![Chipsmall logo]

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# CUI INC®

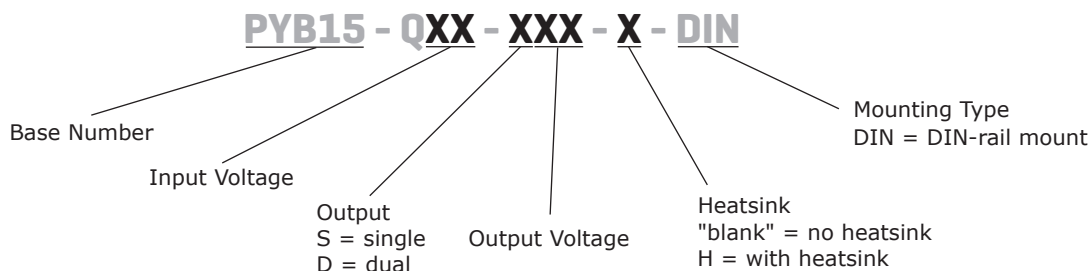## SERIES: PYB15-DIN │ DESCRIPTION: DC-DC CONVERTER

### FEATURES

- up to 15 W isolated output
- industry standard pinout
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- smaller package
- single/dual regulated outputs
- 1,500 Vdc isolation
- continuous short circuit, over current protection, over voltage protection
- reverse polarity protection
- temperature range  (-40~85°C)
- six-sided metal shielding
- efficiency up to 88%

## MODEL

| 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 (%) |
| PYB15-Q24-S3-DIN | 24 | 9~36 | 3.3 | 200 | 4000 | 13.2 | 100 | 85 |
| PYB15-Q24-S5-DIN | 24 | 9~36 | 5 | 150 | 3000 | 15 | 100 | 88 |
| PYB15-Q24-S12-DIN | 24 | 9~36 | 12 | 63 | 1250 | 15 | 100 | 87 |
| PYB15-Q24-S15-DIN | 24 | 9~36 | 15 | 50 | 1000 | 15 | 100 | 87 |
| PYB15-Q24-S24-DIN | 24 | 9~36 | 24 | 31 | 625 | 15 | 100 | 88 |
| PYB15-Q24-D5-DIN | 24 | 9~36 | ±5 | ±75 | ±1500 | 15 | 100 | 84 |
| PYB15-Q24-D12-DIN | 24 | 9~36 | ±12 | ±32 | ±625 | 15 | 100 | 86 |
| PYB15-Q24-D15-DIN | 24 | 9~36 | ±15 | ±25 | ±500 | 15 | 100 | 86 |
| PYB15-Q48-S3-DIN | 48 | 18~75 | 3.3 | 200 | 4000 | 13.2 | 100 | 85 |
| PYB15-Q48-S5-DIN | 48 | 18~75 | 5 | 150 | 3000 | 15 | 100 | 87 |
| PYB15-Q48-S12-DIN | 48 | 18~75 | 12 | 63 | 1250 | 15 | 100 | 86 |
| PYB15-Q48-S15-DIN | 48 | 18~75 | 15 | 50 | 1000 | 15 | 100 | 88 |
| PYB15-Q48-D5-DIN | 48 | 18~75 | ±5 | ±75 | ±1500 | 15 | 100 | 84 |
| PYB15-Q48-D12-DIN | 48 | 18~75 | ±12 | ±32 | ±625 | 15 | 100 | 86 |
| PYB15-Q48-D15-DIN | 48 | 18~75 | ±15 | ±25 | ±500 | 15 | 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

**PYB15 - QXX - XXX - X - DIN**

Base Number

Input Voltage

Output
S = single
D = dual

Output Voltage

Heatsink
"blank" = no heatsink
H = with heatsink

Mounting Type
DIN = DIN-rail mount

# 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 | | | 17.8 | Vdc |
| under voltage shutdown[1] | 24 Vdc input models | 7.5 | | | 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 | nominal input, constant load | | 10 | | ms |
| filter | pi filter | | | | |
| CTRL[2] | models ON (CTRL open or connect TTL 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 | | ±0.2 | ±0.5 | % |
| load regulation | 5% to 100% load | | ±0.5 | ±1 | % |
| cross regulation | dual output models: main output 50% load, secondary output from 10% to 100% load | | | ±5 | % |
| voltage accuracy | | | ±1 | ±3 | % |
| voltage balance[3] | dual output, balanced loads | | ±0.5 | ±1 | % |
| adjustability[4] | | | ±10 | | % |
| switching frequency | PWM mode | | 300 | | kHz |
| transient recovery time | 25% load step change | | 300 | 500 | µs |
| transient response deviation | 25% load step change | | ±3 | ±5 | % |
| temperature coefficient | 100% load | | | ±0.02 | %/°C |

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

# PROTECTIONS

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| short circuit protection | hiccup, continuous, automatic recovery | | | | |
| over current protection | | | 160 | | % |
| 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 |
| | 24 Vdc output models | | 30 | | Vdc |

# SAFETY AND COMPLIANCE

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| isolation voltage | input to output for 1 minute at 1 mA max. | 1,500 | | | Vdc |
| isolation resistance | input to output at 500 Vdc | 1,000 | | | MΩ |

## SAFETY AND COMPLIANCE (CONTINUED)

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| 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 curves | -40 | | 85 | °C |
| storage temperature | | -55 | | 125 | °C |
| storage humidity | non-condensing | 5 | | 95 | % |
| case temperature | at full load, Ta=71°C | | | 105 | °C |
| vibration | 10~55 Hz for 30 min. along X, Y and Z axis | | 10 | | G |

## MECHANICAL

| parameter | conditions/description | min | typ | max | units |
|---|---|---|---|---|---|
| dimensions | DIN-rail mount: 76 x 31.5 x 25.8<br>DIN-rail mount with heatsink: 76 x 31.5 x 29.7 | | | | mm<br>mm |
| case material | aluminum alloy | | | | |
| weight | DIN-rail mount<br>DIN-rail mount with heatsink | | 70<br>78 | | g<br>g |

# MECHANICAL DRAWING

### DIN-RAIL MOUNT

units: mm[inch]
tolerance: ±0.50[±0.02]

wire range: 24~12 AWG
mounts to TS35 rails

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

Top View

Front View
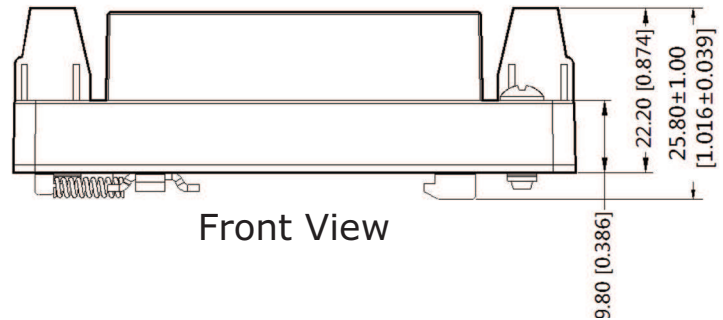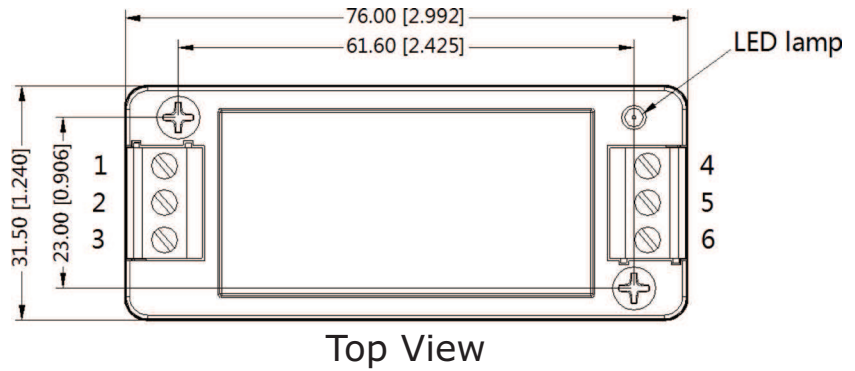
### DIN-RAIL MOUNT WITH HEATSINK

units: mm[inch]
tolerance: ±0.50[±0.02]

wire range: 24~12 AWG
mounts to TS35 rails

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

Top View

Front View
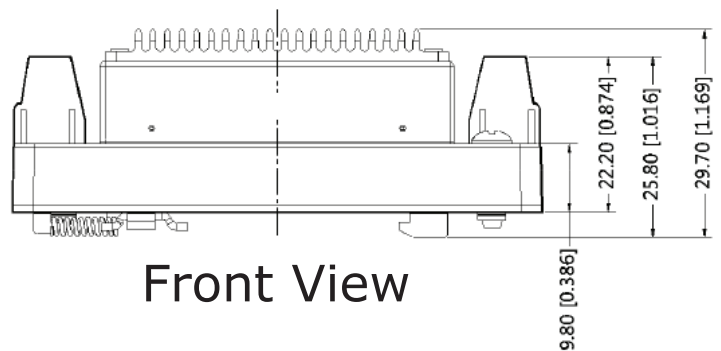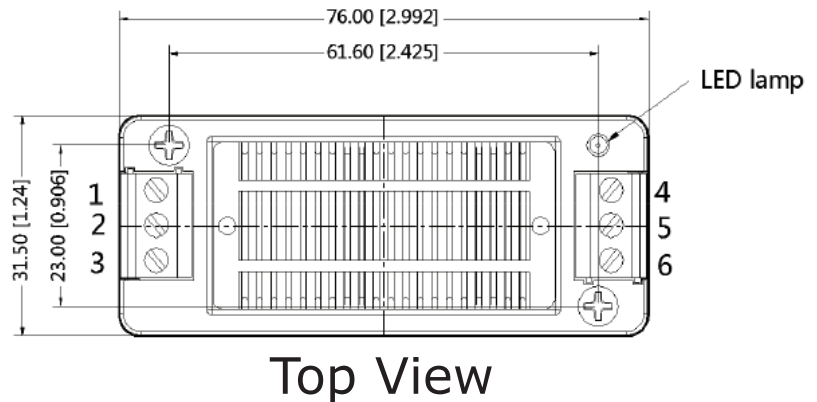
## DERATING CURVES
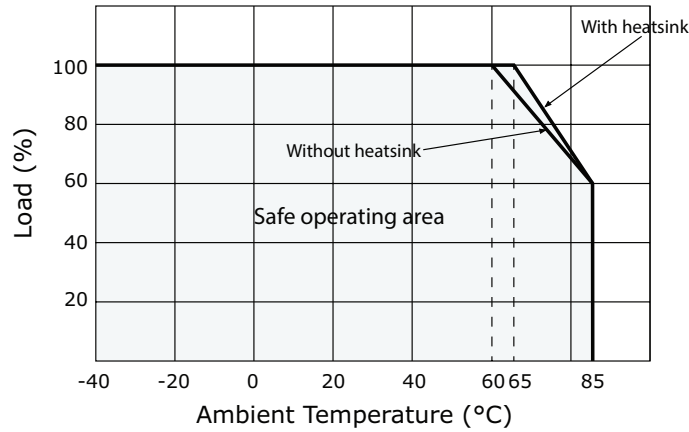


## EMC RECOMMENDED CIRCUIT

**Figure 1**
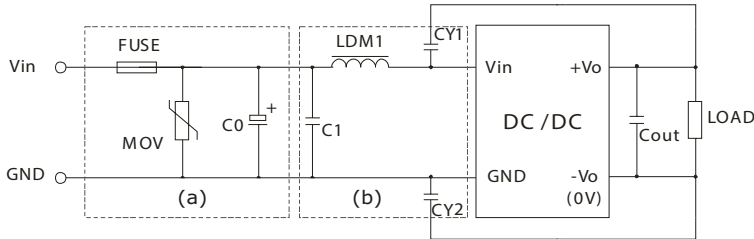


**Table 1**

| Recommended external circuit components | | |
|---|---|---|
| Vin (Vdc) | 24 | 48 |
| FUSE | Choose according to input current | |
| MOV | S14K35 | S14K60 |
| LDM1 | 4.7µH | 4.7µH |
| C0 | 330µF/50V | 330µF/100V |
| C1 | 1µF/50V | 1µF/100V |
| CY1 | 1nF/2kV | 1nF/2kV |
| CY2 | 1nF/2kV | 1nF/2kV |

Note:        1. See Table 2 for Cout values.

# 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 2). If you want to further decrease the input/output ripple, you can increase the capacitance accordingly or choose capacitors with low ESR (see Table 2). 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 3).

**Figure 2**

Single Output

Dual Output



**Table 2**

| Single Vout (Vdc) | Cin (µF) | Cout (µF) | Dual Vout (Vdc) | Cin (µF) | Cout[1] (µF) |
|---|---|---|---|---|---|
| 3.3 | 100 | 470 | -- | -- | -- |
| 5 | 100 | 470 | ±5 | 100 | 220 |
| 12 | 100 | 220 | ±12 | 100 | 100 |
| 15 | 100 | 220 | ±15 | 100 | 100 |
| 24 | 100 | 100 | -- | -- | -- |

Note:     1. For each output.

**Table 3**

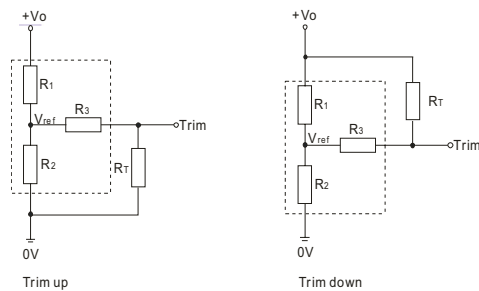| Single Vout (Vdc) | Max. Capacitive Load (µF) | Dual Vout (Vdc) | Max. Capacitive Load[1] (µF) |
|---|---|---|---|
| 3.3 | 10200 | -- | -- |
| 5 | 4020 | 5 | 4800 |
| 12 | 1035 | 12 | 800 |
| 15 | 705 | 15 | 500 |
| 24 | 470 | -- | -- |

Note:     1. For each output.

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

**Figure 3**
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 4
   $R_T$: Trim Resistor
   a: User-defined parameter, no actual meanings
   Vo': The trim up/down voltage

**Table 4**

| Vout (Vdc) | R1 (kΩ) | R2 (kΩ) | R3 (kΩ) | Vref (V) |
|---|---|---|---|---|
| 3.3 | 4.801 | 2.863 | 15 | 1.24 |
| 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 |
| 24 | 24.872 | 2.863 | 20 | 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 |
| 1.03 | updated spec | 06/15/2015 |

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