



# Tahoe-II Development Kit Technical Reference Manual

## Quick Reference

<b>What is in this document?</b>	<ul style="list-style-type: none"><li>▪ Detailed information about the Tahoe-II hardware</li><li>▪ Mechanical drawings</li></ul>
<b>What is not in this document (and where do I find it)?</b>	<ul style="list-style-type: none"><li>▪ Setup information. See the <i>Getting Started Guide</i>.</li><li>▪ Detailed software development information. Refer to the online help in the Software Development Kit (SDK) for this information.</li></ul>
<b>Where can I get support?</b>	<a href="http://DeviceSolutions.net/Support.aspx">http://DeviceSolutions.net/Support.aspx</a>
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## 1 Introduction

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The Tahoe-II Development Board is a flexible Development System that enables rapid prototyping of devices using the Device Solutions Meridian CPU with the .NET Micro Framework. This is the second generation of Tahoe Development board. It maintains the philosophy of the original by including many expansion options, while adding support for new features present in v3.0 of the .NET Micro Framework.

This document details the technical specifications of the Tahoe-II Development Board. For information on getting started, please refer to the *Getting Started Guide* that is included with the Tahoe-II Development Board.

The product details presented in this manual are subject to change. Please contact Device Solutions for the latest information before beginning any new designs based on this information.

For more information, you should also refer to:

- Meridian Technical Reference Manual
- Tahoe-II Schematics
- SDK Help for more information on programming
- Application notes published on the Device Solutions web site

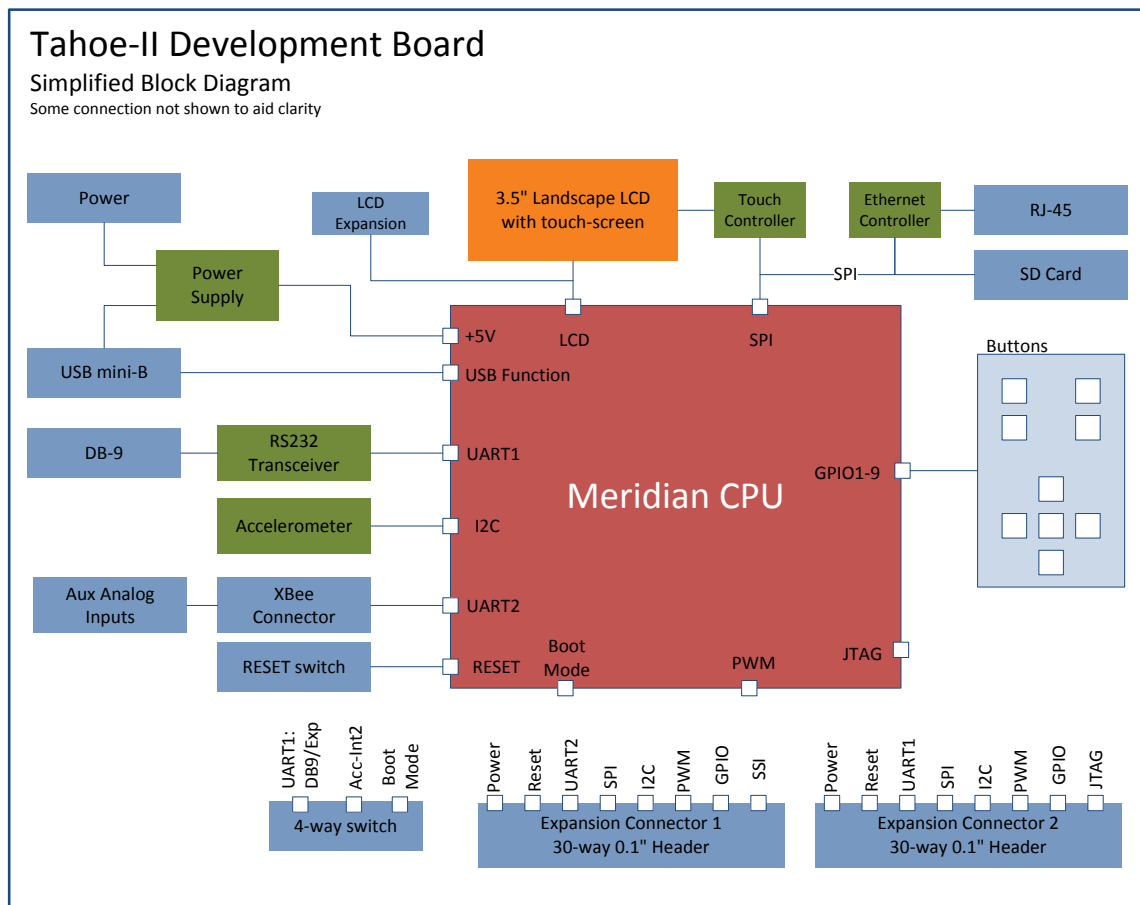
## 2 System Components

This section starts give details on each of the system components that makes up the Tahoe-II Development Board.

It is divided into the following parts:

- Block Diagram
- Meridian CPU
- User Interface Components
- Communications Components
- Expansion and File Storage
- Power Supply

The block diagram below shows the main components on the Tahoe-II board, and how they are connected. The following sections give more details on each component.



## 2.1 MERIDIAN CPU

The Meridian CPU is at the core of the Tahoe-II Development Board. The Meridian includes a Freescale i.MXS processor, 8Mbytes of SDRAM and 4Mbytes of flash, along with other supporting circuitry. The block diagram shows how the various pins on the Meridian connect to the Tahoe-II.

## 2.2 USER INTERFACE COMPONENTS

### 2.2.1 LCD and Touch-Screen

The Tahoe-II features a 3.5" QVGA (320x240) Landscape LCD.

To write code for this LCD, refer to the Microsoft .NET Micro Framework help and sample code. The *New Presentation* sample application is an excellent reference.

This LCD is also equipped with a touch-screen. The .NET Micro Framework now includes support for touch screens, and the Tahoe-II firmware has a built-in driver. Refer to the SDK help for information on how to calibrate the touch-screen in your applications.

### 2.2.2 Buttons

The Tahoe-II includes 9 general purpose buttons as part of the user interface. These are connected to GPIO1-9 on the Meridian CPU. Pressing a button connects the GPIO to 0V.

These GPIO are also used elsewhere on the Tahoe-II. Section 3.2 includes details of where all signals are used.

### 2.2.3 Accelerometer

The Tahoe-II features a Freescale MMA7455 Accelerometer. This is connected to the I2C bus on the Meridian CPU. It can be operated in several different modes; these include direct measurement, and event detection, including free-fall. To support these modes, 2 GPIO are connected to the accelerometer and provide interrupt signals when various events occur. These GPIO are:

- INT1 - GPIO14
- INT2 - GPIO 11

If GPIO11 is required for other purposes, it can be isolated from the Accelerometer by setting Configuration Switch 3 (SW10-3) to the off position. GPIO14 is dedicated to the Accelerometer.

For detailed information on how to program the accelerometer, refer to the application note on the Device Solutions web site.

### 2.2.4 Analog Inputs

There are two analog inputs available as standard on the Tahoe-II and another 5 available if an XBee module is fitted.

The standard inputs are provided by the touch screen controller and are labelled AUX and VBAT on the connector labelled J7. The touch controller is a Texas Instruments TSC2046, and detailed information on the capabilities of the ADC input can be found in the datasheet for this part. This is available on the web at <http://focus.ti.com/docs/prod/folders/print/tsc2046.html>.

- The input voltage range for VBAT is 0.5V to 6V.
- The input voltage range for AUX is 0 to 2.5V

Refer to the XBee documentation for details on the analog inputs provided.

The Tahoe-II SDK documentation has details on how to access the Analog Inputs from your application.

### 2.2.5 Temperature Measurement

The touch controller includes a temperature sensor. This is accessible through a class provided in the Tahoe-II SDK. Refer to this documentation for information on how to access the temperature.

### 2.2.6 Configuration Switches

There are 4 configuration switches on the Tahoe-II. These are labelled:

- UART1-DB9 (2 switches)
- AINT2
- BOOT

#### UART1-DB9

When this is enabled, UART1 is enabled on the DB9 serial port. When these switches are switched to the disable position, the UART1 signals are isolated from the RS232 transceiver, and UART1 is available to use on the expansion connector.

#### AINT2

When enabled, this connects GPIO11 to the Accelerometer Interrupt 2 line. Set this to the off position to use GPIO11 for other functions.

#### BOOT

Boot mode is a special mode of the i.MXS and should only be enabled in conjunction with software supplied by Device Solutions.

### 2.2.7 Reset

The Reset button is connected to the MODULE\_RESET signal on the Meridian CPU.

## 2.3 COMMUNICATIONS COMPONENTS

### 2.3.1 USB Function

The USB function connector provides the primary method of powering and communicating with the Tahoe-II board.

The USB Function port can also be used in your application to communicate with a PC. Refer to the Microsoft documentation for more details on how to enable this functionality.

### 2.3.2 Serial Ports

The Meridian CPU has 2 serial ports, and these are available on the Tahoe-II as:

- RS232 level signals on a DB9 (UART1)
- Logic level (3.3V) signals on EXP1 (UART2) and EXP2 (UART1)
- Logic level (3.3V) to the Xbee expansion (UART2)

In order to use the UART1 signals present on the EXP2 expansion connector, you must disable it from the DB9 connector. This is done using the Configuration Switches.

### 2.3.3 Ethernet

The Tahoe-II includes a 10Base-T Ethernet controller. The RJ-45 connector includes 2 status LEDs.

- Orange: Link Status
- Green: Network Activity

The .NET Micro Framework includes a TCP/IP stack. Refer to the Microsoft documentation for information on writing applications that support networking.

### 2.3.4 Xbee Expansion Connector

The Tahoe-II features a dedicated expansion connector for an XBee radio module.

This is not supplied with the kit. Refer to the Digi web site for details on available modules and where to purchase these from: <http://www.digi.com/products/embeddedolutions/zigbeesolutions/>

Also included on the Tahoe-II is a LED indicating the status of the XBee module, and a header to provide address to the analog input channels provided by the XBee.

### 2.3.5 SPI and I2C

SPI and I2C communications busses are supported by the Meridian CPU, and are used on the Tahoe-II.

The SPI bus is used to connect to Ethernet, Touch-Screen and SD Card components, and the I2C bus is used for the Accelerometer. The drivers for these components are all included as part of the firmware.

These busses also are made available on the expansion headers for you to interface additional components.

Refer to the SDK help files for information on writing drivers to communicate with devices on these busses.

## 2.4 FILE STORAGE

### 2.4.1 SD Card

The Tahoe-II includes an SD card slot for SD memory and SDIO cards (in SPI mode). The standard firmware includes support for SD memory cards in SPI mode. You can access the file system on these cards through the classes provided in the .NET Micro Framework. Refer to the SDK help for more information.

## 2.5 EXPANSION

### 2.5.1 Main Expansion Connectors

The Tahoe-II has two main expansion connectors. This is where you can connect your own hardware, or attach add-on boards from Device Solutions or other vendors. Both connectors include the SPI and I2C bus signals, a UART and GPIO. For full details, refer to section 3.3.10.

### 2.5.2 LCD Expansion

The LCD expansion connector provides all the signals necessary to interface an alternate LCD to the Tahoe-II, including the touch-screen signals. Section 3.3.8 has details on the connector part number and pin-out.

Software modifications will be required for alternate LCDs. Refer to the SDK documentation for details on how to modify this to support your new display.

## **2.6 POWER SUPPLY**

The Tahoe-II can be powered from:

- USB mini-B connector. The USB specification limits this to 500mA.
- Barrel connector (J2)
- 2 pin header (J6)

The nominal input voltage for the Tahoe-II is 5V; however it supports an input range of 4.5V to 6V. Note that the 5V outputs will only be 5V if you power the board with 5V.

The Tahoe-II Board includes a voltage protection circuit to prevent reverse polarity problems, and also over-voltage protection up to 20V.

## 3 Connectors and Signals

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This section is a reference for all the connectors on the Tahoe-II board.

It includes:

- A summary of all connectors
- Cross-reference chart for all Meridian Signals
- Pin-out and part number details for each connector

### 3.1 CONNECTOR SUMMARY

The table below summarizes the connectors and switches found on Tahoe-II. The sections following this table give specific details for each connector.

Designator	Connector	Location
J1	USB Function (Mini-B)	Top
J2	Power (2.1mm Barrel)	Top
J3	Serial DB9	Top
J4	RJ-45 Ethernet	Top
J5	Xbee socket	Top
J6	Power Header (0.1")	Top
J7	Analog Input Expansion (0.1")	Top
J8	SD Card	Bottom
J9	LCD Connector (3.5" LCD)	Bottom
J10	Touch Connector	Bottom
J12	LCD Expansion	Bottom
EXP1	Expansion header 1 (0.1")	Top
EXP2	Expansion header 2 (0.1")	Top
SW1	General Purpose Button (GPIO1)	Top
SW2	General Purpose Button (GPIO2)	Top
SW3	General Purpose Button (GPIO3)	Top
SW4	General Purpose Button (GPIO4)	Top
SW5	General Purpose Button (GPIO5)	Top
SW6	General Purpose Button (GPIO6)	Top
SW7	General Purpose Button (GPIO7)	Top
SW8	General Purpose Button (GPIO8)	Top
SW9	General Purpose Button (GPIO9)	Top
SW10	Configuration Switches	Top
RESET	Reset Button	Top

### 3.2 MERIDIAN SIGNAL CROSS-REFERENCE

The following table lists all Meridian signals, and where they are used on the Tahoe-II.

Primary Function	Location
GPIO01	SW1, EXP2-9
GPIO02	SW2, EXP2-13
GPIO03	SW3, EXP1-17
GPIO04	SW4, EXP1-21
GPIO05	SW5, EXP1-23
GPIO06	SW6, EXP2-17
GPIO07	SW7, EXP2-21
GPIO08	SW8, EXP2-23
GPIO09	SW9, EXP1-25
GPIO10	EXP1-14, J11-37
GPIO11	Accelerometer INT2, SW10-3, EXP2-12, J11-39
GPIO12	EXP2-14, J11-41, SD Card Detect
GPIO13	EXP2-25, SD Card Write Protect
GPIO14	Accelerometer INT1
GPIO15	SD Card Chip Select
UART1_TXD	J3, EXP2-24
UART1_RXD	J3, EXP2-28, SW10-1
UART1_RTS	J3, EXP2-26
UART1_CTS	J3, EXP2-30, SW10-2
UART2_RXD	J5-2, EXP1-28
UART2_TXD	J5-3, EXP1-24
UART2_RTS	J5-16, EXP1-26
UART2_CTS	J5-12, EXP1-30
SPI1_MOSI	Ethernet, Touch, SD Card, EXP1-11, EXP2-11, J11-36
SPI1_MISO	Ethernet, Touch, SD Card, EXP1-7, EXP2-7, J11-40
SPI1_SS	EXP1-13, J11-35
SPI1_SCLK	Ethernet, Touch, SD Card, EXP1-15, EXP2-15, J11-33
SPI1_SPI_RDY	EXP1-7, J11-38
I2C_SCL	J11-25, EXP1-22, EXP2-22, Accelerometer
I2C_SDA	J11-28, EXP1-20, EXP2-20, Accelerometer
TIN	EXP1-16
TMR2OUT	EXP2-16
PWMO	EXP1-18, EXP2-18, J11-7
TRST	EXP2-10
TDO	EXP2-8
TDI	EXP2-6
TMS	EXP2-2
TCK	EXP2-4

Primary Function	Location
LD0	J9-15, J11-12
LD1	J9-16, J11-9
LD2	J9-17, J11-14
LD3	J9-18, J11-11
LD4	J9-19, J11-16
LD5	J9-22, J11-13
LD6	J9-23, J11-18
LD7	J9-24, J11-15
LD8	J9-25, J11-17
LD9	J9-26, J11-20
LD10	J9-27, J11-19
LD11	J9-31, J11-22
LD12	J9-32, J11-21
LD13	J9-33, J11-24
LD14	J9-34, J11-23
LD15	J9-35, J11-26
VSYNC	J9-37, J11-29
HSYNC	J9-26, J11-32
ACD/OE	J9-52, J11-34
CONTRAST	LCD Backlight Enable
SPL_SPR	Touch IRQ
PS	Touch Chip Select
CLS	Ethernet Interrupt
REV	Ethernet Chip Select
LSCLK	J9-38, J11-31
SSIO_TXCLK	EXP1-2
SSIO_TXFS	EXP1-4
SSIO_TXDAT	EXP1-6
SSIO_RXDAT	EXP1-8
SSIO_RXCLK	EXP1-10
SSIO_RXFS	EXP1-12
RESET_OUT	EXP1-27, EXP2-27
MODULE_RESET	Reset Switch, EXP1-29, EXP2-29
BOOT	SW10-4
USB_D+	J1
USB_D-	J1

### 3.3 CONNECTOR DETAILS

#### 3.3.1 Power (J1, J2 and J6)

The Tahoe-II board can be powered by:

- J1 - USB Mini-B connector
- J2 – 2.1mm Barrel connector (centre positive)
- J5 – 0.1" pitch header (+5V and 0V).

The Tahoe-II is normally powered via USB when in development, however if you have additional devices attached you may need to power the board via one of the other connectors.

Note that J6 is not fitted to the board. This allows a polarized connector of your choice to be used.

#### 3.3.2 RS232 Serial (J3)

This is a male DB9 connector. Signals are shown in the following table:

Pin	Signal
1	N/C
2	RXD
3	TXD
4	N/C
5	0V
6	N/C
7	RTS
8	CTS
9	N/C

#### 3.3.3 RJ-45 Ethernet

This is configured as a standard 10Mbps connection. Connect using standard Ethernet twisted-pair cabling. A crossover cable will be required if you are connecting directly to your PC.

#### 3.3.4 Xbee Connector (J5)

The Xbee socket connector accepts Xbee and Xbee-Pro modules manufactured by Digi, Inc.

Pin	Signal	Description
1	VCC	Power for the module – connected to +3.3V
2	DOUT	Connected to UART2_RXD
3	DIN	Connected to UART2_TXD
4	DO8	Not connected <sup>1</sup>
5	RESET	Not connected
6	PWM0	Not connected <sup>1</sup>
7	PWM1	Not connected <sup>1</sup>
8	NC	Not connected

<sup>1</sup> While these pins are not exposed as nicely as the Analog Inputs, you could solder directly to the socket under the board to gain access to this functionality if required. We suggest you unplug your XBee module before doing so!

9	DTR/SLEEP	Not connected <sup>1</sup>
10	GND	0V
11	AD4	Available on J7
12	CTS	Connected to UART2_CTS <sup>2</sup>
13	ON/SLEEP	Connected to XBEE Indicator LED
14	VREF	Available on J7
15	AD5	Available on J7
16	RTS	Connected to UART2_RTS <sup>2</sup>
17	AD3	Available on J7
18	AD2	Available on J7
19	AD1	Available on J7
20	AD0	Not connected <sup>1</sup>

### 3.3.5 Analog Header (J7)

Pin	Signal	Pin	Signal
1	+3.3V	2	AD1
3	AD2	4	AD3
5	AD4	6	AD5
7	0V	8	VREF
9	VBAT	10	AUX

This connector exposes the analog input signals from the board.

AD1, AD2, AD3, AD4, AD5 and VREF are exposed from the XBee module and are only available if a module is fitted. Refer to the Xbee module documentation for details on how to connect signals to this interface.

VBAT and AUX signals are connected to the touch controller.

### 3.3.6 SD Card (J8)

The SD card connector is connected to the SPI bus of the Tahoe-II. This enables SD Memory cards and SDIO cards in SPI mode only. The signals are connected as show below.

Pin	Signal
1	GPIO15 (Chip Select)
2	SPI_MOSI
3	0V
4	+3.3V
5	SPI_SCLK
6	0V
7	SPI_MISO
8	NC
9	NC

<sup>2</sup> Yes, this is correct. Freescale have strange naming conventions for their UART handshaking signals and this has been carried over to the Meridian CPU to avoid (or continue!) confusion.

Card Detect	GPIO12
Write Protect	GPIO13

### 3.3.7 3.5" LCD Interface (J9) and Touch Screen (J10)

These two connectors are specifically for attaching a KWH035ST12-F02 LCD.

### 3.3.8 LCD Expansion (J11)

The LCD expansion enables alternate LCDs to be connected to the Tahoe-II.

Pin	Signal	Pin	Signal
1	+5V	2	Touch-YU
3	+3.3V	4	Touch-XL
5	0V	6	Touch-YD
7	PWM	8	Touch-XR
9	LCDD1	10	0V
11	LCDD3	12	LCDD0
13	LCDD5	14	LCDD2
15	LCDD7	16	LCDD4
17	LCDD8	18	LCDD6
19	LCDD10	20	LCDD9
21	LCDD12	22	LCDD11
23	LCDD14	24	LCDD13
25	I2C_SCL	26	LCDD15
27	0V	28	I2C_SDA
29	VSYNC	30	0V
31	LSCLK	32	HSYNC
33	SPI_SCLK	34	ACD/OE
35	SPI_SS	36	SPI_MOSI
37	GPIO10	38	SPI_RDY
39	GPIO11	40	SPI_MISO
41	GPIO12		

### 3.3.9 Configuration Switches (SW10)

Details on the Configuration Switches can be found in section 2.2.6.

### 3.3.10 Expansion Headers (EXP1 and EXP2)

The Tahoe-II board includes 2 general-purpose expansion headers.

They have a similar pin-out, allowing some expansion boards to operate in either position (with a few software modifications). This allows flexibility in creating these boards.

Each expansion header includes:

- Power
- SPI
- I2C
- GPIO

- UART
- PWM

The complete pin-out for each connector is shown below. Each pin is also marked on the Tahoe-II board for easy reference; however you should always check the exact specification of the pin here before connecting to it. These specifications can be found in the Meridian Technical Reference Manual.

**EXP1**

Pin	Signal	Pin	Signal
1	+5V	2	SSI-TXCLK
3	+3.3V	4	SSI-TXFS
5	0V	6	SSI-TXDAT
7	SPI-MISO	8	SSI-RXDAT
9	SPI-RDY	10	SSI-RXCLK
11	SPI-MOSI	12	SSI-RXFS
13	SPI-SS	14	GPIO10
15	SPI-CLK	16	TIN
17	GPIO3	18	PWM
19	+3.3V	20	I2C-SDA
21	GPIO4	22	I2C-SCL
23	GPIO5	24	UART2-TXD
25	GPIO9	26	UART2-RTS
27	RESET_OUT	28	UART2-RXD
29	MOD_RESET	30	UART2-CTS

**EXP2**

Pin	Signal	Pin	Signal
1	+5V	2	TMS
3	+3.3V	4	TCK
5	0V	6	TDI
7	SPI-MISO	8	TDO
9	GPIO1	10	TRST
11	SPI-MOSI	12	GPIO11
13	GPIO2	14	GPIO12
15	SPI-CLK	16	TMR2OUT
17	GPIO6	18	PWM
19	+3.3V	20	I2C-SDA
21	GPIO7	22	I2C-SCL
23	GPIO8	24	UART1-TXD
25	GPIO13	26	UART1-RTS
27	RESET_OUT	28	UART1-RXD
29	MOD_RESET	30	UART1-CTS

To create an expansion board that will work in either expansion slot, you should design your board to only use the signals shown below.

Pin	Signal	Pin	Signal
1	+5V	2	
3	+3.3V	4	
5	0V	6	
7	SPI-MISO	8	
9	SPI-Interrupt	10	
11	SPI-MOSI	12	
13	SPI-Chip Select	14	GPIO-D
15	SPI-CLK	16	
17	GPIO	18	PWM
19	+3.3V	20	I2C-SDA
21	GPIO-A	22	I2C-SCL
23	GPIO-B	24	UART-TXD
25	GPIO-C	26	UART-RTS
27	RESET_OUT	28	UART-RXD
29	MOD_RESET	30	UART-CTS

### 3.3.11 User Buttons (SW1 – SW9)

Nine buttons supported through GPIO pins will short their respective GPIO signals to 0V when pressed. Each of these switches has a 0 Ohm resistor on the Tahoe-II board. You can remove the resistor to

effectively disconnect the button from the GPIO pin if you choose to use the pin for something else and the button would cause interference.

Five of the buttons are mapped to provide navigation style controls on the Tahoe-II board. These are:

Button	Function
SW5	Up
SW6	Left
SW7	Enter/Select
SW8	Right
SW9	Down

### 3.3.12 RESET

The RESET button shorts MODULE\_RESET to 0V causing a hard reset of the CPU.

## 4 Specifications

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<b>Processor</b>	<ul style="list-style-type: none"><li>▪ Meridian CPU (ARM920T at 100MHz, 4MB Flash, 8MB SDRAM)</li></ul>
<b>Power Supply</b>	<ul style="list-style-type: none"><li>▪ +5V supplied via USB, 2.1mm Barrel connector or 0.1" Header</li><li>▪ Power consumption (i.MXS @ 100MHz): Max current: 2A @ 5V Typical: TBD</li></ul>
<b>Environmental Conditions</b>	<ul style="list-style-type: none"><li>▪ Commercial temperature (0-70 °C)</li></ul>
<b>RoHS Compliance</b>	<ul style="list-style-type: none"><li>▪ RoHS complaint</li></ul>
<b>I/O Pin voltage</b>	<ul style="list-style-type: none"><li>▪ 3.3V max on all I/O pins</li></ul>

## 5 Mechanical Drawings

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These drawing are available in more detail in DXF format.

All measurements are in mm.

