

## FEATURES AND APPLICATIONS

- 2:1 and 4:1 Input Range
- High Efficiency up to 84%
- SIL8 Package
- Low Ripple & Noise
- UL60950-1 certified
- RoHS ✓



## GENERAL DESCRIPTION

The VT03C and VTW03C series is a family of 3 Watt single and dual output DC-DC converters. These converters combine a SIL8 package with high performance features such as 1500 Vdc or 3000 Vdc input/output isolation voltage, continuous short circuit protection with automatic restart and tight line and load regulation.

Models operate from a 2:1 or 4:1 input bus voltage of 5, 12, 24 and 48 Vdc offering output voltage levels of 3.3, 5, 09, 12, 15,  $\pm 5$ ,  $\pm 12$  and  $\pm 15$  Vdc. Cooling is by free-air convection.

### 2:1 Input – Single and Dual Outputs

| Type Number  | Input Voltage [Vdc] | Output Voltage [Vdc] | Output Current [mA] | Input Current no load [mA]<br>5/12/24/48 | Input Current full load [mA]<br>5/12/24/48 | Output Ripple & Noise [mVpp] | Efficiency [%]<br>5/12/24/48 | Cap. Load [ $\mu$ F] |
|--------------|---------------------|----------------------|---------------------|--|--|------------------------------|------------------------------|----------------------|
| VT03C-xx3R3S | 5<br>12<br>24<br>48 | 3.3                  | 700                 | 45/25/16/10                              | 650/263/134/69                             | 50                           | 75/77/76/74                  | 3300                 |
| VT03C-xx05S  |                     | 5.0                  | 600                 | 45/25/16/10                              | 800/325/160/83                             | 50                           | 79/81/82/79                  | 1680                 |
| VT03C-xx09S  |                     | 9.0                  | 333                 | 55/30/17/11                              | 789/329/160/82                             | 50                           | 80/80/82/80                  | 1000                 |
| VT03C-xx12S  |                     | 12.0                 | 250                 | 55/30/18/12                              | 779/316/158/81                             | 50                           | 81/83/83/81                  | 820                  |
| VT03C-xx15S  |                     | 15.0                 | 200                 | 55/30/18/12                              | 769/316/156/80                             | 50                           | 82/83/84/82                  | 680                  |
| VT03C-xx05D  |                     | $\pm 5.0$            | $\pm 300$           | 55/30/17/12                              | 810/320/164/83                             | 50                           | 78/82/80/79                  | $\pm 1000$           |
| VT03C-xx12D  |                     | $\pm 12.0$           | $\pm 125$           | 60/30/18/12                              | 779/316/158/80                             | 50                           | 81/83/83/82                  | $\pm 470$            |
| VT03C-xx15D  |                     | $\pm 15.0$           | $\pm 100$           | 60/30/18/12                              | 779/316/154/79                             | 50                           | 81/83/85/83                  | $\pm 330$            |

### 4:1 Input – Single and Dual Outputs

| Type Number   | Input Voltage [Vdc] | Output Voltage [Vdc] | Output Current [mA] | Input Current no load [mA]<br>12/24/48 | Input Current full load [mA]<br>12/24/48 | Output Ripple & Noise [mVpp] | Efficiency [%]<br>12/24/48 | Cap. Load [ $\mu$ F] |
|---------------|---------------------|----------------------|---------------------|--|--|------------------------------|----------------------------|----------------------|
| VTW03C-xx3R3S | 12<br>24<br>48      | 3.3                  | 700                 | 35/20/12                               | 285/140/71                               | 30                           | 74/75/74                   | 3300                 |
| VTW03C-xx05S  |                     | 5.0                  | 600                 | 40/20/12                               | 338/165/82                               | 30                           | 78/80/80                   | 1680                 |
| VTW03C-xx09S  |                     | 9.0                  | 333                 | 40/19/13                               | 333/165/82                               | 30                           | 79/80/80                   | 1000                 |
| VTW03C-xx12S  |                     | 12.0                 | 250                 | 40/20/14                               | 329/160/81                               | 30                           | 80/82/81                   | 820                  |
| VTW03C-xx15S  |                     | 15.0                 | 200                 | 40/19/14                               | 329/160/81                               | 30                           | 80/82/81                   | 680                  |
| VTW03C-xx05D  |                     | $\pm 5.0$            | $\pm 300$           | 40/25/14                               | 329/167/84                               | 30                           | 80/79/79                   | $\pm 1000$           |
| VTW03C-xx12D  |                     | $\pm 12.0$           | $\pm 125$           | 40/25/14                               | 329/162/81                               | 30                           | 80/81/81                   | $\pm 470$            |
| VTW03C-xx15D  |                     | $\pm 15.0$           | $\pm 100$           | 40/25/14                               | 329/162/81                               | 30                           | 80/81/81                   | $\pm 330$            |

xx ... nominal Input voltage:

**VT03C-Series:**    05 (4.5 – 9 Vdc)  
                          12 (9 – 18 Vdc)  
                          24 (18 – 36 Vdc)  
                          48 (36 – 75 Vdc)

**VTW03C-Series:**    12 (4.5 – 18 Vdc)  
                          24 (9 – 36 Vdc)  
                          48 (18 – 75 Vdc)

Options :            Suffix H    3 kVdc Isolation

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## ELECTRICAL SPECIFICATIONS

Specifications typical at +25°C, nominal Input voltage, rated output current unless otherwise specified.

### Input Specifications

Input Voltage Range

| 2:1 input (VT03C-Series) | 4:1 input (VTW03C-Series) |
|--------------------------|---------------------------|
| 5V: 4.5 to 9 Vdc         | 12V: 4.5 to 18 Vdc        |
| 12V: 9 to 18 Vdc         | 24V: 9 to 36 Vdc          |
| 24V: 18 to 36 Vdc        | 48V: 18 to 75 Vdc         |
| 48V: 36 to 75 Vdc        |                           |

Input Filter

Capacitor type

Input Surge Voltage

|                          |                           |
|--------------------------|---------------------------|
| 5V: 15 Vdc, 100mS, max.  | 12V: 36 Vdc, 100mS, max.  |
| 24V: 50 Vdc, 100mS, max. | 48V: 100 Vdc, 100mS, max. |

Input reflected ripple current

| 2:1 input           | 4:1 input          |
|---------------------|--------------------|
| 5V: 400 mApp, max.  | 12V: 25 mApp, max. |
| 12V: 150 mApp, max. | 24V: 10 mApp, max. |
| 24V: 380 mApp, max. | 48V: 8 mApp, max.  |
| 48V: 170 mApp, max. |                    |

Start Up time

30 mS, max.

### Output Specifications

Output Power

3 Watt, max.

Output Voltage Accuracy

±1%

Min. Load for specified regulation

0%

Ripple and Noise (20 MHz BW)

see table

Line Voltage Regulation

±0.2% (LL to HL at full load)

Load Voltage Regulation

Single: ±1% (No load to full load)

Dual: ±1% (No load to full load)

Single: ±0.5% (5% to 90% load)

Cross Regulation (Dual)

±5%

(Asymmetrical load 25%/100% FL)

Temperature Coefficient

±0.02%/°C, max.

Short Circuit Protection

Continuous (Hiccup)

Transient response recovery time

500 µsec (2:1 Input Type)

(25% load step change)

250 µsec (4:1 Input Type)

### General Specifications

Efficiency

see table

Switching Frequency

100 kHz, min.

Isolation Voltage

Standard: 1500 Vdc, min. (1 minute)

H-Option: 3000 Vdc, min. (1 minute)

Isolation Resistance

10<sup>9</sup> Ohms, min.

Isolation Capacitance

Standard: 200 pF, max.

H-Option: 40 pF, max.

Approvals

UL60950-1 certified (E352836)

IEC/EN60950-1 (designed to meet)

### Remote ON/OFF Control

Control Voltage referenced to negative (-) input

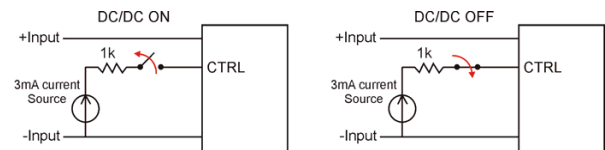
DC/DC ON Open or high impedance

DC/DC OFF Control pin applied current

2~4 mA max. (via 1 kΩ)

Remote off input current

2.5 mA



### Environmental Specification

Operating Temperature -40°C to +71°C without Derating

+71°C to +100°C with Derating

Storage Temperature

-55°C to +125°C

Cooling

Free-air Convection

MTBF

2:1 input / 4:1 input

Bellcore TR-NWT-000332: 4.386x 10<sup>6</sup> Hrs / 3.963 x 10<sup>6</sup> Hrs  
Case1, 50% Stress, 40°C

MIL-HDBK-217F: 2.401 x 10<sup>6</sup> Hrs / 1.707 x 10<sup>6</sup> Hrs  
Notice2 @25°C, FL, Ground, Benign, controlled environment

Thermal Shock

MIL-STD-810F

Vibration

MIL-STD-810F

Relative Humidity

5% to 95% RH

### Physical Characteristics

Dimensions

21.8 x 9.1 x 11.2 mm

0.86 x 0.36 x 0.44 inches

Case Material

Non-conductive black plastic

Potting Material

Silicon (UL94-V0)

Weight

4.8 g

### EMC Characteristics

EMI

EN55022 Class A

with an External Filter – see Recommended EMI Filter

ESD

EN61000-4-2 Perf. Criteria A (Air ±8 kV; Contact ±6 kV)

Radiated Im.

EN61000-4-3 Perf. Criteria A (10 V/m)

F. Transients.

EN61000-4-4 Perf. Criteria A (±2 kV)

Surge

EN61000-4-5 Perf. Criteria A (±1 kV)

An external filter capacitor is required if the module has to meet EN61000-4-4 and EN61000-4-5.

Recommended 2:1 Input Type: 220 µF/100 V, ERS 48 mΩ

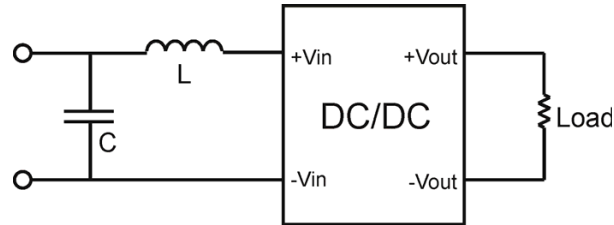
Recommended 4:1 Input Type: 100 µF/100 V, ERS 110 mΩ

Conducted I.

EN61000-4-6 Perf. Criteria A (10 Vrms)

**CAUTION:** This power module is not internally fused. An input line fuse must always be used!

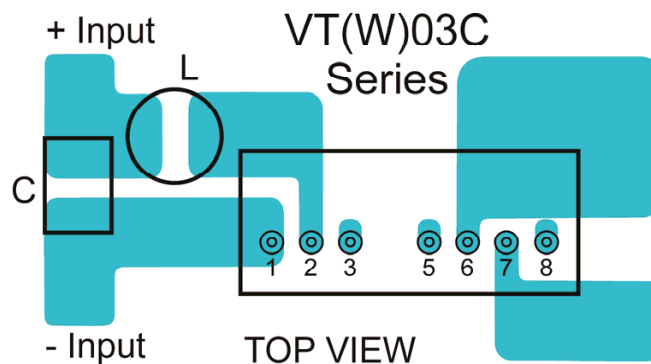
### Recommended Filter for EN55022 Class A or Class B Compliance



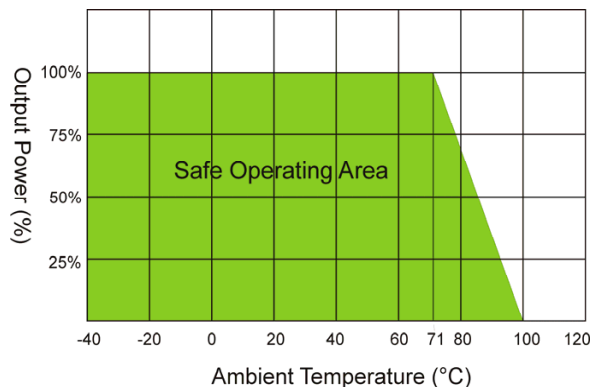
Recommended Components as follows:

|              | Class A Compliance               |  | Class B Compliance              |   |
|--------------|----------------------------------|--|---------------------------------|---|
|              | C                                | L  | C                               | L   |
| VT03C-05xxx  | 2.2 $\mu$ F / 10V<br>1206 MLCC   | 3.3 $\mu$ H<br>0504 SMD Inductor PMT-044 | 10 $\mu$ F / 10V<br>1206 MLCC   | 3.3 $\mu$ H<br>0504 SMD Inductor PMT-044                  |
| VT03C-12xxx  | 0.68 $\mu$ F / 25V<br>1206 MLCC  | 10 $\mu$ H<br>0504 SMD Inductor PMT-047  | 2.2 $\mu$ F / 25V<br>1206 MLCC  | 18 $\mu$ H<br>0504 SMD Inductor PMT-046                   |
| VT03C-24xxx  | 4.7 $\mu$ F / 50V<br>1210 MLCC   | 10 $\mu$ H<br>0504 SMD Inductor PMT-047  | 6.8 $\mu$ F / 50V<br>1812 MLCC  | 18 $\mu$ H<br>0504 SMD Inductor PMT-046                   |
| VT03C-48xxx  | 0.47 $\mu$ F / 100V<br>1812 MLCC | 56 $\mu$ H<br>0504 SMD Inductor PMT-045  | 2.2 $\mu$ F / 100V<br>1812 MLCC | 27 $\mu$ H 0.9A 0.2 $\Omega$<br>0504 SMD Inductor PMT-063 |
| VTW03C-12xxx | 4.7 $\mu$ F / 25V<br>1212 MLCC   | 2.2 $\mu$ H<br>0504 SMD Inductor PMT-059 | 10 $\mu$ F / 25V<br>1812 MLCC   | 2.2 $\mu$ H<br>0504 SMD Inductor PMT-059                  |
| VTW03C-24xxx | 2.2 $\mu$ F / 50V<br>1212 MLCC   | 10 $\mu$ H<br>0504 SMD Inductor PMT-047  | 6.8 $\mu$ F / 50V<br>1812 MLCC  | 18 $\mu$ H<br>0504 SMD Inductor PMT-046                   |
| VTW03C-48xxx | 2.2 $\mu$ F / 100V<br>1212 MLCC  | 10 $\mu$ H<br>0504 SMD Inductor PMT-047  | 2.2 $\mu$ F / 100V<br>1812 MLCC | 18 $\mu$ H<br>0504 SMD Inductor PMT-046                   |

Recommended EN55022 Class A or Class B Filter Circuit Layout:



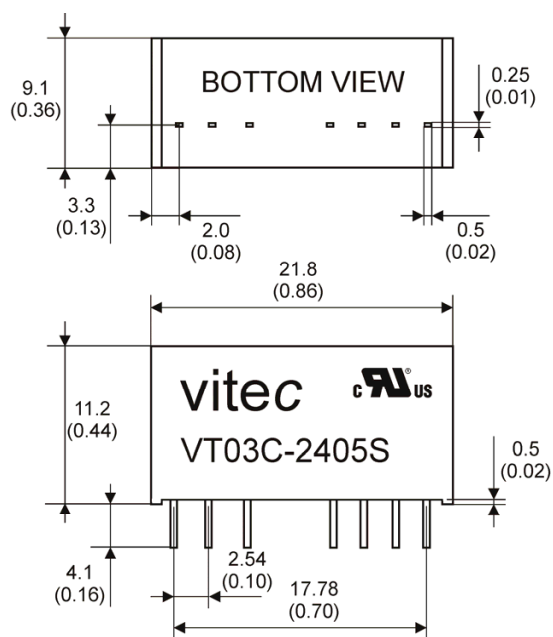
## Derating



## PIN Connections

| SIL 8 Standard PIN Connections |               |             |
|--------------------------------|---------------|-------------|
| Pin                            | Single Output | Dual Output |
| 1                              | -V Input      | -V Input    |
| 2                              | +V Input      | +V Input    |
| 3                              | Ctrl          | Ctrl        |
| 5                              | NC / NP       | NC / NP     |
| 6                              | +V Output     | +V Output   |
| 7                              | -V Output     | Common      |
| 8                              | NC            | -V Output   |

NC ... not Connected for Standard Types  
NP ... no Pin for 3kV Isolation Types (H-Option)



Notes: All dimensions in millimeters (inches). Tolerance  $\pm 0.25\text{mm}$  (0.01).

Specifications can be changed without prior notice. Products are not intended for and must not be used in life support systems, human implantation, nuclear facilities or systems or any other application where product failure or malfunction of the component could lead to loss of life or catastrophic property damage.