**Features**

- Compact Single Board Computer designed around Xilinx Zynq-7020
- Radiation hardening utilizes Space Micro’s patented mitigation technologies
- 1U Cubesat form factor (8.81 cm × 8.95 cm)
- Various interfaces supported
- Robust hybrid computing platform for wide range of applications
- Low SWAP-C

**Specifications**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processor</strong></td>
<td>Xilinx Zynq-7020 System on Chip (SOC)</td>
</tr>
<tr>
<td></td>
<td>Dual Arm Core and Reconfigurable 7-Series FPGA Fabric</td>
</tr>
<tr>
<td></td>
<td>2.5 DMIPS/MHz per CPU</td>
</tr>
<tr>
<td></td>
<td>CPU frequency: 766 MHz</td>
</tr>
<tr>
<td><strong>IO</strong></td>
<td>Reconfigurable IO:</td>
</tr>
<tr>
<td></td>
<td>26x MIO (Multiplexed IO)</td>
</tr>
<tr>
<td></td>
<td>60x HR SelectIO (High Range Select IO)</td>
</tr>
<tr>
<td></td>
<td>*Not all interfaces can be used simultaneously</td>
</tr>
<tr>
<td><strong>Memory</strong></td>
<td>32 Gbit Rad Tolerant NAND Flash [FM]</td>
</tr>
<tr>
<td></td>
<td>2 Gbit NAND Flash [EM]**</td>
</tr>
<tr>
<td></td>
<td>8 Gbit DDR3 SDRAM (4 Gbit when EDAC is active) ***</td>
</tr>
<tr>
<td></td>
<td><strong>Legacy Note: All CSP EMs in the 94500 and 97930 RevE series and prior are manufactured with 8 Gbits of NAND Flash.</strong>*</td>
</tr>
<tr>
<td></td>
<td><em><strong>Legacy Note: All CSP EMs in the 94500 and 97930 RevJ series and prior are manufactured with 2 Gbits of SDRAM.</strong></em></td>
</tr>
<tr>
<td><strong>FPGA Programmable Logic</strong></td>
<td>10 MHz — 250 MHz Clock</td>
</tr>
<tr>
<td></td>
<td>24 differential pairs, 12 single ended</td>
</tr>
<tr>
<td></td>
<td>140 - 36Kbit Block RAM (4.9 Mbit)</td>
</tr>
<tr>
<td></td>
<td>Programmable I/O Blocks Support LVCMOS, LVDS, and SSTL, with 1.8 V, 2.5 V, 3.3 V I/O</td>
</tr>
<tr>
<td><strong>Power</strong></td>
<td>1.6 W — 2.85 W</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td>Designed in a 1U Cubesat form factor (8.81 cm x 8.95 cm)</td>
</tr>
<tr>
<td></td>
<td>Thickness: 0.25 cm (tallest component) [EM]</td>
</tr>
<tr>
<td></td>
<td>Thickness: 1.73 cm (tallest component) [FM]</td>
</tr>
<tr>
<td><strong>Mass</strong></td>
<td>60 g [EM]</td>
</tr>
<tr>
<td></td>
<td>74 g [FM]</td>
</tr>
</tbody>
</table>
## Interfaces

### CSP Evaluation Board
- EM kit includes:
  - Connects to Samtec SEAF-RA 4x40 Connector on CSP
- Included PHYS:
  - 1x USB
  - 1x Ethernet
  - 1x JTAG
  - 1x UART
  - 3x SpaceWire
  - 1x CameraLink
  - GPIO Breakout Headers
  - Power Regulators to Power CSP
  - FMC Header

### CSP USB/UART Board
- Connects to Evaluation Board
- USB to UART Converter
- RS-422 Converter

### CSP Board
- SpaceWire
- UART
- SPI
- I2C
- JTAG*
- Ethernet*
- USB*
  *Requires external PHY (Included with EM Evaluation Board)

## Parts Grade
- Commercial Space

## Operating Temperature
- CSP-01: EM 0°C to 70°C
- CSP-02: FM 0°C to 70°C

## Workmanship Standards
- CSP-01: IPC-A-610 Class 2 Acceptability of Electronic Assemblies
- CSP-02: IPC-A-610 Class 3 Acceptability of Electronic Assemblies, J-STD-001 with the J-STD-001 Space Addendum

## End Item Data Package (EIDP)
- **Engineering Model**
  - CSP PCBA Kit Test Procedure/Record
  - CAD Model for CSP PCBA (SolidWorks)
  - Certificate of Conformance
- **Flight Model**
  - CSP Board Test Procedure/Record
  - CSP Load Procedure/Record
  - Random Vibration Test Procedure/Record
  - Thermal Cycle Test/Record
  - Burn-In Test Procedure/Record
  - Non-Environmental Test Procedure/Record
  - Certificate of Conformance
Cubesat Space Processor (CSP)

**Specifications**

**Hardware Models**
- CSP-01: Engineering Model [EM]
- CSP-02: Flight Model [FM]

**Connector**
- Samtec SEAF-RA 4x40 Connector
  - Designed to be Connected to a Samtec SEAM 4 x 40 Backplane

**Radiation Tolerance**
- **SEL**
  - No Destructive Events
  - Watchdog SEL/SEB $L_{TH} \geq 86 \text{MeV} \cdot \text{cm}^2 / \text{mg}$
- **SEU**
  - Unmitigated—Same SEU rates as a commercial Xilinx 7 family Zynq part
  - 30 krads (Si)
- **TID**
  - Mitigated with Watchdog for ARM Cores (Patent Number 7,237,148 plus Re-Examination Certificate number RE42,314 C1)

**Software**

**Operating Systems**
- Bare Metal
  - Bare-metal functional test code is included.
- Linux
  - Buildroot configuration files are provided to support Linux development.
- ThreadX
  - Supported with additional license purchase—contact factory for more information

Many additional Options are supported on the Zynq-7020. Refer to Xilinx literature for more details.

**Testing**

<table>
<thead>
<tr>
<th>Tested Interfaces (EM and FM)</th>
<th>Test Code Provided</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAND Flash</td>
<td>Yes</td>
<td>Tested across entire memory range.</td>
</tr>
<tr>
<td>DDR3/SDRAM</td>
<td>Yes</td>
<td>Tested across entire memory range. Read and write eye tested.</td>
</tr>
<tr>
<td>SpaceWire*</td>
<td>Yes</td>
<td>Transmit (Tx) and Receive (Rx) packets validated through external SpaceWire probe.</td>
</tr>
<tr>
<td>Ethernet PHY*</td>
<td>Yes</td>
<td>Internet ping test. Assigned MAC address.</td>
</tr>
<tr>
<td>USB-UART</td>
<td>Yes</td>
<td>Tx and Rx packets used for outputting all serial test data to external PC.</td>
</tr>
</tbody>
</table>

*Only tested in default configuration.*
Figure 1: CSP-02 FM (dimensions in inches)

Figure 2: CSP-01 EM on Evaluation Board

Figure 3: CSP-01 EM Development Kit

CSP Development Kit

1. Evaluation Board
2. USB to UART Converter Board
3. CSP

Specifications Subject to Change Without Notice
Rev 9: 4/30/2019

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