Flying Probe Data Acquisition PCB

Author(s): Bianca Berselli, Qinglan Lin, Dat Le, Mahira Mirza, Tianfan Zhou, Chenxiao Zhang
Schulich School of Engineering, University of Calgary

Abstract
Alongside Tangent Design Solutions, we are working to develop a Data Acquisition Unit PCB for a flying probe. The goal of the DAQ is to take multiple measurements including voltage, current and power. Our deliverables include two circuit boards, firmware, software for circuit board control, and the testing script. We have developed a power measurement board and its corresponding firmware, testing script and software needed for the system's functionality, and the hardware for the DAQ developed.

Introduction
• Tangent, based in Calgary, Alberta, offers electrical, mechanical, and software design services and recently acquired SMT equipment for faster printed circuit board assemblies.
• Testing these boards is time-consuming, using a dedicated bed of nails fixture.
• The project aimed to develop a versatile data acquisition system and software to automate PCB testing.

Results
• PCB Design Package for Data Acquisition and Power Measurement board.
• One physical copy of the Data Acquisition Board, four physical copies of the Power Measurement Board.
• Software GUI for scripting test sequences.
• Firmware for controlling the Power Measurement Board.

Contact
Bianca Berselli
Email: bianca.berselli@ucalgary.ca
Phone: 587-717-8553

Introduction
• Tangent, based in Calgary, Alberta, offers electrical, mechanical, and software design services and recently acquired SMT equipment for faster printed circuit board assemblies.
• Testing these boards is time-consuming, using a dedicated bed of nails fixture.
• The project aimed to develop a versatile data acquisition system and software to automate PCB testing.

Results
• PCB Design Package for Data Acquisition and Power Measurement board.
• One physical copy of the Data Acquisition Board, four physical copies of the Power Measurement Board.
• Software GUI for scripting test sequences.
• Firmware for controlling the Power Measurement Board.

Abstract
Alongside Tangent Design Solutions, we are working to develop a Data Acquisition Unit PCB for a flying probe. The goal of the DAQ is to take multiple measurements including voltage, current and power. Our deliverables include two circuit boards, firmware, software for circuit board control, and the testing script. We have developed a power measurement board and its corresponding firmware, testing script and software needed for the system's functionality, and the hardware for the DAQ developed.

Discussion
• The Data Acquisition PCB project is an essential tool needed for any hardware manufacturing company, to efficiently test any PCB in an automated fashion.
• Lessons learned
  ○ correction of wiring when a PCB connection is incorrect and discovered after assembly
  ○ Utilizing Altium and resolving issues
  ○ Organization of all meetings and overall scheduling of the project.

Specification

<table>
<thead>
<tr>
<th>Device Power Supply</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device shall run via USB or external 5-24 VDC power supply</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control and Configuration Interface</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Device shall connect to computer for control &amp; configuration via USB and/or Ethernet</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programmable Data Channels</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of 8 channels for measurements and stimulus of the unit under test. Channels shall be configurable in function via software. Data channels shall be capable of sampling at 0.5-5 Msamples/sec.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measured Values</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power, Voltage, Current, Resistance, Capacitance</td>
<td></td>
</tr>
</tbody>
</table>

Data Flow

Methods and Materials
• All materials, supplies and tools were provided by Tangent Design Engineering and MakerSpace (Schulich School of Engineering).
• The technology commonly used today to assemble a Printed Circuit Board (PCB) is Surface Mount Technology (STM). We are using NUCLEO-F443RE as our CPU and firmware is being developed in STM32CubeIDE.
• Designed the PCB in Altium. Parts were chosen from Digikey or Mouser and imported into Altium.
• Bill of material (BOM) was generated to help us estimate the price of the project.
• Oscilloscope, power supplier and digital multimeter were used to support project execution.

Contact
Bianca Berselli
Email: bianca.berselli@ucalgary.ca
Phone: 587-717-8553