

## 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.

| 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                                        |

### 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/doc?99912](http://www.vishay.com/doc?99912)


**RoHS**  
COMPLIANT

| DIMENSIONS in millimeters (± 0.5 mm)                            |                                                                 |                                                              |
|-----------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------|
| <p><b>P16NP</b></p> <p>Thickness nut 2 mm<br/>washer 1.5 mm</p> | <p><b>P16NM</b></p> <p>Thickness nut 2 mm<br/>washer 1.5 mm</p> | <p><b>Panel Cutout</b></p> <p>Panel thickness max.: 3 mm</p> |
|                                                                 |                                                                 |                                                              |

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



| 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                                                                                                                       |
|-------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Ohmic value code, tolerance code and taper</li> <li>Manufacturing date code</li> </ul> |

| CONTROL KNOB                                                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Black metallic knob (NM).<br/>           Black plastic knob (NP).<br/>           For white and blue color see ordering information.<br/>           Other dimensions, shapes, colors of control knobs are manufactured on request - please consult Vishay.<br/>           Other reference marks (shapes, colors) and legends can be printed on plastic knob on request - please consult Vishay.</p> |

| PACKAGING                                                                 |
|---------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Carton box of 20 pieces</li> </ul> |

| P16 STANDARD RESISTANCE ELEMENT DATA       |                              |                                     |                                  |                              |                                     |                                  |
|--------------------------------------------|------------------------------|-------------------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------------|
| STAN-<br>DARD<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      |                              |                                     |                                  |                              |                                     |                                  |
|--------------------------------------------|------------------------------|-------------------------------------|----------------------------------|------------------------------|-------------------------------------|----------------------------------|
| STAN-<br>DARD<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                                    |                                                                                                                                                |   |                                                                          |   |                                                       |   |                                                                                                   |   |                               |   |                                                      |   |  |  |  |  |  |
|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------|---|-------------------------------------------------------|---|---------------------------------------------------------------------------------------------------|---|-------------------------------|---|------------------------------------------------------|---|--|--|--|--|--|
| P                                                       | 1                                                                                                                                              | 6 | N                                                                        | P | 2                                                     | 2 | 3                                                                                                 | M | A                             | B | 1                                                    | 5 |  |  |  |  |  |
| MODEL                                                   | STYLE                                                                                                                                          |   | OHMIC VALUE                                                              |   | TOLERANCE                                             |   | TAPER                                                                                             |   | PACKAGING CODE                |   | SPECIAL NUMBER                                       |   |  |  |  |  |  |
| <b>P16</b> = cermet<br><b>PA16</b> = conductive 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 range see electrical specification |   | <b>M</b> = ± 20 %<br>On request:<br><b>K</b> = ± 10 % |   | <b>A</b> : linear<br><b>L</b> : clockwise logarithmic<br><b>F</b> : inverse clockwise logarithmic |   | <b>B15</b> = box of 20 pieces |   | (If applicable)<br>Given by Vishay for custom design |   |  |  |  |  |  |

| PART NUMBER DESCRIPTION (for information only) |       |       |           |       |         |           |         |                |
|------------------------------------------------|-------|-------|-----------|-------|---------|-----------|---------|----------------|
| P16                                            | NP    | 22 kΩ | 20 %      | A     |         | BO        |         | e3             |
| MODEL                                          | STYLE | VALUE | TOLERANCE | TAPER | SPECIAL | PACKAGING | SPECIAL | LEAD (Pb)-FREE |

| RELATED DOCUMENTS                                                 |                                                                        |
|-------------------------------------------------------------------|------------------------------------------------------------------------|
| <b>APPLICATION NOTES</b>                                          |                                                                        |
| 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> |



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