**Checkpoint #2**

**ATAPI Controller**

- Seven bytes long
- Normally write parameters in to the registers first
- Write the command code last
- Written 8 bits at a time in the lower half of DD[0:15]

**ATA Command Block**

<table>
<thead>
<tr>
<th>Register</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
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<tbody>
<tr>
<td>Features</td>
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<tr>
<td>Sector Count</td>
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<tr>
<td>Sector Number</td>
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<tr>
<td>Cylinder Low</td>
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<tr>
<td>Cylinder High</td>
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<tr>
<td>Device/Type</td>
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</tbody>
</table>

**Command Code**

- $CSO$ and $CS1$ are active low
- They are asserted (A) when they are zero

**The PACKET command**

- Introduced to expand aging ATA drive control spec
- Prepares the device to accept an ATAPI command packet
- The PACKET command doesn’t need registers set up before it is sent

**Addressing ATA registers**

- $CSO = 0$
- $CS1 = 1$
- $DA0 = 1$
- $DA1 = 1$
- $DA2 = 1$

**40 SIGNALS ?!?!?**

Be really careful with the wire wrapping

**BIG I/O Block and Test Bit File (our gifts to you)**
The ATAPI Command Packet

- 12 bytes
- Written 16 bits at a time on DD[0:15]
- M = minutes
- S = seconds
- F = frame (1/75th second)

<table>
<thead>
<tr>
<th>Bit</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>Reserved</td>
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<tr>
<td>1</td>
<td>Reserved</td>
</tr>
<tr>
<td>2</td>
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<td>14</td>
<td>Reserved</td>
</tr>
<tr>
<td>15</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

Three ATAPI commands

- PLAY AUDIO MSF
  - 47h
- START / STOP UNIT
  - 1Bh
- PAUSE / RESUME
  - 4Bh

The 4 tasks:

- Wire wrap board
- Implement ATAPI commands
- Create TOC
- Make real time

Table of Contents

- Pick a CD to hard code the track beginning times in MSF format
- Pick a CD that you won’t mind hearing the first song 10,000 times
- Keep a record of present track
- We can use the TOC to jump to the next and previous tracks

Implement CD controls

- Required Commands:
  - Play
  - Next Track
  - Previous Track
  - Stop
  - Pause / Resume
  - Eject

Real Time

- Replace the existing “random time”
- Create a counter that counts @ 1 Hz
  - 0.953674 Hz = 16MHz / 2^24
- Elapsed time since beginning of track
- Resets to zero with STOP
- Pauses with PAUSE
TONS OF REDUNDANT DATA

- Think about how to encode your commands to minimize space

TIPS

- Buy an IDE cable and leave it on your board
- Buy a ZIP disk at IEEE and back up your project to it every day
- Learn to put signals out to pins and look at them on the logic analyzer

The End

- Demo cable pins
- GOOD LUCK !!!!!!!