TX517 Dual Channel, 17-Level With RTZ, Integrated Ultrasound Transmitter

User's Guide

Literature Number: SLOU317B
August 2011–Revised December 2011

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General Texas Instruments High Voltage Evaluation (TI HV EVM) User Safety Guidelines

WARNING

Always follow TI's set-up and application instructions, including use of all interface components within their recommended electrical rated voltage and power limits. Always use electrical safety precautions to help ensure your personal safety and those working around you. Contact TI's Product Information Center http://support/ti./com for further information.

Save all warnings and instructions for future reference.
Failure to follow warnings and instructions may result in personal injury, property damage or death due to electrical shock and burn hazards.

The term TI HV EVM refers to an electronic device typically provided as an open framed, unenclosed printed circuit board assembly. It is *intended strictly for use in development laboratory environments, solely for qualified professional users having training, expertise and knowledge of electrical safety risks in development and application of high voltage electrical circuits. Any other use and/or application are strictly prohibited by Texas Instruments.* If you are not suitable qualified, you should immediately stop from further use of the HV EVM.

1. Work Area Safety:
   (a) Keep work area clean and orderly.
   (b) Qualified observer(s) must be present anytime circuits are energized.
   (c) Effective barriers and signage must be present in the area where the TI HV EVM and its interface electronics are energized, indicating operation of accessible high voltages may be present, for the purpose of protecting inadvertent access I
   (d) All interface circuits, power supplies, evaluation modules, instruments, meters, scopes and other related apparatus used in a development environment exceeding 50Vrms/75VDC must be electrically located within a protected Emergency Power Off EPO protected power strip.
   (e) Use stable and non conductive work surface.
   (f) Use adequately insulated clamps and wires to attach measurement probes and instruments. No freehand testing whenever possible.
2. Electrical Safety:
   As a precautionary measure, it is always a good engineering practice to assume that the entire EVM may have fully accessible and active high voltages.
   (a) De-energize the TI HV EVM and all its inputs, outputs and electrical loads before performing any electrical or other diagnostic measurements. Revalidate that TI HV EVM power has been safely de-energized.
   (b) With the EVM confirmed de-energized, proceed with required electrical circuit configurations, wiring, measurement equipment hook-ups and other application needs, while still assuming the EVM circuit and measuring instruments are electrically live.
   (c) Once EVM readiness is complete, energize the EVM as intended.

WARNING

While the EVM is energized, never touch the EVM or its electrical circuits as they could be at high voltages capable of causing electrical shock hazard.

3. Personal Safety:
   (a) Wear personal protective equipment e.g. latex gloves or safety glasses with side shields or protect EVM in an adequate lucent plastic box with interlocks from accidental touch.

Limitation for safe use: EVMs are not to be used as all or part of a production unit.

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TX517 Dual Channel, 17-Level With RTZ, Integrated Ultrasound Transmitter

TX517 is a fully integrated, dual channel, high voltage Transmitter designed by Texas Instruments Incorporated. This EVM provides a means to evaluate the functionality of the device. The EVM includes a FPGA to provide an embedded pattern generator and digital control of the device. The output pattern and configuration settings are controlled by 8 push buttons on the EVM.

1 Default Configuration

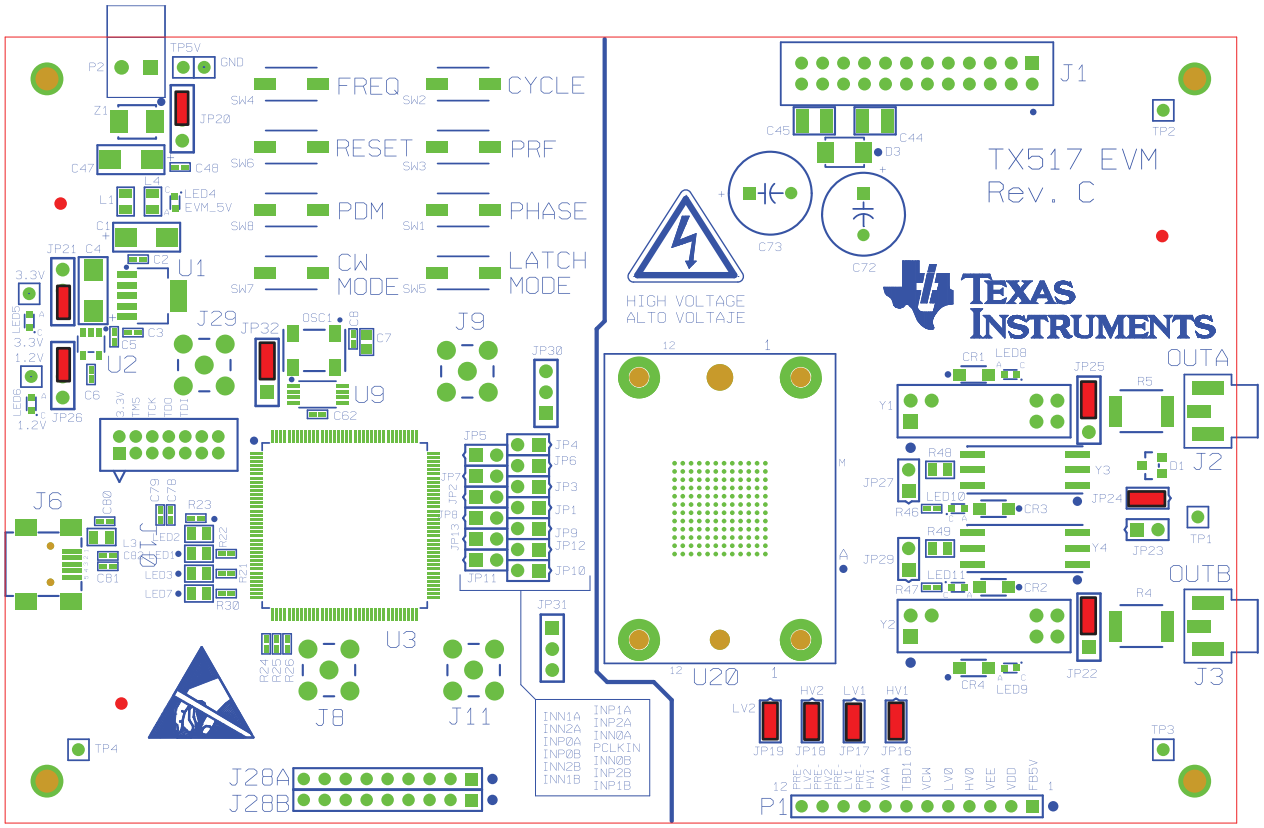

Figure 1. Tx517 EVM Basic Configuration

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2 Buttons

There are eight buttons for controlling the output waveform settings. They are listed in Table 1.

Table 1. Buttons

Button	Functionality
PHASE_BUTTON	Each time the button is pressed, the current INPx pattern becomes the pattern for INNx, the current INNx pattern becomes the pattern for INPx.
PRF_BUTTON	Changes the Pulse Repetition Frequency of the output waveform as given in Table 2 Each press increases the PRF and then cycles back to 0.
CYCLE_BUTTON	Changes the number of times the output pattern cycles within the pulse burst, as given in the Table 3. Each press moves 1 level up and then back to 0
FREQ_BUTTON	Changes the Frequency of the output waveform as given in the Table 4. Each press increases the frequency and then cycles back to 0
RESET_BUTTON	Reset all the setting to its default
PDM_BUTTON	One press changes the mode to Power down mode.
CW_MODE_BUTTON	First six times the button is pressed will change the pattern depth as shown in Table 5. Seventh press will change the device to CW mode. In CW mode, pressing the button will revert back to 17-level. The latch mode is unaffected. Refer to Table 5 and Table 6.
LATCH_MODE_BUTTON	First press changes to latch mode. Every consecutive pulse will toggle the mode between Latch and Non latch mode

Table 2. PRF

Index	PRF(kHz)	Comments
0	0.5	
1	1	
2	5	17-level Ramp Only
3	10	17-level Ramp Only

Table 3. Cycle

Index	PRF (kHz)	Comments
0	1	Longer than 5-level Only
1	2	Longer than 5-level Only
2	3	
3	5	
4	10	

Table 4. Frequency

Index	Frequency (MHz)	Comments
0	10	
1	20	
2	50	
3	100	

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There are 7 patterns: 17-, 5-, 3-, 32-, 4- and 2-level. The patterns are given in Table 6.

Table 5. Pattern Depth

Index	Pattern Depth	Comments
0	17	
1	5	
2	3	
3	32	
4	4	
5	2	
6	CW	

Table 6. Patterns of Different Level

17 level			5 level			3 level		
S/N	Pattern	Level	S/N	Pattern		S/N	Pattern	
1	516	8	1	516	8	1	516	8
2	514	7	2	1026	4	2	2145	0
3	577	6	3	2145	0	3	264	–8
4	1028	5	4	144	–4			
5	1026	4	5	264	–8			
6	1089	3						
7	2084	2						
8	2082	1						
9	2145	0						
10	81	–1						
11	73	–2						
12	2208	–3						
13	144	–4						
14	136	–5						
15	2336	–6						
16	272	–7						
17	264	–8						

3 SYNC Trigger

A **Sync trigger** pulse is generated at the start of the pattern transmission for triggering the monitoring device. Sync pulse will be 5 pattern clock cycle wide and it is active high. Sync pulse output thru J8 SMA connector..

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4 Power up TX517

Connect +5V adaptor to P2 connector.

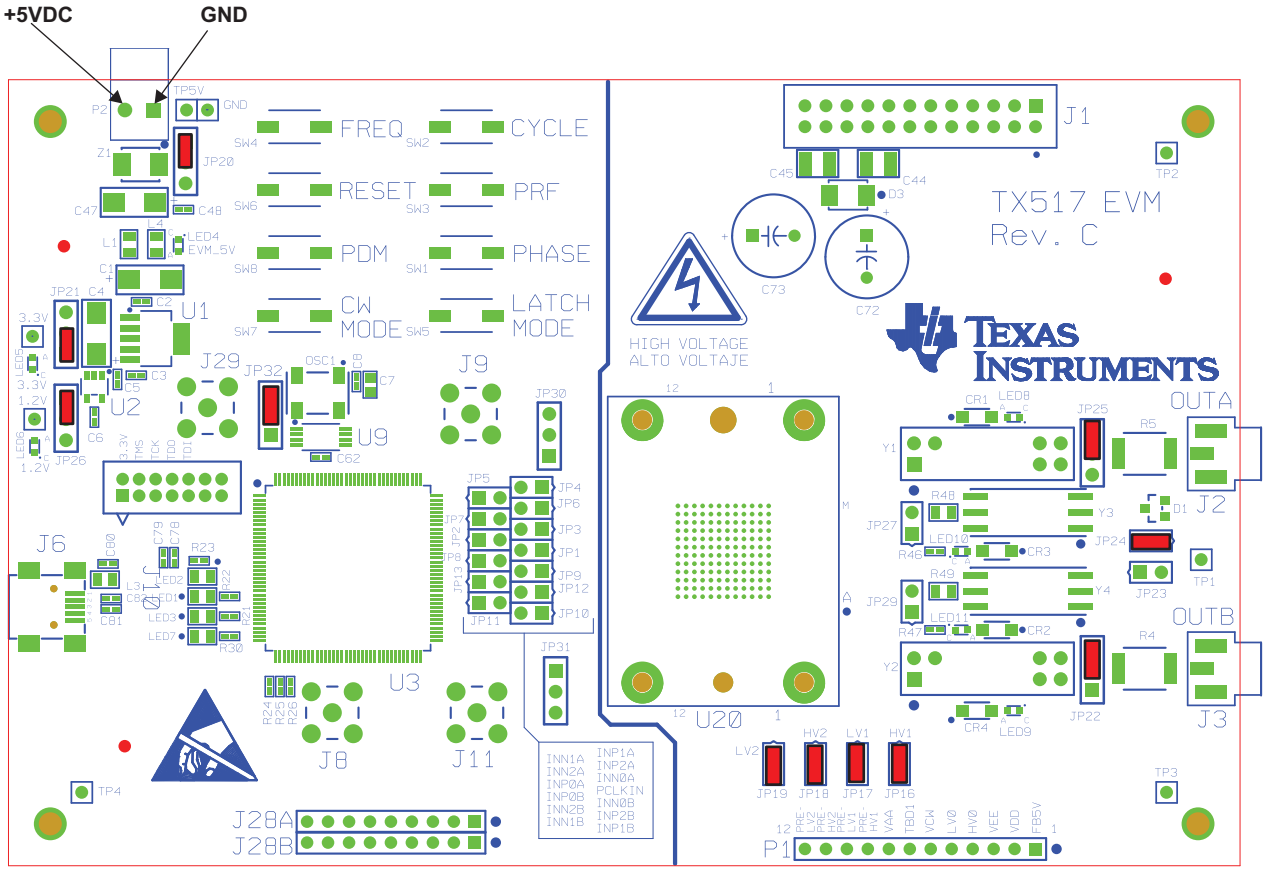

Figure 2. Power-Up Indications

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5 Power Supplies for Output Waveform

Either J1-Header or P1-Header but not both, is used for this purpose.

WARNING

User may be exposed to high voltage depending on power supplies setting !

Table 7. Pin Definition for J1-Header

Pin	Voltage [1]	Pin	Voltage	COMMENT
1	GND	2	OPEN	FB5V
3	GND	4	+5 V	VDD
5	GND	6	–5 V	VEE
7	GND	8	+1.9 V	HV0
9	GND	10	-1.9 V	LV0
11	GND	12	+11 V	VCW
13	GND	14	OPEN	OPEN
15	GND	16	+2.5 V	VAA
17	GND	18	+61 V	HV1
19	GND	20	–20.9 V	LV1
21	GND	22	+32 V	HV2
23	GND	24	–11.9 V	LV2

(1) Use a GND test point for ground

Table 8. Pin Definition for P1-Header

Pin	Voltage	COMMENT
1	OPEN	FB5V
2	+5 V	VDD
3	-5 V	VEE
4	+1.9 V	HV0
5	–1.9 V	LV0
6	+11 V	VCW
7	OPEN	OPEN
8	+2.5 V	VAA
9	+61 V	HV1
10	–20.9 V	LV1
11	+32 V	HV2
12	–11.9 V	LV2

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5.1 Input/Output Pattern

- **17 Level**

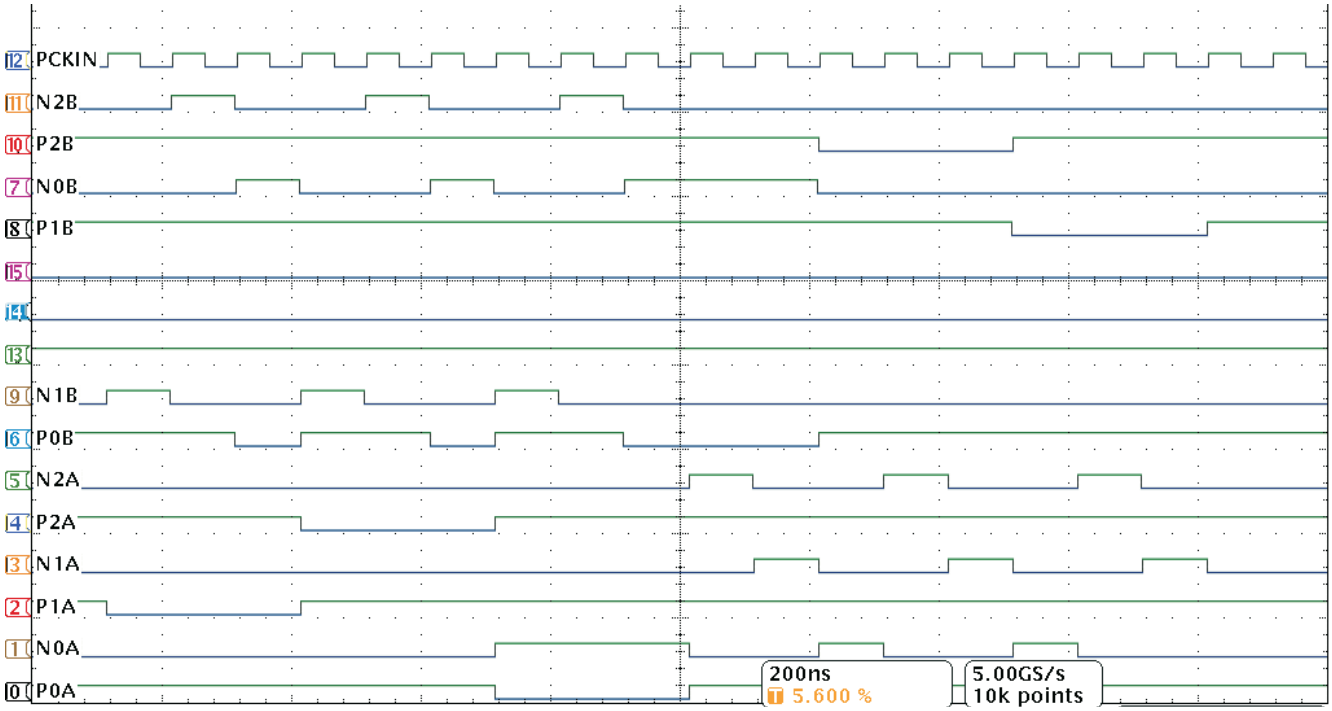

Figure 3. Input Pattern for 17-Level

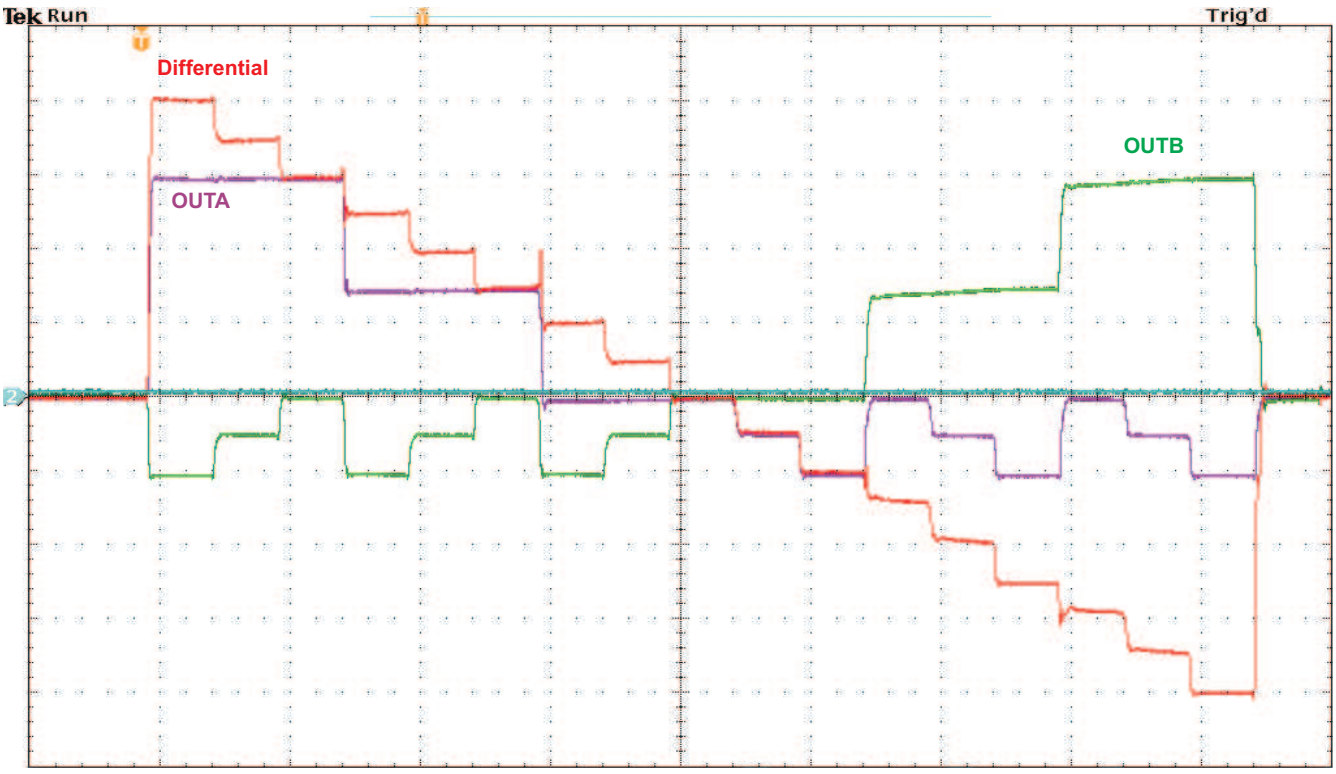

Figure 4. Output Waveform for 17-Level

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- **5 Level**

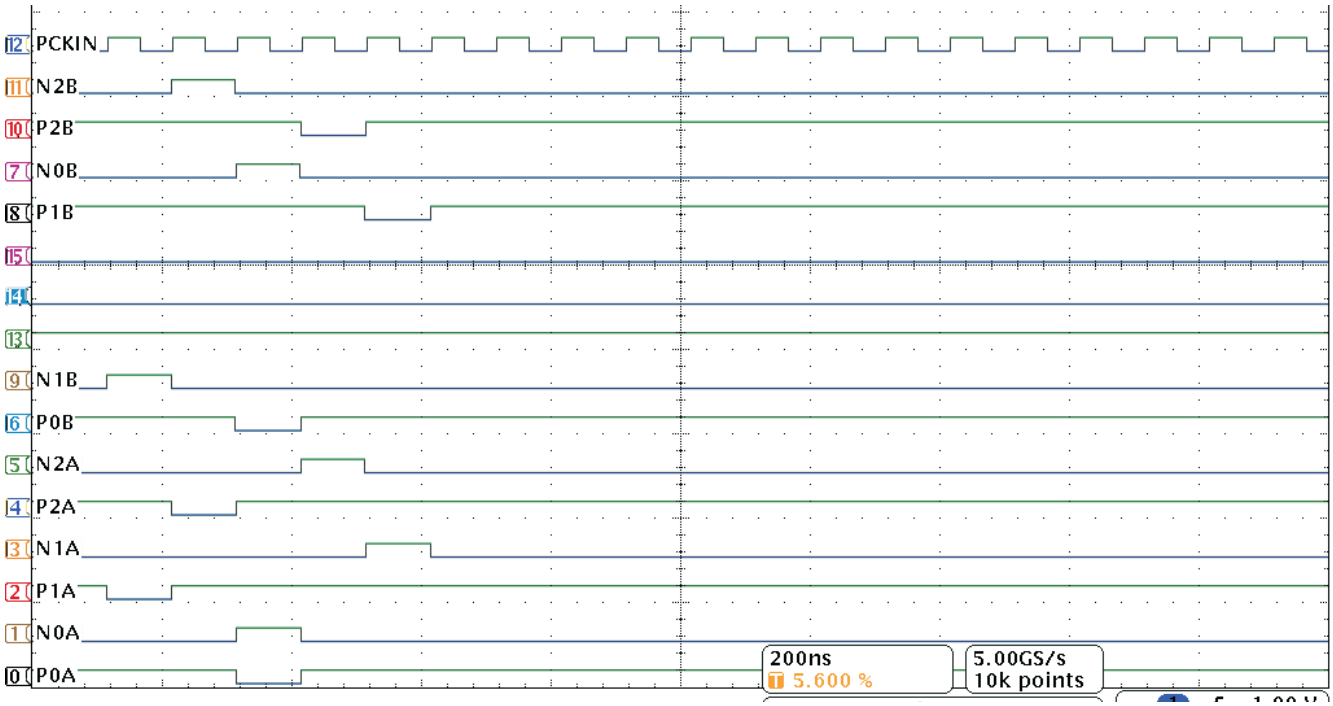

Figure 5. Input Pattern for 5-Level

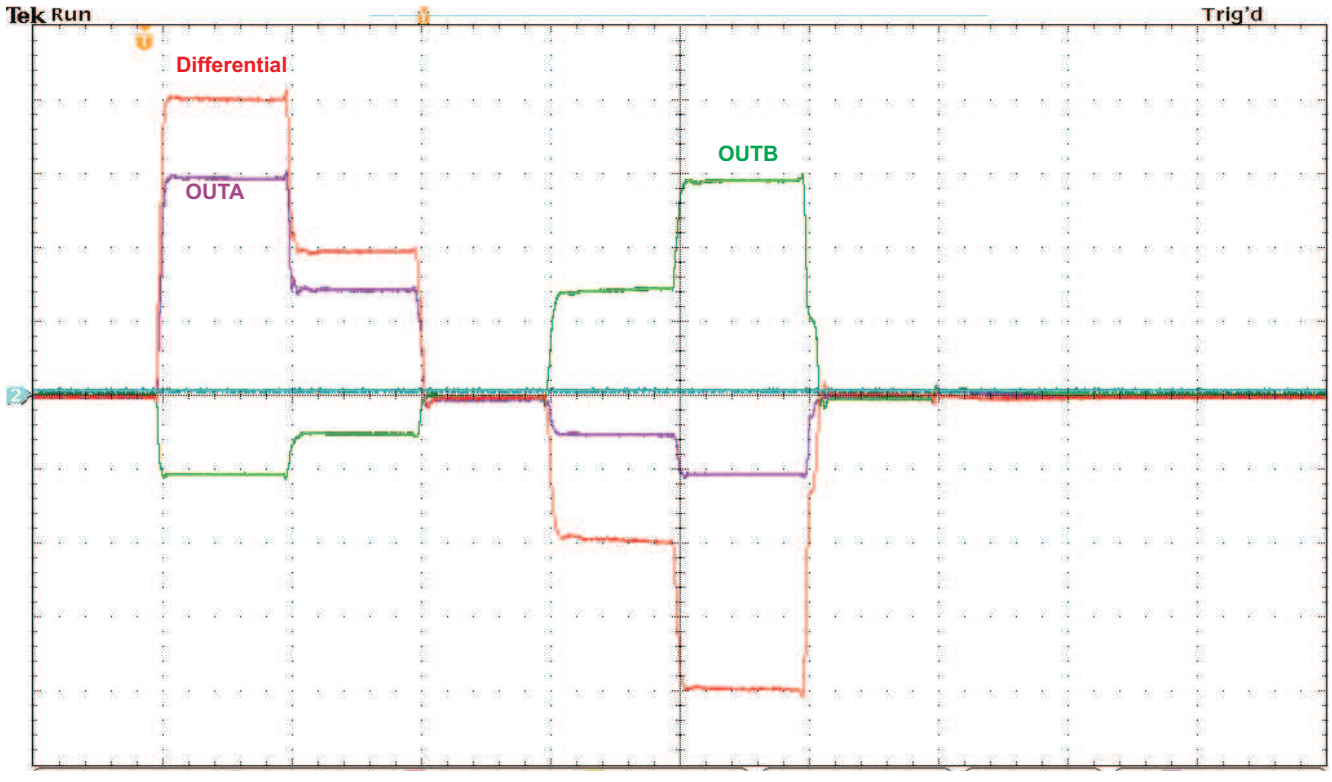

Figure 6. Output Waveform for 5-Level

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- **3 Level**

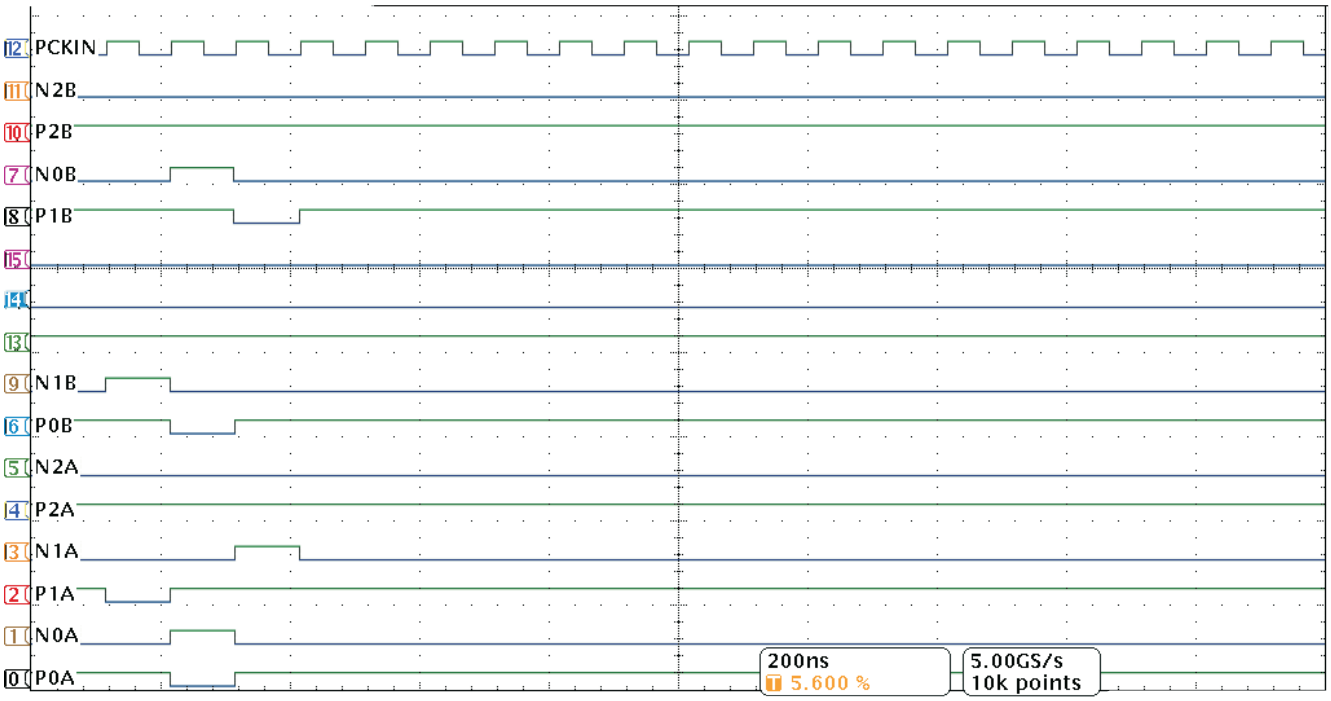

Figure 7. Input Pattern for 3-Level

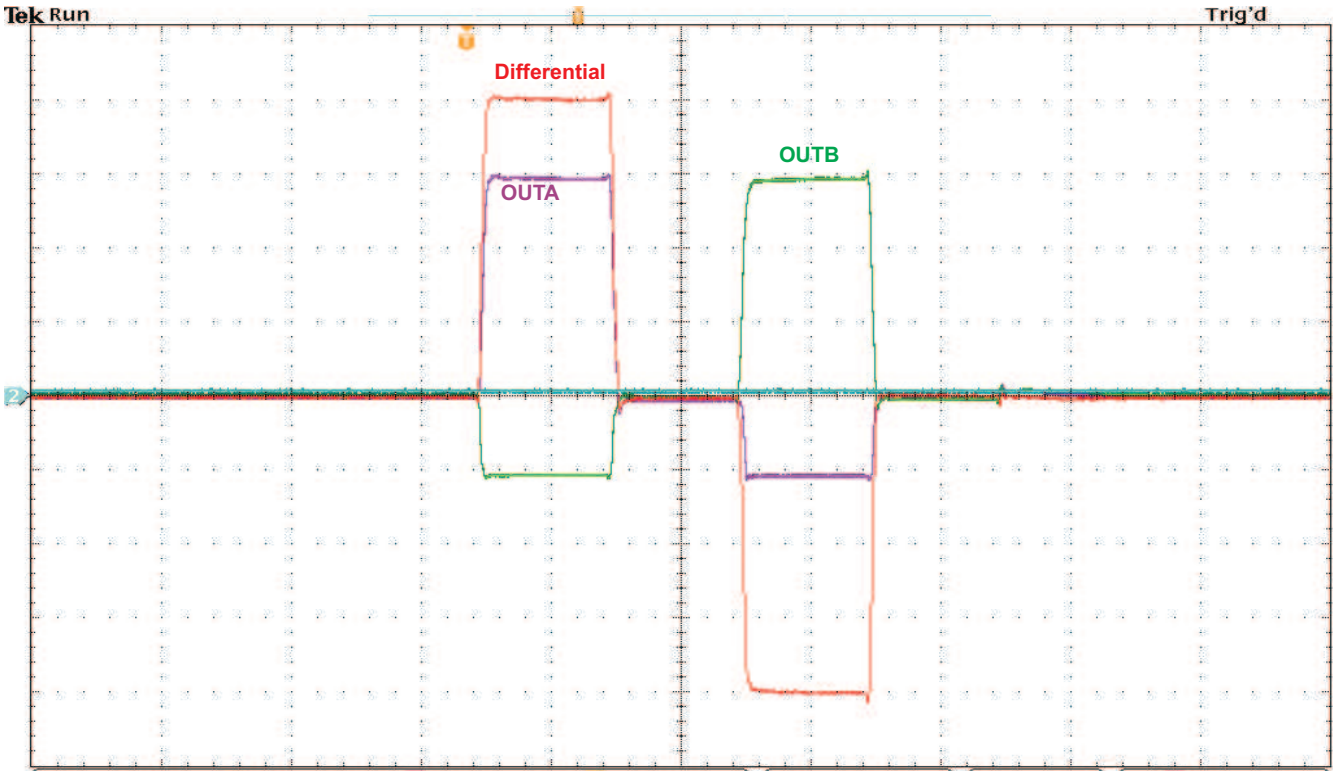

Figure 8. Output Waveform for 3-Level

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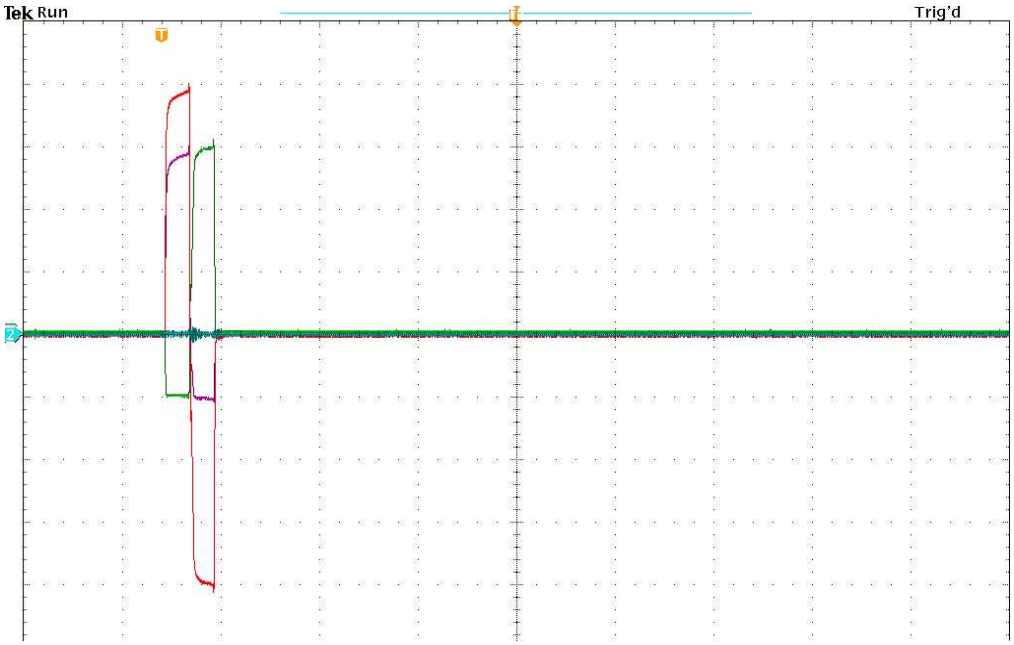

Figure 9. Output Waveform for 2-Level

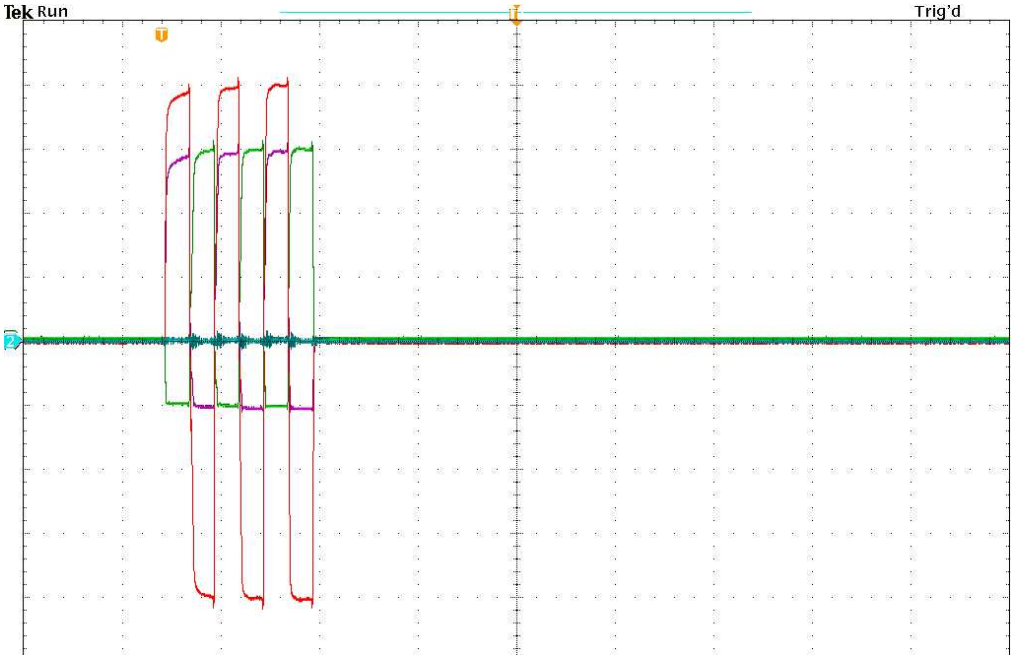

Figure 10. Output Waveform for 2-Level With Three Cycles

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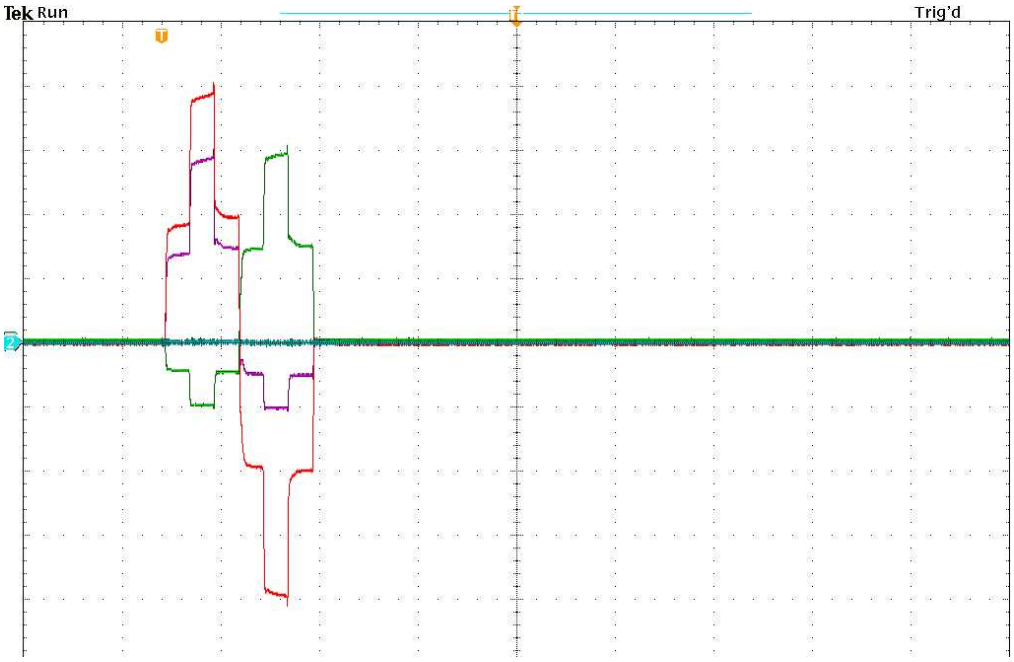

Figure 11. Output Waveform for 4-Level

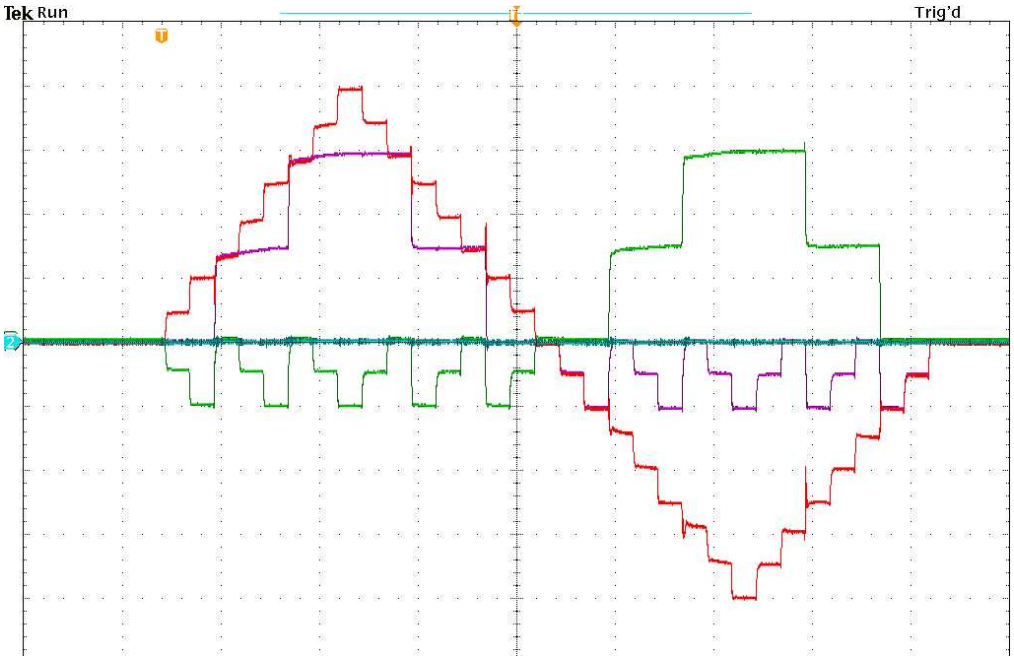

Figure 12. Output Waveform for 32-Level

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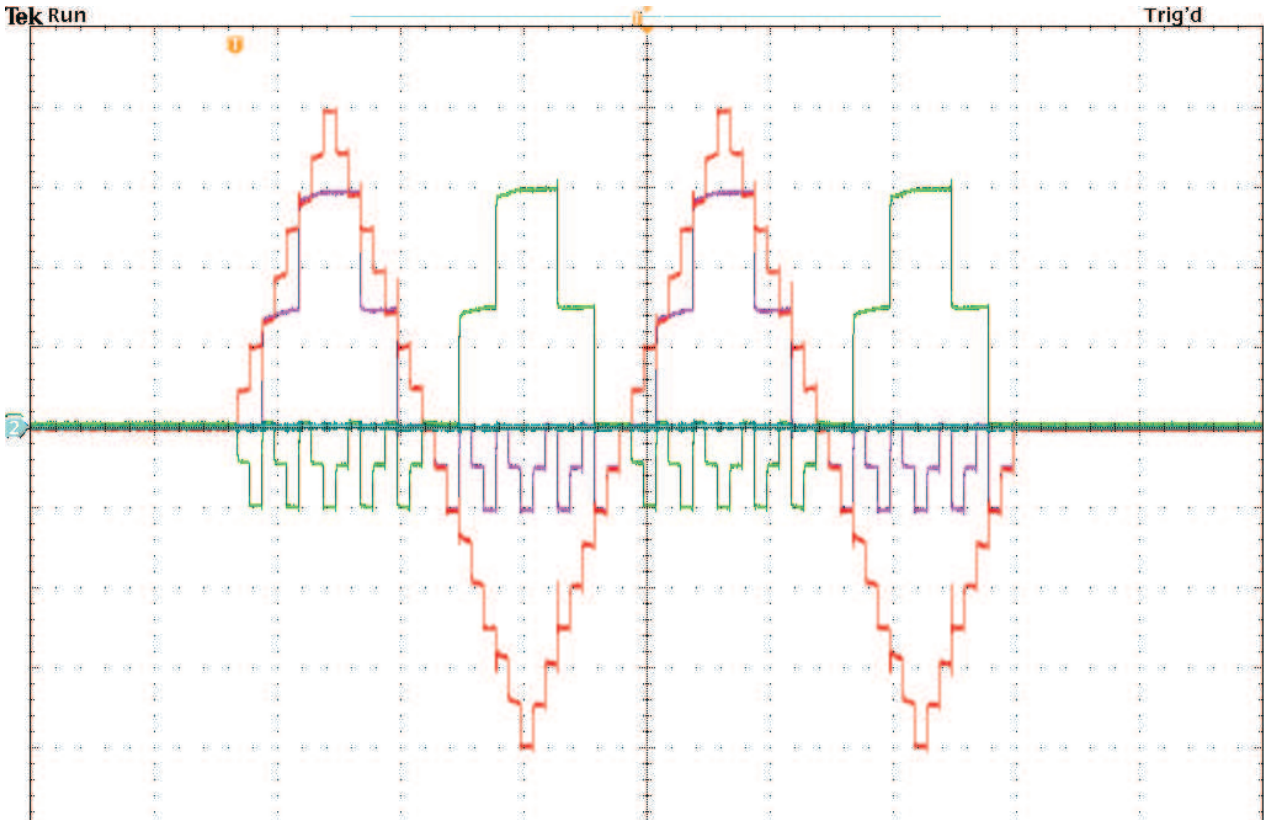

Figure 13. Output Waveform for 32-Level With Two Cycles

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6 Board Configuration

Table 9. Input/Output, Power, and USB

Connector	Description
P1	External power supplies to the device
P2	+5V power supply connector.
TP5V, TEST_GND	Test points for +5V power supply.
JP20	Jumper to select +5V or FB_5V.
JP21	Select +3.3V.
JP26	Select +1.2V
JP32	External clock/On board OSC
TP1,TP2,TP3,TP4	Ground test points.
TP33V, TP12V	Test points for +3.3V and +1.2V respectively.
JP16	Short always
JP17	Short always
JP18	Short always
JP19	Short always
JP22	Default setup is to output directly/ Others is to drive thru on board transformer.
JP25	JP25: Default setup is to output directly/ Others is to drive thru on board transformer.
JP23	Open when output directly. Short when driving thru transformer
JP24	Short always
JP27	Open
JP29	Open
JP1..JP13	Test points for test pattern. They can also be used for external test patterns.
JP30/JP31	CWINA/CWINB selection.
J6	USB interface connector

Table 10. LED Indicators

Reference Designator	Power Supply
LED1/LED2	USB interface indication
LED3/LED7	FPGA alive
LED4	+5V
LED5	+3.3V
LED6	+1.2V

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7 EVM Schematics

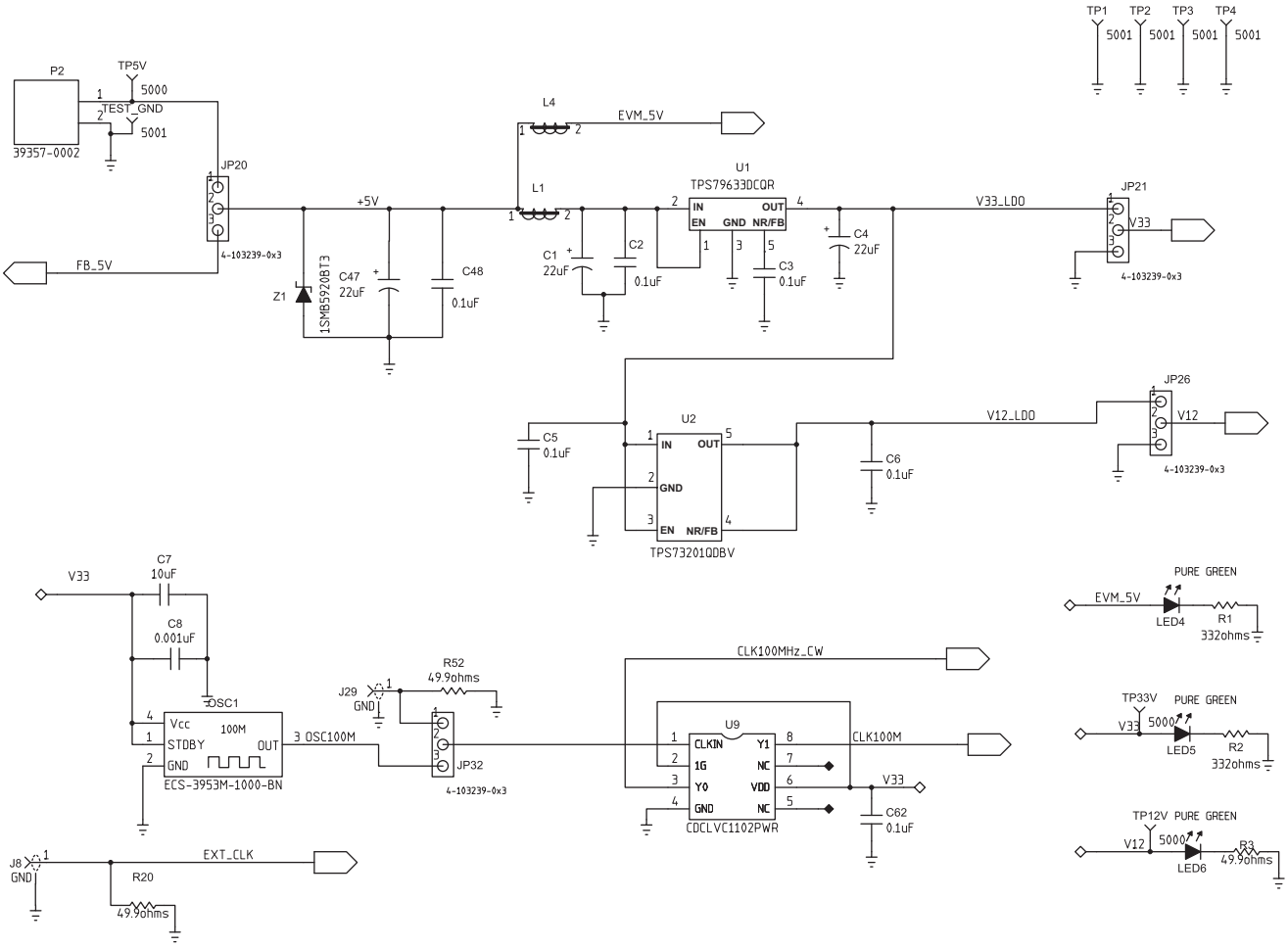

Figure 14. Schematic (1 of 8)

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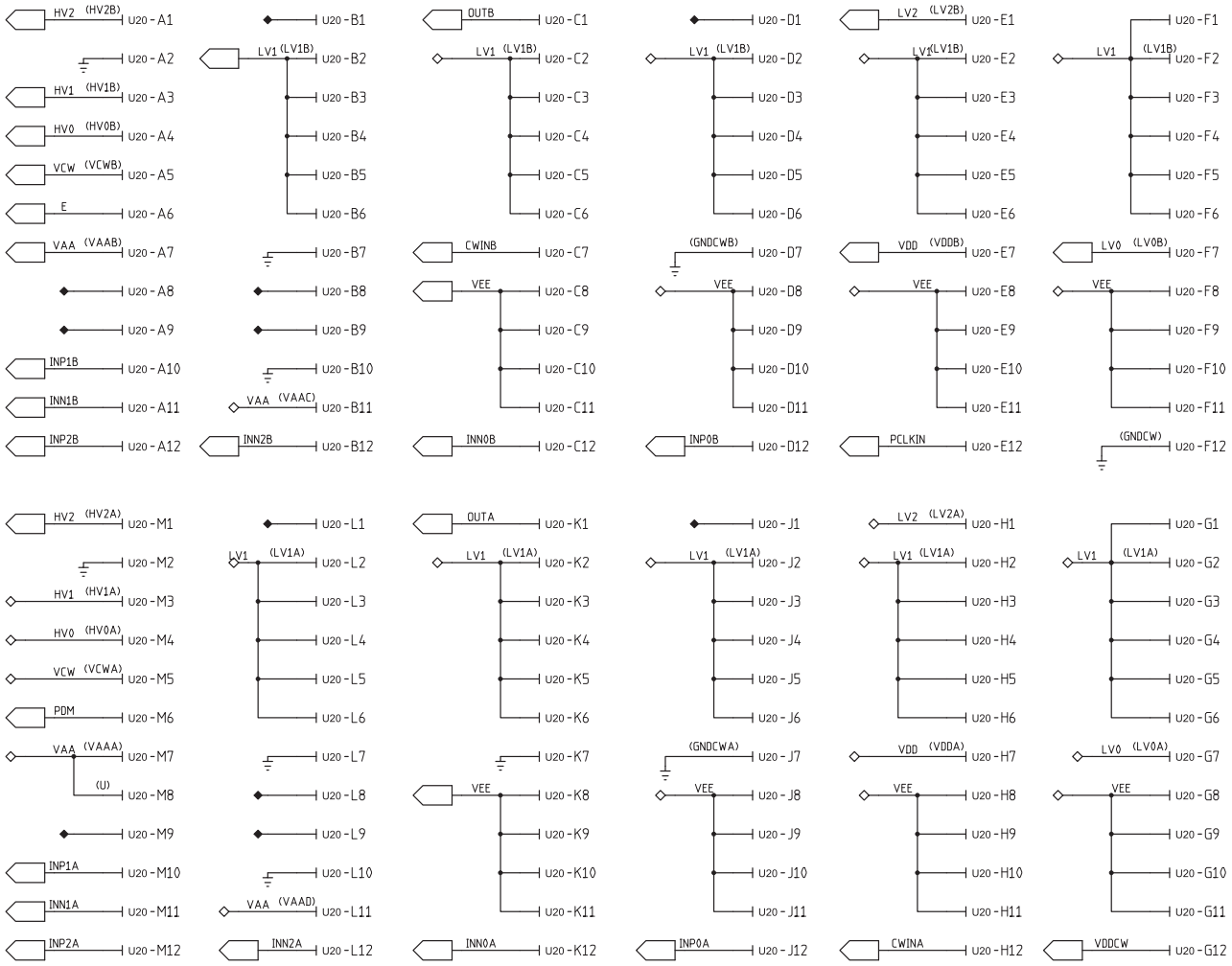
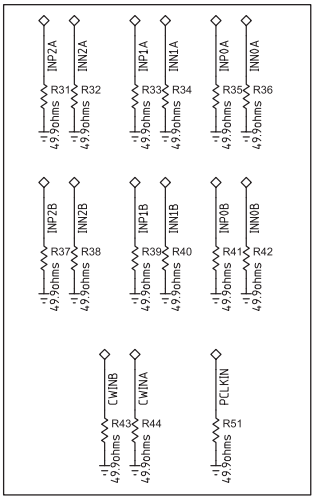
SOCKET or TX517



WARNING: Users may be exposed to high voltage



These resistors are not installed. They are required when an external generator is used for pattern generation.

Figure 15. Schematic (2 of 8)

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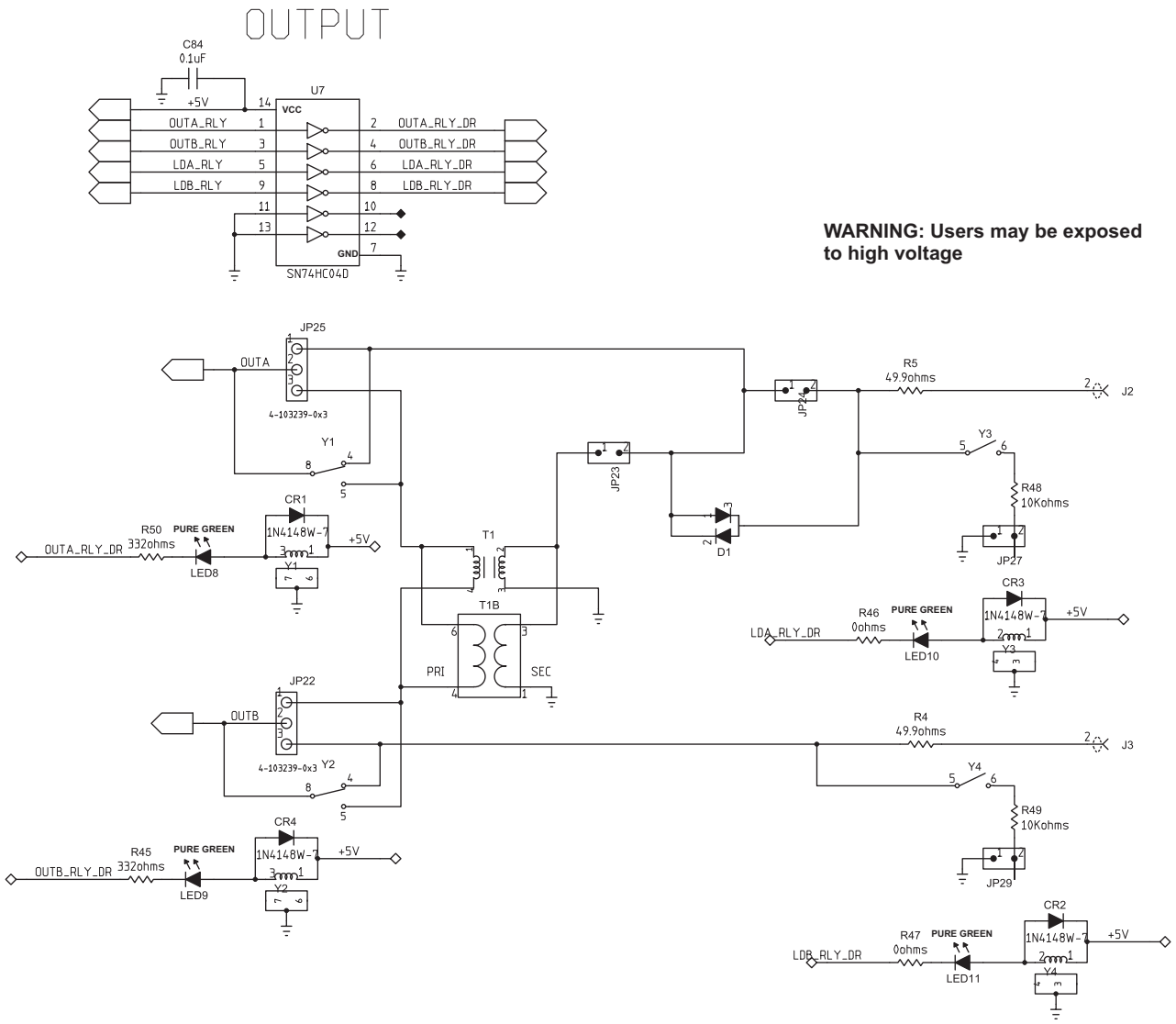

Figure 16. Schematic (3 of 8)

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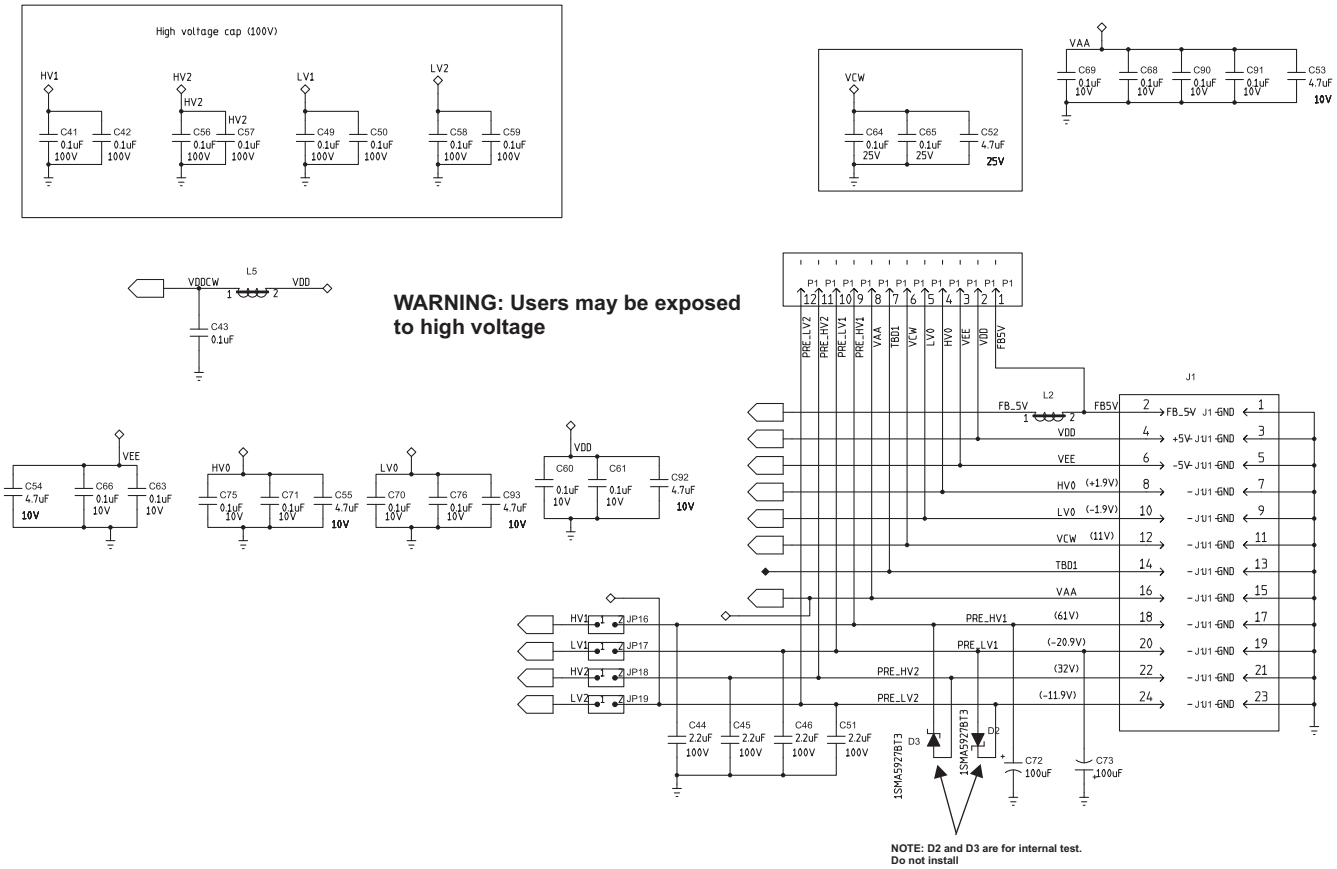

Figure 17. Schematic (4 of 8)

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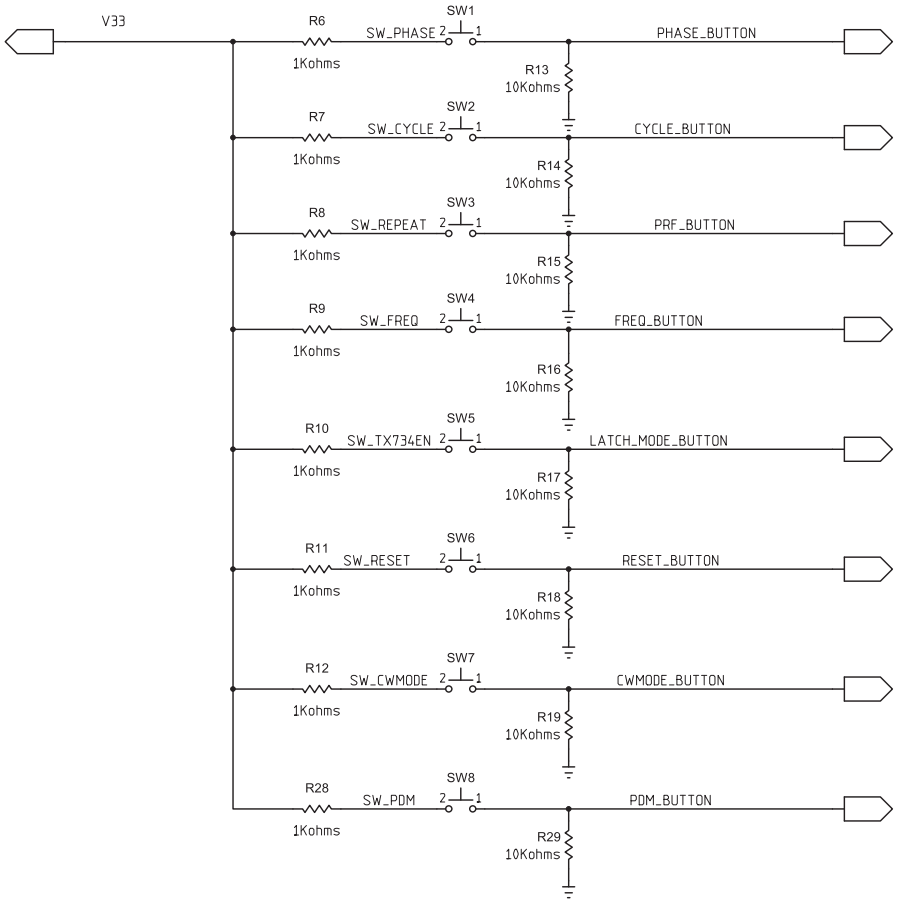

Figure 18. Schematic (5 of 8)

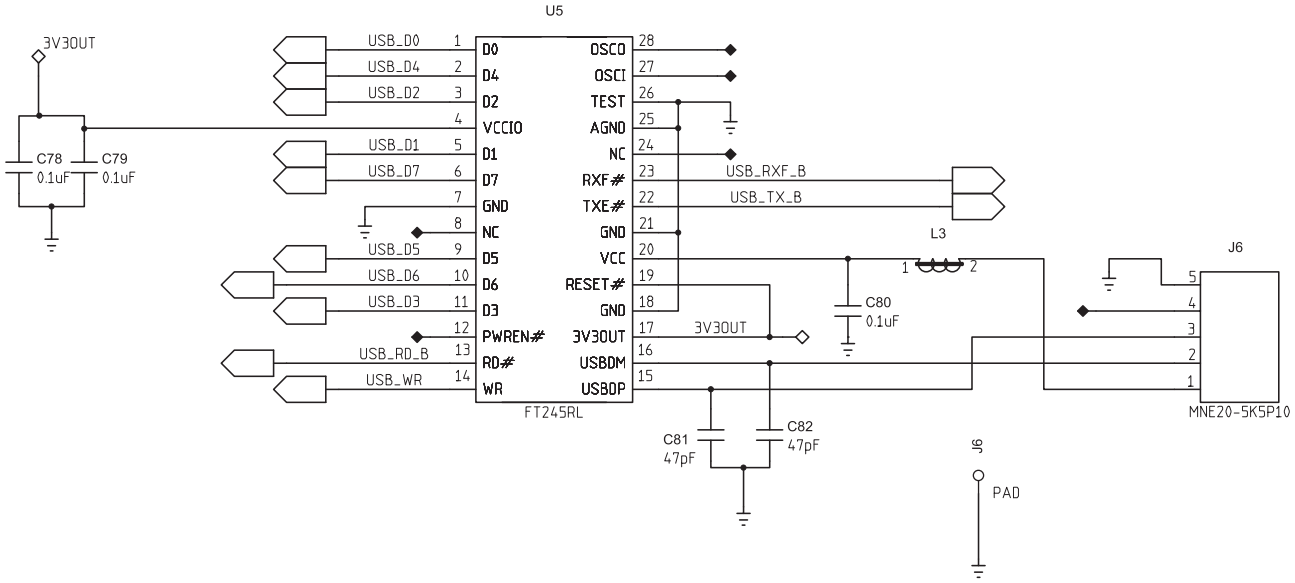

Figure 19. Schematic (6 of 8)

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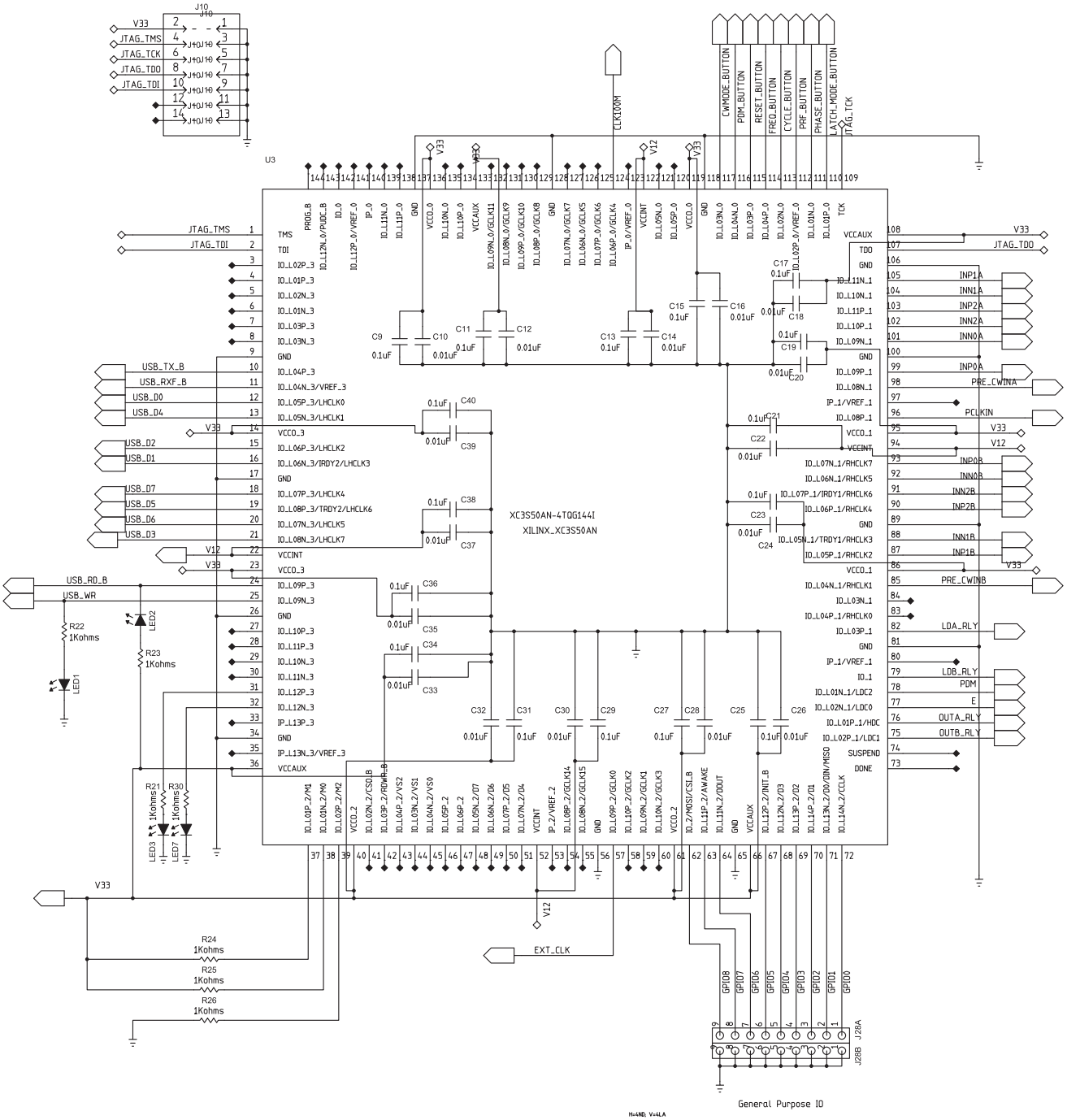

Figure 20. Schematic (7 of 8)

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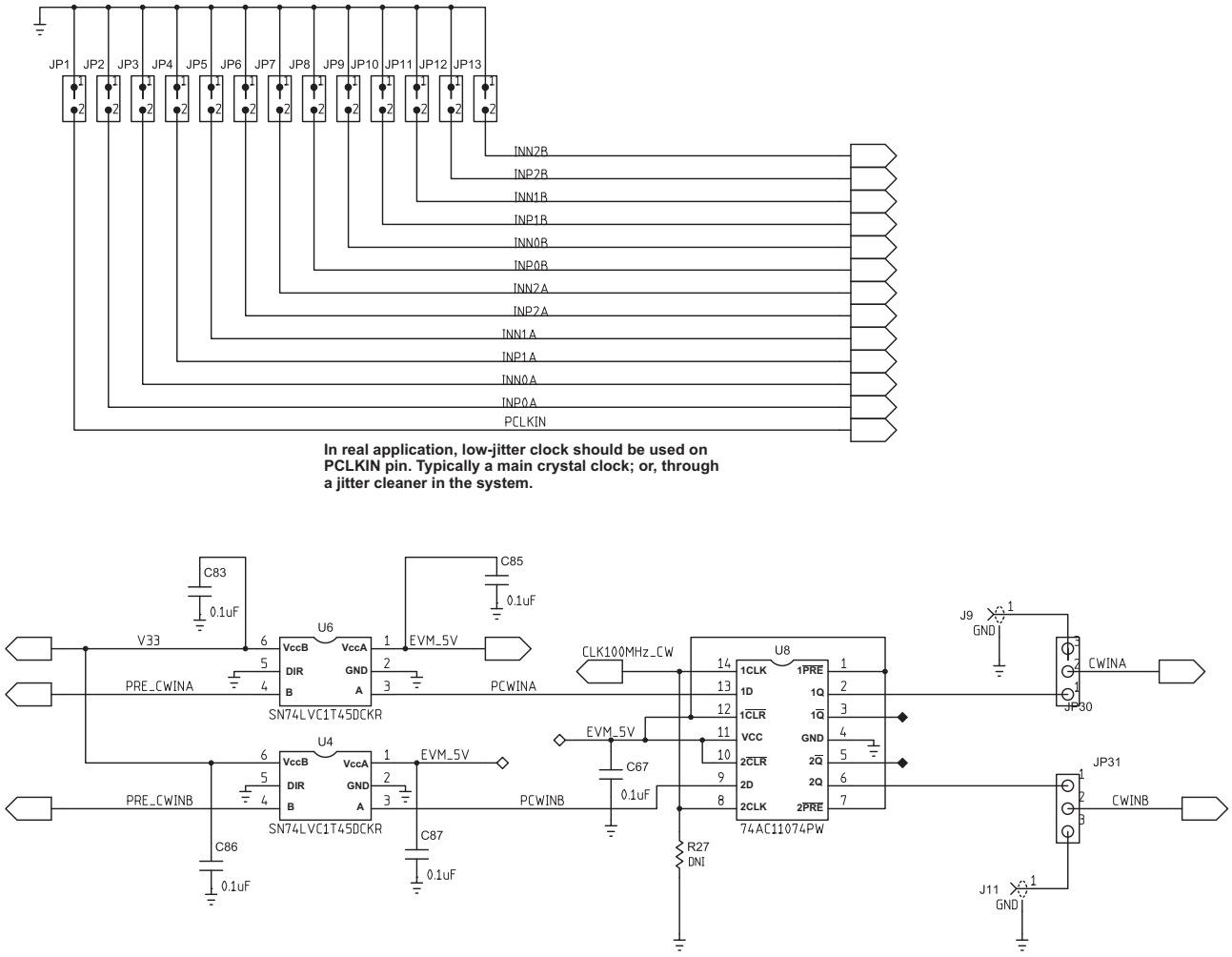

Figure 21. Schematic (8 of 8)

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8 Bill of Materials

Table 11. Bill of Materials (BOM)

QTY	MFG	MFG PART#	RefDes	Description	Value or Function
1	TX517	TX517	U20	Ultrasound Transmitter	TX517 transmitter (TI Provide)
2	PANASONIC	EEUFC2A101L	C72, C73	CAP,RAD,ELEC	CAP,THRU,ELE,100uf,100V,20%
16	AVX	0402YC103KAT2A	C10, C12, C14, C16, C18, C20, C22, C24, C26, C28, C30, C32, C33, C35, C37, C39	CAP,SMT,0402	CAPACITOR,SMT,0402,CERAMIC,10000pF,16V,10%,X7R
13	AVX	0402YC104KAT2A	C43, C60, C61, C63, C66, C68, C69, C70, C71, C75, C76, C90, C91	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,16V,10%,0.1uF
31	KEMET	C0402C104K8PAC	C2, C3, C5, C6, C9, C11, C13, C15, C17, C19, C21, C23, C25, C27, C29, C31, C34, C36, C38, C40, C48, C62, C67, C78, C79, C80, C83, C84, C85, C86, C87	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,0.1uF,10V,10%,X5R
1	PANASONIC	ECJ-0EB1H102K	C8	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,1000pF,50V,10%,X7R
2	PANASONIC	ECJ-0EC1H470J	C81, C82	CAP,SMT,0402	CAPACITOR,SMT,0402,CER,47pF,50V,5%,NPO
2	AVX	06033C104JAT2A	C64, C65	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,0.1uF,25V,5%,X7R
1	CAPAX	0603X475J250SW	C52	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,4.7uF,25V,5%,X7R
1	TAIYO YUDEN	JMK107BJ106MA-T	C7	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,10uF,6.3V,20%,X5R
5	TAIYO YUDEN	LMK107BJ475KA-T	C53, C54, C55, C92, C93	CAP,SMT,0603	CAPACITOR,SMT,0603,CERAMIC,4.7uF,10V,10%,X5R
8	AVX	08051C104KAZ2A	C41, C42, C49, C50, C56, C57, C58, C59	CAP,SMT,0805	CAPACITOR,SMT,0805,CERAMIC,0.1uF,100V,10%
4	TAIYO YUDEN	HMK325BJ225KN	C44, C45, C46, C51	CAP,SMT,1210	CAPACITOR,SMT,1210,CERAMIC,2.2uF,100V,10%,X7R
2	VISHAY	593D226X9016C2T	C1, C4	CAP,SMT,TANT	CAP,TAN,SMT,EIA-C,16V,10%, 22uF
1	AVX	TPSC226K016R0375	C47	CAPACITOR,SMT,TANT	10%, 16V, 22uF
2	JOHNSON COMPONENTS	142-0711-826	J2, J3	CON,SMA,SMT	SMA JACK,END LAUNCH,A068,062PCB,BRASS/NICKEL
1	ADVANCED CONNECTEK	MNE20-5K5P10	J6	CONN,SMT,5P	MINI-AB USB OTG RECEPTACLE R/A SMT TYPE
4	AMPHENOL	901-144-8	J8, J9, J11, J29	CONNECTOR,SMA	SMA COAX STRAIGHT PCB CURRENT P/N IS 901-144-8RFX
1	Customer Supply	DO NOT INSTALL	T1	Transformer	Do Not Install
4	DIODES INC.	1N4148W-7	CR1, CR2, CR3, CR4	DIODE,SMT,2P	DIODE,SMT,SWITCHING,1N4148
1	DIODES INC.	MMBD3004S-7-F	D1	DIODE,SMT,3P	DIODE SWITCH 300V 350MW SOT23-3
5	STEWARD	HI0805R800R-00	L1, L2, L3, L4, L5	FERRITE BEAD,SMT,2P	
1	SAMTEC	IPL-112-01-S-D-K	J1	HEADER,THP,24P	HEADER,THP,24P,MALE,2X12,100LS,.120TL
1	MOLEX	39357-0002	P2	HEADER,THRU,2P	HEADER, THRU, POWER, 2P,3.5MM, EUROSTYLE
1	SPC TECH	8431-1x12 (DNI)	P1	HEADER,THU,12P	HEADER,THU,MALE,0.1LS,12P,1X12,335H,120TL,(Do Not Install)
1	MOLEX	87831-1420	J10	HEADER,THU,14P	HEADER,MALE,14POS,2 ROWS,2mm LS,15u,LF,TL=098
2	SPC TECH	8431-1x9	J28A, J28B	HEADER,THU,9P	HEADER,THU,MALE,0.1LS,9P,1X9,335H,120TL

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Table 11. Bill of Materials (BOM) (continued)

QTY	MFG	MFG PART#	RefDes	Description	Value or Function
21	TYCO ELECTRONICS	4-103239-0x2	JP1, JP2, JP3, JP4, JP5, JP6, JP7, JP8, JP9, JP10, JP11, JP12, JP13, JP16, JP17, JP18, JP19, JP23, JP24, JP27, JP29	HEADER,THU,JUMPER	MALE,2PIN,.100CC MAKE FROM 4-103239-0x2
8	TYCO ELECTRONICS	4-103239-0x3	JP20, JP21, JP22, JP25, JP26, JP30, JP31,JP32	HEADER,THU,JUMPER	MAKE FROM 4-103239-0
2	TI	SN74LVC1T45DCKR	U4, U6	IC,SMT,6P	SINGLE BIT DUAL SUPPLY BUS TRANSCEIVER
1	TI	SN74HC04D	U7	IC,SMT,SOIC-14N	HEX INVERTER
1	TI	TPS79633DCQR	U1	IC,SMT,SOT223-6	ULTRALOW-NOISE HI PSRR FAST RF 1-A LDO LINEAR REGULATOR,3.3V
1	TI	TPS73201QDBV	U2	IC,SMT,SOT23-5	CAP-FREE NMOS 250-mA LOW DROPOUT REGULATOR
1	FUTURE TECHNOLOGY DEVICE INT.	FT245RL	U5	IC,SMT,SSOP-28	USB FIFO IC INCORPORATE FTDICHIP-ID SECURITY DONGLE
1	XILINX	XC3S50AN-4TQG144I	U3	IC,SMT,TQFP-144	XILINX SPARTAN-3AN 144QFP
1	TI	74AC11074PW	U8	IC,SMT,TSSOP-14	DUAL POS-EDGE-TRIG D-TYPE FLIP-FLOP W CLEAR AND PRESET,PW-14
1	TI	CDCLVC1102PWR	U9	IC,SMT,TSSOP-8	3.3V AND 2.5V LVCMOS HIGH PERF CLOCK BUFFER FAMILY
7	PANASONIC	LNJ308G8PRA	LED4, LED5, LED6, LED8, LED9, LED10, LED11	LED,SMT,0603	LED,SMT,0603,PURE GREEN,2.03V
4	KINGBRIGHT	KP-2012ID	LED1, LED2, LED3, LED7	LED,SMT,2P	LED,RED,SMT,0805
1	ECS	ECS-3953M-1000-BN	OSC1	OSCILLATOR,SMT,4P	OSC,SMT,3.3V,50ppm,-40~85C,5nS,100.000 MHz
2	*COTO TECHNOLOGY	9402-05-20	Y3, Y4	RELAY,SMT,6P	SPST,SMT,50 OHM,5V,0.5A,200 OHM COIL,J-LEAD (Not Install)
2	*COTO TECHNOLOGY	2911-05-321	Y1, Y2	RELAY,THRU,7P	RELAY,THRU,7P,RR,SPDT,1FC,5V,0.25A,230R COIL,COAXIAL SHIELD (Not Install)
15	PANASONIC	ERJ-2RKF1001X	R6, R7, R8, R9, R10, R11, R12, R21, R22, R23, R24, R25, R26, R28, R30	RES,SMT,0402	RESISTOR,SMT,0402,1.00K,1%,1/16W
8	PANASONIC	ERJ-2RKF1002X	R13, R14, R15, R16, R17, R18, R19, R29	RES,SMT,0402	RESISTOR,SMT,0402,10.0K,1%,1/16W
7	PANASONIC	ERJ-2RKF3320X	R1, R2, R3, R45, R46, R47, R50	RES,SMT,0402	RESISTOR,SMT,0402,332 OHM,1%,1/16W
2	PANASONIC	ERJ-2RKF49R9X	R20, R52	RES,SMT,0402	RESISTOR,SMT,0402,49.9 OHM,1%,1/16W,
2	VISHAY	CRCW08051002F	R48, R49	RES,SMT,0805	RESISTOR,SMT,0805,THICK FILM,1%,1/8W,10.0K
2	VISHAY	CRCW251249R9FKEG	R4, R5	RESISTOR,SMT,2512	RESISTOR,SMT,2512,THICK FILM,49.9 OHM,1%,1W
8	ITT INDUSTRIES	PTS635SK25SM	SW1, SW2, SW3, SW4, SW5, SW6, SW7, SW8	SWITCH,SMT,2P	SWITCH,SMT,2P,SPST-NO,2.5mm HEIGHT,MOM,RECTANGULAR,0.05A,12V
3	KEYSTONE ELECTRONICS	5000	TP12V, TP33V, TP5V	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS,120TL, RED
5	KEYSTONE ELECTRONICS	5001	TP1, TP2, TP3, TP4, TEST_GND	TESTPOINT,THU,1P	TESTPOINT,THU,MINIATURE,0.1LS,120TL, BLACK
2	ON SEMI	1SMA5927BT3	D2, D3	ZENER DIODE,SMT,SMA	ZENER DIODE,12V,SMT,SMA,1.5W (Not Installed)
1	ON SEMI	1SMB5920BT3	Z1	ZENER DIODE,SMT,SMB	ZENER DIODE,6.2V,SMT,SMB,3W
2	TYCO	50935	Y1, Y2	SOCKET PIN - INSTALL 1ST	DIA_038, PIN_013-020, EXP_146, B125

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Table 11. Bill of Materials (BOM) (continued)

QTY	MFG	MFG PART#	RefDes	Description	Value or Function
1	PANASONIC	ERJ-2RKF49R9X	R27	RES,SMT,0402	RESISTOR,SMT,0402,49.9 OHM,1%,1/16W(Not Install)
1	Customer Supply	DO NOT INSTALL	T1B	Transformer	DO NOT INSTALL
15	PANASONIC	ERJ-2RKF49R9X(DNI)	R31, R32, R33, R34, R35, R36, R37, R38, R39, R40, R41, R42, R43, R44, R51	RES,SMT,0402	RESISTOR,SMT,0402,49.9 OHM,1%,1/16W, Uninstall
4	KEYSTONE ELECTRONICS	24436K-ND		STANDOFF HEX M3 THR ALUM 18MM	STANDOFF HEX M3 THR ALUM 18MM
4	KEYSTONE ELECTRONICS	29311K-ND		SCREW STEEL M3 THR 6MM	SCREW STEEL M3 THR 6MM
	TE Connectivity	1658621-5		Cover for P1	Snap latch into place. Install as needed
SPECIAL NOTES AND INSTRUCTIONS					

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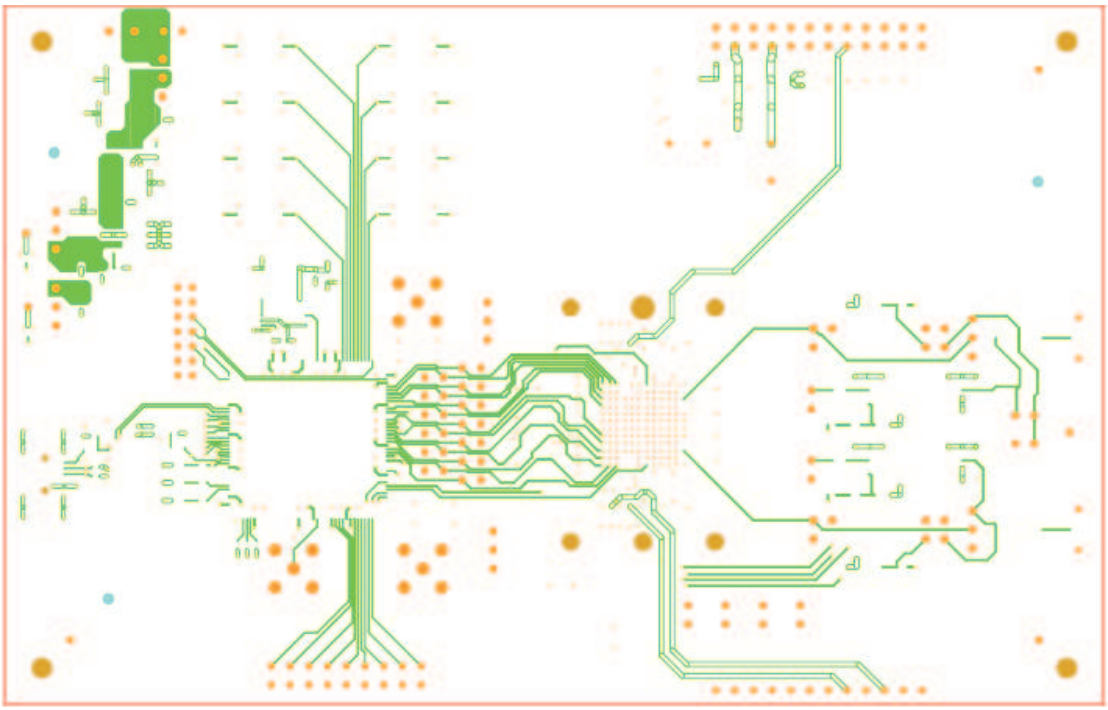
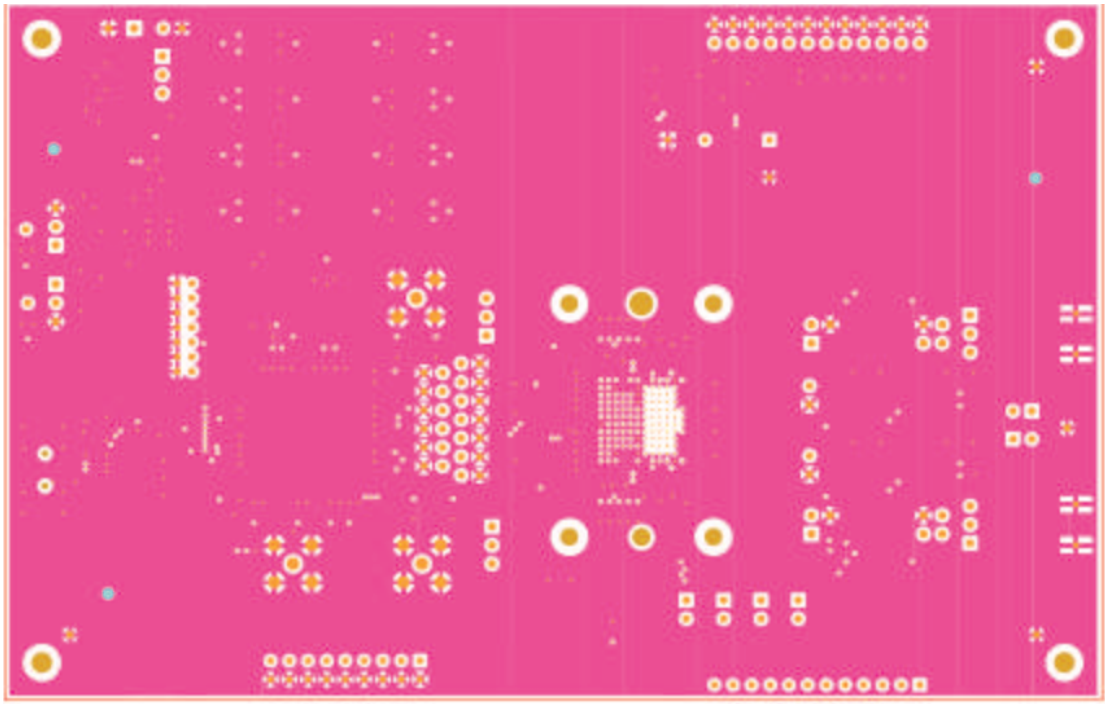
9 PCB Layouts





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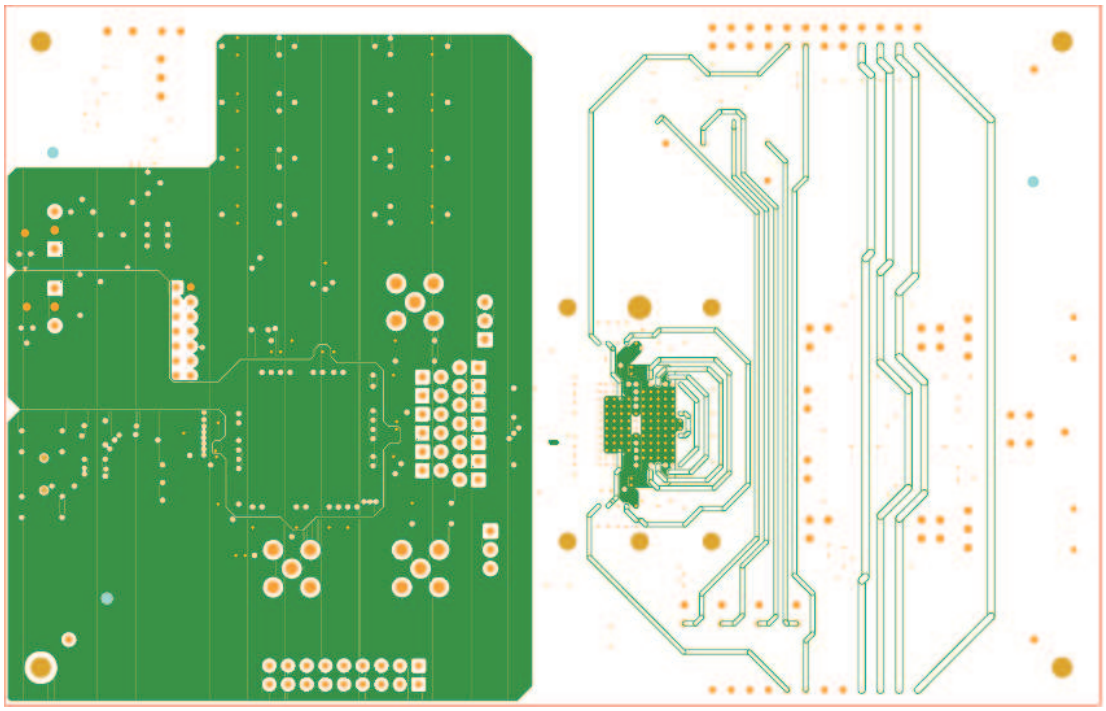

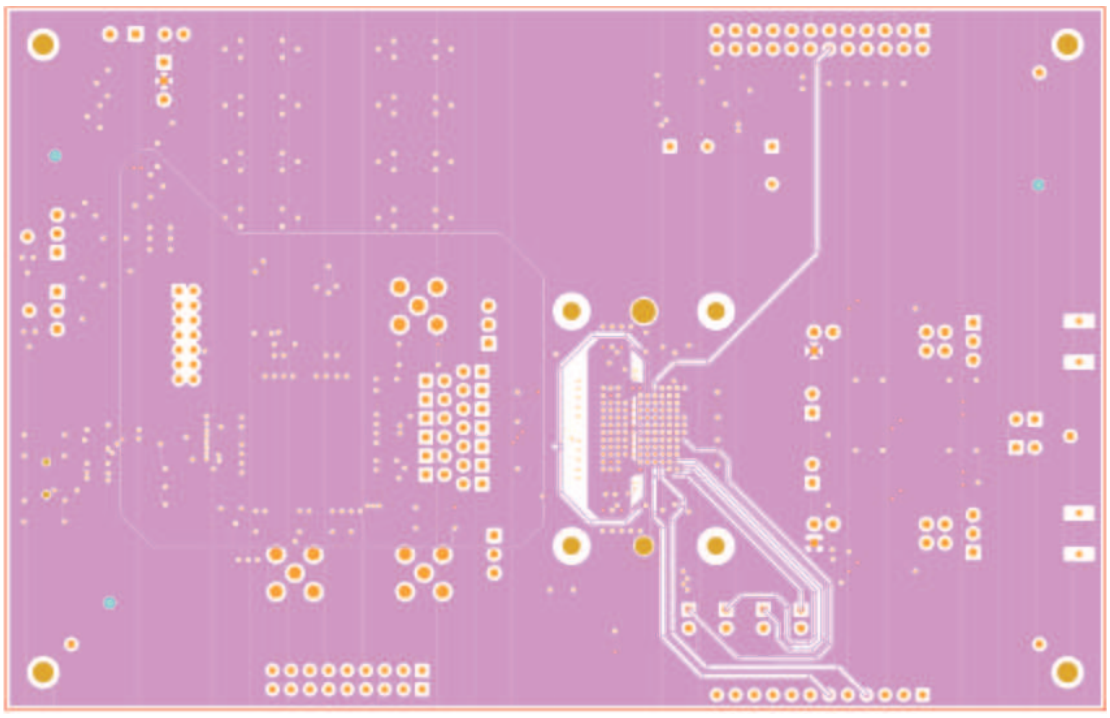

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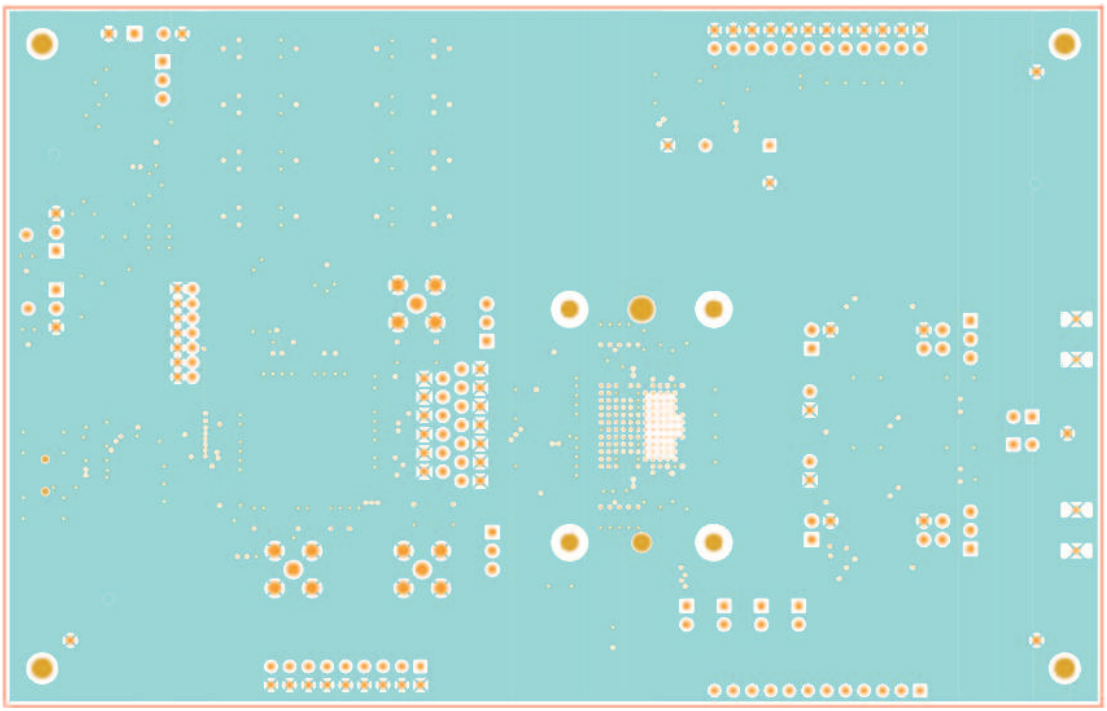

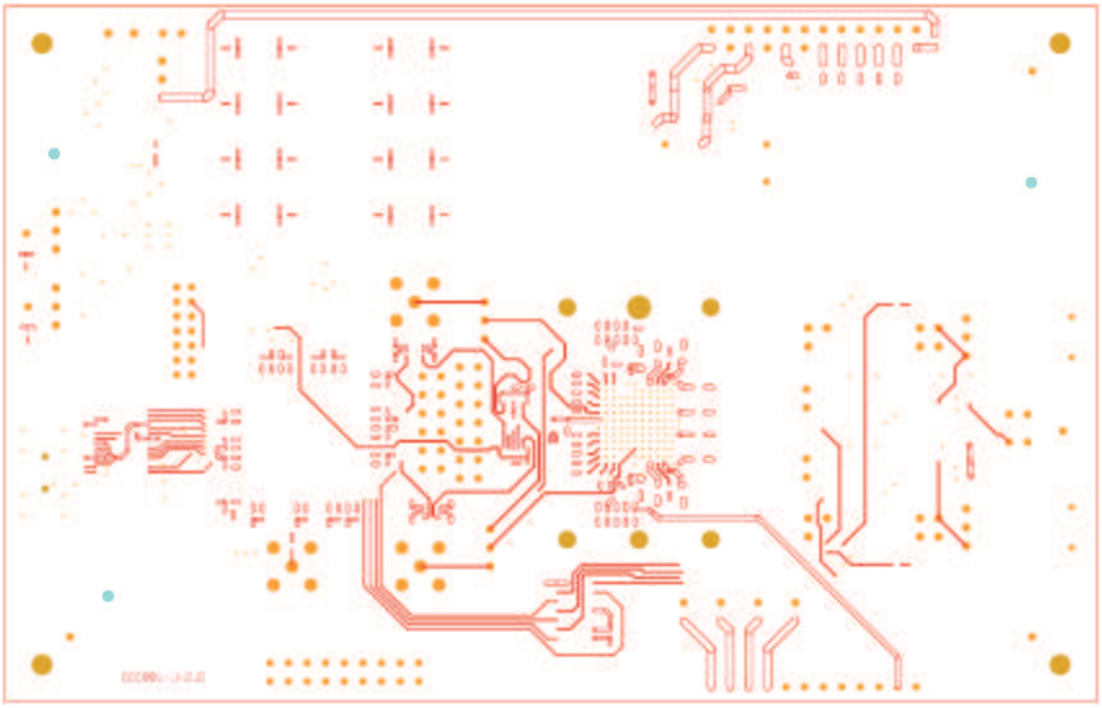

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