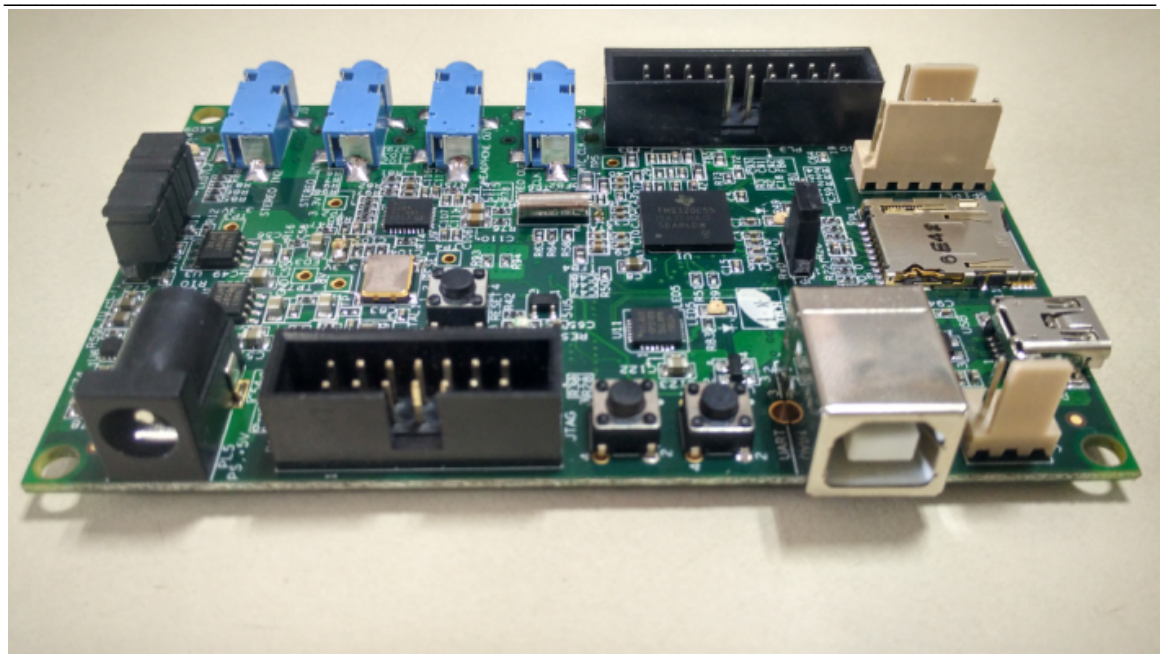
EPB_C5515 Manual



About This Manual

This document describes board level operations of the EPB_C5515 based on the Texas Instruments TMS320C5515 DSP

The EPB_C5515 is a stand-alone module permitting engineers and software developer's evaluation of certain characteristics of the TMS320C5515 DSP to determine processor applicability to design requirements. Evaluators can create software to execute onboard or expand the system in a variety of ways.

Notational Conventions

This document uses the following conventions.
The "Educational Practice Board C5515" will sometimes be referred to as the "EPB_C5515".

Information about Cautions

This Technical Reference Manual may contain cautions.

This is an example of a caution statement.
A caution statement describes a situation that could potentially damage your software, hardware, or other equipment. The information in a caution is provided for your protection. Please read each caution carefully.

Chapter1

Introduction to the EPB_C5515

This chapter provides a description of the EPB_C5515 for the TMS320C5515 DSP, key features, and block diagram of the circuit board

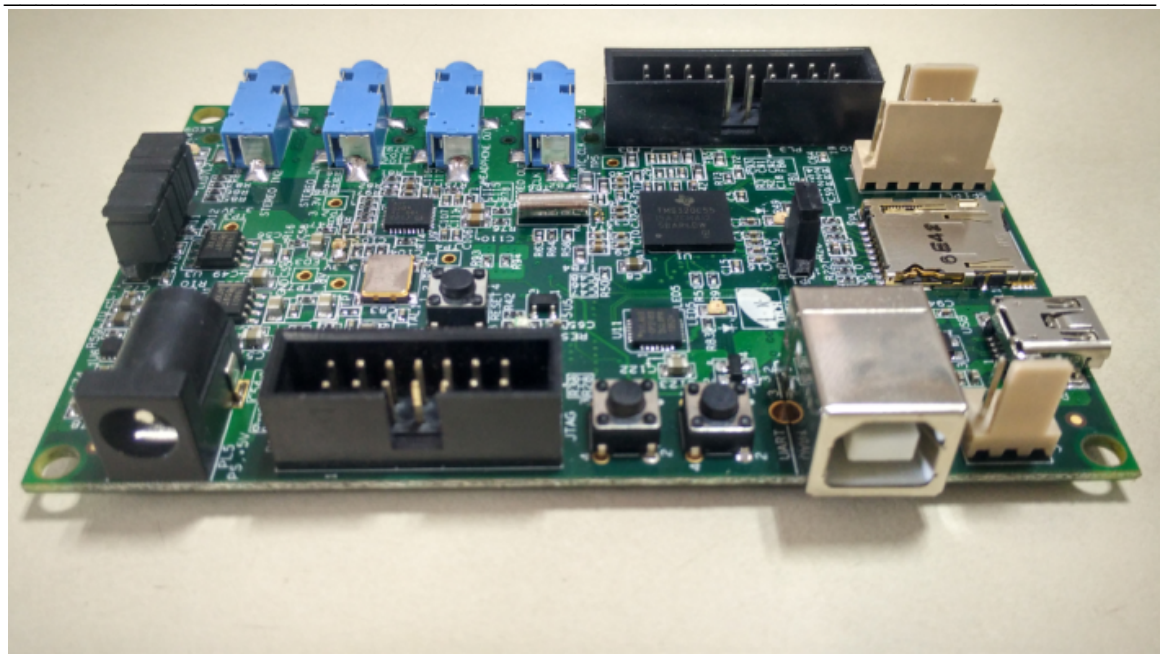
Topic

1.0 Overview of the EPB_C5515

The EPB_C5515 is a stand-alone card--allowing developers to evaluate the TMS320C5515 DSP to determine if it meets their Application requirements. Furthermore, the module is an excellent platform to develop and run software for the TMS320C5515 DSP.

The EPB_C5515 is shipped with a TMS320C5515 DSP. The EPB_C5515 allows full speed verification of C5515 code.

To simplify code development and shorten debugging time, a C5000 Code Composer Studio driver is provided. In addition, an onboard JTAG connector provides interface to emulators, with assembly language and ‘C’ high level language debug.



1.1 Key Features of the EPB_C5515

1.1.1 Hardware Features

Mechanical Parameters
Size: 99mm x 62.5mm
Input Voltage - 5V DC

Processor
TMS320C5515 – Fixed Point Digital Signal Processor
DSP with up to 60, 75, 100, 120 MHz Clock Rate.
On board 14 Pin (2x7 Pin) JTAG emulation connector

Memory
On board 32MB Flash Memory (3V 70ns Parallel NOR Flash Memory)
320K Bytes Zero-Wait State On-Chip RAM, Composed of:

- 64K Bytes of Dual-Access RAM (DARAM), 8 Blocks of 4K x 16-Bit
- 256K Bytes of Single-Access RAM (SARAM), 32 Blocks of 4K x 16-Bit

128K Bytes of Zero Wait-State On-Chip ROM (4 Blocks of 16K x 16-Bit)

Data Transfer Interfaces
On board 3 pin header for UART interface
On board USB TYPE B Connector for UART interface for Debug Console
On board Reset Switch with LED indication
On board Mini USB Type AB Connector for USB device interface
On board SPI based micro SD card interface

On board 6 pin relimate connector for SPI communication
On board 4 pin relimate connector for I2C communication

Input/Output Interfaces and other Facilities
On board 20 Pin GPIO connector
On board 3.3V Power-On LED indication
On board XF LED indication
On board 4 User LED at GPIO Pin as GPIO Test point
On board ADC based 2 user push buttons for various applications
On board 10 bit 4 channels Successive Approximation ADC input facility

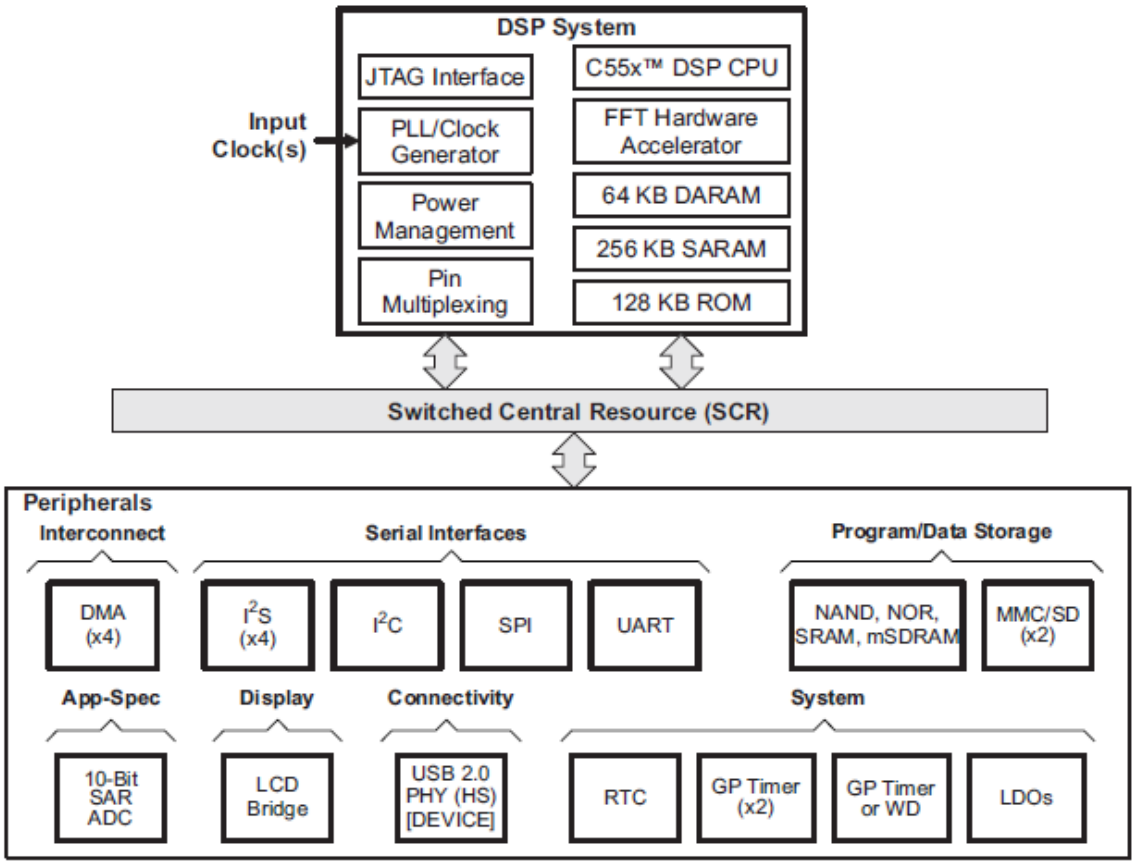
Special functionality
On board audio jack for Headphone out
On board audio jack for Stereo out
On board audio jack for Stereo In1
On board audio jack for Stereo In2
On board LED to indicate power surge
On board LED to indicate high voltage input
On board excessive voltage protection circuit with LED indication
LED indication for USB connection for Debug Console
Various test points for various signals
On board jumper selection to switch UART between USB connector and 3 pin connector for RXD line

1.1.2 Software Features

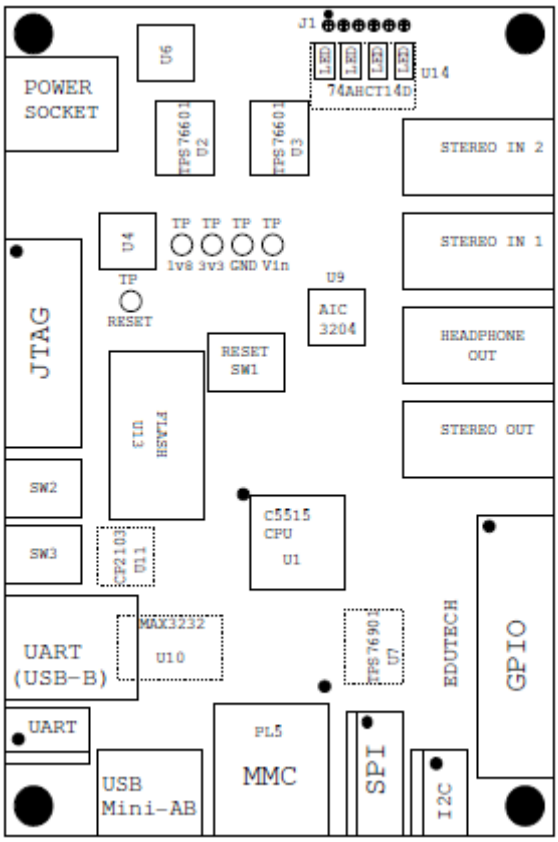
- TI Code Composer Studio 5.0 or later

1.2 Functional Overview of the EPB_C5515

1.2.1 Figure shows a block diagram of the basic configuration for the TMS320C5515.



1.2.2 Figure shows a block diagram of the basic configuration for the EPB_C5515.


J1
U6
POWER SOCKET
LED
LED
LED
LED
U14
74AHCT14D
TPS76601 D2
TPS76601 D3
STEREO IN 2
STEREO IN 1
U4
TP TP TP TP
1v8 3v3 GND Vin
TP
RESET
U9
AIC 3204
HEADPHONE OUT
STEREO OUT
JTAG
RESET SW1
FLASH U13
SW2
SW3
CF2103 U11
C5515 CPU U1
MAX3232 U10
TPS76901 U7
EDUTECH
GPIO
UART (USB-B)
UART
USB Mini-AB
PL5
MMC
SPI
I2C

Chapter 2
Operation of the EPB_C5515

This chapter describes the operation of the EPB_C5515, key interfaces and includes a circuit board outline.

2.0 EPB_C5515 Operation

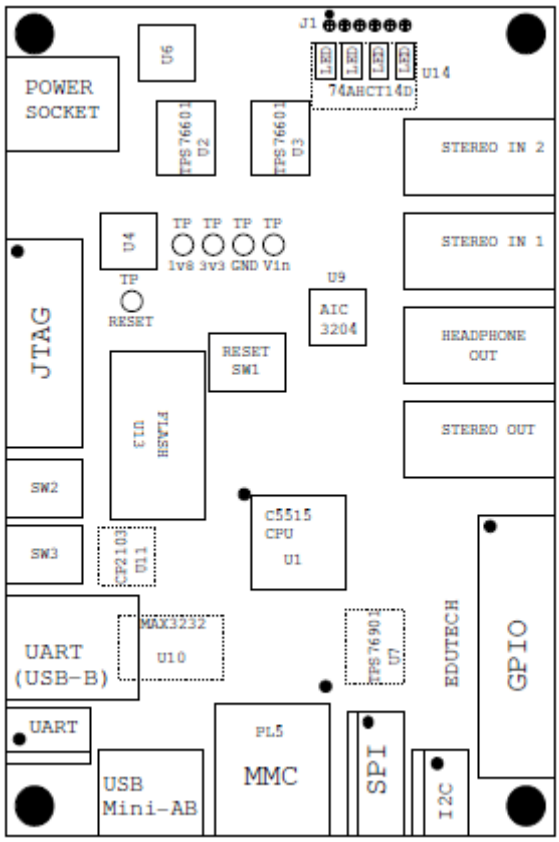
This chapter describes the EPB_C5515, key components, and operation.
Information on the EPB's various interfaces is also included. The EPB_C5515 consists of seven major blocks of logic:

- Power Supply
- Audio Interface Connector
- I/O Interface Connector
- On board Memory
- JTAG Interface
- Communication Block
- Control Circuitry

2.0.1 Specifications:

Parameter	Description
Voltage Supply	5V DC
CPU	TMS320C5515
Operating Frequency	60, 75, 100, 120 MHz
Operating Temperature	from -40ºC to 85ºC

2.1 The EPB_C5515 Board



2.2 The EPB_C5515 Memory

The EPB includes the following on-chip memory:

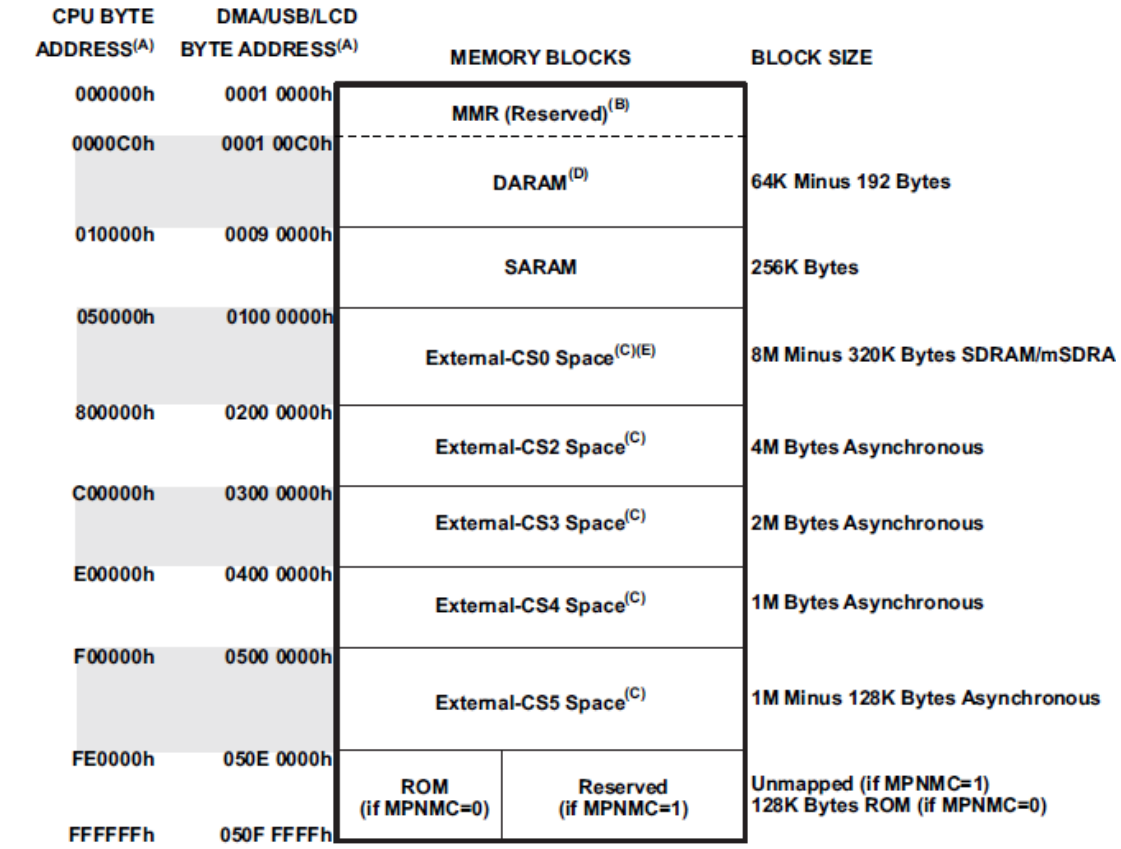
320K Bytes Zero-Wait State On-Chip RAM, Composed of:
- 64K Bytes of Dual-Access RAM (DARAM), 8 Blocks of 4K x 16-Bit
- 256K Bytes of Single-Access RAM (SARAM), 32 Blocks of 4K x 16-Bit

128K Bytes of Zero Wait-State On-Chip ROM (4 Blocks of 16K x 16-Bit)

In addition On board Off-chip 32MB Flash Memory (3V 70ns Parallel NOR Flash Memory)

2.2.1 Memory Map

The figure below shows the memory map configuration on the EPB_C5515



A. Address shown represents the first byte address in each block.
B. The first 192 bytes are reserved for memory-mapped registers (MMRs).
C. Reading/Writing to/from unmapped returns zeros.
D. The USB and LCD controllers do not have access to DARAM.
E. The CS0 space can be accessed by CS0 *only* or by CS0 *and* CS1.

Figure 2-1. Memory Map Summary

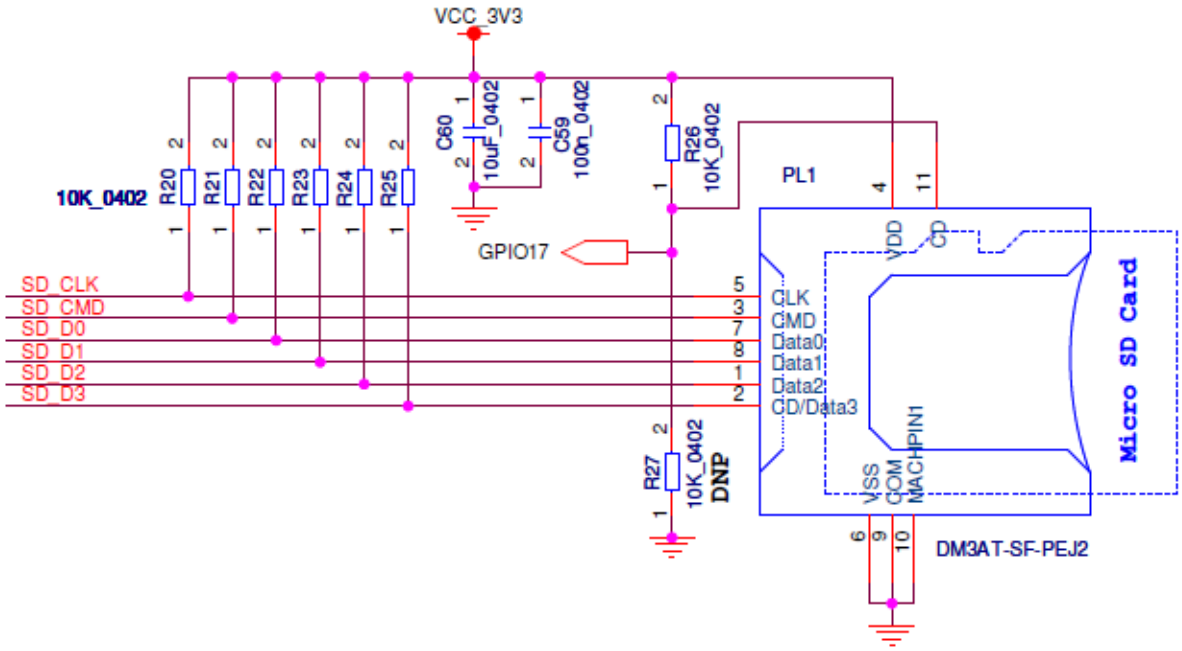
2.3 EPB_C5515 Connectors

The EPB_C5515 has 22 connectors. The function of each connector is shown in the table below:

Unit	Reference	Description
MMC	PL1	Micro SC Card Connector
JTAG	P2	14 pin FRC Connector
GPIO	PL3	20 pin FRC connector
Power Supply	PL5	Power Jack socket
I2C	PL6	4 pin relimate
SPI	PL7	6 pin relimate
USB	PL8	USB Mini AB type connector
UART	PL13	3 pin relimate Connector
UART	PL14	USB B type Connector
ADC input channel	J1	6 pin burgstrip
Audio	J2	Stereo In1 audio connector
Audio	J3	Stereo In2 audio connector
Audio	J4	Headphone out audio connector
Audio	J5	Stereo out audio connector

2.3.1 MMC Connector (PL1):

The EPB_C5515 has an MMC connector which brings out the MMC related SPI signals which are routed to J1.



The pin numbers and their corresponding signals are shown in the table below.

Pin Number	Connection
1	MMCD2
2	MMCD3
3	MMC_CMD
4	3.3V
5	MMC_CLK
6	VSS/ GND
7	MMCD0
8	MMCD1
9	COM/ GND
10	MechPIN/ GND
11	MMC_CD

2.3.2 JTAG Connector (P2):

The EPB_C5515 is supplied with a 14-pin header interface, J3. This is the standard interface used by JTAG emulators to interface to Texas Instruments DSPs.

The pin numbers and their corresponding signals are shown in the figure below.

Pin Number	Connection
1	TMS
2	TRSTn
3	TDI
4	GND
5	PD/VCC
6	NC
7	TDO
8	GND
9	RTCK
10	GND
11	TCK
12	GND
13	EMU0
14	EMU1

2.3.3 GPIO Connector (PL3)

The EPB_C5515 is supplied with a 20-pin FRC connector interface, PL3 for General purpose input output interface..

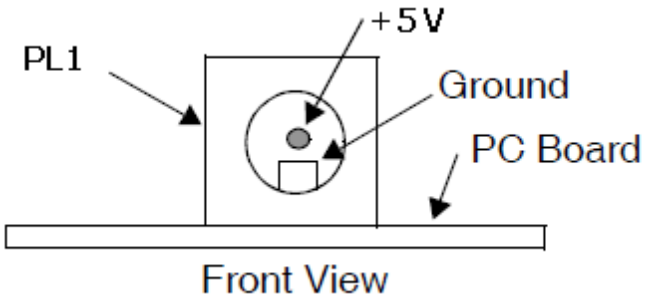
The pin numbers and their corresponding signals are shown in the figure below

Pin Number	Connection
1	GP4
2	GP5
3	GP28
4	GP29
5	NC
6	GP20
7	NC
8	GP27
9	NC
10	GP12
11	GP13
12	GP14
13	GP15
14	GP16
15	GP17
16	GP18
17	GP19
18	3.3V
19	5V
20	GND

2.3.4 Power Connector (PL5):

Power (5 volts) is brought onto the EPB_C5515 via the J16 connector. The connector has an outside diameter of 5.5 mm. and an inside diameter of 2 mm.

The diagram of PL5, which has the input power, is shown below.



2.3.5 I2C Connector (PL6):

The EPB_C5515 has one 4 pin relimate connector which brings out the I2C signals on PL6. The pin positions for the PL6 connector are shown below.

Pin Number	Connection	CPU PIN
1	VCC	
2	SDA	B8
3	SCL	B7
4	GND	

2.3.6 SPI Connector (PL7):

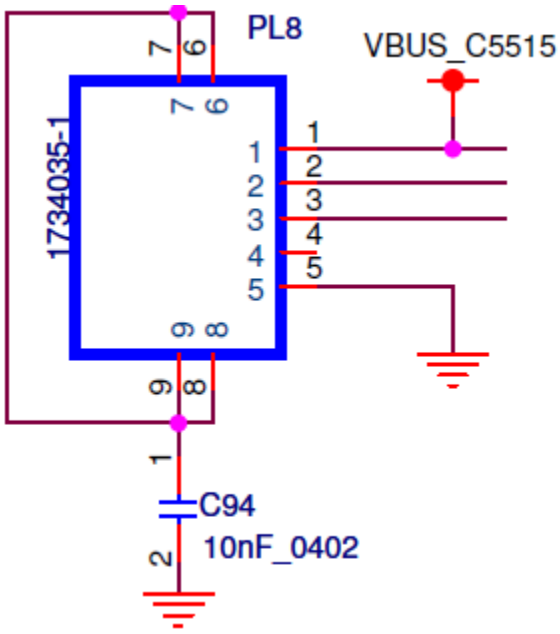
The EPB_C5515 has one 6 pin relimate connector which brings out the SPI signals on PL7. The pin positions for the PL7 connector are shown below.

Pin Number	Connection	CPU PIN
1	VCC	
2	SPI_CLK	N3
3	SPI_MISO/ SPI_RX	P6
4	SPI_MOSI/ SPI_TX	N6
5	SPI_CS0	P4

6	GND	

2.3.7 USB Connector (PL8):

The EPB_C5515 has USB DEVICE connector which brings out the USB signals which are routed to PL8.



Pin details for the connector are as shown here.

Pin Number	Connection
1	VBUS
2	D-
3	D+
4	NC
5	GND
6	Cap w.r.t GND
7	Cap w.r.t GND
8	Cap w.r.t GND
9	Cap w.r.t GND

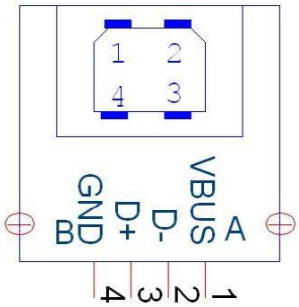
2.3.8 UART Module (PL13):

The EPB_C5515 has a 3 pin male relimate connector which brings out the UART signals. This UART connector uses MAX3232 and is routed to a 3 pin male relimate connector, PL13. The pin numbers and their corresponding signals are shown in the table below.

Pin Number	Connection	CPU PIN
1	GND	
2	TxD	P14
3	RxD	N13

2.3.9 UART Module (PL14):

The EPB_C5515 has an USB B-type connector which brings out the UART signals. This USB connector uses CP2103 and is routed to a USB B-Type, PL14. User can use USB connector directly with the PC to use the serial port UART. The pin positions for the PL14 connector are shown below



The pin numbers and their corresponding signals are shown in the table below.

Pin Number	Connection
1	VBUS
2	D-
3	D+
4	GND

UART Receive line Jumper (JP1):

If Jumper is connected between pin1 and pin2, UART will work using 3 pin relimate connector

If Jumper is connected between pin2 and pin3, UART will work using USB connector/ Using CP2103

2.3.10 ADC channel input Connector (J1)

The EPB_C5515 has 6 pin male burgstrip which brings out the ADC channels which is routed to J1 connector. EPB_C5515 is having Successive approximation type 10 bit 4 channel ADC. Pin details for the J1 are as follows.

Pin Number	Connection	CPU PIN
1	VCC	
2	Ch1	D10
3	Ch2	A11
4	Ch3	B11
5	Ch3	C11
6	GND	

2.3.11 Stereo in1 Connector (J2)

The EPB_C5515 has one 3.5 mm Audio jack connector which brings out the Audio IN (Stereo In) signal on J2. The audio codec used as hardware is TLV320AIC3106IRGZ. The pin positions for the J2 connector are shown below.

Pin Number	Connection
1	GND
2	IN2_Right
3	IN2_Left
4	GND

2.3.12 Stereo in1 Connector (J3)

The EPB_C5515 has one 3.5 mm Audio jack connector which brings out the Audio IN (Stereo In) signal on J3. The audio codec used as hardware is TLV320AIC3106IRGZ. The pin positions for the J3 connector are shown below.

Pin Number	Connection
1	GND
2	IN3_Right
3	IN3_Left
4	GND

2.3.13 Headphone out Connector (J4)

The EPB_C5515 has one 3.5 mm Audio jack connector which brings out the Headphone out (Audio OUT) signal on J4. The audio codec used as hardware is TLV320AIC3106IRGZ. The pin positions for the J4 connector are shown below.

Pin Number	Connection
1	GND
2	Headphone_Right
3	Headphone_Left
4	GND

2.3.14 AUDIO OUT Connector (J5)

The EPB_C5515 has one 3.5 mm Audio jack connector which brings out the stereo out (Audio OUT) signal on J5. The audio codec used as hardware is TLV320AIC3106IRGZ. The pin positions for the J5 connector are shown below.

Pin Number	Connection
1	GND
2	Line_Out_Right
3	Line_Out_Left
4	GND

2.4 Jumpers

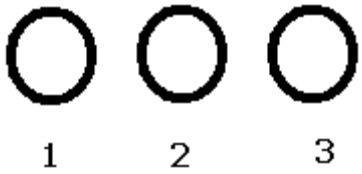
The EPB_C5515 has 1 jumper available to the user which determines UART RXD Data line selection. The table below lists the jumper, its type and their position as shipped from factory.

Jumper Number	Type	Position as Shipped from Factory
J1	1x3	Pin 1 and pin 2 short

Jumper J1:

J1 is used to select UART RXD line to use via MAX3232 IC and 3 pin relimate connector PL13 or by CP2103 IC and USB connector PL14.

Type:



- Short pin1 and pin2 of J13 of UART2- RXD line so that UART2 can be worked using 3 pin relimate connector PL13

- Short pin2 and pin3 of J11 of UART2- RXD line so that UART2 can be worked using CP2103 IC and USB connector PL14.

2.5 LEDs

The EPB_C5515 has 9 light-emitting diodes.

LED1 (RED) is ON when board is in Reset otherwise it remains OFF

LED2 (RED) indicates the presence of over-voltage. Power off the board if it remains ON. It fluctuates when power fluctuation is there.

LED3 indicates the presence of +3.3 volts and is normally ‘on’ when power is applied to the board via power socket or USB connector

LED4 is XF LED.

LED5 is USB power supply indication LED from PL14 USB B type connector.

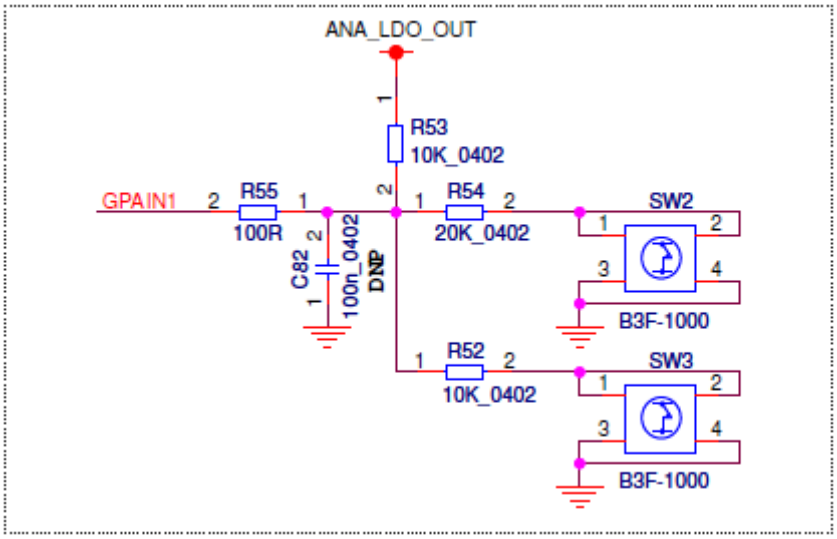
LED6, LED7, LED8 and Led9 are user LEDs. It can be controlled by User Program

2.6 Switches

The EPB_C5515 has 3 switches.

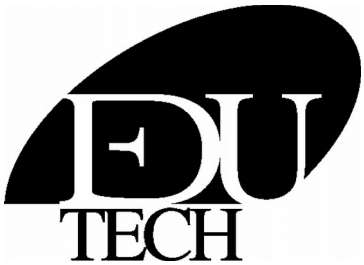
SW1 is RESET switch. It is used to reset the board without power off.

SW2 and SW3 are User switches. These switches are controlled by user program using ADC peripheral as shown here



2.7 Test Point Information:

Designator	Use and description
TP1	1.8V power supply
TP2	3.3V power supply
TP3	3.3V power supply
TP4	RESET
TP5	RTC_CLKOUT
TP6	CLKOUT
TP7	GND



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