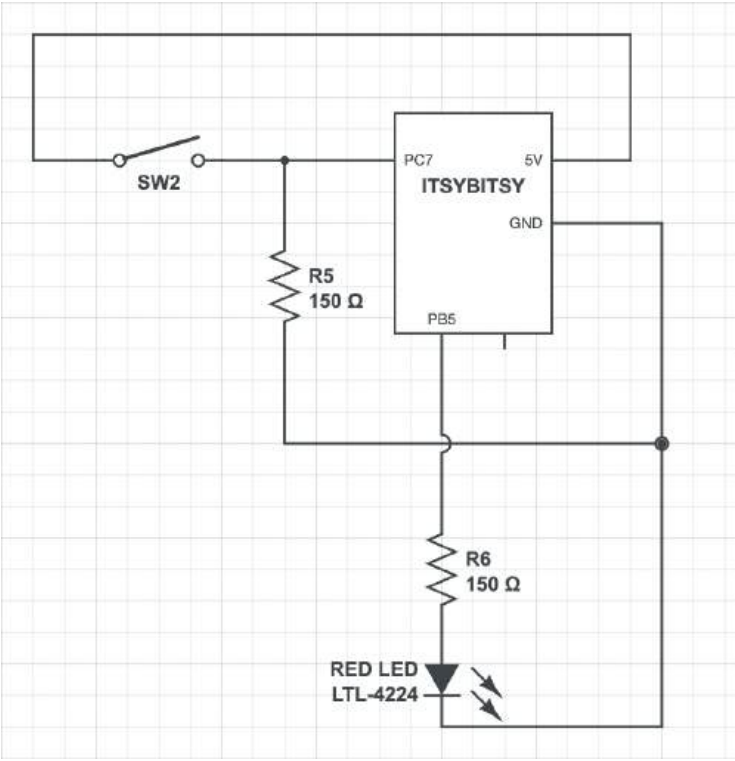
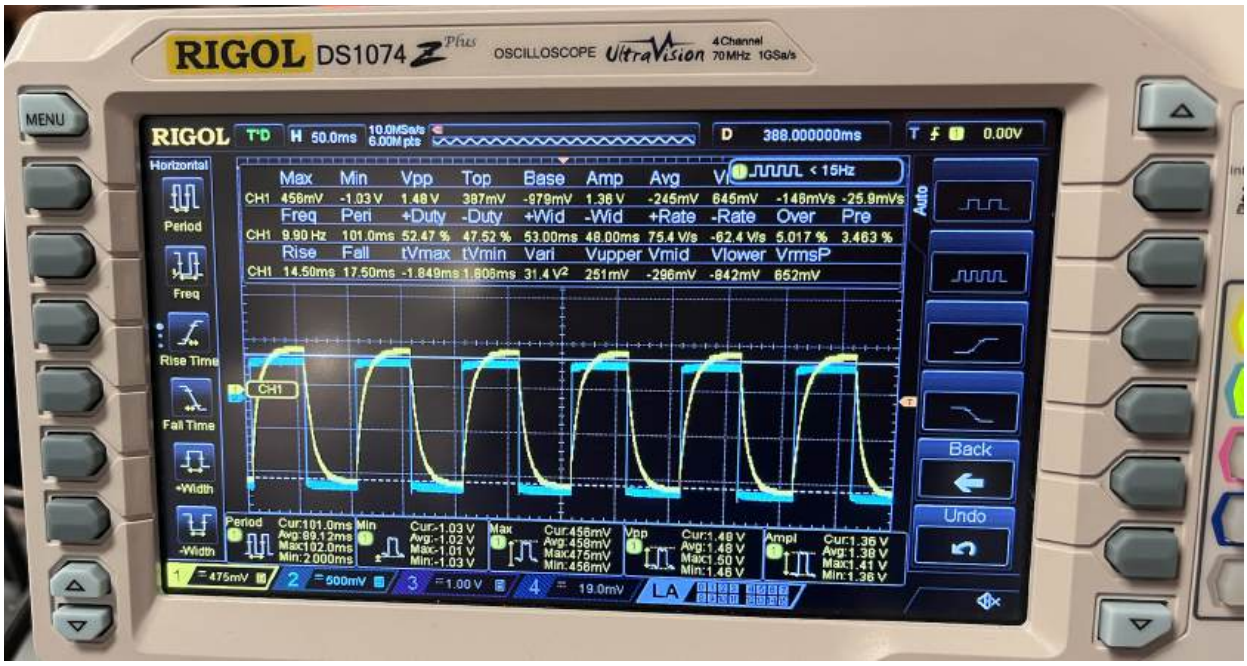
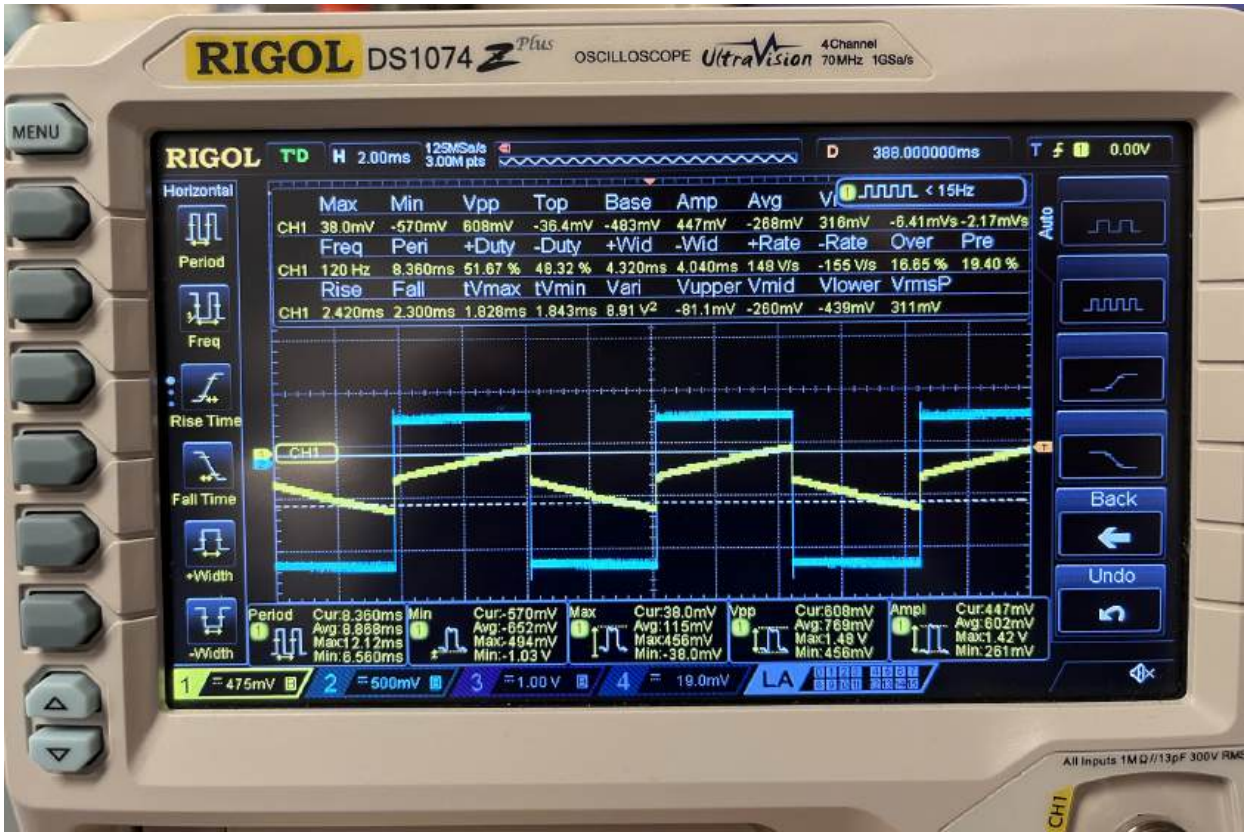
MEAM 5100 LAB2

2.1.1

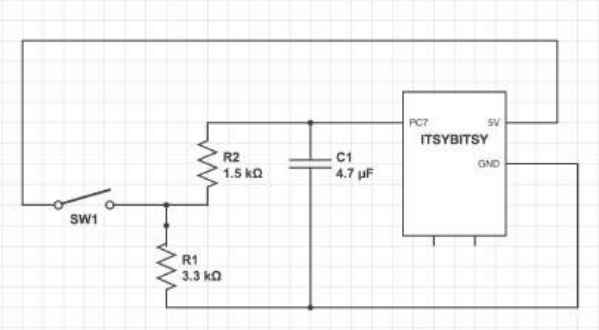


2.1.2


RIGOL DS1074Z Plus
OSCILLOSCOPE UltraVision 4Channel 70MHz 1GSa/s
MENU
Horizontal
Period
Freq
Rise Time
Fall Time
+Width
-Width
Back
Undo
CH1
CH1 456mV -1.03 V 1.48 V 387mV -979mV 1.36 V -245mV 645mV -148mVs -25.9mVs
CH1 9.90 Hz 101.0ms 52.47 % 47.52 % 53.00ms 48.00ms 75.4 V/s -62.4 V/s 5.017 % 3.463 %
CH1 14.50ms 17.50ms -1.849ms 1.808ms 31.4 V² 251mV -296mV -842mV 652mV


RIGOL DS1074Z Plus
OSCILLOSCOPE UltraVision 4Channel 70MHz 1GSa/s
MENU
Horizontal
Period
Freq
Rise Time
Fall Time
+Width
-Width
Back
Undo
CH1
CH1 38.0mV -570mV 608mV -36.4mV -483mV 447mV -268mV 316mV -6.41mVs -2.17mVs
CH1 120 Hz 8.360ms 51.67 % 48.32 % 4.320ms 4.040ms 148 V/s -155 V/s 16.65 % 19.40 %
CH1 2.420ms 2.300ms 1.828ms 1.843ms 8.91 V² -81.1mV -260mV -439mV 311mV
All Inputs 1MΩ//13pF 300V RMS

2.1.3



Fastest time - 1250

2.2.1

Table of potential drop across phototransistor in series with different resistance values

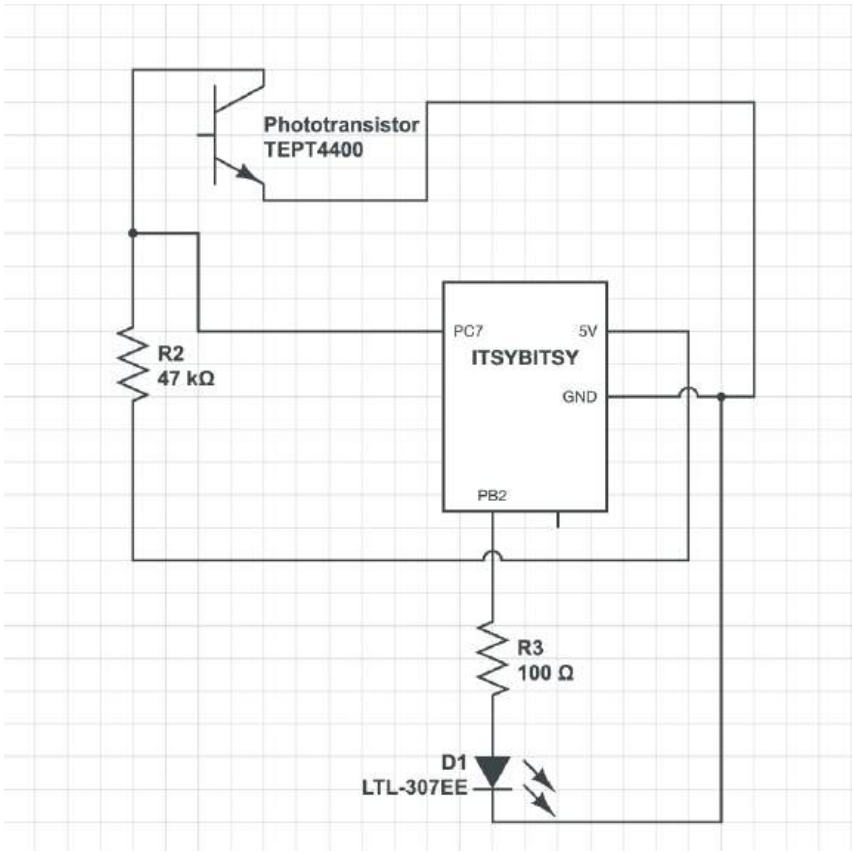
Resistor	Pot.drop with Light	Pot.drop without Light	ATmega32U4 valid logic high	ATmega32U4 valid logic low
4.7 kΩ	2 V	4.70 V	YES	NO
47 kΩ	500 mV	4.47 V	YES	YES
470 kΩ	80 mV	1.8 V	NO	NO

In general when intensity of light increases the electrical conductivity of a phototransistor also increases.
While using a 4.7 kΩ resistor we never get a valid logic low.
While using a 470 kΩ resistor we never get a valid logic high.
47 kΩ resistance is in the sweet spot and we get valid logic highs and valid logic lows for the ATmega32U4.

2.2.2A

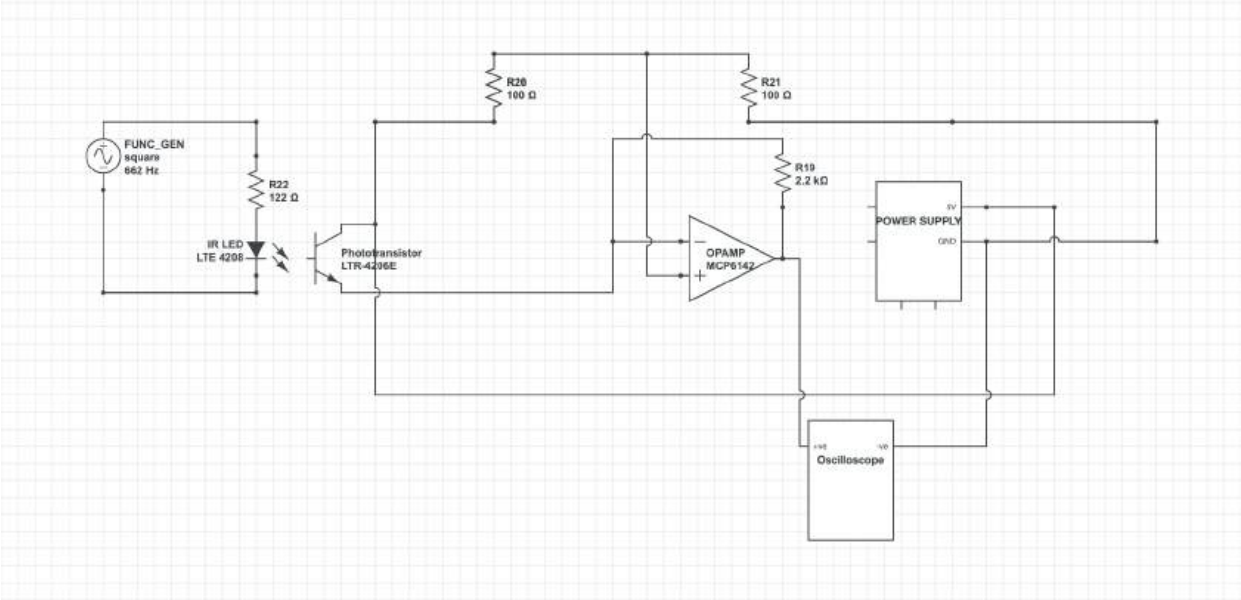
DEMO VIDEO

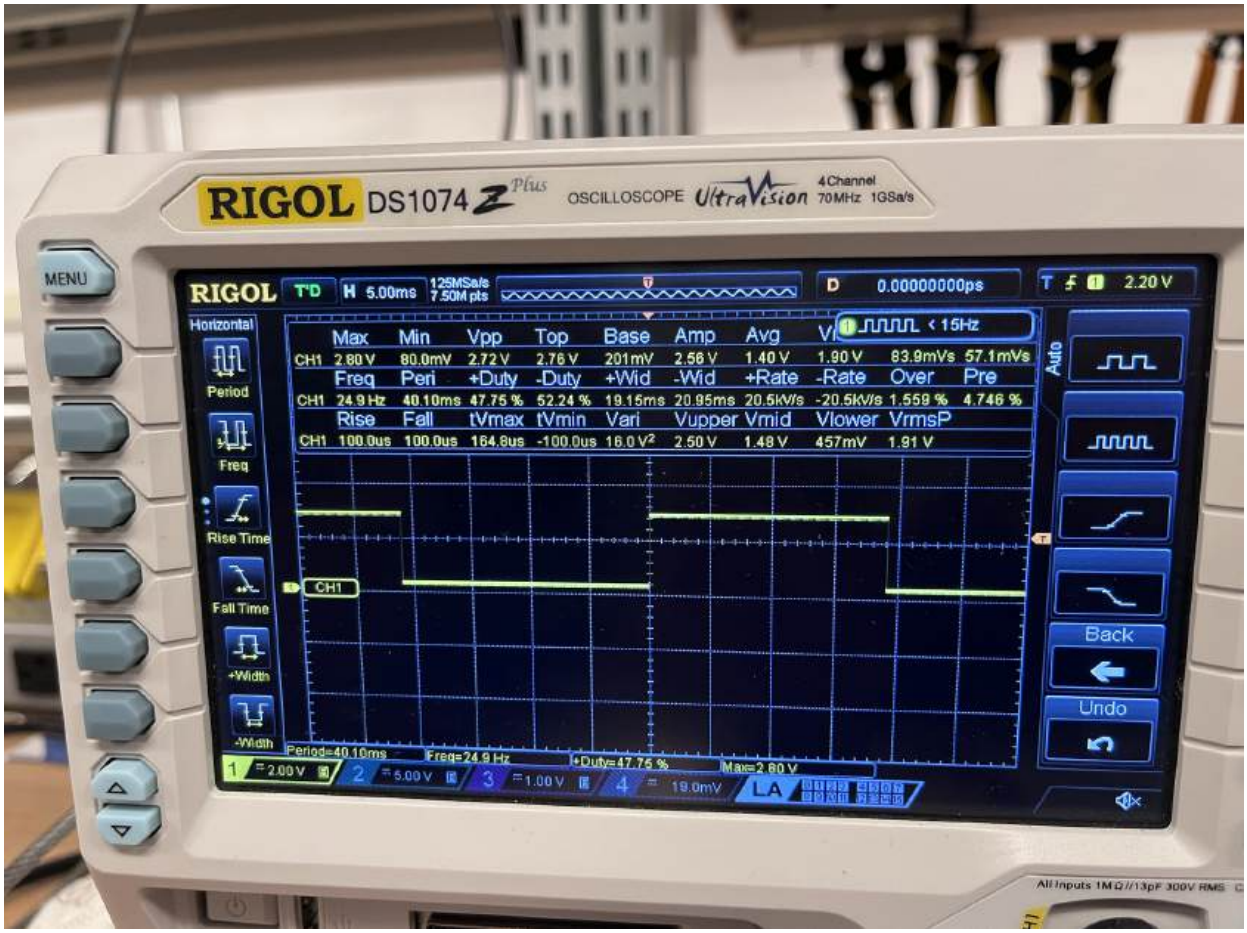
2.2.2B

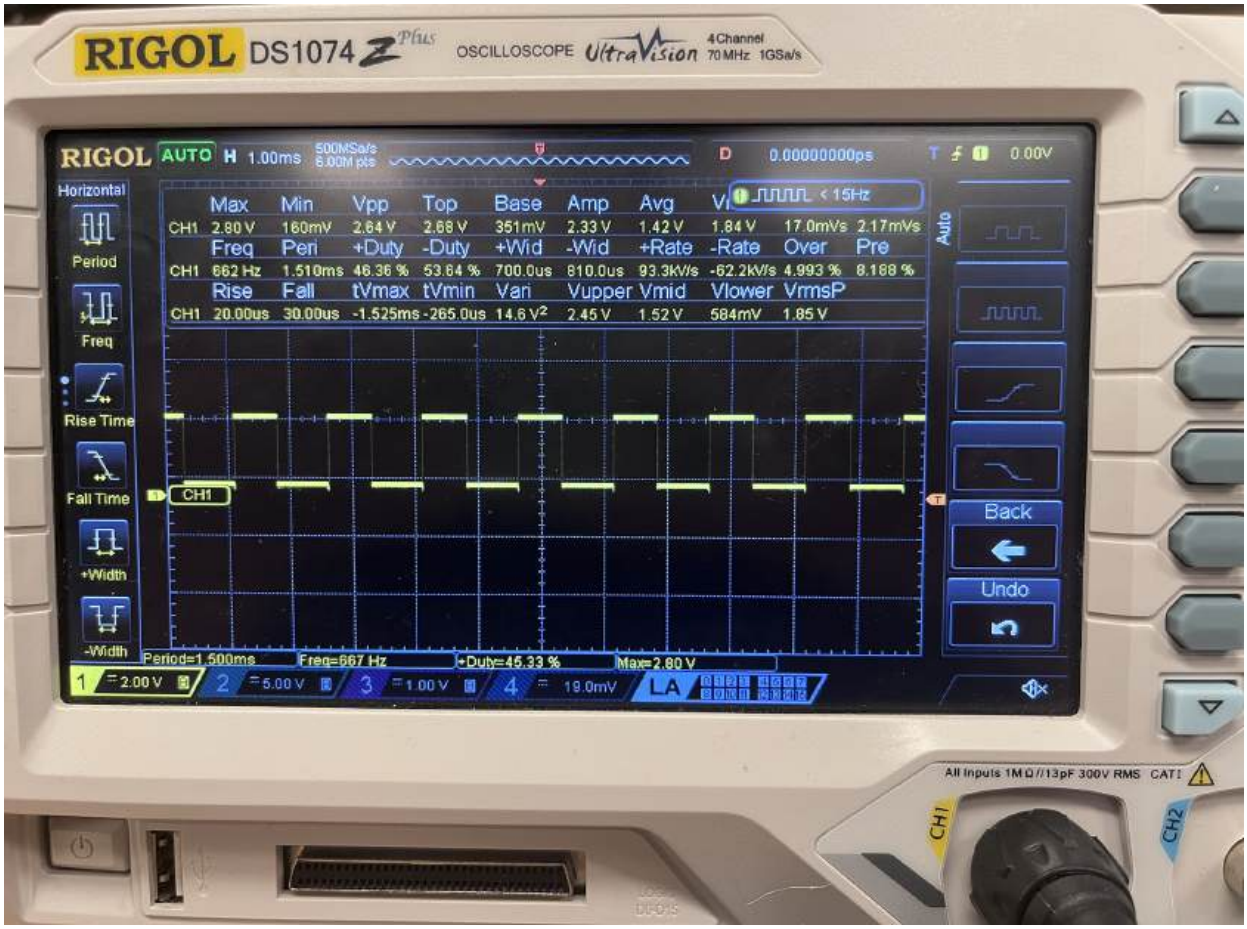


DEMO VIDEO

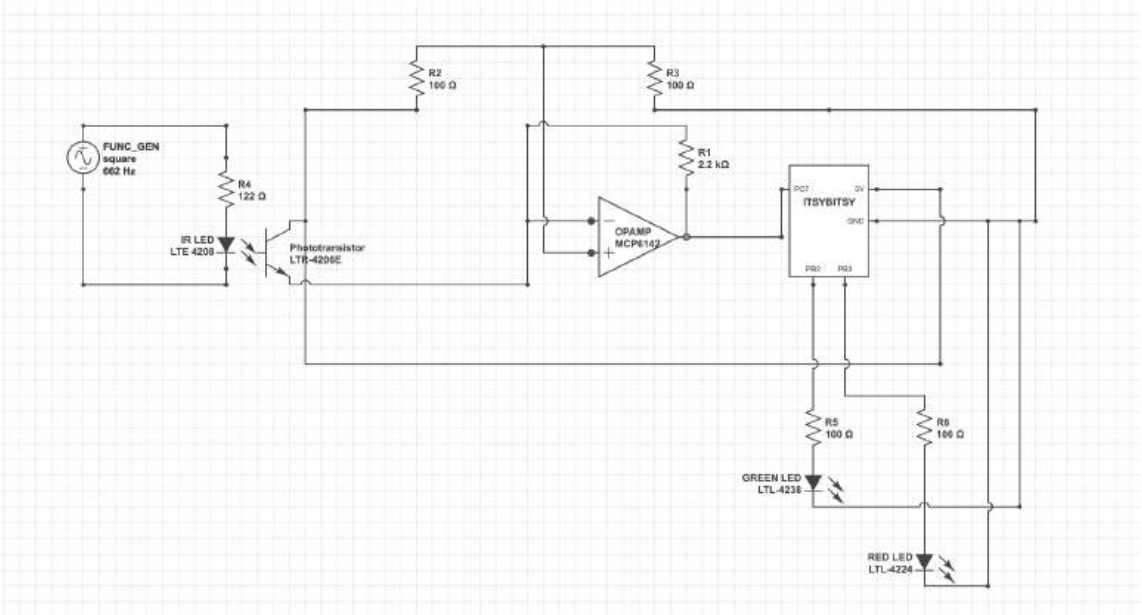
2.3.1


R20
100 Ω
R21
100 Ω
FUNC_GEN
square
662 Hz
R22
122 Ω
R19
2.2 kΩ
IR LED
LTE 4208
Phototransistor
LTR-4206E
OPAMP
MCP6142
POWER SUPPLY
Oscilloscope


RIGOL DS1074Z Plus
OSCILLOSCOPE UltraVision
4 Channel
70MHz 1GSa/s
MENU
Horizontal
Period
Freq
Rise Time
Fall Time
+Width
-Width
Back
Undo
Auto
CH1
Period=40.10ms
Freq=24.9 Hz
+Duty=47.75 %
Max=2.80 V

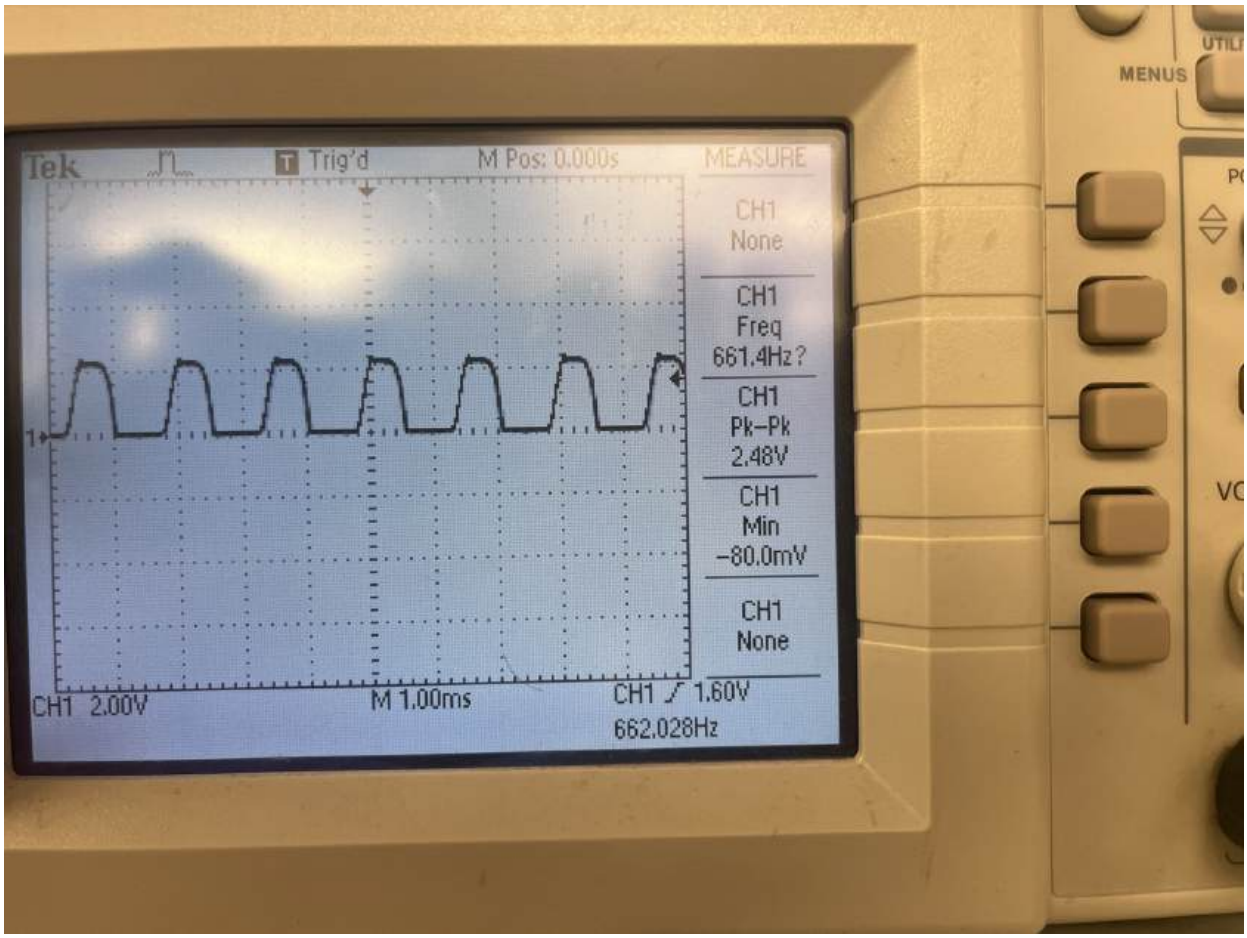

RIGOL DS1074Z Plus
OSCILLOSCOPE UltraVision 4 Channel 70 MHz 1GSa/s
RIGOL AUTO H 1.00ms 500MSa/s 6.00M pts D 0.00000000ps T 0.00V
Horizontal
Period
Freq
Rise Time
Fall Time
+Width
-Width
Max Min Vpp Top Base Amp Avg
CH1 2.80 V 160mV 2.64 V 2.68 V 351mV 2.33 V 1.42 V
Freq Peri +Duty -Duty +Wid -Wid +Rate -Rate Over Pre
CH1 662 Hz 1.510ms 46.36 % 53.64 % 700.0us 810.0us 93.3kV/s -62.2kV/s 4.993 % 8.188 %
Rise Fall tVmax tVmin Vari Vupper Vmid Vlower VrmsP
CH1 20.00us 30.00us -1.525ms -265.0us 14.6 V² 2.45 V 1.52 V 584mV 1.85 V
< 15Hz
Auto
Back
Undo
CH1
Period=1.500ms Freq=667 Hz +Duty=45.33 % Max=2.80 V
1 2.00 V 2 5.00 V 3 1.00 V 4 19.0mV LA
All Inputs 1MΩ//13pF 300V RMS CAT I
CH1
CH2

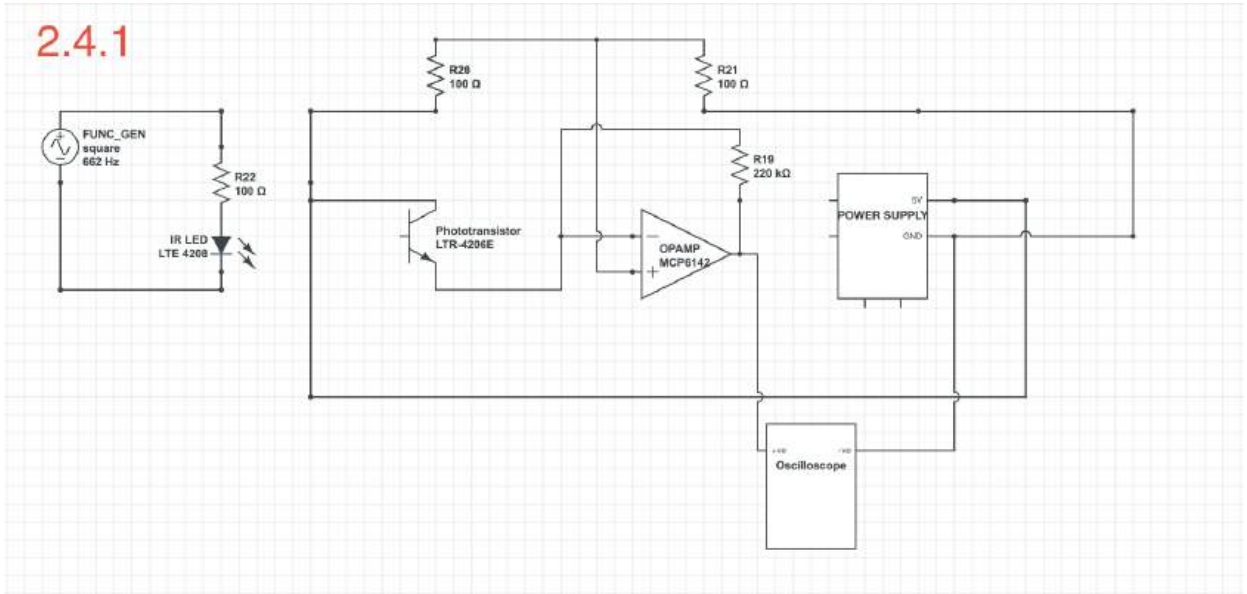
2.3.2


R2
100 Ω
R3
100 Ω
FUNC_GEN
square
662 Hz
R4
122 Ω
IR LED
LTE 4208
Phototransistor
LTR-4206E
R1
2.2 kΩ
OPAMP
MCP6142
ITSYBITSY
R5
100 Ω
R6
100 Ω
GREEN LED
LTL-4238
RED LED
LTL-4224

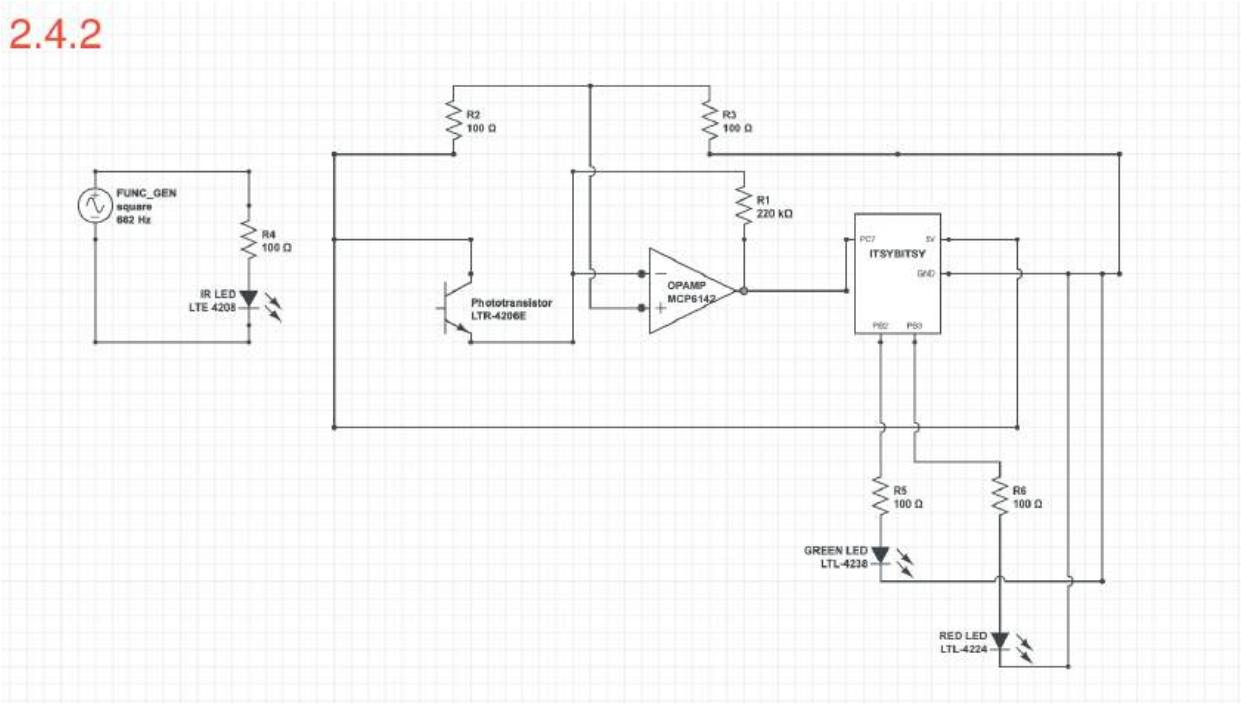
code

2.4.1


Tek
Trig'd
M Pos: 0.000s
MEASURE
CH1
None
CH1
Freq
661.4Hz?
CH1
Pk-Pk
2.48V
CH1
Min
-80.0mV
CH1
None
CH1 2.00V
M 1.00ms
CH1 1.60V
662.028Hz
MENUS


2.4.1
FUNC_GEN
square
662 Hz
R22
100 Ω
IR LED
LTE 4208
R20
100 Ω
R21
100 Ω
R19
220 kΩ
Phototransistor
LTR-4206E
OPAMP
MCP6142
POWER SUPPLY
5V
GND
Oscilloscope

2.4.2



2.5

SECTION	HOURS
2.1	2
2.2	2
2.3	5
2.4	7