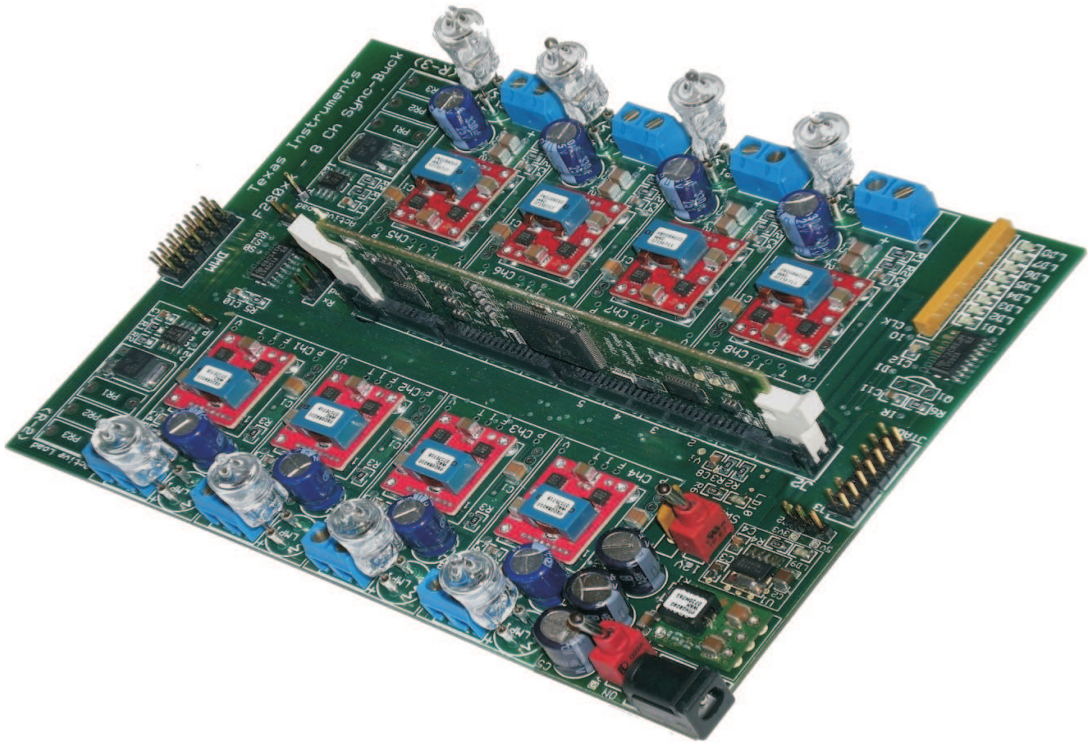
Texas Instruments

Quick Start Guide

SPRUFR7–July 2008

TMS320C2000 DSC DC/DC Developer's Kit



Providing a great way to experiment and learn about digital power control, the TMS320C2000™ DC/DC Developer's Kit highlights the TMS320C28x™ digital signal controller (DSC) as a multi-rail controller for multi-phase applications. This kit contains a power motherboard which has eight TI PowerTrain™ modules, small and efficient 10 Amp synchronous buck power stages, and can interface with any of the TI plug-in controlCARDs. The board requires a single 9-V DC supply and has a separately switched and fused rail as the input voltage bus to the Buck modules. This allows for safe, convenient software experimentation and debug without the risk of hardware damage. The software package for this kit uses the TMS320F28x DSC to digitally control the output voltage, ramp rates and sequence timing for each of the eight DC/DC voltage rails.

Features of the DC/DC Developer's Kit include:

- Eight non-isolated 10-Amp SyncBuck DC/DC power stages (no heat-sink required) with built in MOSFET drivers
- Closed loop digital control with voltage feedback using F28x on-chip ePWM and ADC
- Sequencing and ramp rate parameters in software allow DC/DC rails to be controlled independently and in an organized manner
- Voltage input and output measurements via ADC
- Temperature measurement for each channel monitored by ADC
- Current measurement for each channel monitored by ADC
- Over-current protection and fault flag detection via GPIO
- 8 x LED indicators for diagnostics and fault status
- UART communications header available for host control
- Host GUI, a friendly way to control / demo the application, based on open source C# freeware
- Hardware Developer's Package is available and includes schematics, bill of materials, Gerber files,…etc

CAUTION

During experimentation the lamp loads (LMP1-LMP8 – see Hardware Overview) may become HOT if output voltages are left running for an extended time (avoid if possible). DO NOT TOUCH until the loads cool down.

1 Hardware Overview

The DC/DC Developer's Kit consists of eight identical buck power stages. The input bus voltage for all stages is 9 V. Shown below is a diagram of the DC/DC Developer's Kit board and some key features.

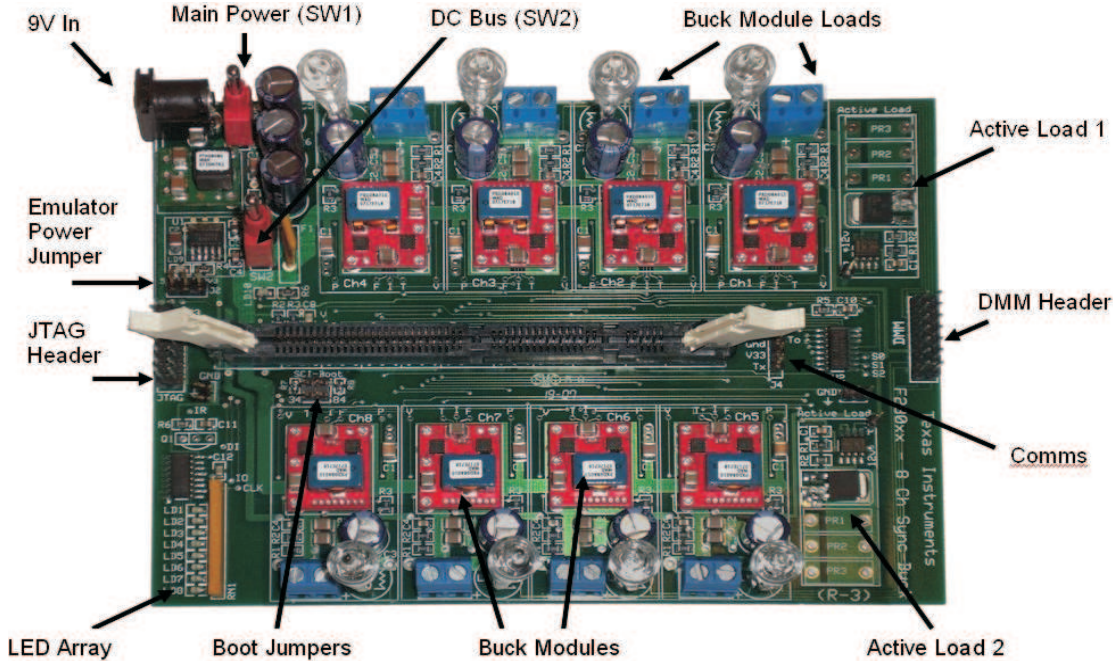


Table 1. Hardware Components

Component	Description
9V In	DC power supply from plug pack (12V supply may also be used)
Main Pwr	SW1 – Master power switch for entire EVM
DC Bus	SW2 – Power switch for Vin to buck stages only. When off the DIMM controller card will still operate (next to the DC bus switch is a resettable fuse)
Buck 1-8	Buck power stage modules with temperature/current measurement and over current protection
Load 1-8	Load terminals and/or buck converter output - next to each terminal block is a light bulb or "visual" load (these draw approx 300 mA hot)
Active Load 1/2	Switched loads controlled by the ECAP peripheral via software. These loads are connected to the output of buck 1 & 5 respectively. PR1, PR2, or PR3 will need to be populated for each active load module to function correctly. (ECAP peripheral not available on F28044)
DMM Header	Provides convenient access to the outputs of the eight buck converters
Emulator Pwr	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.
Boot Jumpers	Controls how the F280x will boot. • If no jumpers are placed the target will boot from flash. • If a jumper is placed at 34, the target will boot from the SCI. • If a jumper is placed at 29 and 34, the target will boot from RAM.
Comms	Serial communications UART (allows connection to the external GUI)

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™ software or emulation tools. This provides a great way to run or demo the application code quickly and see what functionality the hardware offers. Note: exactly 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:

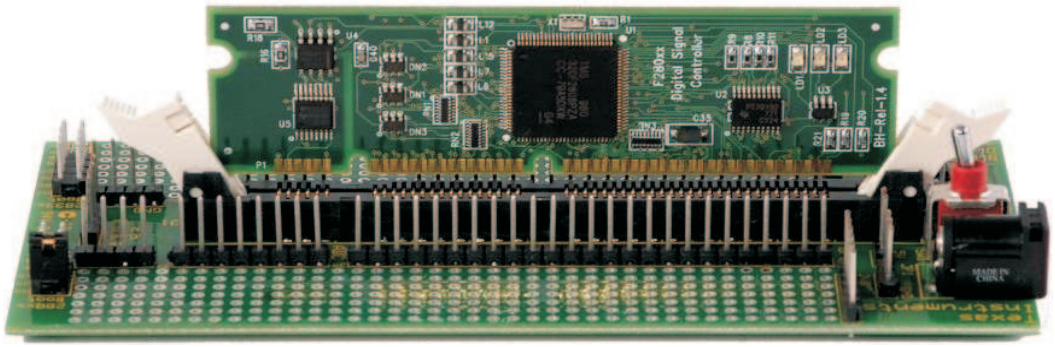
Step 1. Unpack the DIMM style controlCARD.

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

Step 3. Sit the DIMM card loosely in the connector slot. Align the 2 keyed notches carefully 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 simply spread open the retaining clips with thumbs).

Step 5. Be sure 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. Insert a jumper in position 34 on the board's 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 Set Up 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 3.3-V or 5-V 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 Set Up - Code Composer Studio Development. For full details (schematics, pin-out table, etc) of the hardware see the Hardware Developer's Package, EightChBuck-HWdevPkg. See Software Set Up for the download location.

3 Software Set Up

The DC/DC Developer's Kit application software example, GUI, step-by-step lab style documentation, and other useful soft collateral is available 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 hardware set up 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, first you must install the baseline code, which contains the header files, libraries, etc. If you already have the baseline software installed, skip the baseline install steps and go to the DC/DC Developer's 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. DC/DC Developer's Kit soft collateral and hardware documents

a. On an Internet browser type: http://www.ti.com/f28xkits
b. Then choose the DC/DC Developer's 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 Eight Channel Buck Software Set Up.
f. The installer will create the following default directories:

C:\TI_F28xxx_SysSW
EightChannelBuck
~Docs
~GUI

C:\TI_F28xxx_SysHW
EightChBuck-HWdevPkg

4 Running the Application

To run the application specific hardware, choose either *TestDrive-GUI* or *CCS-Development* options below and follow the appropriate steps.

Step 1. TestDrive-GUI

a. Open the GUI Quick Start Guide, QSG-EightChannelBuck-GUI.pdf, found in:
   C:\TI_F28xxx_SysSW\EightChannelBuck\~Docs\
b. Go to directory C:\TI_F28xxx_SysSW\EightChannelBuck\~GUI
c. Open EightChannelBuck-GUI.exe
d. Follow the step-by step instructions found in the 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 EightChannelBuck.pjt found in:
   C:\TI_F28xxx_SysSW\EightChannelBuck\
b. See the *EightChannelBuck.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\EightChannelBuck\~Docs\.

5 Emulators

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

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

6 References

For more information, see the following guides:

- *EightChannelBuck* – provides detailed information on the EightChannelBuck project within an easy to use lab-style format.
  C:\TI_28xxx_SysSW\EightChannelBuck\~Docs\EightChannelBuck.pdf
- *QSG-EightChannelBuck-GUI* – gives an overview on how to demo the EightChannelBuck project quickly using an intuitive GUI interface.
  C:\TI_28xxx_SysSW\EightChannelBuck\~Docs\QSG-EightChannelBuck-GUI.pdf
- *EightChBuck-HWdevPkg* – a folder containing various files related to the hardware on the DC/DC Developer's Kit board (schematics, bill of materials, Gerber files, PCB layout, etc). All schematics and PCB files created with the freeware ExpressPCB package.
  C:\TI_28xxx_SysHW\EightChBuck-HWdevPkg\
- F28x User's Guides http://www.ti.com/f28xuserguides

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