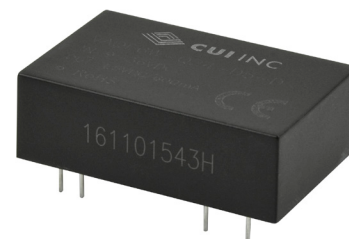


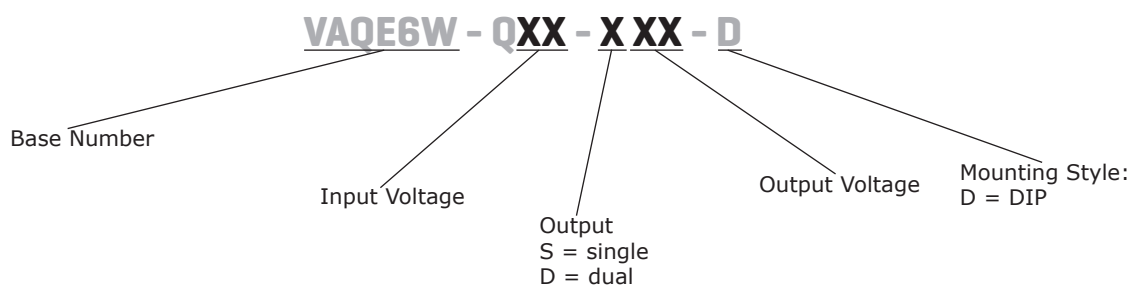
**SERIES: VAQE6W-D | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- industry standard footprint
- high efficiency up to 88%
- single and dual output models available
- board mount
- 3000 Vdc isolation
- industrial operating temp -40~+85 °C
- 4:1 wide input range
- input under voltage protection & over voltage protection
- over current protection
- EN 62368-1



| MODEL            | input voltage |                | output voltage<br>(Vdc) | output current |             | output power<br>max<br>(W) | ripple & noise <sup>1</sup><br>max<br>(mVp-p) | efficiency <sup>2</sup><br>typ (%) |
|------------------|---------------|----------------|-------------------------|----------------|-------------|----------------------------|-----------------------------------------------|------------------------------------|
|                  | typ<br>(Vdc)  | range<br>(Vdc) |                         | min<br>(mA)    | max<br>(mA) |                            |                                               |                                    |
| VAQE6W-Q24-S3-D  | 24            | 9~36           | 3.3                     | 0              | 1500        | 4.95                       | 120                                           | 79                                 |
| VAQE6W-Q24-S5-D  | 24            | 9~36           | 5                       | 0              | 1200        | 6                          | 120                                           | 82                                 |
| VAQE6W-Q24-S9-D  | 24            | 9~36           | 9                       | 0              | 667         | 6                          | 120                                           | 85                                 |
| VAQE6W-Q24-S12-D | 24            | 9~36           | 12                      | 0              | 500         | 6                          | 120                                           | 86                                 |
| VAQE6W-Q24-S15-D | 24            | 9~36           | 15                      | 0              | 400         | 6                          | 120                                           | 88                                 |
| VAQE6W-Q24-S24-D | 24            | 9~36           | 24                      | 0              | 250         | 6                          | 120                                           | 87                                 |
| VAQE6W-Q24-D5-D  | 24            | 9~36           | ±5                      | 0              | ±600        | 6                          | 120                                           | 80                                 |
| VAQE6W-Q24-D12-D | 24            | 9~36           | ±12                     | 0              | ±250        | 6                          | 120                                           | 84                                 |
| VAQE6W-Q24-D15-D | 24            | 9~36           | ±15                     | 0              | ±200        | 6                          | 120                                           | 85                                 |
| VAQE6W-Q48-S3-D  | 48            | 18~75          | 3.3                     | 0              | 1500        | 4.95                       | 120                                           | 79                                 |
| VAQE6W-Q48-S5-D  | 48            | 18~75          | 5                       | 0              | 1200        | 6                          | 120                                           | 83                                 |
| VAQE6W-Q48-S12-D | 48            | 18~75          | 12                      | 0              | 500         | 6                          | 120                                           | 87                                 |
| VAQE6W-Q48-S15-D | 48            | 18~75          | 15                      | 0              | 400         | 6                          | 120                                           | 88                                 |
| VAQE6W-Q48-S24-D | 48            | 18~75          | 24                      | 0              | 250         | 6                          | 120                                           | 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. 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     | 14   | 15.5 |     | Vdc   |
| current                   | 24 Vdc input models     |      |      | 268 | mA    |
|                           |                         |      |      | 320 | mA    |
|                           | 48 Vdc input models     |      |      | 134 | mA    |
|                           |                         |      |      | 154 | mA    |
| filter                    | Pi filter               |      |      |     |       |
| no load power consumption |                         |      | 0.12 |     | W     |

## OUTPUT

| parameter                            | conditions/description                      | min                                        | typ  | max   | units |
|--------------------------------------|---------------------------------------------|--------------------------------------------|------|-------|-------|
| maximum capacitive load <sup>1</sup> | 3.3, 5 Vdc output models                    |                                            |      | 2,200 | μF    |
|                                      | 9 Vdc output models                         |                                            |      | 1,000 | μF    |
|                                      | ±12 Vdc output models                       |                                            |      | 330   | μF    |
|                                      | ±15 Vdc output models                       |                                            |      | 220   | μF    |
|                                      | all other models                            |                                            |      | 680   | μF    |
| voltage accuracy                     | 5% to full load                             |                                            | ±1   | ±3    | %     |
|                                      | 0%~5% load                                  | single output models<br>dual output models | ±1   | ±3    | %     |
|                                      |                                             |                                            | ±2   | ±5    | %     |
| line regulation                      | from low line to high line, full load       |                                            |      |       |       |
|                                      | positive outputs                            |                                            | ±0.2 | ±0.5  | %     |
|                                      | negative outputs                            |                                            | ±0.5 | ±1    | %     |
| load regulation <sup>2</sup>         | from 5% to full load                        |                                            |      |       |       |
|                                      | positive outputs                            |                                            | ±0.5 | ±1    | %     |
|                                      | negative outputs                            |                                            | ±0.5 | ±1.5  | %     |
| voltage balance <sup>3</sup>         | dual output models                          |                                            | ±0.5 | ±1.5  | %     |
| cross regulation                     | dual output models:                         |                                            |      |       |       |
|                                      | main output 50% load                        |                                            |      | ±5    | %     |
|                                      | secondary output from 10~100% load          |                                            |      |       |       |
| switching frequency <sup>4</sup>     | PWM mode                                    |                                            | 300  |       | 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   | ±5    | %     |
| temperature coefficient              | at full load                                |                                            |      | ±0.03 | %/°C  |

Note:

1. Tested at input voltage range and full load.
2. At 0~100% load, the max load regulation is ±5%.
3. Unbalanced loads should not exceed ±5%. If ±5% is exceeded, the product performance cannot be guaranteed.
4. 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  | 24 Vdc output models      | 110 | 220 | 290 | %     |
|                          | all other models          | 110 | 140 | 190 | %     |
| short circuit protection | continuous, self recovery |     |     |     |       |

## SAFETY AND COMPLIANCE

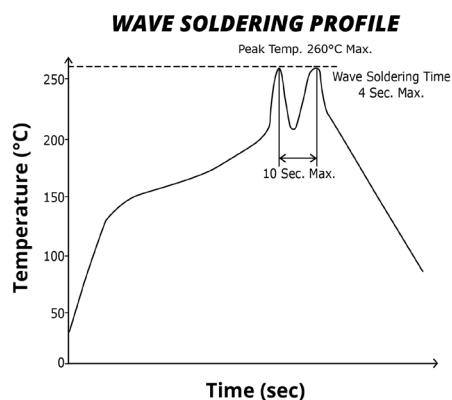
| parameter                    | conditions/description                                                                                     | min       | typ   | max | units |
|------------------------------|------------------------------------------------------------------------------------------------------------|-----------|-------|-----|-------|
| isolation voltage            | input to output for 1 minute at 1 mA                                                                       | 3,000     |       |     | Vdc   |
| isolation resistance         | input to output at 500 Vdc                                                                                 | 1,000     |       |     | MΩ    |
| isolation capacitance        | input to output, 100 kHz / 0.1 V                                                                           |           | 1,000 |     | pF    |
| safety approvals             | certified to 62368-1: EN<br>certified to 60950-1: UL                                                       |           |       |     |       |
| conducted emissions          | CISPR22/EN55022, class A (no external circuit); class B (external circuit required, see Figure 3-b or 4-b) |           |       |     |       |
| radiated emissions           | CISPR22/EN55022, class A (no external circuit); class B (external circuit required, see Figure 3-b or 4-b) |           |       |     |       |
| ESD                          | IEC/EN61000-4-2, contact ±4 kV, class B                                                                    |           |       |     |       |
| radiated immunity            | IEC/EN61000-4-3, 10 V/m, class A                                                                           |           |       |     |       |
| EFT/burst                    | IEC/EN61000-4-4, ±2 kV, class B (external circuit required, see Figure 3-a or 4-a)                         |           |       |     |       |
| surge                        | IEC/EN61000-4-5, ±2 kV, class B (external circuit required, see Figure 3-a or 4-a)                         |           |       |     |       |
| conducted immunity           | IEC/EN61000-4-6, 3 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                         | 2011/65/EU                                                                                                 |           |       |     |       |

## ENVIRONMENTAL

| parameter             | conditions/description               | min | typ | max | units |
|-----------------------|--------------------------------------|-----|-----|-----|-------|
| operating temperature | see derating curve                   | -40 |     | 85  | °C    |
| storage temperature   |                                      | -55 |     | 125 | °C    |
| storage humidity      | non-condensing                       | 5   |     | 95  | %     |
| vibration             | 10~55 Hz for 30 minutes on each axis |     | 10  |     | G     |

## 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    | 31.60 x 20.30 x 10.20 [1.244 x 0.799 x 0.402 inch]  |     |     |     | mm    |
| case material | black flame-retardant heat-proof plastic (UL 94-V0) |     |     |     |       |
| weight        |                                                     |     | 13  |     | g     |

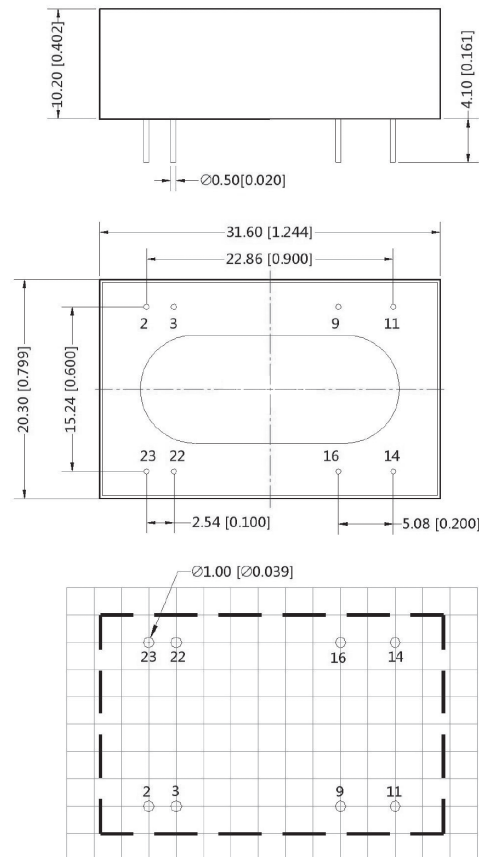
## MECHANICAL DRAWING

units: mm [inch]

tolerance:  $\pm 0.50$  [ $\pm 0.020$ ]pin diameter tolerance:  $\pm 0.10$  [ $\pm 0.004$ ]

| PIN CONNECTIONS |          |       |
|-----------------|----------|-------|
| PIN             | Function |       |
|                 | Single   | Dual  |
| 2, 3            | GND      | GND   |
| 9               | No Pin   | 0V    |
| 11              | NC       | -Vout |
| 14              | +Vout    | +Vout |
| 16              | 0V       | 0V    |
| 22, 23          | Vin      | Vin   |

NC=no connection

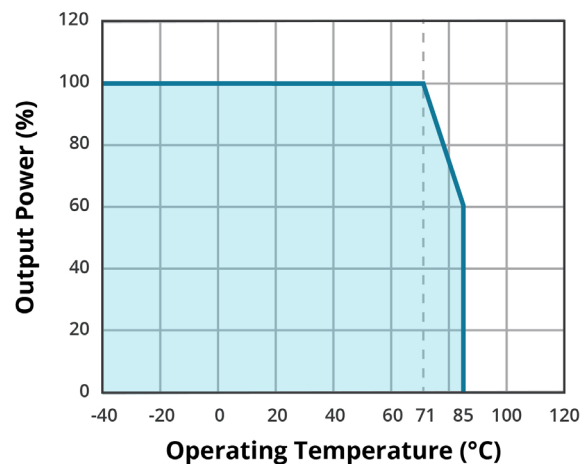


Note: 2.54 x 2.54 mm grid

Recommended PCB Layout  
Top View

## DERATING CURVE

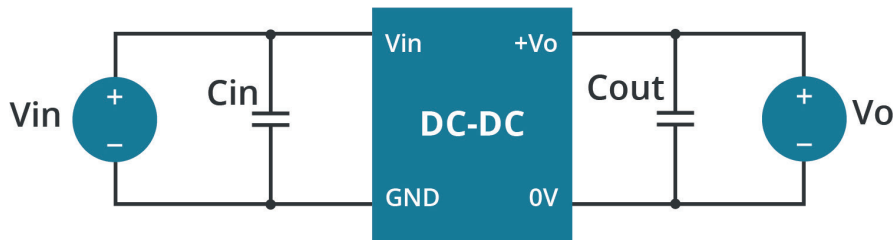
### TEMPERATURE DERATING CURVE



## 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.

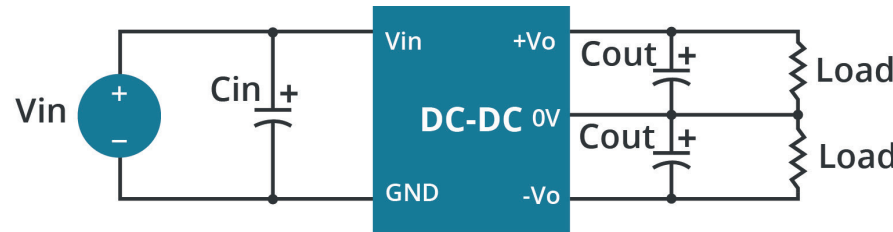
**Figure 1**  
Single Output Models



**Table 1**

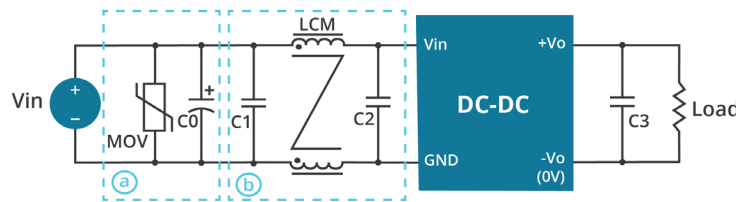
| Vin (Vdc) | Cin (μF) | Cout (μF) |
|-----------|----------|-----------|
| 24        | 100      | 10        |
| 48        | 10~47    | 10        |

**Figure 2**  
Dual Output Models



## EMC RECOMMENDED CIRCUIT

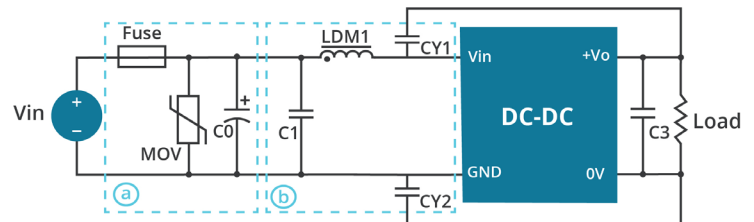
**Figure 3**  
Single Output Models



**Table 2**

| Recommended External Circuit Components |                                          |                |
|-----------------------------------------|------------------------------------------|----------------|
| Vin (Vdc)                               | 24                                       | 48             |
| FUSE                                    | choose according to actual input current |                |
| MOV                                     | S20K30                                   | S14K60         |
| C0                                      | 330 μF / 50 V                            | 330 μF / 100 V |
| C1, C2                                  | 2.2 μF / 50 V                            | 2.2 μF / 100 V |
| LCM                                     | 2.2 mH                                   |                |
| C3                                      | 10 μF                                    |                |

**Figure 4**  
Dual Output Models



**Table 3**

| Recommended External Circuit Components |                                          |
|-----------------------------------------|------------------------------------------|
| Vin (Vdc)                               | 24                                       |
| FUSE                                    | choose according to actual input current |
| MOV                                     | S20K30                                   |
| C0                                      | 1,000 μF / 50 V                          |
| C1                                      | 1 μF / 50 V                              |
| C3                                      | 10 μF                                    |
| LDM1                                    | 4.7 μF                                   |
| CY1, CY2                                | 1 nF / 3 kV                              |

## REVISION HISTORY

| rev. | description                                         | date       |
|------|-----------------------------------------------------|------------|
| 1.0  | initial release                                     | 02/20/2018 |
| 1.01 | features and safety line updated, packaging removed | 01/14/2021 |
| 1.02 | derating curve and circuit figures updated          | 07/22/2021 |

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



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CUI offers a two (2) year limited warranty. Complete warranty information is listed on our website.

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