



## Features

- 2.0 x 3.5" x 1.3" Package
- Up to 65W Convection Cooled Output Power
- Compliant to high levels of EMC per EN61000-4
  - 15kV ESD (Air), 8kV (Contact)
  - 4kV Surge
- Meets Class B Conducted EMI with 6db margin, Class B Radiated EMI with 3db margin
- Up to 90% Efficiency
- >10 year e-cap life
- Universal Input 90-264Vac Input Range
- DC OK Signal, PSU Temperature Signal
- Class I and II Input Models
- 3 Year Warranty



## Description

A Superior performance 65 Watts AC to DC power supply designed for Test and Measurement and Industrial applications. Feature rich and highly efficient TB65 product family can easily fit in 1U chassis and provides 65 Watts, convection cooled. Input, output and internal temperature monitoring/alarms are additional features of the TB65 family. All models are CE marked to low voltage directive and approved to ITE standards of IEC/UL/EN60950 and CSA C22.2, 2nd edition.

## Model Selection

Model Number <sup>4</sup>	Output Voltage (Nom)	Output Current	Efficiency <sup>1</sup>	Ripple & Noise <sup>2</sup> (pk-pk)	Total Regulation	OVP Threshold	MTBF <sup>3</sup>
TB65S12K	12V	5.4A	88%	120mV	±3%	14.0 ± 1.1V	500,000
TB65S15K	15V	4.3A	88%	180mV	±3%	21.0 ± 2.0V	500,000
TB65S24K	24V	2.7A	90%	240mV	±3%	28.0 ± 2.5V	500,000
TB65S36K	36V	1.8A	88%	360mV	±3%	46.3 ± 3.0V	500,000
TB65S48K	48V	1.35A	90%	480mV	±3%	55.0 ± 4.0V	500,000

- Notes:
1. Efficiency values listed are typical and are measured at 115Vac input, full load output current, at an ambient temperature of 25°C.
  2. Measured at 25°C ambient with noise probe directly at end of 6" twisted pair terminated with 0.1µF ceramic and 10µF low ESR capacitors. Values will be higher at ambient temperatures below 0°C.
  3. MTBF values are in hours, per Telcordia 332, Issue 6, 25°C, full rated load (w/airflow) at 110Vac input.
  4. Change the "K" suffix to "C" for Input Class II (ungrounded) models.

## General Specifications

<b>AC Input</b>	85-264Vac, single phase. (Safety Approved to 90-264Vac).	<b>Turn On Time</b>	<2 Seconds at 110Vac.
<b>Input Current</b>	1.5A at 110Vac, 1A at 240Vac	<b>Rise Time</b>	<30mS, 56V model: <35mS
<b>Inrush Current</b>	40Arms Maximum within a half line cycle, cold start at 25C. See application note.	<b>Hold-up Time</b>	20mS min. from loss of AC input at 110 Vac, full load, 25°C.
<b>I<sup>2</sup>T Characteristic</b>	See Table below.	<b>Over Load Protection (OCP)</b>	115% - 200% of rated output current value. Hiccup Mode, Auto-recovery

## General Specifications

<b>Turn-On Input Voltage</b>	>75Vac ± 8Vac. Full spec performance at 85Vac.	<b>Short Circuit Protection (SCP)</b>	Short across the output terminals will not cause damage to the unit. Hiccup Mode , Auto-recovery
<b>Turn-Off Input Voltage</b>	<63Vac ± 8Vac	<b>Over Voltage Protection (OVP)</b>	Latches off when output voltage is with range as shown in table. Requires AC Power cycle to reset
<b>Input Fuses</b>	3.15A, 250Vac, line and neutral inputs	<b>Over Temperature Protection (OTP)</b>	Power shuts down at temperature of 70°C (typical) at full load. Hiccup Mode , Auto-recovery
<b>Earth Leakage Current</b>	<500µA@264Vac, 60Hz input, NC	<b>Output Reverse Voltage Protection</b>	Outputs protected against momentary reverse current less than 20A peak for less than 10mS with 0.5A average. Sustained reverse current at high levels may damage unit.
<b>Leakage Current (Output to Earth)</b>	<4 mA@264Vac, 60Hz input	<b>Isolation</b>	Input-Output: 3000Vac Input-Ground: 1900Vac Output-Ground: 500Vac
<b>Output Voltage</b>	12V to 48Vdc. See models chart for part numbering.	<b>Turn-On &amp; Operating Temperature</b>	-20°C to +70°C. Turn on Temperature = -40°C at >=120Vac, allowing [x] seconds for stabilization. De-rated output power at 70°C = 45.5W
<b>Voltage Adjustability</b>	+/- 10% (+/-5% for 48V model)	<b>Storage Temperature</b>	-40°C to +85°C
<b>Efficiency</b>	88% - 90% typical at 115/230Vac, 25°C. See chart for additional details	<b>Altitude</b>	Operating: -500m to 5000m Non-operating: -500 to 40,000 feet
<b>Output Power</b>	65W continuous convection cooled, -20C to 50°C ambient. 85Vac to 264Vac. See chart for de-rating above 50°C.	<b>Relative Humidity</b>	5% to 95%, non-condensing
<b>Transient Response</b>	500µS typ. response time for return to within 0.5% of final value for a 50% load change, $\Delta i/\Delta t < 0.2A/\mu s$ . Max. volt. deviation is ±3.5%.	<b>IPC 610</b>	Class 2
<b>Minimum Load</b>	Not required.	<b>Safety Standards</b>	IEC 60950-1, 2 <sup>nd</sup> Edition CAN/CSA – C22.2 No 60950-1 DEMKO EN60950-1
<b>Shock (IEC 60068-2-27)</b>	<u>Operating:</u> Half-sine shock waveform. Impact Acceleration: 20g, Pulse duration: 11mS. Cycles: 3 times per axis in X,Y, Z direction <u>Non-Operating:</u> Half-sine shock waveform. Impact Acceleration: 100g, Pulse duration: 6mS Cycles: 3 times per direction on 3 axes (X,Y, Z)	<b>Vibration (IEC 60068-2-6) (IEC 60068-2-64)</b>	<u>Operating:</u> Sinusoidal Frequency: 10-500Hz, Impact Acceleration: 1g, Sweep rate: 1 octave/min Cycles: 10 times per axis in X, Y, Z direction <u>Random Vibration:</u> <u>Operating:</u> 0.003g <sup>2</sup> /Hz, 1.224grms overall, 3 axes, 10 min per axis, 1-500Hz. <u>Non-Operating:</u> 0.02g <sup>2</sup> /Hz, 3.1grms overall, 3 axes, 1 hour per axis, 20-500 Hz
<b>E-Cap Life</b>	>10 Years in use condition of 40°C ambient, at 12h/day, 261 days/year. Additional information on other use profiles available on request.	<b>MTBF</b>	572,500 hours @ 110/220Vac, 25°C Bellcore issue 6.
<b>Overshoot</b>	<2% overshoot at turn-on, <1% overshoot at turn-off, under all conditions.	<b>Weight</b>	140g, typical
<b>Total Regulation</b>	±1.0 % for all models.	<b>Dimensions</b>	W: 2.0" x L: 3.5" x H: 1.3" W: 50.8mm x L: 88.9mm x H: 33.02mm

## Auxiliary Signals

<b>DC OK:</b>	During normal operation, this signal is logic HIGH. Signal will go LOW for output less than 90% (typical) of nominal. Green LED will light on PCB top side during normal operation.	<b>PSU Temperature</b>	Provides resistive value indicating internal temperature of power supply. See Temp Sensor Conversion Table below.
---------------	---	------------------------	---

## EMI/EMC Compliance

<b>Conducted Emissions</b>	EN55022/CISPR22 Class B, FCC Part 15.107, Class B, 6db margin, typical.
<b>Radiated Emissions</b>	EN55022/CISPR22 Class B, FCC Part 15.109, Class B, 3db margin, typical.
<b>Common Mode Noise: High Frequency (100Khz -20 Mhz)</b>	<50mA pk-pk, 6mA rms CM current. See Application Note.
<b>Common Mode Noise: Low Frequency (50-120 Hz)</b>	<50mA pk-pk, 6mA rms CM current. See Application Note.
<b>Static Discharge Immunity</b>	EN55024/IEC61000-4-2, Level 4, 8kV Contact Discharge, 15kV air discharge, Criteria A
<b>Radiated RF Immunity</b>	EN55022/IEC61000-4-3, Level 3, 10V/m, Criteria A
<b>EFT/Burst Immunity</b>	EN55024/IEC61000-4-4, Level 3, 4kV (PS Output), Criteria A; 2kV (signal outputs), Criteria B
<b>Line Surge Immunity</b>	EN55024/IEC61000-4-5, Level 4, 2kV diff., 4kV Common-mode, Criteria A
<b>Conducted RF Immunity</b>	EN55022/IEC61000-4-6, Level 3, 10V/m, Criteria A
<b>Power Frequency Magnetic Field Immunity</b>	EN55024/IEC61000-4-8, Level 4, 30A/m, Criteria A
<b>Voltage Dip Immunity</b>	EN55024/IEC61000-4-11, Dips: 100%, 10ms; 30%, 500ms; 60%, 100ms; Interruptions: 100%, 5000ms; Performance Criteria A, A, B & B
<b>Line Harmonic Emissions</b>	EN55024/IEC61000-3-2, Class A.
<b>Flicker Test</b>	EN55024/IEC61000-3-3

**Notes:** Performance criteria are based on EN55024. According to the standards, performance criteria are defined as following:  
A – Normal performance during and after the test  
B – Temporary degradation, self-recoverable  
C – Temporary degradation, operator intervention required to recover the operation  
D – Permanent damage

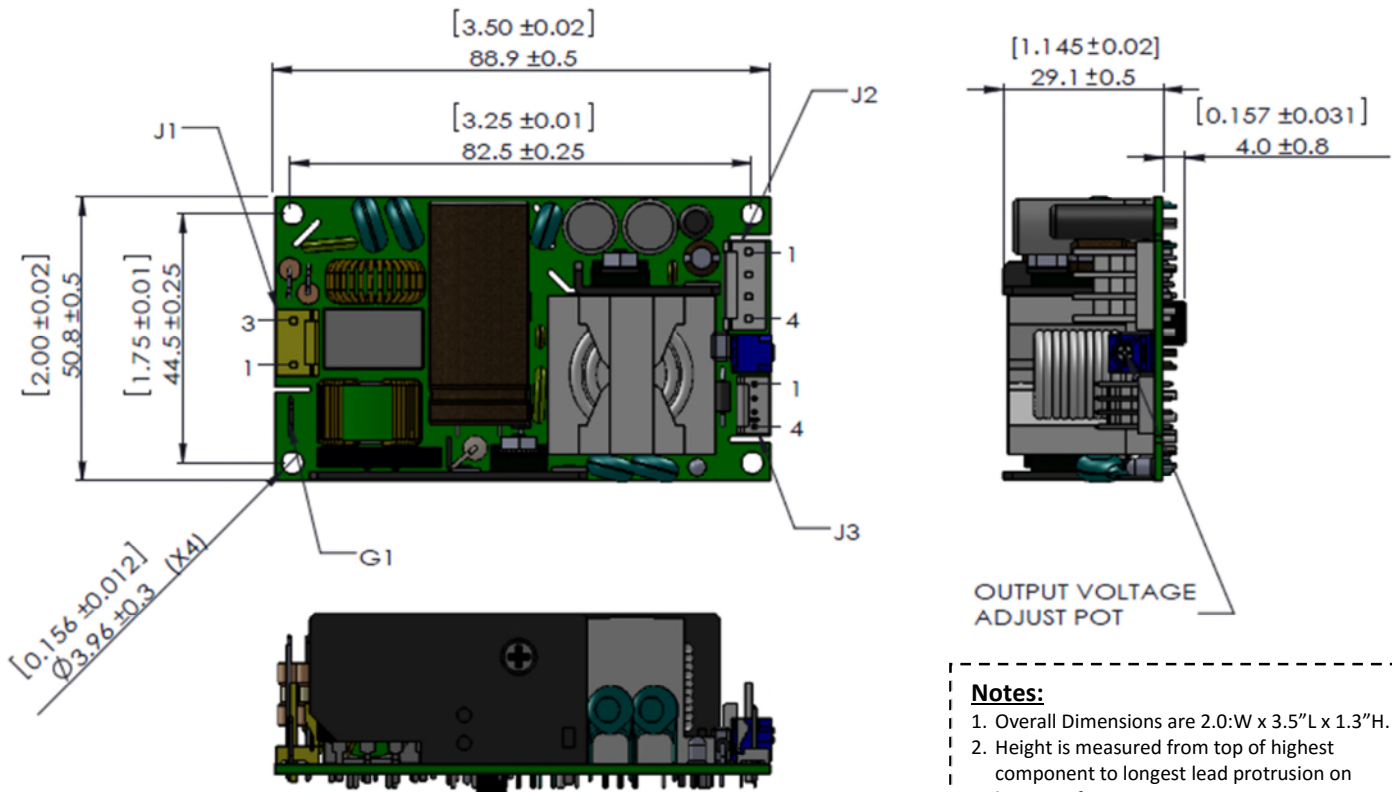
## Isolation Specifications

Parameter	Conditions/Description	Min	Nom	Max	Units
Insulation Safety Rating	Input/Ground		1900Vac		
	Input/Output		3000Vac		
	Output/Ground		500Vac		
Electric Strength Test Voltage	Input/Ground	1900	-	-	Vac
	Input/Output	3000	-	-	Vac
	Output/Ground	500	-	-	Vac

## Connector Information

Input Connector J1	DC Output Connector J2	Ground Connector G1	Signal Connector J3
PIN 1) AC Line PIN 2) Empty (removed) PIN 3) AC Neutral	Pin 1) (+V) Pin 3) (-V) Pin 2) (+V) Pin 4) (-V)	FG 0.187" Quick-connect tab	PIN 1) RTN Pin 3) TEMP SEMSOR (+) PIN 2) DC_OK Pin 4) TEMP SEMSOR (-)
<u>Mating Connector:</u> Tyco/AMP 640250-3 Pins: 640252-2	<u>Mating Connector:</u> Tyco/AMP 640250-4 Pins: 640252-2	<u>Mating Connector:</u> Molex 01-90020005	<u>Mating Connector:</u> Tyco/AMP 1375820-4 Pins: 1375819

## Mechanical Drawing



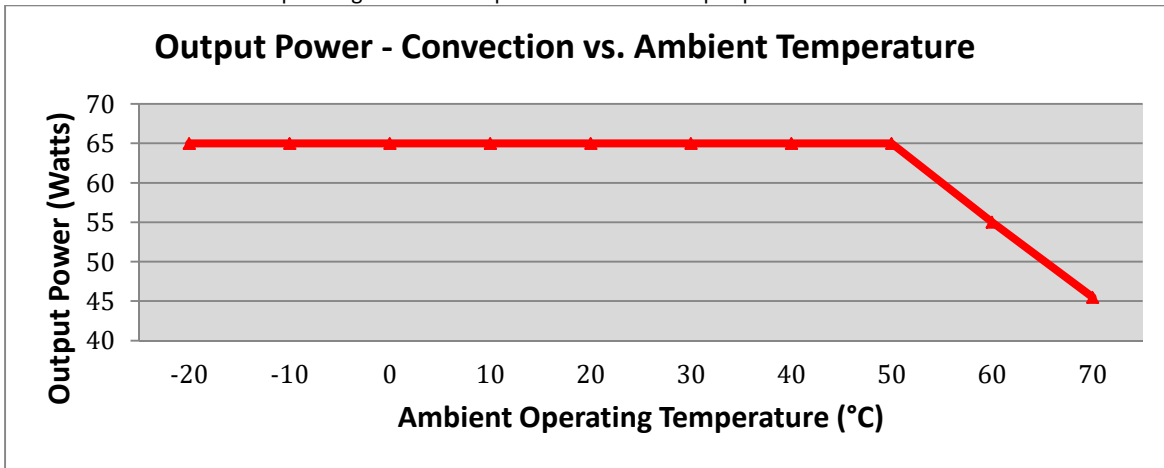
### Notes:

- Overall Dimensions are 2.0"W x 3.5"L x 1.3"H.
- Height is measured from top of highest component to longest lead protrusion on bottom of PCB.
- Input & Output Connectors on opposite ends.
- Mounting hole pattern: 1.75" x 3.25". 4 holes
- Mounting holes isolated from ground for Class II designs. Mounting standoff height to be  $\geq$  xx mm.

## Characteristic Curves

### Output vs. Temperature

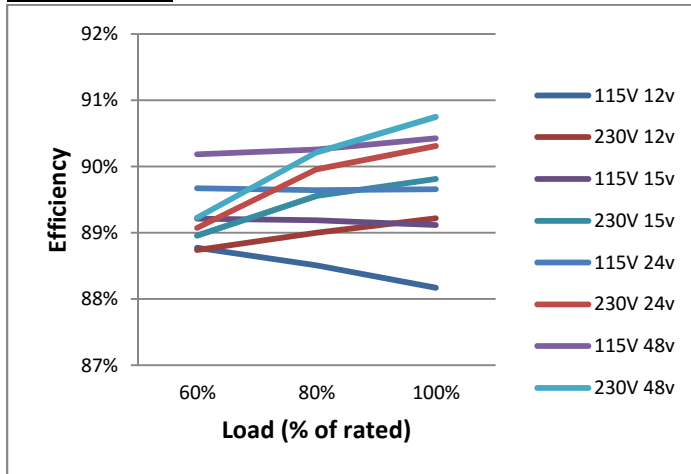
65W convection cooled at -20°C to 50°C operating ambient temperature. De-rate output power to 45.5W at 70°C.



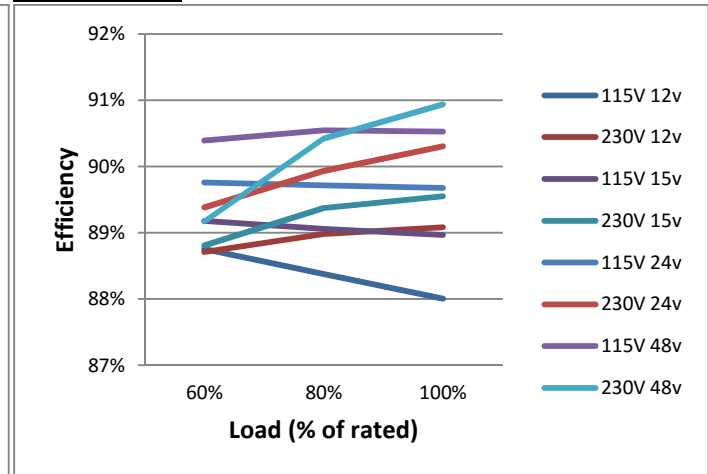
### Efficiency vs. Loading

The charts below detail the TB65 efficiency vs input voltage and output loading conditions at 25°C, 50°C and 70°C under de-rated power.

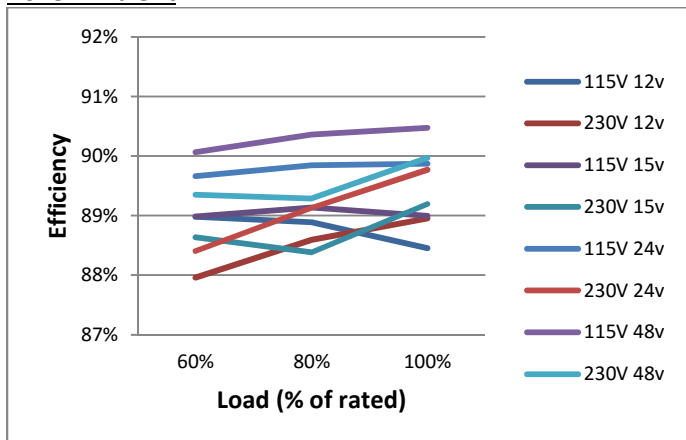
#### 25°C ambient



#### 50°C Ambient



#### 70°C Ambient



### Inrush Current, peak (I<sup>2</sup>T rating)

Measured at 264Vac, 50°C at 100% loading, 70°C at de-rated load condition

Model	50°C - I <sup>2</sup> T rating (A <sup>2</sup> Seconds, Typical)	70°C - I <sup>2</sup> T rating (A <sup>2</sup> Seconds, Typical)
12V Model	8.5	11.0
15V Model	6.5	13.2
24V Model	10.9	11.7
48V Model	10.4	11.1

### Internal Temperature Sensor Conversion Table - Resistance

Value across connector J3, pins 3-4	Internal Temperature
6,040K ohms	-20°C
3,227K ohms	-10°C
1,788K ohms	0°C
1,025K ohms	10°C
605.1K ohms	20°C
367.6K ohms	30°C
229.2K ohms	40°C
146.4K ohms	50°C
95.62K ohms	60°C
63.80K ohms	70°C
43.40K ohms	80°C
30.07K ohms	90°C
21.19K ohms	100°C

**Notes:** 1) Tolerances: -20°C to 60°C: +/- 4°C; 70°C to 80°C: +/- 5°C; 90°C to 100°C: +/- 6°C.