Aug 30, 2022

Edge Impulse's FOMO Technology and Sony's Computer Vision Platform: A Compelling Combination

Armaghan Ebrahimi – Partner Solutions Engineer at Sony
Jenny Plunkett– Senior Developer Relations Engineer at Edge Impulse

Aug 30, 2022

Spresense

Sony’s Multicore Microcontroller Technology with Global LTE Connectivity

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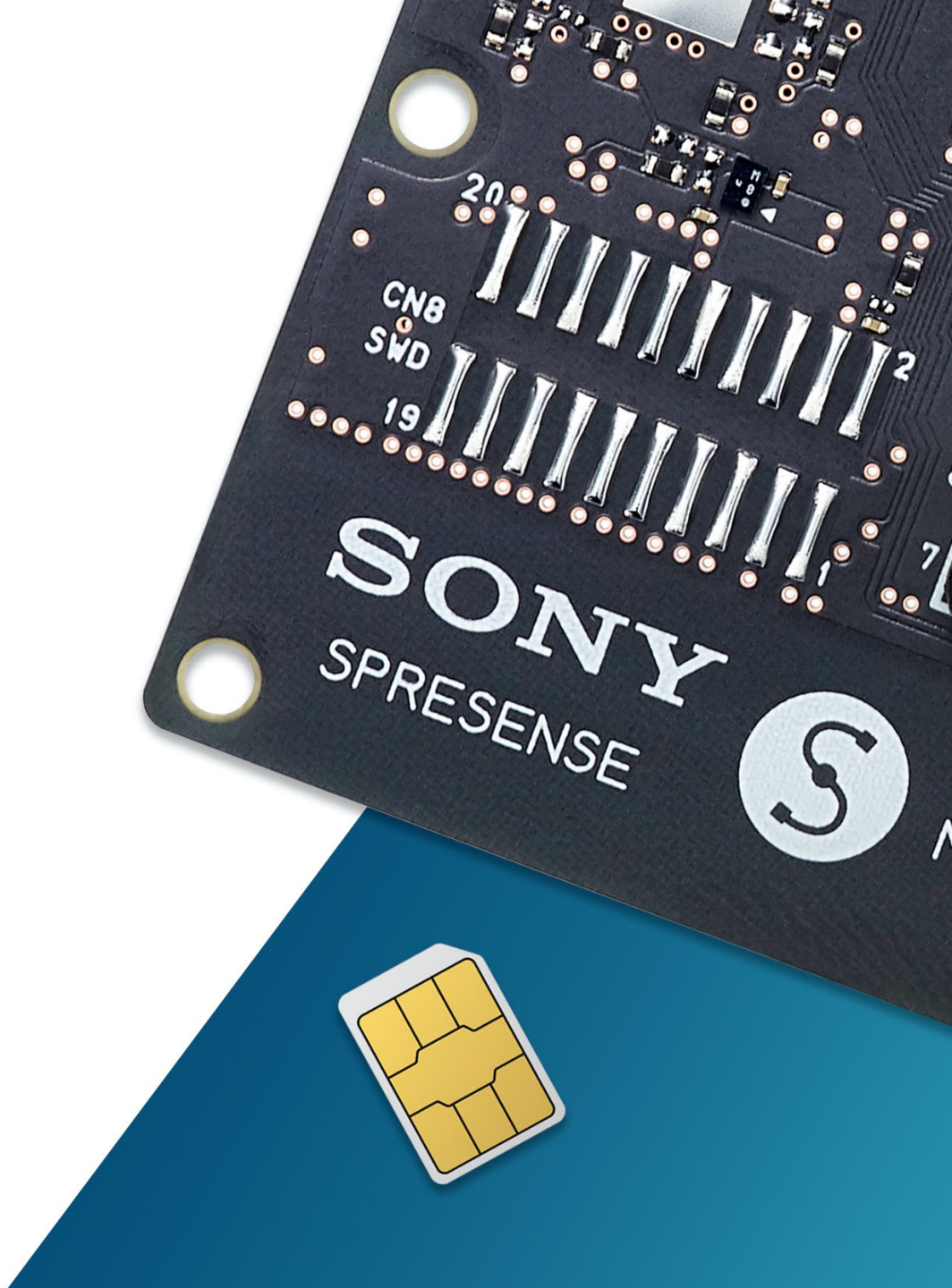
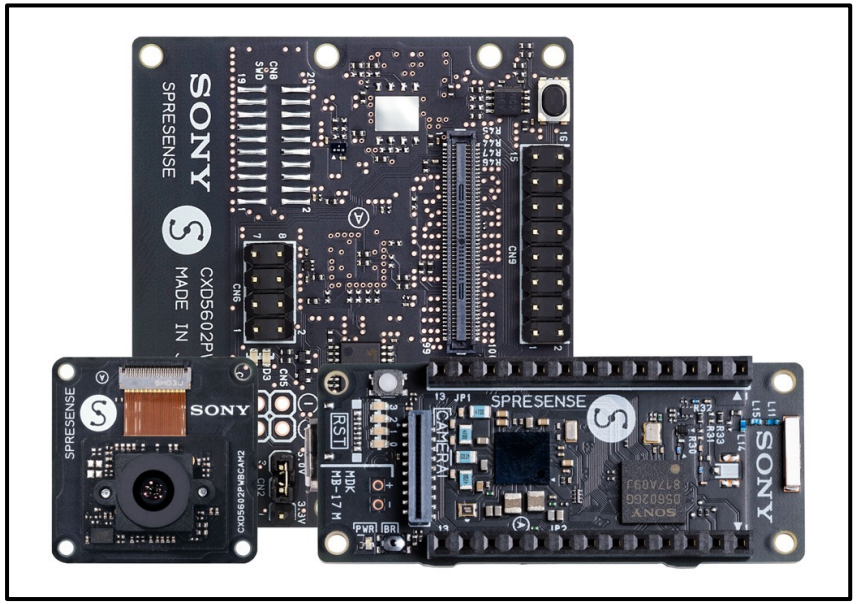
Armaghan Ebrahimi – Partner Solutions Engineer



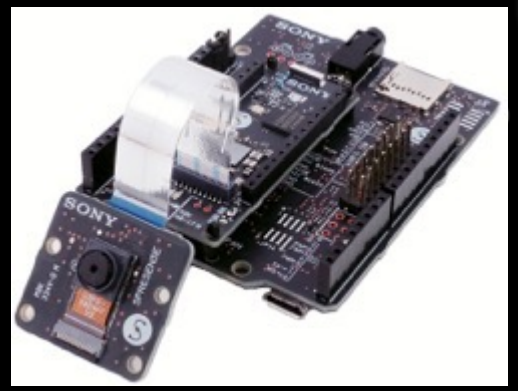
Agenda

- Spresense Microcontroller
- Development with Spresense
- Spresense LTE Board
- Spresense HDR Camera
- Spresense and Edge Impulse

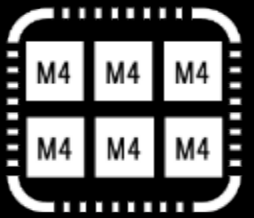


Spresense Microcontroller

SPRESENSE™



CPU	ARM® Cortex®-M4F x 6
Clock	Up to 156MHz
SRAM	1.5MB
Flash Memory	8MB
Digital I/O	GPIO, SPI, I2C, UART, PWM
Analog Inputs	6ch (3.3V range)
Audio I/O	8ch Digital MICs or 4ch Analog MICs, Stereo Speaker
GNSS	GPS, GLONASS, BeiDou, Galileo, QZSS
Others	Camera IF, SD CARD, I2S



Low Power Multi Processor

- 28nm FD-SOI*1 technology
- 0.7V core voltage
- ASMP framework*2 for the multi processor

*1 Fully Depleted Silicon-On-Insulator to enable ultra-low-power features
*2 Software Framework to make communication between processors

Audio Products for Music Lovers

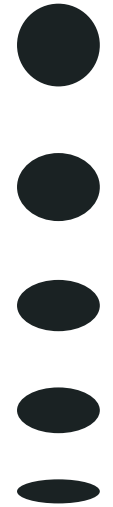
Provide New User Experience

- 192kHz/24bit High-Resolution audio
- 4 analog or 8 digital microphone inputs
- Class-D full digital amplifier

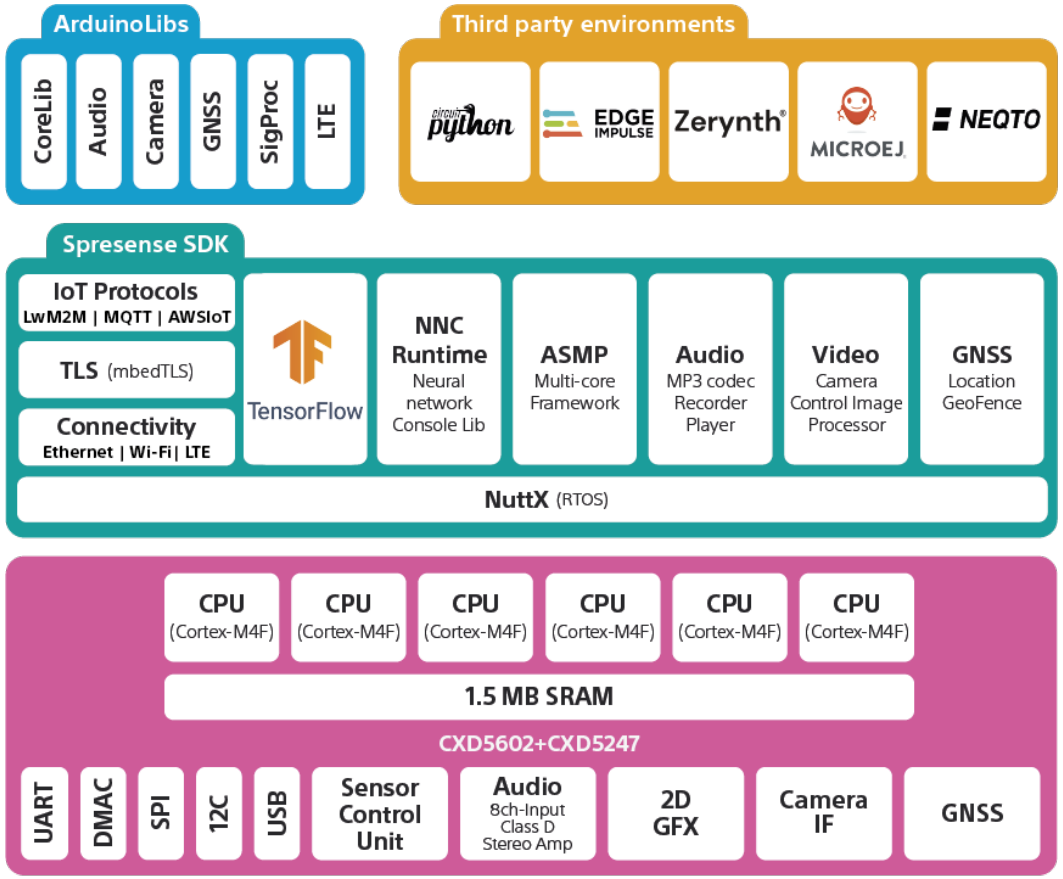
Positioning Features

- Ultra low power consumption
- Multiple GNSS systems supported: GPS, GLONASS, QZSS, BeiDou, Galileo

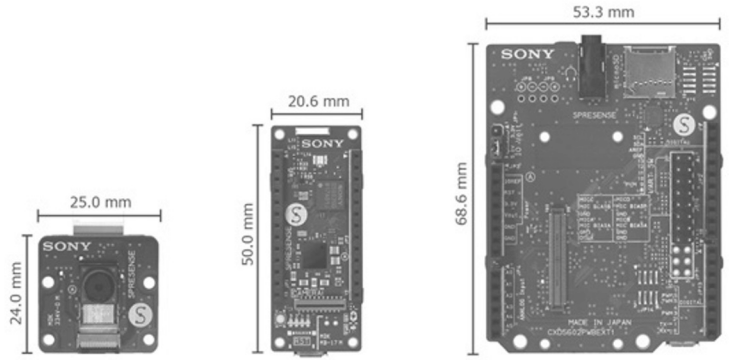
Development with Spresense



Development with Spresense



Hardware Components

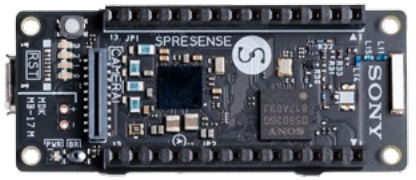


CAMERA BOARD MAIN BOARD EXTENSION BOARD

HDR CAMERA BOARD

LTE EXTENSION BOARD

MAIN BOARD



CXD5247GF

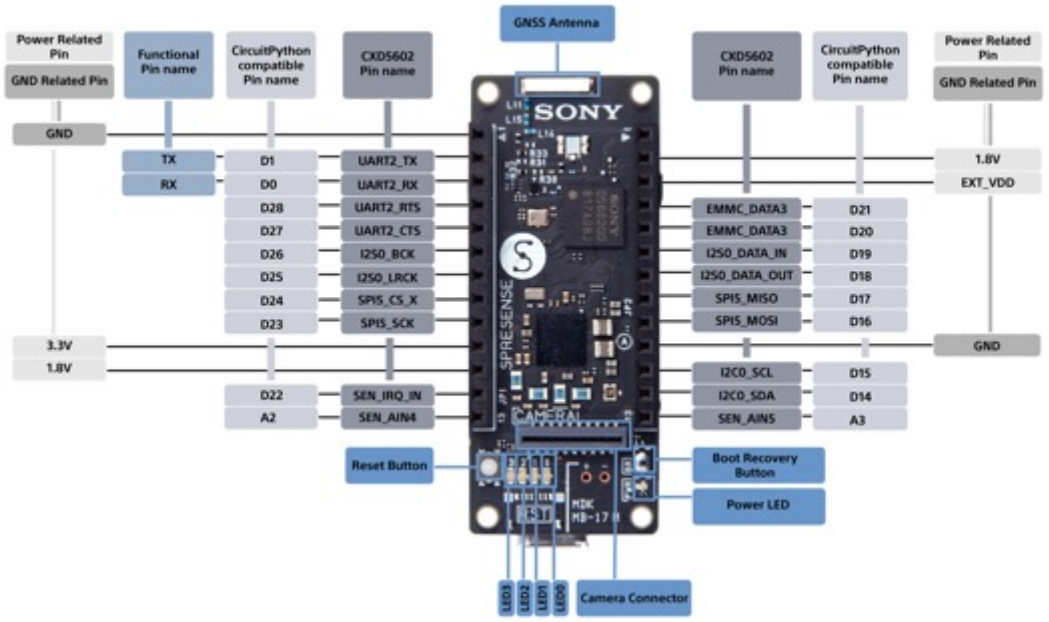
- Power Management
- Class D Full Digital Amplifier
- Microphone Interface
- Speaker Interface
- Battery Charger

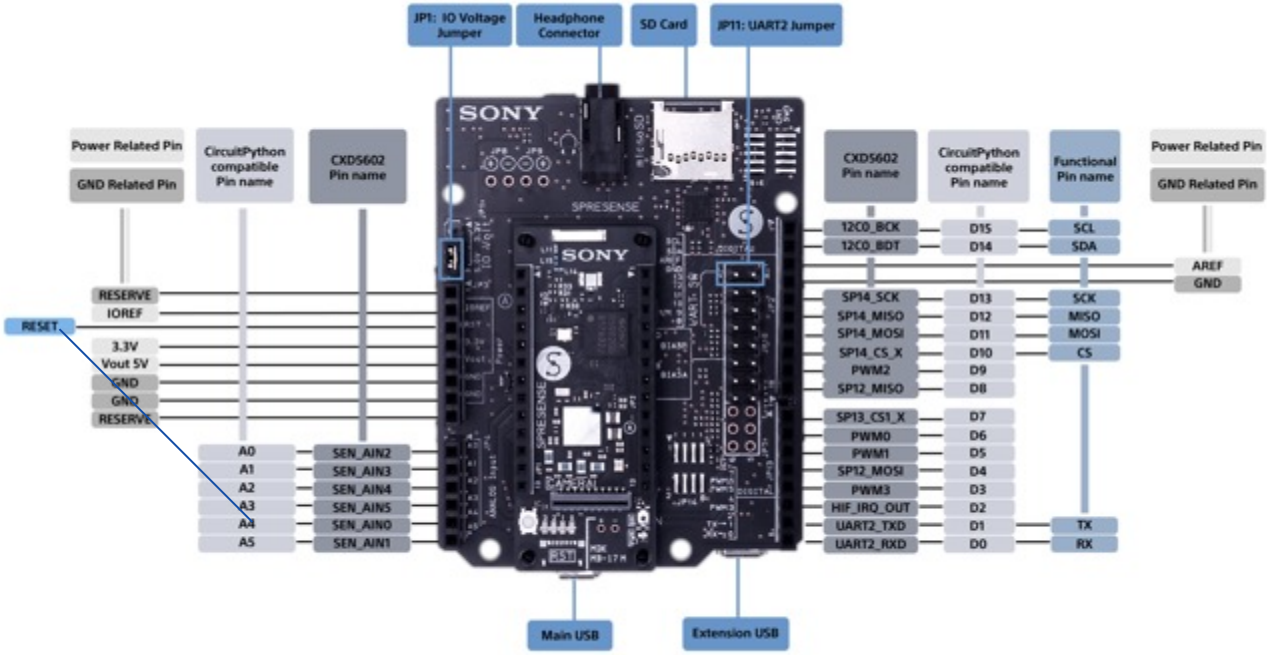
CXD5602GG

- Low Power GNSS function
- Multicore Processor
- High Resolution Audio codec
- Camera Interface

https://developer.sony.com/develop/spresense/buy-now

Opensource SW to Accelerate Open Innovation





[Link to Schematics, Bill of Materials (BOM) and design guidelines to build your own board]

Fast Prototyping

Wi-fi
Add-on

BLE
Add-on

Sigfox
Add-on

LoRa-BLE
Add-on

Sensor
Add-on

Sensor
Add-on

Sensor
Add-on

Flexible and Expandable

Sandwich Concept Design

Portable Player Extension Board

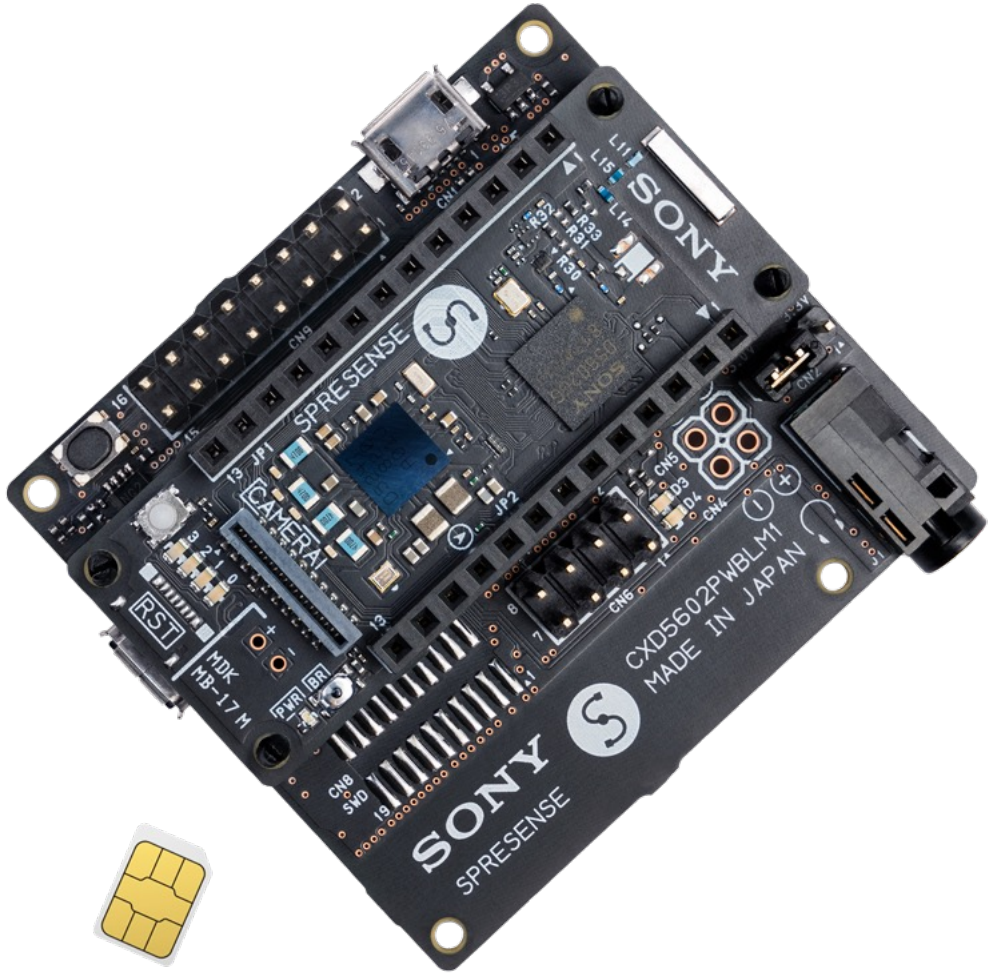
Extension Board
from Sony

LTE(Cat-M) Extension Board from Sony

Introducing LTE board

TRUPHONE

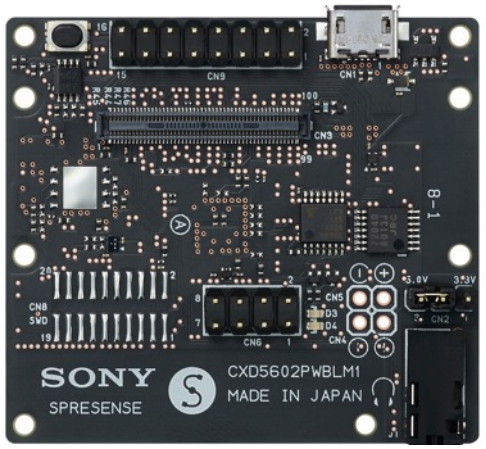
SORACOM

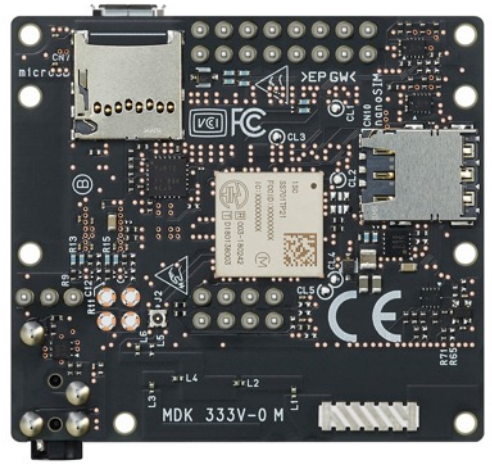


https://developer.sony.com/develop/spresense/spresense-lte/

Spresense LTE Board

Model name	CXD5602PWBLM1
Size	45 mm x 50 mm
Onboard module	LBAD0XX1SC (Murata Manufacturing module equipped with Altair Semiconductor's ALT1250 Chipset)
SIM card	nanoSIM
RAT (Radio Access Technology)	LTE Cat-M1 NB-IoT
Bands	US Band 2, 4, 12, 13 EU Band 3, 20
Antenna	Equipped with onboard antenna
Audio input / output	2 ch analog microphone input or 4 ch digital microphone input Headphone output
Digital input / output	Selectable from 3.3 V or 5 V
Analog input terminal	2 ch (5.0 V range)
External memory interface	microSD card slot



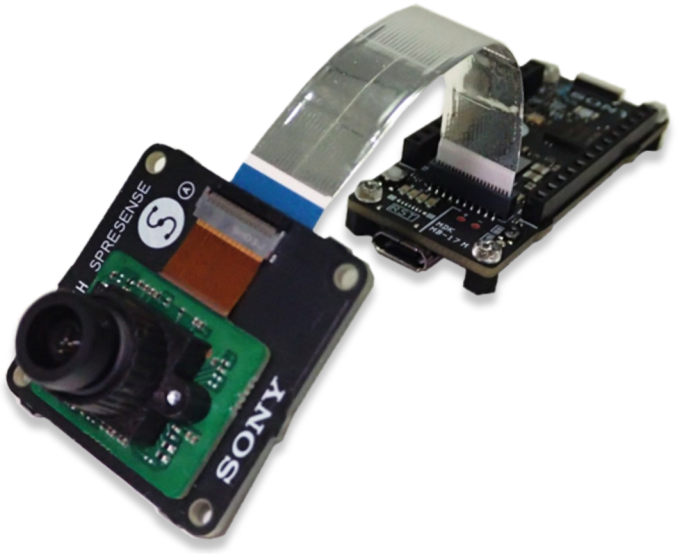


Introducing HDR Camera

ISX019

https://developer.sony.com/develop/spresense/spresense-hdr-camera-board/

ISX019 HDR Camera Board

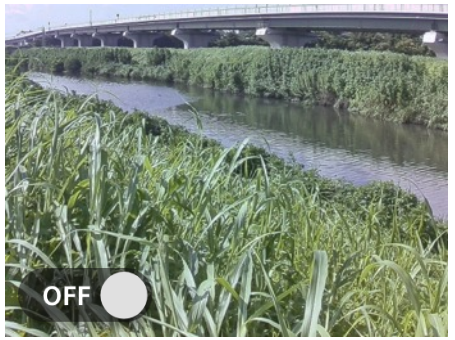


Model name	CXD5602PWBCAM2W
Size	28.0 mm x 28.0 mm
Number of effective pixels	1280 (H) x 960 (V) = approx. 1.23 M pixels
Operation voltage	DC 3.7 V
I/O voltage	DC 1.8 V
Camera interface	CMOS 8 bit parallel
Output format	Y/C, RGB, RAW and JPEG
Control interface	I2C
High Dynamic Range (HDR)	120dB@30fps (3-frames combination) 100dB@30fps (2-frames combination)
Built-in filter	IR cut filter
FOV	Horizontal FOV 41.8° Vertical FOV 31.2° Diagonal FOV 50.3°
Focal length	5.1mm
F-Value	2.0
TV-distortion	-2.15%
Lens barrel	M8 P0.35
Operating conditions	Temperature: -20 - 65 ℃, Humidity: 30% - 80% (no condensation)
Storage conditions	Temperature: -20 - 65 ℃, Humidity: 10% - 80% (no condensation)
Additional functions	High Dynamic Range (120dB), Interchangeable lens, Low-light capturing, Close-up function

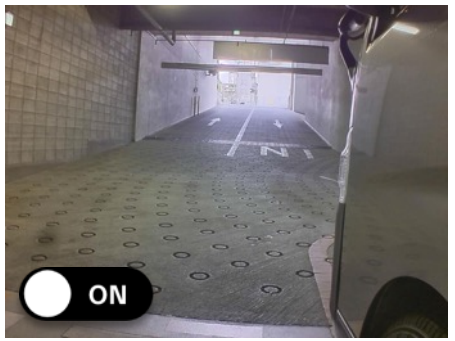
ISX019 HDR Camera

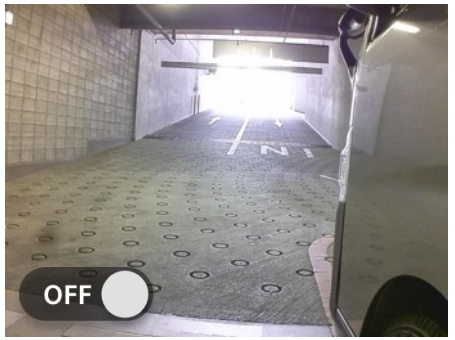
HDR On/Off

Night Vision



Sudden light transition





Macro Shoot

Why Spresense for IoT applications?

1. **Powerful processors:**
   Small form factor with 6 ARM cores

2. **Edge device:**
   Data can be processed on device and less data transfer needed over cloud connection

3. **Power efficient:**
   Low battery consumption means devices can run longer

4. **On board Capabilities:**
   - Camera
   - High resolution Audio
   - Integrated GPS

The combination of above capabilities with LTE enables variety of use cases.

https://developer.sony.com/develop/spresense/buy-now

EDGE IMPULSE

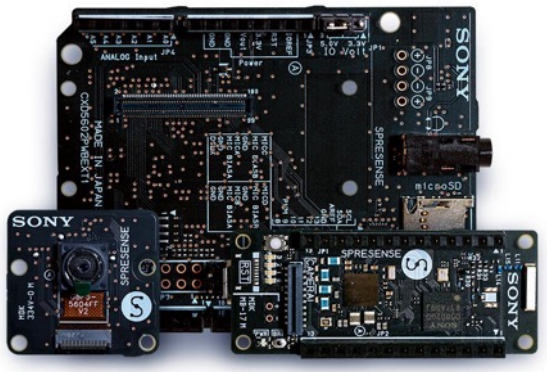
EDGE IMPULSE

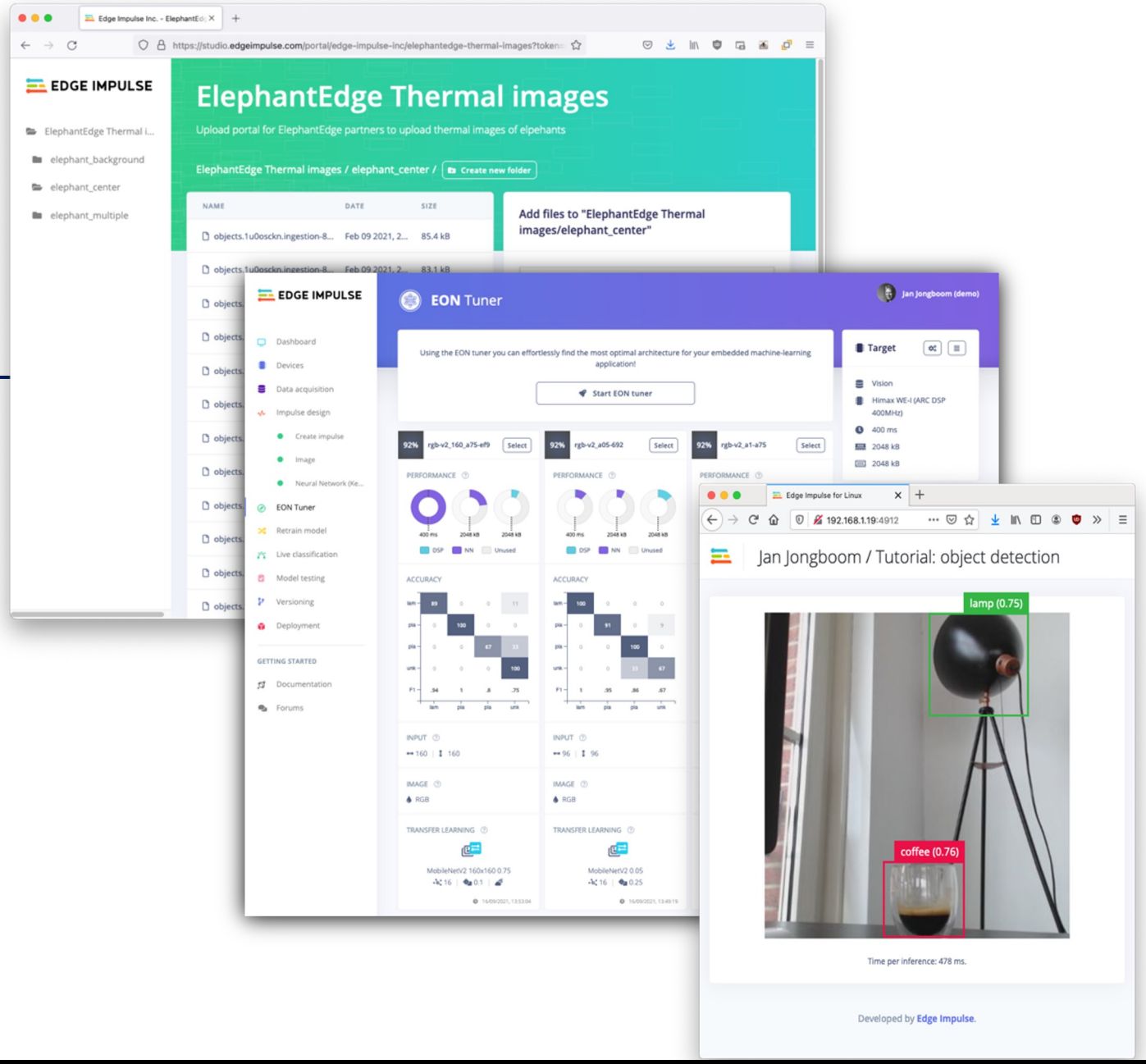
The Ultimate Embedded Platform

Ingest Data

Create Models

Optimize & Run

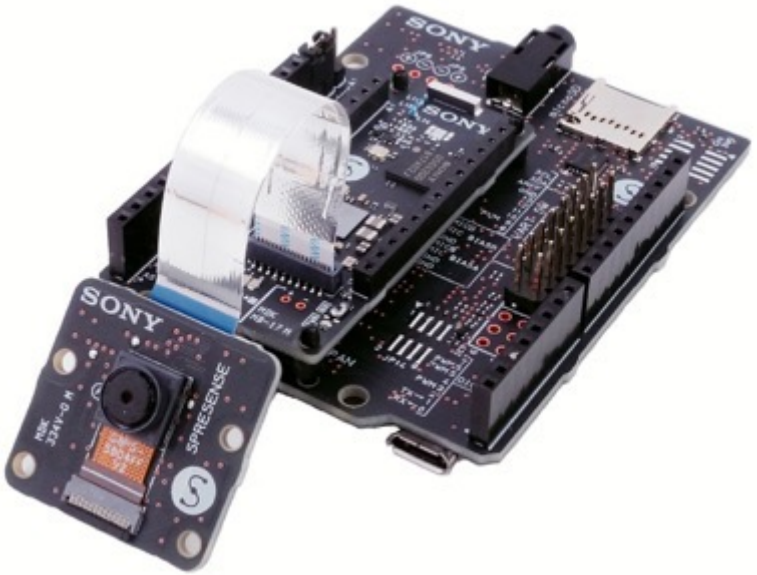




https://docs.edgeimpulse.com/docs/sony-spresense

Summary

Spresense development board enables edge solutions with high computing ability and low power consumption.



Spresense website: https://developer.sony.com/develop/spresense/

Twitter: @SonyDevWorld

Contact us: https://developer.sony.com/develop/spresense/purchase-inquiries

Forum: https://forum.developer.sony.com/category/5/spresense

YouTube: https://www.youtube.com/user/SonyXperiaDev

Web shop: https://developer.sony.com/develop/spresense/buy-now

Edge Impulse: https://docs.edgeimpulse.com/docs/sony-spresense

Q/A

Q/A

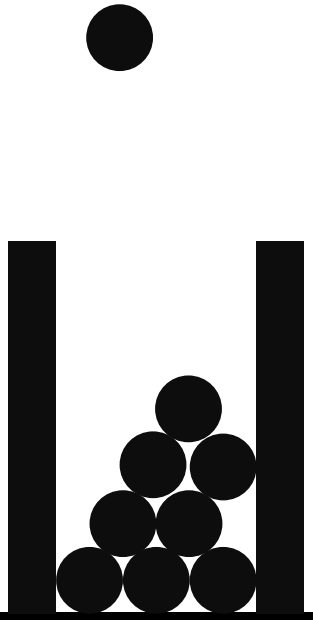
Q: What is the lowest power consumption in sleep mode?
A: It is possible to reach as low as just above 6µA during Deep Sleep using the Spresense mainboard. Please refer to this link:
https://developer.sony.com/develop/spresense/docs/hw_docs_en.html#_how_to_achieve_6%C2%B5a_current_consumption_%20on_mainboard

Q: What is the maximum size of the AI model you can use?
A: It is around 1 MB, it depends on the size of the application because Spresense has 1.5 MB of RAM, and you need to fit your application and model within that 1.5 MB

Q: Can I only use the main board, or do I need the extension board to port my AI model?
A: You can use the main board if the model is in the flash memory, but it is much easier to use the SD card and have the model on the SD card.

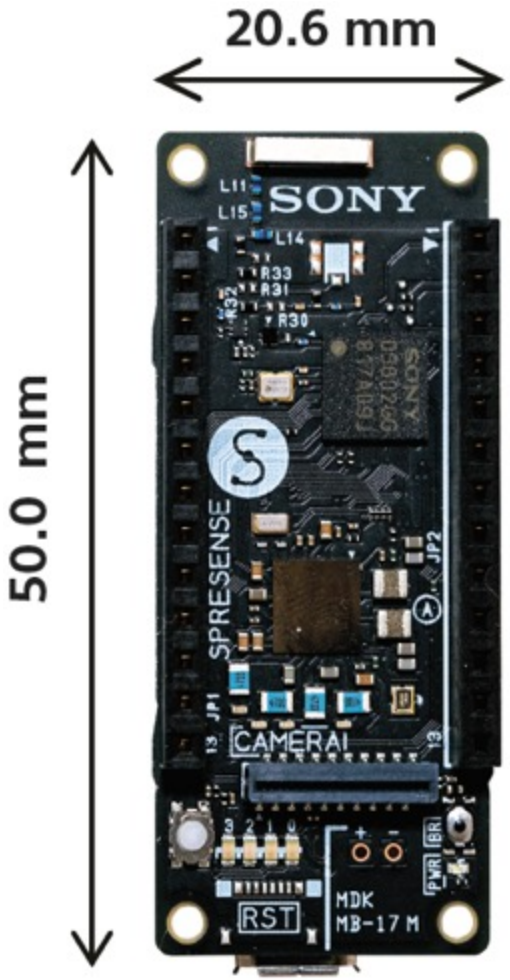
Q: Can I use data from sensors other than audio and camera as an input to my neural network?
A: Yes, you can. You can connect other sensors to Spresense and use the data as input to your neural network.

Q: Can I train my model on Spresense?
A: No, it is not possible. You must do the training on a PC or cloud and then you can run the trained model on Spresense.



Appendix

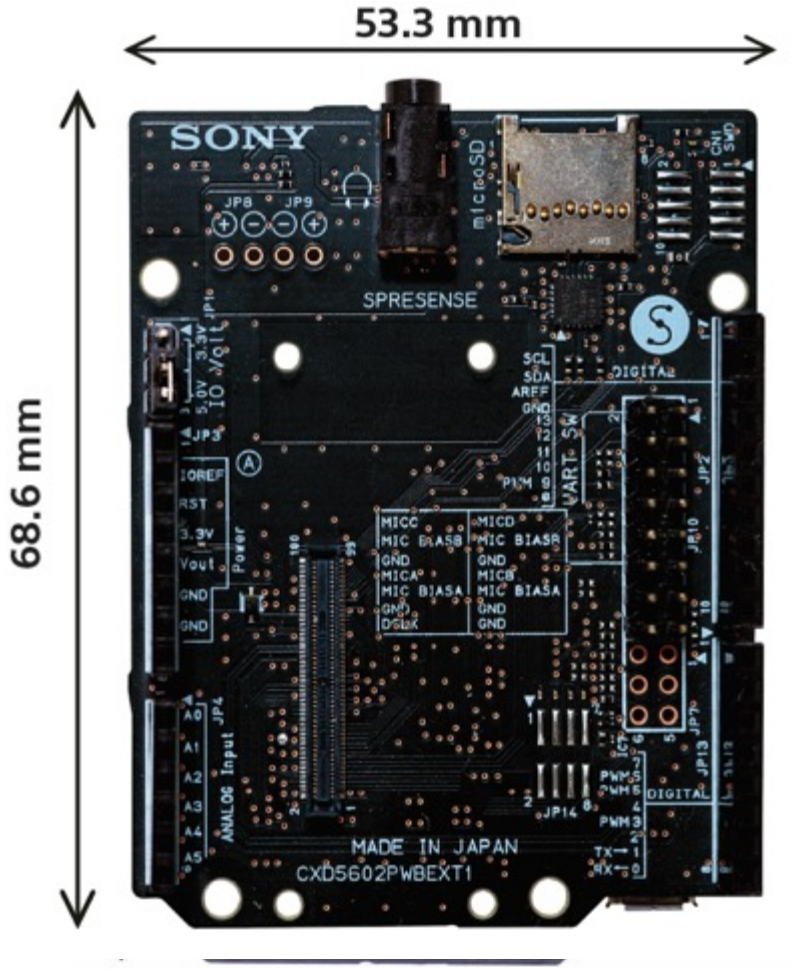
Spresense Main Board Specifications



Model name	CXD5602PWBMAIN1
Size	50.0 mm x 20.6 mm
CPU	ARM® Cortex®-M4F x 6 cores
Maximum clock frequency	156 MHz
SRAM	1.5 MB
Flash memory	8 MB
Digital input / output	GPIO, SPI, I2C, UART, I2S
Analog input	2 ch (0.7 V range)
GNSS	GPS(L1-C/A), QZSS(L1-C/A), GLONASS(L1), WAAS, QZSS(L1-S)
Camera input	Dedicated parallel interface
Operating conditions	Temperature: 10 - 40 ℃ Humidity: 30% - 80% (no condensation)
Storage conditions	Temperature: -20 - 60 ℃ Humidity: 10% - 80%

Spresense specifications details

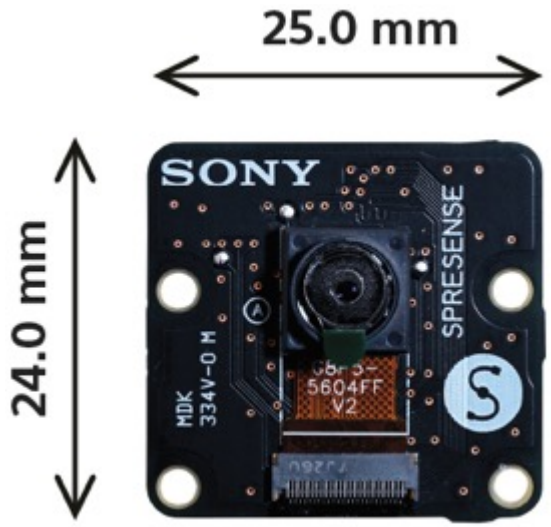
Spresense Extension Board Specifications



Model name	CXD5602PWBEXT1
Size	68.6 mm x 53.3 mm
Audio input / output	4 ch analog microphone input or 8 ch digital microphone input, headphone output
Digital input / output	3.3 V or 5 V digital I/O
Analog input	6 ch (5.0 V range)
External memory interface	microSD card slot
Operating conditions	Temperature: 10 - 40 ℃, Humidity: 30% - 80% (no condensation)
Storage conditions	Temperature: -20 - 60 ℃, Humidity: 10% - 80%

[Spresense specifications details]

Spresense Camera Board Specifications



Model name	CXD5602PWBCAM1
Size	24.0 mm x 25.0 mm
Number of effective pixels	2608 (H) x 1960 (V) = approx. 5.11 M pixels
Operation voltage	DC 3.7 V
I/O voltage	DC 1.8 V
Camera interface	CMOS 8 bit parallel
Output format	Y/C, RGB, RAW and JPEG
Control interface	I2C
Built-in filter	IR cut filter
FOV	78° ± 3°
Depth of field	77.5 cm ～ ∞
F value	2.0 ± 5%
Focus	Fixed focus
Operating conditions	Temperature: 10 - 40 ℃, Humidity: 30% - 80% (no condensation)
Storage conditions	Temperature: -20 - 60 ℃, Humidity: 10% - 80%

Spresense specifications details