

TLV320AIC10/11 EVM

User's Guide

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Read This First

About This Manual

This document presents a description of the TLV320AIC10/11 EVM.

How to Use This Manual

This document contains the following chapters:

- Chapter 1 – Introduction
- Chapter 2 – Analog Interface
- Chapter 3 – Digital Interface
- Chapter 4 – Software Driver
- Chapter 5 – PC Board and Bill of Materials
- Appendix A – Schematics

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Introduction

The TLV320AIC10/11 EVM is designed to be a daughterboard that plugs directly into the peripheral connector of the TMS320VC5402 DSK board. For more information about the C5402 DSK, go to

<http://www.ti.com/sc/docs/tools/dsp/tmdx320005402.htm>

The AIC10/ 11-EVM is populated with two TLV320AIC10/11 devices and has footprints for six more to provide full capability of cascading eight TLV320AIC10/11s (one master and seven slaves) to one single DSP's McBSP. The two populated TLV320AIC10/11s (U1 and U2) can be configured as either two separate masters (or slaves) to connect to two McBSPs, or as a master/slave cascade to connect to one McBSP. For analog input/output, U1 is interfaced with DAA, normal analog input, and speaker, and U2 is interfaced with microphone, normal analog input, and speaker. The EVM is powered by either a 3.3-V or a 5-V power supply.

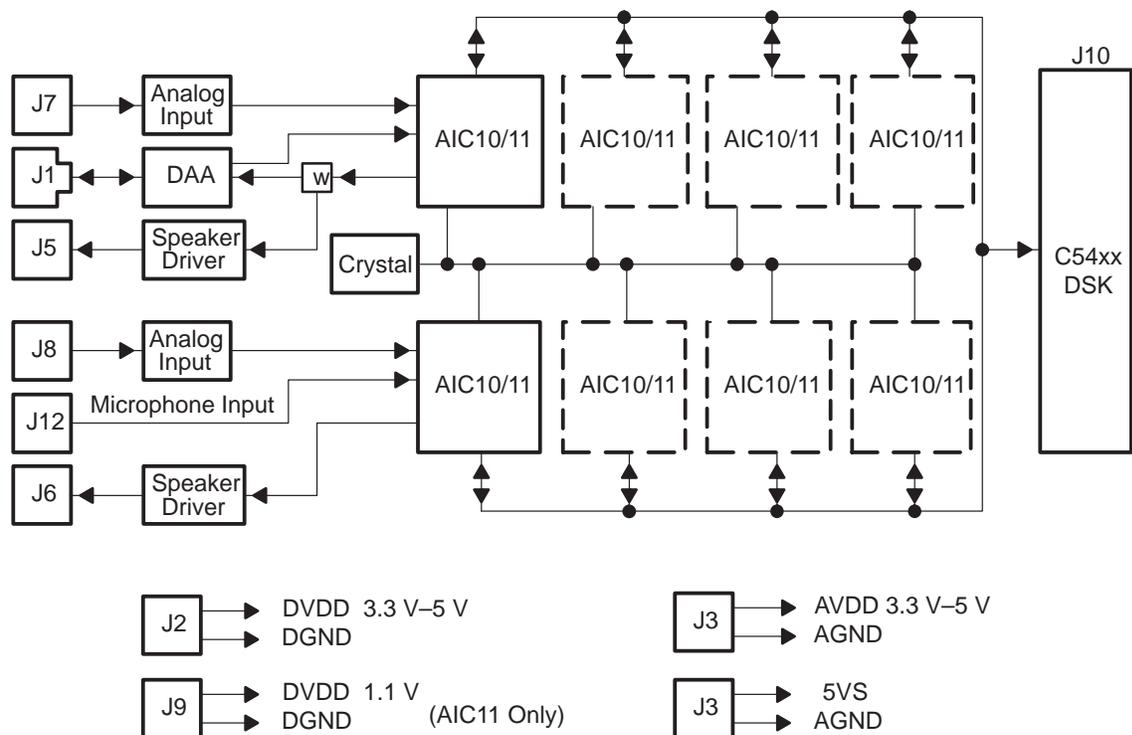
For more information about the C5402 DSK, go to *<http://www.ti.com/sc/docs/tools/dsp/tmdx320005402.htm>*

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1.1 System Block Diagram	1-2

1.1 System Block Diagram

The TLV320AIC10/11 EVM provides a practical platform for evaluating the TLV320AIC10/11 voiceband codec. The system block diagram is shown in Figure 1–1. This illustration provides a general idea of the system configuration. It is not meant to replace the circuit diagram, but to give a brief indication of the features and functions available. It should be read in combination with the circuit diagram supplied.

Figure 1–1. Block Diagram



Analog Interface

This chapter presents the system analog interface.

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2.1 Single-Ended to Differential Converter

There are two single-ended-to-differential converter circuits on the AIC10/11-EVM board connected through J7 and J8. These circuits provide differential analog signals to the INP/INM input of U1 and the AURXP and AURXM inputs to U2. The design of these converters uses the TI TLV2462 (U12, U13), a low-power rail-to-rail input/output operational amplifier designed for single-supply portable applications.

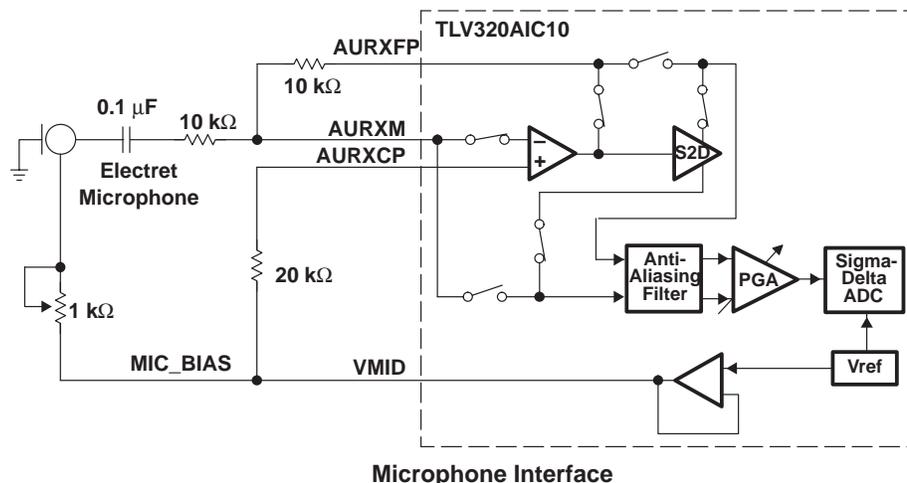
2.2 DAA Interface

By setting the jumpers W2, W3, W35, and W36, the codec U1 can be connected to interface with the DAA U11 for communication with the PSTN. The phone line is plugged to J1. The TLV320AIC10/11 controls the DAA's OH (off-hook) and RING (ring detection) by programming the ALTIN and FLAG pins. The operational amplifier (U18) is low-voltage logic translation that provides the logic level to be used by the \overline{OH} and \overline{CIO} pins of the DAA.

2.3 Microphone Interface

The user can program the codec U2s built-in MIC preamp to interface the TLV320AIC10/11 with a microphone plugged to J12. The common mode of this on-chip preamp is referenced by VMID that also is used to bias the microphone.

Figure 2–1. Microphone Interface With TLV320AIC10/11



2.4 Speaker Interface

The U1 and U2 codecs can be configured to interface to the speaker drivers. The speaker driver is a TI TPA4861 audio power amplifier capable of delivering 1 W of continuous average power into an 8-Ω load. Two jumpers, W2 and W3, select between the DAA transmitter and the speaker driver U9 as the U1's differential output load. Jumpers W39 and W60 connects the analog output of U2 to the speaker driver U10. External speakers are connected to J5 and J6.

2.5 Power Supply

The AIC10/11-EVM requires 3 separate external power supplies. The 5-V to 3.3-V supply from J2 is used for the digital circuits on the board. The AIC11 requires 1.8 V digital supply for its digital I/O, which comes from J9 instead of J2, and the jumper W61 to short pins 1 and 2. The 5-V supply from J4 is used for the DAA and speaker drivers. The 5-V to 3.3-V supply from J3 is used for all analog circuits.

Digital Interface

This chapter describes the TLV320AIC10/11-EVM's digital interface.

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3.1 Master/Slave Selection

Both U1 and U2 codecs can be individually configured to function as either a master or a slave by selecting the proper jumper position on W1 and W11.

3.2 C5402 DSK McBSP Interface

The codec U1 is designed to gluelessly connect to the C5402's McBSP0 via the common connector on the C5402 DSK board. Jumpers W13, W15, W16, and W17 are intended to connect U2 to the same McBSP0 as a slave of U1, or to the McBSP1 as a separate master/slave.

3.3 Host Interface

The host interface on the AIC10/11-EVM is primarily designed for the master/slave cascade configuration. In this configuration the DCSI (direct configuration) uses jumper W20 to select the serial data input source from either the DSK's McBSP1 or from an external source.

3.4 Master Clock

The AIC10/11-EVM contains an onboard crystal that generates a clock frequency of 8.2 MHz. Jumper W14 selects the master clock source for all TLV320AIC10/11 devices from either the onboard crystal, or from an external source (such as the CLOCKOUT from C5402).

3.5 Frame Sync Mode

Input pins M0 and M1 select frame sync modes, as described in section 2.8 of the TLV320AIC10/11 data manual. Jumpers W4 and W5 configure M0 and M1 of codec U1, respectively. Jumpers W9 and W10 configure M0 and M1 of codec U2, respectively.

3.6 LED

The two LEDs of D2 and D3 are controlled by the FLAG pins on two AIC10/11 of U1 and U2 which are programmed by the software driver to make LEDs flash. This indicates good communication between the AIC10/11 and the DSP.

3.7 AIC10/11-EVM Jumper Position Setup

Jumper	Position			Description
	1	2	3	
W1	•	•		Set U1 as a master codec
		•	•	Set U1 as a slave codec
W2	•	•		Connect OUTP of U1 to TX+ of U11
		•	•	Connect OUTP of U1 to IN+ of U9 (speaker driver)
W3	•	•		Connect OUTM of U1 to TX– of U11
		•	•	Connect OUTM of U1 to IN– of U9 (speaker driver)
W4	V _{dd}	•	GND	These two pins are used to set frame sync mode (M0, M1) of U1 (set both jumpers to position 2–3 to work with C54xx driver)
W5	V _{dd}	•	GND	
W6	•	•		Use external supply via J2 for DVDD (digital supply)
		•	•	Use C54xx DSK supply for DVDD (digital supply)
W7	•	•		Use external supply via J3 for AVDD (analog supply)
		•	•	Use C54xx DSK supply for AVDD (analog supply)
W9	V _{dd}	•	GND	These two pins are used to set frame sync mode (M0, M1) of U2 (set both jumpers to position 2–3 to work with C54xx SW driver)
W10	V _{dd}	•	GND	
W11	•	•		Set U2 as a master codec
		•	•	Set U2 as a slave codec
W12	•	•		To connect to the input CID of U11
W13	•	•		Connect FS of U2 to FSX of C54x's McBSP1
		•	•	Connect FS of U2 to FSD of U1 (U1 = master, U2 = slave)
	•	•	•	Short all 3 positions together for using DCSI with C54 SW driver
W14	•	•		Connect MS_CLOCK on the EVM to C54 DSK's CLKOUT
		•	•	Connect MS_CLOCK on the EVM to onboard oscillator U16
W15	•	•		Connect SCLK of U2 to C54 McBSP1's CLKX
		•	•	Connect SCLK of U2 to C54 McBSP0's CLKX
	•	•	•	Short all 3 positions together for using DCSI with C54 SW driver
W16	•	•		Connect DIN of U2 to C54 McBSP1's DX
		•	•	Connect DIN of U2 to C54 McBSP0's DX
W17	•	•		Connect DOUT of U2 to C54 McBSP1's DR
		•	•	Connect DOUT of U2 to C54 McBSP0's DR
W18	•	•		Connect DVDB of AIC10EVM to motherboard's 5-V supply
		•	•	Connect DVDB of AIC10EVM to motherboard's 3.3-V supply
W19	•	•		Connect AVDB of AIC10EVM to motherboard's 5-V supply
		•	•	Connect AVDB of AIC10EVM to motherboard's 3.3-V supply
W20	•	•	•	Use C54 McBSP1's DX to send data to DCSI of both U1 and U2
W21	•	•		For C54 DSK motherboard to detect AIC10EVM
W22	•	•		To power down the AIC10 on the EVM
W35	•	•		To connect RX+ and RX_ of U11 to INP and INM of U1, respectively
W36	•	•		
W37	•	•		To connect the output of op-amp input buffer to INP and INM of U2
W38	•	•		
W39	•	•		To connect OUTP and OUTM of U2 to IN+ and IN– of U10 (speaker driver)
W60	•	•		
W61	•	•		To connect DVDD1 to 1.8-V external supply J9
		•	•	To connect DVDD1 to 3.3-V/5-V external supply J2
W40	•	•		To disable FC pin of U1
W41	•	•		To disable FC pin of U2

3.7.1 Default Jumper Positions of AIC10/11-EVM

W2 1–2	W3 1–2	W4 2–3	W5 2–3	W1 1–2	W9 2–3
W10 2–3	W11 2–3	W16 2–3	W17 2–3	W14 2–3	W6 1–2
W7 1–2	W22 2–3	W60 SHORT	W39 SHORT	W38 SHORT	W37 SHORT
W21 SHORT	W36 SHORT	W35 SHORT	W13 1–2–3	W15 1–2–3	W20 1–2–3
		W12 1–2	W40 SHORT	W41 SHORT	W61 2–3

All other jumpers are open.

3.8 Interface Signals

The following table shows the AIC10/11-EVM interface signals.

Pin Number	Pin Name	I/O/Z	DSP McBSPx	Description
21	X_CLKX0	I/O	0	Transmit clock
23	X_FSX0	I/O	0	Transmit frame sync
24	X_DX0	I	0	Transmit serial data
27	X_CLKR0	I/O	0	Receive clock
29	X_FSR0	I/O	0	Receive frame sync
30	X_DR0	O/Z	0	Receive serial data
33	X_CLKX1	I/O	1	Transmit clock
35	X_FSX1	I/O	1	Transmit frame sync
36	X_DX1	I	1	Transmit serial data
39	X_CLKR1	I/O	1	Receive clock
41	X_FSR1	I/O	1	Receive frame sync
42	X_DR1	O/Z	1	Receive serial data

Note: Other signals are coming from the DSP and are not used by the AIC10/11-EVM

Software Driver

There are two AIC10/11 software versions available for downloading from the TLV320AIC10/11 development tool web site. AIC10-EVM test software and CCS software driver plug-in AIC10/11-EVM test software. (The software drivers can be downloaded from https://www-a.ti.com/apps/dc_plugins/aic10/11_register.asp)

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4.2 TLV320AIC10/11 Plug-In for Code Composer Studio	4-3

4.1 AIC10-EVM Test Software

Software drivers *aic10sw_m* and *aic10sw_ms* contain code for a single master codec and a master/slave cascade, respectively. The following C54xx software subroutines are included. They have been tested with the TI code composer, and they demonstrate how to program the C54xx DSK to control a cascade of master U1 and slave U2 on the AIC10/11–EVM.

- AIC10_DTMF.C
This C-code serves as the main program and generates DTMF for phone number 972-480-1094 based on a sampling rate of 16 KSPS. It also contains two ISRs (interrupt service routines) for McBSP0 and McBSP1 in which McBSP0 services the master/slave cascading of the two TLV320AIC10/11s on the board, and McBSP1 programs both U1 and U2's FLAG pins using DCSI via jumper W20 to make the two LED D1 and D2 flash.
- C5402VEC.ASM
This code defines the vector table for C54xx software.
- DCSI_COMM.ASM
This code controls McBSP1 data transfer for TLV320AIC10/11's direct configuration (DCSI).
- INIT5402.ASM
This code initializes the C5402 registers.
- MCBSP.ASM
This code initializes the C5402's McBSP registers.
- INITAIC10.ASM
This code detects master and slave codecs and initializes their four control registers:
 - Set sampling rate at 16 KSPS.
 - Turn on OFF-HOOK for DAA interface with the master codec.
 - Enable the MIC preamp to receive input from the microphone.
- MS_COMM.ASM
This code controls McBSP0 data transfer to/from the master TLV320AIC10/11 codec.
- SL_COMM.ASM
This code controls McBSP0 data transfer to/from the slave TLV320AIC10/11 codec.

4.2 TLV320AIC10/11 Plug-In for Code Composer Studio

There are two examples for the AIC10/11 in this zip-file:

- Dial tone
- Sample

Dial tone demonstrates the write-block function of the AIC10/11 driver. It generates a sequence of dial tones based on a telephone number and puts it out on the master output.

Sample demonstrates the read-block function of the AIC10/11 driver. It reads a block of samples from the master and slave AIC10/11 and stores it in the DSP memory.

Unzip the file to the original folders and load the project file (AIC10/11_CCS.mak for both examples).

Dial Tone:

- Hook up a speaker to the master speaker port.
- Load the program to the DSP DSK and start it with F5.

Sample:

- Set a breakpoint at the dc_rblock function (line 38), load the program to the DSK and start the program with F5.
- After each cycle (F5), the data contains the samples from the AIC10/11 chain.
- Open a graph window to see the samples as a wave-form.

Note:

These subroutines have been tested using the C54xx C/ASM compiler Ver 3.1. If a different compiler version is used, the user may have to adjust the pipeline delay (that is, NOP) associated with McBSP code to meet the McBSP timing requirement.

The DSK is bundled with a special version of *Code Composer Studio*, allowing new designers to experiment with code composer features like real-time analysis and data visualization. *Code Composer Studio's* unrivaled feature set makes DSP development easy. The DSK's special 32-K object code generation tool set allows users to experiment with sample code, test algorithms, and write their own application. Users have the flexibility of writing their application in C, making getting started easier than ever before.

For more information about the C5402 DSK, go to <http://www.ti.com/sc/docs/tools/dsp/tmdx320005402.htm>

New *Code Composer Studio Free Evaluation Tools* (FETs) from TI are a full featured, full-function 30-day time-limited version of the C5000 DSPs software development tools, and are now available for download at <http://www.ti.com/sc/docs/tools/dsp/5ccsfreetool.htm>

PC Board and Bill of Materials

This chapter presents an introduction to the power supplies used with the AIC10/11-EVM, and a listing of the parts required to build this evaluation module.

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5.1 Printed-Circuit Board	5-2
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5.1 Printed-Circuit Board

This section presents the printed-circuit board for the TLV230AIC10/11 EVM.

Figure 5–1. Printed-Circuit Board (Top)

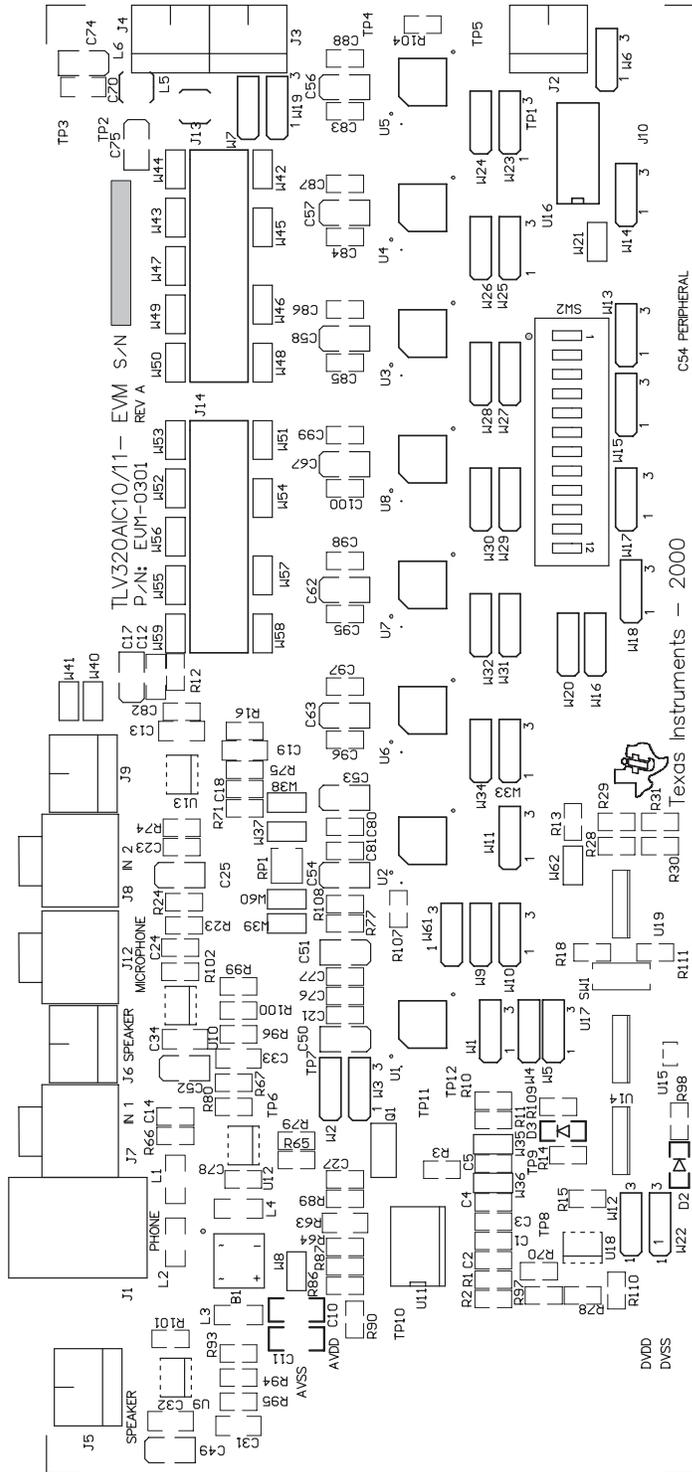


Figure 5-2. Printed-Circuit Board (Bottom)

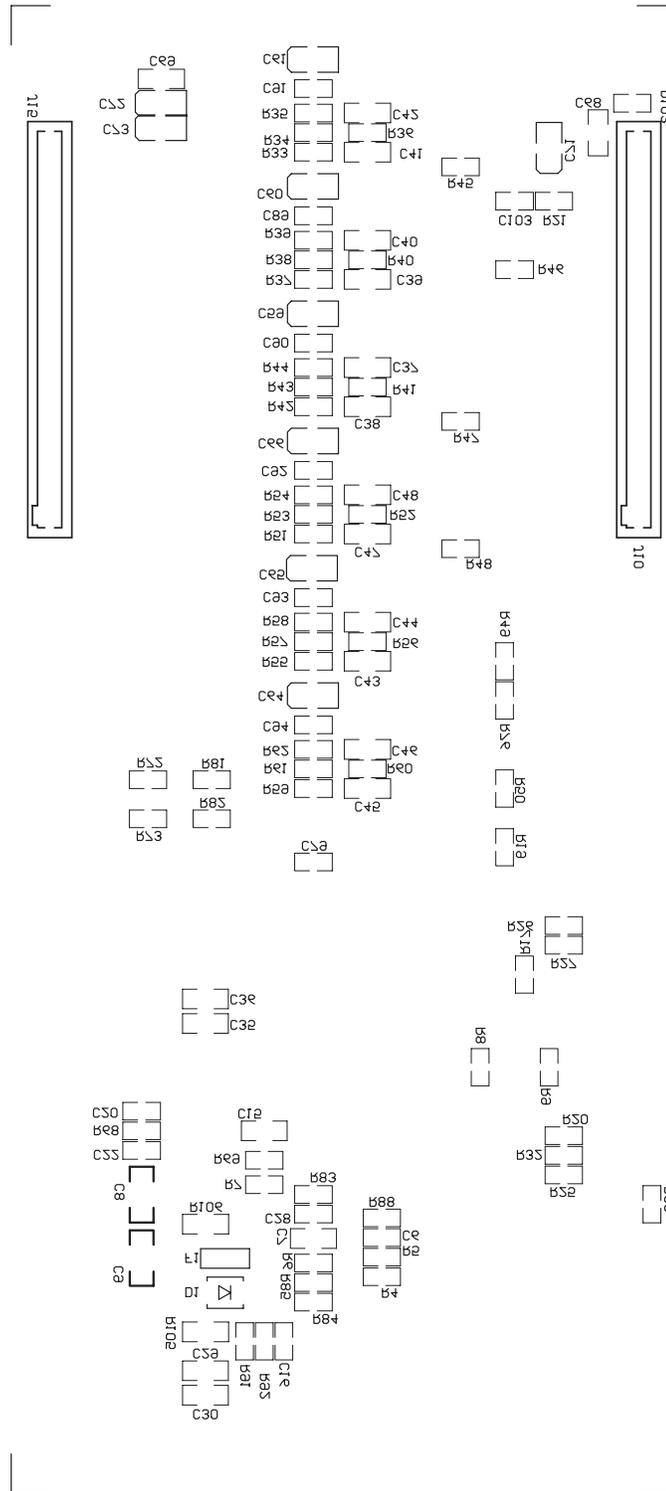


Figure 5–3. Printed-Circuit Board Layer 1

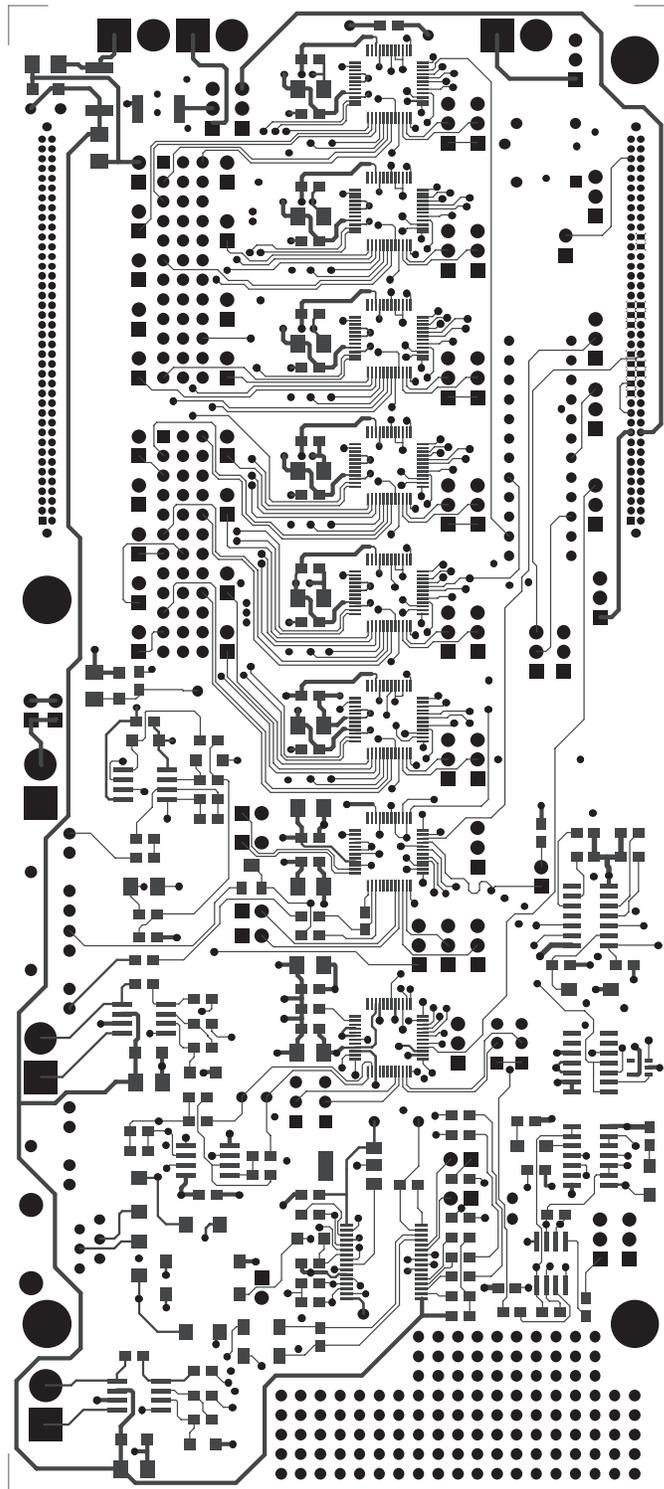


Figure 5-4. Printed-Circuit Board Layer 2

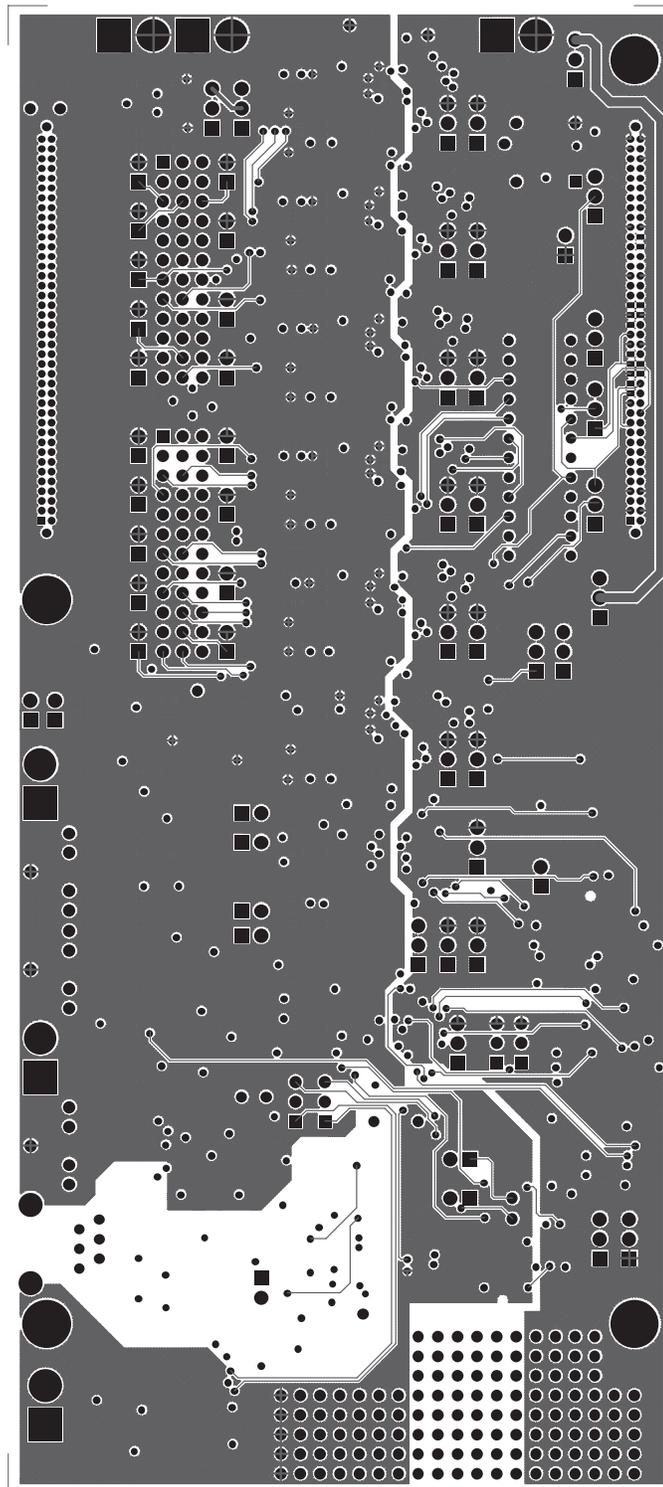


Figure 5–5. Printed-Circuit Board Layer 3

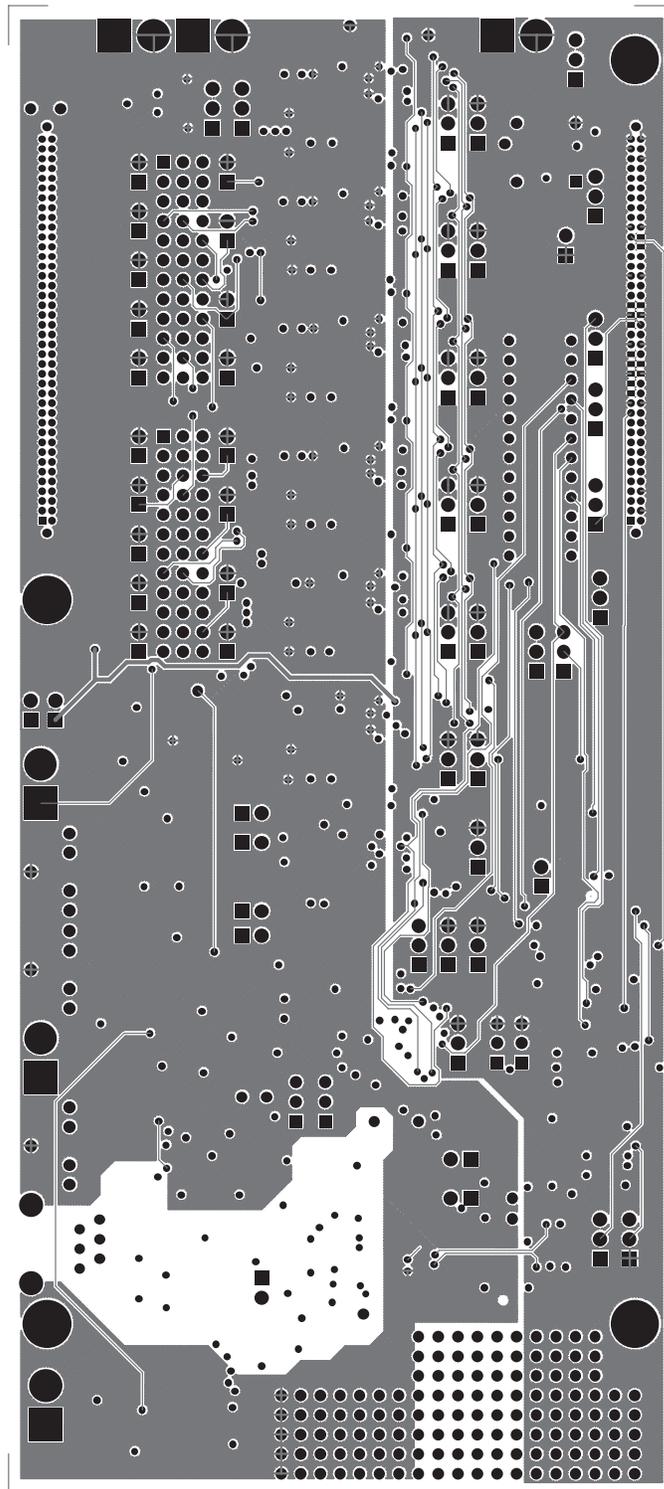


Figure 5-6. Printed-Circuit Board Layer 4

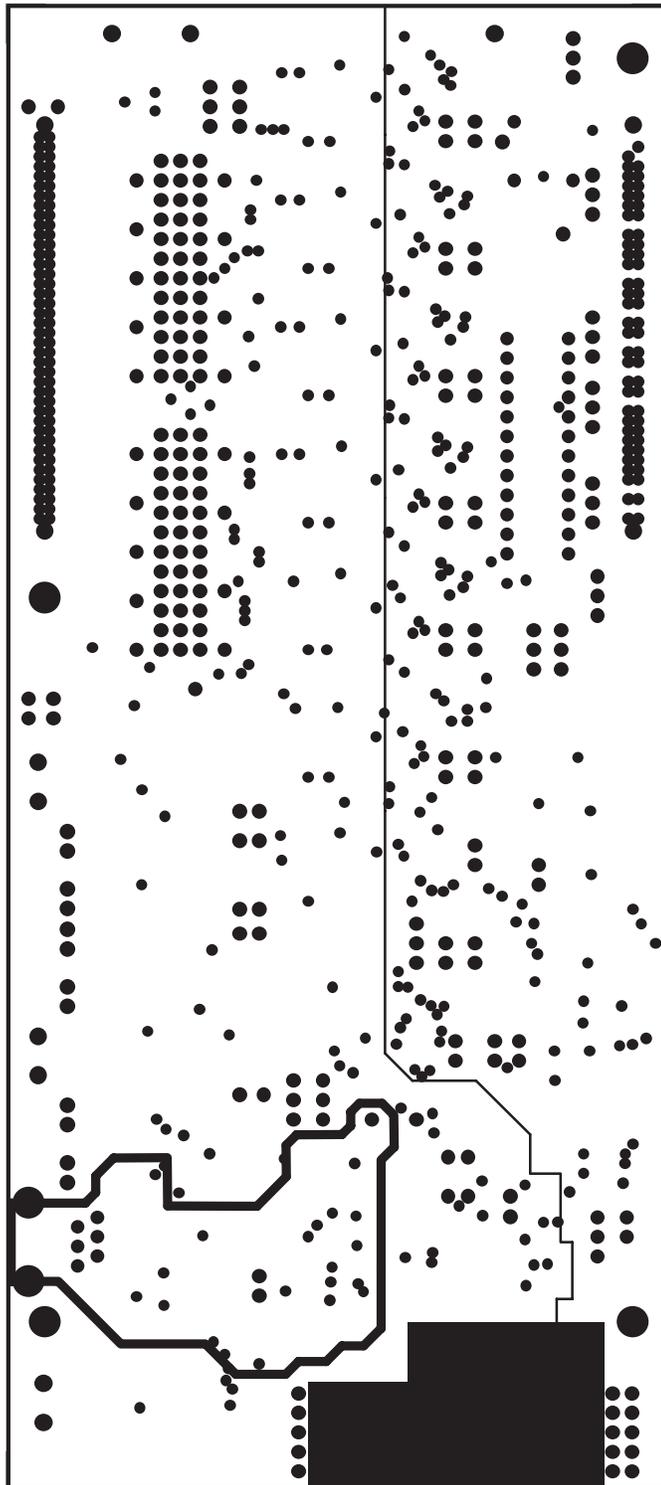


Figure 5–7. Printed-Circuit Board Layer 5

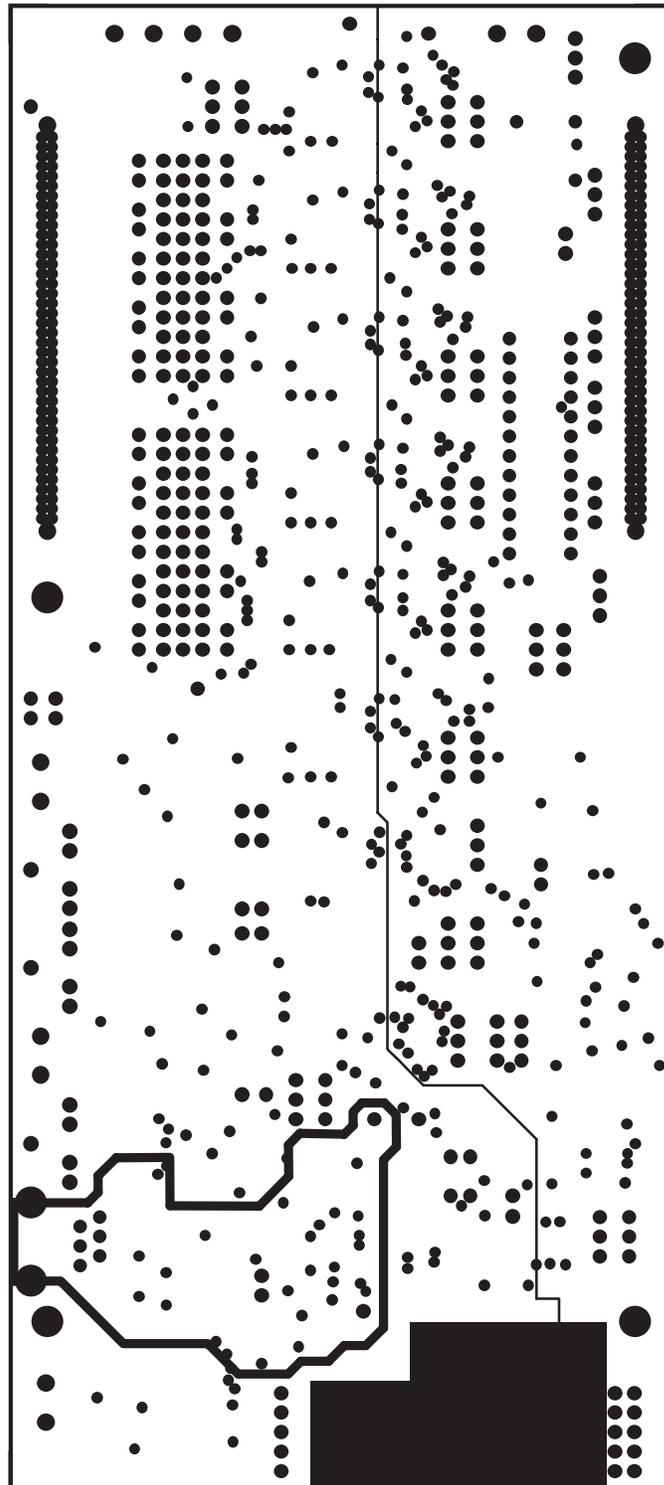
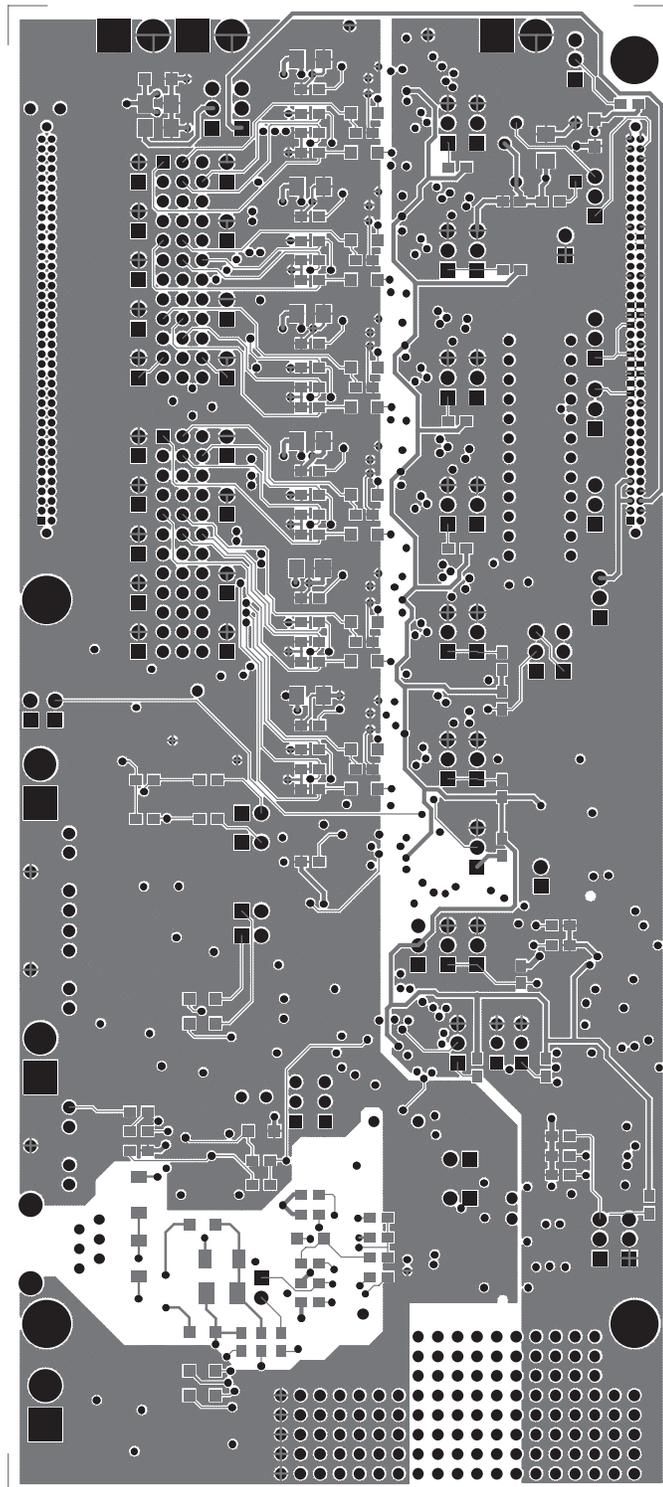


Figure 5–8. Printed-Circuit Board Layer 6



5.2 Bill of Materials

Ref Des	Used	Part Type	Footprint	Description	Population Status
B1	1	SMT_BRIDGE	SAL_F27_1N	SHINDENGEN S1NB60 or Digikey DF06SGICT-ND	
C1 C100 C102 C104 C2 C20 C21 C23 C24 C3 C4 C5 C6 C76 C77 C78 C79 C80 C81 C82 C83 C84 C85 C86 C87 C88 C89 C90 C91 C92 C93 C94 C95 C96 C9 C98 C99	36	0.1 μ F	0805	Ceramic multilayer capacitor	
C10 C11 C8 C9	4	220 pF 2KV	1808	NOVACAP SP1808B221M202N	
C12 C13 C15 C19 C22 C29 C30 C31 C32 C33 C34 C35 C36 C27 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48 C68 C69 C70	28	1 μ F	1260	Ceramic multilayer capacitor	
C14 C18	2	560 pF	0805	Ceramic multilayer capacitor	
C16	1	4.7 nF	0805	Ceramic multilayer capacitor	
C17 C25 C49 C50 C51 C52 C53 C54 C56 C57 C58 C59 C60 C61 C62 C63 C64 C65 C66 C67 C71 C72 C73 C74 C75	25	10 μ F	3528		
C27	1	0.01 μ F	0805	Ceramic multilayer capacitor	
C28	1	0.47 μ F	0805	Ceramic multilayer capacitor	
C7	1	0.001 μ F 500 V	1206	NOVACAP 1206B102K501N	
D1	1	P3100SB	DO-214	TECCOR (Mouser 5191-P3100SA)	
D2	1	LED red	1206	Digikey L62201CT-ND	
D3	1	LED green	1206	Digikey L62205CT-ND	
F1	1	FUSE	3216-CHIP (1206)	WICKMANN 4431100000 1A 63 V Digikey WK4661CT-ND	
J1	1	RJ12	154-UL6663	Mouser RJ12 phone jack -PN 154-UL6663	
J10 J15	1	TFM-140	TFM-140	TFM-140-31-S-D	J15 TFM used for mechanical support
J12 J7 J8	3	PHONO_JACK	161-3504	PCB mount phone jack Mourser 161-3504	
J13 J14	2	12X3X.1	12X3X.1	36 pin header for PCB interconnect	DO NOT POPULATE
J2 J3 J4 J5 J6 J9	6	CON_2TERM_ SCREW	2term_screw_con	2 terminal screw connector	

Ref Des	Used	Part Type	Footprint	Description	Population Status
L1 L2 L3 L4	4	BEAD	1806	Taiyo Yuden FBMJ4516HM111N	
L5 L6	2	4.7 μ H	DO1608C	DO1608C-Series – Coil Craft	
Q1	1	CPC5602C	4-SOT223	N-Channel FET, 4 pin SOT-223	
R1	1	200K	805	RES, SMD, 0805	
R10 R107 R108 R111 R111 R13 R17 R18 R19 R20 R21 R22 R23 R24 R25 R26 R27 R28 R29 R30 R31 R32 R33 R34 R35 R36 R37 R38 R39 R40 R41 R42 R43 R44 R45 R46 R47 R48 R49 R50 R51 R42 R53 R54 R55 R56 R57 R58 R59 R6 R60 R61 R62 R8 R9	55	10K	805	RES, SMD, 0805	
R100 R101 R102 R74 R77 R93 R94 R95 R96 R99	10	20K	805	RES, SMD, 0805	
R103 R12	2	1	805	RES, SMD, 0805	
R104	1	0	805	RES, SMD, 0805	
R105 R106	2	10	1206	RES, SMD, 1206	
R16 R69 R7 R75	4	44K	805	RES, SMD, 0805	
R2	1	604K 1%	805	RES, SMD, 0805	
R3 R4	2	150K	805	RES, SMD, 0805	
R5	1	10M	805	RES, SMD, 0805	
R63	1	10M, 1/4W	1206	RES, SMD, 1206	
R97 R110	2	11K	805	RES, SMD, 0805	
R64	1	1.2M	805	RES, SMD, 0805	
R14 R15 R65 R66 R67 R68 R70 R71 R72 R73 R74 R78	12	22K	805	RES, SMD, 0805	
R76 R98 R109	3	1K	805	RES, SMD, 0805	
RP1	1	1K	TRIM POT	3214W-1-102E	
R79 R80 R81 R82	4	470	805	RES, SMD, 0805	
R83	1	8.2	805	RES, SMD, 0805	
R84	1	300	805	RES, SMD, 0805	
R85	1	604 1%	805	RES, SMD, 0805	
R86 R87	2	806K 1%	805	RES, SMD, 0805	
R88	1	402 1%	805	RES, SMD, 0805	
R89	1	100	805	RES, SMD, 0805	
R90	1	1M	0805	RES, SMD, 0805	
R91 R92	2	1.5M	0805	RES, SMD, 0805	
SW1	1	SW-PB	EVQ-PJ	Panasonic EVQ-PJS05K	
SW2	1	SW 12 POS	X-435640-X	Dip switch, AMP 7100 series, 12 pos	

Bill of Materials

Ref Des	Used	Part Type	Footprint	Description	Population Status
TP1 TP2 TP10 TP11 TP12 TP13 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9	13	TP_0.025	test_point2	SAMTEC TWS-101-07-L-S 0.025" pin	
U1 U2 U3 U4 U5 U6 U7 U8	8	TLV320AIC10	48-TQFP (PFB)	TLV320AIC10	DO NOT POPULATE U3-U8
U10 U9	2	TPA4861D	8-SOP (D)	TPA4861	
U11	1	CPC5604	32_SOIC	CPC5604	
U12 U13 U18	3	TLV2462D	8-SOP(D)	TLV2462A	
U14	1	SN74HC02	14-SOP (D)	Quad 2 input pos OR	
U15	1	TPS3823	5-SOT (DBV)	TPS3823	
U16	1	EPSON 8.200 MHz	4PIN_XTL_DC	EPSON SG-8002DC-SCC- 8.200 MHZ	
U17	1	SN74HC74	14-SOP (D)	Dual D PET FF RS CR	
U19	1	SN84HC08	14-SOP (D)	Quad NAND gate	
W21 W35 W36 W37 W38 W39 W40 W41 W42 W43 W44 W45 W46 W47 W48 W49 W50 W51 W52 W53 W54 W55 W56 W57 W58 W59 W60 W8 W62	29	2POS_JUMPER	2 pos_jump	SAMTEC TSW-102-07-L-S 0.1" spacing	DO NOT POPULATE W42-W50 W51-W59

Jumper Hook Up Table TLV320AIC10

W3 1-2		W2 1-2	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W11 2-3		W10 2-3	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W22 2-3		W7 1-2	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W36 SHORT		W21 SHORT	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W9 2-3		W1 1-2	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W6 1-2		W14 2-3	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W37 SHORT		W38 SHORT	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W20 1-2-3		W15 1-2-3	3 pos short	S.V.Trionics 70-0000-3
W13 1-2-3			3 pos short	S.V.Trionics 70-0000-3
W5 1-2		W4 1-2	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W17 2-3		W16 2-3	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W39 SHORT		W60 SHORT	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W41 SHORT		W35 SHORT	2 pos short	SAMTEC SNT-100-BK-T or equivalent
W61 2-3		W40 SHORT	2 pos short	SAMTEC SNT-100-BK-T or equivalent

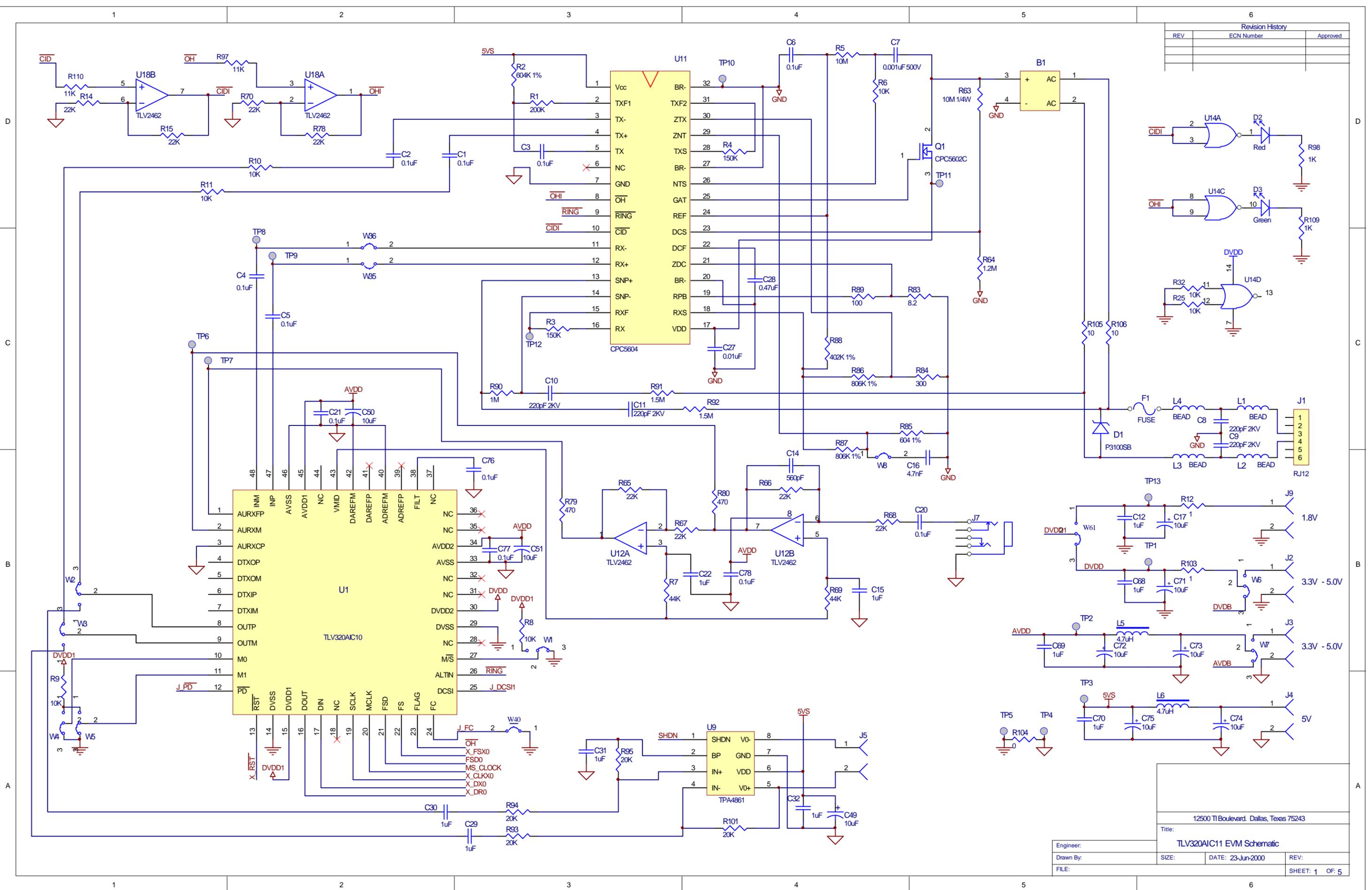
Jumper Hook Up table TLV320AIC11

W61 1-2			2 pos short	SAMTEC SNT-100-BK-T or equivalent
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Schematics

This Appendix contains the TLV320AIC10/11 EVM schematics.

Revision History		
REV	ECN Number	Approved



12500 TI Boulevard, Dallas, Texas 75243

Title: TLV320AIC11 EVM Schematic

Engineer: _____

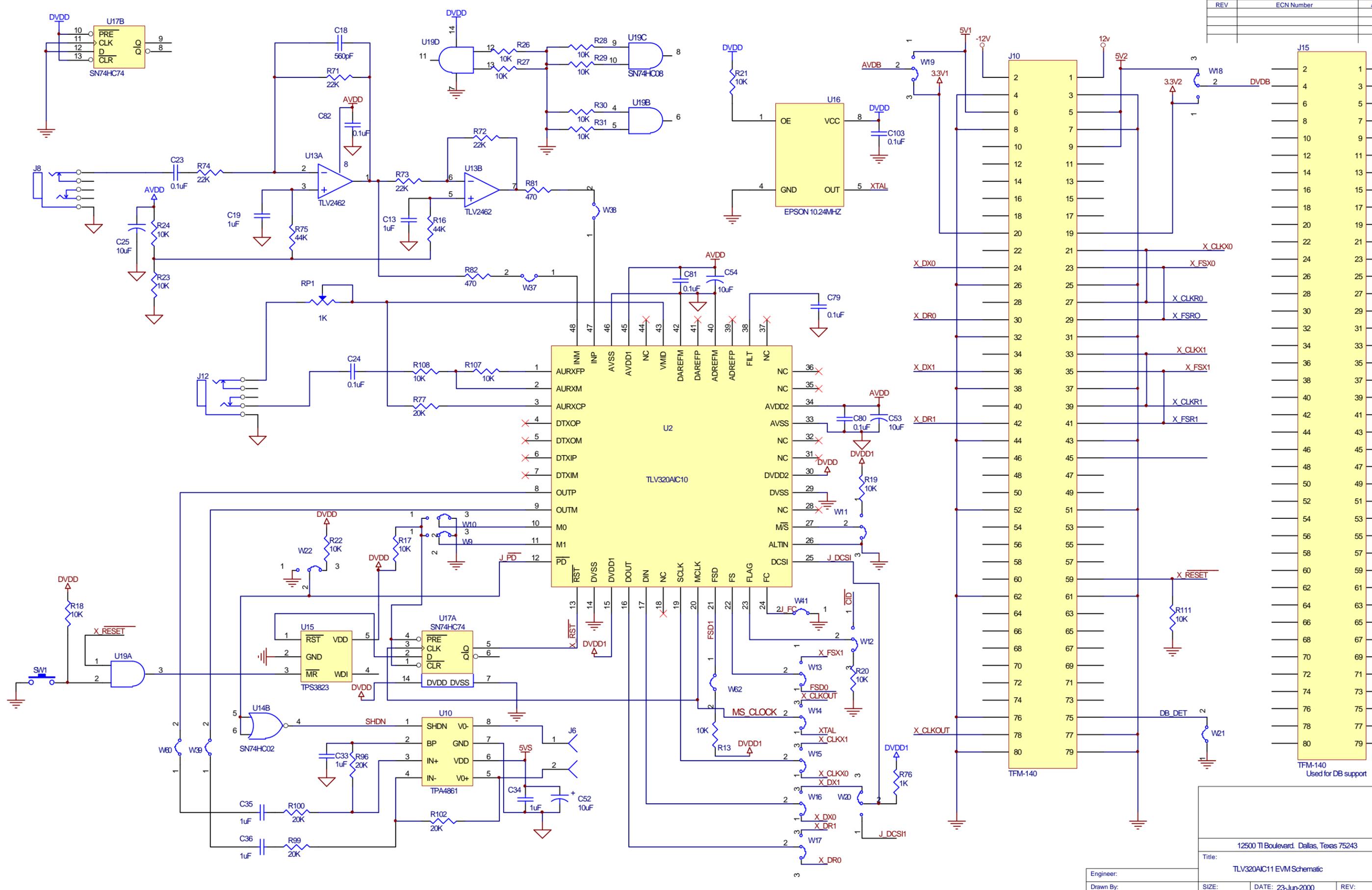
Drawn By: _____

FILE: _____

SIZE: _____ DATE: 23-Jun-2000 REV: _____

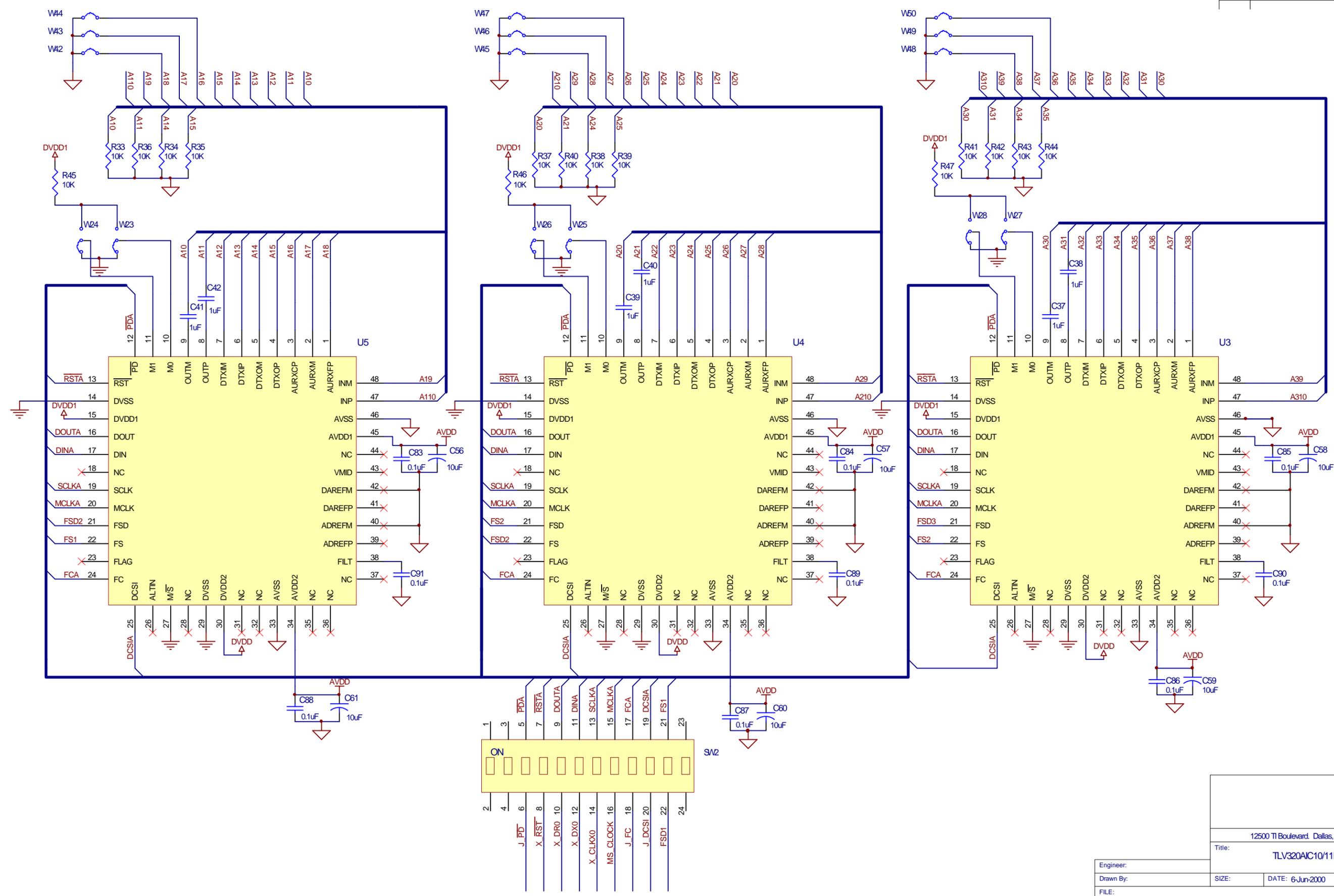
SHEET: 1 OF: 5

Revision History		
REV	ECN Number	Approved



12500 TI Boulevard, Dallas, Texas 75243			
Title: TLV320AIC11 EVM Schematic			
Engineer:	SIZE:	DATE: 23-Jun-2000	REV:
Drawn By:	FILE:	SHEET: 2	OF: 5

Revision History		
REV	ECN Number	Approved

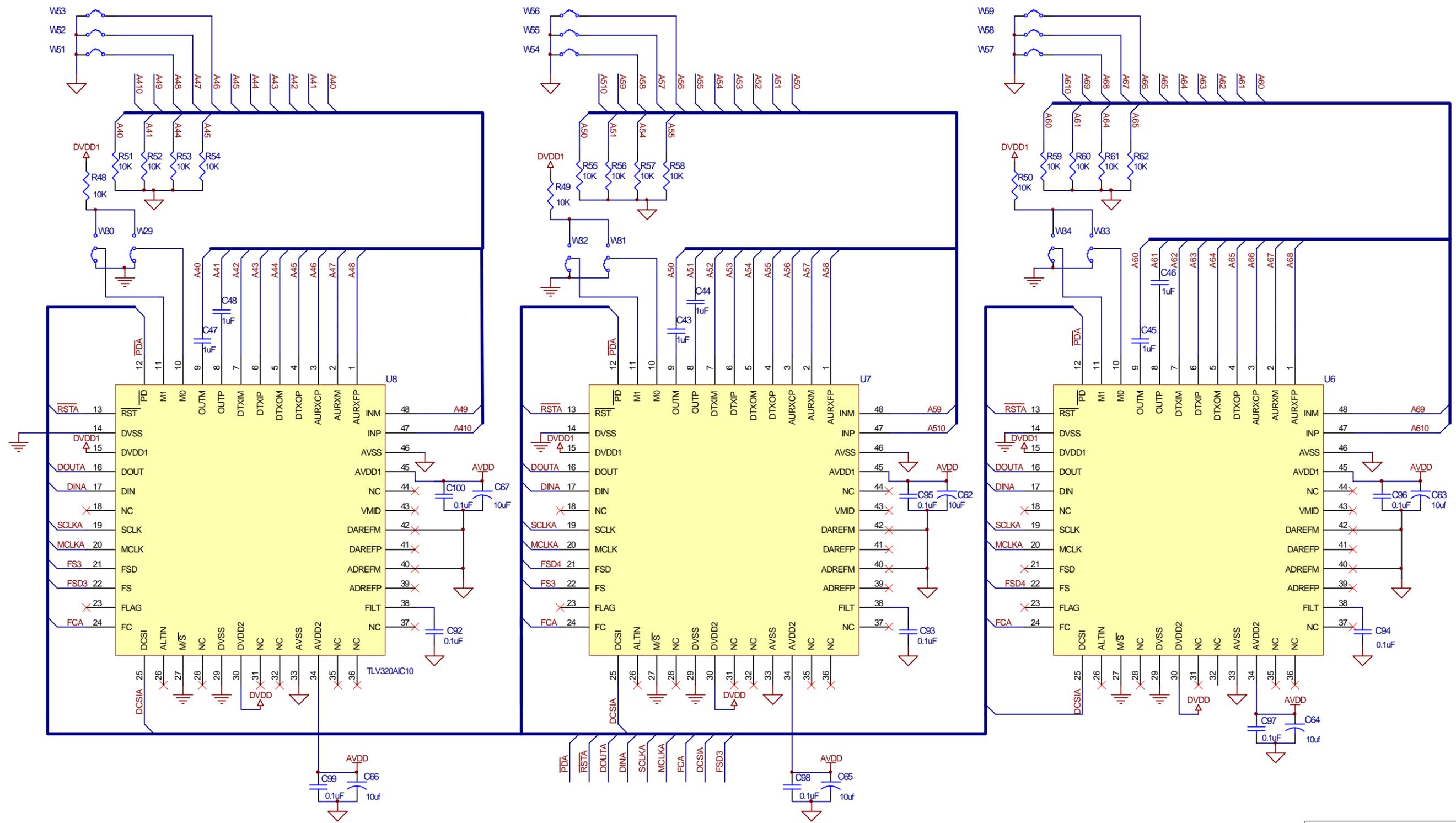


12500 TI Boulevard, Dallas, Texas 75243		
Title: TLV320AIC10/11EVM		
Engineer:	SIZE:	DATE: 6-Jun-2000
Drawn By:	REV:	SHEET: 3 OF: 5
FILE:		

D
C
B
A

D
C
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A

Revision History		
REV	ECN Number	Approved

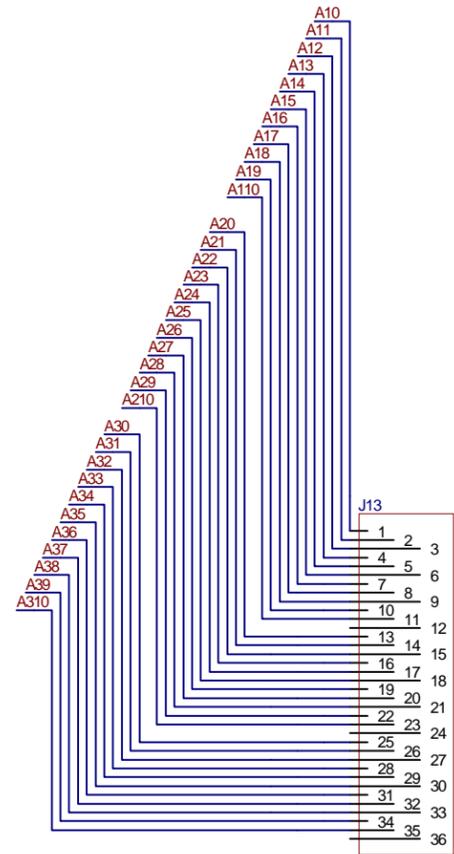


12500 TI Boulevard, Dallas, Texas 75243

Title: TLV320AIC10/11EVM

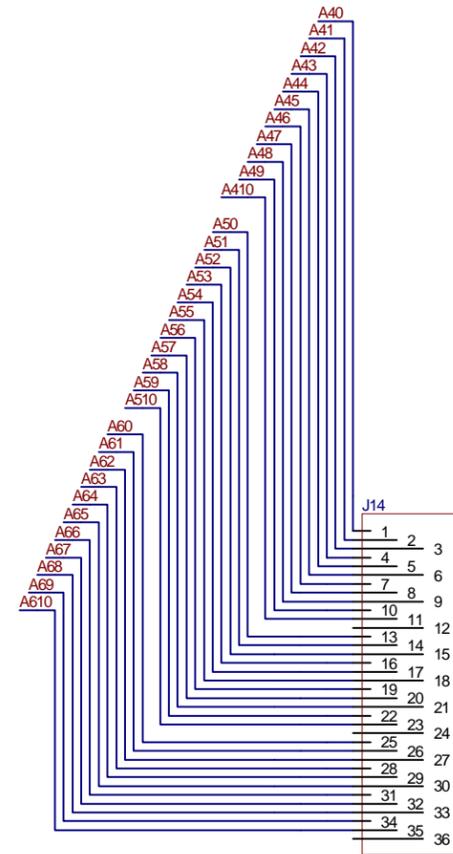
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Drawn By:	FILE:	SHEET: 4	OF: 5

Revision History		
REV	ECN Number	Approved



12X3X.1

CRANE PEG36TS-TBR



12X3X.1

CRANE PEG36TS-TBR

12500 TI Boulevard, Dallas, Texas 75243			
Title: TLV320AIC10/11EVM			
Engineer:	SIZE:	DATE: 6Jun-2000	REV:
Drawn By:	FILE:	SHEET: 5 OF 5	