LCMX02 FPGA Breakout Board
Harware Brief
Rev. 1r0

Digital design had been traditionally worked by connecting an ensemble of standard logic gates together to get the desired function. We have the 7400 series of ICs to build TTL based circuit, and the 4000 series if you want to build it using CMOS. We also have in the wild a mix of the two technologies that has the low power requirement of CMOS and the speed and drive of TTL, such as the 74HC00 series. We 'glue' them together to build digital circuits, hence the reason why they are colloquially referred to as Glue Logic.

This technology, while aging, has served us well. But recent changes in consumer habit use of technology now inevitably requires complex digital circuits that sports high speed performance, small footprint, and cost effective design. You can't possibly meet these design criteria if you limited yourself with the use of standard logic design toolkit.

FIELD PROGRAMMABLE GATE ARRAY FPGA

FPGA is the cutting edge design technology when it comes to digital circuit design. It all but replaced the glue logic in high performance digital circuits. It's the modern way of building digital circuit.

With FPGA, you build digital circuits by quite literally describing how it works. You use Hardware Description Language HDL to describe a circuit - VHDL (Very High Speed Integrated Circuit HDL, shortened to VHDL) or Verilog.
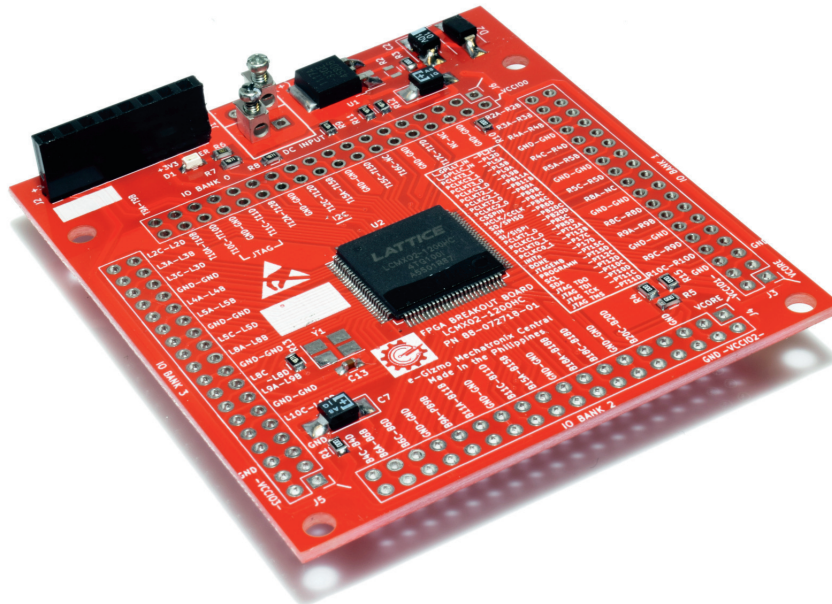

Figure 1. e-Gizmo LCMX02 FPGA Breakout Board. I/O connectors are left unpopulated. This will allow you to install your choice connector on either the top or bottom side of the board.

       LCMX02 FPGA Breakout Board

Nowadays, you can't call yourself a digital hardware designer if you are not a skilled FPGA and HDL designer. If HDL is the modern way to do digital designs, why is not everyone into it, at least here in the Philippines?

One reason - prohibitively high cost of FPGA development kits. The cost of a programming interface, the FPGA kit itself, and the software development suite, can easily break the financial even of a typical Filipino middle class family.

E-GIZMO LCMX02 FPGA BREAKOUT BOARD

Lattice Semiconductor, an industry leader in programmable logic devices, took an initiative that made HDL and FPGA learning affordable to every digital designer wannabe in this planet, by throwing out in the wild some powerful yet affordable FPGA chips, a FREE software design suite, and a chip programmer that uses off-the-shelf components any DIY'er can build. This made it possible for us to produce an entry level FPGA design kit that you can use as a learning kit for FPGA and HDL design development. e-Gizmo LCMX02 FPGA breakout board paired with FT2232 breakout kit (JTAG Programmer) makes a truly affordable solution made for students and experimenters wishing to indulge themselves into this field.

Following is a brief description of the inherited features of this kit:

FPGA : LCMX02-1200HC-4TG100
     - 100 pins, 79 I/O
     - 1280 Look Up Tables LUT
     - 64kbits Embedded Block RAM EBR
     - 64knits User Flash Memory UFM
     - 1 PLL
     - 2x I2C, SPI, Timer/Counter
     - 3.3V logic

The kit has an on board 3.3V LDO regulator, and a solder pads for an optional external crystal oscillator. All I/O pins are accessible through a network of unpopulated header mounting pads. You can solder a standard pitch (0.1" spacing) two

row header connectors on either the top or bottom side of the PCB should you wish to.

The kit is a breakout board, other than the on board LDO and a number of power supply decoupling chips, it basically contains the just the bare FPGA device itself. Consult the device datasheet to learn more about its pin functions and features. One last note: To keep the cost low, the breakout board is mounted on the two layer PCB, it does not have the benefit of power
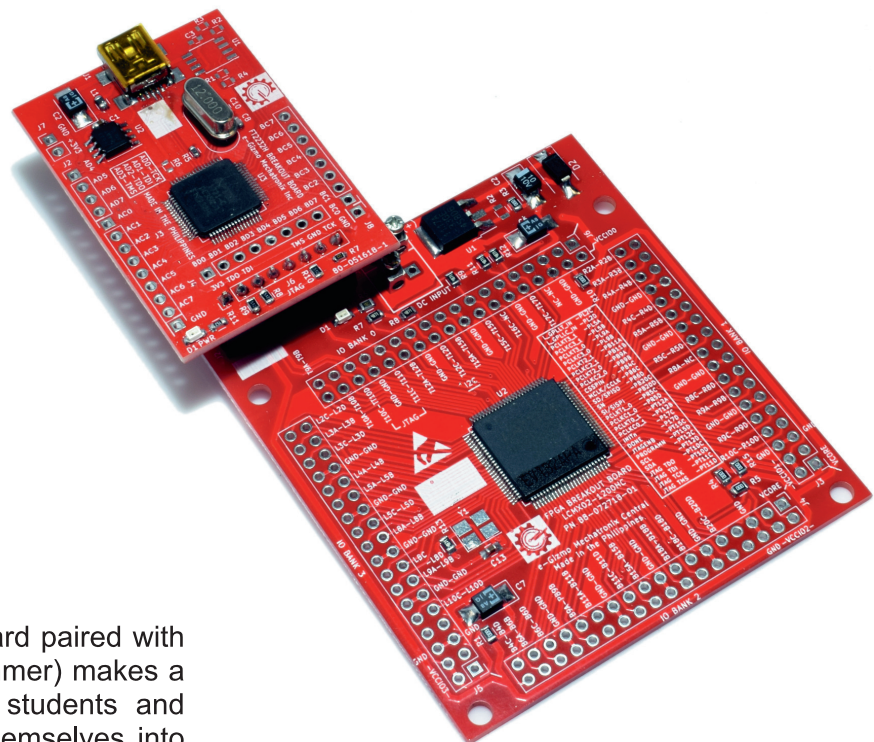

Figure 2. FPGA Breakout Board with FT2232 JTAG programmer attached.

planes that are necessary for good very high speed operation. In other words, expect some operational hiccups when operating with speeds in excess of 100MHz or so. But the real speed limiting factor will be your external wirings - proper high speed wiring is an expertise by itself. It requires deep understanding of how wires and components behaves at very high frequencies. If you think that plain wires functions the same at any frequencies, then you do not have the necessary skills to do high speed circuits.

Tip to self learners - The FPGA device itself is a very complex device. If you are new to this field,

start learning by walking through a tutorial. Explore the device one bite of a feature at a time. Do not attempt to dive through the tons of information all at once, you will likely end up in frustration. Pick a learning pace you are comfortable with.

Useful Links:

MachX02 product page. Contains links to datasheets, application examples, and download link to Lattice Diamond Software Development Suite.

http://www.latticesemi.com/Products/FPGAandCPLD/MachXO2

Tutorial:

Lattice Diamond quick start guide (Video)
https://www.youtube.com/watch?v=SmdEP_ZsBM

Hello world with Lattice Machx02 breakout board
http://www.farrellf.com/projects/hardware/2016-01-03_Lattice_MachXO2_Breakout_Board_HelloWorld/

Forums/Community

Elab - Pinoy Electronics Forum. Get advice and tips from industry professionals and fellow learners.
http://www.elab.ph/forum

Elab FPGA and HDL discussion board
http://www.elab.ph/forum/index.php?board=4.0

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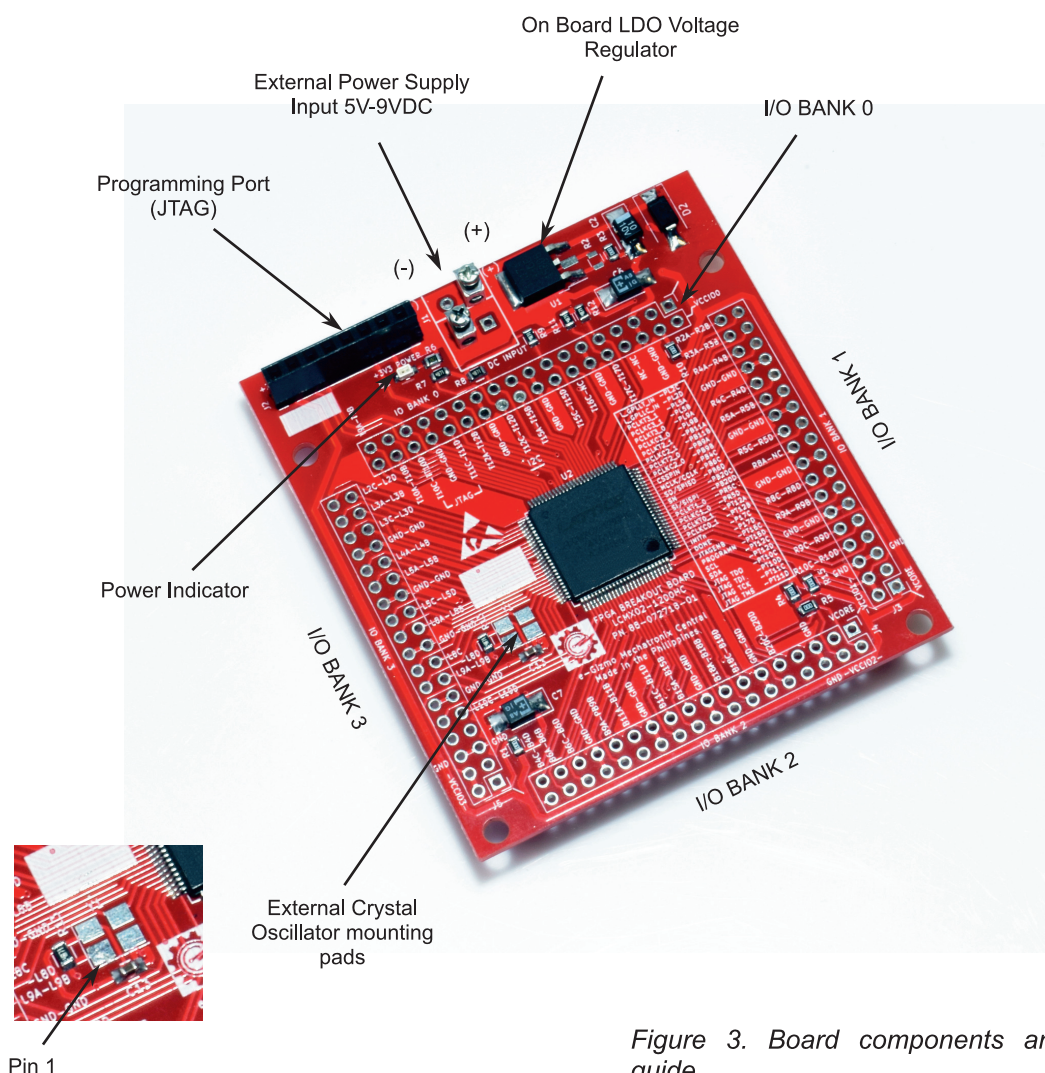http://www.gstitt.ece.ufl.edu/courses/eel4712/labs/free_range_vhdl.pdf

Figure 3. Board components and function location guide.

Figure 4. e-Gizmo LCMX02 FPGA Breakout Board schematic diagram.