AEM10941 Fujikura NGK Energy Harvesting Power Module

Hardware Specification

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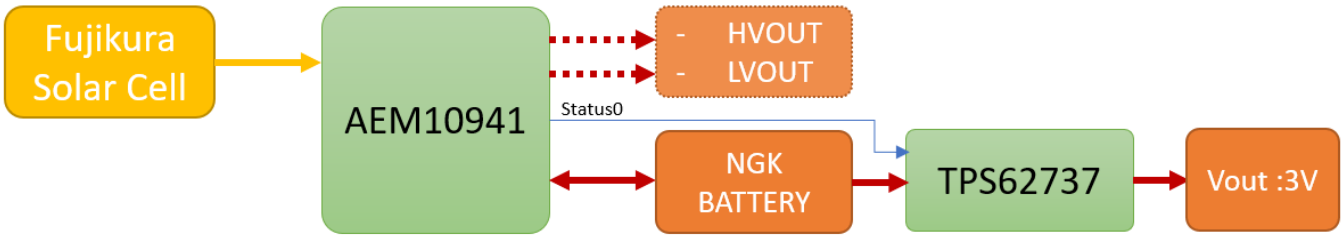
History :

Date	Author	Description
26 / 03/ 2021	*Juan HIDALGO*	*Creation of the files*

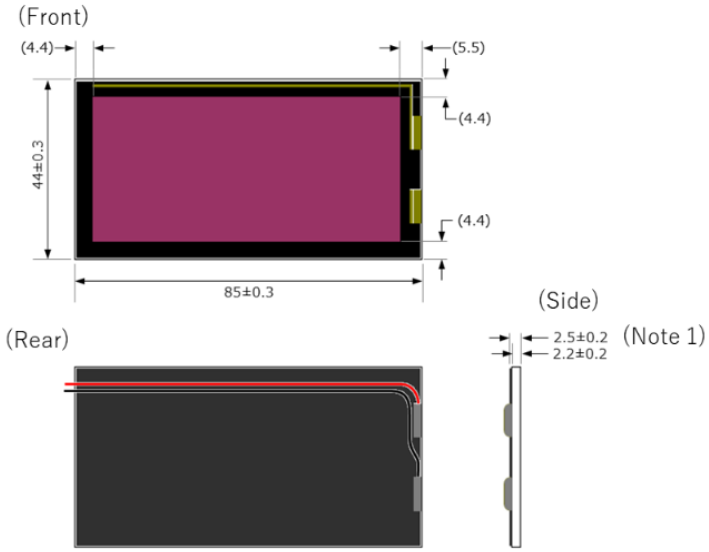
Contents

1 High level architecture



2 Fujikura Solar Cell

Model : FDSC-FSC5FGC
Dimensions : 44 x 85 mm



Electric specifications

Item	Unit	Specification	Typical value	Condition
Maximum Power (P_m)	µW	Minimum 117 (Maximum output rating)	165	White LED 200 lx Ambient temperature 23°C
Operation Current (I_{op}) at 0.38 V	µA	Minimum 304	425	
Open Circuit Voltage (V_{oc})	V	0.45 - 0.65	0.50	

Maximum Power Point:
MPP Max = 0.38/0.45 = 85% MPP Min = 0.38/0.65 = 58.5% **MPP Typ = 0.38/0.5 = 76%**

Fujikura recommendation is to use a 75% MPP Ratio to cover a wide range of light intensity (100 - 5000 Lux).

3 NGK Battery

Model : EC382704P-C

Characteristics :

Model Number	EC382704P-C
	
Dimension	38×27×0.45mm 1.50×1.06×0.018inch
Nominal Capacity	100mWh（27mAh）
Energy density	220mWh/cc
Nominal Voltage	3.8V
Peak discharge current*2	170mA

- Maximum Charging voltage : 4.3V
- Discharge cut-off voltage : 3V

- Maximum charging current is 0.75C
(1C=27mA for 4.3V charge, 24mA for 4.2V charge, respectively.)
Then, it is 20mA for 4.3V charge, and 18mA for 4.2V charge, respectively
These values will be large enough for Fujikura's DSSC.

AGK proposes to set AEM10941's output as 4.2V.

No standard configuration for these threshold values, the nearer one is 4.12V- 3.67V- 3.01V

Final proposed threshold values using a custom configuration:
- Vovch : 4.2V
- Vchrdy : 3.6V
- Vovdis : 3V

4 AEM10941 PMIC

By default, all configurations can be done with 0603 0 Ohms resistors. A predefined configuration can be mounted in production to match the characteristics of the solar cell and the storage element.

There are other functionalities we're not normally using but we could also keep for more flexibility :

- LDOs outputs and enable pins
- Primary battery. Non rechargeable battery used as a backup in the case the rechargeable battery is empty.
- FB_HB. Feedback resistors bridge for setting the HVOUT LDO voltage when using the custom mode.
- FB_COLD. Resistor bridge to increase the voltage at which the AEM will cold start.

4.1 Solar Cell MPP Configuration

MPP set to 75% : SELMPP[1:0] = 01

4.2 Battery Configuration

Custom Configuration : CFG[2:0] = 000
Vovch = 4.2V
Vchrdy = 3.6V
Vovdis = 3V

5 TPS62737 Buck Converter

Pinout:

PIN				DESCRIPTION
NAME	TPS62736 RGY	TPS62737 RGY	TYPE	
EN1	5	5	Input	Digital input for chip enable, standby, and ship-mode. EN1 = 1 sets ship mode independent of EN2. EN1=0, EN2 = 0 disables the buck converter and sets standby mode. EN1=0, EN2=1 enables the buck converter. Do not leave either pin floating.
EN2	6	6	Input	
IN	1	1	Input	Input supply to the buck regulator
NC	2, 3, 4, 14	4, 14	Input	Connect to VSS
OUT	11	11	Output	Step down (buck) regulator output
SW	13	2, 13	Input	Inductor connection to switching node
Thermal Pad	15	15	Input	Connect to VSS
VIN_OK	10	10	Output	Push-pull digital output for power-good indicator for the input voltage. Pulled up to VIN pin.
VIN_OK_SET	8	8	Input	Resistor divider input for VIN_OK threshold. Pull to VIN to disable. Do not leave pin floating.
VOUT_SET	9	9	Input	Resistor divider input for VOUT regulation level
VRDIV	7	7	Output	Resistor divider biasing voltage
VSS	12	3, 12	Input	Ground connection for the device

Circuit : used the same as suggested in the datasheet:

10.2.1 TPS62737 3-Resistor Typical Application Circuit

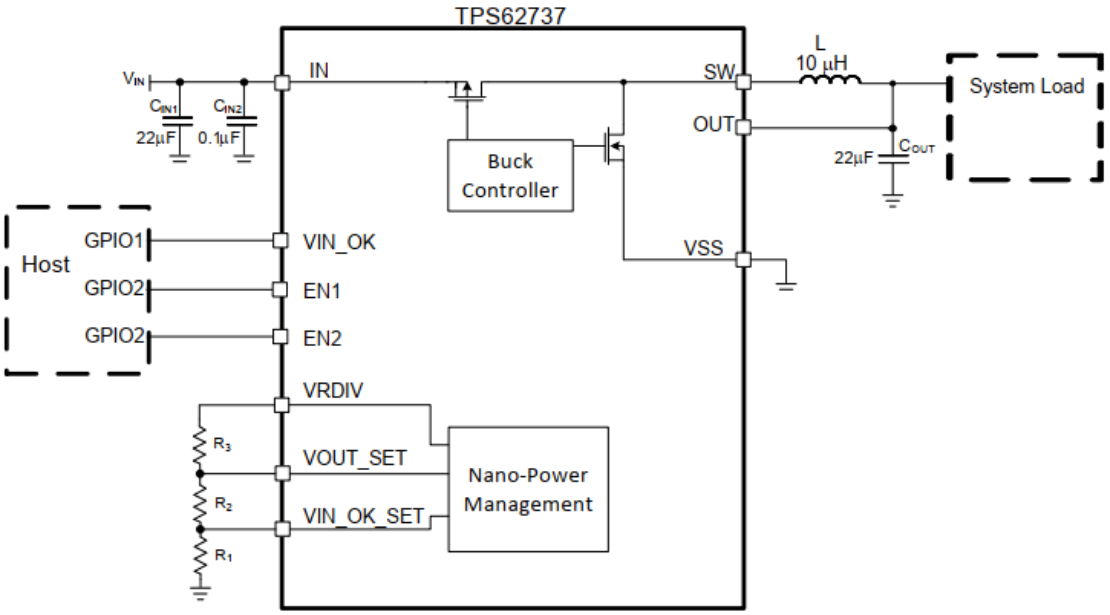


Figure 52. TPS62737 3-Resistor Typical Application Circuit

5.1 Configuration

Output voltage 3V.

VinOK output set to 3.12V. This output is asserted when the battery voltage rises the settled value, 3.12V in this case.

Resistor values for the above preliminary configuration : R1 = 4.99 MΩ, R2 = 200 kΩ, R3 = 7.68 MΩ

EN1 disables the IC when connected to the battery, having a minimal current consumption of 10nA. A small SMD switch is used to completely disable the IC or to be controlled by the AEM10941 Status0.

EN2 is not used (connected to Vin).

6 PCB

Dimensions : Same as the solar cell.
Thickness : 1.55mm 4 layers
Aperture for the solar cell cables
Footprint for the battery
Two pins header for the 3V output for the external application circuit.