PRU CAPE Hardware

Verified Design

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PRU CAPE Hardware

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1 Introduction

This document describes the hardware architecture of the PRU Cape that is compatible with the Beagle Bone Black development platform.

1.1 Description

The PRU Cape is a test, development, and evaluation module system that enables developers to write software and develop hardware around the PRU subsystem. Examples of basic I/O such as push buttons and LEDs as well as more complicated examples such as audio and 1-Wire for temperature sensing are available on this cape to showcase what the PRU can accomplish in terms of inputs and outputs.

The following sections give more details regarding the PRU Cape.

1.2 EVM System View

The PRU Cape is shown in Figure 1.

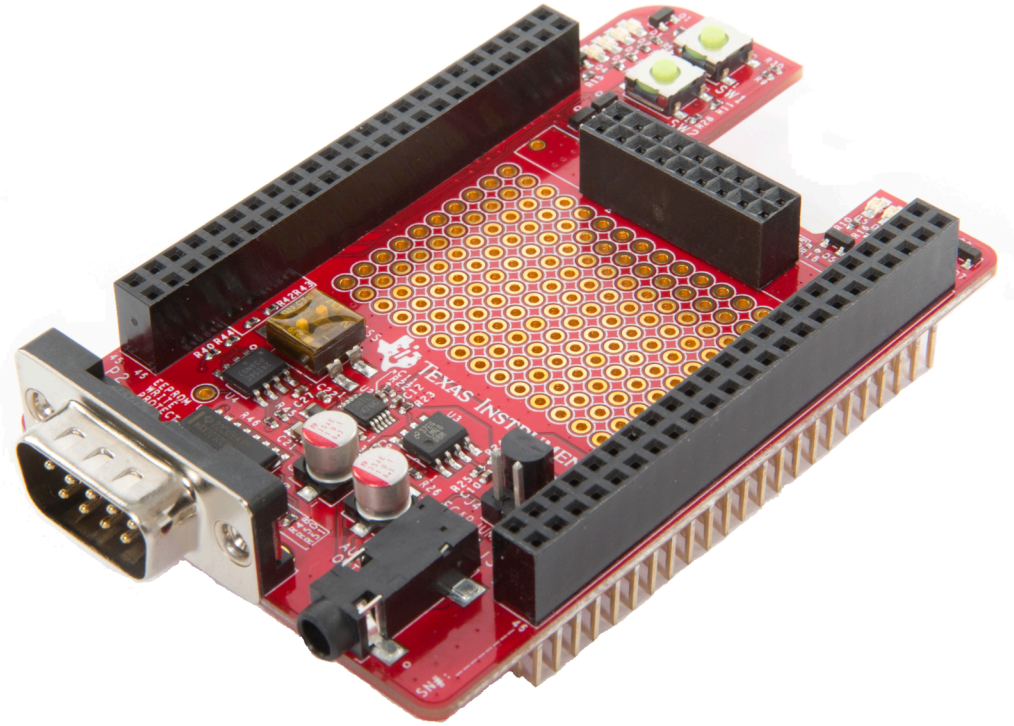

Figure 1. PRU Cape Angle

2 System Description

2.1 System Board Diagram

The system block diagram of the PRU Cape are shown in Figure 2 and Figure 3.

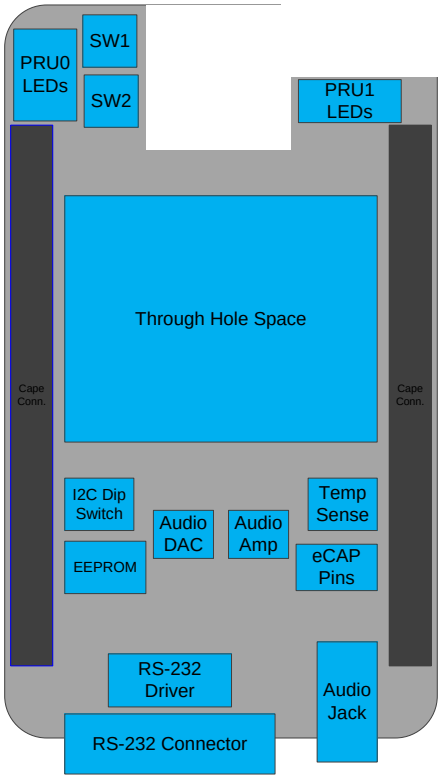

Figure 2. PRU Cape Board Layout

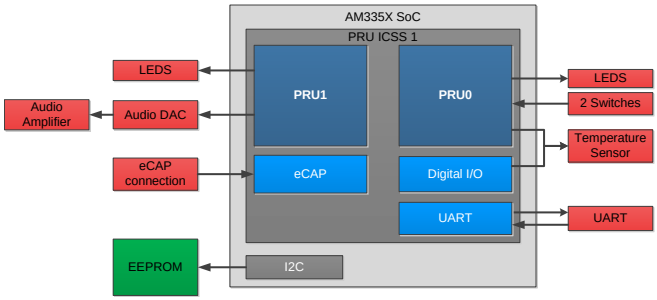

Figure 3. PRU Cape Functional Block Diagram

2.2 Signals Used

Table 1. Signals Used

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	CAPE USE
PR1_PRU0_GPO0	P9-31	MCASP0_ACLKX	PRU0 Blue LED
PR1_PRU0_GPO1	P9-29	MCASP0_FSX	PRU0 Orange LED
PR1_PRU0_GPO2	P9-30	MCASP0_AXR0	PRU0 Green Led
PR1_PRU0_GPO3	P9-28	MCASP0_AHCLKR	PRU0 Red LED
PR1_PRU1_GPO3	P8-44	LCD_DATA3	PRU1 Blue LED
PR1_PRU1_GPO4	P8-41	LCD_DATA4	PRU1 Green LED
PR1_PRU1_GPO5	P8-42	LCD_DATA5	PRU1 Red LED
PR1_PRU0_GPI7	P9-27	GPIO3_19	SW1
PR1_PRU0_GPI5	P9-25	GPIO3_21	SW2
PR1_PRU1_GPO0	P8-45	LCD_DATA0	Audio Data
PR1_PRU1_GPO1	P8-46	LCD_DATA1	Audio Clock
PR1_PRU1_GPO2	P8-43	LCD_DATA2	Audio Sync
PR1_UART0_TXD	P9-24	UART1_TXD	UART TxD
PR1_UART0_RXD	P9-26	UART1_RXD	UART RxD
PR1_UART0_RTS	P9-21	UART2_TXD	UART RTS
PR1_UART0_CTS	P9-22	UART2_RXD	UART CTS
PR1_PRU_EDIO_DATA_OUT6	P8-39	LCD_DATA6	LCD RS
PR1_PRU_EDIO_DATA_OUT4	P8-28	LCD_PCLK	LCD E
PR1_PRU_EDIO_DATA_OUT0	P9-18	I2C1_SDA	LCD Data4
PR1_PRU_EDIO_DATA_OUT1	P9-17	I2C1_SCL	LCD Data5
PR1_PRU_EDIO_DATA_OUT2	P8-27	LCD_VSYNC	LCD Data6
PR1_PRU_EDIO_DATA_OUT3	P8-29	LCD_HSYNC	LCD Data7
PR1_PRU_EDIO_DATA_OUT5	P8-30	LCD_DE	HDQ input
PR1_PRU0_GPI14	P8-16	GPIO1_14	HDQ output
I2C2_SDA	P9-20	I2C2_SDA	I2C SCL
I2C2_SCL	P9-19	I2C2_SCL	I2C SDA
PR1_ECAP0_IN_PWM0_OUT	P9-42	ECAP0_IN_PWM0_OUT	ECAP0_IN_PWM0_OUT
PR1_PRU0_GPI15	P8-15	GPMC_AD15	PRU0_GPI_15
VDD_3V3C	P9-3, P9-4	VDD_3V3C	VDD_3V3C
DGND	P8-1, P8-2, P9-1,P9-2	DGND	DGND
DGND	P9-43, P9-44, P9-45, P9-46	DGND	DGND

3 PRU Cape Functional Block Descriptions

This section describes major functional blocks of the PRU Cape.

3.1 Audio

The audio portion of the PRU Cape is composed of a dual 8-bit DAC (DAC082S085) and a dual 105-mW amplifier (LM4808). The output is then sent to a 3.5-mm audio jack with a max pk-pk of .89 V, following the consumer standard.

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	CAPE USE
PR1_PRU1_GPO0	P8-45	LCD_DATA0	Audio Data
PR1_PRU1_GPO1	P8-46	LCD_DATA1	Audio Clock
PR1_PRU1_GPO2	P8-43	LCD_DATA2	Audio Sync

3.2 Electrically Erasable Programmable Read-Only Memory (EEPROM)

The EEPROM on the PRU cape is the CAT24C256WI-G EEPROM 256-Kb I2C SOIC8, and has an attached DIP switch to manipulate the I2C address. The first 78 bytes hold a file that the Beagle Bone Black will read to identify the cape. The rest of the EEPROM is available for use.

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	CAPE USE
I2C2_SDA	P9-20	I2C2_SDA	I2C SCL
I2C2_SCL	P9-19	I2C2_SCL	I2C SDA

3.3 Enhanced Capture (eCAP)

These pins are brought out on the board that connect to the eCAP0 PWM0 IN to allow use of the eCAP IP.

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	CAPE USE
PR1_ECAP0_IN_PWM0_OUT	P9-42	ECAP0_IN_PWM0_OUT	ECAP0_IN_PWM0_OUT
PR1_PRU0_GPI15	P8-15	GPMC_AD15	PRU0_GPI_15

3.4 Light-Emitting Diodes (LEDs)

The PRU Cape has seven surface mounted LEDs including red, orange, blue, and green colors. Four LEDs connect to the PRU0 output and three LEDs connect to the PRU1 output.

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	PRU CAPE USE
PR1_PRU0_GPO0	P9-31	MCASP0_ACLKX	PRU0 Blue LED
PR1_PRU0_GPO1	P9-29	MCASP0_FSX	PRU0 Orange LED
PR1_PRU0_GPO2	P9-30	MCASP0_AXR0	PRU0 Green Led
PR1_PRU0_GPO3	P9-28	MCASP0_AHCLKR	PRU0 Red LED
PR1_PRU1_GPO3	P8-44	LCD_DATA3	PRU1 Blue LED
PR1_PRU1_GPO4	P8-41	LCD_DATA4	PRU1 Green LED
PR1_PRU1_GPO5	P8-42	LCD_DATA5	PRU1 Red LED

3.5 Switches

The PRU Cape has two pushbutton switches connected to PRU0 inputs.

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	PRU CAPE USE
PR1_PRU0_GPI7	P9-27	GPIO3_19	SW1
PR1_PRU0_GPI5	P9-25	GPIO3_21	SW2

3.6 Temperature Sensor

The temperature sensor is a MAX31820 ambient temperature sensor with a 1-Wire interface. Two pins are tied together from the PRU to create input and output on a single wire.

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	CAPE USE
PR1_PRU_EDIO_DATA_OUT5	P8-30	LCD_DE	HDQ input
PR1_PRU0_GPI14	P8-16	GPIO1_14	HDQ output

3.7 Test Space

The test space is a set of 150 through holes (15×10). The through holes have no connection in between and are meant for attaching a through hole component, whether it be passive or an IC, to test with the PRU or any signal that can be accessed through the cape headers.

3.8 Universal Asynchronous Receiver/Transmitter (UART)

The PRU Cape has one RS-232 connector (DB9 male). The MAX3232ECD is the line driver and receiver.

CAPE NAME	BBB HEADER NUMBER	BBB MODE 0 NAME	CAPE USE
PR1_UART0_TXD	P9 24	UART1_TXD	UART TxD
PR1_UART0_RXD	P9 26	UART1_RXD	UART RxD
PR1_UART0_RTS	P9 21	UART2_TXD	UART RTS
PR1_UART0_CTS	P9 22	UART2_RXD	UART CTS

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