

# MPC5748G EVB User Guide

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# 1. Introduction

This user guide details the setup and configuration of the Freescale MPC5748G customer Evaluation Board (hereafter referred to as the EVB). The EVB is intended to provide a mechanism for easy evaluation of the MPC5748G family of microcontrollers, and to facilitate hardware and software development. Various daughtercards are available which connect to the EVB via two high density connectors. Please consult your Freescale representative for more details on daughtercard pricing and availability.

The EVB is intended for bench / laboratory use and has been designed using normal temperature specified components (+70°C).

This product contains components that may be damaged by electrostatic discharge. Observe precautions for handling electrostatic sensitive devices when using this EVB and associated microcontroller.

The user manual is intended to be read alongside the respective MCU documentation available at [www.freescale.com](http://www.freescale.com) and includes:

- Reference Manuals
- Product Data Sheets
- Application notes
- Chip Errata

## 1.1. Peripheral Daughtercards

The EVB has connectors for various peripheral daughtercards (for example MLB) that provide additional peripheral functionality. These are not supplied with the EVB and must be sourced separately. Please contact your Freescale representative for pricing and availability.

# 2. EVB Features

The EVB provides the following key features:

- Single 10-14 V DC external power supply input with on-board regulators to provide all of the necessary EVB and MCU voltages. Power may be supplied to the EVB via a 2.1 mm barrel style power jack or a 2-way screw type connector. 12 V operation allows in-car use if desired.
- Master power switch and regulator status LED's.
- USB Serial interface
- 2 x High Speed CAN transceiver routed to 3-way headers
- 2 x LIN interfaces routed to standard Molex headers
- Main clock supplied from on board crystal or SMA connector
- User reset switch with reset status LED's
- Ethernet PHY and RJ45 socket configurable as RMII or MII
- USB Type A Host interface
- USB Type AB (micro USB) OTG interface

- 2 x FlexRay interfaces with standard 2-pin connectors
- 14-pin JTAG and 50 pin Nexus (Trace) connectors
- 2 x High Density daughter card connectors allowing an MCU specific daughtercard to be fitted<sup>1</sup>
- MLB daughtercard connector
- SAI Audio board connectors (2 x 0.1 inch pitch headers and 2 x TWRPI style headers)
- SD connector (mounted to the underside of the board) supporting hardware write protect and card detection
- 4 user LEDs wired to MCU ports, also available at a user header
- 4 user pushbutton switches wired to MCU ports, also available at a user header
- Hexadecimal encoded switch wired to 4 MCU ports, also available at a user header
- Simple potentiometer connected to analogue input channel

### NOTE

To alleviate confusion between jumpers and connector headers, all EVB jumpers are 2 mm pitch whereas headers are 0.1 inch (2.54 mm). This prevents inadvertently fitting a jumper to a header.

<sup>1</sup> There is no MCU fitted to the EVB. A daughtercard must be fitted before the EVB can be used.

### 3. Configuration Overview

Throughout this document, all of the default jumper and switch settings are clearly marked with “(D)” and are shown in blue text. This allows a more rapid return to the default state of the EVB if required. Note that the default configuration for 3-way jumpers is a header fitted between pins 1 and 2. On the EVB, 2-way, and 3-way jumpers have been aligned such that pin1 is either to the top or to the left of the jumper. On 2-way jumpers, the source of the signal is connected to pin1.

The EVB has been designed with ease of use in mind and has been segmented into functional blocks as shown below. Detailed silkscreen legend has been used throughout the board to identify all switches, jumpers and user connectors.

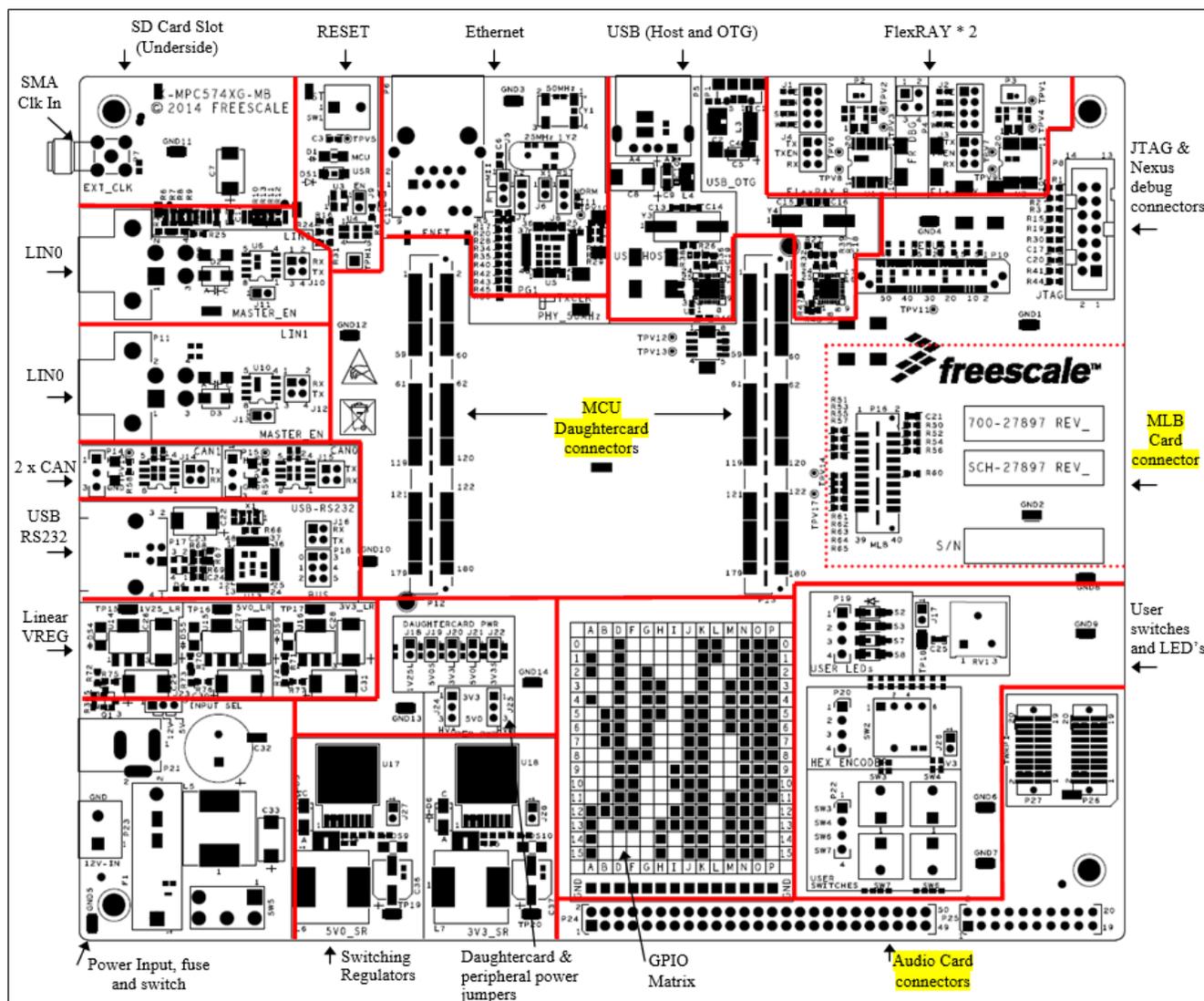


Figure 1. EVB Functional Blocks

## 4. MCU Daughtercard information

In order to use the EVB, an MCU daughtercard must be fitted as described in the following section. Before fitting or removing a daughtercard, ensure the EVB is powered OFF

### 4.1. Fitting a daughtercard

Gently place the daughtercard on the EVB connectors ensuring the correct orientation as shown in the following figure. The connectors are polarized so the daughtercard will only fit in one orientation (with the jumpers at the bottom of the daughtercard). Once the connectors have been located correctly, firmly push down all four corners of the daughter card simultaneously in order to ensure the connectors are mated. (The following picture also shows the default jumper positions for the 256BGA daughtercard)



Figure 2. Daughtercard Fitted to EVB

### 4.2. Removing a daughtercard

In order to prevent damage to the daughtercard connectors, it is important to remove the daughtercard correctly. Carefully lift either the top or bottom edge of the daughtercard and it should easily lift off as shown in the following figure (viewed from the left side of the EVB).



Figure 3. Removing a daughtercard

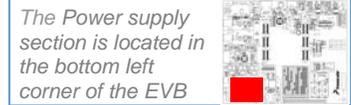
#### CAUTION

Do not attempt to lift the left or right edge of the daughtercard as this will result in connector damage.

## 5. Initial Configuration

This section details the power, reset, clocks, and debug configuration which is the minimum configuration needed in order to power ON the EVB.

### 5.1. Power Supply Configuration



The EVB requires an external power supply voltage of between 10 V-14 V DC (nominal 12 V), minimum 2 A. This allows the EVB to be used in a vehicle if required. The 12 V input is regulated on the EVB using two switching and three linear regulators to provide the required voltages of 5.0 V, 3.3 V (both linear and switcher) and 1.25 V (linear). For flexibility, there are two power supply input connectors on the EVB as detailed below:

#### 5.1.1. Power Supply Connectors (P21, P23)

- **2.1 mm Barrel Connector – P21**

This connector should be used to connect the supplied wall-plug mains adapter. Note – if a replacement or alternative adapter is used, care must be taken to ensure the 2.1 mm plug uses the correct polarisation as shown below:

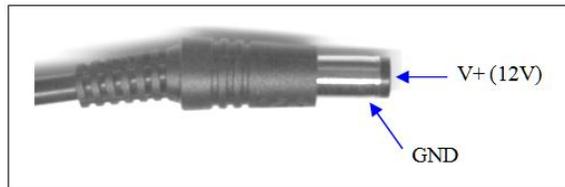


Figure 4. 2.1mm Power Connector

- **2-Way Screw Type Connector – P23**

This can be used to connect a bare wire lead to the EVB, typically from a laboratory power supply. The polarisation of the connectors is clearly marked on the EVB. Care must be taken to ensure correct connection.

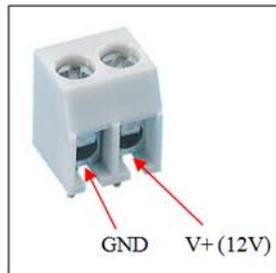


Figure 5. 2-Lever Power Connector

### 5.1.2. Power Switch (SW5)

Slide switch SW5 can be used to isolate the power supply input from the EVB voltage regulators if required.

- Moving the slide switch to the right (away from the fuse) will turn the EVB OFF.
- Moving the slide switch to the left (towards the fuse) will turn the EVB ON.

### 5.1.3. Regulator Power Jumper (J23)

All of the regulators are permanently powered from the main 12 V supply line and active with the exception of the 1.25 V linear regulator which has a 3-way jumper to allow selection of the input voltage.

The table below details the jumper configurations for the linear 1.25 V regulator source voltage. By default, the regulator is powered from the 12 V supply line.

**Table 1. 1.25 V Linear Regulator Source Select (J23)**

Jumper	Position	PCB Legend	Description
J23 (INPUT SEL)	1-2 (D)	12V	1.25V Linear regulator is powered from main 12V
	2-3	5V	1.25V Linear regulator is powered from 5V switching regulator output
	Removed		1.25V Linear regulator is not powered (disabled)

### 5.1.4. Power Status LED's and Fuse

When power is applied to the EVB, five green LED's adjacent to the voltage regulators show the presence of the supply voltages as follows:

- LED DS4 – Indicates that the 1.25V linear regulator is enabled and working correctly
- LED DS5 – Indicates that the 5.0V linear regulator is enabled and working correctly
- LED DS6 – Indicates that the 3.3V linear regulator is enabled and working correctly
- LED DS9 – Indicates that the 5.0V switching regulator is enabled and working correctly
- LED DS10 – Indicates that the 3.3V switching regulator is enabled and working correctly

If no LED's are illuminated when power is applied to the EVB and the regulators are correctly enabled using the appropriate jumpers, it is possible that either power switch SW5 is in the "OFF" position or that the fuse F1 has blown. The fuse is provided to protect the external power supply and for EVB circuitry reverse-bias protection. If the fuse has blown, check the polarity of your power supply and replace the fuse with a 20 mm 1.5 A fast blow fuse.

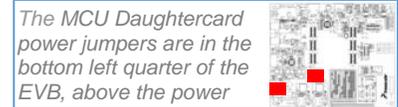
Note that the fuse will not protect against one of the EVB regulators being shorted. If this happens, damage is likely to occur to the EVB and / or components.

#### CAUTION

In the event of a short in the regulator output, the regulator and/or the shorted component may be hot



### 5.1.5.MCU Power Supply Jumpers (J18, J19, J20, J21, J22, J23)



All of the regulated power supplies are routed to the MCU daughtercard via jumpers. This allows each power supply to be individually isolated and facilitates current measurement at the respective jumper.

Note that only the daughtercard is connected to the power lines after the jumpers so MCU current measurements are accurate. There are an additional two jumpers that control the voltages used by EVB peripherals connected to the VDD\_HV\_A and VDD\_HV\_B domains as described in section 5.1.7.

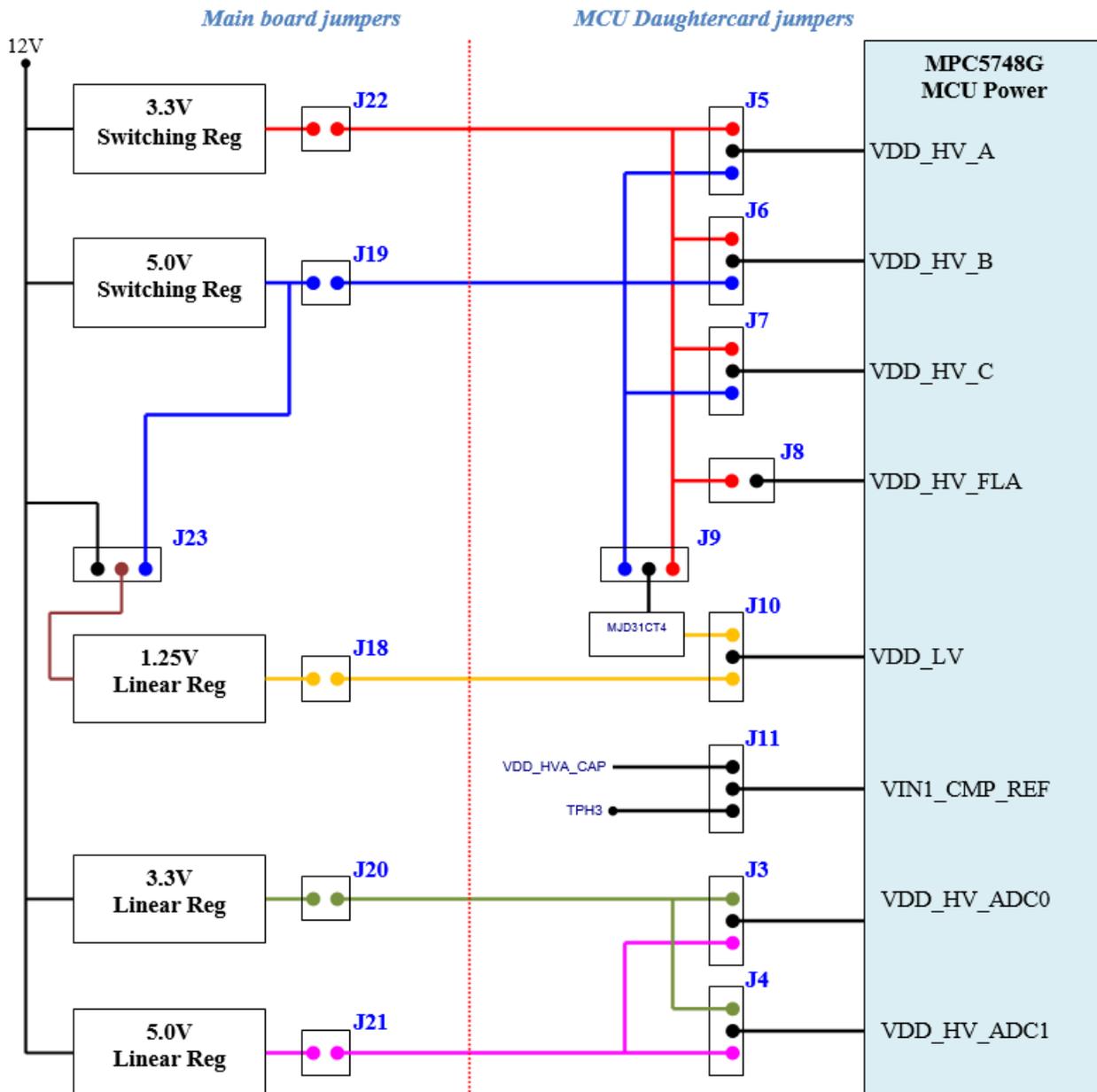


Figure 6. Power Supply Jumper Schematic

The power supply jumper description table is shown in the following table:

**Table 2. Daughter Card Power Supply Jumpers (on main board)**

Jumper	Position	PCB Legend	Description
<b>J18</b> 1V25L	Fitted (D)		1.25V Linear regulator output is routed to daughter card
	Removed		1.25V Linear regulator output is disconnected from daughtercard
<b>J19</b> 5V0S	Fitted (D)		5.0V Switching regulator output is routed to daughter card
	Removed		5.0V Switching regulator output is disconnected from daughtercard
<b>J20</b> 3V3L	Fitted (D)		3.3V Linear regulator output is routed to daughter card
	Removed		3.3V Linear regulator output is disconnected from daughtercard
<b>J21</b> 5V0L	Fitted (D)		5.0V Linear regulator output is routed to daughter card
	Removed		5.0V Linear regulator output is disconnected from daughtercard
<b>J22</b> 3V3S	Fitted (D)		3.3V Switching regulator output is routed to daughter card
	Removed		3.3V Switching regulator output is disconnected from daughtercard
<b>J23</b> INPUT SEL (Above Power Jack)	1-2 (D)	12V	1.25v Linear regulator is powered by main 12V input
	2-3	5V	1.25v Linear regulator is powered by output from 5.0V switching reg
	Removed		1.25v Linear regulator is not powered (disabled)

### 5.1.6. Daughtercard Power Jumpers (J3 to J11)

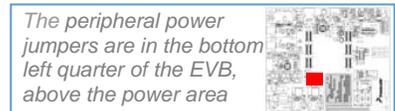
The following power control jumpers are located on the MCU daughtercard. Note that not all of the jumpers will be on each daughtercard variant.

**Table 3. MCU Power Supply Jumpers (on daughtercard)**

Jumper	Position	PCB Legend	Description
<b>J3</b> ADC0	1-2 (D)	3V3	MCU ADC0 pin is connected to 3.3V (Linear)
	2-3	5V0	MCU ADC0 pin is connected to 5.0V (Linear)
	Removed		MCU ADC0 pin is not connected to power
<b>J4</b> ADC1	1-2 (D)	3V3	MCU ADC1 pin is connected to 3.3V (Linear)
	2-3	5V0	MCU ADC1 pin is connected to 5.0V (Linear)
	Removed		MCU ADC1 pin is not connected to power
<b>J5</b> HVA	1-2 (D)	3V3	MCU VDD_HV_A domain is connected to 3.3V (Switching Regulator)
	2-3	5V0	MCU VDD_HV_A domain is connected to 5.0V (Switching Regulator)
	Removed		MCU VDD_HV_A domain is not connected to power
<b>J6</b> HVB	1-2 (D)	3V3	MCU VDD_HV_B domain is connected to 3.3V (Switching Regulator)
	2-3	5V0	MCU VDD_HV_B domain is connected to 5.0V (Switching Regulator)
	Removed		MCU VDD_HV_B domain is not connected to power
<b>J7</b> HVC	1-2 (D)	3V3	MCU VDD_HV_C domain is connected to 3.3V (Switching Regulator)
	2-3	5V0	MCU VDD_HV_C domain is connected to 5.0V (Switching Regulator)
	Removed		MCU VDD_HV_C domain is not connected to power

Jumper	Position	PCB Legend	Description
<b>J8<sup>2</sup> FLA</b>	Fitted (D) Removed		MCU VDD_HV_FL A pin is connected to 3.3v (Switching Regulator) MCU VDD_HV_C domain is connected to 5.0V (Switching Regulator)
<b>J9 REG</b>	1-2 (D) 2-3 Removed	3V3 5V0	MCU ballast transistor collector is connected to 3.3V (Switching) MCU ballast transistor collector is connected to 5.0V(Switching) MCU ballast transistor collector is not connected to power
<b>J10 VDDL V</b>	1-2 (D) 2-3 Removed	REG 1V25L	MCU VDD_LV domain is powered from ballast transistor MCU VDD_LV domain is powered from 1.25V Linear regulator MCU VDD_LV domain is not powered
<b>J11 DAC</b>	1-2 (D) 2-3 Removed	HVA USR	MCU VIN1_CMP_REF is powered from VDD_HV_A MCU VIN1_CMP_REF is powered from user testpoint (TPH3) MCU VIN1_CMP_REF is not powered

### 5.1.7. Peripheral Power Supply Jumpers (J24, J25)



There are two additional power supply jumpers controlling the I/O voltage for the peripherals on the EVB in the HVA and HVB voltage domains.

The settings on these jumpers must match the VDD\_HV\_A and VDD\_HV\_B jumper voltage setting on the MCU daughtercard.

The default configuration matches the MCU daughtercard default configuration with both jumpers set to 3.3V.

**Table 4. Peripheral Power Control (J24, J25)**

Jumper	Position	PCB Legend	Description
<b>J24 HVA</b>	1-2 (D) 2-3 Removed	3V3 5V0	EVB peripherals in HVA domain are set to use I/O voltage of 3.3V EVB peripherals in HVA domain are set to use I/O voltage of 5.0V Invalid Configuration, avoid!
<b>J25 HVB</b>	1-2 (D) 2-3 Removed	3V3 5V0	EVB peripherals in HVB domain are set to use I/O voltage of 3.3V EVB peripherals in HVB domain are set to use I/O voltage of 5.0V Invalid Configuration, avoid!

### 5.1.8. EVB Voltage Regulators

The following table shows the usage of each EVB voltage regulator. This provides a useful cross reference point should any regulator be disabled. In addition, the distribution of the peripheral voltages HVA (J24) and HVB (J25) are shown.

<sup>2</sup> Note that jumper J8 (FLA) jumper must only be fitted when VDD\_HV\_A (J5) is connected to 3.3V.

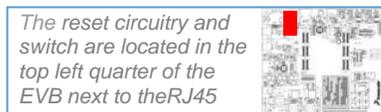
**Table 5. Power Supply Distribution**

Regulator	Used On
<b>12V (Unregulated) P12V</b>	All voltage regulators (switching and Linear, jumper selectable on 1.25V linear) 1.25V linear regulator LED supply via FET MCU Daughtercard connector MLB Daughtercard connector FlexRay transceiver VBAT pin
<b>5.0V Switcher 5V0_SR</b>	Daughtercard connector (post daughtercard power jumper) Daughtercard connector (direct feed via zero ohm link) Peripheral power control jumpers (position 2-3) CAN transceivers VCC (main power) USB RS232 (FTDI) transceiver (main power and protection diode) USB Host / OTG transceiver power (VBAT) pin FlexRay Transceiver power pins (VCC / VBUF) SAI Audio connector Input to 1.25V linear regulator (in alternate jumper configuration)
<b>3.3V Switcher 3V3_SR</b>	Daughtercard connector (post daughtercard power jumper) Daughtercard connector (direct feed via zero ohm link) Peripheral power control jumpers (position 1-2) Reset LED's (user and target) USB HOST / OTG transceiver I/O voltage ( <b>USB operation is fixed at 3.3V</b> ) <sup>3</sup> Ethernet Transceiver supply and I/O ( <b>Ethernet operation is fixed at 3.3V</b> ) <sup>3</sup> SAI Audio connector MLB Daughtercard connector SD Card power supply / pullup resistors ( <b>SD Card operation is fixed at 3.3V</b> ) <sup>3</sup> User LED's supply voltage Hex encoder switch supply voltage User pushbutton switches supply voltage
<b>5.0V Linear 5V0_LR</b>	Daughtercard connector (post daughtercard power jumper) Daughtercard connector (direct feed via zero ohm link)
<b>3.3V Linear 3V3_LR</b>	Daughtercard connector (post daughtercard power jumper) Daughtercard connector (direct feed via zero ohm link) MLB Daughtercard connector ADC Input Pot (user variable resistor)
<b>1.25V Linear 1V25_LR</b>	Daughtercard connector (post daughtercard power jumper) Daughtercard connector (direct feed via zero ohm link)
<b>J24 PER_HVA</b>	Reset control circuitry (including reset pullup) JTAG Pullup resistors & reference voltage CAN Transceiver I/O Voltage select LIN Transceiver Enable (and I/O voltage select) USB RS232 (FTDI) transceiver I/O voltage select FlexRay Transceiver I/O Voltage select (and pullups)
<b>J25 PER_HVB</b>	Nexus Connector reference voltage and Pullups

<sup>3</sup> These voltages are fixed due to device specifications and cannot be changed.

Note that the JTAG pins are in domain VDD\_HV\_A whereas the Nexus pins are VDD\_HV\_B. Normally this would mean that for trace, the HVA and HVB domains should be at the same voltage however some development tools can automatically adapt to the voltages on the trace signals. Please consult your tools vendor for further details.

## 5.2. Reset Control (J9, SW1)



The MCU has a single bi-directional open drain Reset pin. Rather than connect multiple devices to the reset pin directly, a reset-in and reset-out buffering scheme has been implemented on the EVB as shown in Figure 7 below. The reset “in” from the reset switch (SW1) and the debug connectors are logically OR’d together using an AND gate and then connected to the buffer to provide an open-drain output.

The “reset-out” circuitry provides a buffered reset signal that can be used to drive any circuitry requiring a reset control from the MCU.

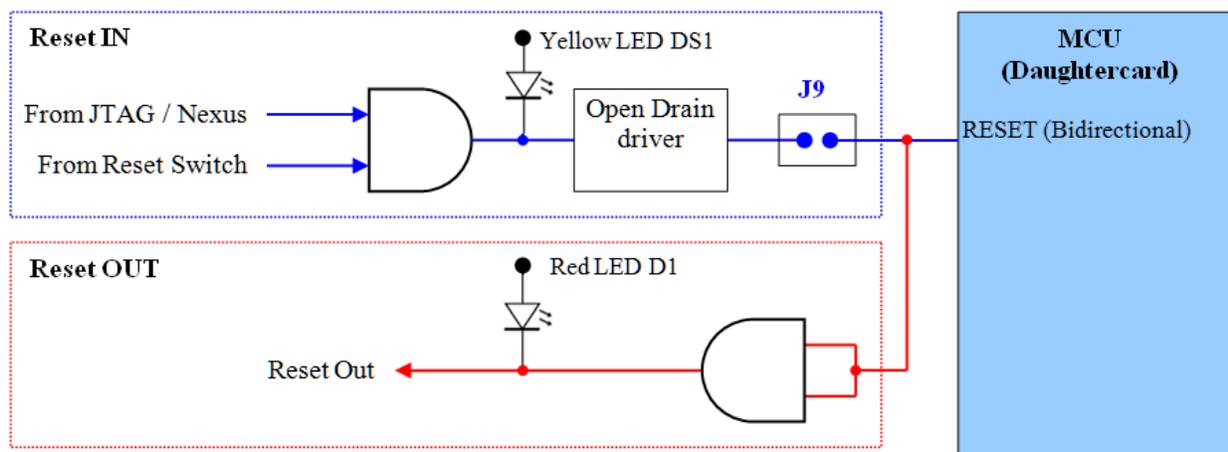


Figure 7. EVB Reset Control

Jumper J9 is used to disconnect the reset signal from the external reset sources if required.

Table 6. Reset Control (J9)

Jumper	Position	PCB Legend	Description
J9 (EN)	Fitted (D) Removed		Reset from reset switch and debug connectors is active Reset from reset switch and debug connectors is inactive

Note that removing jumper J9 will mean that an external reset source will not reset the MCU. This will impact most debuggers which will typically issue a reset before establishing a debug connection.

### 5.2.1. Reset LEDs

As can be seen in Figure 7 above, there are two reset LED’s that can be used to identify the source / cause of a reset:

RED LED D1 (titled “MCU”) will illuminate if:

- The MCU issues a reset (in this condition ONLY this LED will be illuminated and LED DS1 will be off)
- There is a target reset (ie from the reset switch or from the debugger in which case LED DS1 will be ON)

YELLOW LED DS1 (titled “USR”) will illuminate when an external hardware device issues a reset to the MCU:

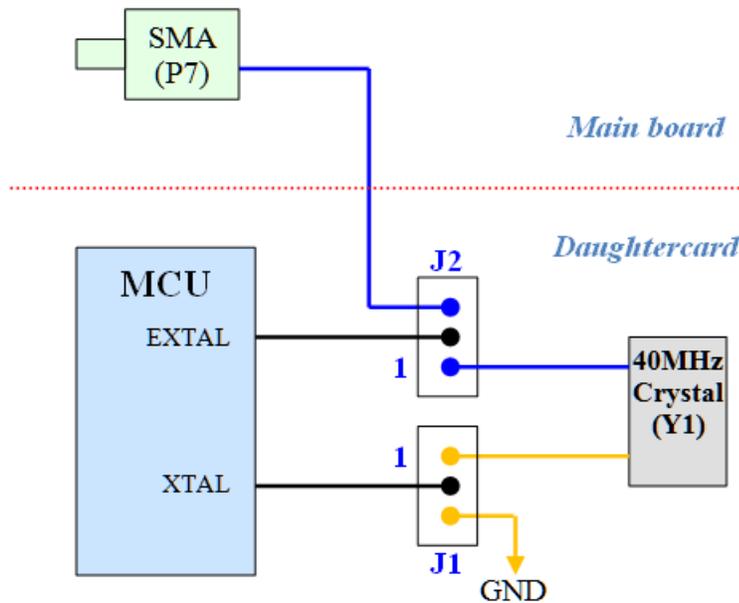
- The reset switch is pressed
- There is a reset being driven from one of the debug connectors

**Table 7. Reset LED Decoding**

LED DS1 (Yellow)	LED D1 (Red)	Description
OFF	OFF	No Reset being issued from MCU or external logic
OFF	ON	MCU has issued a reset
ON	OFF	External reset issued from switch or debug BUT not being issued to MCU (check J9 is fitted on the EVB)
ON	ON	External reset issued from reset switch or debug and has been issued to MCU.

### 5.3. MCU Clock Configuration

There are 2 clock configuration jumpers on the daughtercard and an external clock input connector on the main board to allow an externally generated clock to be supplied if desired. See Figure 8 below.



**Figure 8. EVB Clock Selection**

### 5.3.1. External Clock Input (P7)



The external clock input on the EVB is applied via SMA connector P7. When driving an external clock into the SMA connector, the jumpers on the daughtercard must be reconfigured to route the external clock to the MCU.

Note that the following conditions must be met when supplying an external clock:

- The clock frequency must be between 8MHz and 40MHz
- The amplitude of the clock input should not exceed the voltage being driven into the VDD\_HV\_A pins. This is selectable between 3.3V and 5.0V on the daughtercard.

### 5.3.2. MCU Clock Configuration (J1, J2 on Daughtercard)

There are two external clock crystals on the MPC5748G daughtercards:

- 40MHz fast external crystal for clocking the main system clock
- 32KHz slow external crystal for accurate time of day keeping

The 40MHz crystal is connected to the MCU XTAL and EXTAL pins via 3-way jumper headers as shown in the diagram above. These jumpers allow an external clock to be routed from the SMA connector (P7) on the main board if desired. The default configuration is with both daughtercard jumpers (J1 and J2) set to position 1-2 which routes the external 40MHz crystal to the MCU pins. If you wish to supply a clock via the SMA connector on the main EVB, move the daughtercard jumpers J1 and J2 to position 2-3.

The 32 KHz external crystal is permanently connected to the MCU EXTAL32 and XTAL32 pins and has no configuration options.

**Table 8. EXTAL Clock Source Selection (J1, J2 Daughtercard)**

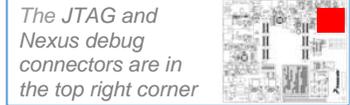
Jumper	Position	PCB Legend	Description
J1 (XTAL)	1-2 (D)	Y1	MCU XTAL signal is routed to crystal Y1
	2-3	GND	MCU XTAL signal is Grounded (for ext clock mode) <sup>4</sup>
J2 (EXTAL)	1-2 (D)	Y1	MCU EXTAL signal is routed to crystal Y1
	2-3	EXT	MCU EXTAL signal is routed from EVB SMA P7

<sup>4</sup> Note that the XTAL pin is left open by default with J1 in position 2-3. Resistor R34 must be populated with a zero ohm resistor in order to ground the XTAL pin.

## 5.4. Debug Connectors (P8, P10)

The EVB provides two debug connectors:

- Standard 14 pin JTAG
- 50 Pin Nexus connector (Samtec ASP-148422-01, Nexus Standard HP50 connector)



There is no user configuration required to use the connectors however the following points should be noted:

- The JTAG connector is routed to the JTAG signals in the default position which are powered from the MCU VDD\_HV\_A power domain. The Nexus signals are located in the VDD\_HV\_B power domain. If you are using Nexus, you may have to ensure that the VDD\_HV\_A and VDD\_HV\_B domains are at the same voltage. Consult your tools vendor for specific information
- The Nexus signals are not bonded out in every MCU package. Before using Nexus, please ensure the MCU fitted to the EVB (via the daughtercard) supports the Nexus signals.

### 5.4.1. Debug Connector Pinouts

The following tables list the pinouts for each of the debug connectors used on the EVB

**Table 9. 14-Pin JTAG Debug Connector Pinout**

Pin No	Function	Connection	Pin No	Function	Connection
1	TDI	PC0	2	GND	GND
3	TDO	PC1	4	GND	GND
5	TCLK	PH9	6	GND	GND
7	EVTI	PL8	8	N/C	---
9	RESET	JTAG-RSTx	10	TMS	PH10
11	VREF	PER_HVA	12	GND	GND
13	RDY	---	14	JCOMP	10K Pulldown

**Table 10. 50-pin Samtec (Nexus) Debug Connector Pinout**

Pin No	Function	Connection	Pin No	Function	Connection
1	MSEO_0	PL9	2	VREF	PER_HVB
3	MSEO_1	PL11	4	TCK	PH9
5	GND	GND	6	TMS	PH10
7	MDO0	PL2	8	TDI	PC0
9	MDO1	PL3	10	TDO	PC1
11	GND	GND	12	JCOMP	10K Pulldown
13	MDO2	PL4	14	RDY	---
15	MDO3	PL5	16	EVTI	PL8
17	GND	GND	18	EVTO	PL12
19	MCKO	PL10	20	RESET	DEBUG_RST
21	MDO4	PL6	22	RST_OUT	MCU_RST
23	GND	GND	24	GND	GND
25	MDO5	PL7	26	CLKOUT	Test Point
27	MDO6	PL13	28	TD/WT	---
29	GND	GND	30	GND	GND



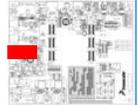
Pin No	Function	Connection	Pin No	Function	Connection
31	MDO7	PL14	32	DAI1	---
33	MDO8	PL15	34	DAI2	---
35	GND	GND	36	GND	GND
37	MDO9	PM0	38	ARBREQ	---
39	MDO10	PM1	40	ARBGRT	---
41	GND	GND	42	GND	GND
43	MD011	PM2	44	MDO13	PM8
45	MDO12	PM7	46	MDO14	PM9
47	GND	GND	48	GND	GND
49	MDO15	PM10	50	N/C	---

## 6. Communications & Memory Interfaces:

This section details the communication interface and storage peripherals that are implemented on the EVB.

### 6.1. CAN Interfaces (P14, P15, J14, J15)

The CAN Physical interface circuits are located on the left edge of the EVB



The EVB incorporates two identical CAN interface circuits connected to MCU CAN0 and CAN1 using MC33901 transceivers. Both transceivers are configured for high speed operation by pulling pin 8 to GND via a 4.7K Ohm resistor. There are test points to allow the Select pin to be driven high if desired. The MC33901 is pin compatible with other CAN transceivers supporting full CAN FD data rates.

For flexibility, the CAN transceiver I/O is connected to a standard 0.1" connector (P14 for CAN1 / P15 for CAN0) rather than using non standard DB9 connectors. The pinout of these headers is shown below and is also detailed on the PCB silkscreen

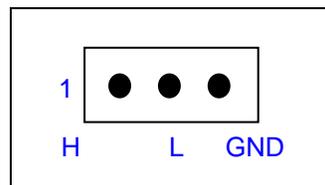


Figure 9. CAN Physical Interface Connectors

The CAN0 and CAN1 MCU TX/RX signals are jumpered as shown in the table below to allow the transceivers to be isolated from the respective MCU pin if desired. The default configuration is with all jumper headers fitted routing the TX and RX signals to the MCU.

**Table 11. CAN Control Jumpers (J51, J53)**

Jumper	Position	PCB Legend	Description
<b>J15 (CAN0) Posn 1-2</b>	<b>FITTED (D)</b> Removed	TX	MCU CAN0_TX signal (PB0) is routed to CAN interface MCU CAN0_TX signal (PB0) is not routed to CAN interface
<b>J15 (CAN0) Posn 3-4</b>	<b>FITTED (D)</b> Removed	RX	MCU CAN0_RX signal (PB1) is routed to CAN interface MCU CAN0_RX signal (PB1) is not routed to CAN interface
<b>J14 (CAN1) Posn 1-2</b>	<b>FITTED (D)</b> Removed	TX	MCU CAN1_TX signal (PC10) is routed to CAN interface MCU CAN1_TX signal (PC10) is not routed to CAN interface
<b>J14 (CAN1) Posn 3-4</b>	<b>FITTED (D)</b> Removed	RX	MCU CAN1_RX signal (PC11) is routed to CAN interface MCU CAN1_RX signal (PC11) is not routed to CAN interface

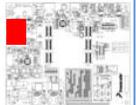
**NOTE**

Care should be taken when fitting the jumper headers to the 2x2 jumper blocks J14 and J15 as they can easily be fitted in the incorrect orientation. Jumper headers should be fitted **horizontally**.

The CAN TX / RX MCU pins are powered from the VDD\_HV\_A domain, which is configured between 3.3V and 5.0V on the daughtercard using jumper J5. The CAN transceivers I/O voltage is connected to the PER\_HVA net configured with jumper J24 on the main EVB. Care must be taken to ensure that the MCU VDD\_HV\_A and PER\_HVA supplies are the same when using the CAN transceiver.

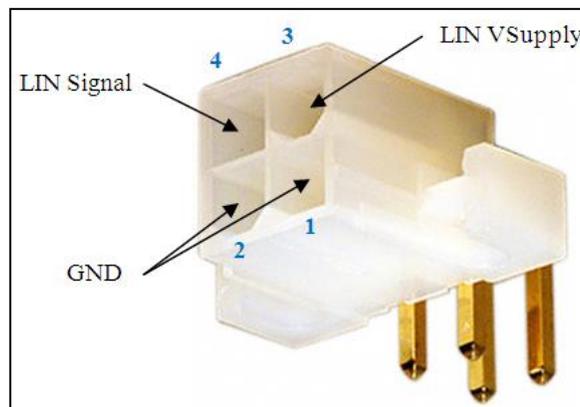
**6.2. LIN Interfaces (P9, P11, J10, J12)**

*The LIN Physical interface circuits are located on the left edge of the EVB*



The EVB incorporates two identical LIN transceiver circuits connected to MCU LIN0 and LIN1 using a Freescale MC33662LEF transceiver supporting both master and slave mode (jumper selectable)

The output from the LIN transceiver is connected to a standard 4-pin Molex connector as used on most other Freescale EVB's supporting LIN as shown in the following figure:



**Figure 10. LIN Molex Physical Interface Connector**

The LIN0 and LIN1 MCU TX/RX signals are jumpered as shown in the following to allow the transceivers to be isolated from the respective MCU pin if desired. The default configuration is with all jumper headers fitted routing the TX and RX signals to the MCU.

Each transceiver also has a master mode enable jumper which is fitted by default to configure the transceiver for Master mode. To configure the transceiver for slave mode, remove the respective “Master\_EN” jumper.

**Table 12. LIN Control Jumpers (J10, J11, J12, J13)**

Jumper	Position	PCB Legend	Description
<b>J10 (LIN0)</b> Posn 1-2	<b>FITTED (D)</b> Removed	RX	MCU LIN0_RX signal (PB3) is routed to LIN0 interface MCU LIN0_RX signal (PB3) is not routed to LIN0 interface
<b>J10 (LIN0)</b> Posn 3-4	<b>FITTED (D)</b> Removed	TX	MCU LIN0_TX signal (PB2) is routed to LIN0 interface MCU LIN0_TX signal (PB2) is not routed to LIN0 interface
<b>J11</b> (Master_EN)	<b>FITTED (D)</b> Removed		LIN0 is configured in Master Mode LIN0 is configured in Slave Mode
<b>J12 (LIN1)</b> Posn 1-2	<b>FITTED (D)</b> Removed	RX	MCU LIN1_TX signal (PC7) is routed to LIN1 interface MCU LIN1_TX signal (PC7) is not routed to LIN1 interface
<b>J12 (LIN1)</b> Posn 3-4	<b>FITTED (D)</b> Removed	TX	MCU LIN1_RX signal (PC6) is routed to LIN interface MCU LIN1_RX signal (PC6) is not routed to LIN interface
<b>J13</b> (Master_EN)	<b>FITTED (D)</b> Removed		LIN1 is configured in Master Mode LIN1 is configured in Slave Mode

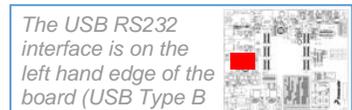
#### NOTE

Care should be taken when fitting the jumper headers to the 2x2 jumper blocks J10 and J12 as they can easily be fitted in the incorrect orientation. Jumper headers should be fitted **horizontally**

The LIN TX / RX MCU pins are powered from the VDD\_HV\_A domain, which is configured between 3.3V and 5.0V on the daughtercard using jumper J5. The LIN transceivers enable pin is connected to the PER\_HVA net configured with jumper J24 on the main EVB. Care must be taken to ensure that the MCU VDD\_HV\_A and PER\_HVA supplies are the same when using the LIN transceiver.

*Note that in order for the LIN transceiver to function, external power must be supplied via pin 3 of the molex connector as detailed in Figure 10.*

### 6.3. USB RS232 Serial Interface (P17, J16)



The EVB incorporates a USB RS232 serial interface providing RS232 connectivity via a direct USB connection between the PC and the EVB. The circuit contains an FTDI FT2232D USB to Serial interface which should automatically install the drivers for two additional COM ports on your PC. Note that only one of these is used so you will need to try both (usually the higher numbered COM port is the active one). For more information on the USB drivers and general fault finding, consult the FTDI website at <http://www.ftdichip.com/>

The MCU LIN2 signals are routed to the FTDI transceiver via a 2-way jumper header (J16) allowing the transceiver to be isolated from the MCU pin if desired. The default configuration is with the jumper

header fitted, routing the TX and RX signals from the MCU to the FTDI transceiver. No other configuration is required.

**Table 13. USB RS232 Control Jumpers**

Jumper	Position	PCB Legend	Description
<b>J16</b> Posn 1-2	<b>FITTED (D)</b> Removed	RX	MCU LIN2_RX signal (PC9) is routed to the FTDI interface MCU LIN2_RX signal (PC9) is not routed to the FTDI interface
<b>J16</b> Posn 3-4	<b>FITTED (D)</b> Removed	TX	MCU LIN2_TX signal (PC8) is routed to the FTDI interface MCU LIN2_TX signal (PC8) is not routed to the FTDI interface

**NOTE**

Care should be taken when fitting the jumper headers to the 2x2 jumper block J16 as they can easily be fitted in the incorrect orientation. Jumper headers should be fitted **horizontally**.

The MCU LIN2 (SCI) pins are powered from the VDD\_HV\_A domain, which is configured between 3.3V and 5.0V on the daughtercard using jumper J5. The FTDI transceiver I/O voltage pin is connected to the PER\_HVA net configured with jumper J24 on the main EVB. Care must be taken to ensure that the MCU VDD\_HV\_A and PER\_HVA supplies are the same when using the FTDI transceiver.

## 6.4. USB HOST / OTG Interfaces



The EVB includes Type A (Host) and Type AB (OTG) USB interfaces, routed to standard and micro USB sockets respectively. Each USB circuit contains a USB83340 transceiver with a shared USB power switch. There is no user configuration required on either of the USB circuits.

The USB transceivers have a 3.3V (only) interface. All of the USB0 (connected to the OTG transceiver) and USB1 (connected to the HOST transceiver) signals are in the VDD\_HV\_A domain and must be configured as 3.3V via daughtercard jumper J5. If VDD\_HV\_A is set to 5V, the USB0 and USB1 MCU signals should be left tri-stated to prevent damage to the USB transceivers.

## 6.5. Ethernet (P6, J5, J6, J7, J8, R45, R80)



The MPC5748G supports both MII and RMII Ethernet interfaces. The EVB incorporates a DP83848c transceiver supporting both MII and RMII modes. The transceiver is connected to a pulse J1011F21PNL RJ45 connector which includes a built-in isolation transformer.

The default configuration, with all 2-way jumpers fitted and all 3-way jumpers in position 1-2, configures the transceiver for MII mode with the reset signal to the PHY being driven from the MCU Reset out (eg any reset causing the MCU Reset line to assert will reset the PHY)

In order to configure the EVB for RMII mode, jumpers J5, J6 and J7 need to be changed as described in Table 14 below. In addition, a surface mount 0Ω resistor needs to be de-soldered and moved as shown in the figure below. This option is fitted as a resistor instead of a jumper to maintain signal integrity on the Ethernet clock signal.

For MII mode (default) R45 should have a jumper populated as shown. For RMII mode, remove R45 and fit it between R45 and R80

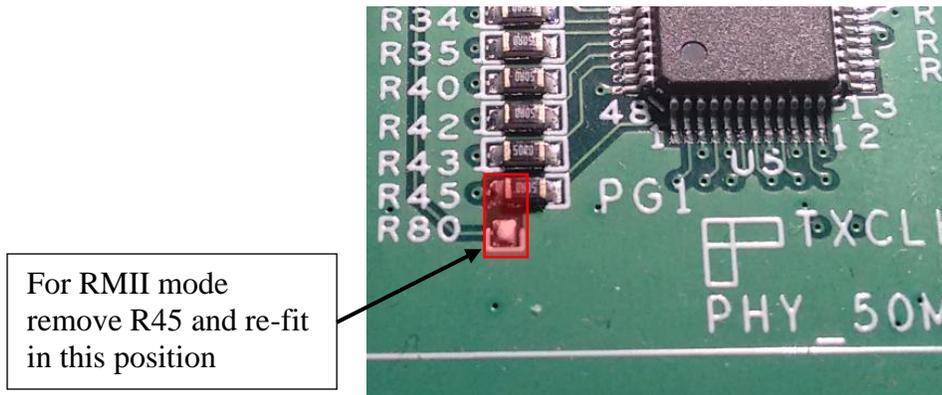


Figure 11. MII / RMII Clock Selection Resistor

To change the reset routing so that the Ethernet PHY can be reset via MCU pin PI11 (rather than being tied to the MCU reset), jumper J8 should be moved to position 2-3

Table 14. Ethernet Control jumpers (J5, J6, J7, J8, R45, R80)

Jumper	Position	PCB Legend	Description
<b>J5</b>	1-2 (D)	MII	Ethernet PHY is configured in MII mode
	2-3	R	Ethernet PHY is configured in RMII mode
	Removed		Invalid Configuration, avoid!
<b>J6 (X1)</b>	1-2 (D)		Ethernet PHY X2 clock is connected to 25MHz xtal
	2-3		Ethernet PHY X2 clock is not connected to 25MHz xtal <sup>5, 6</sup>
<b>J7 (X2)</b>	1-2 (D)		Ethernet PHY X1 clock is connected to 25MHz xtal
	2-3		Ethernet PHY X1 clock is driven from 50MHz xtal
	Removed		Ethernet PHY X1 clock is disconnected (invalid configuration, avoid)
<b>J8 (RST)</b>	1-2 (D)	NORM	The Ethernet PHY will be reset along with MCU reset
	2-3	PI11	The Ethernet PHY reset is controlled via MCU pin PI11 (Pulled high)
	Removed		Invalid Configuration, avoid!
<b>R45 (R80)</b>	Fitted R45		MII Mode – Clock is supplied from PHY to MCU
	R45 to R80		RMII Mode – Clock is supplied from external 50MHz oscillator to MCU

The MCU Ethernet signals are all in the VDD\_HV\_B domain. The Ethernet PHY will ONLY function with 3.3V I/O so VDD\_HV\_B must be set to 3.3V on the MCU daughtercard before the Ethernet is used. If VDD\_HV\_B is set to 5V, the signals routed to the Ethernet PHY (see the EVB schematics) must be left as tristate.

<sup>5</sup> If jumper J7 is in position 1-2 (25MHz XTAL), J6 must be fitted and R45 must be fitted.

<sup>6</sup> If jumper J7 is in position 2-3 (50MHz oscillator), J6 must be removed and R45 must be removed and placed between R45 and R80

## 6.6. FlexRay (P2, P3, J1, J2, J3, J4)



The EVB incorporates two FlexRay TJA1080TS/N interfaces connected to MCU FlexRay channels A and B and routed to two Molex 1.25mm pitch PicoBlade shrouded headers (standard on many Freescale EVB's). Jumpers are provided to disconnect the MCU signals from the FlexRay interface if required as well as providing general configuration.

By default, all of the jumper headers are fitted which routes the MCU signals to the FlexRay physical interface as well as configuring the controller for a default mode of operation (Transmitter enabled, Receiver enabled, not in low power mode). Please consult the FlexRay transceiver and general FlexRay specifications before changing any of the mode jumpers.

**Table 15. FlexRay Configuration Jumpers (J1, J2, J3, J4)**

Jumper	Position	PCB Legend	Description
<b>FlexRay A</b>			
<b>J3</b> Posn 1-2	<b>FITTED (D)</b> Removed	TX	MCU PC5 is connected to FlexRay A transceiver TX MCU PC5 is not connected to FlexRay A transceiver TX
<b>J3</b> Posn 3-4	<b>FITTED (D)</b> Removed	TXEN	MCU PE2 is connected to FlexRay A transceiver TXEN MCU PE2 is not connected to FlexRay A transceiver TXEN
<b>J3</b> Posn 5-6	<b>FITTED (D)</b> Removed	RX	MCU PE3 is connected to FlexRay A transceiver RX MCU PE3 is not connected to FlexRay A transceiver RX
<b>J2</b> Posn 1-2	<b>FITTED (D)</b> Removed	BGE	FlexRay A PHY Bus Guardian Enable (Transmitter is enabled) FlexRay A PHY transmitter is disabled (Receive only mode)
<b>J2</b> Posn 3-4	<b>FITTED (D)</b> Removed	EN	FlexRay A PHY is enabled FlexRay A PHY is disabled
<b>J2</b> Posn 5-6	<b>FITTED (D)</b> Removed	STBN	FlexRay A PHY will not enter Standby Mode FlexRay A PHY will enter Standby Mode
<b>J2</b> Posn 7-8	<b>FITTED (D)</b> Removed	WAKE	FlexRay A PHY Wakeup signal pulled low FlexRay A PHY Wakeup signal pulled high
<b>FlexRay B</b>			
<b>J4</b> Posn 1-2	<b>FITTED (D)</b> Removed	TX	MCU PE4 is connected to FlexRay B transceiver TX MCU PE4 is not connected to FlexRay B transceiver TX
<b>J4</b> Posn 3-4	<b>FITTED (D)</b> Removed	TXEN	MCU PC4 is connected to FlexRay B transceiver TXEN MCU PC4 is not connected to FlexRay B transceiver TXEN
<b>J4</b> Posn 5-6	<b>FITTED (D)</b> Removed	RX	MCU PE5 is connected to FlexRay B transceiver RX MCU PE5 is not connected to FlexRay B transceiver RX
<b>J1</b> Posn 1-2	<b>FITTED (D)</b> Removed	BGE	FlexRay B PHY Bus Guardian Enable (Transmitter is enabled) FlexRay B PHY transmitter is disabled (Receive only mode)
<b>J1</b> Posn 3-4	<b>FITTED (D)</b> Removed	EN	FlexRay B PHY is enabled FlexRay B PHY is disabled
<b>J1</b> Posn 5-6	<b>FITTED (D)</b> Removed	STBN	FlexRay B PHY will not enter Standby Mode FlexRay B PHY will enter Standby Mode
<b>J1</b> Posn 7-8	<b>FITTED (D)</b> Removed	WAKE	FlexRay B PHY Wakeup signal pulled low FlexRay B PHY Wakeup signal pulled high

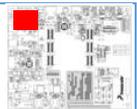
The MCU FlexRay pins are powered from the VDD\_HV\_A domain, which is configured between 3.3V and 5.0 V on the daughtercard using jumper J5. The FlexRay transceivers I/O voltage pin is connected to the PER\_HVA net configured with jumper J24 on the main EVB. Care must be taken to ensure that the MCU VDD\_HV\_A and PER\_HVA supplies are the same when using the FlexRay transceiver.

### Important:

The EVB daughtercards are supplied with a 40 MHz crystal which is a requirement for FlexRay in order to generate the correct clock timing. If you have changed the default crystal on the daughtercard and wish to use FlexRay, you must ensure a 40 MHz crystal is fitted.

## 6.7. SD Card Socket (P200)

The SD socket is mounted on the underside of the board in the top left



The EVB supports a 4-bit SD interface (note that MPC5748G supports 8-bit SD data) which is routed to a full sized SD card connector on the underside of the EVB. There is no user configuration required.

The SD socket has hardware card detection (routed to PA0) and write protection (routed to PH8) status outputs which will be grounded when active.

The MCU SD card signals are all in the VDD\_HV\_A domain. The SD card specification is for an interface voltage of between 2.7V and 3.6V so the SD card can only be used when VDD\_HV\_A is set to 3.3V (PER\_HVA has no impact on the voltage on the SD card)

### CAUTION

If VDD\_HV\_A is set to 5V, damage may be caused to an SD card if an attempt is made to access it in software. If you need to leave the SD card in the socket with VDD\_HV\_A set to 5V, ensure all the SD card pads are left as high impedance

## 7. AV Interface Connectors

This section details the Audio / Video interface connectors on the EVB. Each of these connectors can be used to add additional daughtercards (not supplied) to add functionality.

### 7.1. SAI Audio Connectors (P24, P25)

The SAI audio connector is on the bottom edge of the EVB



The EVB includes two 0.1" headers that can be used to interface to an SAI audio board (available separately, please consult your Freescale representative). There is no EVB configuration required when using these connectors other than to ensure the EVB is switched off prior to fitting or removing the daughtercard.

The pinout of the connectors is shown below for reference and these connectors can also be used for GPIO connectivity

**Table 16. 50-pin SAI Audio Daughtercard Connector P24**

Pin No	Function	Connection	Pin No	Function	Connection
1	3.3V	3V3_SR	2	GND	GND
3	SAI0_DATA3	PF2	4	GND	GND
5	SAI0_DATA2	PF3	6	GND	GND
7	SAI0_DATA1	PF4	8	GND	GND
9	SAI0_DATA0	PF5	10	GND	GND
11	SAI0_BCLK	PF1	12	GND	GND
13	SAI0_SYNC	PB10	14	GND	GND
15	SAI0_MCLK	PF0	16	GND	GND
17	eMIOS1_7H	PH5	18	GND	GND
19	I2C_SCL3	PE11	20	GND	GND
21	I2C_SDA3	PE10	22	GND	GND
23	SAI1_DATA0	PJ2	24	GND	GND
25	SAI1_BCLK	PJ3	26	GND	GND
27	eMIOS1_6H	PH4	28	GND	GND
29	SAI1_SYNC	PF6	30	GND	GND
31	SAI1_MCLK	PF7	32	GND	GND
33	I2C_SCL2	PE9	34	GND	GND
35	I2C_SDA2	PE8	36	GND	GND
37	SAI2_DATA0	PI14	38	GND	GND
39	SAI2_BCLK	PJ1	40	GND	GND
41	SAI2_SYNC	PJ0	42	GND	GND
43	SAI2_MCLK	PI15	44	GND	GND
45	eMIOS1_5H	PH3	46	GND	GND
47	GPIO Control	PA5	48	GND	GND
49	5.0V	5V0_SR	50	GND	GND

**Table 17. 20-pin SAI Audio Daughtercard Connector P25**

Pin No	Function	Connection	Pin No	Function	Connection
1	N/C	N/C	2	GND	GND
3	DSPI0_SIN	PA12	4	GND	GND
5	DSPI0_SOUT	PA13	6	GND	GND
7	DSPI0_SCK	PA14	8	GND	GND
9	DSPI0_SS0	PA15	10	GND	GND
11	DSPI3_SOUT	PG2	12	GND	GND
13	DSPI3_SS3	PG3	14	GND	GND
15	DSPI3_SCK	PG4	16	GND	GND
17	DSPI3_SIN	PG5	18	GND	GND
19	N/C	N/C	20	GND	GND

Note that connector P25 is not populated and must be fitted if required

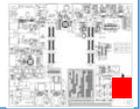
**CAUTION**

Before the daughtercard is installed or removed, the EVB must be powered OFF to prevent potential damage to the EVB or daughter card components.



## 7.2. TWRPI Connectors (P26, P27)

The TWRPI connectors are at the bottom right hand corner



The EVB includes two fine pitch TWRPI headers that can be used to interface to an SAI audio board (available separately, please consult your Freescale representative) along with the 0.1” headers mentioned in the section above. There is no EVB configuration required when using these connectors other than to ensure the EVB is switched off prior to fitting or removing the daughtercard. The pinout of the connectors is shown below for reference.

**Table 18. TWRPI Connector P26**

Pin No	Function	Connection	Pin No	Function	Connection
1	5V	5V0_SR	2	3.3V	3V3_SR
3	GND	GND	4	3.3V	3V3_LR
5	GND	GND	6	GND	GND
7	GND	GND	8	ADC0	PD5
9	ADC1	PD6	10	GND	GND
11	GND	GND	12	ADC2	PD4
13	GND	GND	14	GND	GND
15	GND	GND	16	GND	GND
17	ID0	PD7 <sup>7</sup>	18	ID1 <sup>7</sup>	PD8
19	GND	GND	20		

**Table 19. TWRPI Connector P27**

Pin No	Function	Connection	Pin No	Function	Connection
1	GND	GND	2	GND	GND
3	I2C0_SCL	PO0	4	I2C0_SDA	PO1
5	GND	GND	6	GND	GND
7	GND	GND	8	GND	GND
9	DSPIO_SIN	PA12	10	DSPIO_SOUT	PA13
11	DSPIO_SS0	PA15	12	DSPIO_SCK	PA14
13	GND	GND	14	GND	GND
15	GPIO0/IRQ	PK3	16	GPIO1	PK0
17	GPIO2	PK1	18	GPIO3	PK2
19	GPIO4	PK4	20	N/C	N/C

## 7.3. MLB Daughtercard Connector (P16)

The MLB daughtercard connector is on the RHS of the EVB



There is a 40-pin interface connector on the EVB for connecting an MLB (Media Local Bus) daughtercard. There is no hardware configuration possible at EVB level for this connector.

MLB Daughtercards are available direct from SMSC

As with all daughtercards, the EVB must be powered OFF to prevent damage to the EVB or daughtercard components.

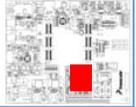
<sup>7</sup> ID0 and ID1 have a 10K pullup to 3V3

## 8. User Interface (I/O)

This section details the user I/O available on the EVB and includes the GPIO matrix, switches, LED's and the ADC variable resistor.

### 8.1. GPIO Matrix

The GPIO matrix is on the bottom edge of the EVB above the SAI audio



All of the available GPIO pins (those not already used for existing EVB peripherals) are available at the GPIO matrix shown below. The matrix provides an easy to follow, intuitive, space saving grid of 0.1" header through-hole pads. Users can solder wires, fit headers or simply insert a scope probe into the respective pad.

To use the matrix, simply read the port letter from the top or bottom row of text then the pad number from the columns on the left or right of the matrix. For example, the 1<sup>st</sup> pad available on Port B is PB5 as highlighted in green below.

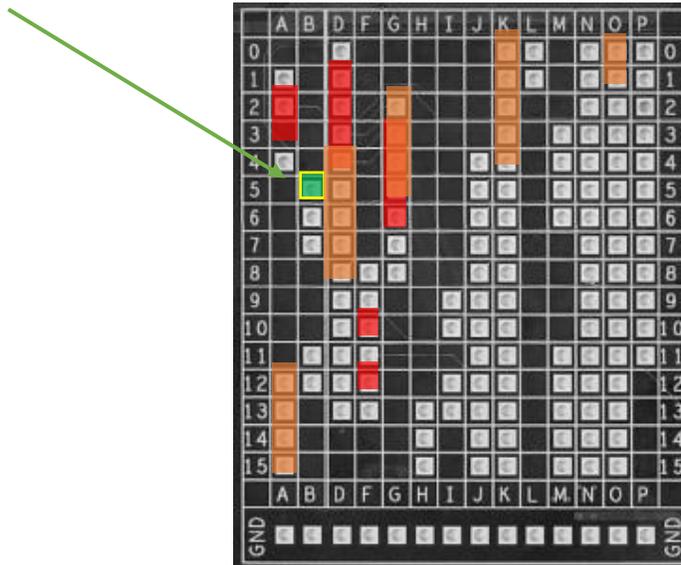


Figure 12. GPIO Matrix

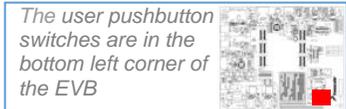
If a pad is populated in the matrix, it means this is available for exclusive use as GPIO. The exception to this are the port pins detailed below which are also shared with switches or user LED's (shaded red in the matrix diagram above).

- PG2, PG3, PG4, PG5 – User LED's 1..4
- PD0, PD1, PD2, PD3 – HEX Encoder Switch
- PA1, PA2, PF9, PF11 – User pushbutton Switches

In addition there are GPIO pins that are shared with the SAI Audio and TWRPI connectors as detailed below and shaded orange. These are totally available unless the SAI / TWRPI headers are being used.

PA[12..15], PD[4..8], PG[2..5], PK[0..4], PO[0..1]

## 8.2. User Switches (SW3, SW4, SW6, SW7, P22)



There are 4 active high (pulled low, driven to 3.3V) pushbutton switches (SW3, SW4, SW6, SW7) connected to a 4 way header (P22) in a box titled “User Switches”. The switches are also directly connected to MCU ports so no additional wiring is required unless you require to route these to a different GPIO port.

The switches are connected as follows:

**Table 20. User Pushbutton Switches (SW3, SW4, SW6, SW7)**

Switch	Number	MCU Pin	P18 Connection Pin
SW3	1	PA1	Pin1 (UpperMost)
SW4	2	PA2	Pin2
SW6	3	PF9	Pin3
SW7	4	PF11	Pin4

### NOTE

The MCU ports used on the user pushbutton switches are also routed to the GPIO matrix.

There are zero ohm resistors on the direct connections between each switch and the MCU pins. These can be removed if required to isolate the switch from the respective MCU pin (useful if the switch is being manually routed to another pin on the GPIO matrix).

### 8.3. Hex Encoder Switch (SW2, J26, P20)



There is a single hex encoded 16 position rotary switch on the EVB. This outputs a binary encoded hex value (active high) on 4 MCU ports (Port D[0..3]) as well as a 4 pin header P20. There is a jumper J26 which can be used to isolate the supply to the hex encoder if required. This prevents any voltage being asserted on the MCU pins irrespective of the position of the switch

**Table 21. Hex Encoder Switch (SW2)**

Position	HEX_SW4 (PD3, P20-4)	HEX_SW3 (PD2, P20-3)	HEX_SW2 (PD1, P20-2)	HEX_SW1 (PD0, P20-1)
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A	1	0	1	0
B	1	0	1	1
C	1	1	0	0
D	1	1	0	1
E	1	1	1	0
F	1	1	1	1

**Table 22. Hex Encoder Switch Power Jumper (J26)**

Jumper	Position	PCB Legend	Description
J26 (3V3)	FITTED (D) Removed		The hex encoder switch is powered with 3.3V (functional) The hex encoder switch is not powered and will not drive outputs

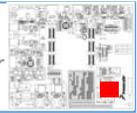
#### NOTE

The MCU ports used on the user pushbutton switches are also routed to the GPIO matrix.

There are zero ohm resistors on the direct connections between the switch output and the MCU pins. These can be removed if required to isolate the switch from the respective MCU pin (useful if the switch is being manually routed to another pin on the GPIO matrix).

## 8.4. User LED's (DS2, DS3, DS7, DS8, P19)

The user LED's are above the user switches in the lower right quarter



There are four active low user LED's connected directly to 4 MCU ports (PG[2..5]) as well as to a 4 pin header.

**Table 23. User LEDs (DS2, DS3, DS7, DS8, P19)**

Switch	Number	MCU Pin	P19 Connection Pin
DS2	1	PG2	Pin1 (Upper Pin)
DS3	2	PG3	Pin2
DS7	3	PG4	Pin3
DS8	4	PG5	Pin4

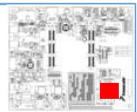
### NOTE

The MCU ports used on the LEDs are also routed to the GPIO matrix.

There are zero ohm resistors on the direct connections between each LED and the MCU pins. These can be removed if required to isolate the LED from the respective MCU pin (useful if the LED is being manually routed to another pin on the GPIO matrix).

## 8.5. ADC Input Potentiometer (J17, RV1)

The ADC Pot is to the right of the user LED's in the lower right corner



There is a small variable resistor RV1 on the EVB which routes a voltage between 0v and 3.3V to MCU pin PB4. This is useful for quick ADC testing. Jumper J17 which is fitted by default can be removed to disconnect MCU PB4 from RV1 if desired.

**Table 24. ADC Input Potentiometer Enable (J19)**

Jumper	Position	PCB Legend	Description
J17	FITTED (D) Removed		Output from RV1 is routed to MCU PB4 pin MCU PB4 is not connected to RV1

There is also a test point TP18 connected to the variable resistor output for monitoring purposes.

## 9. MCU Port Pin EVB Functions

The table below shows what each MCU pin is used for on the EVB. Note that not all MCU pins will be available depending on the device package being used.

**Table 25. Port Pin Functions**

No	PortA	PortB	PortC	PortD	PortE	PortF	PortG	PortH
0	SD Card	CAN0	JTAG	GPIO <sup>3</sup>	MLB	SAI Audio	Ethernet	Ethernet
1	GPIO <sup>2</sup>	CAN0	JTAG	GPIO <sup>3</sup>	MLB	SAI Audio	Ethernet	Ethernet
2	GPIO <sup>2</sup>	LIN0	USB1	GPIO <sup>3</sup>	FlexA	SAI Audio	GPIO <sup>4,5</sup>	Ethernet
3	Ethernet	LIN0	USB1	GPIO <sup>3</sup>	FlexA	SAI Audio	GPIO <sup>4,5</sup>	SAI Audio
4	GPIO	ADC Pot	FlexB	GPIO <sup>5</sup>	FlexB	SAI Audio	GPIO <sup>4,5</sup>	SAI Audio
5	SAI Audio	GPIO	FlexA	GPIO <sup>5</sup>	FlexB	SAI Audio	GPIO <sup>4,5</sup>	SAI Audio
6	MLB	GPIO	LIN1	GPIO <sup>5</sup>	SD Card	SAI Audio	GPIO	MLB
7	Ethernet	GPIO	LIN1	GPIO <sup>5</sup>	SD Card	SAI Audio	GPIO	MLB
8	Ethernet	EXTAL32	RS232	GPIO <sup>5</sup>	SAI Audio	GPIO	GPIO	SD Card
9	Ethernet	XTAL32	RS232	GPIO	SAI Audio	GPIO <sup>2</sup>	MLB	JTAG
10	Ethernet	SAI Audio	CAN1	GPIO	SAI Audio	GPIO	USB1	JTAG
11	Ethernet	GPIO	CAN1	GPIO	SAI Audio	GPIO <sup>2</sup>	USB1	USB1
12	GPIO <sup>5</sup>	GPIO	Flex	GPIO	Ethernet	GPIO	Ethernet	USB1
13	GPIO <sup>5</sup>	MLB	Flex	GPIO <sup>1</sup>	Ethernet	GPIO	Ethernet	GPIO
14	GPIO <sup>5</sup>	MLB	Flex	MLB	USB1	Ethernet	USB1	GPIO
15	GPIO <sup>5</sup>	MLB	Flex	MLB	USB1	Ethernet	USB1	GPIO

No	PortI	PortJ	PortK	PortL	PortM	PortN	PortO	PortP	PortQ
0	SD Card	SAI Audio	GPIO <sup>5</sup>	GPIO	NEXUS	GPIO	GPIO <sup>5</sup>	GPIO	USB0
1	SD Card	SAI Audio	GPIO <sup>5</sup>	GPIO	NEXUS	GPIO	GPIO <sup>5</sup>	GPIO	USB0
2	SD Card	SAI Audio	GPIO <sup>5</sup>	NEXUS	NEXUS	GPIO	GPIO	GPIO	USB0
3	SD Card	SD Card	GPIO <sup>5</sup>	NEXUS	GPIO	GPIO	GPIO	GPIO	USB0
4	USB1	GPIO	GPIO <sup>5</sup>	NEXUS	GPIO	GPIO	GPIO	GPIO	USB0
5	USB1	GPIO	GPIO	NEXUS	GPIO	GPIO	GPIO	GPIO	USB0
6	USB0	GPIO	GPIO	NEXUS	GPIO	GPIO	GPIO	GPIO	USB0
7	USB1	GPIO	GPIO	NEXUS	NEXUS	GPIO	GPIO	GPIO	USB0
8	MLB	GPIO	GPIO	JTAG	NEXUS	GPIO	GPIO	GPIO	-
9	GPIO	GPIO	GPIO	NEXUS	NEXUS	GPIO	GPIO	GPIO	-
10	GPIO	GPIO	GPIO	NEXUS	NEXUS	GPIO	GPIO	GPIO	-
11	Ethernet	GPIO	GPIO	NEXUS	GPIO	GPIO	GPIO	GPIO	-
12	GPIO <sup>1</sup>	GPIO	GPIO	NEXUS	GPIO	GPIO	GPIO	USB0	-
13	GPIO <sup>1</sup>	GPIO	GPIO	NEXUS	GPIO	GPIO	GPIO	USB0	-
14	SAI Audio	GPIO	GPIO	NEXUS	GPIO	GPIO	GPIO	USB0	-
15	SAI Audio	GPIO	GPIO	NEXUS	GPIO	GPIO	GPIO	USB0	-

<sup>1</sup> Shared with MLB header (via no populated zero ohm resistors)

<sup>2</sup> Shared with user switches

<sup>3</sup> Shared with Hex Encoder Switch

<sup>4</sup> Shared with user LED's

<sup>5</sup> Shared with TWRPI (P26, P27) or SAI Audio P25

## 10. Default Jumper Summary Table

The following tables detail the default (D) jumper configuration of the EVB and daughtercards

**Table 26. Default Jumper Positions (Main Board)**

Jumper	Default Posn	PCB Legend	Description
J1 Posn 1-2	Fitted (D)	BGE	FlexRay B PHY Bus Guardian Enable (Transmitter is enabled)
J1 Posn 3-4	Fitted (D)	EN	FlexRay B PHY is enabled
J1 Posn 5-6	Fitted (D)	STBN	FlexRay B PHY will not enter Standby Mode
J1 Posn 7-8	Fitted (D)	WAKE	FlexRay B PHY Wakeup signal pulled low
J2 Posn 1-2	Fitted (D)	BGE	FlexRay A PHY Bus Guardian Enable (Transmitter is enabled)
J2 Posn 3-4	Fitted (D)	EN	FlexRay A PHY is enabled
J2 Posn 5-6	Fitted (D)	STBN	FlexRay A PHY will not enter Standby Mode
J2 Posn 7-8	Fitted (D)	WAKE	FlexRay A PHY Wakeup signal pulled low
J3 Posn 1-2	Fitted (D)	TX	MCU PC5 is connected to FlexRay A transceiver TX
J3 Posn 3-4	Fitted (D)	TXEN	MCU PE2 is connected to FlexRay A transceiver TXEN
J3 Posn 5-6	Fitted (D)	RX	MCU PE3 is connected to FlexRay A transceiver RX
J4 Posn 1-2	Fitted (D)	TX	MCU PE4 is connected to FlexRay B transceiver TX
J4 Posn 3-4	Fitted (D)	TXEN	MCU PC4 is connected to FlexRay B transceiver TXEN
J4 Posn 5-6	Fitted (D)	RX	MCU PE5 is connected to FlexRay B transceiver RX
J5	1-2 (D)	MII	Ethernet PHY is configured in MII mode
J6 (X1)	1-2 (D)		Ethernet PHY X2 clock is connected to 25MHz xtal
J7 (X2)	1-2 (D)		Ethernet PHY X1 clock is connected to 25MHz xtal
J8 (RST)	1-2 (D)	NORM	The Ethernet PHY will be reset along with MCU reset
J9 (EN)	Fitted (D)		Reset from reset switch and debug connectors is active
J10 (LIN0) 1-2	Fitted (D)	RX	MCU LIN0_RX signal (PB3) is routed to LIN0 interface
J10 (LIN0) 3-4	Fitted (D)	TX	MCU LIN0_TX signal (PB2) is routed to LIN0 interface
J11 (Master_EN)	Fitted (D)		LIN0 is configured in Master Mode
J12 (LIN1) 1-2	Fitted (D)	RX	MCU LIN1_TX signal (PC7) is routed to LIN1 interface
J12 (LIN1) 3-4	Fitted (D)	TX	MCU LIN1_RX signal (PC6) is routed to LIN interface
J13 (Master_EN)	Fitted (D)		LIN1 is configured in Master Mode
J14 (CAN1) 1-2	Fitted (D)	TX	MCU CAN1_TX signal (PC10) is routed to CAN interface
J14 (CAN1) 3-4	Fitted (D)	RX	MCU CAN1_RX signal (PC11) is routed to CAN interface
J15 (CAN0) 1-2	Fitted (D)	TX	MCU CAN0_TX signal (PB0) is routed to CAN interface
J15 (CAN0) 3-4	Fitted (D)	RX	MCU CAN0_RX signal (PB1) is routed to CAN interface
J16 Posn 1-2	Fitted (D)	RX	MCU LIN2_RX signal (PC9) is routed to the FTDI interface
J16 Posn 3-4	Fitted (D)	TX	MCU LIN2_TX signal (PC8) is routed to the FTDI interface
J17	Fitted (D)		Output from RV1 is routed to MCU PB4 pin
J18 (1V25L)	Fitted (D)		1.25V Linear regulator output is routed to daughter card
J19 (5V0S)	Fitted (D)		5.0V Switching regulator output is routed to daughter card
J20 (3V3L)	Fitted (D)		3.3V Linear regulator output is routed to daughter card
J21 (5V0L)	Fitted (D)		5.0V Linear regulator output is routed to daughter card
J22 (3V3S)	Fitted (D)		3.3V Switching regulator output is routed to daughter card
J23 (INPUT SEL)	1-2 (D)	12V	1.25V Linear regulator is powered from main 12V
J24 (HVA)	1-2 (D)	3V3	EVB peripherals in HVA domain are set to use I/O voltage of 3.3V
J25 (HVB)	1-2 (D)	3V3	EVB peripherals in HVB domain are set to use I/O voltage of 3.3V
J26 (3V3)	Fitted (D)		The hex encoder switch is powered with 3.3V (functional)

**Table 27. Default Jumper Positions (Daughterboards)**

Jumper	Default Posn	PCB Legend	Description
<b>J1 (XTAL)</b>	1-2 (D)	Y1	MCU XTAL signal is routed to crystal Y1
<b>J2 (EXTAL)</b>	1-2 (D)	Y1	MCU EXTAL signal is routed to crystal Y1
<b>J3 (ADC0)</b>	1-2 (D)	3V3	MCU ADC0 pin is connected to 3.3V (Linear)
<b>J4 (ADC1)</b>	1-2 (D)	3V3	MCU ADC1 pin is connected to 3.3V (Linear)
<b>J5 (HVA)</b>	1-2 (D)	3V3	MCU VDD_HV_A domain is connected to 3.3V (Switching Regulator)
<b>J6 (HVB)</b>	1-2 (D)	3V3	MCU VDD_HV_B domain is connected to 3.3V (Switching Regulator)
<b>J7 (HVC)</b>	1-2 (D)	3V3	MCU VDD_HV_C domain is connected to 3.3V (Switching Regulator)
<b>J8 (FLA)</b>	Fitted (D)		MCU VDD_HV_FLA pin is connected to 3.3v (Switching Regulator)
<b>J9 (REG)</b>	1-2 (D)	3V3	MCU ballast transistor collector is connected to 3.3V (Switching)
<b>J10 (VDDL)</b>	1-2 (D)	REG	MCU VDD_LV domain is powered from ballast transistor
<b>J11 (DAC)</b>	1-2 (D)	HVA	MCU VIN1_CMP_REF is powered from VDD_HV_A
<b>J12</b>	Fitted (D)		Ballast collector supply is enabled (jumper can be used for current measure)
<b>J13</b>	1-2 (D)		** Only valid on certain devices – External Ballast enabled.

Note that not all jumpers will be present on all of the daughterboards.



# 11. Default Jumper Diagram

The diagram below shows the location and configuration of the default jumpers of the main board and provides an easy to use cross reference. By default all of the jumpers are fitted to the daughtercard (3 way jumpers in position 1-2).

### NOTE

Following figure is of an older board revision however there were no additional jumpers and no jumpers have moved position.

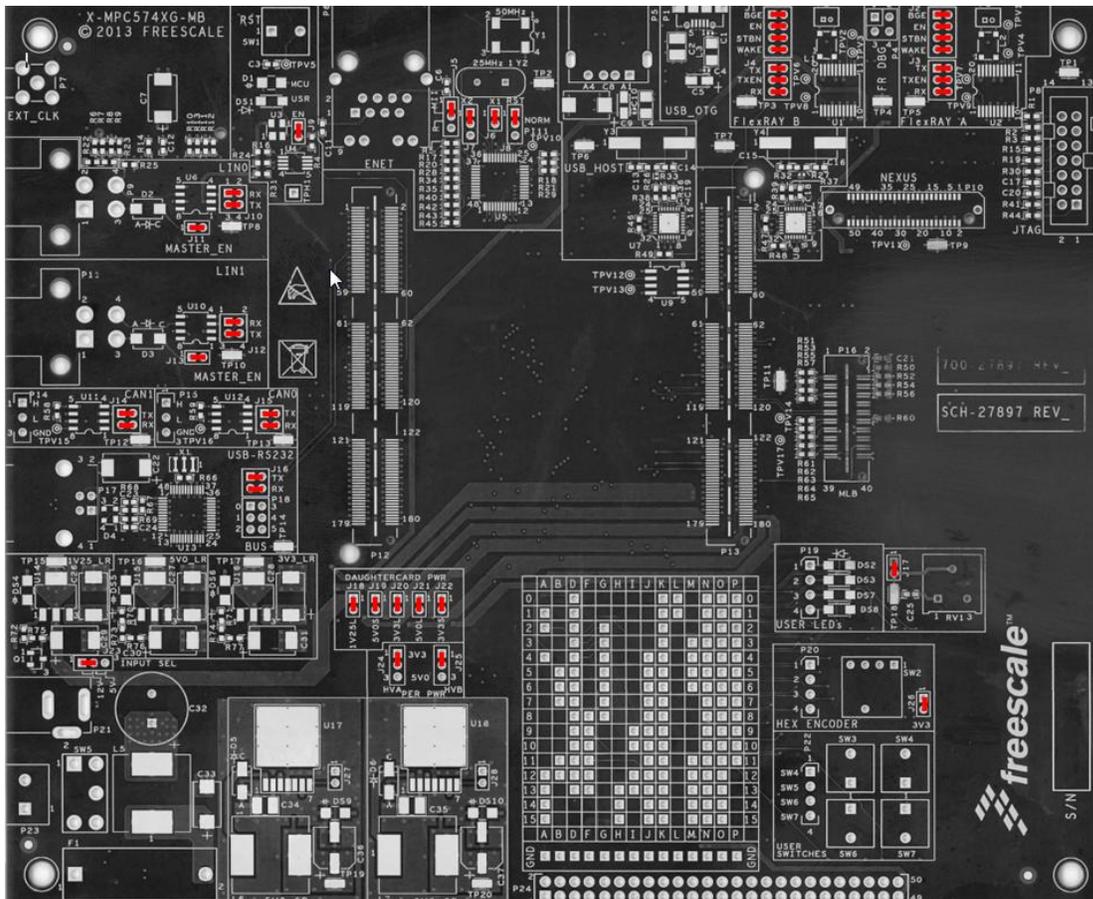


Figure 13. Default Jumper Position

# 12. Revision History

Date	Substantial changes
August 2015	Initial release

## 13. Appendix

The following EVB schematics are detailed in the following sections:

- Main EVB (motherboards)
- 324BGA Daughtercard
- 256BGA Daughtercard
- 176QFP Daughtercard
- 100QFP Daughtercard (MPC5746C only)



Main EVB



# MPC574xx Customer Evaluation Board (X-MPC574xx)

## Table Of Contents:

Power - Main input and Linear voltage regulators	Sheet 2
Power - Switching voltage regulators	Sheet 3
Daughter Card Connectors (Sockets)	Sheet 4
Reset and External Clock Input	Sheet 5
JTAG and Nexus Connectors	Sheet 6
Comms - CAN and LIN	Sheet 7
Comms - RS232 (USB FTDI interface)	Sheet 8
Comms - USB Interfaces	Sheet 9
Comms - Ethernet	Sheet 10
Comms - FlexRAY	Sheet 11
Audio - SAI Audio. AVB and TWRPI headers	Sheet 12
AV - MOST Interface	Sheet 13
Memory - SD Card Slot	Sheet 14
User - Switches, LED's and Potentiometer	Sheet 15
User - GPIO Pin Matrix	Sheet 16

### Caution:

These schematics are provided for reference purposes only. As such, Freescale does not make any warranty, implied or otherwise, as to the suitability of circuit design or component selection (type or value) used in these schematics for hardware design using the Freescale MPC574xG family of Microprocessors. Customers using any part of these schematics as a basis for hardware design, do so at their own risk and Freescale does not assume any liability for such a hardware design.

### Notes:

- All components and board processes are to be ROHS compliant
- All small capacitors are 0402 unless otherwise stated
- All resistors are 0603 5% 0.1w unless otherwise stated. All zero ohm links are 0603
- All connectors and headers are denoted Px and are 2.54mm pitch unless otherwise stated
- All jumpers are denoted Jx. Jumpers are 2mm pitch
- Jumper default positions are shown in the schematics. For 3 way jumpers, default is always posn 1-2.
- 2 Pin jumpers generally have the "source" on pin 1.
- All switches are denoted SWx
- All test points (SMT wire loop style) are denoted TPx
- Test point Vias (just through hole pads) are denoted TPVx

Signals (ports) have not been routed via busses as this makes it harder to determine where each signal goes.

User notes are given throughout the schematics.

Specific PCB LAYOUT notes are detailed in *ITALICS*

## Revision Information

Rev	Date	Designer	Comment
0.1	01 Feb 2012	Alasdair Robertson	Start of cap
X1	19 Feb 2012	Alasdair Robertson	1st release
X2	28 Feb 2012	Alasdair Robertson	2nd release
X3	11 Mar 2013	Alasdair Robertson	Final review
X4	13 Mar 2013	Alasdair Robertson	Version sen
X5	14 Mar 2013	Alasdair Robertson	Component
X6	29 Mar 2013	Alasdair Robertson	Changes ma
X7	02 Apr 2013	Alasdair Robertson	LAY RefD
A	17 Apr 2013	Alasdair Robertson	Post Layout
AX1	24 Jun 2013	Alasdair Robertson	Fixes and c
AX2	10 July 2013	Alasdair Robertson	Added CAN
AX3	12 July 2013	Alasdair Robertson	Corrected g
B	12 July 2013	Alasdair Robertson	Production
BX1	20 Aug 2013	Alasdair Robertson	Change to E
C	20 Aug 2013	Alasdair Robertson	Production
CX1	18 Dec 2013	Alasdair Robertson	CAN trans
CX2	05 May 2014	Alasdair Robertson	Added com
CX3	25 June 2014	Alasdair Robertson	PH3..5 now
CX4	26 June 2014	Alasdair Robertson	Minor chan
CX5	26 June 2014	Alasdair Robertson	Part Manag
CX6	18 Aug 2014	Alasdair Robertson	Added addi
CX7	03 Sept 2014	Alasdair Robertson	Added addi
D	24 Sept 2014	Alasdair Robertson	Released to
D1	14 Aug 2015	Alasdair Robertson	Tidy up Sch

3 Different test points used in design:

TPVx - Through Hole Pad small

TPHx - Through Hole Pad Large (for standard 0.1" header).  
Also used on IO Matrix (IOMx)

TPX - Surface Mount Wire Loop



This document is for procurement or

Designer:  
A. Robertson

Drawn by:  
A. Robertson

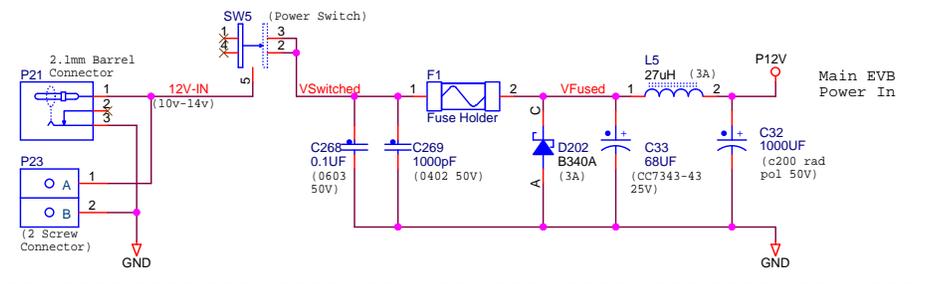
Approved:  
A. Robertson



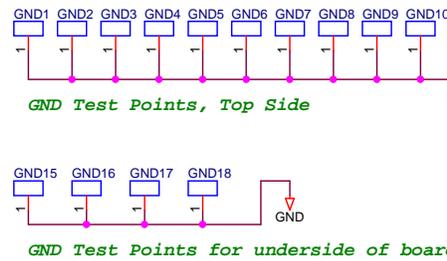
# Input and Linear Voltage Regulators

at 12V DC nominal (range 10v - 14v)  
 See note on schematic sheet 3 regarding 3.3V regulator when running at < 11V)

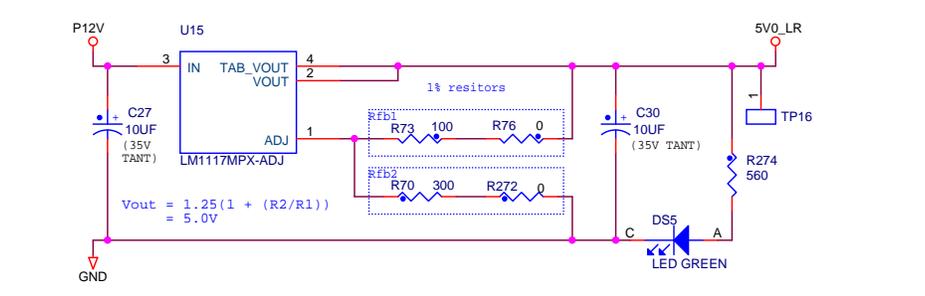
## Power Supply Input and Filter



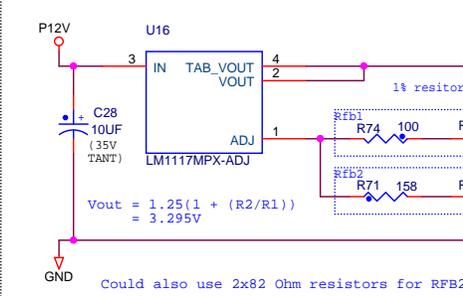
## Test and reference points



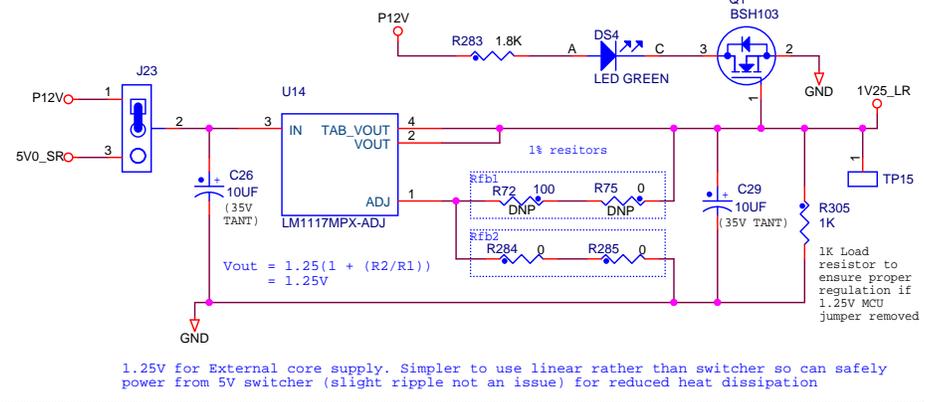
## 5.0V Linear Regulator (800mA Max \*\*)



## 3.3V Linear Regulator (800mA Max \*\*)



## 1.25V Linear Regulator (800mA Max \*\*)

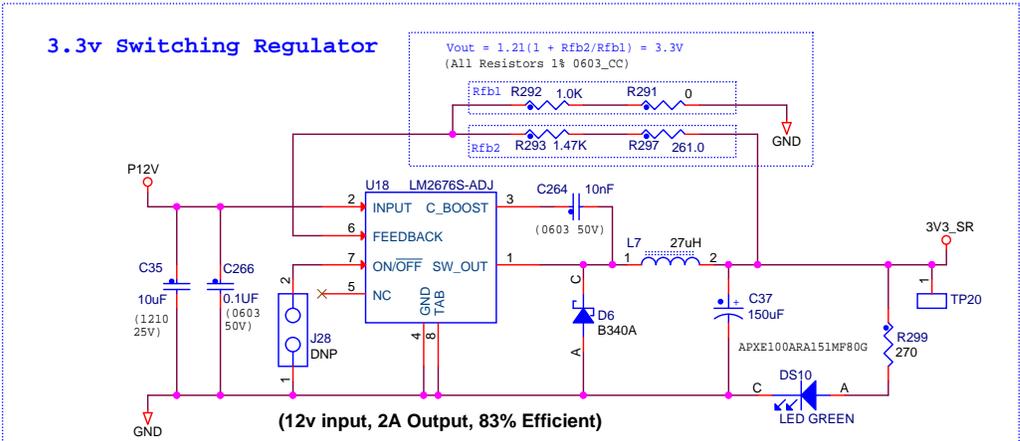
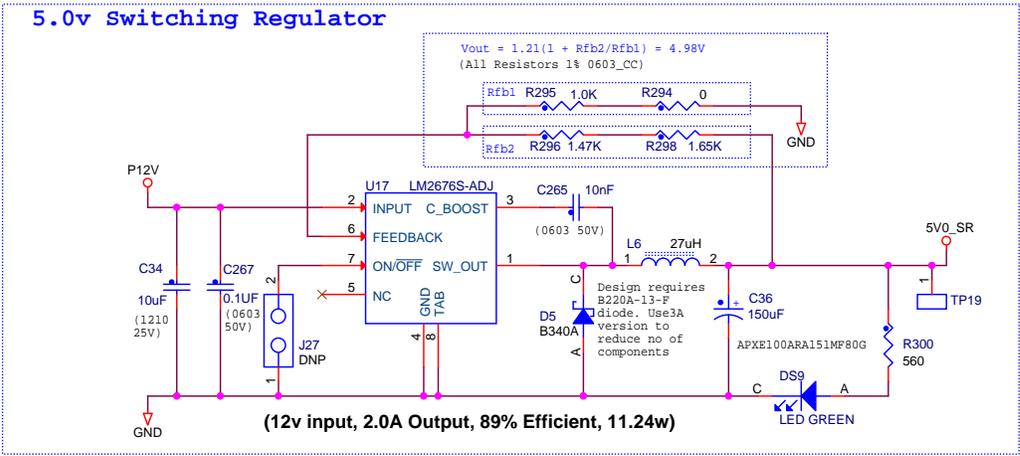


## \*\* Notes on Linear Regulator LM1117

The LM1117 linear regulators provide a maximum current of 800mA in ideal conditions. The current requirement for each regulator is in the range of mA (significantly under the maximum rating) these regulators will run cool on the EVB.

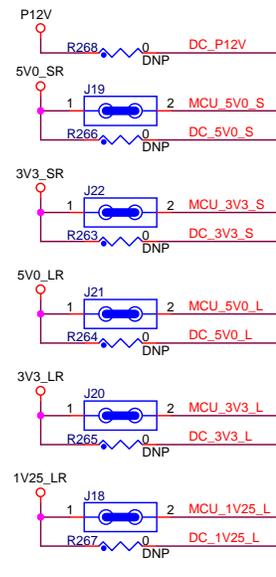


# 5V Voltage Regulators and Supply Jumpers

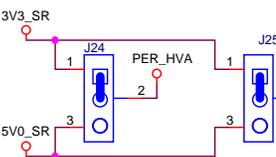


**Caution** The 3.3v regulator design is optimised for an input voltage of 12V. If the input voltage drops below approx 11V, the 3.3v output voltage ripple may increase. This can be reduced by increasing the bulk storage capacitor if required.

### Global MCU Daughtercard Supply Jumpers and DC power



### Peripheral Power Control



These jumpers control the voltage peripherals connected to MCU power domains and are used for the respective jumpers at the board level to be used for MCU current measurement.

The settings on these jumpers mirror the setting of the respective MCU VDD\_HV\_A / HB\_V jumpers

Using Adjustable version of LM2676 rather than fixed 3.3V / 5V regulators to reduce number of components in BOM.

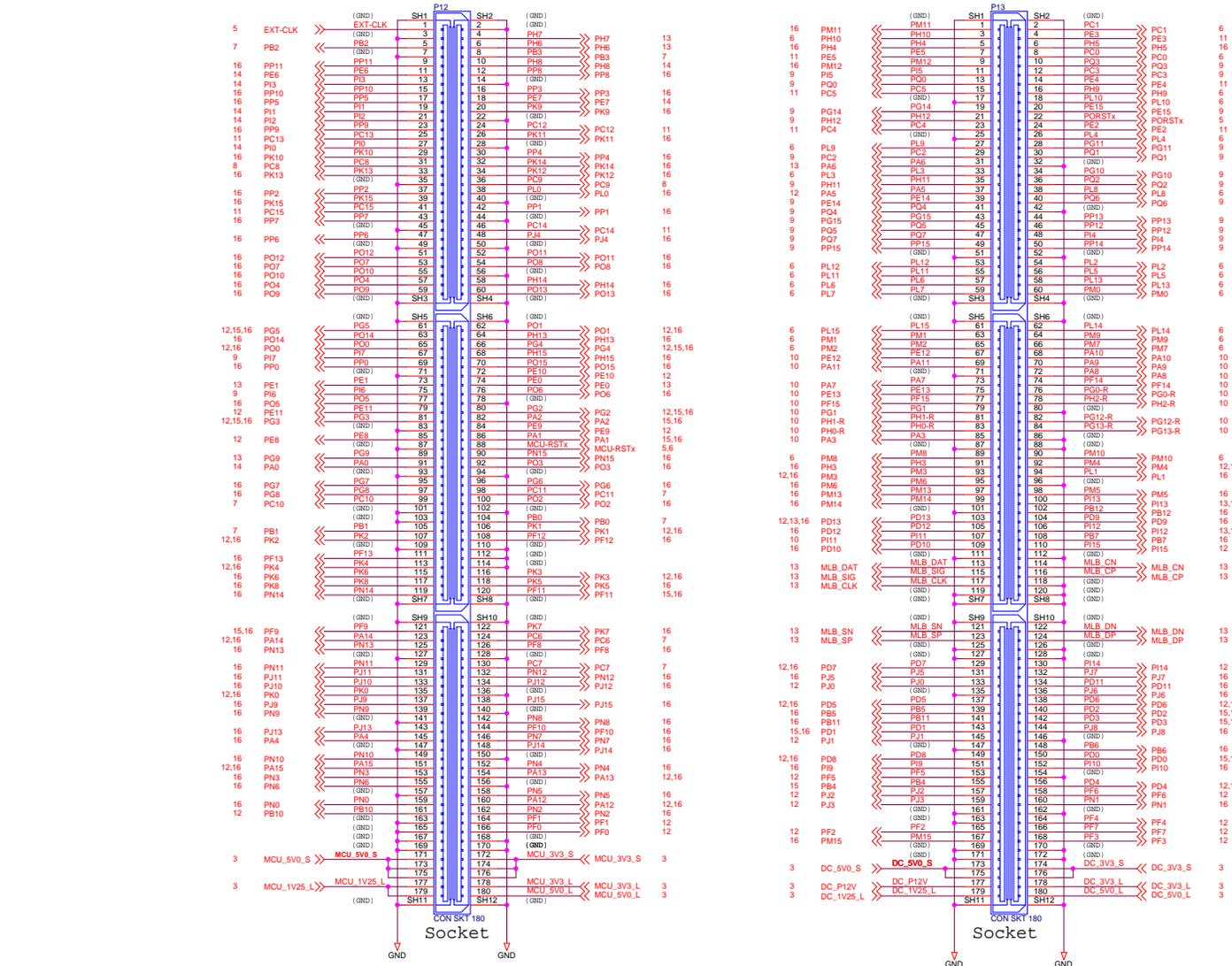
Where possible, components have been shared across the regulator designs to further reduce component count.



# Board Connectors (Sockets)

way to fit these connectors onto a B sized sheet so unfortunately the sheet size has been .ll need to be printed on larger paper.

- The MCU Clock circuitry (apart from external clock) is local to the daughtercard so not pinned out on the connectors
- Power is supplied to the daughtercard via MCU specific jumpered supplies (left connector) or direct supplies from the regulators (right connector)

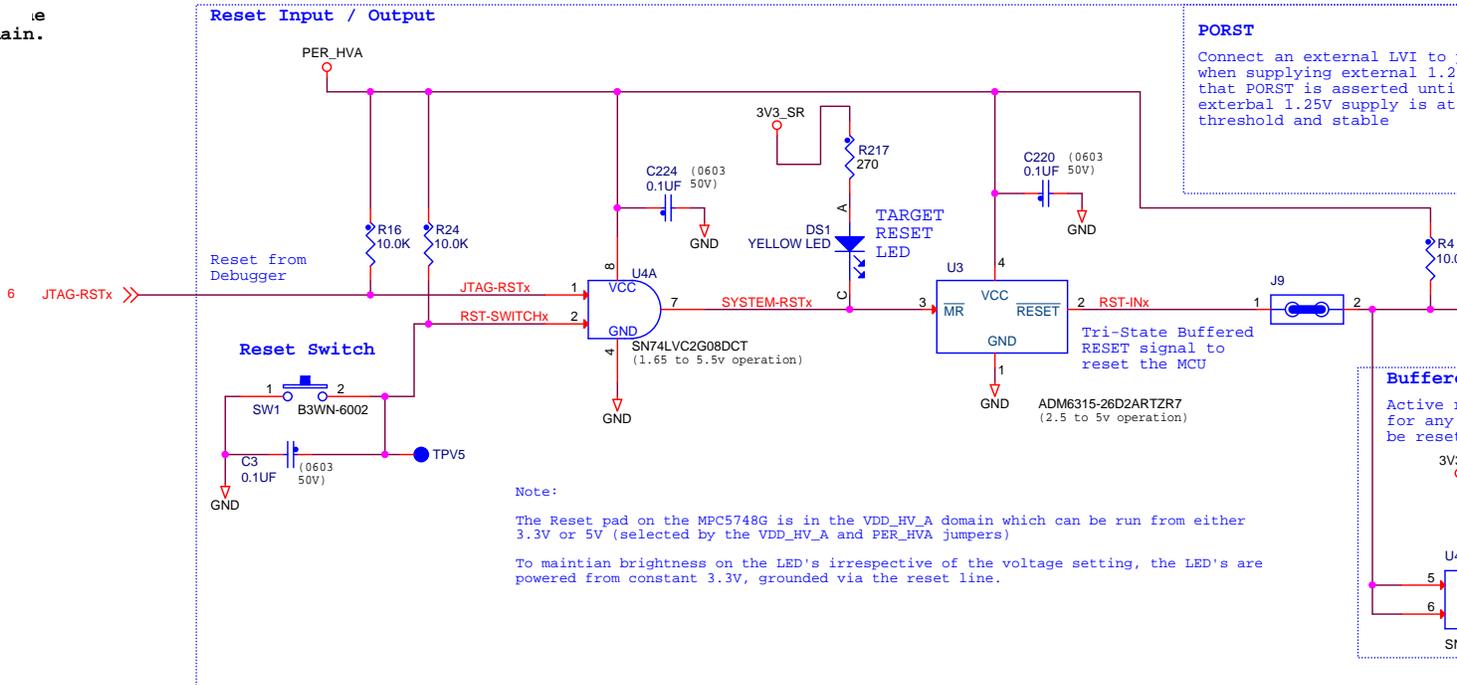


Not routed through the connectors:  
 - Crystal signals  
 - Specific MCU power pins (Power supplies are however taken to daughtercard)



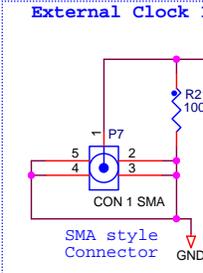
# Reset External Clock In

VDD\_HVA domain.



**PORST**  
Connect an external LVI to... when supplying external 1.2... that PORST is asserted until... external 1.25V supply is at... threshold and stable

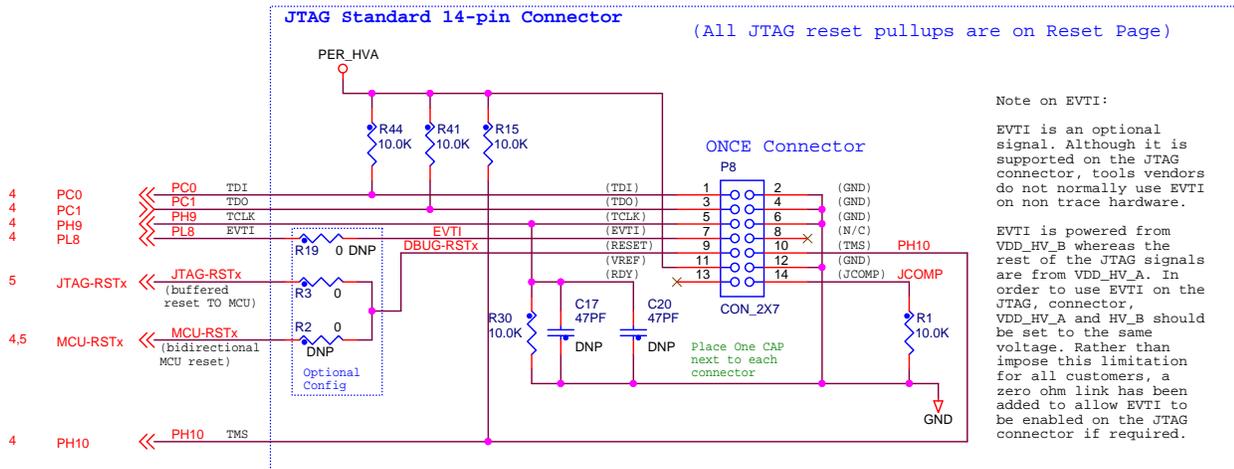
**Buffer**  
Active... for any... be reset... 3V...  
U...  
5...  
6...  
SI...







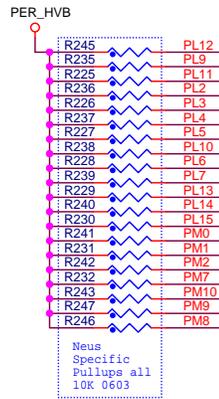
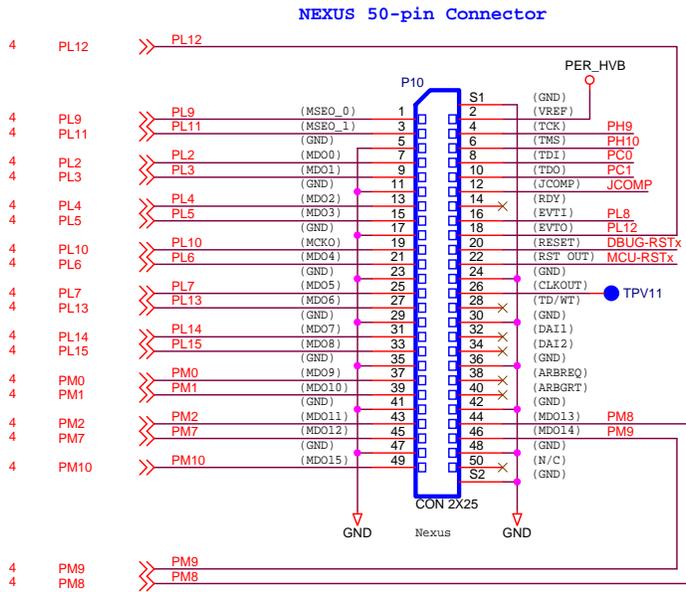
# Connectors (JTAG and NEXUS)



**Voltage Domain**

All of the sig  
 exception of E  
 the VDD\_HV\_A d  
 signals used f  
 VDD\_HV\_B.

If you are usi  
 the VDD\_HV\_A a  
 same voltage a  
 peripheral sup  
 VDD\_HV\_A / B.  
 configuration

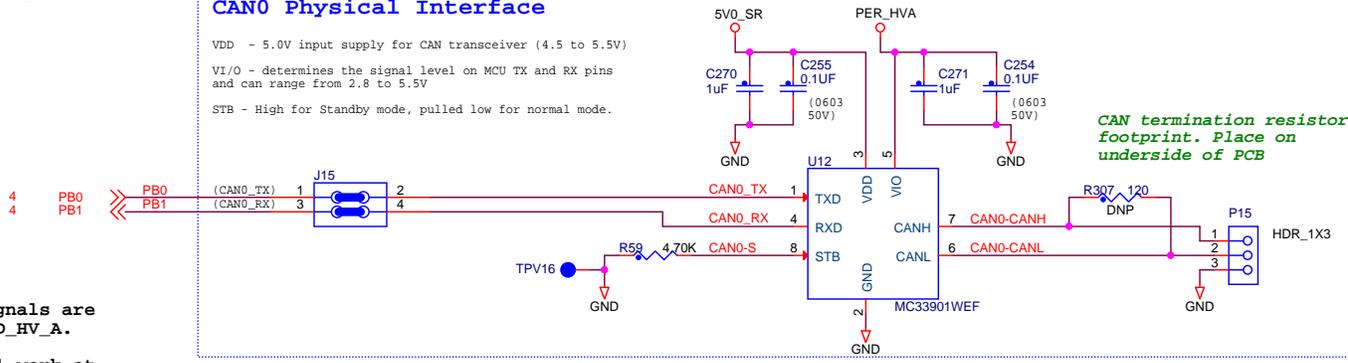




# IN Physical

## CAN0 Physical Interface

VDD - 5.0V input supply for CAN transceiver (4.5 to 5.5V)  
 VI/O - determines the signal level on MCU TX and RX pins and can range from 2.8 to 5.5V  
 STB - High for Standby mode, pulled low for normal mode.

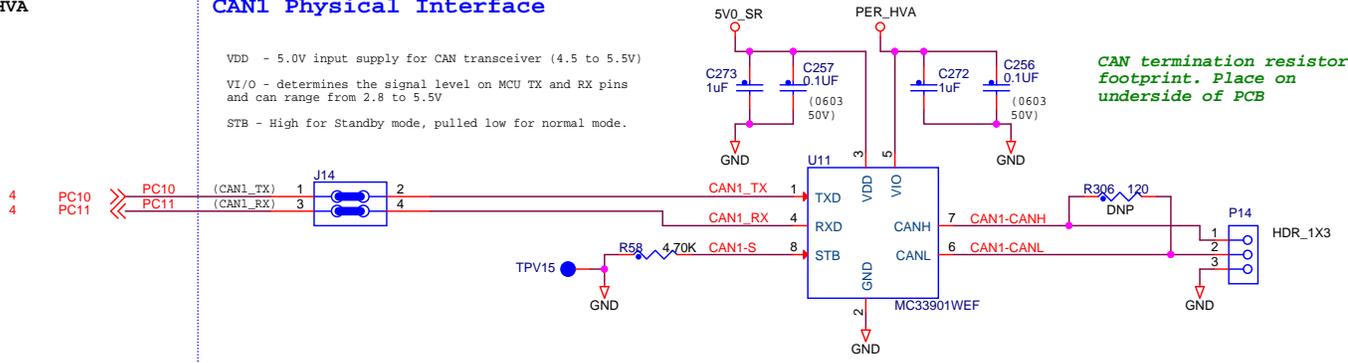


All CAN and LIN signals are in power domain VDD\_HV\_A.

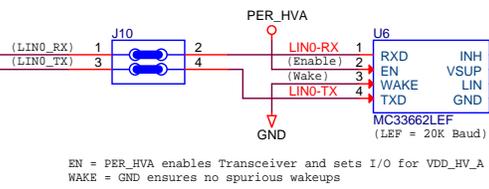
All interfaces will work at 3.3V or 5.0V (PER\_HVA jumper)

## CAN1 Physical Interface

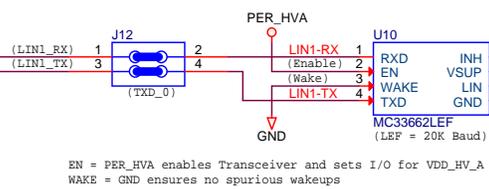
VDD - 5.0V input supply for CAN transceiver (4.5 to 5.5V)  
 VI/O - determines the signal level on MCU TX and RX pins and can range from 2.8 to 5.5V  
 STB - High for Standby mode, pulled low for normal mode.



## LIN0 Physical Interface



## LIN1 Physical Interface



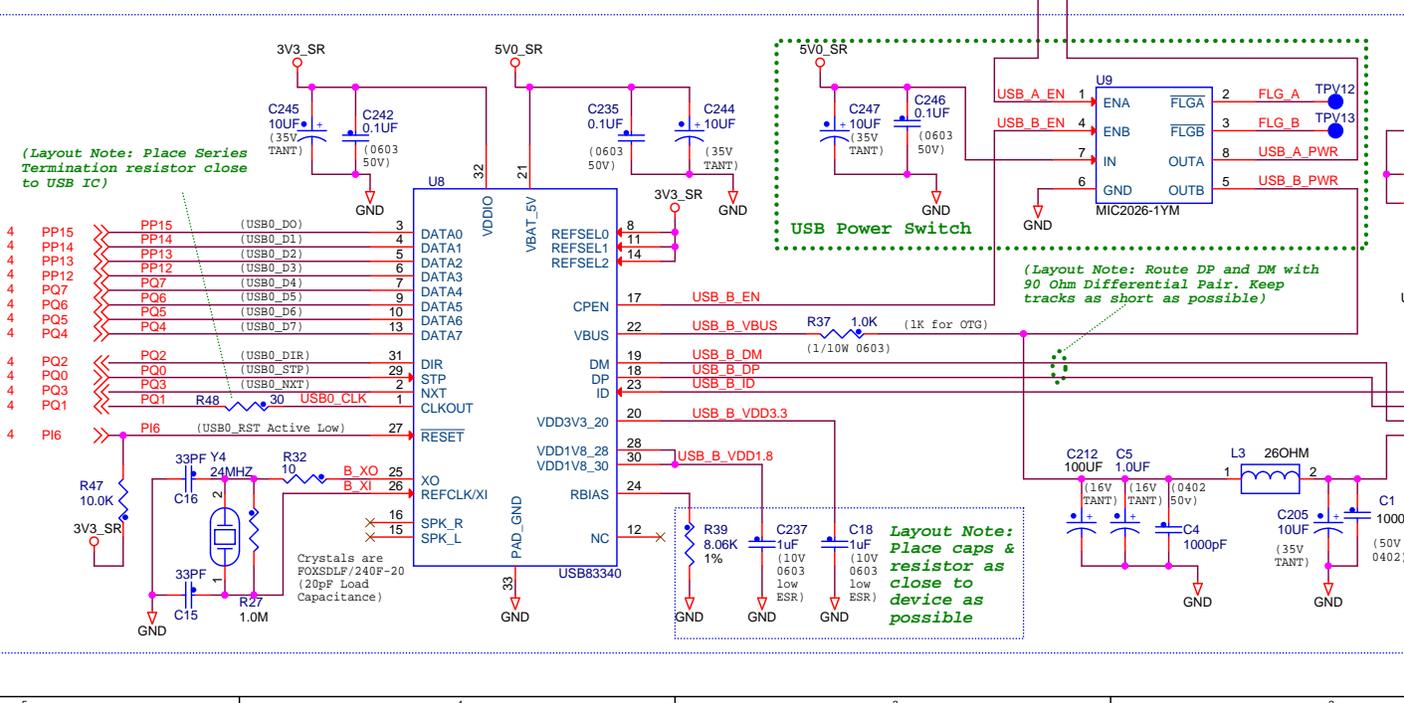
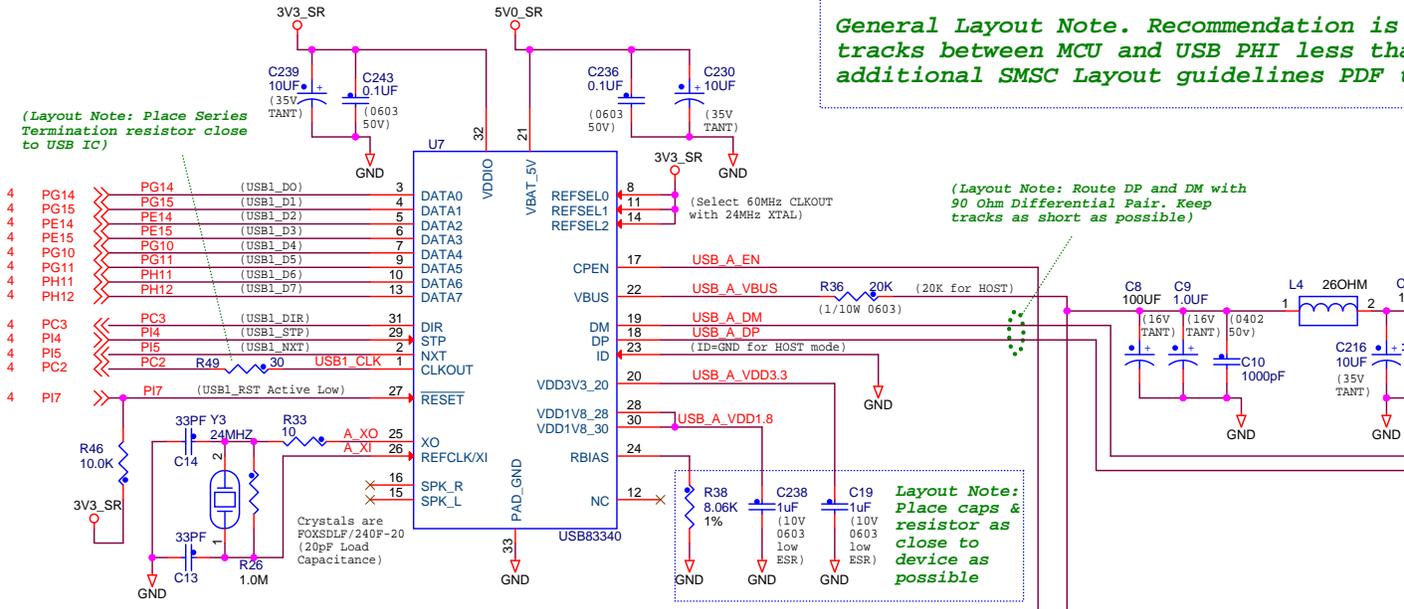




# A Host and Type AB OTG

power domain VDD\_HV\_A

The USB interface only supports 3.3V operation. All I/O signals must be 3.3V. If VDD\_HVA is set to 5V, USB MCU pads must be left as tri-state with no pullups.





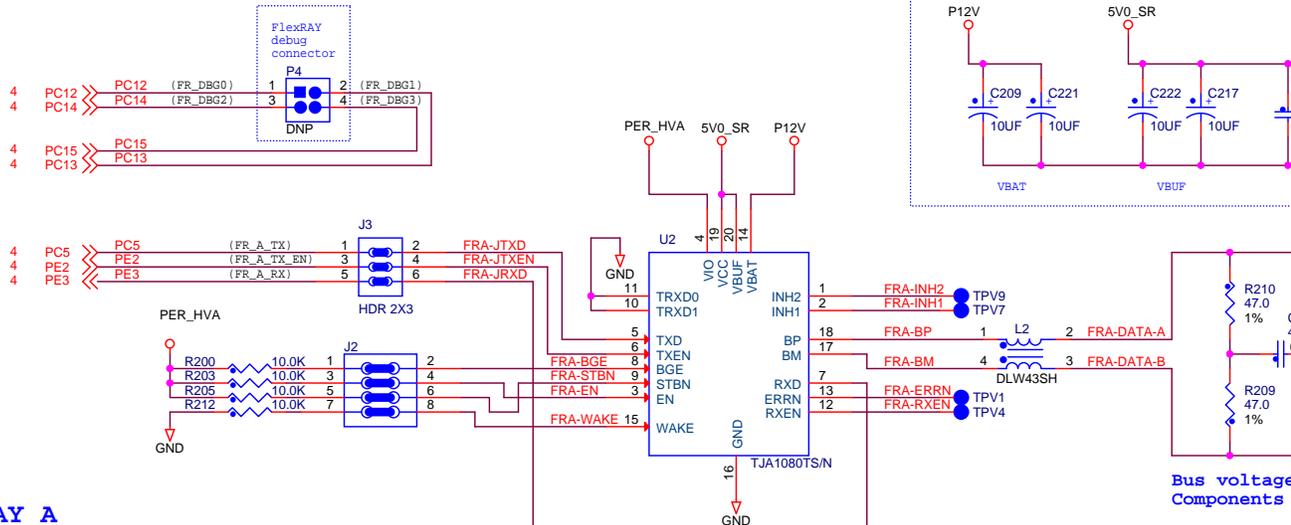


# Physical Interface

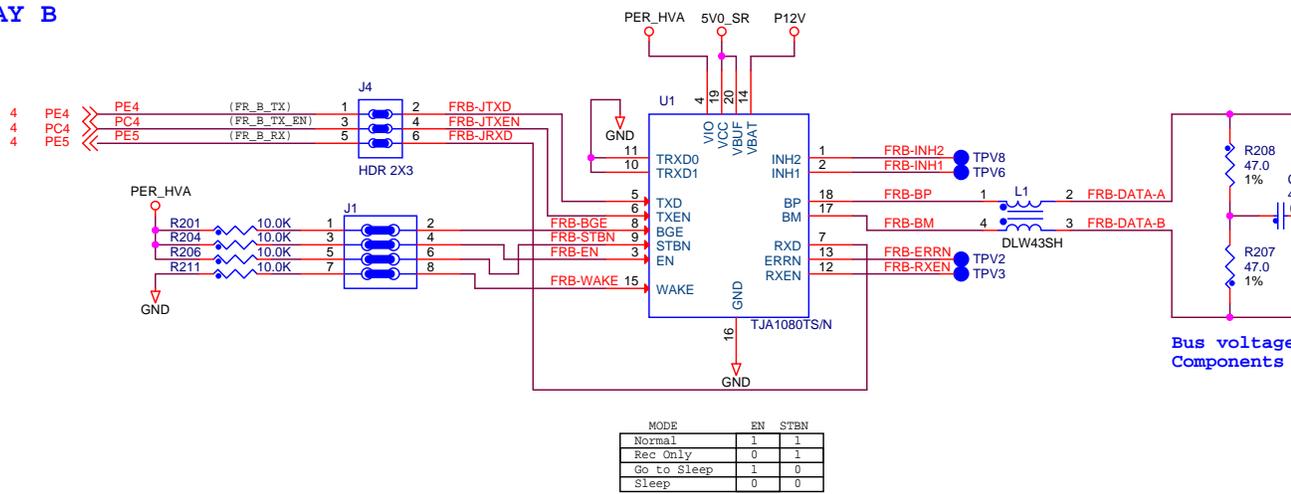
All Signals are in power domain VDD\_HV\_A.

FlexRAY interface will work at 3.3V or 5.0V (PER\_HVA jumper)

Decoupling Caps for BOTH IC's. Place



FlexRAY A



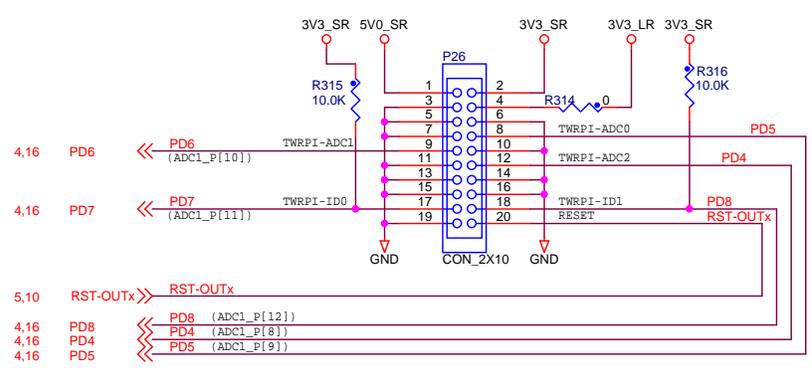
FlexRAY B

MODE	EN	STBN
Normal	1	1
Rec Only	0	1
Go to Sleep	1	0
Sleep	0	0

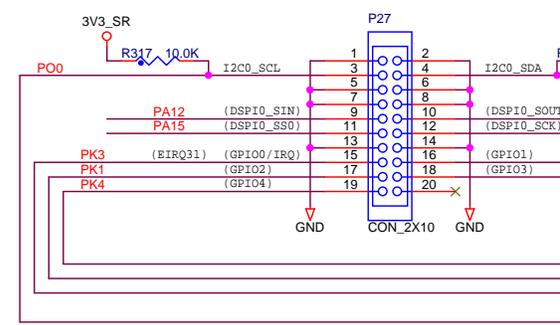


# Lo, AVB & TWRPI Connectors

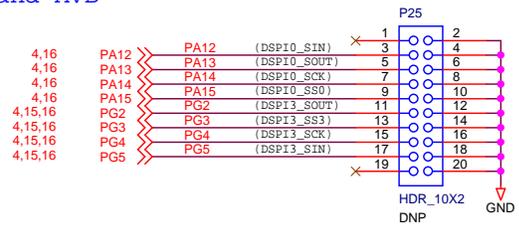
## purpose TWRPI



Note: Ports PD[4..8] are shared with the GPIO Matrix

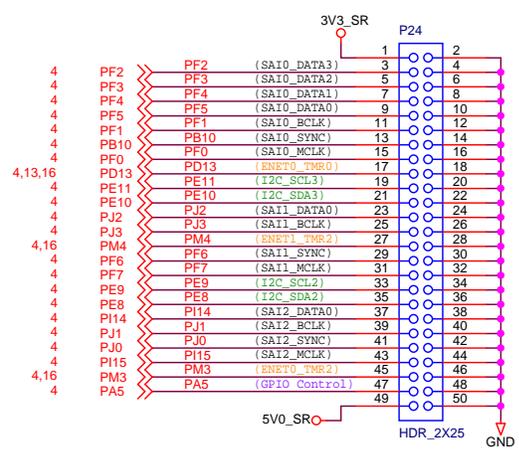


## SAI Audio and AVB



Pins used on this header are also at GPIO Matrix

- PA12 - DSP10\_SIN (Also shared with TWRPI)
- PA13 - DSP10\_SOUT (Also shared with TWRPI)
- PA14 - DSP10\_SCK (Also shared with TWRPI)
- PA15 - DSP10\_SS0 (Also shared with TWRPI)
- PG2 - DSP13\_SOUT (Also shared with User LED)
- PG3 - DSP13\_SS3 (Also shared with User LED)
- PG4 - DSP13\_SCLK (Also shared with User LED)
- PG5 - DSP13\_SIN (Also shared with User LED)



Differences to RevC  
 Pin 17 was PH5, now PD13\*\* (PH5 now routed to GPIO Matrix)  
 Pin 27 was PH4, now PM4 (PH4 now routed to GPIO Matrix)  
 Pin 45 was PH3, now PM3 (PH3 now routed to GPIO Matrix)

\*\* Note PD13 is also routed to MLB header via DNP link

Black - SAI Channels  
 Green - I2C Channels  
 Orange - ENET TMRx channels



# SMC) Daughtercard Connector

MLB track lengths should be < 80mm  
(from MCU through daughter card to connector)

All MLB Signals are in power domain VDD\_HV\_C.

The MLB interface only supports 3.3V operation. All I/O signals must be 3.3V. If VDD\_HVC is set to 5V, MLB MCU pads must be left as tri-state with no pullups.

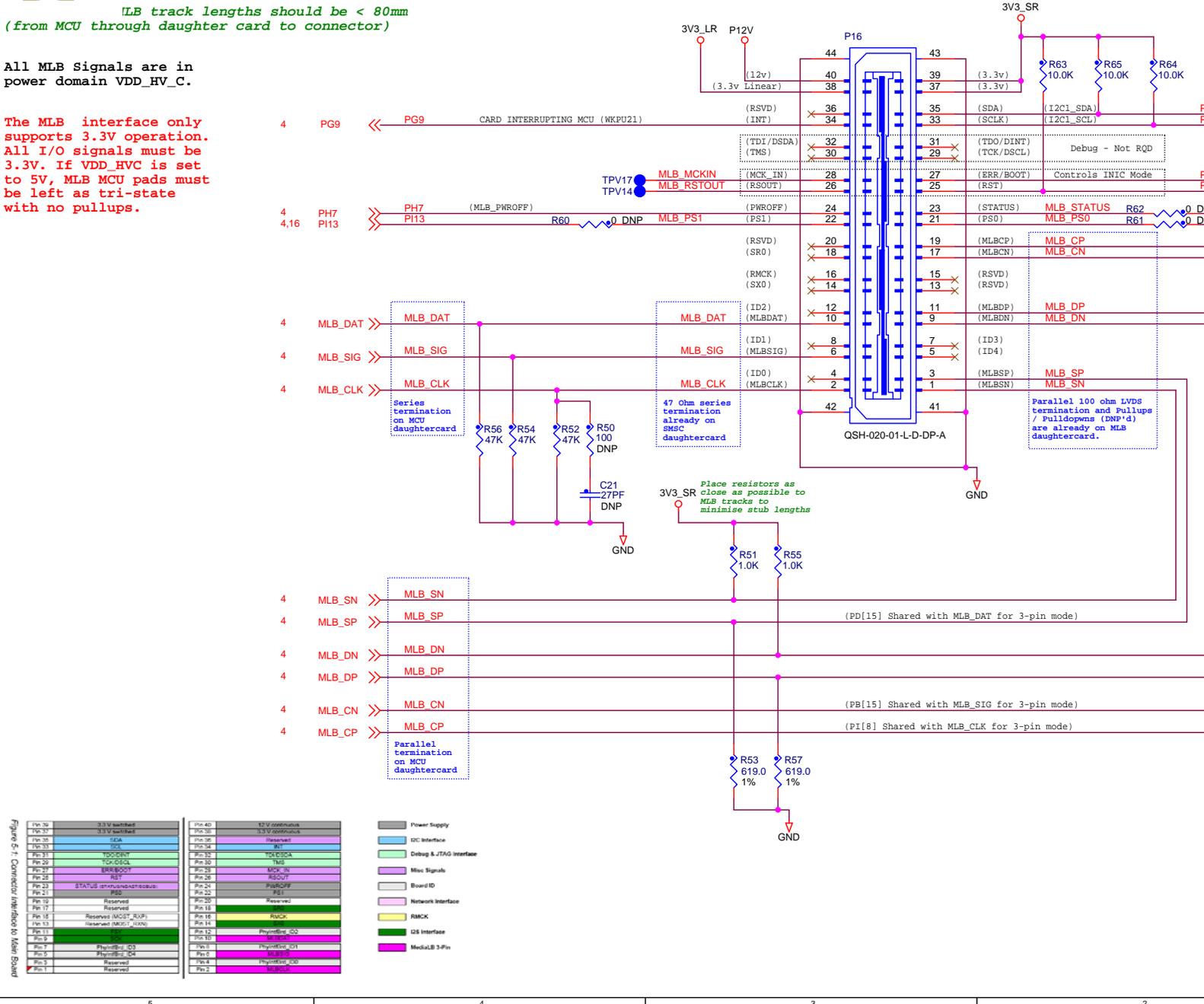
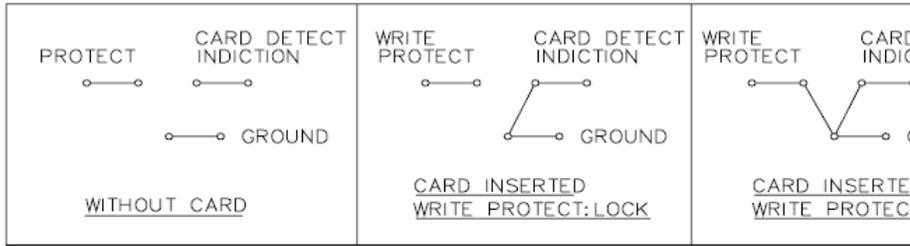
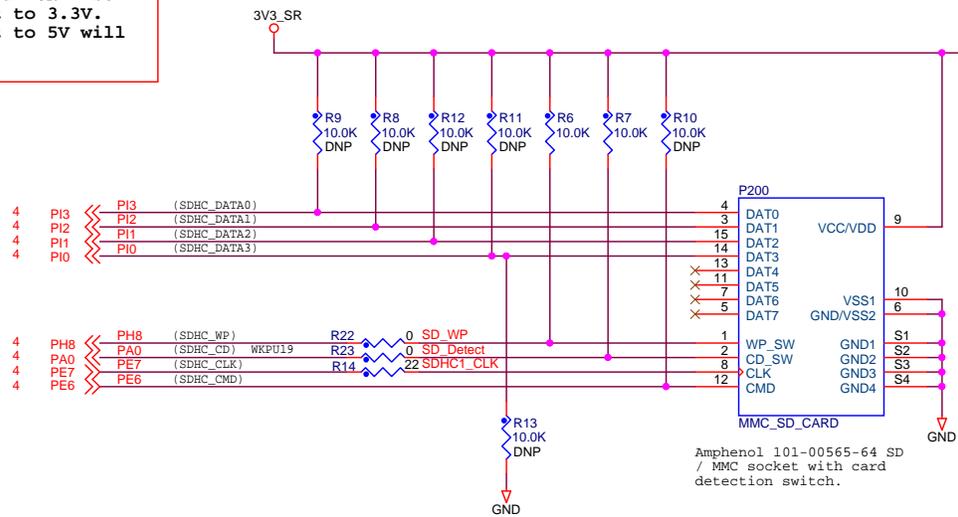


Figure 5-7: Connector Interface to Main Board



**Caution**

The SD card specification details an operating voltage of between 2.7 and 3.6V. If using the SD card, it can ONLY be used when VDD\_HV\_A (and PER\_HVA) jumpers are set to 3.3V. Inserting an SD card with VDD\_HV\_A / PER\_HVA set to 5V will result in card damage.

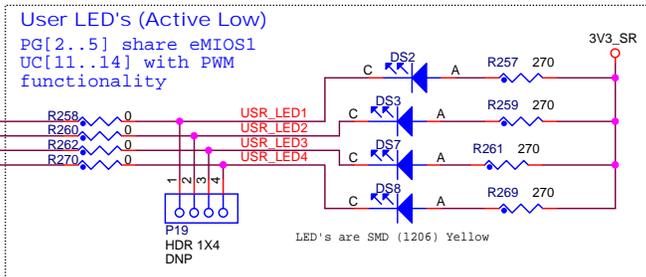


Card Detect: Grounded when Card Inserted, Pulled high when card removed  
 Write Protect: Grounded when NOT protected, Pulled high when protected (or card removed)

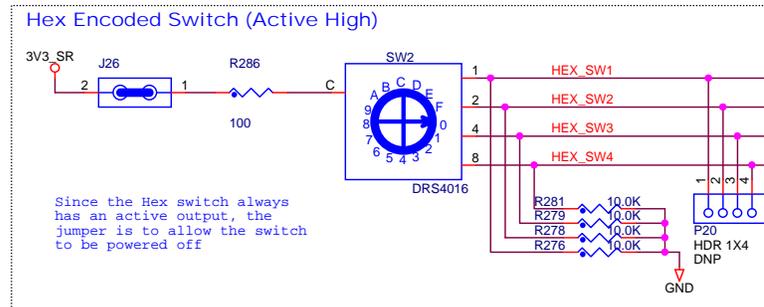
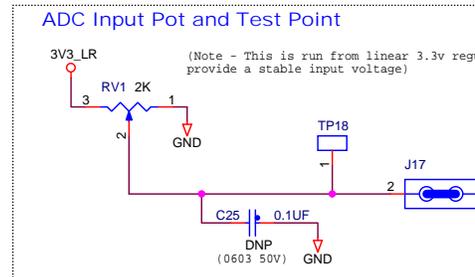


# Peripherals, Audio Controls and GPIO

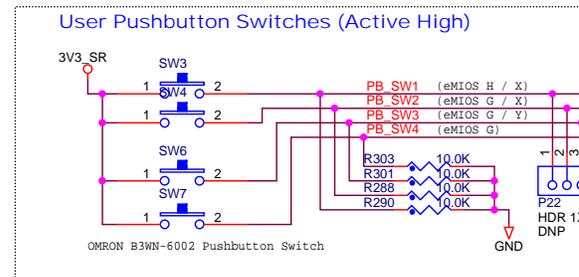
The ADC is hard wired to 3.3V rather than 5V so it's not possible to drive 5V into a 3.3V pad (which would cause damage)  
 The LED's are active low with 3.3v supply so can be safely coupled to pads on either 3.3V or 5V domains  
 The ADC input is limited to 3.3V, again to prevent driving 5V into a 3.3V pad which would cause damage



Note that LED2 and LED4 (PG3 and PG5) can be controlled in LPU\_RUN mode (and also have pad keepers in LPU\_STANDBY)



The LED's, Hex switches and push-button switches are connected to MCU pads vvia zero ohm links. If desired these can be removed and direct connection made to the LED or switch. All of the ports used for LED's / Switches are also bonded out to the GPIO matrix

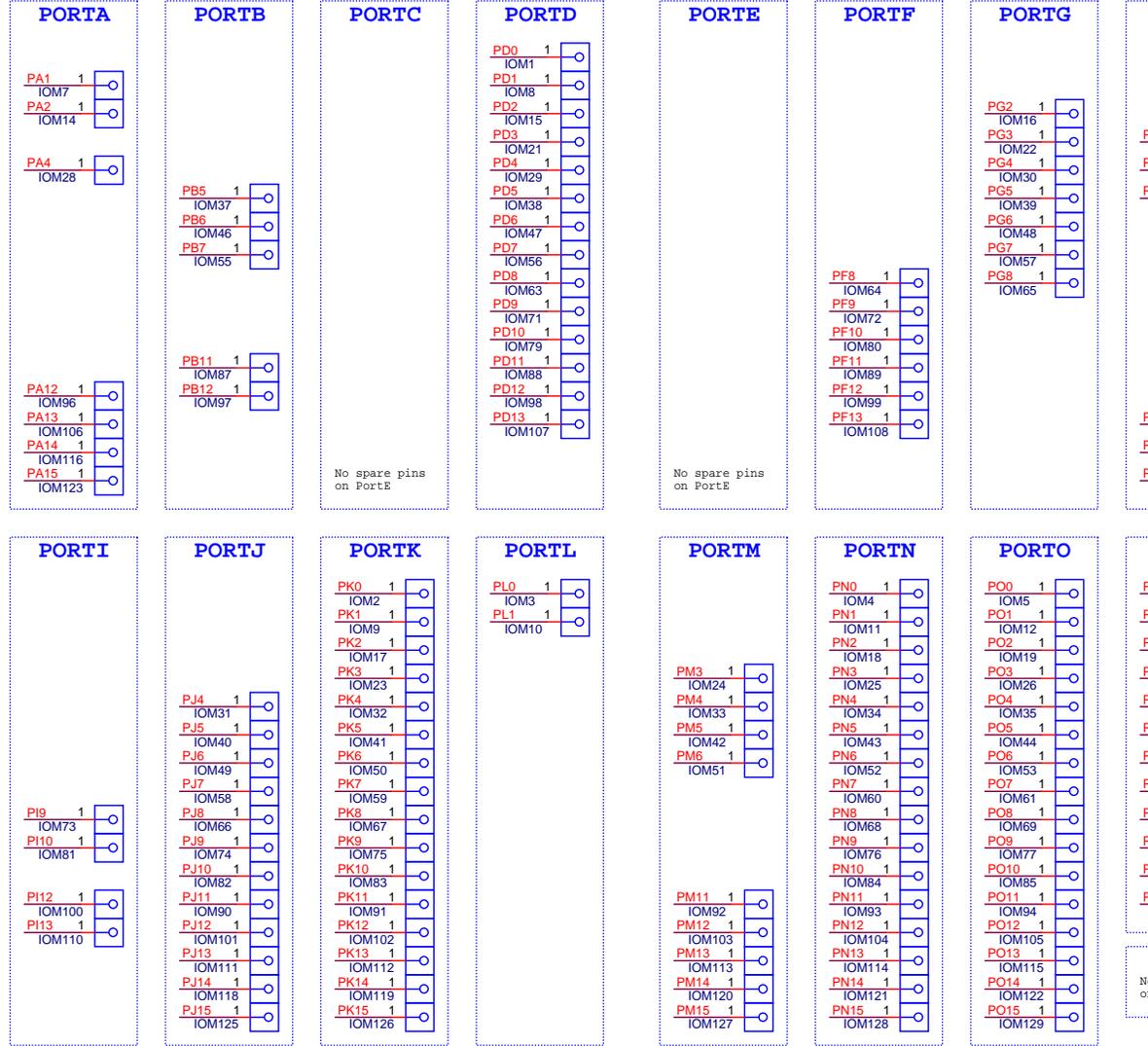




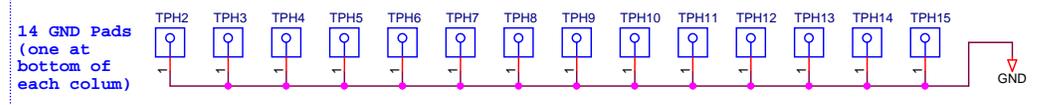
# Matrix

All pads are DNP (Do Not Populate) 0.1" pitch headers placed on a 0.1" grid

PA[1,2] shared with user switches	4,15	PA1	PA1
	4,15	PA2	PA2
	4	PA4	PA4
PA[12..15] shared with SAI Audio and TWRPI	4,12	PA12	PA12
	4,12	PA13	PA13
	4,12	PA14	PA14
	4,12	PA15	PA15
	4	PB5	PB5
	4	PB6	PB6
	4	PB7	PB7
	4	PB11	PB11
	4	PB12	PB12
PD[0..3] shared with Hex Switch	4,15	PD0	PD0
	4,15	PD1	PD1
	4,15	PD2	PD2
	4,15	PD3	PD3
PD[4..8] shared with TWRPI connector with pullup on PD[7], PD[8]	4,12	PD4	PD4
	4,12	PD5	PD5
	4,12	PD6	PD6
	4,12	PD7	PD7
	4,12	PD8	PD8
	4	PD9	PD9
	4	PD10	PD10
	4	PD11	PD11
	4	PD12	PD12
	4	PD13	PD13
PD[13] shared with SAI Audio and MLB headers	4,12,13	PD13	PD13
PI[12,13] shared with MLB header	4	PI9	PI9
	4	PI10	PI10
	4,13	PI12	PI12
	4,13	PI13	PI13
	4	PJ4	PJ4
	4	PJ5	PJ5
	4	PJ6	PJ6
	4	PJ7	PJ7
	4	PJ8	PJ8
	4	PJ9	PJ9
	4	PJ10	PJ10
	4	PJ11	PJ11
	4	PJ12	PJ12
	4	PJ13	PJ13
	4	PJ14	PJ14
	4	PJ15	PJ15
PK[0..4] shared with TWRPI header	4,12	PK0	PK0
	4,12	PK1	PK1
	4,12	PK2	PK2
	4,12	PK3	PK3
	4,12	PK4	PK4
	4	PK5	PK5
	4	PK6	PK6
	4	PK7	PK7
	4	PK8	PK8
	4	PK9	PK9
	4	PK10	PK10
	4	PK11	PK11
	4	PK12	PK12
	4	PK13	PK13
	4	PK14	PK14
	4	PK15	PK15
	4	PL0	PL0
	4	PL1	PL1



Busses are not used on ports as it makes it harder to see which pins are shared with other functions



- Layout Notes:**
- Pads must be placed in a 13 x 16 matrix pattern, 2.54 mm pitch
  - 13 wide (one column for each port EXCLUDING those with no available pads ie C, E, H, Q)
  - 16 tall (1 row for each port number from 0 to 15).
  - GND pad at bottom of each column
  - After production, pads should be through hole (not solder filled)



324 BGA DC





# MCU Power Connections

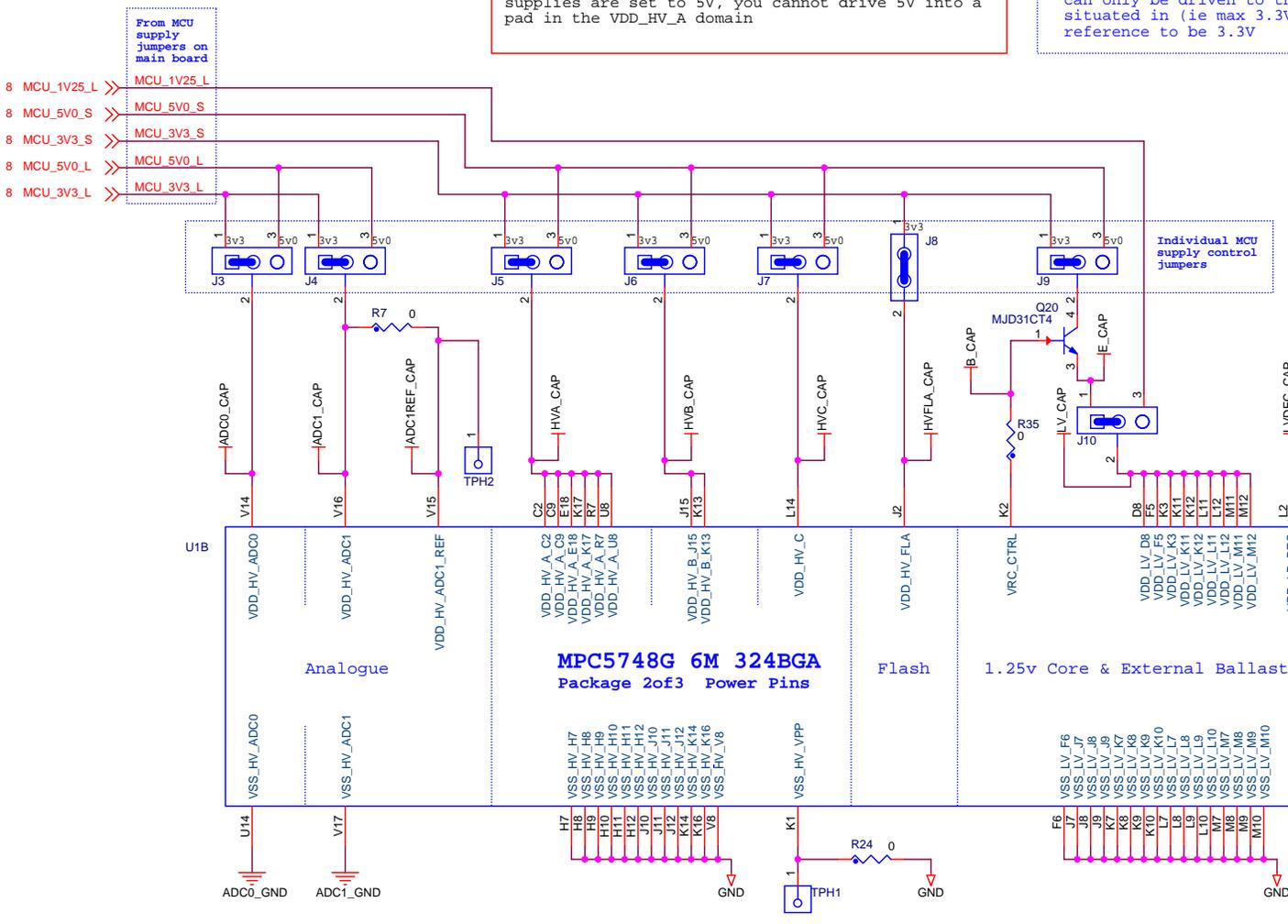
**Caution:**

- If VDD\_HV\_A is driven from 5V, the VDD\_HV\_FL A pin must not be supplied from 3.3V (remove the HVA\_FL A jumper)
- Don't attempt to over drive an analogue pad to 5V when the digital VDD\_HV\_x supply is set to 3.3V. This will trigger the ESD protection on that pad. For example if VDD\_HV\_A is set to 3.3V and the analogue supplies are set to 5V, you cannot drive 5V into a pad in the VDD\_HV\_A domain

**Default Configuraiton:**

- ALL MCU supply voltage
- VDD\_HV\_B, VDD\_HV\_C, VBAI
- VDD\_HV\_FL A = External
- VDD\_LV Supplied from K

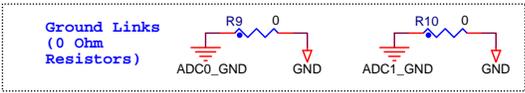
This is not necessarily VDD\_HV\_x domains have at 3.3V. Therefore the defa can only be driven to th situated in (ie max 3.3V reference to be 3.3V



From MCU supply jumpers on main board

- MCU\_1V25\_L
- MCU\_5V0\_S
- MCU\_3V3\_S
- MCU\_5V0\_L
- MCU\_3V3\_L

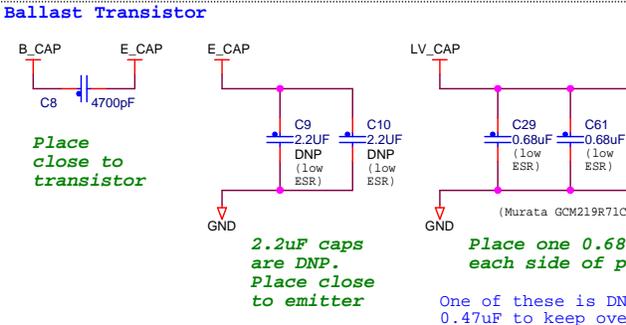
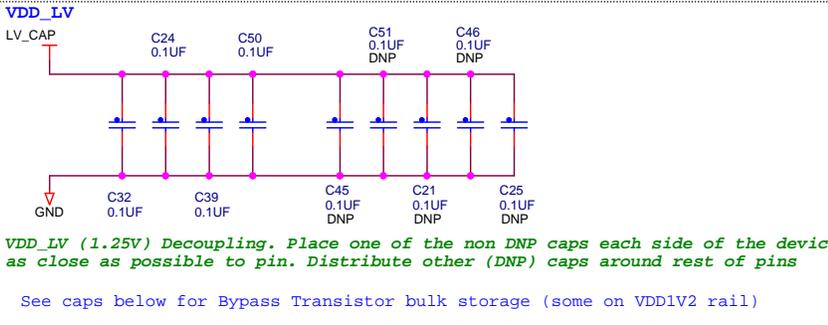
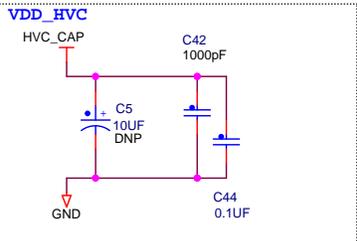
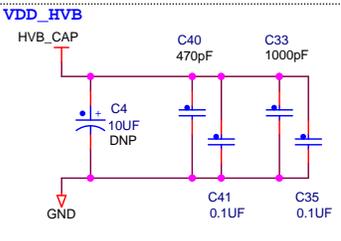
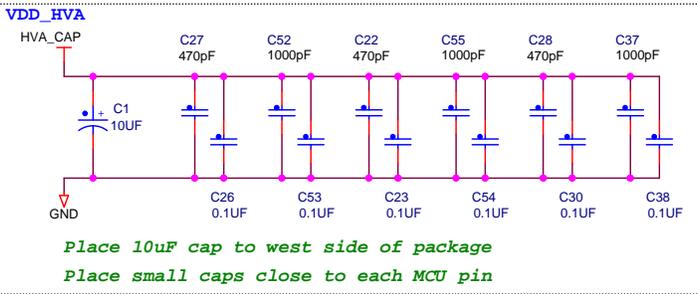
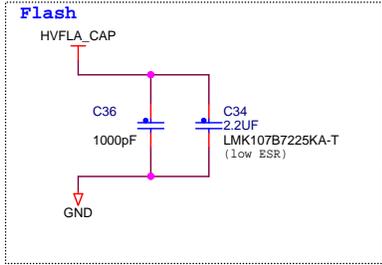
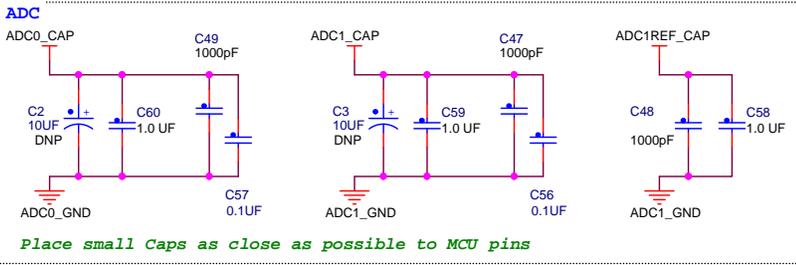
Individual MCU supply control jumpers





# MCU Decoupling and bulk storage

Capacitance values:  
 470pF  
 1000pF  
 4700pF  
 0.01uF  
 0.1uF  
 0.68uF  
 1.0uF  
 2.2uF  
 4.7uF  
 10uF  
 4.7uF  
 7343-10





# GPIO 1 of 2

U1A

## MPC5748G 324 BGA Package Iof3 GPIO Pins1

\*\* PA1 is also NMI. Routed to I/O Matrix

(WKPU2 / NMIO) (WKPU3)

8	PA0	((SD_CD - WKPU19) PA0	L5	PA0
8	PA1	((SW1 & GPIO**) PA1	K6	PA1
8	PA2	((SW2 & GPIO) PA2	J6	PA2
8	PA3	((MII_RXCLK) PA3	M17	PA3
8	PA4	((CMP1_13 / IO) PA4	P6	PA4
8	PA5	((SAL_GPIO) PA5	A14	PA5
8	PA6	((MLB_GPIO) PA6	A13	PA6
8	PA7	((MII_RXD2) PA7	F17	PA7
8	PA8	((RMI1_RXD1) PA8	F18	PA8
8	PA9	((RMI1_RXD0) PA9	E17	PA9
8	PA10	((MII_COL) PA10	D18	PA10
8	PA11	((RMI1_RXER) PA11	D17	PA11
8	PA12	((CMP1_15 / IO) PA12	N8	PA12
8	PA13	((CMP1_14 / IO) PA13	P7	PA13
8	PA14	((CMP1_12 / IO) PA14	T3	PA14
8	PA15	((CMP1_10 / IO) PA15	N7	PA15

Key to text colours:

- Purple - Core physical interfaces
- Orange - Other peripherals and I/O
- Blue - Debug (JTAG & Nexus)
- Black - Clock, Reset and Control
- RED - I/O Matrix and other functions (eg LED)
- Green - I/O Matrix (dedicated)

8	PB0	((CAN0_TX) PB0	N1	PB0
8	PB1	((CAN0_RX) PB1	N2	PB1
8	PB2	((LINO_TX) PB2	G9	PB2
8	PB3	((LINO_RX) PB3	G8	PB3
8	PB4	((ADC_POT) PB4	N11	PB4
8	PB5	((GPIO) PB5	R14	PB5
8	PB6	((GPIO) PB6	N12	PB6
8	PB7	((GPIO) PB7	P14	PB7
6	PB8	((XTAL32) PB8	V10	PB8/XTAL32
6	PB9	((EXTAL32) PB9	V9	PB9/EXTAL32
8	PB10	((SAIO_SYNC) PB10	P9	PB10
8	PB11	((GPIO) PB11	P13	PB11
8	PB12	((GPIO) PB12	N13	PB12
8	PB13	((MLB_DN) PB13	T18	PB13
7	PB14	((MLB_SN) PB14	R17	PB14
7	PB15	((MLB_CN / SIG) PB15	R18	PB15

8	PC0	((TDI) PC0	F9	PC0
8	PC1	((TDO) PC1	F10	PC1
8	PC2	((USB1_CLK) PC2	C13	PC2
8	PC3	((USB1_DIR) PC3	D11	PC3
8	PC4	((FR_A_TX_EN) PC4	B12	PC4
8	PC5	((FR_A_TX) PC5	A11	PC5
8	PC6	((LINI_TX) PC6	R3	PC6
8	PC7	((LINI_RX) PC7	U2	PC7
8	PC8	((RS232_TX) PC8	D5	PC8
8	PC9	((RS232_RX) PC9	D4	PC9
8	PC10	((CAN1_TX) PC10	M5	PC10
8	PC11	((CAN1_RX) PC11	M4	PC11
8	PC12	((FR_DBG0) PC12	D6	PC12
8	PC13	((FR_DBG1) PC13	E6	PC13
8	PC14	((FR_DBG2) PC14	B2	PC14
8	PC15	((FR_DBG3) PC15	C3	PC15

8	PD0	((HEX1 & GPIO) PD0	R12	PD0
8	PD1	((HEX2 & GPIO) PD1	T13	PD1
8	PD2	((HEX3 & GPIO) PD2	T14	PD2
8	PD3	((HEX4 & GPIO) PD3	R13	PD3
8	PD4	((GPIO) PD4	P11	PD4
8	PD5	((GPIO) PD5	T15	PD5
8	PD6	((GPIO) PD6	U15	PD6
8	PD7	((GPIO) PD7	R15	PD7
8	PD8	((GPIO) PD8	F12	PD8
8	PD9	((GPIO) PD9	N15	PD9
8	PD10	((GPIO) PD10	P15	PD10
8	PD11	((GPIO) PD11	V18	PD11
8	PD12	((GPIO) PD12	N16	PD12
8	PD13	((GPIO & MLB_ST) PD13	N14	PD13
7	PD14	((MLB_DP) PD14	T17	PD14
7	PD15	((MLB_SF / DAT) PD15	P17	PD15

8	MCU-RSTx	((MCU-RSTx) L1	RESET
8	PORSTx	((PORSTx) C12	PORST
6	MCU-XTAL	((MCU-XTAL) V6	XTAL
6	MCU-EXTAL	((MCU-EXTAL) V7	EXTAL

PE0	H3	PE0	((MLB_I2C1_SCL)
PE1	H2	PE1	((MLB_I2C1_SDA)
PE2	A12	PE2	((FR_A_TX_EN)
PE3	D10	PE3	((FR_A_RX)
PE4	B11	PE4	((FR_B_TX)
PE5	A10	PE5	((FR_B_RX)
PE6	F9	PE6	((SD_CMD)
PE7	D7	PE7	((SD_CLK)
PE8	K5	PE8	((SAI_I2C2_SDA)
PE9	K4	PE9	((SAI_I2C2_SCL)
PE10	H1	PE10	((SAI_I2C3_SDA)
PE11	J1	PE11	((SAI_I2C3_SCL)
PE12	C18	PE12	((MII_CRS)
PE13	G17	PE13	((MII_RXD3)
PE14	C15	PE14	((USB1_D2)
PE15	E12	PE15	((USB1_D3)

PF0	N9	PF0	((SAIO_MCLK)
PF1	R9	PF1	((SAIO_BCLK)
PF2	P10	PF2	((SAIO_D3)
PF3	U10	PF3	((SAIO_D2)
PF4	N10	PF4	((SAIO_D1)
PF5	V12	PF5	((SAIO_D0)
PF6	T11	PF6	((SAI1_SYNC)
PF7	R10	PF7	((SAI1_MCLK)
PF8	T2	PF8	((GPIO)
PF9	T1	PF9	((SW3 & GPIO) WKPU22)
PF10	R5	PF10	((CMP1_8 / IO)
PF11	P5	PF11	((SW4 & GPIO) WKPU15)
PF12	N5	PF12	((GPIO)
PF13	N6	PF13	((CMP1_11 / IO)
PF14	G18	PF14	((RMI1_MDIO)
PF15	H17	PF15	((RMI1_RXDV)

PG0	H18	PG0	((RMI1_MDC)
PG1	J16	PG1	((RMI1_TXCLK)
PG2	J4	PG2	((LED1 & GPIO)
PG3	J5	PG3	((LED2 & GPIO)
PG4	G2	PG4	((LED3 & GPIO)
PG5	F2	PG5	((LED4 & GPIO)
PG6	M2	PG6	((CLKOUT1 GPIO)
PG7	M1	PG7	((CLKOUT0 GPIO)
PG8	L3	PG8	((GPIO)
PG9	L3	PG9	((MLB_IRQ - WKPU21)
PG10	D14	PG10	((USB1_D4)
PG11	D13	PG11	((USB1_D5)
PG12	L18	PG12	((MII_TXD2)
PG13	M18	PG13	((MII_TXD1)
PG14	F12	PG14	((USB1_D0)
PG15	C16	PG15	((USB1_D1)

PH0	L17	PH0	((RMI1_TXD1)
PH1	K18	PH1	((RMI1_TXD0)
PH2	J18	PH2	((RMI1_TXEN)
PH3	J17	PH3	((eMIOS1_UC_5H)
PH4	C10	PH4	((eMIOS1_UC_6H)
PH5	B10	PH5	((eMIOS1_UC_7H)
PH6	A9	PH6	((MLB_RST)
PH7	D9	PH7	((MLB_PRR)
PH8	E8	PH8	((SD_WP)
PH9	E9	PH9	((TCK)
PH10	E10	PH10	((TMS)
PH11	C14	PH11	((USB1_D6)
PH12	D12	PH12	((USB1_D7)
PH13	F3	PH13	((GPIO)
PH14	E2	PH14	((GPIO)
PH15	G4	PH15	((GPIO)





# MPC5748G GPIO 2 of 2

## Legend

- Orange - Various peripherals and I/O
- Blue - Debug (JTAG & Nexus)
- Black - Clock, Reset and Control
- RED - I/O Matrix and other functions (eg LED)
- Green - I/O Matrix (dedicated)

U1C

**MPC5748G 324 BGA**  
 Package 3of3 GPIO Pins2

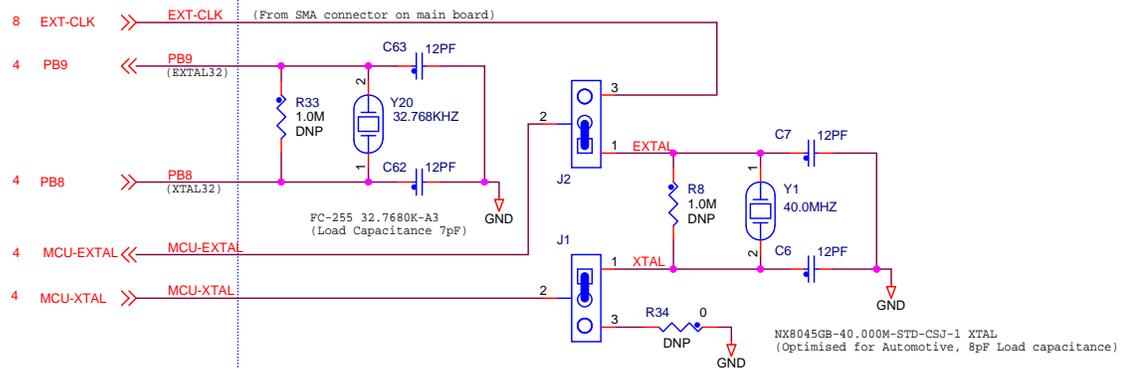
8	PI0	((SD_D3))	PI0	C6
8	PI1	((SD_D2))	PI1	E7
8	PI2	((SD_D1))	PI2	C7
8	PI3	((SD_D0))	PI3	C8
8	PI4	((USB1_STP))	PI4	A18
8	PI5	((USB1_NXT))	PI5	E11
8	PI6	((USB0_RST))	PI6	H4
8	PI7	((USB1_RST))	PI7	G3
8	PI8	((MLB_CP / CLK))	PI8	P18
8	PI9	((GPIO))	PI9	T12
8	PI10	((GPIO))	PI10	U12
8	PI11	((ENET_RST))	PI11	N18
8	PI12	((GPIO & MLB_PS0))	PI12	N17
8	PI13	((GPIO & MLB_PS1))	PI13	M16
8	PI14	((SAI2_D0))	PI14	R16
8	PI15	((SAI2_MCLK))	PI15	P16
8	PJ0	((SAI2_SYNC))	PJ0	U18
8	PJ1	((SAI2_BCLK))	PJ1	V13
8	PJ2	((SAI1_D0))	PJ2	R11
8	PJ3	((SAI1_BCLK))	PJ3	U11
8	PJ4	((GPIO))	PJ4	A1
8	PJ5	((GPIO))	PJ5	T16
8	PJ6	((GPIO))	PJ6	U16
8	PJ7	((GPIO))	PJ7	U17
8	PJ8	((GPIO))	PJ8	U13
8	PJ9	((GPIO))	PJ9	V5
8	PJ10	((GPIO))	PJ10	V4
8	PJ11	((GPIO))	PJ11	U3
8	PJ12	((GPIO))	PJ12	V3
8	PJ13	((GPIO))	PJ13	T6
8	PJ14	((GPIO))	PJ14	R6
8	PJ15	((GPIO))	PJ15	U4
8	PK0	((GPIO))	PK0	T4
8	PK1	((GPIO))	PK1	N3
8	PK2	((GPIO))	PK2	N4
8	PK3	((GPIO))	PK3	P1
8	PK4	((GPIO))	PK4	P2
8	PK5	((GPIO))	PK5	P3
8	PK6	((GPIO))	PK6	P4
8	PK7	((GPIO))	PK7	R1
8	PK8	((GPIO))	PK8	R2
8	PK9	((GPIO))	PK9	B7
8	PK10	((GPIO))	PK10	A6
8	PK11	((GPIO))	PK11	B6
8	PK12	((GPIO))	PK12	A5
8	PK13	((GPIO))	PK13	B5
8	PK14	((GPIO))	PK14	C5
8	PK15	((GPIO))	PK15	A4
8	PL0	((GPIO))	PL0	B4
8	PL1	((GPIO))	PL1	L15
8	PL2	((MDO0))	PL2	E15
8	PL3	((MDO1))	PL3	E14
8	PL4	((MDO2))	PL4	F13
8	PL5	((MDO3))	PL5	F14
8	PL6	((MDO4))	PL6	F15
8	PL7	((MDO5))	PL7	G13
8	PL8	((EVT1))	PL8	D15
8	PL9	((MSE00))	PL9	E13
8	PL10	((MCK0))	PL10	G12
8	PL11	((MSE01))	PL11	E16
8	PL12	((EVT0))	PL12	D16
8	PL13	((MDO6))	PL13	F16
8	PL14	((MDO7))	PL14	G16
8	PL15	((MDO8))	PL15	G15
8	PQ0	((USB0_STP))	PQ0	C11
8	PQ1	((USB0_CLK))	PQ1	B13
8	PQ2	((USB0_DIR))	PQ2	B14
8	PQ3	((USB0_NXT))	PQ3	F11
8	PQ4	((USB0_D7))	PQ4	A15
8	PQ5	((USB0_D6))	PQ5	A16
8	PQ6	((USB0_D5))	PQ6	B15
8	PQ7	((USB0_D4))	PQ7	A17

PI0		
PI1		
PI2		
PI3		
PI4		
PI5		
PI6		
PI7		
PI8		
PI9		
PI10		
PI11		
PI12		
PI13		
PI14		
PI15		
PJ0		
PJ1		
PJ2		
PJ3		
PJ4		
PJ5		
PJ6		
PJ7		
PJ8		
PJ9		
PJ10		
PJ11		
PJ12		
PJ13		
PJ14		
PJ15		
PK0		
PK1		
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PK4		
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PK9		
PK10		
PK11		
PK12		
PK13		
PK14		
PK15		
PL0		
PL1		
PL2		
PL3		
PL4		
PL5		
PL6		
PL7		
PL8		
PL9		
PL10		
PL11		
PL12		
PL13		
PL14		
PL15		
PQ0		
PQ1		
PQ2		
PQ3		
PQ4		
PQ5		
PQ6		
PQ7		

PM0	G14	PM0	(MDO9)
PM1	H13	PM1	(MDO10)
PM2	H15	PM2	(MDO11)
PM3	L13	PM3	(GPIO)
PM4	K15	PM4	(GPIO)
PM5	M14	PM5	(GPIO)
PM6	L16	PM6	(GPIO)
PM7	H16	PM7	(MDO12)
PM8	J13	PM8	(MDO13)
PM9	H14	PM9	(MDO14)
PM10	J14	PM10	(MDO15)
PM11	G10	PM11	(GPIO)
PM12	G11	PM12	(GPIO)
PM13	M13	PM13	(GPIO)
PM14	M15	PM14	(GPIO)
PM15	T10	PM15	(GPIO)
PN0	T9	PN0	(GPIO)
PN1	V11	PN1	(GPIO)
PN2	U9	PN2	(GPIO)
PN3	T8	PN3	(GPIO)
PN4	U7	PN4	(GPIO)
PN5	R8	PN5	(GPIO)
PN6	P8	PN6	(GPIO)
PN7	U6	PN7	(GPIO)
PN8	U5	PN8	(GPIO)
PN9	T5	PN9	(GPIO)
PN10	T7	PN10	(GPIO)
PN11	V2	PN11	(GPIO)
PN12	V1	PN12	(GPIO)
PN13	U1	PN13	(GPIO)
PN14	R4	PN14	(GPIO)
PN15	L4	PN15	(GPIO)
PO0	G1	PO0	(GPIO)
PO1	F1	PO1	(GPIO)
PO2	M6	PO2	(GPIO)
PO3	L6	PO3	(GPIO)
PO4	E1	PO4	(GPIO)
PO5	H6	PO5	(GPIO)
PO6	H5	PO6	(GPIO)
PO7	D1	PO7	(GPIO)
PO8	D2	PO8	(GPIO)
PO9	E3	PO9	(GPIO)
PO10	D3	PO10	(GPIO)
PO11	C1	PO11	(GPIO)
PO12	B1	PO12	(GPIO)
PO13	E4	PO13	(GPIO)
PO14	F4	PO14	(GPIO)
PO15	G6	PO15	(GPIO)
PP0	G5	PP0	(GPIO)
PP1	B3	PP1	(GPIO)
PP2	C4	PP2	(GPIO)
PP3	F7	PP3	(GPIO)
PP4	E5	PP4	(GPIO)
PP5	G7	PP5	(GPIO)
PP6	A2	PP6	(GPIO)
PP7	A3	PP7	(GPIO)
PP8	B8	PP8	(GPIO)
PP9	A7	PP9	(GPIO)
PP10	A8	PP10	(GPIO)
PP11	B9	PP11	(GPIO)
PP12	B17	PP12	(USB0_D3)
PP13	B16	PP13	(USB0_D2)
PP14	C17	PP14	(USB0_D1)
PP15	B18	PP15	(USB0_D0)



### Oscillators and External Clock





# Speed Signal Termination

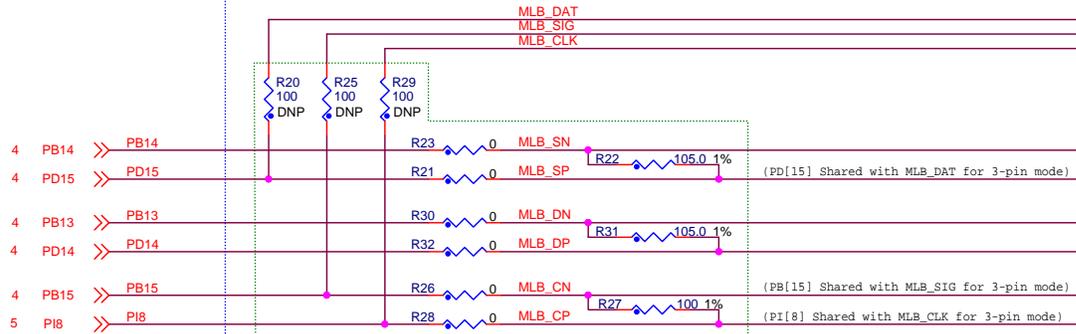
5 4 3 2

## Ethernet Termination



Place resistors as close as possible to MCU

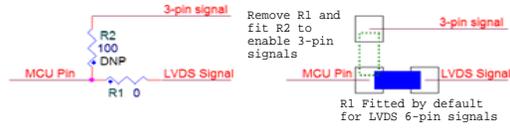
## MLB Termination



Place resistors as close as possible to MCU

## From MCU

Layout Note - Place resistors as shown with shared pad (as close to MCU as possible)



5 4 3 2





256 BGA DC



# MPC5748G Customer EVB 256BGA [6M/3M] Daughter Card (X-MP

Table Of Contents:	
Power - MPC5748G power pins footprint	Sheet 2
Power - MPC5748G Decoupling Capacitors	Sheet 3
GPIO - MPC5748G GPIO pins 1 of 2	Sheet 4
GPIO - MPC5748G GPIO pins 2 of 2	Sheet 5
Clocks	Sheet 6
Bus Termination	Sheet 7
Daughtercard Connectors	Sheet 8

### Revision Information

Rev	Date	Designer	Comments
X1	11 Mar 2013	Alasdair Robertson	Initial release
X2	13 Mar 2013	Alasdair Robertson	Version sent
X3	15 Mar 2013	Alasdair Robertson	Component c
X4	29 Mar 2013	Alasdair Robertson	Changes mad
X5	15 Apr 2013	Alasdair Robertson	LAY RefDes
A	15 Apr 2013	Alasdair Robertson	Post Layout (
X1	16 Mar 2014	Jesus Sanchez	Changes on M SCH-27899 d
A	18 Apr 2014	Jesus Sanchez	Post Layout.
A1	18 Aug 2015	Alasdair Robertson	Tidy up Sche

### Caution:

These schematics are provided for reference purposes only. As such, Freescale does not make any warranty, implied or otherwise, as to the suitability of circuit design or component selection (type or value) used in these schematics for hardware design using the Freescale MPC5748G family of Microprocessors. Customers using any part of these schematics as a basis for hardware design, do so at their own risk and Freescale does not assume any liability for such a hardware design.

### Notes:

- All components and board processes are to be ROHS compliant
- All small capacitors are 0402 unless otherwise stated
- All resistors are 0603 5% 0.1w unless otherwise stated. All zero ohm links are 0603
- All connectors and headers are denoted Px and are 2.54mm pitch unless otherwise stated
- All jumpers are denoted Jx. Jumpers are 2mm pitch
- Jumper default positions are shown in the schematics. For 3 way jumpers, default is always posn 1-2.
- 2 Pin jumpers generally have the "source" on pin 1.
- All switches are denoted SWx
- All test points are denoted TPx
- Test point Vias are denoted TPVx

User notes are given throughtout the schematics.

Specific PCB LAYOUT notes are detailed in *ITALICS*



This document is for procurement or

Designer:  
A. Robertson / J. Sand

Drawn by:  
A. Robertson

Approved:  
A. Robertson / J. Sand



# MCU Power Connections

### Caution:

- If VDD\_HV\_A is driven from 5V, the VDD\_HV\_FL A pin must not be supplied from 3.3V (remove the HVA\_FL A jumper)

- Don't attempt to over drive an analogue pad to 5V when the digital VDD\_HV\_x supply is set to 3.3V. This will trigger the ESD protection on that pad. For example if VDD\_HV\_A is set to 3.3V and the analogue supplies are set to 5V, you cannot drive 5V into a pad in the VDD\_HV\_A domain

**Default Configuraiton:**

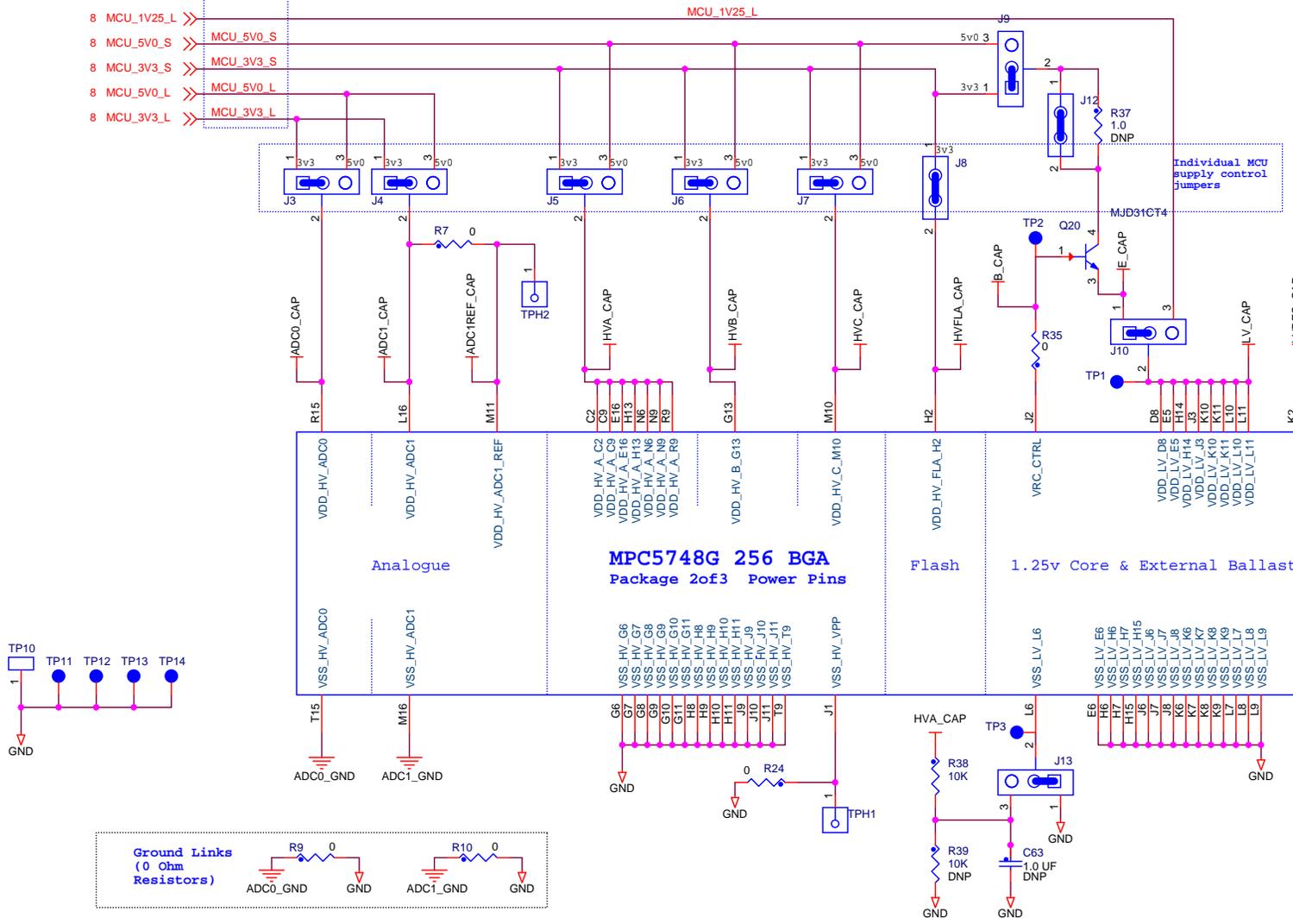
- ALL MCU supply voltage
- VDD\_HV\_B, VDD\_HV\_C, VBAI
- VDD\_HV\_FL A = External
- VDD\_LV Supplied from K

This is not necessarily VDD\_HV\_x domains have at 3.3V. Therefore the defa can only be driven to th situated in (ie max 3.3V reference to be 3.3V

From MCU supply jumpers on main board

- 8 MCU\_1V25\_L >> MCU\_1V25\_L
- 8 MCU\_5V0\_S >> MCU\_5V0\_S
- 8 MCU\_3V3\_S >> MCU\_3V3\_S
- 8 MCU\_5V0\_L >> MCU\_5V0\_L
- 8 MCU\_3V3\_L >> MCU\_3V3\_L

Individual MCU supply control jumpers



Ground Links (0 Ohm Resistors)

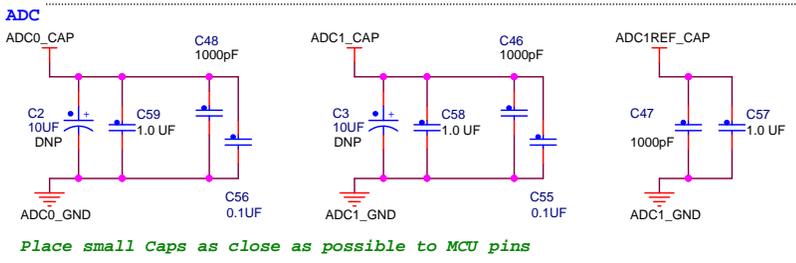
ADC0\_GND GND

ADC1\_GND GND

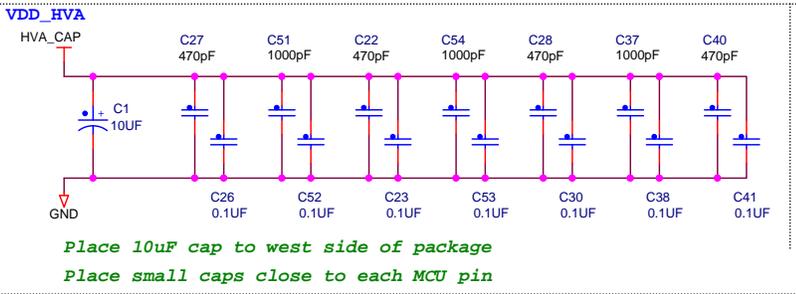
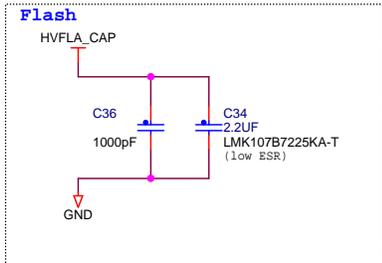


# MCU Decoupling and bulk storage

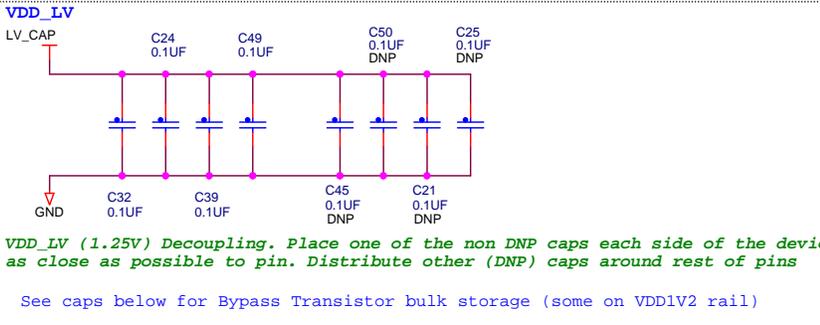
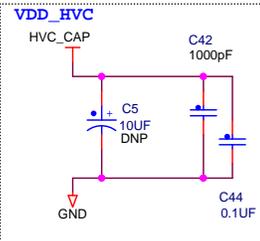
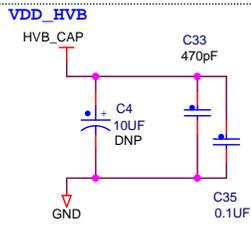
Capacitance values:  
 470pF  
 1000pF  
 4700pF  
 0.01uF  
 0.1uF  
 0.68uF  
 1.0uF  
 2.2uF  
 4.7uF  
 10uF  
 4.7uF  
 7343-10



Place small Caps as close as possible to MCU pins

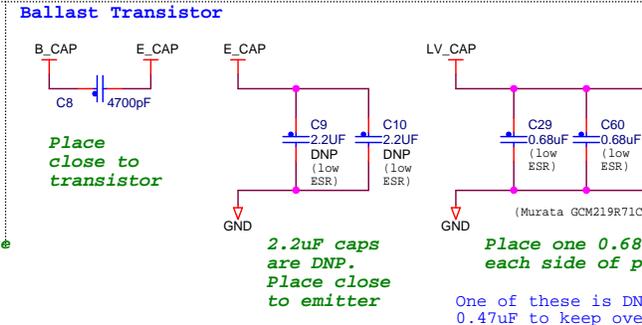


Place 10uF cap to west side of package  
 Place small caps close to each MCU pin



VDD\_LV (1.25V) Decoupling. Place one of the non DNP caps each side of the device as close as possible to pin. Distribute other (DNP) caps around rest of pins

See caps below for Bypass Transistor bulk storage (some on VDD1V2 rail)



Place close to transistor

2.2uF caps are DNP. Place close to emitter

Place one 0.68uF each side of p

One of these is DNP 0.47uF to keep ove

Differences to 324BGA

- 1 more VDD\_HV\_A capacitor pair
- 1 fewer VDD\_HV\_B capacitor pair
- 1 fewer VDD\_LV capacitor (one of DNP caps)

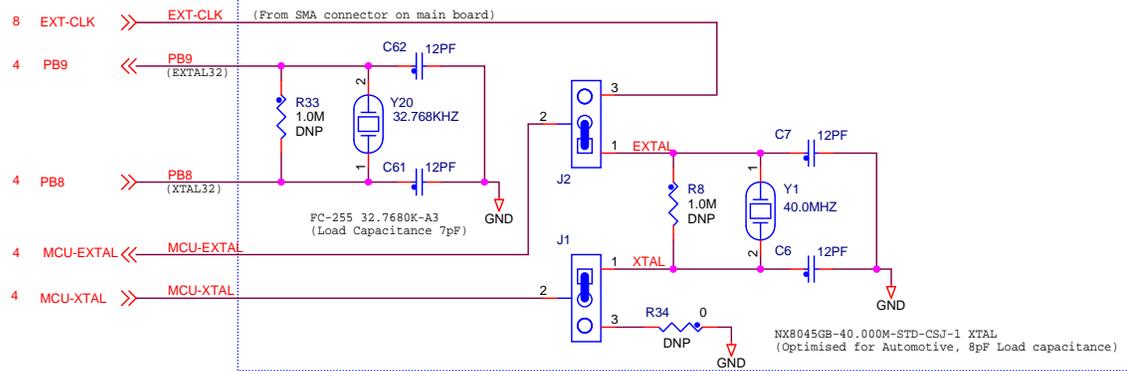








### Oscillators and External Clock





# Speed Signal Termination

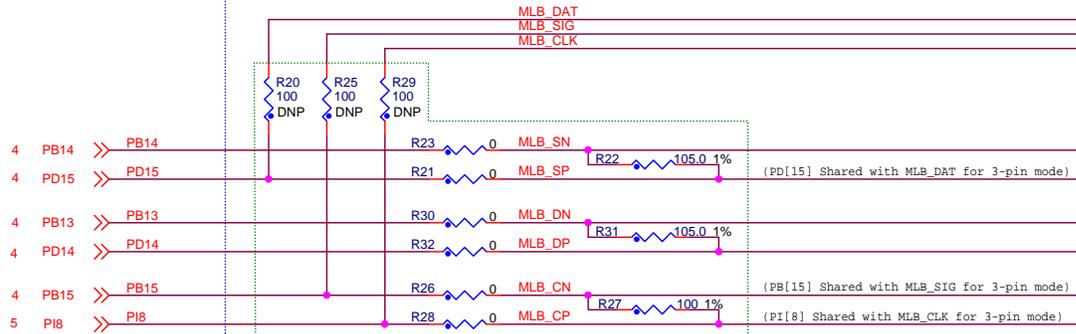
5 4 3 2

## Ethernet Termination



Place resistors as close as possible to MCU

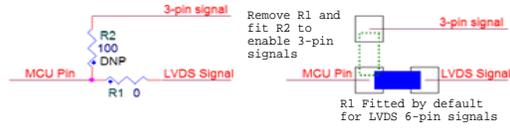
## MLB Termination



Place resistors as close as possible to MCU

## From MCU

Layout Note - Place resistors as shown with shared pad (as close to MCU as possible)



5 4 3 2





176 QFP DC





# MCU Power Connections

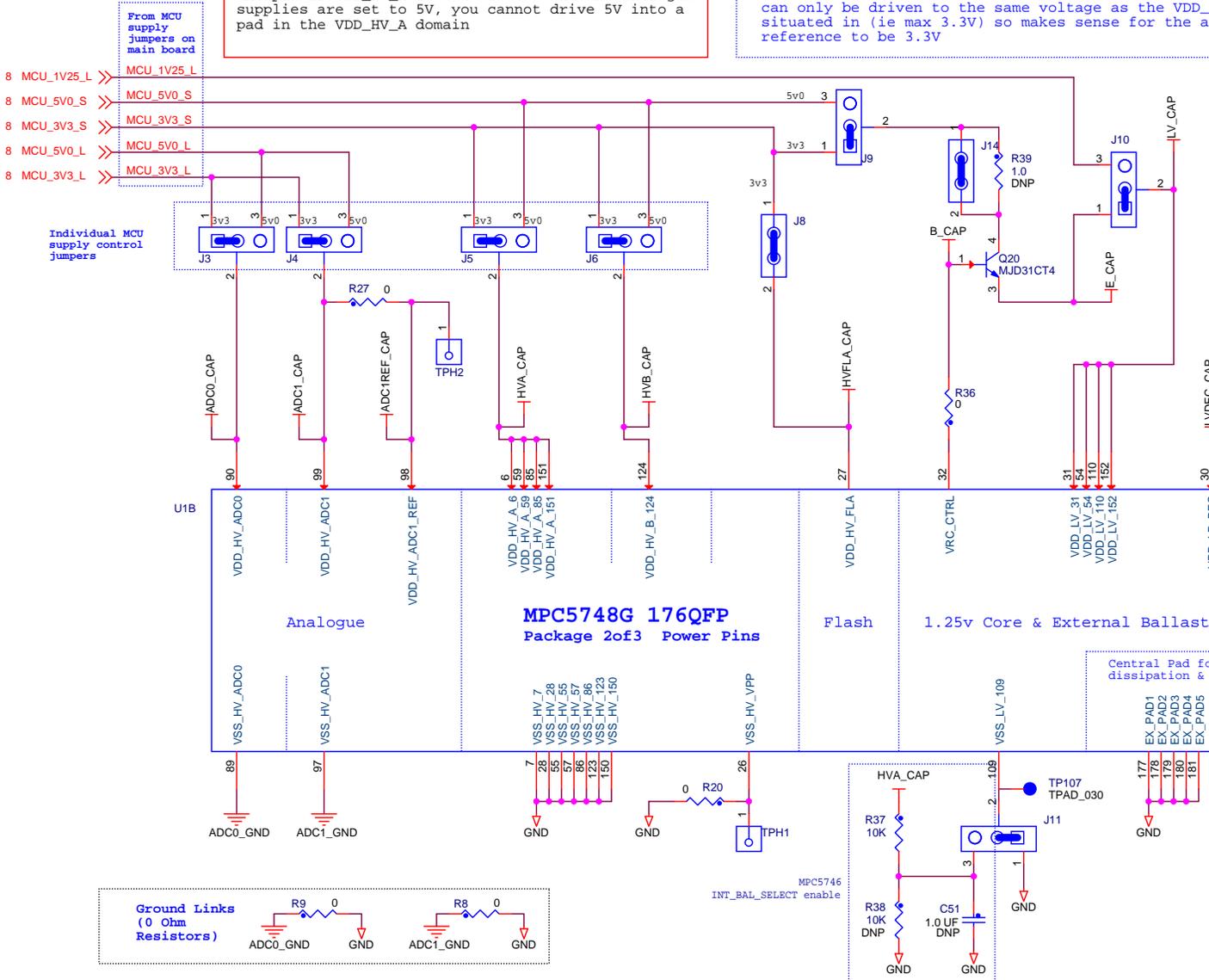
### Caution:

- If VDD\_HV\_A is driven from 5V, the VDD\_HV\_FL A pin must not be supplied from 3.3V (remove the HVA\_FL A jumper)
- Don't attempt to over drive an analogue pad to 5V when the digital VDD\_HV\_x supply is set to 3.3V. This will trigger the ESD protection on that pad. For example if VDD\_HV\_A is set to 3.3V and the analogue supplies are set to 5V, you cannot drive 5V into a pad in the VDD\_HV\_A domain

### Default Configuraiton:

- ALL MCU supply voltages are set to 3.3V (ADC0, A VDD\_HV\_B, VDD\_HV\_C, VBallast)
- VDD\_HV\_FL A = External 3.3V supplied (jumper fitted)
- VDD\_LV Supplied from ballast transistor

This is not necessarily the same as the default sh VDD\_HV\_x domains have at least one peripheral that 3.3V. Therefore the default is to run these from 3 can only be driven to the same voltage as the VDD\_ situated in (ie max 3.3V) so makes sense for the a reference to be 3.3V

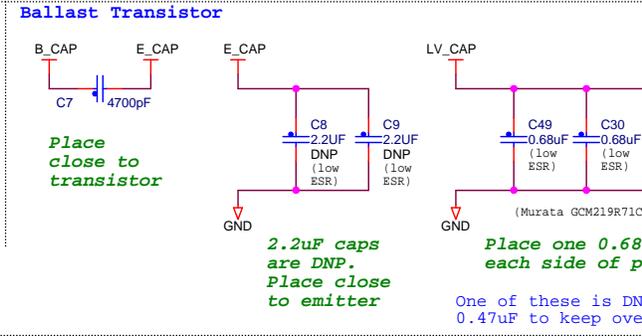
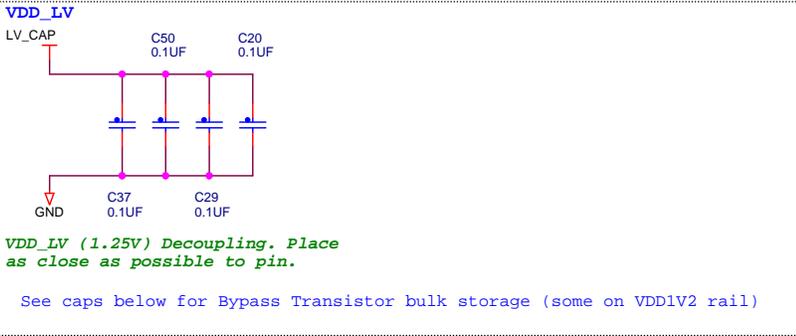
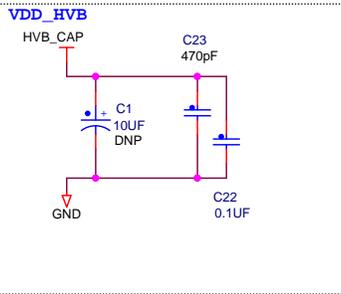
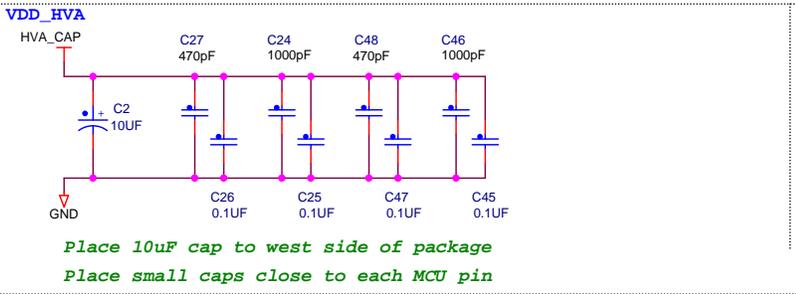
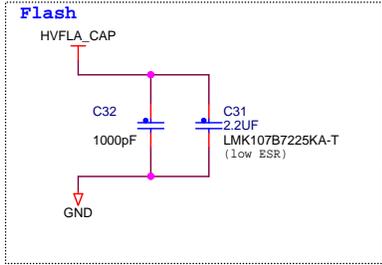
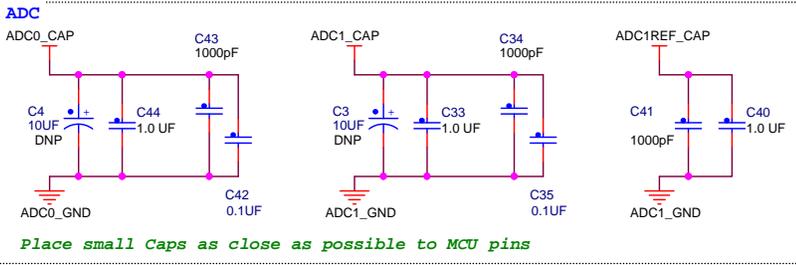






# MCU Decoupling and bulk storage

Capacitance values:  
 470pF  
 1000pF  
 4700pF  
 0.01uF  
 0.1uF  
 0.68uF  
 1.0uF  
 2.2uF  
 4.7uF  
 10uF  
 4.7uF  
 7343-10



- Differences to 324BGA
- 2 Fewer VDD\_HV\_A capacitor pairs
  - 1 fewer VDD\_HV\_B capacitor pair
  - No VDD\_HV\_C capacitor pairs
  - 5 fewer VDD\_LV capacitor pairs





# MPC5748G GPIO 2 of 2

Key to text colours:

- Purple - Comms Physical Interfaces
- Orange - Other Peripherals and I/O
- Blue - Debug (JTAG & Nexus)
- Black - Clock, Reset and Control
- RED - I/O Matrix and other functions (eg LED)
- Green - I/O Matrix (dedicated)

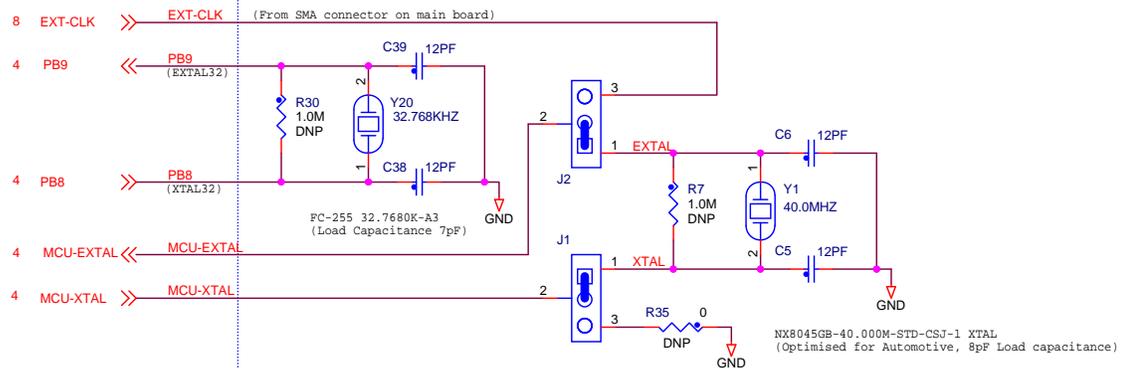
8	PI0	<<<	(SD_D3)	PI0	172	
8	PI1	<<<	(SD_D2)	PI1	171	
8	PI2	<<<	(SD_D1)	PI2	170	
8	PI3	<<<	(SD_D0)	PI3	169	
8	PI4	<<<	(USB1_STP)	PI4	143	
8	PI5	<<<	(USB1_NXT)	PI5	142	
8	PI6	<<<	(USB0_RST)	PI6	11	
8	PI7	<<<	(USB1_RST)	PI7	12	
7	PI8	<<<	(MLB_CP / CLK)	PI8	108	
			(GPIO)			
8	PI11	<<<	(ENET_RST)	PI11	111	
8	PI12	<<<	(GPIO & MLB_PS0)	PI12	112	PI11
8	PI13	<<<	(GPIO & MLB_PS1)	PI13	113	PI12
8	PI14	<<<	(SAI2_D0)	PI14	76	PI13
8	PI15	<<<	(SAI2_MCLK)	PI15	75	PI14
						PI15
8	PJ0	<<<	(SAI2_SYNC)	PJ0	74	
8	PJ1	<<<	(SAI2_BCLK)	PJ1	73	PJ0
8	PJ2	<<<	(SAI1_D0)	PJ2	72	PJ1
8	PJ3	<<<	(SAI1_BCLK)	PJ3	71	PJ2
8	PJ4	<<<	(GPIO)	PJ4	5	PJ3
						PJ4

U1C

**MPC5748G 176QFP**  
 Package 3of3 GPIO Pins2



### Oscillators and External Clock





# Speed Signal Termination

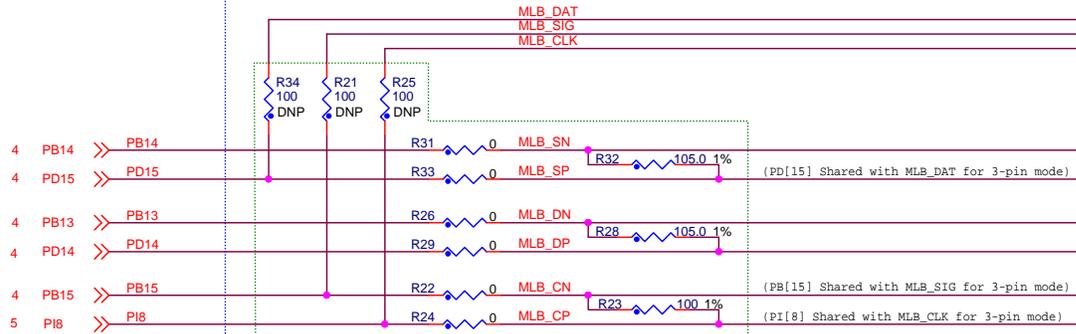
5 4 3 2

## Ethernet Termination



Place resistors as close as possible to MCU

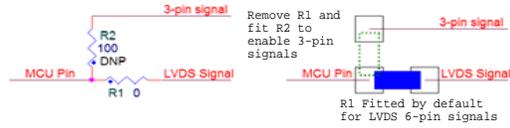
## MLB Termination



Place resistors as close as possible to MCU

## From MCU

Layout Note - Place resistors as shown with shared pad (as close to MCU as possible)



5 4 3 2





100 QFP DC







# MCU Power Connections

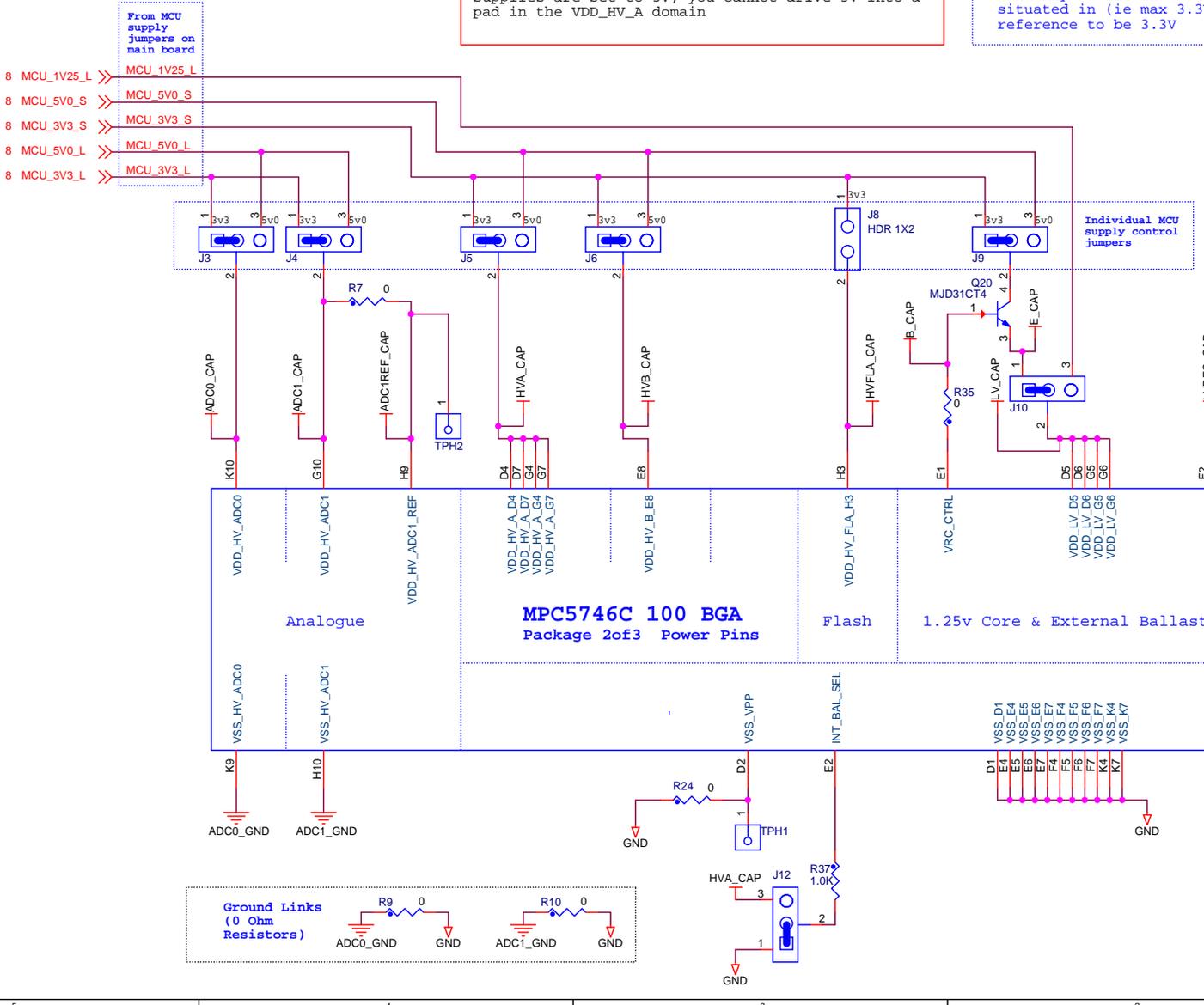
### Caution:

- If VDD\_HV\_A is driven from 5V, the VDD\_HV\_FL A pin must not be supplied from 3.3V (remove the HVA\_FL A jumper)
- Don't attempt to over drive an analogue pad to 5V when the digital VDD\_HV\_x supply is set to 3.3V. This will trigger the ESD protection on that pad. For example if VDD\_HV\_A is set to 3.3V and the analogue supplies are set to 5V, you cannot drive 5V into a pad in the VDD\_HV\_A domain

**Default Configuraiton:**

- ALL MCU supply voltage
- VDD\_HV\_B, VDD\_HV\_C, VBAI
- VDD\_HV\_FL A = External
- VDD\_LV Supplied from K

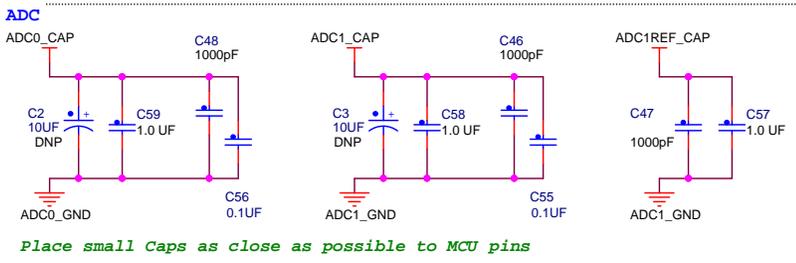
This is not necessarily VDD\_HV\_x domains have at 3.3V. Therefore the defa can only be driven to the situated in (ie max 3.3V reference to be 3.3V



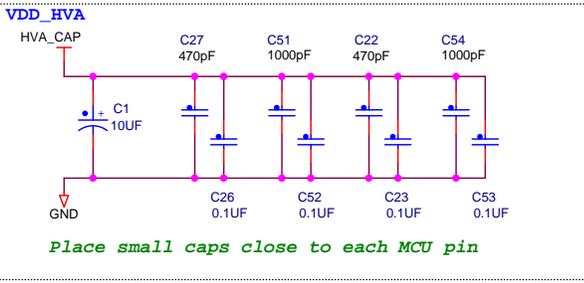
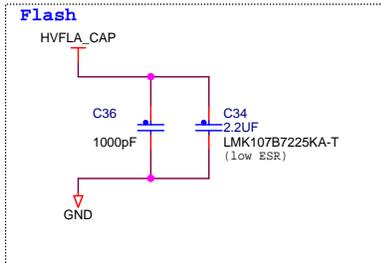


# MCU Decoupling and bulk storage

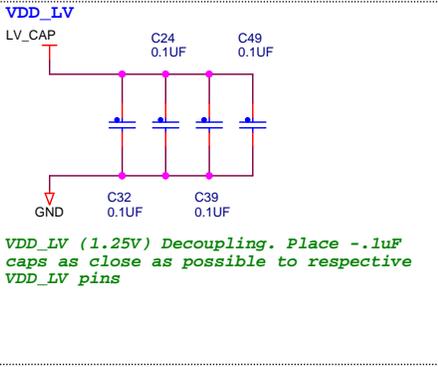
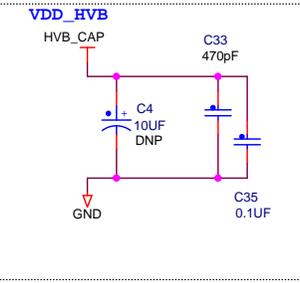
Capacitance values:  
 470pF  
 1000pF  
 4700pF  
 0.01uF  
 0.1uF  
 0.68uF  
 1.0uF  
 2.2uF  
 4.7uF  
 10uF  
 4.7uF  
 7343-10



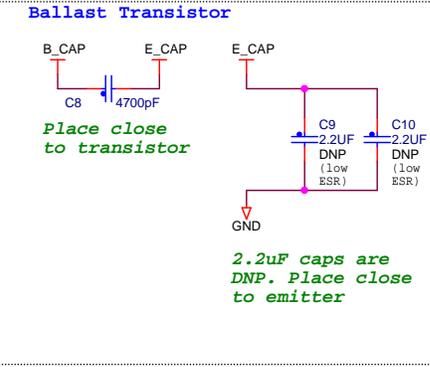
Place small Caps as close as possible to MCU pins



Place small caps close to each MCU pin

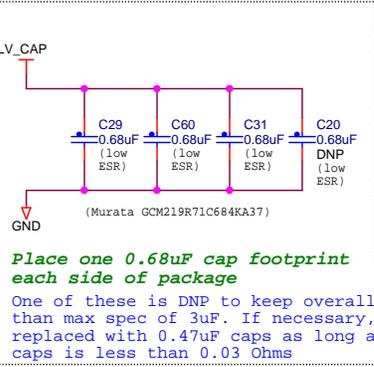


VDD\_LV (1.25V) Decoupling. Place .1uF caps as close as possible to respective VDD\_LV pins



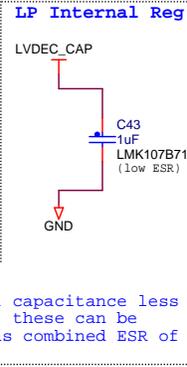
Place close to transistor

2.2uF caps are DNP. Place close to emitter



Place one 0.68uF cap footprint each side of package

One of these is DNP to keep overall capacitance less than max spec of 3uF. If necessary, these can be replaced with 0.47uF caps as long as combined ESR of caps is less than 0.03 Ohms



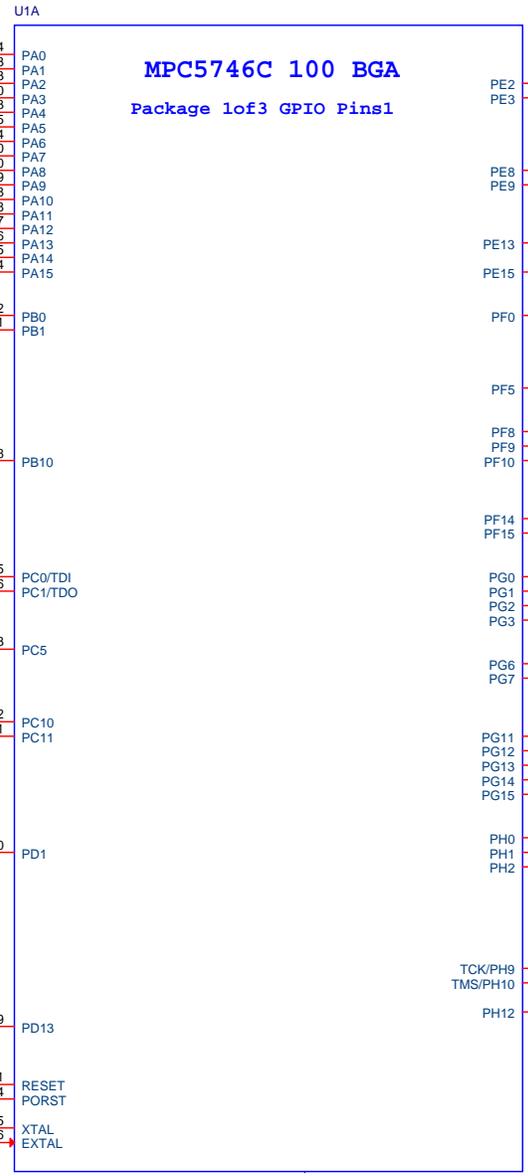


# GPIO 1 of 2

\*\* PA1 is also NMI. Routed to I/O Matrix (WKP2 / NMIO) (WKP3)

Key to text colours:	
Purple	- Comms Physical Interfaces
Orange	- Other Peripherals and I/O
Blue	- Debug (JTAG & Nexus)
Black	- Clock, Reset and Control
RED	- I/O Matrix and other functions (eg LED)
Green	- I/O Matrix (dedicated)

8	PA0	<<< (SD_CD - WKP19)	PA0	H4	PA0
8	PA1	<<< (SW1 & GPIO**) PA1	G3	PA1	
8	PA2	<<< (SW2 & GPIO)	PA2	F3	PA2
8	PA3	<<< (MII_RXCLK)	PA3	C10	PA3
8	PA4	<<< (CMP1_13 / IO)	PA4	J3	PA4
8	PA5	<<< (SAI_GPIO)	PA5	A5	PA5
8	PA6	<<< (MLB_GPIO)	PA6	B4	PA6
8	PA7	<<< (MII_RXD2)	PA7	A10	PA7
8	PA8	<<< (RMII_RXD1)	PA8	B10	PA8
8	PA9	<<< (RMII_RXD0)	PA9	B9	PA9
8	PA10	<<< (MII_COL)	PA10	B8	PA10
8	PA11	<<< (RMII_RXER)	PA11	C8	PA11
8	PA12	<<< (CMP1_15 / IO)	PA12	J7	PA12
8	PA13	<<< (CMP1_14 / IO)	PA13	J6	PA13
8	PA14	<<< (CMP1_12 / IO)	PA14	J5	PA14
8	PA15	<<< (CMP1_10 / IO)	PA15	J4	PA15
8	PB0	<<< (CAN0_TX)	PB0	H2	PB0
8	PB1	<<< (CAN0_RX)	PB1	H1	PB1
8	PB10	<<< (SAI0_SYNC)	PB10	K8	PB10
8	PC0	<<< (TDI)	PC0	C5	PC0/TDI
8	PC1	<<< (TDO)	PC1	C6	PC1/TDO
8	PC5	<<< (FR_A_TX)	PC5	E3	PC5
8	PC10	<<< (CAN1_TX)	PC10	G2	PC10
8	PC11	<<< (CAN1_RX)	PC11	G1	PC11
8	PD1	<<< (HEX2 & GPIO)	PD1	J10	PD1
8	PD13	<<< (GPIO & MLB_ST)	PD13	G9	PD13
8	MCU-RSTx	<<< MCU-RSTx	F1	RESET	
8	PORSTx	<<< PORSTx	A4	PORST	
6	MCU-XTAL	<<< MCU-XTAL	K5	XTAL	
6	MCU-EXTAL	<<< MCU-EXTAL	K6	EXTAL	



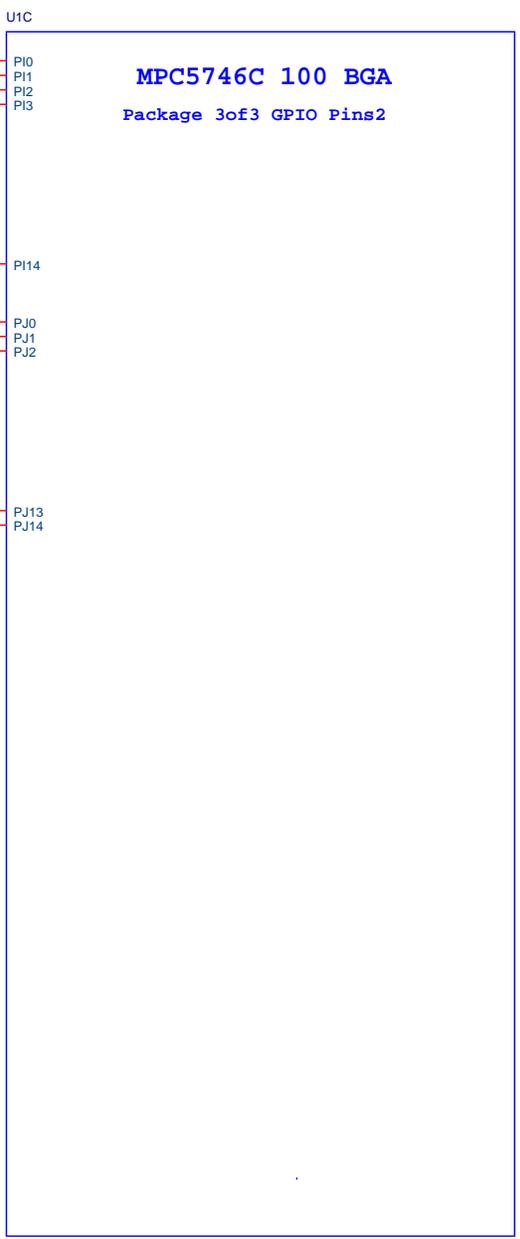
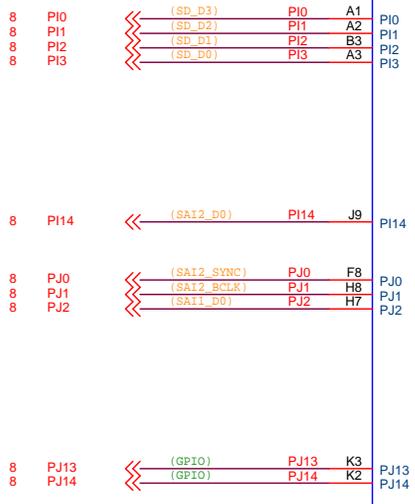
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# GPIO 2 of 2

Key to text colours:

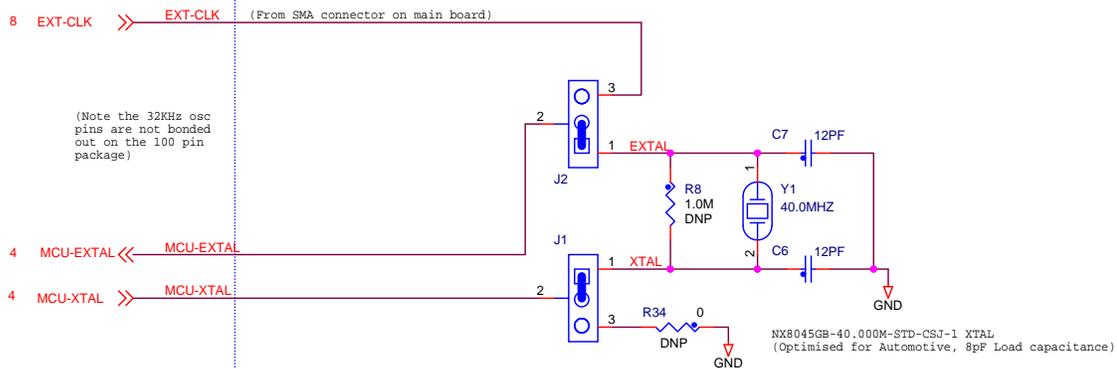
- Purple - Comms Physical Interfaces
- Orange - Other Peripherals and I/O
- Blue - Debug (JTAG & Nexus)
- Black - Clock, Reset and Control
- RED - I/O Matrix and other functions (eg LED)
- Green - I/O Matrix (dedicated)



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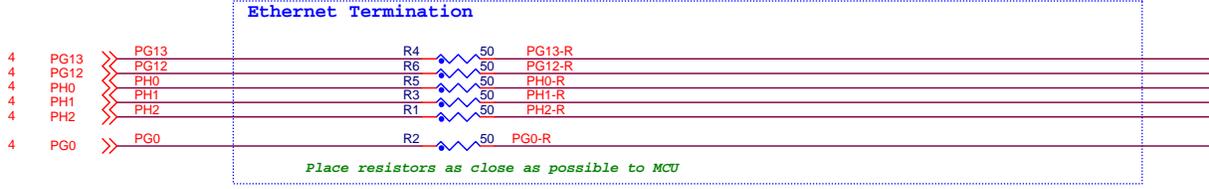


### Oscillators and External Clock





# Speed Signal Termination





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