Texas Instruments XIO2200 EVM Guide

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1 Overview

The XIO2200 Evaluation Board (EVM) is a functional implementation of a PCI Express to Two-Port 1394a OHCI controller using the Texas Instruments XIO2200 PCI Express to PCI Bus Translation Bridge with 1394a OHCI and Two-Port PHY. Designed as a x1 add-in card, it is routed on FR4 as a standard 4-layer (2 signal, 1 power, 1 ground) board with a 100-Ω differential impedance (for PCI-Express pairs), 110-Ω differential impedance (for 1394a pairs), and 50-Ω single-ended impedance using routing guidelines and requirements specified in the *PCI Express Card Electromechanical Specification* rev 1.0a, *PCI Local Bus Specification* rev 2.3, and *IEEE 1394-1995 Specification*. All board power for the XIO2200 EVM and any bus power provided to the 1394 connectors are provided or derived from the standard voltages provided on the PCI-Express connector. However due to the limited availability of 12-V current (for 1394 bus power) an option has been provided to power 12-V rail from an external 4-pin floppy drive connector if testing bus-powered 1394a devices which require more than the 500 mA that can be drawn (by specification) from the PCI Express x1 Connector.

Upon request gerber files for the EVM may be provided to illustrate techniques used to achieve fan out (of the u*BGA), use of split power planes, placement of filters and other critical components, and methods used to achieve length matching on PCI and PCI Express signals on a standard 4-layer board.

Schematics and a Bill of Materials are provided below to illustrate the design of this particular EVM.

2 EVM Features

2.1 PCI Express Connector

The EVM is designed as a PCI Express add-in card. The card will fit into any standard x1, x2, x4, x8, or x16 add-in connector that is compliant to the *PCI Express Card Electromechanical Specification* revision 1.0a. In addition to the standard transmit and receive pairs the connector must supply 3.3 V, 12 V, PERST#, a 100-MHz differential clock, and Vaux. The WAKE# signal is also supported by the EVM although as an optional pin the system is not required to support this signal.

The card may be placed within a case that permits insertion of standard PCI Express Add-In cards; however the lack of a mounting bracket may lead to instability when 1394a cables are plugged/unplugged from the card.

2.2 1394a Connectors

The XIO2200 EVM provides 2 standard 1394a connectors. 12 V is provided to the connectors so that bus powered peripherals may be used although fuses limit the amount of current that may be drawn to 1 A per each port. Also see section 2.4 on the external power connector for further information of power limitations.

2.3 EEPROM interface

Each XIO2200 EVM provides an on board EEPROM. As shipped each EEPROM is programmed with values that will allow the EVM to function in most systems. The EEPROM interface is left as programmable (not write protected) so that EEPROM contents may be modified for testing other optional settings. Unless required it is recommended that the values contained in the EEPROM remain unchanged. If a change is desired in EEPROM contents, values may be changed using EEPROM access registers as detailed in the XIO2200 data manual or upon request TI may provide an EEPROM access tool.

2.4 External Power Connector

As previously mentioned the *PCI Express Card Electromechanical Specification* revision 1.0a limits the amount of current an x1 card can draw from the 12-V rail to 500 mA. Since the 12-V rail on the EVM is used solely for providing bus power to attached 1394 devices it is possible that 2 attached devices may exceed this requirement. If testing is desired with devices that exceed this limit the board may be altered to provide power through a standard 4-pin floppy connector which will be able to provide a much higher amount of current from the 12-V rail.

The modifications are as follows:

Remove D7 and populate D4 with the removed part being careful that the part is properly oriented. The notched edge (cathode) should be oriented away from J3 (notched part on left) if in D4, if in D7 the notched edge should be placed up (away from P1).

Populate J3 with a 4 pin header. The part used for design was an AMP 171826-4.

Note: if these modifications are made the PCI Express Connector will no longer provide power to the 1394 connectors. If power is then not provided from the floppy connector, bus powered 1394 devices will no longer function. If desired, it is possible to place another diode (MBRS340T3) in D4 without removing D7 then power could be provided safely from either source as the Diodes would isolate the 2 power sources preventing any conflict.

2.5 LEDs

The XIO2200 EVM has LEDs on board to indicate availability of power and status of certain control signals. The onboard LEDs are as follows

D1 – 1.5V (note: this LED will generally not light due to absence of LED with Vf <= 1.5V)
D2 – 12V power indicator
D3 – 3.3V power indicator
D4 – PCI Express WAKE# indicator (power on, WAKE# asserted)
D5 – PCI Express PERST# indicator (power on, reset asserted)

3 FAQ/Troubleshooting

Use of the EVM is fairly straightforward, place the EVM into a PCI express add-in slot and turn the system on. At any time 1394a peripherals may be attached to the EVM. From the operating system perspective the XI22000 appears to be a standard PCI to PCI Bridge (PCI header type 1) with a 1394a OHCI controller behind it, and the OS will be able to configure the XIO2200 accordingly using legacy PCI configuration transactions. Below are some issues that may impair use of the bridge in a system.

3.1 BIOS fail to assign a memory window to the bridge.

Microsoft operating systems generally attempt to respect the resource allocations made by system BIOS. The XIO2200 requires a memory window in order to access some registers used by the device. If Microsoft determines that the BIOS failed to assign a memory window to the XIO2200 it will assume that one can not be assigned and that the device is non-functional. In this situation the OS will not enumerate devices behind the bus and they will never be configured or assigned resources. This failure can be determined by examining device manager, if this has occurred the bridge will appear “banged out” and if the bridge properties are examined the OS will explain that insufficient resources were available to configure the device. The only solution for this issue is to use the EVM in a system which assigns appropriate resources.

3.2 1394 Controller is banged out in Windows Device Manager. .

In Windows device manager the XIO2200 will appear as a Texas Instruments OHCI Controller. Since 1394 requires that all devices have a GUID (Global Unique Identification) number for routing purposes, if the OS reads that the appropriate register is all 0s. The OS will show that there is an error as this is an invalid GUID. The XIO2200 EVM programs the GUID of the controller from the onboard EEPROM, so a bang next to the device will most likely indicate that the EEPROM was not

properly programmed. However if this is the case the EVM will still function despite the indication of a problem in Windows device manager.

3.3 Windows takes a long time to boot when peripherals are attached.

Occasionally when the system is booted with a peripheral attached, it will take a long time for the OS to load and when it does come up the peripheral will not be present. Detaching and re-attaching the cable will result in the peripheral appearing. This is a known issue with Windows enumeration of all 1394 controllers. It appears infrequently but can be avoided by not booting with 1394 peripherals attached or by waiting then unplugging and re-plugging the peripherals.

3.4 What to do if EVM is not working

3.4.1 Check 1.5-V Power.

The XIO2200 requires 1.5 V for proper operation. As this voltage is not provided from the PCI Express connector it is regulated from 3.3 V from the connector. 1.5 V may be probed at pin 4 of the regulator (U3), at the anode of D1, or one end of C44.

3.4.2 Check if Bridge is link training

If the system does not boot, detach all 1394 peripherals from EVM and try again. If system is hanging before OS loads then it is likely that the system and the EVM are having difficulty completing link training which is most likely an issue with signal integrity on the differential pairs. If a PCI Express analyzer is unavailable then try a different express slot or a different system if possible. Re-check the 1.5-V rail and examine the differential clock on an oscilloscope to ensure it is clean.

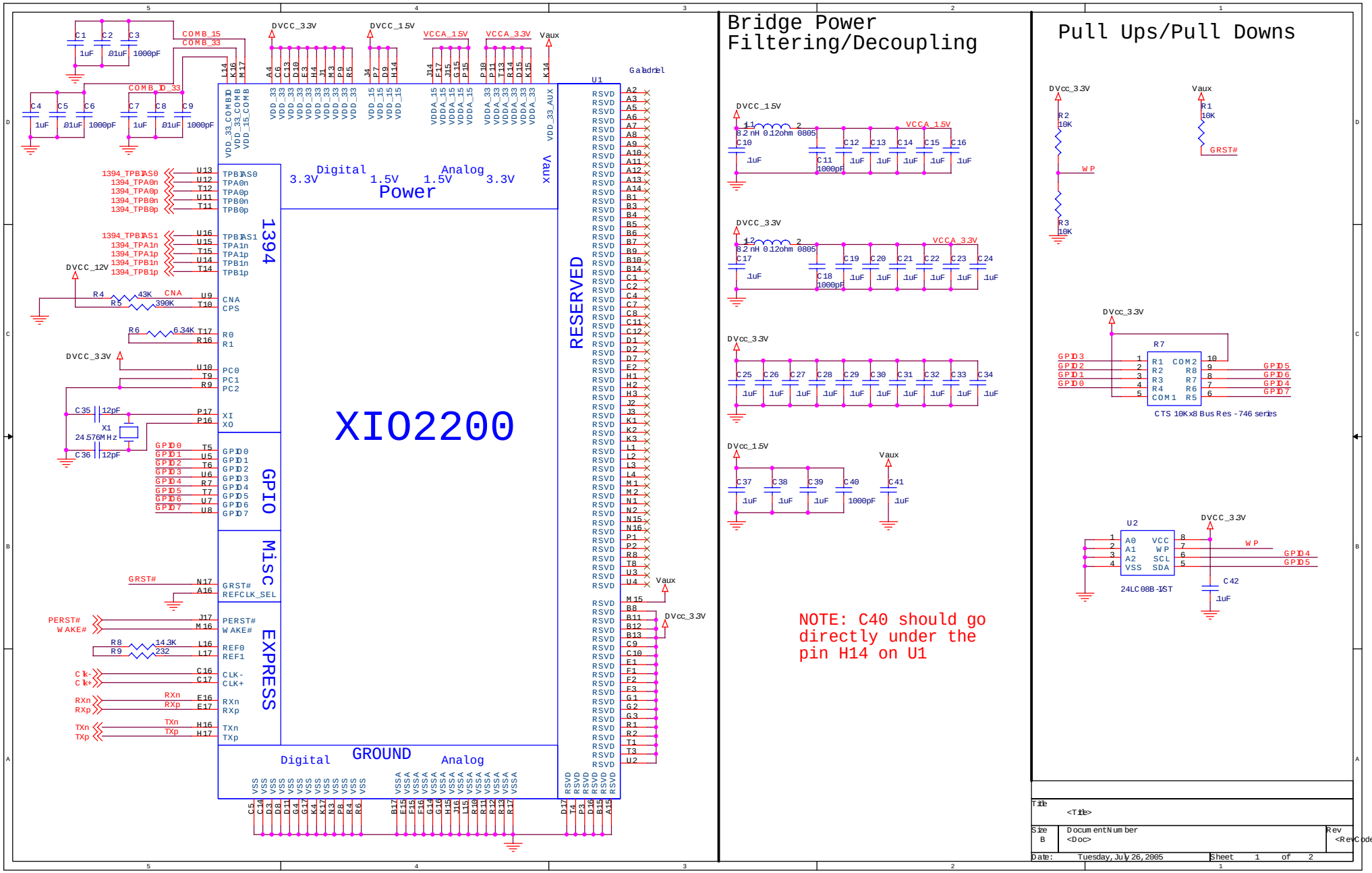
If link training successfully completes the system will boot and the XIO2200 will appear in the device manager. If the bridge does not appear in the device manager then the system may not have detected the presence of the bridge, again perform the previous checks.

Also, if PCI add-in cards have enough weight and there is no mechanical support, the EVM may flex and some components may crack or become disconnected. Check the coupling caps on the EVM transmit lines (C51 and C52), these .1-µF 0402 components have a tendency to crack if enough stress is put on the board; they will need to be replaced if they are damaged.

3.4.3 Check if the XIO2200 has been configured

Once the bridge is communicating with the system, BIOS and/or the OS are expected to configure the bridge in order for proper operation. As the XIO2200 appears to software to be a standard PCI to PCI Bridge with a PCI based 1394 controller behind it, most existing BIOS and OS should be capable of configuring the bridge and controller with no special considerations for PCI Express. PCI Bridge registers to be configured. Setup for the 1394 device is also standard and should be configured by standard drivers.

4 EVM Schematics


XIO2200
Power
Digital
Analog
3.3V
1.5V
1.5V
3.3V
Vaux
1394
GPIO
Misc
EXPRESS
RESERVED
GROUND
Digital
Analog
Galadriel
Bridge Power Filtering/Decoupling
NOTE: C40 should go directly under the pin H14 on U1
Pull Ups/Pull Downs
CTS 10Kx8 Bus Res - 746 series
24LC08B-I/ST
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Rev
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Date: Tuesday, July 26, 2005
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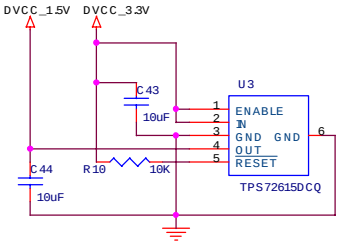
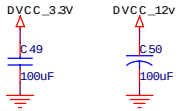
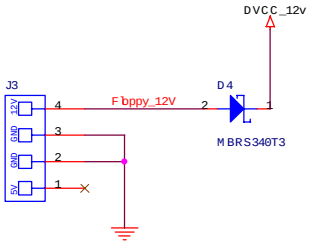
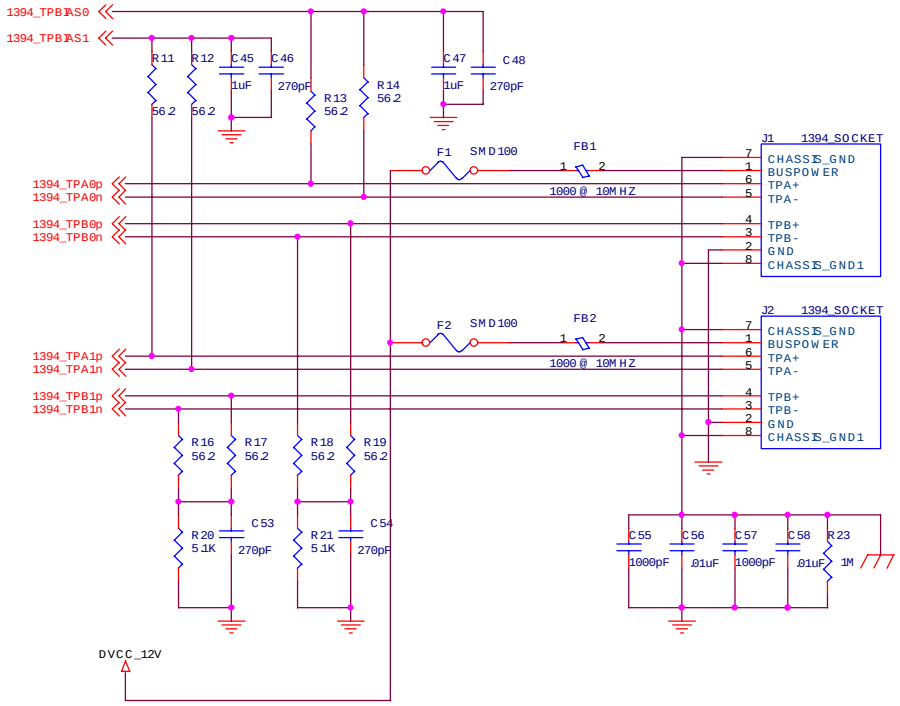
Power



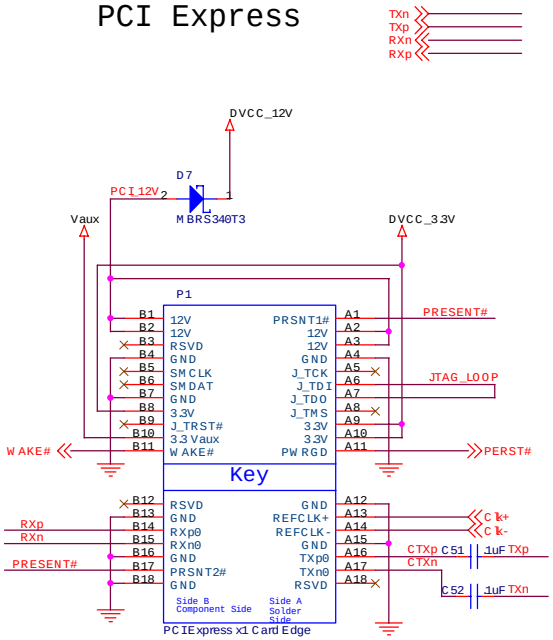




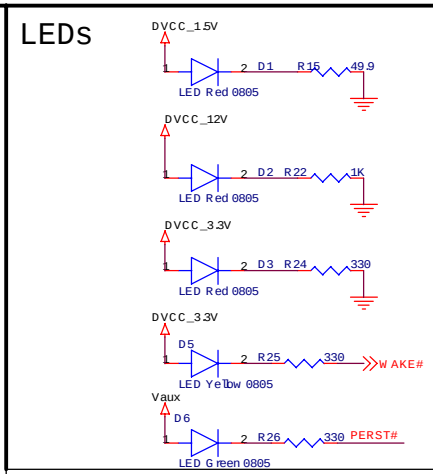
1394



PCI Express



LEDs



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Date: Tuesday, July 26, 2005	Sheet 2 of 2	

5 EVM Bill of Materials

Evaluation board bill of materials as assembled. Unused options (e.g., 3.3-V VIO) are not populated and not listed.

XIO2200 EVM Bill Of Materials							
Item	**Qty**	**Reference**	**Part**	**Manufacturer**	**Part #**	**Package**	**Tolerance**
1	3	C1,C4,C7	1 µF			402	10%
2	5	C2,C5,C8,C56,	0.01 µF			402	10%
		C58					
3	8	C3,C6,C9,C11,	1000 pF			402	5%
		C18,C40,C55,C57					
4	2	C10,C17	0.1 µF			805	10%
5	28	C12,C13,C14,C15,	0.1 µF			402	10%
		C16,C19,C20,C21,					
		C22,C23,C24,C25,					
		C26,C27,C28,C29,					
		C30,C31,C32,C33,					
		C34,C37,C38,C39,					
		C41,C42,C51,C52					
6	2	C36,C35	12 pF			805	1%
7	2	C43,C44	10 µF			805	10%
8	2	C47,C45	1 µF			805	10%
9	4	C46,C48,C53,C54	270 pF			805	10%
10	1	C49	100 µF			1812	10%
11	1	C50	100 µF			ECE_A_KS	
12	3	D1,D2,D3	LED Red 0805	Lumex	SML_LX0805SRC	805	
13	2	D7,D4	MBRS340T3	ON Semiconductor	MBRS340T3	SMC	
14	1	D5	LED Yellow 0805	Lumex	SML_LX0805YC	805	
15	1	D6	LED Green 0805	Lumex	SML_LX0805GC	805	
16	2	FB1,FB2	1000 @ 10 MHz	MuRata	BLM41P102SG	1806BEAD	
17	2	FB3,FB4	220 @ 100 MHz	Murata	BLM21B221SD	402	
18	2	F1,F2	SMD100	RAYCHEM	SMD100		
19	2	J1,J2	1394_SOCKET	Molex	53462-0611		
20	1	J3	4-pin Power Connector	AMP	171826-4	See Drawing	
21	1	P1	PCIe x1 Card Edge				
22	4	R1,R2,R3,R10	10 kΩ			805	10%
23	1	R4	43 kΩ			402	10%
24	1	R5	390 kΩ			805	10%
25	1	R6	6.34 kΩ			805	1%
26	1	R7	10kΩx8 Bus Res	CTS	746X101103JCT-ND	25 mil pitch	
27	1	R8	14.3 kΩ			805	1%

28	1	R9	232 Ω			805	1%
29	8	R11,R12,R13,R14,	56.2 Ω			402	1%
		R16,R17,R18,R19					
30	1	R15	49.9 Ω			402	1%
31	2	R21,R20	5.1 kΩ			805	10%
32	1	R22	1 kΩ			402	10%
33	1	R23	1 MΩ			1206	10%
34	3	R24,R25,R26	330 Ω			402	10%
35	1	U1	XIO2200	TI	XIO2200	176 pin GGW	
36	1	U2	24LC08B-I/ST	Microchip	24LC08B-IST	8-pin TSSOP	
37	1	U3	TPS72615DCQ	TI	TPS72615	6 pin DCQ	
38	1	X1	24.576 MHz	Fox	FE 24.576	FE	

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