

FEATURES

- 2 Watts
- 5000 Vac Reinforced Isolation
- 2x MOPP
- 8 mm Clearance / Creepage Distance
- Low Leakage Current $<2\mu\text{A}$
- 5000 meter Operating Altitude
- High Efficiency
- Semi Regulated Output
- Short Current Protection
- SIL9 Housing
- Medical and Industrial Applications

GENERAL DESCRIPTION

The VTMU02-Series 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, 15 or 24 Vdc and offering a SEMI regulated output voltage levels of 3.3, 5, 12, 15, ± 5 , ± 12 , and ± 15 Vdc. Typical applications are in medical, telecom/datacom, industry control and measurement systems for on board power distribution.



PART NUMBER STRUCTUR

VTMU02	-	24	05	S
Series Name		Input Voltage (VDC)	Output Voltage (VDC)	Output Quantity
		05: 4.5-7 12: 9.6-14.4 15: 12-18 24: 19.2-28.8	3R3: 3.3 05: 5 12: 12 15: 15 05: ± 5 12: ± 12 15: ± 15	S: Single D: Dual

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. [%]
VTMU02-053R3S	5.0 (4.5~7)	3.3	600	5	2000	78
VTMU02-0505S		5	400	5	820	81
VTMU02-0512S		12	167	20	470	83
VTMU02-0515S		15	134	20	470	83
VTMU02-0505D		±5	±200	5	±470	82
VTMU02-0512D		±12	±83	20	±220	83
VTMU02-0515D		±15	±67	20	±220	81
VTMU02-123R3S	12 (9.6~14.4)	3.3	600	4	2000	79
VTMU02-1205S		5	400	4	820	81
VTMU02-1212S		12	167	10	470	84
VTMU02-1215S		15	134	10	470	83
VTMU02-1205D		±5	±200	4	±470	81
VTMU02-1212D		±12	±83	10	±220	83
VTMU02-1215D		±15	±67	10	±220	82
VTMU02-153R3S	15 (12~18)	3.3	600	4	2000	79
VTMU02-1505S		5	400	4	820	81
VTMU02-1512S		12	167	8	470	84
VTMU02-1515S		15	134	8	470	83
VTMU02-1505D		±5	±200	4	±470	81
VTMU02-1512D		±12	±83	8	±220	83
VTMU02-1515D		±15	±67	8	±220	80
VTMU02-243R3S	24 (19.2~28.8)	3.3	600	3	2000	78
VTMU02-2405S		5	400	3	820	80
VTMU02-2412S		12	167	6	470	82
VTMU02-2415S		15	134	6	470	82
VTMU02-2405D		±5	±200	3	±470	81
VTMU02-2412D		±12	±83	6	±220	81
VTMU02-2415D		±15	±67	6	±220	80

INPUT SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Operating input voltage range	5 Vin (nom)		4.5	5	7	Vdc
	12 Vin (nom)		9.6	12	14.4	
	15 Vin (nom)		12	15	18	
	24 Vin (nom)		19.2	24	28.8	
Input surge voltage	1s, max.	5 Vin (nom)	-	-	15	Vdc
		12 Vin (nom)	-	-	25	
		15 Vin (nom)	-	-	25	
		24 Vin (nom)	-	-	35	
	Note	If the input will be switched electromechanically, the input should install an external capacitor to avoid voltage transient: 100 μ F/25V for 5 V in item 47 μ F/100V for other items				

OUTPUT SPECIFICATIONS

Item	Conditions		Min.	Typ.	Max.	Unit
Voltage accuracy	measured by nom. input & 60% FL	3.3 / 5 / ± 5 Vout	-3.0	-	+3.0	%
	measured by nom. input & 90% FL	Others				
Line regulation	-		-2	-	+2	%
Load regulation	10% load to 100% load		-4	-	+4	%
Minimum load	Reference Characteristic Curve		0	-	-	%
Cross regulation	Asymmetrical load 25%/100% FL; Dual output		-	± 4	-	%
Ripple and noise	Measured by 20MHz band-width	3.3 / 5 / ± 5 Vout	-	100	-	mVp-p
		Others	-	125	-	
Temperature coefficient	-		-0.03	-	+0.03	%/°C
Short circuit protection	-		continuous, automatic recovery			

ENVIRONMENTAL SPECIFICATIONS

Item	Conditions	Min.	Typ.	Max.	Unit
Operating ambient temperature	without derating	-40	-	+85	°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			

GENERAL SPECIFICATIONS

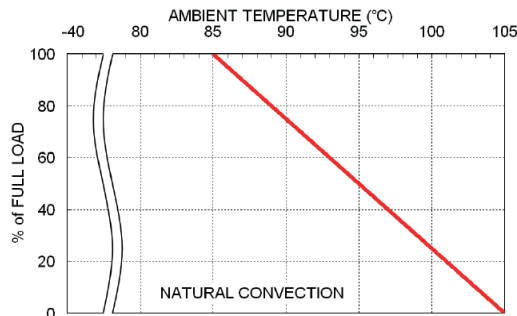
Item	Conditions		Min.	Typ.	Max.	Unit
Isolation voltage	1 minute	Input to Output	5000	-	-	Vdc
Isolation resistance	500 Vdc		10			GΩ
Isolation capacitance	-		-	10	20	pF
Leakage current	240 Vac, 60 Hz.		-	-	2	μA
Switching frequency	-		180	-	400	kHz
Clearance/Creepage	-		8.0	-	-	mm
Safety standards	designed to meet		IEC / UL / EN60601-1 IEC / UL / EN62368-1			
Case material	-		Non-conductive black plastic			
Base material	-		none			
Potting material	-		Silicone (UL94 V-0)			
Weight	-		4.8g (0.17oz)			
MTBF	MIL-HDBK-217F, Full load		1.014 x 10 ⁷ hrs			

EMC SPECIFICATIONS

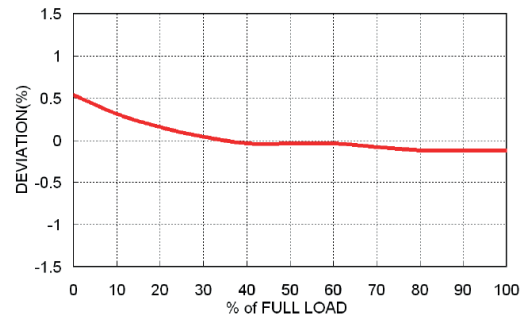
Item	Conditions		Level
EMI	EN55011, EN55032, EN60601-1-2	with external components	Class A Class B
EMS	EN55035, EN60601-1-2		Perf. Criteria A
ESD	EN61000-4-2	Air ±15kV and Contact ±8kV	Perf. Criteria A
Radiated Immunity	EN61000-4-3	10 V/m	Perf. Criteria A
Fast transient	EN61000-4-4	±2 kV	Perf. Criteria A
	External input filter circuite is required, for further information, please contact sales		
Surge	EN61000-4-5	±2kV	Perf. Criteria A
	External input filter circuite is required, for further information, please contact sales		
Conduced 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

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

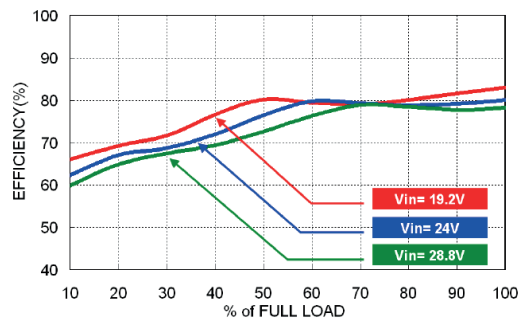
CHARACTERISTIC CURVE



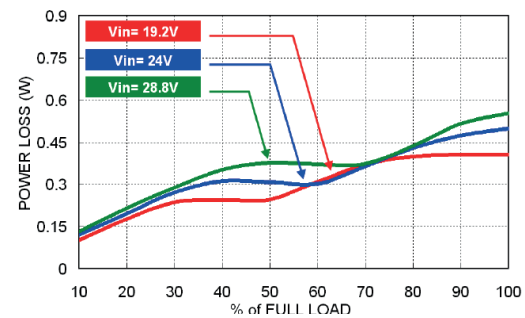
VTMU02-2405S Derating



VTMU02-2405S Vout Deviation vs. Output Load



VTMU02-2405S Efficiency vs. Output Load



VTMU02-2405S Power Dissipation vs. Output Load

FUSE CONSIDERATION

This power module 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.

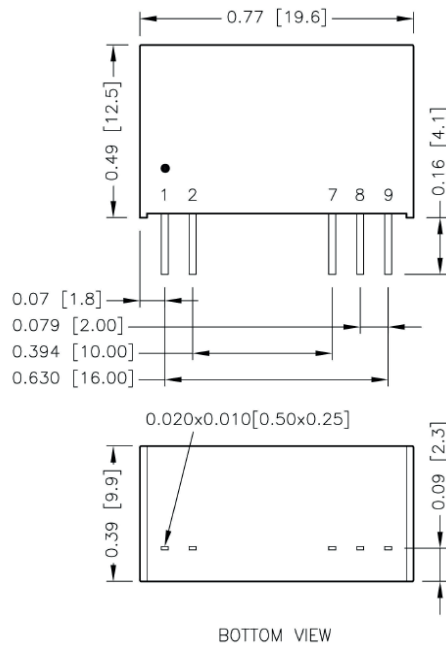
To maximum flexibility, internal fusing is not included; however, to achieve maximum safety and system protection, always use an input line fuse.

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
15 Vin-Models	0.50	Slow-Blow
24 Vin-Models	0.315	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

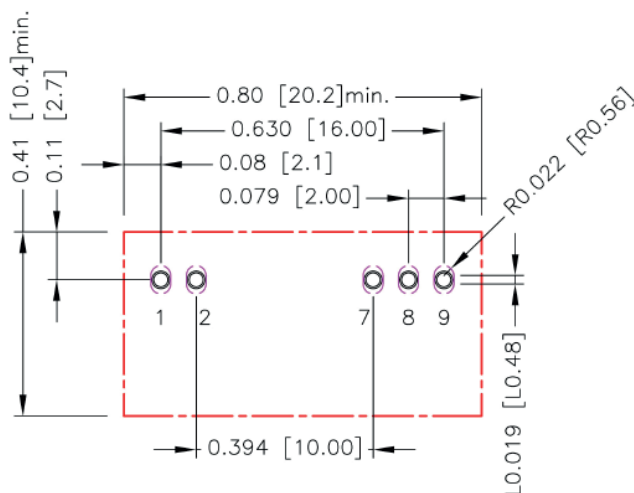


PIN CONNECTION

PIN	Single	Dual
1	+ Vin	+ Vin
2	- Vin	- Vin
7	- Vout	- Vout
8	No Pin	Common
9	+Vout	+ Vout

- 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]

RECOMMENDED PAD LAYOUT

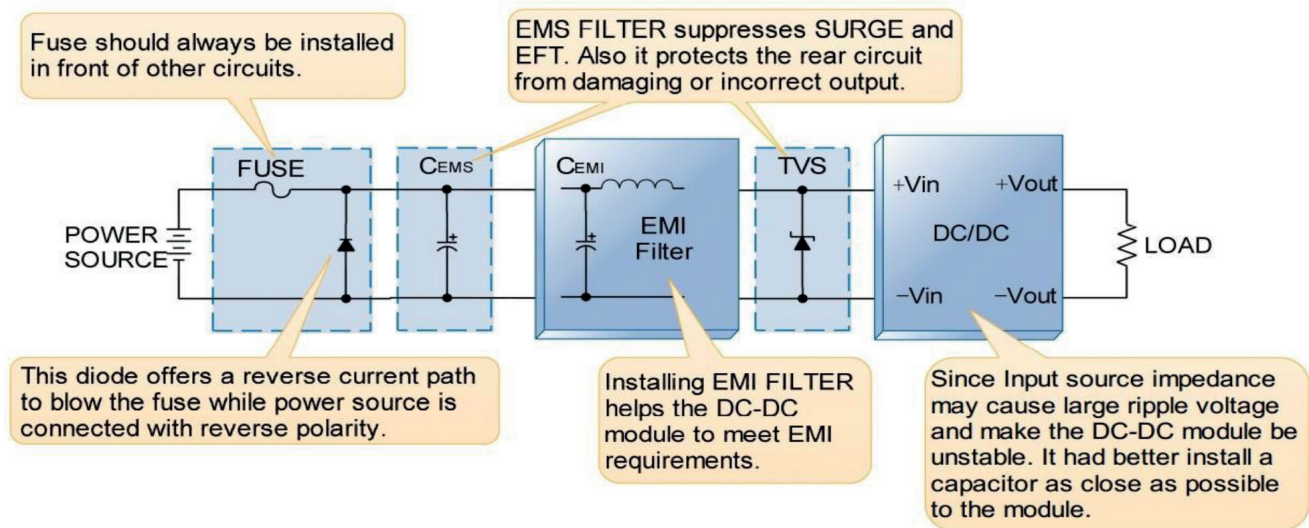


All dimensions in inch[mm]
Pad size(lead free recommended)
Through hole 1.2.78.9: diameter 0.031[0.80]
Top view pad 1.2.78.9: diameter 0.039[1.00]
Bottom view pad 1.2.78.9: Groove R0.022[0.56] L0.019[0.48]

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

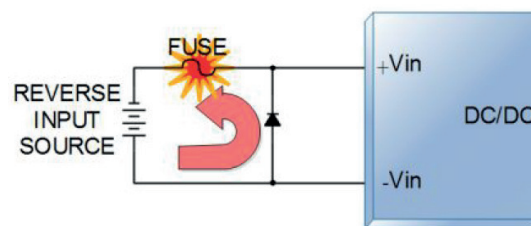
TYPICAL APPLICATION

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.



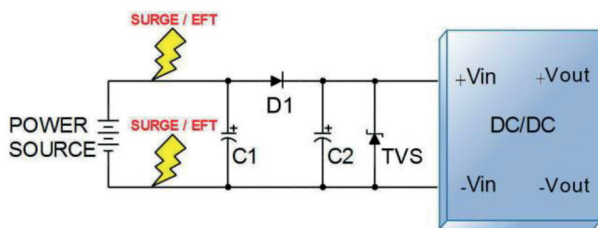
Model	Voltage Rating of the Diode	Current Rating of the Diode
5 Vin-Models	20V	1 ~ 1.5 x Fuse Rating
12 Vin-Models	40V	
15 Vin-Models	40V	
24 Vin-Models	60V	

EMC CONSIDERATIONS

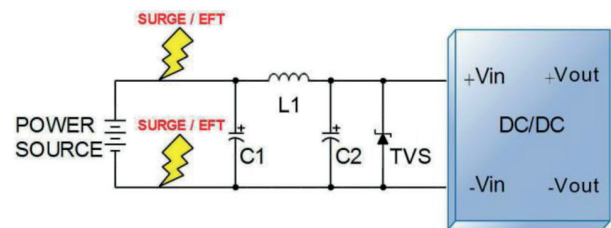
The module can meet EMS requirements as below. An external input filter capacitor is required if the module has to meet EN610004-4, EN61000-4-5.

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



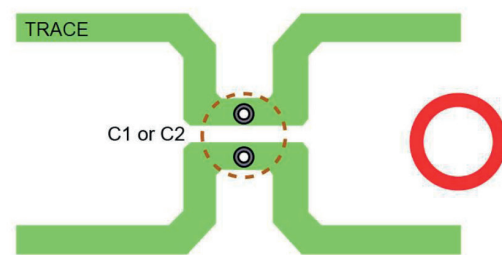
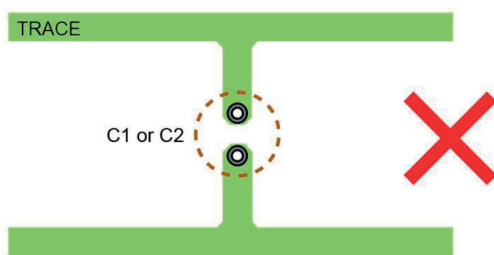
5V-Input Modules



12/15/24-Input Modules

PCB Trace

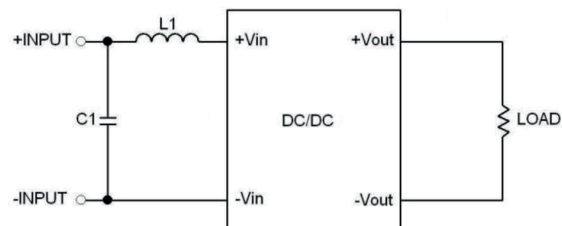
It should be noticed that the current path of the PCB trace. Wrong PCB layout reduces ability of suppressing SURGE or EFT.



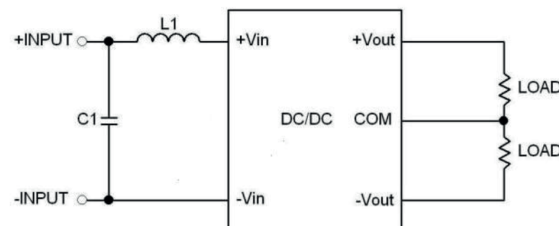
Module	Component	Specification	Reference
5V-Input Module	C1	680 μF /50V	Chemi-con KY
	C2	2200 μF /50V	Chemi-con KMG
	D1	65V/3A	NA03QSA065
	TVS	15V/3000W	SMDJ15A
12V-Input Module	C1 & C2	2200 μF /50V	Chemi-con KMG
15V-Input Module	L1	22 μH	PMT-188
24V-Input Module	TVS	36V/3000W	SMDJ36A

EMI CONSIDERATIONS

Recommended external EMI filter for EN55032 Class A



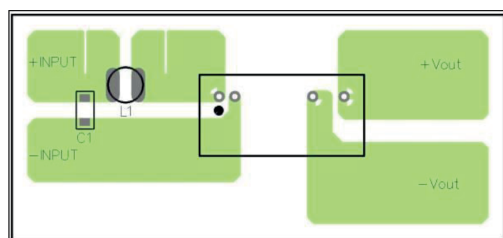
Single Output



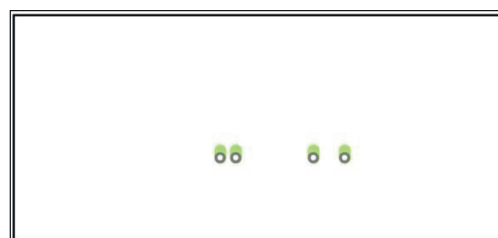
Dual Output

Module	C1	L1
5V-Input Module	22 μ F/25V 1206 MLCC	10 μ H, PMT-172
12V-Input Module	10 μ F/50V 1206 MLCC	22 μ H, PMT-188
15V-Input Module		
24V-Input Module		

Recommended Layout Pattern for Single Output

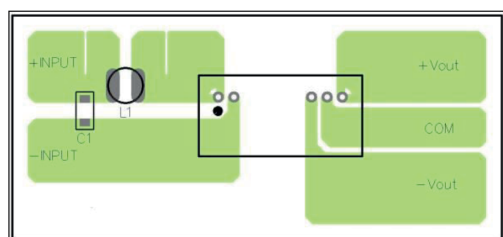


TOP VIEW

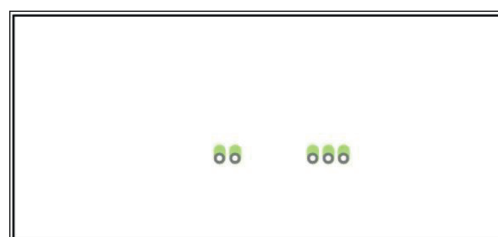


BOTTOM VIEW

Recommended Layout Pattern for Dual Output



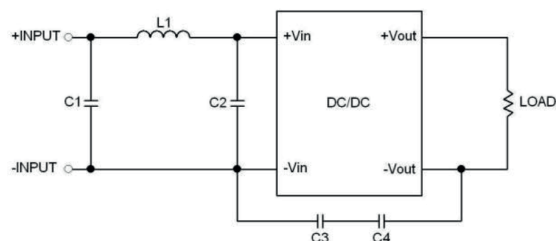
TOP VIEW



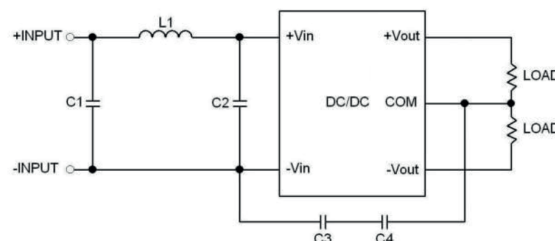
BOTTOM VIEW

EMI CONSIDERATIONS (continued)

Recommended external EMI filter for EN55032 Class B



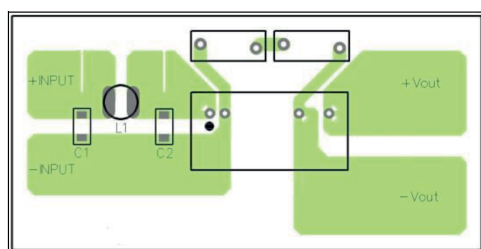
Single Output



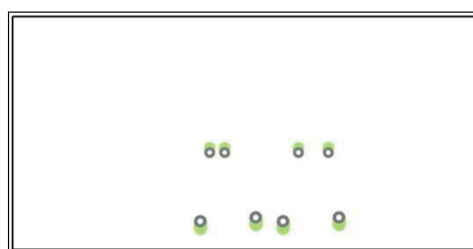
Dual Output

Module	C1, C2	C3, C4	L1
5V-Input Module	22 μ F/25V 1206 MLCC	100pF Y1 /TDK CD45 series	10 μ H, PMT-172
12V-Input Module	10 μ F/50V 1206 MLCC	100pF Y1 /TDK CD45 series	22 μ H, PMT-188
15V-Input Module			
24V-Input Module			

Recommended Layout Pattern for Single Output

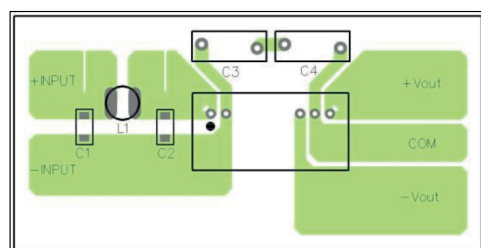


TOP VIEW

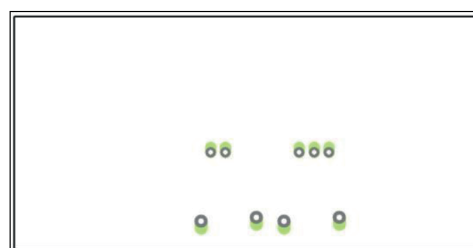


BOTTOM VIEW

Recommended Layout Pattern for Dual Output

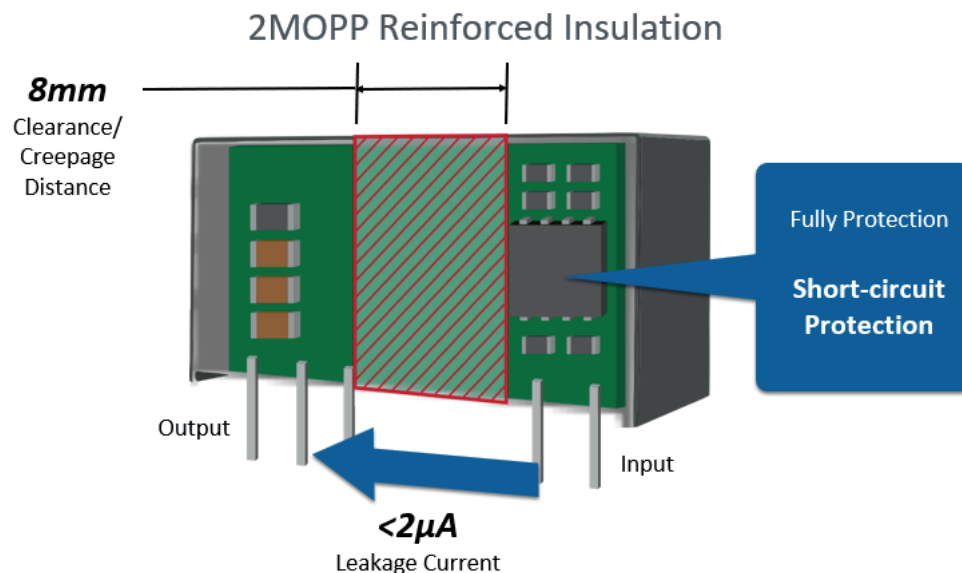


TOP VIEW



BOTTOM VIEW

2MOPP REINFORCED INSULATION



THERMAL CONSIDERATIONS

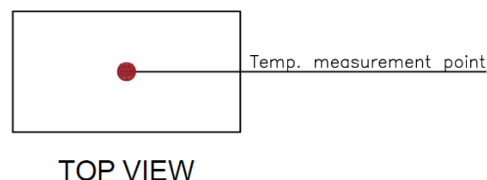
The power module operates in a variety of thermal environments. However, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. Proper cooling can be verified by measuring the middle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