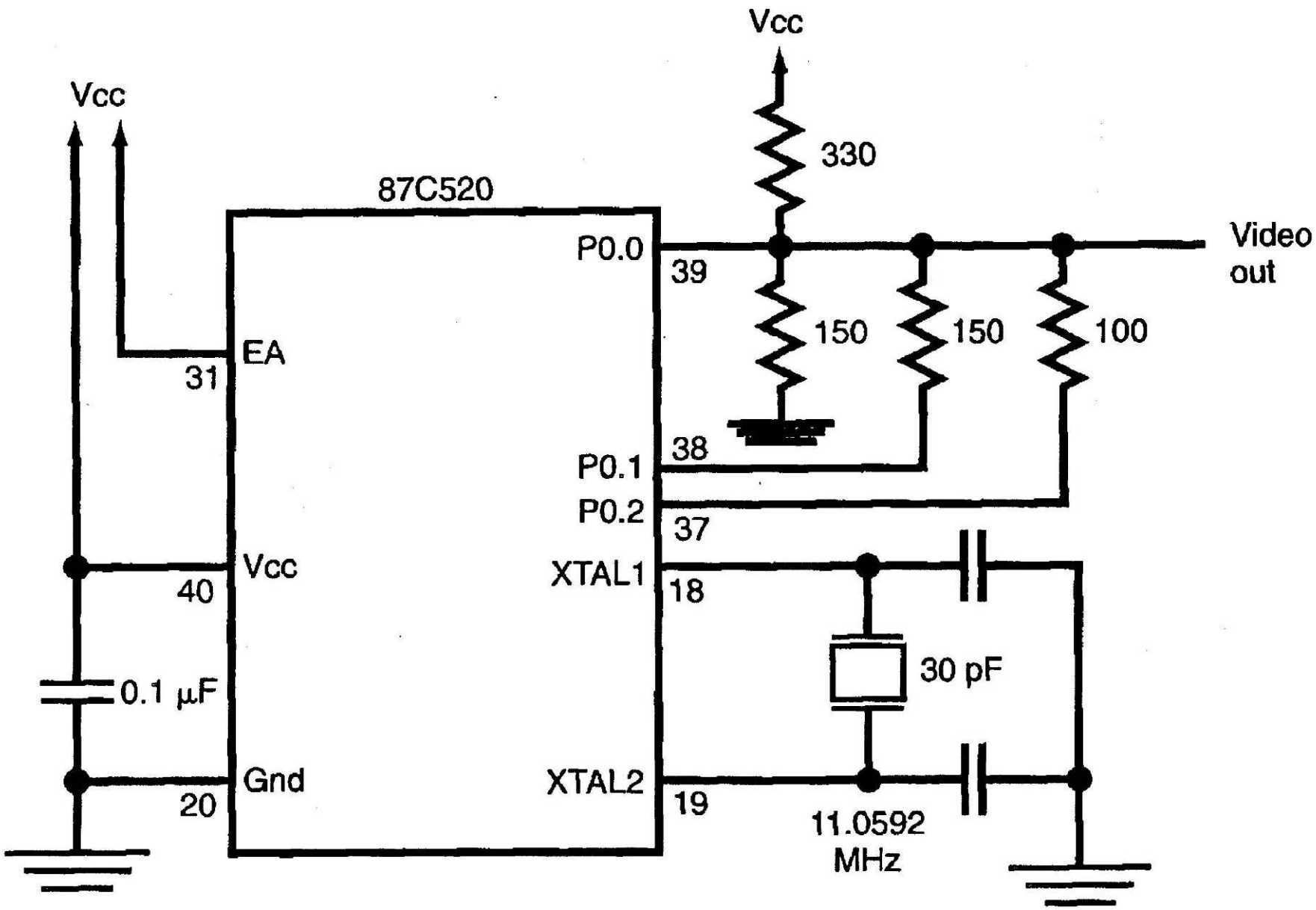
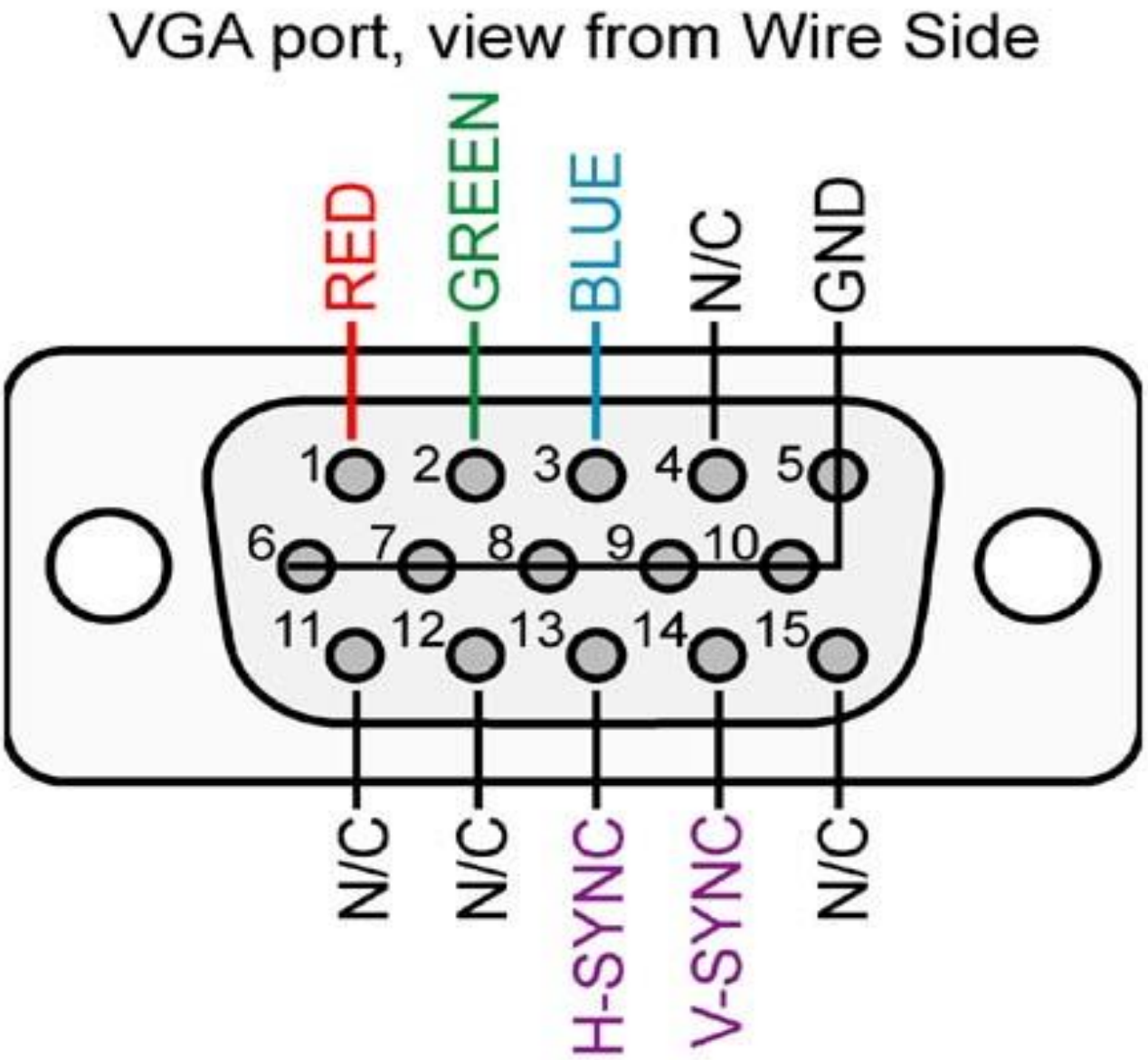

Vcc
Vcc
330
87C520
P0.0
39
Video
out
150
150
100
EA
31
38
P0.1
P0.2
37
Vcc
40
XTAL1
18
30 pF
0.1 µF
Gnd
20
XTAL2
19
11.0592
MHz

HOME
MOVIE

VGA Connection: D15 Sub-Miniature



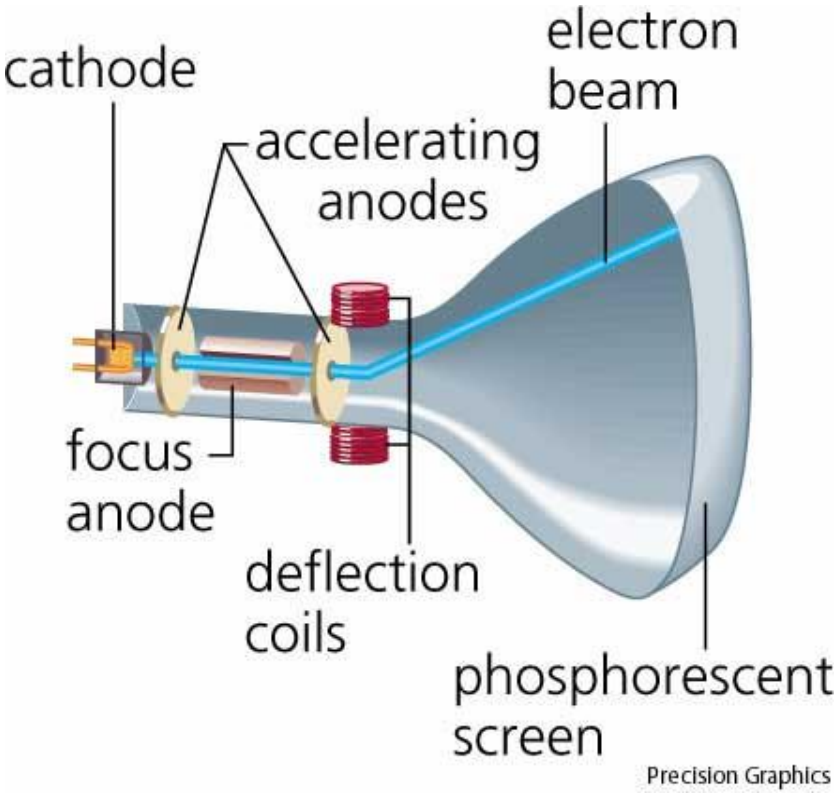
VGA: How does it work?

> the image is drawn line by line, frame by frame

> the monitor draws the image using 5 signals: **Hsync**, **Vsync**, **Red**, **Green**, and **Blue**

> each end of **line** is signaled by a **sync pulse** from **Hsync**

> each end of **frame** is signaled by a different sync pulse from **Vsync**



Syncing: Horizontal Sync

The **Hsync** signal has 4 parts:

> Horizontal Front Porch (**HFP**) - **0.94 µs**

> Horizontal Sync Pulse (**HSP#**) - **3.77 µs**

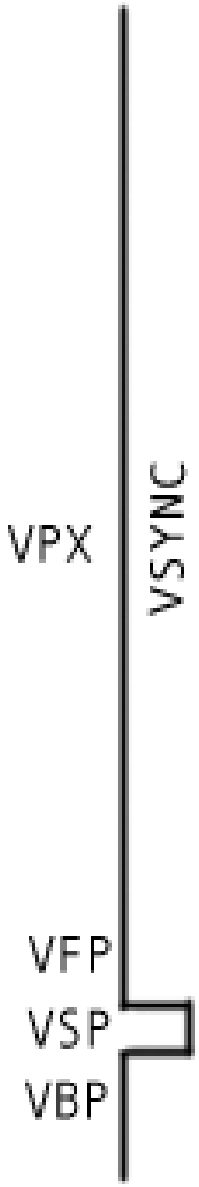
> Horizontal Back Porch (**HBP**) - **1.89 µs**

> Active Video Region (**HPX**) - **25.17 µs**

> **Total Time: 31.77 µs / Frequency: 31.4686 KHz**

# indicates signal is active low

Syncing: Vertical Sync



The **Vsync** signal also has 4 parts:

> Vertical Front Porch (**VFP**) - **11 lines** = 0.35 ms

> Vertical Sync Pulse (**VSP#**) - **2 lines** = 0.06 ms

> Vertical Back Porch (**VBP**) - **31 lines** = 1.02 ms

> Active Video Region (**VPX**) - **480 lines** = 15.25 ms

> **Total Lines: 524 lines / Frequency: 59.94 Hz**

Red, Green, and Blue

> R, G, and B signals are active only during the active video region (HPX & VPX)

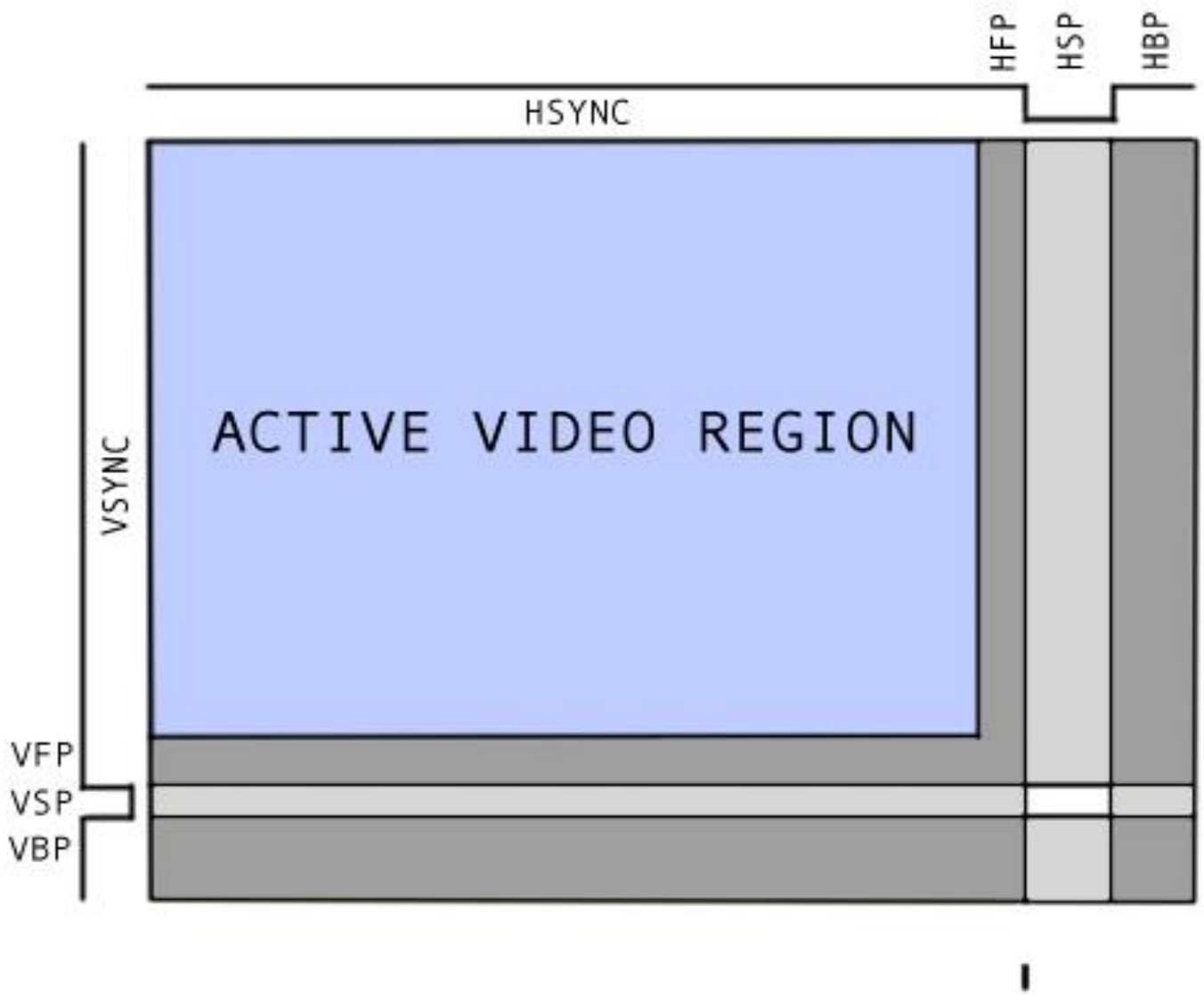
> RGB input to monitor must be btwn 0 V - 0.7 V

> varying voltage level varies color intensity

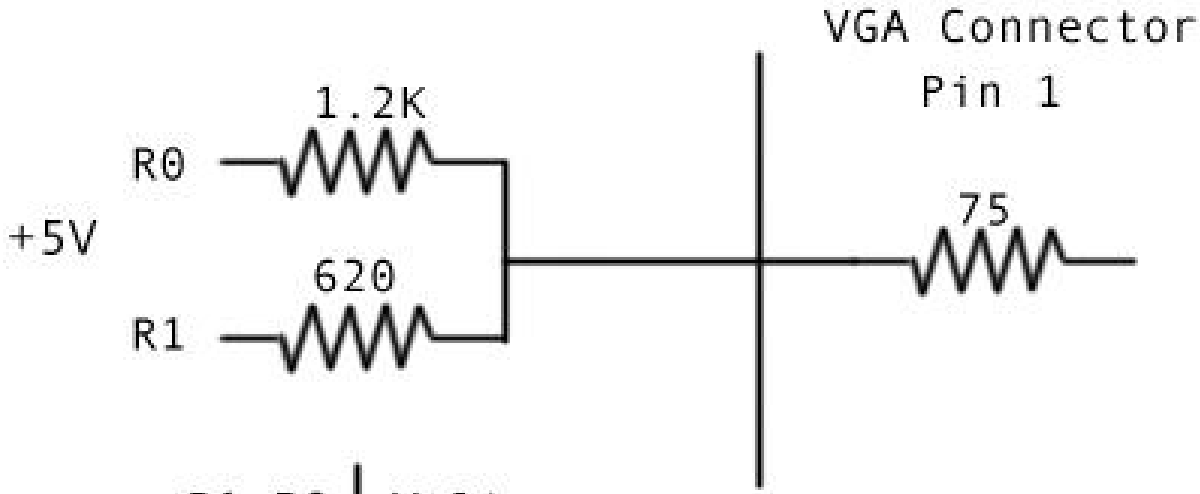
> if R, G, and B = 0 V, color output is black

> if R, G, and B = 0.7 V, color output is bright white

Active Video vs. Sync



Creating Color! (6-bit resistor DAC)



R1,R0	Voltage
0,0	0 V
0,1	0.29 V
1,0	0.54 V
1,1	0.77 V

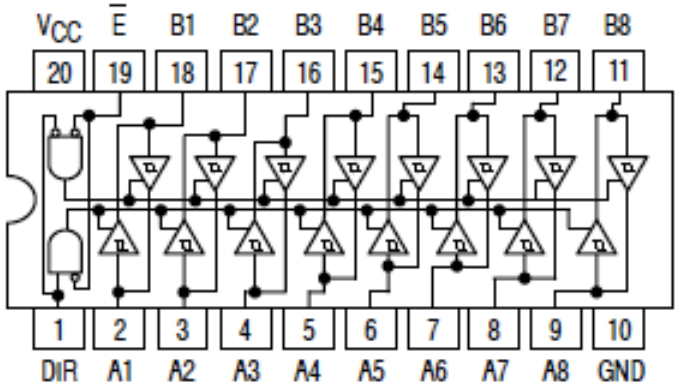
The 74LS245

Port 1's internal 30K resistors and the VGA connector's 75 Ohm impedance requires a buffer between the 89C430 and the VGA connector/DAC.

OCTAL BUS TRANSCEIVER

LOW POWER SCHOTTKY

LOGIC AND CONNECTION DIAGRAMS DIP (TOP VIEW)

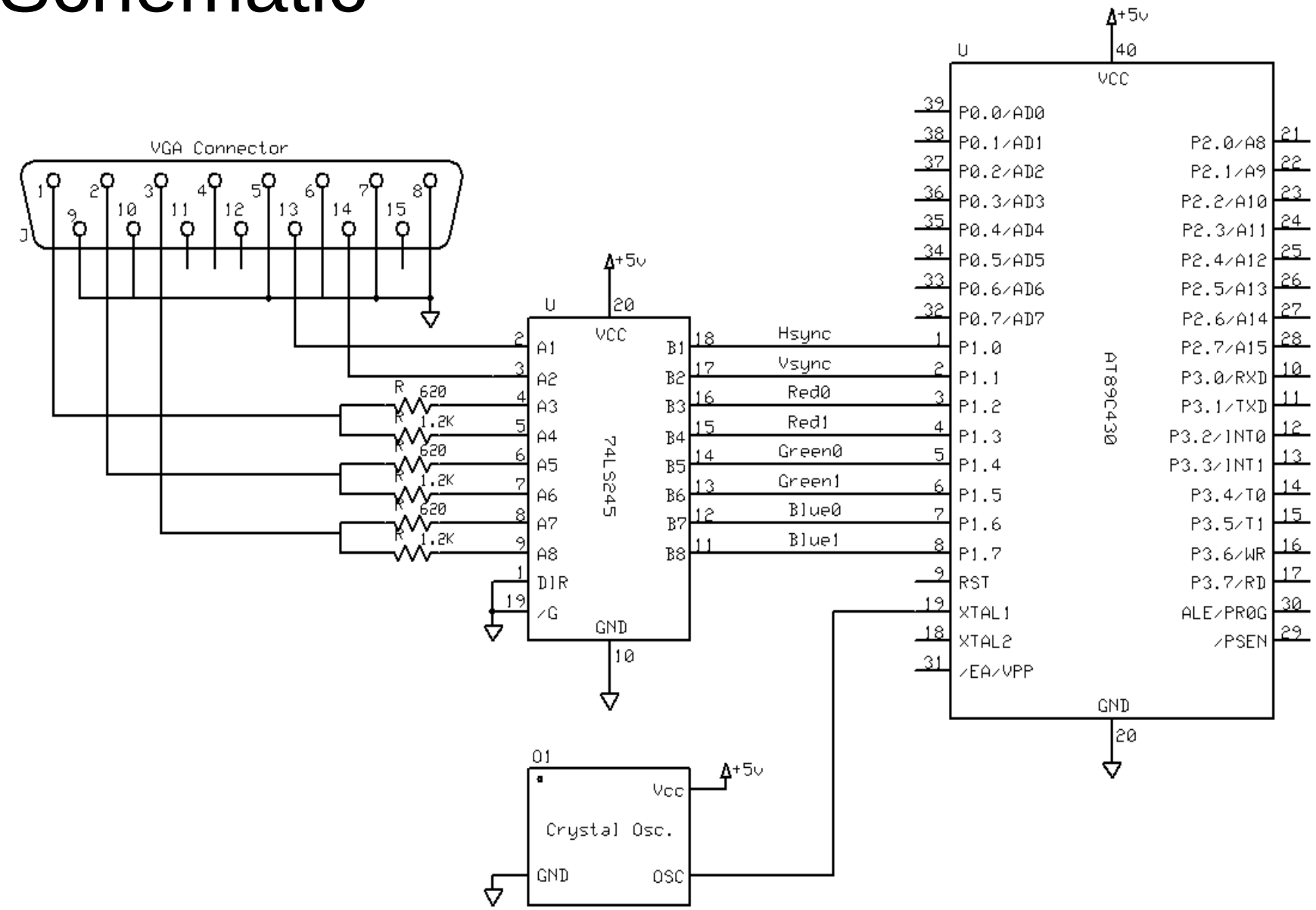


TRUTH TABLE

INPUTS		OUTPUT
E	DIR	
L	L	Bus B Data to Bus A
L	H	Bus A Data to Bus B
H	X	Isolation

H = HIGH Voltage Level
L = LOW Voltage Level
X = Immaterial

Schematic


VGA Connector
J
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
R 620
R 1.2K
R 620
R 1.2K
R 620
R 1.2K
U
74LS245
VCC
GND
+5v
20
10
A1
A2
A3
A4
A5
A6
A7
A8
DIR
/G
B1
B2
B3
B4
B5
B6
B7
B8
Hsync
Vsync
Red0
Red1
Green0
Green1
Blue0
Blue1
U
AT89C430
VCC
GND
+5v
40
20
P0.0/AD0
P0.1/AD1
P0.2/AD2
P0.3/AD3
P0.4/AD4
P0.5/AD5
P0.6/AD6
P0.7/AD7
P1.0
P1.1
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
RST
XTAL1
XTAL2
/EA/VPP
P2.0/A8
P2.1/A9
P2.2/A10
P2.3/A11
P2.4/A12
P2.5/A13
P2.6/A14
P2.7/A15
P3.0/RXD
P3.1/TXD
P3.2/INT0
P3.3/INT1
P3.4/T0
P3.5/T1
P3.6/WR
P3.7/RD
ALE/PROG
/PSEN
O1
Crystal Osc.
Vcc
GND
OSC
+5v