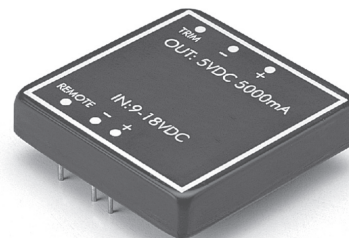


**SERIES: VCD40 | DESCRIPTION: DC-DC CONVERTER**
**FEATURES**

- up to 40 W isolated output
- wide input (2:1)
- 2"x2" six sided shielded metal case
- single, dual, and triple regulated outputs
- 1500 V isolation
- short circuit, over voltage and over temperature protection
- wide temperature (-25~71°C)
- efficiency up to 92%
- EN 62368-1

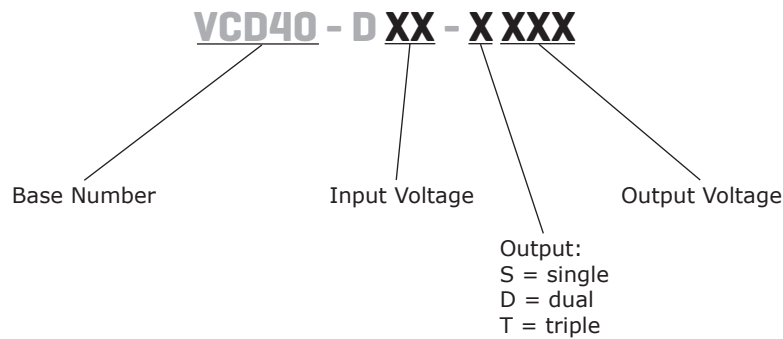


| MODEL          | input voltage |             | output voltage<br>(Vdc) | input current |                | output current |          | ripple and noise <sup>1</sup><br>max (mVp-p) | efficiency<br>typ (%) |
|----------------|---------------|-------------|-------------------------|---------------|----------------|----------------|----------|----------------------------------------------|-----------------------|
|                | typ (Vdc)     | range (Vdc) |                         | no load (mA)  | full load (mA) | max (mA)       | min (mA) |                                              |                       |
| VCD40-D12-S2R5 | 12            | 9~18        | 2.5                     | 200           | 2,367          | 10,000         | 0        | 50                                           | 88                    |
| VCD40-D12-S3R3 | 12            | 9~18        | 3.3                     | 200           | 3,090          | 10,000         | 0        | 50                                           | 89                    |
| VCD40-D12-S5   | 12            | 9~18        | 5                       | 200           | 3,745          | 8,000          | 0        | 50                                           | 89                    |
| VCD40-D12-S12  | 12            | 9~18        | 12                      | 200           | 3,703          | 3,333          | 0        | 75                                           | 90                    |
| VCD40-D12-S15  | 12            | 9~18        | 15                      | 200           | 3,702          | 2,666          | 0        | 75                                           | 90                    |
| VCD40-D12-D12  | 12            | 9~18        | ±12                     | 100           | 4,045          | ±1,800         | 90       | 120                                          | 89                    |
| VCD40-D12-D15  | 12            | 9~18        | ±15                     | 100           | 3,889          | ±1,400         | 70       | 150                                          | 90                    |
| VCD40-D12-T312 | 12            | 9~18        | 3.3/±12                 | 200           | 2,784          | 6000/±400      | 600/±40  | 100                                          | 88                    |
| VCD40-D12-T315 | 12            | 9~18        | 3.3/±15                 | 200           | 2,727          | 6000/±300      | 600/±30  | 100                                          | 88                    |
| VCD40-D12-T512 | 12            | 9~18        | 5/±12                   | 200           | 3,750          | 6000/±400      | 600/±40  | 100                                          | 88                    |
| VCD40-D12-T515 | 12            | 9~18        | 5/±15                   | 200           | 3,611          | 6000/±300      | 600/±30  | 100                                          | 90                    |
| VCD40-D24-S2R5 | 24            | 18~36       | 2.5                     | 100           | 1,184          | 10,000         | 0        | 50                                           | 88                    |
| VCD40-D24-S3R3 | 24            | 18~36       | 3.3                     | 100           | 1,545          | 10,000         | 0        | 50                                           | 89                    |
| VCD40-D24-S5   | 24            | 18~36       | 5                       | 100           | 1,831          | 8,000          | 0        | 50                                           | 91                    |
| VCD40-D24-S12  | 24            | 18~36       | 12                      | 100           | 1,811          | 3,333          | 0        | 75                                           | 92                    |
| VCD40-D24-S15  | 24            | 18~36       | 15                      | 100           | 1,810          | 2,666          | 0        | 75                                           | 92                    |
| VCD40-D24-D12  | 24            | 18~36       | ±12                     | 100           | 1,978          | ±1,800         | 90       | 120                                          | 91                    |
| VCD40-D24-D15  | 24            | 18~36       | ±15                     | 100           | 1,902          | ±1,400         | 70       | 150                                          | 92                    |
| VCD40-D24-T312 | 24            | 18~36       | 3.3/±12                 | 100           | 1,361          | 6000/±400      | 600/±40  | 100                                          | 90                    |
| VCD40-D24-T315 | 24            | 18~36       | 3.3/±15                 | 100           | 1,333          | 6000/±300      | 600/±30  | 100                                          | 90                    |
| VCD40-D24-T512 | 24            | 18~36       | 5/±12                   | 100           | 1,833          | 6000/±400      | 600/±40  | 100                                          | 90                    |
| VCD40-D24-T515 | 24            | 18~36       | 5/±15                   | 100           | 1,806          | 6000/±300      | 600/±30  | 100                                          | 90                    |
| VCD40-D48-S2R5 | 48            | 36~72       | 2.5                     | 50            | 585            | 10,000         | 0        | 50                                           | 89                    |
| VCD40-D48-S3R3 | 48            | 36~72       | 3.3                     | 50            | 764            | 10,000         | 0        | 50                                           | 90                    |
| VCD40-D48-S5   | 48            | 36~72       | 5                       | 60            | 926            | 8,000          | 0        | 50                                           | 90                    |
| VCD40-D48-S12  | 48            | 36~72       | 12                      | 60            | 916            | 3,333          | 0        | 75                                           | 91                    |
| VCD40-D48-S15  | 48            | 36~72       | 15                      | 60            | 906            | 2,666          | 0        | 75                                           | 92                    |
| VCD40-D48-D12  | 48            | 36~72       | ±12                     | 50            | 1,000          | ±1,800         | 90       | 120                                          | 90                    |
| VCD40-D48-D15  | 48            | 36~72       | ±15                     | 50            | 962            | ±1,400         | 70       | 150                                          | 91                    |

**MODEL**

|                | input voltage |             | output voltage | input current |                | output current |          | ripple and noise <sup>1</sup> | efficiency |
|----------------|---------------|-------------|----------------|---------------|----------------|----------------|----------|-------------------------------|------------|
|                | typ (Vdc)     | range (Vdc) | (Vdc)          | no load (mA)  | full load (mA) | max (mA)       | min (mA) | max (mVp-p)                   | typ (%)    |
| VCD40-D48-T312 | 48            | 36~72       | 3.3/±12        | 50            | 688            | 6000/±400      | 600/±40  | 100                           | 89         |
| VCD40-D48-T315 | 48            | 36~72       | 3.3/±15        | 50            | 690            | 6000/±300      | 600/±30  | 100                           | 89         |
| VCD40-D48-T512 | 48            | 36~72       | 5/±12          | 50            | 938            | 6000/±400      | 600/±40  | 100                           | 88         |
| VCD40-D48-T515 | 48            | 36~72       | 5/±15          | 50            | 903            | 6000/±300      | 600/±30  | 100                           | 90         |

notes: 1. ripple and noise are measured at 20 Hz BW

**PART NUMBER KEY****INPUT**

| parameter               | conditions/description  | min | typ | max | units |
|-------------------------|-------------------------|-----|-----|-----|-------|
| operating input voltage |                         | 9   | 12  | 18  | Vdc   |
|                         |                         | 18  | 24  | 36  | Vdc   |
|                         |                         | 36  | 48  | 72  | Vdc   |
| under voltage lockout   | 12 Vin power up 8.8 V   |     |     | 8.8 | Vdc   |
|                         | 12 Vin power down 8.0 V |     |     | 8.0 | Vdc   |
|                         | 24 Vin power up 17 V    |     |     | 17  | Vdc   |
|                         | 24 Vin power down 16 V  |     |     | 16  | Vdc   |
|                         | 48 Vin power up 34 V    |     |     | 34  | Vdc   |
|                         | 48 Vin power down 32 V  |     |     | 32  | Vdc   |
| input filter            | PI type                 |     |     |     |       |

**OUTPUT**

| parameter                    | conditions/description        | min  | typ | max  | units |
|------------------------------|-------------------------------|------|-----|------|-------|
| line regulation <sup>1</sup> | single and dual output models |      |     | ±0.5 | %     |
|                              | triple output models          |      |     | ±1.0 | %     |
|                              |                               |      |     | ±3.0 | %     |
| load regulation <sup>2</sup> | single and dual output models |      |     | ±0.5 | %     |
|                              |                               |      |     | ±1.0 | %     |
|                              | dual positive output models   | 3.3V |     | ±1.5 | %     |
|                              |                               | 5V   |     | ±4.0 | %     |
|                              | triple output models          |      |     | ±1.0 | %     |
|                              |                               |      |     | ±4.0 | %     |
| voltage accuracy             | single output models          |      |     | ±1.5 | %     |
|                              | dual positive output models   | 3.3V |     | ±1.5 | %     |
|                              |                               | 5V   |     | ±3.0 | %     |
|                              | triple output models          |      |     | ±1.5 | %     |
|                              |                               |      |     | ±5.0 | %     |

## OUTPUT

| parameter                     | conditions/description                     | min | typ | max   | units |
|-------------------------------|--------------------------------------------|-----|-----|-------|-------|
| cross regulation <sup>3</sup> | +3.3V                                      |     |     | ±1.0  | %     |
|                               | +5V                                        |     |     | ±4.0  | %     |
| voltage balance               | dual output models                         |     |     | ±2.0  | %     |
| transient response            | 75-100% step load change<br>±5% error band |     |     | 300   | µs    |
| external trim adjust range    | single and dual output models              |     | ±10 |       | %     |
|                               | dual positive output models                |     | ±5  |       | %     |
| current limit                 |                                            | 110 |     | 140   | %     |
| switching frequency           |                                            |     | 350 |       | kHz   |
| temperature coefficient       |                                            |     |     | ±0.02 | %/°C  |

Notes: 1. measured from high line to low line  
2. measured from full load to 10% load  
2. measured from max. load to 10% load, other output at 10% load

## PROTECTIONS

| parameter                   | conditions/description | min  | typ | max | units |
|-----------------------------|------------------------|------|-----|-----|-------|
| short circuit protection    | continuous, hiccup     |      |     |     |       |
| over temperature protection |                        |      | 110 |     | °C    |
| over-voltage protection     | zener diode clamp      | 2.5V |     | 3.6 | Vdc   |
|                             |                        | 3.3V |     | 3.9 | Vdc   |
|                             |                        | 5V   |     | 6.2 | Vdc   |
|                             |                        | 12V  |     | 15  | Vdc   |
|                             |                        | 15V  |     | 18  | Vdc   |

## SAFETY AND COMPLIANCE

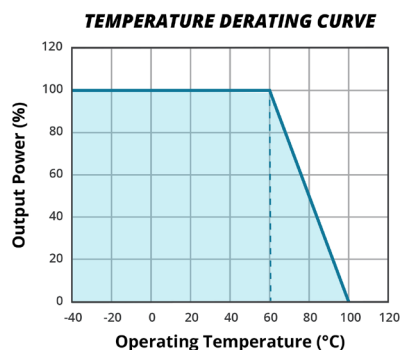
| parameter             | conditions/description                               | min   | typ | max | units |
|-----------------------|------------------------------------------------------|-------|-----|-----|-------|
| isolation voltage     |                                                      | 1,500 |     |     | Vdc   |
| insulation resistance |                                                      | 1,000 |     |     | MΩ    |
| safety approvals      | certified to 62368-1: EN<br>certified to 60950-1: UL |       |     |     |       |
| RoHS compliant        | yes                                                  |       |     |     |       |

## ENVIRONMENTAL

| parameter                          | conditions/description | min | typ | max | units |
|------------------------------------|------------------------|-----|-----|-----|-------|
| operating temperature <sup>1</sup> |                        | -40 |     | 85  | °C    |
| case temperature <sup>1</sup>      |                        |     |     | 100 | °C    |
| storage temperature                |                        | -55 |     | 105 | °C    |

Notes: 1. measured from high line to low line

## DERATING CURVES

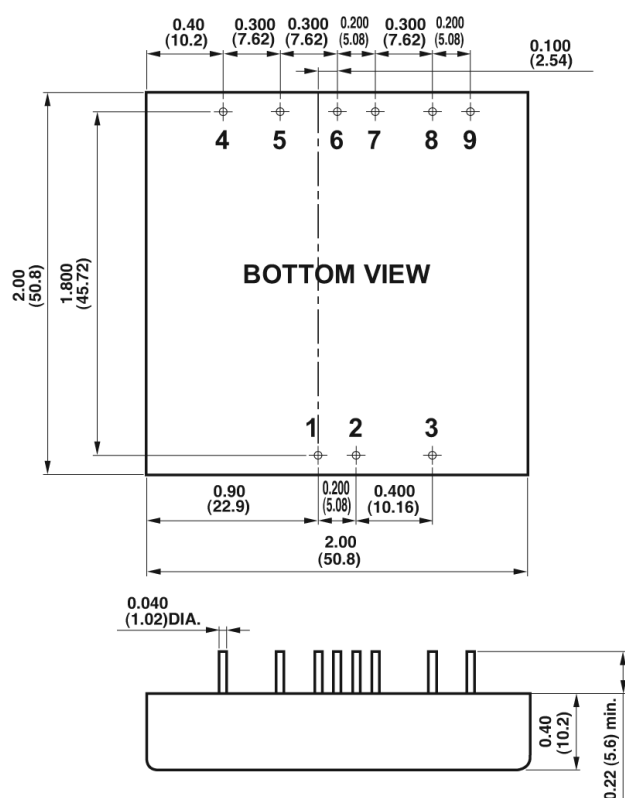


## MECHANICAL

| parameter     | conditions/description                       | min | typ | max | units |
|---------------|----------------------------------------------|-----|-----|-----|-------|
| dimensions    | 2 x 2 x 0.4 (50.8 x 50.8 x 10.2 mm)          |     |     |     | inch  |
| case material | black coated copper with non-conductive base |     |     |     |       |
| weight        |                                              |     | 65  |     | g     |

## MECHANICAL DRAWING

units: inches (mm)

tolerance: x.xx =  $\pm 0.02$ , x.xxx =  $\pm 0.010$ (x.x =  $\pm 0.5$ , x.xx =  $\pm 0.25$ )pin tolerance  $\pm 0.05$ mm

### PIN CONNECTIONS

|     | SINGLE OUTPUT | DUAL OUTPUT | DUAL POSITIVE | TRIPLE OUTPUT |
|-----|---------------|-------------|---------------|---------------|
| PIN | FUNCTION      | FUNCTION    | FUNCTION      | FUNCTION      |
| 1   | +Vin          | +Vin        | +Vin          | +Vin          |
| 2   | -Vin          | -Vin        | -Vin          | -Vin          |
| 3   | on/off        | on/off      | on/off        | on/off        |
| 4   | NC            | no pin      | +3.3Vo        | +Aux. out     |
| 5   | -sense        | +Vo         | com(5V RTN)   | common        |
| 6   | +sense        | common      | trim          | -Aux. out     |
| 7   | +Vo           | common      | NC            | +Vo           |
| 8   | -Vo           | -Vo         | +5 Vo         | -Vo (common)  |
| 9   | trim          | trim        | com(5V RTN)   | NC            |

### REMOTE ON/OFF CONTROL

|                       |                            |
|-----------------------|----------------------------|
| logic compatibility   | CMOS or Open Collector TTL |
| EC-on                 | >+5.5 Vdc or Open Circuit  |
| EC-off                | <1.8 Vdc                   |
| shutdown idle current | 10 mA                      |
| control common        | referenced to input minus  |

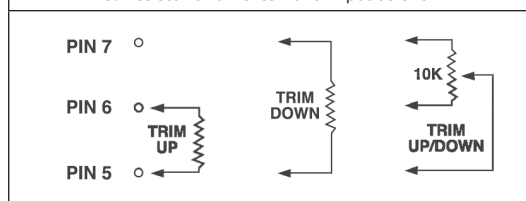
### TRIPLE OUTPUT LOADING TABLE<sup>1</sup>

| PIN | VOLTAGE  | AMPERES          |      |
|-----|----------|------------------|------|
|     |          | min <sup>2</sup> | typ  |
| 7   | +5       | 0.50             | 3.5  |
| 8,5 | $\pm 12$ | 0.10             | 0.31 |
| 8,5 | $\pm 15$ | 0.10             | 0.25 |

Notes:

1. Maximum total power from all outputs is limited to 25 watts but no output should exceed its maximum current.
2. Minimum current on each output is required to maintain specified regulation.

### EXTERNAL OUTPUT TRIMMING

Output may optionally be externally trimmed ( $\pm 10\%$ ) with a fixed resistor or an external trimpot as shown.

1. The value of Rtrim-up defined as:

$$R_{trim-up} = \left( \frac{R1 \times Vr}{Vo - Vo, nom} \right) - Rt \text{ (K}\Omega\text{)}$$

Where: R trim-up is the external resistor in Kohm.  
Vo,nom is the nominal output voltage.  
Vo is the desired output voltage.

R1 ,Rt and Vr are internal to the unit and are defined in Table 1.

For example, to trim-up the output voltage of 5.0V module (VCD40-D48-S5) by 5% to 5.25V, R trim-up is calculated as follows:

$$Vo - Vo, nom = 5.25 - 5.0 = 0.25V$$

$$R1 = 2.32 \text{ Kohm}$$

$$Rt = 8.2 \text{ Kohm}, Vr = 2.5$$

$$R_{trim-up} = \frac{2.32 \times 2.5}{0.25} - 8.2 = 15 \text{ (K}\Omega\text{)}$$

The value of R trim-down defined as:

$$R_{trim-down} = \frac{R1 \times (Vo - Vr)}{Vo, nom - Vo} - Rt \text{ (K}\Omega\text{)}$$

Where: R trim-down is the external resistor in Kohm.  
Vo,nom is the nominal output voltage.  
Vo is the desired output voltage.

R1 ,Rt and Vr are internal to the unit and are defined in Table 1.

For example, to trim-down the output voltage of 5.0V module (VCD40-D48-S5) by 5% to 4.75V, R trim-down is calculated as follows :

$$Vo, nom - Vo = 5.0 - 4.75 = 0.25 \text{ V}$$

$$R1 = 2.32 \text{ Kohm}$$

$$Rt = 8.2 \text{ Kohm}, Vr = 2.5$$

$$R_{trim-down} = \frac{2.32 \times (4.75 - 2.5)}{0.25} - 8.2 = 12.68 \text{ (K}\Omega\text{)}$$

Table 1 - Trim Resistor Values

| Model Number                 | Output Voltage(V) | R1 (Kohm) | Rt (Kohm) | Vr  |
|------------------------------|-------------------|-----------|-----------|-----|
| VCD40-D24-S5<br>VCD40-D48-S5 | 5.0               | 2.32      | 8.2       | 2.5 |

Table 2 - Trim Resistor Values

| Model Number                     | Output Voltage(V) | R1 (Kohm) | R2 (Kohm) | R3 (Kohm) | Rt (Kohm) | Vr   |
|----------------------------------|-------------------|-----------|-----------|-----------|-----------|------|
| VCD40-D24-S3R3<br>VCD40-D48-S3R3 | 3.3V              | 2.74      | 1.8       | 0.27      | 9.1       | 1.24 |
| VCD40-D24-S12<br>VCD40-D48-S12   | 12V               | 6.8       | 2.4       | 2.32      | 22        | 2.5  |
| VCD40-D24-S15<br>VCD40-D48-S15   | 15V               | 8.06      | 2.4       | 3.9       | 27        | 2.5  |

In order to trim the voltage up or down one needs to connect the trim resistor either between the trim pin and -Vo for trim-up and between trim pin and +Vo for trim-down. The output voltage trim range is ±10%. This is shown in Figures 1 and 2:

2. The output Voltage 3.3V, 12V and 15V value of Rtrim are defined as below:

$$R_{trim-up} = \left( \frac{Vr \times R1 \times (R2 + R3)}{(Vo - Vo, nom) \times R2} \right) - Rt \text{ (K}\Omega\text{)}$$

$$R_{trim-down} = R1 \times \left( \frac{Vr \times R1}{(Vo, nom - Vo) \times R2} - 1 \right) - Rt \text{ (K}\Omega\text{)}$$

Where: R trim-up is the external resistor in Kohm.

Vo,nom is the nominal output voltage.

Vo is the desired output voltage.

R1, R2, R3, Rt and Vr are internal to the unit and are defined in Table 2.

Figure 1

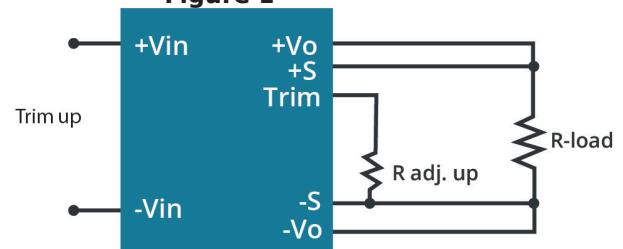
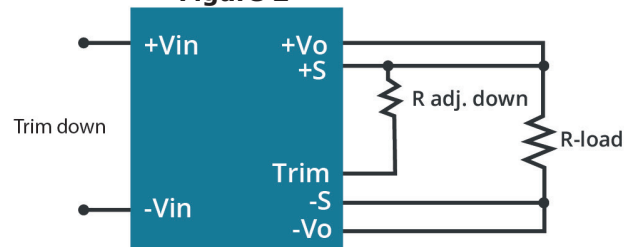


Figure 2



## REVISION HISTORY

| rev. | description                                            | date       |
|------|--------------------------------------------------------|------------|
| 1.0  | initial release                                        | 06/28/2007 |
| 1.01 | layout update, addition of triple output loading table | 10/09/2009 |
| 1.02 | new template applied, V-Infinity branding removed      | 09/07/2012 |
| 1.03 | spec updated                                           | 04/01/2013 |
| 1.04 | safeties updated in features and safety line           | 03/23/2021 |
| 1.05 | derating curve and trim figures updated                | 08/31/2021 |

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



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