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eZdsp^{TM} F2808 USB

Technical
Reference

eZdsp^{TM} F2808 USB
Technical Reference

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Contents

List of Figures

List of Tables

About This Manual

This document describes board level operations of the eZdsp^{TM} F2808 based on the Texas Instruments TMS320F2808 Digital Signal Processor.

The eZdsp^{TM} F2808 is a stand-alone module permitting engineers and software developers evaluation of certain characteristics of the TMS320F2808 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^{TM} F2808" will sometimes be referred to as the "eZdsp".

"eZdsp" will include the socketed or unsocketed 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 TMS320F28x DSP CPU and Instruction Set Reference Guide, literature #SPRU430
Texas Instruments TMS320F28x Assembly Language Tools Users Guide, literature #SPRU513
Texas Instruments TMS320F28x Optimizing C/C++ Compiler User's Guide, literature #SPRU514
Texas Instruments Code Composer Studio Getting Started Guide, literature #SPRU509

Table 1: Manual History

Revision	History
A	Preliminary Release
B	Production Release
C	Corrected Table in Chapter 2

Table 2: Board History

Revision	History
A	Prototype Release
B	Production Release

Chapter 1

Introduction to the eZdsp^{TM} F2808

This chapter provides a description of the eZdsp^{TM} for the TMS320F2808 Digital Signal Processor, key features, and block diagram of the circuit board.

1.0 Overview of the eZdsp^{TM} F2808

The eZdsp^{TM} F2808 is a stand-alone card--allowing evaluators to examine the TMS320F2808 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 TMS320F2808 processor.

The eZdsp^{TM} F2808 is shipped with a TMS320F2808 DSP. The eZdsp^{TM} F2808 allows full speed verification of F2808 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^{TM} F2808

The eZdsp^{TM} F2808 has the following features:

- TMS320F2808 Digital Signal Processor

- 100 MIPS operating speed

- 18K words on-chip zero wait state SARAM

- 64K words on-chip Flash memory

- 256K bits serial I^{2}C EEPROM memory

- 20 MHz. clock

- Expansion Connectors (analog, I/O)

- Onboard IEEE 1149.1 JTAG Controller

- 5-volt only operation with supplied AC adapter

- TI F28xx Code Composer Studio tools driver

- On board USB JTAG emulation connector

- 2 SCI UART channels

- 2 eCAN channels

1.2 Functional Overview of the eZdsp^{TM} F2808

Figure 1-1 shows a block diagram of the basic configuration for the eZdsp^{TM} F2808. The major interfaces of the eZdsp are the JTAG interface, and expansion interface.

Figure 1-1, BLOCK DIAGRAM eZdsp^{TM} F2808
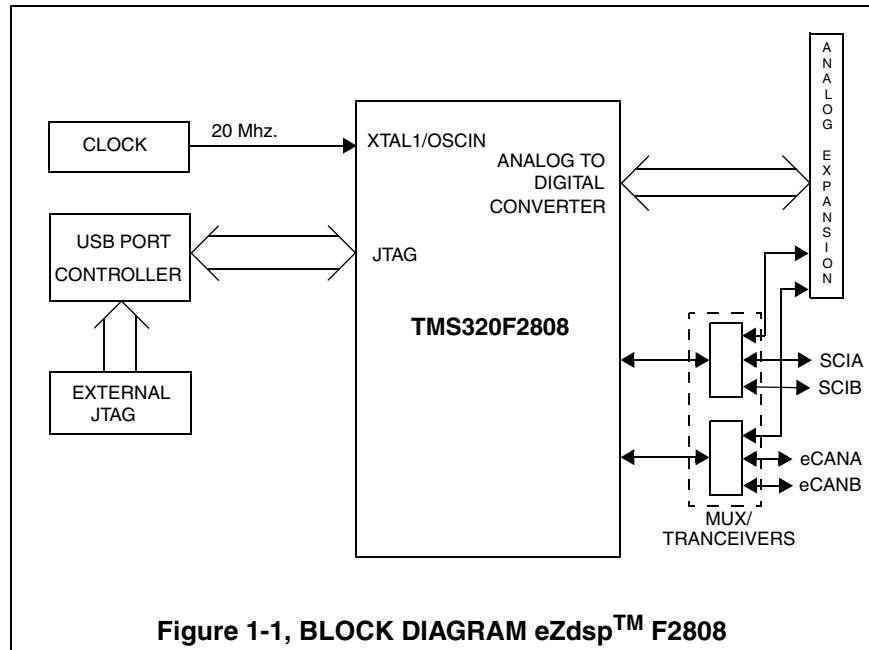
Chapter 2

Operation of the eZdsp^{TM} F2808

This chapter describes the operation of the eZdsp^{TM} F2808, key interfaces and includes a circuit board outline.

2.0 The eZdsp^{TM} F2808 Operation

This chapter describes the eZdsp^{TM} F2808, key components, and operation. Information on the eZdsp's various interfaces is also included. The eZdsp^{TM} F2808 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^{TM} F2808 Board

The eZdsp^{TM} F2808 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 eZdsp^{TM} F2808.
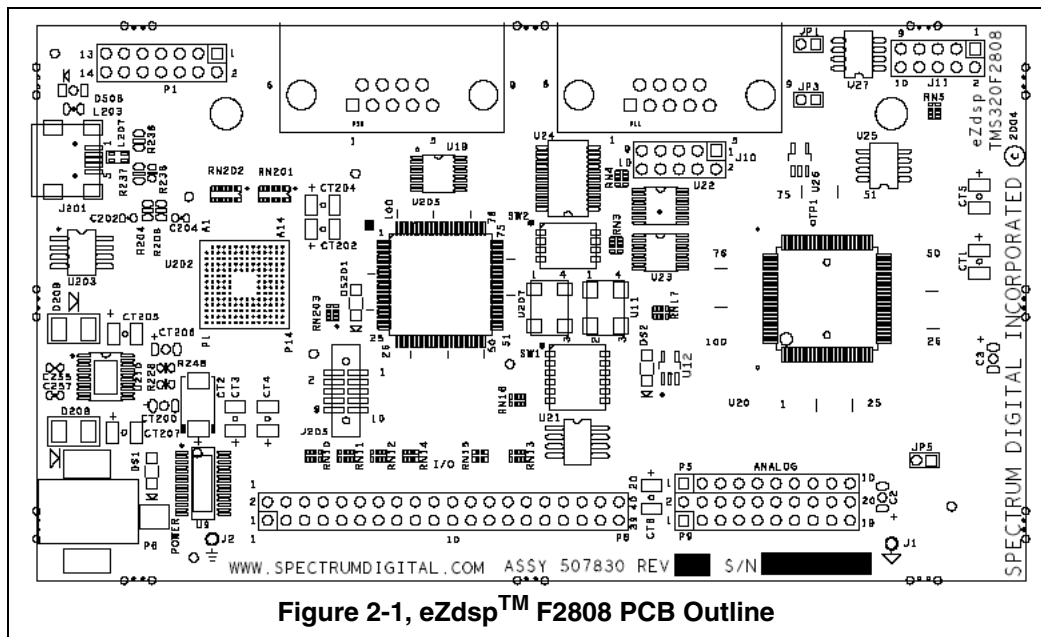
Figure 2-1, eZdsp^{TM} F2808 PCB Outline

2.1.1 Power Connector

The eZdsp^{TM} F2808 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^{TM} F2808 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
- 2 blocks of 1K x 16 SARAM

The eZdsp can load ram for debug, or Flash can be programmed and run. For larger software projects it is suggested to do a initial debug with on eZdsp F2808 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 F2808.

2.2.1 Memory Map

The figure below shows the memory map configuration on the eZdsp^{TM} F2808.

Block Start Address	F2808	
	Data Space	Program Space
0x0000-0000	M0 SARAM	
0x0000-0400	M1 SARAM	
0x0000-0800	Peripheral Frame 0	Do Not Use !
0x0000-0D00	Pie Vector Table (256 x 16)	
0x0000-0E00		
0x0000-6000	Peripheral Frame 1	Do Not Use !
0x0000-7000	Peripheral Frame 2 (16 Bit access only)	
0x0000-8000	L0 SARAM	
0x0000-9000	L1 SARAM	
0x0000-A000	H0 SARAM	
0x0000-C000		
0x003D-7800	OTP (Read Only)	
0x003D-7800		
0x003E-8000	Flash (Read Only) (64K x 16)	
0x003F-7FFF		
0x003F-8000	L0 SARAM Mirror	
0x003F-9000	L1 SARAM Mirror	
0x003F-A000	H0 SARAM Mirror	
0x003F-C000		
0x003F-F000	Boot ROM (Read Only)	
0x003F-FFFF		

Figure 2-2, eZdsp^{TM} F2808 Memory Space

2.3 eZdsp^{TM} F2808 Connectors

The eZdsp^{TM} F2808 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 1: eZdsp^{TM} F2808 Connectors

Connector	Function
P1	JTAG Interface
P8	I/O Interface
P5/P9	Analog Interface
P6	Power Connector
P10	DB-9, RS-232
P11	DB9, eCAN-A
J10	2x5 Header, SCIB
J11	2x5 header, eCAN-B
J201	USB Controller Interface

The diagram below shows the position of each connector
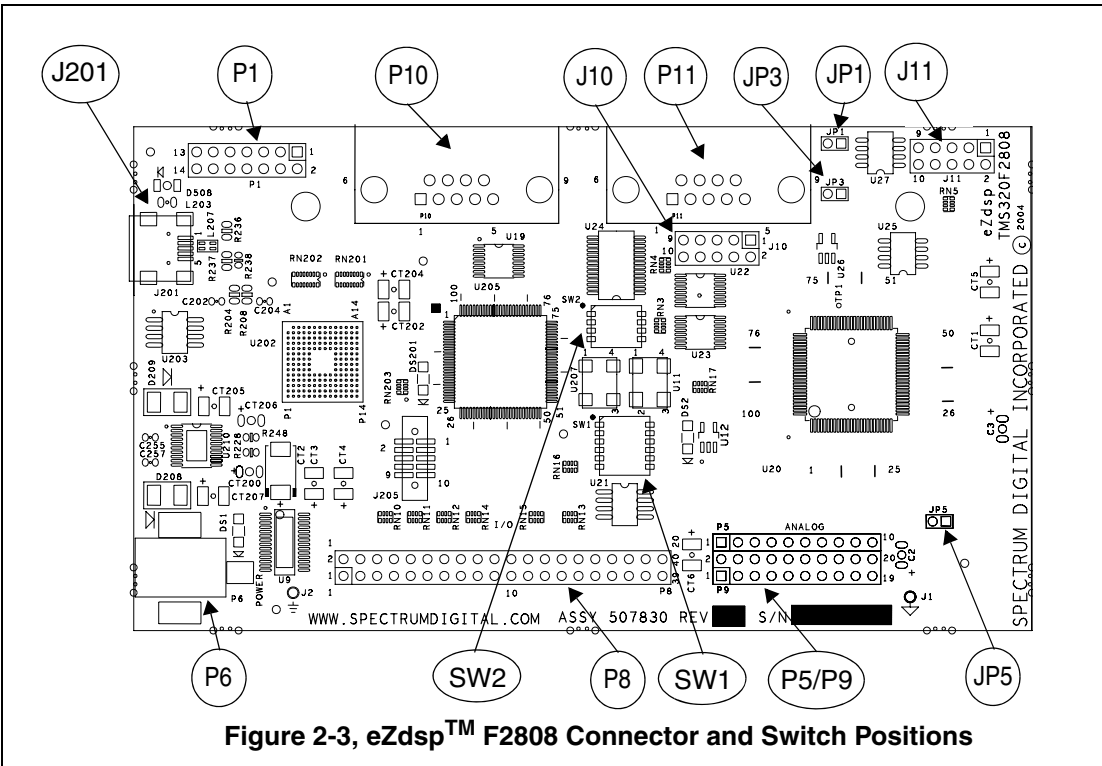
Figure 2-3, eZdsp^TM F2808 Connector and Switch Positions

2.3.1 P1, JTAG Interface

The eZdsp^TM F2808 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.

Fig 2-4, P1 Pin Locations
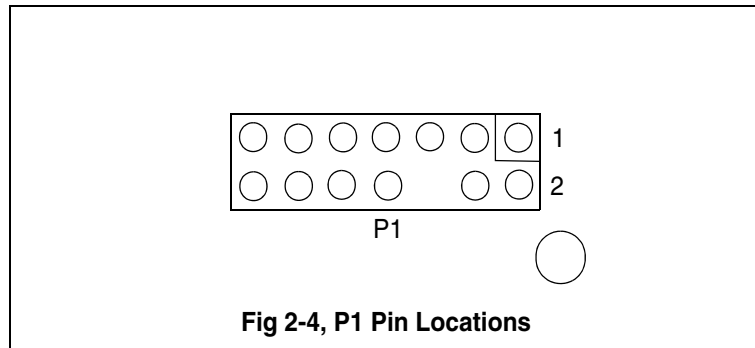
The definition of P1, which has the JTAG signals is shown below.

Table 2: 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

2.3.2 P3, USB Port/JTAG Interface

The eZdsp^{TM} F2808 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

2.3.3 P8, I/O Interface

The connector P8 presents the I/O signals from the DSP. The layout of this connector is shown below.

2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
1	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33	35	37	39

P8

Figure 2-5, P8 Connector
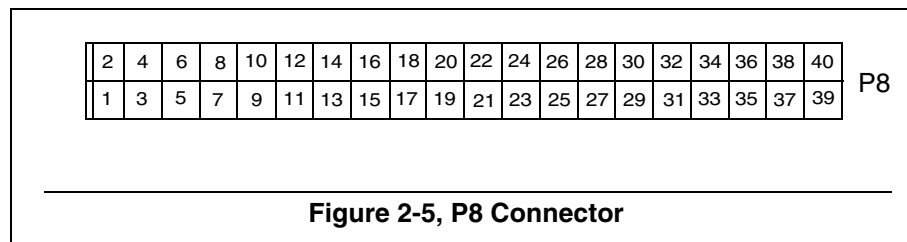
The pin definition of P4/P8 connectors are shown in the table below.

Table 3: P4/P8, I/O Connectors

P8 Pin #	P8 Signal	P8 Pin #	P8 Signal
1	+3.3V/+5V/NC *	2	+3.3V/+5V/NC *
3	MUX_GPIO29	4	MUX_GPIO28
5	GPIO14	6	GPIO20
7	GPIO21	8	GPIO23
9	GPIO0	10	GPIO1
11	GPIO2	12	GPIO3
13	GPIO4	14	GPIO5
15	GPIO27	16	GPIO6
17	GPIO13	18	GPIO34
19	GND	20	GND
21	GPIO7	22	GPIO15
23	GPIO16	24	GPIO17
25	GPIO18	26	GPIO19
27	MUX_GPIO31	28	MUX_GPIO30
29	MUX_GPIO11	30	MUX_GPIO8
31	MUX_GPIO9	32	MUX_GPIO10
33	GPIO22/GPIO24	34	GPIO25
35	GPIO26	36	GPIO32
37	GPIO12	38	GPIO33
39	GND	40	GND

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

2.3.4 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.

P5			ANALOG						
1	2	3	4	5	6	7	8	9	10
2	4	6	8	10	12	14	16	18	20
1	3	5	7	9	11	13	15	17	19

P9

Figure 2-6, Connector P5/P9 Pin Locations
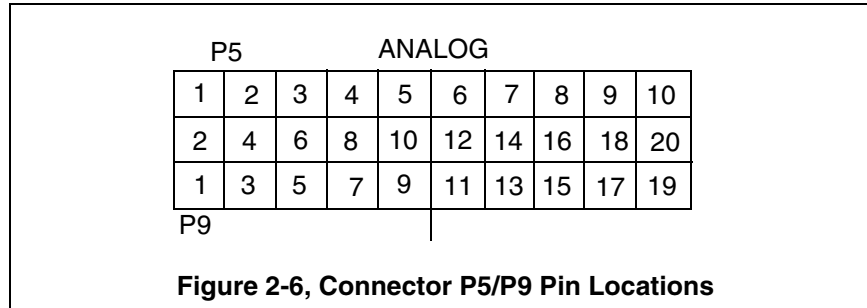
The definition of P5/P9 signals are shown in the table below.

Table 4: 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.

2.3.5 P6, Power Connector

Power (5 volts) is brought onto the eZdsp^{TM} F2808 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.

Figure 2-7, Connector P6 Location
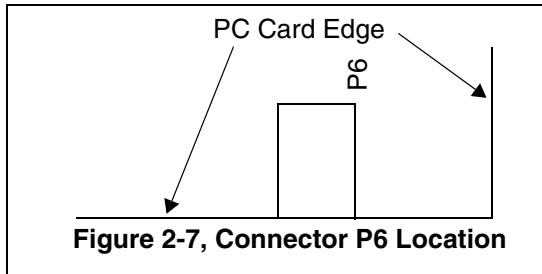
The diagram of P6, which has the input power is shown below.

Front View
Figure 2-8, eZdsp^{TM} F2808 Power Connector
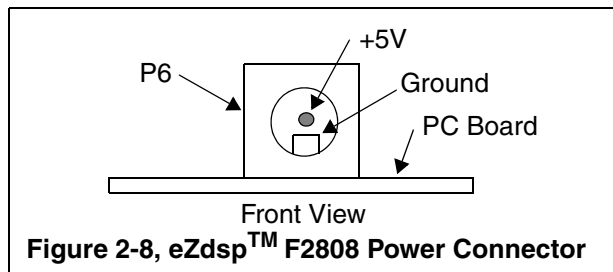
2.3.6 P10, RS-232 Connector

The eZdsp F2808 has an RS-232 connector which brings out the SCIA transmit and receive signals to be used as UART. This UART uses the MAX3238 RS-232 line driver and is routed to a male 9 pin D-connector, P10. The pin positions for the P10 connector as viewed from the edge of the printed circuit board are shown below.

```
   5   4   3   2   1
   o   o   o   o   o

     o   o   o   o
     9   8   7   6
```
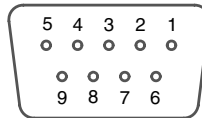
Figure 2-9, P10, DB9 Female Connector

The pin numbers and their corresponding signals are shown in the table below. This corresponds to a standard dual row to DB-9 connector interface used on personal computers.

Table 5: P10, RS-232 Pinout

Pin #	Signal Name	Direction
1	No Connect	
2	PCRXDA	Out
3	PCTXDA	In
4	No Connect	
5	GND	N/A
6	No Connect	
7	No Connect	
8	No Connect	
9	No Connect	

2.3.7 P11, CAN Connector

The eZdsp F2808 has a 9 Pin female D-connector which brings out the CANA transmit and receive signals. This CAN interface uses the SN65HVD235 CAN driver. The pin positions for the P11 connector as viewed from the edge of the printed circuit board are shown below.

```
  5  4  3  2  1
  o  o  o  o  o
    o  o  o  o
    9  8  7  6
```
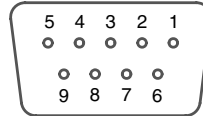
Figure 2-10, P11, DB9 Female Connector

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

Table 6: P11, CANA Pinout

Pin #	Signal Name
1	No Connect
2	CANLA
3	GND
4	No Connect
5	No Connect
6	No Connect
7	CANHA
8	No Connect
9	No Connect

2.3.8 J10, SCIB 5 x 2 Header

The SCIB signals are routed through the MAX3238 line driver to a 5 x 2 double row header, J10. The pin numbers for J10 and their corresponding signals are shown in the table below.

Table 7: J10, 5 x 2 Pinout

Pin #	Signal Name	Direction	Pin #	Signal Name	Direction
1	No Connect		2	No Connect	
3	PCRXDB	Out	4	No Connect	
5	PCTXDB	In	6	No Connect	
7	No Connect		8	No Connect	
9	GND	N/A	10	No Connect	

2.3.9 J11, CANB 5 x 2 Header

The CANB signals are routed through the SN65HVD235 CAN driver to a 5 x 2 double row header, J11. The pin numbers for J11 and their corresponding signals are shown in the table below.

Table 8: J11, 5 x 2 Pinout

Pin #	Signal Name	Pin #	Signal Name
1	No Connect	2	No Connect
3	CANLB	4	CANHB
5	GND	6	No Connect
7	No Connect	8	No Connect
9	No Connect	10	No Connect

2.3.10 Connector Part Numbers

The table below shows the part numbers for connectors which can be used on the eZdsp^{TM} F2808. Part numbers from other manufacturers may also be used.

Table 9: eZdsp^{TM} F2808 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^{TM} F2808 Jumpers

The eZdsp^{TM} F2808 has 2 jumpers, JP4 and JP5. JP4 will allow power to be supplied to the expansion headers. Jumper JP5 selects the ACDREFIN. The table below lists the jumpers and their function. The following sections describe the use of each jumper.

Table 10: eZdsp^{TM} F2808 Jumpers

Jumper #	Size	Function	Position As Shipped From Factory
JP1	1 x 2	Terminator Resistor - CANB	Installed
JP3	1 x 2	Terminator Resistor - CANA	Installed
JP4	1 x 3	+3.3/5 Volts to P8 Pin 1,2 and P4, Pin 1	Not connected
JP5	1 x 2	Selects ADCREFIN voltage	Not connected
JP6	1 x 3	Selects GPIO22 or GPIO24 to Pin 33, P8	2 - 3, GPIO24 to Pin 33, P8

2.4.1 JP4, Voltage Jumper, +3.3/5 Volts for P8, P4

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

Figure 2-11, eZdsp^{TM} F2808 Jumper Positions (Bottom Side)
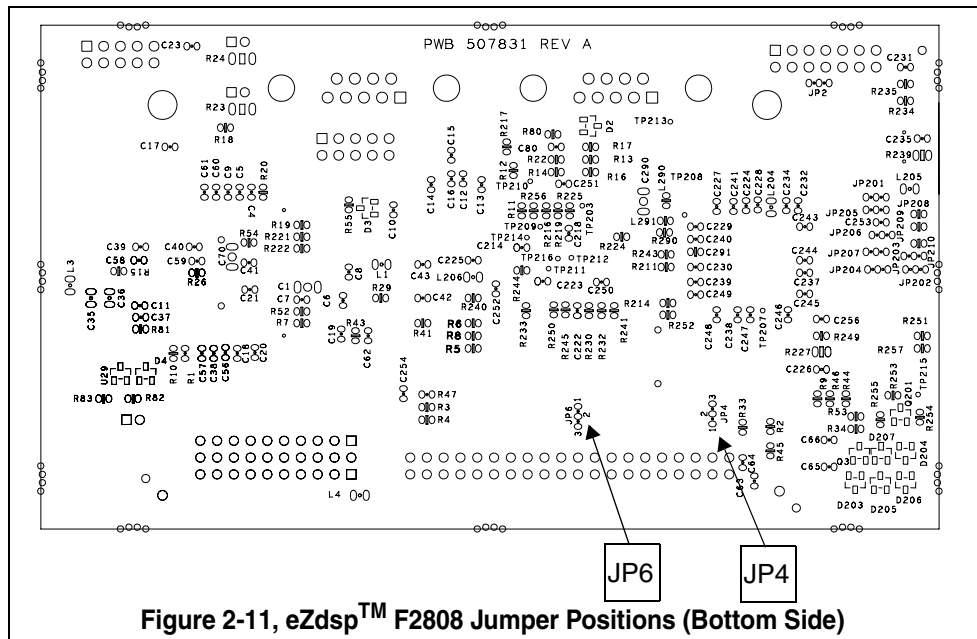
Jumper JP4 allows the user to provide either +3.3 or +5 volts to pins 1 and 2 of expansion connector P8.

Figure 2-12, JP4 Layout
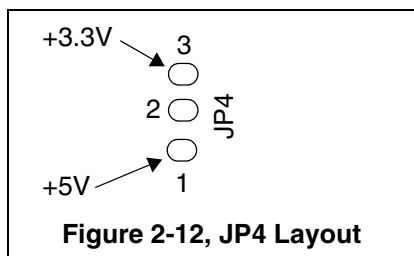
The table below shows the functions of the two positions of JP4.

Table 11: JP4, Voltage Jumper,+3.3/5 Volts for P8, P4
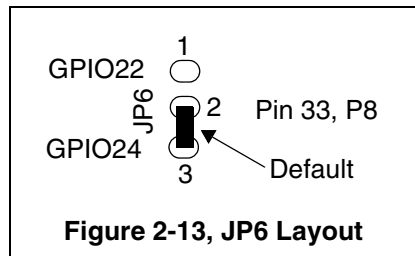
Position	Function
1 - 2	+5V connected to P8
2 - 3	+3.3 connected to P8

2.4.2 JP5, ADCREFIN Select

Jumper J5 is used to select ADCREFIN as the voltage reference for the analog to digital converter. When the jumper is shorted the +2.048 voltage level is routed to the ADCREFIN signal of the DSP. When the jumper is open the ADCREFIN floats.

2.4.3 JP6, GPIO22/GPIO24 Select

Jumper JP6 selects which signal, GPIO22 or GPIO24, to be routed to Pin 33, P8. When the 1-2 jumper position is selected GPIO22 is connected to pin 33, P8. The 2-3 selection will route GPIOI24 to Pin 33, P8. The figure below shows the connector layout on the bottom side of the board.

Figure 2-13, JP6 Layout

The table below shows the functions of the two positions of JP6.

Table 12: JP6, GPIO22/GPIO24 Select

| Position	Function
1 - 2	GPIO22 connected to Pin 33, P8
2 - 3	GPIO24 connected to Pin 33, P8 *

* default

2.5 Switches

The eZdsp F2808 has 2 switches, SW1 and SW2, which are used to configure various functions on the board. The switches and their functionality are described in the following sections.

2.5.1 Switch SW1

The eZdsp F2808 has a 6 position switch, SW1, that allows the user to configure the board for their application. The function of each position on SW1 is shown in the table below.

Table 13: SW1 Switch Positions

Position	Function
1-3	Boot Mode Select
4	Serial EEPROM WP
5	Serial EEPROM Pullups
6	Serial EEPROM - A1

Figure 2-14, SW1 Layout
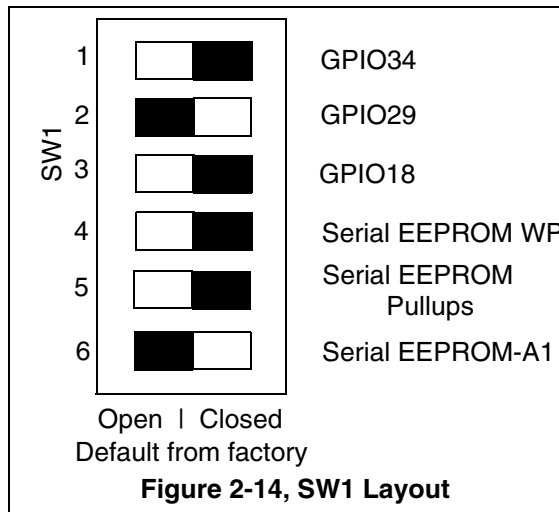
2.5.1.1 Switch SW1, Positions 1-3, Boot Mode Select

Positions 1-3 on switch SW1 are used to determine what mode the DSP will use for bootloading on power up. The options are shown in the table below.

Table 14: SW1, Positions 1-3

Position 3 GPIO18	Position 2 GPIO29	Position 1 GPIO34	Boot Mode
Open-1	Open-1	Open-1	Flash
Open-1	Open-1	Closed-0	SCI-A
Open-1	Closed-0	Open-1	SPI-A
Open-1	Closed-0	Closed-0	I^{2}C-A
Closed-0	Open-1	Open-1	eCAN-A
Closed-0	Open-1	Closed-0	M0 SARAM *
Closed-0	Closed-0	Open-1	OTP
Closed-0	Closed-0	Closed-0	I/O

* factory default

2.5.1.2 Switch SW1, Position 4, EEPROM Write Enable/Disable

Position 4 on switch SW1 is used to enable or disable the Write Enable for the EEPROM. When position 4 is in the "Closed" state the Write Protect to the EEPROM is disabled, therefore allowing the EEPROM to be written. When position 4 is in the "Open" state the EEPROM Write Protect is enabled, not allowing the EEPROM to be written. These positions are shown in the table below.

Table 15: SW1, Position 4

Position	Function
Closed-0 *	EEPROM WP Disabled (EEPROM can be written to) *
Open-1	EEPROM WP Enabled (EEPROM cannot be written to)

* factory default

2.5.1.3 Switch SW1, Position 5, Serial EEPROM Pull-ups

Position 5 on switch SW1 are used to select if the EEPROM is using pull up resistors. When position 5 is in the "Closed" state pull up resistors are used. When position 5 is in the "Open" state the pull-up resistors are not used. These positions are shown in the table below.

Table 16: SW1, Position 5

Position	Function
Closed-1 *	Pull up resistors used *
Open-0	Pull up resistors not used

* factory default

2.5.1.4 Switch SW1, Position 6, Serial EEPROM Address A1

Position 6 on switch SW1 are used to select if the address line A1 to the serial EEPROM is pulled high or low. When position 6 is in the "Closed" state A1 equals 1. When position 6 is in the "Open" state A1 equals 0. These positions are shown in the table below.

Table 17: SW1, Position 6

| Position	Function
Closed-1	A1 = 1
Open-0	A1 = 0 *

* factory default

2.5.2 Switch SW2

Switch SW2 on the eZdsp F2808 has 4 positions that allow the user to configure the SCI/CAN MUX. The function of each position is shown in the table below.

Table 18: SW2 Switch Positions

Position	Function	Settings
1	SCIA/ECANA MUX Control	Open/High GPIO28-GPIO31 to expansion connector P8 Closed/Low GPIO28-GPIO31 to SCIA/CANA transceivers
2	SCIA/ECANA MUX Enable	Open/High GPIO28-GPIO31 isolated Closed/Low GPIO28-GPIO31 not isolated
3	SCIB/ECANB MUX Control	Open/High GPIO8-GPIO11 to expansion connector P8 Closed/Low GPIO8-GPIO11 to SCIB/CANB transceivers
4	SCIB/ECANB MUX Enable	Open/High GPIO8-GPIO11 isolated Closed/Low GPIO8-GPIO11 not isolated

The layout of switch SW2 is shown in the figure below.

Figure 2-15, SW2 Layout
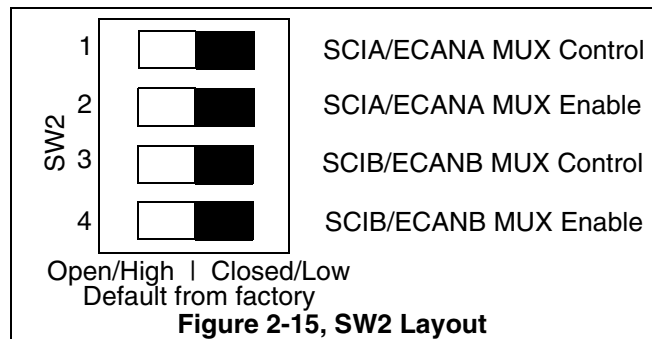
2.6 LEDs

The eZdsp^{TM} F2808 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 GPIO34 pin on the DSP through a buffer. These are shown in the table below.

Table 19: LEDs

LED #	Color	Controlling Signal
DS1	Green	+5 Volts
DS2	Green	GPIO34 bit (GPIO34 high = on)

2.7 Test Points

The eZdsp^{TM} F2808 has two test points. The signals they are tied to are shown in the table below.

Table 20: Test Points

Test Point	Signal
J1	Analog Ground
J2	Ground

Appendix A

eZdsp^{TM} F2808 Schematics

The schematics for the eZdsp^{TM} F2808 can be found on the CD-ROM that accompanies this board. The schematics were drawn on ORCAD.

> **WARNING !**
> The TMS320F2808 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 TMS320F2808. If the eZdsp is connected to another target then the eZdsp must be powered up first and powered down last to prevent lactchup conditions.

REVISIONS

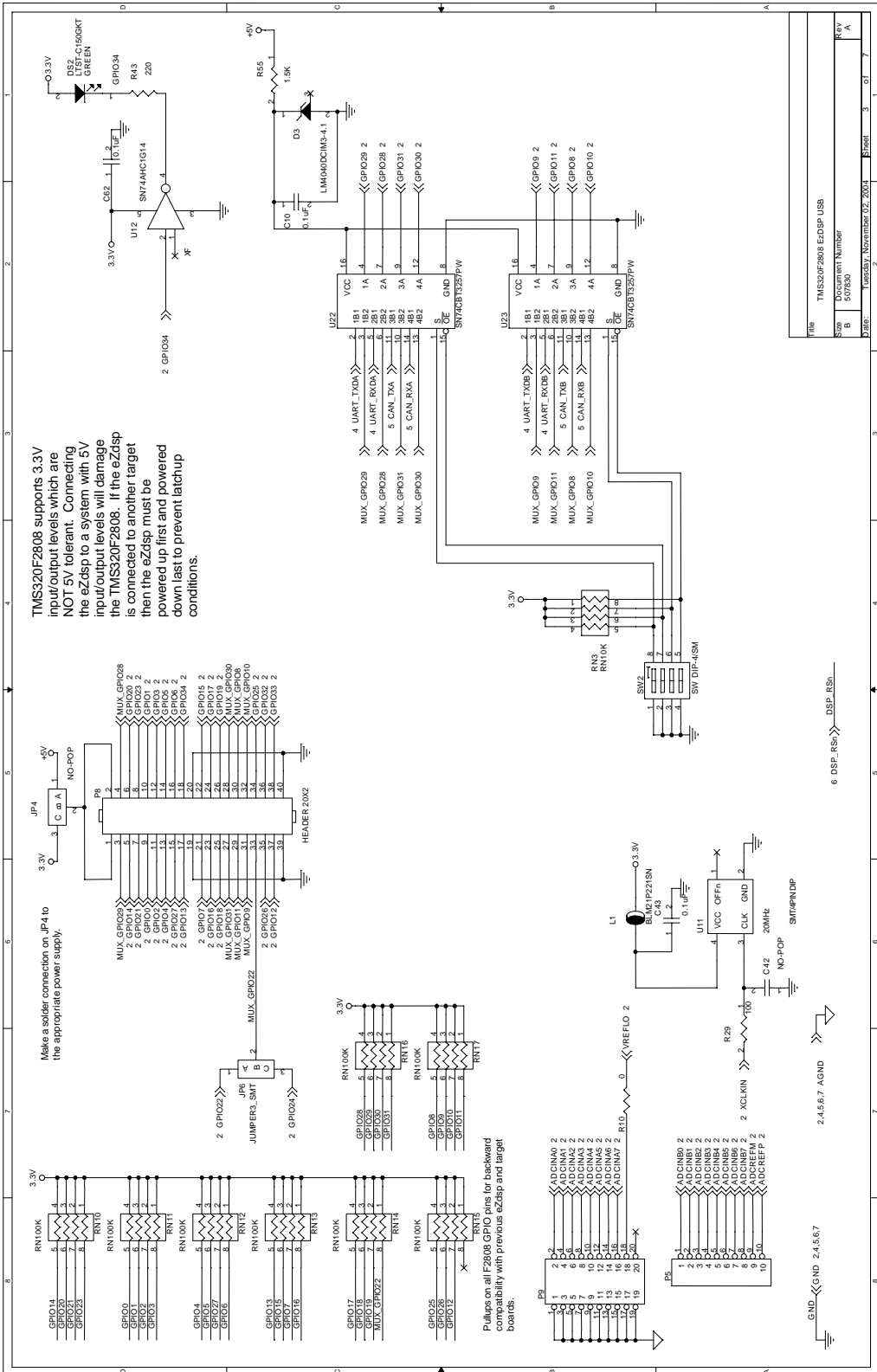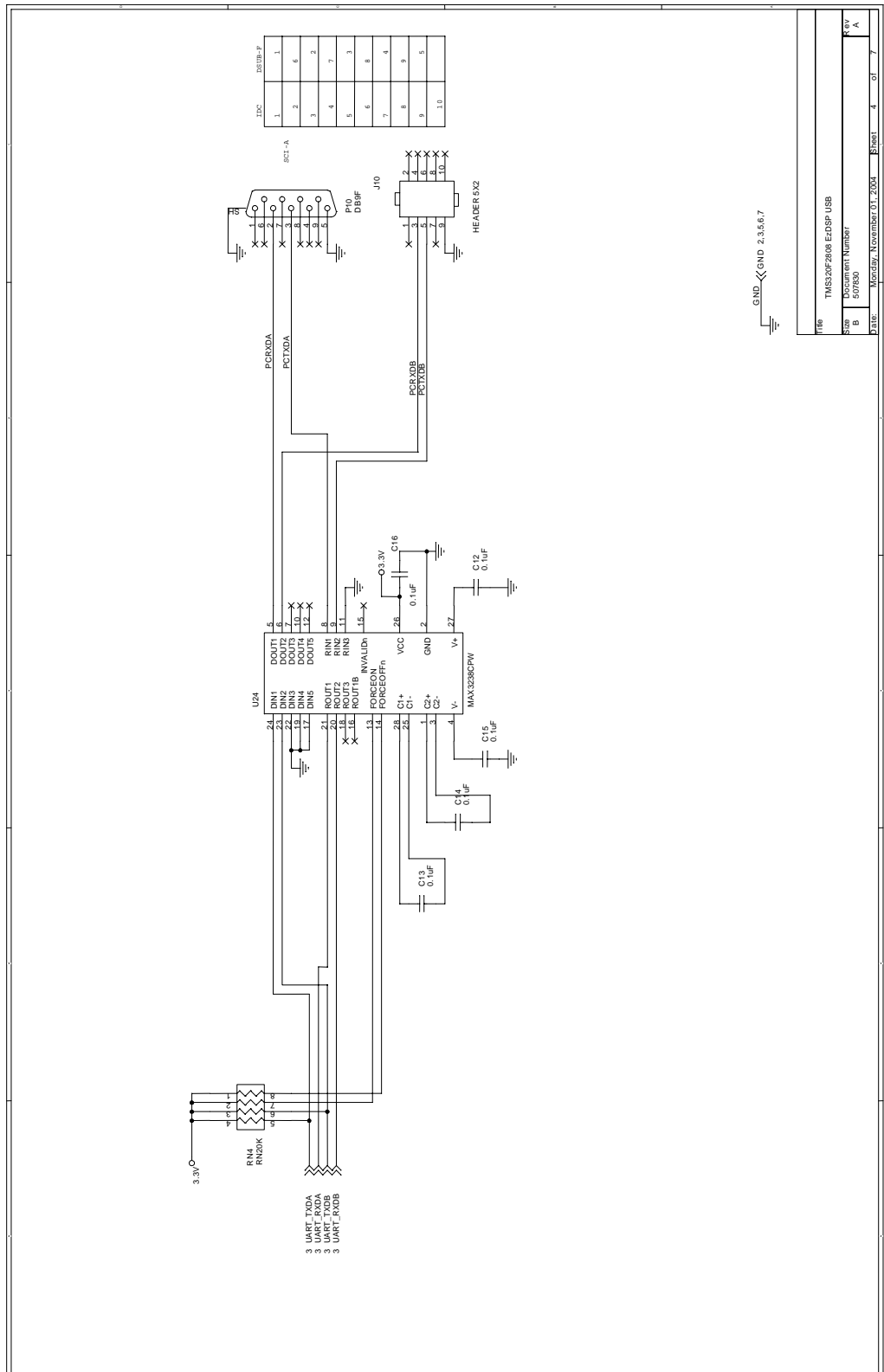| REV	DESCRIPTION	DATE	APPROVED
A	PROTOTYPES		

The TMS320F2808 EzDSP design is based on preliminary information(SPRS230A) for the TMS320F2808 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.
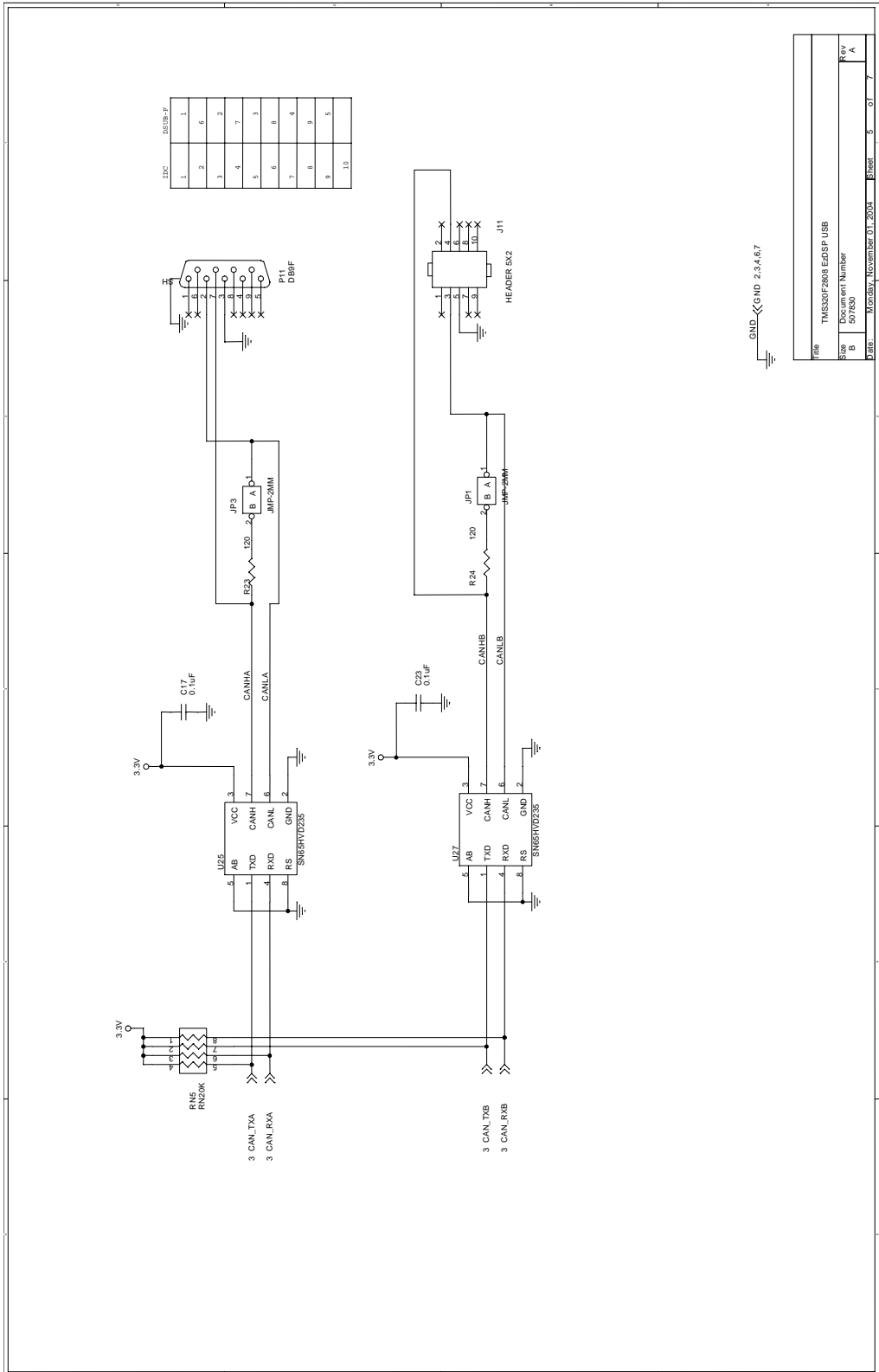
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Title
TMS320F2808 EzDSP USB

Size B   Document Number
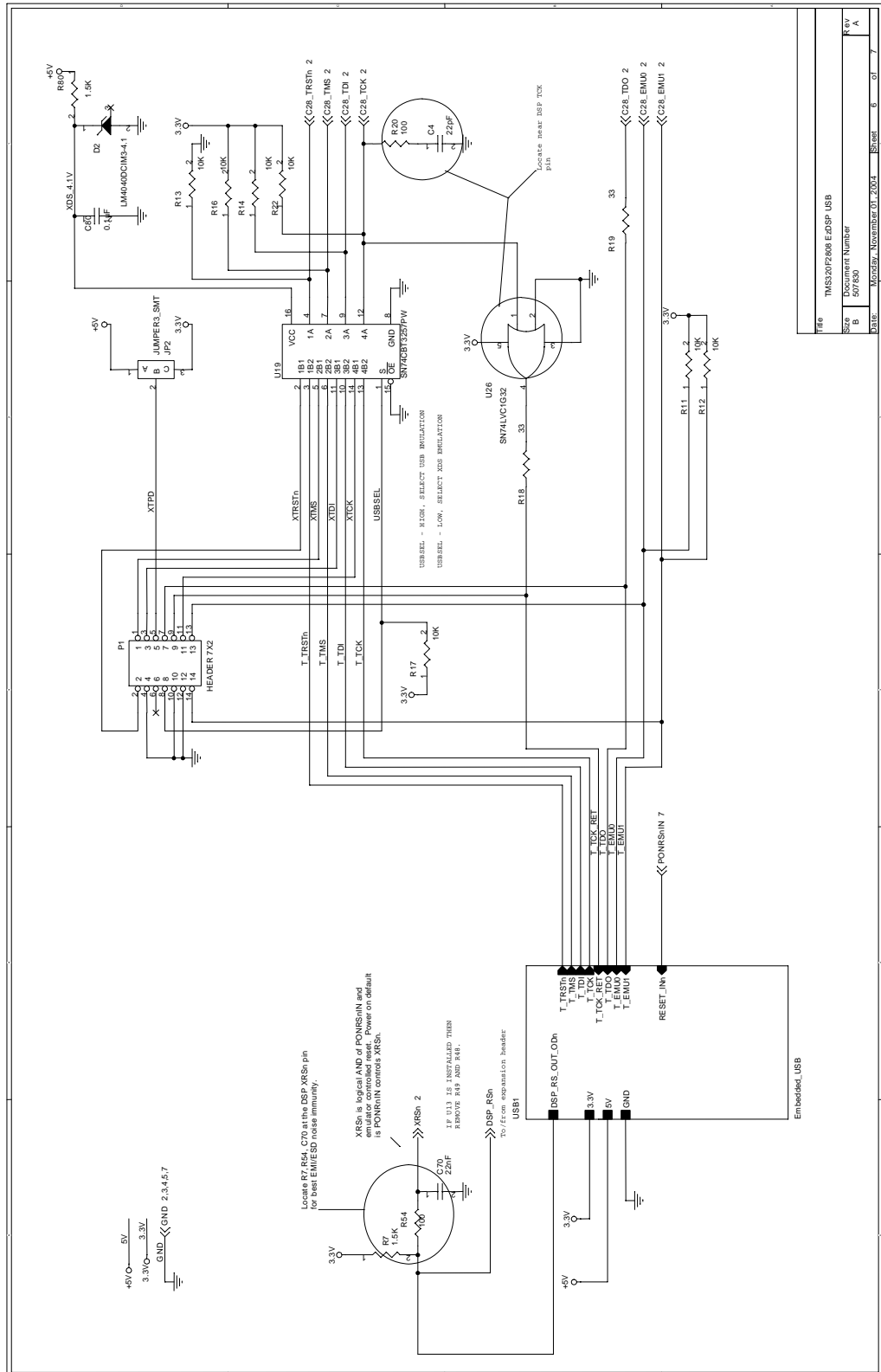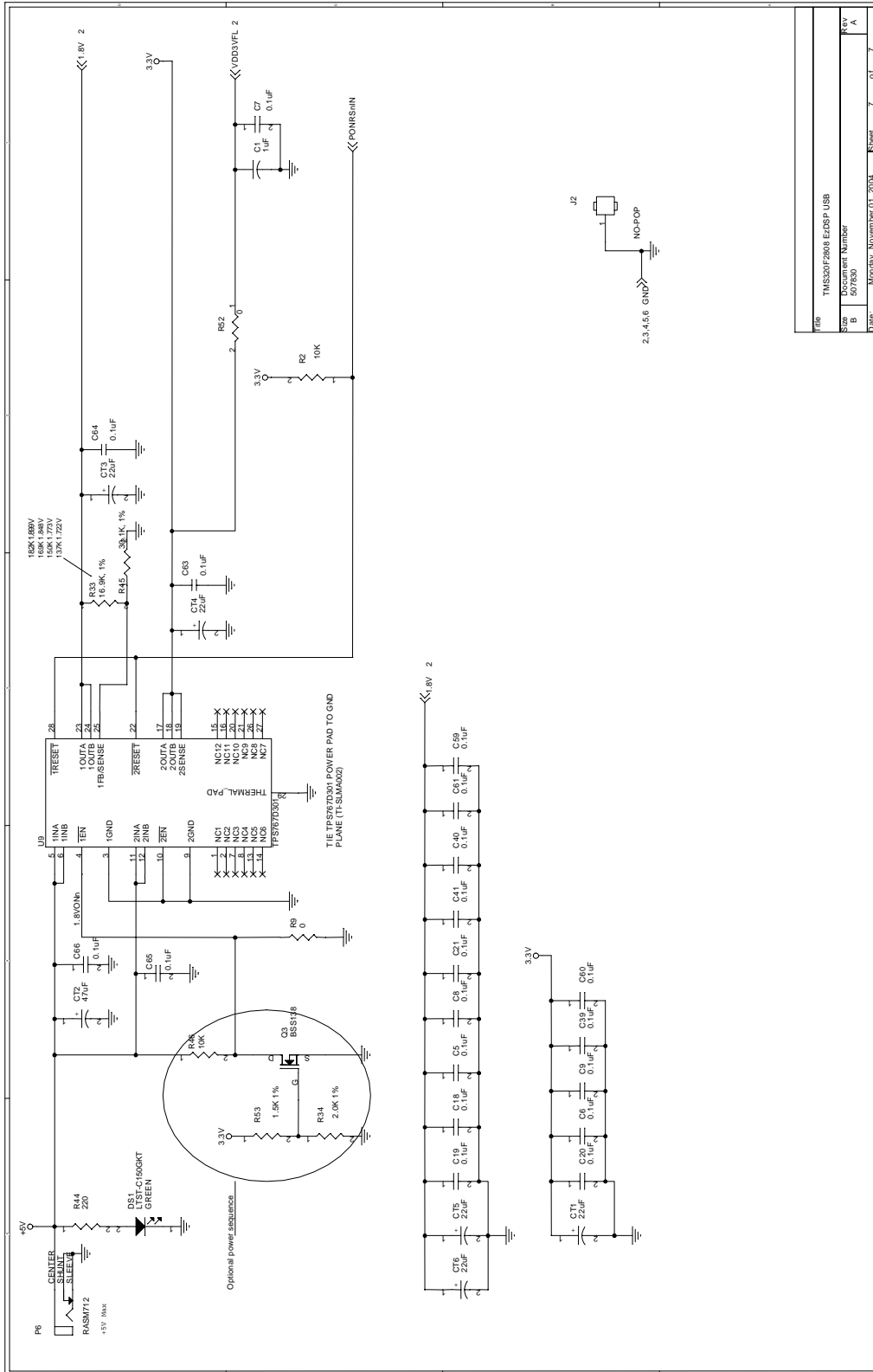507830

Rev A

Date: Monday, November 01, 2004   Sheet 1 of 7

DWN   DATE
CHK   DATE
ENGR   DATE
ENGR-MGR   DATE
QA   DATE
MFG   DATE
RLSE   DATE

NEXT ASSY   USED ON
APPLICATION

REVISION STATUS OF SHEETS

REV							
SH							
REV							
SH							
REV	A	A	A	A	A	A	A
SH	1	2	3	4	5	6	7

TMS320F2808 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 TMS320F2808. If the eZdsp
is connected to another target
then the eZdsp must be
powered up first and powered
down last to prevent latchup
conditions.

Make a solder connection on JP4 to
the appropriate power supply.

Pullups on all F2808 GPIO pins for backward
compatibility with previous eZdsp and target
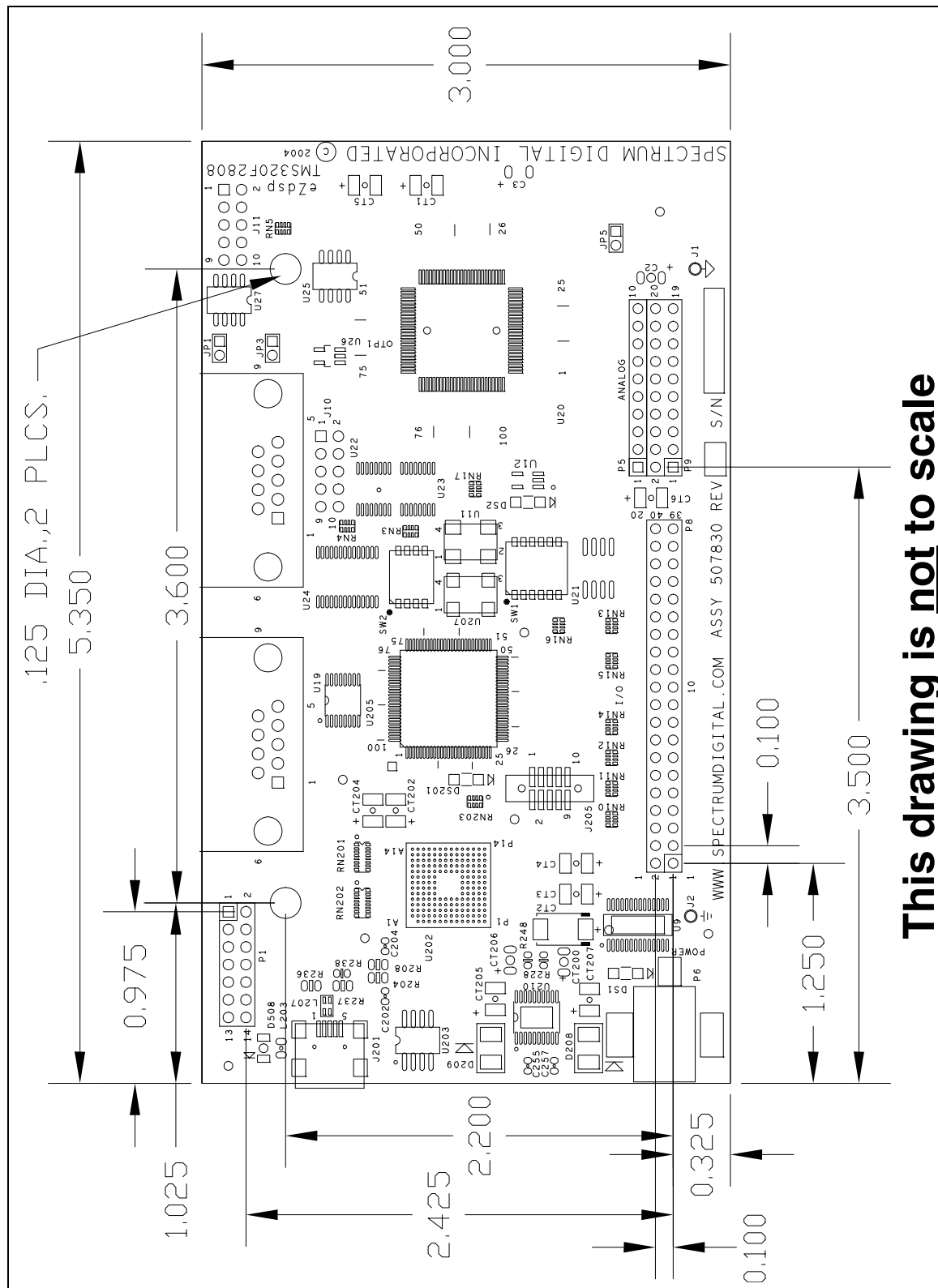boards.

Appendix B

eZdsp^{TM} F2808
Mechanical Information

This appendix contains the mechanical information about the socketed and unsocketed versions of the eZdsp^{TM} F2808
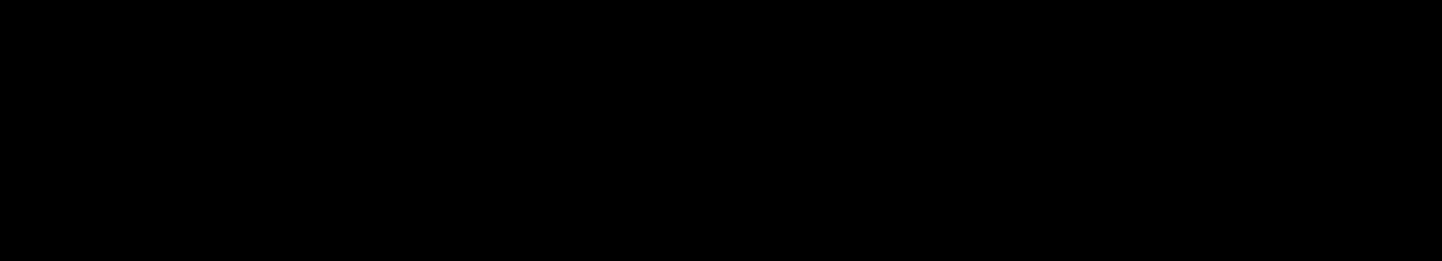
This drawing is <u>not</u> to scale

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