LeopardBoard with VGA Camera Board

LeopardBoard Hardware Guide

Rev. 1.1

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The kit can't be returned, it can be exchanged if it is defect.

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What's included?

1.   This section is a description of what comes in the box when the LeopardBoard is purchased and Optional Parts provided for purchasing. See Figure 1

Figure 1. LeopardBoard in Box

NOTE: Standard package only includes LeopardBoard and VGA Camera Board; all other optional parts are sold separately.
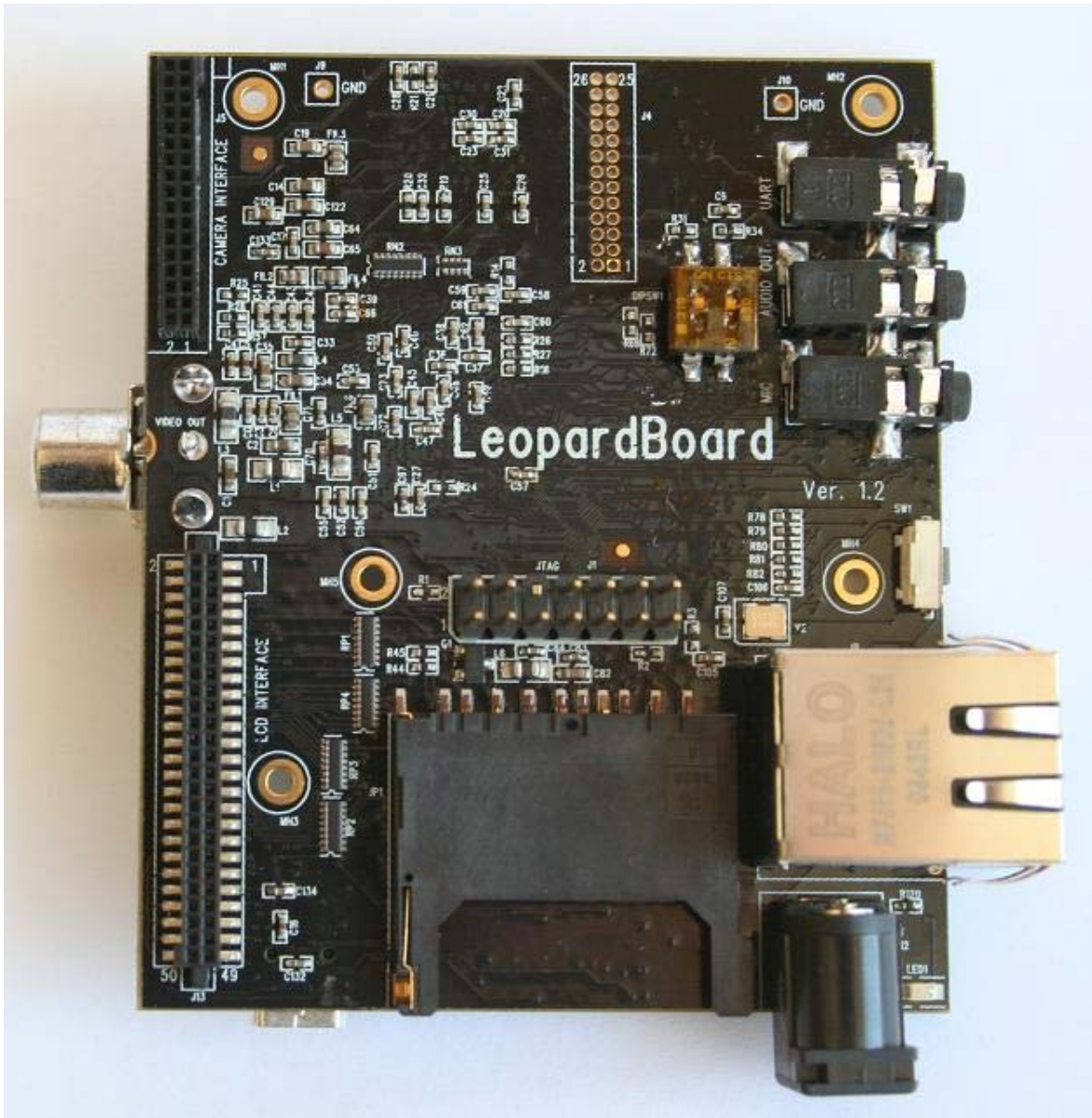
1.1   LeopardBoard, see Figure 2.

Figure 2. LeopardBoard

1.2   VGA Camera Board, see Figure 3.
- Part number: **LI-LBCMVGA**
- Sensor: Micron/Aptina 1/11" CMOS Sensor MT9V113
- # of Pixels: VGA (648 x 488 pixels)
- Output Data Format: YUV (YCbCr)
- Optical Filter: Infrared Coating at 650nm+/-10nm
- Focal Length, F#: f=1.34+/-0.1mm, F2.8+/-5%
- Vertical View Angle: 660
- Focus Distance: 40cm+/-2cm
- Focus Range: 20cm to Infinity
- RoHS Compliance
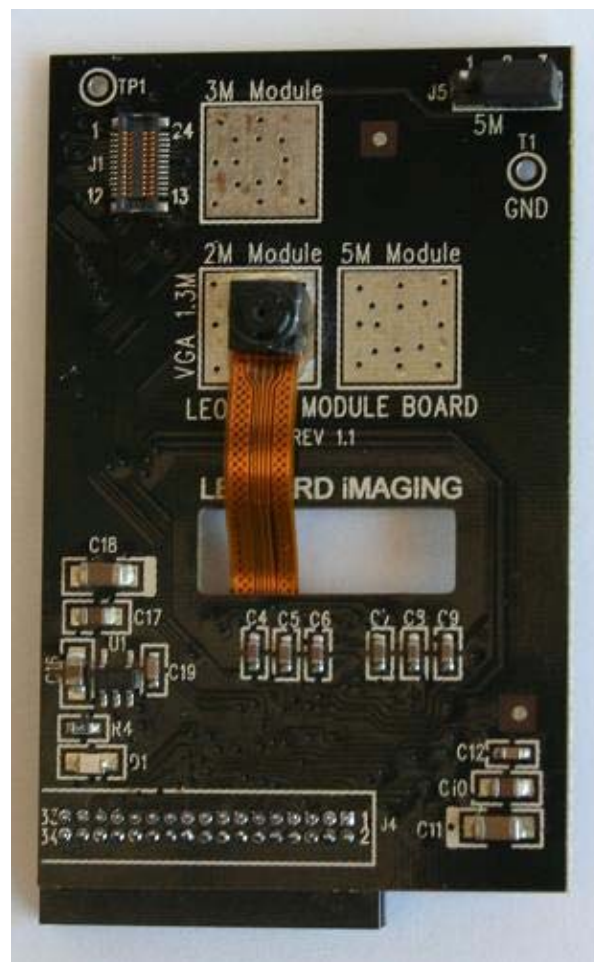- **Higher Resolution Camera Board, see 1.3.5 for Optional Boards**

Figure 3. VGA Camera Board

1.3   Optional Parts, not included in the package, these parts have to be purchased separately

1.3.1   Serial Cable, see Figure 4.
- Part number: LI-SER-01
- One end is Female DB9 connector
- Another end is 2.5mm Stereo Plug connector
- Cable Length: 70"

Figure 4. Serial Cable

1.3.2   +5VDC Power Adapter, see Figure 5.

- Part number: **LI-PS5-01**

- Wall Mount AC/DC Switching Power Supply (2-prong)

- Universal AC Input

- Power Input Frequency: 50/60Hz

- DC Output: 5VDC@2.5A

- Polarization: Positive Center

- Cord Plug: 2.1mm I.D. x 5.5mm O.D. x 12mm Female

- Cable length: 43"

Figure 5. +5VDC Power Adapter

1.3.3   Mini-B USB Cable, see Figure 6.

- Part number: **LI-USB-01**
- One end: Mini-B
- One end: Type-A

Figure 6. Mini-B USB Cable

1.3.4   Composite Video Cable, see Figure 7
- Part number: **LI-VIC-01**

Figure 7. Composite Video Cable

1.3.5   Higher Resolution Camera Boards
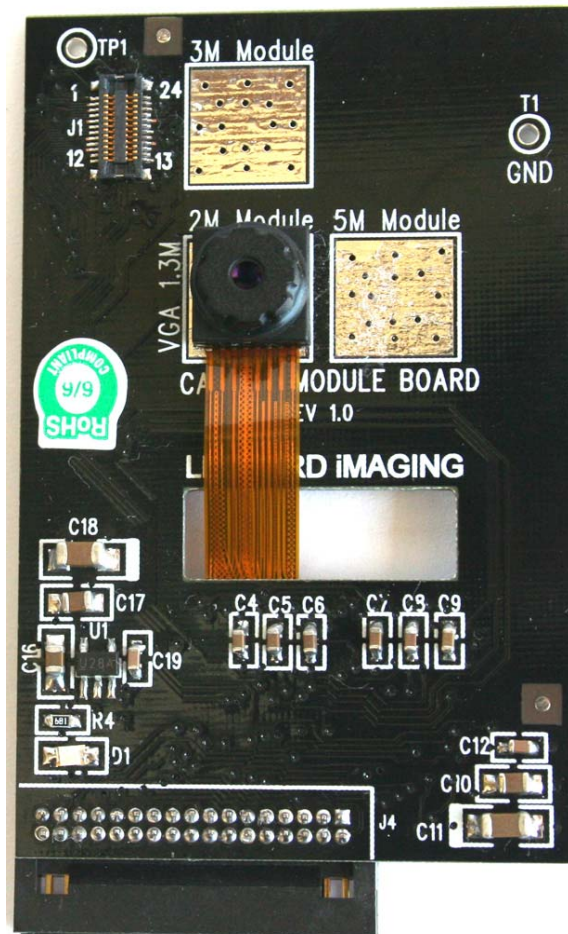
1.3.5.1   1.3 Mega-pixel Camera Board, see Figure 8
- Part number: LI-LBCM1M1
- Sensor: Aptina 1/4" CMOS Sensor MT9M112
- # of Pixels: 1.3Mega (1280 x 1024 pixels)
- Output Data Format: YUV (YCbCr)
- Optical Filter: Infrared Coating at 650nm+/-10nm
- Focal Length, F#: f=4+/-0.1mm, F2.0+/-5%
- Vertical View Angle: 59.30
- Focus Distance: 120cm+/-2cm
- Focus Range: 60cm to Infinity
- RoHS compliance

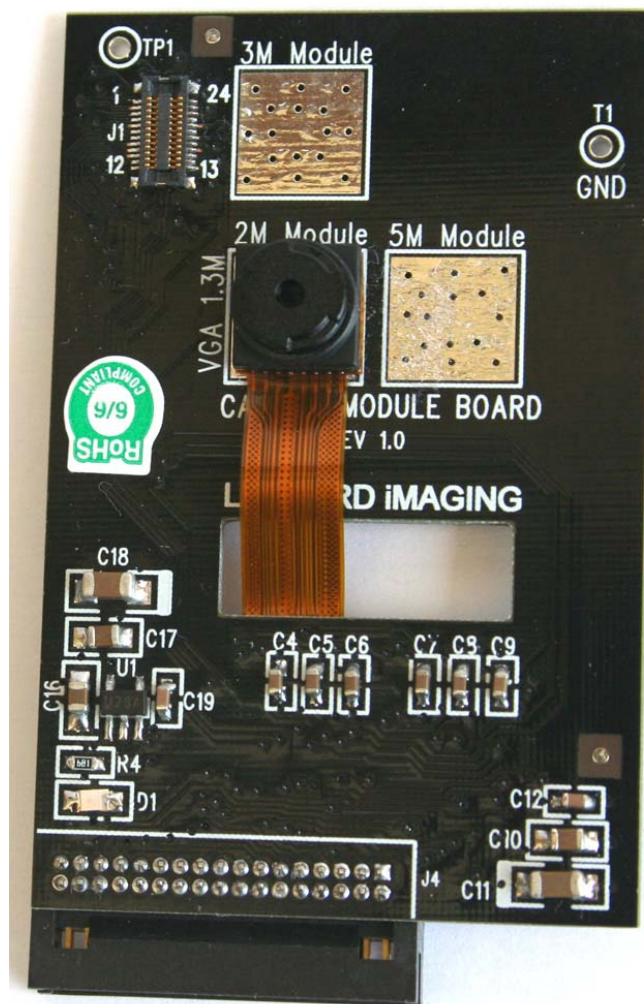**Figure 8. 1.3M Camera Board**

1.3.5.2   2 Mega-pixel Camera Board, see Figure 9

o   Part number: **LI-LBCM2M1**
o   Sensor: Aptina 1/4" CMOS Sensor MT9D112
o   # of Pixels: 2Mega (1600 x 1200 pixels)
o   Output Data Format: YUV (YCbCr)
o   Optical Filter: Infrared Coating at 650nm+/-10nm
o   Focal Length, F#: f=3.79+/-0.1mm, F2.0+/-5%
o   Vertical View Angle: 610
o   Focus Distance: 120cm+/-2cm
o   Focus Range: 60cm to Infinity
o   RoHS Compliance

Figure 9. 2M Camera Board

1.3.5.3   3 Mega-pixel Camera Board, see Figure 10

- o   Part number: LI-LBCM3M1
- o   Sensor: Aptina 1/4" CMOS Sensor MT9T111
- o   # of Pixels: 3Mega (2048 x 1536 pixels)
- o   Output Data Format: YUV (YCbCr)
- o   Optical Filter: Infrared Coating at 650nm+/-10nm
- o   Focal Length, F#: f=3.78+/-0.1mm, F2.8+/-5%
- o   Vertical View Angle: 61.40
- o   Focus Distance: 120cm+/-2cm
- o   Focus Range: 60cm to Infinity
- o   RoHS Compliance

Figure 10. 3M Camera Board

1.3.5.4   5 Mega-pixel Camera Board, see Figure 11

- Part number: LI-LBCM5M1
- Sensor: Aptina 1/2.5" CMOS Sensor MT9P011
- # of Pixels: 5Mega (2592 x 1944 pixels)
- Output Data Format: RGB
- Optical Filter: Infrared Coating at 650nm+/-10nm
- Focal Length, F#: f=6.12+/-0.1mm, F2.8+/-5%
- Vertical View Angle: 60.30
- Focus Distance: 120cm+/-2cm
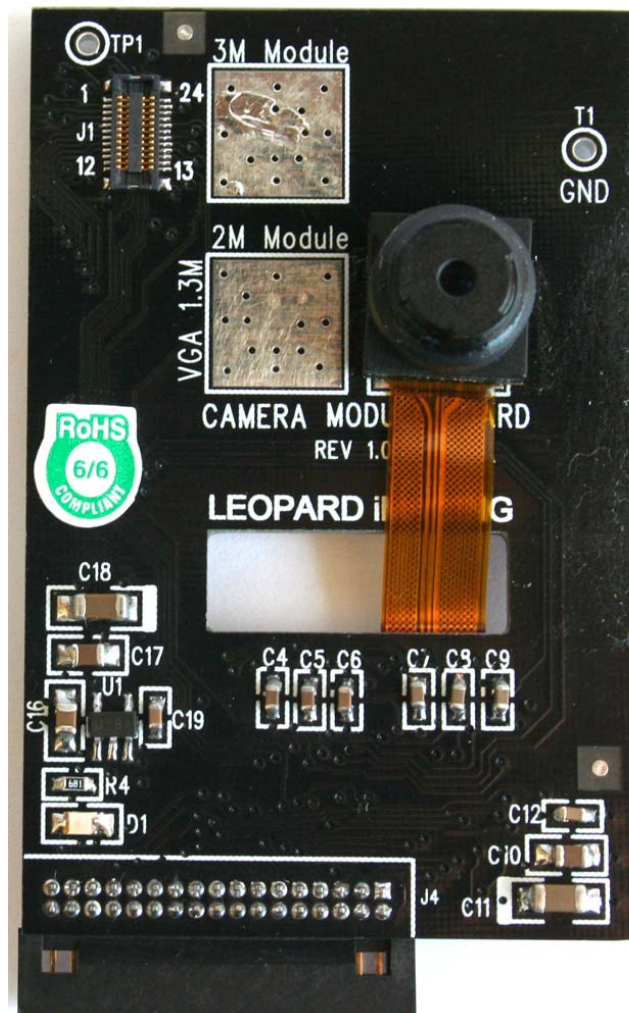- Focus Range: 60cm to Infinity
- RoHS Compliance

Figure 11. 5M Camera Board

Leopard Board Specification

2.   This section covers the specifications of the LeopardBoard and it also provides a high level description of the major components and interfaces that make up the LeopardBoard.

2.1   LeopardBoard features

Table 1 provides a list of the LeopardBoard features.

	Features
Processor	TMS320DM355 Processor
NAND Flash	2Gb Micron NAND Flash (256MB)
DDR2 SDRAM	1Gb Micron DDR2 SDRAM (128MB)
Camera Interface	VGA CMOS Image Sensor by Default, Optional: 1.3M, 2M, 3M and 5 Mega-pixel CMOS Sensors supported
Audio In/Out	AIC3104I Audio chip, Stereo Audio In/Out, 2.5mm Stereo Plug connector
JTAG Port	JTAG Debugging Port
Serial Port RS-232	UART Debugging Port, 2.5mm Stereo Plug connector
USB 2.0 Port	USB 2.0 HS (Device can be powered by USB port)
SD Card Slot	SD/MMC Slot
Power Management	TPS65053 Power management chip
Power Input	+5V Power Input, 2.1mm I.D. x 5.5mm O.D. x 12mm Female
Video Output Port	PAL/NTSC Output
Network Interface	10/100 Ethernet
LCD/DVI Interface	LCD/DVI Interface through adapter board
Expansion Port (Not Populated)	SD/MMC, I2C, UART, McBSP, GPIO, 3.3V power supply
PCB Board Mechanical	3" x 2.5" (76.2mm x 63.5mm)

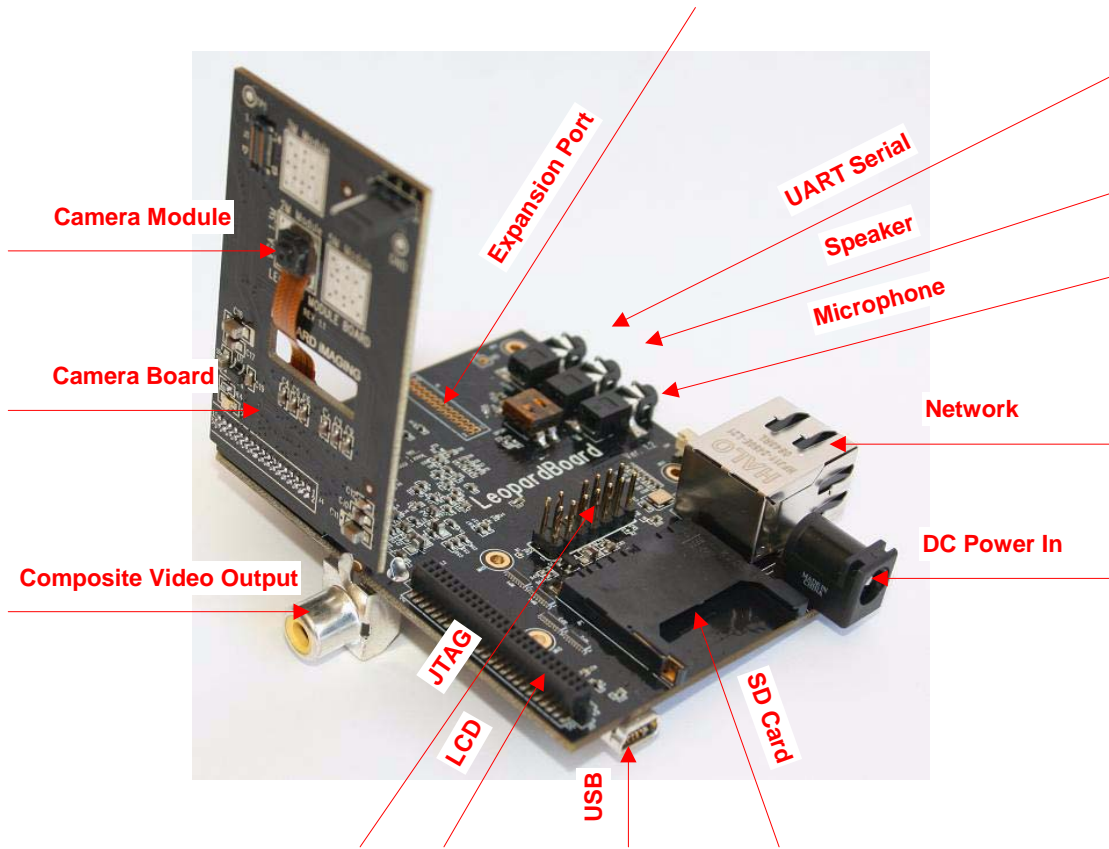## 2.2   LeopardBoard Function Block, see Figure 12

Figure 12. LeopardBoard Function Block

The following sections provide more detail on each feature and components on the LeopardBoard.

2.3   DM355 Processor

The LeopardBoard takes TMS320DM355 as its main processor. The DM355 is a highly integrated, programmable platform for digital still camera, digital photo frames, IP security cameras, video door bell application, and other low cost portable digital video applications. The DM355 combines high performance MPEG4 HD (720p) codecs and JPEG codecs up to 50M pixels per second, high quality, and low power consumption at a very low price point. The DM355 also enables seamless interface to most additional external devices required for a complete digital camera implementation. The interface is flexible enough to support various types of CCD and CMOS sensors, signal conditioning circuits, power management, DDR/mDDR

memory, SRAM, NAND, shutter, Iris and auto-focus motor controls, etc. The DM355 processor core is an ARM926EJ-S RISC processor. The ARM926EJ-S is a 32-bit processor core that performs 32-bit and 16-bit instructions and processes 32-bit, 16-bit, and 8-bit data. The core uses pipelining so that all parts of the processor and memory system can operate continuously. See Figure 13
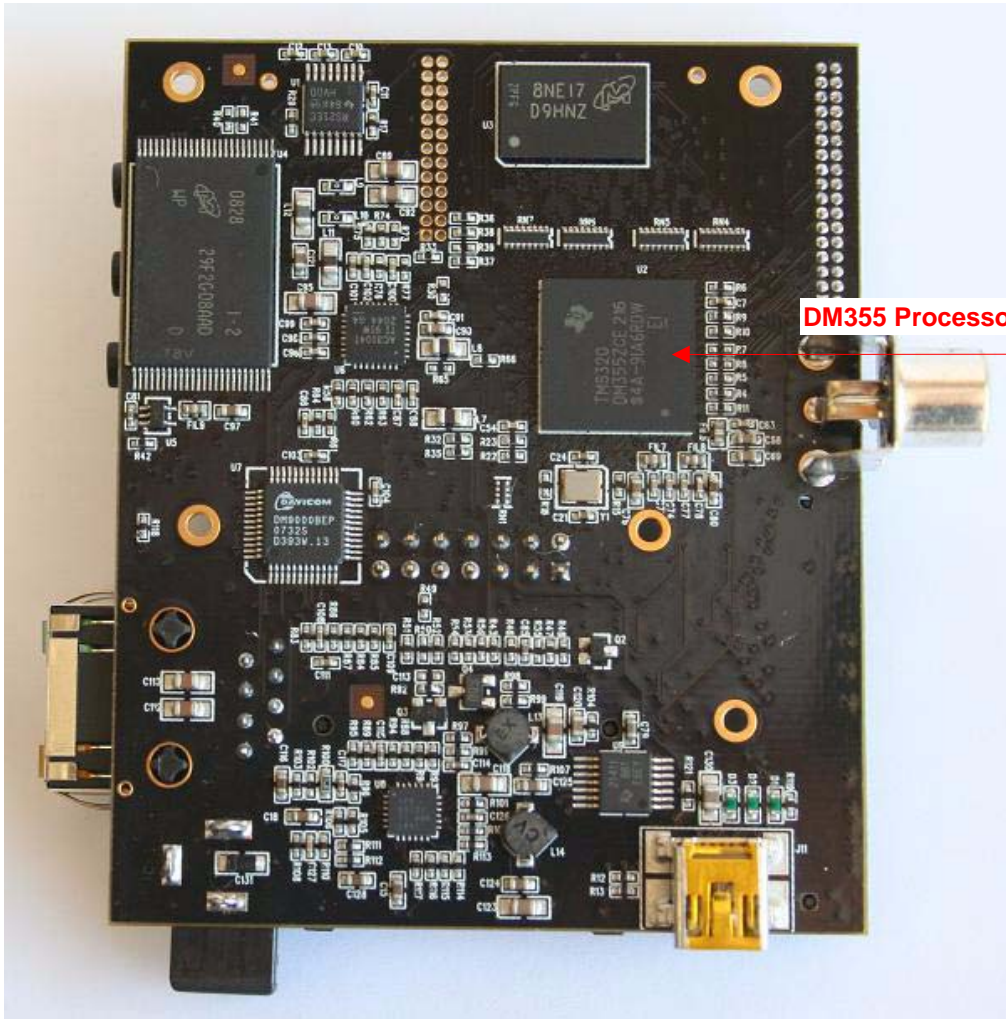

Figure 13. DM355 Processor

2.4   Flash Memory

The Micron Flash Memory is used in LeopardBoard, it is a +3.3V powered, 256M x 8-bit, 2Gb SLC NAND Flash. It is compatible with 1Gb NAND Flash, see Figure 14.
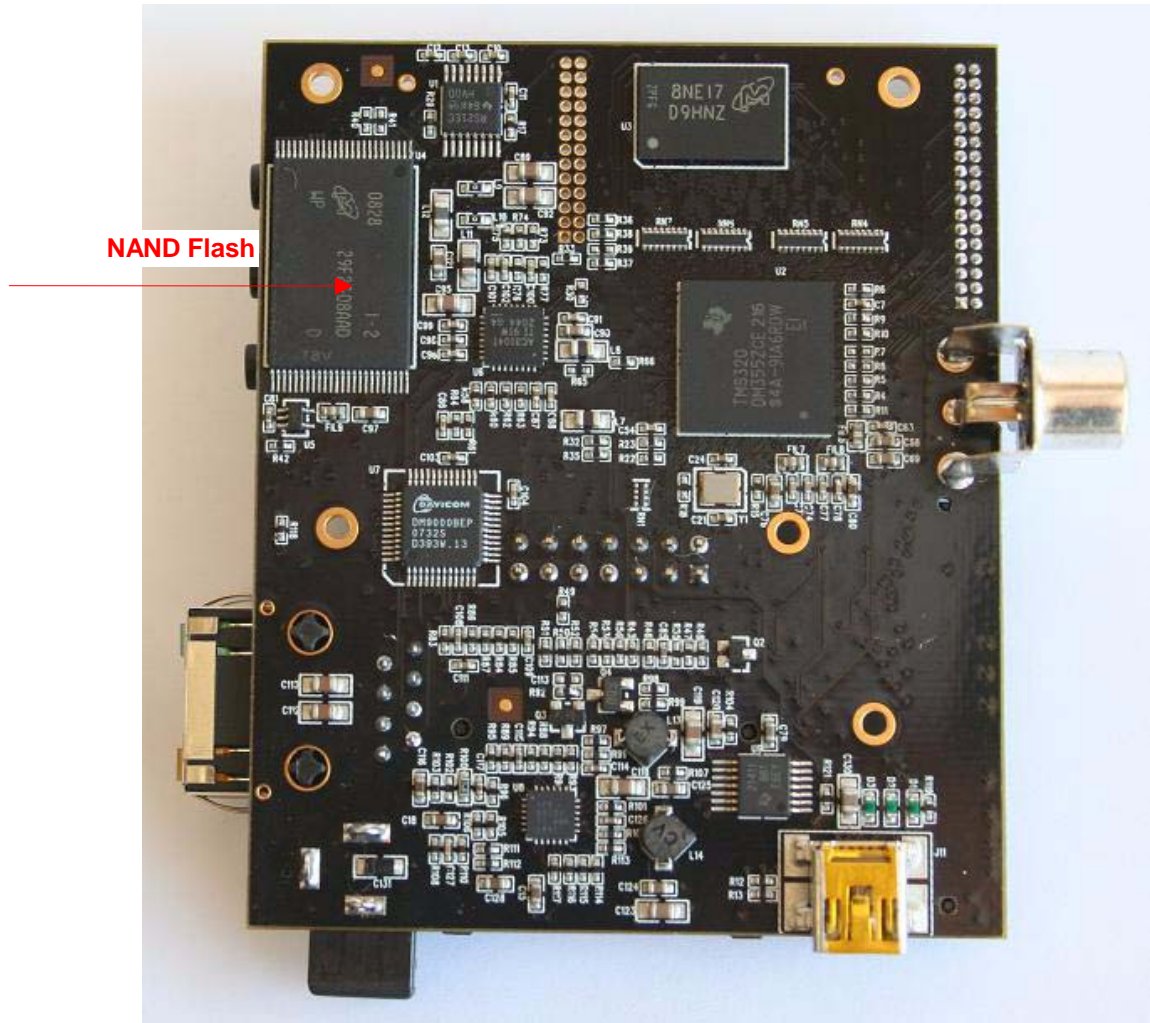
Figure 14. NAND Flash

2.5   DDR2 SDRAM

The Micron DDR2 SDRAM is used in LeopardBoard, it is a +3.3V powered, 8M x 16 x 8 banks, 1Gb DDR2 SDRAM, see Figure 15
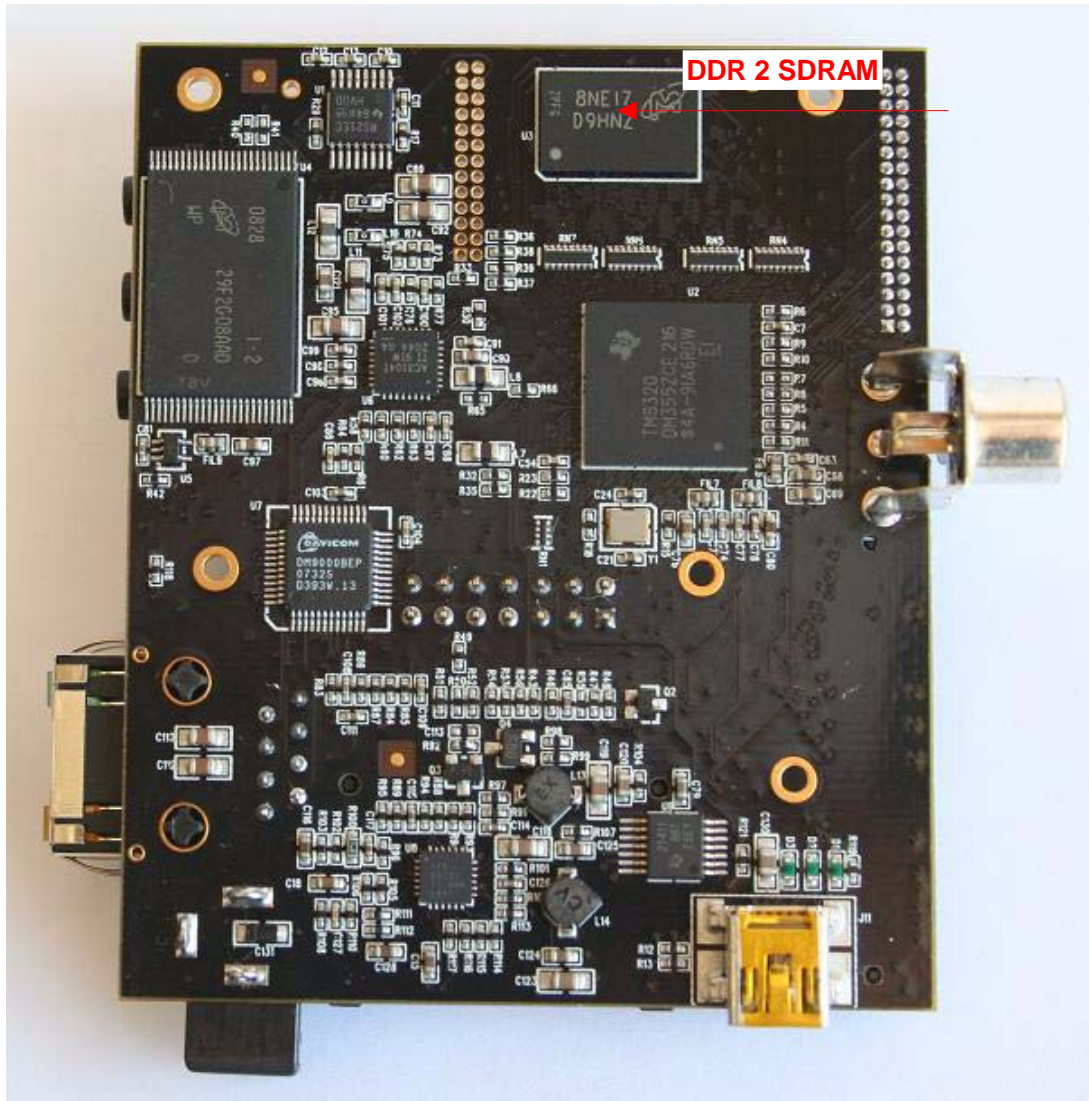
Figure 15. DDR2 SDRAM

2.6   Camera Interface

A VGA camera module board is included in LeopardBoard, which can provide VGA resolution, LeopardBoard supports wide range of CMOS Imagers from VGA, 1.3M, 2M, 3M to 5 Mega-pixel CMOS sensors, see Figure 16.
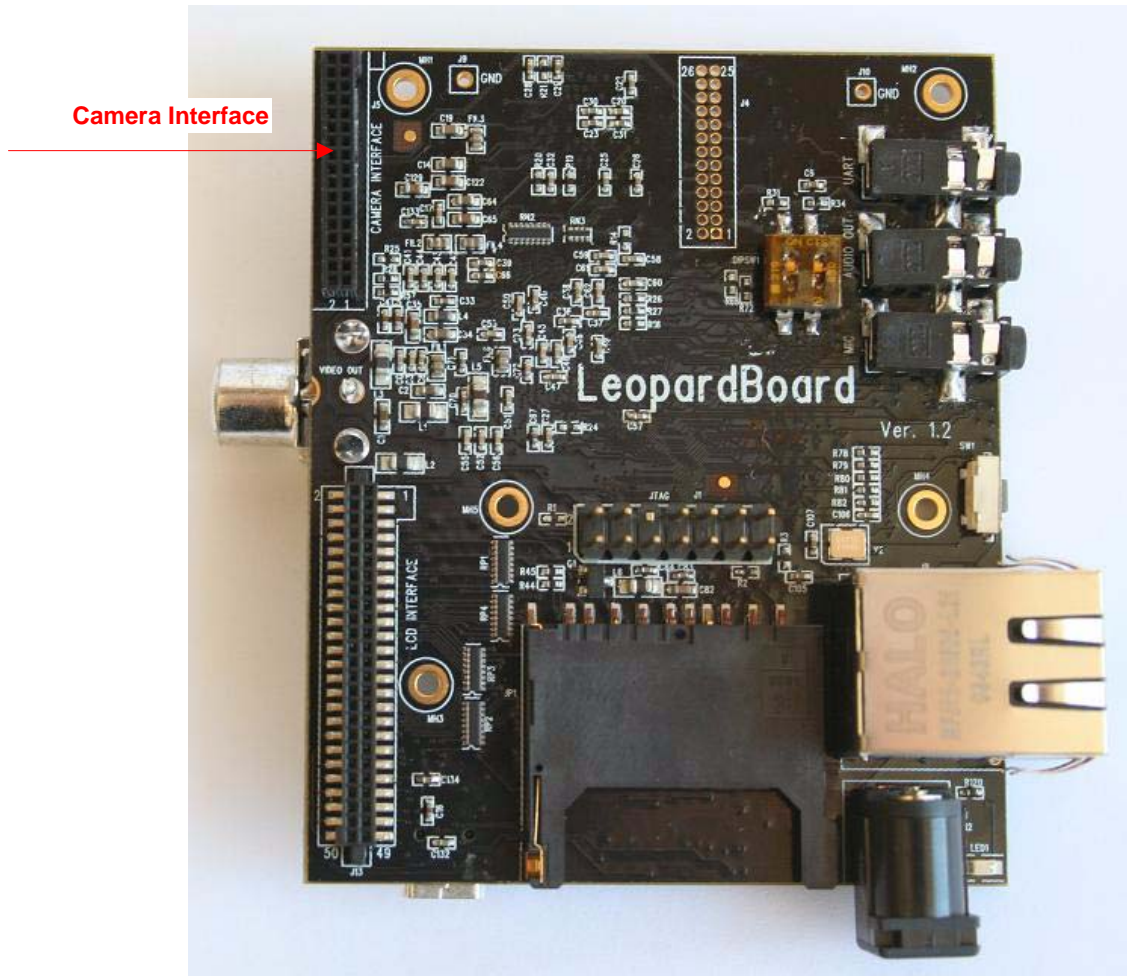
Figure 16. Camera Interface

2.7   Audio Input

Low power stereo audio CODEC TLV320AIC3104 is used in LeopardBoard; a 2.5mm standard stereo audio input jack is provided to receive stereo audio input to CODEC, see Figure 17.
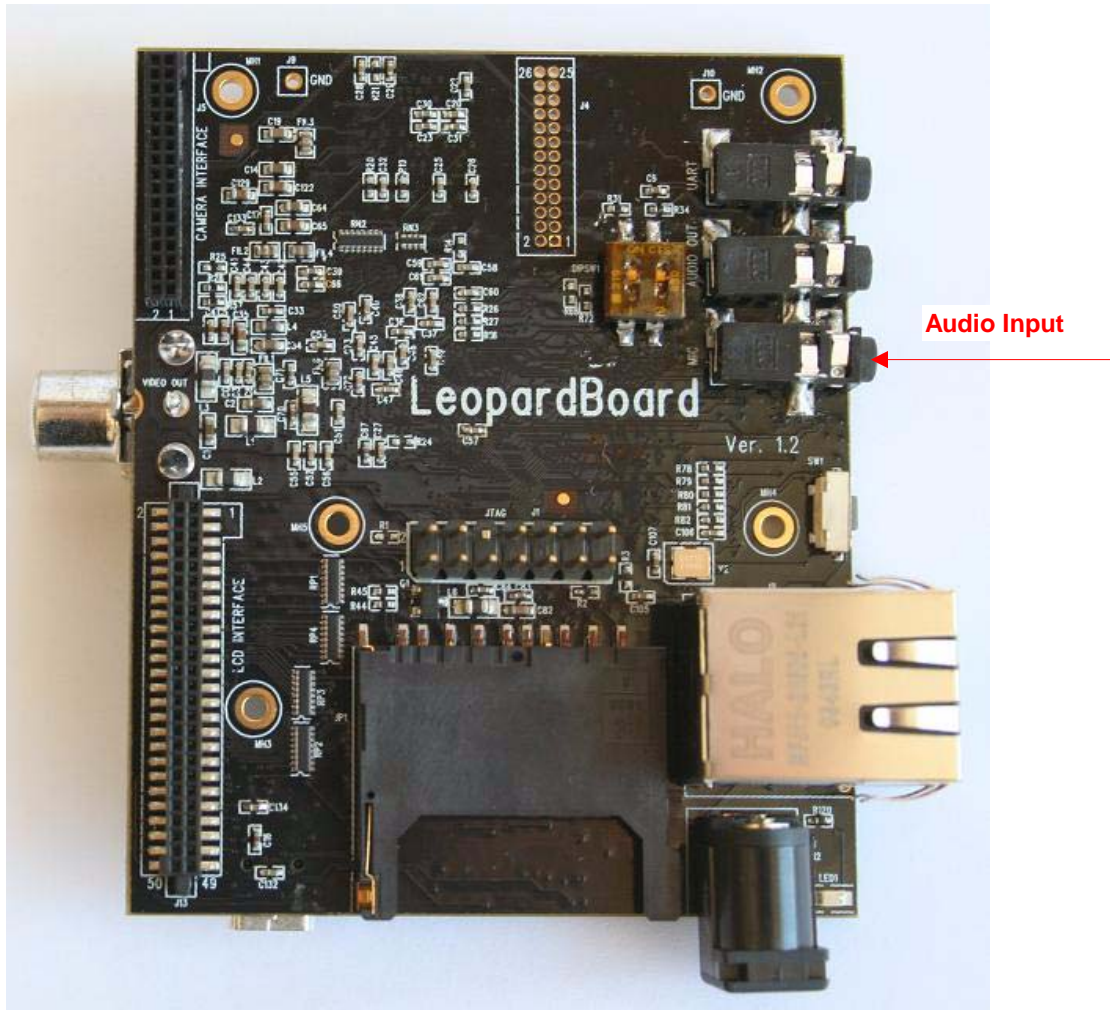
Figure 17. Audio Input

2.8   Audio Output

A 2.5mm standard stereo audio output jack is provided to access the stereo output of the onboard output CODEC, see Figure 18.
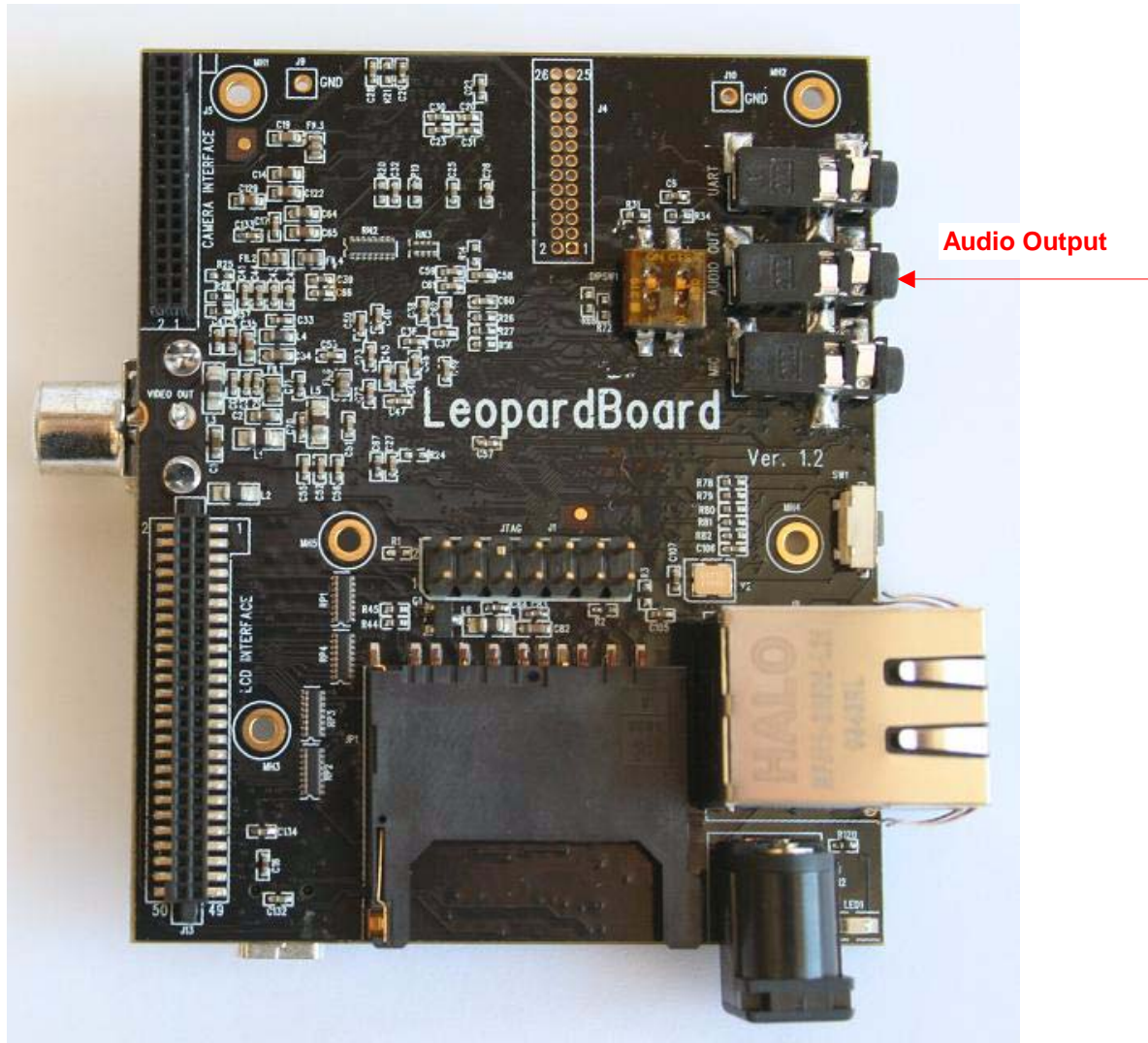
Figure 18. Audio Output

2.9   JTAG Port

A 14 pin JTAG header is provided on the LeopardBoard to facilitate the SW development and debugging of the board by using various JTAG emulators, see Figure 19.
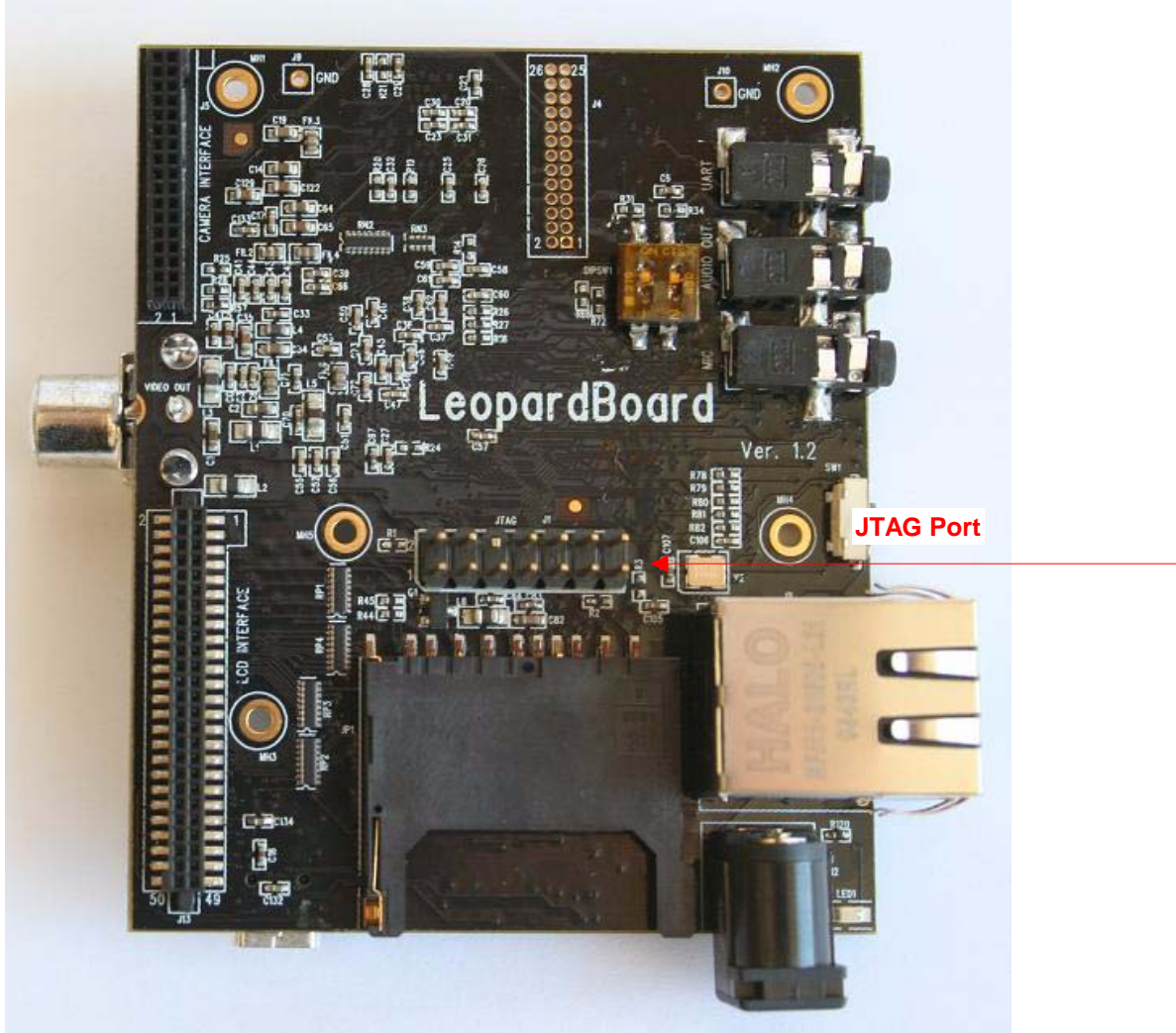
Figure 19. JTAG Connector

2.10   Serial Port: RS-232

Support for RS232 is provided by a 2.5mm stereo audio jack on the LeopardBoard for access to an onboard RS232 transceiver. It does require a 2.5mm stereo audio jack to DB9 Female converter cable, which is an accessory part, to access the serial port, see Figure 20.
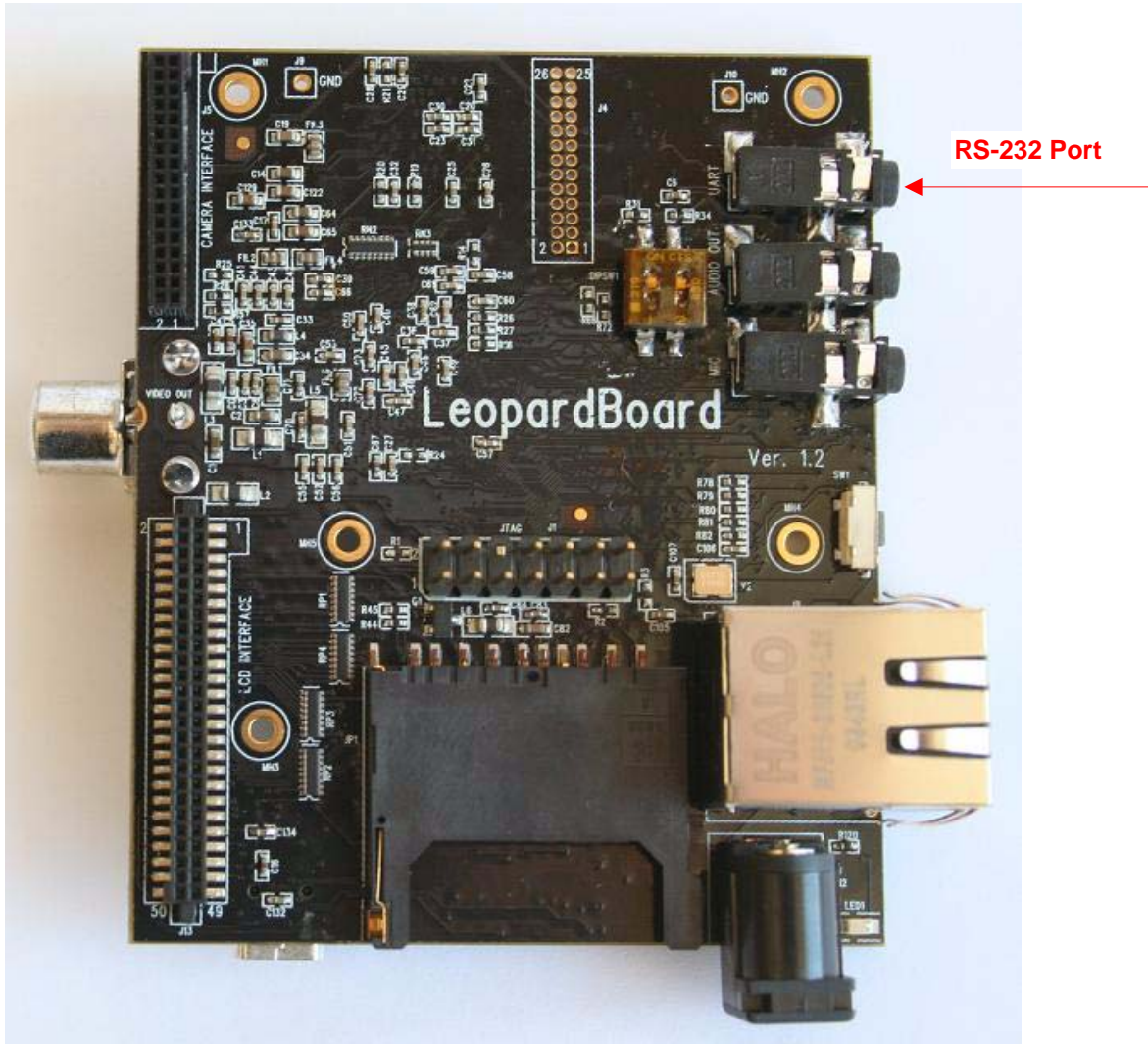
Figure 20. RS-232 Serial Port

2.11   USB 2.0 Port

The LeopardBoard requires a mini-B to USB type-A cable. LeopardBoard can be accessed through USB cable, there is an option to provide +5V power to the LeopardBoard if external +5V power supply is not used, see Figure 21.
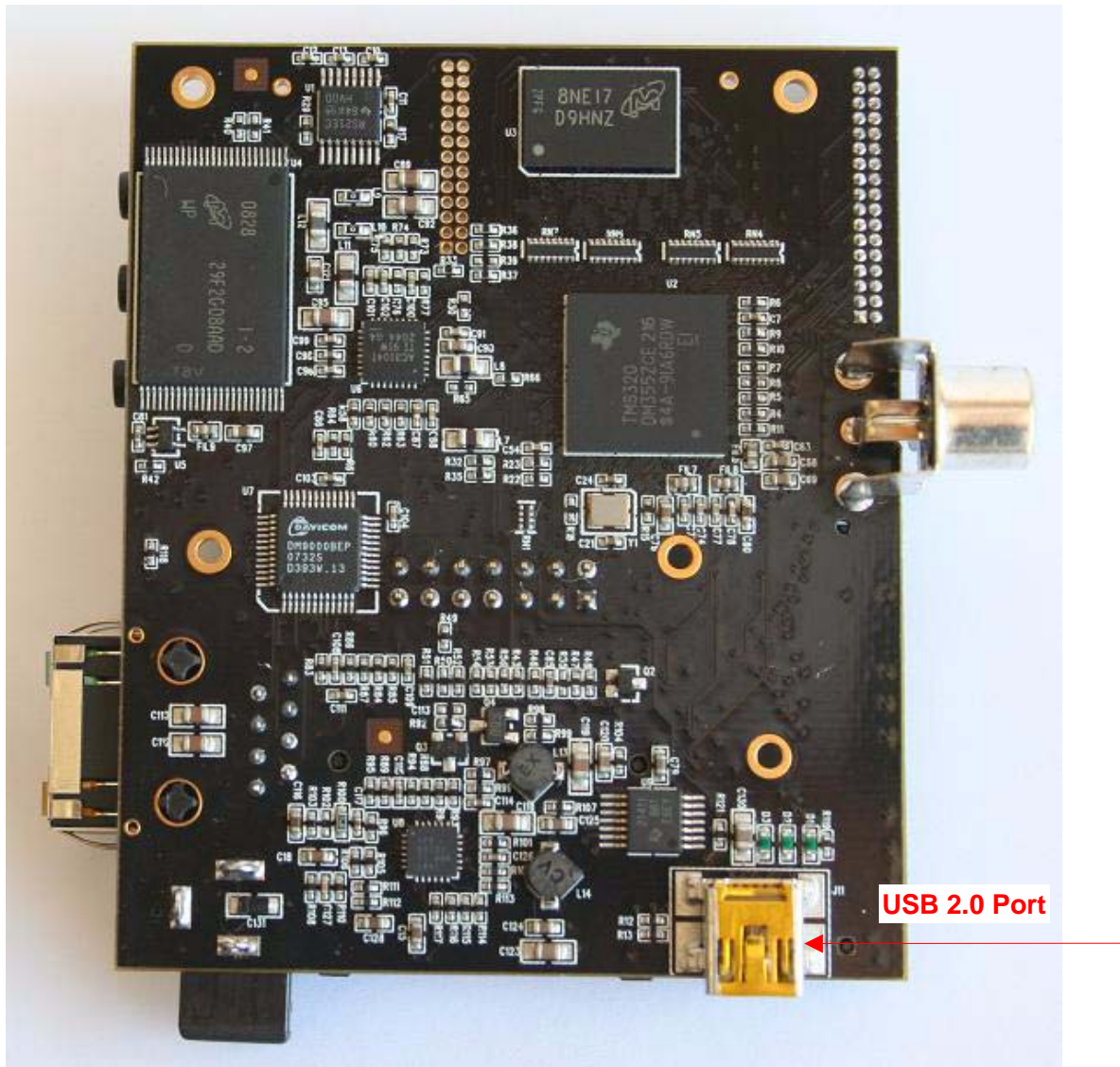

Figure 21. USB 2.0 Port

2.12   SD Card Slot

A SD Card connector is provided as a means for expansion and can support such devices, but not limited as SD memory card, miniSD card, GPS modules, WiFi card, and Bluetooth card, see Figure 22.
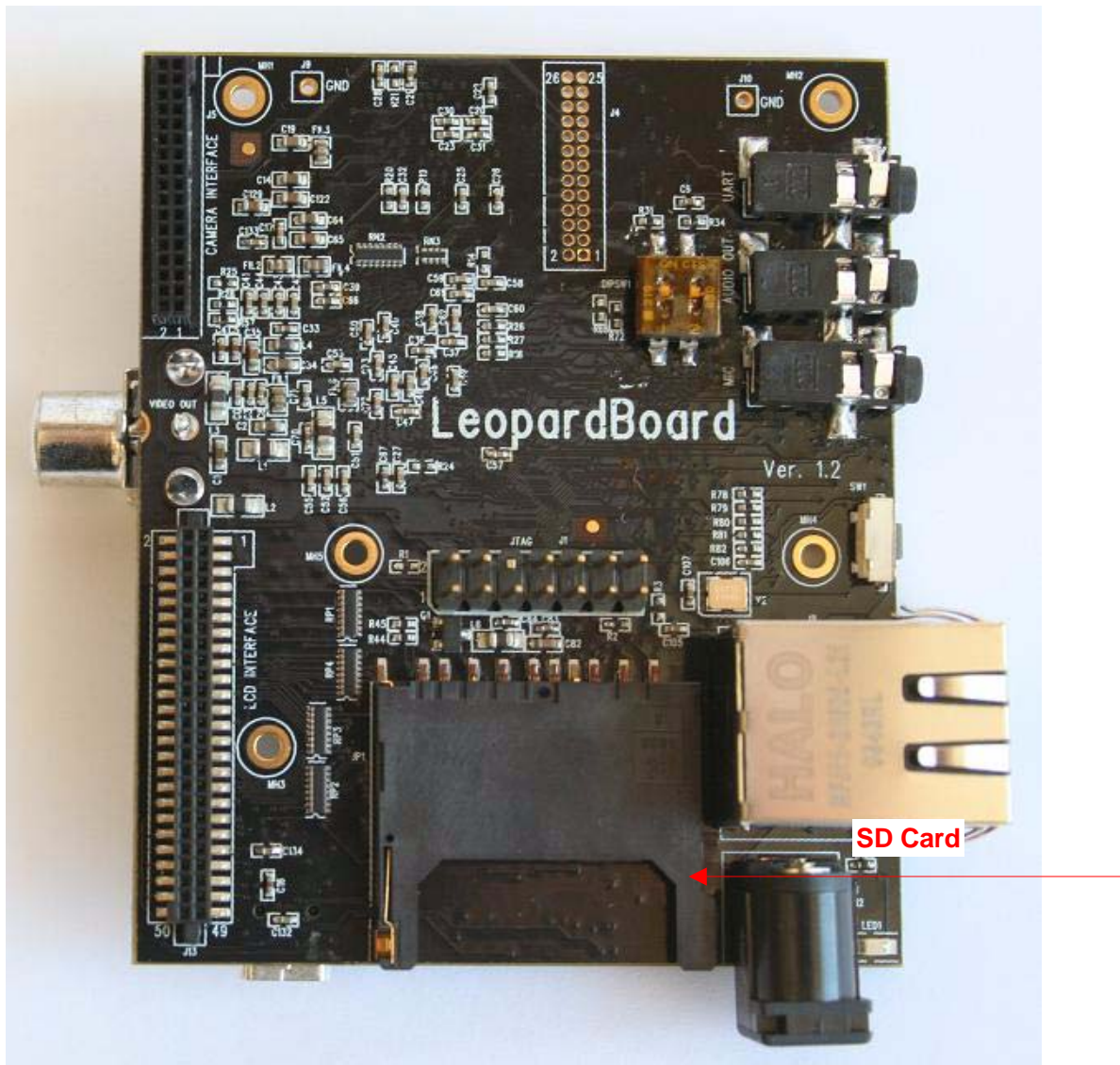

Figure 22. SD Card

2.13   Power Management

A powerful 5-Channel Power Management IC with two step down converters and 3 low-input voltage LDOs chip TPS65053 is provided in LeopardBoard. It serves all powers on the board, see Figure 23.
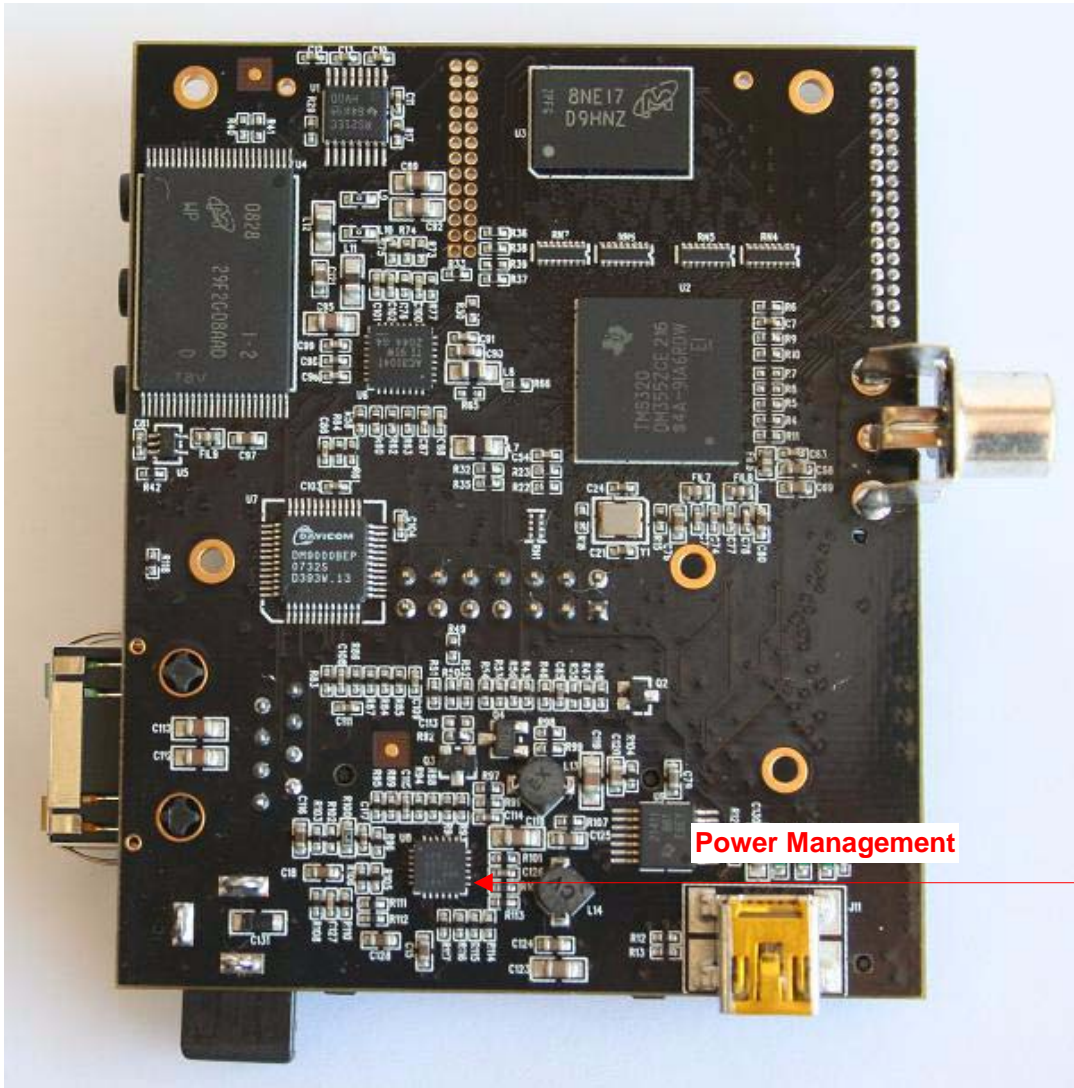

Figure 23. Power Management

2.14   Power Input

A 2.1mm standard power jack is provided in LeopardBoard for +5VDC power supply, the LeopardBoard power consumption is 2W, which includes camera board power consumption running at 720p @ 30fps.

A standard 2.1mm jack wall supply is needed, which is an accessory part, power can also be supplied via the USB connector as an alternative supply,

When external power supply is provided, it will remove the power path from the USB connector.

DO NOT plug in anything but 5V to the power jack, or the board will be possibly damaged although the board has over voltage protection function, see Figure 24.
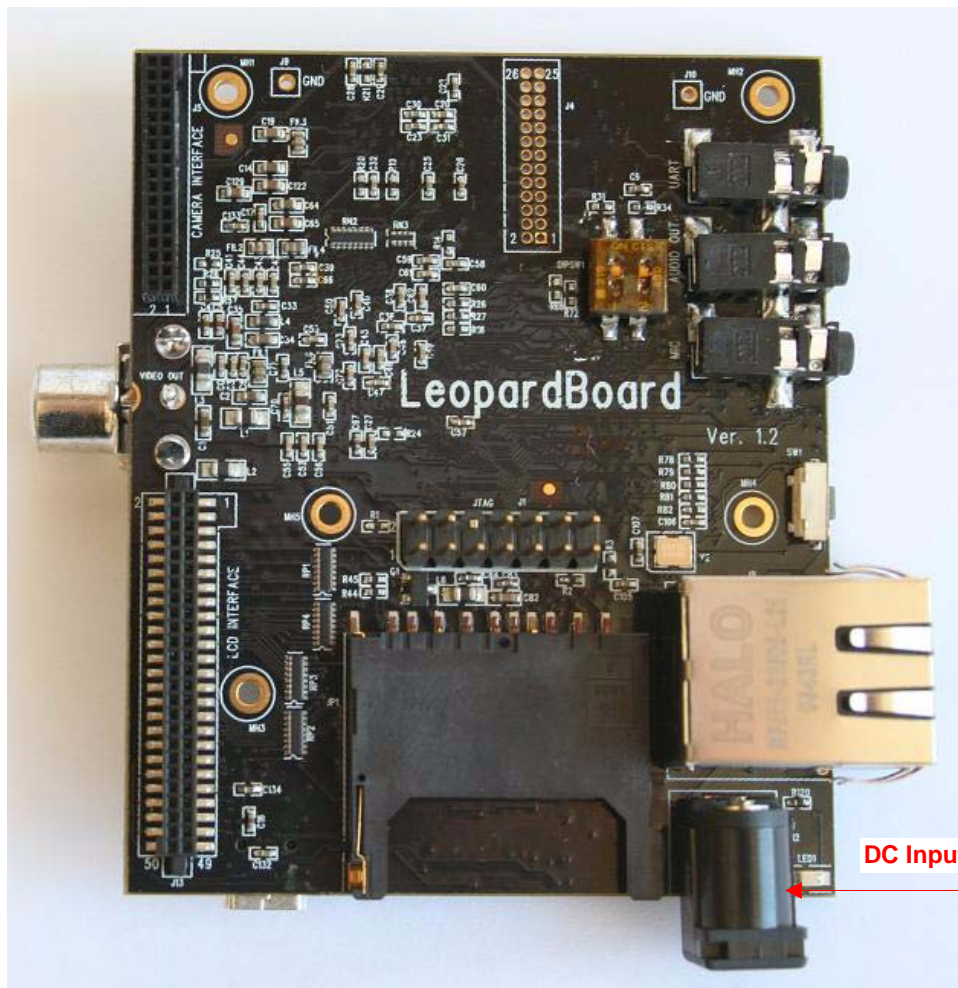

Figure 24. DC Input

2.15   Video Output Port

A video jack is provided to access composite video output of LeopardBoard. It supports NTSC or PAL format output to a standard TV. The default is NTSC, but can be switched to PAL by software, see Figure 25.
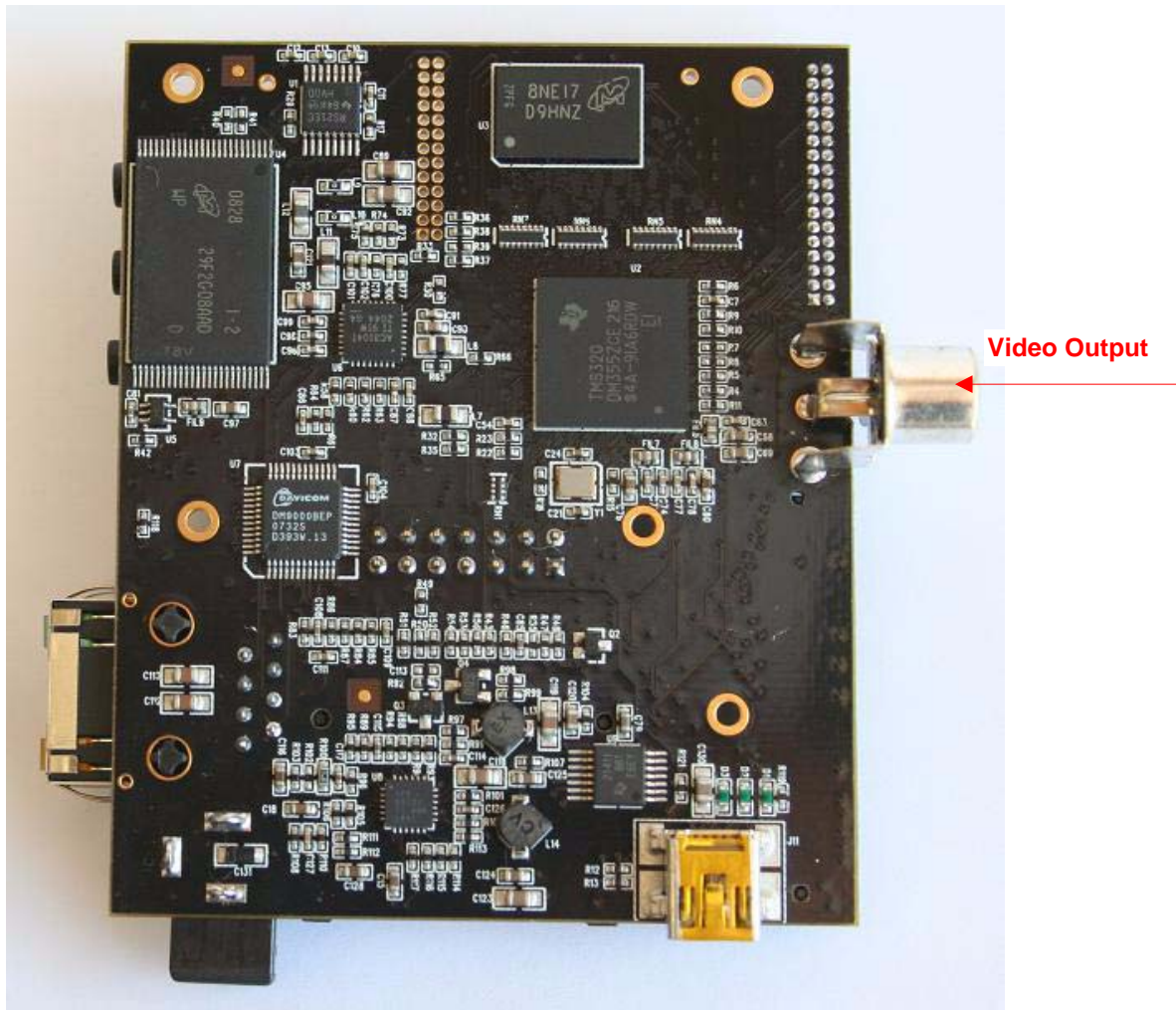

Figure 25. Video Output

2.16   Network Interface

Network is provided in LeopardBoard, this is a standard RJ-45 connector for 10/100 Mbps Ethernet networks, see Figure 26.
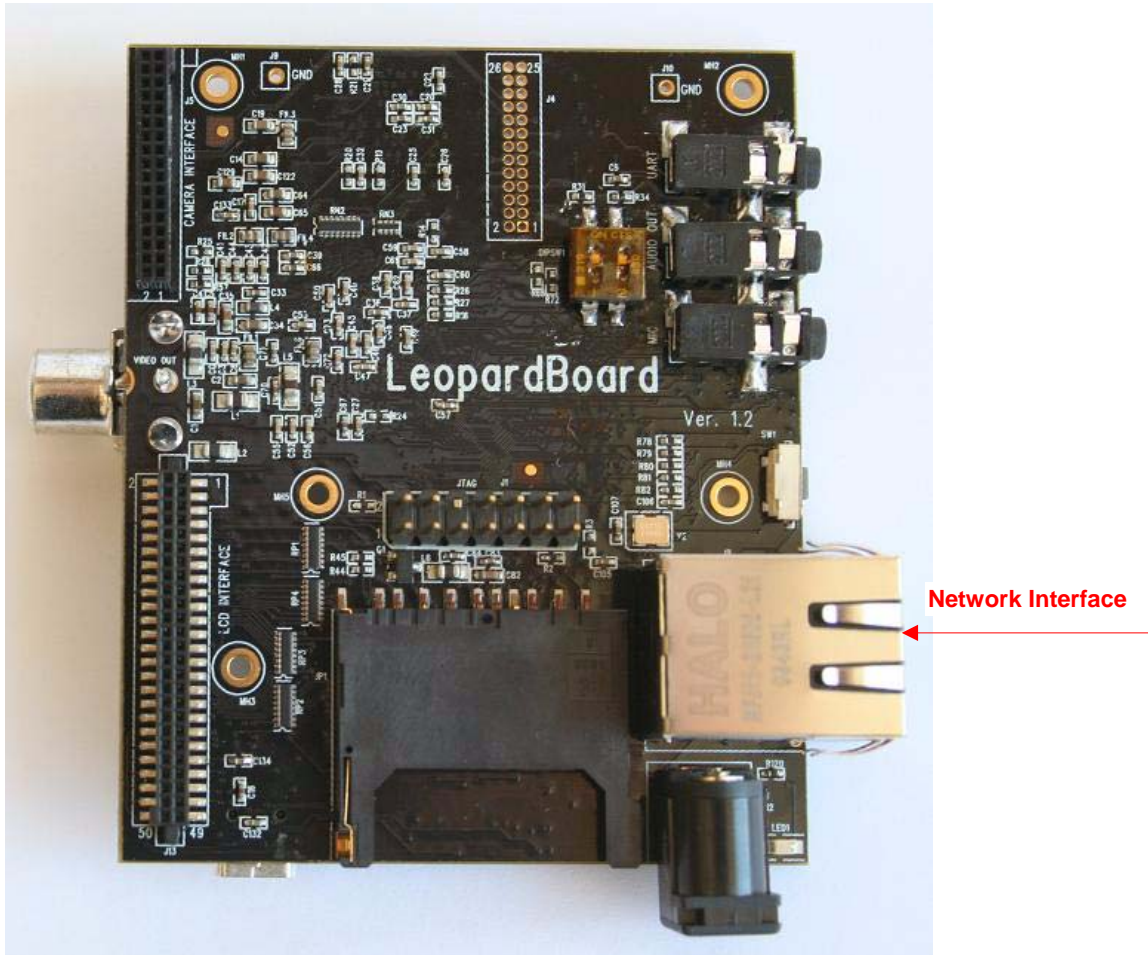

Figure 26. Network Interface

2.17 LCD/DVI Interface

LeopardBoard provides a 50-pin connector, which is fully compatible with DM355EVM expansion connector; it supports LCD daughter card or DVI daughter card, see Figure 27.
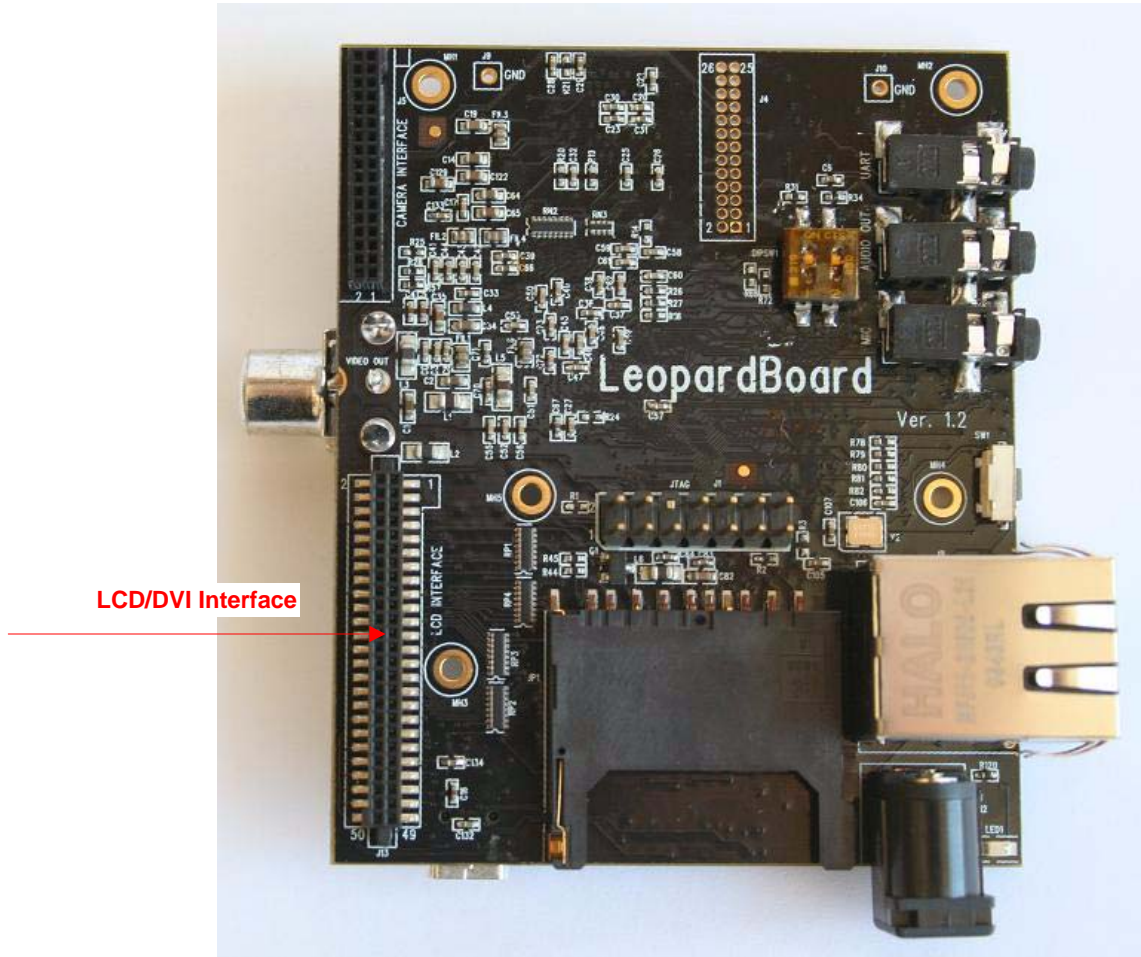

Figure 27. LCD/DVI Interface

2.18   Expansion Port

A 26-pin connector is provided as expansion port to support the following functions, see Figure 28.

- SD/MMC
- I2C
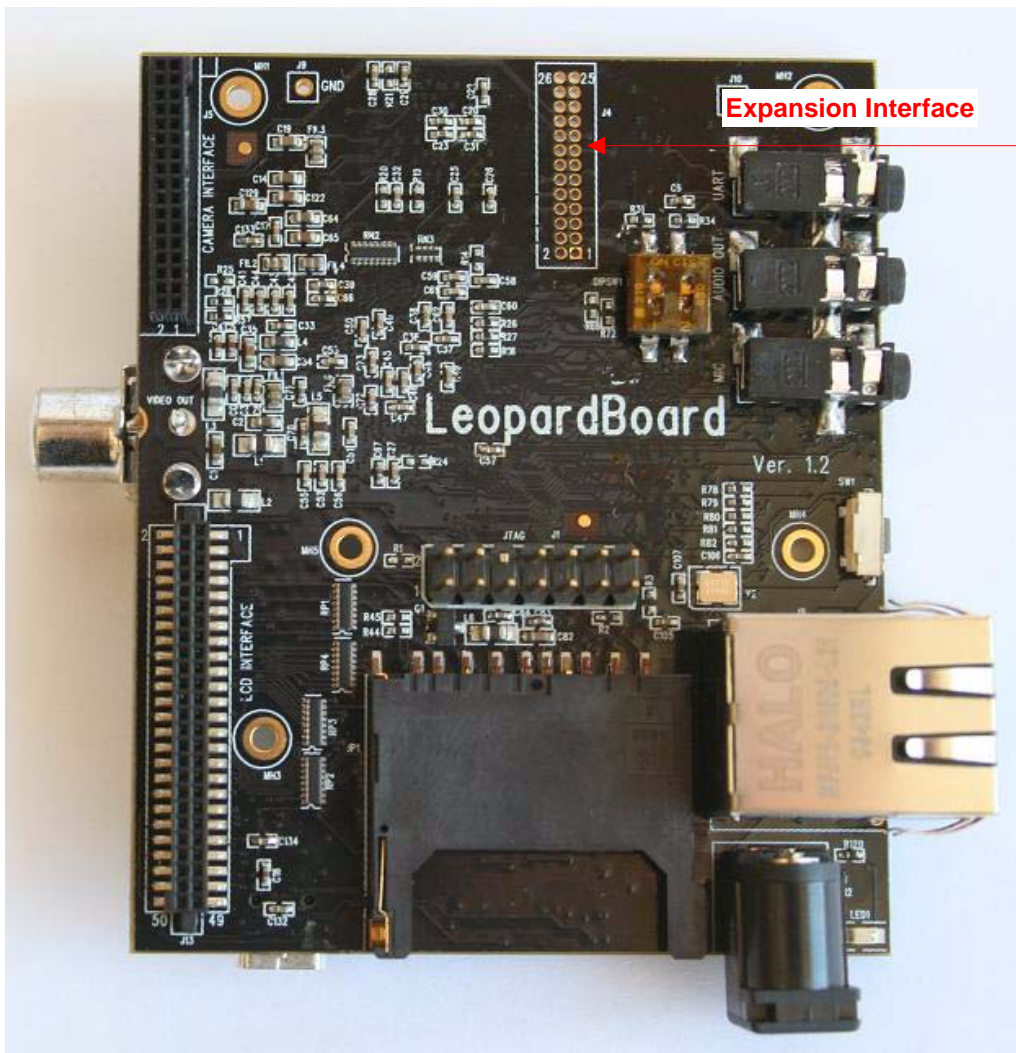- UART
- McBSP
- GPIO
- 3.3V power supply.

Figure 28. Expansion Interface

2.19   Reset Button

Reset button can reset board to power-up status. See Figure 29

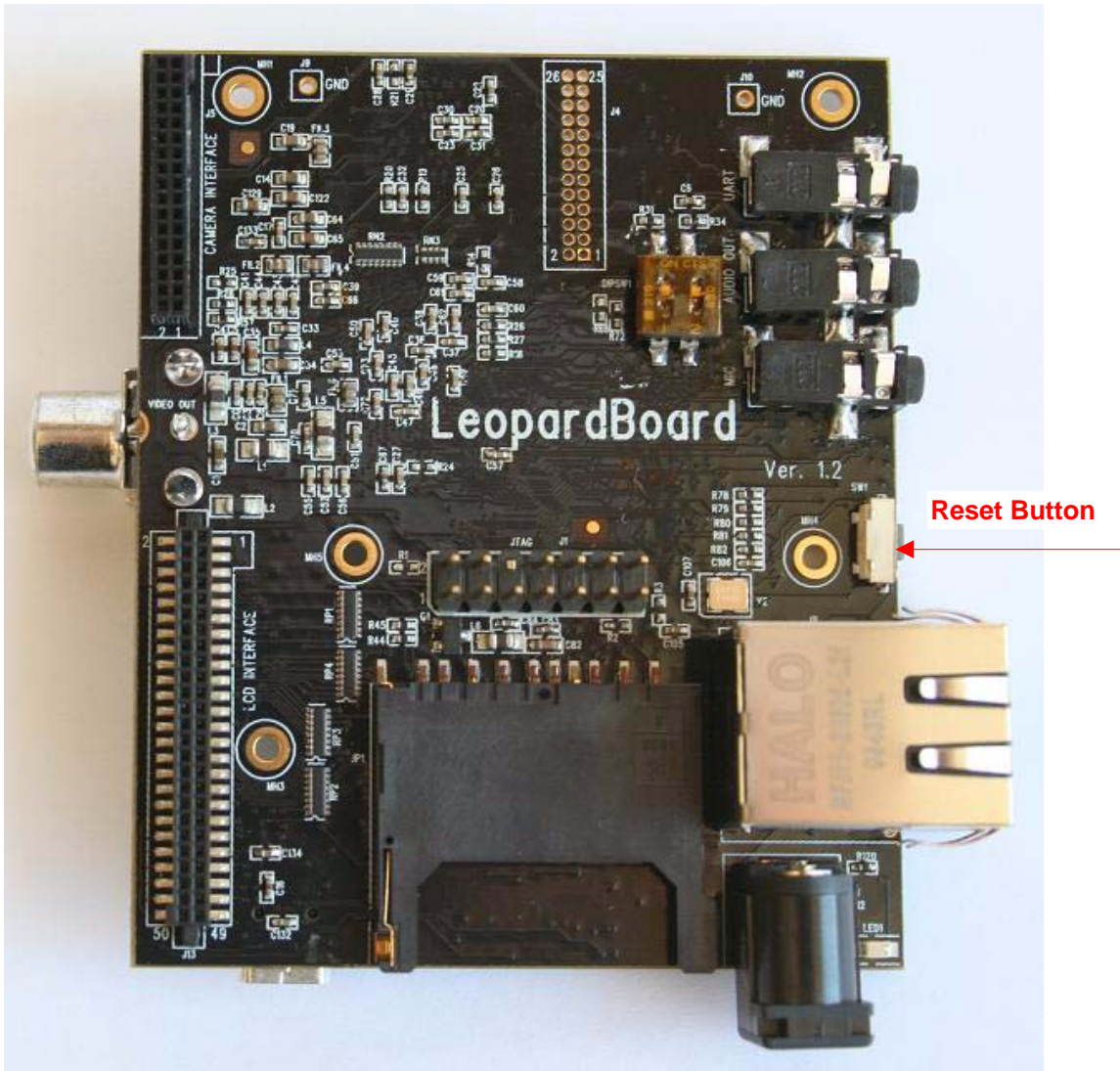**Figure 29. Reset Button**

2.20   PCB Board Mechanical Specification

Board Size: 3.0" x 2.5"
Max height: 0.7" with RJ45 Connector
Layers: 6
Color: Black
PCB thickness: .062"
RoHS Compliant: Yes
Weight: 1.6 Oz with VGA Camera Board