User's Guide
TPA6304-Q1 Evaluation Module

TEXAS INSTRUMENTS

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ABSTRACT

This manual describes the operations of the TPA6304Q1EVM. The TPA6304Q1EVM is a stand-alone Evaluation Module (EVM). The PurePath™ Control Console 3 GUI (PPC3) is used to initialize and operate the EVM.

Table of Contents

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Trademarks

PurePath™ is a trademark of Texas Instruments.

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1 Required Equipment and Accessories:

1. TPA6304Q1EVM
2. USB A male to micro B male cable
3. Power Supply Unit (PSU) up to 18 V, 6 A capable
4. 1-4 resistive loads or speaker loads
5. 2-6 pair of wires stripped both ends
6. 2-mm slotted screwdriver
7. 1-4 RCA cables

2 Hardware Overview

2.1 TPA6304Q1 Evaluation Module Description

The TPA6304Q1EVM is a stand-alone EVM. USB adapter is provided for a more thorough evaluation of the device. Figure 2-1 shows the EVM board.
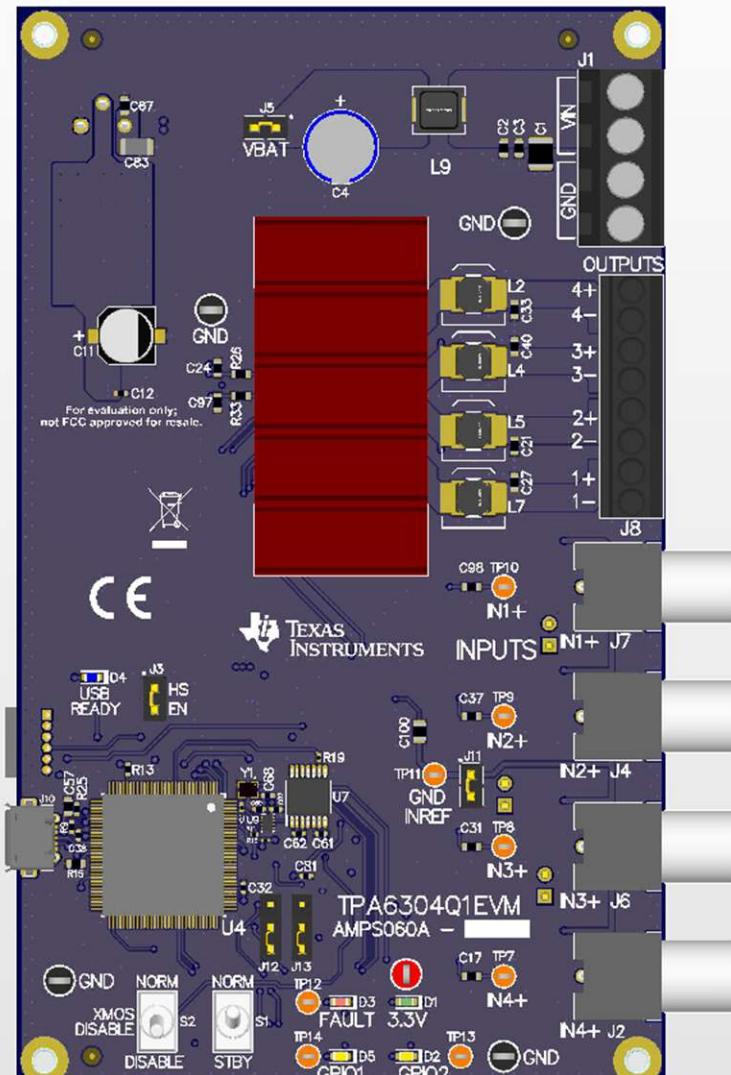
Figure 2-1. TPA6304Q1EVM

Figure 2-2 shows the TPA6304Q1EVM signal flow:
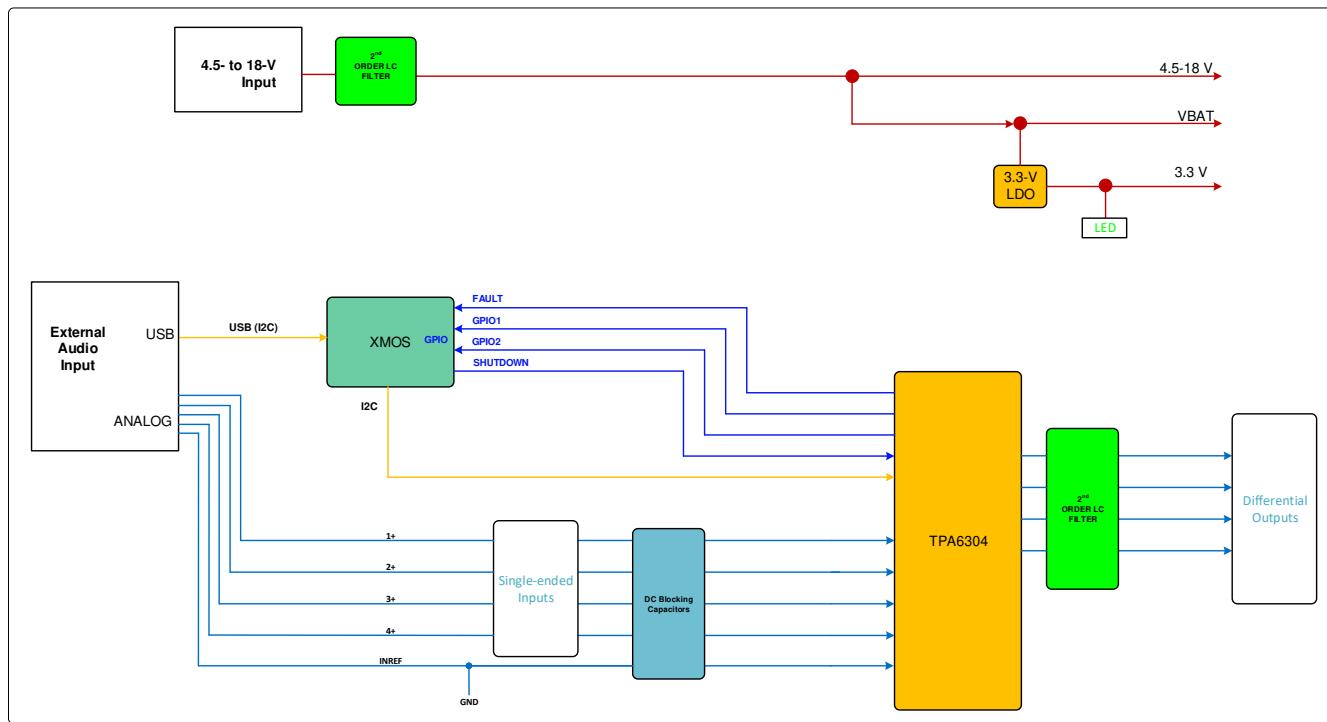
Figure 2-2. EVM Block Diagram

2.2 TPA6304-Q1 Evaluation Module Functions

- There are two switches
  - Standby switch puts the device on or out of standby.
  - XMOS Disable switch enables or disables the onboard XMOS.
- The board has 8 jumpers
  - J3 enables or disables the onboard XMOS.
  - J5 allows VBAT to be supplied by PVDD or another power supply.
  - J11 ties INREF to GND.
  - J12 and J13 allow for external I2C controller to run I2C commands the the TPA6304-Q1.
  - J14, J15, and J16 allow multiple input channels to be tied to the same input source.

3 Software Overview

3.1 PurePath™ Console 3 (PPC3) Access and Description

PPC3 is a server-based tool. Request access at PUREPATHCONSOLE: PurePath Console Graphical Development Suite for Audio System design and Development. Once approval is given, download the software from Texas Instruments mySecure Software site.
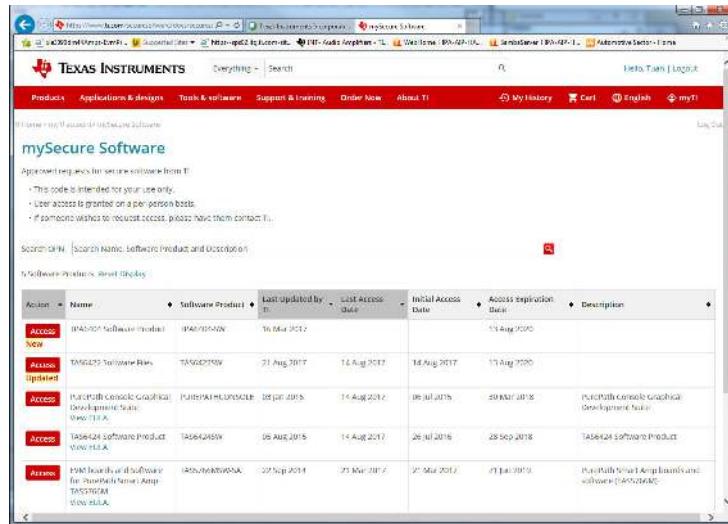
Figure 3-1. PPC3 Download Window

Run the installation program. Also download the PPC3 User Manual (slou408) for further instructions.

Figure 3-2 shows the window displayed when first running PPC3. Click *Sign in* to see TPA6304 EVM application.

Figure 3-2. PPC3 Window

Different Apps might be displayed in Figure 3-3 depending on the user's access.

Figure 3-3. Available Apps Window

Click the TPA6304 EVM App box to download the TPA6304-Q1 application. An Installation window appears, next click Install. Figure 3-4 shows the downloading progress of the application.

Figure 3-4. PPC3 Downloading App

The TPA6304 EVM box appears in the Installed EVM Apps section, see Figure 3-5. Click the TPA6304 EVM box to launch the TPA6304 EVM App.

Figure 3-5. PPC3 Installed Apps

3.2 PurePath™ Console 3 – TPA6304Q1EVM Home Window

There are three windows available with the TPA6304Q1EVM PPC3: Home Window, Register Map Window, and Device Monitor & Control Window. When the TPA6304Q1EVM PPC3 is launched, the Home Window displays (see Figure 3-6). If the EVM is powered on and the USB is connected to the PC, the Home Window displays the Connect box in the bottom left hand corner. If the EVM is not powered on or the USB is not connected, only TPA6304Q1EVM – Offline is displayed.
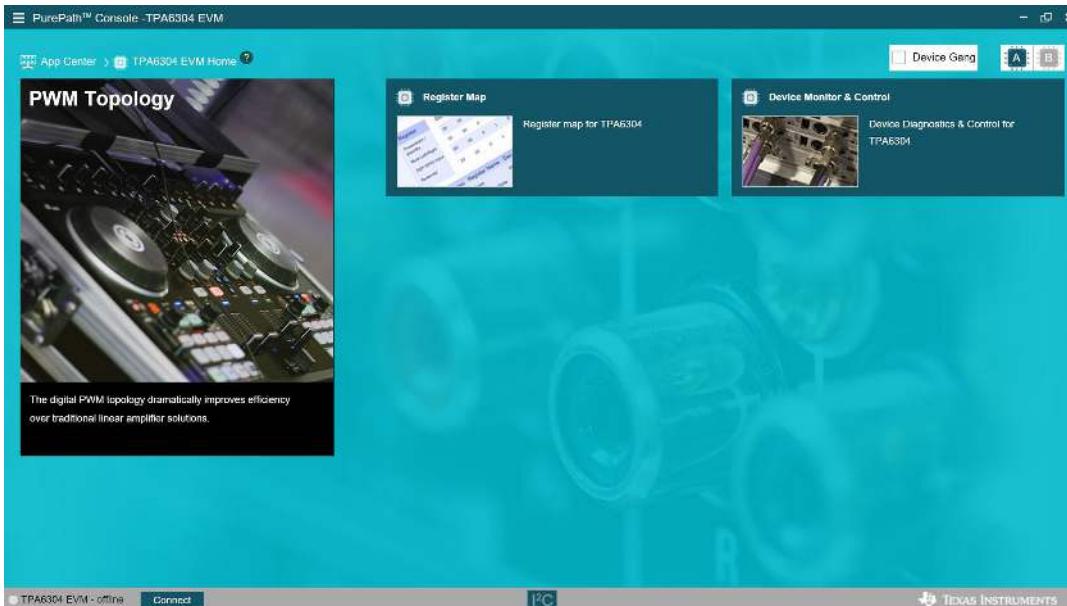
Figure 3-6. TPA6304Q1EVM Home Window

3.3 PurePath™ Console 3 – TPA6304Q1EVM Register Map Window

Click on the Register Map Box in the Home Window to display the Register Map Window. The Register Map indicates the current setting of all the registers in the TPA6304-Q1 device.
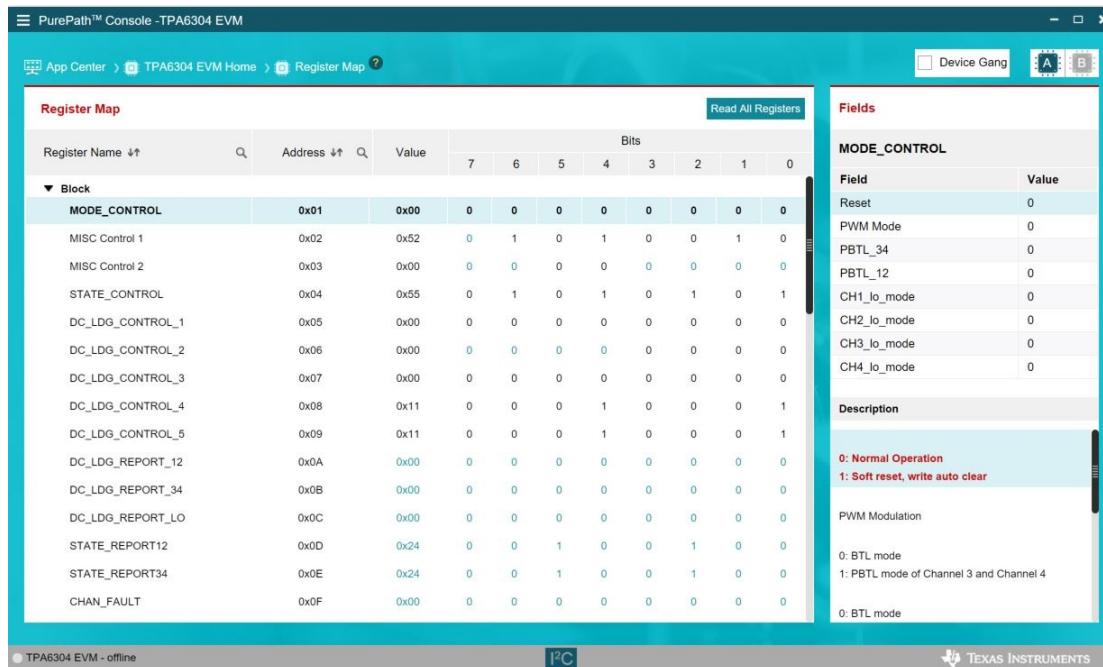
Figure 3-7. TPA6304Q1EVM Register Map Window

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3.4 PurePath™ Console 3 – TPA6304Q1EVM Monitor & Control Window

Click on Device Monitor & Control box in the Home Window to display Device Monitor & Control window.
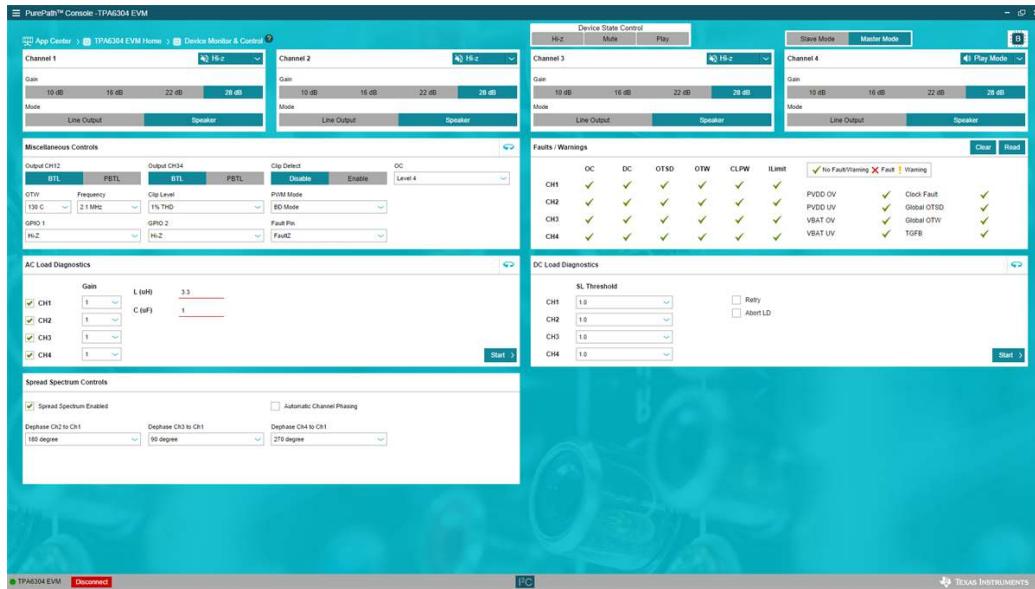
Figure 3-8. TPA6304Q1EVM Device Monitor & Control Window

4 TPA6304-Q1 Start Up

This section describes the TPA6304-Q1 start up procedure. Have all the equipment and accessories listed on the first page of this document available.

4.1 TPA6304Q1EVM Setup
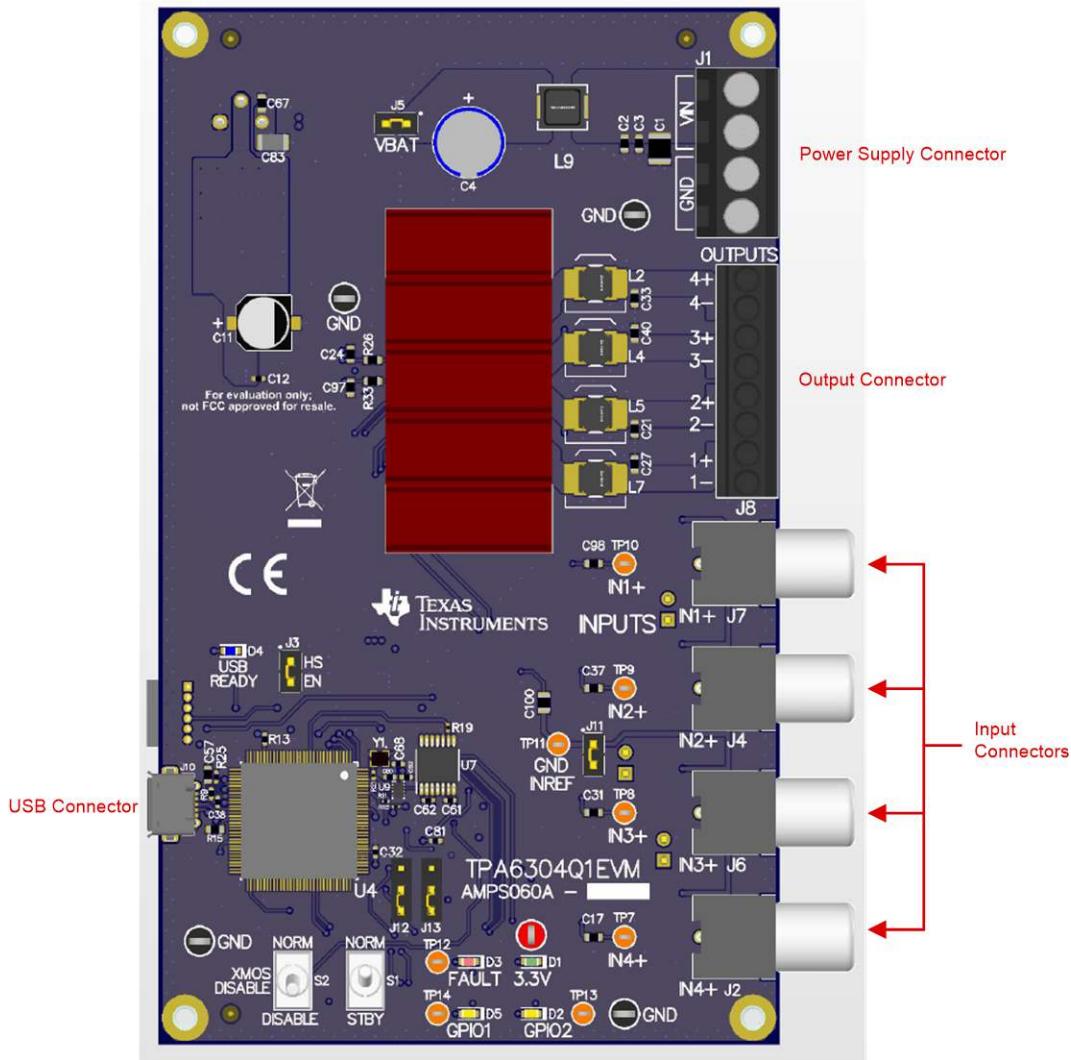
Figure 4-1. TPA6304Q1EVM Connections

Hardware and software connections:

- Desktop or laptop PC running Windows 7 or 10, open PPC3 GUI
- Connect 14.4-VDC PSU to the TPA6304Q1EVM
- Connect speakers or resistive loads to the TPA6304Q1EVM
- Connect USB micro cable from the PC to the EVM
- Set the STANDBY switch to down position and the XMOS DISABLE switch to the up position
- Turn on the PSU
- Connect the audio source – this can be a 3-mm stereo connector connected from the PC to the EVM as shown in Figure 4-1
- At this point, 3.3V LED, and USB-LOCK LED are on
- On the PPC3 window, launch the TPA6304Q1EVM application

- Click Connect at the bottom left corner of the window
- Click Device Monitor & Control
- Click on Play at the top left corner of the window
- On the PC make sure the volume level is set as desired
- On the EVM, first switch up the STANDBY switch
- The audio can now be streamed to the speakers

4.2 TPA6304-Q1 Settings on Device Monitor & Control Window

Most of the register settings are done on the Device Monitor & Control window. The TPA6304-Q1 Register Map window is for reference.

Click the CONNECT button on the bottom left corner of the TPA6304Q1EVM application window, see Figure 3-6. The LED next to the TPA6304Q1EVM changes from gray to green and the CONNECT button changes to a DISCONNECT button.

Click on the TPA6304-Q1 *Device Monitor & Control* box, the window should now display Figure 4-2.
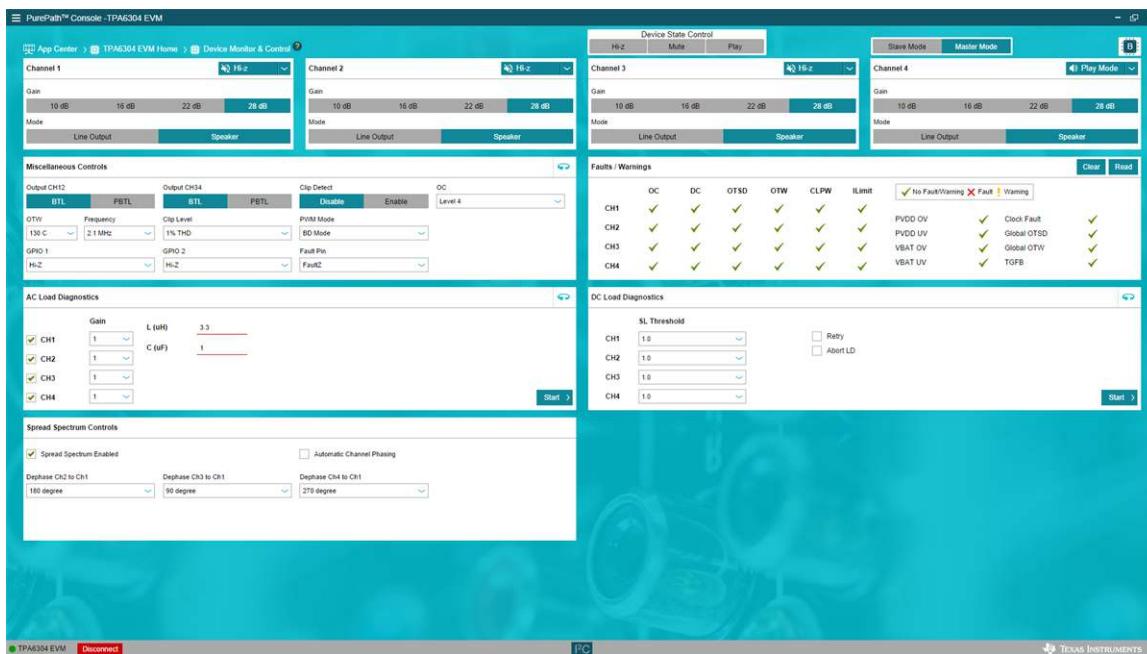
Figure 4-2. Device Monitor & Control Window

This window has 8 major sections: the Device State Control section, Channel Control section, Miscellaneous Control section, Fault / Warning Signal Configuration section, Faults and Warnings section, AC Load Diagnostics section, DC Load Diagnostics section, and Spread Spectrum Controls section.

4.2.1 Device State Control Section

This section allows the user to control all 4 channels at the same time instead of changing one channel at a time. When Hi-Z is selected, all 4 channels are put in Hi-Z. The display for each channel in the channel control section reflects these button selections.
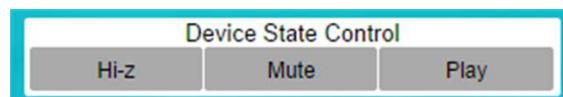
Figure 4-3. Device State Control Section

To the right hand side of the Device State Control section is the Master/Slave Mode Selector switch. The default state of the device is Master Mode.

Figure 4-4. Master Mode/Slave Mode Section

4.2.2 Channel Control Section

Each channel has the same setting selections: Hi-Z, Mute, Play, Gain, Line Output mode and Speaker mode.

The drop down menu allows the user to select either Hi-Z, Mute or Play Mode for each channel.

The default gain for each channel is 28 dB. The other gain options are 10 dB, 16 dB and 22 dB. If another gain is needed, select the button to the corresponding gain.

The default setting for each channel is Speaker mode. If Line Output is used select the Line Output button.
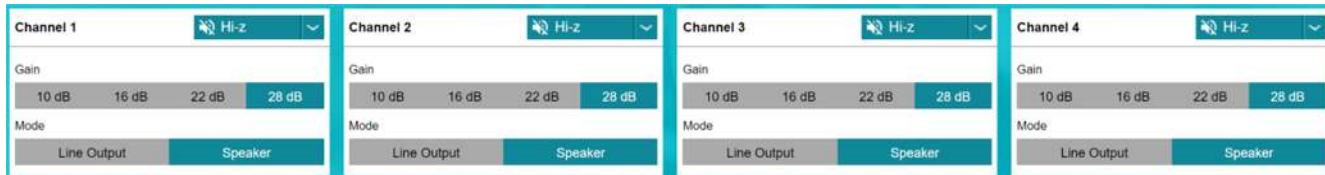
Figure 4-5. Channel Control Section

4.2.3 Miscellaneous Control Section

There are miscellanous settings that are available on the GUI for easy access (see Figure 4-6).
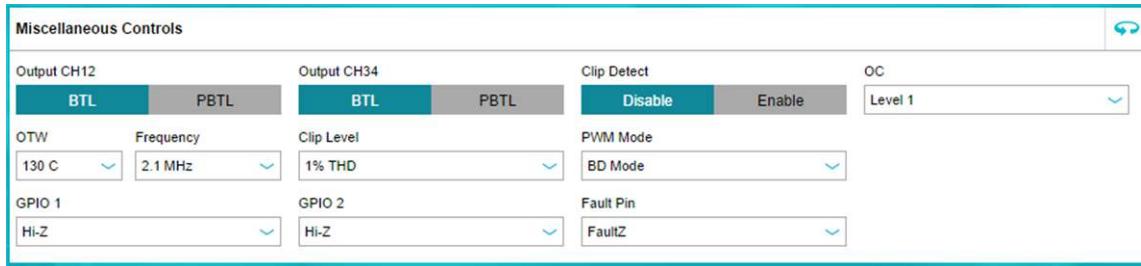
Figure 4-6. Miscellaneous Control Section

This device supports parallel bridged-tied load operations. Channels 1 and 2 can be one PBTL channel and channels 3 and 4 can be the other. Before setting the channels to PBTL mode, connect the (+) terminals of channels 1 and 2 and/or channels 3 and 4. Then connect the same channels together for their respective (-) terminals. The device needs to be in standby before reconfiguring the output to PBTL.

The Clip Detect can be set to either disable or enable, with disable being the default setting.

The overcurrent (OC) has four level that can be changed via the drop-down menu in the OC box. The default level is 1.

Overtemperature warning (OTW) can be programed using the pull-down menu to choose the OTW temperature. The default setting is 130°C.

The output switching frequency (FSW) or Pulse Width Modulation (PWM) frequency is set at 2.1 MHz. The pull-down menu on the Frequency box is used to change the PWM to 384kHz, 576kHz, and 2.3MHz.

Another feature this device has is being able to adjust at what THD level the clip detect goes off. The pull-down menu on the Clip Level box allows the user to set the detect threshold to go off at either 1% THD, 2% THD, 3% THD or 10% THD. 1% THD is the default value.

PWM Mode allows the user to choose between a BD modulation scheme or a BDHE/1SPW modulation scheme. BD modulation is the default value.

GPIO 1 and GPIO 2 pull-down menus have the same configuration options but are for their respective pins. Each one can be used to output specific signals or as inputs depending on the setting chosen. The states that can be selected for GPIO 1 and GPIO 2 are the following: Hi-Z, WarningZ, FaultZ, Clip Detect 1, Clip Detect 2, Sync Out, DVDD, GND, Sync In, and Mute Z. WarningZ and FaultZ are the Warning and Fault output signals and the MuteZ setting allows the device to have a hardware control mute pin. Default setting is Hi-Z for both GPIO 1 and GPIO 2.

The final part of the Miscellaneous Controls section is the Fault Pin pull-down menu. This changes the corresponding device fault pin. It can be selected to read out either FaultZ, WarningZ, Clip Detect 1 or Clip Detect 2. FaultZ is the default setting.

4.2.4 $\overline{\text{Fault}}$ / $\overline{\text{Warning}}$ Signal Configuration Section

This section controls what the $\overline{\text{Fault}}$ and $\overline{\text{Warning}}$ signals report when selected. To get to this section click the

↩ icon on the top right of the Miscellaneous Control Section. This changes the display to show Figure 4-7.
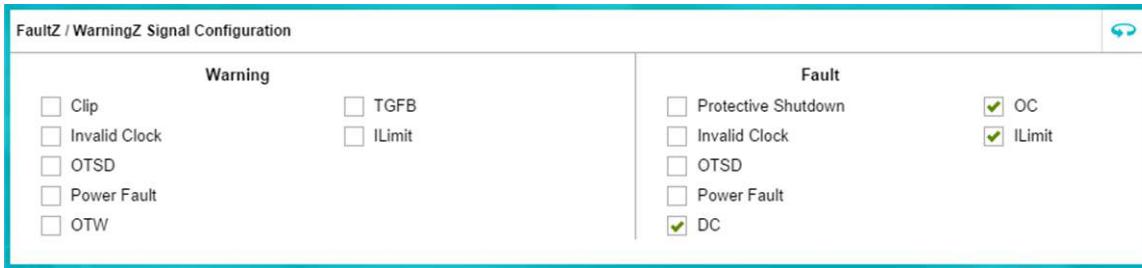
Figure 4-7. $\overline{\text{Fault}}$ / $\overline{\text{Warning}}$ Signal Configuration Section

The $\overline{\text{Warning}}$ signal can be set to report when a Clip, Invalid Clock, Overtemperature Shutdown (OTSD), Power Fault, overtemperature warning (OTW), Temperature Gain Foldback (TGFB), or ILimit event is triggered. By default, $\overline{\text{Warning}}$ does not have any event selected.

The $\overline{\text{Fault}}$ signal can be set to report when a Protective Shutdown, Invalid Clock, OTSD, Power Fault, DC fault detection, Overcurrent (OC), or ILimit event is triggered. By default the $\overline{\text{Fault}}$ signal will report a fault only when a DC, OC, or ILimit event is detected.

4.2.5 Faults / Warnings Section

The top right buttons on the Faults / Warnings box serve as controlling and monitoring faults. Clip enable route the clip detection bit to the warning pin. This is displayed as a yellow LED on the EVM. Thermal enable route the overtemperature warning bit to the warning pin. This is displayed as the same yellow LED on the EVM. The Clear button clears all the faults and warnings. The Read button manually read the faults and warnings.
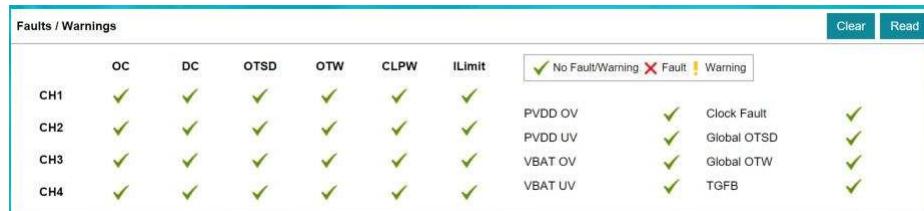
Figure 4-8. Faults / Warnings Section

4.2.6 AC Load Diagnostics Section

The AC load diagnostics report speaker impedance and phase. The diagnostics can be performed with one or all four channels.

Figure 4-9. AC Load Diagnostics Section

Select the correct output impedance and click the Start > button. Follow the pop up instructions to run the load diagnostics.

Click on the   icon located on the top right of the AC load diagnostics box to see the results.

4.2.7 DC Load Diagnostics Section

The DC load diagnostics report if a channel's output is short to power, short to ground, short to load, or open.
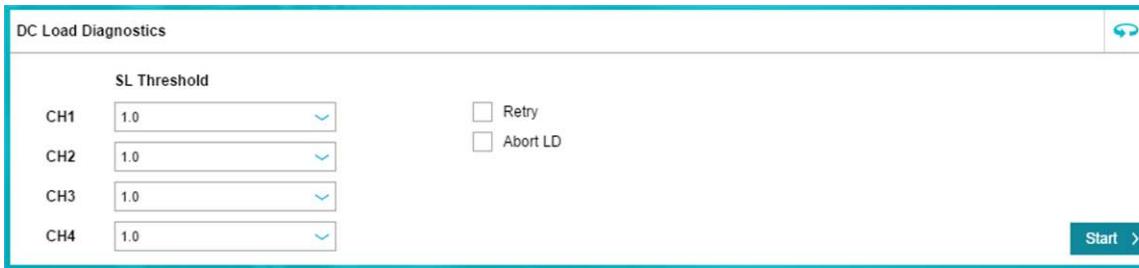
Figure 4-10. DC Load Diagnostics Section

Select the impedance of the load from 0.5 to 5 Ω. Click "Start >" and then click the   icon on the top right of the box to view results.

4.2.8 Spread Spectrum Control Section

The Spread Spectrum Controls Section allows the user to control features related to spread spectrum and managing electromagnetic conductivity/interference.
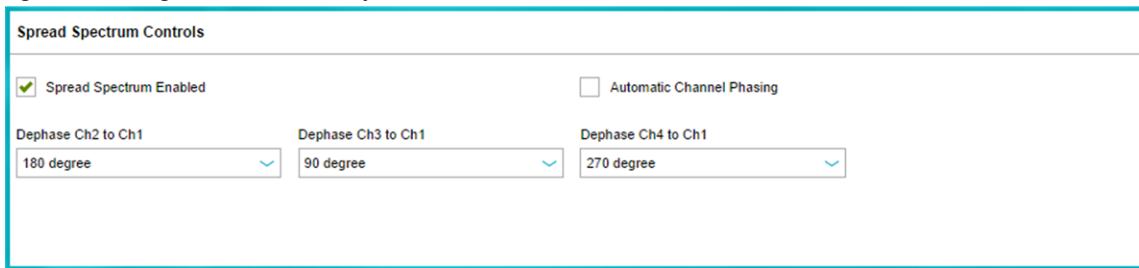
Figure 4-11. Spread Spectrum Control Section

By default, spread spectrum is enabled. This can be disabled by clicking on the Spread Spectrum Enabled button. To re-enable, simply click the box again.

Another button found in this section is the Automatic Channel Phasing. By default Automatic Channel Phasing is disabled but can be enabled the same way as Spread Spectrum is.

The three drop-down menus, Dephase Ch2 to Ch1, Dephase Ch3 to Ch1, and Dephase CH4 to Ch1, all control the channels output phases from each other. Each can be set to be either 0 degrees, 45 degrees, 90 degrees,

135 degrees, 180 degrees, 225 degrees, 270 degrees or 315 degrees out of phase from channel 1. The default values for Dephase Ch2 to Ch1, Dephase Ch3 to Ch1, and Dephase CH4 to Ch1 are 180 degree, 90 degree, and 270 degree, respectively.

4.3 TPA6304-Q1 Settings on Register Map Window

Select a particular register then double click on any bit, that isn't reserved, and the bit changes state. This state is executed at the end of the click.
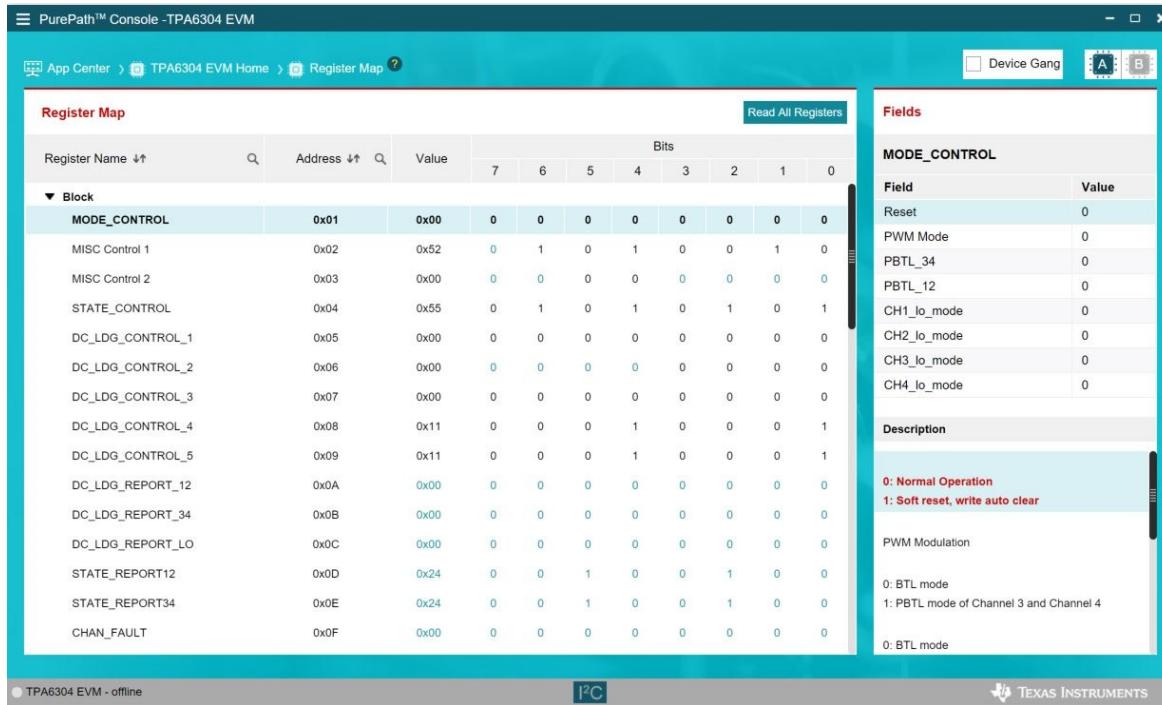
Figure 4-12. Register Map Window

4.4 I2C Monitor Window

The PPC3 has an I2C monitor and also configuration program options (see Figure 4-13).
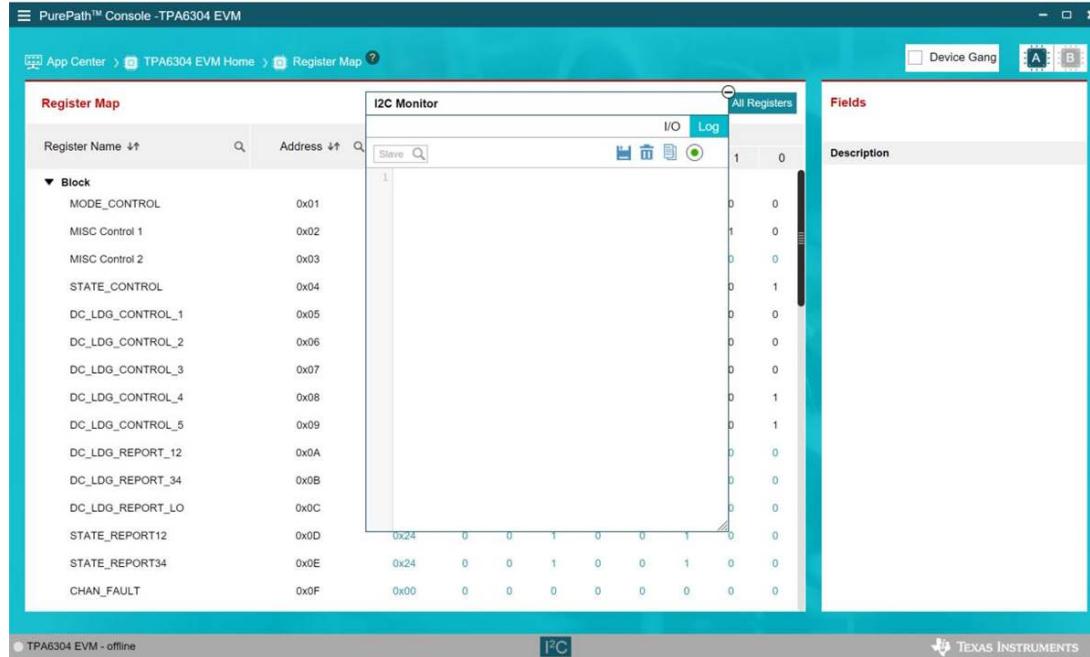
Figure 4-13. I2C Monitor Window - I2C Logging

When this window is first open, the round button is green. To record I2C commands, click on this button to turn it red. This button can be clicked again to stop recording I2C commands. Doing this will turn the button back to green. The recording can be saved for later use by clicking the save icon.

The I2C commands can also be copied to the clip board by clicking the ⬚ icon next to trash bin icon.
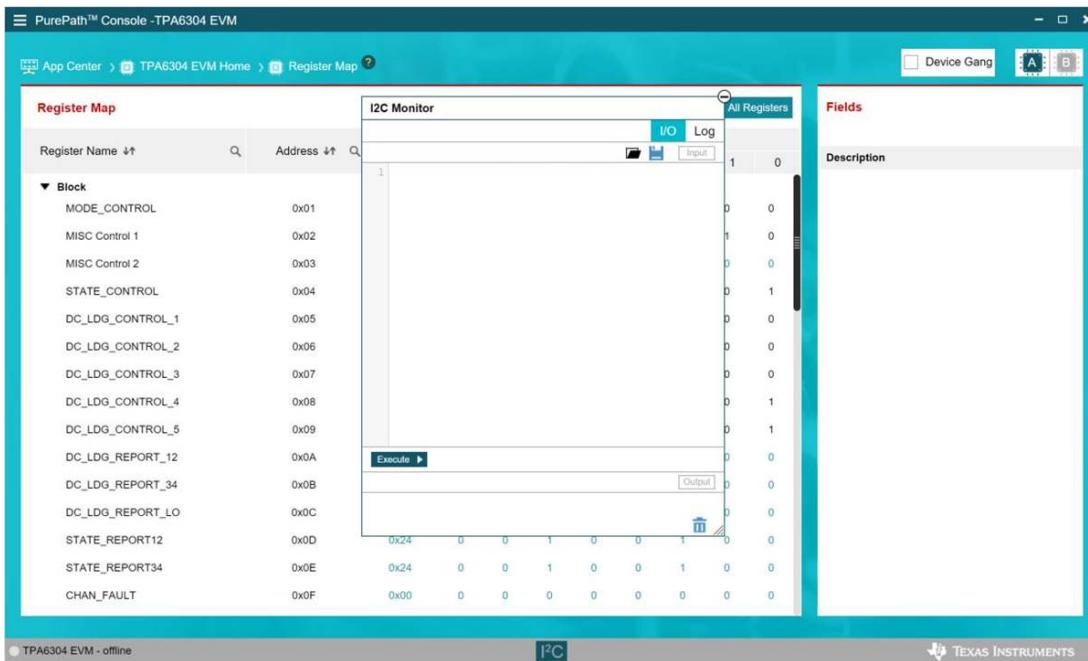
Figure 4-14. I2C Monitor Window - I2C Logging

A set of I2C commands can be loaded and executed from this window. On the top right corner, click on the I/O button to display the window in Figure 4-14. Write I2C commands here, or open an existing *.cfg file then click the Execute button on the bottom left corner of the I2C Monitor window. The I2C commands are sent to the device when the Execute button is pressed.

5 Board Layout, Schematic and Bill of Materials
5.1 Board Layout
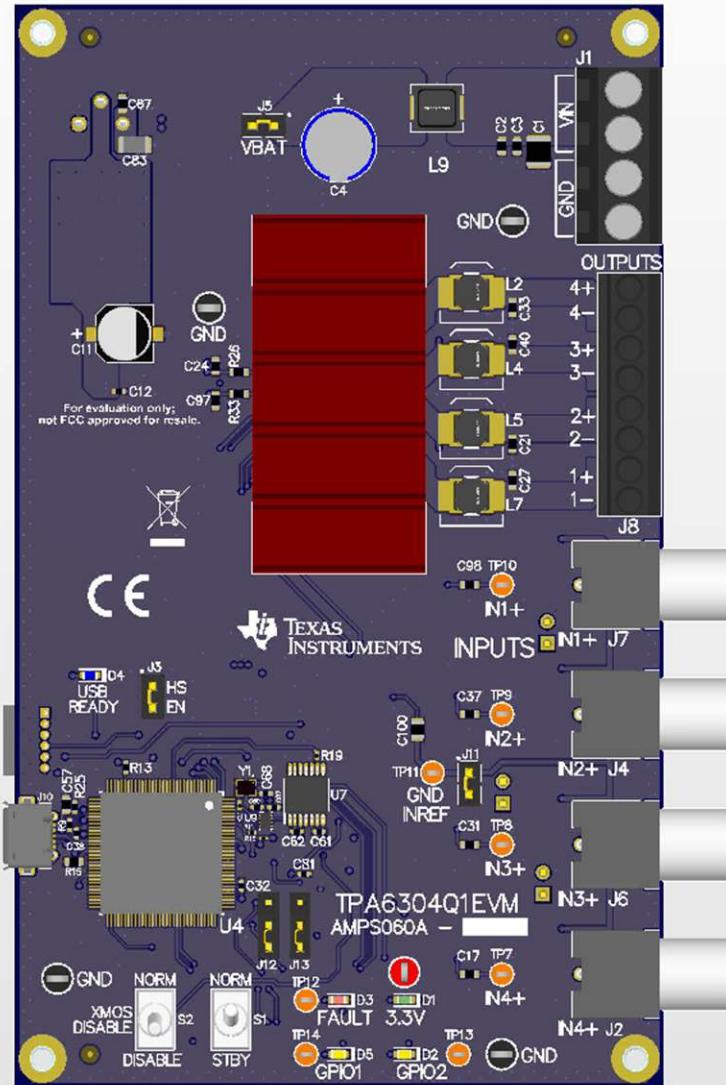
Figure 5-1. TPA6304Q1EVM Top
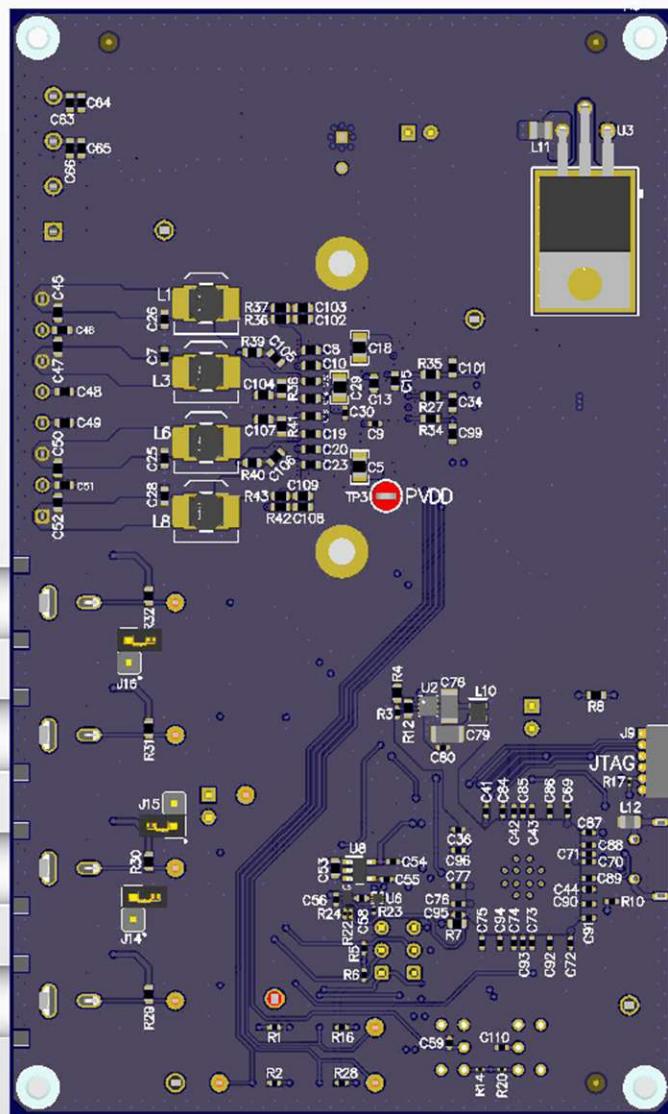
Figure 5-2. TPA6304Q1EVM Bottom

5.2 Schematic
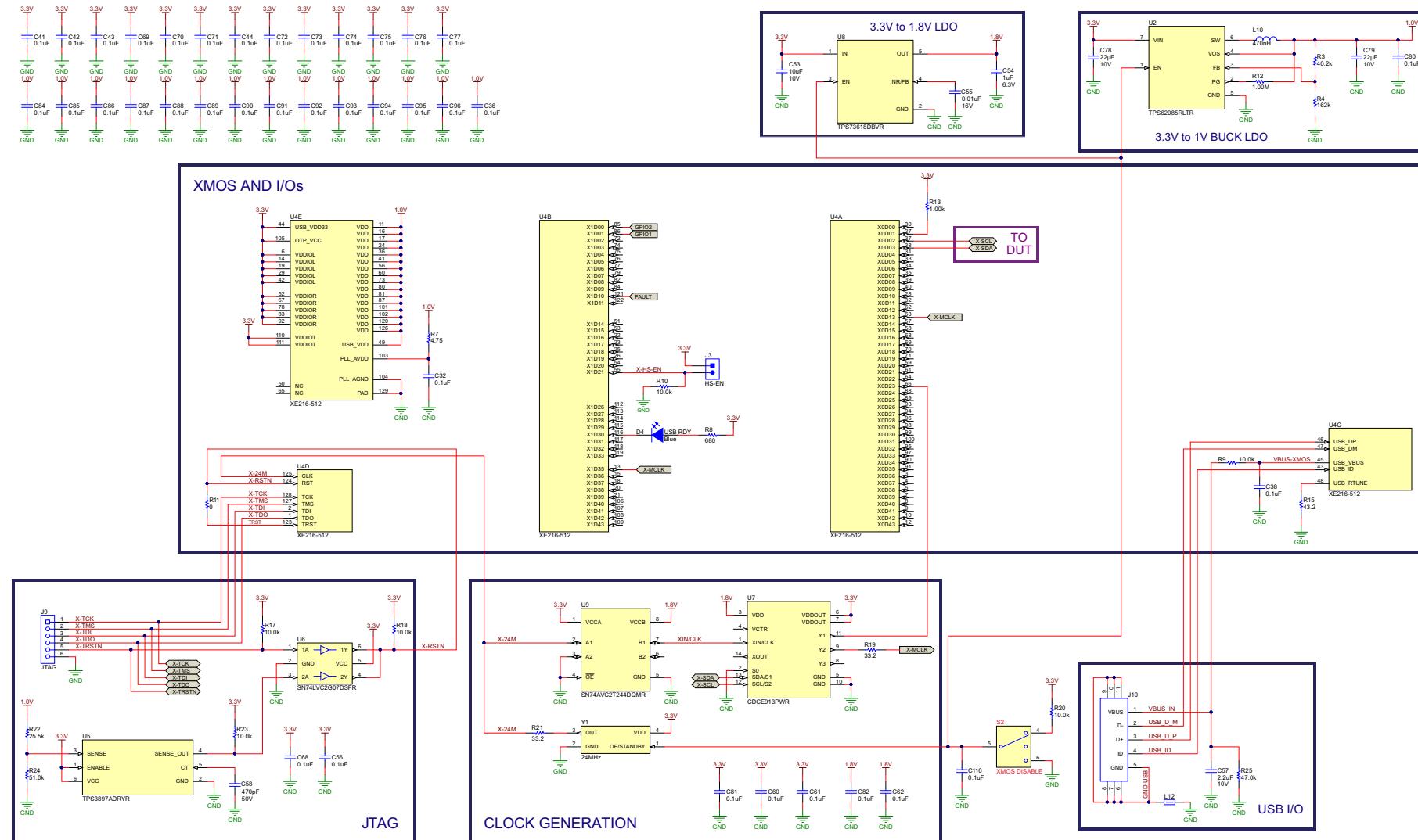
Figure 5-3. Schematic (Page 1)
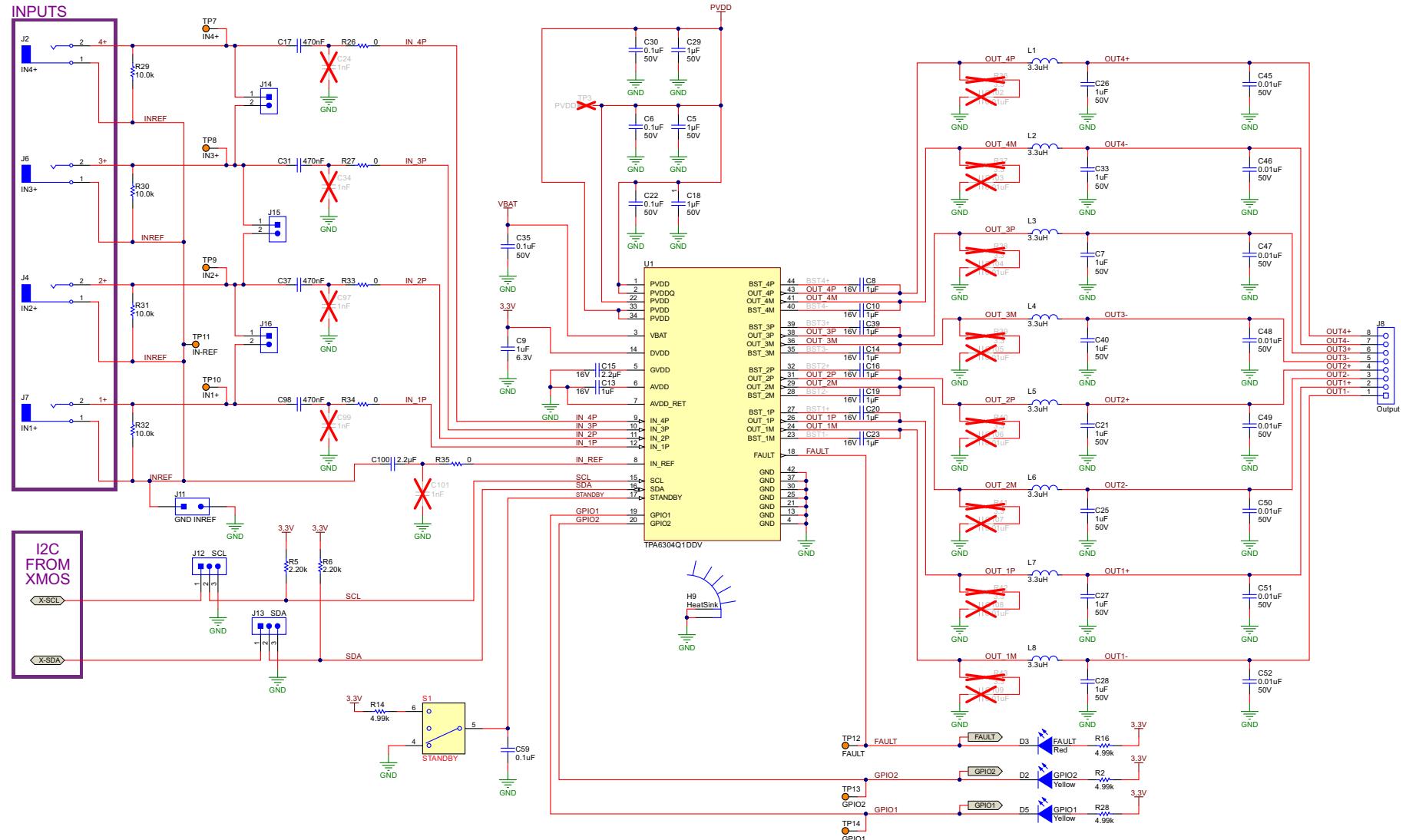
Figure 5-4. Schematic (Page 2)
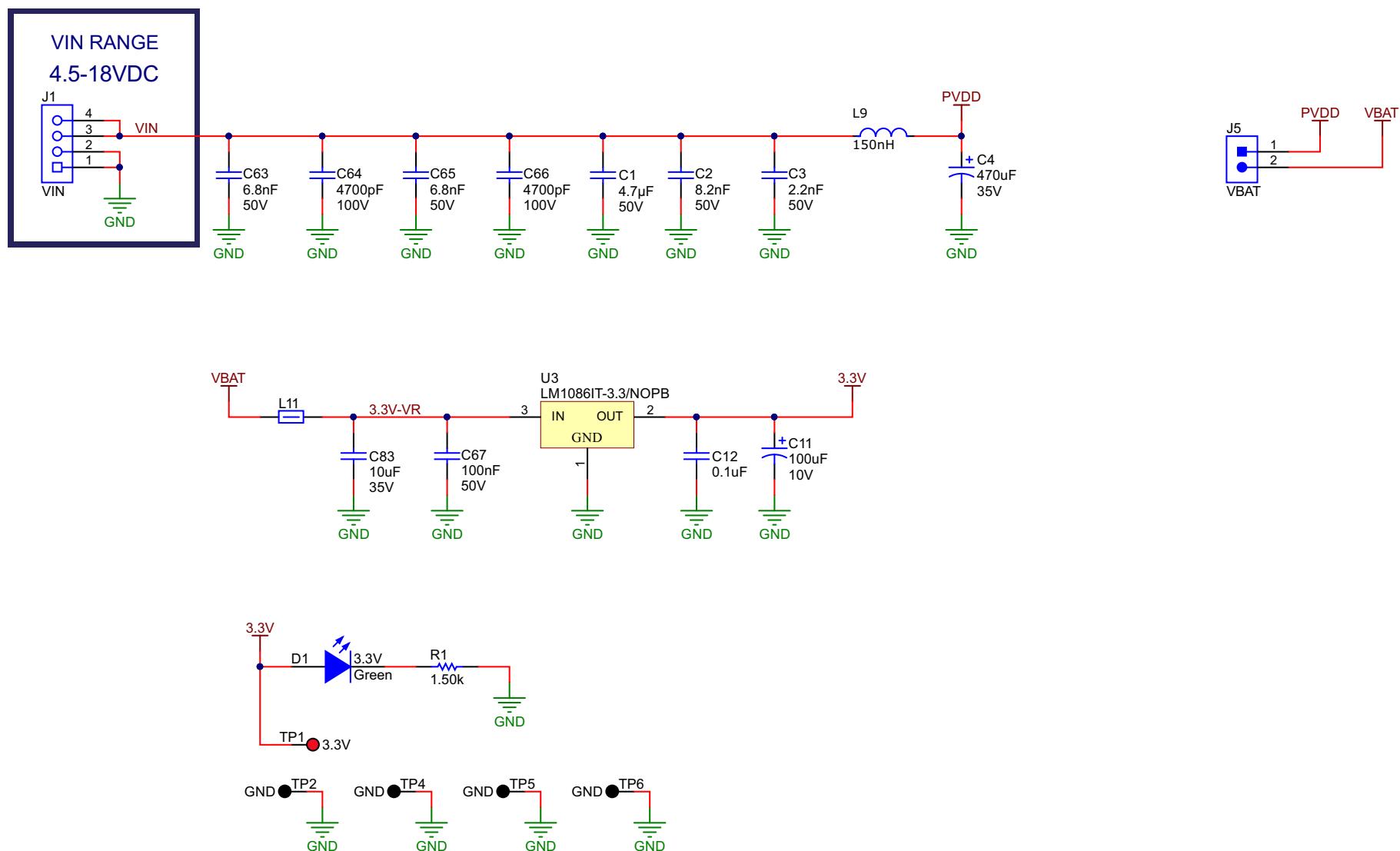
Figure 5-5. Schematic (Page 3)

5.3 Bill of Materials

Table 5-1. Bill of Materials

| Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
C1	1	4.7uF	CAP, CERM, 4.7 µF, 50 V,+/- 20%, X7R, AEC-Q200 Grade 1, 1210	1210	UMK325B7475MMHT	Taiyo Yuden
C2	1	8200pF	CAP, CERM, 8200 pF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCD188R71H822KA01D	MuRata
C3	1	2200pF	CAP, CERM, 2200 pF, 50 V, +/- 10%, X7R, 0603	0603	C0603X222K5RACTU	Kemet
C4	1	470uF	CAP, AL, 470 uF, 35 V, +/- 20%, 0.03 ohm, TH	RCAP, 8x20mm	EEU-FR1V471LB	Panasonic
C5, C18, C29	3	1uF	CAP, CERM, 1 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805	08055C105K4Z2A	AVX
C6, C12, C22, C30, C32, C35, C36, C38, C41, C42, C43, C44, C56, C59, C60, C61, C62, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C80, C81, C82, C84, C85, C86, C87, C88, C89, C90, C91, C92, C93, C94, C95, C96, C110	44	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0402	0402	C1005X7R1H104K050BB	TDK
C7, C21, C25, C26, C27, C28, C33, C40	8	1uF	CAP, CERM, 1 uF, 50 V, +/- 10%, X7R, 0603	0603	UMK107AB7105KA-T	Taiyo Yuden
C8, C10, C13, C14, C16, C19, C20, C23, C39	9	1uF	CAP, CERM, 1 uF, 16 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71C105KA64D	MuRata
C9	1	1uF	CAP, CERM, 1 uF, 6.3 V,+/- 10%, X7R, 0402	0402	GRM155R70J105KA12D	MuRata
C11	1	100uF	CAP, AL, 100 uF, 10 V, +/- 20%, 0.44 ohm, SMD	6.3x5.8	UUD1A101MCL1GS	Nichicon
C15	1	2.2uF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X7R, 0603	0603	EMK107BB7225KA-T	Taiyo Yuden
C17, C31, C37, C98	4	0.47uF	CAP, CERM, 0.47 uF, 25 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1E474K080AB	TDK
C45, C46, C47, C48, C49, C50, C51, C52	8	0.01uF	CAP, CERM, 0.01 uF, 50 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0603	0603	CGA3E2C0G1H103J080AA	TDK
C53	1	10uF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A106M080AC	TDK
C54	1	1uF	CAP, CERM, 1 uF, 6.3 V, +/- 20%, X7R, 0402	0402	GRM155R70J105MA12D	MuRata
C55	1	0.01uF	CAP, CERM, 0.01 uF, 16 V, +/- 10%, X7R, 0402	0402	885012205031	Wurth Elektronik
C57	1	2.2uF	CAP, CERM, 2.2 uF, 10 V, +/- 10%, X7R, 0603	0603	GRM188R71A225KE15D	MuRata
C58	1	470pF	CAP, CERM, 470 pF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	CGA2B2X7R1H471K050BA	TDK
C63, C65	2	6800pF	CAP, CERM, 6800 pF, 50 V, +/- 10%, X7R, 0603	0603	C0603C682K5RACTU	Kemet
C64, C66	2	4700pF	CAP, CERM, 4700 pF, 100 V, +/- 5%, C0G/NP0, 0603	0603	C0603C472J1GAC7867	Kemet
C67	1	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, 0603	0603	885012206095	Wurth Elektronik
C78, C79	2	22uF	CAP, CERM, 22 µF, 10 V,+/- 10%, X7R, 1206	1206	CL31B226KPHNFNE	Samsung Electro-Mechanics
C83	1	10uF	CAP, CERM, 10 uF, 35 V, +/- 10%, X7R, 1206	1206	C3216X7R1V106K160AC	TDK
C100	1	2.2uF	CAP, CERM, 2.2 uF, 25 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0805	0805	CGA4J3X7R1E225K125AB	TDK
D1	1	Green	LED, Green, SMD	LED_0603	150060GS75000	Wurth Elektronik

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Table 5-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
D2, D5	2	Yellow	LED, Yellow, SMD	LED_0603	150060YS75000	Wurth Elektronik
D3	1	Red	LED, Red, SMD	LED_0603	150060RS75000	Wurth Elektronik
D4	1	Blue	LED, Blue, SMD	LED_0603	150060BS75000	Wurth Elektronik
H1, H2, H3, H4	4		MACHINE SCREW PAN PHILLIPS 4-40	Machine Screw, 4-40, 1/4 inch	PMSSS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		ROUND STANDOFF 4-40 ALUM 1/2"	ROUND STANDOFF 4-40 ALUM 1/2 inch	2027	Keystone
H9	1		Heat Sink, Aluminum, 0.25" Corner, Used for TPA63xxEVM Boards	Heatsink	HeatSink_TAS54xxPHD	Any Machine Shop
J1	1		Terminal Block, 4x1, 5.08mm, TH	4x1 Terminal Block	39544-3004	Molex
J2, J4, J6, J7	4		RCA Jack, 1Pos, Tin, R/A, TH	RCJ Jack, 1Pos, R/A, TH	RCJ-041	CUI Inc.
J3, J5, J11, J14, J15, J16	6		Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator	PBC02SAAN	Sullins Connector Solutions
J8	1		Terminal Block, 3.5mm, 8x1, Tin, TH	Terminal Block, 3.5mm, 8x1, TH	393570008	Molex
J9	1		Receptacle, 50mil, 6x1, Gold, R/A, TH	6x1 Receptacle	LPPB061NGCN-RC	Sullins Connector Solutions
J10	1		Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	5.6x2.5x8.2mm	475890001	Molex
J12, J13	2		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
L1, L2, L3, L4, L5, L6, L7, L8	8	3.3uH	3.3µH Shielded Wirewound Inductor 2.9A 0.058Ohm Max Nonstandard	SMT_IND_4MM0_4MM0	ASWPA4035S3R3MT	Sunlord
L9	1		FIXED IND 150NH 16A 4.1 MOHM SMD	SMD2	SRP5015TA-R15Y	Bourns
L10	1		FIXED IND 470NH 2A 52 MOHM SMD	SMD2	NRV2010TR47NGFV	Taiyo Yuden
L11	1	180 ohm	Ferrite Bead, 180 ohm @ 100 MHz, 3.4 A, 0806	0806	NFZ2MSM181SN10L	MuRata
L12	1	600 ohm	Ferrite Bead, 600 ohm @ 100 MHz, 2 A, 0805	0805	MPZ2012S601AT000	TDK
R1	1	1.50k	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	RMCF0402FT1K50	Stackpole Electronics Inc
R2, R16, R28	3	4.99k	RES, 4.99 k, 1%, 0.063 W, 0402	0402	RC0402FR-074K99L	Yageo America
R3	1	40.2k	RES, 40.2 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ-2RKF4022X	Panasonic
R4	1	162k	RES, 162 k, 1%, 0.1 W, 0603	0603	RC0603FR-07162KL	Yageo
R5, R6	2	2.20k	RES, 2.20 k, 1%, 0.063 W, 0402	0402	RC0402FR-072K2L	Yageo America
R7	1	4.75	RES, 4.75, 1%, 0.1 W, 0603	0603	RC0603FR-074R75L	Yageo
R8	1	680	RES, 680, 1%, 0.1 W, 0603	0603	RC0603FR-07680RL	Yageo
R9, R10	2	10.0k	RES, 10.0 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1002X	Panasonic
R11	1	0	RES, 0, 5%, 0.05 W, AEC-Q200 Grade 1, 0201	0201	ERJ-1GE0R00C	Panasonic
R12	1	1.00Meg	RES, 1.00 M, 1%, 0.1 W, 0603	0603	RC0603FR-071ML	Yageo
R13	1	1.00k	RES, 1.00 k, 1%, 0.0625 W, 0402	0402	RC0402FR-071KL	Yageo America
R14	1	4.99k	RES, 4.99 k, 1%, 0.05 W, 0201	0201	RC0201FR-7D4K99L	Yageo America
R15	1	43.2	RES, 43.2, 1%, 0.1 W, 0603	0603	RC0603FR-0743R2L	Yageo

Table 5-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
R17, R18, R20, R23	4	10.0k	RES, 10.0 k, 1%, 0.05 W, 0201	0201	RC0201FR-0710KL	Yageo America
R19, R21	2	33.2	RES, 33.2, 1%, 0.05 W, 0201	0201	RC0201FR-0733R2L	Yageo America
R22	1	25.5k	RES, 25.5 k, 1%, 0.05 W, 0201	0201	RC0201FR-0725K5L	Yageo America
R24	1	51.0k	RES, 51.0 k, 1%, 0.05 W, 0201	0201	RC0201FR-0751KL	Yageo America
R25	1	47.0k	RES, 47.0 k, 1%, 0.0625 W, 0402	0402	RC0402FR-0747KL	Yageo America
R26, R27, R33, R34, R35	5	0	RES, 0, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	ERJ-3GEY0R00V	Panasonic
R29, R30, R31, R32	4	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	ERJ-3EKF1002V	Panasonic
S1, S2	2		Switch, Toggle, SPDT 1Pos, TH	7 X 11 X4.5 mm	G12AP	NKK Switches
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8	8	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
TP1	1		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	5010	Keystone
TP2, TP4, TP5, TP6	4		Test Point, Compact, Black, TH	Black Compact Testpoint	5006	Keystone
TP7, TP8, TP9, TP10, TP11, TP12, TP13, TP14	8		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone
U1	1		45-W, 2.1-MHz Analog Input 4-Channel Automotive Class-D Audio Amplifier with Load Dump Protection and I2C Diagnostics, DDV0044E (TSSOP-44)	DDV-44	TPA6304Q1DDV	Texas Instruments
U2	1		3-A Step-Down Converter with DCS-Control and Hiccup Short Circuit Protection in 2x2 HotRod Package, RLT0007A (VSON-HR-7)	RLT0007A	TPS62085RLTR	Texas Instruments
U3	1		1.5A Low Dropout Positive Regulators, 3-pin TO-220, Pb-Free	NDE0003A	LM1086IT-3.3/NOPB	Texas Instruments
U4	1		IC MCU 512KB RAM, 128TQFP	TQFP-128	XEF216-512-TQ128-C20	XMOS semiconductor
U5	1		Single-Channel Ultra-Small Adjustable Supervisory Circuit With Active-High Open-Drain Output, DRY0006A (USON-6)	DRY0006A	TPS3897ADRYR	Texas Instruments
U6	1		Enhanced Product Dual Buffer/Driver with Open-Drain Output, DCK0006A (SOT-SC70-6)	DSF0006A	SN74LVC2G07DSFR	Texas Instruments
U7	1		Programmable 1-PLL VCXO Clock Synthesizer with 2.5-V or 3.3-V LVCMOS Outputs, PW0014A (TSSOP-14)	PW0014A	CDCE913PWR	Texas Instruments
U8	1		Single Output LDO, 400mA, Adj.(1.2 to 5.5V), Cap free, Low Noise, Reverse Current Protection, DBV0005A (SOT-23-5)	DBV0005A	TPS73618DBVR	Texas Instruments
U9	1		Dual-Bit Dual-Supply Bus Transceiver, DQM0008A (X2SON-8)	DQM0008A	SN74AVC2T244DQMR	Texas Instruments
Y1	1		OSC, 24 MHz, 2.25 - 3.63 V, SMD	2x1.6mm	ASTMLPA-24.000MHZ-EJ-E-T	Abracon Corporation
C24, C34, C97, C99, C101	0	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 10%, X7R, 0603	0603	C0603X102K5RACTU	Kemet
C102, C103, C104, C105, C106, C107, C108, C109	0	0.01uF	CAP, CERM, 0.01 uF, 50 V, +/- 5%, C0G/NP0, 0603	0603	C1608NP01H103J080AA	TDK
FID1, FID2, FID3, FID4, FID5, FID6	0		Fiducial mark. There is nothing to buy or mount.	N/A	N/A	N/A
R36, R37, R38, R39, R40, R41, R42, R43	0	3.3	RES, 3.3, 5%, 0.1 W, 0603	0603	CRCW06033R30JNEA	Vishay-Dale

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Table 5-1. Bill of Materials (continued)

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
TP3	0		Test Point, Multipurpose, Red, TH	Red Multipurpose Testpoint	5010	Keystone

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Revision * (September 2019) to Revision A (October 2020)	Page
• Added Spread Spectrum Control Section..15	

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