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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input voltage</td>
<td>(V_{IN})</td>
<td>4 to 16</td>
<td>V</td>
</tr>
<tr>
<td>Output voltage</td>
<td>(V_{OUT})</td>
<td>1/3, 3/1.8, 1.5 (^{(1)})</td>
<td>V</td>
</tr>
<tr>
<td>Output current (channel 1 to channel 4)</td>
<td>(I_{OUT})</td>
<td>3/3/1/1 (^{(2)})</td>
<td>A</td>
</tr>
</tbody>
</table>

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 \(V_{IN} \times D_{MAX}\) 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

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EVM54304-MN-00A EVALUATION BOARD

(LxW) 63.5mm x 63.5mm

<table>
<thead>
<tr>
<th>Board Number</th>
<th>MPS IC Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVM54304-MN-00A</td>
<td>MPM54304GMN-0000</td>
</tr>
</tbody>
</table>

Efficiency vs. Load Current

$V_{IN} = 12V$

<table>
<thead>
<tr>
<th>Load Current (A)</th>
<th>Efficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>1</td>
<td>90</td>
</tr>
<tr>
<td>2</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
</tr>
</tbody>
</table>

Output V_{out}:
- CH1: 1V
- CH2: 3.3V
- CH3: 1.8V
- CH4: 1.5V
# EVM54304-MN-00A BILL OF MATERIALS

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

Performance curves and waveforms are tested on the evaluation board. $V_{IN} = 12V$, $V_{OUT1/2/3/4} = 1V/3.3V/1.8V/1.5V$, $f_{SW} = 800kHz$, $T_A = 25^\circ C$, CCM mode, unless otherwise noted.
EVB TEST RESULTS (continued)

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

Steady State with Full Load

\begin{align*}
\text{CH1: } V_{OUT1} \\
\text{CH2: } V_{OUT2} \\
\text{CH3: } V_{OUT3} \\
\text{CH4: } V_{OUT4}
\end{align*}

Steady State with No Load

\begin{align*}
\text{CH1: } V_{OUT1} \\
\text{CH2: } V_{OUT2} \\
\text{CH3: } V_{OUT3} \\
\text{CH4: } V_{OUT4}
\end{align*}

EN On with Full Load

\begin{align*}
\text{CH1: } V_{OUT1} \\
\text{CH2: } V_{OUT2} \\
\text{CH3: } V_{OUT3} \\
\text{CH4: } V_{OUT4}
\end{align*}

EN Off with Full Load

\begin{align*}
\text{CH1: } V_{OUT1} \\
\text{CH2: } V_{OUT2} \\
\text{CH3: } V_{OUT3} \\
\text{CH4: } V_{OUT4}
\end{align*}

En On without Load

\begin{align*}
\text{CH1: } V_{OUT1} \\
\text{CH2: } V_{OUT2} \\
\text{CH3: } V_{OUT3} \\
\text{CH4: } V_{OUT4}
\end{align*}

En Off without Load

\begin{align*}
\text{CH1: } V_{OUT1} \\
\text{CH2: } V_{OUT2} \\
\text{CH3: } V_{OUT3} \\
\text{CH4: } V_{OUT4}
\end{align*}
**EVB TEST RESULTS**

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

- **V\_IN On without Load**
  - CH1: \( V_{OUT1} \)
  - CH2: \( V_{OUT2} \)
  - CH3: \( V_{OUT3} \)
  - CH4: \( V_{OUT4} \)

- **V\_IN Off without Load**
  - CH1: \( V_{OUT1} \)
  - CH2: \( V_{OUT2} \)
  - CH3: \( V_{OUT3} \)
  - CH4: \( V_{OUT4} \)

- **V\_IN On with Load**
  - CH1: \( V_{OUT1} \)
  - CH2: \( V_{OUT2} \)
  - CH3: \( V_{OUT3} \)
  - CH4: \( V_{OUT4} \)

- **V\_IN Off with Load**
  - CH1: \( V_{OUT1} \)
  - CH2: \( V_{SW1} \)
  - CH3: \( V_{IN} \)
  - CH4: \( I_{OUT1} \)

- **SCP Entry with Full Load**
  - CH1: \( V_{OUT1} \)
  - CH2: \( V_{SW1} \)
  - CH3: \( V_{IN} \)
  - CH4: \( I_{OUT1} \)

- **SCP Recovery with Full Load**
  - CH1: \( V_{OUT1} \)
  - CH2: \( V_{SW1} \)
  - CH3: \( V_{IN} \)
  - CH4: \( I_{OUT1} \)
EVB TEST RESULTS (continued)
Performance curves and waveforms are tested on the evaluation board. $V_{IN} = 12V$, $V_{OUT1/2/3/4} = 1V/3.3V/1.8V/1.5V$, $f_{SW} = 800kHz$, $T_A = 25^\circ C$, CCM mode, unless otherwise noted.
EVB TEST RESULTS (continued)

Performance curves and waveforms are tested on the evaluation board. $V_{IN} = 12V$, $V_{OUT1/2/3/4} = 1V/3.3V/1.8V/1.5V$, $f_{SW} = 800kHz$, $T_A = 25^\circ C$, 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 $4 \leq V_{\text{IN}} \leq 16 \text{V}$.
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.