

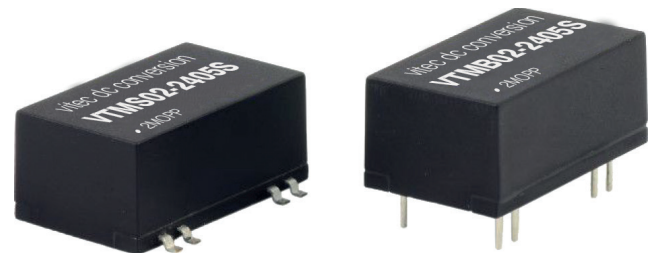
FEATURES

- 2 Watts
- 2:1 Wide Input Range
- 5000 Vac Reinforced Isolation
- 2x MOPP
- 8 mm Clearance / Creepage Distance
- Low Leakage Current <2μA
- Remote on/off
- 5000 meter Operating Altitude
- High Efficiency
- Regulated Output
- Short Current Protection
- Over Voltage Protection
- Under Voltage Protection
- DIL16 or SMD16 Housing
- Medical and Industrial Applications

GENERAL DESCRIPTION

The VTMS02-Series (SMD16 housing) and VTMB02-Series (DIL16 housing) is a family of 2 Watt single and dual DC/DC converters designed for application where isolated output is required from a distributed power system. The converters feature reinforced isolation of 5000 Vac. They meet the 2xMOPP standard and have a clearance/creepage distance of 8 mm, making them suitable for medical applications.

Models operate from an input bus voltage of 5, 12, 24 or 28Vdc and offering a regulated output voltage levels of 3.3, 5, 9, 12, 15, 24, ±12, and ±15 Vdc. Typical applications are in medical, telecom/datacom, industry control and measurement systems for on board power distribution.



PART NUMBER STRUCTUR

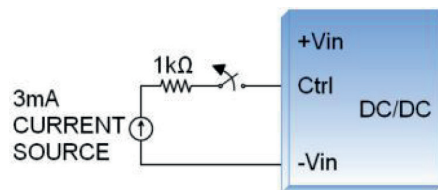
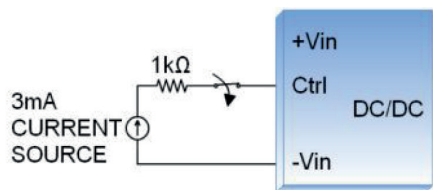
VTMx02	-	24	05	S
Series Name		Input Voltage (VDC)	Output Voltage (VDC)	Output Quantity
VTMS02: SMD type		05: 4.5-12	3R3: 3.3	S: Single
VTMB02: DIL type		12: 9-18	05: 5	
		24: 18-36	09: 9	
		48: 36-75	12: 12	
			15: 15	
			24: 24	
			12: ±12	D: Dual
			15: ±15	

SELECTION GUIDE

Model No.	nominal Input Voltage Range [Vdc]	nominal Output Voltage [Vdc]	Output Current @ full load [mA]	Input Current @ No Load [mA]	Max. Capacitive Load [μF]	Efficiency typ. [%]
VTMS(B)02-053R3S	5.0 (4.5~12)	3.3	600	60	1000	75
VTMS(B)02-0505S		5	400	60	1000	78
VTMS(B)02-0509S		9	222	60	430	78
VTMS(B)02-0512S		12	167	70	220	82
VTMS(B)02-0515S		15	134	80	170	82
VTMS(B)02-0524S		24	83	80	100	82
VTMS(B)02-0512D		±12	±83	80	±170	82
VTMS(B)02-0515D		±15	±67	90	±100	80
VTMS(B)02-123R3S	12 (9~18)	3.3	600	30	1000	76
VTMS(B)02-1205S		5	400	40	1000	78
VTMS(B)02-1209S		9	222	40	430	79
VTMS(B)02-1212S		12	167	40	220	82
VTMS(B)02-1215S		15	134	45	170	82
VTMS(B)02-1224S		24	83	45	100	81
VTMS(B)02-1212D		±12	±83	45	±170	81
VTMS(B)02-1215D		±15	±67	45	±100	81
VTMS(B)02-153R3S	24 (18~36)	3.3	600	20	1000	76
VTMS(B)02-1505S		5	400	20	1000	79
VTMS(B)02-1509S		9	222	25	430	80
VTMS(B)02-1512S		12	167	25	220	81
VTMS(B)02-1515S		15	134	25	170	81
VTMS(B)02-1524S		24	83	25	100	81
VTMS(B)02-1512D		±12	±83	25	±170	81
VTMS(B)02-1515D		±15	±67	25	±100	81
VTMS(B)02-243R3S	48 (36~75)	3.3	600	10	1000	76
VTMS(B)02-2405S		5	400	10	1000	78
VTMS(B)02-2409S		9	222	12	430	79
VTMS(B)02-2412S		12	167	12	220	80
VTMS(B)02-2415S		15	134	12	170	82
VTMS(B)02-2424S		24	83	12	100	81
VTMS(B)02-2412D		±12	±83	12	±170	81
VTMS(B)02-2415D		±15	±67	12	±100	81

Note: Use **VTMS02**-xxxxs for the SMD type, or **VTMB02**-xxxxx for the DIL type!

INPUT SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range	5 Vin (nom)		4.5	5	12	Vdc
	12 Vin (nom)		9	12	18	
	24 Vin (nom)		18	24	36	
	48 Vin (nom)		36	48	75	
Startup voltage	5 Vin (nom)		-	-	4.5	Vdc
	12 Vin (nom)		-	-	9	
	24 Vin (nom)		-	-	18	
	48 Vin (nom)		-	-	36	
Shutdown voltage	5 Vin (nom)		2	3	4	Vdc
	12 Vin (nom)		6	7	8	
	24 Vin (nom)		13	15	17	
	48 Vin (nom)		29	32	35	
Startup time	Constant resistive load	Power up Remote ON/OFF	-	10	20	ms
Input surge voltage	1s, max.	5 Vin (nom)	-	-	15	Vdc
		12 Vin (nom)	-	-	25	
		24 Vin (nom)	-	-	50	
		48 Vin (nom)	-	-	100	
Remote ON/OFF	Referred to -Vin pin and Ctrl pin applied current	DC-DC ON	Open or high impedance			
		DC-DC OFF	2.0	3.0	4.0	mA
		Remote off input current	-	2.5	-	
	 					

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

OUTPUT SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy	-		-1.0	-	+1.0	%
Line regulation	Low Line to High Line at Full Load		-0.2	-	+0.2	%
Load regulation	No Load to Full Load	Single	-1.0	-	+1.0	%
		Dual	-1.0	-	+1.0	
	10% Load to 90% Load	Single	-0.5	-	+0.5	
		Dual	-0.8	-	+0.8	
Cross regulation	Asymmetrical load 25%/100% FL; Dual output		-5.0	-	+5.0	%
Ripple and noise	Measured by 20MHz bandwidth		-	50	-	mVp-p
Temperature coefficient	-		-0.02	-	+0.02	%/°C
Transient response recovery time	25% load step change		-	500	-	µs
over voltage protection	-	3.3 Vout	4.0	-	6.5	Vdc
		5 Vout	6.0	-	8.0	
		9 Vout	10.0	-	14.0	
		12 Vout	13.0	-	19.0	
		15 Vout	16.0	-	22.0	
		24 Vout	25.0	-	35.0	
Short circuit protection	-		continuous, automatics recovery			

GENERAL SPECIFICATIONS

Item	Conditions	Min.	Typ.	Max.	Unit
Isolation voltage	1 minute; Reinforced insulation for 250 Vac working voltage	5000	-	-	Vac
Isolation resistance	500 Vdc	10	-	-	GΩ
Isolation capacitance	-	-	16	20	pF
Leakage current	240 Vac, 60 Hz.	-	-	2	µA
Switching frequency	-	100	-	-	kHz
Clearance/Creepage	-	8.0	-	-	mm
Safety standards	designed to meet	IEC / UL / EN60601-1 IEC / UL / EN62368-1			
Case material	-	Non-conductive black plastic			
Base material	-	Non-conductive black plastic			
Potting material	-	Silicone (UL94 V-0)			
Weight	-	7g (0.24oz)			
MTBF	MIL-HDBK-217F, Full load	6.809 x 10 ⁶ hrs			

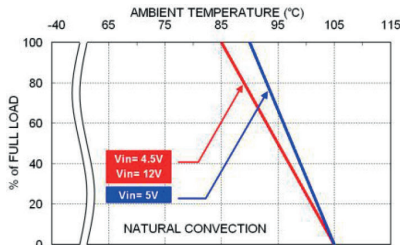
ENVIRONMENTAL SPECIFICATIONS

Item	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	with derating	-40	-	+105	°C
Maximum case temperature	-	-	-	+105	°C
Storage temperature range	-	-55	-	+125	°C
Operating altitude	-	-	-	5000	m
Thermal shock	-	MIL-STD-810F			
Shock	-	MIL-STD-810F			
Vibration	-	MIL-STD-810F			
Relative humidity	-	5% to 95% RH			
Moisture sensitivity level (MSL)	Only for SMD type; Verification according to IPC J-STD-020E	IPC J-STD-033C Level 2			
Lead-free reflow solder process	Only for SMD type	The time above 217°C: 30~60 sec. Peak temperature: 245°C max. Time above 240°C: 10 sec. max.			

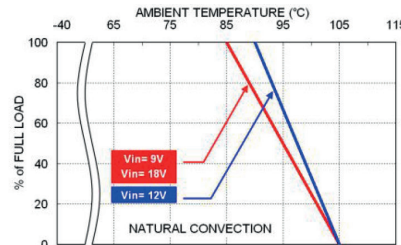
EMC SPECIFICATIONS

Item	Conditions		Level
EMI	EN55011, EN55032, EN60601-1-2, FCC Part 18/15	with external components	Class A Class B
EMS	EN55035, EN60601-1-2		Perf. Criteria A
ESD	EN61000-4-2	Air ± 15 kV and Contact ± 8 kV	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	± 2 kV	Perf. Criteria A
	5 Vin type	With an external input filter capacitor (Nippon chemi-con KY series, 1000 μ F/25V) and a TVS (SMA-J18A, 18V, 400 Watt peak puls power) in parallel	
	12 & 24 Vin type	With an external input filter capacitor (Nippon chemi-con KY series, 470 μ F/50V)	
	48 Vin type	With an external input filter capacitor (Nippon chemi-con KY series, 220 μ F/100V)	
Surge	EN61000-4-5	± 2 kV	Perf. Criteria A
	5 Vin type	With an external input filter capacitor (Nippon chemi-con KY series, 1000 μ F/25V) and a TVS (SMA-J18A, 18V, 400 Watt peak puls power) in parallel	
	12 & 24 Vin type	With an external input filter capacitor (Nippon chemi-con KY series, 470 μ F/50V)	Perf. Criteria A
	48 Vin type	With an external input filter capacitor (Nippon chemi-con KY series, 220 μ F/100V)	
Conducted immunity	EN61000-4-6	10 Vrms	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

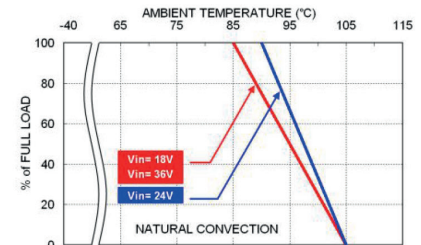
CHARACTERISTIC CURVE



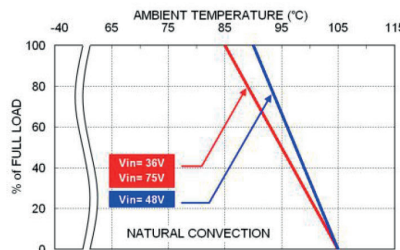
VTMS(B)02-05xxx Derating



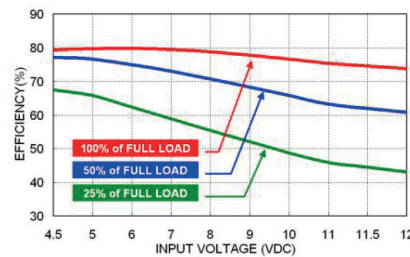
VTMS(B)02-12xxx Derating



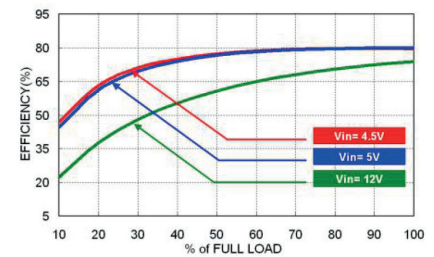
VTMS(B)02-24xxx Derating



VTMS(B)02-48xxx Derating



VTMS(B)02-0505S
Efficiency vs. Input Voltage



VTMS(B)02-0505S
Efficiency vs. Output Load

FUSE CONSIDERATION

This power modules is not internally fused. An input line fuse must always be used.
This encapsulated power module can be used in a wide variety of applications, ranging from simple stand-alone operation to an integrated part of sophisticated power architecture.
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

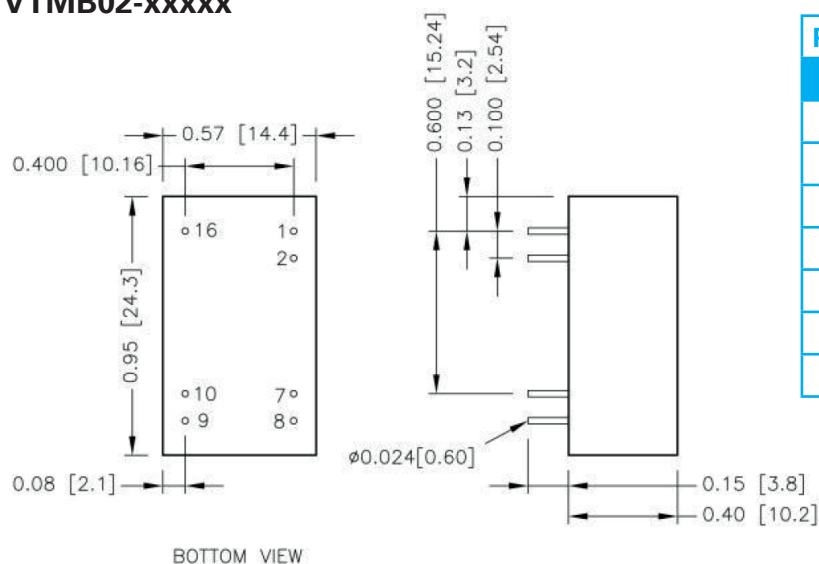
The input line fuse suggest as below:

Model	Fuse Rating [A]	Fuse Type
5 Vin-Models	1.00	Slow-Blow
12 Vin-Models	0.50	Slow-Blow
24 Vin-Models	0.315	Slow-Blow
48 Vin-Models	0.16	Slow-Blow

The table based on the information provided in this data sheet on inrush energy and maximum DC input current at low Vin.

MECHANICAL DRAWING

VTMB02-xxxxx

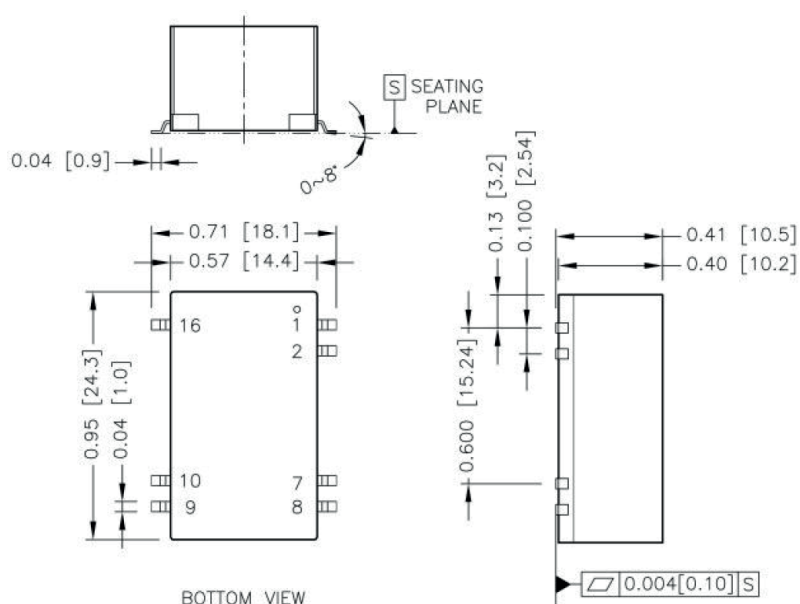


PIN CONNECTION

PIN	Single	Dual
1	-Vin	-Vin
2	Ctrl	-Ctrl
7	NC	NC
8	NC	Common
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

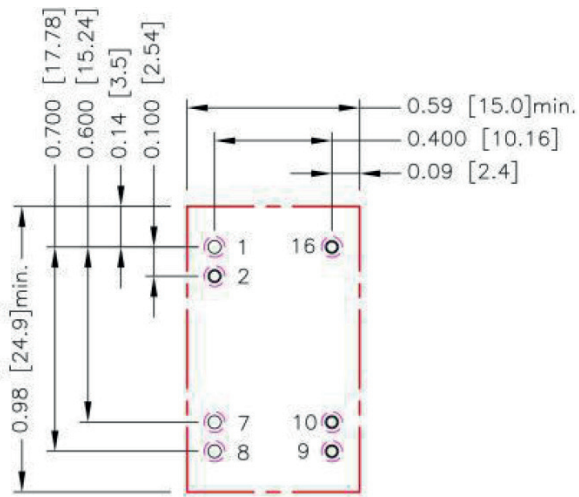
- All dimensions in inch [mm]
Tolerance: x.xx±0.02 [x.x±0.5]
x.xxx±0.01 [x.x±0.25]
- Pin dimension tolerance ±0.004 [±0.10]

VTMS02-xxxxx



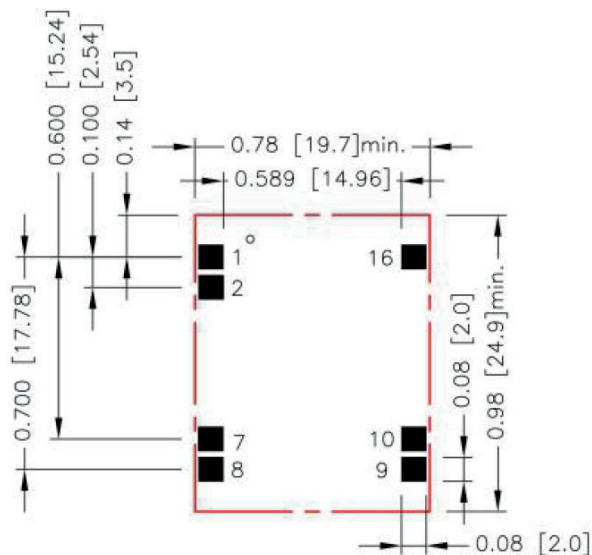
RECOMMENDED PAD LAYOUT

VTMB02-xxxxx



All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.7.8.9.10.16: diameter 0.035[0.90]
Top view pad 1.2.7.8.9.10.16: diameter 0.044[1.13]
Bottom view pad 1.2.7.8.9.10.16: diameter 0.071[1.80]

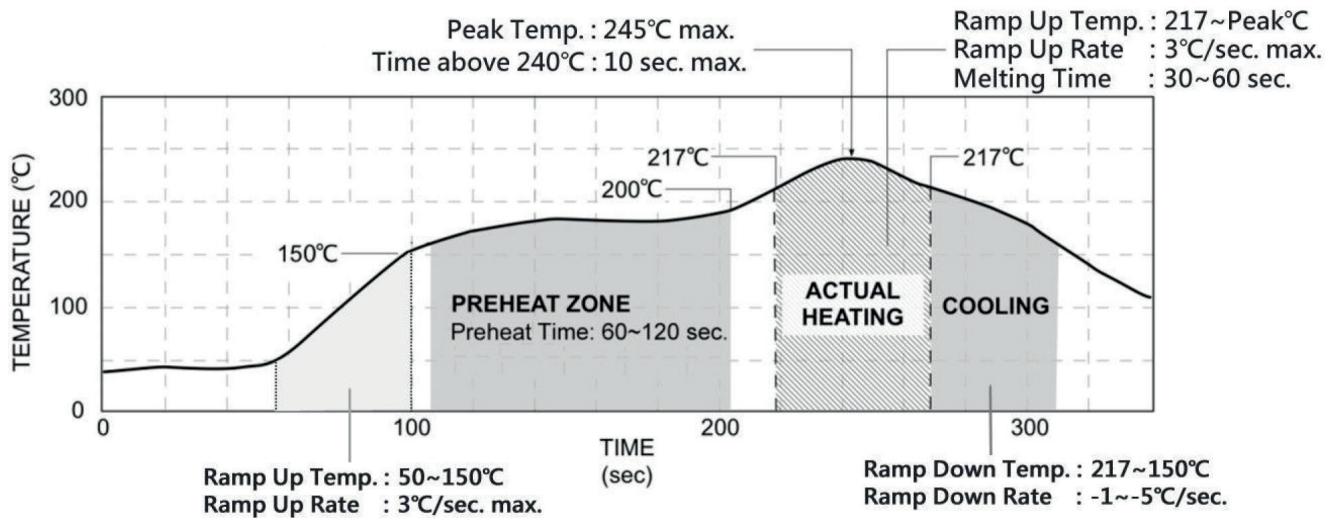
VTMS02-xxxxx



All dimensions in inch[mm]
Pad size(lead free recommended)
Top view pad: 0.080x0.080[2.00x2.00]

IMPORTANT NOTE: There should be at least 8mm distance between primary and secondary circuit!

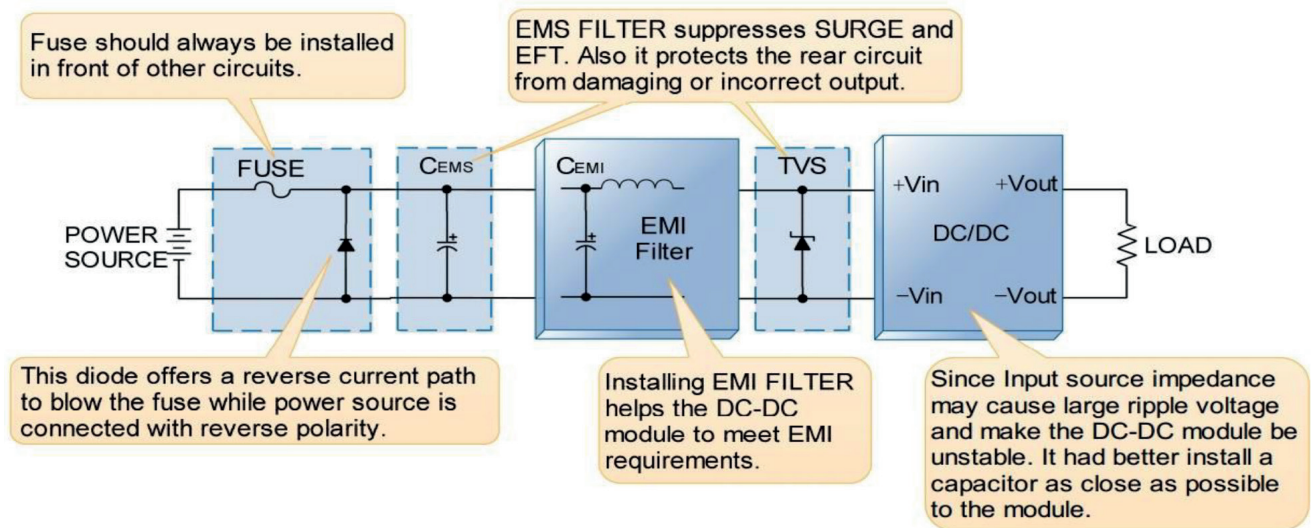
LEAD FREE REFLOW PROFILE - for SMD Type



The curves define the maximum peak reflow temperature permissible measured on pin1 or Vin pin.

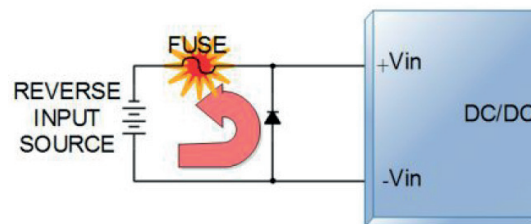
TYPICAL APPLICATION

Below shows some blocks connected between power source and DC/DC module. Install the circuit of the block which is required. Each block has individual function and should be placed on the corresponding location. If C_{EMI} is an Aluminum electrolytic capacitor and connected in parallel with C_{EMS} , The capacitance we recommended for meeting EMS requirements could be C_{EMS} plus C_{EMI} .



REVERSE INPUT VOLTAGE PROTECTION

Avoid the reverse polarity input voltage; otherwise, it will damage the DC/DC converter. It is likely to protect the module from the reverse input voltage by installing an external diode. The diode can blow the line fuse to protect DC/DC converter. Recommend using Schottky diode for reverse input voltage protection.



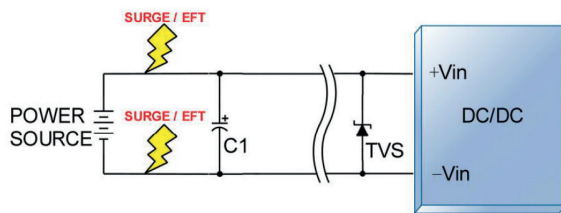
Model	Voltage Rating of the Diode	Current Rating of the Diode
5 Vin-Models	20V	1 ~ 1.5 x Fuse Rating
12 Vin-Models	40V	
24 Vin-Models	60V	
48 Vin-Models	100V	

EMC CONSIDERATIONS

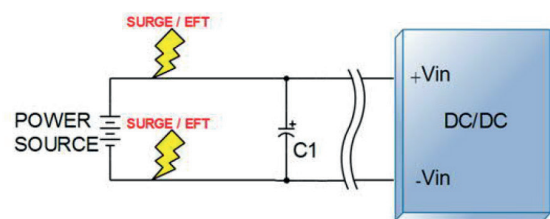
The module can meet EMS requirements as below. An external input filter capacitor is required if the module has to meet EN610004-4, EN61000-4-5.

Item	Conditions		Level
ESD	EN61000-4-2	Air $\pm 15\text{kV}$ and Contact $\pm 8\text{kV}$	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	$\pm 2\text{ kV}$	Perf. Criteria A
Surge	EN61000-4-5	$\pm 2\text{kV}$	Perf. Criteria A
Conducted immunity	EN61000-4-6	10 Vrms	Perf. Criteria A
Power frequency magnetic field	EN61000-4-8	100A/m continuous; 1000A/m 1 second	Perf. Criteria A

Surge & EFT Protections



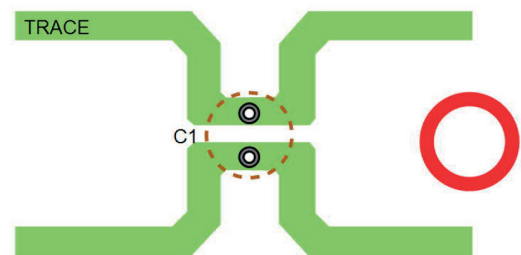
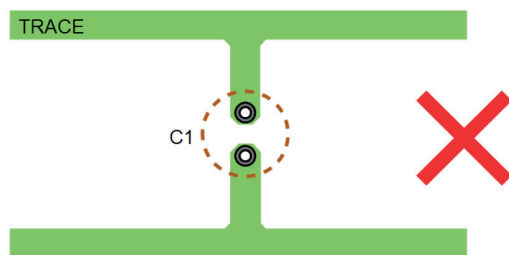
5V-Input Modules



12/24/48-Input Modules

PCB Trace

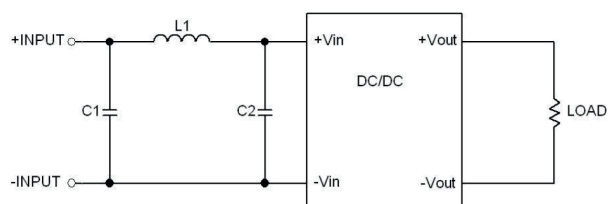
It should be noticed that the current path of the PCB trace. Wrong PCB layout reduces ability of suppressing SURGE or EFT.



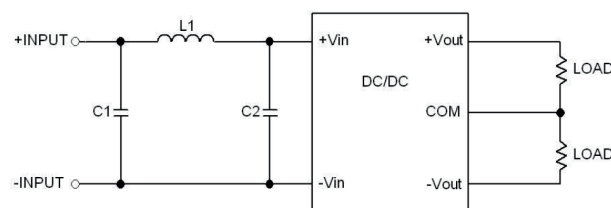
Module	Component	Specification	Reference
5V-Input Module	C1	1000 μF /25V	Chemi-con KY
	TVS	18V/400W	SMDJ18A
12V-Input Module	C1	470 μF /50V	Chemi-con KY
24V-Input Module			
48V-Input Module	C1	220 μF /100V	Chemi-con KY

EMI CONSIDERATIONS

Recommended external EMI filter for EN55032 Class A & Class B



Single Output



Dual Output

External EMI Filter for EN55032 Class A

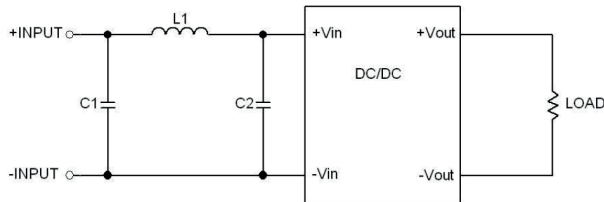
Module	C1	C2	L1
5V-Input Module	22 μ F/16V 1206 MLCC	N/A	3.3 μ H, PMT-110
12V-Input Module	10 μ F/25V 1206 MLCC	N/A	10 μ H, PMT-111
24V-Input Module	10 μ F/50V 1206 MLCC	N/A	15 μ H, PMT-131
48V-Input Module	2.2 μ F/100V 1206 MLCC	N/A	68 μ H, PMT-133

External EMI Filter for EN55032 Class B

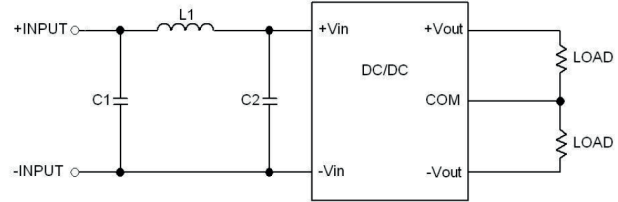
Module	C1	C2	L1
5V-Input Module	22 μ F/16V 1206 MLCC	22 μ F/16V 1206 MLCC	6.8 μ H, PMT-129
12V-Input Module	10 μ F/25V 1206 MLCC	10 μ F/25V 1206 MLCC	10 μ H, PMT-111
24V-Input Module	10 μ F/50V 1206 MLCC	10 μ F/50V 1206 MLCC	15 μ H, PMT-131
48V-Input Module	2.2 μ F/100V 1206 MLCC	2.2 μ F/100V 1206 MLCC	68 μ H, PMT-133

EMI CONSIDERATIONS (continued)

Recommended external EMI filter for EN55032 Class A & Class B

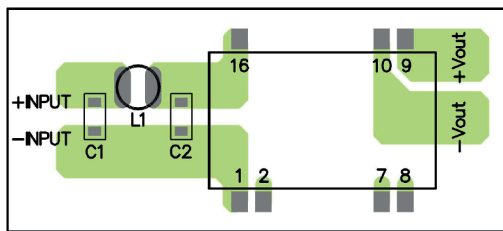


Single Output

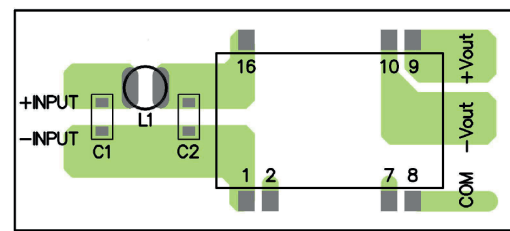


Dual Output

Recommended Layout Pattern for VTMS02

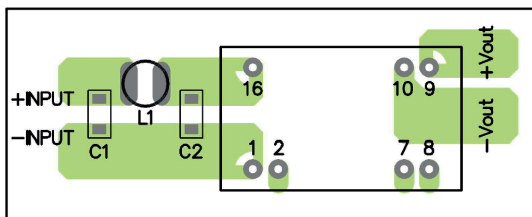


TOP VIEW - Single Output

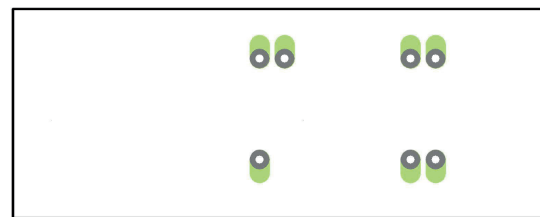


TOP VIEW - Dual Output

Recommended Layout Pattern for VTMB02 Single Output

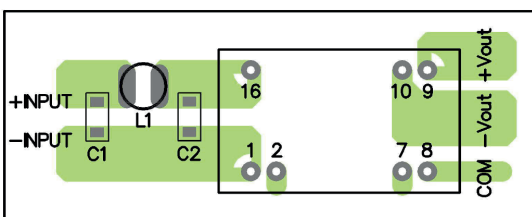


TOP VIEW

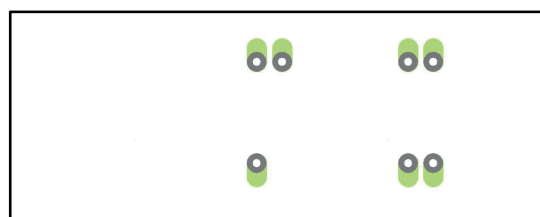


BOTTOM VIEW

Recommended Layout Pattern for VTMB02 Dual Output

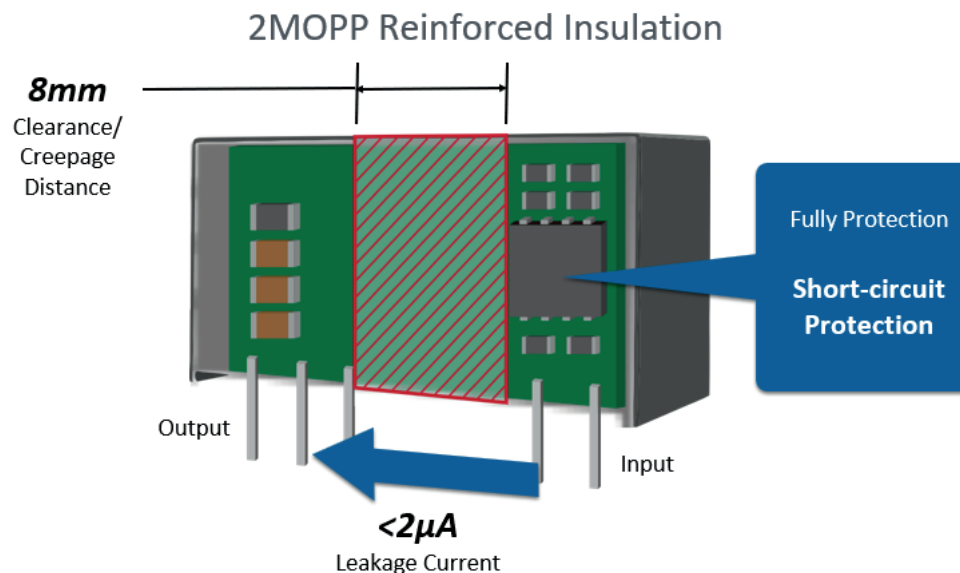


TOP VIEW



BOTTOM VIEW

2MOPP REINFORCED INSULATION



THERMAL CONSIDERATIONS

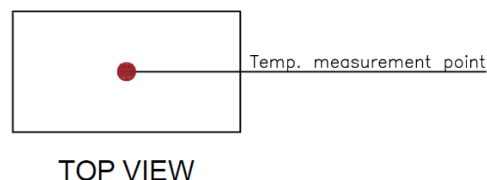
The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the middle point on top of the module.

The temperature at this location should not exceed „Maximum case temperature“

When operating, adequate cooling must be provided to maintain the test point temperature at or below „Maximum case temperature“

You can limit this Temperature to a lower value for extremely high reliability.

Thermal test condition with vertical direction by natural convection (20LFM).



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.