

# EPM12V1

## Non-isolated DC-DC converter



### Product features

- Non-isolated DC-DC converter
- 3 - 14 Vdc input voltage range
- Efficiency up to 89.5%
- Operating ambient temperature from -40 °C to +82 °C
- Short circuit protection and remote ON/OFF function
- Programmable output voltage from 0.9 - 5.5 Vdc
- EN62368 safety approval

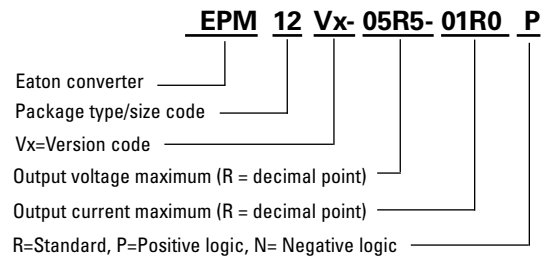
### Applications

- Industrial
  - Automation & testing equipment
  - Displays
  - Lighting
  - IoT
  - Power Supply
- Energy
  - Solar and wind inverters
  - Battery management
- Medical
  - Hospital & home care equipment
  - Inventory tracking
  - Diagnostics
- Telecom
  - Networking and telecommunications
  - Infrastructure

### Environmental compliance



### Ordering part number



## Specifications

	Parameter	Conditions	Minimum	Typical	Maximum	Unit
<b>Input</b>	Input voltage range		3	12	14	Vdc
	Start-up voltage		3			Vdc
	Start-up time				6	ms
	Remote ON/OFF	DC-DC ON DC-DC OFF		Open or 1.6 V < Vctrl < 5 V Short or 0 V < Vctrl < 0.1 V		
<b>Output</b>	Efficiency	Vo= 0.9 Vdc		64		%
		Vo= 5 Vdc		89.5		%
		Vo= 5.5 Vdc		90		%
	Output voltage trim <sup>1</sup>		0.9		5.5	Vdc
	Minimum load		0			%
	Line regulation	LL-HL			±0.3	%
	Load regulation	10-100% Load			±0.3	%
	Voltage accuracy			±0.3		
	Operating frequency	100% Load at Nominal Vin		800		kHz
	Ripple & Noise <sup>2</sup>	20 MHz BW	10		40	mVp-p
<b>Environment</b>	Input current	Remote off mode			1	mA
	Operating temperature	Derating curve	-40		82	°C
	Storage temperature		-55		125	°C
	Vibration			MIL-STD-202G-55		
<b>Function</b>	Short circuit protection			continuous, automatic recovery		
	Safety			EN 62368-1		
	MTBF	MIL-HDBK217F	2600			k hours
<b>Physical</b>	Dimension		0.488 (L) x 0.488 (W) x 0.157 (H)			inches
	Weight			1		g
	Case material		Open frame			
	Cooling method		Free air convection			
<b>EMC</b>	EMI	EN 55032	Class A with external circuit			
	ESD	EN61000-4-2 Air ± 8 kV Contact ± 8 kV				Criteria A
	Fast transient <sup>3</sup>	EN 61000-4-4, ±2 kV				Criteria A
	Surge <sup>3</sup>	EN 61000-4-5, ±2 kV				Criteria A

1. The output voltage range is limited by Vin (Vout < Vin \* 0.7)

2. The ripple & noise are measured with 0.1 µF capacitor at 20 MHz BW, show at Vout= 1 V.

3. External input capacitor required 2200 µF/ 25 V with TVS.

4. All specifications valid at nominal input voltage, full load and +25 °C after warm-up time unless otherwise stated.

5. The product information and specifications are subject to change without prior notice.

## Selection guide

Part number	Input voltage	Output voltage	Output current @ full load	Input current @ no load	Efficiency <sup>1</sup> typical	Capacitive load <sup>2</sup> maximum
EPM12V1-05R5-01ROP	3 - 14 Vdc 12 Vdc nominal	0.9 - 5.5 Vdc 5 Vdc nominal	1000 mA	15 mA	89.5%	200 µF

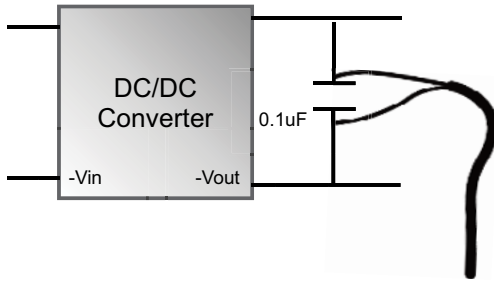
1. The efficiency is test by nominal input and maximum full load at +25 °C.

2. The capacitive load is test by minimum input and constant resistive load.

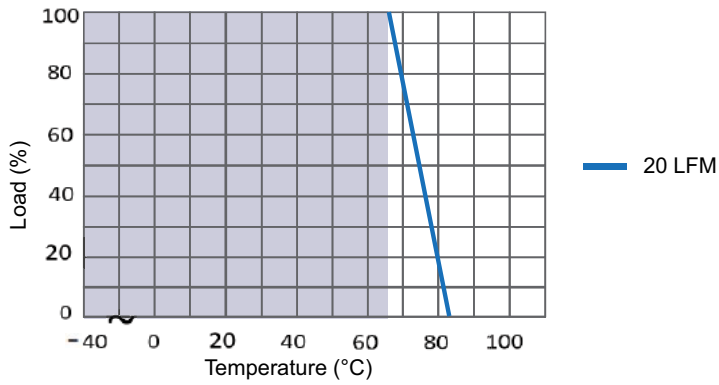
3. All specifications valid at nominal input voltage, full load and +25 °C after warm-up time unless otherwise stated.

4. Special input and output voltage combinations available by request, please contact your local sales representative.

**Measure method**

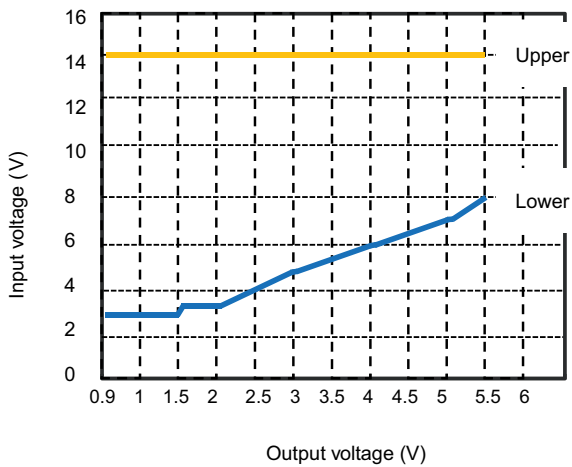


**Derating curve**



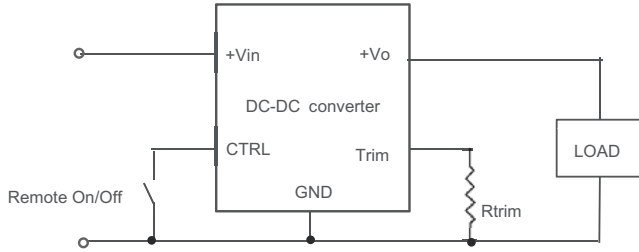
The derating curve was measured at 12 V input and 5 V output.

**Output voltage vs. input voltage**



## Application information

### Output voltage trim



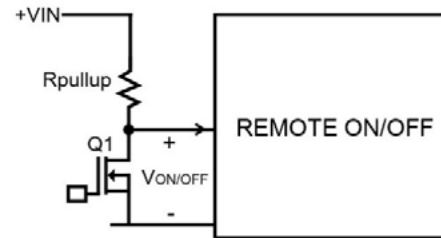
Trim resistor equation

$$R_{trim}(k\Omega) = \left( \frac{49.1355}{V_o - 0.895} \right) - 10.7$$

Output voltage	Calculated Rtrim (kΩ)
5.5 V	0
5 V	1.3
3.3 V	9.8
2.5 V	20.2
1.8 V	44.2
1.5 V	71.3
1.2 V	150
0.895 V	∞ (Open)

The output voltage may be adjusted over a limited range by connection an external trim resistor (Rtrim) between the trim pin and ground.

### Remote On/OFF

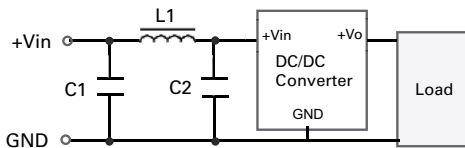


Logic type active mode:

DC/DC ON : Q1 OFF

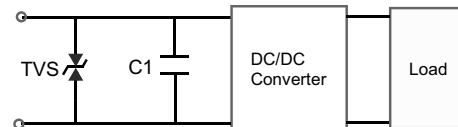
DC/DC OFF : Q1 ON

### EMC filtering circuit



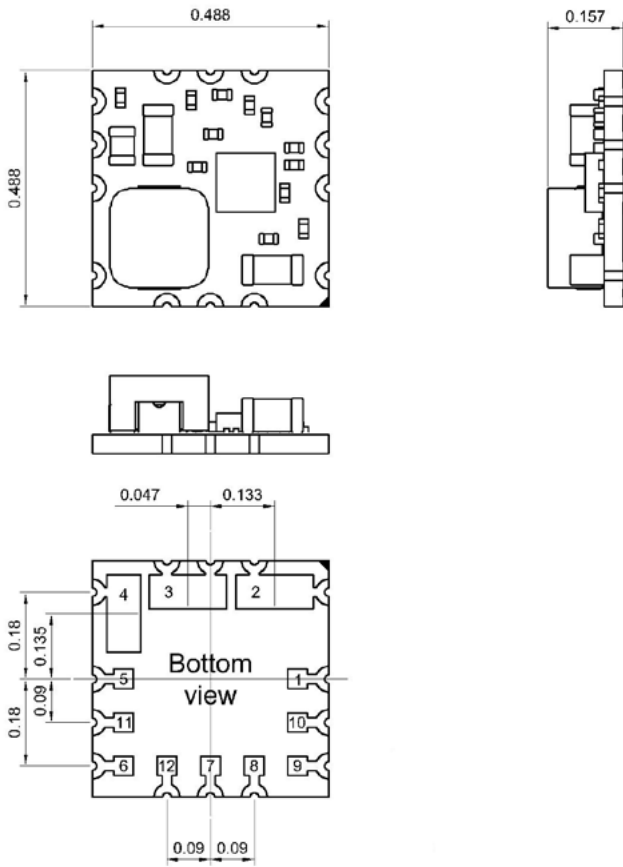
Class	C1	L1	C2
Class A	2.2 μF	10 μH	X

### EFT and surge circuit

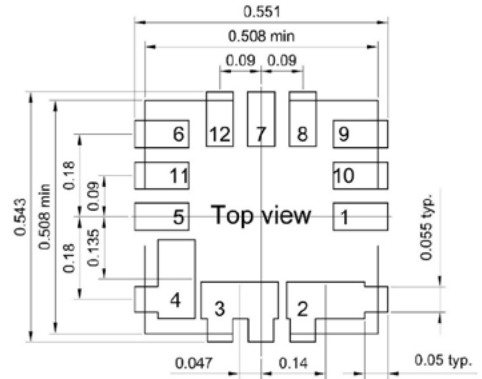


TVS	C1
Eaton 5-0SMDJ22CA	2200 μF

Dimensions - inches

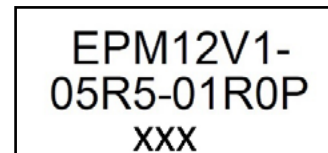


Recommended pad layout



Pad 1&5~12 = 0.118" x 0.059"  
Pad 2&4 = 0.17" x 0.08"  
Pad 3 = 0.168" x 0.08"

Marking



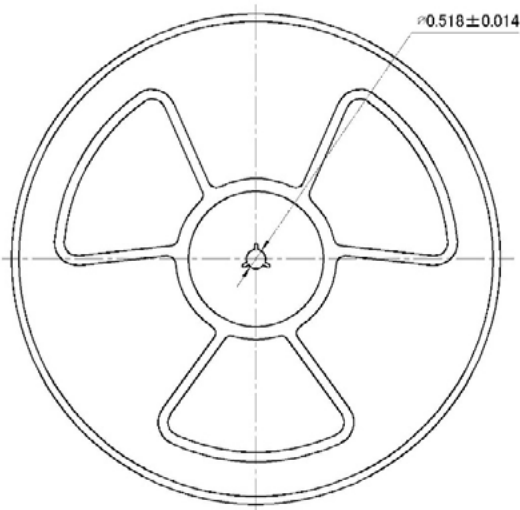
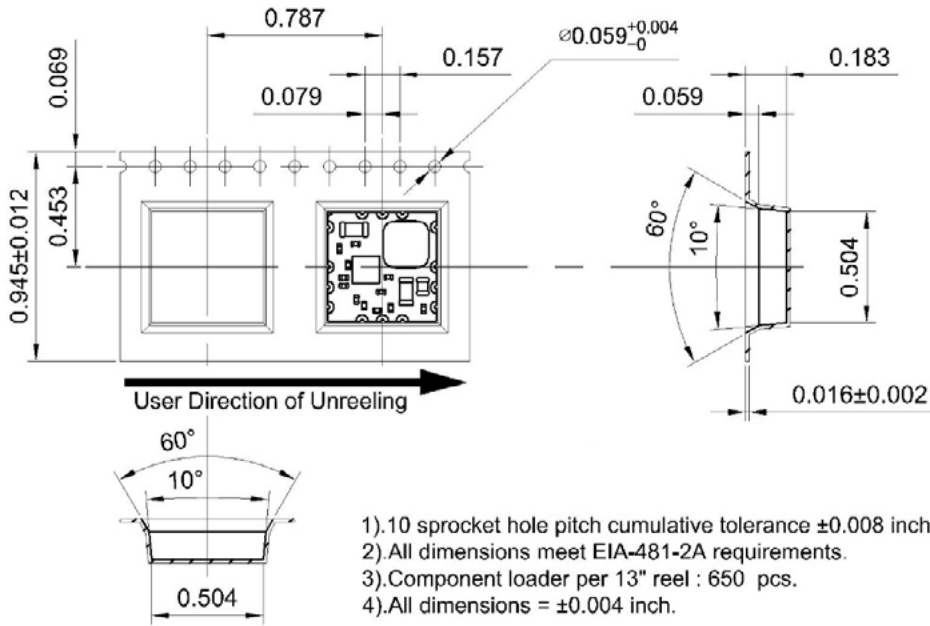
xxx= lot code

Projection: Third angle projection  
Tolerance:  $\pm 0.02$   
Pad 1&5~12 = 0.04 x 0.04  
Pad 2~4 = 0.16 x 0.07

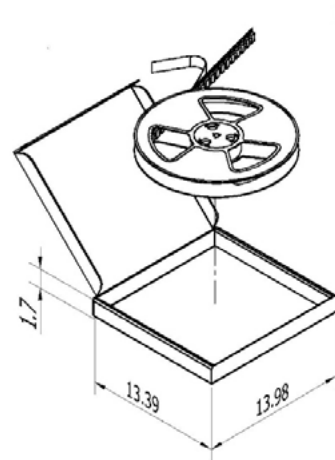
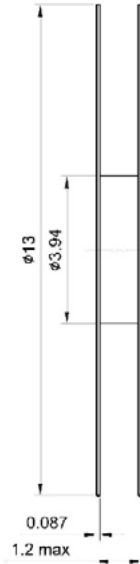
Pin	Function	Pin	Function
1	CTRL	7	GND
2	Vin	8	NC
3	GND	9	NC
4	Vout	10	NC
5	NC	11	GND
6	TRIM	12	NC

NC = no connection

Packaging- Inches

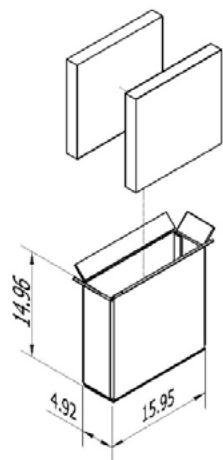


Unit : inch  
Package : 1 Tape Reel = 650 pcs



1 Tape Reel = 650 converters

Unit:inch



Carton accommodates  
2 boxes 1300 converters per carton

## General information

### Pick and place

The 1A Open Frame modules use an open frame construction and are designed for a fully automated pick and place assembly process.

### MSL rating

The 1A Open Frame modules have a MSL rating of 3.

### Storage and handling

The recommended storage environment and handling procedures for moisture-sensitive surface mount packages is detailed in J-STD-033 (Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices).

Moisture barrier bags (MBB) with desiccant are required for MSL ratings of 3 or greater. These sealed packages should not be broken until time of use. Once the original package is broken, the floor life of the product at conditions of 30 °C and 60% relative humidity 168 hours varies according to the MSL rating (see J-STD-033). The shelf life for dry packed SMT packages will be a maximum of 12 months from the bag seal date, when stored at the following conditions: < 40 °C, < 90% relative humidity.

### Post solder cleaning and drying considerations

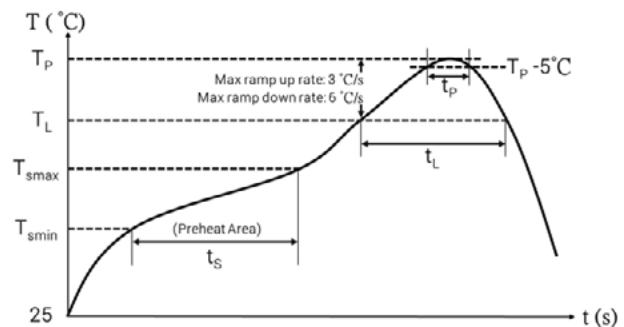
To avoid contamination on the soldering pads extra care has to be taken when handling the boards. Clean soldering surfaces do not generate as many gases when the flux reduce the metal oxides or react with contaminants during the soldering process.

### Nozzle

The module weight has been kept to a minimum by using open frame construction. Variables such as nozzle size, tip style, vacuum pressure and placement speed should be considered to optimize this process.

### Lead-free reflow profile

Power Systems will comply with J-STD-020 (Moisture/Reflow Sensitivity Classification for Nonhermetic Solid State Surface Mount Devices) for both Pb-free solder profiles and MSL classification procedures. This standard provides a recommended forced-air-convection reflow profile based on the volume and thickness of the package. The suggested Pb-free solder paste is Sn/Ag/Cu (SAC). The recommended linear reflow profile using Sn/Ag/Cu solder is shown. Soldering outside of the recommended profile requires testing to verify results and performance.



Profile	Pb-free assembly
Average ramp-up rate ( $T_{smax}$ to $T_p$ )	3 °C/s max.
Preheat	
Temperature min. ( $T_{smin}$ )	150 °C
Temperature max. ( $T_{smax}$ )	200 °C
$T_s$ ( $T_{smin}$ to $T_{smax}$ )	60-120 s
Temperature ( $T_p$ )	245°C
Time maintained above Temperature ( $T_L$ )	217°C
Time ( $t_t$ )	60-150 s
Time within 5 °C of the specified Peak temperature ( $T_p$ )	20-40 s
Ramp down rate ( $T_p$ to $T_L$ )	6 °C/s max
Time 25 °C to peak temperature	8 minutes max.

Life Support Policy: Eaton does not authorize the use of any of its products for use in life support devices or systems without the express written approval of an officer of the Company. Life support systems are devices which support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

Eaton reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Eaton also reserves the right to change or update, without notice, any technical information contained in this bulletin.

**Eaton**  
Electronics Division  
1000 Eaton Boulevard  
Cleveland, OH 44122  
United States  
Eaton.com/electronics

© 2020 Eaton  
All Rights Reserved  
Printed in USA  
Publication No. 11182 BU-MC20159  
October 2020

Eaton is a registered trademark.

All other trademarks are property of their respective owners.

Follow us on social media to get the latest product and support information.

