

# L138/C6748 Development Kit (LCDK)

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Hello Fellow C6748 and OMAP-L138 Developers!

We have just finished our brand new L138/C6748 Development kit (LCDK) which is a complete hardware and software reference design for Analytics, Biometrics, Audio and lot more to think of end applications. This page will enable more collaboration, project sharing and knowledge exchanges. We will continue to improve the site, so expect more to come!.

**TI's new C6748 DSP Development Kit**  
Jump start real-time signal processing innovations:

- Biometric analytics (face detections & fingerprint recognition)
- Audio
- Communications

Order yours today!



Only \$195

## Meet the L138/C6748 Development Kit(LCDK)

### What is LCDK?

LCDK is an easy-to-use development tool for beginners and experienced users alike for creating low power and low cost solutions for biometric, analytics, audio and communication based applications. At \$195, the LCDK offers everything you need to get started with your projects. L138/C6748 development kit is part of single core DSP value line series. The kit includes either a TMS320C6748 DSP or an OMAPL138 application processor with 456 MHz C674x Fixed/Floating point core. It has On-chip RTC, DDR2 running at 150 MHz, NAND FLASH and SD/MMC Slot, USB Serial Port, Fast Ethernet Port, B Host port (USB 1.1), USB OTG port (USB 2.0), SATA Port , VGA port, LCD Port (Beagleboard XM connectors), three AUDIO Ports, Composite IN (RCA Jack) and Leopard Imaging Camera Sensor Input.

For more information, Refer the product page url's for the following:

OMAPL138 LCDK - <http://www.ti.com/tool/tmdslcdk138> <sup>[1]</sup>

C6748 LCDK - [www.ti.com/tool/tmdslcdk6748](http://www.ti.com/tool/tmdslcdk6748) <sup>[2]</sup>

## LCDK Overview

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### Why LCDK?

The LCDK is an easy-to-use, affordable and scalable introduction to the world of TI's C6000 DSP value line family.

Easy-to-use - LCDK includes all of the hardware and software needed to get started. TI provided software solutions, open source projects and code examples help users get up and running quickly.

Affordable – For \$195, the LCDK includes a development board, mini-USB cable, Micro SD card, free & downloadable software development kits – everything you need to get started today.

Scalable – The LCDK is a simple introduction to the single core DSP family. As application requirements change, programs developed on the LCDK can be migrated to higher end single core devices.

### How do I get started?

1. Getting started is easy and affordable - only \$195+ Shipping.

C6748-LCDK Order now! <sup>[3]</sup>

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OMAP-L138 (LCDK) Order now ! <sup>[4]</sup>

2. Download the software components (see On-Line Resources below):

- **Code Composer Studio version 5**
- **Code Generation Tools** - TI provided Compiler Tools for DSP development

3. Follow the Getting Started Guide <sup>[5]</sup> for Processor SDK to setup the software

4. Learn by taking the free Getting Started workshop

5. Visit our Single Core DSP Learning Community!

Tool	Order Today!	Price	More Information
<b>LCDK</b>	<b>C6748-LCDK</b> <sup>[3]</sup>	<b>\$195 + Shipping</b>	See Online Resources below <sup>[6]</sup>
	<b>OMAP-L138 LCDK</b> <sup>[4]</sup>		
<b>Emulators</b> Click here <sup>[7]</sup> to see all options on the TI estore	<b>XDS100</b> <sup>[8]</sup>	<b>\$79 + Shipping</b>	Link to XDS100 wiki <sup>[9]</sup>
	<b>XDS200</b> <sup>[10]</sup>	<b>\$295 + Shipping</b>	Link to XDS200 wiki <sup>[11]</sup>
	<b>XDS510</b> <sup>[12]</sup>	<b>\$1595 + Shipping</b>	Link to XDS510 wiki <sup>[13]</sup>
	<b>XDS560</b> <sup>[14]</sup>	<b>From \$995 + Shipping</b>	Link to XDS560 wiki <sup>[15]</sup>

#### NOTE

- Distributor prices may vary
- XDS110 is **NOT** supported with this board.
- We're building the LCDKs as fast as we can! Additional units are available every 2 weeks. Thanks for your patience.

Included Devices	Description	Documentation
<b>TMS320C6748</b>	TMS320C6748 Fixed/Floating Point DSP	Datasheet
<b>OMAPL138</b>	OMAPL138 DSP+ARM9 Processor	Datasheet

Compiler/Debugger (IDE)	Download Now!	Price
Code Composer Studio (CCS)	<b>Download Now!</b> <sup>[16]</sup> (Requires TI Login)	Evaluation License
CodeGen Tools	<b>Download Now!</b> <sup>[17]</sup> (Requires TI Login)	FREE
.BIOS C6 SDK (Legacy)	<b>Download Now!</b> <sup>[18]</sup> (Requires TI Login)	FREE
Linux SDK (Legacy)	<b>Download Now!</b> <sup>[19]</sup>	FREE
Processor SDK (Latest)	<b>Download Now!</b> <sup>[20]</sup> (Requires TI Login)	FREE

## What's included in the Box?

### L138/C6748 Development Kit Contents

- LCDK development board
- Mini A/B USB cable
- Micro SD card with SD-adapter
- Power brick and power cord
- Quick start guide

### BIOS Development Support

Example projects have been created using Code Composer Studio (CCS) for DSP development. BIOS C6 Software development kit is FREE to download

### Embedded Linux Application Development Support

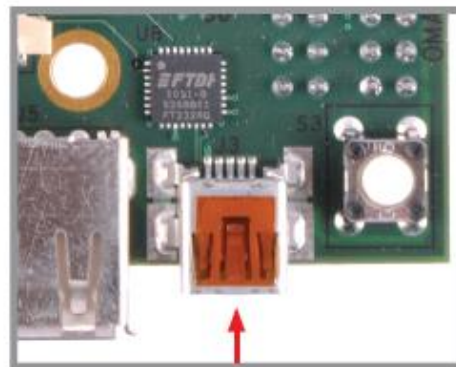
Linux Software development kit (available only with OMAP-L138 LCDK version) is included to help jump start Linux application development with latest open source kernel running on the ARM9 core of OMAP-L138. Linux-based DSP tools are provided with the kit as well to enable programming of the C674 DSP core.

## How to setup a C6748/OMAPL138 Development Kit (LCDK)

The following steps will guide you the initial setup of C6748 Development Kit (LCDK):



- 1** Set the DIP switch with 2, 3, 4 **ON** and 1, 5, 6, 7, 8 **OFF**.



- 2** Connect the supplied mini USB cable to J3 on the UART-USB port on the LCDK. Connect the other end of the cable to a USB port on your host computer.



- 3** On the host computer, open a port terminal like Tera Term and establish the connection to the USB.

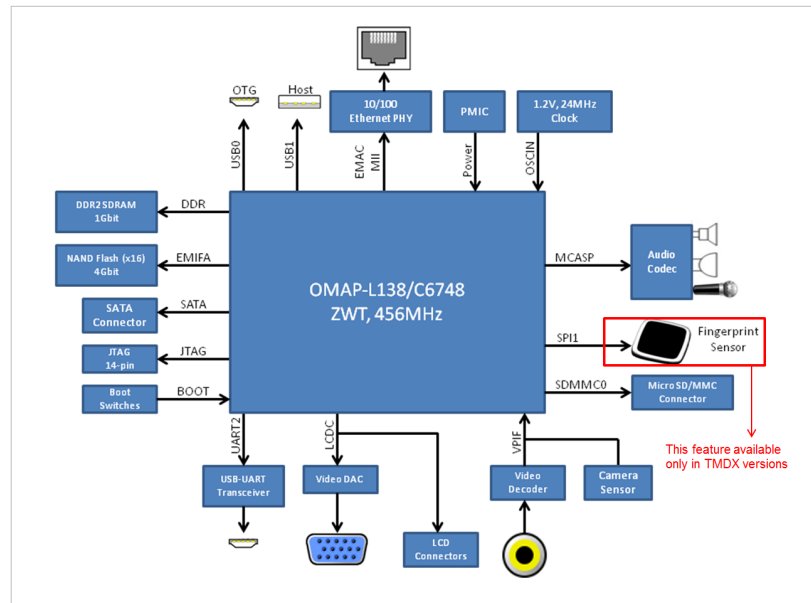
## LCDK Features

### Processor

- TI TMS320C6748 DSP or OMAP-L138 Application Processor
- 456-MHz C674x Fixed/Floating Point DSP
- 456-MHz ARM926EJ RISC CPU (OMAP-L138 only)
- On-Chip RTC

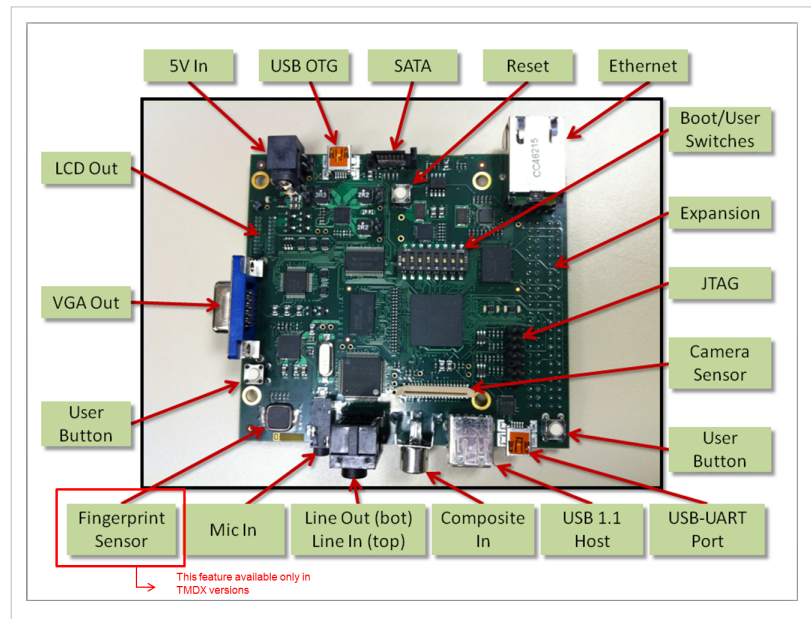
### Memory

- 128 MByte DDR2 SDRAM running at 150MHz
- 128 MByte 16-bit wide NAND FLASH
- 1 Micro SD/MMC Slot



### Interfaces

- One mini-USB Serial Port (on-board serial to USB)
- One Fast Ethernet Port (10/100 Mbps) with status LEDs
- One USB Host port (USB 1.1)
- One mini-USB OTG port (USB 2.0)
- One SATA Port (3Gbps)
- One VGA Port (15 pin D-SUB)
- One LCD Port (Beagleboard XM connectors)
- One Composite Video Input (RCA Jack)
- One Leopard Imaging Camera Sensor Input (36-pin ZIP connector)
- Three AUDIO Ports (1 LINE IN & 1 LINE OUT & 1 MIC IN)
- 14-pin JTAG header (No onboard emulator; external emulator is required)



### Note

- The LCDK does not have an onboard emulator. An external emulator from TI or a third-party will be required to start developing on it.
- The LCD port connector was designed to support off the shelf LCD panel<sup>[21]</sup> that is no longer available from any vendor. We are not aware of any other off the shelf LCD panel that will work with LCDK. To evaluate an LCD panel using the LCDK board, will require users to create their own adapter board.
- TI has released new versions of the OMAPL138 and C6748 LCDK boards. The new boards do not support the Authentec fingerprint swipe sensor. This decision is predicated upon Authentec's decision to discontinue production of this sensor. TI has no plans to replace the sensor with an alternative solution at this time. The change is effective immediately. Any boards shipped from Dec 2012 will reflect this change.

**If you have placed an order that you want to review in light of this information, please contact the channel through which the order was placed. We apologize for any inconvenience this may cause.**

Refer to the following url to see what has changed in the new C6748 LCDK: [http://processors.wiki.ti.com/index.php/C6748\\_new\\_LCDK](http://processors.wiki.ti.com/index.php/C6748_new_LCDK)

## On-Board ICs

### Video

#### Video DAC

<b>Component</b>	U13
<b>Part Number</b>	THS8135PFP
<b>Datasheet</b>	[22]
<b>Description</b>	Texas Instruments 10-bit Video DAC

#### Video Decoder

<b>Component</b>	U21
<b>Part Number</b>	TVP5147M1PFP
<b>Datasheet</b>	[23]
<b>Description</b>	Texas Instruments 10-bit Digital Video Decoder

### Memory

#### NAND Flash

<b>Component</b>	U18
<b>Part Number</b>	MT29F4G16ABADAH4-IT:D
<b>Datasheet</b>	[24]
<b>Description</b>	Micron 4Gbit NAND Flash (x16 data width)

#### DDR2 SDRAM

<b>Component</b>	U17
<b>Part Number</b>	W971GG6KB-25
<b>Datasheet</b>	[25]
<b>Description</b>	Winbond 1Gbit DDR2-1066 SDRAM

### Connectivity

#### Ethernet PHY

<b>Component</b>	U23
<b>Part Number</b>	LAN8710A-EZK
<b>Datasheet</b>	[26]
<b>Description</b>	SMSC 10/100Mb Ethernet PHY with a PHY address of 0x7

## Connectors and User Interface

### Video

#### LCD Connector

<b>Component</b>	P1, P2
<b>Description</b>	Provide connectivity to CircuitCo ULCD7 Lite LCD <sup>[27]</sup>

## User Interface

### Switches (SW1)

Switches 1-4 on SW1 are used to set the BOOT as follows:

Switch #	UART2	NAND 16	MMC/SD0
1	OFF	OFF	OFF
2	ON	ON	OFF
3	OFF	ON	OFF
4	ON	ON	ON

Switches 5-8 on SW1 are user switches connected to GPIOs according to the table below. When the switch is ON, the pin is pulled low. When the switch is OFF, the pin is pulled high.

Switch #	Pin
5	GPIO0[1]
6	GPIO0[2]
7	GPIO0[3]
8	GPIO0[4]

### Push Buttons

There are 3 push buttons on the board connected according to the following table. When a button is pressed, the attached signal is pulled low; otherwise it is pulled high.

Button	Pin
S1	Reset
S2	GPIO2[4]
S3	GPIO2[5]

## LEDs

There are 7 LEDs on the board which function according to the following table.

LED	Signal	Lit when...
D1	5V_IN	5V power is applied to J1
D2	VOLT_ERR	Input voltage is > 5.8V
D3	VCC_5VD_IN	Board is powered from either J1 or USB
D4	GPIO6[13]	Signal is high
D5	GPIO6[12]	Signal is high
D6	GPIO2[12]	Signal is high
D7	GPIO0[9]	Signal is high

## Power

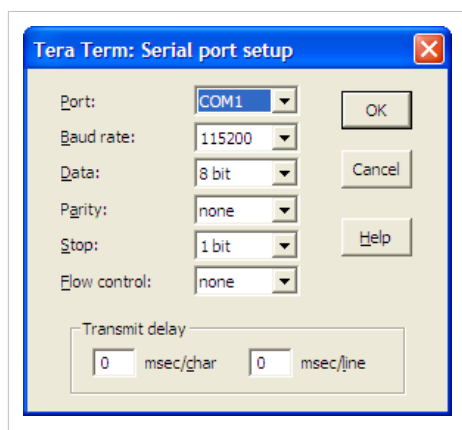
The board can be powered with 5V input through either J1 barrel connector or through J2 mini-USB connector. Current draw for the board can exceed 500 mA under normal operating conditions, so it is not recommended to use the USB power.

## USB UART Port (J3)

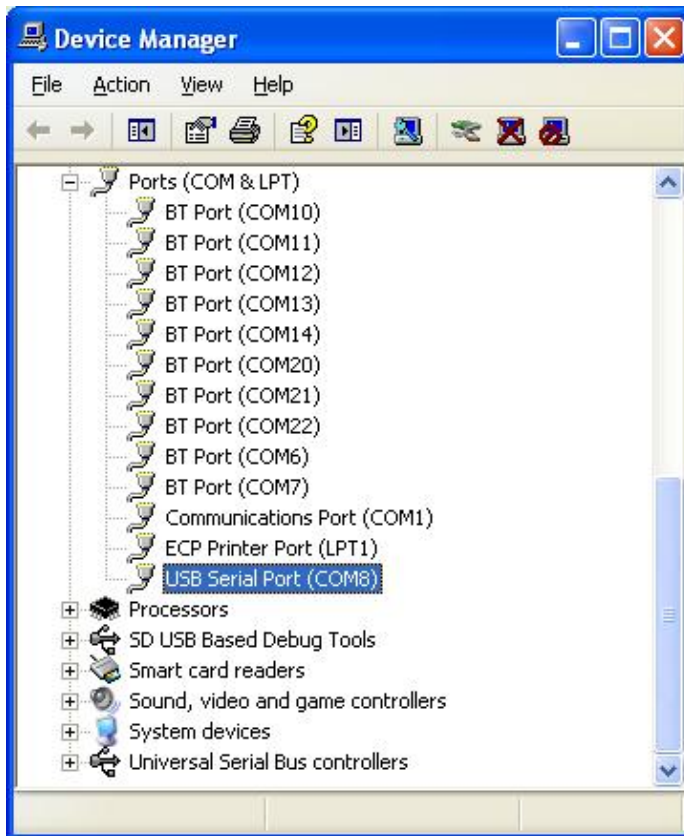
The board contains FD232 USB UART IC, which can be connected to a host PC via a standard mini-USB to USB cable, and it acts an external serial port. It is connected to the OMAP-L138/C6748 UART2 peripheral.

Windows and Linux drivers for the chip can be found on the FTDI Product Page<sup>[28]</sup>.

Configure your serial terminal application (such as Tera Term or HyperTerminal) for 115200 baud, 8 data bits, 1 stop bit, no parity, choosing the COM port corresponding to the USB device:



In Windows, you can determine which COM port the USB serial port is using in Device Manager, as shown below:



## Procedure to Flash and boot the LCDK

The NAND may be flashed either through the USB-serial port or through CCS. The following software provides both tools:

- Serial Boot and Flash Loading Utility for OMAP-L138 <sup>[29]</sup>

The following AISgen config file has the correct settings for NAND16 boot, with the CPU running at 300MHz, and DDR2 at 150MHz:

- LCDK AISgen Config <sup>[30]</sup>
- **Serial Port Method**

First determine what serial port is assigned to the on-board UART->USB IC as show in this section

Next set the boot pins to UART2 boot mode as shown in this section

The following actions can then be performed, where "COMx" refers to the COM port found in the previous step (i.e. COM8). For C6748 boards, replace "OMAPL138\_LCDK" with "C6748\_LCDK".

- Erase the entire NAND (optional):

```
sfh_OMAP-L138.exe -targettype OMAPL138_LCDK -flashtype NAND -p COMx -erase
```

- Flash bootable AIS image (ais\_image.bin) to block 1 of the NAND:

```
sfh_OMAP-L138.exe -targettype OMAPL138_LCDK -flashtype NAND -p COMx  
-flash_noubl ais_image.bin
```

Run the commands and then power cycle or reset the board to initiate the process.

### NOTE

Due to recent reports on TI E2E regarding the out of box demonstrations on C6748 LCDK and OMAPL138, we are providing the binaries that are used by the board manufacturer to flash and run demo on the board so that if you run into similar issue, you can either restore the flash with factory images or run diagnostics to confirm functionality



- **LCDKC6748 Factory Restore Binaries :**

- **LCDKOMAPL138 Binaries:**

- **CCS Method**

1. Connect to the ARM or DSP with the GEL file loaded, which will auto-initialize the DDR
2. Open (CCS3) or import (CCS4, CCS5) the NANDWriter\_ARM or NANDWriter\_DSP project
3. Modify the #define "NANDWIDTH\_8" to "#define NANDWIDTH\_16" in nandwriter.c
4. Rebuild and run the code

### SD/MMC Flashing

See the following wiki for details: [31]

## Power Sequencing

### Note

To keep the cost low, the L138/C6748 LCDK has not followed the right power sequencing recommended by L138/C6748 datasheet. The designer need to implement the right power sequencing for reliable operation. See the following application note for details.

- OMAPL138 Powering | Download Now <sup>[32]</sup>
- TMS320C6748 Powering | Download Now <sup>[33]</sup>

## Online Resources

### C6748/ OMAP-L138 Product Information

- TMS320C6748 Data sheets, Silicon Errata and Technical Reference Manuals | Download now <sup>[34]</sup>
- OMAP-L138 Data sheets, Silicon Errata and Technical Reference Manuals | Download now <sup>[35]</sup>

## LCDK Hardware and Software Documentation

### LCDK Board Revision History

S.NO	Board Name	Board Revision	Silicon Revision	Status	Major Changes
1	TMDXLCDK138/6748	A5	PG2.1 or Older	obsolete	Finger print sensor available (U26)
2	TMDXLCDK138/6748	A6A	PG2.1 or older	obsolete	Finger print sensor (U26 Depopulated),Samsung K4T1G164QF-BCF8 (U17)-DDR2
3	TMDSLCDK138/6748	A7A	PG2.3	<b>Active</b>	Finger print sensor (U26 Depopulated),Winbond W971GG6KB-25 (U17)-DDR2

## Rev A7a

- **OMAP-L138 Schematics,PCB Board file and BOM** - [www.ti.com/tool/tmdslcdk138](http://www.ti.com/tool/tmdslcdk138) <sup>[1]</sup>
- **C6748 Schematics,PCB Board file and BOM** -[www.ti.com/tool/tmdslcdk6748](http://www.ti.com/tool/tmdslcdk6748) <sup>[2]</sup>

## Rev A6a

- OMAP-L138 & C6748 LCDK v.A6a Schematics & BOM | Download now (Fixed error in NAND Flash part number)

## Rev A6

- OMAP-L138 & C6748 LCDK v.A6 Schematics & BOM | Download now
- OMAP-L138 & C6748 LCDK v.A6 & v.A5 Gerber-003 | Download now <sup>[36]</sup>

## Rev A5

- OMAP-L138 & C6748 LCDK v.A5 Schematics | Download now

Note: Change from v.A5 to v.A6: U26 (fingerprint swipe sensor) and associated circuit is not populated.

- Schematic Companion: OMAP-L138 LCDK Schematic Companion

## CCS XML & GEL Files

- Latest Gel files for **LCDK Board version A7a** Download now
- CCS4 and higher configuration XML files & GEL files for initializing the DDR interface | Download Now <sup>[37]</sup> (**Note:** GEL files & XML files are included in current CCS releases by default and it is not required to download explicitly to setup a connection for the board)

## Hardware Emulators

- **XDS 100** - [processors.wiki.ti.com/index.php/XDS100](http://processors.wiki.ti.com/index.php/XDS100) <sup>[9]</sup>
- **XDS 200** -[processors.wiki.ti.com/index.php/XDS200](http://processors.wiki.ti.com/index.php/XDS200) <sup>[11]</sup>
- **XDS 510** - [processors.wiki.ti.com/index.php/XDS510](http://processors.wiki.ti.com/index.php/XDS510) <sup>[13]</sup>
- **XDS 560** - [processors.wiki.ti.com/index.php/XDS560](http://processors.wiki.ti.com/index.php/XDS560) <sup>[15]</sup>

## Software

### Latest Software:

- <http://www.ti.com/tool/PROCESSOR-SDK-OMAPL138>

### Other Legacy software links :

- OMAPL138 SW & HW Comparison | [http://processors.wiki.ti.com/index.php/OMAPL138\\_SW\\_%26\\_HW\\_Comparison#Software\\_Comparison\\_Chart](http://processors.wiki.ti.com/index.php/OMAPL138_SW_%26_HW_Comparison#Software_Comparison_Chart)
- Getting started guide for BIOS C6 Software Development Kit | Download now <sup>[38]</sup>
- User Guide for BIOS C6 Software Development Kit | Download now <sup>[39]</sup>
- Getting Started Guide for OMAP-L138 LCDK Linux Software Development Kit | Download now <sup>[40]</sup>
- Software Developer's Guide for OMAP-L138 LCDK Linux Software Development Kit | Download now <sup>[41]</sup>
- Starterware for OMAP-L138 LCDK | Download now <sup>[42]</sup>
- C6 Benchmarking | Download now <sup>[43]</sup>

### Important Note:

The legacy\* software found on this site is available for download, but is no longer being actively developed or maintained.

*legacy\* - To know, what are all the software packages which comes under legacy, please visit [legacy software](#) <sup>[44]</sup> section in OMAPL138 SW & HW Comparison wiki page*

## Projects

### Cool Project Demonstrations!

#### Finger Printing Demonstration

C6748 LCDK comes with pre programmed Flashed demos. Authentec Finger print sensor mounted on the board is capable of sensing finger with 100% accuracy. The finger print demo provides flexibility to create multiple finger selection for different users by swipe sensor technology. The finger prints are matched in fraction of seconds. Enrollment for each user is completed in four steps and it takes fraction of a second to match the finger print on 300 MHz on the C674x floating point DSP. This demo is also 100% percent accurate for results and has an easy connection to the PC for running the demo and viewing the results.

**Note:** This demo can be recreated only on initial versions of LCDK that were populated with the fingerprint sensor.

#### Face Detection Demonstartion

Second pre flashed demonstartion is Face Detection. This demo supports frontal face detection by using an OpenCV based Haar detect object algorithm. The demo can detect multiple faces in a frame and uses a composite camera to capture and VGA to display the image. The demo also supports D1(720x480) resolution image processing and real time video capture and display This requires additional hardware to be connected to the board to take VGA capture through composite camera interface and output is displayed on the VGA display connected to the VGA port.

Above demonstartions comes with the C6748 BIOS C6 Software development Kit with the source code of the projects.

**Note:** The demo code is provided as part of the C6BIOS SDK. The DSP compiled version of OpenCV libraries are provided only in object code.

#### Other Biometrics demos on C6748

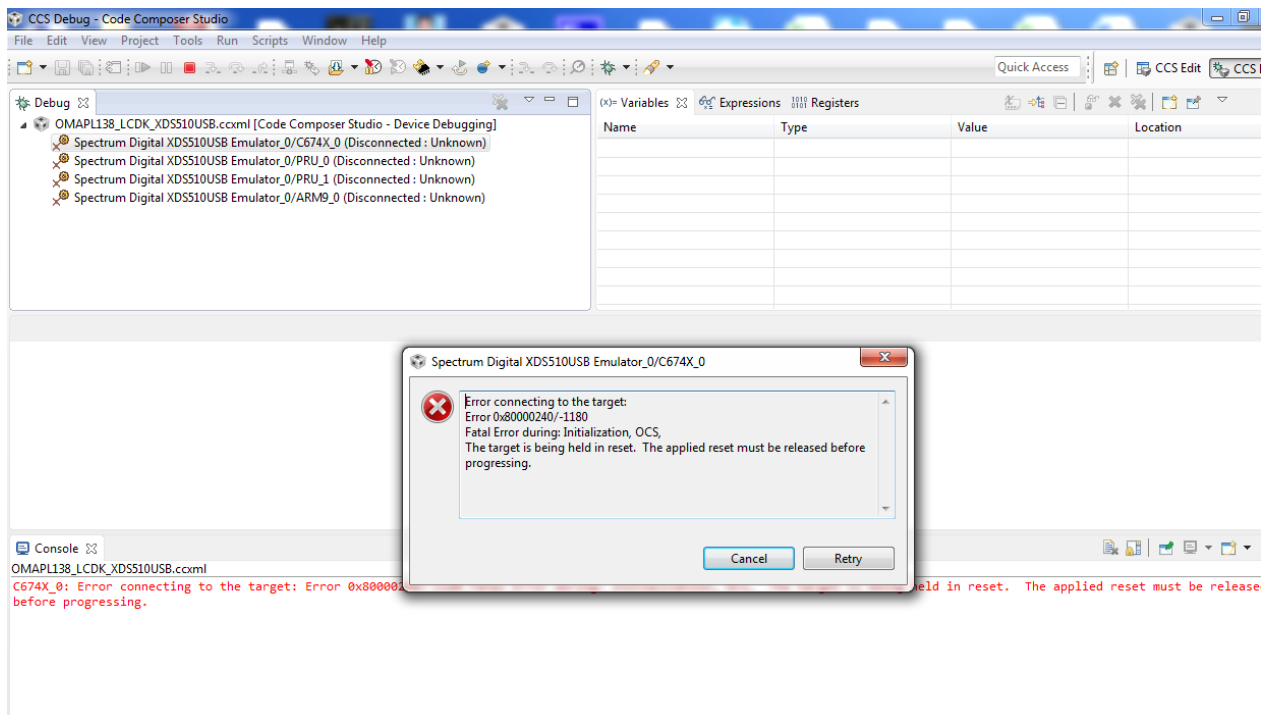
Iris Recognition demo using C6748 based Irishield platform

**Coming Shortly!!**

## FAQs (in progress)

### The target is being held in reset

Would get "target is being held in reset" error while connecting target like below screen shot.



If this issue comes from OMAPL138, then we might have tried to connect the DSP core which should be wakeup by ARM core since OMAPL138 is ARM boot master device, that means ARM comes out from sleep first when RBL code executed then application code or user should wake up the DSP.

To resolve this issue, you should connect the ARM core first and respective gel file get initialize all the peripherals and wake up the DSP.

You should give the following gel file for ARM core.

If CCSv6 C:\ti\ccsv6\ccs\_base\emulation\boards\lcdkomapl138\gel\OMAP-L138\_LCDK.gel

If CCSv5 C:\ti\ccsv5\ccs\_base\emulation\boards\lcdkomapl138\gel\OMAP-L138\_LCDK.gel

## References

- [1] <http://www.ti.com/tool/tmdslcdk138>
- [2] <http://www.ti.com/tool/tmdslcdk6748>
- [3] <https://estore.ti.com/TMDXLCDK6748-TMS320C6748-DSP-Development-Kit-LCDK-P2998.aspx>
- [4] <https://estore.ti.com/TMDXLCDK138-OMAP-L138-Development-Kit-LCDK-P4200.aspx>
- [5] [http://processors.wiki.ti.com/index.php/Processor\\_SDK\\_RTOS\\_Getting\\_Started\\_Guide](http://processors.wiki.ti.com/index.php/Processor_SDK_RTOS_Getting_Started_Guide)
- [6] [http://processors.wiki.ti.com/index.php/L138/C6748\\_Development\\_Kit\\_\(LCDK\)#Online\\_Resources](http://processors.wiki.ti.com/index.php/L138/C6748_Development_Kit_(LCDK)#Online_Resources)
- [7] <https://estore.ti.com/Emulators-C22.aspx>
- [8] <http://www.ti.com/tool/xds100>
- [9] <http://processors.wiki.ti.com/index.php/XDS100>
- [10] <http://www.ti.com/tool/xds200>
- [11] <http://processors.wiki.ti.com/index.php/XDS200>
- [12] <http://www.ti.com/tool/xds510>
- [13] <http://processors.wiki.ti.com/index.php/XDS510>
- [14] <http://www.ti.com/tool/xds560>
- [15] <http://processors.wiki.ti.com/index.php/XDS560>
- [16] [http://processors.wiki.ti.com/index.php/Download\\_CCS](http://processors.wiki.ti.com/index.php/Download_CCS)
- [17] [https://www-a.ti.com/downloads/sds\\_support/TICodegenerationTools/download.htm](https://www-a.ti.com/downloads/sds_support/TICodegenerationTools/download.htm)

- [18] [http://software-dl.ti.com/dsp/dsp\\_public\\_sw/c6000/web/bios\\_c6sdk/latest/index\\_FDS.html](http://software-dl.ti.com/dsp/dsp_public_sw/c6000/web/bios_c6sdk/latest/index_FDS.html)
- [19] [http://software-dl.ti.com/dsp/dsp\\_public\\_sw/c6000/web/omap138\\_lcdk\\_sdk/latest/index\\_FDS.html](http://software-dl.ti.com/dsp/dsp_public_sw/c6000/web/omap138_lcdk_sdk/latest/index_FDS.html)
- [20] <http://www.ti.com/tool/PROCESSOR-SDK-OMAPL138>
- [21] [http://elinux.org/CircuitCo:BeagleBone\\_xM\\_LCD7](http://elinux.org/CircuitCo:BeagleBone_xM_LCD7)
- [22] <http://www.ti.com/lit/gpn/th8135>
- [23] <http://www.ti.com/lit/gpn/tvp5147>
- [24] <http://www.micron.com/parts/nand-flash/mass-storage/mt29f4g16abadah4>
- [25] [https://www.winbond.com/resource-files/w971gg6kb\\_a03.pdf](https://www.winbond.com/resource-files/w971gg6kb_a03.pdf)
- [26] <http://www.smc.com/index.php?tid=149&pid=59&cid=&tab=5>
- [27] [http://boardzoo.com/product\\_info.php?products\\_id=1](http://boardzoo.com/product_info.php?products_id=1)
- [28] <http://www.ftdichip.com/Products/ICs/FT232R.htm>
- [29] [http://processors.wiki.ti.com/index.php/Serial\\_Boot\\_and\\_Flash\\_Loading\\_Utility\\_for\\_OMAP-L138](http://processors.wiki.ti.com/index.php/Serial_Boot_and_Flash_Loading_Utility_for_OMAP-L138)
- [30] [http://processors.wiki.ti.com/images/a/a4/LCDK\\_AISGen\\_Config.zip](http://processors.wiki.ti.com/images/a/a4/LCDK_AISGen_Config.zip)
- [31] [http://processors.wiki.ti.com/index.php/OMAP-L138\\_Preparing\\_SD\\_Card\\_for\\_Boot](http://processors.wiki.ti.com/index.php/OMAP-L138_Preparing_SD_Card_for_Boot)
- [32] <http://www.ti.com/lit/an/slva513/slva513.pdf>
- [33] <http://www.ti.com/lit/an/slva490/slva490.pdf>
- [34] <http://www.ti.com/product/tms320c6748>
- [35] <http://www.ti.com/product/omap-l138>
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