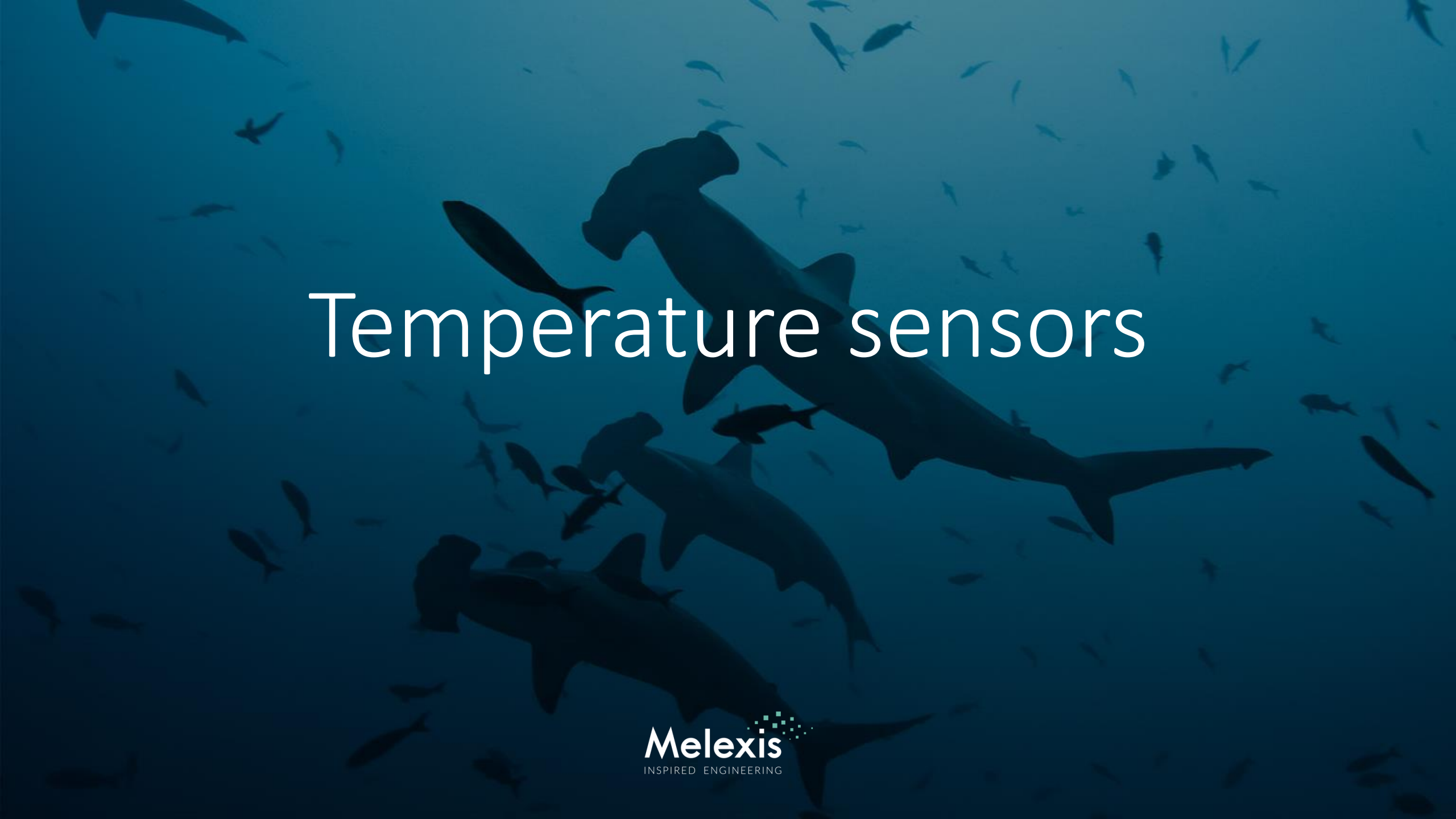
Future Electronics Tech Day

Anuj Patel (Account Manager / FAE)



Temperature sensors

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Agenda

- Portfolio overview with focus on new products
  - Single pixel:
    - TO-Can MLX90614/5
    - Surface Mount MLX90632
  - Thermal array/imager
    - MLX90640 32x24 Array
    - MLX90641 16x12 Array
- Success stories & target markets
  - Smart HVAC/building
  - Appliances & White goods
  - Consumer & Wearables
  - Medical & industrial
  - Automotive
- Summary

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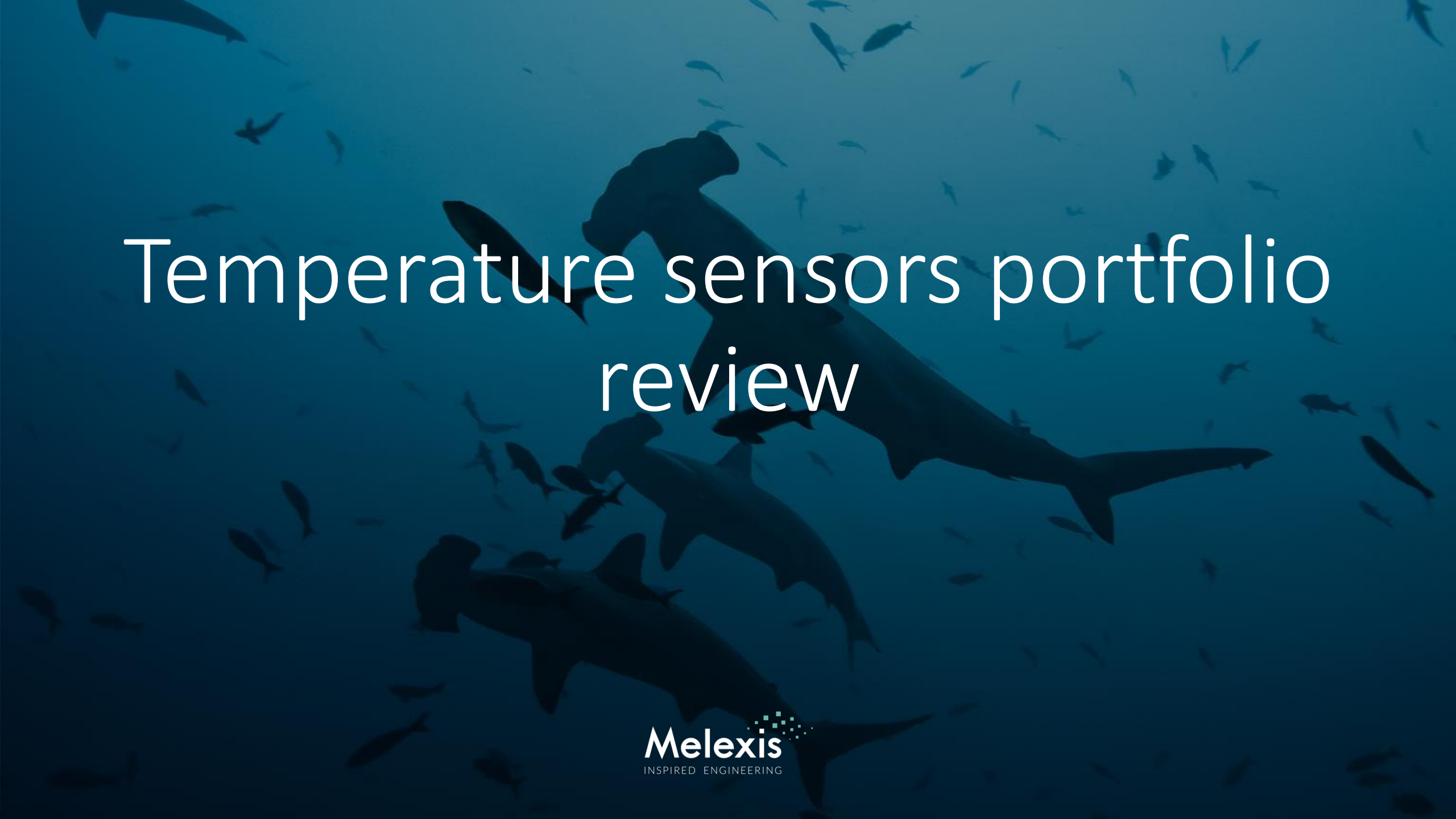

Temperature sensors portfolio review

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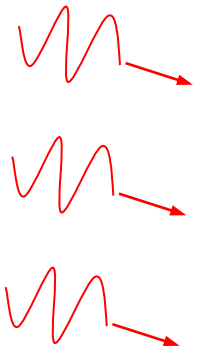
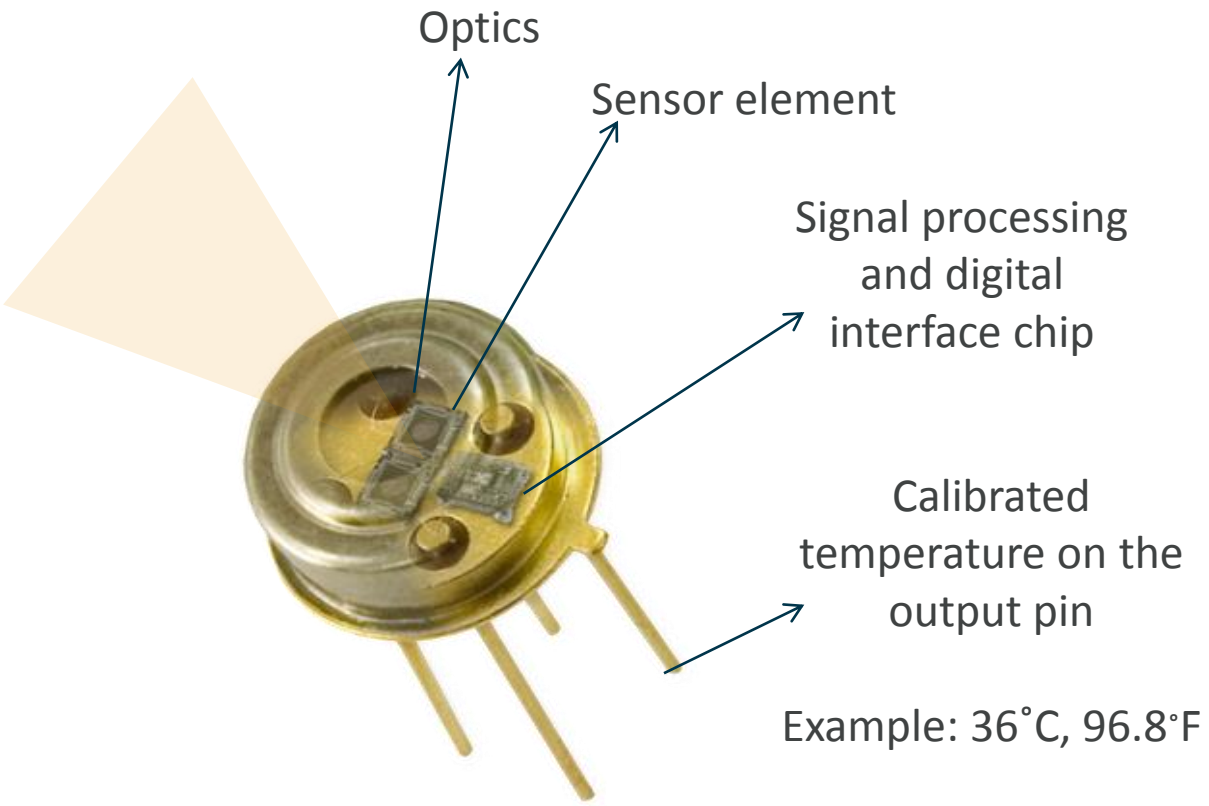
Single pixel temperature sensors

Contactless temperature sensing with FIR

Based on detection of thermal (=far infrared or FIR) radiation





Full system including optics, analog & digital, for plug & play contactless temperature sensing

Melexis family IR products – MLX90614

- Complete system: optics, analogue sensor and signal conditioning chip
- Easy to use, digital (SMBus/PWM), calibrated temperature output;
- Broad portfolio (>20 versions)
  - Wide range of FoV (range from 5° to 90°)
  - Supply voltage: 3 or 5V

Part No.	Temperature Code	Package Code	- Option Code
MLX90614	E (-40°C to 85°C) K (-40°C to 125°C)	SF (TO-39)	- X X X (1) (2) (3)

(1) Supply Voltage/ Accuracy
- A - 5V
- B - 3V
- C - Reserved
- D - 3V medical accuracy

(2) Number of thermopiles:
- A – single zone
- B – dual zone
- C – gradient compensated*

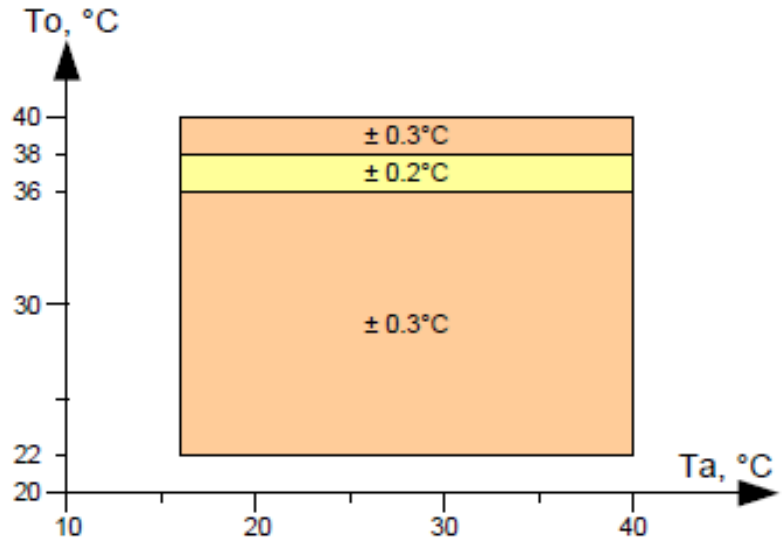
(3) Package options:
- A – Standard package
- B – Reserved
- C – 35° FOV
- D/E – Reserved
- F – 10° FOV
- G – Reserved
- H – 12° FOV (refractive lens)
- I – 5° FOV

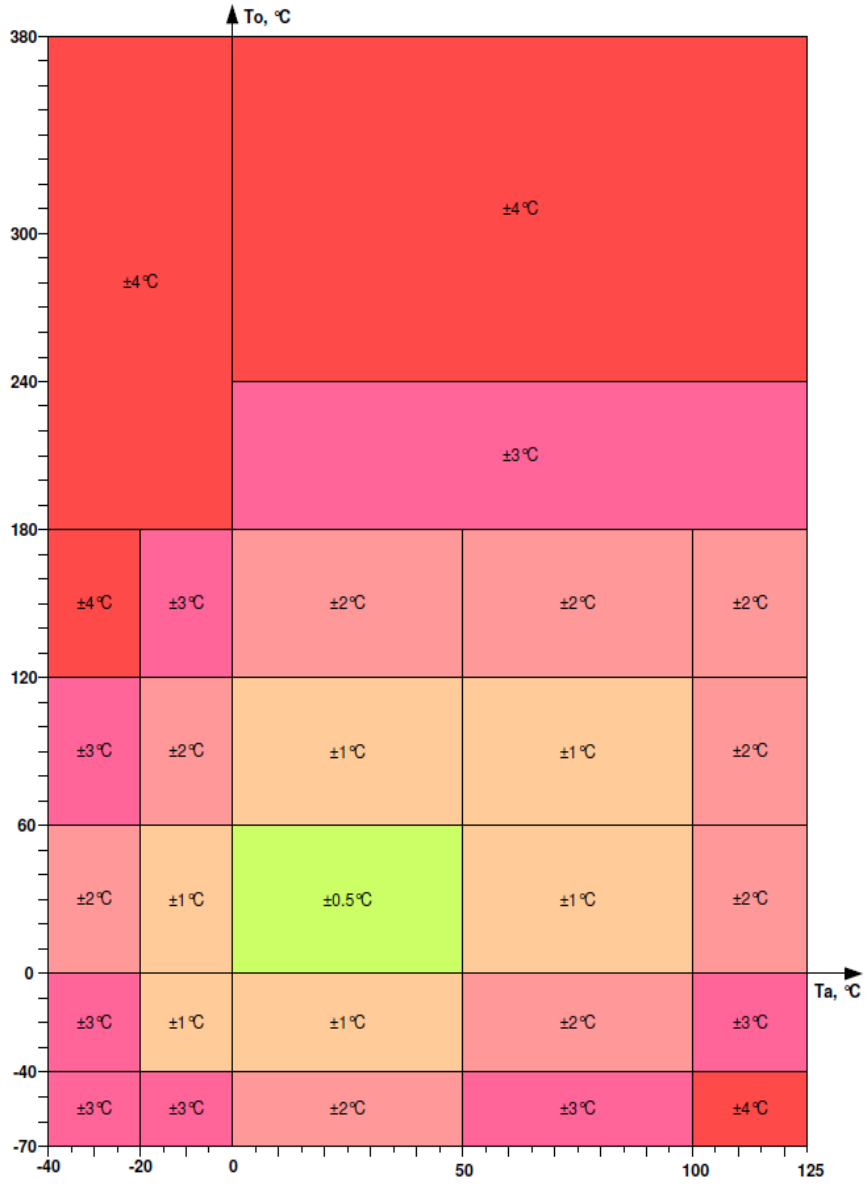
Example:
MLX90614ESF-BAA

* : See page 2

Melexis family IR products – MLX90614

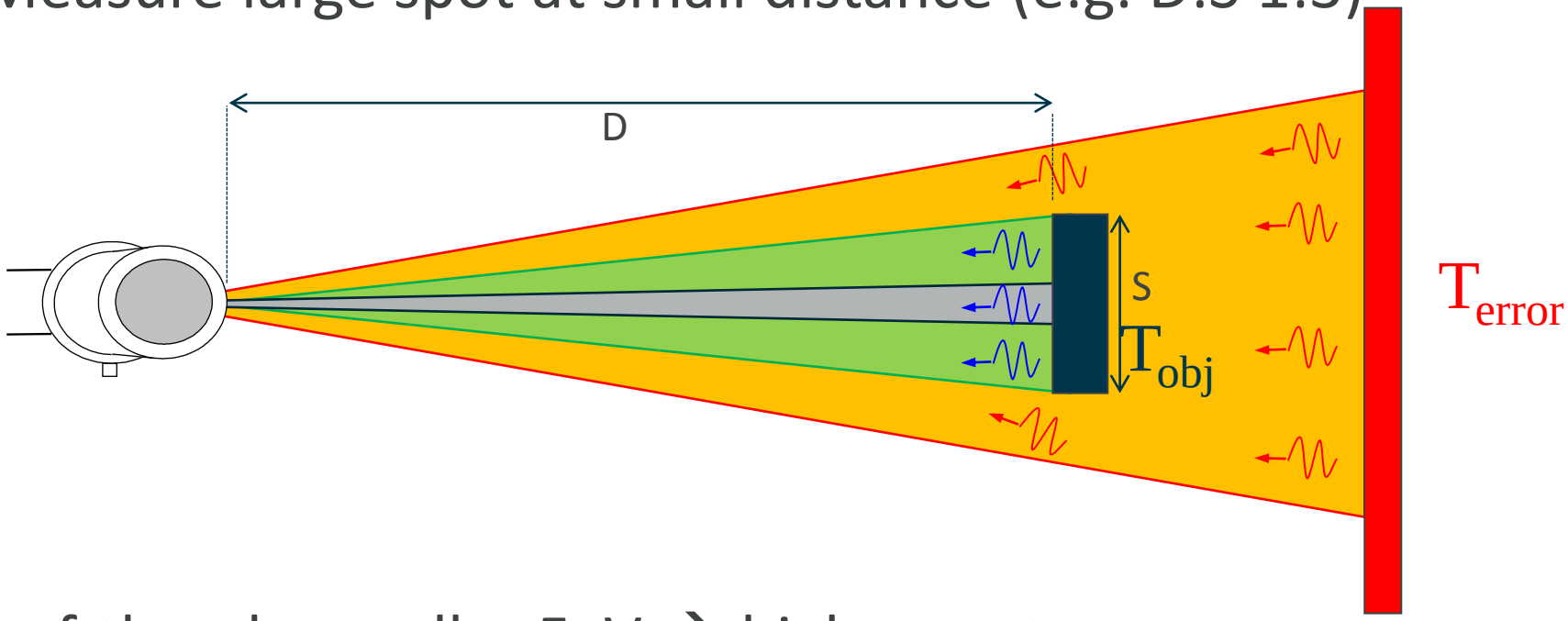
- Factory calibrated in a wide temp range (USP!)
  - To=-70.. 380°C
  - Ta =-40.. 85/125°C
- High accuracy:
  - ±0.5°C in 0..50 °C range
  - ±0.2°C body temp (medical version)





Field of View (FoV) explained

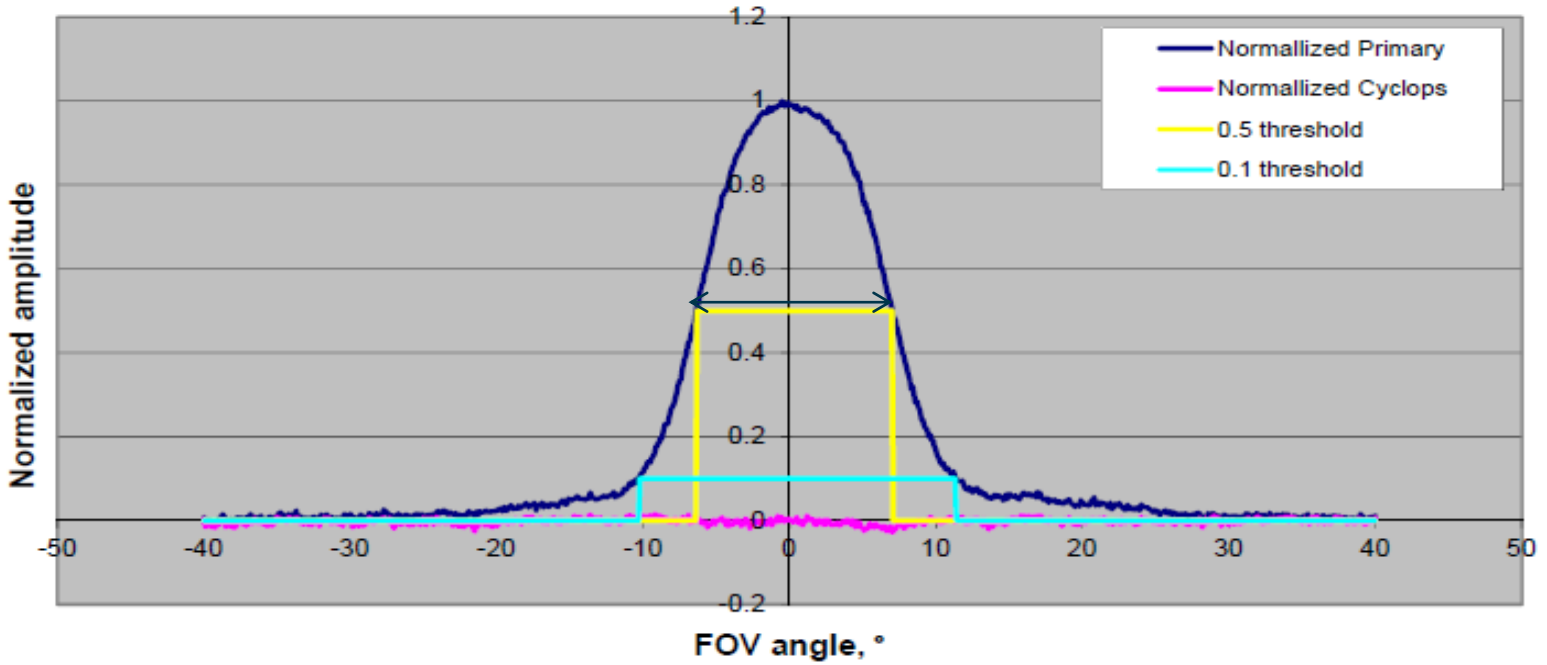
- Optimum FoV depends on distance to Spot (D:S) size ratio
  - Narrow FoV → Measure small spot at large distance (e.g. D:S 3:1)
  - Wide FoV→ Measure large spot at small distance (e.g. D:S 1:3)



- Single pixel rule-of-thumb: smaller FoV → higher cost

MLX90614ESF-ACK= low cost 13° FoV (NEW!)

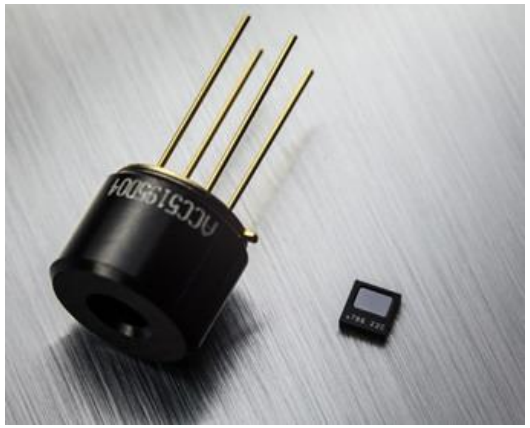
- MLX90614ESF-ACK provides new trade-off point:
  - Narrow FoV (13°)
  - **Low cost** (no lens!) alternative for narrow FoV
- Available Now!

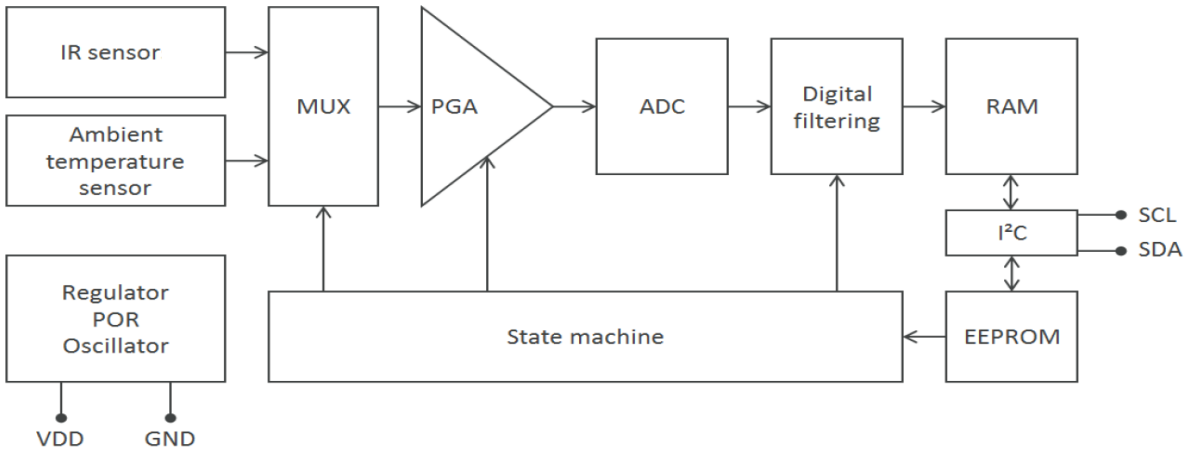


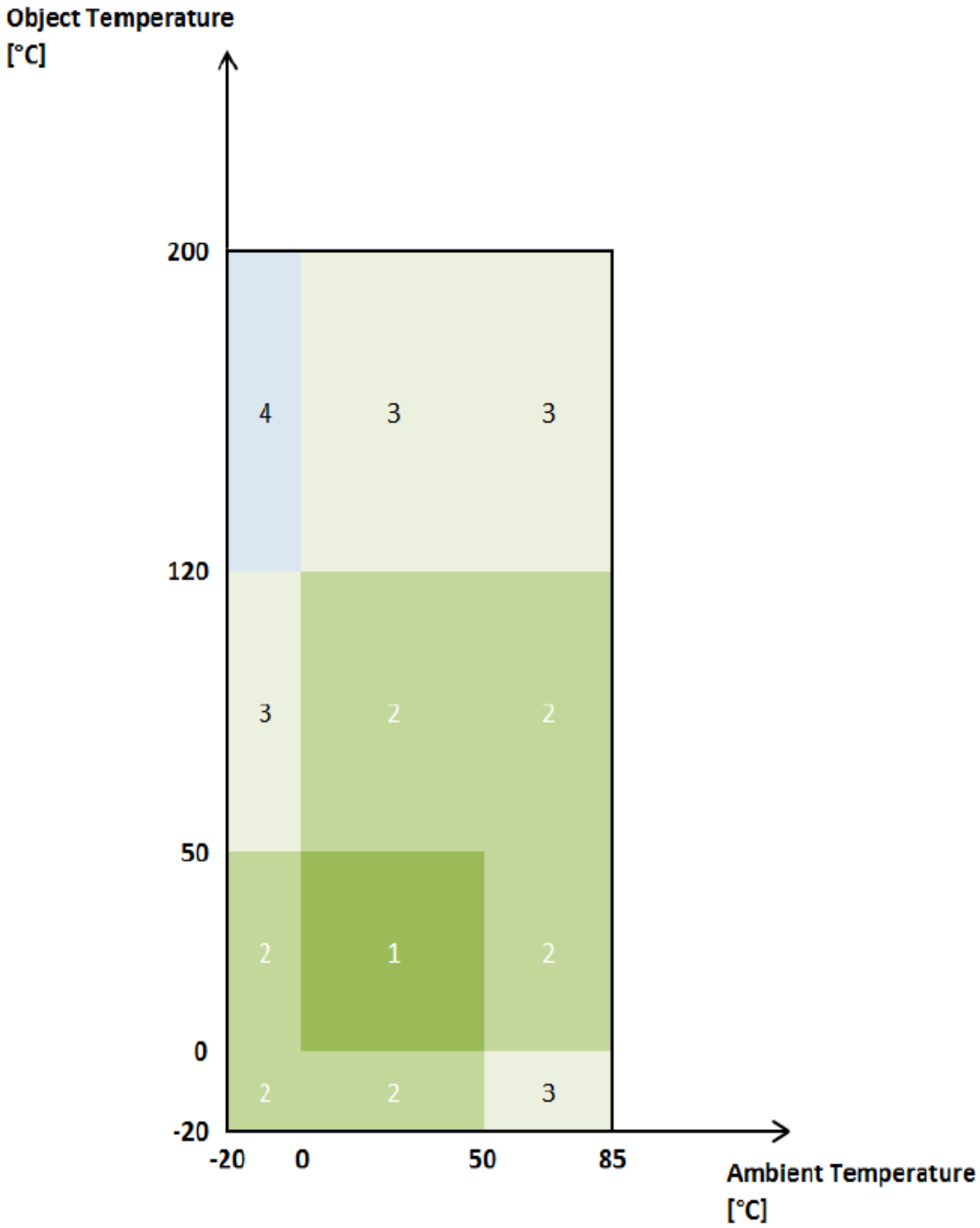
Single pixel SMD:MLX90632

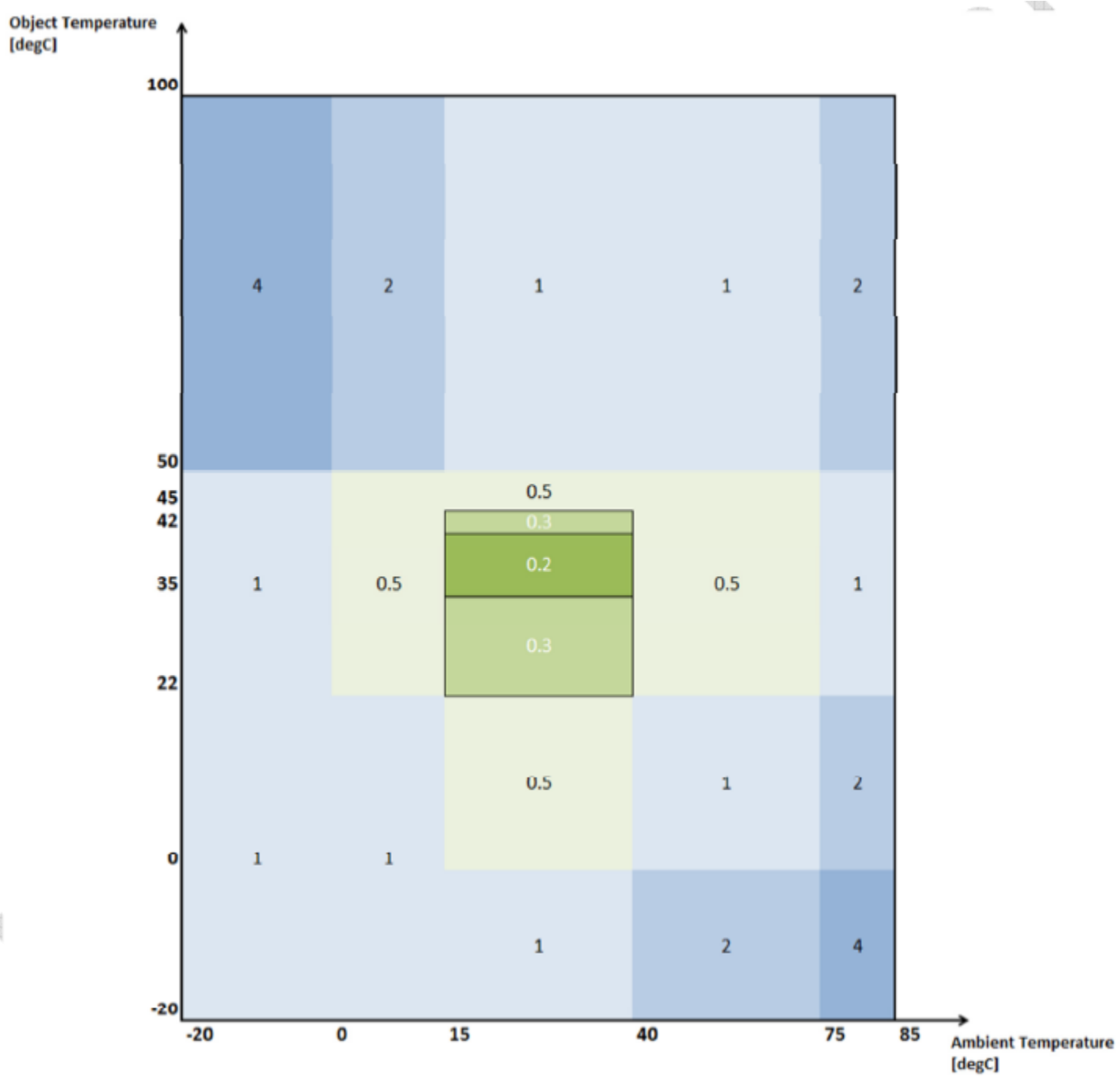
Single pixel SMD: MLX90632

- Small QFN Package: 3x3x1mm; Field of View 50°
- High Thermal Stability vs. thermal gradient and rapid temperature change
- Pre-Calibrated & Digital Output (To, Ta data on I^2C);
- Commercial grade: -20..85°C operating, -20..200C object temperature with ±1˚C accuracy
- Medical grade ±0.2˚C coming in Q2 2019
- Noise equivalent temperature difference = 0.1°C p-p @2Hz
- 1mA@3V3, 2.5uA in sleep mode
- https://www.youtube.com/watch?v=KZSfF-Mha3Q






Object Temperature
[°C]
200
120
50
0
-20
-20
0
50
85
Ambient Temperature
[°C]
4
3
3
3
2
2
2
1
2
2
2
3


Object Temperature
[degC]
100
50
45
42
35
22
0
-20
-20
0
15
40
75
85
Ambient Temperature
[degC]
4
2
1
1
2
0.5
0.3
0.2
0.3
1
0.5
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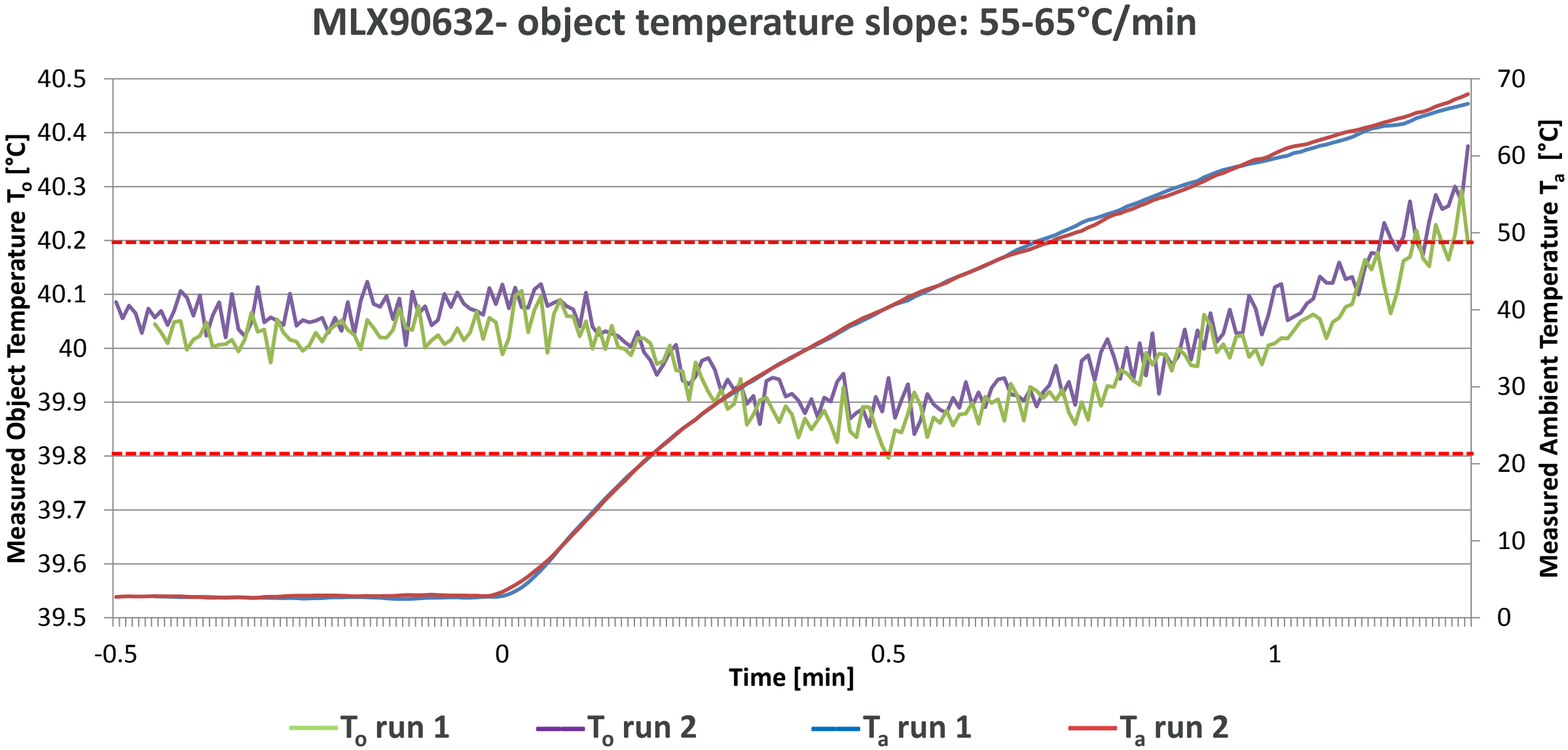
1
0.5
1
2
1
1
1
2
4

High Thermal stability demonstrated



Superior performance against thermal shock

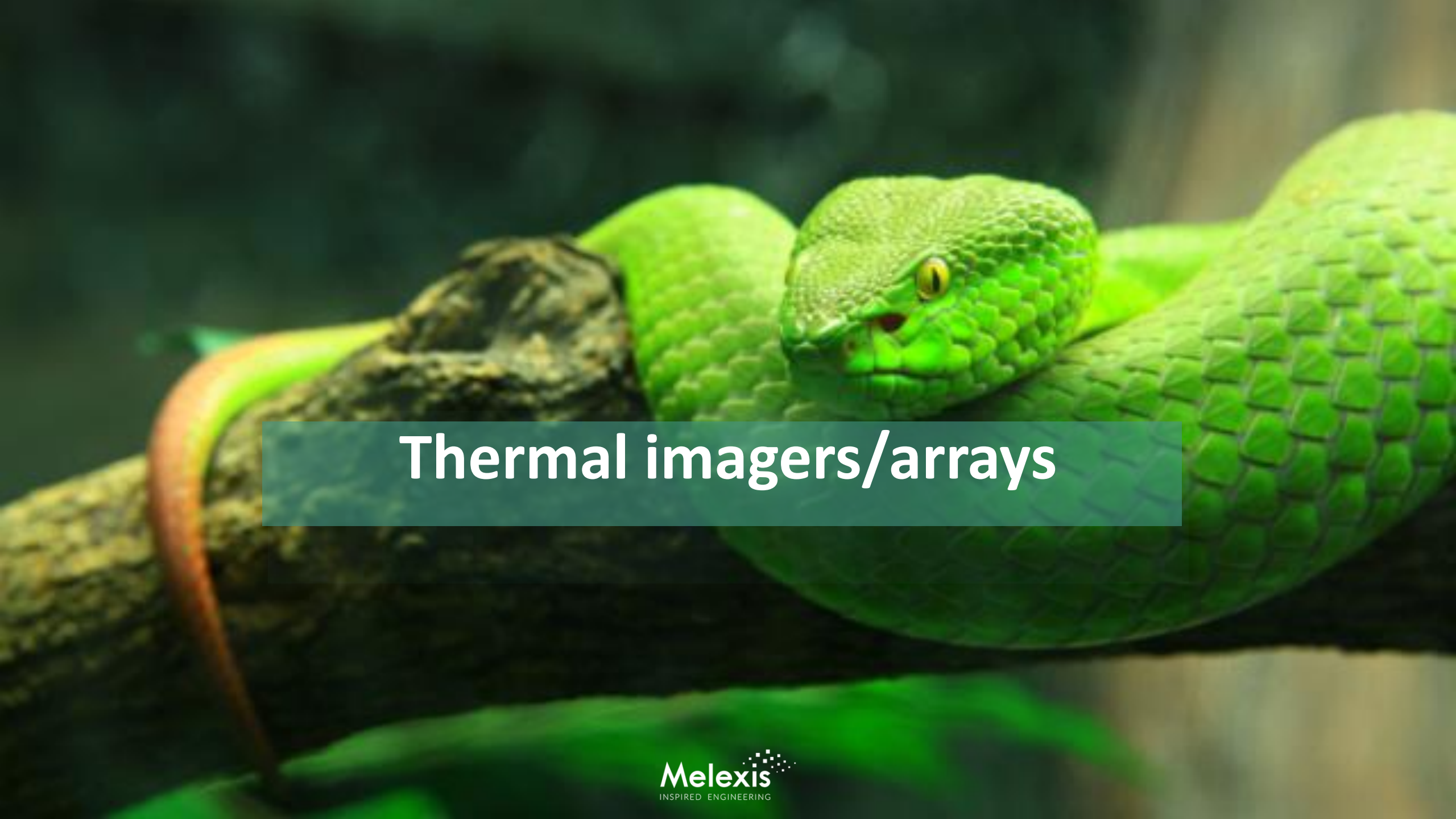
Applications

Medical

- Forehead & ear body thermometer
- Stand-alone or accessory for phone

Smart wearables

- Temperature monitoring with MLX90632
  - Wrist, in ear, chest,…
  - Smart watch, ear-bud,…



Thermal imagers/arrays

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Melexis FIR thermal Array portfolio

- MLX90621: 16x4 pixels
  - FOV: 40°x10°, 60°x15°, 120°x30°
  - MP since 2011, consumer grade

- MLX90641: 16x12 pixels (NEW!)
  - High temperature (125°C operating)
  - Launch March 2019

- MLX90640: 32x24 pixels (NEW!)
  - Launched and Available now!

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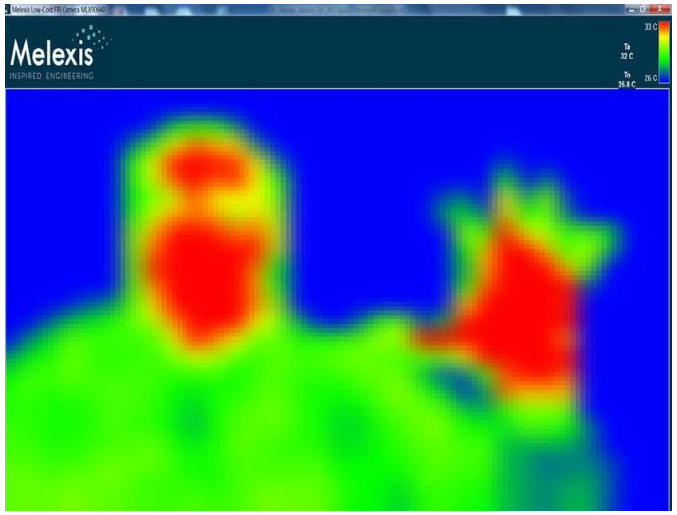
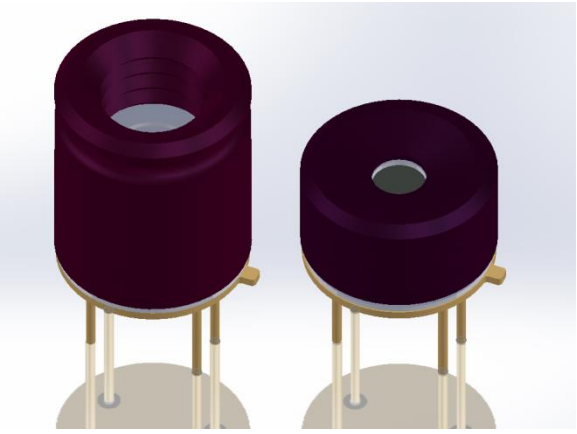
MLX90640: 32x24 thermal array



- MLX90640 spec summary
  - 32x24 pixels in compact 4-pin TO39 can
  - Object temp -40 to 300°C (-40 to 85°C operating)
  - Factory calibrated, no re-calibration required, low noise (0.25K NETD@4Hz)
  - Two different FoV options: 55°x35° and a 110°x75° wide angle version
  - I^2C Fast Mode + (EEPROM write at 400KHz only)
- Unique cost vs. pixel resolution vs. performance
- EVB90640 Available at Future
- https://www.youtube.com/watch?v=WSZ3GGDusTk



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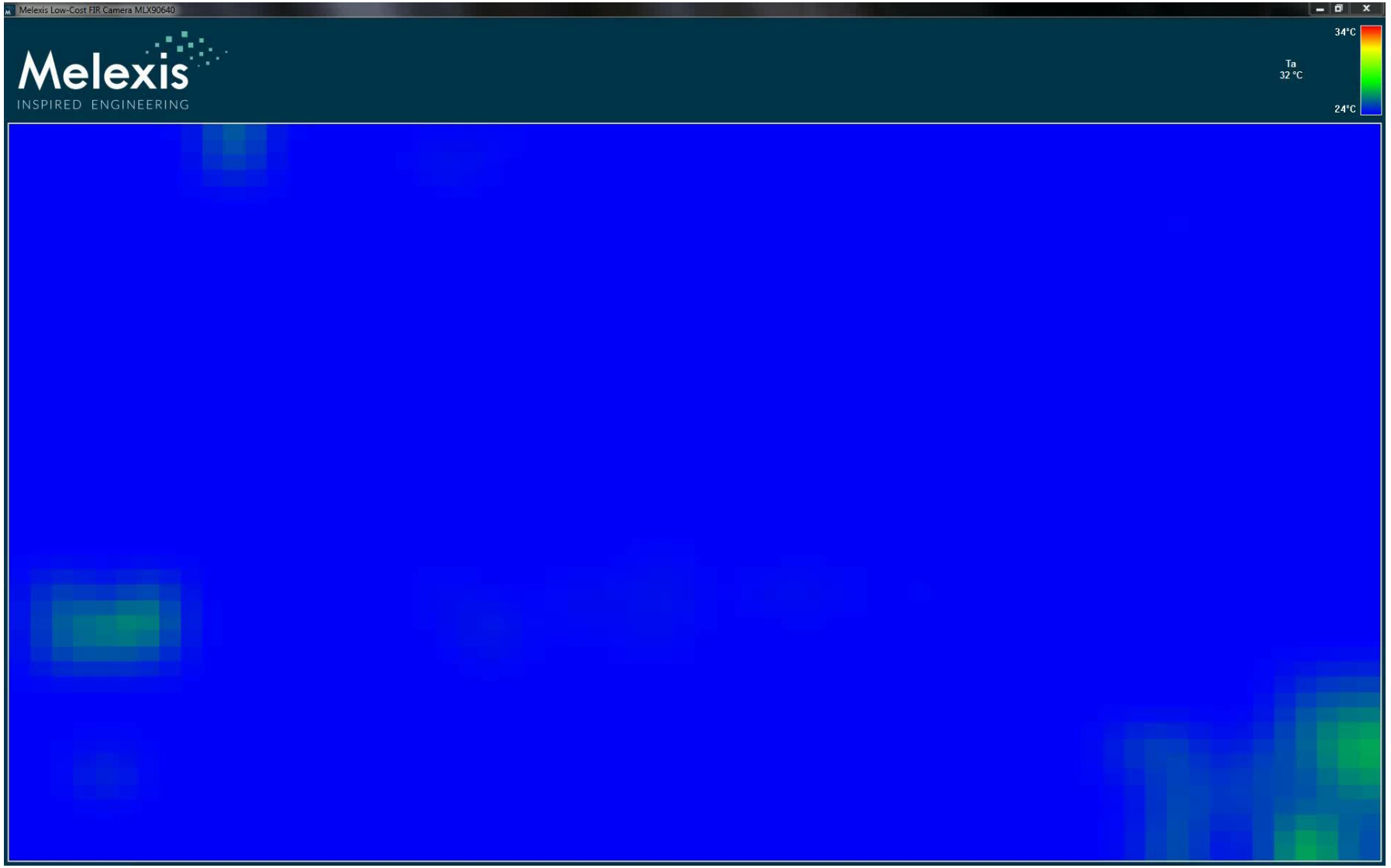
MLX90640 demo movie



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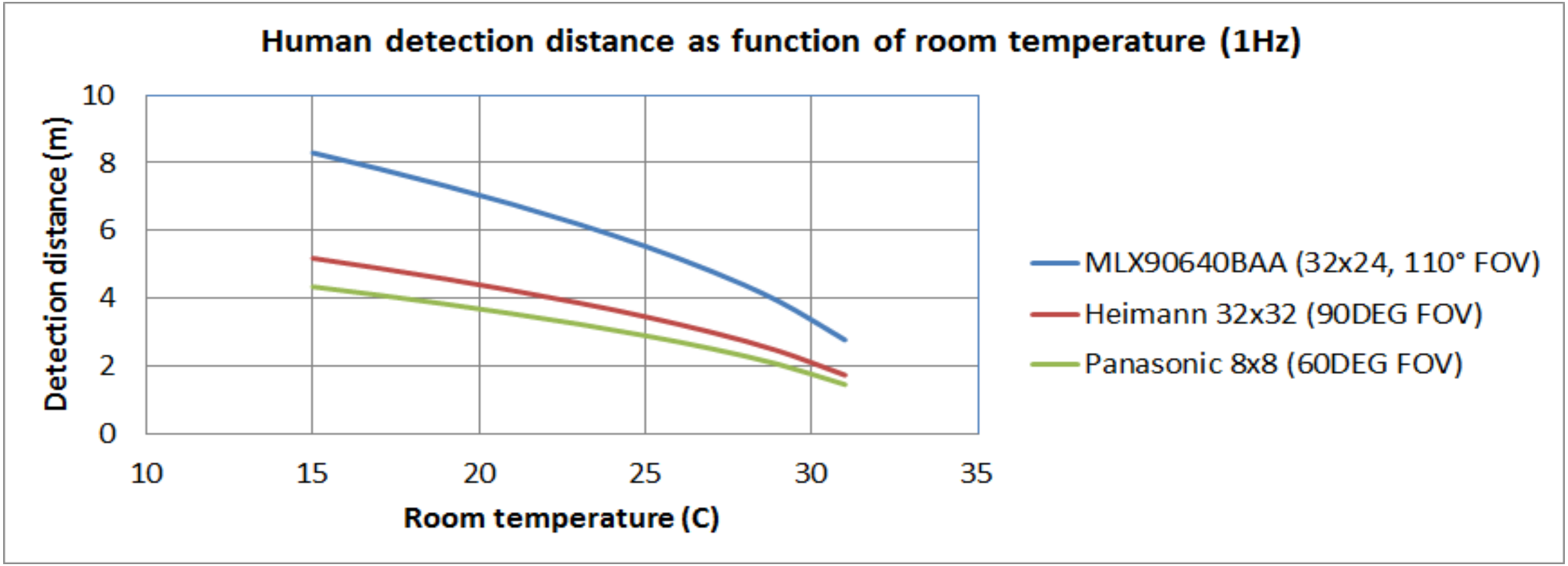
Competitive comparison: people detection



Competing technology: Pyroelectric (PIR)

- Pyro-electronic (Passive Infrared Sensor=PIR) technology (cheap)
- Can be used as motion detector
- Only measures change in temperature
  - Blind for static people
  - No temperature information

Coming in March 2019: 16x12

MLX90641

- **16x12** pixels in compact, low cost 4-pin TO39 can
- -40 to 85C *and* ***125°C*** *version* operation temperature range
- Object temperature: -40C to 200C
- Typical object temperature accuracy of +/-1C
- Noise equivalent temperature difference (NETD) of just 0.1K RMS @ 4Hz refresh rate
- Two different FoV options: standard 55x35 and a 110 x75 wide angle version
- Sampling now
- Compatible with EVB90640!

Success stories & target applications

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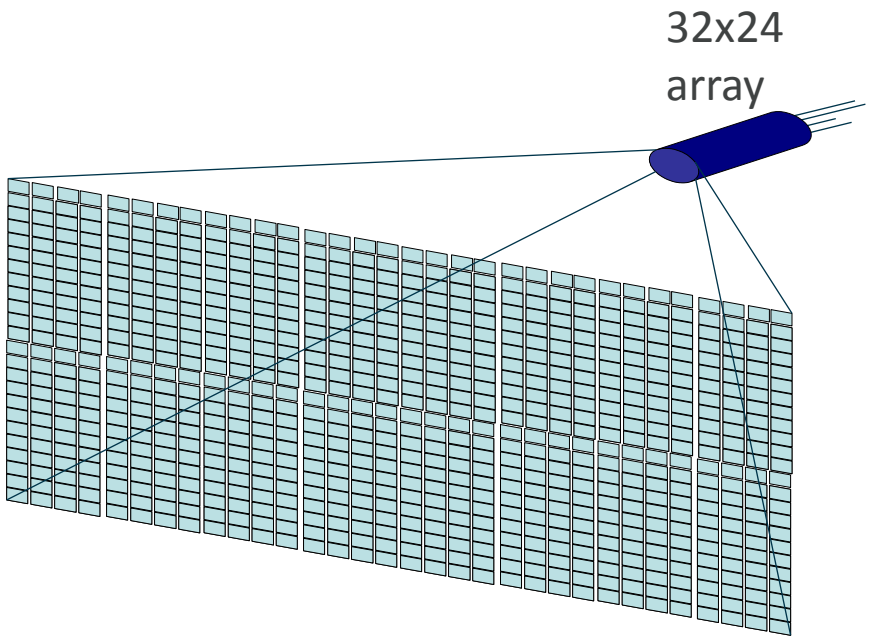
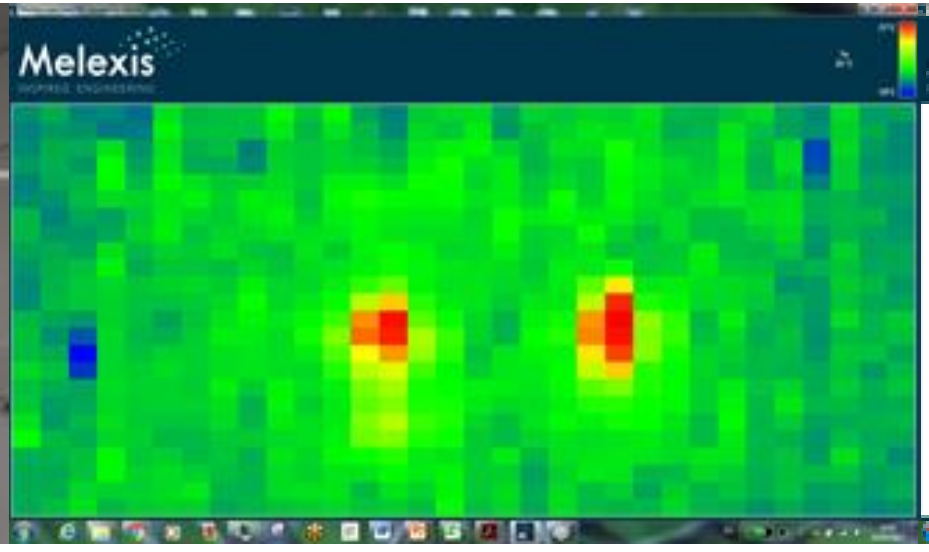
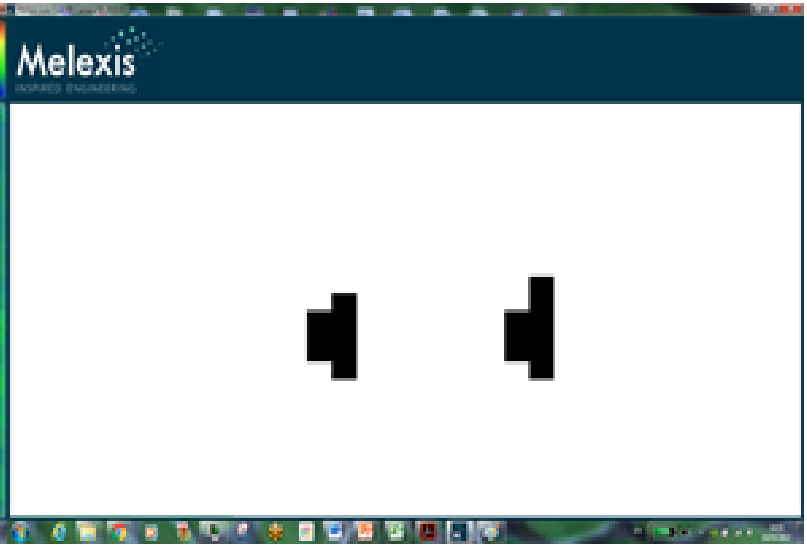
Smart HVAC/building

Smart HVAC with people detection







Smart building/lighting/IoTs with ceiling mounted sensor

- Ceiling mounted wide FoV (110°x75°) thermal array sensor
- People monitoring, fire detection and room temperature
- Home and Office

Appliances & white goods

Smart & Assisted cooking

- Advanced Assisted cooking
  - E.g. food “well done-ness” in oven
- Safety feature in cooking hood
  - Fire prevention with single pixel
- Detect approaching people, simple gestures
  - FIR array smart cooking hood, airco, lighting

- USPs
  - For the first time a “low resolution 32x24 thermal camera” is available for high volume applications
  - 16x12 array with wide temperature range, T_a up to 125degC
  - Factory calibrated by Melexis, digital output

Cook top monitoring: safety and proximity

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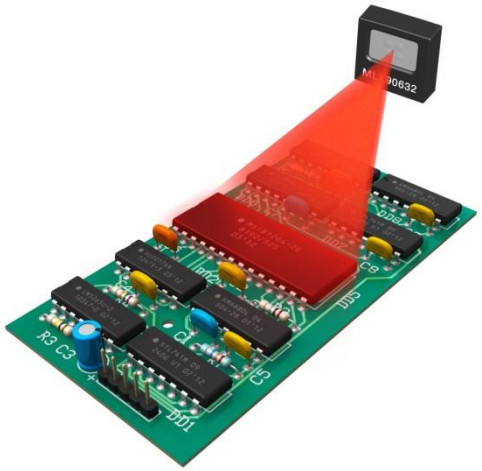
Rice cooker & hair dryer

Consumer & wearables

Consumer electronics

- 3D printer
- Portable memory devices
- Skin & eye safety (light therapy)
- E-cigarette



Smart wearables

- Temperature monitoring with MLX90632
  - wrist, in ear, chest,…
  - Smart watch, ear-bud,…

Medical & industrial

Medical

- Forehead & ear body thermometer
- Stand-alone or accessory for phone

Industrial

- Fire prevention in high power electronics: electrical cabinets, generators,…
- Process automation (e.g. PCB inspection)

Automotive

Automotive use cases with MLX9064x

- HVAC system: input sensor for high comfort (e.g. measuring skin temp) + high efficiency (e.g. for battery EV)
- Occupancy detection
- BEV wireless charging: safety feature
  - Search for hot objects in magnetic field

Summary & conclusion

- Melexis has the industry leading contactless infrared temperature portfolio New products:
  - Surface mount MLX90632: small size, high performance at low cost
  - MLX90614ESF-ACK: low cost narrow field of View
  - 32x24 MLX90640 and 16x12 MLX90641: unique cost vs. resolution vs. performance offer
- Targeted for multi-market
  - Smart HVAC/building
  - Appliances & White goods
  - Consumer & Wearables
  - Medical & industrial
  - Automotive

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