



**THE DATASHEET OF
EK-TM4C1294XL**



Tiva™ C Series TM4C1294 Connected LaunchPad Evaluation Kit

EK-TM4C1294XL

User's Guide



Literature Number: SPMU365C
March 2014–Revised October 2016

| | | |
|----------|--|-----------|
| 1 | Board Overview | 4 |
| 1.1 | Kit Contents..... | 5 |
| 1.2 | Using the Connected LaunchPad | 5 |
| 1.3 | Features..... | 5 |
| 1.4 | BoosterPacks..... | 6 |
| 1.5 | Energia..... | 6 |
| 1.6 | Specifications..... | 6 |
| 2 | Hardware Description | 7 |
| 2.1 | Functional Description | 7 |
| 2.1.1 | Microcontroller..... | 7 |
| 2.1.2 | Ethernet Connectivity..... | 8 |
| 2.1.3 | USB Connectivity | 8 |
| 2.1.4 | Motion Control..... | 8 |
| 2.1.5 | User Switches and LED's..... | 8 |
| 2.1.6 | BoosterPacks and Headers | 9 |
| 2.2 | Power Management..... | 20 |
| 2.2.1 | Power Supplies | 20 |
| 2.2.2 | Low Power Modes | 21 |
| 2.2.3 | Clocking | 21 |
| 2.2.4 | Reset..... | 21 |
| 2.3 | Debug Interface..... | 21 |
| 2.3.1 | In-Circuit Debug Interface (ICDI) | 21 |
| 2.3.2 | External Debugger | 22 |
| 2.3.3 | Virtual COM Port | 22 |
| 3 | Software Development | 23 |
| 3.1 | Software Description..... | 23 |
| 3.2 | Source Code | 23 |
| 3.3 | Tool Options | 23 |
| 3.4 | Programming the Connected LaunchPad..... | 24 |
| 4 | References, PCB Layout, and Bill of Materials | 25 |
| 4.1 | References | 25 |
| 4.2 | Component Locations | 26 |
| 4.3 | Bill of Materials | 27 |
| 5 | Schematic | 30 |
| | Revision History..... | 31 |

List of Figures

| | | |
|------|---|----|
| 1-1. | Tiva C Series Connected LaunchPad Evaluation Board | 4 |
| 2-1. | Tiva Connected LaunchPad Evaluation Board Block Diagram | 7 |
| 2-2. | Default Jumper Locations | 20 |
| 4-1. | Connected LaunchPad Dimensions and Component Locations | 26 |

List of Tables

| | | |
|------|---|----|
| 1-1. | EK-TM4C1294XL Specifications | 6 |
| 2-1. | BoosterPack 1 GPIO and Signal Muxing | 9 |
| 2-2. | BoosterPack 2 GPIO and Signal Muxing | 12 |
| 2-3. | X11 Breadboard Adapter Odd-Numbered Pad GPIO and Signal Muxing | 16 |
| 2-4. | X11 Breadboard Adapter Even-Numbered Pad GPIO and Signal Muxing | 17 |
| 4-1. | Connected LaunchPad Bill of Materials | 27 |

Board Overview

The Tiva™ C Series TM4C1294 Connected LaunchPad Evaluation Board (EK-TM4C1294XL) is a low-cost evaluation platform for ARM® Cortex™-M4F-based microcontrollers. The Connected LaunchPad design highlights the TM4C1294NCPDT microcontroller with its on-chip 10/100 Ethernet MAC and PHY, USB 2.0, hibernation module, motion control pulse-width modulation and a multitude of simultaneous serial connectivity. The Connected LaunchPad also features two user switches, four user LEDs, dedicated reset and wake switches, a breadboard expansion option and two independent BoosterPack XL expansion connectors. The pre-programmed quickstart application on the Connected LaunchPad also enables remote monitoring and control of the evaluation board from an internet browser anywhere in the world. The web interface is provided by 3rd party, Exosite. Each Connected LaunchPad is enabled on the Exosite platform allowing users to create and customize their own Internet-of-Things applications.

Figure 1-1 shows a photo of the Connected LaunchPad with key features highlighted.

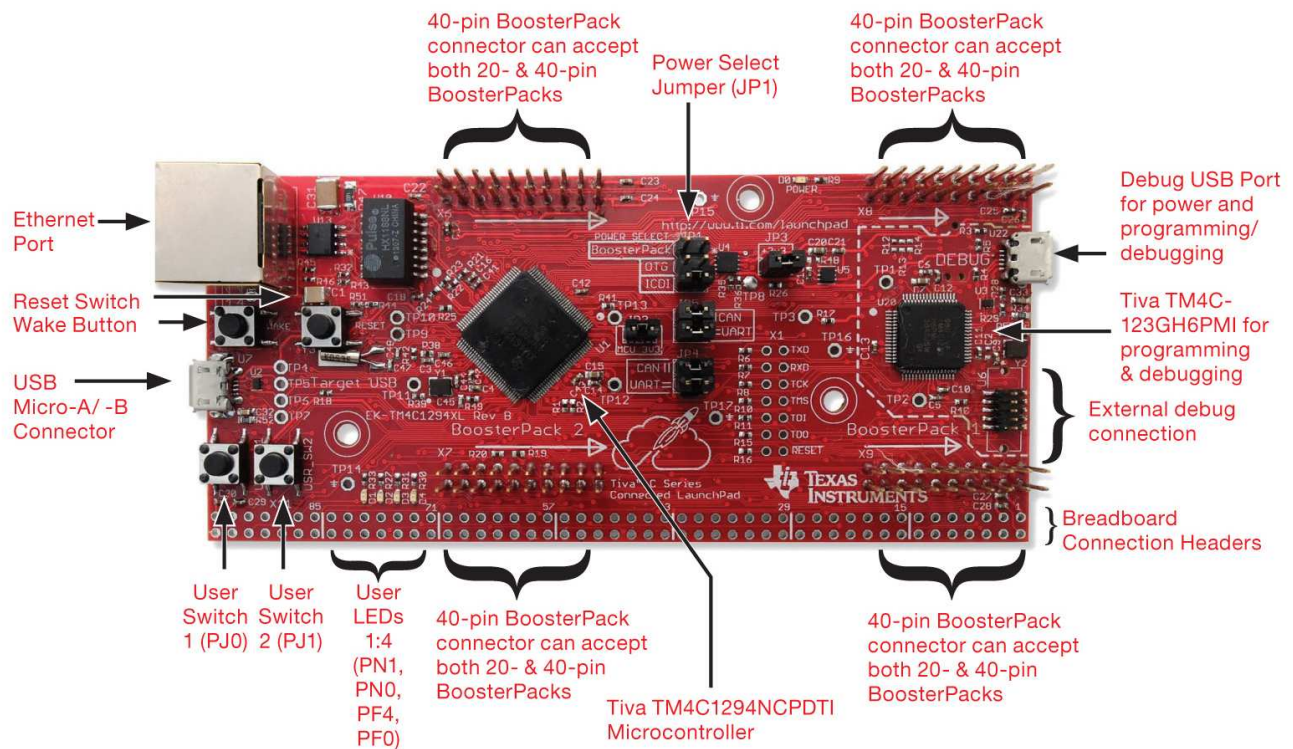


Figure 1-1. Tiva C Series Connected LaunchPad Evaluation Board

Tiva is a trademark of Texas Instruments.
All other trademarks are the property of their respective owners.

1.1 Kit Contents

The Connected LaunchPad Evaluation Kit contains the following items:

- Tiva™ C Series TM4C1294 Evaluation Board (EK-TM4C1294XL)
- Retractable Ethernet cable
- USB Micro-B plug to USB-A plug cable
- [README First](#) document

1.2 Using the Connected LaunchPad

The recommended steps for using the Connected LaunchPad Evaluation Kit are:

1. **Follow the README First document included in the kit.** The README First helps you get the Connected LaunchPad up and running in minutes. Within just a few minutes you can be controlling and monitoring the Connected LaunchPad through the internet using Exosite and the pre-programmed quickstart application.
2. **Experiment with BoosterPacks.** This evaluation kit conforms to the latest revision of the BoosterPack pinout standard. It has two independent BoosterPack connections to enable a multitude of expansion opportunities.
3. **Take the first step towards developing your own applications.** The Connected LaunchPad is supported by TivaWare for C Series. After installing TivaWare, look in the installation directory for *examples\boards\ek-tm4c1294xl*. You can find pre-configured example applications for this board as well as for this board with selected BoosterPacks. Alternately, use Energia for a wiring framework-based cross-platform, fast-prototyping environment that works with this and other TI LaunchPads. See [Chapter 3](#) of this document for more details about software development. TivaWare can be downloaded from the TI website at <http://www.ti.com/tool/sw-tm4c>. Energia can be found at <http://energia.nu>.
4. **Customize and integrate the hardware to suit your end application.** This evaluation kit can be used as a reference for building your own custom circuits based on Tiva C microcontrollers or as a foundation for expansion with your custom BoosterPack or other circuit. This manual can serve as a starting point for this endeavor.
5. **Get Trained.** You can also download hours of written and video training materials on this and related LaunchPads. Visit the Tiva C Series LaunchPad Workshop Wiki for more information.
6. **More Resources.** See the TI MCU LaunchPad web page for more information and available BoosterPacks. (<http://www.ti.com/tiva-c-launchpad>)

1.3 Features

Your Connected LaunchPad includes the following features:

- Tiva TM4C1294NCPDTI microcontroller
- Ethernet connectivity with fully integrated 10/100 Ethernet MAC and PHY Motion Control PWM
- USB 2.0 Micro A/B connector
- 4 user LEDs
- 2 user buttons
- 1 independent hibernate wake switch
- 1 independent microcontroller reset switch
- Jumper for selecting power source:
 - ICDI USB
 - USB Device
 - BoosterPack
- Preloaded Internet-of-Things Exosite quickstart application
- I/O brought to board edge for breadboard expansion
- Two independent BoosterPack XL standard connectors featuring stackable headers to maximize expansion through BoosterPack ecosystem

- For a complete list of BoosterPacks, see the TI MCU LaunchPad web page:
<http://www.ti.com/launchpad>

1.4 BoosterPacks

The Connected LaunchPad provides an easy and inexpensive way to develop applications with the TM4C1294NCPDTI microcontroller. BoosterPacks are add-on boards that follow a pin-out standard created by Texas Instruments. The TI and third-party ecosystem of BoosterPacks greatly expands the peripherals and potential applications that you can easily explore with the Connected LaunchPad.

You can also build your own BoosterPack by following the design guidelines on TI's website. Texas Instruments even helps you promote your BoosterPack to other members of the community. TI offers a variety of avenues for you to reach potential customers with your solutions.

1.5 Energĭa

Energĭa is an open-source electronics prototyping platform started in January of 2012 with the goal of bringing the Wiring and Arduino framework to the TI LaunchPad community. Energĭa includes an integrated development environment (IDE) that is based on Processing.

Together with Energĭa, LaunchPads can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. LaunchPad projects can be stand-alone (only run on the target board, i.e. your LaunchPad), or they can communicate with software running on your computer (Host PC). Energĭa projects are highly portable between supported LaunchPad platforms. Projects written for your Connected LaunchPad can be run on other LaunchPads with little or no modifications.

More information is available at <http://energia.nu>.

1.6 Specifications

Table 1-1 summarizes the specifications for the Connected LaunchPad.

Table 1-1. EK-TM4C1294XL Specifications

| Parameter | Value |
|------------------------|---|
| Board Supply Voltage | 4.75 V _{DC} to 5.25 V _{DC} from one of the following sources: <ul style="list-style-type: none"> • Debug USB U22 (ICDI) USB Micro-B cable connected to PC or other compatible power source. • Target USB (U7) USB Micro-B cable connected to PC or other compatible power source. • BoosterPack 1 (X8-4) • BoosterPack 2 (X6-4) • Breadboard expansion header (X11-2 or X11-97). See schematic symbol JP1 for power input selection. |
| Dimensions | 4.9 in x 2.2 in x .425 in (12.45 cm x 5.59 cm x 10.8 mm) (L x W x H) |
| Break-out Power Output | <ul style="list-style-type: none"> • 5 V_{DC} to BoosterPacks, current limited by TPS2052B. Nominal rating 1 Amp. Board input power supply limitations may also apply. • 3.3 V_{DC} to BoosterPacks, limited by output of TPS73733 LDO. This 3.3-V plane is shared with on-board components. Total output power limit of TPS73733 is 1 Amp. |
| RoHS Status | Compliant |

Hardware Description

The Connected LaunchPad includes a TM4C1294NCPDTI microcontroller with an integrated 10/100 Ethernet MAC and PHY. This advanced ARM® Cortex™ M4F MCU has a wide range of peripherals that are made available to users via the on-board accessories and the BoosterPack connectors. This chapter explains how those peripherals operate and interface to the microcontroller.

Figure 2-1 provides a high-level block diagram of the Connected LaunchPad.

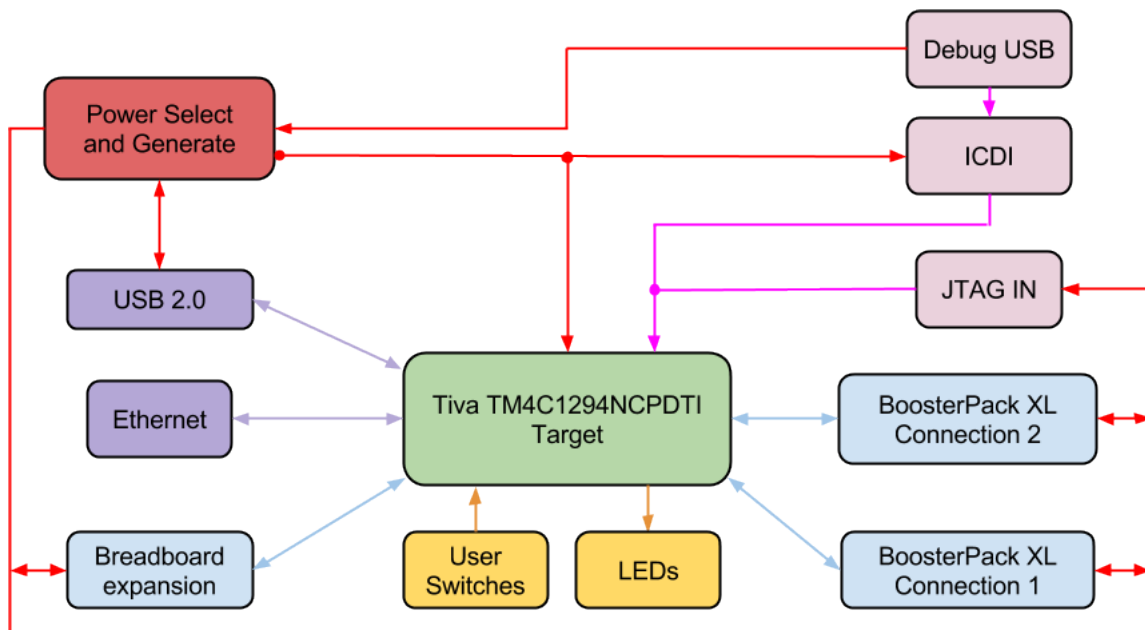


Figure 2-1. Tiva Connected LaunchPad Evaluation Board Block Diagram

2.1 Functional Description

2.1.1 Microcontroller

The TM4C1294NCPDTI is a 32-bit ARM Cortex-M4F based microcontroller with 1024-kB Flash memory, 256-kB SRAM, 6-kB EEPROM, and 120 MHz operation; integrated 10/100 Ethernet MAC and PHY; integrated USB 2.0 connectivity with external high-speed USB 3.0 PHY capability; a hibernation module, a multitude of serial connectivity and motion control PWM; as well as a wide range of other peripherals. See the TM4C1294NCPDTI microcontroller [data sheet](#) for more complete details.

Most of the microcontroller's signals are routed to 0.1-in (2.54-mm) pitch headers or through-hole solder pads. An internal multiplexor allows different peripheral functions to be assigned to each of these GPIO pads. When adding external circuitry, consider the additional load on the evaluation board power rails.

The TM4C1294NCPDTI microcontroller is factory-programmed with a quickstart demo program. The quickstart program resides in on-chip Flash memory and runs each time power is applied, unless the quickstart application has been replaced with a user program. The quickstart application automatically connects to <http://ti.exosite.com> when an internet connection is provided through the RJ45 Ethernet jack on the evaluation board.

2.1.2 Ethernet Connectivity

The Connected LaunchPad is designed to connect directly to an Ethernet network using RJ45 style connectors. The microcontroller contains a fully integrated Ethernet MAC and PHY. This integration creates a simple, elegant and cost-saving Ethernet circuit design. Example code is available for both the uIP and LwIP TCP/IP protocol stacks. The embedded Ethernet on this device can be programmed to act as an HTTP server, client or both. The design and integration of the circuit and microcontroller also enable users to synchronize events over the network using the IEEE1588 precision time protocol.

When configured for Ethernet operation, it is recommended that the user configure LED D3 and D4 to be controlled by the Ethernet MAC to indicate connection and transmit/receive status.

2.1.3 USB Connectivity

The Connected LaunchPad is designed to be USB 2.0 ready. A TPS2052B load switch is connected to and controlled by the microcontroller USB peripheral, which manages power to the USB micro A/B connector when functioning in a USB host. When functioning as a USB device, the entire Connected LaunchPad can be powered directly from the USB micro A/B connector. Use JP1 to select the desired power source.

USB 2.0 functionality is provided and supported directly out of the box with the target USB micro A/B connector. High-speed USB 3.0 functionality can be enabled by adding an external USB PHY. The USB external PHY control and data signals are provided on the breadboard expansion header X11.

2.1.4 Motion Control

The Connected LaunchPad includes the Tiva C Series Motion Control PWM technology, featuring a PWM module capable of generating eight PWM outputs. The PWM module provides a great deal of flexibility and can generate simple PWM signals – for example, those required by a simple charge pump – as well as paired PWM signals with dead-band delays, such as those required by a half-H bridge driver. Three generator blocks can also generate the full six channels of gate controls required by a 3-phase inverter bridge.

A quadrature encoder interface (QEI) is also available to provide motion control feedback.

See the [BoosterPacks and Headers](#) section of this document for details about the availability of these signals on the BoosterPack interfaces.

2.1.5 User Switches and LED's

Two user switches are provided for input and control of the TM4C1294NCPDTI software. The switches are connected to GPIO pins PJ0 and PJ1.

A reset switch and a wake switch are also provided. The reset switch initiates a system reset of the microcontroller whenever it is pressed and released. Pressing the reset switch also asserts the reset signal to the BoosterPack and Breadboard headers. The wake switch is one way to bring the device out of hibernate mode.

Four user LEDs are provided on the board. D1 and D2 are connected to GPIOs PN1 and PN0. These LEDs are dedicated for use by the software application. D3 and D4 are connected to GPIOs PF4 and PF0, which can be controlled by user's software or the integrated Ethernet module of the microcontroller.

A power LED is also provided to indicate that 3.3 volt power is present on the board.

2.1.6 BoosterPacks and Headers

2.1.6.1 BoosterPack 1

The Connected LaunchPad features two fully independent BoosterPack XL connectors. BoosterPack 1, located around the ICDI portion of the board, is fully compliant with the BoosterPack standard with the single exception of GPIO pin PA6 (X8-16), which does not provide analog capability. PA6 is located near the bottom of the inner left BoosterPack XL header.

I2C is provided in both the original BoosterPack standard configuration as well as the updated standard location. Use of I2C on the bottom left of the BoosterPack connections per the updated standard is highly encouraged whenever possible.

Motion control advanced PWM connections are provided on the inner right connector for motion control applications.

[Table 2-1](#) provides a complete listing of the BoosterPack pins and the GPIO alternate functions available on each pin. The TM4C1294NCPDTI GPIO register GPIOCTL values are shown for each configuration. The headers in this table are labeled from left to right in ten pin columns. 'A' and 'D' make up the outer BoosterPack standard pins, 'B' and 'C' make up the inner BoosterPack XL standard pins.

Table 2-1. BoosterPack 1 GPIO and Signal Muxing

| Header | Pin | Standard Function | GPIO | MCU Pin | Analog | Digital Function (GPIOCTL Bit Encoding) | | | | | | | | | | |
|--------|-----|-------------------|------|---------|--------|---|---------|--------|----------|---|--------|-----|----|-----------|----|-----------|
| | | | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 |
| A1 | 1 | +3.3 volts | 3.3V | | | | | | | | | | | | | |
| A1 | 2 | Analog | PE4 | 123 | AIN9 | U1RI | - | - | - | - | - | - | - | - | - | SSI1XDAT0 |
| A1 | 3 | UART RX | PC4 | 25 | C1- | U7Rx | - | - | - | - | - | - | - | - | - | EPI0S7 |
| A1 | 4 | UART TX | PC5 | 24 | C1+ | U7Tx | - | - | - | - | RTCCLK | - | - | - | - | EPI0S6 |
| A1 | 5 | GPIO | PC6 | 23 | C0+ | U5Rx | - | - | - | - | - | - | - | - | - | EPI0S5 |
| A1 | 6 | Analog | PE5 | 124 | AIN8 | - | - | - | - | - | - | - | - | - | - | SSIXDAT1 |
| A1 | 7 | SPI CLK | PD3 | 4 | AIN12 | - | I2C8SDA | T1CCP1 | - | - | - | - | - | - | - | SSI2CLK |
| A1 | 8 | GPIO | PC7 | 22 | C0- | U5Tx | - | - | - | - | - | - | - | - | - | EPI0S4 |
| A1 | 9 | I2C SCL | PB2 | 91 | - | - | I2C0SCL | T5CCP0 | - | - | - | - | - | - | - | USB0STP |
| A1 | 10 | I2C SDA | PB3 | 92 | - | - | I2C0SDA | T5CCP1 | - | - | - | - | - | - | - | USB0CLK |
| B1 | 1 | +5 volts | 5V | | | | | | | | | | | | | |
| B1 | 2 | ground | GND | | | | | | | | | | | | | |
| B1 | 3 | Analog | PE0 | 15 | AIN3 | U1RTS | - | - | - | - | - | - | - | - | - | - |
| B1 | 4 | Analog | PE1 | 14 | AIN2 | U1DSR | - | - | - | - | - | - | - | - | - | - |
| B1 | 5 | Analog | PE2 | 13 | AIN1 | U1DCD | - | - | - | - | - | - | - | - | - | - |
| B1 | 6 | Analog | PE3 | 12 | AIN0 | U1DTR | - | - | - | - | - | - | - | - | - | - |
| B1 | 7 | Analog | PD7 | 128 | AIN4 | U2CTS | - | T4CCP1 | USB0PFLT | - | - | NMI | - | - | - | SSI2XDAT2 |
| B1 | 8 | Analog | PA6 | 40 | - | U2Rx | I2C6SCL | T3CCP0 | USB0EPEN | - | - | - | - | SSI0XDAT2 | - | EPI0S8 |
| B1 | 9 | A out | PM4 | 74 | TMPR3 | U0CTS | - | T4CCP0 | - | - | - | - | - | - | - | - |
| B1 | 10 | A out | PM5 | 73 | TMPR2 | U0DCD | - | T4CCP1 | - | - | - | - | - | - | - | - |

Table 2-1. BoosterPack 1 GPIO and Signal Muxing (continued)

| Header | Pin | Standard Function | GPIO | MCU Pin | Analog | Digital Function (GPIOCTL Bit Encoding) | | | | | | | | | | |
|--------|-----|-------------------|-------|---------|--------|---|---------|--------|---------|----------|---|---|----|----|-----------|-----------|
| | | | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 |
| C1 | 1 | PWM | PF1 | 43 | - | - | - | - | EN0LED2 | M0PWM1 | - | - | - | - | SSI3XDAT0 | TRD1 |
| C1 | 2 | PWM | PF2 | 44 | - | - | - | - | - | M0PWM2 | - | - | - | - | SSI3Fss | TRD0 |
| C1 | 3 | PWM | PF3 | 45 | - | - | - | - | - | M0PWM3 | - | - | - | - | SSI3Clk | TRCLK |
| C1 | 4 | PWM | PG0 | 49 | - | - | I2C1SCL | - | EN0PPS | M0PWM4 | - | - | - | - | - | EPI0S11 |
| C1 | 5 | Capture | PL4 | 85 | - | - | - | T0CCP0 | - | - | - | - | - | - | USB0D4 | EPI0S26 |
| C1 | 6 | Capture | PL5 | 86 | - | - | - | T0CCP1 | - | - | - | - | - | - | USB0D5 | EPI0S33 |
| C1 | 7 | GPIO | PL0 | 81 | - | - | I2C2SDA | - | - | M0FAULT3 | - | - | - | - | USB0D0 | EPI0S16 |
| C1 | 8 | GPIO | PL1 | 82 | - | - | I2C2SCL | - | - | PhA0 | - | - | - | - | USB0D1 | EPI0S17 |
| C1 | 9 | GPIO | PL2 | 83 | - | - | - | - | C0o | PhB0 | - | - | - | - | USB0D2 | EPI0S18 |
| C1 | 10 | GPIO | PL3 | 84 | - | - | - | - | C1o | IDX0 | - | - | - | - | USB0D3 | EPI0S19 |
| D1 | 1 | ground | GND | | | | | | | | | | | | | |
| D1 | 2 | PWM | PM3 | 75 | - | - | - | T3CCP1 | - | - | - | - | - | - | - | EPI0S12 |
| D1 | 3 | GPIO | PH2 | 31 | - | U0DCD | - | - | - | - | - | - | - | - | - | EPI0S2 |
| D1 | 4 | GPIO | PH3 | 32 | - | U0DSR | - | - | - | - | - | - | - | - | - | EPI0S3 |
| D1 | 5 | reset | RESET | | | | | | | | | | | | | |
| D1 | 6 | SPI MOSI | PD1 | 2 | AIN14 | - | I2C7SDA | T0CCP1 | C1o | - | - | - | - | - | - | SSI2XDAT0 |
| D1 | 7 | SPI MISO | PD0 | 1 | AIN15 | - | I2C7SCL | T0CCP0 | C0o | - | - | - | - | - | - | SSI2XDAT1 |
| D1 | 8 | GPIO | PN2 | 109 | - | U1DCD | U2RTS | - | - | - | - | - | - | - | - | EPI0S29 |
| D1 | 9 | GPIO | PN3 | 110 | - | U1DSR | U2CTS | - | - | - | - | - | - | - | - | EPI0S30 |
| D1 | 10 | GPIO | PP2 | 103 | - | U0DTR | - | - | - | - | - | - | - | - | USB0NXT | EPI0S29 |

2.1.6.2 BoosterPack 2

The second BoosterPack XL interface is located near the middle of the board. This interface is fully compliant with the BoosterPack standard, and adds features not covered by the BoosterPack standard that enable operation with additional BoosterPacks.

An additional analog signal is provided on the outer left header (X6-9). This signal can be used to monitor the touch panel on the popular Kentec EB-LM4F120-L35 BoosterPack.

Using the jumpers JP4 and JP5, Controller Area Network (CAN) digital receive and transmit signals can be optionally routed to the BoosterPack 2 interface. The location of these signals is consistent with the CAN interface on the Tiva C Series TM4C123G LaunchPad and the Stellaris LM4F120 LaunchPad. In the default configuration, UART0 is used for the ICDI virtual UART and CAN is not present on the BoosterPack headers. In this configuration, the ROM serial bootloader can be used over the ICDI virtual UART. When the jumpers are configured for CAN on the BoosterPack, then UART2 must be used for the ICDI virtual UART.

To comply with both the original and the new BoosterPack standard, I2C is provided on both sides of the BoosterPack connection. Use of I2C on the bottom left of the BoosterPack connection is highly encouraged where possible, to be in compliance with the new BoosterPack standard. To provide I2C capability on the right side of the connector, per the original standard, two zero-ohm resistors (R19 and R20) are used to combine the SPI and I2C signals. These signals are not shared with any other pins on the LaunchPad and therefore removal of these zero-ohm resistors should not be required. Software should be certain that unused GPIO signals are configured as inputs.

Table 2-2 provides a complete listing of the BoosterPack pins and the GPIO alternate functions available at each pin. The TM4C1294NCPDT GPIO register GPIOCTL values are shown for each configuration. The headers in this table are labeled from left to right in ten pin columns. 'A' and 'D' make up the outer BoosterPack standard pins, 'B' and 'C' make up the inner BoosterPack XL standard pins.

Table 2-2. BoosterPack 2 GPIO and Signal Muxing

| Header | Pin | Standard Function | GPIO | MCU Pin | Analog | Digital Function (FPIOCTL Bit Encoding) | | | | | | | | | | |
|--------|-----|---------------------|------|---------|--------|---|---------|---------|-----|---|--------|---|----|----|---------|-----------|
| | | | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 |
| A2 | 1 | | 3.3V | | | | | | | | | | | | | |
| A2 | 2 | Analog | PD2 | 3 | AIN13 | - | I2C8SCL | T1CCP0 | C2o | - | - | - | - | - | - | SSI2Fss |
| A2 | 3 | UART RX | PP0 | 118 | C2+ | U6Rx | - | - | - | - | - | - | - | - | - | SSI3XDAT2 |
| A2 | 4 | UART TX | PP1 | 119 | C2- | U6Tx | - | - | - | - | - | - | - | - | - | SSI3XDAT3 |
| A2 | 5 | GPIO (See JP4) | PD4 | 125 | AIN7 | U2Rx | - | T3CCP0 | - | - | - | - | - | - | - | SSI1XDAT2 |
| | | | PA0 | 33 | - | U0Rx | I2C9SCL | T0CCP0 | - | - | CANORx | - | - | - | - | - |
| A2 | 6 | Analog (See JP5) | PD5 | 126 | AIN6 | U2Tx | - | T3CCP1 | - | - | - | - | - | - | - | SSI1XDAT3 |
| | | | PA1 | 34 | - | U0Tx | I2C9SDA | T0CCP1 | - | - | CAN0Tx | - | - | - | - | - |
| A2 | 7 | SPI CLK | PQ0 | 5 | - | - | - | - | - | - | - | - | - | - | SSI3Clk | EPI0S20 |
| A2 | 8 | GPIO | PP4 | 105 | - | U3RTS | U0DSR | - | - | - | - | - | - | - | USB0D7 | - |
| A2 | 9 | I2C SCL | PN5 | 112 | - | U1RI | U3CTS | I2C2SCL | - | - | - | - | - | - | - | EPIO0S35 |
| A2 | 10 | I2C SDA | PN4 | 111 | - | U1DTR | U3RTS | I2C2SDA | - | - | - | - | - | - | - | EPIO0S34 |
| B2 | 1 | | 5V | | | | | | | | | | | | | |
| B2 | 2 | | GND | | | | | | | | | | | | | |
| B2 | 3 | Analog | PB4 | 121 | AIN10 | U0CTS | I2C5SCL | - | - | - | - | - | - | - | - | SSI1Fss |

Table 2-2. BoosterPack 2 GPIO and Signal Muxing (continued)

| Header | Pin | Standard Function | GPIO | MCU Pin | Analog | Digital Function (FPIOPTL Bit Encoding) | | | | | | | | | | |
|--------|-----|-------------------|------|---------|--------|---|---------|--------|----------|----------|---|---|----------|-----------|-----------|-----------|
| | | | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 |
| B2 | 4 | Analog | PB5 | 120 | AIN11 | U0RTS | I2C5SDA | - | - | - | - | - | - | - | - | SSI1Clk |
| B2 | 5 | Analog | PK0 | 18 | AIN16 | U4Rx | - | - | - | - | - | - | - | - | - | EPI0S0 |
| B2 | 6 | Analog | PK1 | 19 | AIN17 | U4Tx | - | - | - | - | - | - | - | - | - | EPI0S1 |
| B2 | 7 | Analog | PK2 | 20 | AIN18 | U4RTS | - | - | - | - | - | - | - | - | - | EPI0S2 |
| B2 | 8 | Analog | PK3 | 21 | AIN19 | u4CTS | - | - | - | - | - | - | - | - | - | EPI0S3 |
| B2 | 9 | A out | PA4 | 37 | - | U3Rx | I2C7SCL | T2CCP0 | - | - | - | - | - | - | - | SSI0XDAT0 |
| B2 | 10 | A out | PA5 | 38 | - | U3Tx | I2C7SDA | T2CCP1 | - | - | - | - | - | - | - | SSI0XDAT1 |
| C2 | 1 | PWM | PG1 | 50 | - | - | I2C1SDA | - | - | M0PWM5 | - | - | - | - | - | EPI0S10 |
| C2 | 2 | PWM | PK4 | 63 | - | - | I2C3SCL | - | EN0LED0 | M0PWM6 | - | - | - | - | - | EPI0S32 |
| C2 | 3 | PWM | PK5 | 62 | - | - | I2C3SDA | - | EN0LED2 | M0PWM7 | - | - | - | - | - | EPI0S31 |
| C2 | 4 | PWM | PM0 | 78 | - | - | - | T2CCP0 | - | - | - | - | - | - | - | EPI0S15 |
| C2 | 5 | Capture | PM1 | 77 | - | - | - | T2CCP1 | - | - | - | - | - | - | - | EPI0S14 |
| C2 | 6 | Capture | PM2 | 76 | - | - | - | T3CCP0 | - | - | - | - | - | - | - | EPI0S13 |
| C2 | 7 | GPIO | PH0 | 29 | - | U0RTS | - | - | - | - | - | - | - | - | - | EPI0S0 |
| C2 | 8 | GPIO | PH1 | 30 | - | U0CTS | - | - | - | - | - | - | - | - | - | EPI0S1 |
| C2 | 9 | GPIO | PK6 | 61 | - | - | I2C4SCL | - | EN0LED1 | M0FAULT1 | - | - | - | - | - | EPI0S25 |
| C2 | 10 | GPIO | PK7 | 60 | - | U0RI | I2C4SDA | - | RTCCLK | M0FAULT2 | - | - | - | - | - | EPI0S24 |
| D2 | 1 | | | | | GND | | | | | | | | | | |
| D2 | 2 | PWM | PM7 | 71 | TMPR0 | U0RI | - | T5CCP1 | - | - | - | - | - | - | - | - |
| D2 | 3 | GPIO | PP5 | 106 | - | U3CTS | I2C2SDL | - | - | - | - | - | - | - | USB0D6 | - |
| D2 | 4 | GPIO | PA7 | 41 | - | U2Tx | I2C6SDA | T3CCP1 | USB0PFLT | - | - | - | USB0EPEN | SSI0XDAT3 | - | EPI0S9 |
| D2 | 5 | | | | | RESET | | | | | | | | | | |
| D2 | 6 | SPI MOSI | PQ2 | 11 | - | - | - | - | - | - | - | - | - | - | SSI3XDAT0 | EPI0S22 |
| | | I2C | PA3 | 36 | - | U4Tx | I2C8SDA | T1CCP1 | - | - | - | - | - | - | - | SSI0Fss |
| D2 | 7 | SPI MISO | PQ3 | 27 | - | - | - | - | - | - | - | - | - | - | SSI3XDAT1 | EPI0S23 |
| | | I2C | PA2 | 35 | - | U4Rx | I2C8SCL | T1CCP0 | - | - | - | - | - | - | - | SSI0Clk |
| D2 | 8 | GPIO | PP3 | 104 | - | U1CTS | U0DCD | - | - | - | - | - | - | - | USB0DIR | EPI0S30 |
| D2 | 9 | GPIO | PQ1 | 6 | - | - | - | - | - | - | - | - | - | - | SSI3Fss | EPI0S21 |
| D2 | 10 | GPIO | PM6 | 72 | TMPR1 | U0DSR | - | T5CCP0 | - | - | - | - | - | - | - | - |

2.1.6.3 Breadboard Connection

The breadboard adapter section of the board is a set of 98 holes on a 0.1 inch grid. Properly combined with a pair of right angle headers, the entire Connected LaunchPad can be plugged directly into a standard 300 mil (0.3 inch) wide solder-less breadboard. The right angle headers and breadboard are not provided with this kit. Suggested part numbers are Samtec TSW-149-09-L-S-RE and TSW-149-08-L-S-RA right angle pin headers and Twin industries TW-E40-1020 solder-less breadboard. Samtec TSW-149-09-F-S-RE and TSW-149-09-F-S-RA may be substituted.

A detailed explanation of how to install the headers is available on the TI LaunchPad Wiki or at <http://users.ece.utexas.edu/~valvano/EE345L/Labs/Fall2011/LM3S1968soldering.pdf>.

Nearly all microcontroller signals are made available at the breadboard adapter holes (X11). These signals are grouped by function where possible. For example, all EPI signals are grouped on one side of the connector. Many of the analog signals are grouped near VREF, and UART, SSI and I2C signals are grouped by peripheral to make expansion and customization simpler.

[Table 2-3](#) and [Table 2-4](#) show the GPIO pin and signal muxing for the X11 breadboard adapter pads.

Table 2-3. X11 Breadboard Adapter Odd-Numbered Pad GPIO and Signal Muxing

| Pin | Port | MCU PIN | Analog | Digital Function (GPIOCTL Bit Encoding) | | | | | | | | | | |
|-----|------|---------|--------|---|---------|--------|----------|----------|--------|---|----------|-----------|-----------|---------|
| | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 |
| 1 | | | | 3V3 | | | | | | | | | | |
| 3 | | | | GND | | | | | | | | | | |
| 5 | PB4 | 121 | AIN10 | U0CTS | I2C5SCL | - | - | - | - | - | - | - | - | SSI1Fss |
| 7 | PB5 | 120 | AIN11 | U0RTS | I2C5SDA | - | - | - | - | - | - | - | - | SSI1Clk |
| 9 | PH0 | 29 | - | U0RTS | - | - | - | - | - | - | - | - | - | EPI0S0 |
| 11 | PH1 | 30 | - | U0CTS | - | - | - | - | - | - | - | - | - | EPI0S1 |
| 13 | PH2 | 31 | - | U0DCD | - | - | - | - | - | - | - | - | - | EPI0S2 |
| 15 | PH3 | 32 | - | U0DSR | - | - | - | - | - | - | - | - | - | EPI0S3 |
| 17 | PC7 | 22 | C0- | U5Tx | - | - | - | - | - | - | - | - | - | EPI0S4 |
| 19 | PC6 | 23 | C0+ | U5Rx | - | - | - | - | - | - | - | - | - | EPI0S5 |
| 21 | PC5 | 24 | C1+ | U7Tx | - | - | - | - | RTCCLK | - | - | - | - | EPI0S6 |
| 23 | PC4 | 25 | C1- | U7Rx | - | - | - | - | - | - | - | - | - | EPI0S7 |
| 25 | PA6 | 40 | - | U2Rx | I2C6SCL | T3CCP0 | USB0EPEN | - | - | - | - | SSI0XDAT2 | - | EPI0S8 |
| 27 | PA7 | 41 | - | U2Tx | I2C6SDA | T3CCP1 | USB0PFLT | - | - | - | USB0EPEN | SSI0XDAT3 | - | EPI0S9 |
| 29 | PG1 | 50 | - | - | I2C1SDA | - | - | M0PWM5 | - | - | - | - | - | EPI0S10 |
| 31 | PG0 | 49 | - | - | I2C1SCL | - | EN0PPS | M0PWM4 | - | - | - | - | - | EPI0S11 |
| 33 | PM3 | 75 | - | - | - | T3CCP1 | - | - | - | - | - | - | - | EPI0S12 |
| 35 | | | | GND | | | | | | | | | | |
| 37 | PM2 | 76 | - | - | - | T3CCP0 | - | - | - | - | - | - | - | EPI0S13 |
| 39 | PM1 | 77 | - | - | - | T2CCP1 | - | - | - | - | - | - | - | EPI0S14 |
| 41 | PM0 | 78 | - | - | - | T2CCP0 | - | - | - | - | - | - | - | EPI0S15 |
| 43 | PL0 | 81 | - | - | I2C2SDA | - | - | M0FAULT3 | - | - | - | - | USB0D0 | EPI0S16 |
| 45 | PL1 | 82 | - | - | I2C2SCL | - | - | PhA0 | - | - | - | - | USB0D1 | EPI0S17 |
| 47 | PL2 | 83 | - | - | - | - | C0o | PhB0 | - | - | - | - | USB0D2 | EPI0S18 |
| 49 | PL3 | 84 | - | - | - | - | C1o | IDX0 | - | - | - | - | USB0D3 | EPI0S19 |
| 51 | PQ0 | 5 | - | - | - | - | - | - | - | - | - | - | SSI3Clk | EPI0S20 |
| 53 | PQ1 | 6 | - | - | - | - | - | - | - | - | - | - | SSI3Fss | EPI0S21 |
| 55 | PQ2 | 11 | - | - | - | - | - | - | - | - | - | - | SSI3XDAT0 | EPI0S22 |
| 57 | PQ3 | 27 | - | - | - | - | - | - | - | - | - | - | SSI3XDAT1 | EPI0S23 |
| 59 | PK7 | 60 | - | U0RI | I2C4SDA | - | - | - | - | - | - | - | - | EPI0S24 |
| 61 | | | | GND | | | | | | | | | | |
| 63 | PK6 | 61 | - | - | I2C4SCL | - | EN0LED1 | M0FAULT1 | - | - | - | - | - | EPI0S25 |
| 65 | PL4 | 85 | - | - | - | T0CCP0 | - | - | - | - | - | - | USB0D4 | EPI0S26 |

Table 2-3. X11 Breadboard Adapter Odd-Numbered Pad GPIO and Signal Muxing (continued)

| Pin | Port | MCU PIN | Analog | Digital Function (GPIOCTL Bit Encoding) | | | | | | | | | | | |
|-----|------|---------|--------|---|---------|---------|---------|--------|--------|---------|----|----|----|---------|---------|
| | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 | |
| 67 | PB2 | 91 | - | - | I2C0SCL | T5CCP0 | - | - | - | - | - | - | - | USB0STP | EPI0S27 |
| 69 | PB3 | 92 | - | - | I2C0SDA | T5CCP1 | - | - | - | - | - | - | - | USB0CLK | EPI0S28 |
| 71 | PP2 | 103 | - | U0DTR | - | - | - | - | - | - | - | - | - | USB0NXT | EPI0S29 |
| 73 | PP3 | 104 | - | U1CTS | U0DCD | - | - | - | RTCCLK | - | - | - | - | USB0DIR | EPI0S30 |
| 75 | PK5 | 62 | - | - | I2C3SDA | - | EN0LED2 | M0PWM7 | - | - | - | - | - | - | EPI0S31 |
| 77 | PK4 | 63 | - | - | I2C3SCL | - | EN0LED0 | M0PWM6 | - | - | - | - | - | - | EPI0S32 |
| 79 | PL5 | 86 | - | - | - | T0CCP1 | - | - | - | - | - | - | - | USB0D5 | EPI0S33 |
| 81 | PN4 | 111 | - | U1DTR | U3RTS | I2C2SDA | - | - | - | - | - | - | - | - | EPI0S34 |
| 83 | PN5 | 112 | - | U1RI | U3CTS | I2C2SCL | - | - | - | - | - | - | - | - | EPI0S35 |
| 85 | PN0 | 107 | - | U1RTS | - | - | - | - | - | - | - | - | - | - | - |
| 87 | PN1 | 108 | - | U1CTS | - | - | - | - | - | - | - | - | - | - | - |
| 89 | PN2 | 109 | - | U1DCD | U2RTS | - | - | - | - | - | - | - | - | - | EPI0S29 |
| 91 | PN3 | 110 | - | U1DSR | U2CTS | - | - | - | - | - | - | - | - | - | EPI0S30 |
| 93 | PQ4 | 102 | - | U1Rx | - | - | - | - | - | DIVSCLK | - | - | - | - | - |
| 95 | WAKE | | | | | | | | | | | | | | |
| 97 | 5V | | | | | | | | | | | | | | |

Table 2-4. X11 Breadboard Adapter Even-Numbered Pad GPIO and Signal Muxing

| Pin | Port | MCU PIN | Analog | Digital Function (GPIOCTL Bit Encoding) | | | | | | | | | | | |
|-----|------|---------|--------|---|---------|--------|---|---|---|---|----|----|----|----|-----------|
| | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 | |
| 2 | 5V | | | | | | | | | | | | | | |
| 4 | GND | | | | | | | | | | | | | | |
| 6 | PA2 | 35 | - | U4Rx | I2C8SCL | T1CCP0 | - | - | - | - | - | - | - | - | SSI0Clk |
| 8 | PA3 | 36 | - | U4Tx | I2C8SDA | T1CCP1 | - | - | - | - | - | - | - | - | SSI0Fss |
| 10 | PA4 | 37 | - | U3Rx | I2C7SCL | T2CCP0 | - | - | - | - | - | - | - | - | SSI0XDAT0 |
| 12 | PA5 | 38 | - | U3Tx | I2C7SDA | T2CCP1 | - | - | - | - | - | - | - | - | SSI0XDAT1 |
| 14 | PE0 | 15 | AIN3 | U1RTS | - | - | - | - | - | - | - | - | - | - | - |
| 16 | PE1 | 14 | AIN2 | U1DSR | - | - | - | - | - | - | - | - | - | - | - |
| 18 | PE2 | 13 | AIN1 | U1DCD | - | - | - | - | - | - | - | - | - | - | - |
| 20 | PE3 | 12 | AIN0 | U1DTR | - | - | - | - | - | - | - | - | - | - | - |
| 22 | PE4 | 123 | AIN9 | U1RI | - | - | - | - | - | - | - | - | - | - | SSI1XDAT0 |
| 24 | PE5 | 124 | AIN8 | - | - | - | - | - | - | - | - | - | - | - | SSI1XDAT1 |

Table 2-4. X11 Breadboard Adapter Even-Numbered Pad GPIO and Signal Muxing (continued)

| Pin | Port | MCU PIN | Analog | Digital Function (GPIOCTL Bit Encoding) | | | | | | | | | | |
|-----|------|---------|----------|---|---------|--------|----------|----------|--------|-----|----|----|-----------|-----------|
| | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 |
| 26 | PK0 | 18 | AIN16 | U4Rx | - | - | - | - | - | - | - | - | - | EPI0S0 |
| 28 | PK1 | 19 | AIN17 | U4Tx | - | - | - | - | - | - | - | - | - | EPI0S1 |
| 30 | PK2 | 20 | AIN18 | U4RTS | - | - | - | - | - | - | - | - | - | EPI0S2 |
| 32 | PK3 | 21 | AIN19 | U4CTS | - | - | - | - | - | - | - | - | - | EPI0S3 |
| 34 | VREF | | | | | | | | | | | | | |
| 36 | GND | | | | | | | | | | | | | |
| 38 | PD5 | 126 | AIN6 | U2Tx | - | T3CCP1 | - | - | - | - | - | - | - | SSI1XDAT3 |
| 40 | PD4 | 125 | AIN7 | U2Rx | - | T3CCP0 | - | - | - | - | - | - | - | SSI1XDAT2 |
| 42 | PD7 | 128 | AIN4 | U2CTS | - | T4CCP1 | USB0PFLT | - | - | NMI | - | - | - | SSI2XDAT2 |
| 44 | PD6 | 127 | AIN5 | U2RTS | - | T4CCP0 | USB0EPEN | - | - | - | - | - | - | SSI2XDAT3 |
| 46 | PD3 | 4 | AIN12 | - | I2C8SDA | T1CCP1 | - | - | - | - | - | - | - | SSI2CIk |
| 48 | PD1 | 2 | AIN14 | - | I2C7SDA | T0CCP1 | C1o | - | - | - | - | - | - | SSI2XDAT0 |
| 50 | PD0 | 1 | AIN15 | - | I2C7SCL | T0CCP0 | C0o | - | - | - | - | - | - | SSI2XDAT1 |
| 52 | PD2 | 3 | AIN13 | - | I2C8SCL | T1CCP0 | C2o | - | - | - | - | - | - | SSI2Fss |
| 54 | PP0 | 118 | C2+ | U6Rx | - | - | - | - | - | - | - | - | - | SSI3XDAT2 |
| 56 | PP1 | 119 | C2- | U6Tx | - | - | - | - | - | - | - | - | - | SSI3XDAT3 |
| 58 | PB0 | 95 | USB0ID | U1Rx | I2C5SCL | T4CCP0 | - | - | CAN1Rx | - | - | - | - | - |
| 60 | PB1 | 96 | USB0VBUS | U1Tx | I2C5SDA | T4CCP1 | - | - | CAN1Tx | - | - | - | - | - |
| 62 | GND | | | | | | | | | | | | | |
| 64 | PF4 | 46 | - | - | - | - | EN0LED1 | M0FAULT0 | - | - | - | - | SSI3XDAT2 | TRD3 |
| 66 | PF0 | 42 | - | - | - | - | EN0LED0 | M0PWM0 | - | - | - | - | SSI3XDAT1 | TRD2 |
| 68 | PF1 | 43 | - | - | - | - | EN0LED2 | M0PWM1 | - | - | - | - | SSI3XDAT0 | TRD1 |
| 70 | PF2 | 44 | - | - | - | - | - | M0PWM2 | - | - | - | - | SSI3Fss | TRD0 |
| 72 | PF3 | 45 | - | - | - | - | - | M0PWM3 | - | - | - | - | SSI3CIk | TRCLK |
| 74 | PA0 | 33 | - | U0Rx | I2C9SCL | T0CCP0 | - | - | CAN0Rx | - | - | - | - | - |
| 76 | PA1 | 34 | - | U0Tx | I2C9SDA | T0CCP1 | - | - | CAN0Tx | - | - | - | - | - |
| 78 | PP4 | 105 | - | U3RTS | U0DSR | - | - | - | - | - | - | - | USB0D7 | - |
| 80 | PP5 | 106 | - | U3CTS | I2C2SCL | - | - | - | - | - | - | - | USB0D6 | - |
| 82 | PJ0 | 116 | - | U3Rx | - | - | - | - | - | - | - | - | - | - |
| 84 | PJ1 | 117 | - | U3Tx | - | - | - | - | - | - | - | - | - | - |
| 86 | PM7 | 71 | TMPR0 | U0RI | - | T5CCP1 | - | - | - | - | - | - | - | - |
| 88 | PM6 | 72 | TMPR1 | U0DSR | - | T5CCP0 | - | - | - | - | - | - | - | - |
| 90 | PM5 | 73 | TMPR2 | U0DCD | - | T4CCP1 | - | - | - | - | - | - | - | - |

Table 2-4. X11 Breadboard Adapter Even-Numbered Pad GPIO and Signal Muxing (continued)

| Pin | Port | MCU PIN | Analog | Digital Function (GPIOPCTL Bit Encoding) | | | | | | | | | | |
|-----|------|---------|--------|--|---|--------|---|---|---|---|----|----|----|----|
| | | | | 1 | 2 | 3 | 5 | 6 | 7 | 8 | 11 | 13 | 14 | 15 |
| 92 | PM4 | 74 | TMPR3 | U0CTS | - | T4CCP0 | - | - | - | - | - | - | - | - |
| 94 | | | | RESET | | | | | | | | | | |
| 96 | | | | GND | | | | | | | | | | |
| 98 | | | | 3V3 | | | | | | | | | | |

2.1.6.4 Other Headers and Jumpers

JP1 is provided to select the power input source for the Connected LaunchPad. The top position is for BoosterPack power; this position also disconnects both USB voltages from the board's primary 5-volt input. In the top position, the TPS2052B does not limit current so additional care should be exercised. The middle position draws power from the USB connector on the left side of the board near the Ethernet jack. The bottom position is the default, in which power is drawn from the ICDI (Debug) USB connection.

JP2 separates the MCU 3.3-volt power domain from the rest of the 3.3-volt power on the board allowing an ammeter to be used to obtain more accurate measurements of microcontroller power consumption.

JP3 isolates the output of the TPS73733 LDO from the board's 3.3-V power domain.

JP4 and JP5 are used to configure CAN signals to the BoosterPack 2 interface. In the default horizontal configuration, CAN is not present on the BoosterPack. UART2 goes to the BoosterPack and UART 0 goes to the ICDI virtual serial port to provide ROM serial bootloader capability. In the vertical CAN-enabled configuration, UART2 goes to the ICDI virtual serial port and CAN signals are available on the BoosterPack. The ROM serial bootloader is not available to the ICDI virtual serial port while the jumpers are in the CAN position.

Figure 2-2 shows the default configuration and relative location of the jumpers on the board.

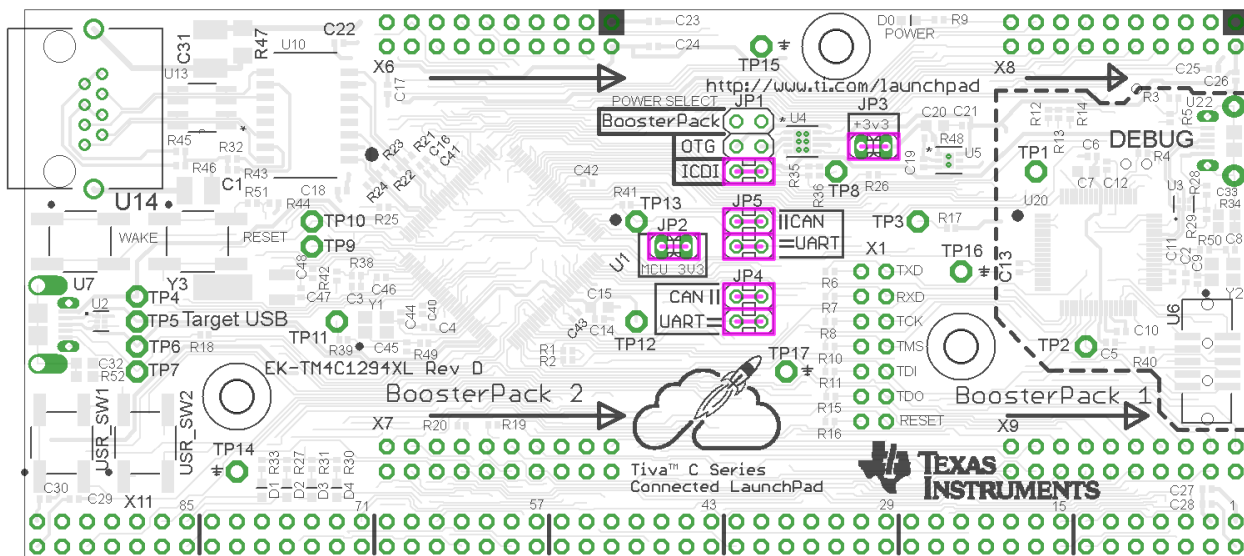


Figure 2-2. Default Jumper Locations

2.2 Power Management

2.2.1 Power Supplies

The Connected LaunchPad can be powered from three different input options:

- On-board ICDI USB cable (Debug, Default)
- Target USB cable
- BoosterPack or Breadboard adapter connection

The JP1 power-select jumper is used to select one of the power sources.

In addition, the JP3 power jumper can be used to isolate the 3.3-volt output of the TPS73733 from the board's 3.3-volt rail.

A TPS2052B load switch is used to regulate and control power to the Target USB connector when the microcontroller is acting in USB host mode. This load switch also limits current to the BoosterPack and Breadboard adapter headers when the JP1 jumper is in the ICDI position.

2.2.2 Low Power Modes

The Connected LaunchPad demonstrates several low power microcontroller modes. In run mode, the microcontroller can be clocked from several sources such as the internal precision oscillator or an external crystal oscillator. Either of these sources can then optionally drive an internal PLL to increase the effective frequency of the system up to 120 MHz. In this way, the run mode clock speed can be used to manage run mode current consumption.

The microcontroller also provides sleep and deep sleep modes and internal voltage adjustments to the flash and SRAM to further refine power consumption when the processor is not in use but peripherals must remain active. Each peripheral can be individually clock gated in these modes so that current consumption by unused peripherals is minimized. A wide variety of conditions from internal and external sources can trigger a return to run mode.

The lowest power setting of the microcontroller is hibernation, which requires a small amount of supporting external circuitry available on the Connected LaunchPad. The Connected LaunchPad can achieve microcontroller current consumption modes under 2 micro-Amps using hibernate VDD3ON mode. Hibernation with VDD3ON mode is not supported on this board. The Connected LaunchPad can be woken from hibernate by several triggers including the dedicated wake button, the reset button, an internal RTC timer and a subset of the device GPIO pins. The hibernation module provides a small area of internal SRAM that can preserve data through a hibernate cycle.

2.2.3 Clocking

The Connected LaunchPad uses a 25 MHz crystal (Y1) to drive the main TM4C1294NCPDTI internal clock circuit. Most software examples use the internal PLL to multiply this clock to higher frequencies up to 120 MHz for core and peripheral timing. The 25-MHz crystal is required when using the integrated Ethernet MAC and PHY.

The Hibernation module is clocked from an external 32.768-KHz crystal (Y3).

2.2.4 Reset

The RESET signal to the TM4C1294NCPDTI microcontroller connects to the RESET switch, BoosterPack connectors, Breadboard adapter and to the ICDI circuit for a debugger-controller reset.

External reset is asserted (active low) under the following conditions:

- Power-on reset (filtered by and R-C network)
- RESET switch is held down.
- By the ICDI circuit when instructed by the debugger (this capability is optional, and may not be supported by all debuggers)
- By an external circuit attached to the BoosterPack or Breadboard connectors.

2.3 Debug Interface

2.3.1 In-Circuit Debug Interface (ICDI)

The Connected LaunchPad comes with an on-board ICDI. The ICDI allows for the programming and debugging of the TM4C1294NCPDTI using LM Flash Programmer and/or any of the supported tool chains. Note that ICDI only supports JTAG debugging at this time. It is possible to use other JTAG emulators instead of the on board ICDI, by connecting to U6. When the ICDI detects an external debug adapter connection on the JTAG connector U6 and disables the ICDI outputs to allow the external debug adapter to drive the debug circuit. For more information, see [Section 2.3.2](#).

Debug out of the ICDI is possible by removing resistors R6, R7, R8, R10, R11, R15, R16 and R40 from the Connected LaunchPad and use the ICDI to drive JTAG signals out on U6 for the purpose of programming or debugging other boards. To restore the connection to the on-board TM4C1294NCPDTI microcontroller, install jumpers from the odd to even pins of X1 or re-install the resistors. Removal of R40 disables the detection of an attached external debugger. R40 must be installed to use an external debug adapter to program or debug the Connected LaunchPad.

2.3.2 External Debugger

The connector U6 is provided for the attachment of an external debug adapter such as the IAR J-Link or Keil ULINK. This connector follows the ARM standard 10-pin JTAG pinout. This interface can use either JTAG or SWD if supported by the external debug adapter.

2.3.3 Virtual COM Port

When plugged into a USB host, the ICDI enumerates as both a debugger and a virtual COM port. JP4 and JP5 control the selection of which UART from the TM4C1294NCPDTI is connected to the virtual COM port. In the default configuration, UART0 maps to the virtual COM port of the ICDI. In the CAN jumper configuration, UART2 maps to the virtual COM port of the ICDI.

Software Development

This chapter provides general information on software development as well as instructions for flash memory programming.

3.1 Software Description

The TivaWare software provides drivers for all of the peripheral devices supplied in the design. The Tiva C Series Peripheral Driver Library is used to operate the on-chip peripherals as part of TivaWare.

TivaWare includes a set of example applications that use the TivaWare Peripheral Driver Library. These applications demonstrate the capabilities of the TM4C1294NCPDTI microcontroller, as well as provide a starting point for the development of the final application for use on the Connected LaunchPad evaluation board. Example applications are also provided for the Connected LaunchPad when paired with selected BoosterPacks.

3.2 Source Code

The complete source code including the source code installation instructions are provided at <http://www.ti.com/tool/sw-tm4c>. The source code and binary files are installed in the TivaWare software tree.

3.3 Tool Options

The source code installation includes directories containing projects, makefiles, and binaries for the following tool-chains:

- Keil ARM RealView® Microcontroller Development System
- IAR Embedded Workbench for ARM
- Sourcery Codebench
- Generic GNU C Compiler
- Texas Instruments' Code Composer Studio™ IDE

Download evaluation versions of these tools from the [Tools & Software](#) section of www.ti.com/tiva. Due to code size restrictions, the evaluation tools may not build all example programs. A full license is necessary to re-build or debug all examples.

For detailed information on using the tools, see the documentation included in the tool chain installation or visit the website of the tools supplier.

3.4 Programming the Connected LaunchPad

The Connected LaunchPad software package includes pre-built binaries for each of the example applications. If you installed the TivaWare™ software to the default installation path of `C:\ti\TivaWare_C_Series_<version>`, you can find the example applications in `C:\ti\TivaWare_C_Series_<version>\examples\boards\ek-tm4c129xl`. The on-board ICDI is used with the LM Flash Programmer tool to program applications on the Connected LaunchPad.

Follow these steps to program example applications into the Connected LaunchPad evaluation board using the ICDI:

1. Install [LM Flash Programmer](#) on a PC running Microsoft Windows.
2. Place JP1 into the ICDI position on the Connected LaunchPad.
3. Connect the USB-A cable plug in to an available USB port on the PC and plug the Micro-B plug to the Debug USB port (U22) on the Connected LaunchPad.
4. Verify that LED D0 at the top of the board is illuminated.
5. Install Windows ICDI and Virtual COM Port drivers if prompted. Installation instructions can be found at <http://www.ti.com/lit/pdf/spmu287>.
6. Run the LM Flash Programmer application on the PC.
7. In the Configuration tap, use the Quick Set control to select “TM4C1294XL LaunchPad”.
8. Move to the Program tab and click the Browse button. Navigate to the example applications directory (the default location is `C:\ti\TivaWare_C_Series_<version>\examples\boards\ek-tm4c1294xl`)
9. Each example application has its own directory. Navigate to the example directory that you want to load and then into the sub-directory for one of the supported tool chains which contains the binary (*.bin) file. Select the binary file and click Open.
10. Set the Erase Method to Erase Necessary Pages, check the Verify After Program box, and check Reset MCU After Program. The example program starts execution once the verify process is complete.

References, PCB Layout, and Bill of Materials

4.1 References

In addition to this document the following references are available for download at www.ti.com.

- TivaWare for C Series (<http://www.ti.com/tool/sw-tm4c>)
- TivaWare Peripheral Driver Library Users' Guide (literature number [SPMU298](#))
- EK-TM4C1294XL Getting Started Guide (literature number [SPMZ858](#))
- LM Flash Programmer Tool (<http://www.ti.com/lmflashprogrammer>)
- TPS73733 Low-Dropout Regulator with Reverse Current Protection (<http://www.ti.com/product/tps79733>)
- Texas Instruments Code Composer Studio website (<http://www.ti.com/ccs>)
- Tiva C Series TM4C1294NCPDT Microcontroller Data Sheet (<http://www.ti.com/lit/gpn/tm4c1294ncpdt>)
- Build Your Own BoosterPack information regarding the BoosterPack standard (<http://www.ti.com/byob>)
- ICDI Driver Installation Guide (literature number [SPMU287](#))

Additional Support:

- Keil RealView MDK-ARM (<http://www.keil.com/arm/mdk.asp>)
- IAR Embedded Workbench for ARM (<http://iar.com/ewarm/>)
- Sourcery CodeBench development tools (<http://www.mentor.com/embedded-software/sourcery-tools/sourcery-codebench/overview>)
- Exosite (<http://ti.exosite.com>)

4.2 Component Locations

Figure 4-1 is a dimensioned drawing of the Connected LaunchPad. This figure shows the location of selected features of the board as well as the component locations.

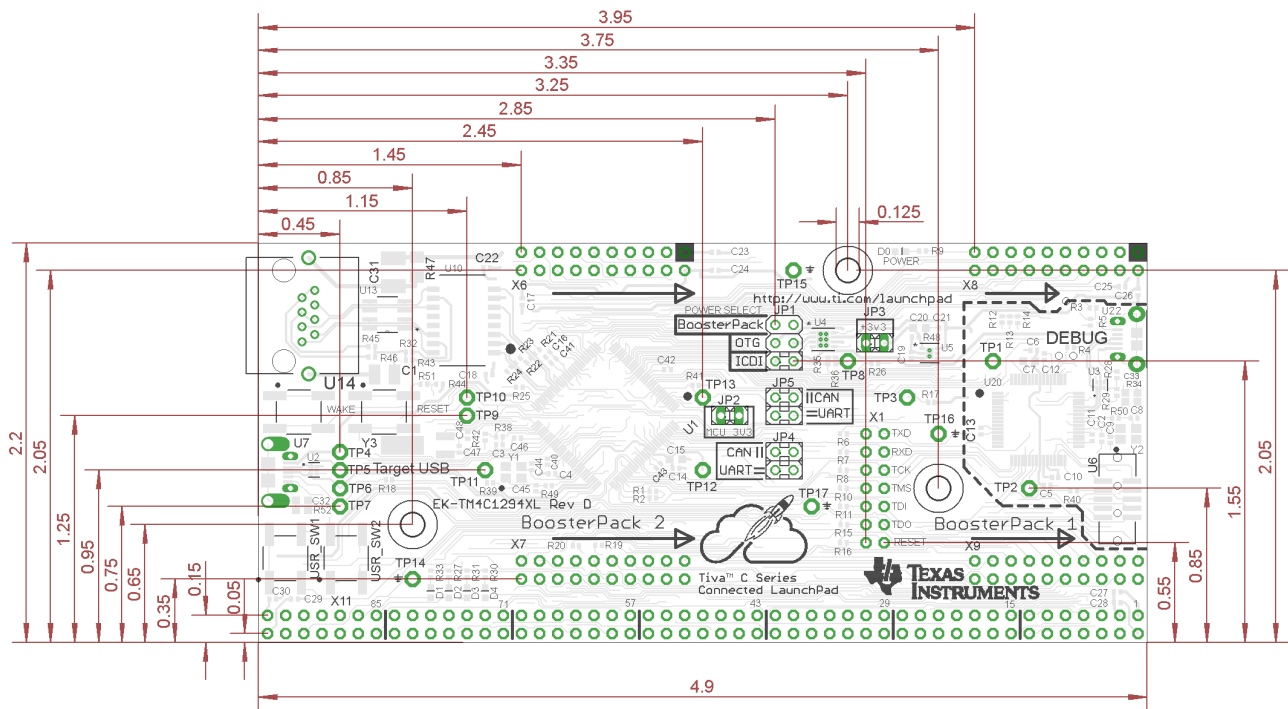


Figure 4-1. Connected LaunchPad Dimensions and Component Locations

4.3 Bill of Materials

Table 4-1 is the Connected LaunchPad bill of materials list.

Table 4-1. Connected LaunchPad Bill of Materials

| Item | Ref | Qty | Description | Mfg | Part Number |
|------|---|-----|---|--------------------------|----------------------|
| 1 | C1 | 1 | Capacitor, 1000pF, 2kV, 20%, X7R, 1210 | Kemet | C1210C102MGRACU |
| 2 | C3, C4, C5, C10, C11, C12, C13, C16, C17, C18, C19, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C40, C41, C42, C43, C46 | 26 | Capacitor, 0.1uF 16V, 10%,0402 X7R | Taiyo Yuden | EMK105B7104KV-F |
| 3 | C31 | 1 | Capacitor, 4700pF, 2kV, 10%,X7R, 1812 | AVX | 1812GC472KAT1A |
| 4 | C32, C33 | 2 | Capacitor, 3300pF, 50V, 10%, X7R, 0603 | TDK | C1608X7R1H332K |
| 5 | C6, C14 | 2 | Capacitor, 1uF, X5R, 10V, Low ESR, 0402 | Johanson Dielectrics Inc | 100R07X105KV4T |
| 6 | C7, C15, C20 | 3 | Capacitor, 2.2uF, 16V, 10%, 0603, X5R | Murata | GRM188R61C225KE15D |
| 7 | C8, C9, C44, C45, C47, C48 | 6 | Capacitor, 12pF, 50V, 5%, 0402, COG | Murata | GRM1555C1H120JZ01D |
| 8 | D0, D1, D2, D3, D4 | 5 | Green LED 0603 | Everlight | 19-217/G7C-AL1M2B/3T |
| 9 | J1, J2, J3, J4, J5, J6, J7 | 7 | Jumper, 0.100, Gold, Black, Open | 3M | 969102-0000-DA |
| | | | | Kobiconn | 151-8000-E |
| 10 | JP1 | 1 | Header, 2x3, 0.100, T-Hole, Vertical Unshrouded, 0.230 Mate, gold | FCI | 67996-206HLF |
| 11 | JP2, JP3 | 2 | Header, 1x2, 0.100, T-Hole, Vertical Unshrouded, 0.220 Mate | 3M | 961102-6404-AR |
| | | | | FCI | 68001-102HLF |
| | | | | Anyone | 1x2-head |
| 12 | JP4, JP5 | 2 | Header, 2x2, 0.100, T-Hole, Vertical Unshrouded, 0.230 Mate | FCI | 67997-104HLF |
| | | | | 4UCON | 00998 |
| 13 | R1, R2, R3, R4, R5, R29, R35, R44 | 8 | Resistor, 10k ohm, 1/10W, 5%, 0402 Thick Film | Yageo | RC0402FR-0710KL |
| 14 | R17, R26, R36 | 3 | 100k 5% 0402 resistor smd | Rohm | MCR01MRTJ104 |
| 15 | R18, R51 | 2 | Resistor 0402 100 ohm 5% | Rohm | MCR1MRTJ101 |
| 16 | R23, R21, R22, R24 | 4 | Resistor 49.9 ohm 0402. 1 % | Rohm | MCR01MRTF49R9 |
| 17 | R25 | 1 | Resistor 4.87k 1% 0402 smd | Rohm | MCR01MRTF4871 |
| 18 | R28 | 1 | Resistor, 5.6k ohm, 1/10W, 5%, 0402 | Panasonic | ERJ-2GEJ562X |
| 19 | R32, R43, R45, R46 | 4 | resistor 75 ohm 0402 5% | Rohm | MCR01MRTJ750 |
| 20 | R34, R52 | 2 | Resistor, 1M OH, 1/10W, 5% 0603 SMD | Panasonic | ERJ-3GEYJ105V |
| 21 | R38 | 1 | Resistor, 51 ohm, 1/10W, 5%, 0402 | Panasonic | ERJ-2GEJ510X |

Table 4-1. Connected LaunchPad Bill of Materials (continued)

| Item | Ref | Qty | Description | Mfg | Part Number |
|------|---|-----|--|-----------------------------|----------------------------|
| 22 | R42 | 1 | Resistor, 1M Ohm, 1/10W, 5%, 0402 | Rohm | MCR01MRTF1004 |
| 23 | R47 | 1 | RES 1M OHM 5% 1206 TF | Panasonic | ERJ-8GEYJ105V |
| 24 | R49, R50 | 2 | Resistor, 2.0k ohm, 1/10W, 5%, 0402 | Panasonic | ERJ-3GEYJ202V |
| 25 | R6, R7, R8, R10, R11, R15, R16, R19, R20, R39, R40, R41 | 12 | Resistor, 0 ohm, 1/10W, 5%, 0402 | Panasonic | ERJ-2GE0R00X |
| 26 | R9, R27, R30, R31, R33 | 5 | Resistor, 330 ohm, 1/10W, 5%, 0402 | Yageo | RC0402FR-07330RL |
| 27 | RESET, USR_SW1, USR_SW2, WAKE | 4 | Switch, Tact 6mm SMT, 160gf | Omron | B3S-1000 |
| 28 | U1 | 1 | Tiva, MCU TM4C1294NCPDT 128 QFP with Ethernet MAC + PHY | Texas Instruments | TM4C1294NCPDT |
| | | | | Texas Instruments | XM4C1294NCPDT |
| 29 | U10 | 1 | Transformer, ethernet, 1 to 1. SOIC 16 | Pulse Electronics | HX1198FNL |
| 30 | U13 | 1 | Diode, 8 chan, +/-15KV, ESD Protection Array, SO-8 | Semtech | SLVU2.8-4.TBT |
| 31 | U14 | 1 | Connector, RJ45 NO MAG, shielded THRU HOLE | TE Connectivity | 1-406541-5 |
| 32 | U2, U3 | 2 | IC 4CH ESD SOLUTION W/CLAMP 6SON | Texas Instruments | TPD4S012DRYR |
| 33 | U20 | 1 | Stellaris TIVA MCU TM4C123GH6PMI | Texas Instruments | TM4C123GH6PMI |
| 34 | U22 | 1 | USB Micro B receptacle right angle with guides | FCI | 10118194-0001LF |
| 35 | U4 | 1 | Fault protected power switch, dual channel, 8-SON | Texas Instruments | TPS2052BDRBR |
| 36 | U5 | 1 | 3.3V LDO TI TPS73733DRV fixed out 5V in | Texas Instruments | TPS73733DRV |
| 37 | U6 | 1 | Header 2x5, 0.050, SM, Vertical Shrouded | Samtec | SHF-105-01-S-D-SM |
| | | | | Don Connex Electronics | C44-10BSA1-G |
| 38 | U7 | 1 | USB Micro AB receptacle. Right angle with through guides | Hirose | ZX62D-AB-5P8 |
| 39 | X6, X7, X8, X9 | 4 | Header, 2x10, T-Hole Vertical unshrouded stacking | Samtec | SSW-110-23-S-D |
| | | | | Major League Electronics | SSHQ-110-D-08-F-LF |
| 40 | Y1 | 1 | Crystal 25 MHz 3.2 x 2.5 mm | NDK | nx3225ga-25.000m-std-crg-2 |
| 41 | Y2 | 1 | Crystal 16 MHz 3.2 x 2.5 mm 4 pin | NDK | NX3225GA-16.000M-STD-CRG-2 |
| 42 | Y3 | 1 | Crystal, 32.768 KHz Radial Can | Citizen Finetech Miyota | CMR200T-32.768KDZY-UT |

Table 4-1. Connected LaunchPad Bill of Materials (continued)

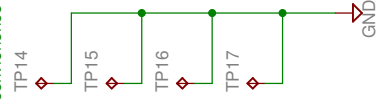
| Item | Ref | Qty | Description | Mfg | Part Number |
|--|--|-----|--|-------------|-------------------|
| PCB Do Not Populate List (Shown for information only) | | | | | |
| 43 | C2 | 1 | Capacitor, 0.1uF 16V, 10%, 0402 X7R | Taiyo Yuden | EMK105B7104KV-F |
| 44 | H1, H4, H6 | 3 | Screw, #4 x 0.625" Pan Head, Sheet Metal, Phillips/Slotted (for fan) | McMaster | 90077A112 |
| 45 | R12, R13, R14 | 3 | Resistor, 5.6k ohm, 1/10W, 5%, 0402 | Panasonic | ERJ-2GEJ562X |
| 46 | R48 | 1 | Resistor 0402 1% 52.3k | Rohm | TRR01MZPF5232 |
| 47 | TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17 | 17 | Terminal, Test Point Miniature Loop, Red, T-Hole | Keystone | 5000 |
| 48 | X1 | 1 | Header, 2x7, 0.100, T-Hole, Vertical, Unshrouded, 0.230 Mate | FCI | 67997-114HLF |
| 49 | X11A | 1 | Valvano style bread board connect. Right Angle extended, 1 x 49 0.100 pitch. | Samtec | TSW-149-09-F-S-RE |
| 50 | X11B | 1 | valvano style breadboard header. | Samtec | TSW-149-08-F-S-RA |

Schematic

This section contains the complete schematics for the Tiva C Series TM4C1294 Connected LaunchPad.

- Microcontroller, USB, Buttons, and LED's
- BoosterPack connectors
- Breadboard connector
- Ethernet and Ethernet LED's
- Power
- In-Circuit Debug Interface

convenience test points for ground

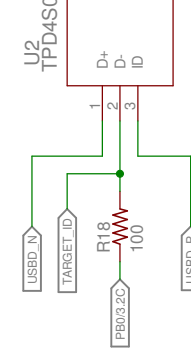


GPIO

| | | | | | |
|-----|-----------------------|-----|-----|-------|-----|
| PA0 | PS33 | PA0 | PB0 | PS95 | PB0 |
| PA1 | PS34 | PA1 | PB1 | PS96 | PB1 |
| PA2 | PS35 | PA2 | PB2 | PS91 | PB2 |
| PA3 | PS36 | PA3 | PB3 | PS92 | PB3 |
| PA4 | PS37 | PA4 | PB4 | PS121 | PB4 |
| PA5 | PS38 | PA5 | PB5 | PS120 | PB5 |
| PA6 | PS40 | PA6 | | | |
| PA7 | PS41 | PA7 | | | |
| PC0 | TARGET_TOK/SWCLK/6.1Z | PC0 | PD0 | PS1 | PD0 |
| PC1 | TARGET_TMS/SWDIO/6.1Z | PC1 | PD1 | PS2 | PD1 |
| PC2 | TARGET_TDI/6.1E | PC2 | PD2 | PS3 | PD2 |
| PC3 | TARGET_TDO/SWO/6.1E | PC3 | PD3 | PS4 | PD3 |
| PC4 | | PC4 | PD4 | PS125 | PD4 |
| PC5 | PS24 | PC5 | PD5 | PS126 | PD5 |
| PC6 | PS23 | PC6 | PD6 | PS127 | PD6 |
| PC7 | PS22 | PC7 | PD7 | PS128 | PD7 |
| PE0 | PS15 | PE0 | PF0 | PS42 | PF0 |
| PE1 | PS14 | PE1 | PF1 | PS43 | PF1 |
| PE2 | PS13 | PE2 | PF2 | PS44 | PF2 |
| PE3 | PS12 | PE3 | PF3 | PS45 | PF3 |
| PE4 | PS123 | PE4 | PF4 | PS46 | PF4 |
| PE5 | PS124 | PE5 | | | |
| PG0 | PS49 | PG0 | PH0 | PS29 | PH0 |
| PG1 | PS50 | PG1 | PH1 | PS30 | PH1 |
| PJ0 | PS116 | PJ0 | PH2 | PS31 | PH2 |
| PJ1 | PS117 | PJ1 | PH3 | PS32 | PH3 |
| PK0 | PS18 | PK0 | PL0 | PS81 | PL0 |
| PK1 | PS19 | PK1 | PL1 | PS82 | PL1 |
| PK2 | PS20 | PK2 | PL2 | PS83 | PL2 |
| PK3 | PS21 | PK3 | PL3 | PS84 | PL3 |
| PK4 | PS63 | PK4 | PL4 | PS85 | PL4 |
| PK5 | PS62 | PK5 | PL5 | PS86 | PL5 |
| PK6 | PS61 | PK6 | PL6 | PS94 | PL6 |
| PK7 | PS60 | PK7 | PL7 | PS93 | PL7 |
| PM0 | PS78 | PM0 | PN0 | PS107 | PN0 |
| PM1 | PS77 | PM1 | PN1 | PS108 | PN1 |
| PM2 | PS76 | PM2 | PN2 | PS109 | PN2 |
| PM3 | PS75 | PM3 | PN3 | PS110 | PN3 |
| PM4 | PS74 | PM4 | PN4 | PS111 | PN4 |
| PM5 | PS73 | PM5 | PN5 | PS112 | PN5 |
| PM6 | PS72 | PM6 | | | |
| PM7 | PS71 | PM7 | | | |
| PP0 | PS118 | PP0 | PQ0 | PS85 | PQ0 |
| PP1 | PS119 | PP1 | PQ1 | PS86 | PQ1 |
| PP2 | PS103 | PP2 | PQ2 | PS11 | PQ2 |
| PP3 | PS104 | PP3 | PQ3 | PS27 | PQ3 |
| PP4 | PS105 | PP4 | PQ4 | PS102 | PQ4 |
| PP5 | PS106 | PP5 | | | |

TM4C1294NCPDT

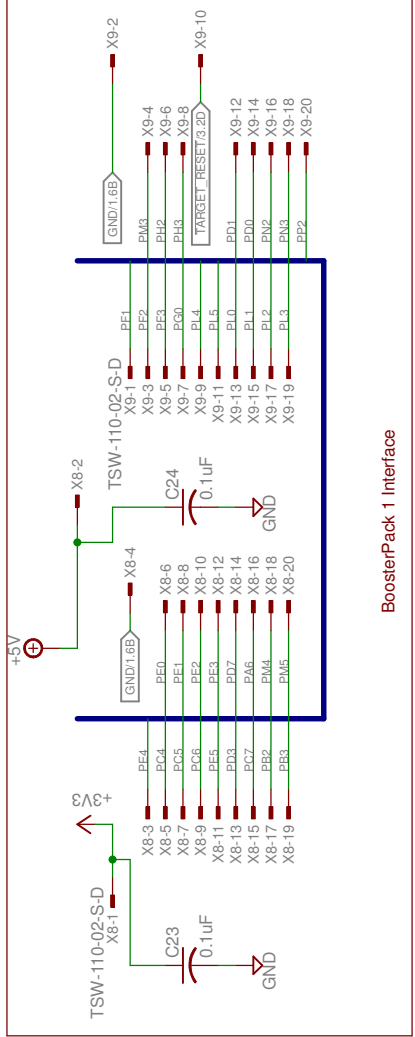
U1G\$1



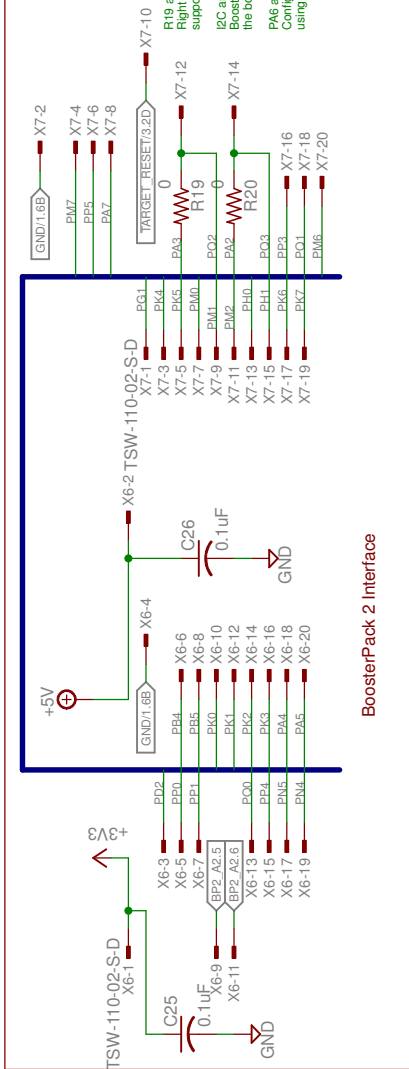
NOTE: TPD4S012 all protection circuit
Connections chosen for simple routing.



See PF0 and Ethernet for



BoosterPack 1 Interface



R19 and R20 can be populated to enable I2C on Right side of BP2 interface. This is for legacy support and the Sensor Hub BoosterPack.

I2C and SSI are available on the corresponding BoosterPack 1 interface pins without modification to the board.

PA6 and PA7 are also used by the onboard radio. Configure the radio to tri-state these GPIO before using them on the boosterpack interface.

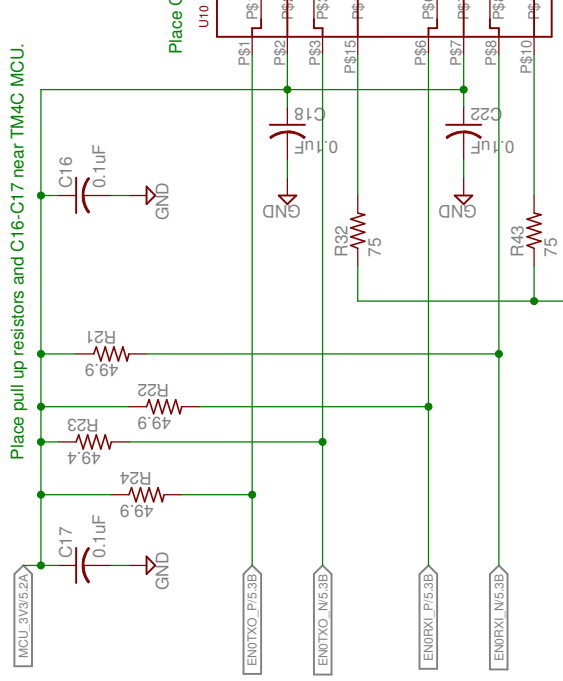
BoosterPack 2 Interface

TITLE: EK-TM4C1294XL R

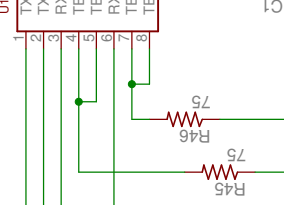
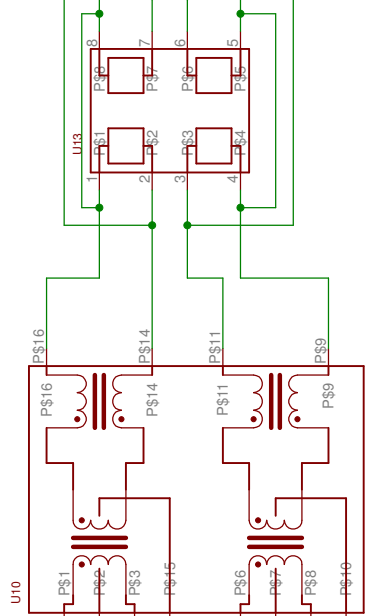
Document Number:

Date: 1/24/2014 4:55:11

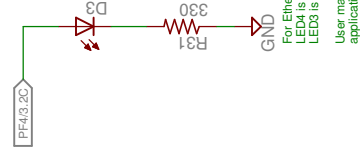
Place pull up resistors and C16-C17 near TM4C MCU.



Place C18 and C22 near pin 2 and pin 7 of U\$10



U10 May be populated with either HX1188FNL or HX1198FNL. HX1198FNL preferred for best Ethernet performance.



Revision History

Changes from B Revision (May 2015) to C Revision

Page

- GLOBAL: Updated/Changed all instances of "UART4" to "UART2"..... [4](#)
-

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an "EVM" or "EVMs") to the User ("User") in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.
 - 1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductor products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM ("Software") shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software
 - 1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.
2. *Limited Warranty and Related Remedies/Disclaimers:*
 - 2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.
 - 2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.
 - 2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.
3. *Regulatory Notices:*
 - 3.1 *United States*
 - 3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.
 - 3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。
http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_01.page

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。技術適合証明を受けていないものご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。日本テキサス・インスツルメンツ株式会社
東京都新宿区西新宿 6 丁目 2 4 番 1 号
西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page
電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。 http://www.tij.co.jp/lstds/ti_ja/general/eStore/notice_02.page

3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):*

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

8.1 *General Limitations.* IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS, REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

IMPORTANT NOTICE FOR TI DESIGN INFORMATION AND RESOURCES

Texas Instruments Incorporated ("TI") technical, application or other design advice, services or information, including, but not limited to, reference designs and materials relating to evaluation modules, (collectively, "TI Resources") are intended to assist designers who are developing applications that incorporate TI products; by downloading, accessing or using any particular TI Resource in any way, you (individually or, if you are acting on behalf of a company, your company) agree to use it solely for this purpose and subject to the terms of this Notice.

TI's provision of TI Resources does not expand or otherwise alter TI's applicable published warranties or warranty disclaimers for TI products, and no additional obligations or liabilities arise from TI providing such TI Resources. TI reserves the right to make corrections, enhancements, improvements and other changes to its TI Resources.

You understand and agree that you remain responsible for using your independent analysis, evaluation and judgment in designing your applications and that you have full and exclusive responsibility to assure the safety of your applications and compliance of your applications (and of all TI products used in or for your applications) with all applicable regulations, laws and other applicable requirements. You represent that, with respect to your applications, you have all the necessary expertise to create and implement safeguards that (1) anticipate dangerous consequences of failures, (2) monitor failures and their consequences, and (3) lessen the likelihood of failures that might cause harm and take appropriate actions. You agree that prior to using or distributing any applications that include TI products, you will thoroughly test such applications and the functionality of such TI products as used in such applications. TI has not conducted any testing other than that specifically described in the published documentation for a particular TI Resource.

You are authorized to use, copy and modify any individual TI Resource only in connection with the development of applications that include the TI product(s) identified in such TI Resource. NO OTHER LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE TO ANY OTHER TI INTELLECTUAL PROPERTY RIGHT, AND NO LICENSE TO ANY TECHNOLOGY OR INTELLECTUAL PROPERTY RIGHT OF TI OR ANY THIRD PARTY IS GRANTED HEREIN, including but not limited to any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information regarding or referencing third-party products or services does not constitute a license to use such products or services, or a warranty or endorsement thereof. Use of TI Resources may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

TI RESOURCES ARE PROVIDED "AS IS" AND WITH ALL FAULTS. TI DISCLAIMS ALL OTHER WARRANTIES OR REPRESENTATIONS, EXPRESS OR IMPLIED, REGARDING TI RESOURCES OR USE THEREOF, INCLUDING BUT NOT LIMITED TO ACCURACY OR COMPLETENESS, TITLE, ANY EPIDEMIC FAILURE WARRANTY AND ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, AND NON-INFRINGEMENT OF ANY THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

TI SHALL NOT BE LIABLE FOR AND SHALL NOT DEFEND OR INDEMNIFY YOU AGAINST ANY CLAIM, INCLUDING BUT NOT LIMITED TO ANY INFRINGEMENT CLAIM THAT RELATES TO OR IS BASED ON ANY COMBINATION OF PRODUCTS EVEN IF DESCRIBED IN TI RESOURCES OR OTHERWISE. IN NO EVENT SHALL TI BE LIABLE FOR ANY ACTUAL, DIRECT, SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF TI RESOURCES OR USE THEREOF, AND REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

You agree to fully indemnify TI and its representatives against any damages, costs, losses, and/or liabilities arising out of your non-compliance with the terms and provisions of this Notice.

This Notice applies to TI Resources. Additional terms apply to the use and purchase of certain types of materials, TI products and services. These include; without limitation, TI's standard terms for semiconductor products (<http://www.ti.com/sc/docs/stdterms.htm>), [evaluation modules](#), and [samples](http://www.ti.com/sc/docs/sampterm.htm) (<http://www.ti.com/sc/docs/sampterm.htm>).

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2017, Texas Instruments Incorporated

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View EK-TM4C1294XL](#) on WIN SOURCE

 [Texas Instruments](#) Information

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management