

## HTPAd HiM I<sup>2</sup>C

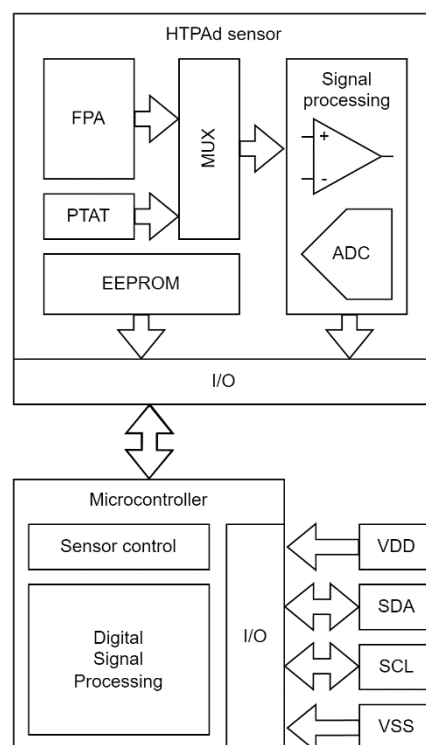
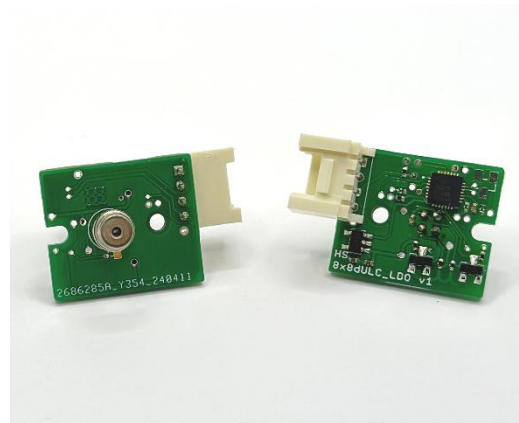
The HTPAd HiM I<sup>2</sup>C module is a device designed for easy access remote temperature measurements. Consisting of a Heimann Sensor HTPAd thermopile sensor and the required readout electronics, the module facilitates development as well as handling.

Due to smallest size, integration into limited space is feasible and provides maximum areas of application. Typical areas of application for the module are imager applications for human or fire / overheat detection or temperature measurements for process surveillance.

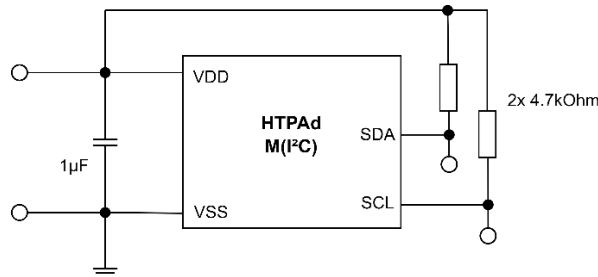
The module is configurable for different HTPAd sensors, matching different applications and thus field-of-views.

The core features of the module are:

- Low power consumption of less than 50 mW
- Digital input voltage selectable between 3.3 V and 5 V
- High framerates of up to 17.8 Hz (depending on HTPAd sensor selection)
- Small size of 20 mm x 17 mm (excl. plug)
- Single connection plug for supply voltage and I<sup>2</sup>C interface
- different HTPAd sensors available (8x8 pixels, 16x16 pixels, or 32x32)
  - for different spatial resolutions (field-of-views from 19° up to 90°)
- high temperature measurement accuracy
- Software-controlled pixel selection to achieve higher frame rates
- existing ESP32 demo code for easy access and development start



## Typical Application Circuit



## Order-Code

|          |    |                 |      |    |          |                         |
|----------|----|-----------------|------|----|----------|-------------------------|
| HTPA8x8d | R1 | <b>L0.8/0.8</b> | F5.0 | Hi | <b>M</b> | <b>(I<sup>2</sup>C)</b> |
| HTPA8x8d | R1 | <b>L2.1/0.8</b> | F5.0 | Hi | <b>M</b> | <b>(I<sup>2</sup>C)</b> |
| 1        | 2  | 3               | 4    | 5  | 6        | 7                       |

|   | Group       | Description  |
|---|-------------|--|
| 1 | Sensortype  | TP Array with 8x8 Pixel<br><br>For all available HTPA and module combinations contact our support  |
| 2 | Revision    | Silicon revision 1   |
| 3 | Optics      | Focal length/F-Number<br><br>Focal length: L0.8 = 0.8 mm<br>F-Number: 0.8  |
| 4 | Filter      | F: Filter characteristics<br>Not declared: Broadband AR Coating  |
| 5 | Sensitivity | Hi default sensitivity   |
| 6 | Version     | A: Application Set: comes with GUI, housing, power supply<br>C: Calibrated sensor<br>M: Modul: HTPA sensor soldered to PCB, calibrated stream  |
| 7 | Interface   | UDP: Ethernet connection, CAT5<br>PoE: Power over Ethernet, CAT5*<br>i <sup>2</sup> C: 4 Pin Connector*<br>USB: Power and data via USB 2.0**<br>Wi-Fi: Shield for ESP32***<br><br>* Interface option is only available for modules (HiM)<br>** Interface option is only available for Application Set (HiA)<br>*** Interface option is only available for calibrated sensors (HiC) |

## Electric Specifications

Table 1: Absolute Maximum Ratings

| Parameter                         | Symbol           | Condition | MIN. | TYP. | MAX.                 | Unit   |
|-----------------------------------|------------------|-----------|------|------|----------------------|--------|
| Supply Voltage                    | V <sub>DD</sub>  |           | -0.3 |      | 5.8                  | V      |
| Voltage at all inputs and outputs | V <sub>IO</sub>  |           |      |      | V <sub>DD</sub> +0.3 | V      |
| Storage Temperature               | T <sub>STG</sub> |           | -40  |      | 85                   | Deg. C |

Table 2: Operating Conditions

| Parameter                               | Symbol           | Condition        | MIN.                      | TYP.                        | MAX.                          | Unit   |
|---|------------------|------------------|---------------------------|-----------------------------|-------------------------------|--------|
| Supply Voltage                          | V <sub>DD</sub>  |                  | 3.3                       | 5.0                         | 5.5                           | V      |
| Supply Current (module running)         | I <sub>DD</sub>  |                  |                           | 8                           |                               | mA     |
| Standby Current (module in sleep state) | I <sub>SBY</sub> |                  |                           | 2.6                         |                               | mA     |
| Operation Temperature                   | T <sub>A</sub>   |                  | -20                       |                             | 85                            | Deg. C |
| ESD-Protection                          |                  | Human body model | 2000                      |                             |                               | kV     |
|   |                  | 100pF + 1k50hm   |                           |                             |                               |        |
| Internal I <sup>2</sup> C Pull up       | R <sub>PU</sub>  |                  |                           | -                           |                               | kOhm   |
| Frame rate (Full Array)                 | FR1              |                  | 5 @10kHz I <sup>2</sup> C | 17 @400kHz I <sup>2</sup> C | 17.8 @600kHz I <sup>2</sup> C | Hz     |

## I<sup>2</sup>C Timings

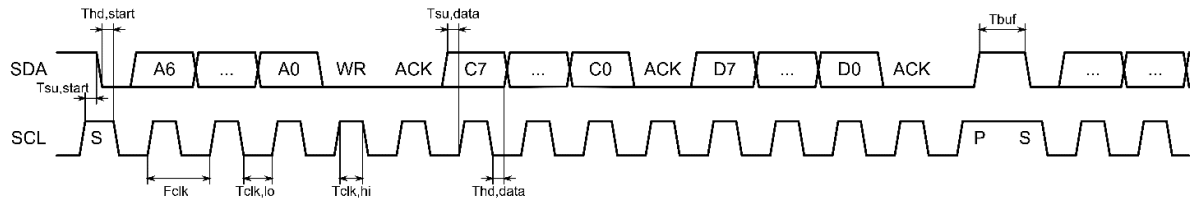
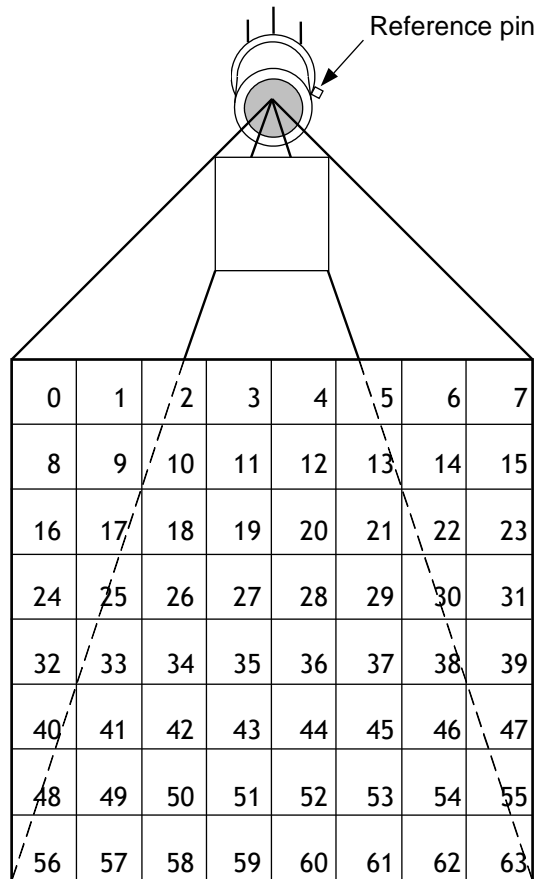


Table 3: I<sup>2</sup>C Timings

| Parameter                           | Symbol                | Condition                 | MIN. | TYP.                | MAX. | Unit |
|-------------------------------------|-----------------------|---------------------------|------|---------------------|------|------|
| I <sup>2</sup> C clock frequency    | F <sub>CLK</sub>      |                           |      | 400                 | 600  | kHz  |
| low pulse duration                  | T <sub>CLK,lo</sub>   | F <sub>CLK</sub> = 400kHz | 1.3  |                     |      | µs   |
| high pulse duration                 | T <sub>CLK,hi</sub>   | F <sub>CLK</sub> = 400kHz | 0.6  |                     |      | µs   |
| data set up time                    | T <sub>SU,data</sub>  | F <sub>CLK</sub> = 400kHz | 0.1  |                     |      | µs   |
| data hold time                      | T <sub>hd,data</sub>  | F <sub>CLK</sub> = 400kHz |      |                     | 0.9  | µs   |
| start setup time                    | T <sub>SU,start</sub> | F <sub>CLK</sub> = 400kHz | 0.6  |                     |      | µs   |
| start hold time                     | T <sub>hd,start</sub> | F <sub>CLK</sub> = 400kHz | 0.6  |                     |      | µs   |
| stop setup time                     | T <sub>SU,stop</sub>  | F <sub>CLK</sub> = 400kHz | 0.6  |                     |      | µs   |
| stop hold time                      | T <sub>hd,stop</sub>  | F <sub>CLK</sub> = 400kHz | 0.6  |                     |      | µs   |
| time between STOP / START           | T <sub>buf</sub>      | F <sub>CLK</sub> = 400kHz | 1.3  |                     |      | µs   |
| Time startup (after Power-on Reset) | T <sub>startup</sub>  |                           |      | 200 (50ms for Rev1) |      | ms   |
| Time wakeup (after sending WAKEUP)  | T <sub>wakeup</sub>   |                           |      | 1                   |      | ms   |

**Optical Orientation of Pixels:**



## Characteristics of Optics

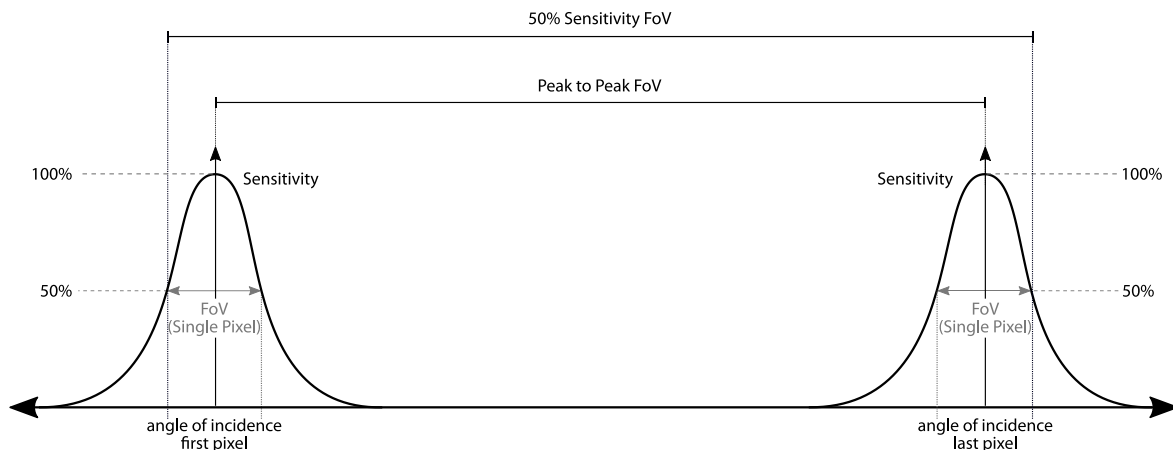
### Common Specification

|                             |   |
|-----------------------------|---|
| Technology                  | n-poly/p-poly Si                          |
| Element Resistance          | approx. 300 kOhms                         |
| Sensitivity                 | approx. 450 V/W without optics and filter |
| Thermal pixel time constant | <4 ms                                     |
| Digital Interface           | I <sup>2</sup> C                          |
| Analog Output               | No  |
| Pitch                       | 90 µm                                     |
| Absorber size               | 44 µm                                     |
| 64 sensitive elements       |   |

### Optical characteristics:

|                |             |             |
|----------------|-------------|-------------|
|                | <b>L0.8</b> | <b>L2.1</b> |
| Focal length:  | 0.8 mm      | 2.1 mm      |
| F-Number:      | 0.8         | 0.8         |
| Field of view: | 51 x 51°*   | 19 x 19°*   |

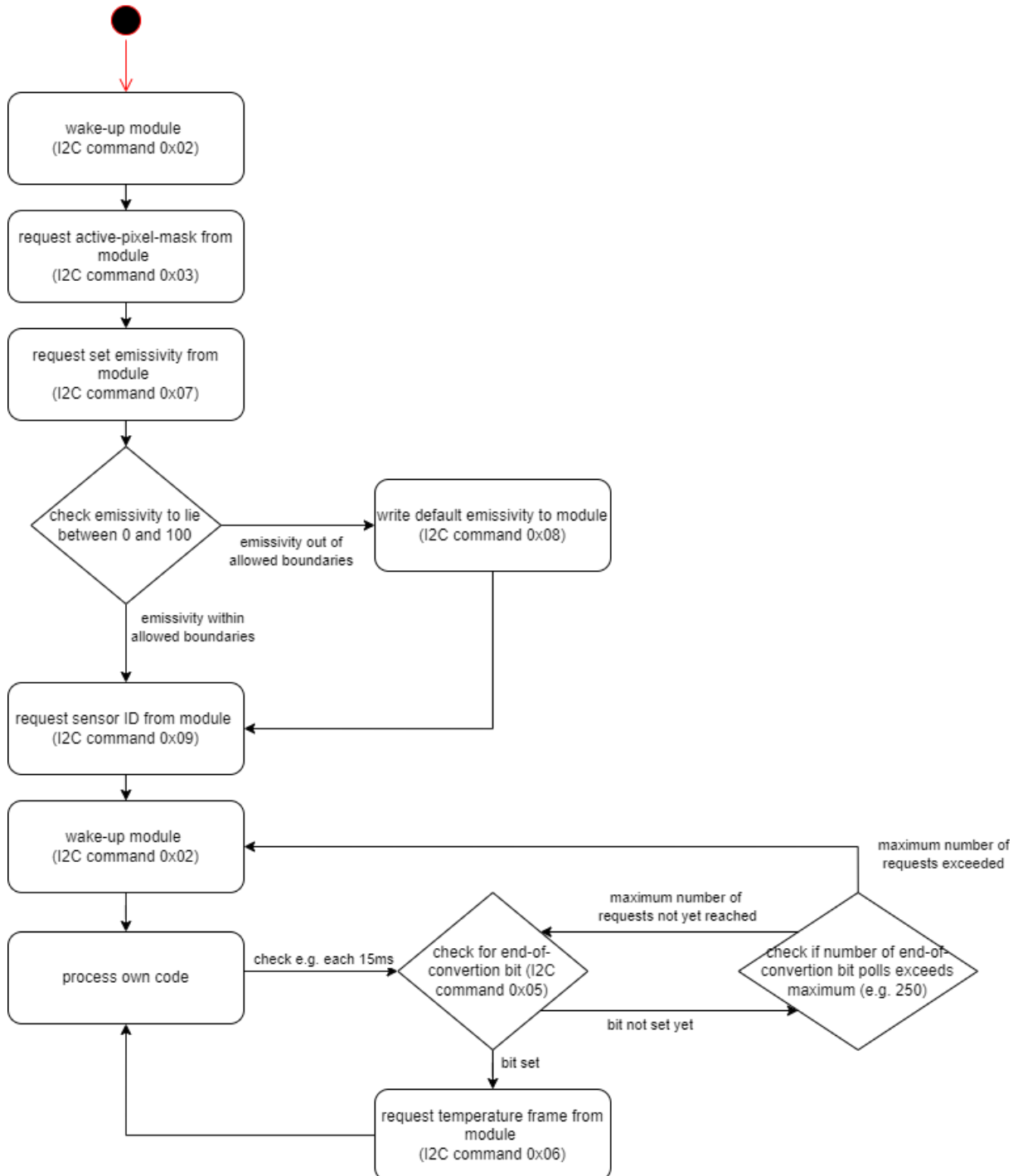
\*Field of view is specified as 50 % sensitivity (See diagram below).



|   |  |
|---|--|
| Lens coating:   | LWP-coating 5.0                                  |
|   | Cut On (Tr. 5 %): 5.0 µm ±0.3 µm                 |
| Accuracy:   | ±3 % or ±3 K (whatever is larger) in the working |
| ambient temperature range of 5 °C to 50 °C and object temperatures ≤300 °C. |  |

## Communication and Timings:

Proposed flow chart of communication.



## Serial order of data in stream:

| HTPA8x8d Temperature Mode |                                 |
|---------------------------|---------------------------------|
| Dataset                   | Value                           |
| 0                         | Temperature of Pixel(0) in K*10 |
| 1                         | Temperature of Pixel(1) in K*10 |
| 2                         | Temperature of Pixel(2) in K*10 |
| 3                         | Temperature of Pixel(3) in K*10 |
| ...                       | ...                             |
| n*                        | Temperature of Pixel(n) in K*10 |
| n+1                       | TAmb in K*10                    |

\* For n the maximum value is 63

Each dataset consists of a 16-bit value, first the Low-Byte is send, then the High-Byte.

## Control Messages:

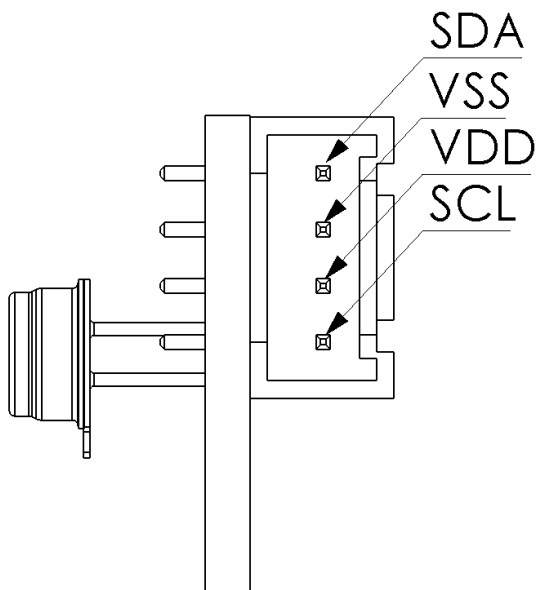
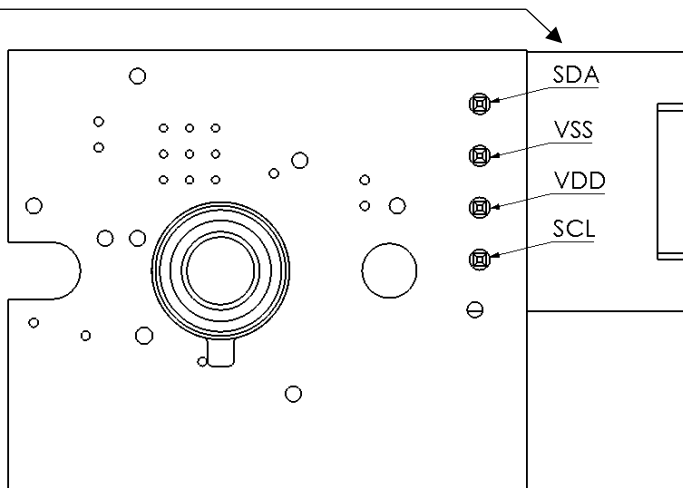
The module is accessed via the I<sup>2</sup>C protocol. Therefore, the device address is set as 0x1C. The following I<sup>2</sup>C commands are available.

| Command         |      | Remarks   |
|-----------------|------|---|
| Sleep           | 0x01 | Device is in sleep after power on reset   |
| WakeUp          | 0x02 | Also starts data conversion stream of sensor  |
| ReadMask        | 0x03 | Device goes into sleep after transmission of mask   |
| WriteMask       | 0x04 | Device goes into sleep after receiving and writing mask. Delay of 120ms required after sent of mask.<br>TAKE CARE: This stores the mask to the FLASH of the controller. FLASH endurance is about 10k write cycles. Therefore, don't do that on every power up, only if necessary. |
| ReadEoC         | 0x05 | Slave transmitts End of Conversion bit.   |
| ReadData        | 0x06 |   |
| ReadEmissivity  | 0x07 | Device goes into sleep after tranmission of emissivity  |
| WriteEmissivity | 0x08 | Device goes into sleep after write of emissivity. Delay of 250ms required after new emissivity sent.  |
| ReadSensorID    | 0x09 | Device goes into sleep after tranmission of SensorID  |

## Pinout:

For powering the module  $V_{DD}$  is +5 V (see drawings below).

### SMAW200-04 Yeonho



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There are no pull-ups in the I2C lines realized.

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Module Dimensions:

