

Industrial

### FEATURES AND BENEFITS

2.0" X 3.5" X 1.3" Package

>10 Year E-Cap Life

Up to 65W Convection Cooled Output Power

Universal Input 90VAC-264VAC Input Range

Up to 90% Efficiency

DC Ok Signal, PSU Temperature Signal

Compliant To High Levels Of EMC Per EN61000-4  
15kV ESD(Air), 8kV(Contact), 4kV Surge

Class I and II Input Models

Meets Class B Conducted EMI with 6db Margin,  
Class B Radiated EMI with 3db Margin

3 Year Warranty

Approved to EN/CSA/IEC/UL62368-1



### 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%	14.0V ± 1.1V	5,00,000
TB65S15K	15V	4.3A	88%	180mV	±3%	21.0V ± 2.0V	5,00,000
TB65S24K	24V	2.7A	90%	240mV	±3%	28.0V ± 2.5V	5,00,000
TB65S36K	36V	1.8A	88%	360mV	±3%	46.3V ± 3.0V	5,00,000
TB65S48K	48V	1.35A	90%	480mV	±3%	55.0V ± 4.0V	5,00,000

#### Notes:

- Efficiency values listed are typical and are measured at 115VAC input, full load output current, at an ambient temperature of 25°C.
- 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.
- MTBF values are in hours, per Telcordia 332, Issue 6, 25°C, full rated load (w/airflow) at 110VAC input.
- Change the "K" suffix to "C" for Input Class II (ungrounded) models.



### INPUT

Input Voltage and Frequency	85VAC–264VAC, single phase (Safety Approved to 90VAC–264VAC)
Input Current	1.5A at 110VAC, 1A at 240VAC
Inrush Current	40Arms maximum within a half line cycle, cold start at 25°C. See application note
Input Fuses	3.15A, 250VAC, line and neutral inputs
Earth Leakage Current (Input to Earth)	<500 $\mu$ A@264VAC, 60Hz input, NC
Patient Leakage Current (Output to Earth)	<4 mA@264VAC, 60Hz input
Efficiency	88%–90% typical at 115VAC/230VAC, 25°C. See chart for additional details
I <sup>2</sup> T Characteristic	See table below

### RELIABILITY

MTBF	5,72,500 hours@110VAC/220VAC, 25°C Bellcore issue 6
E-Cap Life	>10 years in use condition of 40°C ambient, at 12 hours/day, 261 days/year. Additional information on other use profiles available on request

### ISOLATION

Isolation	Input-Output: 3000VAC Input-Ground: 1900VAC Output-Ground: 500VAC
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### PROTECTION

Overtemperature Protection	Power shuts down at temperature of 70°C (typical) at full load. Hiccup Mode, Auto-recovery
Overload Protection	115%–200% of rated output current value. Hiccup Mode, Auto-recovery
Overvoltage Protection	Latches off when output voltage is with range as shown in table. Requires AC Power cycle to reset
Short Circuit Protection	Short across the output terminals will not cause damage to the unit. Hiccup Mode, Auto-recovery
Output Reverse Voltage Protection	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.

### OUTPUT

Output Voltage	12VDC to 48VDC. See models chart for part numbering
Output Power	65W continuous convection cooled, -20°C to 50°C ambient. 85VAC to 264VAC. See chart for derating above 50°C
Turn On Time	<2 seconds at 110VAC
Hold-up Time	20mS min. from loss of AC input at 110VAC, full load, 25°C
Output Voltage Adjustment	$\pm$ 10% ( $\pm$ 5% for 48V model)
Transient Response	500 $\mu$ S 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 $\pm$ 3.5%
Rise Time	<30mS, 56V model: <35mS
Total Load Regulation	$\pm$ 1.0 % for all models
Minimum Load	Not required
Common Mode Noise	High Frequency (100Khz–20Mhz) - <50mA pk-pk, 6mA rms CM current. See Application Note Low Frequency (50Hz–120Hz) - <50mA pk-pk, 6m Arms CM current. See Application Note
Turn-On & Operating Temperature	-20°C to +70°C. Turn on Temperature = -40°C at $\geq$ 120VAC, allowing [x] seconds for stabilization. De-rated output power at 70°C = 45.5W

### SAFETY

Safety Standards	EN/CSA/IEC/UL62368-1
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### AUXILIARY SIGNALS

DC OK	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.
PSU Temperature	Provides resistive value indicating internal temperature of power supply. See Temperature Sensor Conversion Table below.



### ENVIRONMENT

Storage Temperature	-40°C to +85°C
Relative Humidity	5% to 95%, non-condensing
Weight	140 grams, typical
Dimensions	2.0" x 3.5" x 1.3" 50.8mm x 88.9mm x 33.02mm
Operating Altitude	Operating: -500m to 5000m Non-operating: -500 feet to 40,000 feet
Vibration	Operating: Sinusoidal Frequency: 10Hz–500Hz, Impact Acceleration: 1 gram, Sweep rate: 1 octave/min Cycles: 10 times/axis in X, Y, Z direction Operating: 0.003g <sup>2</sup> /Hz, 1.224 grams overall, 3 axes, 10 min/axis, 1Hz–500Hz Non-Operating: 0.02g <sup>2</sup> /Hz, 3.1 grams overall, 3 axes, 1hour/axis, 20Hz–500Hz
Shock	Operating: Half-sine shock waveform. Impact Acceleration: 20 grams, Pulse duration: 11mS Cycles: 3 times/axis in X,Y, Z direction Non-Operating: Half-sine shock waveform Impact Acceleration: 100 grams, Pulse duration: 6mS Cycles: 3 times/direction on 3 axes (X,Y,Z)
Cooling	Convection

### EMI/EMC COMPLIANCE

Conducted Emissions	EN55022/CISPR22 Class B, FCC Part 15.107, Class B, 6db margin, typical
Radiated Emissions	EN55022/CISPR22 Class B, FCC Part 15.109, Class B, 3db margin, typical
Electro-Static Discharge (ESD) Immunity on Power Ports	EN55024/IEC61000-4-2, Level 4, 8kV Contact Discharge, 15kV air discharge, Criteria A
Radiated RF EM Fields Susceptibility <sup>3</sup>	EN55022/IEC61000-4-3, Level 3, 10V/m, Criteria A
Electrical Fast Transients (EFT)/Bursts	EN55024/IEC61000-4-4, Level 3, 4kV (PS Output), Criteria A; 2kV (signal outputs), Criteria B
Surges, Line to Line (DM) and Line to Ground (CM)	EN55024/IEC61000-4-5, Level 4, 2kV diff., 4kV Common-mode, Criteria A
Conducted RF Immunity	EN55022/IEC61000-4-6, Level 3, 10V/m, Criteria A
Power Frequency Magnetic Field Immunity	EN55024/IEC61000-4-8, Level 4, 30A/m, Criteria A
Voltage Dip Immunity	EN55024/IEC61000-4-11, Dips: 100%, 10mS; 30%, 500mS; 60%, 100mS; Interruptions: 100%, 5000mS; Performance Criteria A, A, B & B
Harmonic Current Emissions	EN55024/IEC61000-3-2, Class A
Flicker Test	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

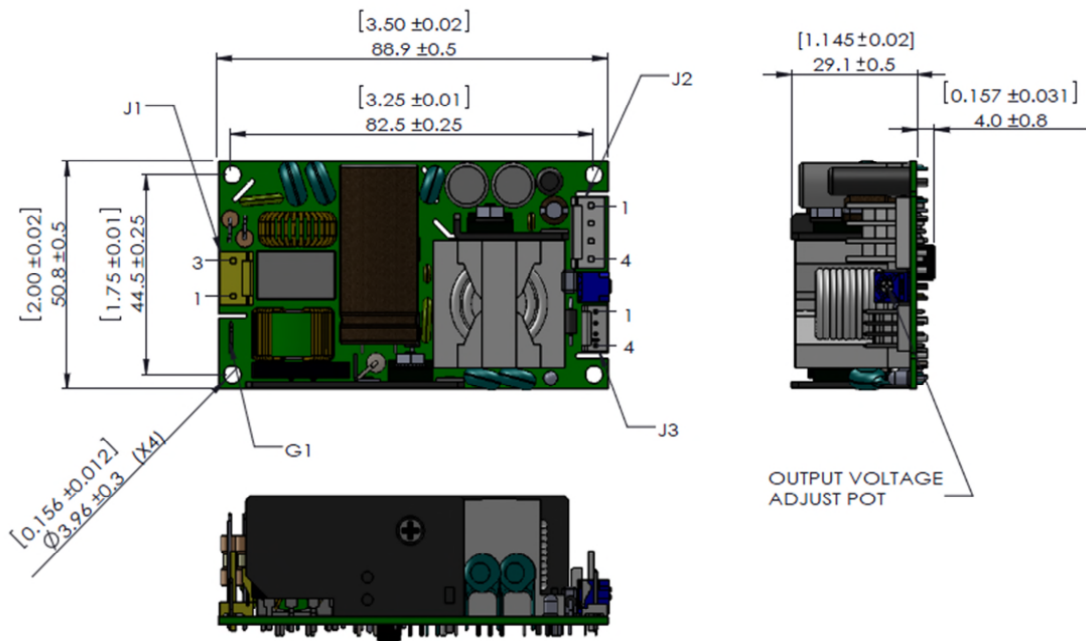
D – Permanent damage

### ISOLATION SPECIFICATIONS

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



### 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.

### CONNECTOR INFORMATION

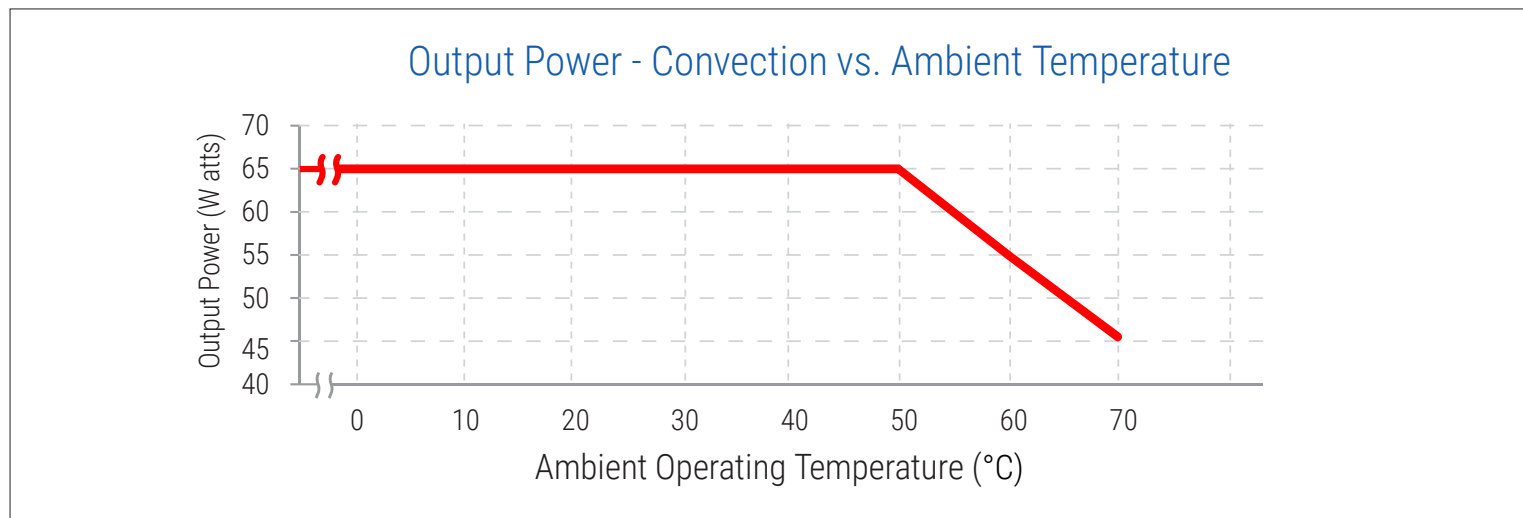
Input Connector J1	DC Output Connector J2	Ground Connector G1	Signal Connector J3
PIN 1) AC Line PIN 2) Empty (removed) PIN 3) AC Neutral	PIN 1) (+V)    PIN 3) (-V) PIN 2) (+V)    PIN 4) (-V)	FG 0.187" Quick-connect tab	PIN 1) RTN    Pin 3) TEMP SENSOR (+) PIN 2) DC_OK    Pin 4) TEMP SENSOR (-)
Mating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



## CHARACTERISTIC CURVES

### Output vs. Temperature

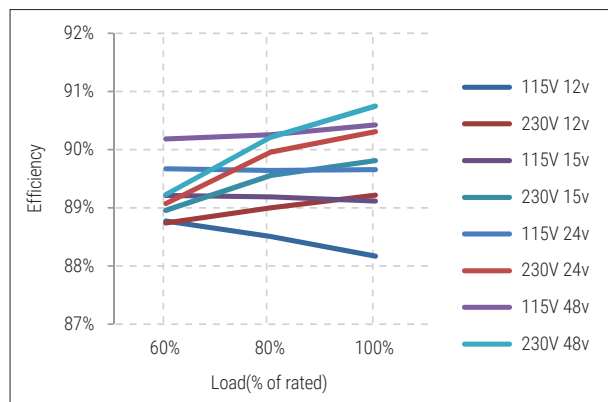
65W convection cooled at -20°C to 50°C operating ambient temperature. De-rate output power to 45.5W at 70°C.



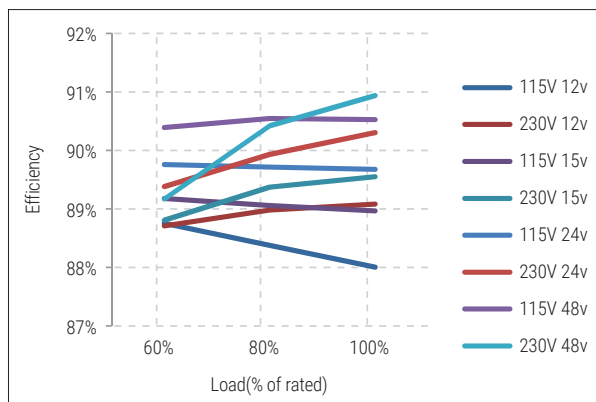
### Efficiency vs. Loading

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.

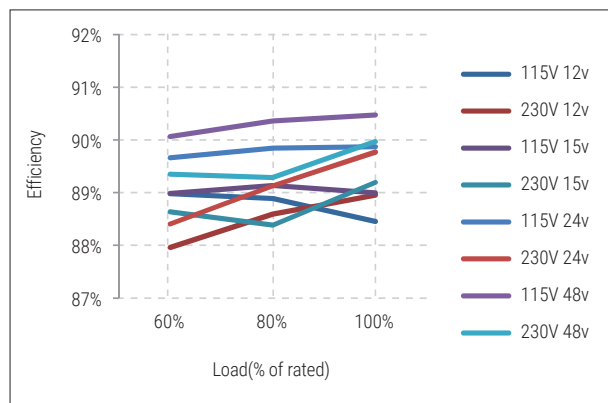
#### 25°C Ambient



#### 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.

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