# Getting Started

12G-SDI FMC Card

Revision

**B**

**2017/10/13**

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# Contents

# 1. Read This First

## 1.1 Important Information

**READ FIRST:**
- Before using this card, be sure to read this Getting Started manual.
- Keep this Getting Started manual so you can refer to it when necessary.
- You should sufficiently understand the card's configuration before you use it.

**Card Application:**
- This card is an FPGA Mezzanine Connector (hereafter FMC) daughter card that can be connected to and used with any FMC that complies with FMC standard. Combining with an FPGA evaluation board (hereafter Evaluation board), this card supports the development and verification of software and hardware for 12G-SDI I/O interfaces. Use this card correctly in line with the application.

**People Who Are Expected to Use This Card:**
- Only people who carefully read and understood this manual and the Reference Manual should use this card. You need a fundamental understanding of FPGA, logic circuits, electronic circuits, and micro-computers to use this card.

**Precautions When Using This Card:**
- This card is a development support card used for the purpose of your hardware and software development and evaluation. This card cannot be used in your mass production products. Furthermore, when you want to use the card's sample designs for your products, please be sure to confirm if it withstands practical use at your own risk by doing necessary and sufficient tests and evaluations.
- Macnica Incorporated (hereafter Macnica Inc.) has no liability for any results arising from the use of the card.
- Macnica Inc. will attempt to provide either free or paid support to handle repair of faults or workarounds for faults with the card. 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 and precautions in this Getting Started manual and on the card are therefore not all-inclusive. You are responsible for using the card correctly and safely.
- Even if there are faults with devices that are mounted on the card, Macnica Inc. will not replace it with a fault-fixed device.
- Each interface is not guaranteed to connect with all products.
- The card will not be replaced if you damaged or modified the card.
- The card uses lead-free parts.
- The rights to the trademarks and registered trademarks of the vendors noted in this manual belong to their respective vendors.

**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, designs, this Getting Started manual, and other documentation at any time, without prior notice to customers.

**Warranty:**

- Macnica Inc. offers to exchange this card free of charge only in case of initial malfunction noticed by you within 30 days from the delivery.
  Macnica Inc. cannot exchange cards in cases where the malfunction is caused by the following reasons:
  (1) Misuse, abuse of the card or use under abnormal conditions
  (2) Remodeling or repair
  (3) A fire, earthquake, fall or other accidents

**Figures:**

- Some figures in this manual may differ from your purchased card.

# 1.2    Developer Information

The Developer of this card is:
Macnica Inc.
1-6-3 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8561 JAPAN

# 1.3    Inquiries

In case you have any inquiries about the use of this card, please contact sales office you purchased or make inquiries through the contact form on the following web site.

Inquiries page:
  http://www.m-pression.com/contact/inquiry
Inquiries to:
  Macnica Inc.
  Sales and Planning Advanced Technology
  1-5-5 Shin-Yokohama, Kouhoku-ku, Yokohama, 222-8563 JAPAN
  TEL: +81-45-470-9838

# 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

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

## 2.2 Cautions

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

| | |
|---|---|
| **Warning** (Continued from previous page) | Plug the power plug securely into the outlet. If the power plug is not securely plugged into the outlet, it may cause accidents involving electrical shock or fire due to heat emitted. |
| | 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. Doing so may cause the equipment to malfunction or fail, or lead to accidents involving electrical shock or fire due to heat emitted. |
| | Periodically remove any dust accumulated on the power plug and around the outlet (socket). 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. Remove any dust on the power plug and around the outlet with a dry cloth. |
| | Do not place any containers, such as cups or vases, filled with water or other liquids on the card. If the card is exposed to water or other liquids, it will cause a malfunction or electric shock. If you spilled water or other liquid on this card, immediately stop using the card, turn off the power, and unplug the power plug. If you have any requests for repairs or technical consultation, please contact sales office you purchased or Mpression inquiry URL. |
| | Keep the card and accessories out of the reach of children. Failure to do so may lead to injuries. |
| **Caution** | Do not place the card on unstable places such as shaky stands or tilted locations. Doing so may cause injuries or cause this card to malfunction if the card should fall. |
| | Do not attempt to use or leave the card 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 card to emit heat, break, ignite, run out of control, warp, or malfunction. Also, some parts of the equipment might emit heat, causing burn injuries. |
| | Do not use the card in places subject to extremely high or low temperatures or severe temperature changes. Doing so may cause the card to fail or to malfunction. Always be sure to use the card within a temperature range of 5°C to 35°C and a humidity range of 0% to 85%. |
| | Unplug the power supply when doing maintenance on equipment in which the card is embedded. Failure to do so may lead to accidents involving electrical shock. |
| | Do not place the card in locations where excessive force might be applied to it. Doing so may cause the printed circuit board to warp, leading to breakage of the printed circuit board, missing parts or malfunctioning parts. |

| | |
|---|---|
| **Caution**<br>(Continued from previous page) | When using the card together with expansion boards or other peripheral equipment, 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 card unless they are specifically mentioned in this Manual or their successful operation with this card has been confirmed in separate documents. |
| | Turn off the power switch when moving or connecting the card.<br>Failure to do so may cause this card to fail or lead to accidents involving electrical shock. |
| | Do not clean this card by using a rag containing chemicals such as benzine or thinner.<br>Doing so could degrade the card. When using a chemically treated cloth, comply with its directions and warnings. |
| | Do not immediately turn on the power if you find that moisture has condensed onto this card after removing it from the box.<br>Condensation may form if the card is cold when moved from the box into a warm room.<br>Turning on the power while there is moisture on the card may cause it to malfunction or shorten the service life of the parts.<br>Allow the card to reach room temperature when you first take it out of the box. If condensation or moisture has occurred on this card, first wait for the moisture to fully evaporate before installing or connecting the card to other equipment. |
| | Operation of the card cannot be guaranteed if it has been disassembled, dismantled, altered, modified, or rebuilt. |

# 3. Introduction

## 3.1 About This Document

This manual describes how to use the reference design used by our 12G-SDI FMC Card (hereafter FMC card).

## 3.2 Required Hardware and Software

Hardware
- 12G-SDI signal generator (e.g. Blackmagic Design's Teranex Express)
- Monitor or analyzer that supports 12G-SDI input (e.g. Blackmagic Design's SmartView 4K)
- Arria 10 GX FPGA Development Kit (board/AC adapter/micro-USB cable)
- BNC cable: 2
- FMC card (card/jumper caps 2 pcs.)

Software
- Quartus Prime Standard Ver. 16.0 Update 2 (Intel FPGA programming software)
- Reference design (You can download the documents and designs from the URL written in the Packing list. )

## 3.3 Related Materials

Materials provided by Macnica: Title (document number)
- 12G-SDI FMC Card Schematic (DATA_000070)
- 12G-SDI FMC Card Reference Manual (DCMT_000331)

Materials from Intel (document number)
- Multi Rate Up to 12G SDI II Reference Design for Arria 10 Devices ( AN768 )
- SDI II IP Core User Guide ( UG-01125 )

Materials from Blackmagic Design
- Teranex Express Manual
- SmartView 4K Manual

# 4. Overview

## 4.1 Hardware Configuration

Figure 4-1 shows a hardware configuration for implementing a reference design.
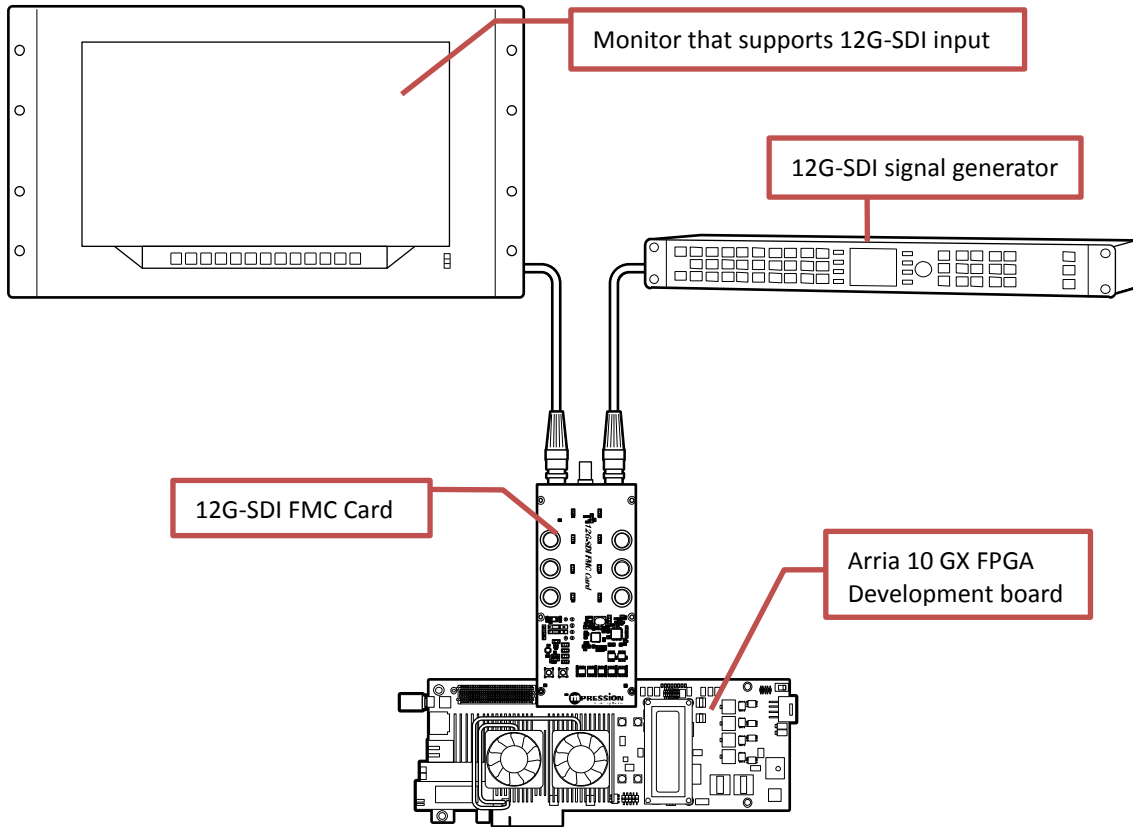


Figure 4-1. Hardware Configuration

## 4.1.1    Hardware & Design Configuration

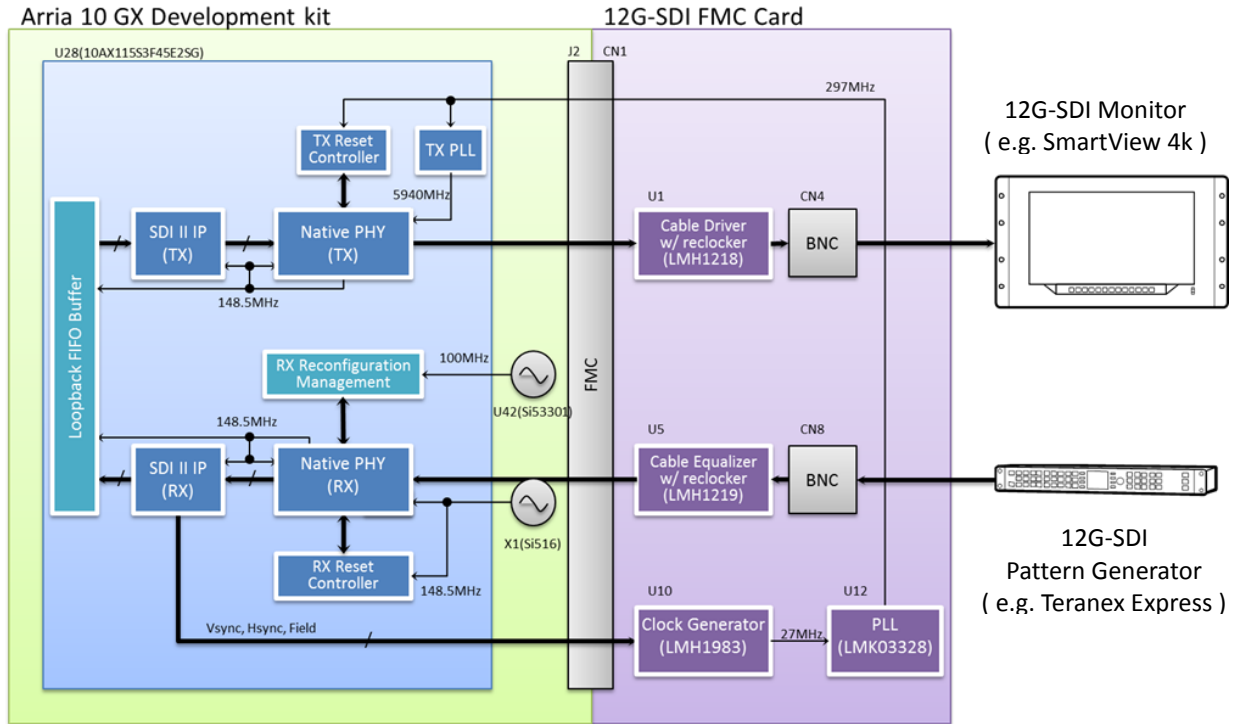Figure 4-2 shows the internal configuration of the reference design.



Figure 4-2. Hardware Design Configuration

# 5.  Hardware Setup

The following shows the procedure for setting up the hardware.

1.  Attach a jumper cap to JP2-2 and JP2-3 on the FMC card.
2.  Attach a jumper cap to JP4-2 and JP4-3 on the FMC card.
3.  Connect the FMC card to FMC Port B (J2) on the Arria 10 GX FPGA Development Board.
4.  Connect the AC adaptor provided to the 12-V DC input (J13).
5.  Set the DIP switches (SW3, SW4, SW5, and SW6) on the Arria 10 GX FPGA Development Board as shown in Figure 5-1.
6.  Use a BNC cable to connect the 12G-SDI signal generator's output terminal to CN8 on the FMC card.
7.  Use a BNC cable to connect the 12G-SDI monitor's input terminal to CN4 on the FMC card.
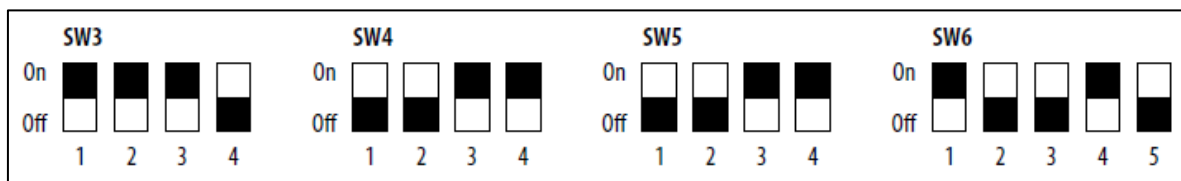
Figure 5-1. Arria 10 GX FPGA Development Board DIP Settings
(The ■ indicates the side to which the switch has been slid)

# 6. Procedure to Implement Reference Design

The following shows the procedure for implementing the reference design.
1. Use Quartus Prime to un-compress the reference design in a project.
2. Compile the developed project and generate a programming file.
3. Write the programming file that you generated to the FPGA.
4. Press the CPU_RESET push button on the Arria 10 GX FPGA Development Board one time.
5. Refer to Figure 6-1 and Table 6-1 to confirm the status of the LEDs on the FMC card and the Arria 10 GX FPGA Development Board.
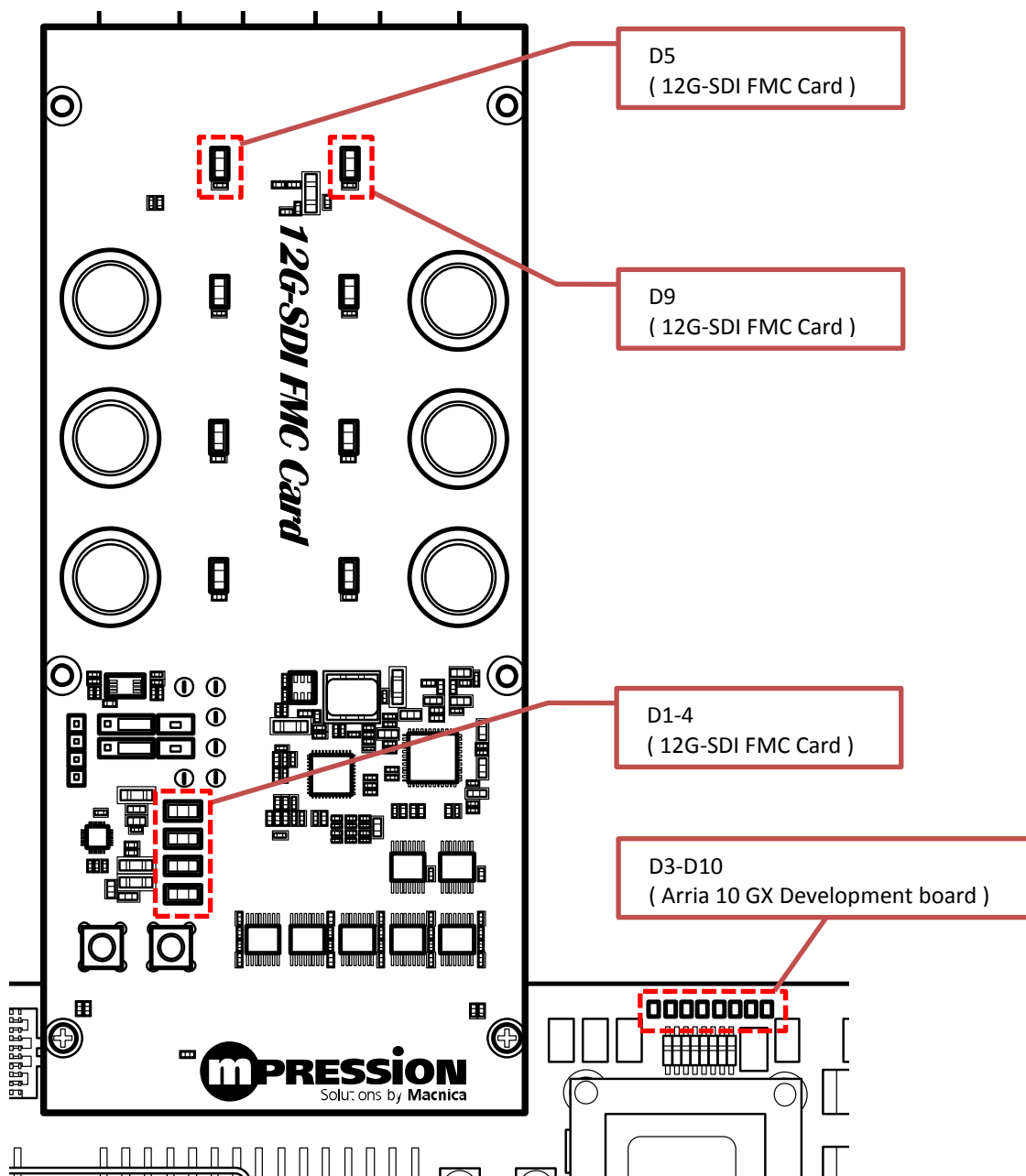


Figure 6-1. Positions to Confirm LEDs

Table 6-1. LED Statuses

| Board/card | Part location | Function silk | Status | Remarks |
|---|---|---|---|---|
| Arria 10 GX FPGA Development board | D3 | - | Flashing | The heartbeat of TX0 clock |
| | D4 | - | Flashing | The heartbeat of RX0 recovered clock |
| | D5 | - | Lit | Frame lock for channel 0 |
| | D6 | - | Lit | TRS locked for channel 0 |
| | D7 | - | Off | CRC error on Chroma/Luma for channel 0 |
| | D8-D10 | - | - | RX signal standard for channel0: "0":OFF, "1":ON<br><br>・ SD: [D8, D9, D10] = "000"<br>・ HD: [D8, D9, D10] = "001"<br>・ 3Gb: [D8, D9, D10] = "010"<br>・ 3Ga: [D8, D9, D10] = "011"<br>・ 6Gb: [D8, D9, D10] = "100"<br>・ 6Ga: [D8, D9, D10] = "101"<br>・ 12Gb: [D8, D9, D10] = "110"<br>・ 12Ga: [D8, D9, D10] = "111" |
| 12G-SDI FMC Card | D1 | FMC_1p8v | Lit | |
| | D2 | FMC_3p3v | Lit | |
| | D3 | FMC_12p0v | Lit | |
| | D4 | 2p5v | Lit | |
| | D5 | TX0_LOCK | Lit | U1 (LMH1218) lock |
| | D6 | TX1_LOCK | Off | |
| | D7 | TX2_LOCK | Off | |
| | D8 | TX3_LOCK | Off | |
| | D9 | RX0_LOCK | Lit | U5 (LMH1219) lock |
| | D10 | RX1_LOCK | Off | |
| | D11 | RX2_LOCK | Off | |
| | D12 | RX3_LOCK | Off | |

# 7. Document Revision History

| Date | Revision | Changes |
|---|---|---|
| February 2, 2017 | A | • First Edition |
| October 13, 2017 | B | • Updated design download URL. |
| | | • |