Merry Circuit Board Christmas!

**Foreword**

First, wow, PCB (printed circuit board) design takes a lot of time! And this design is extremely simple.

Second, I am sending these to people of various technical knowledge levels, from professors to family with no electronics experience. So, if you find this writeup to be too complicated or too simple I apologize, I tried to strike a good balance.

Third, thank you! If I have sent you one of these, I consider you to have played a role in my personal, professional, or educational development and for that I am forever grateful. I hope this makes an enjoyable display piece and gives you some idea of what I have been up to lately.

Best,

Matt Nichols

**Overview**

PCB Christmas trees aren’t exactly anything new, however, I thought this would be a fun simple project and I tried to bring a fun twist with the addition of several songs that can be played by touching the ornaments on the tree. The tree is powered from a single 3V CR2025 battery and has a runtime of approximately 12 hours continuously. A 3D printed base is included or a bit of string or fishing line could be looped through the hole near the star in order to hang the tree.

The entire design was completed in KiCad and is open source using the MIT license (RESEARCH THIS MORE). All files and further details can be found on my github: https://github.com/NicholsMatt/PCBChristmasTree

**Reasons for using the ATMEGA328p-AU**

This entire thing is quite inefficient with its use of digital IO pins. I probably could have gotten away with half of the pin count if I multiplexed the LEDs, however, I wanted this to be super straightforward and since I found myself in quite a time crunch to get the design finished I decided to just go overkill by using the platform I am already familiar with (the 328p which is from the Arduino nano). The 328p is also not that much more expensive than a smaller microcontroller in this small scale ($1.50 vs $0.50). If I was making these in huge quantities, then the BOM cost would be much more important.

Also, I’m using a software PWM Arduino library and I wasn’t completely sure how this would interact with multiplexing the LEDs and since I wanted to be able to program the light show for certain songs easily, I just didn’t bother on this version. The touch sensitive ornaments also eat up 2 pins each. Maybe next year…

**Definitions & Glossary**

PCB – Printed Circuit Board

LED – Light Emitting Diode

IO Pin – Input/Output Pin