SMT338-VP

User Manual



Revision History

Date	Comments	Engineer	Version
16/08/04	First revision	JPA	1.0
17/05/05	Corrected: purpose of Led 5 and Led 6		1.1
07/06/05	07/06/05 Added: power consumption SM		1.2
	Added: SDRAM 63.75MB capacity		
1707/06	Updated DDR SDRAM description	JPA	1.3

Table of Contents

Revision History	2
Table of Contents	3
Table of Figures	4
Precautions (Please Read this!)	4
Introduction	5
Overview	5
Features	5
Power consumption	5
Related documents	5
Architecture description	6
Bloc diagram	6
FPGA	6
Memory	6
Micro-controller	7
Sundance High Speed Bus	7
Comport	7
SLB	7
LED	7
JTAG	7
Booting SMT338-VP	9
Getting started with SMT338-VP1	1
Functional description1	4
Memory banks1	4
Oscillator1	5
Connectors location	5
FPGA pinout1	6
SHB Pinout (LVTTL only)1	6
SLB pinout1	9
JTAG connector	20
RSL2	21

Table of Figures

Figure 1 - Micro controller State Machine.	9
Figure 2 - SMT338-VP to SMT390 Interconnections.	. 11
Figure 3 – Fixings	. 12
Figure 4: DDR SDRAM components bank organization	. 14
Figure 5: view of the top of SMT338-VP	. 15
Figure 6: Top view QSH 30	. 16
Figure 7: J13 footprint	. 20
Figure 8: JTAG connector J13 pinout	. 20

Precautions (Please Read this!)

SHB and RSL connectors are similar but their use is really different. Do NOT connect an SHB and an RSL connectors together with and SHB cable! This would cause irreversible damages to the modules.

In the event of a conflict between the text of this document and the user guide for SMT390-VP, SMT391-VP or SMT381-VP or any other DAQ daughter module, the text of this document DOESN'T take precedence.

Introduction

Overview

The *SMT338-VP* is a single width TIM base module that provides a communication platform between a Virtex-II Pro VP30 FPGA and the on-board 128MB Double Data Rate SDRAM memory, <u>Rocket IOs</u> for high speed serial connections, LVDS connections for high speed parallel connections and LVTTL connections and connectors.

The SMT338-VP can be coupled with analogue daughter boards such as <u>SMT390</u>, <u>SMT391</u> or <u>SMT381</u> for high performance DAQ applications.

The FPGA is configured at power-up via comport. The configuration process is controlled by a microprocessor MSP430.

Features

- 128MBytes of DDR SDRAM 133 MHz for sample storage.
- Two Standard Sundance comports,
- Two SHB interfaces for easy interconnection to Sundance products,
- RSL (RocketIO Serial Link) interfaces for fast transfers,
- On-board MSP430 microprocessor.

Power consumption

The SMT338-VP consumes about 2.12 Watts in idle state (FPGA not configured), and about 5.67 Watts once the FPGA is configured (bitstream for the SMT391-VP).

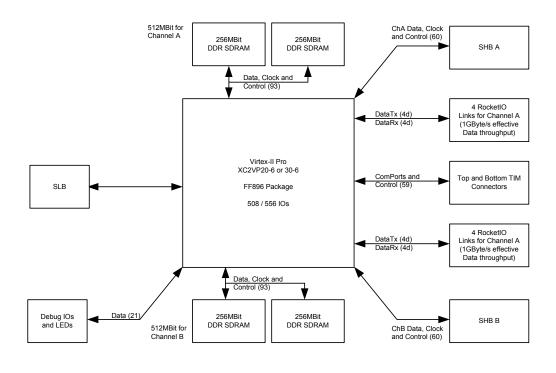
Related documents

<u>SHB technical specification</u> <u>Sundance help file</u> <u>Sundance LVDS Bus (SLB) - Technical Specification</u> <u>RSL Technical Specification</u>

Architecture description

Bloc diagram

This section describes the major blocks of the SMT338-VP board.



Notes: The numbers in brackets denote the amount of FPGA IO pins requires. 'd' is used for differential pairs. 1d Will thus requre 2 IOs

FPGA

The SMT338-VP board uses a Xilinx Virtex II Pro (XC2VP20 or XC2VP30) to control the data flow between the SMT338-VP board and external devices. The FPGA is also used to implement the SHB, SLB, comport and DDR SDRAM interfaces.

The FPGA is configured via comport 3.

Memory

The SMT338-VP board contains four 166 MHz DDR SDRAM components (from Micron: <u>MT46V16M16FN</u>) that provide each 32 MB of storage capacity.

The DDR SDRAM is a high-speed CMOS, dynamic random-access memory.

Examples of DDR SDRAM controller are provided by Xilinx.



Micro-controller

The SMT338VP board is equipped with a micro-controller MSP430

The MSP430 implements board maintenance functions:

- Controls the power start-up sequence
- Controls the reset structure on the module
- Configures the FPGA

Sundance High Speed Bus

SMT338-VP provides two SHB connectors.

Interfaces connected to SHB connector depends on the daughter connected to SLB bus.

Please refer to the <u>SUNDANCE SHB specification</u> for more details.

Comport

The SMT338-VP provides 2 comports: 0 and 3.

ComPort 3 is used to configure and send control words to the FPGA. Comport 0 is left unused by the default firmware and is available for custom applications.

The <u>TI comport specification</u> provides more information about comports.

SLB

The SMT338-VP provides a SLB connector.

Interface to SLB is specific to daughter board.

Please refer to <u>SLB</u> specification for more details.

LED

Six LEDs are available on the board.

LED 1 is on when 5 volts is available on board.

- LED 2 is on when 3.3 volts is available on board.
- LED 3 and 4 are controlled by FPGA.
- LED 5 is connected to MSP430. This led switches on when FPGA is configured.
- LED 6 is mapped to the FPGA (pin AG6). It can be used as GPIO.

JTAG

The SMT338-VP includes JTAG connectors to access FPGA and MSP430. Both devices are in the same JTAG chain.

Connector J13 is a dedicated JTAG connector. See <u>J13</u> pinout for more details.

JTAG chain is also available via some of the pins of the SLB connector. See <u>SLB</u> <u>technical specification</u> for the location of these pins. This is used when a daughter module is connected to SMT338-VP via SLB bus. In this case, J13 isn't accessible anymore and it is required to use SLB to access FPGA and MSP430 via JTAG.

Booting SMT338-VP

The booting of SMT338-VP requests two steps:

- Powering up board.
- Configuring FPGA with bitstream received from comport 3.

This is managed by MSP430.

The following diagram shows what the default micro-controller boot code does:

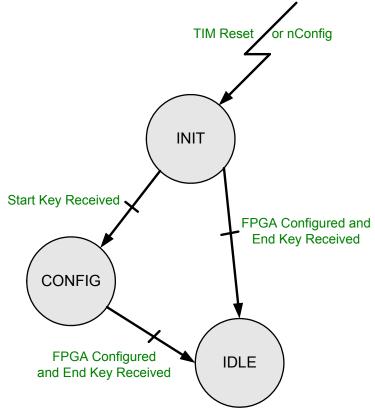


Figure 1 - Micro controller State Machine.

The SMT338-VP is reset by the TIM global reset.

There is also a TIM CONFIG signal provided on the TIM connector J4 pin 74. This provides a means of reprogramming the FPGA without having to drive the TIM Global Reset signal. CONFIG falling will reset the SMT338-VP in the same way that a TIM global Reset pulse will. Other modules in the system that are sensitive to the TIM global Reset signal will not be affected by CONFIG.



CONFIG is driven from another TIM site on the carrier board, for instance, from a DSP module running an application. (See <u>General Firmware Description</u> for information on the DSP TIM CONFIG signal).

After a Global Reset pulse, a DSP module drives CONFIG low and keeps it low by default.

At power-up or on a TIM Reset or on a nConfig line going low, the state machine goes into an *INIT State*.

From there, it has two choices depending on the state of the FPGA (configured i.e. DONE pin high or un-programmed i.e. DONE Pin Low). To reconfigure the FPGA, simply send a Start Key followed by the bitstream and then and End Key. To re-start the FPGA with the current bitstream loaded, simply send a End Key.

Start Key = 0xBCBCBCBC and End Key = 0xBCBCBC00.

A TIM Reset can be issued to reconfigure the FPGA at anytime, but may reset other modules as well. In the case of reconfiguring a particular module, the nConfig line is used.

The SMT6500 software package provides a library of functions to configure the FPGA via comport 3.

Getting started with SMT338-VP

This section gives basic guidelines to start with SMT338-VP.

The example shown below is for an <u>SMT8090_374 system</u>, which is a SMT374 and a SMT390-VP on an SMT310Q carrier board.

The SMT390-VP is a combination of SMT338-VP and a SMT390.

The following diagram shows both boards. The *SMT390* has got 4 holes, as well as the *SMT338-VP*, the usual two TIM mounting holes to provide the module with 3.3 Volts and two extra holes, smaller.

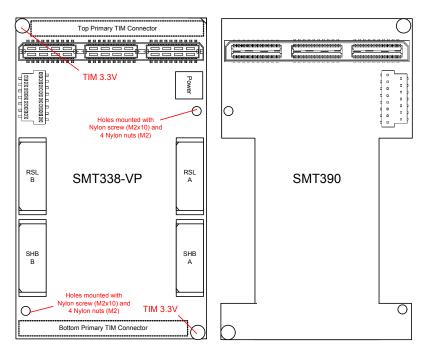


Figure 2 - SMT338-VP to SMT390 Interconnections.

Here is what is required to mount SMT338-VP+SMT390 on the SMT310Q:



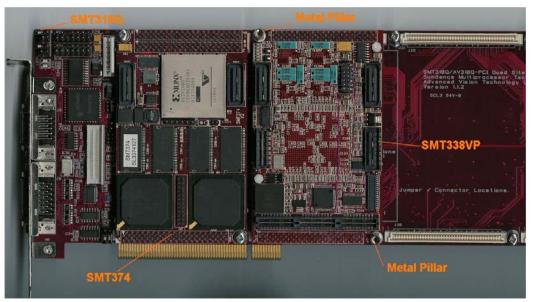
Figure 3 – Fixings

a – First, fit two Nylon screws (M2x10), pointing out (the head of the screws on bottom side).

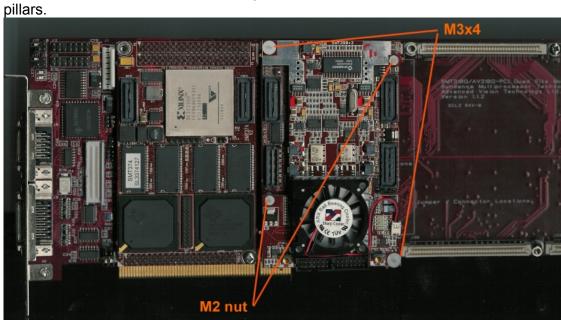
b – Then fit four M2 nuts on each screw.



c – Place the *SMT338-VP* on the second site (*SMT374* already on first site) on the *SMT310Q* and fit two metal pillars (3.3 Volts).



d – Place the *SMT390* on top of the *SMT338-VP*. Make sure that both modules fit firmly.



e - Fit two M2 nuts on the Nylon screws and two M3x4 screws in the 3.3V ars

Functional description

This section describes in detail the implementation of the board.

Memory banks

Memory is organised in two independent banks.

Both banks can be accessed at the same time.

The following diagram shows how the DDR SDRAM components are organized within a memory bank:

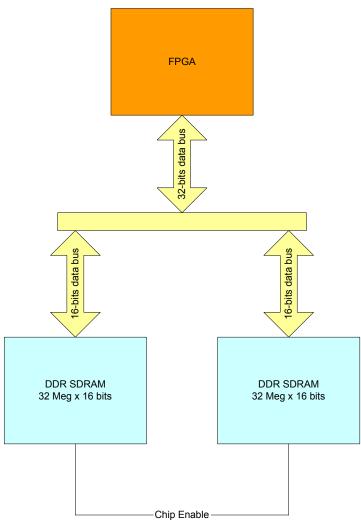


Figure 4: DDR SDRAM components bank organization

One bank is made from two 32M x 16-bits DDR SDRAM components (MT46V32M16FN), each of them having a 16-bit data bus. Memory components are accessed in pairs.



Oscillator

A 125 MHz low jitter oscillator is connected to the FPGA.

Connectors location

The following figure shows the location of connectors on SMT338-VP board.

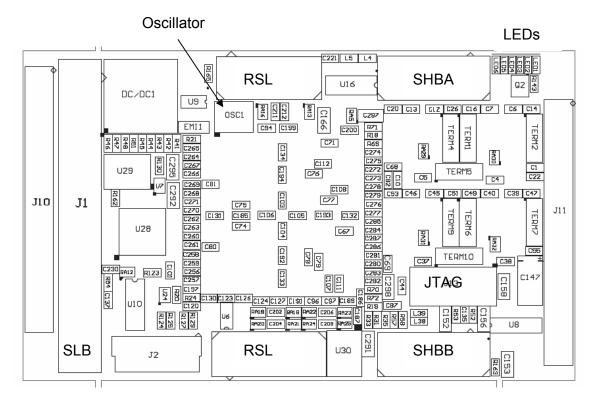


Figure 5: view of the top of SMT338-VP

FPGA pinout

FPGA pinout is gathered in a Xilinx User Constraint File (ucf).

Naming convention is described below for SHB and SLB. Other signals are directly commented in the UCF file itself.

SHB Pinout (LVTTL only)

The following provides naming convention for SHB signals.

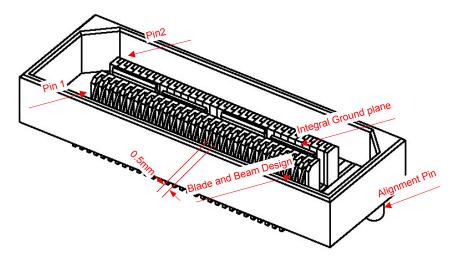


Figure 6: Top view QSH 30



	UCF signal name	Hw	QSH Pin number	QSH Pin number		UCF signal name	Hw
	Shb?Hw0Clock	SHBxCLK0	1	2		Shb?Hw0Data	SHBxD0(0)
	Shb?Hw0Data	SHBxD0(1)	3	4		Shb?Hw0Data	SHBxD0(2)
	Shb?Hw0Data	SHBxD0(3)	5	6		Shb?Hw0Data	SHBxD0(4)
	Shb?Hw0Data	SHBxD0(5)	7	8		Shb?Hw0Data	SHBxD0(6)
	Shb?Hw0Data	SHBxD0(7)	9	10		Shb?Hw0Data	SHBxD0(8)
Q	Shb?Hw0Data	SHBxD0(9)	11	12	Q	Shb?Hw0Data	SHBxD0(10)
Hwo	Shb?Hw0Data	SHBxD0(11)	13	14	Hw0	Shb?Hw0Data	SHBxD0(12)
	Shb?Hw0Data	SHBxD0(13)	15	16		Shb?Hw0Data	SHBxD0(14)
	Shb?Hw0Data	SHBxD0(15)	17	18		Shb?Hw0Control(0)	SHBxUSER0(16)
	Shb?Hw0Control(1)	SHBxUSER0(17)	19	20		Shb?Hw0Control(2)	SHBxUSER0(18)
	Shb?Hw0Control(3)	SHBxUSER0(19)	21	22		Shb?Hw0Control(4)	SHBxWEN1
	Shb?Hw0Control(5)	SHBxREQ1	23	24		Shb?Hw0Control(6)	SHBxACK1
	Shb?FpgaIo(0)	SHBxUSER1(23)	25	26		Shb?FpgaIo(1)	SHBxUSER1(24)
	Shb?FpgaIo(2)	SHBxUSER1(25)	27	28		Shb?FpgaIo(3)	SHBxUSER1(26)
	Shb?FpgaIo(4)	SHBxUSER1(27)	29	30		Shb?FpgaIo(5)	SHBxUSER1(28)
	Shb?FpgaIo(6)	SHBxUSER1(29)	31	32		Shb?FpgaIo(7)	SHBxUSER1(30)
	Shb?FpgaIo(8)	SHBxUSER1(31)	33	34		Shb?FpgaIo(9)	SHBxUSER1(32)
	Shb?FpgaIo(10)	SHBxUSER1(33)	35	36		Shb?FpgaIo(11)	SHBxUSER1(34)
	Shb?Hw1Clock	SHBxCLK3	37	38		Shb?Hw1Data	SHBxD1(0)
	Shb?Hw1Data	SHBxD1(1)	39	40		Shb?Hw1Data	SHBxD1(2)
	Shb?Hw1Data	SHBxD1(3)	41	42		Shb?Hw1Data	SHBxD1(4)
	Shb?Hw1Data	SHBxD1(5)	43	44		Shb?Hw1Data	SHBxD1(6)
	Shb?Hw1Data	SHBxD1(7)	45	46		Shb?Hw1Data	SHBxD1(8)
2	Shb?Hw1Data	SHBxD1(9)	47	48	ž	Shb?Hw1Data	SHBxD1(10)
Hw1	Shb?Hw1Data	SHBxD1(11)	49	50	Hw1	Shb?Hw1Data	SHBxD1(12)
	Shb?Hw1Data	SHBxD1(13)	51	52		Shb?Hw1Data	SHBxD1(14)
	Shb?Hw1Data	SHBxD1(15)	53	54		Shb?Hw1Control(0)	SHBxUSER2(52)
	Shb?Hw1Control(1)	SHBxUSER0(17)	55	56		Shb?Hw1Control(2)	SHBxUSER2(54)
	Shb?Hw1Control(3)	SHBxUSER0(19)	57	58		Shb?Hw1Control(4)	SHBxWEN4
	Shb?Hw1Control(5)	SHBxREQ4	59	60		Shb?Hw1Control(6)	SHBxACK4

Table 1: SHB interfaces table.

16-bit interface

SLB pinout

The following diagram shows the SLB connector signals connected to the FPGA. These names match with names available in UCF file.

...

			J1		1			
DataAICh[15_0]	DataAICh[15_0]	_	BANK A	BANK C			DataA OCh[150]	DataAQCh[15.0]
Decaration[15.0]		DataAICh0 1	DOAI0p	DO AQ0p	81	DataAQCh0		Latar(QCI[13.0]
		DataAICh1 3 DataAICh2 5	DOAI0n	DO AQ0n	83	DataAQChl	1	
		DetaAICh2 5 DetaAICh3 7	DOAI1p	DOAQ1p	87	DataAQCh2 DataAQCh3		
		DataAICh4 9	DOAI1n DOAI2p	DOAQIn	89	DataAQCh4		
		DataAICh5 11	DOAL2p DOAL2n	DO AQ2p DO AQ2n	91	DataAQCh5		
		DataAICh6 13	DOAI3p	DO AQ3p	93	DataAQCh6	1	
		DataAICh7 15 DataAICh8 17	DOAI3n	DO AQ3n	95	DataAQCh7 DataAQCh8		
		DataAICh9 19	DOAI4p DOAI4n	DO AQ4p DO AQ4n	99	DataAQCh9		
		DataAICh 10 21	DOAI4n DOAI5p	DOAQ4n DOAQ5p	10.1	DataAQCh10	/	
		DataAICh11 23 DataAICh12 25	DOAL5p	DO AQ5n	10.3	DataAQChl 1	1	
		DataAICh 12 25 DataAICh 13 27	DOAI6p	DO AQ6p	10.5	DataAQCh12 DataAQCh13		
		DataAICh15 27 DataAICh14 29	DOAI6n	DO AQ6n	10.9	DataAQChl 4		
		DataAICh15 31	DOAI7p DOAI7n	DO AQ7p DO AQ7n	111	DataAQCh15		
DataBICh[15.0]	DataBICh[15.0]	D. DIGIA	Dorum	Doragin	82	D. DOGO	DataBOCh[150]	DataBQCh[15_0]
		DataBICh0 2 DataBICh1 4	DOBIDp	DOBQ0p	82	DataBQCh0 DataBOCh1		
		DataBICh2 6	DOBIOn	DOBQ0n	86	DataBOCh2		
		DataBICh3 8	DOBI1 p DOBI1 n	DOBQ1p DOBQ1n	88	DataBQCh3	1	
		DataBICh4 10	DOBI2p	DOBQ2p	90	DataBQCh4	1	
		Dat aBICh5 12 Dat aBICh6 14	DOBI2n	DOBQ2n	92	DataBQCh5 DataBQCh6		
		DataBICh7 16	DOBBp	DOBQ3p	96	DataBQCh7		
		DataBICh8 18	DOBBn DOBHp	DOBQ3n DOBQ4p	98	DataBQCh8	1	
		DataBICh9 20	DOB#p DOB#n	DOBQ4p DOBQ4n	100	DataBQCh9	1	
		DataBICh10 22 DataBICh11 24	DOBBp	DOBQ5p	10.2	DataBQCh10 DataBQCh11		
		DataBICh11 24 DataBICh12 26	DOBBN	DOBQ5n	104	DataBQCh12		
		DataBICh13 28	DOB16p DOB16n	DOBQ6p DOBQ6a	10.8	DataBQCh13		
		DutaBICh14 30	DOBIN DOBI7p	DOBQ60 DOBQ7p	110	DataBQCh14	1	
	ClockOutICh[1.0]	DataBICh15 32	DOBI7n	DOBQ7n	112	DataBQCh15	ClockOutOCh[1.0]	
ClockOut[Ch[10]	CROKORICIII1.0	ClockOutICh0 33	arrat		113	Clock OutQCh0	Coaconociii	ClockOutQCh[10]
		ClockOutIChl 35	CLKOlp CLKOln	CLKOQp CLKOQn	11.5	ClockOutQCh1		
DataOfRangeICh[10]	DataOfRangeICh[10]		CLAOR	CIROQU	11.4	D. 0.0	DataOfRangeOCh[1.0]	DataOfRangeQCh[1.0]
· · · · · · · · · · · · · · · · · · ·		DataOfRangelCh0 34 DataOfRangelCh1 36	DOIRp	DOIRQp	114	DataOfRangeQCh0 DataOfRangeQCh1	9	
	FpgaSysCkekf101	Dataonangereni 30	DOIRIn	DOIRQn	110	Lanao Inanja Qoni	FpgaRslClock[1.0]	
FpgaSysClock[1_0]		FpgaSysClock0 37	SysClockp	RslClockp	117	FpgaRslClock0	1	FpgaRslClock[10]
		FpgaSysClock1 39	SysClockp	RslClockn	119	FpgaRs/Clock 1	·	
ExtTriggerI[10]	ExfTriggerI[1.0]	ExfTriggerI0 38			118	D. (D.)	ExffriggerO[1.0]	ExtTriggerQ[1.0]
		ExtTriggerI0 38 ExtTriggerI1 40	ExtTriggerIp	ExtTriggerQp	118	Ex ffriggerQ0 Ex ffriggerQ1	J	
		Exungein 40	ExtTriggerIn	ExfTriggerQn	16.0	Externager 21		
	T 0 110 0		BANK B	EDG 4			11.0.184.03	
TmpCntrl[20]	TmpCntrlf201	TmpCntrl0 SMBC1k 41	MSP	FPGA	51	AdoCntr10	AdoCntr1[4.01	AdcCntrl[4.0]
		TmpCntrl1 SMBData 42	SMBClk	Ade Mo de	52	AdoCntr11		
		TmpCntrl2 SMBnAl at 43	SMBData SMBnAlert	AdeClock AdeLoad	53	AdoCntr12	/	
Daught erSeri alNo	DaughterSerialNo	44	SerialNo	AdeData	54	AdoCntr13	1	
	AdcAnalog[2_0]			AdeCal	55	AdoCntr14	AdjClockCntrl[3_0]	
Ade Analog[20]	Add Analog 2.01	Ade Analog0 45			56	AdjClockCntr10	Adje bere mr 15.01	AdjClockCntrl[30]
		Ade Analogl 46	Adc VDac I Adc VDac Q	AdjClk SClk AdjClk SData	57	AdjClockCntrll	/	
		Ade Analog2 47	Ade VDecQ	AdjClkSLoad	58	AdjClockCntrl2	1	
AdcReset	AdcReset	48	AdcReset	AdjClkTest	59	AdjClockCntrl3	Pll Chttl[3_0]	
Date:	D3V3 Enable	49	-		60	Pll Chtrl0	racateli 5.01	PllCntr1[3.0]
D3V3 Enable D2V5 Enable	D2V5_Enable	50	D3V3Emble D2V5Emble	PllClk PllData	61	PllChttl1		
D2v5_Enable			D2 v 3Einde	PIIData PIILe	62	PllChttl2	1	
				PliFoLd	63	Pll Chtrl3	ClkControl[50]	
					64	ClkControl0	Cacconton 5.0	ClkControl[50]
				Ade AClkSel Ade BClkSel	65	CkControll		
				IntClkDivEn	66	ClkControl2	/	
		DIALD IN		Int C kDivn Reset	67	ClkControl3		
		D+3 V3_IN	MCD	IntExtClkSel	68	ClkControl4 ClkControl5		
			JTAG I	ntExt OkSelnRes				
Msp.Jtag[4.0]	Msp.Jag[4_0]	75	MspVRef	FPGA JTAG	-	D+2 V5		
		Msp.Jag0 MspTck 76 Msp.Jag1 MspTims 77	MspTck	FpgaVRef	70	Energia Energy Tala	FogaJ tag[3_0]	FpgaJtag[30]
		Msp.Jag1 MspTins 77 MspJag2 MspTdi 78	MspTms	FpgaTck	72	FpgaJtag0 FpgaTck FpgaJtag1 FpgaTms		
		MspJag3 MspTdo 79	MspTdi MspTdi	FpgaT ms	73	FpgaJtag2 FpgaTdi		
		MspJag4 MspnTrst 80	MspTdo MspnTrst	FpgaT di FpgaT do	74	FpgaJtag3 FpgaTdo		
		121			12.7			
		121	DGND	DGND	127			
		123	DGND INI	EGRAL DGND	12.9			
D	ue to the space limitation sor	nthe SMT3 98 124	DOND GR	OUND DOND	130			
th.	e MSP and FPGA Jtag chain sught er card connector and in	is are routed over the 125 no the appropriate 126	DGND PLA	ANE DGND	13 1 13 2			
	sught er card connector and in tag connectors on the daughte		DGND	DGND	13.2			
n	ot be a problem as these inter	faces will not be	QTH-060-01-F	-D-DP-A	-			
u	sed under normal circumsta	nces						
		_			_	-		
		-			-			

JTAG connector

The following 2 diagrams show connector J13 pinout.

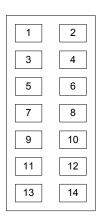


Figure 7: J13 footprint

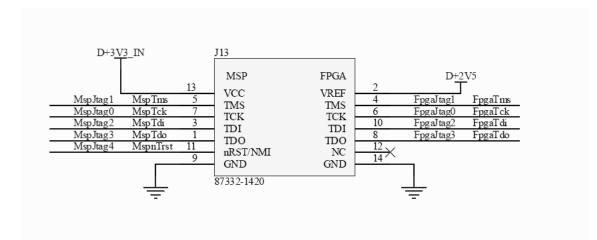


Figure 8: JTAG connector J13 pinout



RSL

Follow is the RSL pinout.

RSL pin name refers to <u>RSL pin-outs</u> documentation.

RSL type B:

RSL pin name	FPGA pin number
TxLink0p	A26
TxLink0n	A27
RxLink0p	A25
RxLink0n	A24
TxLink1p	A19
TxLink1n	A20
RxLink1p	A18
RxLink1n	A17
TxLink2p	A13
TxLink2n	A14
RxLink2p	A12
RxLink2n	A11
TxLink3p	A6
TxLink3n	A7
RxLink3p	A5
RxLink3n	A4



RSL type A:

RSL pin name	FPGA pin number
TxLink0p	AK6
TxLink0n	AK7
RxLink0p	AK5
RxLink0n	AK4
TxLink1p	AK13
TxLink1n	AK14
RxLink1p	AK12
RxLink1n	AK11
TxLink2p	AK19
TxLink2n	AK20
RxLink2p	AK18
RxLink2n	AK17
TxLink3p	AK26
TxLink3n	AK27
RxLink3p	AK25
RxLink3n	AK24

