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Introduction

This document describes the operations of evaluation kits (EVK) concerning the Eaton’s EPM DC-DC non-isolated converter product. The EVK includes test points for all main points where probing is necessary for evaluation. The EVK supports many options for Eaton’s product configuration. Using these options, the user is allowed to test all desired electrical specifications. This guide describes the test configurations and typical equipment setup. The typical input and output waveforms are also presented.

Important notice

- Please read the product datasheet and EVK user guide before using the EVK.
- Please do not remove the product from the EVK.
- This product is an ESD sensitive component and should be tested in an ESD protected area.
- The EVK is designed to operate in clean and dust-free office or laboratory. EVK Should be protected from sunlight and sources of heat, and making sure air is flowing across the tool. Please keep it away from vibration or strong electromagnetic fields generated by electrical equipment.
- When connecting and disconnecting the power interface, please turn off the power supply to avoid accidental short circuits causing injury.
- The power connection must avoid reverse voltage application.
- During the test, the electrical rating should be kept within the range specified in the data sheet.

Description

This EVK supports user test electrical performance of Eaton’s DC-DC non-isolated converter part number EPM12V1-05R5-01R0P. Figure 1 shows the EPM12V1-EVK and function outline. This EVK is made up of the input and output connectors and the DC/DC converter. There are two additional functions, output voltage trim function and remote on/off function.

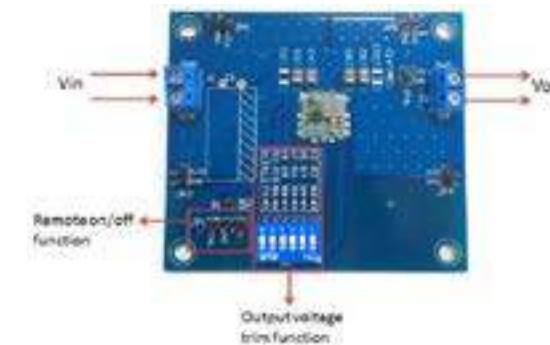


Figure 1. EPM12V1-EVK

Specifications

Table 1 shows the EPM12V1-EVK general performance specifications. The EPM12V1-EVK can deliver up to 1 A of output current and with a wide DC input. The modules can achieve high efficiency up to 89.5%, wide operation temperature from -40 °C to +82 °C, and has short circuit protection. Input range is from 3 V to 14 V, nominal input voltage is 12 V. When the input reaches 3 V, the converter should turn on. Please refer to the product data sheet for the detailed specifications [EPM12V1 data sheet](#)

Table 1- General specifications

	Parameter	Conditions	Minimum	Nominal	Maximum	Unit
Input	Input voltage		3	12	14	Vdc
	Input current	Vin=nom, no load		15		mA
	Start-up voltage	Iout=0% ~ 100% load	3			Vdc
Output	Voltage trim*	Vo= 0.9 Vdc	0.9		5.5	Vdc
	Minimum load		0			%
	Output current	Full load			1000	mA
	Ripple and noise**	Vin=nom, 20 MHz BW			40	mVp-p

* The output voltage range is limited by Vin. (Vout ≤ Vin * 0.7)

** Ripple & noise: measured with 20 MHz bandwidth and 0.1 uF ceramic capacitor.

Test set-up

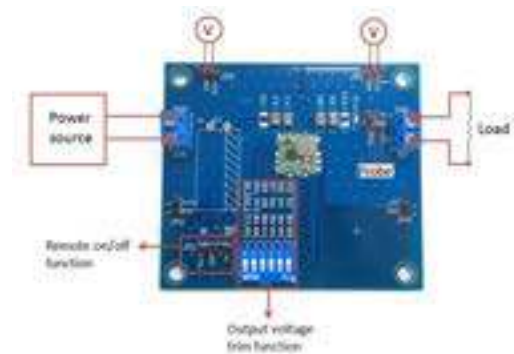


Figure 2: Test set-up example

Table 2- Pin configuration

Connector	Function	Pin symbol	Description
J1	Input terminal	VIN GND	Connect the VIN and GND terminals to the DC power source respectively.
J2	Output terminal	VO GND	Connect the VO and GND terminals to the (electronic) load.
JP1	Remote on/off control	CTRL 5V GND	Switch the module on or off through controlling CTRL signal in positive logic or negative logic.
JP2/JP5	Input voltage measuring point	+VIN GND	Connect the +VIN and GND terminals to the voltage meter.
JP3	Output ripple measuring point	+VO GND	Connect the +VO and GND terminals to the probe with short ground lead.
JP4/JP6	Output voltage measuring point	+VO GND	Connect the +VO and GND terminals to the voltage meter.
SW1	Voltage trim selector	1, 2, 3, 4, 5, 6	Adjust the output voltage with a trim resistor. There is a DIP switch with six choices.

Operation notes

Output voltage trim function

Using a resistor in parallel between TRIM and GND (Figure 3) can adjust the output voltage of the converter and the following formula can calculate the trim resistor of the correspond voltage.

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

Refer to Table 3 for basic values of resistors and switch positions for a particular output voltage. Only one switch should be on at a time. Figure 4 is an example for trimming 5 V output voltage.

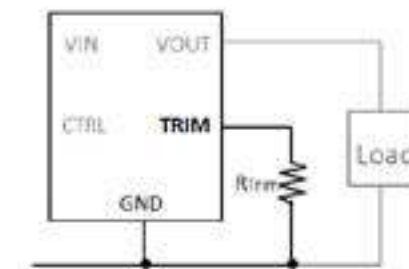


Figure 3: Voltage trim resistor diagram

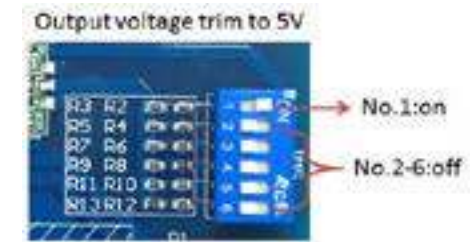


Figure 4: 5 V trimming output example

Table 3- Resistor value and switch position

Output voltage	Calculated Rtrim	Option
5 V	1.3 kΩ	SW 1 : on
3.3 V	9.8 kΩ	SW 2 : on
2.5 V	20.2 kΩ	SW 3 : on
1.8 V	44.2 kΩ	SW 4 : on
1.5 V	71.3 kΩ	SW 5 : on
1.2 V	150 kΩ	SW 6 : on

Remote on/off function

The EVK can switch the converter on or off by controlling the remote on/off signal in positive logic. If the status of ON/OFF is open or from 1.6 V to 5 V, the converter will turn on. Otherwise, if the status of ON/OFF is short to ground or from 0 V to 0.1 V, the converter will shut down.

The remote control circuit on the EVK is shown below. There are CTRL and 5 V pins at connector JP1. For example, when CTRL is high level, the converter will shut down. When CTRL is low level, the converter will turn on.

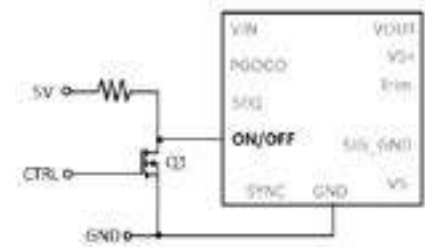


Figure 5: Remote on/off circuit diagram

Table 4- Remote on/off conditions

Condition	CTRL	Q1
DC-DC ON	Low level	Off
DC-DC OFF	High level	On

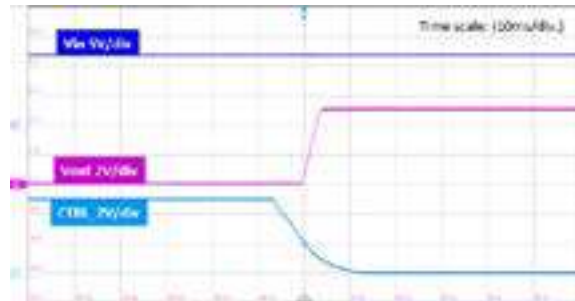


Figure 6: CNTL low level, DC-DC on



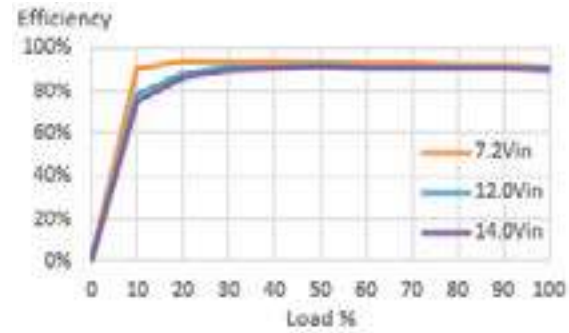
Figure 7: CNTL high level, DC-DC off

Test results

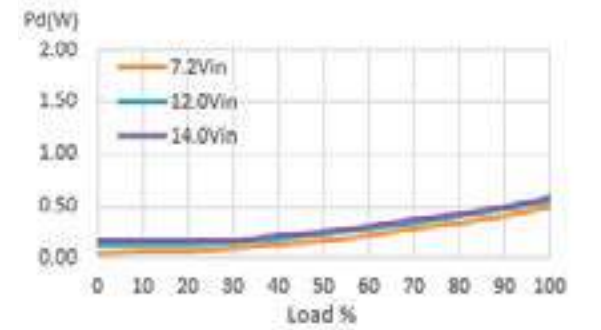
Typical characteristics

Model number: EPM12V1-05R5-01R0P
Condition: Vout=5 V

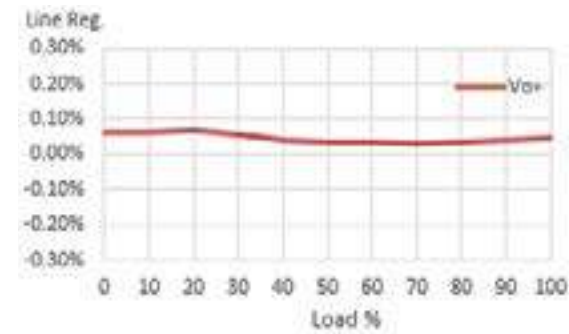
Efficiency vs. load



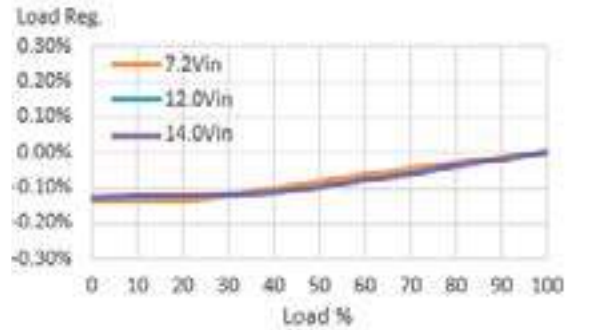
Power dissipation vs. load



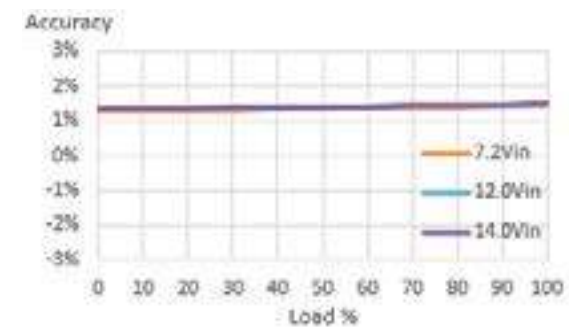
Line regulation vs. load



Load regulation vs. load



Accuracy vs. load



EPM12V1 Evaluation kit user guide

EVK set-up and operation wave form

Model number: EPM12V1-05R5-01R0P

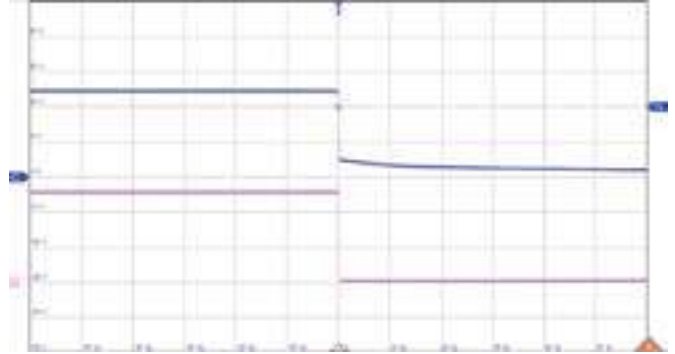
Conditions: $T_a = +25\text{ }^\circ\text{C}$, $V_{IN} = 12\text{ V}$, $V_O = 5\text{ V}$, $I_O = 1\text{ A}$ (full load) This ΔT plus ambient should remain below the specified maximum operating temperature for the module (please refer to the [EPM12V1 data sheet](#)).

Start-up



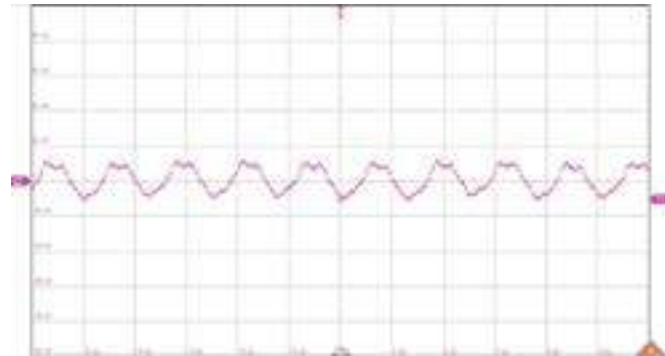
Ch1: Input voltage (5 V/div.) | Time scale: (10 ms/div.)
Ch2: Output voltage (2 V/div.)

Shut-down



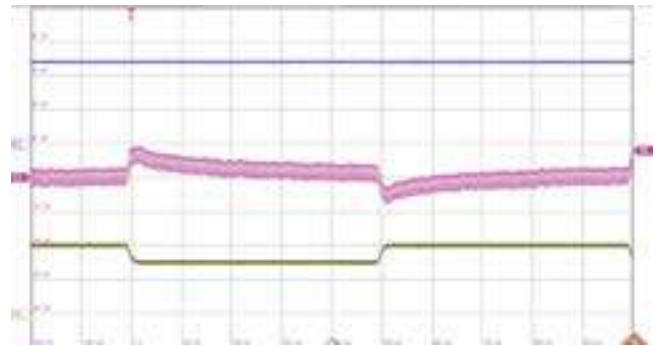
Ch1: Input voltage (5 V/div.) | Time scale: (10 ms/div.)
Ch2: Output voltage (5 V/div.)

Output ripple and noise



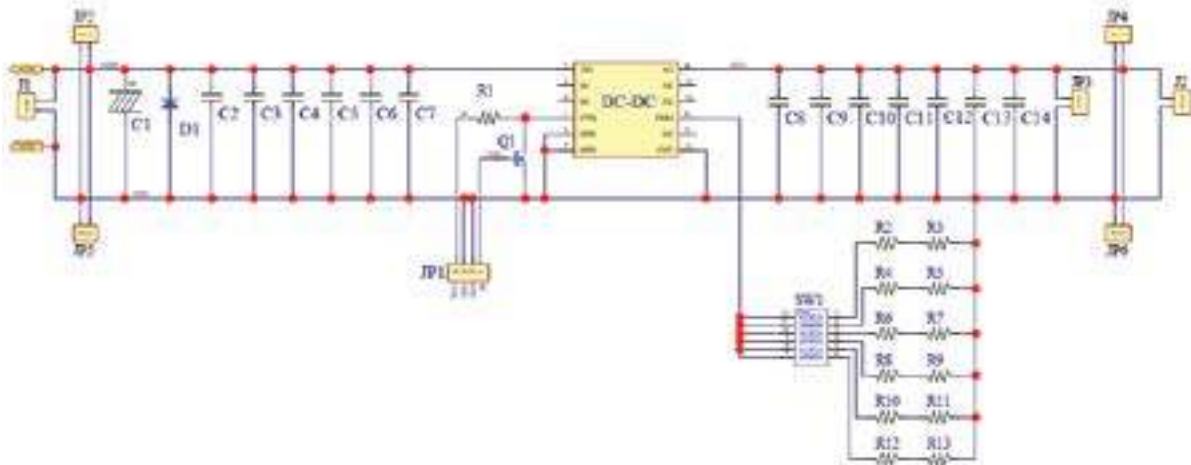
Ch1: Output voltage (10 mV/div.) | Time scale: (1 us/div.)

Transient response (75%-100% load)



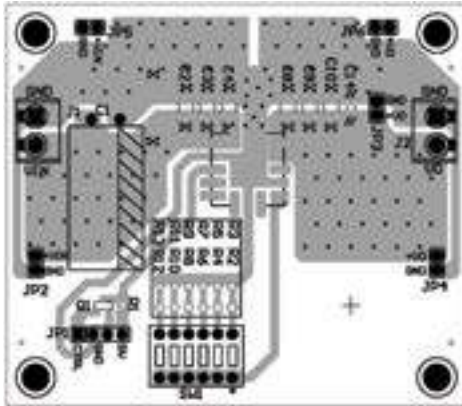
Ch1: Input voltage (5 V/div.) | Ch4: Output current (0.5 A/div)
Ch2: Output voltage (20 mV/div.) | Time scale: (100 us/div.)

Schematic

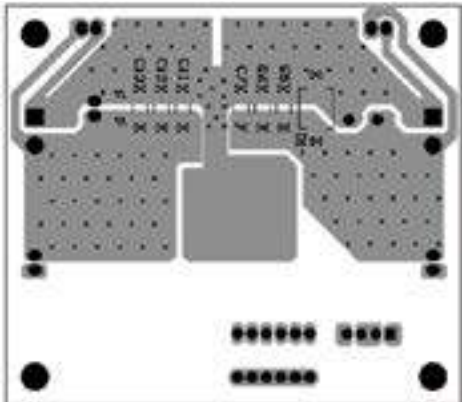


Layout

Top layer



Bottom layer



Component list (for EPM12V1-05R5-01R0P)

Description	Qty	Designator
EPM12V1-05R5-01R0P	1	
Capacitor, X7R, 1210, 10UF±10%, 50V	4	C3, C4, C8, C9
Capacitor, X7R, 0805, 0.1UF±10%, 50V	1	C14
MOSFET, AO3442 (SOT-23), 100V, N-Channel	1	Q1
Resistor, 0805, 10KΩ, 1%	1	R1
Resistor, 0805, 1.3KΩ, 1%	1	R2
Resistor, 0805, 0Ω, 5%	1	R3
Resistor, 0805, 9.76KΩ, 1%	1	R4
Resistor, 0805, 0Ω, 5%	1	R5
Resistor, 0805, 20KΩ, 1%	1	R6
Resistor, 0805, 0Ω, 5%	1	R7
Resistor, 0805, 12KΩ, 1%	1	R8
Resistor, 0805, 31.6KΩ, 1%	1	R9
Resistor, 0805, 68KΩ, 1%	1	R10
Resistor, 0805, 2.55KΩ, 1%	1	R11
Resistor, 0805, 150KΩ, 1%	1	R12
Resistor, 0805, 470Ω, 1%	1	R13
Capacitor, 220UF/200V, KXJ series, 12.5x25 mm	1	C1
Terminal Block, 2P, pitch: 5.0mm	2	J1, J2
DIP Switch, six choices	1	SW1
Pin Header, single row, 14.2mm, 4P	1	JP1
Pin Header, single row, 14.2mm, 2P	5	JP2, JP3, JP4, JP5, JP6

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