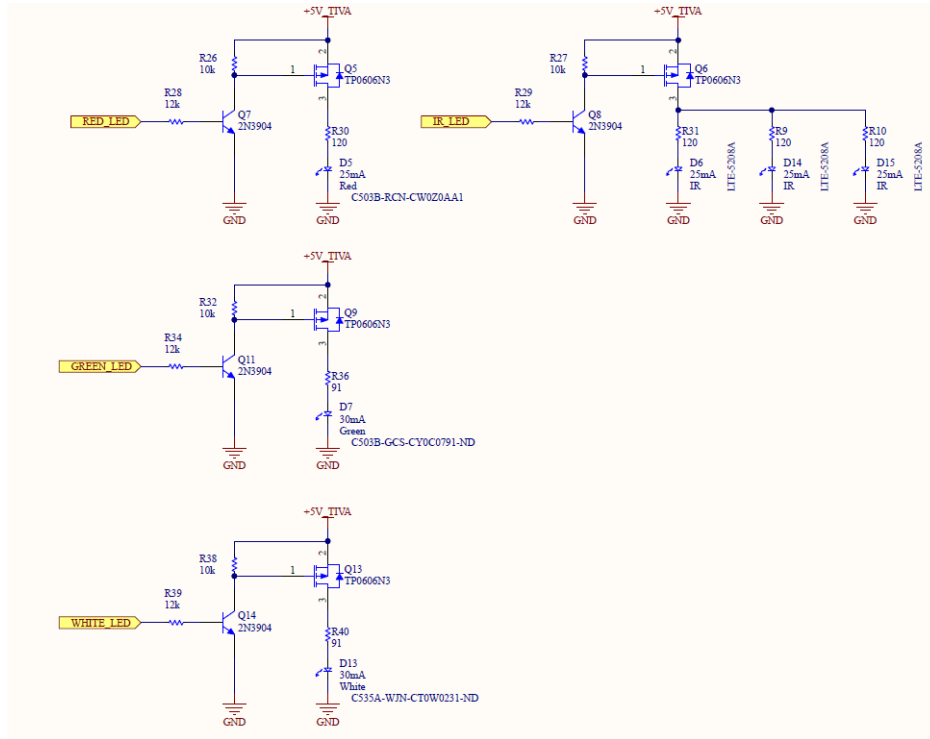# LEDs

ME218B Winter 2017, Team 4

Figure 1: LED Circuitry in Altium

We used a 2N3904 NPN BJT connected to a TP0606N3 PMOS to control the LEDS. We picked 12kΩ for the BJT gate resistance, and 10kΩ for the PMOS gate pullup resistance - typical values we have used in labs in the past. The most important components to pick were the current limiting resistors in series with the LEDs.

Our red LED, C503B-RCN-CW0Z0AA1, has a forward voltage of $V_F = 2.1V$ and a maximum current of $50mA$, and in order to have $25mA$ of current flowing through the LED, the resistance we want is:

$$R_{limit,red} = \frac{5V - V_f}{25mA} = 116\Omega \tag{1}$$

The TP0606N3 has a typical $R_{dson} = 5\Omega$, so a conservative standard resistance to pick would be 120Ω.

Our green LED, C503B-GCS-CY0C0791-ND, has a typical forward voltage of $V_F = 3.2V$ and a maximum current of $30mA$, and in order to have $20mA$ of current flowing through the LED, the resistance we want is:

$$R_{limit,green} = \frac{5V - V_f}{20mA} = 90\Omega \tag{2}$$

The TP0606N3 has a typical $R_{dson} = 5\Omega$, so a reasonable standard resistance to pick would be 91Ω. This results in a current less than 20mA, however after observing that our LED was bright enough we ended up using 91Ω as our final resistor value.

Our white LED, C535A-WJN-CT0W0231-ND, has a typical forward voltage of $V_F = 3.2V$ as well, therefore we picked $R_{limit,white} = 91\Omega$.

Our IR LEDs were the LTE-5208A, with $V_f = 1.2V$ and a maximum current of $100mA$. Since we were having issues with getting the game field ball dispenser to detect the pulses from our IR LEDs, we wanted to run them bright at $30mA$, and did the following calculation:

$$R_{limit,IR} = \frac{5V - V_f}{30mA} = 126\Omega \tag{3}$$

In the end we just used $R_{limit,IR} = 120\Omega$, since we had a bunch of those resistors lying around from the LED circuitry for the red LED. And since our P-channel MOSFET TP0606N3 can handle a continuous drain current of 320 mA, running 3 IR emitters, each at 30 mA, is fine.