User's Guide

SLOU461–November 2016

TAS2557 Evaluation Module

This user's guide describes the characteristics, operation, and use of the TAS2557 Evaluation Module (EVM). A complete schematic diagram, printed-circuit board layouts, and bill of materials are included in this document.

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1 Description

The TAS2557 device is an amplifier with integrated boost converter and programmable digital signal processor. The output amplifier is a Class-D device that can be driven to higher output levels with the on-chip Class-H boost. The on-chip voltage and current sense, together with TI's Smart Amp algorithm, protect the speaker against overheating and excessive excursion.

The TAS2557 EVM supports evaluation and development with the TAS2557 device through the following interfaces:

- USB interface
  - TAS2557 control through PurePath™ Console 3 (PPC3) GUI, USB-HID
  - USB-class audio device, compatible with Microsoft® Windows® 7+
- Digital audio AP and PSIA interface through 100-mil headers
- TI Learning Board 2 for speaker characterization
- SPI interface for TAS2557 control
- I^2C interface for TAS2557 control

2 Specifications

Table 1. EVM Specifications

SOURCE	REQUIREMENT
Amplifier Power Supply (VBAT)	2.9 to 5.5 V
Analog Supply (AVDD)	1.65 to 1.95 V
Digital Supply (DVDD)	1.65 to 1.95 V
EVM Power Supply	5.0 V
IO Power Supply (IOVDD)	1.62 to 3.6 V
Output Power	5.7 W
USB, USB Class-Audio	Micro-USB B

3 Software

The TAS2557 EVM requires PurePath Console 3 with the TAS2557 plug-in.

NOTE: The TAS2557 device needs to be configured using this software. It will not function without this configuration.

Please refer to the Smart Amp Tuning Guide which can be found in the project folder at MySecureSoftware for detailed information about this software and how to configure the TAS2559 device for Smart Amp Speaker Protection.

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4 Mono Setup

1. Install PurePath Console 3 with the TAS2557EVM plug-in.
2. Connect a speaker to J8 on the EVM.
3. Attach a 5.0 V/ 2.5 A power supply to connector J29 (inner = 5V, outer = GND).
4. Connect the EVM to a Windows 7+ PC with a micro-USB cable (J23). It will enumerate as a USB-AudioEVM device (sound card).

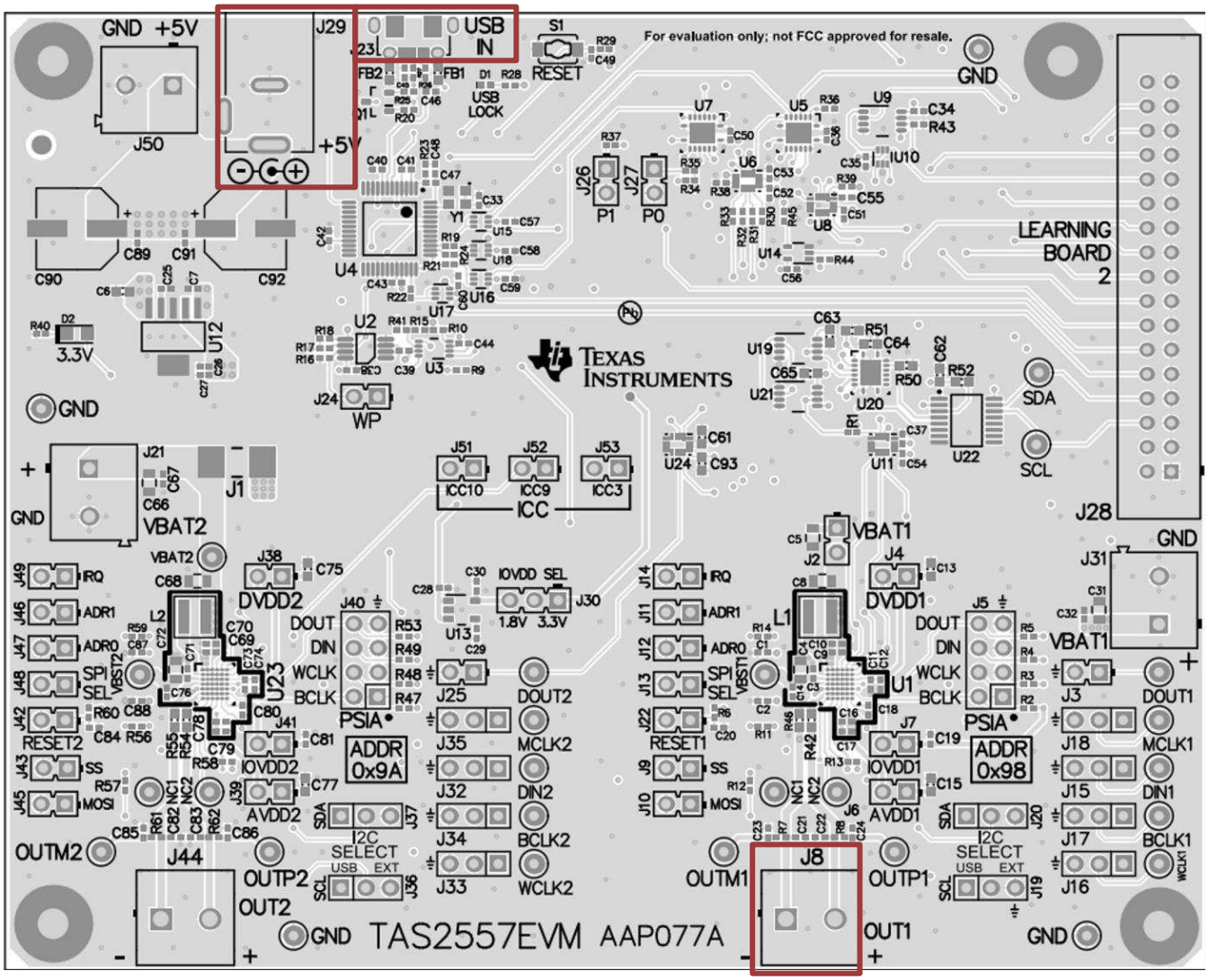


Figure 1. TAS2557 EVM Mono Setup

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5. Verify that the EVM is the default playback device by opening the sound dialog from the Windows Control Panel as shown in Figure 2.

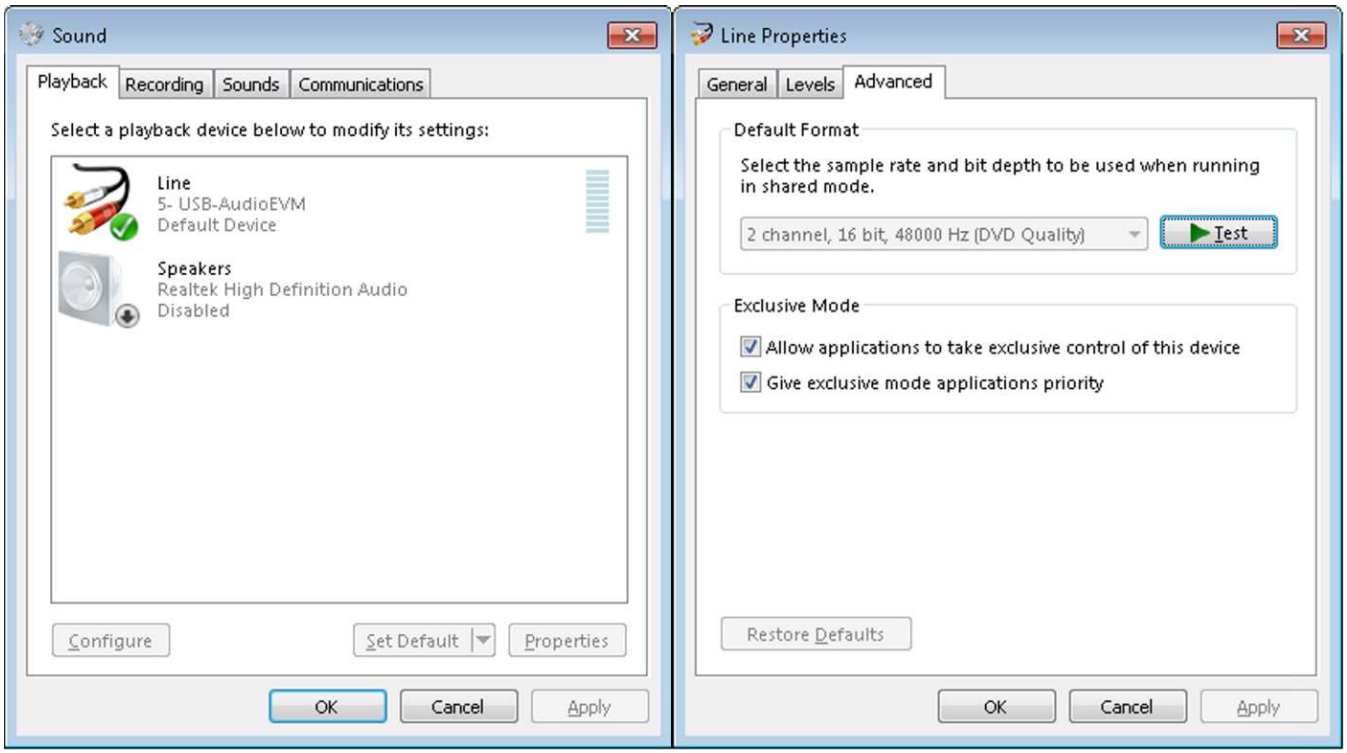


Figure 2. Setting Default Playback Device

6. Check if the sampling rate matches the Windows setting by opening the advanced tab in the properties menu. The EVM firmware enumerates as a USB-AudioEVM that supports 48 kHz sampling rate by default. This setting must match the EVM at 2-channel, 16-bit, 48000 Hz (CD Quality).

Table 2. Default Jumper Settings

JUMPER	SETTING	DESCRIPTION	CHANNEL
J2	Insert	VBAT 5V	
J3	Remove	DOUT	1
J4	Insert	DVDD 1.8V	1
J6	Insert	AVDD 1.8V	1
J7	Insert	IOVDD Setting from J30	1
J9	Remove	SCL / SS	1
J10	Remove	SDA / MOSI	1
J11	Insert	Address Select1	1
J12	Insert	Address Select0	1
J13	Insert	SPI Select	1
J14	Remove	IRQ	1
J15	Pin 1-2	SDIN = on-board	1
J16	Pin 1-2	WCLK = on-board	1
J17	Pin 1-2	BCLK = on-board	1
J18	Pin 1-2	MCLK = on-board	1
J19	Pin 1-2	SCL = on-board	1
J20	Pin 1-2	SDA = on-board	1
J22	Remove	Reset	1

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Table 2. Default Jumper Settings (continued)

JUMPER	SETTING	DESCRIPTION	CHANNEL
J24	Insert	WP = 1, write protect EEPROM	
J25	Remove	DOUT	2
J26	Insert	P1 = 0, select USB for on-board digital audio	
J27	Insert	P0 = 0, select USB for on-board digital audio	
J30	Pin 1-2	IOVDD Select = 3.3 V	2
J32	Pin 1-2	SDIN = on-board	2
J33	Pin 1-2	WCLK = on-board	2
J34	Pin 1-2	BCLK = on-board	2
J35	Pin 1-2	MCLK = on-board	2
J36	Pin 1-2	SCL = on-board	2
J37	Pin 1-2	SDA = on-board	2
J38	Insert	DVDD 1.8V	2
J39	Insert	AVDD 1.8V	2
J41	Insert	IOVDD Setting from J30	2
J42	Remove	Reset	2
J43	Remove	SCL / SS	2
J45	Remove	SDA / MOSI	2
J46	Insert	Address Select1	2
J47	Remove	Address Select0	2
J48	Insert	SPI Select	2
J49	Remove	IRQ	2
J51	Insert	ICC =1, inter-chip communication	
J52	Insert	ICC =1, inter-chip communication	
J53	Insert	ICC =1, inter-chip communication	



Figure 3. 3-Pin Jumper

Please refer to Figure 5 for default jumper settings.

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5 Dual Mono

Dual Mono mode is a stereo configuration where each device independently processes the data stream it has been assigned for Smart Amp tuning. Each device is capable of processing left, right, or both channels.

1. Install PurePath Console 3 with the TAS2557EVM plug-in.
2. Connect speakers to both J44 and J8 on the EVM.
3. Attach a 5.0 V/ 5.0 A power supply to connector J29 (inner = 5V, outer = GND).
4. Connect the EVM to a Windows 7+ PC with a micro-USB cable (J23). It will enumerate as a USB-AudioEVM device (sound card).

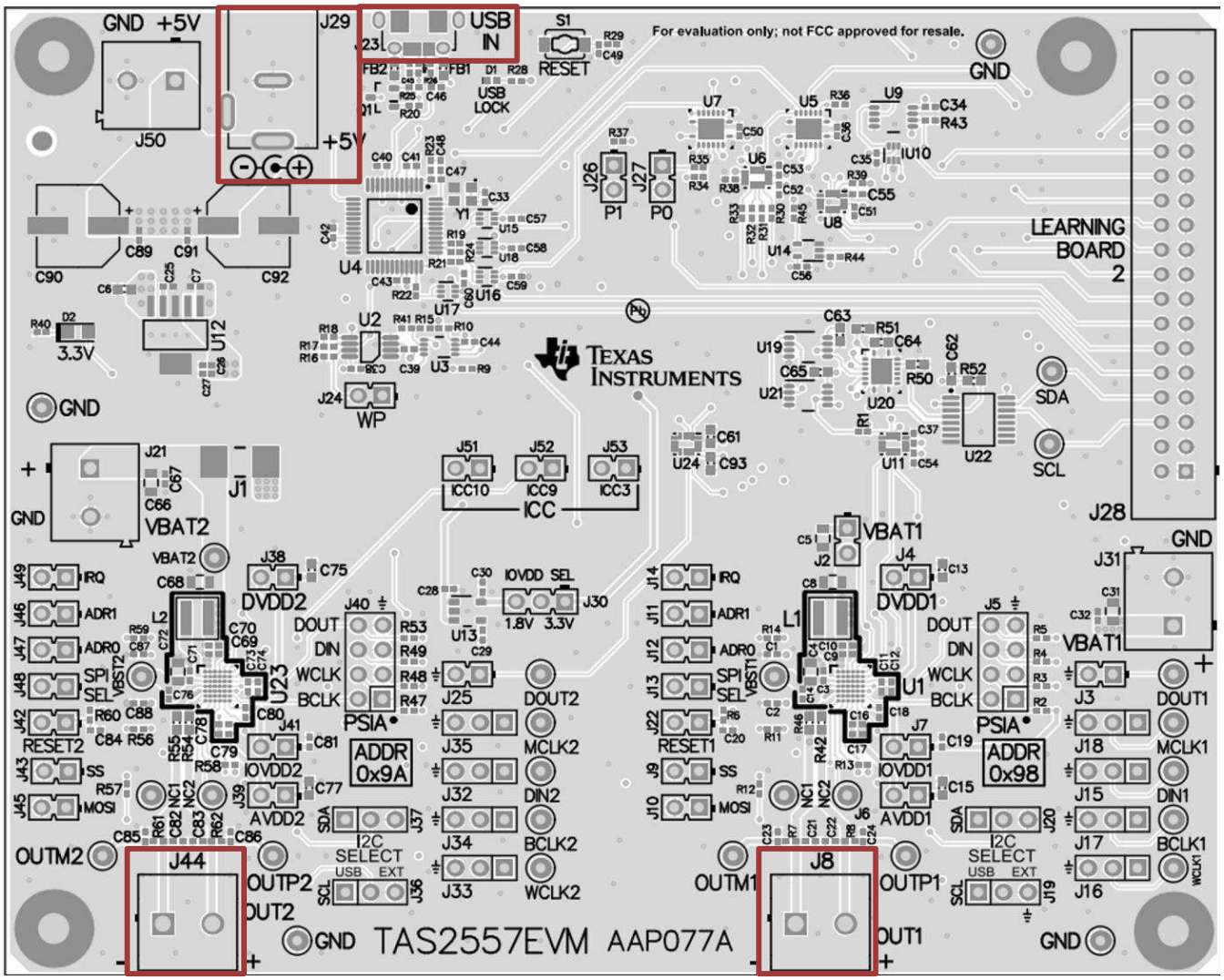


Figure 4. TAS2557EVM Dual Mono Setup

5. Select Dual Mono configuration in PPC3 and proceed with characterization per the PPC3 User's guide.
6. Play the test tone as shown in Figure 2.

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6 Digital Audio Interfaces

The various digital audio interfaces on the TAS2557EVM can be selected through hardware settings and software settings. Several headers close to the TAS2557 device allow access to the following digital audio signals:

- J3: Data Out (DOUT) from the TAS2557 (For example, current and voltage sense data.)
- J15: Data In (DIN) to the TAS2557
- J16: Word Clock or Frame Sync (WCLK)
- J17: Bit Clock (BCLK)
- J18: Master Clock (MCLK) (This is optional if TAS2557 PLL is not used.)

J3 has two pins:

- Digital data (for example, I and V sense data) from the TAS2557 device
- Ground

J15, J16, J17, and J18 have three pins:

- Digital audio signals from the EVM
- Digital audio signals to the TAS2557
- Ground

A jumper inserted in position 1-2 connects the TAS2557 to the digital audio signals from the board (for example, USB or Learning Board 2). Replacing the jumper with a connector from an external source connects the TAS2557 to the external source (for example, AP or PSIA).

The selection between the two on-board digital audio sources (USB or Learning Board 2) is controlled by:

(a) Hardware: J26,J27

- J26 = inserted, J27 = inserted; Selects USB
- J26 = inserted, J27 = removed; Selects Learning Board 2

(b) Software: The PPC3 GUI controls the digital audio routing during speaker characterization. This has priority over the hardware settings from point a.

The secondary digital audio interface from the TAS2557 device is directly available through J5.

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6.1 Digital Audio Interface Selection

6.1.1 USB

The TAS2557EVM contains a microcontroller (TAS1020B) that acts as a USB HID and USB-class audio interface. To select USB, insert both J26 and J27 and insert J15, J16, J17, and J18 in the 1-2 position. This is shown in Figure 5.

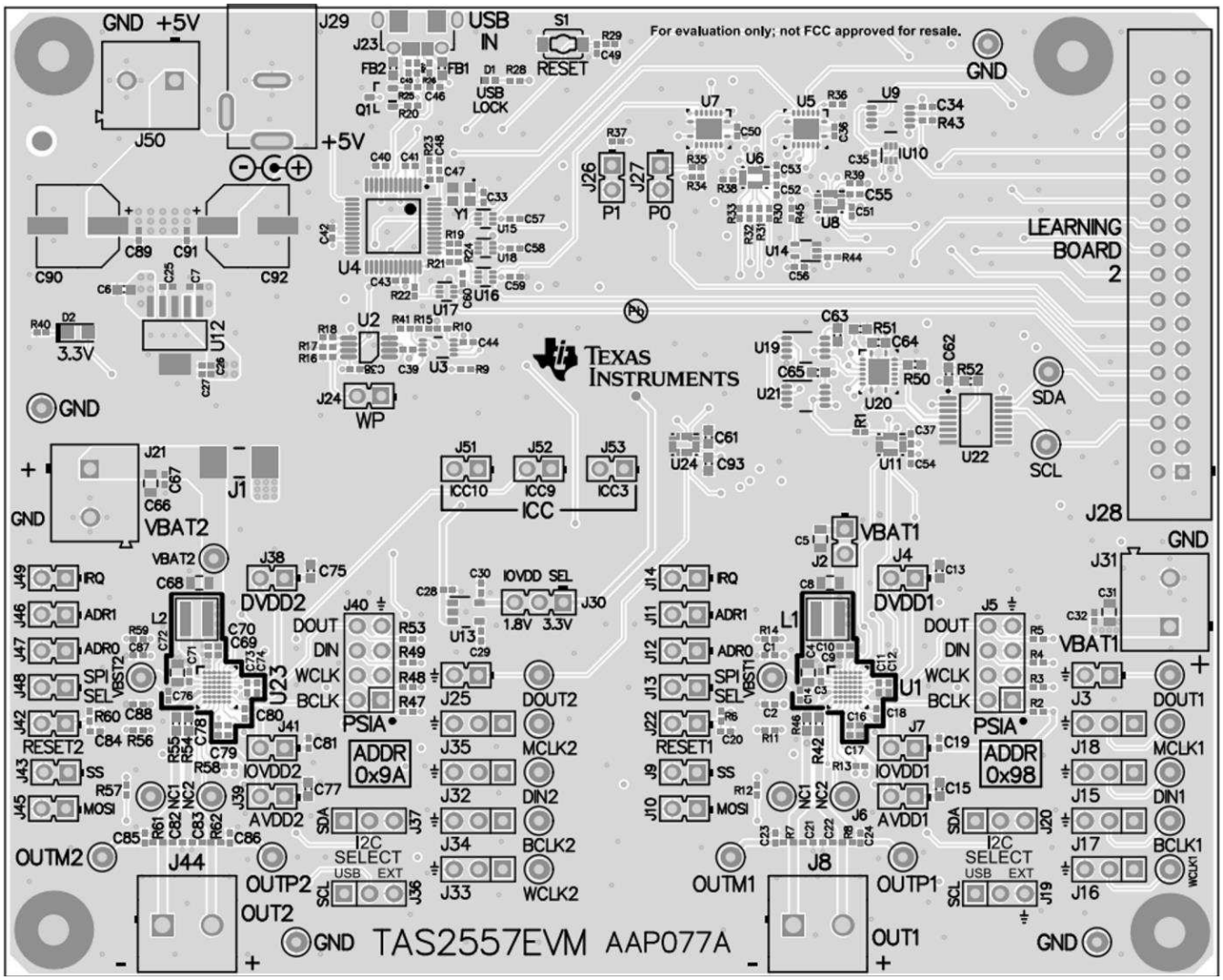


Figure 5. USB Audio Selection

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6.1.2 Direct (AP/PSIA)

Remove the jumpers from J15, J16, J17 and J18 for Channel 1 (or J32, J33, J34, and J35 for Channel 2) and connect the external digital audio source (for example AP or PSIA) to pin 2 of each head. Pin 3 provides a convenient ground connection. This is shown in Figure 6.

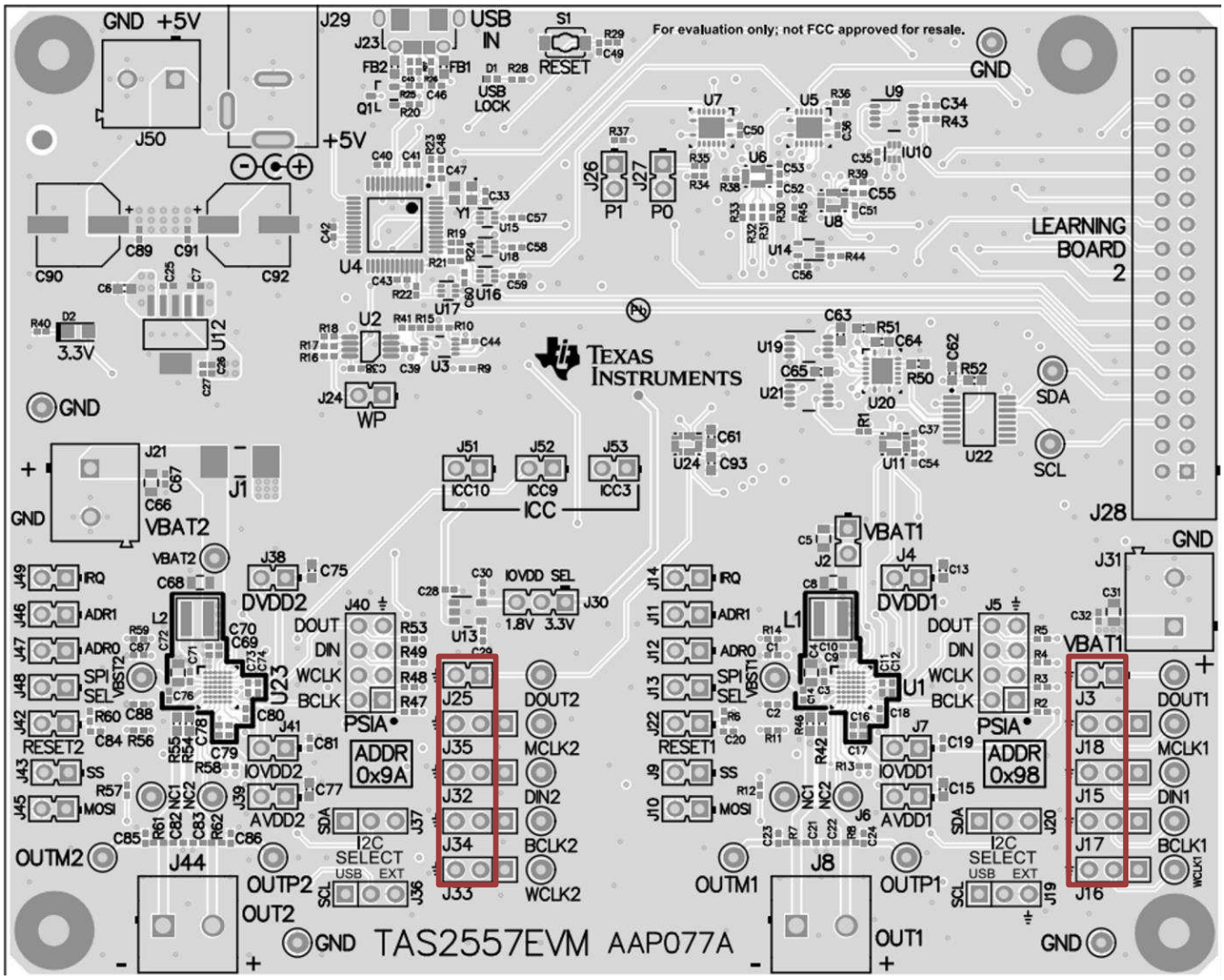


Figure 6. Direct (AP/PSIA) Audio Selection

7 Hardware Documentation

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7.1 TAS2557EVM Schematics

Figure 7 through Figure 12 show the schematics for the TAS2557 EVM.

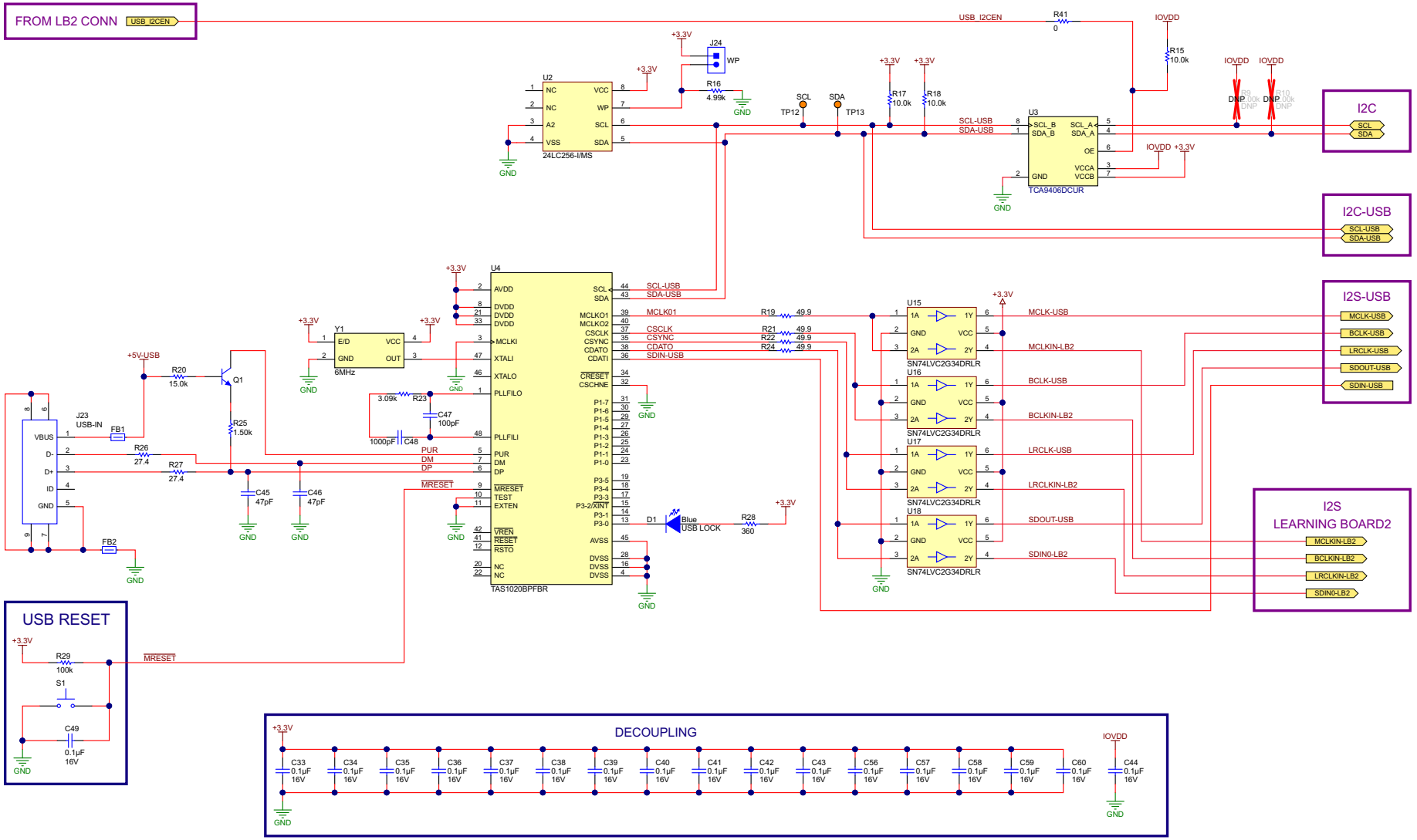


Figure 7. TAS2557EVM USB Block

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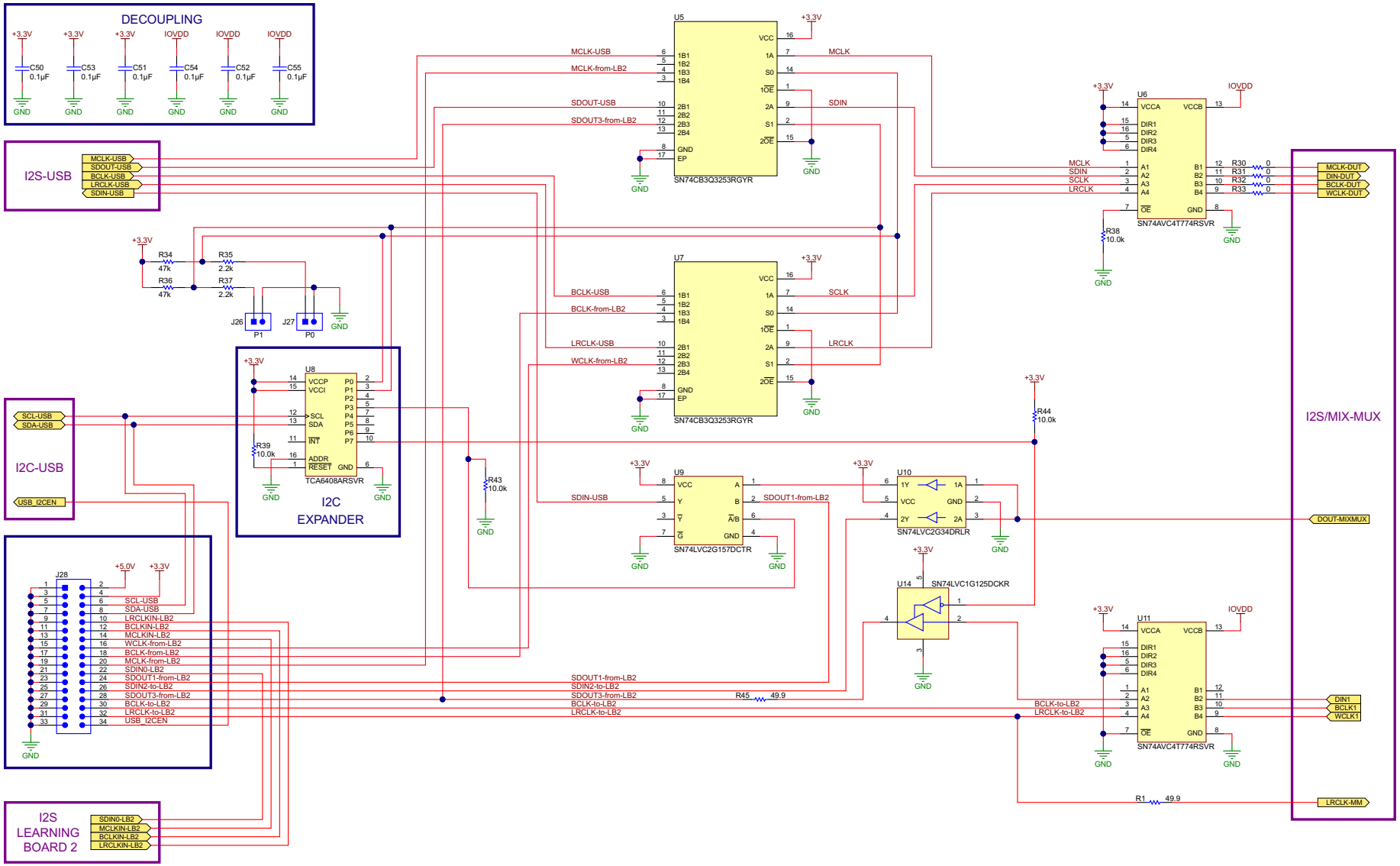


Figure 8. TAS2557EVM Input Muxes and Translators

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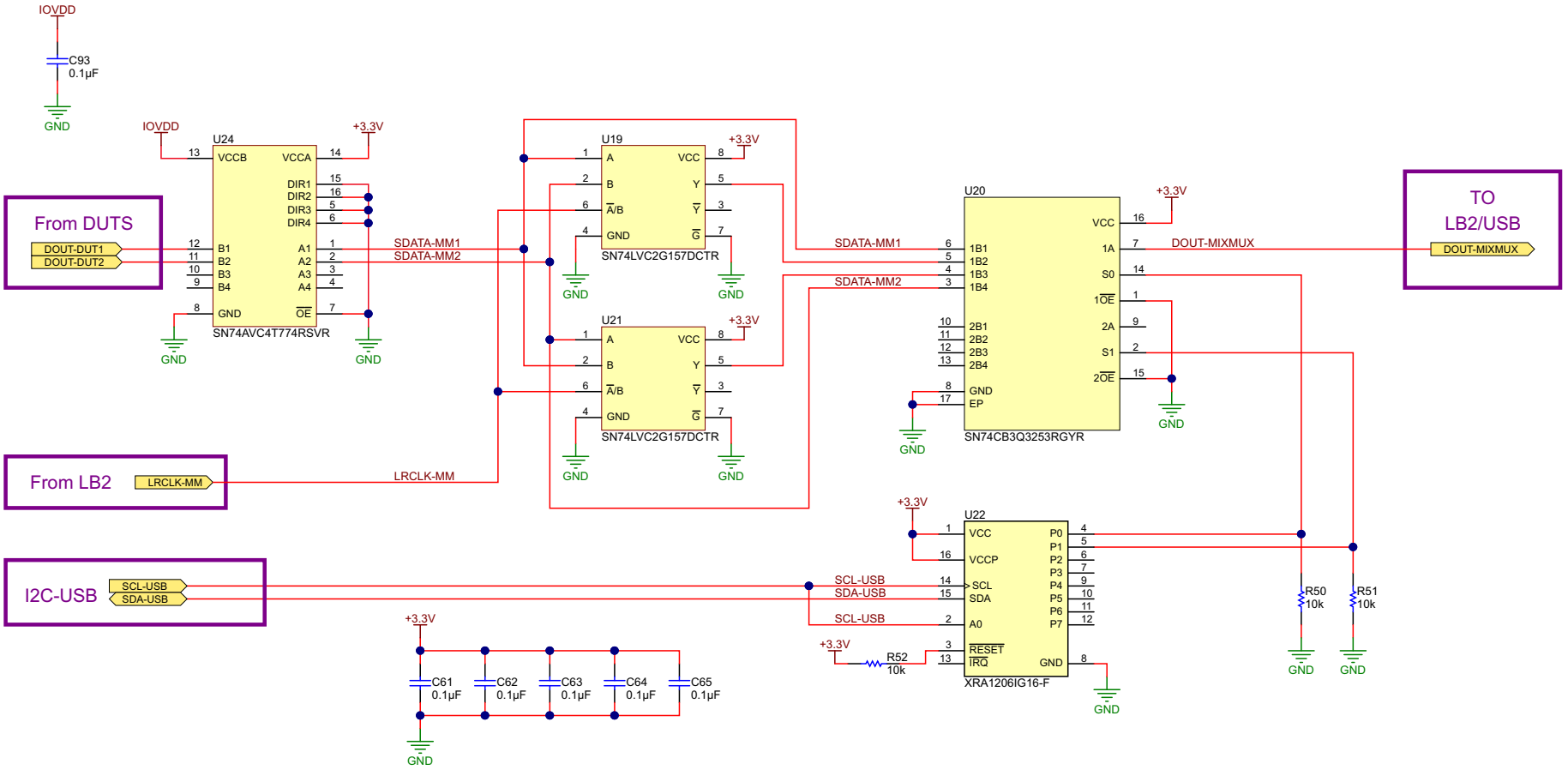


Figure 9. TAS2557EVM Output Muxes and Translators

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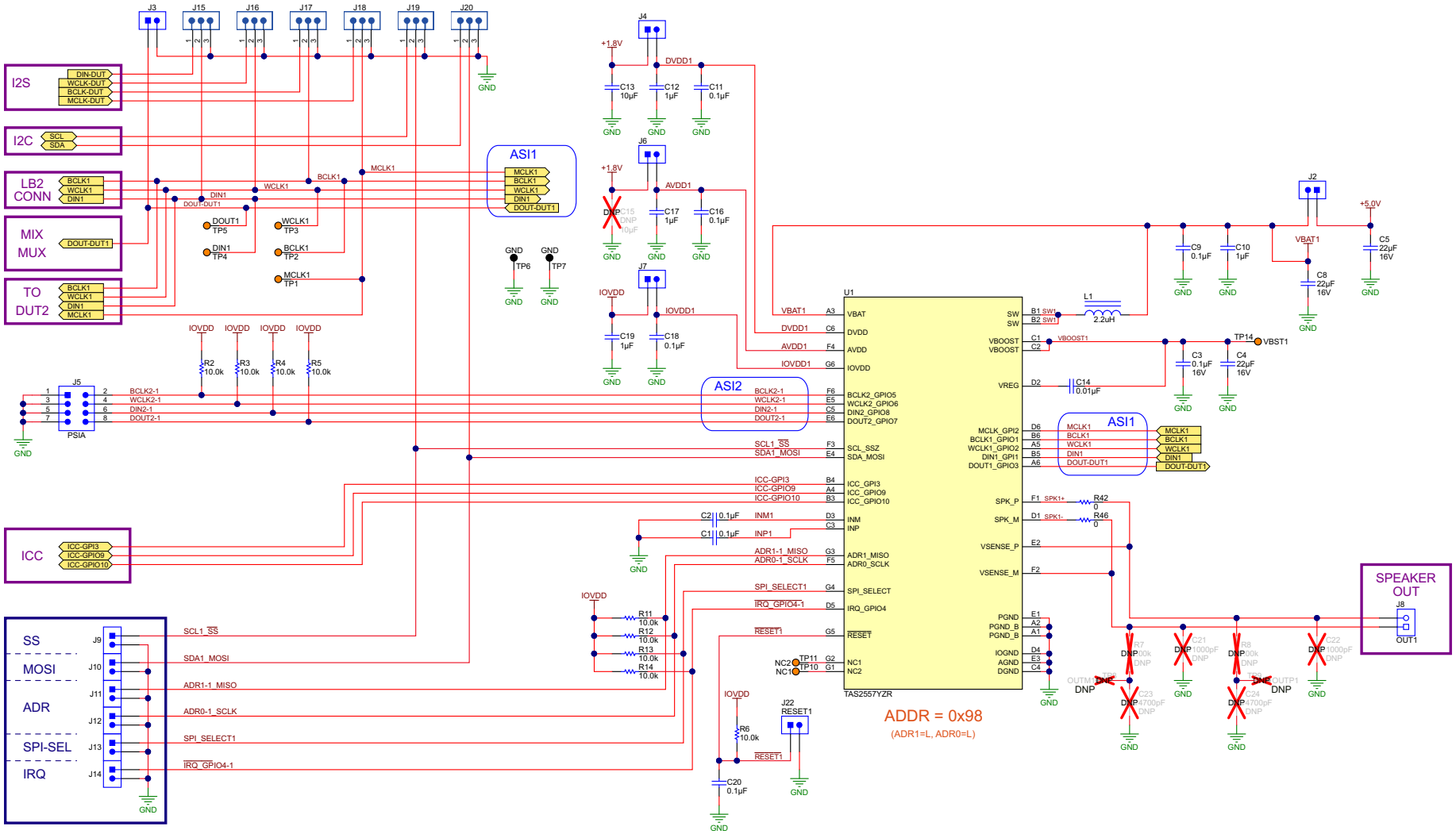


Figure 10. TAS2557EVM Channel 1 Schematic

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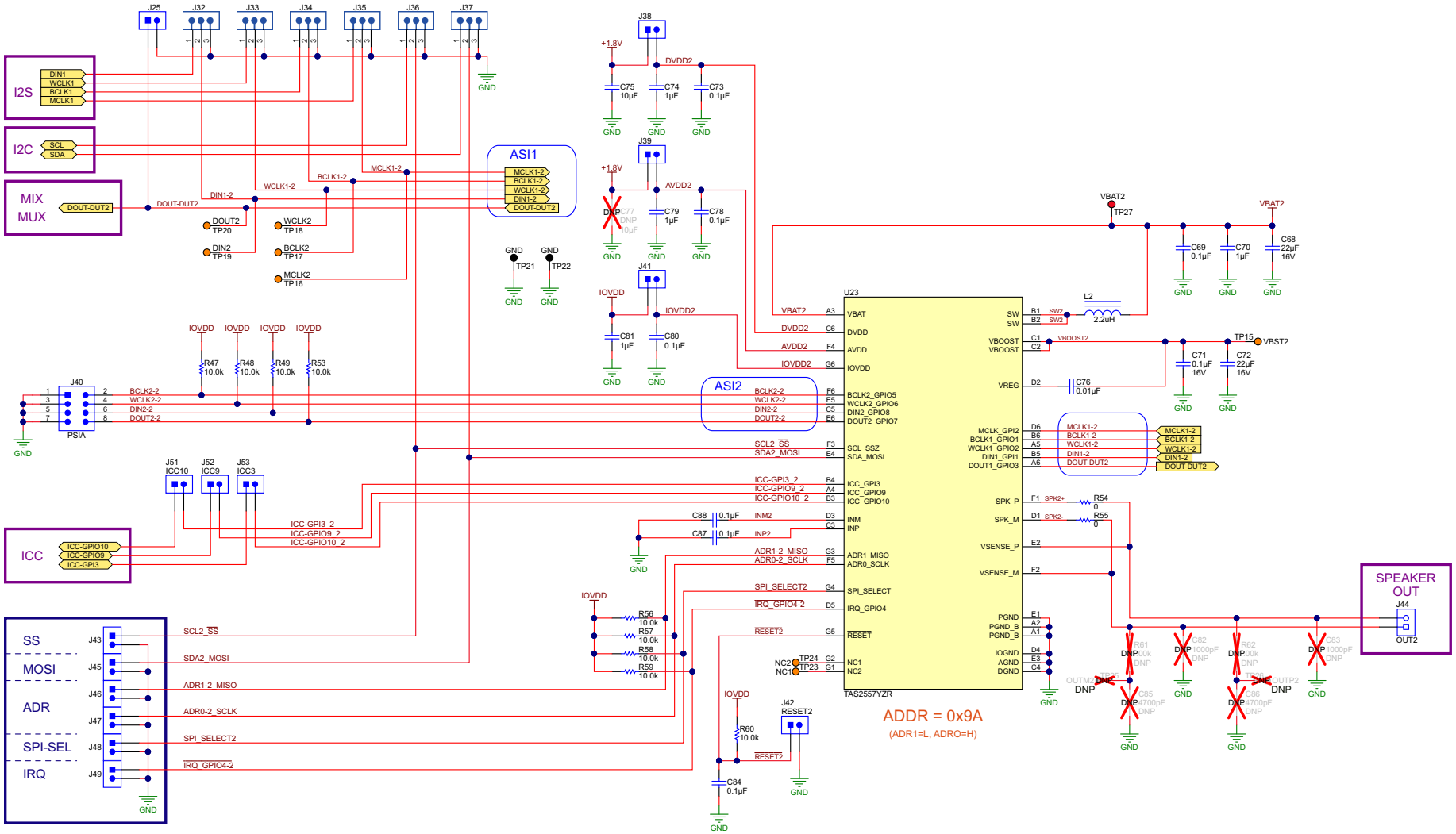


Figure 11. TAS2557EVM Channel 2 Schematic

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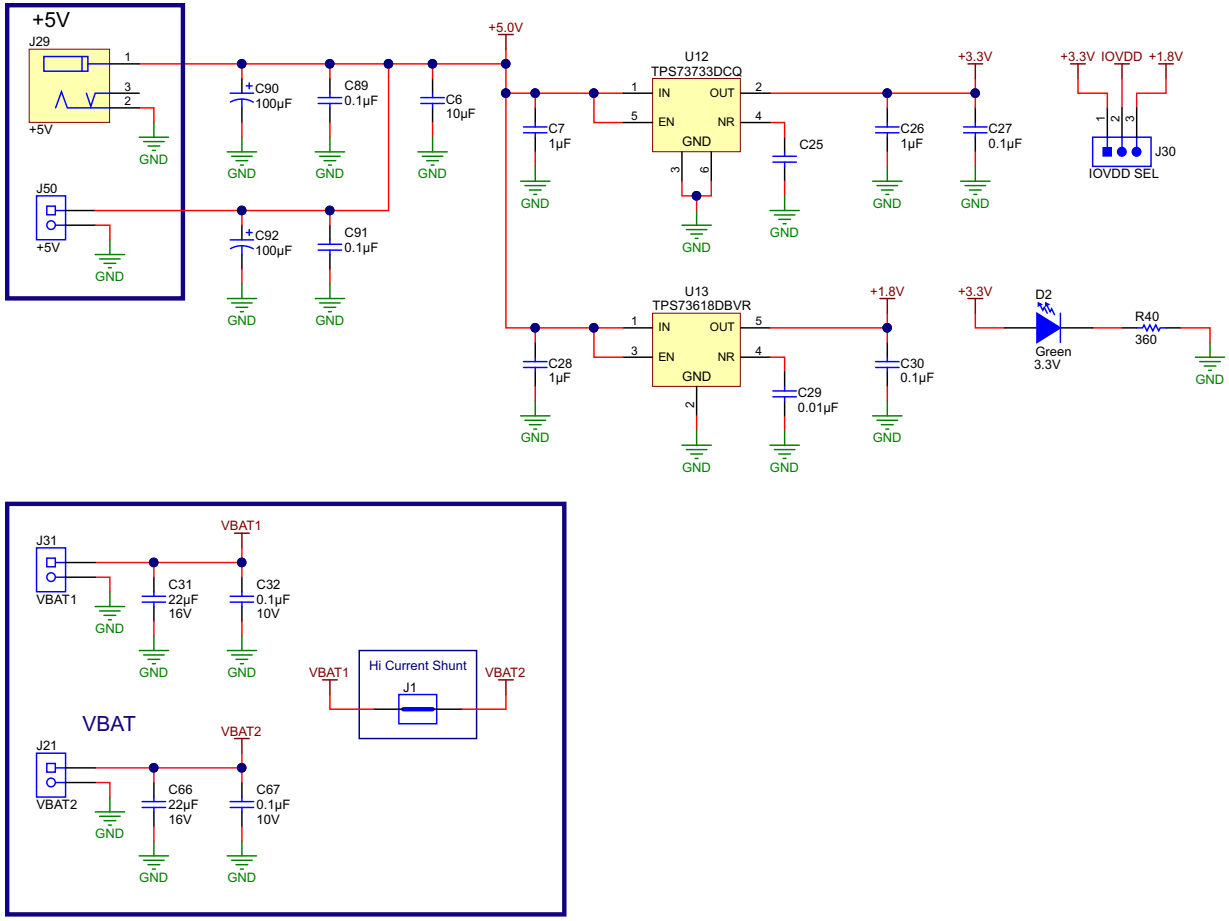


Figure 12. TAS2557EVM Power Supply

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7.2 TAS2557 EVM Printed Circuit Board Layout

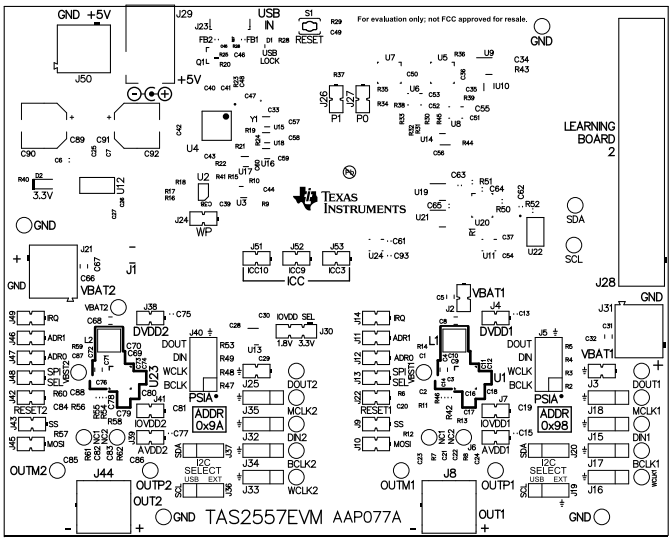


Figure 13. Top Overlay

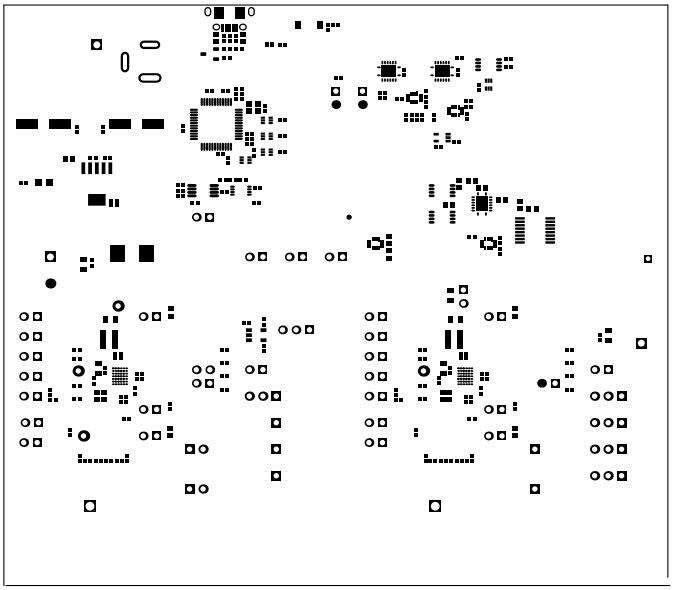


Figure 14. Top Solder Mask

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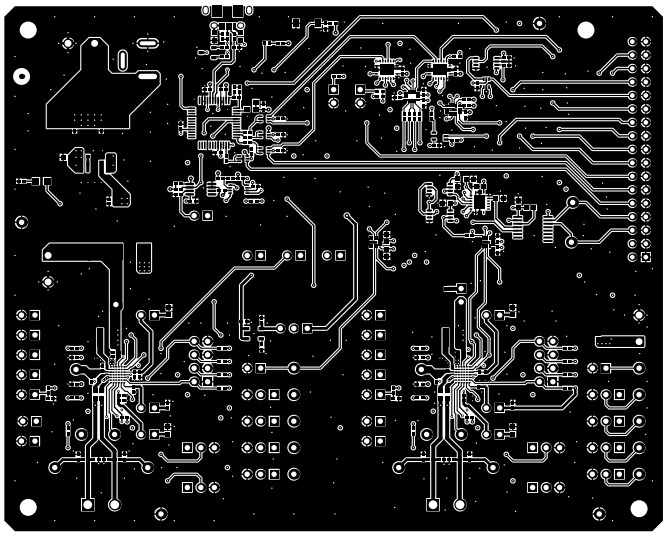


Figure 15. Top Layer

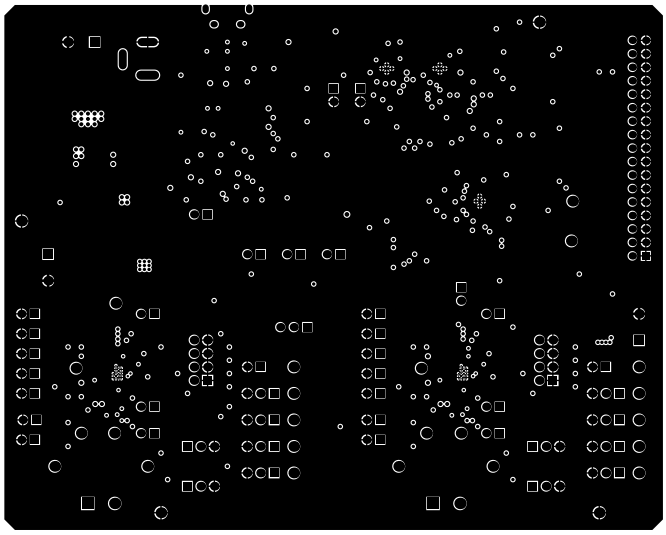


Figure 16. Copper Layer 2

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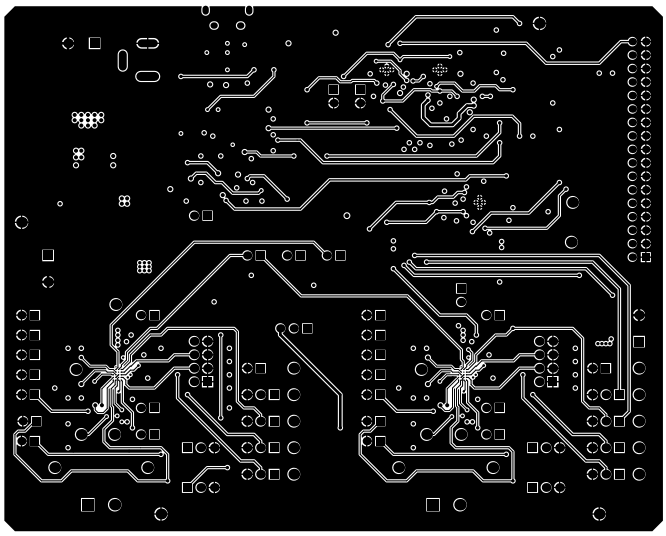


Figure 17. Copper Layer 3

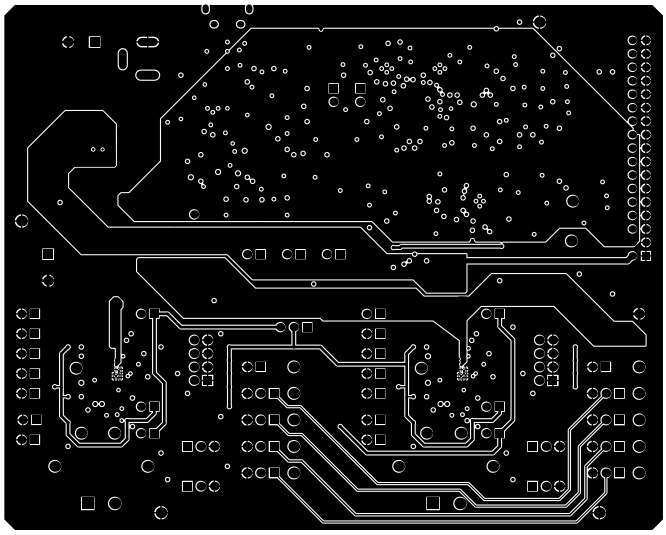


Figure 18. Copper Layer 4

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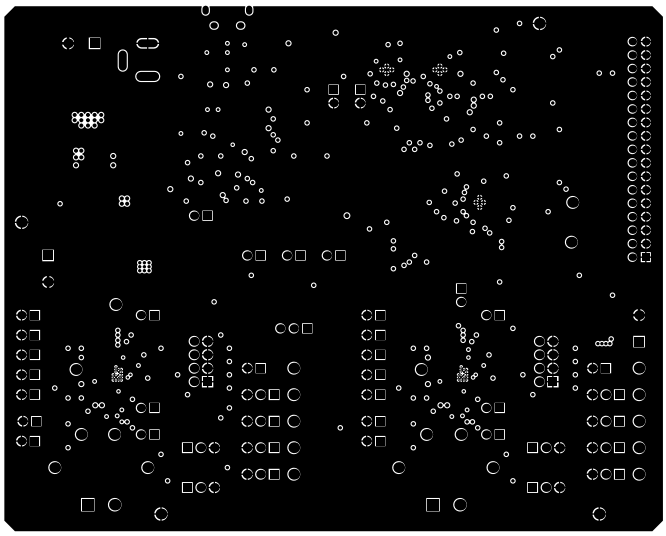


Figure 19. Copper Layer 5

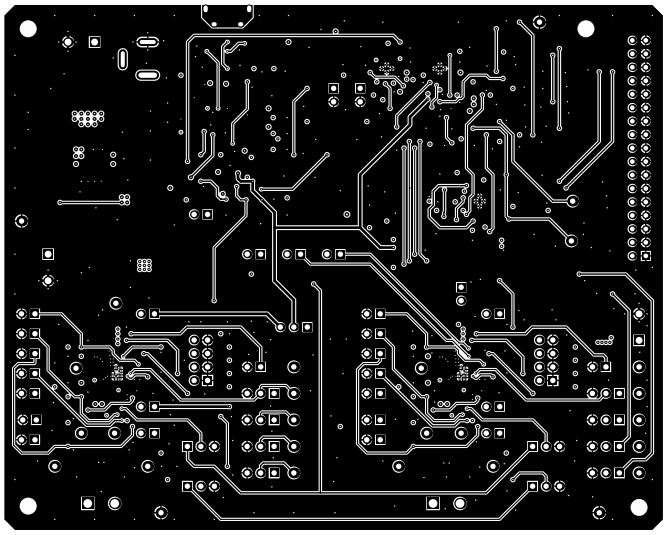


Figure 20. Bottom Layer

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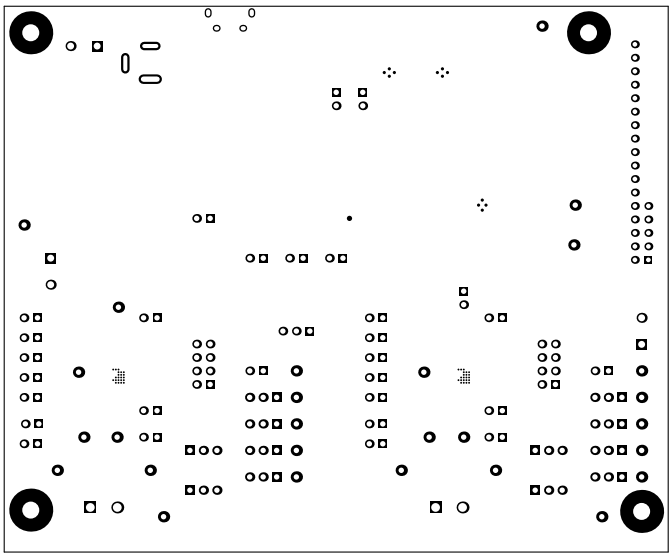


Figure 21. Bottom Solder Mask

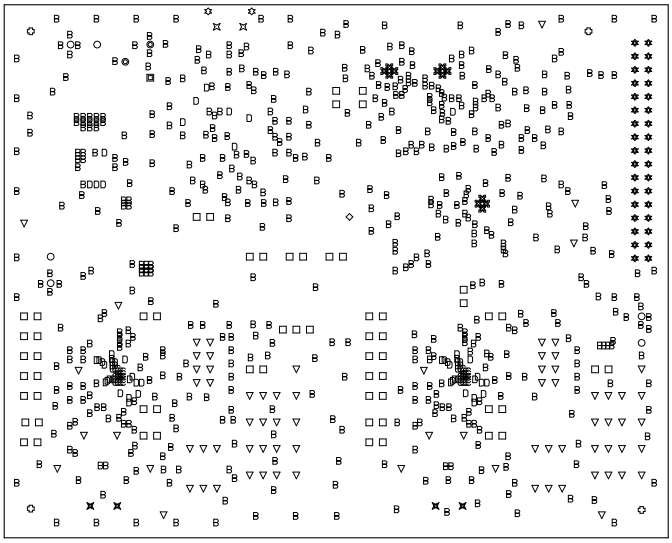


Figure 22. Drill Drawing

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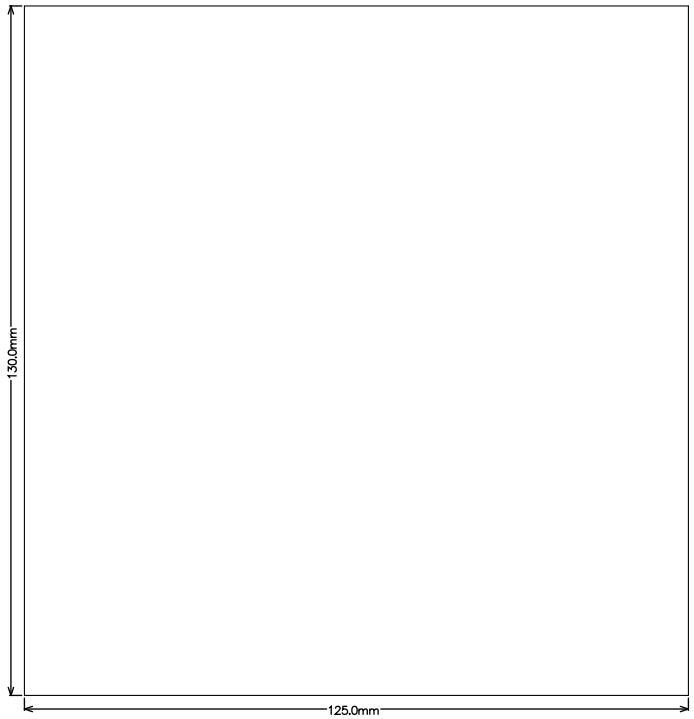


Figure 23. Board Dimensions

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7.3 TAS2557EVM Bill of Materials

Table 3. TAS2557EVM Bill of Materials

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER	ALTERNATE PART NUMBER	ALTERNATE MANUFACTURER
!PCB	1		Printed Circuit Board		AAP077	Any	-	-
C1, C2, C9, C11, C16, C18, C20, C27, C30, C32, C50, C51, C52, C53, C54, C55, C67, C69, C73, C78, C80, C84, C87, C88, C89, C91	26	0.1uF	CAP, CERM, 0.1uF, 10V, +/- 10%, X7R, 0402	0402	GRM155R71A104KA01D	MuRata	-	-
C3, C71	2	0.1uF	CAP, CERM, 0.1 µF, 16 V, +/- 10%, X7R, 0402	0402	GRM155R71C104KA88D	MuRata	-	-
C4, C5, C8, C31, C66, C68, C72	7	22uF	CAP, CERM, 22 µF, 16 V, +/- 10%, X5R, 0805	0805	C2012X5R1C226K125AC	TDK	-	-
C6, C13, C15, C75, C77	5	10uF	CAP, CERM, 10 µF, 10 V, +/- 20%, X5R, 0603	0603	C1608X5R1A106M080AC	TDK	-	-
C7, C10, C12, C17, C19, C26, C28, C70, C74, C79, C81	11	1uF	CAP, CERM, 1 µF, 6.3 V, +/- 20%, X5R, 0402	0402	C1005X5R0J105M050BB	TDK	-	-
C14, C25, C29, C76	4	0.01uF	CAP, CERM, 0.01uF, 6.3V, +/-10%, X7R, 0402	0402	GRM155R70J103KA01D	MuRata	-	-
C21, C22, C48, C82, C83	5	1000pF	CAP, CERM, 1000pF, 50V, +/-5%, C0G/NP0, 0402	0402	GRM1555C1H102JA01D	MuRata	-	-
C23, C24, C85, C86	4	4700pF	CAP, CERM, 4700 pF, 50 V, +/- 10%, X7R, 0402	0402	GRM155R71H472KA01D	MuRata	-	-
C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C49, C56, C57, C58, C59, C60	18	0.1uF	CAP, CERM, 0.1uF, 16V, +/- 10%, X7R, 0402	0402	GRM155R71C104KA88D	MuRata	-	-
C45, C46	2	47pF	CAP, CERM, 47pF, 25V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1E470JA01D	MuRata	-	-
C47	1	100pF	CAP, CERM, 100pF, 50V, +/- 5%, C0G/NP0, 0402	0402	GRM1555C1H101JA01D	MuRata	-	-
C61, C62, C63, C64, C65, C93	6	0.1uF	CAP, CERM, 0.1 µF, 25 V, +/- 5%, X7R, 0603	0603	06033C104JAT2A	AVX	-	-
C90, C92	2	100uF	CAP, AL, 100 µF, 16 V, +/- 20%, 0.4 ohm, SMD	SMT Radial E	EEE-FC1C101P	Panasonic	-	-
D1	1	Blue	LED, Blue, SMD	Blue LED	SMLP12BC7TT86	Rohm	-	-
D2	1	Green	LED, Green, SMD	LED_0805	LTST-C171GKT	Lite-On	-	-
FB1, FB2	2	220 ohm	2.2A Ferrite Bead, 220 ohm @ 100MHz, SMD	0603	MPZ1608S221A	TDK	-	-
H1, H2, H3, H4	4	-	Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply	-	-
H5, H6, H7, H8	4	-	Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone	-	-
H9	1	-	Custom Cable For Connecting Stereo EVM Boards. IDC34 Ribbon Cable With Offset Pins.	IDC34 Custom Cable	CBL007	Any Shop	-	-
H10	1	-	Double Sided Tape for Applying Speakers to Boards	Double Sided Tape	1/2-5-9495LE	3M (TC)	-	-
J1	1	-	JUMPER TIN SMD	6.85x0.97x2.51 mm	S1911-46R	Harwin	-	-

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Table 3. TAS2557EVM Bill of Materials (continued)

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER	ALTERNATE PART NUMBER	ALTERNATE MANUFACTURER
J2, J3, J4, J6, J7, J9, J10, J11, J12, J13, J14, J22, J24, J25, J26, J27, J38, J39, J41, J42, J43, J45, J46, J47, J48, J49, J51, J52, J53	29	-	Header, 2.54 mm, 2x1, Tin, TH	Header, 2.54 mm, 2x1, TH	TSW-102-07-T-S	Samtec	-	-
J5, J40	2	-	Header, 100mil, 4x2, Tin, TH	Header, 4x2, 100mil, Tin	PEC04DAAN	Sullins Connector Solutions	-	-
J8, J44	2	-	Terminal Block, 5.08mm, 2x1, TH	Terminal Block, 5.08mm, 2x1, TH	0395443002	Molex	-	-
J15, J16, J17, J18, J19, J20, J32, J33, J34, J35, J36, J37	12	1x3	Header, 100mil, 3x1, Gold, TH	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions	-	-
J21, J31, J50	3	-	Terminal Block, 5 mm, 2x1, Tin, TH	Terminal Block, 5 mm, 2x1, TH	691 101 710 002	Wurth Elektronik eiSos	-	-
J23	1	-	Connector, Receptacle, Micro-USB Type AB, R/A, Bottom Mount SMT	Connector, USB Micro AB	DX4R205JJAR1800	JAE Electronics	-	-
J28	1	-	Header (shrouded), 2.54 mm, 17x2, Gold, TH	Header (shrouded), 2.54 mm, 17x2, TH	N2534-6002-RB	3M	-	-
J29	1	-	Power Jack, mini, 2.5mm OD, R/A, TH	Jack, 14.5x11x9mm	RAPC712X	Switchcraft	-	-
J30	1	-	Header, 2.54 mm, 3x1, Tin, TH	Header, 2.54 mm, 3x1, TH	TSW-103-07-T-S	Samtec	-	-
L1, L2	2	2.2uH	Inductor, Shielded, Composite, 2.2uH, 3.7A, 0.02 ohm, SMD	4x2x4mm	XFL4020-222MEB	Coilcraft	-	-
LS1, LS2	2	-	Dynamic Speaker	9x16mm	SPS0916B-J-01	AAC Technologies	-	-
Q1	1	0.3V	Transistor, NPN, 40V, 0.15A, SOT-23	SOT-23	MMBT2222A	Fairchild Semiconductor	-	-
R1, R19, R21, R22, R24, R45	6	49.9	RES, 49.9 ohm, 1%, 0.063W, 0402	0402	CRCW040249R9FKED	Vishay-Dale	-	-
R2, R3, R4, R5, R6, R11, R12, R13, R14, R15, R38, R39, R43, R44, R47, R48, R49, R53, R56, R57, R58, R59, R60	23	10.0k	RES, 10.0k ohm, 1%, 0.063W, 0402	0402	CRCW040210K0FKED	Vishay-Dale	-	-
R7, R8, R61, R62	4	1.00k	RES, 1.00 k, 1%, 0.063 W, 0402	0402	CRCW04021K00FKED	Vishay-Dale	-	-
R16	1	4.99k	RES, 4.99k ohm, 1%, 0.063W, 0402	0402	CRCW04024K99FKED	Vishay-Dale	-	-
R17, R18	2	10.0k	RES, 10.0 k, 1%, 0.063 W, 0402	0402	CRCW040210K0FKED	Vishay-Dale	-	-
R20	1	15.0k	RES, 15.0k ohm, 1%, 0.063W, 0402	0402	CRCW040215K0FKED	Vishay-Dale	-	-
R23	1	3.09k	RES, 3.09k ohm, 1%, 0.063W, 0402	0402	CRCW04023K09FKED	Vishay-Dale	-	-
R25	1	1.50k	RES, 1.50k ohm, 1%, 0.063W, 0402	0402	CRCW04021K50FKED	Vishay-Dale	-	-
R26, R27	2	27.4	RES, 27.4 ohm, 1%, 0.063W, 0402	0402	CRCW040227R4FKED	Vishay-Dale	-	-
R28, R40	2	360	RES, 360 ohm, 5%, 0.063W, 0402	0402	CRCW0402360RJNED	Vishay-Dale	-	-
R29	1	100k	RES, 100k ohm, 1%, 0.063W, 0402	0402	CRCW0402100KFKED	Vishay-Dale	-	-

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Table 3. TAS2557EVM Bill of Materials (continued)

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER	ALTERNATE PART NUMBER	ALTERNATE MANUFACTURER
R30, R31, R32, R33	4	0	RES, 0 ohm, 5%, 0.063W, 0402	0402	CRCW04020000Z0ED	Vishay-Dale	-	-
R34, R36	2	47k	RES, 47 k, 5%, 0.063 W, 0402	0402	CRCW040247K0JNED	Vishay-Dale	-	-
R35, R37	2	2.2k	RES, 2.2 k, 5%, 0.063 W, 0402	0402	CRCW04022K20JNED	Vishay-Dale	-	-
R41	1	0	RES, 0, 5%, 0.063 W, 0402	0402	CRCW04020000Z0ED	Vishay-Dale	-	-
R42, R46, R54, R55	4	0	RES, 0, 5%, 0.1 W, 0603	0603	CRCW06030000Z0EA	Vishay-Dale	-	-
R50, R51, R52	3	10k	RES, 10 k, 5%, 0.1 W, 0603	0603	CRCW060310K0JNEA	Vishay-Dale	-	-
S1	v	-	Switch, Tactile, SPST-NO, 0.05A, 12V, SMT	Switch, 4.4x2x2.9 mm	TL1015AF160QG	E-Switch	-	-
SH1, SH2, SH3, SH4, SH5, SH6, SH7, SH8, SH9, SH10, SH11, SH12, SH13, SH14, SH15, SH16, SH17, SH18, SH19, SH20, SH21, SH22, SH23, SH24, SH25, SH26, SH27, SH28, SH29, SH30, SH31, SH32, SH33, SH34, SH35, SH36, SH37, SH38, SH39, SH40, SH41, SH42	42	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec	969102-0000-DA	3M
TP1, TP2, TP3, TP4, TP5, TP8, TP9, TP10, TP11, TP12, TP13, TP14, TP15, TP16, TP17, TP18, TP19, TP20, TP23, TP24, TP25, TP26	22	Orange	Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone	-	-
TP6, TP7, TP21, TP22	4	Black	Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone	-	-
TP27	1	-	Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone	-	-
U1, U23	2	-	5.7-W Class-D Mono Audio Amplifier with Class-H Boost and Speaker Sense, YZ0042-C01 (DSBGA-42)	YZ0042-C01	TAS2557YZR	Texas Instruments	TAS2557YZT	Texas Instruments
U2	1	-	EEPROM, 256KBIT, 400KHZ, MSOP8	MSOP-8	24LC256-I/MS	Microchip	-	-
U3	1	-	TCA9406 Dual Bidirectional 1-MHz I2C-BUS and SMBus Voltage Level-Translator, 1.65 to 3.6 V, -40 to 85 degC, 8-pin US8 (DCU), Green (RoHS & no Sb/Br)	DCU0008A	TCA9406DCUR	Texas Instruments	Equivalent	Texas Instruments
U4	1	TAS1020BPFB	IC, USB Streaming Controller	PQFP48	TAS1020BPFB	TI	-	None
U5, U7, U20	3	-	Dual 1-of-4 FET Multiplexer / Demultiplexer 2.5-V / 3.3-V Low-Voltage High-Bandwidth Bus Switch, RGY0016A	RGY0016A	SN74CB3Q3253RGYR	Texas Instruments	-	Texas Instruments
U6, U11, U24	3	-	4-BIT DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE VOLTAGE TRANSLATION AND 3-STATE OUTPUTS, RSV0016A	RSV0016A	SN74AVC4T774RSVR	Texas Instruments	-	None

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Table 3. TAS2557EVM Bill of Materials (continued)

DESIGNATOR	QTY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER	ALTERNATE PART NUMBER	ALTERNATE MANUFACTURER
U8	1	-	Low-Voltage 8-Bit I2C and SMBus I/O Expander, 1.65 to 5.5 V, -40 to 85 degC, 16-pin UQFN (RSV), Green (RoHS & no Sb/Br)	RSV0016A	TCA6408ARSVR	Texas Instruments	Equivalent	None
U9, U19, U21	3	-	Single 2-Line to 1-Line Data Selector Multiplexer, DCT0008A	DCT0008A	SN74LVC2G157DCTR	Texas Instruments	-	None, Texas Instruments, Texas Instruments
U10, U15, U16, U17, U18	5	-	DUAL BUFFER GATE, DRL0006A	DRL0006A	SN74LVC2G34DRLR	Texas Instruments	-	None
U12	1	-	Single Output LDO, 1 A, Fixed 3.3 V Output, 2.2 to 5.5 V Input, with Reverse Current Protection, 6-pin SOT-223 (DCQ), -40 to 125 degC, Green (RoHS & no Sb/Br)	DCQ0006A	TPS73733DCQ	Texas Instruments	Equivalent	None
U13	1	-	Single Output Low Noise LDO, 400 mA, Fixed 1.8 V Output, 1.7 to 5.5 V Input, with Reverse Current Protection, 5-pin SOT-23 (DBV), -40 to 85 degC, Green (RoHS & no Sb/Br)	DBV0005A	TPS73618DBVR	Texas Instruments	Equivalent	None
U14	1	-	Single Bus Buffer Gate With 3-State Output, DCK0005A	DCK0005A	SN74LVC1G125DCKR	Texas Instruments	SN74LVC1G125DCKT	Texas Instruments
U22	1	-	8-BIT I2C/SMBUS GPIO EXPANDER WITH INTEGRATED LEVEL SHIFTERS, TSSOP-16	4.5x1.2x5.1 mm	XRA1206IG16-F	Exar	-	-
Y1	1	-	Oscillator, 6MHz, 3.3V, SMD	2.5x1x2.5mm	625L3I006M00000	CTS Electrocomponents	-	-
FID1, FID2, FID3	0	-	Fiducial mark. There is nothing to buy or mount.	Fiducial	N/A	N/A	-	-
R9, R10	0	2.00k	RES, 2.00 k, 1%, 0.063 W, 0402	0402	CRCW04022K00FKED	Vishay-Dale	-	-

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STANDARD TERMS AND CONDITIONS FOR EVALUATION MODULES

1. *Delivery:* TI delivers TI evaluation boards, kits, or modules, including 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 and conditions set forth herein. Acceptance of the EVM is expressly subject to the following terms and conditions.

   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 and conditions 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 and conditions 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 any defects that are 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. Moreover, TI shall not be liable for any defects that result from User's design, specifications or instructions for such EVMs. Testing and other quality control techniques are used to the extent TI deems necessary or as mandated by government requirements. TI does not test all parameters of each EVM.

   2.3 If any EVM fails to conform to the warranty set forth above, TI's sole liability shall be at its option to repair or replace such EVM, 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.

3 *Regulatory Notices:*

   3.1 *United States*

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

      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*

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSS standard(s). 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。
http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page

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 by Radio Law of Japan to follow the instructions below with respect to EVMs:

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.

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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:*

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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 ANDCONDITIONS OR THE USE OF THE EVMS PROVIDED HEREUNDER, 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 ONE YEAR AFTER THE RELATED CAUSE OF ACTION HAS OCCURRED.

   8.2 *Specific Limitations.* IN NO EVENT SHALL TI'S AGGREGATE LIABILITY FROM ANY WARRANTY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS AND CONDITIONS, OR ANY USE OF ANY TI EVM PROVIDED HEREUNDER, EXCEED THE TOTAL AMOUNT PAID TO TI FOR THE PARTICULAR UNITS SOLD UNDER THESE TERMS AND CONDITIONS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM AGAINST THE PARTICULAR UNITS SOLD TO USER UNDER THESE TERMS AND CONDITIONS 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.

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