

## Knob Potentiometer



### LINKS TO ADDITIONAL RESOURCES



3D Models



Capabilities and Custom Options

The P16F 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

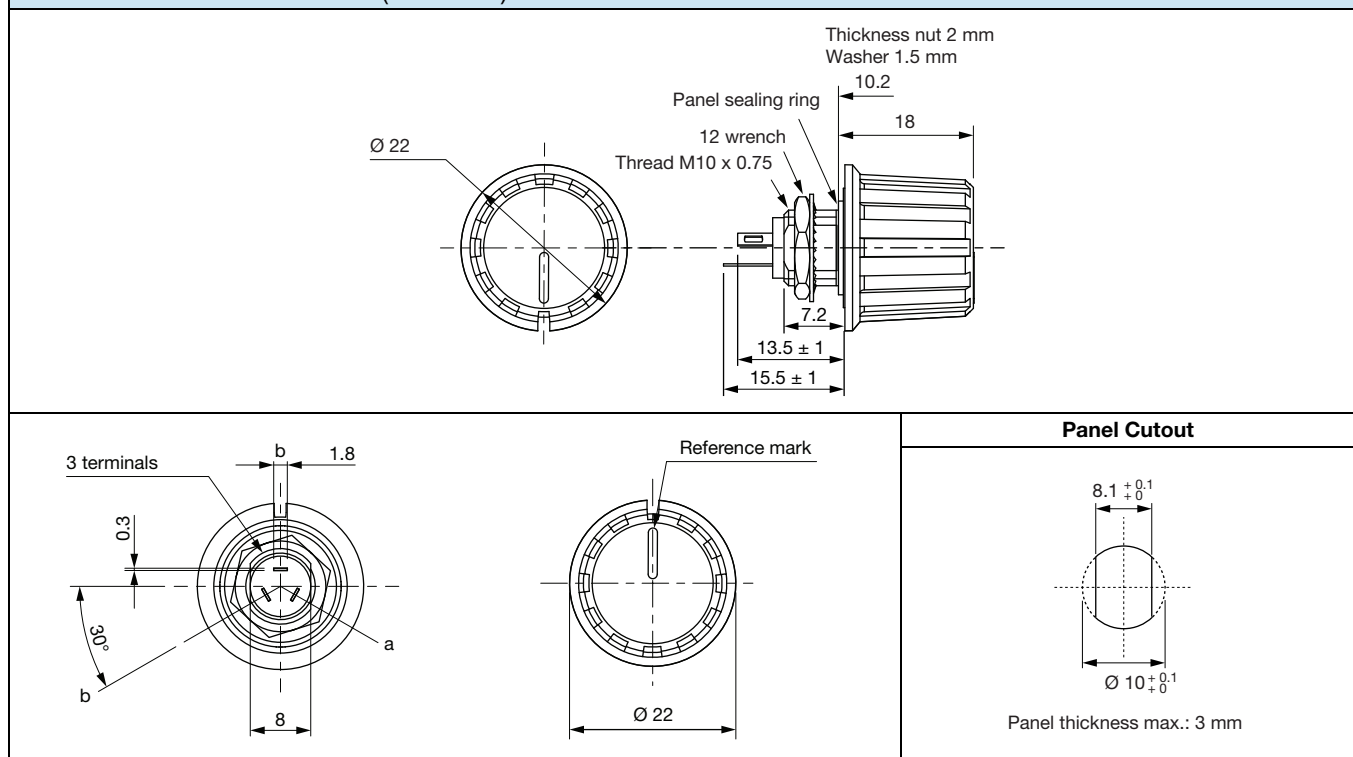
- Test according to CECC 41000 or IEC 60393-1
- **P16F** - version for professional and industrial applications (cermet)  
1 W at 40 °C
- **PA16F** - version for professional audio applications (conductive plastic)  
0.5 W at 40 °C
- Compact (integrated)
- High dielectric strength: 5000 V<sub>AC</sub>
- Fully sealed and panel sealed
- Metallic knob, special marking, or custom knob on request
- Custom knob and marking on request
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

RoHS  
COMPLIANT

### QUICK REFERENCE DATA

|                         |   |
|-------------------------|---|
| Multiple module         | No  |
| Switch module           | Yes   |
| Detent module           | Yes   |
| Special electrical laws | A: linear, L: logarithmic, F: reverse logarithmic |
| Sealing level           | IP 67   |
| Lifespan                | 10K cycles (switch), 50 cycles (track)            |

### DIMENSIONS in millimeters (± 0.5 mm)





| ELECTRICAL SPECIFICATIONS                    |                                   |   |                                     |
|--|-----------------------------------|---|-------------------------------------|
|  | P16F                              | PA16F: VERSION FOR AUDIO PROFESSIONAL APPLICATION |                                     |
| 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                  | 1 kΩ to 1 MΩ<br>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<br>On request            | ± 20 %<br>± 10 %                                  | ± 20 %<br>± 10 % (1 kΩ to 100 kΩ)   |
| Power rating                                 | Linear<br>Logarithmic             | 1 W at +40 °C<br>0.5 W at +40 °C                  | 0.5 W at +40 °C<br>0.25 W at +40 °C |
| Temperature coefficient (typical)            |                                   | ± 150 ppm/°C                                      | ± 500 ppm/°C                        |
| Dielectric strength (RMS)                    |                                   | 5000 V <sub>AC</sub>                              | 5000 V <sub>AC</sub>                |
| Limiting element voltage (linear law)        |                                   | 350 V   | 350 V                               |
| Contact resistance variation                 |                                   | 3 % R <sub>n</sub> or 3 Ω                         | 2 % R <sub>n</sub> or 3 Ω           |
| End resistance (typical)                     |                                   | 1 Ω   | 1 Ω                                 |
| Insulation resistance (500 V <sub>DC</sub> ) |                                   | 10 <sup>6</sup> MΩ                                | 10 <sup>6</sup> MΩ                  |

**MECHANICAL SPECIFICATIONS**

|  |                 |
|--|-----------------|
| Mechanical travel                      | 300° ± 5°       |
| Operating torque                       | 3 Ncm typical   |
| End stop torque                        | 25 Ncm maximum  |
| Max. tightening torque of mounting nut | 180 Ncm maximum |
| Unit weight                            | 10 g typical    |

**ENVIRONMENTAL SPECIFICATIONS**

|                   | METALLIC KNOB (on request)        | 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

**CONTROL KNOB**

Black metallic knob (NM). On request, please consult Vishay.  
Black plastic knob (NP).

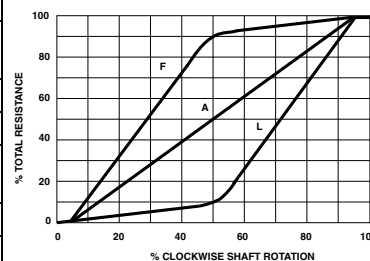
**PACKAGING**

- Carton box of 20 pieces

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

**SWITCH OPTION**

|  |  |             |
|--|--|-------------|
| ON / OFF switch                                | Actuation in counter clockwise between terminal a and terminal b |             |
| Switching current                              | P16F   | 100 mA max. |
|  | P16AF,<br>version for audio professional application             | 1 mA max.   |
| Switching actuation torque                     | 3 Ncm typical  |             |
| Switching actuation travel                     | 30° ± 5°   |             |
| Dielectric strength terminal to terminal (RMS) | 1000 V   |             |
| Insulation resistance between contacts         | 10 <sup>6</sup> MΩ   |             |
| Switch mechanical endurance                    | 10 000 cycles  |             |
| 1 cycle  | ON - OFF - ON  |             |
| Ordering information (special code)            | RSD  |             |





| KNOB MARKING OPTIONS  |                 |                |
|---|-----------------|----------------|
| SPECIAL NUMBER  | MARKING         | EXAMPLE IMAGES |
| On request: several marking options on the top face of the knob |                 |                |
| F2  | 10 graduations  |                |
| F3  | 5 graduations   |                |
| F4  | Gradient        |                |
| F5  | Light           |                |
| F6  | Fan             |                |
| F7  | Temperature     |                |
| F8  | Volume          |                |
| (Special code)  | Other on demand |                |

| P16F 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 | MAX.<br>CUR.<br>THROUGH<br>WIPER | MAX.<br>POWER<br>AT<br>40 °C | MAX.<br>VOLTAGE | 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                        |                 |                                  |
| 10M  | 0.01                         | 350             | 0.012                            |                              |                 |                                  |

| PA16F STANDARD RESISTANCE ELEMENT          |                              |                 |                                  |                              |                 |                                  |
|--|------------------------------|-----------------|----------------------------------|------------------------------|-----------------|----------------------------------|
| STAN-<br>DARD<br>RESIS-<br>TANCE<br>VALUES | LINEAR TAPER                 |                 |                                  | LOG TAPER                    |                 |                                  |
|  | MAX.<br>POWER<br>AT<br>40 °C | MAX.<br>VOLTAGE | MAX.<br>CUR.<br>THROUGH<br>WIPER | MAX.<br>POWER<br>AT<br>40 °C | MAX.<br>VOLTAGE | 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                             |                              |                 |                                  |

### DETENT OPTION

On request:

The detent mechanism is housed in the P16

One detent at CCW position

Mechanical endurance: 10 000 cycles

Ordering information (special code):

CV1D: one detent at CCW position (on request)



| 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 | F   | N | P   | 2 | 2   | 3 | M   | A |  |  |  |  |  |
| MODEL  | STYLE  |   | OHMIC VALUE   |   | TOLERANCE                                   |   | TAPER   |   | SPECIAL NUMBER  |   |  |  |  |  |  |
| P16F =<br>cermet<br><br>PA16F =<br>conductive<br>plastic | NP = plastic black<br><br>NM = metallic black or<br>other color on request |   | 223 = 22 kΩ<br>for ohmic value<br>range see<br>Electrical<br>Specifications |   | M = ± 20 %<br><br>On request:<br>K = ± 10 % |   | A = linear<br>L = clockwise logarithmic<br>F = inverse clockwise<br>logarithmic |   | (If applicable)<br>Given by Vishay<br>for custom design |   |  |  |  |  |  |
|  |  |   |   |   |   |   |   |   |   |   | <b>RSD:</b> switch<br>On request:<br><b>CV1D:</b> detent in CCW position<br><b>F2 =</b> 10 graduations marking<br><b>F3 =</b> 5 graduations marking<br><b>F4 =</b> gradient marking<br><b>F5 =</b> light marking<br><b>F6 =</b> fan<br><b>F7 =</b> temperature<br><b>F8 =</b> volume |  |  |  |  |

| PART NUMBER DESCRIPTION (for information only) |       |       |           |       |         |
|--|-------|-------|-----------|-------|---------|
| P16F   | NP    | 22 kΩ | 20 %      | A     |         |
| MODEL  | STYLE | VALUE | TOLERANCE | TAPER | SPECIAL |

| 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> |
| Capabilities and Custom Options                                   | <a href="http://www.vishay.com/doc?48493">www.vishay.com/doc?48493</a> |



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