

MPC574xx Customer Evaluation Board (X-MPC574XG-MB)

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Revision Information

Rev	Date	Designer	Comments
0.1	01 Feb 2012	Alasdair Robertson	Start of capture, Working version
X1	19 Feb 2012	Alasdair Robertson	1st release for internal review (Complete Board)
X2	28 Feb 2012	Alasdair Robertson	2nd release for internal review (split into main board and DC)
X3	11 Mar 2013	Alasdair Robertson	Final review (including new USB transceiver)
X4	13 Mar 2013	Alasdair Robertson	Version sent to Pre Layout, incorporating fixes from review
X5	14 Mar 2013	Alasdair Robertson	Component consolidation, Few minor changes. Sent to Layout
X6	29 Mar 2013	Alasdair Robertson	Changes made during layout to Daughtercard Connectors
X7	02 Apr 2013	Alasdair Robertson	LAY RefDes Resequenece and SCH BackAnnotate
A	17 Apr 2013	Alasdair Robertson	Post Layout (Back Annotated). Matches PCB RevA
AX1	24 Jun 2013	Alasdair Robertson	Fixes and changes to RevA Prototype design
AX2	10 July 2013	Alasdair Robertson	Added CAN Term (DNP)
AX3	12 July 2013	Alasdair Robertson	Corrected ground on ADC Pot
B	12 July 2013	Alasdair Robertson	Production Release
BX1	20 Aug 2013	Alasdair Robertson	Change to Ethernet 50MHz clock control
C	20 Aug 2013	Alasdair Robertson	Production Release
CX1	18 Dec 2013	Alasdair Robertson	CAN transceivers -> MC33901, ENET clock in RMI mode
CX2	05 May 2014	Alasdair Robertson	Added comment about LM1117 VREG output
CX3	25 June 2014	Alasdair Robertson	PH3..5 now GPIO matrix (was SAI), PM4, PD13, PM3 to SAI
CX4	26 June 2014	Alasdair Robertson	Minor changes made during layout (no component changes)
CX5	26 June 2014	Alasdair Robertson	Part Manager Tidy up
CX6	18 Aug 2014	Alasdair Robertson	Added additional connector with DSPI Signals for AVB
CX7	03 Sept 2014	Alasdair Robertson	Added additional TWRPI header (Sheet 12)
D	24 Sept 2014	Alasdair Robertson	Released to Production (RevD PCB)

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 Calypso 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

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

● TPV?

○ TPH5

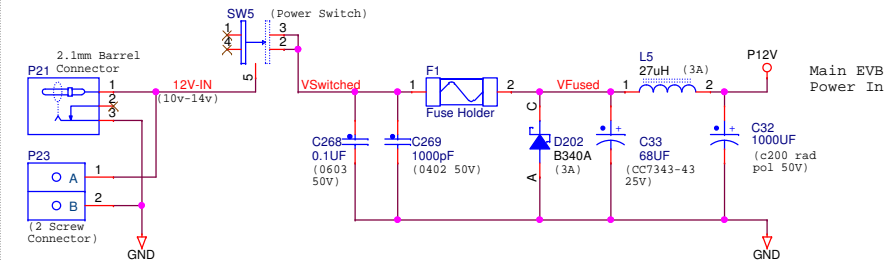
□ TP?

		Automotive Microcontroller Applications East Kilbride, Scotland Freescale General Business Use	
This document contains information proprietary to Freescale and shall not be used for engineering design, procurement or manufacture in whole or in part without the express written permission of Freescale			
Designer: A. Robertson	Drawing Title: MPC574XG-MB		
Drawn by: A. Robertson	Page Title: Index and Title Page		
Approved: A. Robertson	Size B	Document Number SCH-27897 PDF: SPF-27897	Rev D
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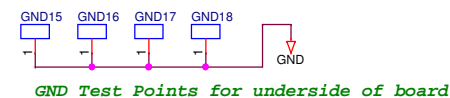
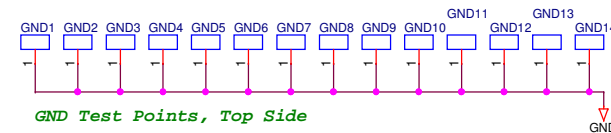
Power Input and Linear Voltage Regulators

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

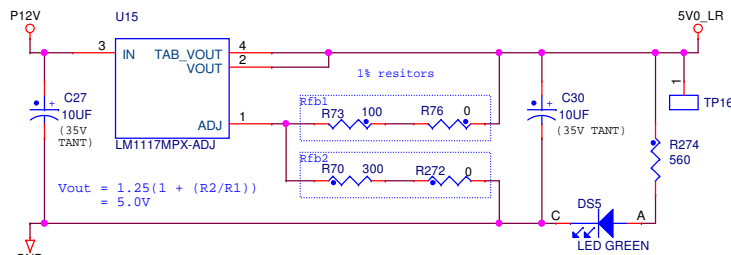
Power Supply Input and Filter



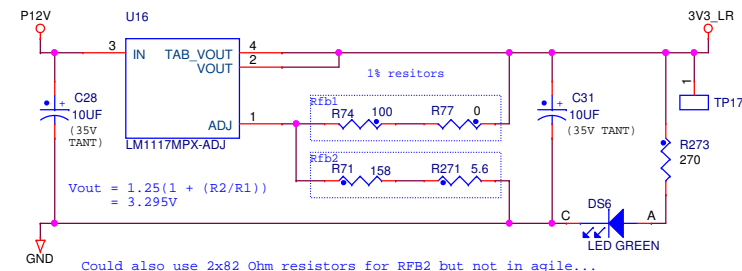
Test and reference points



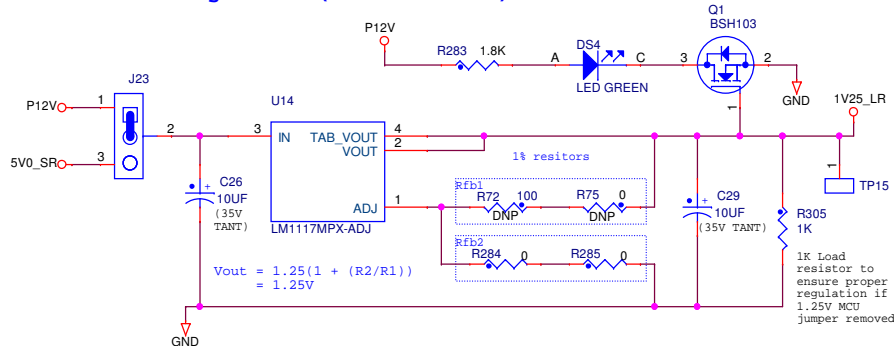
5.0V Linear Regulator (800mA Max **)



3.3V Linear Regulator (800mA Max **)



1.25V Linear Regulator (800mA Max **)



1.25V for External core supply. Simpler to use linear rather than switcher so can safely power from 5V switcher (slight ripple not an issue) for reduced heat dissipation

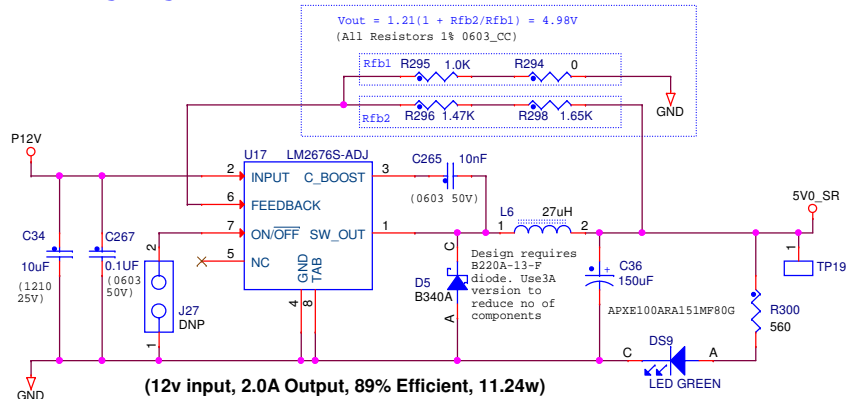
** Notes on Linear Regulator LM1117

The LM1117 linear regulators provide a maximum output current of 800mA in ideal conditions. The current requirement for each regulator is in the region of 10's of mA (significantly under the maximum rating) so these regulators will run cool on the EVB.

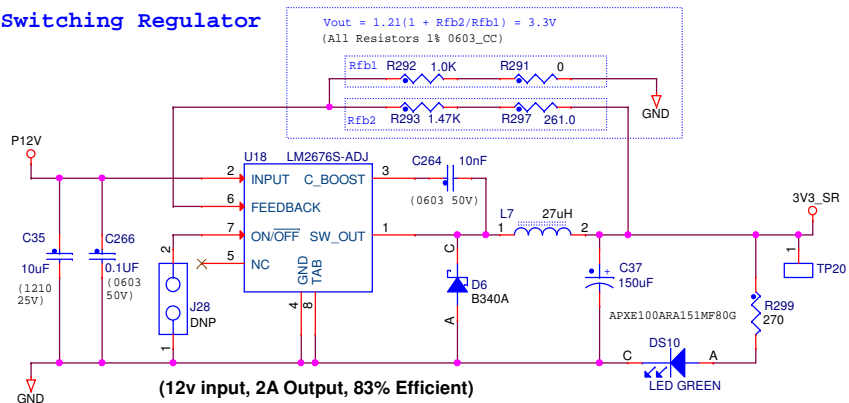
		Automotive Microcontroller Applications	
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Drawing Title: MPC574XG-MB			
Page Title: Power Input and Linear Voltage Regulators			
Size B	Document Number SCH-27897	PDF: SPF-27897	Rev D
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Switching Voltage Regulators and Supply Jumpers

5.0v Switching Regulator



3.3v Switching Regulator



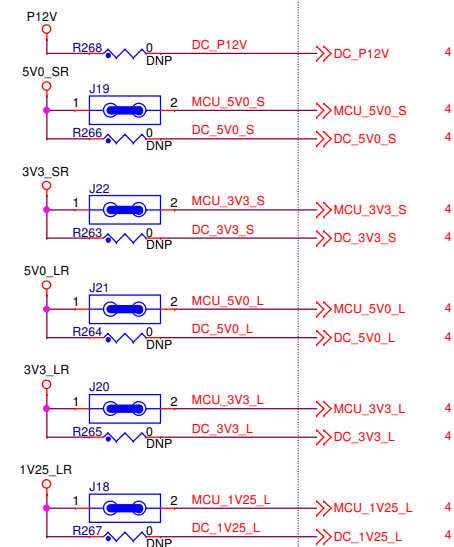
Caution The 3.3v regulator design is optimised for an input voltage of 12V. If the input voltage drops below approx 11V, the 3.3v output voltage ripple may increase. This can be reduced by increasing the bulk storage capacitor if required.

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

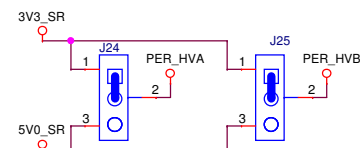
Where possible, components have been shared across the regulator designs to further reduce component count.

Global MCU Daughtercard Supply Jumpers and DC power

To Daughtercard Connectors



Peripheral Power Control



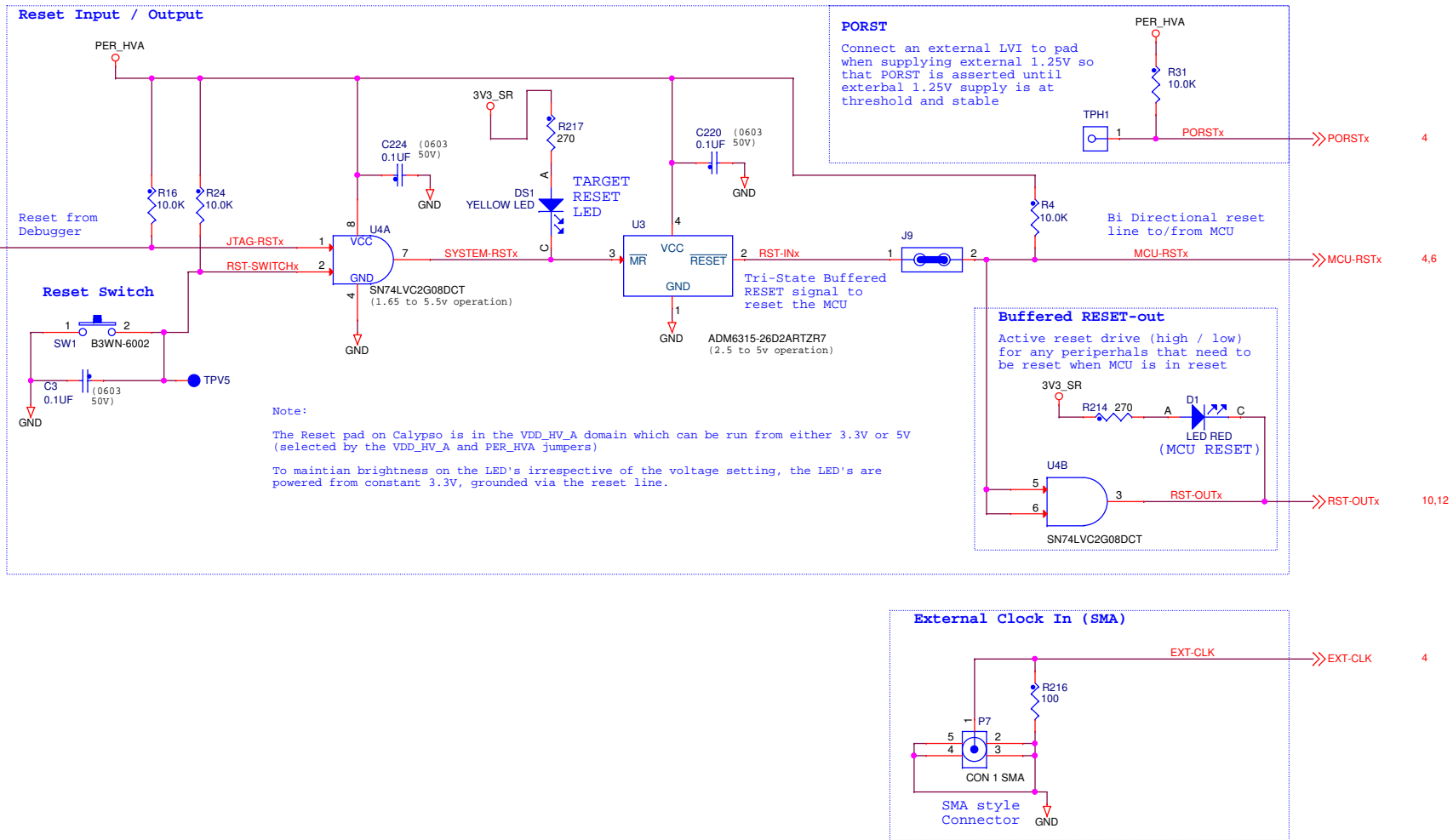
These jumpers control the voltage of the peripherals connected to MCU pads in the VDD_HV_A / HV_B domains and are required so the respective jumpers at the MCU can be used for MCU current measurement.

The settings on these jumpers must mirror the setting of the respective MCU VDD_HV_A / HB_V jumpers

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		Drawing Title: MPC574XG-MB	
Page Title: Switching Voltage Regulators		Date: Tuesday, September 30, 2014	
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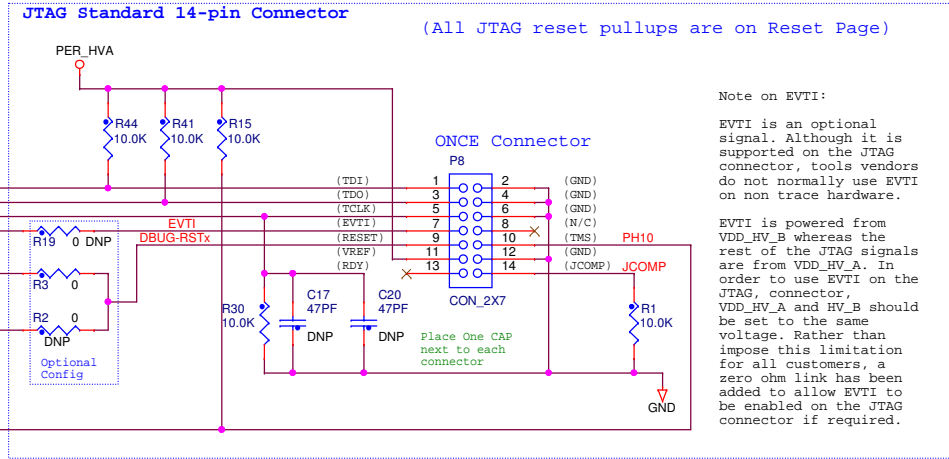
Reset and External Clock In

Reset is in the VDD_HVA domain.



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Page Title:		Reset Circuitry & External Clock In	
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Debug Connectors (JTAG and NEXUS)

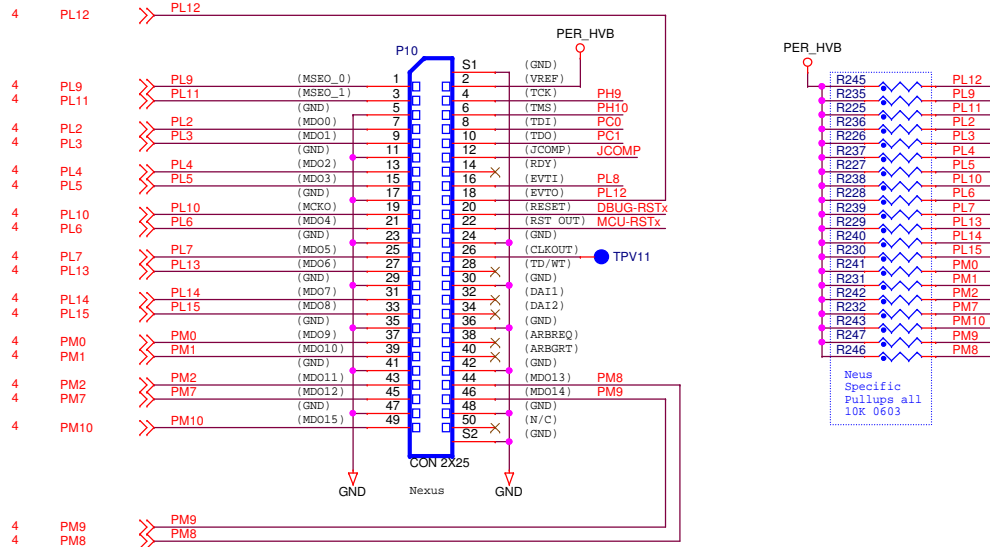


Voltage Domains:

All of the signals used for JTAG (with the exception of EVTI, see note) are powered from the VDD_HV_A domain. All of the additional signals used for Nexus are powered from VDD_HV_B.

If you are using Nexus, you need to ensure that the VDD_HV_A and VDD_HV_B domains are at the same voltage as well as ensuring that the peripheral supplies PER_HVA and PER_HVB match VDD_HV_A / B. See the MCU power page for configuration jumpers.

NEXUS 50-pin Connector

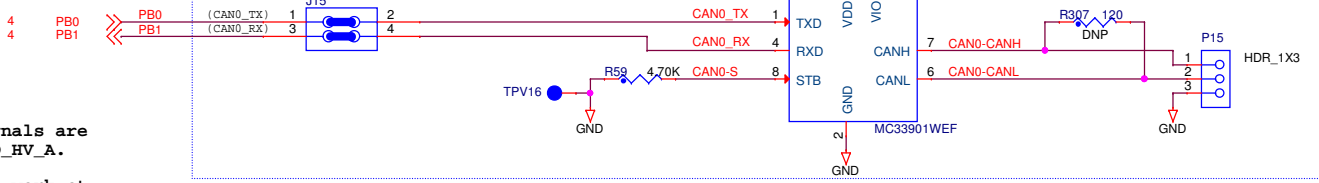


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Page Title:		Debug Connectors (JTAG & Nexus)	
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CAN & LIN Physical

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.



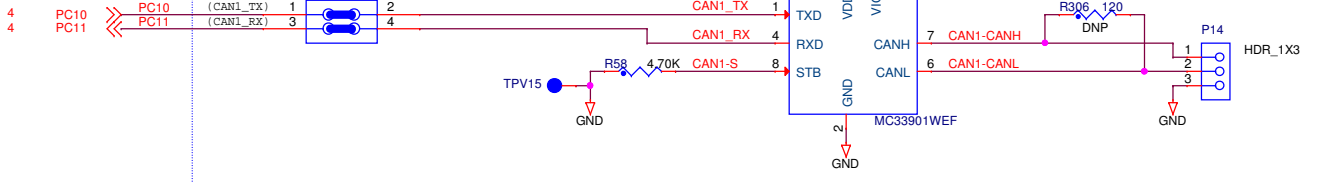
CAN termination resistor footprint. Place on underside of PCB

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

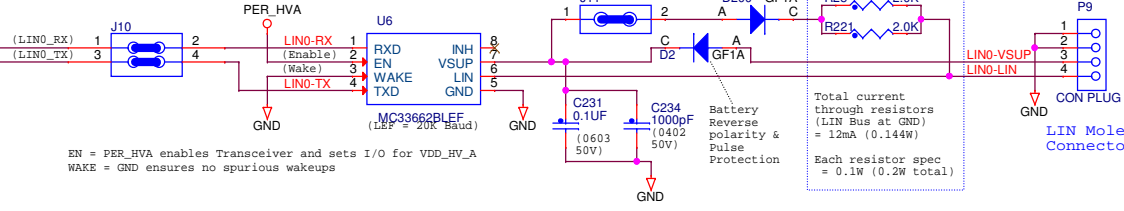
VDD - 5.0V input supply for CAN transceiver (4.5 to 5.5V)
 VI/O - determines the signal level on MCU TX and RX pins and can range from 2.8 to 5.5V
 STB - High for Standby mode, pulled low for normal mode.



CAN termination resistor footprint. Place on underside of PCB

LIN0 Physical Interface

Master Mode Pullup Enable



EN = PER_HVA enables Transceiver and sets I/O for VDD_HV_A
 WAKE = GND ensures no spurious wakeups

Total current through resistors (LIN Bus at GND) = 12mA (0.144W)
 Each resistor spec = 0.1W (0.2W total)

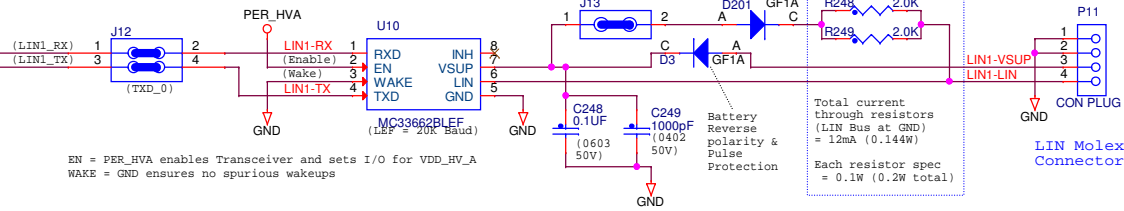
MC33662LEF LIN transceiver is newer version of 33661 offering:

- Full LIN compliance (33661 no longer compliant)
- Improved ESD protection on LIN pin up to 15KV
- Improved ESD on Wake and VSUP Pins
- Other EMC and performance improvements

See freescale.com for more details

LIN1 Physical Interface

Master Mode Pullup Enable



EN = PER_HVA enables Transceiver and sets I/O for VDD_HV_A
 WAKE = GND ensures no spurious wakeups

Total current through resistors (LIN Bus at GND) = 12mA (0.144W)
 Each resistor spec = 0.1W (0.2W total)

		Automotive Microcontroller Applications	
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Page Title: CAN and LIN			
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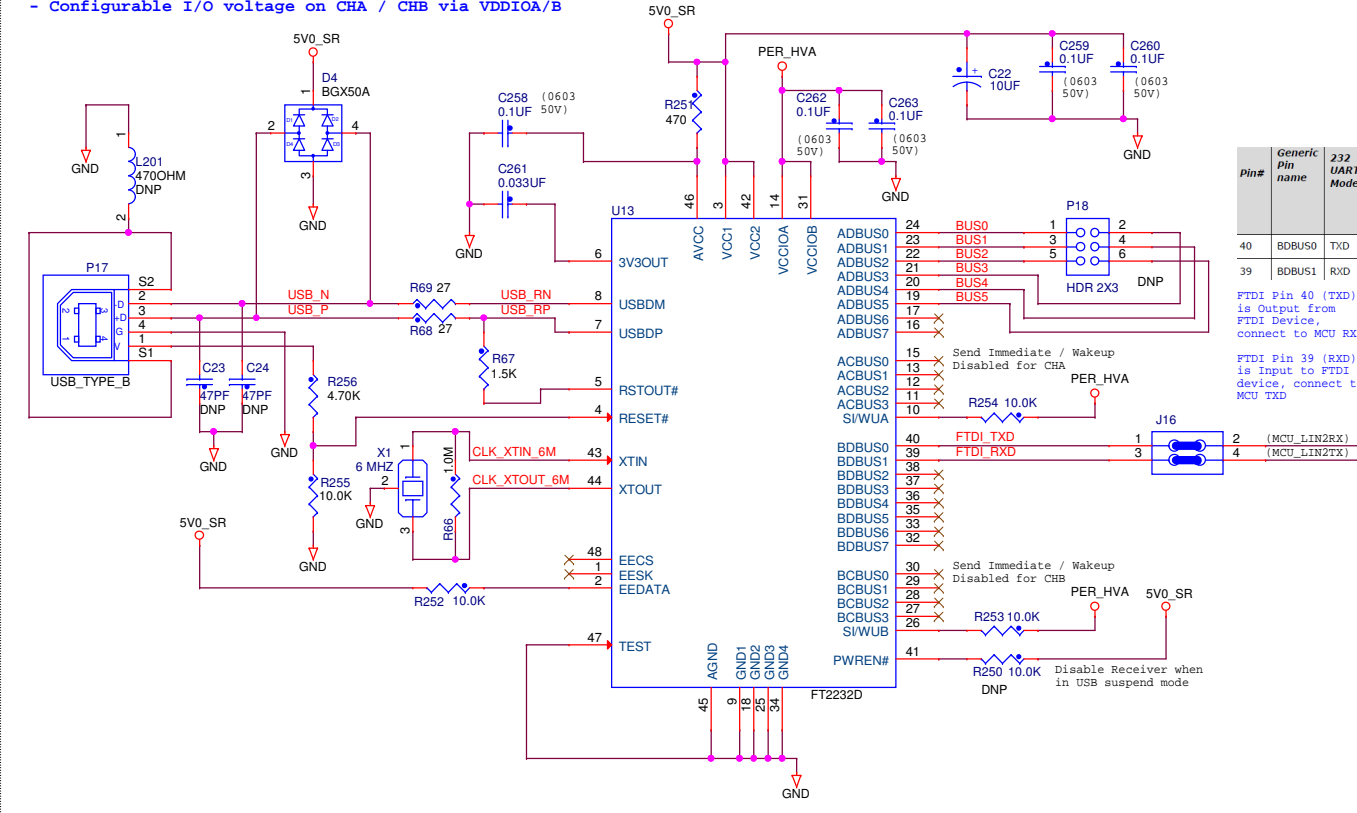
USB RS232 (serial) Interface

All Signals are in power domain
VDD_HV_A.

FTDI interface will work at 3.3V or 5.0V (PER_HVA jumper)

FTDI USB <-> Serial Interface

- Self Powered mode. No power is taken from USB
- Device defaults to Dual serial (RS232) mode ie RS232 on both A and B
- Configurable I/O voltage on CHA / CHB via VDDIOA/B



USB (Type A Host and Type AB OTG)

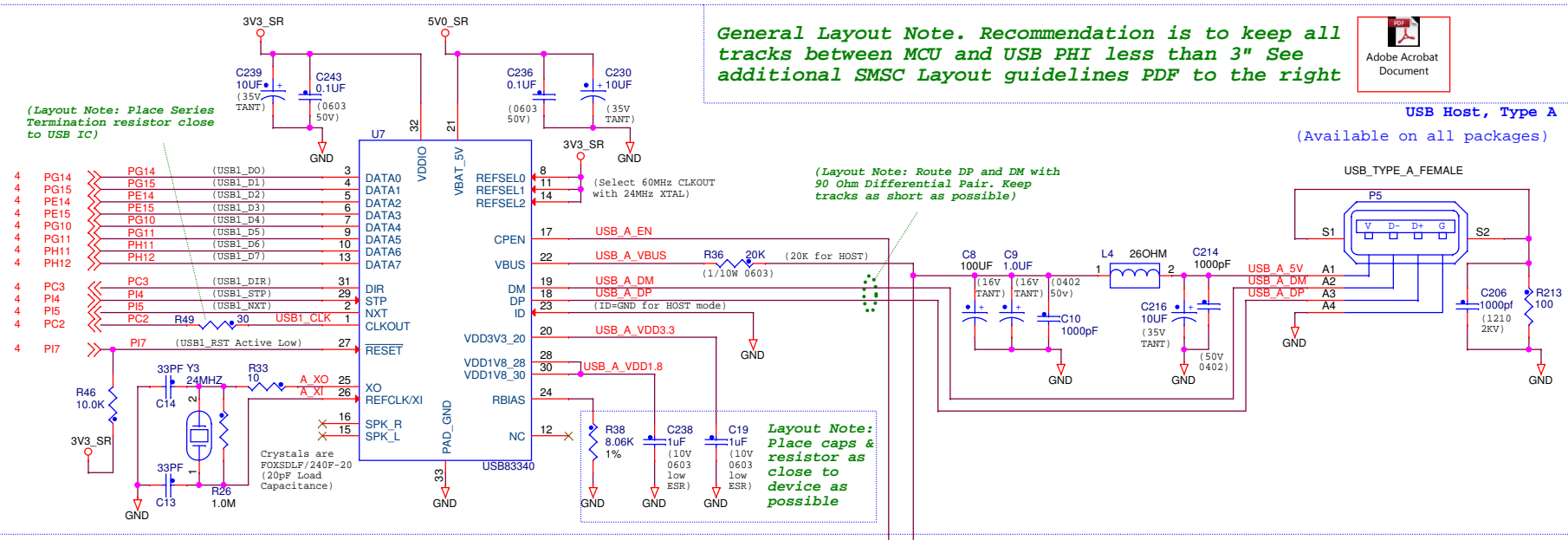
USB Signals are in power domain VDD_HV_A

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.

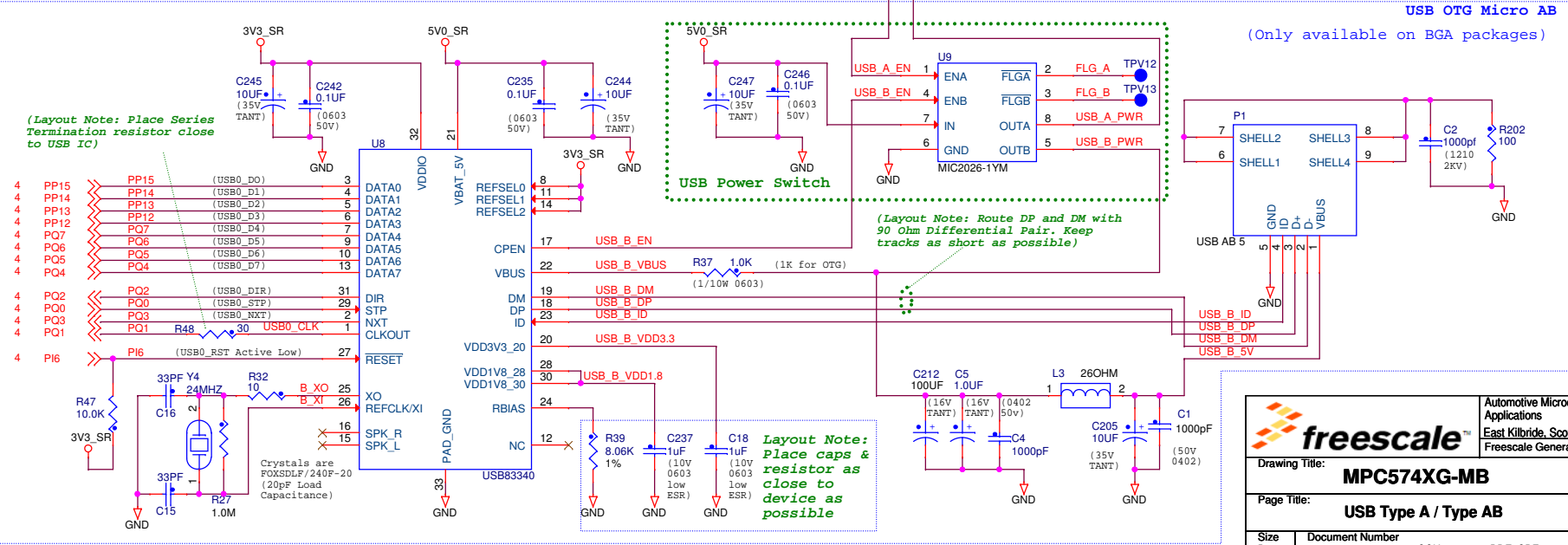


General Layout Note. Recommendation is to keep all tracks between MCU and USB PHI less than 3" See additional SMSC Layout guidelines PDF to the right

USB Host, Type A
(Available on all packages)



USB OTG Micro AB
(Only available on BGA packages)



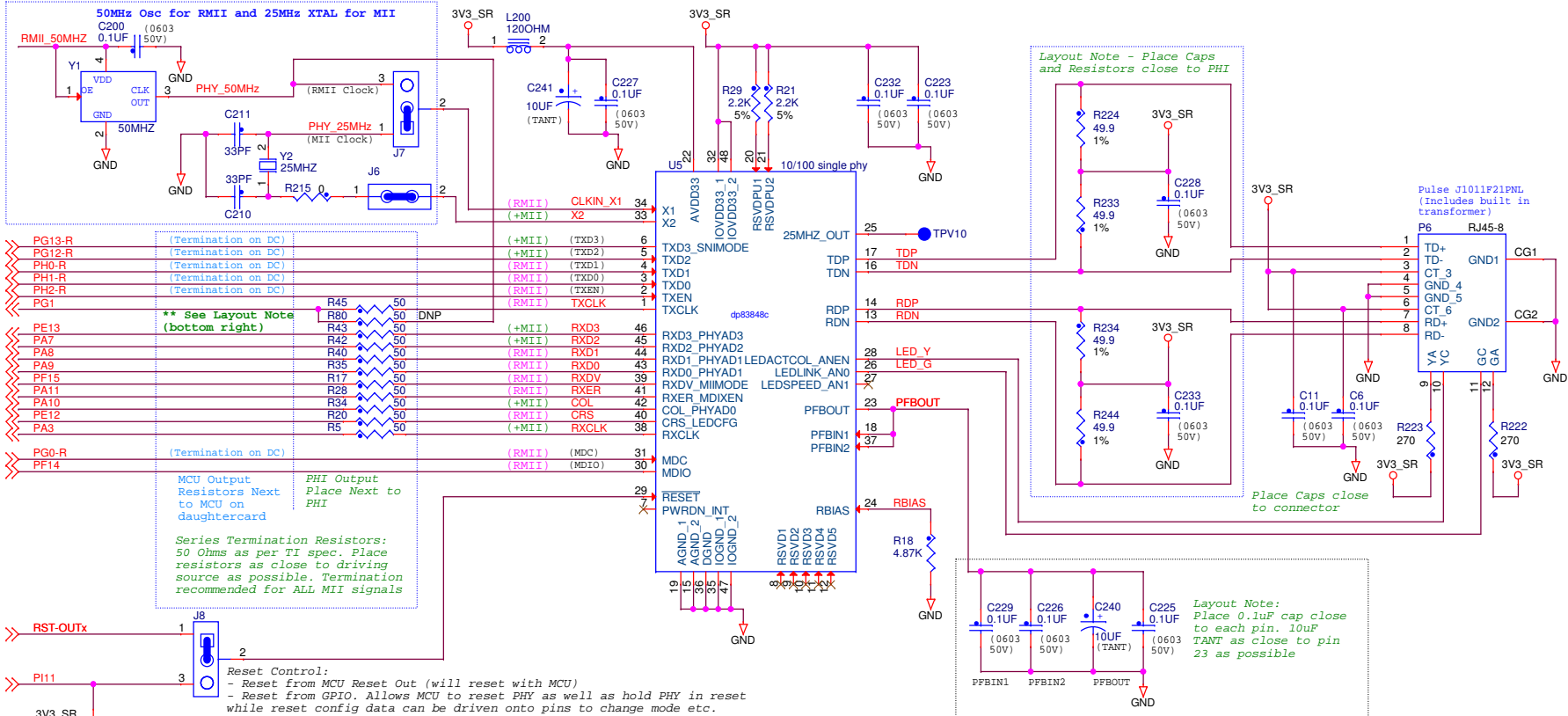
		Automotive Microcontroller Applications	
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Drawing Title: MPC574XG-MB			
Page Title: USB Type A / Type AB			
Size B	Document Number	SCH-27897	PDF: SPF-27897
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Ethernet

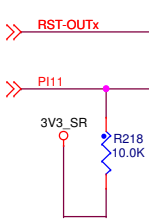
All Ethernet Signals in power domain VDD_HV_B

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

- 4 PG13-R
- 4 PG12-R
- 4 PH0-R
- 4 PH1-R
- 4 PH2-R
- 4 PG1
- 4 PE13
- 4 PA7
- 4 PA8
- 4 PA9
- 4 PF15
- 4 PA11
- 4 PA10
- 4 PE12
- 4 PA3
- 4 PG0-R
- 4 PF14



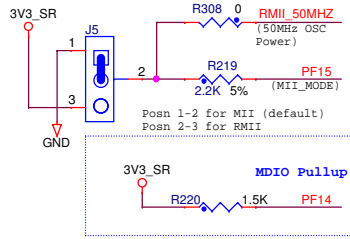
- 5,12 RST-OUTx
- 4 PH11



Boot Configuration (using PHY internal Pulls)

- Auto Negotiation Enable (All speeds / duplex supported) (AN_EN, ANO and AN1 all Internal PullUP)
- Operating Mode (MII or RMII) (SNI_Mode Internal PullDown, MII_Mode control via jumper)
- LED Configuration (Model) (LED_CFG Internal PullUP)
- MDIX Enable (Auto MDIX Enabled) (MDIX_EN Internal PullUP)
- Physical Address (set to 0b00001) (PHYAD[0] Internal PullUp, PHYAD[1..4] Internal PullDown)

Layout Note:
 MII Mode resistor (MII / RMII mode) and the MDIX ullup resistor should be placed as close as possible to the PP15 / PF14 tracks to reduce the effect of a stub on the transmission line.



**** Layout Note - Place resistors as shown with shared pad on PG1 between PG1 and PHY_50MHz**

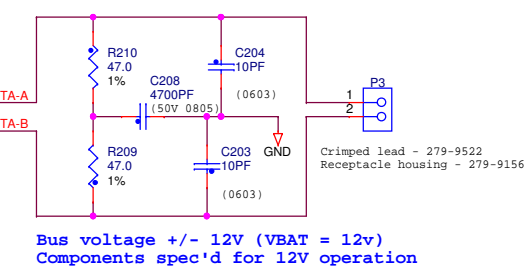
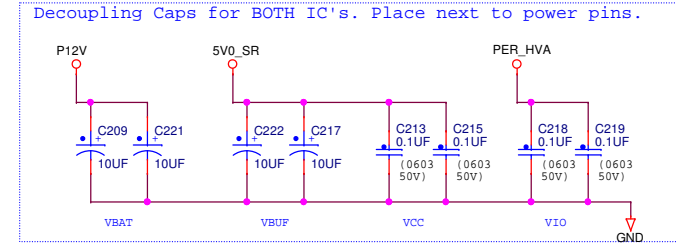
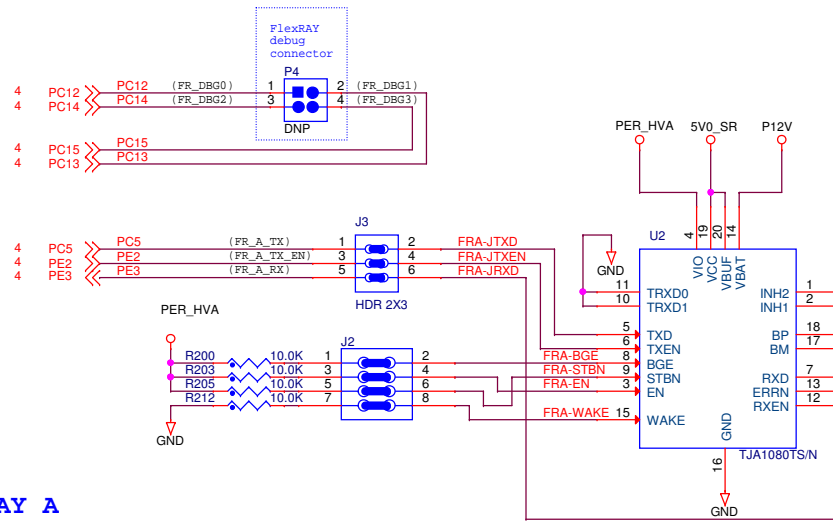
For RMII mode, remove resistor between PG1 and TXCLK and place between PG1 and PHY_50MHz

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Page Title: Ethernet			
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FlexRAY Physical Interface

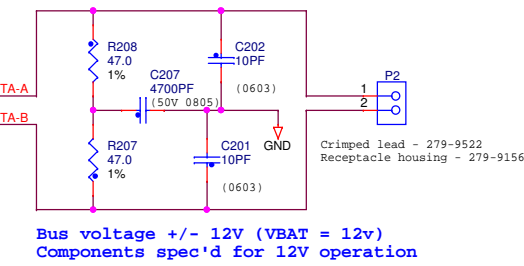
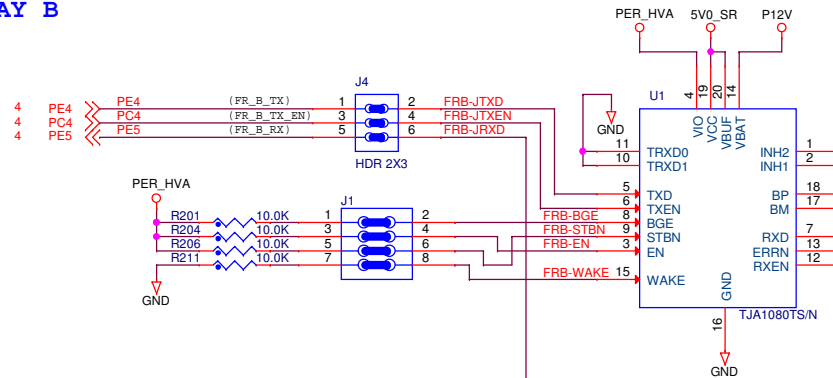
All Signals are in power domain VDD_HV_A.

FlexRAY interface will work at 3.3V or 5.0V (PER_HVA jumper)



FlexRAY A

FlexRAY B



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

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Page Title: **FlexRAY Physical Interface**

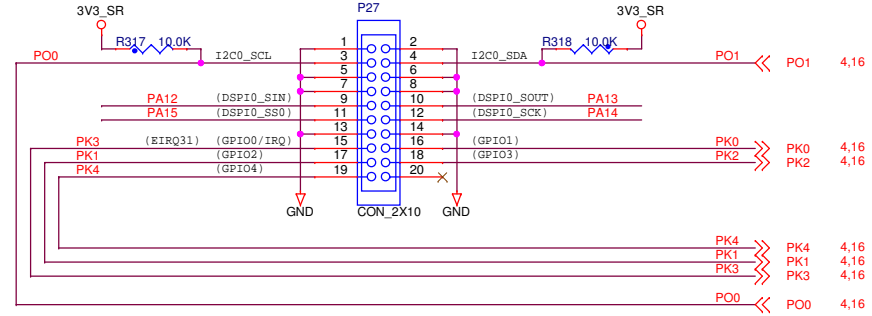
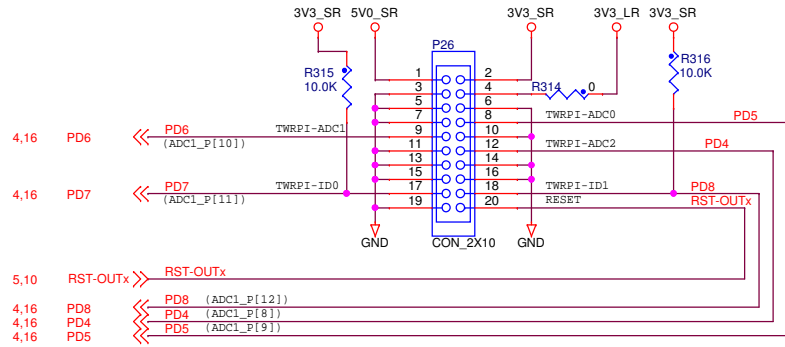
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SAI Audio, AVB & TWRPI Connectors

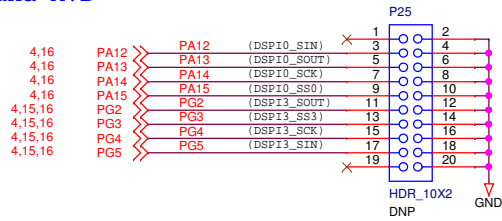
General Purpose TWRPI

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



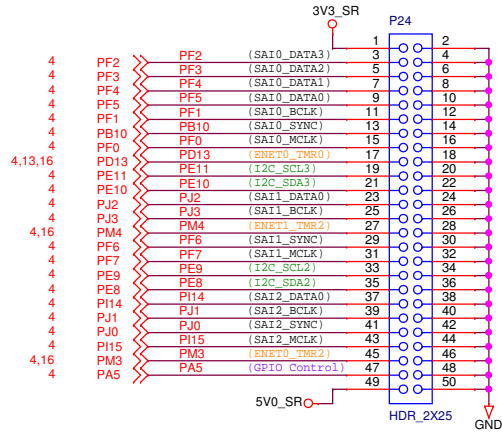
Note: Ports PK[0..5] are shared with the GPIO Matrix

SAI Audio and AVB



Pins used on this header are also at GPIO Matrix

- PA12 - DSPI0_SIN (Also shared with TWRPI)
- PA13 - DSPI0_SOUT (Also shared with TWRPI)
- PA14 - DSPI0_SCK (Also shared with TWRPI)
- PA15 - DSPI0_SCK (Also shared with TWRPI)
- PA15 - DSPI0_SSO (Also shared with TWRPI)
- PG2 - DSPI3_SOUT (Also shared with User LED)
- PG3 - DSPI3_SS3 (Also shared with User LED)
- PG4 - DSPI3_SCLK (Also shared with User LED)
- PG5 - DSPI3_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 PH4 (PH4 now routed to GPIO Matrix)
 Pin 45 was PH3, now PH3 (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

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MLB (SMSC) Daughtercard Connector

Layout Note: 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.

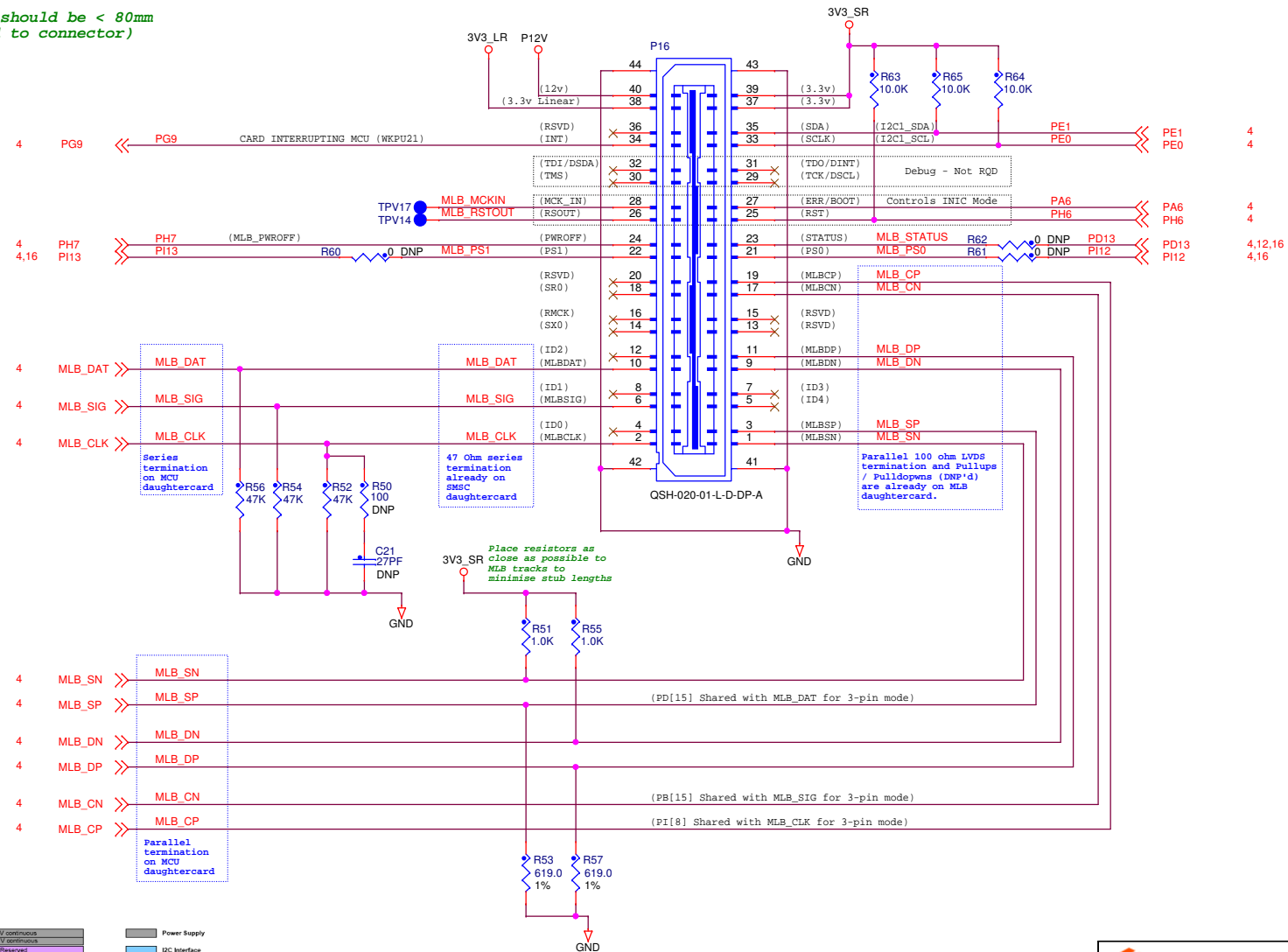


Figure 5-1. Connector reference to Main Board

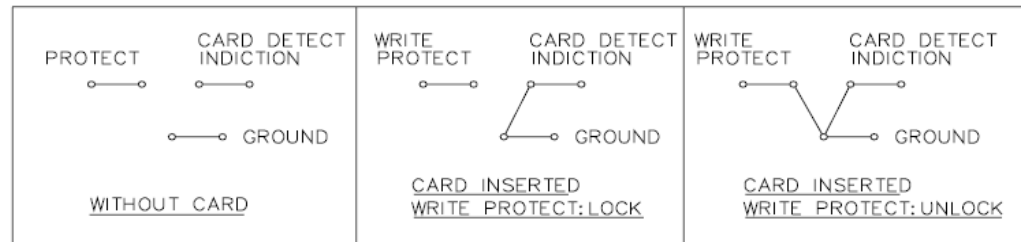
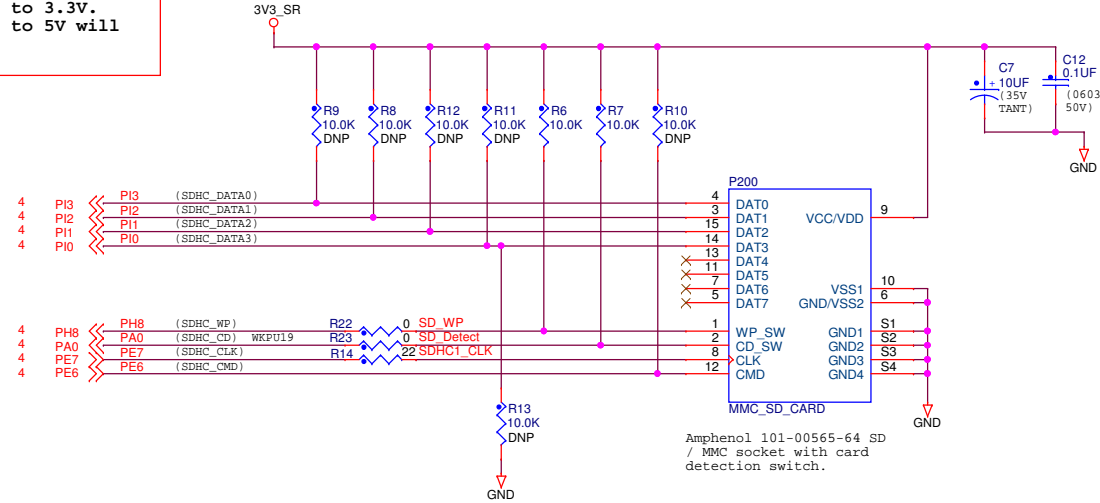
Pin 30	3.3V switched	Pin 40	12V continuous	Power Supply
Pin 37	3.3V switched	Pin 38	3.3V continuous	DC Interface
Pin 35	SDA	Reserved	Reserved	Debug & JTAG Interface
Pin 33	SCL	Pin 34	INT	Misc Signals
Pin 31	TD0/DINT	Pin 32	TD0/SDA	Board ID
Pin 29	TD0/SCL	Pin 30	TMS	Network Interface
Pin 27	ERR/BOOT	Pin 28	MCK_IN	RMCK
Pin 25	SRST	Pin 26	RSOUT	USB Interface
Pin 23	STATUS (status/standby/ready)	Pin 24	PS1	MediaL3 3-Pin
Pin 21	Reserved	Pin 22	Reserved	
Pin 19	Reserved	Pin 18	Reserved	
Pin 17	Reserved (MCK1_RSTP)	Pin 16	RMCK	
Pin 15	Reserved (MCK1_RSTN)	Pin 14	Reserved	
Pin 13	Reserved	Pin 12	PhysIn0_D0	
Pin 11	Reserved	Pin 10	PhysIn0_D1	
Pin 9	PhysIn0_D2	Pin 8	PhysIn0_D3	
Pin 7	PhysIn0_D4	Pin 6	PhysIn0_D5	
Pin 5	Reserved	Pin 4	PhysIn0_D6	
Pin 3	Reserved	Pin 2	MLBCLK	
Pin 1	Reserved			

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SD Connector

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)

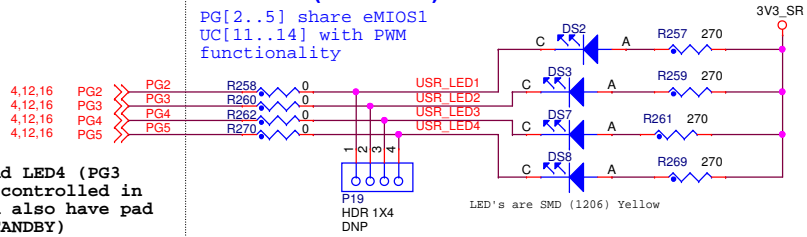
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User Peripherals, Audio Controls and GPIO

Switches are 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)
 Similarly, 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

User LED's (Active Low)

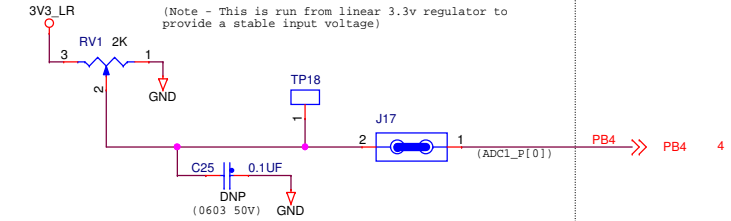
PG[2..5] share eMIOS1
 UC[11..14] with PWM
 functionality



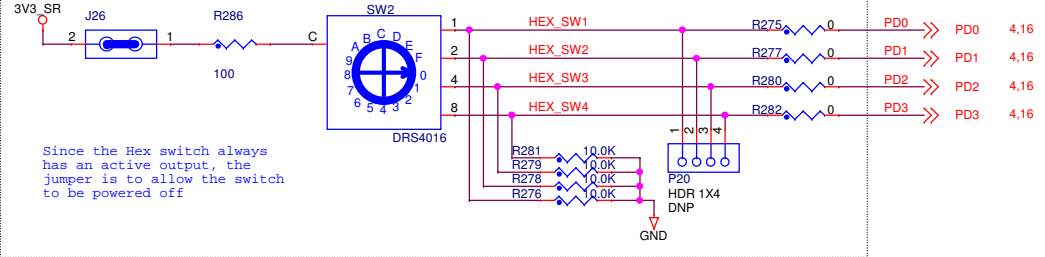
Note that LED2 and LED4 (PG3 and PG5) can be controlled in LPU_RUN mode (and also have pad keepers in LPU_STANDBY)

ADC Input Pot and Test Point

(Note - This is run from linear 3.3v regulator to provide a stable input voltage)



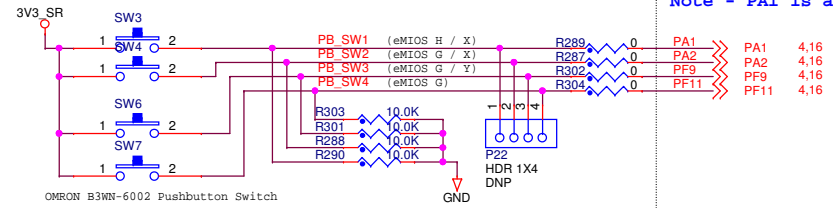
Hex Encoded Switch (Active High)



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

Since the Hex switch always has an active output, the jumper is to allow the switch to be powered off

User Pushbutton Switches (Active High)



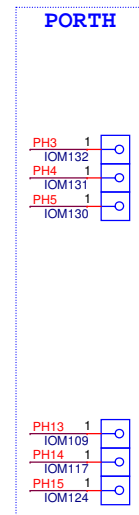
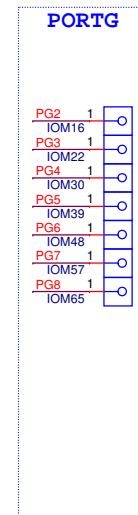
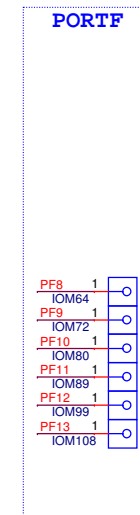
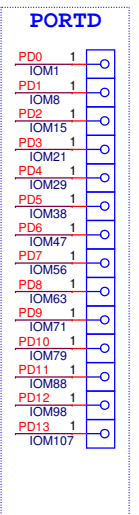
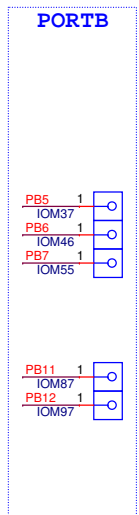
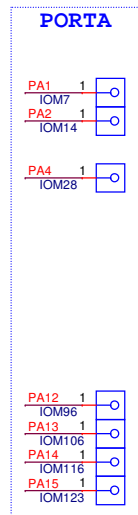
Note - PA1 is also the NMI pin!

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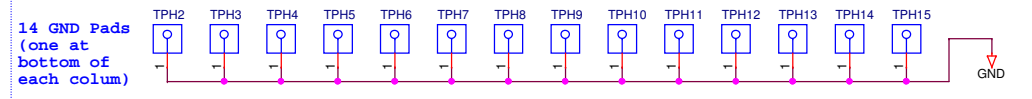
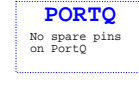
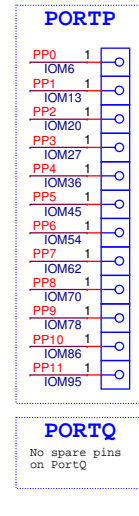
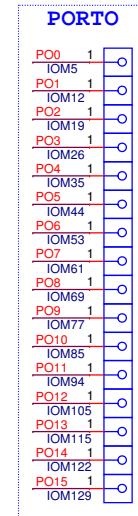
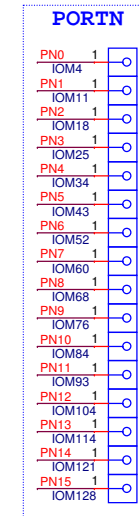
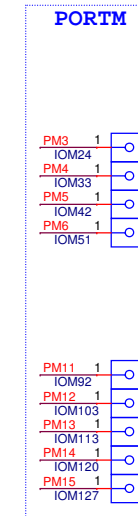
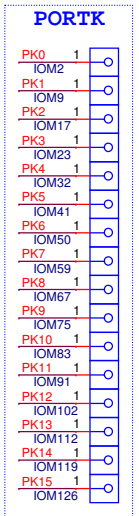
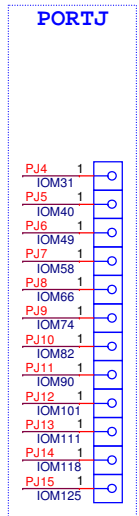
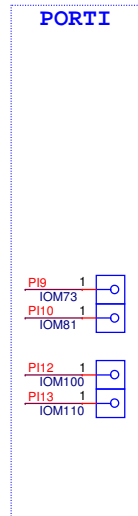
GPIO Pin Matrix

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
	4,12	PA12	PA12
PA[12..15] shared with SAI Audio and TWRPI	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
	4,12	PD4	PD4
	4,12	PD5	PD5
PD[4..8] shared with TWRPI connector with pullup on PD[7], PD[8]	4,12	PD6	PD6
	4,12	PD7	PD7
	4,12	PD8	PD8
	4,12	PD9	PD9
	4	PD9	PD10
	4	PD10	PD11
	4	PD11	PD12
PD[13] shared with SAI Audio and MLB headers	4,12,13	PD12	PD13
	4,12,13	PD13	PD13
	4	PI9	PI9
	4	PI10	PI10
PI[12,13] shared with MLB header	4,13	PI12	PI13
	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



PF8	PF8	4	
PF9	PF9	4,15	
PF10	PF10	4,15	PF[9,11] shared with user switches
PF11	PF11	4	
PF12	PF12	4	
PF13	PF13	4	
PG2	PG2	4,12,15	
PG3	PG3	4,12,15	PG[2..5] shared with user LED's, SAI and TWRPI headers
PG4	PG4	4,12,15	
PG5	PG5	4,12,15	
PG6	PG6	4	
PG7	PG7	4	
PG8	PG8	4	
PH3	PH3	4	
PH4	PH4	4	
PH5	PH5	4	
PH13	PH13	4	
PH14	PH14	4	
PH15	PH15	4	
PM3	PM3	4,12	PM[3..4] shared with SAI Audio header
PM4	PM4	4,12	
PM5	PM5	4	
PM6	PM6	4	
PM11	PM11	4	
PM12	PM12	4	
PM13	PM13	4	
PM14	PM14	4	
PM15	PM15	4	
PN0	PN0	4	
PN1	PN1	4	
PN2	PN2	4	
PN3	PN3	4	
PN4	PN4	4	
PN5	PN5	4	
PN6	PN6	4	
PN7	PN7	4	
PN8	PN8	4	
PN9	PN9	4	
PN10	PN10	4	
PN11	PN11	4	
PN12	PN12	4	
PN13	PN13	4	
PN14	PN14	4	
PN15	PN15	4	
PO0	PO0	4,12	PO[0..1] shared with TWRPI header
PO1	PO1	4,12	
PO2	PO2	4	
PO3	PO3	4	
PO4	PO4	4	
PO5	PO5	4	
PO6	PO6	4	
PO7	PO7	4	
PO8	PO8	4	
PO9	PO9	4	
PO10	PO10	4	
PO11	PO11	4	
PO12	PO12	4	
PO13	PO13	4	
PO14	PO14	4	
PO15	PO15	4	
PP0	PP0	4	
PP1	PP1	4	
PP2	PP2	4	
PP3	PP3	4	
PP4	PP4	4	
PP5	PP5	4	
PP6	PP6	4	
PP7	PP7	4	
PP8	PP8	4	
PP9	PP9	4	
PP10	PP10	4	
PP11	PP11	4	



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)

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