

Sheet# Rev# Description

Revision Notes are on Sheet 33

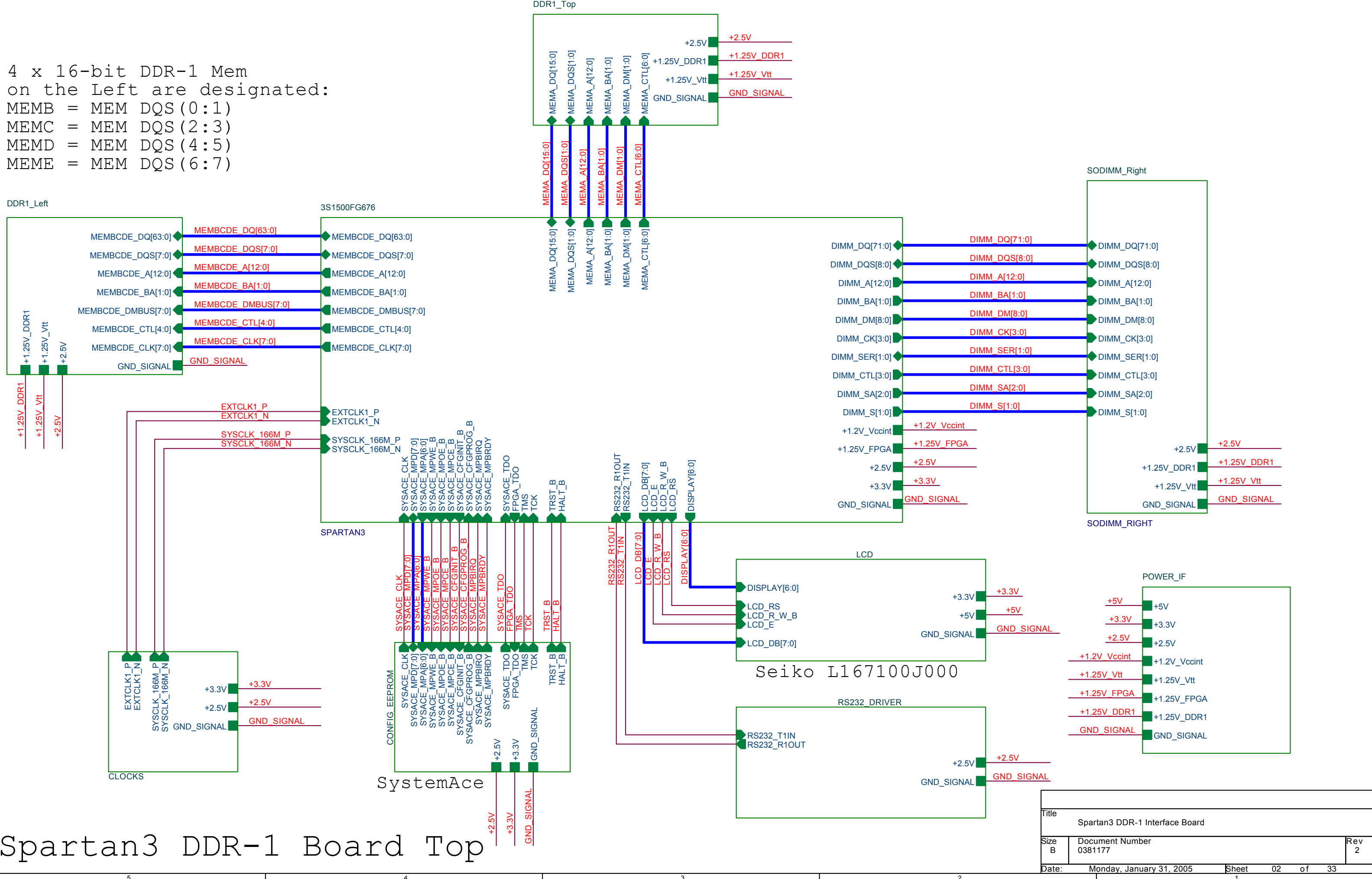
Sheet#	Rev#	Description	Part #	Ref. Des. #:
1	6	Notes Page		
2	2	Top Hierarchical Block Diagram		
3	2	Clock Sources: Epson EC2121CA-166M OSC, SMA's	C452	Q5
4	2	SystemAce Controller & CF Socket, JTAG Conn.		
5	2	DDR-1 Micron MT46V16M16P-75 - MEM Top	D12	R738
6	1	DDR-1 Mem Top Termination Resistors	DD1	SW6
7	3	DDR-1 Micron MT46V16M16P-75 - MemL 01		
8	1	DDR-1 MemL 01 Termination Resistors	J6	U14
9	2	DDR-1 Micron MT46V16M16P-75 - MemL 23	L4	
10	1	DDR-1 MemL 23 Termination Resistors		
11	2	DDR-1 Micron MT46V16M16P-75 - MemL 45	P42	Y2
12	1	DDR-1 MemL 45 Termination Resistors		
13	2	DDR-1 Micron MT46V16M16P-75 - MemL 67		
14	3	DDR-1 MemL 67 Termination Resistors		
15	3	DDR-1 SODIMM 200-pin Socket "Right"		
16	1	DDR-1 SODIMM Termination Resistors		
17	1	LCD I/F Connector, MC74LCX541D level shifters, 7-Segment Display		
18	2	RS232 I/F MAX3316ECUP 2.5V & DB9F Serial Conn (entire pages is DNA)		
19	2	3S1500FG676 BANK0 MemL A[12:0] I/F, SYSCLK INPUT, 2XHEADER I/F, Vcco=+2.5V		
20	2	3S1500FG676 BANK1 Mem Top I/F, Vcco=+2.5V		
21	2	3S1500FG676 BANK2 SODIMM Socket I/F, Vcco=+2.5V		
22	2	3S1500FG676 BANK3 SODIMM Socket I/F, Vcco=+2.5V		
23	2	3S1500FG676 BANK4 SODIMM Socket I/F, SYSACE I/F, Vcco=+2.5V		
24	2	3S1500FG676 BANK5 LCD I/F, RS232 I/F, Vcco=+2.5V		
25	2	3S1500FG676 BANK6 MemL I/F, Vcco=+2.5V		
26	2	3S1500FG676 BANK7 MemL I/F, Vcco=+2.5V		
27	4	3S1500FG676 Config Bank, XCONFIG Conn., Mode Sw, Prog PB Sw		
28	2	3S1500FG676 Power Pins: GND, Vccaux (+2.5V), Vccint (+1.2V)		
29	2	Power: +2.5V, +1.25V Vtt, +1.25V DDR1		
30	5	Power: +3.3V, +1.2V Vccint, +1.25V FPGA		
31	2	Decoupling Caps: +1.25V Vtt, +1.25V FPGA, +1.25V DDR1		
32	6	Decoupling Caps: +5V, +3.3V, +2.5V, +1.2V Vccint		
33	6	Rev. Notes		

Notes Page

Latest Schematic Rev.: 6, on Date 03/15/2005

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Spartan3 DDR-1 Interface Board		
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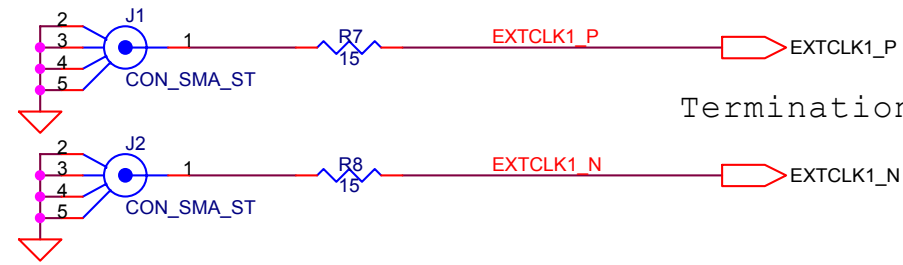
4 x 16-bit DDR-1 Mem
 on the Left are designated:
 MEMB = MEM DQS (0:1)
 MEMC = MEM DQS (2:3)
 MEMD = MEM DQS (4:5)
 MEME = MEM DQS (6:7)



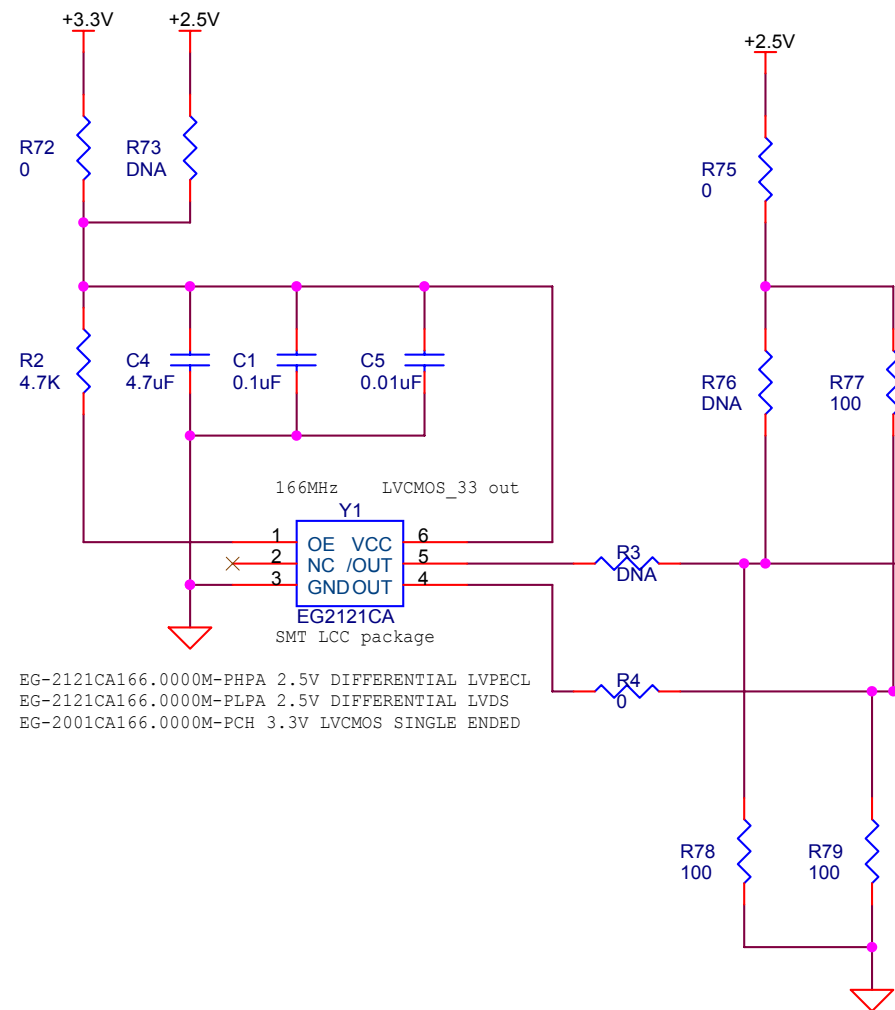
Spartan3 DDR-1 Board Top

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Spartan3 DDR-1 Interface Board		
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Differential Inputs for Test Equip. clock



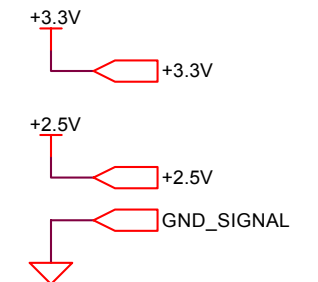
Termination resistors at FPGA Bank4 (Sheet 23)



EG-2121CA166.0000M-PHPA 2.5V DIFFERENTIAL LVPECL
 EG-2121CA166.0000M-PLPA 2.5V DIFFERENTIAL LVDS
 EG-2001CA166.0000M-PCH 3.3V LVCMOS SINGLE ENDED

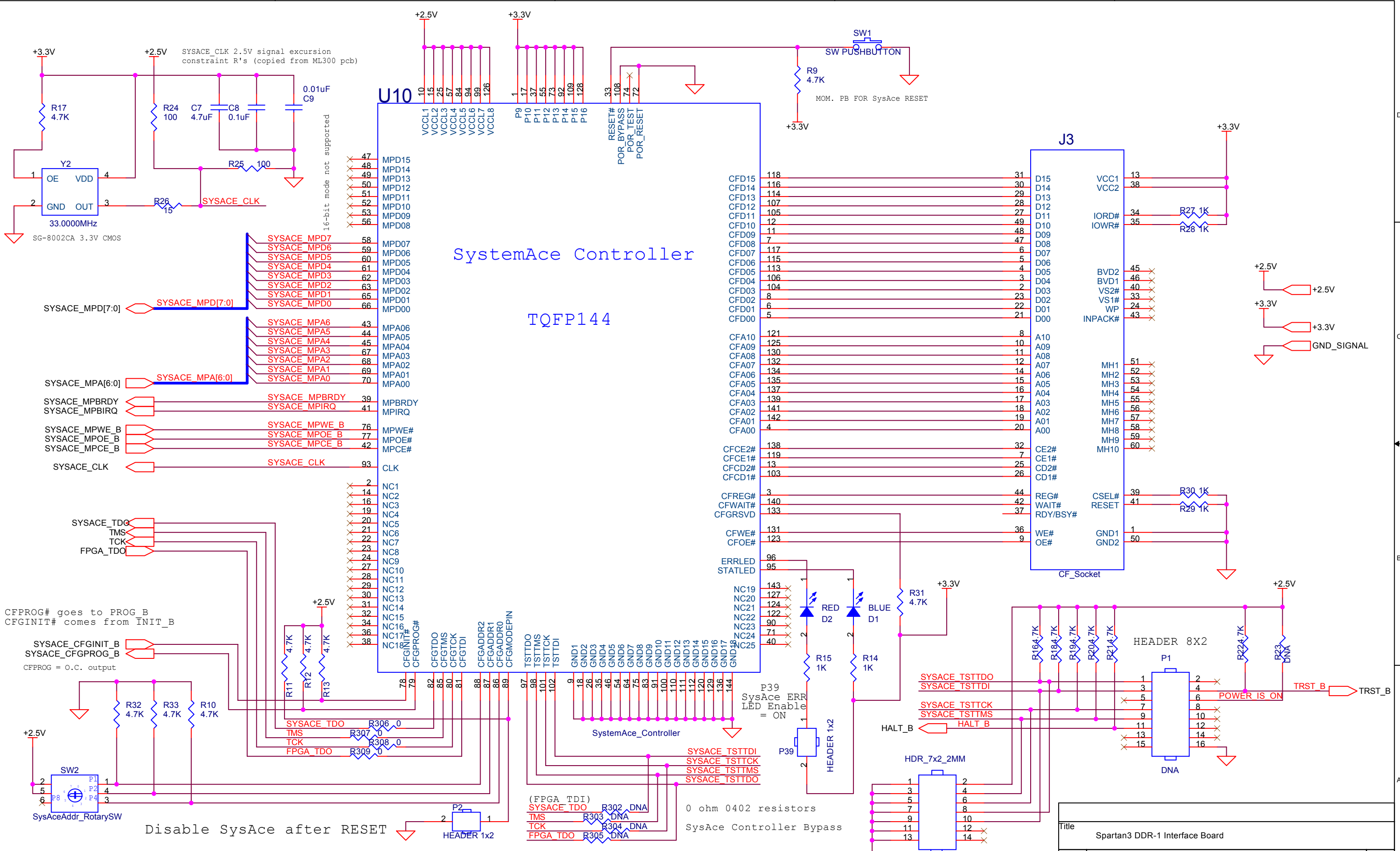
Oscillator	Osc. Power	Resistor Configuration
EG-2121CA 2.5V DIFF'L LVPECL Connect the diff'l P & N outputs No bias network required	+2.5V	R73 0 ohms R72 DNA R4 0 ohms R3 0 ohms R76, R77, R78, R79 all DNA
EG-2001CA 3.3V LVCMOS SINGLE ENDED Connect the SINGLE ENDED "P" output Bias the S.E. output to 2.5V center Pulldown unused diff'l N clock sig	+3.3V	R72 0 ohms R73 DNA R4 0 ohms R3 DNA R77 100 ohms R79 100 ohms R78 100 ohms

50 ohm LVPECL term. R's at FPGA Bank0 (Sheet 19)
 100 ohm LVDS parallel term. R at FPGA Bank0 (Sheet 19)



CLOCKS

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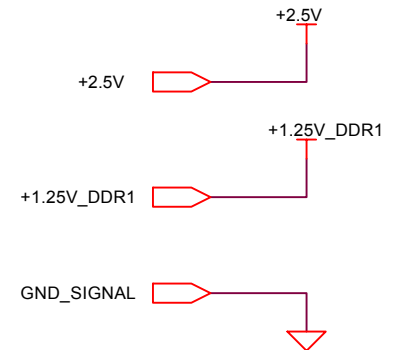
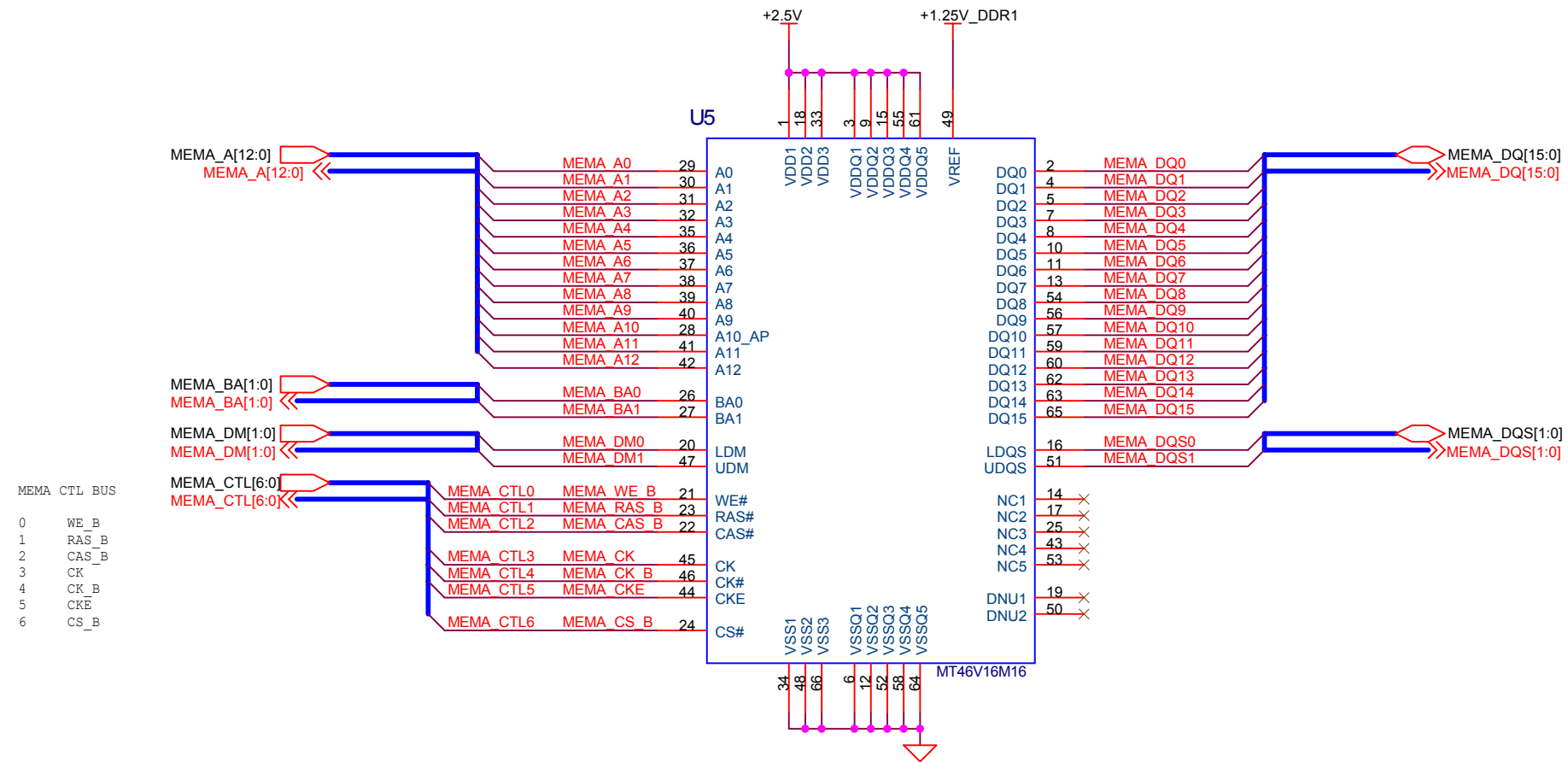


CONFIG via SystemAce CF

Normal=R306,R307,R308,R309 In, R302,R303,R304,R305 Out
 Bypass=R302,R303,R304,R305 In, R306,R307,R308,R309 Out

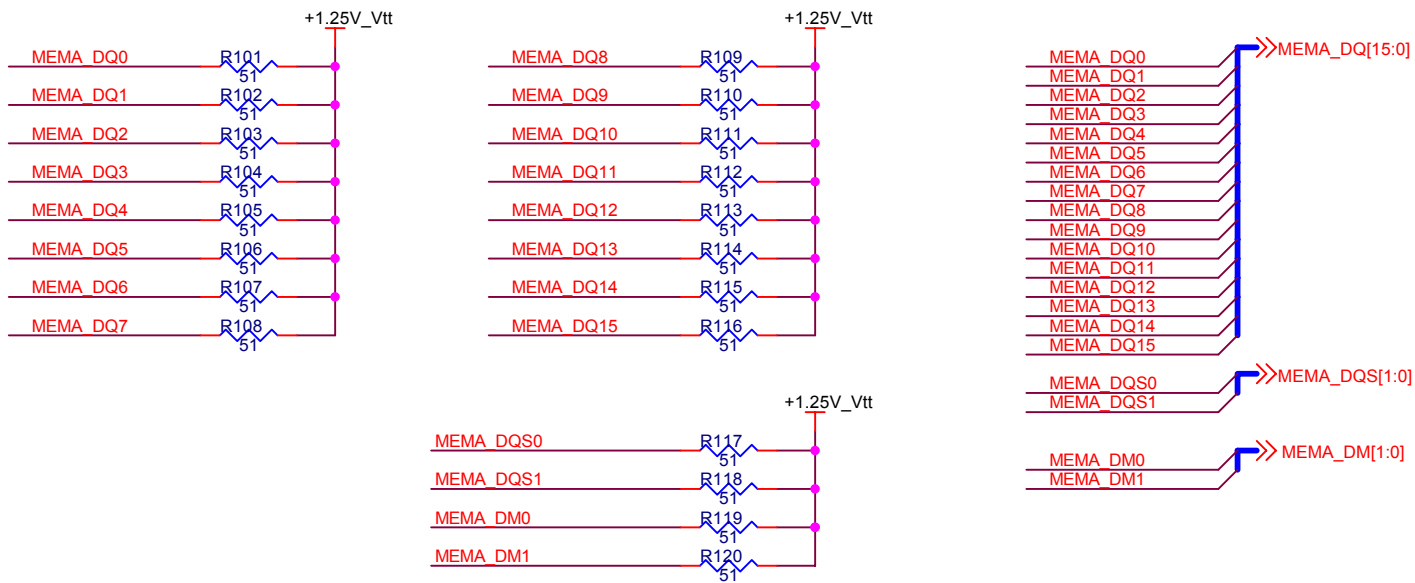
Title		
Spartan3 DDR-1 Interface Board		
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Single DDR-1 Memory on Top is designated MEMA

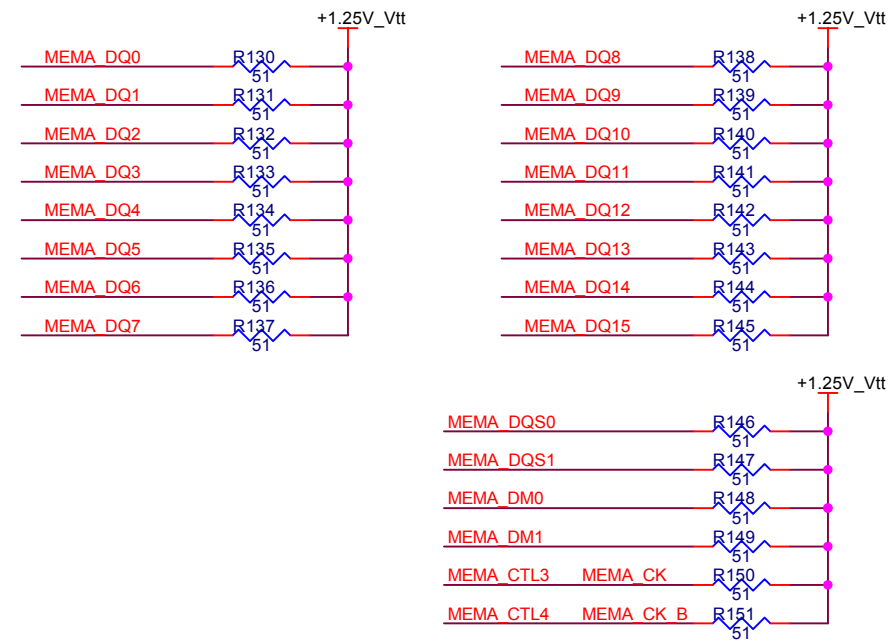


MT46V16M16TG-6P Single DDR-1 Memory on Top (MEM_Top)

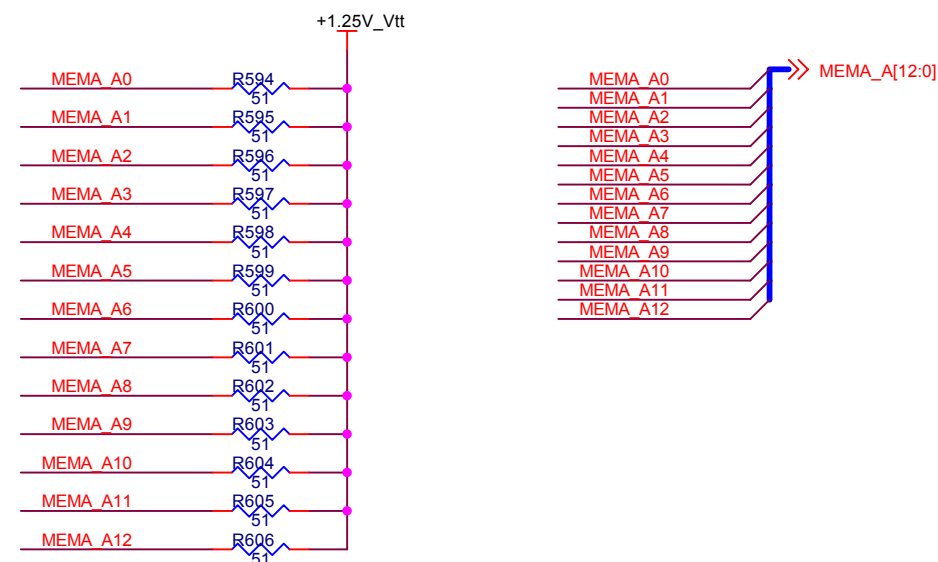
Title		
Spartan3 DDR-1 Board		
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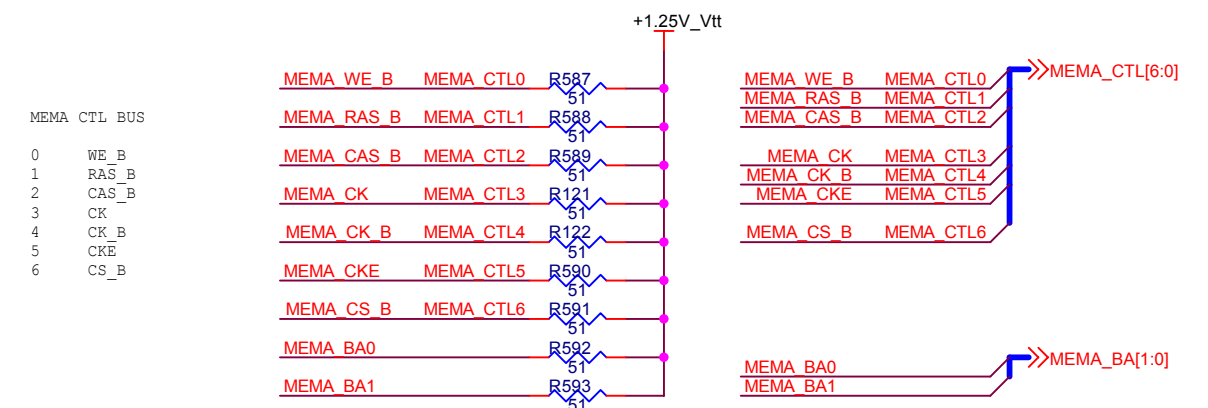
Place these resistors close to the FPGA



Place these resistors close to the MEMA



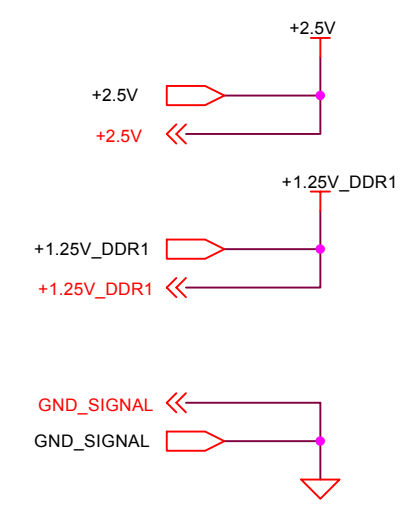
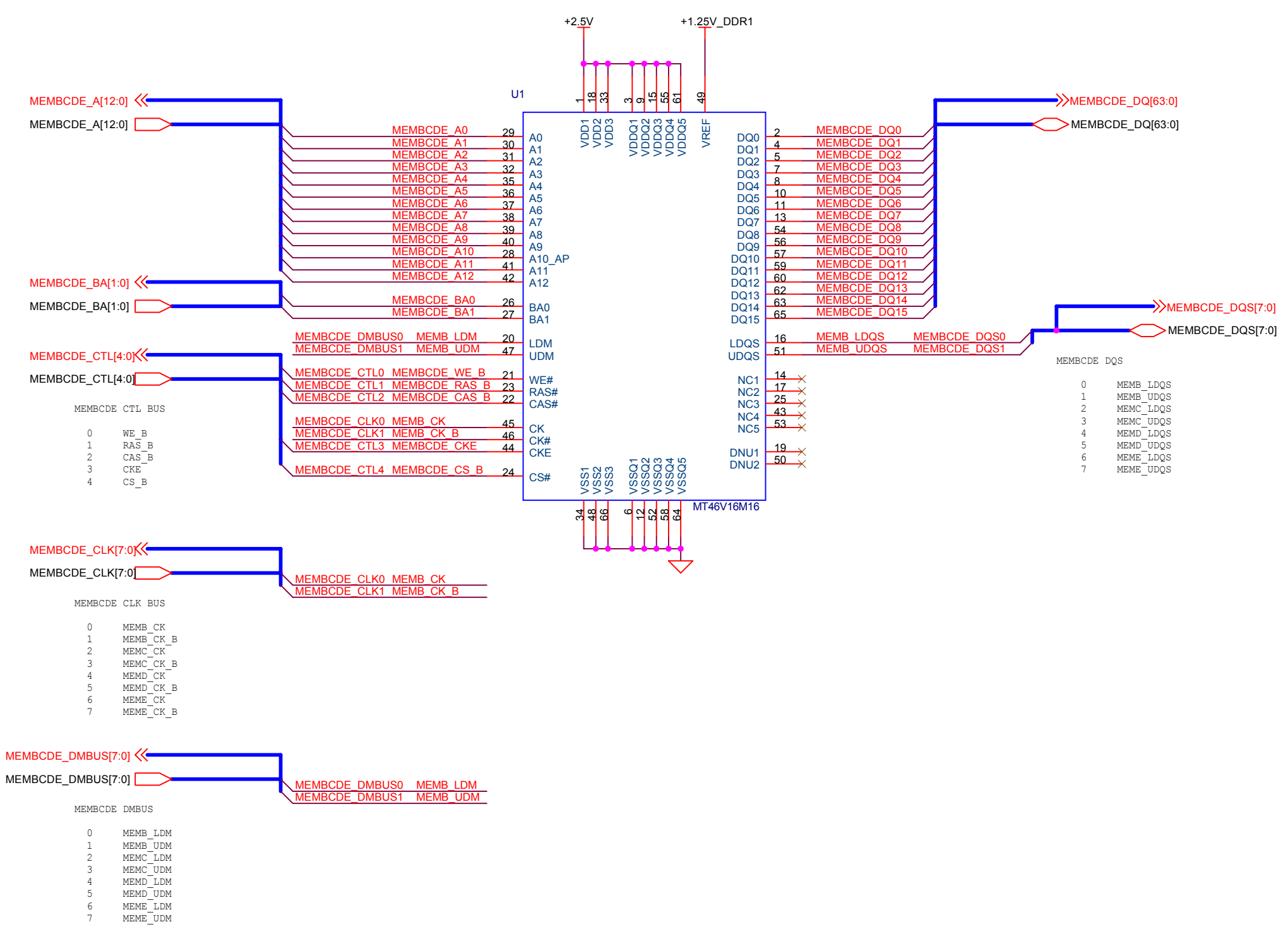
Common address signals
Place these resistors close to the MEMA



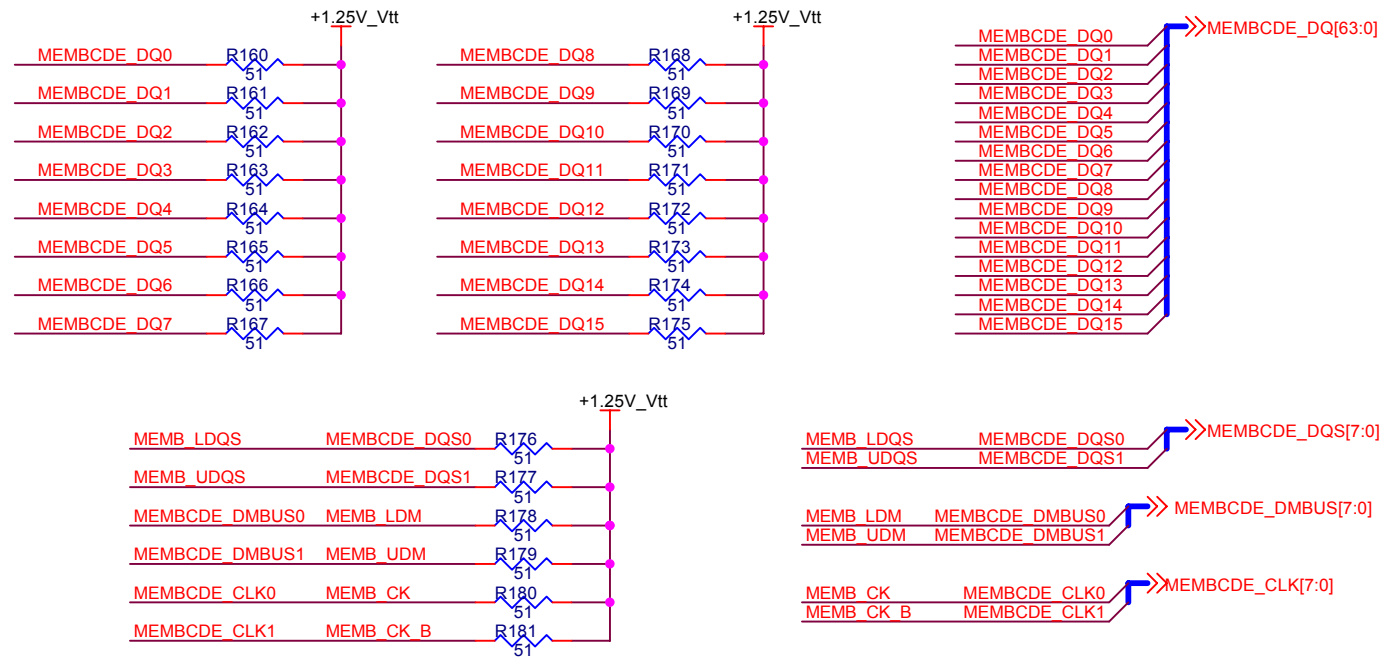
Common control signals
Place these resistors close to the MEMA

MEMA MT46V16M16TG-6P (Top) Termination Resistors

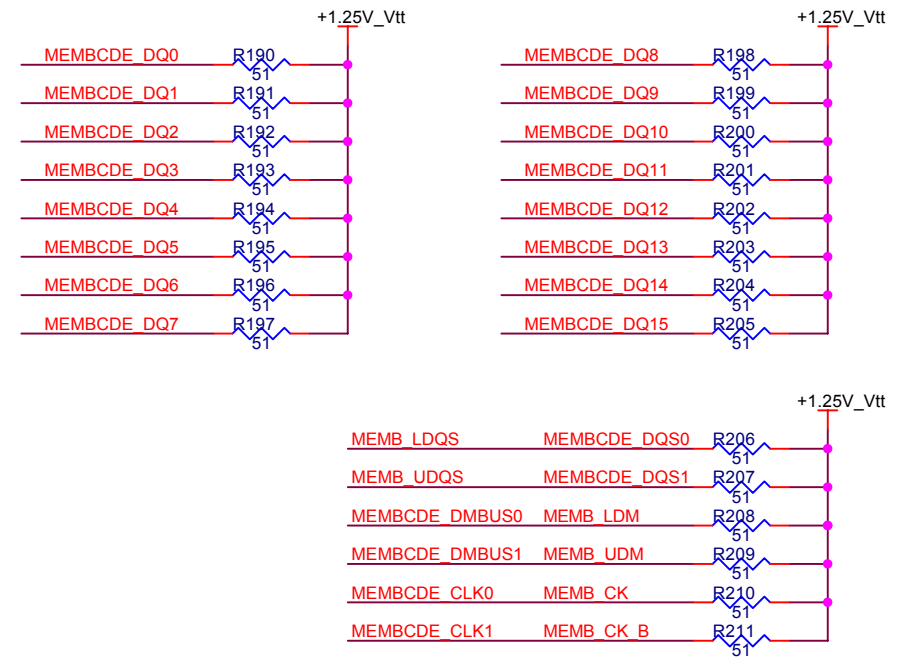




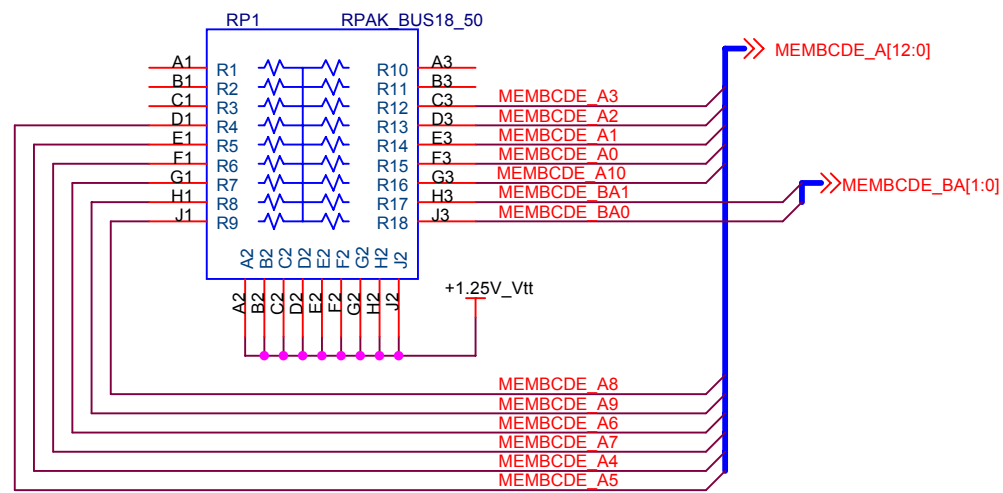
MT46V16M16TG-6P DDR-1 Memory on Left MEMB = MEM DQS (0:1)



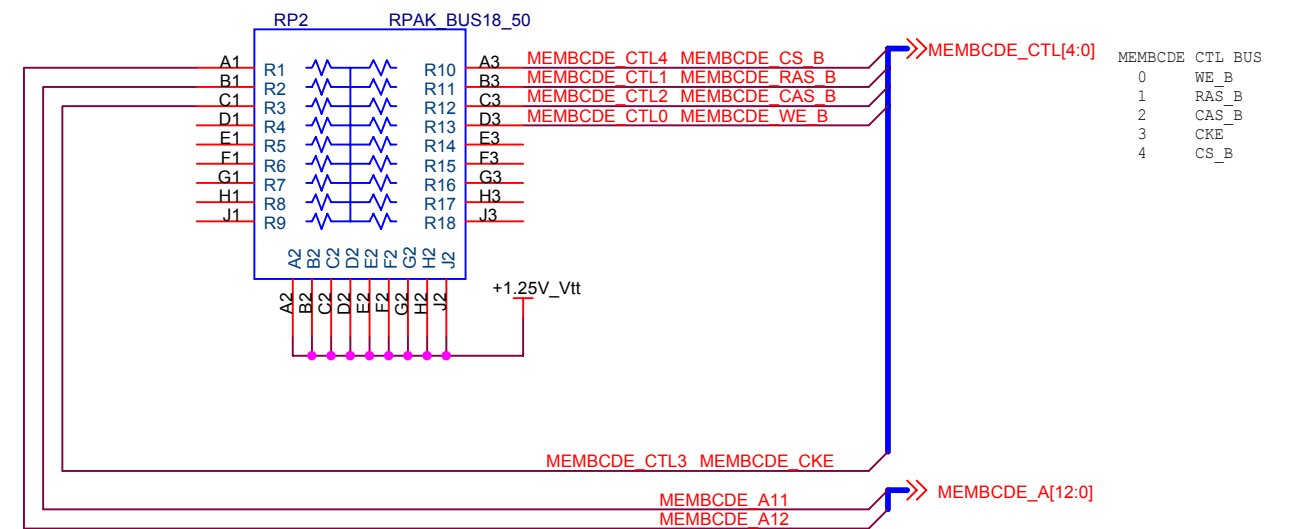
Place these resistors close to the FPGA



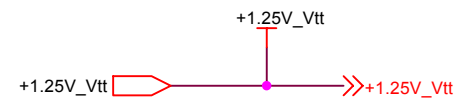
Place these resistors close to the MEMB/U1



Common address signals
Place this Rpak at end of bus "T"

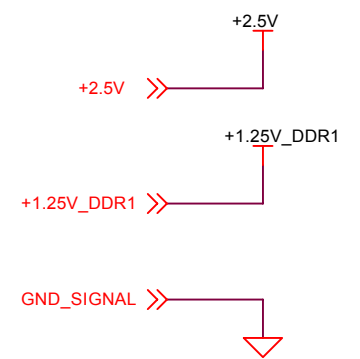
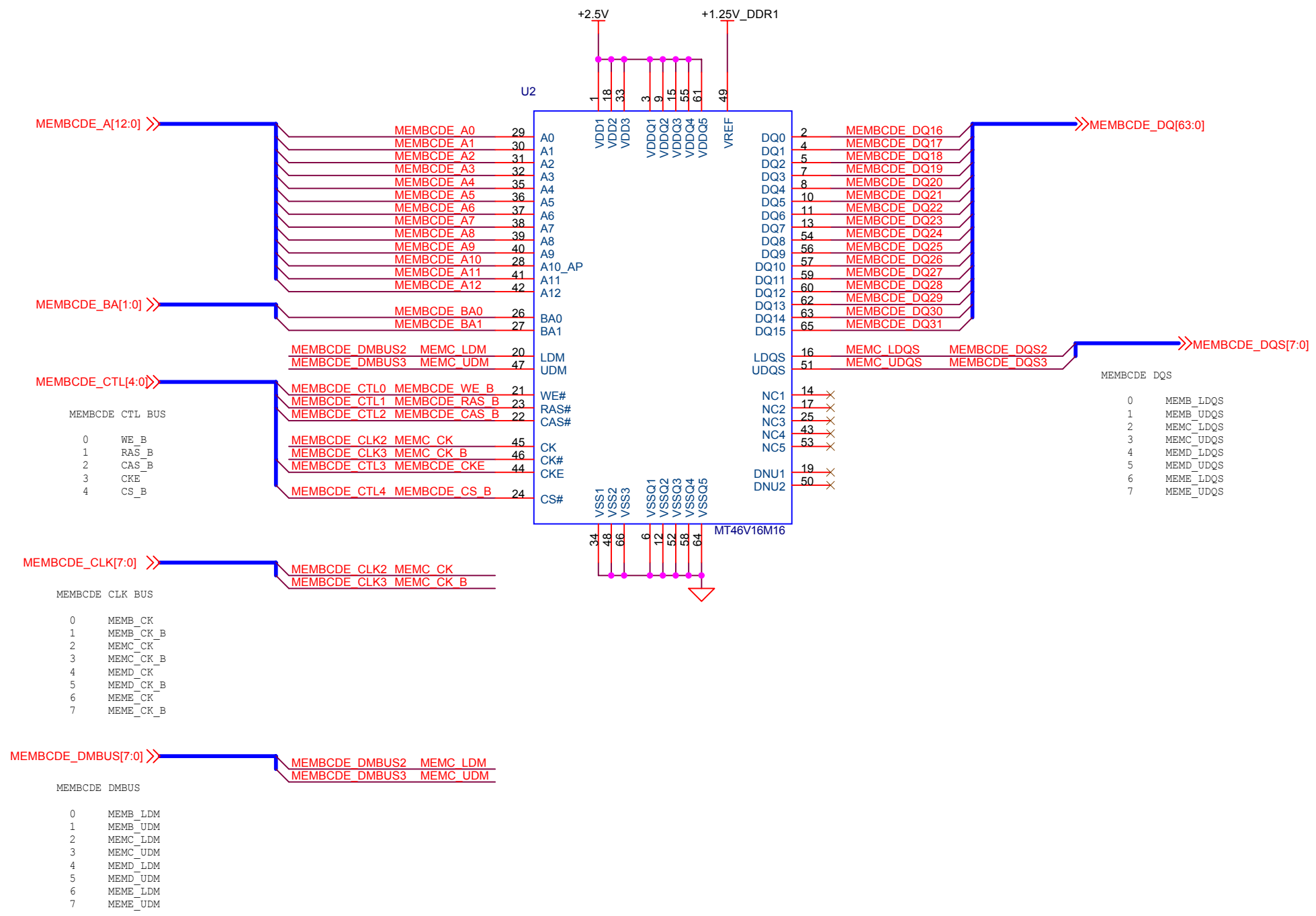


Common control signals
Place this Rpak at end of bus "T"



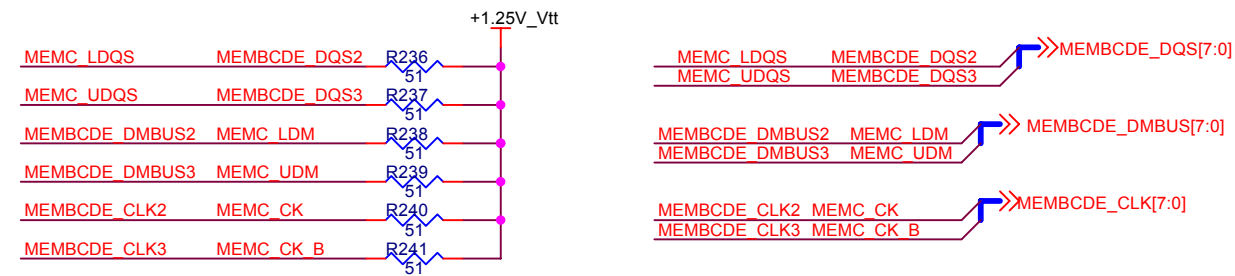
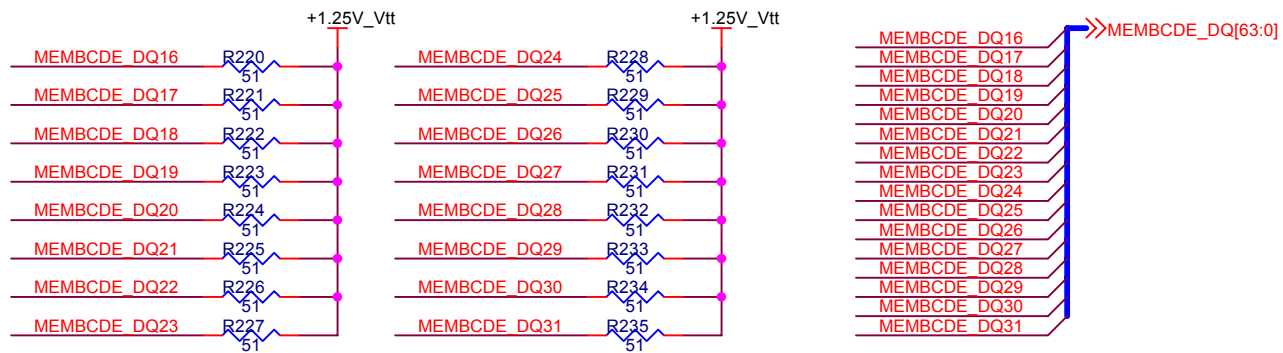
MEMB MT46V16M16TG-6P (Left) "Lower" Termination Resistors

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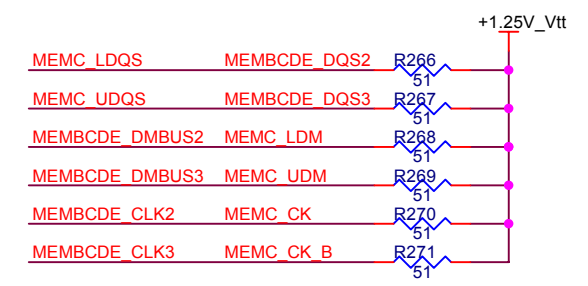
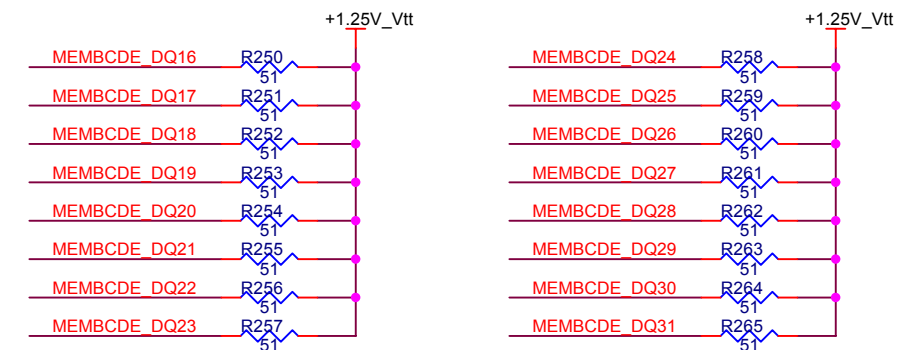


MT46V16M16TG-6P DDR-1 Memory on Left MEMC = MEM DQS (2:3)

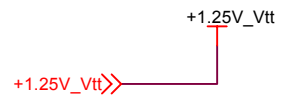
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Spartan3 DDR-1 Board		
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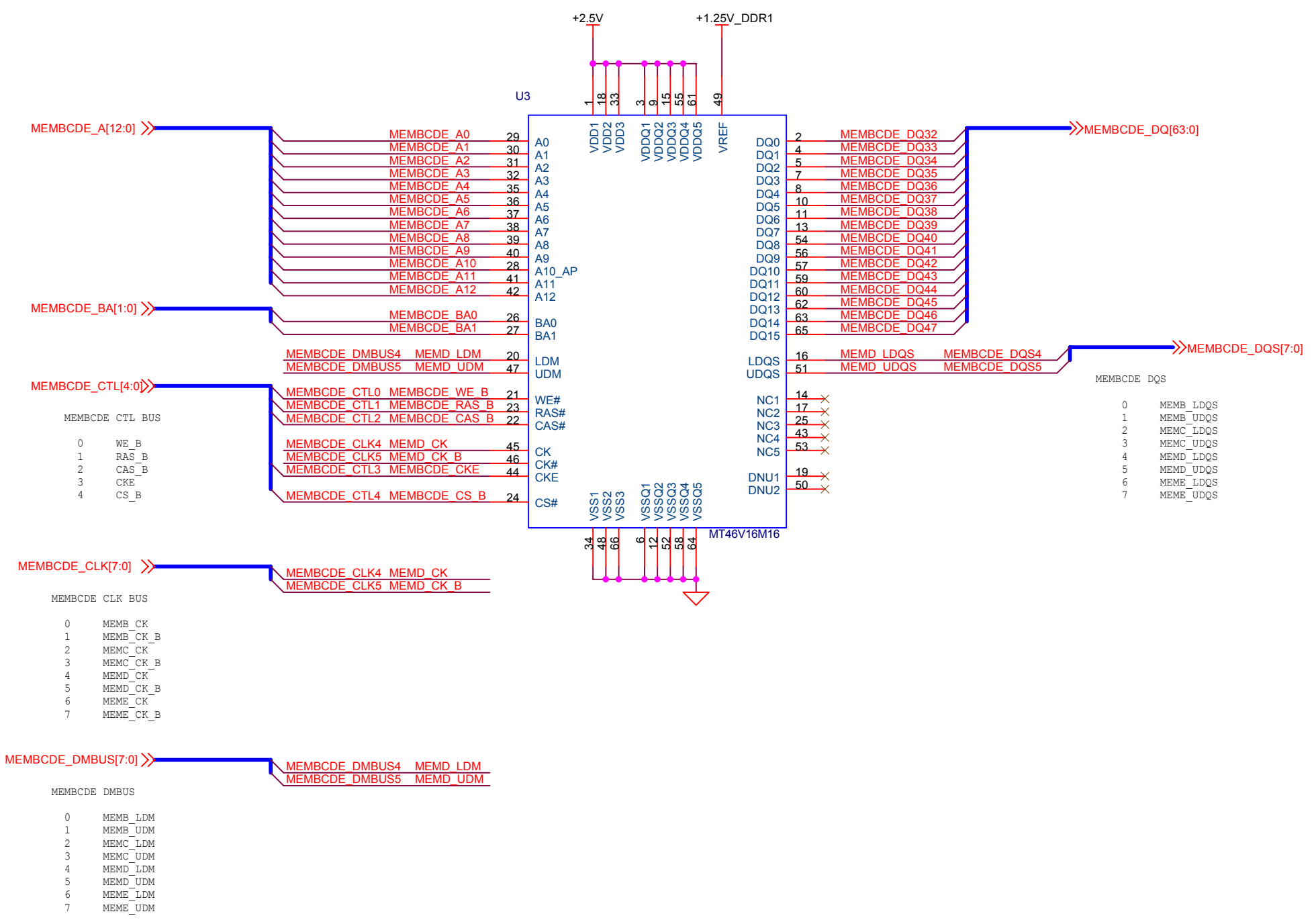


Place these resistors close to the FPGA



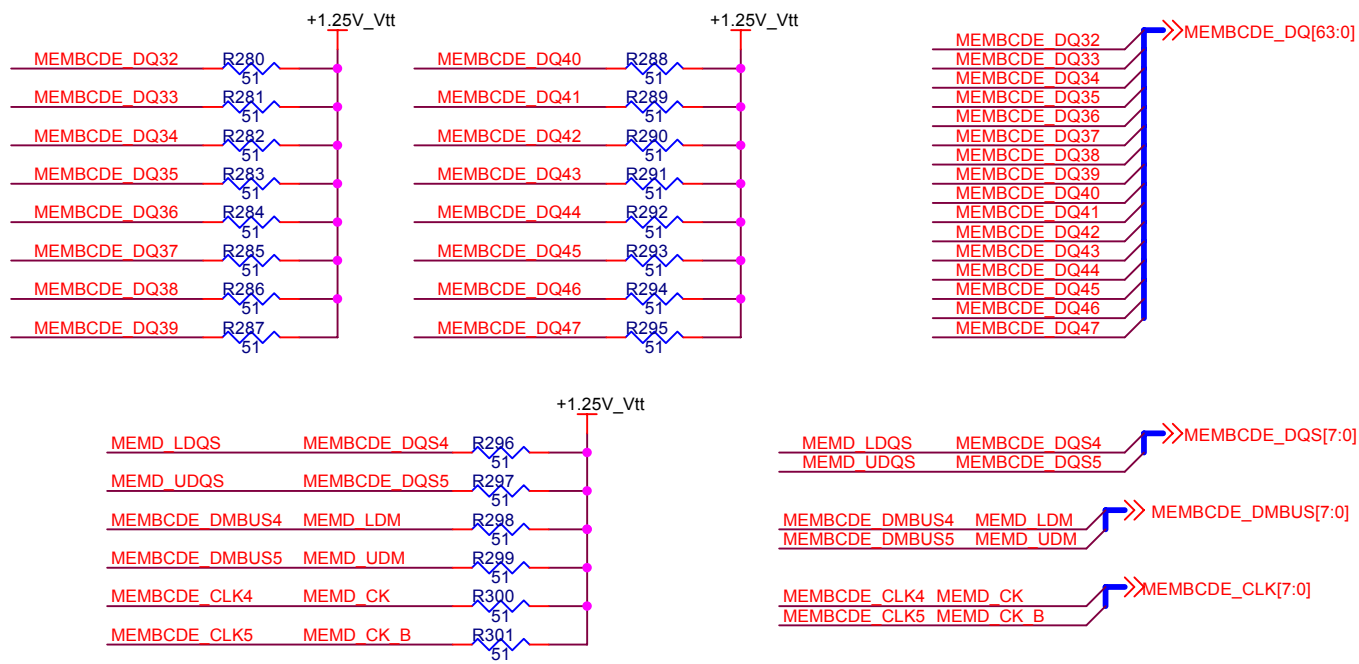
Place these resistors close to the MEMC



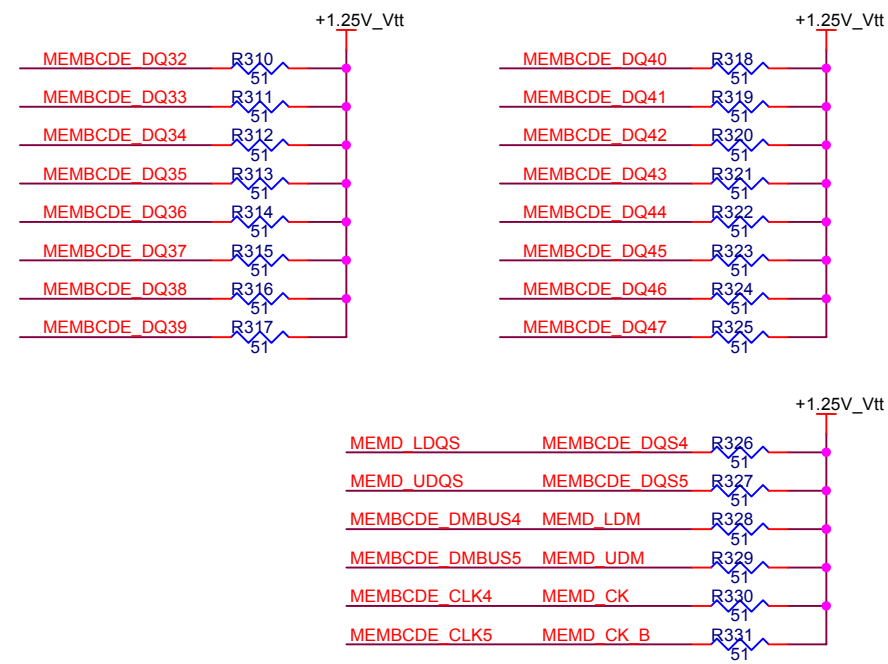


MT46V16M16TG-6P DDR-1 Memory on Left MEMD = MEM DQS (4:5)

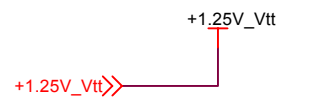
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Spartan3 DDR-1 Board		
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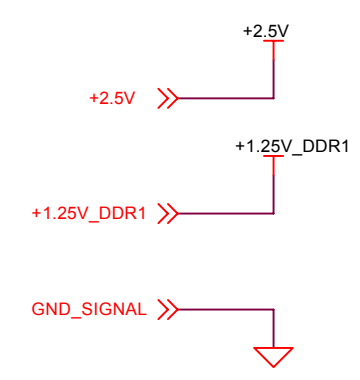
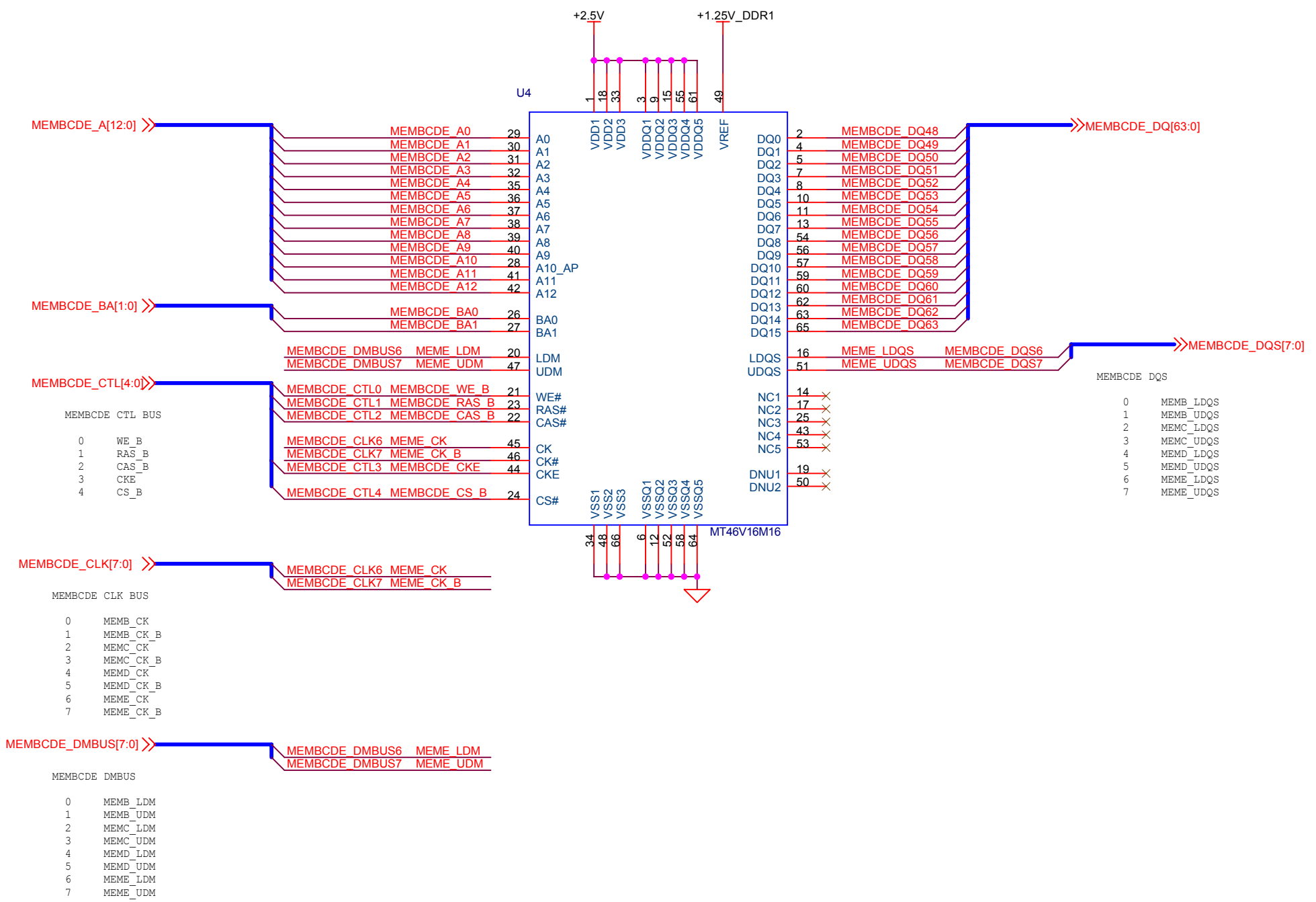


Place these resistors close to the FPGA



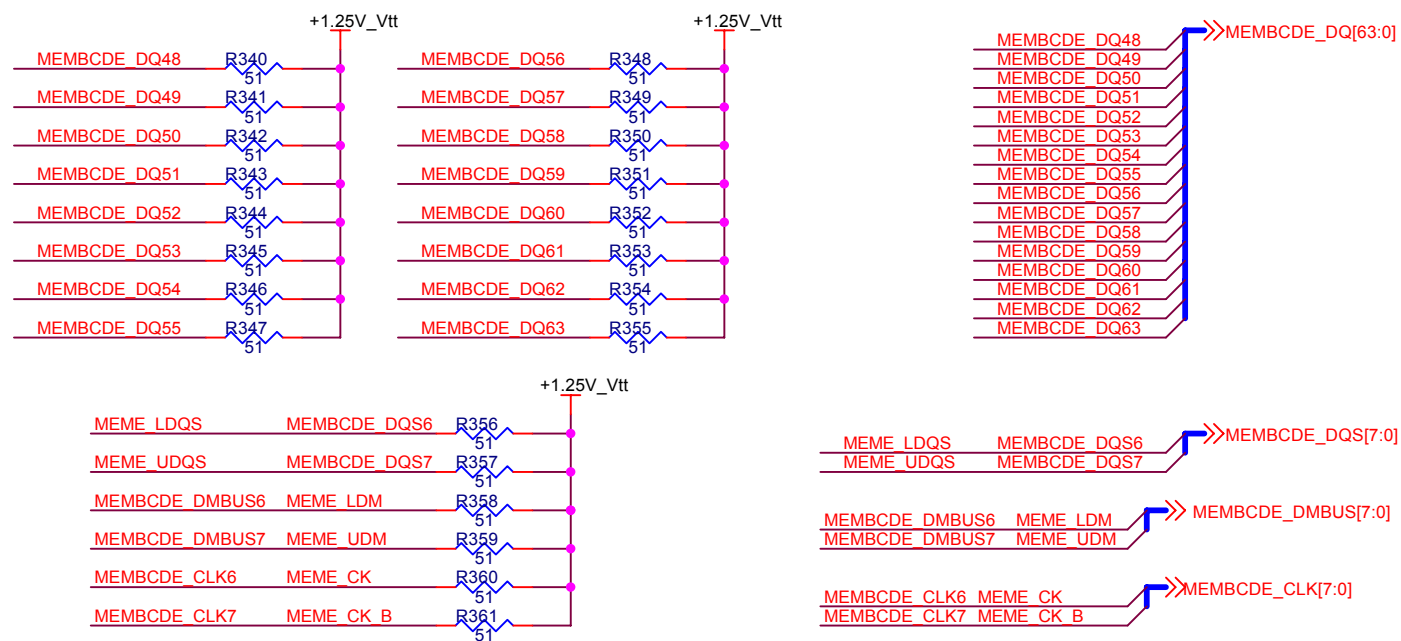
Place these resistors close to the MEMD



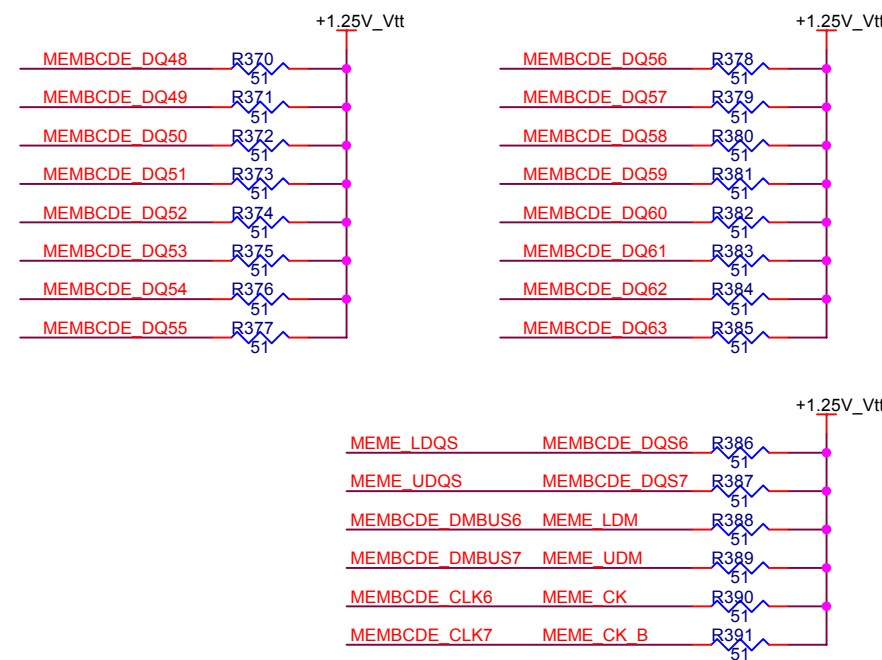


MT46V16M16TG-6P DDR-1 Memory on Left MEME = MEM DQS (6:7)

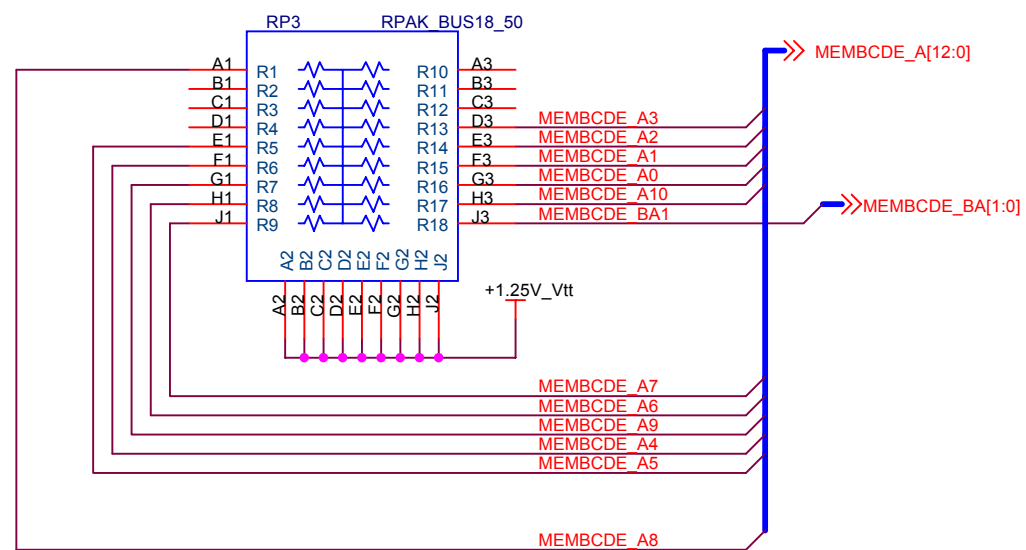
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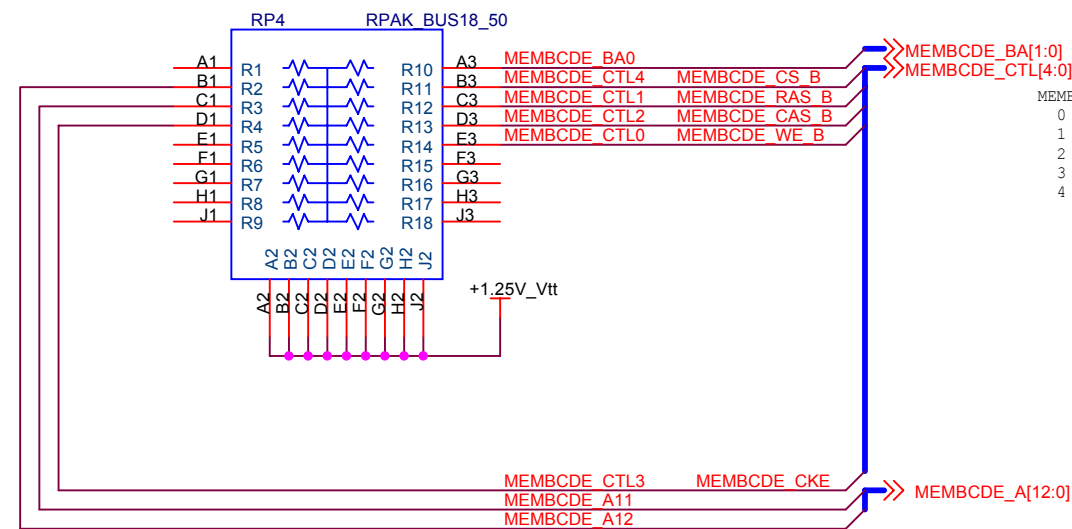
Place these resistors close to the FPGA



Place these resistors close to the MEME/U4



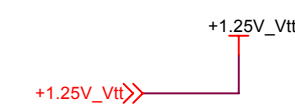
Common address signals
Place this Rpak at end of bus daisy-chain

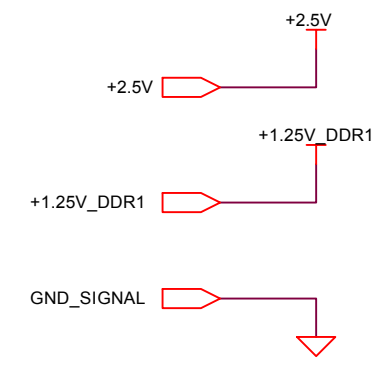
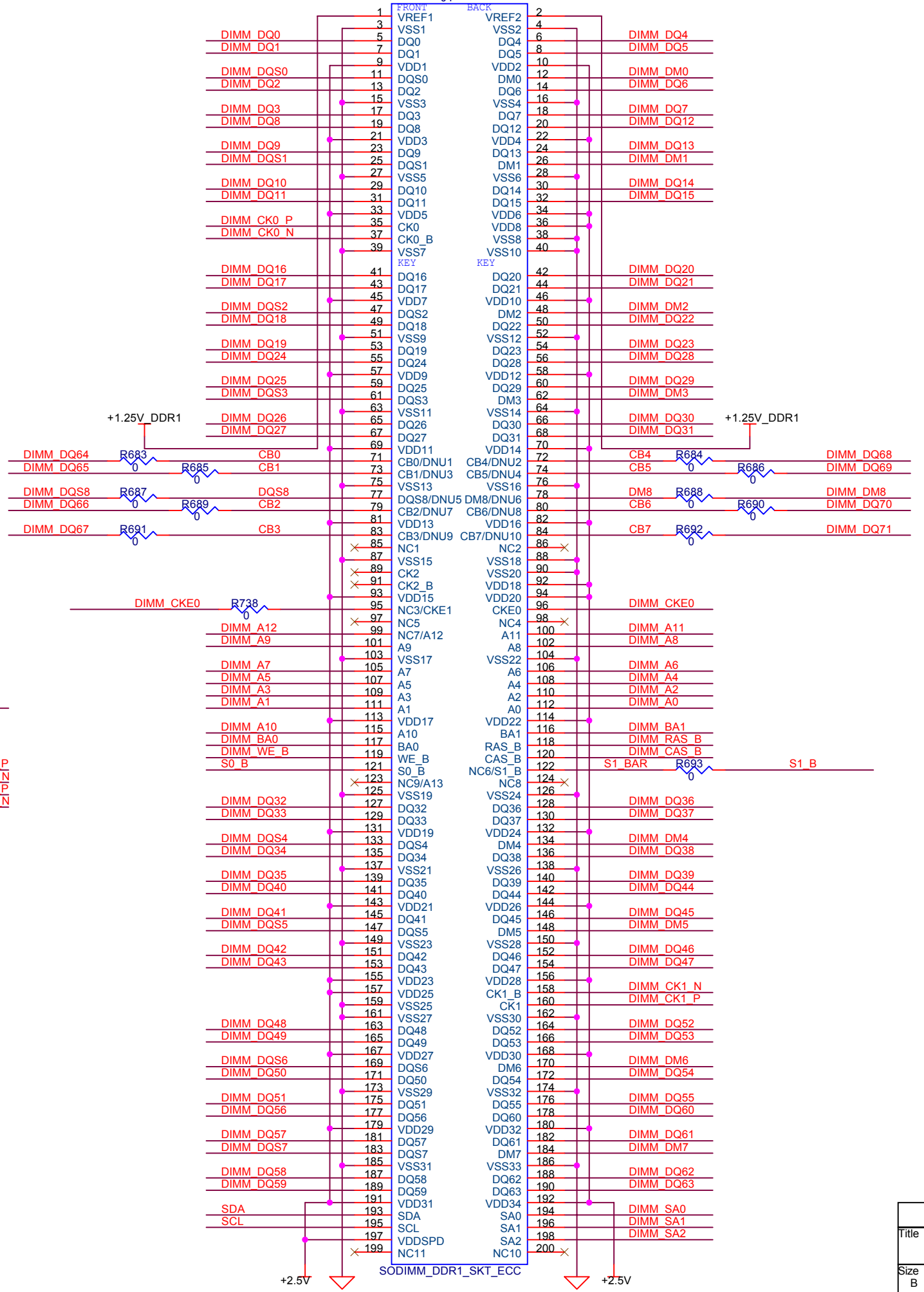
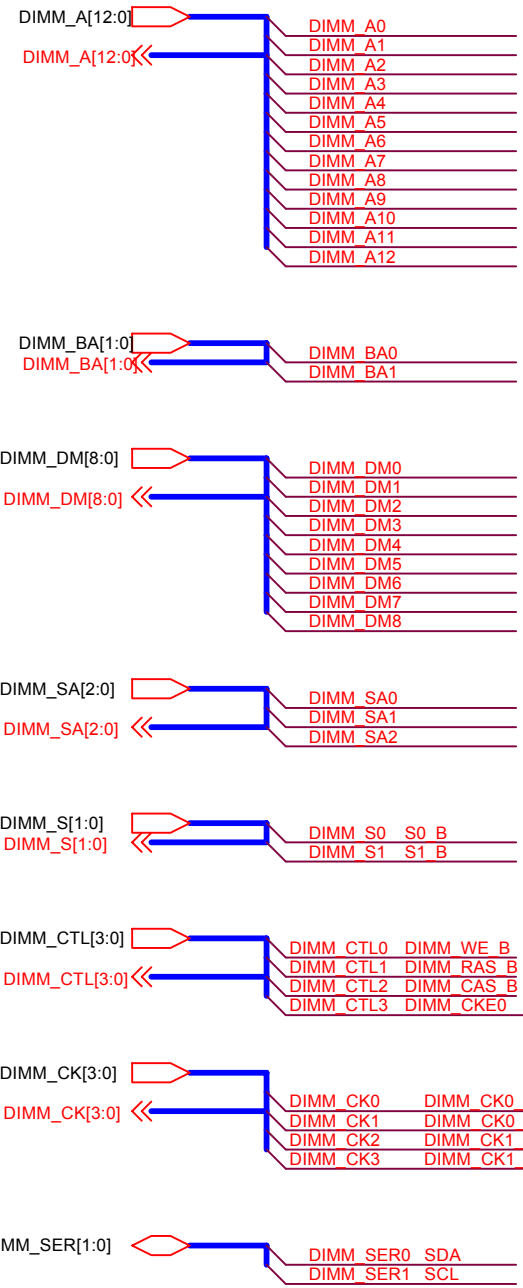
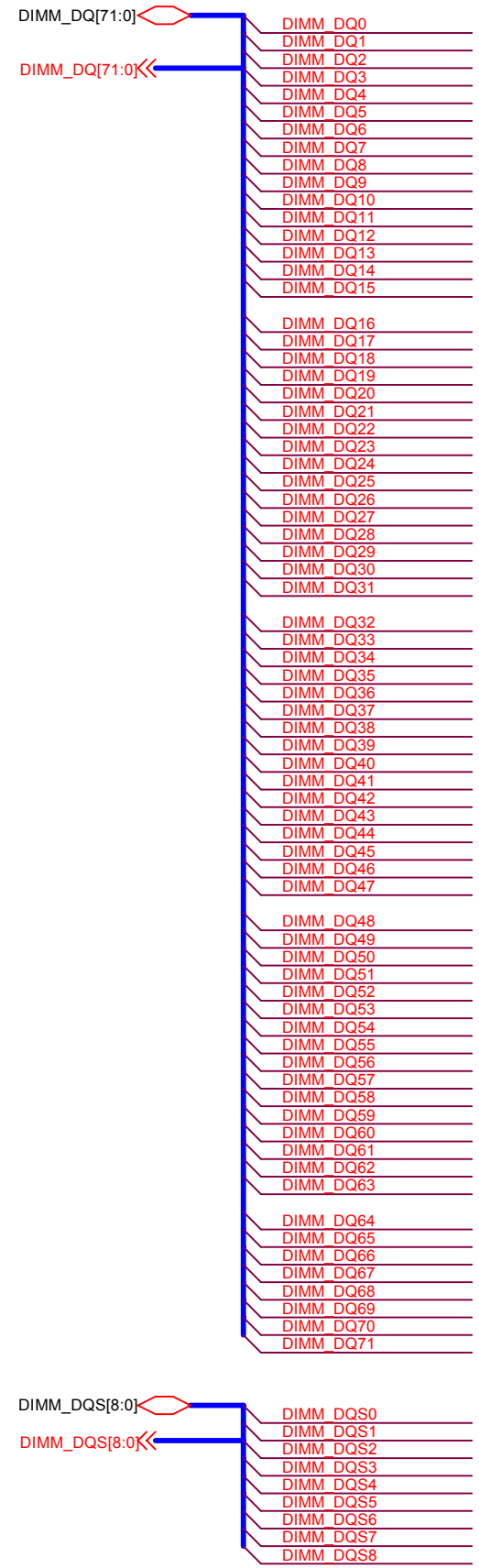


Common control signals
Place this Rpak at end of bus daisy-chain

MEMBCDE_CTL BUS	
0	WE_B
1	RAS_B
2	CAS_B
3	CKE
4	CS_B

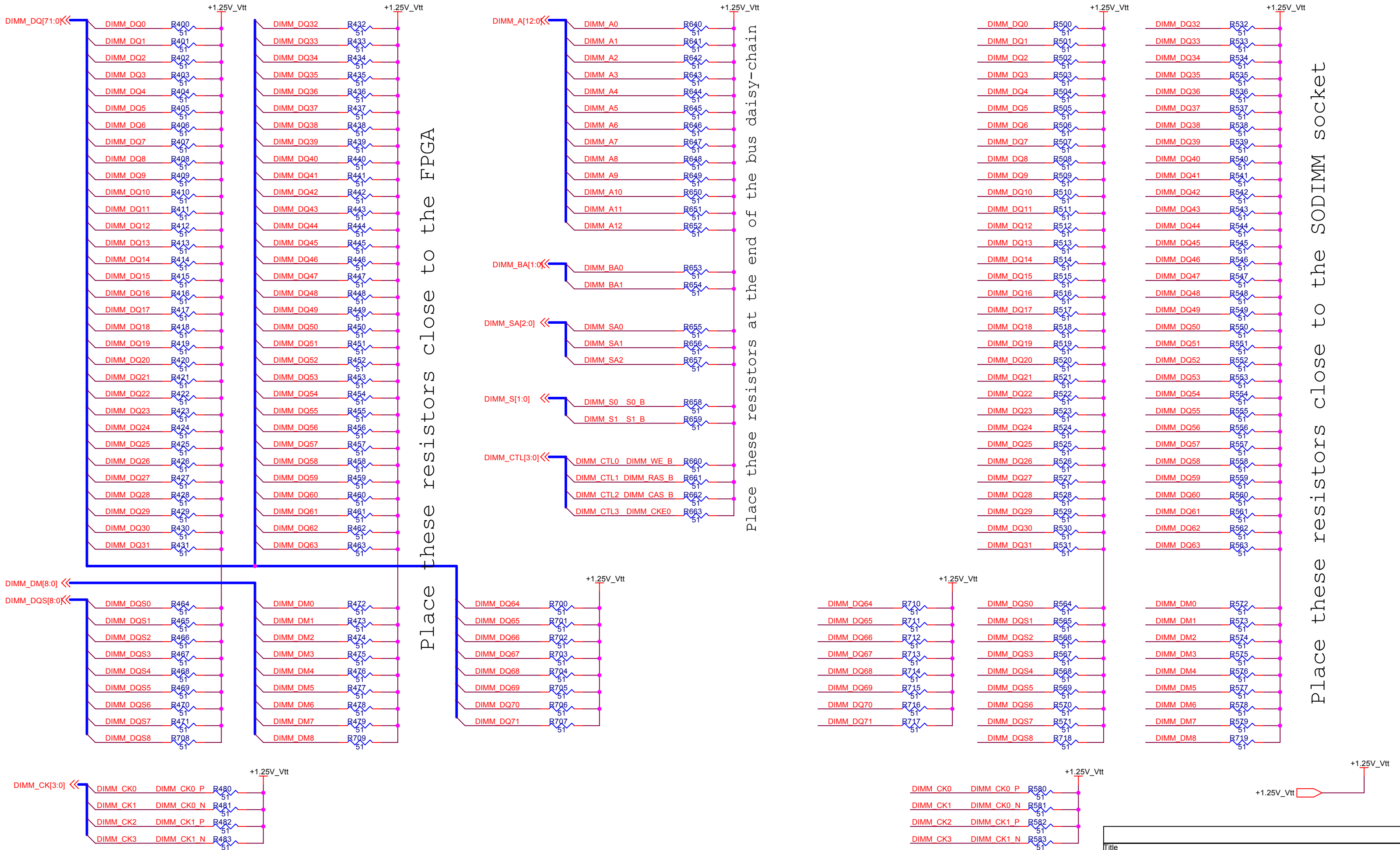
MEME MT46V16M16TG-6P (Left) "Upper" Termination Resistors





SODIMM 200-pin Socket
 MT4VDDT1664HY 128MB Memory

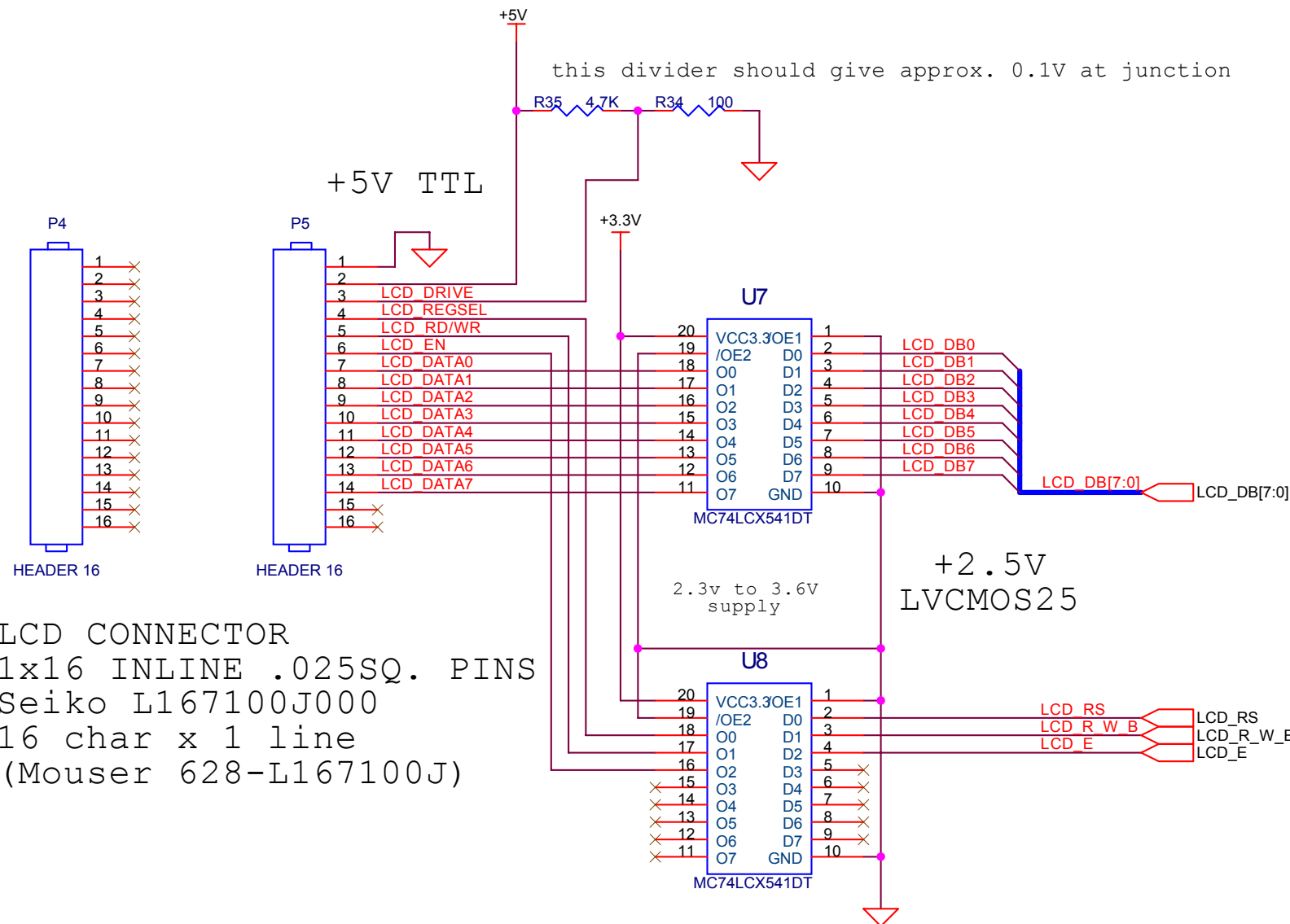
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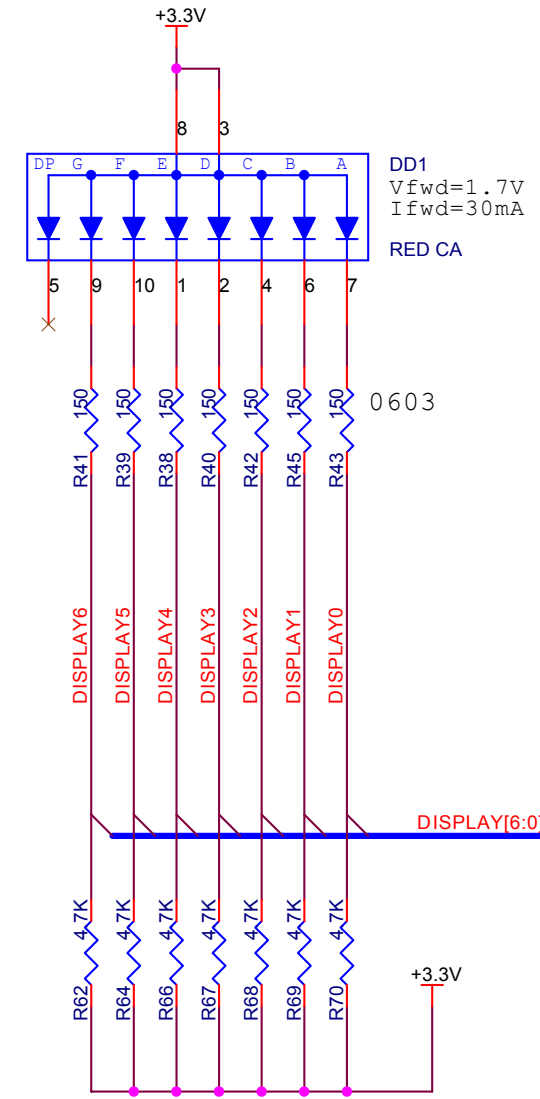
MT4VDDT1664HY 128MB Memory Termination Resistors

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Spartan3 DDR-1 Board		
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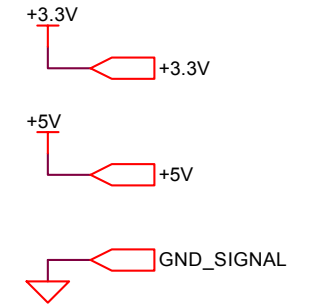
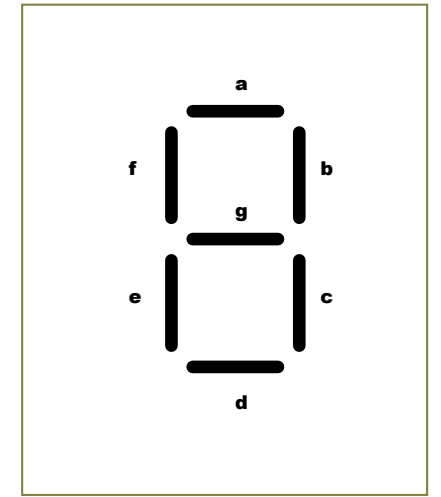
This LCD requires two rows of 16 pins to support it physically
 Place the 1x16 SIP headers 31mm apart per the LCD spec sheet



LCD CONNECTOR
 1x16 INLINE .025SQ. PINS
 Seiko L167100J000
 16 char x 1 line
 (Mouser 628-L167100J)

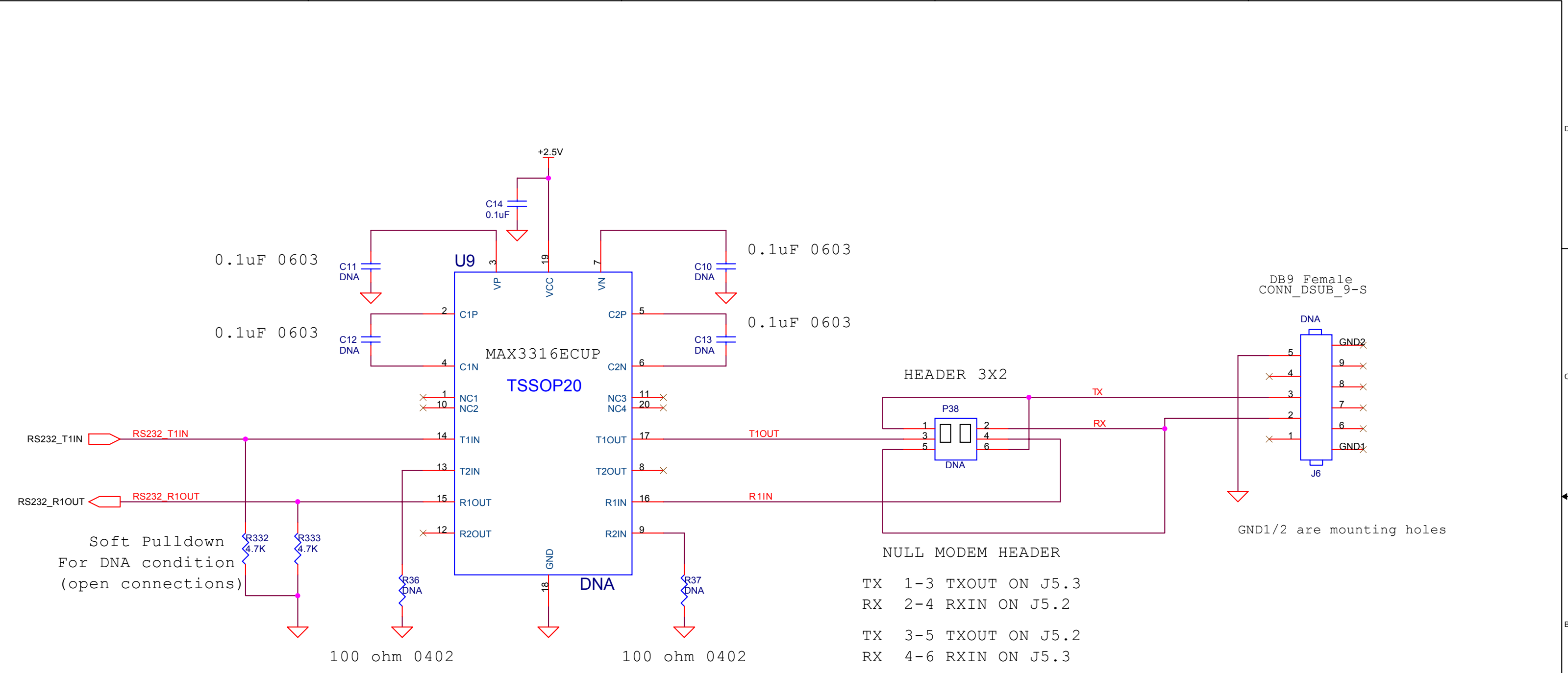


4.7K 0402 Pullups to keep display turned off at power on



LCD

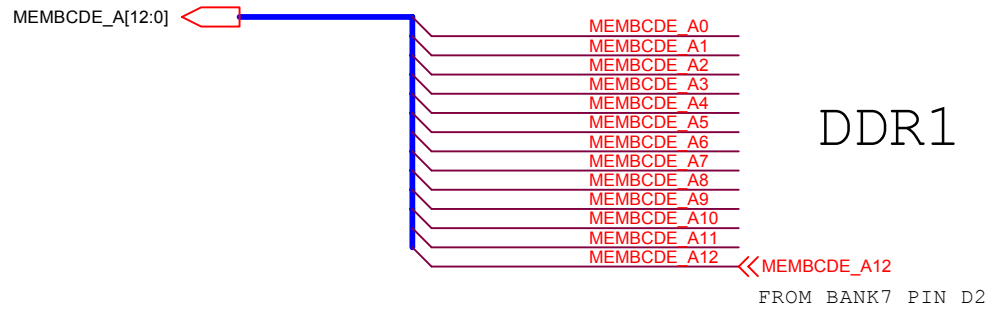
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RS232 Components are not installed, and will not be tested

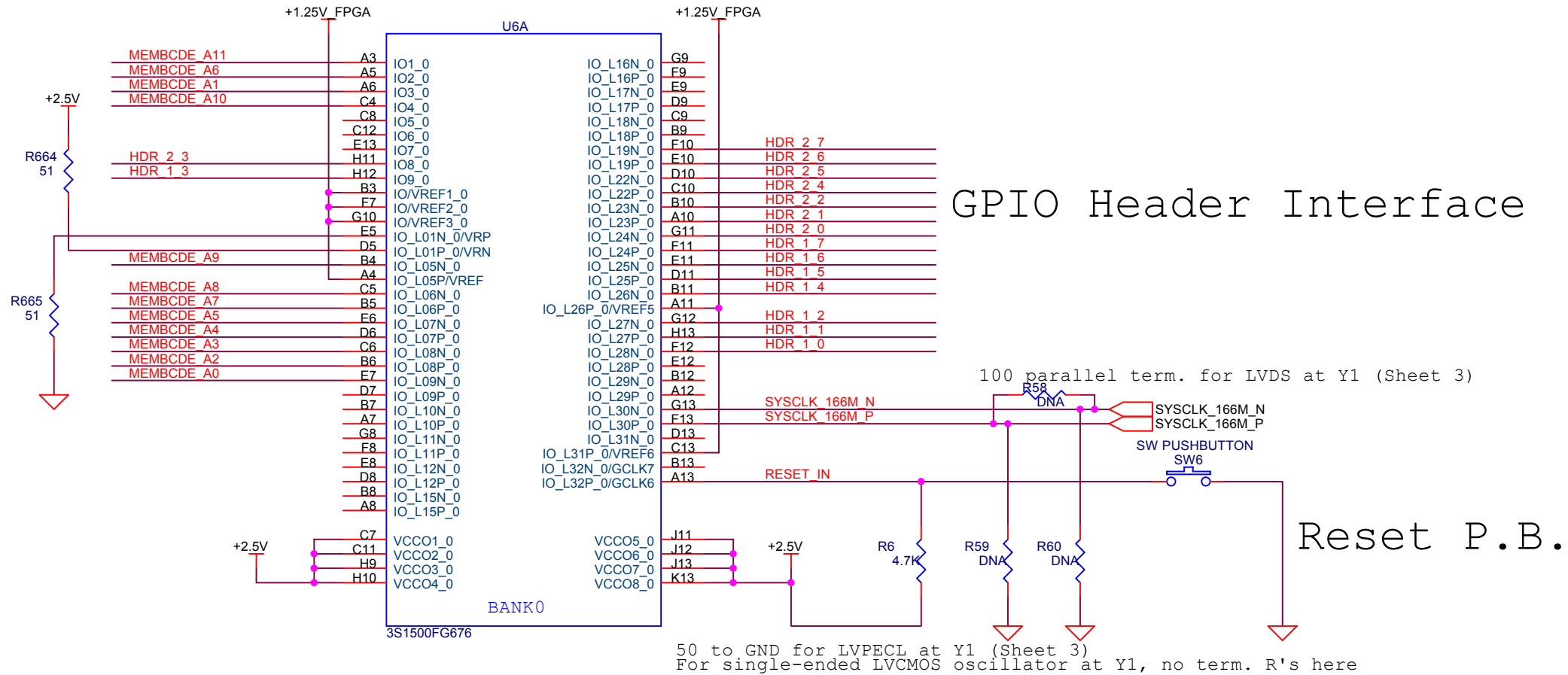
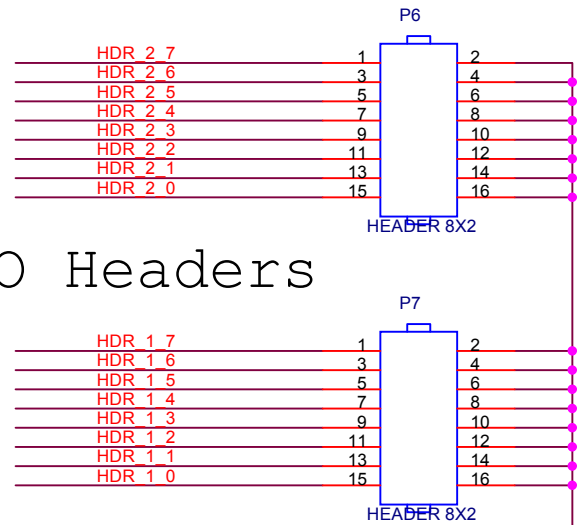
RS232 DRIVER

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DDR1 x4 (MEMB - MEME) "Left" Side Interface

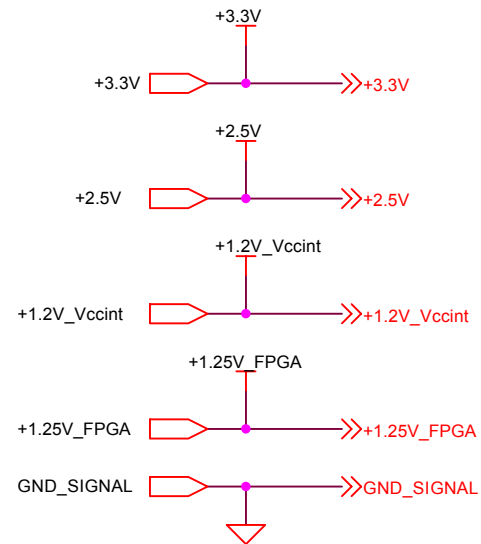
GPIO Headers



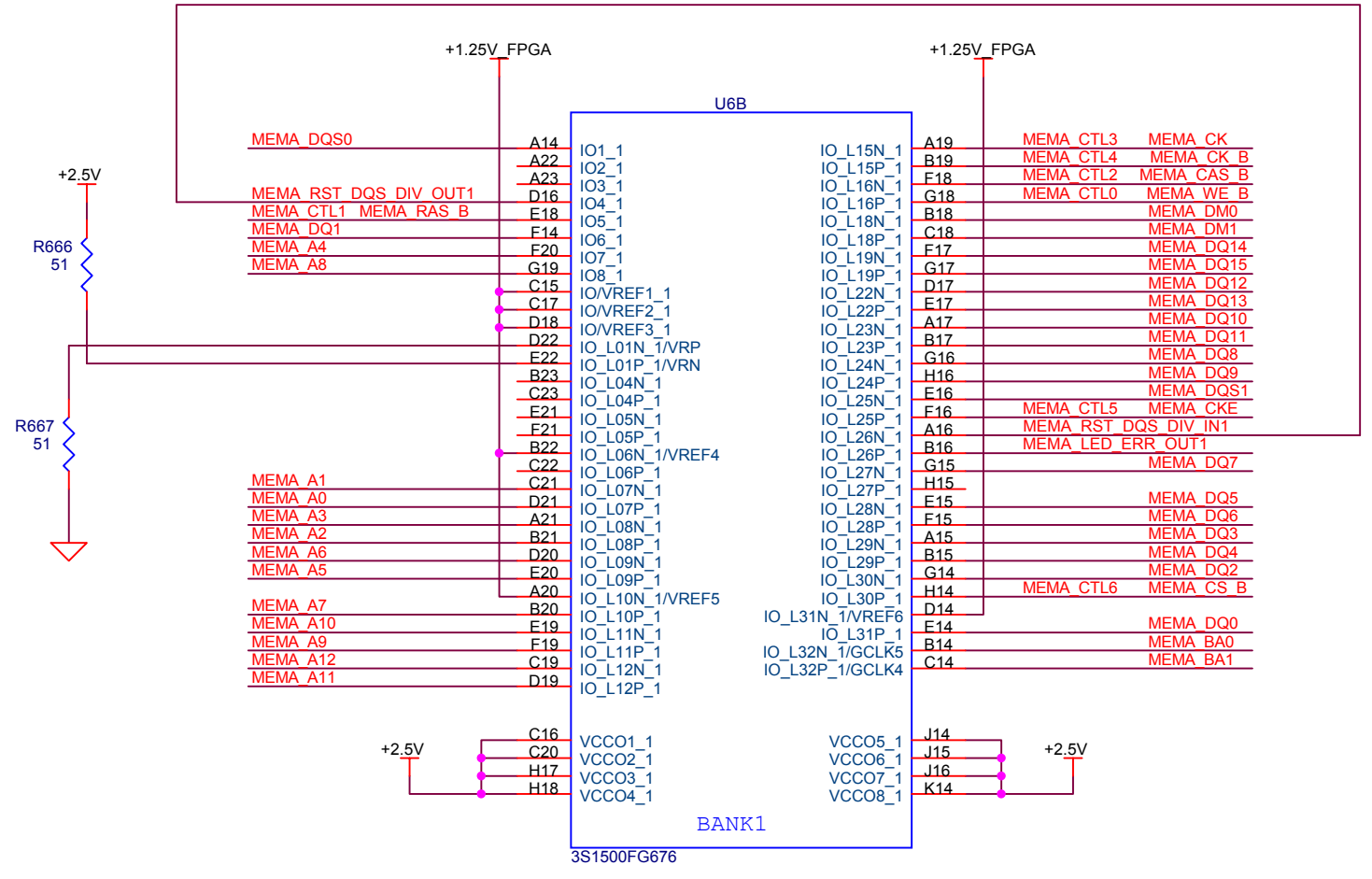
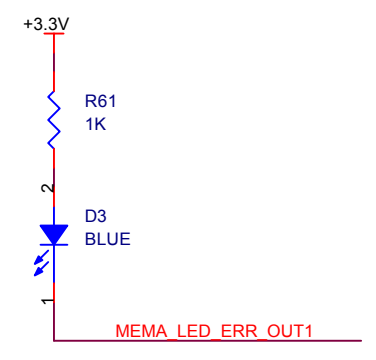
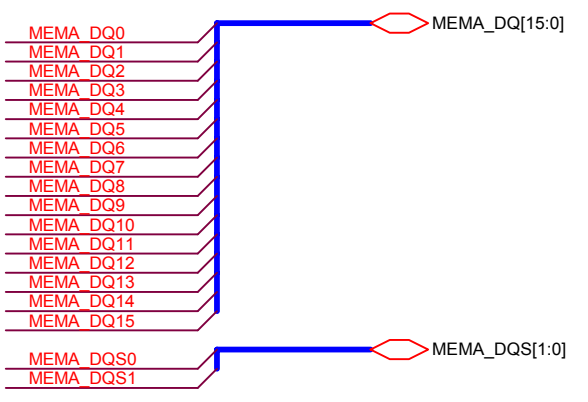
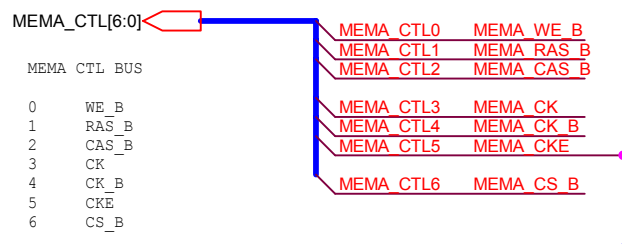
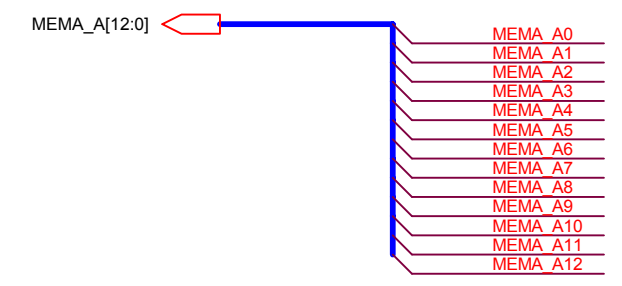
Osc. Y1 Clock Interface

DDR1 x4 (MEMB - MEME) "Left" Side Interface Osc. Y1 Clock Interface Reset P.B. Interface GPIO Header Interface

4 x 16-bit DDR-1 Mem
on the Left are designated:
MEMB = MEM DQS (0:1)
MEMC = MEM DQS (2:3)
MEMD = MEM DQS (4:5)
MEME = MEM DQS (6:7)

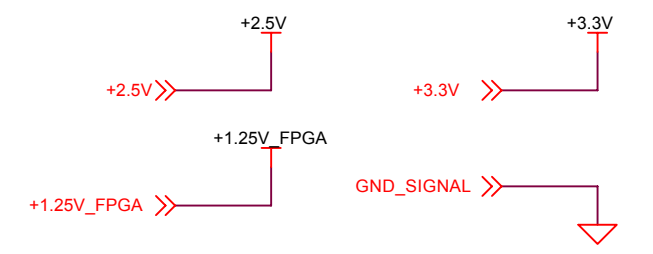


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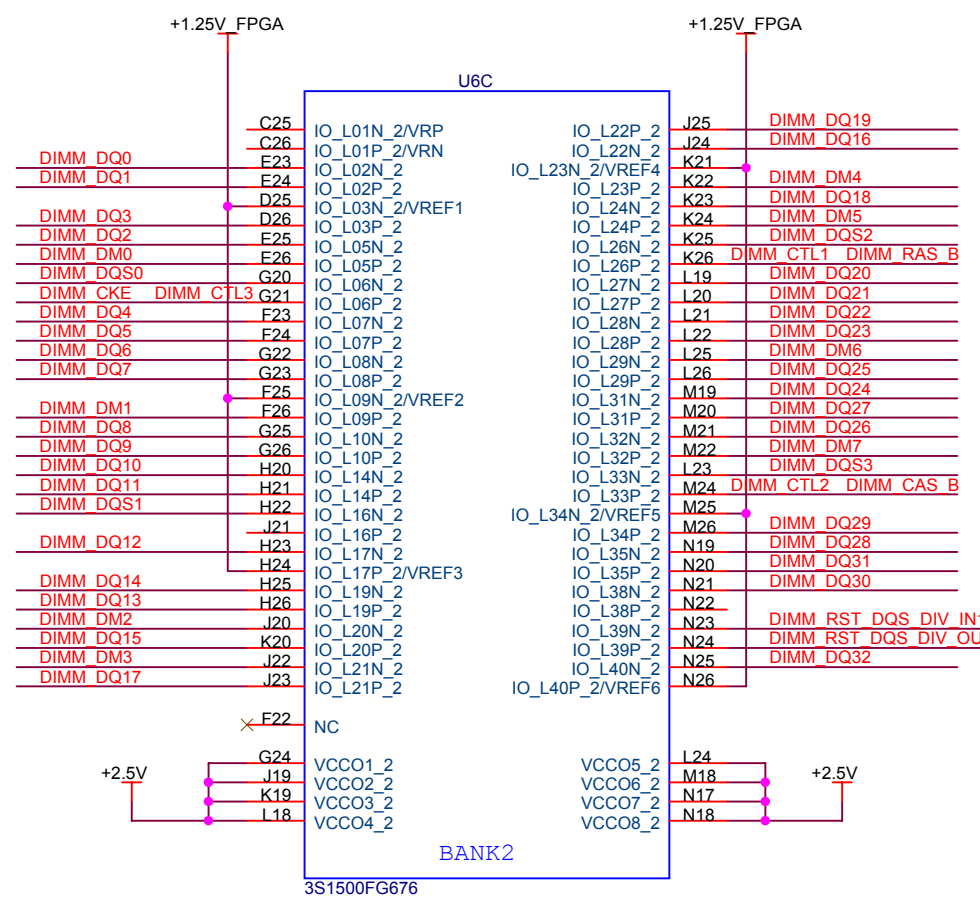
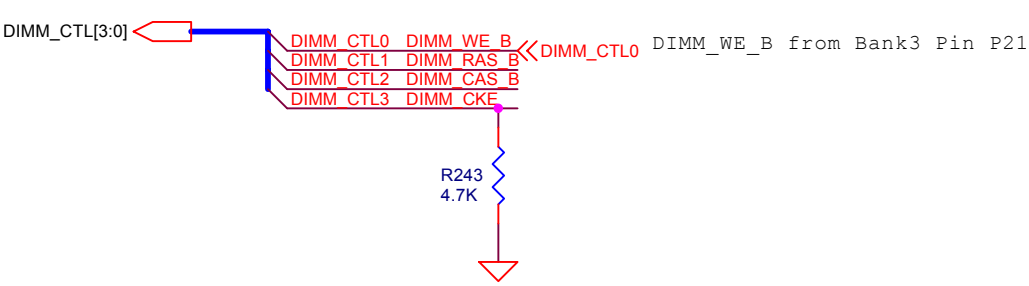
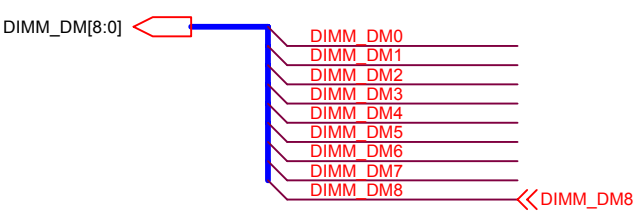
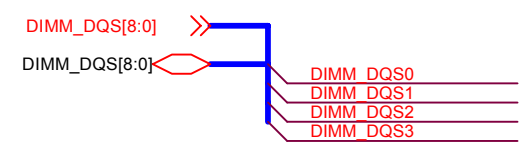
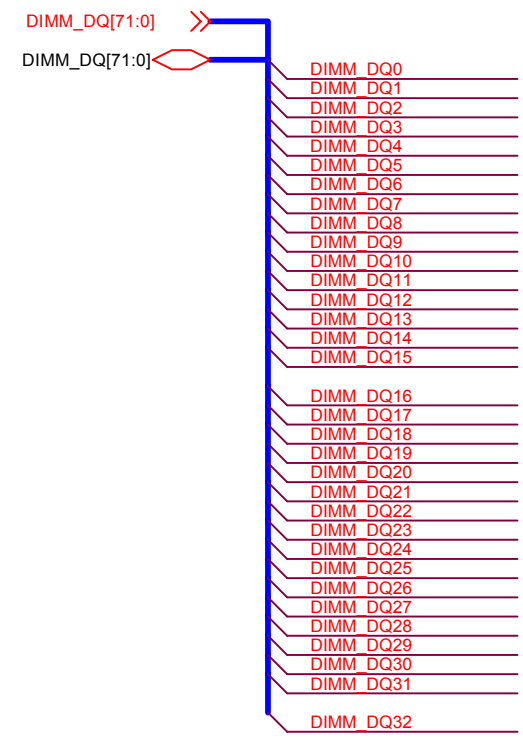
DDR1 x 1 "Top" Interface

"Top" Memory DQS loop wire



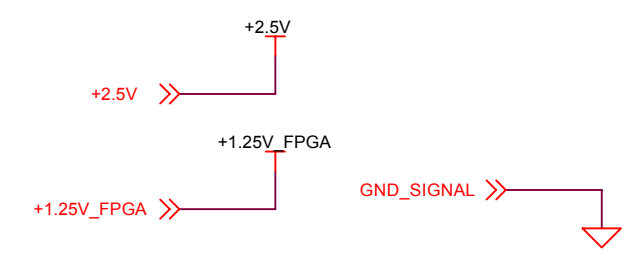
3S1500FG676 Bank1

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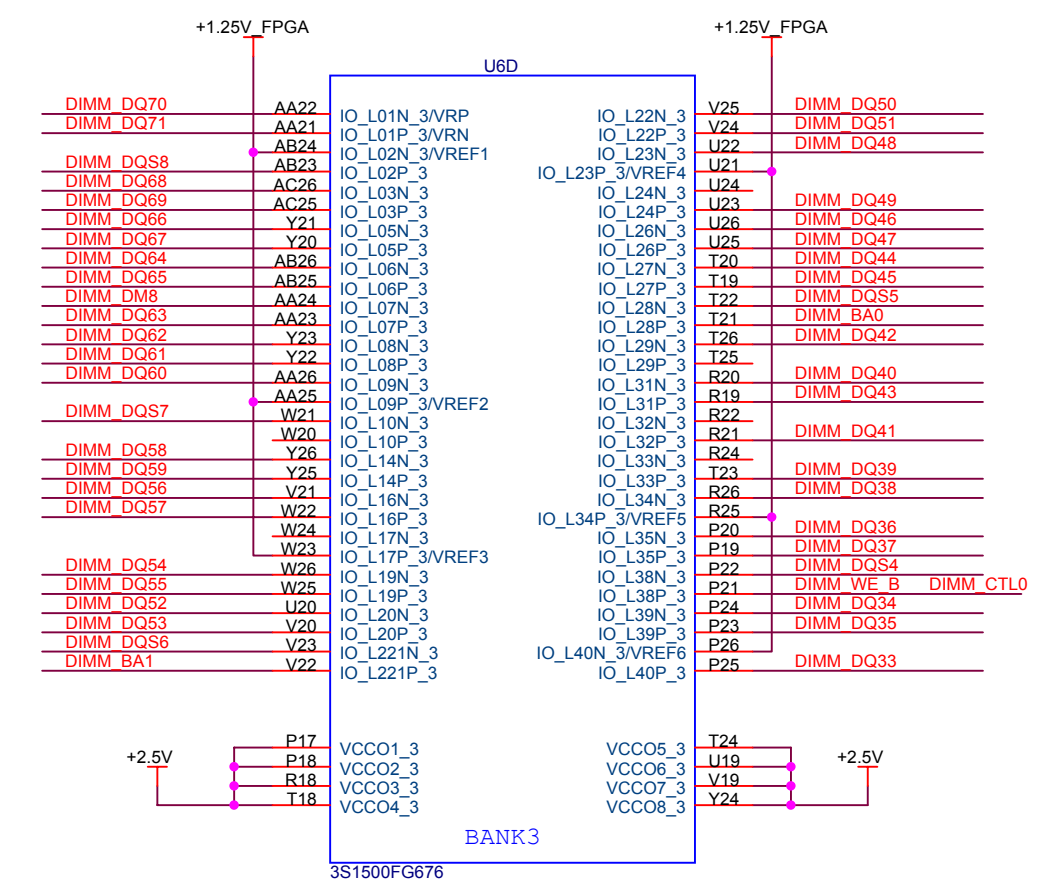
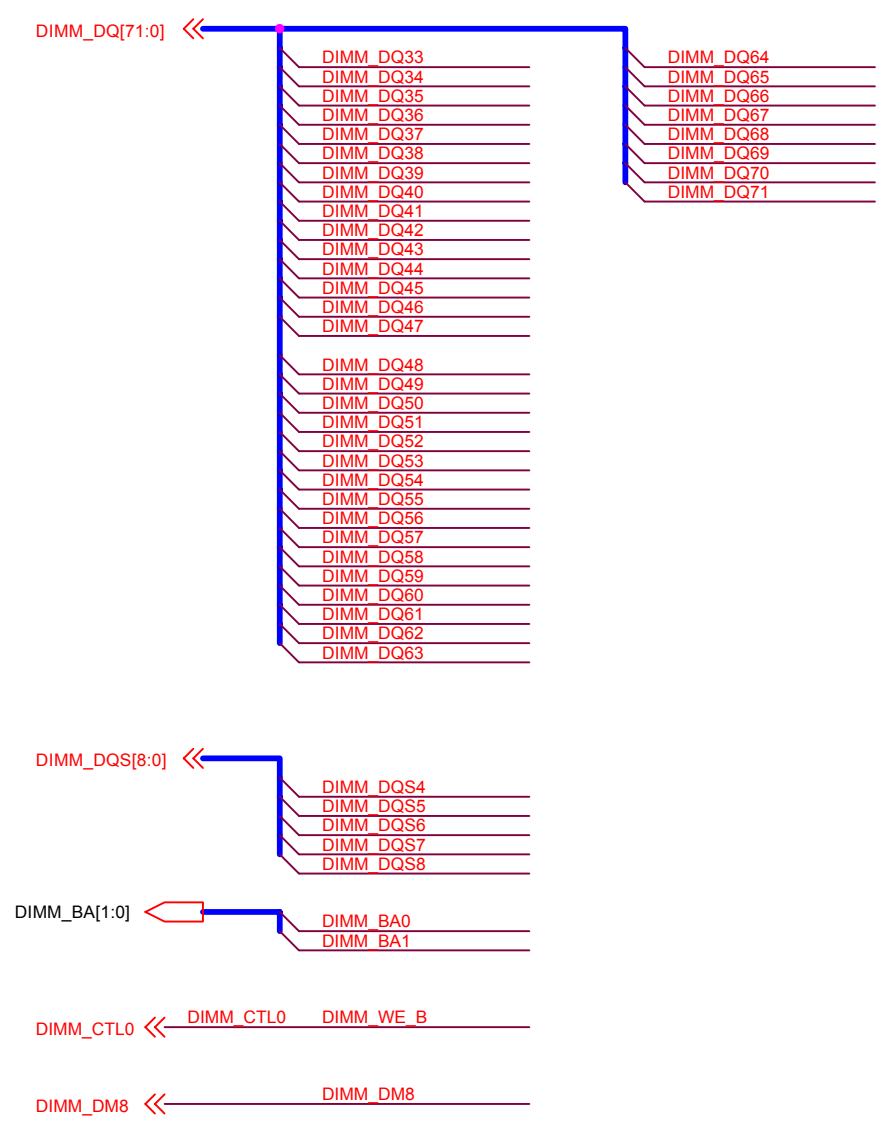
DDR1 SODIMM "Right" Side Interface

SODIMM DQS loop wire

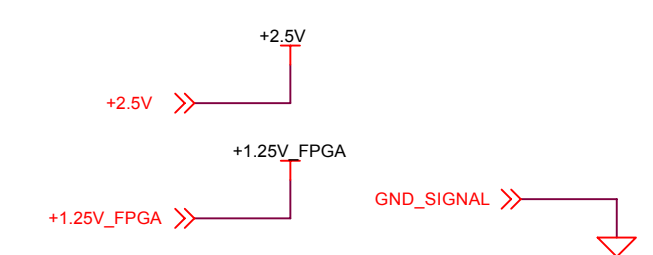


3S1500FG676 Bank2

Title		
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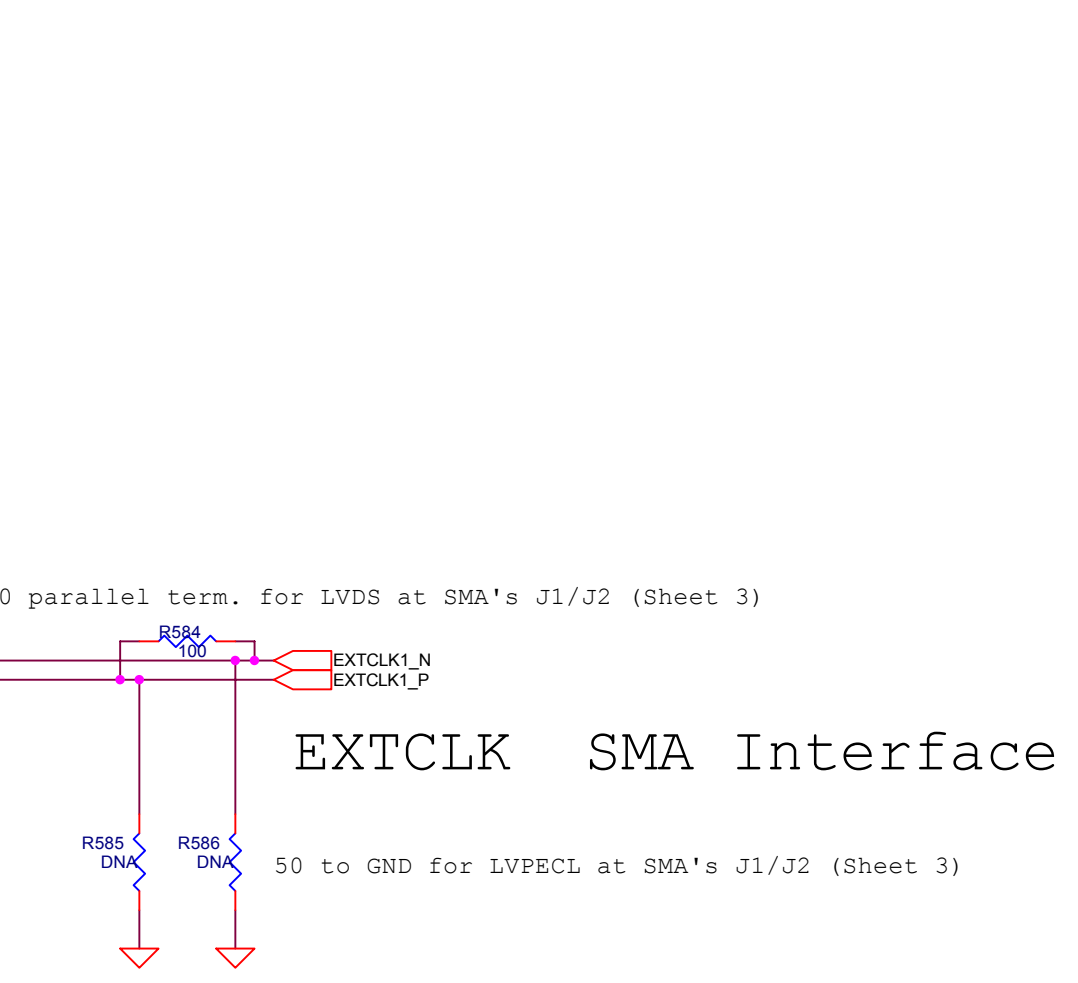
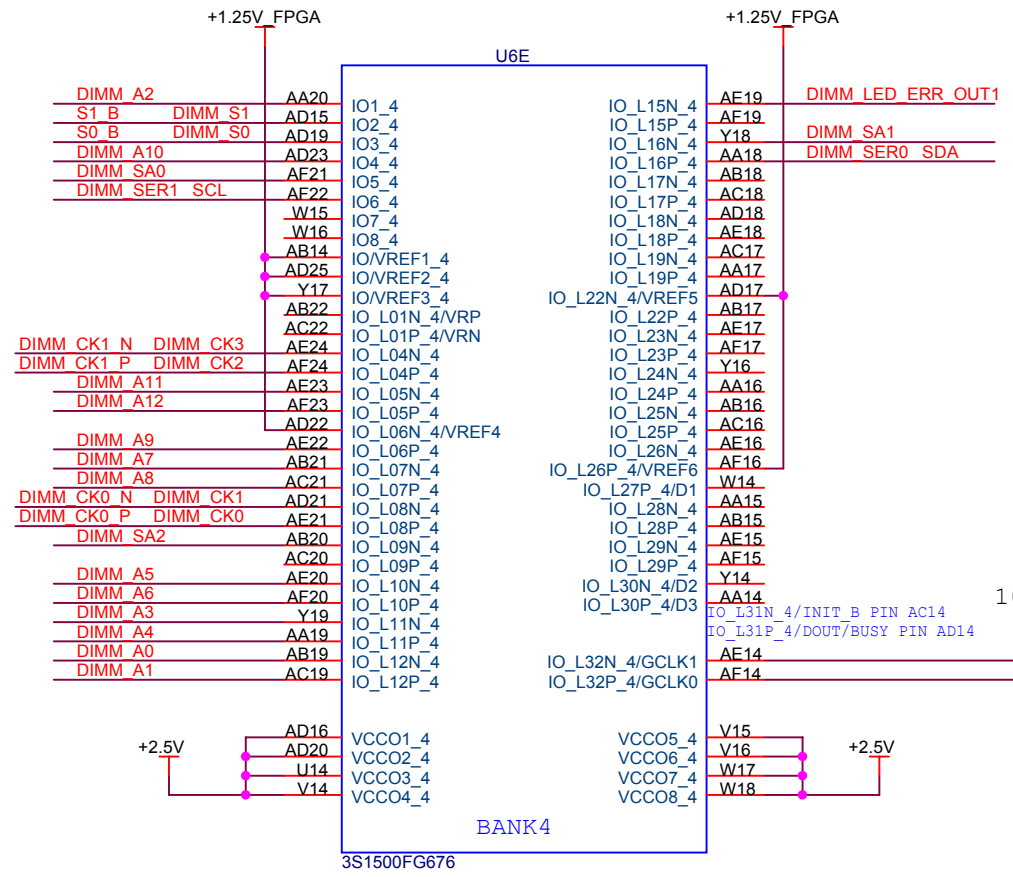
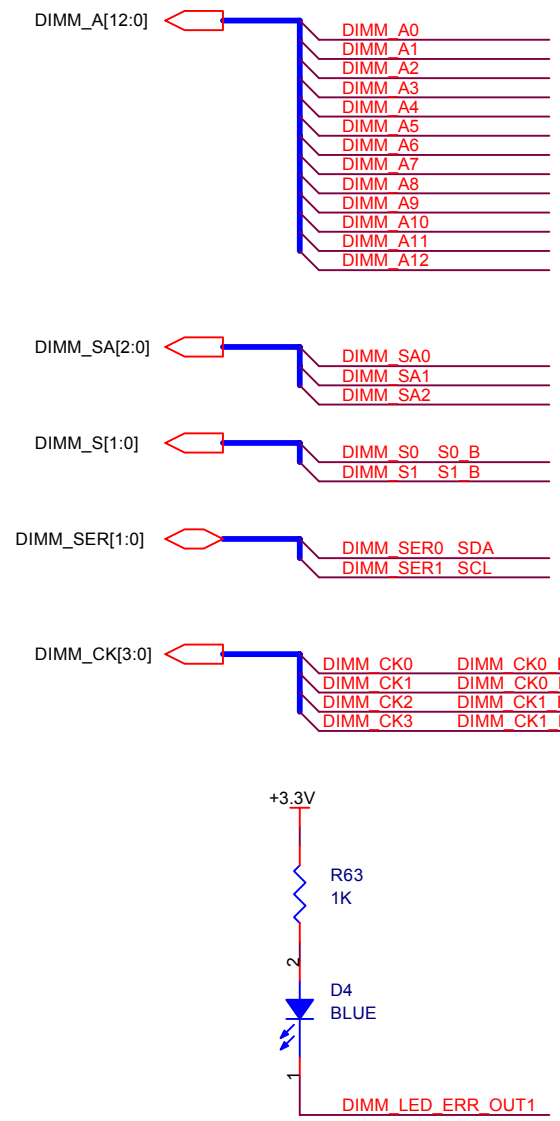
DDR1 SODIMM "Right" Side Interface



3S1500FG676 Bank3

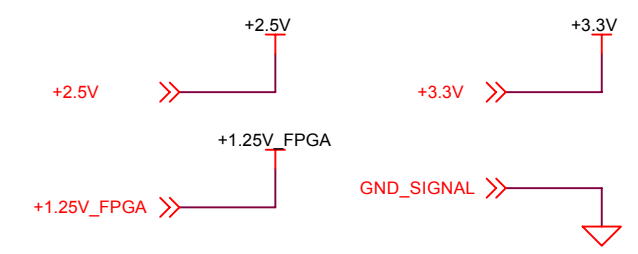
Title Spartan3 DDR-1 Board		
Size B	Document Number 0381177	Rev 2
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DDR1 SODIMM Interface



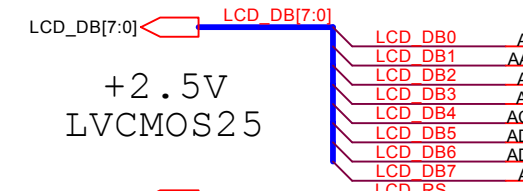
DDR1 SODIMM "Right" Side Interface EXTCLK SMA Interface

3S1500FG676 Bank4

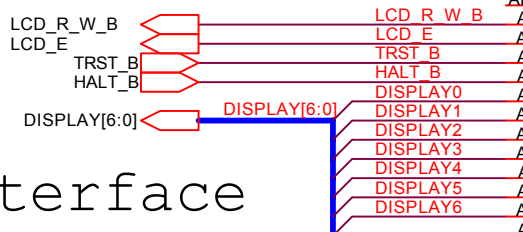


Title Spartan3 DDR-1 Board		
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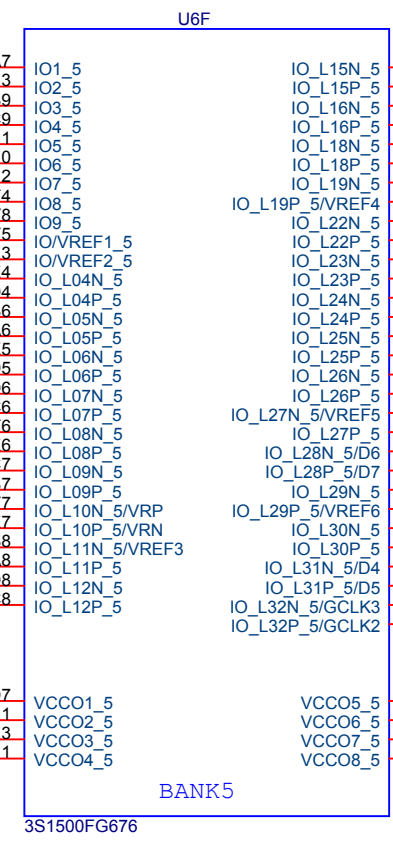
LCD Interface



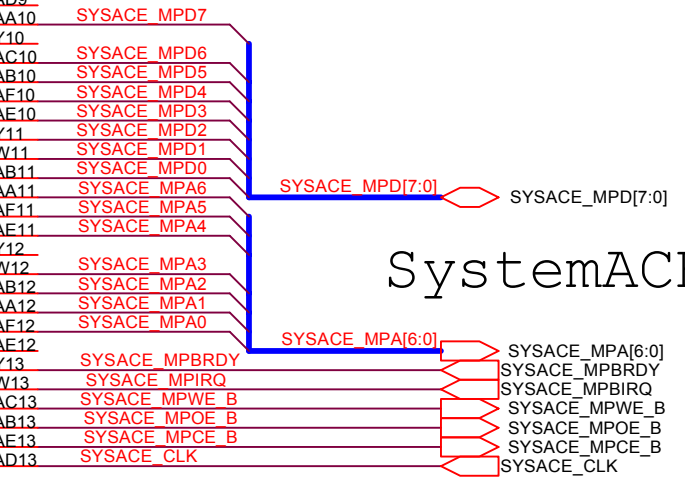
7-Seg. Display Interface



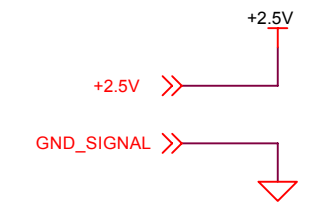
RS232 Interface

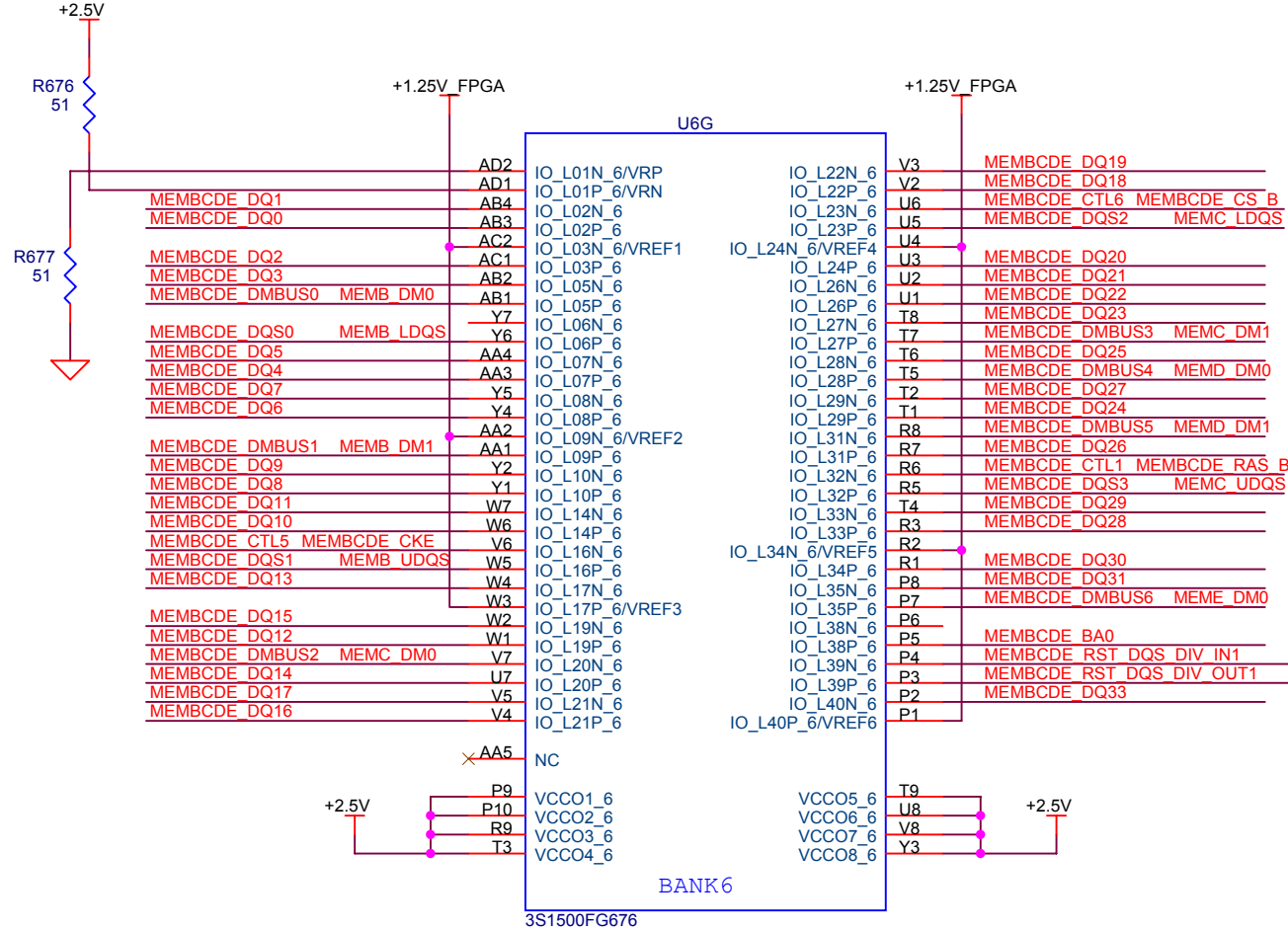
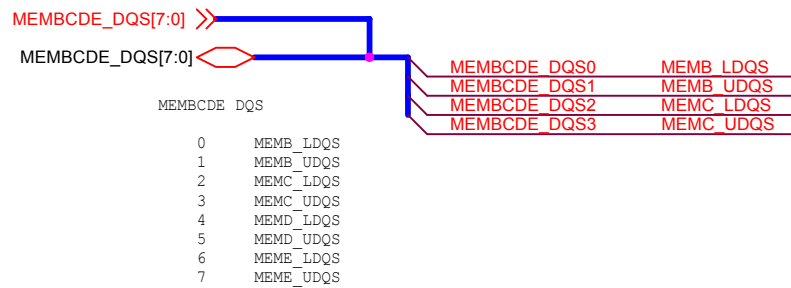
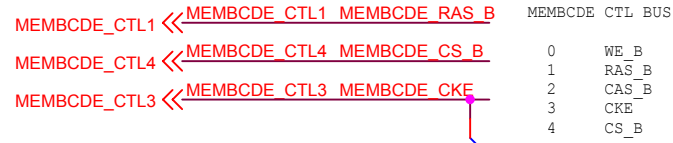
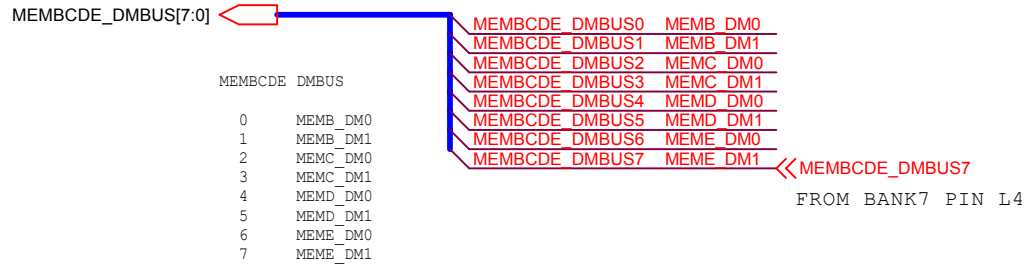


SystemACE Interface



LCD Interface
 7-Seg. Display Interface
 RS232 Interface
 SystemACE Interface

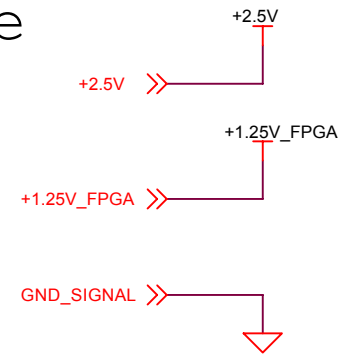


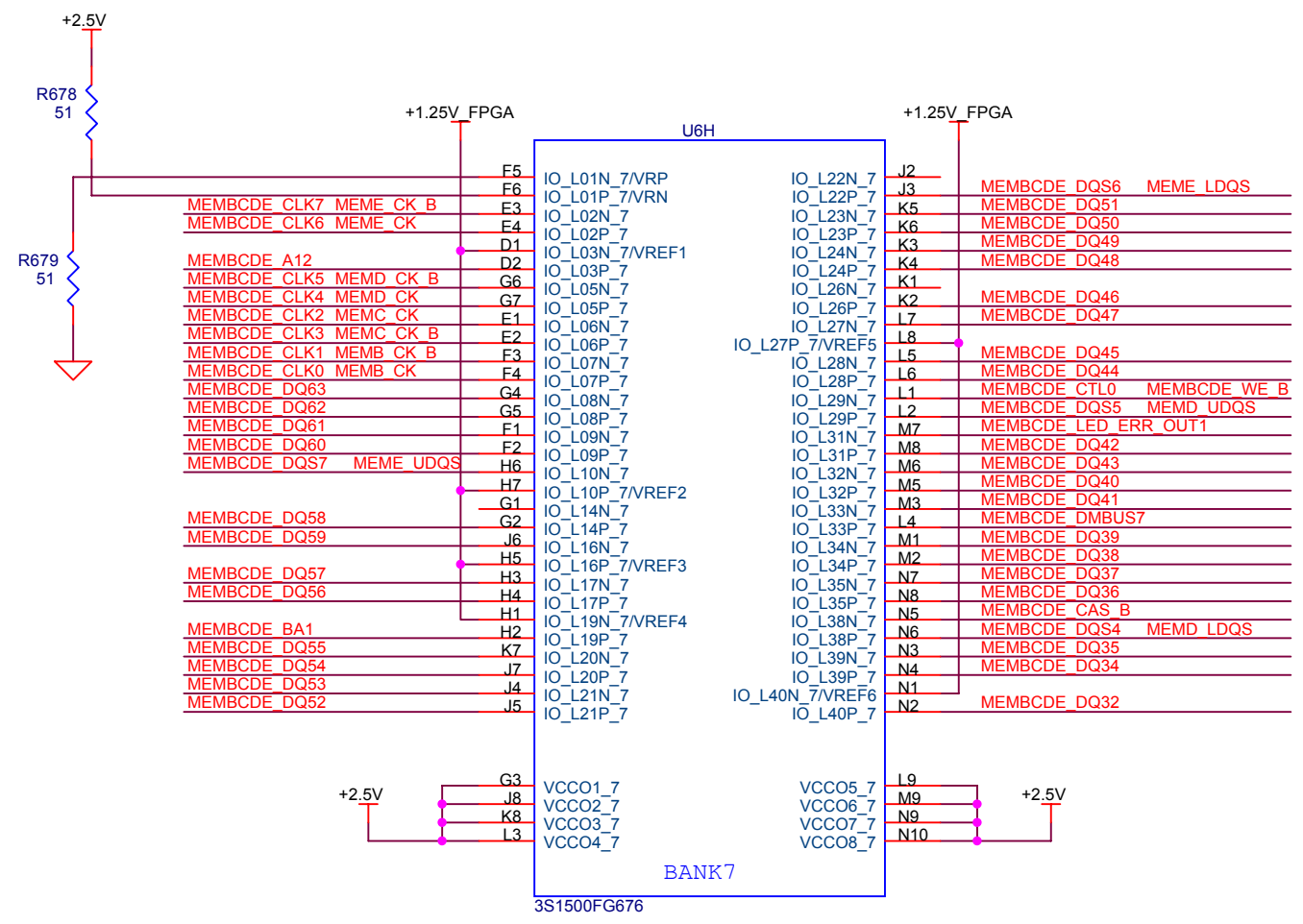
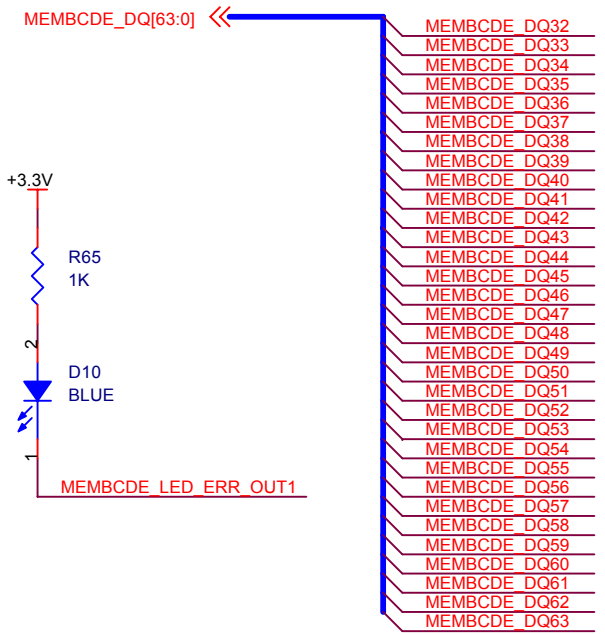
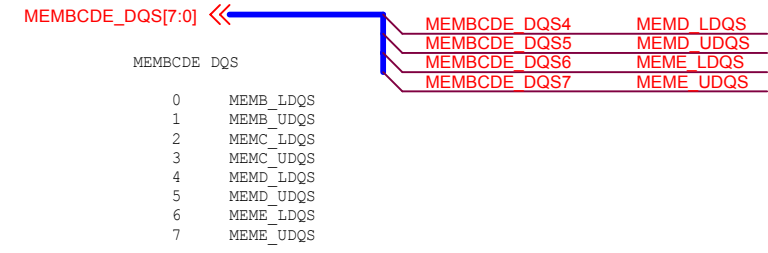
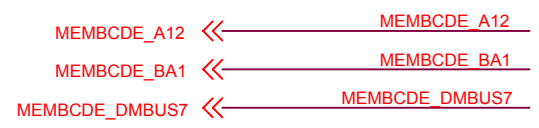
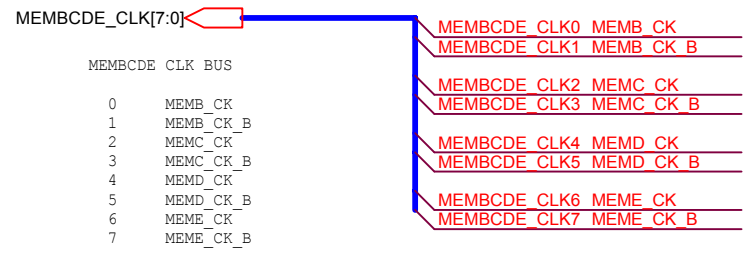
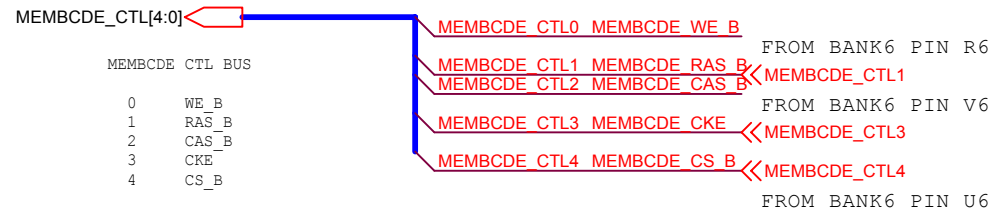


"Left" MEM BCDE DQS loop wire

DDR1 x4 (MEMB - MEME) "Left" Side Interface

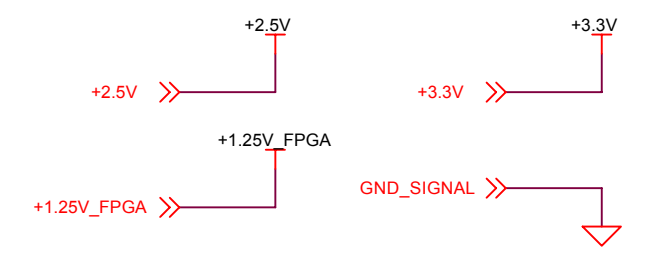
4 x 16-bit DDR-1 Mem
on the Left are designated:
MEMB = MEM DQS (0:1)
MEMC = MEM DQS (2:3)
MEMD = MEM DQS (4:5)
MEME = MEM DQS (6:7)





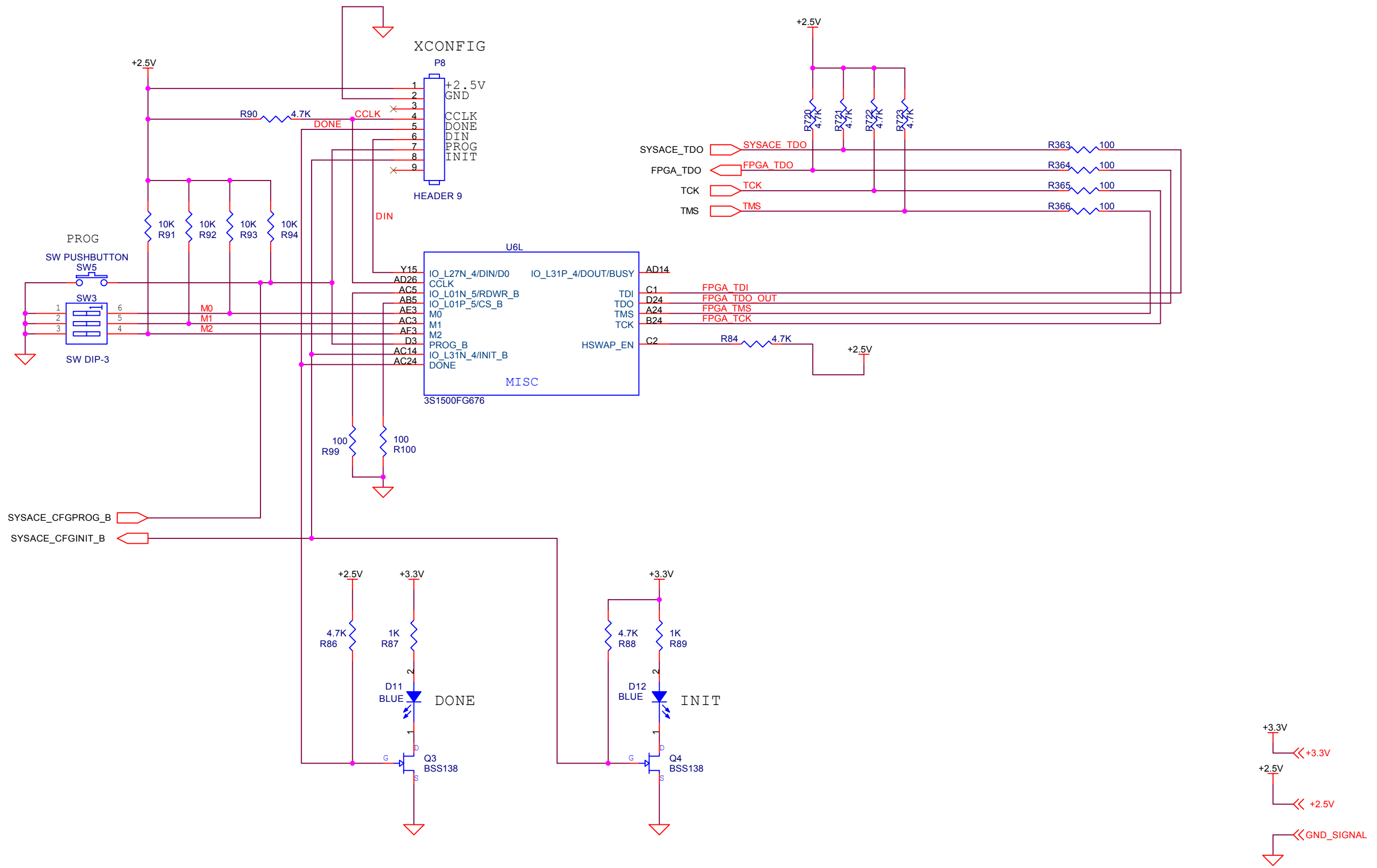
DDR1 x4 (MEMB - MEME) "Left" Side Interface

4 x 16-bit DDR-1 Mem
on the Left are designated:
MEMB = MEM DQS (0:1)
MEMC = MEM DQS (2:3)
MEMD = MEM DQS (4:5)
MEME = MEM DQS (6:7)



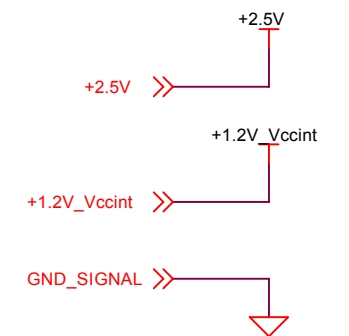
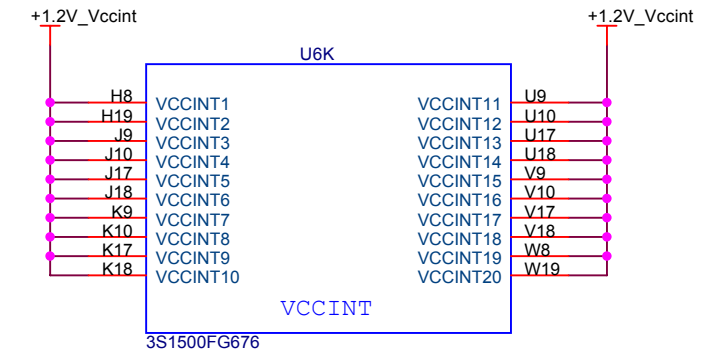
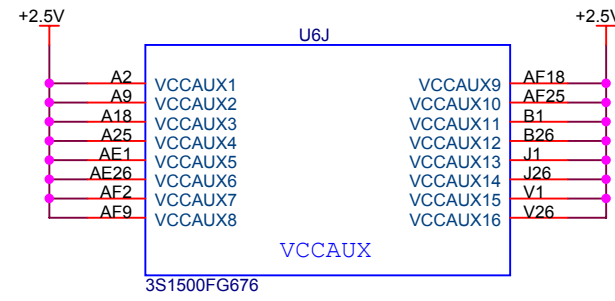
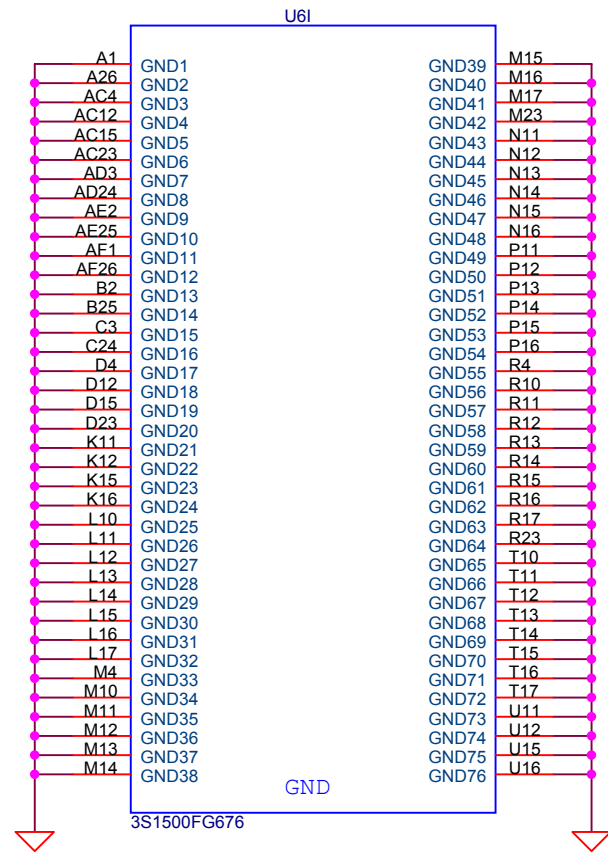
3S1500FG676 Bank7

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Spartan3 DDR-1 Board		
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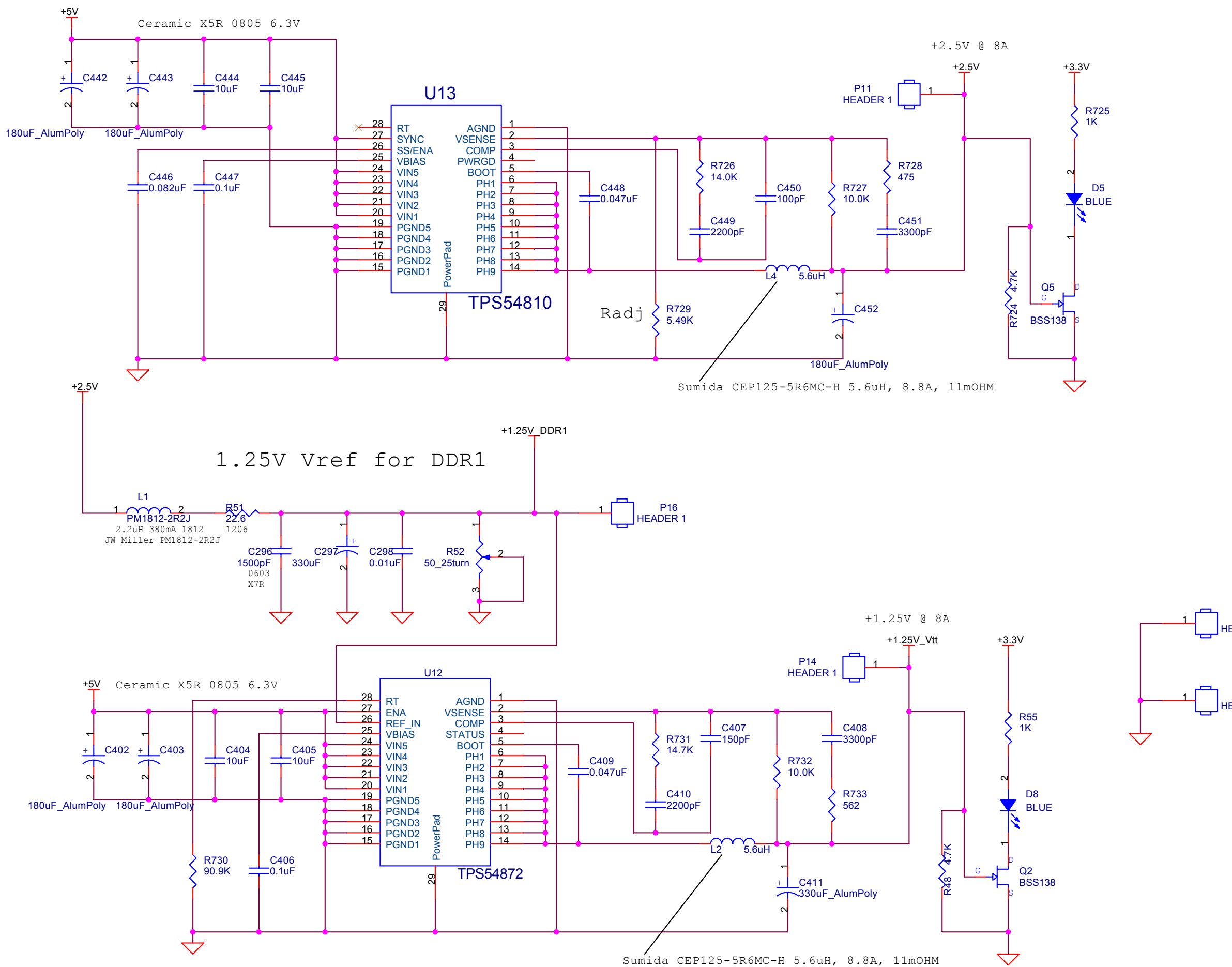
3S1500FG676 MISC

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Spartan3 DDR-1 Board		
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3S1500FG676 GND, VCCAUX, VCCINT

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Spartan3 DDR-1 Board		
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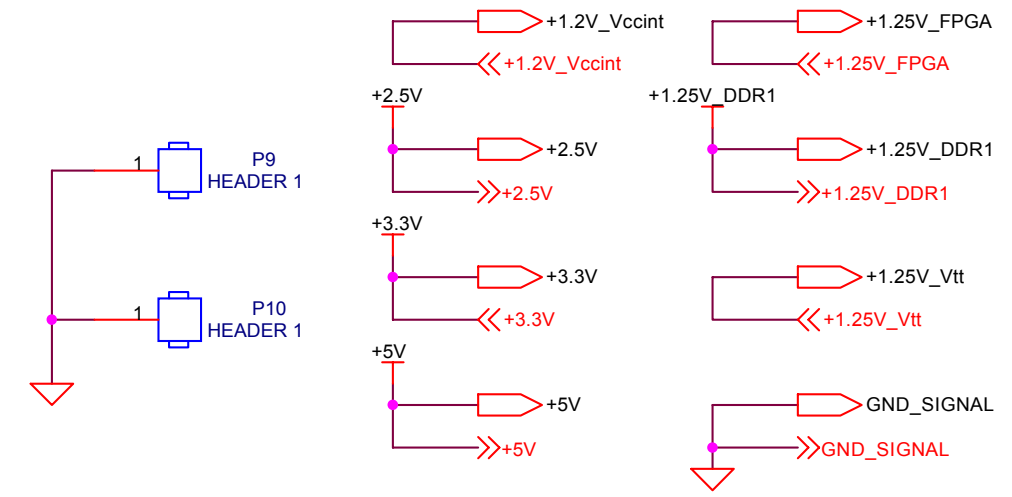


Power Requirements:

Item:	Purpose:	Voltage:	Current:
XC3S1500	Vccaux	2.5V	70mA (typ)
	Vcco	2.5V	1.68A (typ)
	Vccint	1.2V	1.52A (typ)
MT46V16M16	Vdd/Vddq	2.5V	2.2A (wc)
MT5VDDT1672	Vdd	2.5V	2.2A (wc)
Mem.Term.R's	Vtt	1.25V	8.1A (wc)
LEDs, Misc.	3.3V	3.3V	200mA (typ)

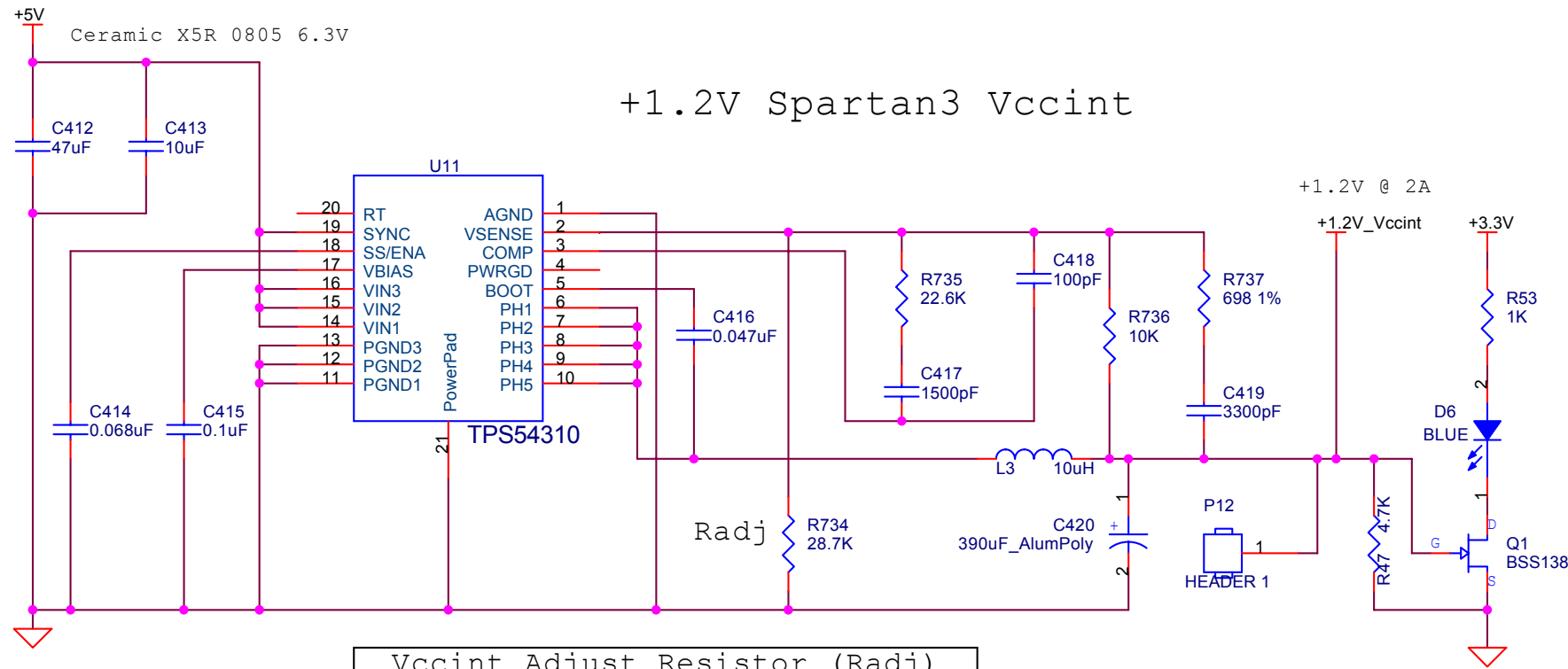
2.5V Adjust Resistor (Radj)

Vout		Std.1%R	Calc Vout
2.375V	-5%	6.04K	2.366V
2.500V	Nom	5.49K	2.514V
2.625V	+5%	5.11K	2.635V

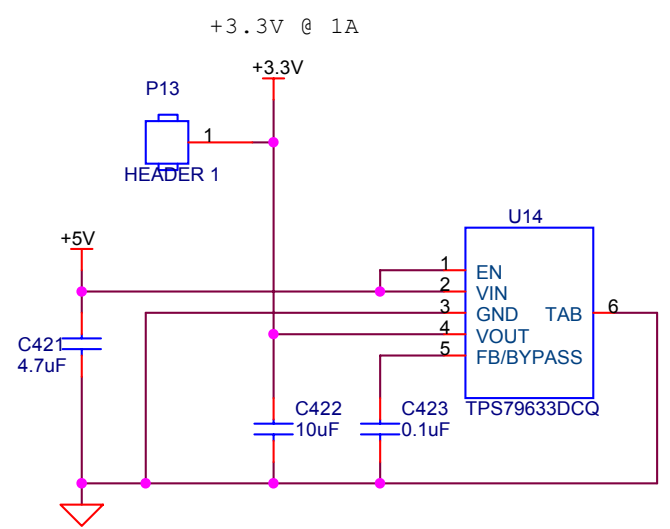


LOCAL POWER REGULATION

Title Spartan3 DDR-1 Interface Board		
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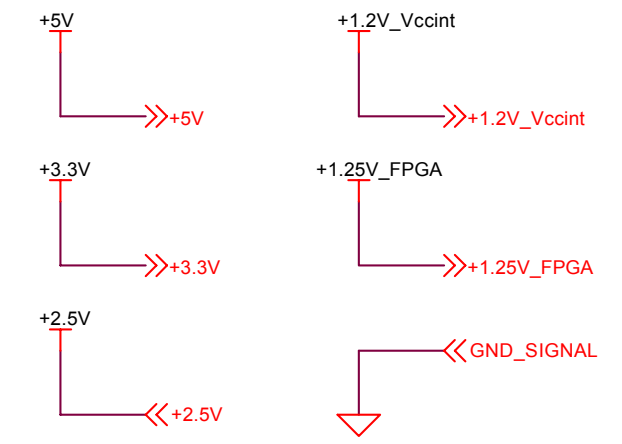
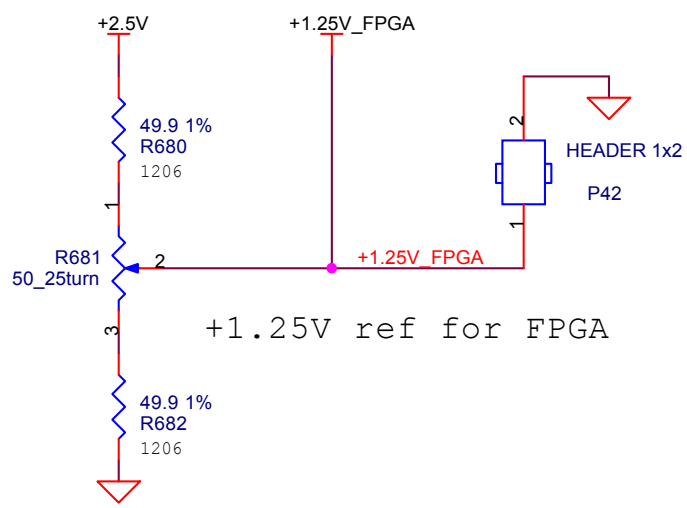
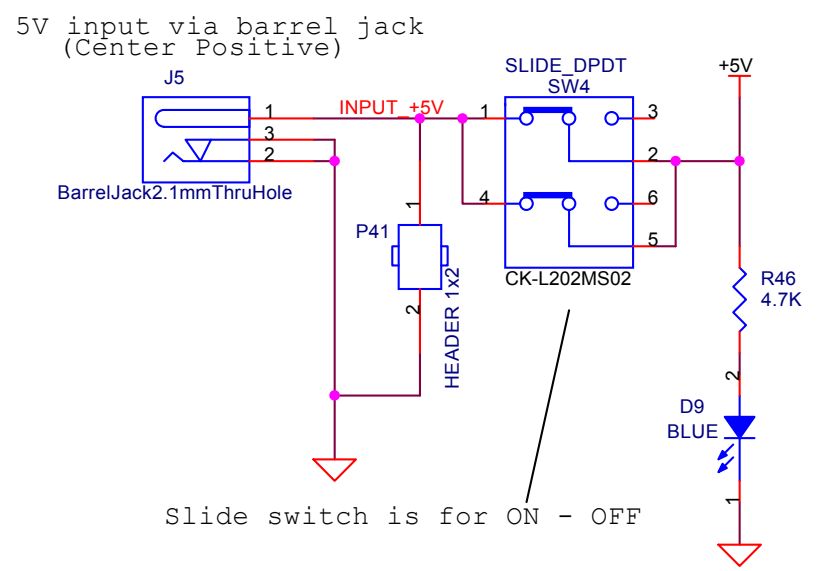


+3.3V (SysAce, LCD I/F, 7-Seg, LED's)



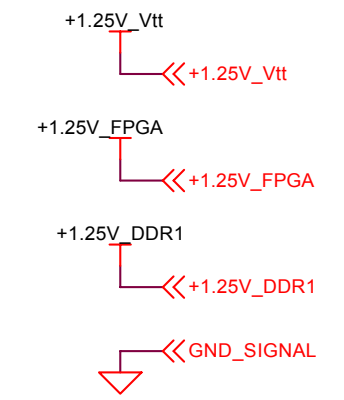
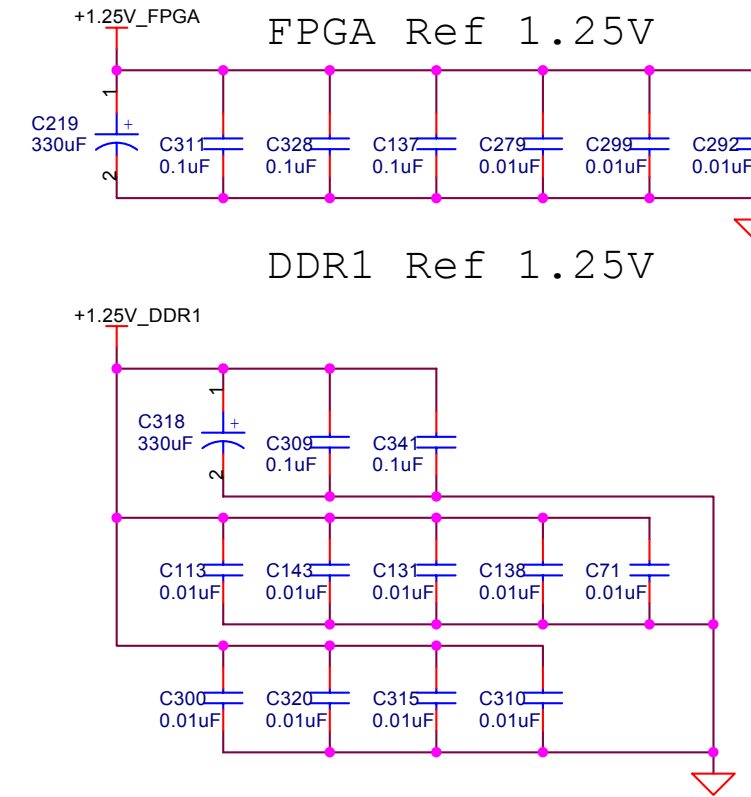
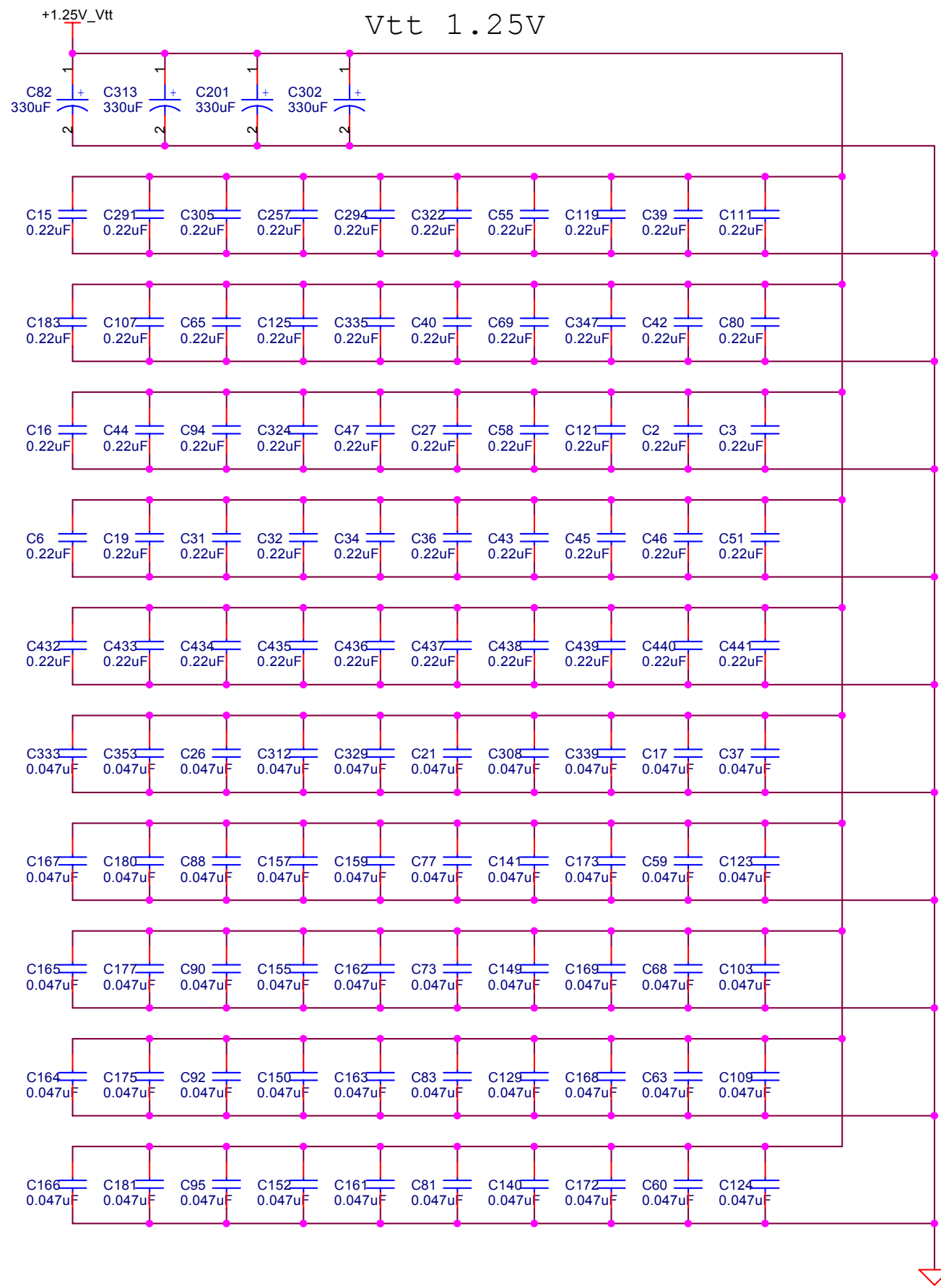
Vccint Adjust Resistor (Radj)

Vout		Std. 1%R	Calc Vout
1.140V	-5%	35.7K	1.141V
1.200V	Nom	28.7K	1.201V
1.260V	+5%	24.0K	1.262V



LOCAL POWER REGULATION

Title Spartan3 DDR-1 Interface Board		
Size B	Document Number 0381177	Rev 5
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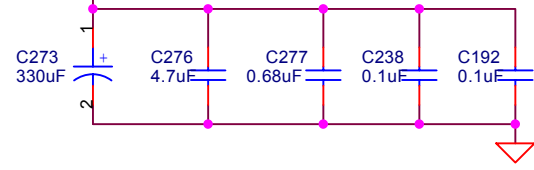


DECOUPLING

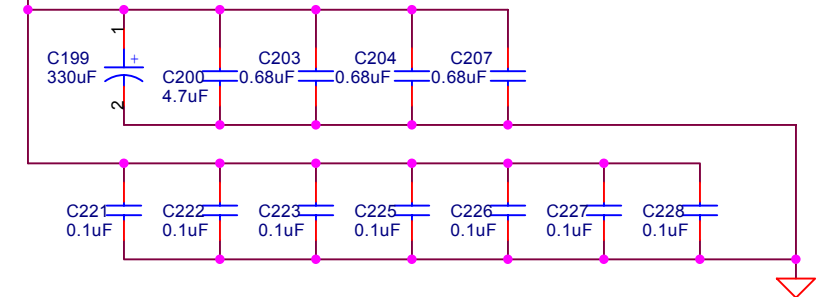
ALL non-Tantalum caps are X7R or X5R

Title Spartan3 DDR-1 Interface Board		
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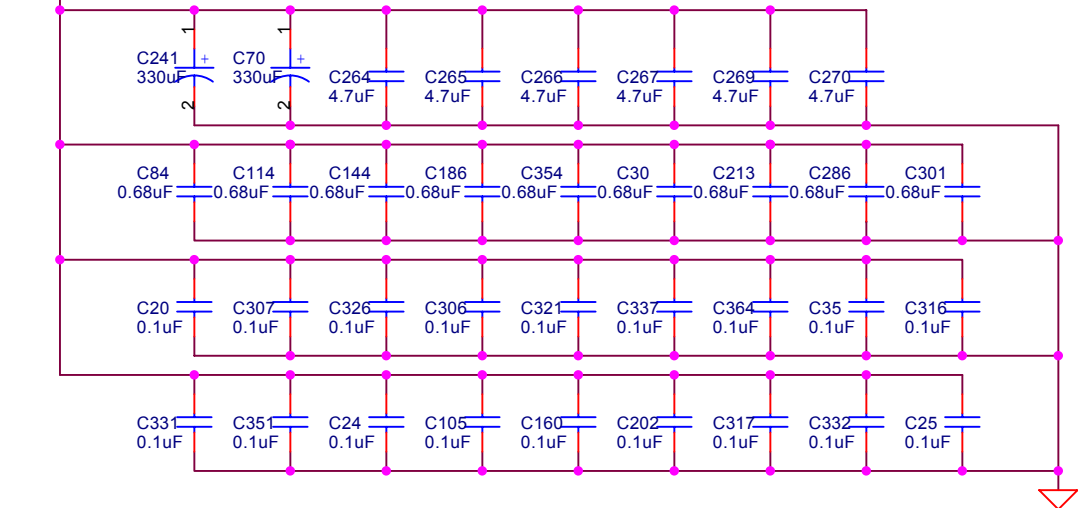
+5V Power Input & LCD



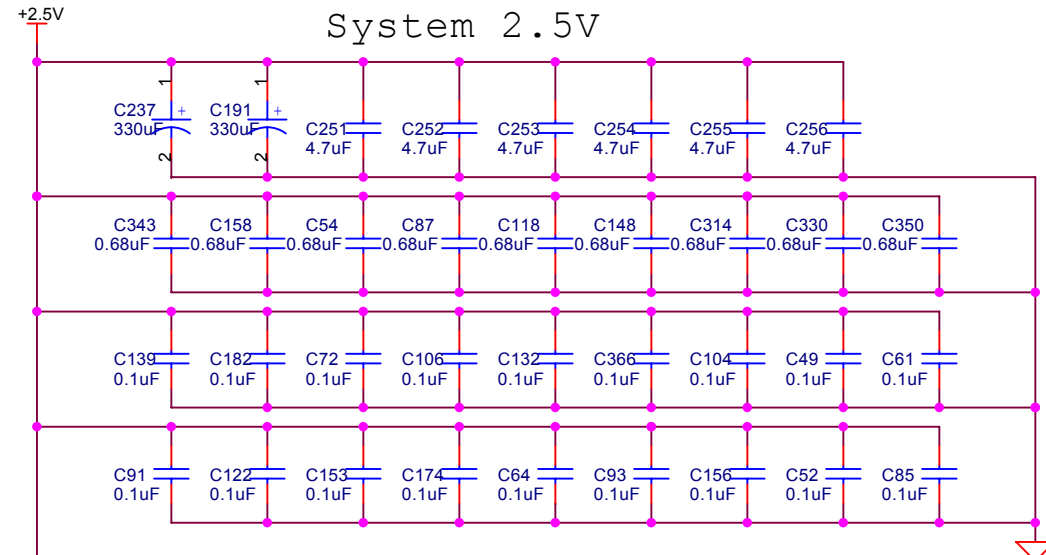
+3.3V



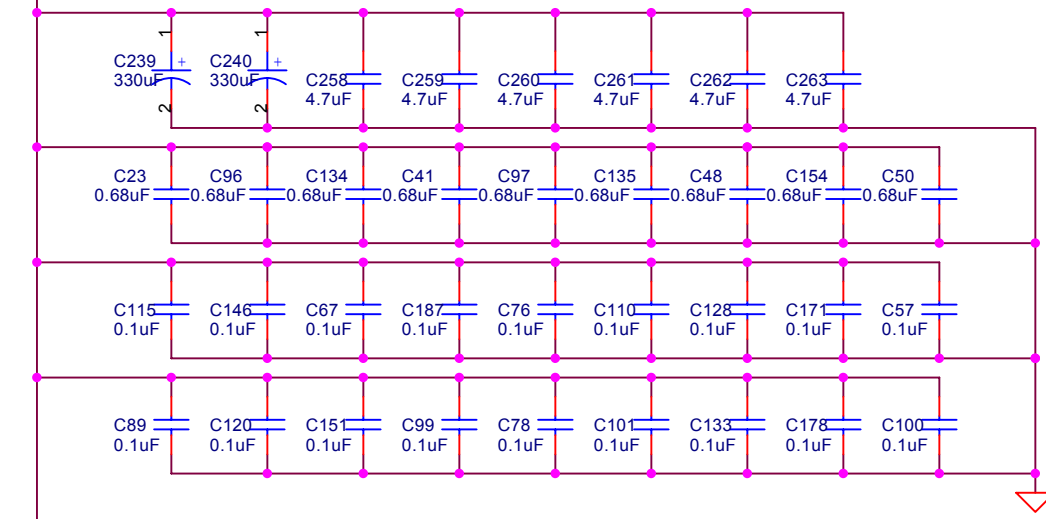
+1.2V_Vccint



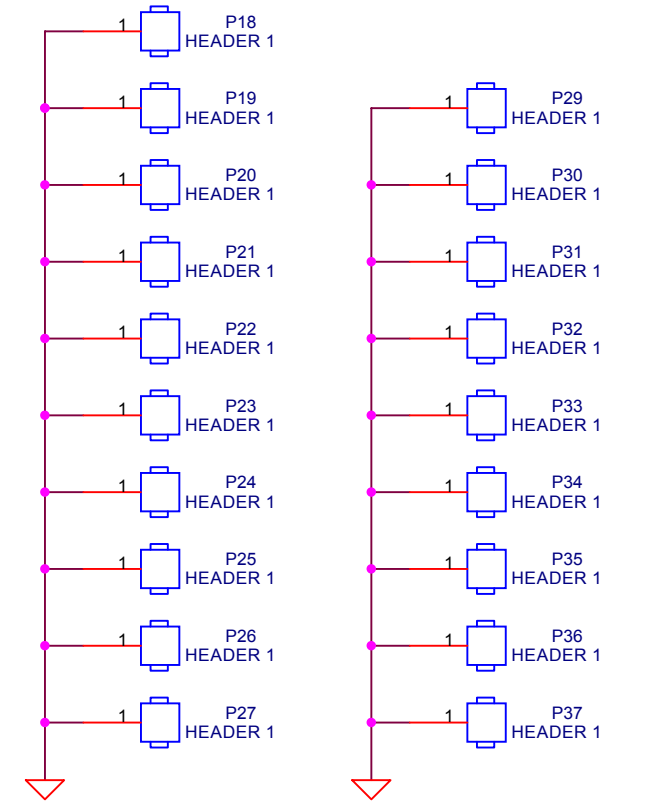
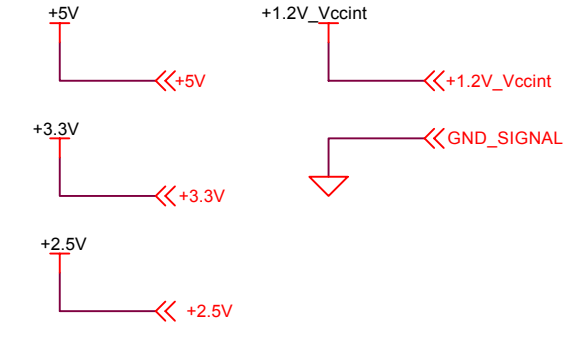
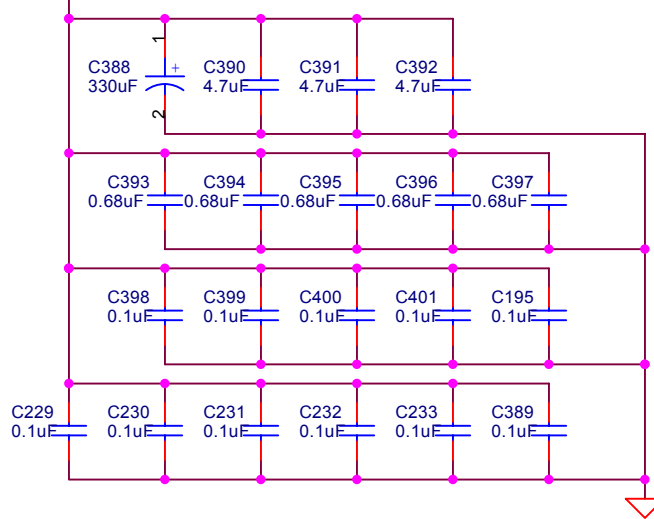
System 2.5V



Vcco 2.5V



Vccaux 2.5V



DECOUPLING

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Rev# Sheet# Description

- 0 All Initial Release
- 1 2 Changed bus widths DIMM_DQ, DIMM_DQS, DIMM_DM
- 15 Changed bus widths DIMM_DQ, DIMM_DQS, DIMM_DM
- 16 Changed bus widths DIMM_DQ, DIMM_DQS, DIMM_DM
- 21 Changed bus widths DIMM_DQ, DIMM_DQS, DIMM_DM
- 22 Changed bus widths DIMM_DQ, DIMM_DQS, DIMM_DM
- 2 Misc Updates resulting from schematic review
- 3 Misc Replaced discrete 0402 50 ohm memory bus term R's with Rpaks
- 15 Added 0 ohm R738 connecting DIMM_CKE0 to CKE1 pin
- 4 27 Correct wiring error: TCK and TMS were swapped
- 5 30 Change R values to 50 ohms: R680,R681(trimpot),R682
- 6 32 Delete GND test pin P28

Rev Notes

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Spartan3 DDR-1 Interface Board		
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