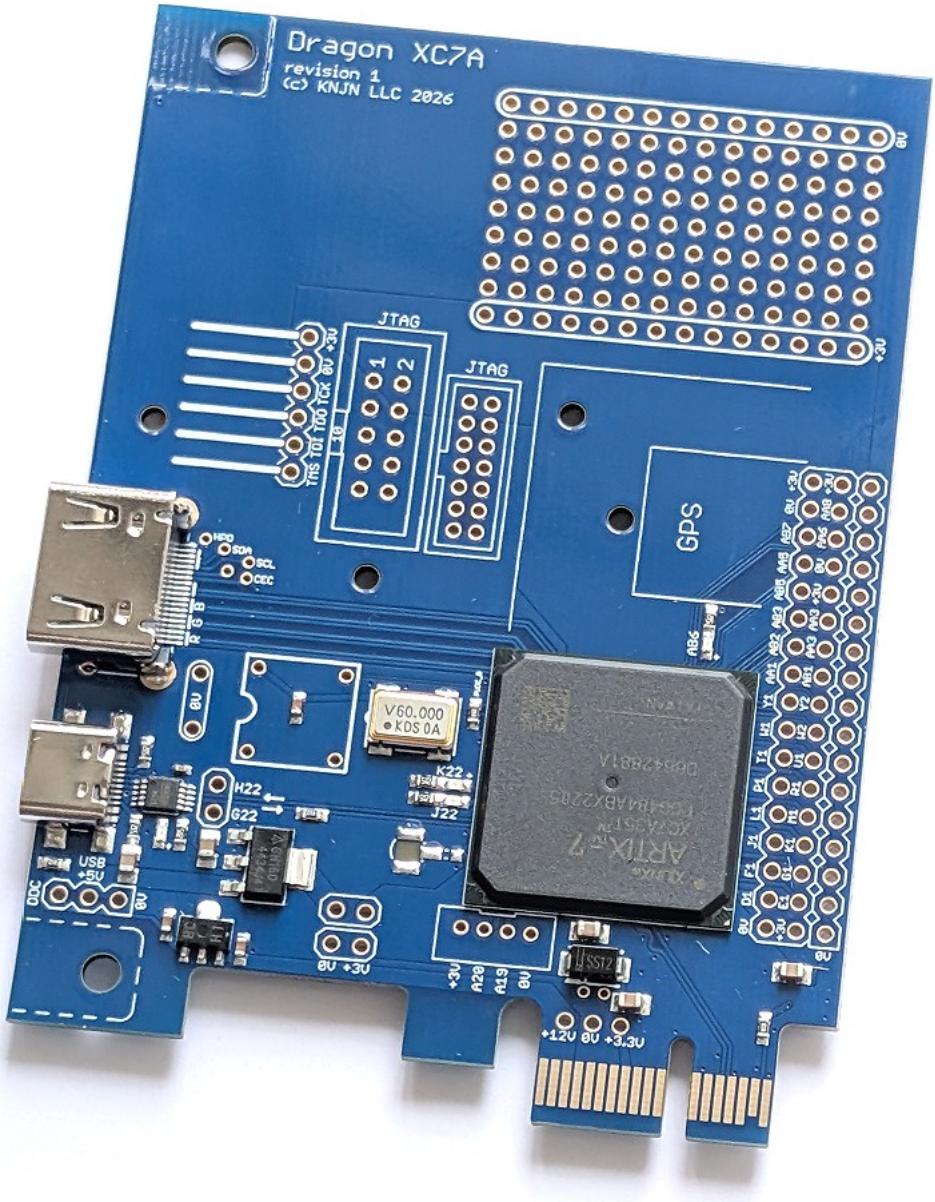
Dragon XC7A & XC7M FPGA development boards

https://www.knjn.com/

This document applies to the following boards

- Dragon XC7A
- Dragon XC7M



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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
    High-stability clock option using a VCTCXO
  - XC7M:
    Low profile PCI express board with 28 GPIOs and 3 LEDs
- HDMI output
- USB-C with CH340 serial interface

1.2 FPGA configuration

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

- Xilinx/AMD: use a DLC10 or compatible cable.
- KNJN: use the KNJN JTAG cable for Dragon XC7A & XC7M (KNJN item#5179)

1.3 FPGA software

Download and install the latest Vivado software. When using the KNJN JTAG cable, we also provide FPGAconf.

1.4 Board power

The board 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

1.5 Clock oscillators

The boards support DIL-8, SMD 5x7 and SMD3225 clock oscillators to drive different FPGA clock inputs.

Board	DIL-8	SMD 5x7	SMD3225
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.

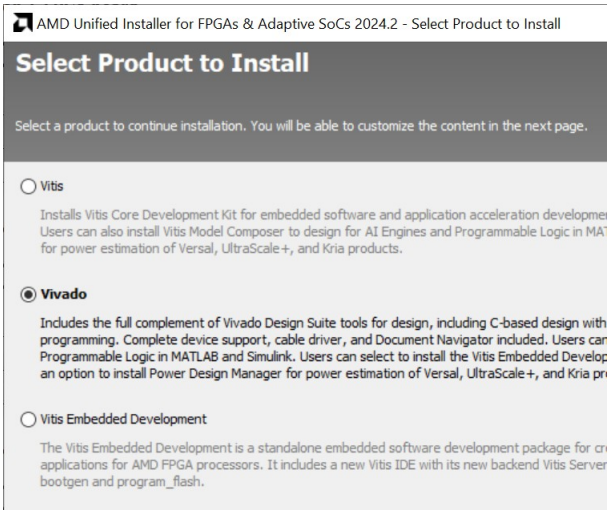
1.6 Purchase

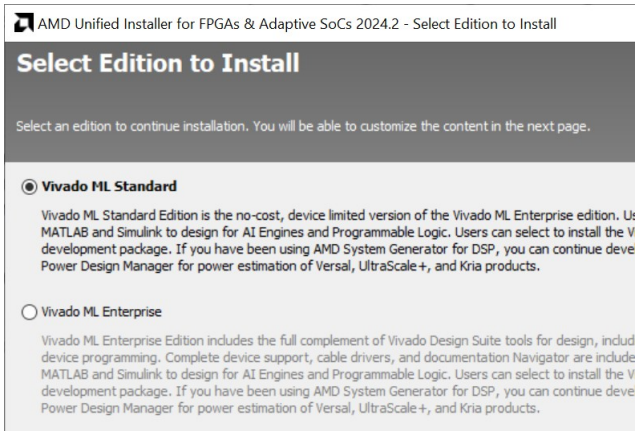
Want one? Go to KNJN's PCI FPGA development boards shopping page.

2 Vivado

2.1 Vivado installation

Download and install the free version of Vivado

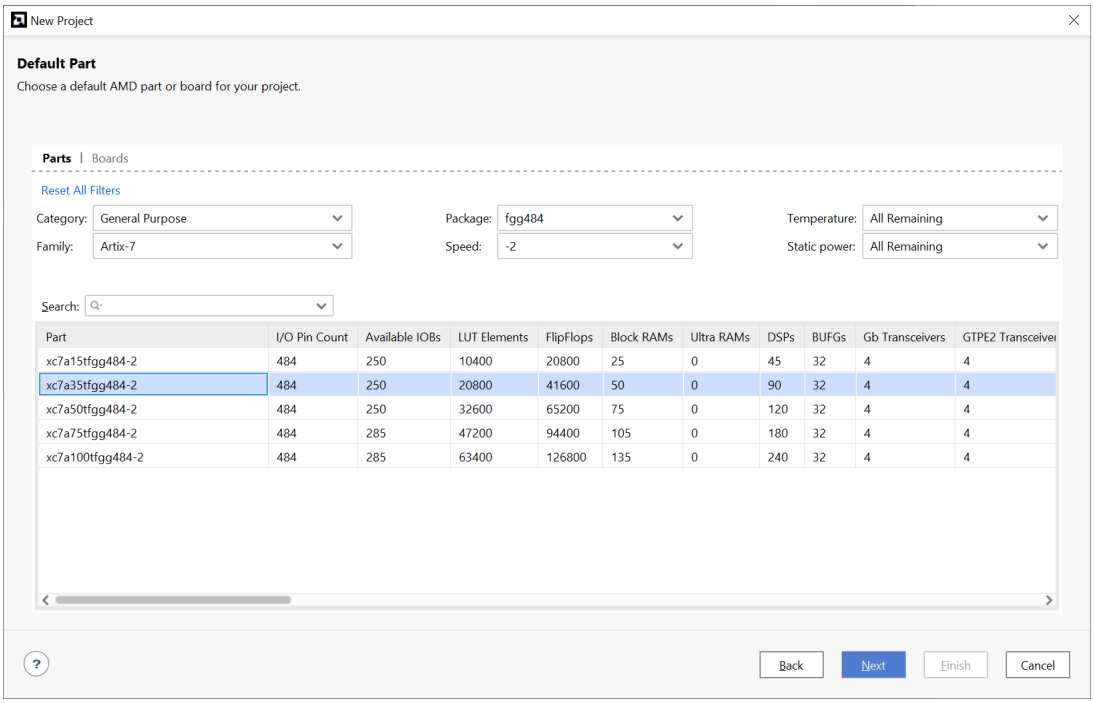




2.2 Vivado project

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

Select the XC7A35T in FGG484 package.



3 FPGAconf

FPGAconf is a software used with the KNJN JTAG cable for FPGA configuration and boot-PROM programming.

3.1 USB driver

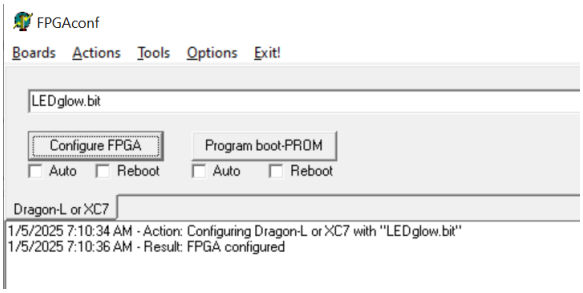
The “KNJN JTAG cable” is provided with a USB driver. The driver is signed and compatible with Windows 10/11.

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 FPGA configuration

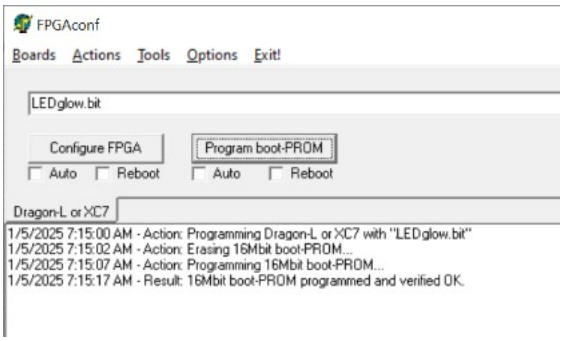
Run FPGAconf.

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



3.3 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.

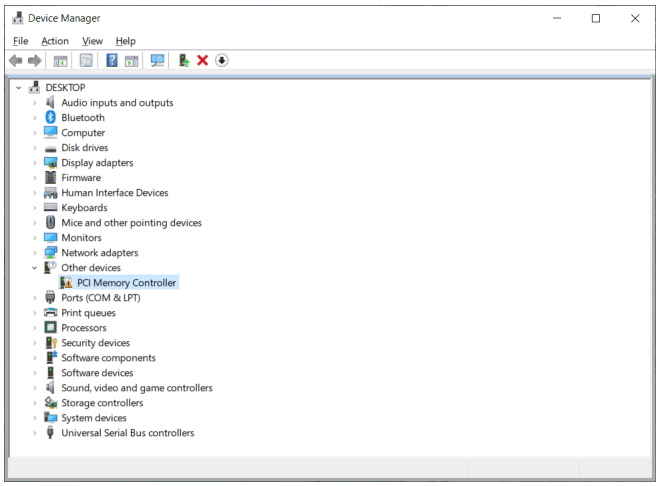
https://www.youtube.com/watch?v=1YgviyNfLYY

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 High-stability clock option

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

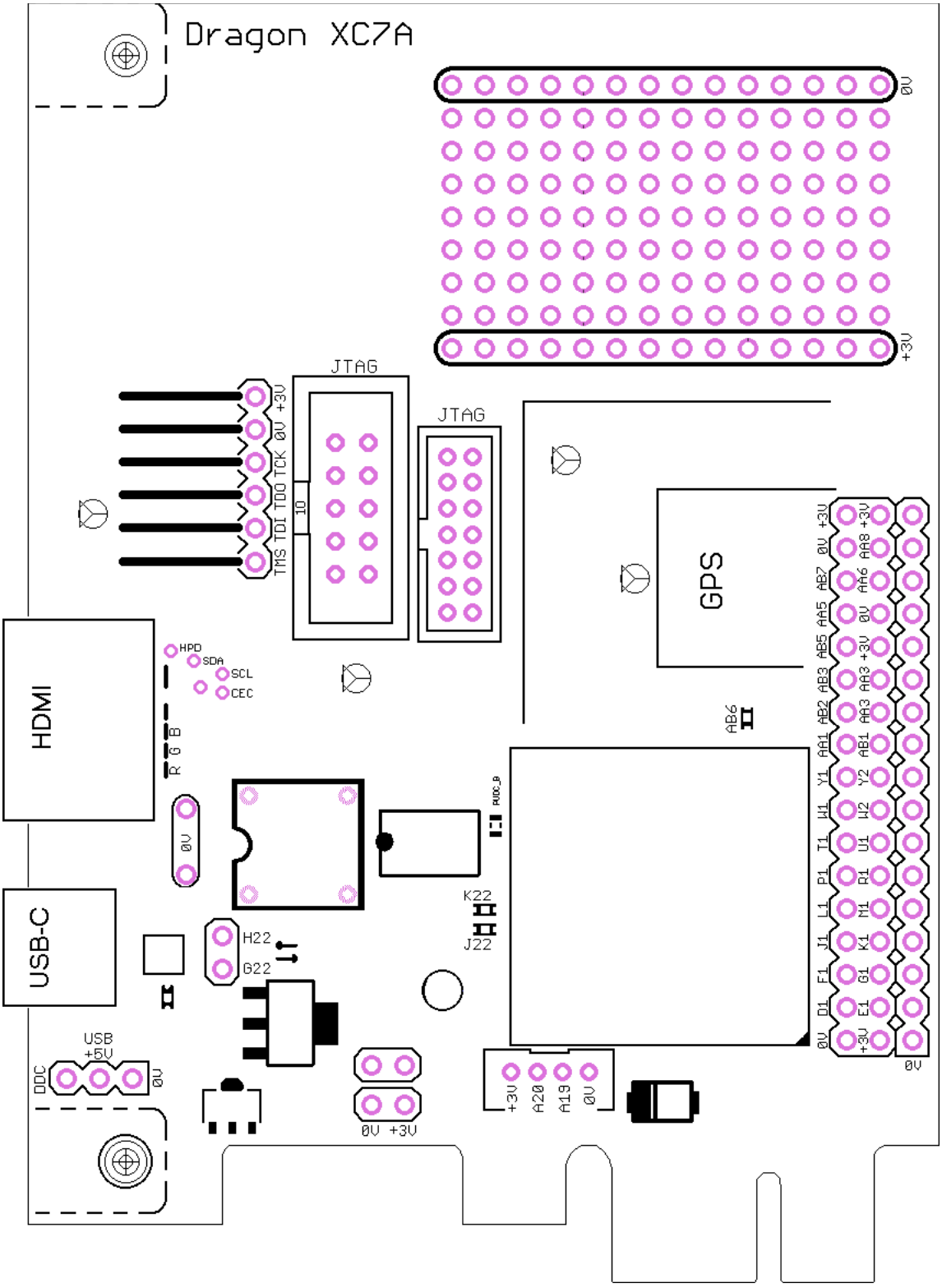
Then a GPS module can be used to monitor the VCTCXO output and create a GPSDO.

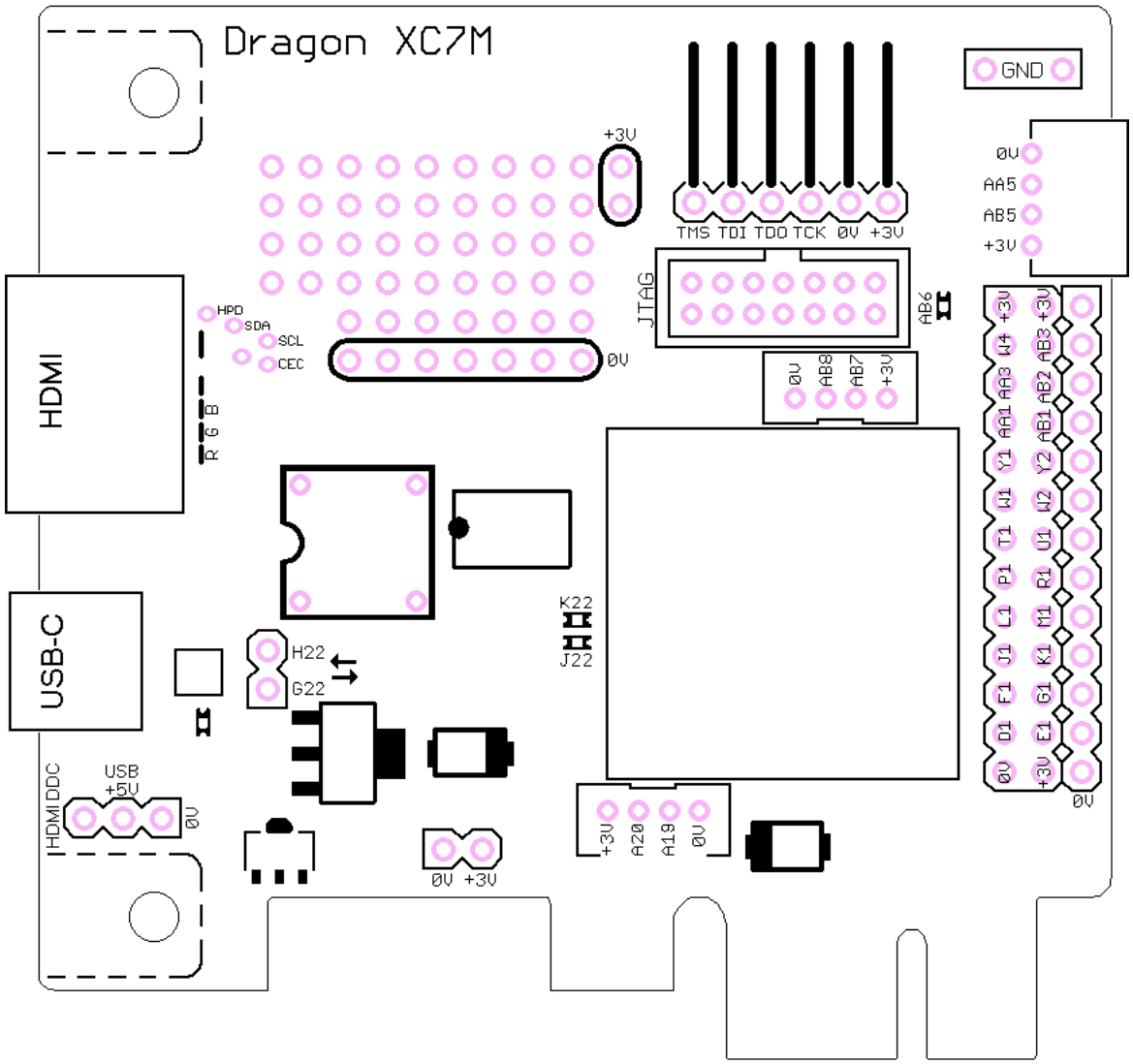
1. Solder a SMD3225 (or smaller SMD2520) VCTCXO on the board, like a RTV-104EF13P-S-10.000-TR or TG2520SMN 40.0000M-CCGNDM5
   The SMD3225 oscillator footprint is located below the FPGA on the back of the board.
2. Connect a GPS module to the space marked “GPS” on the board.
   Make sure to use a GPS module with PPS output. These modules have five pins (usually VCC, GND, RxD, TxD and PPS) and can be powered with either 3.3V or 5V.

Now run the GPSDO example code.

You can order the XC7A board with a VCTCXO and GPS from the FPGA kits page.

7 Boards layout





Notice the IOs indicated on the header pins.

Check also “Dragon XC7M IO schematic.pdf” in the board’s startup-kit.

8 Useful items

Item name	item#
KNJN USB JTAG cable for Dragon XC7A & XC7M	5179
Xilinx style JTAG 2x7 shrouded connector for use with DLC10	2189
DIL-8 oscillator socket	2187
Oscillators DIL-8 or SMD5x7	7000~7999