

# LM10504EVAL User Guide



Triple Buck + LDO Power Management Unit  
Evaluation Kit

## Scope of Document

This document will describe the functionality of the LM10504EVAL, the hardware and software setup, and the use of both the board and software.

### General Description

The LM10504 is an advanced Power Management Unit (PMU) containing three configurable, high efficiency buck regulators for supplying variable voltages. The device is ideal for supporting ASIC and SOC designs for SSD and flash drives.

### Evaluation Kit Overview

LM10504 Evaluation Kit is based on an all-onboard system. The board operates through the USB port.

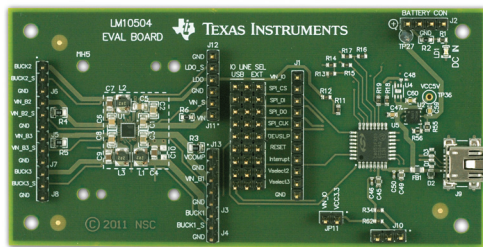


Figure 1: LM10504 Evaluation Board

The evaluation kit consists of:

- LM10504 evaluation board
- USB interface cable
- CD including:
  - Evaluation software graphical user interface (GUI)
  - LM10504 datasheet
- User Guide

## Evaluation Software

LM10504 evaluation software is supplied together with documentation regarding the circuit. Copy the folder “lm10504” to your PC’s hard disk. The software is run by double clicking the icon of lm10504.exe found in the folder. The software does not require any installation.

The evaluation software allows control of all registers necessary to program the device. To simplify the use of software, the registers are set by directly named controls. The user does not need the register value as this is taken care of by the software. For example, to change LDO3 output voltage to 1.0V, choose the related value and the software will send the correct value to the LDO3 control register

## Hardware Set Up

Please use ESD protection when handling the evaluation boards to prevent any damage from ESD events!

Connect the LM10504 evaluation board to the USB port of a PC using the USB cable.

When the USB board is plugged in for the first time, the operating system prompts for “New hardware found” and installs the USB driver. If this does not happen, try unplugging and plugging the cable in again.

Always disconnect the USB cable from the computer when changing jumper settings.

If the evaluation board is not responding or the evaluation software hangs up, disconnect the USB cable for 5 seconds.

## Software Set Up

The graphical user interface has a main screen with two tab screens (System and Log) which allow control and indication for different functions of the device.

Once the evaluation board is connected to the PC, double click on the GUI icon and the device can be controlled via the software interface.

## Software

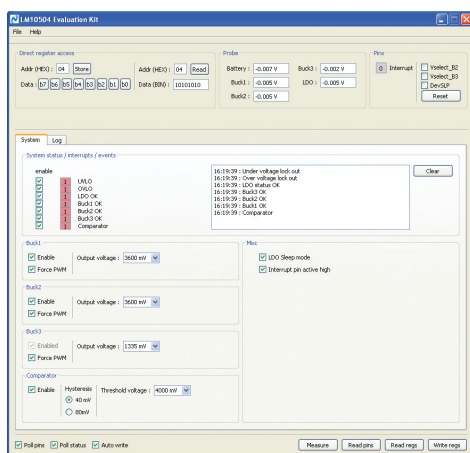


Figure 2: LM10504 Evaluation Software Main Screen

### Using the Evaluation Software

The LM10504EVAL should become active as soon as the USB cable is plugged in. When the device starts up correctly, the green LED LD1 (DC IN) is illuminated. All of the device functions can be accessed via the control buttons.

#### Main screen

As shown in *Figures 2* and *3*, the top and bottom portions of the screen are visible in both tab screens. Common functions can be controlled here.

#### Top of screen

The left corner of the of screen contains the Direct Register Access frame. Binary data may be written and read from the registers. Use hexadecimal values in address fields. Correct data value can be created using buttons b0-b7. Value is immediately written to the device by pressing the Store button and read from the device by pressing the Read button.

The Probe frame in the center of the screen contains the results of voltage measurements. Values can be read by pressing the Measure button in lower right corner of the screen.

The Pins frame in the right corner of the screen shows the status of the Interrupt pin. It also contains the Reset button and checkboxes to control Vselect\_B2 and Vselect\_B3 signals. Pressing the Reset button causes 100 ms positive pulse in reset pin.

LM10504 reads the state of Vselect\_B2 and Vselect\_B3 pins only during startup. When LM10504 is using the USB bus as a power supply, pins Vselect\_B2 and Vselect\_B3 have no effect on LM10504. User can set pins in software and then power up LM10504 using an external power supply. Another way to set pins Vselect\_B2 and Vselect\_B3 is by using user connector J1 before powering up the board.

To save power, the device can be placed into sleep mode (DEVSLP) by asserting the DEVSLP pin high. While in sleep mode, Buck1 and Buck2 are disabled. Buck3's output voltage is transitioned into PSML as set by LM10504 register 0X09. The DEVSLP pin is internally pulled down.

### **Bottom of screen**

This part of the screen contains the following checkboxes and buttons:

#### **Poll pins checkbox**

Allows continuous reading of the Interrupt pin state and results of on-board ADC.

#### **Poll status checkbox**

Allows continuous reading of the evaluation chip status register.

#### **Auto write checkbox**

If this box is checked, any change to registry will be written to the device immediately. Otherwise, the user must press the Write regs button to update registers. This way, the user can change values in several registers and update changes simultaneously.

#### **Measure button**

Reads and shows the onboard voltages at the top of the screen.

#### **Read pins button**

Reads the state of Interrupt pin.

#### **Read regs button**

Reads the content of every register and updates the screen accordingly.

#### **Write regs button**

If the Auto write checkbox is disabled, the user can press this button to update the content of every register.

There is a status bar at the bottom of the screen. It shows whether or not the connection to the evaluation board is established. (In *Figure 2*, the status bar reads ready.)

## Software

### System Settings Tab

Selecting this tab, as shown in *Figure 2*, allows access to the controls of Buck1, Buck2 and Buck3 regulators, comparator, LDO sleep mode, and IRQ (Interrupt) pin polarity. It also shows a log of occurred events.

In the System status/interrupts/events frame, the user can choose which interrupts are enabled with the checkboxes on the left. The user can enable the Poll status checkbox in the lower left corner of the screen to get continuous status updates (1 update per second).

In the Buck1, Buck2, and Buck3 frames, the user can set the output voltage of buck regulator, enable individual regulator, or force it to PWM mode.

In the Comparator frame, the user can enable comparator, set the threshold voltage and hysteresis.

Misc frame contains controls for LDO sleep mode and Interrupt pin polarity.

### Log Tab

This tab, shown in *Figure 3*, records all I<sup>2</sup>C transfers. The user can copy write or read sequences to the clipboard. The log window can be cleared by pressing the Clear button.

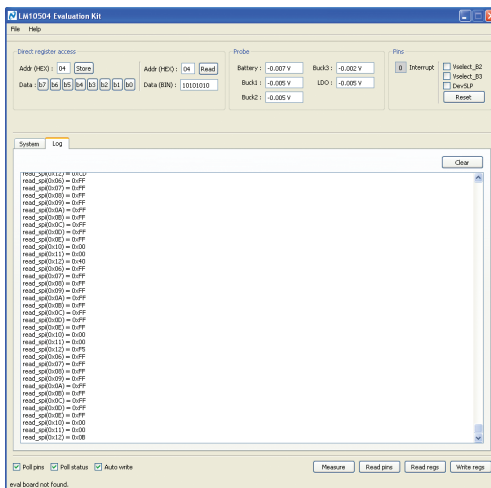


Figure 3 : Log Tab

### Using the Evaluation Hardware

Connectors are provided to allow a battery connection and output voltage measurement. Jumpers allow user selectable or USB controlled settings for device functions.

#### Power supply

The evaluation board may power from a battery connector or from the USB interface.

Set the jumper between J2 pin1 and TP27 to use supply from USB. Maximum current for USB supply is 500 mA.

BATTERY CONNECTOR J2	
Pin	Function
1	Battery (+) terminal
2	GND
3	GND
4	No connection

#### Control

A green LED (DC IN) will be illuminated once the LM10504 has started up.

The logic signals can be controlled either by the evaluation software or externally through USER CONNECTOR J1. Set the jumper block from JP2 to JP10 accordingly.

USER CONNECTOR J1	
Pin	Function
1	VIN_IO
2	SPI_CS
3	SPI_DI
4	SPI_DO
5	SPI_CLK
6	STANDBY
7	RESET
8	IRQ
9	HL_B2
10	HL_B3
11	DEVSLP

For accessing the signals externally via this connector, jumpers from JP2 to JP10 should be set to EXT position.

## Hardware

Control (continued)

CONNECTOR J3	
Pin	Function
1	VIN_B1
2	VIN_B1
3	GND

CONNECTOR J7	
Pin	Function
1	VIN_B3
2	VIN_B3
3	GND

CONNECTOR J4	
Pin	Function
1	BUCK1
2	BUCK1
3	GND

CONNECTOR J8	
Pin	Function
1	BUCK3
2	BUCK3
3	GND

CONNECTOR J5	
Pin	Function
1	VIN_B2
2	VIN_B2
3	GND

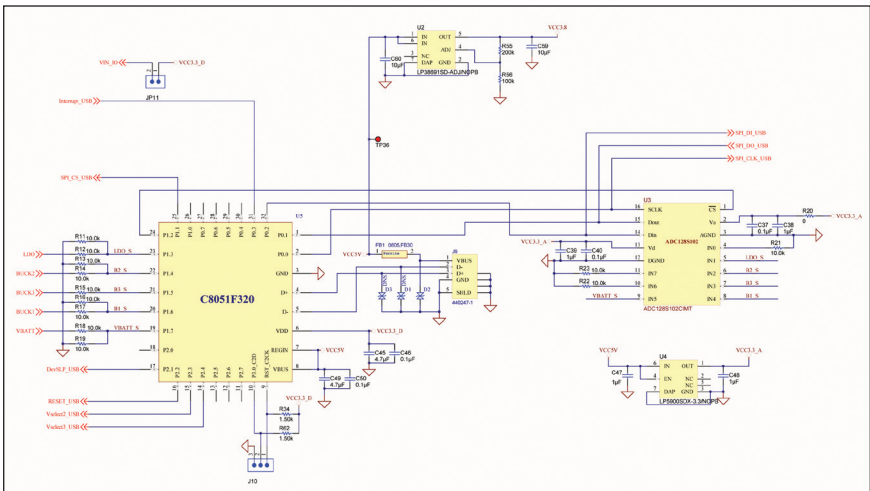
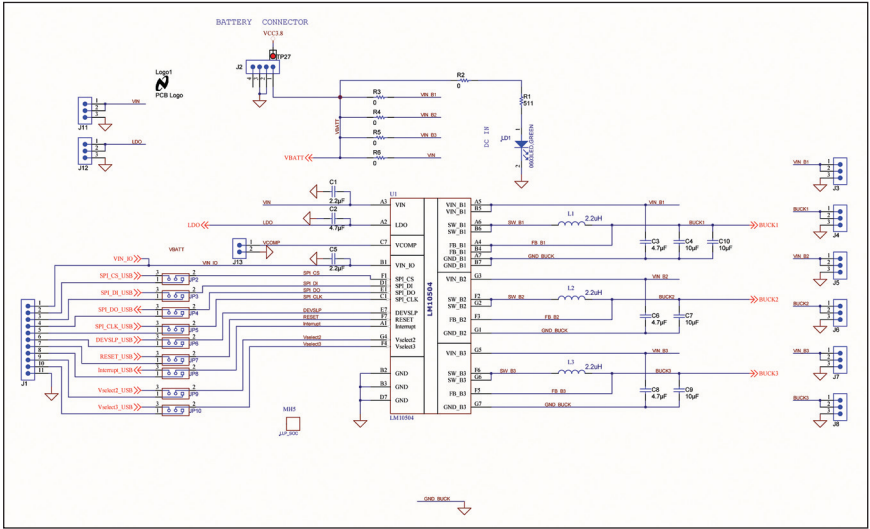
CONNECTOR J11	
Pin	Function
1	VIN
2	VIN
3	GND

CONNECTOR J6	
Pin	Function
1	BUCK2
2	BUCK2
3	GND

CONNECTOR J12	
Pin	Function
1	LDO
2	LDO
3	GND



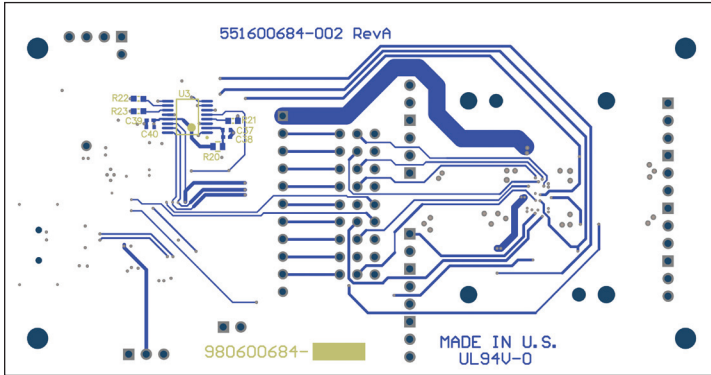
## PCB Schematic



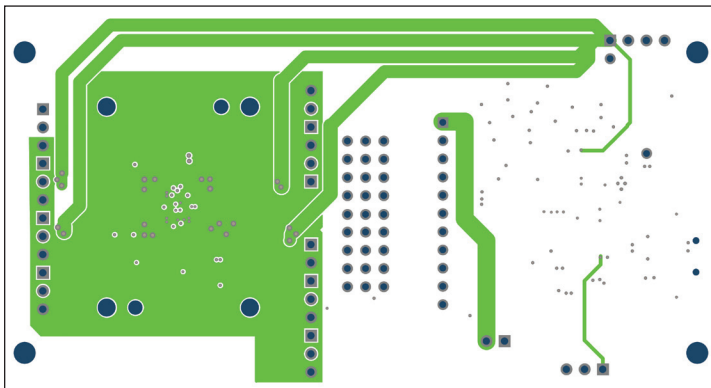
LM10504EVAL Board Schematics

## Hardware

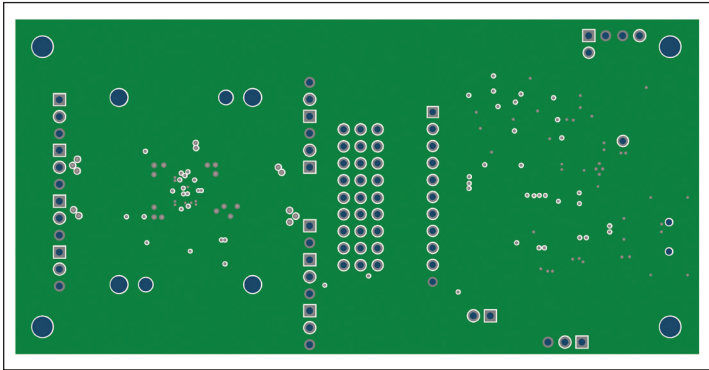
### Board Layout



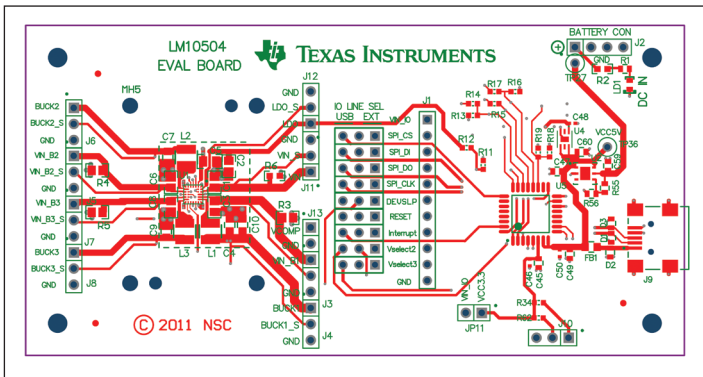
Top Layer



Mid Layer 1



Mid Layer 2



Bottom Layer

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