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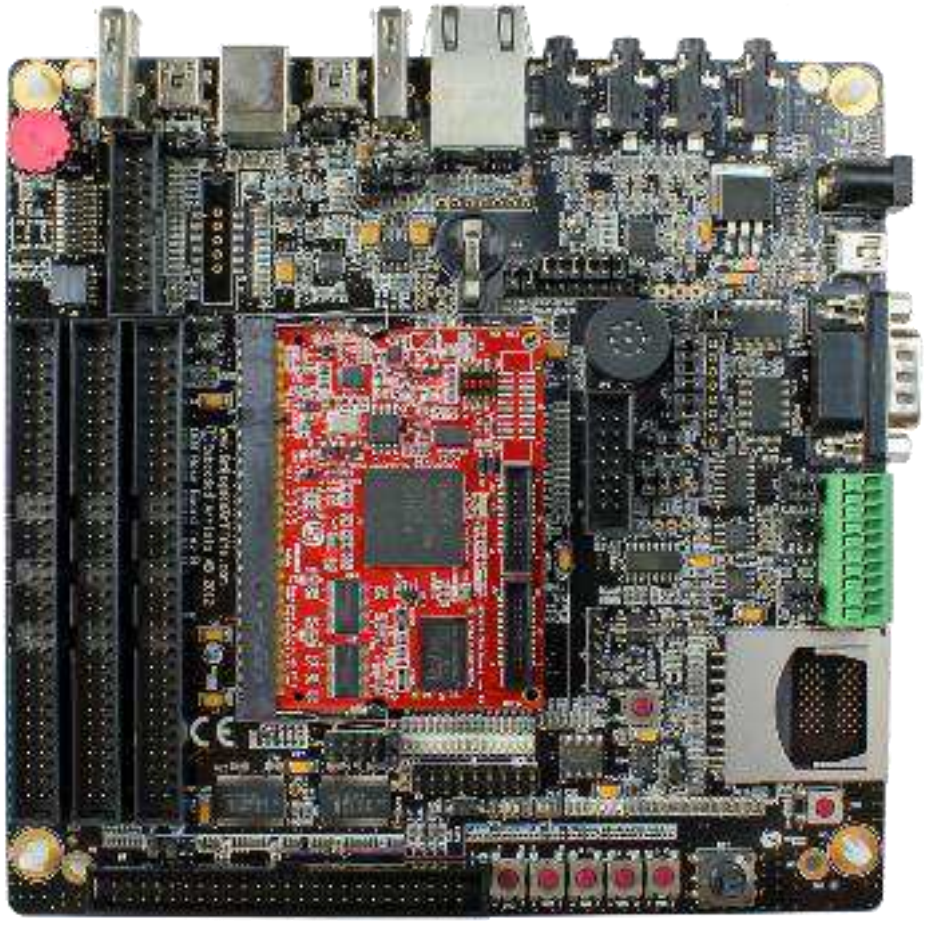
LPC4357 Developer's Kit User's Guide



Get Up-and-Running Quickly and
Start Developing Your Application On Day 1!

Embedded Artists

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Table of Contents

1 Document Revision History

Revision	*Date*	*Description*
PA1	2012-10-29	First version.
PA2	2012-12-08	Added information about ESD sensitive JTAG interface.
PA3	2013-01-21	Minor clarifications.
PA4	2013-04-08	Clarified that JP4 must be shorted (jumper installed) in order for the LPC4357 SWD/JTAG interface to function.

2 Introduction

Thank you for buying Embedded Artists' *LPC4357 Developer's Kit* based on NXP's ARM dual-core Cortex-M4/M0 LPC4357 microcontroller.

This document is a User's Guide that describes the *LPC4357 OEM Board* and the OEM *Base Board* hardware design, which together form the *LPC4357 Developer's Kit.*

2.1 Features

Embedded Artists' *LPC4357 OEM Board* lets you get up-and-running quickly. The small form factor OEM board offers many unique features that ease your learning curve and program development. The board has been designed for OEM applications with volume discount available.

- NXP's ARM dual-core Cortex-M4/M0 LPC4357 microcontroller in BGA package, with 1 MByte program FLASH and 136 KByte SRAM
- 16 MBit QSPI flash on SPIFI interface
- External FLASH memories: 128 MB NAND FLASH
- External data memory: 32 MB SDRAM (32-bit databus width)
- 12.0000 MHz crystal for maximum execution speed and standard serial bit rates, including CAN and USB requirements
- 32.768kHz RTC crystal
- 100/10M Ethernet PHY/interface based on SMSC LAN8720
- Buffered 32-bit data bus for external expansion
- 1 Kbit E2PROM with EUI-48™ number (for Ethernet MAC address)
- 200 pos expansion connector (SODIMM-200 format, 0.6mm pitch)
  - Most LPC4357 pins available (see LPC4357 OEM Board datasheet for details)
- +3.3V only powering
- Onboard reset generation
- Compact SODIMM format: 68 x 50 mm
  - Eight layer PCB design for best EMC performance, with controlled impedance and length matched routing for critical signals

There is an accompanying *OEM Base Board* that can be used for initial prototyping work. The features of the board are:

- Interfaces and Connectors
  - 200 pos, 0.6mm pitch SODIMM connector for *OEM Board*
  - LCD expansion connector with control signals for touch screen interface
  - Expansion connector with all *OEM Board* signals
  - Ethernet connector (RJ45)
  - CAN interface & connector (provision for second CAN interface, but not mounted)
  - USB1: OTG or Host interface & connector

  - USB2: Device or Host interface & connector
  - Provision for NXP JN5148 RF module (former Jennic) interface (RF module not included)
  - Full modem RS232 (cannot be fully used on 32-bit databus OEM boards)
  - RS422/485 interface & connector
  - I2S audio codec (mic in, line in, line out, headphone out)
  - SWD/JTAG connector
  - Trace connector
- Power
  - Power supply, either via USB or external +5V DC
  - Coin cell powering supported (CR1025 battery not incl.) for RTC and LED on ALARM sig.
- Other
  - *OEM Board* current measuring
  - Parallel NOR flash on external memory bus
  - 16-bit register and LEDs on external memory bus
  - 5-key joystick
  - 3-axis accelerometer (I2C connected)
  - LM75 temperature sensor (I2C connected)
  - 5 push-button keys (four via I2C and one on P2.10)
  - 9 LEDs (8 via I2C and one on P2.10)
  - Analog input
  - USB-to-serial bridge on UART #0 (FT232R) and ISP functionality
  - Reset push-button and LED
  - Speaker output on analog output from *OEM Board*, or from I2S audio codec
  - Compact size: 160x150 mm

2.2 ESD Precaution

Please note that the *LPC4357 OEM Board* and *OEM Base Board* come without any case/box and all components are exposed for finger touches – and therefore extra attention must be paid to ESD (electrostatic discharge) precaution.

Make it a habit always to first touch the metal surface of one of the USB or Ethernet connectors for a few seconds with both hands before touching any other parts of the boards. That way, you will have the same potential as the board and therefore minimize the risk for ESD.

Never touch directly on the *LPC4357 OEM Board* and in general as little as possible on the *OEM Base Board*. The push-buttons on the *OEM Base Board* have grounded shields to minimize the effect of ESD.

Note that Embedded Artists does not replace boards that have been damaged by ESD.

2.2.1 ESD sensitivity on JTAG interface

Note that the LPC4357 MCU is sensitive to ESD on the JTAG port. Observe extra care around this.

Make sure the ground of the JTAG interface is connected to the OEM Base Board ground before even connecting the JTAG interface. Never have the OEM Board unpowered while the JTAG pod is powered.

2.3 General Handling Care

Handle the *LPC4357 OEM Board* and *OEM Base Board* with care. The boards are not mounted in a protective case/box and are not designed for rough physical handling. Connectors can wear out after excessive use. The *OEM Base Board* is designed for prototyping use, and not for integration into an end-product.

For boards with LCD, do not exercise excessive pressure on the LCD glass area. That will damage the display. Also, do not apply pressure on the flex cables connecting the LCD/touch screen. These are relatively sensitive and can be damaged if too much pressure is applied to them.

Note that Embedded Artists does not replace boards where the LCD has been improperly handled.

2.4 Code Read Protection

The LPC4357 has a Code Read Protection function (specifically CRP3, see datasheet for details) that, if enabled, will make the LPC4357 impossible to reprogram (unless the user program has implemented such functionality).

Note that Embedded Artists does not replace LPC4357 OEM boards where the LPC4357 has CRP3 enabled. It's the user's responsibility to not invoke this mode by accident.

2.5 CE Assessment

The *LPC4357 Developers Kit* (consisting of the *LPC4357 OEM Board* and *OEM Base Board*) is CE marked. See separate *CE Declaration of Conformity* document.

The *LPC4357 Developers Kit* is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

EMC emission test has been performed on the *LPC4357 Developers Kit*. Standard interfaces like Ethernet, USB, serial have been in use. General expansion connectors where internal signals are made available (for example processor pins) have been left unconnected. Connecting other devices to the product via the general expansion connectors may alter EMC emission. It is the user's responsibility to make sure EMC emission limits are not exceeded when connecting other devices to the general expansion connectors of the *LPC4357 Developers Kit*.

Due to the nature of the *LPC4357 Developers Kit* – an evaluation board not for integration into an end-product – fast transient immunity tests and conducted radio-frequency immunity tests have not been executed. Externally connected cables are assumed to be less than 3 meters. The general expansion connectors where internal signals are made available do not have any other ESD protection than from the chip themselves. Observe ESD precaution.

Note that the *LPC4357 OEM* board is classified as a component and is hence not CE marked separately. It can perform different functions in different integrations and it does not have a direct function. It is therefore not in the scope of the CE Directive. An end product, where an *OEM Board* is integration into, is however very likely to need CE marking.

2.6 Other Products from Embedded Artists

Embedded Artists have a broad range of LPC1000/2000/3000/4000 based boards that are very low cost and developed for prototyping / development as well as for OEM applications. Modifications for OEM applications can be done easily, even for modest production volumes. Contact Embedded Artists for further information about design and production services.

2.6.1 Design and Production Services

Embedded Artists provide design services for custom designs, either completely new or modification to existing boards. Specific peripherals and I/O can be added easily to different designs, for example, communication interfaces, specific analog or digital I/O, and power supplies. Embedded Artists has a broad, and long, experience in designing industrial electronics in general and with NXP's LPC1000/2000/3000/4000 microcontroller families in specific. Our competence also includes wireless and wired communication for embedded systems. For example IEEE802.11b/g (WLAN), Bluetooth™, ZigBee™, ISM RF, Ethernet, CAN, RS485, and Fieldbuses.

2.6.2 OEM / Education / QuickStart Boards and Kits

Visit Embedded Artists' home page, www.EmbeddedArtists.com, for information about other *OEM* / *Education* / *QuickStart* boards / kits or contact your local distributor.

3 LPC4357 OEM Board Design

Please read the *LPC4357 OEM Board* datasheet and associated schematic for information about the board. Some additional information about the *LPC4357 OEM Board* is presented below.

3.1 Memory Layout

The external memory controller on the LPC4357 defines eight memory regions. See table below for details about usage.

Name	***Control signal***	***Address range***	***Memories on LPC4357 OEM Board***	***External memory bus comment***
Static memory #0	CS0	0x1C00 0000 – 0x1CFF FFFF		Available for external use. *OEM Base Board* can connect a parallel NOR flash to this chip select.
Static memory #1	CS1	0x1D00 0000 – 0x1DFF FFFF	NAND FLASH (1 GBit = 128 MByte in size)	Not available for external use. It is however possible to disable NAND flash chip by removing R25 on *LPC4357 OEM Board*.
Static memory #2	CS2	0x1E00 0000 – 0x1EFF FFFF		Available for external use. *OEM Base Board* can connect a 16-bit parallel register to this chip select.
Static memory #3	CS3	0x1F00 0000 – 0x1FFF FFFF		Available for external use.
Dynamic memory #0	DYCS0	0x2800 0000 – 0x2FFF FFFF	SDRAM (256 MBit = 32 MByte in size)	Cannot be accessed on external memory bus.
Dynamic memory #1	DYCS1	0x3000 0000 – 0x3FFF FFFF		Cannot be accessed on external memory bus.

As seen in the table above, it is only the static memory regions that are available on the external memory bus from the *LPC4357 OEM Board*. The data bus buffers on the *LPC4357 OEM Board* are controlled automatically and only enabled when a static memory region is accessed. The address and control bus buffers are always enabled.

Note that the BLS0, BLS1, BLS2 and BLS3 pins must be initialize for these functionalities. Else the buffer control will not work correctly.

3.1.1 NAND Flash

Note that the NAND flash is connected after the memory bus buffers, i.e., on the same side as the LPC4357 OEM Board expansion signals. This is to allow flexibility in NAND flash usage and reduce loading on memory bus that is directly connected to the SDRAM.

The NAND FLASH has an optional busy output that can be used for controlling the erase/program operations with better precision. The signal is available on the expansion connector. If needed, the signal can be routed to a suitable (i.e., free) input pin. The *OEM Base Board* can connect the signal to GPIO72 by inserting a jumper between pin 3-4 on JP2. The busy status of the chip is also available under software control.

3.2 SPIFI

There is a 16 MBit QSPI flash connected to the SPIFI interface of the LPC4357. This memory region is available in the following address region: 0x1400 0000 – 0x1800 0000.

3.3 Bootloader Mode Setting

There are several boot modes for the LPC4357 microcontroller. For details, read the LPC4357 User's manual. The LPC4357 OEM board has four sliders switches, JP1, where the boot mode can bet set. Note that there are situations where the slider switch settings do not affect boot more. Read the LPC4357 User's manual for details about this, but in general the slider settings will be used to determine the boot mode when P2_7 is pulled low during reset. This is accomplished by pulling pin ISP_EN low, which in turn is accomplished by pressing SW6 on the OEM base board during reset. If signal P2_7 is high during reset the LPC4357 boos from internal FLASH by default.

Schematic page 2 of the LPC4357 OEM board contains a list of the boot modes and associated slider settings for JP1.

LED3 on the LPC4357 OEM board is connected to signal P1_1-A6-BS0, and is used by the microcontroller to signal possible errors during booting. LED3 will flash with a 1 Hz rate for 60 seconds if the boot process fails. After 60 seconds, the device is reset.

Slider switch JP1 is found on the top side of the LPC4357 OEM board, in the upper left corner.

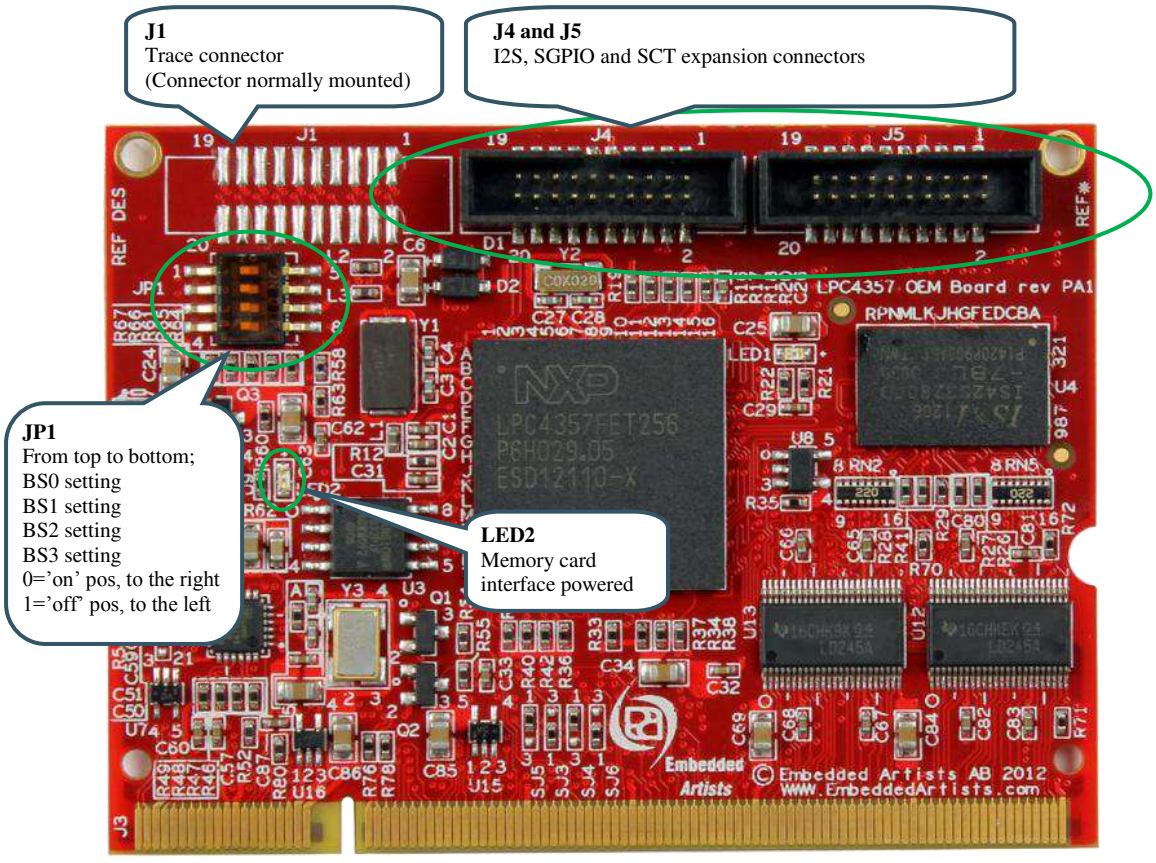

Figure 1 – LPC4357 OEM Board Picture, top side

3.4 Trace Connector

There is a connector on the top side of the LPC4357 OEM board, carrying all signals needed for debugging with trace. It is a standard 20 pos (50 mil pitch) trace connector as defined by ARM. Figure 1 illustrates where J1 is located on the board.

There is a trace connector on the OEM Base Board also, but this shall not be used for trace on the LPC4357. It was not possible to get compatible pinning with other OEM boards. Instead J1 was added to the design to support trace. Debugging without trace can be done either via J1 (on the LPC4357 OEM board) or the 10 pos debug connector (J7) on the OEM Base Board.

3.5 I2S and SGPIO Connectors

There are two 20-pos, 50 mil pitch connectors on the top side of the LPC4357 OEM board. See Figure 1 for location. These connectors carry selected I2S, I2C, SGPIO and SCT signals and can be used to connect these signals to a separate expansion boards. For example an audio and video expansion board. Note that some of the signals can be used on the OEM base board. Before using the signals, always check for possible contentions.

3.6 uSD Memory Card Interface

There is a uSD/transflash memory card interface connector, J2, on the bottom side of the board. See Figure 2 . LED2, on the top side, lights when the interface is powered. See Figure 1to locate LED2.

The signals on the SODIMM edge connector that are normally allocated for memory card interface (on other OEM boards) carry other signals on the LPC4357 OEM board that have no relation to the memory card interface.

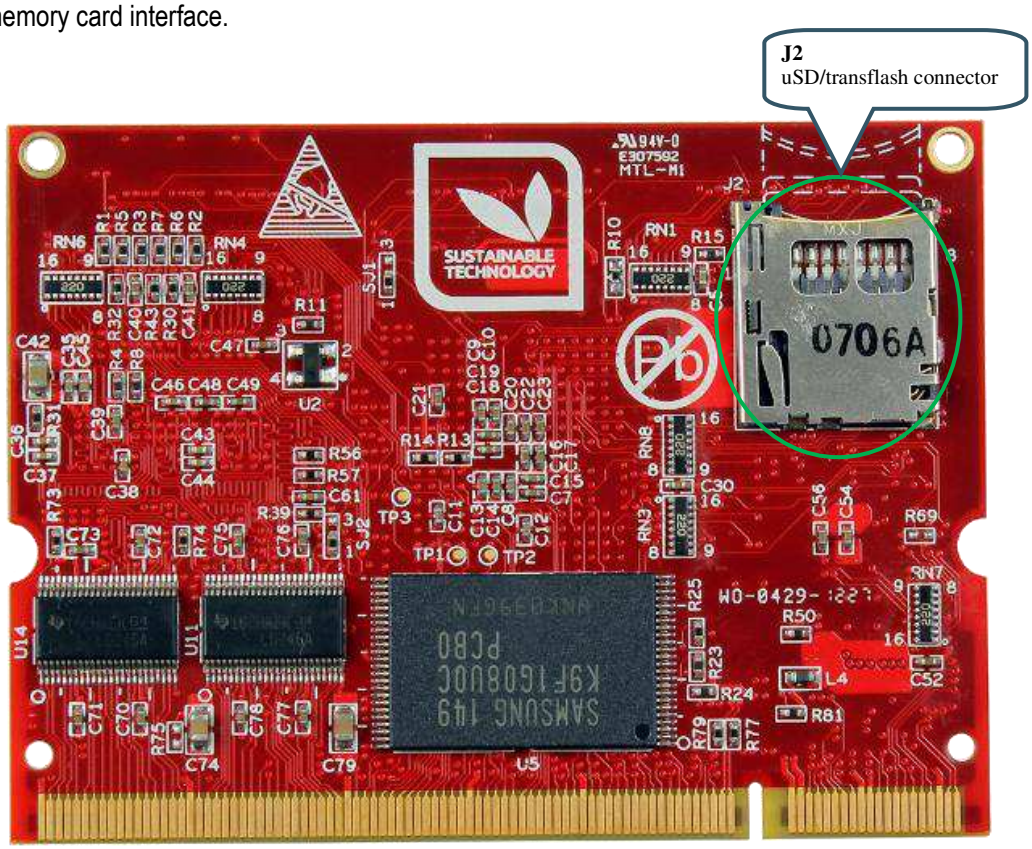

Figure 2 – LPC4357 OEM Board Picture, bottom side

3.7 Board Options

The schematic for the *LPC4357 OEM Board* show some different mounting options, mainly via SJx jumpers but also some resistors that are not mounted per default. The design has been prepared for customized versions for different needs.

3.8 1 kBit I2C E2PROM with EUI-48™ Number

The *LPC4357 OEM Board* contains a small E2PROM, 24AA02E48 from Microchip that can be accessed via I2C. The chip contains a globally unique 48-bit number (EUI-48™) that can be used as Ethernet MAC address. See the 24AA02E48 datasheet for details.

4 OEM Base Board Design

This chapter contains information about the peripherals and general design of the *OEM Base Board* and how to set the different jumpers on the board. The schematic can be downloaded in pdf format from the support page, and is recommended to have printed out while reading this chapter.

Section naming begins with *SPx*, which is short for *Schematic Page x*.

The picture below gives an overview of the *OEM Base Board* design.

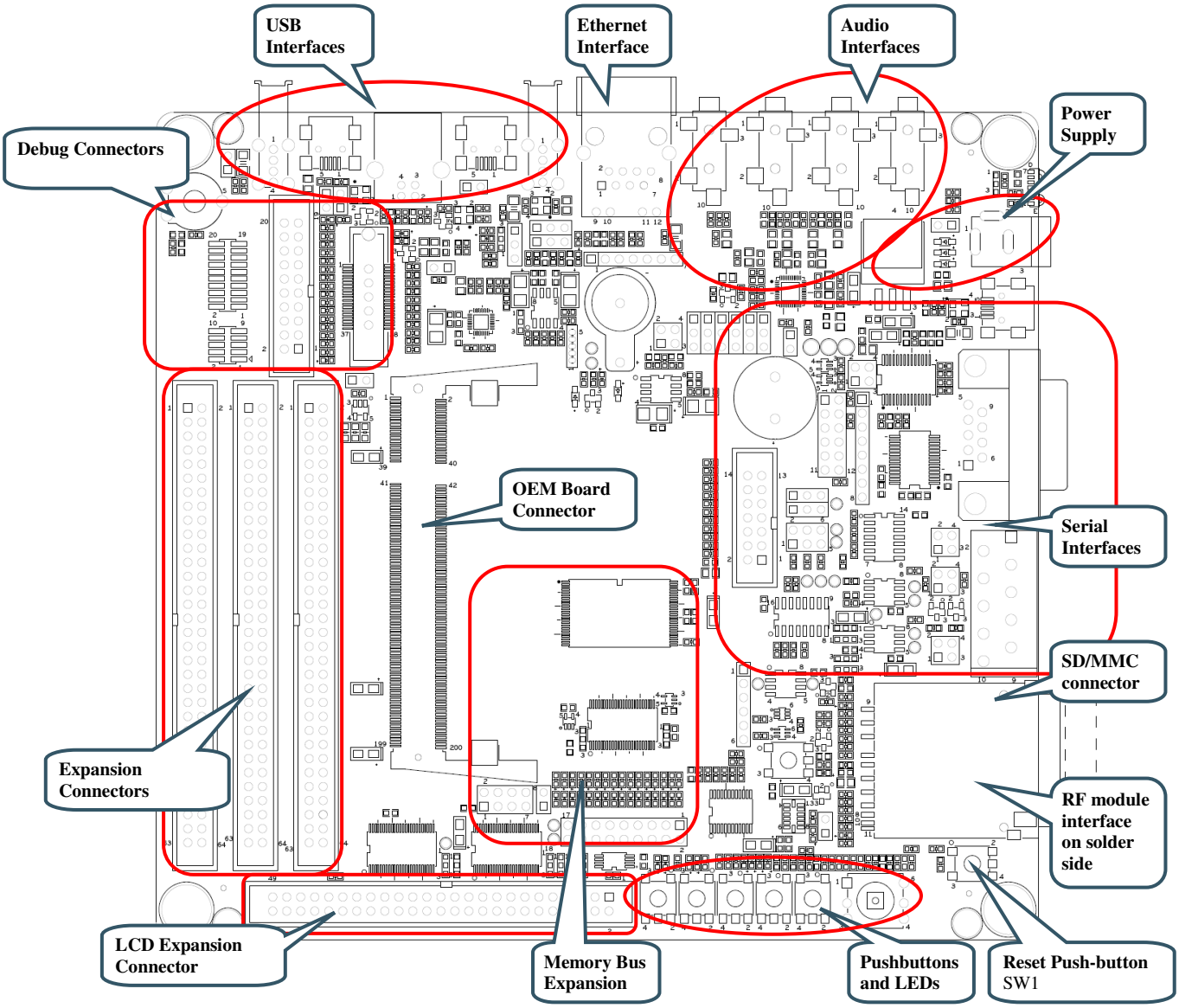

Figure 3 – OEM Base Board Overview

4.1 Modifications to OEM Base Board

The *OEM Base Board* has been designed to be flexible. Most options can be controlled via jumpers but some options might need soldering. Note that modifications to the board are done at own risk and void all warranties.

4.2 SP2: OEM Board Connector

The LPC4357 OEM board connector is a standard DDR2 SO-DIMM socket with 200 positions and 0.6mm pitch. It has 1.8V keying (which is what DDR2 stands for). The JEDEC standard defining the DDR2 SODIMM boards is called JEDEC MO-224.

The signal names are general and represent the OEM base board functionality, rather than the LPC4357 signal names. This is because the OEM base board also supports other OEM boards.

4.3 SP2: Current Measurements

It is possible to accurately measure current consumption of the LPC4357 OEM board. This can be very valuable when working with applications that make use of the low power modes of the LPC4357 processors. The circuit is based on the chip ZXCT1010 from Diodes/Zetex. This chip generates a voltage output proportional to the current through R2. This voltage can be measured over J2. 100mA gives a 500mV output voltage, or expressed differently, 1mV correspond to 0.2mA

It is possible to remove R1, R2 and/or R3 for measuring current with an external multimeter. Note that VCC_MAIN and VCC_BUFFERS are connected on the LPC4357 OEM board so there is no difference between these supplies. This division has been done for compatibility with other OEM boards.

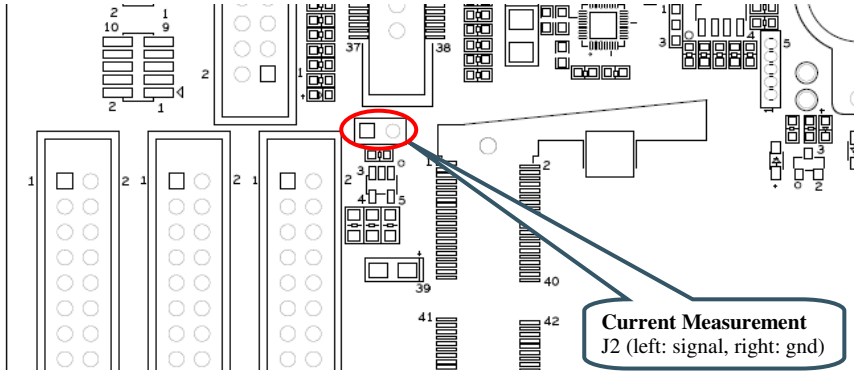

Figure 4 – Current Measurement J2

4.4 SP3: Expansion Connectors

All relevant OEM board signals are available for external use via three 64 pos IDC expansion connectors; J3, J4 and J5. The expansion connectors are close to the SO-DIMM connectors to minimize signal distortion.

Note that some OEM board circuits may need to be disconnected before externally used. Carefully investigate the need for this before using a signal for external expansion.

Note that J4 has gathered all needed signals for expanding the memory bus (16-bit bus expansion). J4 is the expansion connector closest to the board edge. For 32-bit memory bus expansion, J3 is also needed (for the upper 16 bits of the databus).

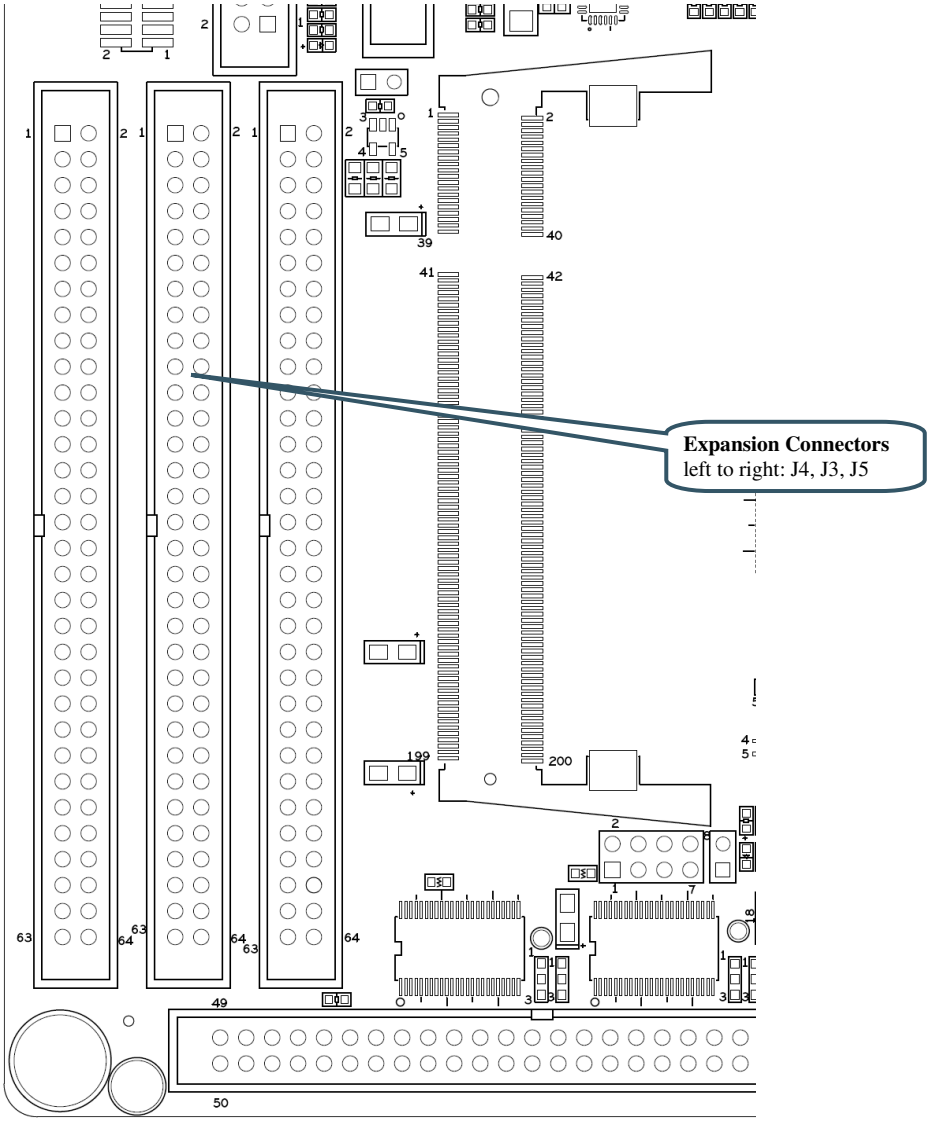

Figure 5 – Expansion Connectors J3, J4, J5

4.5 SP4: External Memory Bus

This part of the OEM Base Board demonstrates how the external memory bus can be used for expansion of custom circuits. Two different devices are connected to the memory bus; a 16-bit parallel NOR flash and a 16-bit register.

In order to be universal between 16- and 32-bit databus width OEM Boards, only the lower 16 bits are connected.

The 16-bit parallel NOR flash is enabled when JP1 is inserted, see picture below for guidance where to find JP1 on the OEM Base Board. Note that the signal name is cryptic since the OEM Base Board is compatible with many different OEM Board. For the LPC4357 OEM Board, the signal BCSY is actually signal BCS0. This means that the NOR flash is accessible in memory region: 0x1C00 0000 - 0x1CFF FFFF.

Also, a 16-bit register is connected to the external memory bus. The 16 bits in the register directly drives 16 LEDs (a high signal light a LED). The signals are also available on an expansion connector (J6). It can for example connect to a logic analyzer, for high-bandwidth logging. The upper and lower 8 bits are individually writeable. Signals BBLS0/BBLS1 controls the lower and upper 8 bits, respectively. Since the OEM Base Board is universal and supports many different OEM Boards, the chip select signal is either signal BCSX or GPIO69. For the LPC4357 OEM Board, the signal BCSX is actually

signal BCS2. This means that the register is accessible in memory region: 0x1E00 0000 - 0x1EFF FFFF. No jumper in JP2 is needed when working with the LPC4357 OEM Board.

SJ12 shall be in default position (pad 1-2 shorted) to let BCS2 control chip select of the 16-bit register.

SJ1 controls the output enable of the register. By default it is grounded (pad 1-2 is shorted) and hence the register drives the LEDs and expansion connector, J6.

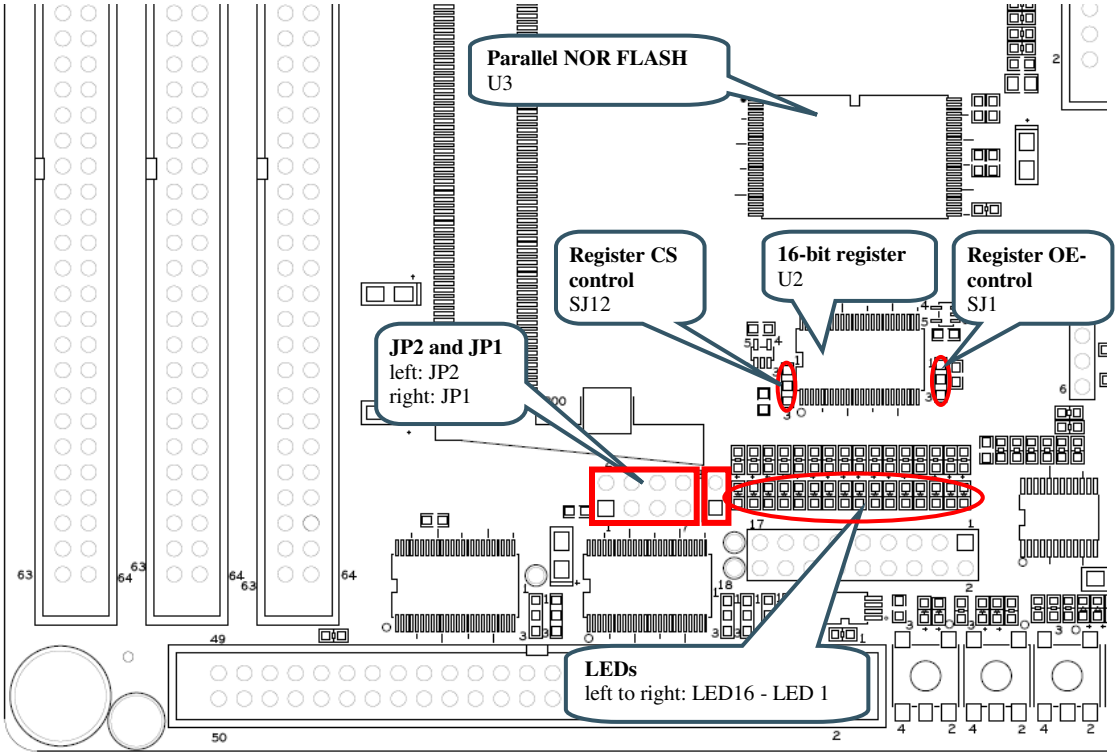

Figure 6 – External Memory Bus Circuit

4.6 SP5: Debug Interfaces

Note that the LPC4357 MCU is sensitive to ESD on the JTAG port. Observe extra care around this.

Make sure the ground of the JTAG interface is connected to the OEM Base Board ground before even connecting the JTAG interface. Never have the OEM Board unpowered while the JTAG pod is powered.

The multiple debug interfaces can look complex, but that is just because the board supports many different OEM Boards. The connectors are:

- J7 – this is the new and smaller footprint standard ARM debug connector. It has 2x5 pins in 50 mil pitch. The connector supports both the SWD and JTAG interfaces. Note that not all, and in particular older, JTAG debug probes do not support the SWD interface standard. Note where pin 1 is found (see picture below) for this connector.
- J8 – this is the old and big footprint standard ARM debug connector. It has 2x10 pins in 100 mil pitch. The connector supports both the SWD and JTAG interfaces. Note that not all, and in particular older, JTAG debug probes do not support the SWD interface.
- J9 – this is the old and big footprint 38 pin Mictor connector for ETM trace for the LPC2478. This connector is not mounted. It is not used when working with the LPC4357 OEM board. The connector can be soldered to the board if needed. The connector can be bought from

Tyco Electronics Amp and is a 38-way receptacle Mictor connector, 0.025" pitch, part number: 767054-1 or 2-5767004-2 (RoHS compliant).

- J10 – this is the new and smaller footprint standard ARM Cortex-M3/M4 connector for trace. It carries the trace signals as well as the debug signals found on J7. **Note that this connector is not used when working with the LPC4357. Instead a 20 pos trace connector, J1, exists on the LPC4357 OEM board itself.**

When working with the LPC4357 OEM Board, J7 is typically used. If an older and big footprint JTAG debug pod is used, J8 can alternatively be used.

If trace is also used, use the connector J1 on the LPC4357 OEM board. Note that this requires an advanced JTAG probe that supports trace.

Note that JP4 shall be shorted in order to enable the JTAG/SWD interface on the LPC4357. JP4 might not be inserted by default on the OEM Base Board.

JP3 is not used for debug purposes when working with the LPC4357 OEM Board.

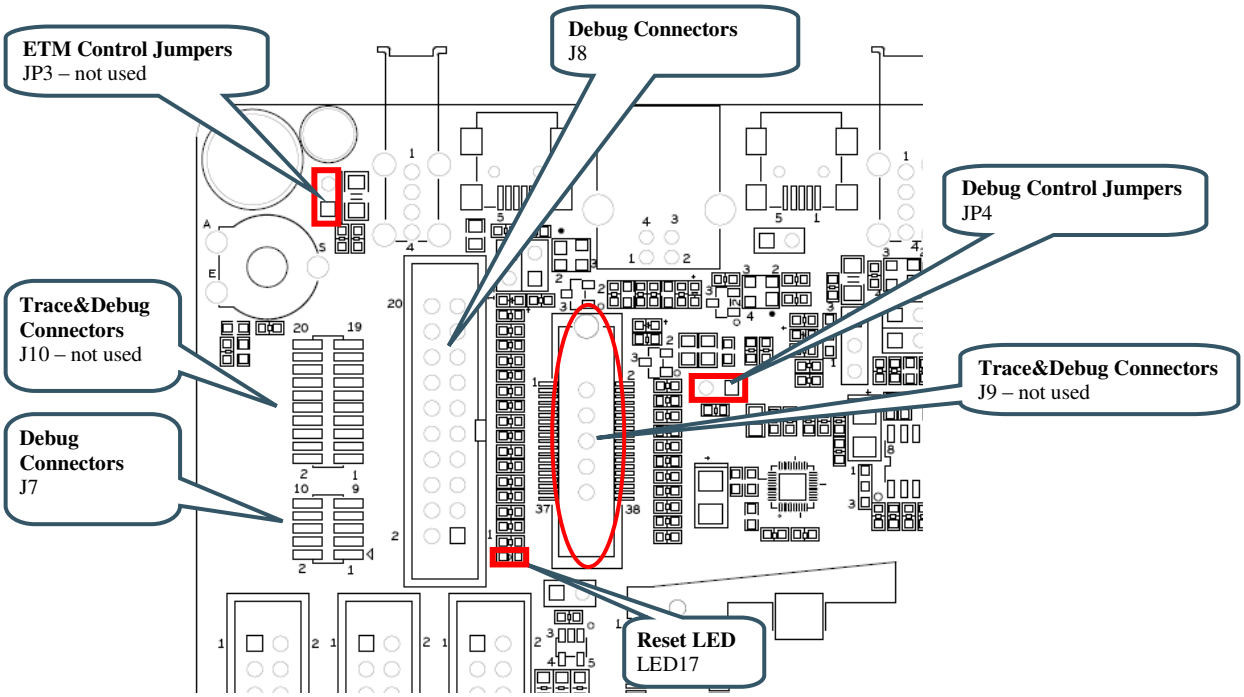

Figure 7 – Debug Interfaces

4.7 SP6: Ethernet Interface

The board has an Ethernet interface, J11, which is a RJ45 connector with integrated magnetics. There is also provision on the board for connecting a PoE interface. All signals can be accessed via expansion pads, J12. Five 0 ohm resistors have to be removed in that case for isolating J11 from the new connector (this is because J11 is not capable of handling a PoE interface so a new RJ45 connector must added). See picture below for where to find the relevant components on the board.

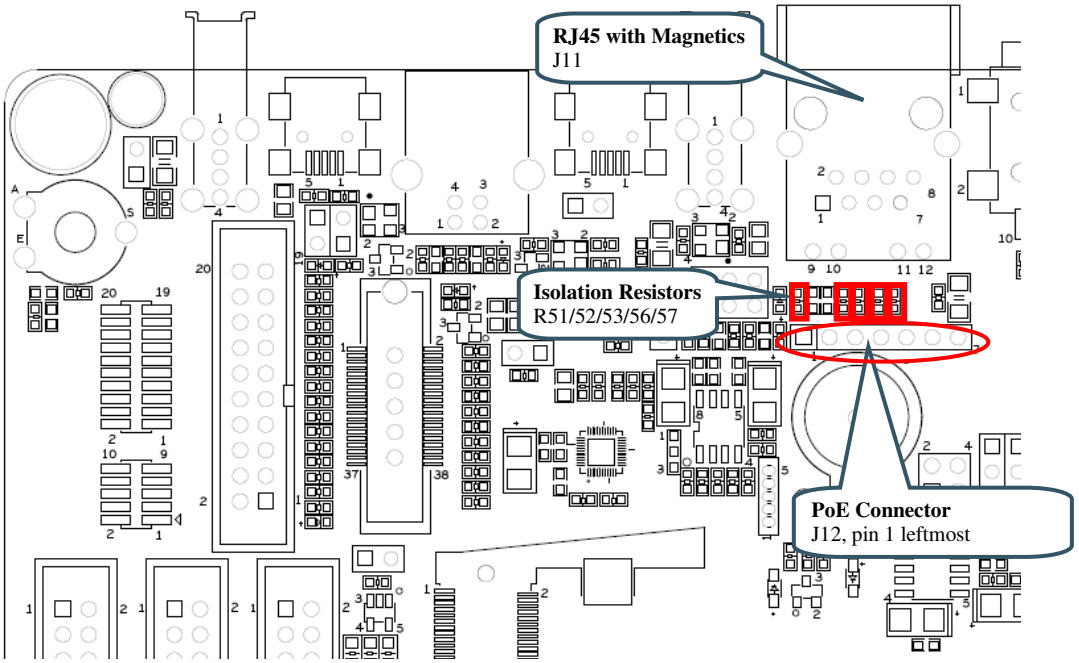

Figure 8 – Debug Interfaces

PoE modules that can be used for testing can for example be found at http://www.silvertel.com/poe_products.htm. Select a version delivering +5V with enough current capability for the specific application in mind. For example, using USB Host with power hungry external devices will require more current. In most situations a 9-10W module will be sufficient.

Besides the PoE module, a RJ45 capable of handling PoE is also needed.

4.8 SP6: SD/MMC Memory Card Interface

The board has a SD/MMC memory card interface, J13. Note that this interface **SHALL NOT** be used for accessing the MCI peripheral interface of the LPC4350. Instead, there is a uSD/transflash memory card interface on the bottom side of the LPC4357 OEM board.

There is visual indication via LED2 on the LPC4357 OEM board that supply voltage to the memory card is present.

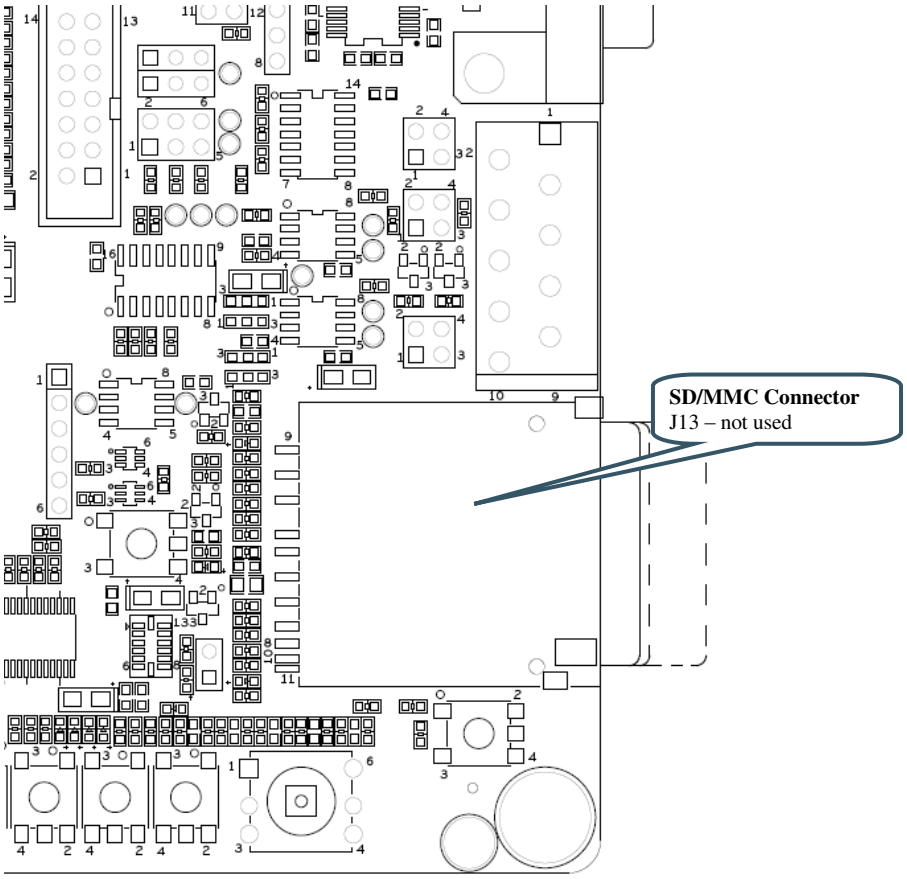

Figure 9 – SD/MMC Memory Card Interface – Not used

4.9 SP6: VBAT/ALARM Handling

The board can power the VBAT input supply (to the OEM board) from two different sources:

- The +3.3V power supply, via D1 (when board is normally powered).
- A 3V Lithium CR1025 size coin battery, via D2. Note that battery is not included.

See the LPC4357 datasheet for details about VBAT voltage range.

The ALARM signal control LED21. Note that LED21 will consume a lot of current from the battery and/or super-capacitor. Restrict on/high time to preserve energy.

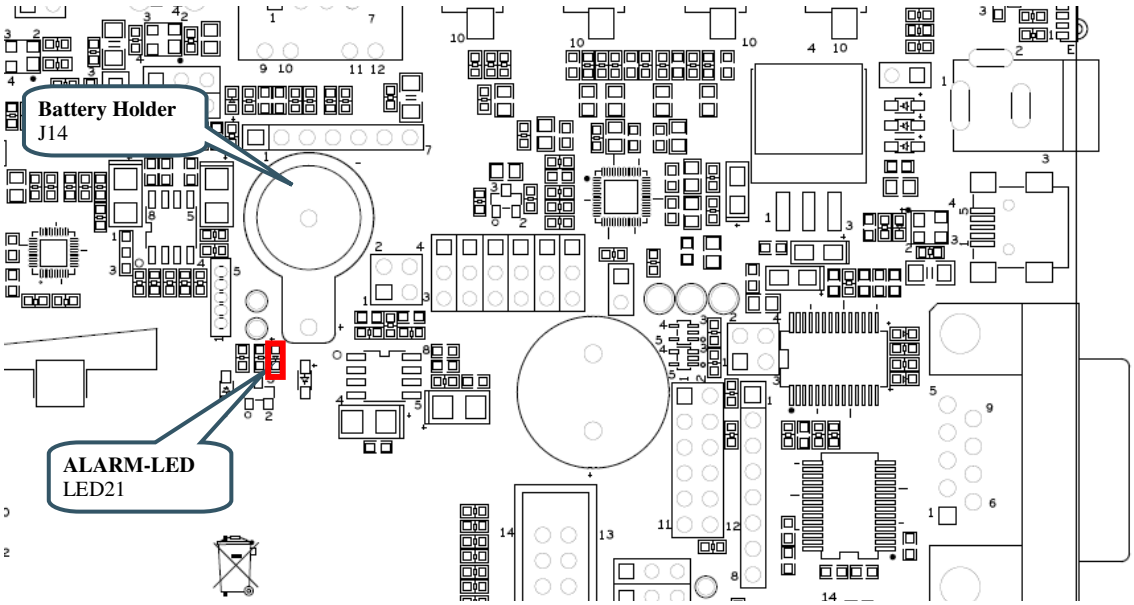

Figure 10 – VBAT and ALARM circuit

4.10 SP7: I2C Peripherals

There are several I2C peripherals on the board. See picture below for locating the different components on the board. The I2C addresses for the individual components are given in the schematic.

- Configuration E2PROM, 64kbit. This chip contains version information about the OEM Base Board.
- LM75 Temperature sensor.
- 3-axis Accelerometer (MMA7455). Note that the two interrupt outputs are not connected but available on JP5.
- Port expander (PCA9532) with 8 LEDs and 4 pushbuttons. The Card Detect and Write Protect signals from the SD/MMC memory card connector are also connected to this chip. LED22/23 are positioned above SW2, LED24/25 are positioned above SW3, LED26/27 are positioned above SW4 and LED28/29 are positioned above SW5.

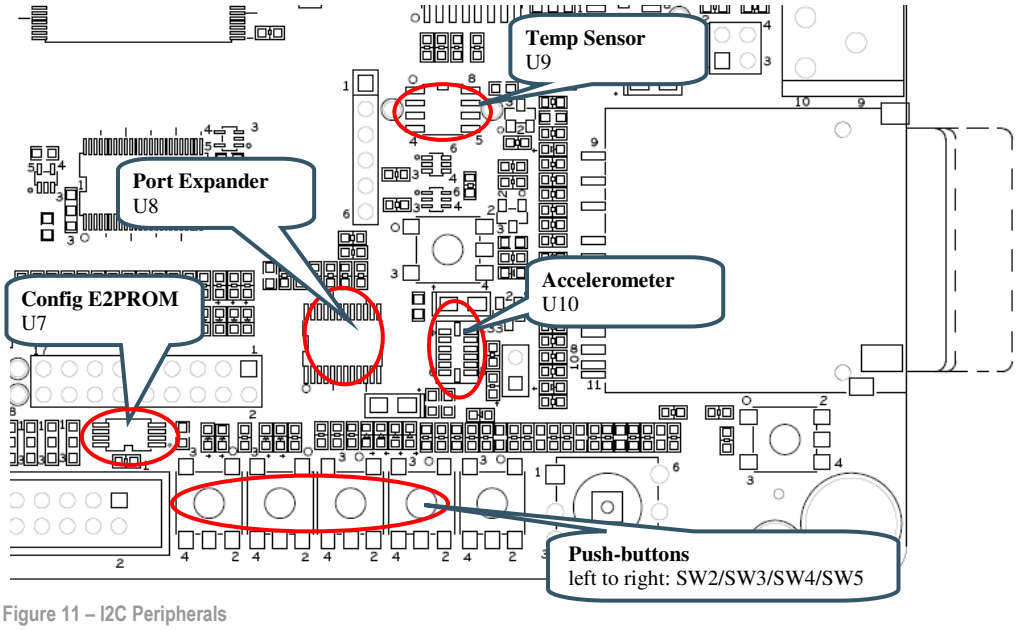

Figure 11 – I2C Peripherals

Signals	LPC4357
I2C-SDA	I2C-SDA
I2C-SCL	I2C-SCL

4.11 SP8: Analog Input

The board contains a trimming potentiometer (R94) for manually generating an adjustable voltage (between GND and VREF). See picture below where to locate the trimming potentiometer on the board. The table list which pin the adjustable voltage is connected to.

It is recommended to remove resistor R93 on the OEM base board in order to be able to use signal ADC6. In order to be compatible with other OEM boards, R93 connects signal V3A and VREF, but signal VREF is carrying signal ADC6 on the LPC4357 OEM board.

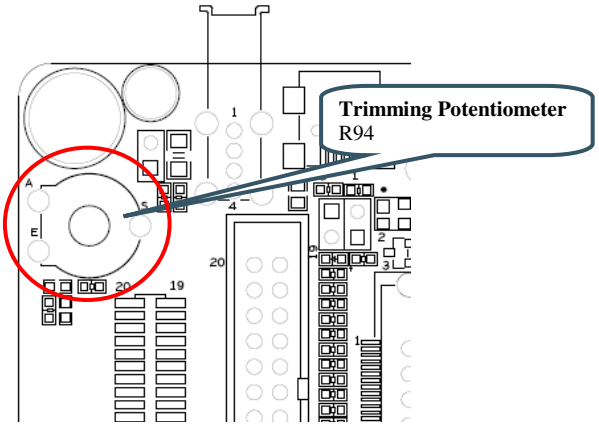

Figure 12 – Analog Input

Signals	LPC4357
GPIO39_AIN2	ADC3

4.12 SP8: Digital IO

There is a push-button (SW6) that is connected to a signal that enable the ISP-mode after reset on the OEM Board. For the LPC4357 this is pin P2_7. If this pin is sampled low after reset, the ISP-mode for the LPC4357 is entered. LED30 is positioned above SW6 and will light when SW6 is pressed. It is also possible to control LED30 as an output from the OEM Board without damaging the output driver when SW6 is pressed. R110 limits the current.

There is also a 5-key joystick that directly connects to five general purpose input/output pins. See picture below for locating SW6 and SW7.

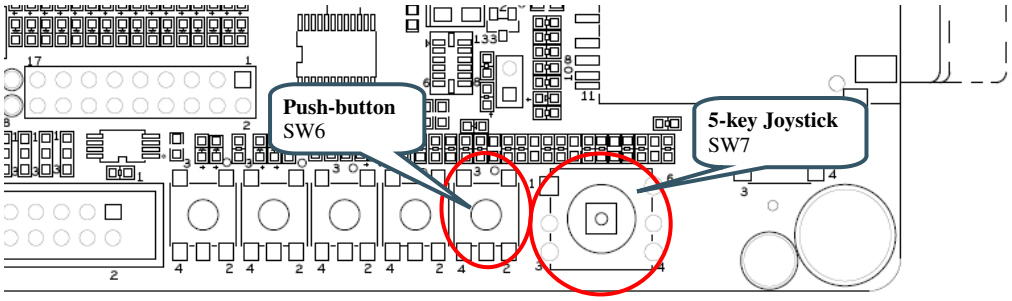

Figure 13 – Digital IO

Signals	LPC4357
GPIO_10	Open collector driver on P2_7. This signal is an input only on the the LPC4357 OEM board and can only be used to pull P2_7 low, i.e., enable ISP mode after a reset.
GPIO_73	PA_1
GPIO_74	PA_2
GPIO_75	PA_3
GPIO_76	P9_0
GPIO_77	P9_1

4.13 SP8: Serial Expansion Connector

The *Serial Expansion Connector* is a standardized serial interface connector that is included on many boards from Embedded Artists, including the OEM Base Board. The purpose is to provide a simple expansion connector for smaller expansion modules. Such modules are typically sensors of different kinds and communication modules, but can also be smaller displays.

The connector contains 14 pins that support SPI, UART and I2C communication. Four additional pins exist for specific functionality, like module reset, interrupt pins, analog signals and pwm signals. Power (3.3V) is also provided. Maximum current consumption of the external module is 250mA. All signals are protected with 470 ohm series resistors to minimize current in case of shorts to ground, +3.3V, or similar.

Usage of the different signals is specific for each module connected. All signals can be configured as either main function or alternatively as a general purpose input/output signal (GPIO). The picture below show where the connector can be found and the table lists which pins are connected. The application program has the responsibility to program the individual pins to correct state/function.

Note that the UART channel is not directly connected to USART channel #3 on the LPC4357. It is multiplexed with other UART channels, see section 4.15 for details. Also note that the *Serial Expansion*

Connector and the RF-module (see section 4.14) share the same UART channel. Once the RF module is soldered, the *Serial Expansion Connector* cannot be used for UART communication.

Also note that pin 13 and 14 on the Serial Expansion Connector, J15, are connected to ADC1 and ADC2, respectively. These pins are input only on the LPC4357. In order to have GPIO functionality on these two pins on J15, other GPIO signals has to be wired to these pins. This can easily be done at the J3, J5 and J5 connectors. For example, pin 27 and 29 of J3 can be shorted/connected. That way, signal MCICMD (carrying LPC4357 pin PC_11) is connected to GPIO38_AIN1. Pin 21 and 23 of J5 can also be shorted/connected. That way, signal GPIO33_LCD-DC (carrying LPC4357 pin P4_0) is connected to GPIO37_AIN0.

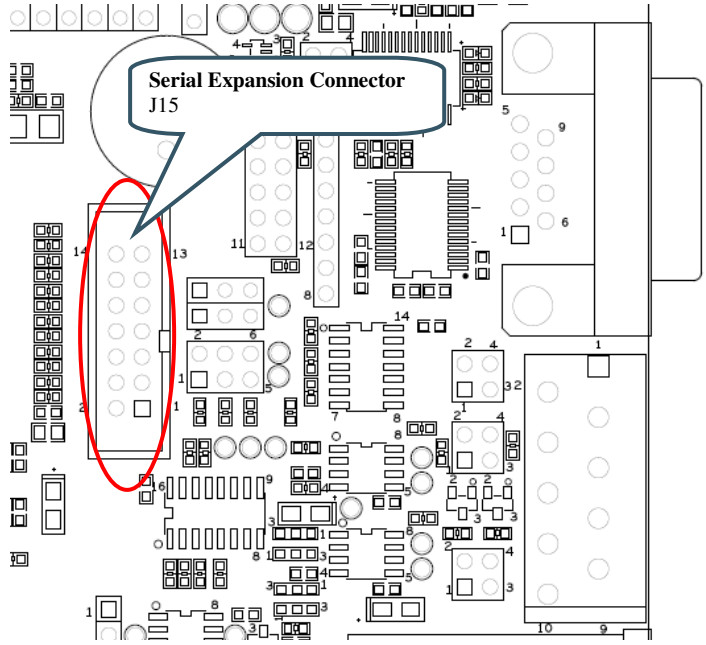

Figure 14 – Serial Expansion Connector

Signals	LPC4357
GPIO29_SPI-CLK	PF_0, SSP0 is used
GPIO31_SPI-MISO	PF_2, SSP0 is used
GPIO32_SPI-MOSI	PF_3, SSP0 is used
GPIO69	P9_2
SIE_UART_RXD	P2_4 via multiplexor, USART#3 is used
SIE_UART_TXD	P9_3 via multiplexor, USART#3 is used
I2C-SCL	I2C-SCL
I2C-SDA	I2C-SDA
GPIO42	P9_6
GPIO72	PC_2
GPIO37_AIN0	ADC1 **This is pin 13 of J15. It is suggested to short pin 27 and 29 of J3 in order to connect LPC4357 pin PC_11 to this signal – to get GPIO functionality on this pin.**