# EVM54304-MN-00A

## 4V to 16V Input, Quad-Output Power Module with I²C and MTP Evaluation Board

## DESCRIPTION

The EVM54304-MN-00A is an evaluation board for the MPM54304, which integrates four high-efficiency, step-down DC/DC converters, inductors, and a flexible logic interface.

The evaluation board can deliver 3A max per output (channels 1 and 2) and 2A per output (channels 3 and 4). Channels 1 and 2 can be paralleled to provide up to 6A of current, and channels 3 and 4 can be paralleled to provide up to 4A of current. The MPM54304 employs constant-on-time (COT) control, which provides ultra-fast load transient response.

The output voltage can be adjusted through the I²C bus or preset by the two-time programmable MTP (multi-time programmable) e-fuse. It can also be adjusted by the external divider; in this condition, the soft-start time is the same from each channel. The power-on/power-off sequence is also configurable via the MTP.

The MPM54304 requires a minimal number of external components, and is available in space-saving LGA (7mmx7mmx2mm) package.

## ELECTRICAL SPECIFICATIONS

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Input voltage | $V_{IN}$ | 4 to 16 | V |
| Output voltage (channel 1 to channel 4) | $V_{OUT}$ | 1/3.3/1.8/ 1.5 (1) | V |
| Output current (channel 1 to channel 4) | $I_{OUT}$ | 3/3/1/1 (2) | A |

**Notes:**

1) EVB default voltage value. Can be configured by the I²C.
2) The output current can also be set to 3A/2A/2A2A.

## FEATURES

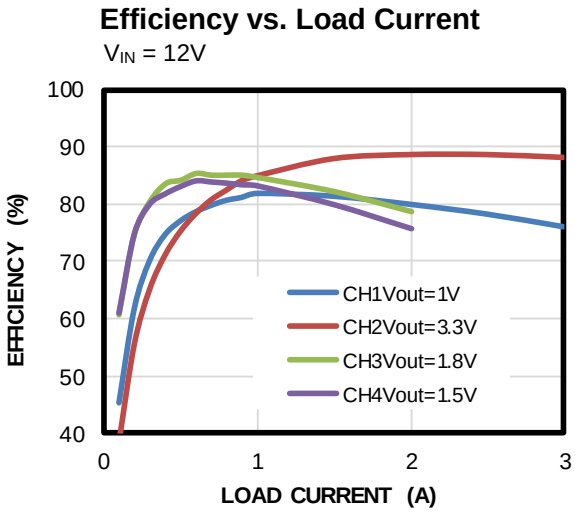
- 4V to 16V Operating Input Range
- Wide Output Voltage:
  - I²C Programmable: 0.55V to 5.4V
  - External Resistor Divider: 0.6V to 7V or $V_{IN}$ * $D_{MAX}$ if $V_{IN}$ < 7V
- Channel 1 and 2: 3A Continuous Current
  Channel 3 and 4: 2A Continuous Current
- Interleaved Operation
- Configurable, Multi-Functional GPIO Pin
- I²C and Configurable Parameters:
  - Paralleling Channel 1 and 2
  - Paralleling Channel 3 and 4
  - Switching Frequency
  - Output Voltage
  - Over-Current and Over-Voltage Protection Threshold
  - Power-On and Power-Off Sequencing
  - Forced PWM or Auto-PWM/PFM
- Preset to MPM54304GMN-0000 Configuration

## APPLICATIONS

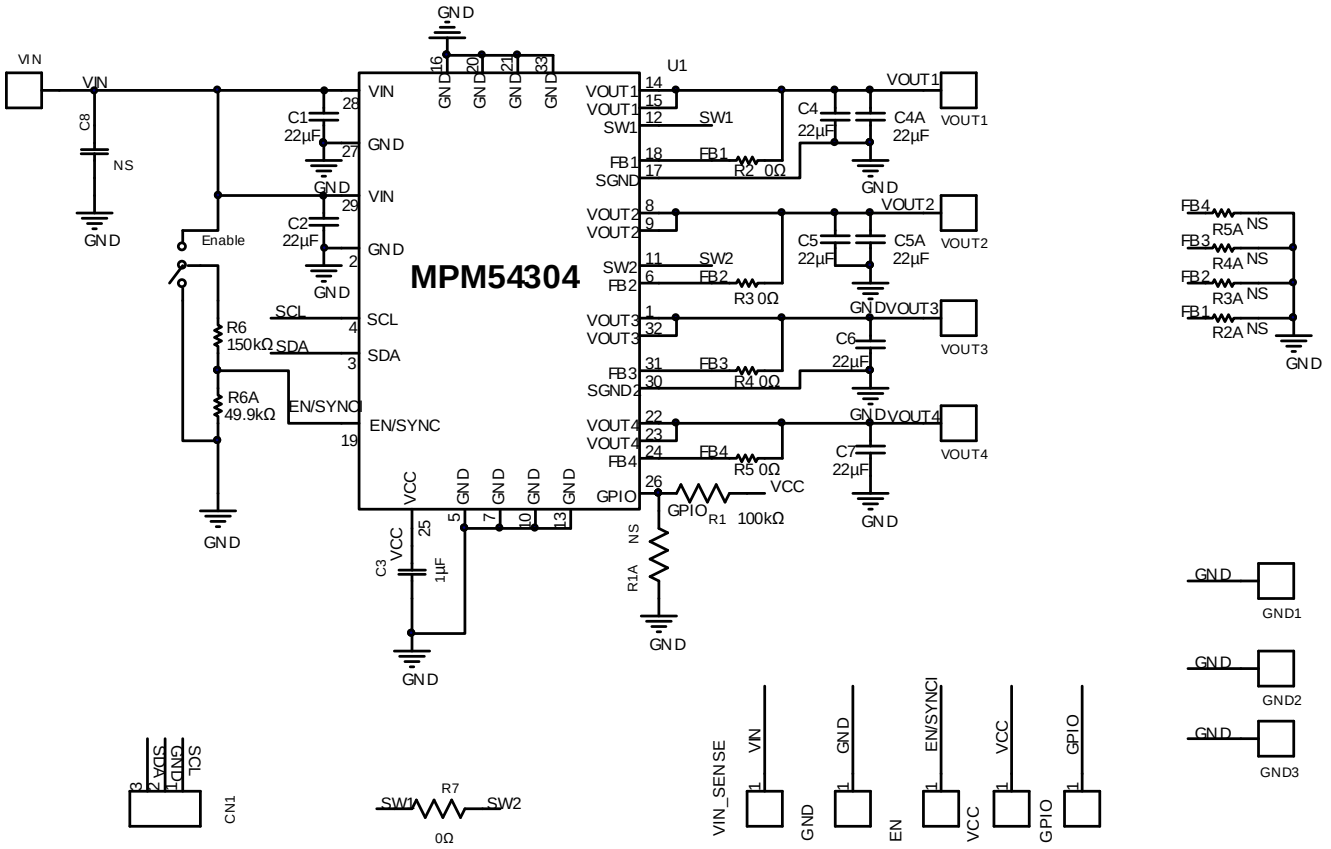
- FPGA Power Supplies
- Multi-Rail Power Systems
- MCU/DSP Power Supplies

# EVM54304-MN-00A EVALUATION BOARD


| (LxW) 63.5mmx63.5mm | |
|---|---|
| **Board Number** | **MPS IC Number** |
| EVM54304-MN-00A | MPM54304GMN-0000 |



# EVALUATION BOARD SCHEMATIC



## EVM54304-MN-00A BILL OF MATERIALS

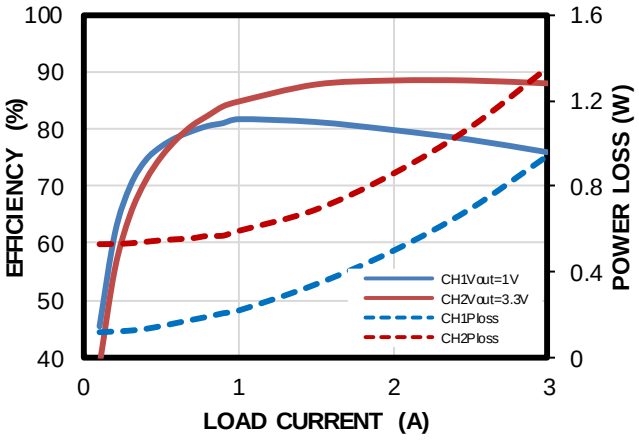
| Item | Qty | Ref. Des. | Value | Description | Package | Manufacturer | Manufactuer P/N |
|---|---|---|---|---|---|---|---|
| 1 | 8 | C1, C2, C4, C5, C6, C7, C4A, C5A | 22µF | Ceramic capacitor, 25V, X5R | 0805 | Murata | GRM21BR61E226ME44L |
| 2 | 1 | C3 | 1µF | Ceramic capacitor, 16V, X6S | 0402 | Murata | GRM155C81C105KE11D |
| 3 | 1 | R6 | 150kΩ | Film res., 1%, 0603, 150kΩ | 0603 | YAGEO | RC0603FR-07150KL |
| 4 | 1 | R6A | 49K9 | Film res., 1%, 0603, 49K9 | 0603 | YAGEO | RC0603FR-0749K9L |
| 5 | 4 | R2, R3, R4, R5 | 0R | Film res., 1%, 0603, 0R | 0603 | YAGEO | RC0603FR-070RL |
| 6 | 1 | R1 | 100kΩ | Film res., 1%, 0402, 100kΩ | 0402 | YAGEO | RC0402FR-07100KL |
| 7 | 1 | PMBUS | 3PINS | 3 pins, 1 row, straight | DIP | WE | 61300311121 |
| 8 | 1 | SWITCH | SWITCH | Tact switch, on-on, vertical type, THT, bulk | DIP | WE | 450301014042 |
| 9 | 1 | U1 | MPM54304 | PMIC module | LGA | MPS | MPM54304 |

## EVB TEST RESULTS

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 12V, $V_{OUT1/2/3/4}$ = 1V/3.3V/1.8V/1.5V, $f_{SW}$ = 800kHz,$T_A$ = 25°C, CCM mode, unless otherwise noted.**

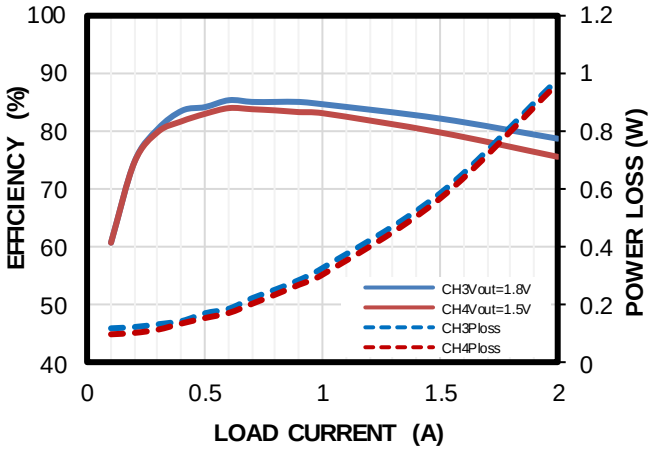
### Efficiency vs. Load Current

$V_{IN}$ = 12V



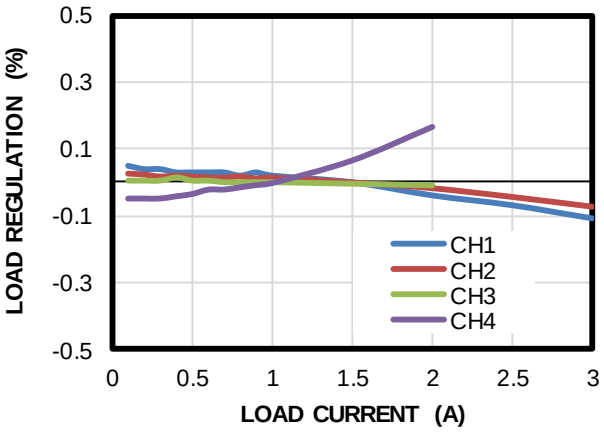

### Efficiency vs. Load Current

$V_{IN}$ = 12V

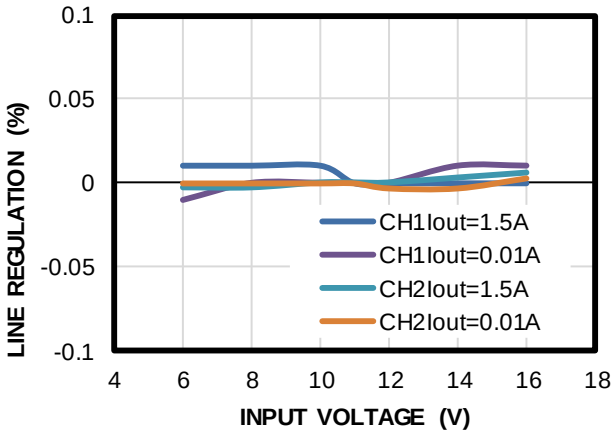



### Load Regulation vs. Load Current

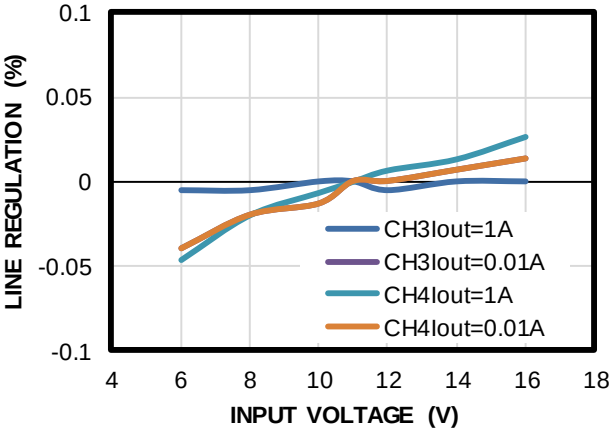
$V_{IN}$ = 12V



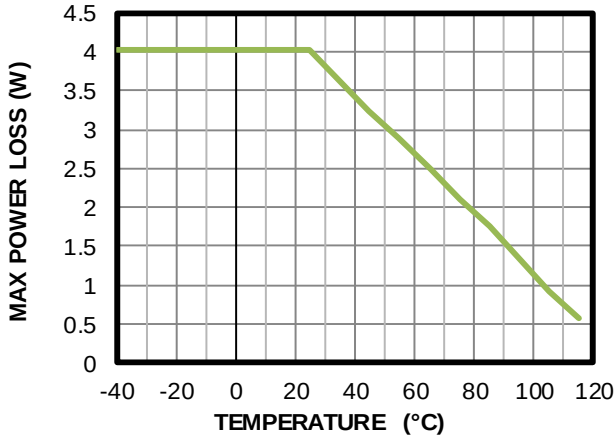

### Line Regulation vs. Input Voltage




### Line Regulation vs. Input Voltage



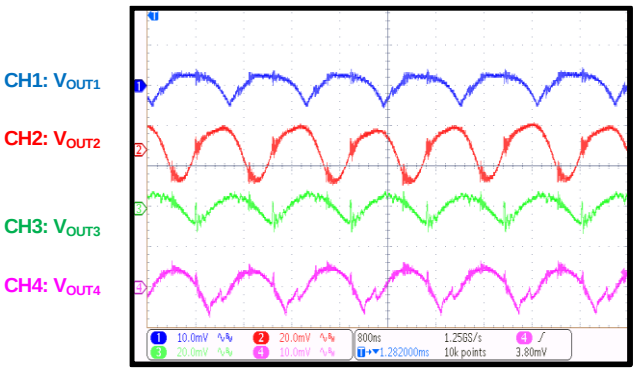

### Max Power Loss vs. Temperature



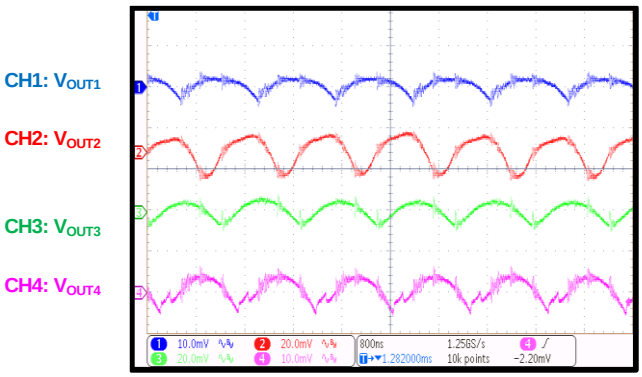
## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 12V, $V_{OUT1/2/3/4}$ = 1V/3.3V/1.8V/1.5V, $f_{SW}$ = 800kHz, $T_A$ = 25°C, CCM mode, unless otherwise noted.**

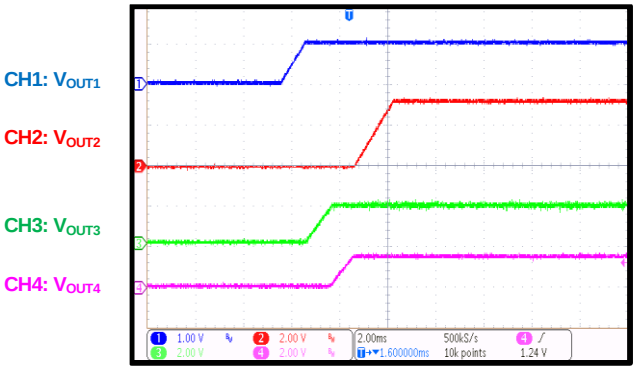
### Steady State with Full Load



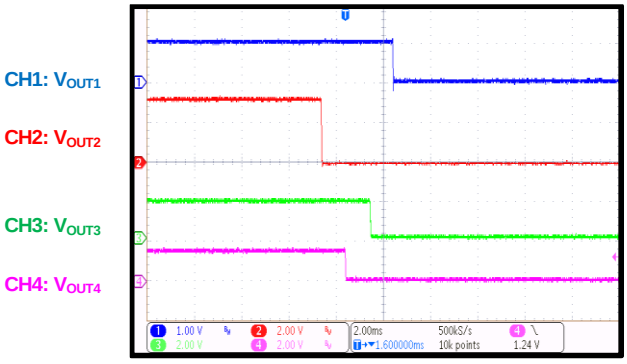

### Steady State with No Load



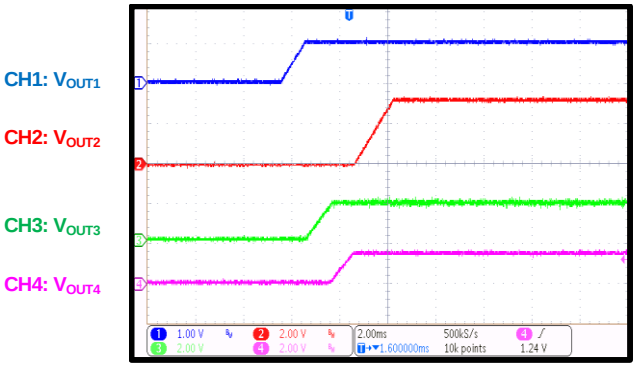

### EN On with Full Load



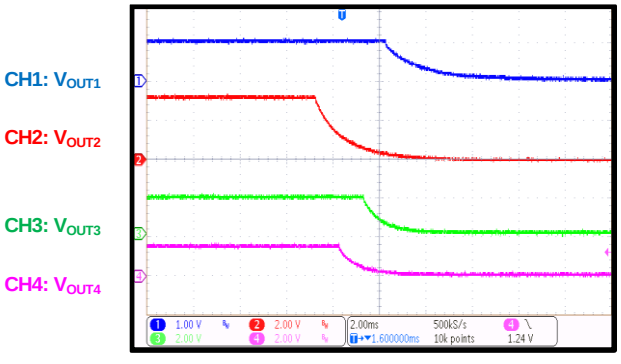

### EN Off with Full Load




### En On without Load



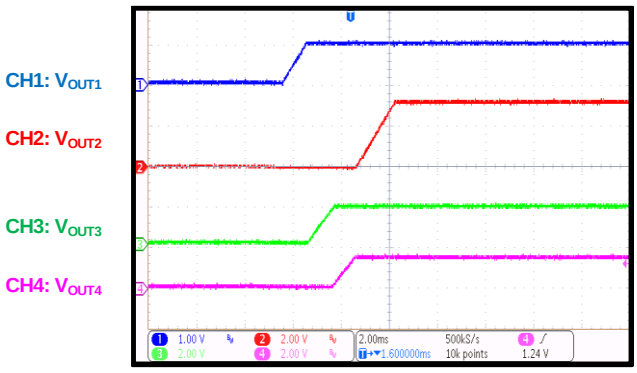

### En Off without Load



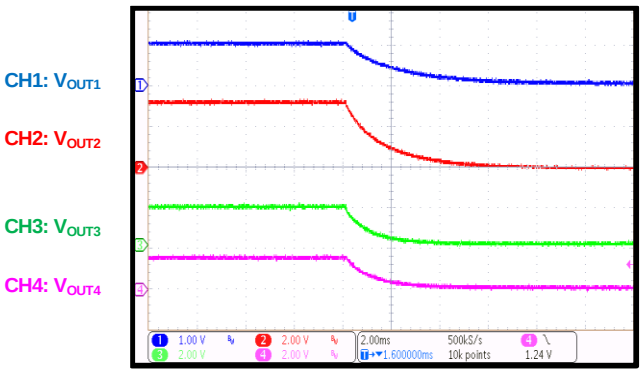
# EVB TEST RESULTS

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 12V, $V_{OUT1/2/3/4}$ = 1V/3.3V/1.8V/1.5V, $f_{SW}$ = 800kHz, $T_A$ = 25°C, CCM mode, unless otherwise noted.**

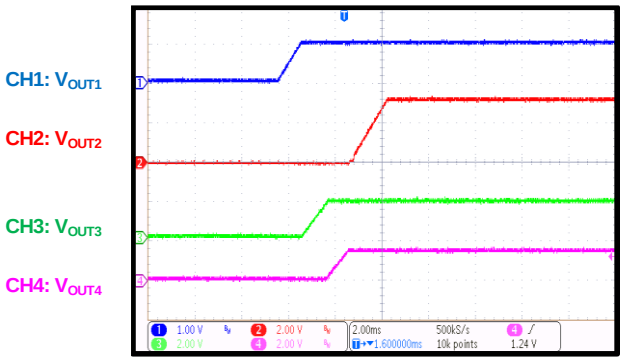
### $V_{IN}$ On without Load



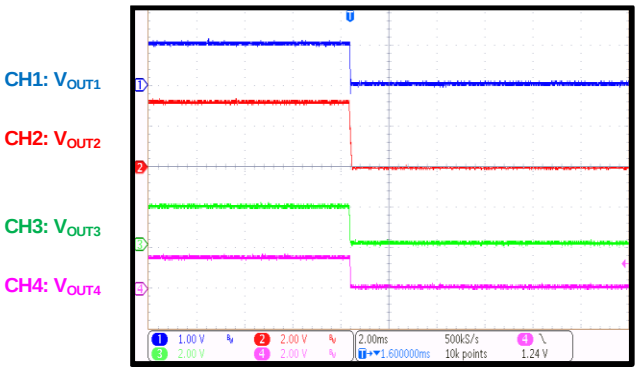

### $V_{IN}$ Off without Load



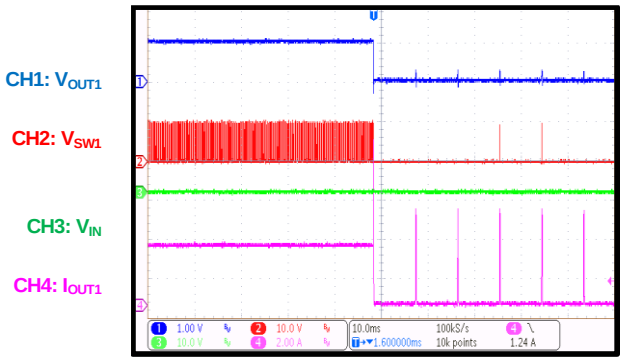

### $V_{IN}$ On with Load



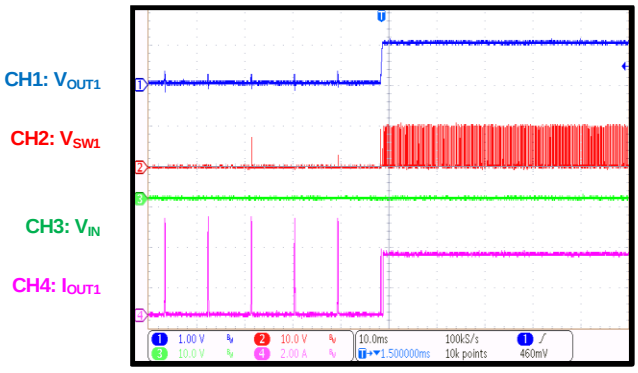

### $V_{IN}$ Off with Load




### SCP Entry with Full Load



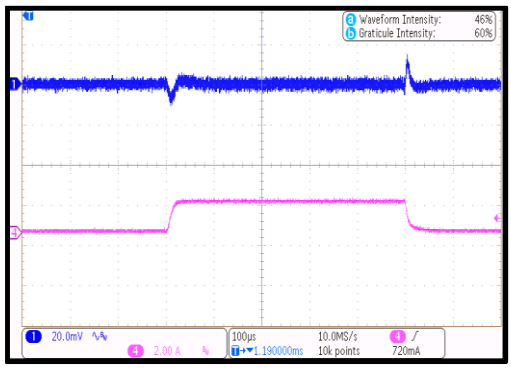

### SCP Recovery with Full Load



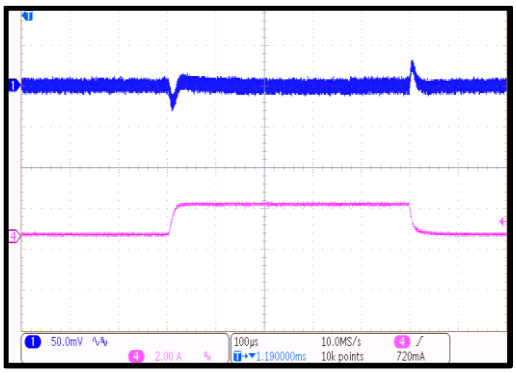
## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 12V, $V_{OUT1/2/3/4}$ = 1V/3.3V/1.8V/1.5V, $f_{SW}$ = 800kHz, $T_A$ = 25°C, CCM mode, unless otherwise noted.**

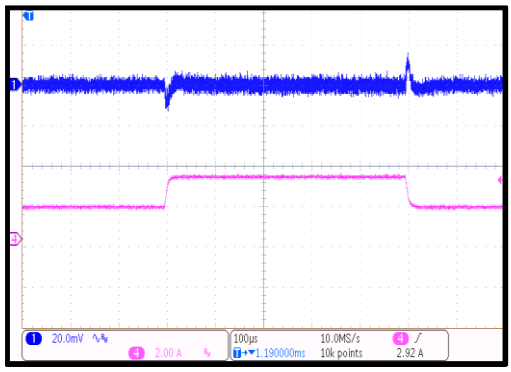
### Load Transient 0A to 1.5A



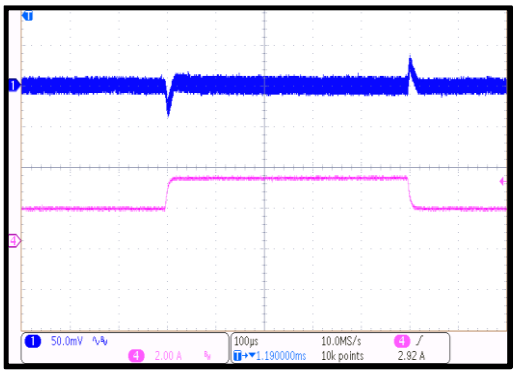

### Load Transient 0A to 1.5A



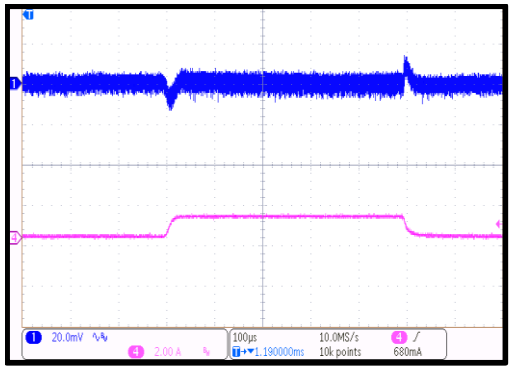

### Load Transient 1.5A to 3A



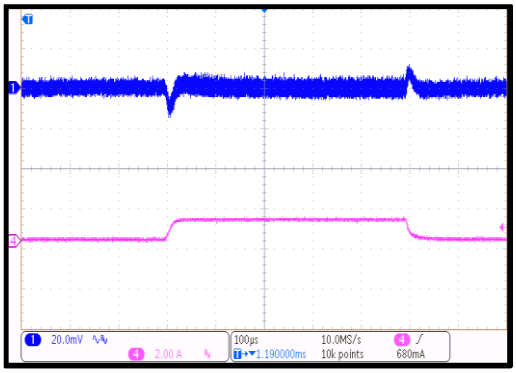

### Load Transient 1.5A to 3A




### Load Transient 0A to 1A



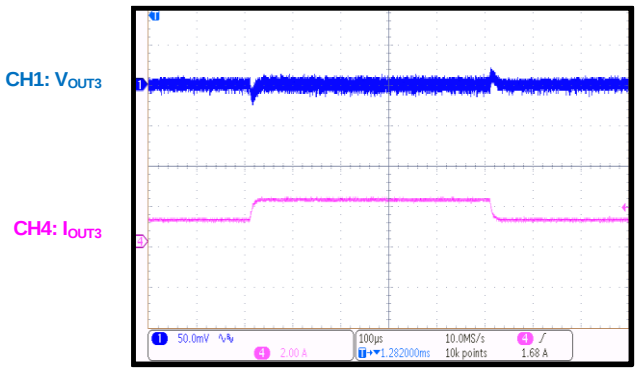

### Load Transient 0A to 1A



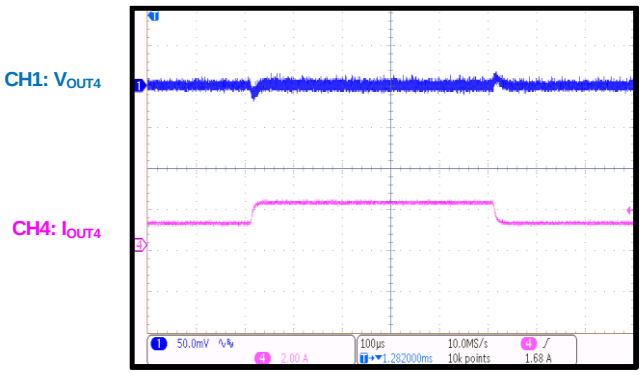
## EVB TEST RESULTS *(continued)*

**Performance curves and waveforms are tested on the evaluation board. $V_{IN}$ = 12V, $V_{OUT1/2/3/4}$ = 1V/3.3V/1.8V/1.5V, $f_{SW}$ = 800kHz, $T_A$ = 25°C, CCM mode, unless otherwise noted.**

**Load Transient 1A to 2A**




**Load Transient 1A to 2A**



# PCB LAYOUT

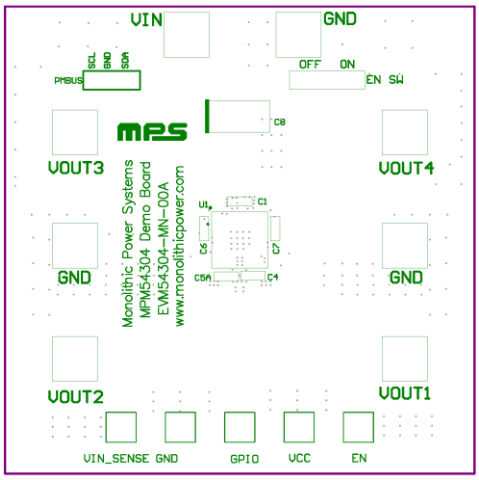



**Figure 1: Top Silk Layer**

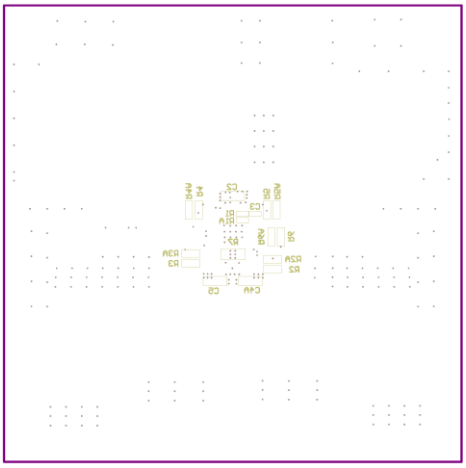


**Figure 2: Bottom Silk Layer**

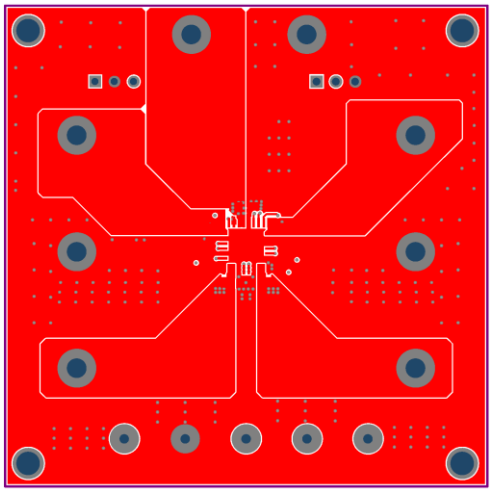


**Figure 3: Top Layer**

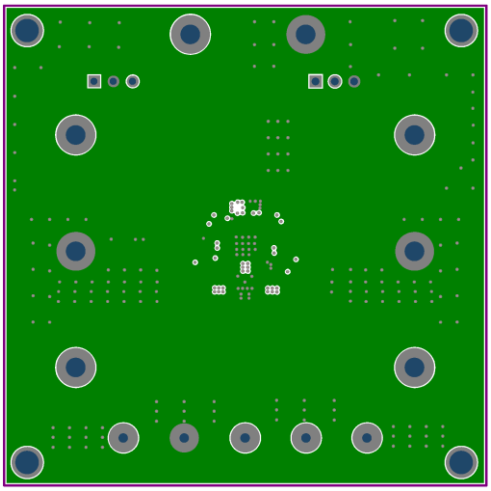


**Figure 4: Mid-Layer 1**

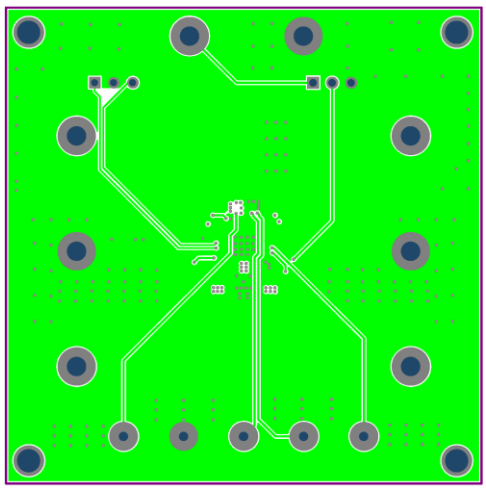


**Figure 5: Mid-Layer 2**

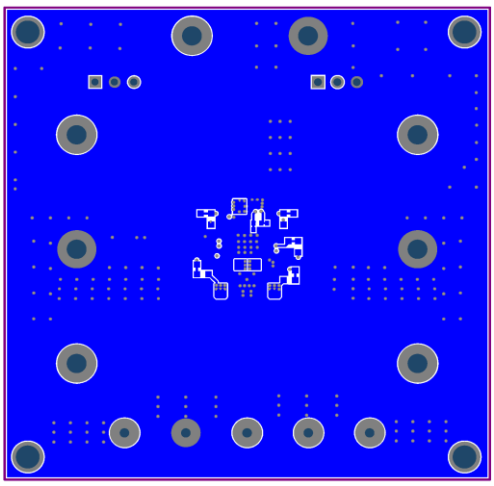


**Figure 6: Bottom Layer**

## QUICK START GUIDE

1. Preset the power supply to 4V ≤ $V_{IN}$ ≤16V.
2. Turn the power supply off.
3. Connect the power supply terminals to:
    a. Positive (+): VIN
    b. Negative (–): GND
4. Choose which channels (1 to 4) to connect the load to:
    a. Positive (+): VOUT
    b. Negative (–): GND
5. Turn the power supply and EN switch on after making the connections. The board should automatically start up.
6. To program the I²C function, connect SCL, SDA, and GND to the I²C start kit board. Connect the I²C start kit board to a PC, then run the MPM54304 GUI software to program the MPM54304 I²C register. The GUI software can be downloaded from the MPS website.

# EVKT-USBI2C-02

**Communication Interface Device**
**USB to I²C/PMBus**

## DESCRIPTION

EVKT-USBI2C-02 provides the communication interface for USB to I²C or USB to PMBus. It is designed to work with MPS I²C and PMBus products, and Virtual Bench Pro, and I²C GUI tools. The EVKT-USBI2C-02 kit includes one USB to I²C communication device interface, one USB cable, one 10-pin ribbon cable one 3-pin ribbon cable, one datasheet, and driver files. Together with MPS Virtual Bench Pro and I²C GUI tools, it provides a quick and easy way to evaluate the performance of MPS digital products.

## EVKT-USBI2C-02


## EVKT-USBI2C-02 CONNECTION

## RIBBON CABLE DESCRIPTION

EVKT-USBI2C-02 supports two kinds of ribbon cable connections between the communication interface device and the evaluation board, 3-Pin ribbon cable and 10-Pin ribbon cable. Figure 1 shows the bottom view of the 10-Pin ribbon cable and Table 1 shows the pin descriptions.

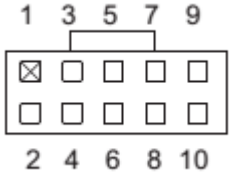



**Figure 1: 10-Pin Ribbon Cable Bottom View**

**Table 1. 10-Pin Ribbon Cable Pins**

| Pin# | Description | Pin# | Description |
|---|---|---|---|
| 1 | SCL | 2 | SCL |
| 3 | GND | 4 | GND |
| 5 | SDA | 6 | SDA |
| 7 | GND | 8 | GND |
| 9 | NC | 10 | NC |

## QUICK START GUIDE

1. Connect the EVKT-USBI2C-02 to the computer.
2. Connect the EVKT-USBI2C-02 to the evaluation board with the 3-pin ribbon cable or 10-pin ribbon cable and ensure they are connected.
3. Turn on the power supply of the evaluation board, then Start the $I^2C$ GUI software, it will check the connection automatically. If the connection is not successful, a warning will appear at the bottom. Otherwise, the address will be listed in the Slave Address bar.
4. Select the part number, the control register information will be seen in the Register Control bar.

**CODICO GmbH**
Zwingenstrasse 6-8
2380 Perchtoldsdorf, Austria
Tel: +43 1 86 305-0
Fax: +43 1 86 305-5000
e-mail: office@codico.com
www.codico.com