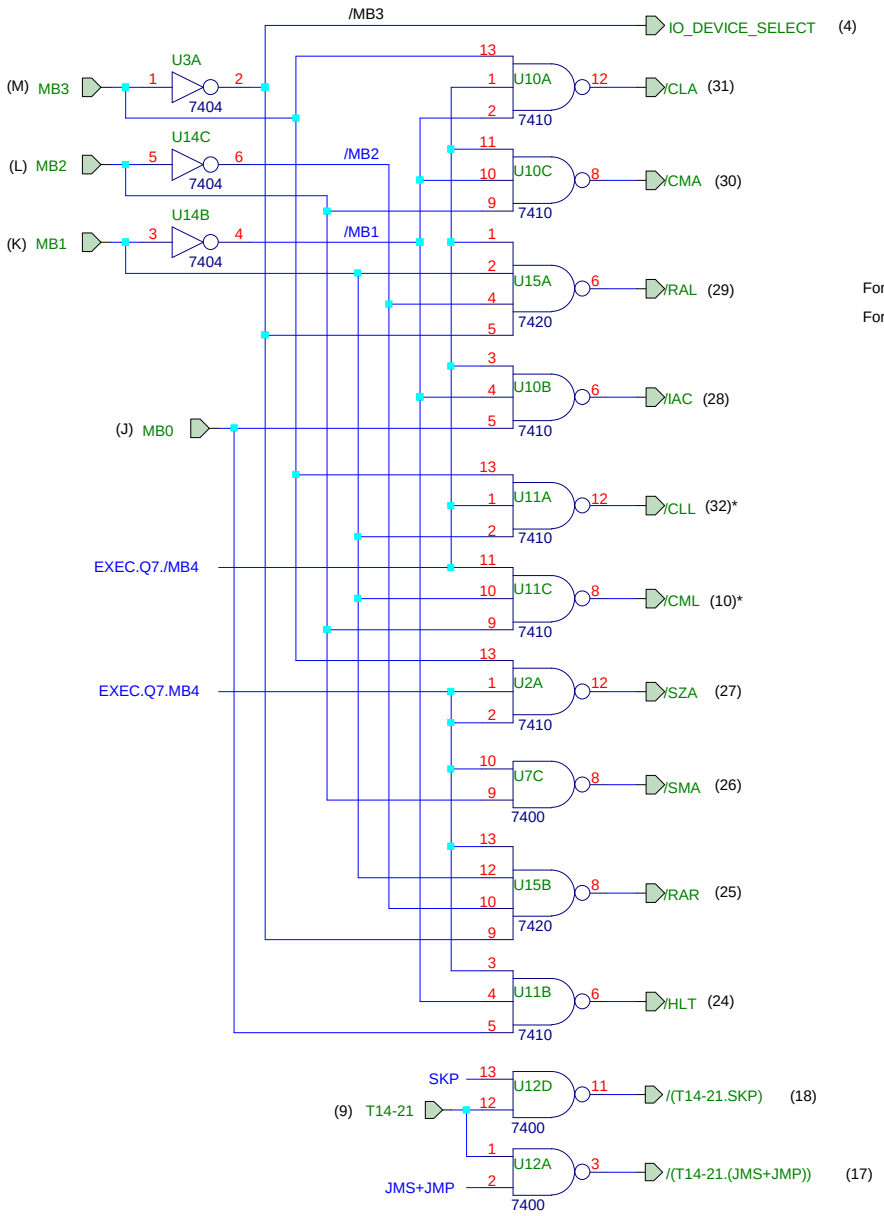


* = New Connection

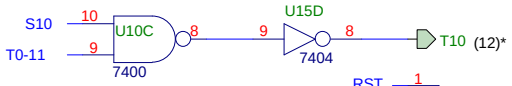
E8/T Modifications

Signal labels FETCH_CYC and EXECUTE_CYC are incorrect.

They should be labelled T0-11 and T12-23.

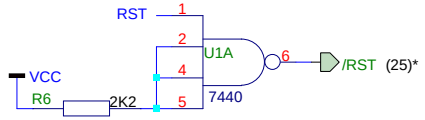
Disconnect S2-9 and T12-23 from U10C.

Signal T14-21_2 becomes T10. Total UL for T14-21_1 goes from 2 to 4.



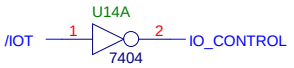
For 74 series only, replace U20 with 74H04 or 74S04.

For 74 series only, replace U1 with 7440.



E8/D Modifications

U7C needs to be replaced with spare gate U14A.



(was U7C)

Signal labels /(Q7+EXEC.MB4) and /(Q7+EXEC).MB4 are incorrect.

They should be labelled EXEC.Q7./MB4 and EXEC.Q7.MB4.

U14B, U14C and U2A are spare gates. New part is U15 7420.

U10 and U11 7400 need to be deleted and replaced with 7410 as to left.

Disconnect T14-21-1 from (10) and connect T14-21 to T14-21-1.

LO = EXEC.Q7./MB4

HI = EXEC.Q7.MB4

CLA = LO.MB3./MB1

CMA = LO.MB2./MB1

RAL = LO.MB1./MB2./MB3

IAC = LO.MB0./MB1

CLL = LO.MB3.MB1

CML = LO.MB2.MB1

SZA = HI.MB3

SMA = HI.MB2

RAR = HI.MB1./MB2./MB3

HLT = HI.MB0./MB1

List of New Instructions

703 RLL (rotate link left through AC register)

707 CML (complement link)

713 CLL (clear link)

717 CLL.CML (set link)

723 RLR (rotate link right through AC register)

727 SNL (skip on negative link)

733 SZL (skip on zero link)

737 SZL.SNL (skip)

Small World Communications	Project: EDUC-8L
6 First Avenue	Macro: E8L/T & E8L/D
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	

E8/A Modifications

U7C needs to be replaced with spare gate U4B.

Disconnect AC7 from U1.P3

Disconnect T1 from U1./CP2 and U3./CP2.

Disconnect RAL from U6C.

U4B, U5C and U6C are spare gates.

E8/P Modifications

Disconnect /(T14-21.(JMP+JMS)) from U12E.

U7C and U12E are spare gates. U4B is spare FF.

Disconnect /(RAR.T13) from U13B.

Disconnect AC = -VE from U11A.

Disconnect AC = 0 from U11B.

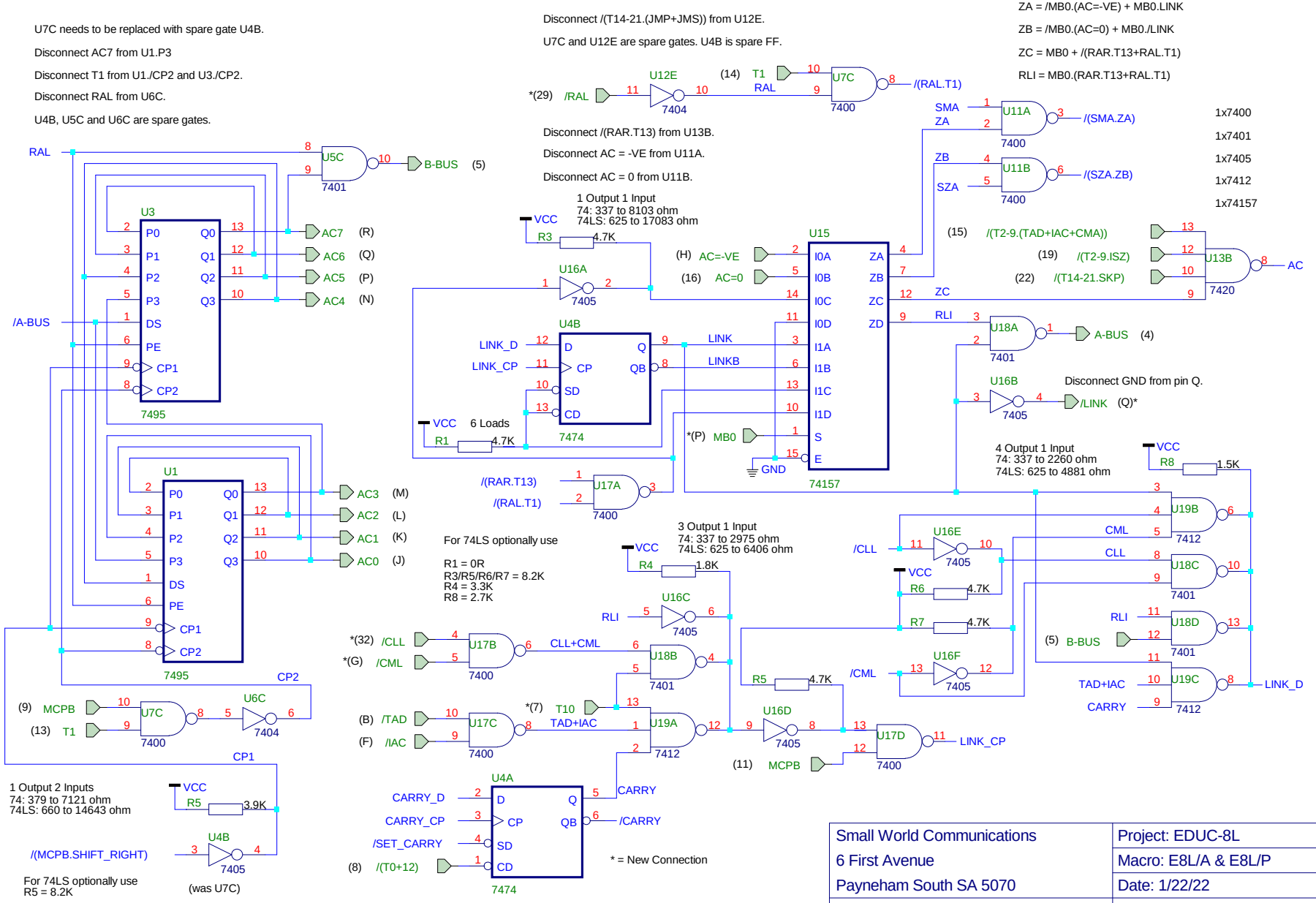
ZA = /MB0.(AC=-VE) + MB0.LINK

ZB = /MB0.(AC=0) + MB0./LINK

ZC = MB0 + /(RAR.T13+RAL.T1)

RLI = MB0.(RAR.T13+RAL.T1)

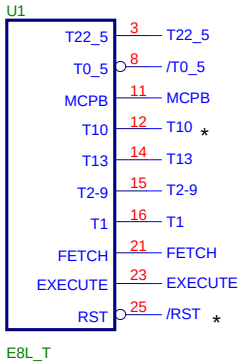
1x7400
1x7401
1x7405
1x7412
1x74157

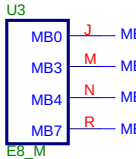


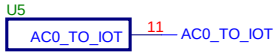
Small World Communications	Project: EDUC-8L
6 First Avenue	Macro: E8L/A & E8L/P
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	

E8/C Modifications

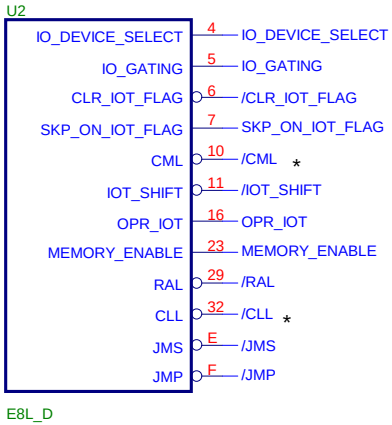
Disconnect T14-21 from pin E8/T(12).



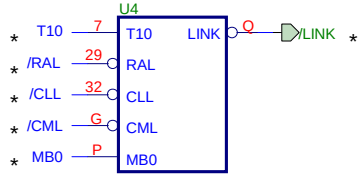


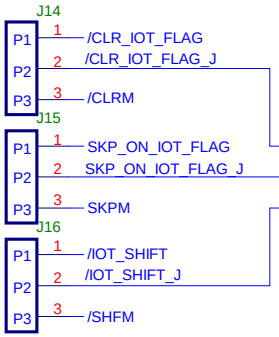


Disconnect T14-21 from pin E8/D(10).
Disconnect GND from pin E8/D(32).

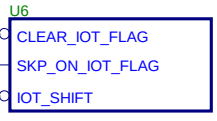


Disconnect D-BUS from pin E8/P(7).
Disconnect GND from pin E8/P(32).
Disconnect GND from pin E8/P(Q).





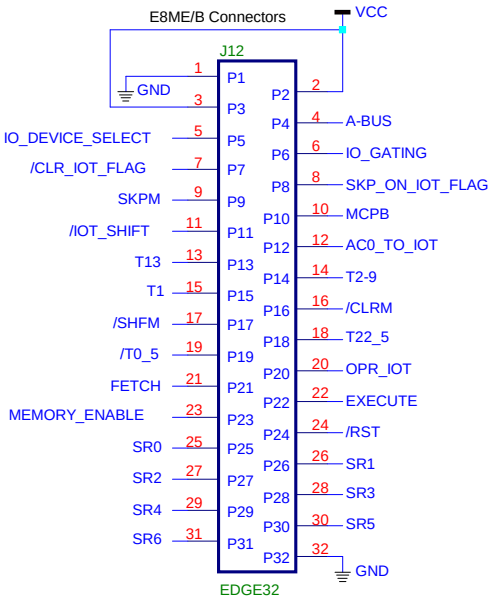
Disconnect /CLEAR_IOT_FLAG from pin E8/IOT(7).
Disconnect SKP_ON_IOT_FLAG from pin E8/IOT(8).
Disconnect /IOT_SHIFT from pin E8/IOT(11).

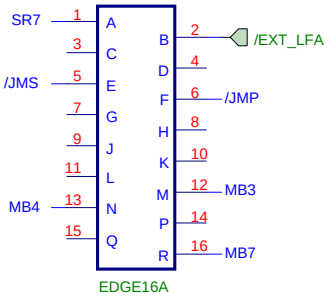


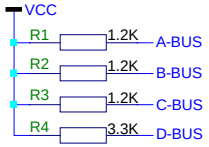
Jumpers in upper position (A-B) without EDUC-8ME.
Jumpers in lower position (B-C) with EDUC-8ME.

* = New Connection

E8ME/B Connectors







No=5, 74 Ii = 3/3 UL: 433 to 1715 ohm; 74LS Ii = 1.5/0.75 UL: 699 to 3661 ohm

No=6, 74 Ii = 1.4/2 UL: 379 to 1510 ohm; 74LS Ii = 0.9/1.25 UL: 792 to 3223 ohm

No=6, 74 Ii = 2.4/3 UL: 433 to 1472 ohm; 74LS Ii = 1.4/1.5 UL: 848 to 3125 ohm

No=1, 74 Ii = 3/3 UL: 433 to 6351 ohm; 74LS Ii = 1.5/0.75 UL: 699 to 12812 ohm (E8ME)

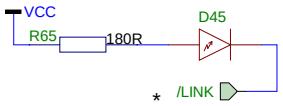
No=2, Iol=0.1mA, Vol=0.45 V: 74 Ii = 3/3 UL: 429 to 7334 ohm; 74LS Ii = 1.5/0.75 UL: 324 to 7885 ohm (EDUC-8)

For 74LS optionally use

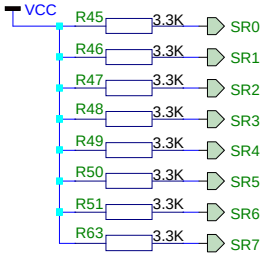
R1/R2 = 2.2K
R3 = 1.8K
R4 = 4.7K

E8/F Modifications

Add LED for LINK next to AC7.

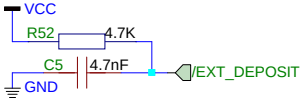


Replace EDUC-8 E8/F 10K SR pullups with 3.3K resistors.
For 74 with 1 output and 3 inputs: 433 to 6351 ohms
For 74LS with 1 output and 3 inputs: 699 to 12812 ohms
For 74LS optionally use 6.8K pullups.



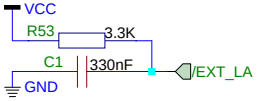
For paper tape reader C5 needs to be changed.
See Electronics Australia, March 1975, page 66.
Have R = 22K and C = 1 nF, RC = 22 us.
For 74 with 1 output and 1 input: 337 to 8103 ohm.
For 74LS with 1 output and 1 input: 625 to 17083 ohm.
Choose R = 4.7K and C = 4.7 nF. RC = 22.09 us.

For 74LS optionally use
R52 = 8.2K
C5 = 2.7nF
RC = 22.14 us

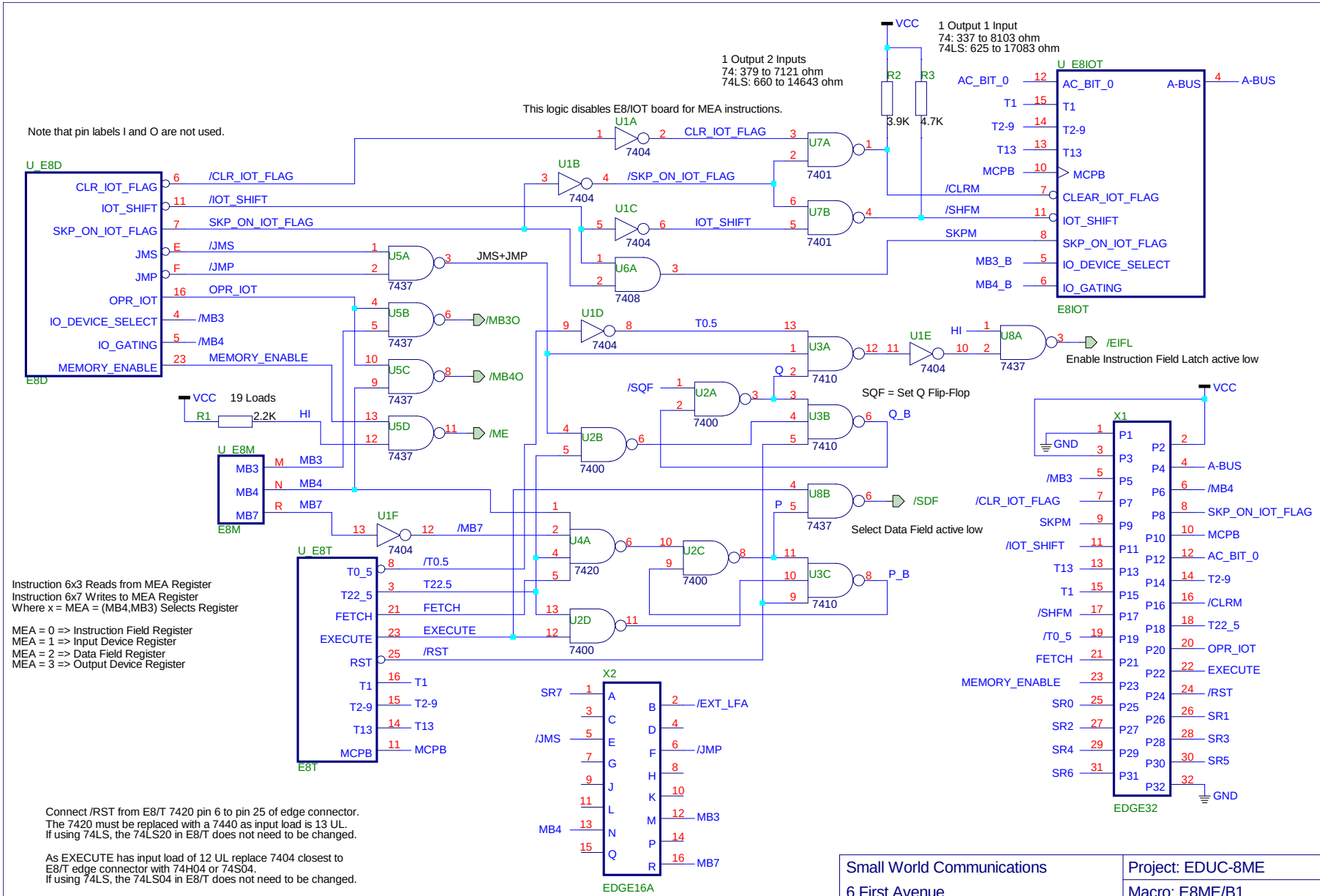


For /EXT_LA have R = 10 K and C = 100 nF. RC = 1 ms.
For 74 with 1 output and 2 inputs: 379 to 7121 ohm.
For 74LS with 1 output and 2 inputs: 660 to 14643 ohm.
Choose R = 3.3K and C = 330 nF. RC = 1.089 ms.

For 74LS optionally use
R53 = 8.2K
C1 = 120nF
RC = 0.984 ms



Small World Communications	Project: EDUC-8L
6 First Avenue	Macro: E8L/C & E8L/F
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/8/24	



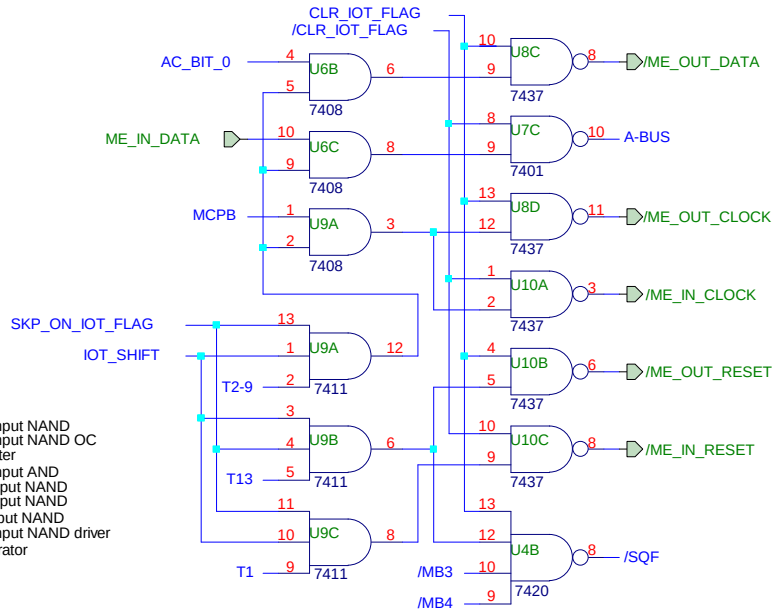
Instruction 6x3 Reads from MEA Register
Instruction 6x7 Writes to MEA Register
Where x = MEA = (MB4,MB3) Selects Register

MEA = 0 => Instruction Field Register
MEA = 1 => Input Device Register
MEA = 2 => Data Field Register
MEA = 3 => Output Device Register

Connect /RST from E8/T 7420 pin 6 to pin 25 of edge connector.
The 7420 must be replaced with a 7440 as input load is 13 UL.
If using 74LS, the 74LS20 in E8/T does not need to be changed.

As EXECUTE has input load of 12 UL replace 7404 closest to
E8/T edge connector with 74H04 or 74S04.
If using 74LS, the 74LS04 in E8/T does not need to be changed.

Small World Communications	Project: EDUC-8ME
6 First Avenue	Macro: E8ME/B1
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	



Parts List

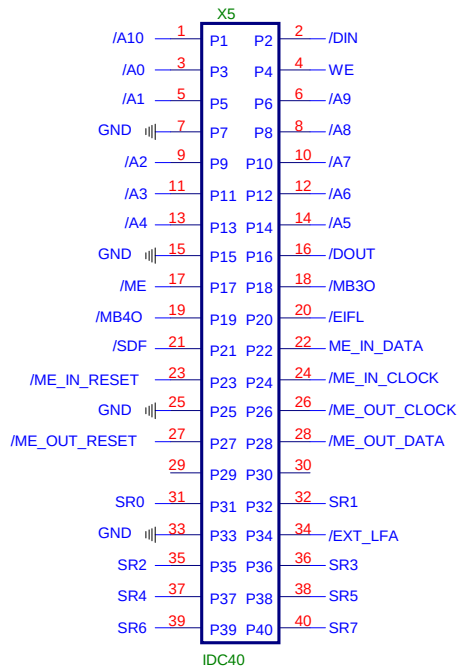
1 7400 quad 2-input NAND
1 7401 quad 2-input NAND OC
1 7404 hex inverter
1 7408 quad 2-input AND
1 7410 triple 3-input NAND
1 7411 triple 3-input NAND
1 7420 dual 4-input NAND
6 7437 quad 2-input NAND driver
1 74122 multivibrator

1 2.2K resistor
1 3.9K resistor
1 4.7K resistor
1 8.2K resistor
1 5K trimpot
1 180 pF capacitor
1 3-pin jumper
1 16-pin socket
1 16-way edge connector
1 32-way edge connector
1 40-way IDC connector

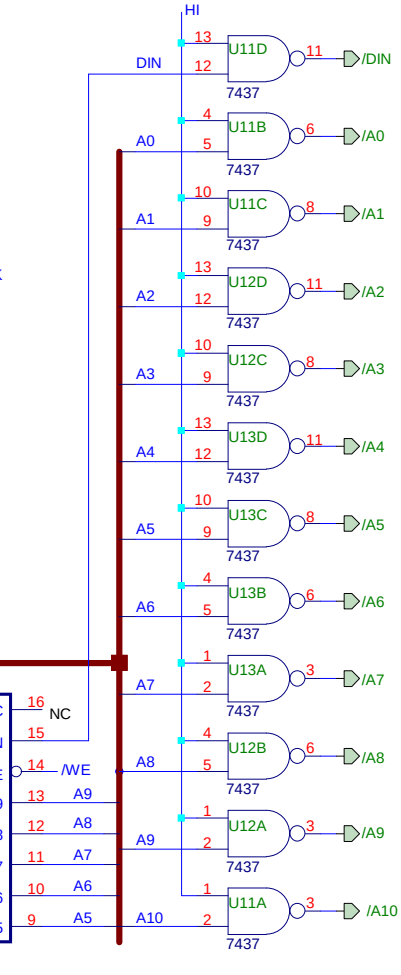
For 74LS optionallly use

R1 = 0R
R2/R3 = 8.2K

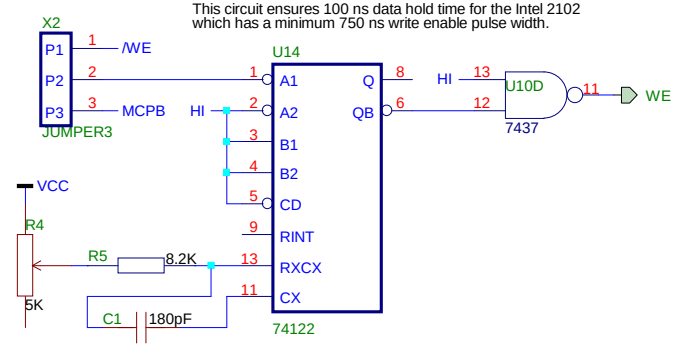
For 74LS122 use C1 = 150pF



Use HI for unused gate inputs to reduce power



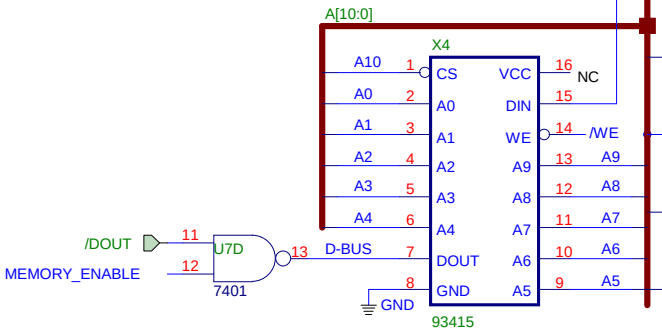
This circuit ensures 100 ns data hold time for the Intel 2102 which has a minimum 750 ns write enable pulse width.



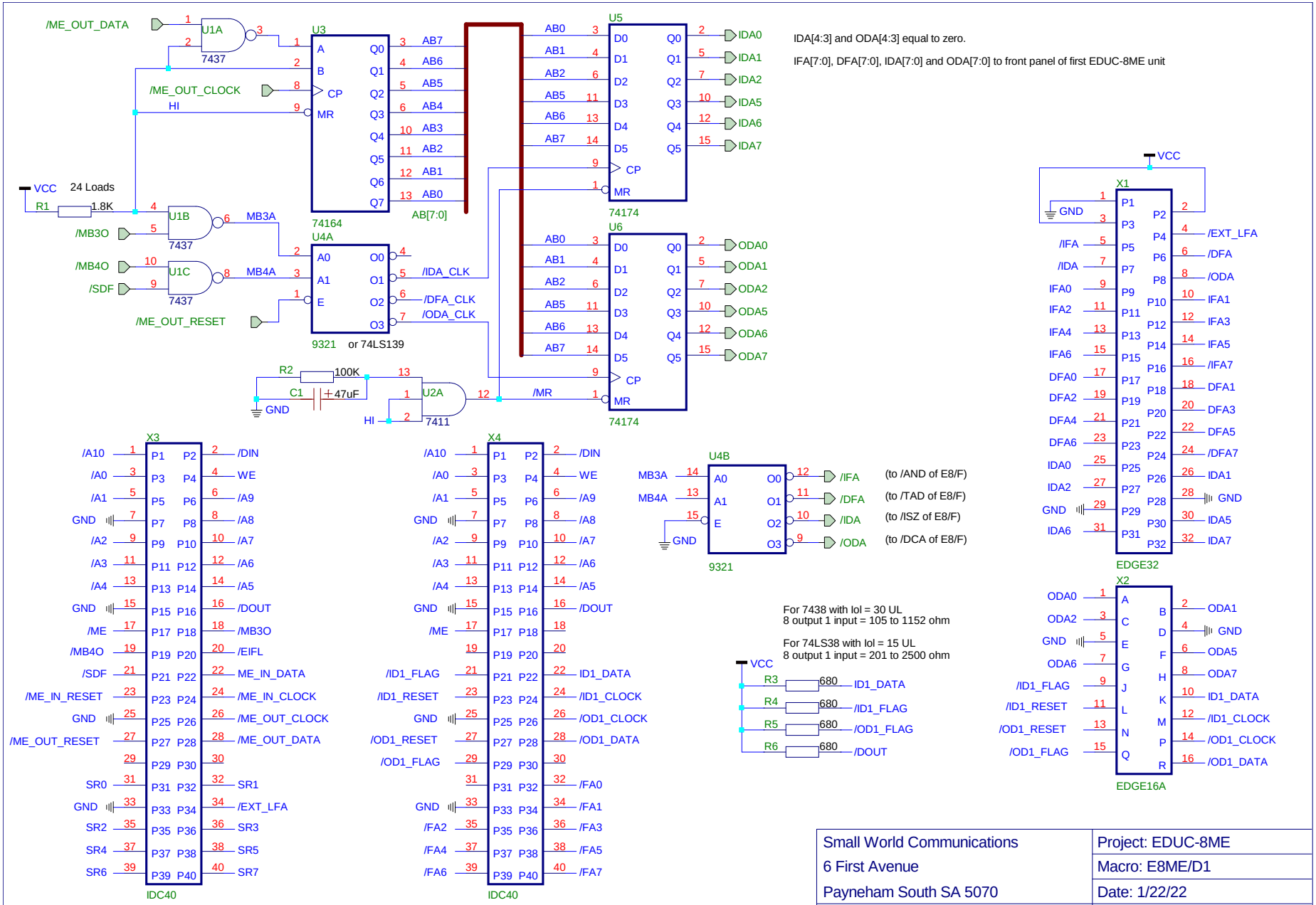
For normal operation jumper pins 1 and 2 of X2.

To adjust WE pulse width, disconnect EDUC-8ME and cable from E8/M.
Insert 93415 into lower position of E8/M and jumper pins 2 and 3 of X2.
Load instruction JMP 0 (500) into address 000 and run program.
Adjust trimpot R4 so that the low width of QB is at least 750 ns
and at most Tch-132 ns where Tch is the MCPB high width in ns.

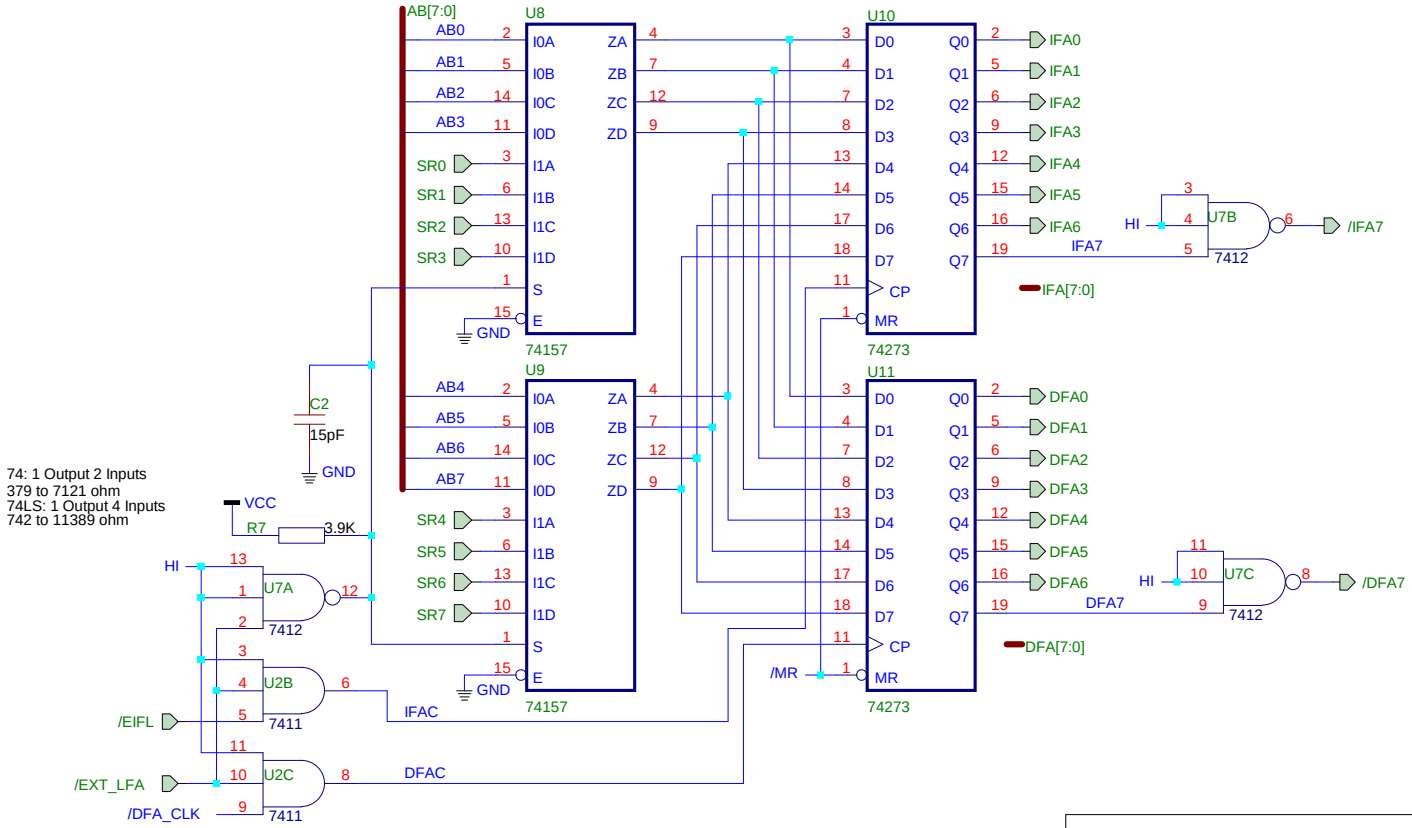
Connect cable from X4 to lower memory position of E8/M.
VCC of X2 must not be connected to board power supply.



Small World Communications	Project: EDUC-8ME
6 First Avenue	Macro: E8ME/B2
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	



Small World Communications	Project: EDUC-8ME
6 First Avenue	Macro: E8ME/D1
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	



74: 1 Output 2 Inputs
379 to 7121 ohm
74LS: 1 Output 4 Inputs
742 to 11389 ohm

Parts List

1 7411 triple 3-input AND
1 7412 triple 3-input NAND OC
3 7437 quad 2-input NAND buffer
1 74139/9321 dual 2 to 4 decoder
4 74153 dual 4 to 1 multiplexer
2 74157 quad 2 to 1 multiplexer
1 74164 8-bit S/P shift register
1 74165 8-bit P/S shift register
2 74174 6-bit D-FF
2 74273 8-bit D-FF

4 680R resistors
1 3.9K resistor
1 100K resistor
1 15 pF capacitor
1 47 uF capacitor
1 16-way edge connector
1 32-way edge connector
2 40-way IDC connectors

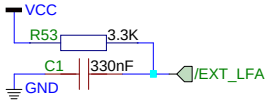
For 74LS optionally use

R1 = 0R
R3 to R6 = 1.5K
R7 = 5.6K

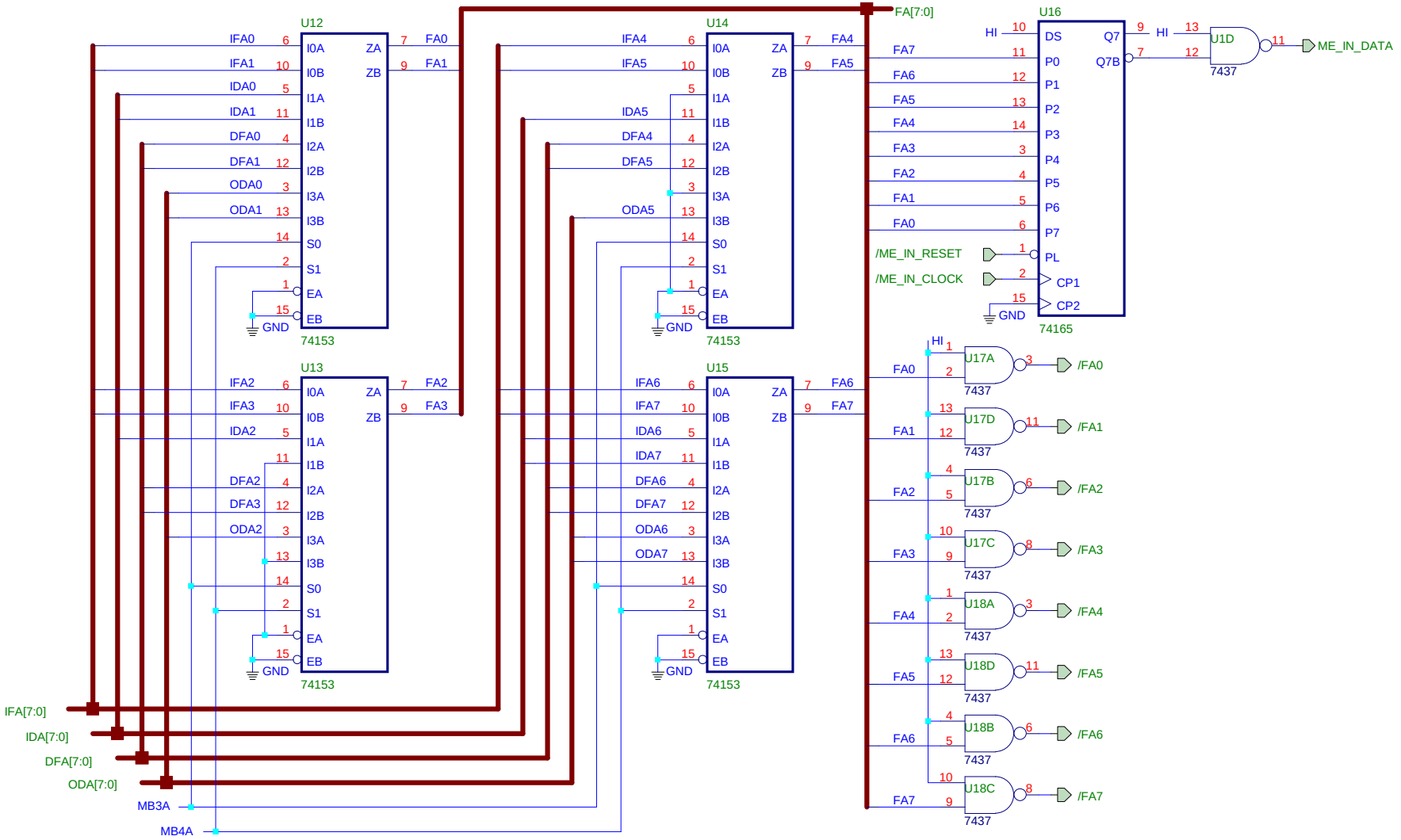
/EXT_LFA goes to /EXT_LA of front panel of first EDUC-8ME unit.
Have R = 10 K, C = 100 nF and RC = 1 ms.
For 74 with 1 output and 3 inputs: 433 to 6351 ohms
For 74LS with 1 output and 3 inputs: 699 to 12812 ohms
Choose R = 3.3K and C = 330 nF. RC = 1.089 ms.

For 74LS optionally use

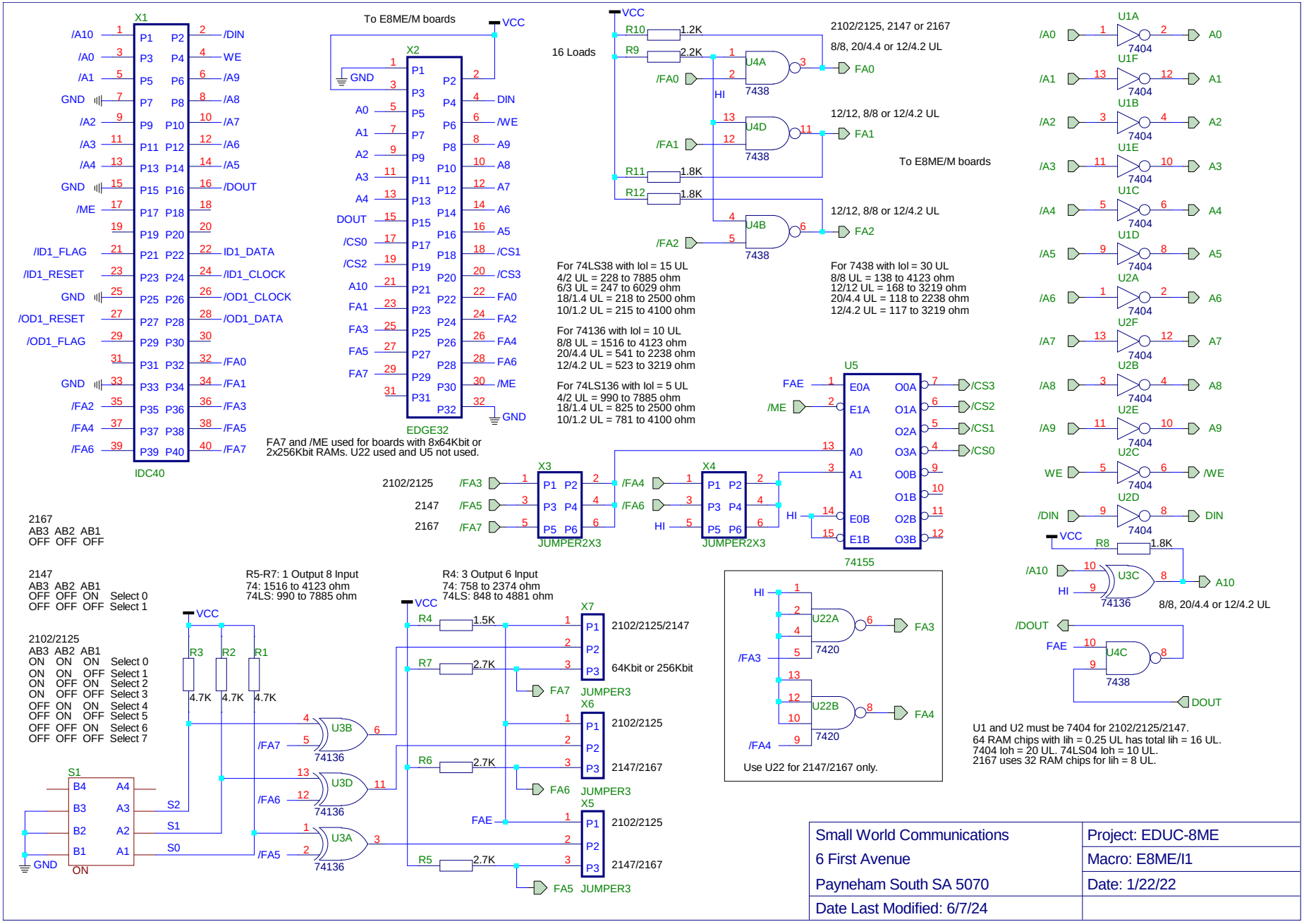
R53 = 6.8K
C1 = 150nF
RC = 1.02 ms



Small World Communications	Project: EDUC-8ME
6 First Avenue	Macro: E8ME/D2
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/8/24	



Small World Communications	Project: EDUC-8ME
6 First Avenue	Macro: E8ME/D3
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	


X1
/A10 1 P1 P2 2 /DIN
/A0 3 P3 P4 4 WE
/A1 5 P5 P6 6 /A9
GND 7 P7 P8 8 /A8
/A2 9 P9 P10 10 /A7
/A3 11 P11 P12 12 /A6
/A4 13 P13 P14 14 /A5
GND 15 P15 P16 16 /DOUT
/ME 17 P17 P18 18
19 P19 P20 20
/ID1_FLAG 21 P21 P22 22 ID1_DATA
/ID1_RESET 23 P23 P24 24 /ID1_CLOCK
GND 25 P25 P26 26 /OD1_CLOCK
/OD1_RESET 27 P27 P28 28 /OD1_DATA
/OD1_FLAG 29 P29 P30 30
31 P31 P32 32 /FA0
GND 33 P33 P34 34 /FA1
/FA2 35 P35 P36 36 /FA3
/FA4 37 P37 P38 38 /FA5
/FA6 39 P39 P40 40 /FA7
IDC40
To E8ME/M boards
VCC
X2
GND 1 P1 P2 2
3 P3 P4 4 DIN
A0 5 P5 P6 6 /WE
A1 7 P7 P8 8 A9
A2 9 P9 P10 10 A8
A3 11 P11 P12 12 A7
A4 13 P13 P14 14 A6
DOUT 15 P15 P16 16 A5
/CS0 17 P17 P18 18 /CS1
/CS2 19 P19 P20 20 /CS3
A10 21 P21 P22 22 FA0
FA1 23 P23 P24 24 FA2
FA3 25 P25 P26 26 FA4
FA5 27 P27 P28 28 FA6
FA7 29 P29 P30 30 /ME
31 P31 P32 32 GND
EDGE32
FA7 and /ME used for boards with 8x64Kbit or
2x256Kbit RAMs. U22 used and U5 not used.
16 Loads
VCC
R10 1.2K
R9 2.2K
/FA0 1 2 U4A 3 FA0
7438
HI
2102/2125, 2147 or 2167
8/8, 20/4.4 or 12/4.2 UL
/FA1 13 12 U4D 11 FA1
7438
12/12, 8/8 or 12/4.2 UL
R11 1.8K
R12 1.8K
/FA2 5 4 U4B 6 FA2
7438
12/12, 8/8 or 12/4.2 UL
To E8ME/M boards
For 74LS38 with Iol = 15 UL
4/2 UL = 228 to 7885 ohm
6/3 UL = 247 to 6029 ohm
18/1.4 UL = 218 to 2500 ohm
10/1.2 UL = 215 to 4100 ohm
For 74136 with Iol = 10 UL
8/8 UL = 1516 to 4123 ohm
20/4.4 UL = 541 to 2238 ohm
12/4.2 UL = 523 to 3219 ohm
For 74LS136 with Iol = 5 UL
4/2 UL = 990 to 7885 ohm
18/1.4 UL = 825 to 2500 ohm
10/1.2 UL = 781 to 4100 ohm
For 7438 with Iol = 30 UL
8/8 UL = 138 to 4123 ohm
12/12 UL = 168 to 3219 ohm
20/4.4 UL = 118 to 2238 ohm
12/4.2 UL = 117 to 3219 ohm
U5
FAE 1 E0A O0A 7 /CS3
/ME 2 E1A O1A 6 /CS2
O2A 5 /CS1
13 A0 O3A 4 /CS0
3 A1 O0B 9
O1B 10
HI 14 E0B O2B 11
15 E1B O3B 12
74155
2102/2125 /FA3 1 X3 2 /FA4 1 X4 2
2147 /FA5 3 P1 P2 P3 P4 4 /FA6 3 P1 P2 P3 P4
2167 /FA7 5 P5 P6 6 HI 5 P5 P6
JUMPER2X3
JUMPER2X3
2167
AB3 AB2 AB1
OFF OFF OFF
2147
AB3 AB2 AB1
OFF OFF ON Select 0
OFF OFF OFF Select 1
2102/2125
AB3 AB2 AB1
ON ON ON Select 0
ON ON OFF Select 1
ON OFF ON Select 2
ON OFF OFF Select 3
OFF ON ON Select 4
OFF ON OFF Select 5
OFF OFF ON Select 6
OFF OFF OFF Select 7
R5-R7: 1 Output 8 Input
74: 1516 to 4123 ohm
74LS: 990 to 7885 ohm
VCC
R3 R2 R1
4.7K 4.7K 4.7K
/FA7 4 5 U3B 6
/FA6 13 12 U3D 11
/FA5 1 2 U3A 3
74136
S1
B4 A4
B3 A3 S2
B2 A2 S1
B1 A1 S0
GND ON
R4: 3 Output 6 Input
74: 758 to 2374 ohm
74LS: 848 to 4881 ohm
VCC
R4 1.5K
R7 2.7K
R6 2.7K
R5 2.7K
X7 1 P1 P2 P3 2 3 2102/2125/2147
64Kbit or 256Kbit
FA7 JUMPER3
X6 1 P1 P2 P3 2 3 2102/2125
2147/2167
FA6 JUMPER3
FAE
X5 1 P1 P2 P3 2 3 2102/2125
2147/2167
FA5 JUMPER3
HI 1 2 U22A 6 FA3
/FA3 4 5
7420
13 12 U22B 8 FA4
10
/FA4 9
7420
Use U22 for 2147/2167 only.
U1A
/A0 1 2 A0
7404
U1F
/A1 13 12 A1
7404
U1B
/A2 3 4 A2
7404
U1E
/A3 11 10 A3
7404
U1C
/A4 5 6 A4
7404
U1D
/A5 9 8 A5
7404
U2A
/A6 1 2 A6
7404
U2F
/A7 13 12 A7
7404
U2B
/A8 3 4 A8
7404
U2E
/A9 11 10 A9
7404
U2C
WE 5 6 /WE
7404
U2D
/DIN 9 8 DIN
7404
VCC
R8 1.8K
/A10 10 U3C 8 A10
HI 9
74136
8/8, 20/4.4 or 12/4.2 UL
/DOUT
FAE 10 U4C 8
9
7438
DOUT
U1 and U2 must be 7404 for 2102/2125/2147.
64 RAM chips with Iih = 0.25 UL has total Iih = 16 UL.
7404 Ioh = 20 UL. 74LS04 Ioh = 10 UL.
2167 uses 32 RAM chips for Iih = 8 UL.
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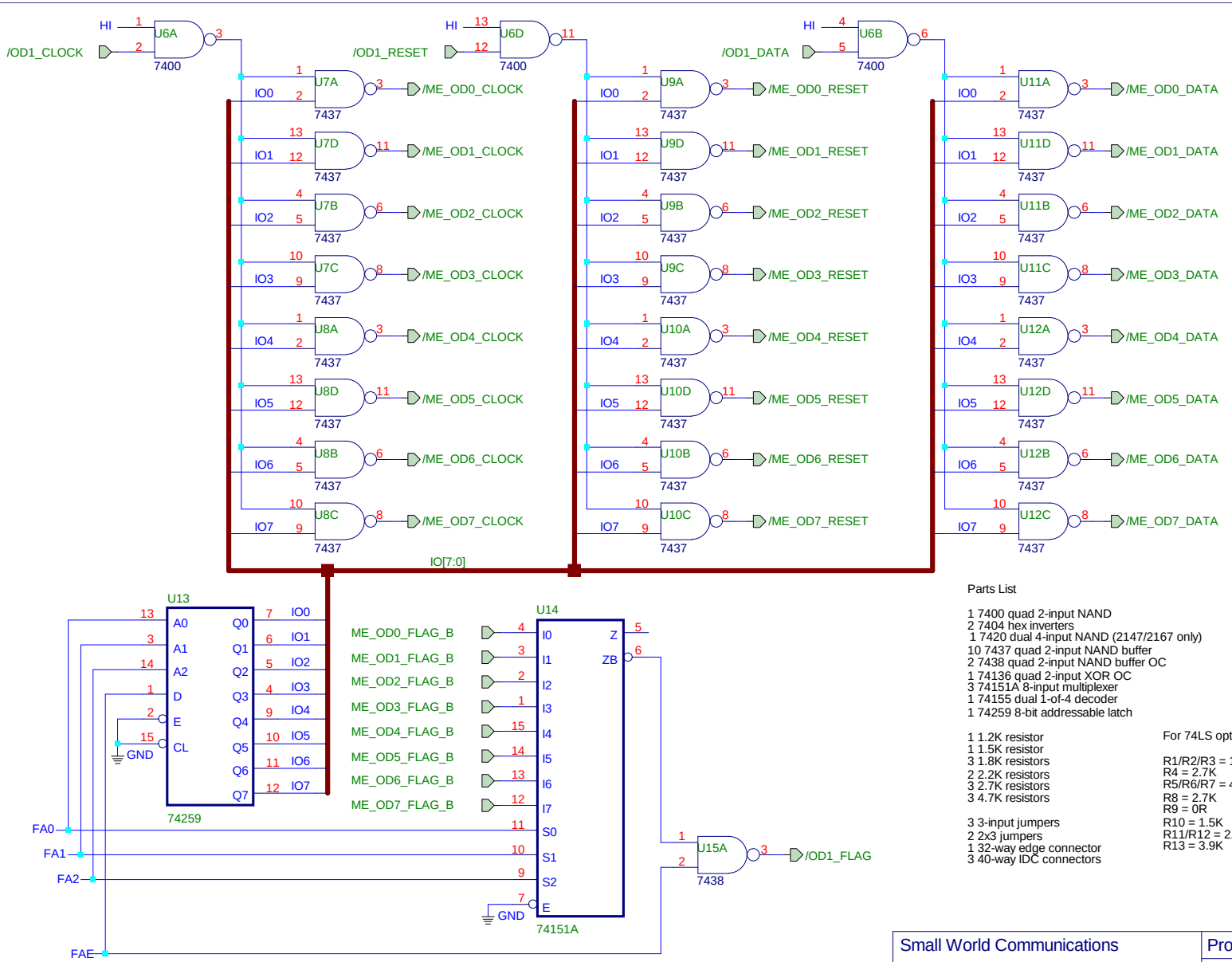
Date Last Modified: 6/7/24
Project: EDUC-8ME
Macro: E8ME/I1
Date: 1/22/22



If not using MUX do not use R13, U6 to U21, X8 and X9.

Parts List

1 7400 quad 2-input NAND
2 7404 hex inverters
1 7420 dual 4-input NAND (2147/2167 only)
10 7437 quad 2-input NAND buffer
2 7438 quad 2-input NAND buffer OC
1 74136 quad 2-input XOR OC
3 74151A 8-input multiplexer
1 74155 dual 1-of-4 decoder
1 74259 8-bit addressable latch

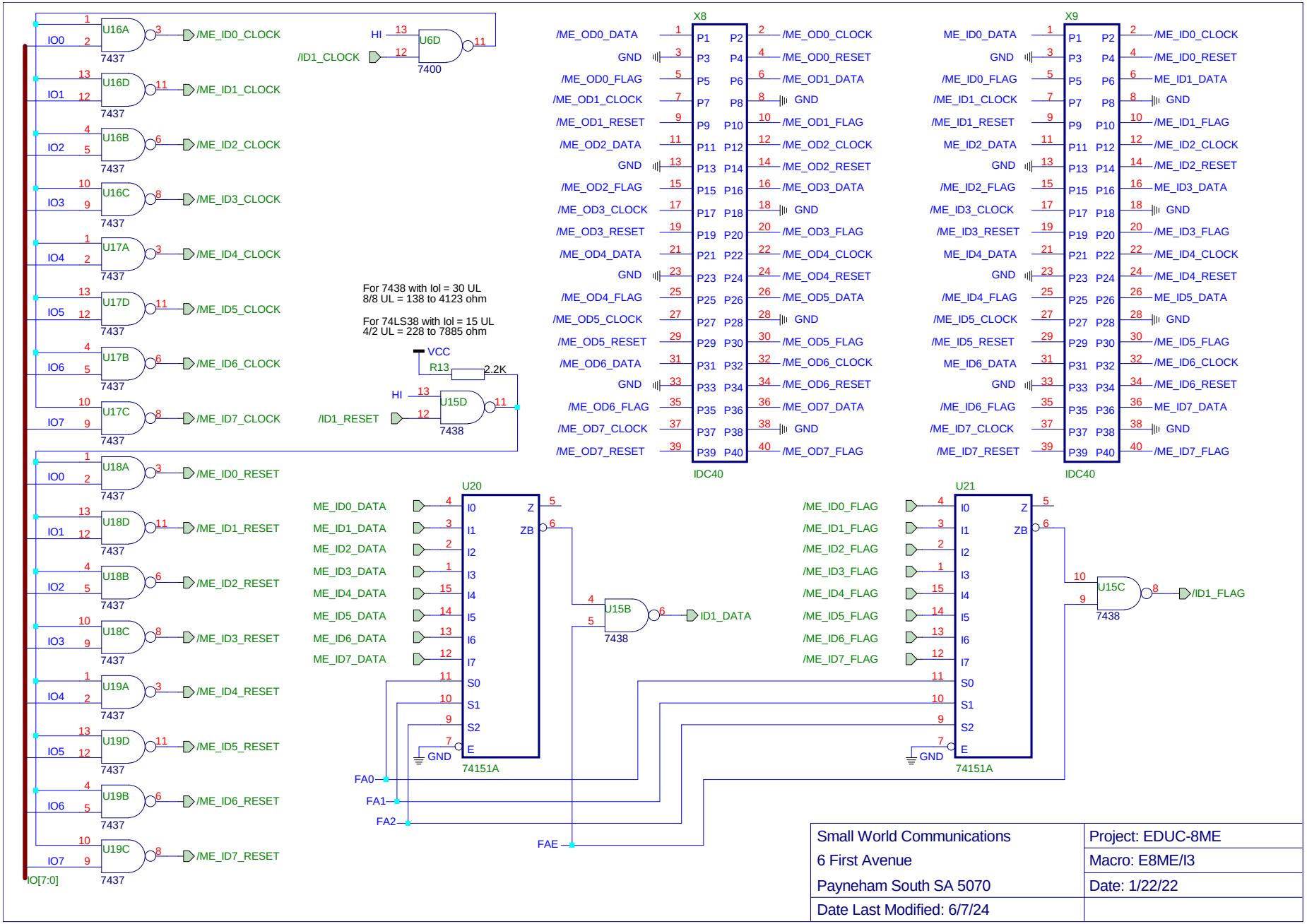
1 1.2K resistor
1 1.5K resistor
3 1.8K resistors
2 2.2K resistors
3 2.7K resistors
3 4.7K resistors

3 3-input jumpers
2 2x3 jumpers
1 32-way edge connector
3 40-way IDC connectors

For 74LS optionally use

R1/R2/R3 = 10K
R4 = 2.7K
R5/R6/R7 = 4.7K
R8 = 2.7K
R9 = 0R
R10 = 1.5K
R11/R12 = 2.2K
R13 = 3.9K

Small World Communications	Project: EDUC-8ME
6 First Avenue	Macro: E8ME/I2
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	


U16A
U16D
U16B
U16C
U17A
U17D
U17B
U17C
U18A
U18D
U18B
U18C
U19A
U19D
U19B
U19C
7437
IO0
IO1
IO2
IO3
IO4
IO5
IO6
IO7
IO[7:0]
/ME_ID0_CLOCK
/ME_ID1_CLOCK
/ME_ID2_CLOCK
/ME_ID3_CLOCK
/ME_ID4_CLOCK
/ME_ID5_CLOCK
/ME_ID6_CLOCK
/ME_ID7_CLOCK
/ME_ID0_RESET
/ME_ID1_RESET
/ME_ID2_RESET
/ME_ID3_RESET
/ME_ID4_RESET
/ME_ID5_RESET
/ME_ID6_RESET
/ME_ID7_RESET
HI
/ID1_CLOCK
U6D
7400
For 7438 with Iol = 30 UL
8/8 UL = 138 to 4123 ohm
For 74LS38 with Iol = 15 UL
4/2 UL = 228 to 7885 ohm
VCC
R13
2.2K
/ID1_RESET
U15D
7438
X8
IDC40
/ME_OD0_DATA
GND
/ME_OD0_FLAG
/ME_OD1_CLOCK
/ME_OD1_RESET
/ME_OD2_DATA
/ME_OD2_FLAG
/ME_OD3_CLOCK
/ME_OD3_RESET
/ME_OD4_DATA
/ME_OD4_FLAG
/ME_OD5_CLOCK
/ME_OD5_RESET
/ME_OD6_DATA
/ME_OD6_FLAG
/ME_OD7_CLOCK
/ME_OD7_RESET
/ME_OD0_CLOCK
/ME_OD0_RESET
/ME_OD1_DATA
/ME_OD1_FLAG
/ME_OD2_CLOCK
/ME_OD2_RESET
/ME_OD3_DATA
/ME_OD3_FLAG
/ME_OD4_CLOCK
/ME_OD4_RESET
/ME_OD5_DATA
/ME_OD5_FLAG
/ME_OD6_CLOCK
/ME_OD6_RESET
/ME_OD7_DATA
/ME_OD7_FLAG
X9
ME_ID0_DATA
ME_ID1_CLOCK
ME_ID1_RESET
ME_ID2_DATA
ME_ID2_FLAG
ME_ID3_CLOCK
ME_ID3_RESET
ME_ID4_DATA
ME_ID4_FLAG
ME_ID5_CLOCK
ME_ID5_RESET
ME_ID6_DATA
ME_ID6_FLAG
ME_ID7_CLOCK
ME_ID7_RESET
ME_ID0_CLOCK
ME_ID0_RESET
ME_ID1_DATA
ME_ID1_FLAG
ME_ID2_CLOCK
ME_ID2_RESET
ME_ID3_DATA
ME_ID3_FLAG
ME_ID4_CLOCK
ME_ID4_RESET
ME_ID5_DATA
ME_ID5_FLAG
ME_ID6_CLOCK
ME_ID6_RESET
ME_ID7_DATA
ME_ID7_FLAG
U20
U21
74151A
I0
I1
I2
I3
I4
I5
I6
I7
S0
S1
S2
E
Z
ZB
U15B
U15C
ID1_DATA
/ID1_FLAG
FA0
FA1
FA2
FAE
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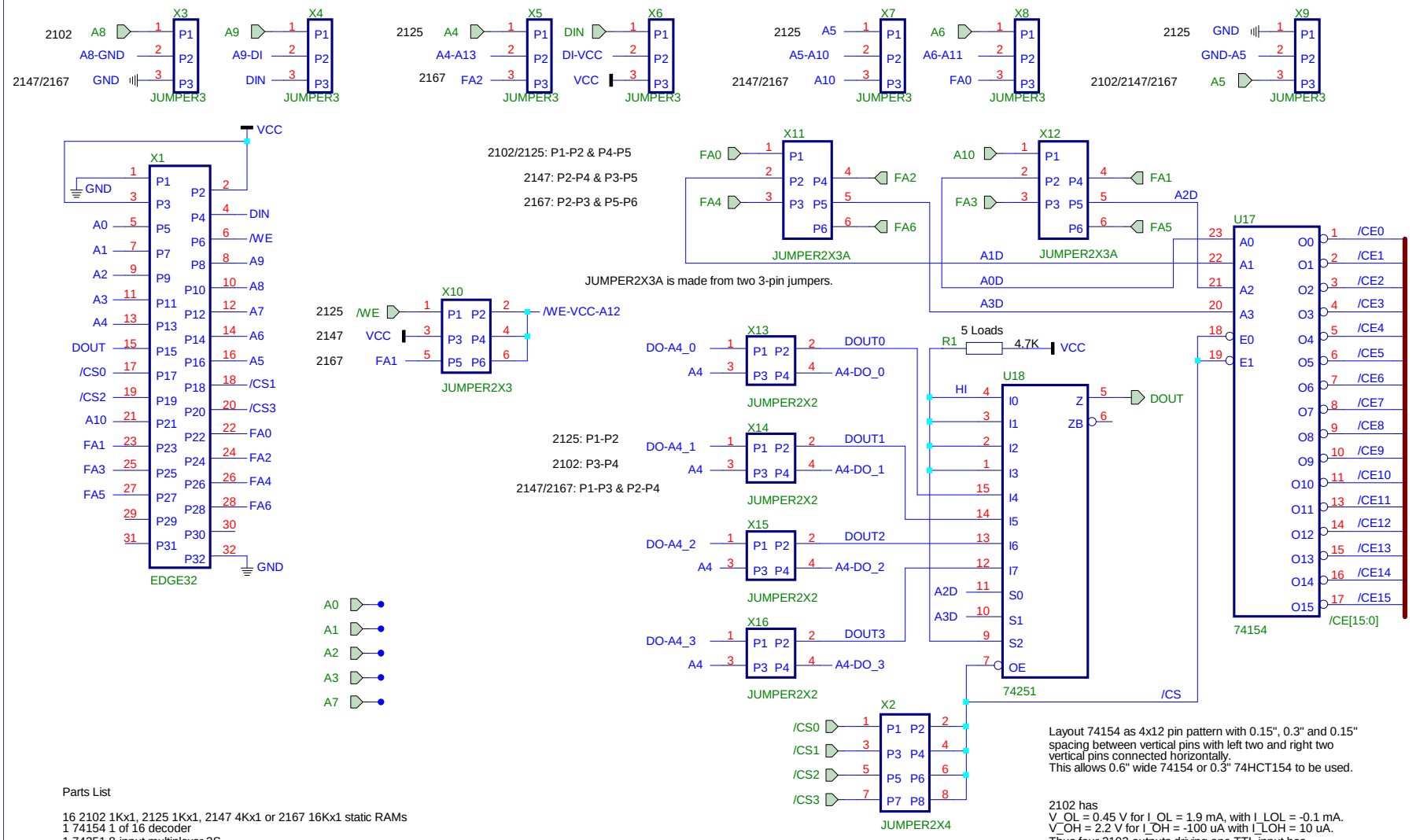
Date Last Modified: 6/7/24
Project: EDUC-8ME
Macro: E8ME/I3
Date: 1/22/22



Parts List

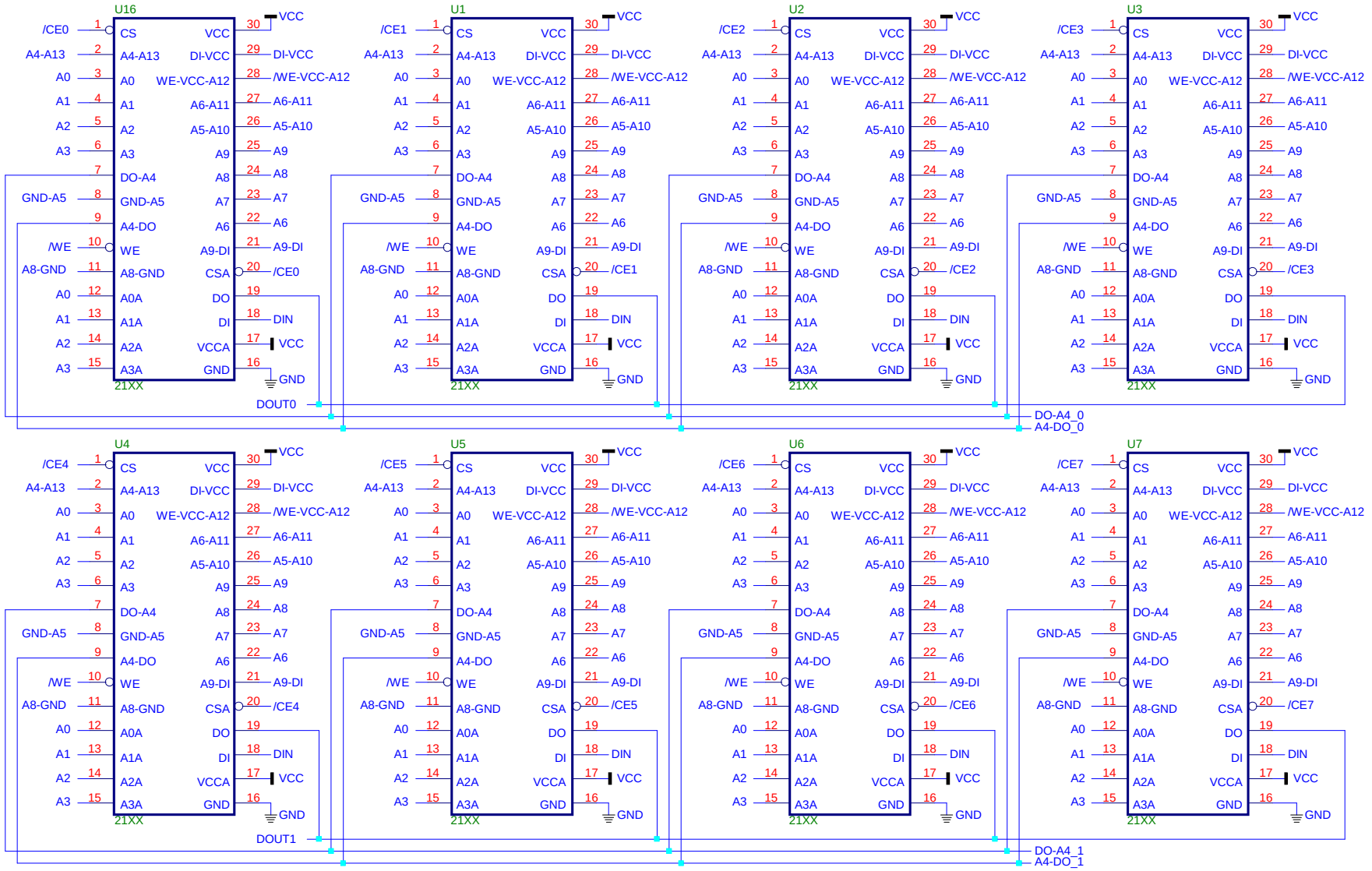
16 2102 1Kx1, 2125 1Kx1, 2147 4Kx1 or 2167 16Kx1 static RAMs
1 74154 1 of 16 decoder
1 74251 8-input multiplexer 3S
1 4.7K resistor
4 2x2 jumpers
1 2x3 jumper
1 2x4 jumper
11 3-pin jumpers
1 32-way edge connector

For 74LS optionally use
R1 = 0R

Layout 74154 as 4x12 pin pattern with 0.15", 0.3" and 0.15" spacing between vertical pins with left two and right two vertical pins connected horizontally.
This allows 0.6" wide 74154 or 0.3" 74HCT154 to be used.

2102 has
V_OL = 0.45 V for I_OL = 1.9 mA, with I_LOL = -0.1 mA.
V_OH = 2.2 V for I_OH = -100 uA with I_LOH = 10 uA.
Thus four 2102 outputs driving one TTL input has
I_L = -1.6-3*0.1 = -1.9 mA and I_H = 40+3*10 = 70 uA.

Small World Communications	Project: EDUC-8ME
6 First Avenue	Macro: E8ME/M1
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	



2102 1Kx1 SRAM. Fit 16-pin DIP to pins (8-15) & (23-16)
2125 1Kx1 SRAM. Fit 16-pin DIP to pins (1-8) & (30-23)
2147 4Kx1 SRAM. Fit 18-pin DIP to pins (3-11) & (28-20)
2167 16Kx1 SRAM. Fit 20-pin DIP to pins (2-11) & (29-20)

2125 compatible with TTL 93425 and CMOS 6508.

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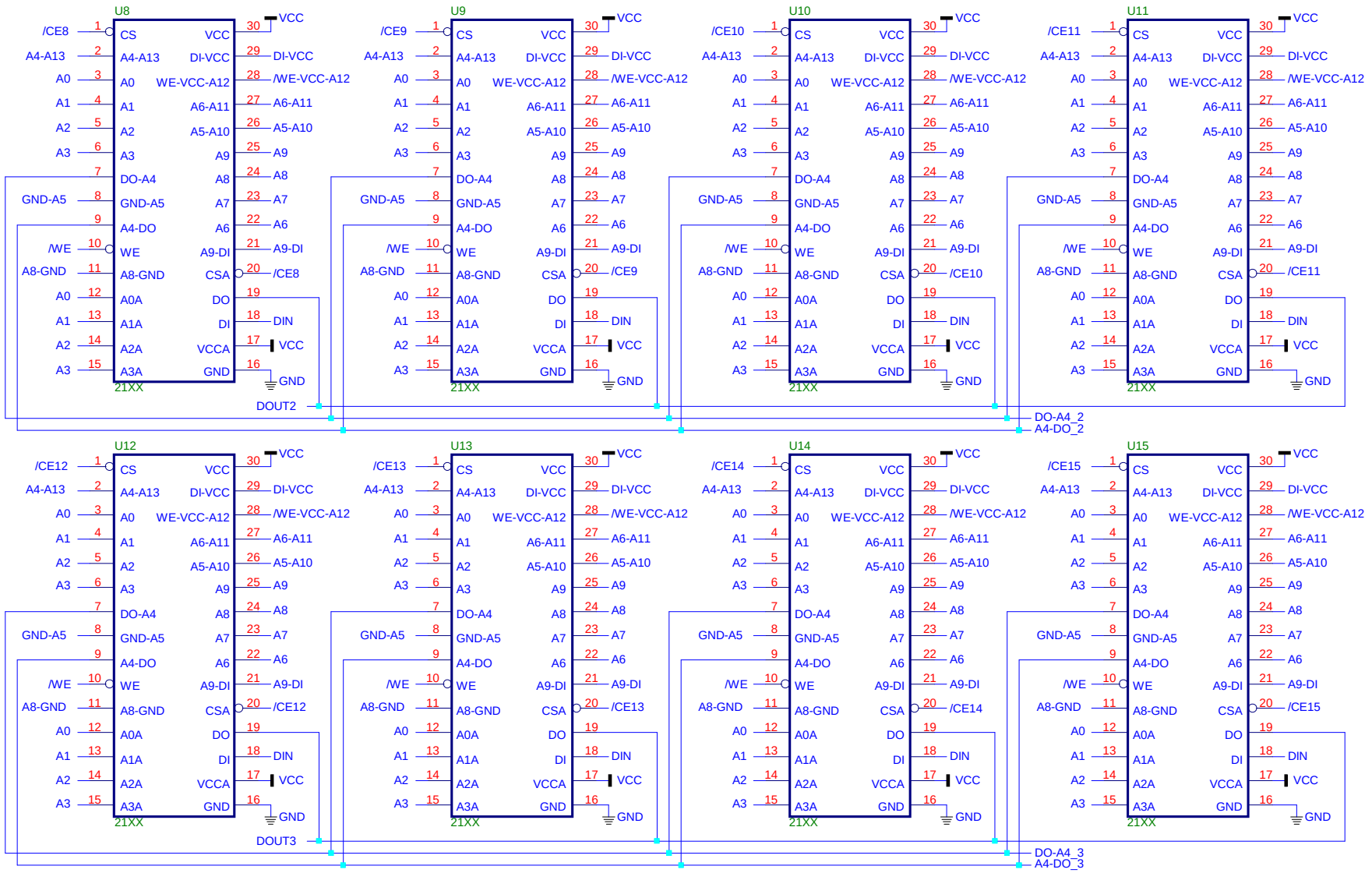
6 First Avenue	Macro: E8ME/M2
Payneham South SA 5070	Date: 1/22/22
Date Last Modified: 6/7/24	



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Date Last Modified: 6/7/24	