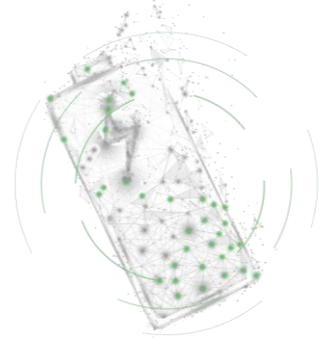




AEM13921

Quick Start Guide EVK



FEATURES

Connectors

- 2 screw connectors for the sources
- 1 screw connector for the storage element
- 1 screw connector for the application circuit
- 1 screw connector for RZMPP
- 1 screw connector for 5 V DC power input
- 1 USB connector for alternative 5 V DC power input / USB to I²C converter

Configuration

- 1 header SRCx_MODE per source to configure the source voltage regulation mode
- 5 headers SRCx_CFG[4:0] per source to configure the source regulation voltage
- 3 headers STO_CFG[2:0] to configure the storage element protection thresholds
- 3 headers LOAD_CFG[2:0] to configure the LOAD output regulation voltage
- 1 header THERM to enable/disable the thermal monitoring
- 1 header to enable/disable the I²C functionalities
- 1 header (7 pins) to connect the I²C communication related pins, ST_STO and ST_LOAD signals
- 3 headers to configure the 5 V charge current
- 1 header to enable/disable the shipping mode

Size

- 76 mm x 49 mm.
- 4 x M2.5 mounting holes.

SUPPORT PCB

BOM around the AEM13921

Designator	Description	Quantity	Manufacturer	Part Number
U1	AEM13921 QFN40	1	e-peas	Order at sales@e-peas.com
CINT	Ceramic Cap 10 μ F, 6.3 V, 20 %, X5R, 0402	1	Murata	GRM155R60J106ME44D
CSTO	Ceramic Cap 47 μ F, 6.3 V, 20 %, X5R, 0603	1	Murata	GRM188R60J476ME15D
CSRC1	Ceramic Cap 22 μ F, 10 V, 20 %, X5R, 0603	1	Murata	GRM188R61A226ME15D
LBOOST1	Power inductor 33 μ H, 0.68 A, LPS4018	1	Coilcraft	LPS4018-333MRB
CSRC2	Ceramic Cap 22 μ F, 10 V, 20 %, X5R, 0603	1	Murata	GRM188R61A226ME15D
LBOOST2	Power inductor 33 μ H, 0.68 A, LPS4018	1	Coilcraft	LPS4018-333MRB
CLOAD	Ceramic Cap 22 μ F, 10 V, 20 %, X5R, 0603	1	Murata	GRM188R61A226ME15D
LBUCK	Power inductor 10 μ H	1	TDK	VLS252012CX-100M-1
RMPP	Resistor	1	To be defined by the user.	
C5	Ceramic Cap 47 μ F, 25 V, 20 %, X5R 1206	1	TDK	C3216X5R1E476M160AC
R1	Resistor 2.2 Ω	1	TE	CRGCQ2512J2R2
R3	Resistor	1	To be defined by the user.	
D1	Zener diode 5.1V	1	ON Semi	1SMB5918BT3G
RSCL	Resistor 1 k Ω	1	Multicomp	MCWR06X1001FTL
RSDA	Resistor 1 k Ω	1	Multicomp	MCWR06X1001FTL
RDIV	Resistor 22 k Ω	1	Yageo	RC0402FR-0722KL
RTH	10 k Ω NTC thermistor	1	Murata	NCP15XH103J03RC

Footprint & Symbol: Information available on the datasheet





STEP 1: Configure the AEM13921



- SRC1 and SRC2 voltage regulation:**

SRCx_MODE and SRCx_CFG[4:0] (seen as HIGH if left floating)

If SRCx_MODE = L (constant voltage):

Configuration pins					Voltage [V]
SRCx_CFG[4:0]					V _{SRCx,REG}
L	L	L	L	L	0.25
L	L	L	L	H	0.30
L	L	L	H	L	0.35
L	L	L	H	H	0.41
L	L	H	L	L	0.45
L	L	H	L	H	0.50
L	L	H	H	L	0.56
L	L	H	H	H	0.60
L	H	L	L	L	0.65
L	H	L	L	H	0.71
L	H	L	H	L	0.75
L	H	L	H	H	0.80
L	H	H	L	L	0.86
L	H	H	L	H	0.90
L	H	H	H	L	0.95
L	H	H	H	H	1.01

Configuration pins					Voltage [V]
SRCx_CFG[4:0]					V _{SRCx,REG}
H	L	L	L	L	1.10
H	L	L	L	H	1.20
H	L	L	H	L	1.31
H	L	L	H	H	1.40
H	L	H	L	L	1.50
H	L	H	L	H	1.59
H	L	H	H	L	1.70
H	L	H	H	H	1.79
H	H	L	L	L	1.90
H	H	L	L	H	1.99
H	H	L	H	L	2.19
H	H	L	H	H	2.41
H	H	H	L	L	2.59
H	H	H	L	H	2.82
H	H	H	H	L	3.00
H	H	H	H	H	3.18

If SRCx_MODE = H (MPPT ratio):

Configuration pins			MPPT Ratio [%]
SRCx_CFG[2:0]			R _{MPPT}
L	L	L	35%
L	L	H	50%
L	H	L	65%
L	H	H	70%
H	L	L	75%
H	L	H	80%
H	H	L	85%
H	H	H	ZMPP (SRC1) / 100% (SRC2)

Configuration pins		MPPT wait time [ms]	MPPT Period [ms]
SRCx_CFG[4:3]		T _{MPPT,WAIT} ¹	T _{MPPT,PERIOD}
L	L	1.8	116
L	H	7.3	465
H	L	29	1862
H	H	233	14895

1. The total time in open-circuit is the sum of T_{MPPT, WAIT} (see table above) plus T_{MPPT, MEASURE} (fixed to 1.36ms).

- Storage element protection thresholds: STO_CFG[2:0]** (seen as HIGH if left floating)

Configuration pins			Overdischarge voltage [V]	Charge ready voltage [V]	Overcharge voltage [V]	Storage element type
STO_CFG[2:0]			V _{OVDIS}	V _{CHRDY}	V _{OVCH}	
L	L	L	2.51	2.61	3.79	Lithium-ion Super Capacitor (LiC)
L	L	H	2.51	2.61	3.49	Lithium-ion Super Capacitor 85 °C (LiC)
L	H	L	3.00	3.21	4.13	Lithium-ion
L	H	H	3.00	3.21	3.90	Lithium-ion (long life)
H	L	L	3.51	3.60	3.90	Lithium-ion (super long life)
H	L	H	3.00	3.60	4.35	Lithium Polymer (LiPo), NiMH
H	H	L	2.81	3.11	3.62	Lithium Iron Phosphate (LiFePO4)
H	H	H	2.61	2.70	3.90	Tadiran HLC1020

If the LOAD output is used and configured with the headers (not by I²C), the

V_{CHRDY, BUCK} threshold will be configured automatically in function of STO_CFG[2:0] and V_{LOAD} settings:

Configuration pins				Buck charge ready voltage [V]				Storage element type
STO_CFG[2:0]				V _{CHRDY,BUCK} for V _{LOAD} ≤ 2.5 V	V _{CHRDY,BUCK} for V _{LOAD} = 2.8 V	V _{CHRDY,BUCK} for V _{LOAD} = 3.0 V	V _{CHRDY,BUCK} for V _{LOAD} = 3.3 V	
L	L	L		2.61	2.91	3.11	3.41	Lithium-ion Super Capacitor (LiC)
L	L	H		2.61	2.91	3.11	3.41	Lithium-ion Super Capacitor 85 °C (LiC)
L	H	L		3.21	3.21	3.21	3.51	Lithium-ion
L	H	H		3.21	3.21	3.21	3.51	Lithium-ion (long life)
H	L	L		3.60	3.60	3.60	3.60	Lithium-ion (super long life)
H	L	H		3.60	3.60	3.60	3.60	Lithium Polymer (LiPo), NiMH
H	H	L		3.11	3.11	3.21	3.41	Lithium Iron Phosphate (LiFePO4)
H	H	H		2.70	2.91	3.11	3.41	Tadiran HLC1020





- **5 V charger maximum current:** the maximum charging current can be configured with a jumper (135 mA, 73.5 mA and 13.5 mA) or by mounting R3 resistor (e.g., 1.5 k Ω resistor for 33.3 mA).

Resistor [Ω]	Maximum Charging Current [mA]
R_{SV_IMAX}	I_{SV_CC}
370	135.0
680	73.5
1500	33.3
3700	13.5

- **Thermal monitoring:** connect the jumper THERM to EN/DIS to enable/disable the thermal monitoring feature.

For preconfigured temperature thresholds, see “Storage Element Thresholds” section in the datasheet.

- **Load voltage regulation:** LOAD_CFG[2:0] (seen as HIGH if left floating)

Configuration pins			LOAD voltage [V]
LOAD_CFG[2:0]			V_{LOAD}
L	L	L	Buck disabled
L	L	H	1.2
L	H	L	1.8
L	H	H	2.2
H	L	L	2.5
H	L	H	2.8
H	H	L	3.0
H	H	H	3.3

- **I²C communication:** all the configurations of the AEM, as well as various information, are available through I²C communication. See the datasheet for more details.

Please note that, while ST_STO and ST_LOAD share the same header as the I²C interface, their power domains are not VDDIO but respectively V_{STO} and V_{LOAD} .

- **USB to I²C converter:** to use the “I²C Configuration Tool” for easy configuration of all I²C functionalities, install jumpers on VDDIO, SDA, SCL and IRQ on the I²C communication header and connect the EVK to a computer through the USB connector.

The USB connector can also be used as an alternative power source for the 5 V charger. To do so, install a jumper on the “5V_IN-VUSB” header.

STEP 2: Connect the storage element with a voltage higher than 2.4 V

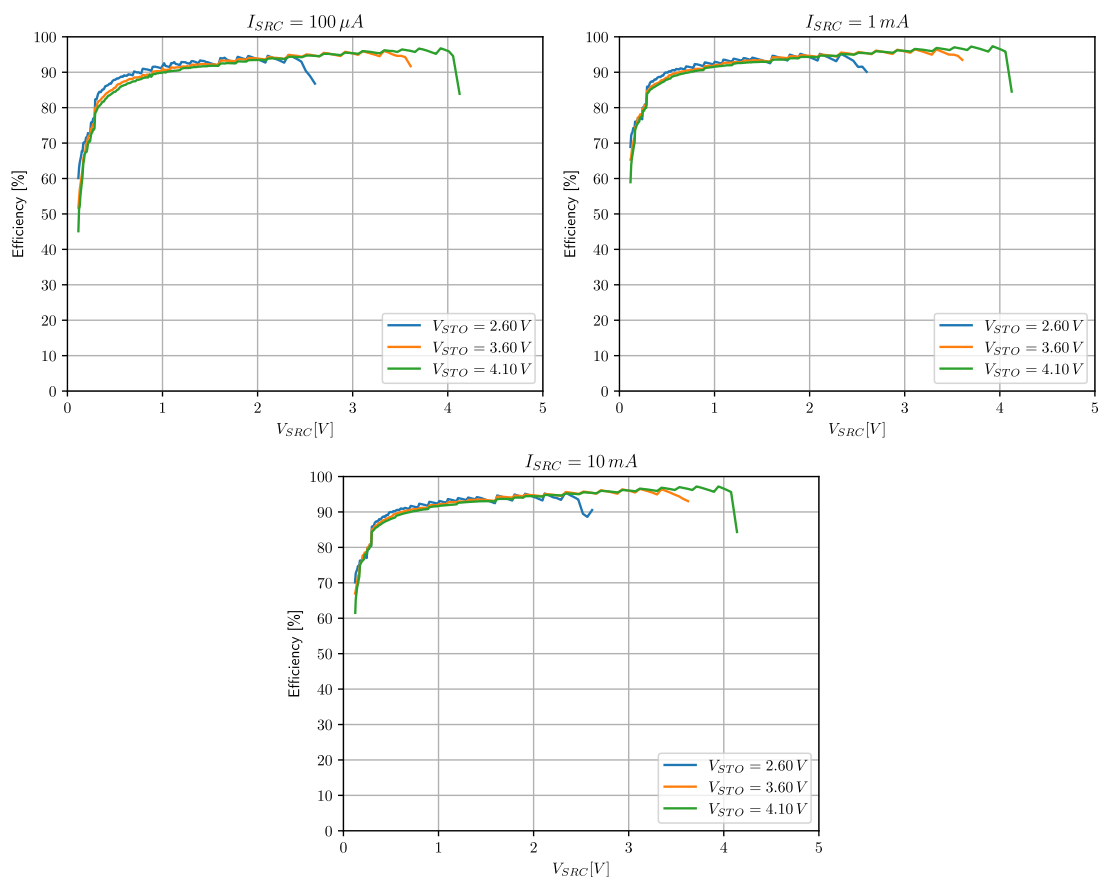
STEP 3: Connect the application circuit

STEP 4: Connect the source(s) or the 5 V power input





Boost efficiency ($L_{\text{BOOSTx}} = 33 \mu\text{H}$ Coilcraft LPS4018-333MRB; boost timing x3):



Buck efficiency ($L_{\text{BUCK}} = 10 \mu\text{H}$ TDK VLS252012CX-100M-1; buck timing x2):

