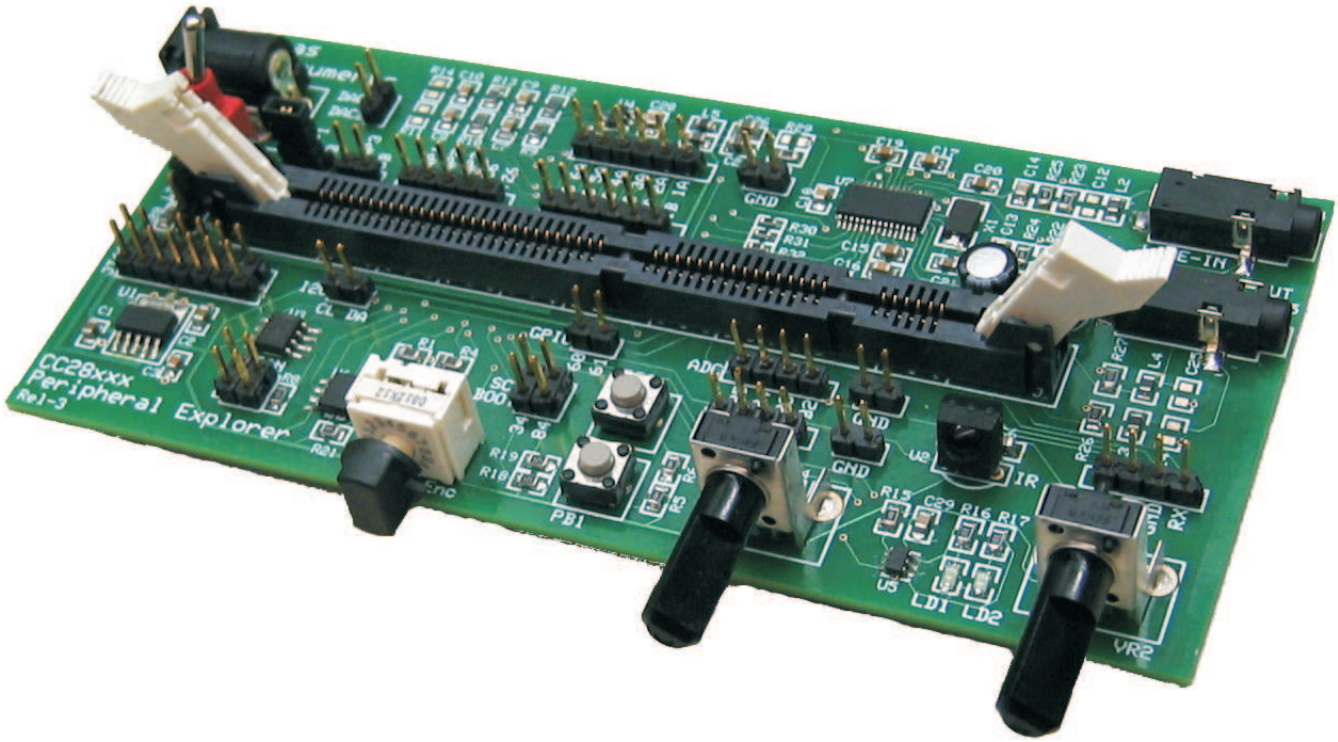
Quick Start Guide
SPRUGM2–January 2009

Peripheral Explorer Kit Overview



The Peripheral Explorer Kit is an evaluation board designed to allow experimentation with many of the peripherals available in the C2000™ F28x family of microprocessors. The board is designed to accept any of controlCARD and contains all hardware (controlCARD socket, power supply) required for normal usage. The kit is self-contained and contains multiple experiments in which external equipment, such as oscilloscopes, are not required. In the majority of these examples, one peripheral reads the output of a different peripheral, confirming the operation of both.

Features of the Peripheral Explorer Kit include:

- Multiple peripheral-based examples
  - EPWM-based sinusoidal output based on a sine table
  - DAC via filtered ePWM signal read by the on-chip ADC
  - eCAP-based IR receiver reading
  - SPI-based EEPROM interaction
  - UART communications header available for host control
  - Potentiomers for ADC evaluation
  - GPIO-based components such as pushbuttons, hex encoder, and LEDs
  - McBSP/DMA-based AIC23 codec software and hardware (F28335 only)
  - I2C header for external use
  - CAN header for external use
- Quick Start GUI, a friendly way to control / demo the application, based on open source C# freeware
- Hardware Developer's Package is available and includes full hardware documentation such as schematics, bill of materials, and Gerber files.

1 Hardware Overview

The Peripheral Explorer Kit consists of multiple peripheral based components. Figure 1 shows a diagram of the Peripheral Explorer board and some of its key features.

Figure 1. Key Features of EVM Board

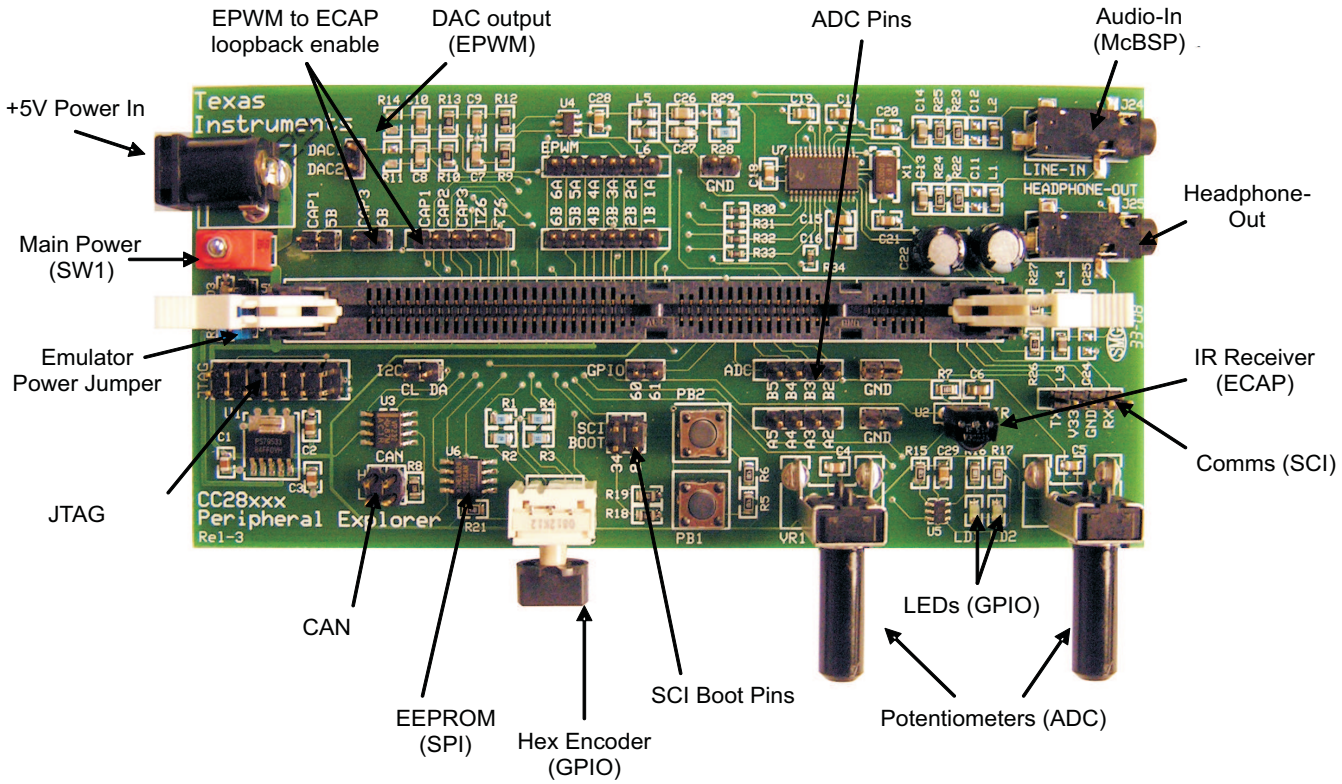


Table 1. Hardware Components

Component	Description
+5V Power In	DC power supply from plug pack (5-V supply may be used as well)
Main Pwr	SW1 - Master power switch for entire EVM
Emulator Power Jumper	Sets the voltage sent to power the emulator. No jumper means no power will be sent to an emulator, a jumper at “5V” will power the emulator with 5 V, and a jumper at “3V3” will power the emulator with 3.3 V.
JTAG	Connector for external JTAG emulator
CAN	External pins available for connection to two parallel CAN devices
EEPROM	256K SPI-based EEPROM
Hex Encoder	4-bit hex encoder which sets the values of GPIOs 12-15
SCI Boot Pins	Controls how the controlCARD boots
	If no jumpers are placed the target boots from flash
	If a jumper is placed at “34”, a F2808 controlCARD boots from SCI
	If a jumper is placed at “84”, a F28335 controlCARD boots from SCI
Potentiometers	Divide a 3.3-V input into a voltage value to be read by ADC-A0 and ADC-A1
LEDs	LED1 and LED2 controlled by GPIO-09 and GPIO-11
Comms	Serial communications UART (connects to the Quick Start GUI)
IR Receiver	Uses the eCAP module to read signals sent by a IR transmitter. The software included with this kit is configured to work with the Sharp TV protocol, for the included Philips universal remote this is code 0509.
Headphone-Out	Output from the TI AIC23B codec that is controlled by the F28x MCU (headphones not included in this package)
Audio-In	Input to the TI AIC23B codec (line-in audio cable not included in this package)
ADC pins	Spare ADC pins available to be connected as desired
DAC output	Output of a filtered ePWM. The ePWM output is connected to a second-order passive filter then connected to these pins
EPWM to ECAP loopback enable	Connecting a jumper across these headers allows for an experiment to be done where the eCAP module reads the duty cycle and period of the ePWM output

2 Hardware Set Up

All the hardware needed to get started (except the emulator) is included in this package (suggested emulators are listed near the end of this document). The application specific motherboard provided in this kit can be used in one of two ways:

1. Test Drive – Using the provided GUI application, the user does not require Code Composer Studio™ or emulation tools. This provides a great way to run or demo the application code quickly and see what functionality the hardware offers. Note: The same functionality can be achieved by using the Code Composer Studio Watch Window and slider features during emulation in the second mode.
2. Code Composer Studio Software Development Platform – With the project code provided, the application can be modified, compiled, loaded, and run in a development environment. Code Composer Studio and Emulation HW tools are required for this.

Follow these steps to set up the hardware for either the GUI or Software Development Platform

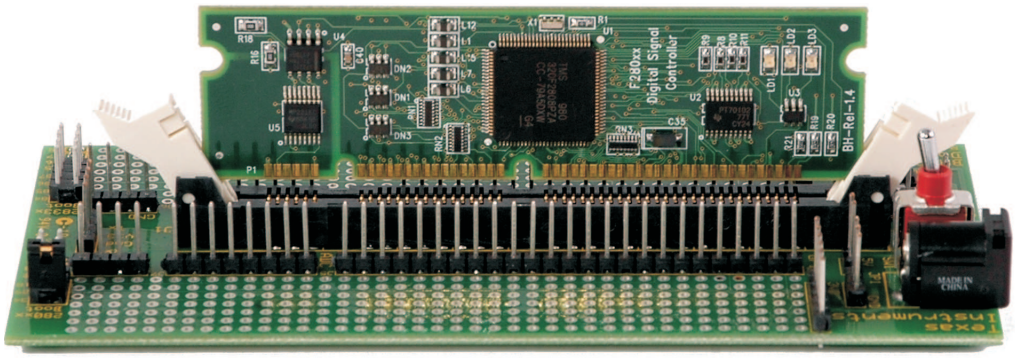
Step 1. Unpack the DIMM style controlCARD.

Step 2. Spread open the winged retaining clips on connector J2.

Step 3. Sit the DIMM card loosely in the connector slot. Make sure to align the 2 keyed notches and position the card bottom corners inside the retaining clips (see picture below).

Step 4. Push vertically down using even pressure from both ends of the card until the clips snap and lock. (note: to remove or eject the card spread open the retaining clips with thumbs).

Step 5. Ensure switch 1 (SW1) is in the off position and connect the included power supply to the power jack .



2.1 Test drive with GUI – (skip if you need only emulation support)

Step 1. Plug in the serial cable provided to connector J4 making sure the red wire aligns with the “Rx” pin on EVM.

Step 2. Inserted a jumper in position 84 on boot pins.

Step 3. Plug the DB9 connector into your PC using either a serial port or a serial-to-USB converter dongle.

Step 4. Turn on the power once you are done with the TI Software download, see Software Setup GUI-TestDrive.

2.2 Code Composer Studio Software Development Platform Emulation - Additional Steps

Step 1. Depending on your emulator type, place the jumper at J2 to either the 3.3V or 5V position

Step 2. Connect the JTAG emulator cable to connector J1

Step 3. Turn on power once you are done with the TI Software download, see Software Setup Code Composer Studio-Development.

Note: For full details (schematics, pin-out table) of the hardware see the Hardware Developer's Package, PeripheralExplorer-HWdevPkg. See Software Setup for download location.

3 Software Set Up

The Peripheral Explorer Kit application software example, GUI, step-by-step lab style documentation, and other useful soft collateral can all be found on the TI website. If you already have your own software project and do not require this collateral, skip this section. As explained in the HW setup section, the target mother board can be run either with the GUI or Code Composer Studio. The GUI executable file is found as part of the main software download. Follow the steps below for either case.

To run any of the application specific software in Code Composer Studio, you must first install the baseline code which contains the header files, libraries, etc. If you already have the base-line software installed, skip the baseline install steps and go to the Peripheral Explorer Kit section.

To download the free TI soft collateral follow these steps:

Step 1. Baseline soft collateral and hardware documents (skip this if you already have this software installed)

a. On an Internet browser type: http://www.ti.com/f28xkits
b. At the C2000 DSP collateral page, choose the *Experimenter's Kit download* link
c. When prompted, fill in the TI customer registration details and click ok
d. Save the .zip file to the directory of your choice
e. Unzip the file and run the install program Baseline Software Set Up
f. The installer will create the following default directories:

C:\TI_F28xxx_SysSW
~Docs
~GeneralPurposeGUI
~SupportFiles
FlashingLeds

C:\TI_F28xxx_SysHW
CC280xxHWdevPkg
CC2833xHWdevPkg
DockingStnHWdevPkg

Step 2. Peripheral Explorer Kit soft collateral and hardware documents

a. On an Internet browser type: http://www.ti.com/f28xkits
b. Then choose the Peripheral Explorer Kit link.
c. When prompted, fill in the TI customer registration details and click ok.
d. Save the .zip file to the directory of your choice.
e. Unzip the file and run the install program Peripheral Explorer Software Set Up.
f. The installer will create the following default directories:

C:\TI_F28xxx_SysSW
PeripheralExplorer
~Docs
~GUI

C:\TI_F28xxx_SysHW
PeripheralExplorer-HWdevPkg

4 Running the Application

To run the application specific hardware, choose either “TestDrive-GUI” or “Code Composer Studio-Development” options below and follow the appropriate steps.

Step 1. TestDrive-GUI

a. Open the GUI Quick Start Guide, QSG-PeripheralExplorer-GUI.pdf, found in: C:\TI_F28xxx_SysSW\PeripheralExplorer\~Docs

b. Browse to the directory: C:\TI_F28xxx_SysSW\PeripheralExplorer\~GUI

c. Open PeripheralExplorer-GUI.exe

d. Follow the step-by step instructions found in the GUI Quick Start Guide

Step 2. Code Composer Studio-Development

a. If you have emulation tools and Code Composer Studio already installed and active, load the project file "PeripheralExplorer.pjt" found in:
C:\TI_F28xxx_SysSW\PeripheralExplorer

b. See the PeripheralExplorer.pdf for a step-by-step walk through of how to compile and run the various labs. This document can be found in:
C:\TI_F28xxx_SysSW\PeripheralExplorer\~Docs

5 Emulators

The following companies provide low cost, full featured emulators designed specifically for C2000™ controllers:

Blackhawk™ http://www.blackhawk-dsp.com	USB2000 Controller (part number TMDSEMU2000U)	$299
Spectrum Digital http://www.spectrumdigital.com	XDS510LC JTAG Emulator (part number 701902)	$249

6 References

For more information, see the following guides:

- PeripheralExplorer – provides detailed information on the Peripheral Explorer C/asm project
  C:\TI_F28xxx_SysSW\PeripheralExplorer\~Docs\PeripheralExplorer.pdf
- QSG-PeripheralExplorer-GUI – gives an overview on how to quickly demo the PeripheralExplorer project using an intuitive GUI interface.
  C:\TI_F28xxx_SysSW\PeripheralExplorer\~Docs\QSG-PeripheralExplorer-GUI.pdf
- PeripheralExplorer-HWdevPkg – a folder containing various files related to the hardware on the Peripheral Explorer board (schematics, bill of materials, Gerber files, PCB layout, etc). All schematics and PCB files were created with the freeware ExpressPCB package.
  C:\TI_F28xxx_SysHW\PeripheralExplorer-HWdevPkg
- System Framework Overview Guide – presents more information on the system framework found in F28xxx EVM projects.
  C:\TI_F28xxx_SysSW\~Docs\SystemFrameworkOverview.pdf
- F28xxx User’s Guides
  http://www.ti.com/f28xuserguides

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