TWL6032 Evaluation Module (EVM) User’s Guide

User's Guide

Texas Instruments

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TWL6032 Evaluation Module (EVM) User’s Guide

1 Introduction

1.1 Description

1.1.1 Device Description

The TWL6032 device is an integrated power-management integrated circuit (PMIC) for applications powered by a rechargeable battery. The device provides five configurable step-down converters with up to 5-A current capability for memory, processor core, I/O, auxiliary, preregulation for low drop-out voltage regulators (LDOs), and so forth. The TWL6032 device also contains nine LDOs for external use that can be supplied from a battery or a preregulated supply. The power-up and power-down controller is configurable and can support any power-up and power-down sequence (programmed in OTP memory). The real-time clock (RTC) provides three 32-kHz clock outputs, seconds, minutes, hours, day, month, and year information, as well as alarm wakeup and timer. The TWL6032 device supports 32-kHz clock generation based on a crystal oscillator.

The TWL6032 device integrates a switched-mode system supply regulator from a universal serial bus (USB) connector. The TWL6032 includes power paths from the USB and battery with supplemental mode for immediate startup, even with an empty battery. The battery switch uses an external low-Ωic PMOS transistor allowing minimal serial resistance during fast charging and when operating from a battery. The TWL6032 device can also be used without the external PMOS transistor; the battery is then always tied to the system supply and the switched-mode regulator is used for battery charging.

Project collateral and source code discussed in this application report can be downloaded from the following URL: http://www.ti.com/lit/zip/SWCU105.

1.1.2 EVM Kit Description

The TWL6032 evaluation module (EVM) is a stand-alone module that demonstrates the functions of the integrated PMIC. The EVM uses a USB cable and an MSP430™ device (mounted on the EVM) to control the standard inter-integrated circuit (I^2C™) interfaces in the TWL6032 device. It includes Windows®-compatible software to interface with the device. The software is a simple graphical user interface (GUI) that simplifies registers access for the IC.

1.1.3 EPROM Power-Up Sequence Description

This user's guide is common for all TWL6032x parts. The only difference in these parts is the EPROM sequence for power up. Each part has a unique EPROM sequence to satisfy the attached application processor. For details of the EPROM sequence, see the corresponding user's guide in the Application Notes section on the TWL6032x product page.

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1.2 Applications

The TWL6032 device is ideal for the following applications:

- Mobile phones and smart phones
- Tablets
- Gaming handsets
- Portable media players
- Portable navigation systems
- Handheld devices

1.3 Features

The TWL6032 device has the following features:

- Five highly efficient buck converters
  - One 3 MHz, 0.6 to 2.1 V @ 5.0 A, DVS-capable
  - One 6 MHz, 0.6 to 2.1 V @ 2.5 A, DVS-capable
  - Three 6 MHz, 0.6 to 2.1 V @ 1.1 A, one being DVS-capable
- 11 general-purpose LDOs
  - Six 1.0 to 3.3 V @ 0.2 A with battery or preregulated supply:
    One can be used as vibrator driver.
  - One 1.0 to 3.3 V @ 50 mA with battery or preregulated supply
  - One low-noise 1.0 to 3.3 V @ 50 mA with battery or preregulated supply
  - One 3.3 V @ 100 mA USB LDO
  - Two LDOs for TWL6032 internal use
- USB OTG module:
  - ID detection, accessory charger adapter (ACA) support
  - Accessory detection protocol (ADP) support
- Backup battery charger
- 12-bit sigma-delta analog-to-digital converter (ADC) with 19 input channels:
  - Seven external input channels
- 13-bit Coulomb counter with four programmable integration periods
- Low power consumption:
  - 8 μA in BACKUP state
  - 20 μA in WAIT-ON state
  - 110 μA in SLEEP state, with two DC-DC converters active
- Real-time clock (RTC) with timer and alarm wake-up:
  - Three buffered 32-kHz outputs
- SIM and SD®/MMC card detections
- Two digital pulse-width modulation (PWM) outputs
- Thermal monitoring:
  - High-temperature warning
  - Thermal shutdown
- Control:
  - Configurable power-up and power-down sequences (OTP memory)
  - Configurable sequences between SLEEP and ACTIVE states (OTP memory)
  - Three digital output signals that can be included in the startup sequence to control external devices
  - Two inter-integrated circuit I^2C interfaces

  - All resources configurable by I^2C
- System voltage regulator and battery charger with power path from USB:
  - Input current limit to comply with USB standard
  - 3-MHz switched-mode regulator with integrated power FET for up to 2.0-A current
  - Dedicated control loop for battery current and voltage
  - External low-Ωic FET for power path and battery charging
  - Boost mode operation for USB on-the-go (OTG)
  - Supplement mode to deliver current from battery during power path operation
  - Charger for single-cell Li-Ion and Li-polymer battery packs
  - Safety timer and reset control
  - Thermal protection
  - Input and output overvoltage protection
  - Charging indicator LED driver
  - Compliant with:
    - USB 2.0
    - OTG and EH 2.0
    - USB battery charging 1.2
    - YD/T 1591-2006
    - Japanese battery charging guidelines (JEITA)
- Battery voltage range from 2.5 to 5.5 V
- Package 5.21 mm × 5.36 mm 155-pin WCSP

2 TWL6032 EVM Resources Summary

- LDOs
- REGEN1
- REGEN2
- SYSEN
- SMPS regulators
- Main bandgap
- Comparators
- Thermal shutdown
- System reset
- Clocks (PWM1 and PWM2)

For detailed electrical characteristics of the switched-mode power supplies (SMPSs) and LDO supplies, see the TWL6032 product data sheet.

3 Schematic

Figure 1 shows the TWL6032 EVM schematic.

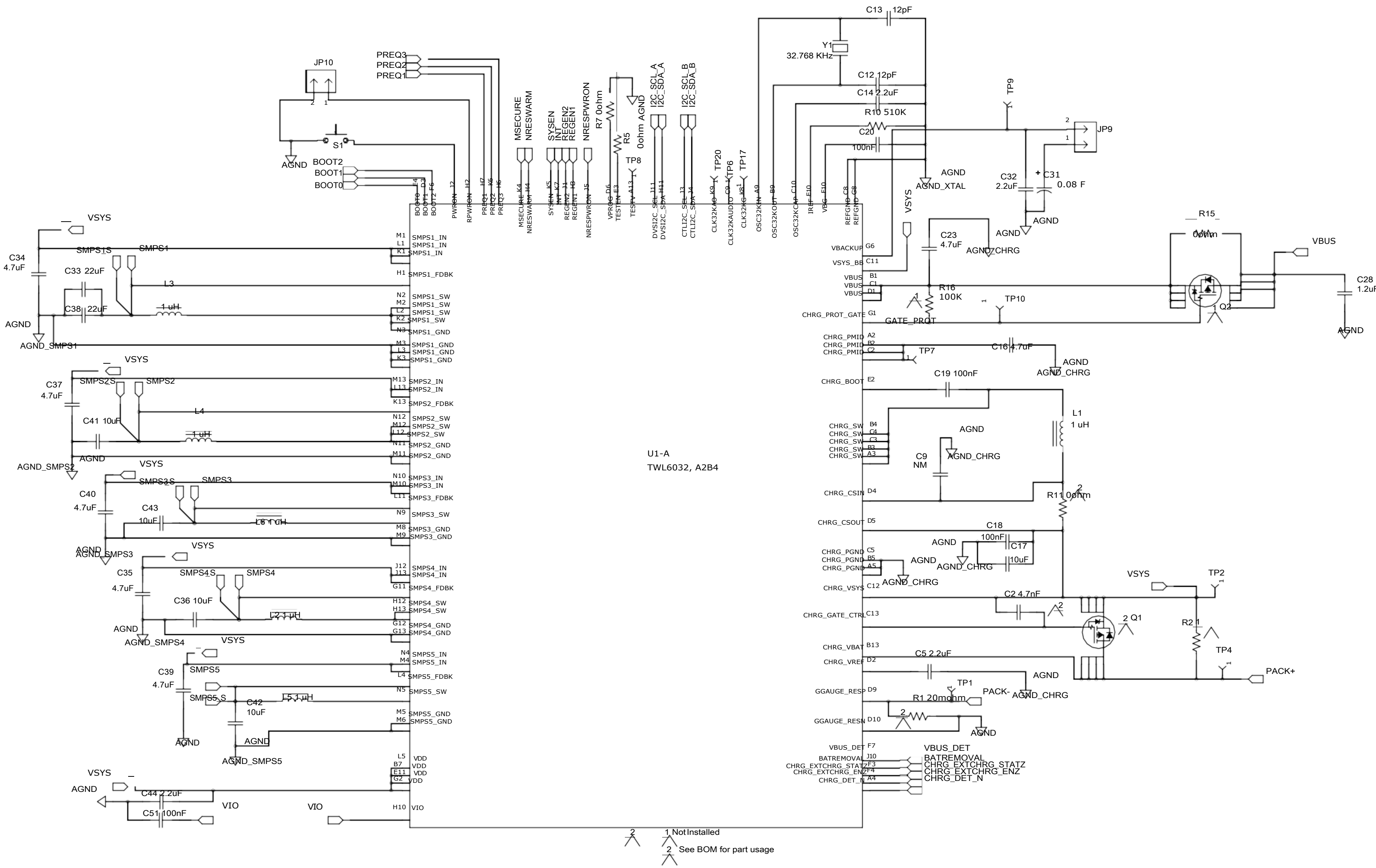

Figure 1. TWL6032 EVM Schematic – TWL6032 Connections

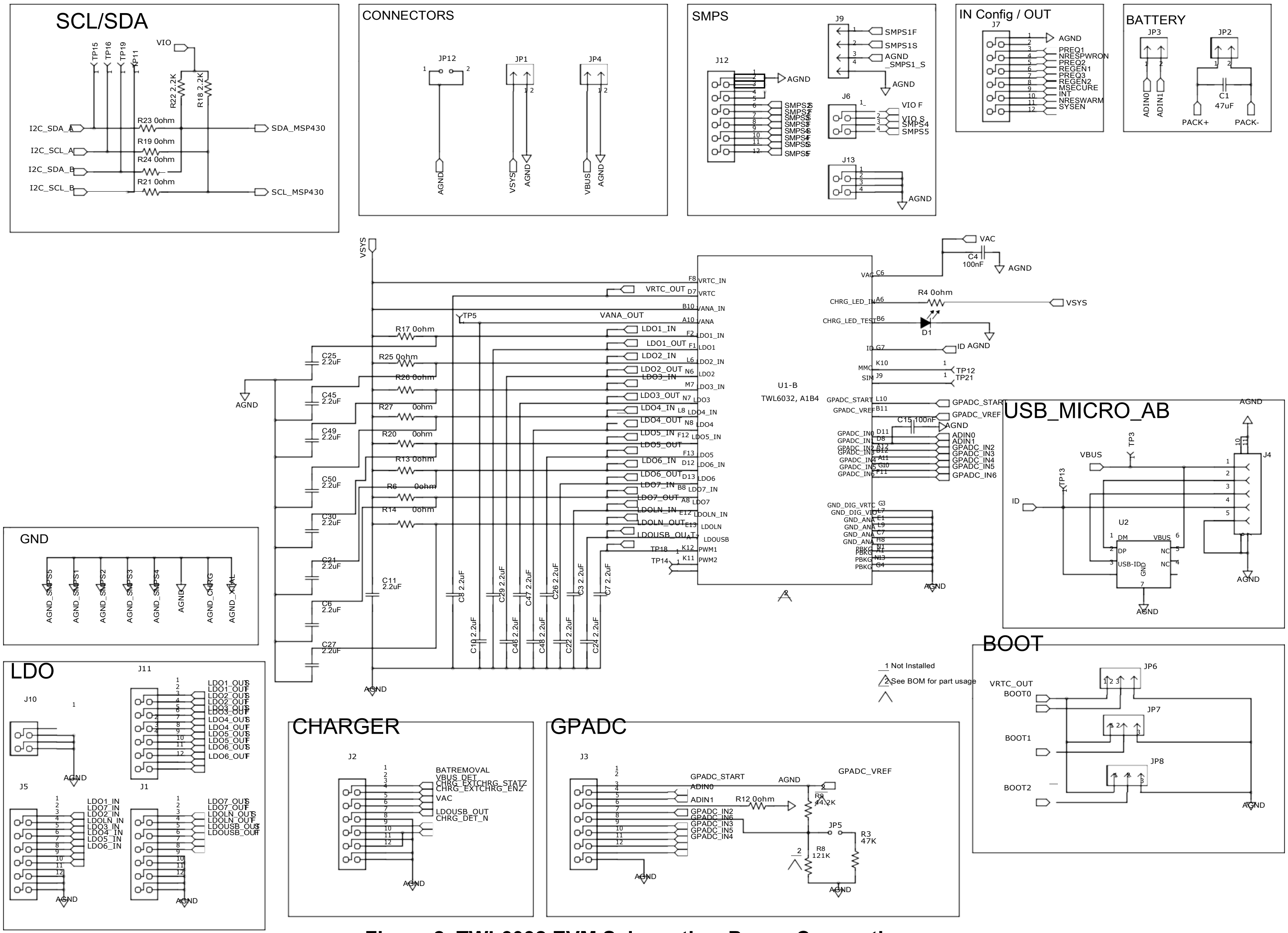

Figure 2. TWL6032 EVM Schematic – Power Connections

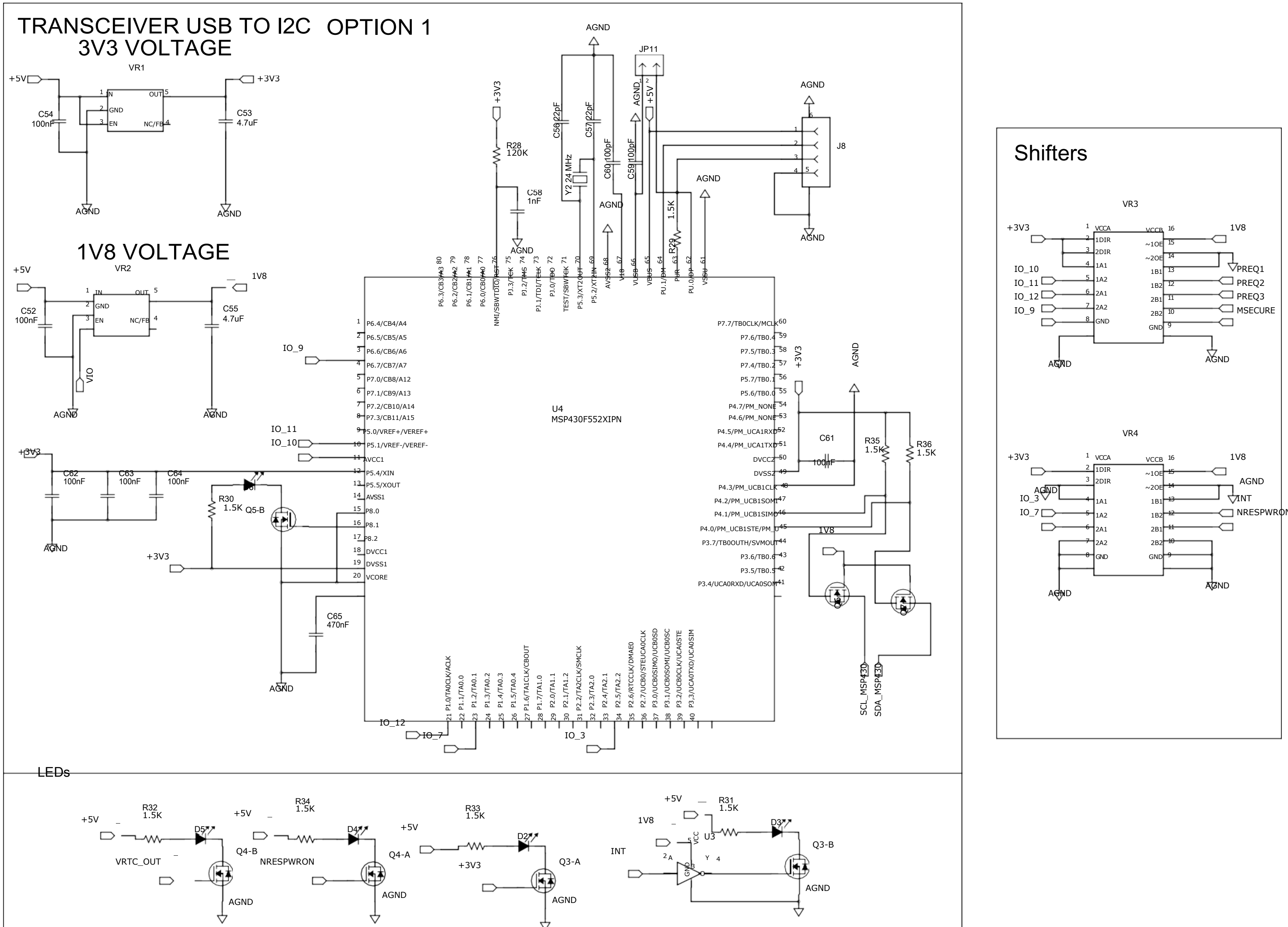

Figure 3. TWL6032 EVM Schematic – MSP430 Connetions

4 Connector and Test Point Descriptions

4.1 Connector Descriptions

4.1.1 Boot Pins

JP6, JP7, and JP8 are used to select the boot pin configuration for proper booting of the device. Table 1 shows the possible boot options.

Table 1. Boot Configuration

State	Boot0	Boot1	Boot2
1	JP6(1-2)	JP7(1-2)	JP8(1-2)
0	JP6(3-2)	JP7(3-2)	JP8(3-2)

4.1.2 Backup Battery

JP9 is used for the backup battery connection. The user can use the onboard 0.8-F, 3.3-V capacitor by shorting JP9-1 and JP9-2.

4.1.3 VBAT and VSYS

Pack+/– (JP2) is the main source input to the PMIC. See Table 2 for the minimum and maximum levels that can be applied to this pin. Use JP12 for ground; the power supply V+ is JP2 (1) and V– to JP2 (2).

Table 2. VBAT Minimum and Maximum Levels

VBAT	Minimum (V)	Typical (V)	Maximum (V)
	2.7	3.6	5.5

VSYS (JP1) is the main input source to the device. Table 3 lists the minimum and maximum levels that can be applied to these pins.

Table 3. VSYS Minimum and Maximum Levels

VSYS	Minimum (V)	Typical (V)	Maximum (V)
	2.7	3.6	5.5

VBUS (JP4) plug insertion is one of the power up events for the device; VBUS is set to 5 V. It is not mandatory to plug in VBUS for power up of the PMIC.

4.1.4 SMPS

There are five SMPSs on the TWL6032 device. SMSPs can be loaded by connecting the load on connectors JP13 and J3. Special consideration must be given to force and sense while loading on SMPS1 (JP13).

Table 4 lists the maximum loads of the SMPSs.

Table 4. SMPS Loads

Connector	Label	Maximum Load
JP9(1-4)	SMPS1	5 A
J12(6-1)	SMPS2	2.2 A
J12(8-1)	SMSP3	1.1 A
J12(10-1)	SMSP4	1.1 A
J12(12-1)	SMSP5	1.1 A

4.1.5 LDO

There are eleven LDOs on the TWL6032 device. Two LDOs are for internal use and nine LDOs are available to supply external power.

Table 5 lists the maximum loads of the LDOs.

Table 5. LDO Loads

Connector	Label	Maximum Load
J11-2	LDO1	50 mA
J11-4	LDO2	200 mA
J11-6	LDO3	200 mA
J11-8	LDO4	200 mA
J11-10	LDO5	200 mA
J11-12	LDO6	250 mA
J1-2	LDO7	200 mA
J1-4	LDOLN	50 mA
J1-6	LDOUSB	100 mA

4.1.6 GPADC

The TWL6032 device has seven general-purpose ADC channels which are externally available and used for various purposes; for example, battery temperature measurement, battery voltage measurement, and so forth. See the TWL6032 data manual for a detailed description about the each channel.

Table 6. GPADC Channels

Connector	Label	Function
J3-1	GPADC_VREF	Reference voltage for GPADC
J3-2	GPADC_START	Start the conversion on ADC
J3-3	ADIN0	Battery detection
J3-5	ADIN1	Battery temperature measurement
J3-7	GPADC2	General purpose
J3-8	GPADC6	General purpose
J3-9	GPADC3	General purpose
J3-10	GPADC5	General purpose
J3-11	GPADC4	General purpose

JP5(1-2) must be connected to simulate the temperature measurements.

4.1.7 I^2C Communication

The TWL6032 device has two slave I^2C interfaces. One is a general-purpose interface to control the internal configuration registers. The second is dedicated to SmartReflex™ applications such as dynamic voltage frequency scaling (DVFS) or adaptive voltage scaling (AVS). J-1 is used to control the communication between the GUI and the MSP430, which in turn control the PMIC.

4.2 Test Point Descriptions

Table 7 lists the test point functions.

Table 7. Test Point Descriptions

Connector	Label	Function
J9-2	SMSP1-OUT	Sense for SMPS1
J12-5	SMPS 2-OUT	Sense for SMPS2
J12-7	SMPS3-OUT	Sense for SMPS3
J12-7	SMPS4-OUT	Sense for SMPS4
J12-11	SMPS5-OUT	Sense for SMPS5
J6-2	VIO-OUT	Sense for VIO
J11-1	LDO1-OUT	Sense for LDO1
J11-3	LDO2-OUT	Sense for LDO2
J11-5	LDO3-OUT	Sense for LDO3
J11-7	LDO4-OUT	Sense for LDO4
J11-9	LDO5-OUT	Sense for LDO5
J11-11	LDO6-OUT	Sense for LDO6
J1-1	LDO7-OUT	Sense for LDO7
J1-3	LDOLN-OUT	Sense for LDOLN
J1-4	LDOUSB-OUT	Sense for LDOUSB
J5-1	LDO1-IN	Input for LDO1
J5-2	LDO7-IN	Input for LDO7
J5-3	LDO2-IN	Input for LDO2
J5-4	LDOLN-IN	Input for LDOLN
J5-5	LDO3-IN	Input for LDO3
J5-6	LDO4-IN	Input for LDO4
J5-7	LDO5-IN	Input for LDO5
J5-8	LDO6-IN	Input for LDO6
J2-1	BATREMOVAL	Battery removal indication
J2-2	VBUSDET	VBUS detection
J2-3	CHRG_EXTCHRG_STATZ	External charging status
J2-4	CHRG_EXTZCHRG_ENZ	External charging enable
J2-5	VAC	VAC detection
J2-7	LDOUSB-OUT	Sense for LDOUSB
J2-8 and J2-10	CHRG_DET_N	USB charger detection

J10 and J13 are extra ground connectors used for any purpose.

5 Test Setup

The following equipment is needed to complete this test procedure.

- Power Supplies

  A power supply capable of supplying up to 3.8 V @ 10 A and a USB cable
- Loads

  Three electronic load circuits capable of drawing 5 A
- Meters

  One DC voltmeter
- Oscilloscope

  One oscilloscope with 1 probe

6 EQUIPMENT SETUP

6.1 Input Supply

Pack+/– (JP2) is the main source input to the PMIC. See Table 8 for minimum and maximum levels that can be applied to this pin; use JP12 for ground.

Table 8. VBAT Minimum and Maximum Levels

PACK	Minimum (V)	Typical (V)	Maximum (V)
	2.7	3.8	5.5

1. Connect the power supply V+ to JP2 (1) and V– to JP2 (2).
2. Connect the USB cable to J8 and the other end to the PC.
3. Connect power supply GND to JP12.

6.2 Basic Jumper Setting

Ensure that the following jumper settings are done so the setup functions as expected.

Table 9 and Table 10 list the input jumper settings.

Table 9. Input Jumper Settings

Jumper ID	Device Input Pin	Use
JP6(2-3)	BOOT0	Boot mode selector
JP7(2-3)	BOOT1	Boot mode selector
JP8(2-3)	BOOT2	Boot mode selector
JP79-2)	VBACKUP	Backup battery to the device
JP5(1-2)	GPADC1	General-purpose ADC for temperature monitoring

Table 10. Input Jumper Settings

Jumper ID	Label	Use
J6(1-3)	SMPS4	VIO follow SMPS4
J2(9-10)	CHRG_DET_N	CHRG_DET_N connected LDO USB to pull it high
J3(3-4)	ADIN0	ADCIN connected to ground
J3(5-6)	ADCIN1	ADIN connected to resistor for temperature simulations

6.3 Load

The load test for DC-DC is performed on one SMPS at a time is:

1. 1. Set the load in 4-W mode.
2. Connect the electronic load to the DC-DC outputs at J12 for SMPS2 through SMPS5, as shown in Table 11.

Table 11. Electronic Load Connections

SMPS	F+	F–	S+	S–
SMPS2	J12(6)	J12(4)	J12(5)	J12(3)
SMPS3	J12(8)	J12(4)	J12(7)	J12(3)
SMPS4	J12(10)	J12(4)	J12(9)	J12(3)
SMPS5	J12(12)	J12(4)	J12(11)	J12(3)

3. Connect the electronic load to the DCDC outputs at J13 for SMPS1.

Table 12. Electronic Load Connections

SMPS	F+	F–	S+	S–
SMPS1	J9(1)	J9(3)	J9(2)	J9(4)

4. Special attention must be taken of the force and the sense connections marked on the J9. SMPS 1 can load up to 5 A.

6.4 Meter

A voltmeter is used to measure input and output voltages.

6.5 Recommended Wire Gauge

To reduce voltage drop and improve the accuracy of loads and measurements, use a minimum connection wire of 22 AWG.

6.6 Install GUI

The GUI accompanying this device is simple and runs on a Windows PC. Ensure that your machine supports Microsoft .NET Framework 3.5.

6.6.1 Installation Instructions

To install the GUI perform the following steps:

1. Unzip the installable file, SWCC013.zip.
2. Create a new folder or unzip it into any appropriate windows folder. By default, the GUI is installed in C:\Program Files\Texas Instruments\TWL6032EVM.
3. Open the GUI by clicking the Setup.exe icon in the folder created in Step 2. The GUI can also be opened by clicking:
   Start → All Programs → Texas Instruments → TWL6032

   Two files are generated: MSP Firmware upgrade utility and TWL6032 EVM

6.6.2 GUI Files

The GUI software consists of the following files:

- .dll
- .exe
- .xml

The .xml file is the main file that contains all the device registers. The registers in this file are categorized in blocks according to the functions. The .xml file also specifies the slave I^2C address for the device.

6.6.3 GUI Description

The GUI windows are divided into the following sections:

6.6.3.1 Register

Following are the blocks seen on the GUI on the left side pane under Register.

1. POWER
2. AUX
3. SMART_REFLEX
4. TEST
5. TRIM
6. DEBUG
7. BQ_24156_USER

Figure 4 shows a sample snapshot of the Registers panel in the GUI.

Each block can be selected independently so that it appears on the main GUI window. Each register instance appears in a separate block.

The user can write to the registers through the I^2C bus. Each bit in the 8-bit register can be written independently or the complete register can be written using 8-bit hexadecimal value in the Value field. Individual bits can be toggled by selecting the drop-down menu or by double-clicking the field.

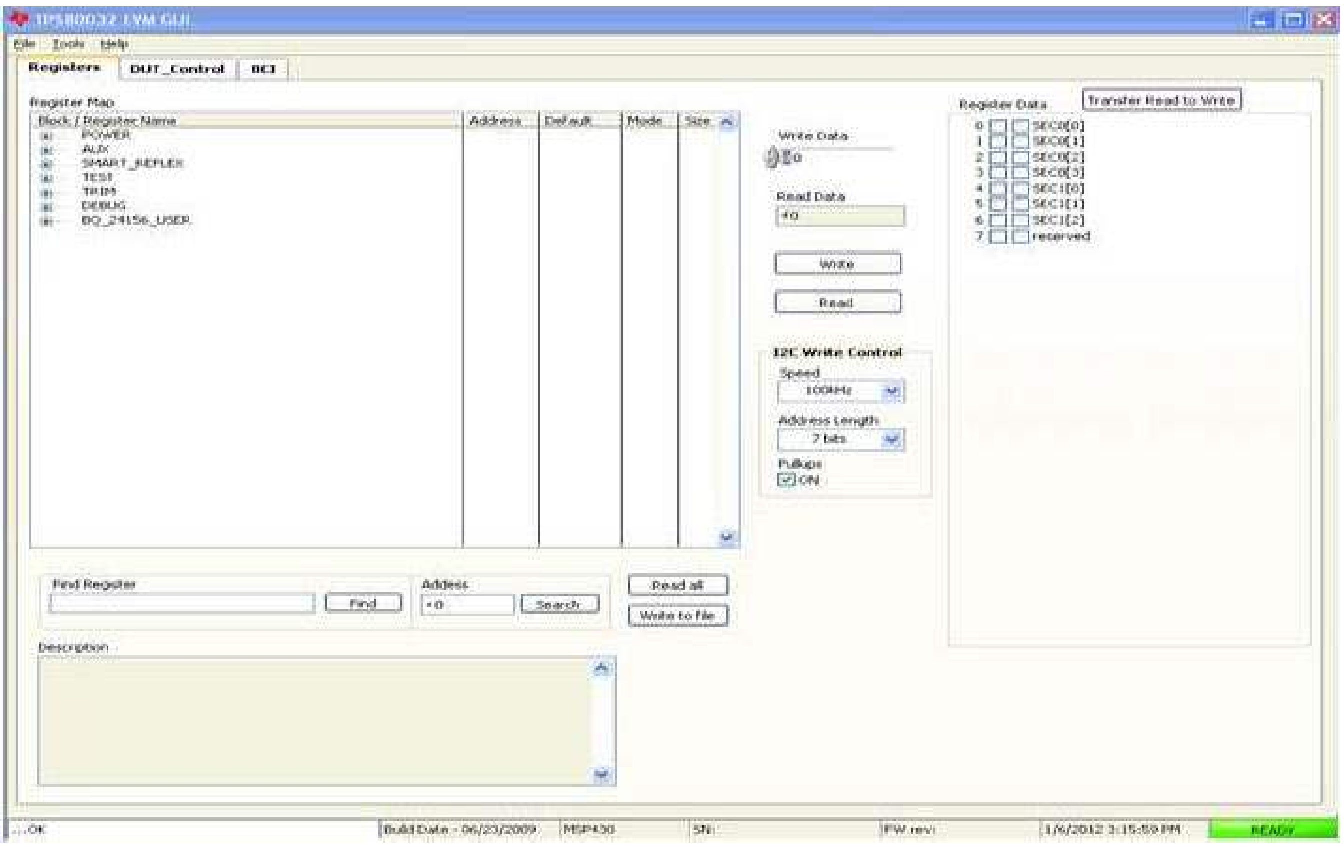

Figure 4. GUI Snapshot – Register

6.6.3.2 DUT Control

The DUT control panel is used to control the static on a few pins on the device; for example, PREQ1, PREQ2, PREQ3, and so forth.

Figure 5 shows a sample snapshot of the DUT_Control panel in the GUI.

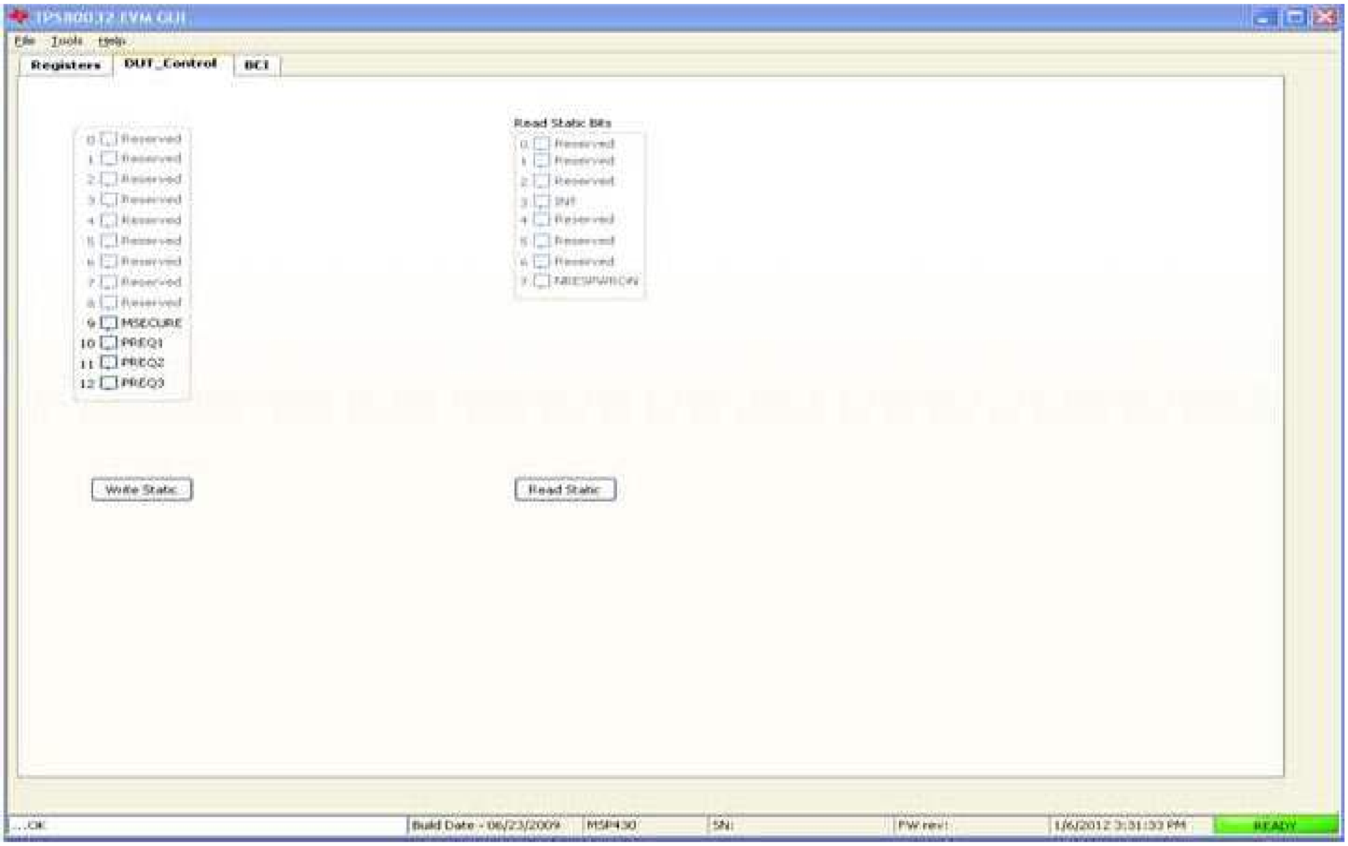

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Figure 5. GUI Snapshot – DUT Control

6.6.3.3 BCI

The BCI panel is used to control the battery charging interface automatically. The BCI panel has a different dropdown to change the charging voltage, charging current, VBUS current, and termination current. There is a provision to read the status, faults, and interrupts from this control panel.

Figure 6 shows a sample snapshot of the BCI panel in the GUI.

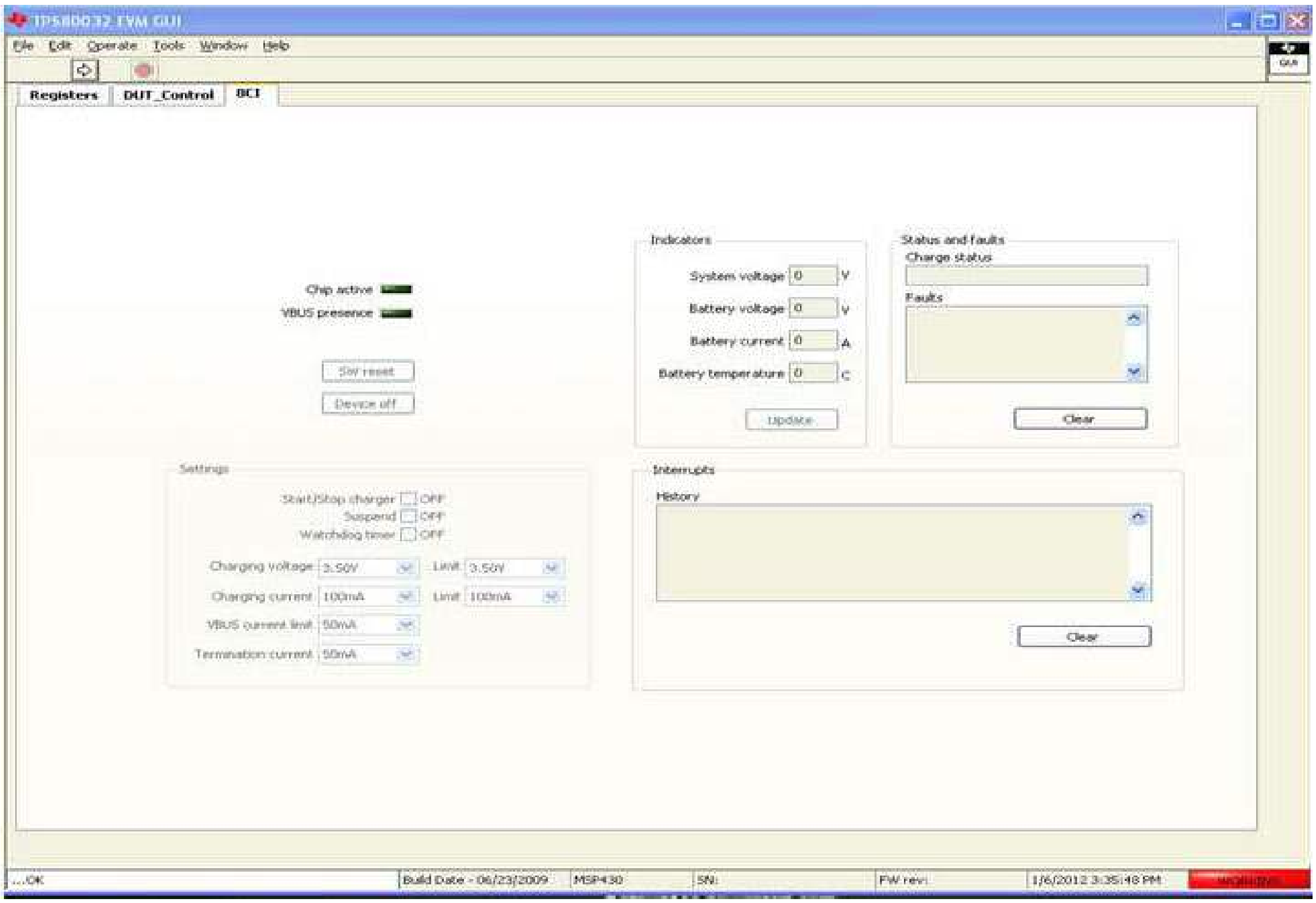

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Figure 6. GUI Snapshot – BCI

7 Test Procedure

7.1 EVM Wakeup

For the first time, the MSP430 firmware must be flashed as follows:

1. Set jumper configuration as described in Table 1 and Table 2.
2. Plug the USB cable into the PC to flash the MSP430 on the board.
3. Load the MSP flash tool on the PC.
4. Click on MSP430 firmware upgrade utility.
5. Click the Next button.
6. Plug the USB cable into the connector on the board.
   (a) Press the browse button then select USB2ANY and hit open
   (b) The Upgrade button should be highlighted
7. Press the Upgrade button.
8. Wait for the MSP430 to be flashed.
9. Close the tool, then disconnect and reconnect the USB cable. The LED should blink three times then stay on.
10. If a voltage source is used instead of a battery, the source must be able to sink some current.

7.2 Set Input Voltage

With the input supply off or disconnected from the unit under test, adjust the input voltage to 3.8 V. For the supply connections, see Section 6.1, *Input Supply*. Ensure that the input power supply current limit is set at 2 A.

CAUTION

Do not exceed an input voltage of 5.5 V at any time during the testing of the UUT.

7.3 Enable DUT

With the power supply connected to the input pins, turn on the power supply.

To power up the UUT, press the POWERON pin for 1 second. Check the following power outputs on the EVM to check if the UUT powered on properly.

Table 13. Expected Voltages

Power Domain	TP	Expected Voltage Range (V)
REGEN1	J7-6	3.77 V to 3.83 V
REGEN2	J7-8	3.77 V to 3.83 V
SMPS4	J12-9	1.75 V to 1.83 V
SYSEN	J7-12	1.77 V to 1.83 V
SMSP3	J12-7	1.220 V to 1.230 V
LDO6	J11-11	1.77 V to 1.83 V
SMPS2	J12-5	0.955 V to 0.969 V
SMPS1	J9-2	0.955 V to 0.969 V
SMPS5	J12-11	0.955 V to 0.969 V
LDOLN	J1-3	1.77 V to 1.83 V
LDO2	J11-3	2.75 V to 2.85 V
NRESPWRON	J7-4	1.77 V to 1.83 V

7.4 Power Consumption Test

When the device is powered on, the supply should show the power consumption in the range of 750 μA to 1.2 mA.

7.5 32-kHz Clock Test

Probe TP20 to check the clock. This should measure a 32-kHz clock.

7.6 Load Test

Turn on the electronic loads (see Section 6.3, *Load*). When the DC-DCs (VDD1, VDD2, and VIO) are loaded, they should regulate at the same voltage as shown in Table 13.

7.7 Test Complete

Turn off the power supply and remove all connections from the UUT.

7.8 Final Jumper Connections

Leave the jumper connections as done above for the test setup.

7.9 Load Test

7.9.1 GUI Test

Connecting the GUI to the EVM:

If the board is powered on, turn it off. Turn on the EVM supply and power on the board and open the GUI. The GUI can be controlled from a PC or laptop. The cable is connected between the PC or laptop USB slot and connector J8 on the TWL6032 EVM.

Once the GUI is connected to the EVM, the device registers can be written. In the Registers section of the GUI, scroll down to the SMPSx_CFG_FORCE register. Write the values listed in Table 14 to the registers.

Table 14. SMPS Register Values

Register Name	Hex Values To Be Written	Value
SMPS2_CFG_FORCE	0x33	1.35 V
SMPS1_CFG_FORCE	0x3C	1.8 V
SMPS5_CFG_FORCE	0x01	0.7 V

Measure the SMPS outputs at the jumpers listed in Table 15.

Table 15. SMPS Jumper Measurements

Register Name	Jumper	Value (V) (No Load Needed)
SMPS2_CFG_FORCE	J12-5	1.3 V to 1.4 V
SMPS1_CFG_FORCE	J2-9	1.75 V to 1.85 V
SMPS5_CFG_FORCE	J12-11	0.65 V to 0.75 V

8 EQUIPMENT SHUTDOWN

No special shutdown procedures are required.

9 EVM Assembly Drawings and Layout

Figure 7 through Figure 15 show the design of the TWL6032 EVM printed circuit board.

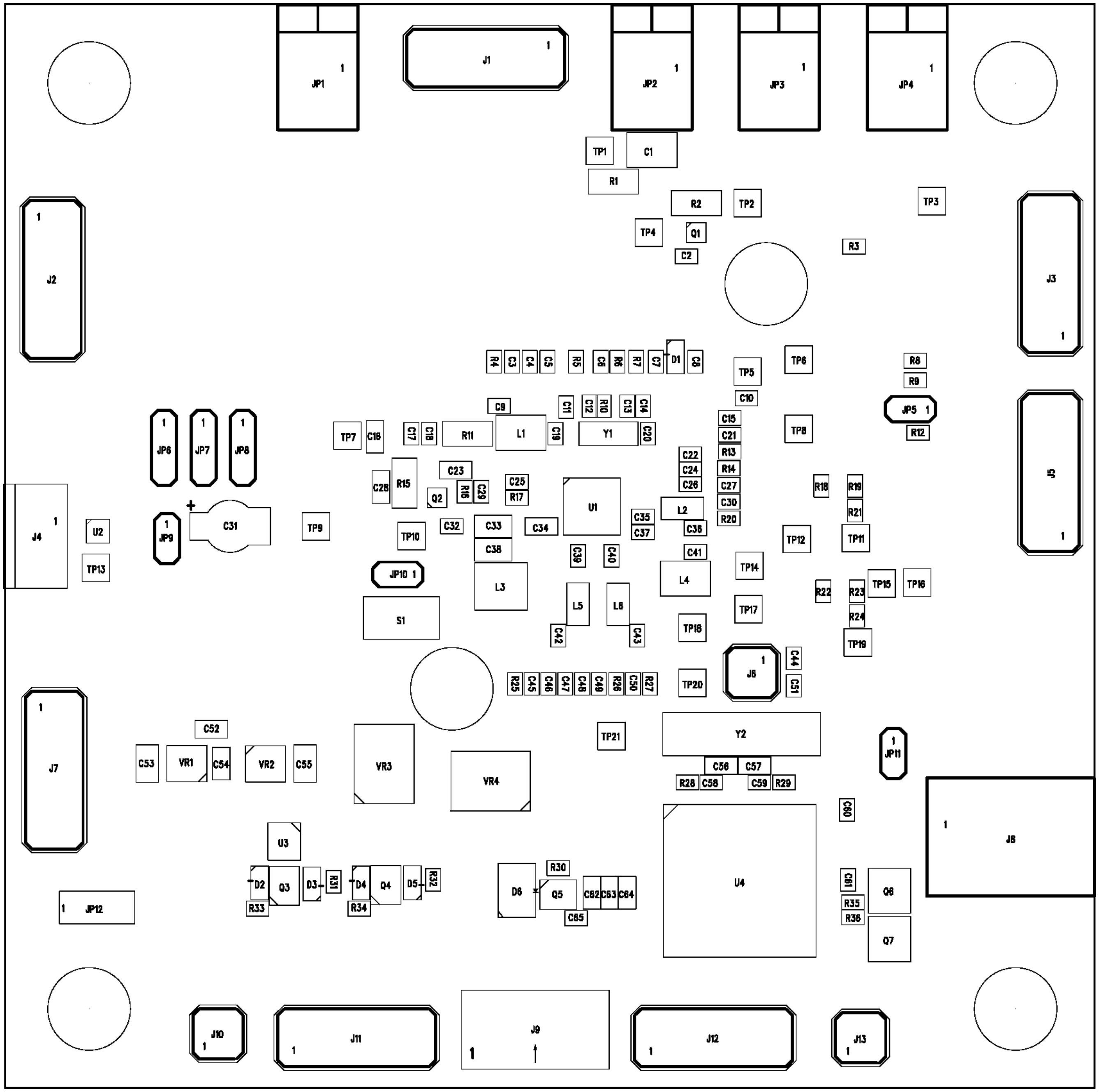

Figure 7. TWL6032 EVM Component Placement With Silkscreen Labels

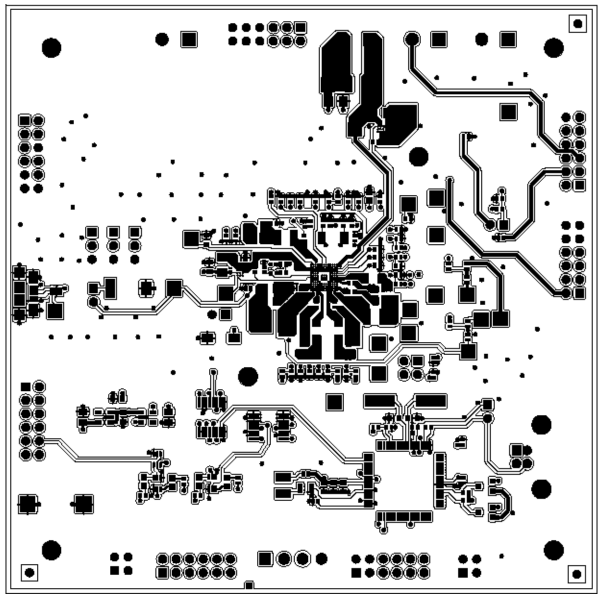

Figure 8. TWL6032 EVM Internal Layer (L1)

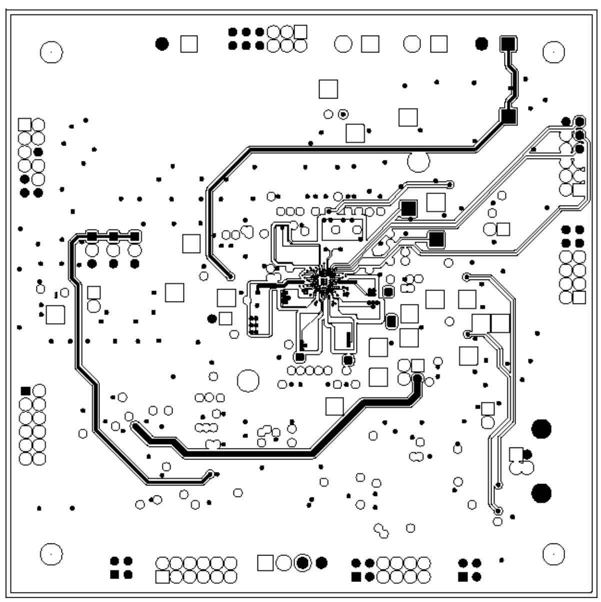

Figure 9. TWL6032 EVM Internal Layer (L2)

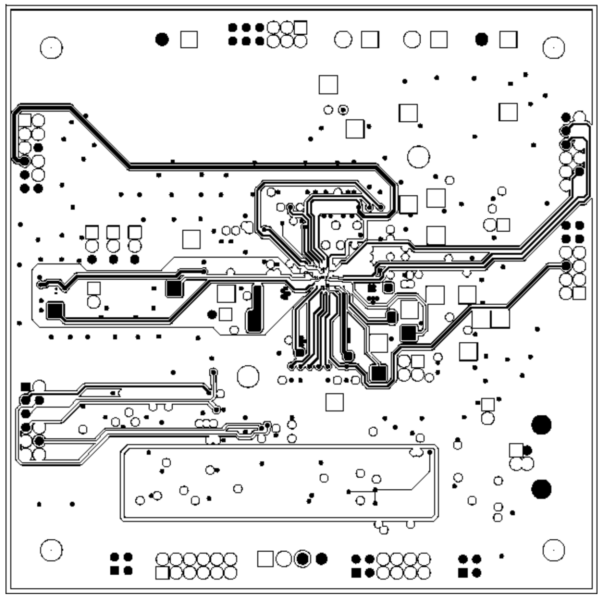

Figure 10. TWL6032 EVM Internal Layer (L3)

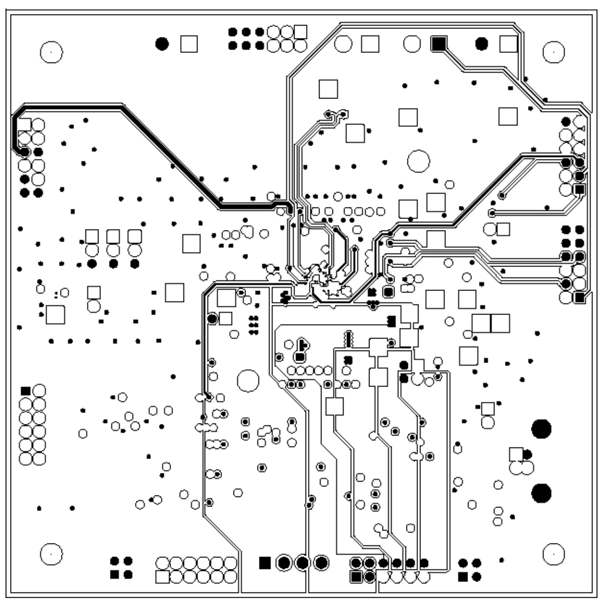

Figure 11. TWL6032 EVM Internal Layer (L4)

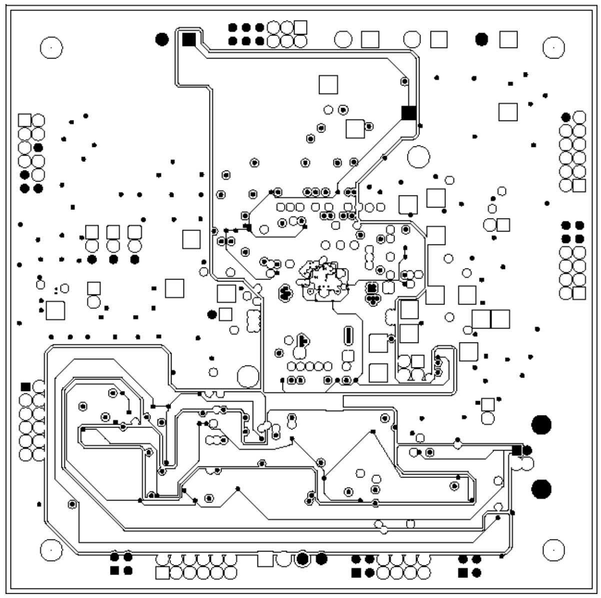

Figure 12. TWL6032 EVM Internal Layer (L5)

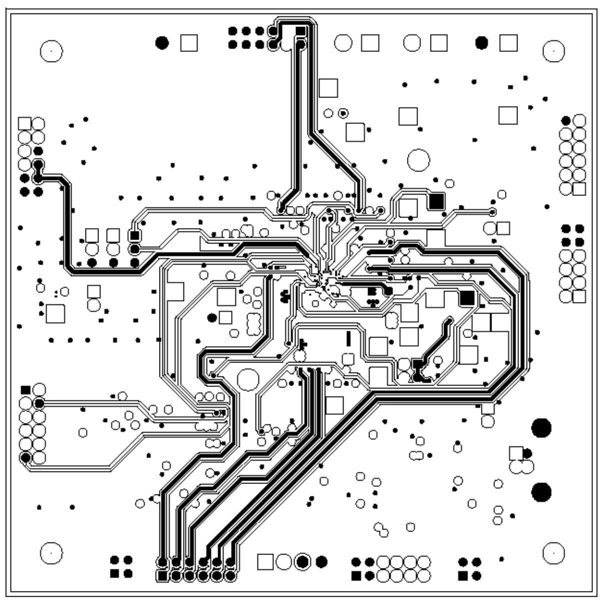

Figure 13. TWL6032 EVM Internal Layer (L6)

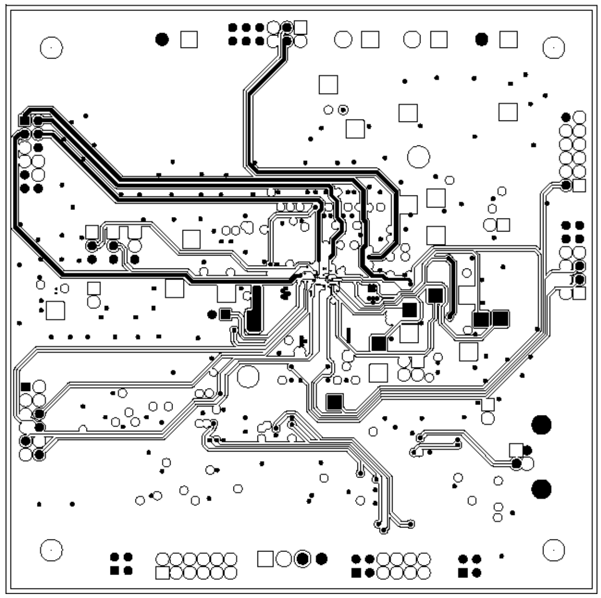

Figure 14. TWL6032 EVM Internal Layer (L7)

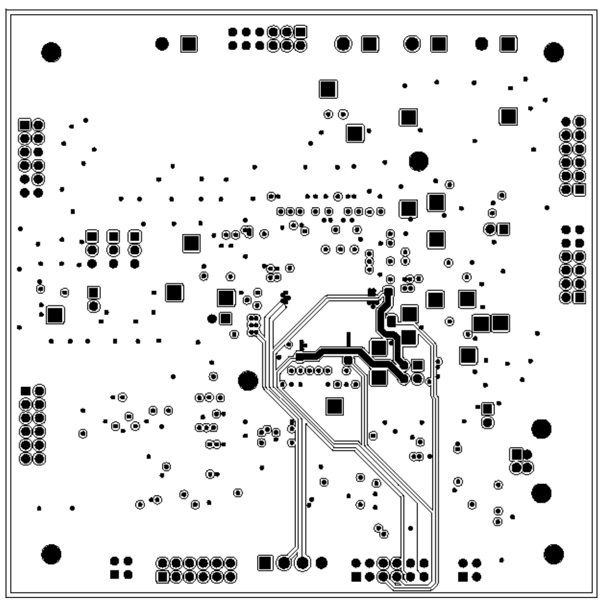

Figure 15. TWL6032 EVM Internal Layer (L8)

10 List of Materials

TWL6032 EVM Bill of Materials lists the EVM components as configured according to the schematic shown in Figure 1.

TWL6032 EVM Bill of Materials

Count	Reference Designator	Value	Description	Size	Part Number	Manufacturer
1	C1	47uF	CAP, CER, 10V, X5R, 20%	1210	GRM32ER61A476ME20	MURATA
2	C12, C13	12pF	CAP,CER,50V,COG,2%	0402	GRM1555C1H120GA01D	MURATA
2	C16, C23	4.7uF	CAP, CER, 16V, X5R, 20%	0603	STD	STD
5	C17, C36, C41, C42, C43	10uF	CAP,CER,6.3V,X5R,20%	0603	C1608X5R0J106M	MURATA
1	C2	4.7nF	CAP, CER, 50V, X7R, 10%	0402	GRM155R71H472KA01D	MURATA
1	C28	1.0uF	CAP, CER, 16V, X7R, 10%	0603	C1608X7R1C105K	TDK
24	C3, C5, C6, C7, C8, C10, C11, C14, C21, C22, C24, C25, C26, C27, C29, C30, C32, C44, C45, C46, C47, C48, C49, C50	2.2uF	CAP,CER,6.3V,X5R,20%	0402	GRM155R60J225ME15D	MURATA
1	C31	0.08 F	CAP, DOUBLE LAYER ELEC, 3.3V	4.8 mm Dia.	XH414HGII06E	SII Micro
2	C33, C38	22uF	CAP, CER, 6.3V,X5R, 20%	0805	GRM21BR60J226ME39	MURATA
1	C34	4.7uF	CAP, CER, 6.3V, X5R, 10%	0603	GRM188R60J475KE19D	MURATA
4	C35, C37, C39, C40	4.7uF	CAP, CER, 6.3V, X5R, 20%	0402	GRM155R60J475ME87	MURATA
6	C4, C15, C18, C19, C20, C51	100nF	CAP,CER,6.3V,X5R,10%	0402	GRM155R60J104KA01D	MURATA
5	C52, C54, C62, C63, C64	100nF	CAP, CER, 50V, X7R, 10%	0603	C0603C104K5RAC	KEMET
2	C53, C55	4.7uF	CAP, CER, 16V, X5R, 10%	0805	C0805C475K4PAC	KEMET
2	C56, C57	22pF	CAP, CER, 50V, NP0, 5%	0603	C0603C220J5GACTU	KEMET
1	C58	1nF	CAP,CER,50V,X7R,10%	0402	GRM155R71H102KA01D	MURATA
2	C59, C60	100pF	CAP,CER,50V,NP0,5%	0402	GRM1555C1H101JD01D	MURATA
1	C61	100nF	CAP,CER, 50V , X7R , 10%	0402	C1005X7R1H104K	KEMET
1	C65	470nF	CAP, CER, X5R, 6.3V, 10%	0402	04026D474KAT2A	ARROW
0	C9	2.2uF	CAP,CER,6.3V,X5R,20%	0402	GRM155R60J225ME15D	MURATA
5	D1, D2, D3, D4, D5	HSMR-CL25	Diode. LED Blue, 5V, 10mA	0603	HSMR-CL25	Avago
1	D6	Yellow_LYT67K-K2M1-26-Z	Diode. LED Hyper-Bright Low Current, yellow, 12V, 20mA	PLCC-2	LYT67K-K2M1-26-Z	Osram
7	J1, J2, J3, J5, J7, J11, J12	PEC06DAAN	Header, Male 2x6 pin, 100mil spacing	0.100 inch x 2X6	PEC06DAAN	Sullins
1	J4	ZX62-AB-5PA	Connector, USB Micro B, 5-pins, SMT	6x8 mm	ZX62-AB-5PA	Hirose

TWL6032 EVM Bill of Materials (continued)

Count	Reference Designator	Value	Description	Size	Part Number	Manufacturer
3	J6, J10, J13	PEC02DAAN	Header, 2x2-pin, 100mil spacing	0.20 x 0.20 inch	PEC02DAAN	Sullins
1	J8	067068-9000	Connector, USB Upstream (Type B)	0.47 x 0.67 inch	067068-9000	Molex
1	J9	ED555/4DS	Connector, Male 4 Pole3.5 mm, 6A, 150V	6.5x14 mm	ED555/4DS	On Shore Tech
4	JP1, JP2, JP3, JP4	MKDS3/2	Header, Side Entry 2-pin, 5mm spacing,	0.441 x 0.200 inch	MKDS3/2	Phoenix Contact
1	JP12	S1731-46R	Jumper, Power SMT	2.3x12.3 mm	S1731-46R	Harwin
4	JP5, JP9, JP10, JP11	PEC02SAAN	Header, Male 2-pin, 100mil spacing,	0.100 inch x 2	PEC02SAAN	Sullins
3	JP6, JP7, JP8	PEC03SAAN	Header, Male 3-pin, 100mil spacing,	0.100 inch x 3	PEC03SAAN	Sullins
2	L1, L4	1 uH	Inductor, Chip Coils, LQM32PN1R0	1210	LQM32PN1R0	muRata
3	L2, L5, L6	1 uH	Inductor, Chip Coils, LQM2MPN1R0NG0L	806	QM2MPN1R0NG0L	muRata
1	L3	1 uH	Inductor, Power, XFL4020-102MEB	0.157 x 0.157 inch	XFL4020-102MEB	Coilcraft
1	Q1	CSD25201W15	MOSFET, PChan, -20V, 4A, 50 mOhm	CSP 1.5x1.5mm	CSD25201W15	Texas Instruments
0	Q2	CSD25201W15	MOSFET, PChan, -20V, 4A, 50 mOhm	CSP 1.5x1.5mm	CSD25201W15	Texas Instruments
3	Q3, Q4, Q5	Si1912EDH	MOSFET, Dual Nch, 20V, 1.28A, 280 mOhm	SOT-363	Si1912EDH-T1-E3	Vishay
2	Q6, Q7	BSS138	MOSFET, Nch, 50V, 0.22A, 3.5 Ohm	SOT23	BSS138	Fairchild
1	R1	20mohm	RES, 0.5W, 1%	1206	LRC-LRF1206LF-01-R020-F	IRCTT
1	R10	510K	RES, 0.0625W, 1%	0402	STD	STD
2	R11, R15	0ohm	RESISTOR,SMT,5%,1/4W	1206	ERJ-8GEY0R00V	PANASONIC
0	R16	100K	RES, 0.0625W, 1%	0402	0402WGF1003TCE	Multicomp
2	R18, R22	2.2K	RES, 0.0625W, 1%	0402	STD	STD
0	R2	0ohm_0.5W Not Mount	Resistor, 0.5 watt	1206		
1	R28	120K	RES,0.0625W, 1%	0402	STD	STD
8	R29, R30, R31, R32, R33, R34, R35, R36	1.5K	RESISTOR,SMT,0.1%,1/16W	0402	PCF0402-R-1K5-B-T1	Multicomp
1	R3	47K	THERMISTOR, NTC, 1%	0402	ERTJ0EP473F	PANASONIC
16	R4, R5, R6, R7, R12, R13, R14, R17, R19, R20, R21, R23, R24, R25, R26, R27	0ohm	Resistor, Chip, 1/16W	0402	CRG0402ZR	TYCO

TWL6032 EVM Bill of Materials (continued)

Count	Reference Designator	Value	Description	Size	Part Number	Manufacturer
1	R8	121K	RESISTOR,1%,1/16W	0402	ERJ-2RKF1213X	Multicomp
1	R9	44.2K	RESISTOR,1%,1/16W	0402	ERJ-2RKF4422X	Multicomp
1	S1	KSR221GLFS	Switch, SMT Subminiature Tact , 50v, 50mA Max.	3.8x7.15 mm	KSR221GLFS	ITT
21	TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP21	PEC01SAAN	Through Hole, O.040 Dia		PEC01SAAN	Sullins
1	U1	TWL6032YFF	IC, Power Management With Power Path and Battery Charge	uBGA	TWL6032A2B4YFF	Texas Instruments
1	U2	RCLAMP1654P	IC, Low Capacitance TVS Array	QFN	RCLAMP1654P	Semtech
1	U3	SN74AUC1G04DCK	IC, Single Inverter	DCK-5	SN74AUC1G04DCK	TI
1	U4	MSP430F5529IPN	IC, Mixed Signal Microcontroller	TQFP-80	MSP430F5529IPN	Texas Instruments
1	VR1	TPS76333DBV	IC, Micro-Power 150 mA LDO Regulator	SOT23-5	TPS76333DBV	TI
1	VR2	TPS76318DBV	IC, Micro-Power 150 mA LDO Regulator	SOT23-5	TPS76318DBV	TI
2	VR3, VR4	SN74AVC4T245PW	IC, 4-BIT DUAL-SUPPLY BUS TRANSCEIVER	TSSOP	SN74AVC4T245PW	TI
1	Y1	32.768 KHz	Crystal, SMT Ceramic , 12.5pF, +/-20ppm	1.8x4.9 mm	CM519-32.768KDZF-UT	Citizen
1	Y2	24 MHz	Crystal, SMT Ceramic , 18pF, +/- 30ppm	3.7x12.7 mm	24.000MHZ 49USMX/30/50/40/18PF	EuroQuartz
6		Keystone Ref 2203 (L= 12.7 mm) Diameter = 6.4mm	4-40 Threaded Standoffs - .250 [6.4] O.D Brass Zinc Plate		2203	Keystone
6			WASHER FLAT #4 .120X.250" NYLON		3348	Keystone
6			Screw 4-40 thread, .250		NY PMS 440 0025 PH	Richco plastic
1			PCB		PWR122	ANY
2	--		Shunt, 100-mil, Black	0.100	929950-00	3M
1	--		Label (See note 5)	1.25 x 0.25 inch	THT-13-457-10	Brady

NOTE:

- These assemblies are ESD sensitive. ESD precautions must be observed.
- These assemblies must be clean and free from flux and all contaminants. Use of contaminated flux is not acceptable.
- These assemblies must comply with workmanship standards IPC-A-610 Class 2. Reference designators marked with an asterisk (**) cannot be substituted. All other
- components can be substituted with equivalent manufacturer's components.

11 Revision History

Note: Numbering may vary from previous versions.

Version	Literature Number	Date	Notes
*	SWCU105	October 2012	See (1)

(1) SWCU105 - initial release.

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