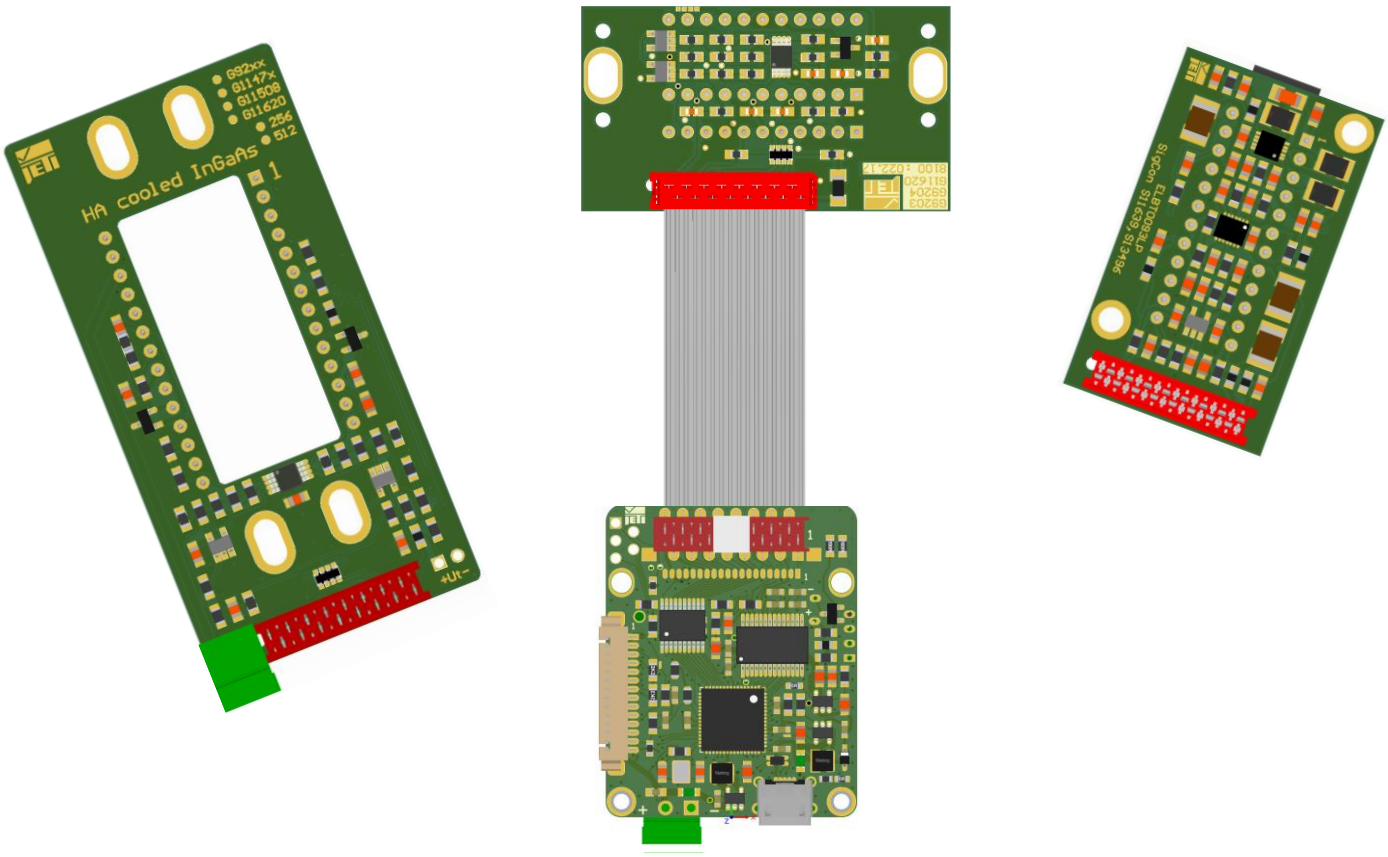
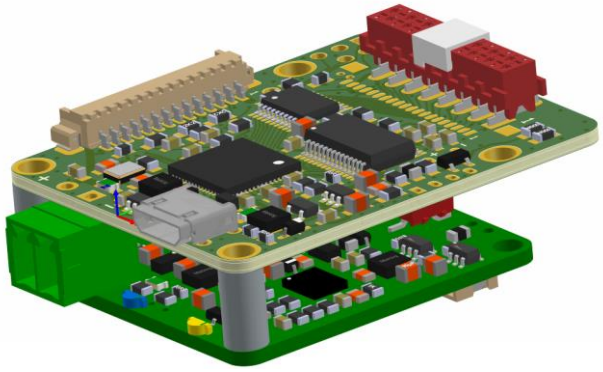
SDCM4 Spectrometer Processing Electronics



The **SDCM4** spectrometer processing electronics is a versatile powerful 32-bit RISC processor-based operation electronics for miniature spectrometers.

It can control various imaging arrays and supports simultaneous Peltier-temperature-regulation as add-on board solution.



It's ideally featured for embedded or mobile spectroscopic applications. It supports Add-ons with high accurate regulated current output for various light sources and enables battery powered applications.

Specifications:

- Powerful 96 MHz MIPS 4K core RISC **CPU**
- 16 bit 5 MS/s **ADC** with programmable offset correction and gain
- Possibility of in field programming and firmware **update** by integrated bootloader
- Various on board **calculations** in firmware (dark correction, averaging, binning, filters,…)
- **Firmware**, that can be used in general application or user specific OEM applications in spectroscopy
- SCPI like **control syntax** for setting of operation parameters, configuration, measurement, data format, endianness, etc.
- User configurable digital-**I/O's** and analog-Inputs
- **USB High speed** communication interface with up to 480 Mbit/s via virtual COM port driver
- **SPI** master or slave communication interface with up to 48 Mbit/s
- LV-TTL-**UART** communication interface 8N1 with up to 24Mbit/s
- Digital **trigger** input LV-TTL
- **Shutter/lamp** control output LV-TTL
- **Power supply** via USB or external 5 V
- Stabilized 5 V **power output**
- Tiny PCB **dimensions** of 45x36x10 mm³

Compatible Hamamatsu Sensors:

- **CMOS:** S11639, S13496, S13014-10, …
- **NMOS:** S838x, …
- **InGaAs (cooled):** G1147x, G11508, G11620, G92xx …
- **InGaAs:** G13913, G11608, …
- **BTCCD:** S10420, S14650, …
- **BTCCD cooled:** S11511, S11850, S1014x, …

…Others on request

Contents

1. Getting started…

1.1. …with SDCM4

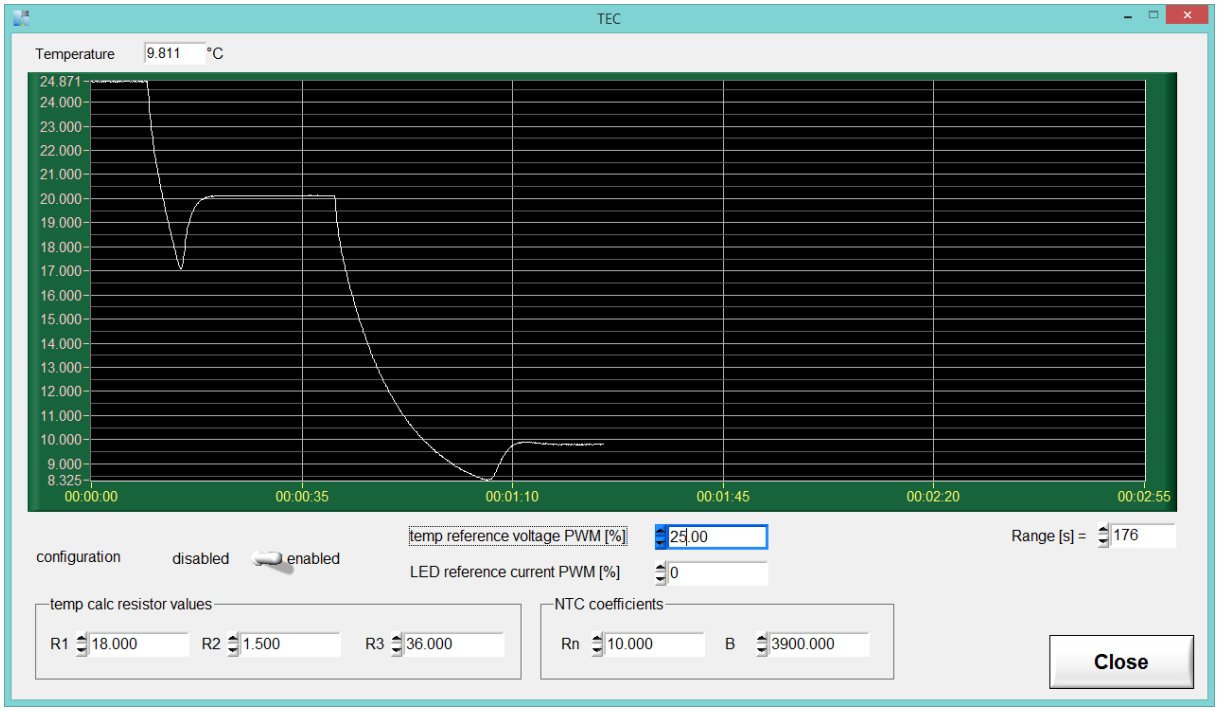
Most configurations of SDCM4 are sold without sensor, so the first step is mounting the sensor into the electronics socket. Pin1 is always marked by a rectangular pad shape and sometimes additionally with a number “1” close to it. Please follow the instructions of sensor manufacturer to mount the sensor without any damage and make sure to follow all ESD precautions to avoid sensor and electronics malfunction.

Connect SDCM4 via micro USB to PC. Drivers are not necessary on Windows 10 or can be found on USB-Stick for other operating systems.

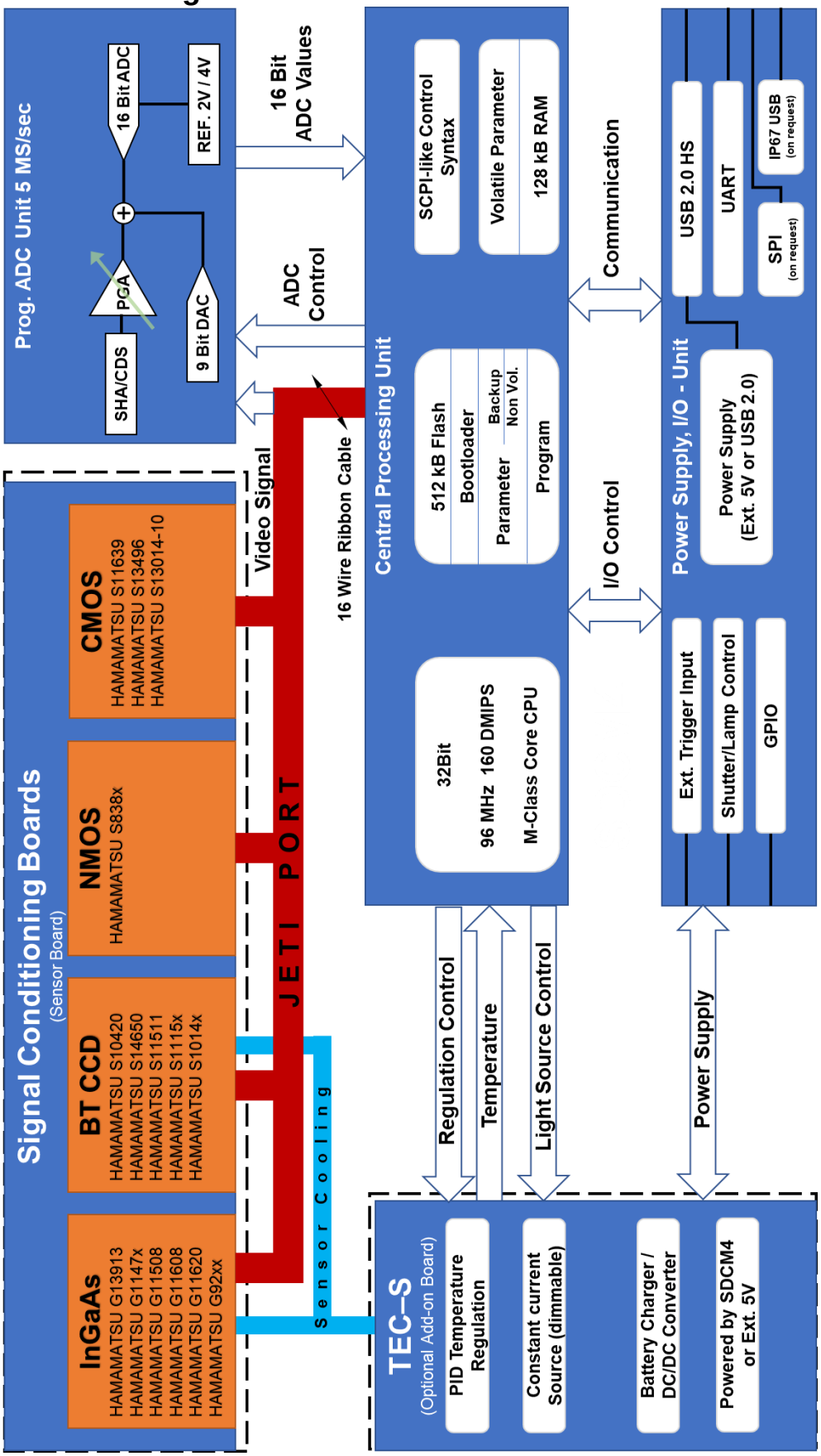
Now the electronics will automatically be found with first start of software *JETI VersaSpec* and first measurements can be performed and visualized.

1.2. …with TEC-S

The TEC-S electronics is configured in hardware for its specific purpose and contains no programmable logic unit. The basic functionality like enabling the different components and PWM-dimming is possible by using the SDCM4 firmware commands or can be accessed using the Software “VersaSpec -> Special -> TEC” like shown in the next picture. It’s also possible to use the TEC-S board independently. Then the settings can be changed with onboard potentiometers on the TOP-Layer.



2. Block Diagramm



3. User Signals

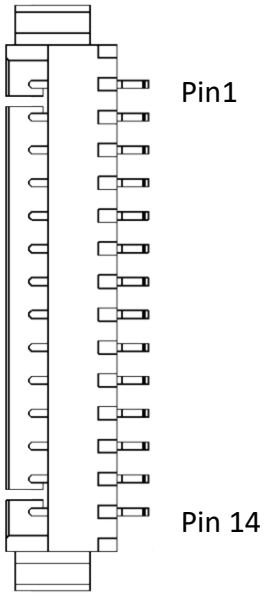
Pin	Name	Signal	Value	Min	Typ	Max	Unit
1	Vext	Power-IN	Voltage	4	5	5.25	V
			Current	40 (sleep mode)	100-150	1200	mA
2	TRIG	Input	High	2.2		5.5	V
			Low	0		0.5	V
3	GPIO12	I/O	High	2.2		3.6	V
			Low	-0,3		0.5	
			Current			15	mA
4	U1RX	Input	High	2.2		3.6	
			Low	-0.3		0.5	V
5	U1TX	Output	High	2.2		3.3	
			Low	0		0.5	
			Current			10	mA
6	SCL	I/O	High	2.2		5.5	V
			Low	0		0.5	V
			Pull-Up		2.2		kOhm
7	SDA	I/O	High	2.2		5.5	V
			Low	-0.3		0.5	
			Pull-Up		2.2		kOhm
8	GND	GND					
9	GND	GND					

10	SHUT/LAMP	Output	High	2.2		3.3	
			Low	0		0.5	
			Current			15mA	
11	Shut_EN (GPIO6)	I/O	High	2.2		3.6	V
			Low	-0,3		0.5	V
			Current			10	mA
12	VPower	Power-Out	Voltage	4	5	5.3	V
			Current			300	mA
13	Ambient Temp. (GPIO11)	Analog-In	ADC-Range	0		3.3	V
			Max. V	-0,3		3.6	V
14	3.3V	Power-Out	Voltage	3.1	3.3	3.4	V
			Current			100	mA

# Denotes low-active signal GPIO-Functionality in GRAY is not implemented yet

3.1. Periphery Connector (P2)

For easy accessing of user signals, all hardware configurations contain the 14-pin WR-WTB 653114131822 connector with 1.25 mm pitch and 1A current rating. It mates with the 14-pin female terminal housing WR-WTB 653114131822 and 1.25 mm crimped wires. All those components can be purchased from Würth Electronic and are included in prototype deliveries.



3.2. Signal Description

3.2.1. V_{ext}

External 5 V power supply input. Voltage between 4.2 V and 5.1 V is allowed with a max current of 1200 mA.

3.2.2. Trig

Trigger input with programmable active slope and internal pull up. Should be debounced. Please refer to “Specfirm Firmware Operation Instructions” for more information about available trigger settings.

3.2.3. GPIO3

User programmable general-purpose-input-output-pin. Refer to Chapter 8: **General Purpose Input/Output-Pins (GPIO’s)** for more Information

3.2.4. U1RX

LV-TTL (3.3 V) UART serial communication input signal RXD. communication protocol is startbit, 8 bit data, no parity, 1 stopbit (8N1), no handshake. The standard baudrate is 115200 and can be set by the baudrate parameter.

3.2.5. U1TX

LV-TTL (3.3 V) UART serial communication output signal TXD. communication protocol is startbit, 8 bit data, no parity, 1 stopbit (8N1), no handshake. The standard baudrate is 115200 and can be set by the baudrate parameter.

3.2.6. SCL

I²C Clock-Signal. Internal pulled up to 5V via 2.2 kOhm

3.2.7. SDA

I²C Data-Signal. Internal pulled up to 5V via 2.2 kOhm

3.2.8. GND

3.2.9. GND

3.2.10. SHUT/LAMP

LV-TTL shutter/lamp output. Can be used to control external light source or shutter. This signals polarity is programmable by the “lamppol” parameter (0/1). It will be active before integration time of the line array begins until its end. The “scandelay” parameter can be used to define the amount of additional time to realize shutter operation or lamp stabilization before integration begins in light- or dark-scans. In case of using a flash lamp, the shut/lamp signal can be used for triggering. Flash lamp burst mode (several

flashes in programmable intervals and pulse length) can be also controlled by this signal.

3.2.11. Shut_EN

Additional Shutter Signal to enable peripheral Shutter Hardware e.g. the JETI “PIEZO Shutter”. Signal is high during dark and light measurements and low otherwise.

3.2.12. VPower

Current limited 5V Power Output. The voltage on that pin depends directly on the active power supply (USB or external) and should not be used as reference voltage.

3.2.13. Ambient_Temp

Analog input for an external 10kOhm NTC temperature sensor.

3.2.14. 3.3 V

Regulated 3.3 V output, internally used for MCU and other digital circuits.

4. USB Interface

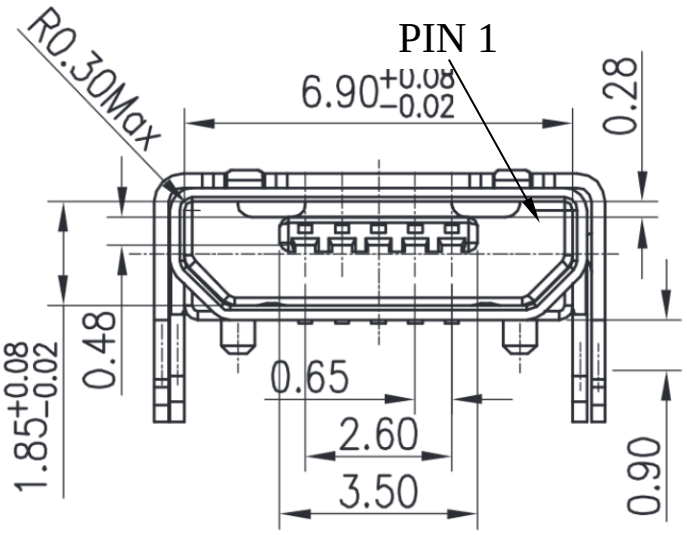
The high speed 2.0 USB communication port can be used for powering the SDCM4 electronics. In combination with temperature control ad-on board, an active USB-Hub may be necessary to provide full 500 mA of current at 4.7 V - 5.25 V.

Passive USB hubs do not provide sufficient power. In this case, the electronics has to be powered externally.

The USB power design provides a USB 2.0 compliant power management sequence during plugin and enumeration of the device.

The OR gated low drop out power circuitry switches automatically between USB or external power, depending on which voltage is higher.

4.1. USB Pinout



The connector in use is a micro USB 2.0 Type B receptacle connector with SMT and THT components for maximal stability:

4.2. USB Signals

Pin-Nr.	Description	Signal	Level	Min	Typ	Max	Unit
1	USB Power	VUSB		4.7	-	5.5	V
2	Differential Data -	USB D-	Low	0	-	0.4	V
			High	2.4	3.3	5.5	
3	Differential	USB D+	Low	0	-	0.4	V

	Data +		High	2.4	3.3	5.5	
4	USB OTG Signal	USB ID		Not used, SDCM4 is always device			
5	USB GND	USB GND		-	0	-	V

5. Power Supply

Beside the standard USB Power supply, which is described above, an external voltage source can be applied to the Vext pins on different connectors.

	Voltage Range	Current	Ripple
minimum requirements	3.0V-5.25 V	500 mA	
recommended	4.5 V-5.1 V	>1500 mA	<100 mV

Exceeding the recommended voltage range and ripple may increase the noise of the video signal.

6. LV TTL UART Interface

The LV TTL UART interface provides an easy to use serial interface for direct communication with embedded hosts.

Communications speed up to 24 Mbit/s are possible

The protocol settings are 8N1 (1 startbit, 8 bit, no parity, 1 stopbit) and no handshake.

7. SPI Interface

The SPI Interface is intended to operate as a SPI-slave in SPI mode 0.

The transmission speed can be up to 48 Mbit/s.

SPI-Interface is available on connectors P3 and P10 which are not included in standard assembly. Please ask for specific configurations.

8. General Purpose Input/Output-Pins (GPIO's)

The provided GPIO Pins provide direct access to the micro-controller and are configure- and controllable by firmware commands. The number of available GPIO-Pins depends on specific hardware configuration and used sensor type. A list of available GPIO-Pins can be accessed via firmware command: *conf:gpio? <CR>

Accessible functions are:

Digital Output

Digital Input with pull-up (on Request)

Digital Input with pull-down (on Request)

Digital Input floating (on Request)

Analog Input (on Request)

Refer to the "Specfirm Firmware Operation Instructions" for more Information.

The following GPIO pins are available:

GPIO	Hardware Pin on P2	Hardware Pin on P4	Function
GPIO0	12		Sensor Clk5
GPIO1	11	-	Sensor Clk4
GPIO2	10	-	Sensor Clk3
GPIO3	9	-	Sensor Clk2
GPIO4	8	-	Sensor Clk1
GPIO5	7	-	Sensor Clk0
GPIO8	13		Sensor Clk6
GPIO12		3	FREE
GPIO13	14		Sensor Clk7

9. Options

9.1. Options on SDCM4

Other assembly options on SDCM4 can be used to realize an IP67 waterproof USB connector or more interface pins as mentioned in chapter8.

9.2. Options on TEC-S Add-on board

The TEC-S Add-on board can be used to drive temperature PID-regulation for sensors or light sources, based on the Peltier-effect. It also provides a constant current source with various dimming features to drive light sources and can be used to enable battery powered usage of the SDCM4-electronics.

Conversely the TEC-S add-on board can be powered by the SDCM4 electronics e.g. for building a complete USB-powered device, or by external 5V supply, which is then powering the SDCM4 electronics.

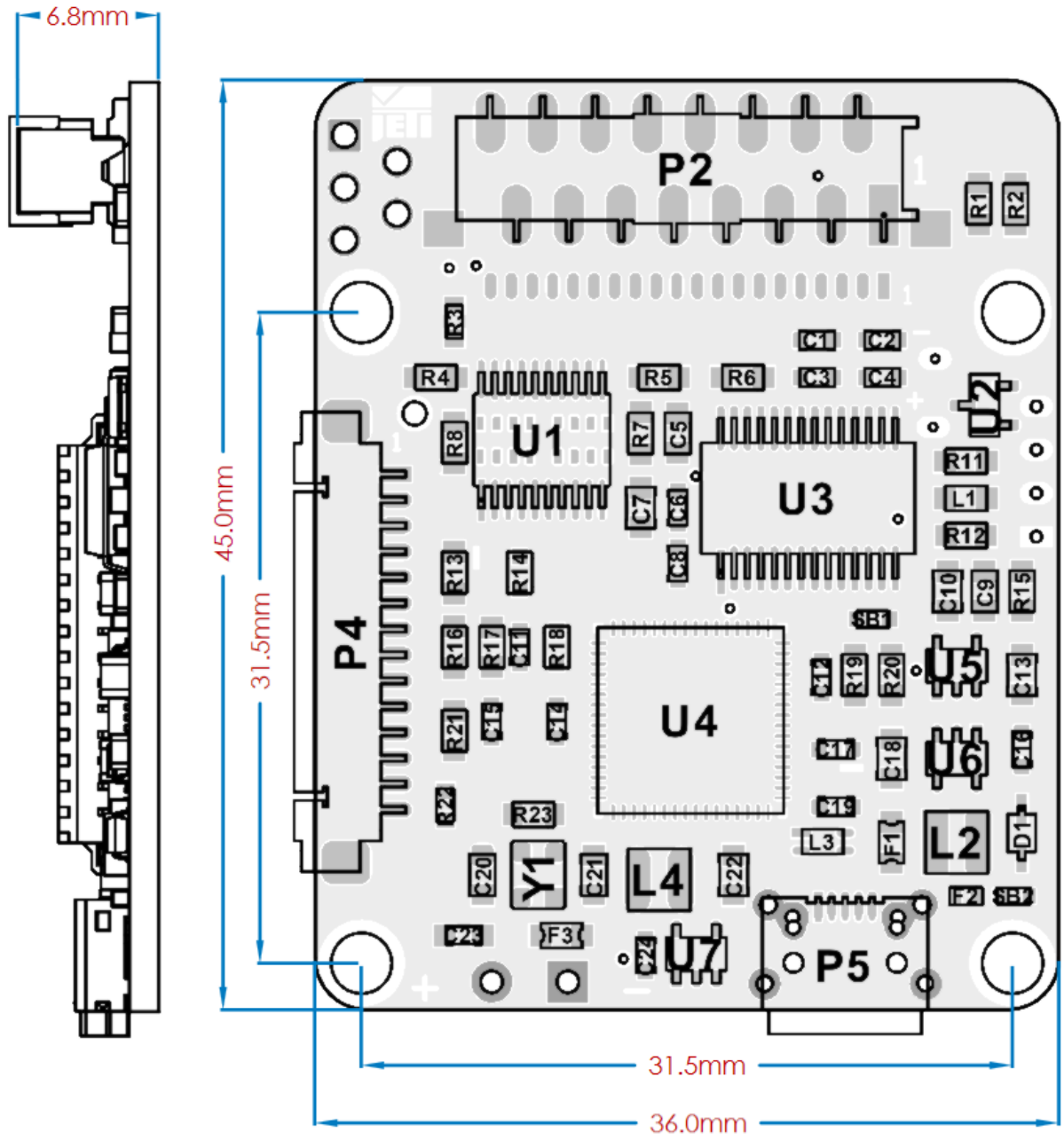
10. Firmware Update Feature

The firmware implemented bootloader allows infield updates of the firmware using the serial interfaces. For proper operation, it is recommended to use only the USB-Interface.

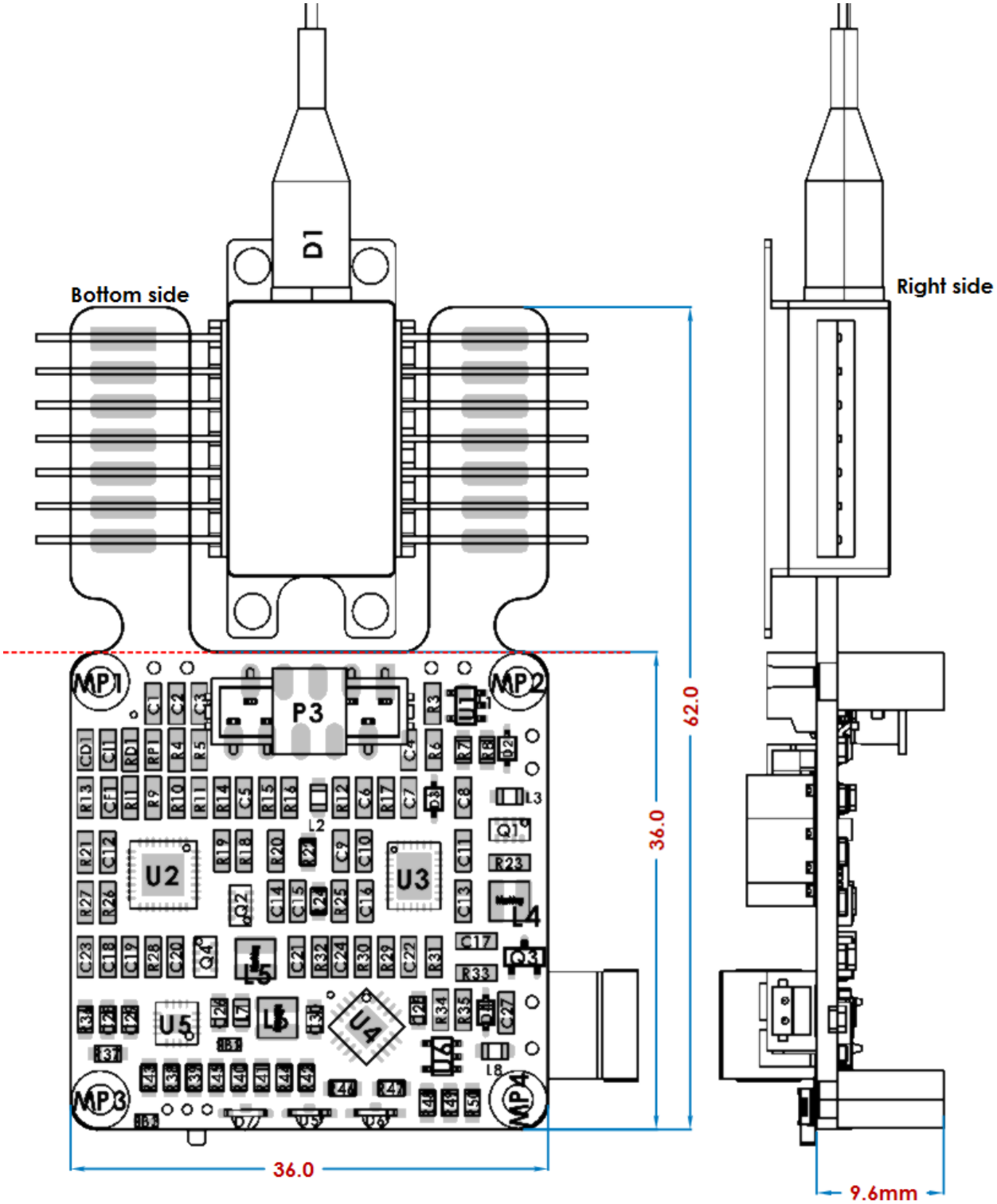
For the necessary tool “SFProg” or if you have any questions concerning technical problems please contact the JETI-support: support@jeti.com

11. Dimensional Drawing

11.1. SDCM4



11.2. TEC-S



12. Orderinformation

12.1. Available SDCM4 standard configurations

SDCM4 Variant	Uni for G11620	Uni for S11850/ S14651 + TEC-S	Uni for S10141 + TEC-S	Uni for S11639
Order ID	**EBG0279**	**EBG0281**	**EBG0282**	**EBG0284**
Sensor	G11620*	S11850/S14651*	S10141*	S11639-01*
TEC-S		0…25°C**	-30…+20°C**	

*on remote PCB, connected via 16pol flat ribbon cable

** possible temperature ranges depend on customers heatsink design and surrounding temperatures

Please contact us for other configurations (e.g. other Sensors).

Send your order to: sales@jeti.com

12.2. Available TEC-S standard configurations

TEC-S Variant	TEC-S LED	TEC-S only
Order ID	**EBG0280**	**EBG0286**
TEC Temp	0-25°C	0-25°C
TEC Current	0-1.8A	0-1.8A
LED Current	0-500mA	Not supported
Battery	not supported	not supported

Please contact us for other configurations.

Send your order to: sales@jeti.com

13. Service

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