Specification for HTPA82x62L22.5/1.0M(SPI)

Rev.1: 2015.09.04 Fg

The HTPA82x62L_/_M(SPI) is a fully calibrated, low cost thermopile array module, with fully digital SPI interface. The module delivers an electrical offset and ambient temperature compensated output stream, which can be already used for image processing, pattern recognition and presence detection purposes. Object temperatures can be easily obtained by this data stream, a look up table and the calibrated sensitivity constants, which can be found in the EEPROM of the module.

Order Code Example

HTPA32x31		L10 / 0.8	F8-14	Hi	M	(SPI)	[Si]

Type:

HTPA32x31	Please contact support for all available HTPA and module combinations.

Output:

d	HTPA sensor with digital output
Not declared	HTPA sensor with analogous output

Optics:

L	Focal length: In example L10 = 10.0 mm focal length
/	F-Number: In example /0.8
	For optics see also “HTPA standard optics”

Filter:

F	Filter characteristics. In example F8-14 (µm, Bandpass)
Not declared	Broad band ARC

Sensitivity:

Hi	Increased sensitivity
Not declared	Standard sensitivity

Version:

A	Application set: comes with GUI, housing, power supply. Always UDP Interface.
C	Calibrated sensor (only digital). Carries calibration constants on internal EEPROM
M	Module: HTPA sensor soldered to PCB, calibrated stream
S	HTPA sensor only. Raw voltage output, not calibrated

Interface:

SPI	SPI device; Three variants: HTPA82x62: 16bit ADC all other analogous HTPAs: 14bit ADC Digital HTPA: 12bit ADC
LC	SPI,Only Analogous HTPA, 12bit ADC low speed, external processing required
UDP	Ethernet, CAT5 cable connection
PoE	Power over Ethernet, CAT5 connection, UDP protocol

Lens Material:

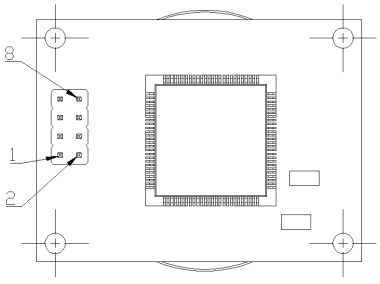
Si	Silicon
Not declared	Germanium

For modules, the recommended type is M(SPI). The advantages are the better ADC resolution, wider input voltage range, wider measurement range.

Pinout

Pin Assignment HTPA82x62M(SPI)

Pin	Name	Description	Type
1	SCK	Serial clock	Digital Input
2	#VD	Valid Data, negotiated.	Digital Output
3	SDO	Serial data out of module	Digital Output
4	SDI	Serial data in of module	Digital Input
5	VSS	Negative supply voltage	Power
6	#SS	Slave select, negotiated	Digital Input
7	#MCLR	Master clear, negotiated	Digital Input
8	VDD	Positive supply voltage	Power



Connector: M22-2520405, Harwin Inc.

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SPI Interface:

SCK-Frequency: 800 kHz …10 MHz [1)]

[1)] For customer specified devices with higher frame rates than usual, higher SCK-Frequencies than 800 kHz might be needed. See also "Communication and Timings"

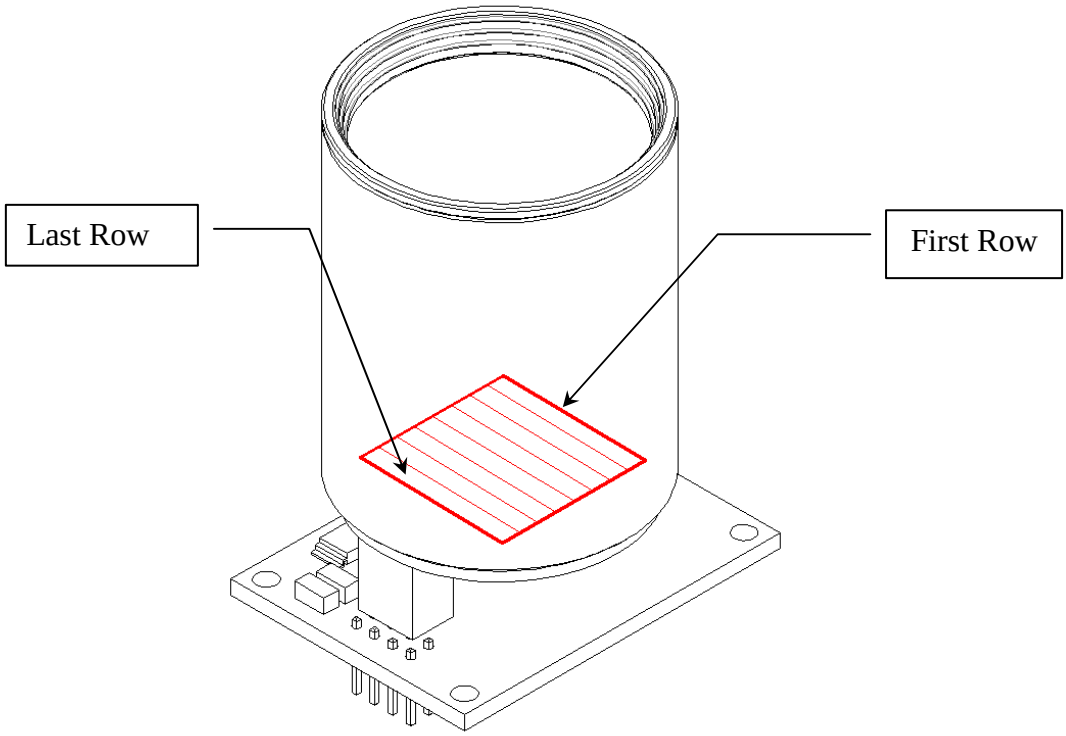
Protocol Specifications:

Data format:	16 data bits
Frame Sync:	None
Module-Selection:	$\overline{SS}$-Pin
Clock Edge Select:	Serial output data changes on transition from idle to active clock state
SPI Data Input Sample Phase:	Data sampled on transition from active to idle clock state
Clock Polarity:	Idle state is high level, active is low level.

Electrical Specifications:

VDD Range:	Supply (2.8 – 3.3 V DC)
SPI Transmit/Receive:	TTL
VSS	GND
Power Supply:	**2.8-3.3** VDC
IDD (Idle mode)	25 mA
IDD (Operating mode)	135 mA

HTPA82x62L22.5/1.0(SPI) Optical Orientation of Pixels:



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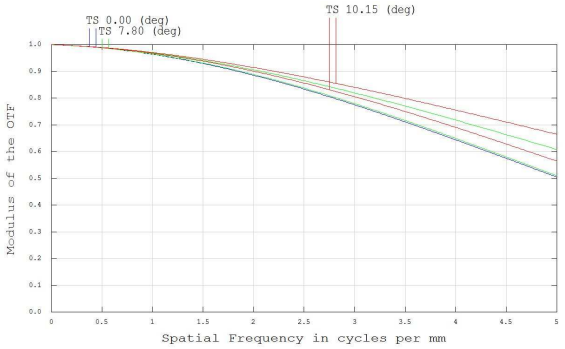
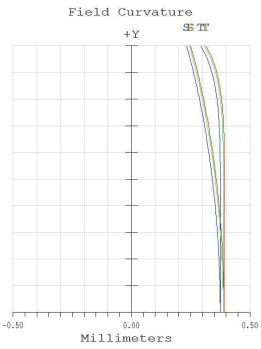
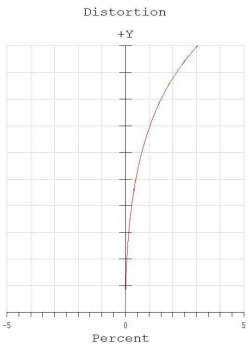
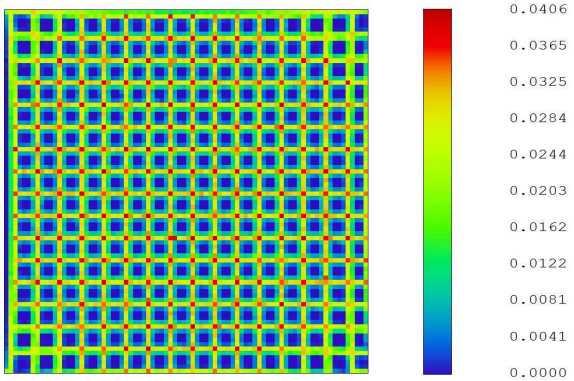
Optical specifications:

NETD	TBD mK (measured at 9 Hz and 20°C object temperature)
Array format	82 (h) x 62(v) active pixels
Pixel pitch	100µm
Framerate	9 Hz
Temperature compensation	Automatic, compensates ambient temperature drift
Non-uniformity correction	Shutterless, not needed
HFOV	20.3°
VFOV	15.6°
Diagonal FOV	24.9°



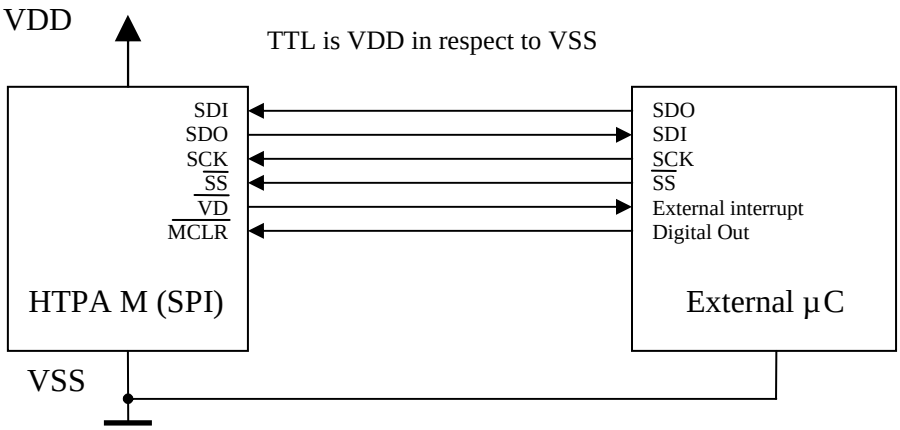




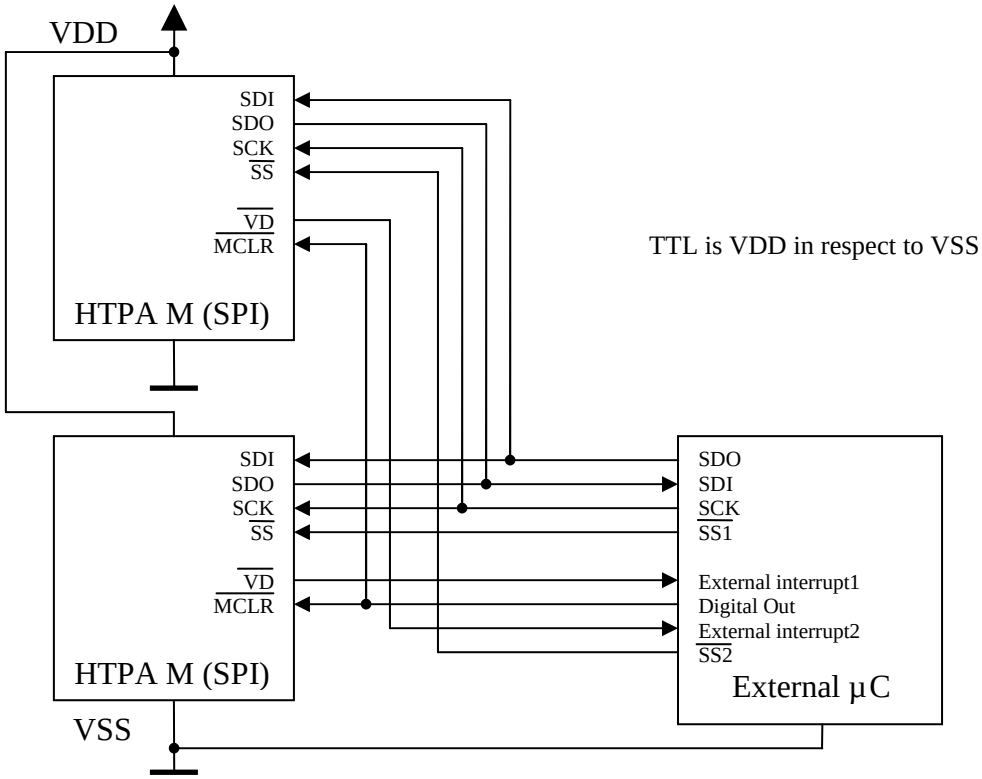


Electrical Connections:

Single Module:



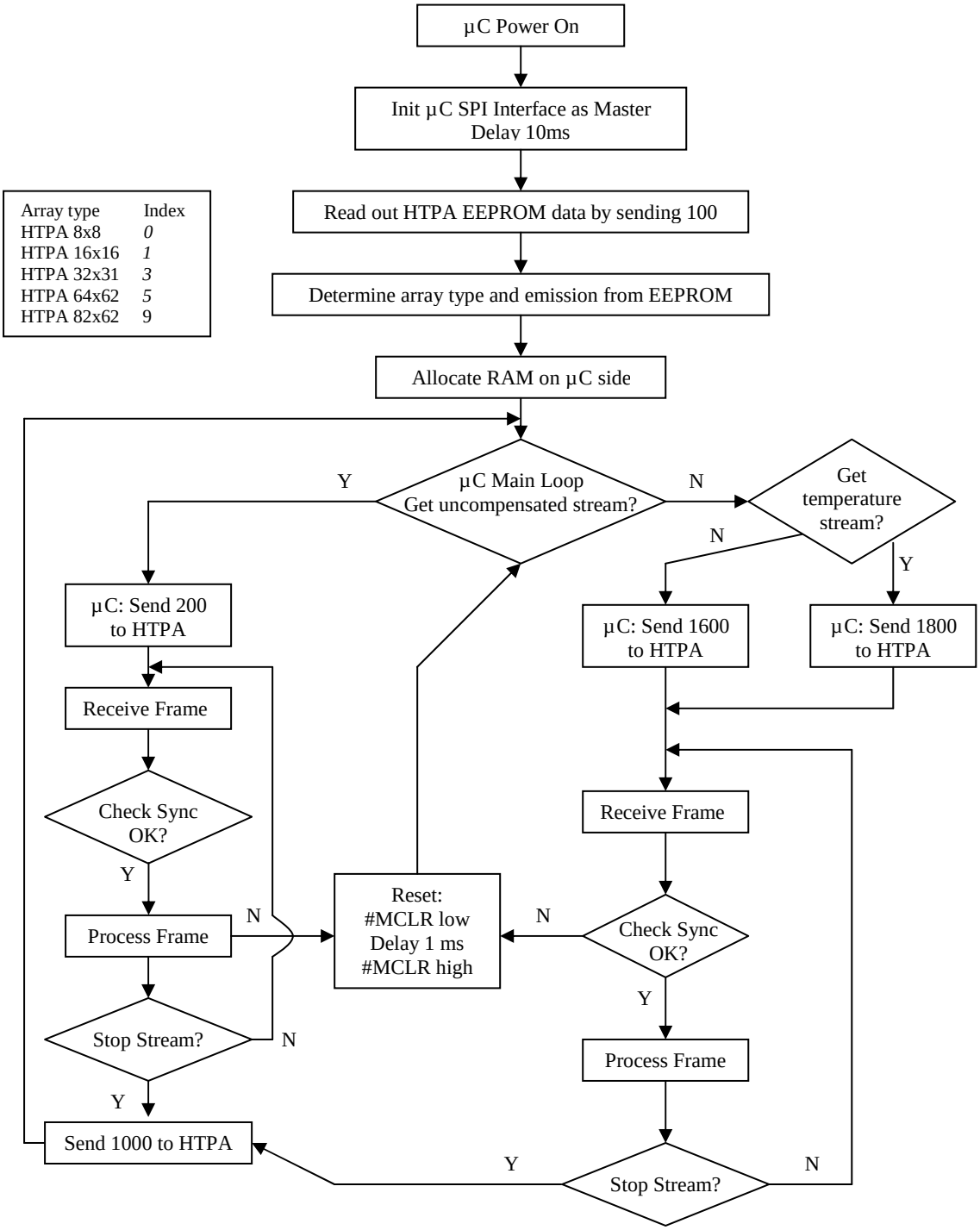
Multiple Modules (preliminary):



Communication and Timings:

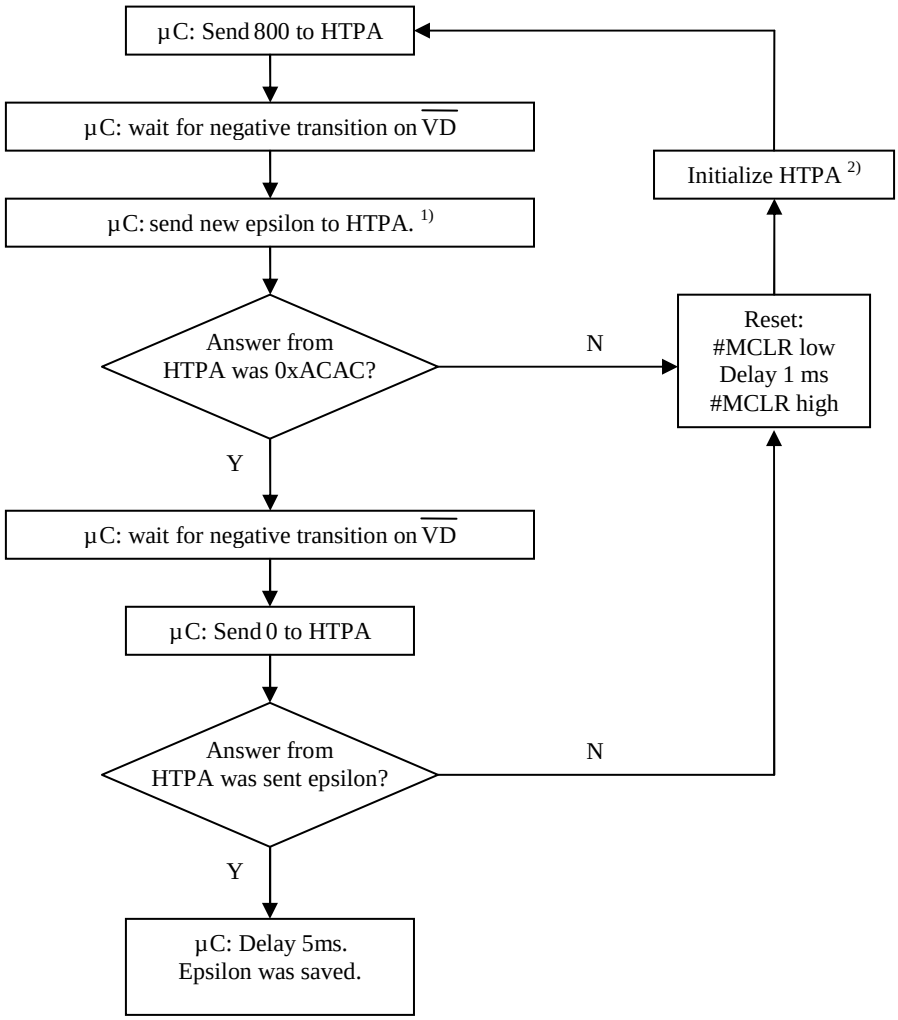
Proposed flow chart of communication. (Master is referred as µC, Slave as HTPA module)

Array type	Index
HTPA 8x8	*0*
HTPA 16x16	*1*
HTPA 32x31	*3*
HTPA 64x62	*5*
HTPA 82x62	9



Communication and Timings:

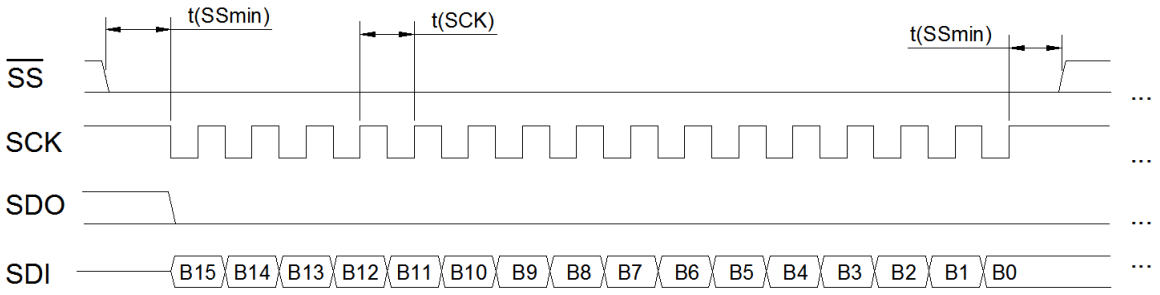
Setting emission coefficient epsilon. (Master is referred as µC, Slave as HTPA module)



1) Epsilon needs to be >0 and <=100. (Decimal)
2) See “Proposed flow chart of communication”.

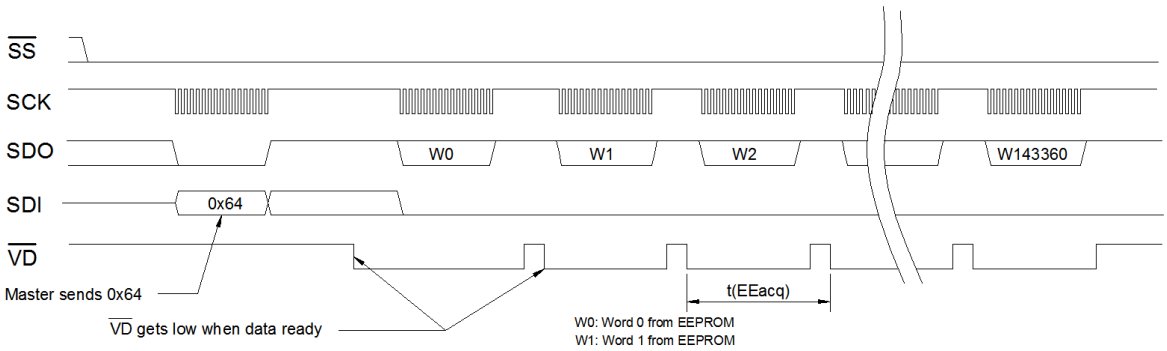
Communication and Timings (continuation):

Receive of command:



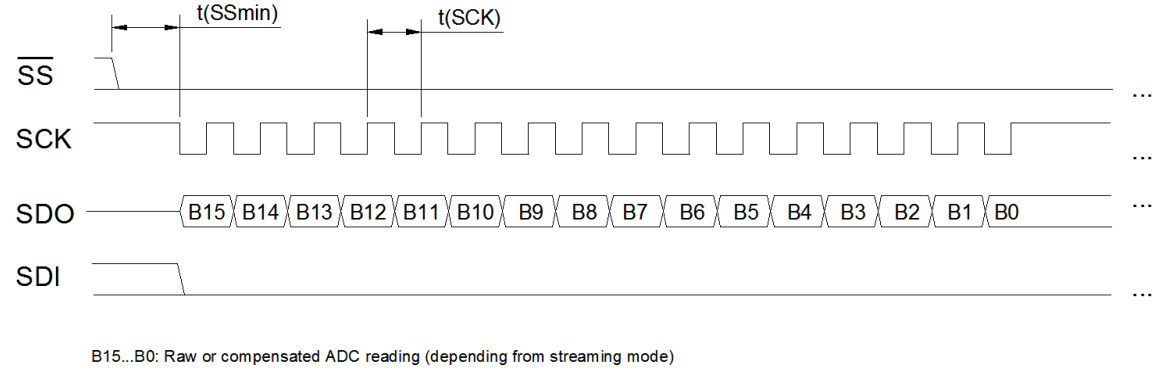
(High state of #SS is not necessary, only for communication with multiple devices)

Send of EEPROM content:



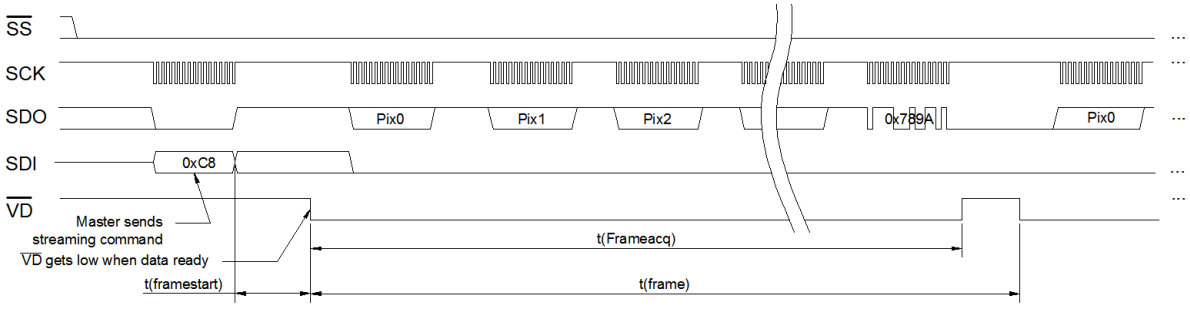
Remark: Send of EEPROM can be only stopped by toggling #MCLR.

Pixel data:



B15...B0: Raw or compensated ADC reading (depending from streaming mode)

Receive of stream command:



Communication and Timings (continuation):

Absolute values:

	MIN	NOM	MAX	Unit	Remarks
MCLR pulse width (low)	2			µs	
t(SSmin)	175			ns	
t(SCK)	0.1	1	1.25	µs	1)
t(EEacq)	8.7			µs	
t(framestart) [Command: 0d200]		150		ms	f(MCLK)=50 kHz
t(framestart) [Command: 0d1600]		315		ms	f(MCLK)=50 kHz
t(framestart) [Command: 0d1800]		380		ms	f(MCLK)=50 kHz
t(frame)		115		ms	f(MCLK)=50 kHz

1) For customer specified devices with other frame rates than usual, lower SCK-Frequencies than 800 kHz might be possible. The time of data acquisition must be always smaller than t(frame)

t(Pix) and t(framestart) depend on the given MCLK frequency of the module. Standard devices come with f(MCLK)=50 kHz. Higher MCLK frequencies do not make much sense, due to the time constant of the pixel.

Important:

All 5380 datasets need to be obtained within t(frame). Otherwise the next frame will be lost, since the device can only buffer one frame. Buffer will be only refreshed if all data is read.

EEPROM Mapping:

Overview:

Start address	End address	Data type	Value
0x0	0x9	float	Heimann Sensor reserved
0xA	0xA	char	Table number
0x22	0x22	char	Arraytype [1)]
0x23	0x33		Heimann Sensor reserved
0x34	0x37	float	PTATgrad
0x38	0x3B	float	PTAToff
0x3C	0x58		Heimann Sensor reserved
0x46	0x46	unsigned char	Emission coefficient epsilon
0x59	0x5A	unsigned int	MCLK Frequency in kHz
0x5B	0x75		Heimann Sensor reserved
0x76	0x76	unsigned char	Moduletype [2)]
0x80	0x3FFF		Heimann Sensor reserved

1) Refer to table Arraytpe.

2) Shows which sensor and PCB type the current module is. Refer to table “Details for Moduletype” for details.

Important Note:

unsigned int: 2 byte; float: 4 byte; char: 1 byte
All the values are stored (if larger than one byte) in little endian, the so called „Intel-Format“.
Example for the MCLK-Frequency:

$$MCLK_{LB} = \text{EEPROM}[0x59] \quad MCLK_{HB} = \text{EEPROM}[0x5A]$$
$$MCLK = 256 \cdot MCLK_{HB} + MCLK_{LB}$$

Details for Moduletype:

Value	Declaration
255	M(LC)
0	M(SPI) + Analogous Chip
1	M(SPI) + Digital Chip
2	M(UDP) + analogous Chip
3	M(PoE) + 16x16d; BCC stored in Flash
4	M(PoE) + 16x16d; BCC stored in Sensor EEPROM

BCC → Binary Calibration Constants

Arraytype:

Arraytype	Value
HTPA 8x8	0
HTPA 16x16	1
HTPA 32x31	3
HTPA 64x62	5
HTPA 82x62	9

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Serial order of data in stream:

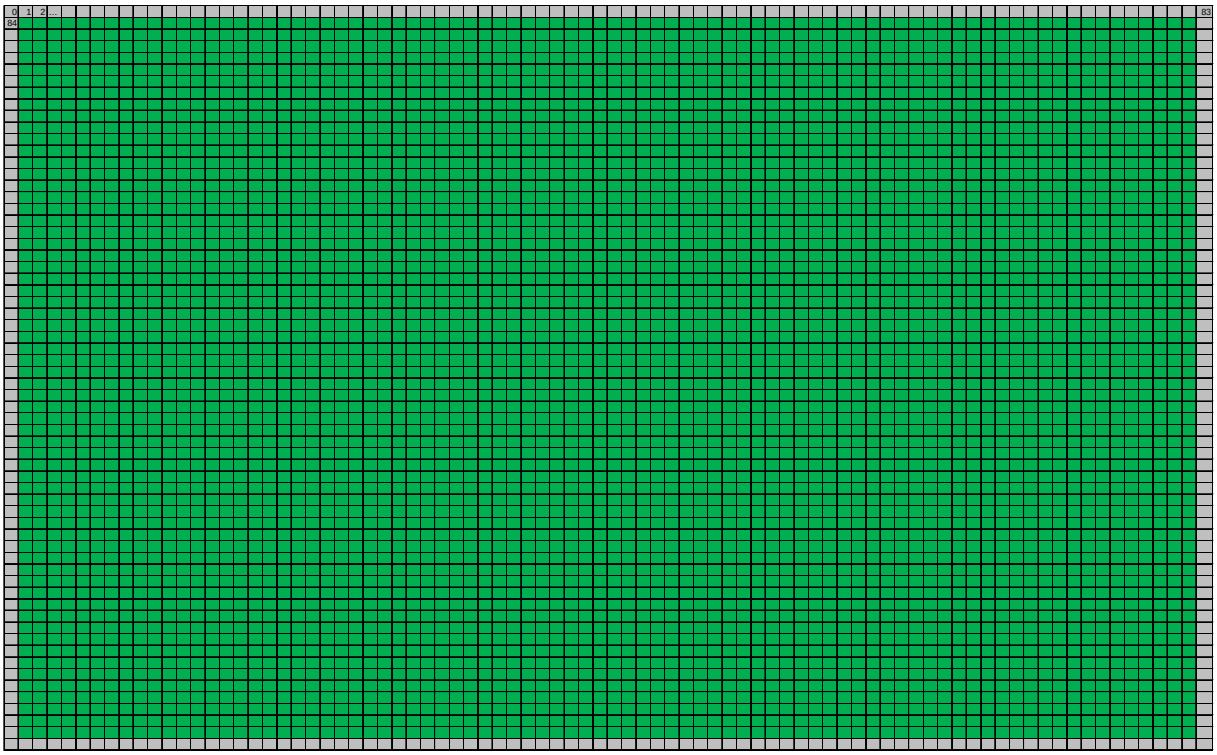
Compensated Voltage Mode	
Dataset	Value
0	offset corrected Voltage of Pixel0 in digits
1	offset corrected Voltage of Pixel1 in digits
2	offset corrected Voltage of Pixel2 in digits
3	offset corrected Voltage of Pixel3 in digits
…	…
5375	offset corrected Voltage of Pixel5375 in digits
5376	PTAT in digits
5377	VDD in digits
5378	Tamb in dK
5379	Module transmitts 0x789A (use for sync)

Raw Voltage Mode	
Dataset	Value
0	absolute Voltage of Pixel0 in digits
1	absolute Voltage of Pixel1 in digits
2	absolute Voltage of Pixel2 in digits
3	absolute Voltage of Pixel3 in digits
…	…
5375	absolute Voltage of Pixel5375 in digits
5376	PTAT in digits
5377	VDD in digits
5378	Tamb in dK
5379	Module transmitts 0x789A (use for sync)

Temperature Mode	
Dataset	Value
0	Object temp. of Pixel0 in deciKelvin
1	Object temp. of Pixel1 in deciKelvin
2	Object temp. of Pixel2 in deciKelvin
3	Object temp. of Pixel3 in deciKelvin
…	…
5375	Object temp. of Pixel5375 in deciKelvin
5376	PTAT in digits
5377	VDD in digits
5378	Tamb in dK
5379	Module transmitts 0x789A (use for sync)

Each dataset consists of a 16 bit value. The 16 bit values are transmitted with MSB first. In case of compensated voltage mode a signed 16 bit value is transmitted, in case of raw voltage mode an unsigned 16 bit value. Signed values are always in 2’s complement.

Pixel Map:



→Active Pixel
→Insensitive Pixel

Readings of insensitive Pixel can be ignored, but must be read.

C-Code for all the calculations can be found in our SDK (**S**oftware **D**evelopment **K**it). Furthermore, the SDK is able to fetch the data from the module and sends it to our GUI (**G**raphical **U**ser **I**nterface) which can visualize the data, records videos and text files and has many additional features. For more information see www.heimannsensor.com.

Communication commands:

Sent Command	Answer / Result
0d100	Output of EEPROM content. Data ready of each 2 bytes is signified by #VD pin.
0d200	Module streams out uncompensated, raw data stream. Data ready of each 4 bytes is signified by #VD pin.
0d700	Device goes in IDLE mode.
0d800	Set emission coefficient
0d1000	Stops streaming mode of module.
0d1600	Module streams offset corrected stream (electrical and thermal). Data ready of each 4 bytes is signified by #VD pin.
0d1800	Module streams temperature stream in deci-Kelvin. Data ready of each 4 bytes is signified by #VD pin

Precondition for all streaming modes:
VDD must be in the given limits.

Absolute Maximum Ratings:

Value	MIN	NOM	MAX	Unit	Remarks
VDD in respect to VSS	-0.3	3	4	V	
VDD in streaming mode	2.8	3	3.3	V	False VDD values affect compensation
Voltage on digital pin with respect to VSS	-0.3		VDD+0.3	V	
Storage temperature	-20		70	°C	
ADC reference voltages	VSS		4.096	V	
ADC resolution		16		bit	16 dig/mV
Max. current sunk/sourced on any pin		20		mA	
Operating temperature	-20		60	°C	non-condensing
Current consumption		135		mA	In streaming
Current consumption		25		mA	Idle

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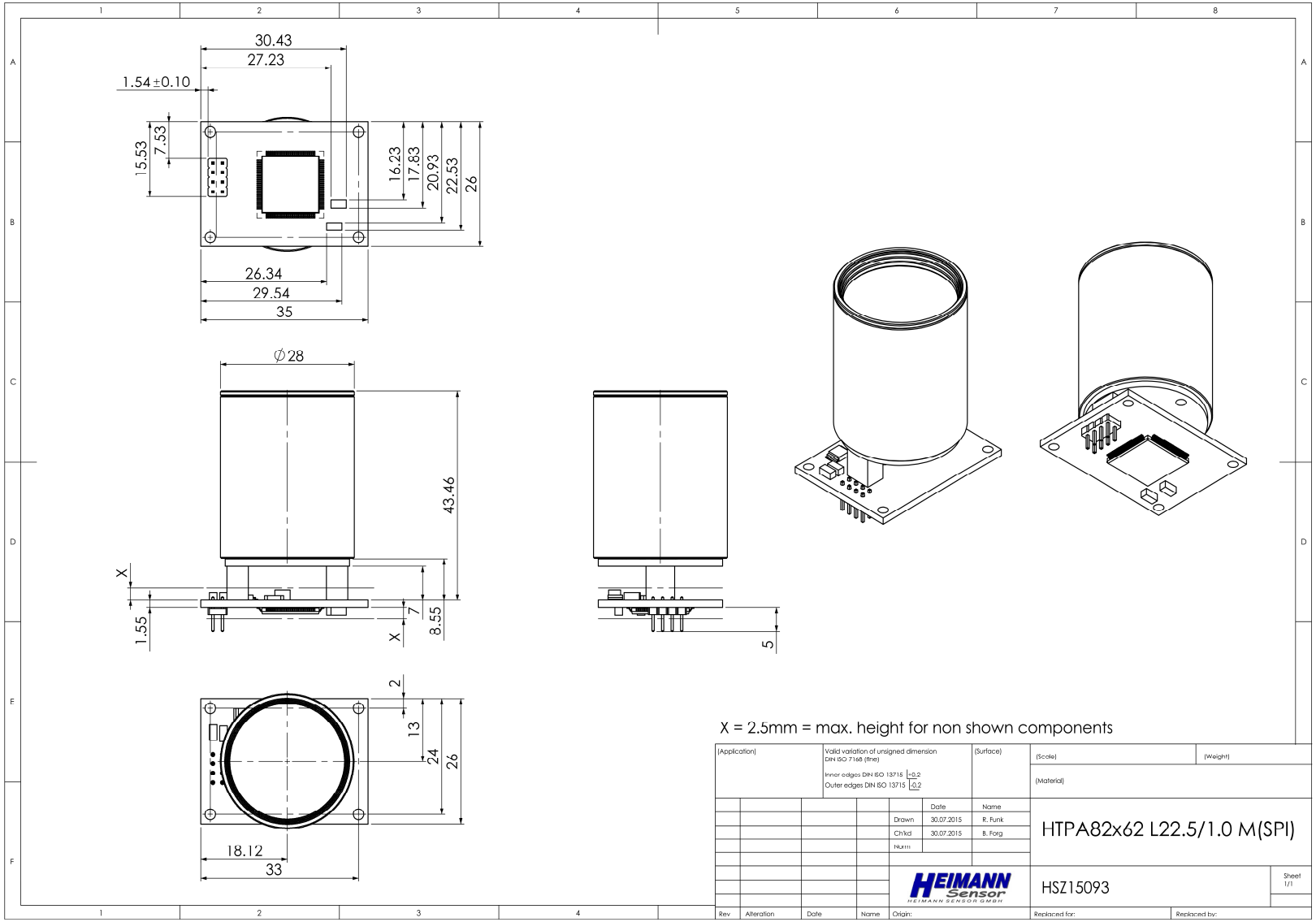
Dimensions:



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