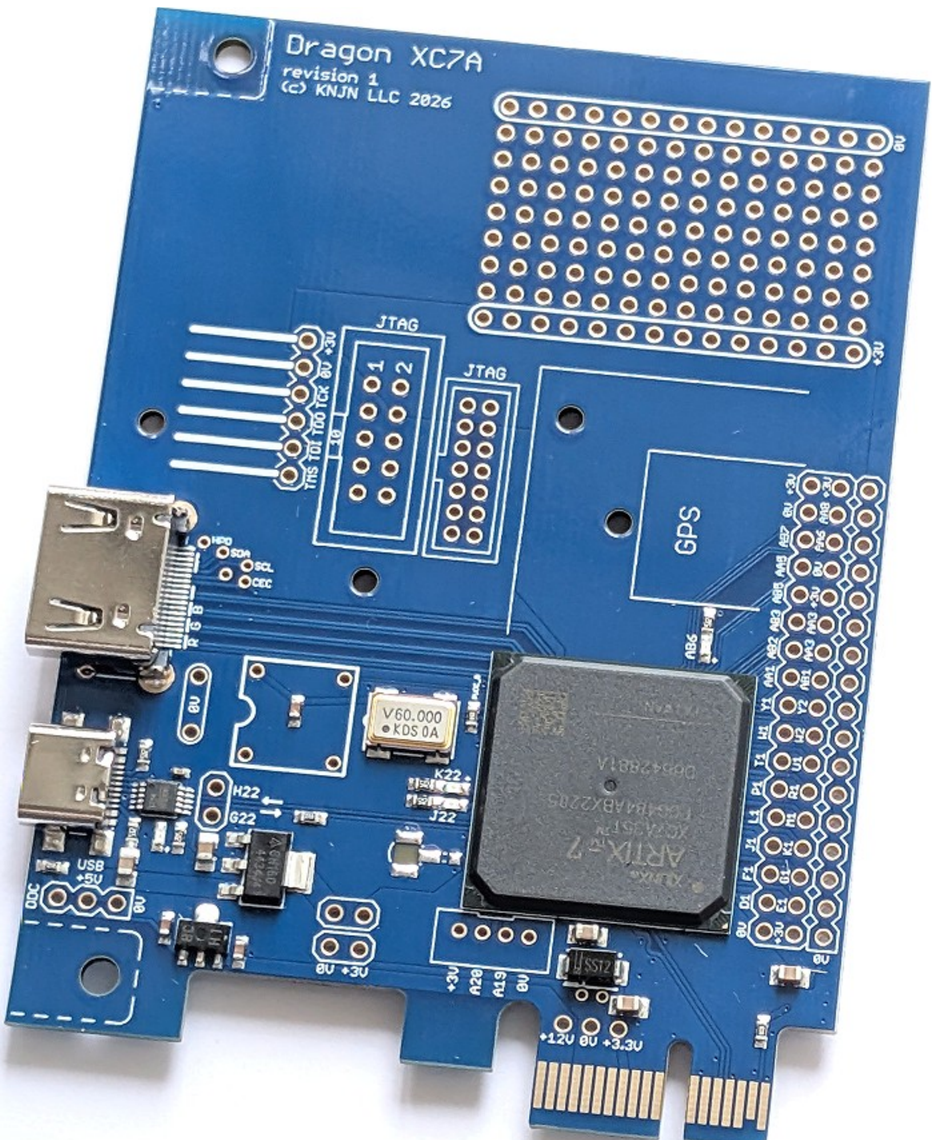
Dragon XC7A & XC7M FPGA development boards

https://www.knjn.com/

This document applies to the following boards

- Dragon XC7A
- Dragon XC7M



Document last revision **March 3, 2026**

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1 Introduction

1.1 Features

- Xilinx/AMD XC7A35T FPGA
  - XC7A:
    Standard height PCI express board with 30 GPIOs and 3 LEDs
  - XC7M:
    Low profile PCI express board with 28 GPIOs and 3 LEDs
- HDMI output
- USB-C with CH340 serial interface

The XC7A/XC7M boards can be used either in standalone mode, or inside a PC (PCI express).

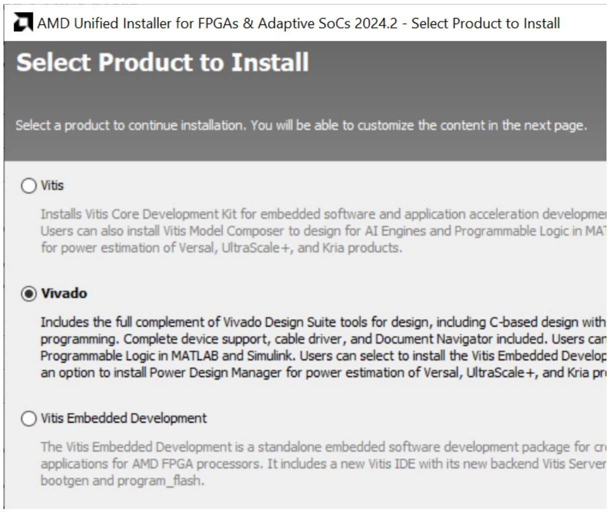
1.2 Software

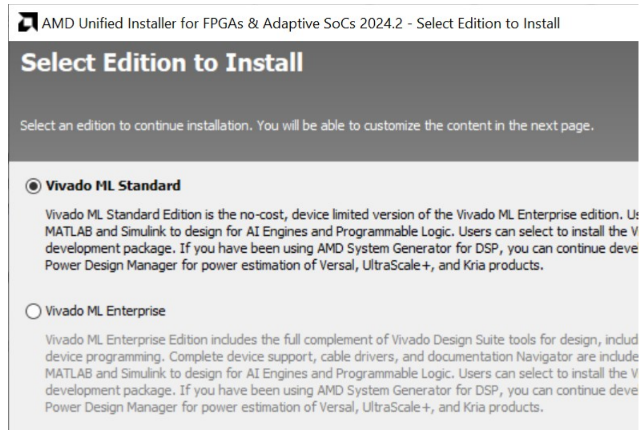
Once your board has shipped, check your order page for links to the FPGA vendor software and the "startup-kit" that includes utilities and example source code.

2 Vivado

2.1 Vivado installation

Download and install the free version of [Vivado]

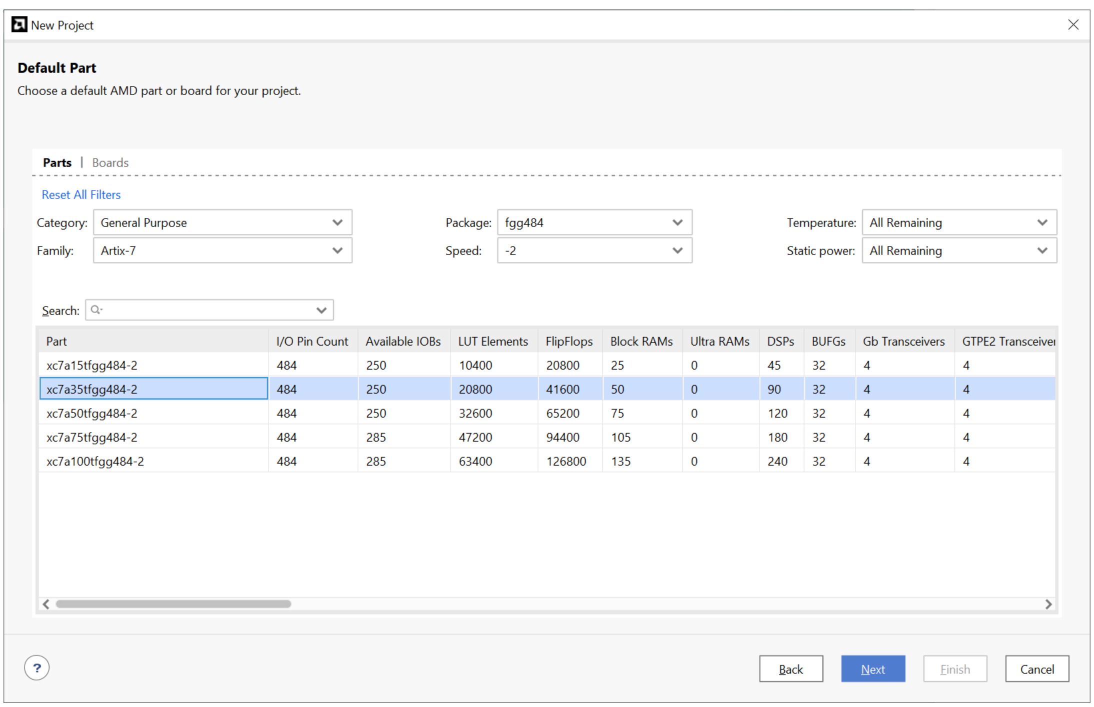




2.2 Vivado project

Once Vivado is installed, you are ready to create a new FPGA project.

Select the XC7A35T in FGG484 package.



3 FPGA configuration

The board is configured using either a Xilinx/AMD or KNJN JTAG cable.

- Xilinx/AMD: use a DLC10 or compatible cable.
- KNJN: use the KNJN USB JTAG cable (KNJN item#5179). Then use the FPGAconf software.

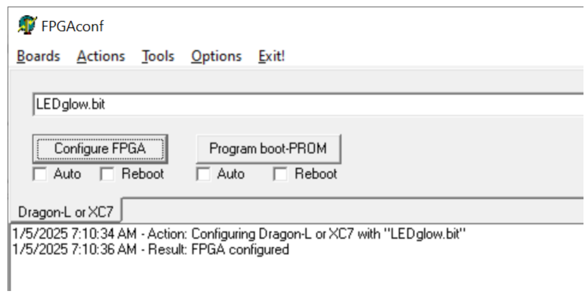
3.1 FPGAconf USB driver

The driver is signed and compatible with Windows 10/11.

1. Plug-in the KNJN JTAG cable in your PC's USB port.
2. Go to the Device Manager and find the new unrecognized device in the USB section. Click on "Update Driver" and select the driver folder.

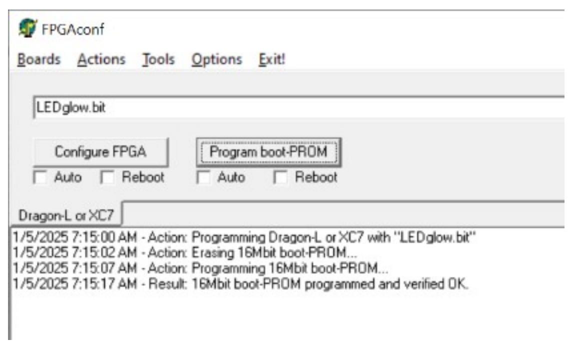
3.2 FPGAconf FPGA configuration

In the "Boards" menu, select "Dragon-L or XC7 (JTAG)".
Then select a bitfile and click on "Configure FPGA".



3.3 FPGAconf boot-PROM programming

Select a bitfile and click on "Program boot-PROM".

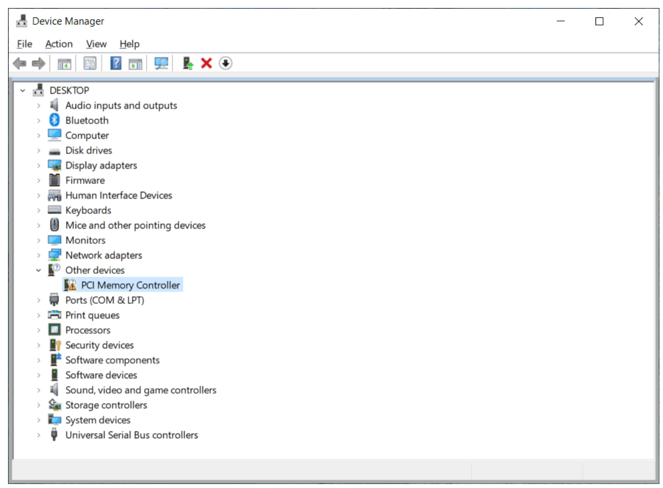


4 PCI Express

The simplest way to get started is with the PIO example.

https://www.youtube.com/watch?v=1YgviyNfLYY

1. Create a PIO example project with a XC7A35TFGG484-2
2. Add these lines to the XDC file
```
set_property PACKAGE_PIN A8 [get_ports pci_exp_rxn[0]]
set_property PACKAGE_PIN A4 [get_ports pci_exp_txn[0]]
set_property CFGBVS VCCO [current_design]
set_property CONFIG_VOLTAGE 3.3 [current_design]
set_property BITSTREAM.GENERAL.COMPRESS true [current_design]
set_property BITSTREAM.CONFIG.UNUSEDPIN pullup [current_design]
set_property BITSTREAM.CONFIG.SPI_BUSWIDTH 2 [current_design]
set_property BITSTREAM.CONFIG.CONFIGRATE 50 [current_design]
```
   and compile the design to get a bit file.
3. Program the bit file in the boot-PROM.
4. Insert the Dragon board into a PCI express socket of your test PC (while the PC is un-powered). Boot the test PC. The board should be recognized by your OS.



5 HDMI

The HDMI source code is a port from https://github.com/hdl-util/hdmi

6 Clock sources

The boards support DIL-8, SMD 5x7 and SMD 3x2 clock oscillators to drive different FPGA clock inputs.

Board	**DIL-8**	**SMD 5x7**	**SMD 3x2**
XC7A	To solder	60MHz	To solder
XC7M rev 1	To solder	To solder	To solder
XC7M rev 2	To solder	To solder	25MHz

Other clock sources include the PCI express interface and the internal configuration clock. Check the LEDglow source code example for more details.

6.1 High-stability clock

If a high-stability clock is desired, the XC7A board can be fitted with a VCTCXO. These oscillators are quite stable, typically ±2.5ppm or better.

Solder a VCTCXO on the SMD 3x2 oscillator footprint located below the FPGA on the back of the board. A small 100KΩ 0603 resistor is also required. Or order “XC7A HSC” for the VCTCXO and resistor pre-assembled.

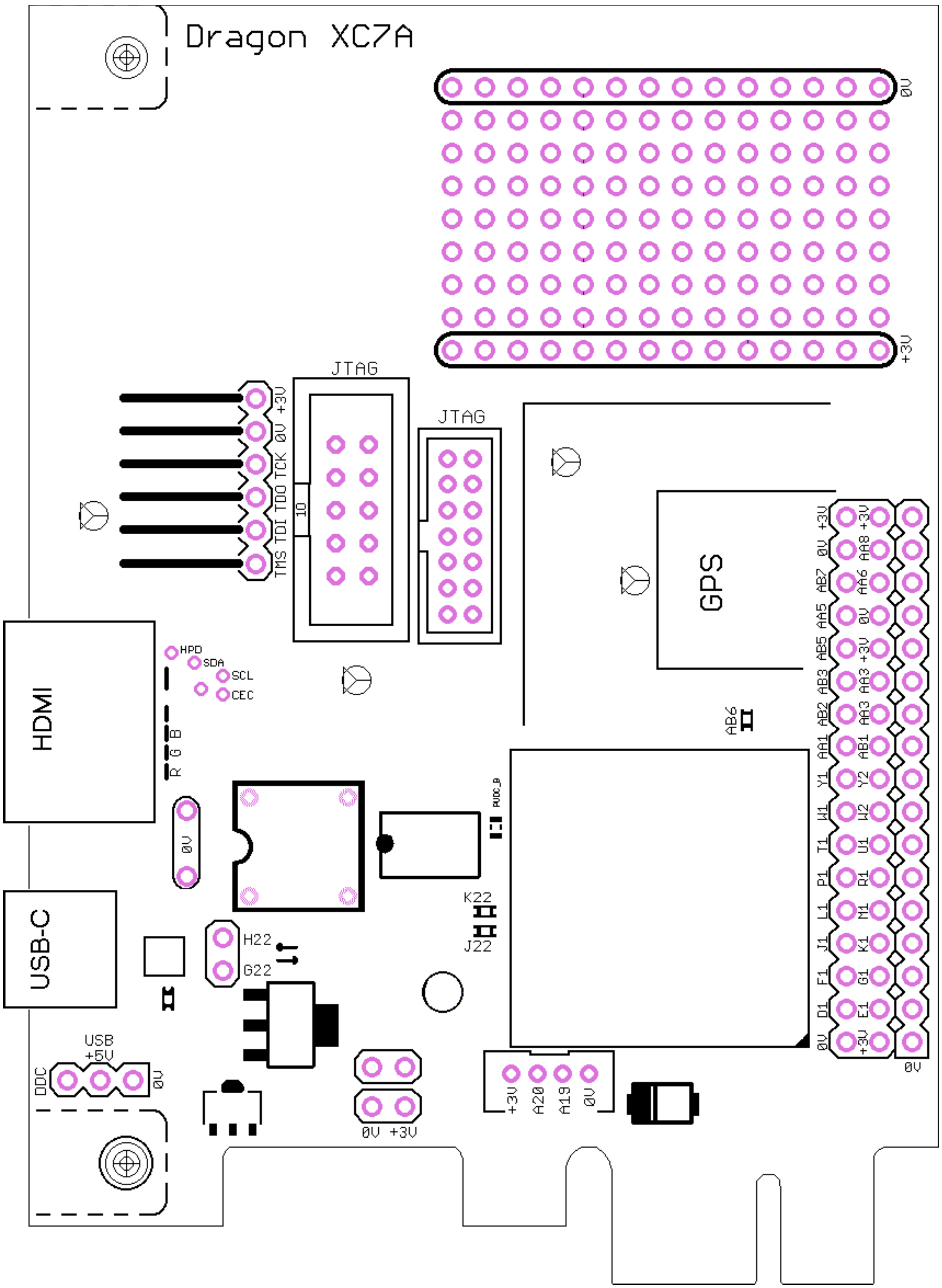
6.2 GPSDO

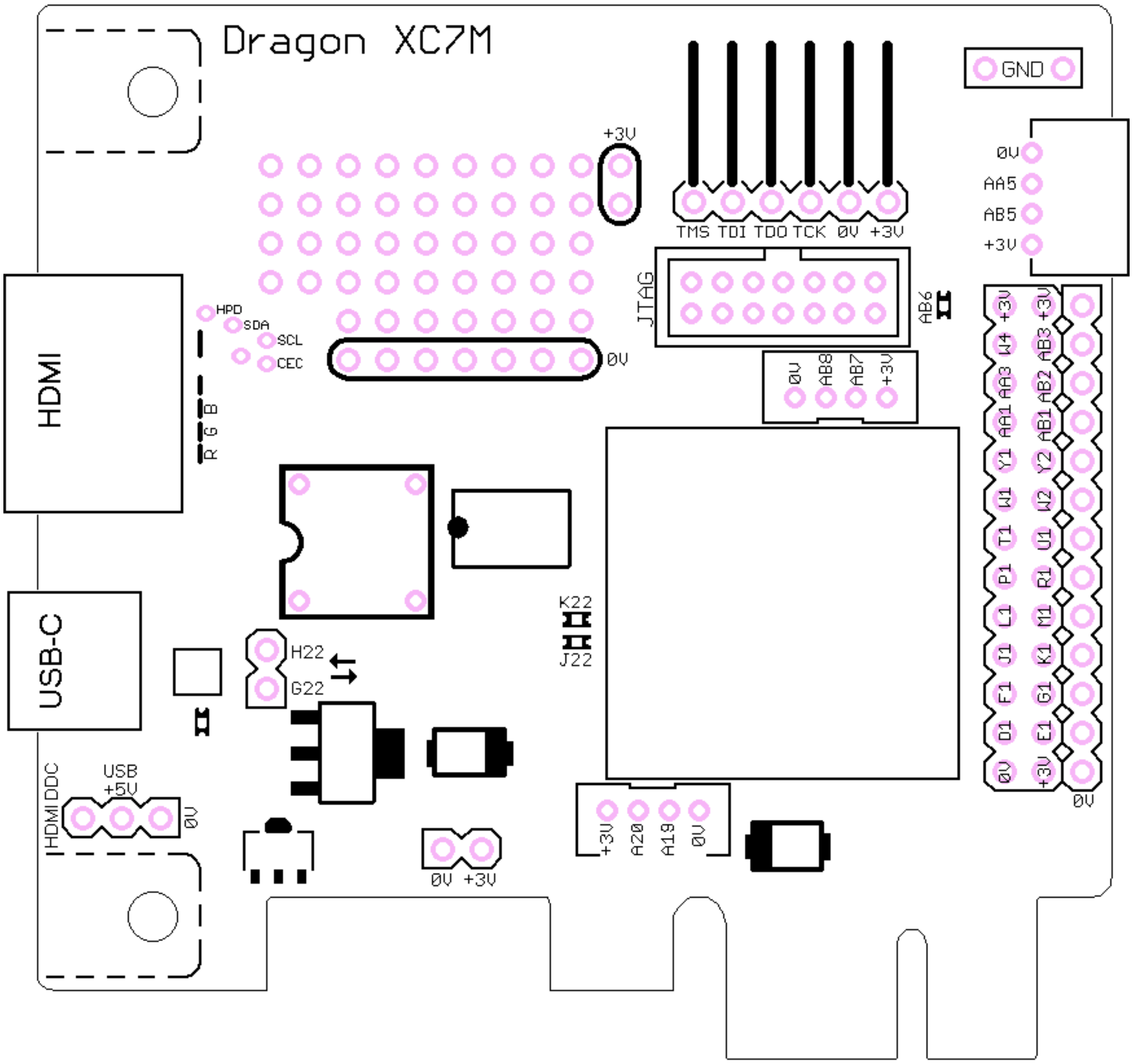
For further accuracy, a GPS module can be used to control the VCTCXO and create a GPSDO.

Connect a GPS module to the space marked “GPS” on the board. Make sure to use a five pins GPS module (with PPS output). Then run the GPSDO example code.

Boards with assembled VCTCXO and GPS modules are available on the FPGA kits page.

7 Boards layout





Notice the IOs indicated on the header pins.

The XC7A and XC7M boards can be powered in multiple ways.

1. PCI express
2. USB-C
3. KNJN JTAG cable
4. External lab power supply, either 3.3V or 5V

Check also “Dragon XC7A IO schematic.pdf” in the board’s startup-kit.

8 Useful items

Item name	item#
DIL-8 oscillator socket	2187
Xilinx style JTAG 2x7 shrouded connector	2189
KNJN USB JTAG cable	5179
Miscellaneous oscillators DIL-8 or SMD 5x7	7000~7999