

AM437x GP EVM Hardware User's Guide

Verified Design



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1 Introduction

This document describes the hardware architecture of the AM437x Evaluation Module (EVM) (part number TMDXEVM437X), which is based on the Texas Instruments (TI) AM437x processor. This EVM is also commonly known as the AM437x General Purpose (GP) EVM.

1.1 Description

The AM437x GP EVM is a standalone test, development, and evaluation module system that enables developers to write software and develop hardware around an AM437x processor subsystem. The main elements of the AM437x subsystem are already available on the base board of the EVM, which gives developers the basic resources needed for most general purpose type projects that encompass the AM437x as the main processor. Furthermore, additional, "typical-type" peripherals are built into the EVM, such as memory, sensors, LCD, Ethernet physical layer (PHY), and so on, so that prospective systems can be modeled quickly without significant additional hardware resources.

The following sections give more details regarding the EVM.

1.2 System View

The system view of the AM437x GP EVM consists of the main board and the camera board. See [Figure 1](#) and [Figure 2](#) of the EVM.



Figure 1. AM437x GP EVM Top View

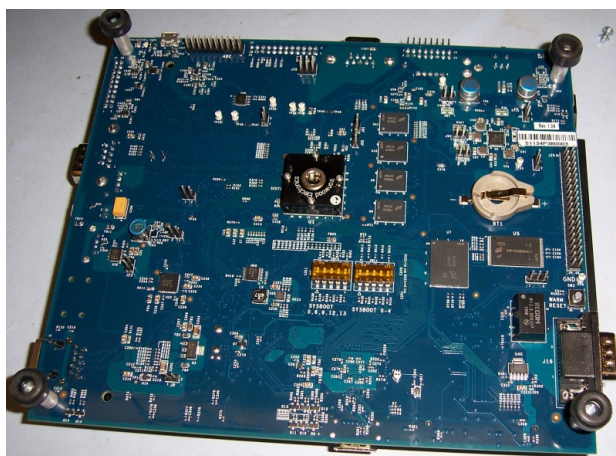


Figure 2. AM437x GP EVM Bottom View

2 Functional Blocks Description

The complete AM437x GP EVM is contained mostly within a single board. The GP EVM can also have a camera and wireless board.

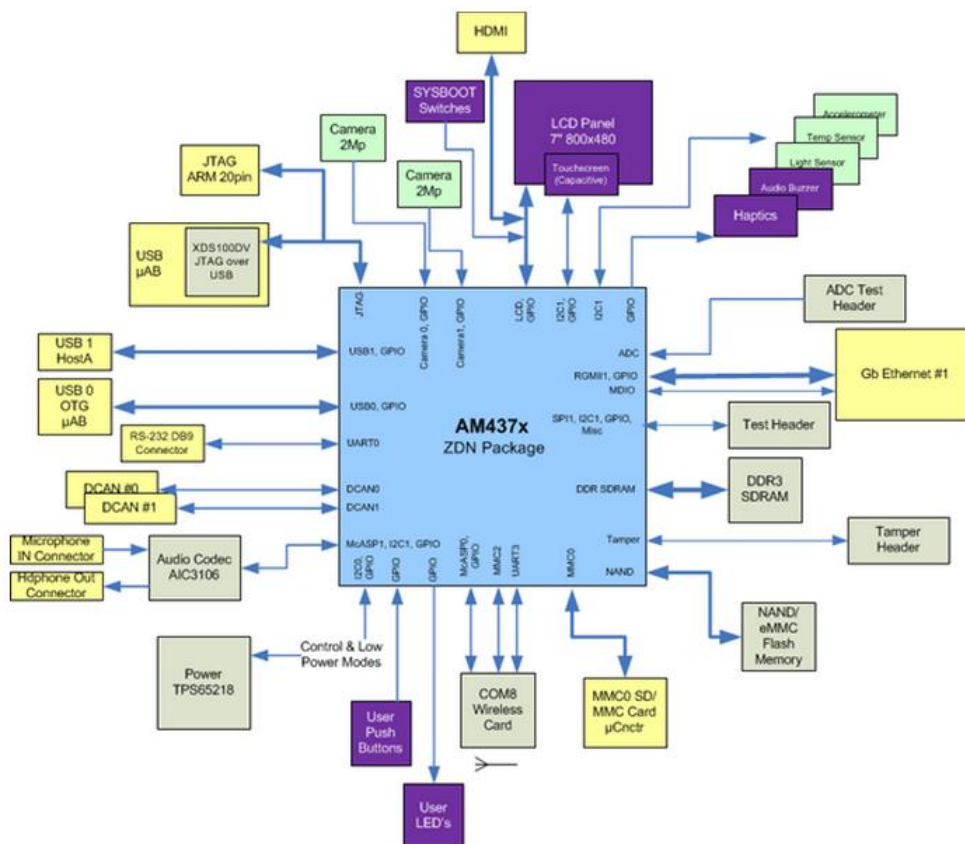


Figure 3. AM437x EVM System Block Diagram

2.1 Processor

The AM437x processor is the central processor to this EVM. All the resources on the board surround the AM437x processor to provide development capabilities for hardware and software. See the [AM437x data sheet](#) and TRM for the details about the processor.

System configuration signals (sysboot0 to 18) can be set on the EVM using resistors and switches to define some startup parameters on the AM437x processor. See [Section 4](#) for more details.

2.2 Clocks

The EVM has several clocks to support the AM437x processor. The main clock for the processor is derived from a 24-MHz crystal. AM437x generates the base clock and subsequent module clocks as needed within the AM437x processor. A 32-kHz clock for the RTC on the AM437x is derived from a 32.768-kHz crystal on the board.

2.3 Reset Signals

SYS_RESETh is a reset signal running to several peripherals and AM437x which performs a reset on those peripherals. SYS_RESETh is asserted by the push-button and is used to force a reset of the AM437x and the other peripherals. AM437x can also pull down the RESET_INOUTH signal to cause the SYS_RESETh line to activate. The power-on reset to the processor is driven from the power good signal of the power manager. Also, a reset push-button is provided for the power on reset of the board.

2.4 **DDR3 SDRAM**

The AM437x GP EVM contains four 4-Gb (512Mb × 8) of DDR3L SDRAM memories from Micron. The part number for the DDR3L SDRAM memory used is MT41K512M8RH. The package used is a 78-ball FBGA package. See the AM437x TRM for memory locations for this memory.

2.5 **NAND Flash**

The GP EVM has a NAND-type of flash. The part number of the memory used is MT29F4G08AB, which is a 4-Gb (512M × 8) flash memory. The GPMC signals are used to communicate with this memory.

2.6 **Board Identity Memory**

Each of the board has a serial EEPROM that contains board specific data that allow the processor to automatically detect which board is connected and the version of that board. This memory device can store other hardware specific data as well. The part number of the memory device is CAT24C256WI-G. See [Section 4](#) for details on the data in this memory.

2.7 **SDMMC0**

The SDMMC0 connector on the GP EVM is a microSD socket with part number SCHA5B0200. This connector is a standard SD/MMC card type of connector. The connector links to the MMC0 port of the AM437x processor. Check the [AM437x data sheet](#) and TRM for supported card types and densities.

2.8 **10/100/1000 Ethernet**

The AM437x GP EVM has a 10/100/1000 Ethernet transceiver from Micrel (KSZ9031RN) that is connected to an RJ45 (J18) connector.

The reset on the transceiver is driven by the board system reset signal SYS_RESETn. A 25-MHz crystal drives the clock input of the KSZ9031RN Ethernet PHY.

The PHY address is set to 0x00h.

2.9 **USB**

The AM437x GP EVM supports 2 USB ports. The USB ports are connected to a microUSB AB connector and a standard A-type connector. The ESD device TPD4S012 and common choke filter ACM2012 (TDK) are used on the USB signals before they are connected to the AM437x pins.

2.10 **Connectivity**

The AM437x GP EVM supports MCS COM8 form factor wireless boards from TI through the J20 COM connector, which is a Samtec card edge type connector MEC6-150-02-S-D-RA1. Therefore, this connector supports COM8 types of boards. More details about this connector can be found in the MCS COM8 board documents.

The COM connector requires 3.6 V, 442 mA on the power supply. Thus, a TPS79501 LDO regulator is used to provide this voltage supply from the base 5.0V supply.

The signals on the COM board are all 1.8-V voltage levels. Thus, voltage translators are placed to convert to/from 3.3V of the AM437x rail for a particular signal which is running at 3.3V.

2.11 **UART**

This EVM supports one RS232 port connector. A MAX3243 RS-232 transceiver is used in between UART0 signals from the processor and the DB9 connector.

2.12 **ADC**

The analog inputs to the AM437x are terminated on the connector J22, where a magnetic swipe assembly can be connected.

2.13 Dual Cameras

The two camera interfaces from the AM437x processor are terminated on the 12×2 headers, J2 and J3. The custom-made camera module from TI with part number 4P0041 interfaces with the header J3. This camera module is a separate camera board that attaches at a right angle so that the camera can face horizontally when the GP EVM is lying on a test bench. The OmniVision OV2659 SOC-based 2-MP camera module from SunnyOptics with part number P212A interfaces with the header J2. The OV2659 delivers a high-definition video and excellent low-light sensitivity for cost-sensitive applications.

2.14 Audio

The headphone output and line input signals from the two 3.5-mm SJ3524 jacks are connected to the audio codec with part number TLV320AIC3106. These signals connect through the McASP1 and I2C interfaces of the AM437x.

3 Power Supplies

This section describes how the power supplies required for the design are generated.

3.1 Power Source

AM437x GP EVM uses an external AC for a 5-V-DC (rated 2.5 A minimum) power adapter. The slide switch SW2 is used to switch the main power to the board on and off. The main power is off when the power switch is in the position away from the power supply jack. The main power is on when the power switch is in the position closest to the power supply jack.

3.2 Power Sequencing

The power sequencing requirements of the AM437X processor (see the [AM437x data sheet](#)) are handled automatically by the TPS65218 PMIC.

3.3 Power Management IC Power Supplies

The AM437x GP EVM uses the TPS65218 power management IC. The I2C0 on AM437x is used to control the Smart Reflex port and control port on the TPS65218. [Table 1](#) and [Table 2](#) detail the power supplies used.

Table 1. AM437x Power Supplies from TPS65218

TPS65218 POWER SUPPLY	AM437X POWER RAIL	VOLTAGE
VDCDC1	VDD_CORE, VDD_TPM	1.1 V
VDCDC2	VDD_MPU	1.1 V
VDCDC3	VDDS_DDR	1.35 V
VLS1	VDD_DDR	1.35 V
V1_8D_AM437X	VDDS_CLKOUT, VDDS_OSC, VDDS_SRAM_CORE_BG, VDDS_SRAM_MPU_BB, VDDS_PLL_CORE_LCD, VDDS_PLL_DDR, VDDS_PLL_MPU, VDDA1P8V_USB0, VDDA1P8V_USB1, VDDS_CTM, VDDS_TPM, VPP, VDDA_MC_ADC, VDDA_TS_ADC, VDDS, COM8, VDDSHV9, VDDSHV11, tamper, ADC input sections	1.8 V
V1_0BAT	CAP_VDD_RTC	1.0 V
V1_8BAT	VDDS_RTC	1.8 V
V3_3D_AM438X	VDDA_3P3V_USB0, VDDA_3P3V_USB1, VDDSHV1, 2, 3, 4, 5, 6, 7, 8, and 10	3.3 V
V5_0D	HDMI circuitry, USB0 power	5.0 V

NOTE: The TPS65218 power management IC that is used on the AM437x GP EVM rev. 1.2 has several issues that can affect operation. See the [errata](#) for the TPS65218 for more details.

3.3.1 Other Power Supplies Used

Table 2. Other Power Supplies

POWER SUPPLY	POWER RAIL	VOLTAGE
V3_3D	NAND memory, QPSI flash, Ethernet PHY, SDMMC0, board ID memory, ARM JTAG, buffers of FTDI section, LCD buffer, touch screen, camera module, HDMI buffer, audio codec, RS-232 sections, COM8 sections, smart card sections, tamper header, platform test section, GPIO header, printer	3.3 V
V3_3FTDI	FT2232 section from TPS79333	3.3 V
VBAT	LCD power generation, camera module, VCOM_BAT generation for COM8 module, USB1 power generation, platform test section, LEDs, GPIO header, buzzer, printer	5.0 V
V1_2D	HDMI section power	1.2 V

3.4 APM Sense Resistors

The AM437x GP EVM has the following subsystems with current sense resistors. These resistors allow the power to be measured on each power rail to check AM437x power requirements during real-time software execution. The value of the resistors is selected to provide the best dynamic range when using a TI INA226 converter. An INA226 converter is installed on the EVM for both the VDD_CORE and VDD_MPU power supply rails of the AM437x. The other power rails have sense resistors but have their measurement connections attached to 2-pin standard headers so they can be read easily by a multimeter or connected to an INA226-converter EVM. The value of the sense resistors for the VDD_CORE and VDD_MPU were selected to give better dynamic range for active power modes rather than sleep or low power modes. If power is to be measured for VDD_CORE or VDD_MPU for sleep or low power modes, then this sense resistor value must be changed to give better shunt voltage values.

Table 3. AM437x GP EVM APM Sense Resistors

VOLTAGE NET	SENSE RESISTOR VALUE
VDD_CORE	0.05 ohm
VDD_MPU	0.05 ohm
VAM437X_DDR	0.05 ohm
VDDS_DDR	0.05 ohm
V1_8D_AM437X	0.1 ohm
V3_3D_AM437X	0.1 ohm

4 Configuration and Setup

4.1 Boot Configuration

The AM437x has sysboot pins that can be configured using two 5-bit DIP switches on the EVM. These sysboot switches will configure the AM437x to different boot settings. The SW12 switch can be used to set sysboot bits 0 to 4, and the SW11 switch can set sysboot bits 5, 6, 9, 12, and 13. Other sysboot pin settings are done through resistors either pulled high or low. See the AM437x TRM and [data sheet](#) for the definitions of each of the sysboot signals. See the GP EVM schematic for more details.

4.2 I2C Address Assignments

In the AM437x GP EVM boards, each separate board has an I2C ID memory that contains the details of the identity of that board, such as its configuration. See the following sections for more details on the memories' contents.

Table 4. AM437x I2C Bus Addresses

AM437X FUNCTION	AM437X I2C PORT	ADDRESS
Board ID memory	I2C0	0x50
PMIC control	I2C0	0x2D
Touch screen control	I2C1	0x5C
Camera module 0	I2C0	0xxx
Camera module 1	I2C1	0xxx
Audio codec	I2C0	0x18
HDMI transmitter	I2C2	0x76
HDMI companion chip	I2C2	0xxx
Multiple smart card slot interface IC	I2C2	0xxx

4.3 I2C ID Memory

The GP EVM has a dedicated I2C EEPROM, which contains specific identity and configuration information for that board. In addition, the dedicated I2C EEPROM has available space in each memory for user-specific configuration information.

The part number of the memory device is CAT24C256WI-G.

Table 5. AM437x GP EVM EEPROM Data

NAME	SIZE (BYTES)	CONTENTS
Header	4	MSB 0xEE3355AA LSB
Board Name	8	Name for board in ASCII "XXXXXXX" = AM437x GP EVM
Version	4	Hardware version code for board in ASCII "1.4A" = rev. 01.4A
Serial Number	12	Serial number of the board. This is a 12-character string: WWYY4P16nnnn where: - WW = 2 digit week of the year of production - YY = 2 digit year of production - nnnn = incrementing board number
Configuration	32	Codes to show the configuration setup on this board. For the available EVM's supported, the following codes are used: - ASCII "SKU#01" = base board for general purpose EVM - ASCII "SKU#02" = base board for industrial motor control EVM - Remaining 26 bytes are reserved
Ethernet MAC address 0	6	MAC address for AM437x Ethernet MAC 1
Ethernet MAC address 1	6	MAC address for AM437x Ethernet MAC 2 or PRU 0
Ethernet MAC address 2	6	MAC address for AM437x PRU 1 (if used)
Available	32702	Available space for other non-volatile codes and data

4.4 JTAG

The AM437x GP EVM supports embedded XDS100V2 USB Emulation through the micro-USB AB connector. The EVM also has an optional 20-pin TI CJTAG connector to support the emulation. This CJTAG connector is not installed by default. Other [JTAG adaptors](#) are available on TI's e-store.

5 User Interfaces

5.1 Keypad

The keypad has six push button switches (SW4, SW5, SW6, SW7, SW8, and SW9) with Omron part number B3SL-1022P on the component side of the board. This keypad uses two power and three scan lines to enable six buttons to be monitored.

5.2 LEDs

There are eight status LEDs (three green LEDs, one yellow LED, one red LED, one blue LED, and one orange LED) on the top side of the EVM. The EVM also has a green LED (D2) to indicate power-on available.

5.3 Audio Buzzer

An audio buzzer is installed on the board to provide auditory cues to the user. This audio buzzer PUI audio AI-1027-TWT-3V-R is driven from a GPIO.

5.4 Capacitive Touch LCD

The LCD is a 7-inch WVGA (800×480) RGB LCD panel part number OSD070T1718-19TS. The LCD is a 24-bit RGB TFT LCD with 21 white LEDs for backlight (controlled by the TPS61081DRC power regulator). The connector used is an FPC-type, 50-pin connector with part number FH12S-50S-0.5SH. The LED backlight on the LCD is controlled by a PWM-controlled LED driver (TPS61081). The LCD has a capacitive touch screen, which is connected to the I2C0 port of the processor. The power required for the LCD is generated using the linear regulator supply (TPS65105).

6 Pin Use Description

6.1 Functional Interface Mapping

Some signals of the AM437x are connected to a fixed device on the EVM where it cannot be changed. However, some of the signals of the AM437x are connected to devices on the EVM based on the profile setting.

6.2 GPIO Definitions

The developer can select and enable pins based on the selective peripheral pins as output or input.

7 Board Connectors

The pinout details of all the connectors used in the GP EVM are provided in [Table 6](#) through [Table 23](#).

7.1 Battery Board Connector - J1

Table 6. Battery Board Connector

PIN NUMBER	SIGNAL NAME
1	VPWR_IN
2	VBAT
3	VPWR_IN
4	VBAT
5	PGOODBU
6	NC
7	NC
8	NC
9	DGND
10	NC
11	AM437X_AIN7
12	NC
13	BAT_HDQ
14	PMIC_AC_DET
15	DGND
16	DGND

7.2 HEADPHONE OUT - J16

Table 7. Audio Out Connector

PIN NUMBER	SIGNAL NAME
1	AGND_AUD
2	AUD_HPLOUT_JCK
3	AUD_HPROUT_JCK
10	NC

7.3 LINE IN - J14

Table 8. Audio Line-in Connector

PIN NUMBER	SIGNAL NAME
1	AGND_AUD
2	AUD_HPLOUT_JCK
3	AUD_HPROUT_JCK
10	NC

7.4 SDMMC0 - J7

Table 9. SDMMC0 Connector

PIN NUMBER	MEMORY CARD PIN NO
1	MMC_D2
2	MMC_D3
3	MMC_CMD
4	VDD
5	MMC_CLK
6	DGND
7	MMC_D0
8	MMC_D1
9	DGND
10	MMC_CD
11	DGND
12	DGND
13	DGND
14	DGND
15	DGND
16	DGND

7.5 LCD Connector - J15

Table 10. LCD Connector

PIN NUMBER	SIGNAL	DESCRIPTION
1	VLED+	Backlight Power +
2	VLED+	Backlight Power +
3	VLED-	Backlight Power –
4	VLED-	Backlight Power –
5	GND	Ground
6	VLCD_VCOM	Voltage
7	VLCD_DVDD	Voltage
8	GND	Ground
9	LCD_EN	LCD Enable
10	LCD_VSYNC	LCD vertical sync
11	LCD_HSYNC	LCD horizontal sync
12	LCD_BLUE7	LCD blue data 7
13	LCD_BLUE6	LCD blue data 6
14	LCD_BLUE5	LCD blue data 5
15	LCD_BLUE4	LCD blue data 4
16	LCD_BLUE3	LCD blue data 3

Table 10. LCD Connector (continued)

PIN NUMBER	SIGNAL	DESCRIPTION
17	LCD_BLUE2	LCD blue data 2
18	LCD_BLUE1	LCD blue data 1
19	LCD_BLUE0	LCD blue data 0
20	LCD_GREEN7	LCD green data 7
21	LCD_GREEN6	LCD green data 6
22	LCD_GREEN5	LCD green data 5
23	LCD_GREEN4	LCD green data 4
24	LCD_GREEN3	LCD green data 3
25	LCD_GREEN2	LCD green data 2
26	LCD_GREEN1	LCD green data 1
27	LCD_GREEN0	LCD green data 0
28	LCD_RED7	LCD red data 7
29	LCD_RED6	LCD red data 6
30	LCD_RED5	LCD red data 5
31	LCD_RED4	LCD red data 4
32	LCD_RED3	LCD red data 3
33	LCD_RED2	LCD red data 2
34	LCD_RED1	LCD red data 1
35	LCD_RED0	LCD red data 0
36	GND	Ground
37	LCD_PCLK	Clock
38	GND	Ground
39	LCD_LEFTRIGHT	Left and right scan direction select
40	LCD_UPDOWN	Up and down scan direction select
41	VLCD_VGH	Voltage high
42	VLCD_VGL	Voltage low
43	VLCD_AVDD	Voltage analog
44	LCD_RESETn	Reset
45	NC	No connect
46	VLCD_VCOM	Voltage
47	LCD_DITHER	Dither
48	GND	Ground
49	NC	No connect
50	NC	No connect

7.6 Touch Screen Connector - J17

Table 11. LCD Capacitive Touch Screen Pin Details

PIN NUMBER	DIRECTION	DESCRIPTION
1	NC	No connect
2	NC	No connect
3	TOUCH_INTn	Touch screen interrupt
4	GP_I2C_SDA	I2C data
5	GP_I2C_SCL	I2C clock
6	SYS_RESETh	Reset
7	GND	Ground
8	VCC	Power

7.7 Ethernet - J18

Table 12. 10/100/1000 Ethernet Connector

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	DGND	Ground
2	NC	No connect
3	ETHER1_D3P	Data 3 ve
4	ETHER1_D3N	Data 3 –ve
5	ETHER1_D2P	Data 2 ve
6	ETHER1_D2N	Data 2 –ve
7	ETHER1_D1P	Data 1 ve
8	ETHER1_D1N	Data 1 –ve
9	ETHER1_D0P	Data 0 ve
10	ETHER1_D0N	Data 0 –ve
11	ACT LED ANODE	Anode of ACT LED
12	ACT LED CATHODE	Cathode of ACT LED
13	LINK LED CATHODE	Cathode of LINK LED
14	LINK LED ANODE	Anode of LINK LED
SHLD1	DGND	Ground
SHLD2	DGND	Ground

7.8 USB - J11

Table 13. Micro AB Connector - USB 0

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	VUSB_VBUS0	USB0 bus voltage
2	USB0_CONN_DM	USB0 data –
3	USB0_CONN_DP	USB0 data +
4	USB0_ID	USB0 identification
5	DGND	Ground

7.9 USB - J13

Table 14. Type A - USB Port 1

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	VUSB_VBUS1	USB1 bus voltage
2	USB1_CONN_DM	USB1 data –
3	USB1_CONN_DP	USB1 data +
4	DGND	Ground

7.10 Camera Interface Header

7.10.1 Camera Interface 0 - J2

Table 15. Camera Header 0

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	AGND_CAM0	Analog ground
2	SENSOR_SIO_D	Sensor serial I/O data
3	V2_8A	2.8-V Supply
4	SENSOR_SIO_C	Sensor serial I/O clock
5	DGND	Ground
6	SENSOR_VSYNC	Sensor VSYNC
7	DGND	Ground
8	SENSOR_HREF	Sensor HREF
9	V1_5D	1.5-V Supply
10	SENSOR_XCLK	Sensor clock
11	SENSOR_PWRDN	Sensor power down
12	V2_8D	2.8-V Supply
13	SENSOR_PCLK	Sensor clock
14	NC	No connect
15	SENSOR_RESET	Sensor reset
16	NC	No connect
17	SENSOR_Y9	Sensor data 9
18	SENSOR_Y8	Sensor data 8
19	SENSOR_Y7	Sensor data 7
20	SENSOR_Y6	Sensor data 6
21	SENSOR_Y5	Sensor data 5
22	SENSOR_Y4	Sensor data 4
23	SENSOR_Y3	Sensor data 3
24	SENSOR_Y2	Sensor data 2

7.10.2 Camera Interface 1 - J3

Table 16. Camera Header 1

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	VBAT	VBAT
2	CAM1_VSYNC	Vertical sync
3	CAM1_DATA0	Data 0
4	CAM1_HSYNC	Horizontal sync
5	CAM1_DATA1	Data 1
6	CAM1_DATA6	Data 6
7	CAM1_DATA2	Data 2
8	CAM1_DATA7	Data 7
9	CAM1_PCLK	Clock
10	CAM1_DATA8	Data 8
11	GND	Ground
12	GND	Ground
13	CAM1_DATA3	Data 3
14	CAM1_DATA9	Data 9
15	CAM1_DATA4	Data 4
16	CAM1_GIO0	GPIO 0
17	CAM1_DATA5	Data 5
18	CAM1_GIO1	GPIO 1
19	CAM1_WEN	Write enable
20	CAM1_FIELD	Field
21	GND	Ground
22	GP_I2C_SCL	I2C clock
23	CAM1_SRCCLK	Clock
24	GP_I2C_SDA	I2C data

7.11 HDMI Connector - J19

Table 17. HDMI Header

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	HDMI_TX2+	Data Transmit2 +ve
2	DAT2_S	Data 2 GND
3	HDMI_TX2-	Data Transmit2 –ve
4	HDMI_TX1+	Data Transmit1 +ve
5	DAT1_S	Data 1 GND
6	HDMI_TX1-	Data Transmit1 –ve
7	HDMI_TX0+	Data Transmit0 +ve
8	DAT0_S	Data 0 GND
9	HDMI_TX0-	Data Transmit0 –ve
10	CLK+	Clock +ve
11	Clock_S	Clock GND
12	Clock-	Clock –ve
13	HDMICONN_CEC	CEC
14	NC	No Connect
15	HDMICONN_I2CSCL	I2C Clock
16	HDMICONN_I2CSDA	I2C Data
17	GND	Ground

7.12 RS232 Connector - J9

Table 18. RS-232 Connector

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	NC	No connect
2	RS232_0RXD	Receive
3	RS232_0TXD	Transmit
4	NC	No connect
5	GND	Ground
6	NC	No connect
7	RRS232_0RTS	Request to send
8	RS232_0CTS	Clear to send
9	NC	No connect

7.13 CAN INTERFACE

7.13.1 CAN INTERFACE 0 - J4

Table 19. CAN 0 Connector

PIN NUMBER	SIGNAL NAME	DESCRIPTION
B1	NC	No connect
B2	CAN0_L	Can diff signal low
B3	GND_CAN0	Ground
B4	NC	No connect
B5	GND_CAN0	Ground
B6	GND_CAN0	Ground
B7	CAN0_H	Can diff signal high
B8	NC	No connect
B9	VCAN0	VCC

7.13.2 CAN INTERFACE 1 - J37

Table 20. CAN 1 Connector

PIN NUMBER	SIGNAL NAME	DESCRIPTION
B1	NC	No connect
B2	CAN1_L	Can diff signal low
B3	GND_CAN1	Ground
B4	NC	No connect
B5	GND_CAN1	Ground
B6	GND_CAN1	Ground
B7	CAN1_H	Can diff signal high
B8	NC	No connect
B9	VCAN1	VCC

7.14 ADC Input Header - J22

Table 21. ADC Input Header

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	V1_8D	1.8-V Supply
2	VBAT	VBAT
3	MON_AIN0	Monitoring analog input 0
4	MON_AIN4	Monitoring analog input 4
5	MON_AIN1	Monitoring analog input 1
6	MON_AIN5	Monitoring analog input 5
7	MON_AIN2	Monitoring analog input 2
8	MON_AIN6	Monitoring analog input 6
9	MON_AIN3	Monitoring analog input 3
10	MON_AIN7	Monitoring analog input 7
11	GND_ADC	Analog ground
12	GND_ADC	Analog ground
13	AM437X_MAG_ADC0	ADC input 0
14	AM437X_MAG_ADC4	ADC input 4
15	AM437X_MAG_ADC1	ADC input 1
16	AM437X_MAG_ADC5	ADC input 5
17	AM437X_MAG_ADC2	ADC input 2
18	AM437X_MAG_ADC6	ADC input 6
19	AM437X_MAG_ADC3	ADC input 3

7.15 GPIO Header - J30

Table 22. GPIO Header

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	V3_3D	Voltage 3.3 V
2	VBAT	Voltage VBAT
3	GPIO0	General Purpose I/O 0
4	NC	No connect
5	GPIO1	General Purpose I/O 1
6	NC	No connect
7	GPIO2	General Purpose I/O 2
8	NC	No connect
9	GPIO3	General purpose I/O 3
10	NC	No connect
11	GPIO4	General purpose I/O 4
12	DGND	Ground
13	GPIO5	General purpose I/O 5
14	SPI1_SCLK	SPI1 clock
15	GPIO6	General purpose I/O 6
16	SPI1_D0	SPI1 DO
17	GPIO7	General purpose I/O 7
18	SPI1_D1	SPI1 D1
19	GPIO8	General purpose I/O 8
20	SPI1_CS0	SPI1 chip select
21	GPIO9	General purpose I/O 9
22	GPIO18	General purpose I/O 18
23	GPIO10	General purpose I/O 10
24	GP_I2C_SCL	I2C clock
25	GPIO11	General purpose I/O 11
26	GP_I2C_SDA	I2C data
27	GPIO12	General purpose I/O 12
28	GPIO19	General purpose I/O 19
29	GPIO13	General purpose I/O 13
30	GPIO20	General purpose I/O 20
31	GPIO14	General purpose I/O 14
32	GPIO21	General purpose I/O 21
33	GPIO15	General purpose I/O 15

7.15.1 I2C Header - J6

Table 23. I2C Header

PIN NUMBER	SIGNAL NAME	DESCRIPTION
1	PWRMON_I2CSCL	I2C clock
2	PWRMON_I2CSDA	I2C data
3	DGND	Ground
4	PM_ALERT	Alert
5	NC	No connect

8 EVM Important Notices

8.1 ADDITIONAL TERMS AND CONDITIONS, WARNINGS, RESTRICTIONS, AND DISCLAIMERS FOR EVALUATION MODULES

NOTE: These EVM terms and conditions can be downloaded in PDF format.

Texas Instruments Incorporated (TI) markets, sells, and loans all evaluation boards, kits, and/or modules (EVMs) pursuant to, and user expressly acknowledges, represents, agrees, and takes sole responsibility and risk with respect to the following:

1. User agrees and acknowledges that EVMs are intended to be handled and used for feasibility evaluation only in laboratory and/or development environments. Notwithstanding the foregoing, in certain instances, TI makes certain EVMs available to users that do not handle and use EVMs solely for feasibility evaluation only in laboratory and/or development environments, but may use EVMs in a hobbyist environment. All EVMs made available to hobbyist users are FCC certified, as applicable. Hobbyist users acknowledge, agree, and shall comply with all applicable terms, conditions, warnings, and restrictions in this document and are subject to the disclaimer and indemnity provisions included in this document.
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3. User agrees that EVMs shall not be used as, or incorporated into, all or any part of a finished product.
4. User agrees and acknowledges that certain EVMs may not be designed or manufactured by TI.
5. User must read the user's guide and all other documentation accompanying EVMs, including without limitation any warning or restriction notices, prior to handling and/or using EVMs. Such notices contain important safety information related to, for example, temperatures and voltages. For additional information on TI's environmental and/or safety programs, please visit www.ti.com/esh [4] or contact TI.
6. User assumes all responsibility, obligation, and any corresponding liability for proper and safe handling and use of EVMs.
7. Should any EVM not meet the specifications indicated in the user's guide or other documentation accompanying such EVM, the EVM may be returned to TI within 30 days from the date of delivery for a full refund. THE FOREGOING LIMITED WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY TI TO USER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. TI SHALL NOT BE LIABLE TO USER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES RELATED TO THE HANDLING OR USE OF ANY EVM.
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9. User assumes sole responsibility to determine whether EVMs may be subject to any applicable federal, state, or local laws and regulatory requirements (including but not limited to U.S. Food and Drug Administration regulations, if applicable) related to its handling and use of EVMs and, if applicable, compliance in all respects with such laws and regulations.
10. User has sole responsibility to ensure the safety of any activities to be conducted by it and its employees, affiliates, contractors or designees, with respect to handling and using EVMs. Further, user is responsible to ensure that any interfaces (electronic and/or mechanical) between EVMs and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard.
11. User shall employ reasonable safeguards to ensure that user's use of EVMs will not result in any property damage, injury or death, even if EVMs should fail to perform as described or expected.

12. User shall be solely responsible for proper disposal and recycling of EVMs consistent with all applicable federal, state, and local requirements

Certain Instructions

User shall operate EVMs within TI's recommended specifications and environmental considerations per the user's guide, accompanying documentation, and any other applicable requirements. Exceeding the specified ratings (including but not limited to input and output voltage, current, power, and environmental ranges) for EVMs may cause property damage, personal injury or death. If there are questions concerning these ratings, user should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the applicable 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 60°C as long as the input and output are maintained at a normal ambient operating temperature. These components include but are not limited to linear regulators, switching transistors, pass transistors, and current sense resistors which can be identified using EVMs' schematics located in the applicable EVM user's guide. When placing measurement probes near EVMs during normal operation, please be aware that EVMs may become very warm. As with all electronic evaluation tools, only qualified personnel knowledgeable in electronic measurement and diagnostics normally found in development environments should use EVMs.

Agreement to Defend, Indemnify and Hold Harmless

User agrees to defend, indemnify, and hold TI, its directors, officers, employees, agents, representatives, affiliates, licensors and their representatives harmless from and against any and all claims, damages, losses, expenses, costs and liabilities (collectively, "Claims") arising out of, or in connection with, any handling and/or use of EVMs. User's indemnity shall apply whether Claims arise under law of tort or contract or any other legal theory, and even if EVMs fail to perform as described or expected.

Safety-Critical or Life-Critical Applications

If user intends to use EVMs in evaluations of safety critical applications (such as life support), and a failure of a TI product considered for purchase by user for use in user's product would reasonably be expected to cause severe personal injury or death such as devices which are classified as FDA Class III or similar classification, then user must specifically notify TI of such intent and enter into a separate Assurance and Indemnity Agreement.

8.2 RADIO FREQUENCY REGULATORY COMPLIANCE INFORMATION FOR EVALUATION MODULES

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Texas Instruments Incorporated (TI) evaluation boards, kits, and/or modules (EVMs) and/or accompanying hardware that is marketed, sold, or loaned to users may or may not be subject to radio frequency regulations in specific countries.

General Statement for EVMs Not Including a Radio

For EVMs not including a radio and not subject to the U.S. Federal Communications Commission (FCC) or Industry Canada (IC) regulations, TI intends EVMs to be used only for engineering development, demonstration, or evaluation purposes. EVMs are not finished products typically fit for general consumer use. EVMs may nonetheless generate, use, or radiate radio frequency energy, but have not been tested for compliance with the limits of computing devices pursuant to part 15 of FCC or the ICES-003 rules. Operation of such EVMs 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.

General Statement for EVMs Including a Radio

User Power/Frequency Use Obligations: For EVMs including a radio, the radio included in such EVMs is intended for development and/or professional use only in legally allocated frequency and power limits. Any use of radio frequencies and/or power availability in such EVMs and their development application(s) must comply with local laws governing radio spectrum allocation and power limits for such EVMs. It is the user's sole responsibility to only operate this radio in legally acceptable frequency space and within legally mandated power limitations. Any exceptions to this are strictly prohibited and unauthorized by TI unless user has obtained appropriate experimental and/or development licenses from local regulatory authorities, which is the sole responsibility of the user, including its acceptable authorization.

U.S. Federal Communications Commission Compliance**For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant Caution**

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Changes or modifications could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at its own expense.

FCC Interference Statement for Class B EVM devices

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Industry Canada Compliance (English)**For EVMs annotated as IC – INDUSTRY CANADA Compliant**

This Class A or B digital apparatus complies with Canadian ICES-003.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Concerning EVMs Including Radio Transmitters

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concerning EVMs Including Detachable Antennas

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Canada Industry Canada Compliance (French)

Cet appareil numérique de la classe A ou B est conforme à la norme NMB-003 du Canada

Les changements ou les modifications pas expressément approuvés par la partie responsable de la conformité ont pu vider l'autorité de l'utilisateur pour actionner l'équipement.

Concernant les EVMs avec appareils radio

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concernant les EVMs avec antennes détachables

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.

Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

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8.3 Important Notice for Users of EVMs Considered "Radio Frequency Products" in Japan

NOTE: These EVM terms and conditions can be downloaded in PDF format.

EVMS entering Japan are NOT certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If user uses EVMS in Japan, user is required by Radio Law of Japan to follow the instructions below with respect to EVMS:

1. Use EVMS in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry's Rule for Enforcement of Radio Law of Japan,
2. Use EVMS only after user obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMS, or
3. Use of EVMS only after user obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMS. Also, do not transfer EVMS, unless user gives the same notice above to the transferee. Please note that if user does not follow the instructions above, user will be subject to penalties of Radio Law of Japan.

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