



***TMS320C5515 eZdsp™***  
***USB Stick***

*Technical  
Reference*



**TMS320C5515 eZdsp™  
USB Stick  
Technical Reference**

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## About This Manual

This document describes the board level operations of the TMS320C5515 eZdsp USB Stick. The Stick is based on the Texas Instruments TMS320C5515 Digital Signal Processor (DSP).

The TMS320C5515 eZdsp USB Stick is a USB based printed circuit board (PCB) that allows engineers and programmers to evaluate certain characteristics of the TMS320C5515 DSP.

## Notational Conventions

This document uses the following conventions.

The TMS320C5515 eZdsp USB Stick will sometimes be referred to as the C5515 Stick, C5515 USB Stick, or C5515 eZdsp.

Program listings, program examples, and interactive displays are shown in a special italic typeface. Here is a sample program listing.

equations  
!rd = !strobe&rw;

## Information About Cautions

This book may contain cautions.

***This is an example of a caution statement.***

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

## Related Documents

Texas Instruments Code Composer Studio IDE Users Guide  
Data sheet for the TMS320C5515

## Chapter 1

### Introduction to the TMS320C5515 eZdsp USB Stick

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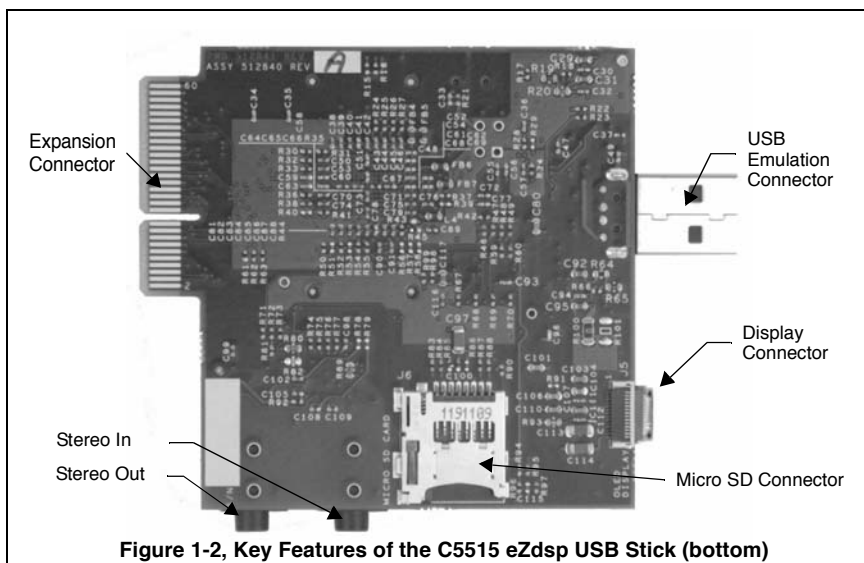
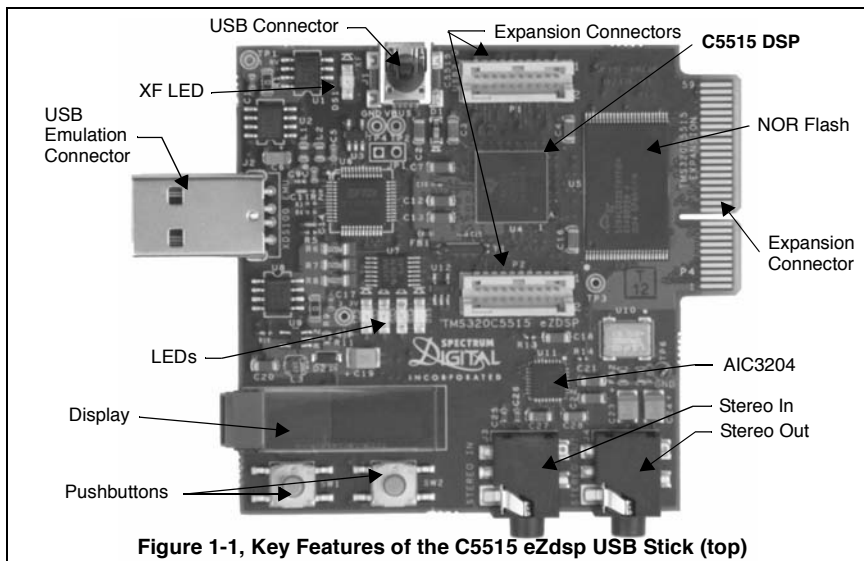
This chapter provides you with an overview of the C5515 eZdsp USB Stick along with the key features.

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## 1.0 Overview of the C5515 eZdsp USB Stick

The C5515 eZdsp USB Stick is an evaluation tool for the Texas Instruments TMS320C5515 Digital Signal Processor (DSP). This USB bus powered tool allows the user to evaluate the following items:

- The TMS320C5515 processor along with its peripherals
- The TLV320AIC3204 codec
- The Code Composer Studio IDE™ software development tools





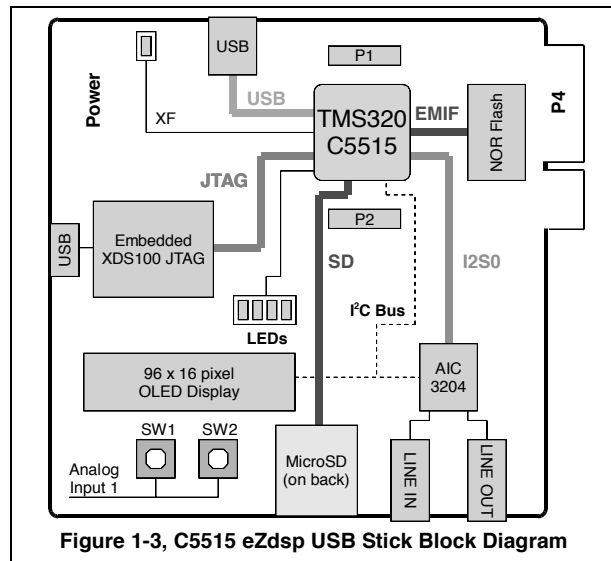
### 1.1 Key Features of the C5515 eZdsp USB Stick

The C5515 eZdsp USB Stick has the following features:

- Texas Instrument's TMS320C5515 Digital Signal Processor
- Texas Instruments TLV320AIC3204 Stereo Codec (stereo in, stereo out)
- Micro SD connector
- USB 2.0 interface to C5515 processor
- 32 Mb NOR flash
- I<sup>2</sup>C OLED display
- 5 user controlled LEDs
- 2 user readable push button switches
- Embedded USB XDS100 JTAG emulator
- Bluetooth board interface
- Expansion edge connector
- Power provided by USB interface
- Compatible with Texas Instruments Code Composer Studio v4
- USB extension cable

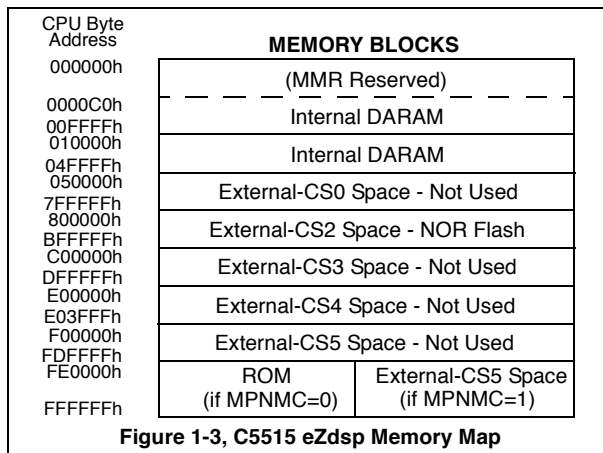
### 1.2 C5515 eZdsp USB Stick Block Diagram

The block diagram of the C5515 eZdsp USB Stick is shown below.



### 1.3 C5515 eZdsp Memory Map

The C5515 eZdsp supports on chip DARAM, and off chip NOR Flash. The addressing for each of these memory blocks is shown in the figure below.



**Note:** MPNMC bit in ST3 Status Register is cleared(0) at RESET so the C5515 will attempt to execute its boot load sequence.

### 1.4 C5515 eZdsp I<sup>2</sup>C Addressing

The C5515 eZdsp has multiple I<sup>2</sup>C devices for different purposes. The table below shows the addresses of these devices on the I<sup>2</sup>C bus.

**Table 1: C5515 eZdsp I<sup>2</sup>C Addresses**

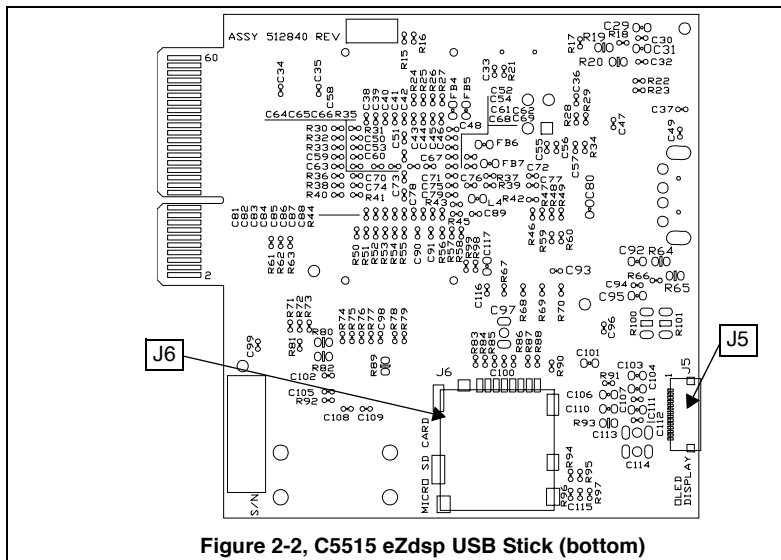
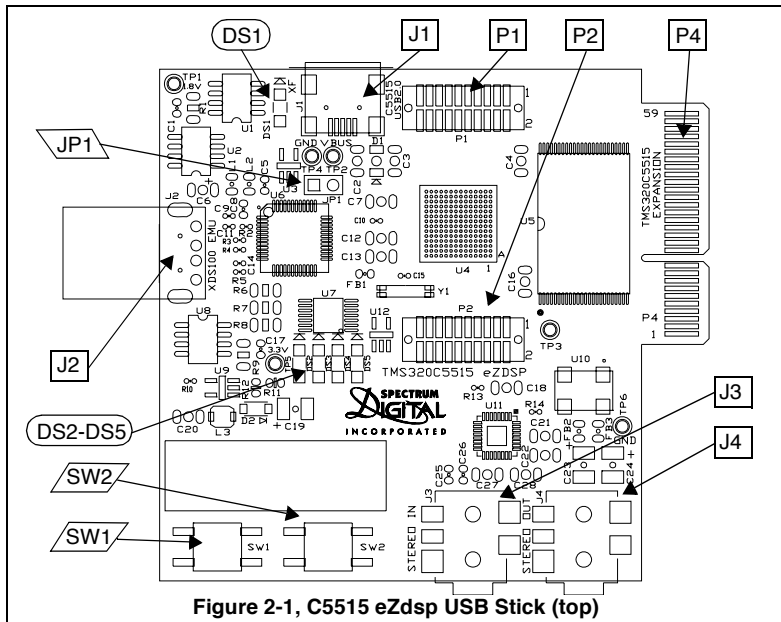
eZdsp I <sup>2</sup> C Device	I <sup>2</sup> C Address	Function
TLV320AIC3204	0x18	Audio CODEC
OSD9616GLBBG01	0x3C	OLED Display

This chapter describes the physical layout of the TMS320C5515 eZdsp USB Stick.

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## 2.0 Board Layout

The C5515 eZdsp USB Stick is a 2.85 x 2.65 inch six (6) layer printed circuit board which is powered off the USB bus of personal computer or laptop computer. This means this board does not require an external power supply.



## 2.1 Connector Index

The C5515 eZdsp USB Stick has nine (9) connectors which provide the user access to various signals on the C5515 Stick. These connectors are shown in the table below.

**Table 1: C5515 eZdsp USB Stick Connectors**

Connector	# Pins	Function	Schematic Page	Board Side
J1	4	C5515 USB	3	Top
J2	6	Emulation USB	13	Top
J3	2	Audio In	10	Top
J4	2	Audio Out	10	Top
J5	14	LCD Interface	11	Top
J6	8	Micro SD Interface	8	Top
P1	20	Bluetooth Board Interface	7	Top
P2	20	Bluetooth Board Interface	7	Top
P4	30 x 2	Expansion	12	Top/Bottom

The following manufacturer and parts numbers can be used to interface to the connectors on the C5515 eZdsp:

**Table 2: C5515 eZdsp Mating Connectors**

Connector	Manufacturer	Part #
J2	PC or laptop	
J3	CUI Inc	CUI SP-3501, Digi-Key CP-3502-ND
J4	CUI Inc	CUI SP-3501, Digi-Key CP-3502-ND
P4	Samtec	Samtec MEC1-130-02-S-D-A, Digi-Key SAM8118-ND

### 2.1.1 J1, C5515 USB Connector

The USB connector, J1, is attached the C5515 processor for use by C5515 software applications. The signals on the pins of this connector are shown below.

**Table 3: J1, C5515 USB Connector**

Pin #	Signal Name
1	USBVDD
2	D-
3	D+
4	ID / NC
5	USBVSS/GND
6-9	GND

### 2.1.2 J2, XDS100 USB Connector

The USB connector, J2, is used to attach the C5515 eZdsp stick to a personal computer or laptop. The signals on the pins of this connector are shown below.

**Table 4: J2, XDS100 USB Connector**

Pin #	Signal Name
1	5V_USB
2	D+
3	D-
4	GND
5	Shield Ground
6	Shield Ground

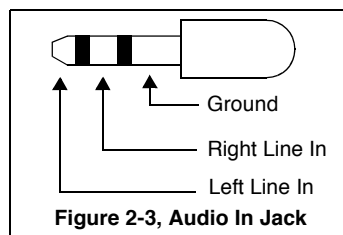
### 2.1.3 J3, Audio In Connector

The Audio In connector, J3, is used to bring signals into the TLP320AIC3204 codec. The signals on the pins of this connector are shown below.

**Table 5: J3, Audio In Connector**

Pin #	Signal Name	AIC3204 Pin #
1	GND-AIC	
2	AIC_LINE2L	15
3	AIC_LINE2R	16
4	No connect	
5	No connect	

The figure below shows a typical stereo jack.



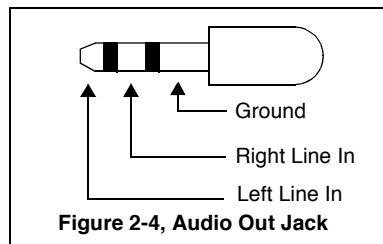
#### 2.1.4 J4, Audio Out Connector

The Audio Out connector, J4, is used to bring signals from the TLP320AIC3204 codec. The signals on the pins of this connector are shown below.

**Table 6: J4, Audio Out Connector**

Pin #	Signal Name	AIC3204 Pin #
1	GND-AIC	
2	HEADPHONE_LOUT	25
3	HEADPHONE_ROUT	27
4	No connect	
5	No connect	

The figure below shows a typical audio out jack.



### 2.1.5 J5, LCD Interface

Connector, J5, is used to interface to an LCD character display. The signals on the pins of this connector are shown below.

**Table 7: J5, LCD Interface**

Pin #	Signal Name
1	C2P
2	C2N
3	C1P
4	C1N
5	VBAT
6	VBREF
7	GND
8	VCC_3V3
9	TARGET_PWR_GOOD
10	I2C_SCL
11	I2C_SDA/
12	IREF
13	VCOMH
14	V13

### 2.1.6 J6, Micro SD Connector

The Micro SD connector, J6, is used to interface the C5515 processor to a Micro SD card. The signals on the pins of this connector are shown below.

**Table 8: J6, Micro SD Connector**

Pin #	Signal Name
1	DAT2
2	DAT3
3	CMD
4	VDD
5	CLK
6	VSS
7	DAT0
8	DAT1
9	INSERT
10	INSERT_COM



### 2.1.7 P1, P2, Bluetooth Board Interface

Connectors P1, and P2 are expansion connectors used to provide an interface to a Bluetooth board. The signals on the pins of these connectors are shown in the tables below.

**Table 9: P1, Bluetooth Board Interface**

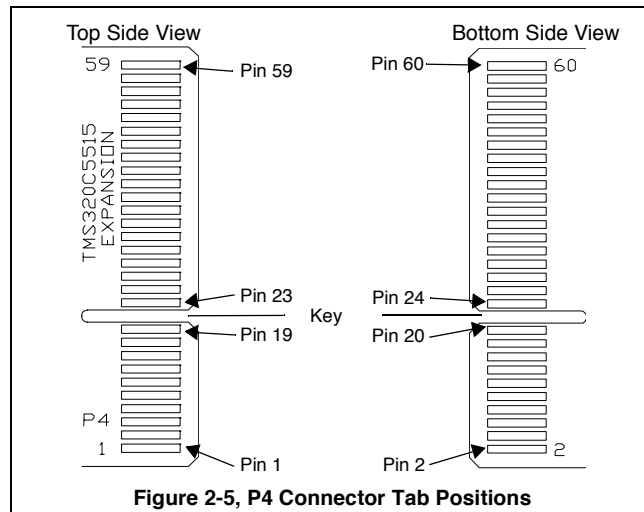
Pin #	Signal Name	Pin #	Signal Name
1	GND	2	SD_DATA0
3	UART_RTS	4	SD_DATA1
5	RTC_CLKOUT	6	SD_DATA2
7	UART_RX	8	SD_DATA3
9	UART_TX	10	GPIO4
11	I2C_SDA	12	GPIO5
13	I2C_SCL	14	I2S2_FS
15	SD_CLK	16	I2S2_CLK
17	SD_CMD	18	I2S2_DX
19	GND	20	I2S2_RX

**Table 10: P2, Bluetooth Board Interface**

Pin #	Signal Name	Pin #	Signal Name
1	NC	2	GND
3	NC	4	NC
5	NC	6	NC
7	VCC_3V3	8	I2S1_DX
9	VCC_3V3	10	I2S1_RX
11	I2S1_FS	12	NC
13	GPIO12	14	NC
15	GPIO14	16	NC
17	I2S1_CLK	18	UART_CTS
19	GPIO14	20	GPIO13

### 2.1.8 P4, Expansion Connector

The Expansion connector, P4, is used to bring signals from C5515 DSP out to a connector for user interface. This card edge connector has all of the odd number (1,3,...,59) tabs on the top side of the board and all of the even number tabs (2,4,...,46) on the bottom side of the board. The diagram below shows the position of these tabs.



The table below lists the signals that appear on each of the tabs of connector P1. The signals on the pins of this connector are shown below.

**Table 11: P4, Expansion Connector**

Pin # Top	Signal Name	Pin # Bottom	Signal Name
1	GND	2	GND
3	SPI_CS1	4	GPIO13
5	SPI_CLK	6	GPIO12
7	SPI_TX	8	GPIO14
9	SPI_RX	10	GPIO15
11	GND	12	GND
13	GND	14	GND
15	GND	16	GND
17	I2C_SDA	18	GPIO16
19	I2C_SCL	20	GPIO17
	Key		Key
23	I2S2_CLK	24	SD_DATA3
25	I2S2_RX	26	SD_DATA2
27	I2S2_DX	28	GPIO5
29	I2S2_FS	30	GPIO4
31	GND	32	GND
33	SD_CLK	34	UART_RTS
35	SD_DATA1	36	UART_CTS
37	SD_DATA0	38	UART_RX
39	SD_CMD	40	UART_TX
41	VCC_3V3	42	VCC_3V3
43	VCC_3V3	44	VCC_3V3
45	I2S0_CLK	46	SPI_CS3
47	I2S0_RX	48	VCC_3V3
49	I2S0_DX	50	GPAIN3
51	I2S0_FS	52	GPAIN2
53	SPI_CS2	54	GPAIN1
55	SPI_CS0	56	GPAIN0
57	VCC_3V3	58	VCC_3V3
59	VCC_3V3	60	VCC_3V3

## 2.2 System LEDs

The C5515 eZdsp USB Stick has 5 Light Emitting Diodes (LED). These LEDs are under the application software control running on the C5515 processor. These LEDs are shown in the table below.

**Table 12: System LEDs**

LED #	Color	Schematic Page	Signal Name
DS1	Green	2	C5515 XF
DS2	Green	11	GPIO17
DS3	Red	11	GPIO18
DS4	Yellow	11	GPIO15
DS5	Blue	11	GPIO14

## 2.3 Switches

The C5515 eZdsp USB Stick has two push button switches. These switches can be read by application software running on the C5515 processor. These switches are shown in the table below.

**Table 13: Switches**

Switch #	Schematic Page	Signal Name/Reading
SW1 only closed	11	GPAIN1, approximately 1.2 volts
SW2 only closed	11	GPAIN1, approximately 0.9 volts
SW1, SW2 closed	11	GPAIN1, approximately 0.72 volts

## 2.4 Jumpers

The C5515 eZdsp stick has one jumper, JP1. When this jumper is shorted the C5515 eZdsp stick will be powered from the target USB interface, not the embedded USB interface. When this jumper is shorted the embedded USB emulation and debug capability are no longer available. This jumper is shipped in the “**open**” state from the factory.

### **WARNING !**

When the jumper J1 is shorted do NOT plug the connector J2 into a USB port. This will damage the C5515 eZdsp stick.

## 2.5 Test Points

The C5515 eZdsp USB Stick has six (6) test points for the monitoring of signals. The location of the test points are shown in the figure below.

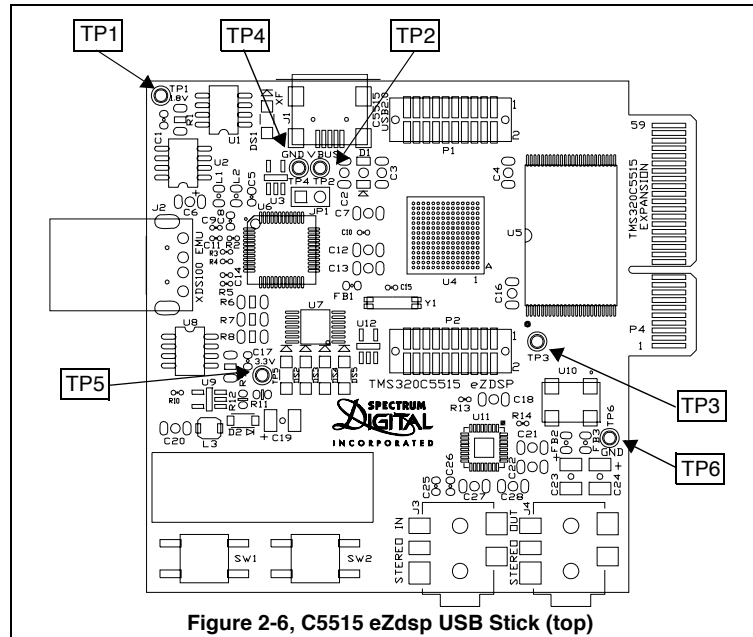


Figure 2-6, C5515 eZdsp USB Stick (top)

The signals on the test points are shown in the table below.

Table 14: Test Points

TP #	Schematic Page	Signal Name
TP1	9	VCC_1V8
TP2	3	VBUS
TP3	3	CLKOUT
TP4	5	GND
TP5	9	VCC_3V3
TP6	10	GND



## Appendix A

### Schematics

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This appendix contains the schematics for the TMS320C5515 eZdsp USB Stick.

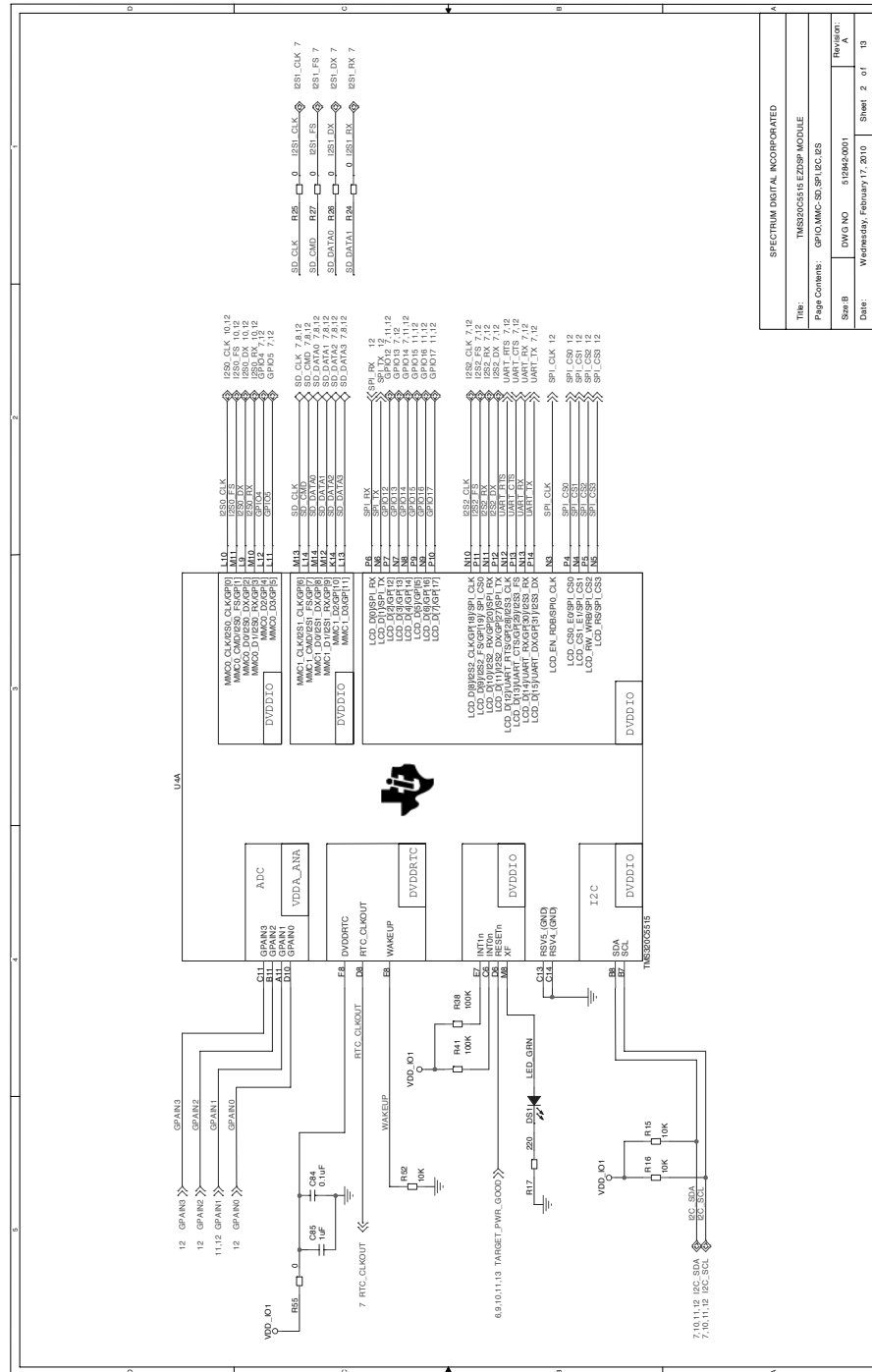
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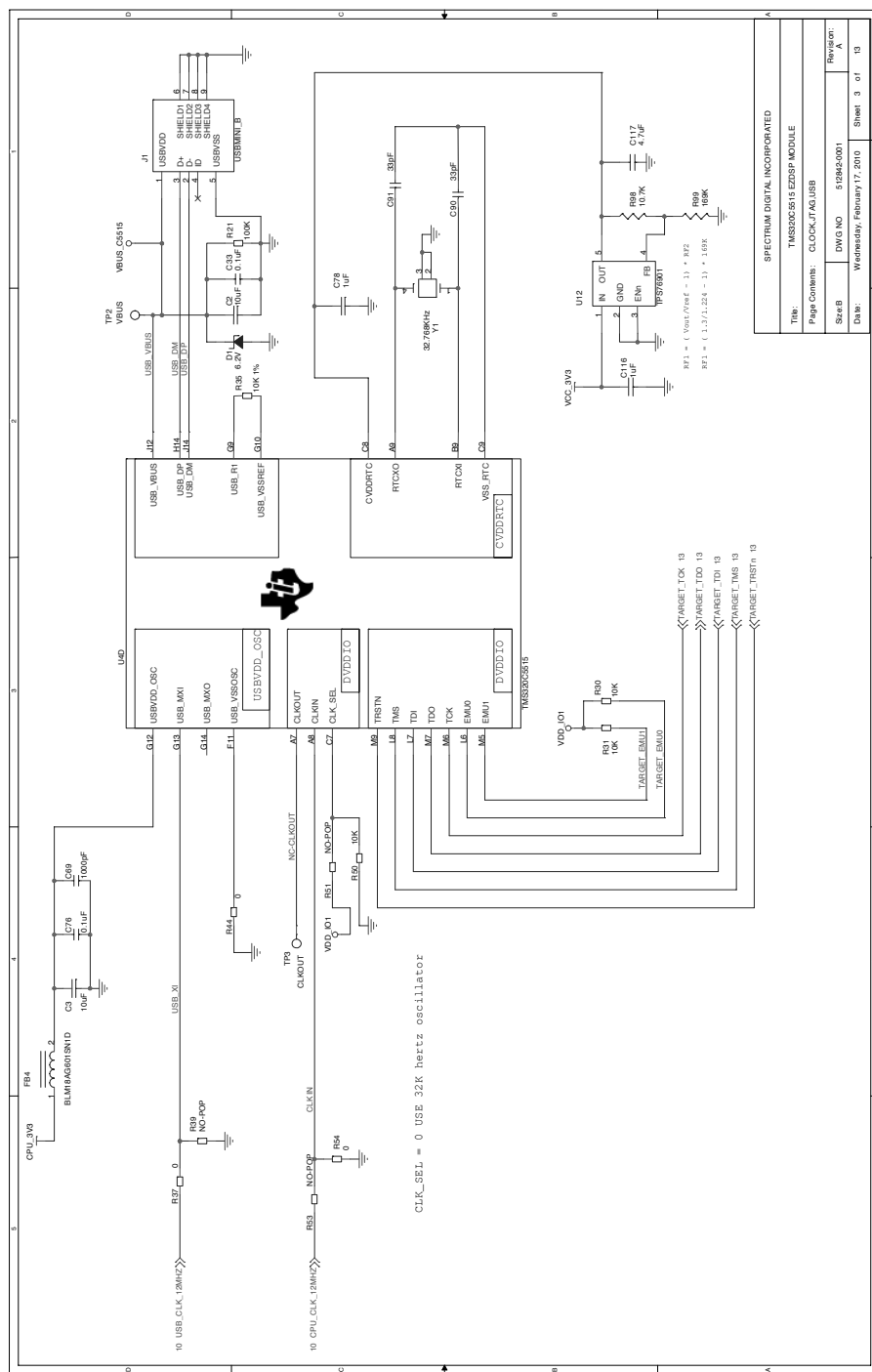
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2. CAPACITANCE VALUES IN MICROFARADS.  
3. REFERENCE DESIGNATORS USED:  
4. ALL 0.1 uF AND 0.01uF CAPACITORS ARE DECOUPLING CAPS UNLESS OTHERWISE SPECIFIED. CAPS ARE TO BE PLACED NEAR THE POWER AND GROUND PINS OF THE IC'S. THE PAGE WITH THE INTEGRATED CIRCUITS THEY SHOULD BE PLACED NEAR.

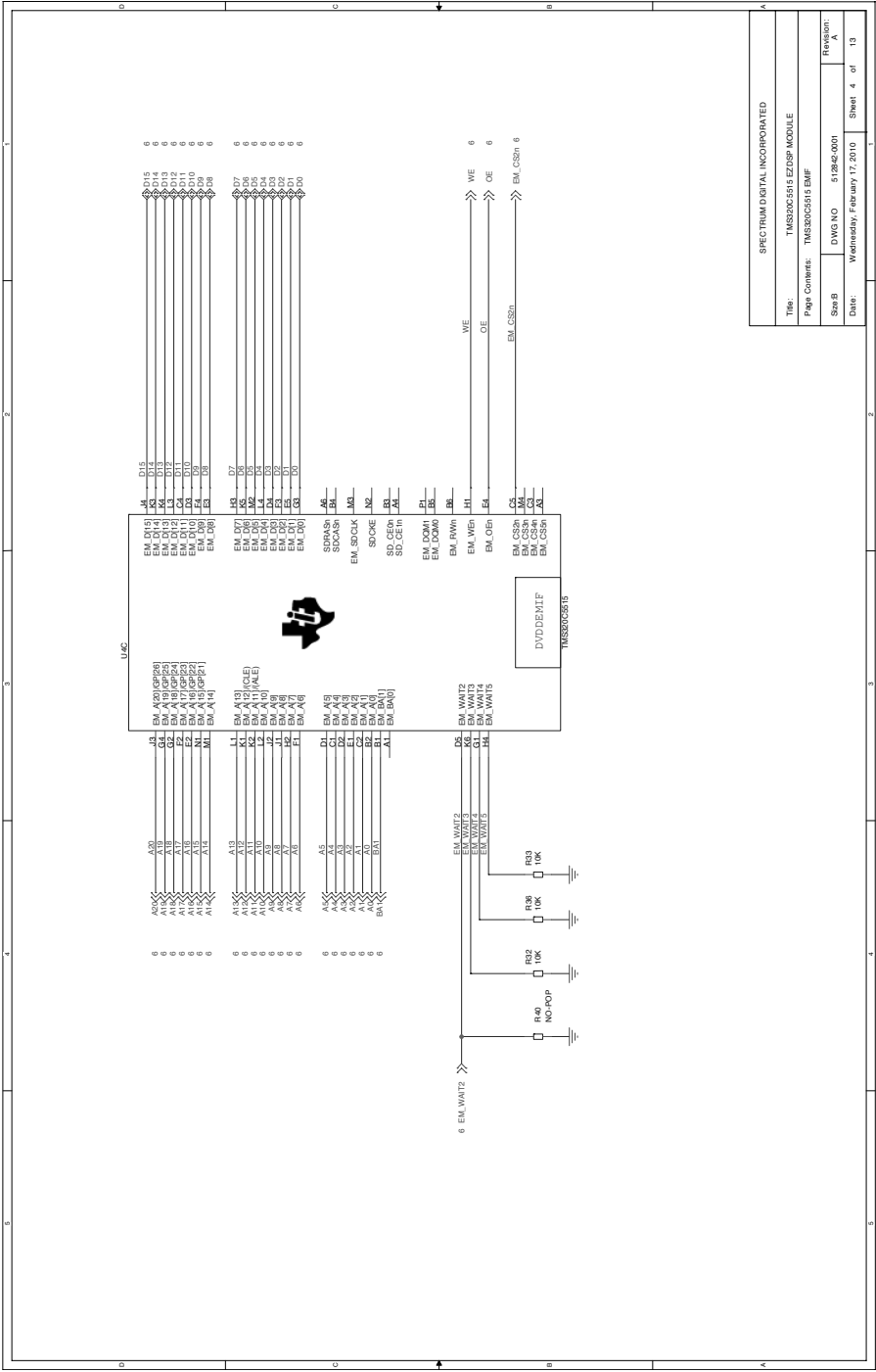
SCHMATIC CONTENTS  
01 - TITLE PAGE  
02 - TMS320C5515 GPIO/MMC/SPI/I2C  
03 - TMS320C5515 CLK/JTAG/USB2  
04 - TMS320C5515 EMIF  
05 - TMS320C5515 POWER  
06 - NOR FLASH  
07 - CC BOARD INTERFACE  
08 - MICRO SD INTERFACE  
09 - POWER SUPPLIES  
10 - AUDIO CODEC  
11 - LCD/USER LEDS/SWITCHES  
12 - EXPANSION CONNECTOR  
13 - XDS100 INTERFACE

REVISION HISTORY OF SHEET												
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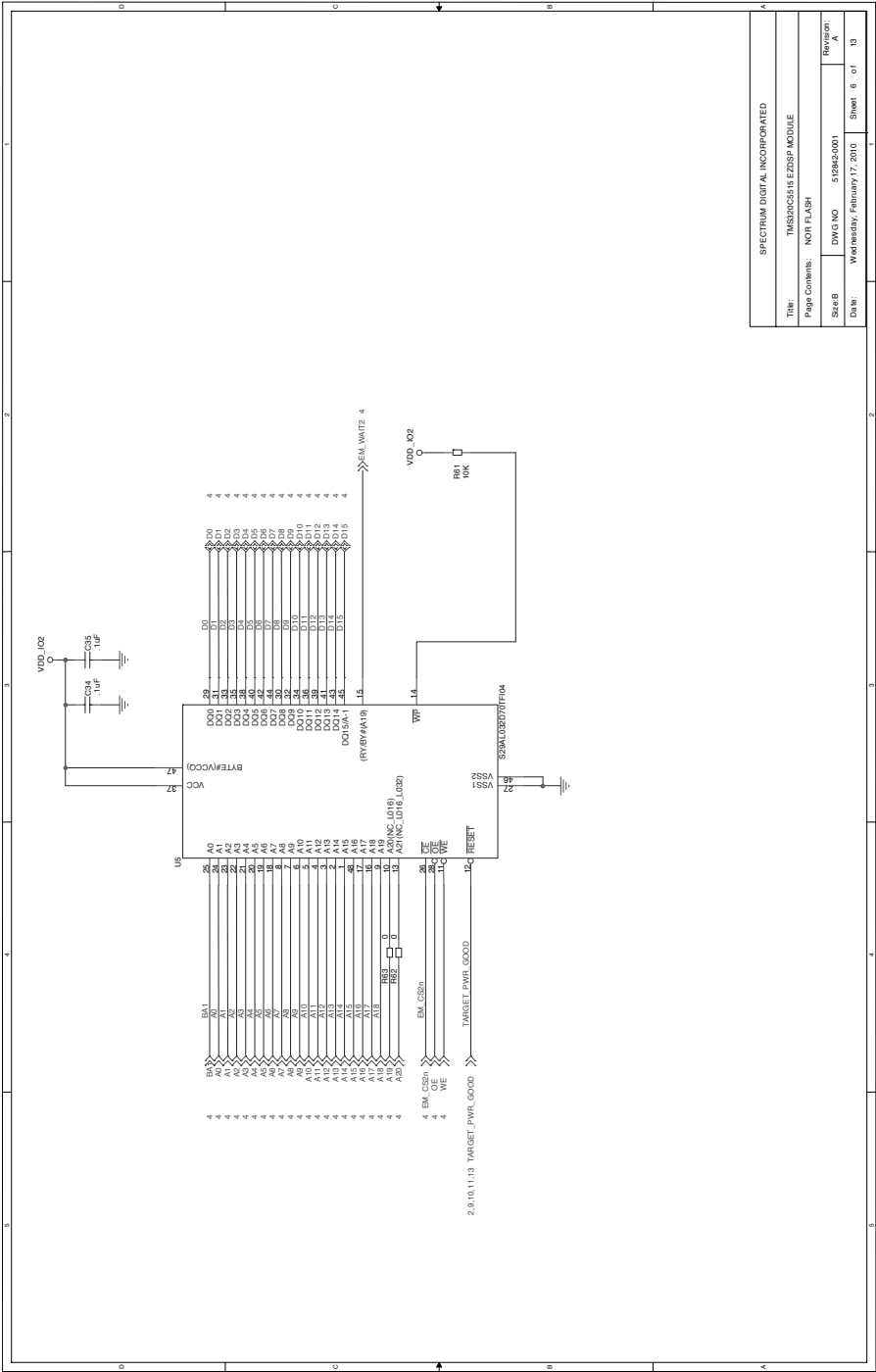


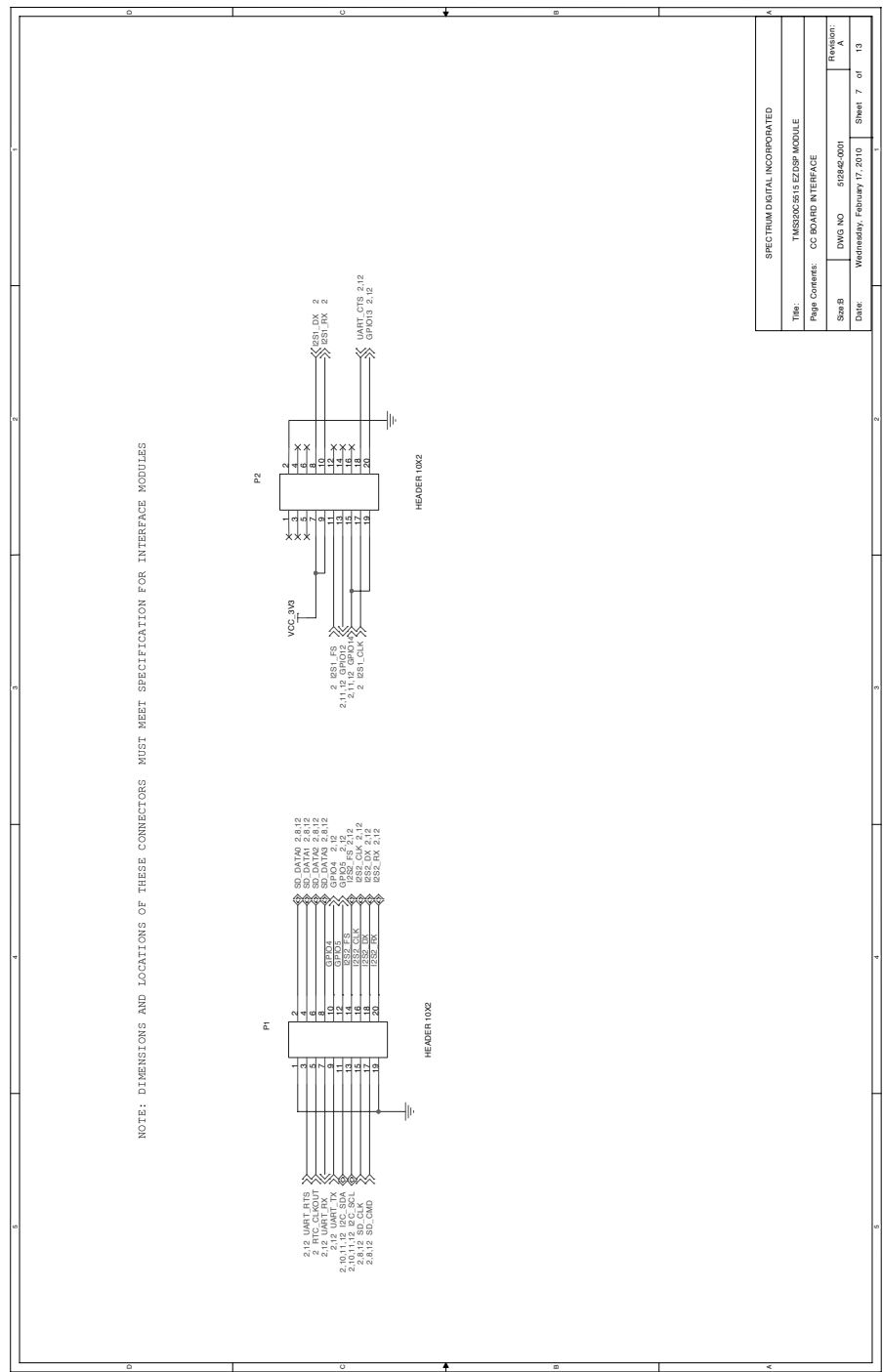


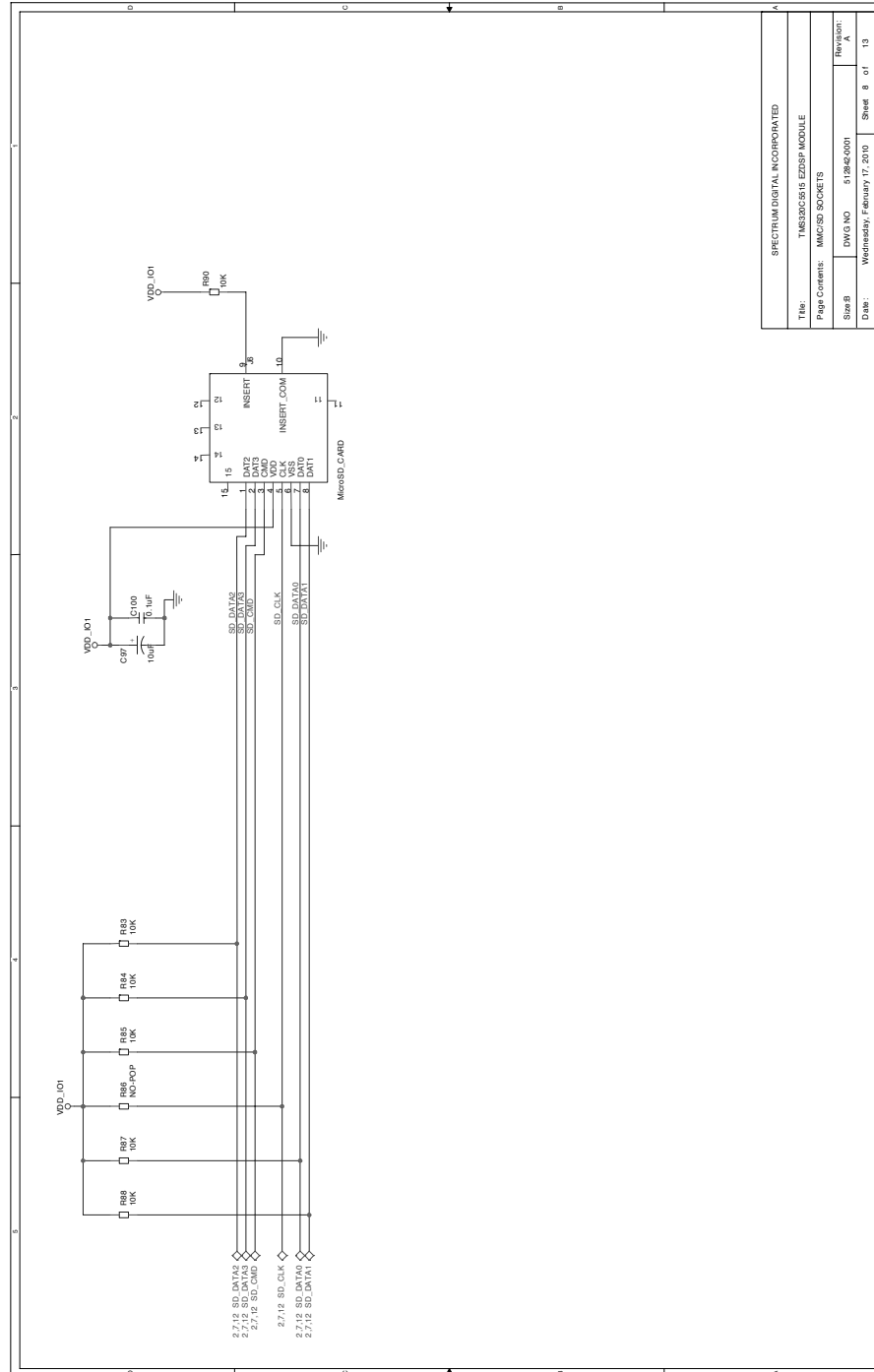


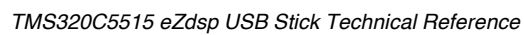




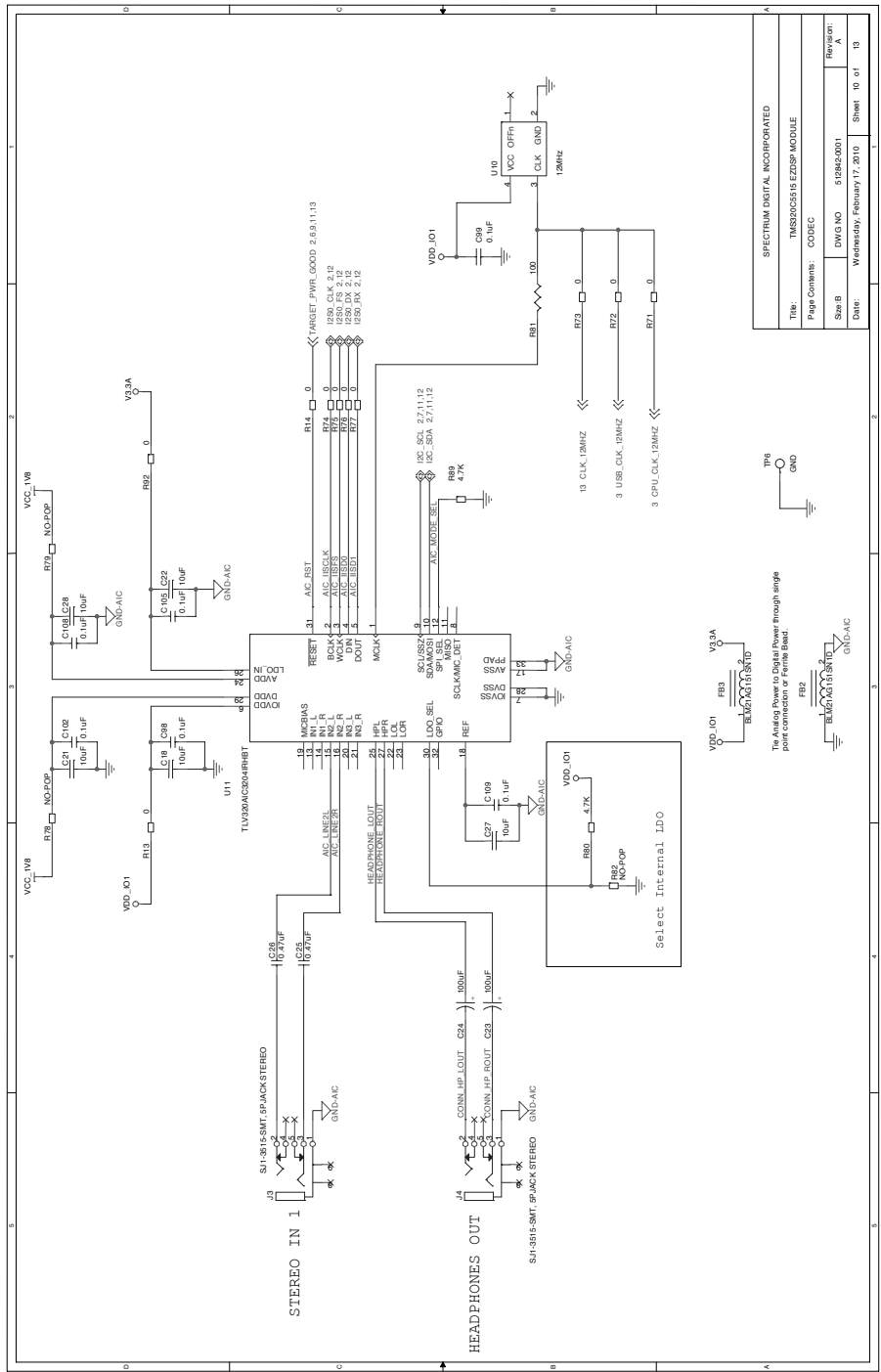


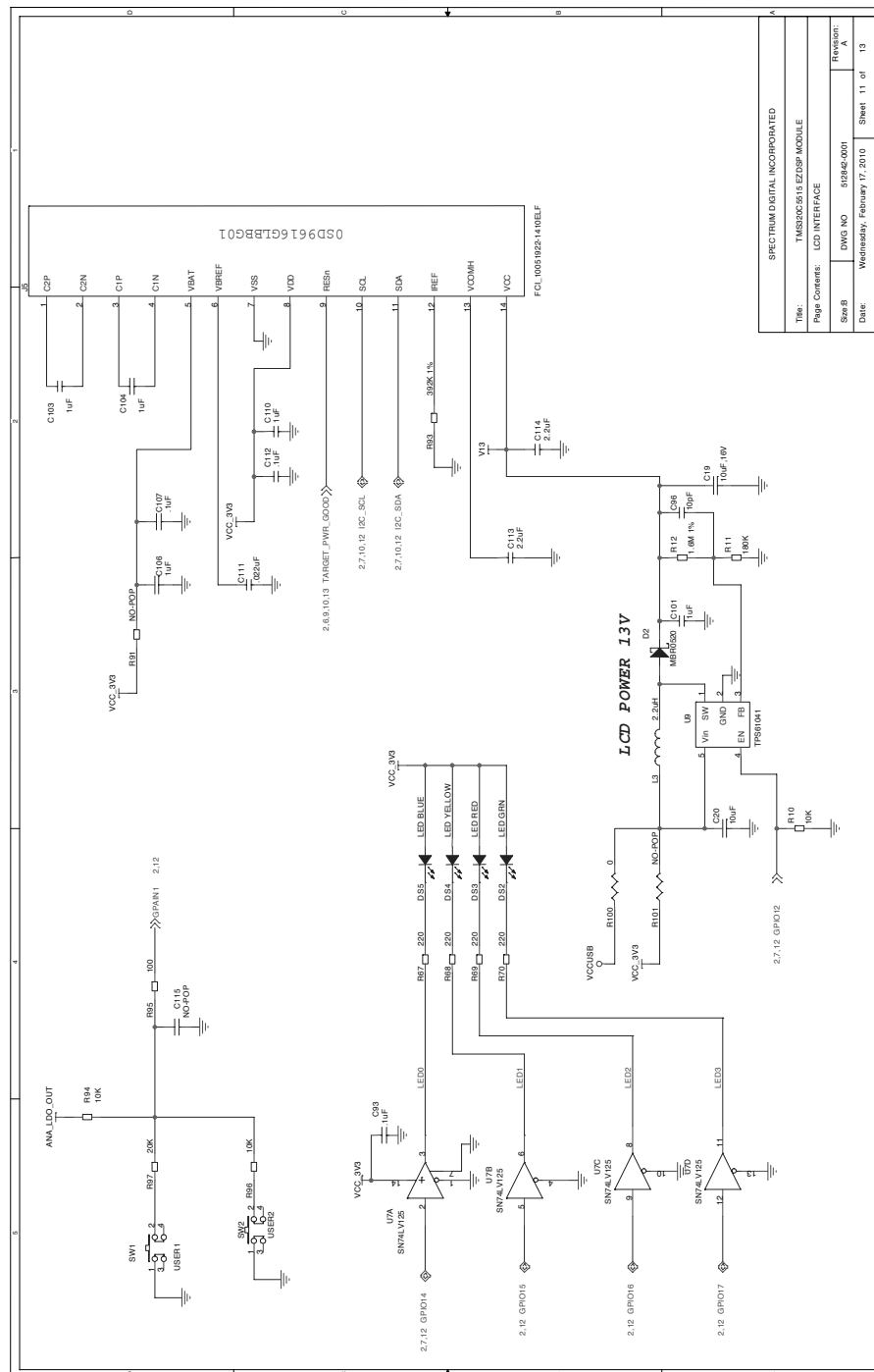




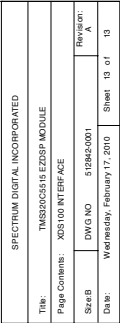












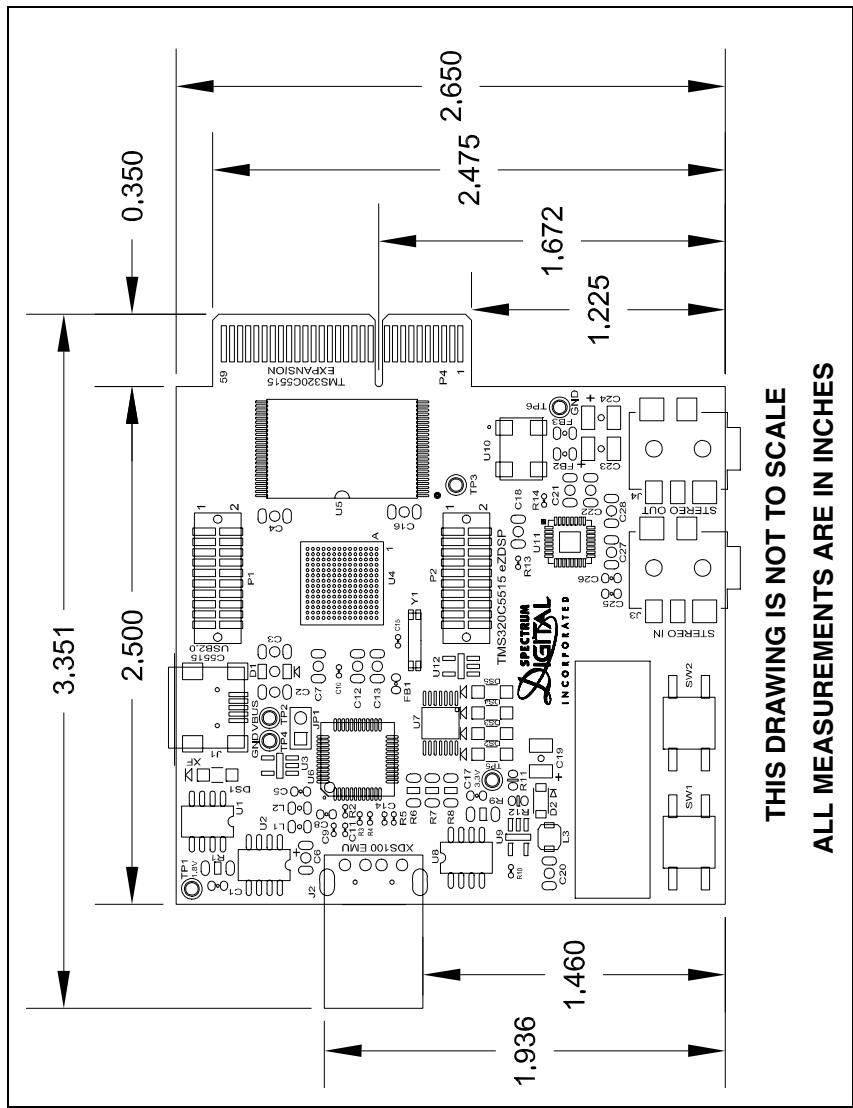
## Appendix B

### Mechanical Information

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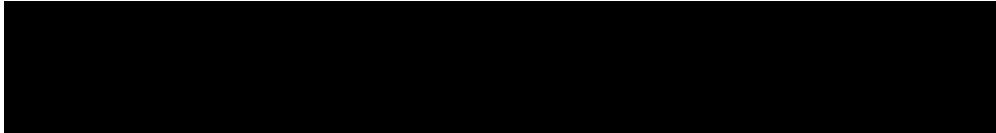
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This appendix contains the mechanical information about the TMS320C5515 eZdsp USB Stick.





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