DATA PATTERNS

DP-OBC-0402

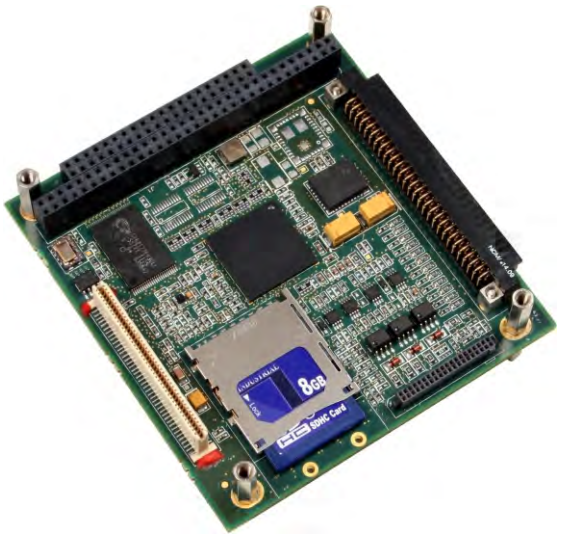
On Board Computer

KEY FEATURES AND BENEFITS

- PC104 form factor compatible
- e200 core processor
- Dual core micro controller operating in lock step mode or decoupled parallel mode (dual core mode)
- Redundant peripherals
- On chip memory with Error Correction Code (ECC)
- EBI (Extended Bus Interface) for memory and I/O expansion
- Code download feature through external module
- Industry standard serial communication interfaces
- Flex PWM (Pulse Width Modulator) units with four 16bit channels per module
- In-built ADC for temperature monitoring and sensor interfaces
- Full redundant bus configuration with two OBCs and a redundant switching module
- Redundant boot option
- 4RS422, 2SPI, 3I^{2}C, 2 Flex CAN and 10/100 Mbps MII (Media Independent Interface) Ethernet interface
- Extended memory - 8GB SD card, 2MB external user flash and 8MB SRAM
- 5V/3.3V power options with low power consumption
- Temperature sensor for temperature monitoring
- WDT for processor health monitoring

APPLICATION

- Micro / nano satellite
- Mission critical applications
- Rovers or other remotely operated vehicles
- Automobiles



DESCRIPTION

The DP-OBC-0402 is a rugged, compact On Board Computer (OBC) module that provides complete low power solution for the signal processing and communication interfaces to the various sub systems of Cube Satellite and mission critical system, supporting wide array of pay loads.

FUNCTIONS OF OBC IN CUBESAT

- The OBC module receives telecommand data from the UHF receiver and generates satellite power management commands, ON/OFF pulse commands, time tag commands, Attitude and Orbit Control System (AOCS) control, navigation control etc.
- The OBC receives compressed payload images from the payload data handler through the SPI interface and stores it in an external 8GB storage memory. The payload can be sent to earth through UHF / S-Band transmitter module up-link systems.
- The OBC determines attitude information from the sensors and maintains the satellite's position and orbit on desired path. It can receive the universal time, latitude and longitude details from the GPS device installed in a system.
- Dedicated master/slave configurable serial bus interface for inter OBC communication in a platform involving redundant configurations.

BLOCK LEVEL EXPLANATION

This module consists of low power high performance microcontroller and various memories (Flash and SRAM) to meet the processing and data loading requirements of CUBESAT applications. It has various serial communication interfaces to communicate with other modules. SD card slot is provided for expandable memories. SD card interface is implemented through Standard Peripheral Interface (SPI).

It also has an in-built ADC for analog sensors and temperature sensor. It has an in-built FPGA to implement the custom serial interfaces. It has PWM controllers to generate programmable PWM outputs. All necessary supplies are generated internally and 3.3V / 5V supply options available.

For debugging and console interface, it supports a standard RS422 port and an optional fast Ethernet port operating at 10/100Mbps for data streaming to the external world. Ethernet physical layer and magnetics, processor JTAG and FPGA JTAG interfaces are supplemented through a separate piggy module (DP-OBC-0402F).

DATA PATTERNS

DP-OBC-0402

MICROCONTROLLER

The OBC has a high performance, low power, dual 32bit power architecture microcontroller operating at a core frequency upto 180MHz. The controller can operate in both lock step mode (Synchronized mode. Both the cores performs the same function) and dual core mode.

MEMORY

The controller has an inbuilt 2MB code flash memory (with ECC), 64KB data flash memory (with ECC), 512KB on chip SRAM (with ECC). The chip also has an EBI to support external SRAM and asynchronous flash memories. The module supports an 8GB SD card for the payload data storage. A stopper is provided for holding the SD card under vibration environment.

SERIAL COMMUNICATION INTERFACE

The module supports a wide array of serial communication interfaces including SPI, I^2C, CAN, UART – RS422/RS485 etc. to interface with the various sensors and I/O modules.

FIELD PROGRAMMABLE GATE ARRAY (FPGA)

An inbuilt low power FPGA is used on EBI bus. The FPGA provides I/O expansion and custom serial interfaces for pay load, additional SPI , UART interfaces.It supports custom I/O interface for video payload applications.

ANALOG TO DIGITAL CONVERTER (ADC)

The module supports 12 analog input channels mapping to the on chip 12bit ADCs for sensing temperature of all sub systems and also 8 channels for precision analog sensor output measurement. It supports AOCS sensors and thermistors based temperature monitoring.

DIGITAL INPUT OUTPUT (DIO)

The module has general purpose digital input and output channels to monitor the health status of various sub systems and enable control commands.

WATCH DOG TIMER (WDT)

The controller supports inbuilt timers and software WDT. Also, the OBC has an external WDT interface implemented in FPGA to continuously monitor the processor health status and reset the processor / trigger the changeover of redundant functions based on application.

SPECIFICATIONS

MICROCONTROLLER

Type	: E200 microcontroller series
Core	: Dual core
Core frequency	: Upto 180MHz
Internal memory	: 512 KB SRAM with ECC
	: 2 MB code flash memory
	: 64 KB data flash memory
External memory	: 8 MB SRAM and 2 MB user flash
Storage memory	: 8 GB Storage card

EXTERNAL SERIAL COMMUNICATION INTERFACE

Ethernet (optional)*

1 channel at 10/100 Mbps MII

JTAG Interface

- Code warrior U multilink JTAG interface for micro controller
- Actel series JTAG Debugger interface for FPGA

I^2C

3 nos. of individual I^2C at transfer speed of 100Kbps

Universal Asynchronous Receiver/Transmitter (UART)

- 4 nos. of RS422 with configurable baud rate upto 115.2 Kbps
- 2 nos. of RS422 with configurable baud rate using FPGA

Serial Peripheral Interface (SPI)

2 nos. of SPI at the data rate of 1 Mbps (Max.) using FPGA

Custom Serial Interfaces

Custom serial interface for payload and external control through FPGA

Controller Area Network (CAN) (optional)

2 nos. at programmable bit rate of 1 Mbps
(Digital Low Voltage Transistor Transistor Logic (LVTTL) interface only)

ANALAOG INPUT

- 12 channels for thermistor monitoring or analog inputs with a range of 0V to 3.3V
- 8 channels for precise analog measurement with a range of 0V to ±5V
- 12 bit resolution

DATA PATTERNS

DP-OBC-0402

SPECIFICATIONS

DIGITAL INPUT OUTPUT

- 4 nos. of general Purpose Output (GPO) control lines
- 9 nos. of LVTTL level General Purpose Inpust (GPIs) for status monitoring

PULSE WIDTH MODULATION CONTROLLED OUTPUT

Resolution : 16bit

Signal type : (LVTTL) signal to H bridge drivers in external I/O expansion module or redundancy switching module

OTHER INTERFACES

- WDT with software selectable time outs
- External WDT monitors the processor health

CONNECTOR SPECIFICATION

5V Power Supply and Local Bus Interface

- PC104 connector stack – 60 pin primary connector (optional) and 44 pin secondary connector (optional)

I/O Interface Connector

- I/O connector 1 – 84 pin Samtec stackable series type with serial peripheral interfaces to redundant switching module.
- I/O connector 2 – 84 pin Nicomatic 3 row right angle for analog input and digital input / output signals.

POWER SUPPLY REQUIREMENT

Input power supply	: 3.3V* / 5V#
Maximum power consumption	: <3W
Maximum power dissipation	: <3W

MECHANICAL

Dimension in mm	: 96(L) x 91(B) x 15(H)
Weight in grams	: <90

ENVIRONMENTAL SPECIFICATION

Operating temperature	: -40ºC to +55ºC
Storage temperature	: -55ºC to +125ºC

(Contact factory for extending the temperature range.)

ORDERING INFORMATION

DP-OBC-0402- X X X X

- X (4th): 0 - Reserved; 3 - Reserved
- X (3rd): 0 - PC104 compliant; 3 - PC104 form factor compliant
- X (2nd): 3 - Air cooled; 6 - Conduction cooled
- X (1st): 3 – Commercial temperature range; 6 – Rugged wide temperature range

Note :
* 3.3V for non PC104 option
# 5V for PC104 option

DP-OBC-0402

BLOCK DIAGRAM OF DP-OBC-0402