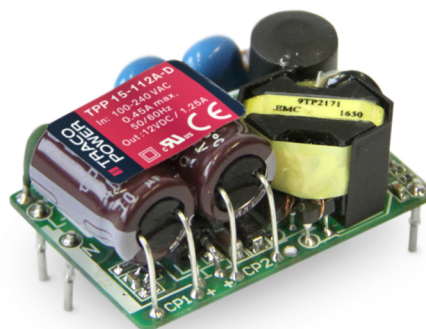


- High power density power supply (open frame)
- Certification according to IEC/EN/ES 60601-1 edition 3.2 for 2 x MOPP
- Low leakage current <100 µA rated for BF applications
- EMC compliance to IEC 60601-1-2 4th edition
- Risk management process according to ISO 14971 incl. risk management file
- Acceptance criteria for electronic assemblies acc. to IPC-A-610 Level 3
- Protection class II
- Operating up to 5000 m altitude
- Ready to meet ErP directive, no load power consumption <100 mW
- 5-year product warranty



ES 60601-1 IEC 60601-1  
UL 62368-1 IEC 60335-1  
IEC 62368-1

The TPP 15A-D AC/DC power supplies feature a reinforced double I/O isolation system according to medical safety standards IEC/EN/ES 60601-1 edition 3.2 for 2 x MOPP approved for an operating altitude of 5000 m. The earth leakage current is below 100 µA what makes the units suitable for BF (body floating) applications. The excellent efficiency of up to 88.5% offers a high power density in the packaging format 1.0" x 1.5". The full load operating temperature range covers -40°C to +60°C while it goes up to 85°C with 50% load derating. The units operate in compliance to the medical EMC emission and immunity levels according to latest standard IEC 60601-1-2 4th edition.

| Models        |                      |                                     |                        |                    |
|---------------|----------------------|-------------------------------------|------------------------|--------------------|
| Order Code    | Output Power<br>max. | Output Voltage<br>nom. (adjustable) | Output Current<br>max. | Efficiency<br>typ. |
| TPP 15-103A-D | 13.2 W               | 3.3 VDC (2.97 - 3.63 VDC)           | 4'000 mA               | 84 %               |
| TPP 15-105A-D | 15 W                 | 5 VDC (4.5 - 5.5 VDC)               | 3'000 mA               | 86 %               |
| TPP 15-109A-D |                      | 9 VDC (8.1 - 9.9 VDC)               | 1'670 mA               | 86 %               |
| TPP 15-112A-D |                      | 12 VDC (10.8 - 13.2 VDC)            | 1'250 mA               | 87 %               |
| TPP 15-115A-D |                      | 15 VDC (13.5 - 16.5 VDC)            | 1'000 mA               | 87 %               |
| TPP 15-124A-D |                      | 24 VDC (21.6 - 26.4 VDC)            | 625 mA                 | 88 %               |
| TPP 15-136A-D |                      | 36 VDC (32.4 - 39.6 VDC)            | 417 mA                 | 88 %               |
| TPP 15-148A-D |                      | 48 VDC (43.2 - 52.8 VDC)            | 313 mA                 | 89 %               |

Note - Other output models are available on request.

## Input Specifications

|                        |                                                                      |                                                                                                                                                                                                                                                                                                  |
|------------------------|----------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Input Voltage          | - AC Range                                                           | Operational Range: <b>85 - 264 VAC</b> (Full Range)<br>Rated Range: <b>100 - 240 VAC</b> (Full Range)                                                                                                                                                                                            |
|                        | - DC Range                                                           | Operational Range: <b>120 - 370 VDC</b><br>Certified Range: <b>120 - 370 VDC</b><br>Polarity: <b>irrelevant</b><br>(When operating with DC input voltage an external fuse T 1.0 A / 400 VDC is needed. Allowed types: Littlefuse 477 series, Cooper Bussmann type S505H-1-R, Bel Fuse type OADK) |
| Input Frequency        |                                                                      | Operational Range: <b>47 - 440 Hz</b><br>Certified: <b>50/60 Hz</b>                                                                                                                                                                                                                              |
| Power Consumption      | - No load & $V_{in} = 230$ VAC<br>- No load & $V_{in} = 115$ VAC     | <b>100 mW max.</b> (Ready to meet ErP directive)<br><b>100 mW max.</b>                                                                                                                                                                                                                           |
| Input Current          | - Full load & $V_{in} = 230$ VAC<br>- Full load & $V_{in} = 115$ VAC | <b>300 mA max.</b><br><b>450 mA max.</b>                                                                                                                                                                                                                                                         |
| Input Inrush Current   | - At 230 VAC<br>- At 115 VAC                                         | <b>40 A max.</b><br><b>25 A max.</b>                                                                                                                                                                                                                                                             |
| Input Protection       |                                                                      | <b>T 1.6 A / 250 VAC</b> (Internal Fuse in L)                                                                                                                                                                                                                                                    |
| Recommended Input Fuse |                                                                      | (The need of an external fuse has to be assessed in the final application.)                                                                                                                                                                                                                      |

## Output Specifications

|                                        |                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Output Voltage Adjustment              |                                                                          | <b>±10%</b> (By external trim resistor)<br>See application note: <a href="http://www.tracopower.com/overview/tp15a-d">www.tracopower.com/overview/tp15a-d</a><br>Output power must not exceed rated power!                                                                                                                                                                                                                                                                    |
| Voltage Set Accuracy                   |                                                                          | <b>±1% max.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Regulation                             | - Input Variation ( $V_{min} - V_{max}$ )<br>- Load Variation (0 - 100%) | <b>0.2% max.</b><br><b>0.7% max.</b> (3.3 and 5 VDC model)<br><b>0.5% max.</b> (other output models)                                                                                                                                                                                                                                                                                                                                                                          |
| Ripple and Noise<br>(20 MHz Bandwidth) |                                                                          | 3.3 VDC model: <b>40 mVp-p typ.</b> (w/ 10 $\mu$ F X5R)<br>5 VDC model: <b>40 mVp-p typ.</b> (w/ 10 $\mu$ F X5R)<br>9 VDC model: <b>70 mVp-p typ.</b> (w/ 10 $\mu$ F X5R)<br>12 VDC model: <b>70 mVp-p typ.</b> (w/ 10 $\mu$ F X5R)<br>15 VDC model: <b>70 mVp-p typ.</b> (w/ 10 $\mu$ F X5R)<br>24 VDC model: <b>100 mVp-p typ.</b> (w/ 10 $\mu$ F X5R)<br>36 VDC model: <b>100 mVp-p typ.</b> (w/ 10 $\mu$ F X5R)<br>48 VDC model: <b>140 mVp-p typ.</b> (w/ 1 $\mu$ F X7R) |
| Capacitive Load                        |                                                                          | 3.3 VDC model: <b>6'000 <math>\mu</math>F max.</b><br>5 VDC model: <b>4'000 <math>\mu</math>F max.</b><br>9 VDC model: <b>1'860 <math>\mu</math>F max.</b><br>12 VDC model: <b>1'200 <math>\mu</math>F max.</b><br>15 VDC model: <b>820 <math>\mu</math>F max.</b><br>24 VDC model: <b>470 <math>\mu</math>F max.</b><br>36 VDC model: <b>220 <math>\mu</math>F max.</b><br>48 VDC model: <b>150 <math>\mu</math>F max.</b>                                                   |
| Minimum Load                           |                                                                          | <b>Not required</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Temperature Coefficient                |                                                                          | <b>±0.02 %/K max.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Hold-up Time                           | - At 115 VAC                                                             | <b>8 ms min.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Start-up Time                          | - At 230 VAC                                                             | <b>850 ms max.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Short Circuit Protection               |                                                                          | <b>Continuous, Automatic recovery</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Output Current Limitation              |                                                                          | <b>120 - 200% of <math>I_{out}</math> max.</b><br><b>145% typ. of <math>I_{out}</math> max.</b>                                                                                                                                                                                                                                                                                                                                                                               |
| Overvoltage Protection                 |                                                                          | <b>115 - 140% of <math>V_{out}</math> nom.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Transient Response                     | - Response Deviation<br>- Response Time                                  | <b>8% max.</b> (75% to 100% Load Step)<br><b>500 <math>\mu</math>s typ.</b> (75% to 100% Load Step)                                                                                                                                                                                                                                                                                                                                                                           |

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

## Safety Specifications

|                       |                                                                                                                                      |                                                                                                |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| Standards             | - IT / Multimedia Equipment                                                                                                          | EN 62368-1<br>IEC 62368-1<br>UL 62368-1                                                        |
|                       | - Household                                                                                                                          | EN 60335-1<br>IEC 60335-1                                                                      |
|                       | - Medical Equipment                                                                                                                  | EN 60601-1<br>IEC 60601-1<br>ANSI/AAMI ES 60601-1                                              |
|                       | - Power Transformers                                                                                                                 | 2 x MOPP (Means Of Patient Protection)<br>IEC 61558-1<br>IEC 61558-2-16                        |
|                       | - Certification Documents                                                                                                            | <a href="http://www.tracopower.com/overview/tpp15a-d">www.tracopower.com/overview/tpp15a-d</a> |
| Protection Class      | Class I & II (Prepared): Reinforced Insulation                                                                                       |                                                                                                |
|                       | See application note: <a href="http://www.tracopower.com/info/protection-class.pdf">www.tracopower.com/info/protection-class.pdf</a> |                                                                                                |
| Pollution Degree      | PD 2                                                                                                                                 |                                                                                                |
| Over Voltage Category | OVC II                                                                                                                               |                                                                                                |

## EMC Specifications

|                 |                                  |                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EMI (Emissions) | - Conducted Emissions            | EN 60601-1-2 edition 4 (Medical Devices)<br>EN 55011 class A (internal filter)<br>EN 55011 class B (internal filter)<br>EN 55014-1 (internal filter)<br>EN 55032 class A (internal filter)<br>EN 55032 class B (internal filter)<br>FCC 47 Part 15 class A (internal filter)<br>FCC 47 Part 15 class B (internal filter)<br>FCC 47 Part 18 class A (internal filter)<br>FCC 47 Part 18 class B (internal filter) |
|                 | - Radiated Emissions             | EN 55011 class A (internal filter)<br>EN 55011 class B (internal filter)<br>EN 55014-1 (internal filter)<br>EN 55032 class A (internal filter)<br>EN 55032 class B (internal filter)<br>FCC 47 Part 15 class A (internal filter)<br>FCC 47 Part 15 class B (internal filter)<br>FCC 47 Part 18 class A (internal filter)<br>FCC 47 Part 18 class B (internal filter)                                             |
|                 | - Harmonic Current Emissions     | EN 61000-3-2, class A                                                                                                                                                                                                                                                                                                                                                                                            |
|                 | - Voltage Fluctuations & Flicker | EN 61000-3-3                                                                                                                                                                                                                                                                                                                                                                                                     |

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

|                                                                                                                                                                                  |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EMS (Immunity)                                                                                                                                                                   |                           | EN 60601-1-2 edition 4 (Medical Devices)<br>EN 55024 (IT Equipment)<br>EN 55035 (Multimedia)<br>EN 55014-2 (Household Appliances Tools)<br>Air: EN 61000-4-2, $\pm 15$ kV, perf. criteria A<br>Contact: EN 61000-4-2, $\pm 8$ kV, perf. criteria A<br>EN 61000-4-3, 20 V/m, perf. criteria A<br>EN 61000-4-4, $\pm 2$ kV, perf. criteria A<br>L to L: EN 61000-4-5, $\pm 1$ kV, perf. criteria A<br>EN 61000-4-6, 20 Vrms, perf. criteria A<br>Continuous: EN 61000-4-8, 30 A/m, perf. criteria A<br>230 VAC / 50 Hz: EN 61000-4-11<br>30%, 25 periods, perf. criteria A<br>60%, 1 period, perf. criteria A<br>>95%, 1 period, perf. criteria A<br>>95%, 250 periods, perf. criteria A<br>115 VAC / 60 Hz: EN 61000-4-11<br>30%, 25 periods, perf. criteria A<br>60%, 1 period, perf. criteria A<br>>95%, 1 period, perf. criteria A<br>>95%, 250 periods, perf. criteria A |
| - Electrostatic Discharge<br><br>- RF Electromagnetic Field<br>- EFT (Burst) / Surge<br><br>- Conducted RF Disturbances<br>- PF Magnetic Field<br>- Voltage Dips & Interruptions |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| EMC / Environmental                                                                                                                                                              | - Certification Documents | <a href="http://www.tracopower.com/overview/tpp15a-d">www.tracopower.com/overview/tpp15a-d</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

### General Specifications

|                                 |                                                                                        |                                                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Relative Humidity               |                                                                                        | 95% max. (non condensing)                                                                                                                                        |
| Temperature Ranges              | - Operating Temperature<br>- Storage Temperature                                       | -40°C to +85°C<br>-40°C to +85°C                                                                                                                                 |
| Power Derating                  | - High Temperature<br>- Low Input Voltage                                              | Depending on model<br>4 %/V below 90 VAC<br>See application note: <a href="http://www.tracopower.com/overview/tpp15a-d">www.tracopower.com/overview/tpp15a-d</a> |
| Cooling System                  |                                                                                        | Natural convection (20 LFM)                                                                                                                                      |
| Altitude During Operation       |                                                                                        | 5'000 m max.                                                                                                                                                     |
| Regulator Topology              |                                                                                        | Flyback Converter                                                                                                                                                |
| Switching Frequency             |                                                                                        | 90 - 110 kHz (PWM)                                                                                                                                               |
| Insulation System               |                                                                                        | Reinforced Insulation                                                                                                                                            |
| Working Voltage (rated)         |                                                                                        | 250 VAC                                                                                                                                                          |
| Isolation Test Voltage          | - Input to Output, 60 s<br>- Input to Case or PE, 60 s<br>- Output to Case or PE, 60 s | 4'000 VAC<br>1'500 VAC<br>1'500 VAC                                                                                                                              |
| Creepage                        | - Input to Output                                                                      | 8 mm min.                                                                                                                                                        |
| Clearance                       | - Input to Output                                                                      | 8 mm min.                                                                                                                                                        |
| Isolation Resistance            | - Input to Output, 500 VDC                                                             | 100 M $\Omega$ min.                                                                                                                                              |
| Leakage Current<br>(at 264 VAC) | - Touch Current                                                                        | 100 $\mu$ A max.                                                                                                                                                 |
| Reliability                     | - Calculated MTBF                                                                      | 3'100'000 h (MIL-HDBK-217F, ground benign)                                                                                                                       |
| Washing Process                 |                                                                                        | Not allowed                                                                                                                                                      |
| Environment                     | - Vibration<br><br>- Mechanical Shock                                                  | IEC 60068-2-6<br>5 g, 3 axis, sine sweep, 3x30 min, 5-500 Hz<br>IEC 60068-2-27<br>50 g, 3 axis, half sine, 11 ms                                                 |
| Pin Material                    |                                                                                        | Copper                                                                                                                                                           |
| Pin Foundation Plating          |                                                                                        | Nickel (2 - 3 $\mu$ m)                                                                                                                                           |
| Pin Surface Plating             |                                                                                        | Tin (3 - 5 $\mu$ m), matte                                                                                                                                       |
| Housing Type                    |                                                                                        | Open Frame                                                                                                                                                       |
| Mounting Type                   |                                                                                        | PCB Mount                                                                                                                                                        |
| Connection Type                 |                                                                                        | THD (Through-Hole Device)                                                                                                                                        |

All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

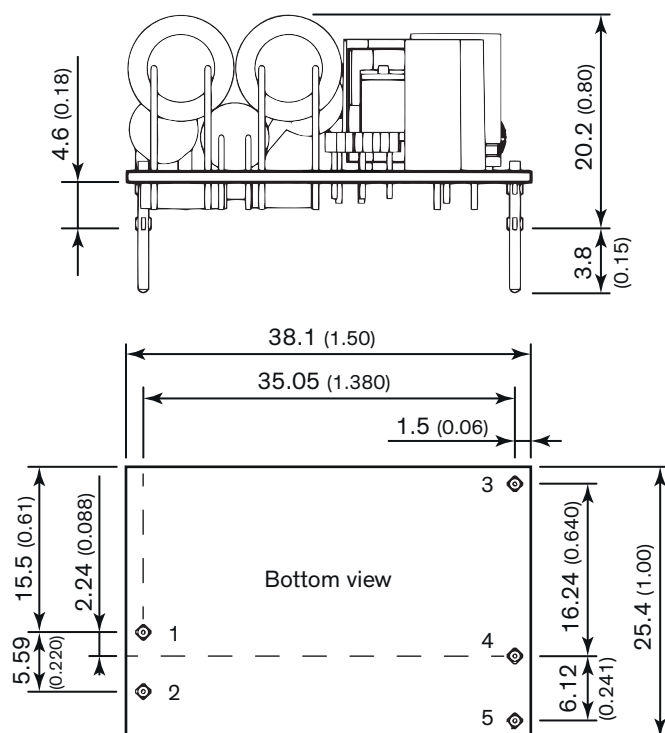
|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Soldering Profile        | Lead-Free Wave Soldering<br>260°C / 6 s max.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Weight                   | 16.5 g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Environmental Compliance | - REACH Declaration<br><a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a><br>REACH SVHC list compliant<br>REACH Annex XVII compliant<br><a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a><br>Exemptions: 7(a), 7(c)-I<br>(RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule).)<br>- RoHS Declaration<br>- SCIP Reference Number<br>31b494fa-2a36-415b-947b-0f32804b2076 |

### Additional Information

|                            |                                                                                                |
|----------------------------|------------------------------------------------------------------------------------------------|
| Supporting Documents       | <a href="http://www.tracopower.com/overview/tpp15a-d">www.tracopower.com/overview/tpp15a-d</a> |
| Frequently Asked Questions | <a href="http://www.tracopower.com/glossary-faq">www.tracopower.com/glossary-faq</a>           |
| Glossary                   | <a href="http://www.tracopower.com/info/glossary.pdf">www.tracopower.com/info/glossary.pdf</a> |

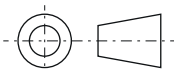
### Outline Dimensions

12, 15, 24, 36, and 48 VDC models - without heatsink



| PCB Pinout |          |
|------------|----------|
| Pin        | Function |
| 1          | Line     |
| 2          | Neutral  |
| 3          | Trim     |
| 4          | -Vout    |
| 5          | +Vout    |

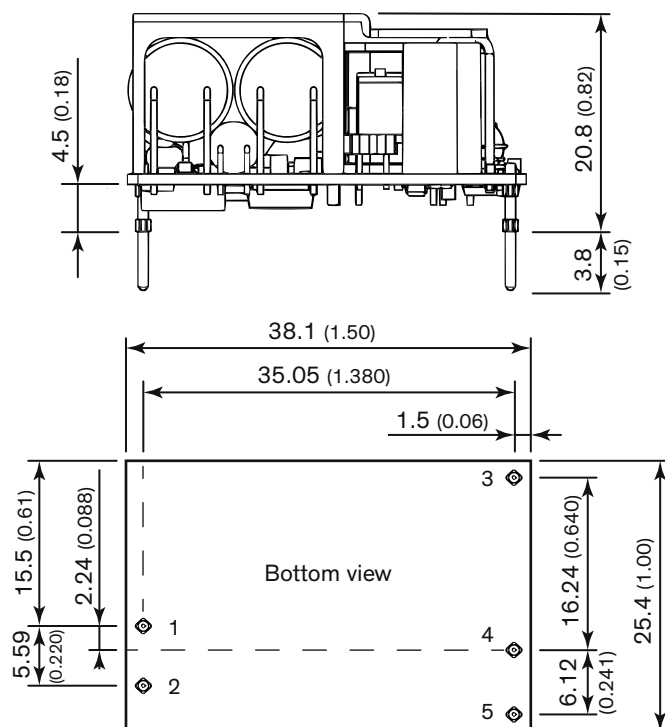
Print thickness: 1.0 mm (0.04)  
Pin diameter: 1.0 mm (0.04)



Dimension in mm (inch)  
Tolerance: x.x ±0.50 (x.xx ±0.02)  
              x.xx ±0.25 (x.xxx ±0.010)  
Pin dimension tolerance: ±0.10 (±0.004)

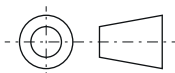
All specifications valid at 230 VAC, resistive full load and +25°C after warm-up time, unless otherwise stated.

### 3.3, 5, and 9 VDC models - with heatsink



Print thickness: 1.0 mm (0.04)

Pin diameter: 1.0 mm (0.04)



Dimensions in mm (inch)

Tolerance:  $x.x \pm 0.50$  ( $x.xx \pm 0.02$ )

$x.xx \pm 0.25$  ( $x.xxx \pm 0.010$ )

Pin dimension tolerance:  $\pm 0.10$  ( $\pm 0.004$ )

| PCB Pinout |          |
|------------|----------|
| Pin        | Function |
| 1          | Line     |
| 2          | Neutral  |
| 3          | Trim     |
| 4          | -Vout    |
| 5          | +Vout    |