# Chipsmall

Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

## Contact us

# CUI INC®

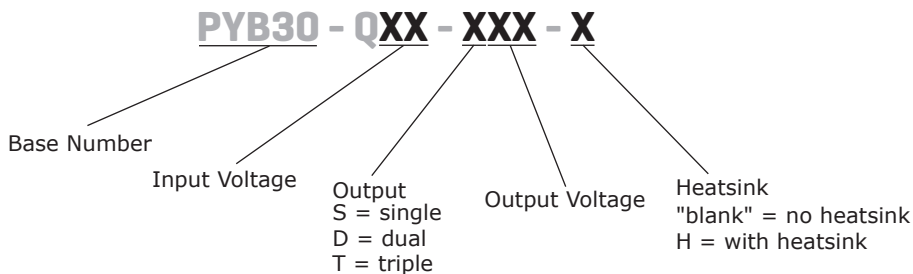**SERIES:** PYB30 | **DESCRIPTION:** DC-DC CONVERTER

## FEATURES

- up to 30 W isolated output
- industry standard pinout
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- smaller package
- single/dual/triple regulated outputs
- 1,500 Vdc isolation
- continuous short circuit, over current protection, over voltage protection
- temperature range  (-40~85°C)
- six-sided metal shielding
- efficiency up to 90%

**RoHS**

| MODEL | input voltage | | output voltage | output current | | output power | ripple and noise[1] | efficiency |
|---|---|---|---|---|---|---|---|---|
| | typ (Vdc) | range (Vdc) | (Vdc) | min (mA) | max (mA) | max (W) | max (mVp-p) | typ (%) |
| PYB30-Q24-S5 | 24 | 9~36 | 5 | 300 | 6000 | 30 | 100 | 88 |
| PYB30-Q24-S12 | 24 | 9~36 | 12 | 125 | 2500 | 30 | 100 | 88 |
| PYB30-Q24-S15 | 24 | 9~36 | 15 | 100 | 2000 | 30 | 100 | 90 |
| PYB30-Q24-D5 | 24 | 9~36 | ±5 | ±150 | ±3000 | 30 | 100 | 86 |
| PYB30-Q24-D12 | 24 | 9~36 | ±12 | ±63 | ±1250 | 30 | 100 | 89 |
| PYB30-Q24-D15 | 24 | 9~36 | ±15 | ±50 | ±1000 | 30 | 100 | 90 |
| PYB30-Q24-T312 | 24 | 9~36 | 3.3 ±12 | 175 ±31 | 3500 ±625 | 26.5 | 100 | 85 |
| PYB30-Q24-T315 | 24 | 9~36 | 3.3 ±15 | 175 ±25 | 3500 ±500 | 26.5 | 100 | 86 |
| PYB30-Q24-T512 | 24 | 9~36 | 5 ±12 | 150 ±31 | 3000 ±625 | 30 | 100 | 88 |
| PYB30-Q24-T515 | 24 | 9~36 | 5 ±15 | 150 ±25 | 3000 ±500 | 30 | 100 | 88 |
| PYB30-Q48-S5 | 48 | 18~75 | 5 | 300 | 6000 | 30 | 100 | 88 |
| PYB30-Q48-S12 | 48 | 18~75 | 12 | 125 | 2500 | 30 | 100 | 88 |
| PYB30-Q48-S15 | 48 | 18~75 | 15 | 100 | 2000 | 30 | 100 | 89 |
| PYB30-Q48-D5 | 48 | 18~75 | ±5 | ±150 | ±3000 | 30 | 100 | 86 |
| PYB30-Q48-D12 | 48 | 18~75 | ±12 | ±63 | ±1250 | 30 | 100 | 87 |
| PYB30-Q48-D15 | 48 | 18~75 | ±15 | ±50 | ±1000 | 30 | 100 | 87 |
| PYB30-Q48-T312 | 48 | 18~75 | 3.3 ±12 | 175 ±31 | 3500 ±625 | 26.5 | 100 | 85 |
| PYB30-Q48-T315 | 48 | 18~75 | 3.3 ±15 | 175 ±25 | 3500 ±500 | 26.5 | 100 | 85 |
| PYB30-Q48-T512 | 48 | 18~75 | 5 ±12 | 150 ±31 | 3000 ±625 | 30 | 100 | 88 |
| PYB30-Q48-T515 | 48 | 18~75 | 5 ±15 | 150 ±25 | 3000 ±500 | 30 | 100 | 87 |

Notes:    1. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 µF ceramic and 10 µF electrolytic capacitors on the output.

## PART NUMBER KEY

PYB30 - QXX - XXX - X

Base Number

Input Voltage

Output
S = single
D = dual
T = triple

Output Voltage

Heatsink
"blank" = no heatsink
H = with heatsink

## INPUT

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| operating input voltage | 24 Vdc input models | 9 | 24 | 36 | Vdc |
| | 48 Vdc input models | 18 | 48 | 75 | Vdc |
| start-up voltage | 24 Vdc input models | | | 9 | Vdc |
| | 48 Vdc input models (single/dual output models) | | | 18 | Vdc |
| | 48 Vdc input models (triple output models) | | | 17.8 | Vdc |
| under voltage shutdown[1] | 24 Vdc input models | 7.8 | | | Vdc |
| | 48 Vdc input models | 16 | | | Vdc |
| surge voltage | for maximum of 1 second | | | | |
| | 24 Vdc input models | -0.7 | | 50 | Vdc |
| | 48 Vdc input models | -0.7 | | 100 | Vdc |
| start-up time | | | 10 | | ms |
| filter | pi filter | | | | |
| CTRL[2] | models ON (CTRL open or connect high level, 2.5~12 Vdc) | | | | |
| | models OFF (CTRL connect GND or low level, 0~1.2 Vdc) | | | | |
| | input current (models OFF) | | 1 | | mA |

Notes:    1. Contact CUI if you are planning to use this feature in your application.
          2. CTRL pin voltage is referenced to GND.

## OUTPUT

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| line regulation | full load, input voltage from low to high | | | | |
| | single and dual output models | | ±0.2 | ±0.5 | % |
| | triple output models (main output) | | | ±1 | % |
| | triple output models (auxiliary outputs) | | | ±5 | % |
| load regulation[3] | 5% to 100% load, nominal input | | | | |
| | single and dual output models | | ±0.5 | ±1 | % |
| | triple output models (main output) | | | ±2 | % |
| | triple output models (auxiliary outputs) | | | ±5 | % |
| cross regulation | dual output models: main output 50% load, secondary output from 10% to 100% load | | | ±5 | % |
| voltage accuracy | single and dual output models | | ±1 | ±3 | % |
| | triple output models (main output) | | ±1 | ±3 | % |
| | triple output models (auxiliary outputs) | | ±3 | ±5 | % |
| adjustability[4] | | | ±10 | | % |
| switching frequency | PWM mode | | 400 | | kHz |
| transient recovery time | 25% load step change | | 300 | 500 | µs |
| transient response deviation | 25% load step change | | ±3 | ±5 | % |
| temperature coefficient | 100% load, single and dual output models | | | ±0.02 | %/°C |
| | 100% load, triple output models | | | ±0.03 | %/°C |

Notes:    3. For dual output models, unbalanced load can not exceed ±5%.  If ±5% is exceeded, it may not meet all specifications.
          4. Output trimming available on single and dual output models only.

## PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| short circuit protection | hiccup, continuous, automatic recovery | | | | |
| over current protection | | | 150 | | % |
| over voltage protection | 3.3 Vdc output models | | 3.9 | | Vdc |
| | 5 Vdc output models | | 6.2 | | Vdc |
| | 12 Vdc output models | | 15 | | Vdc |
| | 15 Vdc output models | | 18 | | Vdc |

## SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| isolation voltage | for 1 minute at 1 mA max. | 1,500 | | | Vdc |
| isolation resistance | at 500 Vdc | 1,000 | | | MΩ |
| conducted emissions | CISPR22/EN55022, class A, class B (external circuit required, see Figure 1-b) | | | | |
| radiated emissions | CISPR22/EN55022, class A, class B (external circuit required, see Figure 1-b) | | | | |
| ESD | IEC/EN61000-4-2, class B, contact ± 4kV | | | | |
| radiated immunity | IEC/EN61000-4-3, class A, 10V/m | | | | |
| EFT/burst | IEC/EN61000-4-4, class B, ± 2kV (external circuit required, see Figure 1-a) | | | | |
| surge | IEC/EN61000-4-5, class B, ± 2kV (external circuit required, see Figure 1-a) | | | | |
| conducted immunity | IEC/EN61000-4-6, class A, 3 Vr.m.s | | | | |
| voltage dips & interruptions | IEC/EN61000-4-29, class B, 0%-70% | | | | |
| MTBF | as per MIL-HDBK-217F @ 25°C | 1,000,000 | | | hours |
| RoHS | 2011/65/EU | | | | |

## ENVIRONMENTAL

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| operating temperature | see derating curve | -40 | | 85 | °C |
| storage temperature | | -55 | | 125 | °C |
| storage humidity | non-condensing | 5 | | 95 | % |
| case temperature | at full load, Ta=71°C | | | 105 | °C |

## SOLDERABILITY

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| hand soldering | 1.5 mm from case for 10 seconds | | | 300 | °C |
| wave soldering | see wave soldering profile | | | 260 | °C |

Wave Soldering Profile
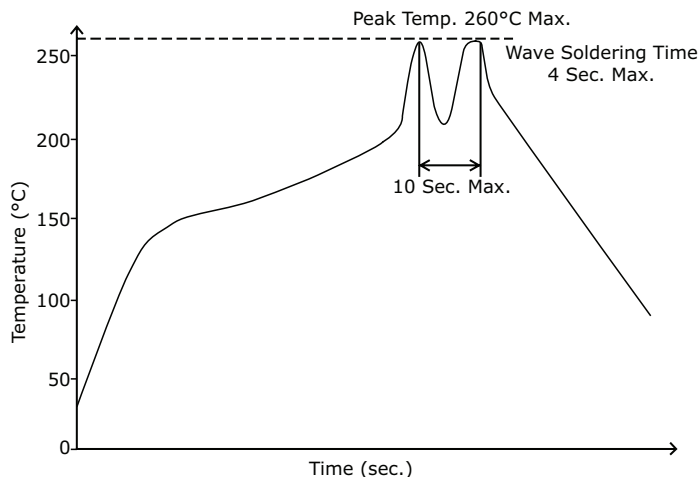
## MECHANICAL

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| dimensions | board mount: 50.8 x 40.6 x 11.8<br>board mount with heatsink: 50.8 x 40.6 x 16.3 | | | | mm<br>mm |
| case material | aluminum alloy | | | | |
| weight | board mount<br>board mount with heatsink | | 50<br>70 | | g<br>g |

## MECHANICAL DRAWING

### BOARD MOUNT

units: mm[inch]
tolerance: ±0.25[±0.010]
pin diameter tolerance: ±0.10[±0.004]
pin height tolerance: ±0.50[±0.020]

| PIN CONNECTIONS | | | |
|---|---|---|---|
| PIN | Single Output | Dual Output | Triple Output |
| 1 | Vin | Vin | Vin |
| 2 | GND | GND | GND |
| 3 | CTRL | CTRL | CTRL |
| 4 | Trim | Trim | -Vo2 |
| 5 | 0V | -Vo | 0V |
| 6 | +Vo | 0V | +Vo1 |
| 7 | NP | +Vo | +Vo2 |



Bottom View

Front View

Grid Size: 2.54mm x 2.54mm
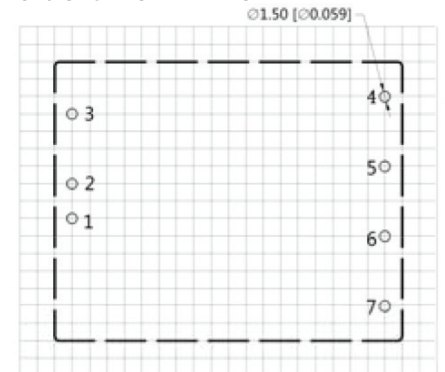
PCB Layout
Top View

### BOARD MOUNT WITH HEATSINK

units: mm[inch]
tolerance: ±0.3[±0.012]
pin diameter tolerance: ±0.10[±0.004]
pin height tolerance: ±0.50[±0.020]

| PIN CONNECTIONS | | | |
|---|---|---|---|
| PIN | Single Output | Dual Output | Triple Output |
| 1 | Vin | Vin | Vin |
| 2 | GND | GND | GND |
| 3 | CTRL | CTRL | CTRL |
| 4 | Trim | Trim | -Vo2 |
| 5 | 0V | -Vo | 0V |
| 6 | +Vo | 0V | +Vo1 |
| 7 | NP | +Vo | +Vo2 |



Top View
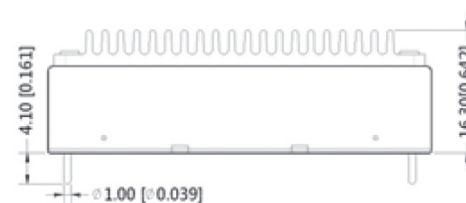
Front View

Grid Size: 2.54mm x 2.54mm
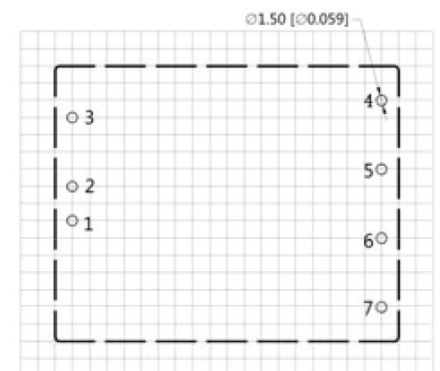
PCB Layout
Top View

## DERATING CURVES



Temperature Derating Curve
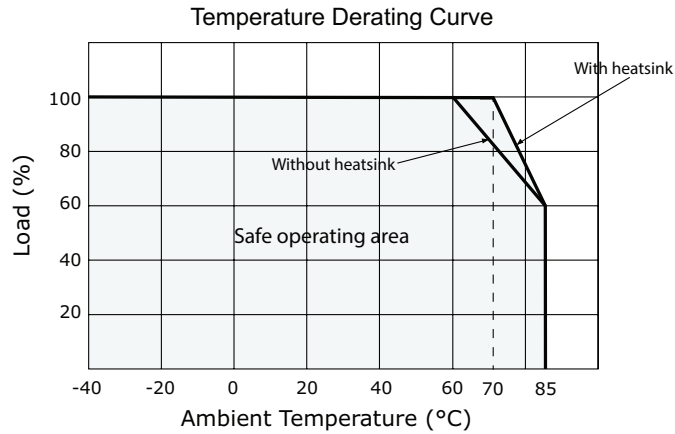
## EMC RECOMMENDED CIRCUIT

**Figure 1**

### Single Output



### Dual Output



### Triple Output
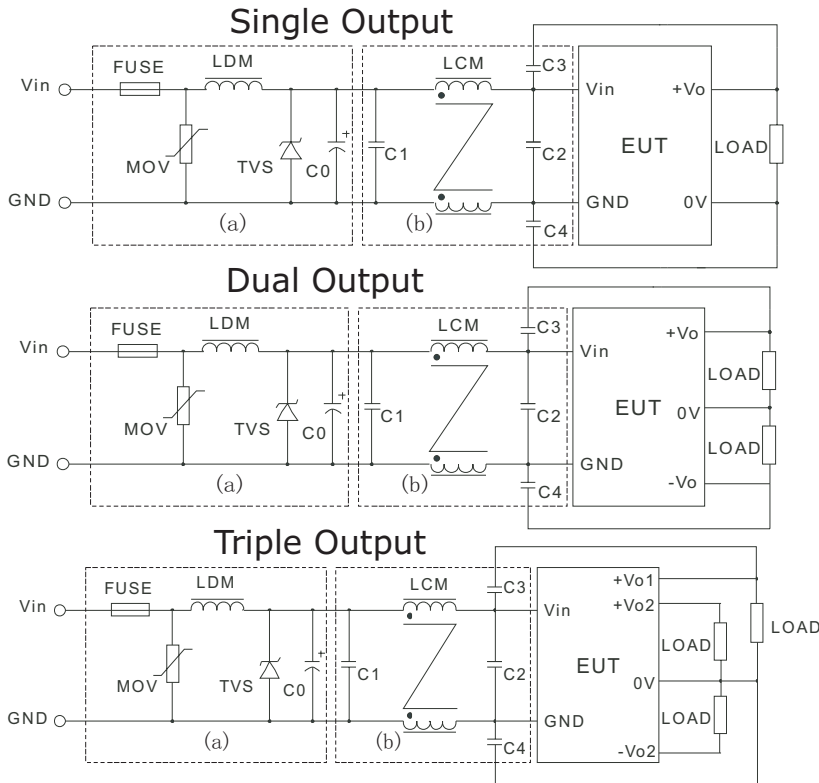


**Table 1**

| Recommended external circuit components | | |
|---|---|---|
| Vin (Vdc) | 24 | 48 |
| FUSE | Choose according to input current | |
| MOV | 10D560K | 10D101K |
| LDM | 56µH | 56µH |
| TVS | SMCJ48A | SMCJ90A |
| C0 | 120µF/50V | 120µF/100V |
| C1 | 4.7µF/50V | 2.2µF/100V |
| LCM | 2.2mH | 2.2mH |
| C2 | 4.7µF/50V | 2.2µF/100V |
| C3* | 1nF/2kV | 1nF/2kV |
| C4* | 1nF/2kV | 1nF/2kV |

Note:  *2nF/2kV capacitors for triple output, 48 Vdc input models.

## TEST CONFIGURATION



**Figure 2**
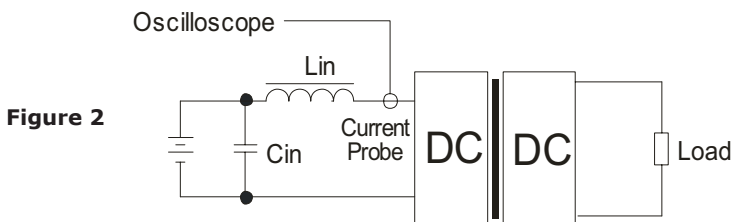
**Table 2**

| External components | |
|---|---|
| Lin | 4.7µH |
| Cin | 220µF, ESR < 1.0Ω at 100 kHz |

Note:     Input reflected-ripple current is measured with an inductor Lin and Capacitor Cin to simulate source impedance.

# APPLICATION NOTES

1. **Recommended circuit**
   This series has been tested according to the following recommended testing circuit before leaving the factory. This series should be tested under load (see Figure 3). If you want to further decrease the input/output ripple, you can increase the capacitance accordingly or choose capacitors with low ESR (see Table 3). However, the capacitance of the output filter capacitor must be appropriate. If the capacitance is too high, a startup problem might arise. For every channel of the output, to ensure safe and reliable operation, the maximum capacitance must be less than the maximum capacitive load (see Table 4).

**Figure 3**
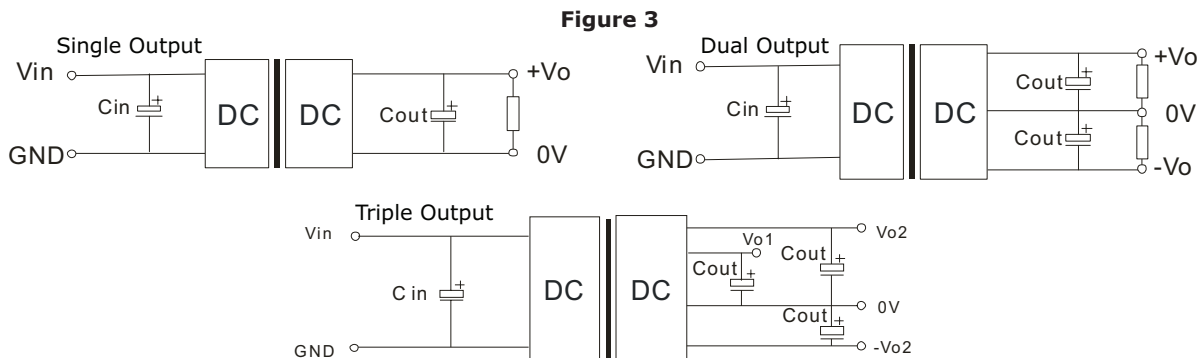


**Table 3**

| Single Vout (Vdc) | Cin (µF) | Cout (µF) | Dual Vout (Vdc) | Cin (µF) | Cout¹ (µF) | Triple Vout (Vdc) | Cin (µF) | Cout¹ (µF) |
|---|---|---|---|---|---|---|---|---|
| -- | -- | -- | -- | -- | -- | 3.3 | 10 | 10 |
| 5 | 10 | 10 | ±5 | 10 | 10 | 5 | 10 | 10 |
| 12 | 10 | 4.7 | ±12 | 10 | 4.7 | ±12 | 10 | 4.7 |
| 15 | 10 | 4.7 | ±15 | 10 | 4.7 | ±15 | 10 | 4.7 |

Note: 1. For each output.

**Table 4**

| Single Vout (Vdc) | Max. Capacitive Load (µF) | Dual Vout (Vdc) | Max. Capacitive Load¹ (µF) | Triple Vout (Vdc) | Max. Capacitive Load¹ (µF) |
|---|---|---|---|---|---|
| -- | -- | -- | -- | 3.3/±12 | 4700/300 |
| 5 | 6000 | 5 | 2000 | 3.3/±15 | 4700/220 |
| 12 | 2500 | 12 | 1250 | 5/±12 | 4700/300 |
| 15 | 1100 | 15 | 680 | 5/±15 | 4700/220 |

Note: 1. For each output.

2. **Output voltage trimming**
   Leave open if not used.

**Figure 4**
Application Circuit for Trim pin
(part in broken line is the interior of models)



Trim up

Trim down
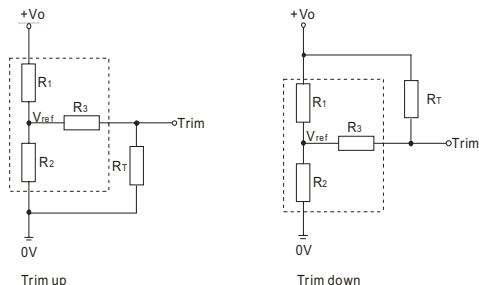
Formula for Trim Resistor

up: $R_T = \dfrac{aR_2}{R_2 - a} - R_3$    $a = \dfrac{Vref}{Vo' - Vref} \cdot R_1$

down: $R_T = \dfrac{aR_1}{R_1 - a} - R_3$    $a = \dfrac{Vo' - Vref}{Vref} \cdot R_2$

Note: Value for R1, R2, R3, and Vref refer to Table 5
$R_T$: Trim Resistor
a: User-defined parameter, no actual meanings
Vo': The trim up/down voltage

**Table 5**

| Vout (Vdc) | R1 (kΩ) | R2 (kΩ) | R3 (kΩ) | Vref (V) |
|---|---|---|---|---|
| 5 | 2.883 | 2.864 | 10 | 2.5 |
| 12 | 10.971 | 2.864 | 17.8 | 2.5 |
| 15 | 14.497 | 2.864 | 17.8 | 2.5 |

Note: 1. Minimum load shouldn't be less than 5%, otherwise ripple may increase dramatically. Operation under minimum load will not damage the converter, however, they may not meet all specifications listed.
2. Maximum capacitive load is tested at input voltage range and full load.
3. All specifications are measured at Ta=25°C, humidity<75%, nominal input voltage and rated output load unless otherwise specified.

## REVISION HISTORY

| rev. | description | date |
|------|-------------|------|
| 1.0 | initial release | 06/26/2013 |
| 1.01 | updated spec | 08/15/2013 |
| 1.02 | updated spec | 08/18/2014 |

The revision history provided is for informational purposes only and is believed to be accurate.