

- Compact encapsulated 65 Watt PCB module (3.2"x2.2")
- I/O isolation 4000 VAC rated for 250 VAC working voltage
- Certification according to IEC/EN/ES 60601-1 3rd edition for 2 x MOPP
- Risk management process according to ISO 14971 incl. risk management file
- Acceptance criteria for electronic assemblies acc. to IPC-A-610 Level 3
- Low leakage current <100 µA rated for BF applications
- Operating temperature -40°C to 80°C
- EMC compliance according to IEC 60601-1-2 4th edition and EN 55032 class B
- Operating up to 5000 m altitude
- 5-year product warranty



The TPP 65E-D is a 65 Watt encapsulated AC/DC modules in a PCB package. It features a reinforced double I/O isolation system according to latest medical safety standards (60601-1 3rd edition, 2 x MOPP). The leakage current is below 100 µA and makes the module suitable for BF (body floating) applications. The excellent efficiency of up to 94% allows a high power density and compact design (3.2" x 2.2"). The operating temperature range is -40°C to +80°C with derating above 60°C. The EMC characteristic is dedicated for applications in industrial and medical fields. High reliability is provided by use of high quality components and an excellent thermal management making the TPP 65E-D an ideal solution for medical devices and for demanding safety and space critical applications.

### Models

Order Code	Output Power max.	Output Voltage nom. (adjustable)	Output Current max.	Efficiency typ.
TPP 65-105E-D	50 W	5 VDC (4.5 - 5.5 VDC)	10'000 mA	90 %
TPP 65-112E-D	65 W	12 VDC (10.8 - 13.2 VDC)	5'420 mA	93 %
TPP 65-115E-D		15 VDC (13.5 - 16.5 VDC)	4'340 mA	94 %
TPP 65-124E-D		24 VDC (21.6 - 26.4 VDC)	2'710 mA	94 %
TPP 65-136E-D		36 VDC (32.4 - 39.6 VDC)	1'810 mA	93 %
TPP 65-148E-D		48 VDC (43.2 - 52.8 VDC)	1'360 mA	93 %

## Input Specifications

Input Voltage	- AC Range	Operational Range: <b>85 - 264 VAC</b> (Full Range) Rated Range: <b>100 - 240 VAC</b> (Full Range)
	- DC Range	Operational Range: <b>120 - 370 VDC</b> (Designed for, no certification) Polarity: <b>+DC: L / -DC: N</b>
Input Frequency		Operational Range: <b>47 - 440 Hz</b> Certified: <b>50/60 Hz</b>
Power Consumption	- No load & Vin = 230 VAC - No load & Vin = 115 VAC	<b>210 mW max.</b> (Ready to meet ErP directive) <b>210 mW max.</b>
Input Current	- Full load & Vin = 230 VAC - Full load & Vin = 115 VAC	<b>900 mA max.</b> <b>1'500 mA max.</b>
Input Inrush Current	- At 230 VAC - At 115 VAC	<b>80 A max.</b> <b>30 A max.</b>
Input Protection		<b>T 3.15 A / 250 VAC</b> (Internal Fuse L & N)
Recommended Input Fuse		<b>3'150 mA</b> (slow blow) (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) See application note: <a href="http://www.tracopower.com/overview/tpp65e-d">www.tracopower.com/overview/tpp65e-d</a> Output power must not exceed rated power!
Voltage Set Accuracy		<b>±1% max.</b>
Regulation	- Input Variation (Vmin - Vmax) - Load Variation (0 - 100%)	<b>0.2% max.</b> <b>0.5% max.</b>
Ripple and Noise (20 MHz Bandwidth)		5 VDC model: <b>100 mVp-p max.</b> (w/ 10 µF) 12 VDC model: <b>100 mVp-p max.</b> (w/ 10 µF) 15 VDC model: <b>100 mVp-p max.</b> (w/ 10 µF) 24 VDC model: <b>120 mVp-p max.</b> (w/ 1 µF) 36 VDC model: <b>120 mVp-p max.</b> (w/ 1 µF) 48 VDC model: <b>200 mVp-p max.</b> (w/ 0.1 µF) 5 VDC model: <b>75 mVp-p typ.</b> (w/ 10 µF) 12 VDC model: <b>75 mVp-p typ.</b> (w/ 10 µF) 15 VDC model: <b>75 mVp-p typ.</b> (w/ 10 µF) 24 VDC model: <b>75 mVp-p typ.</b> (w/ 1 µF) 36 VDC model: <b>75 mVp-p typ.</b> (w/ 1 µF) 48 VDC model: <b>150 mVp-p typ.</b> (w/ 0.1 µF)
Capacitive Load		5 VDC model: <b>20'000 µF max.</b> 12 VDC model: <b>4'520 µF max.</b> 15 VDC model: <b>2'900 µF max.</b> 24 VDC model: <b>1'130 µF max.</b> 36 VDC model: <b>520 µF max.</b> 48 VDC model: <b>285 µF max.</b>
Minimum Load		<b>Not required</b>
Temperature Coefficient		<b>±0.02 %/K max.</b>
Hold-up Time	- At 230 VAC - At 115 VAC	<b>75 ms min.</b> <b>16 ms min.</b>
Start-up Time	- At 230 VAC - At 115 VAC	<b>1'000 ms max.</b> <b>1'000 ms max.</b>
Short Circuit Protection		<b>Continuous, Automatic recovery</b>
Output Current Limitation		<b>120 - 180% of Iout max.</b> <b>145% typ. of Iout max.</b>
Overvoltage Protection		<b>130% typ. of Vout nom.</b> <b>125 - 140% of Vout nom.</b>

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

Transient Response	- Response Deviation	3% max. (50% to 75% Load Step at 2.5 A/μs)
	- Response Time	600 μs typ. (50% to 75% Load Step at 2.5 A/μs)

### Safety Specifications

Standards	- IT / Multimedia Equipment	EN 62368-1 IEC 62368-1 UL 62368-1
	- Medical Equipment	EN 60601-1 IEC 60601-1 ANSI/AAMI ES 60601-1 2 x MOPP (Means Of Patient Protection)
	- Certification Documents	<a href="http://www.tracopower.com/overview/tpp65e-d">www.tracopower.com/overview/tpp65e-d</a>
	Protection Class	Class I & II (Prepared): Reinforced Insulation
Pollution Degree		PD 2
Over Voltage Category		OVC II

### EMC Specifications

EMI Emissions	- Conducted Emissions	EN 55011 class B (internal filter) EN 55032 class B (internal filter) FCC Part 15 class B (internal filter) FCC Part 18 class B (internal filter)
	- Radiated Emissions	EN 55011 class B (internal filter) EN 55032 class B (internal filter) FCC Part 15 class B (internal filter) FCC Part 18 class B (internal filter)
	- Harmonic Current Emissions	EN 61000-3-2, class A
	- Voltage Fluctuations & Flicker	EN 61000-3-3
EMS Immunity	- Electrostatic Discharge	EN 60601-1-2 edition 4 (Medical Devices) Air: EN 61000-4-2, ±15 kV, perf. criteria A Contact: EN 61000-4-2, ±8 kV, perf. criteria A
	- RF Electromagnetic Field	EN 61000-4-3, 20 V/m, perf. criteria A
	- EFT (Burst) / Surge	EN 61000-4-4, ±2 kV, perf. criteria A
	- Conducted RF Disturbances	L to L: EN 61000-4-5, ±1 kV, perf. criteria A
	- PF Magnetic Field	EN 61000-4-6, 20 Vrms, perf. criteria A
	- Voltage Dips & Interruptions	Continuous: EN 61000-4-8, 30 A/m, perf. criteria A
		230 VAC / 50 Hz: EN 61000-4-11
		30%, 25 periods, perf. criteria A
		>95%, 0.5 periods, perf. criteria A
		>95%, 1 period, perf. criteria A
	>95%, 250 periods, perf. criteria B	
	115 VAC / 60 Hz: EN 61000-4-11	
	30%, 25 periods, perf. criteria A	
	>95%, 0.5 periods, perf. criteria A	
	>95%, 1 period, perf. criteria A	
	>95%, 250 periods, perf. criteria B	

### General Specifications

Relative Humidity		95% max. (non condensing)
Temperature Ranges	- Operating Temperature	-40°C to +85°C
	- Storage Temperature	-40°C to +85°C
Power Derating	- High Temperature	Depending on model
	- Low Input Voltage	Depending on model
	See application note:	<a href="http://www.tracopower.com/overview/tpp65e-d">www.tracopower.com/overview/tpp65e-d</a>
Cooling System		Natural convection (20 LFM)
Altitude During Operation		5'000 m max.
Regulator Topology		Flyback Converter

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

Switching Frequency		50 - 130 kHz (PWM QR)
Insulation System		Reinforced Insulation
Working Voltage (rated)		250 VAC
Isolation Test Voltage	- Input to Output, 60 s	4'000 VAC
	- Input to Case or PE, 60 s	2'500 VAC
	- Output to Case or PE, 60 s	2'500 VAC
Creepage	- Input to Output	8 mm min.
	- Input to Case or PE	4 mm min.
	- Output to Case or PE	4 mm min.
Clearance	- Input to Output	4 mm min.
	- Input to Case or PE	4 mm min.
	- Output to Case or PE	4 mm min.
Isolation Resistance	- Input to Output, 500 VDC	100 MΩ min.
Isolation Capacitance	- Input to Output, 100 kHz, 1 V	1'250 pF typ. / 1'500 pF max.
Leakage Current	- Touch Current	100 μA max.
Reliability	- Calculated MTBF	1'494'000 h (MIL-HDBK-217F, ground benign)
Washing Process		According to Cleaning Guideline <a href="http://www.tracopower.com/info/cleaning.pdf">www.tracopower.com/info/cleaning.pdf</a>
Environment	- Vibration	IEC 60068-2-6 5 g, 3 axis, sine sweep, 3x30 min, 5-500 Hz
	- Mechanical Shock	IEC 60068-2-27 50 g, 3 axis, 11 ms
	- Thermal Shock	MIL-STD-810F -40 to +85°C, 72 cycles, 30 min each
Housing Material		Plastic (UL 94 V-0 rated)
Potting Material		Silicone (UL 94 V-0 rated)
Pin Material		Tinned Copper
Pin Foundation Plating		Nickel (2 - 3 μm)
Pin Surface Plating		Tin (3 - 5 μm), matte
Housing Type		Plastic Case
Mounting Type		PCB Mount
Connection Type		THD (Through-Hole Device)
Soldering Profile		Lead-Free Wave Soldering 260°C / 6 s max.
Weight		265 g
Environmental Compliance	- REACH Declaration	<a href="http://www.tracopower.com/info/reach-declaration.pdf">www.tracopower.com/info/reach-declaration.pdf</a> REACH SVHC list compliant REACH Annex XVII compliant
	- RoHS Declaration	<a href="http://www.tracopower.com/info/rohs-declaration.pdf">www.tracopower.com/info/rohs-declaration.pdf</a> Exemptions: 7a, 7c-I (RoHS exemptions refer to the component concentration only, not to the overall concentration in the product (O5A rule))
	- SCIP Reference Number	dd509643-121a-4ee3-a36d-571d3743f609

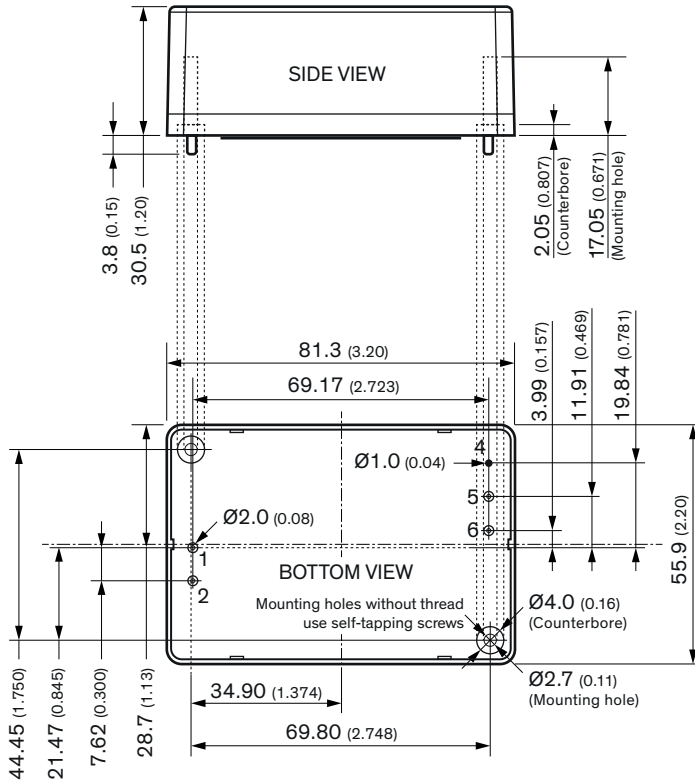
## Supporting Documents

Overview Link (for additional Documents)

[www.tracopower.com/overview/tpp65e-d](http://www.tracopower.com/overview/tpp65e-d)

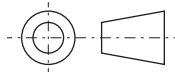
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**Outline Dimensions**



Pinout	
Pin	Function
1	AC (N)
2	AC (L)
4	Trim
5	-Vout
6	+Vout

All dimensions in mm (inch)  
 Tolerance: x.x ±0.5 (x.xx ±0.02)  
 x.xx ±0.25 (x.xxx ±0.010)



Suggested screw: ST2.9 X 6.5  
 Mounting screw locked torque: Max. 0.33 Nm (3.4 kgfcm)