SERIES: PYBE10 | **DESCRIPTION:** DC-DC CONVERTER

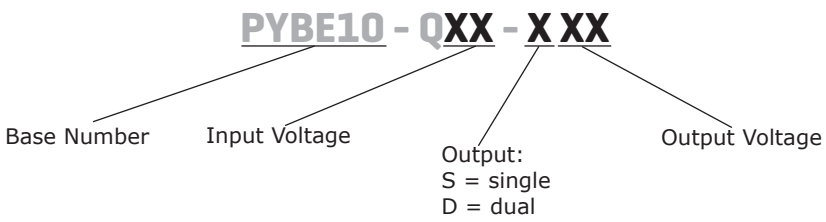
FEATURES

- up to 10 W isolated output
- industry standard pin-out
- 4:1 input range (9~36 Vdc, 18~75 Vdc)
- single/dual regulated outputs
- 1500 Vdc isolation
- continuous short circuit protection
- efficiency up to 88%
- operating temperature range (-40~+85°C)
- EN/BS EN 62368-1

MODEL	input voltage		output voltage	output current		output power	ripple & noise[1]	efficiency[2]
	typ (Vdc)	range (Vdc)	(Vdc)	min (mA)	max (mA)	max (W)	max (mVp-p)	typ (%)
PYBE10-Q24-S3	24	9~36	3.3	0	2400	7.92	80	86
PYBE10-Q24-S5	24	9~36	5	0	2000	10	80	87
PYBE10-Q24-S12	24	9~36	12	0	833	10	80	87
PYBE10-Q24-S15	24	9~36	15	0	667	10	80	87
PYBE10-Q24-S24	24	9~36	24	0	416	10	80	87
PYBE10-Q24-D5	24	9~36	±5	0	±1000	10	80	83
PYBE10-Q24-D12	24	9~36	±12	0	±416	10	80	87
PYBE10-Q24-D15	24	9~36	±15	0	±333	10	80	87
PYBE10-Q48-S3[3]	48	18~75	3.3	0	2400	7.92	80	85
PYBE10-Q48-S5[3]	48	18~75	5	0	2000	10	80	86
PYBE10-Q48-S12[3]	48	18~75	12	0	833	10	80	87
PYBE10-Q48-S15[3]	48	18~75	15	0	667	10	80	87
PYBE10-Q48-S24[3]	48	18~75	24	0	416	10	80	88
PYBE10-Q48-D5[3]	48	18~75	±5	0	±1000	10	80	83
PYBE10-Q48-D12[3]	48	18~75	±12	0	±416	10	80	87
PYBE10-Q48-D15[3]	48	18~75	±15	0	±333	10	80	87

Notes:
1. From 5~100% load, nominal input, 20 MHz bandwidth oscilloscope, with 10 µF tantalum and 1 µF ceramic capacitors on the output. From 0~5% load, ripple and noise is <5% Vo.
2. Measured at nominal input voltage, full load.
3. Model is CE certified.
4. All specifications are measured at Ta=25°C, humidity < 75%, nominal input voltage, and rated output load unless otherwise specified.

PART NUMBER KEY



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				18	Vdc
surge voltage	for maximum of 1 second					
	24 Vdc input models		-0.7		50	Vdc
	48 Vdc input models		-0.7		100	Vdc
under voltage shutdown	24 Vdc input models		5.5	6.5		Vdc
	48 Vdc input models		12	15.5		Vdc
current	24 Vdc input models	3.3 Vdc output models			388	mA
		5 Vdc output models			484	mA
		all other models			515	mA
	48 Vdc input models	3.3 Vdc output models			197	mA
		5 Vdc output models			245	mA
		all other models			258	mA
remote on/off (CTRL)[5]	turn on (3.5~12 Vdc or open circuit)					
	turn off (<1.2 Vdc)					
	input current when switched off			6	10	mA
filter	Pi filter					
no load power consumption				0.12		W

Notes: 5. The voltage of the CTRL pin is referenced to input GND pin.

OUTPUT

parameter	conditions/description	min	typ	max	units
maximum capacitive load[6]	3.3 Vdc output models			1,200	µF
	5, ±5 Vdc output models			1,000	µF
	12, ±12 Vdc output models			470	µF
	15, ±15 Vdc output models			330	µF
	all other models			100	µF
voltage accuracy[7]	0% to full load, 3.3, 5 Vdc output models		±0.5	±2	%
	0% to full load, all other models		±1	±3	%
line regulation	from low line to high line, full load				
	positive outputs		±0.2	±0.5	%
	negative outputs		±0.5	±1	%
load regulation[8]	from 5% to full load				
	positive outputs		±0.5	±1	%
	negative outputs		±0.5	±1.5	%

Note: 6. Tested at input voltage range and full load.
7. At 0~5% load, the max output voltage accuracy for the ±5 Vdc output models is ±5%, and the 3.3, and 5 Vdc models is ±3%.
8. At 0~100% load, the max load regulation is ±5%.

OUTPUT (CONTINUED)

parameter	conditions/description	min	typ	max	units
cross regulation	dual output models: main output 50% load secondary output from 25~100% load			±5	%
switching frequency[9]	PWM mode		350		kHz
transient recovery time	25% load step change, nominal input voltage		300	500	µs
transient response deviation	25% load step change, nominal input voltage 3.3, 5 Vdc output models all other models		 ±5 ±3	 ±8 ±5	 % %
temperature coefficient	at full load			±0.03	%/°C

Note: 9. Value is based on full load. At loads <50%, the switching frequency decreases with decreasing load

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over voltage protection		110		160	%
over current protection	3.3, 5 Vdc output models all other models	110 110	160 140	230 190	% %
short circuit protection	continuous, self recovery				

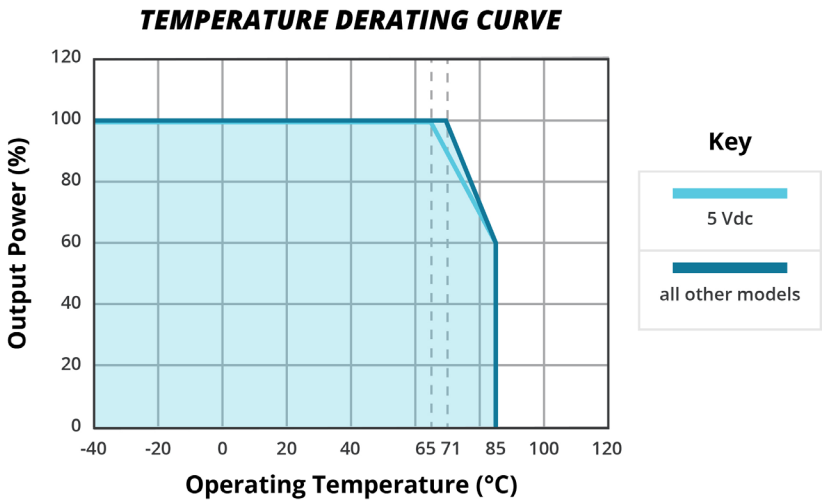
SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output for 1 minute at 1 mA	1,500			Vdc
isolation resistance	input to output at 500 Vdc	1,000			MΩ
isolation capacitance	input to output, 100 kHz / 0.1 V		2,000		pF
safety approvals	certified to 62368-1: EN, BS EN				
conducted emissions	CISPR32/EN55032, class A (no external circuit); class B (external circuit required, see Figure 3-b, 4-b)				
radiated emissions	CISPR32/EN55032, class A (no external circuit); class B (external circuit required, see Figure 3-b, 4-b)				
ESD	IEC/EN61000-4-2, contact ± 4kV, class B				
radiated immunity	IEC/EN61000-4-3, 10V/m, class A				
EFT/burst	IEC/EN61000-4-4, ± 2kV, class B (external circuit required, see Figure 3-a, 4-a)				
surge	IEC/EN61000-4-5, line-line ± 2kV, class B (external circuit required, see Figure 3-a, 4-a)				
conducted immunity	IEC/EN61000-4-6, 10 Vr.m.s, class A				
voltage dips & interruptions	IEC/EN61000-4-29, 0%-70%, class B				
MTBF	as per MIL-HDBK-217F, 25°C	1,000,000			hours
RoHS	yes				

ENVIRONMENTAL

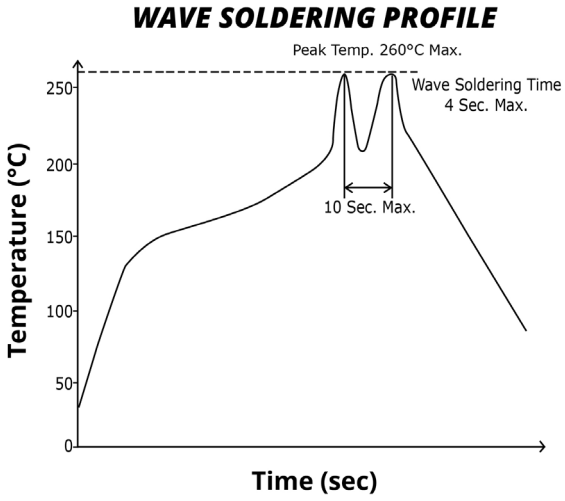
parameter	conditions/description	min	typ	max	units
operating temperature	see derating curves	-40		85	°C
storage temperature		-55		125	°C
storage humidity	non-condensing	5		95	%
vibration	10~150 Hz, 0.75 mm, on each axis		5		G

DERATING CURVES



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



MECHANICAL

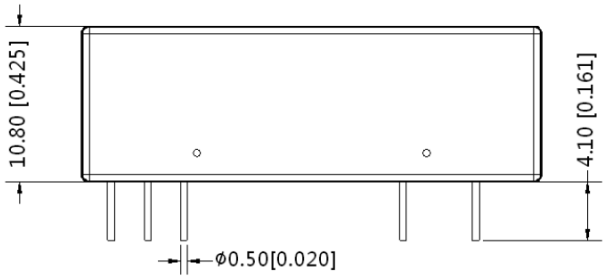
parameter	conditions/description	min	typ	max	units
dimensions	32.00 x 20.00 x 10.80 [1.260 x 0.787 x 0.425 inch]				mm
case material	aluminum alloy				
weight			14		g

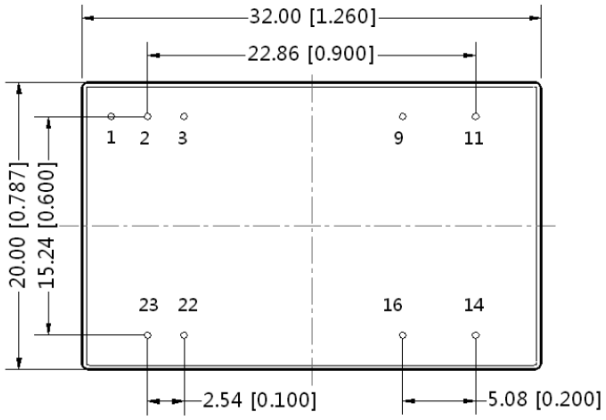
MECHANICAL DRAWING

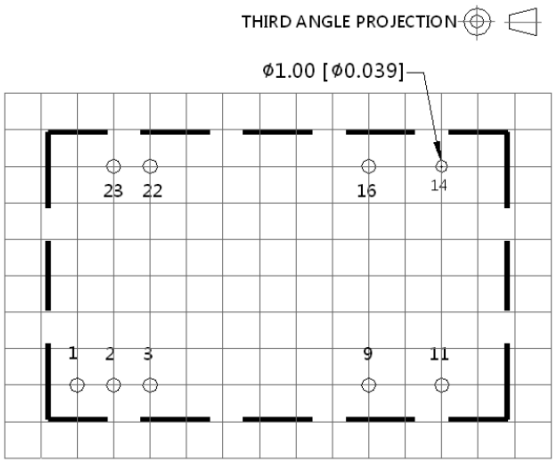
units: mm [inch]
tolerance: ±0.50[±0.020]
pin diameter tolerance: ±0.10[±0.004]

PIN CONNECTIONS		
PIN	Function	
	Single	Dual
1	CTRL	CTRL
2, 3	GND	GND
9	no pin	0V
11	NC	-Vo
14	+Vo	+Vo
16	0V	0V
22, 23	Vin	Vin

Note: NC = no connect







Note:Grid 2.54*2.54mm
Recommended PCB Layout
Top View

APPLICATION CIRCUIT

This series has been tested according to the following recommended circuits (Figures 1 & 2) before leaving the factory. If you want to further reduce the input and output ripple, you can increase the input and output capacitors or select capacitors of low equivalent impedance provided that the capacitance is less than the maximum capacitive load of the model.

Figure 1
Single Output Models

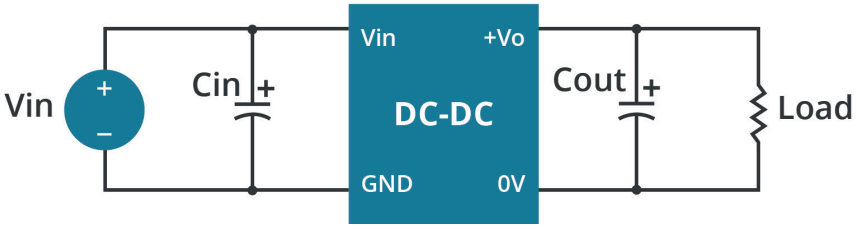


Figure 2
Dual Output Models

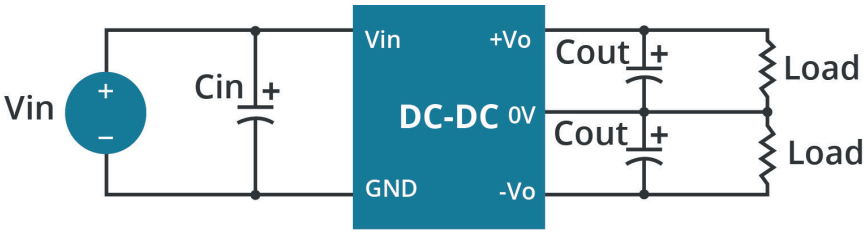


Table 1

Vin (Vdc)	Cin (μF)	Cout (μF)
24	100	10
48	10~47	10

EMC RECOMMENDED CIRCUIT

Figure 3
3.3 & 5 Vdc Output Models

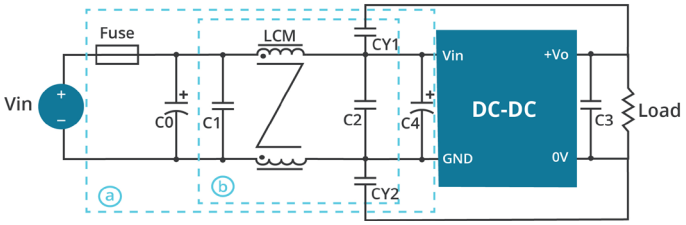


Figure 4
All Other Models

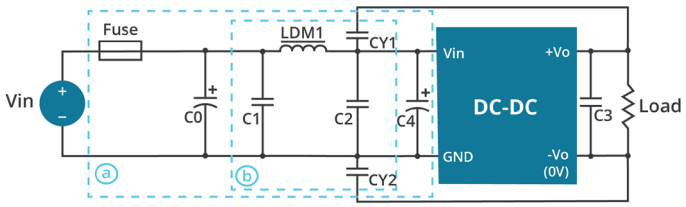


Table 2

Recommended External Circuit Components		
Vin (Vdc)	24	48
FUSE	choose according to actual input current	
C0, C4	330 μF / 50 V	330 μF / 100 V
C1, C2	10 μF / 50 V	10 μF / 100 V
LDM1	10 μH	
LCM1	1.4~1.7 mH	
CY1, CY2	1 nF / 2 kV	
C3	10 μF	

REVISION HISTORY

rev.	description	date
1.0	initial release	01/24/2019
1.01	features updated	01/12/2021
1.02	derating curve and circuit figures updated	07/22/2021
1.03	PYBE10-Q24-S3 is CE certified	08/12/2022
1.04	CE removed for 24 Vdc models	09/07/2022
1.05	efficiency values updated	09/25/2022
1.06	safeties updated	12/01/2022
1.07	efficiency values updated	03/09/2023

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

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