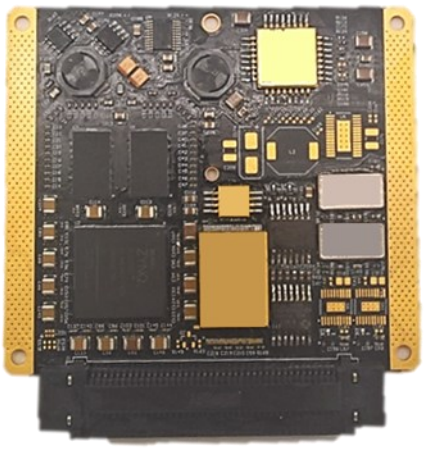
Cubesat Space Processor (CSP)

SPACE MICRO



CSP-02 FM

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 X 8.95 cm)
- Various interfaces supported
- Robust hybrid computing platform for wide range of applications
- Low SWAP-C

SPECIFICATIONS

Processor

Xilinx Zynq-7020 System on Chip (SOC)
Dual Arm Core and Reconfigurable 7-Series FPGA Fabric

2.5 DMIPS/MHz per CPU
CPU frequency: 766 MHz

IO*

Reconfigurable IO:
26x MIO (Multiplexed IO)
60x HR SelectIO (High Range Select IO)

*Not all interfaces can be used simultaneously

Memory

32 Gbit Rad Tolerant NAND Flash [FM]
2 Gbit NAND Flash [EM]**
8 Gbit DDR3 SDRAM (4 Gbit when EDAC is active) ***

**Legacy Note: All CSP EMs in the 94500 and 97930 RevE series and prior are manufactured with 8 Gbits of NAND Flash.
***Legacy Note: All CSP EMs in the 94500 and 97930 RevJ series and prior are manufactured with 2 Gbits of SDRAM.

FPGA Programmable Logic

- 10 MHz — 250 MHz Clock
- 24 differential pairs, 12 single ended
- 140 - 36Kbit Block RAM (4.9 Mbit)
- Programmable I/O Blocks Support LVCMOS, LVDS, and SSTL, with 1.8 V, 2.5 V, 3.3 V I/O

Power

1.6 W — 2.85 W

Size

Designed in a 1U Cubesat form factor (8.81 cm x 8.95 cm)

Thickness: 0.25 cm (tallest component) [EM]
Thickness: 1.73 cm (tallest component) [FM]

Mass

60 g [EM]
74 g [FM]

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SPECIFICATIONS

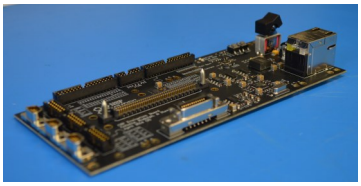
Interfaces

EM kit includes:

Connects to Samtec SEAF-RA 4x40 Connector on CSP

Included PHYs:

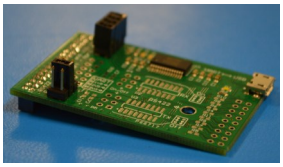
1x USB
1x Ethernet
1x JTAG
1x UART
3x SpaceWire
1x CameraLink
GPIO Breakout Headers
Power Regulators to Power CSP
FMC Header



CSP Evaluation Board

CSP-01 EM Development Kit

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

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Cubesat Space Processor (CSP)

SPACE MICRO

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 LET_{TH} : 86MeV•cm^2/mg

SEU — Unmitigated—Same SEU rates as a commercial Xilinx 7 family Zynq part

TID — 30 krads (Si)

SEFI — 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

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

*Only tested in default configuration.

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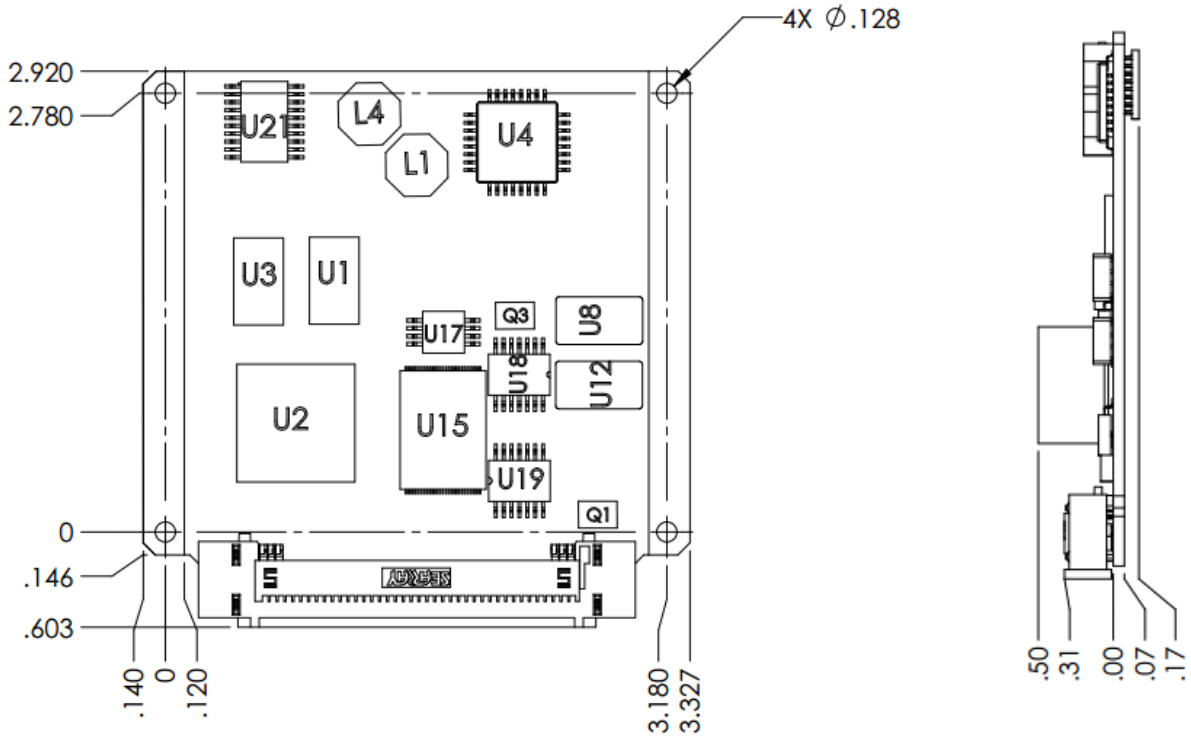


Figure 1: CSP-02 FM (dimensions in inches)

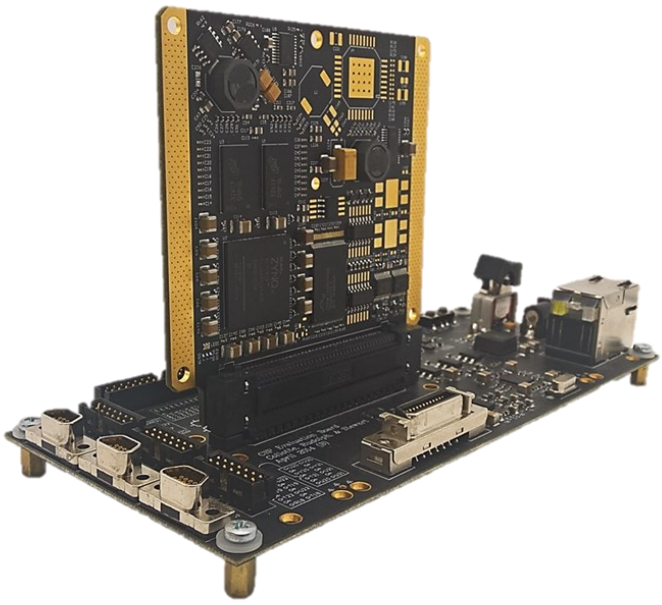
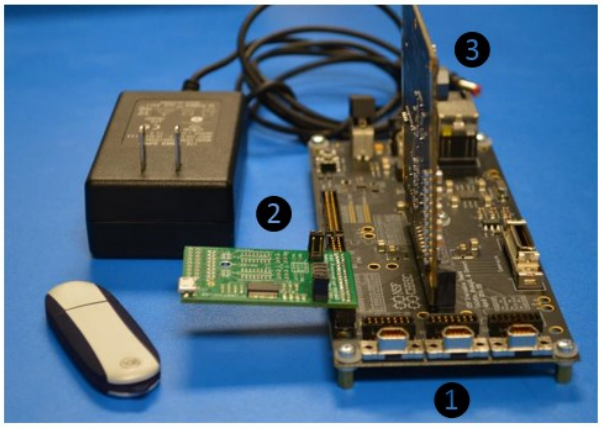


Figure 2: CSP-01 EM on Evaluation Board



CSP Development Kit

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

Figure 3: CSP-01 EM Development Kit

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