EVM User's Guide: TAS5830EVM
TAS5830 Evaluation Module

![Texas Instruments logo]

Description

The TAS5830EVM showcases the latest TI digital input Class-D closed loop amplifier. The EVM is a stand-alone EVM that requires no additional circuitry to function. Users can configure the TAS5830EVM for stereo or mono output, and includes an optional boost supply to use the TAS5830 Class-H algorithm.

Get Started

1. Order the TAS5830EVM and request access to download PurePath™ Console 3 (PPC3) from the TAS5830EVM product page.
2. Read the TAS5830 data sheet.
3. Visit the E2E forum for any questions.

Features

- TAS5830 Class-H algorithm for audio envelope tracking
- Integrates LM5155 boost to provide customer system design reference
- Class-H system configuration: 9V battery input, boost to maximum 21V power rail based on audio envelope tracking
- Default system configuration: External PVDD power supply needed
- Operates in BTL or PBTL
- Provides flexible input signal routing (USB, Analog, Optical and external I2S)
- Demonstration, evaluation and development environment through the PurePath™ Console 3 software (GUI)
- Optional hardware control mode to set switching frequency, analog gain, BTL/PBTL mode and cycle-by-cycle current limit through pin configuration

Applications

- LCD TV, OLED TV, Laser TV, Mobile smart TV
- Smart speakers, Smart displays, sound bars, wireless speakers
- Piano, keyboard, synthesizer, professional speaker systems
- Professional conference systems, enterprise projectors
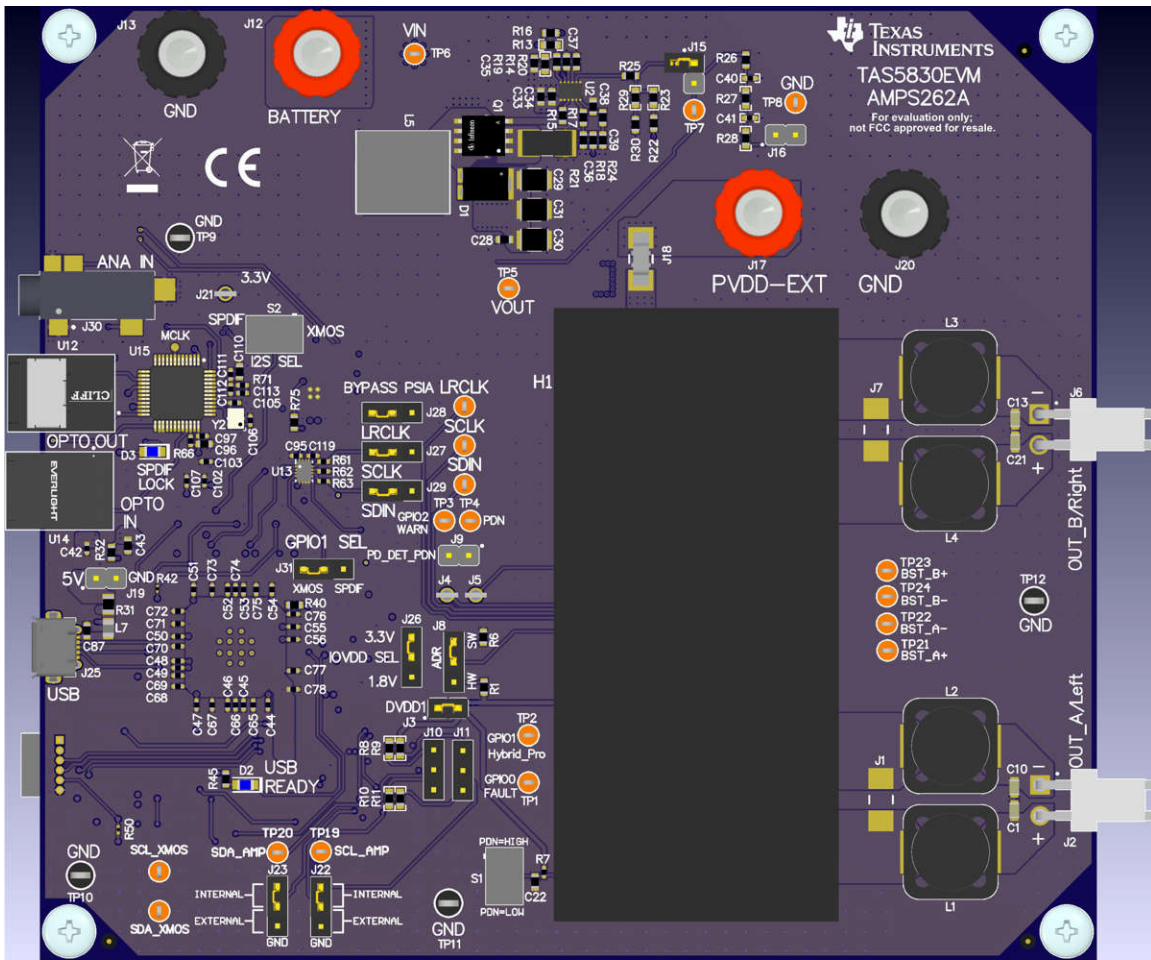
TAS5830EVM Hardware Board

1 Evaluation Module Overview

1.1 Introduction

This user's guide describes the operation of the TAS5830 Evaluation Modules (EVM). The TAS5830EVM is a stand-alone EVM. Use the PurePath™ Console 3 GUI (PPC3) to initialize and operate this EVM. The main contents of this document are:

1. Hardware descriptions and implementation
2. TAS5830EVM operations

Required equipment and accessories:

1. TAS5830EVM
2. A USB micro type-B cable
3. Power Supply Unit (PSU)
4. Speakers and cables
5. Desktop or laptop running Windows 7, Windows 8, Windows 10, or Windows 11
6. Audio source: This can be a DVD player with an optical or analog cable, or playback media from Windows 7, Windows 8, Windows 10, or Windows 11.

1.2 Kit Contents

The evaluation kit contains only the TAS5830EVM. A speaker is not included in the kit, but any speaker or dummy load rated for the expected output power can be connected to the output connectors. Similarly, a power supply is not a part of the kit and must be supplied to the appropriate banana jacks depending on if the Class-H algorithm or constant supply voltage is wanted. A micro-USB cable is also required if software mode is used.

1.3 Specification

The TAS5830 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 TAS5830EVM has an optional battery power supply input to use the LM5155 for Class-H control, an external power supply input to bypass the LM5155 boost, USB control through the PurePath™ Console 3 (PPC3), and flexible audio input options. The TAS5830EVM 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.

1.4 Troubleshooting

This section provides a series of solutions for possible problems that can happen while the TAS5830EVM is in use.

- No audio is playing but the device is on and the outputs are switching
  - Make sure that the I2S jumpers (J27, J28, and J29) are connected to the "bypass" option or that an external PSIA is connected
  - Make sure that the I2S select switch (S2) is set to XMOS if using USB audio or SPDIF if using optical or analog inputs
  - If using USB audio as the input, make sure that the EVM is selected as the playback device and that the volume is set correctly
  - Make sure the device is not muted in register 0x03
  - Probe the I2S signals into the device and make sure SDIN is as expected
- No audio is playing and the outputs are not switching
  - Read registers 0x70 to 0x73 to check for any faults and make adjustments as necessary. Register 0x78 can be used to clear faults after the faults are resolved
- PPC3 can connect to EVM but fails to communicate to the TAS5830
  - Make sure that I^{2}C jumpers (J22 and J23) are inserted
  - Make sure that the correct PVDD jumper to the device is installed and power is supplied. This is jumper J18 for external PVDD or J14 for Class-H control

2 Hardware

2.1 Hardware Setup

Software Control Mode

1. Connect speakers to TAS5830EVM.
2. Make sure jumper configurations are correct according to the desired configuration described in Table 2-1 and Table 2-2
3. Connect a PSU to the TAS5830EVM and turn on the power.
4. Plug in a USB cable from the PC to the TAS5830EVM. Make sure the USB READY LED (blue) illuminates.
5. If an optical source is used, the blue SPDIF LOCK LED illuminates.

Table 2-1. Boost Jumpers Configurations

Jumper	Name	LM5155 Boost Mode Configurations	External Customer Boost Mode Configurations
J12, J13	Battery, GND	IN - Battery input (9V)	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
J22	SCL	1-2 - Internal (Default)	Out
J23	SDA	1-2 - Internal (Default)	Out

Hardware Control Mode

1. Connect speakers to TAS5830EVM.
2. Make sure jumper configurations are correct with the appropriate mode: See Table 2-1 and Table 2-2. Use an external PVDD when in Hardware Control Mode.
3. Configure S2 to the SPDIF input source.
4. Note that in Hardware Control mode, some configurations require resistor modifications on the EVM board. See Table 2-3 and Table 2-4 for more details.
5. Connect a PSU to the TAS5830EVM and turn on the power.
6. Plug in a USB cable from the PC to the TAS5830EVM. The USB READY LED (blue) also illuminates.
7. If an optical source is used, the blue SPDIF LOCK LED illuminates.

2.2 Detailed Operation

The TAS5830EVM only requires a single supply to operate. Users can select three different audio sources:

1. Toggle the S2 switch to XMOS to stream audio through the Windows Media Player.
2. Toggle the S2 switch to SPDIF to stream audio through a DVD player with an optical cable or an analog cable.
3. Use jumpers to insert external I2S signals if an external digital audio source such as Programmable Serial Interface Adapter (PSIA) from Audio Precision is desired.

Both 3.3V and 1.8V DVDD and IOVDD are supported with TAS5830EVM. Use jumper (J26) to select accordingly based on requirement.

The TAS5830EVM provides optional onboard LM5155 boost Class-H evaluation or external customer system boost with Class-H control:

1. Onboard LM5155 boost Class-H evaluation
    *   9V battery power input through J12 and J13. Bypass external PVDD by removing J18
    *   TAS5830 PVDD is from LM5155 boost output: J14 - IN, J18 - OUT
    *   TAS5830 Class-H pin routes to LM5155 FB pin: J15 - IN, J16 - OUT
2. External customer system boost with Class-H control
    *   TAS5830 Class-H pin routes for external customer system boost FB control through TP7 FB and TP8 GND: J15 - OUT, J16 - OUT
    *   Customer system boost output for TAS5830 PVDD through J17 PVDD and J20 GND: J14 - OUT, J18 - IN

The USB connection is also used to provide I^{2}C communications with the two TAS5830 devices on the EVM. The PurePath™ Console 3 (PPC3) is the software tool which can initialize and operate this EVM.

Alternatively, the TAS5830 has an optional Hardware Control Mode to configure switching frequency, analog gain, BTL/PBTL mode and cycle-by-cycle current limit through pin configuration. Hardware Control Mode can be enabled by modifying J8 ADR/HW to HW, J10 SDA/HW_SEL0 to the desired mode according to Table 2-3, and J11 SCK/HW_SEL1 to the desired mode according to Table 2-4.

Table 2-3. Hardware Control - HW_SEL0 Pin5

R11 (GND)	R9 (DVDD)	Analog Gain	H-Bridge Output Configuration
0Ω	DNP	33.0V$_P$/FS	BTL
1kΩ	DNP	23.4V$_P$/FS	BTL
4.7kΩ	DNP	16.4V$_P$/FS	BTL
15kΩ	DNP	8.3V$_P$/FS	BTL
DNP	33kΩ	8.3V$_P$/FS	PBTL
DNP	6.8kΩ	16.4V$_P$/FS	PBTL
DNP	1.5kΩ	23.4V$_P$/FS	PBTL
DNP	0Ω	33.0V$_P$/FS	PBTL

Table 2-4. Hardware Control - HW_SEL1 Pin6

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

3 Hardware Design Files
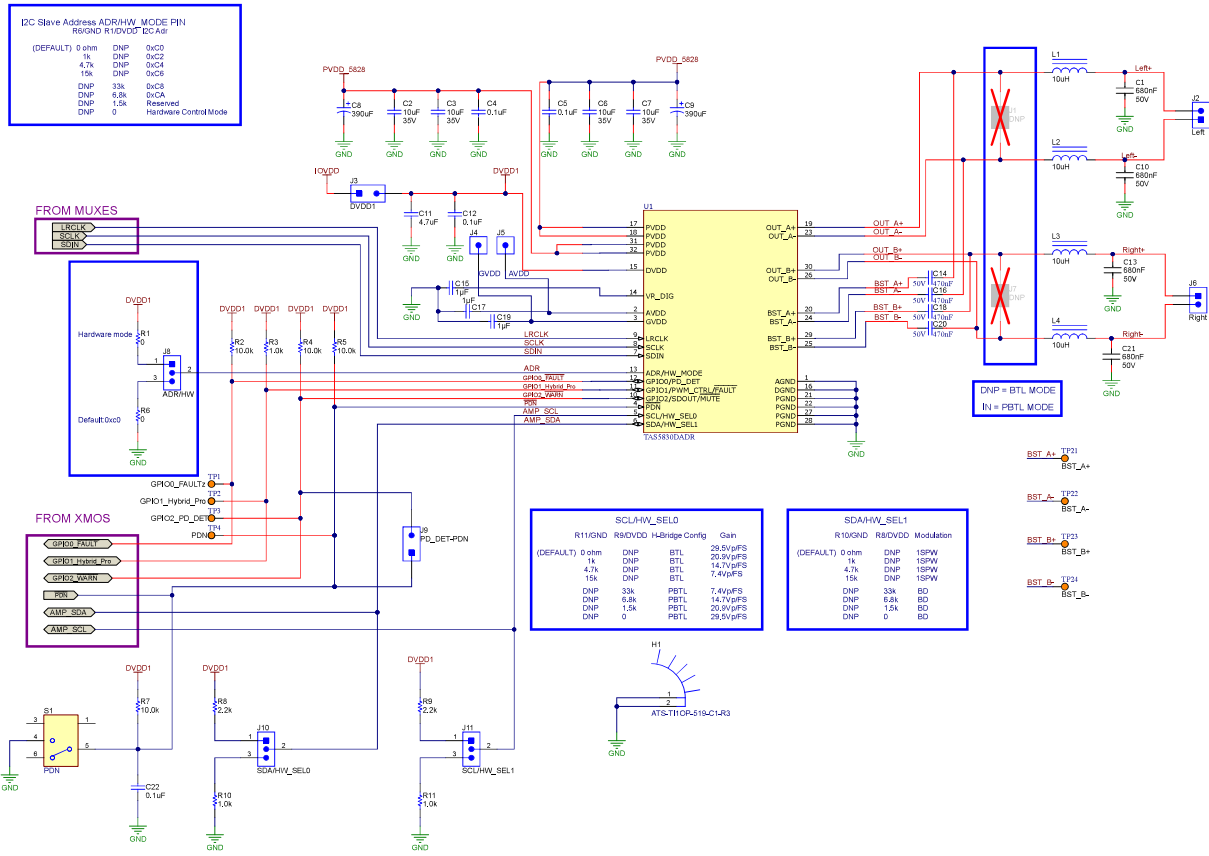
3.1 Schematics

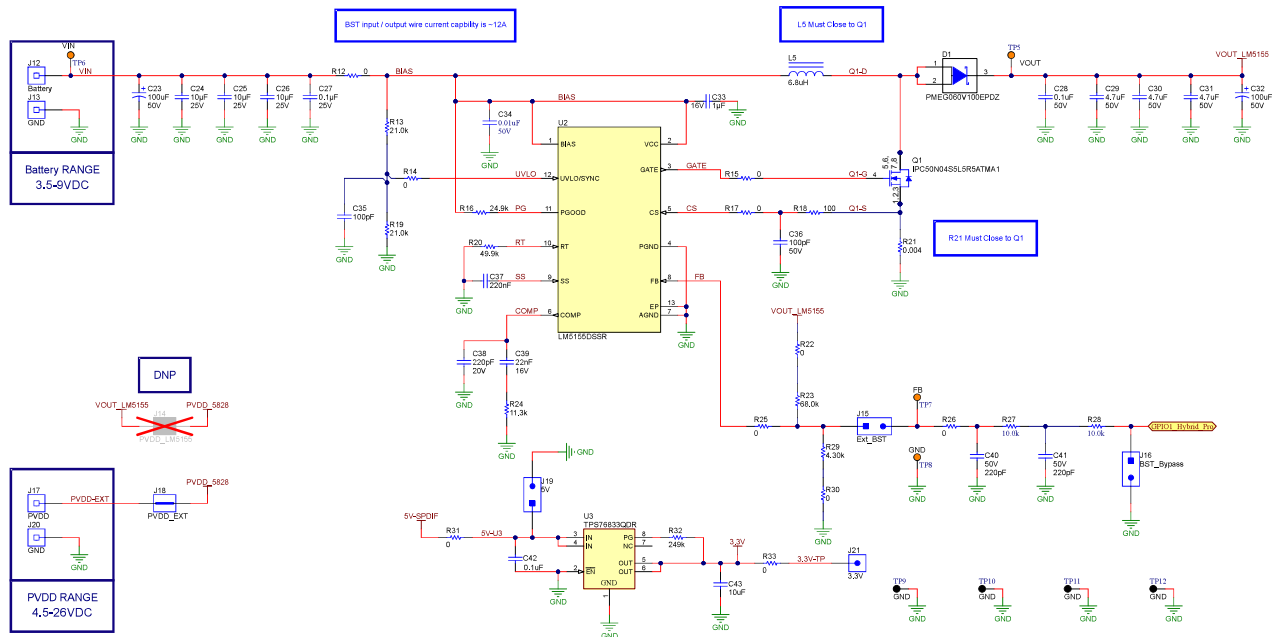**Figure 3-1. TAS5830EVM Schematic (1 of 5)**
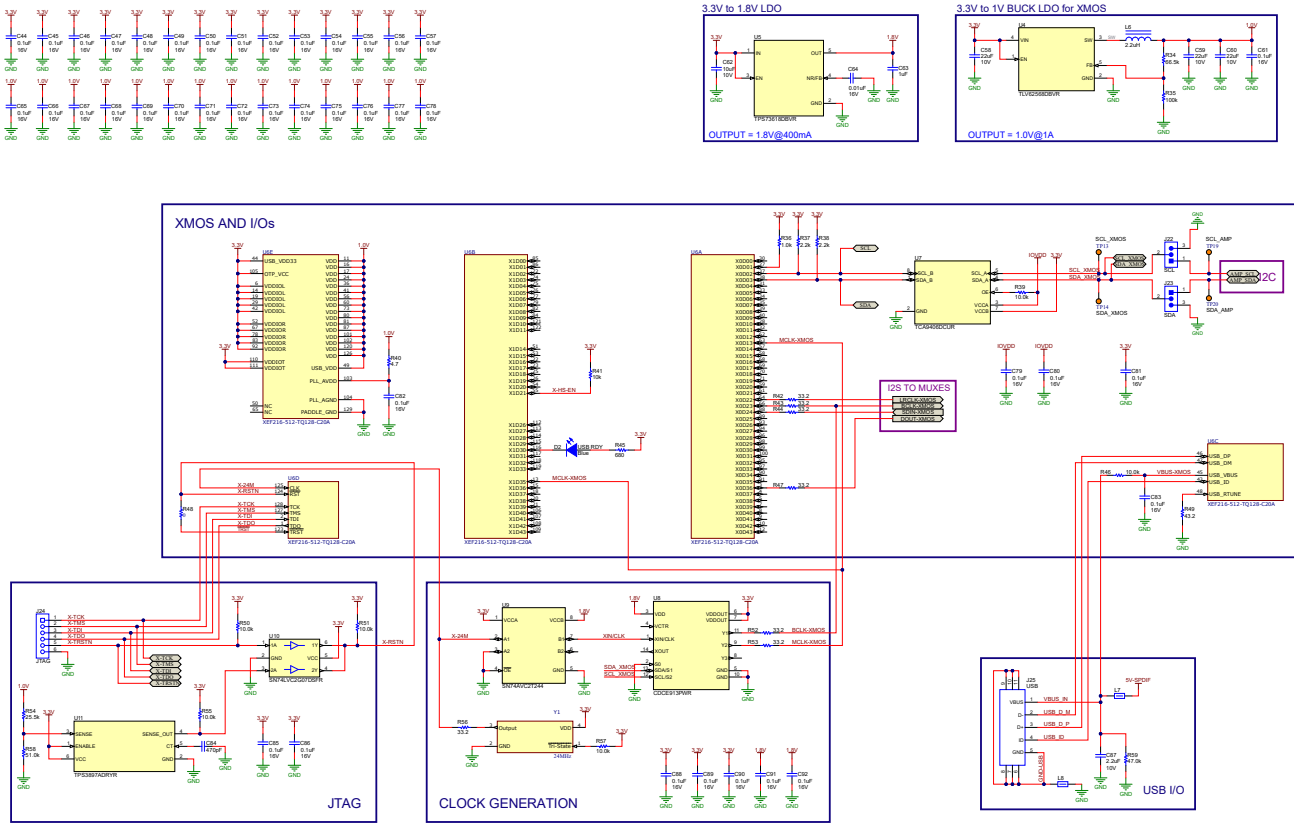

Figure 3-2. TAS5830EVM Schematic (2 of 5)

Figure 3-3. TAS5830EVM Schematic (3 of 5)

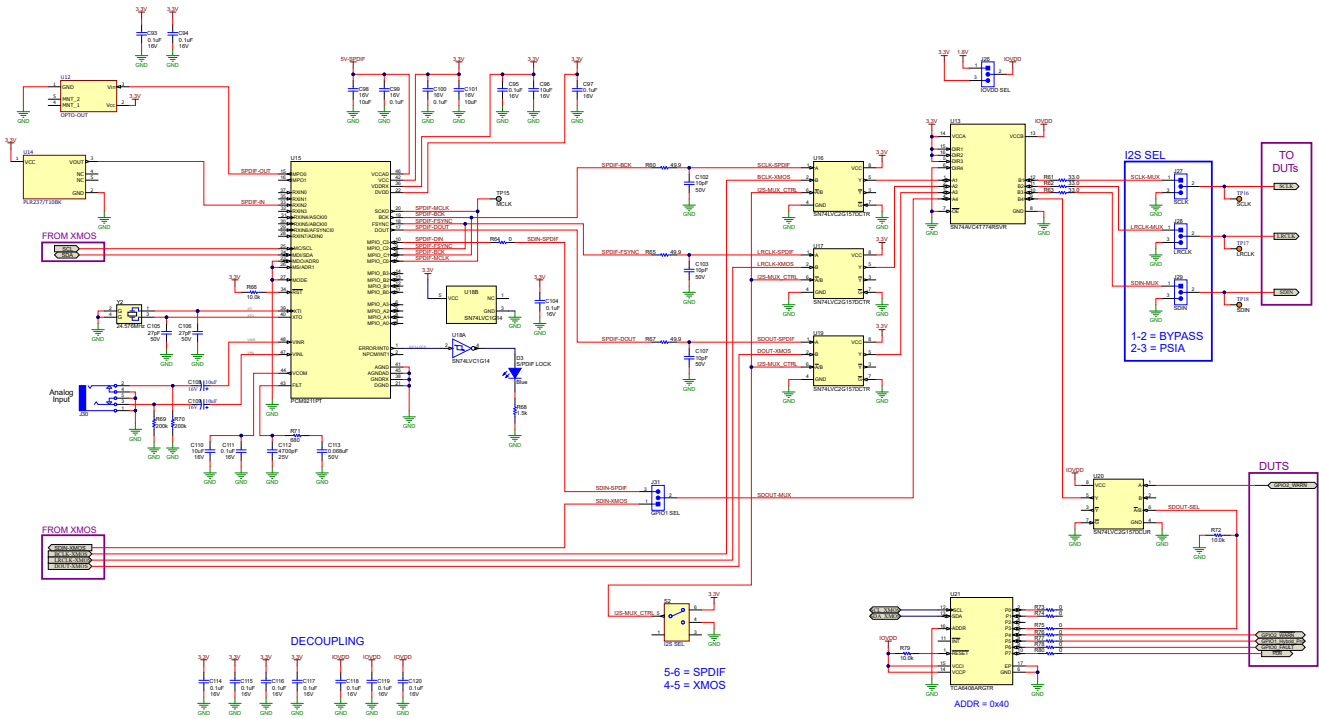**Figure 3-4. TAS5830EVM Schematic (4 of 5)**

H2
M3x8mm

H3
M3x8mm

H4
M3x8mm

H5
M3x8mm

H6
M3x12mm

H7
M3x12mm

H8
M3x12mm

H9
M3x12mm

!PCB1

PCB Number: AMPS262
PCB Rev: A
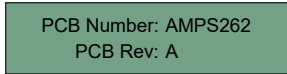
Printed Circuit Board

Logo2
PCB
LOGO
Texas Instruments

Logo3
PCB
LOGO
FCC disclaimer

Logo4
PCB
LOGO
WEEE logo

Logo1

CE Mark

FID1
Fiducial

FID2
Fiducial

FID3
Fiducial

FID4
Fiducial

FID5
Fiducial

FID6
Fiducial

SHUNTS

SH-J1 SH-J2 SH-J3 SH-J4 SH-J5

SH-J6 SH-J7 SH-J8 SH-J9 SH-J10
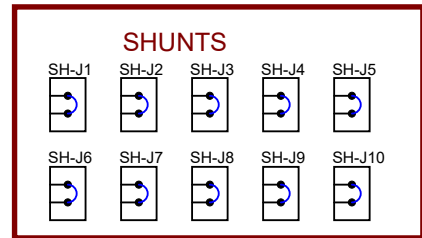
ZZ1
Assembly Note
These assemblies are ESD sensitive, ESD precautions shall be observed.

ZZ2
Assembly Note
These assemblies must be clean and free from flux and all contaminants. Use of no clean flux is not acceptable.

ZZ3
Assembly Note
These assemblies must comply with workmanship standards IPC-A-610 Class 2, unless otherwise specified.

Figure 3-5. TAS5830EVM Schematic (5 of 5)

3.2 Board Layouts

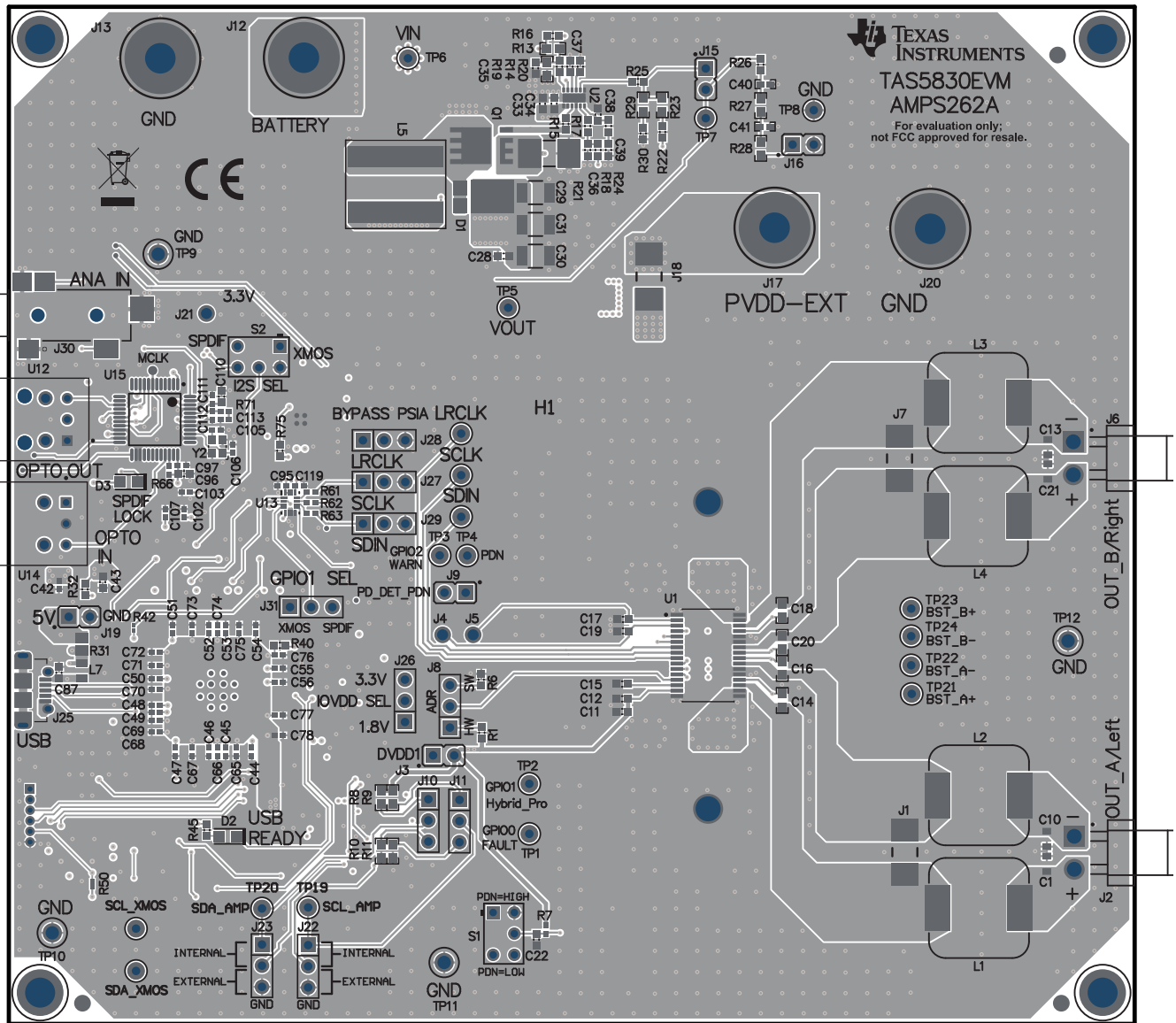Figure 3-6 and Figure 3-7 illustrate the board layouts for the EVM.
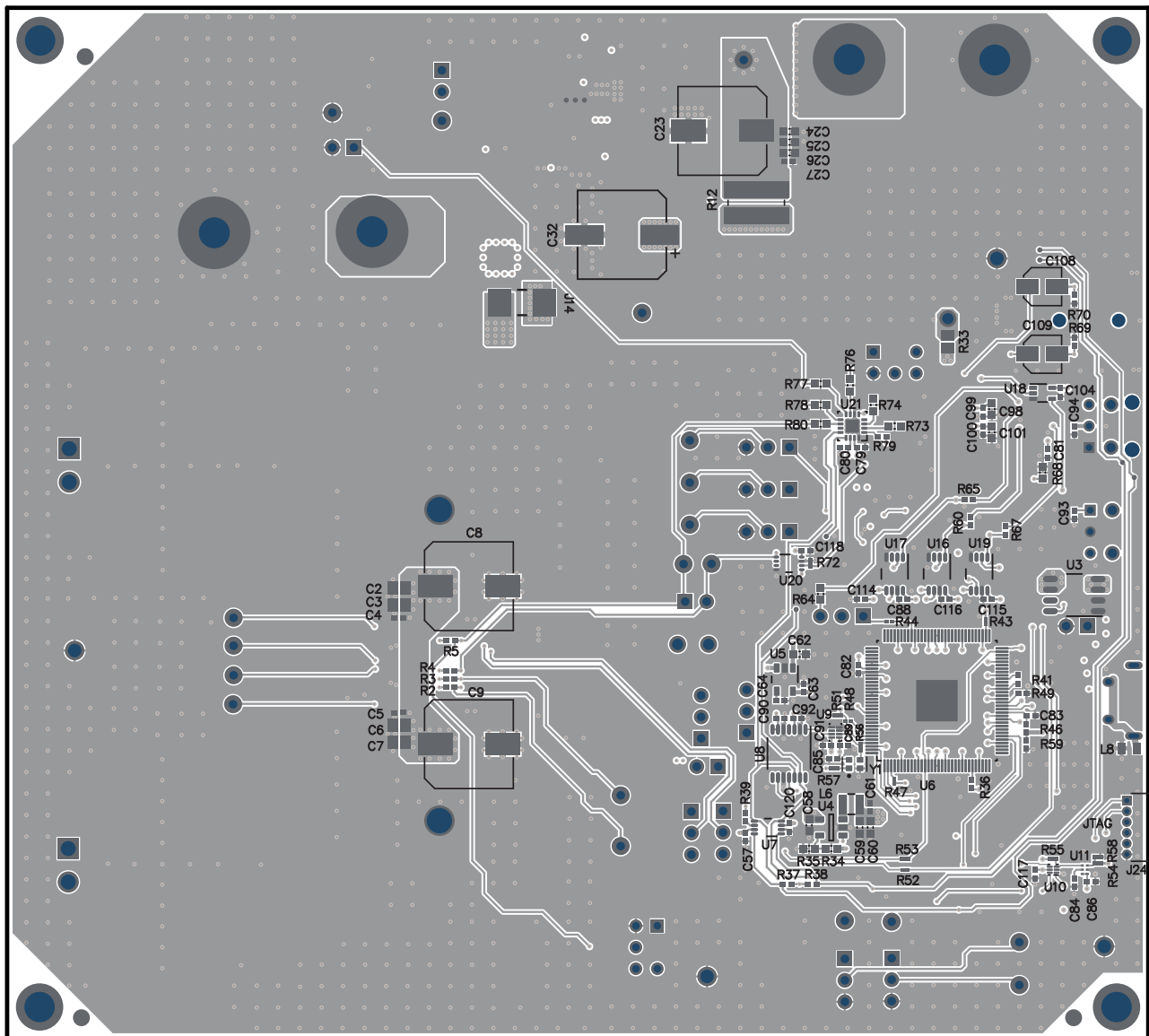

Figure 3-6. TAS5830EVM Top Overlay

Figure 3-7. TAS5830EVM Bottom Overlay

3.3 Bill of Materials

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
C1, C10, C13, C21	4	0.68uF	CAP CER 0.68UF 50V X7R 0805	0805	CGA4J3X7R1H684M125AB	TDK
C2, C3, C6, C7	4	10uF	CAP, CERM, 10 uF, 35 V, +/- 10%, X5R, 0805	0805	C2012X5R1V106K085AC	TDK
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	C0603C475K8PACTU	Kemet
C12, C22	2	0.1uF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0603	0603	C0603C104K4RACTU	Kemet
C14, C16, C18, C20	4	0.47uF	CAP, CERM, 0.47 uF, 50 V, +/- 10%, X7R, 0603	0603	C1608X7R1H474K080AC	TDK
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	EEHZC1H101P	Panasonic
C24, C25, C26	3	10uF	CAP, CERM, 10 µF, 25 V,+/- 10%, X5R, 0603	0603	GRM188R61E106KA73D	MuRata
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
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, AEC-Q200 Grade 1, 0603	0603	GCM188R71H103KA37D	MuRata
C35, C36	2	100pF	CAP, CERM, 100 pF, 50 V,+/- 1%, C0G/NP0, 0603	0603	C0603C101F5GACTU	Kemet
C37	1	0.22uF	CAP, CERM, 0.22 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H224K080AB	TDK
C38	1	220pF	CAP, CERM, 220 pF, 20 V, +/- 5%, C0G/NP0, AEC-Q200 Grade 1, 0603	0603	CGA3E2C0G1H221J080AA	TDK

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
C39	1	0.022uF	CAP, CERM, 0.022 uF, 16 V, +/- 10%, X7R, 0603	0603	C0603C223K4RACTU	Kemet
C40, C41	2	220pF	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
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	470pF	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
C102, C103, C107	3	10pF	CAP, CERM, 10 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	885012005055	Wurth Elektronik
C105, C106	2	27pF	CAP, CERM, 27 pF, 50 V, +/- 5%, C0G/NP0, 0402	0402	GJM1555C1H270JB01	MuRata
C108, C109	2	10uF	CAP, AL, 10 uF, 16 V, +/- 20%, 3 ohm, SMD	SMT Radial B	EEE-FC1C100R	Panasonic
C112	1	4700pF	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

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
D1	1	60V	Diode, Schottky, 60 V, 10 A, AEC-Q101, CFP15	CFP15	PMEG060V100EPDZ	Nexperia
D2, D3	2	Blue	LED, Blue, SMD	LED_0805	LTST-C170TBKT	Lite-On
H1	1		Heat Sink, Vertical	Heatsink	ATS-TI1OP-519-C1-R3	Advanced Thermal Solutions
H2, H3, H4, H5	4		MACHINE SCREW PAN PHILLIPS M3	M3 Screw	RM3X8MM 2701	APM HEXSEAL
H6, H7, H8, H9	4		Standoff, Hex, 12mm, M3, Aluminum	Aluminum M3 12mm Hex Standoff	24434	Keystone
J2, J6	2		Header (friction lock), 3.96mm, 2x1, Tin, R/A, TH	Header, 2x1, 3.96mm, R/A	B2PS-VH(LF)(SN)	JST Manufacturing
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	3			Test point, TH Slot Test point	1040	Keystone
J8, J10, J11, J22, J23, J26, J27, J28, J29, J31	10		Header, 100mil, 3x1, Gold, TH	PBC03SAAN	PBC03SAAN	Sullins Connector Solutions
J12, J17	2		Binding Post, RED, TH	11.4x27.2mm	7006	Keystone
J13, J20	2		Binding Post, BLACK, TH	11.4x27.2mm	7007	Keystone
J18	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	475890001	Molex
J30	1		Audio Jack, 3.5mm, Stereo, R/A, SMT	Phone Jack, 6x5x17mm	35RASMT4BHNTRX	Switchcraft
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
L6	1	2.2uH	Inductor, Multilayer, Ferrite, 2.2 uH, 1.3 A, 0.08 ohm, SMD	SMD, Body 2.5x2mm, Height 1.2mm	LQM2HPN2R2MG0L	MuRata
L7, L8	2	600 ohm	Ferrite Bead, 600 ohm @ 100 MHz, 2 A, 0805	0805	MPZ2012S601AT000	TDK
Q1	1	40V	MOSFET, N-CH, 40 V, 50 A, AEC-Q101, SON-8	SON-8	IPC50N04S5L5R5ATMA1	Infineon Technologies
R1, R6, R15, R17, R22, R25, R26, R30, R73, R74, R75, R76, R77, R78, R80	15	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

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
R3, R36	2	1.0k	RES, 1.0 k, 5%, 0.063 W, AEC-Q200 Grade 0, 0402	0402	CRCW04021K00JNED	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	0.004	RES, 0.004, 1%, 3 W, AEC-Q200 Grade 0, 6.4x3.2mm	6.4x3.2mm	ERJ-MS4SF4M0U	Panasonic
R23	1	68.0k	RES, 68.0 k, 1%, 0.1 W, 0603	0603	RC0603FR-0768KL	Yageo
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	66.5k	RES, 66.5 k, 1%, 0.1 W, 0603	0603	RC0603FR-0766K5L	Yageo
R35	1	100k	RES, 100 k, 1%, 0.1 W, 0603	0603	RC0603FR-07100KL	Yageo
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
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
R42, R43, R44, R47, R52, R53, R56	7	33.2	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

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
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
R61, R62, R63	3	33.0	RES, 33.0, 1%, 0.1 W, 0402	0402	ERJ-2RKF33R0X	Panasonic
R68	1	1.5k	RES, 1.5 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06031K50JNEA	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
S1, S2	2		Switch, SPDT, On-On, 2 Pos, TH	Switch, 7x4.5mm	200USP1T1A1M2RE	E-Switch
SH-J1, SH-J2, SH-J3, SH-J4, SH-J5, SH-J6, SH-J7, SH-J8, SH-J9, SH-J10	10	1x2	Shunt, 100mil, Gold plated, Black	Shunt	SNT-100-BK-G	Samtec
TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8, TP13, TP14, TP16, TP17, TP18, TP19, TP20, TP21, TP22, TP23, TP24	19		Test Point, Miniature, Orange, TH	Orange Miniature Testpoint	5003	Keystone Electronics
TP9, TP10, TP11, TP12	4		Test Point, Compact, Black, TH	Black Compact Testpoint	5006	Keystone Electronics
U1	1		TAS5830DADR	TSSOP32	TAS5830DADR	Texas Instruments
U2	1		2.2-MHz Wide Input Nonsynchronous Boost, Sepic, Flyback Controller, DSS0012B (WSON-12)	DSS0012B	LM5155DSSR	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		1-A High Efficiency Step-Down Converter in SOT23-5 Package, DBV005A, DBV0005A (SOT-5)	DBV0005A	TLV62568DBVR	Texas Instruments
U5	1		Single Output LDO, 400mA, Adj.(1.2 to 5.5V), Cap free, Low Noise, Reverse Current Protection, DBV0005A (SOT-23-5)	DBV0005A	TPS73618DBVR	Texas Instruments

Designator	Quantity	Value	Description	PackageReference	PartNumber	Manufacturer
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 I^{2}C 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
U9	1		Dual-Bit Dual-Supply Bus Transceiver, DQM0008A (X2SON-8)	DQM0008A	SN74AVC2T244DQMR	Texas Instruments
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
U14	1		Optical Receiver 25Mbps Single 650nm	PTH_9MM70_13MM50	PLR237/T10BK	Everlight Electronics
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
U18	1		Single Schmitt-Trigger Inverter, DCK0005A (SOT-SC70-5)	DCK0005A	SN74LVC1G14DCKR	Texas Instruments
U20	1		Single 2-Line to 1-Line Data Selector/Multiplexer, DCU0008A, LARGE T&R	DCU0008A	SN74LVC2G157DCUR	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
Y1	1		Crystal Oscillator 24MHz ±50ppm HCMOS 3.3V SMD 2x1.6mm	SMD_2MM0_1MM6	ASA-24.000MHZ-L-T	Abracon
Y2	1		Crystal, 24.576 MHz, 10pF, 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.

<u>WARNING</u>

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２４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.

IMPORTANT NOTICE AND DISCLAIMER