



## Getting Started

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### Mpression 100BASE-T1 HSMC Card

Revision 1.0

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# 1. Read This First

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## 1.1 Important Information

### READ FIRST:

- **READ** this Getting Started before using this product.
- **KEEP** the Getting Started handy for future reference.
- **Do not attempt** to use the product until you fully understand its mechanism.

### Purpose of the Product:

- This product is a verification board with an Altera FPGA. It supports development and evaluation of a system that uses BroadR-Reach®, image sensor input, display port output, audio input/output, and other interfaces. It provides support for system development in both software and hardware. Make sure to use this product correctly for this purpose.

### For Users of This Product:

- This product can only be used by operators who have carefully read and understand this manual and "Reference Manual". Use of this product requires a basic knowledge of FPGAs, logic circuits, electric circuits, and microcomputers.

### Precautions to be taken when using This Product:

- This product is to be used for development of a program, and the evaluation stage. You cannot install this Board in your product and cannot use this Board for mass-production. When mass-producing a program you have finished developing, be sure to decide at your own responsibility whether it can be put to practical use by performing integration test, evaluation, or some other experiment.
- In no event shall Macnica Inc. be liable for any consequence arising from the use of this product.
- Macnica Inc. shall make effort to provide a workaround or fix for failures of this product, with or without charge. This does not mean, however, that Macnica Inc. guarantees to provide a workaround or fix under all circumstances.
- Macnica Inc. cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this Getting Started and on the product are therefore not all-inclusive. Use this product correctly and safely at your own responsibility.
- Even if a device installed on this product has a failure, it cannot be replaced.
- BroadR-Reach and DisplayPort interface of this product doesn't guarantee to connect for all types of apparatus.
- Remodeling or damages caused by the customer is not guaranteed.
- This product is a lead-free mounting product.
- Generally, the brand names carried in this reference manual each constitute a maker's trademark or registered trademark.

### Improvement Policy:

- Macnica Inc. pursues a policy of continuous improvement in design, performance, and safety of the product. Macnica Inc. reserves the right to change, wholly or partially, specifications, design, Getting Started, and other documentation at any time without notice.

## Warranty:

- Macnica Inc. offers exchange of this product free of charge only in a set range of cases of initial trouble for this product, and within 30 days from when the customer received delivery of the Board.

Macnica Inc. cannot exchange products in cases where breakdown is caused for the following reasons:

- (1) Misuse, abuse of the product or use under abnormal conditions
- (2) Remodeling or repair
- (3) A fire, earthquake, fall or other accidents

## Figures:

- Some figures in this reference manual may differ from your system as purchased.

## 1.2 Developer Information

The Developer of this product is:

Macnica Inc.

1-6-3 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8561 JAPAN

## 1.3 Inquires

In case you have any inquiries about the use this product, please contact your local Macnica company or make inquiries through the contact form on the following web site.

<http://www.m-pression.com/contact>




Macnica companies:

- |                  |                       |   |
|------------------|-----------------------|---|
| • China & HK:    | Cytech Technology     | <a href="http://www.cytech.com/">http://www.cytech.com/</a>                     |
| • ASEAN & India: | Cytech Global         | <a href="http://www.cytechglobal.com/">http://www.cytechglobal.com/</a>         |
| • Taiwan:        | Galaxy Far East Corp. | <a href="http://www.gfec.com.tw/">http://www.gfec.com.tw/</a>                   |
| • North America: | Macnica Americas      | <a href="http://www.macnica-na.com/">http://www.macnica-na.com/</a>             |
| • Brazil:        | Macnica DHW           | <a href="http://www.macnicadhw.com.br/en/">http://www.macnicadhw.com.br/en/</a> |
| • Japan:         | Altima                | <a href="http://www.altima.co.jp">http://www.altima.co.jp</a>                   |
|                  | Elsena                | <a href="http://www.elsena.co.jp">http://www.elsena.co.jp</a>                   |



## 2. For Ensuring Safe Use



Be sure to follow the instructions given in this Manual which are intended to prevent harm to the user and others as well as material damage.


### 2.1 Legend

|  |  |
|--|--|
|  <b>Danger</b>  | Indicates an imminent hazardous situation which if not avoided will result in death or serious injury.                         |
|  <b>Warning</b> | Indicates a potentially hazardous situation which if not avoided could result in death or serious injury.                      |
|  <b>Caution</b> | Indicates a potentially hazardous situation which if not avoided may result in minor or moderate injury or in property damage. |

### 2.2 Cautions

|  |  |
|--|--|
|  <b>Danger</b>   | <p>Make sure to use the AC adapter (included in the package) that meets the specification described in this manual.</p> <p>Using an AC adapter not meeting the specifications described in this Manual may cause the kit to emit heat, explode, or ignite.</p>   |
|  <b>Warning</b> | <p>Do not apply strong impacts or blows to the kit.</p> <p>Doing so may cause the kit to emit heat, explode, or ignite, or the equipment in the kit to fail or malfunction. This may also cause fire.</p>  |
|  | <p>Do not put the main unit or the AC adapter in cooking appliances such as microwave ovens, or high-pressure containers. Doing so might cause the main unit or AC adapter to emit heat, explode, ignite, or emit smoke, or its parts to break or warp.</p>  |
|  | <p>Do not wrap the main unit that is in use with cloth or other materials that are likely to allow heat to build up inside the wrapping.</p> <p>This will cause heat to build up inside the wrapping which may cause the main unit to ignite or malfunction.</p>   |
|  | <p>When disposing of the main unit, do not dispose of it along with general household waste.</p> <p>Throwing the main unit into fire may cause it to explode. Dispose of the main unit following the laws, regulations, and ordinances governing waste disposal.</p>   |
|  | <p>Do not pull the power supply cable with excessive force or place heavy items on it.</p> <p>Do not damage, break, bundle, or tamper with the power supply cable.</p> <p>Damaged parts of the power supply cable might cause a short circuit resulting in fire or accidents involving electrical shock.</p> |
|  | <p>Do not plug or unplug the power plug with wet or moist hands.</p> <p>This might cause injuries or equipment malfunctions or failures due to electrical shock.</p>   |

|  |  |
|--|--|
|  <b>Warning</b><br>(Continued from previous page) | <p>Plug the power plug securely into the outlet.<br/>If the power plug is not securely plugged into the outlet, it may cause accidents involving electrical shock or fire due to heat emitted.</p> <p>Do not connect many electrical cords to a single socket or connect an AC adapter to an outlet that is not rated for the specified voltage.<br/>Doing so may cause the equipment to malfunction or fail, or lead to accidents involving electrical shock or fire due to heat emitted.</p> <p>Periodically remove any dust accumulated on the power plug and around the outlet (socket).<br/>Do not use a power plug with dust accumulated on it because doing so will lead to insulation failure due to moisture which may lead to fire.<br/>Remove any dust on the power plug and around the outlet with dried cloth.</p> <p>Do not place any containers such as cups or vases filled with water or other liquid on this Board.<br/>If this Board is exposed to water or other liquid it may cause the Board to malfunction or lead to accidents involving electrical shock. If you spilled water or other liquid on this Board, immediately stop using the Board, turn off the power, and unplug the power plug. If you have any requests for repairs or technical consultation, please contact the local Macnica company or Mpression inquiry URL.</p> <p>Keep this board and accessories out of reach of children. Failure to do so may lead to injuries.</p>   |
|  <b>Caution</b>                                 | <p>Do not place the kit on unstable places such as shaky stands or tilted locations. Doing so may cause injuries or cause this Board to malfunction if the Board should fall.</p> <p>Do not attempt to use or leave the kit in places subject to strong direct sunlight or other places subject to high temperatures such as in cars in hot weather. Doing so might cause the kit to emit heat, break, ignite, run out of control, warp, or malfunction. Also, some parts of the equipment might emit heat causing burn injuries.</p> <p>Do not use the kit in places subject to extremely high or low temperatures or severe temperature changes.<br/>Doing so may cause the kit to fail or to malfunction. Always be sure to use the kit within a temperature range of 5°C to 35°C and a humidity range of 0% to 85%.</p> <p>Unplug the power supply cable when carrying out maintenance of devices in which the main unit is embedded.<br/>Failure to do so may lead to accidents involving electrical shock.</p> <p>Do not place this Board in locations where excessive force is applied to the Board.<br/>Doing so may cause the PC board to warp, leading to breakage of the PC board, missing parts or malfunctioning parts.</p> <p>When using the kit together with expansion boards or other peripheral devices, be sure to carefully read each of their manuals and to use them correctly.<br/>Developer does not guarantee the operation of specific expansion boards or peripheral devices when used in conjunction with this Board unless they are specifically mentioned in this Manual or their successful operation with this Board has been confirmed in separate documents.</p> |

|  |  |
|--|--|
|  <p><b>Caution</b><br/>(Continued from previous page)</p> | <p>Be sure to turn off the power switch when moving this Board to connect to other devices. Failure to do so may cause this Board to fail or lead to accidents involving electrical shock.</p>   |
|  | <p>Do not clean this Board by using a rag containing chemicals such as benzine or thinner. Failure to do so will likely to cause this Board to deteriorate. When using a chemical cloth be sure to comply with any directions or warnings.</p>   |
|  | <p>Do not immediately turn on the power if you find that water or moisture had condensed onto the main unit after removing the board from the package. Condensation might occur on this Board when taking it out of the box, if the board is cool yet the room temperature is warm.</p>  |
|  | <p>Do not apply power to the Board while water or moisture has condensed on it because the moisture may cause the Board to break or may shorten the service life of the parts.</p>   |
|  | <p>When you first take this Board out of the box be sure to leave it at room temperature for a while before using it. If condensation or moisture has occurred on this Board, first wait for the moisture to fully evaporate before installing or connecting the Board to other devices.</p>   |
|  | <p>Do not disassemble, dismantle, modify, alter, or recycle parts unless they are clearly described as customizable in this Manual.</p> <p>Although this kit is customizable, if parts not specified in this Manual as customizable are modified in any way, then the overall product operation cannot be guaranteed. Please contact the local Macnica company or Mpression inquiry URL beforehand if you wish to customize or modify any parts that are not described in this Manual as customizable.</p> |



## 3. Preparations

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### 3.1 About This Manual

This manual explains how to use the reference design used by this board. This manual also describes the following:

- The basic specifications of this Board
- Executing the Sample Design that Uses the Mpression Nitro – Cyclone® V GX I/O Expansion Base Board

### 3.2 Preparations

#### A. Preparing the Reference Design

The reference design to be provided contains the following:

- Reference Design (Verilog-HDL)
- Altera Quartus II 14.0 project files
- Board information

The Board information contains the following:

- Schematic
- BOM list
- PCB Layout

Download the design described above from the following URL:

<http://www.m-pression.com/solutions/boards/100base-t1-hsmc>

#### B. Preparing Equipment

Prepare the equipment below when executing all of the functions of this design.

- This board: 2
- Mpression Nitro – Cyclone® V GX I/O Expansion Base Board: 2
- Display Port compatible monitor: 1
- Display Port cable: 1
- Audio device(Audio player):1
- Speaker:1

#### C. Preparing Tools

Prepare the following tools before executing this design:

- Altera Quartus II 14.0

#### D. Altera's IP Used in this Design

Altera's IPs are used in this design. Prepare the following IP licenses when recompiling this design:

- VIP (Video and Image Processing Suite)
- TSE MAC (Triple-Speed Ethernet MAC)
- DisplayPort

## 4. Setup

### 4.1 Board Specification

This section describes the layout of components on this Board and their specifications. The following shows the layout of components on this Board.

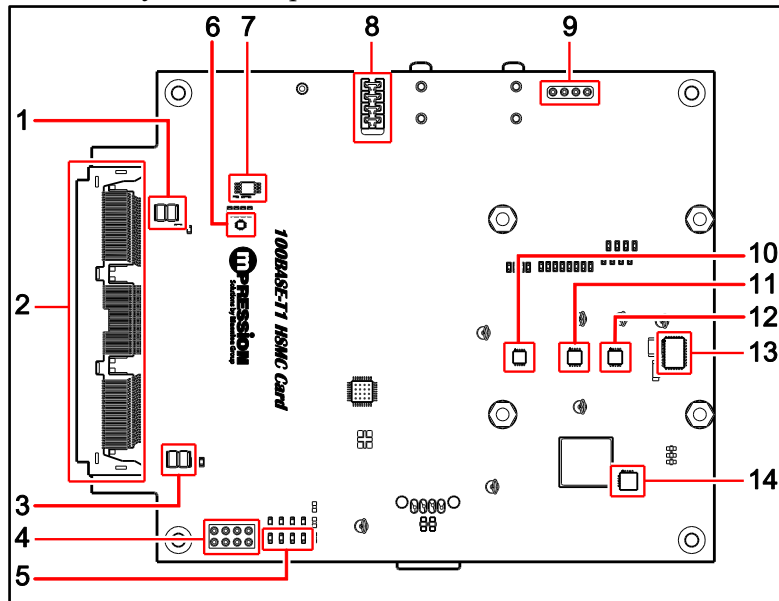


Figure4-1 Layout (Top view)

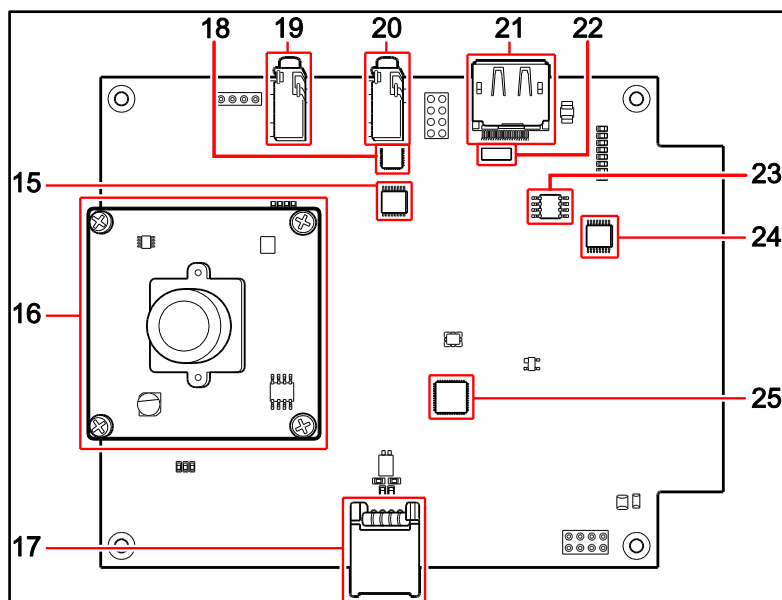


Figure4-2 Layout (Bottom view)

Table 1 Main Components of this Board

|    | Reference No. | Components or Specification | Description   |
|----|---------------|-----------------------------|---|
| 1  | Y2            | Crystal Oscillator          | FCXO-03L_16.000MHz (RIVER ELETEC)<br>16 MHz for Display Port                          |
| 2  | CN1           | HSMC                        | ALTERA FPGA Base Board Interface  |
| 3  | Y3            | Crystal Oscillator          | FCXO-03L_24.576MHZ (RIVER ELETEC)<br>24.576 MHz for Audio                             |
| 4  | CN2           | MDC/MDIO                    | For PHY Setting   |
| 5  | LED1 to 4     | LED                         | 100BASE-T1 Status LED   |
| 6  | U14           | Level shifter               | SN74AVC2T245RSWR (Texas Instruments)<br>Display Port Control Signal Level Shifter     |
| 7  | U5            | Op Amp                      | LM8272MM/NOPB (Texas Instruments)<br>For Display Port AUX Line                        |
| 8  | CN7           | I2S                         | Audio CODEC(U6) Interface   |
| 9  | CN6           | I2C for Camera              | I2C Bus for Setting Shikino High-Tech Sensor Module                                   |
| 10 | U12           | Power Supply                | EY1501DI-ADJ (Enpirion)<br>Provides 1.2 V from 6 V                                    |
| 11 | U9            | Power Supply                | EY1501DI-ADJ (Enpirion)<br>Provides 2.5 V from 6 V                                    |
| 12 | U10           | Power Supply                | EY1501DI-ADJ (Enpirion)<br>Provides 5 V from 6 V                                      |
| 13 | U11           | Power Supply                | EN6337QI (Enpirion)<br>Provides 3.3 V from 6 V  |
| 14 | U8            | Power Supply                | ER3125QI (Enpirion)<br>Provides 6 V from 12 V   |
| 15 | U7            | Level Shifter               | TXB0106PWR (Texas Instruments)<br>Level Shifter for I2S Signal                        |
| 16 | (CN5)         | Camera Interface            | Shikino High-Tech Sensor Module Connector   |
| 17 | CN3           | 100BASE-T1                  | 100BASE-T1 Interface Mini50 Connector   |
| 18 | U6            | Audio CODEC                 | ADAU1961 (Analog Devices)   |
| 19 | J1            | 3.5mm Phone Jack            | Audio Output Line Out   |
| 20 | J2            | 3.5mm Phone Jack            | Audio Input Line In   |
| 21 | CN4           | Display Port                | Display Port Connector  |
| 22 | D2            | Diode                       | TPD8S009DSMR (Texas Instruments)<br>ESD Protection for Display Port                   |
| 23 | U4            | Bus LVDS Transceiver        | DS92LV010A (Texas Instruments)<br>BusLVDS Transceiver for Display Port Control Signal |
| 24 | U3            | Level Shifter               | SN74AVC4T245PWR (Texas Instruments)<br>Display Port Control Signal Level Shifter      |
| 25 | U1            | 100BASE-T1 PHY              | BCM89810 (Broadcom)<br>100BASE-T1 PHY   |

## 4.2 Setting Up the Board

### 4.2.1 External Connection

Set up this Board before booting the Board. The following describes how to set up the Board.

- 1) Connect this board to the HSMC A port of the Nitro board and secure it by attaching the provided bracket. (Refer to 4.2.2.)  
Set up similar to the Image Transmitter side(Nitro + this board) and the Receiver side(Nitro + this board).
- 2) Connect the sound source to Line In(J2) of this board and a speaker to Line Out(J1).
- 3) Use the BroadR-Reach cable to connect the image transmitter board and the receiver board.
- 4) Use the Display Port to connect the receiver board and monitor.
- 5) Set the FPGA\_DIPSW of the Nitro of the transmitter side to ON/ON, and the FPGA\_DIPSW of the receiver side to OFF/OFF.
- 6) Connect the AC adapter to the Nitro DC jack.

### 4.2.2 Securing the Nitro Board and This Board

- 1) Use pan head screws to secure 23-mm spacers to the back of the HSMC A port of the Nitro board.
- 2) Use pan head screws to secure 15-mm spacers to the surface of this board's camera.
- 3) Connect this board to the HSMC A port of the Nitro board.
- 4) Mount the bracket with flat head screws.

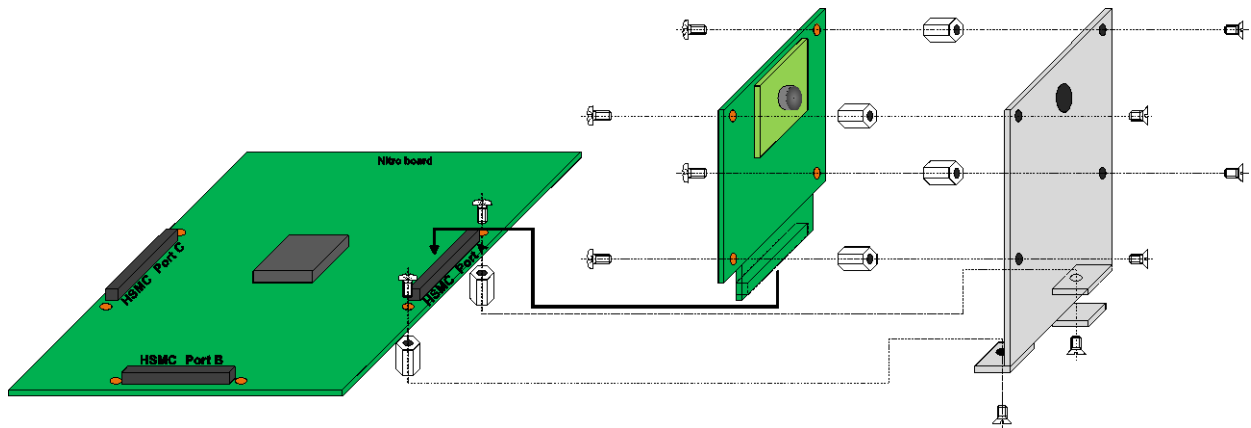


Figure 4-3 Securing the Boards

### 4.2.3 Jumper Settings

| Reference | Signal Name | Setting     |
|-----------|-------------|-------------|
| CN7       | BCLK        | 1-2 shorted |
| CN7       | LRCLK       | 3-4 shorted |
| CN7       | ADC_SDATA   | 5-6 shorted |
| CN7       | DAC_SDATA   | 7-8 shorted |

## 5. Reference Design

### 5.1 About the Reference Design

This reference design runs on FPGA (Cyclone V GX) of the Nitro board.

The transmitter side FPGA encapsulated Ethernet Frame from the video signal of the camera module. And via the BroadR-Reach interface, transmits video signal to the Receiver side FPGA.

The Receiver side FPGA extracts the video signal from the Ethernet Frame. And via the DisplayPort interface output video to the DisplayPort monitor.

Moreover, this reference design includes design for evaluating audio, audio loopback evaluation is available.

#### 5.1.1 Sending Images with BroadR-Reach

Two of this board and two Nitro boards need to be prepared in order to transmit images with BroadR-Reach.

Figure 5-1 shows the connection diagram and data flow.

- 1) The transmitter side FPGA encapsulated Ethernet Frame from the video signal of the camera module.
- 2) FPGA sends the Ethernet Frame to the BroadR-Reach PHY.
- 3) PHY sends to the receiver side via BroadR-Reach.
- 4) The Receiver side FPGA extracts the video signal from the Ethernet Frame.
- 5) Via the DisplayPort output video to the DisplayPort monitor.

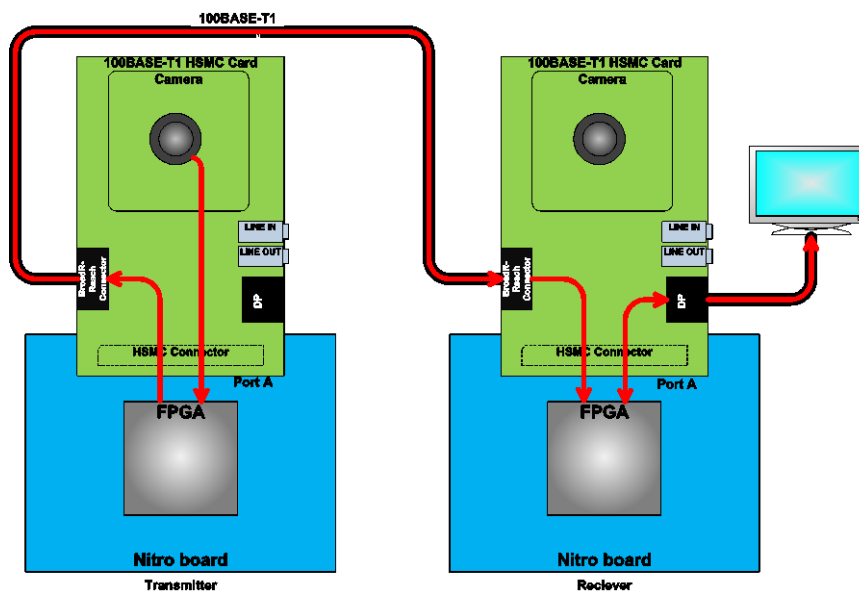


Figure 5-1 Connection Diagram and Data Flow

### 5.1.2 Audio Loopback by FPGA

One of this board and one Nitro board need to be prepared in order to loop back audio with FPGA. Figure 5-2 shows the connection diagram and data flow.

- 1) Input a sound source from the audio player to Line-in (J2) of this board.
- 2) Audio CODEC converts to I2S format from sound source, and data transmit to the FPGA.
- 3) The FPGA send I2S data back to Audio CODEC.
- 4) Audio CODEC output the sound from a speaker that is connected to the Line Out (J1).

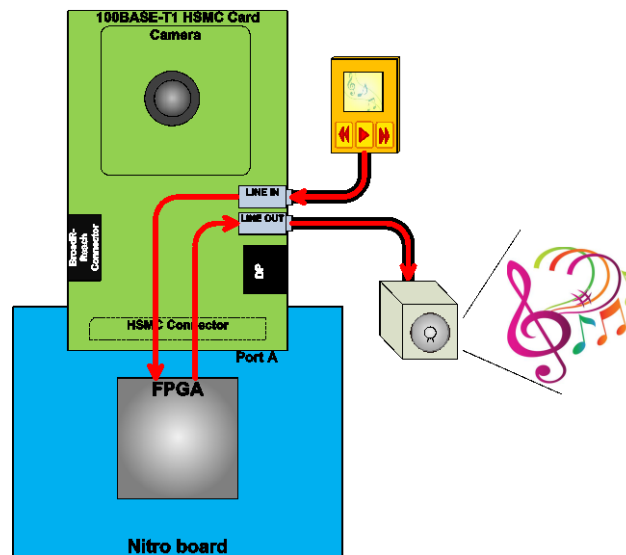


Figure 5-2 Connection Diagram and Data Flow

## 5.2 Writing the Reference Design

The method for writing the reference design is shown below.

- 1) Connect the USB-Blaster to J1 JTAG of the Nitro board.
- 2) Power up the Nitro board.
- 3) Use Quartus II Programmer to write Video\_BRR\_Audio\_Loopback.sof stored in #user\_folder/Design/sample/Nitro/Video\_BRR\_Audio\_Loopback/HW/output\_files/.
- 4) Execute program\_epcq.bat, which is stored in #user\_folder/Design/sample/Nitro/Video\_BRR\_Audio\_Loopback/HW/output\_files/, then write HW/SW to the configuration ROM on the Nitro Board.  
 \*\*Before execute .bat file, make sure to edit line 3 of program\_epcq.bat by text editor.  
 Edit the script to browse the installation directory QuartusII  
 # set CMDSH\_PATH=C:\¥altera¥14.0.200¥nios2eds¥
- 5) Power down the Nitro board.

## 5.3 Executing the Reference Design

The method for executing the reference design is shown below.

- 1) Connect each device (refer to item 4.2.1).
- 2) To play audio, turn on sound source and speaker power.
- 3) To output images to a monitor, turn on monitor power.
- 4) Power up the Nitro board.

## 6. Additional Information

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- Mpression Nitro – Cyclone® V GX I/O Expansion Base Board  
<http://www.m-pression.com/solutions/boards/nitro-board>

## 7. Document Revision History

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| Date        | Revision | Changes         |
|-------------|----------|-----------------|
| Oct 5, 2016 | 1.0      | • First Edition |
|             |          | •               |
|             |          | •               |