



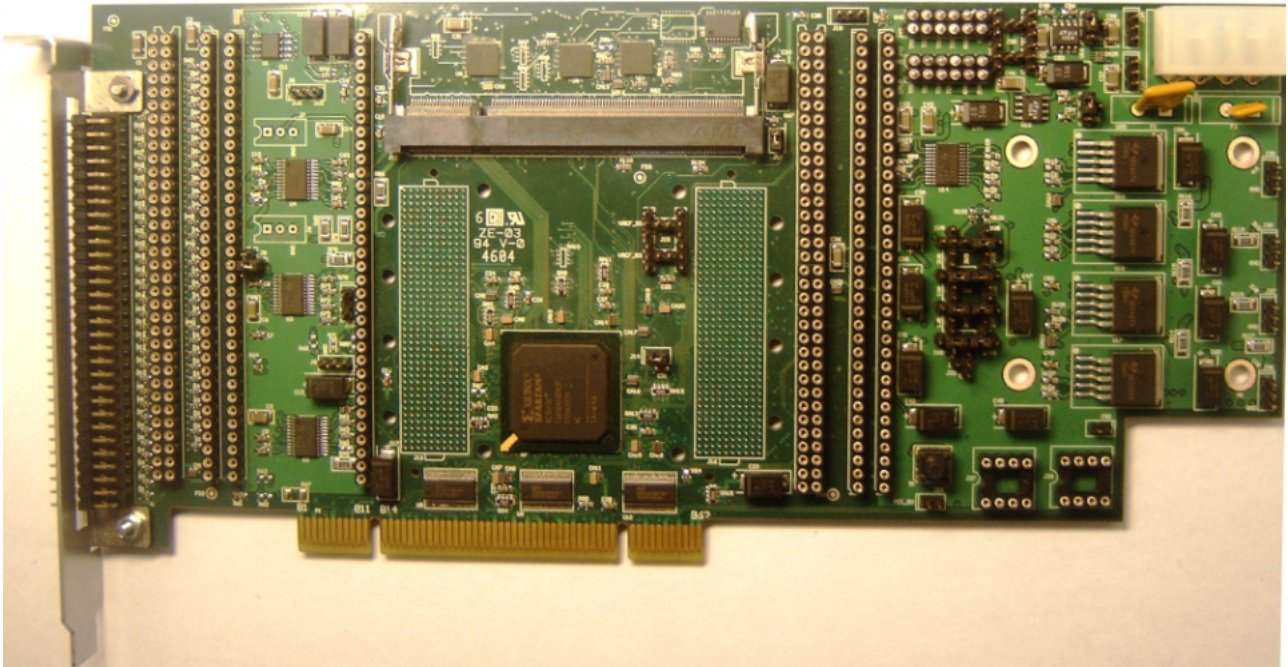
# Broaddown2 User Manual

Issue – 1.02

## **Kit Contents**

You should receive the following items with you Broaddown2 development kit:

- 1 - Broaddown2 Board



**Figure 1 - Broaddown2 Board**

## **Foreword**

**PLEASE READ ALL OF THIS MANUAL BEFORE PLUGGING IN OR POWERING UP YOUR BROADDOWN2. PLEASE TAKE SPECIAL NOTE OF THE WARNINGS WITHIN THE MANUAL.**

## **Trademarks**

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## **Introduction**

Welcome to your Broaddown2 the “Ultimate Spartan-3 Development Board”. Broaddown2 is a member of Enterpoint’s Moel-Bryn product range and offers a highly flexible approach to prototyping FPGA and System designs.

The aim of this manual is assist in using the main features of Broaddown2. There are features such as regulator shutdown control and advanced programming features that are beyond the scope of this edition of the manual. Should you have a need to use these features then please contact the support email [support@enterpoint.co.uk](mailto:support@enterpoint.co.uk) for detailed instructions to use these advanced features.

Broaddown2 comes in 3 principal variants based on the size of FPGA fitted. The Spartan-3 fitted can either be XC3S400-4FG456C, XC3S1000-4FG456C, or XC3S1500-4FG456C. Should you need the faster -5, industrial or automotive grade FPGA’s fitted to a board please contact Enterpoint sales for a quote.

In addition to these principal variants Broaddown-2 has build options for LVDS termination resistors and YFS connectors. Please contact sales for a quote if you require these options.

Broaddown2 modules that are now available to purchase:

- A/D Converter (DIL Header Module)
- Low Cost Programming Cable (Standalone)
- SODIMM I/O Expansion Module
- PCI I/O Expansion Module
- RS232 Module
- RS485 Module
- USB2 Module
- LED 4 Segment Display Module
- PS2 Module
- Ethernet Phy Module
- AD7202 Module

We can also offer custom DIL Header modules should you require a function not covered by our current range of modules. Typical turn around for this service is 2-4 weeks if parts can be obtained in time.

## Finding Your Way Around

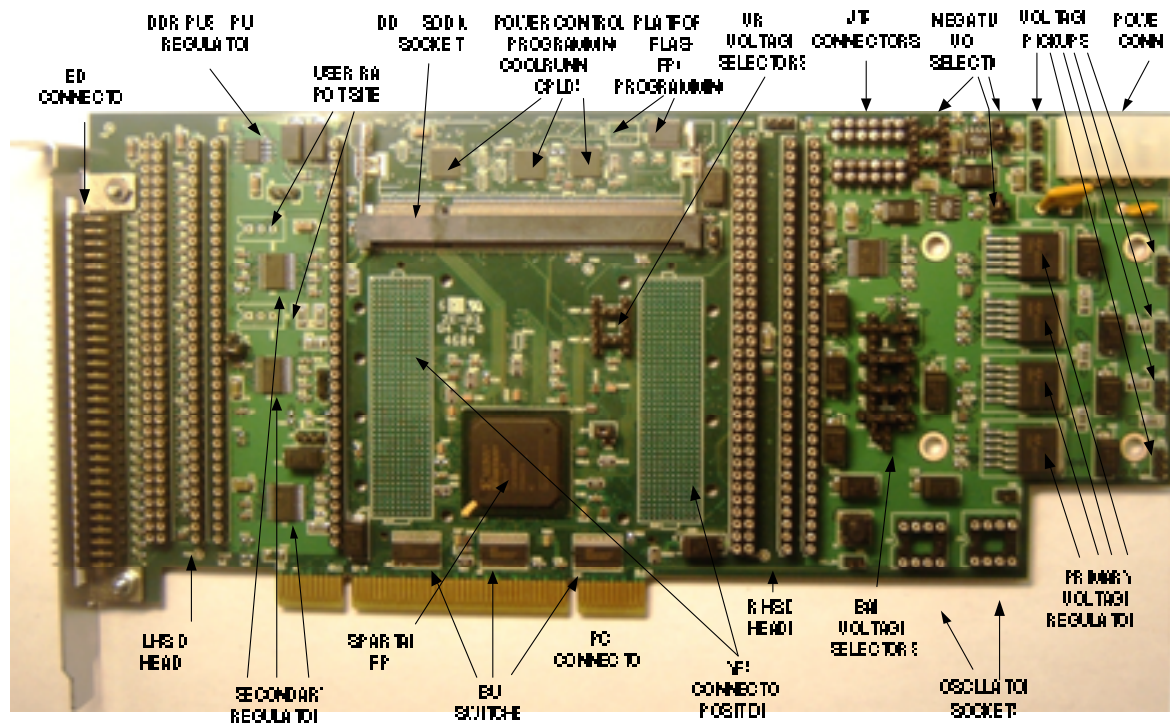


Figure 2 - Front Side of Broaddown2

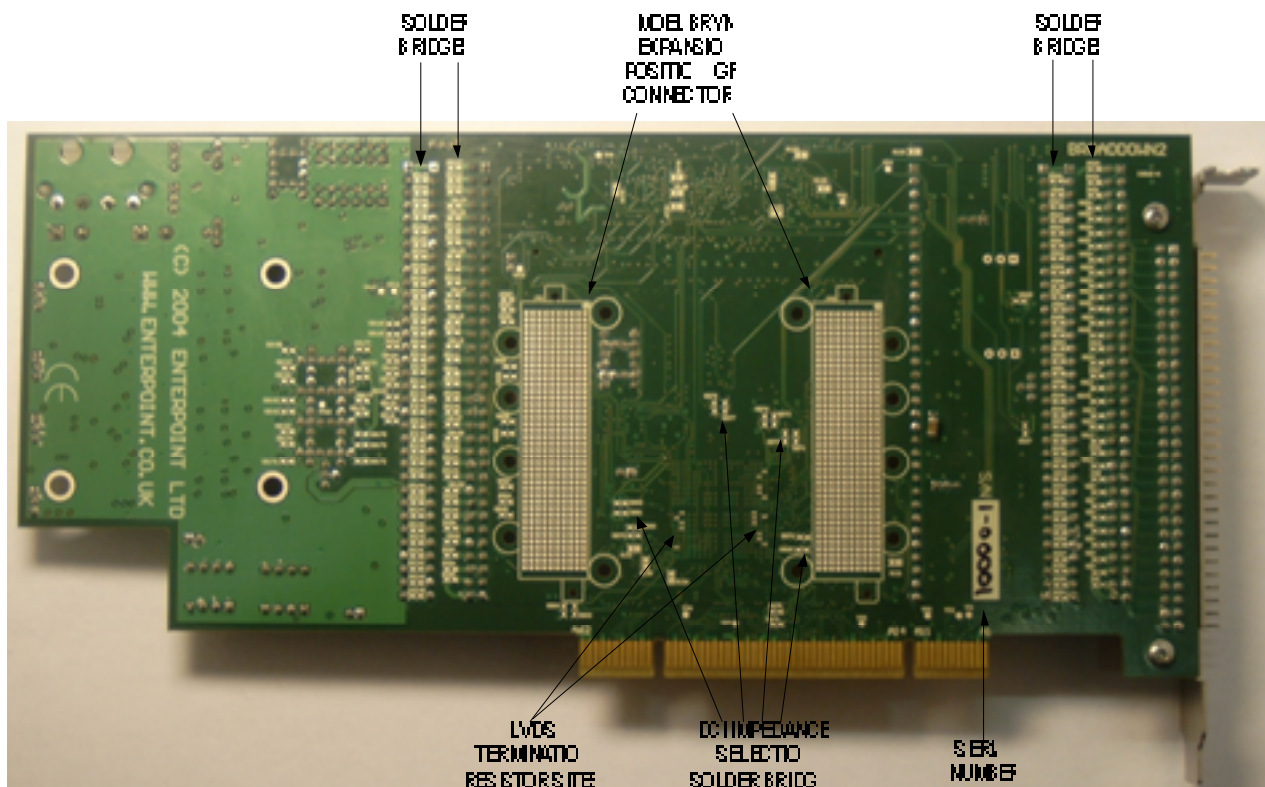


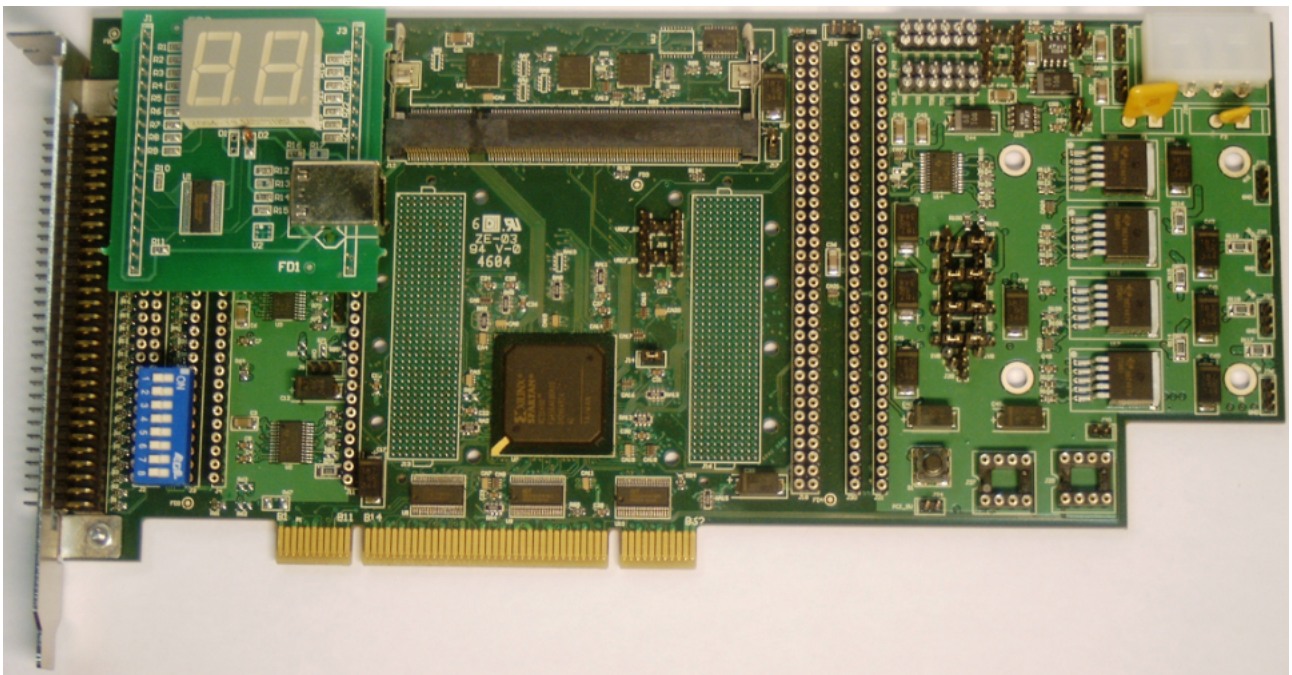
Figure 3 - Back Side of Broaddown2



## **Getting Started**

Your Broaddown2 will be supplied pre-programmed with a test design. A default setting of jumpers will also be fitted. The test design will allow the user to determine that most of the major elements of the Broaddown2 are working. To use this test you must do the following:

- (1) Ensure that the LHS DIL Power Selector is set at the 3.3V position (factory default).
- (3) Connect the Broaddown2 to your power source (un-powered) by the disk drive power connector or by plugging into a PCI slot within a Personal Computer (un-powered). Please note that plugging into a Personal Computer should only be done by an experienced system administrator. As with the addition of any new element to a computer there is a possibility that plugging your Broaddown2 into a computer PCI slot may cause data corruption or loss. You should ensure that adequate backups of data or systems are made before attempting this step. If you do not have a valid PCI supporting design loaded in the FPGA on the board it is likely to freeze the supporting computer.
- (4) Switch on your power source.

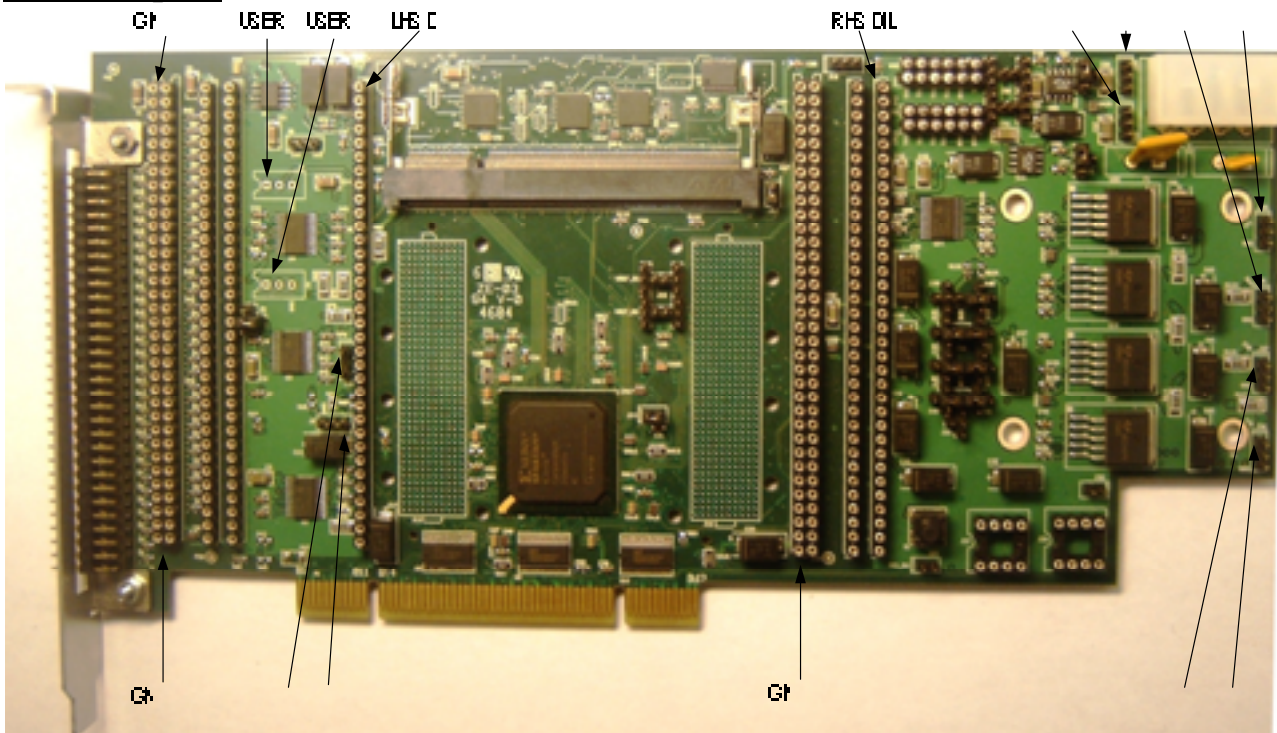


**Figure 4 - Broaddown2 with LED/USB Module and DIP Switch fitted.**

The flash memory/s can be re-programmed at any time using the appropriate JTAG interface. You will need a JTAG programming cable PROG1/2, or Xilinx Parallel IV, or Xilinx USB programming cables (flying leads needed) together with Xilinx ISE tools to re-program the Platform Flash devices.

## Broaddown2 Features

### Power Inputs



Broaddown2 can take current from either the PCI edge connector or the Disk Drive Connector at the top left of the card. The power supplies on the PCI edge connector can be isolated by jumpers J24 and J30 should a power supply contention issue arise. It is recommended that for currents greater than 2 amps on the 5V input and 0.5 amp on the 12V rail then the disk drive connector should be used.

The principal input to Broaddown2 is the 5V input. The 12V input is only used to feed the Negative Voltage Rail circuits and for the Moel-Bryn expansion position.

Reset-able poly-fuses are fitted to both the 5V and 12V inputs. Respective notional ratings of 7 amps and 3 amps are the limits of power input. The actual trip currents of these devices will vary with cooling and ambient temperature and hence the operational cut-offs may be much lower than these figures.

**WARNING – THE POLY-FUSES CAN GET VERY HOT IN NORMAL OPERATION. PLEASE DO NOT TOUCH OR PLACE HIGHLY FLAMABLE MATERIALS NEAR THESE DEVICES WHILST THE BROADDOWN2 IS IN OPERATION.**

## Power Pickups

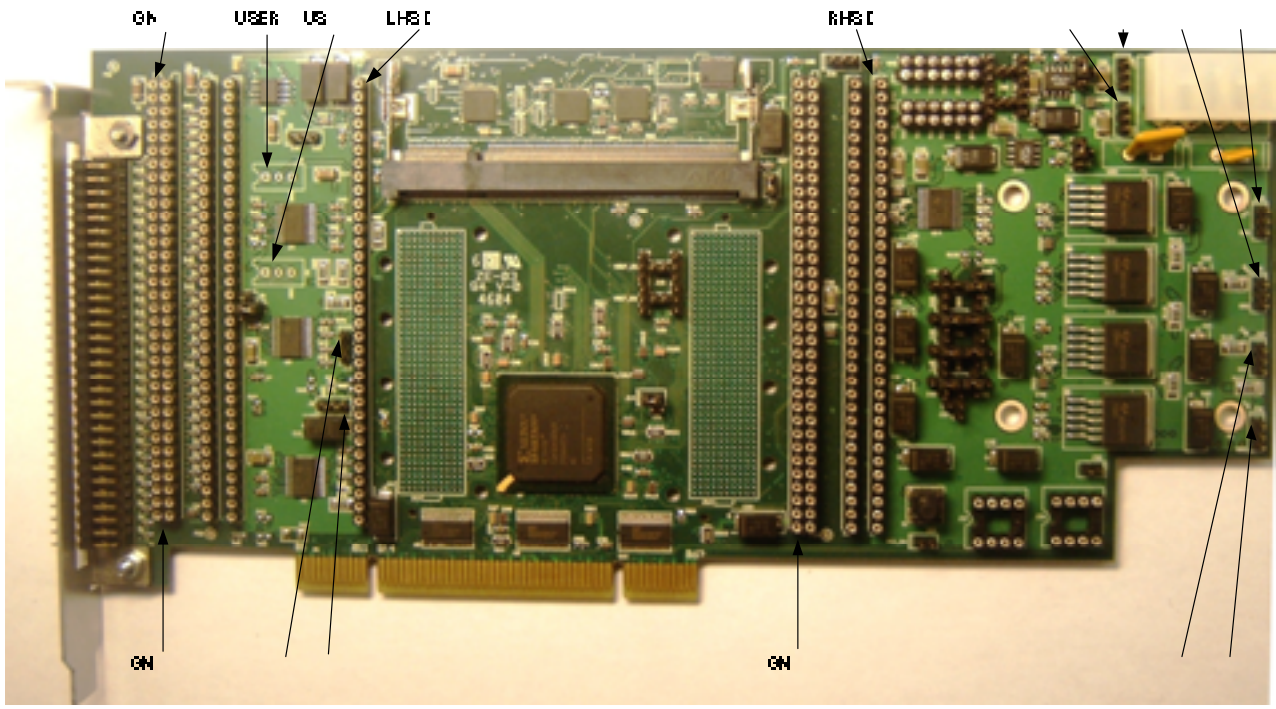


Figure 5 - Broaddown2 Power Pickup Points

**WARNING – DO NOT CONNECT ANY VOLTAGE HIGHER THAN 3.3V TO THE SPARTAN-3 I/O PINS. TAKE GREAT CARE THAN CIRCUITS POWERED FROM VOLTAGES HIGHER THAN 3.3V DO NOT DRIVE SIGNALS CONNECTED TO SPARTAN-3 TO A SIGNALLING VOLTAGE GREATER THAN 3.3V.**

Broaddown2 has power pickup points. Each pickup normally consists of a 3 pin 2mm header although some other types of pick-up are available on Broaddown2. The pinout of the 3 pin pickup points is usually defined as:

Pin1	- Voltage O/P
Pin2	- Isolated
Pin3	- Gnd (0V)

In addition to these pickup points power can be picked up from LHS DIL Header, RHS DIL Header, Bank Voltage Selector J26 and Vref Voltage Selector J15. Please see the relevant sections for more details on these features.

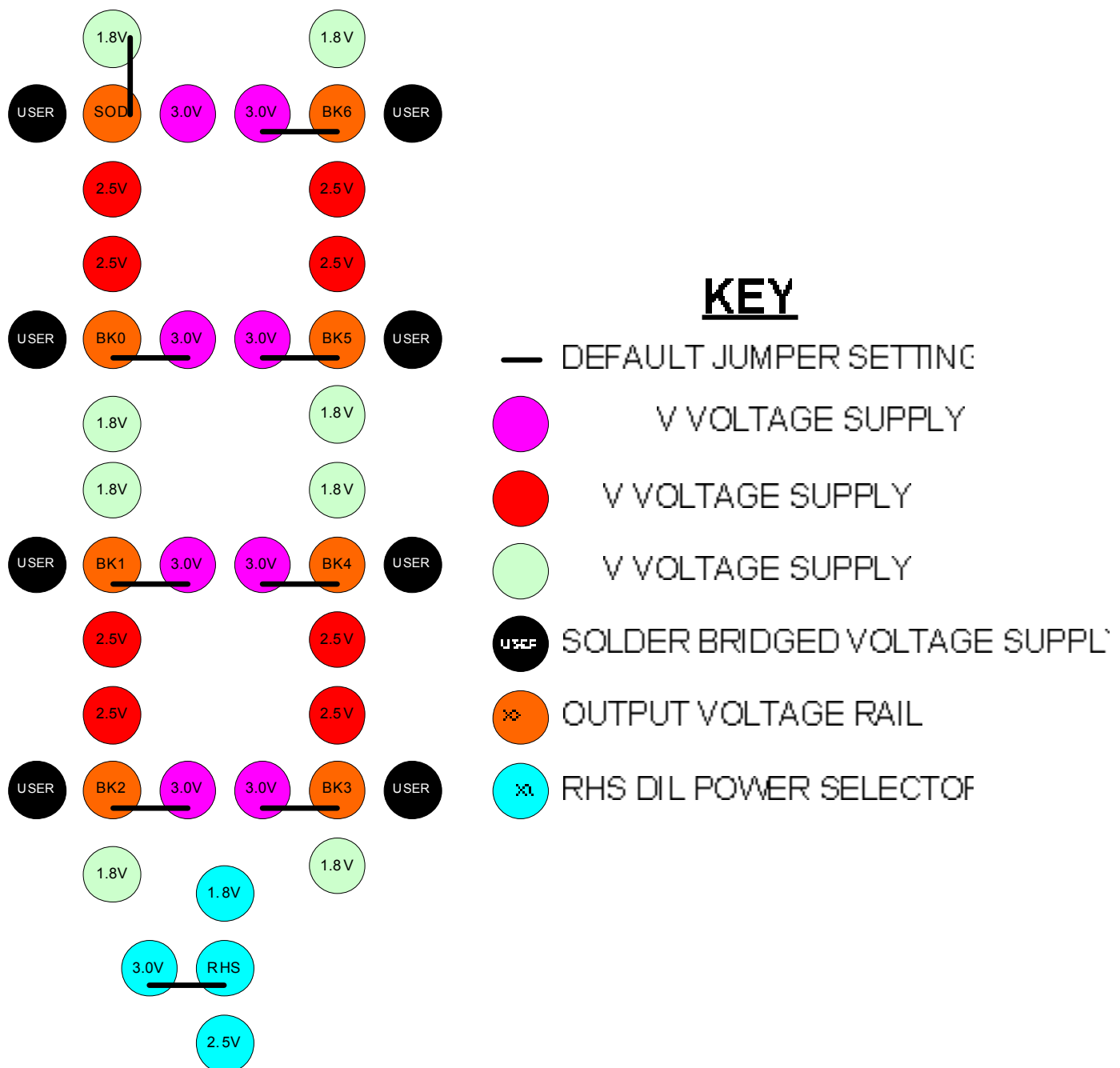


The voltages that are available on 3 pin pickup points are as in the following table.

Voltage	Header	Note
12V	J34	
5V	J33	
4.1V	J39	
3.3V	J38	
2.5V	J37	
1.8V	J36	
1.5V	J10	
1.2V	J9	
User1 Rail	J7	Potentiometer socket, Pin2 not isolated
User2 Rail	J6	Potentiometer socket, Pin2 not isolated. Rail may need to be turned on by CPLD output.

### **Selecting FPGA Bank (Vcciox) + Main SODIMM Voltages**

Broaddown2 divides the I/O pins of the fitted Spartan-3 into 7 banks. The FPGA does natively support 8 banks however on Broaddown2 banks 6+7 share their Vccio. The key to voltage selection and hence support I/O standards is header J26. From this header the 7 bank voltages and SODIMM main voltages can individually be selected from 3V, 2.5V and 1.8V. Additionally 1 extra selection is available to each output power rail. By soldering appropriate solder bridges SB170-185 1.2V or 1.5V can be made available as levels. It is also possible to set a custom level using a flying lead to the header but the voltage supplied should be the range +1.2V to +3.45V. Please note that the header is **not pinned out the same way** for each output power rail. The pinout chosen makes it unlikely that input power rails can be shorted together using a single jumper. The header layout and the nearby RHS DIL Power Selector are shown below.



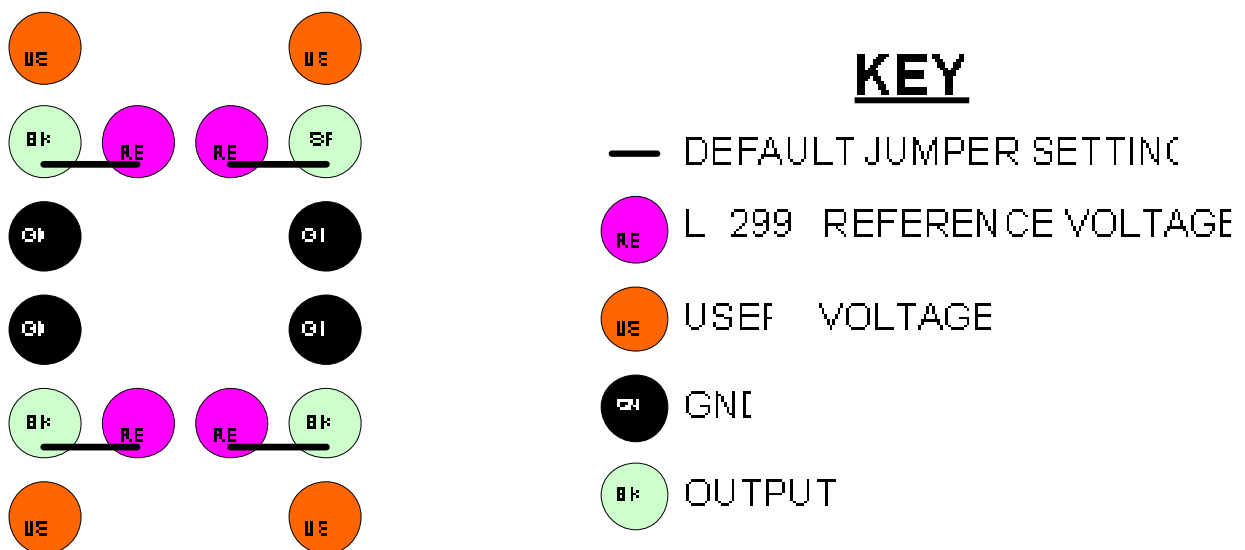
## Selecting FPGA Vref Voltages

Broaddown2 primarily supports Vref voltages for banks 2,3 and 4. It is these banks that connect to the DDR2 SODIMM module. It may be possible to apply Vref for other banks using flying wires but please check with support before attempting this.

The selection of Vref is carried out on header J15. Each of banks 2,3,4 can be connected by jumper to the reference voltage supplied by the push/pull (LP2996) regulator. This regulator generates a reference voltage half that of its input reference voltage which is the SODIMM main supply rail. Please note that jumper setting of J8 will affect the range with which the LP2996 will regulate. For details of this please refer to the LP2996 datasheet.

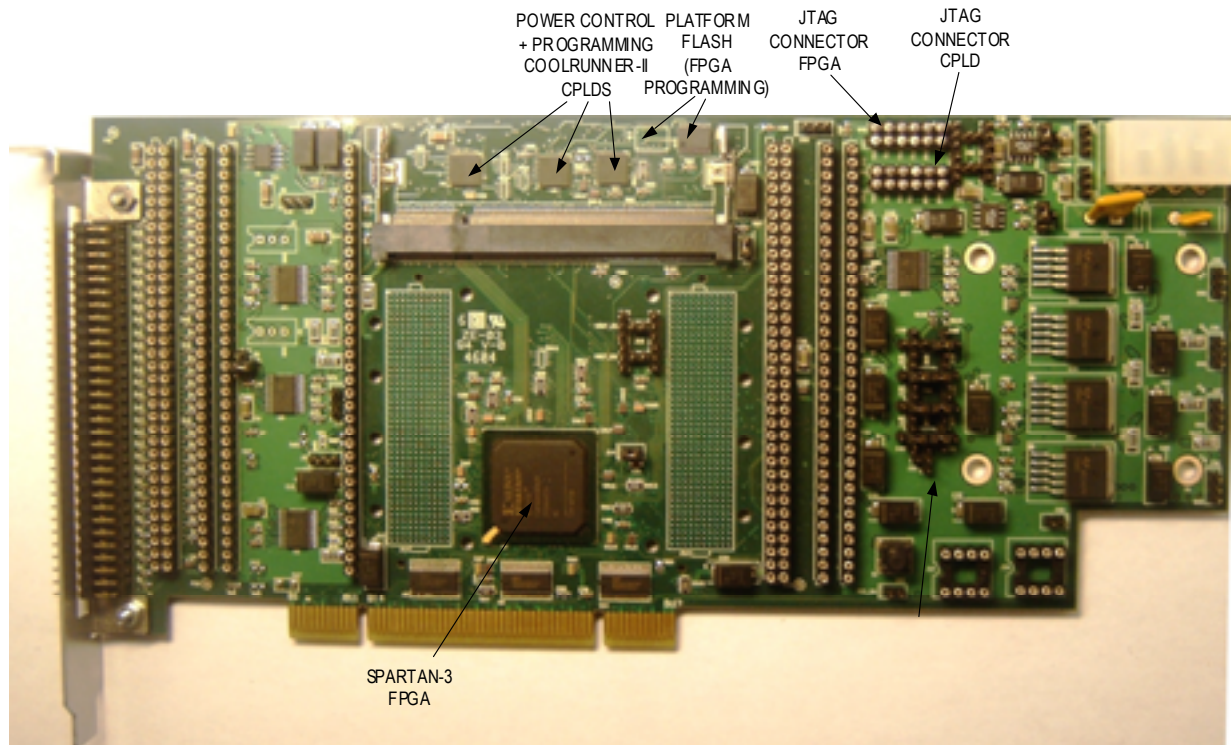
As an alternative the USER1 power rail can be used as a reference but this will not track the SODIMM main voltage rail. V\_USER1 can be set within the range of 1.22V to 3.3V approximately by fitting a potentiometer or resistor in socket position J7 between pins 2 and 3.

A spare selector is included on J15 should you need to pickup the LP2996 reference voltage. J15 also allows the grounding of Vref inputs to the FPGA should you need to do this. The pinout of J15 is shown below.



J8 should also normally be set to the 2V5 setting for DDR2 operation. This will allow generation of a reference voltage of 0.9V when the main SODIMM power rail is set to 1.8V.

## Programming Broaddown2



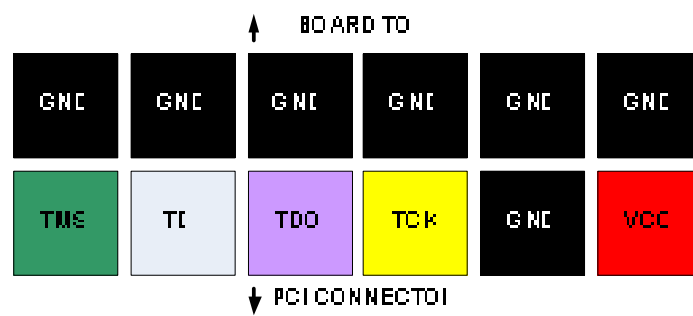
**Figure 6 - JTAG Connector Positions**

The programming of the FPGA, CPLDs and Platform Flash parts on Broaddown2 is achieved using JTAG chains. Principally it is anticipated that a JTAG cable will be used in conjunction Xilinx ISE software although other alternatives do exist including self re-programming.

There are 2 JTAG chains on Broaddown2. The first chain allows the programming of the three Coolrunner-II CPLDs. Normally users will not need to reprogram these devices. However to use special power sequencing and/or advanced programming features reprogramming of these devices may be needed. If you are considering using these features you should study the Broaddown2 circuits and understand the full functionality before modifying the CPLD programming.

The second JTAG chain allows the programming of the Spartan-3 and Platform Flash devices as well as the a Moel-Bryn expansion card if fitted.

Each JTAG connector has a layout is as follows:





The CPLD chain looks like this:

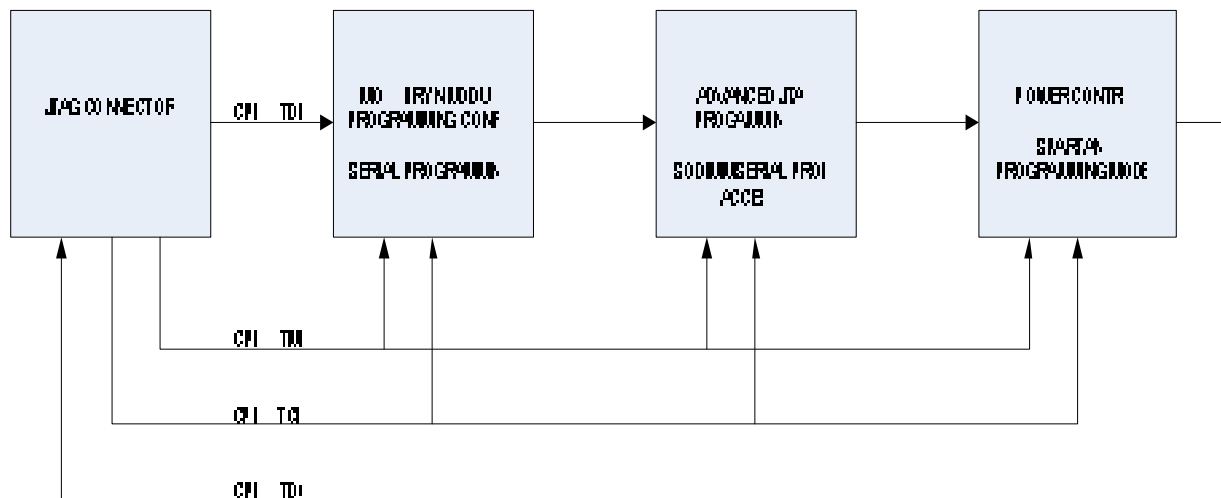


Figure 7 - CPLD JTAG Chain

The FPGA chain looks like this:

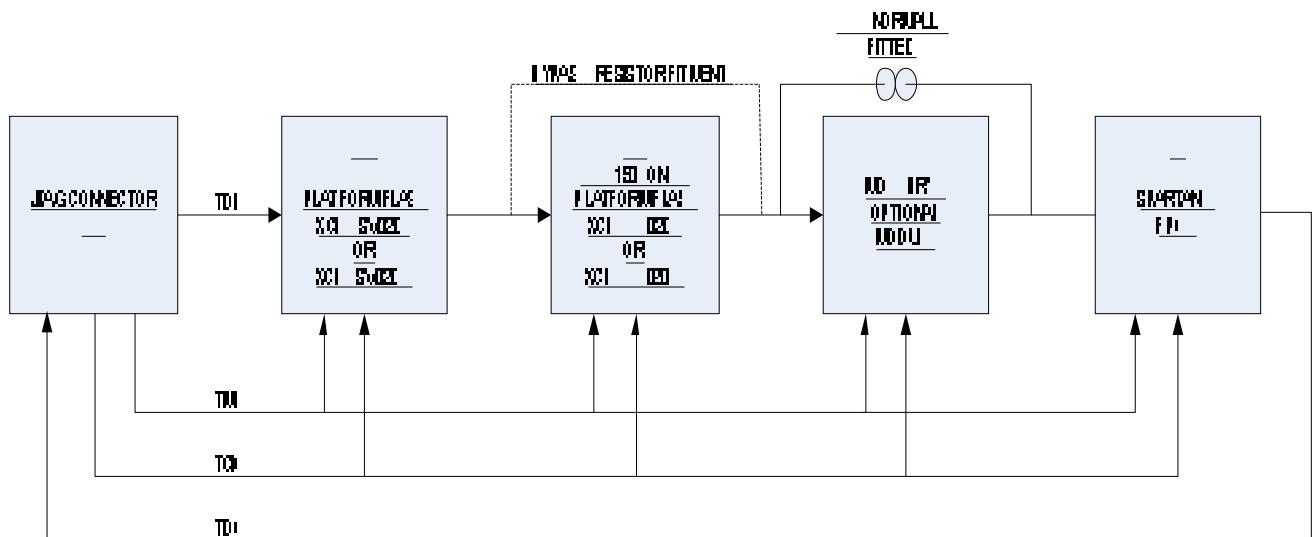
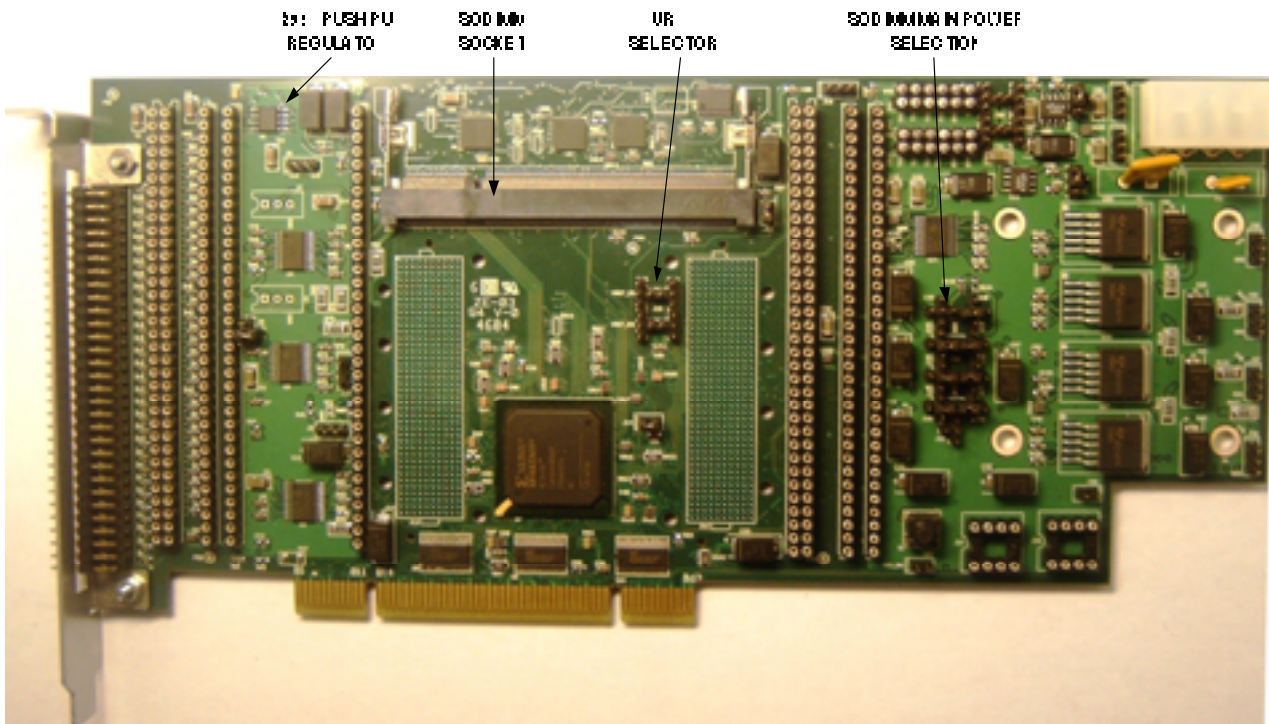


Figure 8 - FPGA JTAG Chain

If a Moel-Bryn module supporting a JTAG programmable device is fitted then jumper J14 should be removed.

Programming of the Spartan-3 FPGA can be achieved by direct JTAG programming or from the Platform Flash memory/s. By default the Spartan-3 devices is programmed from the Platform Flash memories at power up. However the default configuration mode can be altered by reprogramming the Coolrunner-II CPLDs on Broaddown2. Direct JTAG programming is volatile and the FPGA will lose its configuration every time the board power is cycled. From sustained use of FPGA design programming the design into the Platform Flash memory is recommended. Generation of suitable Platform Flash content files and control of the JTAG chain can be achieved using the XILINX ISE tool IMPACT.

## Primary Voltage Regulators



**Figure 9 - Primary Power Regulator Features**

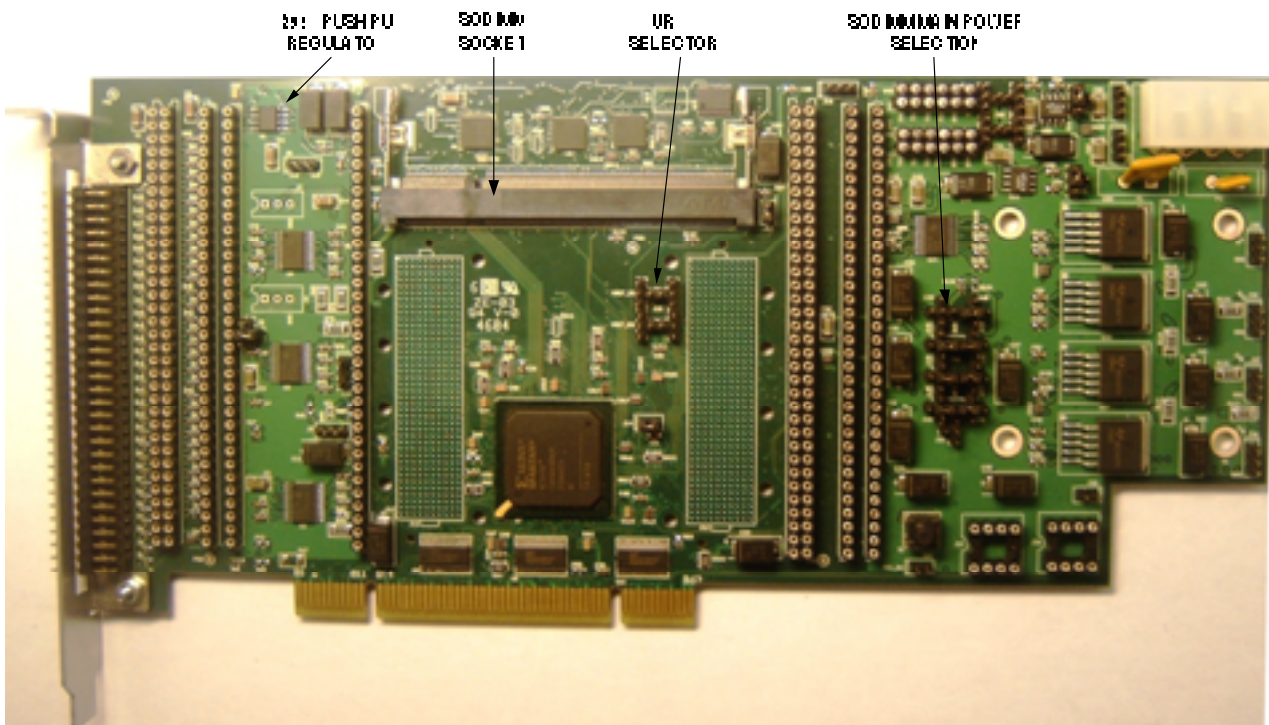
Broaddown2 has a power backbone based on four TPS75901 linear regulators. These regulators are capable of delivering 7.5 amps. The structure of these four regulators is a semi-chain so that effectively all the current taken out of the chain passes through the top regulator (4.1V) and any intermediate chain regulators. Therefore the absolute maximum current that can be delivered into Broaddown2 is limited to 7.5 amps.

The output voltages of this chain are 4.1V, 3.3V, 2.5V and 1.8V. Practically the current delivered by the regulator chain will be limited by the RGE500 reset-able fuse that is fitted on 5V input to the regulator chain. From practical experience and testing the following total current can be delivered in the primary regulators under the following cooling conditions.

Cooling	Approximate Board Input Current Limit
No Forced Cooling	3 Amps
Simple Fan Fitted To Mounts	5 Amps
Special Cooling	7.5 Amps

With the exception of the 4.1V regulator each Primary Regulator has a zero ohm resistors on input supply and on regulator output. It is possible using these resistors to break the chain to allow measurement of individual currents. These features can also be used where more complex power sequencing needs to be modelled or if a switching regulator input needs to be substituted.

## Secondary Power Regulators



**Figure 10 - Secondary Power Regulators**

Broaddown2 has a number of secondary regulators. These regulators are derived from twin regulator devices TPS70402. These regulators will deliver 1 or 2 amps depending on which section of the TPS70402 is being used. The following voltage rails are derived using these regulators.

VOLTAGE	DEVICE	CURRENT RATING	O/P SERIES RESISTOR
Vccaux (SPARTAN-3)	U2	1 AMP	NO
Vccint (SPARTAN-3)	U2	2 AMP	YES
Vccaux2 (NOT USED)	U3	1 AMP	NO
1.5V	U3	2 AMP	YES
USER1	U4	1 AMP	YES
USER2	U4	2 AMP	YES

Current measurement can be achieved by replacing a zero resistor with a low ohm sense resistor where the above table indicates a suitable resistor position.

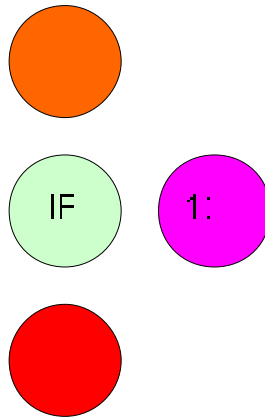
A separate TPS70402 (U14) is also fitted to Broaddown2 for the supply of the Coolrunner-II CPLDs. This device operates independently of the main and secondary regulator chains.

As these regulators are variable regulators rail voltages can be modified to suit particular voltage applications if necessary. The minimum that the TPS70402 will regulate to is 1.22V.

## **Negative Rail Generation + Selection**

Broaddown2 has 2 inverting LT1054 charge pump regulators fitted. Each regulator will deliver about 100 mA and the two outputs can be connected together to give a single 200 mA supply. The regulators are operated in simple inverting mode and do not offer much in regulation in this mode. If you need tight regulation, or low noise, you should fit a post regulator to improve these parameters.

The LT1054 regulators will deliver the approximate inverse of their input voltages. Selection headers J31 and J32 allow the selection of 12V, 5V and 3V as input voltages by jumper. Alternatively different voltages can be feed into the LT1054 by flying wire to J31/ J32 to give other voltages. The LT1054 fitted has a maximum input of 15V and a technical minimum of 3.5V. Enterpoint has found that input voltages lower than 3.5V do work in practise but operation of the LT1054 is not guaranteed at these levels. The pinout of J31 and J32 is as follows.



**Figure 11 - Negative Voltage Regulators Input Selection (J31 / J32)**

J28 header allows the selection of voltages that are to be feed to the Moel-Bryn expansion module. This header also acts as a pickup point for these supplies and users can connect their flying lead connections to this header.



## SODIMM Socket

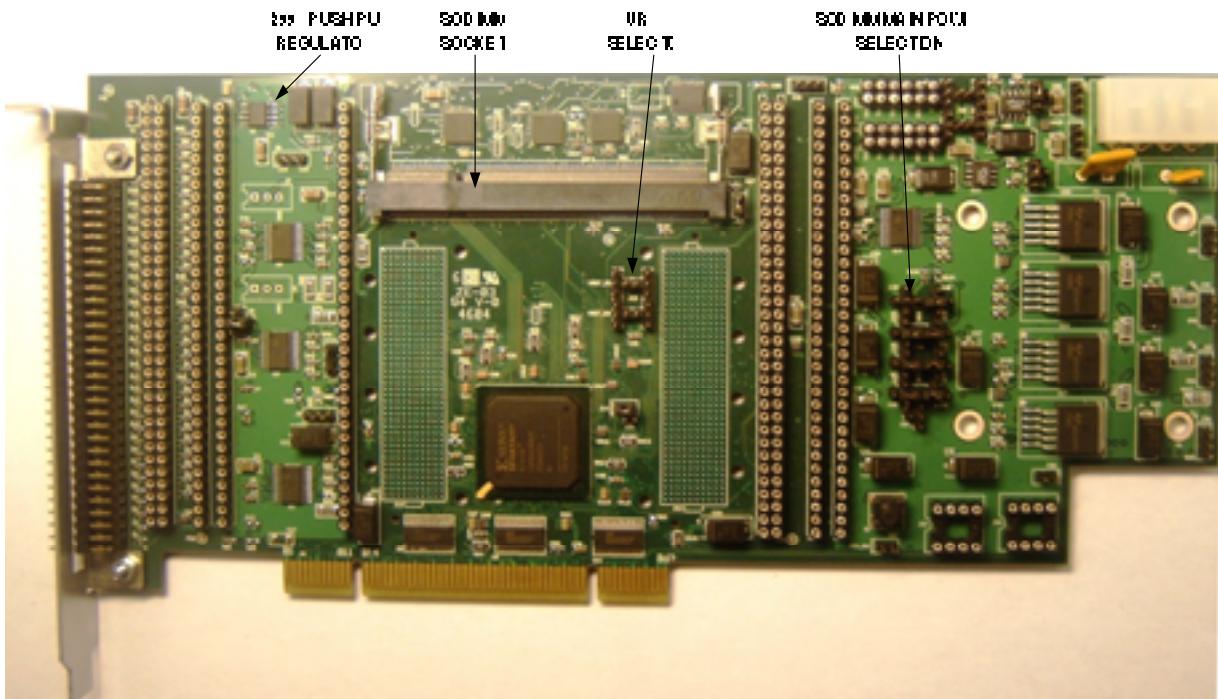


Figure 12 - SODIMM Features

**WARNING – DO NOT INSERT A DDR1 SODIMM INTO THE DDR2 SODIMM SOCKET. IT WILL SHORT OUT THE POWER SUPPLIES.**

**CURRENTLY WE ARE NOT SUPPORTING MEMORY BASED SODIMMS IN THIS SOCKET. THE DETAILS IN THIS SECTION ARE FOR YOUR INFORMATION ONLY.**

Broaddown2 has a DDR2 SODIMM socket allowing the fitting of a I/O expansion module

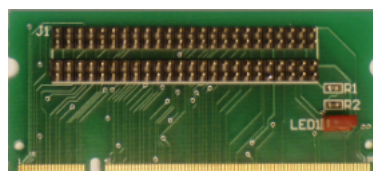


Figure 13 - SODIMM I/O Module

The SODIMM I/O Module can also be used to support loopback testing of the SODIMM Socket when used in conjunction with a suitable test build loaded into the Spartan-3 FPGA.

The SODIMM Socket is keyed and will only support DDR2 style SODIMM modules. DDR2 SODIMM module pinout is incompatible with DDR1 SODIMM pinout. Do not remove the

mechanical key to allow DDR1 modules to fit. If non-memory modules are fitted then the Socket can supply alternative voltages of 3.3V, 2.5V or 1.8V by jumper selection. Other voltages available by flying wire. Please note that the relevant Spartan-3 Bank voltages should be set appropriately for whichever voltage is used. In addition do not exceed the Spartan-3 maximum I/O voltages. A 0 to 3.3V signalling (4.05V absolute max) is the maximum normal range of signalling that Spartan-3 can tolerate.

When used for a DDR2 (currently not supported) memory function the following signal features are available:

- (1) 32 bit data (upper 32 bit not available)
- (2) A0 TO A13 address
- (3) BA0 to BA2 bank address
- (4) DM0 to DM3
- (5) CK0, CK1
- (6) CKE0, CKE1
- (7) RAS
- (8) CAS
- (9) CS0, CS1

Because the data bus has been narrowed from 64 bit to 32 bit any standard DDR2 SODIMM fitted with effectively only have half its stated capacity. Peak data rate of 200 MHz (100 MHz clock) are to be expected.

The signals of the SODIMM Socket have been connected to banks 2, 3, 4 of the Spartan-3 FPGA. To use a DDR2 module you will need to set the relevant Vccio<sub>x</sub> (bank) and Vref (reference) voltages to 1.8V and SODIMM reference voltage respectively. Track lengths between the SODIMM Socket and the Spartan-3 have been matched as closely as is practical to minimise signal skew.

SODIMM configuration prom reading is supported indirectly. It is directly wired to a Coolrunner-II CPLD U11 and can be accessed by the Spartan-3 FPGA via the CPLD Expansion Bus. This feature is not automatically enabled when you Broaddown2 is delivered and you should contact support [support@enterpoint.co.uk](mailto:support@enterpoint.co.uk) if this feature is needed.

The LP2996 regulator will provide a +/- 1.5 amp termination voltage at half the SODIMM main voltage input. J8 allows the power input voltage of the LP2996 to be set to either 2.5V or 3.3V. For DDR2 voltage levels operation the jumper should be fitted between pins 1 and 2 to select 2.5V input supply.

To select the main SODIMM voltage rail please refer to the section on Bank Voltage Selection.

## PCI Edge Connector

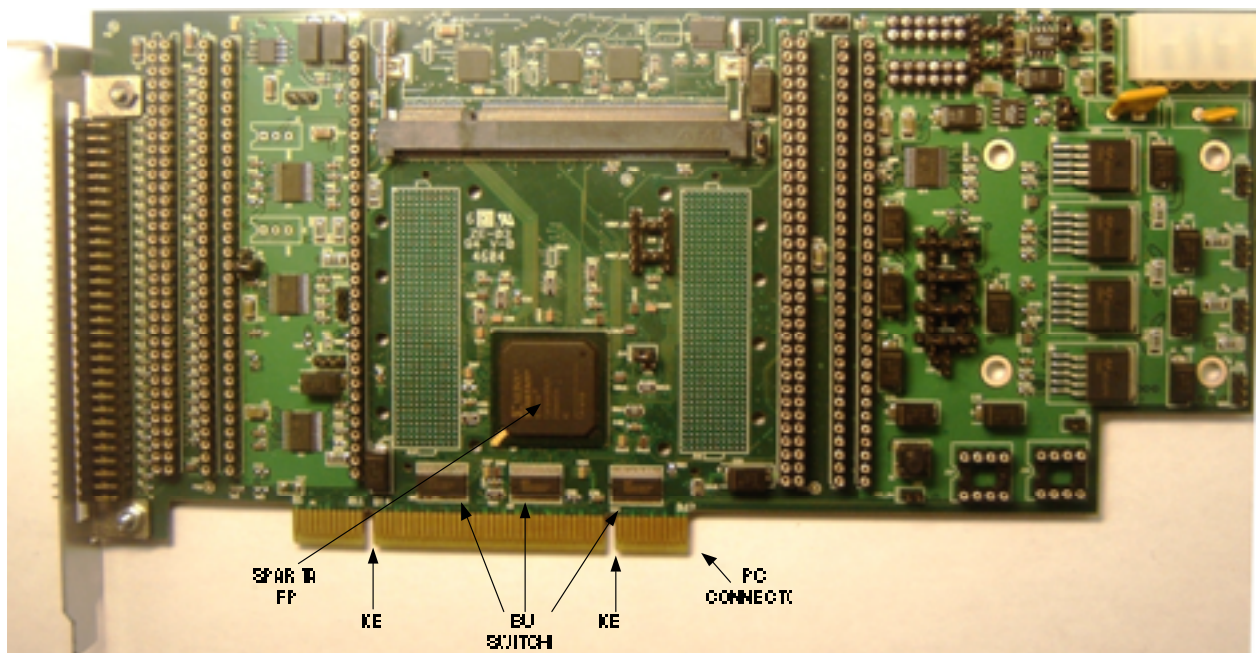


Figure 14 - Broaddown2 PCI Interface Features

**WARNING – BROADDOWN2 HAS BEEN DOUBLE KEYED TO ALLOW USE IN BOTH 3.3V AND 5V PCI SOCKETS. IT IS POSSIBLE TO PLUG BROADDOWN2 INTO THE PCI SOCKET BACKWARDS OR DISPLACED. IF A BROADDOWN2 IS INSERTED INCORRECTLY AND POWERED THE BROADDOWN2, AND HOST SYSTEM, WILL BE DAMAGED.**

**PC POWER SUPPLIES OFFER VERY LITTLE PROTECTION AND WE HAVE SEEN POWER SUPPLY LEADS MELT AND CATCH FIRE UNDER SHORT CIRCUIT CIRCUMSTANCES. TAKE EXTRA CARE TO ENSURE BROADDOWN2 IS INSERTED CORRECTLY.**

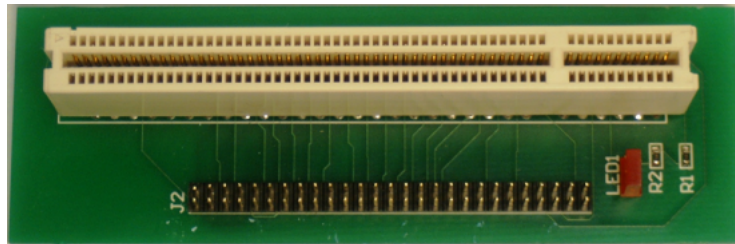
Broaddown2 has been design to work in both 3.3V and 5V PCI systems. For this interface to work as a PCI interface you will need to buy, or design, a suitable FPGA PCI logic circuit or IP core. Broaddown2 will be supplied with test builds containing a PCI IP core and other cores for your evaluation and use. We are hoping to release our own low cost Target Only PCI Core shortly.

Broaddown2 supports a 32 bit, 33 MHz, implementation of PCI.

The pinout of the Spartan-3 FPGA has been chosen such that the PCI interface follows the Xilinx PCI IP core (XC3S400-4FG456C pinout). FPGA pin numbers are available on the customer schematics. Our current test builds use the Xilinx PCI core.

The Spartan-3 FPGA has an absolute input voltage maximum of 4.05V (3.3V signalling). To allow use in 5V PCI systems we have added Bus Switch parts IDTQS32X681 between the PCI Edge Connector and the Spartan-3 FPGA. These parts limit the voltage seen by the Spartan-3 FPGA. Technically addition of these parts make the interface non-compliant with the PCI specification. However in practise this implementation of the interface has no operation issues.

If you don't want to use the PCI Edge Connector for PCI and run Broaddown2 standalone you can use the Disk Drive Power Connector to power the board. Using the optional PCI I/O Expansion Module you can use PCI interface as general I/O.

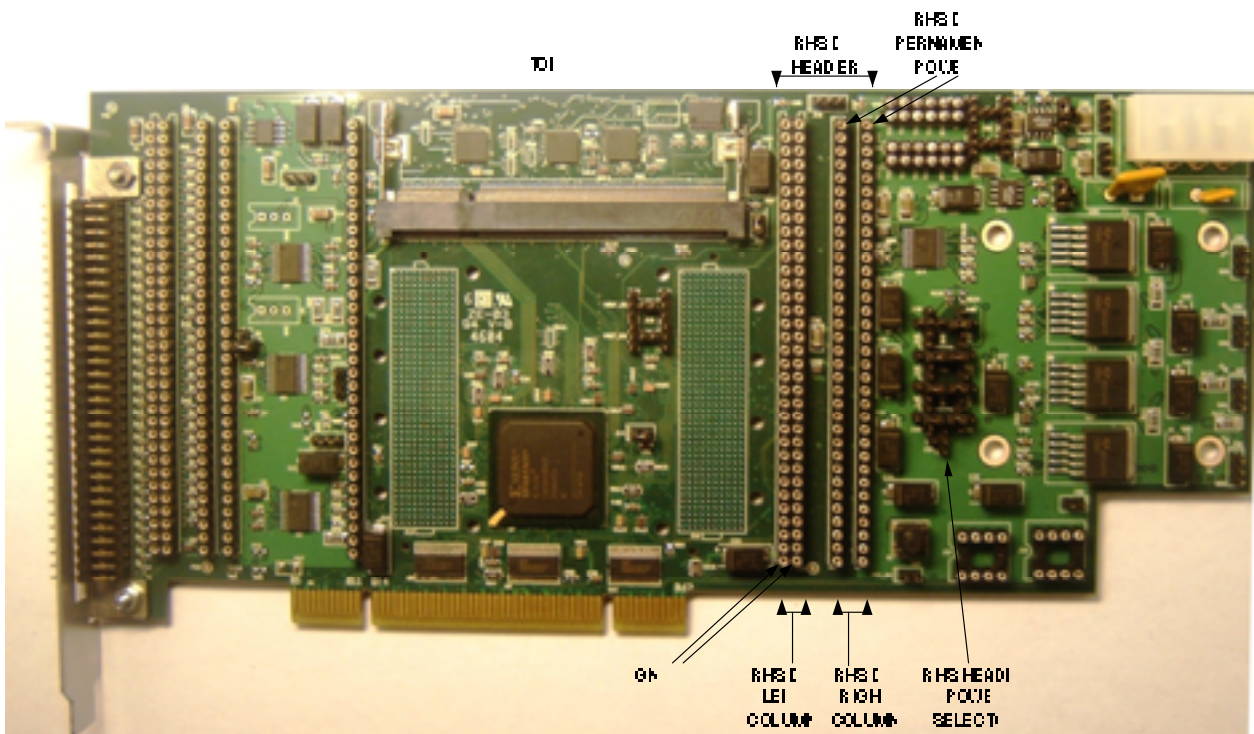


**Figure 15 - PCI I/O Expansion Module**

If you need 5V input tolerant I/O and don't need PCI then, then using this module is an easy way of achieving this. The Bus Switches on Broaddown2, fitted for 5V PCI tolerance, work as well for general 5V input signals. The timing penalty, i.e. through propagation, of the Bus Switches is approximately 250 pico-seconds.



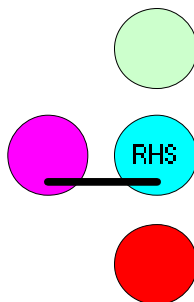
## Right Hand Side DIL Header



The RHS DIL Header provides a simple mechanical and electrical interface for add-on modules. The connectors on this header are on a 0.1 inch, 2.54 mm, pitch and allow either custom modules, stripboard or even dil style components (3.3V/2.5V only) to be fitted. The RHS DIL Header supports modules and components with horizontal lead pitches of 0.3, 0.4, and 0.6 inch pitches.

The header has a permanent positive power pin at the top position of the right column. It also has Gnd (0V) at the bottom of left column of the header. It is also possible to connect any right column to the RHS DIL Power Rail by means of solder bridges on the back of the Broaddown2. Similarly the any position on the left column can be connected to Gnd. If any of the solder bridges are made then the user should ensure that the Spartan-2 FPGA does not attempt to drive the relevant pin. Failure to do so may damage the Broaddown2.

The RHS DIL Power Rail can be selected by jumper to 3.3V, 2.5V or 1.8V. Alternatively other supplies can be connected to the selector by flying wire. It is advised that voltages outside 0 to 3.3V are not used unless special precautions are taken to protect Spartan-3 I/Os. The Spartan-3 has an absolute input voltage rating of 4.05 V. The pinout of the selection header is as follows:



In the current version of Broaddown2 only the 31 pins of this header are available as active signals connected to the Spartan-3. These active signals are located on left column positions 2 to 16 counting from bottom and on the right column positions 1 to 16 counting from bottom. The Spartan-3 pinout connections are shown in the following table as is LVDS pair support.

LEFT COLUMN			RIGHT COLUMN		
LEFT COLUMN POSITION	SPARTAN- 3 PIN		SPARTAN- 3 PIN	RHS DIL VCC	RIGHT COLUMN POSITION
1	NOT USED		VCC		1
2	NOT USED			NOT USED	2
3	NOT USED			NOT USED	3
4	NOT USED			NOT USED	4
5	NOT USED			NOT USED	5
6	NOT USED			NOT USED	6
7	NOT USED			NOT USED	7
8	NOT USED			NOT USED	8
9	NOT USED			NOT USED	9
10	NOT USED			NOT USED	10
11	NOT USED			NOT USED	11
12	NOT USED			NOT USED	12
13	NOT USED			NOT USED	13
14	NOT USED			NOT USED	14
15	SB			SB	15
16	SB			SB	16
17	SB			SB	17
18	SB			SB	18
19	GENERAL	U11	AB11	GENERAL	19
20	GENERAL	U10	V7	GENERAL	20
21	LVDS_P	V11	AA10	LVDS_P	21
22	LVDS_N	W11	AB10	LVDS_N	22
23	LVDS_P	W10	AA9	LVDS_P	23
24	LVDS_N	Y10	AB9	LVDS_N	24
25	LVDS_P	V9	AA8	LVDS_P	25
26	LVDS_N	W9	AB8	LVDS_N	26
27	LVDS_P	V8	Y6	LVDS_P	27
28	LVDS_N	W8	AA6	LVDS_N	28
29	LVDS_P	V6	AA4	LVDS_P	29
30	LVDS_N	W6	AB4	LVDS_N	30
31	LVDS_P	W5	AA3	LVDS_P	31
32	LVDS_N	Y5	Y4	LVDS_N	32
33	GENERAL	V10	U7	GENERAL	33
34	GND	GND	U6	GENERAL	34

VCC	- Power
SB	- Special Function
GENERAL	- General Spartan-3 I/O
LVDS_P	- LVDS Pair With Termination Resistor Site
LVDS_N	- LVDS Pair Without Termination Resistor Site
GND	- Gnd (0V)

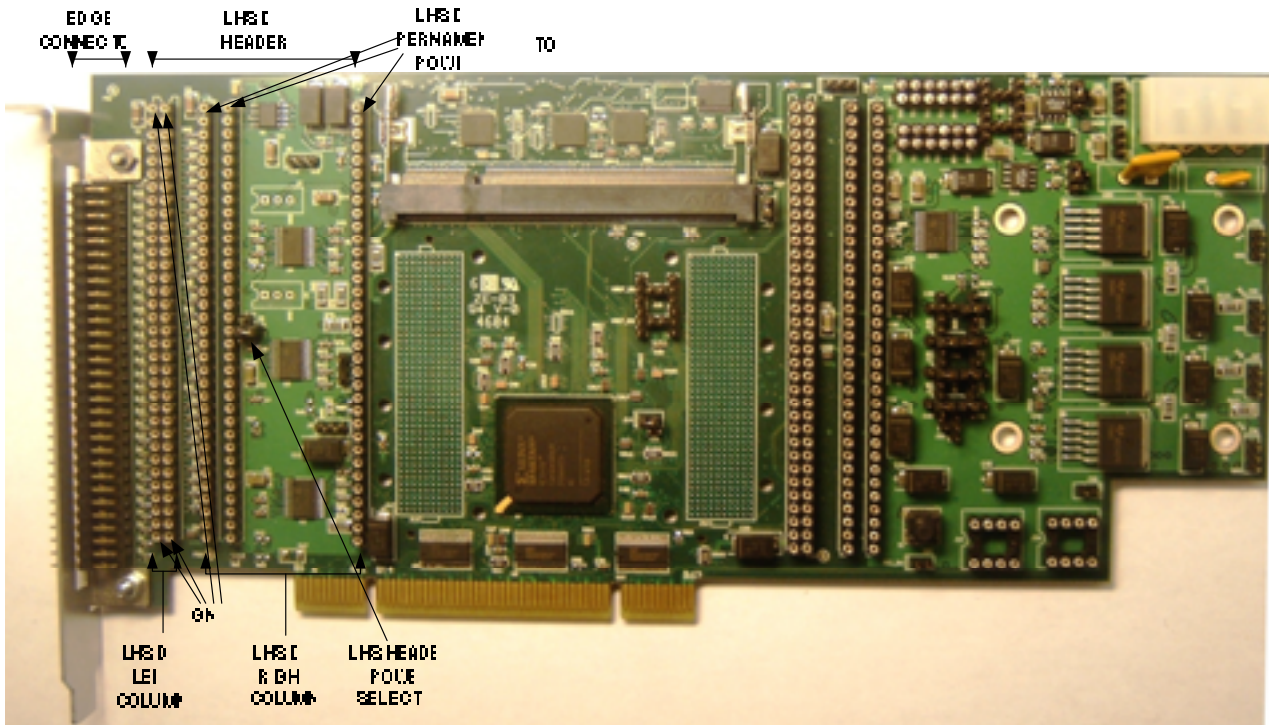
The signals marked as LVDS\_P and LVDS\_N are routed such that the trace lengths approximately match and skew is minimised within pair. Adjacent LVDS\_P and LVDS\_N form the matched pair at the RHS DIL Header and the Spartan-3 FPGA. For example V11 and W11 form one pair.

LVDS pairs marked as with terminating resistor site can be used as LVDS inputs to the Spartan-3 when the resistor is fitted. All LVDS pairs can be used as outputs from Spartan-3. The resistors are 0201 size and are located on the back of Broaddown2 underneath the Spartan-3 FPGA.

When not used as LVDS signals can be used as general I/O subject to Bank Voltage Vccio5's setting and standards mixture. All I/O in positions 19 to 34, left and right columns, connect to Bank5 of the FPGA.

Special Function pins are for advanced JTAG and Moel-Bryn programming support and their use is currently beyond the scope of this manual.

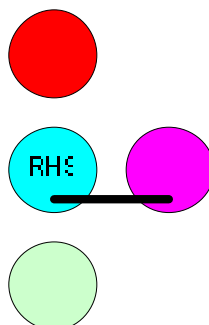
## LHS DIL Header + Card Edge Connector



The LHS DIL Header provides a simple mechanical and electrical interface for add-on modules. The connectors on this header are on a 0.1 inch, 2.54 mm, pitch and allow either custom modules, stripboard or even dil style components (3.3V/2.5V only) to be fitted. The LHS DIL Header supports modules and components with horizontal lead pitches of 0.3, 0.4, and 0.6 and 1.6 inch pitches.

The header has a permanent positive power pin at the top position of the right column. It also has Gnd (0V) at the bottom, and top, of left column of the header. It is also possible to connect any right column to the RHS DIL Power Rail by means of solder bridges on the back of the Broaddown2. Similarly the any position on the left column can be connected to Gnd. If any of the solder bridges are made then the user should ensure that the Spartan-2 FPGA does not attempt to drive the relevant pin. Failure to do so may damage the Broaddown2.

The LHS DIL Power Rail can be selected by jumper to 3.3V, 2.5V or 1.8V. Alternatively other supplies can be connected to the selector by flying wire. It is advised that voltages outside 0 to 3.3V are not used unless special precautions are taken to protect Spartan-3 I/Os. The Spartan-3 has an absolute input voltage rating of 4.05V. The pinout of the selection header is as follows:





The LHS DIL Header Spartan-3 pinout connections are shown in the following table as is LVDS pair support.

LEFT COLUMN			RIGHT COLUMN		
LEFT COLUMN POSITION	SPARTAN- 3 PIN		SPARTAN- 3 PIN		RIGHT COLUMN POSITION
1	GND	GND	VCC	LHS DIL VCC XC3S1000/1500 ONLY	1
2	GENERAL	A12	F14	GENERAL	2
3	GENERAL	A10	F17	GENERAL	3
4	GENERAL	D10	F16	GENERAL	4
5	LVDS_P	B19	E16	GENERAL	5
6	LVDS_N	A19	E13	GENERAL	6
7	LVDS_P	B18	D18	LVDS_P	7
8	LVDS_N	A18	C18	LVDS_N	8
9	LVDS_P	C17	E17	LVDS_P	9
10	LVDS_N	B17	D17	LVDS_N	10
11	LVDS_P	A15	E15	LVDS_P	11
12	LVDS_N	B15	D15	LVDS_N	12
13	LVDS_P	B14	E14	LVDS_P	13
14	LVDS_N	A14	D14	LVDS_N	14
15	LVDS_P	B13	D13	LVDS_P	15
16	LVDS_N	A13	C13	LVDS_N	16
17	LVDS_P	C12	E12	LVDS_P	17
18	LVDS_N	B12	D12	LVDS_N	18
19	LVDS_P	C11	E11	LVDS_P	19
20	LVDS_N	D11	F11	LVDS_N	20
21	LVDS_P	B10	E10	LVDS_P	21
22	LVDS_N	C10	F10	LVDS_N	22
23	LVDS_P	A9	E9	LVDS_P	23
24	LVDS_N	B9	F9	LVDS_N	24
25	LVDS_P	A8	D7	LVDS_P	25
26	LVDS_N	B8	E7	LVDS_N	26
27	LVDS_P	B6	D6	LVDS_P	27
28	LVDS_N	C6	E6	LVDS_N	28
29	LVDS_P	A5	C5	LVDS_P	29
30	LVDS_N	B5	D5	LVDS_N	30
31	GENERAL	D9	F13	GENERAL	31
32	GENERAL	C7	F12	GENERAL	32
33	GENERAL	A3	F7	GENERAL	33
34	GND	GND	F6	GENERAL	34

VCC	- Power
SB	- Special Function
GENERAL	- General Spartan-3 I/O
LVDS_P	- LVDS Pair With Terminator Resistor Site
LVDS_N	- LVDS Pair Without Terminator Resistor Site
GND	- Gnd (0V)

Most of these signals continue on to the Card Edge Connector for use there.

The Edge Connector shares the LHS DIL signal connections to the Spartan-3 and the same signalling levels apply at this connector. Signalling outside the 0V to 3.3V should not be used on this connector as it could damage the Spartan-3 which is also connected to these signals. The pinout of the Card Edge Connector follows and is a sub-set of signals on LHS DIL Header and the signals on the "A" row of the Card Edge Connector connect symmetrically to the left column of the LHS DIL Header. Similarly the "B" row connects to the right column of the LHS DIL Header.

EDGE CONNECTOR ROW A		SPARTAN-3 PIN		SPARTAN-3 PIN		EDGE CONNECTOR ROW B
1	GENERAL	A10		F17	GENERAL	1
2	GENERAL	D10		F16	GENERAL	2
3	LVDS_P	B19		E16	GENERAL	3
4	LVDS_N	A19		E13	GENERAL	4
5	LVDS_P	B18		D18	LVDS_P	5
6	LVDS_N	A18		C18	LVDS_N	6
7	LVDS_P	C17		E17	LVDS_P	7
8	LVDS_N	B17		D17	LVDS_N	8
9	LVDS_P	A15		E15	LVDS_P	9
10	LVDS_N	B15		D15	LVDS_N	10
11	LVDS_P	B14		E14	LVDS_P	11
12	LVDS_N	A14		D14	LVDS_N	12
13	LVDS_P	B13		D13	LVDS_P	13
14	LVDS_N	A13		C13	LVDS_N	14
15	LVDS_P	C12		E12	LVDS_P	15
16	LVDS_N	B12		D12	LVDS_N	16
17	LVDS_P	C11		E11	LVDS_P	17
18	LVDS_N	D11		F11	LVDS_N	18
19	LVDS_P	B10		E10	LVDS_P	19
20	LVDS_N	C10		F10	LVDS_N	20
21	LVDS_P	A9		E9	LVDS_P	21
22	LVDS_N	B9		F9	LVDS_N	22
23	LVDS_P	A8		D7	LVDS_P	23
24	LVDS_N	B8		E7	LVDS_N	24
25	LVDS_P	B6		D6	LVDS_P	25
26	LVDS_N	C6		E6	LVDS_N	26
27	LVDS_P	A5		C5	LVDS_P	27
28	LVDS_N	B5		D5	LVDS_N	28
29	GENERAL	D9		F13	GENERAL	29
30	GENERAL	C7		F12	GENERAL	30

GENERAL	- General Spartan-3 I/O
LVDS_P	- LVDS Pair With Termination Resistor Site
LVDS_N	- LVDS Pair Without Termination Resistor Site

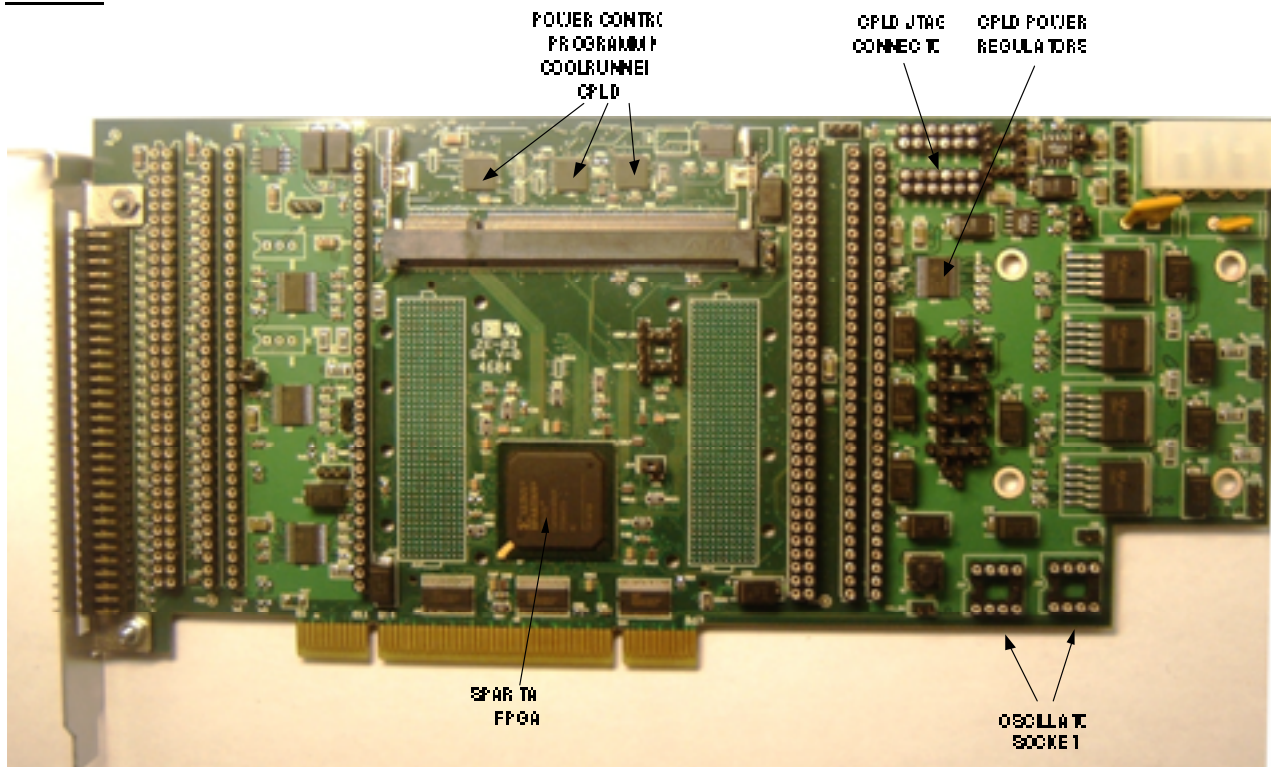
If you wish to have power and Gnd on this connector then you will need to use the solder bridges of the LHS DIL Header to make the necessary connections. Spartan-3 voltage limits apply.

The signals marked as LVDS\_P and LVDS\_N are routed such that the trace lengths approximately match and skew is minimised within pair. Adjacent LVDS\_P and LVDS\_N form the matched pair at the LHS DIL Header and the Spartan-3 FPGA. For example B19 and A19 form one pair.

LVDS pairs marked as with terminating resistor site can be used as LVDS inputs to the Spartan-3 when the resistor is fitted. All LVDS pairs can be used as outputs from Spartan-3. The resistors are 0201 size and are located on the back of Broaddown2 underneath the Spartan-3 FPGA.

When not used as LVDS signals can be used as general I/O. The I/O on this header connects to Banks 0 and 1 of the Spartan-3 FPGA. Supported I/O standards will be determined by Vccio0 or Vccio1 Bank Voltages and the Spartan-3 banking rules. Please note that the PCI clock input from the PCI Edge Connector is connected to pin B11 which is in Bank0. If this input is to operate correctly then this may limit the Bank0 Vccio0 to being 3.3V and hence may limit the standards that can be supported by Bank0 and thence on part of the Card Edge Connector and LHS DIL Header.

## FPGA



**Figure 16 - Broaddown2 FPGA**

Broaddown2 supports Spartan-3 devices in the FG456 package. Broaddown2 is normally available with commercial grade and -4 speed devices fitted in three sizes XC3S400, XC3S1000, and XC3S1500. Should you have an application that needs industrial or faster speed grades please contact sales for a quote at [boardsales@enterpoint.co.uk](mailto:boardsales@enterpoint.co.uk). Broaddown2 has two Platform Flash sites supporting XCF02 and XCF04 devices in a daisy chain configuration. These sites allow a programming capacity of between 2 and 8 Mbits. The size and number of devices fitted will depend which variant of Broaddown2 is ordered.

Simple switch "S1" is fitted as a reset. This is connected to one of the TPS70402 regulators (U14) where a de-bounced and lengthened output pulse on signal "RESET\_N" is generated. "RESET\_N" is connected to one of the Coolrunner-II CPLDs U9. If this switch is needed to control a function or reset in the Spartan-3 FPGA then please use the Expansion Bus to relay the switch status to the FPGA.

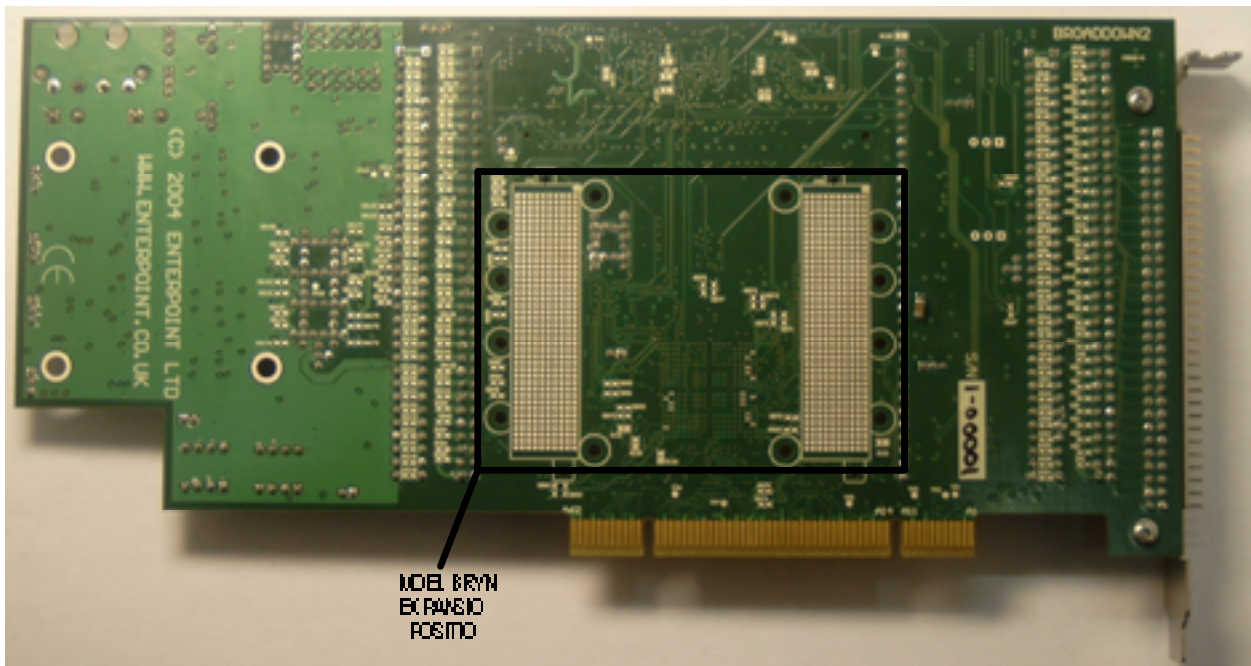
Otherwise the PCI reset signal is connected to the Spartan-3 FPGA and can be used for reset purposes.

The two oscillator sockets on Broaddown2 support 5V, 8-pin DIL outline, oscillator modules. The clock signals are routed through the Bus Switches and then connected to the CPLDs. "CLOCK1" is generated by an oscillator in socket J29 the right most socket and connects to all three CPLDs U6, U9 and U11. This clock can be used in the control of advanced programming and power control functions. Within U11 it can also be routed to either signal "CLOCK3\_P" or "CLOCK3\_N" which are connected to the Spartan-3 FPGA as clock signals. Default factory CPLD programming connects "CLOCK1" to drive "CLOCK3\_N" of the Spartan-3 FPGA (pin AA11).



"CLOCK2" is generated by the left most Oscillator Socket. It only connects to CPLD U11. From U11 it can be routed to either signal "CLOCK3\_P" or "CLOCK3\_N" which are connected to the Spartan-3 FPGA. Default factory CPLD programming connects "CLOCK2" to drive "CLOCK3\_P" of the Spartan-3 FPGA (pin Y11).

If clock with a mark/space ratio of 50:50 is desirable then implementing a divide by 2 in U11 can give an output/s on "CLOCK3\_X" approximately of the desired ration. Otherwise U11 can be used to divide down a clock or produce phased clocks if that is desirable. The Spartan-3 itself has DCMs to produce multiples, divisions and phases of clock signals. Please consult the Spartan-3 datasheet available from the Xilinx website at <http://www.xilinx.com>.



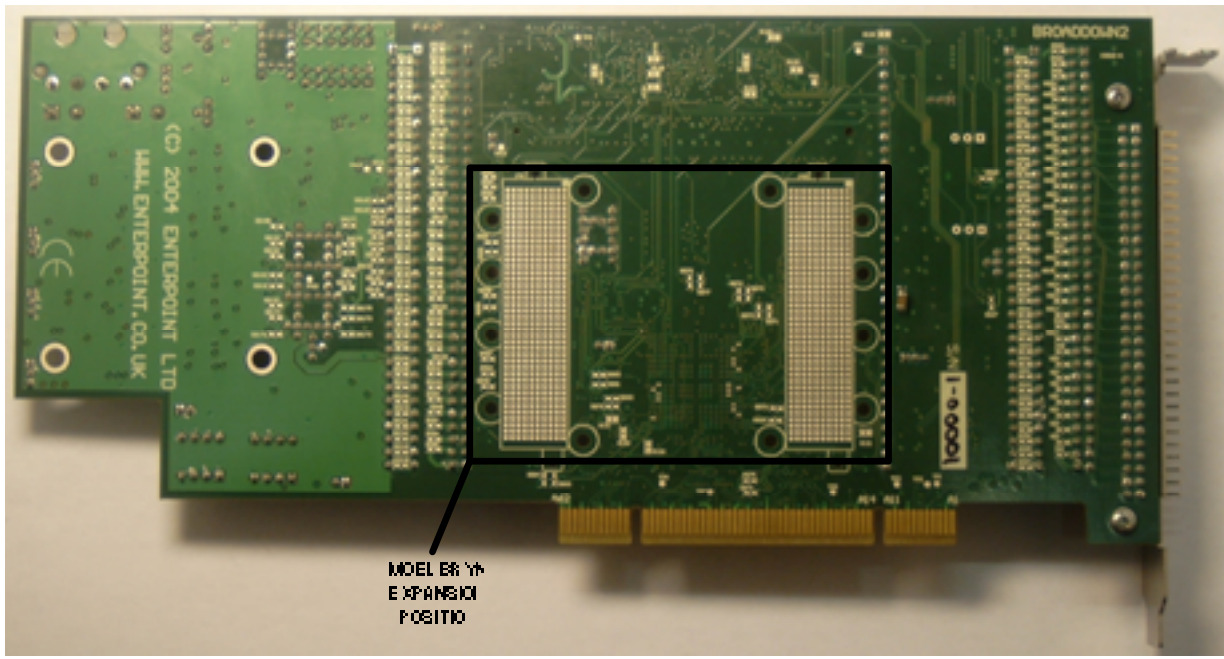
**Figure 17 - DCI Solder Bridges and LVDS Termination Resistors**

Broaddown2 supports the DCI feature of Spartan-3. DCI can be used to match signal impedances to improve signal integrity. Broaddown2 supports independent DCI functions for each bank of the Spartan-3. By default a 100 ohm resistor is connected between VRN, VRP FPGA terminals and the appropriate power rails. It is also possible to connect parallel 100 ohm resistors by solder bridge independently on each VRN or VRP branch. The effect of connecting parallel resistors is to change the effective resistance from 100 ohm to 50 ohm. Please refer to customer schematics for details of solder bridge connections.

Broaddown2 supports 17 input LVDS pairs when termination resistors are fitted. A further 20 pairs of LVDS are supported for output only on LHS and RHS DIL Headers. Other LVDS output pairs are possible via PCI Edge Connector or the SODIMM Socket if these are not being used for their primary functions.

Vref voltages are supported in Banks 2, 3 and 4. Please see the section on the Vref Header for voltage selection.

## Moel-Bryn Expansion Position



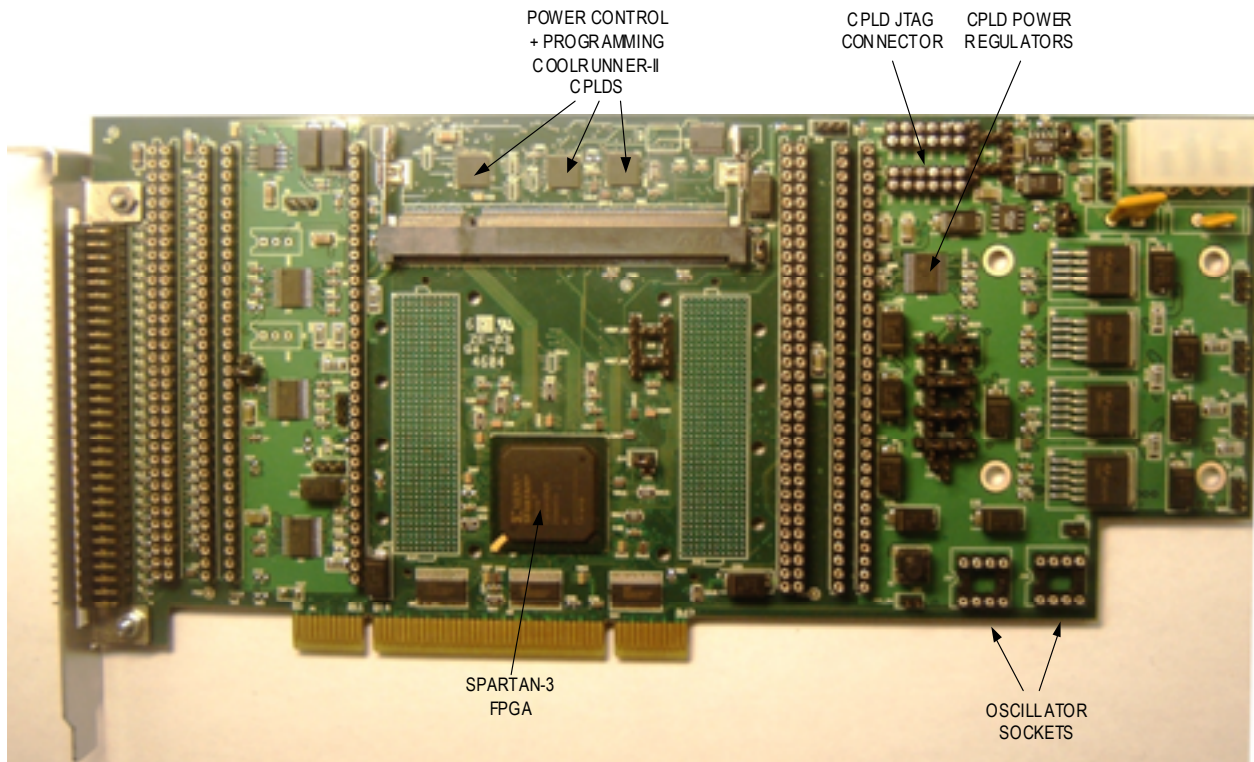
**Figure 18 - Moel Bryn Expansion**

Moel-Bryn expansion uses solder-less connectors to connect modules to the Broaddown2. Enterpoint will be releasing a series of modules shortly for this advanced expansion capability.

The details of this interface will only be released under license and may be subject to license or royalty fee.

The associate YFS connectors allow I/O expansion over the normal Broaddown2 capabilities when a Moel-Bryn Expansion Module is fitted.

## CPLDS



**Figure 19 - Broaddown2 CPLDs**

There are three Coolrunner-II XC2C32-6CP56C CPLDs fitted to Broaddown2. These CPLDs support indirect access for the Spartan-3 FPGA to the SODIMM serial prom. These devices also support advance programming features such driving the FPGA JTAG chain for reprogramming purposes. The CPLDs also support control of most of the linear regulators. Using these features either groups or individual regulators can be turned off or on. There is also support for programming and control of the Moel-Bryn Expansion Position.

To access these features the 9 bit Expansion Bus connects the Spartan-3 FPGA to each of the CPLDs. This bus may be used as a user wishes. However Enterpoint is developing a standard approach to the bus use and this will be implemented in upgrades of Broaddown2. It will also be used in future products such as Broaddown3 and Broaddown4. A future release of this manual will provide more detail of this implementation.

The CPLDs have their own power supply in the shape of a TPD70402 twin regulator package. By having regulators independent of the Main and Secondary Regulators modelling of wake-up power systems is possible. For wake up it is possible to use one of the clock inputs to the CPLDs, derived from the oscillator sockets on Broaddown2, to switch on the regulators for Spartan-3 FPGA.

## **Medical and Safety Critical Use**

Broaddown2 is not authorised for the use in, or use in the design of, medical or other safety critical systems without the express written person of the Board of Enterpoint. If such use is allowed the said use will be entirely the responsibility of the user. Enterpoint Ltd will accepts no liability for any failure or defect of the Broaddown2, or its design, when it is used in any medical or safety critical application.



## **Warranty**

Broaddown2 comes with a 90 return to base warranty. There are a number of places that Broaddown2 can be soldered by a user. We have sited these on the back of the board to avoid damage to other components when solder bridges are made. However do not attempt to solder connections if you are not competent to do so. Enterpoint reserves the right not honour a warranty if the failure is due to poor soldering technique or other maltreatment of the Broaddown2.

Outside warranty Enterpoint offers a fixed price repair or replacement service. We reserve the right not to offer this service where a Broaddown2 has been maltreated or otherwise deliberately damaged. Please contact support if need to use this service.

Other specialised warranty programs can be offered to users of multiple Enterpoint products. Please contact sales on [boardsales@enterpoint.co.uk](mailto:boardsales@enterpoint.co.uk) if you are interested in these types of warranty,

## **Support**

Enterpoint offers support during normal United Kingdom working hours 9.00am to 5.00pm. Please examine our Broaddown2 FAQ web page and the contents of this manual before raising a support query. We can be contacted as follows:

Telephone	- +44 (0) 1684 585262
Email	- <a href="mailto:support@enterpoint.co.uk">support@enterpoint.co.uk</a>