[DA1-0039-UM01-010V01-EN]



APG221 USB-IDE User Manual

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Chapter 1 Introduction

APG221 is a feature-rich 8051 based micro-controller with hardware debug support. A debug monitor is developed to use the built-in USB device module to interface with the debugger software on the PC side. With USB filter driver architecture in Windows OS, debug and application channel can be multiplexed on the same USB connection.

With such an approach, power supply, debug interface and application interface to APG221's development board is possible, with a single USB connection.

Keil's uVision IDE is the development platform for APG221. For the debug monitor to connect to Keil's debugger, a debugger plug-in (in DLL form) is developed according to Keil's application note (<u>http://www.keil.com/appnotes/docs/apnt_145.asp</u>).

In this document, procedures to install the debugger plug-in, as well as how to use it for development with the Keil uVision IDE, will be described.

Chapter 2 APG221 EVK (Evaluation Kit)

The APG221 EVK board is a hardware platform for evaluation of the APG221 micro-controller. With the APG221 USB-IDE, application debugging can be easily achieved.

Description of the connectors and jumpers are described in the following figures.



Chapter 3 Installation

3.1. Install Keil uVision IDE for 8051

The APG221 USB-IDE works with Keil's uVision 2, 3 or 4 for 8051.

Skip this part if uVision has already been installed.

An evaluation copy of uVision 4 is included in the installation package (in folder "KeilUV4EvaVer"). Simply start the installer and follow the instructions to install it.

3.2. Install APG221 USB-IDE

The installer can be found in folder "Setup". For 32/64 bit system, installer "Setup.msi"/"SetupX64.msi" should be executed.

To check what version your Windows is, press "Start" and then right-click on "My Computer" (or "Computer" for Windows 7) and select "Properties".

Control Panel +	System and Security 🔸 System		Search Control Panel
Control Panel Home Device Manager Remote settings System protection Advanced system settings	View basic information Windows edition Windows 7 Professional Copyright © 2009 Microso	about your computer ft Corporation. All rights reser	ved.
	System Rating: Processor: Installed memory (RAM):	System rating is not availabl Pentium(R) Dual-Core CPU 1.00 GB	e E5300 @ 2.60 GHz 2.62 GHz
	System type: 🔇 🔇	64-bit Operating System	
	Pen and Touch:	No Pen or Touch Input is av	ailable for this Display
	Computer name, domain, and	workgroup settings	
See also	Computer name:	WIN-B0M6B8O8DU9	Change settings
Action Center	Full computer name:	WIN-B0M6B8O8DU9	
Windows Update	Computer description:		
Performance Information and Tools	Workgroup:	WORKGROUP	
	Windows activation		

When the installer is executed, the welcome page will be shown.



Press "Next" to proceed.

🛃 APG221 USB-IDE
Select Installation Folder
The installer will install APG221 USB-IDE to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Eolder: C:\Keil\ Disk Cost Install APG221 USB-IDE for yourself, or for anyone who uses this computer:
O E veryone
⊙ Just me
Cancel < Back Next >

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Select the installation folder and press "Next".



Press "Next" to start installation.



Connect the APG221 EVK to PC through USB cable to complete the USB device

driver installation. Make sure that J10 is on the VBUS side and that the power LED is turned on.

The "Found New Hardware Wizard" dialog box will pop up.



Select "No, not this time" and press "Next".

Found New Hardware Wizard			
	This wizard helps you install software for: AppoTech USB Debug Monitor If your hardware came with an installation CD or floppy disk, insert it now.		
	 Install the software automatically (Recommended) Install from a list or specific location (Advanced) 		
	Llick Next to continue.		
	<pre></pre>		

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Select "Install the software automatically (Recommended)" and press "Next".



Press "Finish" to complete USB device driver installation.



After USB device driver installation, press "Next" to install the LibUsb filter

driver.

REMARK: The USB device driver is used by applications to access the USB device, while LibUsb filter driver is used by the debugger plug-in to connect to the debug channel of the device (in parallel to the normal USB connection).

The LibUsb Filter (Driver) Installer will pop up.

libusb-win32 filter installer
Information This program adds/removes libusb-win32 as a driver to an existing device installation. The libusb-win32 filter driver allows access to usb devices using the libusb-win32 api while maintaining compatibility with software which uses the original driver.
Install/Remove Device Filter(s) Install a device filter Remove a device filter Remove all device filters
Next > Cancel

Press "Next" to install the filter driver.

libusb-win32 filter installer		
Device Selection Connect your device and select it from device isn't listed, it may already be filt incompatible with the libusb-win32 filte	the list of unfiltered devices below. ered, be in a "driverless" state, or r driver.	lf your
Hardware ID	Description	м
vid:1908 pid:332c rev:0100	AppoTech USB Debug Monitor	Ap
vid:0e0f pid:0003 rev:0101 mi:01	USB Human Interface Device	(5)
vid:0e0f pid:0003 rev:0101	USB Composite Device	(5)
<		>
	< Back Install	Cancel

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APG221 USB-IDE

From the list of connected USB devices, select the one with description of "AppoTech USB Debug Monitor" and press "Install".



Confirm that the filter has been successfully installed.

🚦 libus	b-win32 filter installer		
Conr Conr devia incor	e Selection nect your device and select it from t :e isn't listed, it may already be filte npatible with the libusb-win32 filter	he list of unfiltered devices below. red, be in a "driverless" state, or driver.	If your
Ha	ardware ID	Description	м
vid vid vid	:0e0f pid:0003 rev:0101 mi:01 :0e0f pid:0003 rev:0101 mi:00 :0e0f pid:0003 rev:0101	USB Human Interface Device USB Human Interface Device USB Composite Device	(S) (S) (S)
<	III.		
		: Back Install	Cancel

Press "Cancel" to exit the LibUsb Filter Installer.

🛱 APG221 USB-IDE			
Installation Complete			
APG221 USB-IDE has been successfully	installed.		
Click "Close" to exit.			
	Cancel	< Back	Close

APG221 USB-IDE has been successfully installed.

3.3. Install LibUsb Filter Driver Manually

When an application with USB device function is developed, APG221 will appear as a USB device other than the "AppoTech USB Debug Monitor".

For the newly developed USB device to work with Windows OS, the developer has to install an appropriate device driver (unless matched USB class driver is available).

For the uVision debugger to connect to the debug channel of the newly developed USB device, a new LibUsb filter has to be installed. To do it, simple execute the appropriate LibUsb Filter Driver Installer (in folder "LibUsb") and select the device for which the filter is to be installed (as illustrated in the above figures).

Chapter 4 Test with the sample applications

Two sample applications are included in the installation package. Users may follow the steps described below as a tutorial of how to use the USB-IDE for application development and debugging.

4.1. The LED sample application

This is an example of how to use the APG221 I/O pins to turn LEDs on and off. Both delay loop and timer interrupt are used for timing control.

4.1.1. Build the sample application

- Copy folder "TestApp\LedTest" to desired location
- Double-click on file "SRC\LedTest.uvproj" to start uVision4 (or SRC\uv2\LedTest.uv2" to start uVision 2 or 3)
- Click on main menu item "Project"/"Rebuild all target files" to rebuild the project
- Verify from the output window that the build is completed successfully with no error

4.1.2. Configure debugger

• In uVision, right-click on "Target 1"

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• Select "Options for Target 'Target 1'...

C Use Simul	ator Setting d to Real-Time	gs 0 Use: APC	221 Debug Monitor ▼ Settings
Load App Initialization Fi	ication at Startup 🔽 Run to main() e:	✓ Load Applie Initialization File	cation at Startup 🔽 Run to main() a:
Restore Del V Break V Watch V Memo	oug Session Settings points I⊄ Toolbox points & PA y Display	Restore Deb	ug Session Settings oints 🔽 Toolbox ooints Display
CPU DLL:	Parameter:	Driver DLL:	Parameter:
\$8051.DLL		\$8051.DLL	- [
Dialog DLL:	Parameter:	Dialog DLL:	Parameter:
DP51.DLL	-p52	TP51.DLL	-p52

• Select tab "Debug" and select "APG221 Debug Monitor" in the list box

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4.1.3. Connect EVK board

- Make sure that jumper JP9 (Bootmode Select) is on the "Monitor" ("GND") side
- Connect the EVK board to PC through USB cable
- Confirm that "Power LED" is turned on

4.1.4. Debug sample application

- In uVision, click on main menu item "Debug"/"Start/Stop Debug Session" (or press shortcut key Ctrl-F5).
- Confirm that debugger is started and then paused at main().
- Select main menu item "View"/"Serial Windows"/"UART #1".



 Press F5 to run and confirm that debug messages are printed to the "UART #1" window and that LED D2, D3 and D4 are flashing

UART #1	Ø×
Led Test	~
	~
3	

- Click on the STOP icon <u>8</u> to pause.
- In the "Watch 1" window, double-click on the line "<double-click or F2 to add> and type "abc" to add variable to watch window.
- Add a breakpoint to line 78 of "main.c" (by double-click on the righthand-side of the line).



- Press F5 to run and confirm that debugger aborts at the breakpoint. Note value of "abc".
- Repeatedly press F5 and confirm that value of "abc" is incremented by 1 everytime the debugger aborts.
- Press Ctrl-F5 to stop debug session.

4.1.5. Flash programming

 Click on main menu item "Flash"/"Configure Flash Tools..." and select "APG221 Debug Monitor"

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APG2	21 Debug Monitor	✓ Settings	Update Target before Debugg	ing
Init File:	-20		Edit	
C Use External Too	l for Flash Programming			
Command:				-
Arguments:				
Г Bu	n Independent			

- Click OK
- Click on main menu item "Flash"/"Download" (REMARK: flash will be erased before program)
- The following messages should be displayed in the "Build Output" window:
 Build Output



4.1.6. Test boot modes

A) Normal Mode

- Short jumper JP9 (Bootmode Select) to "Normal" (i.e. to "VCC 3.6")
- Reset EVK board (by pressing the RESET button or unplug-plug the USB cable)
- Confirm that sample program is running (indicated by flashing LED D2, D3 and D4)

B) Monitor Mode

- Short jumper JP9 (Bootmode Select) to "Monitor" (i.e. to "GND")
- Reset EVK board (by pressing the RESET button or unplug-plug the USB cable)
- Confirm that sample program is not running (LEDs for testing are not flashing)
- Press CTRL-F5 to start debug session
- Confirm that debugger is started and then paused at main().

4.2. The HID sample application

In this example, the APG221 functions as a HID USB device. LED D2, D3 and D4 on the EVK board can be turned on/off through a PC application that control the HID device. Status of jumpers JP8 and JP9 on the EVK board will be indicated on the PC application.

4.2.1. Build the sample application

- Copy folder "TestApp\HidTest" to desired location
- Double-click on file "SRC\HidTest.uvproj" to start uVision4 (or SRC\uv2\HidTest.uv2" to start uVision 2 or 3)
- Click on main menu item "Project"/"Rebuild all target files" to rebuild the project
- Verify from the output window that the build is completed successfully with no error

4.2.2. Configure debugger

• In uVision, right-click on "Target 1"

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• Select "Options for Target 'Target 1'...

ptions for Target 'Target 1'				
Device Target Output Listing User C51 A51 C Use Simulator E Limit Speed to Real-Time	BL51 Locate BL51 Misc Debug Utilities			
✓ Load Application at Startup ✓ Run to main() Initialization File:	Load Application at Startup Run to main() Initialization File:			
Restore Debug Session Settings Breakpoints Toolbox Watchpoints & PA Memory Display	Restore Debug Session Settings			
CPU DLL: Parameter:	Driver DLL: Parameter:			
\$8051.DLL	S8051.DLL			
Dialog DLL: Parameter: DP51.DLL -p52	Dialog DLL: Parameter: TP51.DLL -p52			
OK Ca	ncel Defaults Help			

- Select tab "Debug" and select "APG221 Debug Monitor" in the list box
- Click on "Settings"

• Enter "DEAD" for VID and "BEEF" for PID as follows:

APG221 USB Debug Monitor Setup
USB VID : 0× DEAD
USB PID : 0× BEEF
ОК

4.2.3. Hardware setup

- Make sure that jumper JP9 (Bootmode Select) is on the "Monitor" ("GND") side
- Connect the EVK board to PC through USB cable
- Confirm that "Power LED" is turned on

4.2.4. Execute sample application

- In uVision, click on main menu item "Debug"/"Start/Stop Debug Session"
- Confirm that debugger is started and then pauses at main()
- Select main menu item "View"/"Serial Windows"/"UART #1"

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C:\work\TestApp\H	idTestWer0.1\SRC\HidTest.uvproj - µVision4	
File Edit View Projec	tt Flash Debug Peripherals Tools SVCS Window Help	
i 🗋 💕 🖬 🗿 🐰	14 18 ウ で ← ⇒ 作 作 作 作 作 注 詳 准 版 20 ● ● ● ● ● ● ● ● ●	ି 🔗 🍓 🔳 🚽
👫 🗉 🚳 79 ()	+ (+ *0 ⇒ ⊇ ဩ = (2, ∭ • = • ⊒ • ⊒ • ⊒ • ≫ • ⊒	
Registers 🥑 🗙	Disassembly 🥑 🗙	Symbols 🕜 🕨
Register	84: void main()	M <u>a</u> sk:
E Regs	85: (Name A. Type
10	87: char xdata line[80];	
r2	88: #endif	🗄 🛃 P
r3		E H. Appl
r4	🕐 usbDesc.c 📄 usbDesc.h 📄 usb.h 📄 main.h 📄 bw2210.h 🖆 usb.c 🗡 main.c 🔻 🗙	
15	084 void main()	🗄 🛄 Mod
17	085 {	H m Mod
l⊟ Sys	087 char xdata line[80];	
в	088 #endif	
\$P	089 u8_t portIVal;	
dptr	091 u8 t count;	
FL \$	092	
	C)093 DPCON &= 0x3F; // clear bit746 => vector base address = 0	
	095 #ifdef ENABLE UART DEBUG	
🖻 Project 🚟 Regist		
UART #1	🧷 🗙 Call Stack	g,
	Callee Caller	
	000: \MAIN\MAIN \?C_STARTUP\(0	CvtB}\127
<	×	
Command	1 Call Stack BLocals Memory 1	
		000 sec .

• press F5 to run

APG221 USB Debug Monitor	×
Please connect target	
Abort	

- Dialog box with message "Please connect target ..." will be popped up.
- Execute application "install-filter-win.exe" in folder "LibUsb\x86" or "LibUsb\x64" according to the Windows OS version

🖁 libusb-win32 filter installer	
Information This program adds/removes libusb-win installation. The libusb-win32 filter driver allows ac while maintaining compatibility with sol	132 as a driver to an existing device cess to usb devices using the libusb-win32 api ftware which uses the original driver.
Install/Remove Device Filter(s)	
Remove a device filter Remove all device filters	
	Next > Cancel

• Press "Next"

Ibusb-win32 filter installer Device Selection Connect your device and select it from device isn't listed, it may already be filt incompatible with the libusb-win32 filte	the list of unfiltered devices below. rered, be in a "driverless" state, or r driver.	If your
Hardware ID	Description	М
vid:dead pid:beef rev:0100	USB Human Interface Device	(5
vid:0e0f pid:0003 rev:0101 mi:01	USB Human Interface Device	(SI
vid:0e0f pid:0003 rev:0101	USB Composite Device	(51
		>
	< Back Install	Cancel

 Select the "USB Human Interface Device" with VID "dead" and PID "beef", and press "Install"

ibusb-win32 device filter successfully installed for USB Human Interface Device (usb\vid_dead&pid_beef&re			
libusb-win32 device filter successfully installed for USB Human Interface Device (usb\vid_dead&pid_beef&rev			
ОК			

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• Confirm that the filter has been installed successfully

📱 li	busb-win32 filter installer		
	evice Selection Connect your device and select it from t device isn't listed, it may already be filter incompatible with the libusb-win32 filter (he list of unfiltered devices below. red, be in a "driverless" state, or driver.	If your
	Hardware ID	Description	м
	vid:0e0f pid:0003 rev:0101 mi:01 vid:0e0f pid:0003 rev:0101 mi:00 vid:0e0f pid:0003 rev:0101	USB Human Interface Device USB Human Interface Device USB Composite Device	(S) (S) (S)
			>
		Back Install	Cancel

- Press "Cancel" to terminate the LibUsb Filter Install
- Confirm that the dialog box with message "Please connect target ..." is closed and that debug messages are printed to the "UART #1" window as follows:



• Start application "TestApp\HidMfcDemo\OUTPUT\Release\HidDemo.exe"

HidDemo			
LED Control RED YELLOW	Jumper State Jumper 1 Jumper 2		
ок			

- Check/uncheck the checkboxes under "LED Control" and confirm that LED D2, D3 and D4 on the EVK is turned on/off accordingly
- Move the jumpers JP8 and JP9 on EVK board between "VCC3.6" and "GND" and confirm that the status under "Jumper State" changes accordingly

4.2.5. Flash programming

- Make sure that jumper JP9 (Bootmode Select) is on the "Monitor" ("GND") side and press the Reset button
- Click on main menu item "Flash"/"Configure Flash Tools..." and select "APG221 Debug Monitor"

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		Edit	
ash Programming			
pendent			
	ash Programming	ash Programming pendent	ash Programming

- Click OK
- Click on main menu item "Flash"/"Download" (REMARK: flash will be erased before program)
- The following messages should be displayed in the "Build Output" window:
- ٠

Build Output
Load "C:\\work\\TestApp\\HidTest\\Ver0.1\\SRC\\output\\HidTest"
Flash Erase Done.
Flash Write Done: 1397 bytes programmed.
Flash Verify Done: 1397 bytes verified.

4.2.6. Test boot modes

A) Normal Mode

- Short jumper JP9 (Bootmode Select) to "Normal" (i.e. to "VCC 3.6")
- Reset EVK board (by pressing the RESET button or unplug-plug the USB cable)
- Confirm that sample program is running (by checking the existence with

Device Manager for a "HID-compliant device" with VID=DEAD and PID=BEEF)



 Start application "TestApp\HidMfcDemo\OUTPUT\Release\HidDemo.exe" and confirm that it works as expected

B) Monitor Mode

- Short jumper JP9 (Bootmode Select) to "Monitor" (i.e. to "GND")
- Reset EVK board (by pressing the RESET button or unplug-plug the USB cable)
- Confirm that sample program is not running (LEDs for testing are not flashing)
- Press CTRL-F5 to start debug session
- Confirm that debugger is started and then paused at main().

4.3. The flash read/write sample application

• This is an example of how to read/write the internal serial flash of APG221.

4.3.1. Build the sample application

- Copy folder "TestApp\FlashTest" to desired location
- Double-click on file "SRC\FlashTest.uvproj" to start uVision4 (or SRC\uv2\FlashTest.uv2" to start uVision 2 or 3)
- Click on main menu item "Project"/"Rebuild all target files" to rebuild the project
- Verify from the output window that the build is completed successfully with no error

4.3.2. Configure debugger

• In uVision, right-click on "Target 1"



• Select "Options for Target 'Target 1'...

Rev 1.0.1

Run to main()		
Edi		
Freakpoints Watchpoints Memory Display		

• Select tab "Debug" and select "APG221 Debug Monitor" in the list box

4.3.3. Connect EVK board

- Make sure that jumper JP9 (Bootmode Select) is on the "Monitor" ("GND") side
- Connect the EVK board to PC through USB cable
- Confirm that "Power LED" is turned on

4.3.4. Debug sample application

- In uVision, click on main menu item "Debug"/"Start/Stop Debug Session" (or press shortcut key Ctrl-F5).
- Confirm that debugger is started and then paused at main().
- Select main menu item "View"/"Serial Windows"/"UART #1".

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File Edit View Project Flash Debug Peripherals Tools SVCS Window Help □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	
□ ☞ 및 및 メ 国路 이 여 (← →) 한 휴 휴 读 幸幸// 版 図	
	O' 👯 📃 📲 🎽
[: Řin] 💷 🐨 10 10 10 10 19 [소] 🕲 🔄 🔄 🖓 기 💷 기 💱 기 🔤 기 💹 기 🛄 기 🦉 기 🔤 기 🔛 기 🔛 기 🛄 기	
Registers $\mathcal{O} imes$ Disassembly $\mathcal{O} imes$ Syn	mbols 🖉 🗙
Register 54: void main() 55: (<u>a</u> sk: ×
r0 56: DPCON &= 0x3F; // clear bit7&6 => vector base address = 0 Na r0 57: Na Na <td>Ame A. Type YI S </td>	Ame A. Type YI S
14 bw2210.h main.h main.c STARTUP.A51	
-6 -6 -7 -6 -7 -7 -6 -7 -7 -7 -6 -7 -7 -7 -7 -50 -17 -51 -52 -52 -52 -52 -52 -52 -52 -52	
$\frac{sp}{dpt} = \frac{55}{56} \left\{ \frac{1}{256} \right\} = 0 \times 3F; // clear pit746 => vector pase address = 0$	
FC \$ 	
60 #ifdef ENABLE_USB_DBG_MSG	
E Project Regist	
Command C Call Stack	<u> </u>
Running with Code Size Limit: 2K Caller Load "C:\\work\\TestApp\\LedTest\\verO.2\\SRC\\output\\L 000.\?C_STARTUP\(CvB) X:0xFF1159 001.\?C_STARTUP\(CvB) X:0xFF1159	
002: \2C_STARTUP\{CvtB} X:0xFF1159 003: \2C_STARTUP\{CvtB} X:0xFF1159	
ACE ACCION Process Proces	•
ASSIVE DESERVISED FOR ALL STORY DESERVISED FOR	ser

 Press F5 to run and confirm that debug messages are printed to the "UART #1" window

```
UART #1

Monitor Version = 0.4.3 (G221)

Flash Test

flashBuf[0x00~0x0F]:

00 00 00 02 00 04 00 06 00 08 00 0A 00 0C 00 0E

flashBuf[0x80~0x8F]:

00 80 00 82 00 84 00 86 00 88 00 8A 00 8C 00 8E

flashBuf[0xF0~0xFF]:

00 F0 00 F2 00 F4 00 F6 00 F8 00 FA 00 FC 00 FE

flashBuf[0x100~0x10F]:

01 00 01 02 01 04 01 06 01 08 01 0A 01 0C 01 0E

flashBuf[0x1F0~0x1FF]:

01 F0 01 F2 01 F4 01 F6 01 F8 01 FA 01 FC 01 FE

Test Done
```

- Click on the STOP icon 🙆 to pause.
- Press Ctrl-F5 to stop debug session.

Chapter 5 Trouble Shooting

5.1. Power LED is not turned on

Problem: Power LED is not turned on when the EVK board is connected to PC

Solution: make sure that jumper J10 is connected on the VBUS side.

5.2. "Please connect target ..." pops up

Problem: Dialog box with message "Please connect target ..." pops up when starting a debug session

APG221 USB Debug Monitor	×
Please connect target	
Abort	

There are 2 possible causes.

- 1) The debug session is started while the EVK is not ready. To solve the problem, reset the EVK and make sure the USB cable is connected properly to the PC.
- 2) The LibUsb filter driver has not been installed. Follow chapter 3.3 Install LibUsb Filter Driver Manually of how to install the filter driver.

Appendix A: EVK board schematic



Revision History

Date	Version	Comment	Revised by
Jun 20, 2011	1.0.0	First Release	Thomas Wong
Jul 18, 2011	1.0.1	Add section 4.3 "The flash read/write sample application"	Thomas Wong

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