EVM User's Guide: TAS5827EVM

TAS5827 Evaluation Module

Description

The Texas Instruments' TAS5827EVM evaluation module (EVM) helps designers evaluate the operation and performance of the TAS5827 Digital Input, Closed-Loop Class-D Amplifier. The TAS5827 is a stereo high-performance closed-loop Class-D amp with low power dissipation and advanced audio processing. The graphical user interface or GUI called PurePath™ Control Console 3 is used to interface with USB to the EVM. The EVM has optical SPDIF inputs, I2S, TDM, and audio inputs through the USB interface.

Get Started

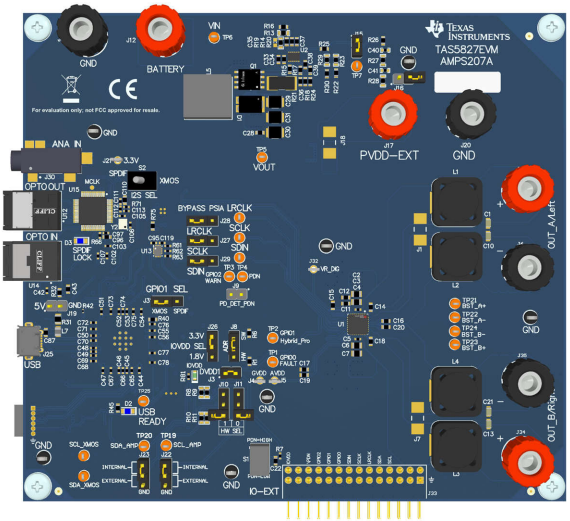
1. Order the TAS5827EVM
2. Download the latest version of the PurePath™ Control Console 3 GUI (PPC3) and request access to TAS5827-SW
3. Read the TAS5827EVM user's guide
4. Refer to the TAS5827 data sheet or E2E for questions and support

Features

- The integrated DSP of the TAS5827 enables Class-H envelope tracking, eliminating the need for development of complex tracking software or an external microcontroller
- Onboard LM5155 boost to evaluate Class-H efficiency performance and provide customer system design reference
- Default system configuration: 5 V battery input, boost to max 20 V power rail based on audio envelope tracking
- Optional hardware control mode to set switching frequency, analog gain, BTL/PBTL mode and Cycle by Cycle current limit through pin configuration
- Provides flexible input signal routing (USB, analog, optical and external I2S)
- Demonstration, evaluation and development environment via the PurePath Console 3 software (GUI)

Applications

- LCD TV, OLED TV, Mobile smart TV, Laser TV, Mobile smart TV
- Smart speakers, Smart displays, sound bars, wireless speakers
- Notebook PC, desktop PC/motherboard
- Piano, keyboard, synthesizer, professional speaker systems
- Professional conference systems, enterprise projectors



TAS5827EVM

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the operation of the TAS5827 Evaluation Modules (EVM). The TAS5827EVM is a stand-alone EVM. Use the PurePath Control Console 3 GUI (PPC3) to initialize and operate this EVM. To utilize the advanced processing features, use the TAS5827-SW to configure the DSP processing blocks, write I^2C commands

1.2 Kit Contents

- TAS5827EVM
- EVM Disclaimer Read Me

1.3 Specification

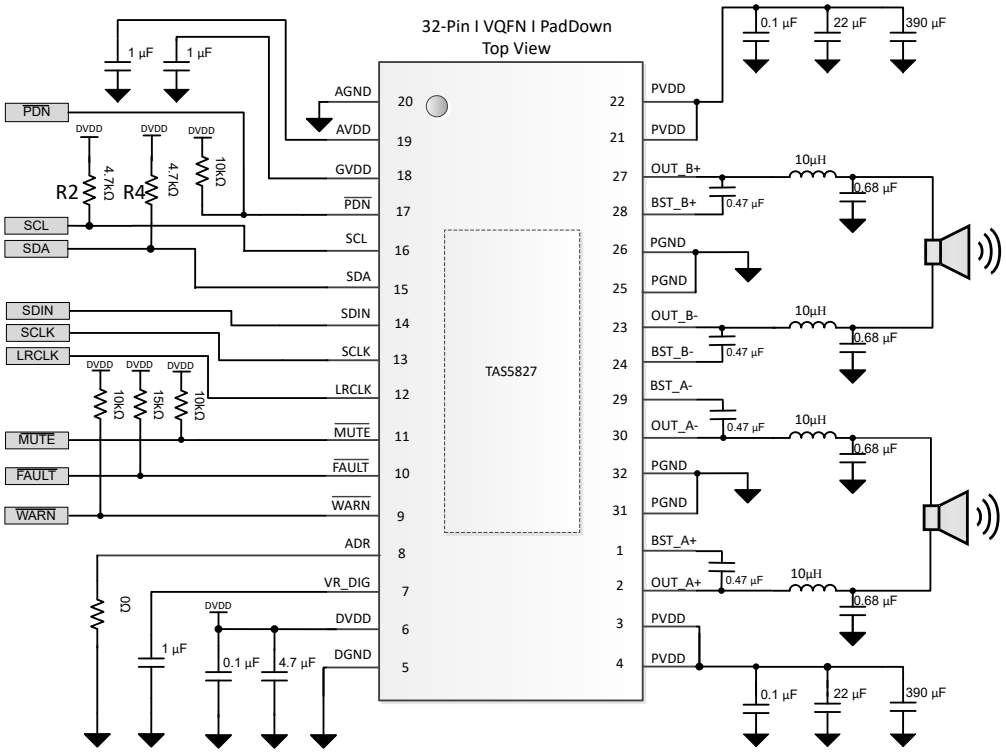


Figure 1-1. TAS5827 Simplified System Diagram

1.4 Device Information

The TAS5827EVM showcases the latest TI digital input Class-D closed loop amplifier. The TAS5827 is a digital input stereo high-efficiency Closed-Loop Class-D audio amplifier with an advanced Class-H algorithm to improve system efficiency and reduce heat without clipping distortion. The TAS5828EVM is a stand-alone EVM, which has an optional battery power supply input with LM5155 boost or external power supply input bypassing the LM5155 boost, USB control via PurePath Control Console 3 (PPC3), and flexible audio input options. The TAS5827EVM also can be configured using the Hardware control mode that supports setting switching frequency, analog gain, BTL/PBTL mode and Cycle by Cycle current limit threshold through pin configuration. This mode is especially designed to eliminate end system software driver integration efforts

2 Hardware

2.1 Setup

Software Control Mode

1. Connect speakers to TAS5827EVM.
2. Connect a PSU to the TAS5827EVM and turn on the power.
3. Plug in a USB cable from the PC to the TAS5827EVM. The USB READY LED (Blue) is also illuminated.
4. If an optical source is used, then he blue SPDIF LOCK LED is illuminated.
5. Make sure jumpers configuration are correct with the appropriate mode:

Table 2-1. Boost Jumpers Configurations

Jumper	Name	LM5155 Boost Mode Configurations	External Customer Boost Mode Configurations
J12, J13	Battery, GND	IN - Battery input	OUT
J17, J20	PVDD, GND	OUT	IN - External PVDD
J14	PVDD_LM5155	IN	OUT
J18	PVDD_EXT	OUT	IN
J16	BST_Bypass	OUT	OUT
J15	Ext_BST	IN	OUT

Table 2-2. Control Mode Jumpers Configurations

Jumper	Name	Software Control Mode	Hardware Control Mode
J8	ADR/HW	2-3 - SW(Default 0xC0 Address)	1-2 - HW
J10	SDA/HW_SEL0	OUT	1-2 or 2-3 as needed
J11	SCL/HW_SEL1	OUT	1-2 or 2-3 as needed

6. Initialize the TAS5827 device using PPC3 to begin playing audio and testing the different features.

Hardware Control Mode

1. Connect speakers to TAS5827EVM.
2. Make sure jumpers configuration are correct with the appropriate mode: See Table 2-1 and Table 2-2.
3. Configure S2 to SPDIF input source.
4. Note, that in Hardware Control mode or some configurations, the appropriate resistors needs to be modified on the EVM.
5. Connect a PSU to the TAS5827EVM and turn on the power.
6. If an optical source is used, the blue SPDIF LOCK LED is illuminated.

2.1.1 I²C Device Addresses

The default 7-bit I²C address on the EVM is set to 0xC0 for the only one TAS5827 device.

2.2 Header & Jumper Information

Table 2-3. TAS5827 Circuit Jumpers

Designator	Name	Positions	Description
J3	DVDD1	IN: Default, IOVDD supplies DVDD OUT: DVDD disconnected	Drives the digital power supply for the TAS5827. If DVDD current draw wants to be measured need to externally drive DVDD to pin 2
J4	GVDD	N/A	Gate drive internal regulator output
J5	AVDD	N/A	Internally regulated 5-V analog supply voltage
J8	ADR/HW	1-2: Hardware Mode 2-3: Default, I2C Mode with 0xC0 as address	When shorted, DVDD puts the TAS5827 into Hardware Mode which also changes other pin functionality in the device. In Software mode, depending on the resistance value and connection changes the I2C Peripheral address
J9	PD_DET-PDN	IN: Connects PDN and PD_DET, for use only in Hardware Mode OUT: Default	This connection is for use in Hardware mode, which shorts PDN and PD_DET pin to turn off the device when the PVDD drops below 8 V
J10	SDA/HW_SEL1	1-2: Default 2-3: Hardware Mode	Default configuration has pull-up for the I2C SDA. In Hardware mode, controls PWM Switching Frequency and Spread Spectrum Enable/Disable selection
J11	SCL/HW_SEL0	1-2: Default 2-3:Hardware Mode	Default configuration has pull-up for the I2C SCL. In Hardware mode controls Analog gain and BTL/PBTL mode selection
J32	VR_DIG	N/A	Internally regulated 1.5-V digital supply voltage. Dependent on DVDD

Table 2-4. J10: Hardware Control - HW_SEL1 Pin6

R10(GND)	R8(DVDD)	F_{SW}&Class D Loop Bandwidth	Cycle By Cycle Current Limit Threshold	Spread Spectrum	Modulation
0 Ω	DNP	768 kHz F_{SW}, 175 kHz BW	CBC Threshold = 80% OCP	Disable	1SPW
1 kΩ	DNP	768 kHz F_{SW}, 175 kHz BW	CBC Disable	Disable	1SPW
4.7 kΩ	DNP	768 kHz F_{SW}, 175 kHz BW	CBC Threshold = 40% OCP	Disable	1SPW
15 kΩ	DNP	768 kHz F_{SW}, 175 kHz BW	CBC Threshold = 60% OCP	Disable	1SPW
DNP	33 kΩ	480 kHz F_{SW}, 100 kHz BW	CBC Disable	Enable	BD
DNP	6.8 kΩ	480 kHz F_{SW}, 100 kHz BW	CBC Threshold = 80% OCP	Enable	BD
DNP	1.5 kΩ	480 kHz F_{SW}, 100 kHz BW	CBC Threshold = 40% OCP	Enable	BD
DNP	0 Ω	480 kHz F_{SW}, 100 kHz BW	CBC Threshold = 60% OCP	Enable	BD

Table 2-5. J11: Hardware Control - HW_SEL0 Pin5

R11 (GND)	R9 (DVDD)	Analog Gain	H-Bridge Output Configuration
0 Ω	DNP	29.5 V_P/FS	BTL
1 kΩ	DNP	20.9 V_P/FS	BTL
4.7 kΩ	DNP	14.7 V_P/FS	BTL
15 kΩ	DNP	7.4 V_P/FS	BTL
DNP	33 kΩ	7.4 V_P/FS	PBTL
DNP	6.8 kΩ	14.7 V_P/FS	PBTL
DNP	1.5 kΩ	20.9 V_P/FS	PBTL
DNP	0 Ω	29.5 V_P/FS	PBTL

Table 2-6. XMOS Circuit Jumpers

Designator	Name	Position	Description
J22	SCL	1-2: Default, PPC3 drives XMOS I2C bus to the TAS5827 OUT: Use Pin 1 and 3 to drive SCL externally to the TAS5827 on the EVM	The SCL Jumper offers a few options to provide or receive I2C signals. Default configuration connects the XMOS I2C bus to the TAS5827 to configure the device with PPC3. Disconnecting the jumper allows for the XMOS I2C bus to be connected to an external TAS5827 system board to configure that device with PPC3 using pins 2 and 3. Alternatively can use an external I2C bus to drive the TAS5827 on the EVM using pins 1 and 3.
J23	SDA	1-2: Default, PPC3 drives XMOS I2C bus to TAS5827 OUT: Use Pin 1 and 3 to drive SDA externally to the TAS5827 on the EVM	The SDA Jumper offers a few options to provide or receive I2C signals. Default configuration connects the XMOS I2C bus to the TAS5827 to configure the device with PPC3. Disconnecting the jumper allows for the XMOS I2C bus to be connected to an external TAS5827 system board to configure that device with PPC3 using pins 2 and 3. Alternatively can use an external I2C bus to drive the TAS5827 on the EVM using pins 1 and 3.

Table 2-7. Audio Input IO Circuit Jumpers & Switches

Designator	Name	Positions	Description
J26	IOVDD	1-2: 1.8V IOVDD 2-3: Default, 3.3V IOVDD	Sets the IOVDD voltage for the Digital Interfaces
J27	SCLK	1-2: Default, Bypass mode that sends SPDIF/ XMOS I2S input to the TAS5827 2-3: Connect external PSIA connector to Pin 2-3 to drive input to TAS5827	Sets the SCLK input to be driven internally using USB/Optical input or driven externally with a PSIA connector
J28	LRCLK	1-2: Default, Bypass mode that sends SPDIF/ XMOS I2S input to the TAS5827 2-3: Connect external PSIA connector to Pin 2-3 to drive input to TAS5827	Sets the LRCLK input to be driven internally using USB/Optical input or driven externally with a PSIA connector
J29	SDIN	1-2: Default, Bypass mode that sends SPDIF/ XMOS I2S input to the TAS5827 2-3: Connect external PSIA connector to Pin 2-3 to drive input to TAS5827	Sets the SDIN input to be driven internally using USB/Optical input or driven externally with a PSIA connector
J31	GPIO1 SEL	1-2: Default, sends the SDOUT data to the XMOS 2-3: Sends SDOUT Data to SPIDIF Optical Output	If the device is not using the Class-H feature, then this jumper can be using to sent the output I2S/TDM data to an external source of either the XMOS & USB or the optical output

Table 2-8. Power Supply Circuit Jumpers

Designator	Name	Positions	Description
J15	Ext_BST	IN: Default, TAS5827 Class H PWM output drives the LM5155 Boost voltage through the Feedback Pin OUT: Disconnect Class H PWM signal	This jumper is used to connect the LM5155 Feedback Pin to the voltage generated by the Class H PWM Control Signal of the TAS5827
J16	BST_Bypass	IN: Max BST Output OUT: Default	When the device is using Class-H, shorting the BST Bypass jumper sets the LM5155 Boost to the max Boost Output
J19	5 V	OUT: Connections for external 5 V and GND connection	If the USB Power that drives the 5V rail is disconnected, this can be driven externally using this header
J21	3.3V	N/A	The 3.3V rail used to power various components on the EVM. R33 can be removed and the 3.3V driven externally to analyze current draw of this rail.

Table 2-9. J33: IO-EXT Pin Description

Number	Name	Description
All odd pins (1 to 27)	GND	Ground connection
2,4,6,26	N/A	Unused floating pins
8	AMP_SCL	I²C serial control clock input for the TAS5827
10	AMP_SDA	I²C serial control clock input for the TAS5827
12	LRCLK	I²S/TDM Frame Clock
14	SCLK	I²S/TDM Bit Clock
16	SDIN	I²S/TDM Data
20	GPIO_$\overline{\text{FAULT}}$	General-purpose input/output configured to be the active-low Fault pin
22	GPIO1_Hybrid_Pro	General-purpose input/output configured to be the Class-H PWM control pin
24	GPIO2_$\overline{\text{WARN}}$	General-purpose input/output configured to be the active-low warning pin
26	$\overline{\text{PDN}}$	Power down, active-low. PDN place the amplifier in Shutdown, turn off all internal regulators.
28	IOVDD	The 3.3V or 1.8V digital power supply

2.3 Test Points

Table 2-10. Test Points

Designator	Name	Description
TP1	GPIO0_FAULTz	Fault terminal,which is pulled LOW when an internal fault occurs.
TP2	GPIO1_Hybrid_Pro	General-purpose input/output configured to be the Class-H PWM control pin.
TP3	GPIO2_PD_DET	PVDD Drop detection, which is pulled LOW when the PVDD drop below 8 V.
TP4	PDN	Power down, active-low. PDN place the amplifier in Shutdown, turn off all internal regulators.
TP5	VIN	Battery input voltage into the LM5155.
TP6	VOUT	LM5155 boost output voltage
TP7	FB	LM5155 Feedback pin used to control the output boost voltage
TP13	SCL_XMOS	Probe point for the I2C serial clock input going generated by the XMOS.
TP14	SDA_XMOS	The I2C serial control data interface input/output generated by the XMOS.
TP16	SCLK	Bit clock for the digital signal that is active on the input data line of the serial data port.
TP17	LRCLK	Word select clock for the digital signal that is active on the serial port's input data line. In I2S, LJ and RJ, this corresponds to the left channel and right channel boundary. In TDM mode, this corresponds to the frame sync boundary.
TP18	SDIN	Data line to the serial data port.
TP19	SCL_AMP	Probe point for the I2C serial clock input going into the TAS5827.
TP20	SDA_AMP	The I2C serial control data interface input/output going into the TAS5827.
TP21	BST_A+	The voltage at the OUT_A+ bootstrap capacitor which is used to create a power supply for the high-side gate drive for OUT_A+.
TP22	BST_A-	The voltage at the OUT_A- bootstrap capacitor which is used to create a power supply for the high-side gate drive for OUT_A-.
TP23	BST_B+	The voltage at the OUT_B+ bootstrap capacitor which is used to create a power supply for the high-side gate drive for OUT_B+.
TP24	BST_B-	The voltage at the OUT_B- bootstrap capacitor which is used to create a power supply for the high-side gate drive for OUT_B-.
TP25	1 V	The 1 V rail used in the XMOS.
All other TP	GND	Ground reference pins for probes.

3 Hardware Design Files

3.1 Schematics

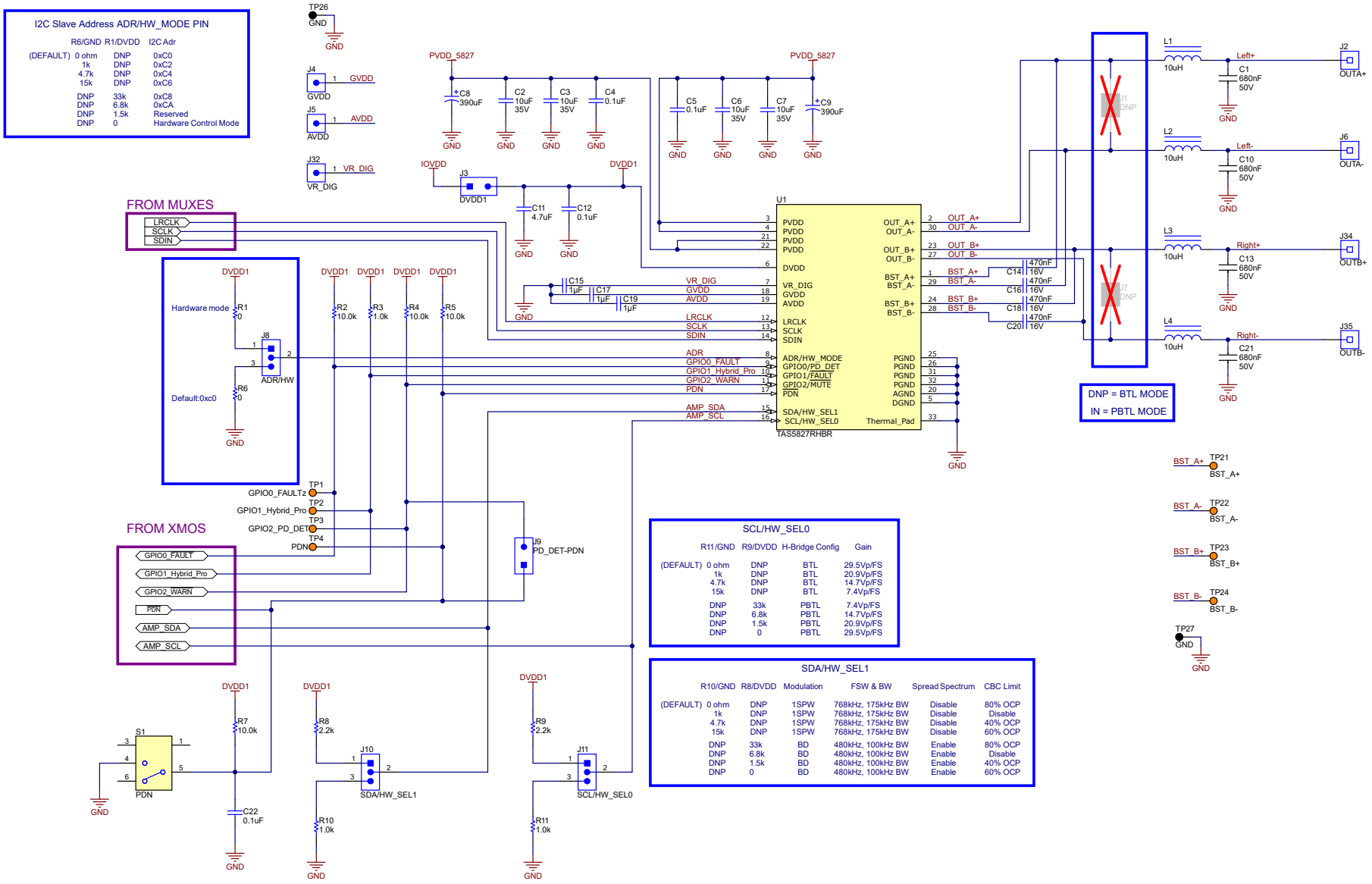


Figure 3-1. TAS5827EVM Schematic (1 of 5)

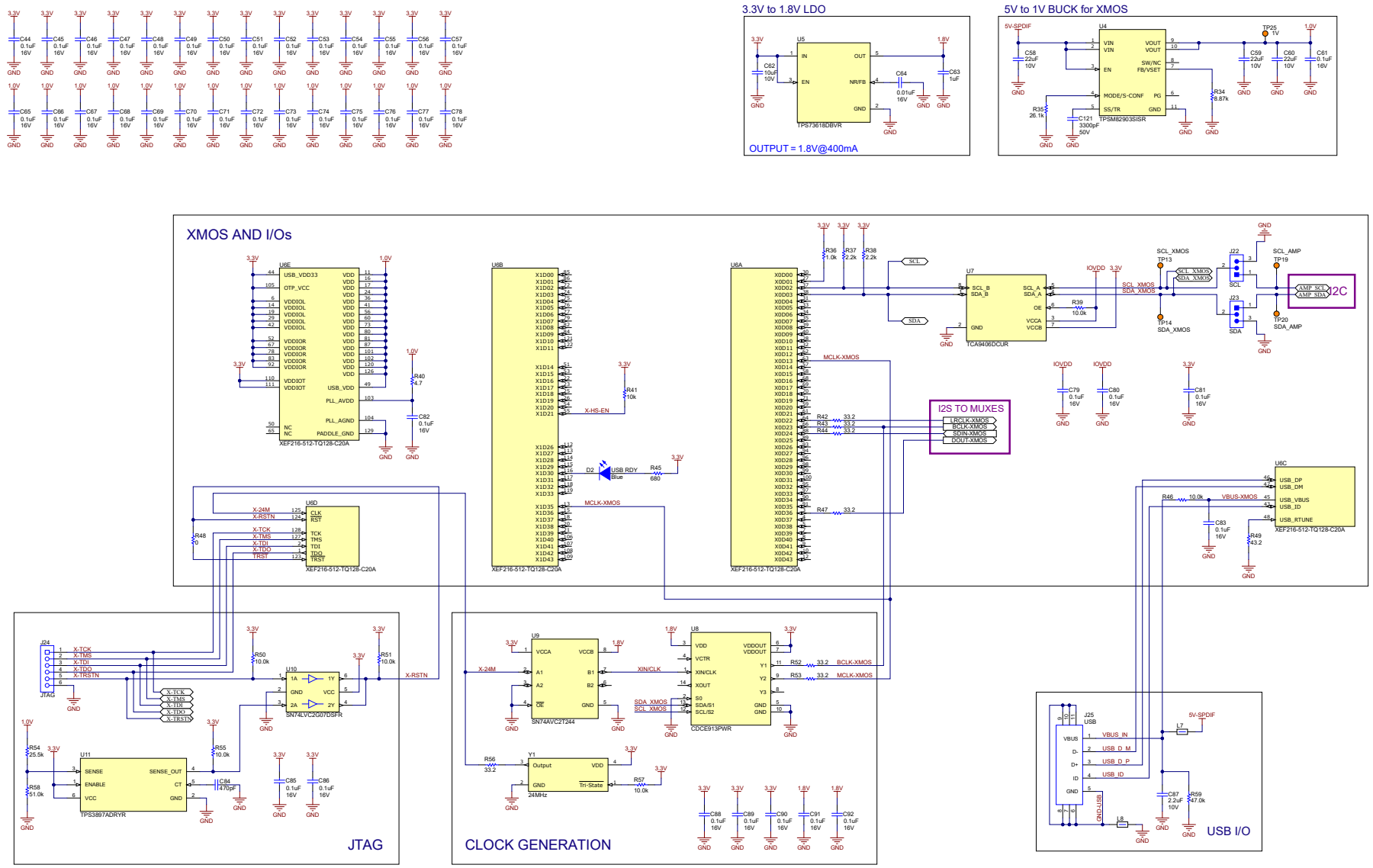


Figure 3-2. TAS5827EVM Schematic (2 of 5)

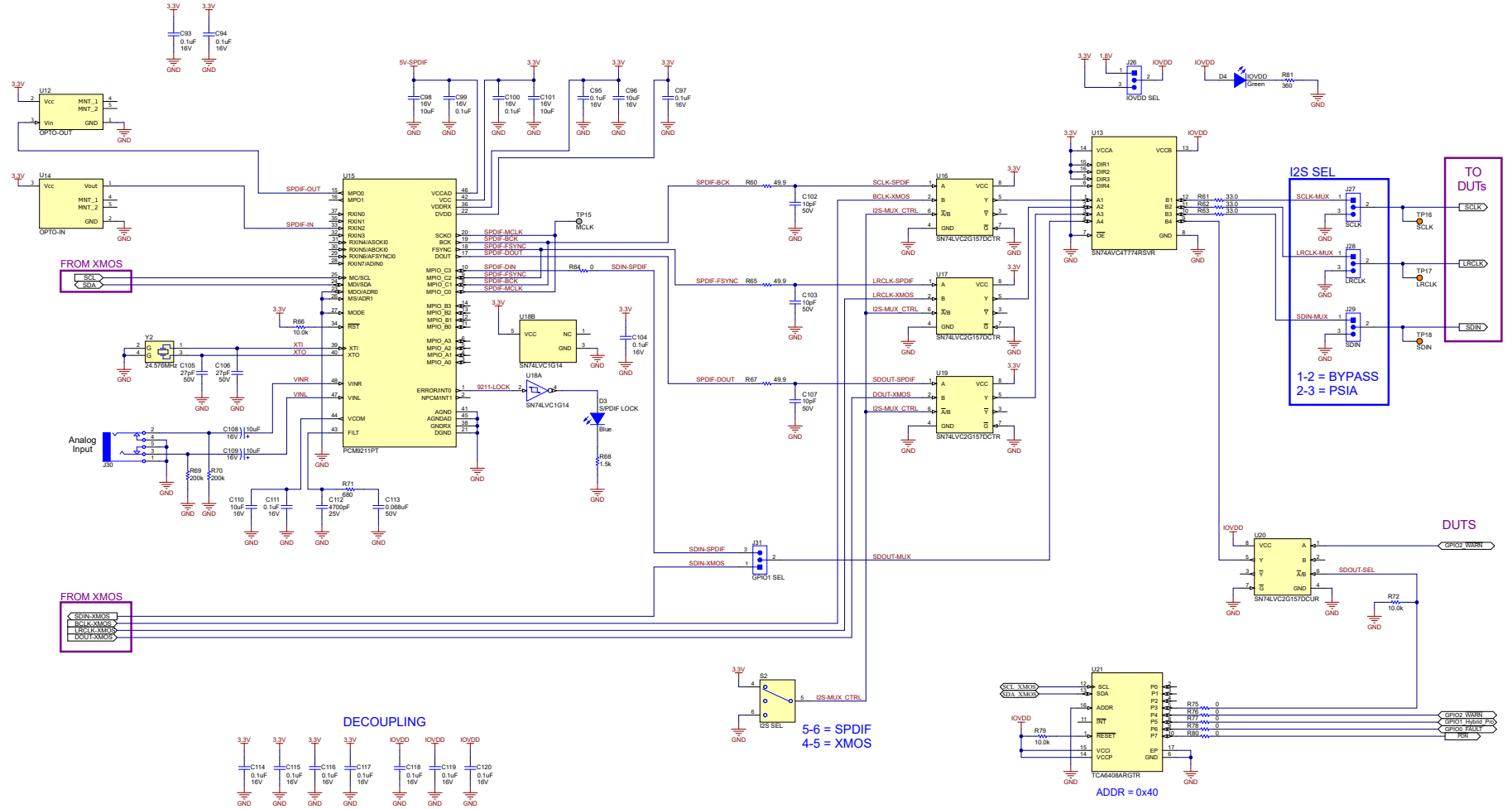


Figure 3-3. TAS5827EVM Schematic (3 of 5)

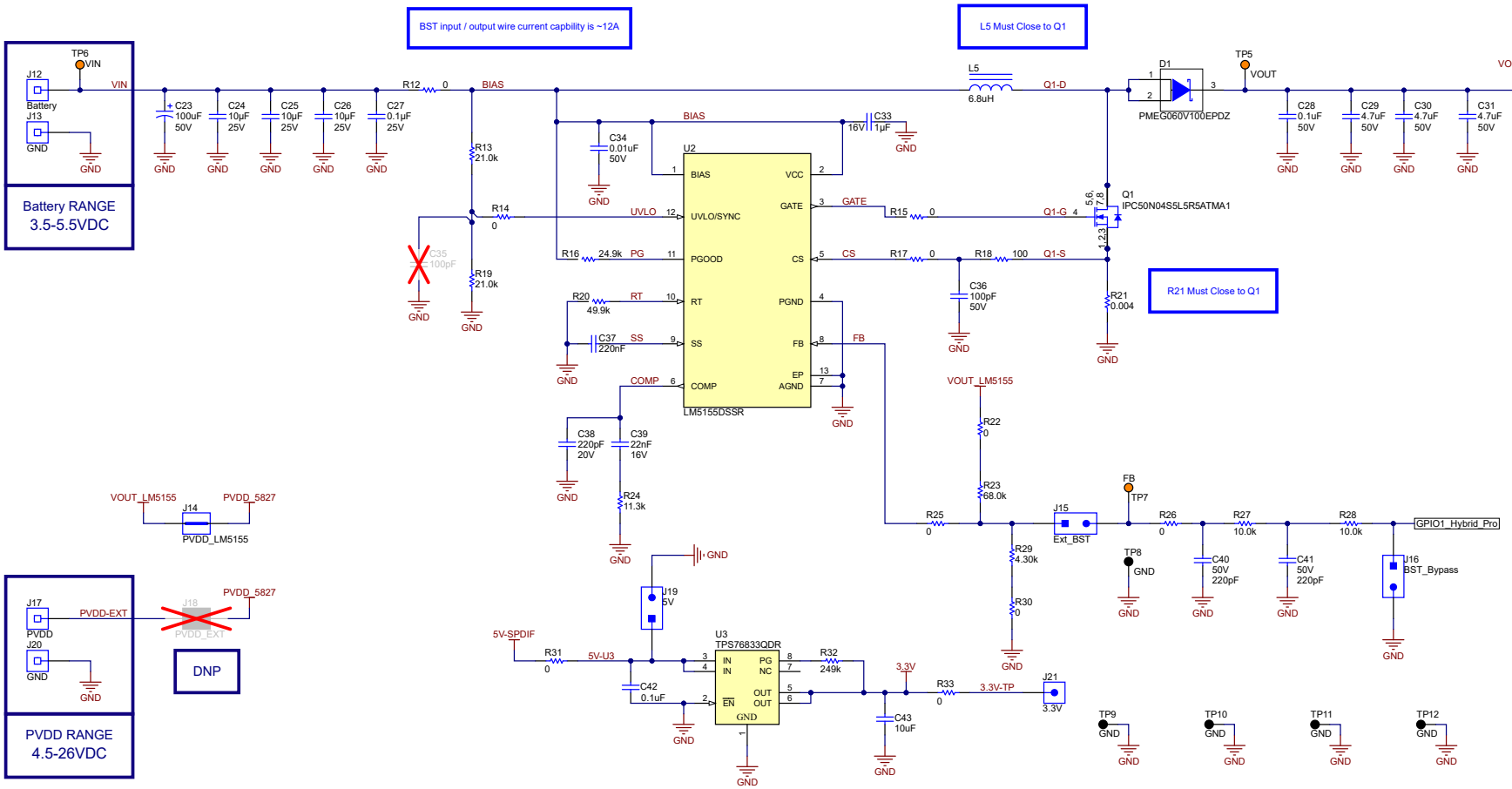


Figure 3-4. TAS5827EVM Schematic (4 of 5)

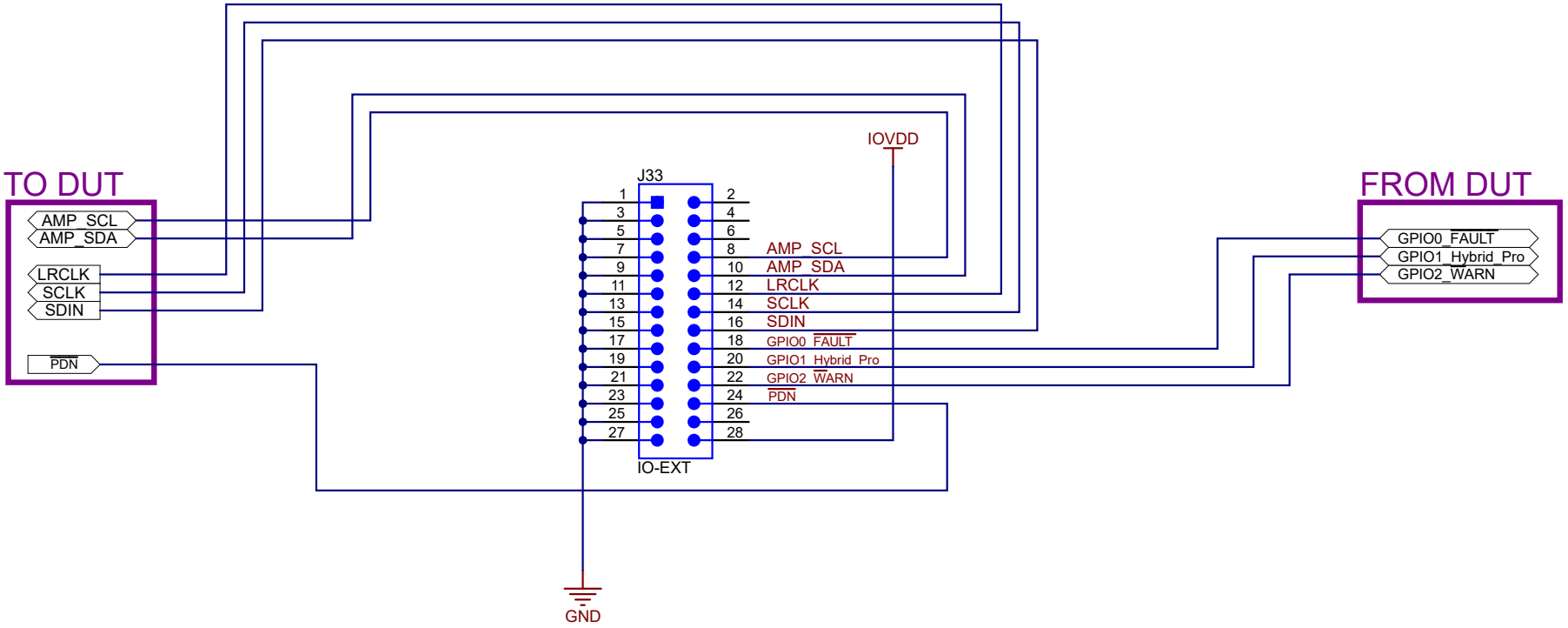


Figure 3-5. TAS5827EVM Schematic (5 of 5)

3.2 PCB Layout

Figure 3-6 and Figure 3-7 illustrate the board layouts for the EVM.

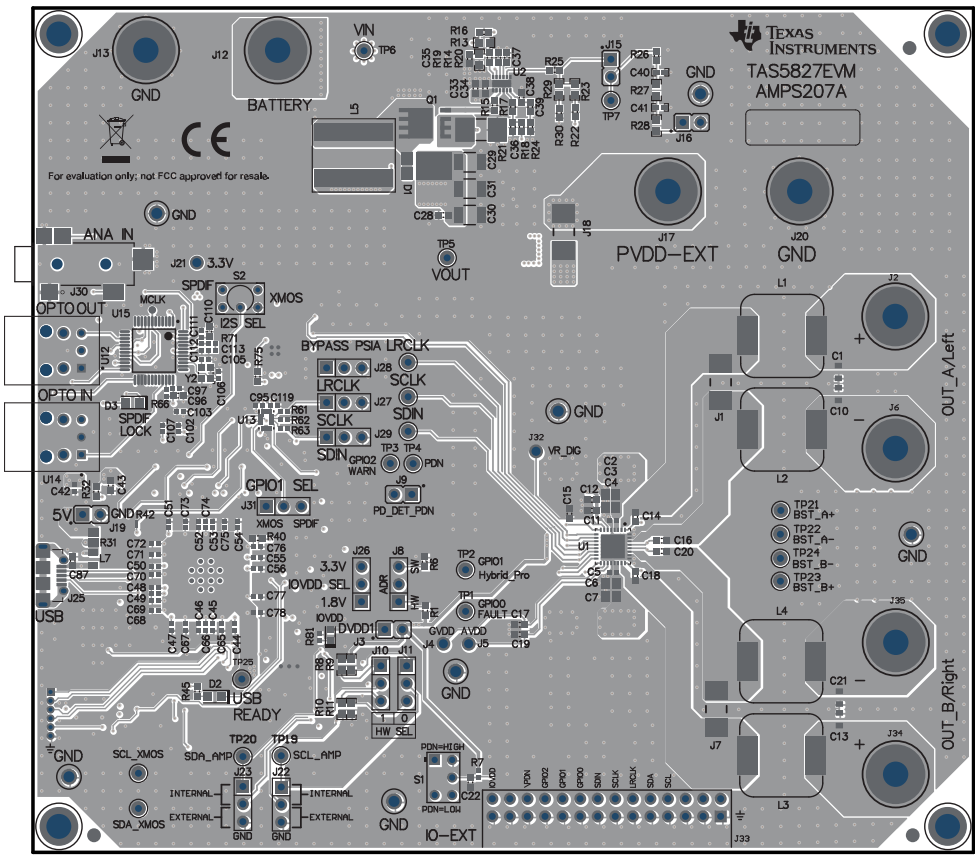


Figure 3-6. TAS5827EVM Top Overlay

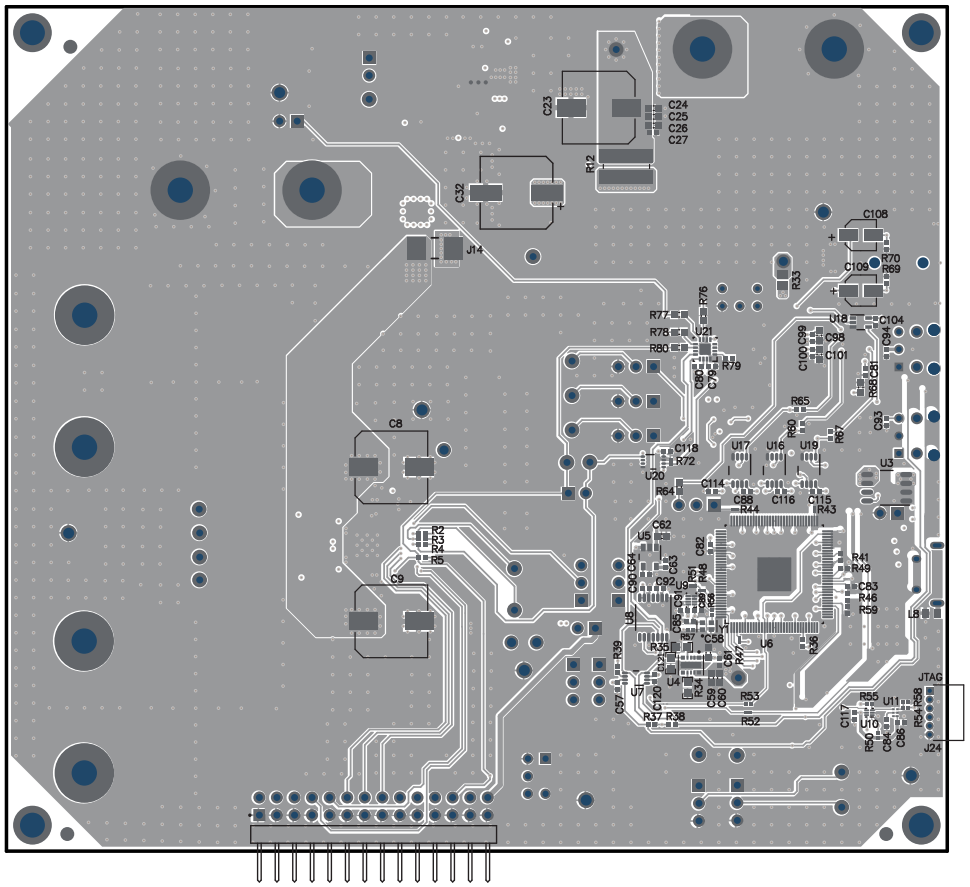


Figure 3-7. TAS5827EVM Bottom Overlay

3.3 Bill of Materials

Table 3-1. Bill of Materials

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
C1, C10, C13, C21	4		CAP CER 0.68UF 50 V X7R 0805	0805	CGA4J3X7R1H684M125AB	TDK Corporation		
C2, C3, C6, C7	4	10uF	CAP, CERM, 10 uF, 35 V, +/- 10%, X5R, 0805	0805	C2012X5R1V106K085AC	TDK	GMC21X5R106K35NT	CAL-CHIP ELECTRONICS, INC.
C4, C5	2	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	CGA2B3X7R1H104K050BB	TDK		
C8, C9	2	390uF	CAP, AL, 390 uF, 35 V, +/- 20%, 0.08 ohm, SMD	10x10	UCL1V391MNL1GS	Nichicon		
C11	1	4.7uF	CAP, CERM, 4.7 uF, 10 V, +/- 10%, X5R, 0603	0603	C0603C475K8PAC7867	Kemet		
C12, C22	2	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0603	0603	C0603C104K4RAC7867	Kemet		
C14, C16, C18, C20	4	0.47uF	CAP, CERM, 0.47 uF, 16 V, +/- 10%, X7R, 0603	0603	C0603C474K4RAC7867	Kemet		
C15, C17, C19	3	1uF	CAP, CERM, 1 µF, 16 V,+/- 20%, X7R, 0603	0603	CL10B105MO8NNWC	Samsung		
C23	1	100uF	CAP, Polymer Hybrid, 100 uF, 50 V, +/- 20%, 28 ohm, 10x10 SMD	10x10	EEH-ZC1H101P	Panasonic	HZA107M050G24VT-F	Cornell Dubilier Electronics (CDE)
C24, C25, C26	3	10uF	CAP, CERM, 10 µF, 25 V,+/- 10%, X5R, 0603	0603	GRM188R61E106KA73D	MuRata	GMC10X5R106K25NT	CAL-CHIP ELECTRONICS, INC.
C27	1	0.1uF	CAP, CERM, 0.1 µF, 25 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	CGA2B3X7R1E104K050BB	TDK		
C28	1	0.1uF	CAP, CERM, 0.1 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E2X7R1H104K080AA	TDK		
C29, C30, C31	3	4.7uF	CAP, CERM, 4.7 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 1210	1210	CGA6P3X7R1H475K250AB	TDK		
C32	1	100uF	CAP, Aluminum Polymer, 100 uF, 50 V, +/- 20%, 0.025 ohm, AEC-Q200 Grade 2, D10xL10mm SMD	D10xL10mm	HHXB500ARA101MJA0G	Chemi-Con	HZA107M050G24VT-F	Cornell Dubilier Electronics (CDE)

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
C33	1	1uF	CAP, CERM, 1 uF, 16 V, +/- 20%, X7R, AEC-Q200 Grade 1, 0603	0603	GCM188R71C105MA64D	MuRata		
C34	1	0.01uF	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0603	0603	CL10B103KB8NNNC	Samsung Electro-Mechanics		
C36	1	100 pF	CAP, CERM, 100 pF, 50 V,+/- 1%, C0G/NP0, 0603	0603	C0603C101F5GAC7867	Kemet		
C37	1	0.22uF	CAP, CERM, 0.22 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H224K080AB	TDK		
C38	1	220 pF	CAP, CERM, 220 pF, 20 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0603	0603	CGA3E2C0G1H221J080AA	TDK		
C39	1	0.022uF	CAP, CERM, 0.022 uF, 16 V, +/- 10%, X7R, 0603	0603	C0603C223K4RAC7867	Kemet		
C40, C41	2	220 pF	CAP, CERM, 220 pF, 50 V,+/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0402	0402	CGA2B2C0G1H221J050BA	TDK		
C42, C44, C45, C46, C47, C48, C49, C50, C51, C52, C53, C54, C55, C56, C57, C61, C65, C66, C67, C68, C69, C70, C71, C72, C73, C74, C75, C76, C77, C78, C79, C80, C81, C82, C83, C85, C86, C88, C89, C90, C91, C92, C93, C94, C95, C97, C99, C100, C104, C111, C114, C115, C116, C117, C118, C119, C120	57	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	0402	885012205037	Wurth Elektronik		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
C43, C62	2	10uF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A106M080AC	TDK		
C58, C59, C60	3	22uF	CAP, CERM, 22 uF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A226M080AC	TDK		
C63	1	1uF	CAP, CERM, 1 uF, 6.3 V, +/- 20%, X5R, 0402	0402	GRM152R60J105ME15D	MuRata		
C64	1	0.01uF	CAP, CERM, 0.01 uF, 16 V, +/- 10%, X7R, 0402	0402	885012205031	Wurth Elektronik		
C84	1	470 pF	CAP, CERM, 470 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1H471JA01D	MuRata		
C87	1	2.2uF	CAP, CERM, 2.2 uF, 10 V, +/- 10%, X7R, 0603	0603	GRM188R71A225KE15D	MuRata		
C96, C98, C101, C110	4	10uF	CAP, CERM, 10 uF, 16 V, +/- 20%, X5R, 0603	0603	EMK107BBJ106MA-T	Taiyo Yuden	GMC10X5R106M16NT	CAL-CHIP ELECTRONICS, INC.
C102, C103, C107	3	10 pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	885012005055	Wurth Elektronik		
C105, C106	2	27 pF	CAP, CERM, 27 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GJM1555C1H270JB01D	MuRata		
C108, C109	2	10uF	CAP, AL, 10 uF, 16 V, +/- 20%, SMD	D55	EMVE160ARA100MD55G	Chemi-Con	UWX1C100MCL1GB	Nichicon
C112	1	4700 pF	CAP, CERM, 4700 pF, 25 V,+/- 10%, X7R, 0402	0402	CC0402KRX7R8BB472	Yageo		
C113	1	0.068uF	CAP, CERM, 0.068 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0402	0402	CGA2B3X7R1H683K050BB	TDK		
C121	1	3300 pF	CAP, CERM, 3300 pF, 50 V, +/- 5%, C0G/NP0, 0603	0603	GRM1885C1H332JA01D	MuRata		
D1	1	60 V	Diode, Schottky, 60 V, 10 A, AEC-Q101, CFP15	CFP15	PMEG060V100EPDZ	Nexperia	V10PM6-M3/H	Vishay General Semiconductor - Diodes Division
D2, D3	2	Blue	LED, Blue, SMD	LED_0805	LTST-C170TBKT	Lite-On		
D4	1	Green	LED, Green, SMD	LED_0603	150060GS75000	Wurth Elektronik		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
H2, H3, H4, H5	4		MACHINE SCREW PAN PHILLIPS M3	M3 Screw	RM3X8MM 2701	APM HEXSEAL		
H6, H7, H8, H9	4		Standoff, Hex, 12 mm, M3, Aluminum	Aluminum M3 12 mm Hex Standoff	24434	Keystone		
J2, J12, J17, J34	4		Binding Post, RED, TH	11.4x27.2mm	7006	Keystone		
J3, J9, J15, J16, J19	5		Header, 100mil, 2x1, Gold, TH	Sullins 100mil, 1x2, 230 mil above insulator	PBC02SAAN	Sullins Connector Solutions		
J4, J5, J21, J32	4			Test point, TH Slot Test point	1040	Keystone		
J6, J13, J20, J35	4		Binding Post, BLACK, TH	11.4x27.2mm	7007	Keystone		
J8, J10, J11, J22, J23, J26, J27, J28, J29, J31	10		Header, 100mil, 3x1, Gold, TH	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions		
J14	1		JUMPER TIN SMD	6.85x0.97x2.51 mm	S1911-46R	Harwin		
J24	1		Receptacle, 50mil, 6x1, Gold, R/A, TH	6x1 Receptacle	LPPB061NGCN-RC	Sullins Connector Solutions		
J25	1		Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	5.6x2.5x8.2mm	0475890001	Molex		
J30	1		Audio Jack, 3.5mm, Stereo, R/A, SMT	Phone Jack, 6x5x17mm	35RASMT4BHNTRX	Switchcraft		
J33	1		Header, 100mil, 14x2, Gold, R/A, TH	14x2 R/A Header	TSW-114-08-G-D-RA	Samtec		
L1, L2, L3, L4	4	10uH	Inductor, Shielded Drum Core, Ferrite, 10 uH, 7.1 A, 0.01294 ohm, SMD	SMD	7447709100	Wurth Elektronik		
L5	1	6.8uH	Inductor, Shielded, Composite, 6.8 uH, 18.5 A, 0.01 ohm, SMD	Inductor, 11.3x10x10mm	XAL1010-682MEB	Coilcraft		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
L7, L8	2	600 ohm	Ferrite Bead, 600 ohm @ 100 MHz, 2 A, 0805	0805	MPZ2012S601AT000	TDK		
LBL1	1		Thermal Transfer Printable Labels, 0.650	PCB Label 0.650 x 0.200 inch	THT-14-423-10	Brady		
Q1	1	40 V	MOSFET, N-CH, 40 V, 50 A, AEC-Q101, SON-8	SON-8	IPC50N04S5L5R5ATMA1	Infineon Technologies	CSD18510Q5B	Texas Instruments
R1, R6, R15, R17, R22, R25, R26, R30, R75, R76, R77, R78, R80	13	0	RES, 0, 5%, 0.1 W, 0603	0603	RC0603JR-070RL	Yageo		
R2	1	15.0k	RES, 15.0 k, .1%, .063 W, AEC-Q200 Grade 0, 0402	0402	ERA-2AEB153X	Panasonic		
R3, R36	2	1.0k	RES, 1.0 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021K00JNED	Vishay-Dale	CRCW04021K00JNTD	Vishay Dale
R4, R5, R7, R66, R79	5	10.0k	RES, 10.0 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0FKED	Vishay-Dale		
R8, R9	2	2.2k	RES, 2.2 k, 5%, 0.1 W, 0603	0603	RC0603JR-072K2L	Yageo		
R10, R11	2	1.0k	RES, 1.0 k, 5%, 0.1 W, 0603	0603	RC0603JR-071KL	Yageo		
R12	1	0	RES, 0, 5%, 2 W, 2512 WIDE	2512 WIDE	RCL12250000Z0EG	Vishay Draloric		
R13, R19	2	21.0k	RES, 21.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0721KL	Yageo		
R14, R64	2	0	RES, 0, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	RMCF0603ZT0R00	Stackpole Electronics Inc		
R16	1	24.9k	RES, 24.9 k, 1%, 0.1 W, 0603	0603	RC0603FR-0724K9L	Yageo		
R18	1	100	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo		
R20	1	49.9k	RES, 49.9 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060349K9FKEA	Vishay-Dale		
R21	1	4.000000000000001E-3	RES, 0.004, 1%, 3 W, AEC-Q200 Grade 0, 6.4x3.2mm	6.4x3.2mm	ERJ-MS4SF4M0U	Panasonic	TLRP3A30WR004FTE	TE Connectivity Passive Product
R23	1	68.0k	RES, 68.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0768KL	Yageo		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
R24	1	11.3k	RES, 11.3 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060311K3FKEA	Vishay-Dale		
R27, R28	2	10.0k	RES, 10.0 k, 1%, 0.1 W, 0603	0603	ERJ-3EKF1002V	Panasonic		
R29	1	4.30k	RES, 4.30 k, 1%, 0.1 W, 0603	0603	RC0603FR-074K3L	Yageo		
R31, R33	2	0	RES, 0, 5%, 0.125 W, 0805	0805	RC0805JR-070RL	Yageo America		
R32	1	249k	RES, 249 k, 1%, 0.1 W, 0603	0603	RC0603FR-07249KL	Yageo		
R34	1	8.87k	RES, 8.87 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06038K87FKEA	Vishay-Dale		
R35	1	26.1k	RES, 26.1 k, 0.1%, 0.1 W, 0603	0603	RT0603BRD0726K1L	Yageo America		
R37, R38	2	2.2k	RES, 2.2 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04022K20JNED	Vishay-Dale		
R39, R46	2	10.0k	RES, 10.0 k, 1%, 0.1 W, 0402	0402	ERJ-2RKF1002X	Panasonic	ERJ-U02F1002X	Panasonic
R40	1	4.7	RES, 4.7, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06034R70JNEA	Vishay-Dale		
R41	1	10k	RES, 10 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040210K0JNED	Vishay-Dale	ERJ-U02F1002X	Panasonic
R42, R43, R44, R47, R52, R53, R56	7	33.2000000000000003	RES, 33.2, 1%, 0.05 W, 0201	0201	RC0201FR-0733R2L	Yageo America		
R45	1	680	RES, 680, 1%, 0.1 W, 0603	0603	RC0603FR-07680RL	Yageo		
R48	1	0	RES, 0, 5%, .05 W, AEC-Q200 Grade 0, 0201	0201	ERJ-1GN0R00C	Panasonic		
R49	1	43.2	RES, 43.2, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	0402	ERJ2RKF43R2X	Panasonic		
R50, R51, R55, R57, R72	5	10.0k	RES, 10.0 k, 1%, 0.05 W, 0201	0201	CRCW020110K0FKED	Vishay-Dale		
R54	1	25.5k	RES, 25.5 k, 1%, 0.05 W, 0201	0201	RC0201FR-0725K5L	Yageo America		
R58	1	51.0k	RES, 51.0 k, 1%, 0.05 W, 0201	0201	RC0201FR-0751KL	Yageo America		
R59	1	47.0k	RES, 47.0 k, 1%, 0.0625 W, 0402	0402	RC0402FR-0747KL	Yageo America		
R60, R65, R67	3	49.9	RES, 49.9, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW040249R9FKED	Vishay-Dale	CRCW040249R9FKEDC	Vishay-Dale

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
R61, R62, R63	3	33	RES, 33.0, 1%, 0.1 W, 0402	0402	ERJ-2RKF33R0X	Panasonic	ERJ-U02F33R0X	Panasonic
R68	1	1.5k	RES, 1.5 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K50JNEA	Vishay-Dale	CRCW06031K50JNEAC	Vishay-Dale
R69, R70	2	200k	RES, 200 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402200KJNED	Vishay-Dale		
R71	1	680	RES, 680, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402680RJNED	Vishay-Dale		
R81	1	360	RES, 360, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW0402360RJNED	Vishay-Dale		
S1	1		Switch, SPDT, On-On, 2 Pos, TH	Switch, 7x4.5mm	200USP1T1A1M2RE	E-Switch		
S2	1		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, SH-J9, SH-J10, SH-J11, SH-J12, SH-J13	13	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP13, TP14, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24, TP25	19		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone Electronics		
TP8, TP9, TP10, TP11, TP12, TP26, TP27	7		Test Point, Compact, Black, TH	Black Compact Testpoint	5006	Keystone Electronics		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
U1	1		43-W Stereo, Digital Input, High Efficiency Closed-Loop Class-D Amplifier with Class-H Algorithm	VQFN32	TAS5827RHBR	Texas Instruments		
U2	1		2.2-MHz Wide Input Nonsynchronous Boost, Sepic, Flyback Controller, DSS0012B (WSON-12)	DSS0012B	LM5155DSSR	Texas Instruments	LM5155DSST	Texas Instruments
U3	1		Single Output Fast Transient Response LDO, 1 A, Fixed 3.3 V Output, 2.7 to 10 V Input, with Low IQ, 8-pin SOIC (D), -40 to 125 degC, Green (RoHS & no Sb/Br)	D0008A	TPS76833QDR	Texas Instruments		
U4	1		3-V to 17-V, High Efficiency and Low IQ Buck Converter Module in MicroSiP Package with Integrated Inductor	uSiL11	TPSM82903SISR	Texas Instruments		
U5	1		Single Output LDO, 400 mA, Adj. (1.2 to 5.5V), Cap free, Low Noise, Reverse Current Protection, DBV0005A (SOT-23-5)	DBV0005A	TPS73618DBVR	Texas Instruments		
U6	1		XCore XEF Microcontroller IC 32-Bit 16-Core 2000MIPs 2MB (2M x 8) FLASH 128-TQFP (14x14)	TQFP128	XEF216-512-TQ128-C20A	XMOS		
U7	1		2-Bit Bidirectional 1-MHz I2C Bus and SMBus Voltage-Level Shifter, DCU0008A (VSSOP-8)	DCU0008A	TCA9406DCUR	Texas Instruments		
U8	1		Programmable 1-PLL VCXO Clock Synthesizer with 2.5-V or 3.3-V LVCMOS Outputs, PW0014A (TSSOP-14)	PW0014A	CDCE913PWR	Texas Instruments	CDCE913PW	Texas Instruments
U9	1		Dual-Bit Dual-Supply Bus Transceiver, DQM0008A (X2SON-8)	DQM0008A	SN74AVC2T244DQMR	Texas Instruments		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
U10	1		Enhanced Product Dual Buffer/Driver with Open-Drain Output, DCK0006A (SOT-SC70-6)	DSF0006A	SN74LVC2G07DSFR	Texas Instruments		
U11	1		Single-Channel Ultra-Small Adjustable Supervisory Circuit With Active-High Open-Drain Output, DRY0006A (USON-6)	DRY0006A	TPS3897ADRYR	Texas Instruments		
U12	1		Optical Jack Transmitter OTJ-8	OTJ8	FCR684208T	Cliff Electronic Components		
U13	1		4-Bit Dual-Supply Bus Transceiver With Configurable Voltage-Level Shifting and 3-State Outputs, RSV0016A (UQFN-16)	RSV0016A	SN74AVC4T774RSVR	Texas Instruments		Texas Instruments
U14	1		Fiber Optic Receiver Digital Audio, Optical 16Mbps - approx. 2.7V - 5.5V 10 mA	CONN_FIBER_OPTIC	FCR684208R	Cliff		
U15	1		216 kHz Digital Audio Interface Transceiver (DIX) with Stereo ADC and Routing, PCM, S / PDIF, ADC, 4.5 - 5.5V for Analog, 2.9 - 3.6V for DIX, -40 to 85 degC, 48-Pin LQFP (PT), Green (RoHS & no Sb/Br)	PT0048A	PCM9211PT	Texas Instruments		
U16, U17, U19	3		Single 2-Line to 1-Line Data Selector/Multiplexer, DCT0008A, LARGE T&R	DCT0008A	SN74LVC2G157DCTR	Texas Instruments	SN74LVC2G157DCUT	Texas Instruments
U18	1		Single Schmitt-Trigger Inverter, DCK0005A (SOT-SC70-5)	DCK0005A	SN74LVC1G14DCKR	Texas Instruments	SN74LVC1G14DCKT	Texas Instruments
U20	1		Single 2-Line to 1-Line Data Selector/Multiplexer, DCU0008A, LARGE T&R	DCU0008A	SN74LVC2G157DCUR	Texas Instruments	SN74LVC2G157DCUT	Texas Instruments
U21	1		Low-Voltage 8-Bit I2C and SMBus I/O Expander, 1.65 to 5.5 V, -40 to 85 degC, 16-pin QFN (RGT), Green (RoHS & no Sb/Br)	RGT0016A	TCA6408ARGTR	Texas Instruments		

Table 3-1. Bill of Materials (continued)

Designator	Quantity	Value	Description	Package Reference	Part Number	Manufacturer	AlternatePart Number	Alternate Manufacturer
Y1	1		Crystal Oscillator 24 MHz ±50ppm HCMOS 3.3V SMD 2x1.6mm	SMD_2MM0_1MM6	ASA-24.000MHZ-L-T	Abracon		
Y2	1		Crystal, 24.576 MHz, 10 pF, SMD	2.5x0.5x2.0mm	ABM10-24.576MHZ-E20-T	Abracon Corporation		

4 Additional Information

4.1 Trademarks

PurePath™ is a trademark of Texas Instruments.
All trademarks are the property of their respective owners.

STANDARD TERMS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including any accompanying demonstration software, components, and/or documentation which may be provided together or separately (collectively, an “EVM” or “EVMs”) to the User (“User”) in accordance with the terms set forth herein. User's acceptance of the EVM is expressly subject to the following terms.

   1.1 EVMs are intended solely for product or software developers for use in a research and development setting to facilitate feasibility evaluation, experimentation, or scientific analysis of TI semiconductors products. EVMs have no direct function and are not finished products. EVMs shall not be directly or indirectly assembled as a part or subassembly in any finished product. For clarification, any software or software tools provided with the EVM (“Software”) shall not be subject to the terms and conditions set forth herein but rather shall be subject to the applicable terms that accompany such Software

   1.2 EVMs are not intended for consumer or household use. EVMs may not be sold, sublicensed, leased, rented, loaned, assigned, or otherwise distributed for commercial purposes by Users, in whole or in part, or used in any finished product or production system.

2 *Limited Warranty and Related Remedies/Disclaimers*:

   2.1 These terms do not apply to Software. The warranty, if any, for Software is covered in the applicable Software License Agreement.

   2.2 TI warrants that the TI EVM will conform to TI's published specifications for ninety (90) days after the date TI delivers such EVM to User. Notwithstanding the foregoing, TI shall not be liable for a nonconforming EVM if (a) the nonconformity was caused by neglect, misuse or mistreatment by an entity other than TI, including improper installation or testing, or for any EVMs that have been altered or modified in any way by an entity other than TI, (b) the nonconformity resulted from User's design, specifications or instructions for such EVMs or improper system design, or (c) User has not paid on time. Testing and other quality control techniques are used to the extent TI deems necessary. TI does not test all parameters of each EVM. User's claims against TI under this Section 2 are void if User fails to notify TI of any apparent defects in the EVMs within ten (10) business days after delivery, or of any hidden defects with ten (10) business days after the defect has been detected.

   2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI’s recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:

EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.

3 *Regulatory Notices:*

3.1 *United States*

3.1.1 *Notice applicable to EVMs not FCC-Approved:*

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 *For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:*

CAUTION

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- *Reorient or relocate the receiving antenna.*
- *Increase the separation between the equipment and receiver.*
- *Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*
- *Consult the dealer or an experienced radio/TV technician for help.*

3.2 *Canada*

3.2.1 *For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions:

(1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur

3.3 *Japan*

3.3.1 *Notice for EVMs delivered in Japan:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。

https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-delivered-in-japan.html

3.3.2 *Notice for Users of EVMs Considered "Radio Frequency Products" in Japan:* EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

【無線電波を送信する製品の開発キットをお使いになる際の注意事項】 開発キットの中には技術基準適合証明を受けていないものがあります。 技術適合証明を受けていないもののご使用に際しては、電波法遵守のため、以下のいずれかの措置を取っていただく必要がありますのでご注意ください。

1. 電波法施行規則第6条第1項第1号に基づく平成18年3月28日総務省告示第173号で定められた電波暗室等の試験設備でご使用いただく。
2. 実験局の免許を取得後ご使用いただく。
3. 技術基準適合証明を取得後ご使用いただく。

なお、本製品は、上記の「ご使用にあたっての注意」を譲渡先、移転先に通知しない限り、譲渡、移転できないものとします。

上記を遵守頂けない場合は、電波法の罰則が適用される可能性があることをご留意ください。 日本テキサス・インスツルメンツ株式会社

東京都新宿区西新宿 6 丁目 2 4 番 1 号

西新宿三井ビル

3.3.3 *Notice for EVMs for Power Line Communication:* Please see http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_02.page

電力線搬送波通信についての開発キットをお使いになる際の注意事項については、次のところをご覧ください。https://www.ti.com/ja-jp/legal/notice-for-evaluation-kits-for-power-line-communication.html

3.4 *European Union*

3.4.1 *For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive)*:

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

4 *EVM Use Restrictions and Warnings:*

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 *Safety-Related Warnings and Restrictions:*

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designees. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designees.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for compliance in all respects with such laws and regulations. User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. *Accuracy of Information:* To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.

6. *Disclaimers:*

6.1 EXCEPT AS SET FORTH ABOVE, EVMS AND ANY MATERIALS PROVIDED WITH THE EVM (INCLUDING, BUT NOT LIMITED TO, REFERENCE DESIGNS AND THE DESIGN OF THE EVM ITSELF) ARE PROVIDED "AS IS" AND "WITH ALL FAULTS." TI DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, REGARDING SUCH ITEMS, INCLUDING BUT NOT LIMITED TO ANY EPIDEMIC FAILURE WARRANTY OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF ANY THIRD PARTY PATENTS, COPYRIGHTS, TRADE SECRETS OR OTHER INTELLECTUAL PROPERTY RIGHTS.

6.2 EXCEPT FOR THE LIMITED RIGHT TO USE THE EVM SET FORTH HEREIN, NOTHING IN THESE TERMS SHALL BE CONSTRUED AS GRANTING OR CONFERRING ANY RIGHTS BY LICENSE, PATENT, OR ANY OTHER INDUSTRIAL OR INTELLECTUAL PROPERTY RIGHT OF TI, ITS SUPPLIERS/LICENSORS OR ANY OTHER THIRD PARTY, TO USE THE EVM IN ANY FINISHED END-USER OR READY-TO-USE FINAL PRODUCT, OR FOR ANY INVENTION, DISCOVERY OR IMPROVEMENT, REGARDLESS OF WHEN MADE, CONCEIVED OR ACQUIRED.

7. *USER'S INDEMNITY OBLIGATIONS AND REPRESENTATIONS.* USER WILL DEFEND, INDEMNIFY AND HOLD TI, ITS LICENSORS AND THEIR REPRESENTATIVES HARMLESS FROM AND AGAINST ANY AND ALL CLAIMS, DAMAGES, LOSSES, EXPENSES, COSTS AND LIABILITIES (COLLECTIVELY, "CLAIMS") ARISING OUT OF OR IN CONNECTION WITH ANY HANDLING OR USE OF THE EVM THAT IS NOT IN ACCORDANCE WITH THESE TERMS. THIS OBLIGATION SHALL APPLY WHETHER CLAIMS ARISE UNDER STATUTE, REGULATION, OR THE LAW OF TORT, CONTRACT OR ANY OTHER LEGAL THEORY, AND EVEN IF THE EVM FAILS TO PERFORM AS DESCRIBED OR EXPECTED.

8. *Limitations on Damages and Liability:*

   8.1 *General Limitations*. IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVMS , REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, , EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

9. *Return Policy.* Except as otherwise provided, TI does not offer any refunds, returns, or exchanges. Furthermore, no return of EVM(s) will be accepted if the package has been opened and no return of the EVM(s) will be accepted if they are damaged or otherwise not in a resalable condition. If User feels it has been incorrectly charged for the EVM(s) it ordered or that delivery violates the applicable order, User should contact TI. All refunds will be made in full within thirty (30) working days from the return of the components(s), excluding any postage or packaging costs.

10. *Governing Law:* These terms and conditions shall be governed by and interpreted in accordance with the laws of the State of Texas, without reference to conflict-of-laws principles. User agrees that non-exclusive jurisdiction for any dispute arising out of or relating to these terms and conditions lies within courts located in the State of Texas and consents to venue in Dallas County, Texas. Notwithstanding the foregoing, any judgment may be enforced in any United States or foreign court, and TI may seek injunctive relief in any United States or foreign court.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES “AS IS” AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI’s products are provided subject to TI’s Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI’s provision of these resources does not expand or otherwise alter TI’s applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265