About SL2

This folder contains the design files for the SL2 transceiver (in the EDA/ directory), instructions for assembling a SL2 kit (Docs/CONTENTS.doc), and instructions for using the kit to form a visible light communications link (Docs/Instructions.doc).

Note that, as described in (Docs/CONTENTS.doc), some commercial off-the-shelf components need to be obtained separately and are not provided with the kit. The design files included in this package only describe the custom-designed parts of the kit and do not include commercial off-the-shelf component designs.

In the EDA/ directory, several packaged Altium[[1]](#footnote-1) projects are present. Although they share similar designs and components, each of the three projects there serves a different purpose.

# VLC\_ThorReceiver

## Purpose:

This Altium project contains the design for the receiver interface board. Its purpose is to serve as an interface between the output of a ThorLabs (or compatible) photodetector and a FTDI TTL-232R-5V USB-to-serial conversion cable.

## Design:

The design is built around a comparator integrated circuit (IC) (LT1719), which compares the input signal voltage against the (running) average input signal voltage to determine whether the input signal is high or low. The running average is obtained using a low-pass filter.

Input signals arrive via a BNC port (since the ThorLabs photodetector uses a BNC port to output signals). The BNC port input is roughly impedance matched to 50 Ohms using a shunt resistor to prevent damage to the ThorLabs photodetector.

Output is provided as the output of the comparator.

A perfboard has also been added to the spare space on the PCB in case any additions or modifications need to be added.

The mounting holes and the rectangular header layout have been inherited from an old design to remain compatible with the older design’s pin arrangement.



## Parts:

(With Digikey part numbers)

|  |  |
| --- | --- |
| A97555-ND | BNC Jack |
|  |  |
| LT1719CS6#TRMPBF | IC Comp |
| CT-ND |  |
| 445-3469-1-ND | CAP CER 10UF 25V Y5V 1206 |
|  |  |
| 493-2331-2-ND | CAP TANT 2.2UF 10V 20% 0805 |
|  |  |
| 445-2672-1-ND | CAP CER 10000PF (10nF) 25V C0G 5% 0805 |
|  |  |
| 445-3463-1-ND | CAP CER 1.0UF 50V Y5V 0805 |
|  |  |
| RNCP1206FTD51R | RES 51.1 OHM 1/2W 1% 1206 SMD |
| 1CT-ND |  |
| 609-3588-ND | CONN RCPT 6POS .100" SNG ROW |
|  |  |

Also needed:

* Through-hole 10k Ohm resistor
* Through-hole 100 Ohm resistor

# VLC\_v3-IR-r2

## Purpose:

This is an infrared transmitter that takes a 0V to 5V digital input signal and produces infrared (IR) light when the input signal is high.

## Design:

The PCB layout has the infrared transmitter on the left and a VLC\_ThorReceiver on the right; the transceiver is manufactured this way because manufacturing them together seems to be cheaper than manufacturing them separately.

The mounting-hole pattern, the header pins, and the large circular hole in the middle are included for compatibility with older designs.

The electrical current through the infrared light-emitting diodes (LEDs) is set by R1, as described in the schematic, and is regulated by the transistors of the DMP2066LSD in a current-mirror configuration.

The design of the IR transmitter differs from the design of the white-light transmitter (described later) due to the difference in forwarding voltages of the LEDs.



## Parts:

|  |  |
| --- | --- |
| 445-2672-1-ND | 10nanoF CERAMIC CAPACITOR |
|  |  |
| 445-3463-1-ND | 1microF CERAMIC CAPACITOR |
|  |  |
| RNCP1206FTD51R1CT-ND | 51.1OHM 1% RESISTOR |
|  |  |
| 475-1471-ND | IR LED |
|  |  |
| ZXM61N02F | N-CH MOSFET |
|  |  |
| DMP2066LSDDICT-ND | P-CH MOSFET |
| 609-3588-ND | CONN RCPT 6POS .100" SNG ROW |

The appropriate through-hole resistors (shown on the schematic) should also be obtained.

# VLC\_v3-DMP2066LSD

## Purpose:

Similar to VLC\_v3-IR-r2, this device modulates light from white LEDs with a digital 0V to 5V input signal.

## Design:

Like for VLC\_v3-IR-r2, the PCB in this project has two parts: a transmitter on the left and a receiver on the right. The receiver shown on the right is an older design that includes onboard photodetectors.

The transmitter on the left is similar to the transmitter in VLC\_v3-IR-r2. However, due to the greater forward voltage drop of the white LEDs, fewer white LEDs than IR LEDs can be supported unless the supply voltage range is also increased. For this reason, only eight white LEDs are present and these white LEDs are split into two groups, which are driven in parallel. Like in VLC\_v3\_IR-r2, the current through each string of LEDs is regulated by transistors in a current-mirror configuration.



## Parts:

Specific Digikey part numbers are not readily available for the old receiver design. The parts for the white transmitter are listed below.

|  |  |
| --- | --- |
| 67-1693-ND | LED 5MM WHITE WATER CLEAR LENS |
|  |  |
| 609-3588-ND | CONN RCPT 6POS .100" SNG ROW |
|  |  |
| 445-3469-1-ND | CAP CER 10UF 25V Y5V 1206 |
|  |  |
| 445-3463-1-ND | CAP CER 1.0UF 50V Y5V 0805 |
|  |  |
| DMP2066LSD | MOSFET P-CH DUAL 20V 5.8A 8-SOIC |
| DICT-ND |  |
| 568-1657-1-ND | MOSFET N-CH 55V 335MA SOT-23 |
|  |  |
| WM6436-ND | CONN HEADER 36POS .100 VERT TIN |
|  |  |

**References** (available at hulk.bu.edu)

1. Jimmy Chau, Thomas Little. “Transceiver Modules for General Illumination and Free-Space Optical Communications.” Smart Lighting Engineering Research Center Site Visit. Troy, NY. Jun 2011.
2. Jimmy Chau, Thomas Little. “Improved Design for an Optical Communication System.” Smart Lighting Engineering Research Center Industry-Academia Day. Boston, MA. Feb 2011.
3. Jimmy Chau, Thomas Little. “Transceiver Modules for General Illumination and Free-Space Optical Communication.” Smart Lighting Engineering Research Center Site Review. Troy, NY. Jul 2010.
4. Jimmy Chau, Thomas Little. “LED Driver Design for an Optical Transmitter and Illuminator.” Smart Lighting Engineering Research Center Industry-Academia Day. Boston, MA. Feb 2010.
5. Smart Lighting Engineering Research Center [www.smartlighting.rpi.edu](http://www.smartlighting.rpi.edu)

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1. *Altium Designer* is a software application for printed circuit board (PCB) design. [↑](#footnote-ref-1)