

# **Tiva™ C Series TM4C1294 Connected LaunchPad Evaluation Kit**

**EK-TM4C1294XL**

## **User's Guide**



Literature Number: SPMU365  
March 2014

|          |                                                      |           |
|----------|------------------------------------------------------|-----------|
| <b>1</b> | <b>Board Overview</b>                                | <b>4</b>  |
| 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         |
| <b>2</b> | <b>Hardware Description</b>                          | <b>7</b>  |
| 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                                     | 17        |
| 2.2.1    | Power Supplies                                       | 17        |
| 2.2.2    | Low Power Modes                                      | 18        |
| 2.2.3    | Clocking                                             | 18        |
| 2.2.4    | Reset                                                | 18        |
| 2.3      | Debug Interface                                      | 18        |
| 2.3.1    | In-Circuit Debug Interface (ICDI)                    | 18        |
| 2.3.2    | External Debugger                                    | 19        |
| 2.3.3    | Virtual COM Port                                     | 19        |
| <b>3</b> | <b>Software Development</b>                          | <b>20</b> |
| 3.1      | Software Description                                 | 20        |
| 3.2      | Source Code                                          | 20        |
| 3.3      | Tool Options                                         | 20        |
| 3.4      | Programming the Connected LaunchPad                  | 21        |
| <b>4</b> | <b>References, PCB Layout, and Bill of Materials</b> | <b>22</b> |
| 4.1      | References                                           | 22        |
| 4.2      | Component Locations                                  | 23        |
| 4.3      | Bill of Materials                                    | 24        |
| <b>5</b> | <b>Schematic</b>                                     | <b>27</b> |

## List of Figures

|      |                                                               |                    |
|------|---------------------------------------------------------------|--------------------|
| 1-1. | Tiva C Series Connected LaunchPad Evaluation Board .....      | <a href="#">4</a>  |
| 2-1. | Tiva Connected LaunchPad Evaluation Board Block Diagram ..... | <a href="#">7</a>  |
| 2-2. | Default Jumper Locations .....                                | <a href="#">17</a> |
| 4-1. | Connected LaunchPad Dimensions and Component Locations .....  | <a href="#">23</a> |

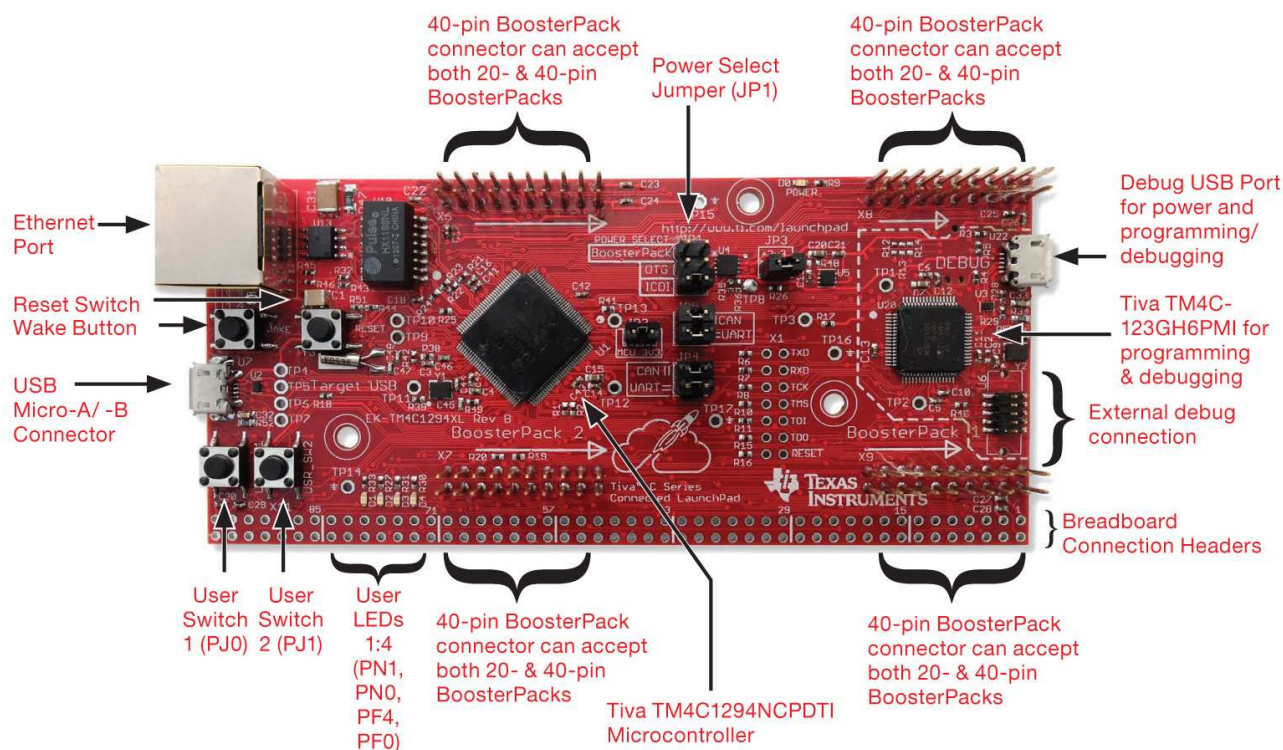
## List of Tables

|      |                                                                       |                    |
|------|-----------------------------------------------------------------------|--------------------|
| 1-1. | EK-TM4C1294XL Specifications .....                                    | <a href="#">6</a>  |
| 2-1. | BoosterPack 1 GPIO and Signal Muxing .....                            | <a href="#">9</a>  |
| 2-2. | BoosterPack 2 GPIO and Signal Muxing .....                            | <a href="#">11</a> |
| 2-3. | X11 Breadboard Adapter Odd-Numbered Pad GPIO and Signal Muxing .....  | <a href="#">13</a> |
| 2-4. | X11 Breadboard Adapter Even-Numbered Pad GPIO and Signal Muxing ..... | <a href="#">15</a> |
| 4-1. | Connected LaunchPad Bill of Materials .....                           | <a href="#">24</a> |

## 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 <sub>DC</sub> to 5.25 V <sub>DC</sub> from one of the following sources: <ul style="list-style-type: none"> <li>• Debug USB U22 (ICDI) USB Micro-B cable connected to PC or other compatible power source.</li> <li>• Target USB (U7) USB Micro-B cable connected to PC or other compatible power source.</li> <li>• BoosterPack 1 (X8-4)</li> <li>• BoosterPack 2 (X6-4)</li> <li>• Breadboard expansion header (X11-2 or X11-97). See schematic symbol JP1 for power input selection.</li> </ul> |
| 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"> <li>• 5 V<sub>DC</sub> to BoosterPacks, current limited by TPS2052B. Nominal rating 1 Amp. Board input power supply limitations may also apply.</li> <li>• 3.3 V<sub>DC</sub> 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.</li> </ul>                                                                                                                       |
| 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.

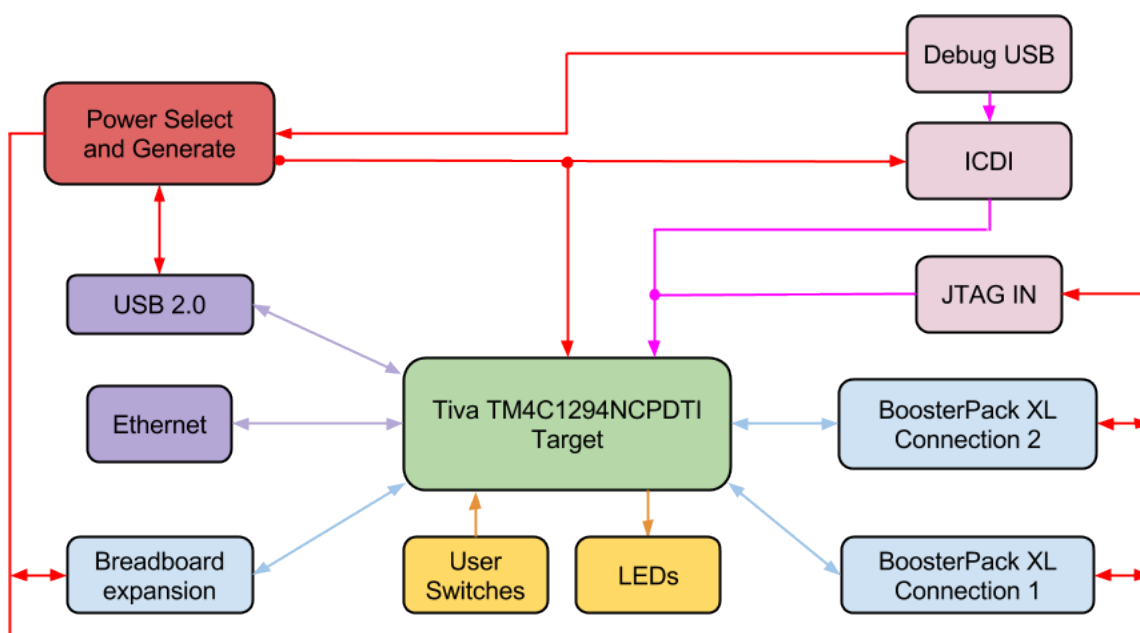


Figure 2-1. Tiva Connected LaunchPad Evaluation Board Block Diagram

## 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   | -                                       | -       | -      | -        | - | -      | -   | -  | -         | -       | SSI1XDAT1 |
| 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 | EPI0S27   |
| A1     | 10  | I2C SDA           | PB3  | 92      | -      | -                                       | I2C0SDA | T5CCP1 | -        | - | -      | -   | -  | -         | USB0CLK | EPI0S28   |
| 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 UART4 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<br>(See JP4)   | PD4  | 125     | AIN7   | U2Rx                                    | -       | T3CCP0  | -   | - | -      | - | -  | -  | -       | SSI1XDAT2 |
|        |     |                     | PA0  | 33      | -      | U0Rx                                    | I2C9SCL | T0CCP0  | -   | - | CANORx | - | -  | -  | -       | -         |
| A2     | 6   | Analog<br>(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   |      |         |        | 5V                                      |         |        |          |        |        |   |          |           |    |         |
| 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  | PC4  | 40      | -      | U2Rx                                    | I2C6SCL | T3CCP0 | USB0EPEN | -      | -      | - | -        | SSI0XDAT2 | -  | EPI0S8  |
| 27  | PA6  | 41      | -      | U2Tx                                    | I2C6SDA | T3CCP1 | USB0PFLT | -      | -      | - | USB0EPEN | SSI0XDAT3 | -  | EPI0S9  |
| 29  | PA7  | 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 |

**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      |
| 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  | EPI0S12 |         |        |                                         |         |         |         |          |        |         |    |    |           |         |
| 63  | PK6     | 61      | -      | -                                       | I2C4SCL | -       | EN0LED1 | M0FAULT1 | -      | -       | -  | -  | -         | EPI0S25 |
| 65  | PL4     | 85      | -      | -                                       | -       | T0CCP0  | -       | -        | -      | -       | -  | -  | USB0D4    | EPI0S26 |
| 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   |      |         |          | 3V3                                     |         |        |          |          |        |     |    |    |           |           |
| 4   |      |         |          | GND                                     |         |        |          |          |        |     |    |    |           |           |
| 6   | PA2  | 35      | -        | U4Rx                                    | I2C8SCL | T1CCP0 | -        | -        | -      | -   | -  | -  | -         | SSI0CIk   |
| 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 |
| 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 | -  | -  | -         | SSI1XDAT2 |
| 44  | PD6  | 127     | AIN5     | U2RTS                                   | -       | T4CCP0 | USB0EPEN | -        | -      | -   | -  | -  | -         | SSI1XDAT3 |
| 46  | PD3  | 4       | AIN12    | -                                       | I2C8SDA | T1CCP1 | -        | -        | -      | -   | -  | -  | -         | SSI2CIk   |
| 48  | PD1  | 2       | AIN14    | -                                       | I2C7SDA | T0CCP1 | C1o      | -        | -      | -   | -  | -  | -         | SSI1XDAT0 |
| 50  | PD0  | 1       | AIN15    | -                                       | I2C7SCL | T0CCP0 | C0o      | -        | -      | -   | -  | -  | -         | SSI1XDAT1 |
| 52  | PD2  | 3       | AIN13    | -                                       | I2C8SCL | T1CCP0 | C2o      | -        | -      | -   | -  | -  | -         | SSI2Fss   |
| 54  | PP0  | 118     | C2+      | U6Rx                                    | -       | -      | -        | -        | -      | -   | -  | -  | -         | SSI1XDAT2 |
| 56  | PP1  | 119     | C2-      | U6Tx                                    | -       | -      | -        | -        | -      | -   | -  | -  | -         | SSI1XDAT3 |
| 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      |

**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    |
| 68  | PF1   | 43      | -      | -                                       | -       | -      | EN0LED2 | M0PWM1 | -      | - | -  | -  | SSI3XDAT0 | TRD1  |
| 70  | PF2   | 44      | -      | -                                       | -       | -      | -       | M0PWM2 | -      | - | -  | -  | SSI3Fss   | TRD0  |
| 72  | PF3   | 45      | -      | -                                       | -       | -      | -       | M0PWM3 | -      | - | -  | -  | SSI3Clk   | 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 | -       | -      | -      | - | -  | -  | -         | -     |
| 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. UART 4 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, UART 4 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.

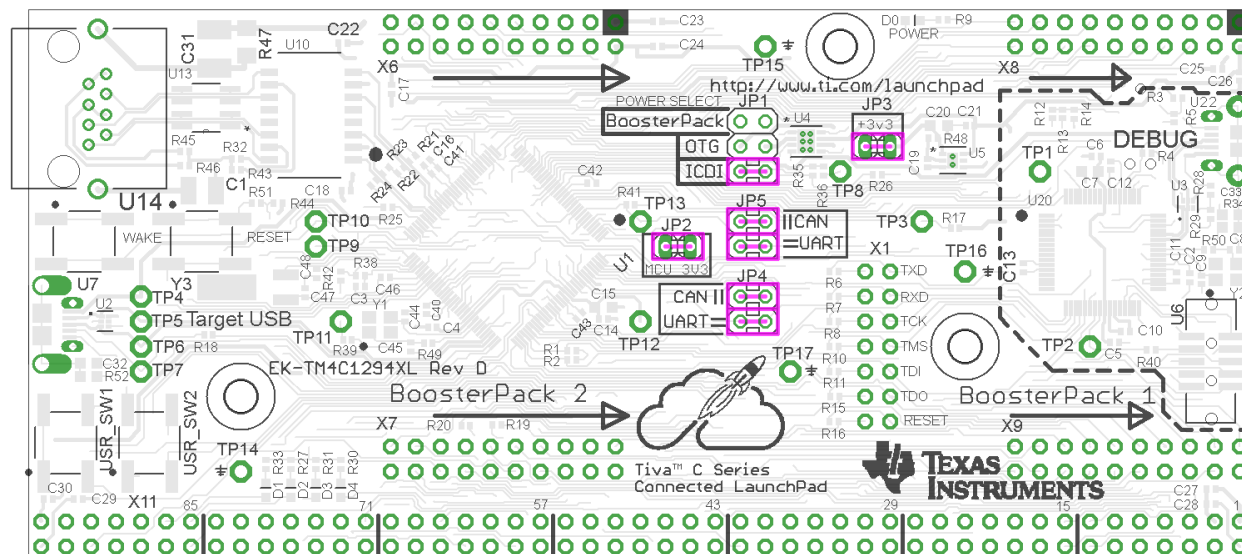


Figure 2-2. Default Jumper Locations

## 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, UART4 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](http://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 tab, 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](http://www.ti.com).

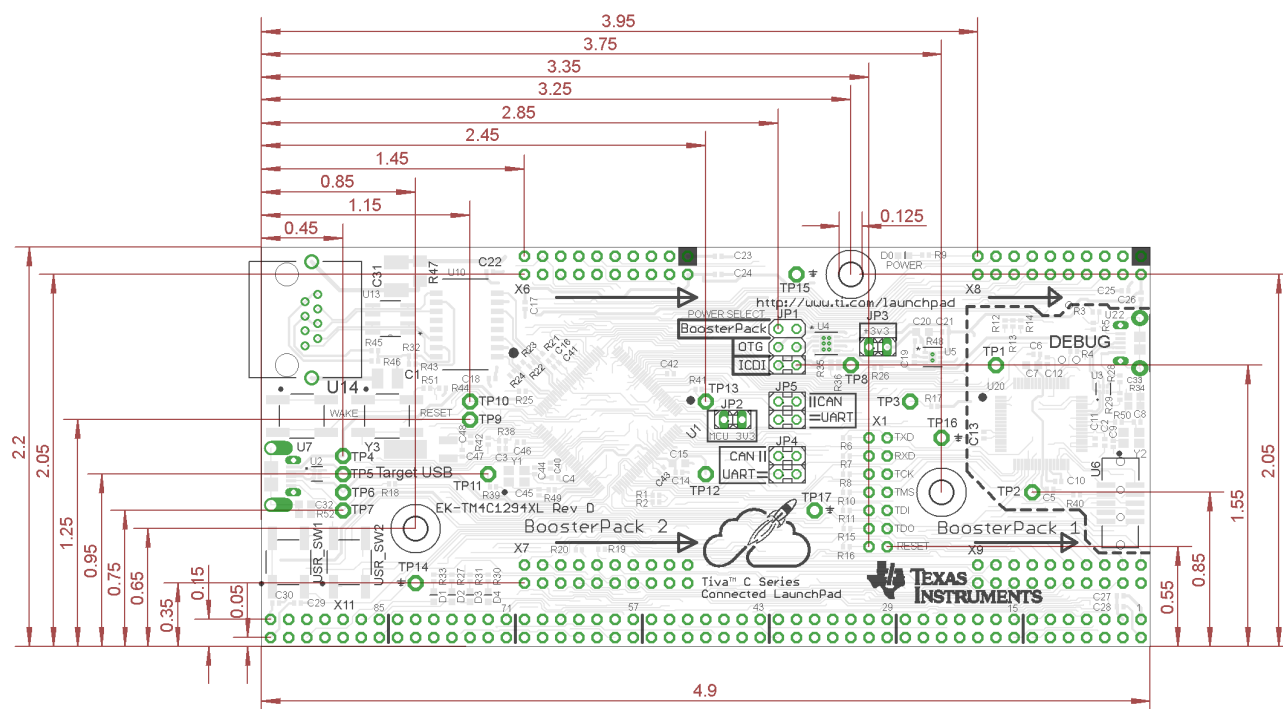
- TivaWare for C Series (<http://www.ti.com/tool/sw-tm4c>)
- TivaWare Peripheral Driver Library Users' Guide (literature number [SPMU298](#))
- EK-TM4C1294XL Getting Started Guide (literature number [SPMZ858](#))
- LM Flash Programmer Tool (<http://www.ti.com/lmflashprogrammer>)
- TPS73733 Low-Dropout 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)**

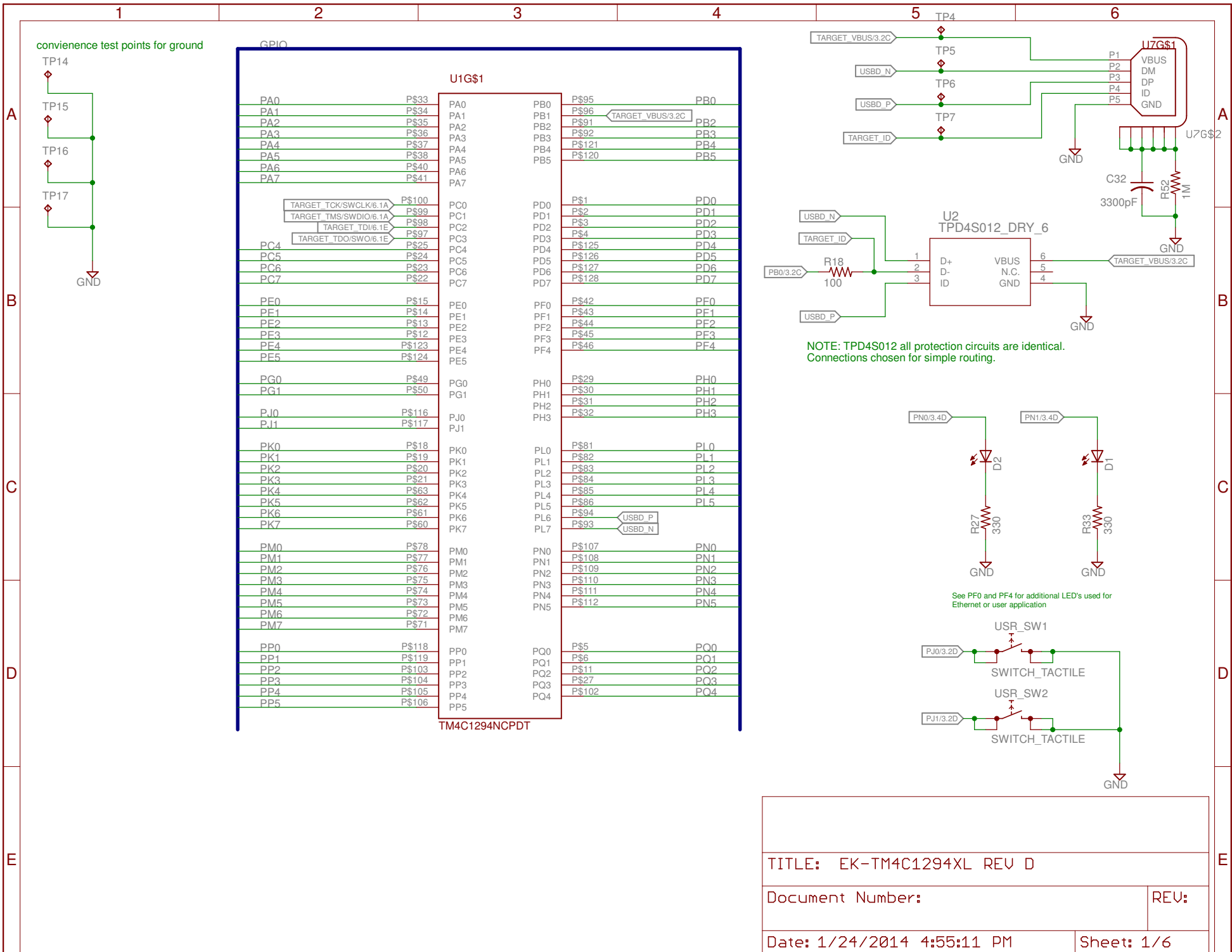
| Item                                                         | Ref                                                                                         | Qty | Description                                                                  | Mfg         | Part Number       |
|--------------------------------------------------------------|---------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------------|-------------|-------------------|
| <b>PCB Do Not Populate List (Shown for information only)</b> |                                                                                             |     |                                                                              |             |                   |
| 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 |

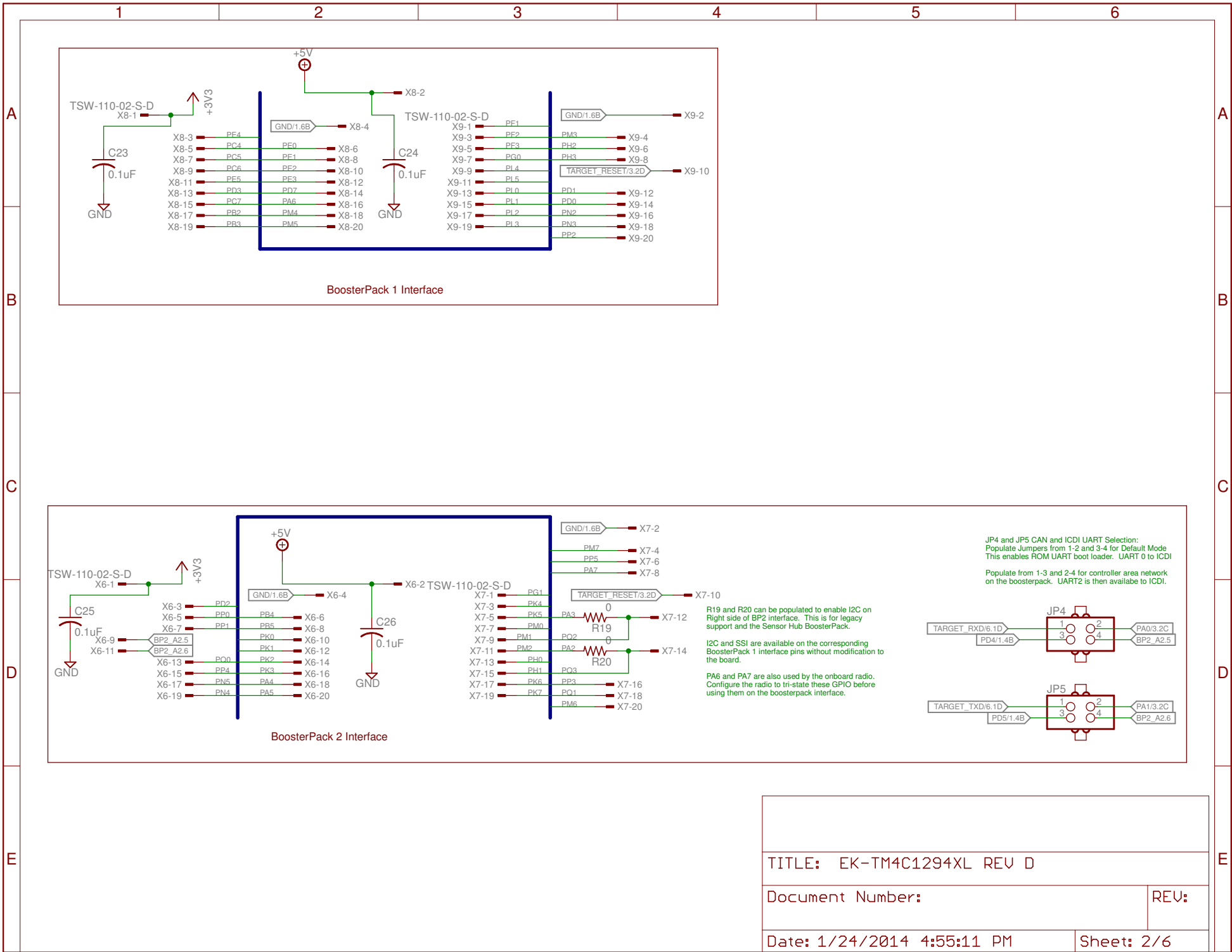
## ***Schematic***

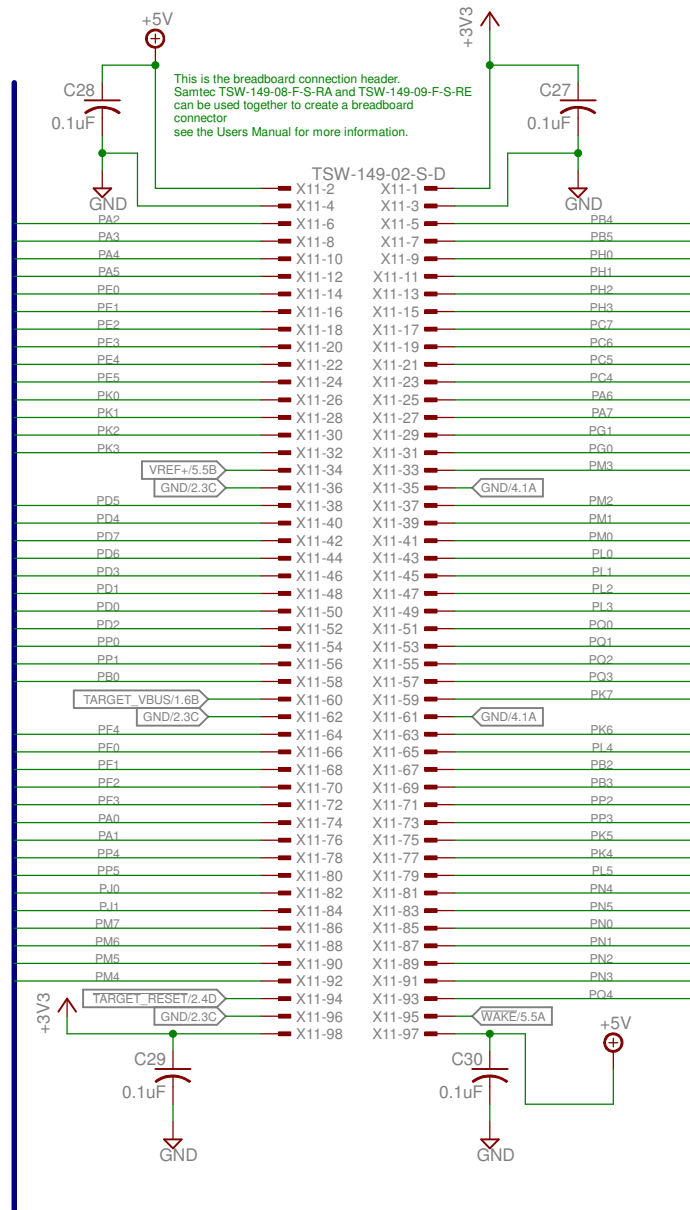
---

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







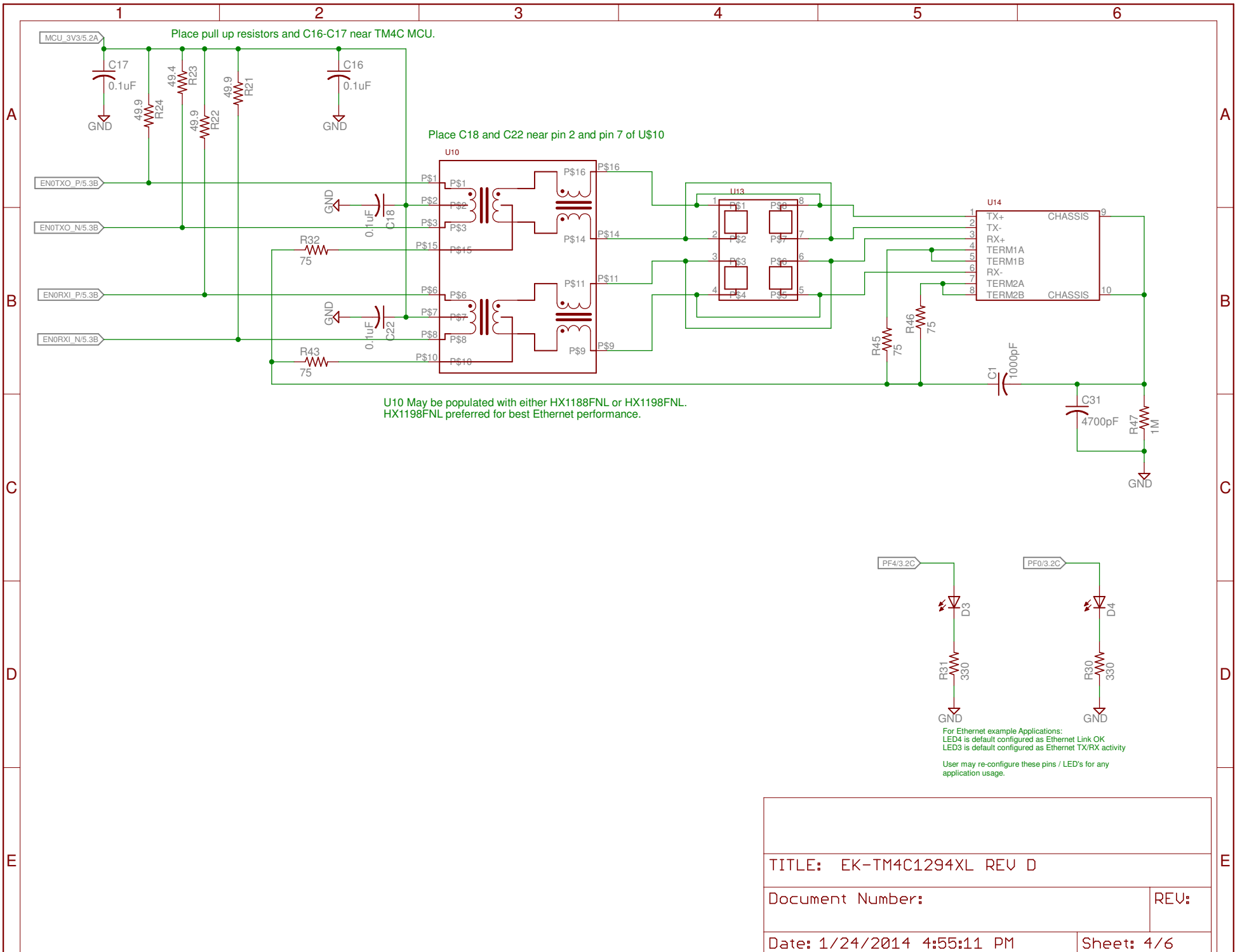
TITLE: EK-TM4C1294XL REV D

Document Number:

REV:

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

Sheet: 3/6

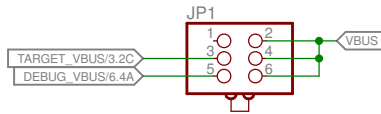


# Power Control Jumper:

- 1) To power from Debug install jumper on pins 5 - 6
- 2) To power from Target USB install jumper on pins 3 - 4
- 3) To power from BoosterPack 5V install jumper on pins 1 - 2  
This is also the off position if BoosterPack does not supply power

When powered from BoosterPack TPS2052B does not provide current limit protection.

When powered by BoosterPack, USB host mode does not supply power to connected devices

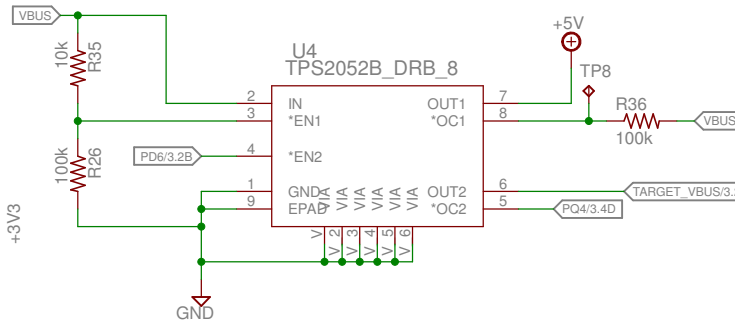
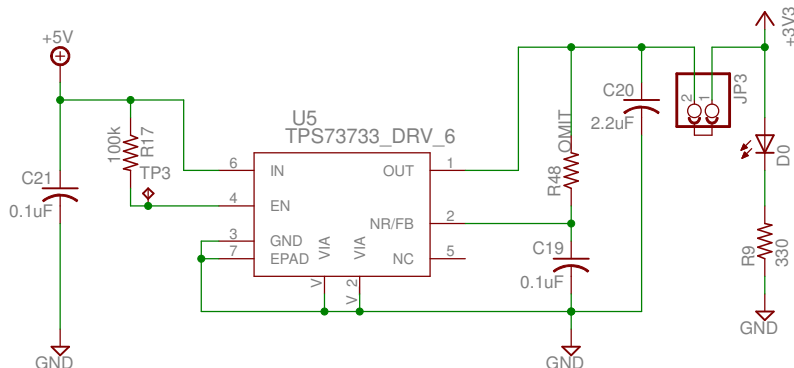


H4  
MOUNT-HOLE3.2

H6  
MOUNT-HOLE3.2

H1  
MOUNT-HOLE3.2

Primary 3.3V regulator  
Disconnect JP3 to power device from 3V3 BoosterPack



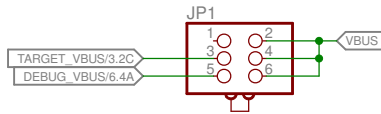
TPS2052B provides current limit for main 5V power.  
Also provides power switching for USB host/OTG modes  
For Host/OTG:  
PD6 configured as USB0EPEN peripheral function.  
PQ4 configure as individual pin interrupt. Indicates power fault on the USB bus. USB0PFLT peripheral pin not available due to pin mux and use on BoosterPacks.  
USB Host mode does not supply power to devices when powered from a BoosterPack  
For Applications that do not use USB:  
Configure PD6 as input with internal pull-down enabled. Turns off power to TARGET\_VBUS

# Power Control Jumper:

- 1) To power from Debug install jumper on pins 5 - 6
- 2) To power from Target USB install jumper on pins 3 - 4
- 3) To power from BoosterPack 5V install jumper on pins 1 - 2  
This is also the off position if BoosterPack does not supply power

When powered from BoosterPack TPS2052B does not provide current limit protection.

When powered by BoosterPack, USB host mode does not supply power to connected devices

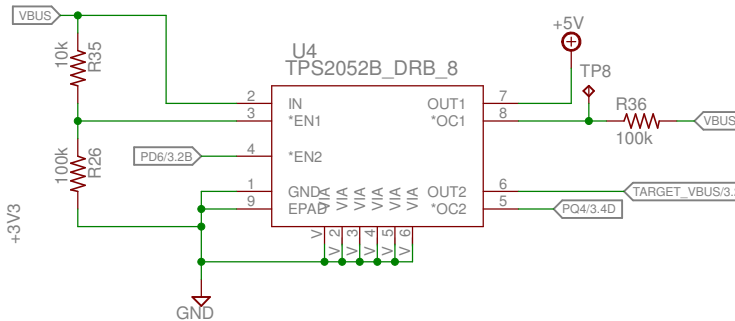
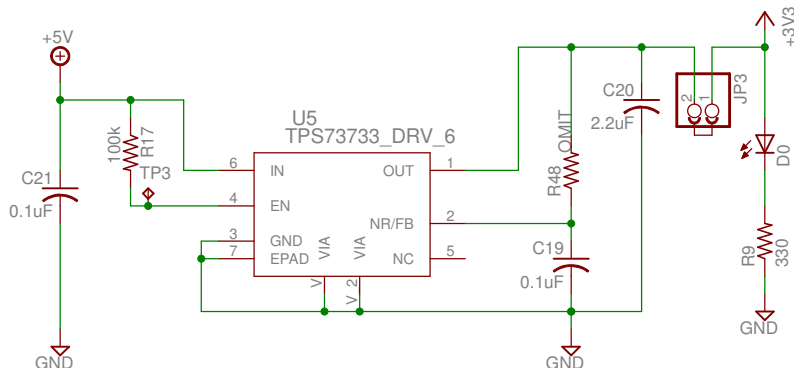


H4  
MOUNT-HOLE3.2

H6  
MOUNT-HOLE3.2

H1  
MOUNT-HOLE3.2

Primary 3.3V regulator  
Disconnect JP3 to power device from 3V3 BoosterPack



TPS2052B provides current limit for main 5V power.  
Also provides power switching for USB host/OTG modes  
For Host/OTG:  
PD6 configured as USB0EPEN peripheral function.  
PQ4 configure as individual pin interrupt. Indicates power fault on the USB bus. USB0PFLT peripheral pin not available due to pin mux and use on BoosterPacks.  
USB Host mode does not supply power to devices when powered from a BoosterPack  
For Applications that do not use USB:  
Configure PD6 as input with internal pull-down enabled. Turns off power to TARGET\_VBUS

TITLE: EK-TM4C1294XL REV D

Document Number:

REV:

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

Sheet: 5/6



## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its components to the specifications applicable at the time of sale, in accordance with the warranty in TI's terms and conditions of sale of semiconductor products. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by applicable law, testing of all parameters of each component is not necessarily performed.

TI assumes no liability for applications assistance or the design of Buyers' products. Buyers are responsible for their products and applications using TI components. To minimize the risks associated with Buyers' products and applications, Buyers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license to use such products or services or a warranty or endorsement thereof. Use of such information 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.

Reproduction of significant portions of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI components or services with statements different from or beyond the parameters stated by TI for that component or service voids all express and any implied warranties for the associated TI component or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
| Audio                        | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                               |
| Amplifiers                   | <a href="http://amplifier.ti.com">amplifier.ti.com</a>                               |
| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

|                               |                                                                                          |
|-------------------------------|------------------------------------------------------------------------------------------|
| Automotive and Transportation | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>                         |
| Communications and Telecom    | <a href="http://www.ti.com/communications">www.ti.com/communications</a>                 |
| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Security                      | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
| Space, Avionics and Defense   | <a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a> |
| Video and Imaging             | <a href="http://www.ti.com/video">www.ti.com/video</a>                                   |

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)