

date 06/21/2019

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# 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%

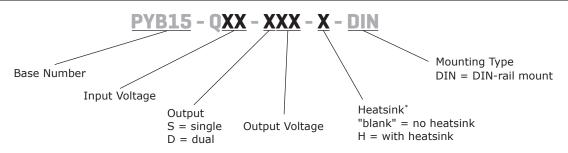




MODEL		nput oltage	output voltage		ıtput rrent	output power	ripple and noise <sup>1</sup>	efficiency
	<b>typ</b> (Vdc)	range (Vdc)	(Vdc)	min (mA)	max (mA)	max (W)	<b>max</b> (mVp-p)	<b>typ</b> (%)
PYB15-Q24-S3-DIN	24	9~36	3.3	200	4000	13.2	100	85
PYB15-Q24-S5-DIN	24	9~36	5	150	3000	15	100	88
PYB15-Q24-S12-DIN	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**



Notes: \*Discontinued heatsink versions.

# **INPUT**

parameter	conditions/description	min	typ	max	units	
operating input voltage	24 Vdc input models 48 Vdc input models	9 18	24 48	36 75	Vdc Vdc	
start-up voltage	24 Vdc input models 48 Vdc input models			9 17.8	Vdc Vdc	
under voltage shutdown¹	24 Vdc input models 48 Vdc input models	7.5 16			Vdc Vdc	
surge voltage	for maximum of 1 second 24 Vdc input models 48 Vdc input models	-0.7 -0.7		50 100	Vdc Vdc	
start-up time	nominal input, constant load		10		ms	
filter	pi filter					
	models ON (CTRL open or connect TTL hig	n level, 2.5~12 Vdc)				
CTRL <sup>2</sup>	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**

	•	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 <sup>3</sup>	dual output, balanced loads		±0.5	±1	%
adjustability <sup>4</sup>			±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

- 3. For dual output models, unbalanced loads should not exceed  $\pm 5\%$ . If  $\pm 5\%$  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		%
	3.3 Vdc output models		3.9		Vdc
	5 Vdc output models		6.2		Vdc
over voltage protection	12 Vdc output models		15		Vdc
J ,	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 (extern	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: $76 \times 31.5 \times 25.8$ DIN-rail mount with heatsink: $76 \times 31.5 \times 29.7$				mm mm
case material	aluminum alloy				
weight	DIN-rail mount DIN-rail mount with heatsink		70 78		g g

#### **MECHANICAL DRAWING**

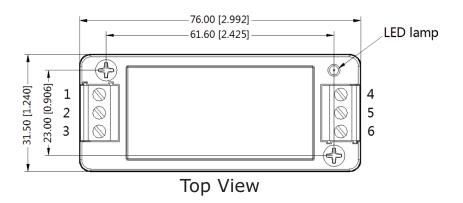
#### **DIN-RAIL MOUNT**

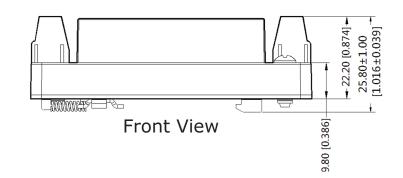
units: mm[inch]

tolerance:  $\pm 0.50[\pm 0.02]$ 

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		





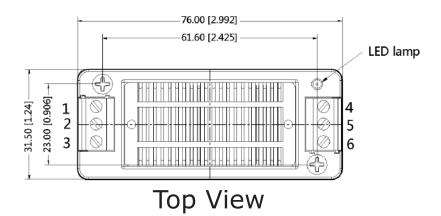
#### **DIN-RAIL MOUNT WITH HEATSINK**

units: mm[inch]

tolerance:  $\pm 0.50[\pm 0.02]$ 

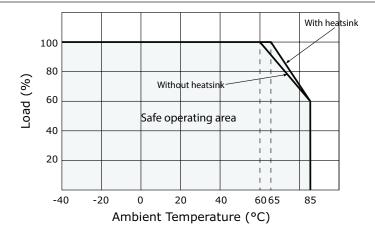
wire range: 24~12 AWG mounts to TS35 rails

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		



22.20 [0.874] 29.70 [1.169] 25.80 [1.016]-9.80 [0.386] Front View

# **DERATING CURVES**



# **EMC RECOMMENDED CIRCUIT**

Figure 1

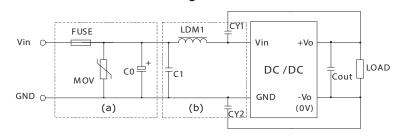


Table 1

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			

1. See Table 2 for Cout values. Note:

# **APPLICATION NOTES**

#### **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 +Vo Cin ⊑ DC DC Cout⊑ 0V **GND** ∽

**Dual Output** +Vo Vin ∽ Cout⊑ Cin ⊑ DC DC 0V Cout **GND** ∽

Table 2

Single Vout Cout **Dual Vout** Cout1 (Vdc) (Vdc) (µF) (µF) (µF) (µF) 3.3 100 470 5 100 470  $\pm 5$ 100 220 12 100 220 100 100 ±12 15 100 220 ±15 100 100 24 100 100 --

Table 3

Single Vout (Vdc)	Max. Capacitive Load (μF)	Dual Vout (Vdc)	Max. Capacitive Load¹ (μF)
3.3	10200		
5	4020	5	4800
12	1035	12	800
15	705	15	500
24	470		

Note: 1. For each output.

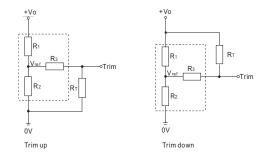
#### **Output voltage trimming**

1. For each output.

Note:

Leave open if not used.

Figure 3 Application Circuit for Trim pin (part in broken line is the interior of models)



Formula for Trim Resistor

$$\begin{array}{cccc} \text{up:} & R_T = \begin{array}{c} aR_2 \\ R_2 \text{-}a \end{array} & -R_3 & a = \begin{array}{c} V\text{ref} \\ V\text{o'} \cdot V\text{ref} \end{array} \cdot R_1 \\ \\ \text{down:} & R_T = \begin{array}{c} aR_1 \\ R_1 \text{-}a \end{array} & -R_3 & a = \begin{array}{c} V\text{o'} \cdot V\text{ref} \\ V\text{ref} \end{array} \cdot R_2 \end{array}$$

Note: Value for R1, R2, R3, and Vref refer to Table 4 R<sub>+</sub>: Trim Resistor

a: User-defined parameter, no actual meanings

Vo': The trim up/down voltage

Vout R2 R3

# Table 4

(kΩ)	(kΩ)	(kΩ)	(V)
4.801	2.863	15	1.24
2.883	2.864	10	2.5
10.971	2.864	17.8	2.5
14.497	2.864	17.8	2.5
24.872	2.863	20	2.5
	4.801 2.883 10.971 14.497	4.801 2.863 2.883 2.864 10.971 2.864 14.497 2.864	4.801 2.863 15   2.883 2.864 10   10.971 2.864 17.8   14.497 2.864 17.8

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
1.04	discontinued heat sink versions	06/21/2019

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



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