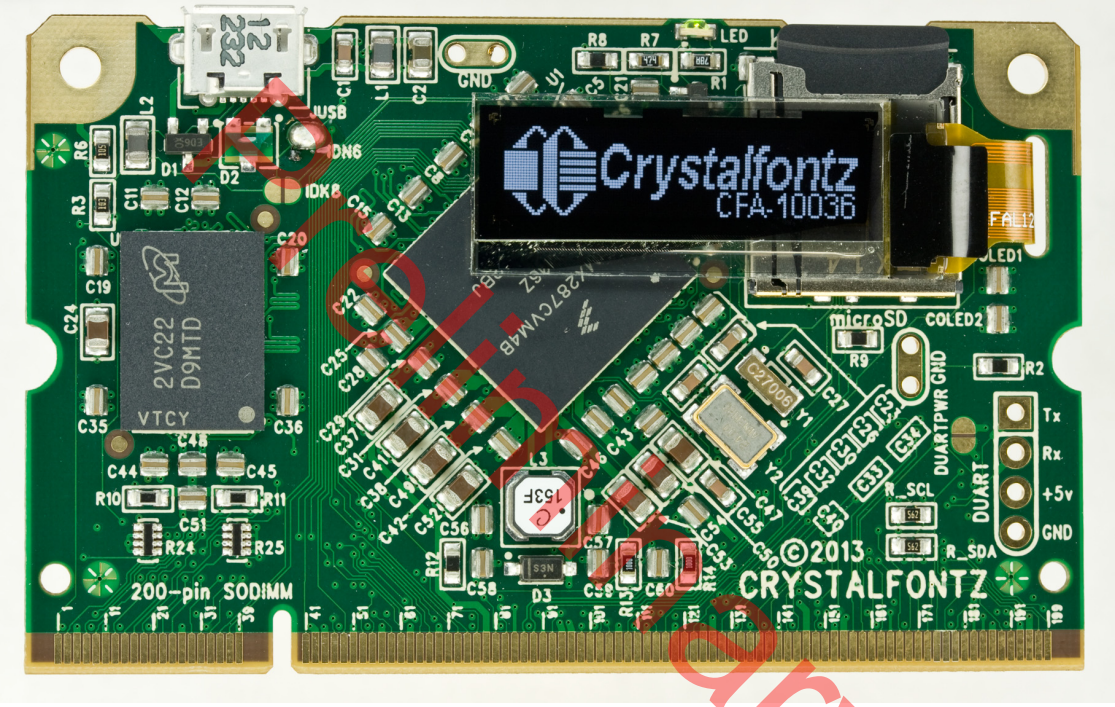
Crystalfontz America, Incorporated

CFA10036 System On Module
Getting Started Guide



CFA10036 with i.MX287 processor and optional CFAL12832D-B OLED

CFA10036 Getting Started Guide Release 2013-04-22
for
CFA10036 Hardware Version: v1.0

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Resources for Technical Support

Hardware Resources
Crystalfontz manufactures and fully supports the CFA10036 hardware. In addition to the hardware information in this *CFA10036 Getting Started User Guide*, the schematic is available for download as a PDF file under the Docs/Files tab on the CFA10036x web pages.

For additional hardware support, please contact Crystalfontz Technical Support at 888-206-9720 or send an email to support@crystalfontz.com.

Software Resources
We worked with Free Electrons to port Linux to the CFA10036 and the Linux mainline kernel. This ensures that as the main line kernel moves forward, the CFA10036 will be supported.

This *CFA10036 Getting Started User Guide* includes some overview information on how to run your applications, including a "Hello World" example. Appendixes describe how to install Linux as a virtual machine on a Windows PC and how to build a disk image.

The following documents are available for download under the Docs/Files tab on the CFA10036 web page:

- Instructions to install Sourcery CodeBench Lite, required to build applications for the CFA10036.
- Instructions to install PuTTy to establish a secure terminal session with the CFA10036 under Windows.
- Instructions to install WinSCP for copying files to and from the CFA10036 over an Ethernet connection under Windows.

For additional software support, this product will be supported by the Linux community by each respective software package maintenance project team.

CFA10036 Hardware Revision Information

For information about hardware revisions, see the Part Change Notifications (PCNs) under the "Notices" tab on the CFA10036 web page.

CFA10036 Getting Started Guide Revision History

Release Date: 2013-04-22
New *Getting Started Guide*.

The Fine Print

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This CFA10036+CFA10037 is not an end product or finished appliance and is not intended or authorized to be integrated into end products as is. Buyer may use the CFA10036+CFA10037 to create prototypes for its own internal experimental use, and may add components, features, software and/or functionality, in the process of designing its own final products. Buyer shall only assign technically qualified electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, subsystems and systems to use the CFA10036+CFA10037, and that such use takes place solely in laboratory/development environments (and not in residential environments). The Non-FCC approved CFA10036+CFA10037 is FOR ENGINEERING DEVELOPMENT, DEMONSTRATION, AND/OR EVALUATION PURPOSES ONLY.

CONTENTS

INTRODUCTION

This User Guide has information for the CFA10036 used in these products:
CFA100361, CFA100362, CFA100365, CFA100366,
CFA920, CFA920-TS, CFA921, CFA921-TS

In the past, new hardware designs consisted of choosing a processor, memory, various peripherals, and an operating system. Much of the effort to design a new product was in the routing of the high speed lines for the processor and memory architecture. By using the low-profile high-density ARM9-based CFA10036 SOM (System On Module), all of the high speed design work is done. Shipped preinstalled with a full Linux operating system, it is now easier to take a design concept and implement it quickly and cost effectively.

You have a choice of two powerful Freescale i.MX28 ARM9 processors for the six layer impedance-controlled PCB. The processors are in Freescale's longevity program and availability is assured for a minimum of 15 years. For more information about the two processors, see Differences Between i.MX283 and i.MX287 Processors (Pg. 10).

Both processors provide the CFA10036 with *lots* of GPIO. The CFA10036 connects to a standard, widely available 200-pin SODIMM socket (available from Digi-Key).

Using the CFA10036's microSD card socket eliminates the need for on-board flash memory and the software tools to support it. The CFA10036 is shipped with one card for its microSD card socket. Using an SD card opens up fantastic on-board user data and logging possibilities.

For status display and debugging, we offer an optional mounted 128x32 OLED, the CFAL12832D-B.

Power can be supplied through the micro USB connector, the DUART +5v interface, or by an external lithium-ion battery (Lion). All other voltages (+3.3v, +1.8v, and +1.5v) are internally generated.

Because a full Linux mainline kernel is already ported to the CFA10036, you can devote your resources to applications in the languages of your choice. All software is open source, will be maintained by the Linux community, and will be available through GitHub.

Rugged and easy to embed, the CFA10036 is an ideal platform for production runs where costly components such as the processor and memory do not need to be mounted on the customer hardware. Since the Linux environment on the CFA10036 has support for all major hardware communications including I^2C, SPI, UART, Ethernet, WiFi (USB), and CAN, rotary encoder, and multiple LCD support. Custom code does not have to be created for customer hardware requiring these interfaces.

If your project requires other functionality, you can build the Linux kernel using Linux or Windows. See APPENDIX A: How to Install Ubuntu on Windows 7 or 8 Using VMware Player (Pg. 19) and APPENDIX B: How to Build the Linux Disk Image (Pg. 30).

Multiple inexpensive carrier boards can be purchased (or manufactured by you) and tested using a single CFA10036.The CFA10036 is available from Crystalfontz in assembled products and kits that include a carrier board or mother board and various sizes of TFT displays, some with touch screens. Drivers for TFTs mounted on our products are included in the preinstalled Linux. For more information, see KITS, ACCESSORIES, AND ASSEMBLED PRODUCTS THAT USE CFA10036 (Pg. 11).

Examples of designs that could benefit from a CFA10036:

- ❑ Home automation systems that require ZigBee communications can be easily added using the I^2C interface.
- ❑ Alarm systems where a large number of GPIO pins for sense and control are required.
- ❑ Remote HVAC monitoring systems where temperature sensors and data logging can be provided over a dedicated wireless ad hoc network, accessed through mobile devices such as iPads and iPhones.

ADVANTAGES OF USING A CFA10036 WITH THE OPTIONAL CFA10037

The CFA10036 mounted on the optional CFA10037 is ideal for rapid prototyping. The CFA10037 gives access to all the port pins of the CFA10036, and by extension the port pins of the i.MX28 processor.

With the 200-pin SODIMM form factor, all processor pins with the exception of memory are brought out for your use. The CFA10036 connects to the CFA10037 via its JDEC MO-224E SODIMM connector. To get the mechanical stability expected in embedded systems, we slightly extended the SODIMM form factor and added two mounting holes. These mate perfectly with blind threaded SMT standoffs that hold the CFA10036 securely to the CFA10037.

Using 0.1" center headers and socketed hook-up wire, you can connect any of the pins on the CFA10036 to any location on the CFA10037's prototype area.

MAIN FEATURES

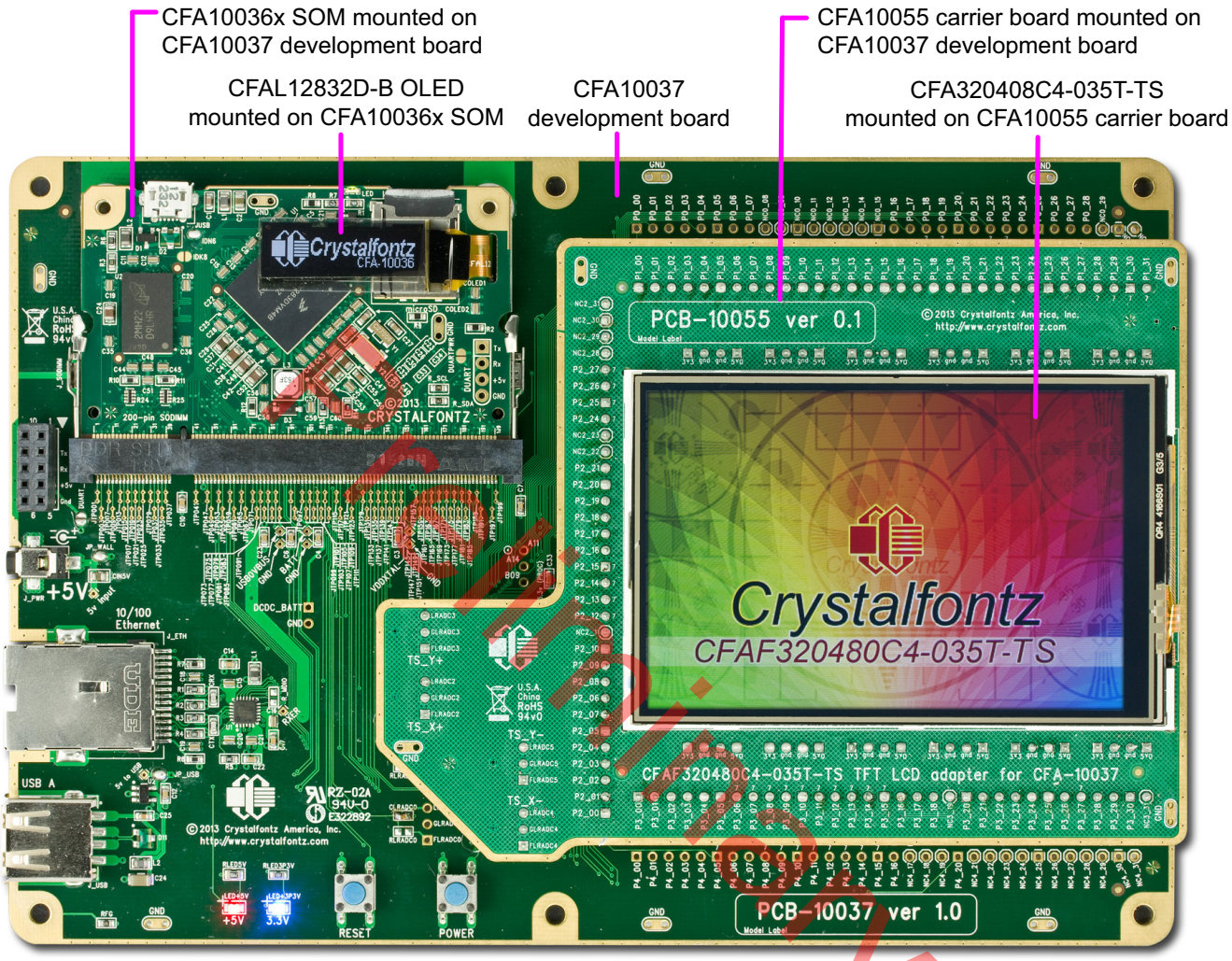


Figure 1. CFA10036 Shown with i.MX287 Processor and Optional CFAL12832D-B OLED

CFA10036 FEATURES

The CFA10036 comes with a list of standard features that make it an excellent core module for designing your next project. Some of the standard features are:

Hardware Features

- ❑ Two choices of processors:
  1. The *i.MX283* processor with *128 MB* DDR2 SDRAM running at 454Mhz with 91 GPIOs.
  2. The *i.MX287* processor with *256 MB* DDR2 SDRAM running at 454Mhz with 126 GPIOs.
- ❑ 200-pin SODIMM brings out all i.MX28 processor functionality (with the exception of DRAM interface) to allow complete customization and configuration of the CFA10036.
- ❑ An optional small-but-pixel dense CFAL12832D-B 128x32 OLED can be mounted on the CFA10036 for status and debugging messages.

- On-board micro-AB receptacle connector for USB 2.0 OTG makes communications simple. USB 2.0 host controller with PHY is included.
- MicroSD/microSDHC/microSDXC support for up to 64 GB of nonvolatile storage.
- On-board DUART connectivity for debugging and early board bring up. Dedicated Rx/Tx debug UART port with 0.1" centers. You can connect a USB633 TTL-to-USB converter to the dedicated DUART.
- Four ways to connect power:
  1. Directly through the micro USB connector.
  2. +5 volts to DUART connection.
  3. +5 volts through the 200-pin SODIMM socket.
  4. Lithium-ion (Lion) battery through 200-pin SODIMM socket.
- To download a PDF file of the Certificate of Compliance: ISO 9001:2008 manufacturer, Product Specifications, RoHS, and REACH:SVHC, go to the Doc/Files tab for the CFA10036x's website page.
- Dense BGA package: 289-ball BGA 17x17 grid on 0.8mm pitch.

Software Features

Complete open source ARM Linux kernel.

- All CFA10036 specific features are checked in to the main Linux kernel and supported by the Linux community.
- Board support packages for the CFA10036 and development boards (for example, the CFA10037).
- Full support for multiple LCD displays, with and without touch screens.
- Driver support for peripherals include rotary encoders, ADC converters, DACs, WiFi, Ethernet, keypad, and others.

I.MX28 PROCESSOR FEATURES

The following lists the features of the i.MX28 processor line. (Note: not all features are available for both processors choices, the i.MX283 and the i.MX287.) See the table below this section for a list of differences between the i.MX283 and the i.MX287 processors. For additional information, see the Freescale i.MX28 Data Sheet.

- ARM926EJ-S CPU running at 454 MHz.
- 16-Kbyte instruction cache and 32-Kbyte data cache.
- ARM embedded trace macrocell (CoreSightTM ETM9TM).
- Parallel JTAG interface.
- 128 Kbytes of integrated low-power on-chip SRAM.
- 128 Kbytes of integrated mask-programmable on-chip ROM.
- 1280 bits of on-chip one-time-programmable (OCOTP) ROM.
- 16-bit mobile DDR (mDDR) (1.8 V), DDR2 (1.8 V) and LV-DDR2 (1.5 V), up to 205 MHz DDR clock frequency with voltage overdrive.
- Four synchronous serial ports (SSP) for SDIO/MMC/MS/SPI: SSP0, SSP1, SSP2, and SSP3. SSP0 and SSP1 can support three modes,1-bit, 4-bit, and 8-bit, whereas SSP2 and SSP3 can support only 1-bit and 4-bit modes.
- Ethernet MAC
  - With the *i.MX283* processor, 10/100-Mbps IEEE 802.3 Ethernet MAC is supported.
  - With the *i.MX287* processor,10/100-Mbps 802.3 Ethernet MAC is 2x is supported.
- Single 10/100 Ethernet with GMII/RMII or Dual 10/100 Ethernet with RMII interface.
- Supporting IEEE Std 1588TM-compatible hardware timestamp.
- Supporting 50-MHz/25-MHz clock output for external Ethernet PHY.
- Two 2.0B protocol-compatible Controller Area Network (CAN) interfaces.
- One USB2.0 OTG device/host controller and PHY.
- One USB2.0 host controller and PHY.
- LCD controller, up to 24-bit RGB (DOTCK) modes and 24-bit system-mode.

- Pixel-processing pipeline (PXP) supports full path from color-space conversion, scaling, alpha-blending to rotation without intermediate memory access.
- SPDIF transmitter.
- Dual serial audio interface (SAIF) to support full-duplex transmit and receive operations; each SAIF supports three stereo pairs.
- Five application Universal Asynchronous Receiver-Transmitters (UART), up to 3.25 Mbps with hardware flow control.
- One debug UART operating at up to 115 Kb/s using programmed I/O.
- Two I2C master/slave interfaces, up to 400 kbps.
- Four 32-bit timers and a rotary decoder.
- Eight Pulse Width Modulators (PWMs).
- Real-time clock (RTC) with 32KHz crystal (requires continuous power).
- GPIO with interrupt capability.
- Power Management Unit (PMU) supports a triple output DC-DC switching converter, multiple linear regulators, battery charger, and detector.
- 16-channel Low-Resolution A/D Converter (LRADC). There are 16 physical channels but they can only be mapped to 8 virtual channels at a time.
- Single channel High Speed A/D Converter (HSADC), up to 2 Msps data rate.
- 4/5-wire touchscreen controller.
- Up to 8X8 keypad matrix with button-detect circuit.
- Security Features
  - Read-only unique ID for Digital Rights Management (DRM) algorithms.
  - Secure boot using 128-bit AES hardware decryption.
  - SHA-1 and SHA256 hashing hardware.
  - High assurance boot (HAB4).

DIFFERENCES BETWEEN I.MX283 AND I.MX287 PROCESSORS

The following table lists the functional differences between the two processor choices.

Function	i.MX283	i.MX287
Application UART	x5	x5
Debug UART	x1	x1
CAN	—	x2
Ethernet	x1	x2
High-speed ADC	x1	x1
L2 Switch	—	Yes
LCD Interface	Yes	Yes
LRADC	x8	x8
PWM	x8	x8
S/PDIF Tx	—	Yes
SD/SDIO/MMC	x4	x4
Security	Yes	Yes
SPI	x4	x4
Touch Screen	Yes	Yes
USB 2.0	OTG HS with HS PHY x1	OTG HS with HS PHY
	HS Host with HS PHY x1	HS Host with HS PHY x1
JTAG	Yes	Yes
For more information, see *the Freescale i.MX28 Data Sheet*.		

KITS, ACCESSORIES, AND ASSEMBLED PRODUCTS THAT USE CFA10036

KITS AND ACCESSORIES

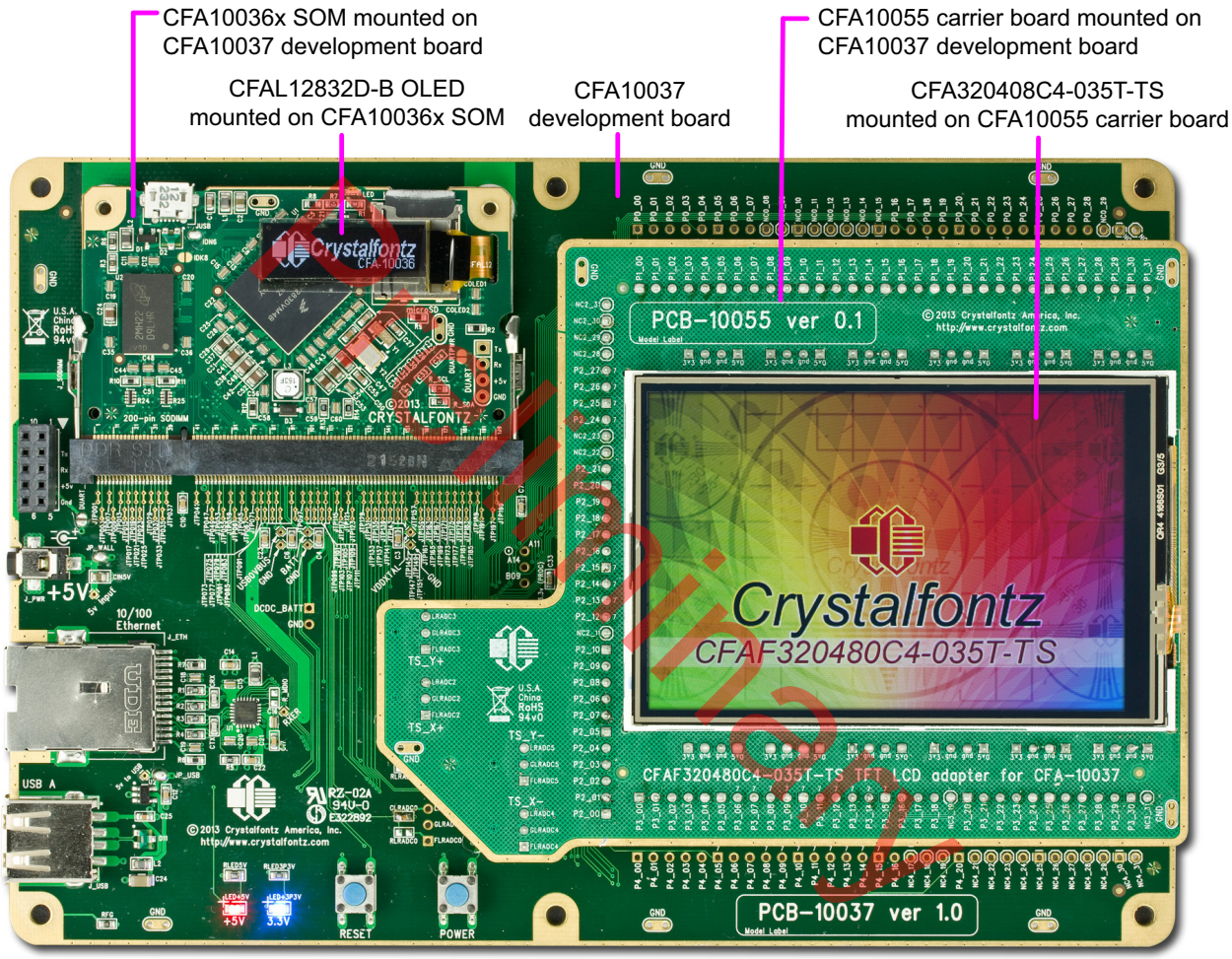


Figure 2. Kit Example

Accessories and kits are available with the products described below. For a list of all kits that include the CFA10036, see CFA10036 Kits here.

CFAL12832D-B OLED

The CFAL12832D-B 128x32 OLED graphics module displays light (near-white) characters on a dark (near-black) background. Less than 0.5-inch high (11.5 mm), the CFAL12832D-B mounts onto the CFA10036 with a ZIF connector. The OLED is useful for status messages and debugging.

CFA10037 Development Board

To easily prototype a CFA10036 based design, we offer the CFA10037 development board.The CFA10037 gives access to all the port pins of the CFA10036, including all the port pins of its i.MX28 processor (i.MX283 or i.MX287). The CFA10037 has a generous prototype area with well-decoupled power distribution in a prototype-friendly 0.1" center format.

Carrier Boards for TFT Displays (TFT LCD Adapters)

A TFT display mounted on a carrier board can be mounted to the CFA10037 development board along with the CFA10036 and the optional CFAL12832D-B. The following carrier boards and TFT displays are available.

Carrier Board	TFT mounted on top of Carrier Board		Active Area Diagonal
CFA100554	CFAF320480C4-035T		3.5-inch
CFA100558	CFAF320480C4-035T-TS *(Photo shows touch screen.)*		
CFA100564	CFAF480800FT2-040T		4.0-inch

USB633 TTL-To-USB Converter

The USB633 is a small PCB that can mount on the CFA10036's DUART for debugging and early board bring up. Dedicated Rx/Tx debug UART port with 0.1" centers. You can connect a USB633 TTL-to-USB converter to the dedicated DUART.

CFA10040PWR

The CFA10040PWR is a110 VAC +5v wall power supply that can be used to power the CFA10037 development board.

WR-USB-Y03 Cable

The WR-USB-Y03 is about 6-feet long. This cable has two different types of USB connectors, one smaller than the other. Connect the cable's smaller 2 mm female USB connector to the module's USB connector. Connect the cable's larger USB-A female connector to host's USB-A connector.

WR-JMPY-40 and WR-JMPY-41

Five packages of 20 each (total 100) female-to -female jumper wires, useful to connect to the optional CFA10037 prototype area headers. Assorted colors.

- WR-JMPY-40: Seven inches long *(shown in photo above).*
- WR-JMPY-41*:* Four inches long.

ASSEMBLED PRODUCTS THAT INCLUDE THE CFA10036

We have a series of Internet ready SOMs (System On Modules) that incorporate the CFA10036. The 900 series consists of

Product	CFA10036 mounted on back of Mother Board	TFT mounted on top of Mother Board		Active Area Diagonal
CFA920		CFAF480800T07-043T		4.3-inch
CFA920-TS		CFAF480800T07-043T-TS *(Photo shows touch screen.)*		
CFA921		CFAF800480A-050T		5.0-inch
CFA921-TS		CFAF800480A-050T-TS *(Photo shows touch screen.)*		

HARDWARE DESIGN INFORMATION

The hardware design schematic can be downloaded on our website under the Doc/Files tab as a PDF file.

PHYSICAL CHARACTERISTICS

CFA10036 Specifications	Without Optional CFAL12832D-B	With Optional CFAL12832D-B
Overall Dimensions (without optional OLED)	67.60 (W) x 71.8 (H) millimeters	same height and width
Weight	9 grams	10 grams
Operating Temperature	-20°C	-70°C
Humidity (RH noncondensing)	0%	90%

VIBRATION

Test conditions:

- GR-63-CORE 5.4.2, Office Vibration, Alternative Test: 5-100-5 Hz at 1.0 g with a sweep rate of .25
- Octave/minute, 35 minutes per axis.
- MIL-STD 810F, Figure 514C-17, Random: 1 hour per axis.
- MIL-STD 810F, Figure 514C-18, Sine: 1 hour per axis.

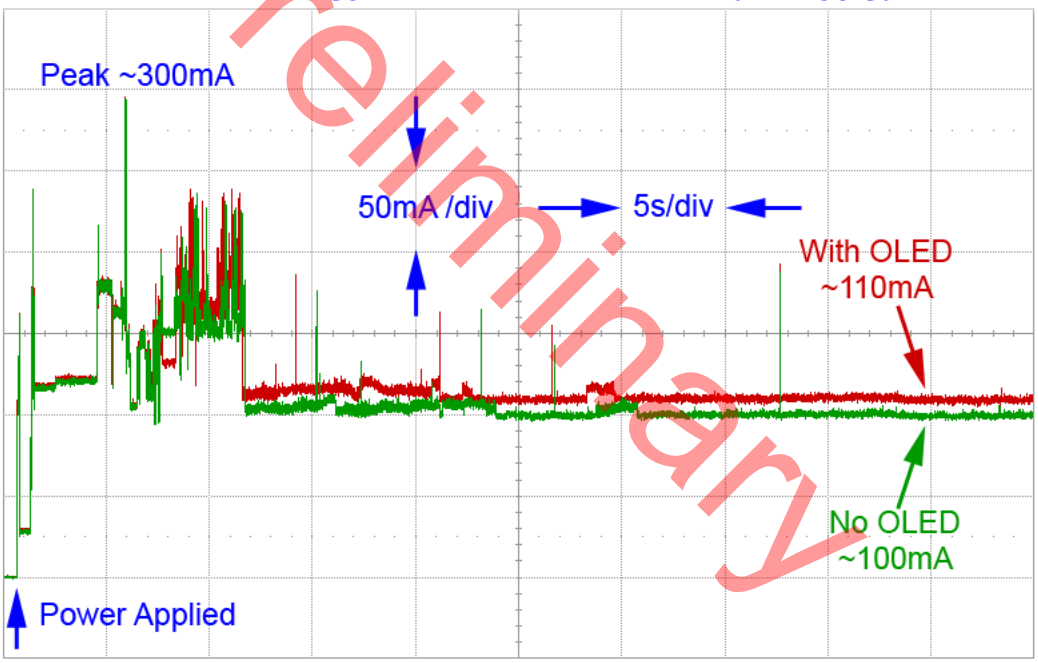
For details see APPENDIX D: Vibration Test Report (Pg. 33).

ELECTRICAL SPECIFICATIONS

DC CHARACTERISTICS

Electrical Specification	Without Optional CFAL12832D-B	With Optional CFAL12832D-B
Typical current consumption at +5.0v	100 mA	110 mA
Typical peak current draw during boot process	350 mA	350 mA
Constant busy loop	120 mA	130 mA

CFA-10036 Typical Boot Current Profile (5v supply)



REFERENCE FOR PIN FUNCTIONS

Freescale has a tool to assist in assigning pin multiplex configurations. The tool will identify “on the fly” any assignment collisions or multiplexing issues. To download, go here and look for the *Interactive i.MX Pin Mux Tool*.

This tool is great for documenting your design. Design configurations can be saved and exported for future use in schematics or software source code as supplementary documentation of a system.

ABOUT ESD

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard antistatic precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

HOW TO RUN APPLICATIONS ON THE CFA10036

The CFA10036 runs a full Linux operating system. It can be programmed in a multitude of languages, both compiled and interpreted. Familiar scripting languages such as Java, Perl, and Python can be run on the CFA10036. Other compiled languages such as C and C++ can also be used to build applications for the CFA10036 using a host build environment.

To run scripting languages, the runtime environment for the given language must first be downloaded and installed on the CFA10036. This can be accomplished using a download program such as `apt-get`.

The following sections describe how to create applications in C or C++ that will run on the CFA10036 under Linux. It describes the tools necessary to cross-compile source code files to ARM binaries and download them to the CFA10036 where they can be executed.

HOW TO CREATE CFA10036 APPLICATIONS FROM WINDOWS 7 OR 8

Step 1: Use Sourcery CodeBench Lite to Cross-Compile Your C or C++ Programs

To create applications that can run on the CFA10036 under Linux, cross-compile your C and C++ programs to Linux ARM binaries. Download the binaries and run them directly on the CFA10036.

Mentor Graphics has a free tool Sourcery CodeBench Lite.To install, double click the icon and follow the instructions. Installation using the default settings were tested and work well.

Special Note for Using Sourcery CodeBench Lite with Windows 8

As of the publication date of the guide, Mentor Graphics does not support Sourcery CodeBench Lite on the Windows 8 platform. However, we found a workaround.

If you chose the defaults during the installation of Sourcery CodeBench Lite, the application binaries will have been installed under the current user. Go to the directory:

```
CodeSourcery\Sourcery_CodeBench_Lite_for_ARM_GNU_Linux\bin
```

under your home directory and type the following:

```
set PATH=%PATH%;%CD%
```

This will add the current directory to your path.

Unlike Windows 7, the tools cannot be run from any directory. You must create a special directory from which the tools will run. Create a working directory (in this case we will call it source) under:

`CodeSourcery\Sourcery_CodeBench_Lite_for_ARM_GNU_Linux`
Use the cd command to change/create the new directory and you are ready to build applications.

Step 2: Use WinSCP to Copy Binary Files

To copy the binary files to the CFA10036, The program WinSCP (Windows Secure Copy) can be used. This program opens a directory on the CFA10036 and allows the user to drag and drop files to the device.

WinSCP is Windows application that uses “Secure copy (SCP)” to transfer files between two computers. The interface is quite simple with drag and drop functionality as well as the ability to edit files on the remote machine.

Step 3: Use PuTTY to Open a Terminal

PuTTY is an SSH and telnet client. You can use PuTTy to open a terminal to the CFA10036 device and run your program from there.

HOW TO CREATE CFA10036 APPLICATIONS FROM A LINUX PC

Unlike the Windows environment, building applications under Linux is straightforward. Instead of installing Sourcery CodeBench Lite as we describe for Windows below, it is recommended that the buildroot environment be installed instead. This environment contains the toolchain to build applications for the CFA10036 as well as be able to build and configure full Linux images.

YOUR FIRST CFA10036 PROGRAM: HELLO WORLD

As an example, here is a simple “Hello World” program. Copy the following code into a file named `hello.c`.

```
#include <stdio.h>

void main(void) {

   printf("\nWelcome to the CFA10036 environment!\n")
}
```

To compile the program, type the following:

```
arm-none-linux-gnueabi-gcc hello.c -o hello
```

This should create a file called “`hello`” in your directory.
Using WinSCP (SCP under Linux), copy the `hello` file over to the CFA10036.

Typing `/hello` from a terminal connected to the CFA10036 should produce the following:

```
Welcome to the CFA10036 environment!
```

CARE AND HANDLING PRECAUTIONS

For optimum operation of the CFA10036 and to prolong its life, please follow the precautions described below. If you have a CFAL12832D-B module mounted on the CFA10036, please be sure to read the Care and Handling Precautions in the module's Data Sheet found on this product's web page under the Doc/Files tab.

ESD (ELECTRO-STATIC DISCHARGE) SPECIFICATIONS

The circuitry is industry standard CMOS logic and is susceptible to ESD damage. Please use industry standard antistatic precautions as you would for any other static sensitive devices such as expansion cards, motherboards, or integrated circuits. Ground your body, work surfaces, and equipment.

DESIGN AND MOUNTING

- Do not disassemble or modify.
- Solder only to the I/O terminals.
- Do not reverse polarity to the power supply connections. Reversing polarity will immediately ruin the product.

AVOID SHOCK, IMPACT, TORQUE, OR TENSION

- Do not expose to strong mechanical shock, impact, torque, or tension.
- Do not drop, toss, bend, or twist.
- Do not place weight or pressure on the product.

OPERATION

- Your circuit should be designed to protect the product from ESD and power supply transients.
- Observe the operating temperature limitations: a minimum of 0°C to a maximum of 50°C noncondensing with minimal fluctuation. Operation outside of these limits may shorten life and/or harm display. Changes in temperature can result in changes in contrast.
  - At lower temperatures.
  - At higher temperature.
- Operate away from dust, moisture, and direct sunlight.

STORAGE AND RECYCLING

- Store in an ESD-approved container away from dust, moisture, and direct sunlight with humidity less than 90% noncondensing.
- Observe the storage temperature limitations: a minimum of -20°C minimum to +80°C noncondensing maximum with minimal fluctuations. Rapid temperature changes can cause moisture to form, resulting in permanent damage.
- Do not allow weight to be placed on the products while they are in storage.
- To discard, please recycle your products at an approved facility.

APPENDIX A: HOW TO INSTALL UBUNTU ON WINDOWS 7 OR 8 USING VMWARE PLAYER

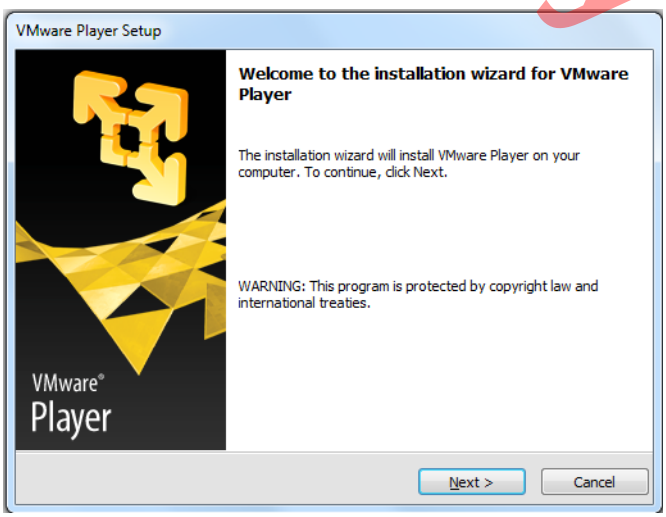
INTRODUCTION

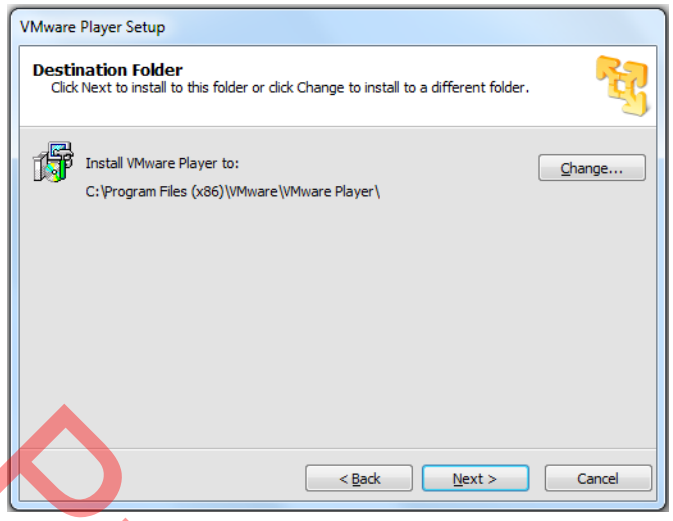
To run a Linux distribution under the Windows 7 or Windows 8, it is necessary to first install virtual machine software to install and run the Linux. This document describes how to install the VMware Player software.

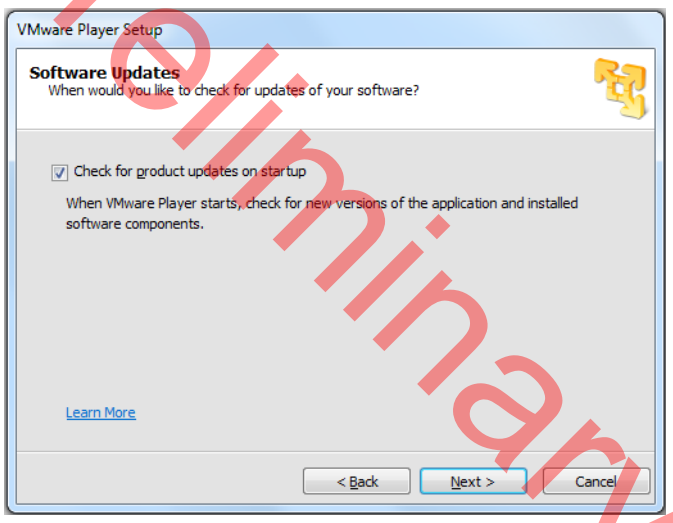
VMware Player was tested under Windows 7 and Windows 8. The player can be downloaded from www.vmware.com/products/player. The download is free for noncommercial use.

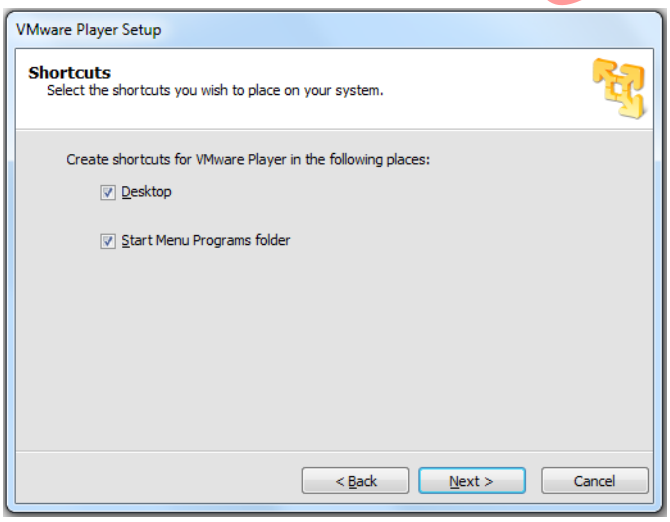
STEP 1: INSTALL VMPLAYER

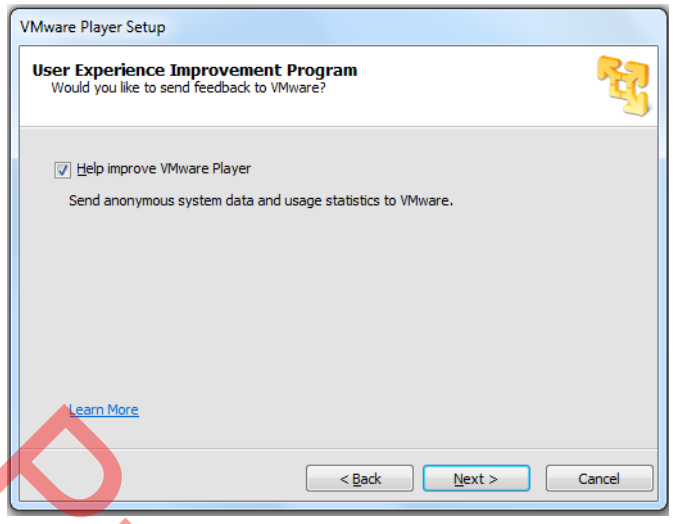
Installation is straightforward and works well with the default settings. The following screenshots show the installation sequence for VMware Player.

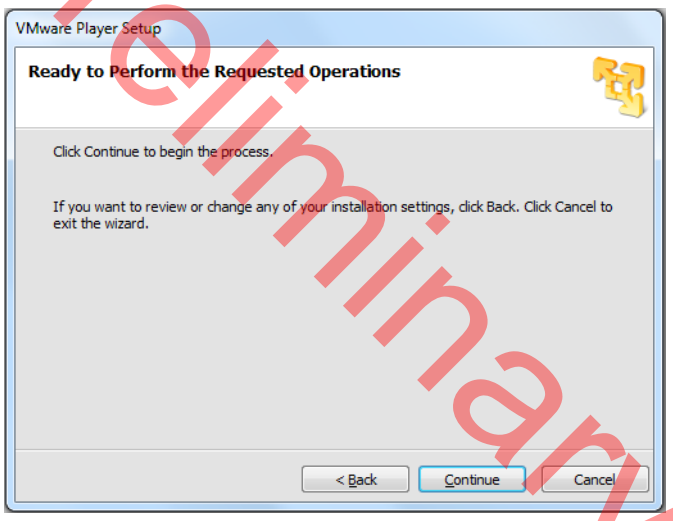


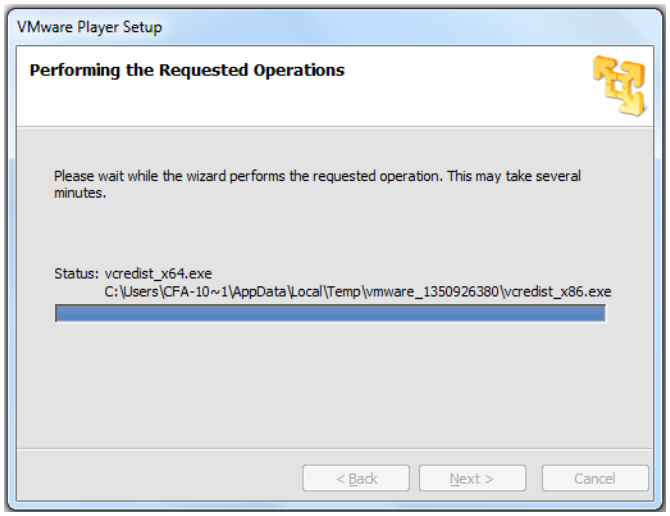


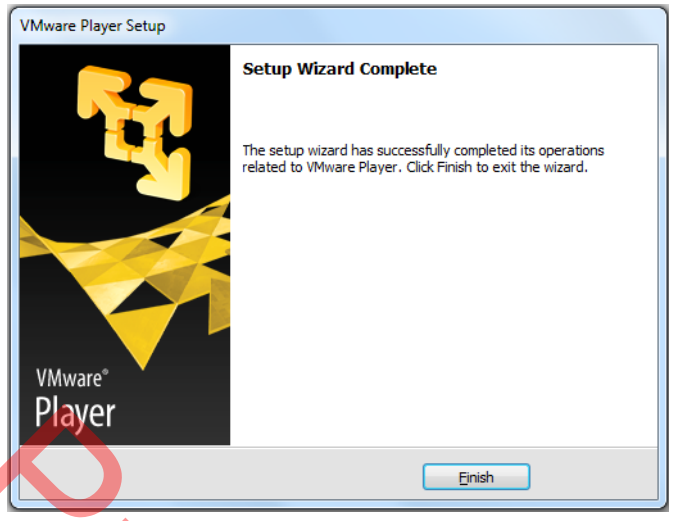








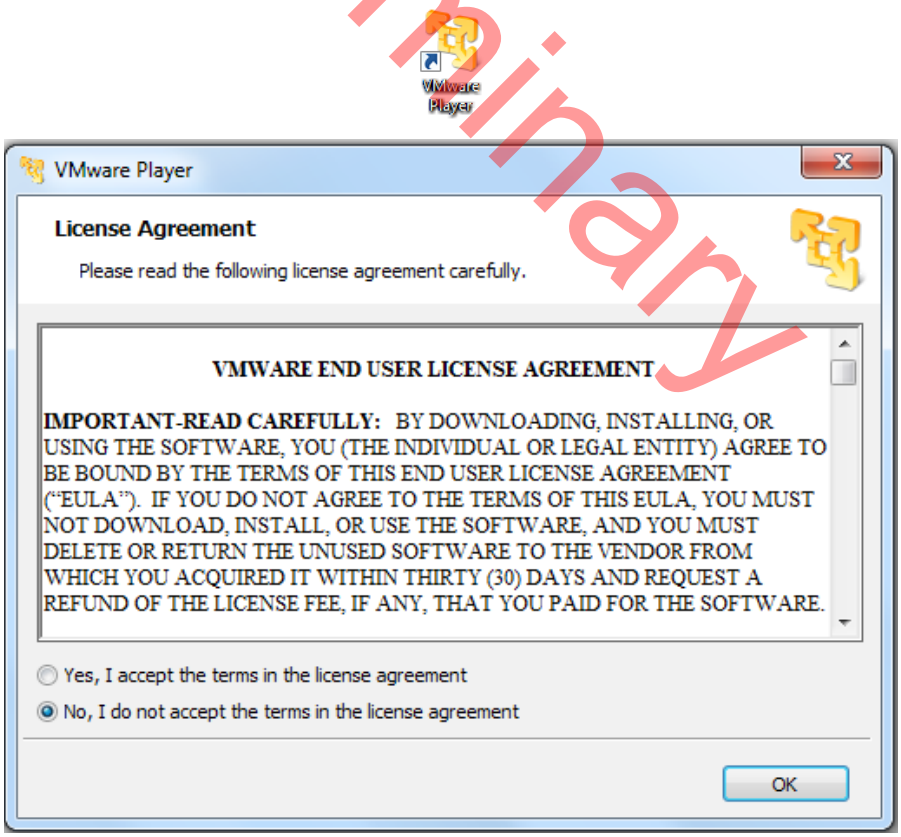




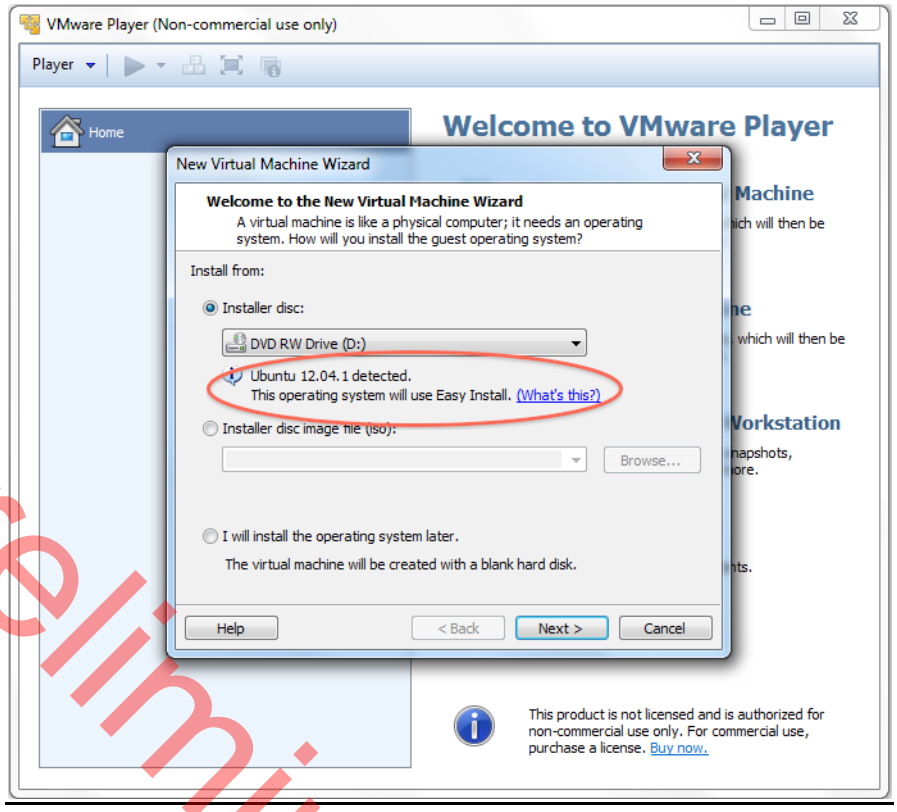
VMware should now be fully installed and ready to use.

STEP 2: INSTALL UBUNTU

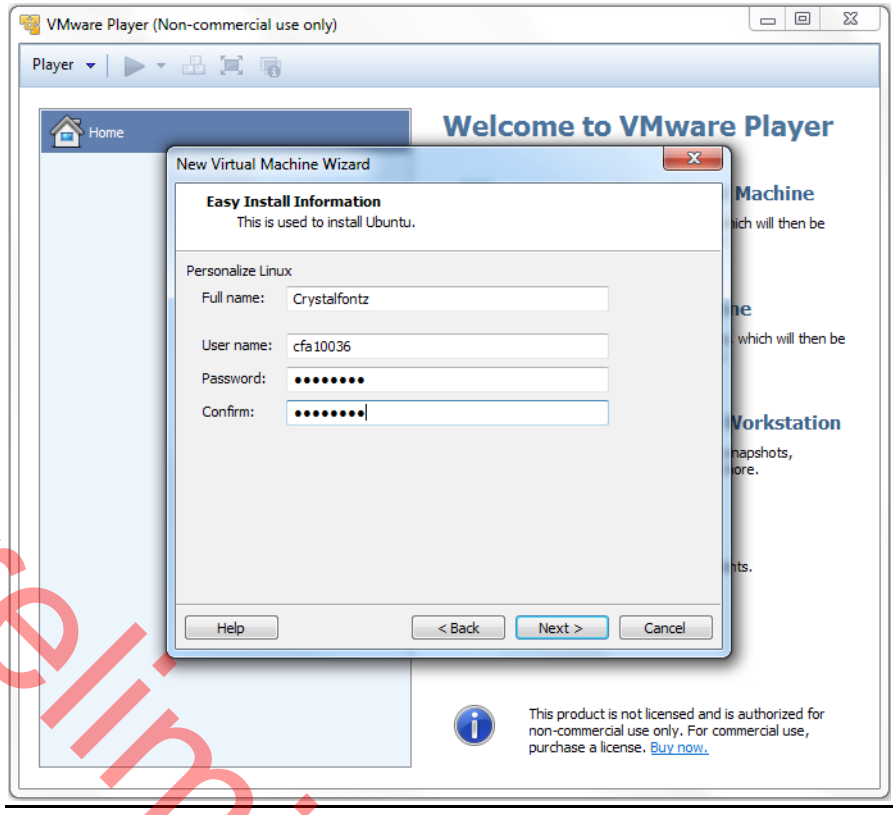
Insert the Ubuntu installation media into the PC's DVD player and click on the desktop icon to start the VMware Player.



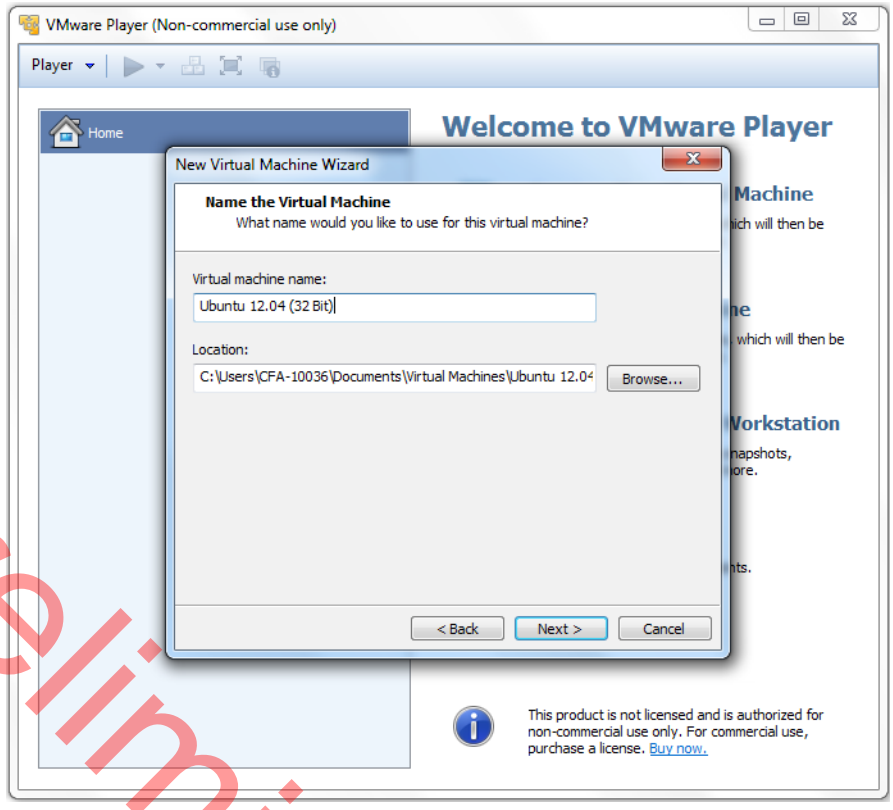
The virtual machine wizard should detect the Ubuntu as shown here.



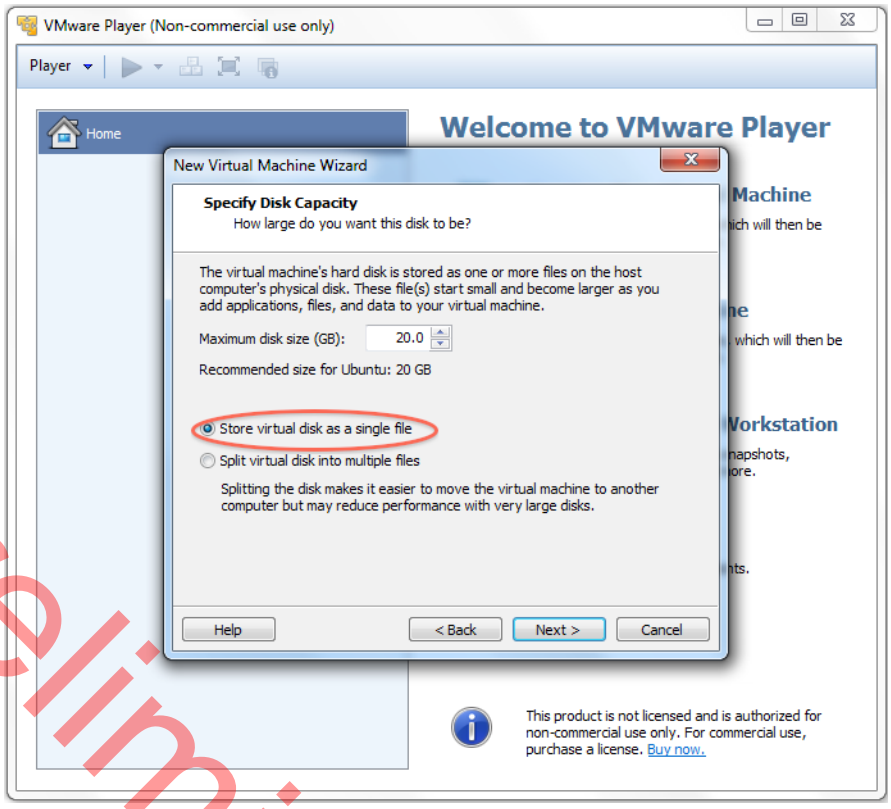
Enter the name you wish to give the virtual machine along with a user ID and password. This information will be passed to the Ubuntu installer.



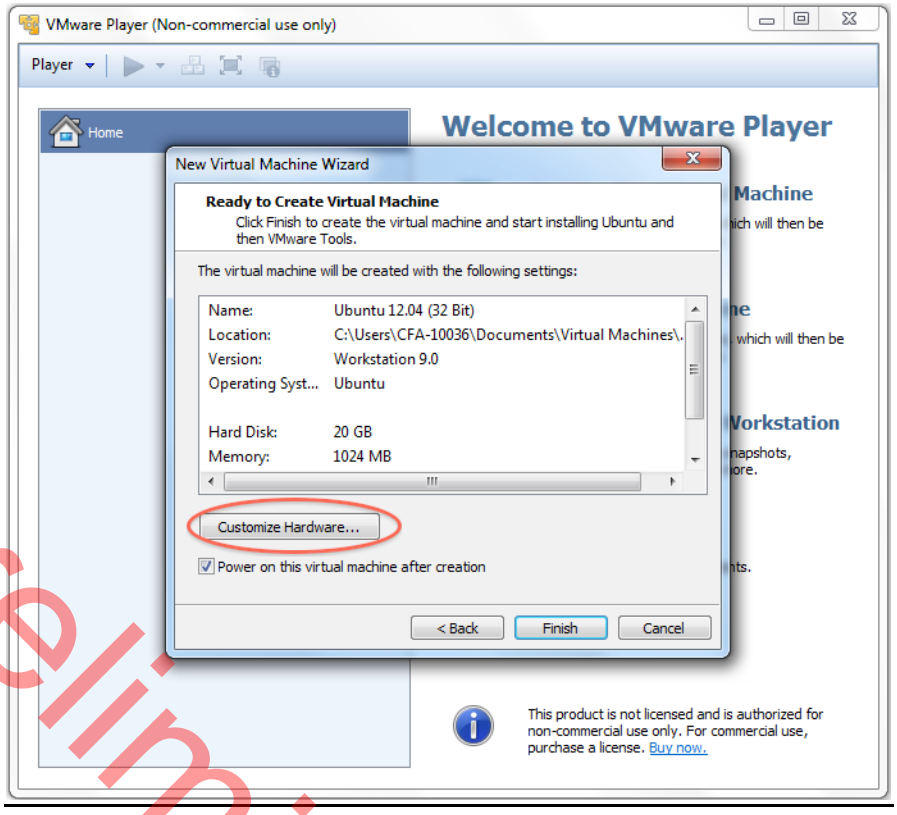
Enter the name you want to appear in the list of virtual machines loaded into VMware Player.



Unless you plan to move the virtual machine to a different PC, select the option given.

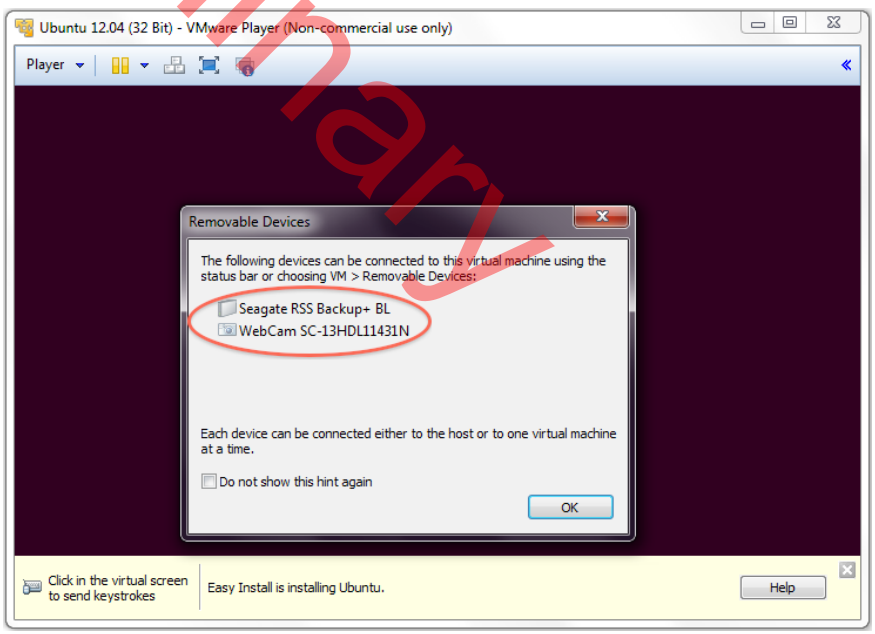


If you are running on a multi-core processor with a lot of memory, the default settings will suffice. You can select the Custom Hardware option if you want to assign more resources to the Ubuntu virtual machine.

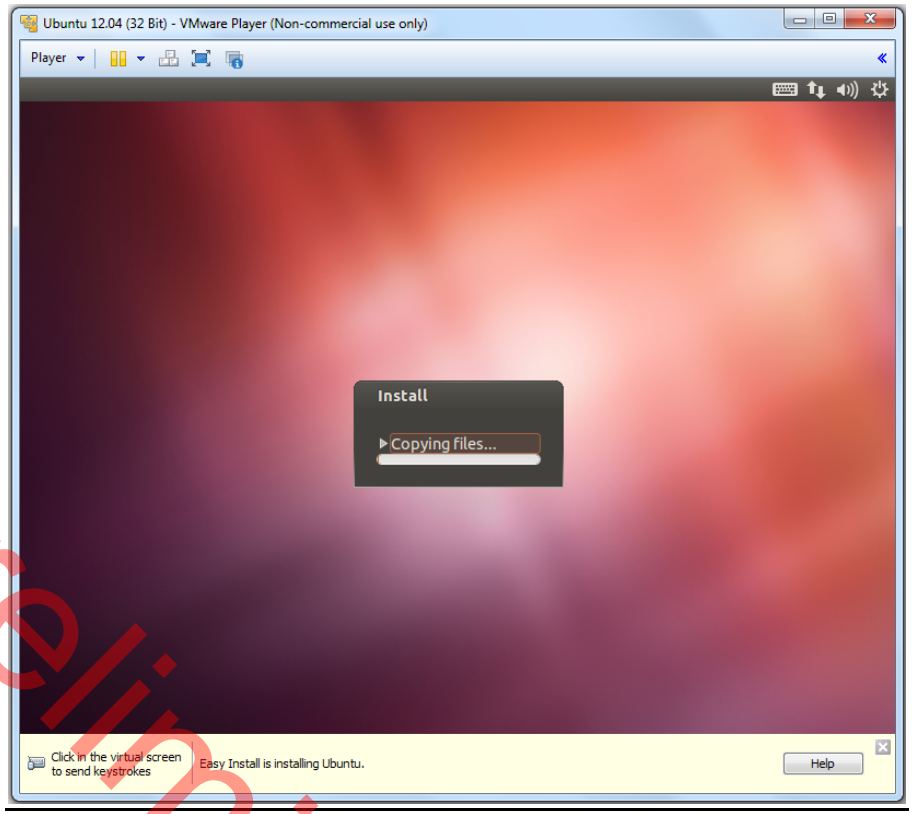


Depending on your hardware, you may get messages similar to this one which lists hardware which can be dynamically swapped between the virtual machine and Windows.

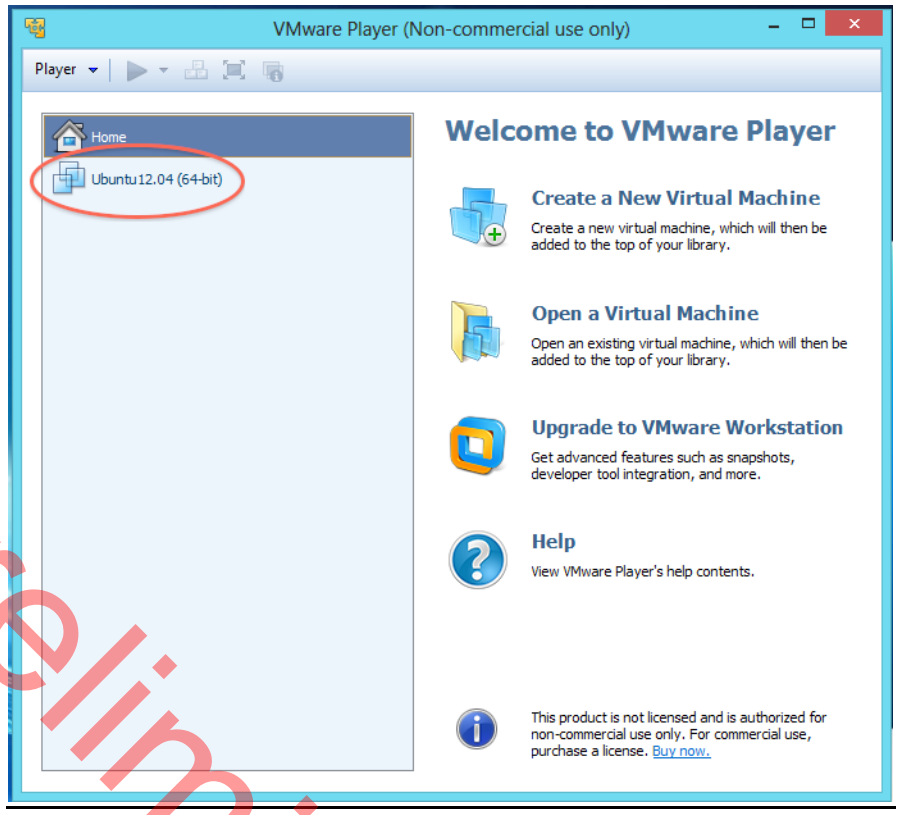
When copying a Linux image to an SSD card, it will be necessary to assign the card to the virtual machine as outlined in the document describing how to build an image.



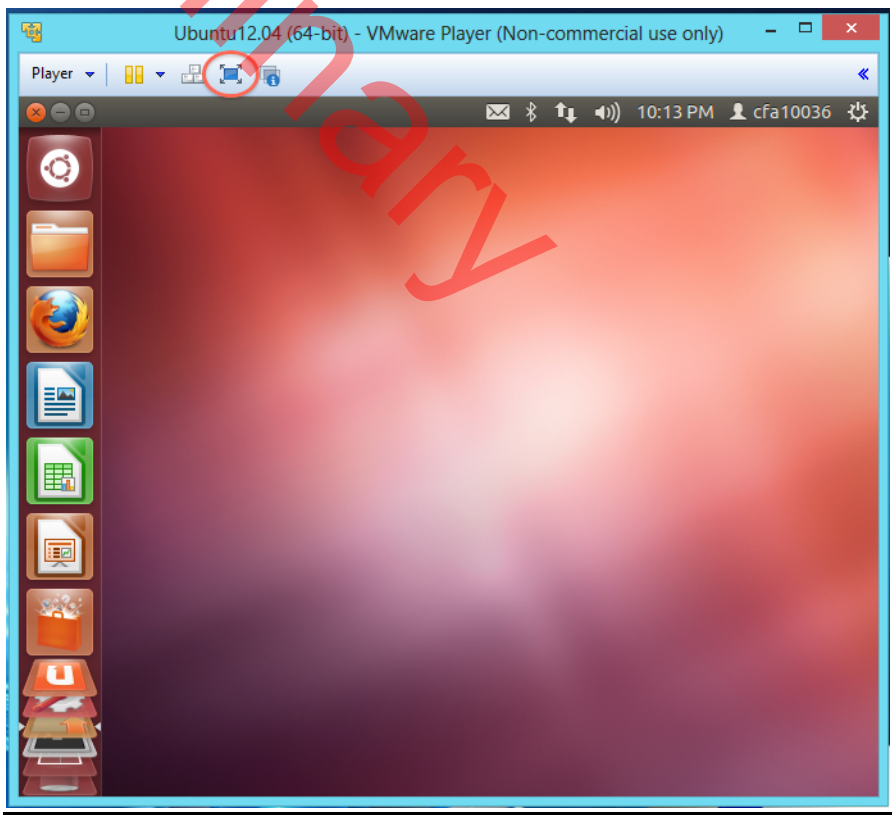
From this point on, the Ubuntu installation is identical to installing on a Linux partition. Refer to the Ubuntu installation instructions if you need more information.



Once Ubuntu is installed, it can be started by opening the VMware Player and selecting the Ubuntu virtual machine.



Ubuntu should now be up and running as a virtual machine under Windows. If you wish to work in full screen mode while in Linux, click on the button marked with a red circle.



APPENDIX B: HOW TO BUILD THE LINUX DISK IMAGE

INTRODUCTION

In most cases, simple changes to the .dts Linux device table are all that is required to support additional hardware. But if your design requires extra functionality, you can configure the kernel to your hardware. This requires a Linux PC or a Windows 7 or 8 VM (virtual machine) running Linux.

Ubuntu 12.04

Ubuntu 12.04 is recommended, as it was tested with buildroot and Freescale's image creation scripts and works well. Due to the subtle differences between different versions of Linux, these instructions were verified to work on Ubuntu 12.04. All other versions of Linux may need some modification to make them work correctly. Ubuntu 12.04 can be downloaded from the following link: www.ubuntu.com/download.

Windows 7 or 8 with Ubuntu Version 12.04 Installed Using a Virtual Machine Manager

To install a virtual Linux operating system under Windows, you will need to install a virtualization platform. VMware player works well for this purpose and is free for noncommercial use. Another option is to use Virtualbox as the virtual machine manager. Virtualbox is a little more complicated to set up and may be confusing to some users. We tested VMware under Windows 7 and 8 and it works well. You can download VMware player from the following link: www.vmware.com/products/player.

Use VMware to install the Ubuntu 12.04 OS. See APPENDIX A: How to Install Ubuntu on Windows 7 or 8 Using VMware Player (Pg. 19).

STEP 1: INSTALL ADDITIONAL UBUNTU 12.04 PACKAGES

Some packages required by buildroot are not included in the Ubuntu 12.04 image. These packages need to be installed before buildroot will run.

Use the command line in a terminal window and type in the following:

```
sudo apt-get install g++
sudo apt-get install bison
sudo apt-get install flex
sudo apt-get install gettext
sudo apt-get install ncurses-dev
sudo apt-get install texinfo
sudo apt-get install git
```

If you are using Ubuntu version later than 12.04, check to see if these packages are included.

STEP 2: DOWNLOAD BUILDROOT

Once the above packages have been installed, download buildroot

```
git clone https://github.com/crystalfontz/cfa_10036_buildroot
```

Buildroot will be downloaded to a directory `cfa_10036_buildroot.`

NOTE: These instructions will change once all of the Crystalfontz modifications have been pushed to the master.

Enter the following commands to build an image:

```
cd cfa_10036_buildroot
make crystalfontz_cfa10036_defconfig
make linux-menuconfig
```

Change the options in the configuration menu to support your hardware. Then type:

```
make
```

Buildroot will start downloading and building a toolchain and all packages necessary for a Linux board support package for the CFA-10036.

STEP 3: LOAD DISK IMAGE ONTO SD CARD

Once the disk image has been built, it can be loaded onto an SD card using the following command:

```
> sudo python board/crystalfontz/cfa-10036/mk_cfa_sd.py \
>     -e output/images/barebox-env \
>     -b output/images/cfa10036_barebox_ivt.sb \
>     -r output/images/rootfs.tar /dev/$device
```

Where device is the name of the device assigned to the SD card.

APPENDIX C: QUALITY ASSURANCE STANDARDS

INSPECTION CONDITIONS

- Environment
  - Temperature: 25±5°C
  - Humidity: 30~85% RH

ACCEPTANCE SAMPLING

DEFECT TYPE	AQL*
Major	≤.65%
Minor	<1.0%
* Acceptable Quality Level: maximum allowable error rate or variation from standard	

DEFECTS CLASSIFICATION

Defects are defined as:

- A *major defect* is a defect that substantially reduces usability of unit for its intended purpose.
- A *minor defect*: is a defect that is unlikely to reduce usability for its intended purpose.

ACCEPTANCE STANDARDS

#	DEFECT TYPE	ACCEPTANCE STANDARDS CRITERIA	MAJOR / MINOR
1	PCB defects	1. Oxidation or contamination on connectors.* 2. Wrong parts, missing parts, or parts not in specification.* 3. Jumpers set incorrectly. 4. Solder (if any) on bezel, LED pad, zebra pad, or screw hole pad is not smooth. **Minor if display functions correctly. Major if the display fails.*	Minor
2	Soldering defects	1. Unmelted solder paste. 2. Cold solder joints, missing solder connections, or oxidation.* 3. Solder bridges causing short circuits.* 4. Residue or solder balls. 5. Solder flux is black or brown. **Minor if display functions correctly. Major if the display fails.*	Minor

APPENDIX D: VIBRATION TEST REPORT

Test: Sine & Random Vibration **Reliability Laboratory**

Originator: Brent Crosby – Crystalfontz America
Test Coordinator: Larry Bettinger - lbetting@keytronic.com 509-927-5577
Test Started: April 9, 2013
Test Completed: April 10, 2013

Summary:

The following Crystalfontz America samples were submitted for operational vibration testing:

Sample Description	S/N
533 Yellow	1148533YYHD063605
533 Blue	1234533TMITD075774
633 Yellow	1037633YYH297069
633 White	1217633TFHD356000
735 Yellow	1212735TFK0002778
735 White	1212735TFK0002778
2x CFA-10036 ver. 1.0	Pilot run samples, no S/N assigned.
2x CFA-10037 ver. 1.0	Pilot run samples, no S/N assigned.

Test Conditions:

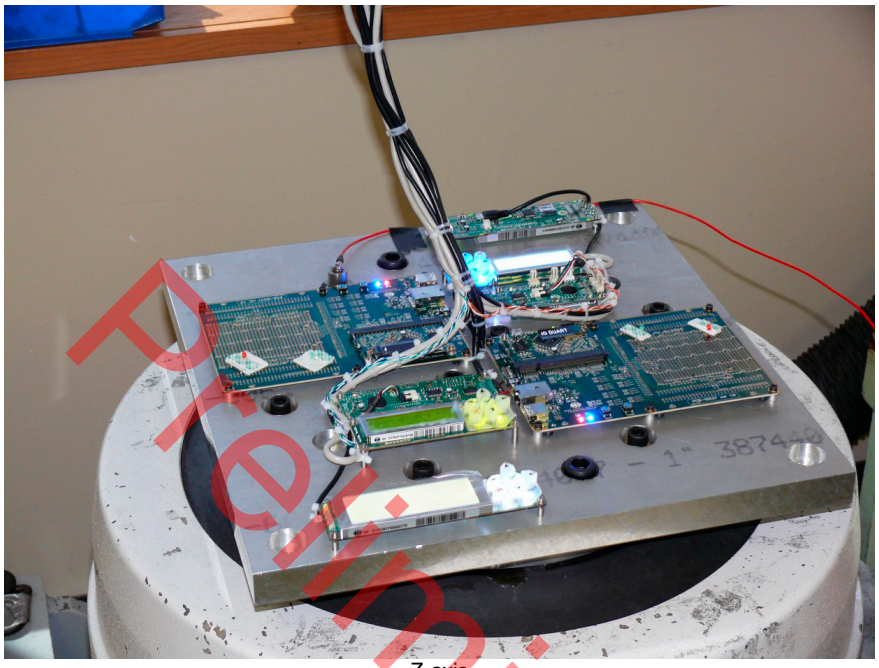
The samples were mounted to a customer's fixture plate which was bolted directly to the slip table for the X and Y-axes. For the Z-axis the fixture was bolted to the tester with a small aluminum coupling plate. The vibration testing was performed on a Ling Dynamic Systems V730 vibrator with a Data Physics SignalStar Scalar vibration control system version 2.2.923. The samples were subjected to following profiles:

- GR-63-CORE 5.4.2, Office Vibration, Alternative Test: 5-100-5 Hz at 1.0 g with a sweep rate of .25 octave/minute, 35 minutes per axis.
- MIL-STD 810F, Figure 514C-17, Random: 1 hour per axis.
- MIL-STD 810F, Figure 514C-18, Sine: 1 hour per axis.

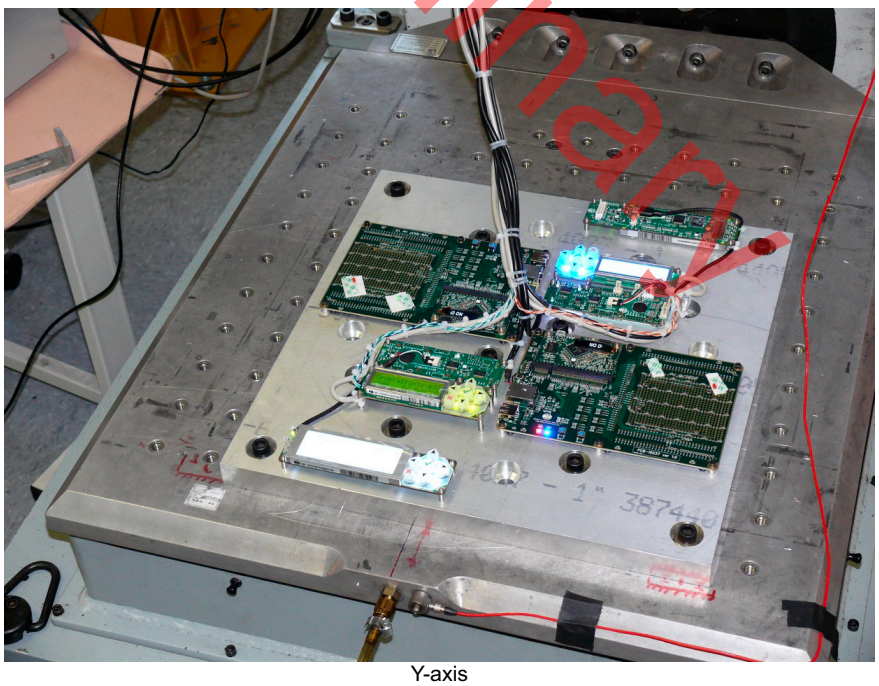
Equipment used:

Equipment	Model	S/N	Calibration Due Date
Endevco Control Accelerometer	7221	AM67	12-03-13
Endevco Charge amplifier	2721B	ER01	12-03-13
Data Physics Vibration controller	SignalStar Scalar	74244	05-29-13

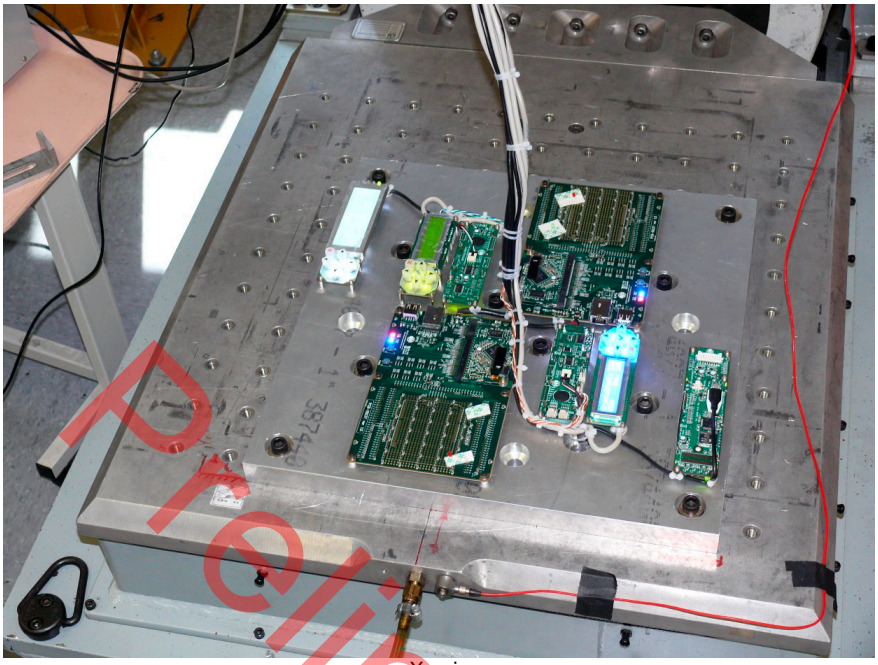
Test Setups:



Z-axis

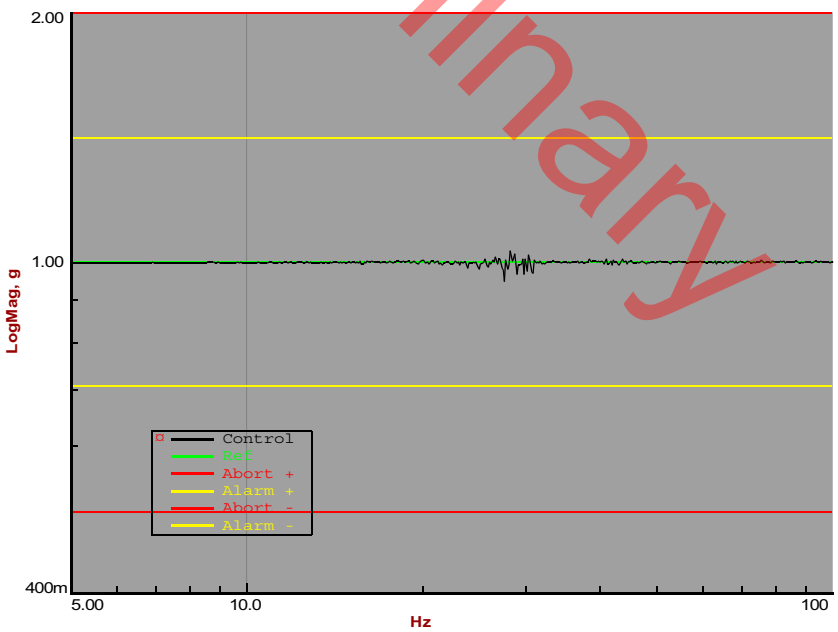


Y-axis

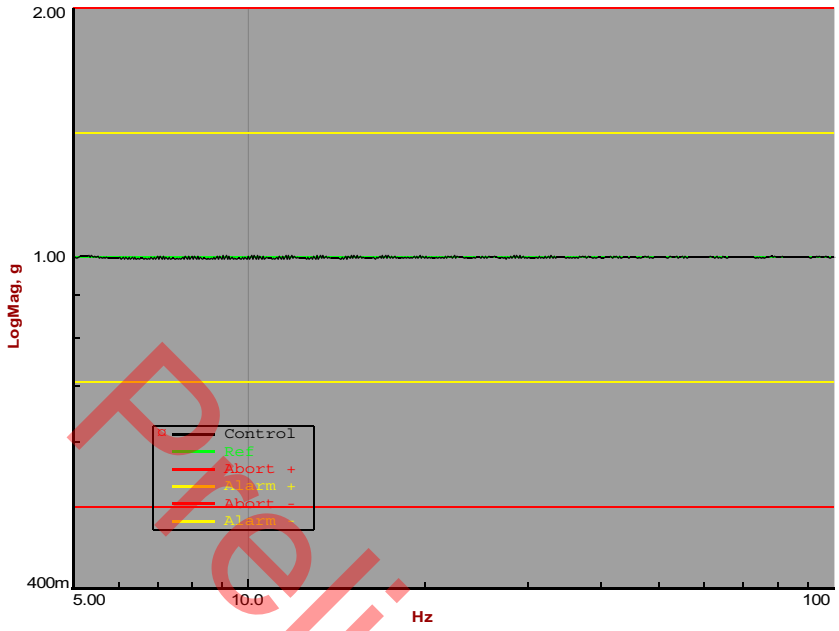


X-axis

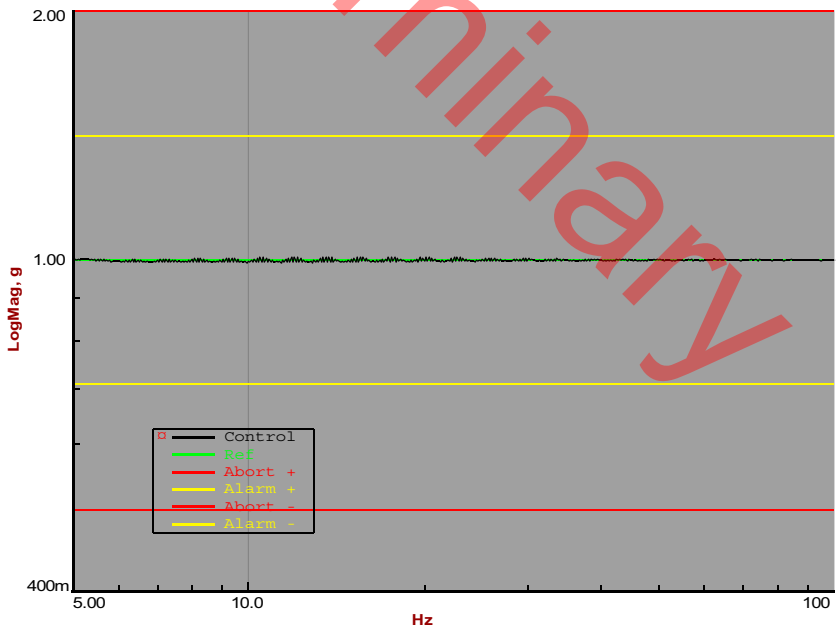
Control accelerometer vibration level graphs:



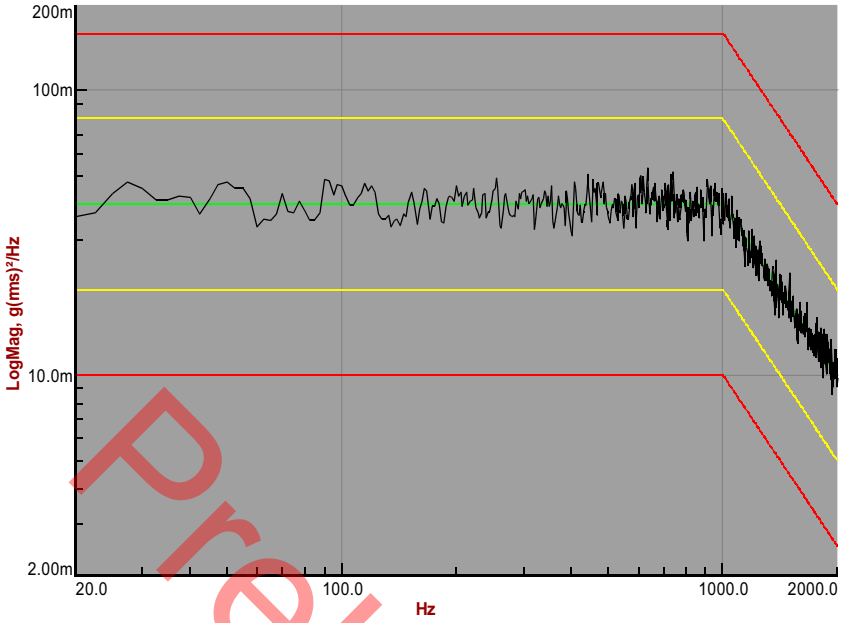
Z-axis (GR-63-CORE 5.4.2, Office Vibration, Alternative Test)



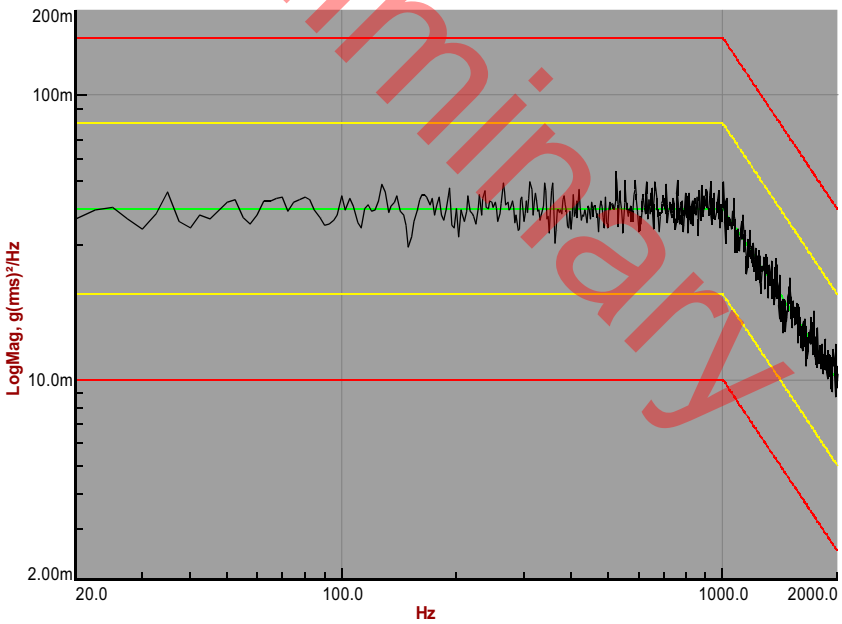
Y-axis (GR-63-CORE 5.4.2, Office Vibration, Alternative Test)



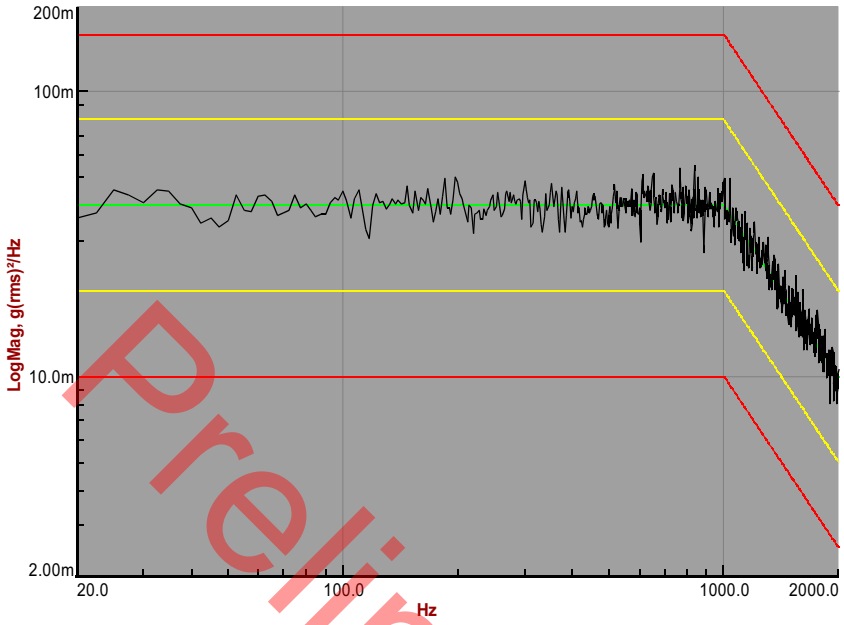
X-axis (GR-63-CORE 5.4.2, Office Vibration, Alternative Test)



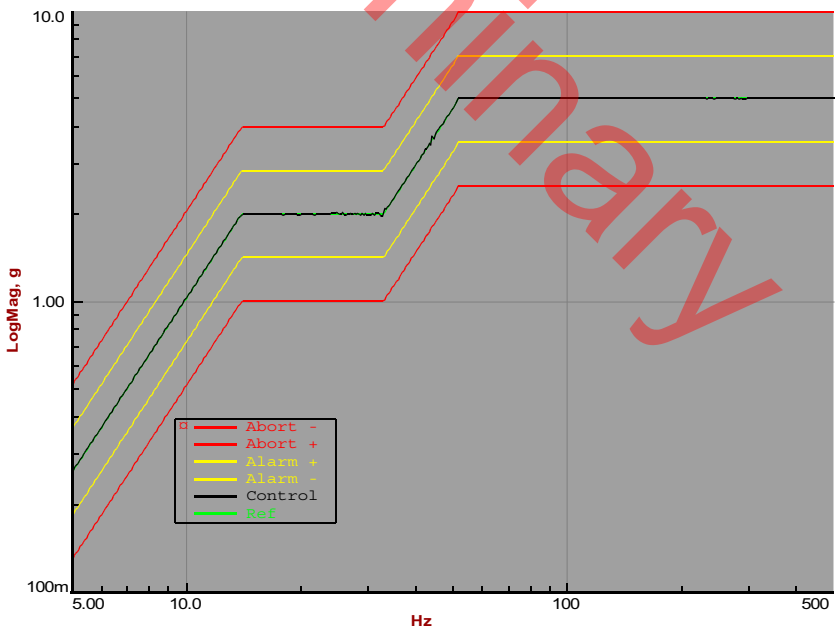
X-axis (MIL-STD 810F, Figure 514C-17, Random)



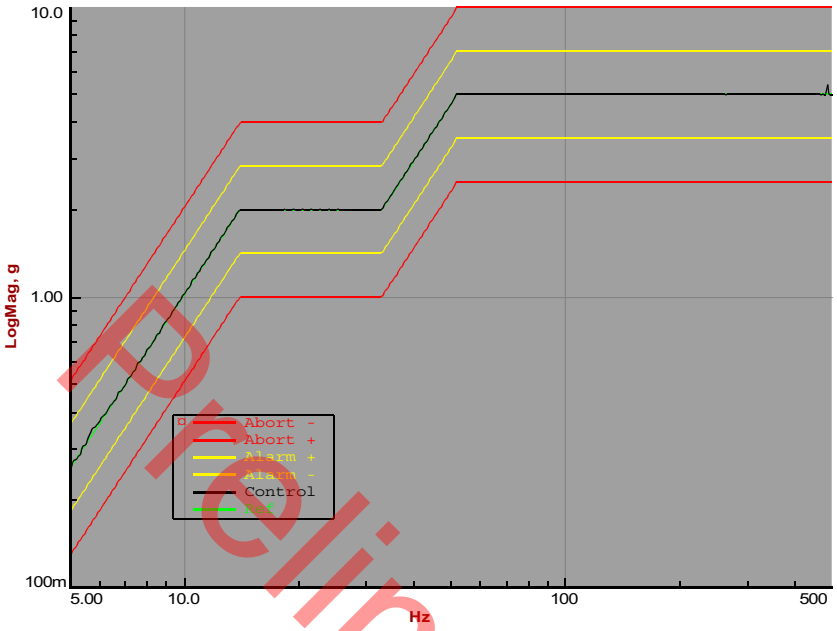
Y-axis (MIL-STD 810F, Figure 514C-17, Random)



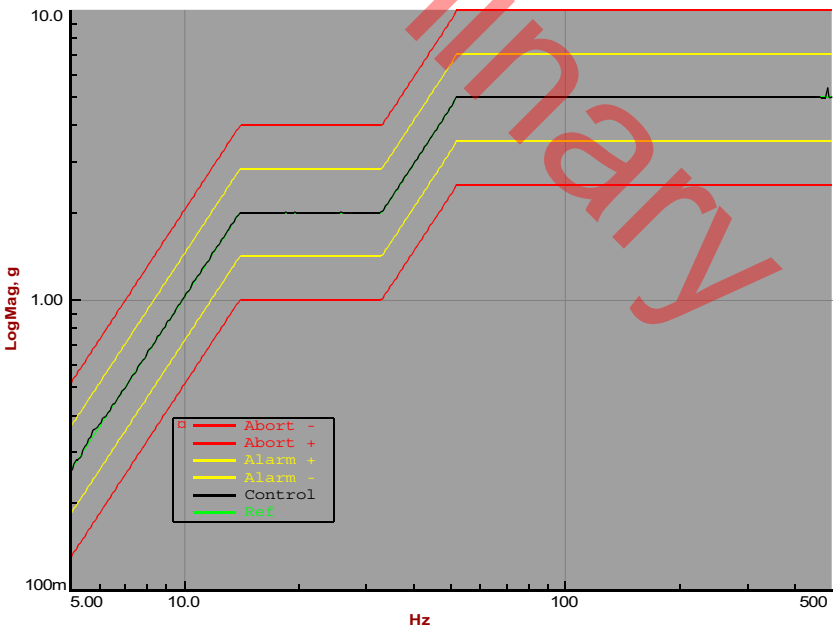
Z-axis (MIL-STD 810F, Figure 514C-17, Random)



Z-axis (MIL-STD 810F, Figure 514C-18, Sine)



Y-axis (MIL-STD 810F, Figure 514C-18, Sine)



X-axis (MIL-STD 810F, Figure 514C-18, Sine)