



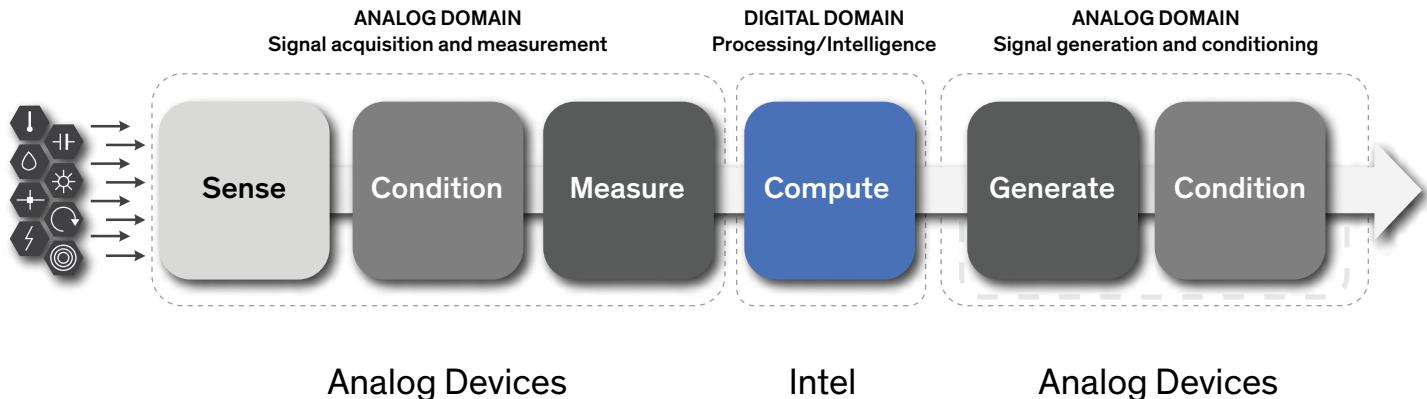
## Analog Solutions Guide for FPGA-Based Designs



# V | Five Years Out

## Collaborating with Analog Devices and Intel

Arrow has brought together Analog Devices and Intel and forged a partnership that brings new solutions to the marketplace. This solutions guide is a compilation of Analog Devices' offerings that are compatible with Intel. In addition to listings of signal converter, RFIC, and signal conditioning boards, the guide also presents solutions from the expanding partner ecosystem to help customers dramatically reduce time to market.



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## Intel Portfolio Overview

### MAX®

The MAX® Series of programmable logic devices features a non-volatile architecture and provides a mix of low cost and low power. MAX devices are broadly used for general-purpose and power-sensitive designs in a wide variety of market segments to perform functions that include I/O expansion, interface bridging, power management, and FPGA configuration control. MAX 10 FPGAs are the latest product within the MAX family, delivering a unique blend of small footprint, instant-on operation, and FPGA flexibility, including more than enough capacity for soft CPU cores.

### CYCLONE®

The Cyclone® Series of FPGAs and SoC FPGAs are optimized for low-cost, high-volume systems. Cyclone V FPGAs and SoC FPGAs deliver capacity, performance, and IP ideal for the majority of embedded applications used in the industrial and automotive markets.

### ARRIA®

The Arria® Series of FPGAs and SoC FPGAs deliver a balance of performance and power efficiency. Arria 10 FPGAs and SoC FPGAs are the latest products within the Arria family. Arria 10 FPGAs and SoC FPGAs at 20 nm feature a unique combination of speed, DSP performance, capacity and power efficiency, and are the only 20 nm FPGA to integrate an embedded processor system.

### STRATIX®

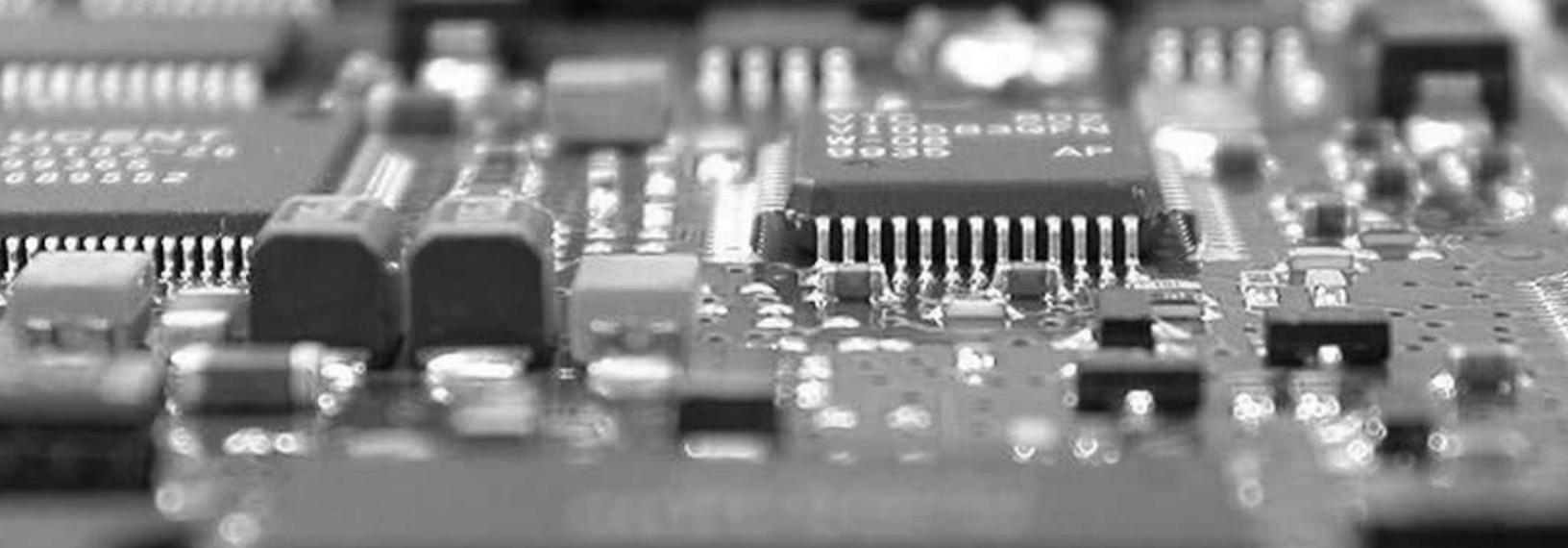
The Stratix® Series of FPGAs and SoC FPGAs is optimized for the most demanding systems where performance is paramount. Stratix 10 FPGAs and SoC FPGAs are the latest product within the Stratix family. Fabricated on Intel 14 nm Tri-Gate technology, Stratix 10 FPGAs and SoCs will offer industry-leading capacity, performance, and architectural innovation for the most challenging computing, signal-processing, and software-defined networking applications. Stratix 10 is proof in silicon that Intel and Altera are indeed better together.

# Featured Intel® Cyclone® 10 and Cyclone® V SoC/FPGA Boards from Intel and Partners

Partner	Board Name	Brief Description	Category
► Arrow	<a href="#">SoCKit (Page 28)</a>	Based on Cyclone V SoC with 110K LEs, the SoCKit offers flexibility and control to evaluate all the capabilities of the FPGA	Development kit
► Critical Link	<a href="#">MitySOM-5CSx (Page 14)</a>	SOM based on Cyclone V SoC with up to 110K LEs	SOM
Critical Link	MitySOM-5CSx Development Kit	Development kit that includes the MitySOM-5CSx SOM and a baseboard with Gigabit Ethernet, PCIe, SATA, and more interfaces	Development kit
Critical Link	MitySOM-5CSx Imaging Board	Cyclone V SOM (with 110K LEs), designed for embedded vision and scientific imaging applications	SOM
Critical Link	MitySOM-5CSx Embed Img Dev Kit	Complete hardware and software framework designed to accelerate the development of vision applications	Development kit
► iWave Systems	<a href="#">iW-RainboW-G17M-Q7 SOM (Page 16)</a>	Cyclone V SX SoC based Qseven compatible module. Supports up to 110K LEs	SOM, Development kit
► NovTech	<a href="#">IoTOctopus® (Page 20)</a>	High-accuracy data acquisition system based on Cyclone V SoC (110K LEs)	SOM, Development kit
► NovTech	<a href="#">IoTCentipede™ (Page 22)</a>	Industry 4.0 gateway board with serial connectivity for aggregation and protocol bridging	Development kit, pre-production board
NovTech	<a href="#">Chameleon96</a>	96Boards standard board with Cyclone V SoC	SBC
► NovTech	<a href="#">Chameleon96™ with LVDS CAM (Page 18)</a>	96Boards standard board with Cyclone V SoC with LVDS CAM	SBC, COTS, Development kit
NovTech	NOVPEKCV 2.0	Evaluation Kit for the NOVSOM™CV SOM, featuring Cyclone V SoC	Development kit
► Shiratech	<a href="#">Spark 102 (Page 24)</a>	SOM based on Cyclone V SoC from 25K LEs and up to 110K LEs. Two optional Fast Ethernet PHYs on board	SOM,SBC, Development kit
Shiratech	<a href="#">Spark 100</a>	SOM based on Cyclone V SoC from 25K LEs and up to 110K LEs	SOM, SBC, Development kit
► Terasic	<a href="#">Intel Cyclone 10 GX FPGA Development Kit (Page 8)</a>	Flexible evaluation platform based on 220K LE FPGA Intel Cyclone 10 GX FPGA	Development kit
► Terasic	<a href="#">DE10-Nano (Page 26)</a>	Dev kit based on Cyclone V SE 5CSEBA6U23I7 device (110K LEs)	Development kit
Terasic	<a href="#">DE1-SoC</a>	Dev kit based on Cyclone V SoC 5CSEMA5F31C6 Device	Development kit
► Trenz Electronic	<a href="#">CYC1000 with Intel Cyclone 10 FPGA (Page 10)</a>	Intel Cyclone 10 LP module with 25K LEs	SOM, COTS, Development kit
► Trenz Electronic	<a href="#">Cyclone® 10 LP Reference Kit (Page 12)</a>	Reference kit based on CYC1000 Intel Cyclone 10 LP module with 55K LEs	SOM, COTS, Development kit

► Featured in this guide





## Featured Intel® Arria® 10 FPGA Boards from Intel® and Partners

Partner	Board Name	Brief Description	Category
► Critical Link	<a href="#">MitySOM-A10S (Page 30)</a>	Available with a 270K LE Intel Arria 10 SX. Options for 160K LE and 480K LE devices are also available	SOM
Critical Link	MitySOM-A10S Development Kit	Development kit that includes the MitySOM-A10S SOM and a baseboard. Design files provided	SOM
Critical Link	MitySOM-A10S Imaging Board	Intel Arria 10 SOM designed for machine vision and scientific imaging applications	SOM
Critical Link	MityCAM-C5000	Vision platform with built in image processing using the Intel Arria 10 SoC	Development kit
Critical Link	MityCAM-C8000	8MP vision platform with built in image processing using the Intel Arria 10 SoC	Development kit
► Dream Chip	<a href="#">Dream Chip with Intel Arria 10 SOM and Evaluation Baseboard (Page 34)</a>	Intel Arria 10 SOM (with 160 to 480K LEs) in a 29×29 mm package. Ideal for vision applications and industrial automation	SOM, Development kit
► iWave Systems	<a href="#">iW-RainboW-G24M SOM and Development Platform (Page 32)</a>	Based on the Intel Arria 10 SX/GX FPGA with the F34 package, with Dual FMC Connector, Display Port, HD-SDI IN/OUT, SFP+	SOM, Development kit
► REFLEX CES	<a href="#">Achilles Instant- Development Kit with Intel Arria 10 SoC SOM (Page 36)</a>	SOM and development kit based on Intel Arria 10 SX (10AS066H2F34I1SG) device up to 660K LEs	SOM, Development kit
Terasic	A10GFP	Features a 10AX115S2F45I1SG device and a one-year license for the Intel Quartus Prime design software	Development kit
► Terasic	<a href="#">Intel Arria10 GX FPGA Development Kit (Page 38)</a>	Based on Intel Arria 10 GX with 1150K LEs	Development kit
► Terasic	<a href="#">Intel Programmable Acceleration Card (PAC) with Intel Arria 10 GX FPGA (Page 42)</a>	Intel Arria 10 GX FPGA (10AX115N2F45E1SG) with 115K LEs	Development kit
► Terasic	<a href="#">TR10a-HL Intel Arria 10 Acceleration Card (Page 40)</a>	Based on Intel Arria 10 GX with 1150K LEs, 8 PCIe Gen 3 and 4 QSFP+ connectors	COTS, Development kit

► Featured in this guide



## Featured Intel® Stratix® 10 FPGA Boards from Partners

Partner	Board Name	Description	Category
► Intel	<a href="#">Intel Stratix 10 GX FPGA Development Kit (Page 48)</a>	Complete design environment to test performance and capabilities available in Intel Stratix 10 GX FPGAs (2800K LEs)	Development kit
► REFLEX CES	<a href="#">Sargon Instant-Development Kit with Intel Stratix 10 FPGA FMC+ IDK (Page 46)</a>	Development kit based on Intel Stratix 10 GX FPGAs SX with 2800K LEs	COTS, Development kit
► Terasic	<a href="#">DE10-Pro with Intel Stratix 10 GX/SX FPGA Development Kit (Page 44)</a>	Intel Stratix 10 GX/SX (2800K LEs) FPGA board with PCIe 3.0, 100G/40G QSFP28 modules, 4 DDR4 SO-DIMM RAM	COTS, Development kit

► Featured in this guide

## Featured Intel® MAX® 10 FPGA Boards from Partners

Partner	Board Name	Description	Category
► Alorium Technology	<a href="#">XLR8 (Page 54)</a>	Arduino-compatible development board based on Intel MAX 10 FPGA	Development kit
Alorium Technology	Snō	Arduino-compatible module based on Intel MAX 10 FPGA	SOM
Alorium Technology	<a href="#">SnōMäkr</a>	SnōMäkr is a breakout board for Alorium Technology's Snō FPGA Module	Development kit
► Shiratech	<a href="#">FPGA Mezzanine for 96Boards (Page 50)</a>	Mezzanine card to add expansion capabilities (Grove, Raspberry Pi, Arduino) to 96Boards FPGA boards	Development kit
Terasic	DE10-Lite	Development kit based on Intel MAX 10 10M50DAF484C7G Device	COTS, Development kit
Trenz Electronic	<a href="#">MAX1000 - IoT Maker Board</a>	FPGA IoT Maker Board based on Intel MAX 10 FPGA with 8K LEs	SOM, COTS, Development kit
► Trenz Electronic	<a href="#">AnalogMAX - ADI Dust Sensor (Page 52)</a>	Smoke detector module with three sensors and Intel MAX 10 FPGA with 8K LEs	SOM, COTS, Development kit

► Featured in this guide

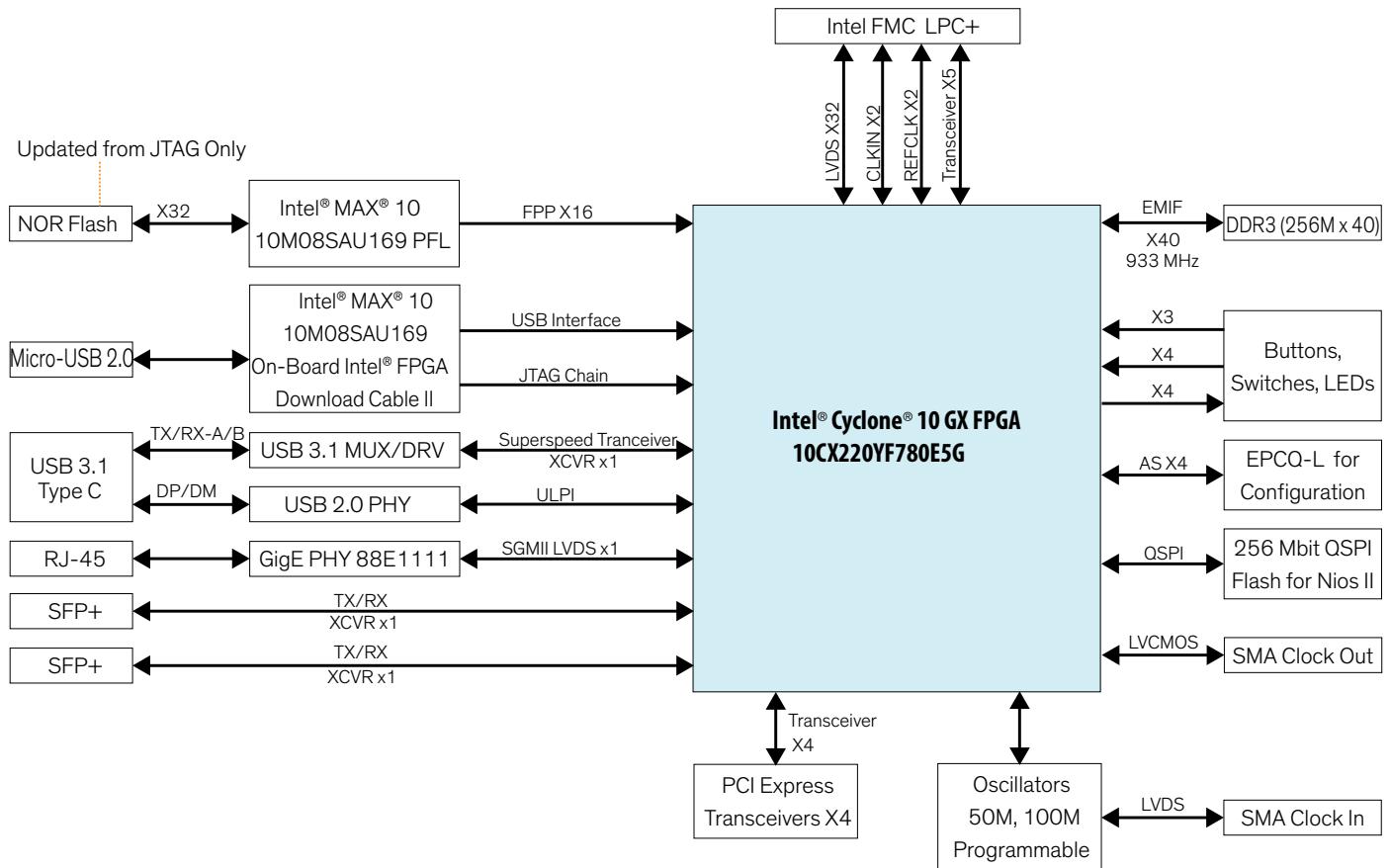


Headquartered in Hsinchu, Taiwan, Terasic is the leading developer and provider for FPGA-based hardware & complex system solution. Experience includes high-end solutions for the industrial and FPGA system markets, rugged system solutions, high performance computing, high frequency trading, network processing, radar detection, instrumentation, etc. Terasic is an approved Analog Devices Alliances Member.

# Intel® Cyclone® 10 GX FPGA Development Kit

## Kit Overview

The Intel Cyclone 10 GX FPGA Development Kit is an ideal starting point for applications, such as embedded vision, factory automation, or video connectivity evaluation or concept proving.



Intel Cyclone 10 GX FPGA Development Kit Block Diagram

## FMC Connector for a Scalable Approach

The kit allows development of modular and scalable designs by using the FPGA mezzanine card (FMC) connectors to interface to a FMC mezzanine card provided by Analog Devices and supporting protocols, such as JESD204B.



Intel Cyclone 10 GX FPGA Development Kit

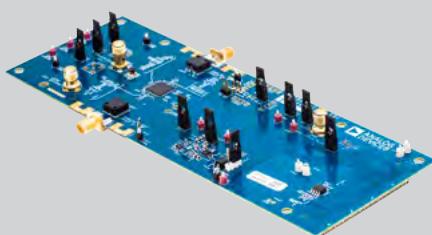
## Applications

- > Embedded vision
- > Factory automation
- > Video connectivity

## Resources

Board part #: [DK-DEV-10CX220-A](#)

## Featured Board from Analog Devices



Part #: [AD9695-1300EBZ](#)

A 14-bit, 1300MSPS / 625MSPS dual analog-to-digital converter (ADC).

Features include:

1. JESD204B coded serial digital outputs with support for lane rates up to 16Gbps/ lane
2. Wide full power bandwidth supports IF sampling of signals up to 2GHz
3. Four Integrated wide-band decimation filter and NCO blocks supporting multi-band receivers
4. Flexible SPI interface controls various product features and functions to meet specific system requirements

All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the development platform. Select Analog Devices' FMC connector are featured in the FMC section of this guide.

→ Contact Arrow for other board options



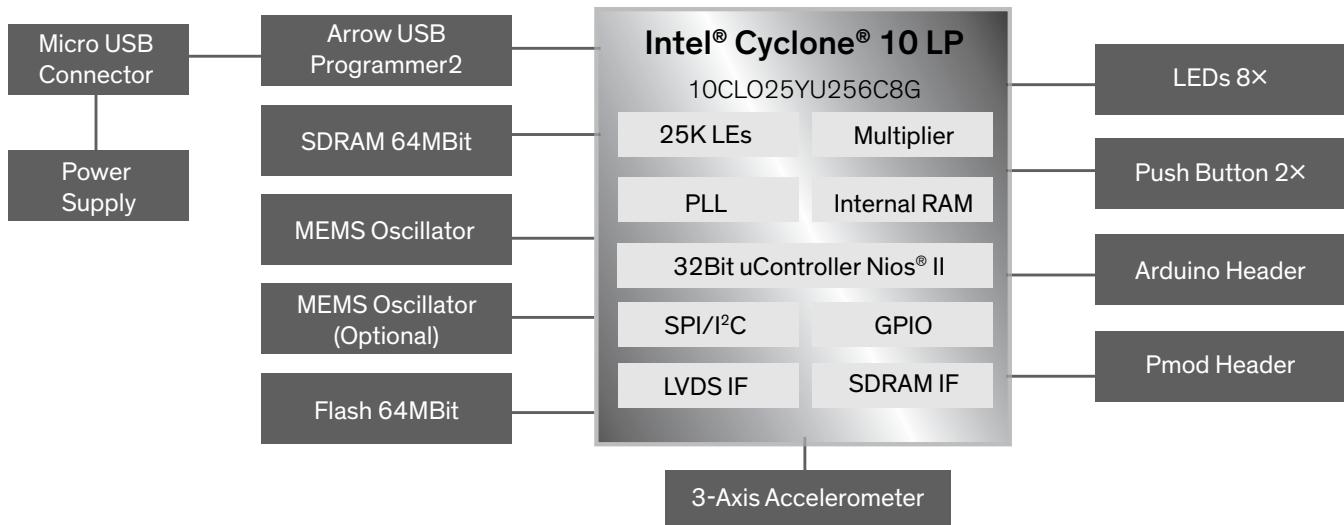
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# Intel® Cyclone® 10 LP FPGA : CYC1000 Board

## Overview

The CYC1000 board from Trenz Electronic is a low-cost starter board for the new Intel Cyclone 10 FPGA family. The board can be used for evaluation or in a customized version as a qualified solution in an end product. With the implemented Arrow USB

Programmer2, it's a full featured plug & play solution without additional costs. The CYC1000 is also perfect for implementing a flexible soft core microcontroller, like NIOS II from Intel.



CYC1000 Block Diagram

The board features Pmod and Arduino connectors, enabling interoperability with a wide-ecosystem of daughter cards.



CYC1000 Board

## Applications

- > Commercial
- > Industrial
- > Test and measurement
- > IoT
- > Maker

## Resources

Board part #: [CYC1000](#)

## Featured Pmod Board from Analog Devices



Fully Isolated Conductivity Measurement Data Acquisition System.

Part #: [EVAL-CN0349-PMDZ](#)

All Analog Devices [Pmod](#) and [Arduino Connector boards](#) are compatible with the development platform. Select Analog Devices' Pmod boards are featured in the Pmod section of this guide. Select Analog Devices' Arduino boards are featured in the Arduino section of this guide.

→ Contact Arrow for other board options



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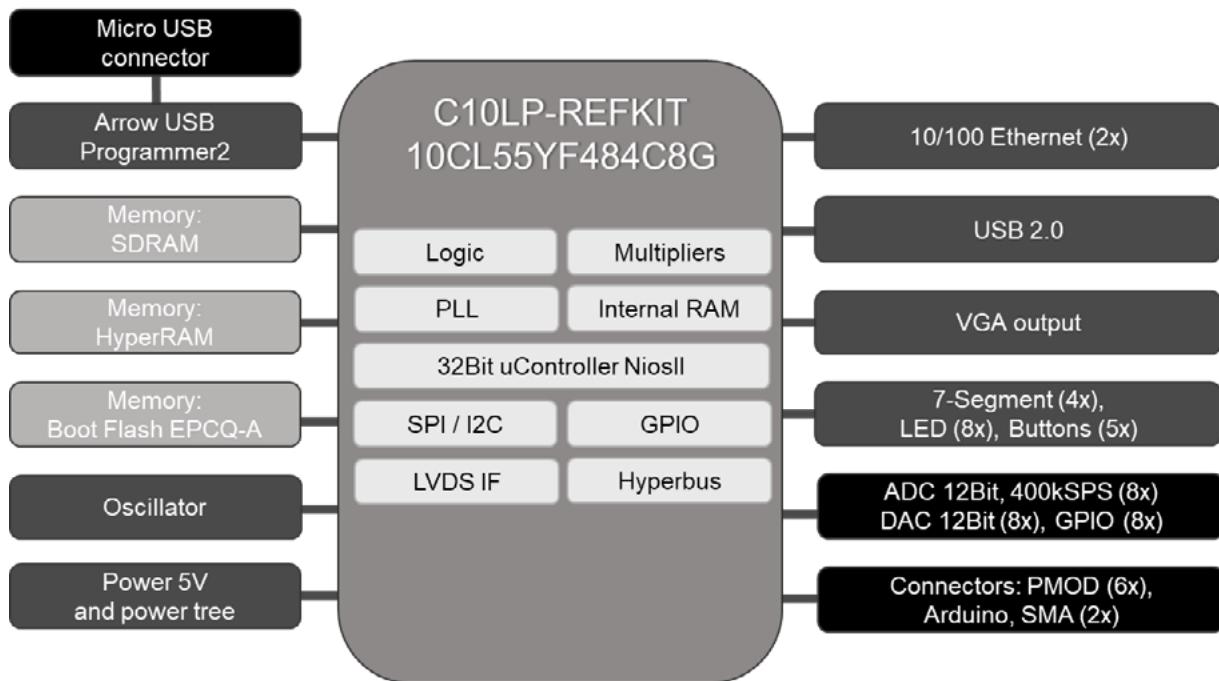
Trenz Electronic develops, manufactures, integrates and distributes FPGA and SoC modules for enterprises and research. The focus is on application-specific HDL and FPGA design as well as on hardware and software development. Trenz Electronics is an approved Analog Devices Alliances Member.

# Intel® Cyclone® 10 LP Reference Kit

## Overview

The Cyclone10 LP Reference Kit from Trenz Electronic is the worldwide first development board with a 55kLE Intel Cyclone10 LP and a huge variety of interfaces for many

applications. The board is fully qualified and ready to use for end products and can also be ordered in customized variants to meet specific end application requirements.



Cyclone 10 LP Reference Kit Block Diagram

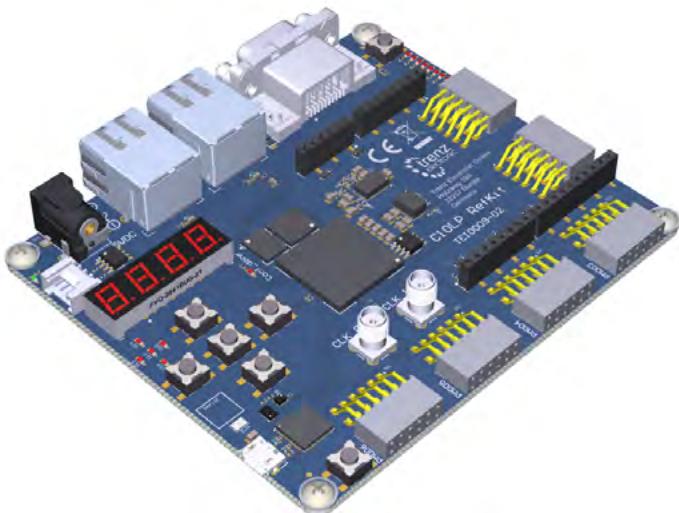
## On-Board Analog Devices Data Converter



8 Channel, 12-Bit, Configurable ADC/DAC with on-chip Reference, SPI interface

Part #: [AD5592](#)

The board features both Arduino and Pmod connectors, enabling interoperability with a wide-ecosystem of daughter cards.



Cyclone 10 LP Reference Kit

## Applications

- > Commercial
- > Industrial
- > Test and measurement
- > IoT end nodes
- > Makers and hobbyists
- > Students

## Resources

Board part #: C10LP-Reference Kit  
Contact Arrow for more information.

### Featured Pmod Board from Analog Devices



4-channel 4.8 kHz 24-bit A/D Converter powered by Analog Devices' AD7193 converter

Part #: [410-243](#)



16-bit Digital-to-Analog converter powered by the Analog Devices AD5541A

Part #: [410-241](#)

All Analog Devices [Pmod Connector boards](#) and [Arduino Shields](#) are compatible with the development platform. Select Analog Devices' Pmod boards are featured in the Pmod section of this guide. Select Analog Devices' Arduino boards are featured in the Arduino section of this guide.

→ Contact Arrow for other board options



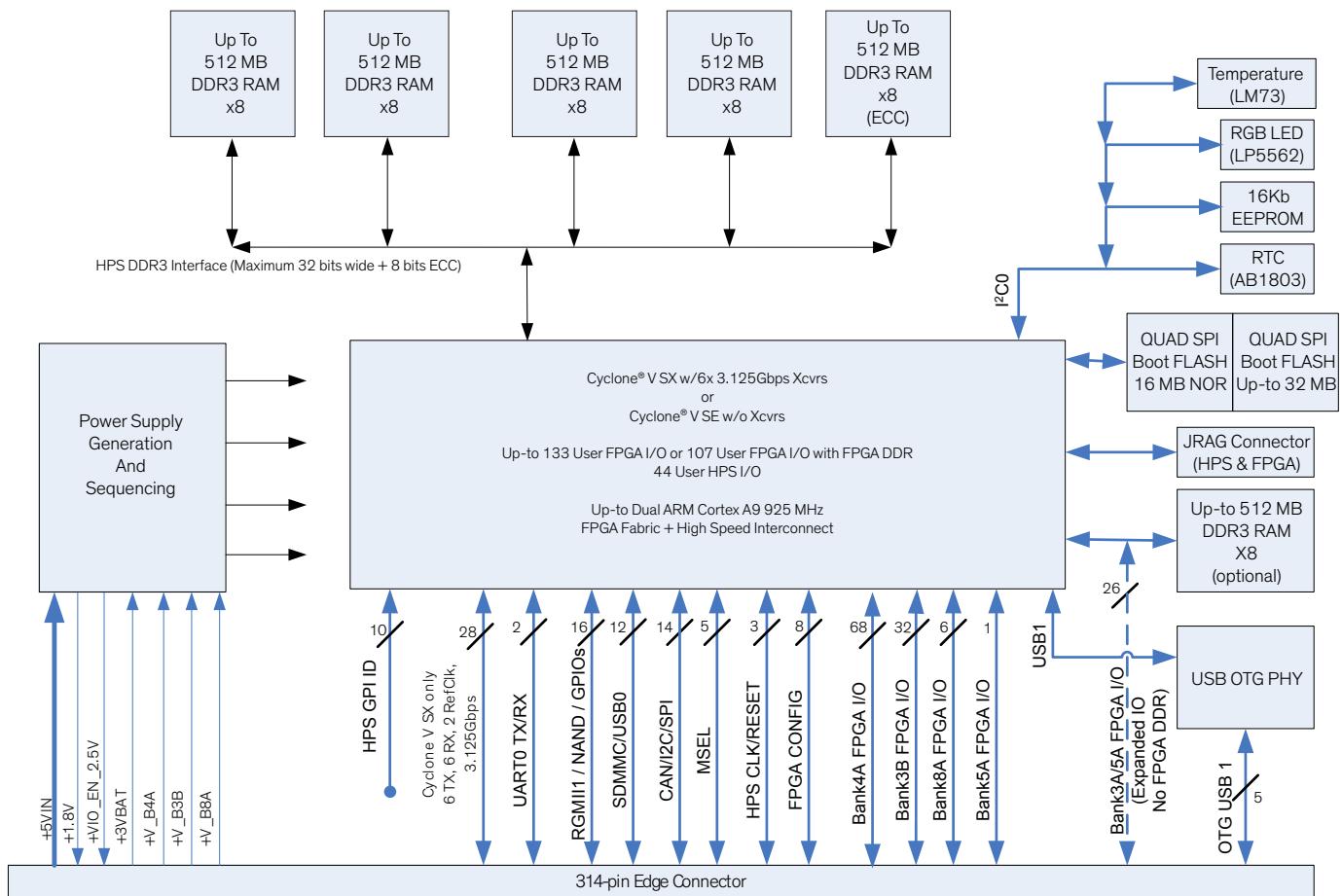
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# Cyclone® V SoC: MitySOM-5CSx

## SOM Overview

The MitySOM-5CSx from Critical Link is a family of highly-configurable, small form-factor System on Module (SOM) designed for high-throughput applications requiring single or dual hard-core Cortex-A9 applications processors tightly integrated with FPGA fabric. The MitySOM-5CSx combines the Cyclone V System on Chip (SoC), memory subsystems

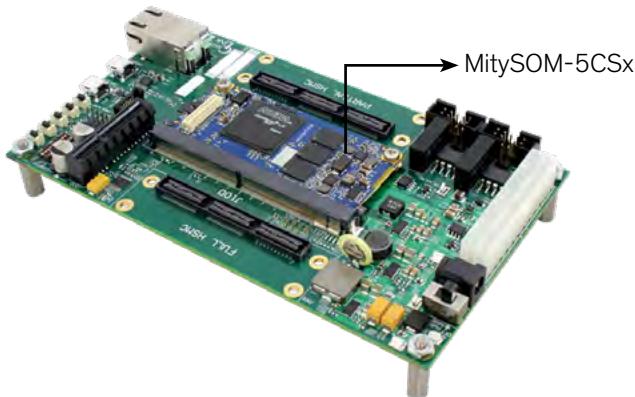
and onboard power supplies. By combining six 3.125Gbps transceivers, one PCIe hard core, up to 133 user I/O, and dual Gigabit Ethernet interfaces, the system can simultaneously acquire and efficiently process large amounts of data. The MitySOM-5CSx provides a complete and flexible CPU and FPGA infrastructure for highly-integrated embedded systems.



MitySOM-5CSx SOM Block Diagram

## MitySOM-5CSx Development Kit

Each MitySOM-5CSx Development Kit includes a compatible MitySOM-5CSx module and a base board that features an array of interfaces and expansion headers such as USB, Debug RS232 to USB Console, Full HSMC Expansion Connector, Partial HSMC Expansion Connector, PCIe x4 Expansion Header, MMC/SD Card, Gigabit Ethernet and Dual CAN Bus interfaces.



MitySOM-5CSx Development Kit

## Applications

- > Machine vision
- > Scientific imaging
- > Motor control
- > Medical imaging
- > Medical instrumentation
- > Test and measurement
- > Industrial instrumentation
- > Military / aerospace

## Resources

Board part #: [80-000640](#)

## Featured Board from Analog Devices



Part #: [DC2085A-A](#)

Demonstration circuit 2085 supports the LTC2000 and LTC2000A, a high speed, high dynamic range family of DACs. It was specially designed for applications that require differential DC coupled outputs. DC2085 supports the complete family of the LTC2000 including 16, 14 and 11 bit parts.

All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the MitySOM- 5CSx Development Kit via the HSMC to FMC transposer board. Select Analog Devices' FMC boards are featured in the FMC section of this guide.

→ Contact Arrow for other board options



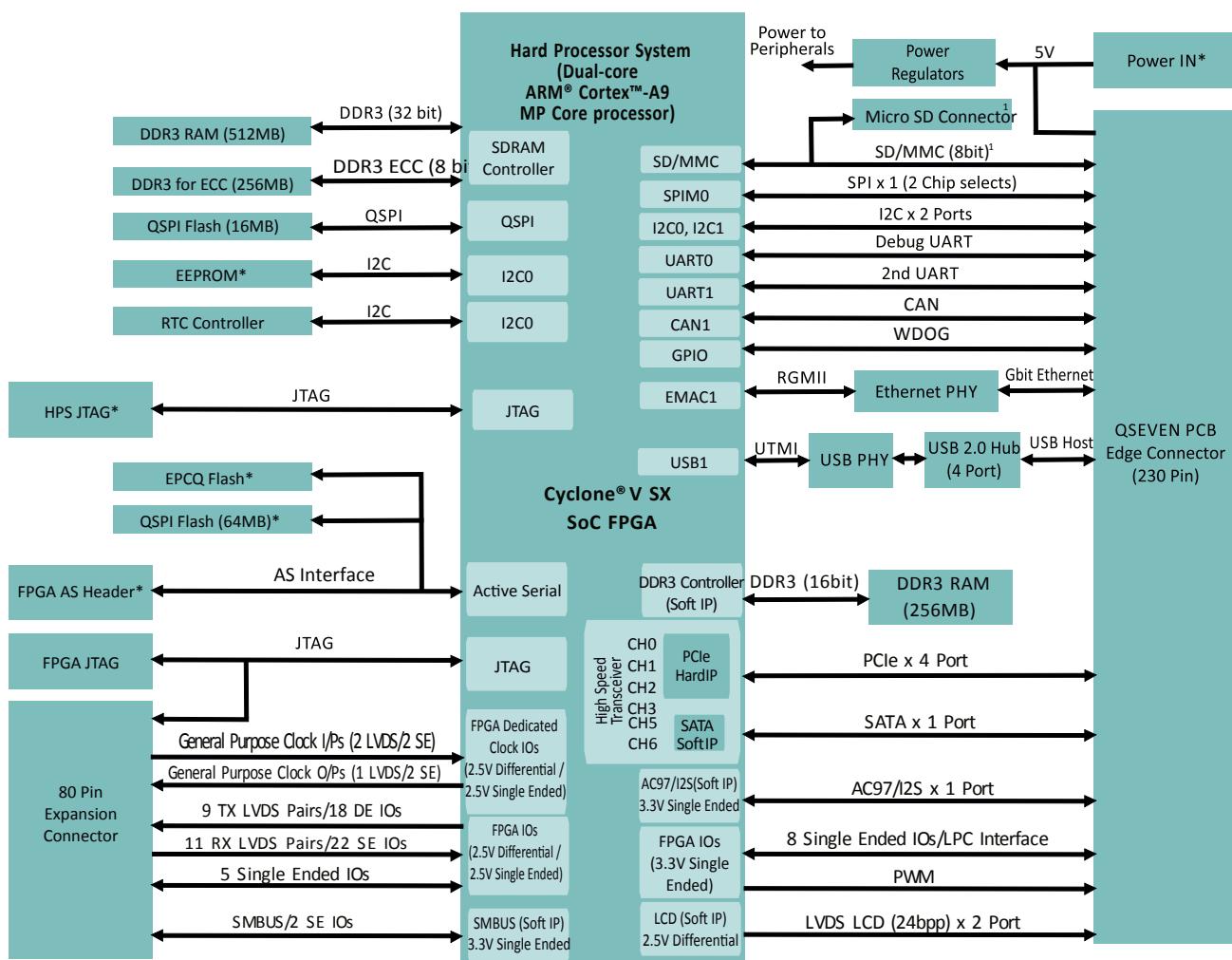
Established in 1999, iWave focuses on standard and customized System on Module/ SBC product development in Industrial, Medical, Automotive & Embedded Computing application domains. iWave Systems provides engineering design services involving embedded hardware, FPGA and software development. iWave is a certified ARM partner and Platinum member of the Intel FPGA Design Solution Network, and is headquartered in Bangalore, India.

# Cyclone® V SoC: iW-RainboW-G17M-Q7 SOM & Development Platform

## SOM Overview

The Cyclone V SoC SOM from iWave is Qseven compatible and based on the Cyclone V SX SoC. The Dual ARM® Cortex-A9 core with the FPGA allows greater flexibility for the system designers and helps lower system cost and power consumption.

The improved logic integration with integrated high speed transceivers and hard memory controllers provides increased bandwidth capacity which is ideal for cost-sensitive high end applications.



iW-RainboW-G17M-Q7 SOM & Development Platform Block Diagram

## iW-RainboW-G17D Cyclone V SoC Development Kit

Cyclone V SoC Development Platform equipped with Cyclone V SoC based Qseven SOM and generic Qseven carrier card for increased system performance requirements. The Dual ARM® Cortex-A9 core with the FPGA allows greater flexibility for system designers and helps lower system cost and power consumption. The improved logic integration with integrated high speed transceivers and hard memory controllers provides increased bandwidth capacity which is ideal for cost-sensitive high end applications.



Cyclone V SoC Development Kit

## Applications

- > Machine vision
- > Video surveillance
- > Smart grid
- > Industrial automation
- > IoT

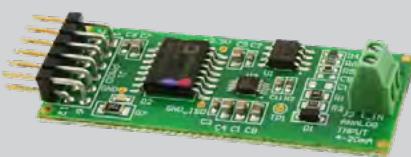
## Resources

Board part #:

- [iW-G17D-Q702-3E512M-S004G-LCA](#)
- [iW-G17D-Q702-3E512M-S004G-LCB](#)
- [iW-G17M-Q702-3E512M-S000G-LIB](#)

Contact Arrow for more information.

## Featured Board from Analog Devices



Part #: [EVAL-CN0336-PMDZ](#)

12-Bit, 300 kSPS, Single-Supply, Fully Isolated, Data Acquisition System for 4-20 mA Inputs. The total error after room temperature calibration is  $\pm 0.06\%$  FSR over a  $\pm 10^\circ\text{C}$  temperature change, making it ideal for a wide variety of industrial measurements. The small footprint of the circuit makes this combination an industry-leading solution for 4 mA to 20 mA data acquisition systems where the accuracy, speed, cost, and size play a critical role.

All Analog Devices [Pmod Connector boards](#) are compatible with the development platform. Select Analog Devices' Pmod boards are featured in the Pmod section of this guide.

→ Contact Arrow for other board options

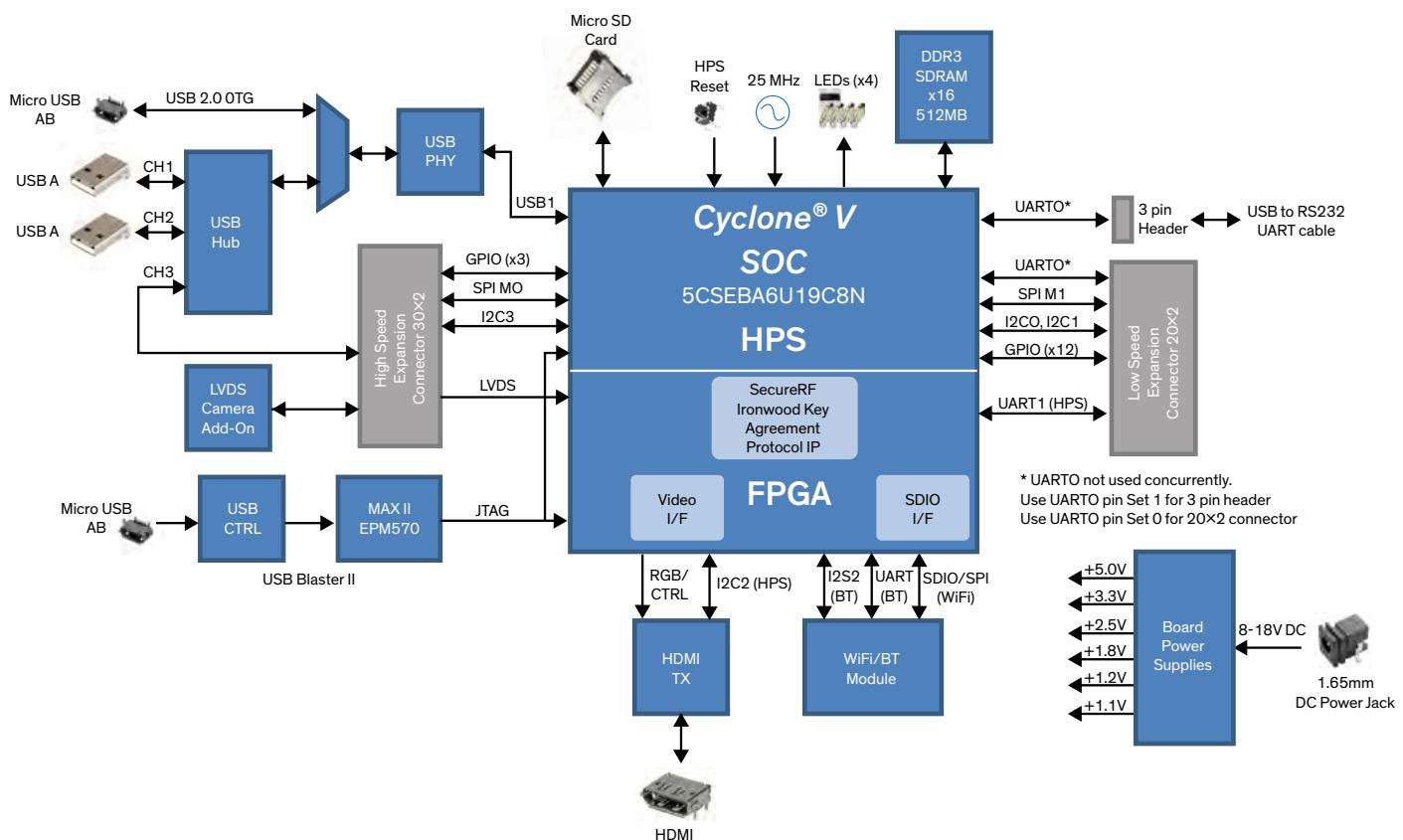


# Cyclone® V SoC: Chameleon96™-Vision, a 96Boards with LVDS Camera

## Overview

The Chameleon96™-Vision is based on NovTech's Cyclone V SoC 96Boards. The Vision add-on board features an 5MP LVDS interface industrial camera with an ambient light sensor and 'mobile phone' type 3X accelerometer. The -3X version features a high-end 3X accelerometer and 3X gyroscope.

The Chameleon96™ meets all 96Boards mandatory specifications (excluding MIPI SDI Interface) and most optional specifications. The Chameleon96™ features Dual ARM® Cortex-A9 processors, an FPGA fabric, and a set of peripherals that allow direct interfacing and connecting to MMC/SD card, HDMI out, USB, WLAN/BLE, I2Cs, UARTs, SPIs and GPIOs.



Chameleon96™ with LVDS CAM Board Block Diagram



Chameleon96™-Vision

## Applications

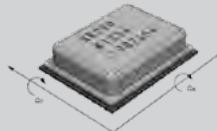
- > Industrial & manufacturing
- > Machinery
- > Robotics
- > Artificial intelligence

## Resources

Board part #:

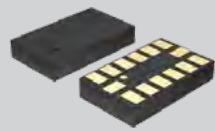
- Chameleon96-Vision\_001-130-0102\_KIT
- Chameleon96-Vision\_001-130-0102-3X\_KIT

## On-Board Analog Devices' Gyroscopes and Accelerometers



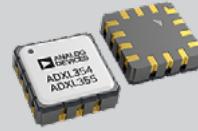
Ultralow noise, dual-axis  
MEMS Gyroscope for  
Stabilization Applications

Part #: [ADXR290\\*](#)



3-Axis,  $\pm 2\text{ g}/\pm 4\text{ g}/\pm 8\text{ g}/\pm 16\text{ g}$  Digital  
Accelerometer

Part #: [ADXL343](#)



Low Noise, Low Drift,  
Low Power, 3-Axis MEMS  
Accelerometer

Part #: [ADXL355\\*](#)

\* Only available on the Chameleon96-Vision\_001-130-0102-3X\_KIT version.

→ Contact Arrow for other board options



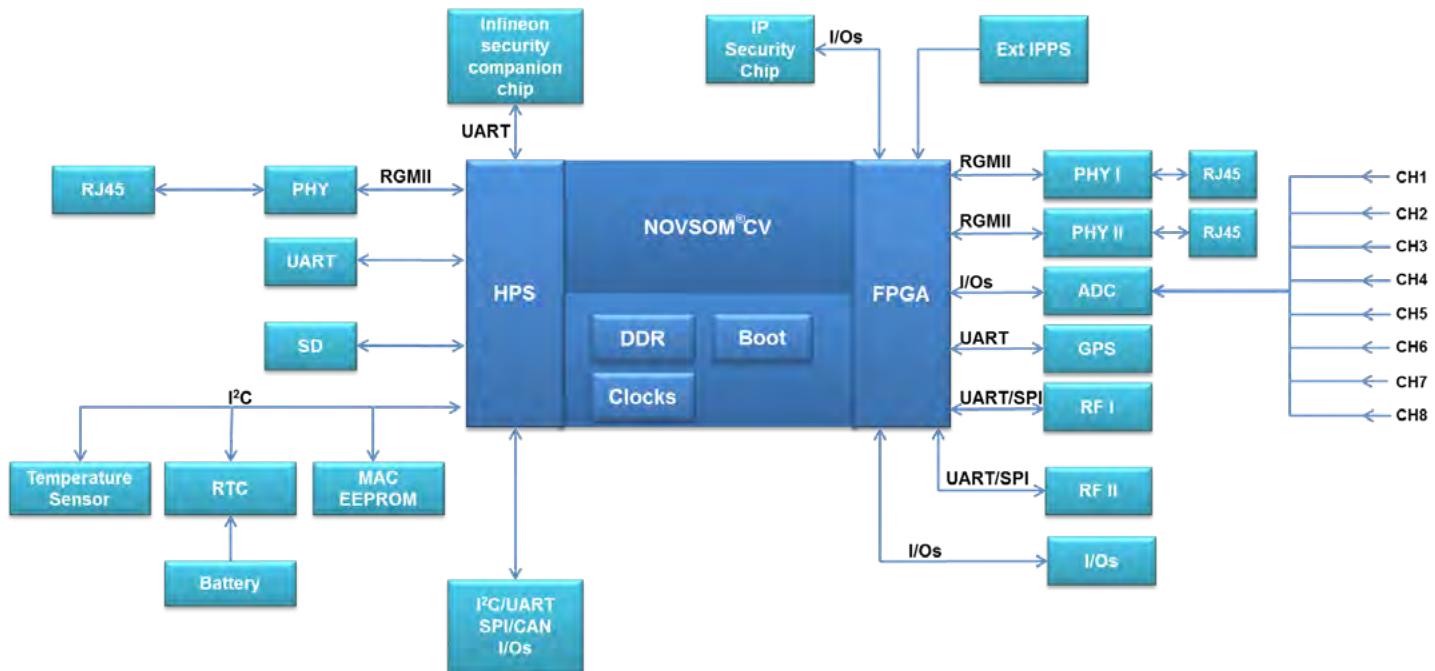
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# Cyclone® V SoC: IoTOctopus®

## Solution Overview

The IoTOctopus from NovTech serves as a high-end industrial IoT node capable of high accuracy and high sampling rate of electro-mechanical equipment. With its simultaneous 8-channels, 24-bit Sigma-Delta ( $\Sigma - \Delta$ ), 32 KHz sample rate, the IoTOctopus converts analog signals to digital data, rearranges,

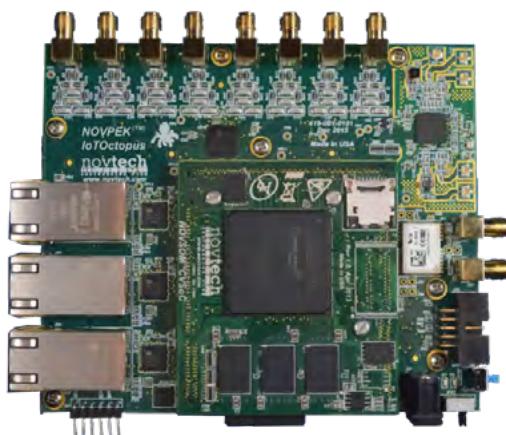
analyzes, stores and transmits data to gateways/local servers/cloud servers. Based on Cyclone V SoC, a dual-core ARM® Cortex-A9 and 110K LE fabric, the IoTOctopus processing power computes, analyzes and transmits complex data in real time.



IoTOctopus Board Block Diagram

## High-Accuracy Analog to Digital Interface in the IoTOctopus

The IoTOctopus includes a high-accuracy analog to digital interface. The IoTOctopus board includes the AD7770 – an 8-Channel, 24-Bit Simultaneous Sampling Sigma-Delta ADC.



IoTOctopus

## Applications

- > Smart grid
- > Smart city
- > Motor monitor/control
- > Engine monitor/control
- > Pump monitor/control
- > Turbine, elevator, A/C, power generator, industrial battery charging, and other electro-mechanical equipment

## Resources

Board part #:  
[IoTOctopus\\_001-125-0102\\_KIT](#)

## Key Features of the Analog Devices AD7770 Sigma-Delta ADC

### **AD7770**

24-Bit Sigma-Delta ADC with current sources, switchable reference inputs and I/O Port. Key features include

- > Single-ended or true differential inputs
- > Programmable gain amplifier (PGA) per channel (gains of 1, 2, 4, and 8)
- > Low DC input current
- >  $\pm 4$  nA (differential) and  $\pm 8$  nA (single-ended)
- > Up to 32 kSPS output data rate (ODR) per channel
- > Programmable ODRs and bandwidth

→ Contact Arrow for other board options

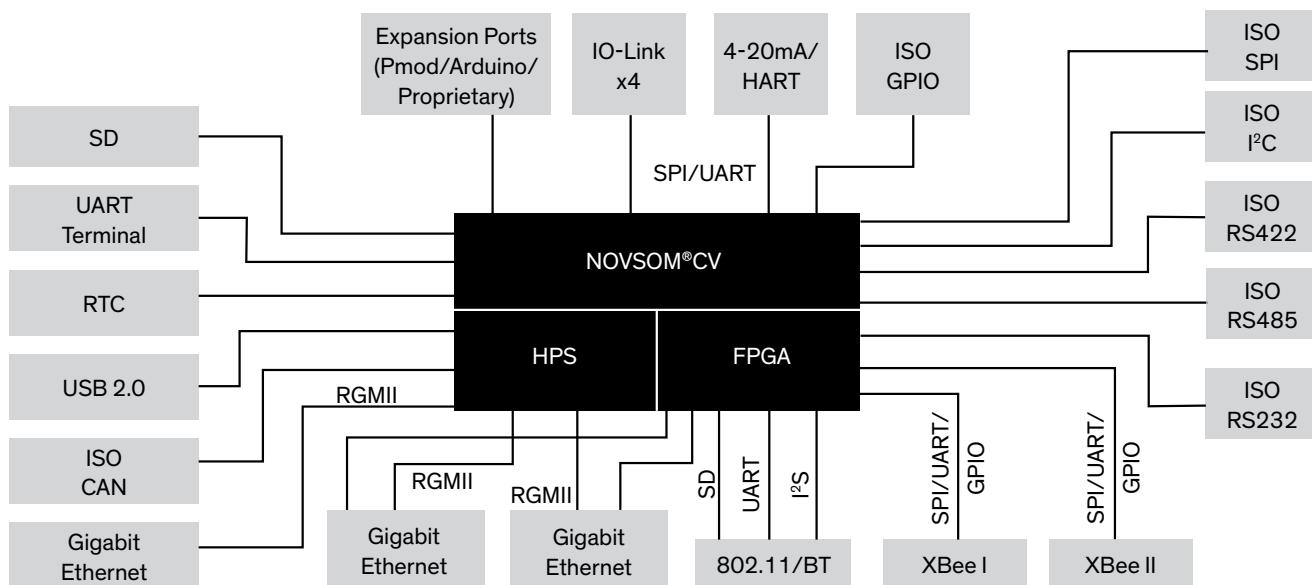


# IoTCentipede™

## Solution Overview

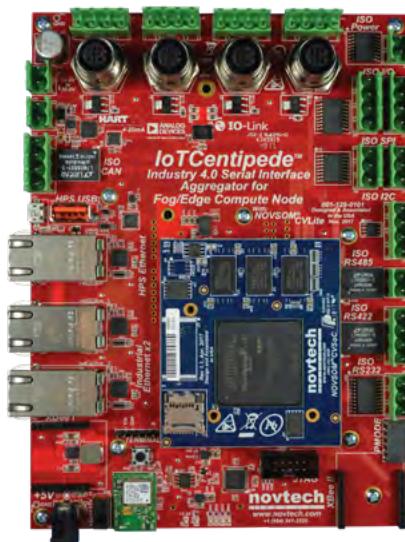
The IoTCentipede from NovTech serves as an aggregator for a large collection of serial protocols deployed in industrial automation and machinery applications. All serial connectivity ports - UART, I<sup>2</sup>C, SPI, CAN, IO-Link®, 4-20mA loop - are isolated to allow direct connection to equipment in the real world. Wireless connectivity options include Wi-Fi®, Bluetooth®,

ZigBee®, 4G/LTE, and any Xbee supported protocols. Data gathered from multiple nodes can be processed in near real-time and sent to remote locations for further analysis or storage. IoTCentipede is a development board that can also act as an ideal reference for any new design that requires multiple serial interfaces.



IoTCentipede Block Diagram

The IoTCentipede features both Pmod and Arduino connectors, enabling interoperability with data converter, sensor and “Circuit from the Lab” Pmod and Arduino shields from Analog Devices. Contact Arrow for a complete list of Analog Devices’ Pmod and Arduino boards.



IoTCentipede

## Applications

- > Equipment upgrading to Industry 4.0
- > Programmable Logic Controllers (PLCs)
- > Industrial Ethernet gateway
- > Production floor
- > Office automation

## Resources

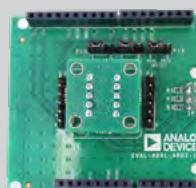
Board part #:  
[IoTCentipede\\_001-129-0102\\_KIT](#)

## Featured Pmod and Arduino Boards from Analog Devices



12-Bit, 300 kSPS, Single-Supply, Fully Isolated, Data Acquisition System for 4-20 mA Inputs

Part #: [EVAL-CN0336-PMDZ](#)



Ultra-low power, 3-axis,  $\pm 200$  g MEMS accelerometer that consumes 22  $\mu$ A at a 3200 Hz output data rate (ODR)

Part #: [EVAL-ADXL372-ARDZ](#)

All Analog Devices [Pmod Connector boards](#) and [Arduino Shields](#) are compatible with the development platform.

→ Contact Arrow for other board options



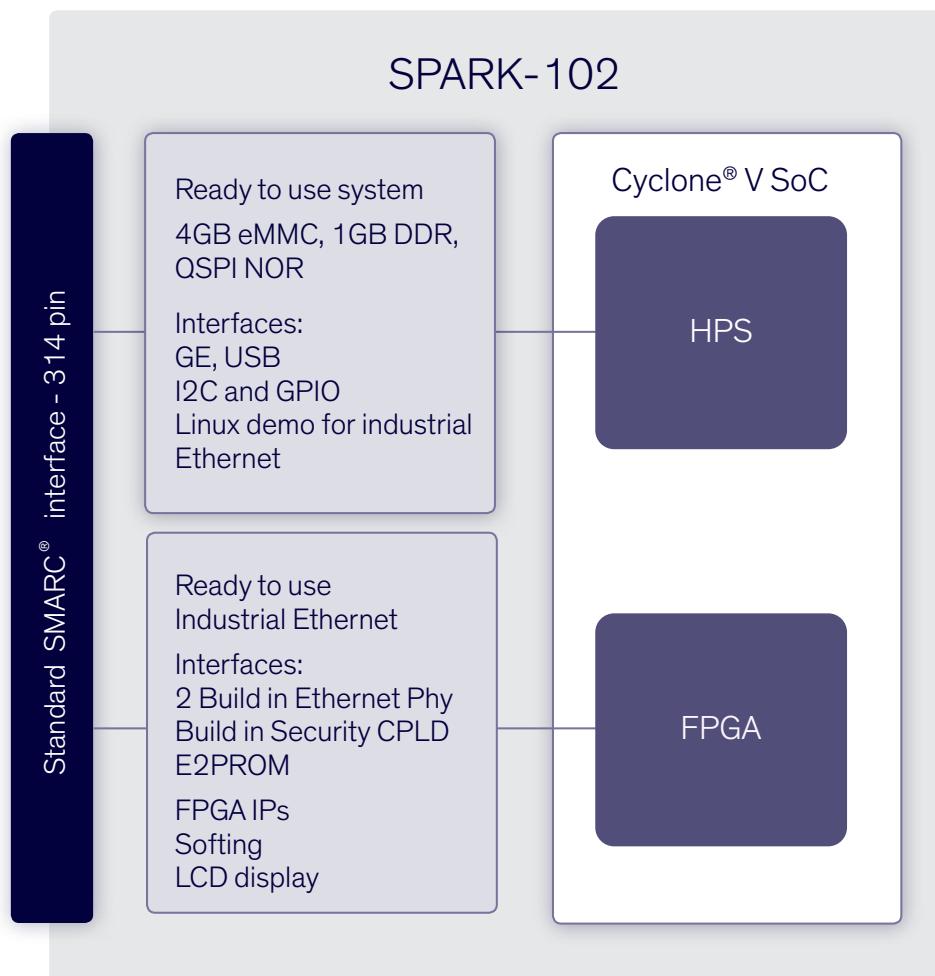
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# Cyclone® V SoC: Spark 102 SOM

## SOM Overview

The Spark-102 board from Shiratech is a low cost, ready to use industrial embedded SOM based on Cyclone V SOC. The Spark-102 combines a high performance ARM using one or two Cortex-A9 cores and a configurable FPGA. One Gigabit Ethernet and another optional two Fast Ethernet on board Phys enable

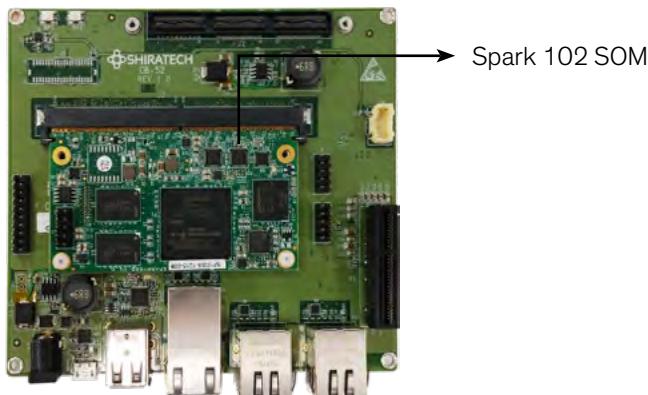
fast bring up of networking applications. The Spark-102 uses a standard SMARC interface, which is supported by key industry vendors, and ensures adherence to strict technical specifications as well as compatibility with other vendor's platforms.



Spark 102 SOM Block Diagram

## CB-52 Development Board

The CB-52 is a full-featured development board for the Shiratech Spark-102, with an emphasis on Industrial Ethernet and networking applications. It provides extensive connectivity to both HPS and FPGA, with built in networking and connectivity interfaces along with an HSMC slot for expansion modules and capacitive touch screen.



CB-52 Development Board

## Applications

- > Industrial machines
- > Industrial automation
- > Communications systems
- > Robotics, Incorporated in the device
- > Industrial Ethernet (EtherCat, Profinet, Ethernet/IP)
- > Video FPGA IP

## Resources

Board part #: [CB-52-PUS-110-SX](#)

## Featured Boards from Analog Devices



Demonstration circuit 2390A is a general-purpose test platform for prototyping and evaluating some of the key applications for the LTC2500 family of high resolution, oversampling ADCs

Part #: [DC2390A-A](#)



Dual AD channels with 14-bit resolution and data rate up to 65 MSPS (part #: AD9248)

Dual DA channels with 14-bit resolution and data rate up to 125 MSPS (part #: AD9767)

Part #: [THDB\\_ADA](#)

All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the CB-52 Development Board via the HSMC to FMC transposer board.

→ Contact Arrow for other board options



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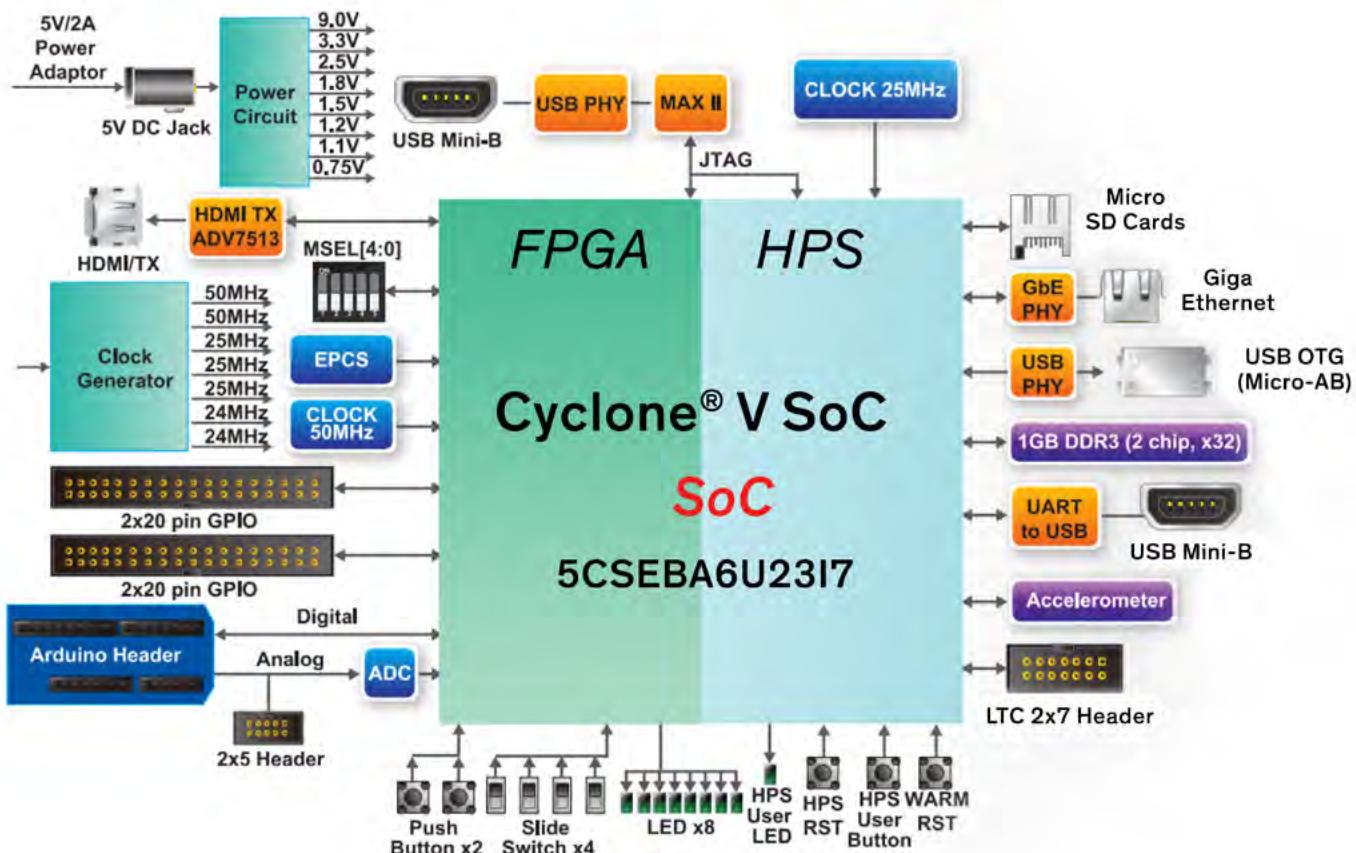
Headquartered in Hsinchu, Taiwan, Terasic is the leading developer and provider for FPGA-based hardware & complex system solution. Experience includes high-end solutions for the industrial and FPGA system markets, rugged system solutions, High Performance Computing, High Frequency Trading, network processing, radar detection, instrumentation, etc. Terasic is an approved Analog Devices Alliances Member.

# Cyclone® V SoC Development Kit: DE10-Nano Kit

## Overview

The Terasic DE10-Nano development board, based on the Cyclone V SoC FPGA (110K LEs), provides a reconfigurable hardware design platform for makers, IoT developers and educators. The kit comes with high-speed DDR3 memory,

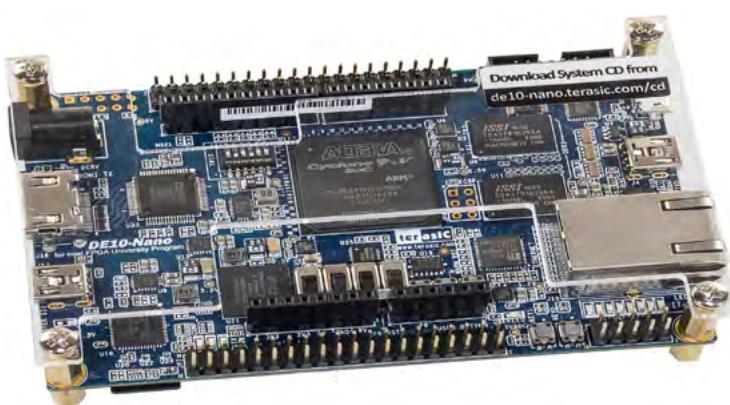
analog to digital capabilities, accelerometer, HDMI TX and Gigabit Ethernet PHY. The kit includes two GPIO expansion headers, an Arduino header, and an HDMI port.



DE10-Nano Kit Block Diagram

## DE10-Nano Development Board

The DE10-Nano features an onboard Intel® FPGA Download Cable II, SDRAM, 2x40-pin expansion headers, and a 12-Bit Resolution ADC.



DE10-Nano Development Board

## Applications

- > Education
- > Robotics & AI
- > IoT
- > Multimedia
- > Embedded system development

## Resources

Board part #: [P0496](#)

## Featured Arduino Shields from Analog Devices



Dual Electrochemical Gas Sensor with  
Temperature Compensation

Part #: [EVAL-CN0396-ARDZ](#)



Ultra-low power, 3-axis,  $\pm 200$  g MEMS  
accelerometer that consumes 22  $\mu$ A at a  
3200 Hz output data rate (ODR)

Part #: [EVAL-ADXL372-ARDZ](#)

All Analog Devices [Arduino Shields](#) for converters, sensors and “Circuit from the Lab” series are compatible with the development platform. Select Analog Devices’ Arduino boards are featured in the Arduino section of this guide.

→ Contact Arrow for other board options



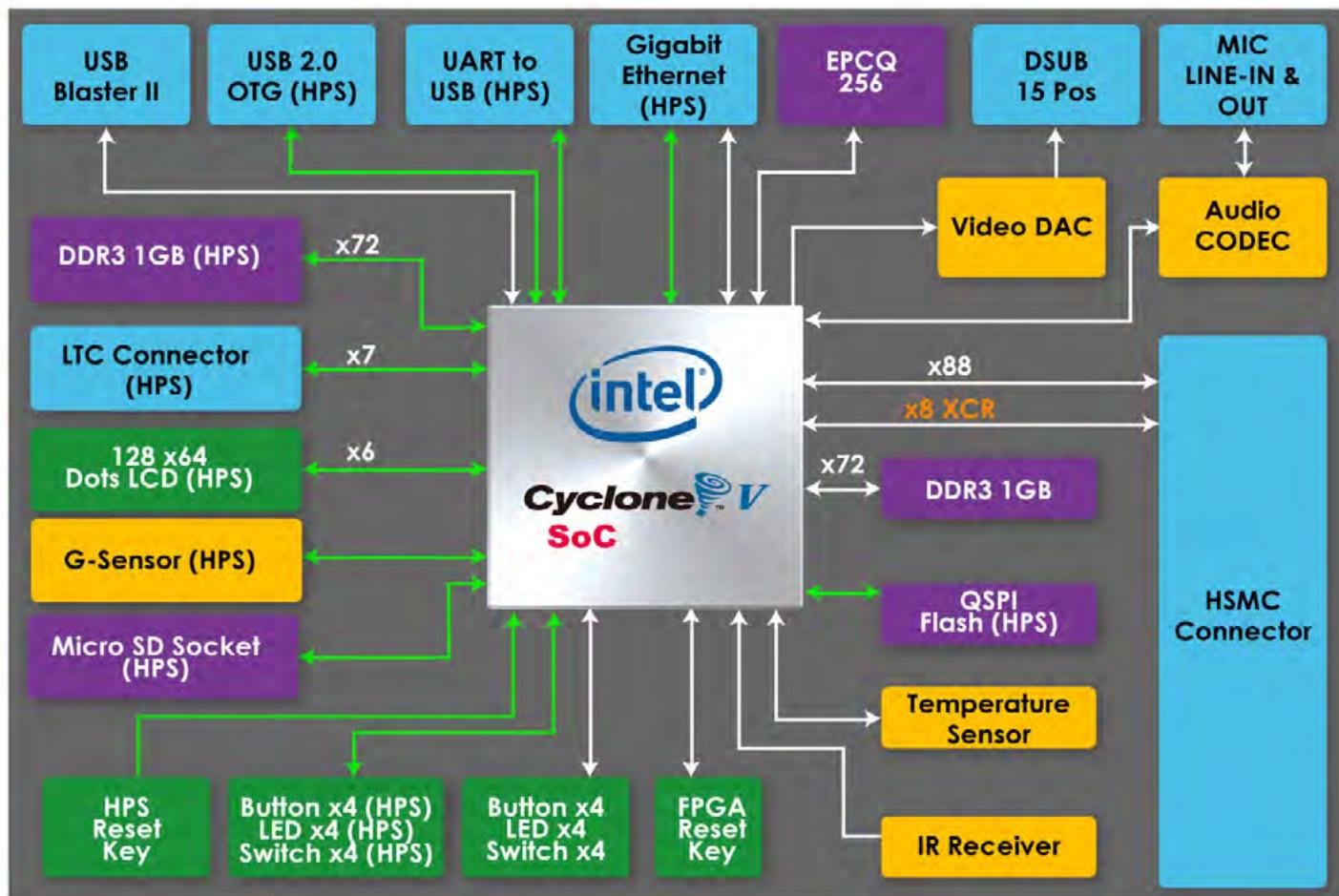
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# Cyclone® V SoC Development Kit: SoCKit

## Overview

Based on the 5CSXFC6D6F31 device, the SoCKit from Arrow offers flexibility and control to evaluate all the capabilities of the Cyclone V SoC. The SoCKit development board includes hardware such as high-speed DDR3 memory, video and audio

capabilities, and Ethernet networking. In addition, an on-board HSMC connector with high-speed transceivers allows for an even greater array of hardware setups.



Cyclone V SoCKit Block Diagram

**ALLIANCES**

## Cyclone V SoCKit

The board has features that allow users to implement a wide range of designed circuits, from simple circuits to various multimedia projects.



Cyclone® V SoCKit

## Applications

- > Industrial control
- > HMI
- > Multi-media applications
- > Prototyping and evaluation

## Resources

Board part #: [SoCKit](#)

## Featured Board from Analog Devices



Gasket adapter board that allows DC890-compatible data converter eval boards to interface with FPGA boards that have an HSMC connector like the SoCKit.

Part #: [DC2511A](#)

All Analog Devices boards with the HSMC Connector are compatible with the SoCKit. Boards with the [FMC Connector](#) can also be used via the HSMC to FMC transposer board. Select Analog Devices' FMC boards are featured in the FMC section of this guide.

→ Contact Arrow for other board options



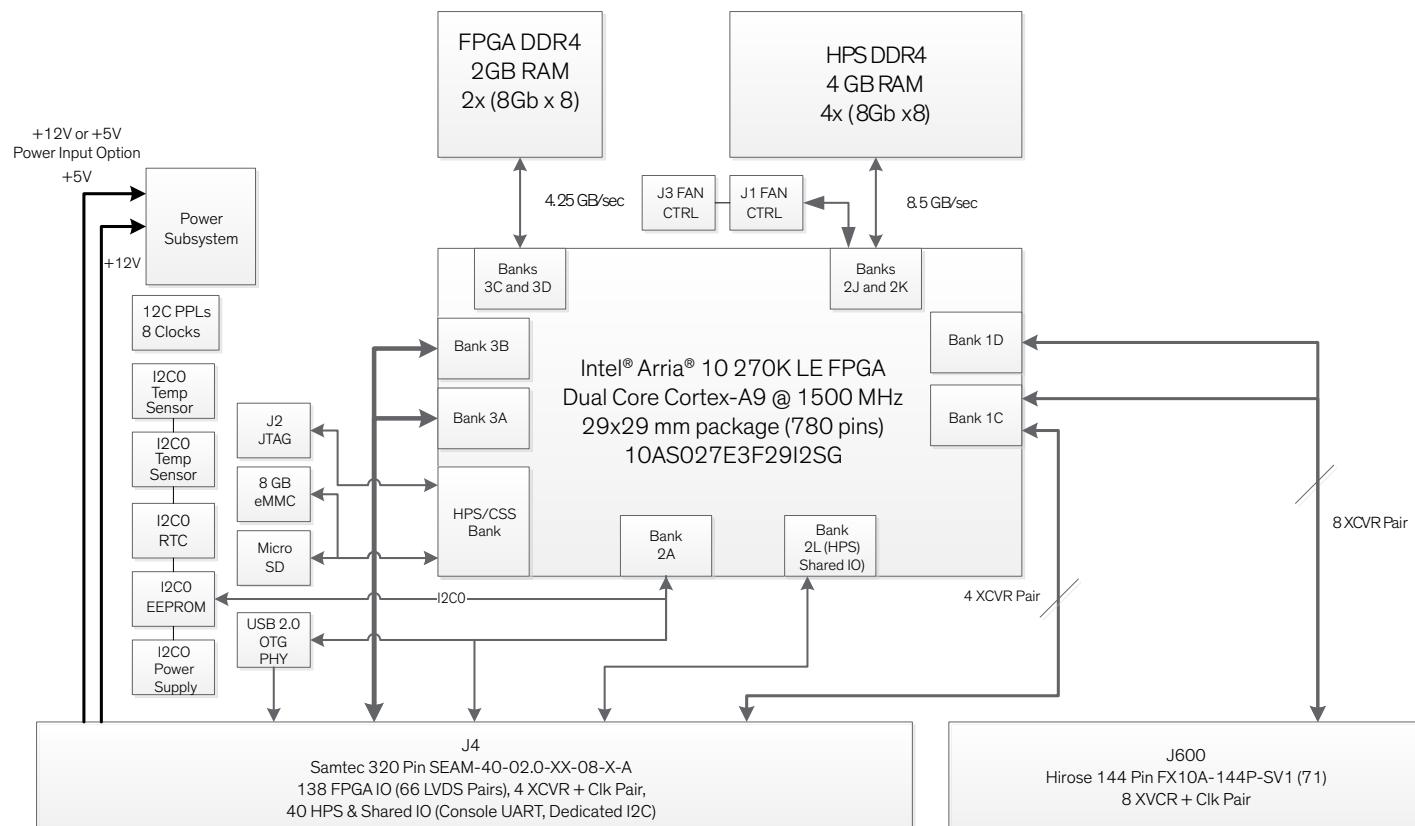
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# Intel® Arria® 10: MitySOM-A10S

## SOM Overview

The Critical Link MitySOM-A10S with dual-side connectors is an Intel Arria 10 SoC board-level solution for machine vision and scientific imaging applications, and other stack-through configurations. In addition to the Intel Arria 10 processor, the module includes on-board power supplies, two DDR4 RAM memory subsystems, micro SD card, a USB 2.0 on the go (OTG) port, and a temperature sensor. The MitySOM-A10S-DSC provides a complete and flexible CPU infrastructure for highly integrated embedded systems.

The MitySOM-A10S-DSC is available with a 270K LE Intel Arria 10 SX which provides dual-core Cortex-A9 32-bit RISC processors with dual NEON SIMD coprocessors. Options up to 480K LE devices are available. This MPU can run a rich set of real-time operating systems containing software APIs expected by modern system designers. The ARM architecture supports several operating systems, including Linux.



MitySOM-A10S SOM Block Diagram

## MitySOM-A 10S Development Kit

MitySOM-A10S development kit includes the baseboard, the MitySOM and design files for the base board. It also comes with a carrier board design guide available for custom board development. The baseboard includes an FMC connector for interfacing with analog base boards.



MitySOM-A10S Development Kit

## Applications

- > Test and measurement
- > Industrial automation and control
- > Industrial instrumentation
- > Medical instrumentation
- > Embedded imaging
- > Machine vision
- > Medical imaging
- > Closed loop motor control

## Resources

Board part #: [80-001181](#)

## Featured Board from Analog Devices



The ADRV9009-W/PCBZ is a radio card designed to showcase the ADRV9009, the widest bandwidth, highest performance RF integrated transceiver. The radio card provides a single 2x2 transceiver platform for device evaluation and rapid prototyping of radio solutions.

Part #: [ADRV9009-W/PCBZ](#)

All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the MitySOM-A10S development kit. Select Analog Devices' FMC boards are featured in the FMC section of this guide.

→ Contact Arrow for other board options



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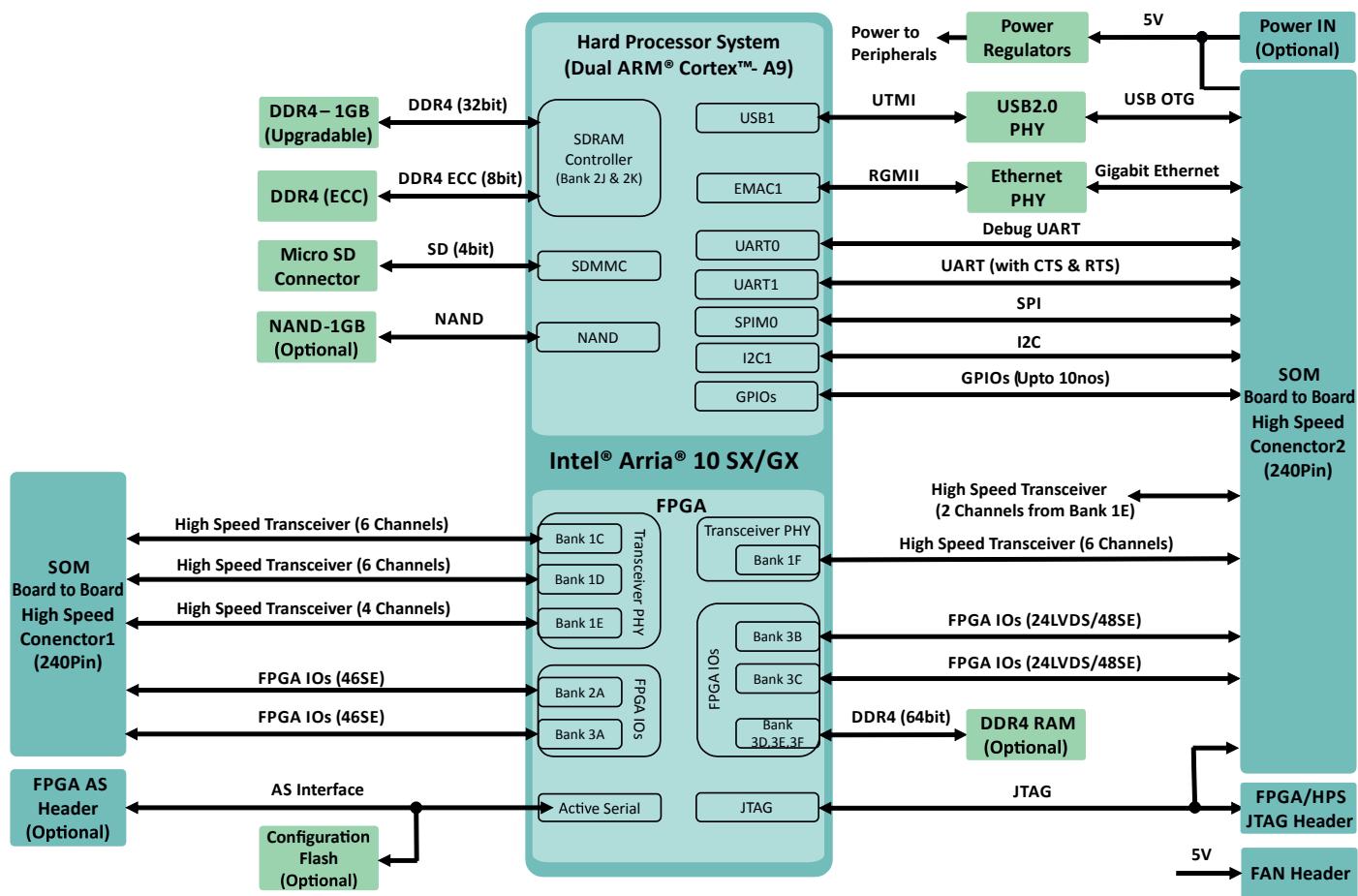
Established in 1999, iWave focuses on standard and customized System on Module/ SBC product development in Industrial, Medical, Automotive & Embedded Computing application domains. iWave Systems Provides engineering design services involving embedded hardware, FPGA and software development. iWave is a certified ARM partner and Platinum member of the Intel FPGA Design Solution Network, and is headquartered in Bangalore, India.

# Intel® Arria® 10 FPGA SoC: iW-RainboW-G24M SOM and Development Platform

## SOM Overview

iWave's Intel Arria 10 SoC System on Module is based on the Intel Arria 10 SX family device with F34 package. The module is equipped with 32-bit DDR4 memory support for HPS with

optional ECC and 64-bit DDR4 support for FPGA. All the IOs and high speed transceiver blocks will be available on the SOM board to board connector.



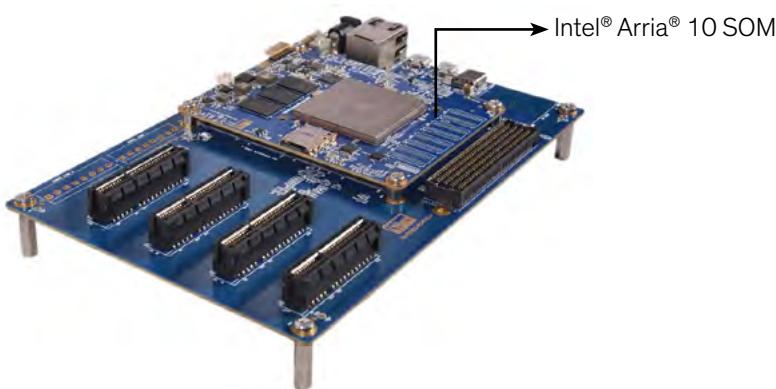
Note:

- HPS (Hard Processing System) is supported only in Intel® Arria®10 SoC family (SX) devices
- All IOs in SOM Board to Board connectors are 1.8V tolerant IOs. Optic, Bank 2A and Bank 3A supports variable IO level setting (1.8V, 1.5V, 1.35V, 1.2V)
- Each FPGA IO Bank (2A, 3A, 3B, 3C) which goes to Expansion connectors support two General Purpose Clock input (1 in 2A) & two General Purpose Clock Output (LVDS/SE)
- Since 3D, 3E & 3F banks are available only in some version of Arria10 parts, FPGA DDR4 (64bit) can be supported only where these banks supported devices are used

iW-RainboW-G24M SOM Block Diagram

## iWave Intel Arria 10 SoC FPGA Development Kit

iWave's Intel Arria 10 SoC/FPGA Development kit comprises of Intel Arria 10 SoC/FPGA SOM and custom carrier card. The SOM is equipped with 32-bit DDR4 memory support for HPS with optional ECC and 64-bit DDR4 support for FPGA. The Intel Arria10 development kit carrier board supports required set of features like Dual FMC Connector, Display Port, SATA 3.0, Type C USB3.0 Port, PCIe x 1 Lane, HD-SDI IN/OUT & SFP+ Port and other On-Board connectors to validate Intel Arria10 SoC HPS interfaces.



Intel Arria 10 SoC FPGA Development Kit

## Applications

- > High processing computing
- > High precision test & measurement
- > Medical imaging diagnostics equipment
- > Wireless infrastructure
- > Broadcasting & distribution equipment
- > Compute & storage equipment
- > Control and intelligence equipment
- > Cloud computing

## Resources

Board part #:

- [IW-G24D-CU2F-4E002G-S008G-LCC](#)
- [iW-G24M-CU2F-4E002G-S000G-BEC](#)
- [iW-G24D-CU2F-4E002G-S008G-LCF](#)
- [iW-G24M-CU2F-4E002G-S000G-BEE](#)

## Featured Board from Analog Devices



The AD-FMCDAQ2-EBZ module is comprised of the AD9680 dual, 14-bit, 1.0 GSPS, JESD204B ADC, the AD9144 quad, 16-bit, 2.8 GSPS, JESD204B DAC, the AD9523-1 14-output, 1GHz clock, and power management components.

Part #: [AD-FMCDAQ2-EBZ](#)

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All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the development platform. Select Analog Devices' FMC boards are featured in the FMC section of this guide.

→ Contact Arrow for other board options



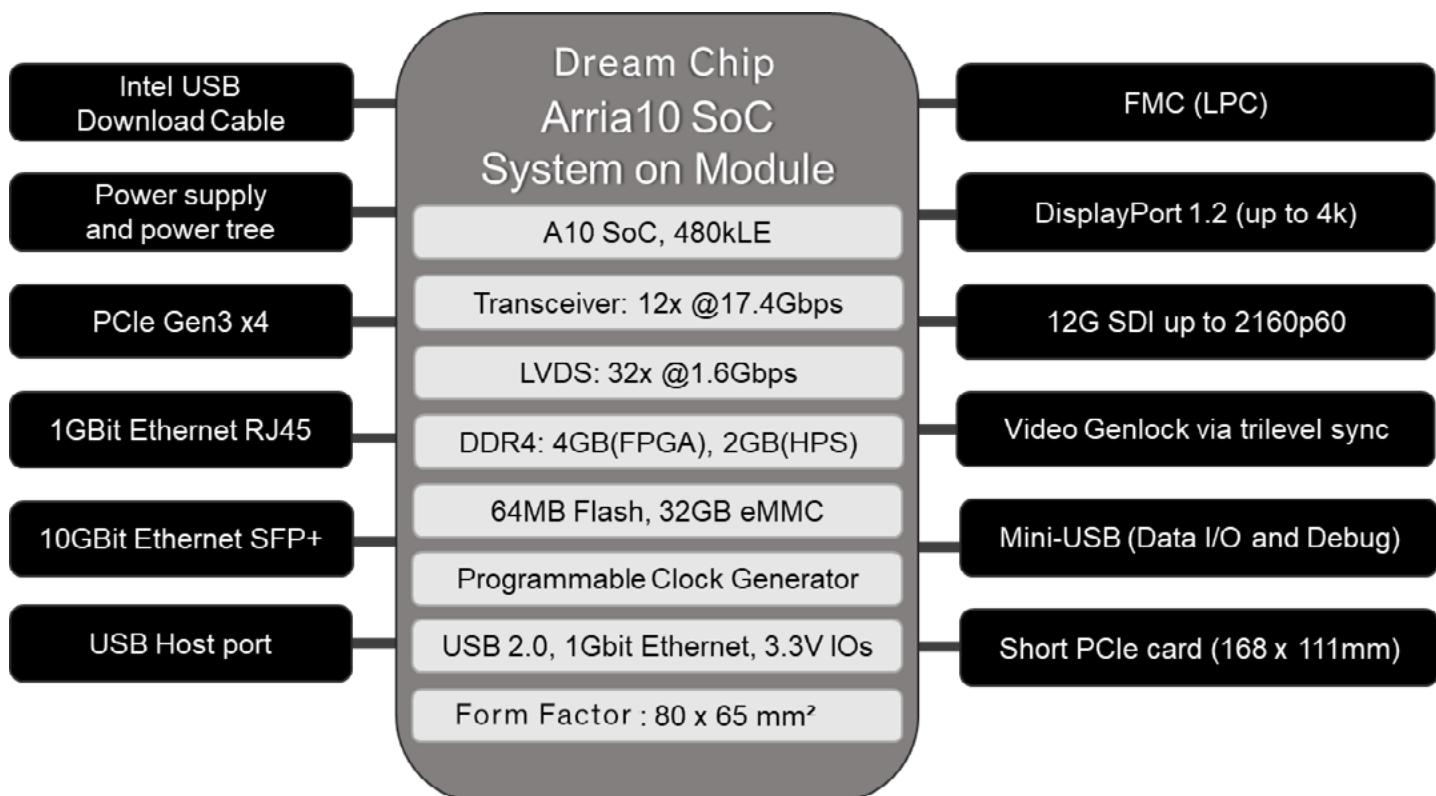
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# Dream Chip with Intel® Arria® 10 SOM and Evaluation Baseboard

## SOM Overview

The Dream Chip with Intel Arria 10 SOM was developed with an emphasis on embedded and various vision applications. Using the Intel Arria 10 SoC devices (with 160 to 480K LEs) in the 29×29 mm package, the module offers a multitude of interfaces

in a small 8 cm by 6.5 cm form factor. Power management on the module guarantees proper power-up and -down sequence, only 12V to be supplied by baseboard.



Dream Chip with Intel Arria 10 SoC SOM and Baseboard Block Diagram

## Dream Chip with Intel Arria 10 Evaluation Baseboard Overview

The baseboard features include 1GBit Ethernet, 10Gbit Ethernet, PCIe Gen3 x4, USB 2.0 Host/Device, USB UART, video Genlock input, and an FMC LPC expansion connector.



Dream Chip with Intel  
Arria 10 SOM



Dream Chip with Intel Arria 10 Evaluation  
Baseboard

## Applications

- > Embedded
- > Machine and intelligent vision
- > Industrial
- > Military
- > Single and multi camera systems
- > Vision platforms

## Resources

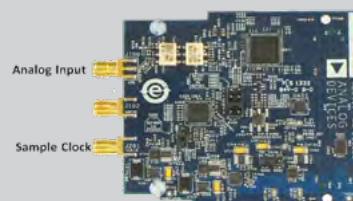
Board part #: [DCT10A-DEVKIT](#)

## Featured Boards from Analog Devices



AD9434 ADC Evaluation Board, 500MSPS  
SPI, Controller/VisualAnalog IDE

Part #: [AD9434-FMC-500EBZ](#)



AD9467 Evaluation Board (16-bit, monolithic,  
IF sampling analog-to-digital converter),  
250MSPS

Part #: [AD9467-FMC-250EBZ](#)

All Analog Devices [FMC LPC Connector boards](#) for converters and RF transceivers are compatible with the development platform.

→ Contact Arrow for other board options



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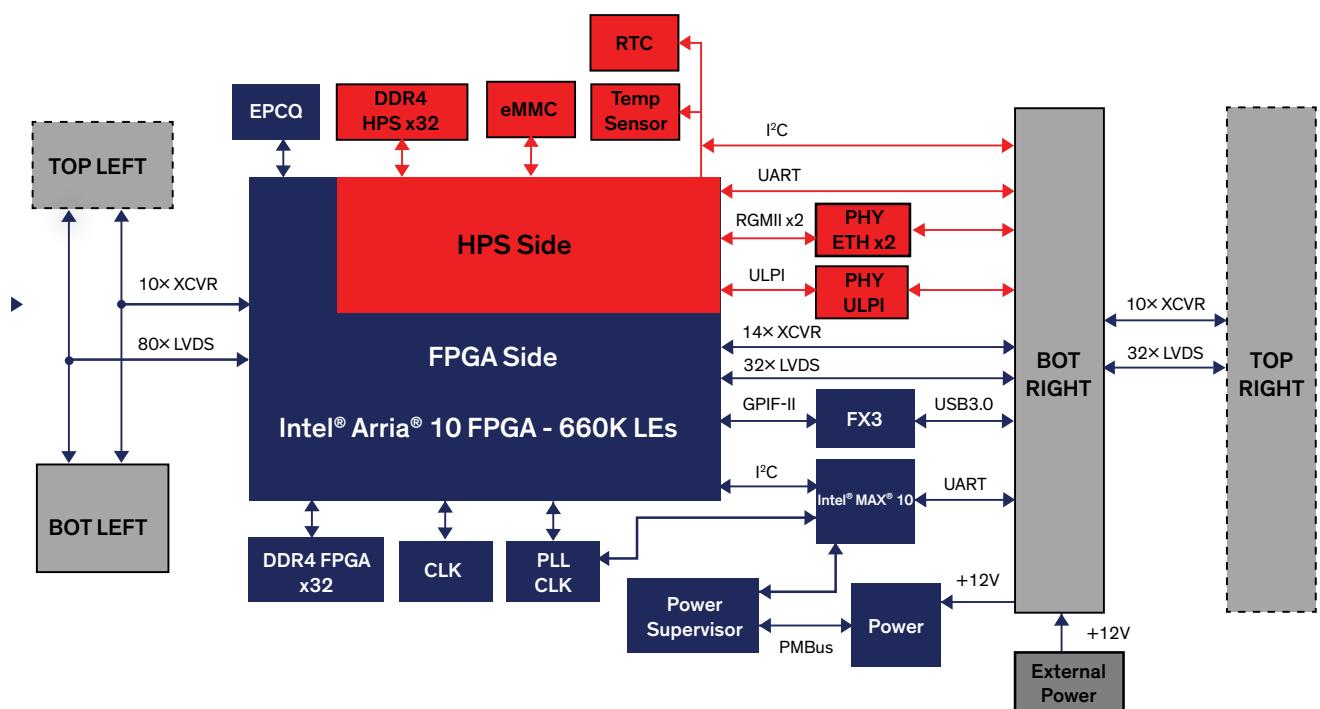
Since 2000, REFLEX CES has been designing and manufacturing high-speed boards and rugged system solutions based on high-density FPGAs and processors. The company has vast experience in leading-edge FPGA technology, and is always at the forefront of the market and trends. REFLEX CES employs 100+ people, and is based in France (Paris area). REFLEX CES is an approved Analog Devices Alliances Member.

## Intel® Arria® 10 SoC: Achilles SOM

### SOM Overview

The REFLEX CES Intel Arria10 SoC SOM provides to developers the best out-of-the box experience combining the Best-In-Class compact hardware platform and the most efficient intuitive software environment. Featuring an ARM dual-core Cortex-A9

MPCore and up to 660K LEs of advanced low-power FPGA logic elements, the Intel Arria 10 SoC combines the flexibility and ease of programming of a CPU with the configurability and parallel processing power of an FPGA.



Achilles Intel Arria 10 SoC SOM Block Diagram

## Achilles Instant-Development Kit

Achilles Instant-DevKit is comprised of the Intel Arria 10 SoC SOM plus a Starter board for quick prototyping and application testing. Comprehensive reference designs are available for a good out-of-the-box experience. Source code is included in the reference designs.



Achilles Development Kit

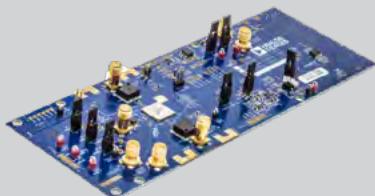
## Applications

- > Automotive
- > Video broadcast
- > Machine and intelligent vision
- > Industrial, military
- > Test & measurement
- > Medical

## Resources

Board part #:  
[RXCA10S066PF34-IDKOSA](#)

## Featured Boards from Analog Devices



The AD9208-3000EBZ supports the AD9208-3000, a 14-bit, 3GSPS dual analog-to-digital converter (ADC)

Part #: [AD9208-3000EBZ](#)



AD9172 16 Bit 12.6G Samples Per Second Digital to Analog Converter (DAC) Evaluation Board

Part #: [AD9172-FMC-EBZ](#)

All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the development platform. Select Analog Devices' FMC boards are featured in the FMC section of this guide.

→ Contact Arrow for other board options



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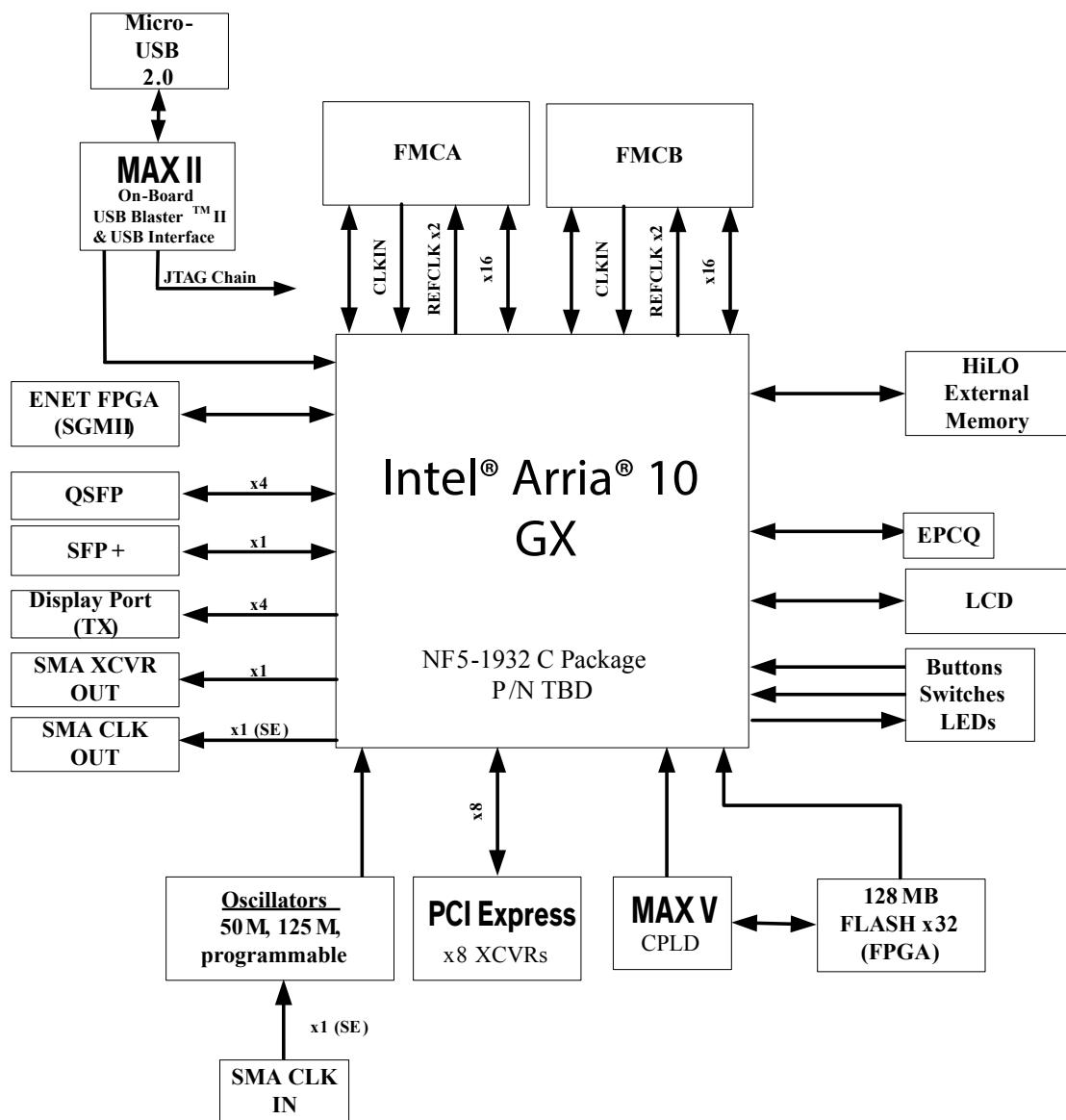
Headquartered in Hsinchu, Taiwan, Terasic is the leading developer and provider for FPGA-based hardware & complex system solution. Experience includes high-end solutions for the industrial and FPGA system markets, rugged system solutions, high performance computing, high frequency trading, network processing, radar detection, instrumentation, etc. Terasic is an approved Analog Devices Alliances Member.

# Intel® Arria® 10 GX FPGA Development Kit

## Kit Overview

The Intel Arria 10 GX FPGA Development Kit delivers a complete design environment that includes all hardware and software needed to start taking advantage of the performance and

capabilities available in Intel Arria 10 GX FPGAs. The board runs on the Intel Arria 10 GX 10AX115S2F45I1SG2 FPGA.



Intel Arria 10 GX FPGA Development Kit Block Diagram

## FMC Connector for a Scalable Approach

The kit allows development of modular and scalable designs by using the FPGA mezzanine card (FMC) connectors to interface to a FMC mezzanine card provided by Analog Devices and supporting protocols, such as JESD204B.



Intel Arria 10 GX FPGA Development Kit

## Applications

- > High performance computing
- > Military and aerospace
- > Designs needing PCI expresss (PCIe) 3.0
- > Designs needing high-performance memory (DDR4, DDR3, QDR IV, and RLDRAM III)

## Resources

Board part #: [DK-DEV-10AX115S-A](#)

## Featured Boards from Analog Devices



16-Bit, 12 GSPS, RF DAC

Part #: [AD9162-FMCC-EBZ](#)



14-Bit, 3GSPS, JESD204B, Dual ADC

Part #: [AD9208-3000EBZ](#)

All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the development platform. Select Analog Devices' FMC boards are featured in the FMC section of this guide.

→ Contact Arrow for other board options



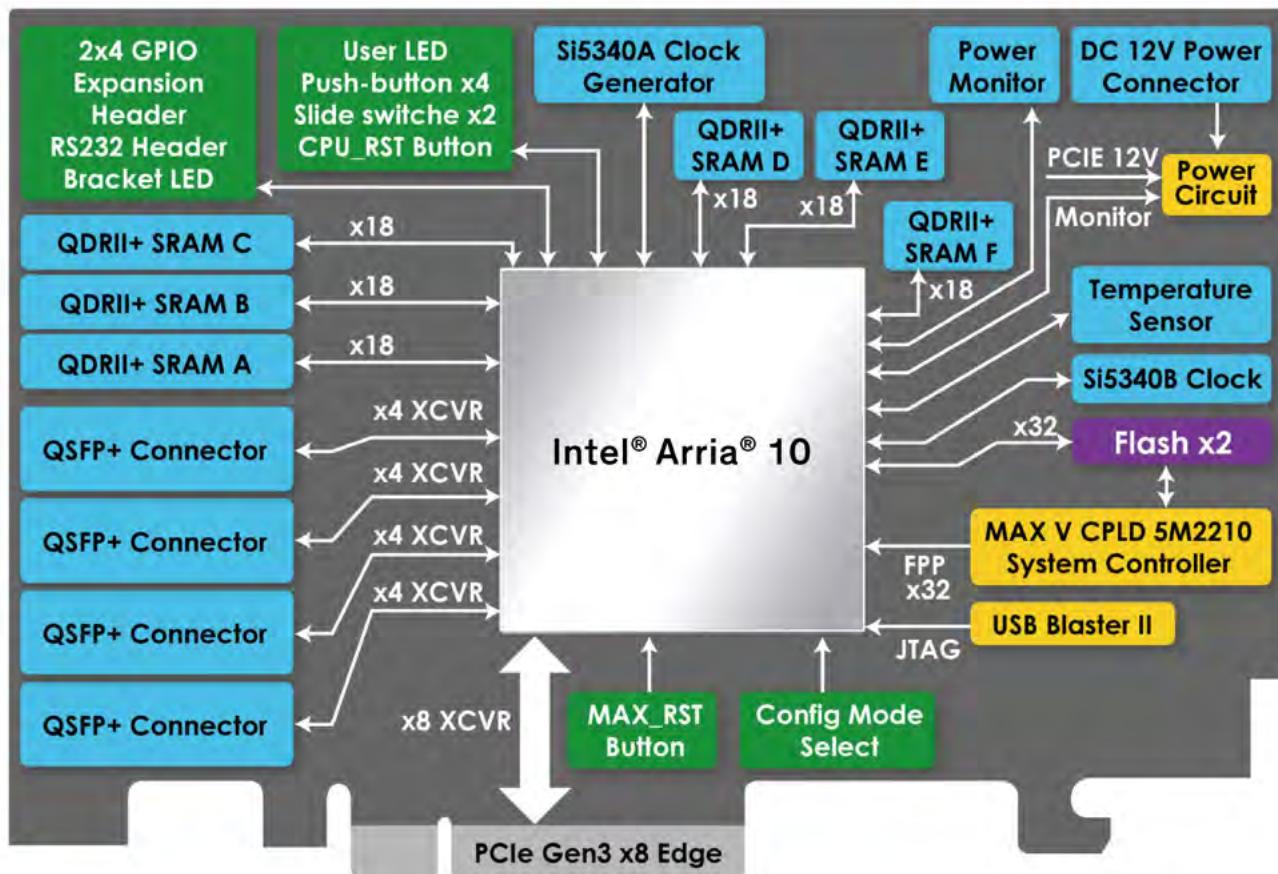
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## TR10a-HL Arria 10 Acceleration Card

### Kit Overview

The Terasic TR10a-HL Arria® 10 GX FPGA Development Kit is ideal for designs that demand high capacity and bandwidth, memory interfacing, ultra-low latency communication, and power efficiency. The TR10a-HL is fully compliant with version 3.0 of the PCI Express standard, supporting ultra low-latency,

and straight connections to four external 100G/40G QSFP28 modules. Also included are four independent banks of DDR4 SO-DIMM sockets with error correction code (ECC) and up to 8GB@1200MHz for each socket.



TR10a-HL Arria 10 Acceleration Card Block Diagram

## Development Kit Hardware Contents

- 115K LEs; On-Board USB Blaster II or JTAG Header for FPGA programming
- Four QSFP+ Connectors; 8 PCI Express Edge Connectors (includes Windows PCIe drivers)
- Six Independent 550 MHz QDRII+SRAMs, 18-bits Data Bus and 72Mbit for each
- 50 MHz Oscillator, Programmable Clock Generator
- Temperature Sensor, Power Monitor; Fan Control ;One RS422 Expansion Header

## Applications

- > Low-latency trading
- > Cloud computing
- > High-performance computing
- > 5G
- > Military & aerospace
- > Medical & biotech
- > Industrial control



TR10a-HL Arria 10 Acceleration Card

## Resources

Board part #: [P0497](#)

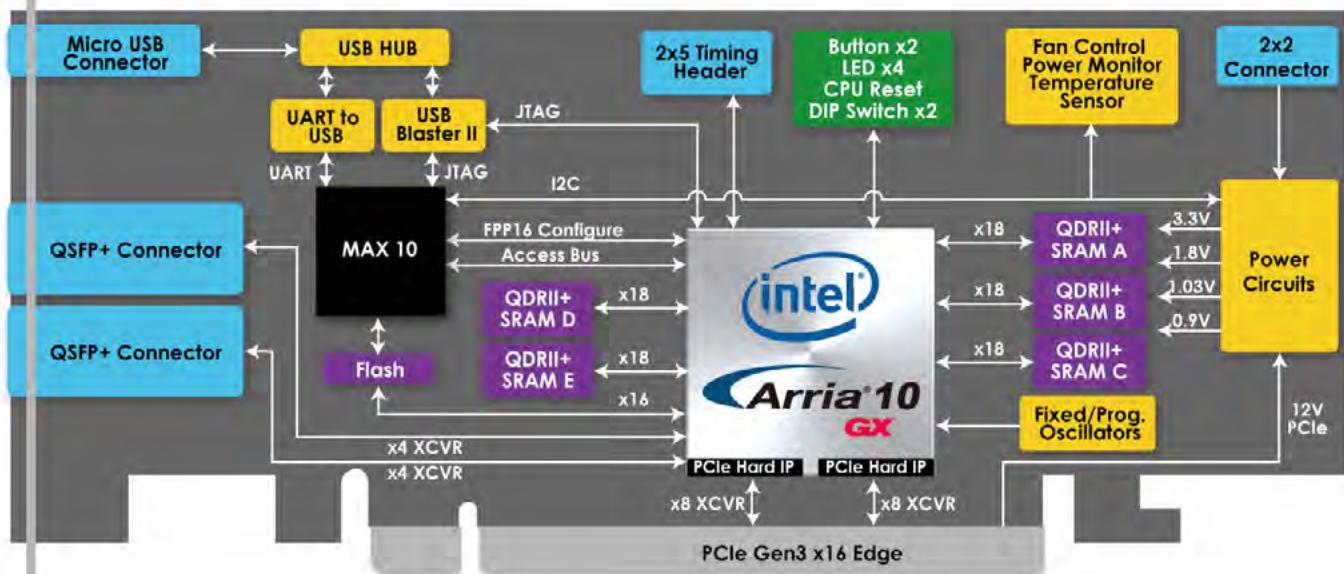


# TR10a-LPQ Arria 10 Acceleration Card

## Kit Overview

Inspired by the demands of AI, Data Center, and High Frequency Trading, Terasic's TR10a-LPQ (DDR4 & QDRII) are purpose-built for acceleration and high-speed connectivity applications to address the demands of the next-generation high-performance systems. The TR10a-LPQ is fully compliant with version 3.0 of the PCI Express standard, and supports ultra low-latency,

straight connections to two external 40G QSFP+ modules. Also included are five ports of QDRII+ SRAM (QDRII version)/ two independent banks of DDR4 (DDR4 version), high-speed parallel flash memory. The board has an Intel Arria 10 GX FPGA (10AX115N2F45E1SG) with 115K LEs.



TR10a-LPQ Arria 10 FPGA Board Block Diagram

## Development Kit Hardware Contents

- PCIe low profile form-factor
- PCIe x16 edge connector (includes dual pcie gen3 x8 interfaces)
- Allows ultra-low-latency, straight connections to 2 external 40G QSFP+ modules
- UART to USB for board management
- 2×5 timing expansion header for 1pps or other high precision clock inputs

## Applications

- > High frequency trading
- > Cloud computing
- > High-performance computing
- > 5G connectivity
- > Military & aerospace
- > Medical & biotech



TR10a-LPQ Arria 10 Acceleration Card

## Resources

Board part #: [P0562](#)



Headquartered in Hsinchu, Taiwan, Terasic is the leading developer and provider for FPGA-based hardware & complex system solution. Experience includes high-end solutions for the industrial and FPGA system markets, rugged system solutions, high performance computing, high frequency trading, network processing, radar detection, instrumentation, etc. Terasic is an approved Analog Devices Alliances Member.

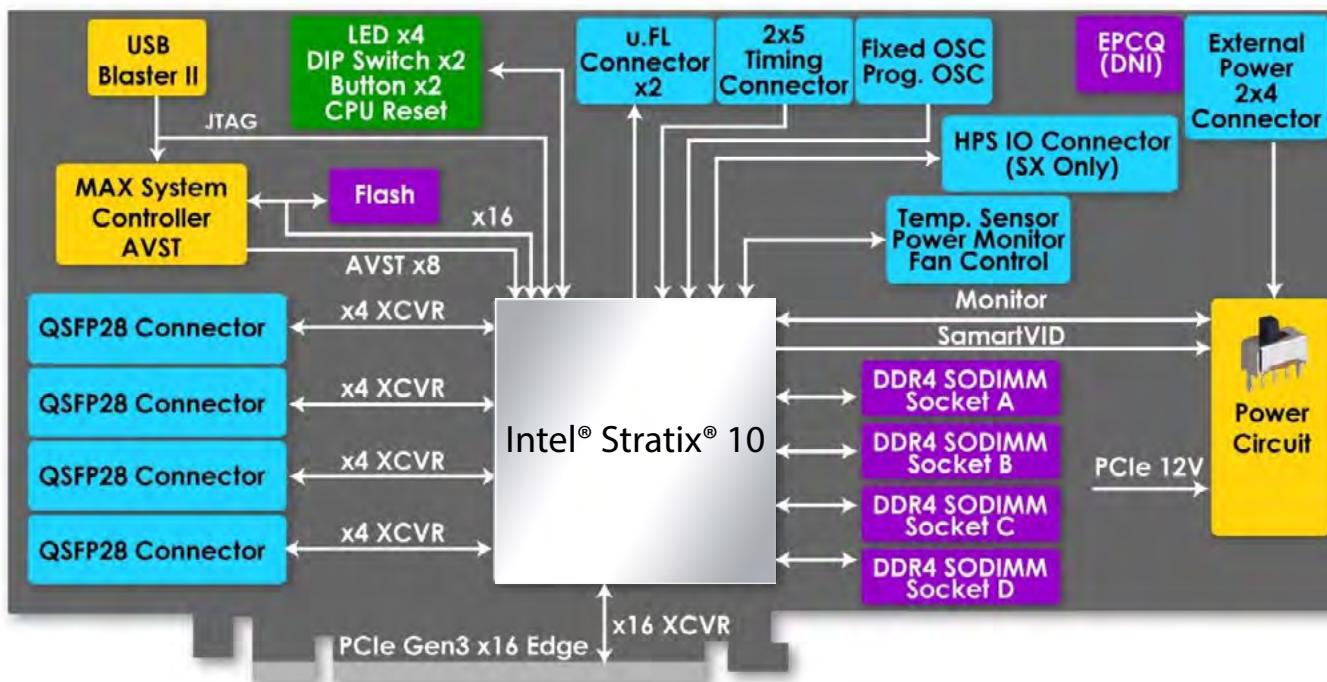
# DE10-Pro Stratix® 10 GX/SX FPGA Development Kit

## Kit Overview

Terasic DE10-Pro Stratix 10 GX/SX (2800K LEs) FPGA Development Kit is ideal for designs that demand high capacity and bandwidth memory interfacing, ultra-low latency communication, and power efficiency.

The Intel Stratix 10 GX/SX FPGA features integrated transceivers that transfer at a maximum of 28 Gbps, allowing the DE10-Pro to be fully compliant with version 3.0 of the PCI Express standard, as well as allowing an ultra low-latency,

straight connections to four external 100G/40G QSFP28 modules. Not relying on an external PHY will accelerate mainstream development of network applications enabling customers to deploy designs for a broad range of high-speed connectivity applications. For designs that demand high capacity and high speed for memory and storage, the DE10-Pro provides 4 independent banks of DDR4 SO-DIMM RAM modules and high-speed parallel flash memory.



DE10-Pro Kit Block Diagram

## DE 10-Pro Kit

The DE10-Pro board includes PCIe 3.0, 100G/40G QSFP28 modules, 4 DDR4 SO-DIMM RAM and high speed parallel flash memory for high speed connectivity applications. The feature-set of the DE10-Pro fully supports all high-intensity applications such as low-latency trading, data acquisition, network processing, etc.



DE10-Pro Kit

## Applications

- > Low-latency trading
- > AI & deep learning
- > High-performance computing
- > Hardware security solutions & gateways
- > Military & aerospace
- > Broadcast & video

## Resources

Board part #: [P0576](#)

## FPGAs Supported

Intel Stratix 10 FPGA

- DE10-Pro-GH1E2S1: 1SG280HU1F50E2VGS1
- DE10-Pro-GL2E1: 1SG280LU2F50E1VG
- DE10-Pro-SL2E2S2: 1SX280LU2F50E2VGS2

## Memory Supported

- Four SO-DIMM Sockets, support DDR4 SDRAM, QDR-IV and QDRII+ memory modules
- 128M Parallel FLASH



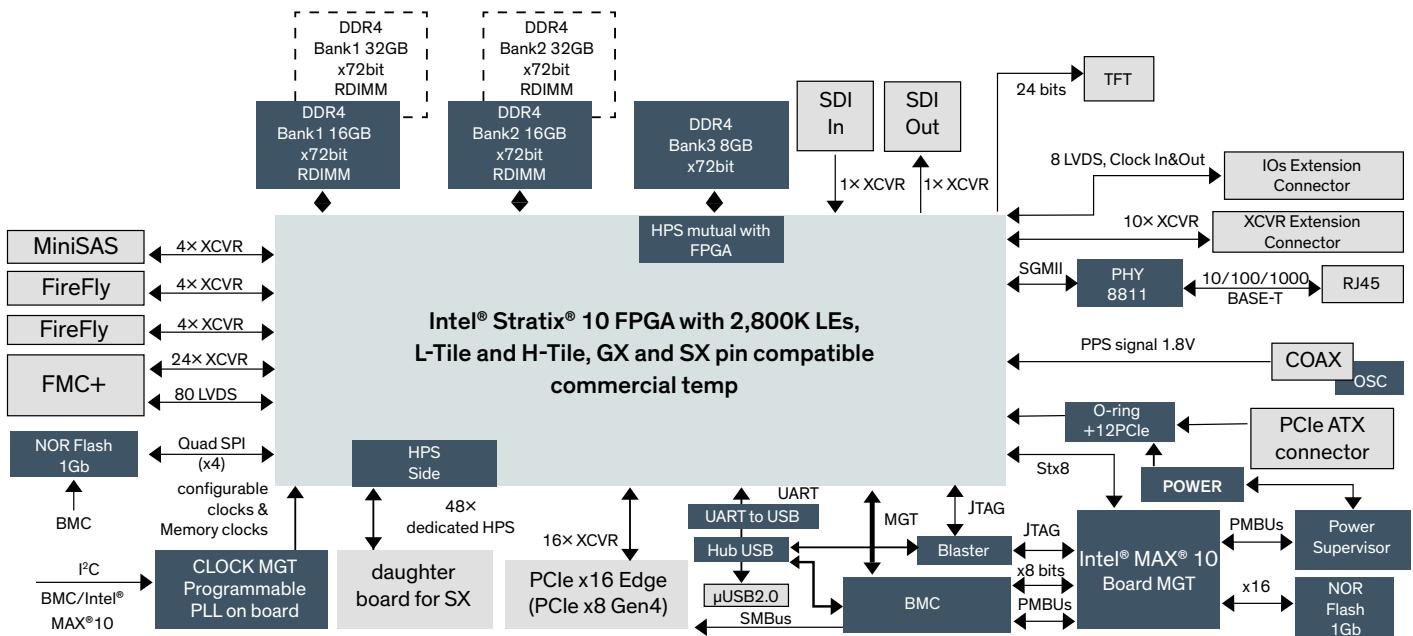
Since 2000, REFLEX CES has been designing and manufacturing high-speed boards and rugged system solutions based on high-density FPGAs and processors. The company has vast experience in leading-edge FPGA technology, and is always at the forefront of the market and trends. REFLEX CES employs 100+ people, and is based in France (Paris area). REFLEX CES is an approved Analog Devices Alliances Member.

# Intel® Stratix® 10 FPGA: Sargon Instant-Development Kit FMC+ IDK

## Kit Overview

The Intel Stratix 10 FPGA FMC+ Instant-Development Kit from REFLEX CES provides developers a solid out-of-the box experience, combining compact hardware platform with the most efficient intuitive software environment. Its unique install

and GUI interface allows an immediate start, and its reference designs enable fast turn-around designs, shortening and securing developments.



Sargon Instant-Development Kit FMC+ IDK Block Diagram

## First Intel Board with the FMC+ Connector

FMC+ is the latest standard in the popular VITA FMC family. This specification increases the performance of FMC Standard by extending the total number of Gigabit Transceivers to 32 and increasing the maximum data rate to 28 Gbps.



Sargon Instant-Development Kit FMC+ IDK

## Applications

- > High performance computing
- > IP & ASIC prototyping

## Resources

Board part #:  
[RXCS10X280HAF50-IDK00A](#)

## Featured Board from Analog Devices



The ADRV9009-W/PCBZ is a radio card designed to showcase the ADRV9009, the widest bandwidth, highest performance RF integrated transceiver. The radio card provides a single 2x2 transceiver platform for device evaluation and rapid prototyping of radio solutions.

Part #: [ADRV9009-W/PCBZ](#)

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All Analog Devices [FMC+ Connector boards](#) for converters and RF transceivers are compatible with the development platform. Boards supporting FMC+ are currently in development.

→ Contact Arrow for other board options



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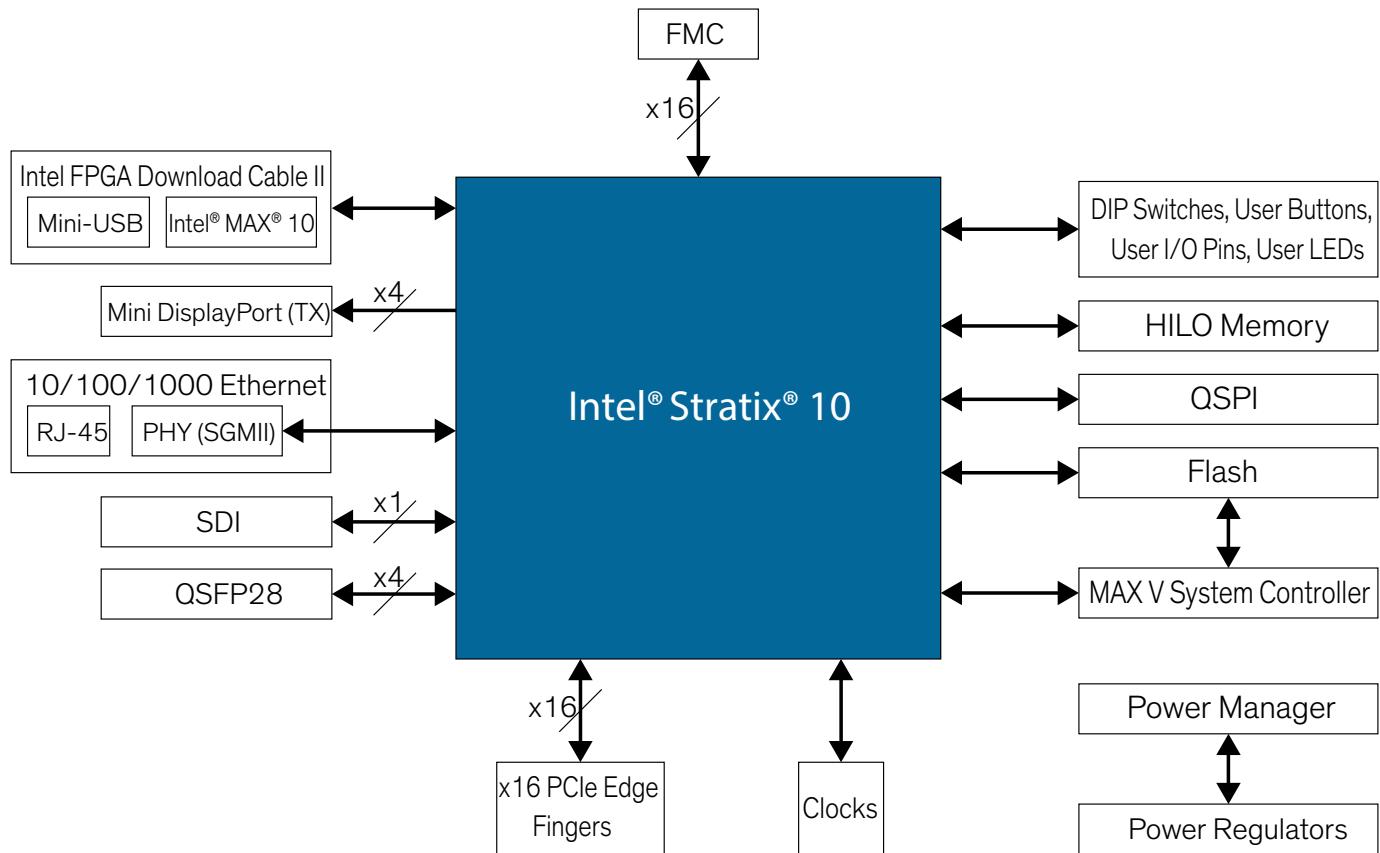
Intel is an American multinational corporation and technology company headquartered in Santa Clara, California, in the Silicon Valley. It is the world's second largest and second highest valued semiconductor chip maker and is the inventor of the x86 series of microprocessors, the processors found in most personal computers (PCs). Intel supplies processors for computer system manufacturers such as Apple, Lenovo, HP, and Dell. Intel also manufactures motherboard chipsets, network interface controllers and integrated circuits, flash memory, graphics chips, embedded processors and other devices related to communications and computing. Intel is an approved Analog Devices Alliances Member.

# Intel® Stratix® 10 GX FPGA Development Kit

## SOM Overview

The Intel Stratix 10 GX FPGA Development Kit delivers a complete design environment that includes all hardware and software needed to start taking advantage of the performance

and capabilities available in Intel Stratix 10 GX FPGAs. Board was developed by Intel Programmable Solutions Group.



Intel Stratix 10 GX FPGA Development Kit Block Diagram

## FMC Connector for a Scalable Approach

The kit allows development of modular and scalable designs by using the FPGA mezzanine card (FMC) connectors to interface to a FMC mezzanine card provided by Analog Devices and supporting protocols, such as JESD204B.



Intel Stratix 10 GX FPGA Development Kit

## Applications

- > High performance computing
- > Military and aerospace
- > Designs needing PCI expresss (PCIe) 3.0
- > Designs needing high-performance memory (DDR4, DDR3, QDR IV, and RLDRAM III)

## Resources

Board part #:

- [DK-DEV-1SGX-L-A](#)
- [DK-DEV-1SGX-H-A](#)

## Featured Boards from Analog Devices



12-Bit, 10.25 GSPS, JESD204B  
RF Analog-to-Digital Converter



14-Bit, 3GSPS, JESD204B, Dual  
ADC



12-Bit, 2.6 GSPS/2.5 GSPS/2.0  
GSPS, 1.3 V/2.5 V ADC

Part #: [AD9213-10GEBZ](#)

Part #: [AD9208-3000EBZ](#)

Part #: [AD-FMCADC2-EBZ](#)

All Analog Devices [FMC Connector boards](#) for converters and RF transceivers are compatible with the development platform. Select Analog Devices' FMC boards are featured in the FMC section of this guide.

→ Contact Arrow for other board options



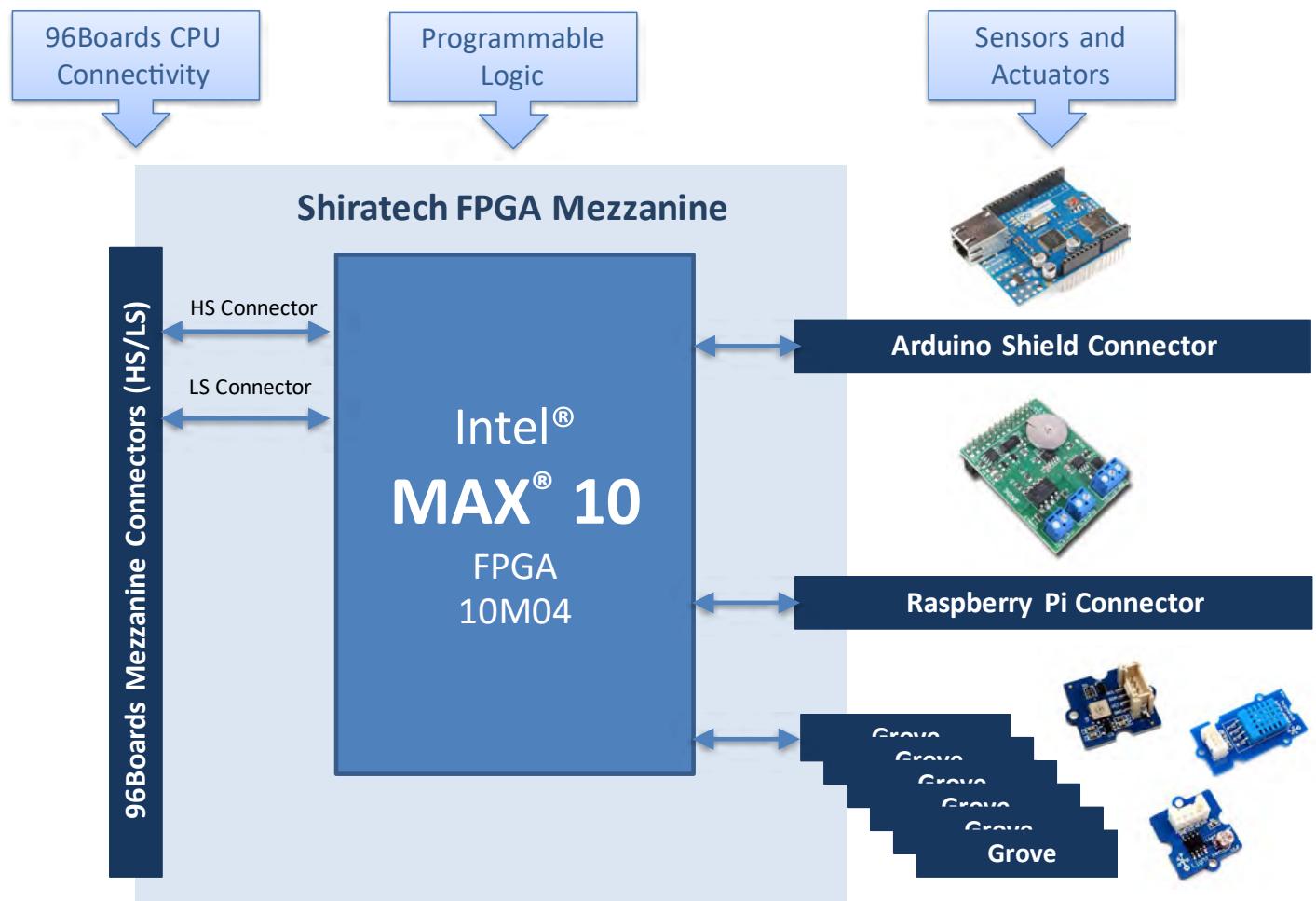
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# Shiratech FPGA Mezzanine for 96Boards

## SOM Overview

The Shiratech FPGA Mezzanine for 96Boards adds configurability to the embedded environment using the Intel MAX 10 FPGA. With the CPU and FPGA combo, designers can connect to any interface and add real time performance to a

project. It offers design flexibility through the use of Raspberry Pi, Arduino & Grove connectors, which allow any combination of 3rd party sensors and actuators.



FPGA Mezzanine for 96Boards Block Diagram

## Benefits of the FPGA Mezzanine for 96Boards

The board offers ultimate flexibility by enabling connectivity between 96Boards and Raspberry Pi, Arduino & Grove. Sensors, data converters, actuators and other capabilities can be easily tested using boards from Analog Devices and 3rd parties. All expansion connectors are directly connected to the FPGA and can be controlled by the FPGA or the CPU.

## Applications

- > 96Boards makers community
- > Hardware engineers and FPGA designers for evaluation, prototyping, and usage in final product

## Expansion Connectors

- > 1 × Raspberry Pi expansion connector
- > 1 × Arduino expansion connector
- > 6 × Grove expansion connectors: 4 digital and 2 analog



FPGA Mezzanine for 96Boards

## Resources

Board part #: [SRT-96B-MEZ-FPGA](#)

## Featured Arduino Shield from Analog Devices



Fully Isolated Conductivity Measurement Data Acquisition System.

Part#: [EVAL-CN0349-PMDZ](#)

All Analog Devices [Arduino Shield](#) boards are compatible with the development platform. NovTech's 96Boards can be used as the FPGA base-board. Select Analog Devices' Arduino boards are featured in the Arduino section of this guide.

→ Contact Arrow for other board options



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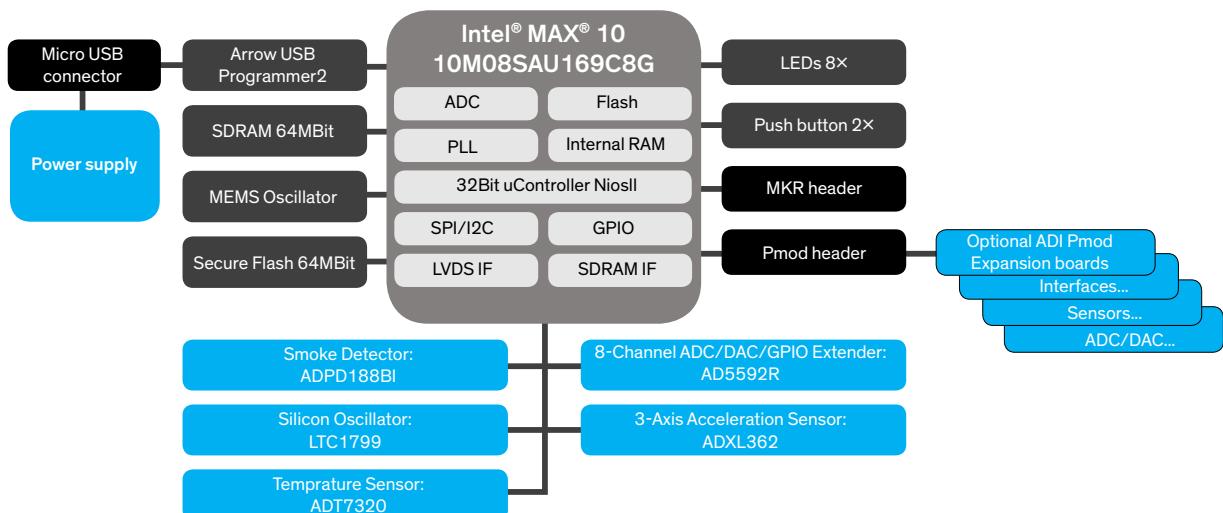
Trenz Electronic develops, manufactures, integrates and distributes FPGA and SoC modules for enterprises and research. The focus is on application-specific HDL and FPGA design as well as on hardware and software development. Trenz Electronic is an approved Analog Devices Alliances Member.

# Intel® MAX® 10 FPGA: AnalogMAX Board

## Board Overview

AnalogMAX is part of the ultra low-cost MAX1000 series of boards from Trenz Electronic. It is a full featured smoke detector sensor board based on the Intel MAX 10 FPGA and ADI's brand-new smoke detector part, the ADPD188BI. The module integrates a highly efficient photometric front end, two LEDs,

and a photodiode. For wider detection areas, integrated drivers of the ADPD188BI can supply external LEDs and additional sensor inputs are available. The data output and functional configuration occur over a 1.8 V I2C or SPI interface.



AnalogMAX Block Diagram

## On-Board Analog Devices Sensors



Micropower, 3-Axis,  
 $\pm 2 \text{ g}/\pm 4 \text{ g}/\pm 8 \text{ g}$  Digital  
 Output MEMS Accelerometer

ADXL362



Integrated Optical Module  
 for Smoke Detection

ADPD188BI



$\pm 0.25^\circ\text{C}$  Accurate, 16-Bit  
 Digital SPI Temperature  
 Sensor

ADT7320

The board features a Pmod connector, enabling interoperability with a wide-ecosystem of daughter cards.



AnalogMAX Board



MAX1000 Board

## Applications

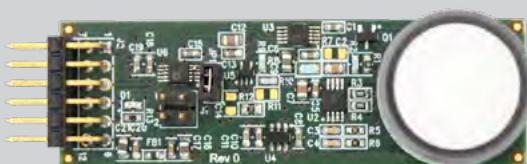
- > Sensor-nodes
- > Commercial
- > Industrial
- > Test and measurement
- > IoT maker

## Resources

Board part #:

- [AnalogMAX-01](#)
- [MAX1000](#)

## Featured Pmod Board from Analog Devices



Part #: [EVAL-CN0357-PMDZ](#)

Low Noise, Single-Supply, Toxic Gas Detector, Using an Electrochemical Sensor with Programmable Gain TIA for Rapid Prototyping.

All Analog Devices [Pmod Connector boards](#) for converters and RF transceivers are compatible with the development platform. Select Analog Devices' Pmod boards are featured in the Pmod section of this guide.

→ Contact Arrow for other board options





Alorium Technology provides FPGA-based embedded computing platforms for advanced makers, embedded systems, and the Industrial IoT. Alorium offers products and solutions that help users rapidly create a strong initial prototype and support final production integration.

# XLR8: Arduino Compatible FPGA Development Board

## Kit Overview

Alorium's XLR8 integrates an AVR-compatible microcontroller in the on-board Intel® MAX® 10 FPGA that is fully compatible with the Arduino IDE. In addition, XLR8 provides a catalog of pre-programmed hardware Xcelerator Blocks (XBs) available through the Arduino IDE such as servo control, floating point math and quadrature. Also available in a more compact, ready for integration footprint is the Snō FPGA System on Module (SOM). Snō offers the enhanced performance features of XLR8 and is based on an FPGA with 2X the programmable logic providing even more space for custom hardware functionality.



XLR8™ Development Kit

## Applications

- > Advanced makers
- > Embedded systems
- > Industrial IoT

## Resources

Board part #: [XLR8R22M08V5UODI](#)

## Featured Arduino Shields from Analog Devices



Ultralow Power Light Recognition System  
for Smart Agriculture

Part #: [EVAL-CN0397-ARDZ N](#)



Soil Moisture and pH Measurement System  
with Temperature Compensation

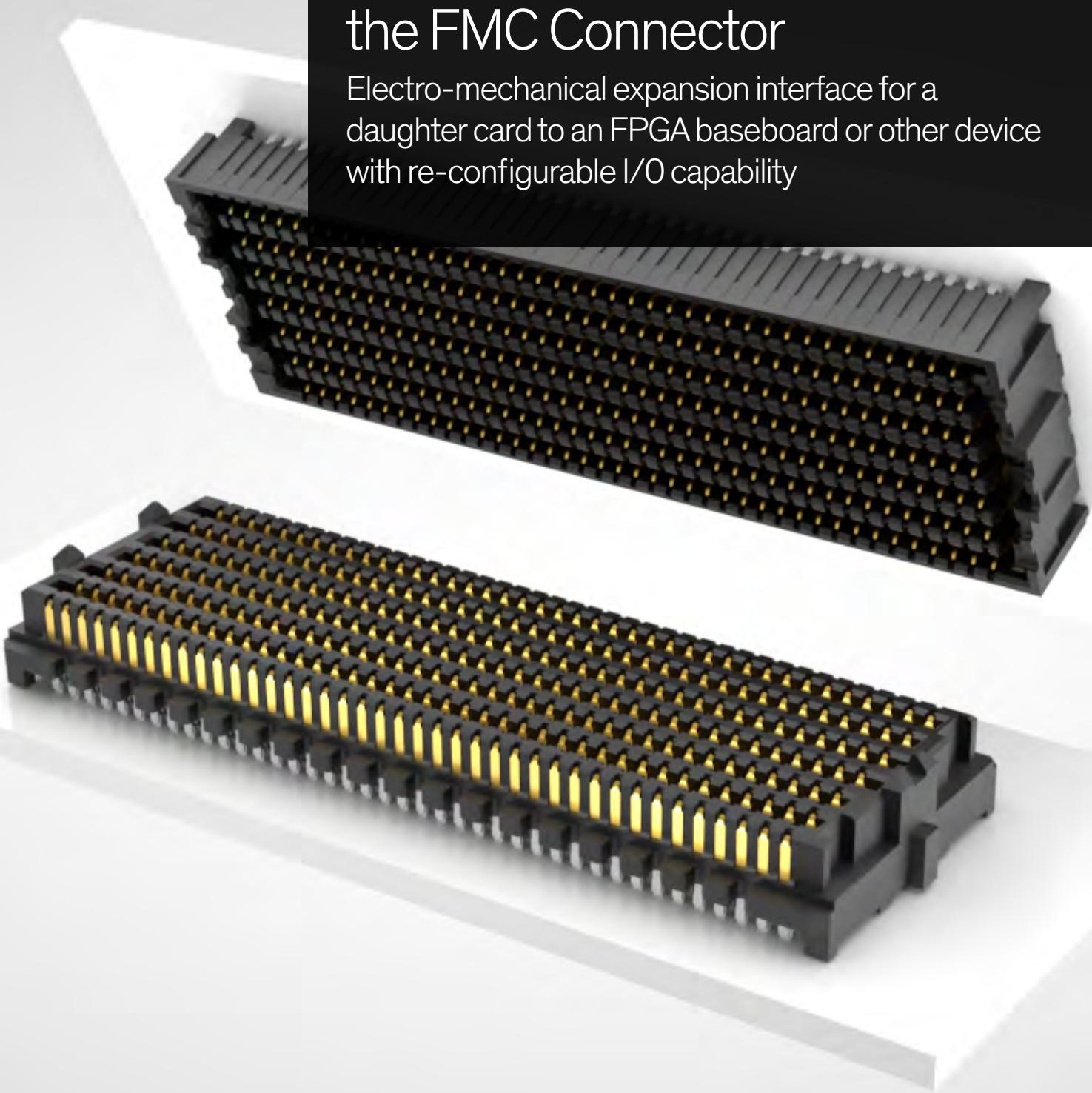
Part #: [EVAL-CN0398-ARDZ](#)

All Analog Devices [Arduino Shields](#) are fully compatible with the XLR8 development board. The Snō board supports 3.3V accessories only. Select Analog Devices' Arduino boards are featured in the Arduino section of this guide.

→ Contact Arrow for other board options

# Analog Devices Boards with the FMC Connector

Electro-mechanical expansion interface for a daughter card to an FPGA baseboard or other device with re-configurable I/O capability



Picture source: Samtec



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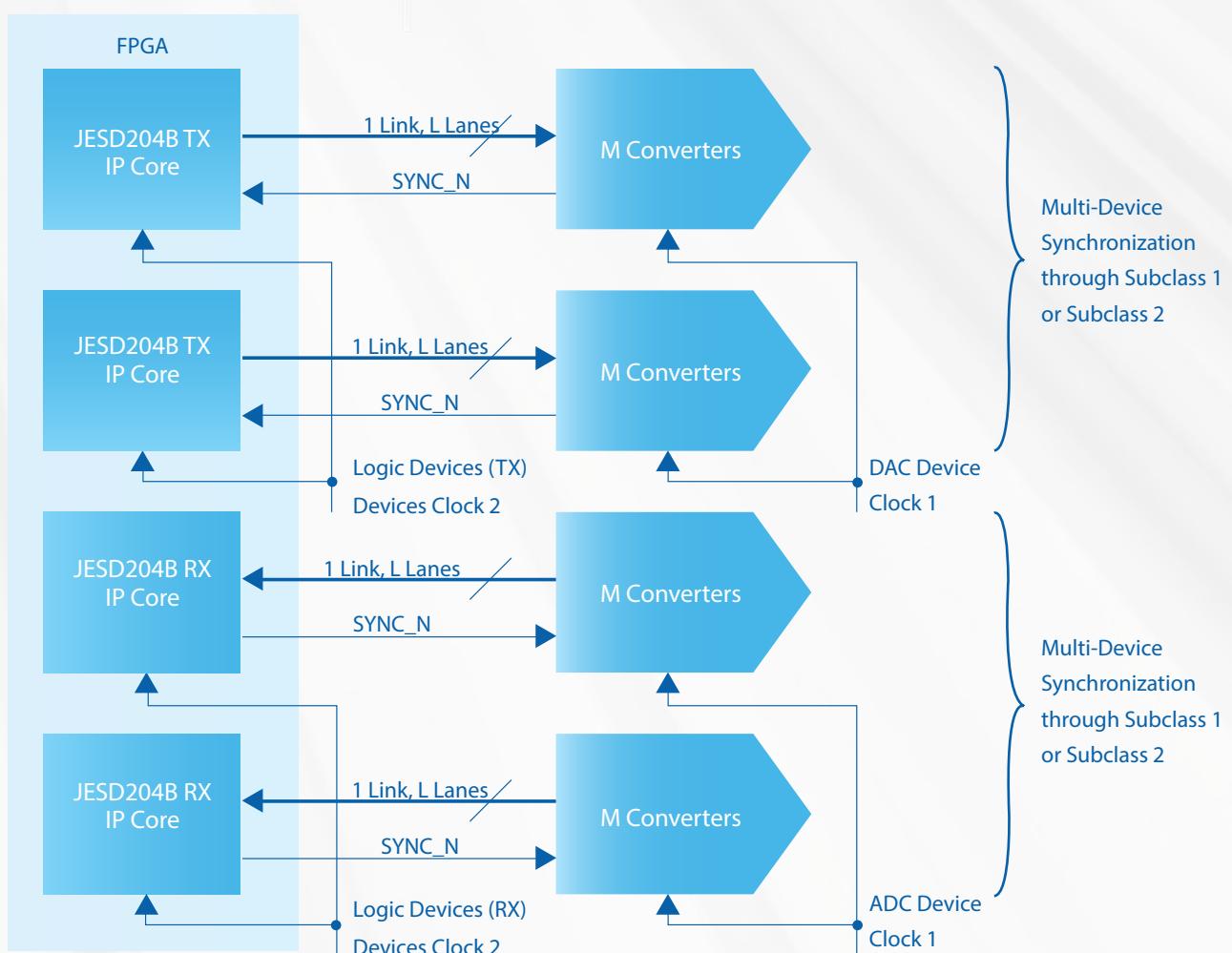
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# FMC Connector: Facilitating the JESD204 Interface

The JESD204B interface is the protocol of choice for communication between FPGAs and high-speed analog components (data converters, RF ICs, etc.). It supports speeds greater than 10 MSPS, and simplifies board layout by minimizing pin-outs. The standard is well suited for high-performance systems and applications requiring multiple ADC channels to be synchronized (ex: RADAR, base stations, mobile backhauls, etc.). The FMC connector acts as the physical layer for the JESD204 interface, and is used to connect an FPGA board with its analog counterparts.

To simplify JESD204 implementation, both Analog Devices and Intel offer software IP that can easily be programmed into the FPGA. Intel's JESD IP supports the entire JESD204 standard. The Analog Devices JESD software framework mirrors the subset of the IP that is in the converters and also delivers information to support clocking. It is optimized for ADI data converters resulting in half the size and power compared to the full JESD204 implementation.



Typical System Application for JESD204B IP Core

# Analog Devices JESD204B Interface Framework

Integrated JESD204B software framework for rapid system-level development and optimization

Analog Devices is an original participating member of the JESD204B standards committee and has developed compliant technology and tools along with a comprehensive product roadmap offering. By providing customers with products that combine cutting edge data converter and transceiver technologies along with the JESD204B interface, customers can solve system design problems, while taking advantage of this interfacing standard.

Analog Devices' JESD204B Interface Framework is a system-level software and HDL package targeted at simplifying system development by providing a performance optimized IP framework that integrates complex hardware such as high speed converters, transceivers and clocks with various FPGA platforms. This framework provides an open platform that includes dynamic configuration capabilities to allow for system changes during operation and constraint handling to support built-in component models such as clocks and converters. These capabilities improve system-level integration and proof-of-concept testing leading to faster time-to-market.

**Part # for the ADI JESD204 Interface Framework: AD-IP-JESD204**

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<https://wiki.analog.com/resources/fpga/peripherals/jesd204>

## Intel JESD204B IP

The JESD204B Intel IP is a high-speed point-to-point serial interface for data converters and RF transceivers to transfer data to FPGA devices.

The JESD204B IP protocol offers higher bandwidth, low I/O count and supports scalability in both number of lanes and data rates. The unidirectional serial interface runs at a maximum data rate of 16.0 Gbps.

The JESD204B Intel IP addresses multi-device synchronization by introducing Subclass 1 and Subclass 2 to achieve deterministic latency.

The Intel JESD IP supports Intel® Stratix® 10, Intel® Arria® 10, Intel® Cyclone® 10, Stratix® V, Arria® V, and Cyclone® V FPGAs. Evaluation version available, and license key is not required in the evaluation mode.

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<https://www.altera.com/jesd204b>

## JESD204C and FMC+ Standards

Higher performance and converter bandwidth requirements are driving the transition to the new JESD204C protocol and the FMC+ connector standards. These next generation connector and protocol standards are backward compatible and offer over 25Gbps links with support up to 32 lanes.

Analog Devices, Intel and our partners are actively rolling out new products to support these technologies and JESD204C options that use FMC/FMC+ connectors will be widely available soon. Work with Arrow to learn more about Analog Devices and Intel JESD204C support and FMC+ products.



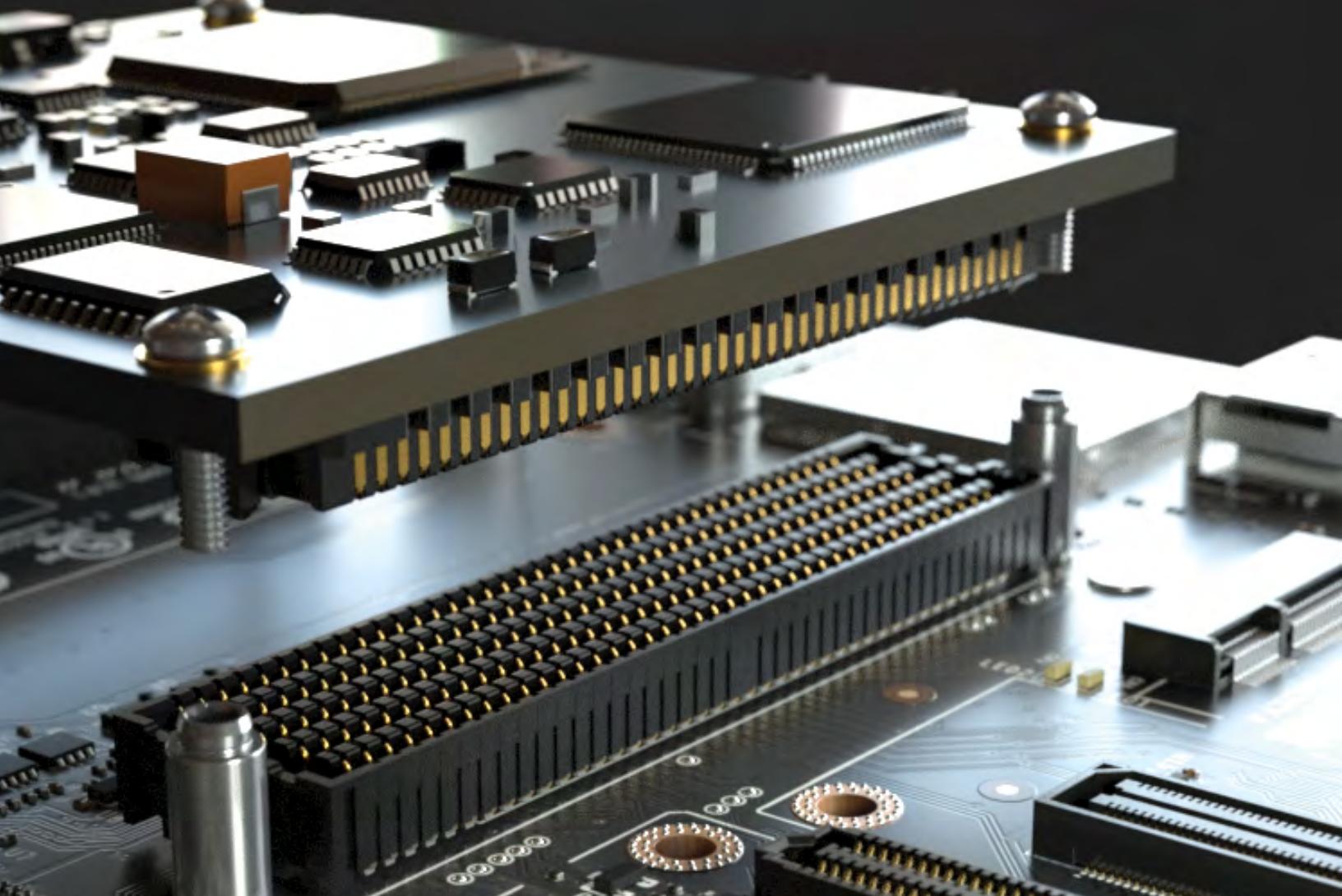
# FMC Connector

## The Preferred Physical Interface for JESD204B/C

FPGA Mezzanine Card (FMC) is an ANSI/VITA (VMEbus International Trade Association) 57.1 standard that defines I/O mezzanine modules with connection to an FPGA or other device with re-configurable I/O capability. The bandwidth of the connector is sufficient to handle up to 10 receive and 10 transmit

lanes of JESD204B data rates of 12.5 Gbps. The FMC connector makes evaluation of analog performance metrics easy by enabling a plug-and-play scheme between the FPGA evaluation kit and analog interface boards.

Example of VITA 57.1 FMC (HPC) 400 I/O connectors



## Interoperability Testing between Intel and Analog Devices Converters and RF Transceivers

All ADI devices with the JESD204B interface will work with Intel. Specific parts were selected for interoperability testing to cover range of portfolios. Efforts are ongoing to ensure seamless

integration with the Intel ecosystem and tools with HDL interface code, device drivers and reference designs.

FPGA Family	Tested Interoperability	Product Description
Intel® Arria® 10	AD6676 Family ( <a href="#">AN-753</a> ) Analog Devices board tested: AD6676 EVM	Wideband IF Receiver Subsystem
	AD9680 ( <a href="#">AN-710</a> ) Analog Devices board tested: D9680 EVM	14-Bit, 1.25 GSPS/1 GSPS/820 MSPS/500 MSPS JESD204B, Dual ADC
	AD9691 ( <a href="#">AN-779</a> ) Analog Devices board tested: AD9691 EVM	14-Bit, 1.25 GSPS JESD204B, Dual ADC
	AD9208 ( <a href="#">AN-810</a> ) Analog Devices board tested: AD9208 EVM	14-Bit, 3GSPS, JESD204B, Dual ADC
	AD9144 ( <a href="#">AN-749</a> ) Analog Devices board tested: AD9144-FMC-EBZ	Quad, 16-Bit, 2.8 GSPS, TxDAC+® DAC
	AD9162 ( <a href="#">AN-785</a> ) Analog Devices board tested: AD9162-FMCC-EBZ	16-Bit, 12 GSPS, RF DAC
	AD9371 ( <a href="#">AN-792</a> ) Analog Devices board tested: AD9371-PCBZ EVM	Integrated, Dual RF Transceiver with Observation Path
	AD9625 Family ( <a href="#">AN-823</a> ) Analog Devices board tested: AD9625 EVM	12-Bit, 2.6 GSPS/2.5 GSPS/2.0 GSPS, 1.3 V/2.5 V ADC
Intel® Stratix® 10	AD9208 ( <a href="#">AN-832</a> ) Analog Devices board tested: AD9208 EVM	14-Bit, 3GSPS, JESD204B, Dual ADC
Stratix® V	AD9625 Family ( <a href="#">AN-712</a> ) Analog Devices board tested: AD9625 EVM	12-Bit, 2.6 GSPS/2.5 GSPS/2.0 GSPS, 1.3 V/2.5 V ADC
	AD9680 ( <a href="#">AN-710</a> ) Analog Devices board tested: AD9680 EVM	14-Bit, 1.25 GSPS/1 GSPS/820 MSPS/500 MSPS JESD204B, Dual ADC
Arria® V	AD9250 Family ( <a href="#">AN-JESD204B-AV</a> ) Analog Devices board tested: AD9250 EVM (AD9250-FMC-250EBZ)	14-Bit, 170 MSPS/250 MSPS, JESD204B, Dual ADC

\* AN: Refers to Intel and Analog Devices Application Note

All ADI devices with the JESD204B interface will work with Intel. Specific parts were selected for interoperability testing to cover a wide range of portfolios. Boards supporting FMC+ and JESD204C are currently in development.



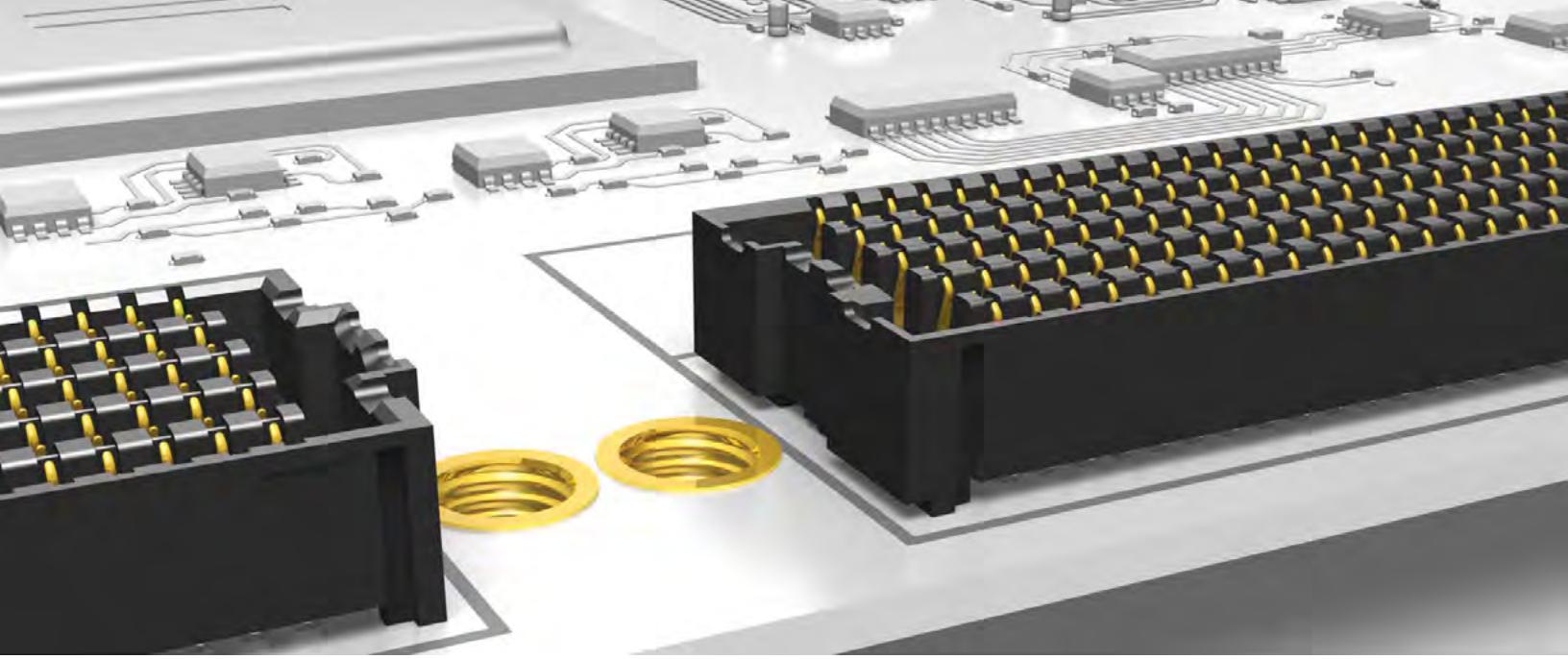


AHEAD OF WHAT'S POSSIBLE™

## Select boards from Analog Devices with FMC Connectors

	ADI Device Description	Board Name
Analog-to-Digital (ADC) Boards with FMC Connector	AD7768: 8-channel, 24-bit, 256 kSPS simultaneous sampling ADC	► <a href="#">EVAL-AD7768FMCZ (Page 65)</a>
	AD7768-1: 24-bit, 256 kSPS ADC	<a href="#">EV-AD7768-1FMCZ</a>
	AD7691: 18-bit, 1.5 LSB INL, 250 kSPS PulSAR® differential ADC in MSOP/QFN	<a href="#">EVAL-AD7691SDZ</a>
	AD7770: 8-channel, 24-bit simultaneous sampling ADC	<a href="#">EVAL-AD7770FMCZ</a>
	AD4020: 20-bit, 1.8 MSPS, precision SAR, differential ADC	<a href="#">EVAL-AD4020FMCZ</a>
	AD4002: 18-bit, 2 MSPS precision pseudo differential SAR ADC	<a href="#">EVAL-AD4002FMCZ</a>
	AD4003: 18-bit, 2 MSPS precision, differential SAR ADC	► <a href="#">EVAL-AD4003FMCZ (Page 64)</a>
	AD4000: 16-bit, 2 MSPS precision pseudo differential SAR ADC	<a href="#">EVAL-AD4000FMCZ</a>
	AD7626: 16-bit, 10 MSPS, PulSAR differential ADC	<a href="#">EVAL-AD7626FMCZ</a>
	AD7625: 16-bit, 6MSPS PulSAR differential ADC	<a href="#">EVAL-AD7625FMCZ</a>
	AD9208-3000: 14-bit, 3GSPS dual ADC	► <a href="#">AD9208-3000EBZ (Page 62)</a>
	AD9680: Dual, 14-bit, 1.25 GSPS, JESD204B ADC	► <a href="#">AD-FMCDAO2-EBZ (Page 63)</a>
Digital-to-Analog (DAC) Boards with FMC Connector	AD9250: 14-bit, 170 MSPS/250 MSPS, dual ADC	<a href="#">AD-FMCJESDADC1-EBZ</a>
	AD9625: 12-bit, 2.5 GSPS monolithic sampling ADC	<a href="#">AD-FMCADC2-EBZ</a>
	AD9172, 16-bit, 12.6 GSPS dual DAC	► <a href="#">AD9172-FMC-EBZ (Page 68)</a>
	AD9174, 16-bit, 12.6 GSPS RF DAC	► <a href="#">AD9174-FMC-EBZ (Page 66)</a>
Transceiver Boards with FMC Connector	AD9162, 16-bit, 12 GSPS RF DAC	► <a href="#">AD9162-FMCB-EBZ (Page 69)</a>
	AD9164, 16-bit, 12 GSPS, RF DAC, and direct digital synthesizer	► <a href="#">AD9164-FMCB-EBZ (Page 67)</a>
	AD9371: 300 MHz to 6000 MHz integrated, dual RF transceivers with observation path	► <a href="#">ADRV9371-W/PCBZ (Page 71)</a>
	AD9361: 70 MHz to 6.0 GHz high-performance, RF Transceiver with a channel bandwidth of <200 kHz to 56 MHz	<a href="#">AD-FMCOMMS2-EBZ</a>
	AD9361: 70 MHz to 6.0 GHz high-performance, RF Transceiver with a channel bandwidth of <200 kHz to 56 MHz	<a href="#">AD-FMCOMMS3-EBZ</a>
	AD9364: 70 MHz to 6.0 GHz 1 × 1 channel high transceiver with integrated 12-bit DACs and ADCs	<a href="#">AD-FMCOMMS4-EBZ</a>
	AD9652: 400MHz to 4.4GHz receiver with 16-bit dual ADCs, 310 MSPS	<a href="#">AD-FMCOMMS6-EBZ</a>
	AD9375: 300MHz – 6GHz, highly integrated, wideband RF transceiver	<a href="#">ADRV9375-W/PCBZ</a>
	ADRV9009: 75 MHz to 6GHz integrated dual RF transceivers	► <a href="#">ADRV9009-W/PCBZ (Page 70)</a>

► Featured in this guide



Picture source: Samtec

## List of FPGA boards with FMC Connectors

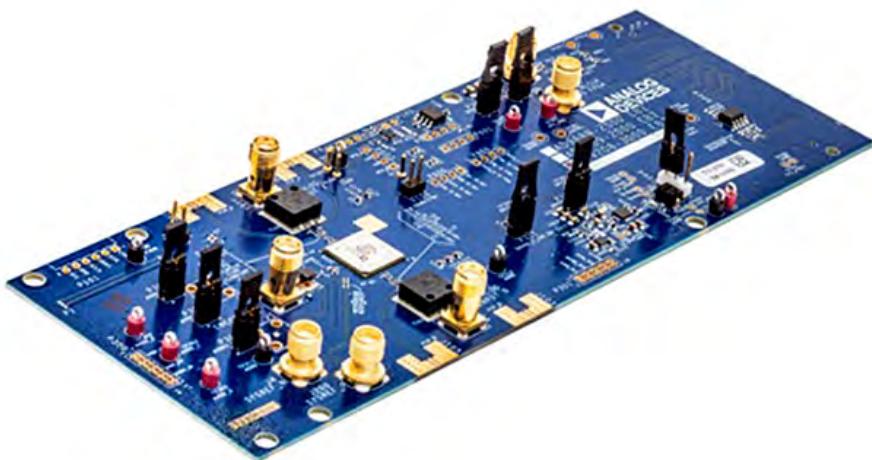
Board Name	Brief Description	Category	Partner
► <a href="#">MitySOM-A10S Development Kit (Page 63)</a>	Includes the MitySOM-A10S SOM and a baseboard. Design files provided	SOM	Critical Link
► <a href="#">Dream Chip Arria 10 SOM and Evaluation Baseboard (Page 34)</a>	Intel Arria 10 SOM (with 160 to 480K LEs) in a 29×29 mm package. Ideal for vision applications and industrial automation	SOM, Development kit	Dream Chip
► <a href="#">iW-RainboW-G24M (Page 32)</a>	Based on the Intel® Arria® 10 SX and GX families. Supports up to 660K LE devices	SOM, Development kit	iWave Systems
► <a href="#">Achilles Instant-Development Kit Arria 10 SoC SOM (Page 36)</a>	SOM and development kit based on Intel Arria 10 SX (10AS066H2F34I1SG) device up to 660K LEs	Development kit	REFLEX CES
► <a href="#">Sargon Instant-Development Kit Stratix 10 FPGA FMC+ IDK (Page 46)</a>	Development kit based on Intel® Stratix® 10 GX FPGAs SX with 2800K LEs	Development kit	REFLEX CES
C10GFP	Intel® Cyclone® 10 GX FPGA Development Kit	COTS, Development kit	Terasic
A10GFP	Kit features a 10AX115S2F45I1SG device and a one-year license for the Intel® Quartus® Prime design software	Development kit	Terasic
► <a href="#">DE10-Nano Kit (Page 26)</a>	Dev kit based on Cyclone® V SE 5CSEBA6U23I7 device (110K LEs)	Development kit	Terasic

► Featured in this guide



# 14-Bit, 3GSPS Dual ADC Evaluation Board: AD9208

The AD9208-3000EBZ supports the AD9208-3000, a 14-bit, 3GSPS dual ADC. This device is designed support direct RF sampling analog signals of up to 5 GHz. The 3 dB bandwidth of the ADC input is greater than 9 GHz. The AD9208 is optimized for wide input bandwidth, high sampling rate, excellent linearity, and low power in a small package.



Part #: [AD9208-3000EBZ](#)

## Suggested FPGA Board

- Interoperability verified with the [Intel® Stratix® 10 GX H-Tile FPGA Development Kit](#)

## Features

- JESD204B coded serial digital outputs with support for lane rates up to 16 Gbps/lane
- Wide full power bandwidth supports IF sampling of signals up to 9GHz (-3dB point)
- Four Integrated wide-band decimation filter and NCO blocks supporting multi-band receivers
- Fast NCO switching enabled through GPIO pins

## Applications

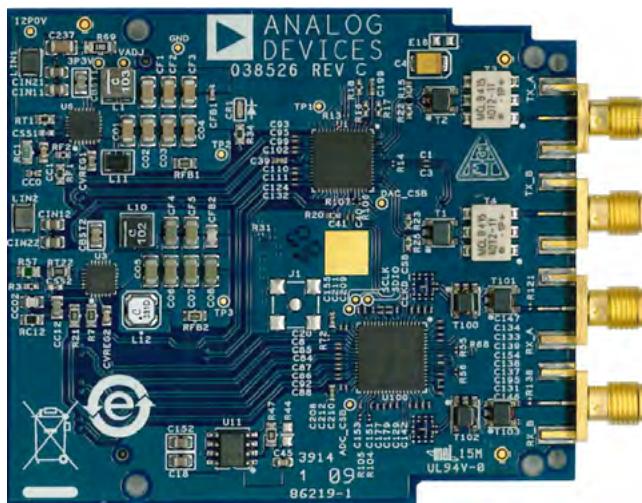
- Aerospace and Defense: Electronic surveillance and countermeasures, radar
- Communications: Wideband RF signal processing, wireless infrastructure
- Instrumentation and Measurement: RF signal analyzers and vector network analyzers

## Reference Documentation

- Arria 10 GX interoperability report
- Statix 10 interoperability report

# Dual, 14-Bit, 1.25 GSPS, JESD204B ADC: AD9680

The AD-FMCDAQ2-EBZ module is comprised of the AD9680 dual, 14-bit, 1.25 GSPS, JESD204B ADC, the AD9152 dual, 16-bit, 2.25 GSPS, JESD204B DAC, the AD9528 clock, and power management components.



Part #: [AD-FMCDAQ2-EBZ](#)

## Features

- Ultrawide signal bandwidth enables emerging wideband and multiband wireless applications
- Advanced low spurious and distortion design techniques provide high quality synthesis of wideband signals from baseband to high intermediate frequencies
- JESD204B Subclass 1 support simplifies multichip synchronization in software and hardware design
- Fewer pins for data interface width with the serializer/deserializer (SERDES) JESD204B four-lane interface

## Reference Documentation

- AN-710: JESD204B IP Core and ADI AD9680 Hardware Checkout Report

## Suggested FPGA Board

- Interoperability verified with the [Intel® Arria® 10 Development Kit](#)

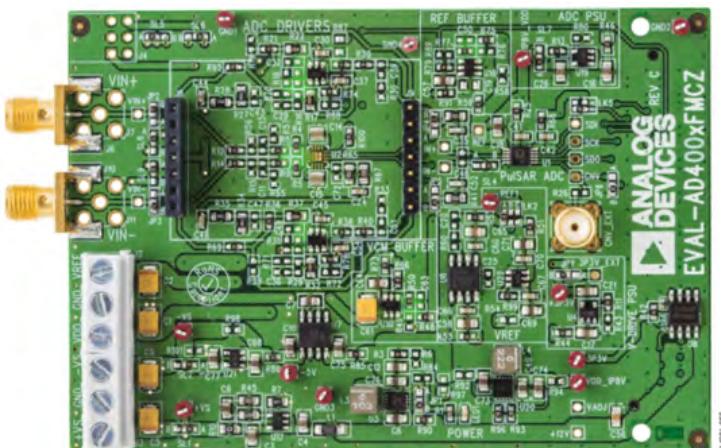
## Applications

- Electronic test and measurement equipment
- General-purpose software radios, radar systems
- Ultra-wideband satellite receivers
- Signals intelligence (SIGINT)
- Point to point communication systems, Multiple input/multiple output (MIMO) radios
- DOCSIS 3.0 CMTS and HFC networks



# 18-Bit, Precision SAR ADC with 2 MSPS Throughput: AD4003

The AD4003 is a low noise, low power, high speed, 18-bit, precision successive approximation register (SAR) ADCs with 2 MSPS throughput. It has ease of use features that reduce signal chain power consumption, reduce signal chain complexity, and enable higher channel density. The evaluation board features a Low Pin Count (LPC) FMC connector.



Part #: EVAL-AD4003FMCZ

## Features

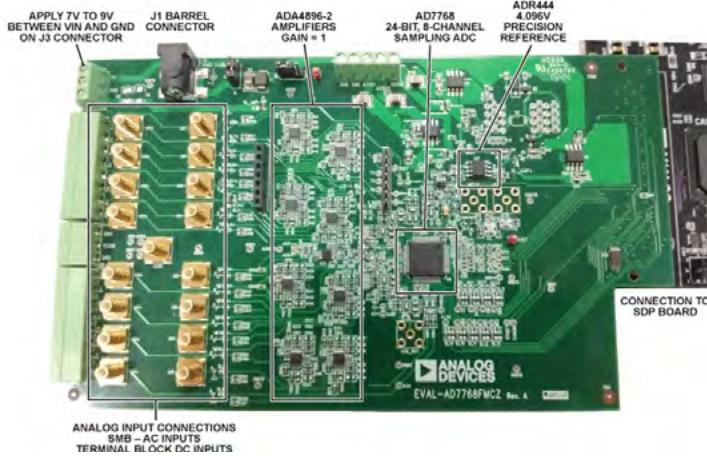
- NL:  $\pm 1.0$  LSB ( $\pm 3.8$  ppm) maximum
  - Guaranteed 18-bit no missing codes
  - 9.5 mW at 2 MSPS, 4.9 mW at 1 MSPS, 2.4 mW at 500 kSPS (VDD only)
  - SNR: 100.5 dB typical at 1 kHz, VREF = 5 V; 99 dB typical at 100 kHz
  - THD: -123 dB typical at 1 kHz, VREF = 5 V; -100 dB typical at 100 kHz
  - Differential analog input range:  $\pm$ VREF (0 V to VREF with VREF from 2.4 V to 5.1 V)

## Applications

- Automatic test equipment
  - Machine automation
  - Medical equipment
  - Battery-powered equipment
  - Precision data acquisition systems

# 24-Bit, 8-Channel, 256 kSPS, Sigma-Delta ADC: AD7768

Evaluation Board for the AD7768 24-Bit, 8-Channel, Simultaneous Sampling, 256 kSPS, Sigma-Delta ADC with Power Scaling. User PC software executable controls the AD7768 over a USB cable through the FPGA board. The evaluation board features a Low Pin Count (LPC) FMC connector.



Part #: [EVAL-AD7768FMCZ](#)

## Features

- 108 dB dynamic range
- 10.8 kHz maximum input bandwidth ( $-3$  dB bandwidth)
- $-120$  dB total harmonic distortion (THD) typical
- $\pm 2$  ppm of full-scale range (FSR) integral nonlinearity (INL),  $\pm 50$   $\mu$ V offset error,  $\pm 30$  ppm gain error
- Optimized power dissipation vs. noise vs. input bandwidth
- Selectable power, speed, and input bandwidth (BW) modes
- Input BW range: dc to 110.8 kHz
- Programmable input bandwidth/sampling rates

## Suggested FPGA Board

- [Intel Cyclone 10 GX: FPGA Development Kit](#)

## Applications

- Data acquisition systems: USB/PXI/Ethernet
- Instrumentation and industrial control loops
- Audio test and measurement
- Vibration and asset condition monitoring
- 3-phase power quality analysis
- Sonar
- High precision medical
  - > Electroencephalogram (EEG)
  - > Electromyography (EMG)
  - > Electrocardiogram (ECG)



# Dual 16-bit, 12.6GSPS RF DAC and Direct Digital Synthesizer: AD9174

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The AD9174 is a high performance, dual, 16-bit digital-to-analog converter (DAC) and direct digital synthesizer (DDS) that supports DAC sample rates up to 12.6GSPS. The device features an 8-lane, 15Gbps JESD204B data input port, a high-performance, on-chip DAC clock multiplier, three complex data input channelizers per DAC, and digital signal processing capabilities. The DDS engine consists of a bank of 32,32-bit numerically controlled oscillators (NCO's), each with its own phase accumulator. The low-power, high dynamic range, wide bandwidth, low single-side band (SSB) phase-noise performance combined with digital signal processing makes these DAC's ideally suited for the most demanding software defined RF synthesis applications.



Part #: AD9174-FMC-EBZ

## Suggested FPGA Board

- MitySOM-A10S Development Kit

## Features

- Direct-to-RF synthesis up to 6GHz
  - > Eliminates analog IF-to-RF conversion stage and LO generation lowering overall system power consumption
  - > Doubles complex signal bandwidth through channelizer data path to 2.4GHz
  - > Supports up to 3.2GHz maximum complex signal bandwidth through main DAC data path
- Common transmit platform for flexible and reliable RF synthesis
  - > Channelizer data input architecture lowers data interface speed requirement and power consumption
  - > Independent NCO and digital gain control per input channel enable flexible signal chain partitioning in single and multi-band
  - > DDS provides phase-coherent, Fast Frequency Hoping engine to support a wide array of signal generation applications

## Applications

- Single/Multi-Band Wireless Communications
- Instrumentation, Automatic Test Equipment (ATE)
- Radar and Jammers

# 6 GSPS, 16-Bit DAC and Direct Digital Synthesizer (DDS): AD9164

The AD9164 is a high performance, 16-bit DAC and direct digital synthesizer (DDS) that supports update rates to 6 GSPS. The DAC core is based on a quad-switch architecture coupled with a 2× interpolator filter that enables an effective DAC update rate of up to 12 GSPS in some modes. The high dynamic range and bandwidth makes these DACs ideally suited for the most demanding high-speed radio frequency (RF) DAC applications.



Part #: [AD9164-FMCB-EBZ](#)

## Suggested FPGA Board

- Intel® Arria® 10 GX Development Kit

## Features

- High dynamic range and signal reconstruction bandwidth supports RF signal synthesis of up to 7.5 GHz
- Up to eight lanes JESD204B SERDES interface flexible in terms of number of lanes and lane speed
- Bandwidth and dynamic range to meet DOCSIS 3.1 compliance and multiband wireless communications standards with margin

## Applications

- Aerospace and Defense: Phased array, missiles and precision munitions, electronic surveillance and countermeasures, radar
- Instrumentation and Measurement: Instrumenting 5G, communications test equipment, signal generators (Audio through RF)

## Reference Documentation

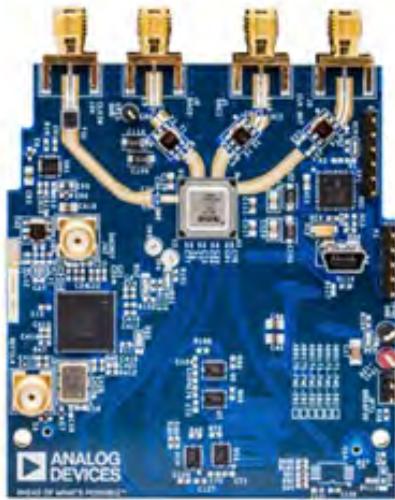
[AN-785: Arria 10 GX interoperability report](#)



# Dual 16-Bit DAC, Up to 12.6 GSPS Sample Rates: AD9172

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The AD9172 is a high performance, dual, 16-bit DAC that supports sample rates up to 12.6 GSPS. The device features an 8-lane, 15 Gbps JESD204B data input port, a high performance, on-chip DAC clock multiplier, and digital signal processing capabilities targeted at single-band and multiband direct to radio frequency (RF) wireless applications.



Part #: [AD9172-FMC-EBZ](#)

Suggested FPGA Board  
• [MitySOM-A10S Development Kit](#)

## Features

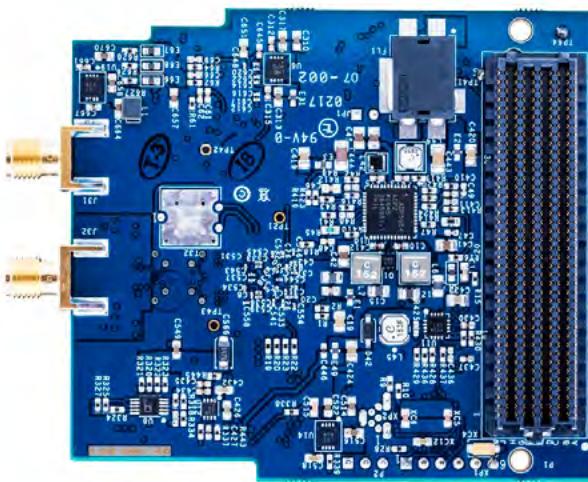
- 3 bypassable, complex data input channels per RF DAC
- 1.54 GSPS maximum complex input data rate per input channel
- 1 independent NCO per input channel
- Flexible 8-lane, 15.4 Gbps JESD204B interface
- Proprietary, low spurious and distortion design

## Applications

- Instrumentation & Measurement: Communications test equipment, electronic test & measurement
- Communications: Wireless infrastructure, wideband RF signal processing
- Aerospace and Defense: Electronic surveillance and countermeasures, milcom, radar, phased array, unmanned systems
- Automotive: Automotive RADAR

# 16-Bit DAC, Data Rates Up To 6 GSPS: AD9162

The AD9162 is a high performance, 16-bit DAC that supports data rates to 6 GSPS. The DAC core is based on a quad-switch architecture coupled with a 2× interpolator filter that enables an effective DAC update rate of up to 12 GSPS in some modes. The high dynamic range and bandwidth makes these DACs ideally suited for the most demanding high-speed radio frequency (RF) DAC applications.



Part #: [AD9162-FMCB-EBZ](#)

Suggested FPGA Board  
• [Intel® Arria® 10 GX Development Kit](#)

## Features

- High dynamic range and signal reconstruction bandwidth supports RF signal synthesis of up to 7.5 GHz
- Up to eight lanes JESD204B SERDES interface flexible in terms of number of lanes and lane speed
- Bandwidth and dynamic range to meet DOCSIS 3.1 compliance with margin

## Reference Documentation

[AN-785: Arria 10 GX interoperability report](#)

## Applications

- Instrumentation, automatic test equipment (ATE)
- Radars and jammers
- Broadband Communications Systems: DOCSIS 3.1 cable modem termination system (CMTS)/video on demand (VOD)/edge quadrature amplitude modulation (EQAM)
- Wireless communications infrastructure: W-CDMA, LTE, LTE-A, point to point



# 75 MHz to 6000 MHz RF Transceiver: ADRV9009

The ADRV9009-W/PCBZ is a radio card designed to showcase the ADRV9009, the widest bandwidth, highest performance RF integrated transceiver. The radio card provides a single 2×2 transceiver platform for device evaluation and rapid prototyping of radio solutions.



Part #: [ADRV9009-W/PCBZ](#)

## Suggested FPGA Board

- [Achilles Instant-Development Kit](#)

## Features

- Dual receivers and dual transmitters
- Dual input shared observation receiver
- Maximum receiver bandwidth: 200 MHz
- Maximum tunable transmitter synthesis bandwidth: 450 MHz
- Maximum observation receiver bandwidth: 450 MHz
- Fully integrated fractional-N RF and clock synthesizers
- Multichip phase synchronization for RF LO and baseband clocks
- JESD204B datapath interface
- Tunable range: 75 MHz to 6000 MHz

## Applications

- Instrumentation & measurement
- Aerospace and defense
- Communications
- RadioVerse: Concept to creation at lightspeed

# 300 MHz to 6000 MHz RF Transceiver: AD9371

ADRV9371-WPCBZ is a radio card designed to showcase the AD9371, a high performance wideband integrated RF transceiver intended for use in RF applications such as test and measurement applications and software defined radios. The radio card provides a single 2x2 transceiver platform for device evaluation and rapid prototyping of radio solutions.



Part #: [ADRV9371-W/PCBZ](#)

## Suggested FPGA Board

- [Achilles Instant-Development Kit](#)

## Features

- Dual differential transmitters (Tx) and receivers (Rx)
- Observation receiver (ORx) with 2 inputs
- Sniffer receiver (SnRx) with 3 inputs
- Tunable range: 300 MHz to 6000 MHz
- Tx synthesis bandwidth (BW) to 250 MHz
- Rx BW: 8 MHz to 100 MHz
- Supports frequency division duplex (FDD) and time division duplex (TDD) operation
- Fully integrated independent fractional-N radio frequency (RF) synthesizers for Tx, Rx, ORx, and clock generation
- JESD204B digital interface

## Applications

- Aerospace and Defense: Radar, milcom, electronic surveillance and countermeasures, unmanned systems
- RadioVerse: Concept to creation at lightspeed

## Reference Documentation

- Reference HDL for Arria 10 GX
- Reference HDL for Arria 10 SoC
- AN-792: Intel® FPGA JESD204B IP Core and ADI AD9371 Hardware Checkout Report



# Resources and References for FMC-based Boards

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## Interoperability reports:

- AN-753: JESD204B IP Core and ADI AD6676 Hardware Checkout Report
- AN-710: JESD204B MegaCore Function and ADI AD9680 Hardware Checkout Report
- AN-779: Intel JESD204B IP Core and AD9691 Hardware Checkout Report
- AN-810: Intel JESD204B IP Core and ADI AD9208 Hardware Checkout Report AN-749
- AN-785: JESD204B IP Core and ADI AD9144 Hardware Checkout Report
- AN-792: JESD204B IP Core and ADI AD9162 Hardware Checkout Report
- AN-823: Intel JESD204B IP Core and ADI AD9625 Hardware Checkout Report for Intel Stratix 10 Devices
- AN-832: Intel JESD204B IP Core and ADI AD9208 Hardware Checkout Report for Intel Stratix 10 Devices
- AN-712: JESD204B MegaCore Function and ADI AD9625 Hardware Checkout Report
- AN-710: JESD204B IP Core and ADI AD9680 Hardware Checkout Report
- JESD204B IP Core and ADI AD9250 Hardware Checkout Report

## Intel JESD204B IP Resources:

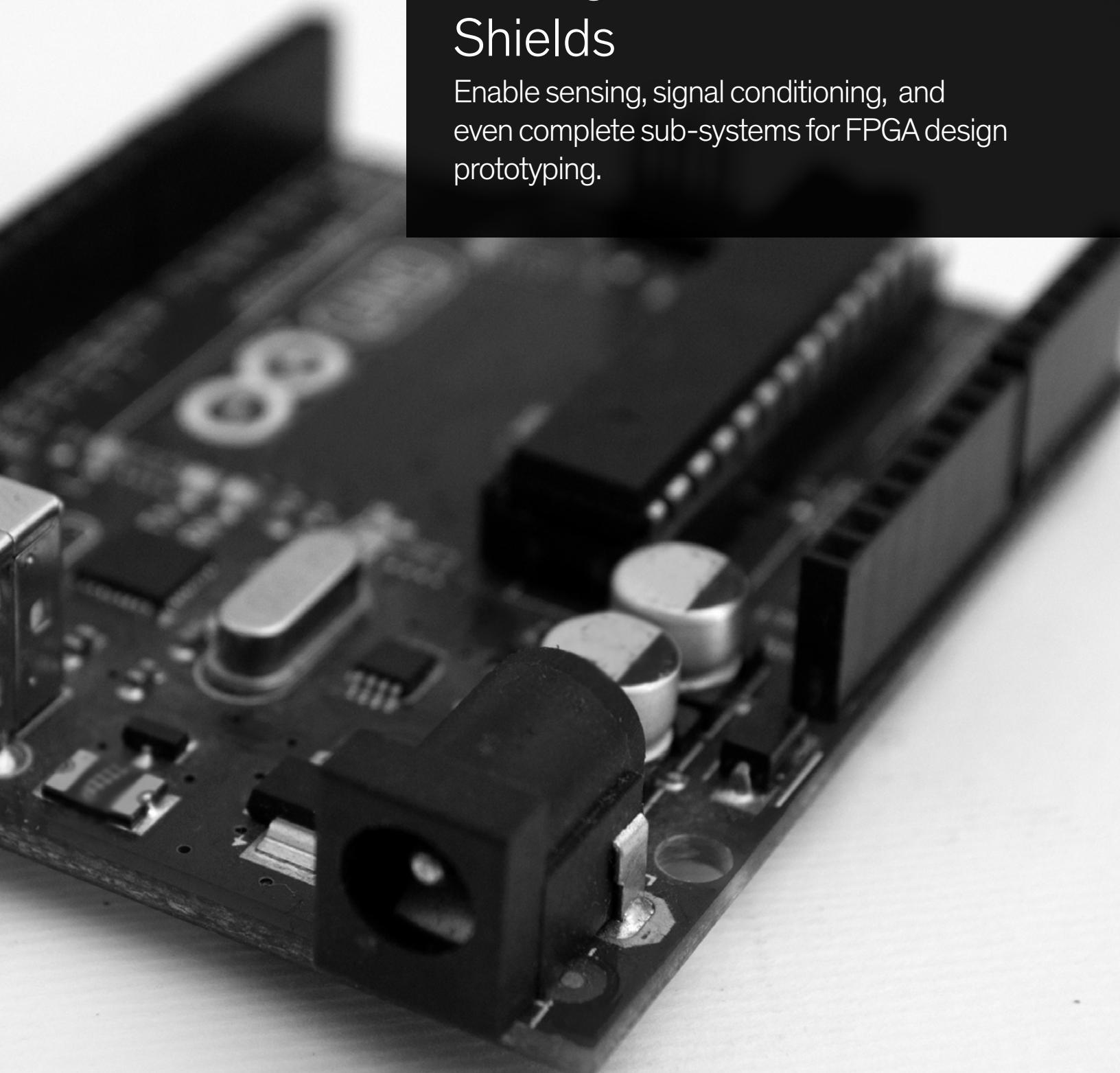
- Intel JESD204B IP User Guide
- JESD204B IP Design Examples User Guide
- AN803: Implementing ADC-Intel® Arria® 10 Multi-Link Design with JESD204B RX IP Core
- AN804: Implementing ADC-Intel® Stratix® 10 Multi-Link Design with JESD204B RX IP Core
- Implementing JESD204B IP Core System Reference Design with Nios® II Processor as Control Unit
- Using the JESD204B Intel IP Function in Arria® V Devices

## Analog Devices JESD204 Resources

- JESD204 Interface Framework: Integrated JESD204 software framework for rapid system-level development and optimization
- JESD204B Survival Guide: Practical JESD204B Technical Information, Tips, and Advice from the World's Data Converter Market Share Leader
- JESD204 Serial Interface and JEDEC Standard Data Converters
- Wiki: JESD204 Interface Framework

# Analog Devices Arduino Shields

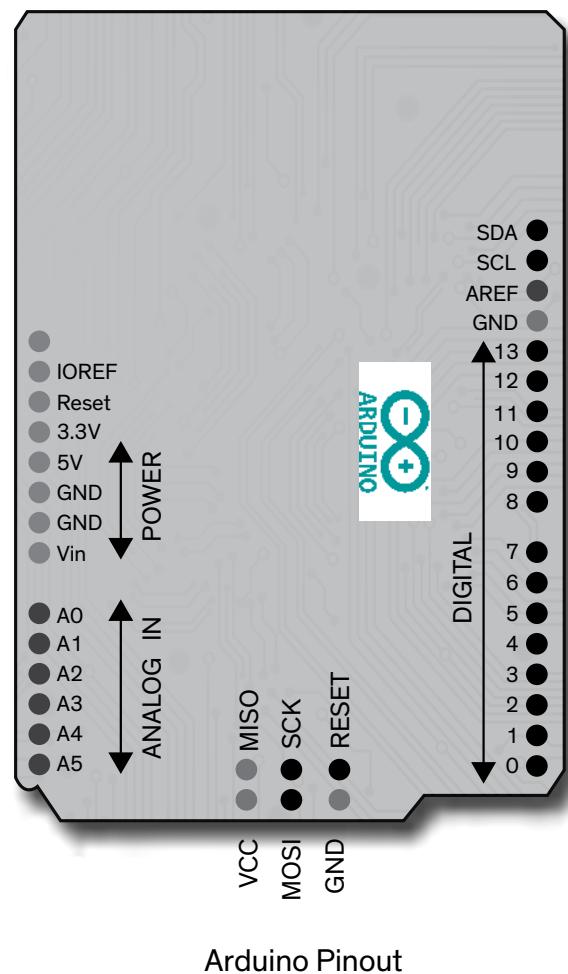
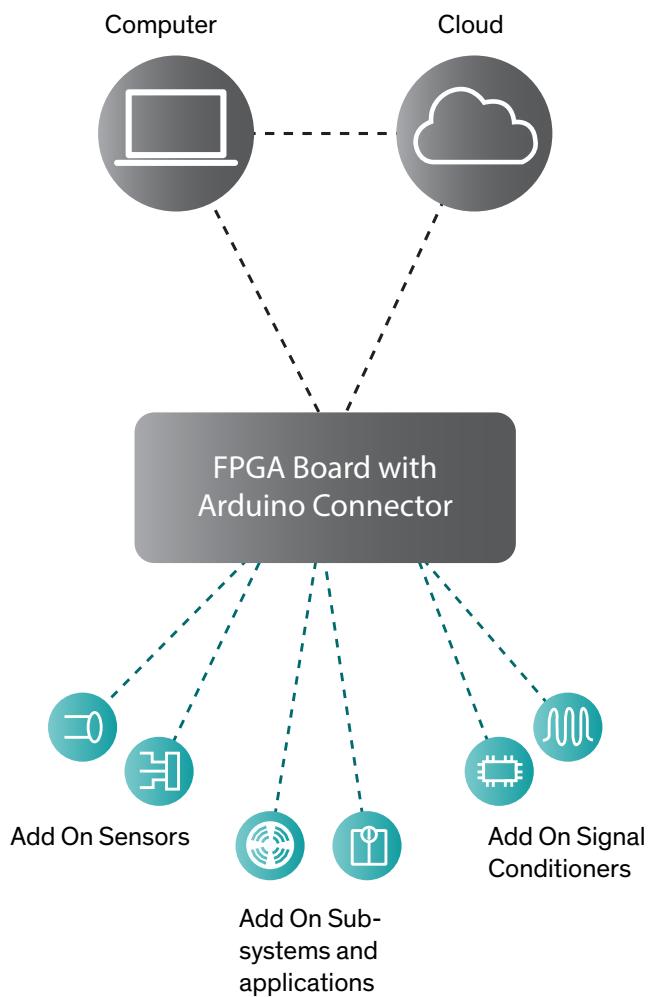
Enable sensing, signal conditioning, and even complete sub-systems for FPGA design prototyping.



# Arduino Introduction

Arduino is an open-source electronics platform based on low-cost and easy-to-use hardware and software. With the open hardware concept, add on capabilities for sensors, data converters, and even complete sub-systems are easily enabled. FPGA boards with the Arduino connector can plug into any

Analog Devices Arduino shields to prototype various capabilities. With open hardware modules and software examples, Analog Devices enables proof-of-concept testing and customization options for application specific requirements around the signal chain.



For more details, go to [Introduction to the Arduino Board](#) website

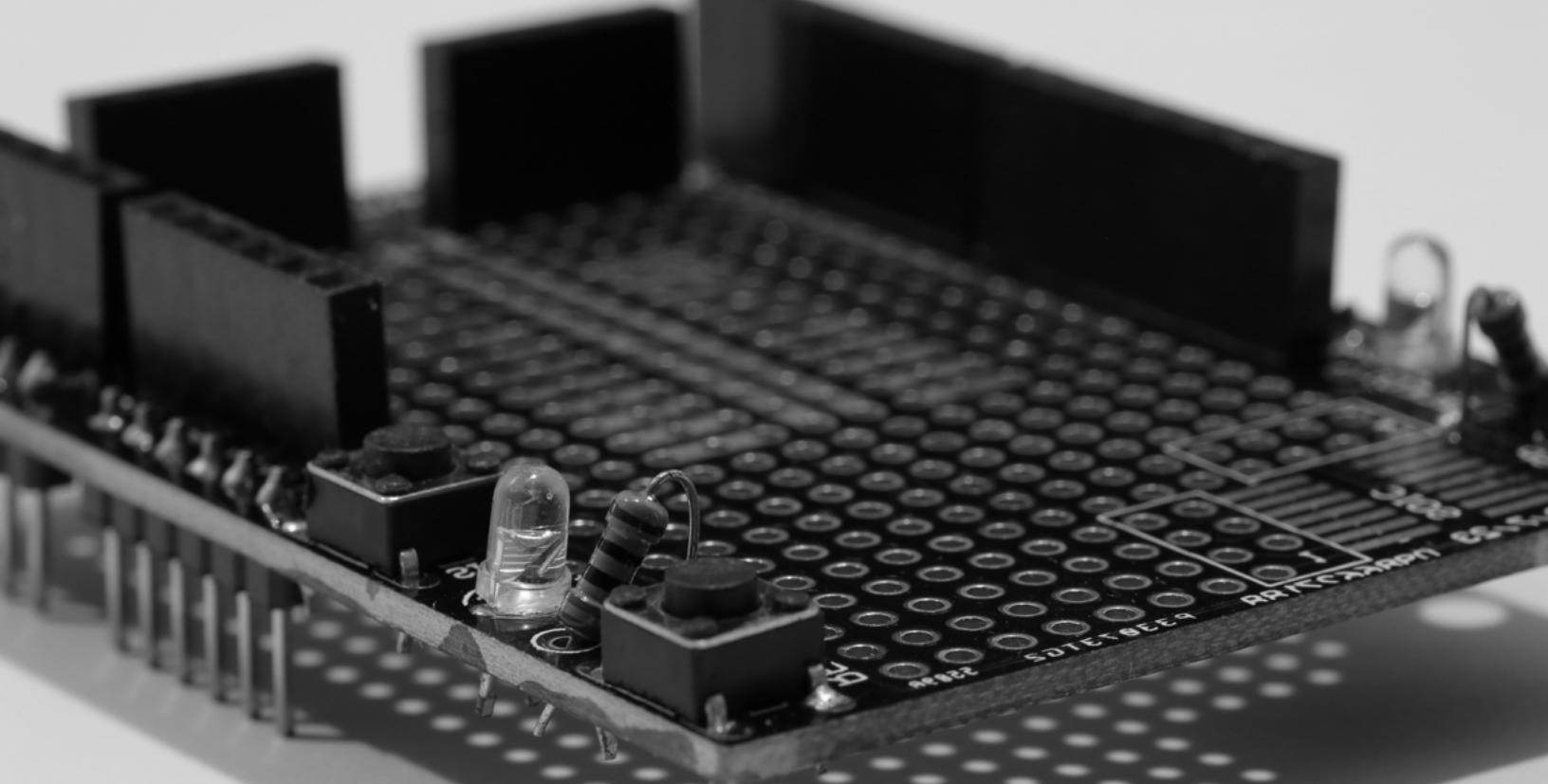
# Select List of Arduino-Compatible “Circuits from the Lab” Shields

Board Part #	Description	ADI Part Number
► <a href="#">EVAL-CN0357-ARDZ (Page 78)</a>	Electrochemical gas detection circuit (CN0357)	AD5270, AD7790, AD8500, ADA4528-2, ADR3412
► <a href="#">EVAL-CN0216-ARDZ (Page 78)</a>	High gain weigh scale design (CN0216)	CN0216
<a href="#">EVAL-CN0391-ARDZ</a>	Single supply, multi-channel thermocouple temperature meter with an 8-channel, low noise, low power, 24-bit, Sigma-Delta ADC	AD7124-8, ADP7118
<a href="#">EVAL-CN0394-ARDZ</a>	Single supply, multi channel thermocouple temperature meter with a low-power precision analog microcontroller, Arm Cortex M3 with dual Sigma-Delta ADCs	ADUCM360
<a href="#">EVAL-CN0338-ARDZ</a>	NDIR thermopile-based gas sensing circuit	AD8629, ADA4528-1, ADP7105, ADUCM360, ADuCM362, ADuCM363
► <a href="#">EVAL-CN0397-ARDZ (Page 79)</a>	Ultralow power light recognition system for smart agriculture	AD7798, AD8500, AD8502, ADR3433
► <a href="#">EVAL-CN0398-ARDZ (Page 79)</a>	Soil moisture and pH measurement system with temperature compensation	AD7124-8, ADR3433, ADA4661-2, ADP7118
<a href="#">EVAL-CN0396-ARDZ</a>	Dual electrochemical gas sensor with temperature compensation	AD7798, ADA4528-1, ADA4528-2, AD5270, ADT7310, ADP7102, ADR3412
<a href="#">EVAL-CN0395-ARDZ</a>	Volatile organic compound detector for indoor air quality measurement	AD7988-1, ADN8810, AD8628, ADG884, ADG758, ADP196, ADP124, ADR4540
<a href="#">EVAL-CN0409-ARDZ</a>	Water turbidity measurement	ADPD105, ADP7105A, ADG3301B
<a href="#">EVAL-CN0410-ARDZ</a>	3-channel programmable LED driver board	AD5686A, ADA4500-2, ADR4520, LTC6820, ADP7112

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“Circuits from the Lab” reference designs provide solutions for standalone applications or a starting point to build complex sub-systems. They are built and tested by Analog Devices, and include complete design and integration files.





## Select List of Arduino Shields for Sensors, Data Converters and Interface Products

	Board Part #	Description	ADI Part Number
Arduino Shields for Sensors	► <a href="#">EVAL-ADXL362-ARDZ (Page 77)</a>	Ultra-low power accelerometer with display Arduino Shield	ADXL362
	<a href="#">EVAL-ADXL372-ARDZ</a>	Micropower, 3-Axis +/-200g digital output MEMS Arduino Shield	ADXL372
Arduino Shields for Data Converters	<a href="#">DC2026C-KIT</a>	16-bit dual rail-to-rail DACs with I2C interface and 1-/2-channel 20-bit µPower no-latency Delta Sigma ADC	DC2026C
	<a href="#">DC2026C</a>	Linduino One isolated USB demo board, Arduino and QuikEval-compatible code development platform	DC2026C
	<a href="#">DC2459A-A</a>	Demo kit for 16-bit, 50 MSPS current output DAC	DC2459A-A
Arduino Shields for Interface	► <a href="#">DC2617A (Page 77)</a>	isoSPI and isolated CAN interface implementation on a single Arduino Shield	DC2617A
	<a href="#">DC2364A</a>	Single bus RS232/RS485 multiprotocol transceiver with integrated termination	DC2364A

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# Ultralow Power, 3-Axis MEMS Accelerometer: ADXL362

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The AD9172 is a high performance, dual, 16-bit DAC that supports sample rates up to 12.6 GSPS. The device features an 8-lane, 15 Gbps JESD204B data input port, a high performance, on-chip DAC clock multiplier, and digital signal processing capabilities targeted at single-band and multiband direct to radio frequency (RF) wireless applications.

## Applications

- Hearing aids
- Home healthcare devices
- Motion enabled power save switches
- Wireless sensors
- Motion enabled metering devices
- Class III medical implantable



Part #: [EVAL-ADXL362-ARDZ](#)

# soSPI/Isolated CAN Arduino Shield: DC2617A

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Demonstration circuit 2617A implements the isoSPI and isolated CAN interface hardware on a single Arduino shield. It allows Arduino-compatible controller boards to communicate with isoSPI and/or CAN bus networks. DC2617A is compatible with both 5V or 3.3V logic controller boards. DC2617A includes the LTC®6820 (isoSPI Isolated Communications Interface) and associated transformers to translate between the Arduino's SPI port and the RJ45 isoSPI connector

## Applications

- Industrial networking
- Battery monitoring systems
- Remote sensors



Part #: [DC2617A](#)



# Electrochemical Gas Detection Circuit: CN0357

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CN0357 single-supply, low noise, portable gas detector circuit using an electrochemical sensor. The Alphasense CO-AX carbon monoxide sensor is used. Electrochemical sensors offer several advantages for instruments that detect or measure the concentration of many toxic gases. Most sensors are gas specific and have usable resolutions under one part per million (ppm) of gas concentration.

ADI parts included in this circuit

Part #	Description
<a href="#">AD7790</a>	16-Bit, Single-Channel, Ultra Low Power, Sigma Delta A/D Converter
<a href="#">ADA4528-2</a>	Precision, Ultralow Noise, RRIO, Zero-Drift Dual Op Amp
<a href="#">AD8500</a>	Micropower Precision CMOS Operational Amplifier
<a href="#">AD5270</a>	1024-Position, 1% Resistor Tolerance Error, SPI Interface and 50-TP Memory Digital Rheostat
<a href="#">ADR3412</a>	Micro-Power, High-Accuracy 1.2V Voltage Reference



Part #: [EVAL-CN0357-ARDZ](#)

# High Gain Weigh Scale Design: CN0216

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Precision weigh scale design using the AD7791 24-Bit Sigma-Delta ADC with external ADA4528-1 zero-drift amplifiers. This solution allows for high dc gain with a single supply. Ultralow noise, low offset voltage, and low drift amplifiers are used at the front end for amplification of the low-level signal from the load cell.

ADI parts included in this circuit

Part #	Description
<a href="#">AD7791</a>	Low Power, Buffered, 24-Bit Sigma-Delta ADC
<a href="#">ADA4528-1</a>	Precision, Ultralow Noise, Rail-to-Rail Input/Output, Zero-Drift Op Amp
<a href="#">ADP3301</a>	High Accuracy anyCAP® 100mA Low Dropout Linear Regulator



Part #: [EVAL-CN0216-ARDZ](#)

# Ultralow Power Light Recognition System for Smart Agriculture: CN0397

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The circuit uses three photodiodes that are sensitive to different wavelengths (red, green, and blue), to measure light intensity levels over the light spectrum where plants are photosynthetically active. The measured results can be used to optimize the light source to match the requirements of the specific plants, enhance the growth rate, and minimize energy losses.

ADI parts included in this circuit

Part #	Description
<a href="#">ADA4528-2</a>	5.0V, Ultralow Noise, Zero Drift, RRIO, Dual Op Amp
<a href="#">AD5270-20</a>	1024-Position, 1% Resistor Tolerance Error, 50-TP Memory Digital Rheostat
<a href="#">ADR3412</a>	Micropower, 0.1% Accurate, 1.2 Voltage Reference
<a href="#">AD8500</a>	Micropower, RRIO, Op Amp
<a href="#">AD7790</a>	Low Power, 16-Bit Sigma-Delta, ADC



Part #: [EVAL-CN0397-ARDZ](#)

# Ultralow Power Light Recognition System for Smart Agriculture: CN0398

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This circuit is a single-supply, low power, high precision complete solution for soil moisture and pH measurements, including temperature compensation. The circuit is optimized for use with capacitive soil moisture sensors that are insensitive to water salinity and do not corrode over time. The circuit also measures soil pH and that function is suitable in a variety of applications.

ADI parts included in this circuit

Part #	Description
<a href="#">AD7124-8</a>	8-Channel, Low Noise, Low Power, 24-Bit, $\Sigma-\Delta$ ADC with PGA and Reference
<a href="#">ADA4528-1</a>	Micropower, High Accuracy Voltage Reference
<a href="#">ADA4661-2</a>	18 V, Precision, 725 $\mu$ A, 4 MHz, CMOS RRIO Operational Amplifier
<a href="#">ADP118-2.5</a>	20 V, 200 mA, Low Noise, CMOS LDO Linear Regulator



Part #: [EVAL-CN0398-ARDZ](#)



# FPGA Boards with the Arduino Connector

Intel part	Board Name	Brief Description	Category	Partner
► Intel® MAX® 10	<a href="#">XLR8 (Page 54)</a>	Arduino-compatible development board based on Intel MAX 10 FPGA	Development kit	Alorium Technology
Intel MAX 10	<a href="#">SnōMākr</a>	SnōMākr is a breakout board for Alorium Technology's Snō FPGA Module	Development kit	Alorium Technology
► Intel® Cyclone®	<a href="#">IoTCentipede™ (Page 22)</a>	Industry 4.0 gateway board with serial connectivity for aggregation and protocol bridging	Development kit, pre-production board	NovTech
► Intel MAX 10	<a href="#">FPGA Mezzanine for 96Boards (Page 50)</a>	Mezzanine card to add expansion capabilities (Grove, Raspberry Pi, Arduino) to 96Boards FPGA boards	Development kit	Shiratech
► Cyclone® V	<a href="#">DE10-Nano (Page 26)</a>	Dev kit based on Cyclone V SE 5CSEBA6U23I7 device (110K LEs)	Development kit	Terasic
Intel MAX 10	DE10-Lite	Development kit based on Intel MAX 10 10M50DAF484C7G Device	COTS, Development kit	Terasic
► Intel Cyclone 10 LP	<a href="#">CYC1000 (Page 10)</a>	Intel Cyclone 10 LP module with 25K LEs	SOM, COTS, Development kit	Trenz Electronic
► Intel Cyclone10 LP	<a href="#">Cyclone10 LP Reference Kit (Page 12)</a>	Reference kit based on CYC1000 Intel Cyclone 10 LP module with 55K LEs	SOM, COTS, Development kit	Trenz Electronic
► Intel MAX 10	<a href="#">MAX1000 (Page 52)</a>	FPGA IoT Maker Board based on Intel MAX 10 FPGA with 8K LEs	SOM, Development kit	Trenz Electronic
► Intel MAX 10	<a href="#">AnalogMAX (Page 52)</a>	Smoke detector module with three sensors and Intel MAX 10 FPGA with 8K LEs	SOM, Development kit	Trenz Electronic

► Featured in this guide





## Analog Devices Pmod Daughter Boards

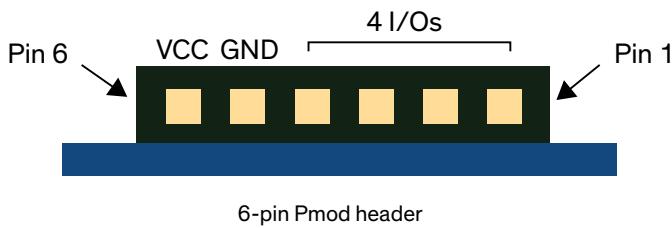
Pmod interface connects low frequency,  
low I/O pin count peripheral modules to the  
FPGA board



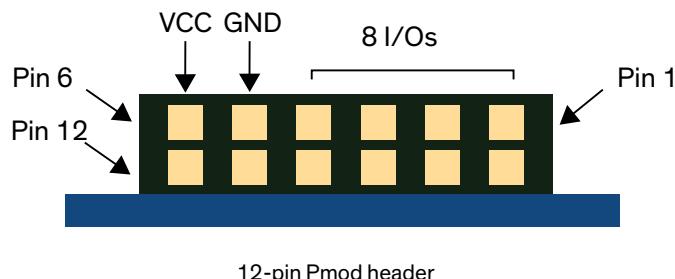
# Pmod Introduction

Pmod interface or Peripheral Module interface is an open standard defined by Digilent Inc for peripherals used with FPGAs or microcontrollers. Since the hardware interface is pre-designed, modules can be quickly assembled with host boards

for prototyping or evaluation purposes with no soldering required. There are six-pin and twelve-pin versions of the interface defined, encompassing SPI, I<sup>2</sup>C, UART, I<sup>2</sup>S, H-bridge and GPIO protocols.



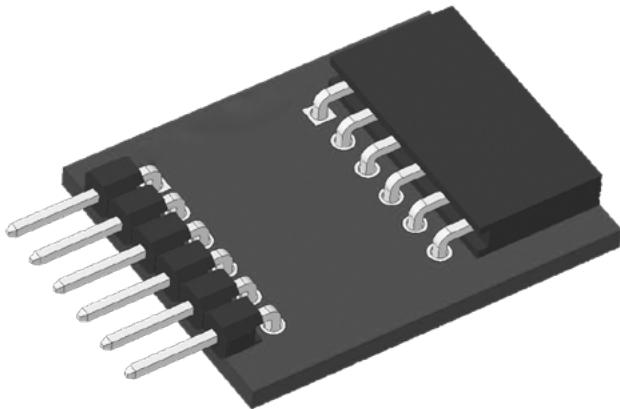
6-pin Pmod header



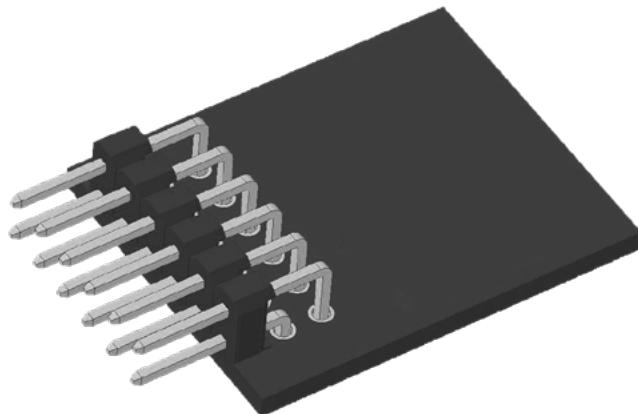
12-pin Pmod header

Analog Devices offers a range of Pmod peripheral modules that can extend the analog, sensor, and application capabilities of

Intel. Reference designs and software examples complement hardware offerings for quick and easy prototyping.



6-pin Pmod Connector\*



12-pin Pmod Connector\*

\* Picture source: Digilent



Picture source: Digilent

## Select List of “Circuits from the Lab” Boards with the Pmod Connector

Board Part #	Description	ADI Part Numbers
<a href="#"><u>EVAL-CN0326-PMDZ</u></a>	A completely isolated low power pH sensor signal conditioner and digitizer with automatic temperature compensation for high accuracy	AD7793, AD8603, ADUM5401
<a href="#"><u>EVAL-CN0335-PMDZ</u></a>	Processes $\pm 10$ V input signals using a single 3.3 V supply. The total error after room temperature calibration is less than $\pm 0.1\%$ FSR over a $\pm 10^\circ\text{C}$ temperature change, making it ideal for a wide variety of industrial measurements	AD7091R, AD8606, ADUM5401
► <a href="#"><u>EVAL-CN0336-PMDZ</u></a> <a href="#"><u>(Page 86)</u></a>	Processes 4 mA to 20 mA input signals using a single 3.3 V supply. The total error after room temperature calibration is $\pm 0.06\%$ FSR over a $\pm 10^\circ\text{C}$ temperature change, making it ideal for a wide variety of industrial measurements	AD7091R, AD8606, ADUM5401
<a href="#"><u>EVAL-CN0337-PMDZ</u></a>	Processes the output of a PT100 RTD and includes an innovative circuit for lead-wire compensation using a standard 3-wire connection	AD7091R, AD8606, ADUM5401
<a href="#"><u>EVAL-CN0346-PMDZ</u></a>	A relative humidity sensing circuit which can be connected up to any Pmod compatible host controller board	AD7745, AD8615
► <a href="#"><u>EVAL-CN0349-PMDZ</u></a> <a href="#"><u>(Page 86)</u></a>	A fully Isolated conductivity measurement data acquisition system	AD5934, AD8606, ADUM5000, ADUM1250, ADG715
<a href="#"><u>EVAL-CN0354-PMDZ</u></a>	A low power multichannel thermocouple measurement system with cold junction compensation	AD7787, AD8495, ADM8829, ADG1609, ADR3412, REF194
► <a href="#"><u>EVAL-CN0355-PMDZ</u></a> <a href="#"><u>(Page 85)</u></a>	A low power signal conditioner for resistive bridge type sensors and includes a temperature compensation channel	AD7793, AD8420, ADA4096-2
► <a href="#"><u>EVAL-CN0357-PMDZ</u></a> <a href="#"><u>(Page 87)</u></a>	An electrochemical gas sensing signal conditioning solution, designed to work with many electrochemical gas sensors down to resolutions of 1 part per million (ppm)	AD7790, ADA4528-2, AD8500, ADR3412, AD5270
<a href="#"><u>EVAL-CN0179-PMDZ</u></a>	A 4 mA-to-20 mA current loop transmitter for communication between a process control system and its actuator	AD5641, AD8657, ADR02
<a href="#"><u>EVAL-CN0216-PMDZ</u></a>	A precision weigh scale signal conditioning system. Ultralow noise, low offset voltage, and low drift amplifiers are used at the front end for amplification of the low-level signal from the load cell	AD7791, ADA4528-1, ADP3301

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# Select List of Sensors, MEMS and Data Converters Boards with the Pmod Connector

	Board Part #	Board and ADI Part # Description	ADI Part Numbers
Sensors and MEMS Boards with the Pmod Connector	► <a href="#">EVAL-ADT7420-PMDZ (Page 85)</a>	+/- 0.25 degree accurate digital temperature sensor	ADT7420
	PmodTMP2	A high accuracy digital temperature sensor over a wide industrial range, housed in a 4 mm × 4 mm LFCSP package	ADT7420
Data Converter Boards with the Pmod Connector	<a href="#">EVAL-AD7942-PMDZ</a>	14-Bit, 250 kSPS PulSAR®, pseudo differential ADC in MSOP/LFCSP	AD7942
	<a href="#">EVAL-AD7946-PMDZ</a>	14-Bit, 500 kSPS PulSAR® ADC in MSOP	AD7946
	<a href="#">EVAL-AD7685-PMDZ</a>	16-Bit, 250 kSPS PulSAR® ADC in MSOP/QFN	AD7685
	<a href="#">EVAL-AD7686-PMDZ</a>	500 kSPS 16-BIT PulSAR® A/D converter in MSOP/QFN	AD7686
	<a href="#">EVAL-AD7687-PMDZ</a>	16-Bit, 1.5 LSB INL, 250 kSPS PulSAR™ differential ADC in MSOP/QFN	AD7687
	<a href="#">EVAL-AD7688-PMDZ</a>	500 kSPS 16- BIT differential PulSAR® A/D converter in µSOIC/QFN	AD7688
	<a href="#">EVAL-AD7690-PMDZ</a>	18-Bit, 1.5 LSB INL, 400 kSPS PulSAR® differential ADC in MSOP/QFN	AD7690
	<a href="#">EVAL-AD7691-PMDZ</a>	18-Bit, 1.5 LSB INL, 250 kSPS PulSAR® differential ADC in MSOP/QFN	AD7691
	<a href="#">EVAL-AD7693-PMDZ</a>	16-Bit, ±0.5 LSB, 500 kSPS PulSAR® differential A/D converter in MSOP/QFN	AD7693
	<a href="#">EVAL-AD7980-PMDZ</a>	16-Bit, 1 MSPS, PulSAR ADC in MSOP/LFCSP	AD7980
	<a href="#">EVAL-AD7982-PMDZ</a>	18-Bit, 1 MSPS PulSAR 7 mW ADC in MSOP/LFCSP	AD7982
	<a href="#">EVAL-AD7983-PMDZ</a>	16-Bit, 1.33 MSPS PulSAR ADC in MSOP/QFN	AD7983
	<a href="#">EVAL-AD7984-PMDZ</a>	18-Bit, 1.33 MSPS PulSAR 10.5 mW ADC in MSOP/QFN	AD7984
	<a href="#">EVAL-AD7988-1-PMDZ</a>	16-Bit, 100ksps, ultra-low power 16-Bit SAR ADC	AD7988-1
	<a href="#">EVAL-AD7988-5-PMDZ</a>	16-Bit, 500ksps, ultra-low power 16 bit SAR ADC	AD7988-5

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## Low Power, Temperature Compensated Bridge Signal Conditioner and Drive: CN0355

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This reference design is a complete, low power signal conditioner for a bridge type sensor and includes a temperature compensation channel. This circuit is ideal for a variety of industrial pressure sensors and load cells that operate with drive voltages of between 5 V and 15 V.

### ADI parts included in this circuit

Part #	Description
<a href="#">AD7793</a>	3-Channel, Low Noise, Low Power, 24-Bit, Sigma-Delta ADC
<a href="#">AD8420</a>	Wide Supply Range, Micropower, Rail-to-Rail In-Amp
<a href="#">ADA4096-2</a>	30 V, MicroPower, Overvoltage Protection, Rail-to-Rail Input/Output (RRIO), Dual Op Amp



Part #: [EVAL-CN0355-PMDZ](#)

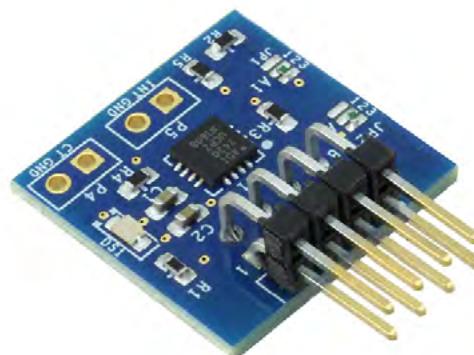
## +/-0.25 Degree Celsius Temperature Measurement Pmod Board: EVAL-ADT7420-PMDZ

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The Pmod compatible evaluation/prototyping board is a small form factor, low cost ambient temperature sensor measurement board. When prototyping, this board is used in conjunction with the ADICUP360 or the ADICUP3029 development platform. The ADT7420 is a high accuracy digital temperature sensor offering breakthrough performance over a wide industrial range, housed in a 4 mm × 4 mm LFCSP package

### Applications

- RTD and thermistor replacement
- Thermocouple cold junction compensation
- Medical equipment
- Industrial control and test
- Food transportation and storage
- Environmental monitoring and HVAC
- Laser diode temperature control



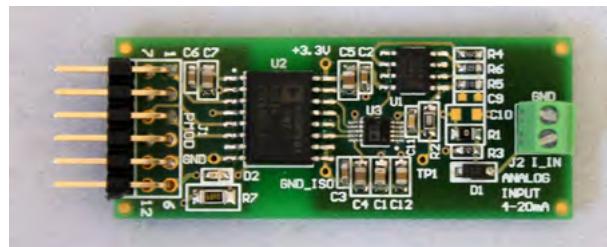
Part #: [EVAL-ADT7420-PMDZ](#)

## 12-Bit, 300 kSPS, Single-Supply, Fully Isolated, Data Acquisition System for 4-20 mA Inputs: CN0336

This circuit is a completely isolated 12-bit, 300 kSPS data acquisition system utilizing only three active devices. The system processes 4 mA to 20 mA input signals using a single 3.3 V supply. The total error after room temperature calibration is  $\pm 0.06\%$  FSR over a  $\pm 10^\circ\text{C}$  temperature change, making it ideal for a wide variety of industrial measurements.

ADI parts included in this circuit

Part #	Description
<a href="#">AD8606</a>	Precision, Low Noise, CMOS, Rail-to-Rail Input/Output Op Amp
<a href="#">AD7091R</a>	1 MSPS, Ultralow Power, 12-Bit ADC
<a href="#">ADuM5401</a>	4-Channel, 2.5 kV Isolators with Integrated DC-to-DC Converter



Board Part #: [EVAL-CN0336-PMDZ](#)

## Fully Isolated Conductivity Measurement Data Acquisition System: CN0349

The solution provides a complete, robust data acquisition solution for processing conductivity cell outputs, including temperature correction. This circuit is ideal for measuring the ionic content of liquids, water quality analysis, and chemical analysis. This design solution is optimized for high precision and low cost, and it uses only five active devices. The circuit has a total error of less than 1% FSR after calibration.

ADI parts included in this circuit

Part #	Description
<a href="#">AD5934</a>	250 kSPS, 12-Bit Impedance Converter Network Analyzer
<a href="#">AD8606</a>	Precision, Low Noise, Rail-to-Rail Input/Output, CMOS, Op Amp (Dual)
<a href="#">ADG715</a>	CMOS, Low Voltage, I <sup>2</sup> C Controlled, Octal SPST Switches
<a href="#">ADuM1250</a>	Dual-Channel I <sup>2</sup> C Digital Isolator
<a href="#">ADuM5000</a>	2.5 kV, Isolated DC-to-DC Converter



Board Part #: [EVAL-CN0349-PMDZ](#)

## Low Noise, Single-Supply, Toxic Gas Detector, Using an Electrochemical Sensor with Programmable Gain TIA for Rapid Prototyping: CN0357

This circuit is a single-supply, low noise, portable gas detector, using an electrochemical sensor. The Alphasense CO-AX carbon monoxide sensor is used in this example. Electrochemical sensors offer several advantages for instruments that detect or measure the concentration of many toxic gases. Most sensors are gas specific and have usable resolutions under one part per million (ppm) of gas concentration.

ADI parts included in this circuit

Part #	Description
<a href="#">ADA4528-2</a>	5.0 V, Ultralow Noise, Zero Drift, RRIO, Dual Op AMP
<a href="#">AD5270-20</a>	1024-Position, 1% Resistor Tolerance Error, 50-TP Memory Digital Rheostat
<a href="#">ADR3412</a>	Micropower, 0.1% Accurate, 1.2 Voltage Reference
<a href="#">AD8500</a>	Micropower, RRIO, Op Amp
<a href="#">AD7790</a>	Low Power, 16-Bit Sigma-Delta, ADC



Board Part #: [EVAL-CN0357-PMDZ](#)



## FPGA Boards with the Pmod Connector

Intel part	Board Name	Brief Description	Category	Partner
► Intel® Cyclone®	<a href="#">IoTCentipede™ (Page 22)</a>	Industry 4.0 gateway board with serial connectivity for aggregation and protocol bridging	Development kit, pre-production board	NovTech
Intel® MAX®10	<a href="#">MAX1000 - IoT Maker Board</a>	FPGA IoT Maker Board based on Intel MAX 10 FPGA with 8000 LEs	SOM, Development kit	Trenz Electronic
► Intel Cyclone 10	<a href="#">CYC1000 with Intel Cyclone 10 FPGA (Page 10)</a>	Intel Cyclone 10 LP module with 25K LEs	SOM, Development kit	Trenz Electronic
► Intel MAX10	<a href="#">AnalogMAX-ADI Dust Sensor (Page 52)</a>	Smoke detector module with three sensors and Intel MAX 10 FPGA with 8K LEs	SOM, Development kit	Trenz Electronic
► Intel Cyclone10 LP	<a href="#">Intel Cyclone10 LP Reference Kit (Page 12)</a>	Reference kit based on CYC1000 Intel Cyclone 10 LP module	SOM, Development kit	Trenz Electronic

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The journey from concept to production for electronic and computing products is complex, and the shortest route to market is not always clear. As the premier global provider of products, services, and solutions, Arrow can streamline the design process and supply chain to get to market quickly and efficiently.

Assisting customers at each stage of the product's development, Arrow offers unparalleled engineering expertise and solutions that work across a broad range of applications. Our design services, training, and tools keep projects on track and accelerate time-to-market.

Arrow provides:

- > Full support from developing application concept to product design and production
- > Advise on technology, system architecture and end-market specific needs
- > Unbiased technology and solutions options
- > Education and training on new technologies, products, and trends
- > On-demand engineering experts and resources
- > A vast eco-system to enable quick-solution build out

This partnership with Analog Devices and Intel is another example on how Arrow breaks down design complexity by bringing together a complementary portfolio of offerings from several vendors.



AHEAD OF WHAT'S POSSIBLE™



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# Overview of Analog Devices Product Portfolio

As the leading provider in analog & mixed signal technologies, Analog Devices provides solutions that bridge the physical and digital world. Armed with cutting edge technology and deep market knowledge, we are paving the way for a safer, healthier and enjoyable world. When you need a new perspective, advanced technology solutions and engineering expertise, you will find it here. Learn more about us by visiting [analog.com](http://analog.com)



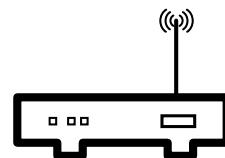
## Sense

Sensing capabilities that ensure precision, power efficiency, and robustness are at the highest integrity from the start.



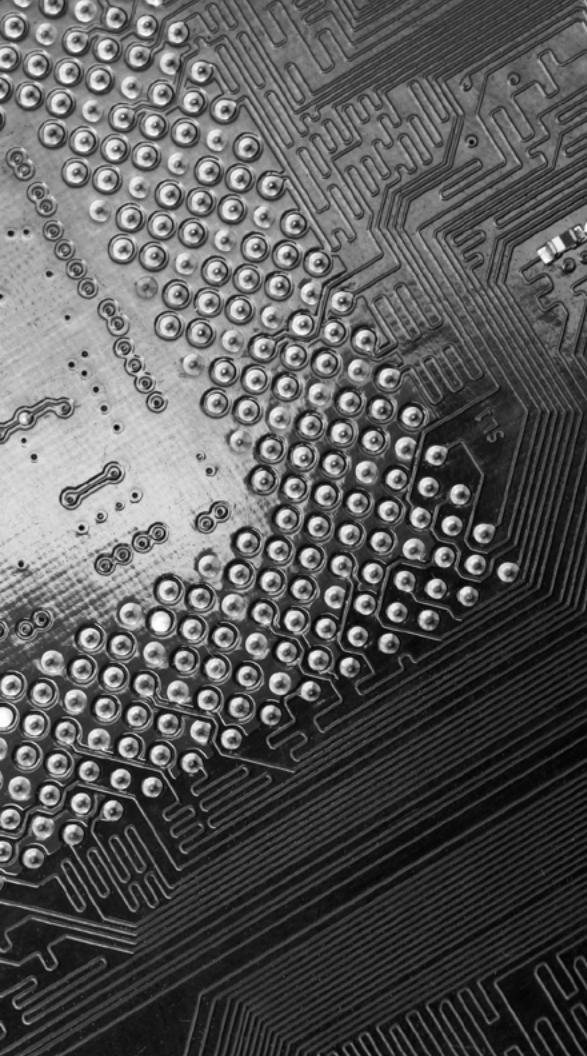
## Measure

Signal conditioning capabilities turn sensitive signals into useful information for solving challenging measurement problems.



## Connect

Next-generation connectivity solutions from RF to mmWave, optical, and cable technologies for a number of wireless protocols and range requirements to enable robust networks.



Visit [arrow.com](http://arrow.com) to buy any of the Intel, Analog Devices or partner boards featured in this guide.

Your local Arrow sales and field application engineers can assist with application-specific requirements, software tools, or any other engineering or supply chain requirements.

## NEXT STEPS

The standards-based development approach with FMC, Arduino and Pmod offers design flexibility and customization options to meet application needs. These standards are being adopted by 3<sup>rd</sup> party solutions providers, greatly increasing the number of available solutions.

This guide highlights solutions from the growing ecosystem of partners. New solutions will be continuously introduced as the Analog Devices, Intel, and Arrow ecosystem continues to expand.



# Are You Five Years Out?

Most people live in the present. The world of now. But a handful of us work in a unique world that doesn't quite exist yet—the world of Five Years Out.

Five Years Out is the tangible future. And the people who live and work there know that new technologies, new materials, new ideas and new electronics will make life not only different, but better. Not just cheaper, but smarter. Not just easier, but more inspired.

Five Years Out is an exciting place to be. So exciting that, once you've been there, it's hard to get excited about the present. Because we know what's coming is going to be so much better.

Five Years Out is a community of builders, designers, engineers and imaginers who navigate the path between possibility and practicality. Creating the future of everything from cars to coffeemakers.

Are you one of them? Then you're probably working with us.

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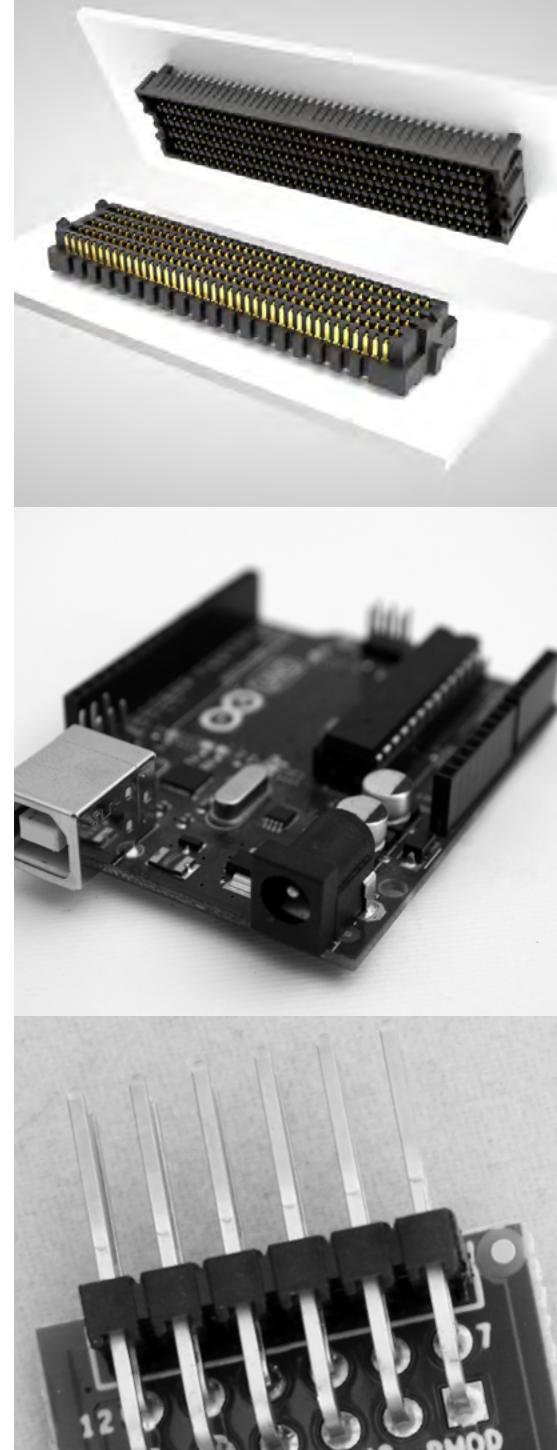
## Via Phone

Contact your local Arrow representative at  
North America **+1 855 326 4757**  
Europe, Middle East, & Africa **+44 20 3936 5486**  
Asia-Pacific **+86 400 920 0628**  
Or visit us at [arrow.com](http://arrow.com)

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Arrow Electronics, Inc.  
9201 East Dry Creek Road  
Centennial, CO 80112, USA



Analog Solutions Guide for FPGA-Based Designs