# XIO2001

**Evaluation Module (EVM)** 

# **User's Guide**



Literature Number: SCPU031 February 2009



# Contents

1	Read This First				
	1.1	About This Manual	4		
	1.2	How to Use This Manual	4		
	1.3	Information About Cautions and Warnings	4		
	1.4	Related Documentation from Texas Instruments	4		
2	Overvi	ew	5		
3	EVM Features				
	3.1	PCI Express Connector	5		
	3.2	PCI Add-In Slots	5		
	3.3	EEPROM Interface	6		
	3.4	Test Header	6		
	3.5	Clock Run (CLKRUN)	7		
	3.6	JTAG Header	7		
	3.7	LEDs	7		
4	FAQ/Troubleshooting				
	4.1	BIOS Fails to Assign Memory Window to Bridge	8		
	4.2	×16 Slots Only Support INTA	8		
	4.3	System Turns On When PCI Card Is Inserted Into EVM Or When EVM Is Plugged Into Slot	8		
	4.4	What To Do If EVM Is Not Working	8		
5	Schematics				
6	Bill of Materials				
	Import	ant Notices	16		



# XIO2001 Evaluation Module (EVM)

#### 1 Read This First

#### 1.1 About This Manual

This manual describes the operation of the XIO2001 evaluation module (EVM) from Texas Instruments.

#### 1.2 How to Use This Manual

This document contains the following sections:

- Overview
- EVM Features
- FAQ/Troubleshooting
- Schematics
- Bill of Materials

#### 1.3 Information About Cautions and Warnings

This manual may contain cautions and warnings.

#### CAUTION

This is an example of a caution statement.

A caution statement describes a situation that could potentially damage your software or equipment.

# WARNING

This is an example of a warning statement.

A warning statement describes a situation that could potentially cause harm to you.

#### 1.4 Related Documentation from Texas Instruments

Table 1 contains a list of data manuals that have detailed descriptions of the integrated circuits used in the design of the TAS3208EVM-LC. The data manuals can be obtained at <u>www.ti.com</u>.

DOCUMENT	LITERATURE NUMBER	
XIO2001 Implementation Guide	SCPA045	
XIO2001 Data Manual	SCPS212	

#### **Table 1. Related TI Documentation**

#### 2 Overview

The XIO2001 evaluation board (EVM) implements a peripheral component interconnect (PCI) express to PCI bridge circuit using the Texas Instruments XIO2001 PCI Express to PCI Bus Translation Bridge. Designed as an ×1 add-in card, it is routed on FR4 as a 8-layer (4 signals, 2 power, and 2 ground) board with a 100- $\Omega$  differential impedance (50- $\Omega$  single-ended) using standard routing guidelines and requirements .<sup>(1)</sup>

Power for the XIO2001 EVM and any PCI add-in card connected to the EVM is provided or derived from the standard voltages provided on the PCI Express connector. Power for the 3.3-V rail is provided directly from the add-in connector, 5-V and 12-V is provided from the IDE power connector, while regulators are present to derive 1.5-V for the XIO2001 and -12-V for the PCI connectors.

Upon request, gerber files for the EVM can be provided that illustrate techniques that achieve fan-out of the  $\mu^*BGA$ , use of split power planes, placement of filters and other critical components, and methods used to match lengths on PCI and PCI Express signals on a standard 8-layer board.

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

- **Note:** Observe proper ESD procedures when handling the EVM. Failure to observe proper procedures may result in damage either to the EVM or the XIO2001 silicon which may cause the board to malfunction.
- <sup>(1)</sup> As specified in *PCI Express Electromechanical Specification*, Revision 1.0a and *PCI Local Bus Specification*, Revision 2.3

#### 3 EVM Features

#### 3.1 PCI Express Connector

The EVM is designed as a half-width PCI Express add-in card. The card fits into any standard  $\times 1$ ,  $\times 2$ ,  $\times 4$ ,  $\times 8$ , or  $\times 16$  add-in connector that is compliant with the *PCI Express Electromechanical Specification*, Revision 2.0 or earlier. 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 V<sub>AUX</sub>. The WAKE signal is also supported by the EVM although, as an optional pin, the system is not required to support this signal.

The height of the board is nonstandard due to the presence of PCI slots. Inserting PCI add-in cards into the EVM will, in most cases, prohibit the EVM from being placed in a case. If possible, provide some mechanical support to the EVM. Otherwise, the weight of PCI add-in cards can strain the board in the PCI Express add-in slot and may result in the board making poor contact with the connector. Poor connector contact can lead to signal integrity issues.

#### 3.2 PCI Add-In Slots

The XIO2001 EVM provides three standard PCI add-in slots. While reversible, these slots, as shipped, are keyed as 5-V slots and provide a 5-V V<sub>IO</sub> clamping voltage that provides accessibility to any 5-V or universally keyed PCI add-in cards. All standard voltages (3.3 V, 5 V, 12 V, and –12 V) are provided through the PCI connectors, enabling standard PCI add-in cards to function without requiring external power.

Cards placed into the PCI add-in slots must be inserted into the slots in accordance with labeling on the EVM. Referencing the component side of the EVM as front and the PCI express edge connector as down, boards must be inserted with the component side of the board down and the mounting bracket to the left of the EVM.



# WARNING

Inserting either a 3.3-V card or a universally keyed card into the EVM backwards will damage the EVM and possibly the add-in card as well.

The PCI bus operates at 66 MHz only when 66-MHz-capable PCI add-in cards are placed in the socket. If a 33-MHz card is inserted into the socket, then the XIO2001 detects the presence of the lower speed device and automatically sets the bus speed to 33 MHz. If 66-MHz operation is desired, place no more than two add-in cards into board slots. (This limitation is due to bus loading issues inherent to the PCI specification.) If a third 66-MHz device is added to the bus, signal integrity may still permit proper functioning of the interface, but such functionality cannot be assured and is beyond the scope of this document.

Two of the reserved pins on the PCI add-in connectors are used to route  $\overline{PME}$  and  $V_{AUX}$  to any add-in cards. These assignments, while not part of the *PCI Local Bus Specification*, are used by many in the industry as de facto standards and must not interfere with any add-in cards. If cards are used that use these terminals for other purposes, the following modifications may be made to the EVM to isolate the signals from the PCI add-in connectors:

- PME (routed to reserved terminal A19 on each connector). Remove resistors R55, R53, and R54 (for slots 0, 1, and 2, respectively).
- V<sub>AUX</sub> (routed to reserved terminal A14 on each connector). Remove resistors R50, R51, and R52 (for slots 0, 1, and 2, respectively).

#### 3.3 EEPROM Interface

Each XIO2001 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. TI recommends that you do not change the EEPROM values. To change EEPROM contents, use the EEPROM access registers as detailed in the XIO2001 data manual or request the WinROM access tool.

#### 3.4 Test Header

Each XIO2001 EVM provides accessibility to the GPIO pins on the XIO2001. From header J1, all five GPIOs have external visibility and can be used in any manner consistent with their functionality as detailed in the XIO2001 data manual. All GPIO signals are labeled on the header and are terminated with an on-board pullup resistor.

By default, GPIO3 and GPIO4 are configured as the EEPROM interface which was detailed in the previous section. The EEPROM interface can be removed from the XIO2001 by removing resistors R28 and R29. This allows these GPIO pins to be used for another purpose, although any configuration done by the EEPROM will then have to be done in some other fashion. While removing R28 and R29 will physically disconnect the EEPROM from GPIO3/GPIO4, in order to release the pins from this functionality, GPIO4 (SCL) must be held low at the deassertion of PERST. As no pulldown is available for this purpose, the pin must be externally shorted at boot time (deassertion of reset) by shorting J1 pin 5 to J1 pin 11. Once the system has booted, this short may be removed and GPIO3 and GPIO4 will be available for other uses.

Pin 9 on the J1 header is a global reset (GRST) for the XIO2001. Driving this pin low will cause all registers and state machines within the XIO2001 to return to a default power-up state. This pin generally must remain disconnected.

Pin 10 is an access point for the PME signal and may be used to externally wire this signal to any PCI add-in card that has the signal available but does not route the signal to pin A19 on the PCI expansion connector.



Pin 8 on header J1 is CLKREQ for the XIO2001. Driving this pin low will allow the REFCLK to stop when the XIO2001 is in PCI PM L1. The CLKREQ protocol as described in the PCI Express Base Specification and Express Card standard is supported.

Pin 7 on header J1 is PERST for the XIO2001. When asserted, this signal generates an internal PCI Express reset, clears all non-sticky bit registers and is deasserted when system power is stable.

Pin 12 on header J1 is PCLK66\_SEL for the XIO2001 controlling the PCI clock frequency. When this signal is pulled high, the PCI clock will operate at 33 or 66 Mz depending on the state of M66EN. When this signal is low, the PCI clock will operate at 25 MHz or 50 MHz, depending on the state of M66EN. Most applications will pull this pin high.

Pin 2 on the connector is a 3.3-V test point and pin 11 is a ground test point. These signals may be used to externally toggle GPIOs for any required testing.

## 3.5 Clock Run (CLKRUN)

The CLKRUN signal is a power-saving mechanism (defined in the *PCI Mobile Design Guide*) that stops the PCI bus clock when the bus is idle. Because devices that do not support this protocol are unable to restart the system clock, this feature is disabled by default on the XIO2001 EVM. This feature may be enabled to function with PCI add-in cards that also support this feature.

Enabling  $\overline{\text{CLKRUN}}$  requires that resistor R24 be populated with a 0805 form factor 10-k $\Omega$  resistor. When this option is populated at the de-assertion of the reset pin, GPIO0 will internally map to CLKRUN. When this happens, GPIO0 will be unavailable for other purposes. An external wire must then be connected from GPIO0/CLKRUN (available on J1 pin 1) to all add-in cards being tested with this functionality.

#### 3.6 JTAG Header

Each XIO2001 EVM provides access to JTAG interface pins for boundary scan testing on test header JP1. The JTAG interface for the XI02001 complies with IEEE standard 1149 using the standard 5 pin interface (TCK, TDI, TDO, TMS and TRST). If boundary scan testing is not needed, TCK (JP1 pin 10) and TRST (JP1 pin 2) should be connected to GND (JP1 pins 1, 3, 5, 7 or 9). The remainder of the JTAG signals can be left unconnected. By default the EVM is configured with 0  $\Omega$  option resistors R40 and R77 that connect TRST and TCK to ground.

If boundary scan testing is needed, TI can provide the appropriate BDSL file upon request.

#### 3.7 LEDs

The XIO2001 EVM has LEDs onboard to indicate availability of power and status of certain control signals. The onboard LEDs are as follows:

- LED1: 5 V power indicator
- LED2: 3.3 V power indicator
- LED4: 12 V power indicator
- LED5: -12 V power indicator



#### 4 FAQ/Troubleshooting

To use the EVM

- Plug the PCI add-in cards into the EVM, oriented as indicated on the board
- Place the EVM into a PCI express add-in slot
- Turn the system on

From the operating system perspective, the XIO2001 appears to be a standard PCI-to-PCI bridge (PCI header type 1) and the OS will configure the bridge and any devices behind the bridge accordingly using legacy PCI configuration transactions. Following sections of this chapter describe issues that may impair use of the bridge in a system.

#### 4.1 BIOS Fails to Assign Memory Window to Bridge

Microsoft operating systems generally attempt to respect the resource allocations made by system BIOS. The XIO2001 requires a memory window in order to access some registers used by the device. If the Microsoft OS determines that the BIOS failed to assign a memory window to the XIO2001, it will assume that one cannot be assigned and that the device is nonfunctional. The OS will then assume the bridge is not functional and will not enumerate devices behind the bus. Consequently, these devices will never be configured or assigned resources.

This failure can be determined by examining device manager in the OS. If failure has occurred, the bridge will appear "banged out" and if the bridge properties are examined the OS will reveal this device cannot find enough free resources that it can use. (Code 12) If you want to use this device, you will need to disable one of the other devices on this system.

### 4.2 ×16 Slots Only Support INTA

As the x16 PCI express add-in slots are designed as a graphics expansion port, many only support a single interrupt (INTA), as this is the only interrupt that will be required by a graphics card. The XIO2001 EVM supports all interrupts and balances interrupt loading by rotating the interrupts to each add-in slot as required by the *PCI Local Bus Specification*. Accordingly, any PCI add-in card behind the bridge that asserts an interrupt other than INTA will not be serviced as the interrupt is not supported by the chipset. Consequently, the add-in card will fail. Any devices that do not require interrupts or that only assert INTA (as routed to the specific slot they are placed in) will still function normally.

### 4.3 System Turns On When PCI Card Is Inserted Into EVM Or When EVM Is Plugged Into Slot

As mentioned previously, PME is routed on the EVM to the various PCI slots through a reserved pin that many PCI add-in cards use for this purpose. On occasion, when a PCI card is inserted into the EVM (while the EVM is plugged into a board), the add-in card may be inserted in such a way as to pull the PME line low on the EVM. When this happens, the XIO2001 sees a PCI device trying to wake the system and will appropriately assert WAKE, which may cause the system to turn on.

Similarly, when the EVM is inserted into the slot,  $V_{AUX}$  from the connector may not have had enough time to pull the PME line high (as the on-board pullup resistors dictate), yet  $V_{AUX}$  may have powered the XIO2001 which now samples PME as low and again wakes the system. This is a limitation of the inability to appropriately power the pullup resistors before the XIO2001 is powered. If this occurs, turn power to the system off and reboot to ensure the EVM receives a clean reset from the system.

### 4.4 What To Do If EVM Is Not Working



#### 4.4.1 Check EVM Power

Diodes LED1, LED2, LED4 and LED5 show the status of the 5-V, 3.3-V, 12-V, and -12-V rails, respectively. 1.5 V may be probed on the top pad of C44 (directly next to U3), and -12 V may be probed from C100. A ground reference is available at J1 pin 11 and JP1 pins 2, 4, 6, 8 and 10. If any of these voltages fail, a problem is likely to occur with EVM functionality. The XIO2001 requires 3.3 V and 1.5 V; other voltages are supplied for use by PCI add-in cards, and PCI  $V_{IO}$  is by default 5 V (which will cause the entire PCI bus to be clamped to 0.7 V if this voltage is not present). If any of these voltages fail, it is likely that the EVM won't function because:

- XIO2001 will not be powered
- The add-in card will not be powered
- Neither the XIO2001 or the add-in card will be powered

All voltages have resettable fuses to prevent overcurrent conditions, so if a particular power rail fails:

- Detach all devices from the EVM
- Remove the EVM from the system
- Wait for 30 minutes before trying again

#### 4.4.2 Check If Bridge Is Link Training

If the system does not boot, remove all PCI add-in cards from EVM and try again. If the system hangs before the OS loads, then probably the system and the EVM are having difficulty completing link training ( probably 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 XIO2001 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, perform the previous checks again.

Also, if the 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 capacitors on the EVM transmit lines (C102 and C103). These 0.1- $\mu$ F 0402 components have a tendency to crack if enough weight is put on the board; they will need to be replaced if they are damaged.

#### 4.4.3 Check If Bridge Has Been Configured

Once the bridge is communicating with the system, the BIOS and/or the OS are expected to configure the bridge for proper operation. As the bridge appears to software to be a standard PCI-to-PCI bridge, most existing BIOS and OS software must be capable of configuring the bridge with no special considerations for PCI Express. In addition to the memory window the bridge requests for internal resources, the following items are required for bridge operation:

- Command register PCI offset 0×4 : The bus master enable (bit 2), memory enable (bit 1), and I/O enable (bit 0) must be set to enable the bridge to send upstream transactions.
- Cache line size register PCI offset 0×C : Must be set to the cache line size for the system. Failure to set this bit will not cause the bridge to fail but will cause the bridge to limit all upstream transactions to 1 DWord.
- Primary, secondary, and subordinate bus numbers- PCI offsets 0×18, 0×19, and 0×1A : The bridge must have the bus numbers configured so that it can determine which transactions are targeting the bridge, which transactions are targeting devices directly attached to the bridge, and which transactions are farther downstream from the bridge.
- I/O base and limit registers and I/O base upper 16 bits and I/O limit upper 16 bits registers –PCI offsets 0×1C, 0×1D, 0×30 and 0×32: If any devices downstream from the bridge require I/O resources, the bridge must be programmed with a window that contains the I/O resources of all devices downstream. Failure to program these windows will cause the bridge to respond to I/O transactions with a response of Unsupported Request. Any transactions initiated on the secondary side of the bus that fall within this range will not be claimed by the bridge. The I/O window for the XIO2001 has a minimum size of 4 KBytes and is naturally 4K-aligned. Typically, most systems use only 16-bit addressing for I/O transactions, so the upper base and limit registers remain 0.



- Memory base and memory limit registers PCI offsets 0×20 and 0×22 : Similar to the I/O base and limit registers, the bridge must be programmed with a memory address window containing the nonprefetchable memory resources of all downstream PCI devices requiring nonprefetchable memory. Memory windows have a minimum size of 1 MByte and are naturally 1M-aligned. The bridge does not claim either a memory transaction initiated from upstream that does not fall within its memory window nor memory transactions initiated downstream that do fall within its memory window.
- Prefetchable memory base, prefetchable memory limit, prefetchable base upper 32-bit, and prefetchable limit upper 32-bit registers PCI offsets 0x24, 0x26, 0x28, and 0×2C: Identical to the memory base and limit registers but for prefetchable memory resources. The prefetchable base upper 32-bit, and prefetchable limit upper 32-bit registers are only used if 64-bit addressing is in use and in most systems both of these registers will remain all zeroes. If 64-bit addressing is desired and the memory window for devices behind the XIO2001 resides all or in part in 64-bit memory space then the prefetchable base upper 32-bit register will combine with the prefetchable base register and the prefetchable limit upper 32-bit register will combine with the prefetchable limit register to create 64-bit base and limit registers. All memory addresses between the two addresses will be considered to be located behind the bridge.
- For all base and limit registers any case in which the limit register contains a lower address than the base register will be considered invalid. In this situation the bridge will react as if all resources of that type resided upstream of the bridge. The bridge will respond to all downstream transactions of that type with Unsupported Request and will claim and forward upstream any transactions of that type that initiate on the PCI bus.

Depending on desired functionality, other PCI registers on the XIO2001 may have to be configured. Consult the XIO2001 Data Manual for a description of the previous registers or for any other XIO2001 registers.

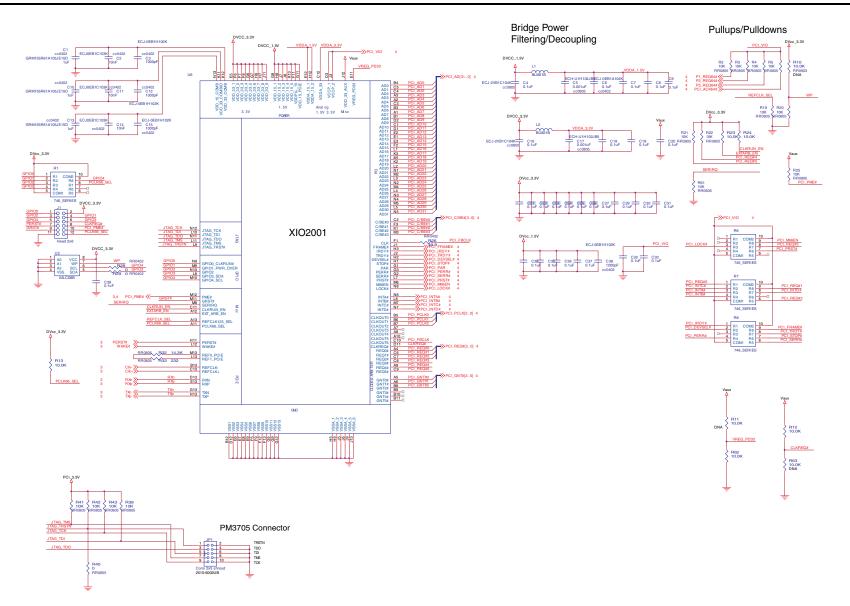
#### 4.4.4 Check Devices Downstream From Bridge

Once the bridge is communicating and is properly configured, check if devices downstream from the bridge have been configured as required. Check the Windows Device Manager to determine if the device drivers have been loaded or if other problems exist with the device. Once you have performed these checks, you can perform PCI transactions on the bus and examine them with any standard PCI analyzer.

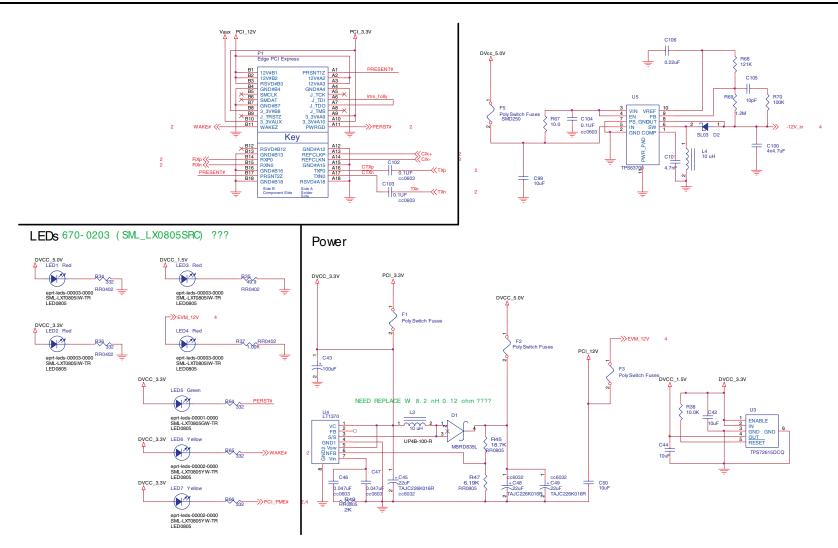
#### 5 Schematics

Schematics for the XIO2001 EVM are shown on the following pages.





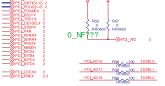






Schematics







## 6 Bill of Materials

Evaluation board bill of materials as assembled. Unused options (e.g., 3.3-V  $V_{\text{IO}})$  are not populated and not listed.

ITEM	QTY	REFERENCE	VALUE	MFR	PART NO.	PACKAGE
1	3	C1, C10, C13	1 μF	Murata	GRM155R61A105JE15D	cc0402
2	3	C2, C11, C14	10 nF	Panasonic	ECJ0EB1C103K	cc0402
3	4	C3, C12, C15, C38	1000 pF	Panasonic	ECJ-0EB1H102K	cc0402
4	2	C4, C16	0.1 μF	Panasonic	ECJ-2VB1C104K	cc0805
5	2	C5, C17	0.001 μF	Panasonic	ECH-U1H102JB5	cc0805
6	72	$\begin{array}{c} C6, C7, C8, C9, C18, C19,\\ C20, C21, C22, C23, C24,\\ C25, C26, C27, C29, C3,\\ C31, C32, C33, C34, C35,\\ C36, C37, C39, C51, C52,\\ C53, C54, C55, C56, C57,\\ C58, C59, C60, C61, C62,\\ C63, C64, C65, C66, C67,\\ C68, C69, C70, C71 C72,\\ C73, C74 C75, C76, C77,\\ C78, C79, C80 C81, C82,\\ C83, C84, C85, C86, C87,\\ C88, C89, C90 C91, C92,\\ C93, C94 C95, C96, C97,\\ C98\end{array}$	0.1 μF	Panasonic	ECJ-0EB1A104K	cc0402
7	6	C42, C44, C50, C99, C100, C101	10 μF	Panasonic	ECJ-2FB1A106K	cc0805
8	1	C43	100 μF	Panasonic	ECA1EHG101	THCap_2P5MM
9	3	C45, C48, C49	22 μF	AVX	TAJC226K016R	cc6032
10	2	C46, C47	0.047 μF	Panasonic	ECJ1VB1C473K	cc0603
11	3	C102, C103, C104	0.1 μF	Kemet	C0603C104M4RACTU	cc0603
12	1	C105	10 pF	TDK	C1608C0G1H100DB	cc0603
13	1	C106	0.22 μF	Panasonic	ECJ1VB1A224K	cc0603
14	1	D1	MBRD835L	Diodes, Inc.	MBRD835L	DPAK_4
15	1	D2	SL03	Vishay	SL03D0-219AB-GS08	sl03_schottky_diode
16	4	F1, F2, F3, F5	Polyswitch fuses	Tyco Electronics	SMD250	SMD250
17	1	J1	Head $2 \times 6$	Berg	54102-T32-05	HDR_6X2
18	1	JP1	Conn $2 \times 5$ shroud	3M	2510-6002UB	eprt-conn-00002-0001
19	2	L1, L2	BLM21B	MuRata	BLM21BB221SN1	cc0805
20	1	L3	10 μH	Coiltronics	UP4B-100-R	IND_UP4B_100_R
21	1	L4	10 μH	Sumida	CDRH5D18NP-100NC	CDRH5D18
22	4	LED1, LED2, LED3, LED4	Red Lumex	Lumex	SML-LXT0805IW-TR	LED0805
23	1	LED5	Green	Lumex	SML-LXT0805GW-TR	LED0805
24	2	LED6, LED7	Yellow	Lumex	SML-LXT0805YW-TR	LED0805
25	1	P1	Edge PCI Express		DNA	eprt-conn- 00023-0000
26	3	P2, P3, P4	PCI 5 V conn	Tyco Electronics	145154-8	Conn_PCI_60_Dual
27	4	R1, R6, R7, R8	746_SERIES	CTS	746X101103JCT-ND?	10Pin_8Res
28	14	R2, R3, R4, R5, R19, R20, R21, R22, R25, R39, R41, R42, R43, R61	10K	Panasonic	ERJ6ENF1002V	RR0805
29	9	R10, R11, R12, R13, R23, R24, R38, R62, R63	10.0K	Panasonic	ERJ3EKF1002V	RR0603
30	2	R26, R35	49.9	Panasonic	ERJ2RKF49R9X	RR0402
31	2	R28, R29	0	Panasonic	ERJ2GE0R00X	RR0402
32	1	R32	14.3K	Panasonic	ERJ6ENF1432V	RR0805
33	1	R33	232	Panasonic	ERJ6ENF2320V	RR0805
34	2	R34,R36	332	Panasonic	ERJ2GEJ3320X	RR0402
35	1	R37	Conn $2 \times 5$ shroud	Panasonic	ERJ2RKF1001V	RR0402

Table 7. Bill of Materials



ITEM	QTY	REFERENCE	VALUE	MFR	PART NO.	PACKAGE
36	7	R40, R50, R51, R52, R53, R54, R55	0	Panasonic	ERJ6ENF0000V	RR0805
37	1	R45	18.7K	Panasonic	ERJ6ENF1872V	RR0805
38	1	R47	6.19K	Panasonic	ERJ6ENF6191V	RR0805
39	1	R49	2К	Panasonic	ERJ6ENF2001V	RR0805
40	2	R56, R57	0	Panasonic	ERJ3GEY0R00V	RR0603
41	3	R58, R59, R60	100	Panasonic	ERJ6ENF1000V	RR0805
42	3	R64, R65, R66	332	Panasonic	ERAV39J3320V	RR0603
43	1	R67	10.0	Panasonic	ERJ2RKF10R0V	RR0402
44	1	R68	121K	Panasonic	ERJ2RKF1213X	RR0402
45	1	R69	1.2M	Vishay	CRCW0603	RR0603
46	1	R70	100K	Panasonic	ERJ2RKF1003V	RR0402
47	1	U2	24LC08B	Microchip	24LC08BIST	TSSOP_8_122X177_ 26
48	1	U3	TPS72615DCQ	Texas Instruments	TPS72615DCQ	TO_263_6_DCQ
49	1	U4	LT1370	Linear Technology	LT1370CR	DDPAK_R_7
50	1	U5	TPS63700	Texas Instruments	TPS63700DRCT	DRC_S_PVSON_N10
51	1	U6	XIO2001_ZAJ	Texas Instruments	XIO2001ZAJ	bga144ZAJ_0p5mm_ socket

#### Table 7. Bill of Materials (continued)

#### **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 <a href="http://www.ti.com/esh">www.ti.com/esh</a>.

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 and the output voltage range of .

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. The EVM is designed to operate properly with certain components above 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 © 2009, 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 TI 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. Information of third parties may be subject to additional restrictions.

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		Applications	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Broadband	www.ti.com/broadband
DSP	dsp.ti.com	Digital Control	www.ti.com/digitalcontrol
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Military	www.ti.com/military
Logic	logic.ti.com	Optical Networking	www.ti.com/opticalnetwork
Power Mgmt	power.ti.com	Security	www.ti.com/security
Microcontrollers	microcontroller.ti.com	Telephony	www.ti.com/telephony
RFID	www.ti-rfid.com	Video & Imaging	www.ti.com/video
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265 Copyright © 2009, Texas Instruments Incorporated