AWC

APP-Va Arm Development Kit

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Overview

The APP-V allows you to develop embedded applications using a power 32-bit Arm processor from NXP (the LPC1114). This CPU operates at 48MHz using very few external components. It also includes a PC board (the GPMPU40) which allows you to provide power to the board, connect a USB or RS-232 cable to the board, and optionally plug the board into a standard solderless breadboard. See the enclosed manual for the GPMPU40 for more information about this board (including assembly instructions).

If You Need Help

If you require assistance, please feel free to contact us. The best way to get support is via e-mail (support@awce.com). Or visit http://www.awce.com/support.htm. Be sure to check out our Web page for updates at http://www.awce.com.

What Else You'll Need

In addition to the APP-V kit, you'll also need a few other easy to obtain items:

- A solderless breadboard (optional)
- An unregulated power supply (DC between 8 and 13V) or a 3.3V regulated power supply. (optional if using USB power)
- Development software (several free options are described later in this manual)
- A PC with a USB port

Features

The LPC1114 CPU has A/D inputs, digital I/O, a hardware serial port and many other I/O devices usable by your programs. The device has 4K bytes of RAM, and 32K of program space. You can find a complete data sheet on the NXP web site.

Assembly

Assembly on the included PC board is straightforward. Note that most of the jumpers do not require installation unless you want to customize the board. In that case, carefully use a razor or hobby knife to cut the existing traces.

Components you must install:

- U1 – Use included socket
- R1, R2
- C1, C3
- You must connect the USB to serial cable to the USB (see table below)
- Boot jumper

Components you probably want to install:

- Reset jumper
- D1, R3 – LED connected to I/O port
- EDGE – Pins to breadboard or other external circuit

Components to install if using external unregulated power or USB power:

- U2 – 3.3V regulator if using external power (7833)

- C2

Components to install if using 3.3V external supply

- Connector or wire to PWR pins

This BOOT header allows you to select programming mode or execution mode by placing (or removing) a jumper on these two pins. With the jumper in place closest to the word BOOT, the APP-V will reset into bootloader mode to allow programming (via the download software). When the jumper is absent or on the far position, the APP-IV resets and runs your program.

By default, power is provided by the USB connector (isolate this with the PUSB jumper which is prewired by default). If isolated, you may provide up to 10V to the PWR holes. Either of these sources route to PSEL which is wired by default to connect them to the regulator to produce 3.3V. However, by cutting traces around PSEL and installing jumpers you can select other power options. Pin 1 of PSEL goes to the regulator input

The USB cable supplied may have a different pin out than required. Starting with pin 1, the wire color should be: red, black, white, green, blue and yellow (note: the blue and yellow wires just go to the HS header, so their order is not especially important). If the cable wire order is not the same, you can either pull the wires and rearrange them (use a pin or needle to lift the little plastic tabs slightly and pull the wire from the back of the connector). You can also cut the connector off and solder the wires directly to the board in the correct order.

Note that U3 and U4 are spare. These allow you to install small ICs or devices and connect them through the adjacent pins. You could install an 8 pin op amp, an EEPROM, a Bluetooth module, or a can oscillator, for example.

Here are the jumper connections on the board:

Jumper Name	Purpose	Notes
AEXT	Allows separate Analog Vdd	Tied to Vdd if not cut
BOOT	Select boot mode (pins 1 and 2 shorted)	Install pins here
EXT PWR	Connects PWR jumper to PSEL	Shorted by default; no jumper required
HS	Handshaking lines from USB serial port	Not required for default use
PSEL	Select power source	Pin 1: connects to regulator (U2) input Pin 2: connects to board 3.3V supply Pin 3: connects to PUSB and EXT PWR jumpers Pin 4: connects to U2 output By default, Pin 1 and 3 connect and pins 2 and 4 connect; no jumper required
PUSB	Allows USB power to be isolated	Shorted by default; no jumper required
PWR	External power connector	Not required by default
RESET	Short pins 1 and 2 to reset board	Install jumper or reset switch
TTLSER	Alternate serial port connection (same pin out as AWC RS-1 board)	Not used by default
USB	Connector for USB serial cable	1=5V (Red) 2=Ground (Black) 3=TXD (White) 4= RXD (Green) 5=CTS (Blue) or RTS 6=RTS (Yellow) or CTS

The LPC1114 has an internal 12MHz clock that can be used to generate a 48MHz system clock. However, if you wish to use an external resonator, you can connect one in the X1 slot. Use one with internal capacitors. If you wish to use a crystal, you may have to add external capacitance (perhaps using the spare area on U3 or U4).

Programming

You can use any standard bootloader programmer to generate to program a bin or hex file using the serial port or USB serial port. Suggested is the lpc21isp tool found here: https://github.com/Zuph/lpc21isp. If you prefer Windows or Mac prebuilt GUI tools, try FlashMagic at http://www.flashmagictool.com/. If you are using an IDE, it may have a programmer built in.

As an example, this would be a typical lpc2isp command if you had a file named TEST.BIN to program:

```
lpc21isp -bin TEST.BIN COM1 115200 48000
```

The bootloader automatically detects baud rate (115200, in this case) and needs to know the clock frequency in kilohertz (48000).

Regardless of software, you must short the bootloader jumper and then momentarily short the reset jumper. After reset, you can remove the bootloader jumper. This is also useful to boot the chip in a known state if you accidentally program a bad clock option, for example).

Because the board will plug into a breadboard, it is easy to connect an LPC-Link or LPC-Link 2 board into a breadboard and make the SWD connections to the chip to do programming (and debugging). Refer to the documentation for the LPC-Link for details. However, in general, it is sufficient to connect pin 2 of the link board to pin 3 of the CPU and pin 3 of the link board to CPU pin 12. You also need a ground connection to the link board on its pin 8.

Compilation Tools

You may compile programs for the LPC1114 online at http://www.mbed.org (not affiliated with AWC). This IDE and library allows you to download a BIN file that you can program using one of the methods previously discussed.

You can also use a variety of other compilers including LPCXpresso, GCC, and others.

Resources

http://www.al-williams.com/app5.htm – Examples and files

http://www.mbed.org – Online IDE compatible with LPC1114

http://www.lpcware.com/ - Tools for LPC development

https://github.com/Zuph - Flash tool and example code

http://www.flashmagictool.com/ - Flash tool

http://www.nxp.com/documents/data_sheet/LPC111X.pdf - Data sheet

http://www.nxp.com/documents/user_manual/UM10398.pdf - CPU user's manual

Schematic Diagram