TMS320C5545 BoosterPack Hardware

User's Guide

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TMS320C5545 BoosterPack Hardware

This user's guide supports the C5545 BoosterPack™, which was designed and developed by Mistral Solutions Pvt. Ltd. for Texas Instruments, Inc.

1 Overview

This section provides an overview of the C5545 BoosterPack along with the key features, functional block diagram and basic operation.

1.1 Key Features

The C5545 BoosterPack is a high performance, low-power platform that enables users to evaluate and develop for the TMS320C5545A processor and its peripherals. The BoosterPack interfaces to LaunchPad™ boards such as MSP432, CC3200, MSP430™ LaunchPads, as well as compatible BoosterPacks.

The key features of C5545 BoosterPack are:

- The C5545 fixed-point DSP based on TI's C55x architecture
- The CC2650 2.4 GHz multi-standard wireless MCU
  - Used as wireless communication companion with C5545 DSP
- 2.4 GHz single ended PCB antenna
- 16M-bit SPI FLASH
- Micro-SD card slot with 8GB card
- OLED display (passive matrix, 96 x 16 pixels, monochrome display)
- Audio CODEC (TLV320AIC3206IRSBT)
- Micro USB connector
- Three user switches and three user LEDs
- One reset switch and two power LEDs
- FTDI chip FT2232HL for JTAG and UART over micro USB connector
- 10-pin JTAG for CC2650 (1.8 V only)
- Audio line-in (MIC) and headphone out
- On-board microphone (CMC-2242PBL-A)
- LaunchPad connectors
- INA current monitors (INA219AIDCNR)
- Powered by USB or LaunchPad
- On-board, XDS100 JTAG emulator for C5545

TMS320C5545A DSP is a new device from TI's TMS320C55x fixed-point digital signal processor with:

- C55x fixed-point DSP architecture (C5545 reached 120 MHz and C55x reaches up to 200 MHz)
- DSP internal memories
  - 64KB dual-access RAM
  - 256KB single-access RAM
  - 128KB read-only memory
- FFT hardware accelerator
- Four DMA with four channels each (16 channels total)
- Three 32-bit general-purpose timers
- Two embedded multimedia card (eMMC) or secure digital (SD) interfaces
- Four inter-IC sound (I2S) for data transport, universal asynchronous receiver/transmitter (UART), serial peripheral interface (SPI) with three chip select, master and slave inter-integrated circuit (I2C)
- LCD bridge with asynchronous interface
- 10-bit 3-input successive approximation (SAR) analog-to-digital converter (ADC)
- Device USB port with integrated 2.0 high-speed PHY supports both high and full speed device
- Software compatible with C55x devices
- Three integrated LDOs
- On-chip ROM bootloader
- 118-terminal, 7x7 mm, 0.5mm pitch Pb-free plastic ball grid array (BGA) (ZQW suffix)

NOTE: The TMS320C5545A device used on this BoosterPack is the 100 MHz version.

The CC2650 is a 2.4 GHz multi-standard wireless MCU from TI's SimpleLink™ ultra-low power portfolio that includes:

- ARM® Cortex®-M3 MCU (up to 48 MHz)
- 128KB of in-system programmable flash
- 20KB of ultra-low leakage SRAM and 8KB of SRAM for cache
- Targets *Bluetooth*™ low-energy (Bluetooth Smart), ZigBee®, and 6LoWPAN
- Very low active RF and MCU current provides excellent battery lifetime
- Excellent receiver sensitivity and reference antenna designs available
- Ultra-low power sensor controller engine (proprietary low-power core for communicating with external sensors)
- Peripherals include UART, 2x serial peripheral interface (SPI), I2C, I2S, and true random number generator
- 12-bit, 8-channel ADC (200 ksps) and ultra-low power comparator comes in 7x7 mm (31 GPIO), 5x5 mm (15 GPIO, used here), and 4x4 mm (10 GPIO) packages

1.2 Functional Block Diagram

The functional block diagram of the C5545 BoosterPack is shown in Figure 1.

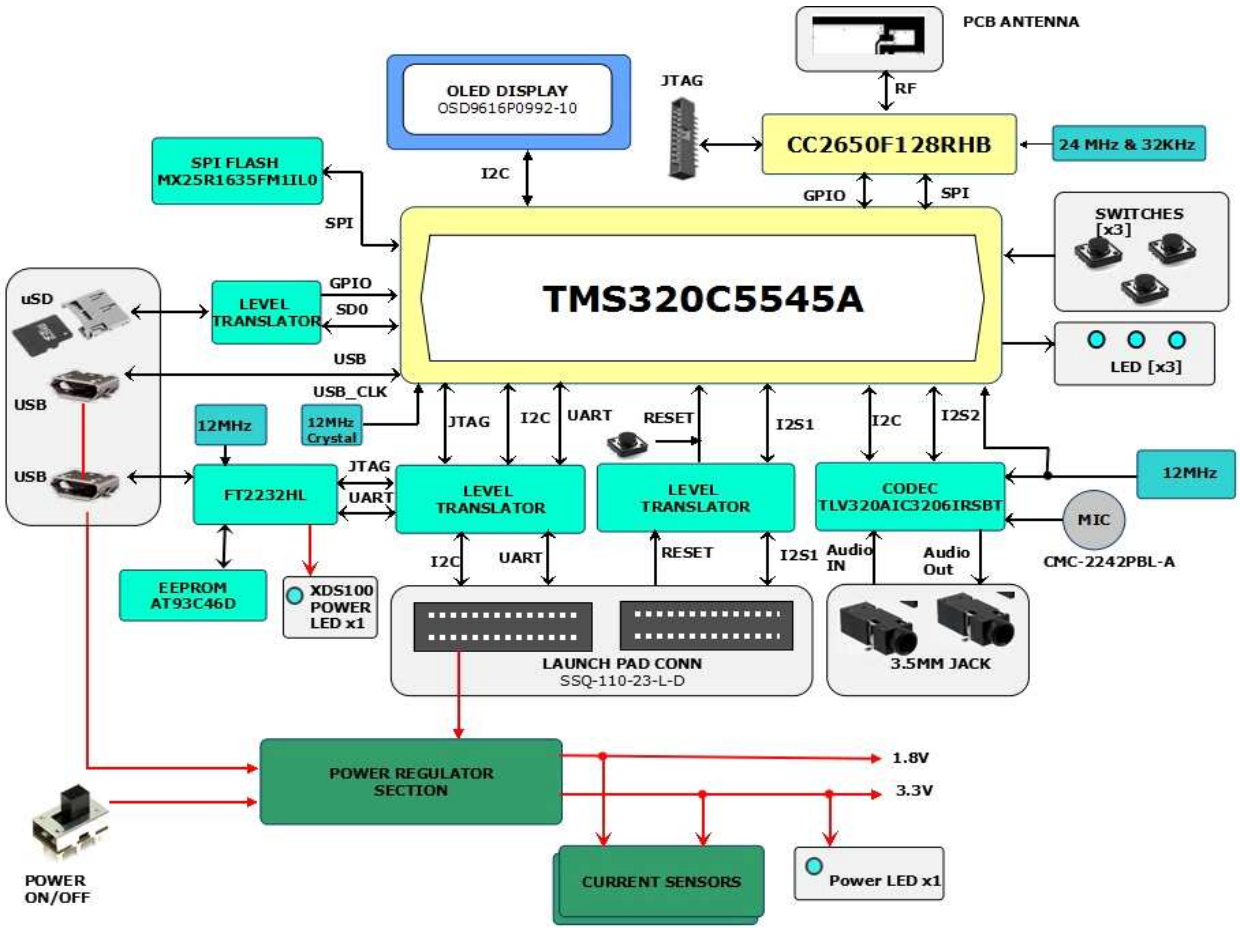


Figure 1. C5545 BoosterPack Functional Block Diagram

1.3 Basic Operation

The C5545 BoosterPack is a full-featured development platform for the TMS320C5545 fixed-point DSP. It supports a comprehensive suite of software including the Code Composer Studio™ v6 Integrated Development Environment, C55x Chip Support Library, and an included out of box audio demo application with source code to accelerate your time to market.

The out of box demo package includes an audio playback demo running on the C5545 BoosterPack and a companion equalizer app for Android device. The audio demo supports either playback of wave (.WAV) audio files included on the SD card or streaming of audio from LINE IN to HEADPHONE port of the C5545 BoosterPack. Audio playback can be controlled using on-board push buttons or voice commands with menu options displayed on the OLED screen. Using the android app provides control for playback equalizer parameters through a Bluetooth Low Energy interface provided by the CC2650. For more details on the out of box demo, see the *TMS320C5545 DSP BoosterPack Software User's Guide* (SPRUI92) .

Follow the instructions below to run the out of box demo:

1. Insert the SD card with the out-of-box demo image and wave audio files into the MicroSD slot (J3) of the C5545 BoosterPack.
2. Connect headphones or speakers to the 'HEADPHONE' port of C5545 BoosterPack.
3. Power ON the C5545 BoosterPack with the SW6 sliding switch (the board receives power through either USB port or an attached LaunchPad).
4. Choose audio source as SD using SW3 when C5545 BoosterPack is powered ON.
5. Launch the equalizer application on the Android device.
6. Allow the application to enable Bluetooth, if not already enabled.
7. Press the 'scan' button to start scanning for the C5545 BoosterPack.
8. Press the 'connect' button once the C5545 BoosterPack is detected by the application.
9. Start playback by pressing SW2 or by speaking 'play' near the C5545 BoosterPack on-board MIC.
10. Slide the equalizer bars on the application to change the equalizer values of playback.
11. Observe the change in audio at headphone output while changing the equalizer values from the application.
12. Pause the playback by pressing SW2 or by speaking 'pause' near the C5545 BoosterPack on-board MIC.
13. Resume playback by pressing SW2 or by speaking 'play' near the C5545 BoosterPack on-board MIC.
14. Stop playback by pressing SW3 or by speaking 'stop' near the C5545 BoosterPack on-board MIC.

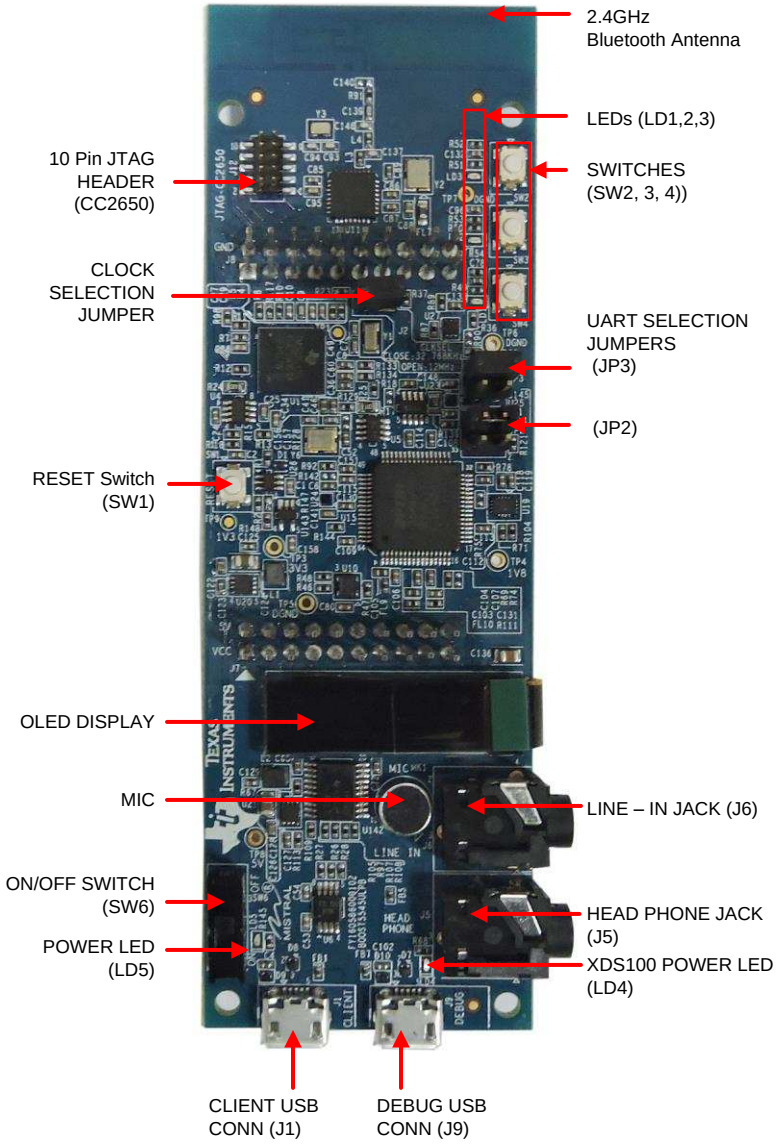


Figure 2. C5545 BoosterPack Top View

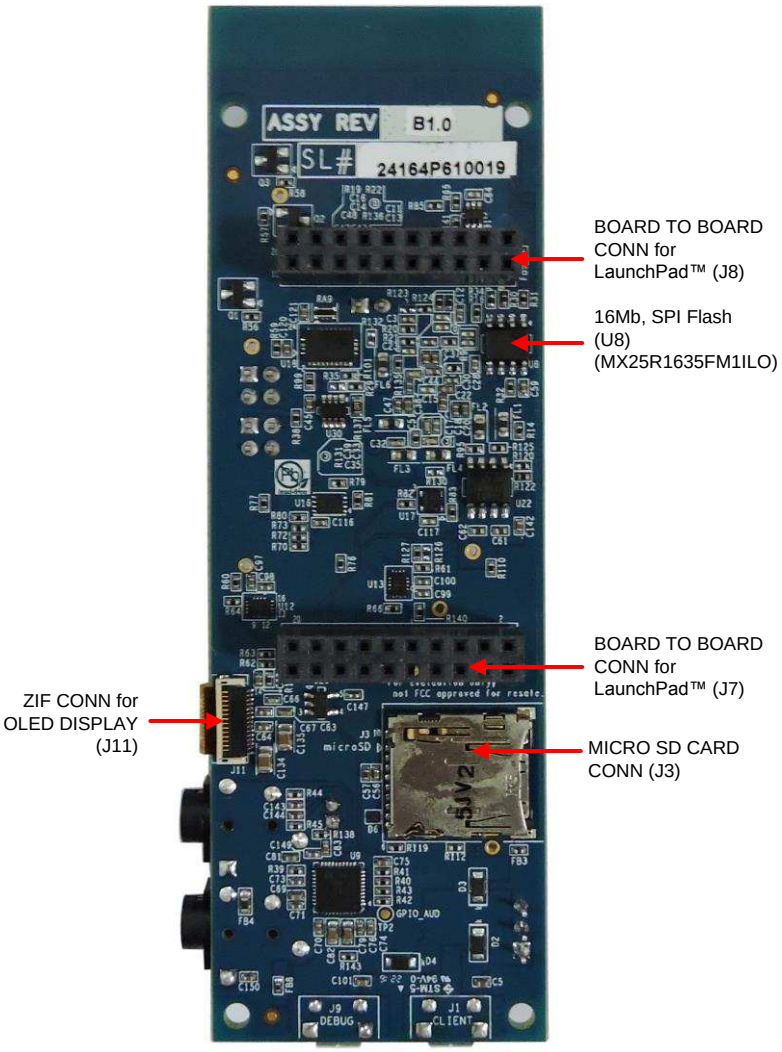


Figure 3. C5545 BoosterPack Bottom View

1.4 Power Supply

The C5545 BoosterPack can be powered from a single +5 V Micro USB AB - Standard USB cable connected to the Host PC. This +5 V input is in turn converted into required supply voltages using regulators.

The regulators used in the C5545 BoosterPack are shown in Table 1.

Table 1. Voltage Regulators

Regulator	Purpose
TPS62161DSGT (U21)	1V8 Generation
TPS62162DSGT (U20)	3V3 Generation
TPS76601D (U22)	External 1V3 Generation for C5545

The DC-DC Buck Regulator IC TPS62161DSGT and TPS62162DSGT (U21 and U20, respectively) takes care of the generation of various powers to the C5545 Processor listed below:

- Core Voltage
  - CVDD
- Internal LDO Voltages
  - DSP_LDO
  - ANA_LDO
  - USB_LDO
- I/O Voltages
  - DVDDIO
- RTC Voltages
  - CVDDRTC

TPS62161DSGT (U21) is enabled by default to generate 1.8 V when C5545 BoosterPack is powered ON. After that, TPS62162DSGT (U20) gets enabled to generate 3.3 V.

2 Introduction to C5545 BoosterPack Board

This section provides an introduction and details of interfaces in C5545 BoosterPack board. It contains:

- XDS100 On-Board Emulator
- CLOCK Distribution
- Reset Circuit and Distribution
- SPI FLASH Interface
- LED and Switch Interface
- CC2650 BLE Interface
- OLED Display Interface
- Audio CODEC Interface
- USB Interface
- UART Interface
- Connection Between C5545 and LaunchPad
- I2C Interface

2.1 XDS100 On Board Emulator Interface

The C5545 BoosterPack contains an on-board XDS100 USB emulator based on the FTDI FT2232 dual port chip. One of the FT2232 ports is configured for UART and the other for JTAG.

All the JTAG lines are connected to C5545 through level translator because FT2232 operates at 3.3 V I/O. The EEPROM (1Kb) is interfaced to the FT2232 to store configuration data. The XDS100 does not interface with or support the CC2650.

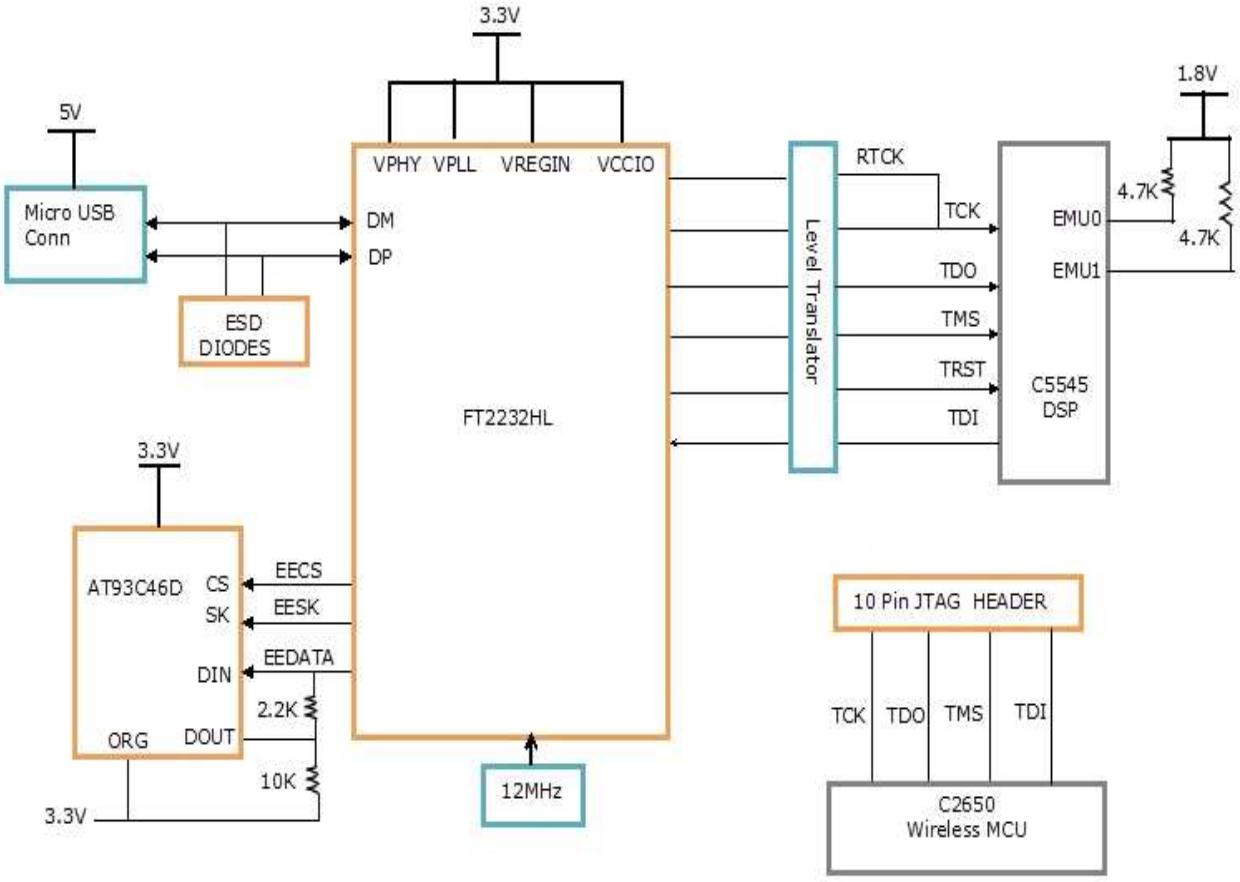


Figure 4. JTAG Interface

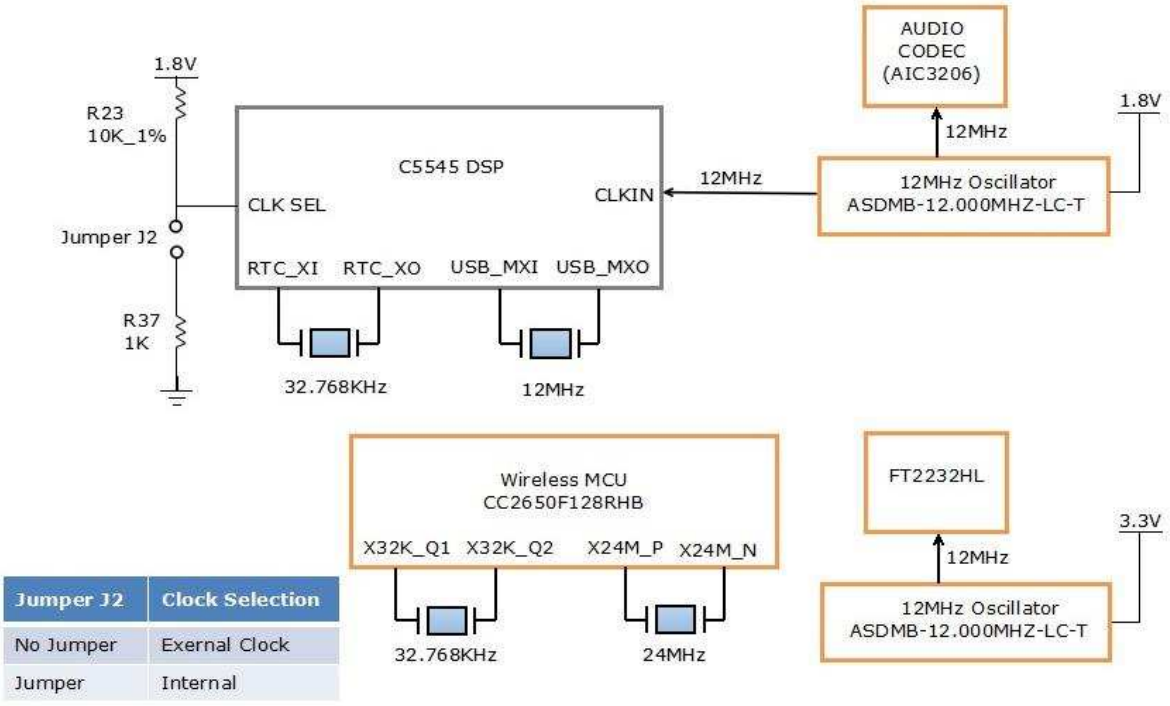
2.2 Clock Distribution

The board clock distribution circuit is as shown in Figure 5. Two 12 MHz oscillators are used on board. One 12 MHz oscillator is connected to the C5545 DSP and the AIC3206 Audio CODEC. The output of another 12 MHz oscillator is connected to the XDS100.

A 32.768 kHz is connected to the C5545 DSP for the RTC section. The C5545 DSP clock source is selected by the clock select jumper (J2) to choose between the internal RTC clock (32.768 kHz) or the external clock (12 MHz). By default, the jumper is mounted and the C5545 DSP to operates with the internal RTC clock. For more information, see the DSP clock selection shown in Figure 5.

Two crystals (32.768 kHz and 24 MHz) are connected to the CC2650.

One 12 MHz crystal is connected to the USB peripheral of the C5545 DSP.



Jumper J2	Clock Selection
No Jumper	Exernal Clock
Jumper	Internal

Figure 5. Clock Distribution and DSP Clock Selection

2.3 Reset Circuit and Distribution

All devices on the C5545 BoosterPack can be reset by the following:

- BoosterPack on-board RESET button (SW1)
- Power good signal from the DC-DC regulator
- Software initiated reset by LaunchPad MCU on pin 5
- Hardware initiated reset by LaunchPad's RESET button or debugger on pin 16

C5545 DSP can be reset independently by the XDS100 USB debugger.

CC2650 wireless MCU can be reset independently by the following:

- Software initiated reset by C5545 DSP
- Hardware initiated reset by external debugger on 10-pin JTAG header

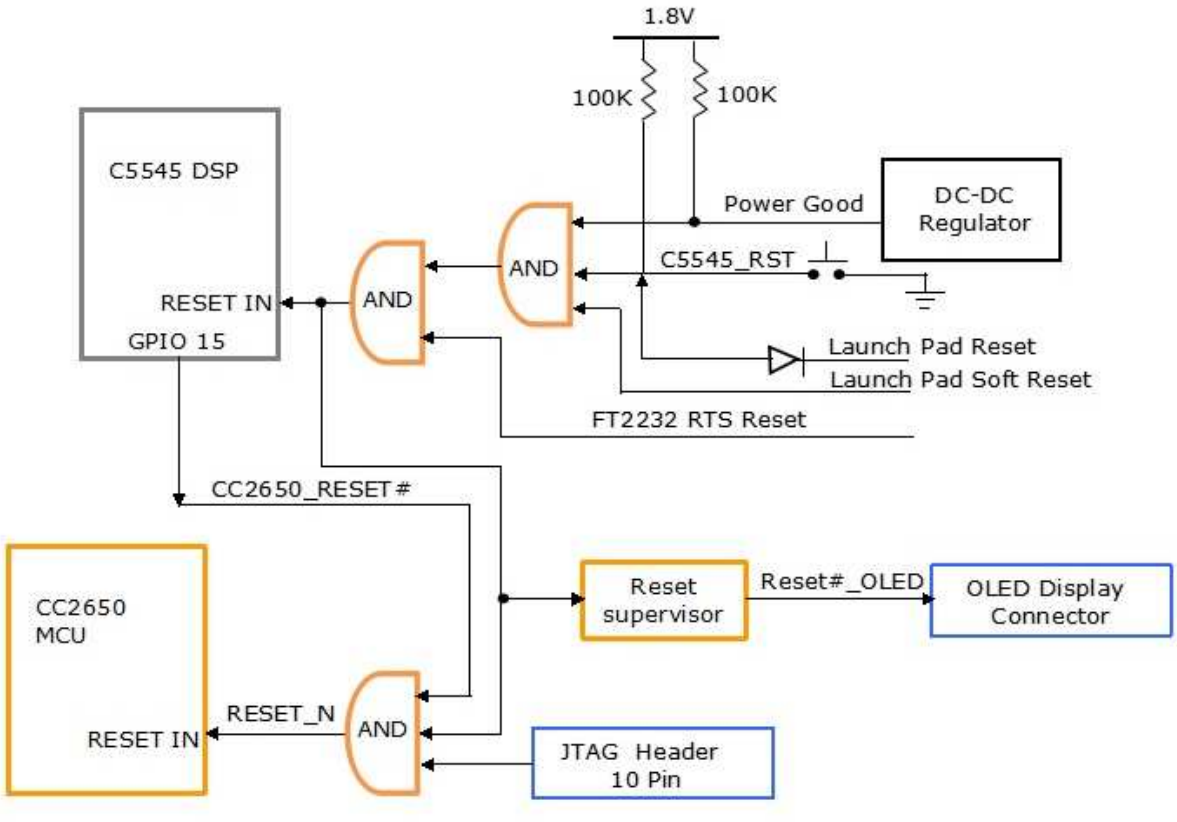


Figure 6. Reset Circuitry

NOTE: The SW1 (RESET) will only reset the C5545 BoosterPack and not the LaunchPad. The 1.8 V IO voltage on the C5545 is incompatible with the 3.3 V IO voltage on the MSP432 LaunchPad. All signals from MSP432 LaunchPad are connected to C5545 through level translators because the MSP432 LaunchPad operates at 3.3 V IO.

2.4 SPI FLASH Interface

The C5545 BoosterPack includes a 2MB Serial Flash (MX25R1635FM1IL0 from Macronix) which is interfaced to the C5545 DSP as shown in Figure 7. The SPI port of the DSP is shared with the SPI Flash and the CC2650, which is selected through chip select 0 and 2, respectively.

The Hold signal (to pause the serial communication without deselecting the device) is disabled with a pull-up resistor. Pull up/pull down options are provided for the write protect signal, which is disabled in the default configuration.

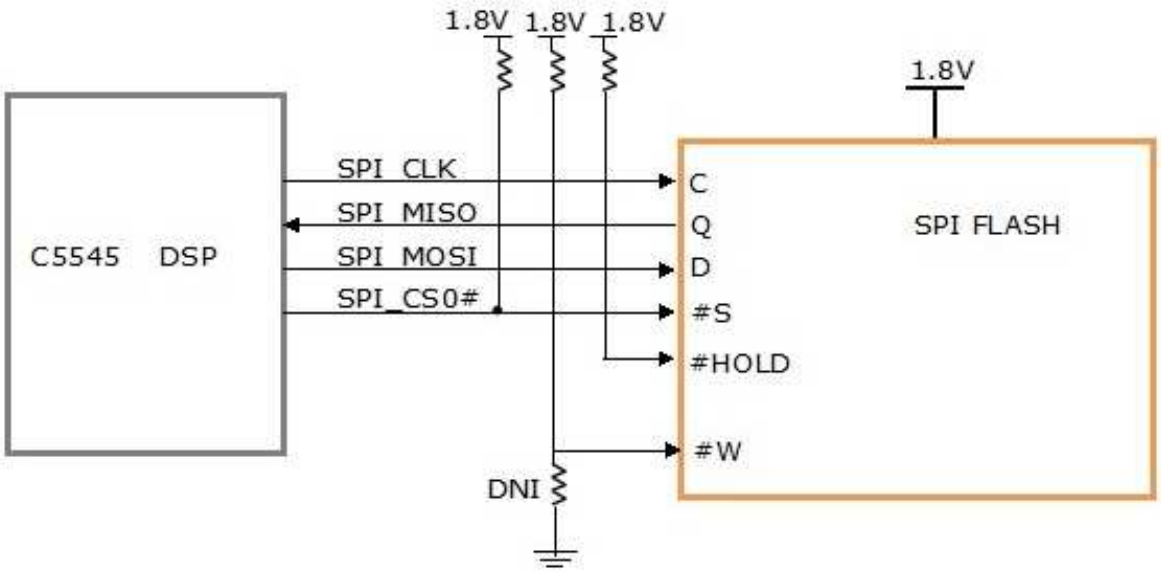


Figure 7. SPI FLASH Interface

2.5 LED and Switch Interface

Three push-buttons and three green LEDs are provided for user input and status.

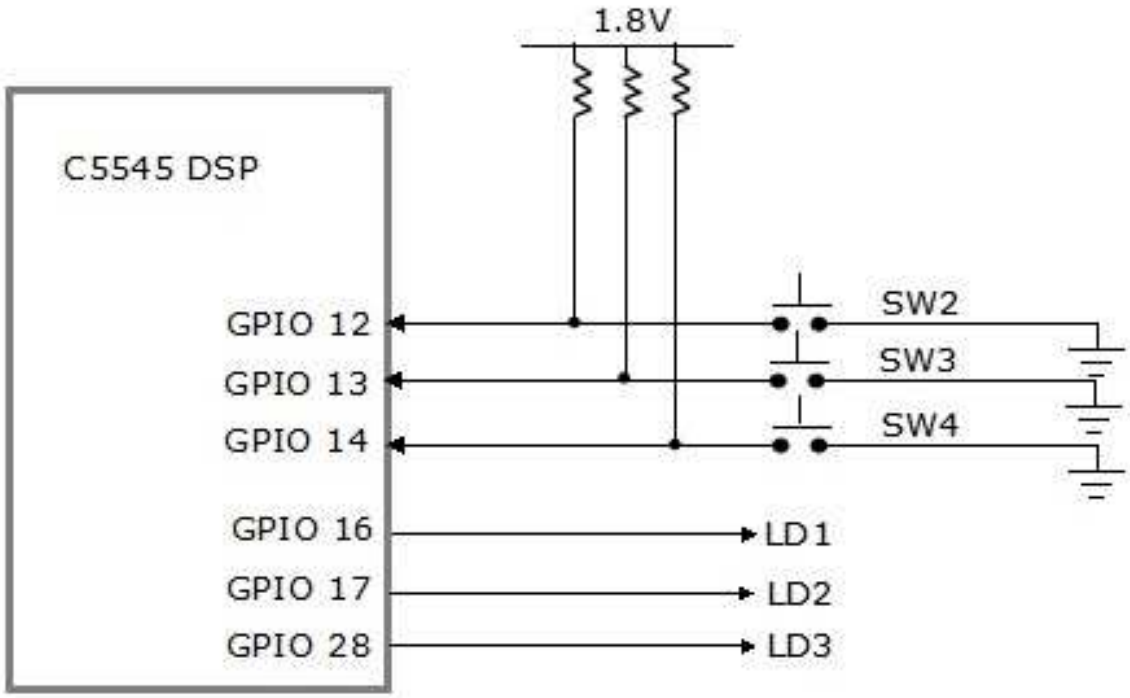


Figure 8. Switch and LED Connection

For more information on how to configure the GPIOs for Switch and LED functionality, see the GPIO Mapping table (Table 3 in Section 2.15).

2.6 CC2650 SPI and GPIO Interface

The CC2650 device is a wireless MCU targeting Bluetooth, ZigBee, 6LoWPAN and ZigBee RF4CE. The device is a member of the CC26xx family of cost-effective, ultra-low power, 2.4-GHz RF devices. The CC2650 device contains a 32-bit ARM Cortex-M3 processor that runs at 48 MHz.

Communication between the CC2650 and the C5545 devices is through a SPI interface using CS2. In addition, two GPIO signals are connected between the C5545 DSP and the CC2650 MCU for power management. For CC2650 reset details, see Section 2.3.

A 10-pin JTAG header is provided for debugging purposes. The IO voltage expected on this header is 1.8 V.

NOTE: Do not connect the MSP432 LaunchPad JTAG to this header as MSP432 LaunchPad expects 3.3 V IO voltages.

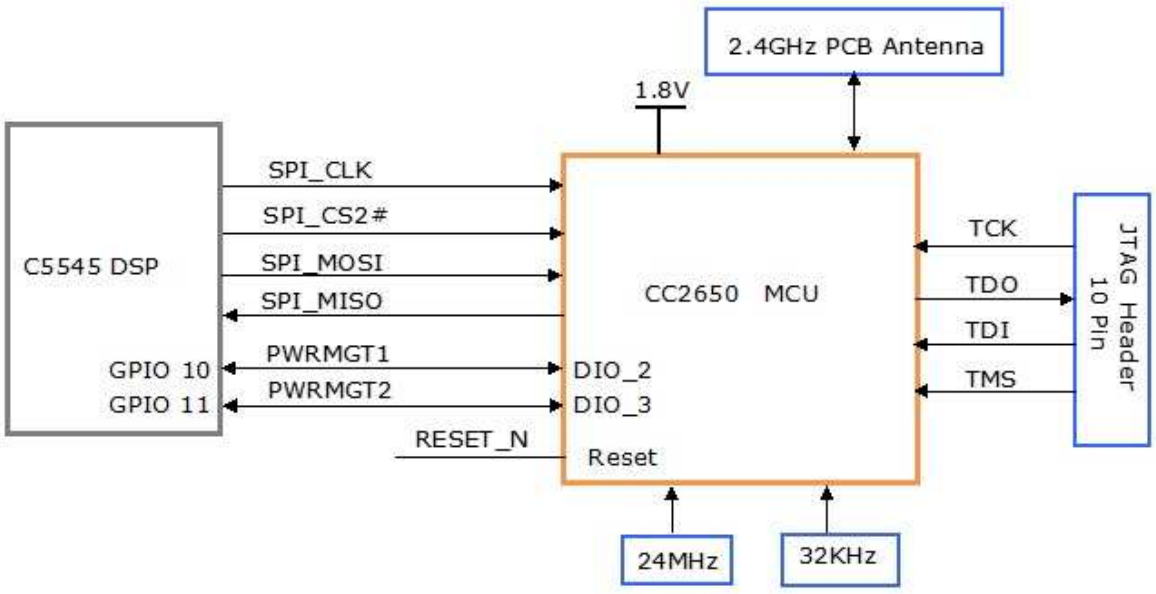


Figure 9. CC2650 SPI and GPIO Interface

For more information on how to configure the GPIOs for power management functionality, see the GPIO Mapping table (Table 3 in Section 2.15).

2.7 Micro SD CARD Interface

A micro SD card connector is connected to the SD0 interface of the C5545 DSP as shown in Figure 10. Level translators are used between the micro SD card connector and C5545 because the IO voltage of the micro SD card is 3.3 V while the C5545 DSP IO voltage is 1.8 V. The TXS0108EPWR level translator contains ESD protection diodes and integrated pull ups for the data and command signals.

The card detect pin from the micro SD card connector is connected to the C5545 DSP GPIO29 to detect the presence of a micro SD card.

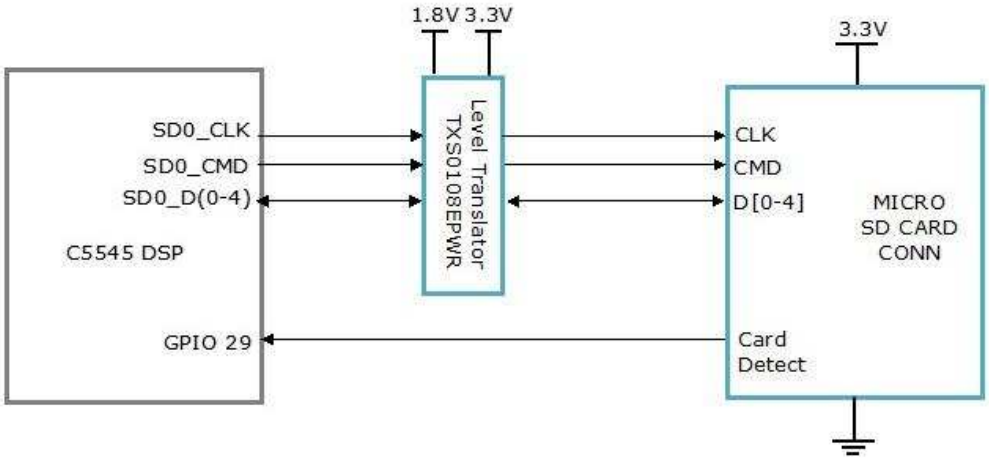


Figure 10. Micro SD Card Interface

To configure the GPIO for micro SD card detect, see Section 3.2.5 for the micro SD card connection details and a GPIO mapping table.

2.8 OLED Display Interface

The OLED "OSD9616P0992-10" from OSD Displays is used on the C5545 Booster Pack as a display device. The OLED display is controlled by C5545 through the I2C interface. It supports an internal regulator to generate the backlight supply. For OLED reset details, see Section 2.3.

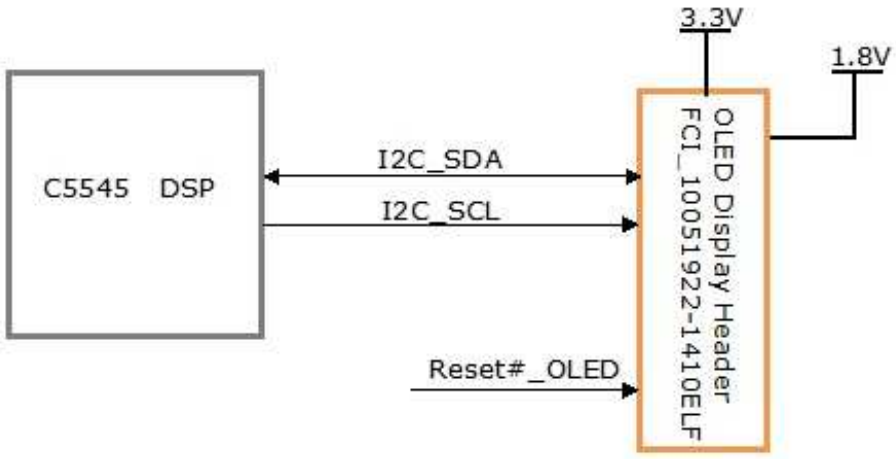


Figure 11. OLED Display Interface

The OLED display with FPC cable is connected to the 10051922-1410ELF (J11), 14 pin FPC connector.

2.9 Audio CODEC Interface

The audio CODEC TLV320AIC3206 is a flexible, low power, low-voltage stereo audio CODEC with programmable input and outputs, PowerTune capabilities, fixed predefined and parameterizable signal processing blocks, integrated PLL, and flexible digital interfaces.

This audio CODEC is interfaced to the I2S2 port and I2C bus of the C5545. Audio line in and line out connections are provided through 3.5 mm audio jacks. An on-board microphone CMC-2242PBLA from CUI is provided for audio recording.

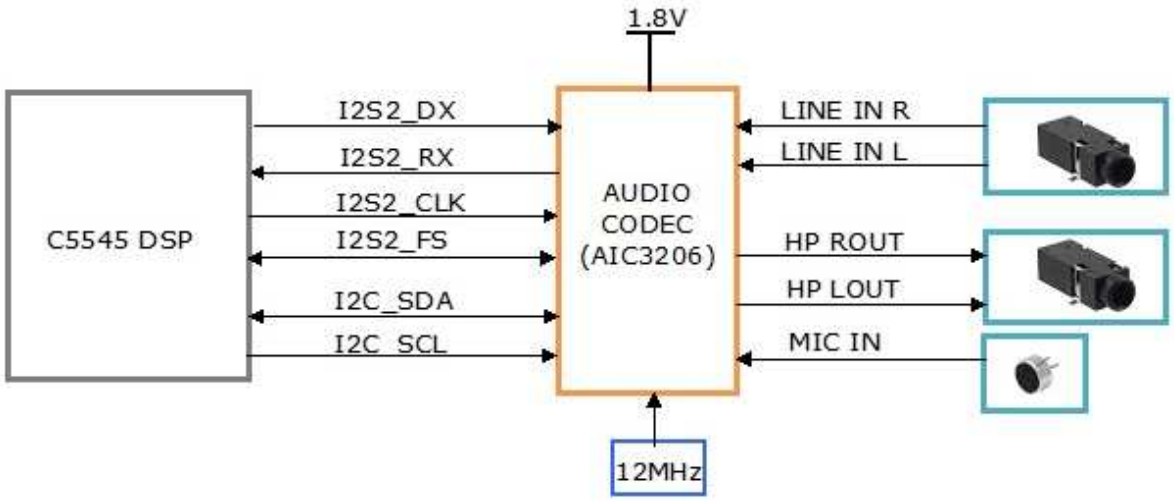


Figure 12. Audio CODEC Interface

NOTE: When the AIC3206 CODEC is not powered (when the C5545 BoosterPack is not powered), a potential for crosstalk between Line In and Stereo Out exists, resulting in distorted audio from Line In to Stereo Out when a high amplitude signal present on Line in.

2.10 USB Interface

The C5545 DSP supports a device-mode USB controller that provides a low-cost connectivity solution for consumer portable devices by providing a mechanism for data transfer to a USB host up to 480 Mbps. The USB controller complies with the USB 2.0 standard high-speed and full-speed specifications.

The C5545 DSP USB signals are terminated at micro USB type-B connector (J1) as shown in Figure 13. ESD diodes are provided for the USB signals. The USB ID pin on the connector is left floating as this is device-only port.

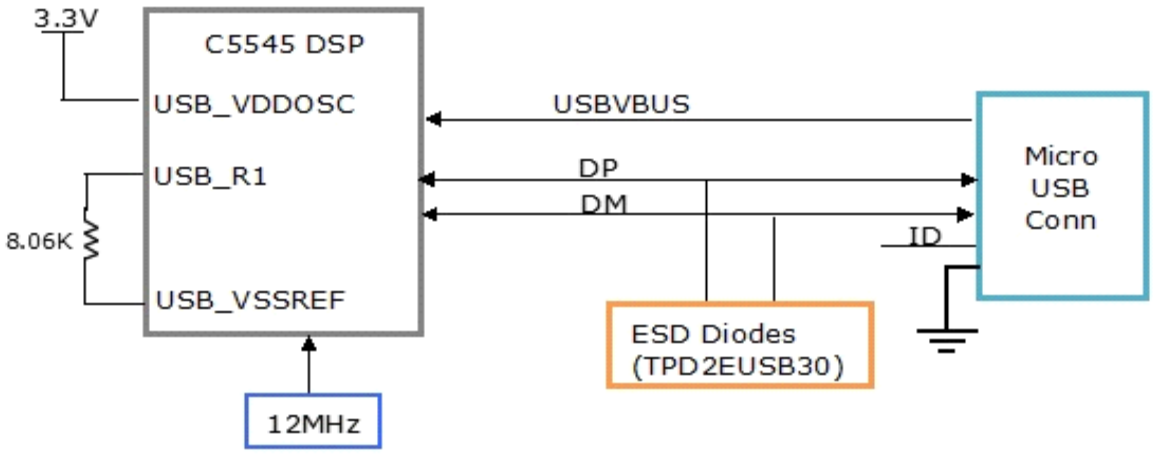


Figure 13. USB Interface

2.11 UART Interface

The UART interfaces available on the C5545 DSP and CC2650 MCU can be connected either to the LaunchPad or to the XDS100 (for UART over USB virtual com port) using the appropriate jumper selections. For more information, see the UART Jumper selection in Figure 14.

Level translators (U12 and U18, SN74AVC4T/8T) are used between the C5545 and LaunchPad and XDS100 signals because the IO voltages of the LaunchPad and XDS100 are 3.3 V while the C5545 DSP IO voltage is 1.8 V.

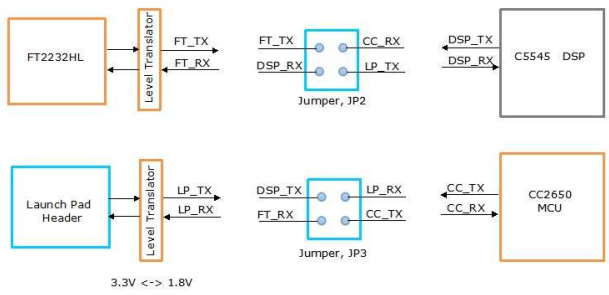


Figure 14. UART Interface

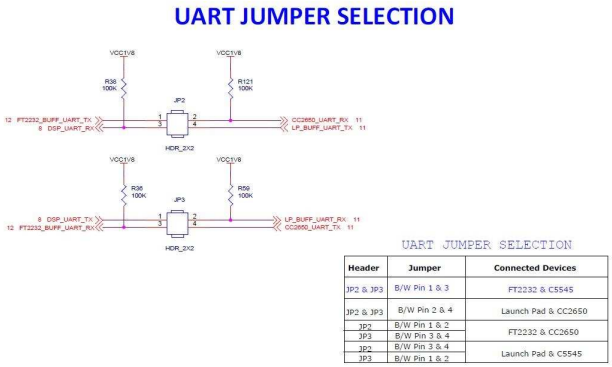


Figure 15. UART Interface - Schematics

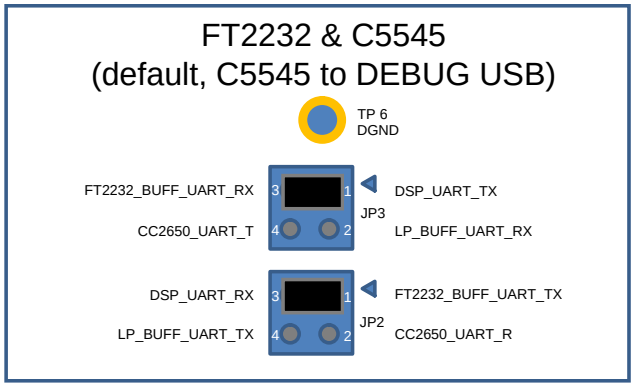


Figure 16. FT2232 and C5545 (default)

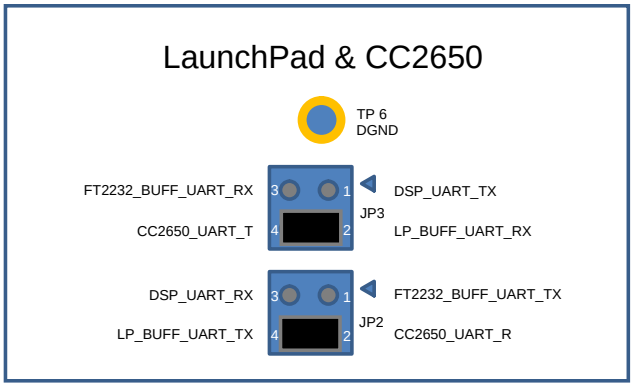


Figure 17. LaunchPad and CC2650

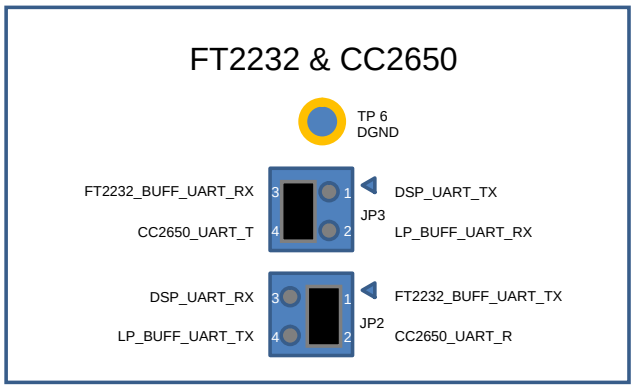


Figure 18. FT2232 and CC2650

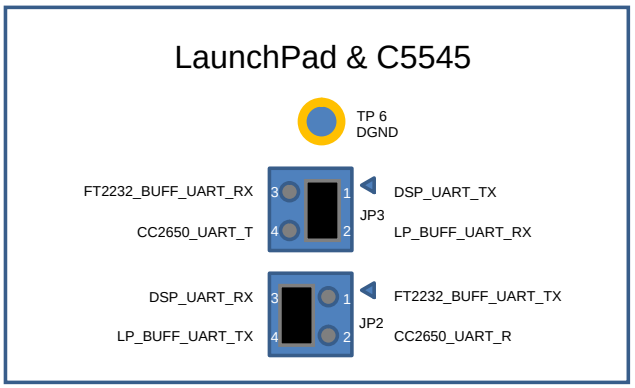


Figure 19. LaunchPad and C5545

2.12 Connection Between C5545 and LaunchPad

2.12.1 Interface Details

The C5545 BoosterPack supports UART, I2C and I2S that are connected to the LaunchPad headers. It can be connected to either the MSP432 LaunchPad (Part Number: MSP-EXP432P401R) or the CC3200 Launchpad - LAUNCHXL Rev3.1. Level translators (U12, U13 - SN74AVC4T245 for UART and I2S interface, U6 - TCA9517DGKR for I2C interface) are used between C5545 DSP and LaunchPad signals because IO voltage of LaunchPad is 3.3 V while the C5545 DSP IO voltage is 1.8 V. The I2S interface from CC3200 LaunchPad (always supports the I2S master) can be connected to C5545 BoosterPack (slave).

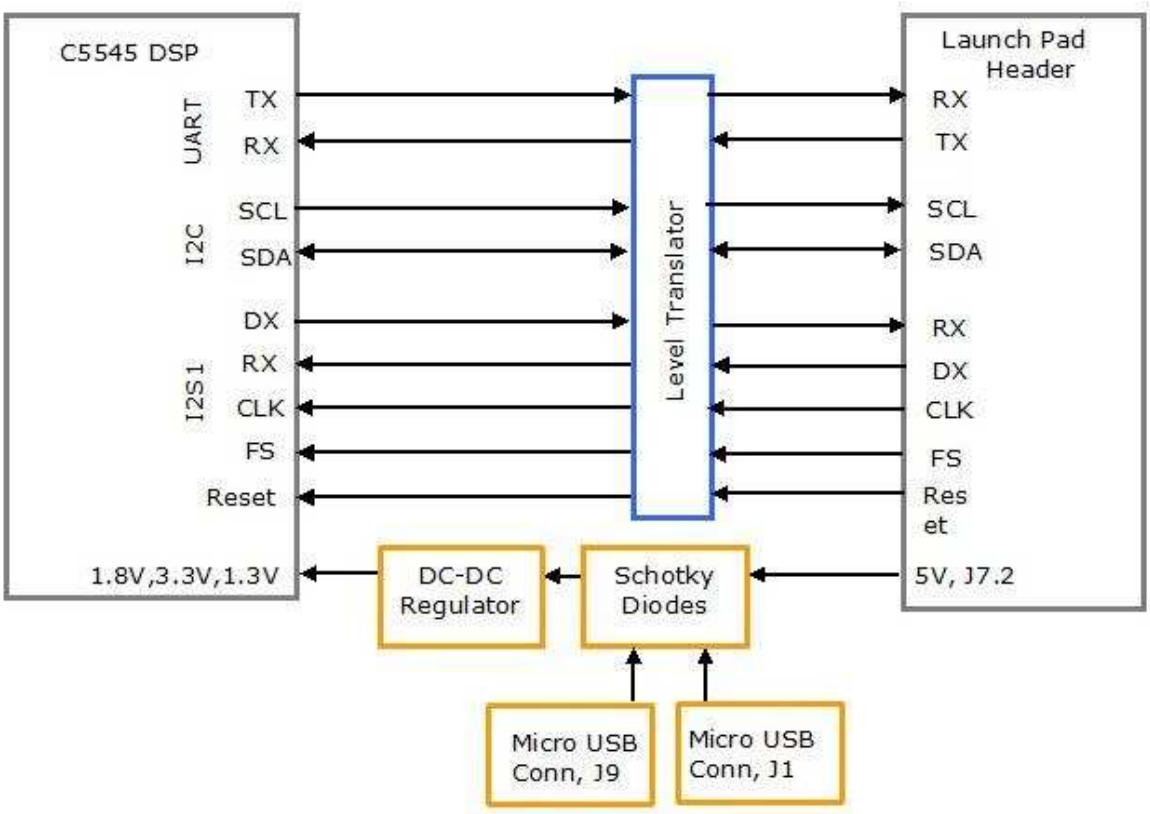


Figure 20. Connection Between C5545 and LaunchPad

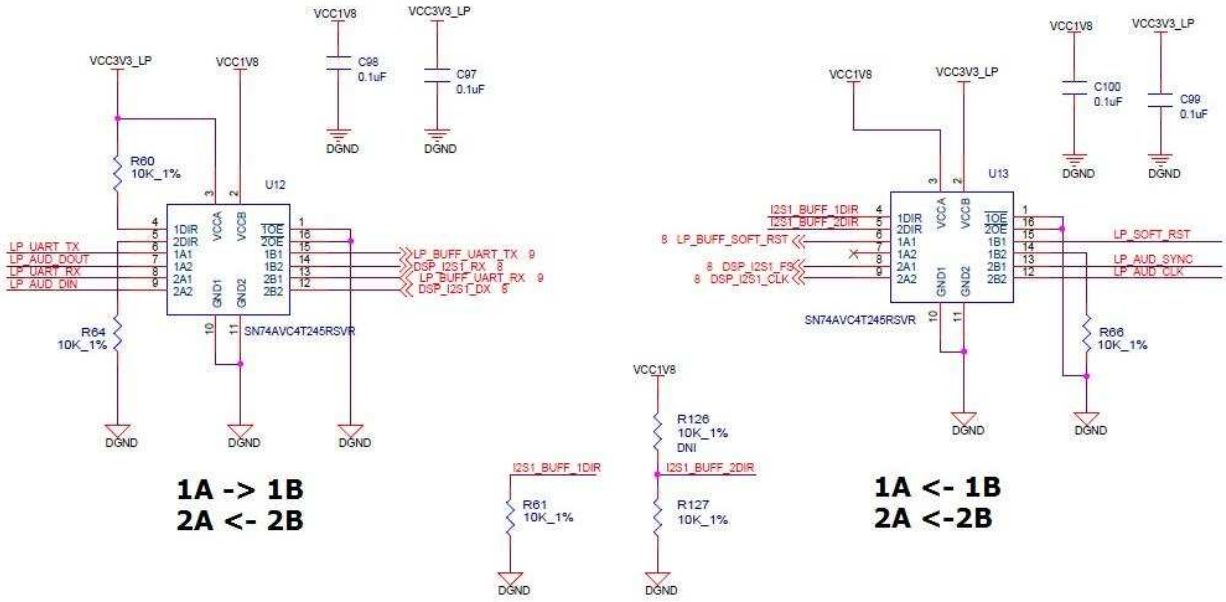


Figure 21. Level Shifter Direction for I2S and UART Interfaces

NOTE: Due to different IO voltage between the LaunchPad (3.3 V) and C5545 BoosterPack (1.8 V), level shifters are present at the LaunchPad headers. These level shifters require a VCC supply from the LaunchPad to operate. When no LaunchPad is attached, or VCC is not supplied, the level shifted signals have no voltage reference and are not available at the headers. To work-around this issue (whenever no LaunchPad is connected), VCC3V3 can be wired from TP3 on the C5545 BoosterPack to J7 pin 1 (LaunchPad J1 pin 1).

2.12.2 Powering C5545 BoosterPack From LaunchPad

The C5545 BoosterPack can be powered from an attached LaunchPad (LP_5V from pin 2 on LaunchPad header J7) or through either of the micro USB ports. Diodes on the BoosterPack prevent back-powering from one power source into another, but this also means that an attached LaunchPad cannot be powered by the BoosterPack.

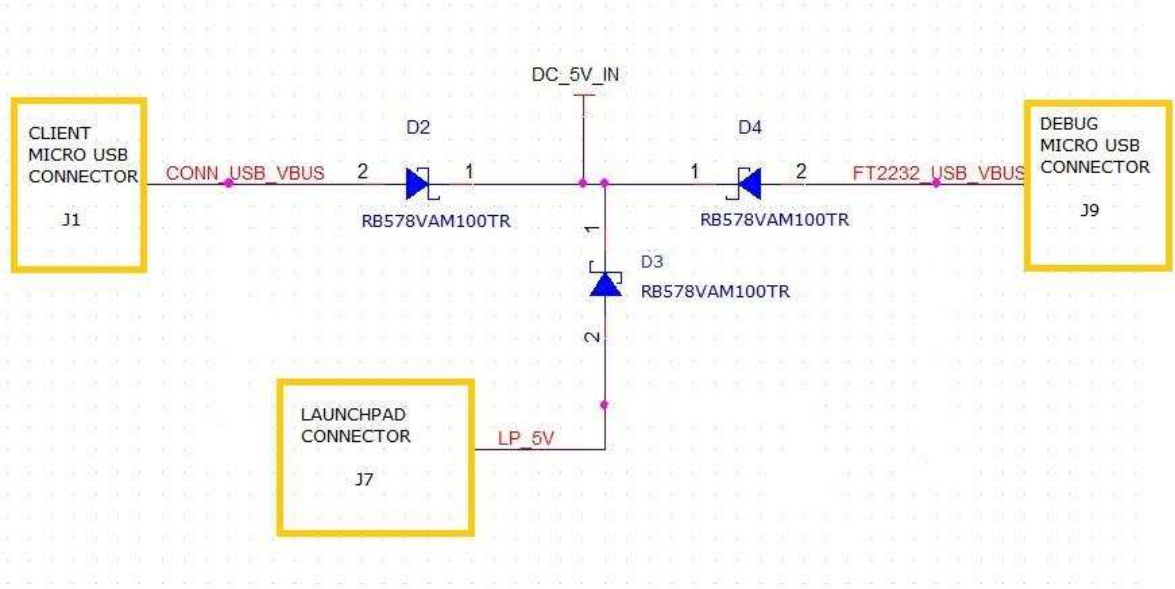


Figure 22. C5545 BoosterPack Powering Options

2.12.3 LaunchPad Reset (refer to Section 2.3)

Hardware reset from the LaunchPad is tied to the BoosterPack through pin 16 on the LaunchPad headers. When the LaunchPad reset button is pressed or when the LaunchPad debugger initiates a reset, both the LaunchPad MCU and the C5545 BoosterPack will be reset together.

The LaunchPad MCU can also initiate a software reset through pin 5 that affects only the C5545 BoosterPack. The reset button (SW1) on the BoosterPack will only affect devices on the BoosterPack and leave the LaunchPad undisturbed.

2.12.4 Connecting C5545 BoosterPack to MSP432P401R LaunchPad

Connect the C5545 BoosterPack to MSP432P401R LaunchPad as shown in Figure 20.

Insert the C5545 BoosterPack headers (J7 and J8) to the LaunchPad headers (J1-J4).

Press gently to avoid the PCB warping issues.

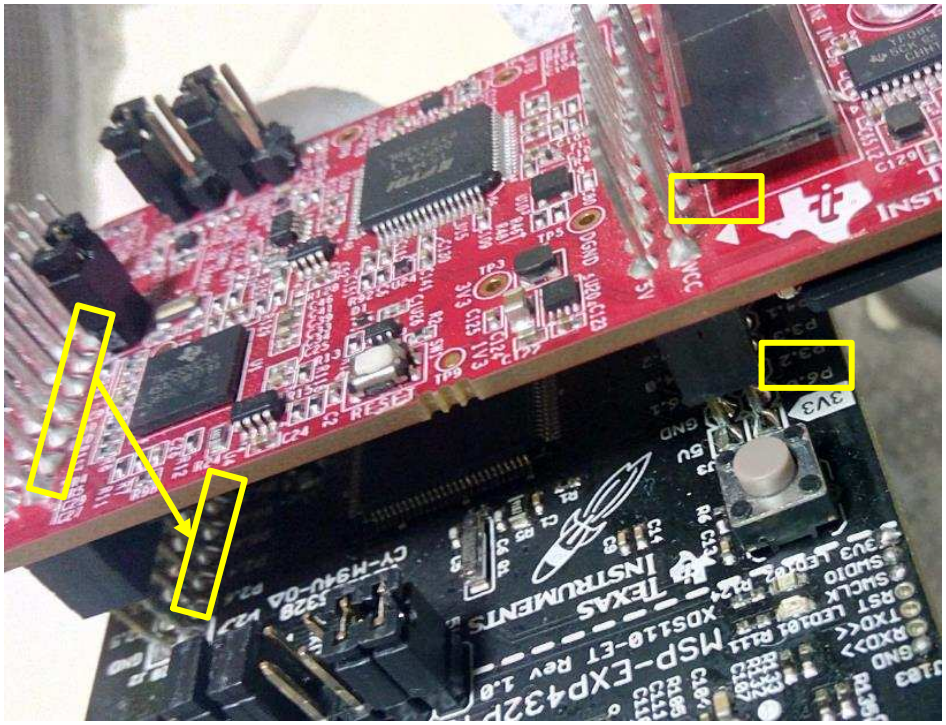
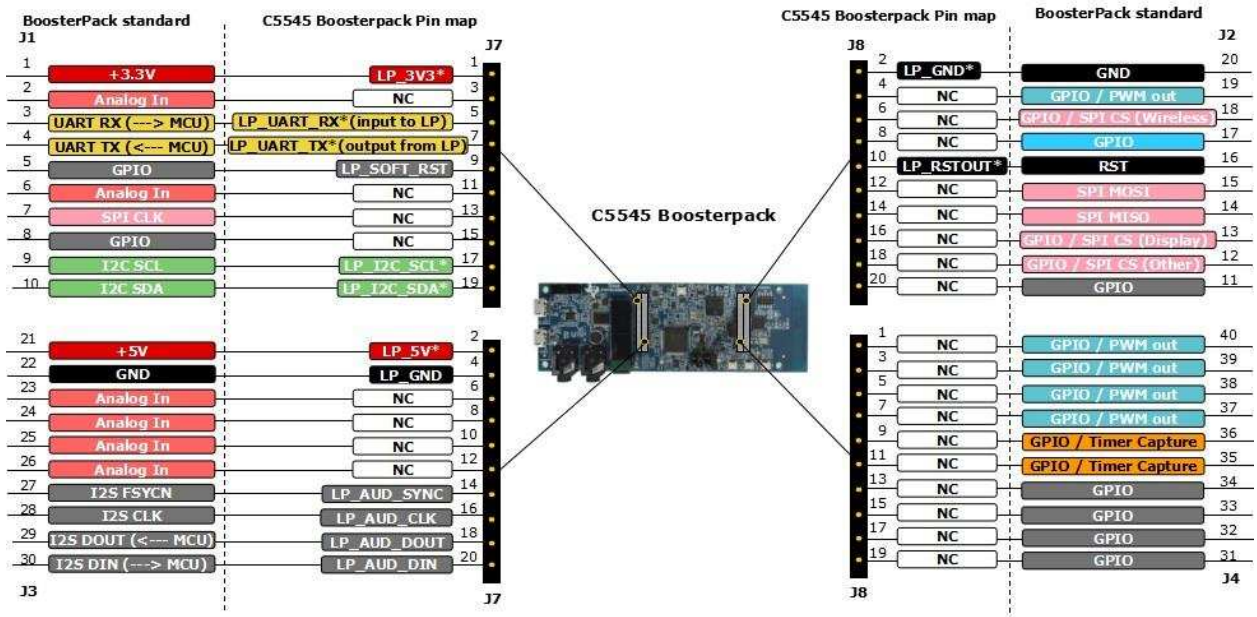


Figure 23. C5545 BoosterPack Connected With MSP432P401R LaunchPad



Note: *Pin aligns with BoosterPack standard (per ti.com/byob)

Figure 24. C5545 BoosterPack Pin Map

2.13 I2C Interface

The C5545 BoosterPack provides an I2C interface that connects the AIC3206 audio CODEC (U9), an OLED Display connector (J11), four INA219 current monitoring devices (U4, U5, U23 and U30) and the LaunchPad header (J7, pin 9 and 10). Linking to the LaunchPad allows the DSP to access any I2C devices on the LaunchPad and the LaunchPad MCU to access any I2C devices on the C5545 BoosterPack.

A level translator (U6 - TCA9517DGKR) is used between C5545 and LaunchPad/current monitoring devices because IO voltage of LaunchPad/current monitoring device are 3.3 V while the C5545 DSP IO voltage is 1.8 V.

For each individual device's I2C address, see Table 2 in Section 2.14.

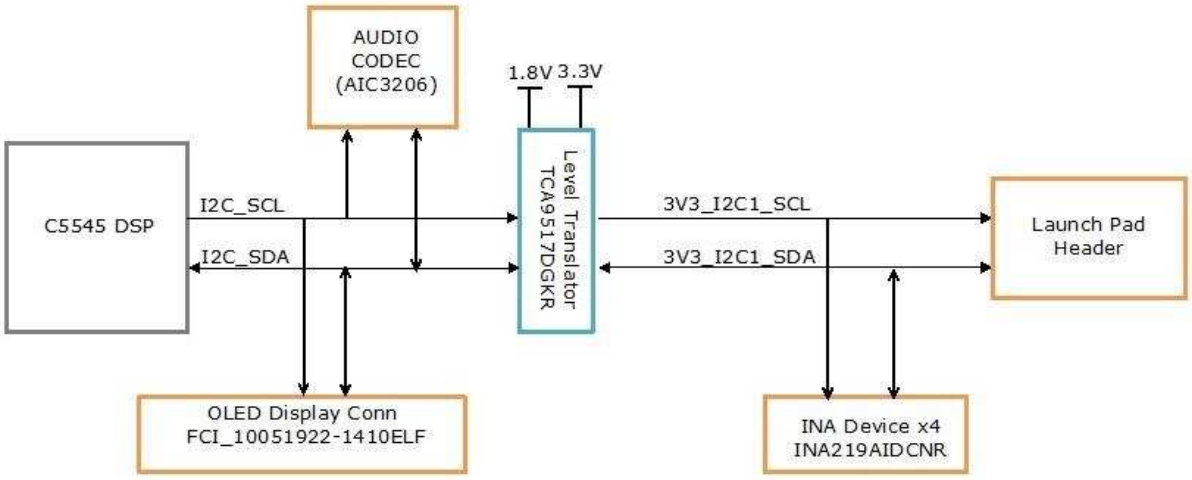


Figure 25. I2C Interface

The I2C bus is shared by the C5545 BoosterPack and the Launchpad. While this allows the Launchpad to access the I2C devices on the BoosterPack (OLED, CODEC, INA219 current measurement devices), it requires configuration for the C5545 to boot properly and for the Launchpad device (ex MSP432) to access the bus.

Before booting from the SD card, the C5545 boot-loader polls the I2C bus looking for an I2C EEPROM with valid boot image. If the I2C signals are held low by the Launchpad or are not configured as I2C signals, then the C5545 bootloader can get stuck waiting for the I2C bus to become ready, and may never boot from the SD card.

Additionally, after the C5545 bootloader polls the I2C bus (even though no I2C EEPROM is present on the board), the C5545 must perform a Start and Stop condition on the I2C bus before the attached Launchpad can access the devices on the I2C bus. Examples of this configuration (provided in the diagnostics software.Care: http://www.ti.com/tool/BOOST5545ULP#Software) must be taken to ensure that any attached Launchpad drives I2C signals as GPIO outputs driven high or configures them as I2C pins (open drain). This must be completed before releasing soft reset to the C5545 BoosterPack.

NOTE: I2C address conflict: Since the I2C address of temperature sensor used in the CC3200 LaunchPad (0x41) is same as I2C address of INA Device (U30 – 0x41) on C5545 BoosterPack. Care should be taken in software while accessing this I2C slave device when BoosterPack is connected with CC3200 LaunchPad.

2.14 I2C Address Mapping

The address mapping for I2C interface on C5545 BoosterPack board is provided in Table 2.

Table 2. I2C Address Mapping

Master	Slave Device	Address
C5545 DSP	LaunchPad	User Programmable
	INA Devices	0x40,0x41,0x44,0x48
	OLED Display	0x3C
	Audio CODEC	0x18
LaunchPad	C5545 DSP	User Programmable

2.15 GPIO Mapping

The GPIO mapping for C5545 BoosterPack Board is provided in Table 3.

Table 3. GPIO Mapping

GPIO Name	C5545 DSP Pin	Purpose	Internal/External Pull Up (PU)/Pull Down (PD0
CC2650_PWRMGT1	GP[10]	POWER MANAGEMENT	INTERNAL PD
CC2650_PWRMGT2	GP[11]	POWER MANAGEMENT	INTERNAL PD
DSP_SDCD	GP[29]	SD CARD DETECT	INTERNAL PD
SWITCH2	GP[12]	KEYPAD	INTERNAL PD
SWITCH3	GP[13]	KEYPAD	INTERNAL PD
SWITCH4	GP[14]	KEYPAD	INTERNAL PD
LED1	GP[16]	LED	INTERNAL PD
LED2	GP[17]	LED	INTERNAL PD
LED3	GP[28]	LED	INTERNAL PD

3 C5545 BoosterPack Board Physical Specifications

This section describes the physical layout of the C5545 BoosterPack board and its connectors, switches and test points. It contains:

- Board Layout
- Connector Index
- Push Buttons
- Test Points
- LEDs

3.1 Board Layout

The C5545 BoosterPack board dimension is 4.567''x1.49'' (116 mm x 37.94 mm). It is a 6-layer board fabricated with epoxy fiberglass FR4 grade material.

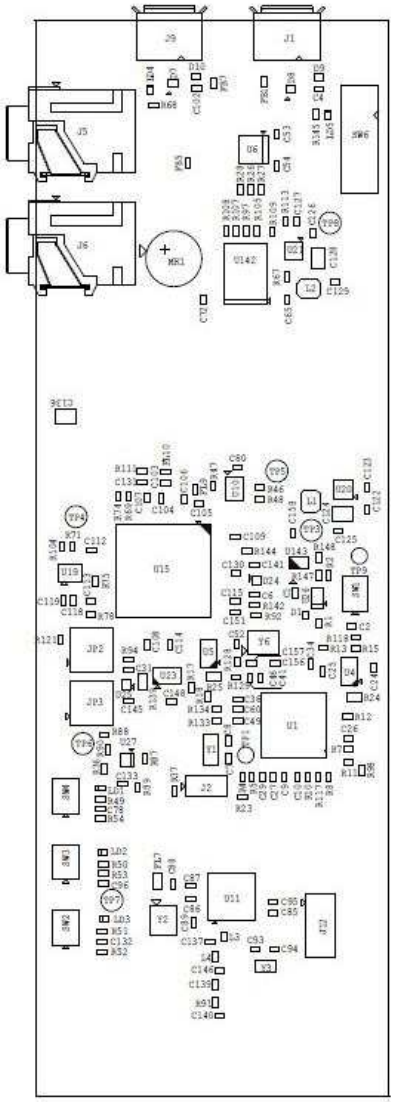


Figure 26. C5545 BoosterPack Board Assembly Layout - Top View

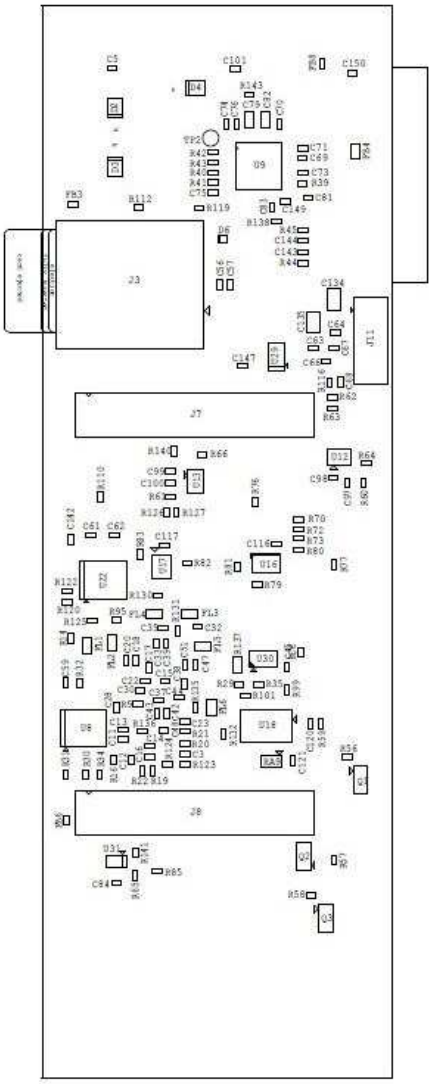


Figure 27. C5545 BoosterPack Board Assembly Layout - Bottom View

3.2 Connector Index

The C5545 BoosterPack board has several connectors that provide access to various interfaces on the board.

Table 4. C5545 BoosterPack Board Connectors

Connector	Part Number	Pins	Function
J1,J9	10118194-0001LF	9	Micro USB connector
J5, J6	SJ-43514	4	Audio jack
J3	DM3AT-SF-PEJM5	14	Micro SD connector
J11	10051922-1410ELF	14	OLED display header
J7, J8	SSQ-110-23-L-D	20	LaunchPad headers
J12	20021121-00010C4LF	10	CC2650 JTAG header

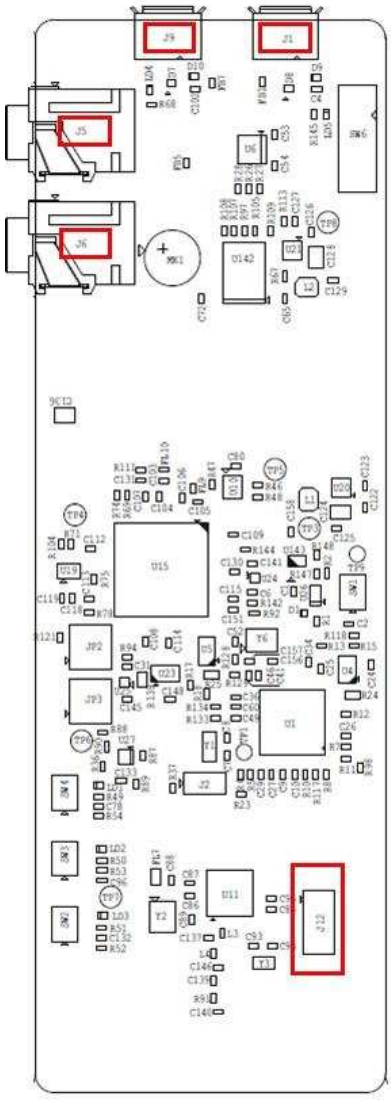


Figure 28. Connectors on C5545 BoosterPack - Top

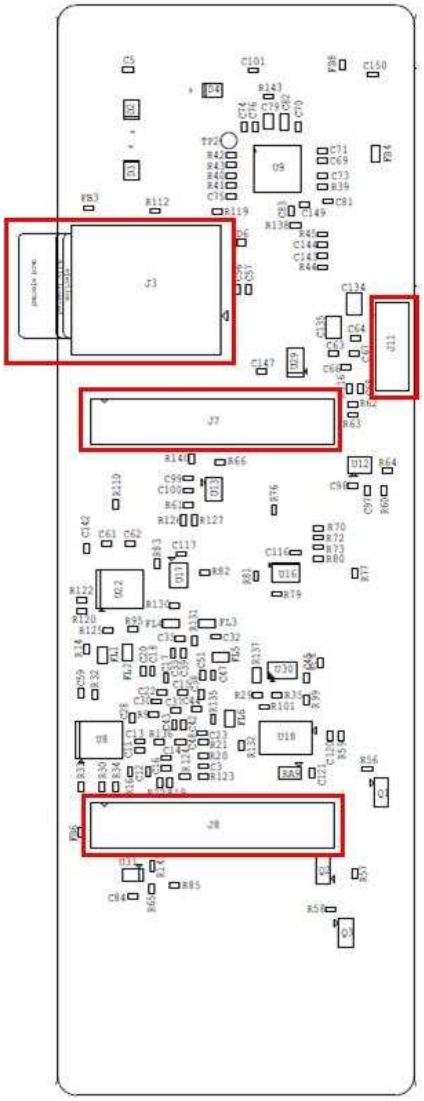


Figure 29. Connectors on C5545 BoosterPack - Bottom

3.2.1 JTAG-XDS100 Micro USB Connector (FT2232H)

Table 5. JTAG-XDS100 Micro USB Connector (FT2232H)

Pin Number	Pin Description	Remarks
1	VBUS	USB power
2	DM	Data -
3	DP	Data +
4	ID	Device configuration
5	GND	Ground
6	SHLD1	Shield ground
7	SHLD2	Shield ground
8	SHLD3	Shield ground
9	SHLD4	Shield ground

3.2.2 JTAG-Header (CC2650)

Table 6. JTAG-Header (CC2650)

Pin Number	Pin Description	Remarks
1	VCC	Power supply
2	TMS	JTAG test mode select
3	GMD	Ground
4	TCLK	Clock into the core
5	GND	Ground
6	TDO	JTAG test data output
7	NC	NC
8	TDI	JTAG test data output
9	GND	Ground
10	RESET	Reset

NOTE: The CC2650 supports 1.8 V JTAG interface which are compatible with XDS200 emulator. Avoid connecting these signals to the embedded JTAG emulator on MSP432 LaunchPad.

3.2.3 Audio Line-In 3.5 mm Stereo Jack

Table 7. Audio Line-In 3.5 mm Stereo Jack

Pin Number	Pin Description	Remarks
1	GND	Ground
2	Left in	Left input
3	Right in	Right input
4	NC	No connection

3.2.4 Audio Headphone-Out 3.5 mm Jack

Table 8. Audio Headphone-Out 3.5 mm Jack

Pin Number	Pin Description	Remarks
1	MIC	MIC input
2	Left out	Left output
3	Right out	Right output
4	GND	Ground

NOTE: The Headphone jack supports headsets with microphone. However, the Apple headsets are not supported at this time.

3.2.5 Micro SD Connector

Table 9. Micro SD Connector

Pin Number	Pin Description	Remarks
1	DAT2	Data 2
2	CD/DAT3	Data 3
3	CMD	Command
4	VDD	Positive supply
5	CLOCK	Clock
6	VSS	Either ground or negative supply
7	DAT0	Data 0
8	DAT1	Data 1
9	CD1	Card detect 1
10	CD2	Card detect 2
11	GND	Ground
12	GND	Ground
13	GND	Ground
14	GND	Ground

3.2.6 OLED Display Connector

Table 10. OLED Display Connector

Pin Number	Pin Description	Remarks
1	C2P	Capacitor 2+
2	C2N	Capacitor 2-
3	C1P	Capacitor 1+
4	C1N	Capacitor 1-
5	VDDB	Positive supply
6	NC	No connect
7	VSS	Ground
8	VDD	Positive supply
9	$\overline{\text{RES}}$	Reset in
10	SCL	I2C CLK
11	SDA	I2C data
12	IREF	Current reference
13	VCOMH	
14	VCC	Positive supply

3.2.7 LaunchPad Headers

Table 11. LaunchPad Headers

LP Pins	C5545 Pins	BoosterPack Standard	C5545 BoosterPack Pin Map
J1	**J7**		
1	1	+3.3 V	LP_3V3 (1)
2	3	Analog In	NC
3	5	UART RX (---> MCU)	LP_UART_RX (input to LP)
4	7	UART TX (<--- MCU)	LP_UART_TX (1) (output from LP)

Table 11. LaunchPad Headers (continued)

LP Pins	C5545 Pins	BoosterPack Standard	C5545 BoosterPack Pin Map
J1	**J7**		
5	9	GPIO	LP_SOFT_RST
6	11	Analog In	NC
7	13	SPI CLK	NC
8	15	GPIO	NC
9	17	I2C SCL	LP_I2C_SCL (1)
10	19	I2C SDA	LP_I2C_SDA (1)
J3	**J7**		
21	2	+5V	LP_5V (1)
22	4	GND	LP_GND
23	6	Analog In	NC
24	8	Analog In	NC
25	10	Analog In	NC
26	12	Analog In	NC
27	14	I2S FSYCN	LP_AUD_SYNC
28	16	I2S CLK	LP_AUD_CLK
29	18	I2S DOUT (<--- MCU)	LP_AUD_DOUT
30	20	I2S DIN (---> MCU)	LP_AUD_DIN
J2	**J8**		
20	2	GND	LP_GND (1)
19	4	GPIO / PWM out	NC
18	6	GPIO / SPI CS (Wireless)	NC
17	8	GPIO	NC
16	10	RST	LP_RSTOUT(1)
15	12	SPI MOSI	NC
14	14	SPI MISO	NC
13	16	GPIO / SPI CS (Display)	NC
12	18	GPIO / SPI CS (Other)	NC
11	20	GPIO	NC
J4	**J8**		
40	1	GPIO / PWM out	NC
39	3	GPIO / PWM out	NC
38	5	GPIO / PWM out	NC
37	7	GPIO / PWM out	NC
36	9	GPIO / Timer Capture	NC
35	11	GPIO / Timer Capture	NC
34	13	GPIO	NC
33	15	GPIO	NC
32	17	GPIO	NC
31	19	GPIO	NC

1. Signifies that pin aligns with BoosterPack standard (per ti.com/byob).

3.3 Push Buttons

The C5545 BoosterPack has four switches. Out of those four switches, three GPIOs can be configured as switches. The other switch is to reset the C5545 BoosterPack. To configure switch functionality, see Section 2.15.

Table 12. C5545 BoosterPack Board LEDs

Button Number	Description
SW2	SWITCH2
SW3	SWITCH3
SW4	SWITCH4
SW1	Reset Switch

3.4 Test Points

The C5545 BoosterPack board has 9 test points. Each test point and its function is provided in Table 13.

Table 13. C5545 BoosterPack Board Test Points

Test Point	Signal
TP1	C5545 CLKOUT
TP2	GPIO_AUD
TP3	VCC3V3
TP4	VCC1V8
TP5,6,7	DGND
TP8	VCC5V0
TP9	VCC1V3

3.5 System LEDs

The C5545 BoosterPack has three LEDs. To configure LED functionality for LED1, LED2 and LED3, see Section 2.15.

Table 14. C5545 BoosterPack Board LEDs

LED Number	Color	Description
LD1	Green	LED1
LD2	Green	LED2
LD3	Green	LED3
LD4	Green	Board Power LED
LD5	Green	FT2232 Power Enable LED

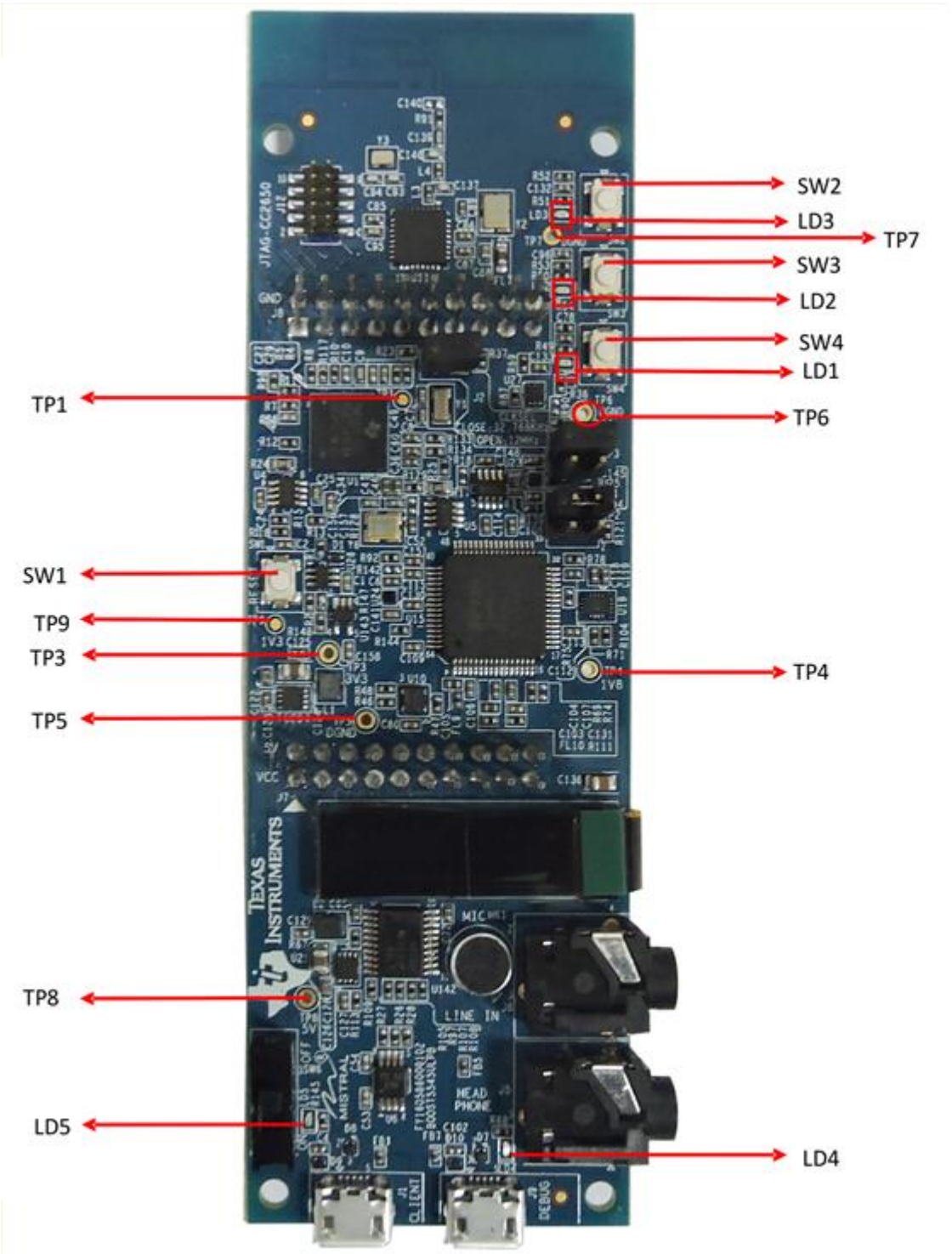


Figure 30. Position of LEDs, Test-Points and Push Buttons on the Board

4 System Power Requirements

This section describes the power supply design of the C5545 BoosterPack board. It contains:

- Power Distribution Diagram
- Power Calculation
- Power-Up Sequence

4.1 Power Distribution Diagram

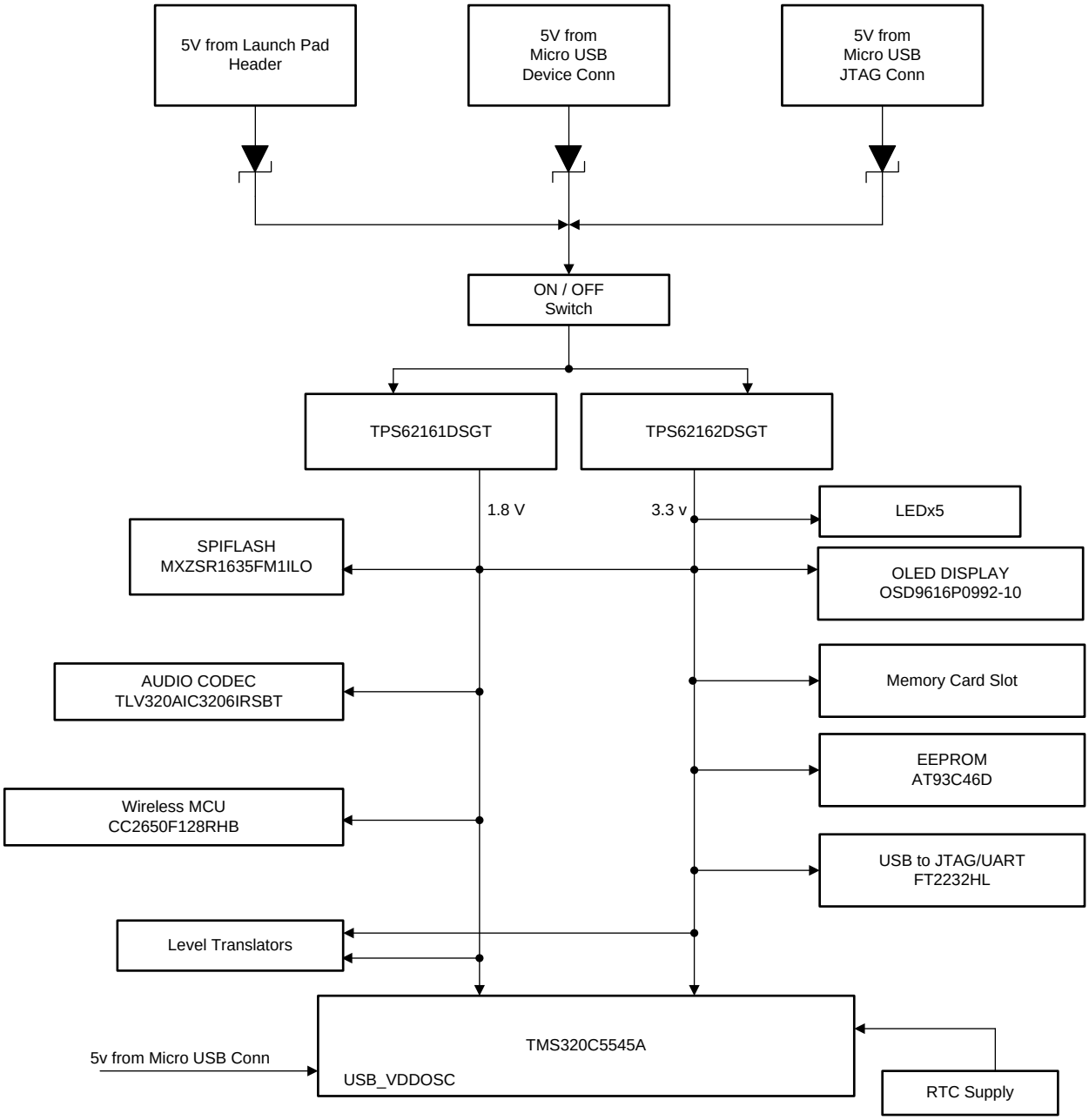


Figure 31. Power Distribution Diagram

4.2 Power Supply Calculation

POWER CALCULATION

INPUT SUPPLY (in V)		5					
Regulator efficiency		0.88		0.92			
Input Voltage (in V)		5		5			
Output Voltage(in V)		1.8		3.3			
Regulator name		TPS62161DSGT		TPS62162DSGT		5V DC IN	
		Active	Standby	Active	Standby	Active	Standby
Description of part	Part Number						
DSP	TMS320C5545A	68.6291	5.5581	17.826	0.958	40.8637583	2.961029051
SPI Flash	MX25R1635FM1IL0	6	0.024			2.454545455	0.009818182
Audio Codec	TLV320AIC3206IRSBT	170	0.01			69.54545455	0.004090909
Wireless MCU	CC2650F128RHB	9.87	0.55			4.037727273	0.225
USB to JTAG/UART	FT2232HL			130	0.55	93.26086957	0.394565217
EEPROM	AT93C46DY6-YH-T			2	0.01	1.434782609	0.007173913
OLED display	OSD9616P0992-10	0.3	0.005	18.3	0.01	13.25098814	0.009219368
Micro SD Card				80	0	57.39130435	0
LED x5				10		7.173913043	0
12MHz Oscillator	ASDMB-12.000MHZ-LC-T	15	15	15	15	16.8972332	16.8972332
INA DEVICE x4	INA219			4	0.03	2.869565217	0.021521739
						0	0
CURRENT CONSUMPTION (in mA)		269.7991	21.1471	277.126		309.1801417	20.52965158
POWER CONSUMPTION (in mW)		485.63838		914.5158		1545.900708	102.6482579

Note: All current ratings are in mA

	ACTIVE	STANDBY
CURRENT CONSUMPTION ON 5V POWER INPUT (in mA)	309.1801417	20.52965158
POWER CONSUMPTION ON 5V POWER INPUT (in mW)	1545.900708	102.6482579

Figure 32. Power Supply Calculation

4.3 Power-Up Sequence

Figure 33 shows the power-up sequence required for the processor.

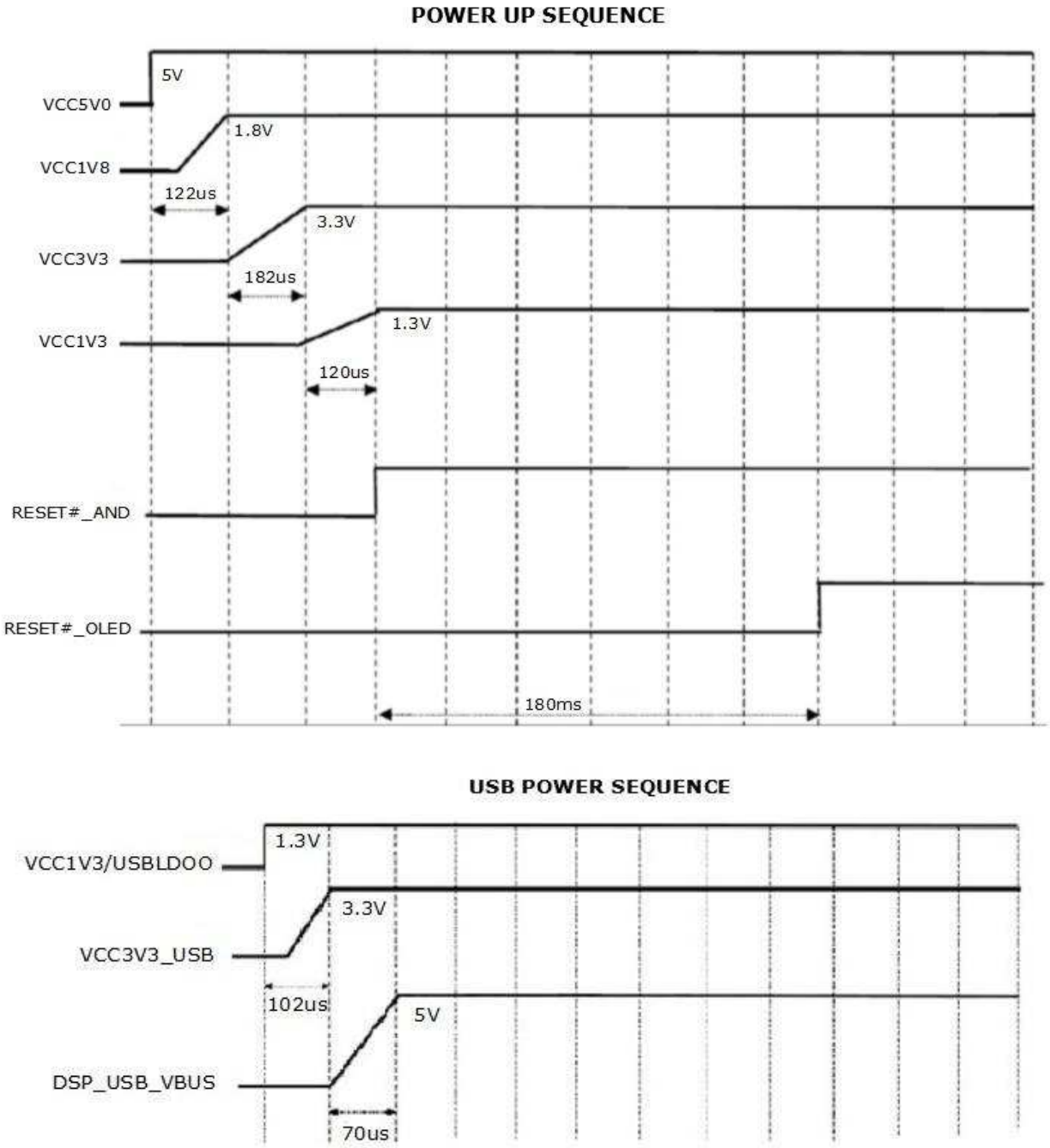


Figure 33. Power-Up Sequencing

NOTE: A power sequence for the C5545 USB peripheral is only required in designs when the USB interface is used. During the power sequence, the internal USB LDO is turned on to supply 1.3 V to the USB core. After the USB LDO is turned on, it is used to enable a load switch that supplies 3.3 V for the USB PHY. Once the 3.3 V supply for the USB PHY is enabled, another load switch links 5 V USB to the C5545 VBUS input. On 1.8 V designs, which do not use the USB peripheral, the 3.3 V DC-DC and two load switches can be eliminated. For more information, see the *TMS320C5545 Fixed-Point Digital Signal Processor Data Sheet* (SPRS853).

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