

PEH 165 105°C

- Long Life
- > 10 years 50°C
- PCB Mounting
- Low ESR and low ESL
- High ripple current ratings

APPLICATION

Smoothing and energy storage in SMPS for data processing, office automation, industrial equipment and telecommunication.

Robust mechanical construction for professional requirements.

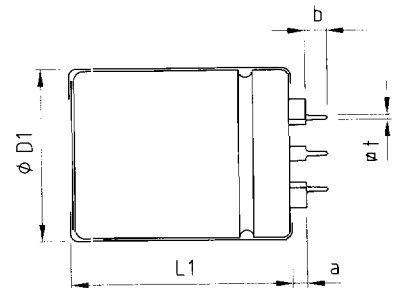
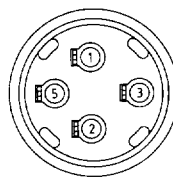
BASIC DESIGN

PEH 165 is a Long Life electrolytic capacitor, high reliability version, polarized, welded design, drop-in solder pins, negative pole connected to the case, safety vent and plastic insulation. PEH 165 is designed to offer low impedance smoothing at high frequencies, high ripple current capability and low mounting cost. The PEH 165 winding is housed in a cylindrical aluminium can with a reinforced moulded phenolic lid. The sealing system is designed for electrolyte

leakage free operation and a very low gas-diffusion rate of electrolyte. Mechanical contact between the winding and the case gives excellent heat transfer from the winding to the ambient, which gives cooler operation. As internal thermal resistance is low, cooling by forced air or chassis mounting can be made very efficient. Low ESR is a result of a very low resistive paper/ electrolyte system, and an all-welded design.

SPECIFICATION

| | |
|--|--|
| Standards | IEC 384-4 Long Life Grade, category 40/105/56 DIN 40040, GPF DIN 41240, type 1A, DIN 41238 GMF |
| RIFA Specification | Corresponding to CECC 30301-805 |
| Capacitance range | 22–68000 μ F |
| Capacitance tolerance | –10 to +30% |
| Rated voltage | 10–500 VDC |
| Temperature range | –40 to +105°C (–40 to +85°C 385–500V) |
| Shelf life | at 0V +85°C 5000 h, +40°C 10 years |
| Diameter range | 25–40 mm |
| Pin configuration, see page 36. | |



Dimensions table PEH 165 (mm)

| D x L | Case code | D1 -0.5 | L1 +1/-2 | a ±0.1 | b ±0.5 | t -0.1 | Weight approx (g) |
|----------|-----------|------------|-------------|-----------|-----------|-----------|-------------------|
| 25 x 37 | A | 25 | 37 | 3 | 4.5 | 0.8 | 25 |
| 25 x 47 | B | 25 | 47 | 3 | 4.5 | 0.8 | 34 |
| 30 x 47 | C | 30 | 47 | 3 | 4.5 | 0.8 | 46 |
| 35 x 47 | D | 35 | 47 | 3 | 4.5 | 0.8 | 65 |
| 35 x 57 | E | 35 | 57 | 3 | 4.5 | 0.8 | 76 |
| 40 x 57 | F | 40 | 57 | 3 | 4.5 | 0.8 | 95 |
| 40 x 77 | G | 40 | 77 | 3 | 4.5 | 0.8 | 135 |
| 40 x 107 | H | 40 | 107 | 3 | 4.5 | 0.8 | 175 |

ARTICLE TABLE PEH 165 (105°C)

| C_R | D x L | Case code | I_{RAC}^* 105°C 100 Hz A | I_{RAC}^* 40°C 10 kHz A | ESR* 20°C 100 Hz mΩ | ESR* 20°C 100 kHz mΩ | L_{ESL} Approx. nH | Article code 1st block |
|-----------------------------------|----------|-----------|-------------------------------------|------------------------------------|------------------------------|-------------------------------|----------------------------|---------------------------|
| μF | mm | | | | | | | |
| 10 VDC (U_R) | | | | | | | | |
| 4700 | 25 x 37 | A | 3.4 | 10.3 | 49 | 36 | 21 | PEH 165EA4470Q |
| 6800 | 25 x 47 | B | 4.4 | 13.3 | 33 | 24 | 21 | PEH 165EB4680Q |
| 10000 | 30 x 47 | C | 5.1 | 14.4 | 26 | 20 | 24 | PEH 165EC5100Q |
| 15000 | 35 x 47 | D | 5.2 | 13.7 | 25 | 21 | 25 | PEH 165ED5150Q |
| 22000 | 35 x 57 | E | 6.2 | 16.2 | 19 | 16 | 25 | PEH 165EE5220Q |
| 33000 | 40 x 57 | F | 6.0 | 14.9 | 22 | 20 | 32 | PEH 165EF5330Q |
| 47000 | 40 x 77 | G | 7.5 | 18.8 | 15 | 14 | 32 | PEH 165EG5470Q |
| 68000 | 40 x 107 | H | 8.9 | 22.3 | 11 | 10 | 32 | PEH 165EH5680Q |
| 16 VDC (U_R) | | | | | | | | |
| 3300 | 25 x 37 | A | 3.2 | 10.3 | 54 | 37 | 21 | PEH 165GA4330Q |
| 4700 | 25 x 47 | B | 4.0 | 13.3 | 37 | 25 | 21 | PEH 165GB4470Q |
| 6800 | 30 x 47 | C | 4.7 | 14.1 | 29 | 21 | 24 | PEH 165GC4680Q |
| 10000 | 35 x 47 | D | 5.0 | 13.7 | 27 | 21 | 25 | PEH 165GD5100Q |
| 15000 | 35 x 57 | E | 6.0 | 16.1 | 20 | 16 | 25 | PEH 165GE5150Q |
| 22000 | 40 x 57 | F | 5.9 | 15.1 | 22 | 20 | 32 | PEH 165GF5220Q |
| 33000 | 40 x 77 | G | 7.4 | 18.8 | 15 | 14 | 32 | PEH 165GG5330Q |
| 47000 | 40 x 107 | H | 8.6 | 22.1 | 11 | 10 | 32 | PEH 165GH5470Q |
| 25 VDC (U_R) | | | | | | | | |
| 2200 | 25 x 37 | A | 2.8 | 10.3 | 62 | 37 | 21 | PEH 165HA4220Q |
| 3300 | 25 x 47 | B | 3.6 | 13.4 | 41 | 24 | 21 | PEH 165HB4330Q |
| 4700 | 30 x 47 | C | 4.3 | 13.9 | 32 | 21 | 24 | PEH 165HC4470Q |
| 6800 | 35 x 47 | D | 4.7 | 13.4 | 30 | 22 | 25 | PEH 165HD4680Q |
| 10000 | 35 x 57 | E | 5.6 | 15.9 | 22 | 16 | 25 | PEH 165HE5100Q |
| 15000 | 40 x 57 | F | 5.8 | 15.2 | 23 | 19 | 32 | PEH 165HF5150Q |
| 22000 | 40 x 77 | G | 7.2 | 18.8 | 16 | 14 | 32 | PEH 165HG5220Q |
| 33000 | 40 x 107 | H | 8.4 | 21.9 | 12 | 10 | 32 | PEH 165HH5330Q |
| 40 VDC (U_R) | | | | | | | | |
| 1500 | 25 x 37 | A | 2.4 | 9.2 | 74 | 38 | 21 | PEH 165KA4150Q |
| 2200 | 25 x 47 | B | 3.1 | 12.2 | 49 | 25 | 21 | PEH 165KB4220Q |
| 3300 | 30 x 47 | C | 3.6 | 11.9 | 40 | 24 | 24 | PEH 165KC4330Q |
| 4700 | 35 x 47 | D | 3.9 | 11.3 | 40 | 28 | 25 | PEH 165KD4470Q |
| 6800 | 35 x 57 | E | 4.7 | 13.5 | 29 | 21 | 25 | PEH 165KE4680Q |
| 10000 | 40 x 57 | F | 4.8 | 12.7 | 32 | 26 | 32 | PEH 165KF5100Q |
| 15000 | 40 x 77 | G | 6.1 | 16.1 | 21 | 18 | 32 | PEH 165KG5150Q |
| 22000 | 40 x 107 | H | 7.2 | 19.2 | 15 | 13 | 32 | PEH 165KH5220Q |
| 63 VDC (U_R) | | | | | | | | |
| 1000 | 25 x 37 | A | 2.2 | 10.2 | 86 | 37 | 21 | PEH 165MA4100Q |
| 1500 | 25 x 47 | B | 2.9 | 13.5 | 56 | 23 | 21 | PEH 165MB4150Q |
| 2200 | 30 x 47 | C | 3.3 | 11.8 | 47 | 25 | 24 | PEH 165MC4220Q |
| 3300 | 35 x 47 | D | 3.9 | 12.3 | 40 | 25 | 25 | PEH 165MD4330Q |
| 4700 | 35 x 57 | E | 4.7 | 14.3 | 33 | 22 | 25 | PEH 165ME4470Q |
| 6800 | 40 x 57 | F | 4.9 | 13.5 | 34 | 27 | 32 | PEH 165MF4680Q |
| 10000 | 40 x 77 | G | 6.0 | 16.7 | 24 | 19 | 32 | PEH 165MG5100Q |
| 15000 | 40 x 107 | H | 6.9 | 18.9 | 17 | 13 | 32 | PEH 165MH5150Q |
| 100 VDC (U_R) | | | | | | | | |
| 470 | 25 x 37 | A | 1.6 | 6.2 | 230 | 140 | 21 | PEH 165PA3470Q |
| 680 | 25 x 47 | B | 2.0 | 8.1 | 160 | 93 | 21 | PEH 165PB3680Q |
| 1000 | 30 x 47 | C | 2.5 | 9.5 | 110 | 70 | 24 | PEH 165PC4100Q |
| 1500 | 35 x 47 | D | 3.0 | 9.8 | 86 | 57 | 25 | PEH 165PD4150Q |
| 2200 | 35 x 57 | E | 3.7 | 11.8 | 60 | 41 | 25 | PEH 165PE4220Q |
| 3300 | 40 x 57 | F | 4.1 | 12.0 | 53 | 40 | 32 | PEH 165PF4330Q |
| 4700 | 40 x 77 | G | 5.2 | 15.3 | 36 | 27 | 32 | PEH 165PG4470Q |
| 6800 | 40 x 107 | H | 6.1 | 17.8 | 25 | 19 | 32 | PEH 165PH4680Q |

* Maximum values

ARTICLE TABLE PEH 165 (105°C)

| C_R | D x L | Case code | I_{RAC}^* 105°C 100 Hz A | I_{RAC}^* 40°C 10 kHz A | ESR* 20°C 100 Hz mΩ | ESR* 20°C 100 kHz mΩ | L_{ESL} Approx. nH | Article code 1st block |
|-----------------------------------|----------|-----------|-------------------------------------|------------------------------------|------------------------------|-------------------------------|----------------------------|---------------------------|
| μF | mm | | | | | | | |
| 250 VDC (U_R) | | | | | | | | |
| 100 | 25 x 37 | A | 0.69 | 3.5 | 1000 | 490 | 21 | PEH 165SA3100Q |
| 150 | 25 x 47 | B | 0.87 | 4.5 | 690 | 320 | 21 | PEH 165SB3150Q |
| 220 | 30 x 47 | C | 1.20 | 5.5 | 480 | 230 | 24 | PEH 165SC3220Q |
| 330 | 35 x 47 | D | 1.50 | 6.9 | 330 | 160 | 25 | PEH 165SD3330Q |
| 470 | 35 x 57 | E | 1.80 | 8.5 | 230 | 120 | 25 | PEH 165SE3470Q |
| 680 | 40 x 57 | F | 2.30 | 9.8 | 170 | 91 | 32 | PEH 165SF3680Q |
| 1000 | 40 x 77 | G | 2.90 | 12.2 | 120 | 62 | 32 | PEH 165SG4100Q |
| 1500 | 40 x 107 | H | 3.50 | 14.5 | 79 | 42 | 32 | PEH 165SH4150Q |
| 350 VDC (U_R) | | | | | | | | |
| 47 | 25 x 37 | A | 0.54 | 2.5 | 1900 | 980 | 21 | PEH 165UA2470Q |
| 68 | 25 x 47 | B | 0.67 | 3.0 | 1300 | 710 | 21 | PEH 165UB2680Q |
| 100 | 30 x 47 | C | 0.89 | 3.9 | 920 | 490 | 24 | PEH 165UC3100Q |
| 150 | 35 x 47 | D | 1.20 | 5.1 | 620 | 330 | 25 | PEH 165UD3150Q |
| 220 | 35 x 57 | E | 1.50 | 6.3 | 430 | 230 | 25 | PEH 165UE3220Q |
| 330 | 40 x 57 | F | 1.90 | 7.6 | 300 | 160 | 32 | PEH 165UF3330Q |
| 470 | 40 x 77 | G | 2.30 | 9.4 | 210 | 110 | 32 | PEH 165UG3470Q |
| 680 | 40 x 107 | H | 2.80 | 11.2 | 140 | 79 | 32 | PEH 165UH3680Q |

* Maximum values

ARTICLE TABLE PEH 165 (85°C)

| C_R | D x L | Case code | I_{RAC}^* 85°C 100 Hz A | I_{RAC}^* 40°C 10 kHz A | ESR* 20°C 100 Hz mΩ | ESR* 20°C 100 kHz mΩ | L_{ESL} Approx. nH | Article code 1st block |
|-----------------------------------|----------|-----------|------------------------------------|------------------------------------|------------------------------|-------------------------------|----------------------------|---------------------------|
| μF | mm | | | | | | | |
| 385 VDC (U_R) | | | | | | | | |
| 47 | 25 x 37 | A | 0.79 | 2.6 | 1800 | 900 | 21 | PEH 165XA2470Q |
| 68 | 25 x 47 | B | 0.99 | 3.2 | 1200 | 620 | 21 | PEH 165XB2680Q |
| 100 | 30 x 47 | C | 1.30 | 4.2 | 830 | 430 | 24 | PEH 165XC3100Q |
| 150 | 35 x 47 | D | 1.70 | 5.3 | 560 | 300 | 25 | PEH 165XD3150Q |
| 220 | 35 x 57 | E | 2.20 | 6.6 | 390 | 200 | 25 | PEH 165XE3220Q |
| 330 | 40 x 57 | F | 2.80 | 7.9 | 270 | 150 | 32 | PEH 165XF3330Q |
| 470 | 40 x 77 | G | 3.40 | 10.0 | 190 | 100 | 32 | PEH 165XG3470Q |
| 680 | 40 x 107 | H | 4.10 | 11.7 | 130 | 72 | 32 | PEH 165XH3680Q |
| 400 VDC (U_R) | | | | | | | | |
| 33 | 25 x 37 | A | 0.68 | 2.2 | 2300 | 1200 | 21 | PEH 165VA2330Q |
| 47 | 25 x 47 | B | 0.83 | 2.7 | 1600 | 830 | 21 | PEH 165VB2470Q |
| 68 | 30 x 47 | C | 1.10 | 3.6 | 1100 | 580 | 24 | PEH 165VC2680Q |
| 100 | 35 x 47 | D | 1.40 | 4.6 | 780 | 400 | 25 | PEH 165VD3100Q |
| 150 | 35 x 57 | E | 1.80 | 5.8 | 530 | 270 | 25 | PEH 165VE3150Q |
| 220 | 40 x 57 | F | 2.30 | 7.1 | 370 | 190 | 32 | PEH 165VF3220Q |
| 330 | 40 x 77 | G | 2.90 | 8.9 | 240 | 130 | 32 | PEH 165VG3330Q |
| 470 | 40 x 107 | H | 3.50 | 10.5 | 170 | 91 | 32 | PEH 165VH3470Q |
| 450 VDC (U_R) | | | | | | | | |
| 22 | 25 x 37 | A | 0.51 | 1.6 | 2800 | 1600 | 21 | PEH165YA2220Q |
| 33 | 25 x 47 | B | 0.64 | 2.0 | 1900 | 1000 | 21 | PEH165YB2330Q |
| 47 | 30 x 47 | C | 0.85 | 2.6 | 1300 | 740 | 24 | PEH165YC2470Q |
| 68 | 35 x 47 | D | 1.10 | 3.4 | 920 | 510 | 25 | PEH165YD2680Q |
| 100 | 35 x 57 | E | 1.40 | 4.2 | 620 | 350 | 25 | PEH165YE3100Q |
| 150 | 40 x 57 | F | 1.90 | 5.6 | 420 | 230 | 32 | PEH165YF3150Q |
| 220 | 40 x 77 | G | 2.30 | 6.9 | 290 | 160 | 32 | PEH165YG3220Q |
| 330 | 40 x 107 | H | 2.80 | 8.3 | 190 | 110 | 32 | PEH165YH3330Q |

* Maximum values

ARTICLE TABLE PEH 165 (85 °C)

| C_R | D x L | Case code | I_{RAC}^* 85°C 100 Hz | I_{RAC}^* 40°C 10 kHz | ESR* 20°C 100 Hz mΩ | ESR* 20°C 100 kHz mΩ | L_{ESL} Approx. nH | Article code 1st block |
|-----------------------------------|----------|-----------|-------------------------------|-------------------------------|------------------------------|-------------------------------|----------------------------|---------------------------|
| μF | mm | | A | A | | | | |
| 500 VDC (U_R) | | | | | | | | |
| 22 | 25 x 37 | A | 0.37 | 1.4 | 5300 | 1800 | 21 | PEH165ZA2220Q |
| 33 | 25 x 47 | B | 0.47 | 1.8 | 3500 | 1200 | 21 | PEH165ZB2330Q |
| 47 | 30 x 47 | C | 0.62 | 2.3 | 2500 | 850 | 24 | PEH165ZC2470Q |
| 68 | 35 x 47 | D | 0.81 | 3.0 | 1800 | 590 | 25 | PEH165ZD2680Q |
| 100 | 35 x 57 | E | 1.00 | 3.7 | 1200 | 400 | 25 | PEH165ZE3100Q |
| 150 | 40 x 57 | F | 1.40 | 5.0 | 780 | 270 | 32 | PEH165ZF3150Q |
| 220 | 40 x 77 | G | 1.70 | 6.3 | 540 | 180 | 32 | PEH165ZG3220Q |
| 330 | 40 x 107 | H | 2.00 | 7.5 | 360 | 130 | 32 | PEH165ZH3330Q |

* Maximum values

OPERATIONAL DATA

Please see operational lifetime section, page 62.

RELIABILITY

The failure rate is derived from our periodic test results. The failure rate (λ_p) is therefore only given at test temperature for life tests. An estimation is also given at 60°C.

The expected failure rate for this capacitor range is based on our periodic test results for capacitors with structural similarity.

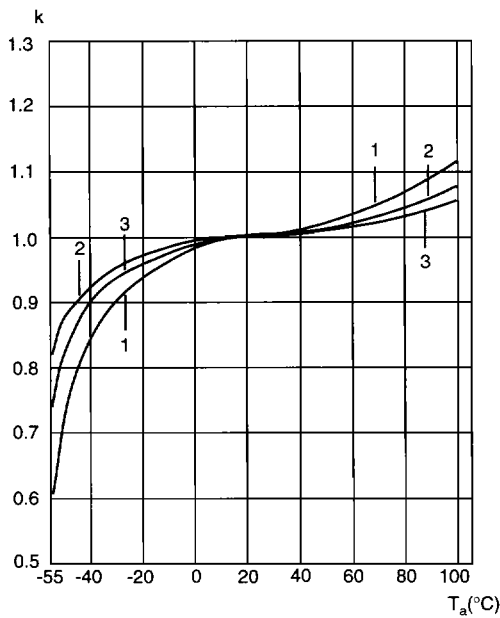
| T_a | Failure rate per hour |
|-------|-----------------------|
| 85°C | 1×10^{-6} |
| 60°C | 1×10^{-7} |

Failure rate per hour for catastrophic plus parametric failures.

TECHNICAL DATA

The capacitance value vs ambient temperature

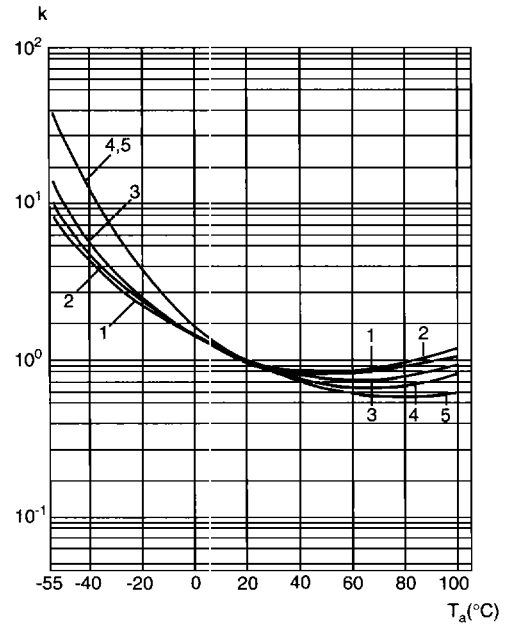
(T_a) at $f = 100$ Hz
 $k = C(T_a) / C(20^\circ\text{C})$



| U_R | Curve |
|------------|-------|
| 10 and 100 | 1 |
| 16-63 | 2 |
| 250-450 | 3 |

TAN δ as a function of ambient temperature

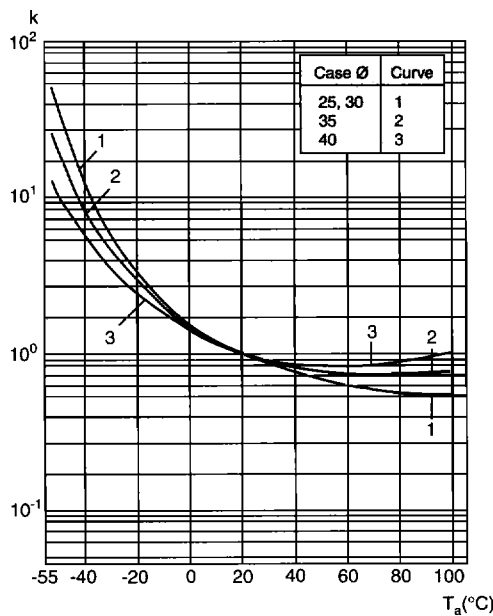
(T_a) at $f = 100$ Hz
 $k = \text{TAN}\delta(T_a) / \text{TAN}\delta(20^\circ\text{C})$



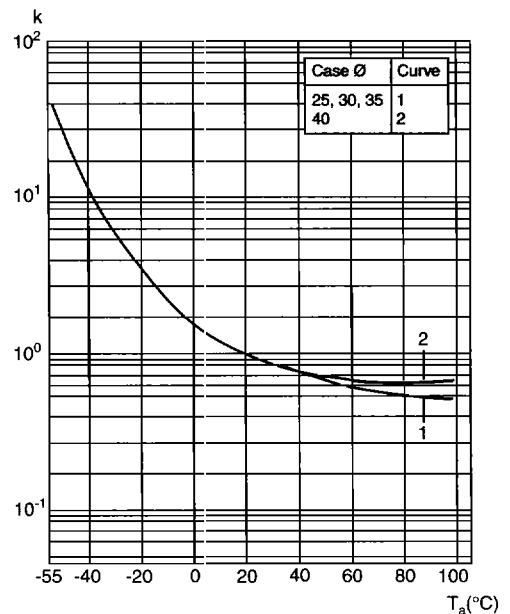
| U_R | Case Code | Curve |
|-------------------------|-----------|-------|
| $10 \leq U_R \leq 25$ | A-C | 4 |
| $10 \leq U_R \leq 25$ | D-F | 3 |
| $10 \leq U_R \leq 63$ | A-H | 2 |
| $40 \leq U_R \leq 63$ | F-H | 1 |
| $100 \leq U_R \leq 450$ | A-H | 5 |

ESR as a function of ambient temperature

(T_a) at $f = 100$ Hz
 $10 \leq U_R \leq 63$
 $k = \text{ESR}(T_a) / \text{ESR}(20^\circ\text{C})$



$100 \leq U_R \leq 450$
 $k = \text{ESR}(T_a) / \text{ESR}(20^\circ\text{C})$



MECHANICAL DATA

The capacitor may be mounted in any position.

Pin no. 1 shall be connected to positive polarity. Pin no. 5 shall be connected to negative polarity. The other pins must be

soldered to isolated pads or pads with the same potential as the negative pole.

Note: All piercing diagram viewed from soldering side.

TECHNICAL DATA

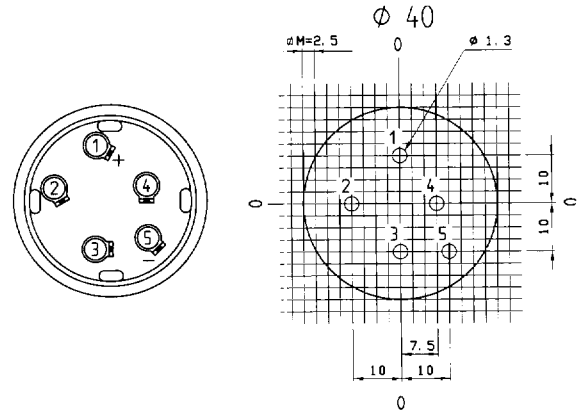
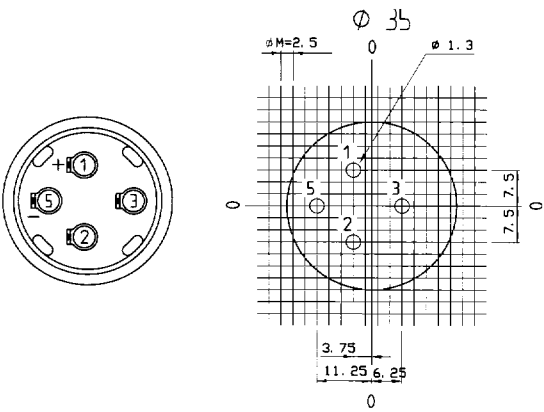
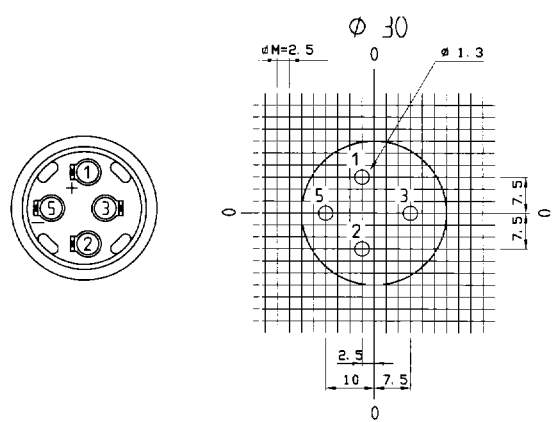
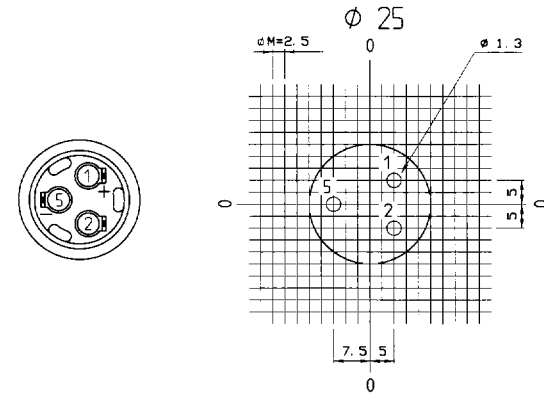
Leakage current

Rated leakage current, I_{RL} (μA)

Rated voltage, U_R (V)

Rated capacitance, C_R (μF)

$$I_{RL} = 0.003 \times C_R \times U_R + 4$$



ORDERING INFORMATION

1st block (pos 1-13)

2nd block (pos 14-20)

P E H 1 6 5 S G 4 1 0 0 Q
1 2 3 4 5 6 7 8 9 10 11 12 13

14 15 16 17 18 19 20

Capacitance tolerances:
Pos. 13: Q: -10 to +30%

Quantities and weights

| CASE CODE | A | B | C | D | E | F | G | H |
|-----------------------|----|----|----|----|----|----|-----|-----|
| Weight approx (g) | 25 | 34 | 46 | 65 | 76 | 95 | 135 | 175 |
| Standard box quantity | 72 | 72 | 56 | 42 | 42 | 30 | 30 | 30 |