



# Meridian CPU Technical Reference Manual

**What is in this document?**

- Detailed information about the Meridian CPU Module hardware
- Mechanical drawings

**What is not in this document (and where do I find it)?**

- Setup information. See the *Getting Started Guide*.
- Detailed software development information.

**Where can I get support?**

<http://DeviceSolutions.net/Support.aspx>

**Where can I find out about updates?**

Device Solutions Blog: <http://blog.DeviceSolutions.net>

**I have found a bug!**

We want to know! Email: [docs@devicesolutions.net](mailto:docs@devicesolutions.net)

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## 1 Introduction

The Meridian CPU module incorporates a Freescale i.MXS or i.MXL ARM920T™ based processor, along with core memory components, into a surface mount, machine place-able package. This allows customers to rapidly incorporate a 32-bit processor into a new product without going through a long and costly design cycle.

For embedded systems developers Microsoft provides an SDK that plugs directly into Visual Studio 2010 so that you can write applications in C# for the Meridian CPU with the .NET Micro Framework. Furthermore, Device Solutions provides an SDK that extends the one from Microsoft to include support for Meridian Processor specific functionality.

This document details the technical specifications of the Meridian CPU module

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.

There are two variants of the Meridian CPU:

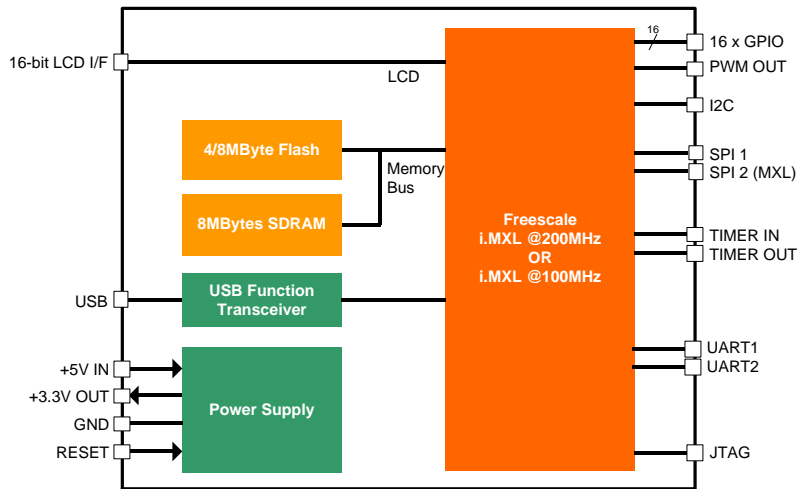
- |                     |   |
|---------------------|---|
| <b>MERIDIAN-MXS</b> | <ul style="list-style-type: none"><li>• i.MXS processor</li><li>• 100MHz core clock-speed</li></ul>                       |
| <b>MERIDIAN-MXL</b> | <ul style="list-style-type: none"><li>• i.MXL processor</li><li>• 200MHz core clock-speed</li><li>• 2 SPI ports</li></ul> |

Please also refer to the following documents for more related information:

- Meridian Mechanical Specification
- Freescale i.MXS or i.MXL documentation

## 2 System Components

The following block diagram shows the major components of the Meridian CPU.



<b>Freescale i.MX Processor</b>	The Meridian CPU includes a 100MHz Freescale i.MXS, or 200MHz i.MXL processor
<b>Boot Flash</b>	4 or 8MByte NOR flash stores the .NET Micro Framework and your custom applications.
<b>SDRAM</b>	Meridian includes 8MByte of SDRAM running at 96MHz.
<b>USB Transceiver</b>	The USB function transceiver provides line level D+ and D- for direct use of USB Function without the need for an external transceiver.
<b>Power Supply</b>	The Meridian module can be powered with +5V or +3.3V. An on-board power supply generates the required core voltage. When powered from 5V, 3.3V is also generated on-board and is available for use externally to the module. When powered off 3.3V, the input voltage should be connected to the 5V and 3.3V pads.
<b>Pin Interface</b>	The Meridian module utilizes 84 pads in a surface mount package that can be placed on to a daughter board using an automated pick and place machine. This footprint contains power and data signals.

## 3 Quick Reference

### GENERAL PURPOSE I/O USAGE

The following table lists all of the signals on the Meridian CPU that are available as GPIO signals.

Signal	Pad	GPIO	Alternate Function
I2C_SCL	19	A-16	
I2C_SDA	18	A-15	
GPIO15	75	A-09	
GPIO14	74	A-08	
GPIO13	73	A-07	
PWMO	20	A-02	
TIN	38	A-01	
UART2_RXD	14	B-31	
UART2_TXD	13	B-30	
UART2_RTS	15	B-29	
UART2_CTS	17	B-28	
GPIO1	48	B-19	
GPIO2	47	B-18	
GPIO3	45	B-17	
GPIO4	44	B-16	
GPIO5	43	B-15	
GPIO6	49	B-14	
GPIO12	42	B-13	SD_CMD*
GPIO11	41	B-12	SD_CLK*
GPIO10	40	B-11	SD_DAT3*
GPIO9	52	B-10	SD_DAT2*
GPIO8	51	B-09	SD_DAT1*
GPIO7	50	B-08	SD_DAT0*
SPI_MOSI	59	C-17	
SPI_MISO	63	C-16	
SPI_SS	62	C-15	
SPI_SCLK	60	C-14	
SPI_SPI_RDY	61	C-13	
UART1_RXD	10	C-12	
UART1_TXD	9	C-11	
UART1_RTS	11	C-10	
UART1_CTS	12	C-09	
SSI_TXCLK	53	C-08	
SSI_TXFS	54	C-07	
SSI_TXDAT	55	C-06	
SSI_RXDAT	56	C-05	
SSI_RXCLK	57	C-04	
SSI_RXFS	58	C-03	
TMR2OUT	39	D-31	
LCDD15	25	D-30	

Signal	Pad	GPIO	Alternate Function
LCDD14	24	D-29	
LCDD13	23	D-28	
LCDD12	22	D-27	
LCDD11	21	D-26	
LCDD10	32	D-25	
LCDD9	30	D-24	
LCDD8	29	D-23	
LCDD7	28	D-22	
LCDD6	27	D-21	
LCDD5	26	D-20	
LCDD4	37	D-19	
LCDD3	36	D-18	
LCDD2	35	D-17	
LCDD1	34	D-16	
LCDD0	33	D-15	
VSYNC	65	D-14	
HSYNC	66	D-13	
ACD/OE	68	D-12	
CONTRAST	64	D-11	
SPL_SPR	69	D-10	SPI2_TXD*
PS	70	D-09	SPI2_RXD*
CLS	71	D-08	SPI2_SS*
REV	72	D-07	SPI2_SCLK*
LSCLK	67	D-06	

\*Functions available on Meridian-MXL only.

## 4 I/O Pin Details

When not used for designated purposes any of the I/O pins may be used as a GPIO using the standard .NET Micro Framework GPIO classes. This section details what the pins are used for and how to access them from your .NET Micro Framework Applications.

### INTER IC COMMUNICATION (I2C)

The Meridian CPU supports interfacing to devices through the internal I2C bus master. The bus is accessible through the normal .NET Micro Framework I2C classes. The base input frequency to the I2C module is 96 MHz the internal divider supports a divisor in the range 22-3840 inclusive to provide a frequency range of 4.36 MHz to 25 kHz

If you request a frequency N, the actual clock frequency will be set to the closest divider frequency that is less than N.

#### I2C\_SCL

This is the I2C Serial clock line used to clock data on the bus. If I2C is not used this pin may be used as a GPIO.

#### I2C\_SDA

This is the standard I2C Serial Data line the controller will send/receive data on this line. If I2C is not used this pin may be used as a GPIO

### UNIVERSAL ASYNCHRONOUS RECEIVE/TRANSMITTERS (UARTs)

The Meridian contains two Universal Asynchronous Receive/Transmitters (UARTs) these are available as normal serial ports in the .NET Micro Framework.

#### UARTx\_RXD

This is the receive data line for the UART. Data received on this pin is processed by the internal UART and made available to applications through the SerialPort or ComPort class Read() method. When not used as a serial port this pin may be used as a GPIO using the standard GPIO classes.

#### UARTx\_TXD

This is the transmit data line for the UART. Data is transmitted on this pin when applications call the Write() method of the SerialPort or ComPort classes.

#### UARTx\_RTS, UARTx\_CTS

These are the hardware handshaking lines. As of this release they are not used by the firmware since the .NET Micro Framework does not support hardware handshaking. These are labeled as RTS/CTS so that when a firmware release is available that does support hardware handshaking they are already defined. If the UART is not used as a UART then these are available as GPIO, if the UART is used as a UART then these pins **must not** be used as GPIO as they may become true handshake signals in a future firmware release, which could break compatibility with your application and system design.

## **PULSE WIDTH MODULATOR (PWM)**

The Meridian CPU includes a Pulse Width Modulator PWM. The .NET Micro Framework introduced standard library support for the PWM in version 4.2. For earlier versions, refer to the Device Solutions SDK for library support.

### **PWMO**

PWMO is the output of the PWM in the CPU. Application code can set the frequency and duty cycle of the PWM via the Configure() method of the PWM class.

## **SERIAL PERIPHERAL INTERFACE (SPI)**

The Meridian CPU contains a built in SPI controller that is accessible through the standard Micro Framework class libraries. A second SPI port is available on the i.MXL variant. The .NET Micro Framework only supports SPI in Master mode.

### **SPI\_MOSI**

This is the standard Master Out Slave In (MOSI) signal for the SPI bus. Data from the Meridian is sent out on this pin.

### **SPI\_MISO**

This is the standard Master In Slave Out (MISO) signal for the SPI bus. Data sent from the external slave device is received by the Meridian on this pin.

### **SPI\_SCLK**

This is the data clock for the SPI bus. The Meridian supports the following clock rates: 4 MHz, 2 MHz, 1 MHz, 500 kHz, 250 kHz, 125 kHz, 62.5 kHz and 31.25 kHz

### **SPI\_SS**

SPI\_SS is the Slave Select (SS) pin (sometimes referred to as a chip select) While ANY GPI pin can be used as a slave select, this one is supported directly in the SPI controller and therefore is the most efficient.

### **SPI\_SPI\_RDY**

This is an optional signal available on many SPI devices, particularly data provider type devices like an A/D converter. It is normally used to signal the master the device has data available. While the Micro Framework libraries do not have any direct support for the SPI RDY signal this pin can be used as a GPI interrupt to trigger the application or driver code to read data from the device.

There are a few SPI devices on the market that support a RDY signal but multiplex it on the data or clock lines depending on the state of the Slave Select signal. This is NOT directly supported by the Meridian; to use such a device would require additional logic to generate an independent RDY signal that could be connected to this (or any other GPIO line)

## **TIMERS**

The Meridian contains a number of internal timers that are not currently supported by the Micro Framework or Meridian Specific SDK extensions. These may be supported in a future release. Until then the timer related pins are available as GPIO.

### **TIN**

Input signal for a timer. This pin is currently not supported except as a GPIO.

### **TMR2OUT**

Output clock of an internal timer. This pin is currently not supported except as a GPIO.

### **SYNCHRONOUS SERIAL INTERFACE/INTER IC SOUND (SSI/I2S)**

The Meridian hardware supports a Synchronous Serial Interface and Inter IC Sound. However, the .NET Micro Framework currently has no support for either interface. Thus, the SSI\_xxx pins are available for use as GPI only at this time. Future firmware updates may provide support for this functionality.

### **LCD CONTROLLER**

The Meridian contains an LCD controller suitable for many small LCD panels used for .NET Micro Framework based devices. At this time the LCD parameters, (size color depth, timing etc...) are only configurable by Device Solutions as a special Firmware build.

## 5 Connectors

### MERIDIAN

#### Meridian 84 Pad Footprint

The following lists the pads on the Meridian Footprint.

Pad	Signal	Pad	Signal
1	0V	84	nTRST
2	+5V_IN	83	nTDO
3	+3V3_OUT	82	TDI
4	/RESET_OUT	81	TCK
5	BOOT_MODE	80	TMS
6	MODULE_RESET	79	NC
7	USB_N	78	NC
8	USB_P	77	NC
9	UART1_TXD	76	NC
10	UART1_RXD	75	GPIO15
11	UART1_RTS	74	GPIO14
12	UART1_CTS	73	GPIO13
13	UART2_TXD	72	REV
14	UART2_RXD	71	CLS
15	UART2_RTS	70	PS
16	0V	69	SPL_SPR
17	UART2_CTS	68	ACD/OE
18	I2C_SDA	67	LSCLK
19	I2C_SCL	66	HSYNC
20	PWM	65	VSYNC
21	LCDD11	64	CONTRAST
22	LCDD12	63	SPI_MISO
23	LCDD13	62	SPI_SS
24	LCDD14	61	SPI_RDY
25	LCDD15	60	SPI_SCLK
26	LCDD5	59	SPI_MOSI
27	LCDD6	58	SSI_RXFS
28	LCDD7	57	SSI_RXCLK
29	LCDD8	56	SSI_RXDAT
30	LCDD9	55	SSI_TXDAT
31	0V	54	SSI_TXFS
32	LCDD10	53	SSI_TXCLK
33	LCDD0	52	GPIO09
34	LCDD1	51	GPIO08
35	LCDD2	50	GPIO07
36	LCDD3	49	GPIO06
37	LCDD4	48	GPIO01
38	TIN	47	GPIO02
39	TMR2OUT	46	0V
40	GPIO10	45	GPIO03
41	GPIO11	44	GPIO04
42	GPIO12	43	GPIO05

## 6 Part Numbers

Meridian is available in a variety of configurations.

Meridian - MXx - RRR - FFF – T – V

x	CPU variant	S: i.MXS (100MHz) L: i.MXL (200MHz, extra SPI)
RR	RAM	08: 8 Mbytes
FF	NAND Flash size	04: 4 Mbytes 08: 8 MBytes 512: 512MBytes
T	Temperature rating	I:- -20 to 85C C: 0 to 70C
V	Version	Blank: Rev C E: Rev E

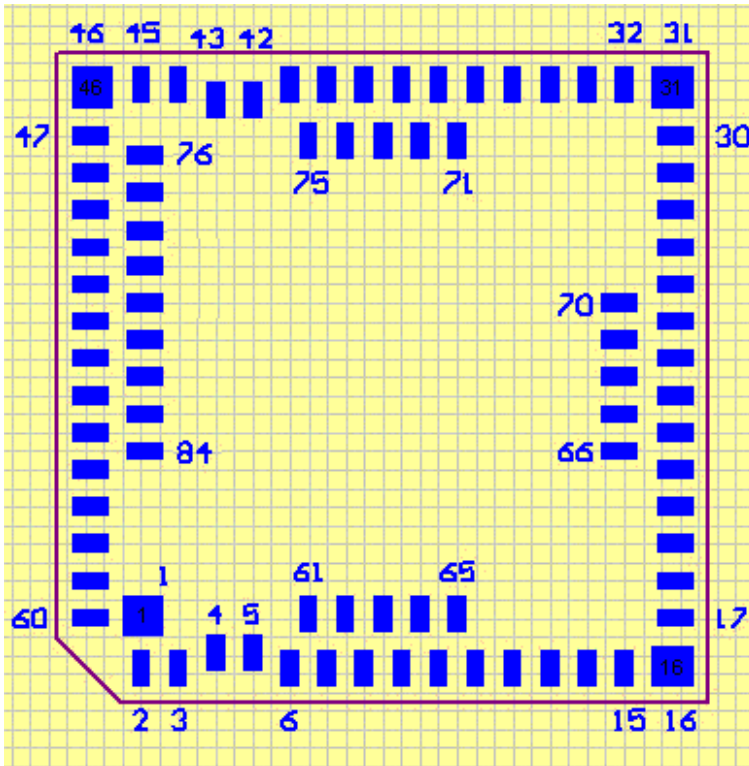
Standard variants are:

- Meridian-MXL-08-08-C-E
- Meridian-MXS-08-08-C-E

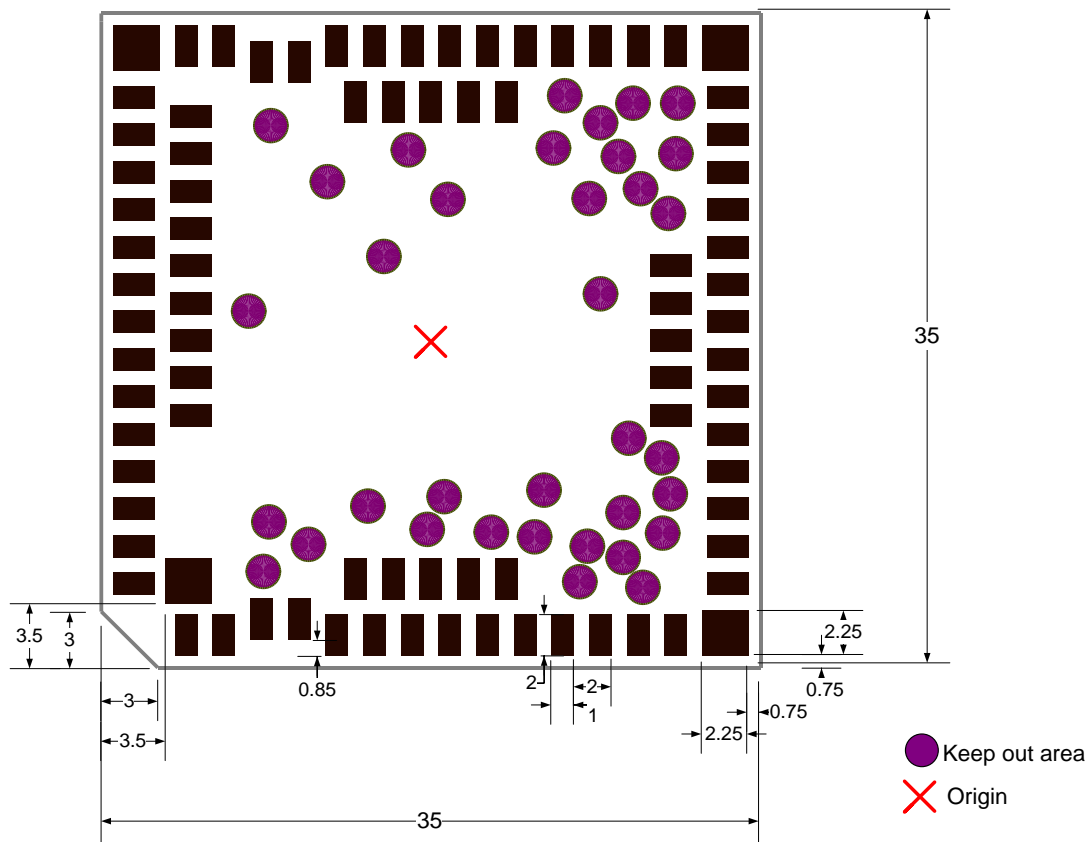
## 7 Mechanical Specification

### COMPONENT OUTLINE

This is the top view of the component. PCB dimensions are 35mm x35mm with a 3.5mm chamfer on the corner nearest pin 1.



### BASIC MECHANICAL DRAWING



### PAD CENTRE LOCATIONS

Default pad size is 1mm x 2mm

Pad size for pad 1, 16, 31 and 46 is 2.25mm x 2.25mm

Default pad centre to pad centre (pin pitch) dimension is 2.0mm

All dimensions in mm

Datum 0.0, 0.0 is the centre of the Meridian

Number	X Coordinate	Y Coordinate	Pad Name	Number	X Coordinate	Y Coordinate	Pad Name
1	-12.875mm	-12.875mm	0V	43	-9mm	14.9mm	GPIO5
2	-13mm	-15.75mm	+5V	44	-11mm	15.75mm	GPIO4
3	-11mm	-15.75mm	+3V3	45	-13mm	15.75mm	GPIO3
4	-9mm	-14.9mm	RESET_OUT	46	-15.625mm	15.625mm	0V
5	-7mm	-14.9mm	BOOT	47	-15.75mm	13mm	GPIO2
6	-5mm	-15.75mm	MODULE_RESET	48	-15.75mm	11mm	GPIO1
7	-3mm	-15.75mm	D-	49	-15.75mm	9mm	GPIO6
8	-1mm	-15.75mm	D+	50	-15.75mm	7mm	GPIO7

Number	X Coordinate	Y Coordinate	Pad Name	Number	X Coordinate	Y Coordinate	Pad Name
9	1mm	-15.75mm	UART1_TXD	51	-15.75mm	5mm	GPIO8
10	3mm	-15.75mm	UART1_RXD	52	-15.75mm	3mm	GPIO9
11	5mm	-15.75mm	UART1_RTS	53	-15.75mm	1mm	SSI_TXCLK
12	7mm	-15.75mm	UART1_CTS	54	-15.75mm	-1mm	SSI_TXFS
13	9mm	-15.75mm	UART2_TXD	55	-15.75mm	-3mm	SSI_TXDAT
14	11mm	-15.75mm	UART2_RXD	56	-15.75mm	-5mm	SSI_RXDAT
15	13mm	-15.75mm	UART2_RTS	57	-15.75mm	-7mm	SSI_RXCLK
16	15.625mm	-15.625mm	0V	58	-15.75mm	-9mm	SSI_RXFS
17	15.75mm	-13mm	UART2_CTS	59	-15.75mm	-11mm	SPI1_MOSI
18	15.75mm	-11mm	I2C_SDA	60	-15.75mm	-13mm	SPI1_SCLK
19	15.75mm	-9mm	I2C_SCL	61	-4mm	-12.75mm	SPI1_RDY
20	15.75mm	-7mm	PWM	62	-2mm	-12.75mm	SPI1_SS
21	15.75mm	-5mm	LCDD11	63	0mm	-12.75mm	SPI1_MISO
22	15.75mm	-3mm	LCDD12	64	2mm	-12.75mm	CONTRAST
23	15.75mm	-1mm	LCDD13	65	4mm	-12.75mm	VSYNC
24	15.75mm	1mm	LCDD14	66	12.75mm	-4mm	HSYNC
25	15.75mm	3mm	LCDD15	67	12.75mm	-2mm	LSCLK
26	15.75mm	5mm	LCDD5	68	12.75mm	0mm	ACD/OE
27	15.75mm	7mm	LCDD6	69	12.75mm	2mm	SPL_SPR
28	15.75mm	9mm	LCDD7	70	12.75mm	4mm	PS
29	15.75mm	11mm	LCDD8	71	4mm	12.75mm	CLS
30	15.75mm	13mm	LCDD9	72	2mm	12.75mm	REV
31	15.625mm	15.625mm	0V	73	0mm	12.75mm	GPIO13
32	13mm	15.75mm	LCDD10	74	-2mm	12.75mm	GPIO14
33	11mm	15.75mm	LCDD0	75	-4mm	12.75mm	GPIO15
34	9mm	15.75mm	LCDD1	76	-12.75mm	12mm	NC
35	7mm	15.75mm	LCDD2	77	-12.75mm	10mm	NC
36	5mm	15.75mm	LCDD3	78	-12.75mm	8mm	NC
37	3mm	15.75mm	LCDD4	79	-12.75mm	6mm	NC
38	1mm	15.75mm	TIN	80	-12.75mm	4mm	TMS
39	-1mm	15.75mm	TMR2OUT	81	-12.75mm	2mm	TCK
40	-3mm	15.75mm	GPIO10	82	-12.75mm	0mm	TDI
41	-5mm	15.75mm	GPIO11	83	-12.75mm	-2mm	TDO
42	-7mm	14.9mm	GPIO12	84	-12.75mm	-4mm	TRST

## ROUTING/COPPER KEEP-OUT LOCATIONS ON MOUNTING SURFACE

All dimensions in mm

Datum 0,0, 0,0 is the centre of the Meridian

The following 35 locations are each the centre point for a 1.6mm diameter routing/copper exclusion keep out on the surface of the customers PCB design.

X Coordinate	Y Coordinate
-8.525mm	11.525mm
-9.7mm	1.6mm
-5.525mm	8.525mm
-2.525mm	4.525mm
8.975mm	2.525mm
10.475mm	-5.2mm
12.575mm	6.825mm
8.975mm	11.675mm
11.225mm	-13.175mm
10.175mm	-9.175mm
8.375mm	7.625mm
3.175mm	-10.225mm
-6.525mm	-10.875mm
7.875mm	-12.875mm
-8.925mm	-12.325mm
13.075mm	12.725mm
12.975mm	10.025mm
12.225mm	-10.275mm
-3.37mm	-8.83mm
-1.225mm	10.225mm
12.225mm	-6.25mm
12.675mm	-8.175mm
5.975mm	-7.975mm
10.175mm	-11.575mm
8.275mm	-10.975mm
5.475mm	-10.475mm
10.7mm	12.725mm
-8.625mm	-9.675mm
9.925mm	9.875mm
-0.225mm	-10.075mm
0.875mm	7.579mm
7.075mm	13.125mm
6.475mm	10.325mm
0.675mm	-8.325mm
11.1mm	8.15mm

## 8 Specifications

### TECHNICAL SPECIFICATIONS

Absolute Maximum Input Voltage

- -0.3 V to 6 V

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Operating Input Voltage

- 4.3 V to 5.5 V (when external 3.3V is required)
- 3.3V (connect input voltage to 5V and 3.3V pads)

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GPIO Specifications

- 3.3V max
- 4mA max current (source or sink)

*Note that GPIO pins are connected directly to the i.MXS and have NO extra ESD or overvoltage protection. Refer to the Freescale data sheet for more information on the GPIO pins.*

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Operating Temperature

- 0 to 70°C (extended temperature available on request)

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Typical Power Consumption

- TBD

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RoHS Compliance

- RoHS compliant