

## FEATURES AND APPLICATIONS

- 2:1 Input Range
- High Efficiency up to 84%
- SIL8 Package
- Extended Temperature Range
- RoHS ✓
- UL60950-1 certified



## GENERAL DESCRIPTION

The VT02 series is a family of 2 Watt single and dual output DC-DC converters. These converters combine a SIL8 package with high performance features such as 1500Vdc input/output isolation voltage, continuous short circuit protection with automatic restart and tight line and load regulation. Models operate from a 2:1 input bus voltage of 5, 12, 24 and 48 Vdc offering output voltage levels of 3.3, 5, 9, 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] 5/12/24/48	Input Current full load [mA] 5/12/24/48	Output Ripple & Noise [mVpp]	Efficiency [%] 5/12/24/48	max. Cap. Load [ $\mu$ F]
VT02-xx3R3S	5 12 24 48	3.3	500	35/20/15/8	458/188/93/48	50	76/77/78/76	2200
VT02-xx05S		5.0	400	35/20/15/8	526/216/108/56	50	80/81/81/78	1000
VT02-xx09S		9.0	222	40/20/15/8	513/214/107/52	50	82/82/82/84	470
VT02-xx12S		12.0	167	40/20/15/8	519/211/105/53	50	81/83/83/83	170
VT02-xx15S		15.0	134	40/20/15/8	506/208/104/53	50	83/84/84/83	110
VT02-xx05D		$\pm 5.0$	$\pm 200$	40/30/15/8	533/216/110/55	50	79/81/80/80	$\pm 470$
VT02-xx12D		$\pm 12.0$	$\pm 83$	40/30/15/8	513/211/105/54	50	82/83/83/81	$\pm 100$
VT02-xx15D		$\pm 15.0$	$\pm 67$	40/30/15/8	519/208/107/54	50	81/84/82/81	$\pm 47$

xx ... nominal Input voltage:

<b>VT02-Series:</b>	<b>05</b>	<b>(4.5 – 9 Vdc)</b>
	<b>12</b>	<b>(9 – 18 Vdc)</b>
	<b>24</b>	<b>(18 – 36 Vdc)</b>
	<b>48</b>	<b>(36 – 75 Vdc)</b>

### ELECTRICAL SPECIFICATIONS

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

#### Input Specifications

2:1 Input Voltage Range	5V: 4.5 to 9 Vdc 12V: 9 to 18 Vdc 24V: 18 to 36 Vdc 48V: 36 to 75 Vdc
Input Filter	Capacitor type
Input Surge Voltage (an external capacitor at input reduce the reflected ripple current)	5V: 15 Vdc, 100mS, max. (10µF/MLCC) 12V: 36 Vdc, 100mS, max. (10µF/MLCC) 24V: 50 Vdc, 100mS, max. (10µF/MLCC) 48V: 100 Vdc, 100mS, max. (10µF/MLCC)
Input reflected ripple current	5V: 400 mApp, max. 12V: 150 mApp, max. 24V: 380 mApp, max. 48V: 170 mApp, max.
Start Up time	5 mS, max.

#### Output Specifications

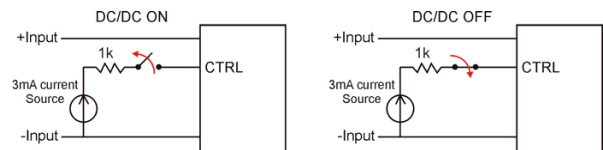
Output Power	2 Watts, max.
Output Voltage Accuracy	±1%
Min. Load for specified regulation	0%
Ripple and Noise (20 MHz BW)	see table
Line Voltage Regulation	±0.2% (LL to HL at full load)
Load Voltage Regulation	Single: ±1% (No load to full load) Dual: ±1% (No load to full load) Single: ±0.5% (10% to 90% load) Dual: ±0.8% (10% to 90% load)
Cross Regulation (Dual) (Asymmetrical load 25%/100% FL)	±5%
Temperature Coefficient	±0.02%/°C, max.
Short Circuit Protection	Continuous (Hiccup)
Transient response recovery time	500 µsec (25% load step change)

#### General Specifications

Efficiency	see table
Switching Frequency	100 kHz, min.
Isolation Voltage	1500 Vdc, min. (1 minute)
Isolation Resistance	10 <sup>9</sup> Ohms, min.
Isolation Capacitance	200 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 1kΩ)  
 Remote off input current 2.5 mA



#### Environmental Specification

Operating Temperature	-40°C to +85°C without Derating
Storage Temperature	-55°C to +125°C
Cooling	Free-air Convection
MTBF	Bellcore TR-NWT-000332: 5.107 x 10 <sup>6</sup> Hrs (Case1, 50% Stress, 40°C) MIL-HDBK-217F: 2.886 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 90% RH

#### Physical Characteristics

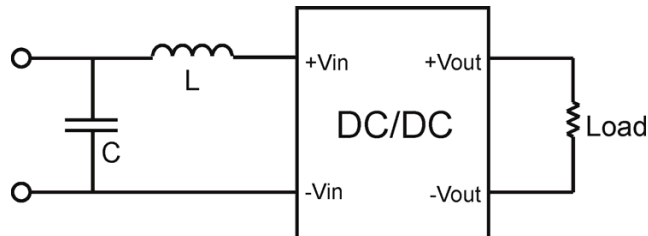
Dimensions	21.8 x 9.1 x 11.2 mm 0.86 x 0.36 x 0.44 inches
Potting Material	Silicon (UL94-V0)
Case Material	Non-conductive black plastic
Weight	4.8 g

#### 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: 220 µF/100 V, low ERS	
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!**

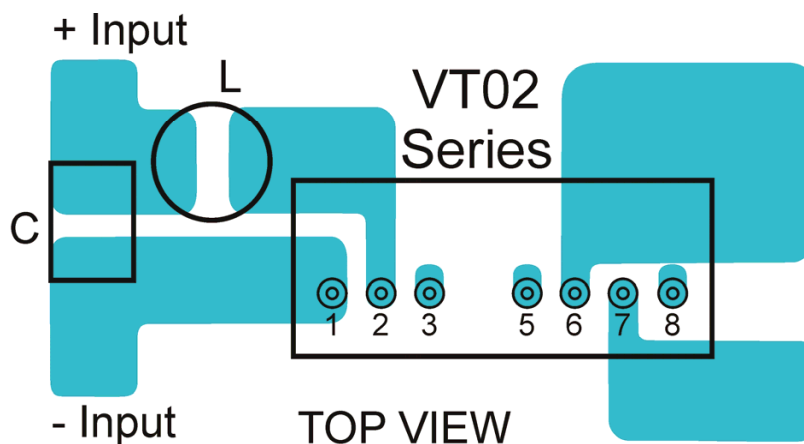
### Recommended Filter for EN55022 Class A or Class B Compliance



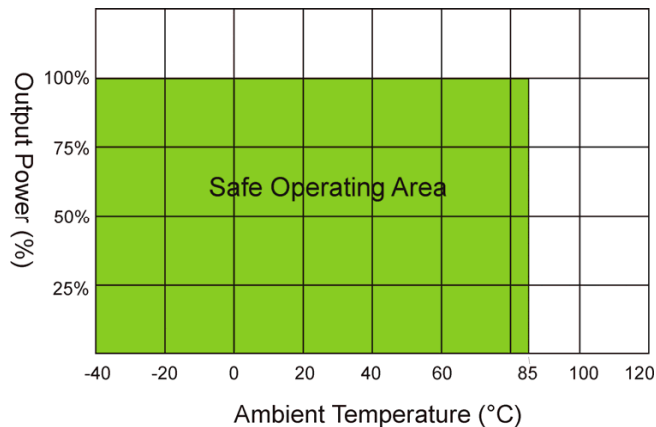
Recommended Components as follows:

	Class A Compliance		Class B Compliance	
	C	L	C	L
VT02-05xxx	10 $\mu$ F / 25V 1812 MLCC	2.2 $\mu$ H 0504 SMD Inductor PMT-059	22 $\mu$ F / 25V 1812 MLCC	3.3 $\mu$ H 2.0A 0.06 $\Omega$ 0504 SMD Inductor PMT-044
VT02-12xxx	10 $\mu$ F / 25V 1812 MLCC	2.2 $\mu$ H 0504 SMD Inductor PMT-059	22 $\mu$ F / 25V 1812 MLCC	3.3 $\mu$ H 2.0A 0.06 $\Omega$ 0504 SMD Inductor PMT-044
VT02-24xxx	6.8 $\mu$ F / 50V 1812 MLCC	3.3 $\mu$ H 0504 SMD Inductor PMT-044	4.7 $\mu$ F / 50V 1812 MLCC	12 $\mu$ H 1.4A 12 $\Omega$ 0504 SMD Inductor PMT-062
VT02-48xxx	2.2 $\mu$ F / 100V 1812 MLCC	10 $\mu$ H 0504 SMD Inductor PMT-047	2.2 $\mu$ F / 100V 1812 MLCC	27 $\mu$ H 0.9A 0.2 $\Omega$ 0504 SMD Inductor PMT-063

Recommended EN55022 Class A or Class B Filter Circuit Layout:



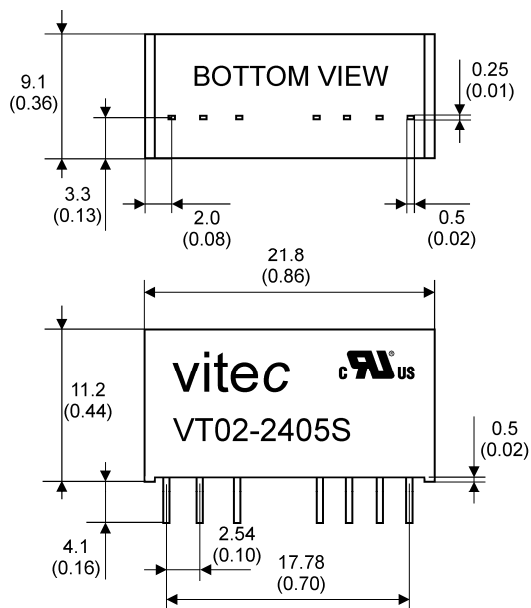
## Derating



## 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	NC
6	+V Output	+V Output
7	-V Output	Common
8	NC	-V Output

NC ... not connected



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.