221e

PEOPLE
IDEAS
TECHNOLOGY

Products Overview

Something about us

221e MEANS INFINITY, BECAUSE ENDLESS ARE THE BOUNDARIES OF IMAGINATION AND SO OF INNOVATION

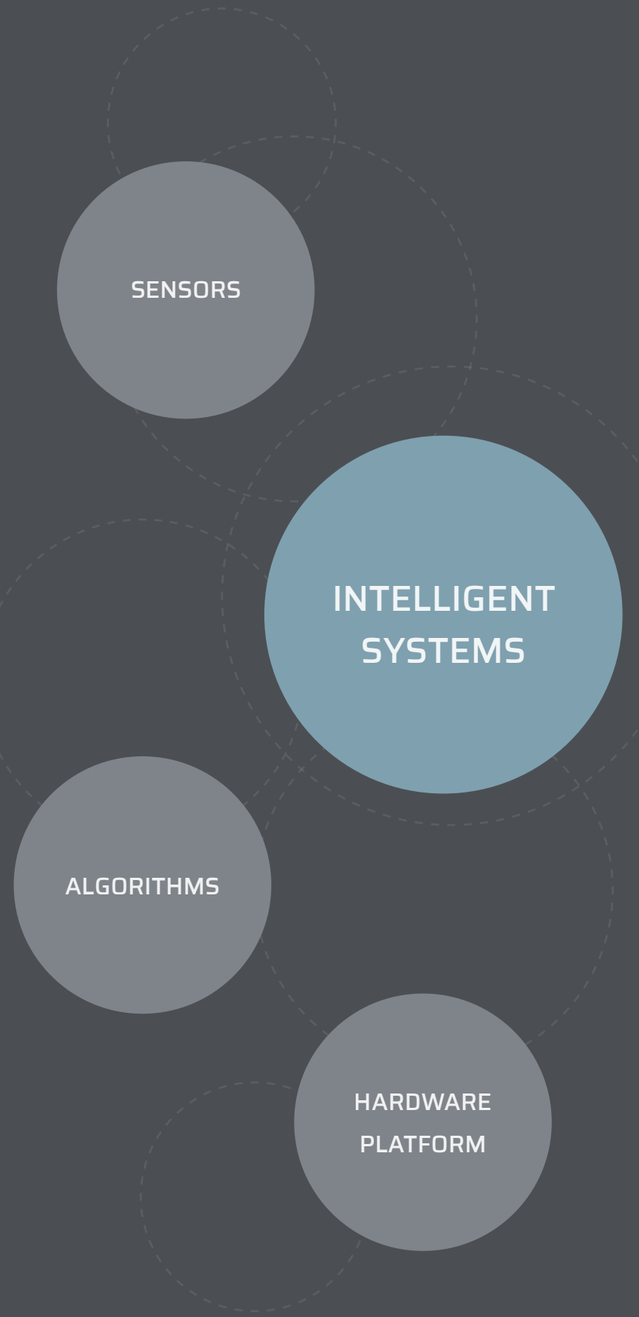
It takes the imagination of dreamers, the creativity of passionate minds and the experience of pioneers **to change established rules and extend the boundaries of what is possible**.

We surf the wave of **IoT** and **wearable systems**, merging advanced hardware designs with intelligent software architectures driven by an approach devoted to continuous **improvement**, solid engineering skills, curiosity and **passion** towards data and its science.

We embrace **diversification as opportunity**, pushing the company to new challenges and expanding business in different industries.

Our technologies are pervasively suitable to a wide range of applications.

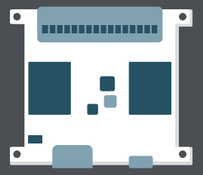
We have a clear mission: research, development and production of electronic systems **embedded with proprietary algorithms** to collect, elaborate and return **clear data ready to be used**.



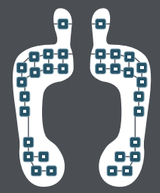
Explore the benefits of our solutions

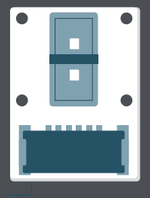
Our Products

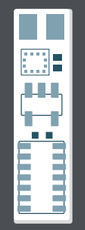
Multi Sensor platforms



Sensing peripherals

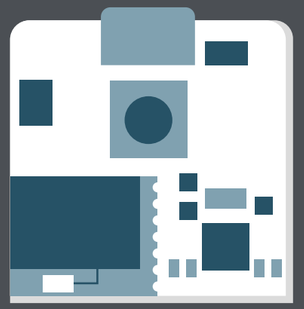






MUSE

Multi Sensor



PART NUMBER 03b1Av2x

Form factor

25 L × 25 W × 4 H mm - 3.3 gr. (board dimensions)
42 L × 28 W × 11.5 H mm – 15 gr. (incl. case and battery)

\+ Datasheet

Contact us

Short description

MUSE is a cutting-edge multisensor embedded platform. The processed data, seamlessly provided by proprietary algorithms, enable MUSE to be easily integrated into any IOT system and wearable project.

Only creativity sets the bounds, MUSE gets data imperceptible to the human eye

What can be measured with MUSE?

MUSE can measure accelerations, angular rates, temperature, ambient pressure and magnetic fields. It can also provide 3D rotations expressed in quaternion from the embedded sensor fusion algorithm.

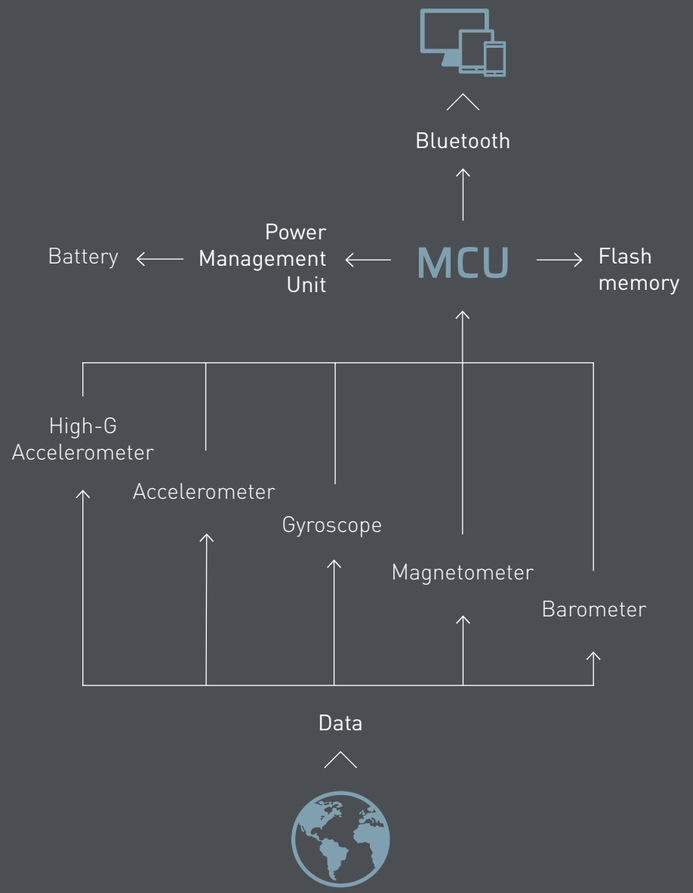
Applications

- Motion capture
- Biomedical science
- Fall & Event detection
- Automotive & Inertial navigation
- Ambient monitoring
- Fitness & Sport
- Proximity tracking
- Vibration monitoring
- Asset & Fleet management
- Indoor localization

Sensors

- High-G accelerometer
- 3-axis accelerometer
- 3-axis gyroscope
- 3-axis magnetometer
- High resolution barometer
- Thermometer
- Humidity
- Bluetooth

Functional Model



Technical Specifications

SYSTEM

Architecture	Arm® 32-bit Cortex®-M4 CPU with FPU, MPU and DSP
Frequency	80 MHz
Memories	256 KB single bank Flash, proprietary code readout protection 64 KB of SRAM
Temperature range	-30 °C ~ +85 °C Limited by battery specs

CONNECTIVITY

Available ports	1 × USB 2.0 (Micro USB, Type B)

BLUETOOTH

Version	Classic Bluetooth 3.0 or Bluetooth 4.0 Low Energy
Transmission rate	Up to 1.5 Mbps
Multipoint	Implementation dependent
Compliance	• CE qualified • BQE qualified • FCC, IC modular approval certified

POWER

POWER SUPPLY

Type	Li-Poly rechargeable
Capacity	165 mAh

CURRENT CONSUMPTION

Idle	6 mA
Streaming @ 100 Hz	35 mA
Logging @ 100 Hz	10 mA

SENSORS

ACCELEROMETER

Measurement range	±2 / ±4 / ±8 / ±16 g
Linear Acceleration Sensitivity	0.061 / 0.122 / 0.244 / 0.488 mg / LSB
Zero-rate Offset	±10 mg

HIGH-G ACCELEROMETER

Measurement range	±100/±200/±400 g dynamically selectable full scale
Zero-g Offset	±1 g

GYROSCOPE

Measurement range	±125 / ±250 / ±500 / ±1000 / ±2000 / ±4000 dps
Angular Rate Sensitivity	4.375 / 8.75 / 17.50 / 35 / 70 / 140 mdps / LSB
Zero-rate Offset	±1 dps

BAROMETER

Measurement range	from 260 to 1260 hPa
Pressure noise	0.01 – 0.03 hPa RMS

MAGNETOMETER

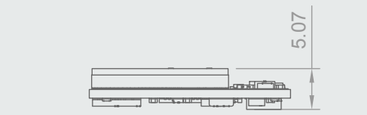
Measurement range	±50 Gauss
Sensitivity	1.5 ± 7% mGauss/LSB

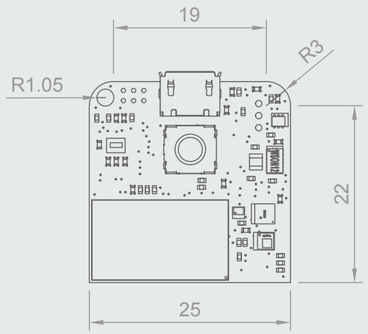
TEMPERATURE SENSOR

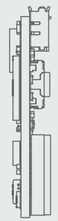
Accuracy	±0.5 °C
Temperature range	-40 °C ~ +120 °C

HUMIDITY SENSOR

Accuracy	±3.5% rH
Temperature range	0 ~ 100% rH







All dimensions are in mm

Dept.	Technical reference	Created by	Approved by
221e		Document type: 2D DRAWING	Document status
		Title: Muse	DWG No.: v1.0
			Rev. / Date of issue / Sheet: 1/1

CLICK FOR MORE

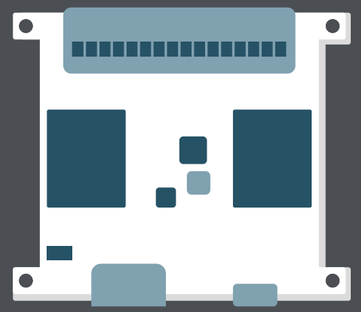
Smart mobility
&
Urban intelligence

Smart Cities
&
Clean Tech construction

Robotics
&
Smart Automation

MITCH

Multi Sensor Inertial Chameleon



PART NUMBER 03b2Av1x

Form factor

31 L × 29 W × 7 H mm - 6 gr. (board dimensions)
35 L × 47 W × 19 H mm - 17 gr. (incl. case and battery)

+ Datasheet

Contact us

Short description

MITCH is a state-of-the-art scalable inertial data acquisition platform that can be integrated with different sensing peripherals making it suitable for a wide range of applications.

Like a chameleon hiding its colors, MITCH brings a palette of solutions

What can be measured with MITCH?

MITCH can measure acceleration, angular rate and magnetic field. The embedded algorithms ease the use of our plug and play sensors for the measurement of foot pressure points (YETI peripheral), distance and proximity (TOF peripheral), heart rate and pulse-oximetry (PPG peripheral).

Applications

- Motion capture
- Hands tracking
- Biomechanics research
- Entertainement Performing arts
- Presence detection*
- Fitness & Sport
- Gait analysis
- Gaming & VR
- Pressure mapping*
- Distance measurement*

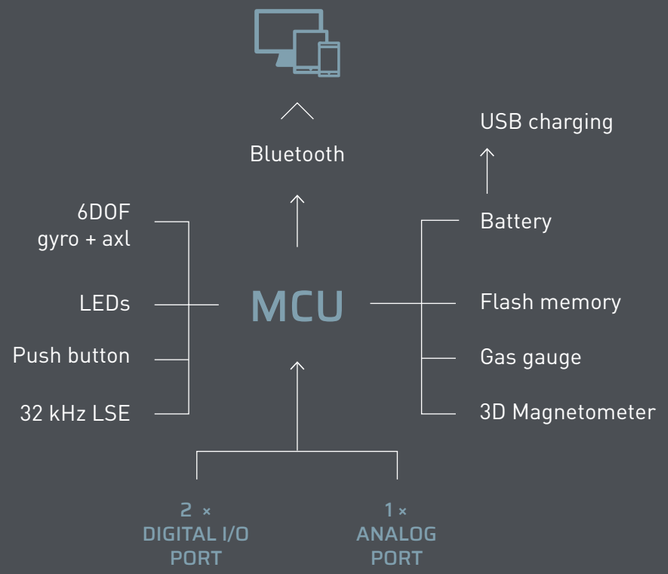
* depending on sensing peripheral's features

Sensors

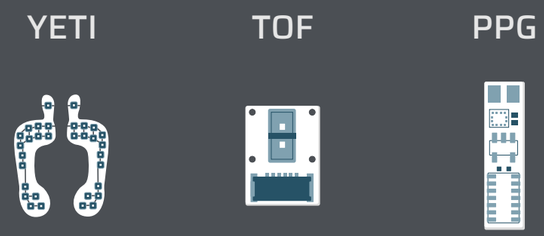
- 3-axis accelerometer
- 3-axis gyroscope
- 3-axis magnetometer
- Bluetooth

Expansion ports for additional sensors and peripherals

Functional Model



Plug and play with



Technical Specifications

SYSTEM

Architecture	Arm® 32-bit Cortex®-M4 CPU with with FPU, MPU and DSP
Frequency	80 MHz
Memories	256 KB single bank Flash, proprietary code readout protection 64 KB of SRAM
Temperature range	-30 °C ~ +85 °C Limited by battery specs

CONNECTIVITY

Available ports	2 × Digital I/O port 1 × Analog port 1 × I2C 1 × USB 2.0 (Micro USB, Type B)

BLUETOOTH

Version	Bluetooth 4.1 Low Energy
Transmission rate	Up to 1.5 Mbps
Multipoint	Implementation dependent
Compliance	• CE qualified • BQE qualified • FCC, IC modular approval certified

SENSORS

ACCELEROMETER

Measurement range	±2 / ±4 / ±8 / ±16 g
Linear Acceleration Sensitivity	0.061 / 0.122 / 0.244 / 0.488 mg / LSB
Zero-rate Offset	±40 mg

GYROSCOPE

Measurement range	±125 / ±250 / ±500 / ±1000 / ±2000 dps
Angular Rate Sensitivity	4.375 / 8.75 / 17.50 / 35 / 70 mdps / LSB
Zero-rate Offset	±1 dps

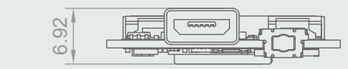
MAGNETOMETER

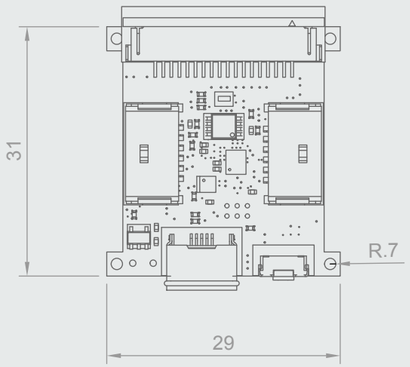
Measurement range	±50 Gauss
Sensitivity	1.5 ± 7% mGauss/LSB

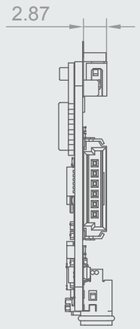
POWER

Power supply type	Li-Poly rechargeable
Model	LP382024[1]
Rated Voltage	3.7 V
Rated Capacity	155 mAh, 0.57 Wh
Operating Temperature	Recharge: 0 °C ~ 45 °C Discharge: -20 °C ~ +60 °C

[1] It is also possible to request the installation of a thinner battery (i.e., LP381522, 80 mAh, 3.7 V)







All dimensions are in mm

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221e		Document type: 2D DRAWING	Document status
		Title: Mitch	DWG No.: v1.0
			Rev. / Date of issue / Sheet: 1/1

CLICK FOR MORE

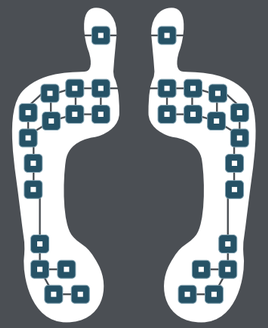
Smart Health

Sport Wearables

Protective Equipment

YETI

Pressure Membrane



PART NUMBER 03b4Cv2x

Available sizes

From 36-37 to 46-47

+ Datasheet

Contact us

Short description

YETI is a membrane sensor designed to be a plug and play peripheral sensor of the MITCH system suitable for foot pressure points measurement. It can be used by healthcare professionals, trainers, makers, creatives, engineers, scientists and researchers.

Express the pressure of steps, increase awareness and predict movements

What can be measured with YETI?

YETI detects and measures contact, touch, force and applied load, rate of change of a force load over time and force thresholds to trigger appropriate action.

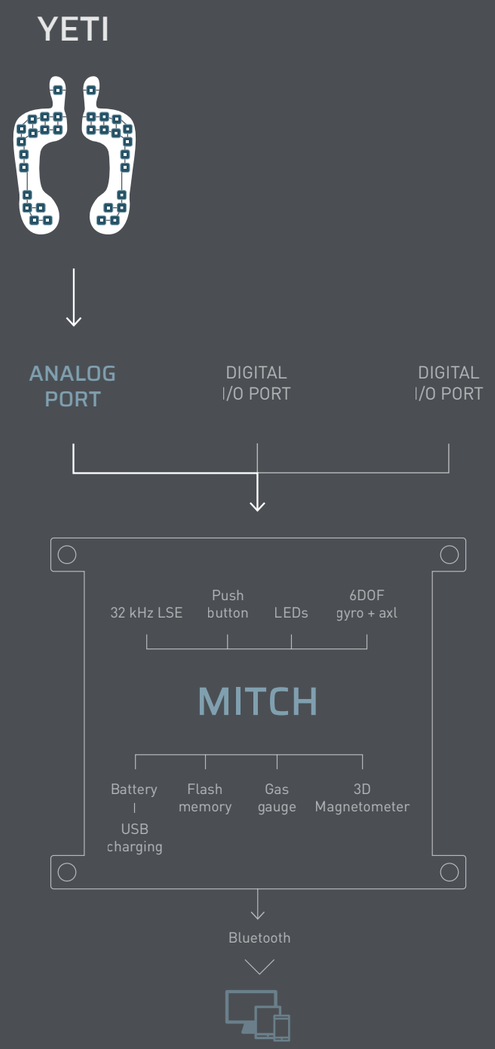
Applications

- Plantar pressure mapping
- Gait analysis
- Post-injury recovery
- Postural monitoring
- Sport

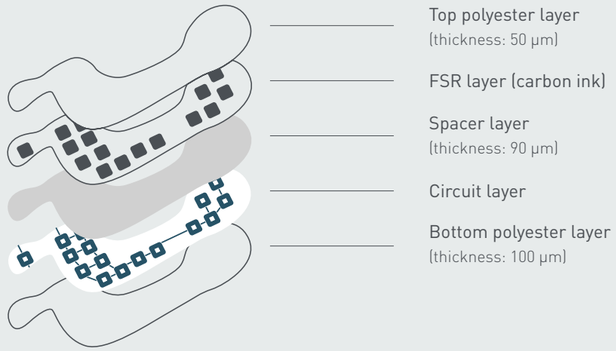
Key features

- Force Sensing Resistors
- Thin and flexible
- Customizable
- Easy to use

Functional Model



FSR Technology



This in-shoe sensor behaves like a Force Sensing Resistor (FSR), exhibiting a resistance value inversely proportional to the amount of force applied. When no pressure is applied, the sensor features an infinite resistance.

As the applied pressure increases, the equivalente resistance of the sensor decreases. YETI sensors are manufactured as a sandwich of a polymer sheet and semi-conductive ink deposited with silk-screen printing methods: applying force to the surface of the sensor causes the particles within the ink to contact the electrodes, thereby changing the resistance of the sensor. The mk1 of the YETI project is an FSR sensor in the form a pressure mapping insole, with an overall thickness of 0.24 mm and 16 measuring points, carefully designed through a study aiming to maximize pressure-points data entropy. It seamlessly connects to the MITCH platform.

Technical Specifications

SYSTEM

FORCE-SENSING RESISTORS (FSR) PRESSURE MEMBRANE

Operating Temperature	-20 °C ~ +50 °C
Substrate	Polyester
Overall membrane thickness	240 µm
Circuit thickness	100 µm
Pads' dimensions	H 16.67 mm - W 15 mm
Overall sensing area	40 cm^2
Connection flat length (including connector)	140 mm

TYPICAL PERFORMANCE

Linearity (typical)	± 10 %
Repeatability (typical)	± 3 %

CONNECTIVITY

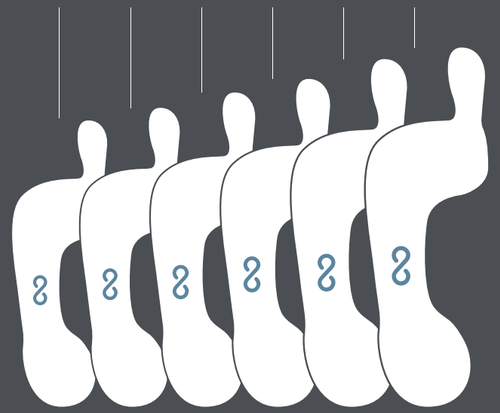
Interface	16 × analog outputs + 2 ground

EXPRESS THE BEST WITH YETI

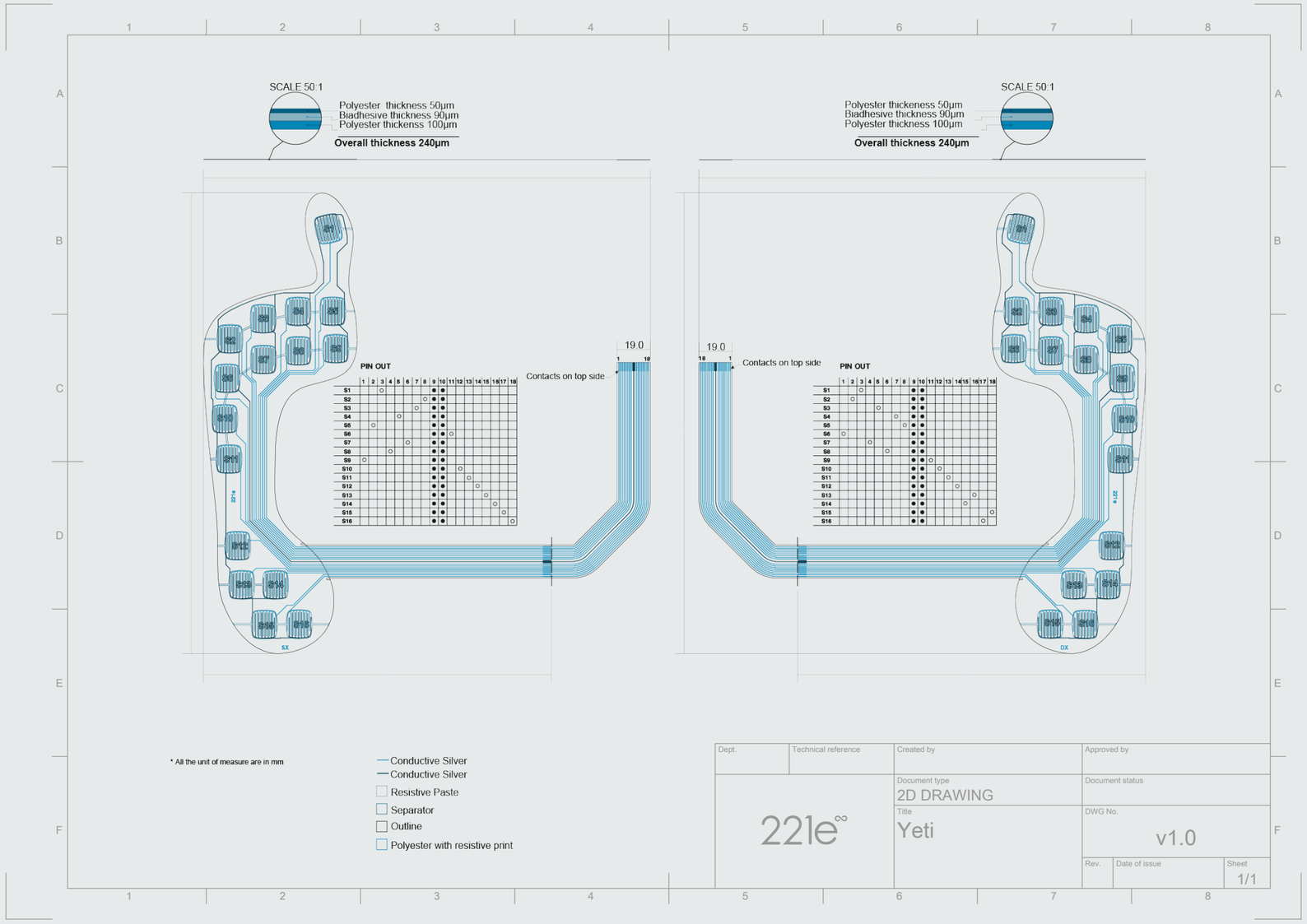
Our mechanical design to maximize data.

SIZES

EU	36 / 37	38 / 39	40 / 41	42 / 43	44 / 45	46 / 47
UK	3½ / 4½	5 / 6	6½ / 7½	8 / 9	9½ / 10½	11 / 12
US	4½ / 5½	6 / 7	7½ / 8½	9 / 10	10½ / 11½	12 / 13

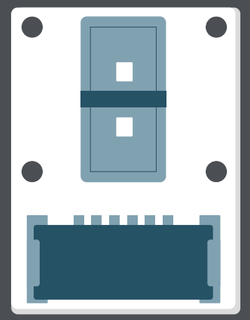


FSR designs can be also customized following specifications.



TOF

Time of Flight



PART NUMBER 03b8Bv1x

Form factor

16 L × 21 W × 6 H mm - <1 gr. (board dimensions)
36,2 L × 25,2 W × 11 H mm - 5.55 gr. (incl. case)

+ Datasheet

Contact us

Short description

TOF is a proximity and ambient light sensor designed to be a plug-and-play peripheral sensor of the MITCH system. It is the ideal complementary sensor for health care professionals, trainers, makers, creatives, engineers, scientists and researchers.

Fast and synchronous beams of light to obtain data

What can be measured with TOF?

TOF detects proximity and measures ambient light intensity.

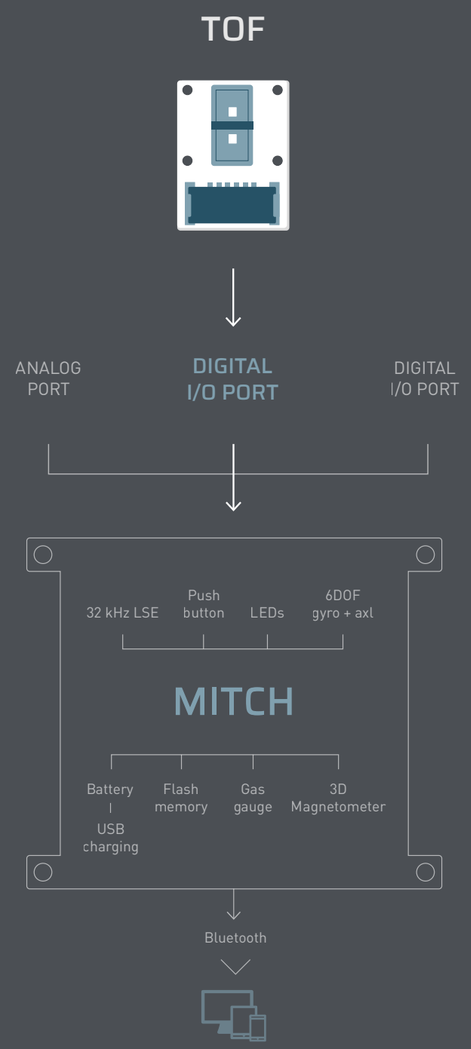
Applications

- Object detection
- Contactless switch
- Digital level meter
- Gesture interaction
- Entertainement

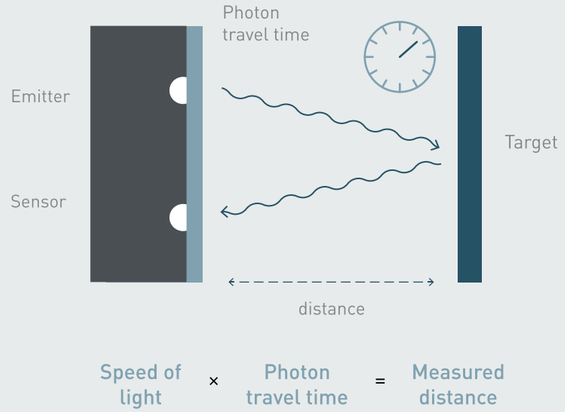
Key features

- Laser accuracy distance measure
- Ambient light conditions
- Compact design
- Configurable ranges

Functional Model



TOF Technology (Time-of-Flight)



Time of flight is a ground-breaking technology allowing relative distance to be measured independent of target reflectance. Instead of estimating the distance by measuring the amount of light reflected back from the object, significantly influenced by color and surface, a TOF system precisely measures the light travel time to the nearest object and back to the sensor. Combining an IR emitter, a range sensor and an ambient light sensor in a three-in-one ready-to-use reflowable package easy to integrate, this module is designed for low power operation. Multiple thresholds and interrupt schemes are supported to minimize host operations.

Technical Specifications

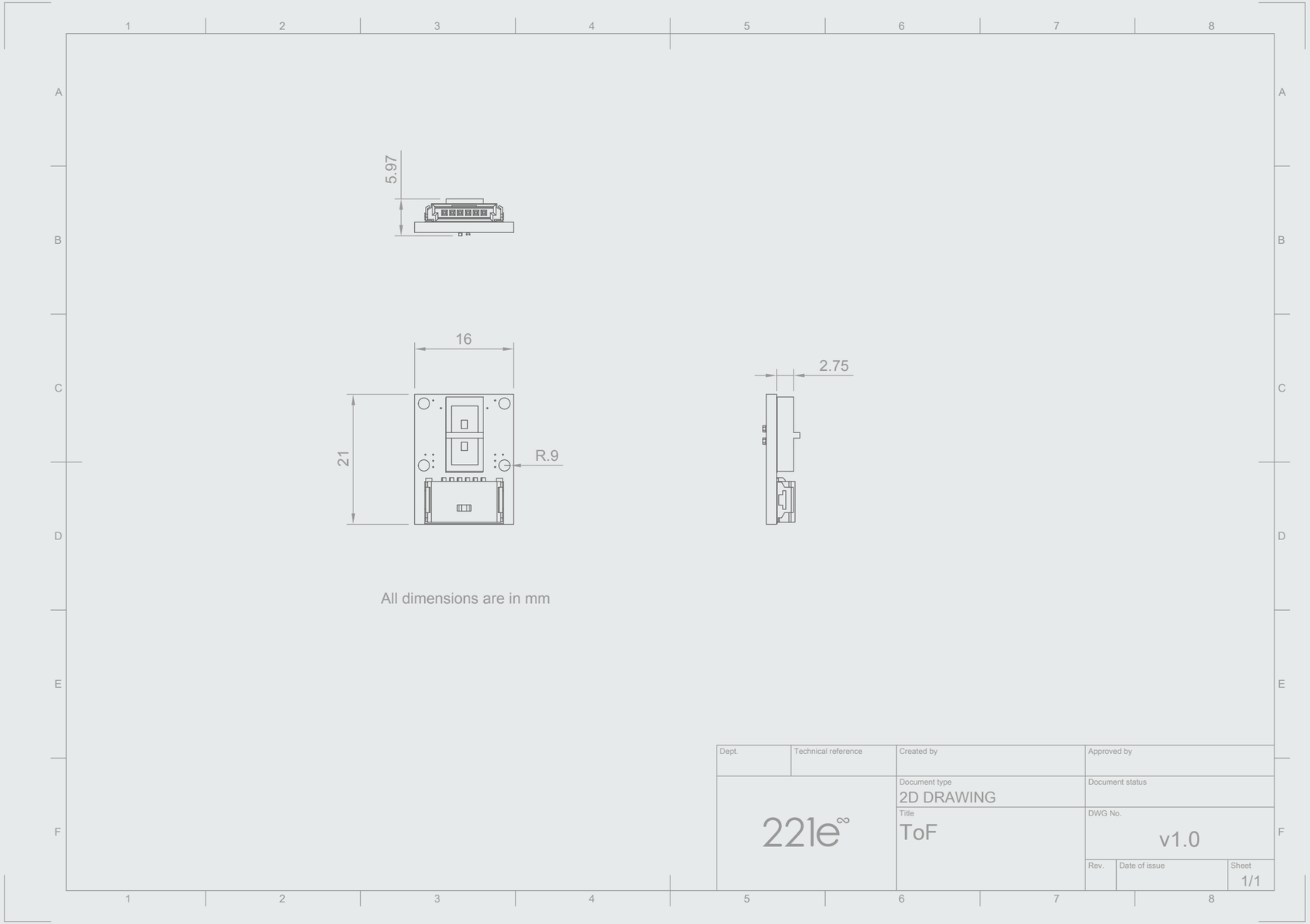
SYSTEM

PROXIMITY AND AMBIENT LIGHT SENSOR

Measurement range	0 ÷ 200 mm
Resolution	+/- 1 mm
Temperature range	-20 °C ~ +70 °C
Input range	< 1 Lux up to 100 kLux
Output resolution	16 bit output resolution
Sensor gain	8 manual gain settings

CONNECTIVITY

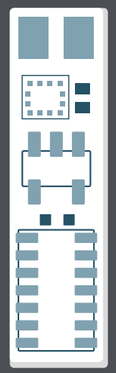
Interface	1 × I2C



CLICK FOR MORE

PPG

Photoplethysmography



PART NUMBER 03b9Bv1x

Form factor

17L × 4W × 2,5H mm - <1 gr.

+ Datasheet

Contact us

Short description

PPG is an electro-optical sensor designed to be a plug and play probe of the MITCH platform. It is the ideal complementary sensor for health care professionals, trainers, makers, creatives, engineers, scientists and researchers.

An innovative companion alongside traditional analyses

What can be measured with PPG?

PPG provides a non-invasive tool to measure volumetric changes of blood and oxygenationlevels in the tissues; furthermore, it has the potential ability to detect physiological parameters that are linked to the cardiovascular and respiratory systems.

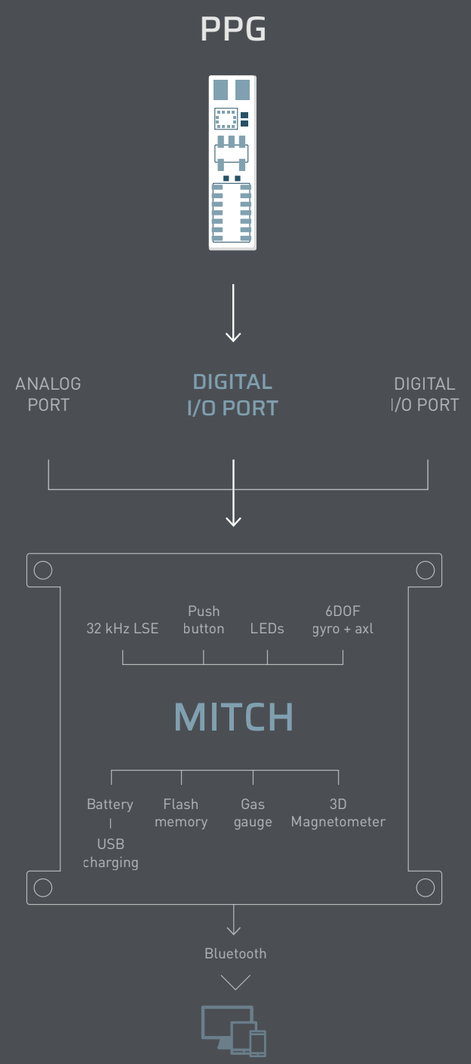
Applications

- Bio-signals
- Fitness & Sport
- Remote health monitoring
- Personal protective equipment
- Respiration rate

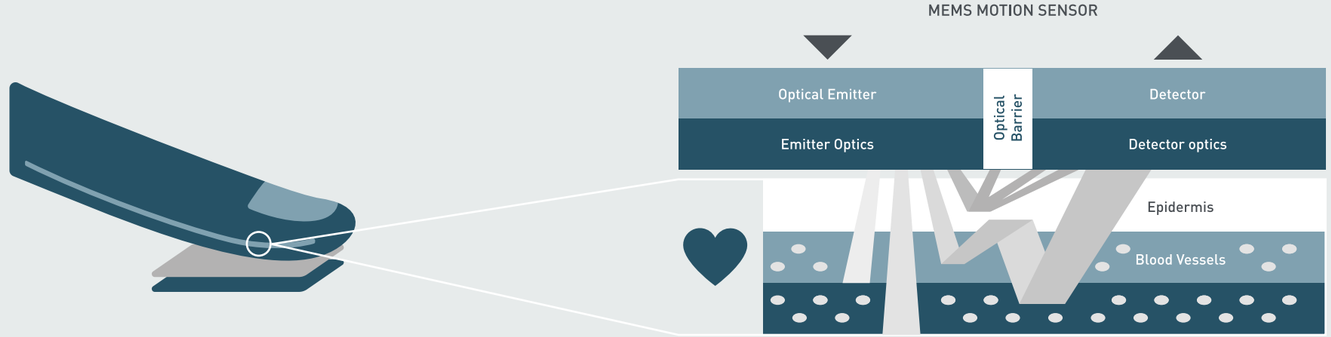
Key features

- Non invasive vital signs monitor
- SpO2 oxygenation index monitor
- Accelerometer for sensor fusion
- Easy to wear

Functional Model



PPG Technology



Photoplethysmography, best known as PPG, is a low-cost and non-invasive electro-optical technique that allows to measure the volumetric variations of the blood into the tissues.
This measurement provides valuable information concerning the cardiovascular system.
The popularity of the PPG technology as an alternative heart rate monitoring method has recently increased, mainly thanks to the simplicity of its operation, the wearing comfort for its users, and its cost effectiveness. Nowadays most of wrist wearable devices integrate a PPG sensor as a mean of heart rate estimation.

One of the major difficulties in using PPG-based monitoring techniques is their inaccuracy in tracking the signals during daily routine activities and physical exercises.
This limitation is due to the fact that the PPG signals are very susceptible to motion artifacts caused by movements and also other factors, such as environmental optical noise.
Alongside this PPG probe, we have therefore developed proprietary algorithms mitigating motion artefacts and providing reliable estimates of both heart rate and blood oxygenation levels.

Technical Specifications

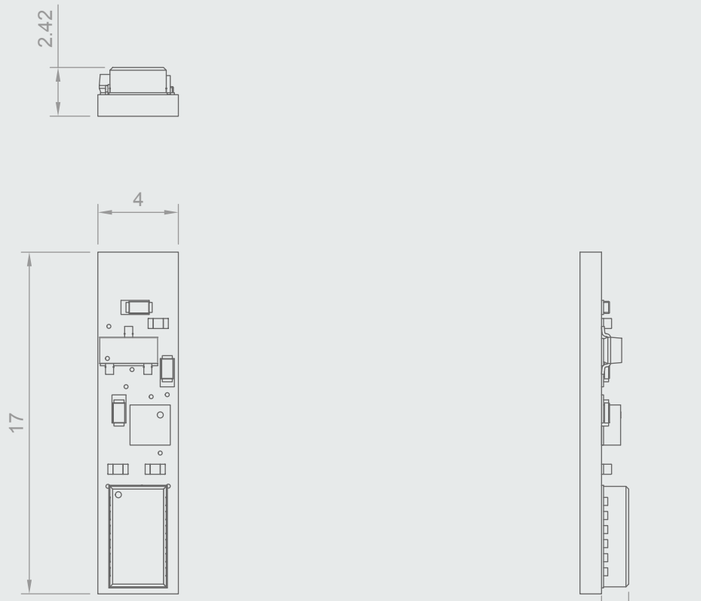
SYSTEM

PHOTOPLETHYSMOGRAPHY (PPG) OPTICAL SENSOR MODULE

Module dimensions	2.8 mm × 5.0 mm module with integrated optical components
Technology	660 nm LED, 880 nm IR LED, and photodiode
Applications	Optical heart rate monitoring Reflective SpO2 measurement

CONNECTIVITY

Interface	1 × I2C



All dimensions are in mm

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221e		Document type: 2D DRAWING	Document status
		Title: PPG adp version	DWG No.: v1.0
			Rev. / Date of issue / Sheet: 1/1

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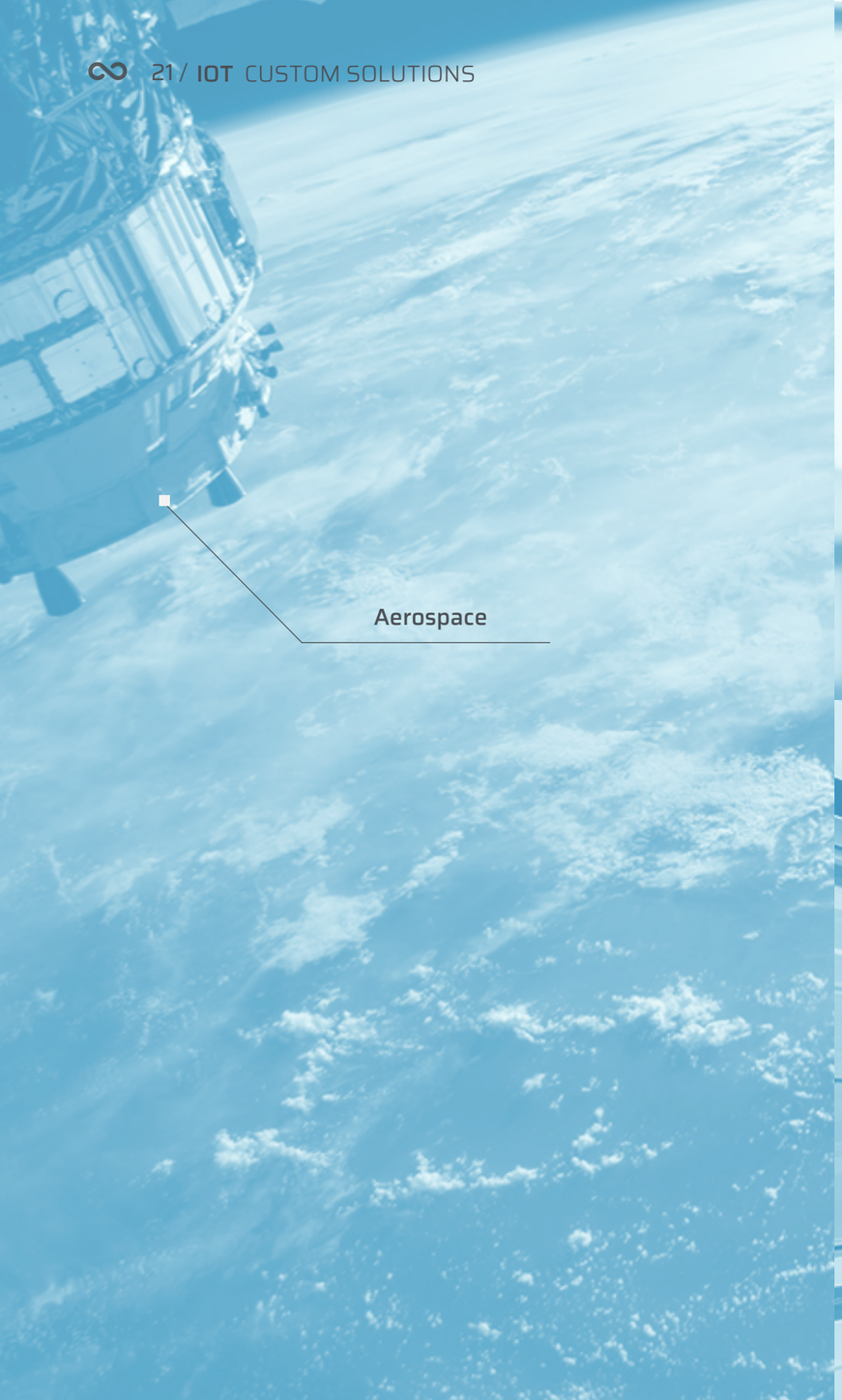


Aerospace

Virtual reality
&
Entertainment

Logistics

Enviromental monitoring

SDK

SOFTWARE DEVELOPMENT KIT ALLOWS USERS TO SPEED UP THEIR PROJECTS

Q: How can I interact with your devices?

A: Example projects and Application Programming Interfaces (APIs) are the major access point to devices functionalities.

Q: How can I become familiar with the SDK?

A: Application notes can be exploited by the user to become familiar with 221e technologies. Toy applications allows to access device functionalities, configuration and calibration routines.

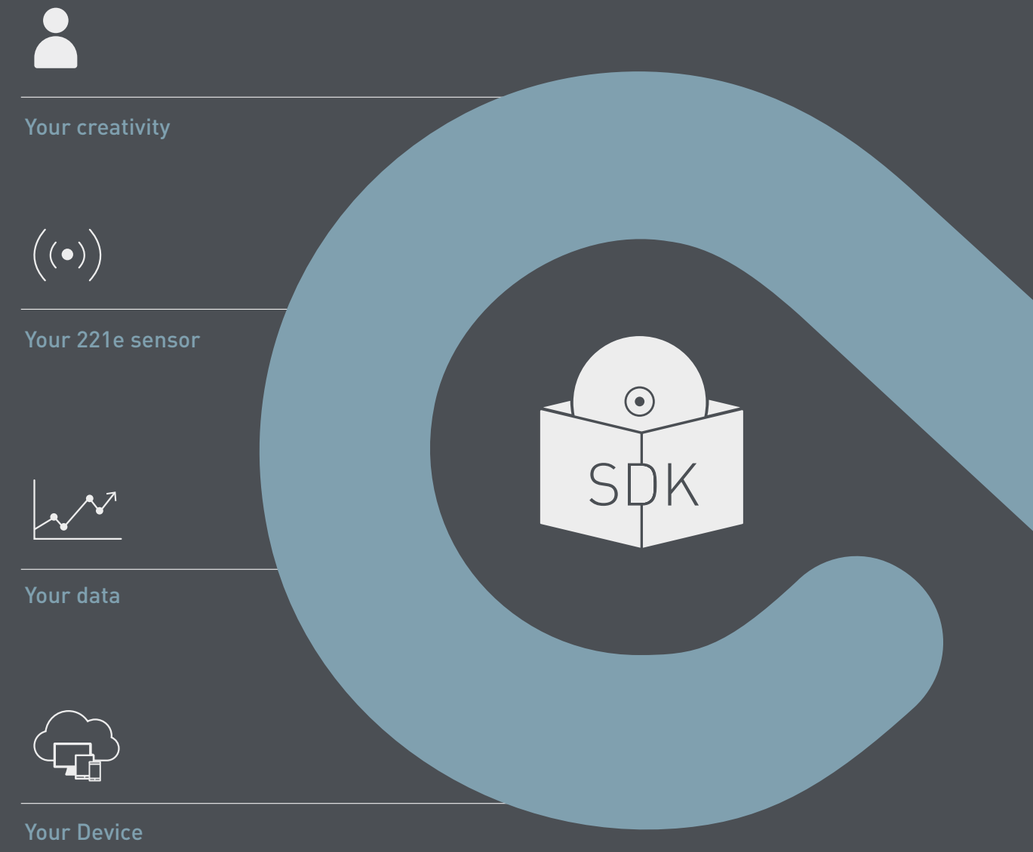
Q: How the SDK can help my development activity?

A: The SDK includes APIs as well as a number of toy applications, test projects and application notes useful to provide the user with examples and concrete use cases.

Q: What OS do you support?

A:

Windows iOS Linux Android



MOTION PROCESSING LIBRARY

The 221e Motion Processing (MP) library brings together a set of tools and functionalities suitable for the time-frequency analysis of motion, independently of the application context.

Sensors technology is used almost everywhere, beginning to closely mimic the ultimate sensing machine: **the human being**. The technology that allows this to happen is **Sensor Fusion**, which leverages a microcontroller to fuse the individual data collected from multiple sensors to get a more accurate and reliable information.

At the core of 221e MP library, a proprietary Kalman filter-based sensor fusion solution integrates the inertial information from **gyroscope** and **accelerometer** with **magnetometer** measurements to provide an accurate and reliable 3D space orientation estimates in quaternion form.

The whole is much greater than the sum of its parts. The software library is compatible with embedded processing architectures and operating systems and can be delivered as either a pre-compiled static library or a full chip binary.

GYROSCOPE

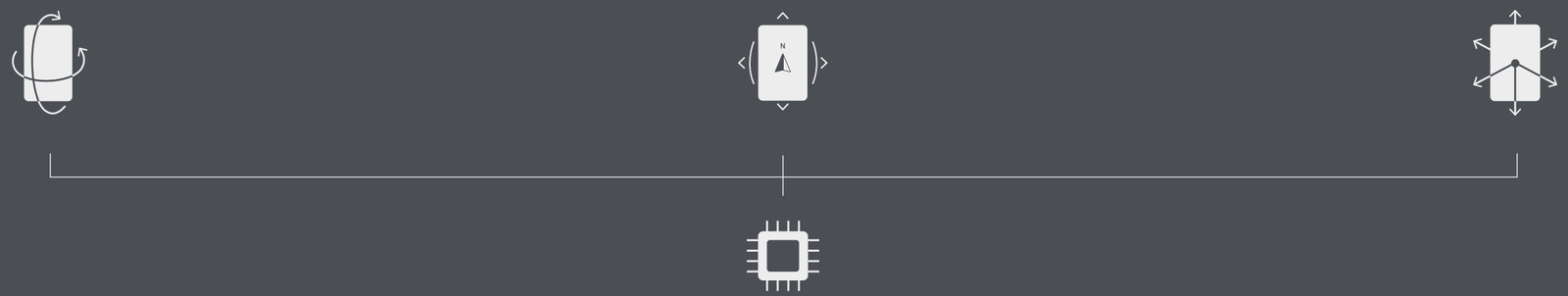
Measures the angular rate applied to the device. In dynamic conditions, by integration of the 3-axis angular rate, the 3D orientation can be computed.

MAGNETOMETER

Measures the magnetic field around the device. In static and not perturbed conditions the projection of the geomagnetic field on the three axes allows the heading angle to be computed.

ACCELEROMETER

Measures the linear acceleration of the device. In static conditions, the projection of gravity on the axes allows to compute the tilt angles.



SENSOR FUSION

APIs

C/C++

Enable low-level integrations (i.e., Unix-based) and embedded solutions

C#

Cover .NET/Microsoft environments and Cross-platform solutions

Java

Favor integration into Android / AWS environments and UI projects

Java Script

Enable and explore real time web applications

Phyton

Access huge knowledge base in the field of scientific computing and data analysis

Matlab

Support scientific research activities in academic environments

Android

Cover Google ANDROID OS for mobile applications

Swift

Cover Apple (macOS, iOS, watchOS, tvOS) native OS, for mobile applications

ROS

Evolve SDKs for integration

Each API includes:

Protocol Specification
Communication protocol definition

Data definition
Data type and representation

Utilities Implementation
Encoding and decoding functionalities

COMMUNITY

We are developing a great place where developers and students can share innovative ideas.

Our open source library and application notes support creativity and new projects.

The community already boasts members and continues to grow every day.

Join Our Community

221e

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31011 – Asolo (TV)

Headquarter

049 5013451

Piazza dell'Artigianato, 10
35031 – Abano Terme (PD)

via Pasubio, 5
24044 – Dalmine (BG)

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