

SERIES: PQAE50 | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

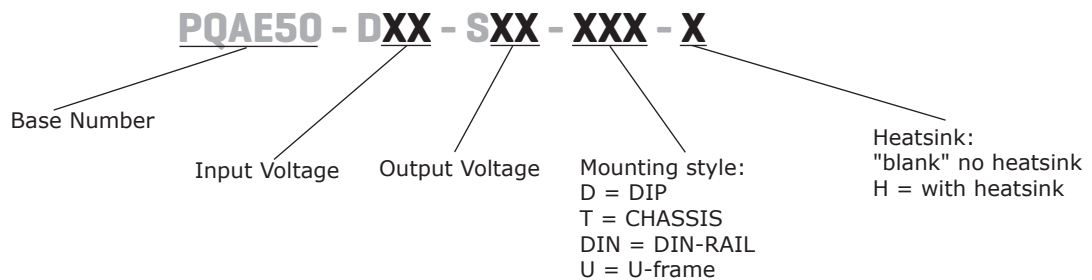
- up to 50 W isolated output
- 2:1 input range (18~36 Vdc, 36~75 Vdc)
- single, regulated output
- 1,500 Vdc isolation
- short circuit, over current, and over voltage protection
- input under voltage protection
- remote on/off
- wide operating temperature range -40~105°C
- efficiency up to 92%
- EN/BS EN 62368 certified



MODEL	input voltage		output voltage (Vdc)	output current		output power max (W)	ripple and noise ² max (mVp-p)	efficiency ³ typ (%)
	typ (Vdc)	range ¹ (Vdc)		min (A)	max (A)			
PQAE50-D24-S3 ⁴	24	18~36	3.3	0.5	10.0	33	200	91
PQAE50-D24-S5 ⁴	24	18~36	5	0.5	10.0	50	200	91
PQAE50-D24-S12 ⁴	24	18~36	12	0.208	4.167	50	250	91
PQAE50-D24-S15 ⁴	24	18~36	15	0.167	3.333	50	250	91
PQAE50-D24-S24 ⁴	24	18~36	24	0.104	2.083	50	300	91
PQAE50-D48-S3	48	36~75	3.3	0	10.0	33	200	91
PQAE50-D48-S5	48	36~75	5	0	10.0	50	200	91
PQAE50-D48-S12	48	36~75	12	0	4.167	50	250	92
PQAE50-D48-S15	48	36~75	15	0	3.333	50	250	92
PQAE50-D48-S24	48	36~75	24	0	2.083	50	350	92

- Notes:
1. Minimum input voltage is 1V greater for DIN rail and chassis mount models.
 2. 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.
 3. Measured at nominal input voltage and full load.
 4. Model is not CE & UKCA certified.

PART NUMBER KEY



INPUT

parameter	conditions/description	min	typ	max	units
input voltage	24 Vdc input models	18	24	40	Vdc
	48 Vdc input models	36	48	80	Vdc
current (full load/no load)	24 Vdc input models	3.3 Vdc output model	1511/2	1545/-	mA
		5 Vdc output model	2289/3	2341/-	mA
		12 Vdc output model	2289/5	2341/-	mA
		15 Vdc output model	2289/11	2341/-	mA
	48 Vdc input models	24 Vdc output model	2289/4	2341/-	mA
		3.3 Vdc output model	756/1	773/-	mA
		5 Vdc output model	1145/2	1171/-	mA
		12 Vdc output model	1133/4	1158/-	mA
start-up voltage	24 Vdc input models	15 Vdc output model	1133/4	1158/-	mA
		24 Vdc output model	1133/3	1158/-	mA
	48 Vdc input models	18		Vdc	
		36		Vdc	
under voltage protection	24 Vdc input models	11	13		Vdc
	48 Vdc input models	26	30		Vdc
surge voltage	for maximum of 1 second				
	24 Vdc input models	-0.7		50	Vdc
start-up time	48 Vdc input models	-0.7		80	Vdc
	nominal input, constant load		10	120	ms
CTRL ¹	models ON (CTRL open or connect high level, 3~12 Vdc)				
	models OFF (CTRL connect GND or low level, 0~1.2 Vdc)				
	input current (models OFF)				
filter	24 Vdc input models		6	12	mA
	48 Vdc input models		2	12	mA
filter	pi filter				

Note 1. 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	%
voltage accuracy	5% to 100% load		±1	±3	%
switching frequency	PWM mode		300		kHz
transient recovery time	25% load step change		250	500	µs
transient response deviation	25% load step change		±3	±8	%
	3.3 & 5 Vdc output models		±3	±5	%
temperature coefficient	other output models				
temperature coefficient	100% load			±0.03	%/°C
trim			±10		%

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over voltage protection		110	140	160	%
over current protection		110	140	200	%
short circuit protection	continuous, auto recovery, hiccup				

SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output at 1 mA for 1 minute	1,500			Vdc
	input or output to housing at 1 mA for 1 minute	1,000			Vdc
isolation resistance	input to output at 500 Vdc	100			MΩ
isolation capacitance	input to output at 100 kHz, 0.1 Vdc		2,200		pF
safety approvals	certified to 62368: EN, IEC, BS EN				
conducted emissions	CISPR32/EN55032 CLASS B (see Fig.2 for recommended circuit)				
radiated emissions	CISPR32/EN55032 CLASS B (see Fig.2 for recommended circuit)				
ESD	IEC/EN61000-4-2 Contact ±4KV (for 18~36 Vdc) ±6KV (for 36~75 Vdc) perf. Criteria B				
radiated immunity	IEC/EN61000-4-3 10V/m perf. Criteria A				
EFT/burst	IEC/EN61000-4-4 100KHz ±2KV (see Fig.2 for recommended circuit) perf. Criteria B				
surge	IEC/EN61000-4-5 line to line ±2KV (see Fig.2 for recommended circuit) perf. Criteria B				
conducted immunity	IEC/EN61000-4-6 10 Vr.m.s perf. Criteria A				
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 curve	-40		105	°C
storage temperature		-55		125	°C
storage humidity	non-condensing	5		95	%
vibration	10 ~ 150Hz, 5G, 0.75mm. along X, Y and Z			5	G

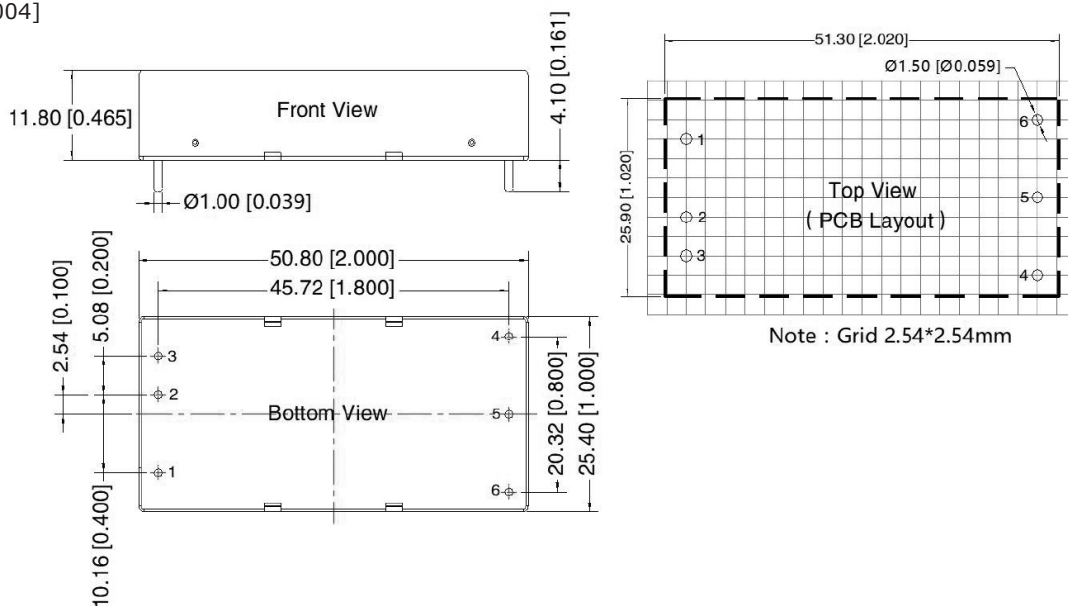
MECHANICAL

parameter	conditions/description	min	typ	max	units	
dimensions	without heatsink:					
	horizontal package 50.80 × 25.40 × 11.80				mm	
	chassis mount 76.00 × 31.50 × 21.20				mm	
	DIN-Rail mounting 76.00 × 31.50 × 25.80				mm	
	U-frame mounting 55.00 × 52.30 × 19.00				mm	
	with heatsink:					
weight	horizontal package 51.40 × 26.20 × 16.50				mm	
	chassis mount 76.00 × 31.50 × 25.30				mm	
	DIN-Rail mounting 76.00 × 31.50 × 29.90				mm	
	case material	aluminum alloy				
	weight	without heatsink:				
		horizontal package		42		g
chassis mounting			65		g	
DIN-Rail mounting			85		g	
U-frame mounting			70		g	
with heatsink:						
weight	horizontal package		50		g	
	chassis mounting		73		g	
	DIN-Rail mounting		93		g	

MECHANICAL DRAWING

units: mm[inch]
 pin diameter tolerance: $\pm 0.10[\pm 0.004]$
 general tolerance: $\pm 0.50[\pm 0.020]$

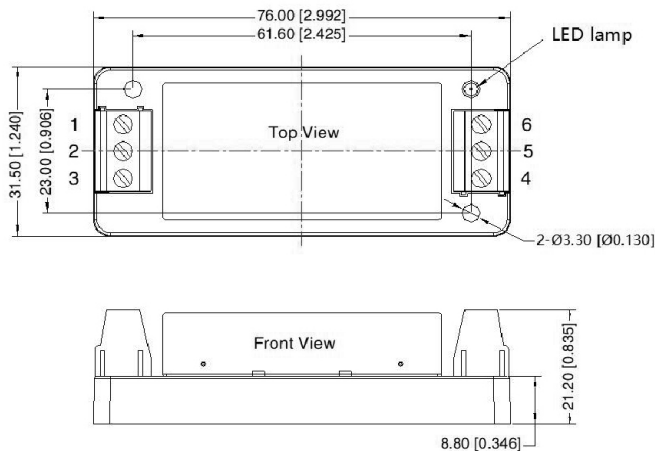
PIN CONNECTIONS	
PIN	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	0V
6	Trim



CHASSIS MOUNT

units: mm[inch]
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

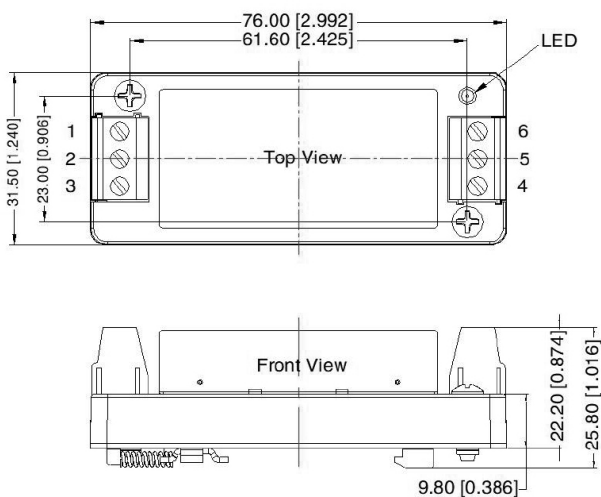
PIN OUT	
PIN	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	0V
6	Trim



DIN-RAIL MOUNT

units: mm[inch]
 mounting rail: TS35
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

PIN OUT	
PIN	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	0V
6	Trim

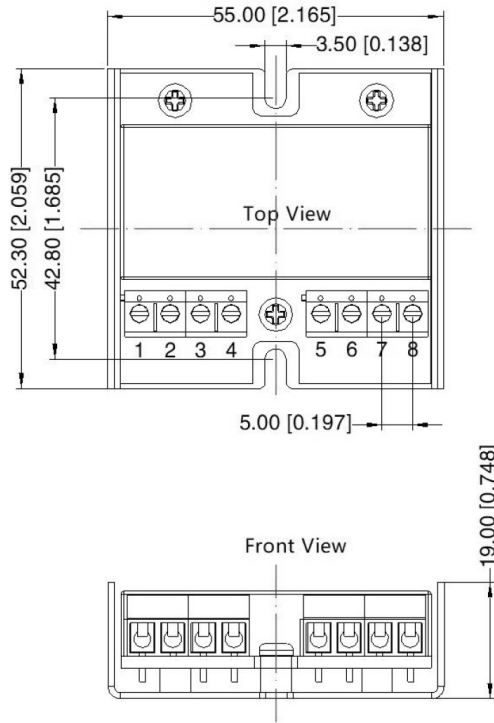


MECHANICAL DRAWING (CONTINUED)

U-FRAME

units: mm[inch]
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

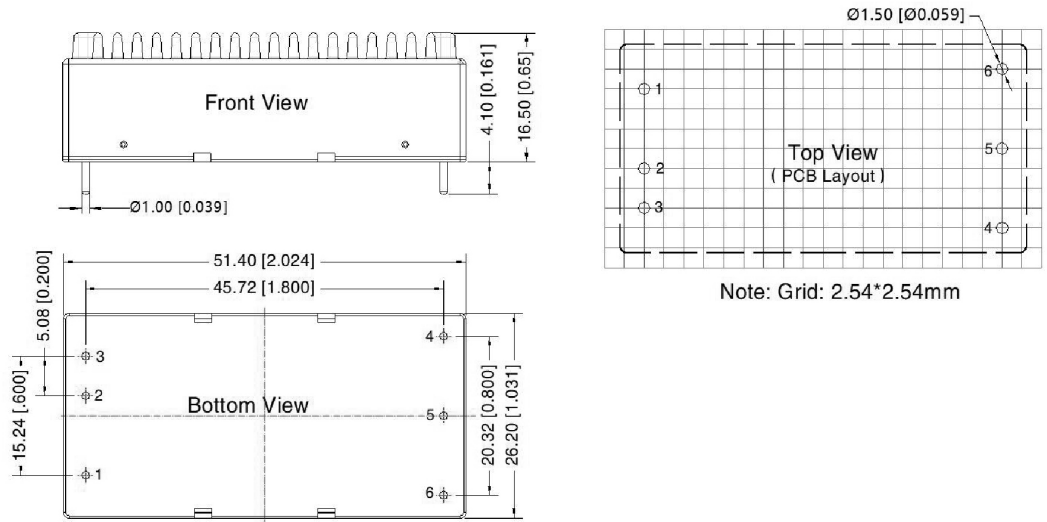
PIN CONNECTIONS	
PIN	Function
1	GND
2	Vin
3	CTRL
4	Case
5	NC
6	+Vo
7	0V
8	Trim



WITH HEATSINK

units: mm[inch]
 pin diameter tolerance: $\pm 0.10[\pm 0.004]$
 general tolerance: $\pm 0.50[\pm 0.020]$

PIN CONNECTIONS	
PIN	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	0V
6	Trim

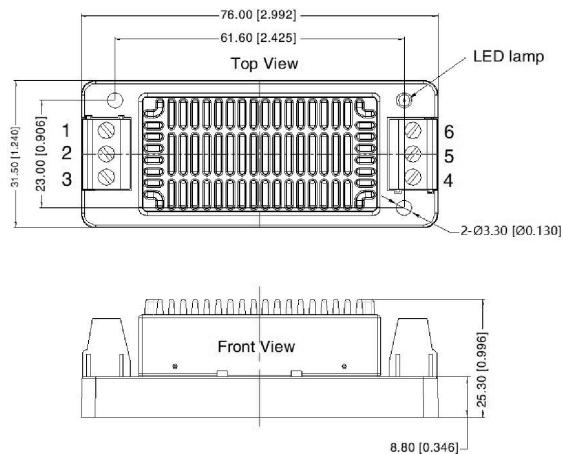


MECHANICAL DRAWING (CONTINUED)

CHASSIS MOUNT WITH HEATSINK

units: mm[inch]
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

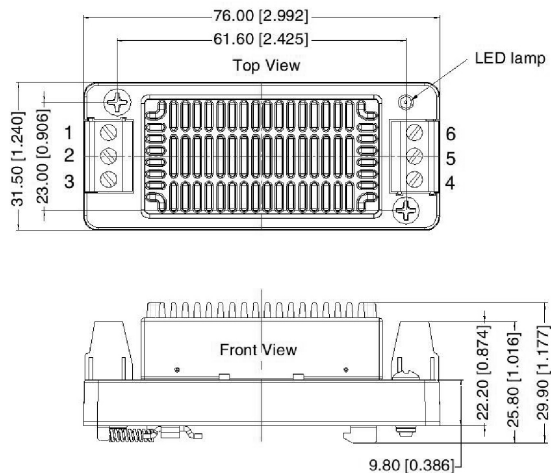
PIN OUT	
PIN	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	0V
6	Trim



DIN-RAIL MOUNT WITH HEATSINK

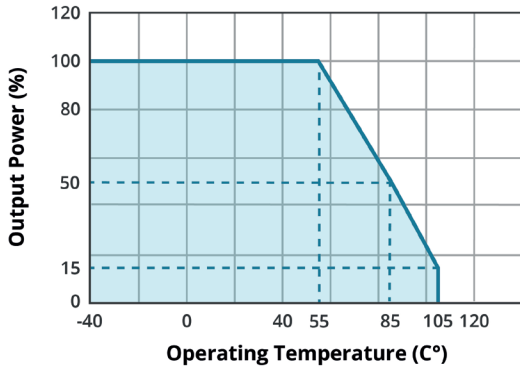
units: mm[inch]
 mounting rail: TS35
 wire range: 24-12 AWG
 tightening torque: Max 0.4 N·m
 general tolerance: $\pm 1.00[\pm 0.039]$

PIN OUT	
PIN	Function
1	CTRL
2	GND
3	Vin
4	+Vo
5	0V
6	Trim



DERATING CURVES

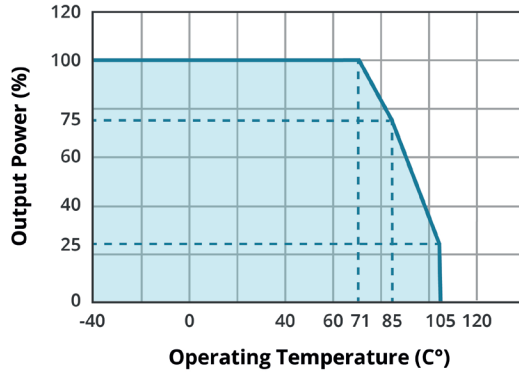
TEMPERATURE DERATING CURVE
without heatsink



Key

- PQAE50-D24-S3
- PQAE50-D24-S5
- PQAE50-D24-S12
- PQAE50-D24-S15
- PQAE50-D24-S24

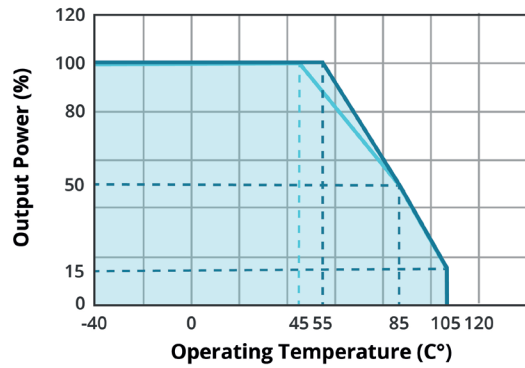
TEMPERATURE DERATING CURVE
with heatsink



Key

- PQAE50-D24-S3-H
- PQAE50-D24-S5-H
- PQAE50-D24-S12-H
- PQAE50-D24-S15-H
- PQAE50-D24-S24-H

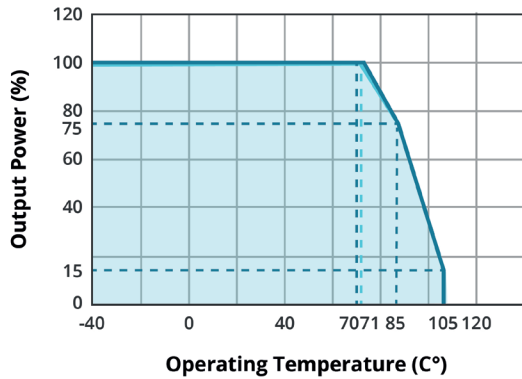
TEMPERATURE DERATING CURVE
without heatsink



Key

- PQAE50-D48-S3
- PQAE50-D48-S5
- PQAE50-D48-S12
- PQAE50-D48-S15
- PQAE50-D48-S24

TEMPERATURE DERATING CURVE
with heatsink



Key

- PQAE50-D48-S3-H
- PQAE50-D48-S5-H
- PQAE50-D48-S12-H
- PQAE50-D48-S15-H
- PQAE50-D48-S24-H

APPLICATION DESIGN REFERENCE

If you want to further reduce the input and output ripple, a filter capacitor may be connected to the input and output terminals (Figure 1) provided that the capacitance is less than the maximum capacitive load of the model, otherwise start-up problems may be caused if the capacitance is too large.

Figure 1

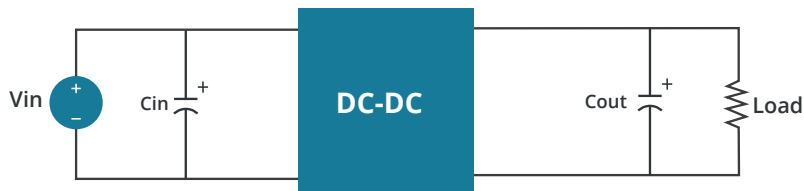


Table 1

Vin (Vdc)	Vout (Vdc)	Cin (μF)	Cout (μF)
24/48	3.3	100μF	470μF/10V
	5		470μF/10V
	12		100μF/25V
	15		100μF/25V
	24		47μF/50V

EMC RECOMMENDED CIRCUIT

Figure 2

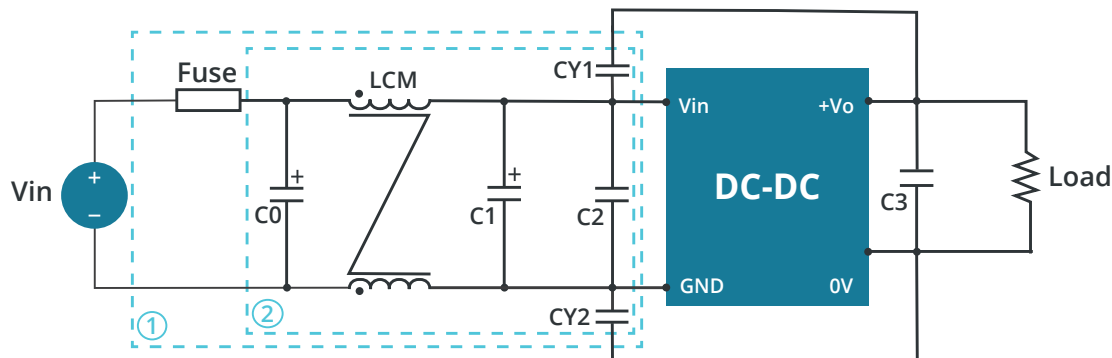


Table 2

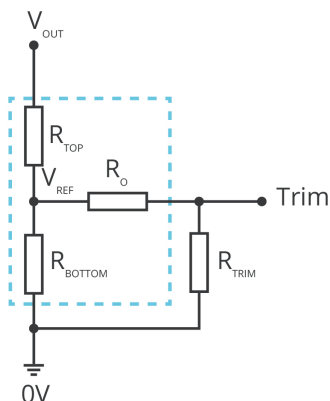
MODEL	Vin: 24V	Vin: 48V
FUSE	T/4A/250Vac	T/2A/250Vac
C0	680μF/50V	330μF/100V
LCM	2.2mH	2.2mH
C1	330μF/50V	330μF/100V
C2	4.7μF/50V	2.2μF/100V
CY1, CY2	Y1 Safety capacitor 2.2nF/250Vac	Y1 Safety capacitor 3.3nF/250Vac
C3	refer to Cout in Table 1	refer to Cout in Table 1

APPLICATION DESIGN REFERENCE (CONTINUED)

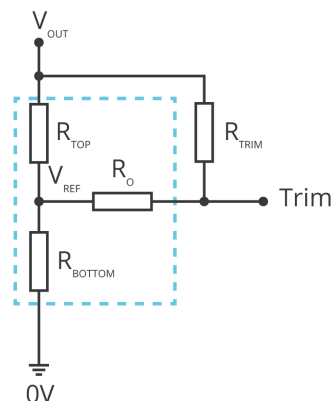
TRIM FUNCTION FOR OUTPUT VOLTAGE ADJUSTMENT (OPEN IF UNUSED)

Figure 3

Trim up



Trim down



$$R_{TRIM} = \frac{a \cdot R_{BOTTOM}}{R_{BOTTOM} - a} - R_O \quad a = \frac{V_{REF}}{V_{OUT} - V_{REF}} \cdot R_{TOP}$$

Formula for Trim up

$$R_{TRIM} = \frac{a \cdot R_{TOP}}{R_{TOP} - a} - R_O \quad a = \frac{V_{OUT} - V_{REF}}{V_{REF}} \cdot R_{BOTTOM}$$

Formula for Trim down

Note: Trim resistor connection (dashed line shows internal resistor network).

Table 3

Model number	Vout adjustable value (V)	RT (KΩ)	R1 (KΩ)	R2 (KΩ)	R3 (KΩ)	Vref (V)
PQAE50-D24-S3	Up: 3.63 Down: 2.97	15.0 18.7	4.83 4.83	2.87 2.87	4.7 4.7	1.24 1.24
PQAE50-D24-S5	Up: 5.5 Down: 4.5	13.3 5.4	2.97 2.97	2.87 2.87	4.7 4.7	2.5 2.5
PQAE50-D24-S12	Up: 13.2 Down: 10.8	7.6 60.7	10.90 10.90	2.87 2.87	15 15	2.5 2.5
PQAE50-D24-S15	Up: 16.5 Down: 13.5	8.9 90.2	14.35 14.35	2.87 2.87	15 15	2.5 2.5
PQAE50-D24-S24	Up: 26.4 Down: 21.6	21.6 185.9	24.77 24.77	2.87 2.87	5.1 5.1	2.5 2.5
PQAE50-D48-S3	Up: 3.63 Down: 2.97	10 13.5	4.83 4.83	2.87 2.87	10 10	1.24 1.24
PQAE50-D48-S5	Up: 5.5 Down: 4.5	4.3 1.5	2.87 2.87	2.87 2.87	10 10	2.5 2.5
PQAE50-D48-S12	Up: 13.2 Down: 10.8	7.6 60.7	10.90 10.90	2.87 2.87	15 15	2.5 2.5
PQAE50-D48-S15	Up: 16.5 Down: 13.5	8.9 90.2	14.35 14.35	2.87 2.87	15 15	2.5 2.5
PQAE50-D48-S24	Up: 26.4 Down: 21.6	21.6 185.9	48.77 48.77	2.87 2.87	5.1 5.1	2.5 2.5

Note: Value for R_{TOP} , R_{BOTTOM} , R_O , and V_{REF} refer to Table 3 (fixed internal values).

R_{TRIM} : Trim resistance

a: User-defined parameter, no actual meanings

V_{OUT} : Nominal output voltage

REVISION HISTORY

rev.	description	date
1.0	initial release	11/16/2020
1.01	part number key updated	12/14/2020
1.02	mechanical drawings updated	01/12/2021
1.03	datasheet updated	07/29/2021
1.04	updated notes in model table	10/01/2021
1.05	application design reference section updated	02/24/2022
1.06	protections updated, application design reference section updated	07/22/2022
1.07	U-frame option added, CE certification updated for 24V models	10/24/2022

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



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