

# Knob Potentiometer



## DESIGN SUPPORT TOOLS


[click logo to get started](#)

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

- Test according to CECC 41000 or IEC 60393-1
- **P16** - version for professional and industrial applications (cermet)  
1 W at 40 °C
- **PA16** - version for professional audio applications (conductive plastic)  
0.5 W at 40 °C
- Compact (integrated)
- High dielectric strength: 2500 V<sub>RMS</sub>
- Fully sealed and panel sealed
- Metallic or plastic knob options
- Custom knob on request
- Material categorization: for definitions of compliance please see [www.vishay.com/doc299912](http://www.vishay.com/doc299912)

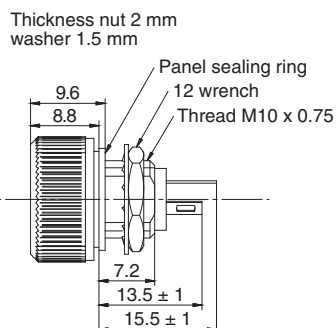

**RoHS**  
COMPLIANT

## QUICK REFERENCE DATA

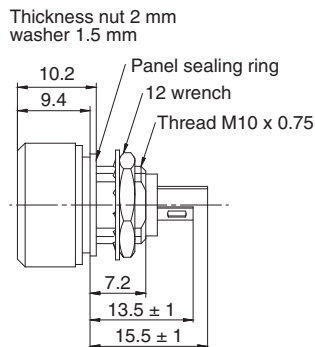
|                         |                                                   |
|-------------------------|---------------------------------------------------|
| Multiple module         | No                                                |
| Switch module           | n/a                                               |
| Detent module           | n/a                                               |
| Special electrical laws | A: linear, L: logarithmic, F: reverse logarithmic |
| Sealing level           | IP 67                                             |
| Lifespan                | 50K cycles                                        |

## DIMENSIONS in millimeters (± 0.5 mm)

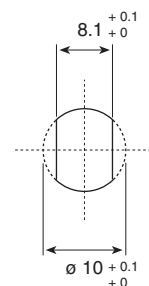
### P16NP



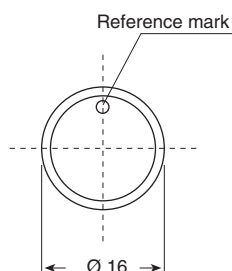
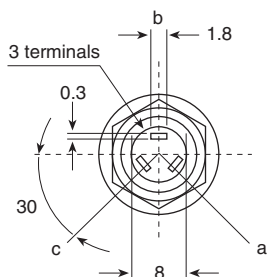
### P16NM



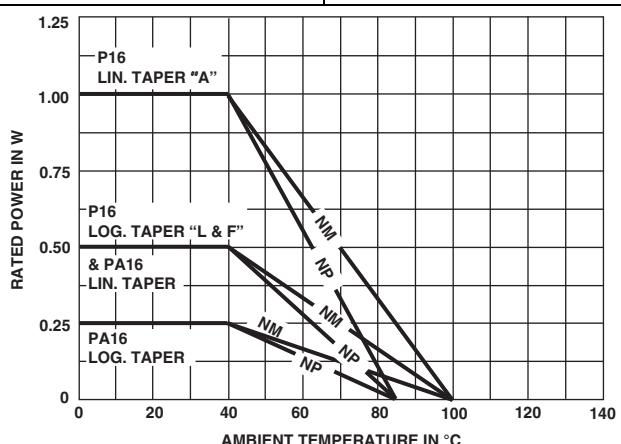
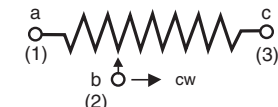
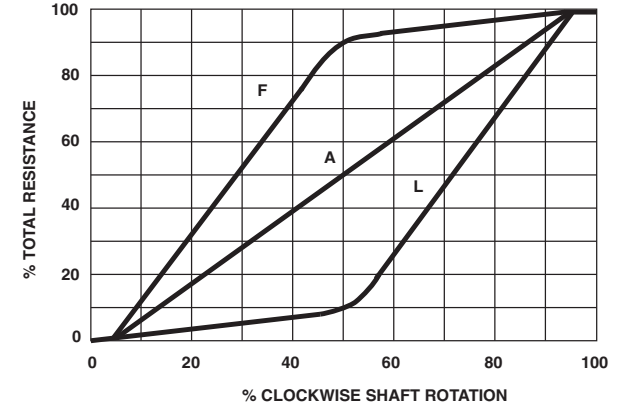
### Panel Cutout



Panel thickness max.: 3 mm





| ELECTRICAL SPECIFICATIONS                    |                                                                                                     |                                                                |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------|
|                                              | P16                                                                                                 | PA16                                                           |
| Resistive element                            | Cermet                                                                                              | Conductive plastic                                             |
| Electrical travel                            | $270^\circ \pm 10^\circ$                                                                            | $270^\circ \pm 10^\circ$                                       |
| Power rating chart                           |                   |                                                                |
| Circuit diagram                              |                   |                                                                |
| Taper                                        |                  |                                                                |
| Resistance range                             | linear taper<br>22 $\Omega$ to 10 M $\Omega$<br>logarithmic taper<br>100 $\Omega$ to 2.2 M $\Omega$ | 1 k $\Omega$ to 1 M $\Omega$<br>470 $\Omega$ to 500 k $\Omega$ |
| Standard series E3                           | 1 - 2.2 - 4.7 and on request 1 - 2 - 5                                                              | 1 - 2.2 - 4.7                                                  |
| Tolerance                                    | standard<br>$\pm 20\%$<br>on request<br>$\pm 10\%$                                                  | $\pm 20\%$<br>$\pm 10\%$ (1 k $\Omega$ to 100 k $\Omega$ )     |
| Power rating                                 | linear<br>1 W at $+40^\circ\text{C}$<br>logarithmic<br>0.5 W at $+40^\circ\text{C}$                 | 0.5 W at $+40^\circ\text{C}$<br>0.25 W at $+40^\circ\text{C}$  |
| Temperature coefficient (typical)            | $\pm 150$ ppm/ $^\circ\text{C}$                                                                     | $\pm 500$ ppm/ $^\circ\text{C}$                                |
| Dielectric strength (RMS)                    | 2500 V                                                                                              | 2500 V                                                         |
| Limiting element voltage (linear law)        | 350 V                                                                                               | 350 V                                                          |
| Contact resistance variation                 | 3 % R <sub>n</sub> or 3 $\Omega$                                                                    | 2 % R <sub>n</sub> or 3 $\Omega$                               |
| End resistance (typical)                     | 1 $\Omega$                                                                                          | 1 $\Omega$                                                     |
| Insulation resistance (500 V <sub>DC</sub> ) | 10 <sup>6</sup> M $\Omega$                                                                          | 10 <sup>6</sup> M $\Omega$                                     |

**MECHANICAL SPECIFICATIONS**

|                                        |                 |
|----------------------------------------|-----------------|
| Mechanical travel                      | 300° ± 5°       |
| Operating torque                       | 2 Ncm typical   |
| End stop torque                        | 25 Ncm maximum  |
| Max. tightening torque of mounting nut | 180 Ncm maximum |
| 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                              |                  |

**MARKING**

- Ohmic value code, tolerance code and taper
- Manufacturing date code

**PACKAGING**

- Carton box of 20 pieces

**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, colors) and legends can be printed on plastic knob on request - please consult Vishay.

**P16 STANDARD RESISTANCE ELEMENT DATA**

| STANDARD<br>RESIS-<br>TANCE<br>VALUES | LINEAR TAPER                 |                                     |                                  | LOG TAPER                    |                                     |                                  |
|---------------------------------------|------------------------------|-------------------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------------|
|                                       | MAX.<br>POWER<br>AT<br>40 °C | MAX.<br>VOLTAGE<br>THROUGH<br>WIPER | MAX.<br>CUR.<br>THROUGH<br>WIPER | MAX.<br>POWER<br>AT<br>40 °C | MAX.<br>VOLTAGE<br>THROUGH<br>WIPER | MAX.<br>CUR.<br>THROUGH<br>WIPER |
| Ω                                     | W                            | V                                   | mA                               | W                            | V                                   | mA                               |
| 22                                    | 1                            | 4.69                                | 213                              |                              |                                     |                                  |
| 47                                    | 1                            | 6.85                                | 146                              |                              |                                     |                                  |
| 100                                   | 1                            | 10                                  | 100                              |                              |                                     |                                  |
| 220                                   | 1                            | 14.8                                | 67.4                             | 0.5                          | 7.1                                 | 71                               |
| 470                                   | 1                            | 21.7                                | 46.1                             | 0.5                          | 10.5                                | 48                               |
| 1K                                    | 1                            | 31.6                                | 31.6                             | 0.5                          | 15.3                                | 32.6                             |
| 2.2K                                  | 1                            | 46.9                                | 21.3                             | 0.5                          | 22.4                                | 22.4                             |
| 4.7K                                  | 1                            | 68.5                                | 14.6                             | 0.5                          | 33.2                                | 15.1                             |
| 10K                                   | 1                            | 100                                 | 10                               | 0.5                          | 48.5                                | 10.3                             |
| 22K                                   | 1                            | 148                                 | 6.74                             | 0.5                          | 70.7                                | 7.07                             |
| 47K                                   | 1                            | 217                                 | 4.61                             | 0.5                          | 105                                 | 4.77                             |
| 100K                                  | 1                            | 316                                 | 3.16                             | 0.5                          | 153                                 | 3.26                             |
| 220K                                  | 0.56                         | 350                                 | 1.59                             | 0.5                          | 224                                 | 2.24                             |
| 470K                                  | 0.26                         | 350                                 | 0.75                             | 0.5                          | 332                                 | 1.51                             |
| 1M                                    | 0.12                         | 350                                 | 0.35                             | 0.26                         | 350                                 | 0.74                             |
| 2.2M                                  | 0.05                         | 350                                 | 0.16                             | 0.12                         | 350                                 | 0.35                             |
| 4.7M                                  | 0.02                         | 350                                 | 0.07                             | 0.056                        | 350                                 | 0.16                             |
| 10M                                   | 0.01                         | 350                                 | 0.012                            |                              |                                     |                                  |

**PA16 STANDARD RESISTANCE ELEMENT DATA**

| STANDARD<br>RESIS-<br>TANCE<br>VALUES | LINEAR TAPER                 |                                     |                                  | LOG TAPER                    |                                     |                                  |
|---------------------------------------|------------------------------|-------------------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------------|
|                                       | MAX.<br>POWER<br>AT<br>40 °C | MAX.<br>VOLTAGE<br>THROUGH<br>WIPER | MAX.<br>CUR.<br>THROUGH<br>WIPER | MAX.<br>POWER<br>AT<br>40 °C | MAX.<br>VOLTAGE<br>THROUGH<br>WIPER | MAX.<br>CUR.<br>THROUGH<br>WIPER |
| Ω                                     | W                            | V                                   | mA                               | W                            | V                                   | mA                               |
| 470                                   |                              |                                     |                                  | 0.25                         | 10.8                                | 23.1                             |
| 1K                                    | 0.5                          | 22.4                                | 22.4                             | 0.25                         | 15.8                                | 16                               |
| 2.2K                                  | 0.5                          | 33.2                                | 15.1                             | 0.25                         | 23.5                                | 11                               |
| 4.7K                                  | 0.5                          | 48.5                                | 10.3                             | 0.25                         | 34.3                                | 7                                |
| 10K                                   | 0.5                          | 70.7                                | 7.07                             | 0.25                         | 50.0                                | 5.0                              |
| 22K                                   | 0.5                          | 105                                 | 4.77                             | 0.25                         | 74                                  | 3.4                              |
| 47K                                   | 0.5                          | 153                                 | 3.26                             | 0.25                         | 108                                 | 2.3                              |
| 100K                                  | 0.5                          | 224                                 | 2.24                             | 0.25                         | 158                                 | 1.6                              |
| 220K                                  | 0.5                          | 332                                 | 1.51                             | 0.25                         | 235                                 | 1.1                              |
| 470K                                  | 0.26                         | 350                                 | 0.74                             | 0.25                         | 343                                 | 0.7                              |
| 1M                                    | 0.12                         | 350                                 | 0.35                             |                              |                                     |                                  |

**PERFORMANCE**

| TESTS                   | CONDITIONS                                                | TYPICAL VALUES AND DRIFTS |                              |                                                                                 |
|-------------------------|-----------------------------------------------------------|---------------------------|------------------------------|---------------------------------------------------------------------------------|
|                         |                                                           | $\Delta R_T/R_T$ (%)      | $\Delta R_{1-2}/R_{1-2}$ (%) | OTHER                                                                           |
| Electrical endurance    | 1000 h at rated power<br>90°/30° cycle at +40 °C          | ± 5 %                     | -                            | Insulation resistance: > 10 <sup>4</sup> MΩ<br>Contact res. variation: < 2 % Rn |
| Damp heat, steady state | 56 days<br>40 °C, 93 % HR                                 | ± 2 %                     | ± 1 %                        | Insulation resistance: > 10 <sup>4</sup> MΩ                                     |
| Mechanical endurance    | 50 000 cycles                                             | ± 5 %                     | -                            | Contact res. variation: < 2 % Rn                                                |
| Shock                   | 50 g's at 11 ms<br>3 successive shocks<br>in 3 directions | ± 0.2 %                   | ± 0.5 %                      | -                                                                               |
| Vibration               | 10 Hz to 55 Hz<br>0.75 mm or 10 g's<br>during 6 h         | ± 0.2 %                   | -                            | $\Delta V_{1-2}/\Delta V_{1-3} \leq \pm 0.5$ %                                  |

**Note**

- Nothing stated herein shall be construed as a guarantee of quality or durability

**ORDERING INFORMATION**

|                                                                      |                                                                                                                                                |          |          |                                                                                   |          |          |                                                           |                                                                                                      |          |          |                                     |                                                               |  |  |  |  |  |
|----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|-----------------------------------------------------------------------------------|----------|----------|-----------------------------------------------------------|------------------------------------------------------------------------------------------------------|----------|----------|-------------------------------------|---------------------------------------------------------------|--|--|--|--|--|
| <b>P</b>                                                             | <b>1</b>                                                                                                                                       | <b>6</b> | <b>N</b> | <b>P</b>                                                                          | <b>2</b> | <b>2</b> | <b>3</b>                                                  | <b>M</b>                                                                                             | <b>A</b> | <b>B</b> | <b>1</b>                            | <b>5</b>                                                      |  |  |  |  |  |
| <b>MODEL</b>                                                         | <b>STYLE</b>                                                                                                                                   |          |          | <b>OHMIC VALUE</b>                                                                |          |          | <b>TOLERANCE</b>                                          | <b>TAPER</b>                                                                                         |          |          | <b>PACKAGING CODE</b>               | <b>SPECIAL NUMBER</b>                                         |  |  |  |  |  |
| <b>P16</b> =<br>cermet<br><br><b>PA16</b> =<br>conductive<br>plastic | <b>NM</b> : metallic black<br><b>NP</b> : plastic black<br><b>WM</b> : metallic white<br><b>WP</b> : plastic white<br><b>BP</b> : plastic blue |          |          | <b>223</b> = 22 kΩ<br>for ohmic value<br>range see<br>electrical<br>specification |          |          | <b>M</b> = ± 20 %<br><br>On request:<br><b>K</b> = ± 10 % | <b>A</b> : linear<br><b>L</b> : clockwise logarithmic<br><b>F</b> : inverse clockwise<br>logarithmic |          |          | <b>B15</b> =<br>box of<br>20 pieces | (If applicable)<br>Given by<br>Vishay<br>for custom<br>design |  |  |  |  |  |

**PART NUMBER DESCRIPTION** (for information only)

|            |           |              |             |          |         |           |         |                   |
|------------|-----------|--------------|-------------|----------|---------|-----------|---------|-------------------|
| <b>P16</b> | <b>NP</b> | <b>22 kΩ</b> | <b>20 %</b> | <b>A</b> |         | <b>BO</b> |         | <b>e3</b>         |
| MODEL      | STYLE     | VALUE        | TOLERANCE   | TAPER    | SPECIAL | PACKAGING | SPECIAL | LEAD<br>(Pb)-FREE |

**RELATED DOCUMENTS****APPLICATION NOTES**

|                                                                   |                                                                        |
|-------------------------------------------------------------------|------------------------------------------------------------------------|
| Potentiometers and Trimmers                                       | <a href="http://www.vishay.com/doc?51001">www.vishay.com/doc?51001</a> |
| Guidelines for Vishay Sfernice Resistive and Inductive Components | <a href="http://www.vishay.com/doc?52029">www.vishay.com/doc?52029</a> |



## Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.