GRIDEYE SENSOR
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PRODUCT INTRODUCTION
**WHAT IS GRIDEYE?**

**GridEYE Webpage**

**Overview**
- GridEYE is an 8x8 (64) pixel infrared array sensor.
- It uses an array of thermopile to measure actual temperature as well as temperature gradients.
- It is a high precision compact SMD design using MEMS technology.

**Features**
- GridEYE can detect the direction of moving people and objects – up, down, left, right and diagonally.
- Its coordinated array of sensing elements can even detect multiple people or objects moving in different directions.

January 6, 2017
Grid-EYE Sensor

**Silicon lens**
- Image formation

**Mixed signal processing IC**
- 64-Pixels signal readout
- Analog amplification
- Analog to Digital conversion
- Sensitivity correction
- Correction for temperature effects
- Digital communication

**Ceramic package**
- Air tightness
- Radio shielding
- Possible to use with Reflow soldering

**IR detector**
- 8 x 8 pixels
- Thermal insulation structure using MEMS technology
- Infrared absorption
- Thermoelectric conversion
Sensor works by detecting infrared and converting it to temperature.
### PRODUCT SPECIFICATION

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power voltage</td>
<td>3.3V ±10%, 5V ±10%</td>
</tr>
<tr>
<td>Current consumption</td>
<td>4.5mA (normal), 0.8mA (standby), 0.2mA (sleep)</td>
</tr>
<tr>
<td>View angle</td>
<td>60 degrees (x,y)</td>
</tr>
<tr>
<td>Absolute temperature accuracy</td>
<td>High gain: ±2.5°C, Low gain: ±3°C</td>
</tr>
<tr>
<td>Noise Equivalent Temperature Difference</td>
<td>0.5°C @ 1Hz</td>
</tr>
<tr>
<td>Frame rate (selectable)</td>
<td>1 frame/sec or 10 frames/sec</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>0 ~ 80°C (high gain), -20 ~ 80°C (low gain)</td>
</tr>
<tr>
<td>Detection temperature range</td>
<td>0 ~ 80°C (high gain), -20 ~ 100°C (low gain)</td>
</tr>
<tr>
<td>External interface</td>
<td>I²C 12bit</td>
</tr>
<tr>
<td>Operation mode</td>
<td>Normal, Standby, Sleep</td>
</tr>
</tbody>
</table>

![Image of product with dimensions: 11.6(L) x 8.0(W) 4.3(H) mm, Can package, Silicone lens, Ceramic base, MEMS sensor chip and ASIC]
## Grid EYE 2nd Generation Spec and Schedule

<table>
<thead>
<tr>
<th>Infrared Array Sensor Grid-EYE</th>
<th>Current Model</th>
<th></th>
<th>New Generation</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High Gain Type</td>
<td>Low Gain Type</td>
<td>High Gain Type</td>
<td>Low Gain Type</td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
<td>![Appearance Image]</td>
<td>![Appearance Image]</td>
<td>![Appearance Image]</td>
<td>![Appearance Image]</td>
</tr>
<tr>
<td><strong>Part Number</strong></td>
<td>AMG8831</td>
<td>AMG8832</td>
<td>AMG8833</td>
<td>AMG8834</td>
</tr>
<tr>
<td></td>
<td>AMG8851</td>
<td>AMG8852</td>
<td>AMG8853</td>
<td>AMG8854</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>11.6x8.0 x H4.3mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Number of pixels</strong></td>
<td>64 pixels (Vertical 8 x Horizontal 8 Matrix)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td>I2C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(new generation is 100% compatible to existing designs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Detection Angle</strong></td>
<td>60° × 60°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supply Voltage</strong></td>
<td>3.3Vdc or 5Vdc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Frame rate</strong></td>
<td>10 frames per second or 1 frame per second</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Absolute temperature accuracy</strong></td>
<td>+/- 2.5°C</td>
<td>+/- 3.0°C</td>
<td>+/- 2.5°C</td>
<td>+/- 3.0°C</td>
</tr>
<tr>
<td><strong>Detection Temperature</strong></td>
<td>0 to 80°C</td>
<td>-20 to 100°C</td>
<td>0 to 80°C</td>
<td>-20 to 100°C</td>
</tr>
<tr>
<td><strong>Operation Temperature</strong></td>
<td>0 to 80°C</td>
<td>-20 to 80°C</td>
<td>0 to 80°C</td>
<td>-20 to 80°C</td>
</tr>
<tr>
<td><strong>NETD</strong>&lt;sup&gt;1&lt;/sup&gt;</td>
<td>0.5°C</td>
<td>0.5°C</td>
<td>0.16°C</td>
<td>0.2°C</td>
</tr>
<tr>
<td><strong>Detection Distance</strong>&lt;sup&gt;2&lt;/sup&gt;</td>
<td>5m</td>
<td>5m</td>
<td>7m</td>
<td>7m</td>
</tr>
<tr>
<td><strong>MP</strong></td>
<td>Already MP</td>
<td>Already MP</td>
<td>April 2016</td>
<td>April 2016</td>
</tr>
</tbody>
</table>

*1 Typ. Noise Equivalent Temperature Difference @ 10Hz
*2 Please see the spec sheet for measurement conditions
### ADVANTAGES/COMPARISON

<table>
<thead>
<tr>
<th></th>
<th>Moving object</th>
<th>Motionless object</th>
<th>Movement direction</th>
<th>Temperature measuring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyroelectric</td>
<td>Possible</td>
<td>Impossible</td>
<td>Impossible</td>
<td>Impossible</td>
</tr>
<tr>
<td>Thermopile</td>
<td>Possible</td>
<td>Impossible</td>
<td>Impossible</td>
<td>Possible</td>
</tr>
<tr>
<td>(Single element)</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
<tr>
<td>Grid-EYE</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

- A lot more functionality as compared to Pyro-electric and Thermopile.
- Above extended features of GridEYE make it possible to be used in a wide variety of applications.
- GridEYE is the latest technology of sensor products available in smallest size in market today.
TARGETED APPLICATIONS
TARGETED APPLICATIONS

Home Appliances
AIR CONDITIONER APPLICATION

- Detection of temperature distribution for optimal temperature control

- Comfort – Regularize room temperature
- Saving Energy – Control temperature of necessary areas
MICROWAVE APPLICATION

- Detect food temperature

- Convenience – Avoid food being too hot.
- Saving Energy – Only heat up necessary area

Detected Temperature

<table>
<thead>
<tr>
<th>degC</th>
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<tbody>
<tr>
<td>36</td>
</tr>
<tr>
<td>40</td>
</tr>
<tr>
<td>43</td>
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<td>35</td>
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</tbody>
</table>

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TARGETED APPLICATIONS

Home Appliances

Hot Spot Detection
HOT SPOT DETECTION

- Detect hot spots in critical industrial areas e.g. Circuit breakers

**Functionalities: hot spot detection (permanent monitoring)**
- Pre-alarm / alarm: crossing of pre-defined threshold T° values
- Hot spot localization
- T max, Surface of the hot spot

Detected Temperature

<table>
<thead>
<tr>
<th></th>
<th>36</th>
<th>36</th>
<th>40</th>
<th>41</th>
<th>43</th>
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</tr>
</tbody>
</table>
TARGETED APPLICATIONS

Home Appliances
Hot Spot Detection
Area Monitoring
Innovation for Cold Chain Business in Japan

- Monitoring and Preservation of Fish for transportation

Transportation Tuna Fish with Snow Ice

Temp: -1.0°C  Salt Density: >1%

Snow Ice  Normal Ice
TARGETED APPLICATIONS

- Home Appliances
- Hot Spot Detection
- Area Monitoring
- Ambient Assisted Living

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- Each device to have 2 grid eye sensors.
- Application: People and Fall detection in Hospitals/old homes/Apartments
Ambient Assisted Living

- GridEYE on the roof
- Application: People and Fall detection in Hospitals/old homes/Apartments
TARGETED APPLICATIONS

- Home Appliances
- Hot Spot Detection
- Area Monitoring
- Ambient Assisted Living
- Industry Safety & Control

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INDUSTRIAL SAFETY & CONTROL

- Area monitoring near sensitive or dangerous machines
- Unauthorized people or people near dangerous machines
TARGETED APPLICATIONS

- Home Appliances
- Hot Spot Detection
- Area Monitoring
- Ambient Assisted Living
- Consumer Comfort
- Energy Saving
- Industry Safety & Control

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Grid-EYE Unit

- Panasonic Product
- 4 Grid-EYE Sensors
- In production and commercialized in Japan
- Used to achieve Zero Energy Building
- Used to control lighting and Air conditioning
Control of Lighting and Air Conditioning by utilizing the information from Grid-EYE unit. (Number of people, position, moving direction, and Temp information)
# COMPARISON TABLE – ENERGY SAVING

<table>
<thead>
<tr>
<th>Type</th>
<th>Grid-EYE Unit Type</th>
<th>PIR</th>
<th>Camera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>3.6 m × 3.6 m</td>
<td>Φ 4.9 m</td>
<td>7.2 m × 7.2 m</td>
</tr>
<tr>
<td>Number</td>
<td>YES (8 People)</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Position</td>
<td>YES (4 × 4)</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Temp</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Privacy Protection</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>Energy Saving</td>
<td>&lt;20 %</td>
<td>&lt;5 %</td>
<td>&lt;10 %</td>
</tr>
</tbody>
</table>
TARGETED APPLICATIONS

Home Appliances

Hot Spot Detection

Area Monitoring

Ambient Assisted Living

Industry Safety & Control

Energy Saving

Stove Guard

Consumer Comfort

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STOVE GUARD

- EU Regulation that every household to have a stove guard
- Total no. of households in EU in 2014 were 216 million

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TARGETED APPLICATIONS

Home Appliances
Hot Spot Detection
Area Monitoring
Ambient Assisted Living
Business Intelligence
Stove Guard
Consumer Comfort
Energy Saving
Industry Safety & Control

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BUSINESS INTELLIGENCE

- Monitor number of people near an advertisement or crossing it inside a shopping mall.
- Use this information to sell at a higher price.
GRIDEYE Videos

https://www.youtube.com/watch?v=HA1DX4DQdM
https://www.youtube.com/watch?v=ycluaZY6EUc
https://www.youtube.com/watch?v=SUпV8WSUub_l
TECHNICAL DETAILS
MEMS TECHNOLOGY

MEMS Technology of Grid EYE

Downsizing and Larger pixel number by Unique MEMS Technology

8×8 Infrared Array Sensor Chip
(Chip Size: 3mm×3mm)

Pixel pitch: 290 μm

Cross-section

- Thermal Contact point
- P-Poly Si
- N-Poly Si
- MOS SW
- Cold Junction
- SiO₂+SiN
- Anisotropic Etching
- Si Base Plate
Principle of Grid-EYE

Sensor ⇒ Selector ⇒ Digital Output
Grid-EYE detects human from about 5m away with using appropriate software.
EVALUATION KIT
EVALUATION KIT

- Plug & Play
- Quick prototyping & testing GridEYE
- Open source Firmware and Software
- Strong customer support
Evaluation Kit Deliverables

Avnet Abacus Grid-EYE Evaluation Kit Webpage

Panasonic Grid-EYE Evaluation Kit Software and Documentation

Technical Information for Download

The following supporting documents which include all the details for setting up, using and developing evaluation kit are available for download here:

- Evaluation Kit Presentation
- Quick Start Guide
- User Manual
- Schematics Evaluation Kit
- Grid-EYE FAQs
- Grid-EYE Application Notes
- Communication Protocol
- Windows 8/10 USB Driver Installation (Disable Driver Signature Verification)
- SAM-BA Application Notes

Software & Source Code for Download

Along with the evaluation kit, Panasonic is also providing the customers with a free PC software. This can be downloaded below. The kit is a “plug & play” device when used with this software on PC. Links below also include all source code. LabView that can be further used by our customers to develop their own application. Moreover, you can also find APIs of Grid-EYE developed by Panasonic and available free of charge for our customers. Please feel free to use provided by Panasonic in your development and prototyping.

- Grid-EYE Evaluation Kit Software 32 Bits (File size 325MB)
- Grid-EYE Evaluation Kit Software 64 Bits (File size 370MB)
- USB Driver
- Grid-EYE APIs
- Grid-EYE Sample Code (Python)
- Micro Controller Firmware
- Arduino Code (Compatible with Evaluation Kit)
- Arduino Old Code (Sample Only - Not Compatible with Evaluation Kit)
- Labview Sample Code
- SAM BA 2.15 (Note: SAM BA 2.16 is currently not compatible with Evaluation Kit)
FAQs
AVAILABLE FAQs

FAqs

(Frequently Asked Questions)

INFRARED GRIDEYE SENSOR

Author: Mubeen Abbas
Date: 6/11/2015 4:20
Version: 1.0

Which aperture (if used within a housing) should be used?
A thin plate which is transparent for infrared beam of 5-13 μm has to be selected. Several materials like B190 with optical flat, Polyethylene (PE), or ZnO+H2O or others can be chosen.

What are the performance differences between normal, stand-by and sleep mode?
Stand-by mode: Frame rate is 1 frame/s. Frame rate is the same as normal mode but temperature register is only updated every 10 or 60 sec.
Sleep mode: Temperature register is not updated.
Reading and writing is possible while all 3 modes.

Is GRIDEYE able to measure temperatures higher/ lower than mentioned in the specification?
In principle yes, but it depends on the sensor temperature (ΔT to thermistor). Furthermore the accuracy of temperature will be worse than specified in the detector.

Is it possible to place an additional lens in front of GridEYE in order to change the Field of View (FOV) or detection distance?
An infrared image is formed on the sensor surface through the Silicon lens. This sensor is placed on the focal point of the lens and only parallel infrared beam can be detected. If an additional lens is placed on front of the sensor, the focal point is changed and the infrared image is out of focus. A changed field of view means another focal point. In this case the height of GridEYE and the lens step height have to be changed. Please contact your local sales representative to evaluate if a special type is possible.

What is the worst case temperature difference (ΔT) between two pixels if the same temperature is measured over all pixels?
Worst case 6°C typ. 5°C. If one pixel has the tolerance of 10°C and the other pixel has some noise with ± 1°C the temperature difference could be 6°C.

What is the set up time after starting the GridEYE sensor?
We recommend waiting at least 15 s, because this is the time GridEYE needs to stabilize the output.

What is the benefit of 1 frame/s compared with µ-controller calculation?
The cascade volume of µ-Controller can be reduced.

What is the difference between 1 frame/s and 10 frame/s?
The GridEYE AS46 has externally 10 frame/s. 1 frame/s is the average of 10 frames/s.

What is the benefit between 1 frame/s compared to 10 frame/s?
The noise level is reduced. The noise level will be about 1/3 compared with 10 frame/s.
Thank you