NA2202/NA2203/NA2204

Analog Front End with High precision 16/20/24-Bit Delta Sigma A-D Converter

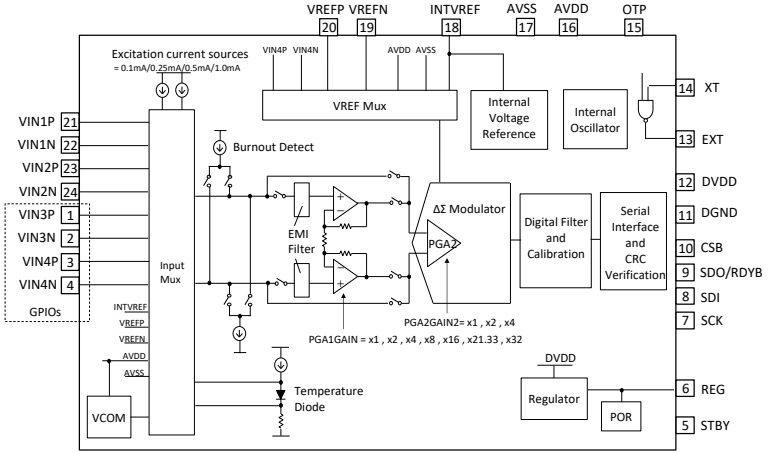
- 4-channel built-in multiplexer detects a wide variety of sensor signals
- Small package (QFN4040-24-NB: 4 mm square) contributes to miniaturization of customer application and reduction of mounting area
- Negative voltage input enables detection of sensor signals from near GND
- Communication error detection (CRC8, Check SUM) and disconnection detection functions reduce the risk of false detection

KEY SPECIFICATIONS

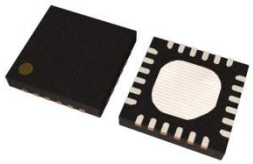
- Power Supply Voltage: Analog : ±2.7V to ±5.5V (unipolar) or ±2.5V (bipolar); Digital : ±2.7V to ±5.5V
- Ambient Operating Temperature: -40°C to +125°C
- ADC Resolution: 16/20/24-Bit (No missing codes)
- Data Rate: 3.125 to 9.6 ksps(1)
- Input mode: Differential : 4 inputs; Single-ended : 8 inputs (2); Pseudo-differential
- PGA: 1V/V to 128V/V
- System Calibration for offset & gain drift
- Built-in Regulator: 2.048V±20mV
- Built-in Oscillator: 1.2288MHz±3%
- 50Hz/60Hz: Rejection Mode
- Current Consumption: Analog : 2.9mA(Normal Mode) 0.9mA(Low Power Mode); Digital : 0.3mA
- Conversion mode: Single / continuous
- Excitation Current Source: 2 systems (0.1mA, 0.25mA, 0.5mA, 1.0mA)
- Interface: SPI
- CS(Chip Select)
- Error detection: CRC8, Check Sum

(1) Case of Continuous conversion. (Single conversion is 1/3 the data rate.)
(2) PGA2 can be used only. (PGA1 cannot be used.) Eight channels of VIN1P, VIN1N, VIN2P, VIN2N, VIN3P, VIN3N, VIN4P and VIN4N can be used.

BLOCK DIAGRAM



PACKAGE



QFN4040-24-NB
4.0×4.0×0.75(mm)
(Pitch: 0.5mm)

NA2202/03/04 is Pin to Pin compatible

APPLICATIONS

- Temperature controller
- Pressure sensors
- Flowmeters
- PLC
- Digital Panel Mater

4 differential inputs / 8 single inputs possible

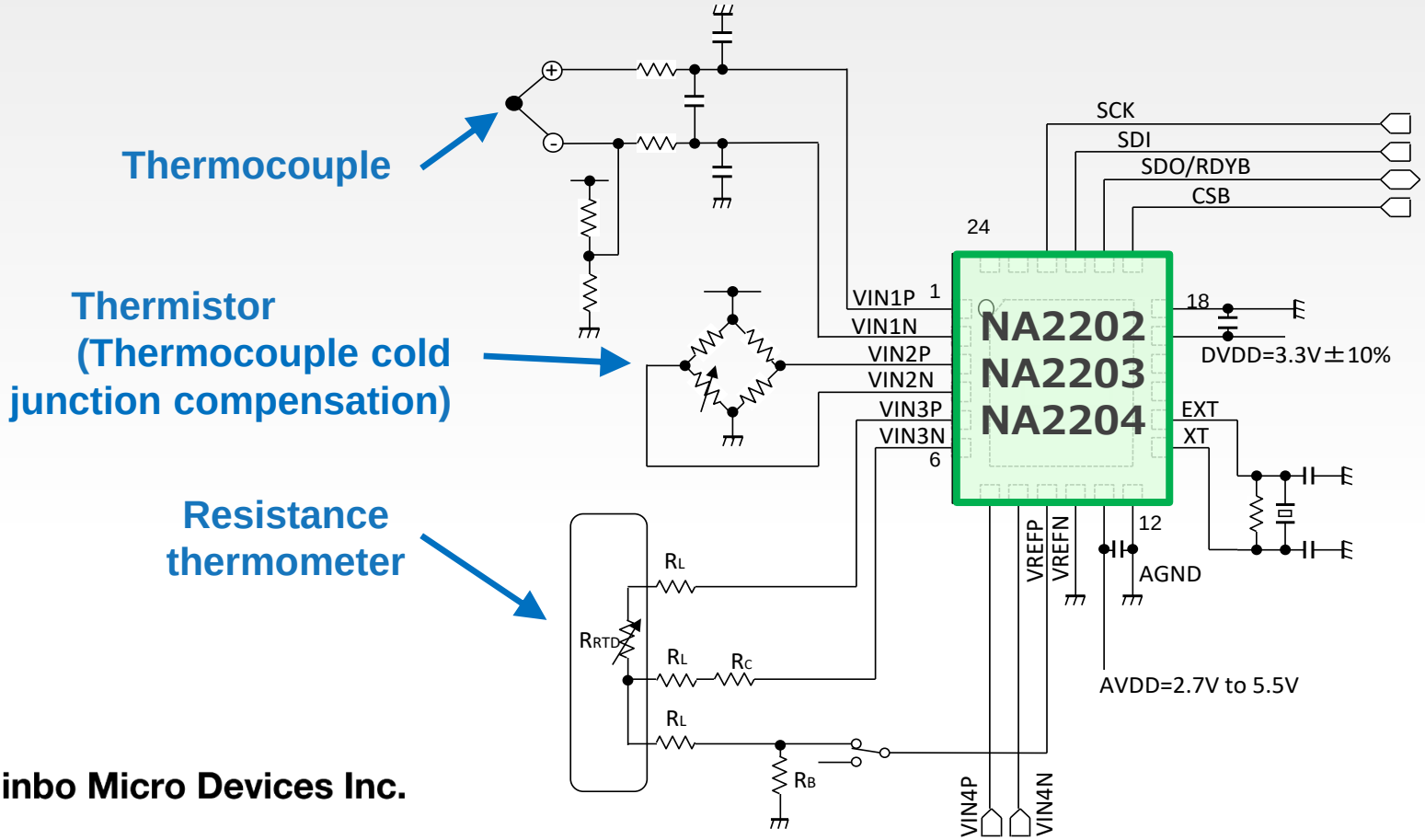
General Issue

- When customer wants to use multiple sensors in combination (e.g. thermocouple + cold junction compensation, temperature sensor + pressure sensor, etc.)

Our Solution

- Process multiple sensors with one AFE!

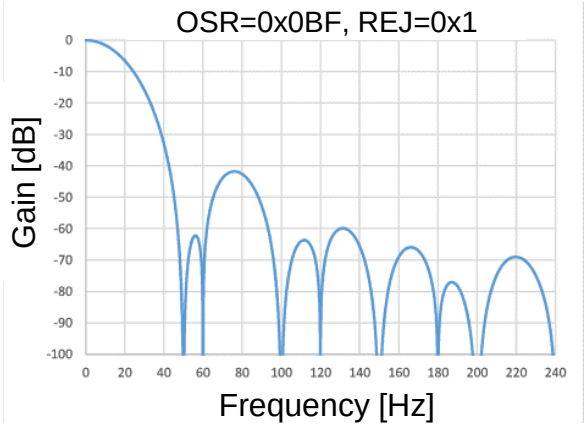
Connection example with temperature sensor



50Hz, 60Hz rejection

Reject commercial power frequency noise

Remove 50Hz*n, 60Hz*n frequency components (n is an integer greater than or equal to 1)The figure below shows the case of FOSC=1228.8kHz.



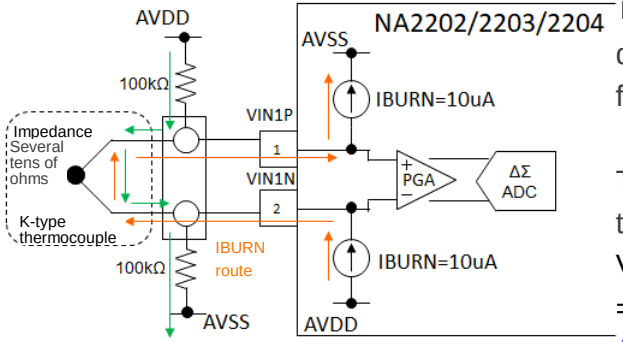
50Hz, 60Hz rejection when using built-in OSC (FOSC=1228.8kHz±3%)

OSR [9:0]	0x09F	0x0BF	0x0BF	0x17F	0x2FF	0x3BF
REJ [1:0]	0x0	0x0	0x1	0x1	0x1	0x0
Oversampling rate	10240	12288	12288	24576	49152	61440
Data rate during continuous conversion 1/Tadc [sps]	60.0	50.0	50.0	25.0	12.5	10.0
50Hz±1Hz Attenuation amount [dB]	-36.8	-77.6	-64.0	-66.2	-74.5	-80.1
50Hz±2Hz Attenuation amount [dB]	-34.7	-68.4	-57.2	-59.9	-70.6	-73.4
60Hz±1Hz Attenuation amount [dB]	-79.5	-44.2	-56.3	-62.8	-73.9	-82.7
60Hz±2Hz Attenuation amount [dB]	-71.2	-43.1	-53.1	-61.0	-70.6	-77.1

Disconnection detection function

Detect disconnection of sensors (thermocouples, etc.)

AVDD=5V,AVSS=0V, Assuming PGA gain of 32x

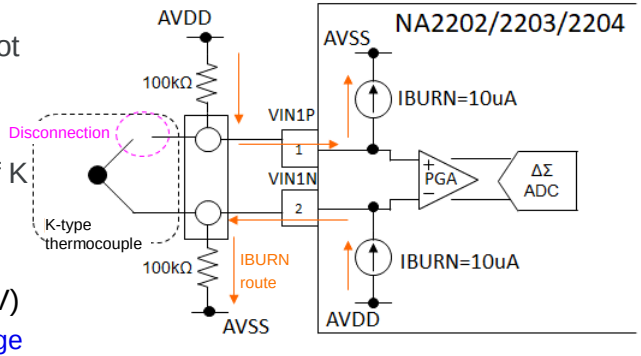


Thermocouple bias current = (5V-0V)/(100kΩ+several tens of Ω+100kΩ)≒25μA
→VIN1P,VIN1N bias voltage is approximately 2.5V

■When there is no disconnection IBURN does not flow to 100kΩ

Thermoelectromotive force of K type thermocouple
VIN1P-VIN1N
= −(a few mV) ～ +(a few mV)
ADC output is within normal range

AVDD=5V,AVSS=0V, Assuming PGA gain of 32x

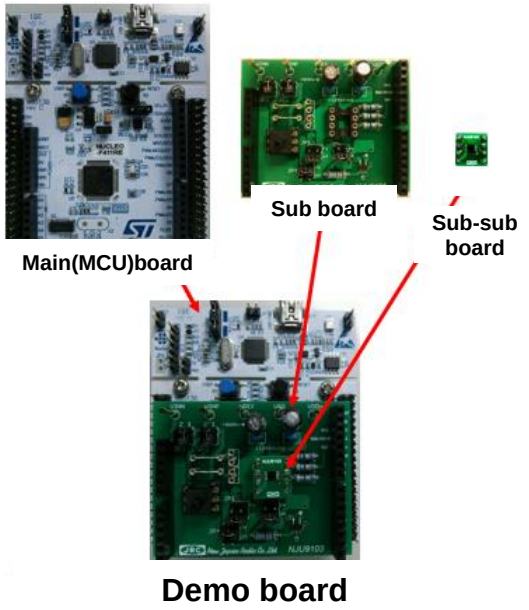
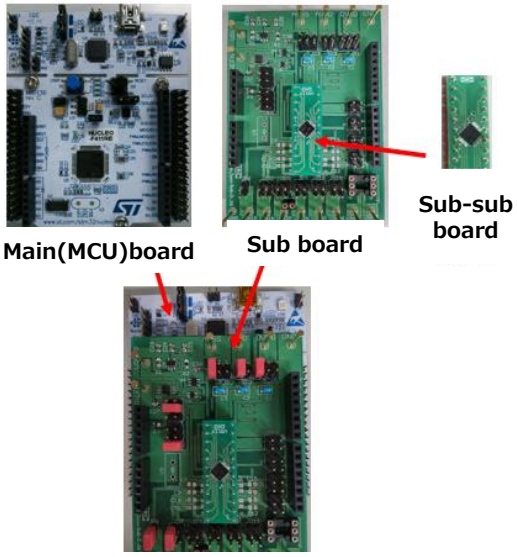


■When there is a disconnection IBURN flows to 100kΩ

VIN1P=AVDD-10μA*100kΩ=4V
VIN1N=AVSS+10μA*100kΩ=1V
VIN1P-VIN1N=3V

ADC output sticks to full scale so disconnection can be detected

Evaluation board list

NJU9103	NA2202/NA2203/NA2204
	

It is available for rent, so please ask our sales staff. The MCU board is the same as STM32F411 Nucleo-64 (manufactured by ST-Micronics).
https://www.st.com/en/development-tools/stsw-link009.html
Driver installation required.

NA2202/NA2203/NA2204

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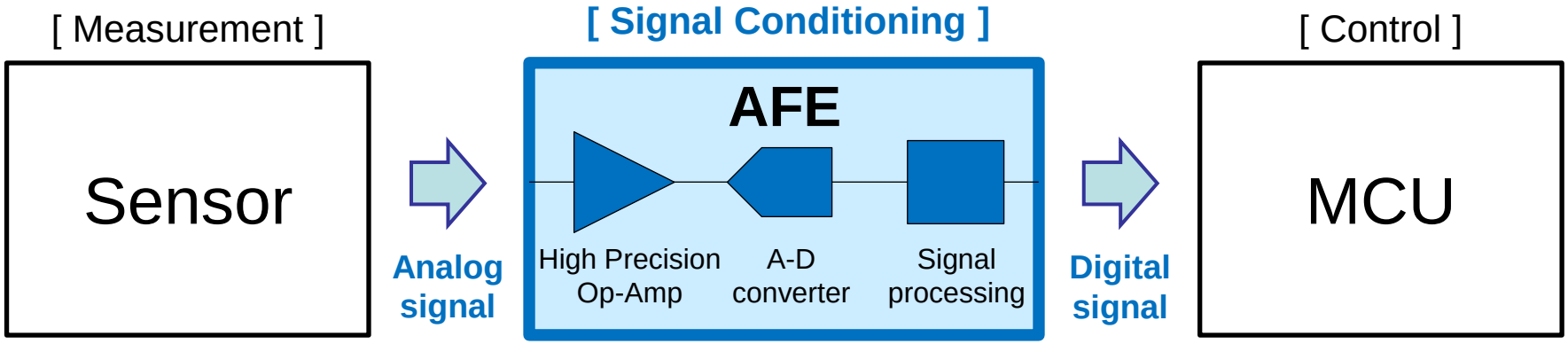
NISSHINBO

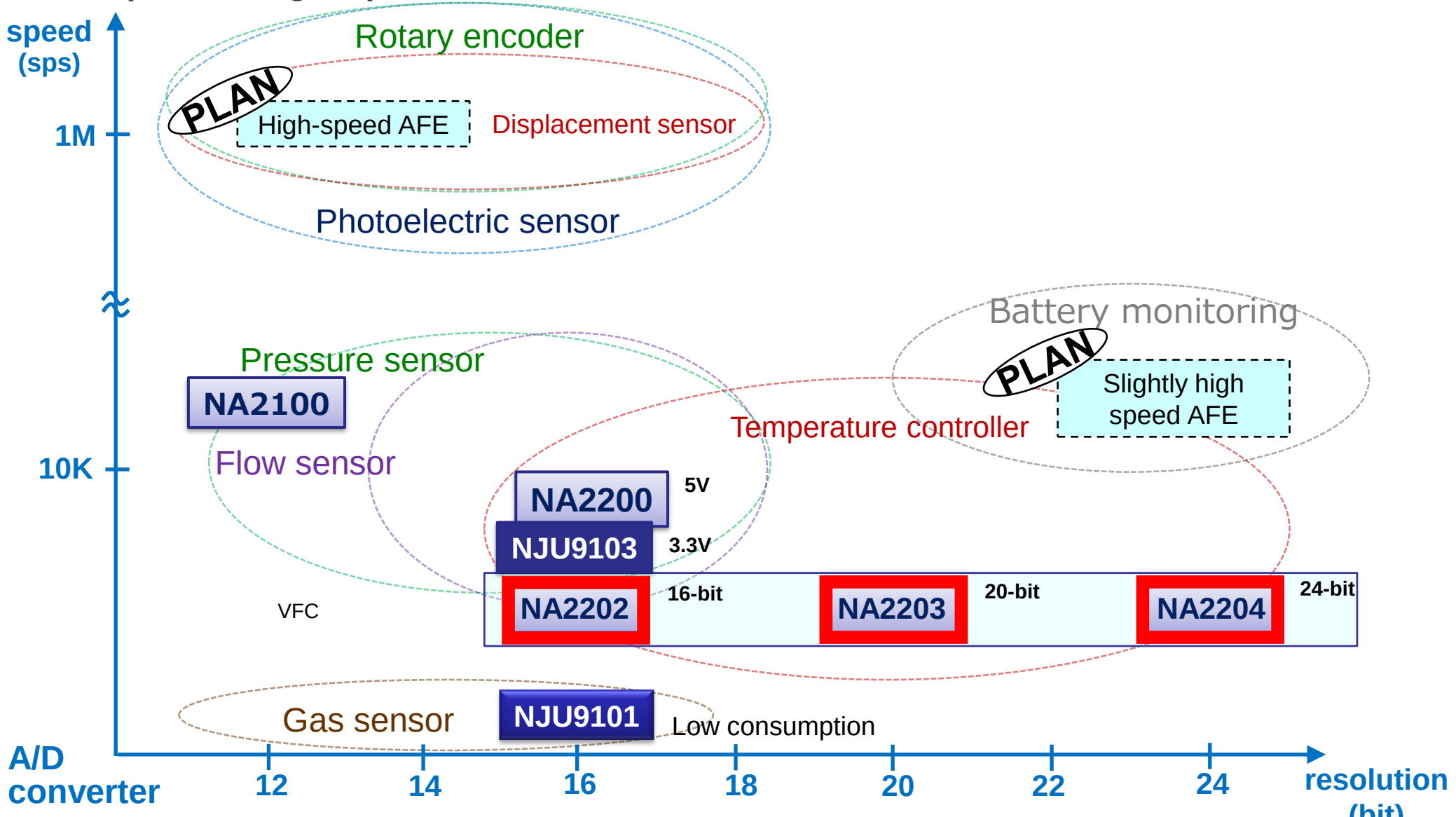
AFE converts “sensor signals” into “signals that can be processed by MCU”



■ AFE comparison table

Item \ Product name	NJU9101	NJU9103	NA2200	NA2202/03/04
Function	Low consumption	Built-in high gain PGA		Built-in high precision PGA
Target application	Gas detector	Pressure sensor		Temperature controller
Operating power supply voltage	+2.4V to +3.6V	+2.7V to +3.6V	+2.7V to +5.5V	+2.7V to +5.5V, ±2.5V
Input method	Dual	Differential 1ch	Differential 2ch	Differential 4ch Negative voltage input
A-D converter	16-bit			16-bit/20-bit/24-bit
PGA	64times	512times		128times
excitation current source	—	—	2 system(0.1mA, 0.25mA, 0.5mA, 1mA)	
Package size	EQFN24-LE: 4.0mm × 4.0mm	ESON8-V1: 2.3mm × 2.3mm SSOP8: 3.5mm × 6.4mm	SSOP16-BD: 5.0mm × 6.4mm	QFN4040-24-NB: 4.0mm × 4.0mm

AFE positioning map of Nisshinbo Micro Devices



ORDER INFOMATION

Product Name	Package	Quantity per Reel	RoHS	Halogen Free
NA2202NBAE2S	QFN4040-24-NB	1000	✓	✓
NA2203NBAE2S	QFN4040-24-NB	1000	✓	✓
NA2204NBAE2S	QFN4040-24-NB	1000	✓	✓

■ PRODUCT NAME INFORMATION

NA220x aa c dd e

Composition	Item	Description
x		2:16-bit, 3:20-bit, 4:24-bit
aa	Package Code	Indicates the package. Refer to the order information.
c	Version	Product version A: Specified value
dd	Packing	Insert direction. Refer to the packing specifications.
e	Grade	Indicates the quality grade. S:Consumer

e : Quality grade

e	Applications	Operating Temperature Range	Test Temperature
S	General-purpose and Consumer application	-40℃ to 125℃	25℃


Nisshinbo Micro Devices Inc.