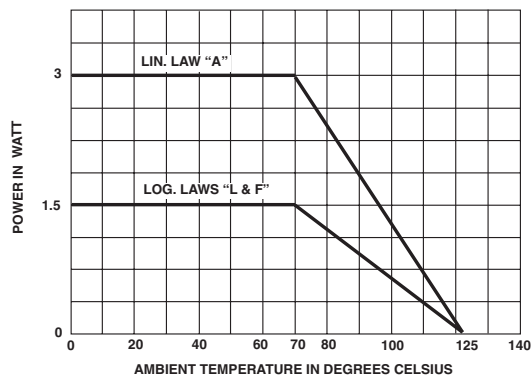
MECHANICAL SPECIFICATIONS

Mechanical Travel $300^\circ \pm 5^\circ$
 Operating Torque (max. Ncm) 3 typical
 End Stop Torque (max. Ncm) 70
 Max Tightening Torque of Mounting Nut (Ncm) 250
 Unit Weight (max. g) 23 to 32

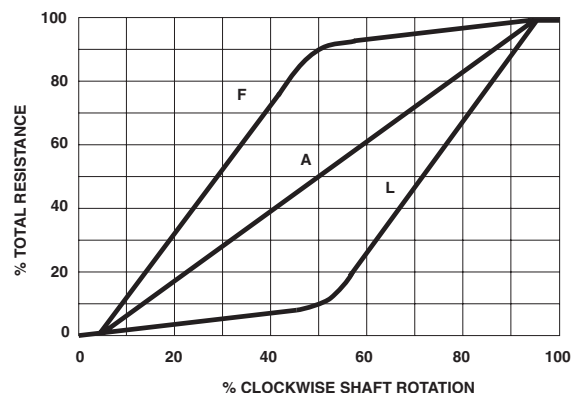
ENVIRONMENTAL SPECIFICATIONS

Temperature Range -55°C to $+125^\circ\text{C}$
 Climatic Category 55/125/56
 Sealing fully sealed container IP67

POWER RATING CHART



RESISTANCE LAWS





Fully Sealed Container Cermet Potentiometer Vishay Sfernice
Military and Professional Grade

PERFORMANCE						
CECC 41 301 - 002					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 10 %		± 10 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days 40 °C 93 % HR	± 10 %	Insulation resistance: > 100 MΩ		± 0.5 %	± 1 %
Rotational Life	25 000 cycles	± 10 %	Contact res. variation: < 7 % Rn		± 3 %	Contact res. variation: < 2 % Rn
Load Life	1000 h at rated power 90/30' - ambient temp. 70 °C	± 10 %	Contact res. variation: < 7 % Rn		± 1 %	Contact res. variation: < 3 % Rn
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 3 %			± 0.5 %	
Shock	50 g at 11 ms 3 successive shocks in 3 directions	± 2 %			± 0.1 %	± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 2 %			± 0.1 %	± 0.2 %

STANDARD RESISTANCE ELEMENT DATA							
STANDARD RESISTANCE VALUES	LINEAR LAW			LOGS LAW			TCR -55 °C +125 °C
	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	MAX. POWER AT 70 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	W	V	mA	W	V	mA	ppm/°C
22	3	8.12	369				200
47	3	11.87	252				
100	3	17.32	173				± 100
220	3	25.69	116				
470	3	37.55	79				
1K	3	57.44	54	1.5	38.7	38.7	
2.2K	3	81.24	37	1.5	57.4	26.1	
4.7K	3	118.74	25	1.5	83.9	17.9	
10K	3	173.20	17	1.5	122	12.2	
22K	3	256.9	11	1.5	181.6	8.25	
47K	1.91	300	6.3	1.5	265	5.64	
100K	0.90	300	3	0.9	300	3	
220K	0.41	300	1.36	0.41	300	1.36	
470K	0.19	300	0.63	0.19	300	0.63	
1M	0.09	300	0.30	0.09	300	0.30	
2.2M	0.04	300	0.13				
4.7M	0.02	300	0.06				
10M	0.01	300	0.03				

MARKING

- Printed:
- VISHAY trademark
 - model
 - NF types if applicable
 - ohmic value (in Ω, kΩ or MΩ)
 - tolerance (in %)
 - manufacturing date
 - marking of terminals 1, 2, 3 or a, b, c

ORDERING INFORMATION							
PE30	AC	200 kΩ	± 20 %	A	BO	e3	
MODEL	FEATURE	SHAFT LENGTH	OHMIC VALUE	TOLERANCE	LAW	PACKAGING	LEAD FINISH
P	Panel sealing*	AC 16 mm, slotted AM 25 mm, slotted AL 50 mm, plain		± 20 % standard ± 10 % on request	A Linear L clockwise logarithmic inverse F clockwise logarithmic		e3: pure Sn

* PE Panel sealing with locating peg (former designation E108)

SAP PART NUMBERING GUIDELINES																	
P	E	3	0	L	0	F	G	2	0	4	M	A	B				
MODEL			BUSHING OPTION		SHAFT		OHMIC VALUE			TOL	LAW	PACKAGING		SPECIAL (IF APPLICABLE)			

See the end of this data book for conversion tables

Power Panel Potentiometer



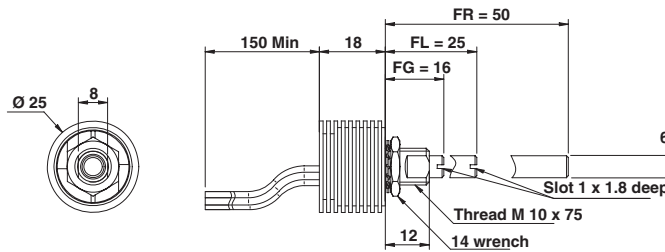
FEATURES

- 6 Watt at 25 °C
- Cermet element
- High power rating (6 W)
- Full sealing
- Mechanical strength
- Use of faston 2.86 connections
- Industrial and professional grade



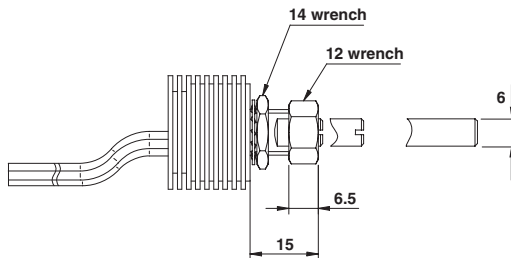
DIMENSIONS in millimeters

PE60L

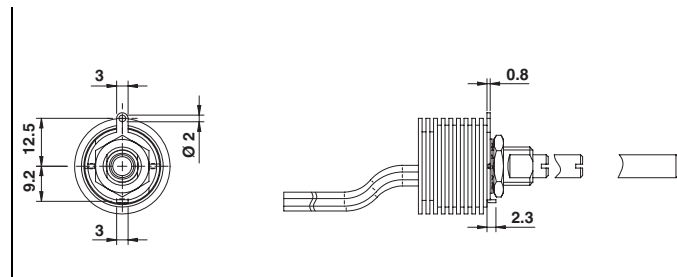


Available in 6.35 Dia (Code GG - GL - GR)

OPTION D: DBAN SHAFT LOCKING



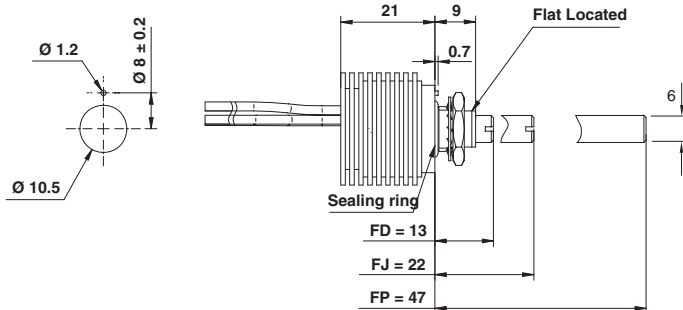
OPTION L: PE60 LPRP - WITH LOCATING PEG



Panel sealed version

PE60M

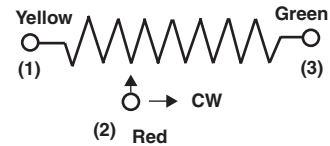
OPTION E: Including locating peg (Available only for PE60M)



Tolerance unless otherwise specified: ± 0.5

Available in 6.35 Dia (Code GD - GJ - GP)

CIRCUIT DIAGRAM



**SPECIAL FEATURES
COMMAND SHAFT**

Length is measured from the mounting surface to the free end of the shaft. The screwdriver slot is aligned with the wiper within $\pm 10^\circ$. Special shafts are available, in accordance to drawings supplied by customers. We recommend that customers should not machine shafts, in order to avoid damage. Bending or torsion of terminals should also be avoided.

PANEL SEALING: PE60M

The panel sealing device consists of a ring located in a slot on the potentiometer face. Sealing is obtained by tightening the ring against the panel when mounting the potentiometer.

SHAFT LOCKING: DBAN

The shaft locking device consists of a tapered nut tightening a slotted notched washer against both bushing and shaft. DBAN tightening torque is 200 Ncm, shaft locking torque being 30 Ncm.

DBAN is also available with all special types.

This device is normally supplied in a separate bag. Can be pre-mounted on request.

LOCATING PEG: LPRP

Location is obtained by fitting a special washer in 2 holes drilled at 180° in the potentiometer face. The peg can therefore be positioned at 90° , 180° , 270° and 360° .

ELECTRICAL SPECIFICATIONS		
Resistive Element		cermet
Electrical Travel		$270^\circ \pm 10^\circ$
Resistance Range	Linear Law	1 Ω to 1 M Ω
	Logarithmic Laws	100 Ω to 2.2 M Ω
Standard series E3		1 - 2 - 2.5 - 5
Tolerance	Standard	$\pm 20\%$
	On Request	$\pm 10\% - \pm 5\%$
Power Rating	Linear	6 W at + 25 $^\circ\text{C}$
	Logarithmic	3 W at + 25 $^\circ\text{C}$
Temperature Coefficient		See Standard Resistance Element Data
Limiting Element Voltage (Linear Law)		350 V
Contact Resistance Variation		3 % Rn or 0.5 Ω
End Resistance (Typical)		0.5 Ω or 1 %
Dielectric Strength (RMS)		2500 V
Insulation Resistance (500 VDC)		10 ⁶ M Ω

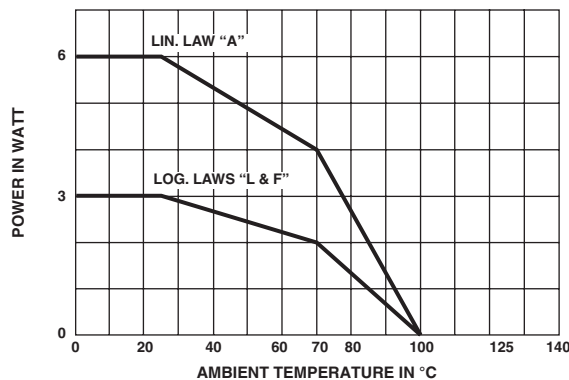
MECHANICAL SPECIFICATIONS

Mechanical Travel	300 $^\circ \pm 5^\circ$
Operating Torque (max. Ncm)	3 typical
End Stop Torque (max. Ncm)	70
Max Tightening Torque of Mounting Nut (Ncm)	250
Unit Weight (max. g)	23 to 35

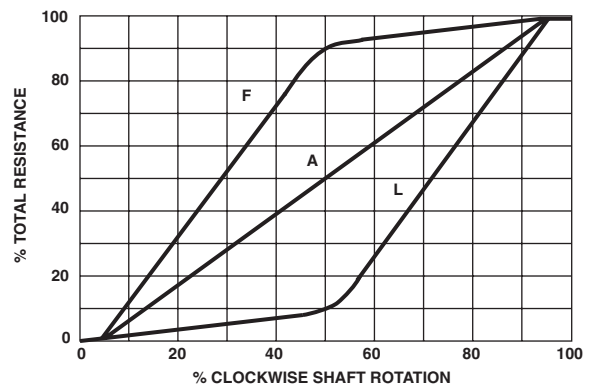
ENVIRONMENTAL SPECIFICATIONS

Temperature Range	- 55 $^\circ\text{C}$ to + 100 $^\circ\text{C}$
Climatic Category	55/100/56
Sealing	fully sealed container IP67

POWER RATING CHART



RESISTANCE LAWS





PERFORMANCE						
CECC 41 000					TYPICAL VALUES AND DRIFTS	
TESTS	CONDITIONS	$\frac{\Delta RT}{RT}$ (%)	REQUIREMENTS	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)	$\frac{\Delta RT}{RT}$ (%)	$\frac{\Delta R_{1-2}}{R_{1-2}}$ (%)
Climatic Sequence	Phase A dry heat 125 °C Phase B damp heat Phase C cold - 55 °C Phase D damp heat 5 cycles	± 10 %		± 10 %	± 0.5 %	± 1 %
Long Term Damp Heat	56 days	± 10 %	Insulation resistance: > 100 MΩ		± 0.5 %	± 1 % Insulation resistance: > 10 ⁴ MΩ
Rotational Life	25 000 cycles	± 10 %	Contact res. variation: < 7 % Rn		± 3 %	Contact res. variation: < 2 % Rn
Load Life	1000 h at rated power 90°/30° - ambient temp. 25 °C	± 10 %	Contact res. variation: < 7 % Rn		± 1 %	Contact res. variation: < 3 % Rn
Rapid Temperature Change	5 cycles - 55 °C at + 125 °C	± 3 %			± 0.5 %	
Shock	50 g at 11 ms 3 successive shocks in 3 directions	± 2 %			± 0.1 %	± 0.2 %
Vibration	10 - 55 Hz 0.75 mm or 10 g during 6 hours	± 2 %			± 0.1 %	± 0.2 %

STANDARD RESISTANCE ELEMENT DATA				
STANDARD RESISTANCE VALUES	LINEAR LAW			TCR - 55 °C + 125 °C ppm/°C
	MAX. POWER AT 25 °C	MAX. WORKING VOLTAGE	MAX. CUR. THROUGH WIPER	
Ω	W	V	mA	
20	6	11.0	548	± 300
25	↓	12.2	490	
50		17.3	346	
100		24.5	245	
200		34.6	173.2	
250		38.7	154.9	
500		54.8	109.5	
1K		77.5	77.5	
2K		110	54.8	
2.5K		122	49.0	
5K		173	34.64	
10K	245	24.49		
20K	6	346	17.32	
25K	4.90	350	14.00	
50K	2.45	↓	7.00	
100K	1.23		3.50	
200K	0.61		1.75	
250K	0.49		1.40	
500K	0.25		0.70	
1M	0.12	350	0.35	

MARKING

- Printed:
- VISHAY trademark
 - model
 - ohmic value (in W, kW or MW)
 - tolerance (in %)
 - manufacturing date
 - packaging in box

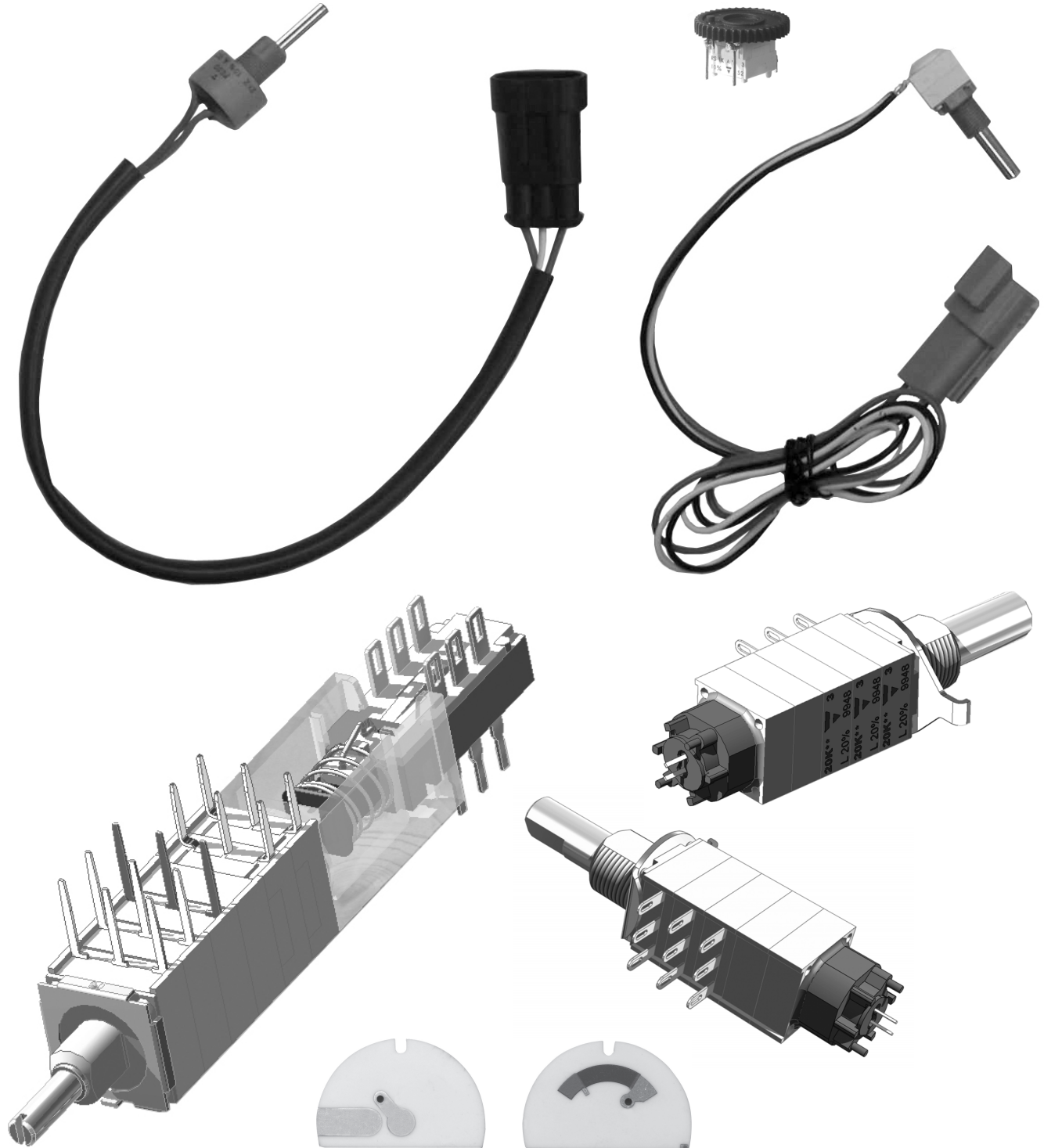
ORDERING INFORMATION								
PE60	L	O	FG	W	200 kΩ	± 20 %	A	e3
MODEL	BUSHING	OPTION	SHAFT LENGTH	LEADS	OHMIC VALUE	TOLERANCE	LAW	LEAD FINISH
	M: Panel sealings L: STD	0 = none D = DBAN L = LPRP B = DBAN & LPRP E = Peg	FG 16 mm, slotted FL 25 mm, slotted FR 50 mm, plain	W: Wire		± 20 % standard ± 10 % on request ± 5 % on request	A = Linear L = clockwise logarithmic F = clockwise inverse logarithmic	e3 = pure Sn

SAP PART NUMBERING GUIDELINES																		
P	E	6	0	L	0	F	G	W	2	0	4	M	A					
MODEL				BUSHING		OPTION		SHAFT	LEADS		OHMIC VALUE			TOL	LAW		SPECIAL (IF APPLICABLE)	
See the end of this data book for conversion tables																		

Potentiometers Special Designs

Our experience with the Potentiometers along with our ability to quickly design custom products allow us to offer the best solution and technical support for your application.

See below for some examples of special designs.





Accessories

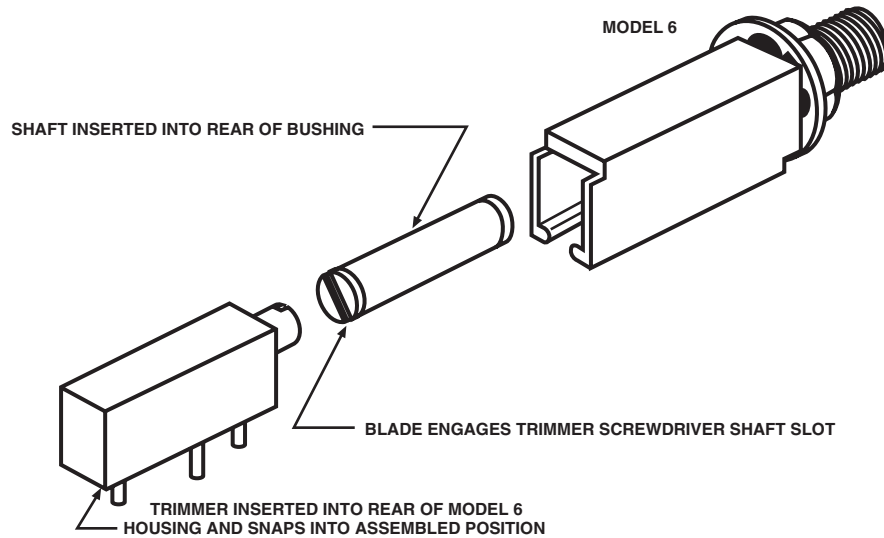
Model Numbers

6.....	140
8.....	142
ACC POT, TRI	143



Snap-On Panel Mount Adapters

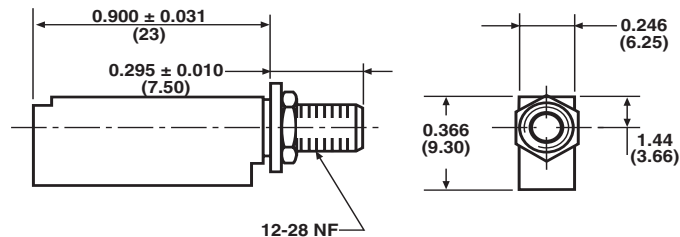
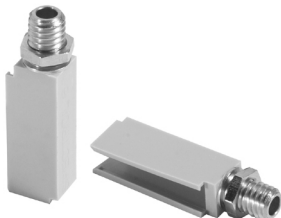
Vishay Spectrol's standard 3/4" and 1 - 1/4" rectangular trimming potentiometers, the Models 43 and 70, may be easily panel mounted through the use of Vishay Spectrol Model 6 panel mount adapters. The adapters are designed to convert these standard trimmer models into panel mount trimmers in a quick, convenient, and economical manner. Assembly with the trimmer is accomplished by snap-in, providing for minimal installation time.



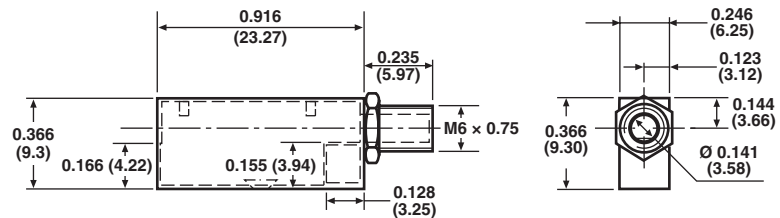
DIMENSIONS in inches (millimeters)

ACTUAL SIZES

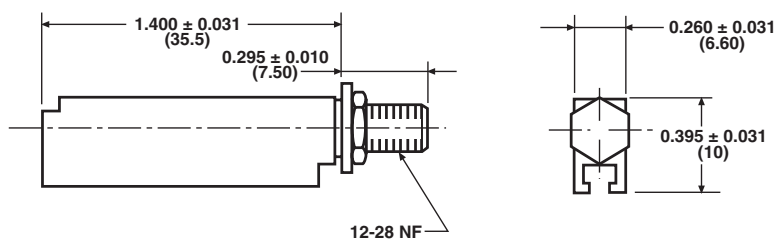
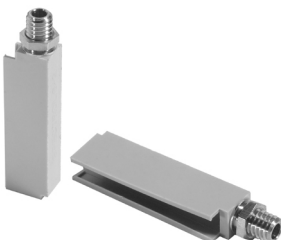
6-1-0



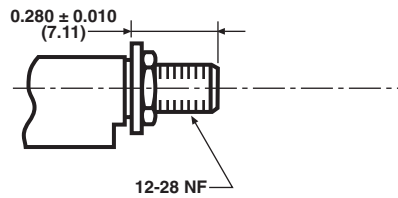
6-1-0-P



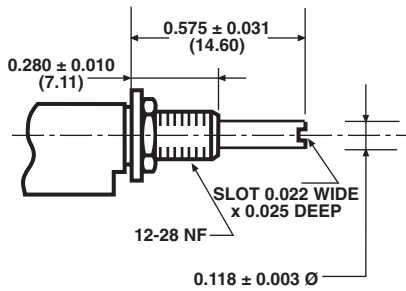
6-2-0



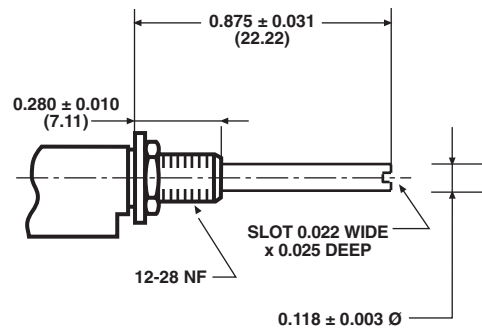
AVAILABLE SHAFT CONFIGURATIONS



6-1-2



6-1-3



SHAFT DIMENSIONS APPLY TO 6-1-X AND 6-2-X VERSION

MECHANICAL SPECIFICATIONS

- Construction** Molded polyester plastic
- Bushing Material** Brass nickel plated
- Bushing Hardware** Panel nut and lock washer
- Shafts Available (Inches)** (1) Flush (2) 0.575 (3) 0.875

See photos and drawings for additional information

PACKAGING

Box of 100 pieces

ORDERING INFORMATION			
6 MODEL	1 TRIMMER SIZE	2 SHAFT EXTENSION	OPTION
	1. Fits Vishay Spectrol Model 43 2. Fits Vishay Spectrol Model 70	0. No extra shaft 1. Shaft flush with bushing 2. 0.575 Shaft extension 3. 0.875 Shaft extension	P: Plastic bushing

SAP PART NUMBERING GUIDELINES																	
A	C	C	T	R	I	A	D	B	3	0	6	1	2				
MODEL						STYLE		PACKAGING			SPECIAL						
See the end of this data book for conversion tables																	



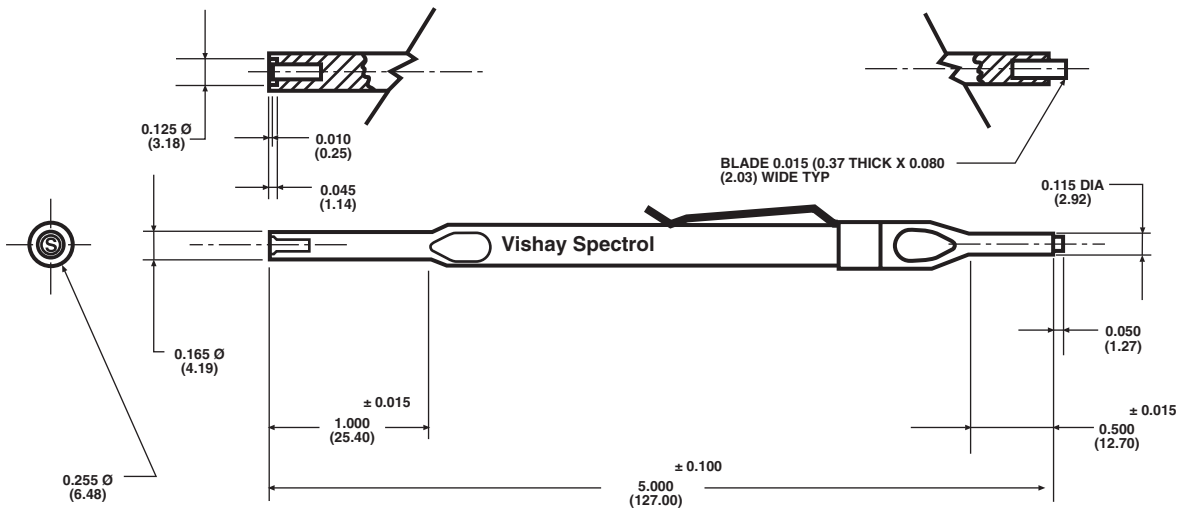
Trimmer Adjustment Tool

FEATURES

- Extended as well as recessed blade for critical adjustments
- Designed to adjust trimmers of all sizes
- Available with customer trademark



DIMENSIONS in millimeters



TOLERANCES: UNLESS OTHERWISE NOTED DECIMALS ± 0.005

MECHANICAL SPECIFICATIONS


Material Glass filled nylon body with corrosion resistant stainless steel blades

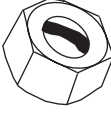
PACKAGING
Box of 100 pieces


ORDERING INFORMATION	
8 MODEL	T000 TRADEMARK OPTION
	T000 Vishay Spectrol trademark T001 Customer trademark T005 No trademark T006 Same as T000 except no clip T007 Same as T005 except no clip T300 Vishay trademark


SAP PART NUMBERING GUIDELINES																	
A	C	C	T	R	I	T	O	B	3	0	8	T	0	0	0		
MODEL						STYLE		PACKAGING			SPECIAL						
See the end of this data book for conversion tables																	

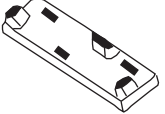
Accessories

DE SHAFT AND PANEL SEALING HARDWARE					
					
TYPE	LENGTH	WRENCH	Ø SHAFT	ORDERING INFORMATION	PACKAGING
Ø M6 x 0.75	9	12	3	ACCPOTDEB173351950	25

DBAN SHAFT LOCKING					
					
TYPE	LENGTH	WRENCH	Ø SHAFT	ORDERING INFORMATION	PACKAGING
Ø M10 x 0.75	6.5	12	6	ACCPOTDBB173190100	25

LOCATING PEG			
			
PRODUCT	THICKNESS	ORDERING INFORMATION	PACKAGING
PE30 or PRV4	0.8	ACCPOTLPB153804132	20

LOCATING PEG				
				
PRODUCT	THICKNESS	L FROM CENTER	ORDERING INFORMATION	PACKAGING
P11 - 148	0.4	6.2 mm (0.244 in)	ACCPOTERB253651650	50
P11 - 148	0.4	7.75 mm (0.305 in)	ACCPOTERB253651660	50
P11 V - P11 2 - 148	0.8	13.5 mm (0.53 in)	ACCPOTERB253651190	50

BASE RAISER			
			
PRODUCT	HEIGHT	ORDERING INFORMATION	PACKAGING
M43 T18	1.6	ACCTRICAB253850610	50

NUTS



THICKNESS	WRENCH	PRODUCT	ORDERING INFORMATION	PACKAGING
nut H 10 ep. 2.5	14	PE30 - P13V	ACCPOTECB303401100	100
nut H 7 ep. 2	10	P11Q - P12Q - P13Q	ACCPOTECB303351680	100
nut H 6 ep. 1.8	10	P12T - P13T	ACCPOTECB302005700	100
nut H 6 ep. 1.8	8	P11T	ACCPOTECB303651550	100
nut H 8 ep. 2	12	P11P	ACCPOTECB303652600	100
nut H 10 ep. 2	12	P11V - P11CC	ACCPOTECB303653200	100
nut H 3/8" ep. 2.5	12.5/1/2"	P112 - P110	ACCPOTECB303653230	100
nut H 1/4" ep. 2	8	P117 - P11 77 - PRV6	ACCPOTECB303430230	100

WASHER



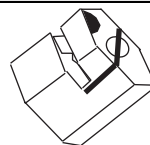
DIAMETER	PRODUCT	ORDERING INFORMATION	PACKAGING
Internal Washer JZ Ø 10	P11V - P12/P13V - PE30	ACCPOTRDB300685710	100
Internal Washer JZ Ø 7	P11Q - P13Q	ACCPOTRDB300683707	100
Internal Washer JZ Ø 6	P11T - P12T - P13T	ACCPOTRDB300683706	100
External Washer JZ Ø 1/4	P117	ACCPOTRDB303430600	100
Internal Washer 3/8"	P112	ACCPOTRDB300683952	100

O RING

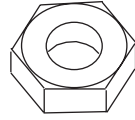


TYPE	PRODUCT	DIMENSIONS	ORDERING INFORMATION	PACKAGING
Panel O ring toric	PRV6	Ø int 8 mm/Ø tore 1 mm	ACCPOTJOB303342420	100
Panel O ring plate	P16	Ø ext 13.2 mm/Ø int 9.7 mm/Ep 0.8 mm	ACCPOTJOB303753950	100
Panel O ring plate	P11P	Ø ext 12.5 mm/Ø int 9.5 mm/Ep 1.2 mm	ACCPOTJOB303652780	100

HEXAGONAL LOCKING NUT



TYPE	LENGTH	WRENCH	Ø SHAFT	ORDERING INFORMATION	PACKAGING
Hex nut M6 x 0.75	10	10	3	ACCPOTECB253651420	50

LOCKING NUT FOR SLOTTED BUSHING


TYPE	WRENCH	SHAFT DIAMETER	PRODUCT	ORDERING INFORMATION	PACKAGING
locking nut Ø 6.35 mm	8	3.17 mm	P117H - PRV6H	ACCPOTECB303656590	100
locking nut Ø 6 mm	8	3 mm	P13H	ACCPOTECB303430400	100

SAP PART NUMBERING GUIDELINES

A	C	C	P	O	T	E	C	B	3	0	3	4	0	1	1	0	0
MODEL						STYLE		PACKAGING			SPECIAL						

See the end of this data book for conversion tables



Conversion Tables

Model Numbers

SAP Part Numbering Ohmic
Value, Tolerance and
Packaging 148

SAP Part Numbering
Shaft..... 149

SAP Part Numbering
Bushing 150

CCTU Code Shaft 151



SAP Part Numbering Ohmic Value, Tolerance, Packaging, Shaft and Bushing

SAP PART NUMBERING: CONVERSION TABLE FOR OHMIC VALUE			
OHMS	SAP CODE	OHMS	SAP CODE
10	100	10 000	103
20	200	20 000	203
22	220	22 000	223
25	250	25 000	253
47	470	47 000	473
50	500	50 000	503
100	101	100 000	104
200	201	200 000	204
220	221	220 000	224
250	251	250 000	254
470	471	470 000	474
500	501	500 000	504
1000	102	1 000 000	105
2000	202	2 000 000	205
2200	222	2 200 000	225
2500	252	2 500 000	255
4700	472	4 700 000	475
5000	502	5 000 000	505

3 Digit Code: The first two digits are significant figures, the third one is the multiplier.

SAP PART NUMBERING: CONVERSION TABLE FOR TOLERANCE	
TOLERANCE	SAP CODE
± 5 %	J
± 10 %	K
± 20 %	M

SAP PART NUMBERING: CONVERSION TABLE FOR PACKAGING			
BULK			
SAP CODE	QUANTITY	EUROPE OLD CODE	US OLD CODE
B	VARIOUS	BO	
B08	8	BO8	
B10	10	BO10	
B12	15	BO15	
B15	20	BO20	
B16	24	BO24	
B17	25	BO25	
B24	45	BO45	
B25	50	BO50	BO4
B26	60	BO60	
B28	80	BO80	
B30	100	BO100	
B40	200	BO200	
B41	250	BO250	BO4
SPECIAL CODE WITH 2 DIGITS: BULK			
B1	15	BO	
B2	25	BO	
B3	50	BO	
B4	100	BO	
REEL			
R05	250	TR250	RG1
R10	500	TR500	RB2
R15	1000	TR1000	RF7
R20	2000	TR2000	
R32	750	TR750	RF4
TUBE			
T10	25	TU25	D07
T20	50	TU50	D06



SAP PART NUMBERING: TABLE OF SHAFT DIMENSIONS																				
LENGTH		mm	9.5	12	CONCENTRIC	13	13.5	15	15.88	19.05	20	22.23	22.5	25.4	30	32	38.1	47	48	50.8
DIAMETER		INCH	3/8"	1/2"		0.531	0.551	0.612	5/8"	3/4"	0.816	7/8"	0.918	1"	1.224	1.306	1.5"	1.918	1.939	2"
mm	INCH	SAP CODE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
3	0.1181	A	AA	AB	-	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	-	AQ	AR
3.175	1/8"	B	BA	BB	-	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR
Concentric		C	-	-	CC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.5	0.1378	D	DA	DB	-	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR
4	0.1575	E	EA	EB	-	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER
6	0.2362	F	FA	FB	-	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR
6.35	1/4"	G	GA	GB	-	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR

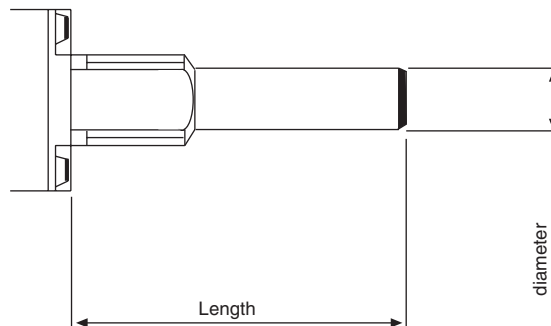
AP = Custom Shaft

3 Digit Code: First digit is the diameter, second digit is the length, third digit in the end shaft shape

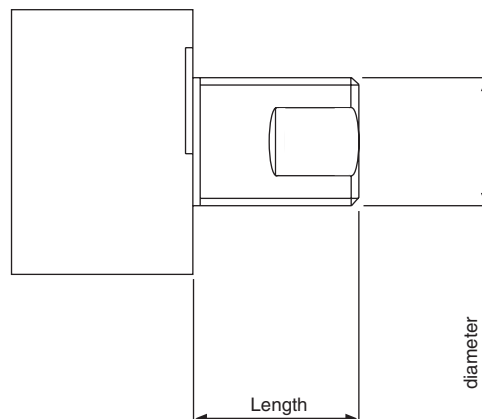
END SHAFT SHAPE	
S	Slotted Shaft
R	Round Shaft
F	Flat Shaft
K	Knurled Shaft
D	Custom End Shaft

Example:

DAS Diameter 3.5 mm
Length 3/8"
Slotted



SAP PART NUMBERING: TABLE OF BUSHING DIMENSIONS						
SAP CODE	THREAD	DIAMETER		LENGTH		SPECIAL
		MM	INCH	MM	INCH	
A	32 UNEF - 2A	6.35	1/4"	6.35	1/4"	-
B	32 UNEF - 2A	6.35	1/4"	9.52	3/8"	-
C	32 UNEF - 2A	6.35	1/4"	12.7	1/2"	-
D	32 UNEF - 2A	6.35	1/4"	9.52	3/8"	Slotted
E	32 UNEF - 2A	6.35	1/4"	12.7	1/2"	Slotted
F	32 UNEF - 2A	9.52	3/8"	9.52	3/8"	-
G	M8 x 0.75	8	0.315	8	0.315	Sealed
H	M7 x 0.75	7	0.276	6.5	0.256	-
I	M7 x 0.75	7	0.276	9.5	0.374	-
J	M7 x 0.75	7	0.276	6.5	0.256	Sealed
K	M7 x 0.75	7	0.276	9.5	0.374	Sealed
L	M10 x 0.75	10	0.394	12	0.472	-
M	M10 x 0.75	10	0.394	9	0.354	-
N	M10 x 0.75	10	0.394	9.5	0.374	-
O	M6 x 0.75	6	0.236	11	0.433	Slotted
P	M6 x 0.75	6	0.236	8	0.315	Sealed
Q	M7 x 0.75	7	0.276	8	0.315	-
R	M7 x 0.75	7	0.276	7	0.276	-
S		special		special		-
T	M6 x 0.75	6	0.236	8	0.315	-
U	M6 x 0.75	6	0.236	7	0.276	-
V	M10 x 0.75	10	0.394	9.5	0.374	-
W	32 UNEF - 2A	9.52	3/8"	6.35	1/4"	-





According to CCTU 05-01 and 05-02

CCTU 05-01

CODE	DIA mm	L mm	SLOT*	SHAFT LOCKING	VISHAY SFERNICE REFERENCE
C 095 AN	3 + 0.01/- 0.06	9.5 ± 0.5	with	without	K (P11T - P12T - P13T)
C 125 AN		12.5 ± 0.5	with	without	M (P11T - P12T - P13T)
C 125 AL			with	with	P12H - P13H - M + ES1 (P11P)
C 160 AN		16 ± 0.5	with	without	Particular shaft
C 160 AL			with	with	Particular shaft
C 220 BN		22 ± 0.5	without	without	R (P12T - P13T)
C 220 AN			with	without	R (P11T)
F 160 AN	6 + 0.01/- 0.075	16 ± 0.5	with	without	AC (PE30 - P13V) D (P11V)
F 160 AL			with	with	AC or D + DBAN
F 250 BN		25 ± 0.5	without	without	Particular shaft
F 250 AN			with	without	AM (PE30 - P13V) N (P11V)
F 250 AL			with	with	AM or N + DBAN
F 320 BN		32 ± 0.5	without	without	Particular shaft
F 500 BN		50 ± 0.5	without	without	AL (PE30 - P13V)
F 500 AN			with	without	S (P11V)

For the diameters:

* Shaft slot is aligned with the wiper within ± 10°.

3.17 mm (1/8") the code letter becomes D ex.: D 160 AN

6.35 mm (1/4") the code letter becomes G ex.: G 160 AN

4 mm (0.157") the code letter becomes E ex.: E 125 AN

CCTU 05-02

CODE	DIA mm	L mm	SLOT	SHAFT LOCKING	VISHAY SFERNICE REFERENCE
A	6 + 0.03/- 0.05	16 ± 0.5	with	with	AC or D + DBAN
B			with	without	AC or D
C		25 ± 0.5	with	with	AM or N + DBAN
D			with	without	AM or N
E			with	without	Particular shaft
F		32 ± 0.5	without	without	Particular shaft
G		50 ± 0.5	without	without	AL (PE30 - P13U)
K	3 + 0.03/- 0.03	9.5 ± 0.5	with	with	Particular shaft
L		12.5 ± 0.5	with	with	P12H - P13H - M + ES1
M			with	without	M (P12T - P13T - P11T)
N		16 ± 0.5	with	with	Particular shaft
P			with	without	Particular shaft
R			22 ± 0.5	without	without

For the diameters:

3.17 mm (1/8") or 6.35 mm (1/4") add "1" at the code letter

TOLERANCE CODE ON OHMIC VALUE: M = ± 20 %; K = ± 10 %















ONLINE INFORMATION

For product information and a current list of sales offices,
representatives and distributors, visit our website:

www.vishay.com

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One of the World's Largest

Manufacturers

of Discrete Semiconductors and Passive Components



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