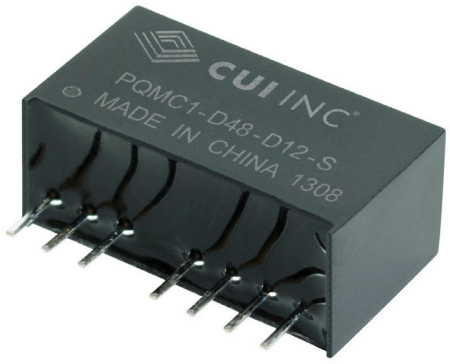
CUI INC®

SERIES: PQMC1-S | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

- 1 W isolated output
- smaller package
- single/dual regulated output
- 1,500 Vdc isolation
- short circuit protection
- temperature range (-40~105°C)
- high efficiency at light load
- efficiency up to 81%



RoHS

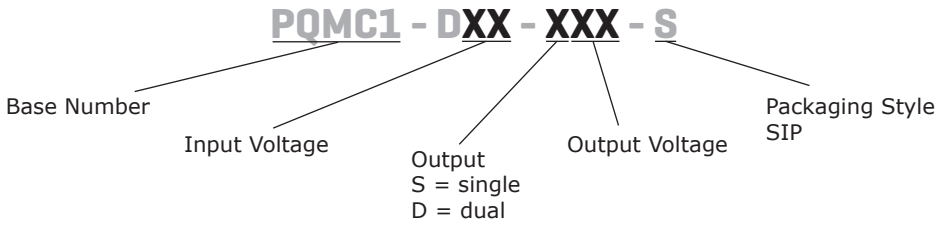
MODEL	input voltage		output voltage	output current		output power	ripple and noise[1]	efficiency
	typ (Vdc)	range (Vdc)	(Vdc)	min (mA)	max (mA)	max (W)	max (mVp-p)	typ (%)
PQMC1-D5-S5-S	5	4.5~9	5	10	200	1	75	72
PQMC1-D5-S12-S	5	4.5~9	12	4	83	1	75	76
PQMC1-D5-S15-S	5	4.5~9	15	3	67	1	75	75
PQMC1-D5-D5-S	5	4.5~9	±5	±5	±100	1	75	73
PQMC1-D5-D12-S	5	4.5~9	±12	±2	±42	1	75	76
PQMC1-D5-D15-S	5	4.5~9	±15	±2	±33	1	75	75
PQMC1-D12-S3-S	12	9~18	3.3	15	303	1	75	75
PQMC1-D12-S5-S	12	9~18	5	10	200	1	75	77
PQMC1-D12-S9-S	12	9~18	9	6	111	1	75	79
PQMC1-D12-S12-S	12	9~18	12	4	83	1	75	80
PQMC1-D12-S15-S	12	9~18	15	3	67	1	75	80
PQMC1-D12-D5-S	12	9~18	±5	±5	±100	1	75	78
PQMC1-D12-D12-S	12	9~18	±12	±2	±42	1	75	81
PQMC1-D12-D15-S	12	9~18	±15	±2	±33	1	75	80
PQMC1-D24-S3-S	24	18~36	3.3	15	303	1	75	75
PQMC1-D24-S5-S	24	18~36	5	10	200	1	75	77
PQMC1-D24-S12-S	24	18~36	12	4	83	1	75	81
PQMC1-D24-S15-S	24	18~36	15	3	67	1	75	79
PQMC1-D24-S24-S	24	18~36	24	2	42	1	75	77
PQMC1-D24-D5-S	24	18~36	±5	±5	±100	1	75	80
PQMC1-D24-D12-S	24	18~36	±12	±2	±42	1	75	80
PQMC1-D24-D15-S	24	18~36	±15	±2	±33	1	75	80
PQMC1-D48-S3-S	48	36~75	3.3	15	303	1	75	75
PQMC1-D48-S5-S	48	36~75	5	10	200	1	75	76
PQMC1-D48-S12-S	48	36~75	12	4	83	1	75	81
PQMC1-D48-S15-S	48	36~75	15	3	67	1	75	80

MODEL (CONTINUED)

	input voltage		output voltage	output current		output power	ripple and noise[1]	efficiency
	typ (Vdc)	range (Vdc)	(Vdc)	min (mA)	max (mA)	max (W)	typ (mVp-p)	typ (%)
PQMC1-D48-D5-S	48	36~75	±5	±5	±100	1	75	76
PQMC1-D48-D12-S	48	36~75	±12	±2	±42	1	75	80
PQMC1-D48-D15-S	48	36~75	±15	±2	±33	1	75	80

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



INPUT

parameter	conditions/description	min	typ	max	units
operating input voltage	5 Vdc input models	4.5	5	9	Vdc
	12 Vdc input models	9	12	18	Vdc
	24 Vdc input models	18	24	36	Vdc
	48 Vdc input models	36	48	75	Vdc
start-up voltage	5 Vdc input models	3.5	4	4.5	Vdc
	12 Vdc input models	4.5	8	9	Vdc
	24 Vdc input models	11	16	18	Vdc
	48 Vdc input models	24	33	36	Vdc
surge voltage	for maximum of 1 second				
	5 Vdc input models	-0.7		12	Vdc
	12 Vdc input models	-0.7		25	Vdc
	24 Vdc input models	-0.7		50	Vdc
	48 Vdc input models	-0.7		100	Vdc
filter	capacitance filter				
CTRL[2]	models ON (CTRL open or insulated)				
	models OFF (connect voltage, current into CTRL is 5~10mA)				

Notes: 2. See application notes on page 5.

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		±0.4	±0.75	%
voltage accuracy	5% to 100% load		±1	±3	%
no-load voltage accuracy			±1.5	±5	%
voltage balance[3]	dual output, balanced loads		±0.3	±0.5	%
switching frequency	100% load, nominal input voltage, PFM mode		200		kHz
transient recovery time	25% load step change		0.5	2	ms
transient response deviation	25% load step change		±2.5	±5	%
temperature coeffecient	100% load		±0.02	±0.03	%/°C

Notes: 3. For dual output models, unbalanced loads should not exceed ±5%. If ±5% is exceeded, it may not meet all specifications.

PROTECTIONS

parameter	conditions/description	min	typ	max	units
short circuit protection	automatic recovery				

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
conducted emissions	CISPR22/EN55022, class B (external circuit required, see Figure 1-b)				
radiated emissions	CISPR22/EN55022, 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		105	°C
storage temperature		-55		125	°C
storage humidity	non-condensing			95	%
temperature rise	at full load, Ta=25°C		25		°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

MECHANICAL

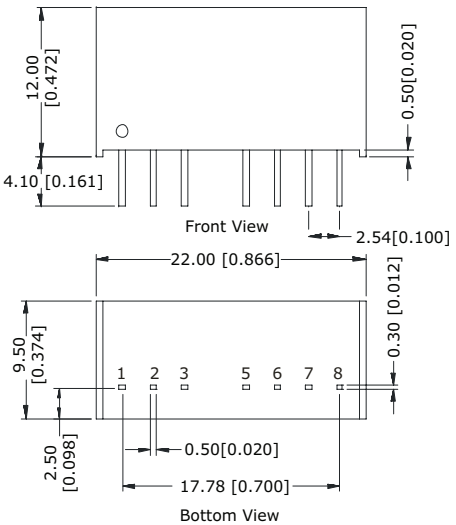
parameter	conditions/description	min	typ	max	units
dimensions	22.00 x 9.50 x 12.00 (0.866 x 0.374 x 0.472 inch)				mm
case material	plastic (UL94-V0)				
weight			4.9		g

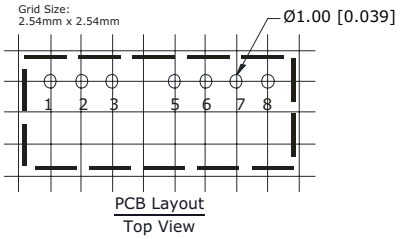
MECHANICAL DRAWING

units: mm[inch]
tolerance: ±0.25[±0.010]
pin section tolerance: ±0.10[±0.004]

PIN CONNECTIONS		
PIN	Single Output	Dual Output
1	GND	GND
2	Vin	Vin
3	Ctrl	Ctrl
5	NC	NC
6	+Vo	+Vo
7	0V	0V
8	CS	-Vo

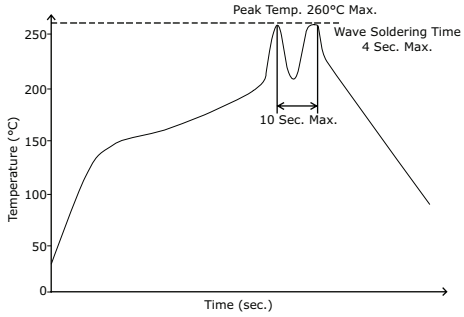
NC: No Connection



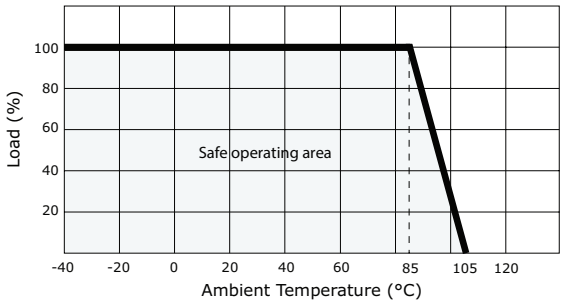


DERATING CURVES

Wave Soldering Profile



Temperature Derating Curve



EMC RECOMMENDED CIRCUIT

Figure 1

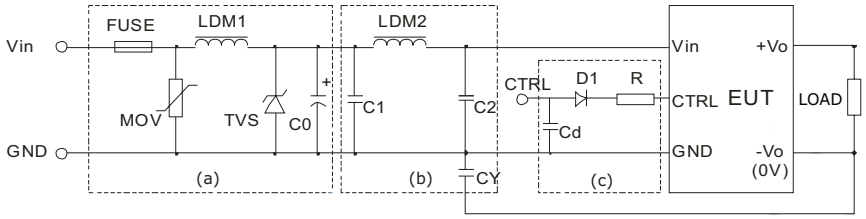


Table 1

Recommended external circuit components				
Vin (Vdc)	5	12	24	48
FUSE	choose according to practical input current			
MOV	--	--	S14K35	S14K60
LDM1	--	--	56µH	56µH
TVS	SMCJ13A	SMCJ28A	SMCJ48A	SMCJ90A
C0	680µF/16V	680µF/25V	330µF/50V	330µF/100V
C1	4.7µF/50V	4.7µF/50V	4.7µF/100V	4.7µF/100V
LDM2	12µH	12µH	12µH	12µH
C2	4.7µF/50V	4.7µF/50V	4.7µF/50V	4.7µF/100V
CY	1nF/2kV	1nF/2kV	1nF/2kV	1nF/2kV
D1	RB160M-60/1A	RB160M-60/1A	RB160M-60/1A	RB160M-60/1A
R	Follows: $R = \frac{V_C - V_D - 1.0}{I_C} - 300$			
Cd	47nF/100V	47nF/100V	47nF/100V	47nF/100V

Note: Figure 1-c is on/off control circuit. See page 5 for details.

TEST CONFIGURATION

Figure 2

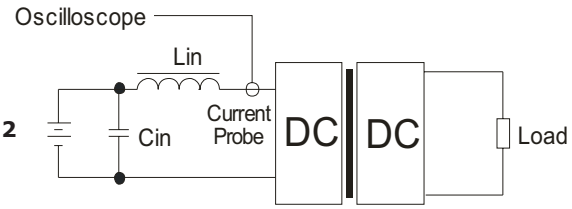


Table 2

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. **Output load requirement**
   To ensure this module can operate efficiently and reliably, the minimum output load may not be less than 5% of the full load during operation. If the actual output power is low, connect a resistor at the output end in parallel to increase the load.

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

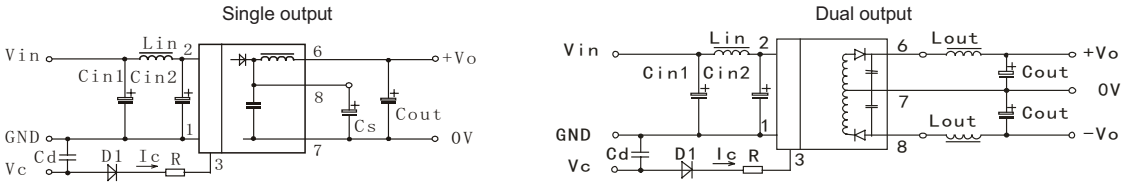


Figure 3

Table 3

Vin (Vdc)	Cin1 (μF)	Cin2 (μF)	Lin (μH)	Cs[1] (μF)	Cout (μF)	Lout[2] (μH)	Cd (nF/V)
5	100	47	4.7~12	10~22	100	2.2~10	47/100
12	100	47	4.7~12	10~22	100	2.2~10	47/100
24	10	1	4.7~12	10~22	100	2.2~10	47/100
48	10	1	4.7~12	10~22	100	2.2~10	47/100

Note: 1. For single output only
2. For dual output only

Table 4

Single Vout (Vdc)	Max. Capacitive Load (μF)	Dual Vout (Vdc)	Max. Capacitive Load[1] (μF)
3.3	2700	--	--
5	2200	5	1000
9	1800	--	--
12	1000	12	470
15	680	15	330
24	470	--	--

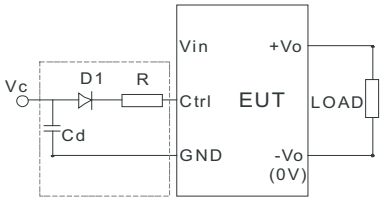
Note: 1. For each output.

3. **CTRL Terminal**
   When open or applied high impedance, the converter will turn on. When it's pulled high, the converter will shutdown. The input current should between 5~10mA. Exceeding the maximum 20mA will cause permanent damage to the converter. The value for R can be derived as follows:

$$R = \frac{V_C - V_D - 1.0}{I_C} - 300$$

V_c: Control pin input voltage
V_D: Forward voltage drop of diode D1
I_c: Input current to control pin
R: Resistor of control circuit

Figure 4



4. **Input Current**
   When it is used in an unregulated condition, make sure that the input fluctuations and ripple voltage do not exceed the module standard. Refer to Figure 5 and Table 5 for the startup current of this dc-dc module.

Figure 5

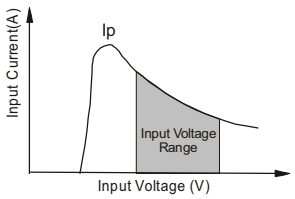


Table 5

Vin (Vdc)	Ip (mA)
5	450
12	220
24	110
48	55

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	03/20/2013
1.01	added models, updated spec	10/14/2014

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

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