

eZdspTM R2812 USB

*Technical
Reference*

eZdsp™ R2812 USB Technical Reference

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About This Manual

This document describes board level operations of the eZdsp™ R2812 based on the Texas Instruments TMS320R2812 Digital Signal Processor.

The eZdsp™ R2812 is a stand-alone module permitting engineers and software developers evaluation of certain characteristics of the TMS320R2812 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 “eZdsp™ R2812” will sometimes be referred to as the “eZdsp”.

“eZdsp” will include the socketed or unsocket version

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, hardware, or other equipment. The information in a caution is provided for your protection. Please read each caution carefully.

Related Documents

Texas Instruments TMS320R28x DSP CPU and Instruction Set Reference Guide,
literature #SPRU430
Texas Instruments TMS320R28x Assembly Language Tools Users Guide,
literature #SPRU513
Texas Instruments TMS320R28x Optimizing C/C++ Compiler User's Guide,
literature #SPRU514
Texas Instruments Code Composer Studio Getting Started Guide,
literature #SPRU509

Chapter 1

Introduction to the eZdsp™ R2812

This chapter provides a description of the eZdsp™ for the TMS320R2812 Digital Signal Processor, key features, and block diagram of the circuit board.

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1.0 Overview of the eZdsp™ R2812

The eZdsp™ R2812 is a stand-alone card--allowing evaluators to examine the TMS320R2812 digital signal processor (DSP) to determine if it meets their application requirements. Furthermore, the module is an excellent platform to develop and run software for the TMS320R2812 processor.

The eZdsp™ R2812 is shipped with a TMS320R2812 DSP. The eZdsp™ R2812 allows full speed verification of R2812 code. Expansion connectors are provided for any necessary evaluation circuitry not provided on the as shipped configuration.

To simplify code development and shorten debugging time, a C2000 Tools Code Composer driver is provided. In addition, an onboard JTAG connector provides interface to emulators, operating with other debuggers to provide assembly language and 'C' high level language debug.

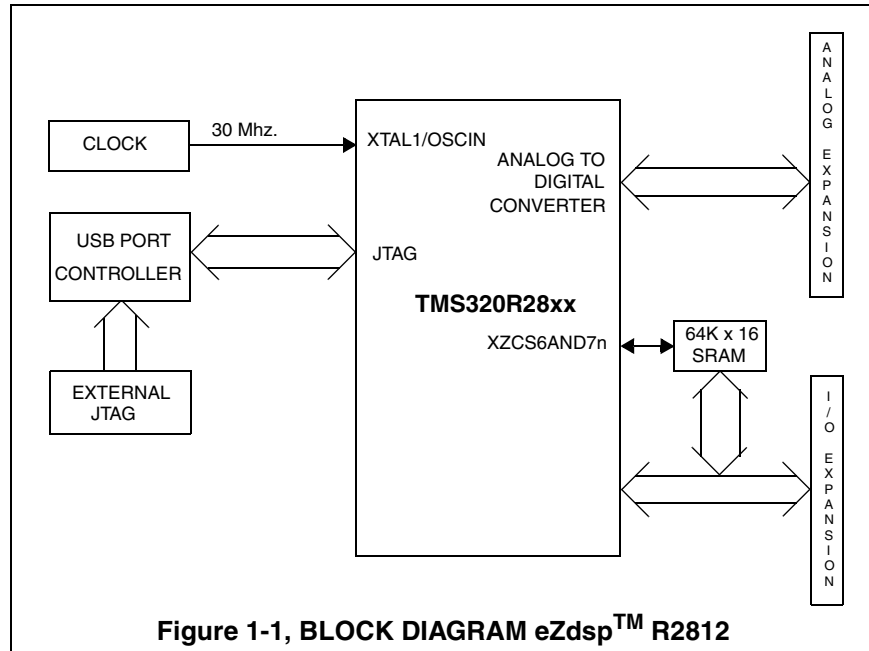
1.1 Key Features of the eZdsp™ R2812

The eZdsp™ R2812 has the following features:

- TMS320R2812 Digital Signal Processor
- 150 MIPS operating speed
- 20K words on-chip zero wait state SARAM
- 64K words off-chip SRAM memory
- 256K bits serial EEPROM memory
- 30 MHz. clock
- Expansion Connectors (memory, analog, I/O)
- Onboard IEEE 1149.1 JTAG Controller
- 5-volt only operation with supplied AC adapter
- TI R28xx Code Composer Studio tools driver
- On board USB JTAG emulation connector

1.2 Functional Overview of the eZdsp™ R2812

Figure 1-1 shows a block diagram of the basic configuration for the eZdsp™ R2812. The major interfaces of the eZdsp are the JTAG interface, and expansion interface.



Chapter 2

Operation of the eZdsp™ R2812

This chapter describes the operation of the eZdsp™ R2812, key interfaces and includes a circuit board outline.

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2.0 The eZdsp™ R2812 Operation

This chapter describes the eZdsp™ R2812, key components, and operation. Information on the eZdsp's various interfaces is also included. The eZdsp™ R2812 consists of four major blocks of logic:

- Analog Interface Connector
- I/O Interface Connector
- JTAG Interface
- USB Port JTAG Controller Interface

2.1 The eZdsp™ R2812 Board

The eZdsp™ R2812 is a 5.25 x 3.0 inch, multi-layered printed circuit board, powered by an external 5-Volt only power supply. Figure 2-1 shows the layout of the top side of the R2812 eZdsp.

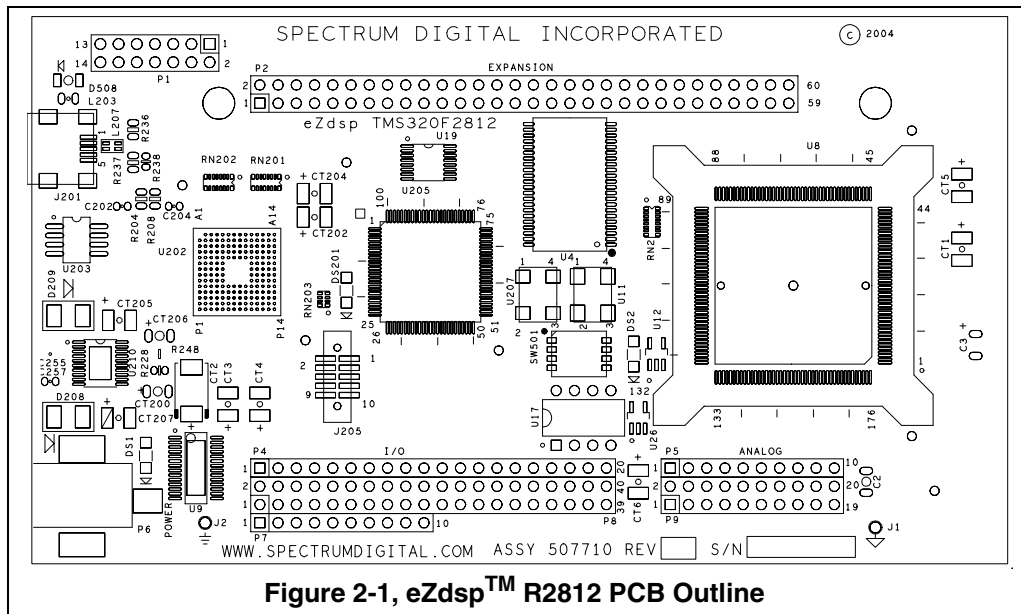


Figure 2-1, eZdsp™ R2812 PCB Outline

2.1.1 Power Connector

The eZdsp™ R2812 is powered by a 5-Volt only power supply, included with the unit. The unit requires 500mA. The power is supplied via connector P6. If expansion boards are connected to the eZdsp, a higher amperage power supply may be necessary. Section 2.3.6 provides more information on connector P6.

2.2 eZdsp™ R2812 Memory

The eZdsp includes the following on-chip memory:

- 2 blocks of 4K x 16 single access RAM (SARAM)
- 1 block of 8K x 16 SARAM
- 4 blocks of 1K x 16 SARAM

In addition 64K x 16 off-chip SRAM is provided. The processor on the eZdsp can be configured for boot-loader mode or non-boot-loader mode.

For bootloading user code a 256K bit serial EEPROM is provided

The eZdsp can load ram for debug, or EEPROM can be loaded and run. For larger software projects it is suggested to do a initial debug with on eZdsp R2812 module which supports a total RAM environment. With careful attention to the I/O mapping in the software the application code can easily be ported to the R2812.

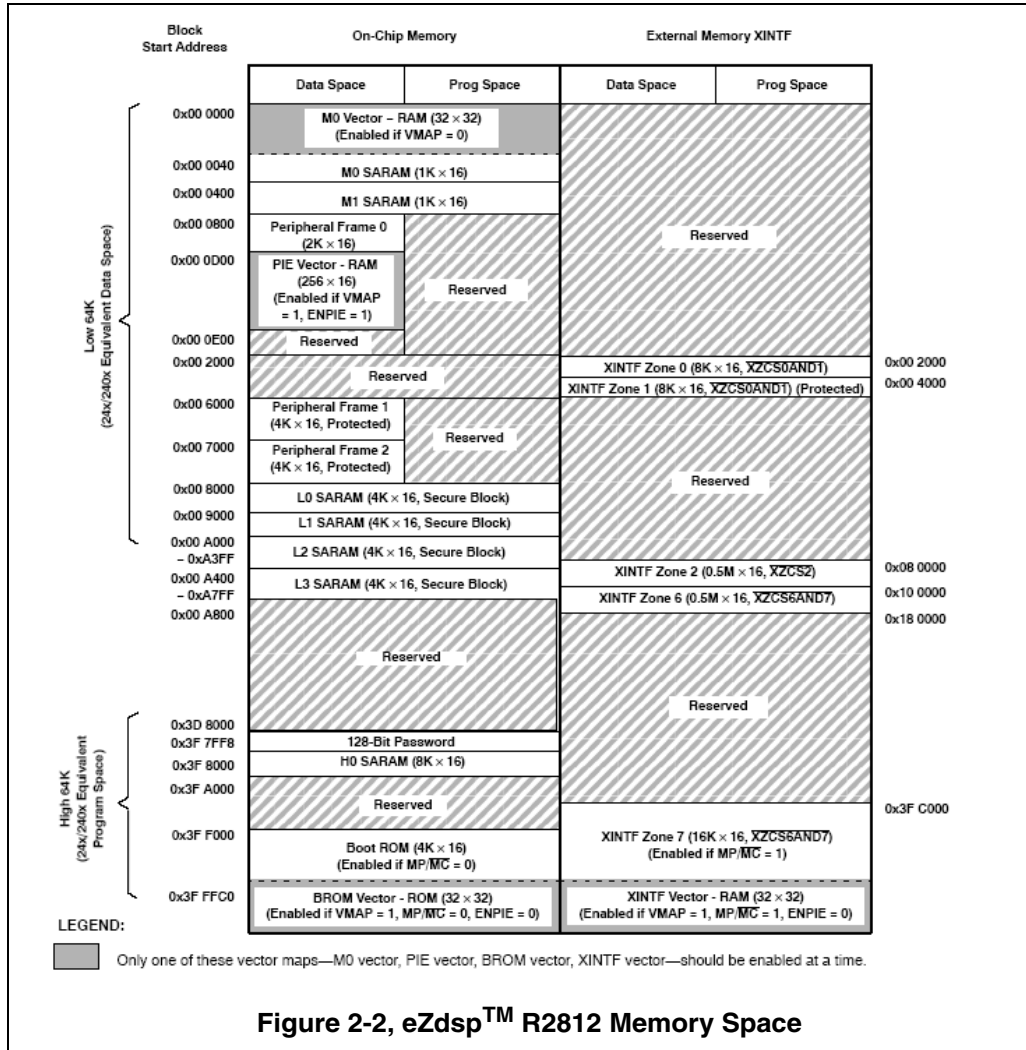
The table below shows the external chip select signal and its use.

Table 1: External Chip Select and Usage

Chip Select Signal	Use
XZCS0AND1n	Expansion header
XZCS2n	Expansion Header
XZCS6AND7n	External SRAM

2.2.1 Memory Map

The figure below shows the memory map configuration on the eZdsp™ R2812.



2.2.2 External Memory Timing

This section describes the timing for the external memory bus when the R2812 is operating at 150 Mhz. In addition a segment of 'C' code is provided to configure the EMIF.

Table 2: External Memory Timing

Memory Function	Time in ns.
Write Cycle Time	40.4ns
Write Low Time	14.0ns
Write High Time	26.4ns
Read Cycle Time	60.8ns
Read Low Time	26.8ns
Read High Time	34.0ns

The following 'C' code segment will initialize the EMIF for 150 Mhz operation.

```
#define XINTCNF2 ( 0x13 )

#define XWRTRAIL(x) ((x & 3))
#define XWRACTIVE(x) ((x & 7)<<2)
#define XWRLEAD(x) ((x & 3)<<5)

#define XRDTRAIL(x) ((x & 3)<<7)
#define XRDACTIVE(x) ((x & 7)<<9)
#define XRDLEAD(x) ((x & 3)<<12)

#define USEREADY (1<<14)
#define ASYNCREADY (1<<15)

#define XTIMING6 (XWRTRAIL(2) | \
                 XWRACTIVE(1) | \
                 XWRLEAD(2) | \
                 XRDTRAIL(2) | \
                 XRDACTIVE(3) | \
                 XRDLEAD(2) )

XINTF_Init()
{
    *(unsigned long *)0xB2C = (unsigned long)XTIMING6;
    *(unsigned long *)0xB34 = (unsigned long)XINTCNF2;
}
```

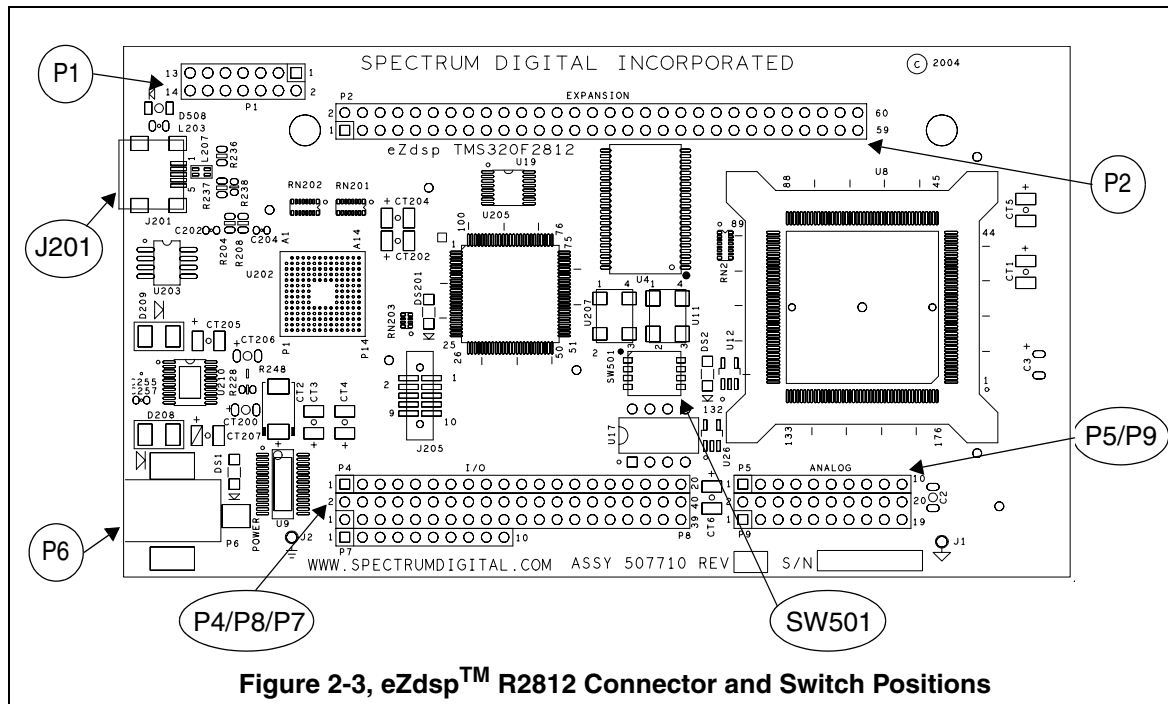
2.3 eZdsp™ R2812 Connectors

The eZdsp™ R2812 has five connectors. Pin 1 of each connector is identified by a square solder pad. The function of each connector is shown in the table below:

Table 3: eZdsp™ R2812 Connectors

Connector	Function
P1	JTAG Interface
P2	Expansion
J201	USB Controller Interface
P4/P8/P7	I/O Interface
P5/P9	Analog Interface
P6	Power Connector

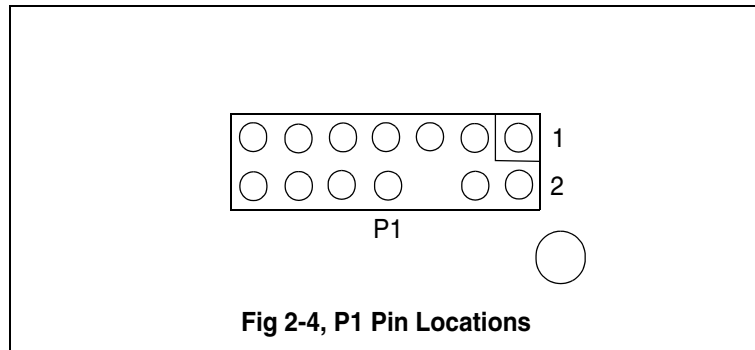
The diagram below shows the position of each connector



2.3.1 P1, JTAG Interface

The eZdsp™ R2812 is supplied with a 14-pin header interface, P1. This is the standard interface used by JTAG emulators to interface to Texas Instruments DSPs.

The positions of the 14 pins on the P1 connector are shown in the diagram below as viewed from the top of the eZdsp.



The definition of P1, which has the JTAG signals is shown below.

Table 4: P1, JTAG Interface Connector

Pin #	Signal	Pin #	Signal
1	TMS	2	TRST-
3	TDI	4	GND
5	PD (+5V)	6	no pin
7	TDO	8	GND
9	TCK-RET	10	GND
11	TCK	12	GND
13	EMU0	14	EMU1

WARNING !

The TMS320R2812 supports +3.3V Input/Output levels which are NOT +5V tolerant. Connecting the eZdsp to a system with +5V Input/Output levels will damage the TMS320R2812. If the eZdsp is connected to another target then the eZdsp must be powered up first and powered down last to prevent latching conditions.

2.3.2 P2, Expansion Interface

The positions of the 60 pins on the P2 connector are shown in the diagram below as viewed from the top of the eZdsp.

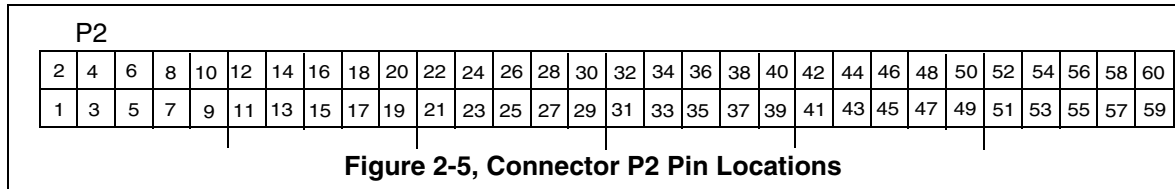


Figure 2-5, Connector P2 Pin Locations

The definition of P2, which has the I/O signal interface is shown below.

Table 5: P2, Expansion Interface Connector

Pin #	Signal	Pin #	Signal
1	+3.3V/+5V/NC *	2	+3.3/+5V/NC *
3	XD0	4	XD1
5	XD2	6	XD3
7	XD4	8	XD5
9	XD6	10	XD7
11	XD8	12	XD9
13	XD10	14	XD11
15	XD12	16	XD13
17	XD14	18	XD15
19	XA0	20	XA1
21	XA2	22	XA3
23	XA4	24	XA5
25	XA6	26	XA7
27	XA8	28	XA9
29	XA10	30	XA11
31	XA12	32	XA13
33	XA14	34	XA15
35	GND	36	GND
37	XZCS0AND1n	38	XZCS2n
39	XREADY	40	10K Pull-up
41	XRnW	42	10K Pull-up
43	XWE	44	XRDn
45	+3.3V	46	XNMI/INT13
47	XRSn/RSn	48	No connect
49	GND	50	GND
51	GND	52	GND
53	XA16	54	XA17
55	XA18	56	XHOLDn
57	XHOLDAn	58	No connect
59	No connect	60	No connect

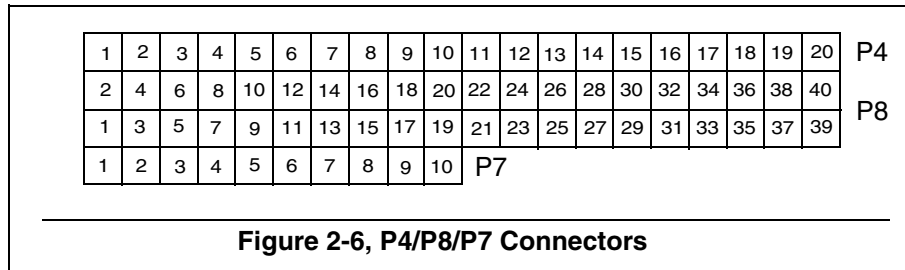
* Default is No Connect (NC). User can jumper to +3.3V or +5V on backside of eZdsp with JP5.

2.3.3 P3, USB Port/JTAG Interface

The eZdsp™ R2812 uses a custom USB port JTAG interface device. The device has direct access to the integrated JTAG interface. Drivers for C2000 Code Composer tools are shipped with the eZdsp modules

2.3.4 P4/P8/P7, I/O Interface

The connectors P4, P8, and P7 present the I/O signals from the DSP. The layout of these connectors are shown below.



The pin definition of P4/P8 connectors are shown in the table below.

Table 6: P4/P8, I/O Connectors

P4 Pin #	P4 Signal	P8 Pin #	P8 Signal	P8 Pin #	P8 Signal
1	+3.3V/+5V/NC *	1	+3.3V/+5V/NC *	2	+3.3V/+5V/NC *
2	XINT2/ADCSOC	3	SCITXDA	4	SCIRXDA
3	MCLKXA	5	XINT1n/XBIO _n	6	CAP1/QEP1
4	MCLKRA	7	CAP2/QEP2	8	CAP3/QEP11
5	MFSXA	9	PWM1	10	PWM2
6	MFSRA	11	PWM3	12	PWM4
7	MDXA	13	PWM5	14	PWM6
8	MDRA	15	T1PWM/T1CMP	16	T2PWM/T2CMP
9	No connect	17	TDIRA	18	TCLKINA
10	GND	19	GND	20	GND
11	CAP5/QEP4	21	No connect	22	XINT1N/XBIO _n
12	CAP6/QEPI2	23	SPISIMOA	24	SPISOMIA
13	T3PWM/T3CMP	25	SPICLKA	26	SPISTEA
14	T4PWM/T4CMP	27	CANTXA	28	CANRXA
15	TDIRB	29	XCLKOUT	30	PWM7
16	TCLKINB	31	PWM8	32	PWM9
17	XF/XPLLDIS _n	33	PWM10	34	PWM11
18	SCITXDB	35	PWM12	36	CAP4/QEP3
19	SCIRXDB	37	T1CTRIP/PDPINTA _n	38	T3CTRIP/PDPINTB _n
20	GND	39	GND	40	GND

* Default is No Connect (NC). User can jumper to +3.3V or +5V on backside of eZdsp with JP4.

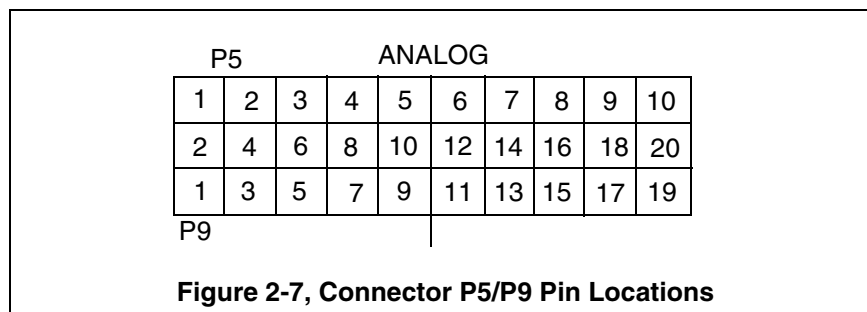
The pin definition of P7 connector is shown in the table below.

Table 7: P7, I/O Connector

P7 Pin #	P7 Signal
1	C1TRIPn
2	C2TRIPn
3	C3TRIPn
4	T2CTRIPn/EVASOCn
5	C4TRIPn
6	C5TRIPn
7	C6TRIPn
8	T4CTRIPn/EVBSOCn
9	No connect
10	GND

2.3.5 P5/P9, Analog Interface

The position of the 30 pins on the P5/P9 connectors are shown in the diagram below as viewed from the top of the eZdsp.



The definition of P5/P9 signals are shown in the table below.

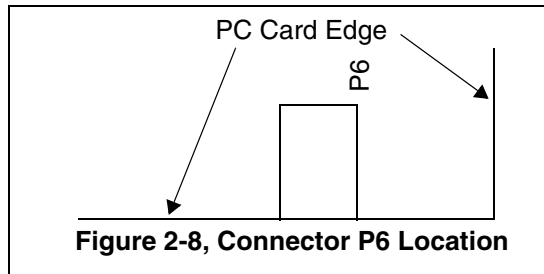
Table 8: P5/P9, Analog Interface Connector

P5 Pin #	Signal	P9 Pin #	Signal	P9 Pin #	Signal
1	ADCINB0	1	GND	2	ADCINA0
2	ADCINB1	3	GND	4	ADCINA1
3	ADCINB2	5	GND	6	ADCINA2
4	ADCINB3	7	GND	8	ADCINA3
5	ADCINB4	9	GND	10	ADCINA4
6	ADCINB5	11	GND	12	ADCINA5
7	ADCINB6	13	GND	14	ADCINA6
8	ADCINB7	15	GND	16	ADCINA7
9	ADCREFM	17	GND	18	VREFLO *
10	ADCREFP	19	GND	20	No connect

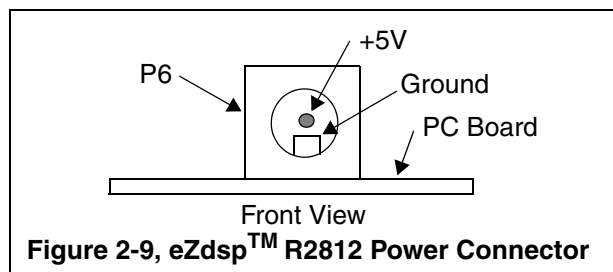
* Connect VREFLO to AGND or VREFLO of target system for proper ADC operation.

2.3.6 P6, Power Connector

Power (5 volts) is brought onto the eZdsp™ R2812 via the P6 connector. The connector has an outside diameter of 5.5 mm. and an inside diameter of 2.5 mm. The position of the P6 connector is shown below.



The diagram of P6, which has the input power is shown below.



2.3.7 Connector Part Numbers

The table below shows the part numbers for connectors which can be used on the eZdsp™ R2812. Part numbers from other manufacturers may also be used.

Table 9: eZdsp™ R2812 Suggested Connector Part Numbers

Connector	Male Part Numbers	Female Part Numbers
P1	SAMTEC TSW-1-10-07-G-T	SAMTEC SSW-1-10-01-G-T
P2	SAMTEC TSW-1-20-07-G-T	SAMTEC SSW-1-20-01-G-T

*SSW or SSQ Series can be used

2.4 eZdsp™ R2812 Jumpers

The eZdsp™ R2812 has 2 jumpers, JP4 and JP5, which will allow power to be supplied to the expansion headers. The table below lists the jumpers and their function. The following sections describe the use of each jumper.

Table 10: eZdsp™ R2812 Jumpers

Jumper #	Size	Function	Position As Shipped From Factory
JP4	1 x 3	+3.3/5 Volts to P8,P4	Not connected
JP5	1 x 3	+3.3/5 Volts to P2	Not Connected

2.4.1 JP4, JP5 Voltage Jumpers

Jumpers JP4 and JP5 are unpopulated jumpers on the bottom side of the board that provide either +3.3 volts or +5 volts to pins on the expansion connectors. These jumpers are shipped uninstalled to prevent accidental damage by connecting wires or circuitry to the expansion connector. The user may connect these jumpers by installing a jumper wire or zero ohm resistor. The position of these jumpers are shown in the figure below.

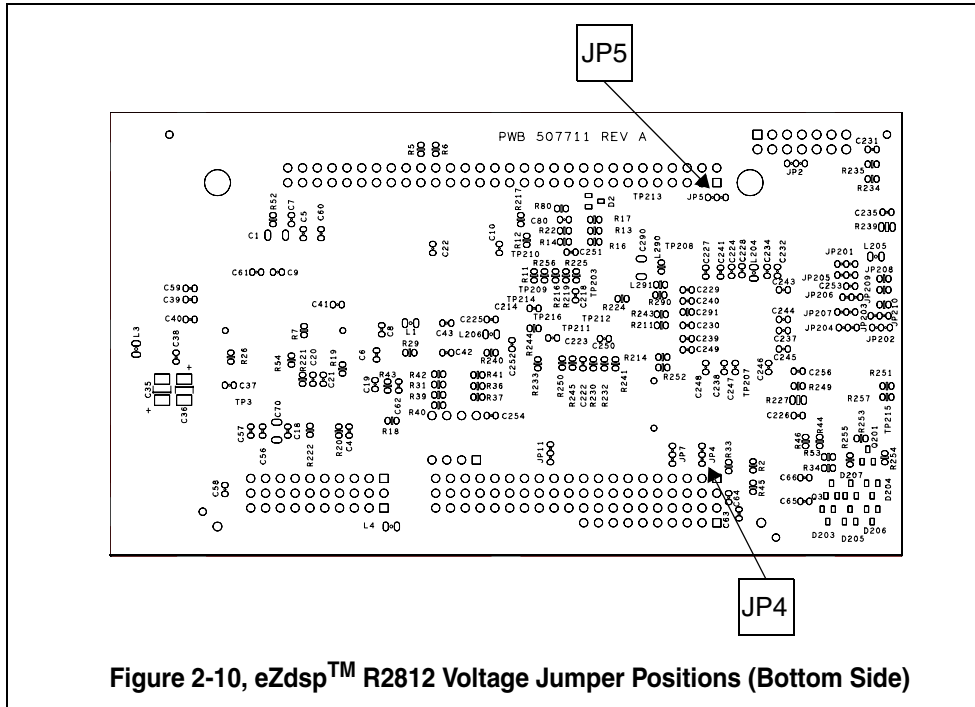


Figure 2-10, eZdsp™ R2812 Voltage Jumper Positions (Bottom Side)

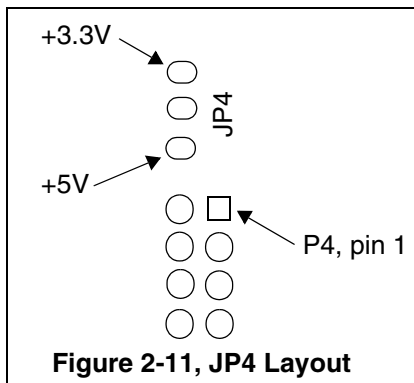
2.4.1.1 JP4, +3.3/5 Volts for P8, P4

Jumper JP4 allows the user to provide either +3.3 or +5 volts to pins 1 and 2 of expansion connector P8, and pin 1 of P4. The settings for this jumper are shown in the table below

Table 11: JP4, +3.3/5 Volts for P8, P4

Position	Function	Jumper Position
Middle - Bottom	Connect +5 Volts to P8, pins 1,2, and P4 pin1	<p>The diagram shows a three-pin header labeled JP4. The top pin is labeled 3.3V, the middle pin is labeled 5V, and the bottom pin is unlabeled. A black jumper is placed across the 5V and the bottom pin.</p>
Middle - Top	Connect +3.3 Volts to P8, pins 1,2, and P4 pin1	<p>The diagram shows a three-pin header labeled JP4. The top pin is labeled 3.3V, the middle pin is labeled 5V, and the bottom pin is unlabeled. A black jumper is placed across the 3.3V and the bottom pin.</p>
No connect *		<p>The diagram shows a three-pin header labeled JP4. The top pin is labeled 3.3V, the middle pin is labeled 5V, and the bottom pin is unlabeled. No jumper is present.</p>

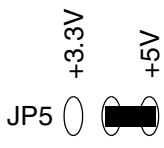
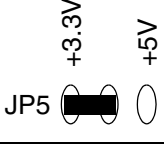
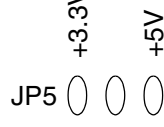
* As shipped from factory



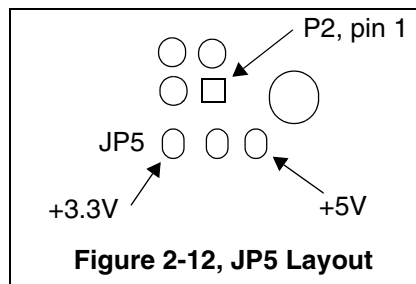
2.4.1.2 JP5, +3.3/5 Volts for P2

Jumper JP5 allows the user to provide either +3.3 or +5 volts to pins 1 and 2 of expansion connector P2. The settings for this jumper are shown in the table below.

Table 12: JP5, +3.3/5 Volts for P2

Position	Function	Jumper Position
Middle - Right	Connect +5 Volts to P2, Pins 1,2	
Middle - Left	Connect +3.3 Volts to P2, pins 1,2	
No connect *		

* As shipped from factory

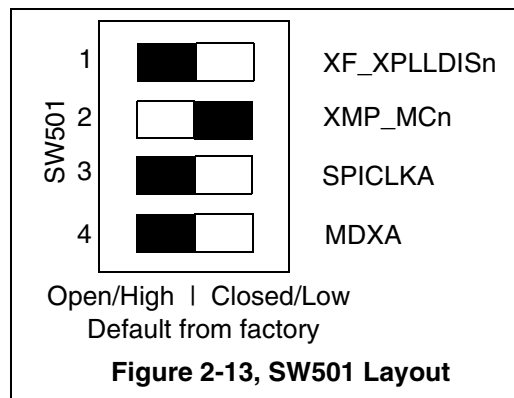


2.5 Switch SW501

The eZdsp R2812 has a 4 position switch that allows the user to configure the board for their application. The function of each position is shown in the table below.

Table 13: SW501 Switch Positions

Position	Function
1	PLL Enable/Disable
2	MP/MC Select
3, 4	Boot Mode Select



2.5.1 Switch SW501, Position 1, PLL Enable/Disable

Position 1 on switch SW501 is used to enable/disable the use of the Phase Lock Loop (PLL) logic on the DSP. The selection of the open position enables the use of the PLL. If the closed position is used the PLL is disabled. This signal is latched at reset and may be used as XF after reset. The positions are shown in the table below.

Table 14: SW501, Position 1

Position	Function
Open-1 *	PLL Enabled
Closed-0	PLL disabled

* as shipped from the factory

2.5.2 Switch SW501, Position 2, XMP/MCn Mode Select

Position 2 on switch SW501 is used to select the XMP/MCn option. The open selection allows the DSP to operate in the Microprocessor mode. The closed selection allow the DSP to operate in the Microcontroller mode. The positions are shown in the table below.

Table 15: SW501, Position 2

Position	Function
Open-1	Microprocessor mode
Closed-0 *	Microcontroller mode

* as shipped from factory

2.5.3 Switch SW501, Position 3, 4, Boot Mode Select

Positions 3 and 4 on switch SW501 along with position 2 are used to determine what mode the DSP will use for bootloading on power up. The options are shown in the table below.

Table 16: SW501, Position 3, 4

Position 2 XMP_MCn	Position 3 SPICLKA	Position 4 MDXA	Boot Mode
Closed-0	Open-1	Do not care	SPI *
Closed-0	Closed-0	Open-1	SCI
Closed-0	Closed-0	Closed-0	H0
Open-1	Do not care	Do not care	Microprocessor Mode

* factory default

2.6 LEDs

The eZdsp™ R2812 has two light-emitting diodes. DS1 indicates the presence of +5 volts and is normally 'on' when power is applied to the board. DS2 is under software control and is tied to the XF pin on the DSP through a buffer. These are shown in the table below.

Table 17: LEDs

LED #	Color	Controlling Signal
DS1	Green	+5 Volts
DS2	Green	XF bit (XF high = on)

2.7 Test Points

The eZdsp™ R2812 has two test points. The signals they are tied to are shown in the table below.

Table 18: Test Points

Test Point	Signal
J1	Analog Ground
J2	Ground

Appendix A

eZdsp™ R2812

Schematics

The schematics for the eZdsp™ R2812 can be found on the CD-ROM that accompanies this board. The schematics were drawn on ORCAD.

WARNING !

The TMS320R2812 supports +3.3V Input/Output levels which are NOT +5V tolerant. Connecting the eZdsp to a system with +5V Input/Output levels will damage the TMS320R2812. If the eZdsp is connected to another target then the eZdsp must be powered up first and powered down last to prevent latchup conditions.

REV	DESCRIPTION	DATE	APPROVED
A	PROTOTYPES	25-April-2004	

REVISIONS

The TMS320R2812 EzDSP design is based on preliminary information (SPRS174G) for the TMS320F2812 device. This schematic is subject to change without notification. Spectrum Digital Inc. assumes no liability for applications assistance, customer product design or infringement of patents described herein.

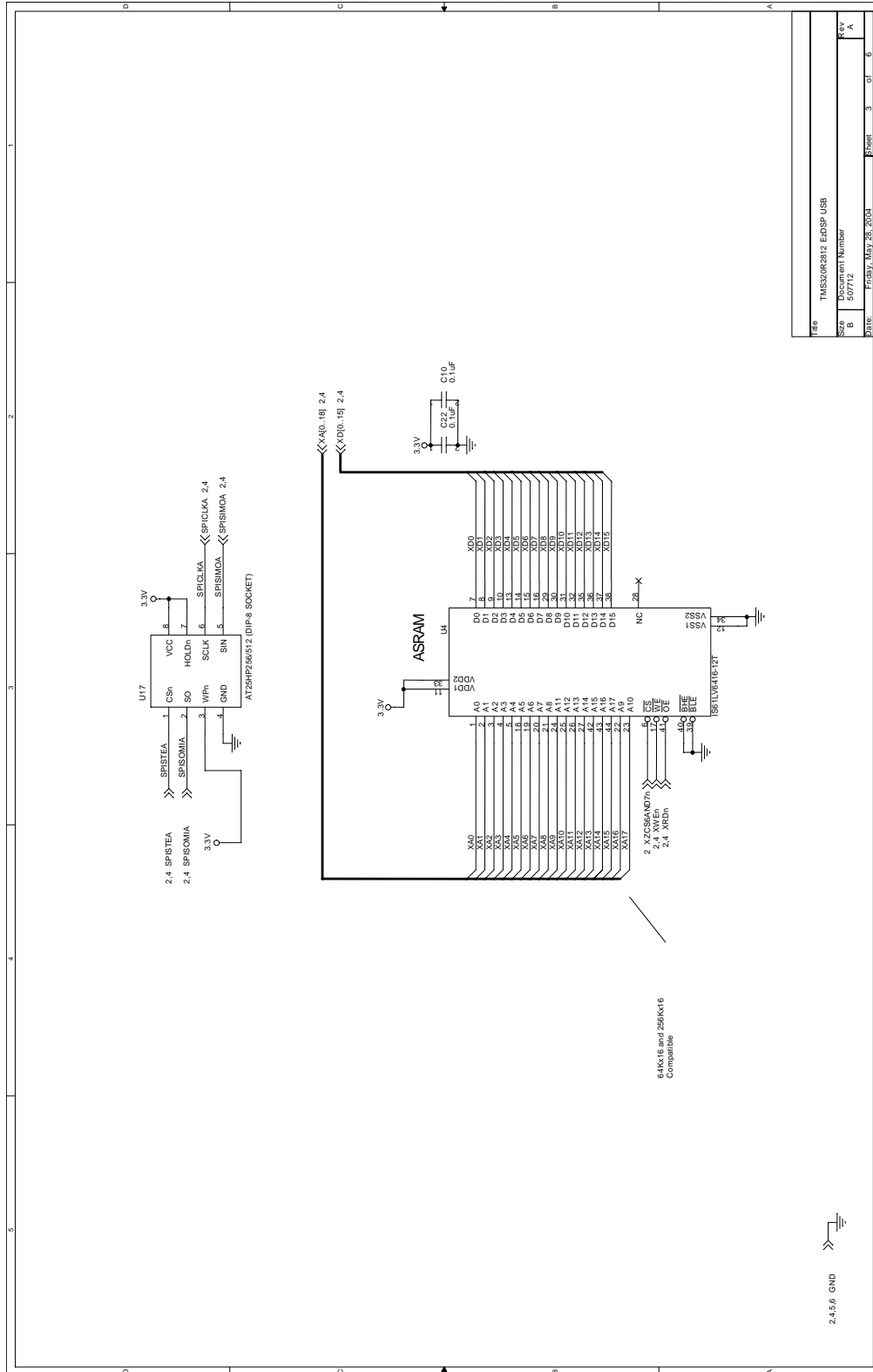
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DATE	Friday, May 28, 2004
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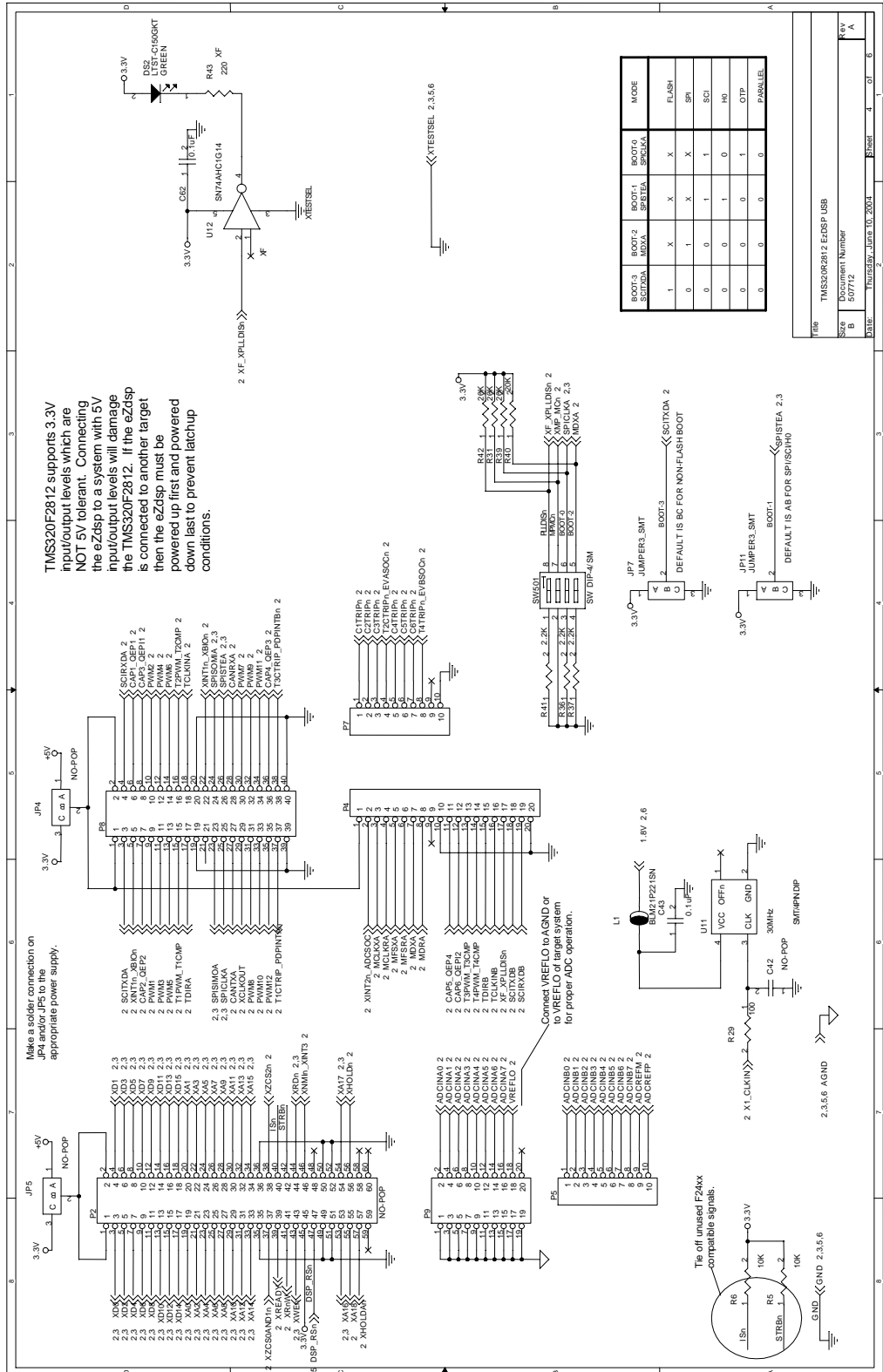
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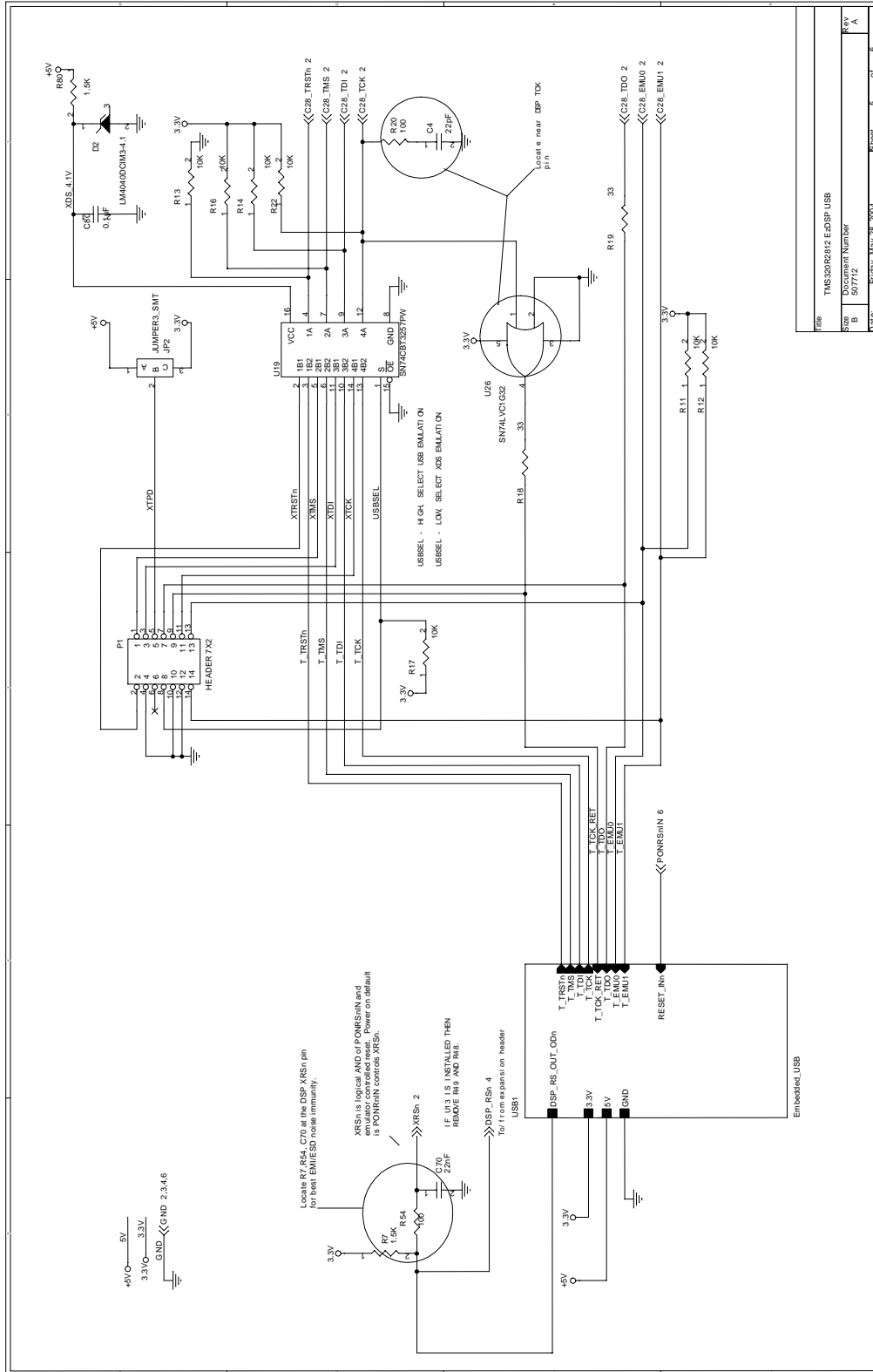
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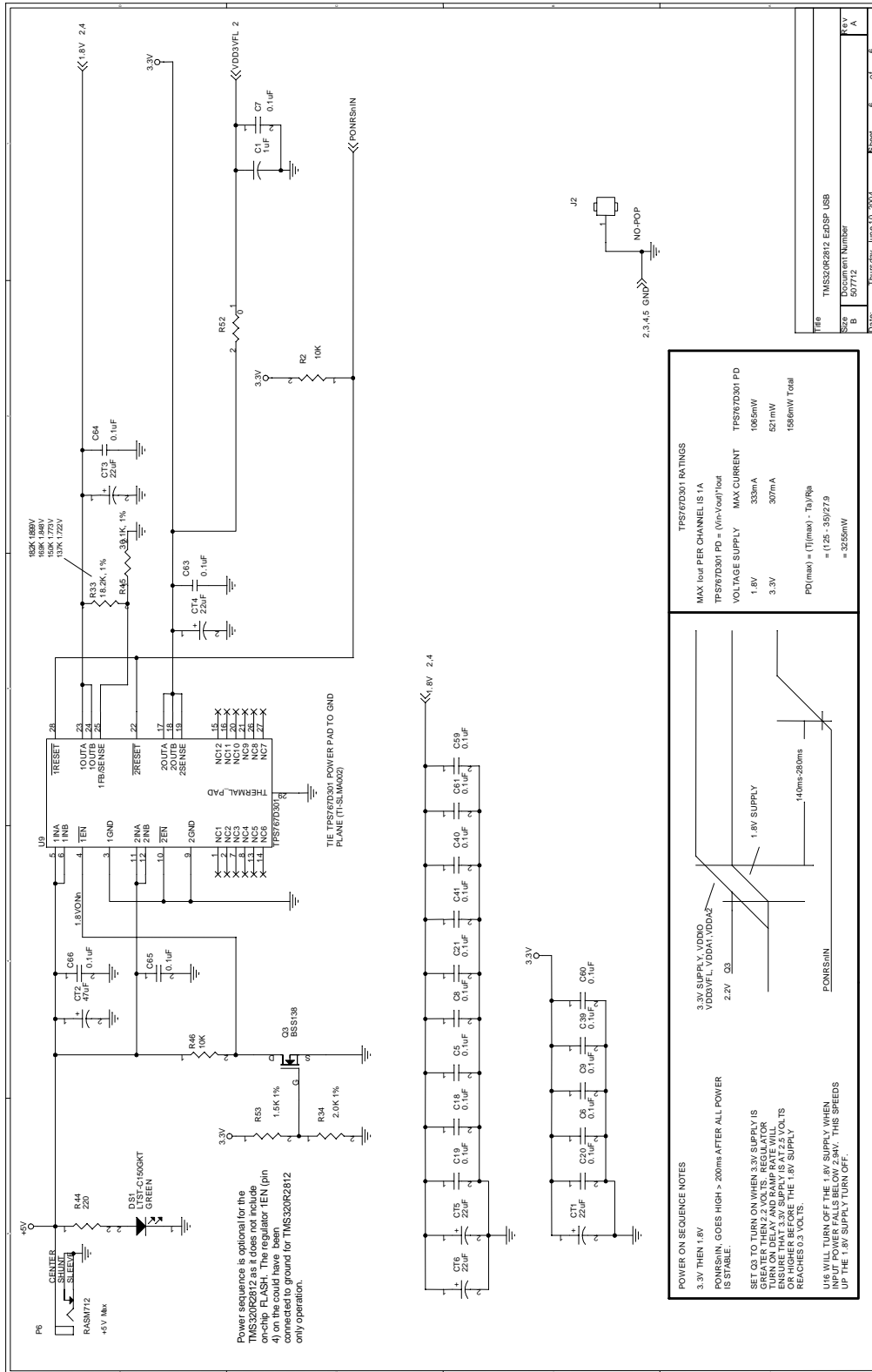
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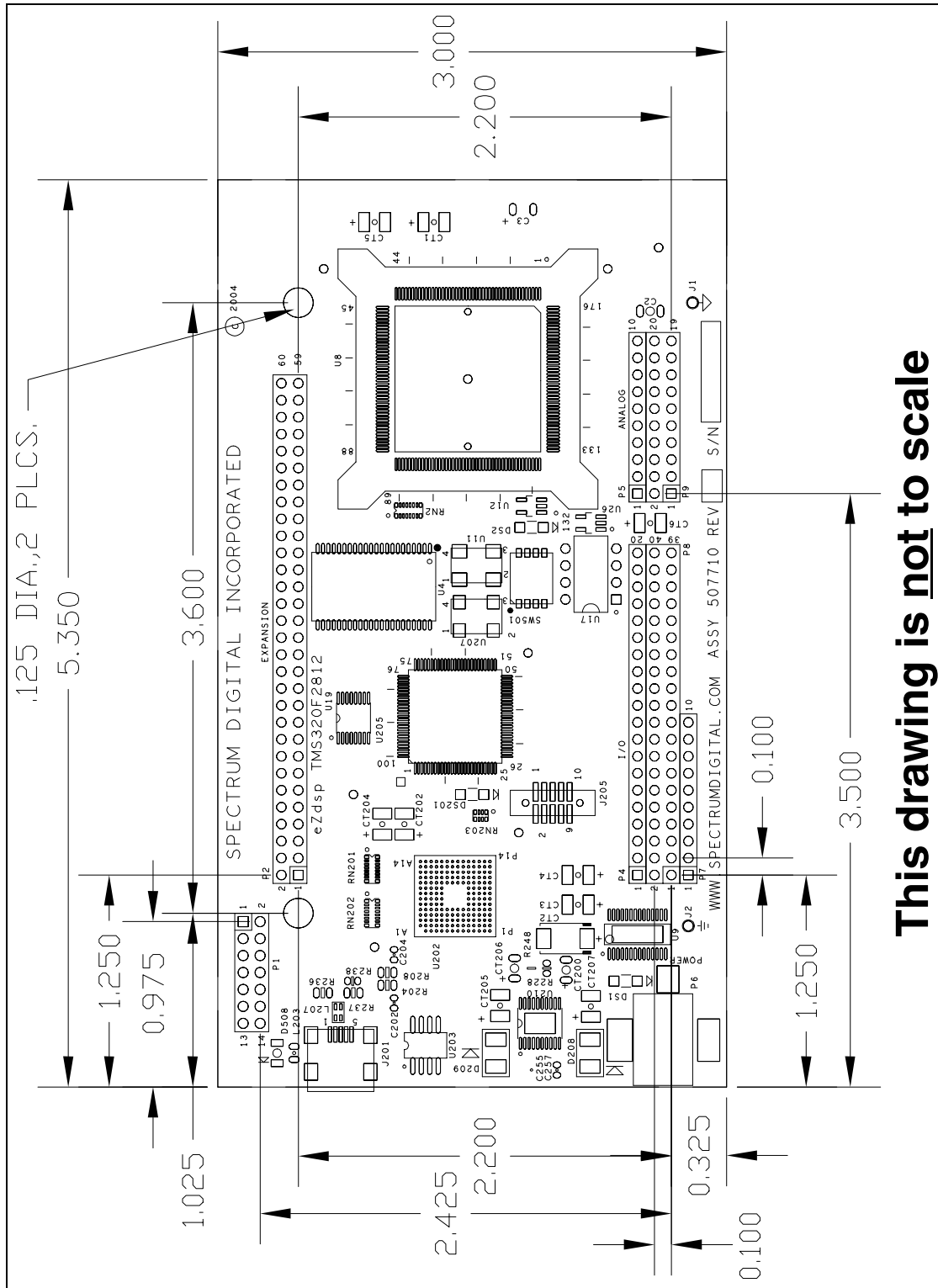


Appendix B

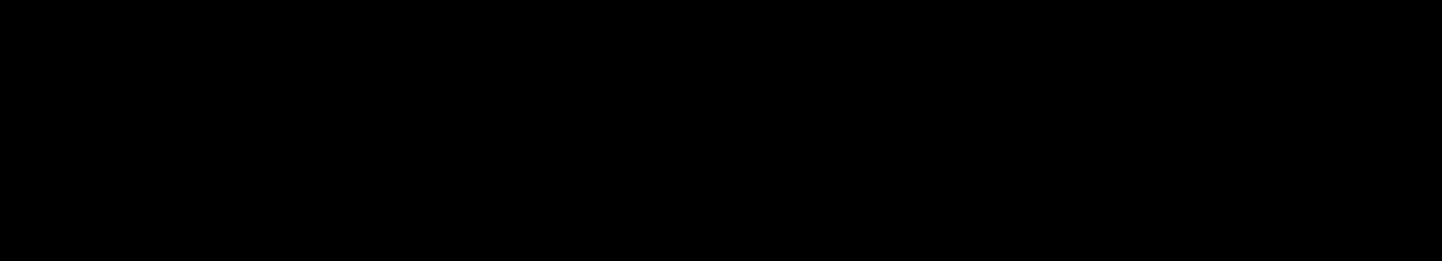
eZdsp™ R2812

Mechanical Information

This appendix contains the mechanical information about the socketed and unsocketed versions of the eZdsp™ R2812



This drawing is not to scale



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