

# VR-78M Series

0.5A Output Current, Non-Isolated DC/DC converter



## Features

- 3 Pin SIL
- Non isolated, No need for heatsinks
- Wide Input Range, Step-down switching dc-dc converter
- Full SMD Technology
- Continuous Short Circuit Protection
- Pin-out compatible with LM78MXX three terminals positive Regulator
- Efficiency up to 97%
- -40 ~ 85°C Operation Temperature Range



The VR series is a family of cost effective 0.75~7.5W single output buck DC-DC converters. These converters are encapsulated in a non-conductive black plastic package 3-pin SIL case, continuous short circuit protection with automatic restart and good line / load regulation. Devices are filled up with flame retardant resin. Input voltages of 4.75~30, 4.75~34, 6.5~34, 8~34, 9~34, 11~34, 15~34 and 18~34 with output voltage of 1.5, 1.8, 2.5, 3.3, 5, 6.5, 7.2, 9, 12, 15Vdc. High performance features include high efficiency operation up to 97%. Standard features include an input range of 4.75~34Vdc tolerance and low output noise and ripple.

All specifications typical at Ta=25°C, nominal input voltage and full load unless otherwise specified.

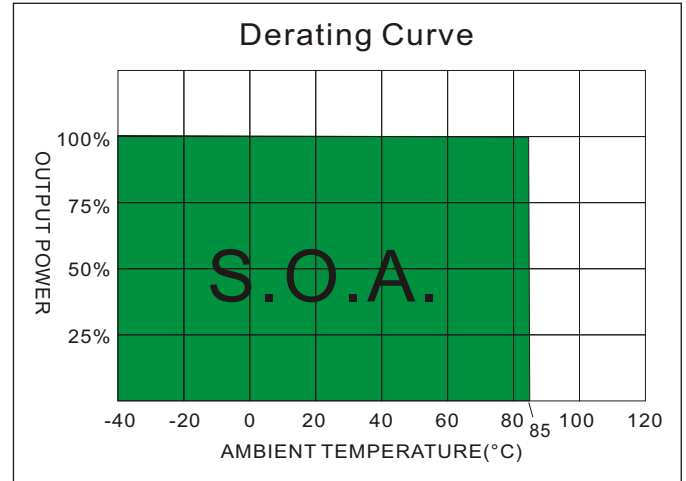
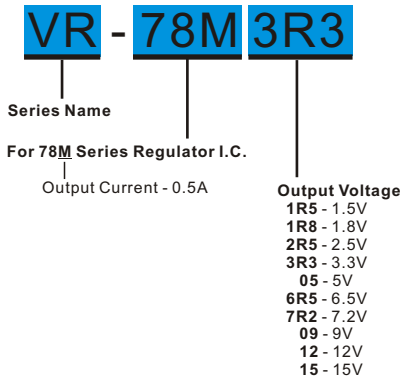
OUTPUT SPECIFICATIONS		PHYSICAL SPECIFICATIONS	
Voltage Accuracy	±2%, max.	Case Material	Non-conductive Black Plastic(UL94V-0 rated)
Line Regulation	±0.5%, max.	Pin Material	0.5mm Alloy42 Solder-coated
Load Regulation	(From 10% to 100% Load) ±0.6%, max.	Potting Material	Epoxy (UL94V-0 rated)
Ripple & Noise (20 MHz bandwidth)(1)	60mVpk-pk, max.	Weight	2.0g
Short Circuit Protection	Indefinite(Automatic Recovery)	Dimensions	0.46"x0.29"x0.40"
Temperature Coefficient	±0.02%/°C	EMC CHARACTERISTICS	
Capacitor Load(2)	See table, max.	Radiated Emissions	EN55032 CLASS B
INPUT SPECIFICATIONS		Conducted Emissions(4)	EN55032 CLASS B
Input Voltage Range	See table	ESD	IEC61000-4-2 Perf. Criteria A
Input Current (No-Load)	See table, max.	RS	IEC61000-4-3 Perf. Criteria A
Input Current (Full-Load)	See table, typ.	EFT(5)	IEC61000-4-4 Perf. Criteria A
Input Filter	Capacitors	CS	IEC61000-4-6 Perf. Criteria A
Input Reflected Ripple Current(3)	35mApk-pk, typ.	PFMF	IEC61000-4-8 Perf. Criteria A
GENERAL SPECIFICATIONS		ABSOLUTE MAXIMUM RATINGS(6)	
Efficiency	See table, typ.	These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability.	
Switching Frequency	330kHz, typ.	Input Voltage	34Vdc, max.
Humidity	95% rel H	Soldering Temperature	260°C, max.
Reliability Calculated MTBF(MIL-HDBK-217 F)	>4.5Mhrs	(1.5mm from case 10sec max.)	
ENVIRONMENT SPECIFICATIONS			
Operating Temperature	-40°C~85°C (See Derating Curve)		
Maximum Case Temperature	100°C		
Storage Temperature	-40°C~125°C		
Cooling	Nature Convection		

## NOTE

1. Ripple/Noise measured with 20MHz bandwidth. Load condition : 10% ~ 100%, output noise arise when load is under 10%.
2. Tested by minimal Vin and constant resistive load.
3. Measured Input reflected ripple current with a simulated source inductance of 12μH.
4. Input filter components (C1, C2, L) are used to help meet conducted emissions requirement for the module.  
These components should be mounted as close as possible to the module; and all leads should be minimized to decrease radiated noise.
5. An external filter capacitor is required if the module has to meet IEC61000-4-4.  
The filter capacitor Motien suggest: Nippon chemi-con KY series, 220μF/100V.
6. Do not operate the unit(s) exceeding the absolute maximum rating, over rating causes damage to the units.
7. Operation under no-load conditions will not damage these devices, however they may not meet all listed specifications.

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## PART NUMBER STRUCTURE



## MODEL SELECTION GUIDE

MODEL NUMBER	INPUT Voltage Range (Vdc)	INPUT Current			OUTPUT Voltage (Vdc)	OUTPUT Current		EFFICIENCY		Capacitor Load @FL (μF, max.)
		No-Load (mA, max.)	Full Load (mA, typ.) @Min. Vin	@Max. Vin		Min. Load (mA)	Full Load (mA)	Full Load (% , typ.) @Min. Vin	@Max. Vin	
VR-78M1R5	4.75 - 30	8	202	38	1.5	50	500	78	65	220
VR-78M1R8	4.75 - 34	8	231	38	1.8	50	500	82	70	220
VR-78M2R5	4.75 - 34	8	302	48	2.5	50	500	87	76	220
VR-78M3R3	4.75 - 34	8	381	60	3.3	50	500	91	81	220
VR-78M05	6.5 - 34	8	409	86	5.0	50	500	94	85	220
VR-78M6R5	8 - 34	8	427	108	6.5	50	500	95	88	220
VR-78M7R2	9 - 34	8	421	118	7.2	50	500	95	89	220
VR-78M09	11 - 34	8	426	144	9.0	50	500	96	92	220
VR-78M12	15 - 34	8	412	188	12	50	500	97	94	220
VR-78M15	18 - 34	8	430	232	15	50	500	97	95	220

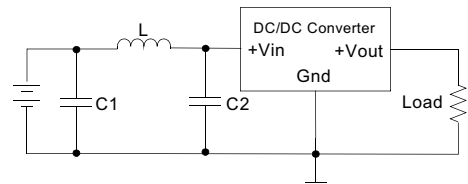
## EMC COUNTERMEASURES

### EMC Countermeasures

Input filter components (C1, C2, L) are used to help meet conducted emissions requirement for the module.

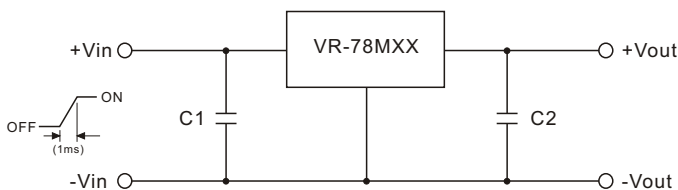
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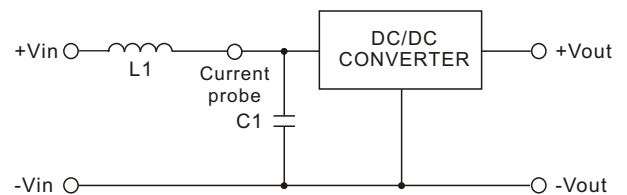
	C1	L	C2
VR-78MXX	470μF,35V	6.4μH	470μF,35V

## STANDARD APPLICATION CIRCUIT



1. To protect the converter during power-up, use soft start Vin and C1=47μF
2. C2=100μF(Optional)

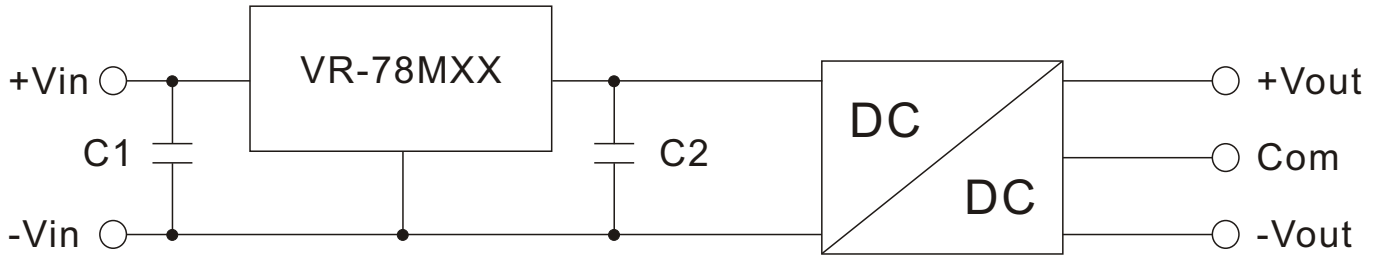
## TEST CONFIGURATIONS



Input reflected ripple current is measured through a source inductor L1(12μH) and a source capacitor C1=47μF at nominal input and full load.

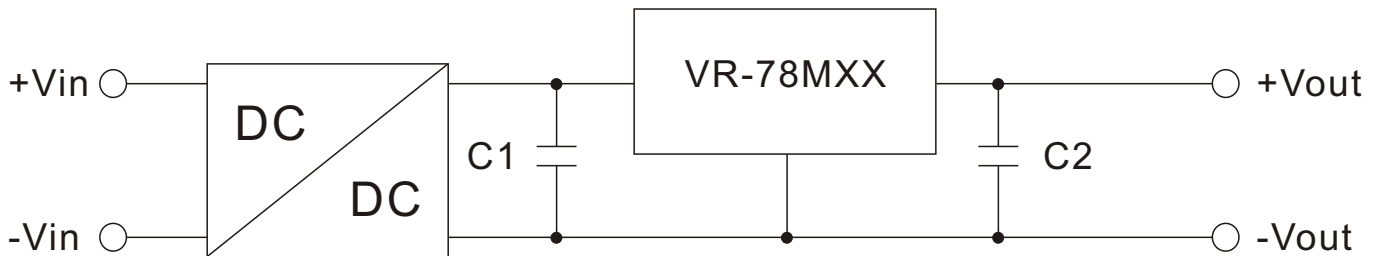
## APPLICATION EXAMPLES

High efficiency, isolated, dual unregulated outputs, one economic way to build up isolated dual output



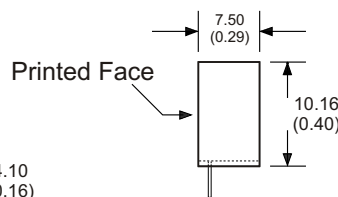
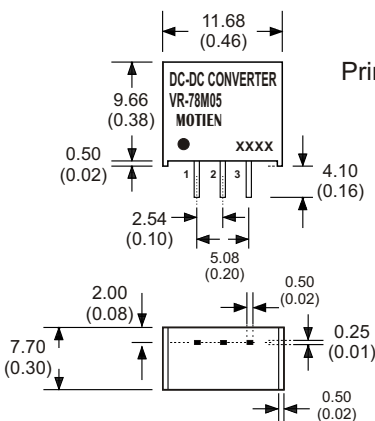
- Isolated dual outputs
- Wide input range 4.75V to 34V
- C1: Optional
- C2: Required (further decoupling filtering may be necessary between the two converters)

Isolated (up to 6KV), wide input range regulated output



- High isolation voltage
- Wide input voltage range
- Improved loading / line regulation
- Point-of-load Architecture
- C1: Required (further decoupling filtering may be necessary between the two converters)
- C2: Optional

## MECHANICAL SPECIFICATIONS



- Notes : All dimensions are typical in millimeters ( inches ).
1. Pin diameter:  $0.5 \pm 0.05$  (  $0.02 \pm 0.002$  )
  2. Pin pitch and length tolerance:  $\pm 0.35$  (  $\pm 0.014$  )
  3. Pin to case tolerance:  $\pm 0.5$  (  $\pm 0.02$  )
  4. Case Tolerance:  $\pm 0.5$  (  $\pm 0.02$  )

PIN CONNECTIONS	
PIN NUMBER	SINGLE
1	+V Input
2	GND
3	+V Output