MPCIe-750 Graphics Card for Intel Galileo

User Manual

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Introduction

This document provides all the information required to setup and get started with the MPCIe-750-16MB-G-XX graphics card. This variant of the graphics card is designed exclusively for use with the Intel Galileo Arduino Development board. Other variants of the card are available that are compatible with embedded boards featuring a spare mini PCI express slot. For information on other variants of the MPCIe-750 graphics card please contact info@micropassion.co.uk

Regulatory Statements

This product is sold as an evaluation board/kit for use in conjunction with the Intel Galileo development board and is intended for use for ENGINEERING DEVELOPMENT, DEMONSTRATION, OR EVALUATION PURPOSES ONLY and is not considered by Micro Passion 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.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user indemnifies Micro Passion 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.

Product Support

The MPCIe-750-16MB-G-XX is sold on a **no support** basis, however Micro Passion will at their discretion offer free technical support over email. Dedicated support contacts can be purchased by contacting info@micropassion.co.uk.

Warrantee

The MPCIe-750-16MB-G-XX is warranted against defects in materials and workmanship for a period of 90 days from purchase. This warranty does not cover any problems occurring as a result of improper use, modifications, exposure to water, excessive voltages, abuse, or accidents. All boards will be returned via standard mail if an issue is found. If no issue is found or express return is needed, the customer will pay all shipping costs.

Limitations of Liability

In no event shall Micro Passion be held liable for any loss, expenses or damages of any kind whatsoever, whether direct, indirect, incidental or consequential, arising from the design or use of this product or the support materials supplied with this product. If this product proves to be defective, Micro Passion is only obliged to replace or refund the purchase price at Micro Passion's discretion.

Product Overview

The MPCIe-750-16MB-G-XX graphics card has been designed to allow developers utilising the Intel Galileo board, to add video output capability to projects. Supported displays include VGA / TV monitors up to 1920x1800 resolution, and raw 18bit TFT LCD Panels also up to 1920x1080 resolution. An on board touch screen controller is provided to allow interactive touch screen LCD designs to be created.

Product Specifications.

GPU:	Silicon Motion SM750
Bus:	PCI Express x1
Memory:	16MB MB DDR SDRAM
CRT output:	Support display resolution up to 1920 x 1080 and vertical refresh rate up to 75Hz
LCD output:	• 18 bit TFT LCD interface • Support display resolutions up to 1920 x 1080 • PWM Controlled LED backlight • 4 wire resistive touch screen controller
Dual Display Mode:	LCD+VGA, supports single, clone and dual mode
Intel Galileo Support:	• Custom Arduino environment including graphics library compatible with Adafruit GFX • Custom POKY YOCTO Linux OS including Qt graphics environment
Dimensions:	30mm x 50.95mm
Power Consumption:	TBD

GPU

The MPCIe-750-16MB-G-XX graphics card features a Silicon Motion SM750 graphics controller with integrated 2D accelerator.

Video Memory

The MPCIe-750-16MB-G-XX graphics card implements 16MB onboard video memory.

VGA Header - P3

The MPCIe-750 –16MB-G-V graphics card can be connected to VGA / TV monitors. Connectivity is provided by a Molex 12way PicoBlade connector (53398-1271). This model of graphics card is

packaged with a VGA extension cable of approximately 150mm in length. The pin out of P3 is detailed below.

Pin Number	Description	Notes
1	VGA Red	
2	5V Out	
3	VGA Green	
4	Ground	
5	VGA Blue	
6	No Connect	Reserved for EDID data
7	Ground	
8	VGA HSYNC	
9	Ground	
10	VGA VSYNC	
11	Ground	
12	No Connect	Reserved for EDID clock

LCD Header - P2

The MPCIe-750 –16MB-G-LT graphics card can be connected to 18-bit LCD TFT displays, including displays with integrated 4-wire touch screens. Connectivity is provided by a FCI 40 Way FFC connector (62684-401100ALF). The Micro Passion LCD430-G-R LCD board is a 4.3" LCD module that complements the MPCIe-750 –16MB-G-LT graphics card. The pin out of P2 is detailed below.

Pin Number	Description	Pin Number	Description
1	Touch Y+	21	Green 4
2	Touch X-	22	Green 5
3	Touch Y-	23	Ground
4	Touch X+	24	Red 0
5	Gound	25	Red 1
6	I2C Clock (Cap Touch)	26	Red 2
7	I2C Data (Cap Touch)	27	Red 3
8	I2C Interrupt (Cap Touch)	28	Red 4
9	Ground	29	Red 5
10	Blue 0	30	Ground
11	Blue 1	31	Display Enable
12	Blue 2	32	Vertical Sync
13	Blue 3	33	Horizontal Sync
14	Blue 4	34	Pixel Clock
15	Blue 5	35	Panel Enable
16	Ground	36	3V3 Power
17	Green 0	37	3V3 Power
18	Green 1	38	Ground
19	Green 2	39	LED Backlight Anode
21	Green 3	40	LED Backlight Cathode

Touch Screen Controller

The MPCIe-750 –16MB-G-LT graphics card features a Microchip AR1100 4 wire resistive touch screen controller.

Product Installation

Installing the MPCIe-750 –16MB-G-LT and LCD430-G-R board onto an Intel Galileo

Follow ESD precautions when installing the MPCIe-750 –16MB-G-LT and LCD430-G-R board onto an Intel Galileo.

The following items are required to install the MPCIe-750 –16MB-G-LT and LCD430-G-R boards onto an Intel Galileo board.
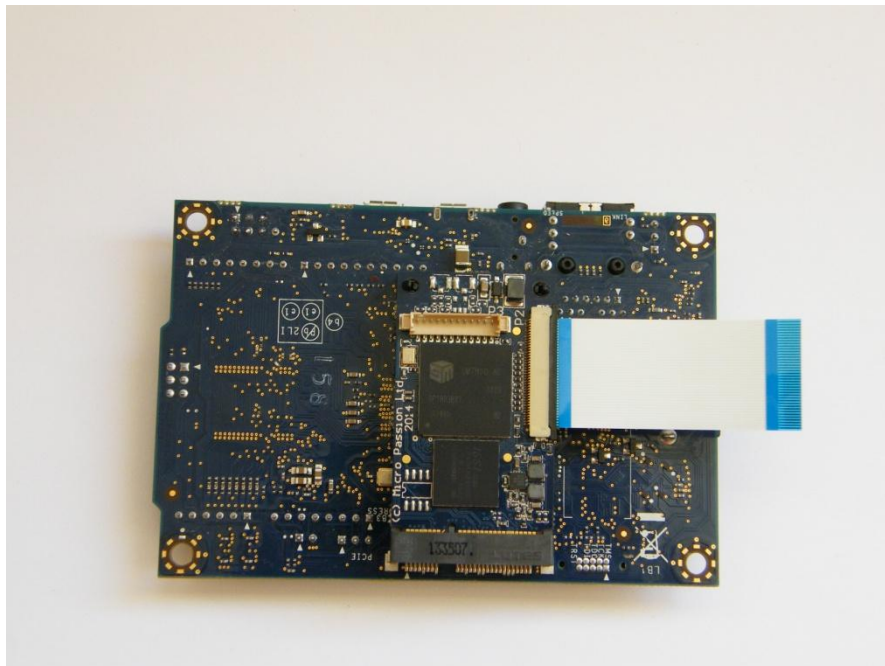
1. MPCIe-750 –16MB-G-LT graphics card

2. LCD430-G-R LCD module

3. 40mm 40way FFC cable

4. 4 x screws

5. Intel Galileo Board (Not supplied)

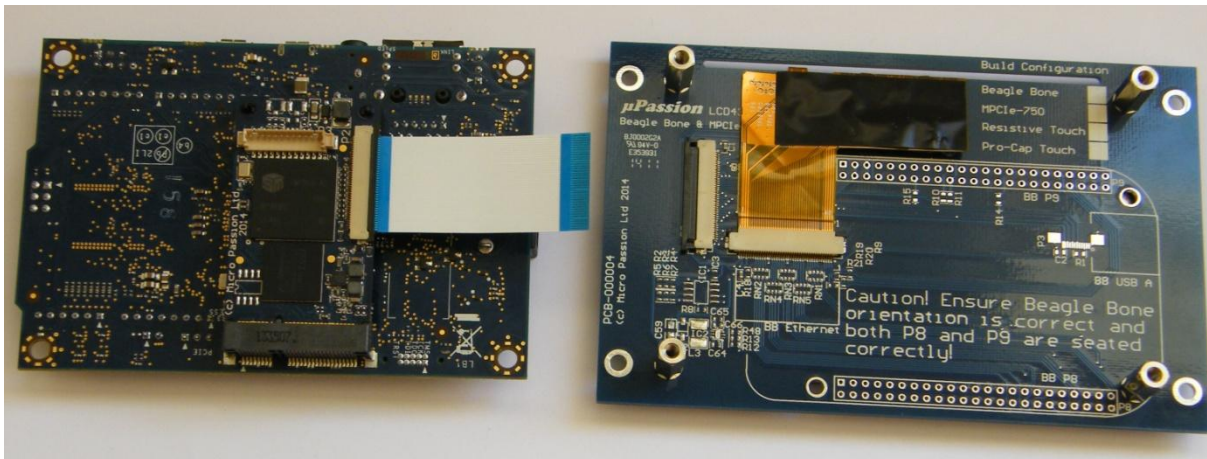6. Cross headed screw driver (Not supplied)

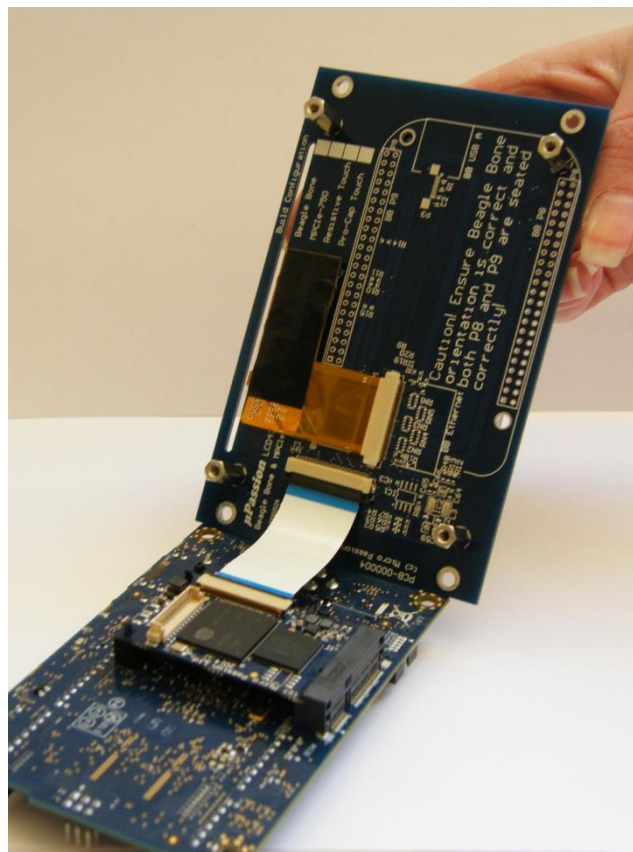Stage 1 - Unclip the P2 LCD FFC connector clamp.
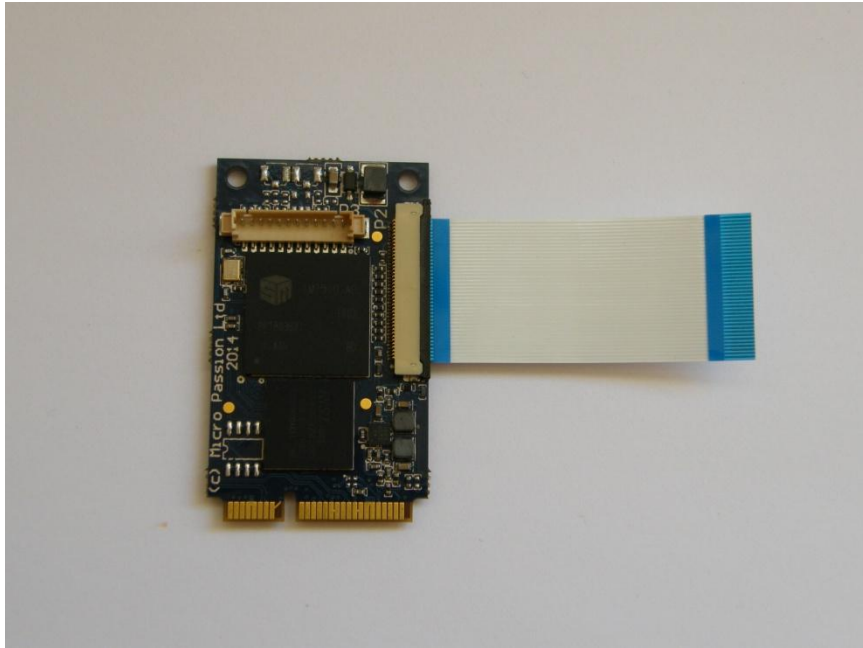
Stage 2 - Insert the 40mm 40way FFC cable into P2 and clamp the cable in place

Stage 3 - Place the Intel Galileo board on a flat surface with the mini PCI express
connector facing up, and Plug in the MPCIe-750 –16MB-G-LT graphics card
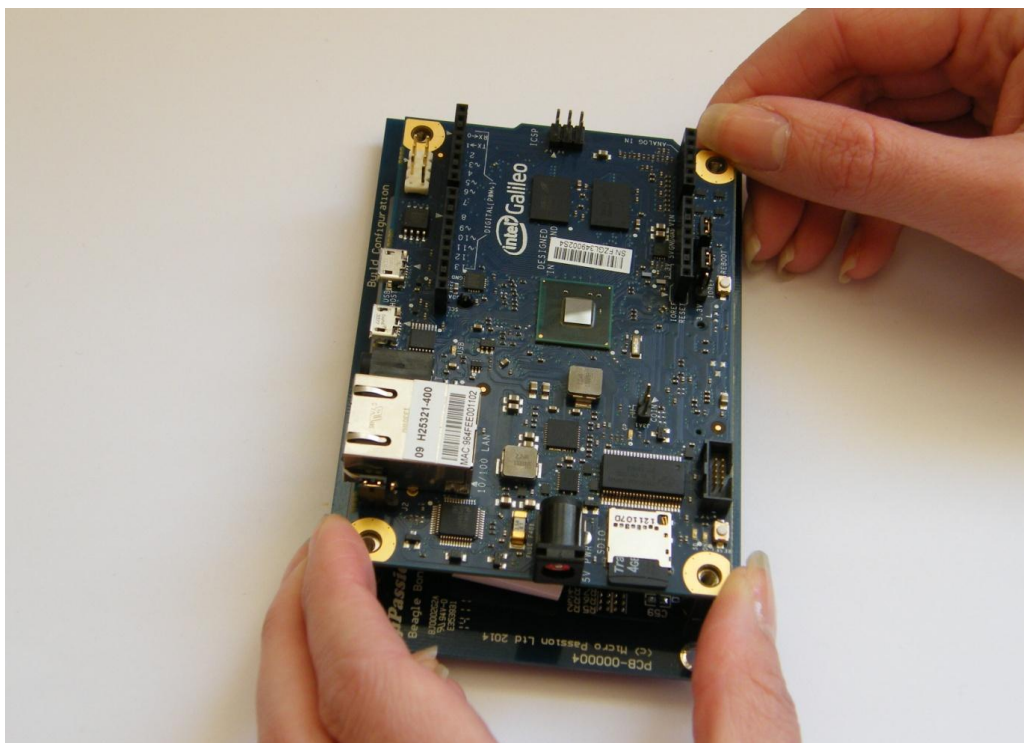
Stage 5 - Place the LCD430-G-R LCD module, LCD down and adjacent to the MPCIe-750 –16MB-G-LT graphics card.
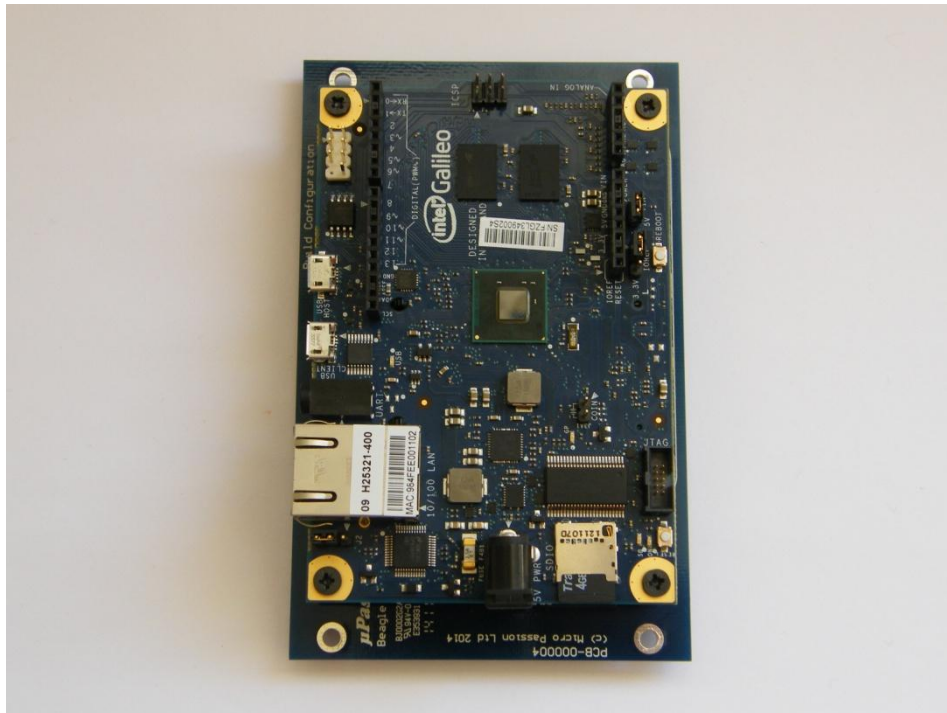

Stage 6 - Unclip the LCD430-G-R LCD FFC connector clamp, and insert the FCC cable. A second pair of hands can be useful at this stage.
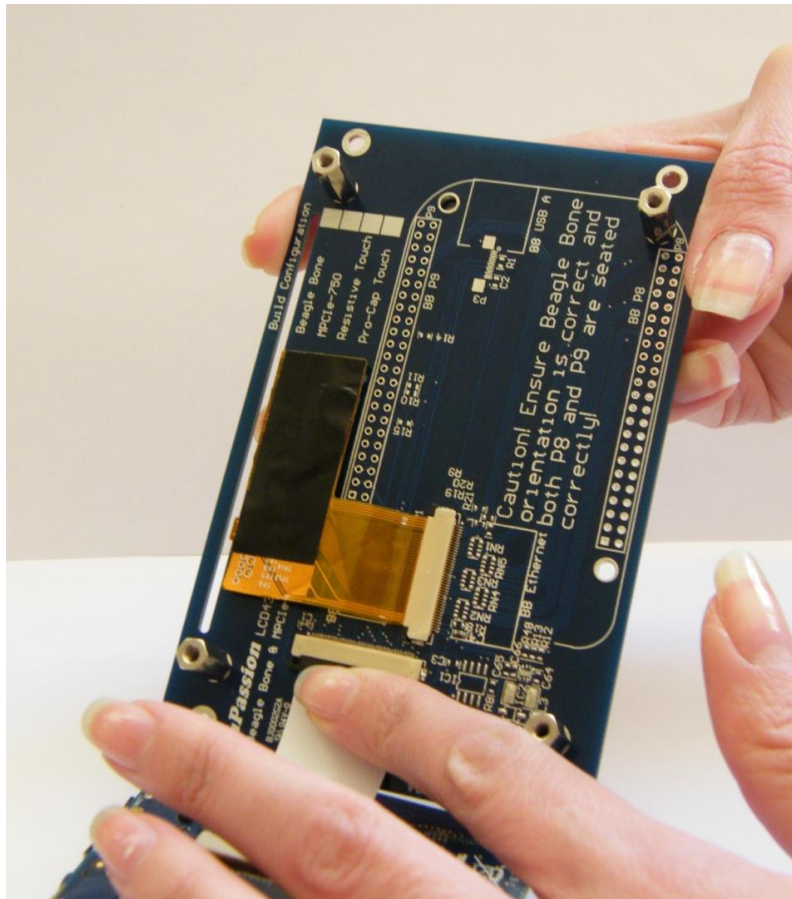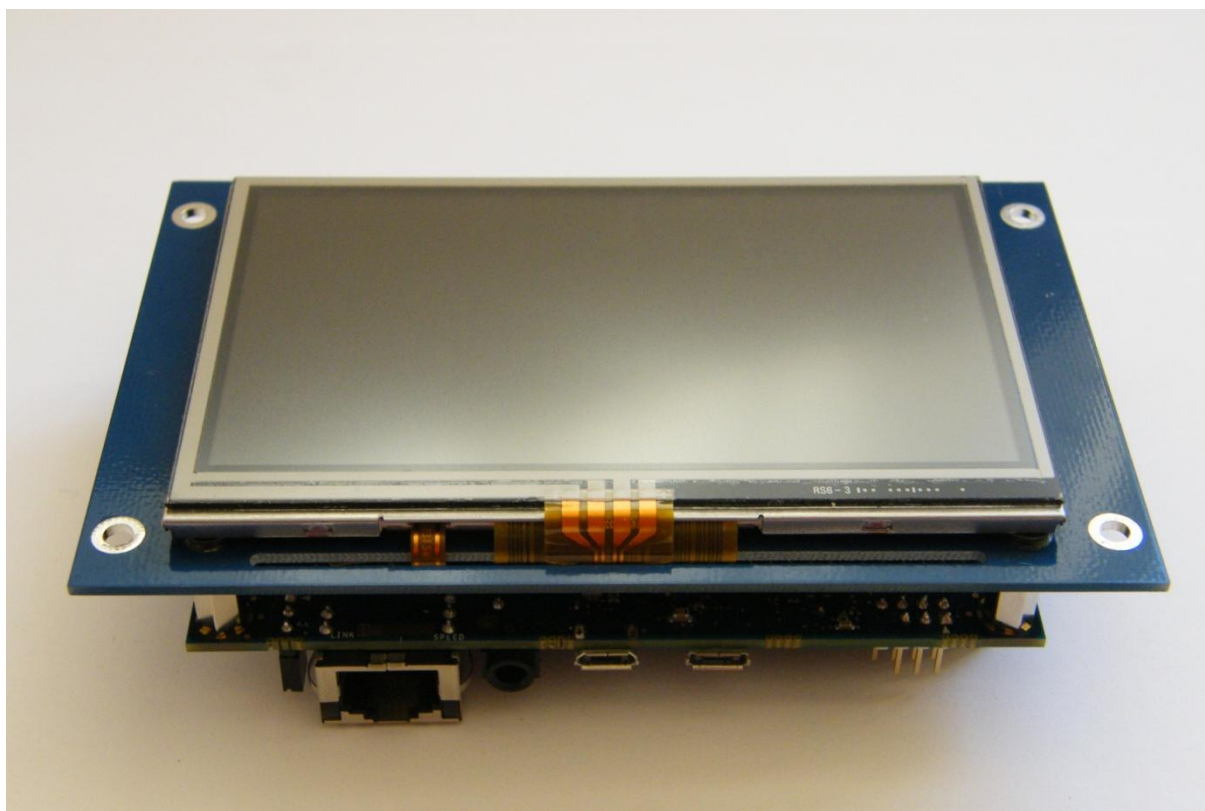
Stage 7 - Clamp the FFC cable into the LCD430-G-R LCD FFC connector

Stage 8 - Place the LCD430-G-R LCD down, and **carefully** rotate the Intel Galileo board so that the LCD430-G-R mounting spacers align with the Intel Galileo mounting holes.

Stage 9 - Finally insert and secure the four screws.

Stage 10 - The unit is now assembled. Rotate the unit so that the LCD is facing up.

Installing the MPCIe-750 –16MB-G-V board onto an Intel Galileo

Follow ESD precautions when installing the MPCIe-750 –16MB-G-V board onto an Intel Galileo.

The following items are required to install the MPCIe-750 –16MB-G-V board onto an Intel Galileo board.

1. MPCIe-750 –16MB-G-V graphics card

2. VGA extension cable

Stage 1 - Connect the VGA extension cable to the MPCIe-750 –16MB-G-V graphics card
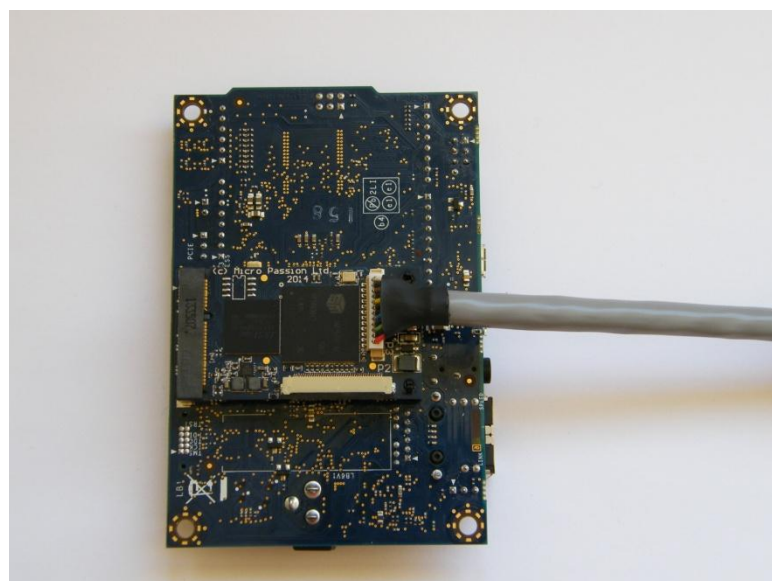
Stage 2 - Plug the MPCIe-750 –16MB-G-LT graphics card into an Intel Galileo board, before connecting to a VGA monitor.

Demo software

Some demonstration software has been put together that shows how the MPCIe-750 –16MB-X can be used in both an Arduino, and QT development environment in conjunction with the Intel Galileo board. Both environments rely on booting the Intel Galileo board from an SD card containing a customised kernel, and YOCTO root file system.

The following downloads are available:

Download URL	Description
http://www.micropassion.co.uk/downloads/arduino-1.5.3.1.zip	A Windows Arduino development environment for the Intel Galileo board including MPCIe-750 graphics library and demo applications
http://www.micropassion.co.uk/downloads/galileo-mpcie750-yoctofull-qt-touchV100.tar.bz2	YOCTO root file system including QT librarys, demo applications, and touch screen support.
http://www.micropassion.co.uk/downloads/Galileo-MPCIe750MicroSDFATPartitionV100.zip	Customised Intel Galileo Linux kernel and GRUB configuration including support for the MPCIe-750 graphics card.
http://www.micropassion.co.uk/downloads/galileo-mpcie750-yoctofull-qt-touch-sdimageV100.zip	A raw image of a 2GB micro SD card, partition, and containing Linux kernel, and YOCTO root file system.

SD Card creation Method 1

Purchase a pre-image micro SD Card from Micro Passion. Contact info@micropassion.co.uk for details.

SD Card creation Method 2

To create an SD card using the raw SD card image use the following steps.

1. In a Linux environment attach an SD card of at least 2GB in size.
2. In a console type, "dmesg | tail", and note down the name of the micro SD card. In the following example the sdcard drive name is "/dev/sdc"

```
[ 4528.160460] sd 3:0:0:1: [sdc] 3854336 512-byte logical blocks: (1.97 GB/1.83 GiB)
[ 4528.166631] sd 3:0:0:0: [sdb] Attached SCSI removable disk
[ 4528.173231] sd 3:0:0:1: [sdc] Write Protect is off
[ 4528.173236] sd 3:0:0:1: [sdc] Mode Sense: 03 00 00 00
[ 4528.185294] sd 3:0:0:1: [sdc] No Caching mode page present
[ 4528.185412] sd 3:0:0:1: [sdc] Assuming drive cache: write through
[ 4528.222988] sd 3:0:0:1: [sdc] No Caching mode page present
[ 4528.223077] sd 3:0:0:1: [sdc] Assuming drive cache: write through
[ 4528.226472] sdc: sdc1 sdc2
[ 4528.262808] sd 3:0:0:1: [sdc] No Caching mode page present
[ 4528.262904] sd 3:0:0:1: [sdc] Assuming drive cache: write through
[ 4528.263002] sd 3:0:0:1: [sdc] Attached SCSI removable disk
```

3. In a console type, "wget http://www.micropassion.co.uk/downloads/galileo-mpcie750-yoctofull-qt-touch-sdimageV100.zip" to download the raw SD card image.
4. In a console type, "unzip galileo-mpcie750-yoctofull-qt-touch-sdimageV100.zip" to extract the raw SD card image

5. In a console type, "dd if=./galileo-mpcie750-yoctofull-qt-touchV100.sdimage of=/dev/sdc" to copy the raw SD card image to a SD card. IMPORTANT: replace /dev/sdc with the drive identified in step 2. Mistakes with the dd command will destroy data.

6. Once the transfer is complete, remove the SD card and plug it into the Intel Galileo board.

GRUB configuration for MPCIe-750

The default GRUB configuration is setup for the 4.3" LCD on the LCD430-G-R LCD module. The resolution of this panel is 480x272. To setup the MPCIe-750 card to drive VGA resolutions see the following steps.

1. Mount the SD card created above in either Linux or Windows.
2. Navigate the "BOOTME" partition of the SD card and edit the file, "boot\grub\grub.conf "
3. Replace all instances of, "480x272" with the required VGA resolution. Some examples or supported resolutions include, "640x480", "800x600", "1024x768", "1920x1080".
4. Save the file.

Arduino development environment

The Arduino development environment is based on the current Intel Galileo release (V1.5.3) with the addition of a mPCIe750 graphics library. To use the Arduino development environment follow the below steps.

1. Download the Arduino environment from,
   http://www.micropassion.co.uk/downloads/arduino-1.5.3.1.zip
2. Extract the file to the root of a drive to ensure file path lengths are kept to a minimum
3. Enter the arduino-1.5.3.1 directory and launch arduino.exe
4. Insert the micro SD card created earlier into an Intel Galileo board and power the board. If the Intel Galileo board is using the latest software the board will boot from the SD Card, and display a login prompt on the display after approximately 60 seconds.
5. If the Intel Galileo board doesn't boot from the SD card the firmware may need to be upgraded. This can be achieved by using the firmware update feature of the Arduino environment. See the Intel Galileo getting started guide for details. https://communities.intel.com/servlet/JiveServlet/downloadBody/21838-102-7-25423/Galileo_GettingStarted_329685_005.pdf
6. Write an application and upload it to the Intel Galileo

Arduino demo applications

The Arduino development environment comes with a graphics library targeting the MPCIe-750 graphics card. The library is located in, "arduino-1.5.3.1\libraries\mPCIe750".

Two demo applications are included with the library.

Demo Application	Location	Description
TFTBitmapLogo	libraries\mPCIe750\examples\TFTBitmapLogo	Demonstrates drawing a JPEG image to the display in random locations
TFTPong	libraries\mPCIe750\examples\TFTPong	An example of the classic Pong game that uses analogue inputs to move the paddle.

QT demo applications

The customised YOCTO root file system includes the QT graphics library and standard demo applications. To test the QT demo applications follow the below steps.

1. Insert the micro SD card created earlier into an Intel Galileo board and power the board. If the Intel Galileo board is using the latest software the board will boot from the SD Card, and display a login prompt on the display after approximately 60 seconds.
2. If the Intel Galileo board doesn't boot from the SD card the firmware may need to be upgraded. This can be achieved by using the firmware update feature of the Arduino environment. See the Intel Galileo getting started guide for details. https://communities.intel.com/servlet/JiveServlet/downloadBody/21838-102-7-25423/Galileo_GettingStarted_329685_005.pdf
3. Once at the login prompt login with the user, "root" (Password is not required)
4. Navigate to, "/usr/bin/qtopia/demos"
5. Pick and launch a demo. E.g. type, "./spreadsheet/spreadsheet -qws"

Touch Screen Calibration

The customised YOCTO root file includes the touch screen library tslib. To calibrate the touch screen follow the below steps.

1. At the login prompt login with the user, "root" (Password is not required)
2. type, "ts_calibrate"
3. Touch the cross hairs in turn.

~ Happy Developing ~

We are always interested to find out what exciting things you have used our products for and feedback on how we can improve.