Octa-core Single Board Computer

IME-157 Fall 2011
Final Project

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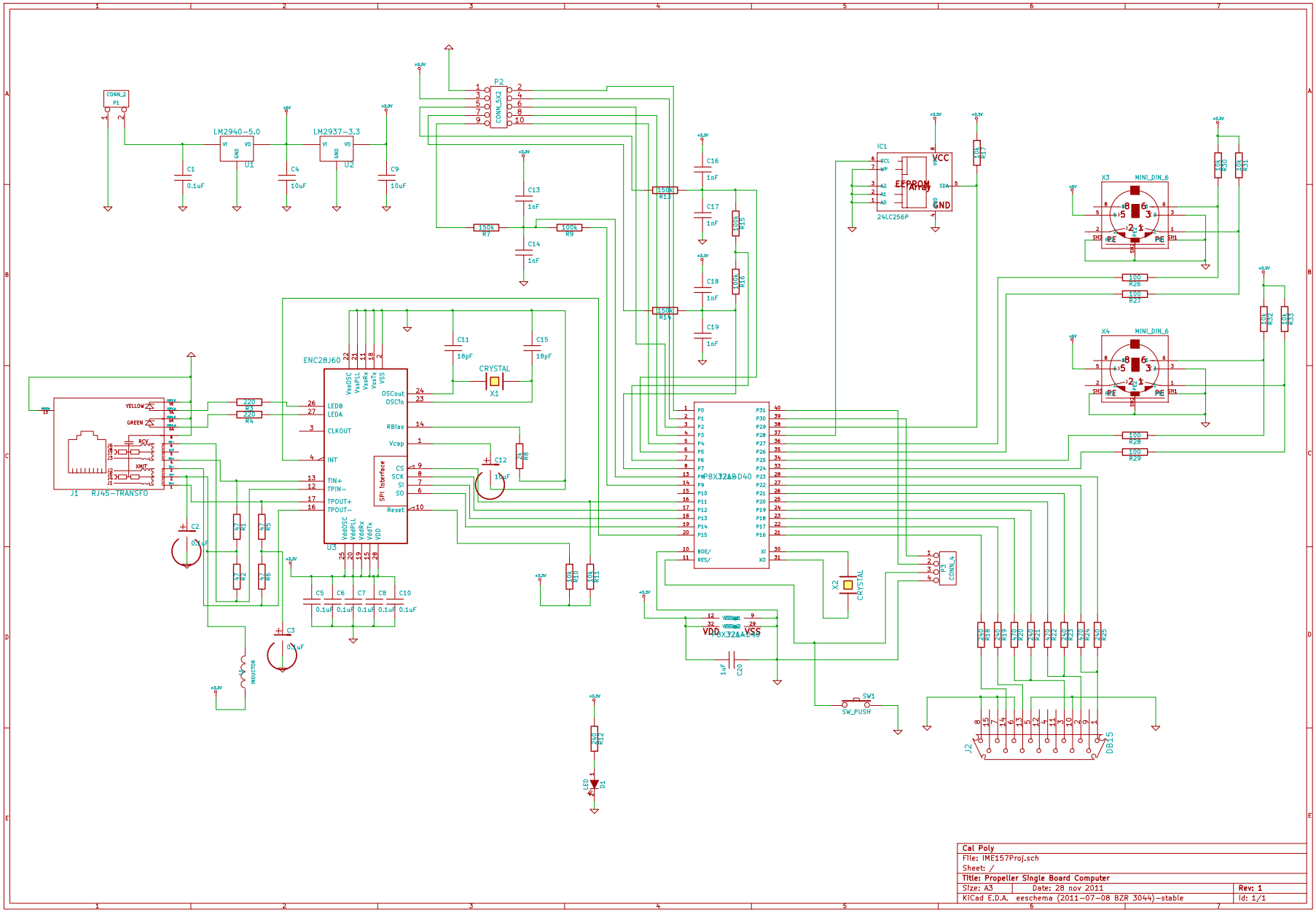
Computer Engineering

Design

- Microprocessor: Parallax Propeller P8X32A
  - Runs at 80MHz
  - Eight 32-bit cores
  - 32KB RAM
- External memory: 32KB EEPROM
- Microchip ENC28J60 Ethernet controller
- I/O Ports:
  - 2 PS/2, VGA, RJ45 jack, 4 pin ISP header
- Onboard sigma-delta ADCs
- 10 pin expansion port (5x2 pin header)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Title: Propeller SIngle Board Computer
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Date: 28 nov 2011
Rev: 1
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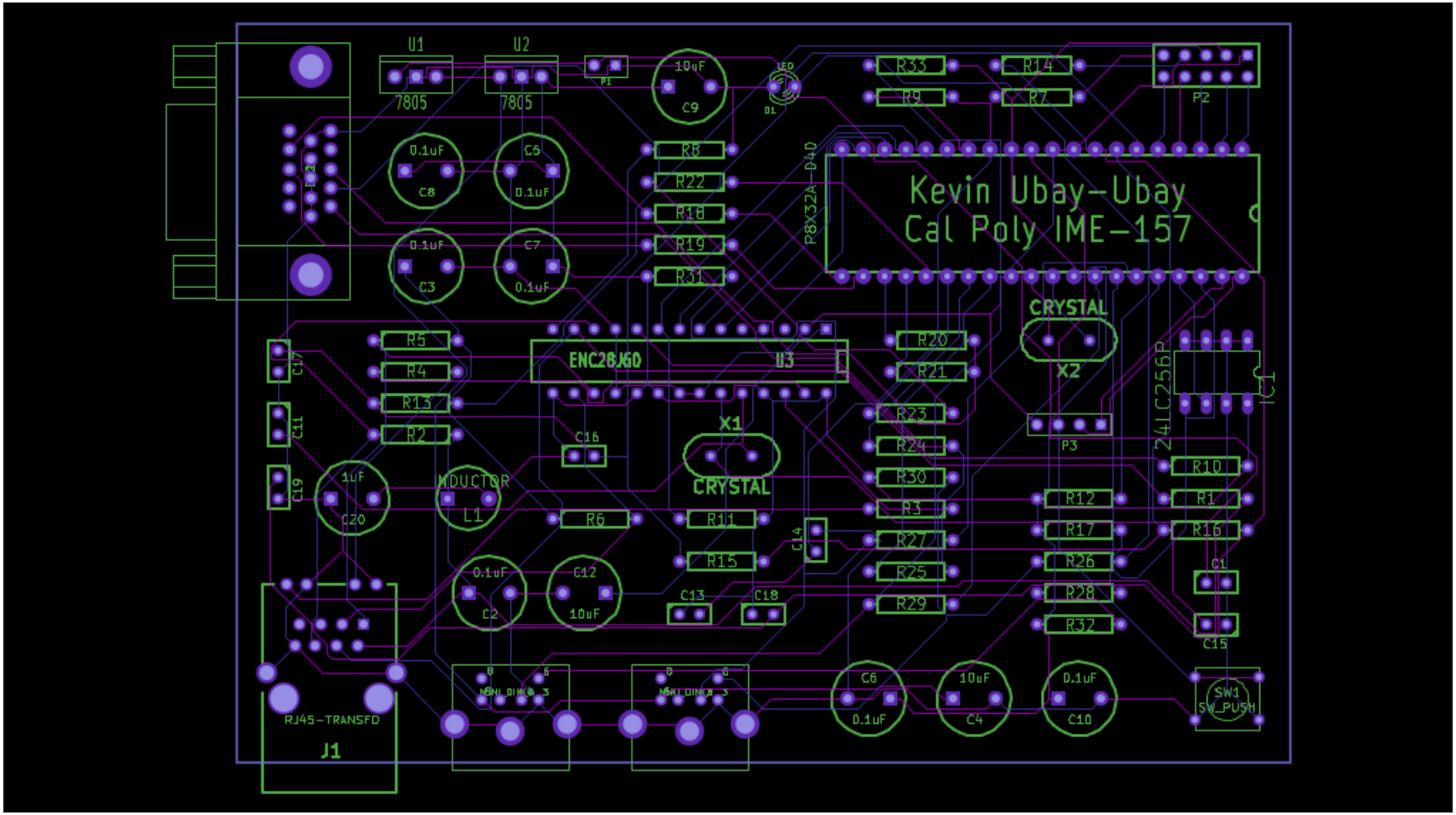
Id: 1/1

PCB Layout


U1
U2
7805
7805
10uF
C9
LED
D1
R33
R14
R9
R7
P2
0.1uF
C8
C5
0.1uF
R8
R22
R18
R19
R31
R8X32A_D4D
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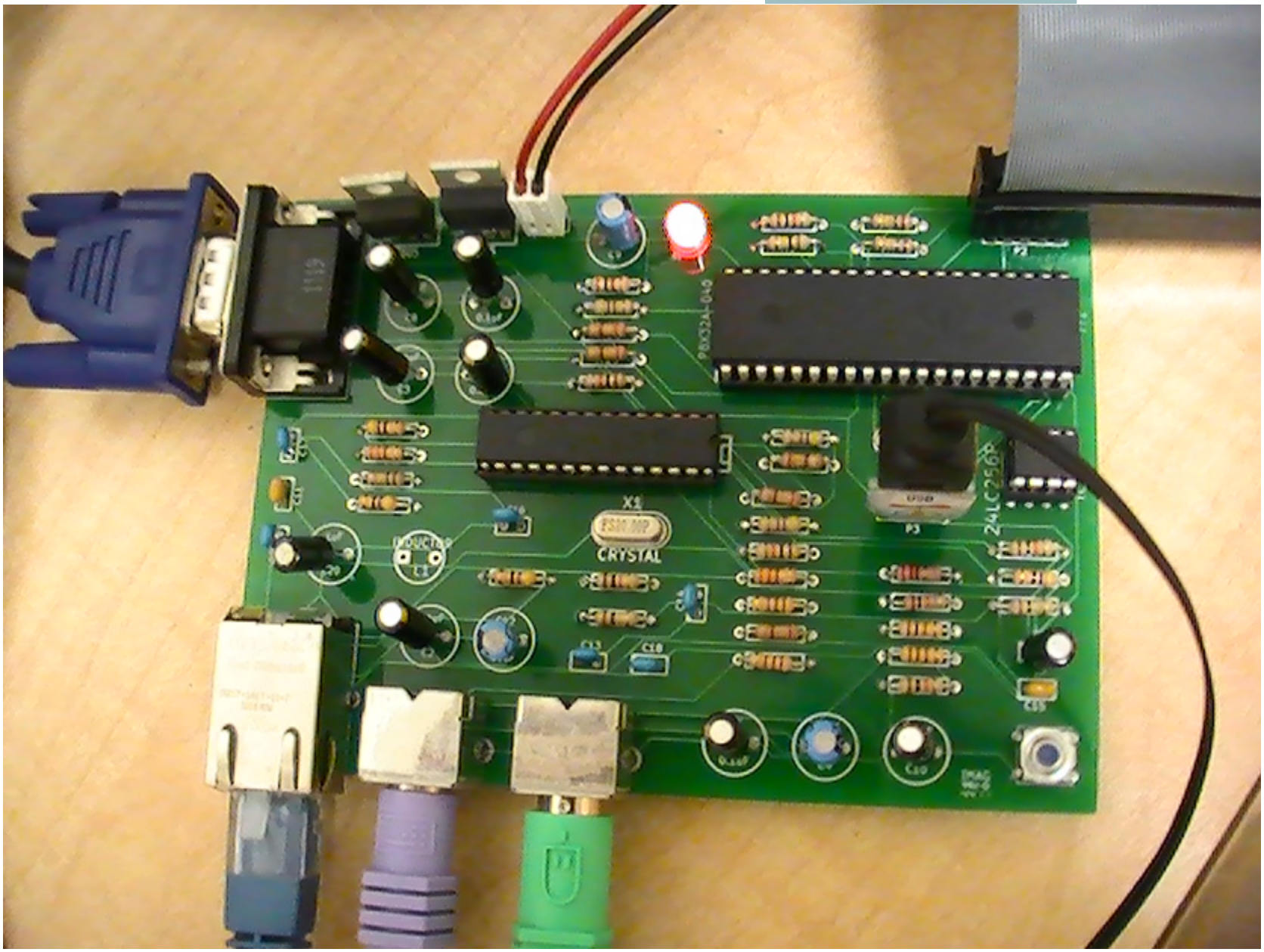
0.1uF
C3
C7
0.1uF
CRYSTAL
X2
R5
R4
R13
R2
ENC28J60
U3
R20
R21
C7
C11
C16
X1
CRYSTAL
R23
R24
R30
R3
R27
R25
R29
P3
24LC256R
U2
C19
1uF
C20
INDUCTOR
L1
R6
R11
R15
C14
R12
R17
R26
R28
R32
R10
R1
R16
C1
C15
0.1uF
C2
C12
10uF
C13
C18
RJ45-TRANSFD
J1
C6
0.1uF
10uF
C4
0.1uF
C10
SW1
SW_PUSH


CRYSTAL
24LC256

Spectrum Analyzer (Demonstration)

- Discrete Fast Hartley Transform

$$H_k = \sum_{n=0}^{N-1} x_n \left[\cos\left(\frac{2\pi}{N} nk\right) + \sin\left(\frac{2\pi}{N} nk\right) \right] \qquad k = 0, \ldots, N-1$$

  - Employs split 2 radix decimation in time algorithm (DIT) for fast computation
- Audio data is digitized (Python script)
  - Downsampled to 14KHz providing spectral frequency range 0Hz to 7KHz
  - Data sent through serial port
- http://www.youtube.com/watch?v=w9wYNL66UyU

Conclusions

- Spectrum analyzer works! (Meaning the computer is functional)
- Writing the spectrum analyzer was pretty difficult, however there were a few technical hardware problems
  - Sigma delta ADCs wouldn't function properly
    - Forgot AC coupling capacitor
    - Too much noise on board
- Boring chassis….
- Overall, designing and building the project was fun.