

TAS5132DDV2EVM for the TAS5132 Digital Amplifier Power Output Stage

User's Guide

TAS5132DDV2EVM for the TAS5132 Digital Amplifier Power Output Stage

User's Guide

Literature Number: SLLU097
April 2007

Contents

1	Related Documentation from Texas Instruments	5
1.1	Additional Documentation	5
2	Overview	5
2.1	TAS5132DDV2EVMV2 Features	6
2.2	PCB Key Map	7
3	Quick Setup Guide	7
3.1	Electrostatic Discharge Warning	7
3.2	Unpacking the EVM	7
3.3	Power Supply Setup	8
3.4	GUI Software Installation	8
3.5	Operational Sequence and Indicators	9
4	System Interfaces	10
4.1	Power Supply (PSU) Interface (J7 and J8)	10
4.2	J9/J10 Amplifier Controller Connectors	10
4.3	J11 External Power Connector	11
4.4	Loudspeaker Connectors (J3 - J6)	11
4.5	SPDIF Optical Input Connector	11
4.6	SPDIF Co-Axial Input Connector	12
4.7	USB Connector	12
5	Protection	12
5.1	Short-Circuit Protection and Fault-Reporting Circuitry	12
5.2	Fault Reporting	12
Appendix A	Design Documents	13
A.1	HLP_MC012 Schematic	13
A.2	TAS5132DDV2EVM Schematic	15
A.3	TAS5132DDV2EVM Composite Drawings	16
A.4	HPL-MC012 Composite Drawings	18
A.5	Heat Sink Drawing	20
A.6	HPL-MC012 Parts List	21
A.7	TAS5132DDV2EVM Parts List	23
	Important Notices	25

List of Figures

1	Integrated PurePath Digital™ Amplifier System	6
2	Physical Structure for TAS5132DDV2EVM (Rough Outline).....	7
3	TAS5086 GUI Window	9
4	Recommended Power-Up Sequence.....	10

List of Tables

1	Related Documentation from Texas Instruments	5
2	Recommended Supply Voltage	8
3	Recommended Supply Voltages	10
4	J7 and J8	10
5	J9/J10 Pin Description Amplifier/Controller Connector	10
6	J11 Pin Description External Power Connector	11
7	J3 - J6 Pin Description.....	11
8	TAS5132 Warning/Error Signal Decoding	12
A-1	Bill of Materials for HPL-MC012	21
A-2	Bill of Materials for TAS5132DDV2EVM	23

TAS5132DDV2EVM for the TAS5132 Digital Amplifier Power Output Stage

This user's guide describes the operation of the TAS5132DDV2EVM evaluation module from Texas Instruments.

1 Related Documentation from Texas Instruments

Table 1 contains a list of data sheets that have detailed descriptions of the integrated circuits used in the design of the TAS5086-5132V2EVM. These documents can be obtained from the Texas Instruments Web site at <http://www.ti.com>.

Table 1. Related Documentation from Texas Instruments

Part Number	Literature Number
TAS5132DDV2 Application Report	SLLA258
TAS5086	SLES131
TAS5132	SLES190
TUSB3210	SLLS466
UA78M12CKTPR	SLVS059
TPS40200D	SLUS659
TPS3825-33DBVT	SLVS165

1.1 Additional Documentation

- TAS5132DDV2EVM Application Report ([SLLA258](#))
- PC Configuration Tool for TAS5086 (TAS5086 GUI version 4.0 or later)

2 Overview

The TAS5132DDV2EVM is composed of two separate modules, the HPL-MC012 Modulator/Controller Module and the TAS5132DDV2EVM Amplifier Module. They are designed so that the user can separate the two modules and connect the TAS5132DDV2EVM Amplifier Module in to a target system via a ribbon cable. Keep this ribbon cable as short as possible to avoid degradation in the PWM signals.

The TAS5132DDV2EVM PurePath Digital™ customer evaluation amplifier module demonstrates two audio integrated circuits — the TAS5086 and the TAS5132 from Texas Instruments (TI).

The TAS5086DBT is a high-performance, 32-bit (24-bit input), multichannel PurePath Digital™ pulse width modulator (PWM) based on Equibit™ technology with fully symmetrical AD modulation scheme. It accepts an input sample rate from 32 kHz to 192 kHz. The device also has digital audio processing (DAP) that provides bass management, advanced performance, and a high level of system integration.

The TAS5132DDV is a compact, high-power, digital amplifier power stage designed to drive an 8-Ω loudspeaker up to 20 W/10% THD+N. It contains integrated gate-drive, four matched and electrically isolated enhancement-mode N-channel power DMOS transistors, and protection/fault-reporting circuitry.

Overview

The DDV package has a PowerPAD™ package on the top side for heat transfer through a heat sink. The heat sink in this design is for evaluation purposes only.

This EVM plus the HPLMC-012 is a complete 2-channel, digital audio amplifier system which includes digital input (S/PDIF), control interface (via USB) to PC and DAP features like digital volume control, bass management, and input and output multiplexers.

This EVM is designed to illustrate a low-cost approach to an amplifier design using this device. Improved performance, at increased cost, can be achieved with a high-performance configuration.

2.1 TAS5132DDV2EVMV2 Features

- Modular approach comprised of TAS5132DDV2EVM amplifier module and HPL-MC012 modulator/controller module
- Two- channel, PurePath Digital™ evaluation module (double-sided, plated-through PCB layout).
- Self-contained protection system (short-circuit and thermal).
- Standard I²S and I²C / control via SPDIF and USB
- Double-sided, plated-through PCB layout
- Single power supply operation

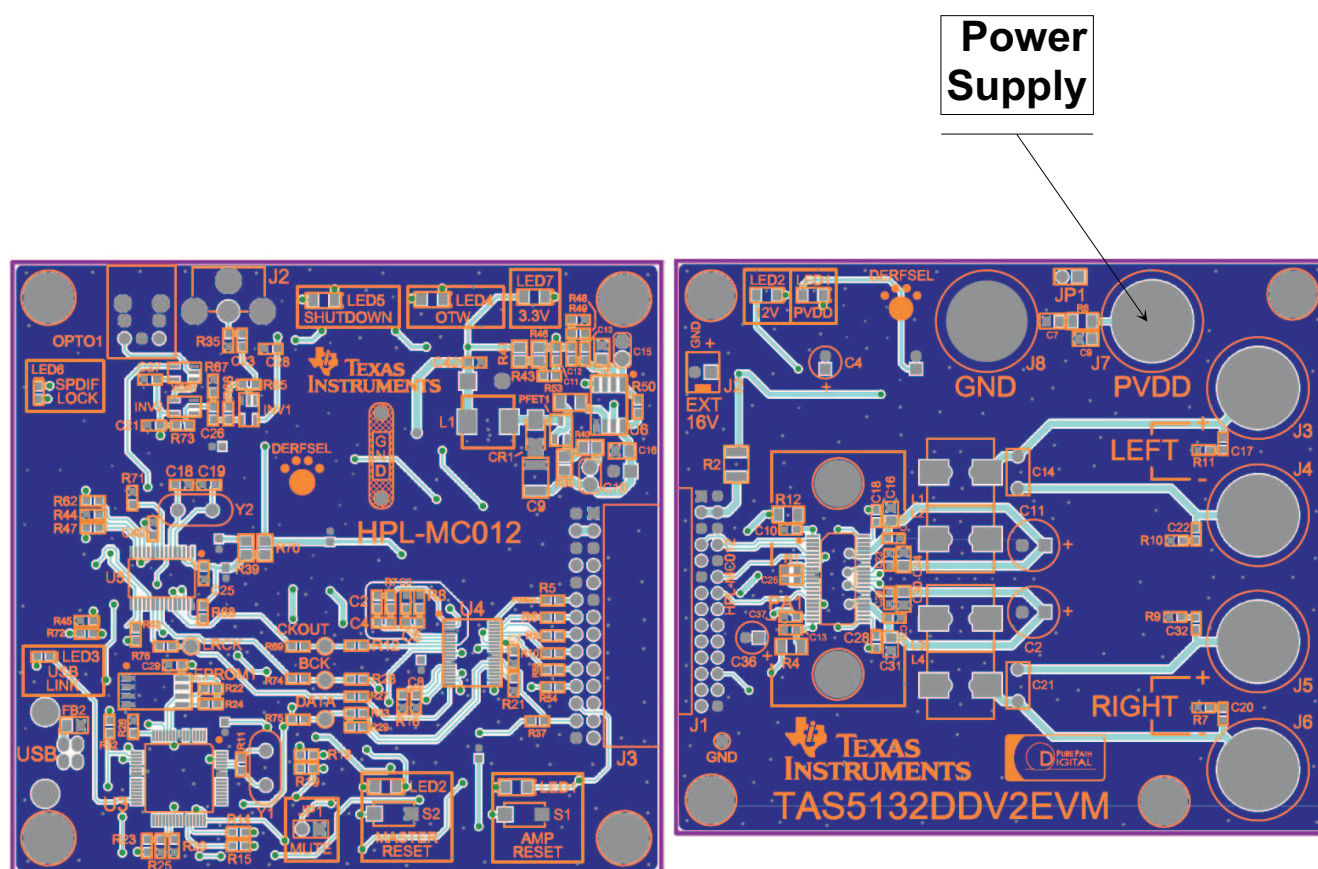


Figure 1. Integrated PurePath Digital™ Amplifier System

2.2 PCB Key Map

Physical structure for the TAS5132DDV2EVM is illustrated in Figure 2.

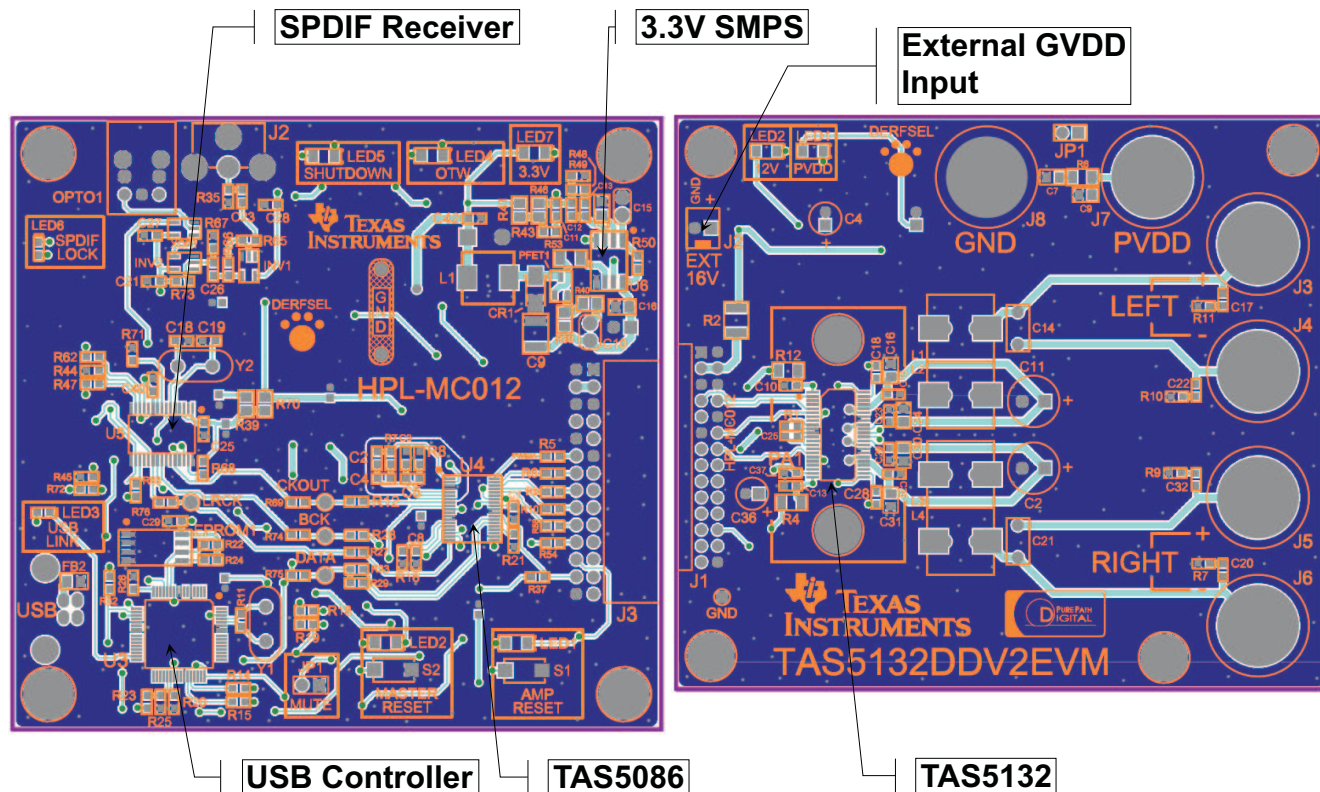


Figure 2. Physical Structure for TAS5132DDV2EVM (Rough Outline)

3 Quick Setup Guide

This section describes the TAS5132DDV2EVM board in regards to power supplies and system interfaces. It provides information regarding handling and unpacking, absolute operating conditions, and a description of the factory default switch and jumper configuration.

The section also provides a step-by-step guide to configuring the TAS5132DDV2EVM for device evaluation.

3.1 Electrostatic Discharge Warning

Many components on the TAS5132DDV2EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

CAUTION

Failure to observe ESD handling procedures may result in damage to EVM components.

3.2 Unpacking the EVM

On opening the TAS5086-5132V2EVM package, ensure that the following items are included:

- 1 pc. TAS5132DDV2EVM Power Stage Board

- 1 pc. HPL-MC012 Modulator/Input Board
- Because this system has standard connectors, no cables are supplied
- 1 pc. TAS5132DDV2EVM CD-ROM.

If any of these items are missing, contact the Texas Instruments Product Information Center nearest you to inquire about a replacement.

Connect the Modulator/Input board to the Power Stage board with the docking connectors on each board. Use care because this connector is not keyed.

3.3 Power Supply Setup

To power up the EVM, one power supply is needed for system power, logic and gate-drive, and for output stage supply. The power supply is connected to the EVM with banana cables or stripped insulated wire.

Table 2. Recommended Supply Voltage

Description	Voltage Limitations	Current Requirement	Connector
Output stage power supply	12 V – 19 V	5 A	Red/black

CAUTION

Applying voltages above the limitations given in [Table 2](#) may cause permanent damage to your hardware.

3.4 GUI Software Installation

The TAS5086 GUI provides easy control of all registers in TAS5086. To install the GUI, run the setup file from the TAS5132DDV2 CD-ROM.

After installation, turn on the power supply, and connect the USB cable to the Modulator/Controller board.

Start the GUI program from The Windows™ menu. (Program Files/Texas Instruments) The start-up of the GUI takes few seconds.



Figure 3. TAS5086 GUI Window

From the files menu, load the configuration file:

TAS5132DDV2EVM Configuration (1.00).cfg

The file is located on the TAS5132DDV2EVM CD-ROM. This file contains all settings for a default setup of the EVM.

For easy access of the file, it is recommended to copy the files into directory where the GUI is installed. Default is C:\Program Files\Texas Instruments Inc\TAS5086\.

For more advanced use of the GUI and the features of the TAS5086 modulator, see the GUI User's Guide and the TAS5086 data sheet ([SLES131](#)). The GUI User's Guide can be accessed by clicking on Help in the toolbar and then selecting *User's Guide* in the drop-down menu.

3.5 Operational Sequence and Indicators

- After connecting the power supply and turning it on, the power supply current should be ~40 mA. The amplifier reset LED should be on.
 - The PVDD, GVDD, and 3.3V LEDs should be on. If not, check for the presence of JP1 on the TAS5132DDV2 EVM. Install JP1 if necessary.
- Connect the SPDIF cable, either optical or coaxial, to an SPDIF source.
- Connect the USB cable and the USB LED (blue LED should be on).
 - The EVM should enumerate without the installation of a USB driver; it is a Windows™ audio class device.
- Start the GUI. (It should not give an indication of COMMUNICATION ERROR).
 - C:\Program Files\Texas Instruments Inc\TAS5086 GUI
- Load the configuration file.
 - (File, Load, Config File, TAS5132DDV2EVM)
 - The AMP RESET LED should go off.
 - The power supply current should be ~96 mA.
 - This indicates that the amplifier is now switching and ready for audio input.
 - The SPDIF indicator should be on (blue LED), when locked to a valid source of SPDIF.
- If the preceding conditions are met, the EVM system is now ready to accept audio data.

System Interfaces

- Note: The default gain setting of the TAS5086 GUI is 0 dB. If you are connecting directly from a music source (CD player) for input and speakers for output, you may want to use the volume control function of GUI to reduce the gain before the program material is started.

4 System Interfaces

This section describes the TAS5132DDV2EVM board in regards to power supplies and system interfaces.

4.1 Power Supply (PSU) Interface (J7 and J8)

The TAS5132DDV2EVM module must be powered from a well regulated external power supply. Good audio performance requires a stabilized power supply with low ripple voltage and low output impedance.

Note: The length of power supply cable must be minimized. Increasing the length of the PSU cable is equal to increasing the distortion for the amplifier at high output levels and low frequencies.

Maximum output stage supply voltage depends of the speaker load resistance. For the recommended maximum supply voltage, seen the TAS5132 data sheet ([SLES190](#)).

Table 3. Recommended Supply Voltages

Description	Voltage Limitations (4-Ω Load)	Current Recommendations
Output stage power supply	12 V – 19 V	5 A ⁽¹⁾

⁽¹⁾ The rated current corresponds to 2-channel full scale (25 W each).

The recommended TAS5132 power-up sequence is shown in [Figure 4](#). For proper TAS5132 operation, the $\overline{\text{RESET}}$ signal should be kept low during power up. $\overline{\text{RESET}}$ is pulled low during power up for 200 ms by the onboard reset generator (U2).

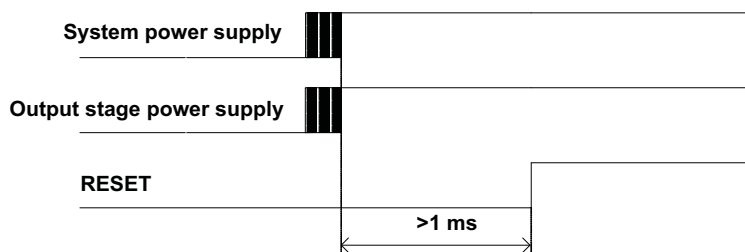


Figure 4. Recommended Power-Up Sequence

Table 4. J7 and J8

Function	Connector
PVDD	J7
Ground	J8

4.2 J9/J10 Amplifier Controller Connectors

Table 5. J9/J10 Pin Description Amplifier/Controller Connector

Pin No.	Net-Name at Schematics	Description
1, 2, 5, 6, 10, 11	DGND	Low-current ground for modulator/controller

Table 5. J9/J10 Pin Description Amplifier/Controller Connector (continued)

Pin No.	Net-Name at Schematics	Description
3, 4	PVDD2	PVDD buffered through 24-Ω resistor to power the modulator/controller
7	$\overline{\text{OTWX}}$	Overttemperature warning from the amplifier ($T > 125^{\circ}\text{C}$)
8	$\overline{\text{SDX}}$	Error and amplifier has stopped switching
9, 13, 15, 17, 19, 21, 23, 27, 28	NC	Not connected
12	PWMX1	Channel 1 PWM signal from modulator
14	PWMX2	Channel 2 PWM signal from modulator
16	PWMX3	Channel 3 PWM signal from modulator
18	PWMX4	Channel 4 PWM signal from modulator
20	PWMX5	Channel 5 PWM signal from modulator
22	PWMX6	Channel 6 PWM signal from modulator
24	$\overline{\text{AMP_RESET}}$	Resets the TAS5132
25	VALID1	Valid output signal from modulator; not used on this amplifier
26	$\overline{\text{BKND_ERR}}$	Power stage error; not used on this amplifier

4.3 J11 External Power Connector

Table 6. J11 Pin Description External Power Connector⁽¹⁾

Pin No.	Net-Name at Schematics	Description
1	External voltage input	Powers controller board
2	DGND	Low-current ground for modulator/controller

⁽¹⁾ (Optional – Used to power GVDD from separate 12-V to 15-V power supply, for idle current measurement. JP1 must be removed to use this connector. JP1 must be installed for normal operation.)

4.4 Loudspeaker Connectors (J3 - J6)

CAUTION

Both positive and negative speaker outputs are floating and may not be connected to ground (e.g., through an oscilloscope).

Table 7. J3 - J6 Pin Description

Jack No.	Net-Name at Schematics	Description
J3	OUT_A	Speaker positive output
J4	OUT_B	Speaker negative output
J5	OUT_C	Speaker positive output
J6	OUT_D	Speaker negative output

4.5 SPDIF Optical Input Connector

This connector is a standard TOSLINK connector that connects the SPDIF digital audio input to the SPDIF receiver on the HPL-MC012 PCB. This connector, or the SPDIF co-axial input, is used, but not both connectors at the same time.

4.6 SPDIF Co-Axial Input Connector

This connector is a standard RCA connector that connects the SPDIF digital audio input to the SPDIF receiver on the HPL-MC012 PCB. This connector, or the SPDIF optical Input, is used, but not both connectors at the same time.

4.7 USB Connector

This connector is a standard USB connector and is used to connect GUI control information from a PC to the HPL-MC012 PCB. The USB system does not stream audio from a PC.

5 Protection

This section describes the short-circuit protection and fault-reporting circuitry of the TAS5132 device.

5.1 Short-Circuit Protection and Fault-Reporting Circuitry

The TAS5132 is a self-protecting device that provides fault reporting (including high-temperature protection and short-circuit protection). The TAS5132 is configured in back-end auto-recovery mode and therefore resets automatically after all errors (M1 and M3 are set low and M2 is set high). This means that the device re-starts itself after an error and reports with the $\overline{SD}$ error signal. Furthermore, the modulation is 1N mode.

5.2 Fault Reporting

The $\overline{OTW}$ and $\overline{SD}$ outputs from TAS5132 indicate fault conditions. See the TAS5132 data sheet ([SLES190](#)) for a description of these pins.

Table 8. TAS5132 Warning/Error Signal Decoding

$\overline{OTW}$	$\overline{SD}$	Device Condition
0	0	High-temperature error and/or high-current error
0	1	High-temperature warning
1	0	Undervoltage lockout or high-current error
1	1	Normal operation, no errors/warnings

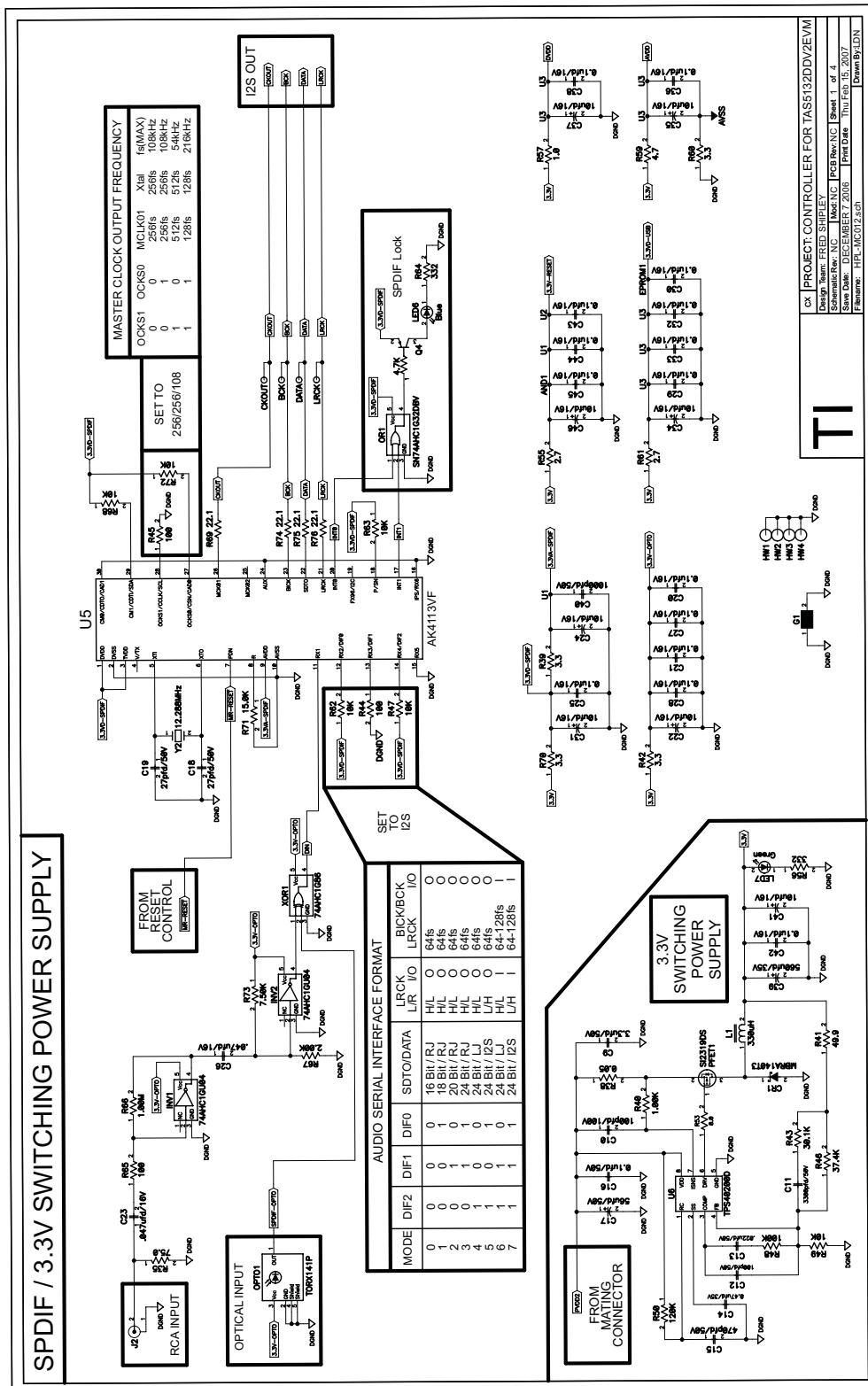
The temperature warning signals at the TAS5132DDV2EVM board can be wired-OR to one temperature warning signal ($\overline{OTW}$ — pin 7 in docking connector). Shutdown signals can be wired-OR into one shutdown signal ($\overline{SD}$ — pin 8 in the docking connector).

The shutdown signals, together with the temperature warning signal, give chip state information as described in [Table 8](#). Device fault-reporting outputs are open-drain outputs.

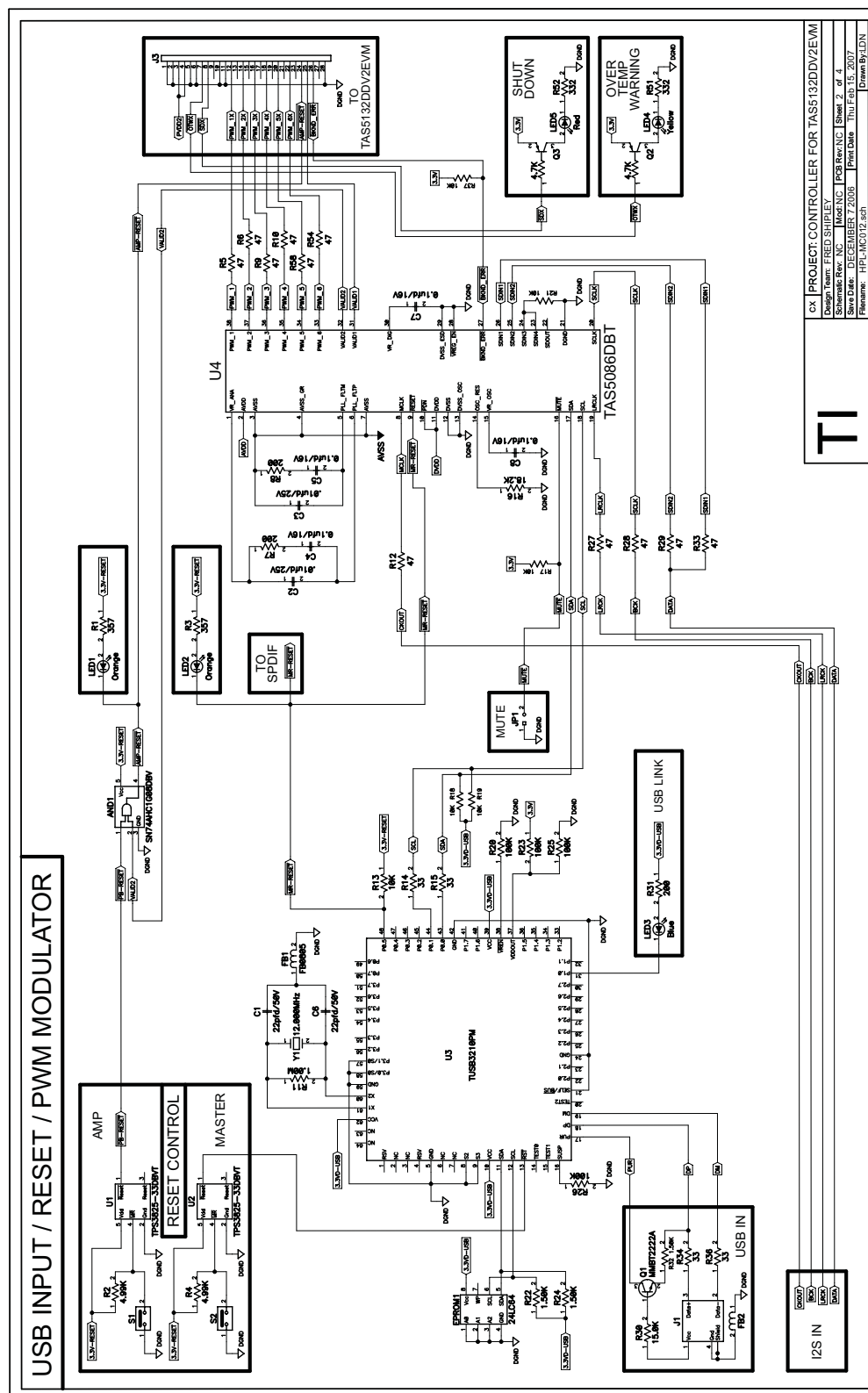
An LED is connected to each of these logic signals and is lit when error conditions occur.

Appendix A Design Documents

A.1 HLP_MC012 Schematic



HLP_MC012 Schematic



CK	PROJECT: CONTROLLER FOR TAS5132DDV2EVM
Design Team	FRED SHIPLEY
Design Date	DEC 15, 2007
Rev	1.0
Rev Date	DEC 15, 2007
Rev Description	Initial Release
Rev By	LDN

TI

SHUT DOWN
OVER TEMP WARNING

USB LINK

MUTE

TAS5086BT

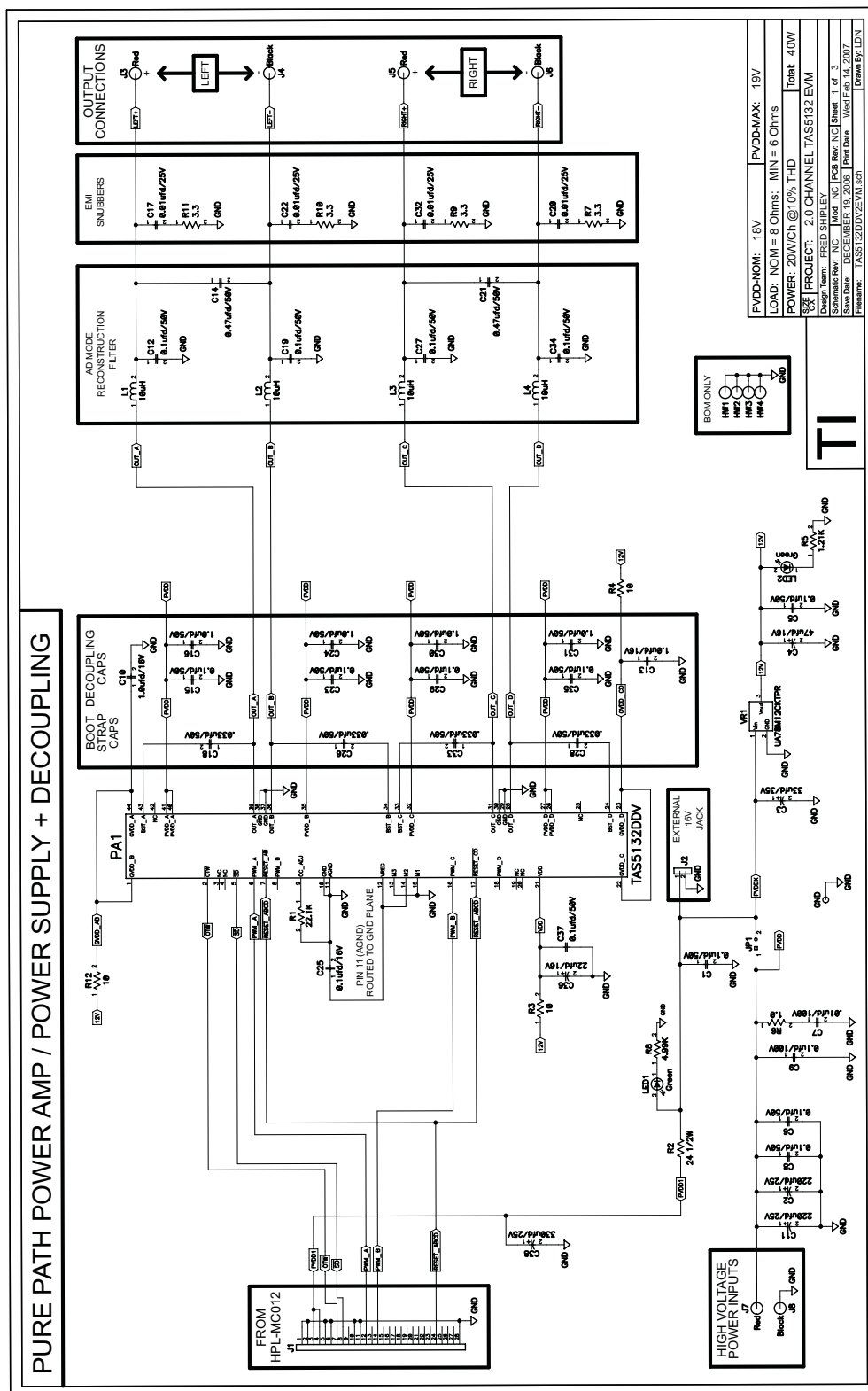
AMP

RESET CONTROL

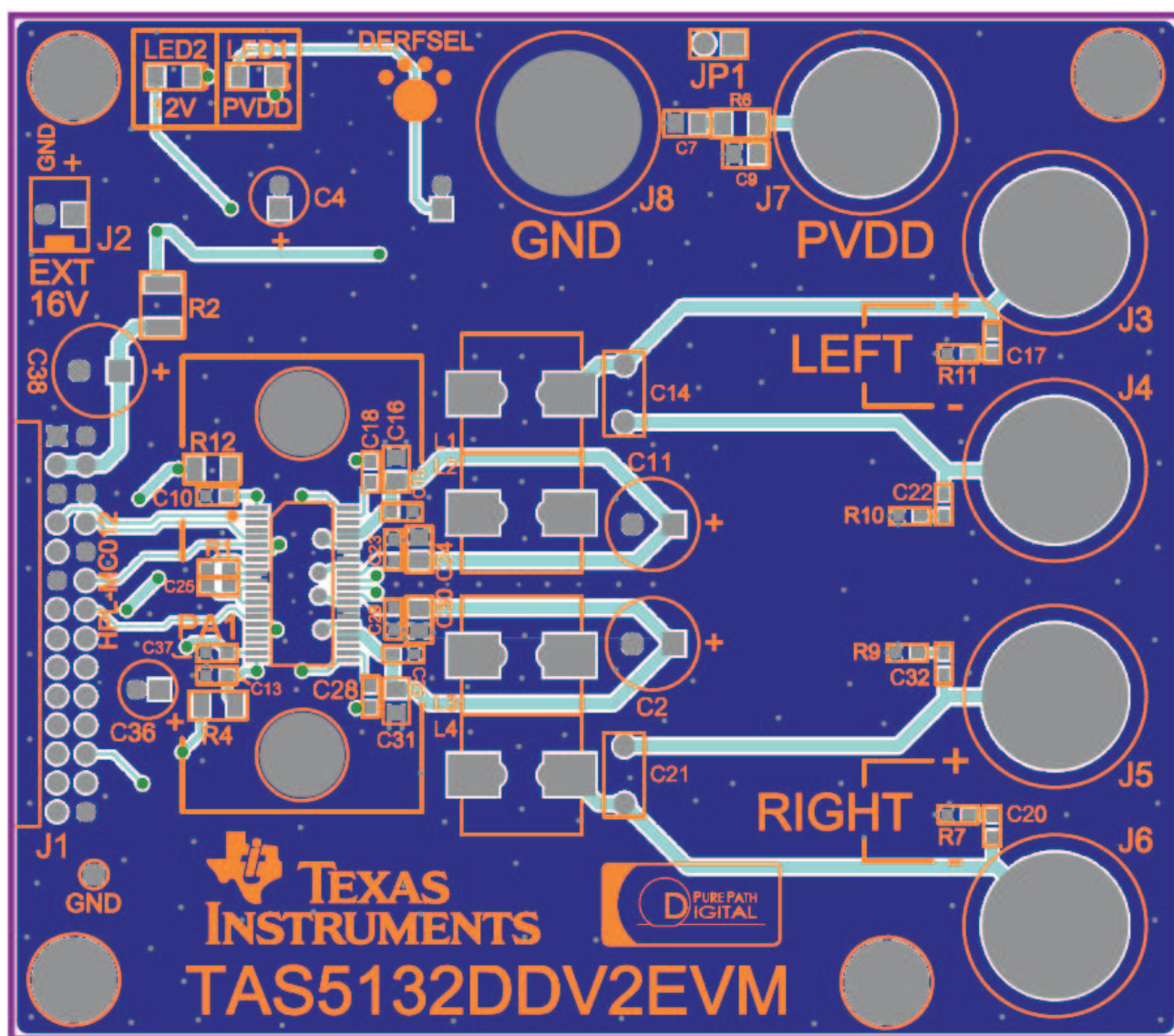
MASTER

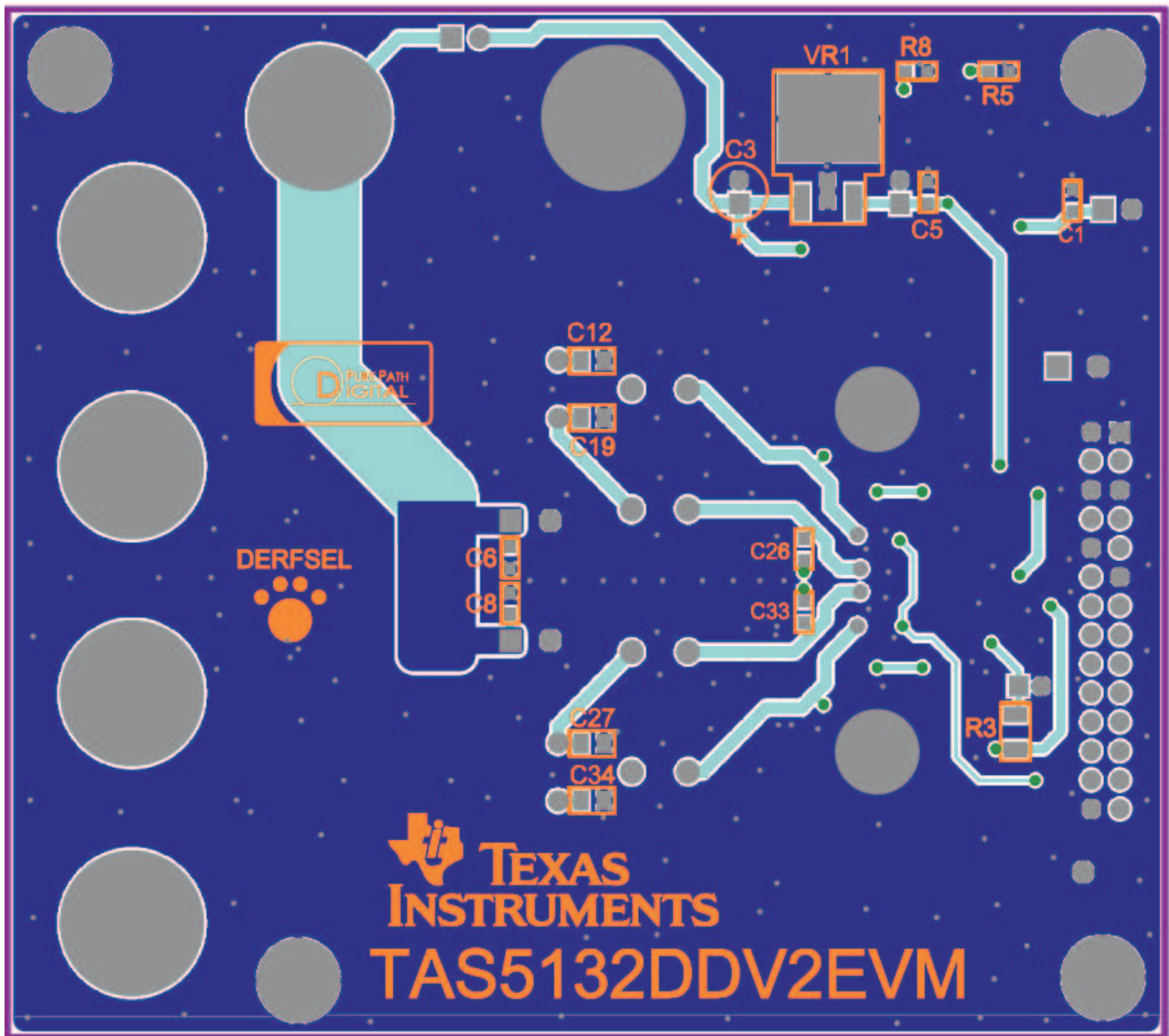
USB INPUT / RESET / PWM MODULATOR

A.2 TAS5132DDV2EVM Schematic

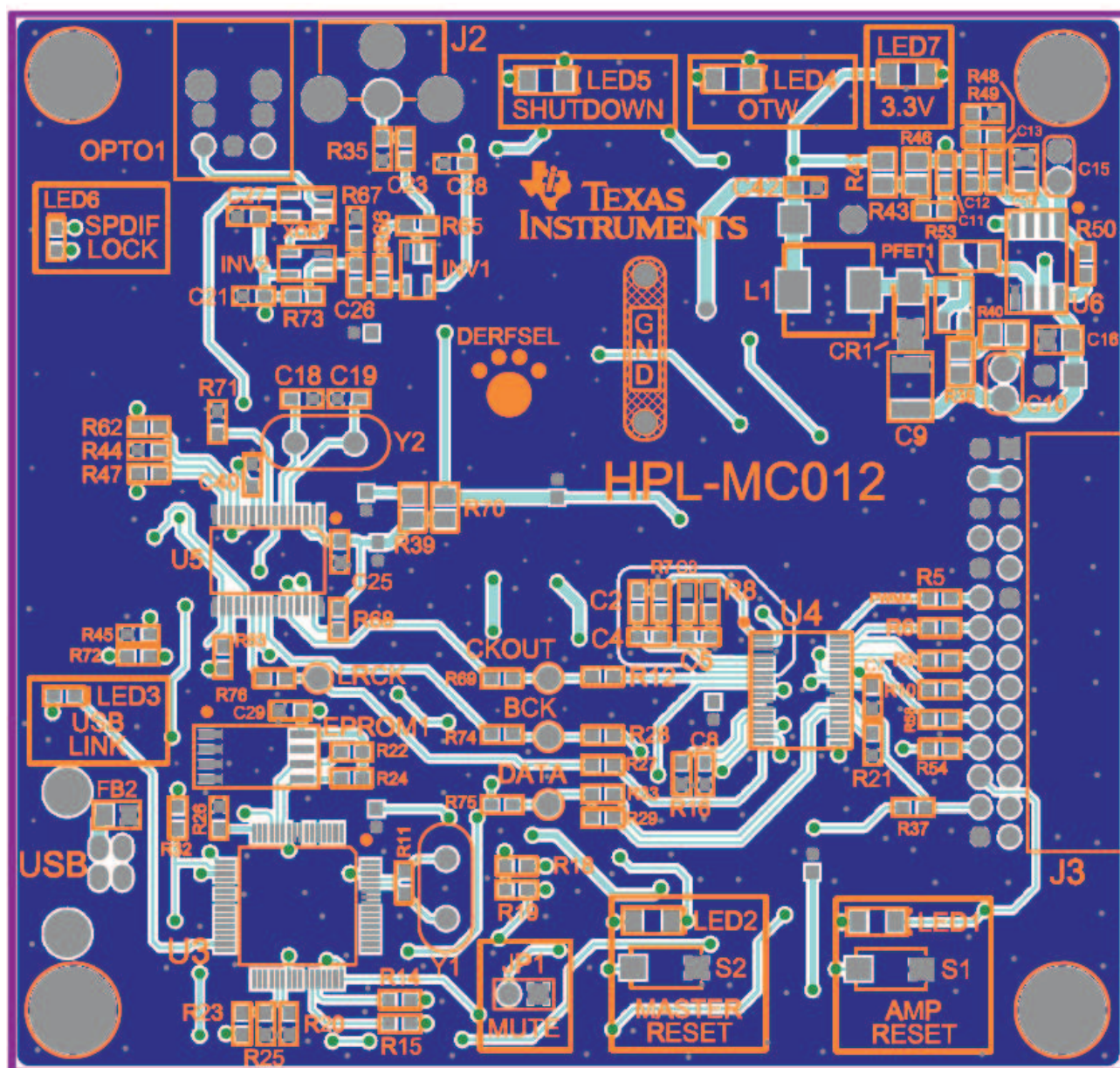


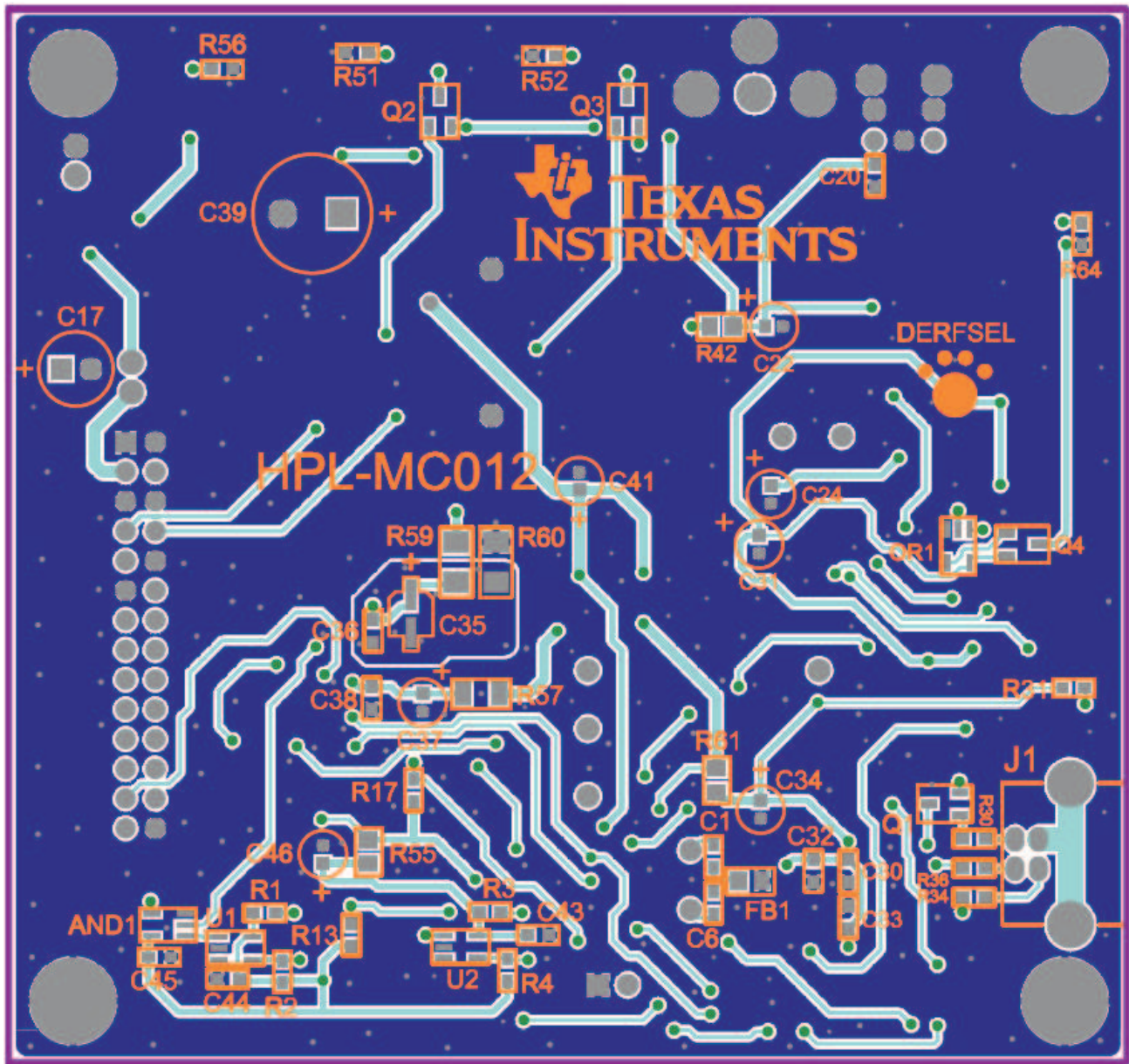
A.3 TAS5132DDV2EVM Composite Drawings





A.4 HPL-MC012 Composite Drawings



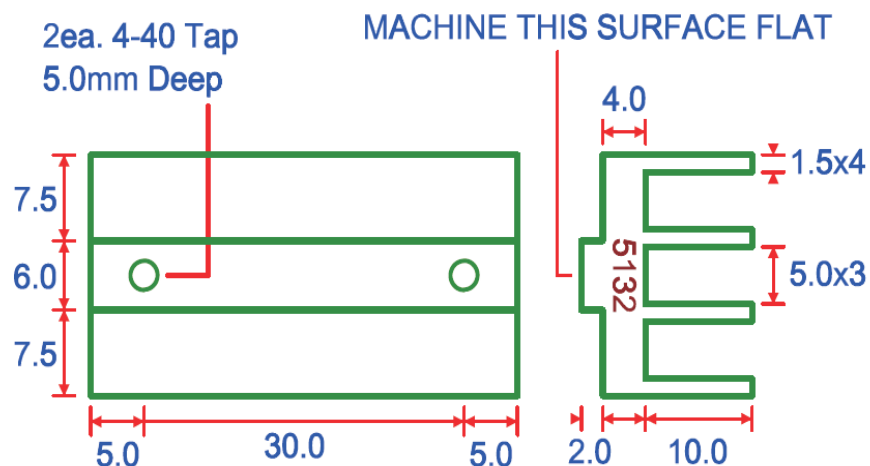


A.5 Heat Sink Drawing

HEAT SINK FOR TAS5132DDV2EVM

LAST EDIT: 09NOV2006

CONTACT: LES NANCE (214) 480-3848



ALL DIMS IN MILLIMETERS, UNLESS OTHERWISE SPECIFIED
TOLERANCE = ± 0.1 mm
MATERIAL = ALUMINUM
Stamp "5132" On End Where Indicated

NO SHARP EDGES

**TEXAS
INSTRUMENTS**

A.6 HPL-MC012 Parts List

Table A-1. Bill of Materials for HPL-MC012

Qty.	RefDes	Description	MFG	MFG Part No.	Vendor	Vendor Part No.
1	U4	PWM modulator, 6 CH, TSSOP38-DBT	Texas Instruments	TAS5086DBT	Digi-Key	296-17808-2
1	U3	USB, general purpose device controller, LQFP64-PM	Texas Instruments	TUSB3210PM	Digi-Key	296-11092
2	INV1, INV2	Single inverter gate, SOT23-DBV5	Texas Instruments	SN74AHC1GU04DBVR	Digi-Key	296-1095-2
1	AND1	Single 2-input Positive-AND gate, SOT23-DBV5	Texas Instruments	SN74AHC1G08DBVR	Digi-Key	296-191-2
1	OR1	Single 2-input Positive-OR gate, SOT23-DBV5	Texas Instruments	SN74AHC1G32DBVR	Digi-Key	296-1093-2
1	XOR1	Single 2-input Exclusive-OR gate, SOT23-DBV5	Texas Instruments	SN74AHC1G86DBVR	Digi-Key	296-1094-2
2	U1, U2	Processor supervisor circuit, 3.3V	Texas Instruments	TPS3825-33DBVT	Digi-Key	296-2636-2
1	U6	Wide input range voltage mode controller, SOP8-D	Texas Instruments	TPS40200D	Texas Instruments	TPS40200D
1	U5	SPDIF receiver, 192kHz 6-1 SEL, SSOP30-DB	ASKM Semiconductor	AK4113VF	Electrospec Sales	AK4113VFP
1	OPTO1	Optical receiver, 3.3V, EDGE PCB-RA	Toshiba	TORX141P	Memec Insight	TORX141P
1	Y1	Crystal, 12.000MHz, HC49US	ECS	ECS-120-32-4	Digi-Key	X172
1	Y2	Crystal, 12.288MHz, HC49US	ECS	ECS-122.8-S-4	Digi-Key	X174
1	EPROM1	EEPROM, Serial 64K 2.5V SOP8-PS	Microchip Technology	24LC64-I/SM	Digi-Key	24LC64-I/SM
1	PFET1	PFET -3.0A, -40V, 0.1Ω, SOT23-DBV3	Vishay Siliconix	SI2319DS-T1	Memec Insight	SI2319DS-T1
1	Q1	Transistor NPN, 40V, 600mA, SOT-23	Diodes, Inc.	MMBT2222A-7	Digi-Key	MMBT2222ADITR
3	Q2, Q3, Q4	Transistor PNP 50V Prebiased/4.7K, 100mA, SOT23-DBV3	Diodes, Inc.	DDTA143TCA-7	Digi-Key	DDTA143TCADITR
1	CR1	Schottky diode, 1A 40V, SMA	On Semi	MBRA140T3	Digi-Key	MBRA140T30STR
2	LED3, LED6	LED, blue SMD0603	Lite-On Trading	LTST-C191TBKT	Digi-Key	160-1647-2
2	LED1, LED2	LED, orange SM1206	Lumex Opto	SML-LX1206SOC-TR	Digi-Key	67-1696-2
1	LED5	LED, red SM1206	Chicago Miniature	CMD15-21VRD/TR8	Digi-Key	L62301TR
1	LED4	LED, yellow SM1206	Chicago Miniature	CMD15-21VYD/TR8	Digi-Key	L62307TR
1	LED7	LED, green SM1206	Chicago Miniature	CMD15-21VGD/TR8	Digi-Key	L62305TR
2	C1, C8	CAP 22PFD 50V CERM 0603 NPO	Panasonic	ECJ-1VC1H220J	Digi-Key	PCC220ACVTR
2	C18, C19	CAP 27PFD 50V CERM 0603 NPO	Panasonic	ECU-V1H270JCV	Digi-Key	PCC270ACVTR
1	C12	CAP 100PFD 50V CERM 0603 NPO	Panasonic	ECU-V1H101JCV	Digi-Key	PCC101ACVTR
1	C40	CAP 1000PFD 50V CERM 0603 X7R	Panasonic	ECU-VIH102KBV	Digi-Key	PCC102BVTR
1	C11	CAP 3300PFD 50V CERM 0603 X7R	Panasonic	ECJ-1VB1H332K	Digi-Key	PCC1778TR
2	C2, C3	CAP 0.1UFD 25V CERM 0603 X7R	Panasonic	ECJ-1VB1E103K	Digi-Key	PCC1763TR
1	C13	CAP 0.022PFD 50V CERM 0603 X7R	Panasonic	ECJ-1VB1H223K	Digi-Key	PCC2282TR
2	C23, C26	CAP 0.047PFD 16V CERM 0603 X7R	Panasonic	ECJ-1VB1C473K	Digi-Key	PCC1758TR
19	C4, C5, C7, C8, C21, C25, C27-C30, C32, C33, C36, C38, C42-C45	CAP 0.1PFD 50V CERM 0603 X7R	Panasonic	ECJ-1VB1C104K	Digi-Key	PCC1762TR
1	C10	CAP ceramic 100PFD 100V 5% Radial COG	EPCOS	B37979N1101J054	Digi-Key	495-1012-3
1	C15	CAP 470PFD 50V 5% Multilayer ceramic COG	EPCOS	B37979N5471J054	Digi-Key	495-1032-1
1	C16	CAP 0.1UFD 50V CERM 0805 X7R	Panasonic	ECJ-2YB1H104K	Digi-Key	PCC1840TR
1	C14	CAP 0.47UFD 35V CERM 0805 X5R	Taiyo Yuden	GMK212BJ474KG-T	Digi-Key	587-1289-2
1	C9	CAP 3.3UFD 50V CERM 1210 X7R	TDK Corp.	C3225X7R1H335M	Digi-Key	445-1432-2
1	C35	CAP 10UFD 16V Alum Elec SMD VSA	Panasonic	ECE-V1CS100SR	Digi-Key	PCE3061TR

Table A-1. Bill of Materials for HPL-MC012 (continued)

Qty.	RefDes	Description	MFG	MFG Part No.	Vendor	Vendor Part No.
7	C22, C24, C31, C34, C37, C41, C46	CAP 10UFD 16V RAD Alum Elec KGA	Panasonic	ECE-A1CKG100	Digi-Key	P910
1	C17	CAP 56UFD 50V RAD Alum Elec FC	Panasonic	EEU-FC1H560	Digi-Key	P10322
1	C39	CAP 560UFD 3550V RAD Alum Elec FC	Panasonic	EEU-FC1V561	Digi-Key	P11238
4	R69, R74–R76	RES 22.1 Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF22R1V	Digi-Key	P22.1HTR
4	R14, R15, R34, R36	RES 33 Ω 1/10W 5% SMD 0603	Yageo	9C06031A33R0JLHFT	Digi-Key	311-33GTR
11	R5, R6, R9, R10, R12, R27–R29, R33, R54, R58	RES 47 Ω 1/16W 5% SMD 0603	Yageo	9C06031A47R0JLHFT	Digi-Key	311-47GTR
1	R35	RES 75.0 Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF75R0V	Digi-Key	P75.GHTR
3	R44, R45, R65	RES 100 Ω 1/16W 5% SMD 0603	Yageo	9C06031A1000JLHFT	Digi-Key	311-100GTR
3	R7, R8, R31	RES 200 Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF2000V	Digi-Key	P200HTR
4	R51, R52, R64, R56	RES 332 Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF3320V		P332HTR
2	R1, R3	RES 357 Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF3570V	Digi-Key	P357HTR
3	R22, R24, R32	RES 1.50 k Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF1501V	Digi-Key	P1.50KHTR
1	R67	RES 2.00 k Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF2001V	Digi-Key	P2.00KHTR
2	R2, R4	RES 4.99 k Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF4991V	Digi-Key	P4.99KHTR
1	R73	RES 7.50 k Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF7501V	Digi-Key	P7.50KHTR
12	R17–R19, R21, R37, R13, R47, R49, R62, R63, R68, R72	RES 10 k Ω 1/16W 5% SMD 0603	Panasonic	9C06031A1002JLHFT	Digi-Key	311-10KGTR
2	R30, R71	RES 1.50 k Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF1502V	Digi-Key	P15.0KHTR
1	R16	RES 18.2 k Ω 1/10W 1% SMD 0603	Yageo	9C06031A1822FKHFT	Digi-Key	311-18.2KHTR
1	R43	RES 30.1 k Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF3012V	Digi-Key	P30.1KHTR
5	R20, R23, R25, R26, R48	RES 100 k Ω 1/16W 5% SMD 0603	Yageo	9C06031A1003JLHFT	Digi-Key	311-100KGTR
1	R50	RES 120 k Ω 1/16W 5% SMD 0603	Yageo	9C06031A1203JLHFT	Digi-Key	311-120KGTR
2	R11, R66	RES 1.00 M Ω 1/16W 1% SMD 0603	Panasonic	ERJ-3EKF1004V	Digi-Key	P1.00MHTR
1	R38	RES 0.05 Ω 1/4W 1% SMD 0805	Vishay/Dale	WSL0805R0500FEA18	Digi-Key	WSLB-.05TR
2	R55, R61	RES 2.7 Ω 1/10W 5% SMD 0805	Panasonic	ERJ-6RQJ2R7V	Digi-Key	P2.7BTR
3	R39, R42, R70	RES 3.3 Ω 1/10W 5% SMD 0805	Pasasonic	ERJ-6RQJ3R3V	Digi-Key	P3.3BTR
1	R41	RES 49.9 Ω 1/10W 1% SMD 0805	Panasonic	ERJ-6ENF49R9V	Digi-Key	P49.9CTR
1	R40	RES 1.00 k Ω 1/10W 1% SMD 0805	Panasonic	ERJ-6ENF1001V	Digi-Key	P1.00KCTR
1	R46	RES 37.4 k Ω 1/10W 1% SMD 0805	Panasonic	ERJ-6ENF3742V	Digi-Key	P37.4KCTR
1	R53	RES 0.0 Ω 1/8W 5% SMD 1206	Pasasonic	ERJ-8GEY0R00V	Digi-Key	P0.0ETR
1	R57	RES 1.0 Ω 1/8W 5% SMD 1206	Panasonic	ERJ-8GEYJ1R0V	Digi-Key	P1.0ETR
1	R60	RES 3.3 Ω 1/8W 5% SMD 1206	Panasonic	ERJ-8RQJ3R3V	Digi-Key	P3.3PTR
1	R59	RES 4.7 Ω 1/8W 5% SMD 1206	Panasonic	ERJ-8RQJ4R7V	Digi-Key	P4.7PTR
1	FB1	Ferrite bead, 11 Ω , 1.5A SM0805	Steward	MI0805K110R-00	Digi-Key	240-1034-2
1	FB2	Ferrite bead, 39 Ω , 1.4A SM0805	Panasonic	EX-ML20A390U	Digi-Key	P10191TR
1	L1	Inductor, 330 UH, SMD-DR74	Coiltronics	DR74-331	Digi-Key	DR74-331
1	J2	Jack, RCA, PCB-RA, ECONO All-Metal	CUI STACK	RCJ=017	Digi-Key	CP-1466

Table A-1. Bill of Materials for HPL-MC012 (continued)

Qty.	RefDes	Description	MFG	MFG Part No.	Vendor	Vendor Part No.
1	J1	Jack, USB PCB-Right Angle	Assmann	AU-Y1007	Digi-Key	AE1985
1	JP1	Header, 2 pin male, straight, gold	Sullins	PZC02SAAN	Digi-Key	S0111-02
1	J3	Socket Header, 2x14 pin female gold PCB-RA	Samtec	SSW-114-02-G-D-RA	Samtec	SSW-114-02-G-D-RA
2	S1, S2	Switch, momentary SMT-short, black tab, 160g	Panasonic	EVQ-PPBA25	Digi-Key	P8086STR
4	BCK, CKOUT, DATA, LRCK	PC Testpoint, orange	Keystone Electronics	5003	Digi-Key	5003K
1	GND	Bus Wire ground loop, 25mm length, 18 WAWG	Belden CDT	9019000100	Mouser	566-8019
4	HW1–HW4	Standoff 4-40 threaded M/F 0.75 in ALUM-HEX	Keystone Electronics	8403	Digi-Key	8403K
4	HW1–HW4	LockWasher, #4 internal-tooth, Zinc/Steel	Building Fasteners	INT LWZ 004	Digi-Key	H236
4	HW1–HW4	Hex Nut, 4-40, Zinc/Steel	Building Fasteners	HNZ440	Digi-Key	H216
Component Count: 176						

A.7 TAS5132DDV2EVM Parts List

Table A-2. Bill of Materials for TAS5132DDV2EVM

Qty.	RefDes	Description	MFG	MFG Part No.	Vendor	Vendor Part No.	Alternate Part No.
TI-SEMICONDUCTORS							
1	PA1	PurePath Digital™ power AMP, HTSSOP44-DDV	Texas Instruments	TASS132DDV	Texas Instruments	TASS132DDV	NO ALT PART NO.
1	VR1	Voltage regulator 12V, 0.5A, 2-PFM KTP	Texas Instruments	UA78M12CKTPR	Digi-Key	296-11142-2	296-11142-2
SEMICONDUCTORS							
2	LED1, LED2	LED, Green SM1206	Chicago Miniature	CND15-21VGD/TR8	Digi-Key	L62305TR	L62305CT
CAPACITORS							
4	C17, C20, C22, C32	CAP 0.01UFD, 25V, CERM 0603 X7R	Panasonic	ECJ-1VB1E103K	Digi-Key	PCC1763TR	PCC1763CT
4	C18, C26, C28, C33	CAP 0.33UFD, 50V, CERM 0603 X7R	Panasonic	ECJ-1VB1H333K	Digi-Key	PCC2284TR	PCC2284CT
1	C25	CAP 0.1UFD, 16V, CERM 0603 X7R	Panasonic	ECJ-1VB1C104K	Digi-Key	PCC1762TR	PCC1762CT
9	C1, C5, C6, C8, C15, C23, C29, C35, C37	CAP 0.1UFD, 50V, CERM 0603 X7R	Murata	GRM188R71H104KA93D	Digi-Key	490-1519-2	490-1519-1
2	C10, C13	CAP 1.0UFD, 15V, CERM 0603 X5R	Panasonic	ECJ-1VB1C105K	Digi-Key	PCC2224TR	PCC2224CT
1	C7	CAP 0.01UFD, 100V, CERM 0805 X7R	Panasonic	ECJ-2VB2A103K	Digi-Key	PCC1991TR	PCC1991CT
4	C12, C19, C27, C34	CAP 0.1UFD, 50V, CERM 0805 X7R	Panasonic	ECJ-2YB1H104K	Digi-Key	PCC1840TR	PCC1840CT
1	C9	CAP 0.1UFD, 100V, CERM 0805 X7R	TDK Corporation	C2012X7R2A104K	Digi-Key	445-1418-2	445-1418-1
4	C16, C24, C30, C31	CAP 1.0UFD, 50V, CERM 0805 X7R	Taiyo Yuden	UMK212F105ZG-T	Digi-Key	587-1308-2	587-1308-1
2	C14, C21	CAP 0.47UFD, 50V, Metal polyester film MKT	EPCOS	B32529C5474J	Digi-Key	495-1086	NO ALT PART NO.
1	C36	CAP 22UFD, 16V, RAD ALUM ELEC M series	Panasonic	ECA-1CM220	Digi-Key	P5135	NO ALT PART NO.
1	C3	CAP 33UFD 35V, RAD ALUM ELEC FC	Panasonic	EEU-FC1V330	Digi-Key	P10290	NO ALT PART NO.

Table A-2. Bill of Materials for TAS5132DDV2EVM (continued)

Qty.	RefDes	Description	MFG	MFG Part No.	Vendor	Vendor Part No.	Alternate Part No.
1	C4	CAP 47UF 16V, RAD ALUM ELEC FC	Panasonic	EEU-FC1C470	Digi-Key	P11196	NO ALT PART NO.
2	C2, C11	CAP 22UF 25V, RAD ALUM ELEC FC ROHS	Panasonic	EEU-FC1E221	Digi-Key	P10271	NO ALT PART NO.
1	C38	CAP 33UF 25V, RAD ALUM ELEC FC	Panasonic	EEU-FC1E331L	Digi-Key	P10272	NO ALT PART NO.
RESISTORS							
4	R7, R9–R11	RES 3.3Ω, 1/16W, 5%, SMD, 0603	Yageo	9C06031A3R30JLHFT	Digi-Key	311-3.3GTR	311-3.3GCT
1	R5	RES 1.21kΩ, 1/16W, 1%, SMD 0603	Panasonic	ERJ-3EKF1211V	Digi-Key	P1.21KHTR	P1.21KHCT
1	R8	RES 4.99kΩ, 1/16W, 1%, SMD 0603	Panasonic	ERJ-3EKF4991V	Digi-Key	P4.99KHTR	P4.99KHCT
1	R1	RES 22.1kΩ, 1/16W, 1%, SMD 0603	Panasonic	ERJ-3EKF2212V	Digi-Key	P22.1KHTR	P22.1KHCT
1	R6	RES 1.0kΩ, 1/4W, 5%, SMD 1206	Yageo	9C12063A1R00JLHFT	Digi-Key	311-1.0ETR	311-1.0ECT
3	R3, R4, R12	RES 10Ω, 1/4W, 5%, SMD 1206	Yageo	9C12063A10R0JLHFT	Digi-Key	311-10ETR	311-10ECT
1	R2	RES 24Ω, 1/2W, 5%, SMD 1210	Panasonic	ERJ-P14J240U	Digi-Key	P24ASTR	P24ASCT
INDUCTORS							
4	L1–L4	Inductor 10UH 28mΩ, 4.4A, DS106C2	Toko	B966AS-100M	Toko	B966AS-100M	NO ALT PART NO.
JACKS, HEADERS, AND CONNECTORS							
1	JP1	Header, 2 pin male, straight, gold	Sullins	PZC02SAAN	Digi-Key	S1011-22	NO ALT PART NO.
1	J2	Header, 2 pin male straight, tin, fric. lock	Molex	22-23-2021	Digi-Key	WM4200	No alternate part number
1	J1	Header, 2x14 pin male gold PCB-RA	Sullins	PZC14DBAN	Digi-Key	S2111-14	NO ALT PART NO.
TESTPOINTS AND BINDING POSTS							
1	G1	PC testpoint, white	Keystone Electronics	5002	Digi-Key	5002K	NO ALT PART NO.
3	J4, J6, J8	Binding Post, black brass 60V, 30A	Pomona	5018-0	Newark	50F1463	NO ALT PART NO.
3	J3, J5, J7	Binding post, red brass 60V, 30A	Pmona	5018-2	Newark	50F1464	NO ALT PART NO.
STANDOFFS AND HARDWARE							
4	HW1–HW4	Standoff 4-40 Threaded M/F 0.75 in. ALUM-HEX	Keystone Electronics	8403	Digi-Key	8403K	NO ALT PART NO.
4	HW1–HW4	LockWasher, #4 internal-tooth, Zinc/Steel	Building Fasteners	INT LWZ 004	Digi-Key	H236	NO ALT PART NO.
4	HW1–HW4	Hex Nut, 4-40, Zinc/Steel	Building Fasteners	HNZ440	Digi-Key	H216	NO ALT PART NO.
Component Count: 80							

EVALUATION BOARD/KIT IMPORTANT NOTICE

Texas Instruments (TI) provides the enclosed product(s) under the following conditions:

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. Persons handling the product(s) must have electronics training and observe good engineering practice standards. As such, the goods being provided are not intended to be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including product safety and environmental measures typically found in end products that incorporate such semiconductor components or circuit boards. This evaluation board/kit does not fall within the scope of the European Union directives regarding electromagnetic compatibility, restricted substances (RoHS), recycling (WEEE), FCC, CE or UL, and therefore may not meet the technical requirements of these directives or other related directives.

Should this evaluation board/kit not meet the specifications indicated in the User's Guide, the board/kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies TI from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge.

EXCEPT TO THE EXTENT OF THE INDEMNITY SET FORTH ABOVE, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

TI currently deals with a variety of customers for products, and therefore our arrangement with the user **is not exclusive**.

TI assumes **no liability for applications assistance, customer product design, software performance, or infringement of patents or services described herein**.

Please read the User's Guide and, specifically, the Warnings and Restrictions notice in the User's Guide prior to handling the product. This notice contains important safety information about temperatures and voltages. For additional information on TI's environmental and/or safety programs, please contact the TI application engineer or visit www.ti.com/esh.

No license is granted under any patent right or other intellectual property right of TI covering or relating to any machine, process, or combination in which such TI products or services might be or are used.

FCC Warning

This evaluation board/kit is intended for use for **ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY** and is not considered by TI to be a finished end-product fit for general consumer use. It generates, uses, and can radiate radio frequency energy and has not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC rules, which are designed to provide reasonable protection against radio frequency interference. Operation of this equipment in other environments may cause interference with radio communications, in which case the user at his own expense will be required to take whatever measures may be required to correct this interference.

EVM WARNINGS AND RESTRICTIONS

It is important to operate this EVM within the input voltage range of 12 V to 18 V and the output voltage range of 12 V to 18 V.

Exceeding the specified input range may cause unexpected operation and/or irreversible damage to the EVM. If there are questions concerning the input range, please contact a TI field representative prior to connecting the input power.

Applying loads outside of the specified output range may result in unintended operation and/or possible permanent damage to the EVM. Please consult the EVM User's 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, some circuit components may have case temperatures greater than 80° C. The EVM is designed to operate properly with certain components above 100° C as long as the input and output ranges are maintained. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors. These types of devices can be identified using the EVM schematic located in the EVM User's Guide. When placing measurement probes near these devices during operation, please be aware that these devices may be very warm to the touch.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2007, Texas Instruments Incorporated

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
Low Power Wireless	www.ti.com/lpw

Applications

Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2007, Texas Instruments Incorporated