Description

The AEM10900 evaluation kit (EVK) is a printed circuit board (PCB) featuring all the required components to operate the AEM10900 integrated circuit (IC) in QFN28 package.

The AEM10900 evaluation board allows users to test the e-peas IC and analyze its performances in a laboratory-like setting or in product mock-ups.

It allows easy connections to an energy harvester (e.g. a single element PV cell) and a storage element. It also provides all the configuration access to set the device in any of the modes described in the datasheet. The control and status signals are available on standard pin headers or through an I²C bus communication, allowing users to override preconfigured board settings through host MCU and evaluate the IC performances.

The AEM10900 EVK is a plug and play, intuitive and efficient tool to optimize the AEM10900 configuration, allowing users to design a highly efficient subsystem for the desired target application. Component replacement and operating mode switching is convenient and easy.

More detailed information about AEM10900 features can be found in the datasheet.

Features

Two-way screw terminals
- Source of energy (DC).
- ZMPP configuration.
- Energy storage element (battery).
- Thermistor used for thermal monitoring.

2-pin “Shrouded Header”
- Alternative connector for the storage element.

3-pin headers
- Maximum power point ratio (R_MPP) configuration.
- Maximum power point timing (T_MPP) configuration.
- Energy storage element threshold configuration.
- Mode configuration.
- Thermal monitoring configuration.

6-pin header
- I²C communication pins.

Applications

<table>
<thead>
<tr>
<th>Wearable Electronics</th>
<th>Keyboards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Control Units</td>
<td>Electronic Shelf Labels</td>
</tr>
<tr>
<td>Smart Buildings</td>
<td>Indoor Sensors</td>
</tr>
</tbody>
</table>

Evaluation Kit Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>2AEM10900C001 REV:3</td>
<td>76 mm x 50 mm</td>
</tr>
</tbody>
</table>

Device Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Package</th>
<th>Body size</th>
</tr>
</thead>
<tbody>
<tr>
<td>10AEM10900C0000</td>
<td>QFN 28-pin</td>
<td>4x4mm</td>
</tr>
</tbody>
</table>
1. Connections Diagram

Figure 1: Connection diagram
## 1.1. Signals Description

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>CONNECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Power signals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SRC</td>
<td>Connection to the harvested energy source.</td>
<td>Connect the source element.</td>
</tr>
<tr>
<td>STO</td>
<td>Connection to the energy storage element.</td>
<td>Cannot be left floating, voltage must always be above 2.8 V.</td>
</tr>
<tr>
<td>I²C_VDD</td>
<td>Connection to I²C voltage supply.</td>
<td>Connect to I²C supply.</td>
</tr>
<tr>
<td>ZMPP</td>
<td>Configuration of the constant impedance MPP.</td>
<td>Connect $R_{ZMPP}$ resistor.</td>
</tr>
<tr>
<td>VINT</td>
<td>AEM Internal voltage supply.</td>
<td>Leave floating.</td>
</tr>
<tr>
<td>BUFSRC</td>
<td>AEM connection to a capacitor buffering the boost converter input (no connector on EVK).</td>
<td></td>
</tr>
<tr>
<td><strong>Configuration signals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T_MPP[1:0]</td>
<td>Configuration of the MPP timing.</td>
<td>Connect jumpers.</td>
</tr>
<tr>
<td>TH_MON</td>
<td>Configuration of the thermal monitoring.</td>
<td>Connect a thermistor.</td>
</tr>
<tr>
<td><strong>Control signals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIS_STO_CH</td>
<td>Disabling pin for the storage charging.</td>
<td>Connect jumper (see Section 2.5.2).</td>
</tr>
<tr>
<td>KEEP_ALIVE</td>
<td>Enabling pin to supply internal circuitry from the storage element if no power on SRC.</td>
<td>Connect jumper (see Section 2.5.2).</td>
</tr>
<tr>
<td><strong>I²C signals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SDA</td>
<td>Bidirectional data line.</td>
<td>Connect to host I²C bus.</td>
</tr>
<tr>
<td>SCL</td>
<td>Unidirectional serial clock.</td>
<td>Connect $I²C_VDD$ to GND (SDA and SCL will be pulled down by $R_1$ and $R_2$).</td>
</tr>
<tr>
<td>IRQ</td>
<td>Interrupt request.</td>
<td>Connect to host GPIO.</td>
</tr>
</tbody>
</table>

Table 1: Pin description
2. General Considerations

2.1. Safety Information

Always connect the elements in the following order:

1. Reset the board: push the “RESET” (SW2) switch during 5 seconds minimum.
2. Completely configure the PCB (jumpers/resistors):
   - Battery configuration.
   - Mode configuration.
   - Thermal monitoring configuration.
3. Connect I2C_VDD:
   - To GND if I²C is not used (SDA and SCL will also be connected to GND through their pull up resistors).
   - To a power supply if I²C is used (1.5 V to 2.2 V).
4. Connect the storage elements on STO with a voltage higher than 2.8 V.
5. Connect the source to the SRC connector (open circuit voltage lower than 2.0 V).
2.2. Basic Configurations

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Availability Through Pins</th>
<th>MPPT ratio</th>
<th>V_MPP / V_OC</th>
</tr>
</thead>
<tbody>
<tr>
<td>R_MPP[3:0]</td>
<td>I²C Interface¹</td>
<td>Configuration pins²</td>
<td></td>
</tr>
<tr>
<td>LLLL</td>
<td>yes</td>
<td>yes</td>
<td>ZMPP</td>
</tr>
<tr>
<td>LLLH</td>
<td>yes</td>
<td>yes</td>
<td>90%</td>
</tr>
<tr>
<td>LLHL</td>
<td>yes</td>
<td>yes</td>
<td>65%</td>
</tr>
<tr>
<td>LLHH</td>
<td>yes</td>
<td>no</td>
<td>60%</td>
</tr>
<tr>
<td>LLLL</td>
<td>yes</td>
<td>yes</td>
<td>85%</td>
</tr>
<tr>
<td>LLLH</td>
<td>yes</td>
<td>yes</td>
<td>75%</td>
</tr>
<tr>
<td>LLHH</td>
<td>yes</td>
<td>yes</td>
<td>70%</td>
</tr>
<tr>
<td>LHHH</td>
<td>yes</td>
<td>yes</td>
<td>80%</td>
</tr>
<tr>
<td>HLLL</td>
<td>yes</td>
<td>no</td>
<td>35%</td>
</tr>
<tr>
<td>HLLH</td>
<td>yes</td>
<td>no</td>
<td>50%</td>
</tr>
</tbody>
</table>

Table 2: Configuration of R_MPP

1. For I²C configuration, R_MPP[3:0] value is set thanks to the MPPTCFG[3:0] register.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Availability Through Pins</th>
<th>MPP Timing</th>
<th>Sampling duration TVOC [ms]</th>
<th>Sampling period TMPPT [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_MPP[2:0]</td>
<td>I²C Interface¹</td>
<td>Configuration pins²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LLL</td>
<td>yes</td>
<td>no</td>
<td>2</td>
<td>64</td>
</tr>
<tr>
<td>LLH</td>
<td>yes</td>
<td>no</td>
<td>256</td>
<td>16384</td>
</tr>
<tr>
<td>LHL</td>
<td>yes</td>
<td>no</td>
<td>64</td>
<td>4096</td>
</tr>
<tr>
<td>LHH</td>
<td>yes</td>
<td>no</td>
<td>8</td>
<td>1024</td>
</tr>
<tr>
<td>HLL</td>
<td>yes</td>
<td>yes</td>
<td>4</td>
<td>256</td>
</tr>
<tr>
<td>HLH</td>
<td>yes</td>
<td>yes</td>
<td>2</td>
<td>128</td>
</tr>
<tr>
<td>HHL</td>
<td>yes</td>
<td>yes</td>
<td>4</td>
<td>512</td>
</tr>
<tr>
<td>HHH</td>
<td>yes</td>
<td>yes</td>
<td>2</td>
<td>256</td>
</tr>
</tbody>
</table>

Table 3: Configuration of T_MPP

1. For I²C configuration, T_MPP[2:0] value is set thanks to the MPPTCFG[6:4] register (see Table 5).

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Availability Through Pins</th>
<th>Storage Element Threshold Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>STO_CFG[2:0]</td>
<td>I²C Interface</td>
<td>V_OVCH</td>
</tr>
<tr>
<td>LLL</td>
<td>yes</td>
<td>4.50 V</td>
</tr>
<tr>
<td>LLH</td>
<td>yes</td>
<td>4.00 V</td>
</tr>
<tr>
<td>LHL</td>
<td>yes</td>
<td>3.63 V</td>
</tr>
<tr>
<td>LHH</td>
<td>yes</td>
<td>3.90 V</td>
</tr>
<tr>
<td>HLL</td>
<td>yes</td>
<td>3.90 V</td>
</tr>
<tr>
<td>HLH</td>
<td>yes</td>
<td>3.90 V</td>
</tr>
<tr>
<td>HHL</td>
<td>yes</td>
<td>4.35 V</td>
</tr>
<tr>
<td>HHH</td>
<td>yes</td>
<td>4.12 V</td>
</tr>
</tbody>
</table>

Table 4: Usage of STO_CFG[2:0]
### 2.3. I²C Register Map

<table>
<thead>
<tr>
<th>Address</th>
<th>Name</th>
<th>Bit</th>
<th>Field Name</th>
<th>Access</th>
<th>RESET</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00</td>
<td>VERSION</td>
<td>[3:0]</td>
<td>MINOR</td>
<td>R</td>
<td>-</td>
<td>Chip ID</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[7:4]</td>
<td>MAJOR</td>
<td>R</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0x01</td>
<td>MPPTCFG</td>
<td>[3:0]</td>
<td>RATIO</td>
<td>R/W</td>
<td>0x07</td>
<td>MPPT ratios</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[6:4]</td>
<td>TIMING</td>
<td>R/W</td>
<td>0x07 (2ms/256ms)</td>
<td>MPPT timings</td>
</tr>
<tr>
<td>0x02</td>
<td>VOVDIS</td>
<td>[5:0]</td>
<td>THRESH</td>
<td>R/W</td>
<td>0x2D</td>
<td>Overdischarge level of the storage element</td>
</tr>
<tr>
<td>0x03</td>
<td>VOVCH</td>
<td>[5:0]</td>
<td>THRESH</td>
<td>R/W</td>
<td>0x33</td>
<td>Overcharge level of the storage element</td>
</tr>
<tr>
<td>0x04</td>
<td>TEMPCOLD</td>
<td>[7:0]</td>
<td>THRESH</td>
<td>R/W</td>
<td>0x8F</td>
<td>Cold temperature level</td>
</tr>
<tr>
<td>0x05</td>
<td>TEMPHOT</td>
<td>[7:0]</td>
<td>THRESH</td>
<td>R/W</td>
<td>0x2F</td>
<td>Hot temperature level</td>
</tr>
<tr>
<td>0x06</td>
<td>PWR</td>
<td>[0:0]</td>
<td>KEEPALEN</td>
<td>R/W</td>
<td>0x01</td>
<td>Keepalive enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1:1]</td>
<td>HPEN</td>
<td>R/W</td>
<td>0x01</td>
<td>High power mode enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[2:2]</td>
<td>TMONEN</td>
<td>R/W</td>
<td>0x01</td>
<td>Temperature monitoring enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3:3]</td>
<td>STOCHDIS</td>
<td>R/W</td>
<td>0x00</td>
<td>Battery charging disable</td>
</tr>
<tr>
<td>0x07</td>
<td>SLEEP</td>
<td>[0:0]</td>
<td>EN</td>
<td>R/W</td>
<td>0x01</td>
<td>Sleep mode enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3:1]</td>
<td>THRESH</td>
<td>R/W</td>
<td>0x00</td>
<td>Sleep threshold</td>
</tr>
<tr>
<td>0x08</td>
<td>STOMON</td>
<td>[2:0]</td>
<td>RATE</td>
<td>R/W</td>
<td>0x00</td>
<td>ADC rate</td>
</tr>
<tr>
<td>0x09</td>
<td>APM</td>
<td>[0:0]</td>
<td>EN</td>
<td>R/W</td>
<td>0x00</td>
<td>APM enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1:1]</td>
<td>MODE</td>
<td>R/W</td>
<td>0x00</td>
<td>APM mode</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3:2]</td>
<td>WINDOW</td>
<td>R/W</td>
<td>0x00</td>
<td>APM computation window</td>
</tr>
<tr>
<td>0x0A</td>
<td>IRQEN</td>
<td>[0:0]</td>
<td>I2CRDY</td>
<td>R/W</td>
<td>0x01</td>
<td>IRQ serial interface ready enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1:1]</td>
<td>VOVDIS</td>
<td>R/W</td>
<td>0x00</td>
<td>IRQ STO OVDIS enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[2:2]</td>
<td>VOVCH</td>
<td>R/W</td>
<td>0x00</td>
<td>IRQ STO OVCH enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3:3]</td>
<td>SLPTHRESH</td>
<td>R/W</td>
<td>0x00</td>
<td>IRQ SRC LOW enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[4:4]</td>
<td>TEMP</td>
<td>R/W</td>
<td>0x00</td>
<td>IRQ temperature enable</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[5:5]</td>
<td>APMDONE</td>
<td>R/W</td>
<td>0x00</td>
<td>IRQ APM done enable</td>
</tr>
<tr>
<td>0x0B</td>
<td>CTRL</td>
<td>[0:0]</td>
<td>UPDATE</td>
<td>R/W</td>
<td>0x00</td>
<td>Load I²C registers configuration</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[2:2]</td>
<td>SYNCBUSY</td>
<td>R</td>
<td>0x00</td>
<td>Synchronization busy flag</td>
</tr>
<tr>
<td>0x0C</td>
<td>IRQFLG</td>
<td>[0:0]</td>
<td>I2CRDY</td>
<td>R</td>
<td>0x00</td>
<td>IRQ serial interface ready flag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[1:1]</td>
<td>VOVDIS</td>
<td>R</td>
<td>0x00</td>
<td>IRQ STO OVDIS flag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[2:2]</td>
<td>VOVCH</td>
<td>R</td>
<td>0x00</td>
<td>IRQ STO OVCH flag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3:3]</td>
<td>SLPTHRESH</td>
<td>R</td>
<td>0x00</td>
<td>IRQ SRC LOW flag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[4:4]</td>
<td>TEMP</td>
<td>R</td>
<td>0x00</td>
<td>IRQ temperature flag</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[5:5]</td>
<td>APMDONE</td>
<td>R</td>
<td>0x00</td>
<td>IRQ APM done flag</td>
</tr>
<tr>
<td>0x0D</td>
<td>STATUS</td>
<td>[1:1]</td>
<td>VOVDIS</td>
<td>R</td>
<td>0x00</td>
<td>Status STO OVDIS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[2:2]</td>
<td>VOVCH</td>
<td>R</td>
<td>0x00</td>
<td>Status STO OVCH</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[3:3]</td>
<td>SLPTHRESH</td>
<td>R</td>
<td>0x00</td>
<td>Status SRC LOW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[4:4]</td>
<td>TEMP</td>
<td>R</td>
<td>0x00</td>
<td>Status temperature</td>
</tr>
<tr>
<td></td>
<td></td>
<td>[6:6]</td>
<td>CHARGE</td>
<td>R</td>
<td>0x00</td>
<td>Status STO Charge</td>
</tr>
<tr>
<td>0x0E</td>
<td>APM0</td>
<td>[7:0]</td>
<td>DATA</td>
<td>R</td>
<td>0x00</td>
<td>APM data 0</td>
</tr>
<tr>
<td>0x0F</td>
<td>APM1</td>
<td>[7:0]</td>
<td>DATA</td>
<td>R</td>
<td>0x00</td>
<td>APM data 1</td>
</tr>
<tr>
<td>0x10</td>
<td>APM2</td>
<td>[7:0]</td>
<td>DATA</td>
<td>R</td>
<td>0x00</td>
<td>APM data 2</td>
</tr>
<tr>
<td>0x11</td>
<td>TEMP</td>
<td>[7:0]</td>
<td>DATA</td>
<td>R</td>
<td>0x00</td>
<td>Temperature data</td>
</tr>
<tr>
<td>0x12</td>
<td>STO</td>
<td>[7:0]</td>
<td>DATA</td>
<td>R</td>
<td>0x00</td>
<td>Storage element voltage</td>
</tr>
<tr>
<td>0x13</td>
<td>SRC</td>
<td>[7:0]</td>
<td>DATA</td>
<td>R</td>
<td>0x00</td>
<td>SRC ADC value</td>
</tr>
</tbody>
</table>

Table 5: Register summary
2.4. I²C Communication

The device address on the I²C bus is 0x41. All information about the I²C communication is available in the AEM10900 datasheet, “System configuration” Section.

I²C_VDD must be connected to an external power supply which voltage is within the 1.5 V to 2.2 V range. On the Evaluation Board, 1 kΩ pull-up on SDA and SCL (R1 and R2) to I²C_VDD are provided.

In case one or more configurations are set by I²C communication, none of the configuration pins (GPIOs) will be taken into account anymore. Thus, applying the default values to any registers that have not been explicitly configured by I²C.

2.5. Advanced Configurations

A complete description of the system constraints and configurations is available in Section “System configuration” of the AEM10900 datasheet.

2.5.1. ZMPP Configuration

If ZMPP configuration is chosen (see Table 2), the AEM10900 regulates \( V_{SRC} \) at a voltage equals to the product of \( R_{ZMPP} \) times the current available at the source \( SRC \).

\[
10 \, \Omega \leq R_{ZMPP} \leq 100 \, k\Omega
\]

If unused, leave both the \( R_{ZMPP} \) resistor footprint and screw connector empty.

2.5.2. Mode Configuration

**DIS_STO_CH**

Enabling/disabling battery charging can be done by setting a jumper on the corresponding 3-pin header.

- Use a jumper to connect the **DIS_STO_CH** to H to disable the charge of the storage element.
- Use a jumper to connect the **DIS_STO_CH** to L to enable the charge of the storage element.

**KEEP_ALIVE**

The **KEEP_ALIVE** feature allows to supply the internal circuitry from the storage element when no power is available on the source terminal.

- Use a jumper to connect the **KEEP_ALIVE** to H to enable the feature.
- Use a jumper to connect the **KEEP_ALIVE** to L to disable the feature.

2.5.3. Thermal Monitoring

The thermal monitoring feature protects the battery by disabling the battery charging when ambient temperature is outside a specified range. The higher and lower thresholds are configurable using the I²C communication (see datasheet).

- Place a jumper between **TH_MON** and **VINT** to disable the feature.
- Place a jumper between **TH_MON** and **THERM** to enable the feature.
3. Functional Tests

This section presents a few simple tests that allow users to understand the functional behavior of the AEM10900. To avoid damaging the board, follow the procedure found in Section 2.1 “Safety Information”. If a test has to be restarted, make sure to properly reset the system to obtain reproducible results.

The measurements use the following equipment:
- Two Source Measurement Units (SMU, four-quadrant power supply).
- One 2-channel oscilloscope.

The following functional tests were made using the following setup:
- EVK jumpers configuration:
  - \( R_{MPP}[2:0] = HHL \) (70%).
  - \( T_{MPP}[1:0] = HH \) (2 ms / 256 ms).
  - \( STO\_CFG[2:0] = HHH \) (3.01 V - 4.12 V).
  - \( DIS\_STO\_CH = L \).
  - \( KEEP\_ALIVE = H \).
  - Place the jumper to connect \( TH\_MON \) with \( VINT \).
  - Place a jumper to connect \( I^2C\_VDD \) and GND if the \( I^2C \) communication is not used.

Users can adapt the setup to match the use case system as long as the input limitations are respected, as well as the minimum storage voltage and cold-start constraints (see “Introduction” Section of AEM10900 datasheet).

3.1. Start-up

The following example allows users to observe the start-up behavior of the AEM10900.

**Setup**
- Place oscilloscope probes on \( VINT \) and \( STO \).
- Referring to Figure 1, follow steps 1 to 5 explained in Section 2.1 “Safety Information”.
- \( STO \): SMU set as a 3.0 V voltage source with 1 mA current compliance.
- \( SRC \): SMU set as a 1 mA or 100 \( \mu \)A current source with 0.8 V voltage compliance.

**Observations and measurements**
- \( VINT \): voltage rises to 2.2 V.
- \( STO \): observe the current absorbed by the SMU as power is transferred from \( SRC \) to \( STO \).

3.2. Shutdown

This test allows users to observe the behavior of the AEM10900 when the system is running out of energy. This test is to be done when the AEM10900 has already started, as at the end of the test described in Section 3.1.

**Setup**
- Disable the \( KEEP\_ALIVE \) feature (\( KEEP\_ALIVE = L \)).
- Place the oscilloscope probe on \( VINT \).
- Referring to Figure 1, follow steps 1 to 5 explained in Section 2.1 “Safety Information”. Configure the board in the desired state and start the system (see Section 3.1).
- Disconnect the SMU from \( SRC \).

**Observations and measurements**
- \( VINT \): voltage falls to GND.
- \( STO \): no leakage from \( STO \) (probe impedance considered).

3.3. Cold Start

The following test allows users to observe the minimum voltage required to coldstart the AEM10900. To prevent current leakage caused by the probe impedance, users should avoid probing any unnecessary node. Make sure to properly reset the board to observe the cold-start behavior.

**Setup**
- Place oscilloscope probe on \( SRC \).
- Referring Figure 1, follow steps 1 to 5 explained in Section 2.1.
- \( SRC \): SMU set as 20 \( \mu \)A current source with 0.3 V voltage compliance.
- \( STO \): SMU as 3.0 V voltage source with 100 \( \mu \)A current compliance.

**Observations and measurements**
- \( SRC \) voltage clamped at the cold-start voltage during the cold-start phase and then regulated at the selected MPPT percentage of Voc configured thanks to \( R_{MPP} \) when cold start is over. The duration of the cold-start phase decreases as the input power increases. Select the input power accordingly to be able to observe the cold-start phase.
- \( STO \): SMU starts absorbing current sourced by the \( STO \) pin once the cold-start phase is completed.
3.4. Thermal Monitoring

The following test allows users to observe the thermal monitoring functionality.

**Setup**
- Place a 10 kΩ NTC thermistor with $\beta = 3380$ on $R_{th}$.
- Place a 22 kΩ pull-up resistor on $R_{DIV}$.
- Place the jumper to connect $TH\_MON$ with $THERM$.
- Place the probes on the nodes to be observed.
- Referring to Figure 1, follow steps 1 to 5 as explained in Section 2.1 “Safety Information”. Configure the board in the desired state and start the system (see Section 3.1).

**Observations and measurements**
- If the temperature is lower than 0°C, the charge of the storage element is disabled.
- If the temperature is higher than 45°C, the charge of the storage element is disabled.
- If the temperature is between 0°C and 45°C, the charge of the storage element is enabled.

3.5. Keep-alive

The **KEEP_ALIVE** feature sets the behavior of the AEM10900 when no power is available on SRC.

**Setup**
- Place the oscilloscope probe on VINT.
- Referring to Figure 1, follow steps 1 to 5 explained in Section 2.1 “Safety Information”. Configure the board in the desired state and start the system (see Section 3.1).
- Enable the **KEEP_ALIVE** feature (connect **KEEP_ALIVE** to H).
- Disconnect the SMU from the SRC pin.

**Observations and measurements**
- VINT: the internal circuitry is supplied by the storage element ($V_{\text{VINT}}$ does not drop).

3.6. Disable Storage Element Charge

The **DIS_STO_CH** feature allows to disable the storage element charge.

**Setup**
- Use a jumper to connect **DIS_STO_CH** to H to disable the charge of the storage element.
- **STO**: SMU set as a 3.0 V voltage source with 1 mA current compliance.
- Referring to Figure 1, follow steps 1 to 5 explained in Section 2.1 “Safety Information”. Configure the board in the desired state and start the system (see Section 3.1).

**Observations and measurements**
- **STO**: observe that no current is absorbed by the SMU on **STO** when power is applied on **SRC**.

3.7. I²C Communication

This test allows users to change a configuration through the I²C communication.

**Setup**
- Place the oscilloscope probe on **SRC**.
- Referring to Figure 1, follow steps 1 to 5 explained in Section 2.1 “Safety Information”. Configure the board in the desired state and start the system (see Section 3.1).
- Connect **I²C _VDD** to the I²C supply (between 1.8 V and 2.2 V).
- Write ‘0010 0011’ (0x23) on the MPPTCFG register (0x01):
  - $V_{\text{MPP}} / V_{\text{OC}} = 60\%$.
  - 64 ms $V_{\text{OC}}$ sampling duration.
  - 4 s $V_{\text{OC}}$ sampling period.
- Write ‘1’ to the **CTRL** register (0x0B) to load the I²C register configuration (at startup the AEM10900 load its configurations from the pins settings).

**Observations and measurements**
- **SRC**: observe that the voltage regulation switches to 60% of the open circuit voltage $V_{\text{OC}}$ as defined by the **SRC** SMU voltage compliance, when the register value is loaded.
- **SRC**: observe that the timing between two MPP evaluation is 4 s and the duration of the MPP is 64 ms.
3.8. Efficiency

This test allows users to reproduce the efficiency graphs of the boost converter (see “DCDC Conversion Efficiency” Section in the AEM10900 datasheet).

**Setup**

- Referring to Figure 1, follow steps 1 to 5 explained in Section 2.1 “Safety Information”. Configure the board in the desired state and start the system (see Section 3.1).
- **STO**: connect SMU configured as a 4.7 V voltage source with a 100 mA current compliance.
- **SRC**: connect SMU configured as a source current with a voltage compliance of 1.0 V to ensure the AEM10900 coldstarts.

**Manipulations**

- **STO**: set the SMU to the desired voltage, between $V_{OVDIS}$ and $V_{OVCH}$. Make sure the SMU integration time is as long as possible.
- **SRC**: sweep the voltage compliance of the SMU from 0.12 V to 1.5 V to let the AEM10900 set $V_{MPP}$ according to the MPP ratio.

**Observations and measurements**

- For each data point of the SRC voltage sweep, note the SRC SMU voltage and current, as well as the STO SMU voltage and current. Repeat the measurement for each data point a copious number of times to ensure capturing current peaks.
- The efficiency $\eta$ in percent is computed by applying the following formula:

$$\eta = 100 \frac{V_{STO} \cdot I_{STO}}{V_{SRC} \cdot I_{SRC}}$$

**NOTE**: to ensure optimal efficiency, make sure a minimal decoupling capacitance of 22 µF is present on the STO pin.
Figure 2: AEM10900 efficiency (LDCDC: TDK VLS252012HBX-6R8M-1)
4. Schematics

Figure 3: AEM10900 Evaluation Board Schematic
## 5. Revision History

<table>
<thead>
<tr>
<th>EVK Version</th>
<th>User Guide Revision</th>
<th>Date</th>
<th>Description</th>
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<tbody>
<tr>
<td>Up to 1.2</td>
<td>0.9</td>
<td>February, 2022</td>
<td>Creation of the document.</td>
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<tr>
<td>1.3</td>
<td>1.0</td>
<td>September, 2023</td>
<td>Fixed some inconsistencies and updated images.</td>
</tr>
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Table 6: Revision History