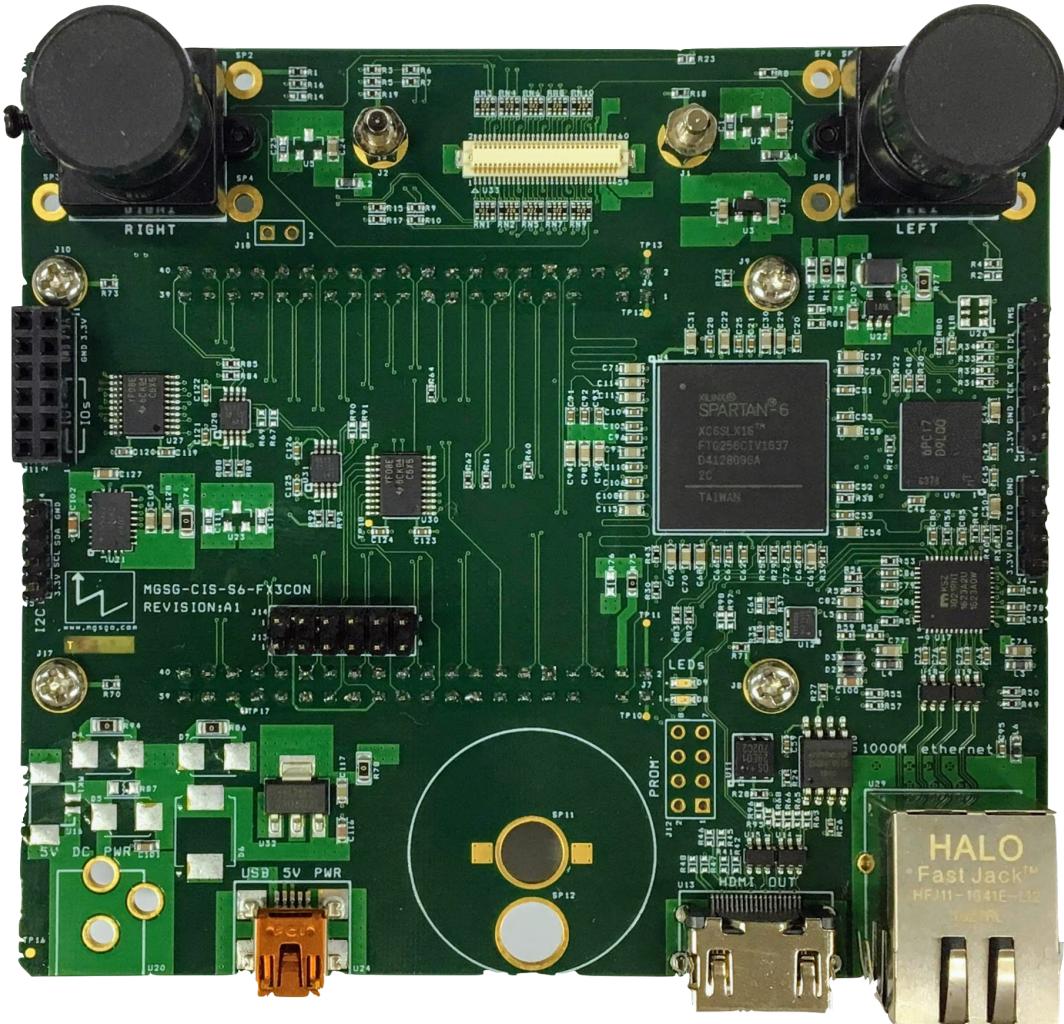


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## M-CIS-S6-FX3CON USER MANUAL



# M-CIS-S6-FX3CON 사용설명서 KOR

REVISION 1.0.0

MGSG CO., LTD

## Revision history

Revision	Date	Description	Update by
1.0.0	2019.02.23	Initial creation	jhyoo
	2019.04.27	Update	jhyoo

## Table of Contents

- 1. Package**
- 2. Overview**
- 3. Examples**
- 4. Support**

## 1. Package

### 1.1 내용물



- 2.54mm jumper 6개
- Tripod 와 고정용 nut
- PCB 보드
- USB 전원 케이블(USB A to USB mini B)
- CYUSB3KIT-003 보드 미포함
- Xilinx JTAG cable 미포함

Figure 1.1.1 M-CIS-S6-FX3CON 내용물

## 1.2 삼각대

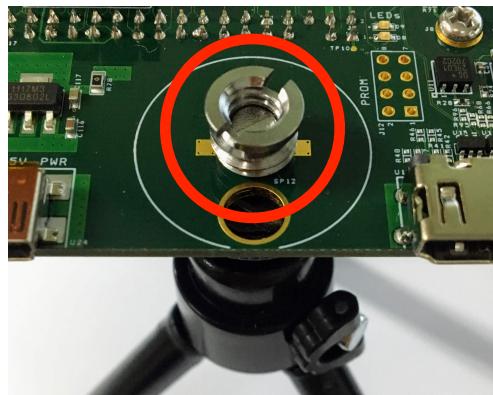


Figure 1.2.1 M-CIS-S6-FX3CON 삼각대와 고정용 너트 조립

## 2. Overview

M-CIS-S6-FX3CON은 이미지센서, USB3.0, Gigabit ethernet, HDMI를 위한 FPGA 개발보드입니다. 다양한 예제를 제공하며, 영상처리를 위한 용도로도 사용 할 수 있습니다.

### 2.1 보드 구성

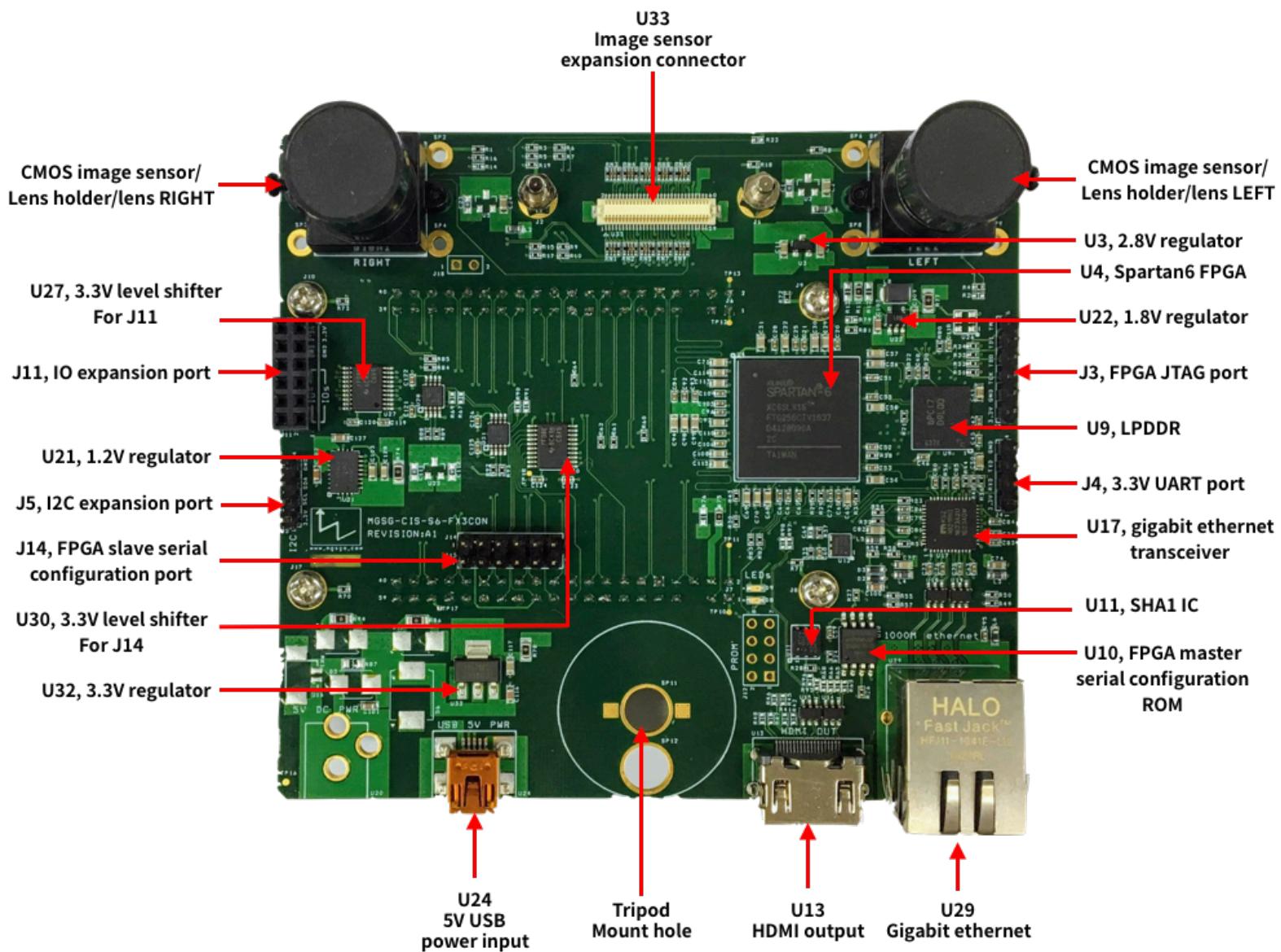


Figure 2.1.1 M-CIS-S6-FX3CON 보드 윗면 구성

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## M-CIS-S6-FX3CON USER MANUAL

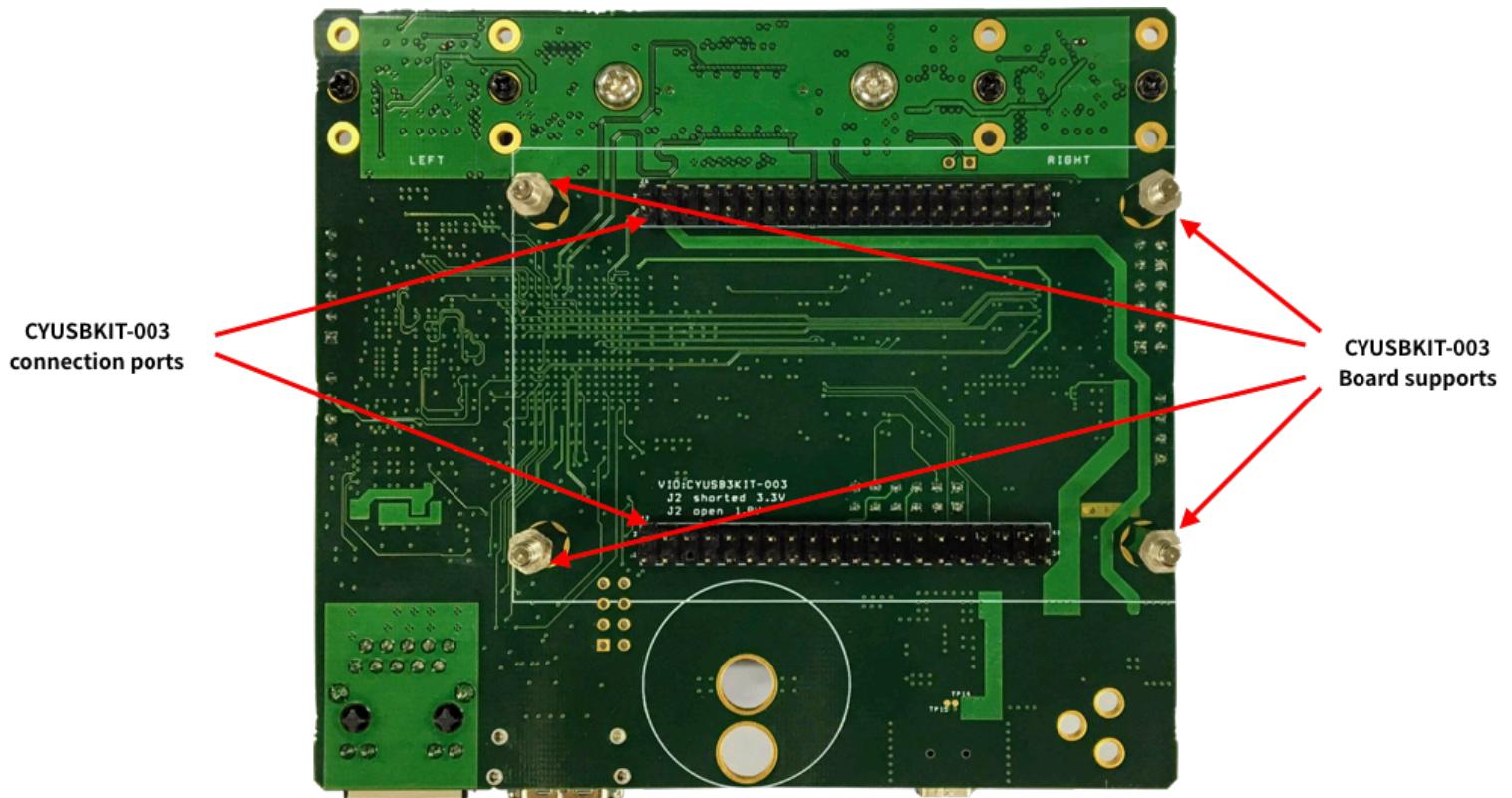


Figure 2.1.2 M-CIS-S6-FX3CON 보드 아랫면 구성

## 2.2 보드 크기

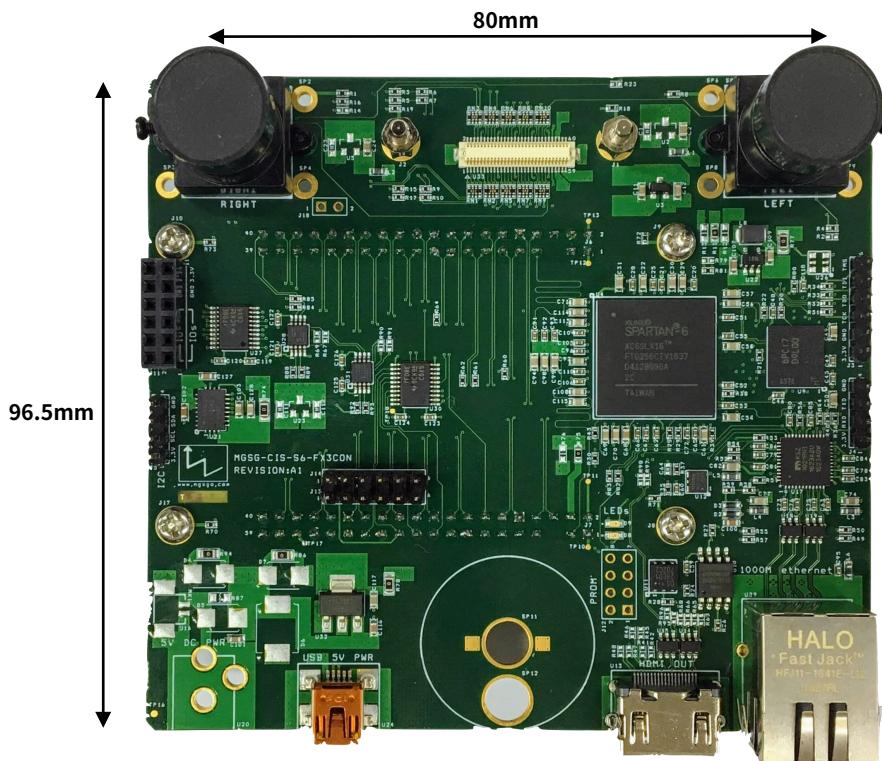


Figure 2.2.1 M-CIS-S6-FX3CON 보드 윗면 치수

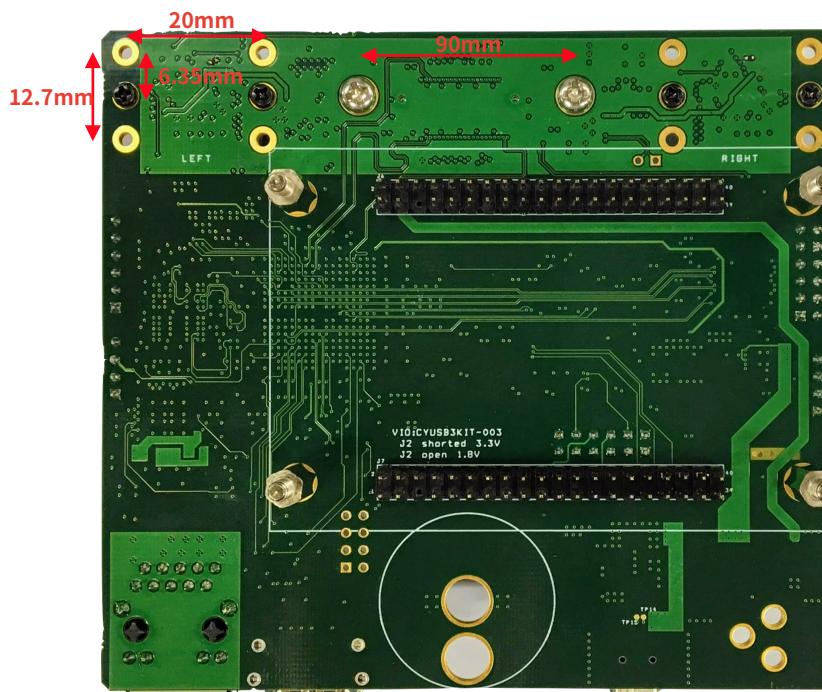


Figure 2.2.2 M-CIS-S6-FX3CON 보드 아랫면 치수

## 2.3 사양

- 전원 입력
  - DC 5V 최대 1A
  - USB mini-B port
- FPGA
  - XC6SLX16-2FTG256C
  - Xilinx Spartan6
- 두개의 CIS(CMOS image sensor)
  - MT9M114EBLSTCZ-CR1
  - ONSEMI(Aptina) 1280x960 CIS
- 두개의 M12(지름 12mm) 렌즈 홀더
- 두개의 M12 렌즈
  - 초점거리 3.6mm 혹은 유사한 초점거리
  - IR 차단 필터 없음
- LPDDR DRAM
  - MT46H32M16LFBF-5 IT:C
  - Micron LPDDR
- Gigabit ethernet PHY
  - KSZ9021RNI
  - MICREL Gigabit ethernet PHY
- CYUSB3KIT-003(Cypress FX3 board) 연결 단자
  - 두개의 2.54mm 간격 40핀 커넥터
  - **CYUSB3KIT-003 보드 미포함**
- HDMI 단자
  - Spartan6에서 출력된 TMDS 신호(TMDS\_33 IO) 연결
  - HDMI HOT plug detect voltage output 미지원
  - HDMI CEC/I2C(DDC) 제어 미지원

## 3. Examples

### 3.1 시스템 요구 및 기본사항

- DC 5V USB 전원 케이블 연결(키트에 포함됨, 전원 아답터 미포함)

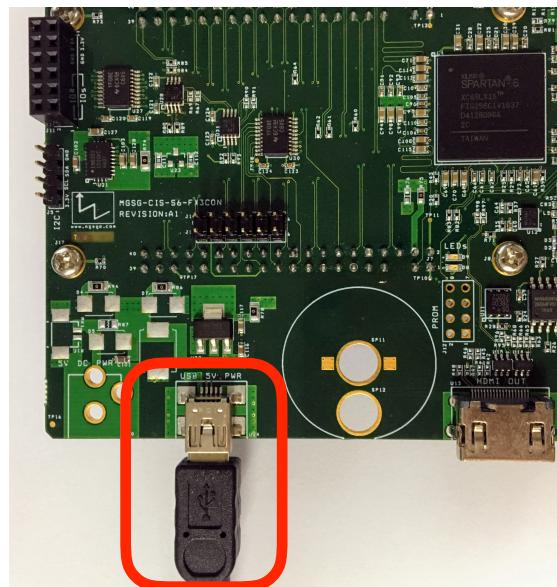


Figure 3.1.1 M-CIS-S6-FX3CON USB 전원 케이블 연결

- Xilinx JTAG(for FPGA configuration) cable : 3.3V IOs

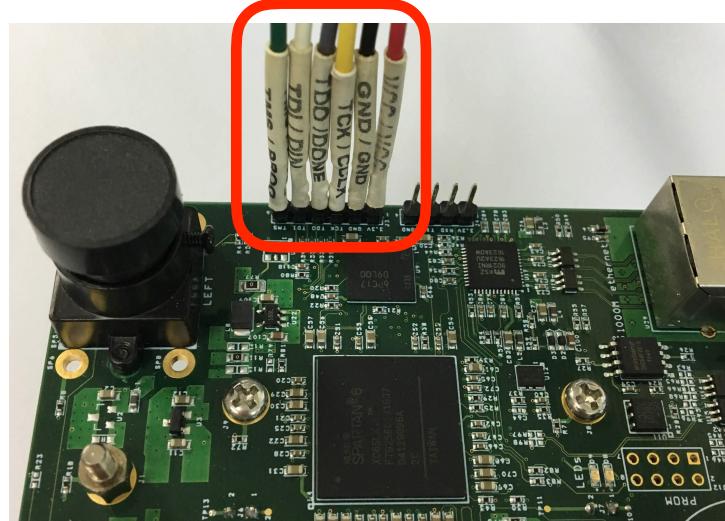


Figure 3.1.2 M-CIS-S6-FX3CON Xilinx JTAG cable(미포함) 연결

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## M-CIS-S6-FX3CON USER MANUAL

- Xilinx Spartan6/Cypress FX3 개발툴
  - Xilinx ISE 14.7
    - [https://www.xilinx.com/support/download/index.html/content/xilinx/en/downloadNav/design-tools/v2012\\_4---14\\_7.html](https://www.xilinx.com/support/download/index.html/content/xilinx/en/downloadNav/design-tools/v2012_4---14_7.html)
    - [https://www.xilinx.com/support/download/index.html/content/xilinx/en/downloadNav/design-tools/14\\_7-windows.html](https://www.xilinx.com/support/download/index.html/content/xilinx/en/downloadNav/design-tools/14_7-windows.html)
  - Cypress FX3 SDK 1.3.4
    - <https://www.cypress.com/documentation/software-and-drivers/ez-usb-fx3-software-development-kit>
- Xilinx ISE14.7를 이용한 bit file 생성

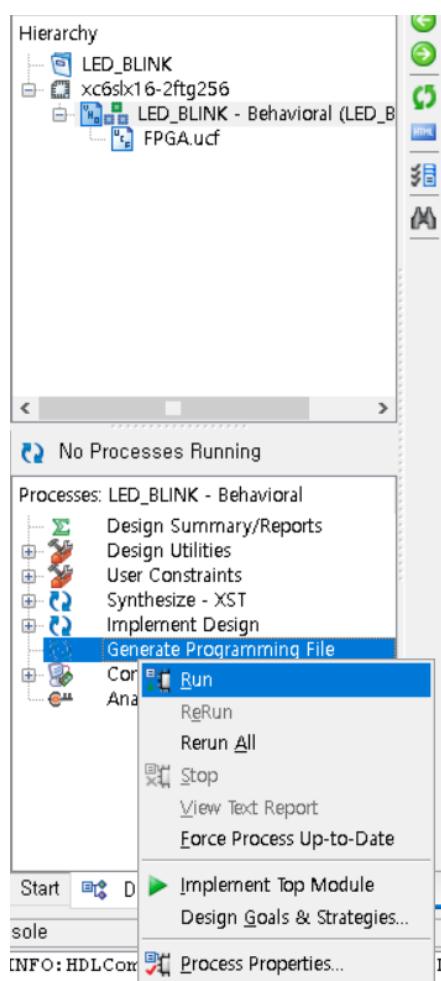


Figure 3.1.3 Xilinx ISE14.7를 이용한 bit file 생성

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## M-CIS-S6-FX3CON USER MANUAL

- Xilinx JTAG과 iMPACT를 이용한 Spartan6 FPGA에 bit file 다운로드

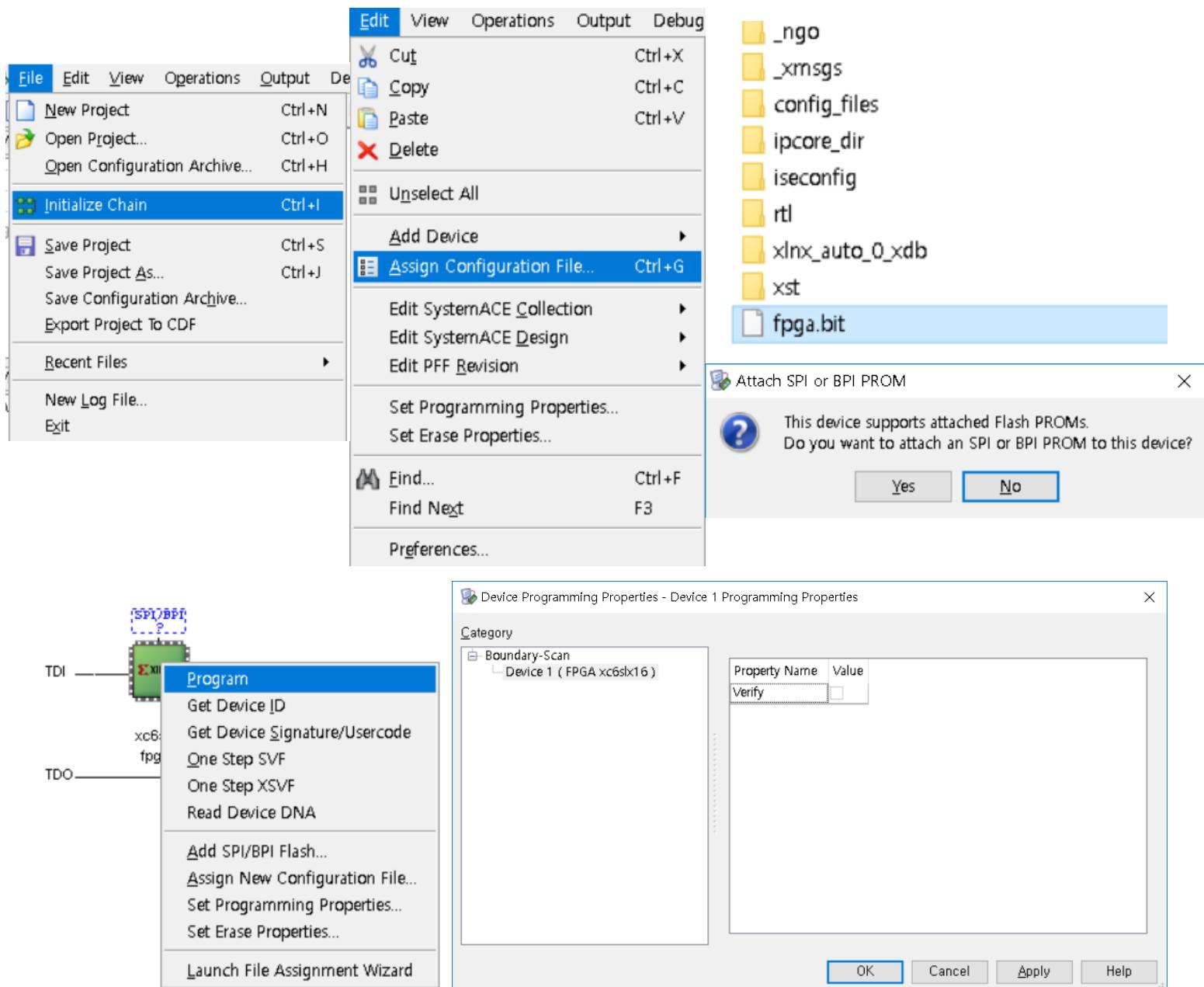


Figure 3.1.4 Xilinx JTAG과 iMPACT를 이용한 Spartan6 FPGA에 bit file 다운로드

## M-CIS-S6-FX3CON USER MANUAL

- iMPACT를 이용한 64MB FPGA boot flash(W25Q64FVSSIG) MCS파일 생성

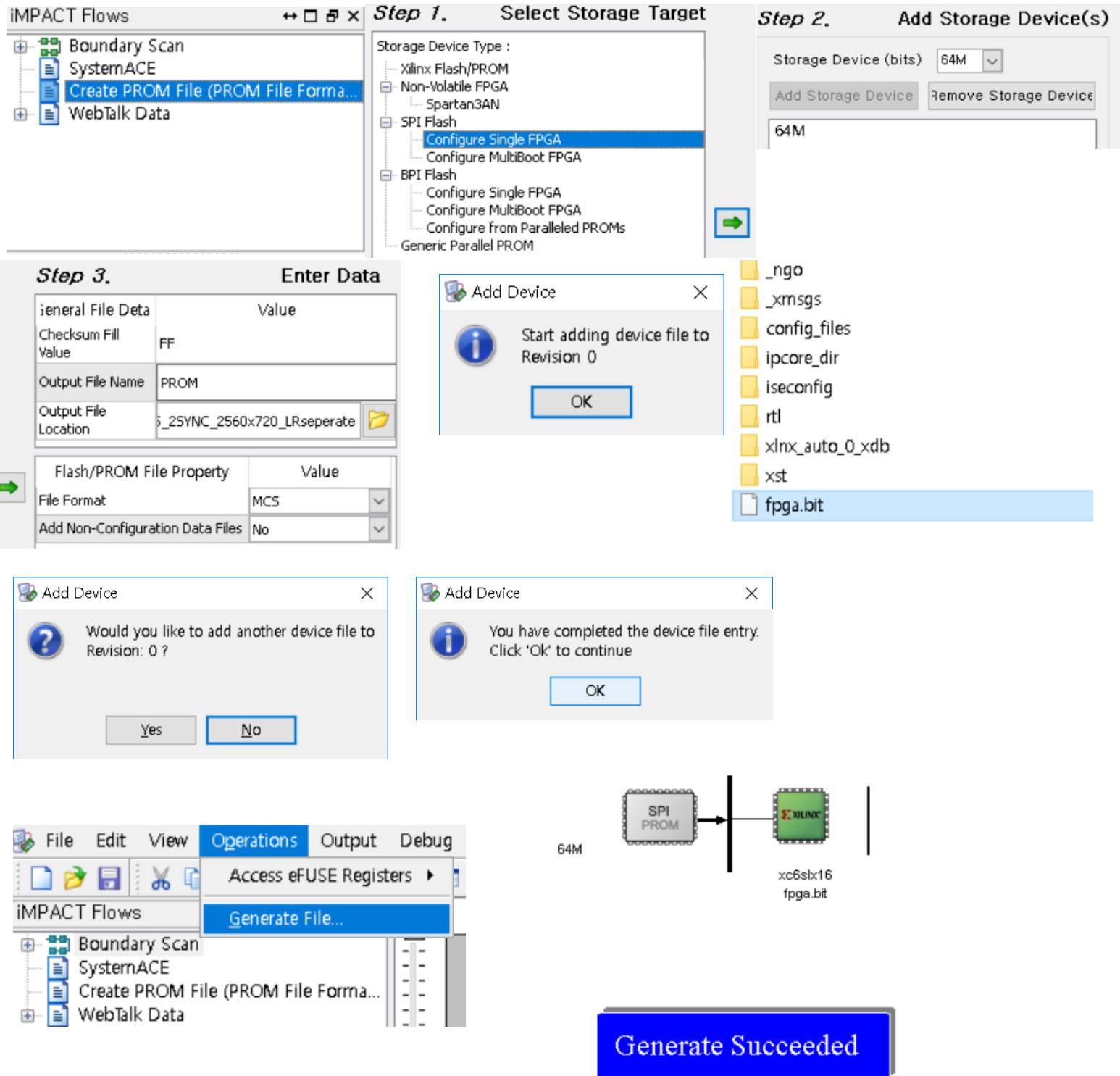


Figure 3.1.5 iMPACT를 이용한 64MB FPGA boot flash(W25Q64FVSSIG) MCS파일 생성

## M-CIS-S6-FX3CON USER MANUAL

- iMPACT를 이용한 64MB FPGA boot flash(W25Q64FVSSIG) MCS파일 다운로드

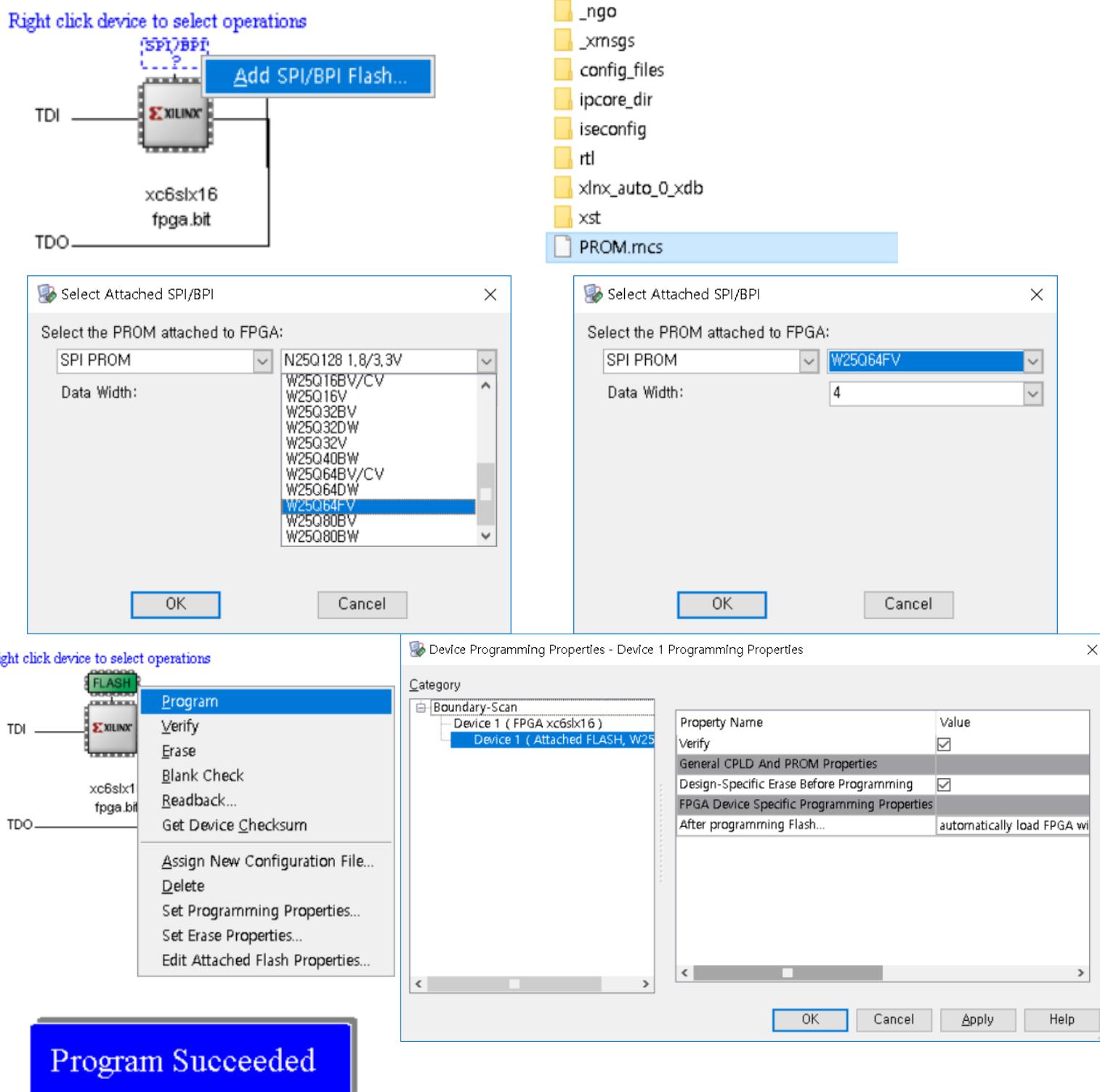


Figure 3.1.6 iMPACT를 이용한 64MB FPGA boot flash(W25Q64FVSSIG) MCS파일 다운로드

### 3.2 LED blink 예제

- LED\_BLINK : LED D8, D9가 번갈아가면서 켜지는 예제
- FPGA N11 핀 출력이 low(0V) 일때, D8 LED 켜짐
- FPGA T11 핀 출력이 high(3.3V) 일때, D9 LED 켜짐

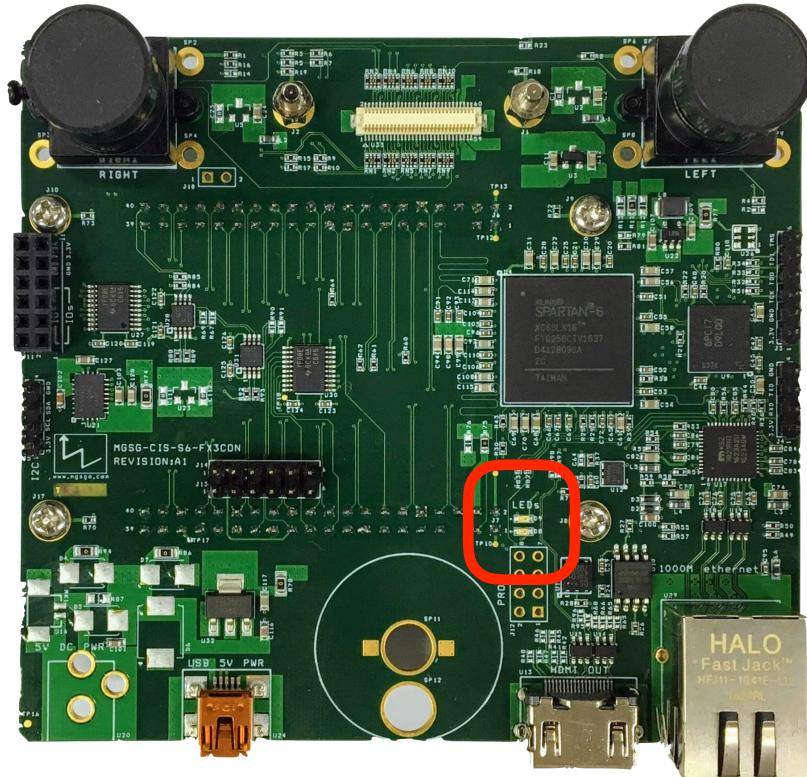


Figure 3.2.1 M-CIS-S6-FX3CON 보드의 LED D8/D9 위치

### 3.3 USB3.0 UVC single CIS (AN75779, 1280x720@30fps) 예제

- UVC\_CIS\_BYPASS\_LEFT\_1280x720 : UVC(Universal Video Class) 카메라 예제, 이미지센서 1개 사용
- M-CIS-S6-FX3CON는 AN75779(Cypress FX3 UVC example)에서 MT9M114 센서보드처럼 동작할 수 있다
  - AN75779 : <https://www.cypress.com/documentation/application-notes/an75779-how-implement-image-sensor-interface-using-ez-usb-fx3-usb>
  - AN75779 코드 수정 없이 사용 가능함
- **CYUSB3KIT-003 보드 미포함**
- CYUSBKIT-003 kit link : [https://www.cypress.com/products/ez-usb-fx3-superspeed-usb-30-peripheral-controller#tabs-0-bottom\\_side-3](https://www.cypress.com/products/ez-usb-fx3-superspeed-usb-30-peripheral-controller#tabs-0-bottom_side-3)

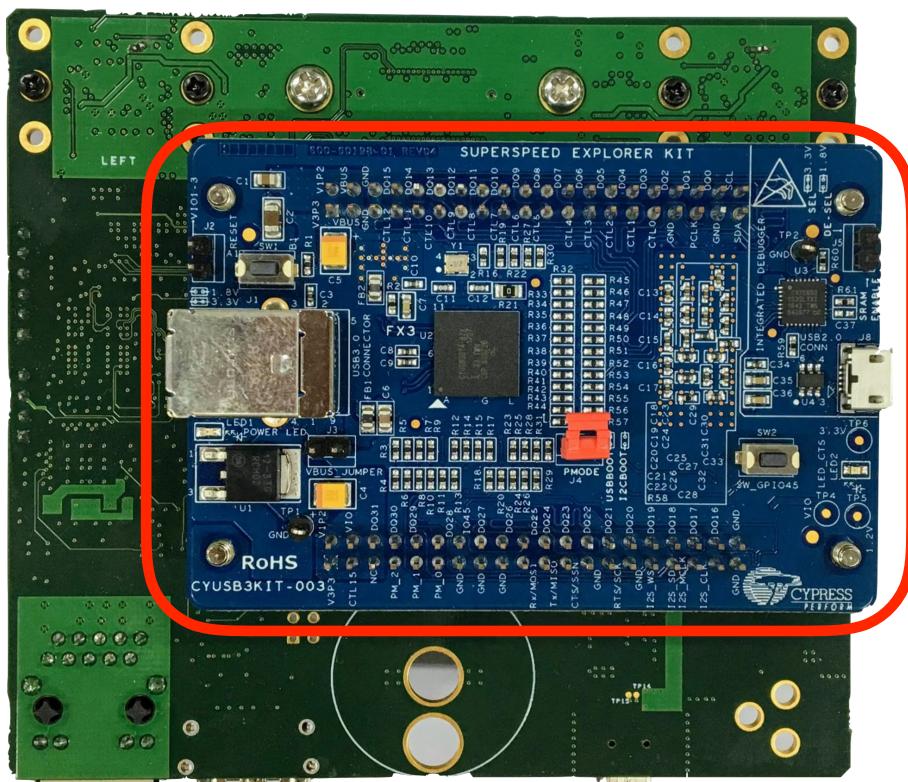


Figure 3.3.1 M-CIS-S6-FX3CON 과 CYUSBKIT-003(**미포함**) 연결(모든 점퍼 OFF, PMODE J4제외)

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## M-CIS-S6-FX3CON USER MANUAL

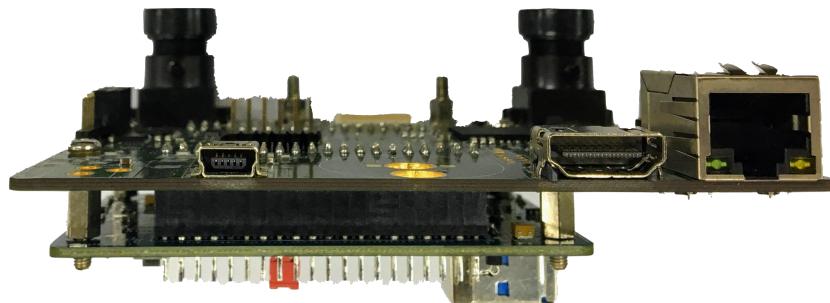


Figure 3.3.2 M-CIS-S6-FX3CON 과 CYUSBKIT-003(미포함) 연결

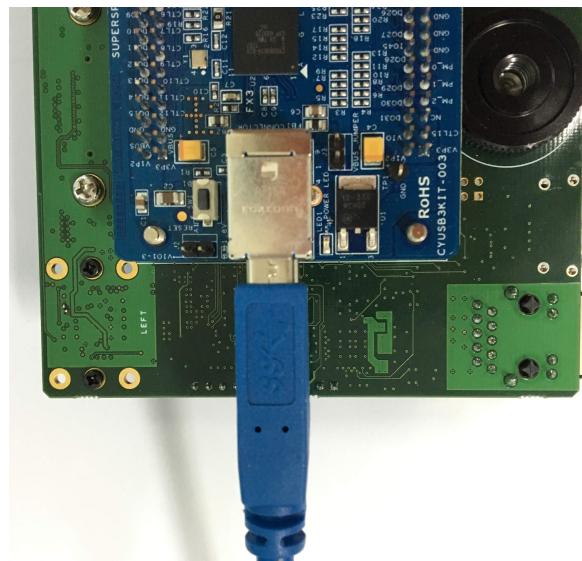


Figure 3.3.3 CYUSBKIT-003(미포함) USB3.0 cable 연결

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## M-CIS-S6-FX3CON USER MANUAL

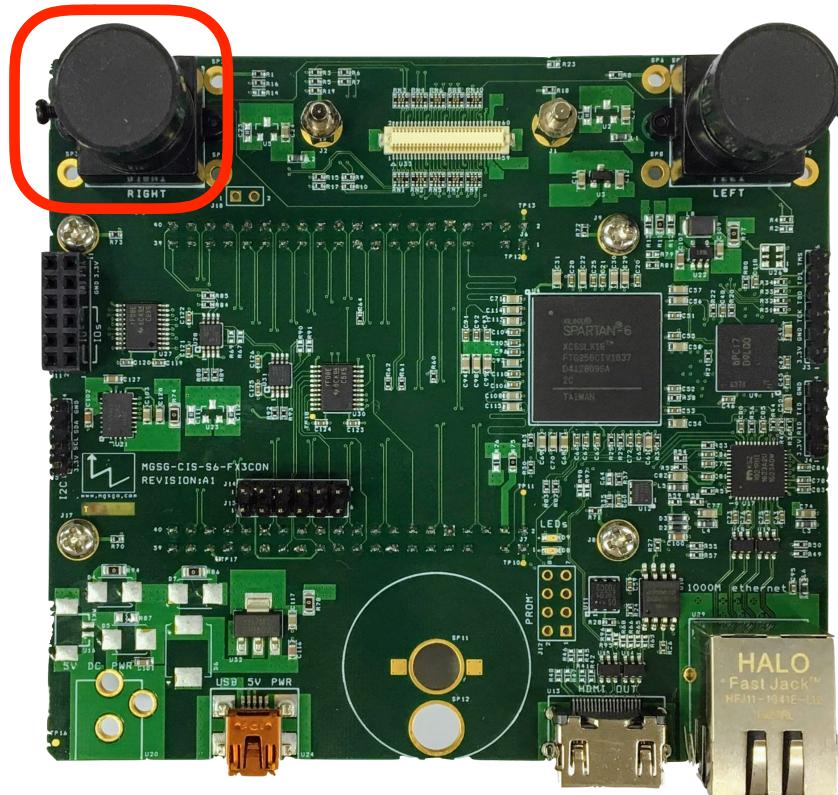


Figure 3.3.4 MT9M114 CMOS 이미지센서와 렌즈

### 3.4 USB3.0 UVC single CIS (AN75779, 2560x720@30fps) 예제

- UVC\_CIS\_LEFT\_RIGHT\_2560x720 : UVC(Universal Video Class) 카메라 예제, 이미지센서 2개 사용
- M-CIS-S6-FX3CON는 AN75779(Cypress FX3 UVC example)에서 MT9M114 센서보드처럼 동작할 수 있다
- AN75779 : <https://www.cypress.com/documentation/application-notes/an75779-how-implement-image-sensor-interface-using-ez-usb-fx3-usb>
- AN75779 코드 수정
  - GPIO bus 폭 : 8bit ==> 16bit
  - 영상 해상도@속도 : 1280x720@30fps ==> 2560x720@30fps
- CYUSB3KIT-003 보드 미포함
  - CYUSBKIT-003 kit link : [https://www.cypress.com/products/ez-usb-fx3-superspeed-usb-30-peripheral-controller#tabs-0-bottom\\_side-3](https://www.cypress.com/products/ez-usb-fx3-superspeed-usb-30-peripheral-controller#tabs-0-bottom_side-3)

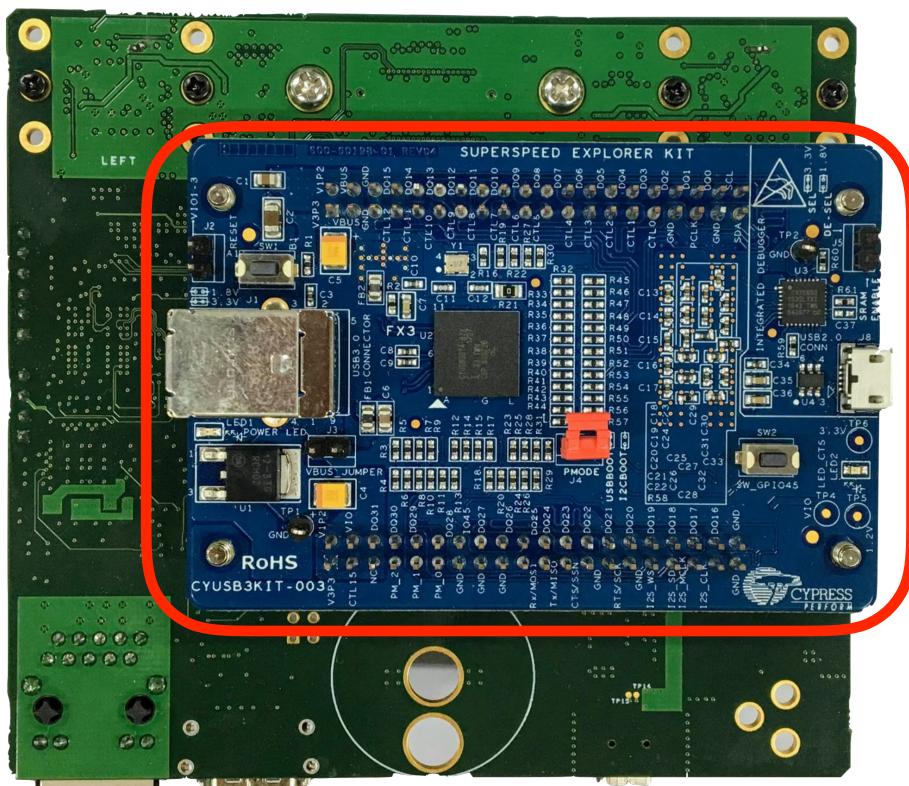


Figure 3.4.1 M-CIS-S6-FX3CON 과 CYUSBKIT-003(**미포함**) 연결(모든 점퍼 OFF, PMODE J4제외)

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## M-CIS-S6-FX3CON USER MANUAL

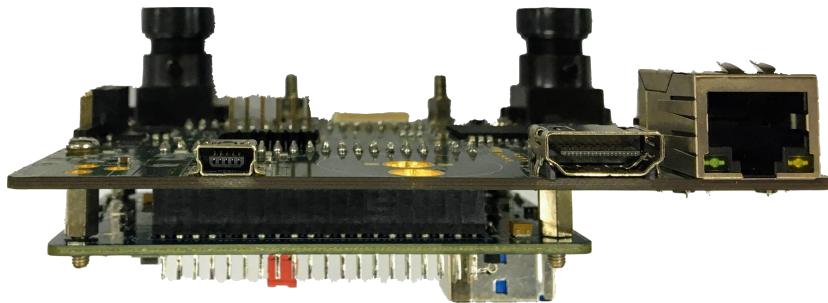


Figure 3.4.2 M-CIS-S6-FX3CON 과 CYUSBKIT-003(**미포함**) 연결

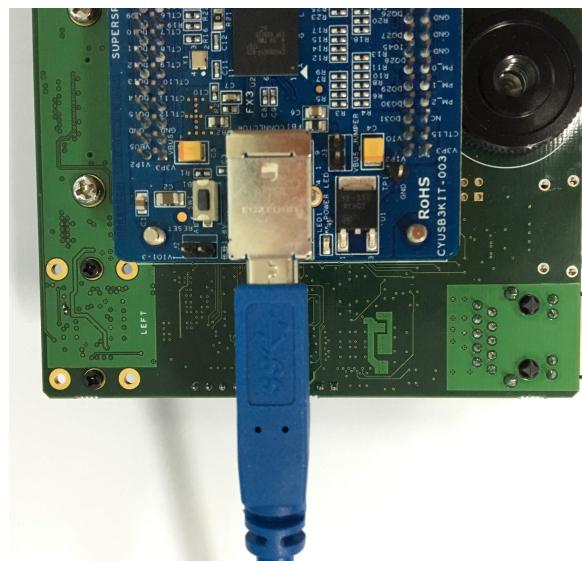


Figure 3.4.3 CYUSBKIT-003(**미포함**) USB3.0 cable 연결

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## M-CIS-S6-FX3CON USER MANUAL

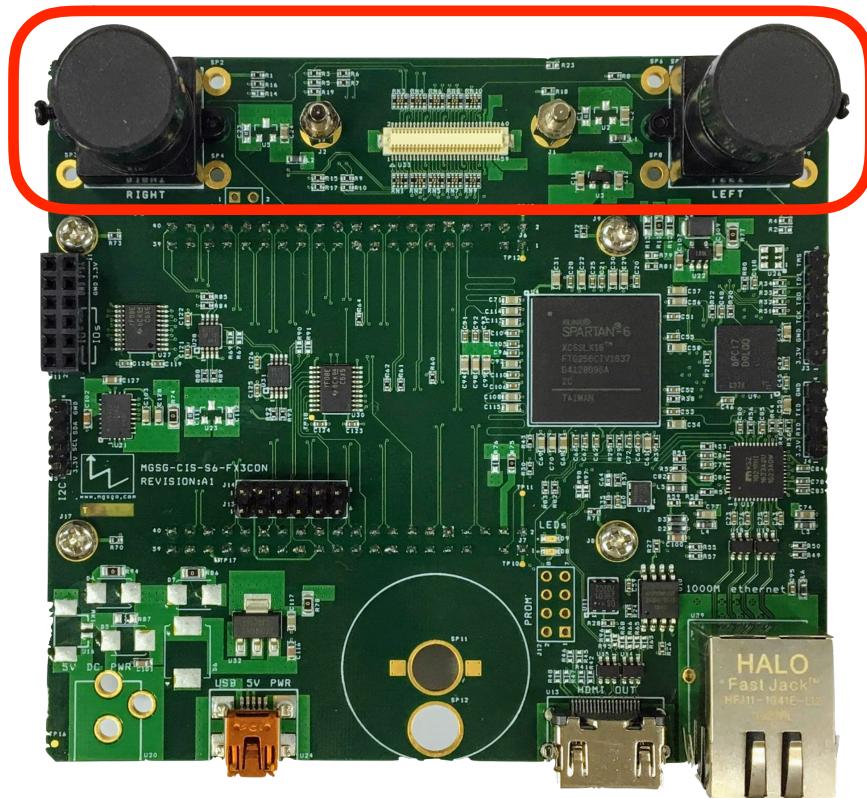


Figure 3.4.4 MT9M114 CMOS 이미지센서와 렌즈

### 3.5 Configuring an FPGA over FX3(use AN84868) 예제

- CONFIG\_FPGA\_OVER\_FX3 : AN84868(Configuring FPGA example)에서 FX3가 Spartan6 FPGA를 mode slave serial로 configuration 하는 예제
- AN84868 : <https://www.cypress.com/documentation/application-notes/an84868-configuring-fpga-over-usb-using-cypress-ez-usb-fx3>
- FPGA를 configuration하는 데 필요한 binary 파일은 LED blink 예제를 사용한다
- **CYUSB3KIT-003 보드 미포함**
- CYUSBKIT-003 kit link : [https://www.cypress.com/products/ez-usb-fx3-superspeed-usb-30-peripheral-controller#tabs-0-bottom\\_side-3](https://www.cypress.com/products/ez-usb-fx3-superspeed-usb-30-peripheral-controller#tabs-0-bottom_side-3)

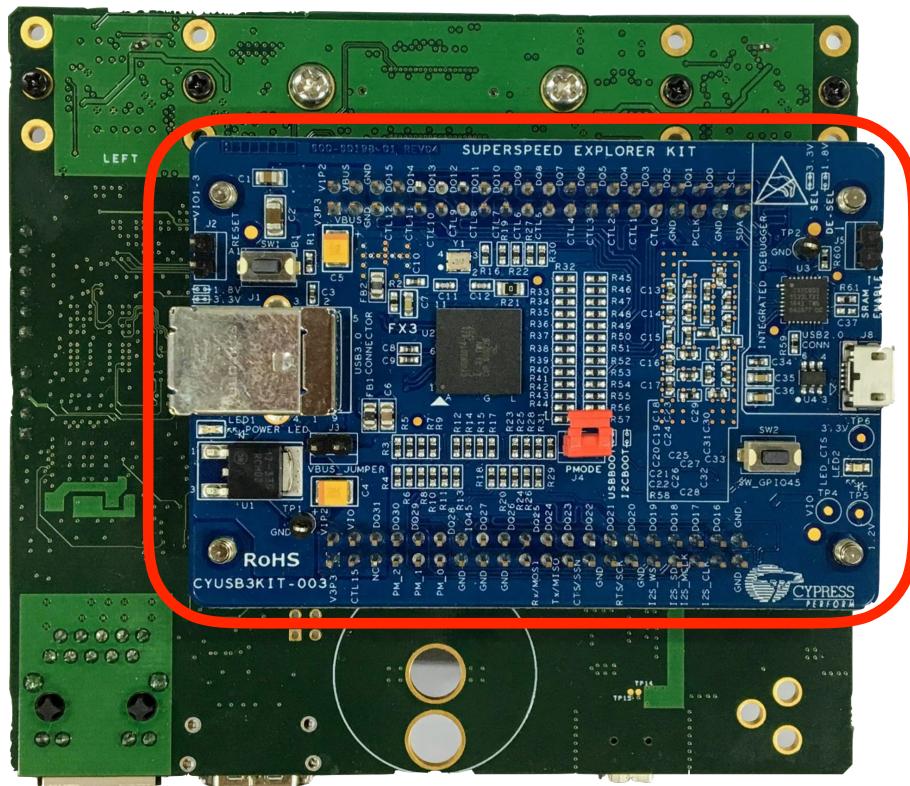


Figure 3.5.1 M-CIS-S6-FX3CON 과 CYUSBKIT-003(**미포함**) 연결(모든 점퍼 OFF, PMODE J4제외)

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## M-CIS-S6-FX3CON USER MANUAL

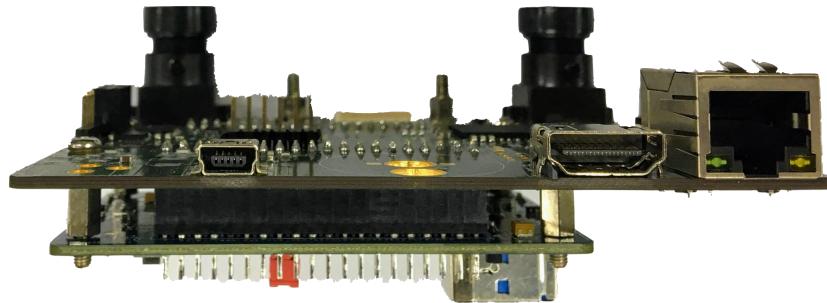


Figure 3.5.2 M-CIS-S6-FX3CON 과 CYUSBKIT-003(미포함) 연결

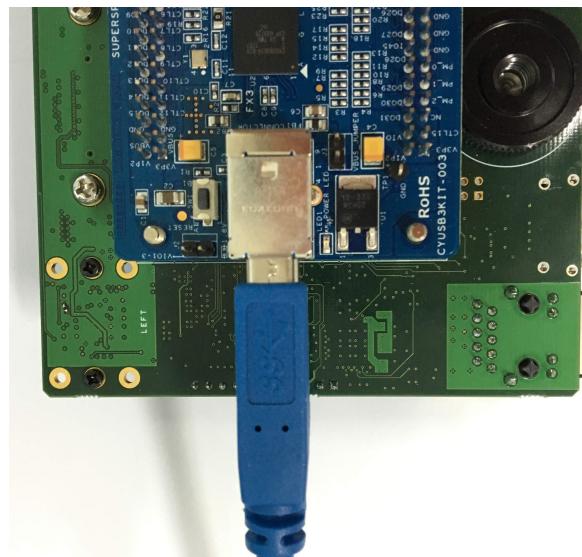


Figure 3.5.3 CYUSBKIT-003(미포함) USB3.0 cable 연결



Figure 3.5.4 AN84868 예제를 위한 M-CIS-S6-FX3CON J14 점퍼연결

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### 3.6 HDMI(TMDS) video 출력 예제

- HDMI\_TMDS\_VIDEO\_OUT : Spartan6 FPGA에서 TMDS\_33 IO를 이용하여 TMDS 신호를 출력하는 예제
  - Xilinx UG381([https://www.xilinx.com/support/documentation/user\\_guides/ug381.pdf](https://www.xilinx.com/support/documentation/user_guides/ug381.pdf))
- HDMI 커넥터로 출력되는 TMDS 신호 최대속도 : 1280x720@60Hz or 1920x1080@30Hz
- HDMI HOT plug detect voltage 출력 미지원, HDMI CEC/I2C(DDC) 제어 미지원
- HDMI 케이블 **미포함**

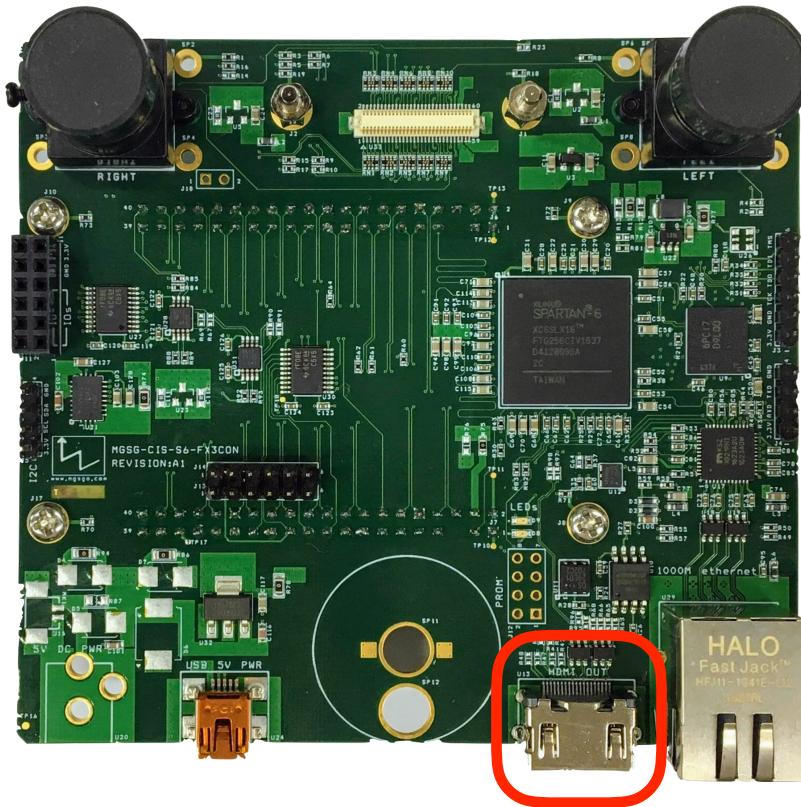


Figure 3.6.1 M-CIS-S6-FX3CON HDMI 출력 포트

### 3.7 Gigabit ethernet(1000M) UDP throughput test 예제

- GIGABIT\_UDP\_THROUGHPUT\_TEST\_BINARY : Gigabit ethernet MAC/UDP stack을 이용한 UDP 출력 테스트 (bit 파일 제공)
- Gigabit ethernet(1000M) PHY : KSZ9021 IC
- Gigabit ethernet(1000M) MAC/UDP stack
  - COMBLOCK IP use(COM-5401SOFT, COM-5402SOFT)
  - <https://comblock.com/download/com5401soft.pdf>
  - <https://comblock.com/download/com5402soft.pdf>
- Ethernet 케이블 미포함
  - 1Gbps 연결을 위해서 CAT5E 혹은 그 이상의 케이블을 사용해야함
  - PC LAN card와 직접 연결할 경우 cross 케이블 사용해야함

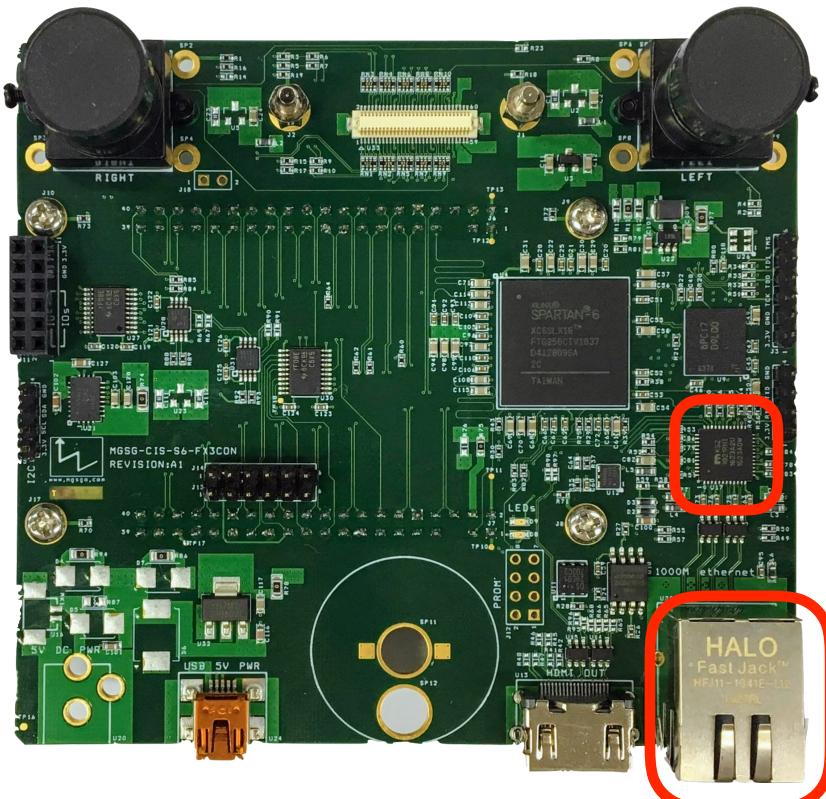


Figure 3.7.1 M-CIS-S6-FX3CON Ethernet port(RJ45)와 PHY IC(KSZ9021)

### 3.8 Xilinx MIG를 이용한 LPDDR test 예제

- LPDDR\_MIG\_TRAFFIC : Xilinx MIG(UG388)를 이용한 200MHz에서 작동하는 LPDDR write/read 예제
  - [https://www.xilinx.com/support/documentation/user\\_guides/ug388.pdf](https://www.xilinx.com/support/documentation/user_guides/ug388.pdf)
  - LPDDR part number : MT46H32M16LFBF-5 IT:C

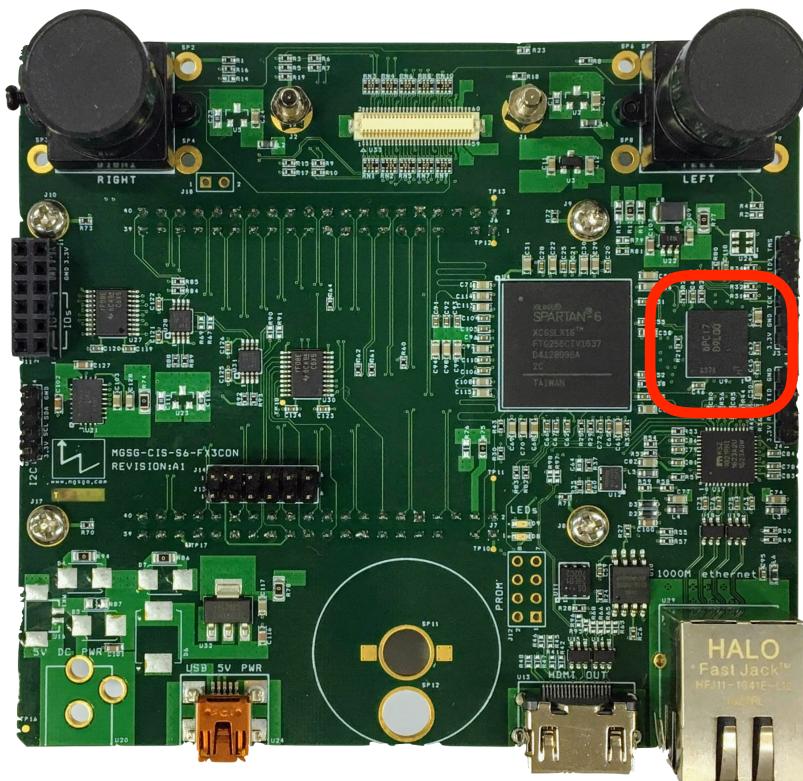


Figure 3.8.1 M-CIS-S6-FX3CON LPDDR memory

### 3.9 SHA-1 EEPROM 제어 예제

- SHA1\_AUTHENTICATION : SHA-1 EEPROM 제어 예제(AVNET reference design 필요함)
  - DS28E01 reference design(S6LX16 PicoBlaze SHA-1 Authentication Design)
    - <https://www.avnet.com/shop/us/products/avnet-engineering-services/aes-s6ev-lx16-g-3074457345630217084/>
  - XAPP780(DS2432를 사용할 경우)
    - [https://www.xilinx.com/support/documentation/application\\_notes/xapp780.pdf](https://www.xilinx.com/support/documentation/application_notes/xapp780.pdf)

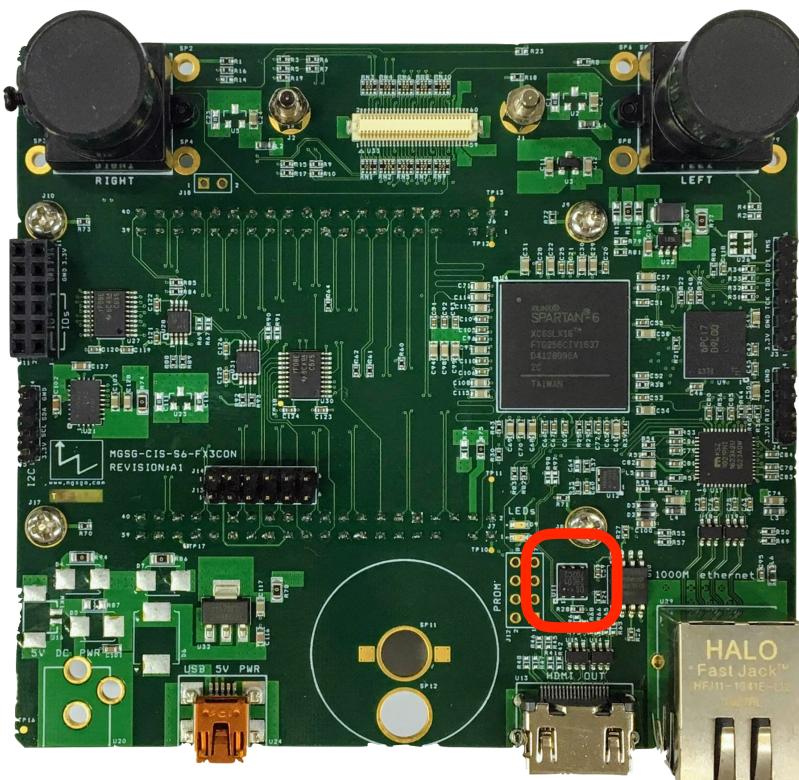


Figure 3.9.1 SHA-1 IC(DS28E01)

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## 4. Support

### 4.1 구매 지원

각 유통업체를 통해서 구매 가능

### 4.2 기술지원

Contact to [mgsg\\_opensource@gmail.com](mailto:mgsg_opensource@gmail.com)

Github page [github.com/mgsgo/M-CIS-S6-FX3CON](https://github.com/mgsgo/M-CIS-S6-FX3CON)

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