

## AEM00901 Evaluation Board User Guide

### Description

The AEM00901 evaluation kit (EVK) is a printed circuit board (PCB) featuring all the required components to operate the AEM00901 integrated circuit (IC) in QFN28 package.

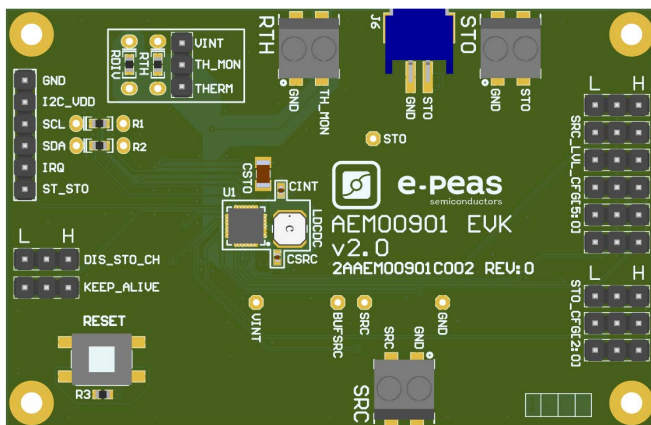
The AEM00901 evaluation board allows users to test the e-peas IC and analyze its performances in a laboratory-like setting or in product mock-ups.

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 I<sup>2</sup>C bus communication, allowing users to override preconfigured board settings through host MCU and evaluate the IC performances.

The AEM00901 EVK is a plug and play, intuitive and efficient tool to optimize the AEM00901 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 AEM00901 features can be found in the datasheet.

### Appearance



### Features

#### Two-way screw terminals

- Source of energy (DC).
- Energy storage element (battery).
- Thermistor used for thermal monitoring.

#### 2-pin "Shrouded Header"

- Alternative connector for the storage element.

#### 3-pin headers

- Constant source voltage (SRC\_LVL\_CFG configuration).
- Energy storage element threshold configuration.
- Mode configuration.
- Thermal monitoring configuration.

#### 6-pin header

- I<sup>2</sup>C communication pins.
- Storage status

### Applications

Wearable Electronics	Keyboards
Remote Control Units	Electronic Shelf Labels
Smart Buildings	Indoor Sensors

### Evaluation Kit Information

Part Number	Dimensions
2AAEM00901C002 REV:0	76 mm x 49 mm

### Device Information

Part Number	Package	Body size
10AEM00901C0001	QFN 28-pin	4x4mm

## 1. Connections Diagram

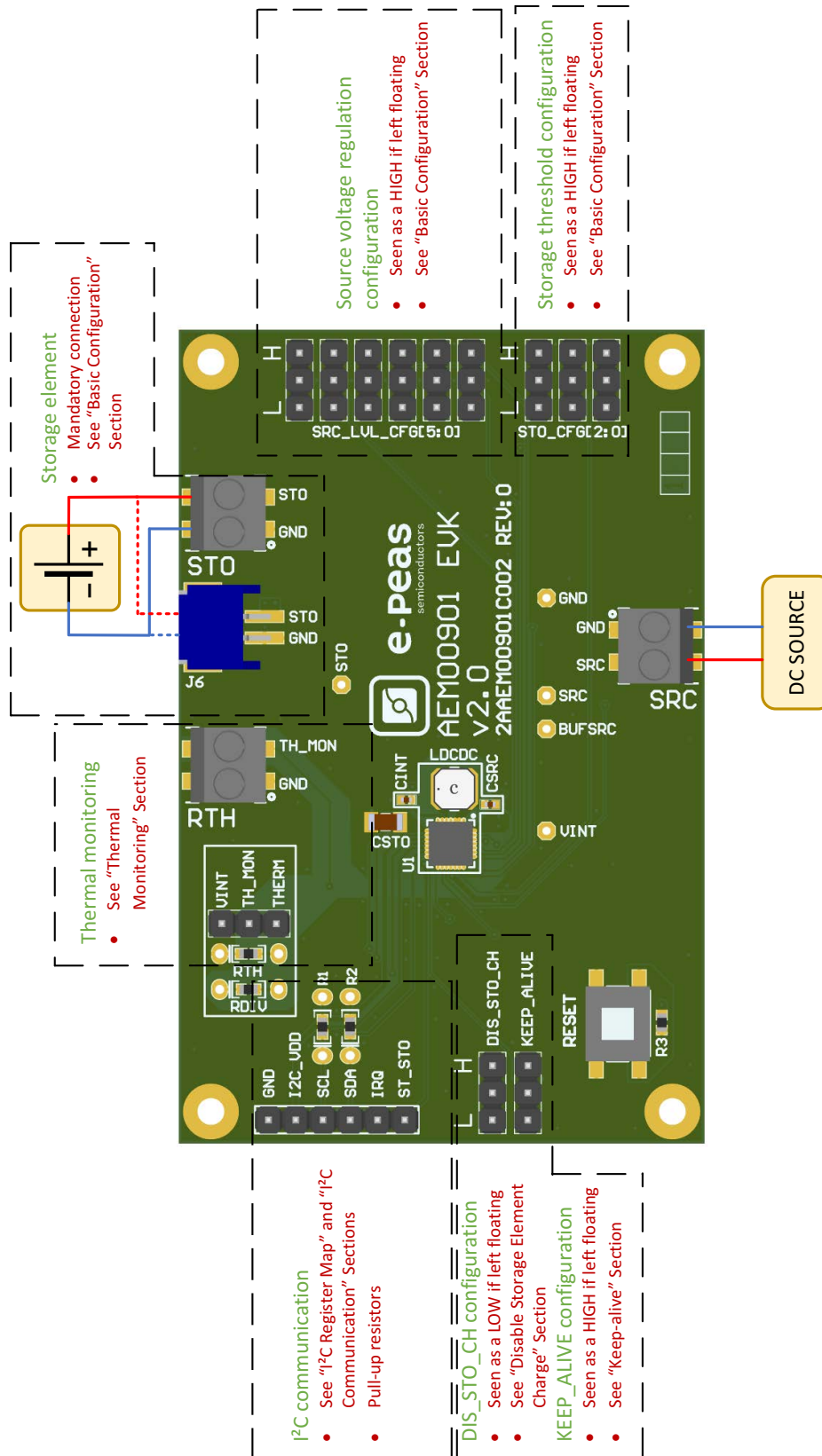


Figure 1: Connection diagram



## 2. Signals Description

NAME	FUNCTION	CONNECTION	
		If used	If not used
Power signals			
SRC	Connection to the harvested energy source.	Connect the source element.	Can be left floating.
STO	Connection to the energy storage element.	Cannot be left floating, voltage must always be above 2.5 V.	
I <sup>2</sup> C_VDD	Connection to I <sup>2</sup> C voltage supply.	Connect to I <sup>2</sup> C supply.	Connect to GND.
VINT	AEM Internal voltage supply.		
BUFSRC	AEM connection to a capacitor buffering the boost converter input (no connector on EVK).		
Configuration signals			
SRC_LVL_CFG[5:0]	Used for the configuration of the source voltage level.	Connect jumpers.	Read as HIGH if left floating.
STO_CFG[2:0]	Configuration of the threshold voltages for the energy storage element.	Connect jumpers.	Read as HIGH if left floating.
TH_MON	Configuration of the thermal monitoring.	Connect a thermistor.	Connect to VINT.
Control signals			
DIS_STO_CH	Disabling pin for the storage charging.	Connect jumper (see Section 3.5.1).	Read as LOW if left floating.
KEEP_ALIVE	Enabling pin to supply internal circuitry from the storage element if no power on SRC.	Connect jumper (see Section 3.5.1).	Read as LOW if left floating.
I <sup>2</sup> C signals			
SDA	Bidirectional data line.	Connect to host I <sup>2</sup> C bus.	Connect I <sup>2</sup> C_VDD to GND (SDA and SCL will be pulled down by R <sub>1</sub> and R <sub>2</sub> ).
SCL	Unidirectional serial clock.		
IRQ	Interrupt request.	Connect to host GPIO.	Leave floating.
Status signal			
ST_STO	Logic output. <ul style="list-style-type: none"><li>- Rises when V<sub>STO</sub> is above V<sub>OVDIS</sub> + 100 mV.</li><li>- Falls after V<sub>STO</sub> is held under V<sub>OVDIS</sub> for 2.5 s.</li><li>- Logic HIGH is at V<sub>STO</sub> voltage.</li></ul>	Connect to application circuit.	leave floating.

Table 1: Pin description

## 3. General Considerations

### 3.1. Safety Information

Always perform these steps in the following order:

1. Reset the board: push the “RESET” switch during 5 seconds minimum.
2. Completely configure the PCB (jumpers/resistors):
  - Source configuration.
  - Battery configuration.
  - Mode configuration.
  - Thermal monitoring configuration.
3. Connect I2C\_VDD:
  - To GND if I<sup>2</sup>C is not used (SDA and SCL will also be connected to GND through their pull up resistors).
  - To a power supply if I<sup>2</sup>C is used (1.5 V to 5 V).
4. Connect the storage elements on STO with a voltage higher than 2.5 V.
5. Connect the source to the SRC connector (open circuit voltage lower than 3 V).



### 3.2. Basic Configurations

Configuration pins						Voltage Level
SRC_LVL_CFG[5:0]						$V_{SRC,REG}$
L	L	L	H	H	L	0.12 V
L	L	L	H	H	H	0.13 V
L	L	H	L	L	L	0.15 V
L	L	H	L	L	H	0.16 V
L	L	H	L	H	L	0.18 V
L	L	H	L	H	H	0.19 V
L	L	H	H	L	L	0.21 V
L	L	H	H	L	H	0.22 V
L	L	H	H	H	L	0.24 V
L	L	H	H	H	H	0.25 V
L	H	L	L	L	L	0.27 V
L	H	L	L	L	H	0.28 V
L	H	L	L	H	L	0.30 V
L	H	L	L	H	H	0.33 V
L	H	L	H	L	L	0.36 V
L	H	L	H	L	H	0.39 V
L	H	L	H	H	L	0.42 V
L	H	L	H	H	H	0.45 V
L	H	H	L	L	L	0.48 V
L	H	H	L	L	H	0.51 V
L	H	H	L	H	L	0.54 V
L	H	H	L	H	H	0.57 V
L	H	H	H	L	L	0.60 V
L	H	H	H	L	H	0.63 V
L	H	H	H	H	L	0.66 V
L	H	H	H	H	H	0.69 V
H	L	L	L	L	L	0.72 V
H	L	L	L	L	H	0.75 V
H	L	L	L	H	L	0.78 V

Configuration pins						Voltage Level
SRC_LVL_CFG[5:0]						$V_{SRC,REG}$
H	L	L	L	H	H	0.81 V
H	L	L	H	L	L	0.84 V
H	L	L	H	L	H	0.90 V
H	L	L	H	H	L	1.00 V
H	L	L	H	H	H	1.05 V
H	L	H	L	L	L	1.10 V
H	L	H	L	L	H	1.14 V
H	L	H	L	H	L	1.20 V
H	L	H	L	H	H	1.25 V
H	L	H	H	L	L	1.29 V
H	L	H	H	L	H	1.35 V
H	L	H	H	H	L	1.40 V
H	L	H	H	H	H	1.44 V
H	H	L	L	L	L	1.50 V
H	H	L	L	L	H	1.59 V
H	H	L	L	H	L	1.66 V
H	H	L	L	H	H	1.70 V
H	H	L	H	L	L	1.79 V
H	H	L	H	L	H	1.90 V
H	H	L	H	H	L	1.99 V
H	H	L	H	H	H	2.10 V
H	H	H	L	L	L	2.19 V
H	H	H	L	L	H	2.25 V
H	H	H	L	H	L	2.32 V
H	H	H	L	H	H	2.41 V
H	H	H	H	L	L	2.50 V
H	H	H	H	L	H	2.59 V
H	H	H	H	H	L	2.68 V
H	H	H	H	H	H	2.73 V

Table 2: Configuration of SRC\_LVL\_CFG[5:0]

Configuration	Configuration availability		Storage Element Threshold Voltage		Battery type
STO_CFG[2:0]	I <sup>2</sup> C Interface	Configuration pins	V <sub>OVCH</sub>	V <sub>OVDIS</sub>	
LLL	yes	yes	4.50 V	3.30 V	NiCd 3 cells
LLH	yes	yes	4.00 V	2.80 V	Tadrian TLI1020A
LHL	yes	yes	3.63 V	2.80 V	LiFePO4
LHH	yes	yes	3.90 V	2.80 V	Tadrian HCL1020
HLL	yes	yes	3.80 V	2.50 V	LIC
HLH	yes	yes	3.90 V	3.01 V	Li-ion (long life)
HHL	yes	yes	4.35 V	3.01V	LiPo
HHH	yes	yes	4.12 V	3.01 V	Li-ion/solid-state/ NiMH

Table 3: Usage of STO\_CFG[2:0]

### 3.3. I<sup>2</sup>C Register Map

Address	Name	Bit	Field Name	Access	RESET	Description
0x00	VERSION	[7:0]	VERSION	R	-	Version number
0x01	SRCREGU	[6:0]	VALUE	R/W	0x77 (1.54V)	Source voltage regulation
0x02	VOVDIS	[5:0]	THRESH	R/W	0x2D (3.05V)	Overdischarge level of the storage element
0x03	VOVCH	[5:0]	THRESH	R/W	0x33 (4.1V)	Overcharge level of the storage element
0x04	TEMPCOLD	[7:0]	THRESH	R/W	0x8F (0°C)	Cold temperature level
0x05	TEMPHOT	[7:0]	THRESH	R/W	0x2F (45°C)	Hot temperature level
0x06	PWR	[0:0]	KEEPALEN	R/W	0x01	Keep-alive enable
		[1:1]	HPEN	R/W	0x01	High-power mode enable
		[2:2]	TMONEN	R/W	0x01	Temperature monitoring enable
		[3:3]	STOCHDIS	R/W	0x00	Battery charging disable
0x07	SLEEP	[0:0]	EN	R/W	0x01	Sleep mode enable
		[3:1]	THRESH	R/W	0x00	Sleep threshold
0x08	RSVD	[2:0]	-	R/W	-	This register can be written in but it will have no effect
0x09	APM	[0:0]	EN	R/W	0x00	APM enable
		[1:1]	MODE	R/W	0x00	APM mode
		[3:2]	WINDOW	R/W	0x00	APM computation window
0x0A	IRQEN	[0:0]	I2CRDY	R/W	0x01	IRQ serial interface ready enable
		[1:1]	VOVDIS	R/W	0x00	IRQ STO OVDIS enable
		[2:2]	VOVCH	R/W	0x00	IRQ STO OVCH enable
		[3:3]	SLPTHRESH	R/W	0x00	IRQ SRC LOW enable
		[4:4]	TEMP	R/W	0x00	IRQ temperature enable
		[5:5]	APMDONE	R/W	0x00	IRQ APM done enable
		[6:6]	APMERR	R	0x00	IRQ APM error enable
0x0B	CTRL	[0:0]	UPDATE	R/W	0x00	Load I <sup>2</sup> C registers configuration
		[2:2]	SYNCBUSY	R	0x00	Synchronization busy flag
0x0C	IRQFLG	[0:0]	I2CRDY	R	0x00	IRQ serial interface ready flag
		[1:1]	VOVDIS	R	0x00	IRQ STO OVDIS flag
		[2:2]	VOVCH	R	0x00	IRQ STO OVCH flag
		[3:3]	SLPTHRESH	R	0x00	IRQ SRC LOW flag
		[4:4]	TEMP	R	0x00	IRQ temperature flag
		[5:5]	APMDONE	R	0x00	IRQ APM done flag
		[6:6]	APMERR	R	0x00	IRQ APM error flag
0x0D	STATUS	[1:1]	VOVDIS	R	0x00	Status STO OVDIS
		[2:2]	VOVCH	R	0x00	Status STO OVCH
		[3:3]	SLPTHRESH	R	0x00	Status SRC LOW
		[4:4]	TEMP	R	0x00	Status temperature
		[6:6]	CHARGE	R	0x00	Status STO Charge
0x0E	APM0	[7:0]	DATA	R	0x00	APM data 0

Table 4: Register summary



Address	Name	Bit	Field Name	Access	RESET	Description
0x0F	APM1	[7:0]	DATA	R	0x00	APM data 1
0x10	APM2	[7:0]	DATA	R	0x00	APM data 2
0x11	TEMP	[7:0]	DATA	R	0x00	Temperature data
0x12	STO	[7:0]	DATA	R	0x00	Battery voltage
0x13	RSVD	[7:0]	-	R	-	Reserved
0xE0	PN0	[7:0]	DATA	R	0X31	Part number 0 data
0xE1	PN1	[7:0]	DATA	R	0X30	Part number 1 data
0xE2	PN2	[7:0]	DATA	R	0X39	Part number 2 data
0xE3	PN3	[7:0]	DATA	R	0X30	Part number 3 data
0xE4	PN4	[7:0]	DATA	R	0X31	Part number 4 data

Table 4: Register summary



### 3.4. I<sup>2</sup>C Communication

The device address on the I<sup>2</sup>C bus is 0x41. All information about the I<sup>2</sup>C communication is available in the AEM00901 datasheet, "System configuration" Section.

I<sup>2</sup>C\_VDD must be connected to an external power supply which voltage is within the 1.5 V to 5.0 V range. On the Evaluation Board, 1 kΩ pull-up on SDA and SCL (R1 and R2) to I<sup>2</sup>C\_VDD are provided.

In case one or more configurations are set by I<sup>2</sup>C 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 I<sup>2</sup>C.

### 3.5. Advanced Configurations

A complete description of the system constraints and configurations is available in Section "System configuration" of the AEM00901 datasheet.

#### 3.5.1. 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.

#### 3.5.2. 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 I<sup>2</sup>C 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.

## 4. Circuit Behavior

### 4.1. Startup and Supply

#### 4.1.1. Configuration

- SRC is supplied by a 1.0 V voltage source with 5 mA current compliance.
  - $V_{OC} = 1.0\text{ V}$
  - $I_{SRC} = 5\text{ mA}$
- SRC\_LVL\_CFG[5:0] = LHHLLH
  - $V_{SRC,REG} = 0.51\text{ V}$
- STO\_CFG[2:0] = HHL
  - $V_{OVDIS} = 3.01\text{ V}$
  - $V_{OVCH} = 4.35\text{ V}$
- Temperature monitoring disabled.
- DIS\_STO\_CH = L
  - Storage element charge is enabled.
- <KEEP\_ALIVE= H
  - Keep-alive functionality is enabled.

#### 4.1.2. Observations

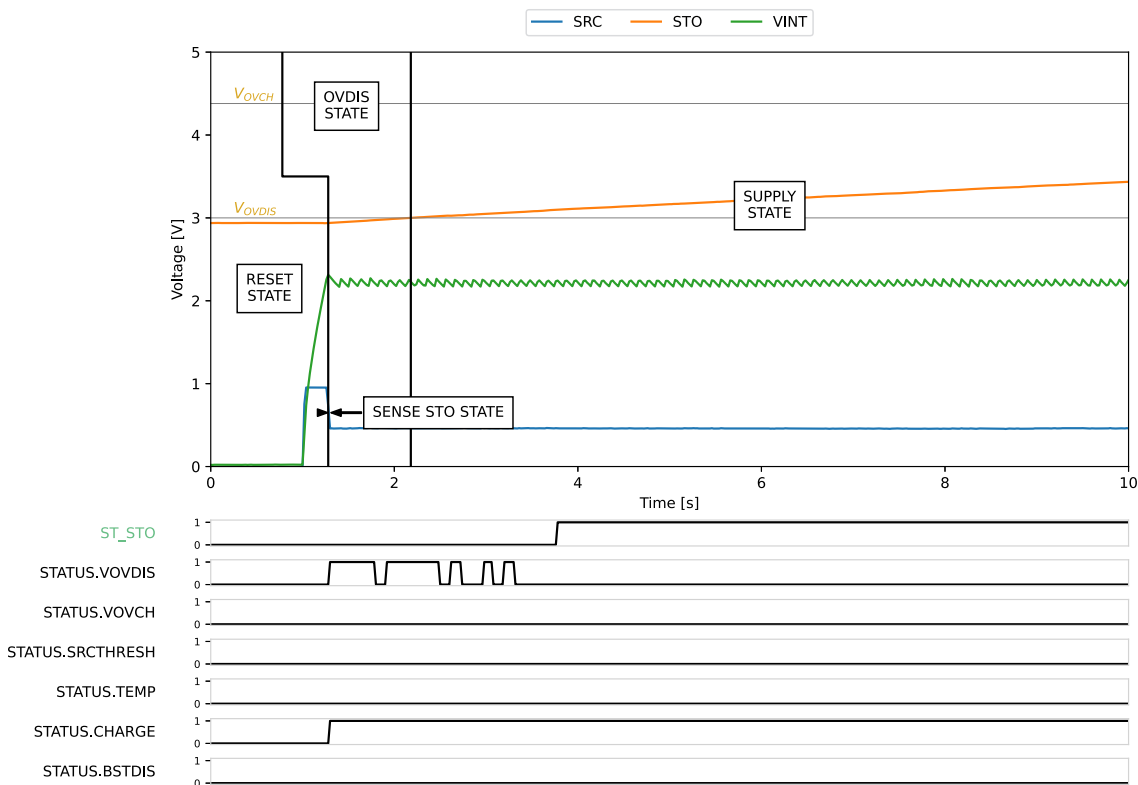


Figure 2: Startup and charge behavior

- The AEM0090x is initially in **RESET STATE**.
- Once the supply connected on **SRC** is switched on, the AEM0090x coldstarts.  $C_{INT}$  is charged until  $V_{INT}$  reaches  $V_{INT,CS}$ . Then, the AEM0090x switches to **SENSE STO STATE**.
- In **SENSE STO STATE**, the AEM0090x measures  $V_{STO}$ , which is slightly below  $V_{OVDIS}$ . The AEM0090x goes into **OVDIS STATE**.
- In **OVDIS STATE**, the AEM0090x performs a first  $V_{OC}$  evaluation and charges the storage element on **STO** by harvesting the energy from **SRC**.  $V_{SRC}$  is regulated at 0.51 V.  $V_{INT}$  is supplied by **SRC**. Once  $V_{STO}$  reaches  $V_{OVDIS}$ , the AEM0090x switches to **SUPPLY STATE**.
- In **SUPPLY STATE**, the AEM0090x charges the storage element.
  - Once  $V_{STO}$  reaches  $V_{OVDIS} + 100\text{ mV}$ , the **ST\_STO** toggles from LOW to HIGH.

## 4.2. Supply and Overcharge

### 4.2.1. Configuration

- **SRC** is supplied by a 1.0 V voltage source with 5 mA current compliance.
  - $V_{OC} = 1.0\text{ V}$
  - $I_{SRC} = 5\text{ mA}$
- **SRC\_LVL\_CFG[5:0] = LHHLLH**
  - $V_{SRC,REG} = 0.51\text{ V}$
- **STO\_CFG[2:0] = HHL**
  - $V_{OVDIS} = 3.01\text{ V}$
  - $V_{OVCH} = 4.35\text{ V}$
- Temperature monitoring disabled.
- **DIS\_STO\_CH = L**
  - Storage element charge is enabled.
- **KEEP\_ALIVE = H**
  - Keep-alive functionality is enabled.

### 4.2.2. Observations

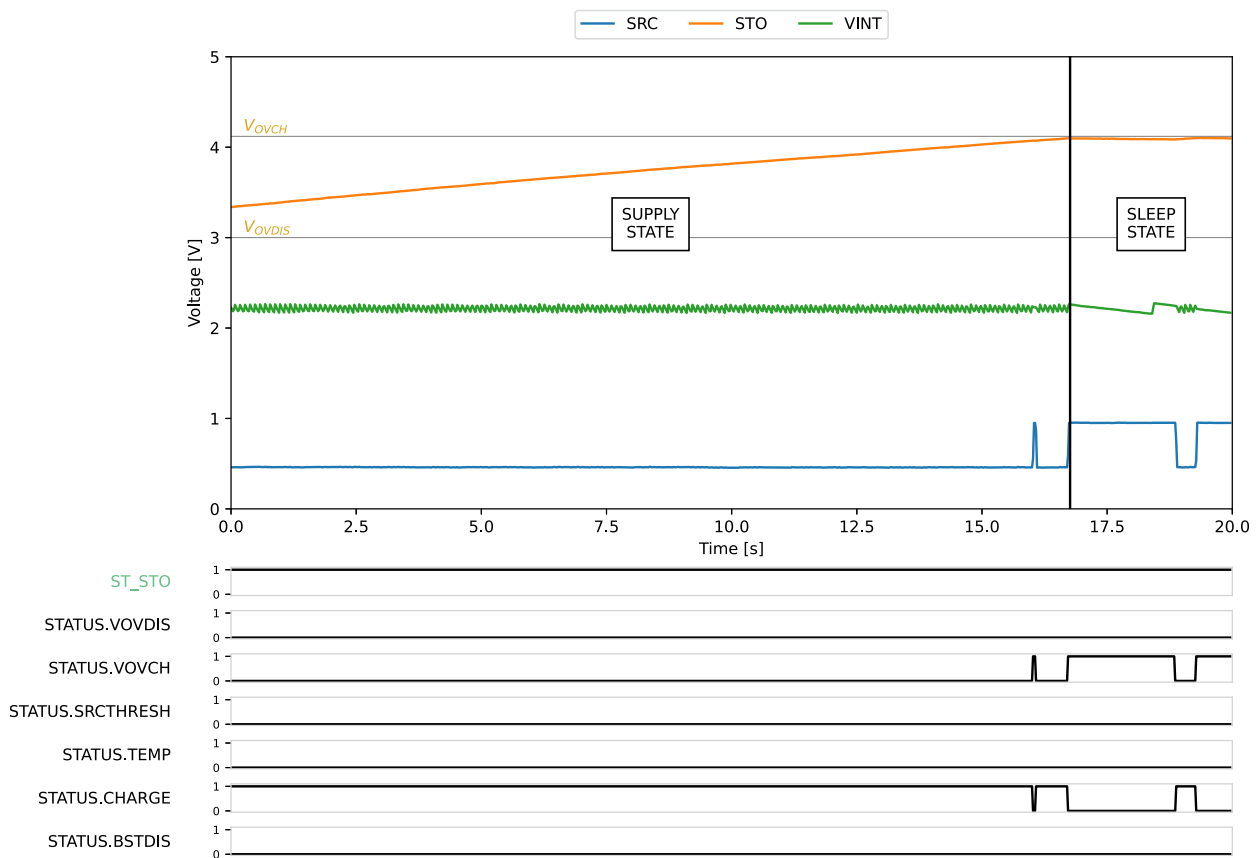


Figure 3: Supply and overcharge behavior

- In **SUPPLY STATE**, the AEM0090x charges the storage element.
- In **SLEEP STATE**, **STO** and **VINT** are fully charged. The AEM0090x stops harvesting energy from **SRC**. Please note that around 19 s, the AEM0090x recharges **VINT** from **STO**, thus briefly switching to **SUPPLY STATE** to compensate for the energy taken from **STO**.

### 4.3. Overdischarge

#### 4.3.1. Configuration

- SRC is supplied by a 1.0 V voltage source with 5 mA current compliance.
  - $V_{OC} = 1.0\text{ V}$
  - $I_{SRC} = 5\text{ mA}$
- SRC\_LVL\_CFG[5:0] = LHHLLH
  - $V_{SRC,REG} = 0.51\text{ V}$
- STO\_CFG[2:0] = HHL
  - $V_{OVDIS} = 3.01\text{ V}$
  - $V_{OVCH} = 4.35\text{ V}$
- Temperature monitoring disabled.
- DIS\_STO\_CH = L
  - Storage element charge is enabled.
- KEEP\_ALIVE = H
  - Keep-alive functionality is enabled.

#### 4.3.2. Observations

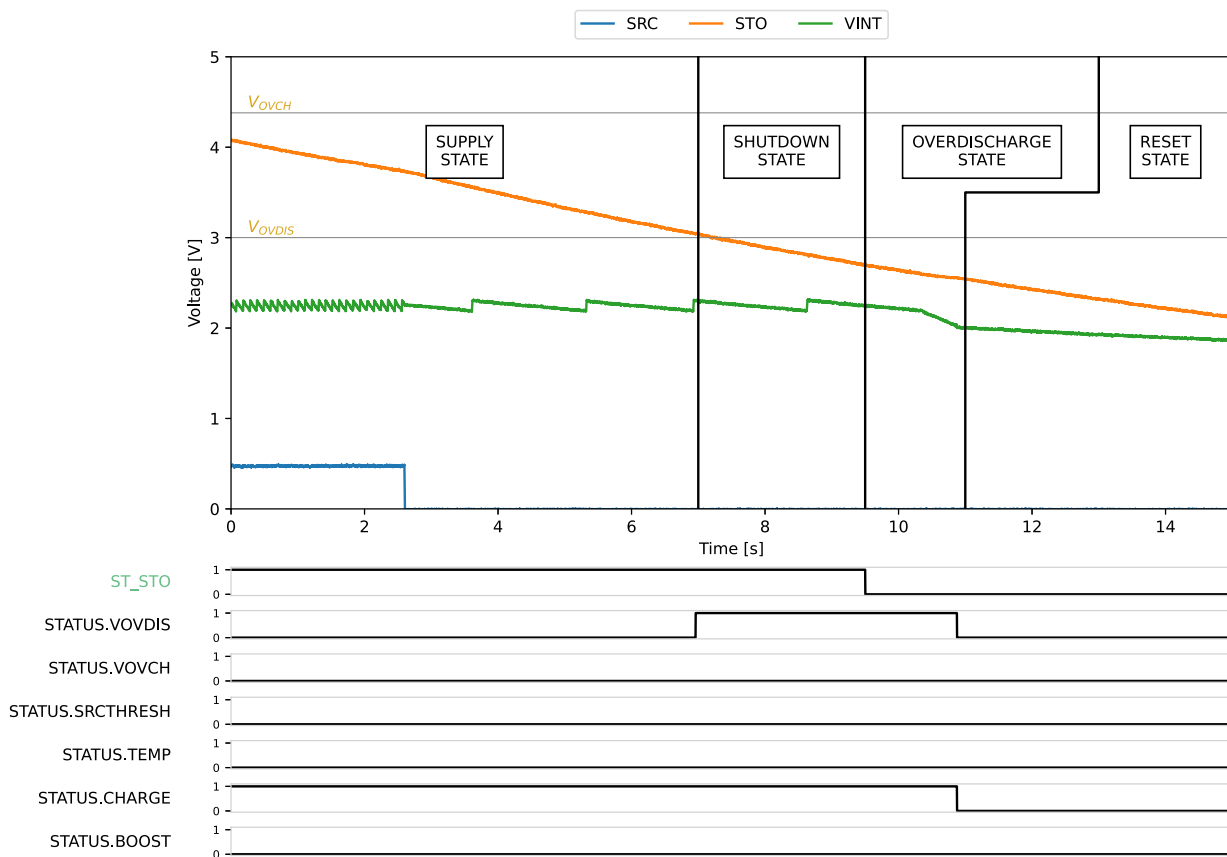


Figure 4: Overdischarge behavior

- The AEM0090x is initially in **SUPPLY STATE**.
- The AEM0090x is initially in **SLEEP STATE** since the sleep condition is satisfied:  $SLEEP.EN \ \& \ KEEP\_ALIVE \ \& \ (V_{STO} > V_{OVCH} \mid STATUS.TEMP \mid <Pin \ Control>DIS\_STO\_CH \mid V_{MPP} < SLEEP.SRCTHRESH)$ .
- Once  $V_{STO}$  reaches  $V_{OVDIS}$ , the AEM0090x enters **SHUTDOWN STATE**.
  - After 2.5 s in **SHUTDOWN STATE**, the AEM0090x goes in **OVDIS STATE** and  $ST\_STO$  toggles from HIGH to LOW.  $V_{INT}$  is no longer supplied and  $C_{INT}$  starts to discharge.
  - Once  $V_{INT}$  falls below 2 V, the AEM0090x goes in **RESET STATE**. All STATUS signals are set to LOW.

## 4.4. Keep-alive

### 4.4.1. Configuration

- SRC is supplied by a 1.0 V voltage source with 5 mA current compliance.
  - $V_{OC} = 1.0\text{ V}$
  - $I_{SRC} = 5\text{ mA}$
- SRC\_LVL\_CFG[5:0] = LHHLLH
  - $V_{SRC,REG} = 0.51\text{ V}$
- STO\_CFG[2:0] = HHL
  - $V_{OVDIS} = 3.01\text{ V}$
  - $V_{OVCH} = 4.35\text{ V}$
- Temperature monitoring disabled.
- DIS\_STO\_CH = L
  - Storage element charge is enabled.
- KEEP\_ALIVE: is enabled on Figure 5 and disabled on Figure 6.

### 4.4.2. Observations

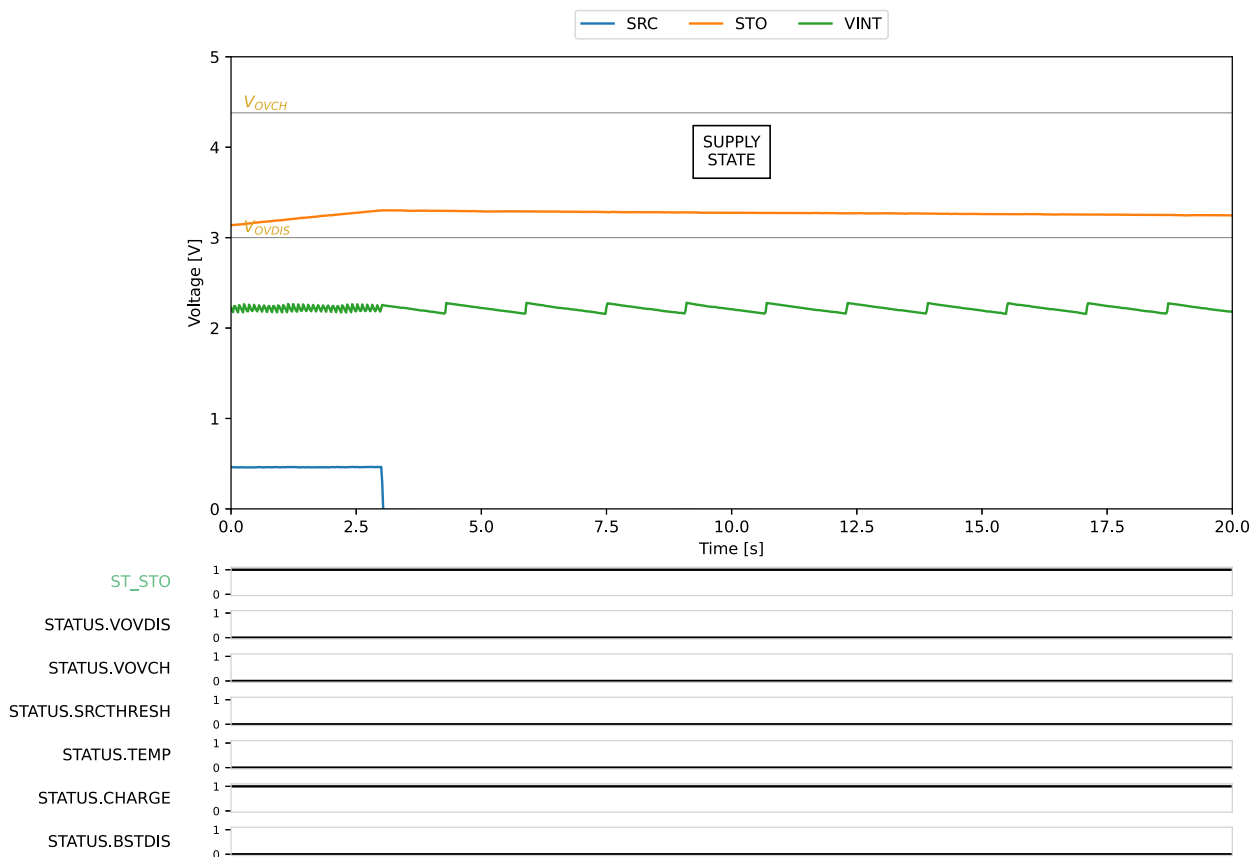


Figure 5: KEEP\_ALIVE HIGH behavior

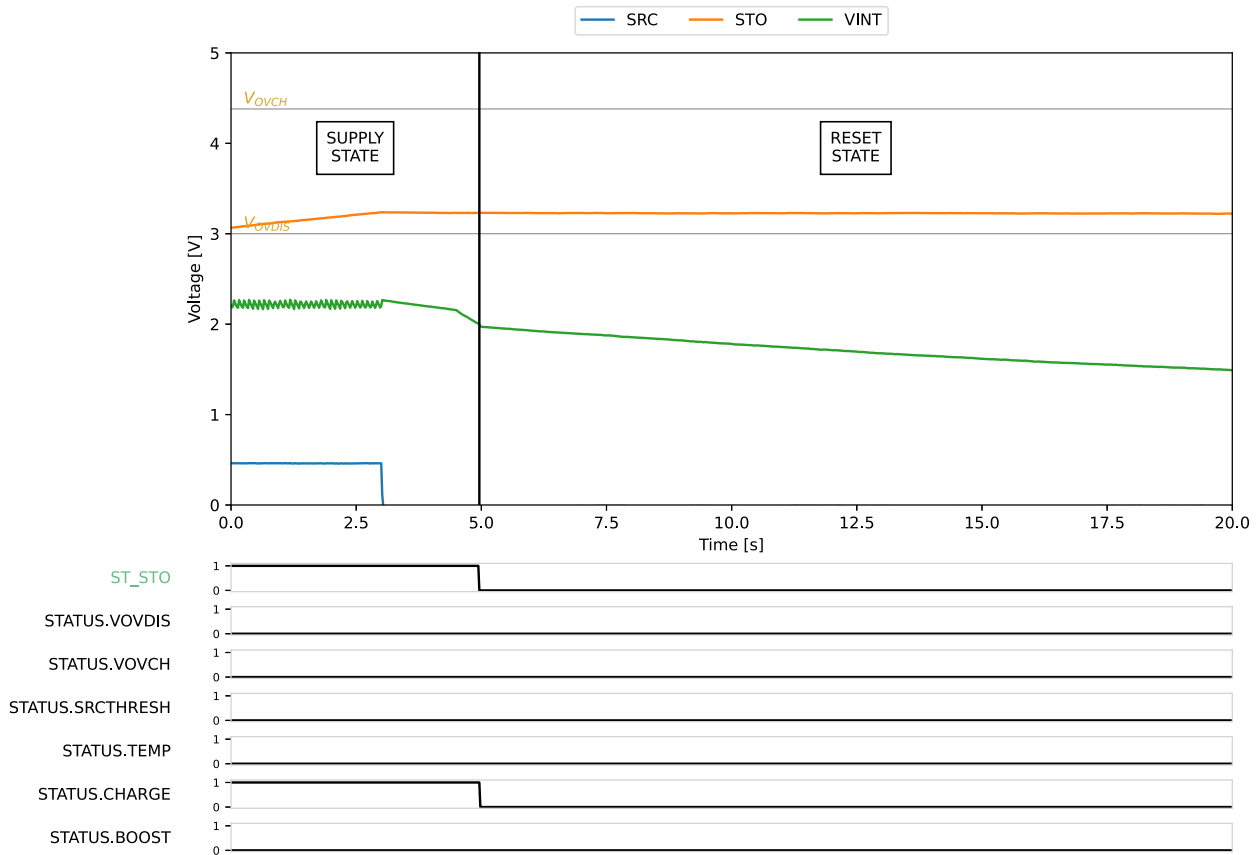


Figure 6: KEEP\_ALIVE LOW behavior

In both cases, the AEM0090x is first in **SUPPLY STATE**. The storage element connected to **STO** is charged by extracting power from **SRC**.

At 3 s, the energy source connected to the **SRC** pin is switched off in both cases. The behavior after that depends on whether the Keep-alive functionality is enabled or not:

- KEEP\_ALIVE = H (Keep-alive enabled, Figure 5): the AEM0090x switches to **SLEEP STATE**, so **VINT** keeps being supplied from the storage element connected to **STO**. The AEM0090x will be able to harvest again as soon as power is restored to the **SRC** pin. On the other hand, a small current is pulled from the storage element ( $I_{QSLEEP}$ , see Table 3).

- KEEP\_ALIVE = L (Keep-alive disabled, Figure 6): **VINT** can only be supplied from the energy available on **SRC**, so as soon as the power source is switched off, **VINT** stops being supplied. The AEM0090x switches to **RESET STATE**, so that no current is pulled from the storage element. The stored energy is thus preserved. On the other hand, when power is restored to the **SRC** pin, the AEM0090x must perform a cold start to resume harvesting.

## 4.5. Temperature Monitoring

### 4.5.1. Configuration

- SRC is supplied by a 1.0 V voltage source with 5 mA current compliance.
  - $V_{OC} = 1.0\text{ V}$
  - $I_{SRC} = 5\text{ mA}$
- SRC\_LVL\_CFG[5:0] = LHHLLH
  - $V_{SRC,REG} = 0.51\text{ V}$
- STO\_CFG[2:0] = HHL
  - $V_{OVDIS} = 3.01\text{ V}$
  - $V_{OVCH} = 4.35\text{ V}$
- Temperature monitoring is enabled with default values:
  - The temperature range in which the AEM0090x charges the storage element is 0 °C to 45 °C.
- DIS\_STO\_CH = L
  - Storage element charge is enabled.
- KEEP\_ALIVE = H
  - Heep-alive feature is enabled.

### 4.5.2. Observations

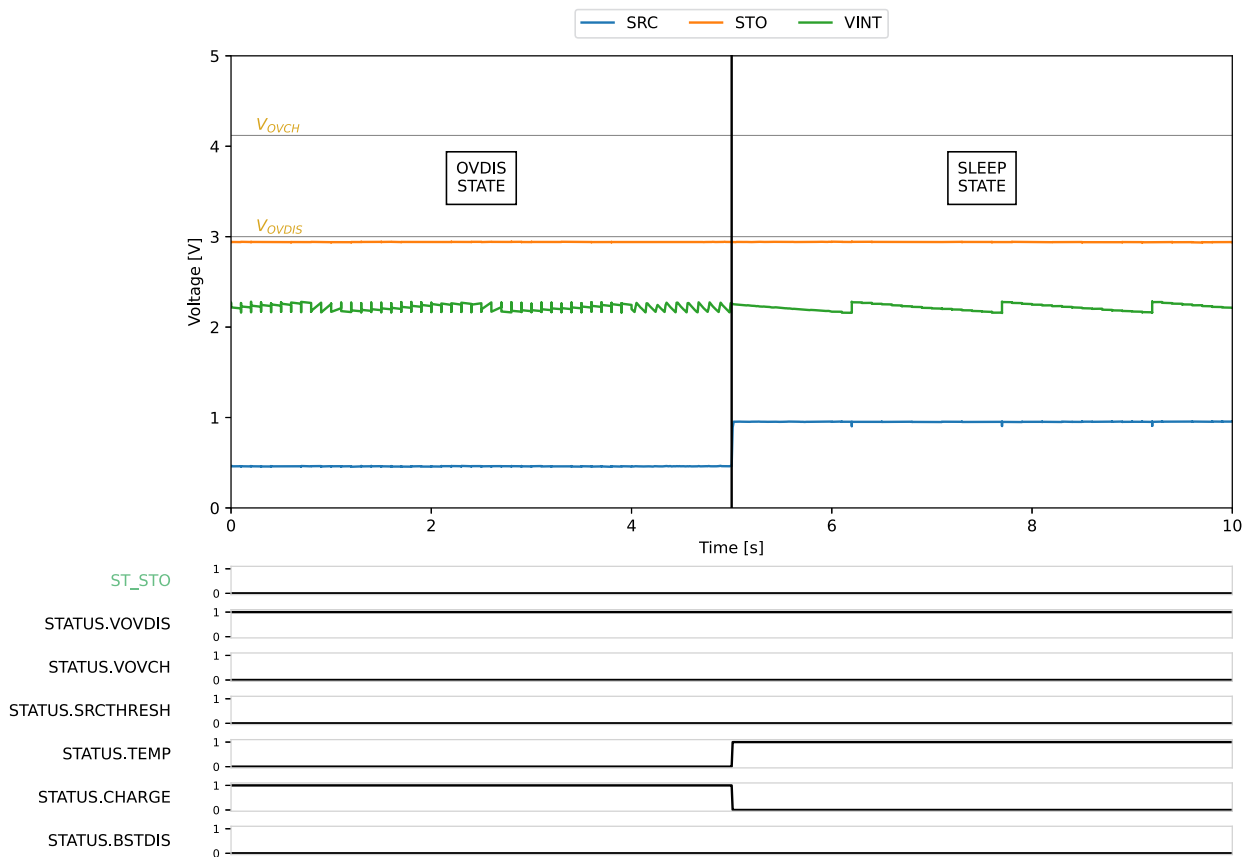


Figure 7: Temperature monitoring behavior

Figure 7 shows the AEM0090x charging the storage element while being in **OVDIS STATE**. At 5 s, the temperature drops below 0 °C, causing the AEM0090x to stop charging the storage element. The AEM0090x goes in **SLEEP STATE**

## 5. Functional Tests

This section presents a few simple tests that allow users to understand the functional behavior of the AEM00901. To avoid damaging the board, follow the procedure found in Section 3.1. 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:

- **SRC\_LVL\_CFG[5:0]** = LHHHL (0.54 V).
- **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 **I2C\_VDD** and **GND** if the I<sup>2</sup>C 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 AEM00901 datasheet).

### 5.1. Cold-start

The following test allows users to observe the minimum voltage required to coldstart the AEM00901. 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 3.1.
- **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 **V<sub>SRC,REG</sub>** 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.

### 5.2. I<sup>2</sup>C Communication

This test allows users to change a configuration through the I<sup>2</sup>C communication.

#### Setup

- Place the oscilloscope probe on **SRC**.
- Referring to Figure 1, follow steps 1 to 5 explained in Section 3.1. Configure the board in the desired state and start the system.
- Connect **I2C\_VDD** to the I<sup>2</sup>C supply (between 1.8 V and 5.5 V).
- Write ‘0010 0011’ (0x23) on the register (0x01)

- Write ‘1’ to the CTRL register (0x0B) to load the I<sup>2</sup>C register configuration (at startup the AEM00901 loads its configurations from the pins settings)

#### Observations and measurements

- **SRC**: observe that the voltage regulation switches to 0.285 V, when the register value is loaded



### 5.3. Efficiency

This test allows users to reproduce the efficiency graphs of the boost converter (see “DCDC Conversion Efficiency” Section in the AEM00901 datasheet).

#### Setup

- Referring to Figure 1, follow steps 1 to 5 explained in Section 3.1. 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 AEM00901 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 AEM00901 set VMPP 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:

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

## 6. DCDC Conversion Efficiency

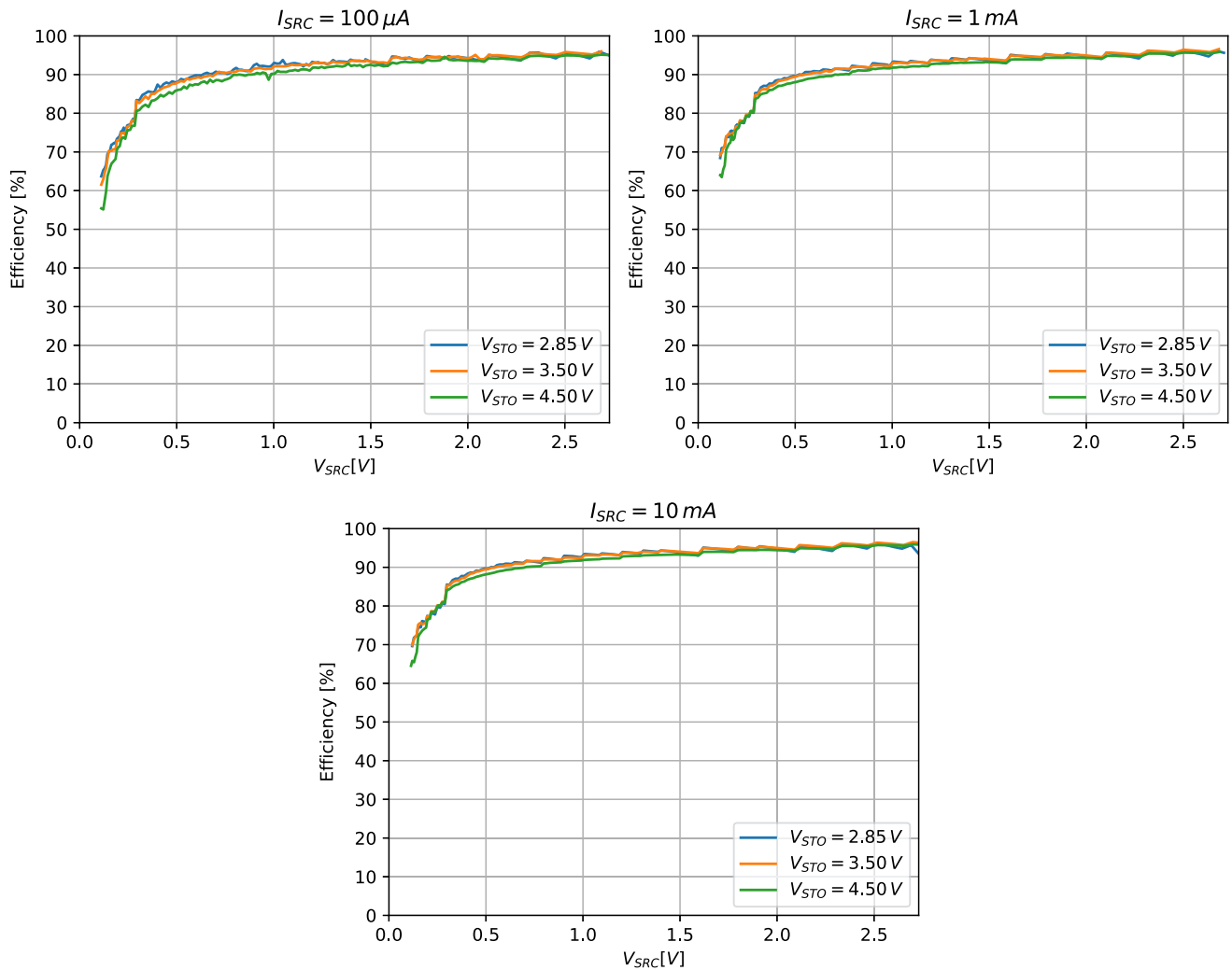


Figure 8: AEM00901 DCDC conversion efficiency (LDCDC: Coilcraft LPS4018-333MRB)

## 7. Schematics

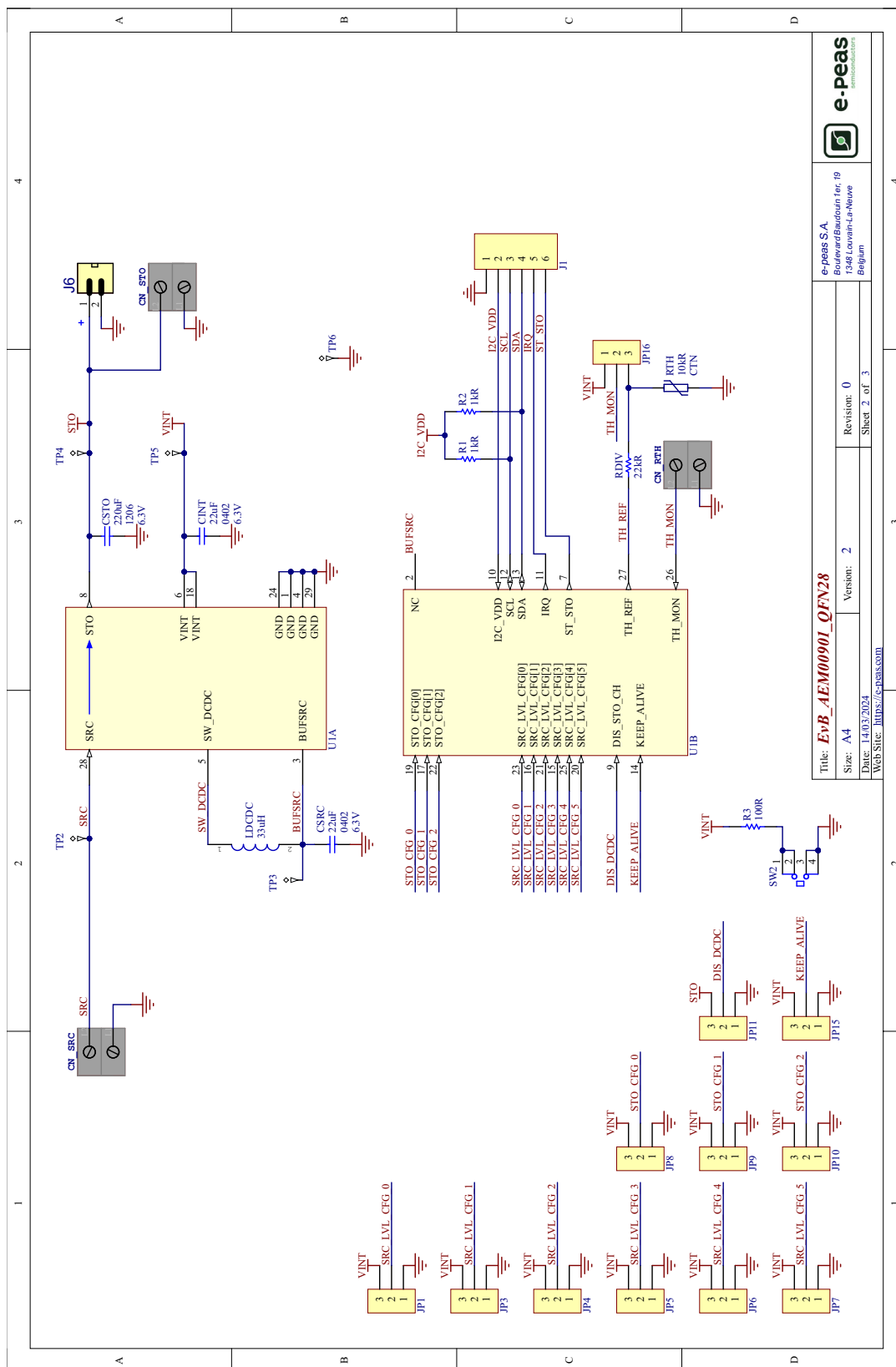


Figure 9: AEM00901 Evaluation Board Schematic

## 8. Revision History

EVK Version	User Guide Revision	Date	Description
Up to 1.1	1.0	February, 2022	Creation of the document.
1.2	1.1	September, 2023	Fixed some inconsistencies and updated images.
2.0	1.0	November, 2024	<ul style="list-style-type: none"> <li>- Added ST_STO</li> <li>- Removed user warning on silkscreen</li> <li>- Added extended range on SRC</li> <li>- Changed regmap: <ul style="list-style-type: none"> <li>- Changed version register</li> <li>- Added APM IRQ flag and error registers</li> <li>- Added part number registers</li> </ul> </li> <li>- Added circuit behavior section</li> </ul>

Table 5: Revision History