

# ***TMS320C5535 eZdsp<sup>TM</sup>***

*Technical  
Reference*



# TMS320C5535 eZdsp™

## Technical Reference

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## About This Manual

This document describes the board level operations of the TMS320C5535 eZdsp. The eZdsp is based on the Texas Instruments TMS320C5535 Digital Signal Processor.

The TMS320C5535 eZdsp is a USB based printed circuit board (PCB) that allows engineers and software developers to evaluate certain characteristics of the TMS320C5535 DSP.

## Notational Conventions

This document uses the following conventions.

The TMS320C5535 eZdsp will sometimes be referred to as the C5535 eZdsp, or 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 TMS320C5535

# Chapter 1

## Introduction to the TMS320C5535 eZdsp

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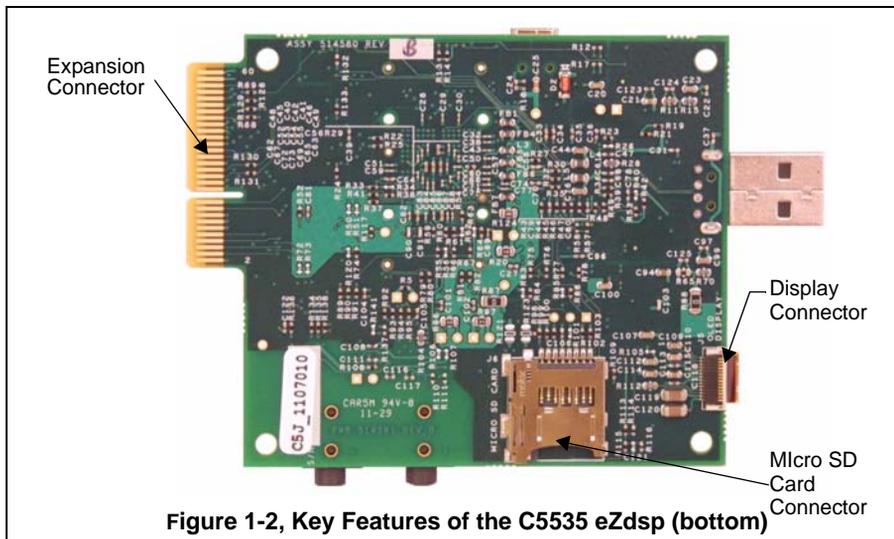
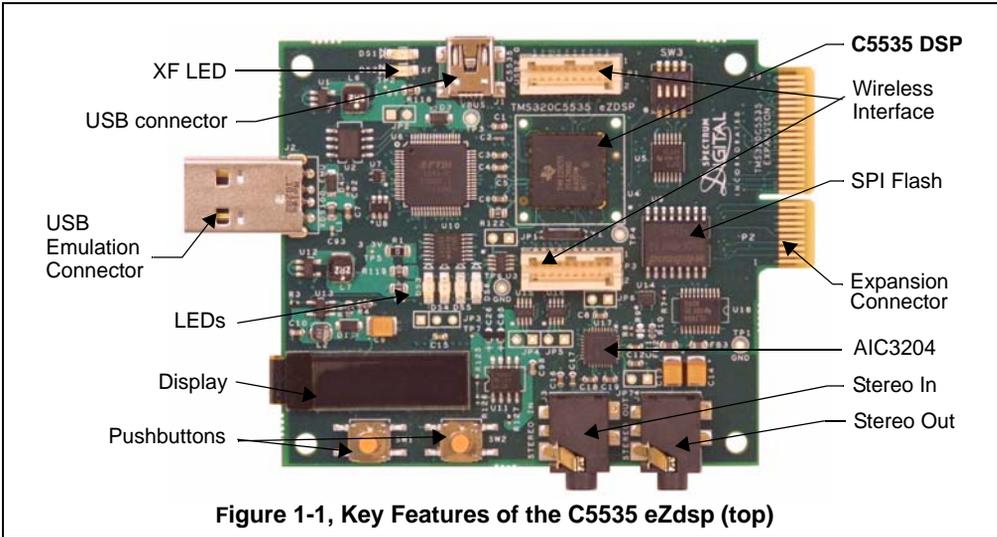
This chapter provides you with a description of the C5535 eZdsp along with the key features.

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### 1.0 Overview of the C5535 eZdsp

The C5535 eZdsp is an evaluation tool for the Texas Instruments TMS320C5535 Digital Signal Processor (DSP). This USB bus powered tool allows the user to evaluate the following items:

- The TMS320C5535 processor along with its peripherals
- The TLV320AIC3204 codec
- The Code Composer Studio IDE™ software development tools



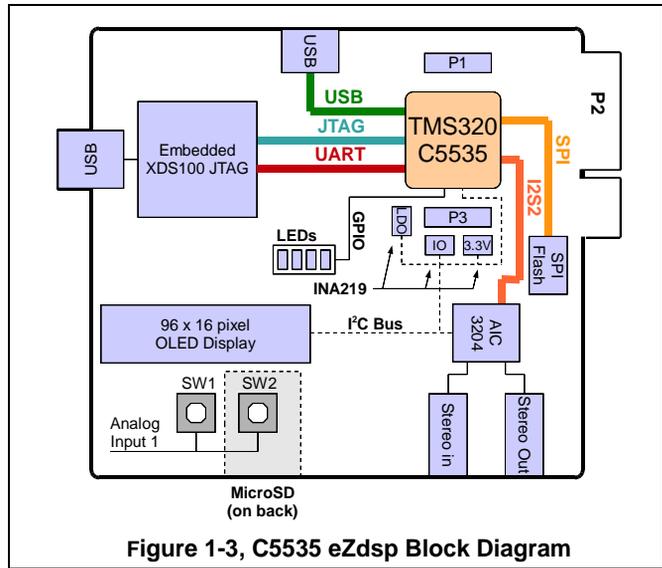
## **1.1 Key Features of the C5535 eZdsp**

The C5535 eZdsp has the following features:

- Texas Instrument's TMS320C5535 Digital Signal Processor
- Texas Instruments TLV320AIC3204 Stereo Codec (stereo in, stereo out)
- Micro SD card connector
- USB 2.0 interface to C5535 processor
- 8 Mbytes SPI flash
- I<sup>2</sup>C OLED display
- 5 user controlled LEDs
- 2 user readable push button switches
- 3 INA219 I<sup>2</sup>C Current/Power Monitors
- Embedded USB XDS100 JTAG emulator
- Wireless interface
- Expansion edge connector
- Power measurement test points
- Power provided by USB interface
- Compatible with Texas Instruments Code Composer Studio v4
- USB cable

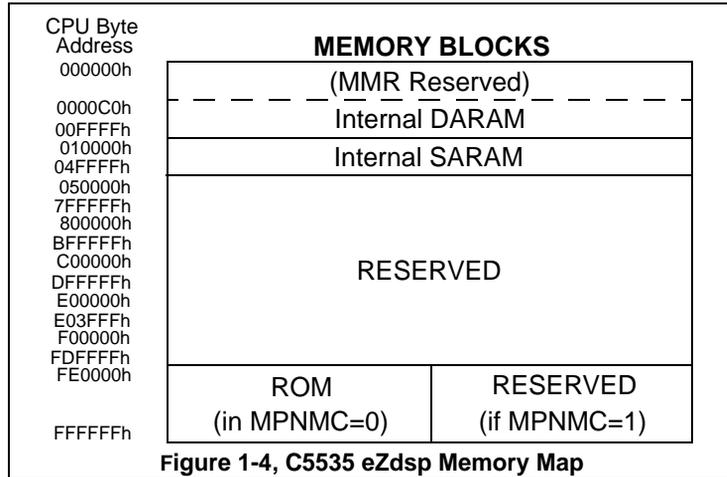
### 1.2 C5535 eZdsp Block Diagram

The block diagram of the C5535 eZdsp is shown below.



### 1.3 C5535 eZdsp Memory Map

The C5535 eZdsp supports on chip DARAM, SARAM, and off chip SPI 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 C5535 will attempt to execute its boot load sequence.

## 1.4 C5535 eZdsp I<sup>2</sup>C Addressing

The C5535 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: C5535 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
OSD9616GLBGG01	0x3C	OLED Display
U16, INA219IDCN	0x40	USB 3.3V Power Monitor
U15, INA219IDCN	0x44	VDD_IO 3.3V Power Monitor
U3, INA219IDCN	0x48	VDD Core Power Monitor



## Physical Description

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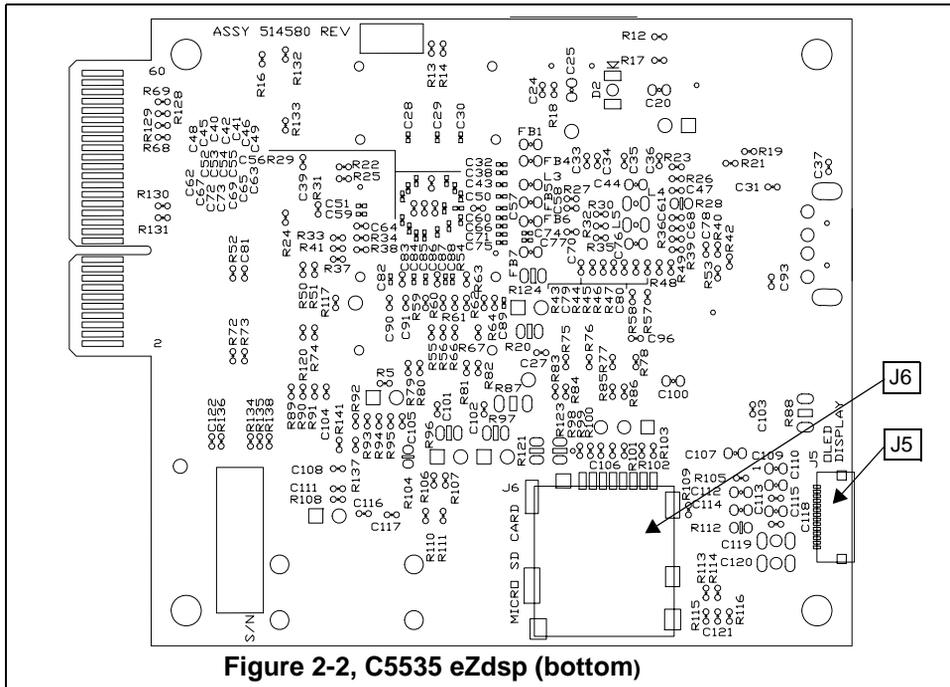
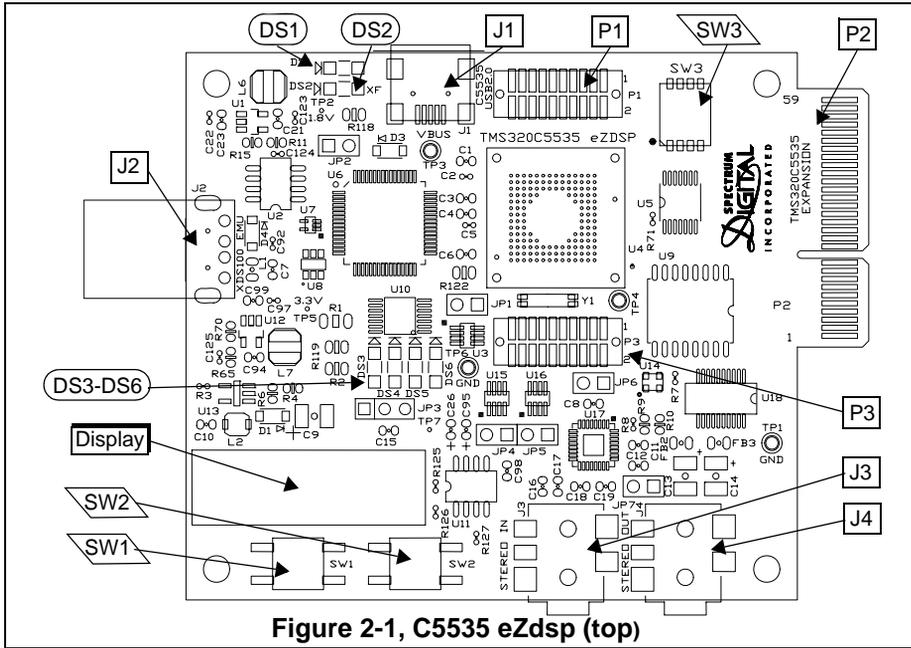
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This chapter describes the physical layout of the TMS320C5535 eZdsp.

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## 2.0 Board Layout

The C5535 eZdsp is a 3.35 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 C5535 eZdsp has nine (9) connectors which provide the user access to various signals on the eZdsp. These connectors are shown in the table below.

**Table 1: C5535 eZdsp Connectors**

Connector	# Pins	Function	Schematic Page	Board Side
J1	25	C5535 USB	2	Top
J2	6	Emulation USB	13	Top
J3	2	Audio In	10	Top
J4	2	Audio Out	10	Top
J5	14	LCD Interface	11	Bottom
J6	8	Micro SD Card Interface	7	Bottom
P1	20	Wireless Interface	6	Top
P2	30 x 2	Expansion Connector	12	Top/Bottom
P3	20	Wireless Interface	6	Top

The following manufacturer and parts numbers can be used to interface to the connectors on the C5535 eZdsp:

**Table 2: C5535 eZdsp Mating Connectors**

Connector	Manufacturer	Part #
J1	PC or laptop	
J2	PC or laptop	
P1	CUI Inc	CUI SP-3501, Digi-Key CP-3502-ND
P2	Samtec	Samtec MEC1-120-02-S-D-A, Digi-Key SAM8117-ND
P3	CUI Inc	CUI SP-3501, Digi-Key CP-3502-ND

### 2.1.1 J1, C5535 USB Connector

The USB connector, J1, is attached the C5535 processor for use by C5535 software applications. The signals on the pins of this connector are shown below.

**Table 3: J1, USB Connector**

Pin #	Signal Name
1	USBVDD
2	D-
3	D+
4	ID / NC
5	USBVSS/GND
6,7,8,9	GND (shield)

### 2.1.2 J2, XDS100 USB Connector

The USB connector, J2, is used to attach the C5535 eZdsp to a personal computer or laptop. This allows the user to develop and debug software on the C5535 eZdsp. The signals on the pins of this connector are shown below.

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

Pin #	Signal Name
1	U7, Pin 1 (VCC), VCCUSB, 5V_USB
2	U7, Pin 5 (IO4), U6, Pin 7(DM), D-
3	U7, Pin 3(IO1), U6, Pin 8(DP), D+
4	GND
5	GND, shield
6	GND, shield

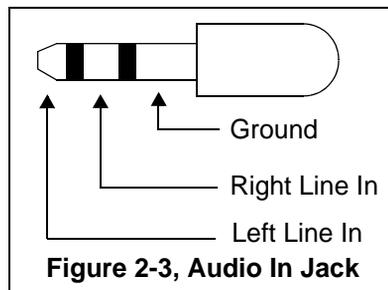
### 2.1.3 J3, Audio In Connector

The Stereo In connector, J3, is used to bring signals into the TLV320AIC3204 codec, U17. 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	U17, Pin 15
3	AIC_LINE2R	U17, Pin 16
4	No connect	
5	No connect	

The figure below shows a typical stereo jack.



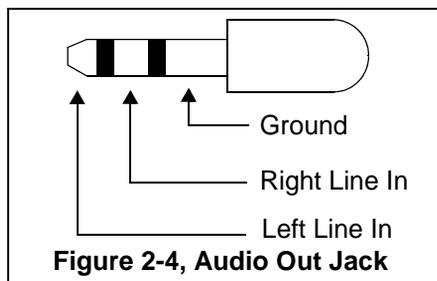
### 2.1.4 J4, Audio Out Connector

The Audio Out connector, J4, is used to bring signals from the TLV320AIC3204 codec, U17. 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	U17, Pin 25
3	HEADPHONE_ROUT	U17, Pin 27
4	No connect	
5	No connect	

The figure below shows a typical headphone 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	VSS, GND
8	VDD, VCC_3V3
9	RESn, TARGET_PWR_GOOD
10	SCL, I2C_SCL
11	SDA, I2C_SDA
12	IREF
13	VCOMH
14	VCC, V13

### 2.1.6 J6, Micro SD Card Connector

The Micro SD connector, J6, is used to interface the C5535 processor to a micro SD card. The signals on the pins of this connector are shown below.

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

Pin #	Signal Name
1	DAT2, SD_DATA2
2	DAT3, SD_DATA3
3	CMD, SD_CMD
4	VDD, VCC_3V3
5	CLK, SD_CLK
6	GND
7	DAT0, SD_DATA0
8	DAT1, SD_DATA1
9	INSERT, VCC_3V3
10	INSERT_COM, GND
11,12,13,14	NC

### 2.1.7 P1, P3, Wireless Interface

Connectors P1 and P3 are used to provide an interface to Texas Instruments Wireless Interface modules. The signals on the pins of these connectors are shown in the tables below.

**Table 9: P1, Wireless Interface Connector**

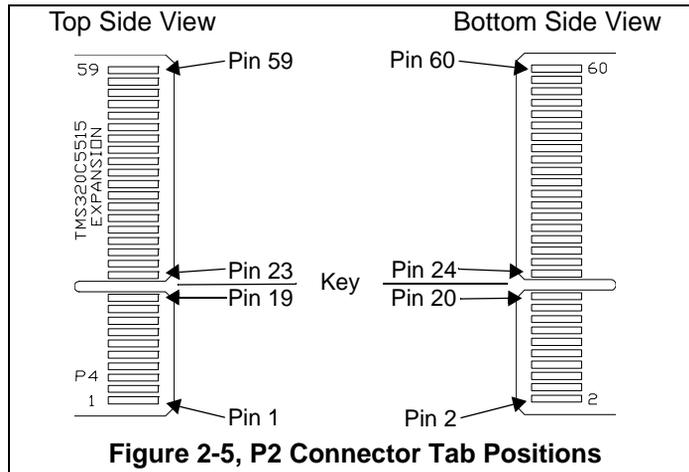
Pin #	Signal Name	Pin #	Signal Name
1	GND	2	SD_DATA0
3	UART_RTS	4	SD_DATA1
5	RTC_CLKOUT	6	SD_DATA2
7	UART_TX	8	SD_DATA3
9	UART_RX	10	GPIO10
11	I2C_SDA	12	GPIO11
13	I2C_SCL	14	SPI_CS2
15	SD_CLK	16	SPI_CLK
17	SD_CMD	18	SPI_TX
19	GND	20	SPI_RX

**Table 10: P3, Wireless Interface Connector**

Pin #	Signal Name	Pin #	Signal Name
1	NC	2	GND
3	NC	4	NC
5	NC	6	NC
7	VCC_3V3	8	I2S1_RX
9	VCC_3V3	10	I2S1_DX
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 P2, Expansion Connector

The expansion edge connector, P2, provides the C5535 serial interface signals to limitless user expansion boards. This 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 P2. The signals on the pins of this connector are shown below.

**Table 11: P2, 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	GPIO11
25	I2S2_RX	26	GPIO10
27	I2S2_DX	28	GPIO5
29	I2S2_FS	30	GPIO4
31	GND	32	GND
33	I2S1_CLK	34	UART_RTS
35	I2S1_RX	36	UART_CTS
37	I2S1_DX	38	UART_RX
39	I2S1_FS	40	UART_TX
41	VCC_3V3	42	VCC_USB_DUAL
43	VCC_3V3	44	VCC_USB_DUAL
45	I2S0_CLK	46	SPI_CS3
47	I2S0_RX	48	VCC_USB_DUAL
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_USB_DUAL
59	VCC_3V3	60	VCC_USB_DUAL

## 2.2 System LEDs

The C5535 eZdsp has 6 Light Emitting Diodes (LED). LEDs DS2- DS6 are under the application software control running on the C5535 processor. The C5535 eZdsp LEDs are shown in the table below.

**Table 12: System LEDs**

LED #	Color	Schematic Page	Signal Name
DS1	Green	13	U6, Pin 60, PWREN#
DS2	Green	2	U4, Pin J3, XF
DS3	Green	11	U4, Pin P8, GPIO17
DS4	Red	11	U4, Pin P3, GPIO16
DS5	Yellow	11	U4, Pin N7, GPIO15
DS6	Blue	11	U4, Pin P2, GPIO14

## 2.3 Switches

The C5535 eZdsp has three switches, two push button switches, and one DIP switch. 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
SW3	5	4 position DIP switch

### 2.3.1 SW1, SW2, Momentary Push Button Switches

Switches SW1, and SW2 are momentary push button switches read by the application software running on the C5535 processor using the GPAIN1 port.

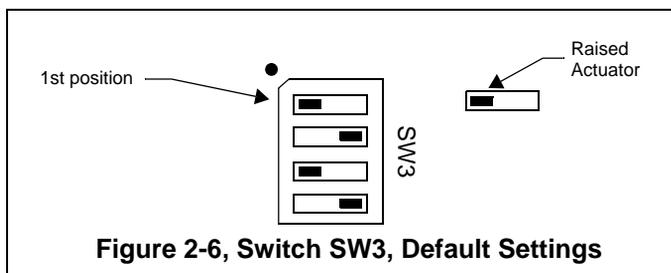
### 2.3.2 SW3, 4 Position DIP Switch

Switch SW3 is a 4 position DIP switch. The signals attached to each position are shown in the table below.

**Table 14: Switch SW3**

Position	Signal Name	Default Setting
1	CLK_SEL	OFF
2	UART_BUFF_EN	ON
3	AIC3204I2C_ENn	OFF
4	SPI_CS0	ON

The figure below shows switch SW3 default settings.



**Figure 2-6, Switch SW3, Default Settings**

The table below shows the functions of the setting in each position of SW3.

**Table 15: Switch SW3 Functions**

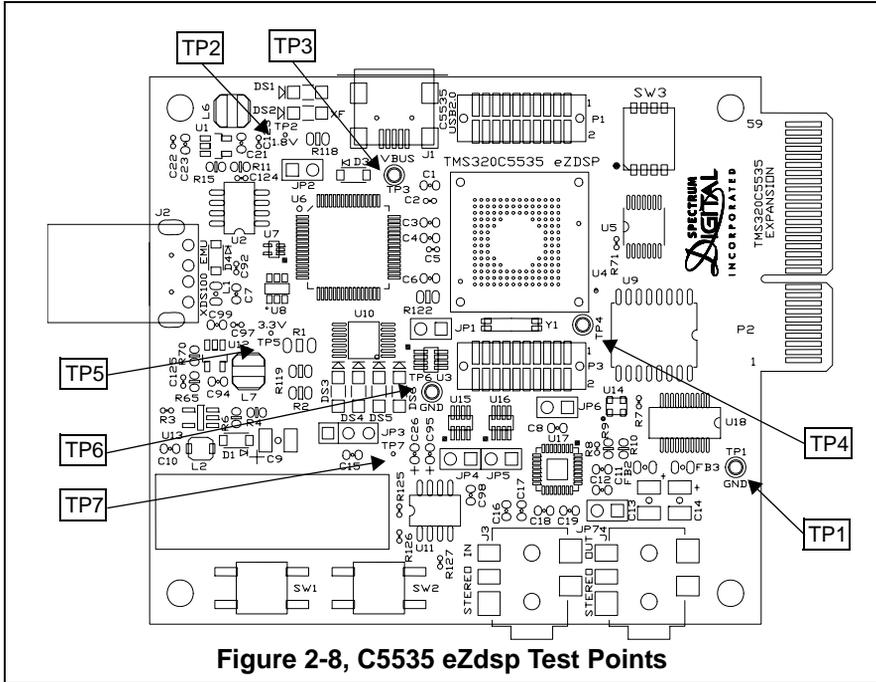
Position	Setting	Function
1	ON	Select external 12 MHz. clock
	OFF	Select internal 32 MHz. RTC clock
2	ON	* Enable UART via J2 for VCP
	OFF	* Disable UART via J2
3	ON	Disable AIC3204 interface
	OFF	Enable AIC3204 interface
4	ON	Enable SPI Flash CS
	OFF	Disable SPI Flash CS

\* **Note:** GPIO15 can overwrite



## 2.5 Test Points

The C5535 eZdsp has seven (7) test points for the monitoring of signals. The location of the test points are shown in the figure below.



**Figure 2-8, C5535 eZdsp Test Points**

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

**Table 17: Test Points**

TP #	Schematic Page	Signal Name
TP1	4	GND
TP2	8	VCC_1V8_TP
TP3	2	U4, Pin I14, VBUS/VBUS_C5535
TP4	2	U4, Pin A2, CLKOUT
TP5	8	VCC_3V3_TP
TP6	10	GND
TP7	9	U11, Pin 7,8, VCC_1V3, VCC_1V3_TP

# Appendix A

## Schematics

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This appendix contains the schematics for the TMS320C5535 eZdsp.

<p>NOTES, UNLESS OTHERWISE SPECIFIED:                  1. RESISTANCE VALUES IN OHMS.                  2. CAPACITANCE VALUES IN MICROFARADS.                  3. REFERENCE DESIGNATORS USED:                  4. ALL 0.1 uF AND 0.01uF CAPACITORS ARE DECOUPLING CAPS UNLESS OTHERWISE NOTED. THEY ARE SHOWN ON THE PAGE WITH THE INTEGRATED CIRCUITS THEY SHOULD BE PLACED NEAR.</p>		<p>REV</p>		<p>DESCRIPTION</p>		<p>DATE</p>		<p>APPROVED</p>	
		A		Initial schematic for layout		1/10/2011		RRP	
		B		BETA UPDATES		6/19/2011		RRP	
		C		PRODUCTION UNITS		7/19/2011		RRP	

<p>SCHEMATIC CONTENTS</p> <p>01 - TITLE PAGE</p> <p>02 - TMS320C5535 IO</p> <p>03 - UART BUFFER</p> <p>04 - TMS320C5535 POWER</p> <p>05 - SEI FLASH</p> <p>06 - CC BOARD INTERFACE</p> <p>07 - MICRO SD INTERFACE</p> <p>08 - POWER SUPPLIES</p> <p>09 - AUDIO CODEC</p> <p>10 - LCD/USER LEADS/SWITCHES</p> <p>11 - EXPANSION CONNECTOR</p> <p>12 - XDS100-V2 INTERFACE</p>									
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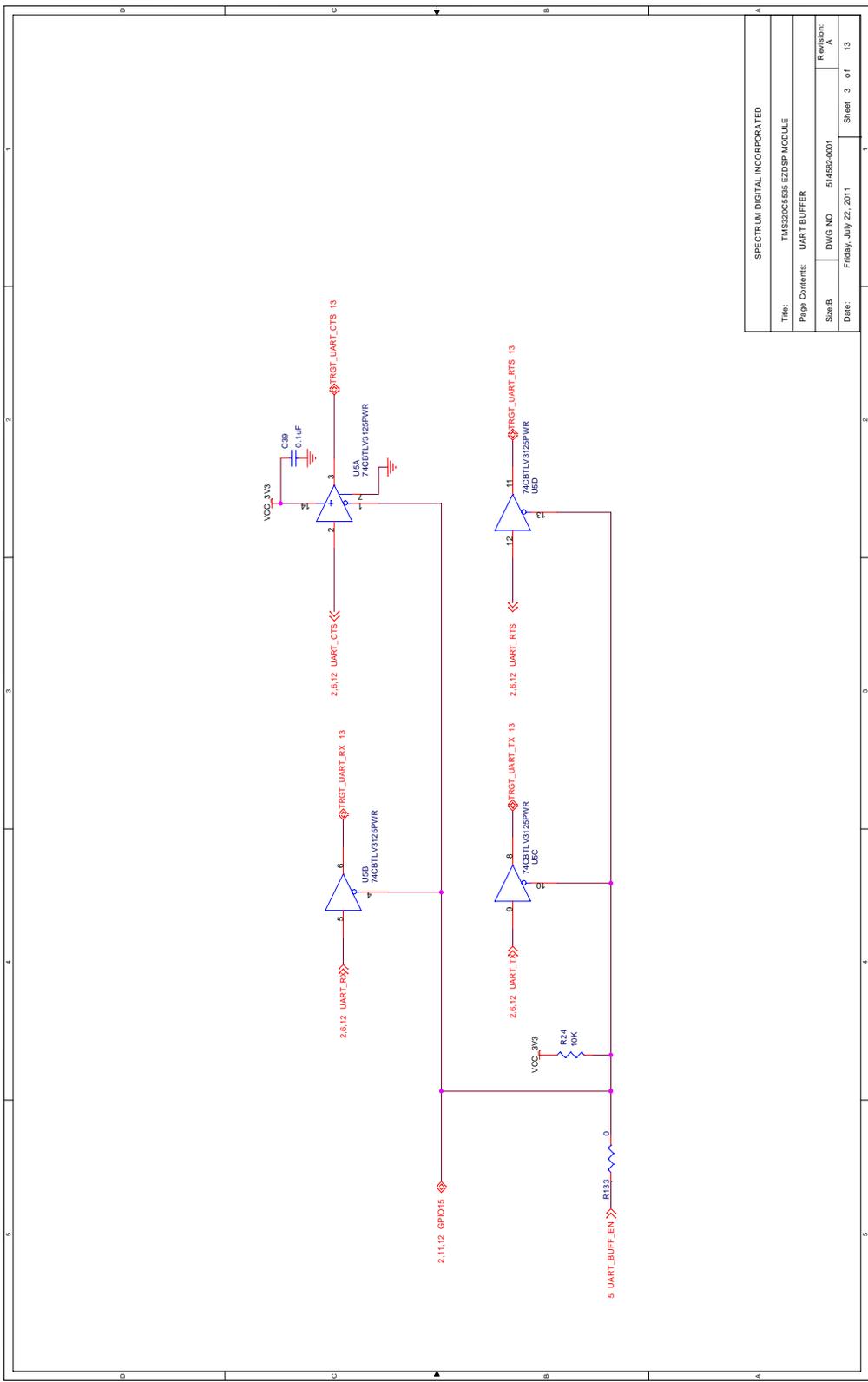
  

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G	7	10/12/2009	...	...	10/12/2009	...	...	10/12/2009	...	...
H	8	10/12/2009	...	...	10/12/2009	...	...	10/12/2009	...	...
I	9	10/12/2009	...	...	10/12/2009	...	...	10/12/2009	...	...
J	10	10/12/2009	...	...	10/12/2009	...	...	10/12/2009	...	...

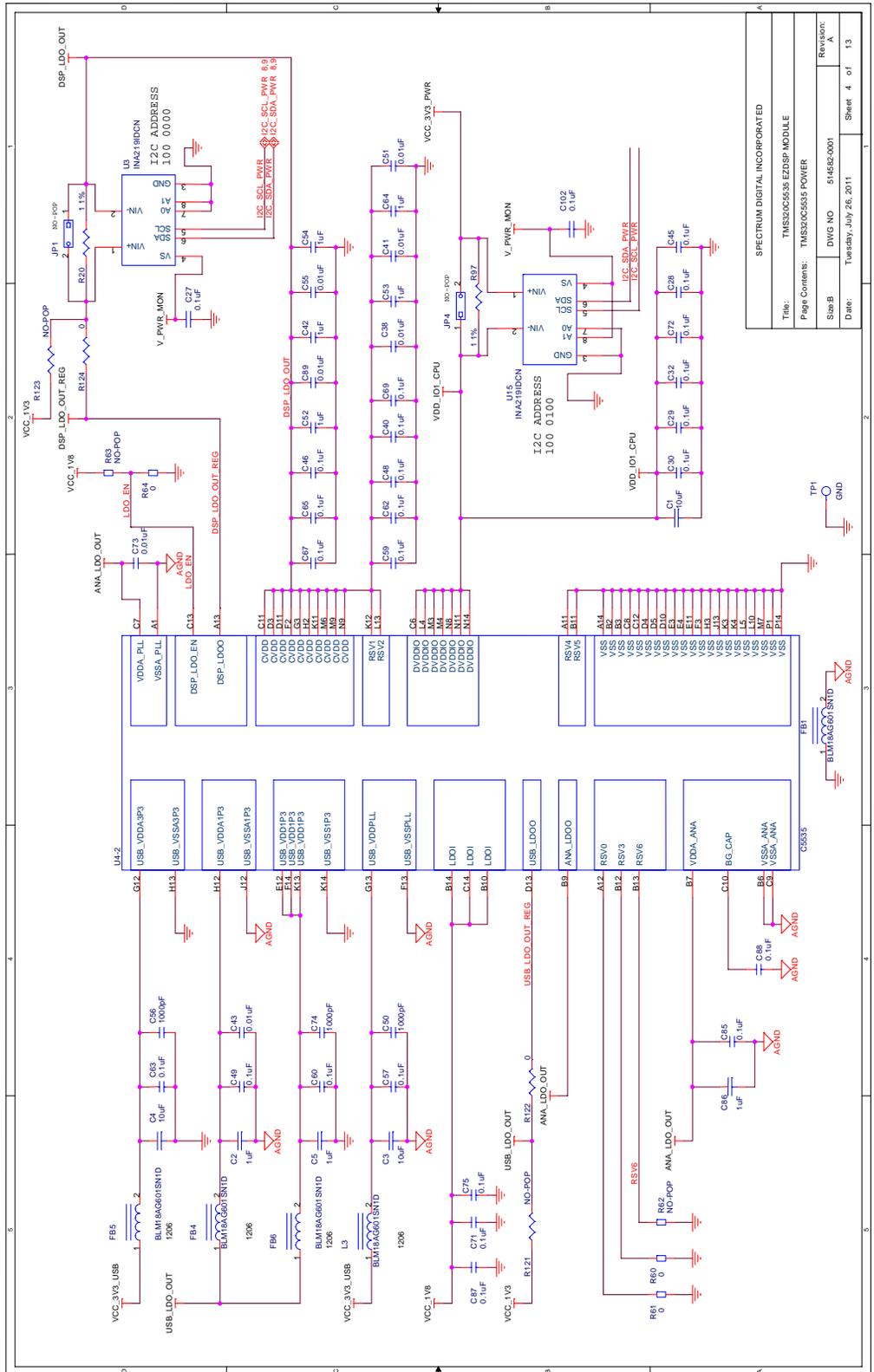
  

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<p>Date: Tuesday, July 26, 2011</p>	<p>Sheet 1 of 13</p>



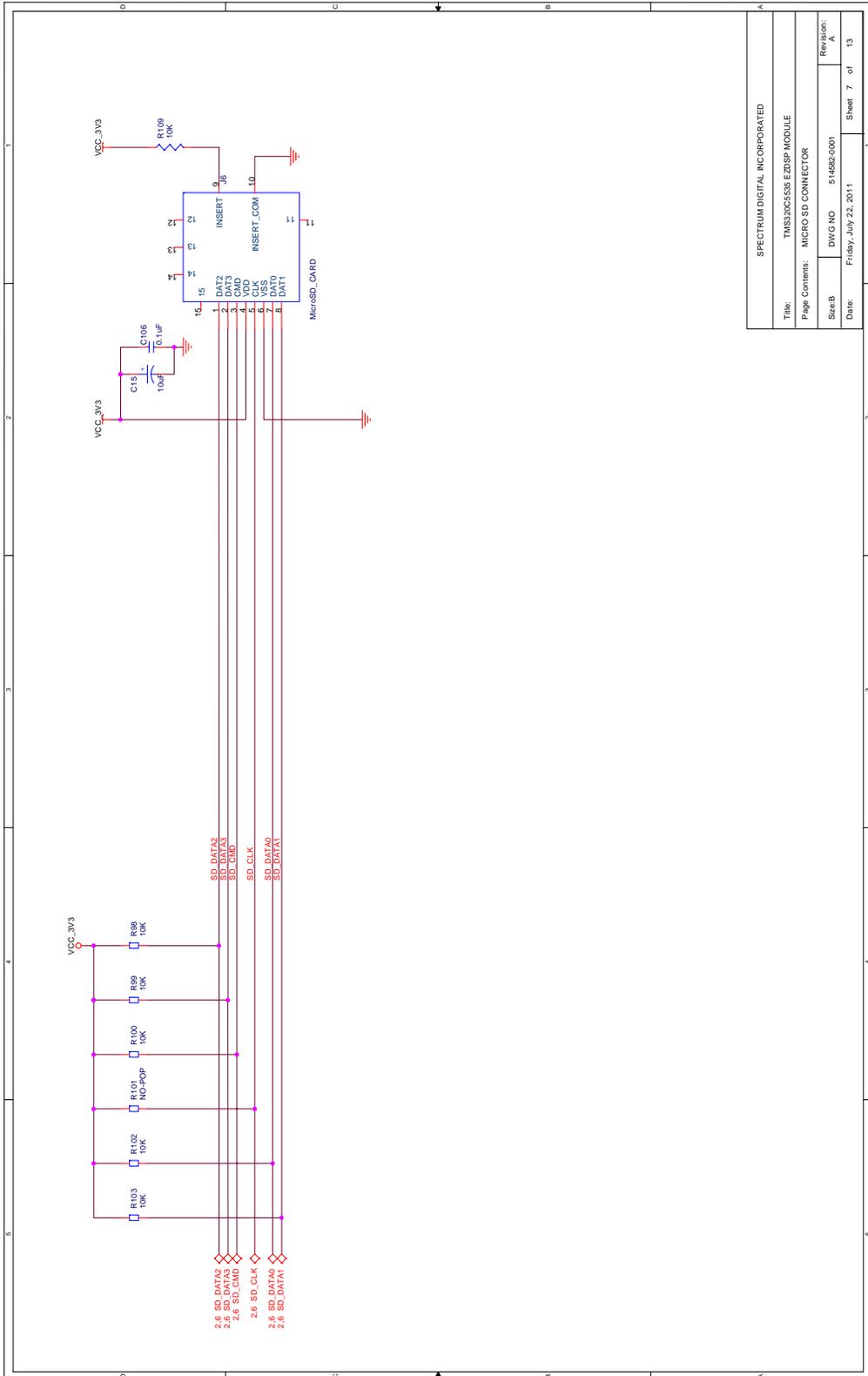


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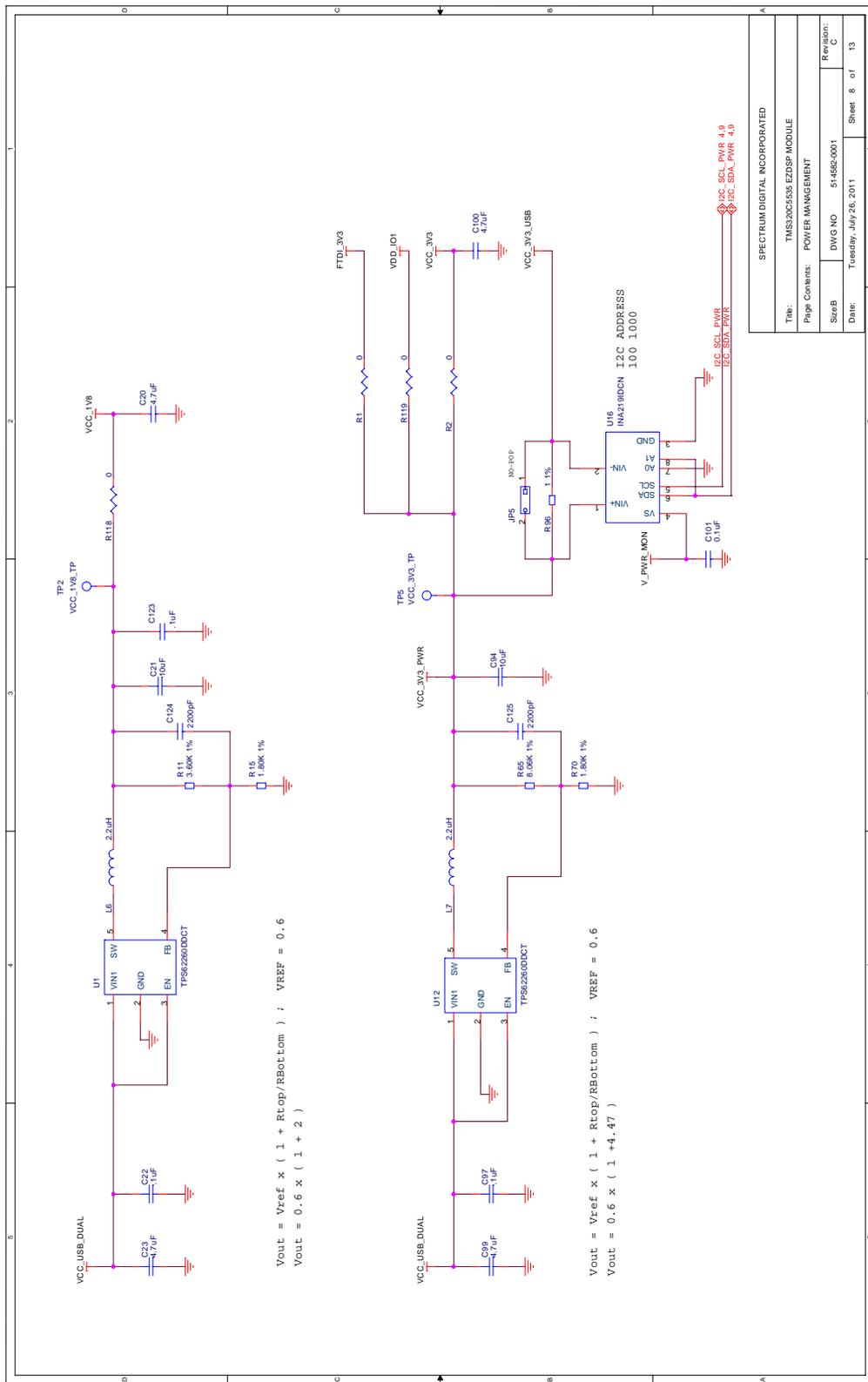




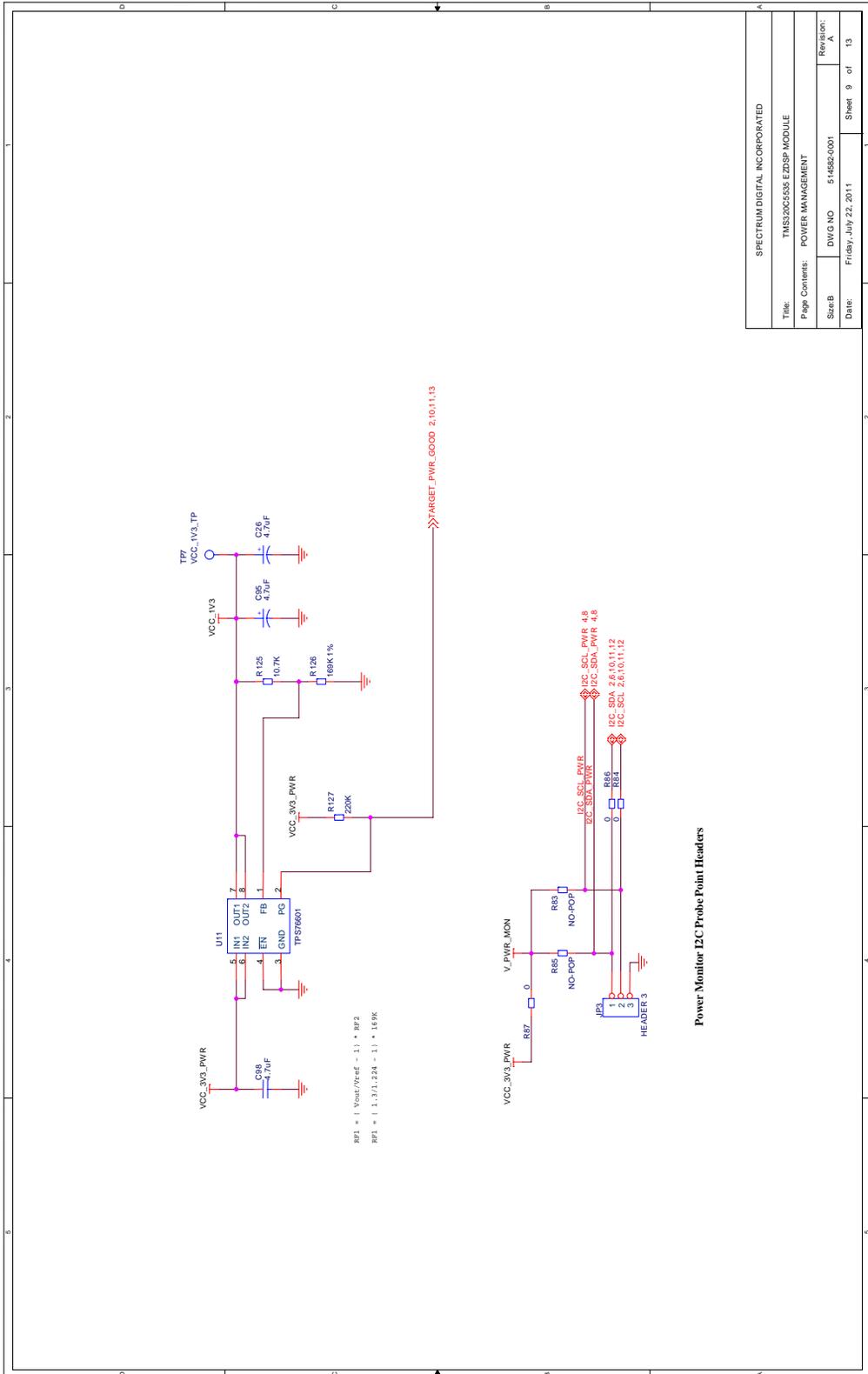




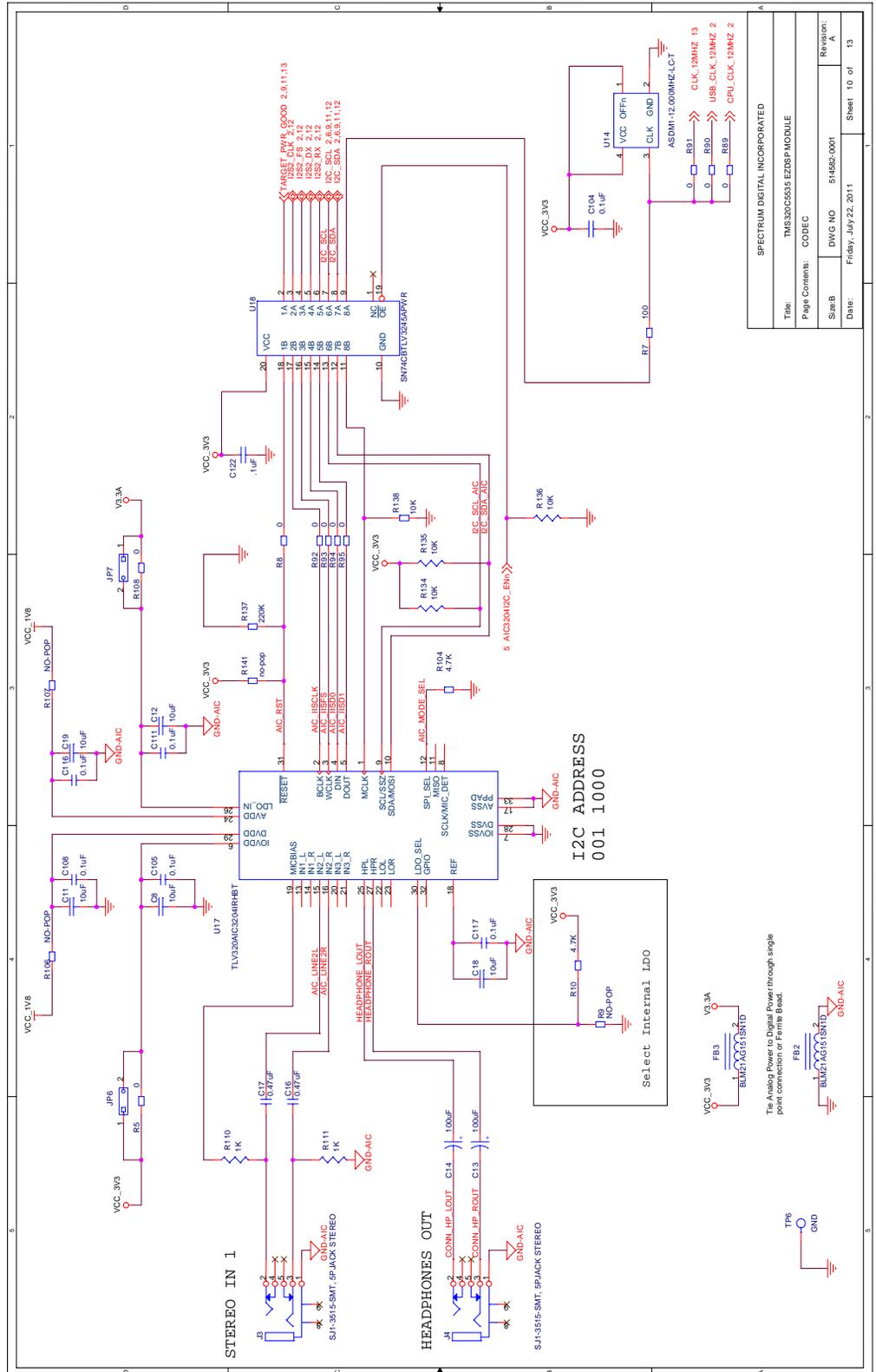
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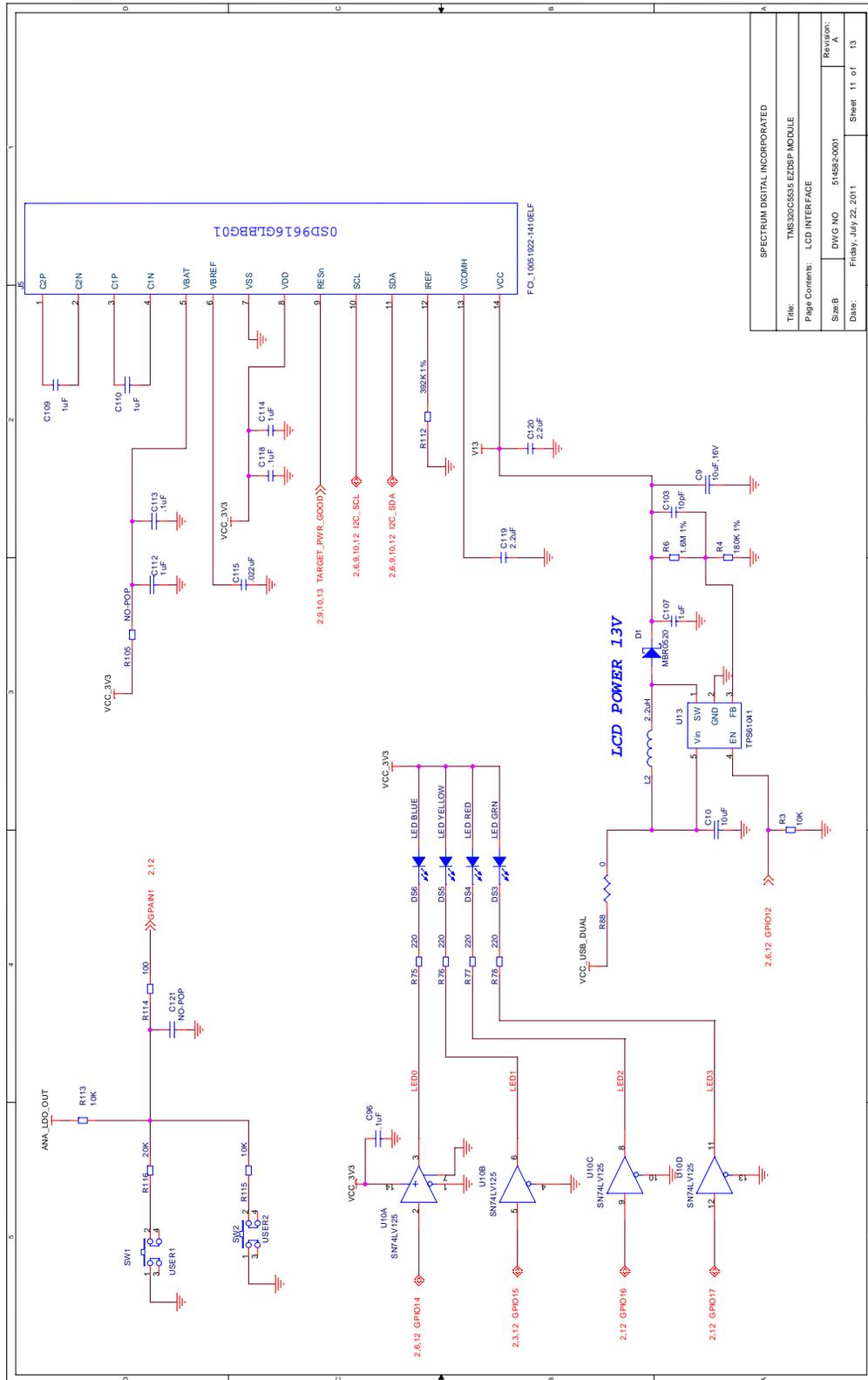


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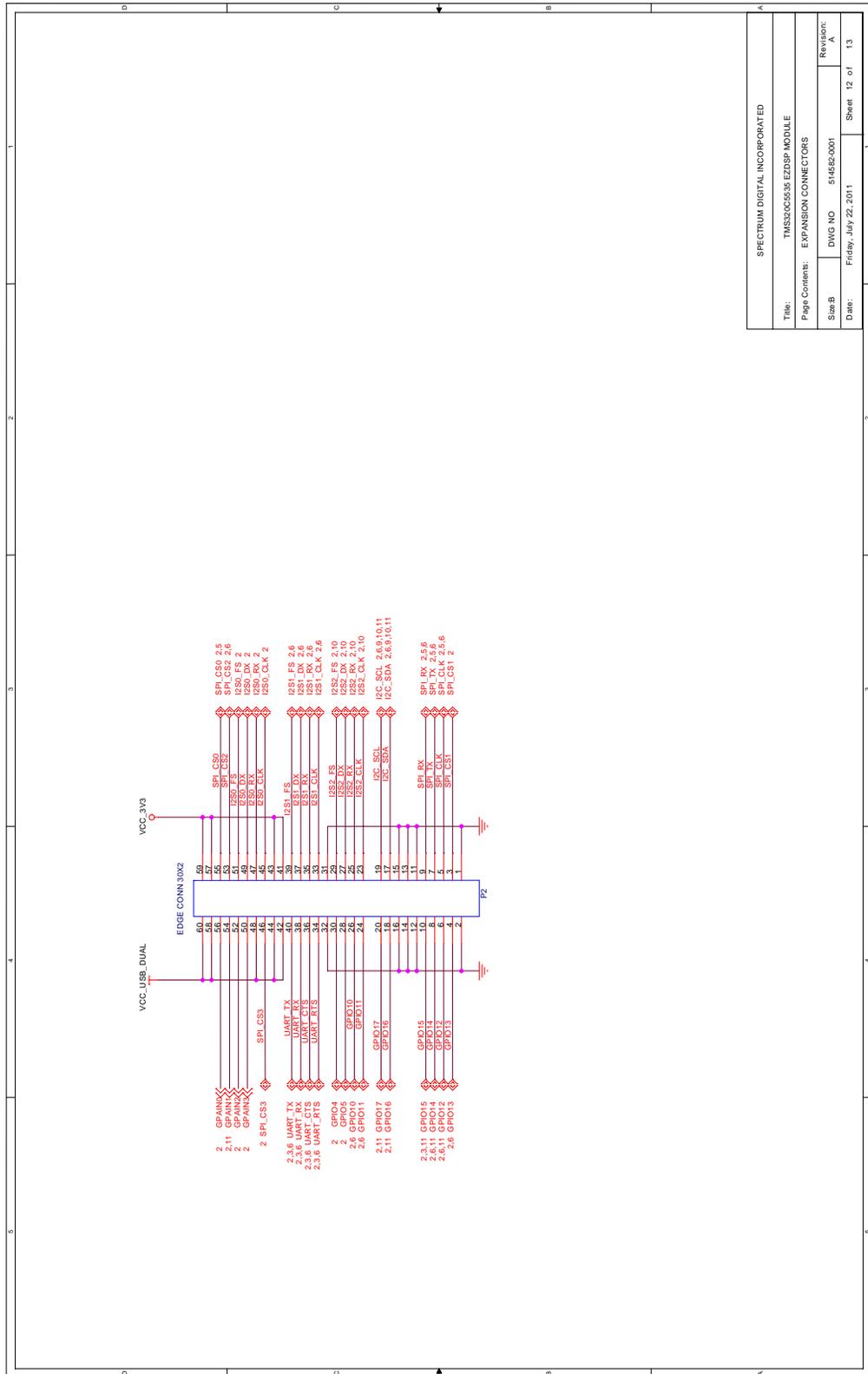


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Page Contents:	CODEC	SizeB:	DWG NO 514592-0001
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The Analog Power to Digital Power through single point connection of Ferrite Beads.



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Page Contents:	LCD INTERFACE
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## Mechanical Information

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This appendix contains the mechanical information about the TMS320C5535 eZdsp produced by Spectrum Digital.

