NanoPower
P60 ACU-200

Datasheet

Array Conditioning Unit daughterboard for the P60 system

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Product name: NanoPower P60 ACU-200

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Confidentiality Notice

1 Table of Contents

2 System Overview

The P60 ACU-200 (Array Conditioning Unit) is a GomSpace daughterboard to be used with the P60 Dock. It contains 6 input channels each rated to 2 A.

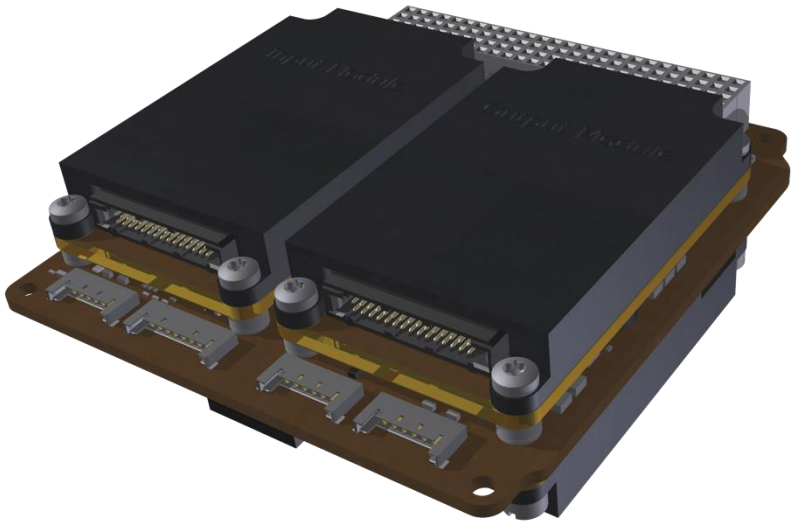


Figure 1 CAD drawing of a NanoDock P60 with four shielded daughter boards

2.1 Highlighted Features

P60 ACU-200 module

- 6 PV input channels per module
- High voltage solar input, up to 16 V and 32 V
  - PV array open circuit voltage must be below the battery voltage.
- Each input rated nominally to 2 A
- Individual power point tracking on each input channel
- Current and voltage measurements on each input channel
- Synchronized out-of-phase converters for low EMI operation
- Spread Spectrum Frequency Modulation
- PCB material: Glass/Polyimide IPC 6012C cl. 3/A
- IPC-A-610 Class 3 assembly

Note that the total power conversion is limited by thermal considerations. Hence installation hardware and operating voltages is indirectly a limiting factor – in general the higher voltage the higher power.

2.2 Block Diagram

The ACU module uses 6 individual maximum power point tracking boost converters. The input is available only in the TFM connector on the input module. Multiple pins are used on each input to increase current carrying capacity - these pins do not include protection diodes to combine multiple strings. GomSpace solar arrays in the correct configuration (including one panel-mounted protection diode per string) can be combined into a single input channel.

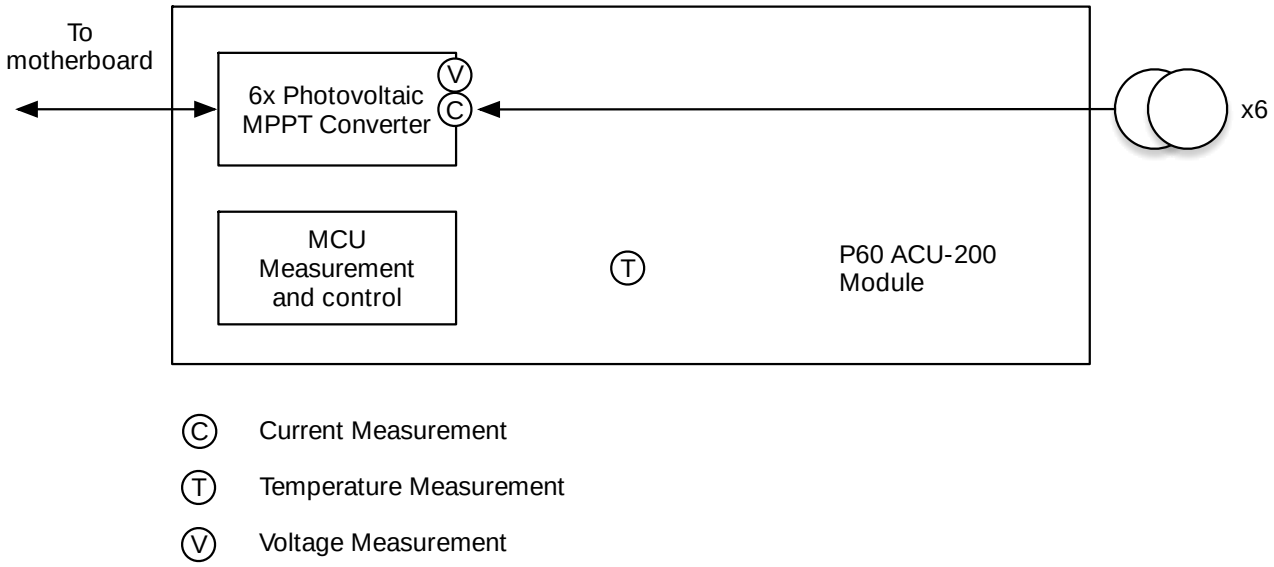
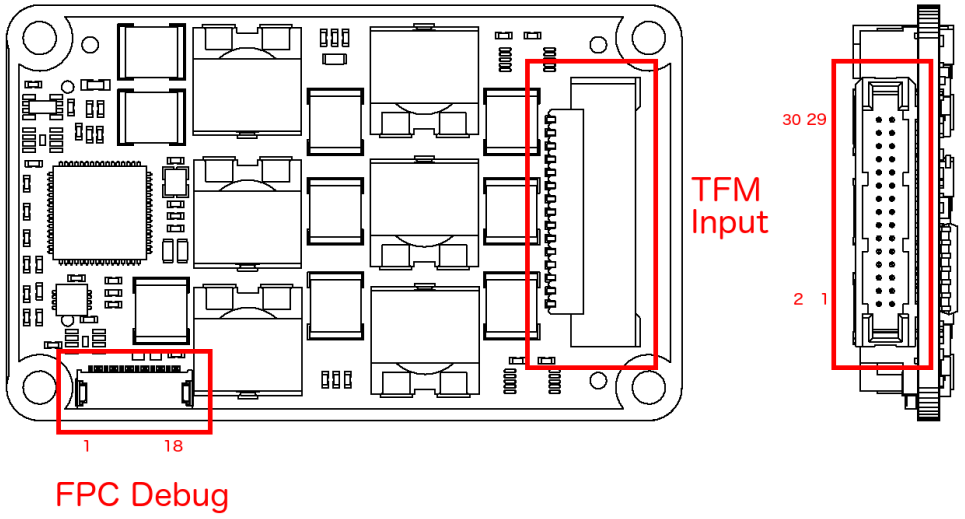


Figure 2 P60 ACU-200 block diagram

3 Connector Pinout



3.1 TFM Input

Samtec TFM-115-02-L-DH

Note that the polarization key is located next to pin 30.

Pin	Description	Pin	Description
1	PV 0	**2**	GND
3	PV 0	**4**	GND
5	PV 1	**6**	GND
7	PV 1	**8**	GND
9	PV 2	**10**	GND
11	PV 2	**12**	GND
13	PV 3	**14**	GND
15	PV 3	**16**	GND
17	PV 4	**18**	GND
19	PV 4	**20**	GND
21	PV 4	**22**	GND
23	PV 4	**24**	GND
25	PV 5	**26**	GND
27	PV 5	**28**	GND
29	PV 5	**30**	GND

3.2 FPC Debug

Molex 51281-1894

Programming and test connector.

Pin	Description
1	GND
2	VCC
3	RESET_NOT
4	JTAG_TDI
5	JTAG_TMS
6	JTAG_TCK
7	JTAG_TDO
8	GND
9	VCC
10	UART_RX (GOSH)
11	UART_TX (GOSH)
12	VREF
13	VREF
14	Not connected
15	Not connected
16	Not connected
17	Not connected
18	GND

4 Absolute Maximum Ratings

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the P60. Exposure to absolute maximum rating conditions for extended periods may affect the reliability.

Symbol	Description	Min.	Max.	Unit
T_{amb}	Operating Temperature	-35 °C	+85 °C	°C
V_{io}	Voltage on I^2C/USART pins	-0.1	3.4	V

5 Electrical Characteristics

Parameter	Condition	Min.	Typ.	Max.	Unit
Battery **- Voltage** **- Current, charge**		 6	 4	 34 6	 V A
PV inputs **- Voltage** - **Current** **- Efficiency**	Photo-voltaic inputs Depends on Input voltage, current and battery back configuration.	 4.5 0.0	 16.0 90	 25.0 2.0	 V A %
Supply **- VCC** **- Current, cont.**	Regulated input from P60 Dock From -35 °C to +85 °C Total current	 3.20 0.00	 3.29 0.1	 3.39 0.50	 V A

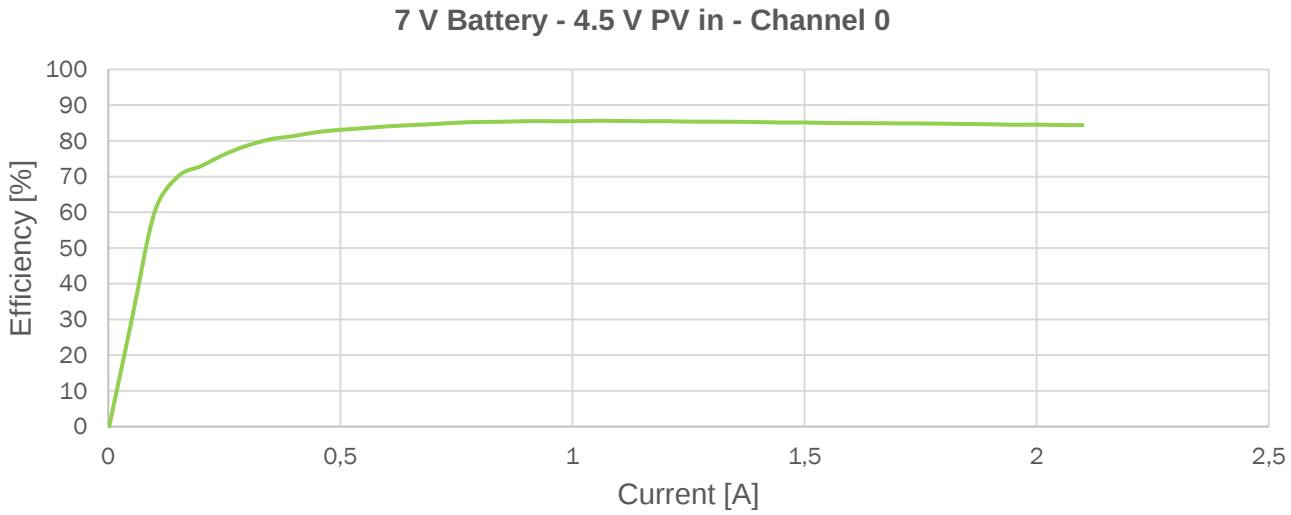
6 Physical Characteristics

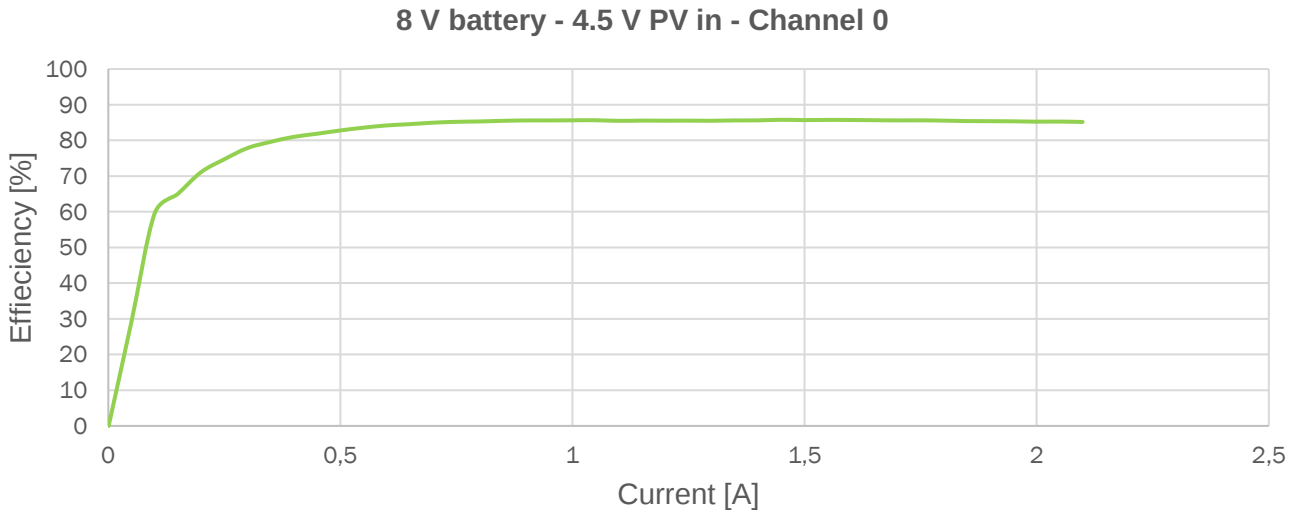
Description	Value	Unit
Mass – with shield	54	g
Size	65.3 x 40.0 x 12.3	mm

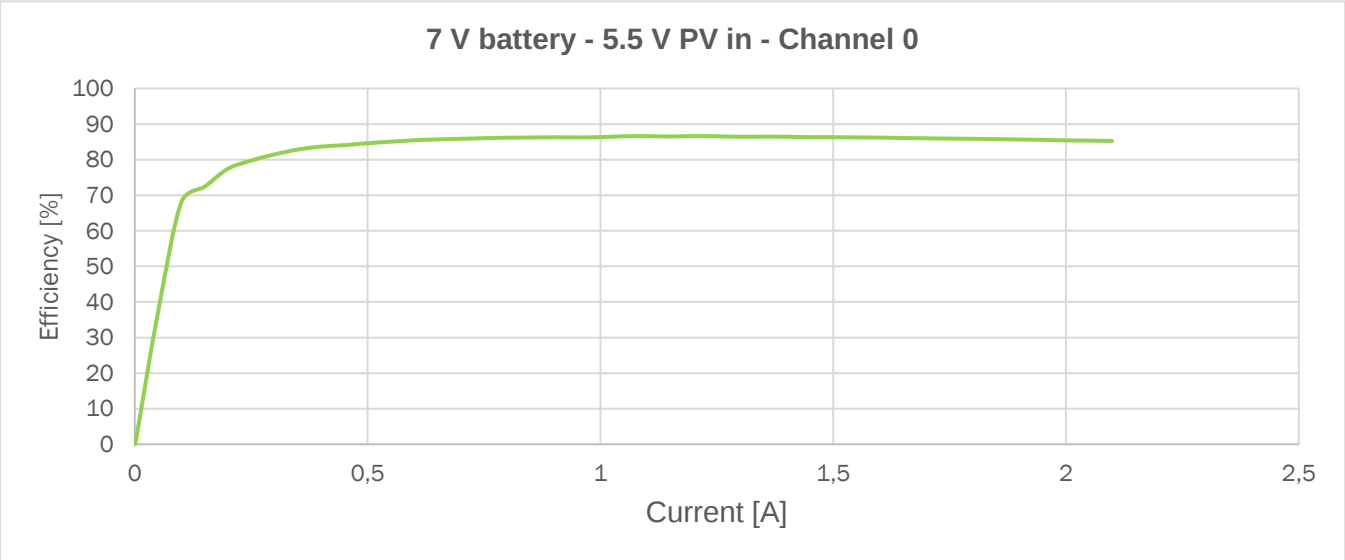
7 Input Channel Efficiency

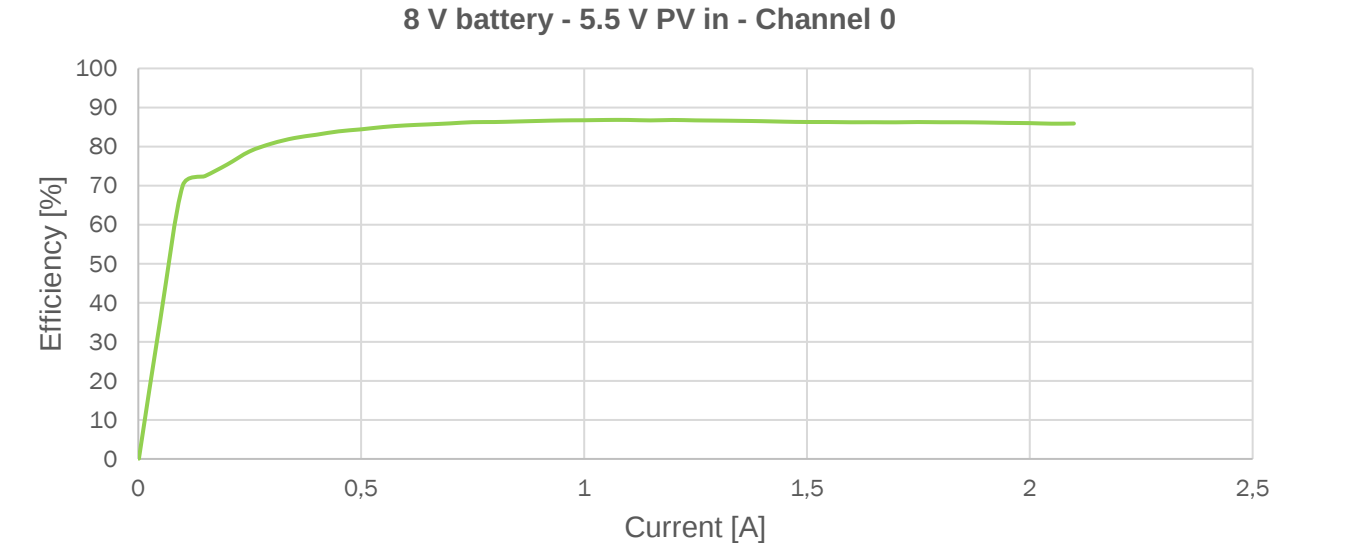
This chapter shows the measured system efficiency, using the P60 system with an 8 V battery pack. The P60 dock has one ACU-200 and one PDU-200 module installed. The efficiencies are shown, not considering the standby power consumption (600 mW). Hence the standby power consumption should be considering on a power budget level, combined with the number of input/output channels and their expected efficiency at the expected load.

Efficiency is measured from the PV input to the battery interface. Hence it includes all losses in the connections to/from the board and the P60 Dock power interface protection switches.









8 Physical Layout

The ACU PCB top under the shield has two connectors at the right edge and at the bottom left corner. Middle left is a MCU. Top left a LED. Middle area has six Boost MFFT. Two ADC top right and bottom right.

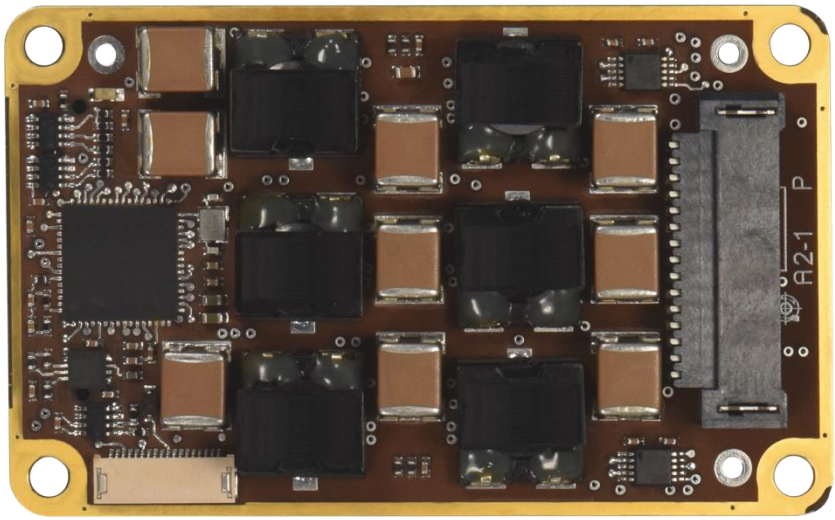


Figure 3 ACU module top, no shield

The bottom side has two FSI connectors to the left. Middle area is power electronics for the Boost MFFT converter. Right side has a SSFM and a FRAM.

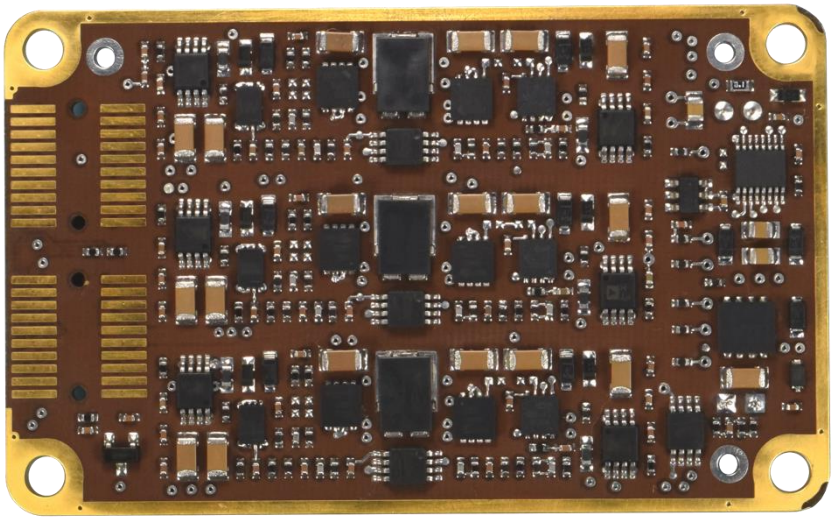
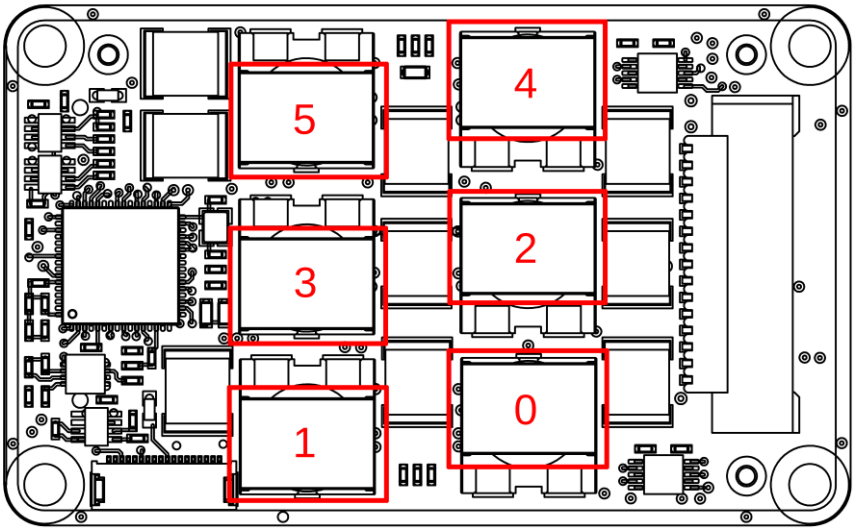


Figure 4 ACU module bottom

8.1 Thermal Load Spread



The figure above shows the placement of each converter on the ACU. If using only a few inputs it is recommended to select converters that are furthest away from each other to even out the heat generation. So if you e.g. use three channels, using 1, 2 and 5 could be a solution.