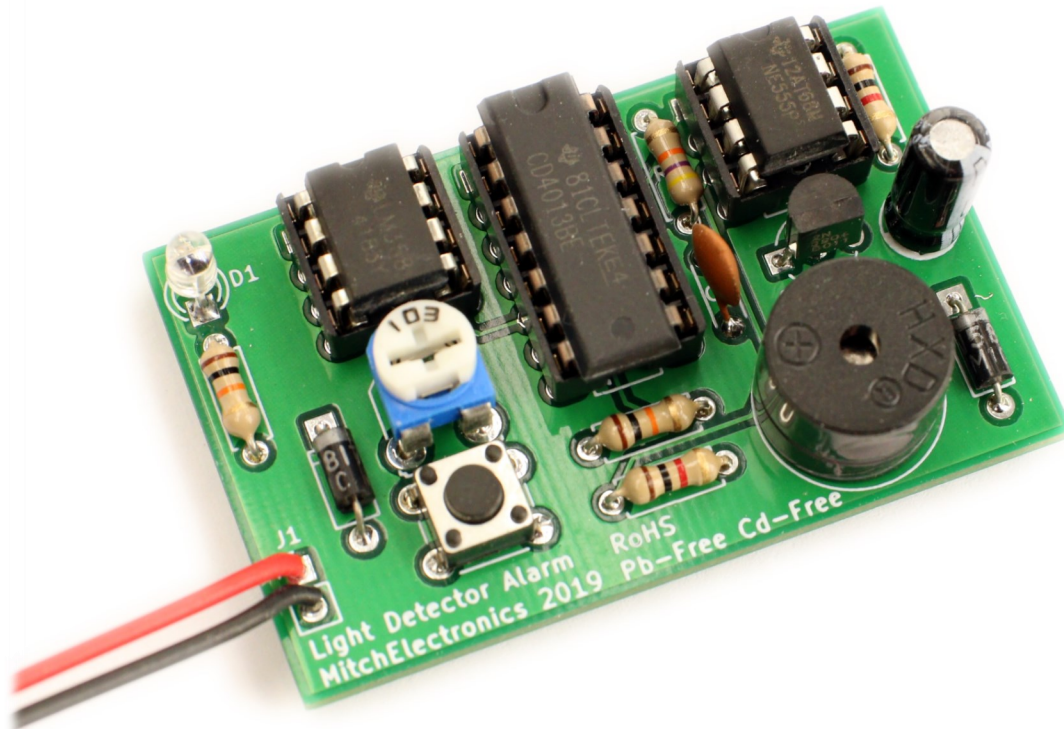


Light Alarm

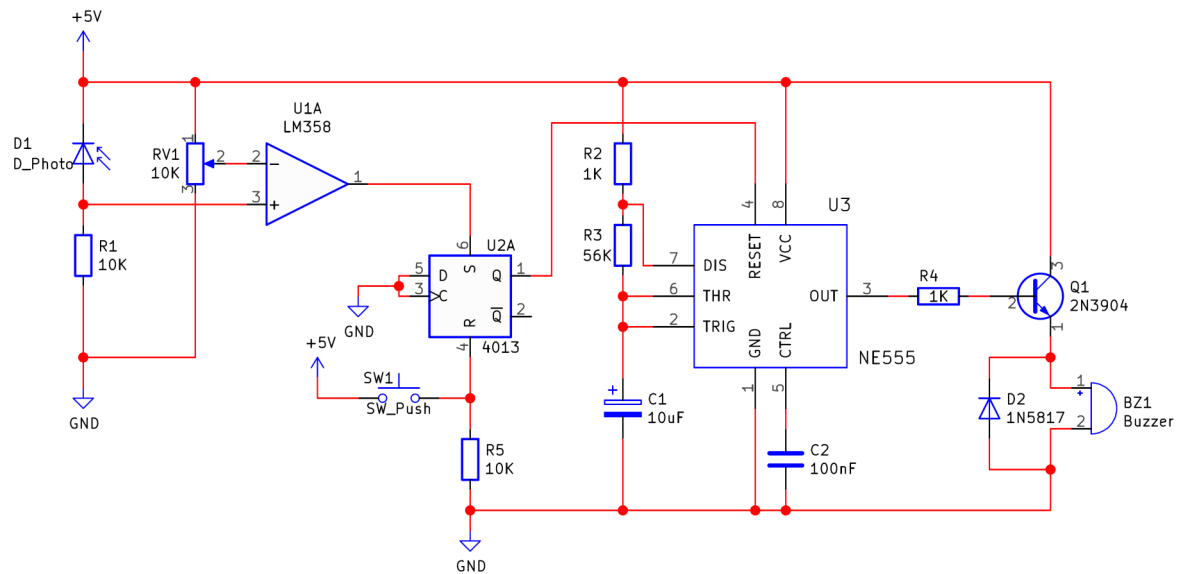
MitchElectronics® 2019



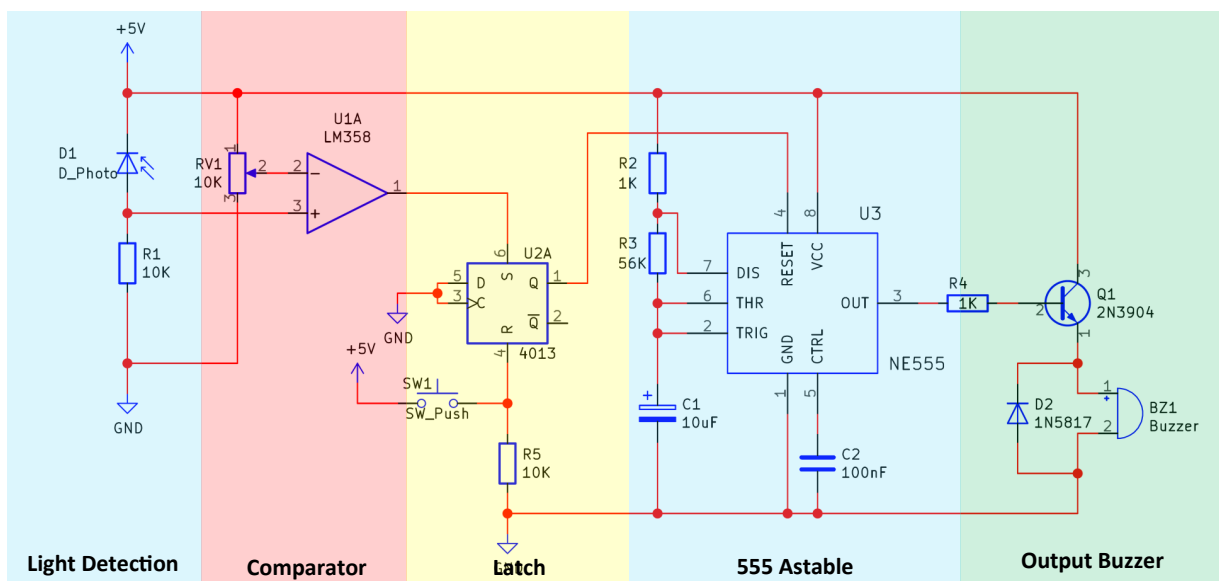
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SCHEMATIC



Schematic (Blocktised)



SCHEMATIC EXPLANATION

The **Light Alarm** is a circuit that sounds a buzzer when the light level falling on the circuit reaches a certain level. However, once triggered, the circuit will continue to beep even if the light falls below the trigger level and this can be useful in security situations where a burglars torch activates the alarm! So, how *does* this circuit work and what makes it better than other light detection circuits?

The most important component in this kit is D1 which is a photodiode. Photodiodes are essentially sensitive LEDs that produce a current when light falls on them. In our circuit you will notice that D1 is in reverse bias configuration which means that when there is no light falling on D1 current cannot flow through D1 and therefore the voltage across R1 is 0V. When light falls on D1 it causes D1 to become conductive and therefore conduct current which causes a voltage to form across R1. This is the light detection stage and the voltage across R1 is then sent to the comparator stage.

Most other kits use LDRs instead of photodiodes for light detection which is something that you must avoid! LDRs are almost always based on cadmium which is a restricted substance due to its carcinogenic properties and is no longer allowed to be used in commercial products. Many sellers ignore this and still use them in kits which can pose harm to hobbyists and so it is recommended that you use photodiodes instead of LDRs.

The next stage is the comparator stage which is made up of a single op-amp U1 which compares the voltage across R1 with a potentiometer. The potentiometer is used to set the sensitivity of the light detector and when the voltage across R1 is greater than the voltage from the potentiometer then the output of the comparator goes to +5V. Since the output of the comparator is connected to the SET pin of the 4013, the 4013 latch U2A is set when the comparator detects a light level greater than the potentiometer setting. The output of U2A is connected to the RESET pin of the 555 which is an inverted input so when the output of the 4013 is 0V the 555 stops oscillating and when the output of the 4013 is +5V then the 555 oscillates.

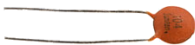
The 555 oscillator is connected to a transistor driver than provides power to the buzzer which beeps whenever the transistor is turned on. When the 4013 is set the 555 can oscillate which causes the buzzer to make short beeps like a security alarm system and the magnetic buzzer in this kit can make a lot of noise! If the system is to be reset and armed the button SW1 is pushed which resets the latch U2A and therefore prevents the 555 astable from oscillating.

To summarise

- R1 produces a voltage across it when light falls on D1
- The comparator sets the latch U2A when the voltage across R1 is greater than RV1
- The latch controls the 555 astable circuit and enables it when its output is high (Q = +5V)
- The 555 astable controls a transistor which provides power to a buzzer

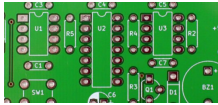
MATERIALS

Check that you have the following components

Component	Component Name	Quantity	Looks like
LM358	U1	1	
NE555	U2	1	
4013	U3	1	
8-DIP Socket	U1, U2	2	
14-DIP Socket	U3	1	
100nF Capacitor	C2	1	
10uF Capacitor	C1	1	
1K Resistor	R2, R4	2	
10K Resistor	R1, R5	2	
56K Resistor	R3	1	
10K Potentiometer	RV1	1	
1N5817	D2	1	
2N3904	Q1	1	
Buzzer	BZ1	1	
Tactile Switch	SW1	1	
Photodiode	D1	1	

MATERIALS

Check that you have the following components

Component	Component Name	Quantity	Looks like
Red Wire	-	1	
Black Wire	-	1	
PCB	-	1	

CONSTRUCTION

Download the electronics construction manual

To learn how to construct circuits on PCBs download the Electronics Construction Manual from MitchElectronics using the link below. This document shows you how to install all electronic components used in MitchElectronics kits. The list below shows the sections relevant to this kit so do not worry if you see component sections in the document that don't come with this kit!

www.mitchelectronics.co.uk/electronicsConstructionManual.pdf

Relevant sections in the electronics construction manual

Resistors

Capacitors

Diodes

ICs

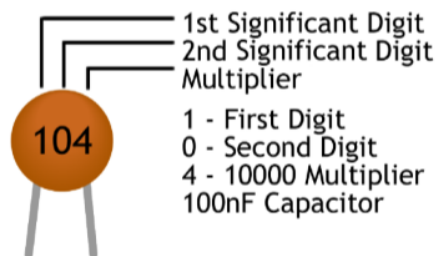
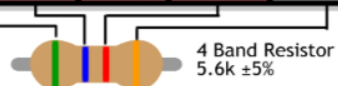
Switches

Buzzers

Wires

RESISTOR AND CAPACITOR IDENTIFICATION

Colour	1 ST Band	2 ND Band	3 RD Band	Multiplier	Tolerance
BLACK	0	0	0	1Ω	
BROWN	1	1	1	10Ω	±1%
RED	2	2	2	100Ω	±2%
ORANGE	3	3	3	1kΩ	
YELLOW	4	4	4	10kΩ	
GREEN	5	5	5	100kΩ	±0.50%
BLUE	6	6	6	1MΩ	±0.25%
VIOLET	7	7	7	10MΩ	±0.10%
GREY	8	8	8		±0.05%
WHITE	9	9	9		
GOLD					±5%
SILVER					±10%



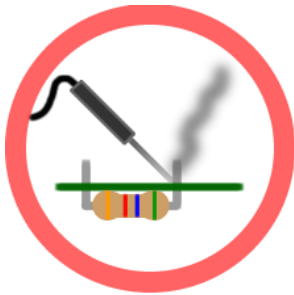
IMPORTANT INFORMATION



RoHS Compliant Kit (Lead free)



Low Voltage Kit



Caution! Soldering Required

TERMS AND CONDITIONS

MitchElectronics Mission

The main goal of MitchElectronics products is to provide safe electronics to makers and professionals alike while keeping the cost affordable. MitchElectronics kits are ideal for classrooms whereby students can learn about electronics using a hands-on approach which is not only highly effective at teaching students but also improves hand-eye co-ordination as well as grow interest in electronics. Since MitchElectronics kits are aimed at novices and those who are new to electronics they are designed to use low voltage power supplies such as 9V batteries which are inherently safe due to their limited voltage and current capabilities.

MitchElectronics Liability

MitchElectronics kits must be inspected and tested by a competent individual before use and must be constructed by those who are competent to do so. MitchElectronics is not liable for kits and products that are constructed incorrectly or to a poor standard whereby poor standard includes (but not limited to) poor solder connections, overheated components, and damaged components. MitchElectronics is not liable for harm, injury, or damage caused by the misuse of kits and/or products if

- Incorrectly constructed
- Powered by sources other than “portable batteries” or the specified power supply
- Kits used outside their operational range (such as voltage supply, temperature etc.)
- Used as a sub-system (i.e. connected to additional circuits and modules)
- Used in a non-educational environment
- Used in a commercial environment
- Used in any dangerous or potentially hazardous environment
- Purchased from an unauthorised third party

Portable batteries refers to low powered alkali batteries. Lithium-based batteries and those with large current capabilities (such as lead-acid batteries) are not considered portable or safe

The use of the kits or products in the above scenarios automatically voids any warrantee or guarantee of that kit or product.

Kits must be

- Inspected for damage before and after construction
- Inspected for missing parts
- Constructed correctly by a qualified individual
- Used in an appropriate manner (i.e. within operational ranges)
- Purchased from an authorised seller

Those who are not competent to construct, inspect, and test kits and products must be accompanied by a competent individual and that competent individual assumes all responsibility for harm or damages and MitchElectronics is not liable for any harm or damage.

Missing Parts

MitchElectronics is only liable for missing parts for kits that have been purchased within 28 days and that have been purchased directly from www.mitchelectronics.co.uk. MitchElectronics is not liable for any product sold by an unauthorised third party.