Effective May 2021 Supersedes October 2020

# EPM12V2 Non-isolated DC-DC converter



## **Product features**

- Non-isolated DC-DC converter
- 3 14.4 Vdc input voltage range
- Efficiency up to 91%
- Operating ambient temperature from -40 °C to +90 °C
- Short circuit protection and remote
   ON/OFF function
- Programmable output voltage from 0.6 - 5.5 Vdc
- EN62368 safety approval

## **Engineering tools**

- EPM12V2 Evaluation kit available (2 options)
- PN: EPM12V2-P-EVK (Positive logic version) Includes evaluation board with EPM12V2 sample
- PN: EPM12V2-N-EVK (Negative logic version) Includes evaluation board with EPM12V2 sample
- EPM12V2 Evaluation kit user guide

## 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
Input	Input voltage range			3	12	14.4	Vdc
	Start-up voltage	0%~100% load				3	Vdc
	VULO			2.6			V
	Remote ON/OFF	Positive	DC-DC ON DC-DC OFF	S	Open or 1.6 V s hort to Gnd or 0	≤ Von/off ≤ 5.5 V V ≤ Von/off ≤ 0.6	V
		Negative	DC-DC ON DC-DC OFF	S	hort to Gnd or 0 1 V ≤ Von	$V \le Von/off \le 0.6$ /off $\le 5.5 V$	δV
	Efficiency	Vo = 5 Vdc			91		%
		Vo = 3.3 Vdc			88		%
		Vo = 2.5 Vdc			86		%
		Vo = 1.8 Vdc			82.5		%
		Vo = 1.2 Vdc			77		%
		Vo = 0.6 Vdc			65		%
	Output voltage trim <sup>1</sup>			0.6		5.5	Vdc
	Minimum load			0			%
	Line regulation	LL-HL				±0.4	%
Output	Load regulation	10-100% Load				±0.2	%
	Voltage accuracy				±0.3		%
	Operating frequency	100% Load at nominal Vin			800		kHz
	Ripple & poiso <sup>2</sup>	$Vo \le 1.2 Vdc$			30		mVp-p
		Vo > 1.2 Vdc			3% Vo		mVp-p
	Power good	Overvoltage threshold for PG	OOD ON		116.5		%
		Overvoltage threshold for PG	OOD OFF		120		%
		Undervoltage threshold for Pl	GOOD ON		91		%
		Undervoltage threshold for P	GOOD OFF		87		%
		PGOOD low sink current @VF	PG00D = 0.2 V		100		μΑ
	Operating temperature	With derating		-40		+90	°C
Environment	Storage temperature			-55		+125	°C
Linnonment	Relative humidity					95	%RH
	Vibration				MIL-STD-202G		
	Short circuit protection			Contin	uous, automatic	recovery	
Function	Safety				EN 62368-1		
	MTBF	MIL-HDBK217F		1132			khours
	Synchronization frequency r	ange <sup>3</sup>			800	840	kHZ
Frequency	High-level input voltage			2			V
synchronization	Low-level input voltage					0.8	V
	Input current, SYNC				1		μA
Physical	Dimension			0.480	L) x 0.480 (W) x	0.122 (H)	inches
	Weight				0.8		g
	Case material			Open f	rame		
	Cooling method			Free a	ir convention		
	EMI	EN 55032		Class A	1		
EMC	ESD	EN61000-4-2 Air ± 8 kV Contact ± 8 kV		Criteria	В		
	Fast transient	EN 61000-4-4, ±2 kV		Criteria	В		
	Surge	EN 61000-4-5, ±2 kV		Criteria	А		

 1. The output voltage range is limited by Vin. (Vout  $\leq$  Vin – 2 Vdc)

 2. The ripple & noise are measured with 47 µF + 47 µF + 0.1 µF capacitor at 20 MHz BW.

3. SYNC frequency must be greater than operating frequency, externally tie SYNC to GND if synchronization functionality not required.

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.

## EPM12V2 Non-isolated DC-DC converter

## 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	ON/OFF Logic
EPM12V2-05R5-12R0P	3 - 14.4 Vdc	0.6 - 5.5 Vdc	12 A	30 mA	91%	200 µF	Positive
EPM12V2-05R5-12R0N	3 - 14.4 Vdc	0.6 - 5.5 Vdc	12 A	30 mA	91%	200 µF	Negative

1. The no load input current is test by 0.6 V output.

2. The efficiency is test by nominal input, 5 Vout and full load @ +25 °C.

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

4. All specifications valid at 12 V input, full load and +25  $^{\circ}\mathrm{C}$  after warm-up time unless otherwise stated.

### Measure method



## **Derating curve**



The derating curve was measured at 12 V input and 5 V output. \* The derating curve is at 7 V input and 5 V output

## Output voltage vs. input voltage



## **Application information**

## Output voltage trim



Vo-0.6

Output voltage	Calculated Rtrim (kΩ)
5.0 V	2.727
3.3 V	4.444
2.5 V	6.316
1.8 V	10
1.5 V	13.3
1.2 V	20
0.6 V	∞ (Open)

## Power good

Power good monitor output. This open-drain output goes low during overcurrent, short-circuit, UVLO, overvoltage and undervoltage, overtemperature, or when the output is not regulated (such as a pre-bias output). An external pullup resistor to VDD or to an external rail is required. Included is a 20-µs deglitch filter. PGOOD pin can be connected through a pullup resistor suggested value 100 k $\Omega$ ) to a source of 5 Vdc or lower.

## Synchronization

The module switching frequency can be synchronized to a signal with an external frequency within a specified range. Synchronization can be done by using the external signal applied to the SYNC pin of the module, with the converter being synchronized by the rising edge of the external signal. The electrical specifications table specifies the requirements of the external SYNC signal. If the SYNC pin is not used, the module should free run at the default switching frequency. If synchronization is not being used, connect the SYNC pin to GND.



## Output voltage sequencing

The SEQ pin can be used when master-slave power-supply tracking is required.

The voltage applied to the SEQ pin should be scaled down by the same ratio as used to scale the output voltage down to the reference voltage of the module. This is accomplished by an external resistive divider connected across the sequencing voltage before it is fed to the SEQ pin. The minimum recommended delay between the ON/OFF signal and the sequencing signal is 10 ms to ensure that the module output is ramped up according to the sequencing signal. This ensures that the module soft-start routine is completed before the sequencing signal is allowed to ramp up.

When an analog voltage is applied to the SEQ pin, the output voltage tracks this voltage until the output reaches the set-point voltage. The final value of the SEQ voltage must be set higher than the set-point voltage of the module. The output voltage follows the voltage on the SEQ pin on a one-to-one basis. By connecting multiple modules together, multiple modules can track their output voltages to the voltage applied on the SEQ pin.

To initiate simultaneous shutdown of the modules, the SEQ pin voltage is lowered in a controlled manner. The output voltage of the modules tracks the voltages below their setpoint voltages on a one-to-one basis. A valid input voltage must be maintained until the tracking and output voltages reach ground potential.



The SEQ pin can be used when master-slave power-supply tracking is required

## **Remote ON/OFF**



Logic type active mode Positive Logic DC/DC ON : Q1 OFF DC/DC OFF : Q1 ON

Negative Logic DC/DC ON : Q1 ON DC/DC OFF: Q1 OFF

4

## EPM12V2 Non-isolated DC-DC converter

## **EMC filtering circuit**



## Mechanical dimension and pinning - inches







Recommended pad layout



## Marking



xxx= lot code

982 15 6 0.180 11 12 14 6.090 Bottom view 13 5 0.000 10 17 0.090 0.136 4 3 0.180 2 88 8 888 8

Projection: Third angle projection Tolerance:  $\pm$  0.01 Pad 1&5-12 = 0.04 × 0.04 Pad 2~4 = 0.07 × 0.157

Pin	Function	Pin	Function
1	On/Off	10	PGOOD
2	Vin	11	SYNC
3	GND	12	VS-
4	Vout	13	SIG_GND
5	VS+ (Sense)	14	NC
6	TRIM	15	NC
7	GND	16	NC
8	NC	17	NC
9	SEQ		
NC = n	o connection		

## ETF and surge circuit



TVS	C1			
Eaton P4SMA13CA	10000 µF 25 V			

## **Packaging-Inches**



1).10 sprocket hole pitch cumulative tolerance ±0.008 inch.

- 2).All dimensions meet EIA-481-2A requirements.
- 3).Component loader per 13" reel : 850 pcs.

4).All dimensions = ±0.004 inch.





Carton accommodates 2 boxes 1700 converters per carton

## **General information**

## **Pick and place**

The 12 A open frame modules use an open frame construction and are designed for a fully automated pick and place assembly process.

## **MSL** rating

The 12 A 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

Powerina Business Worldwide

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.



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