

**4 Tx/4 Rx, 0.1 GHz to 20 GHz Apollo MxFE 3UVPX Tuner + Digitizer + Processor****FEATURES**

- ▶ Four transmit (Tx) channels
  - ▶ Up to 28GSPS DACs
- ▶ Four receive (Rx) channels
  - ▶ Up to 20GSPS ADCs
- ▶ Swappable RF tuner personality cards
  - ▶ 0.1-20GHz tuning
  - ▶ Multiple tuner options
  - ▶ Phase and Hop Coherency
- ▶ Memory Options
  - ▶ 8 GB DDR4 Data Memory
  - ▶ 4 GB DDR4 Processing Memory
  - ▶ 270 Mb Ultra RAM
- ▶ Apollo MxFE™ Integrated DSP
  - ▶ DDC and DUC Up To 1,536x
  - ▶ RX to TX loopback
  - ▶ Fractional Sample Rate Converter
  - ▶ 512-point FFT Sniffer
- ▶ 12 V power supply
- ▶ Virtex™ VU11P
- ▶ Zynq™ ZU4EG
- ▶ Offload and Control Interfaces
  - ▶ 1 Gb Ethernet
  - ▶ 10 Gb Ethernet
  - ▶ 40 Gb Ethernet
  - ▶ 2x100 Gb Optical Ethernet
  - ▶ PCIe Gen. 3 interface x 8 lanes
- ▶ SOSA-aligned
  - ▶ 1" pitch 3UVPX form factor

**APPLICATIONS**

- ▶ Electronic test and measurement systems
- ▶ Radar and communications
  - ▶ Electronic warfare
  - ▶ Phased array system
  - ▶ Broadband communications systems

**GENERAL DESCRIPTION**

Analog Devices' ADSY1100-series is a family of wideband multi-channel RF digitizers in a 3UVPX SOSA™-aligned format. The system is built around ADI's next generation "Apollo" MxFE™ product ([AD9084](#)) featuring DAC sample rates up to 28 GSPS and ADC sample rates up to 20 GSPS in a 4Tx / 4Rx configuration. The [AD9084](#) includes integrated digital signal processing such as digital decimation, interpolation, numerically controlled oscillators (NCO), FFT sniffers, RX to TX loopback, linearization algorithms, fractional rate samplers and more. These built-in power-efficient DSP features free up FPGA resources for user-defined mission-specific processing. The digitizer card pairs [AD9084](#) with the AMD Virtex™ Ultrascale+ family of FPGAs. Depending on processing and power requirements, the user can vary settings options of the FPGA as needed. Swappable RF/Microwave Tuner Personality Cards mate to the digitizer card within the single 1" pitch chassis to allow optimized performance for a variety of applications. A Sensor Open Systems Architecture™ (SOSA™) aligned slot profile is used for the backplane connectors, allowing for a flexible system design which integrates well into customer prototype demonstrations. Software drivers are provided for enabling fast deployment.

TABLE OF CONTENTS

|                               |   |                                                  |   |
|-------------------------------|---|--------------------------------------------------|---|
| Features.....                 | 1 | Electrostatic Discharge (ESD) Ratings.....       | 5 |
| Applications.....             | 1 | ESD Caution.....                                 | 5 |
| General Description.....      | 1 | Pin Configuration and Function Descriptions..... | 6 |
| Functional Block Diagram..... | 3 | Theory of Operation.....                         | 7 |
| Specifications.....           | 4 | Outline Dimensions.....                          | 8 |
| Absolute Maximum Ratings..... | 5 | Model Descriptions.....                          | 8 |

The diagram illustrates the ADASY1100 system architecture, centered around two main processing blocks: a Zynq™ ULTRASCALE+™ ZU4EG and a Virtex™ ULTRASCALE+™ VU11P.

**Top Section (Zynq and External Interfaces):**

- Zynq™ ULTRASCALE+™ ZU4EG:**
  - Connected to an **SD CARD** via **SD CARD** interface.
  - Connected to an **ADI CRYPTOGRAPHIC CONTROLLER** via **SPI**.
  - Connected to **DDR4 + ECC** via **32-BIT** interface.
  - Connected to **SPI FLASH 2Gb** via **QSPI**.
  - Connected to **ADI POWER MANAGEMENT/ SEQUENCING** via **12V, 3.3V** and **CLK\_P0**.
  - Connected to **JTAG** and **UART** interfaces.

**Bottom Section (Virtex and System Interfaces):**

- Virtex™ ULTRASCALE+™ VU11P:**
  - Connected to the Zynq block via **SelMap**, **Aurora**, and **JTAG** interfaces.
  - Connected to two **DDR4** blocks via **32-BIT** interfaces.
  - Connected to **1GbE**, **40GbE/100GbE**, **10GbE/25GbE**, **x4 PCIe GEN 3**, and **x4 PCIe GEN 3** interfaces.
  - Connected to two **x4 25G OPTICAL TRANSCEIVER** blocks via **x4** interfaces, which are further connected to **100GbE** ports.
  - Connected to an **ADI CLOCK TREE** via **SYNC AND REFERENCE CLOCK** and **CLK\_P0** interfaces.
  - Connected to the **ADI AD9084 Apollo MxFE™** block via **JESD204C VSR** and **CONTROL** interfaces.
- ADI AD9084 Apollo MxFE™:**
  - Connected to the **ADI 0.1GHz TO 20GHz RF/ MICROWAVE TUNER PERSONALITY CARD OPTIONS** block via **4 Tx** and **4 Rx** interfaces.
  - Connected to the **ADI CLOCK TREE** via **SAMPLE CLOCK** and **LO AND REFERENCE** interfaces.
- ADI 0.1GHz TO 20GHz RF/ MICROWAVE TUNER PERSONALITY CARD OPTIONS:**
  - Connected to the **ADI CLOCK TREE** via **LO AND REFERENCE** interface.
  - Connected to the **ADI AD9084 Apollo MxFE™** block via **4 Tx** and **4 Rx** interfaces.
- ADI CLOCK TREE:**
  - Connected to the **ADI AD9084 Apollo MxFE™** block via **SAMPLE CLOCK** and **LO AND REFERENCE** interfaces.
  - Connected to the **Virtex™ ULTRASCALE+™ VU11P** via **SYNC AND REFERENCE CLOCK** and **CLK\_P0** interfaces.

**System Ports (P0, P1, P2):**

- P0:** Includes **12V, 3.3V**, **CLK\_P0**, **JTAG**, and **UART** ports.
- P1:** Includes **1GbE**, **40GbE/100GbE**, **10GbE/25GbE**, **x4 PCIe GEN 3**, and **x4 PCIe GEN 3** ports.
- P2:** Includes **100GbE** ports connected to the **x4 25G OPTICAL TRANSCEIVER** blocks.

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## SPECIFICATIONS

Table 1. Specifications

| Parameter                    | Test Conditions/Comments                                        | Min  | Typ                               | Max | Unit |
|------------------------------|-----------------------------------------------------------------|------|-----------------------------------|-----|------|
| SYSTEM DIGITAL OFFLOAD       | ADSY1100-1Bxx<br>ADSY1100-1Cxx                                  |      | 2x 100 GigE optical<br>No optical |     |      |
| ENVIRONMENTAL CLASS          | ADSY1100-xx0x, intended for Lab Use                             |      | 25                                |     | °C   |
|                              | ADSY1100-xx1x, VITA 47 ECC1                                     | 0    |                                   | 55  | °C   |
|                              | ADSY1100-xx3x, VITA 47 ECC2                                     | -40  |                                   | +70 | °C   |
| TUNER PERSONALITY CARD       |                                                                 |      |                                   |     |      |
| Tx Channels                  |                                                                 |      | 4                                 |     |      |
| Rx Channels                  |                                                                 |      | 4                                 |     |      |
| Features and Frequency Range |                                                                 |      |                                   |     |      |
|                              | ADSY1100-1xxA, 1st Nyquist digitizer                            | 0.1  |                                   | 20  | GHz  |
|                              | ADSY1100-1xxB, 1st Nyquist digitizer                            | 0.01 |                                   | 8.5 | GHz  |
|                              | ADSY1100-1xxD, passthru Tuner, 1st and/or 2nd Nyquist digitizer | TBD  |                                   | TBD | GHz  |
|                              | ADSY1100-1xxE, 1st and/or 2nd Nyquist digitizer                 | 0.1  |                                   | 18  | GHz  |
| POWER SUPPLIES               |                                                                 |      |                                   |     |      |
| 12_SYS                       |                                                                 |      | 12                                |     | V    |
| 3V3_AUX                      |                                                                 |      | 3.3                               |     | V    |
| 12_SYS Current               |                                                                 |      | TBD                               |     | A    |
| 3V3_AUX Current              |                                                                 |      | TBD                               |     | A    |

**ABSOLUTE MAXIMUM RATINGS****Table 2. Absolute Maximum Rating**

| Parameter              | Rating          |
|------------------------|-----------------|
| Maximum Supply Voltage | TBD             |
| Temperature            |                 |
| Operating Range        |                 |
| VITA 47, ECC1          | 0°C to 55°C     |
| VITA 47, ECC3          | -40°C to +70°C  |
| Storage Range Maximum  |                 |
| VITA 47, ECC1          | -40°C to +70°C  |
| VITA 47, ECC3          | -50°C to +100°C |

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

**ELECTROSTATIC DISCHARGE (ESD) RATINGS**

The following ESD information is provided for handling of ESD-sensitive devices in an ESD-protected area only.

Human body model (HBM) per ANSI/ESDA/JEDEC JS-001.

**ESD Ratings for ADSY1100****Table 3. ADSY1100, 3U VPX**

| ESD Model | Withstand Threshold (V) | Class |
|-----------|-------------------------|-------|
| HBM       | TBD                     | TBD   |

**ESD CAUTION**

**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

## PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

The ADSY1100 backplane IO is aligned with VITA 65.0 payload slot profile: [Figure 2](#). P2A/B pinning is described in [Table 4](#).

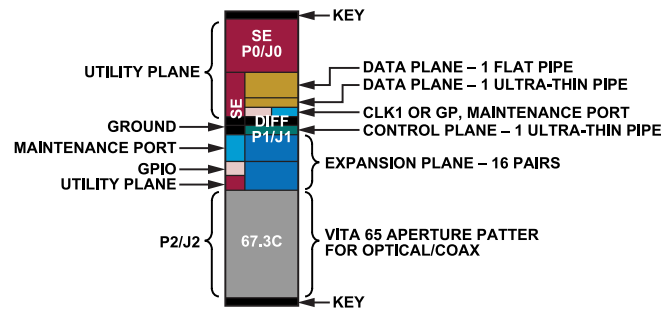


Figure 2. VITA 65.0 Payload Slot Profile SLT3-PAY-1F1U1S1S1U1U2F1H-14.6.11-12

Table 4. Pin Function Descriptions

| Pin No. | Mnemonic  | Type         | Description                                            |
|---------|-----------|--------------|--------------------------------------------------------|
| P2A-MT1 | Optical A | Input Output | MT Ferrule A, 1x 100Gbps Optical Ethernet              |
| P2A-B1  | NIC       | NIC          | NIC                                                    |
| P2A-B2  | NIC       | NIC          | NIC                                                    |
| P2A-B3  | NIC       | NIC          | NIC                                                    |
| P2A-B4  | NIC       | NIC          | NIC                                                    |
| P2A-C1  | REF_N     | Input        | Reference Clock Input Negative, Matched to 50 $\Omega$ |
| P2A-C2  | NIC       | NIC          | NIC                                                    |
| P2A-C3  | NIC       | NIC          | NIC                                                    |
| P2A-C4  | REF_P     | Input        | Reference Clock Input Positive, Matched to 50 $\Omega$ |
| P2A-D1  | RX0       | Input        | Channel 0, RF Input, Matched to 50 $\Omega$            |
| P2A-D2  | RX1       | Input        | Channel 1, RF Input, Matched to 50 $\Omega$            |
| P2A-D3  | RX2       | Input        | Channel 2, RF Input, Matched to 50 $\Omega$            |
| P2A-D4  | RX3       | Input        | Channel 3, RF Input, Matched to 50 $\Omega$            |
| P2B-MT1 | Optical B | Input Output | MT Ferrule B, 1x 100Gbps Optical Ethernet              |
| P2B-B1  | NIC       | NIC          | NIC                                                    |
| P2B-B2  | NIC       | NIC          | NIC                                                    |
| P2B-B3  | NIC       | NIC          | NIC                                                    |
| P2B-B4  | NIC       | NIC          | NIC                                                    |
| P2B-C1  | SYNC_N    | Input        | SYNC Input Negative, Matched to 50 $\Omega$            |
| P2B-C2  | NIC       | NIC          | NIC                                                    |
| P2B-C3  | NIC       | NIC          | NIC                                                    |
| P2B-C4  | SYNC_P    | Input        | SYNC Input Positive, Matched to 50 $\Omega$            |
| P2B-D1  | TX0       | Output       | Channel 0, RF Output, Matched to 50 $\Omega$           |
| P2B-D2  | TX1       | Output       | Channel 1, RF Output, Matched to 50 $\Omega$           |
| P2B-D3  | TX2       | Output       | Channel 2, RF Output, Matched to 50 $\Omega$           |
| P2B-D4  | TX3       | Output       | Channel 3, RF Output, Matched to 50 $\Omega$           |

## THEORY OF OPERATION

The ADSY1100 Digitizer Base Card houses the AD9084, Virtex™ UltraScale+™ FPGA and Zynq™ UltraScale+™ MPSoC, as well as optical transceivers, on-board memory, a power distribution network, clock conditioning and more. The P0 and P1 backplane connectors connect directly to the ADSY1100 Digitizer Base Card to provide a 12V power source, clock sources, auxiliary power, UART, JTAG, PCIe Gen3 data plane, 40 / 100Gb Ethernet data plane, 10 / 25Gb Ethernet data plane, 1Gb Ethernet SGMII control plane, Aurora expansion plane and more. An on-board phase-locked loop / synthesizer accepts a low-frequency reference clock and synthesizes two 20GHz low phase noise output signals used to serve as the sample clock for AD9084 and the Local Oscillator for some attached Tuner Personality Cards.

A family of Tuner Personality Cards mate to the ADSY1100 Digitizer Base Card to allow for optimized performance based on user case. Typical Tuner Personality Card functions include variable gain and attenuation, RF filtering, optional RF frequency conversion, and switched paths. Among these, the 0.01-8.5 GHz personality card employs a simple RF chain to operate in the 1<sup>st</sup> Nyquist. However, if a higher frequency range is needed, a 0.1-18GHz personality card implements a switchable filter bank to operate in the 1<sup>st</sup> and 2<sup>nd</sup> Nyquist. For a different high frequency option, a 0.1-20GHz personality card uses an integrated up-converter and down-converter to operate in the 1<sup>st</sup> Nyquist. Additionally, a Pass-thru personality card is available that omits the front-end signal chain and instead enables direct signal flow into the base card. Detected and synthesized signals arrive on the ADSY1100 Digitizer Base Card via RF / Microwave connectors which are delivered from the Tuner Personality Card.

Data is offloaded from the ADSY1100 Digitizer Base Card either by means of a 2x 100Gb Ethernet optical transceiver interface, which feeds P2A and P2B connectors, or by storing the digitized data to on-board memory and subsequently querying the memory from the SGMII interface.

OUTLINE DIMENSIONS

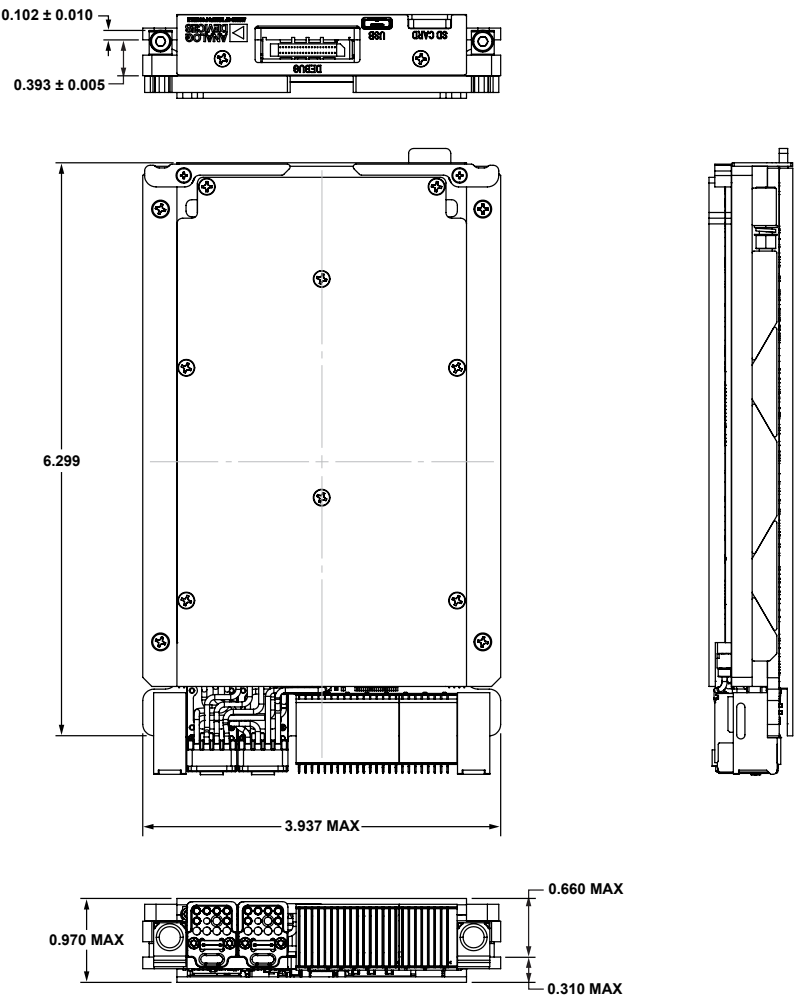


Figure 3. 40-Lead Module with Connector Interface [MODULE]  
(ML-40-1)  
Dimensions shown in inches

Table 5. Product Listing with Distinguishing Features

| Model         | System Digital Offload | Environmental Class        | Tuner Personality Card                                                            |
|---------------|------------------------|----------------------------|-----------------------------------------------------------------------------------|
| ADSY1100-1B0A | 2x 100 GigE Optical    | Intended for Lab Use       | 4Tx/4Rx, 0.1-20GHz, 1 <sup>st</sup> Nyquist Digitizer                             |
| ADSY1100-1B0B | 2x 100 GigE Optical    | Intended for Lab Use       | 4Tx/4Rx, 0.01-8.5GHz, 1 <sup>st</sup> Nyquist Digitizer                           |
| ADSY1100-1B0D | 2x 100 GigE Optical    | Intended for Lab Use       | 4Tx/4Rx, Passthru Tuner, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer |
| ADSY1100-1B0E | 2x 100 GigE Optical    | Intended for Lab Use       | 4Tx/4Rx, 0.1-18GHz, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer      |
| ADSY1100-1B1A | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, 0.1-20GHz, 1 <sup>st</sup> Nyquist Digitizer                             |
| ADSY1100-1B1B | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, 0.01-8.5GHz, 1 <sup>st</sup> Nyquist Digitizer                           |
| ADSY1100-1B1D | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, Passthru Tuner, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer |
| ADSY1100-1B1E | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, 0.1-18GHz, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer      |
| ADSY1100-1B3A | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, 0.1-20GHz, 1 <sup>st</sup> Nyquist Digitizer                             |
| ADSY1100-1B3B | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, 0.01-8.5GHz, 1 <sup>st</sup> Nyquist Digitizer                           |
| ADSY1100-1B3D | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, Passthru Tuner, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer |
| ADSY1100-1B3E | 2x 100 GigE Optical    | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, 0.1-18GHz, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer      |
| ADSY1100-1C0A | No Optical             | Intended for Lab Use       | 4Tx/4Rx, 0.1-20GHz, 1 <sup>st</sup> Nyquist Digitizer                             |

## MODEL DESCRIPTIONS

Table 5. Product Listing with Distinguishing Features (Continued)

| Model         | System Digital Offload | Environmental Class        | Tuner Personality Card                                                            |
|---------------|------------------------|----------------------------|-----------------------------------------------------------------------------------|
| ADSY1100-1C0B | No Optical             | Intended for Lab Use       | 4Tx/4Rx, 0.01-8.5GHz, 1 <sup>st</sup> Nyquist Digitizer                           |
| ADSY1100-1C0D | No Optical             | Intended for Lab Use       | 4Tx/4Rx, Passthru Tuner, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer |
| ADSY1100-1C0E | No Optical             | Intended for Lab Use       | 4Tx/4Rx, 0.1-18GHz, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer      |
| ADSY1100-1C1A | No Optical             | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, 0.1-20GHz, 1 <sup>st</sup> Nyquist Digitizer                             |
| ADSY1100-1C1B | No Optical             | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, 0.01-8.5GHz, 1 <sup>st</sup> Nyquist Digitizer                           |
| ADSY1100-1C1D | No Optical             | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, Passthru Tuner, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer |
| ADSY1100-1C1E | No Optical             | Temperatures: VITA 47 ECC1 | 4Tx/4Rx, 0.1-18GHz, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer      |
| ADSY1100-1C3A | No Optical             | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, 0.1-20GHz, 1 <sup>st</sup> Nyquist Digitizer                             |
| ADSY1100-1C3B | No Optical             | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, 0.01-8.5GHz, 1 <sup>st</sup> Nyquist Digitizer                           |
| ADSY1100-1C3D | No Optical             | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, Passthru Tuner, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer |
| ADSY1100-1C3E | No Optical             | Temperatures: VITA 47 ECC3 | 4Tx/4Rx, 0.1-18GHz, 1 <sup>st</sup> and/or 2 <sup>nd</sup> Nyquist Digitizer      |