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Interfacing PIC18F46K22 MCU with VGA Monitor – Graphics Test Example

This post shows how to generate VGA signal using PIC18F46K22 8-bit microcontroller.

In this example the PIC18F46K22 MCU is used to draw shapes
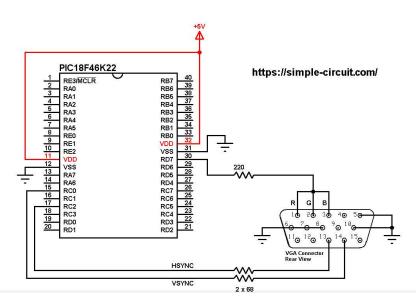
Hardware required:

- PIC18F46K22 microcontroller
- VGA monitor
- 2 x 68 ohm resistor
- 220 ohm resistor
- VGA connector
- 5V source
- Breadboard
- Jumper wires

Interfacing PIC18F46K22 MCU with VGA monitor circuit:

Example circuit diagram is shown below.

HSYNC (horizontal synchronization) pin of the VGA connector (pin #13) is connected to PIC18F46K22 microcontroller pin RC2 (#17) through 68 ohm resistor.
VSYNC (vertical synchronization) pin of the VGA connector (#14) is connected to PIC18F46K22 microcontroller pin RC0 (#15) through 68 ohm resistor.

Color pins (R: red, G: green, B: blue) of the VGA connector (respectively #1, #2 and #3) are connected together in order to get white and black colors, they are connected to PIC18F46K22 microcontroller pin RD7 (#30) through 220 ohm resistor.

In this project the PIC18F46K22 microcontroller runs with its internal oscillator @ 64 MHz (16 MIPS), MCLR pin is configured as input.

Interfacing PIC18F46K22 MCU with VGA monitor code:

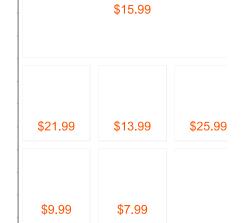The C code below is for CCS C compiler, it was tested with version 5.083.

The following CCS C code requires two libraries:
The first library is a simple and small library for generating the required VGA signals (VSYNC, HSYNC and video).
The HSYNC (horizontal synchronization) signal is generated on pin RC2 (fixed).
The VSYNC (vertical synchronization) signal is generated on pin RC0 (default), other pin may be used.
The video signal is generated on pin RD7 (fixed).

this interrupt the PIC18F46K22 outputs vertical synchronization
pulse and video signal.

So, to get a PWM signal of 31.496 kHz, CCP1 module is configured
to work in PWM mode using Timer2 module where the duty cycle is
set to 88%. You can find this setting with comments in function
named VGA_begin().

The VGA display has total of 525 lines, the VSYNC signal is
generated with frequency of about 60Hz (31.25 kHz/525) with
duty cycle of about 99%.

Note that this library uses all latch D register (PORTD), so
connecting another device to PORTD may give some wrong results,
but pins RD0~6 may still be used as inputs!

The actual displayed width of the VGA display is fixed to 160 pixel
and the height may be: 64, 96, 128 or 160 pixel where the default
height is 64 pixel.

The VGA library is configured to work with microcontroller
frequency of 64MHz (16 MIPS) and PIC18F46K22.
An image of the display is stored in the microcontroller RAM space
as a buffer (vga_buffer). The size of this buffer depends on the pre-
defined height of the display (default is 160×64/8 = .1280).
The default VGA buffer is filled with an image (house) as shown in
the above picture, I got it from MikroElektronika!

The VGA library is designed to work with graphics library which
helps us to easily draw many shapes and write texts with different
sizes. This library generates the video signal in 2 colors, connecting
the three color pins of the VGA connector together as shown in the
circuit diagram above will give black and white colors.

The VGA library download link is below, its full name (with
extension) is VGA.c:
VGA Library for CCS C compiler

Facebook Page:
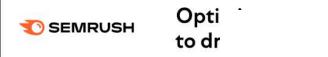
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After the download of the 2 library files, add both of them to the project folder.

Rest of code is described through comments.

Full CCS C code:

```
14  // uncomment only one of the following if you want to us
15  //#define VGAHEIGHT_96
16  //#define VGAHEIGHT_128
17  //#define VGAHEIGHT_160
18
19  // uncomment this line if you want to use VSYNC pin othe
20  //#define VSYNCPIN PIN_B2
21
22  #include <18F46K22.h>
23  #fuses  NOMCLR, NOLVP, NOBROWNOUT, PUT, NOXINST
24  #use delay(internal = 64MHz)
25  #use fast_io(c)
26  #use fast_io(d)
27  #include <VGA.c>          // include VGA driver source
28  #include <GFX_Library.c>  // include graphics library so
29  // define random max number
30  #define RAND_MAX  (display_width - 1)
31  // include std library source code (required by rand()
32  #include <stdlib.h>
33
34
35  #define NUMFLAKES 10
36  #define XPOS 0
37  #define YPOS 1
38  #define DELTAY 2
39
40  #define LOGO16_GLCD_HEIGHT 16
```

The video below shows my breadboard test circuit:

VGA

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