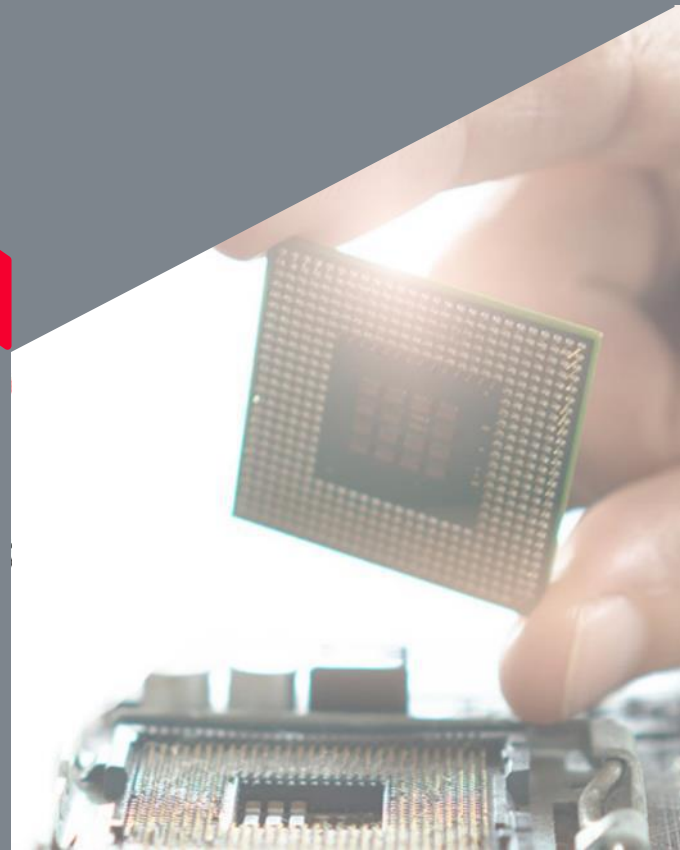**KUMIHIMO**
Tech Camp with **Murata**

- Murata Products Introduction -

Murata's list of products to be used for developing your application
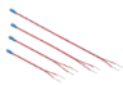
Sensor

Air pressure sensor | IR sensor | NTC/PTC thermistor | Soil sensor | Picoleaf
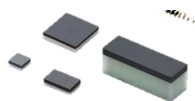
Angle sensor | G sensor | 6DoF IMU sensor | CO2 sensor | RFID | Micro Blower
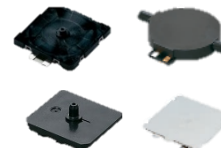
Communication Module

Wi-Fi/BT/BLE Module | LPWA Module | UWB Module

LTE-M | NB-IoT

NXP
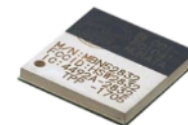
Bluetooth Low Energy Module

Please propose co-creation business ideas using the outlines Murata products

Sensor Products

Air Pressure Sensor (Barometric Pressure)

![muRata INNOVATOR IN ELECTRONICS]

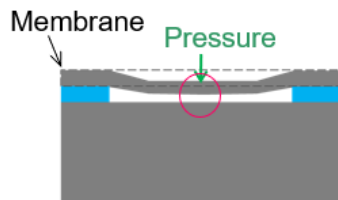## Appearance

ZPA4756-0311A-R

3.0 x 3.0 x 2.1 mm

Feature

- Waterproof Type
- Low noise
- Low current consumption
- Capacitive MEMS
- Temperature compensation

Principle

$$\Delta P \propto \Delta d \propto {}^{1}\!/_{\Delta C}$$

Membrane
Pressure

Application

● **Weather observation**
Barometer

● **E-cigarette Medical Device**
Pressure change detection
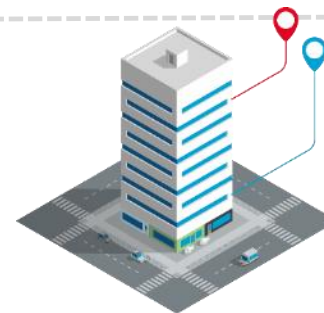
● **Indoor Navigation**
Altitude detection of floor

● **Healthcare /Fitness**
Altitude/Stairs detection, Using the number of walk stairs steps for a calorie calculation

IR Sensor

Appearance

● **Dual Type**
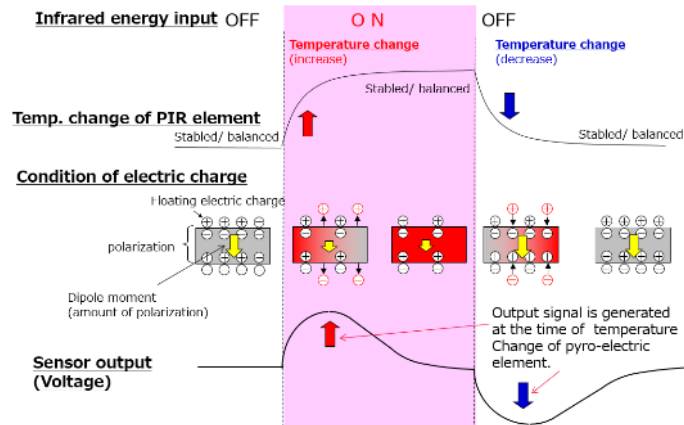**IRA-S200 Series**

● **Quad Type**
IRA-S500 Series

Size：9φ　TO-5 type

Feature

- Excellent S/N ratio
- Excellent stability against ambient temperature change
- Excellent immunity against electromagnetic waves

Principle

Pyro electric effect

Infrared energy input OFF　　O N　　OFF
Temperature change (increase)
Temperature change (decrease)
Stabled/ balanced

Temp. change of PIR element
Stabled/ balanced
Stabled/ balanced

Condition of electric charge
Floating electric charge
polarization
Dipole moment (amount of polarization)

Output signal is generated at the time of temperature Change of pyro-electric element.

Sensor output (Voltage)

Output signal is generated when the temperature of the pyroelectric element changes.

Application

● Human Detection
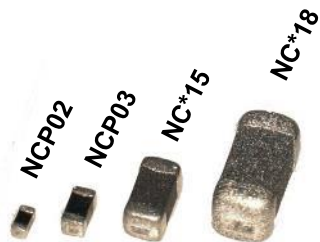(Security, Lighting System, IP camera etc.)

● **Lighting**

● **Security**

@wake-up

● **Home / Office security**

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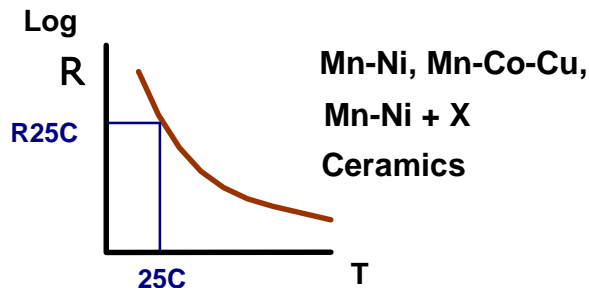
NTC Thermistor ～ SMD Type～

Appearance

NCP02 (0.4x0.2x0.2mm)
NCP03 (0.6x0.3x0.3mm)
NCP15 (1.0x0.5x0.5mm)
NCP18 (1.6x0.8x0.8mm)

NCU15 (1.0x0.5x0.5mm)
NCU18 (1.6x0.8x0.8mm)
*Available for Automotive

NCP02 NCP03 NC*15 NC*18

Feature

- The Highest standard QCDS from Various Line up
- High Accuracy * Up to the Part Number
（R Tolerance : +/-1%, +/- 0.5%）
- UL / cUL Approved item
（0603, 1005, 1608mm Size）

Principle

Log R

R25C

25C   T

Mn-Ni, Mn-Co-Cu,
Mn-Ni + X
Ceramics

The resistance characteristic is generally negative over any temperature.
It has high accuracy for all temp range.

Application

● Internal heat generation, chassis Temperature Detection of Mobile Digital Appliance like Smart phone, PC, Wearable, Automotive
●Temperature Detection of Rechargeable Battery, White goods
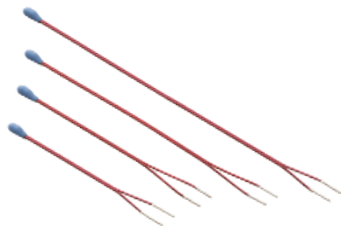●Temperature Detection, Compensation of Circuit, crystal oscillator, Sensor

●**Smartphone / Tablet**   ●**Wearable**   ●**Note PC**   ●**Li Battery**   ●**LED Bulb**

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NTC Thermistor ～Lead Type～
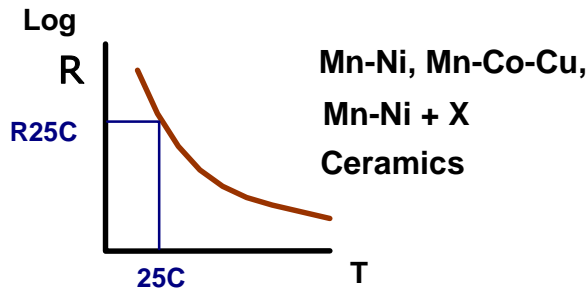
Appearance

NXF Series

1.2×1.2× 21～50mm

*21,25～50mm(5mm STEP)

Feature

- Small sensing head
  *muRata's chip NTC(NCP15) inside
- High accuracy and High sensibility
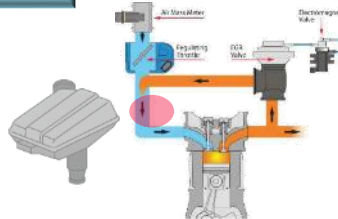- Flexible lead, Self-standing

Principle

Log R

R25C

25C

T

Mn-Ni, Mn-Co-Cu, Mn-Ni + X Ceramics

The resistance characteristic is generally negative over any temperature.
It has high accuracy for all temp range.

Application

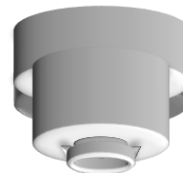🔴 Suitable for temperature sensing for various applications
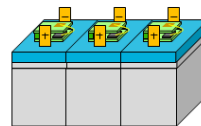
●**MAF, MAP Sensor**   ●**Healthcare**   ●**Fire Alarm**

●**EV, BMS, LED etc.**   ●**White goods**

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PTC Thermistor

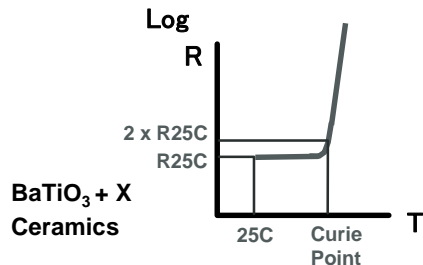## Appearance

PRF Series

PRF03** (0.6x0.3x0.3mm)
PRF15** (1.0x0.5x0.5 mm)
PRF18** (1.6x0.8x0.8 mm)
PRF21** (2.0x1.25x0.9 mm)

Feature

- Miniaturization of electronic circuit
- Great thermal responsiveness
- Mechanical vibration and shock-resistant
- Non-contact operation
- Non-noise generating

Principle

Log
R

2 x R25C
R25C

$BaTiO_3 + X$
Ceramics

25C   Curie
      Point

T

The resistance characteristic is generally negative over any temperature.
It has high accuracy for all temp range.

Application

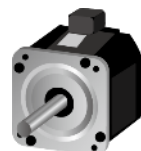● **Overheat protection**
● **Temperature control**

● **Note PC**

● **Tablet / Smartphone**

● **EV, BMS, LED etc.**

● **Motor**

● **LED TV**

● **LED bulk**

Soil Sensor

Appearance

LT500*
132.5 x 27 x 16.2 mm

Feature

- EC, Temperature, Moisture measurement
- High accuracy moisture (No effect of ion and temperature)
- High accuracy EC (High accuracy by multi-electrodes and pore EC measurement)
- Robust structure (IP68 equivalent)
- Multi interface

Principle

- EC sensor:
  Electrical resistance measurement
- Temperature sensor:
  K-factor measurement of diodes
- Moisture sensor:
  Dielectric constant measurement
  Air~1, water~80 (at room temp.)

Application

- **Crop quality improvement**
- **Environment countermeasure**

● **River and pond water condition monitoring**

● **Culture pond condition control**

● **Agriculture irrigation system control**

● **Soil condition monitoring**

Picoleaf™

Appearance
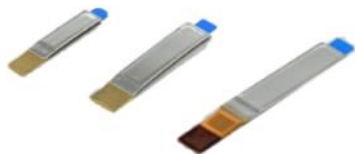
■size
・3x17mm
・2x10mm

Feature

The organic piezoelectric film used in Picoleaf is made from polylactic acid, made by fermenting starch extracted from plants to make lactic acid.
Since plants synthesize starch by absorbing carbon dioxide from the atmosphere, it is a carbon-neutral film material that does not increase CO_2.

Principle

The piezoelectric properties of Picoleaf sensors enable the detection of both 'displacement direction' and 'displacement velocity'.

Sensor output
⊕ output
⊖ output
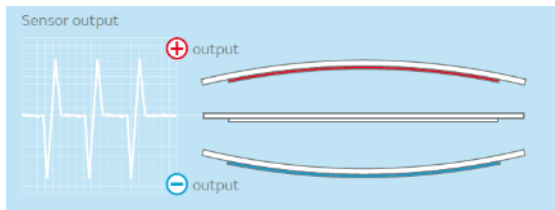
●Light, thin, short, and small
●Flexible structure
●High sensitivity

Application

● **Wearables** ● **Stylus Pen**

● **Home Appliance**

● **Touch screen**

● **Gaming**

Angle Sensor (Inclinometer)

Appearance

SCL3300 Series(3axis)

7.6 x 8.6 x 3.3 mm

Feature

- - Excellent stability over temperature and time
- - Excellent accuracy
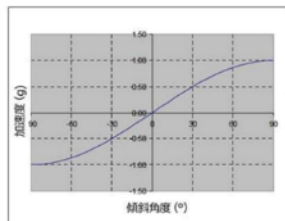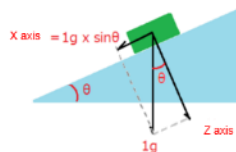- - Excellent noise performance
- - Advanced self-diagnostic features

Principle

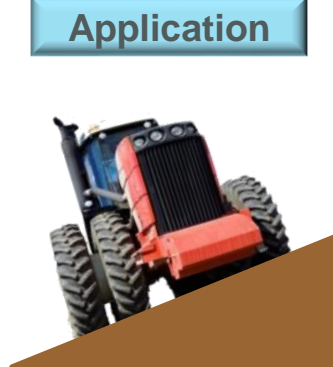The principle is same as Accelerometer described. Angle is calculated with formula based on the Accelerometer output.

α= arcsin (X)
α= arctan (X/Z)
α：angle
X, Z：Accelerometer Output

X axis = 1g x sinθ

θ

Z axis

1g

加速度 (g)

傾斜角度 (°)

Application

● **Heavy Duty Vehicle leveling instrument**

● **Solar panel control systems**

● **Rail tracks alignment**

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G Sensor (Accelerometer)

Appearance

**SCA800series**(Digital1axis)
SCA2000series(Digital2axis)
SCA3000series(Digital3axis)

7.6 x 8.6 x 3.3 mm

Feature

- High sensitivity using bulk MEMS adoption
- Excellent bias stability with low noise and high linearity
- Wide Series Line up
- Remove high-frequency vibration component in MEMS
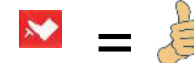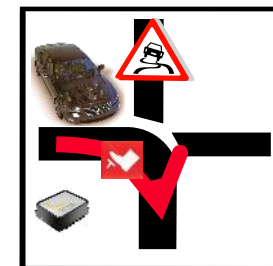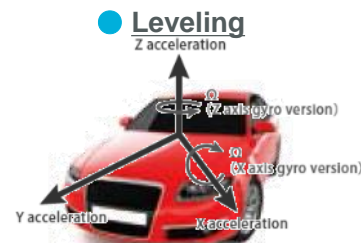- Qualified according to AEC-Q100 standard

Principle

Silicon

Thin metal film **Glass**

1 軸用 MEMS

C_1

C_2

$F=m*a$

Beam / spring

Dimension: 8.6×7.6×3.3mm
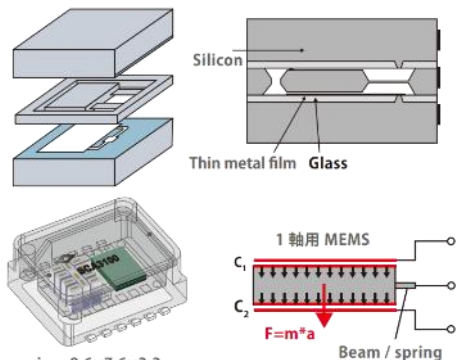
Accelerometer is constructed with mass and spring in MEMS sensing layer. When external vibration or motion are applied, mass starts to move.
The mass moving amount is seen as capacitance signal change.

Application

● **Leveling**
Z acceleration

Ω (Z axis gyro version)

ω (X axis gyro version)

Y acceleration

X acceleration

● **Electronically Controlled Suspension(ECS)** ● **Antilock Braking(ABS)**

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6DoF IMU sensor

Appearance

19.71 x 12.15 x 4.5 mm
（Component Size with Pin）
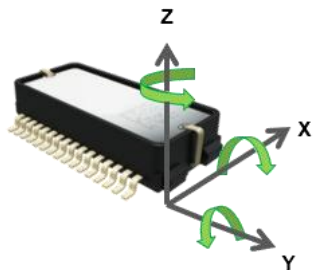（L×W×T）

For Automotive
SCHA634 Series

For Industry
SCHA63T Series

（3axis Accelerometer ／ 3axis Gyro）

Feature

− High-precision 3-axis acceleration and 3-axis gyro
  sensor integrated into a single package
− Calibration improves other axis sensitivity error
  at component level
− Excellent gyro RMS noise level
− Advanced self-diagnostic features

Principle

Gyro 3 axes and
Accelerometer 3 axes are
combined in one
component. Principle of
gyro and Accelerometer are
same as what described.

Application

● **Advanced Driver Assistance System (ADAS)**

● **Autonomous delivery robot(AD)** ● **inertial measurement unit （IMU）**
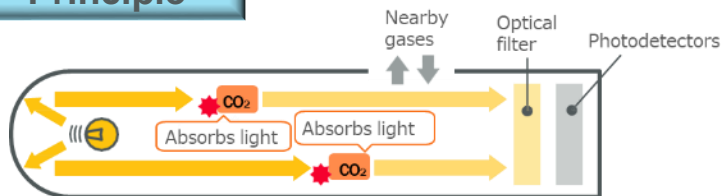
CO$_2$ Sensor

Appearance

IMG series
67× 92× 20 mm

Feature

− Dual wavelength NDIR type
− High measurement accuracy
− Maintenance free by automatic calibration
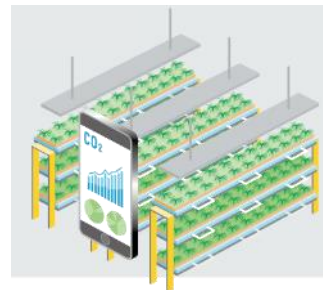− Long-term stability (low drift)

Principle

Nearby gases

Optical filter

Photodetectors

CO$_2$

Absorbs light

Absorbs light

CO$_2$

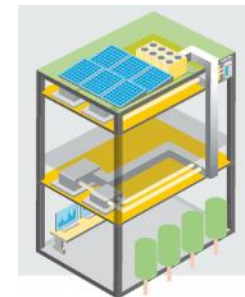$$\Delta I = Io \times [1\text{-exp}(\text{-acL})]$$

Light intensity change

Io：The Infrared light intensity in the case of the CO$_2$ that concentration is 0ppm.
α：CO$_2$ absorption coefficient
c：CO$_2$ concentration
L：Light path length

Application

● **Smart agriculture**

Promoting photosynthesis and increasing yields

● **BEMS / Room atmosphere**

Energy savings by automatic ventilation control

Communication Module Products

Wi-Fi®+Bluetooth®Module

LBEE5QD1ZM-572
9.6 x 8.7 x 1.3 mm

Feature

- 11a/b/g/n/ac+Blutooth5.1(Dual)
- NXP 88W8987 inside
- Sport 2.4GHz&5GHz dual band

CMWC1ZZABR-107
22.0 x 19.0 x 3.0 mm

- 11b/g/n
- NXP 88MW320 inside
- Sport 2.4GHz single band
- Host processor embedded in the module

Application

IOT Devices accessing to internet
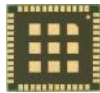
● **Smart Home**   ● **DSC**   ● **VR/AR**

LPWA module

Appearance

LBAD0XX1SC

11.4 x 11.1 x 1.5 mm

CMWX1ZZABZ

12.5mm x 11.6mm x 1.76mm

Feature

- LTE Cat M1 / NB-IoT
- SONY(Altair) ALT1250 inside
- IOP tested for cellular carriers in Japan

- LoRaWAN®
- Chipset:
      Semtech SX1276 inside
      STMicroelectronics STM32L0 inside
- STM32 LoRaWAN Discovery Board

Application

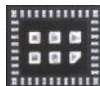A device for long range communication with low power consumption.

- **Smart meter**
- **Smart Watch**
- **Smart Label**

UWB module

Appearance

LBUA0VG2BP

6.6 x 5.8 x 1.2 mm

Feature

- IEEE802.15.4z
- NXP SR150 inside
- EVK is Ready for ranging demo

Application

A device with high resolution of ranging.

● **Smart home / digital key**

● **Asset tracking**

● **Traffic monitor**

Bluetooth® Low Energy module

Appearance

WSM-BL241-ADA-008

7.4 x 7.0 x 0.9mm

Feature

- Bluetooth5.0 LE
- Nordic nRF52832 inside
- Embedded antenna

Application

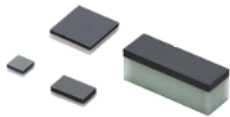Devices accessing to smartphone or tablet to transfer small data.

● **Blood pressure meter**

● **Wearable device**

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RFID tag

Appearance

P/N LXMS series
LXTB series

Size: 1.2 × 1.2mm (min)

Feature

- Ultra small size with minimum 1.2x1.2mm
- Robust structure that can endure injection molding
- Embeddable inside products enabling traceability after selling to the market.

Application

RFID tag assigns unique ID to each product by attaching/embedding inside the product.
Murata RFID tag is used in many different use-case.

● **Anti-counterfeit**

● **Device authentication**

● **Traceability**

● **Inventory management**

● **Production tracking**

Other Products

Microblower (Air Pump)

Appearance

MZB1001T02

MZB4001T05

MZB3004T04

MZB3005T06

- **MZB1001T02** (20.0 x 20.0 x 1.85 mm)
- **MZB3004T04** (21.0 x 19.0 x 3.4 mm)
- **MZB3005T06** (19.0 x 19.0 x 2.3 mm)
- **MZB4001T05** (Φ28.0 x 5.0 mm)

※Except Nozzle and Terminal

Feature

- Compact, Thin, Lightweight
- Silent
- No pulsation occurs
- Responsive

Application

Microblowers are used for various applications and devices
which require air to be discharged/suctioned and pressure increased/reduced

Blood Pressure Monitor

PCR Testing Equipment

Smart Watch

Breast Pump

●**Fragrance** ●**Gas detection** ●**Medical/Healthcare** ●**Wearable Device**