Light Sensitive Flash Camera

Preparation

1. Be aware that even though the inductor has two leads and they aren't the same length, this is not a polarized device. It makes no difference which way it is plugged into the circuit board.
2. Review the pin outs on all the devices.
3. Review how to solder.
4. This circuit works when the phototransistor is covered with the pen cap.

Setup

1. Place on the table:

   The cardboard lid which has the following components

   555 timers
   TL499A DC/DC converters
   47uH inductors
   Phototransistors
   100 ohm resistors
   510 ohm resistors
   4.7K resistors
   27K resistors
   100K resistors
   10uf capacitors
   33uf capacitors
   MAC 228 Triacs
   Small protoboards
   1.5 V AA batteries
   Insulated paperclips

   The box of camera bodies
   Solder
   Black electrical tape
   Box of wire pieces

   Place at each work bench

   1 soldering iron
   1 brass sponge
   1 coaxial cable
   1 BNC to minigrabber adapter

Component Instruction

555 Timer – you already know how to use this. The components selected will give a pulse approximately once every 7 seconds.

TL499A – DC/DC converter. This device takes the 1.5 volts from the camera and boosts it up to 8+ volts. Its purpose is to provide enough voltage to power the 555 timer. The 47uh inductor must be installed to work. The leads on the inductor are not the same length and this usually means the device is polarized. This is not the case for this component. There is no polarity involved. Plug it in any way you want. You must have the 33uf capacitor installed or you will not get the correct voltage out from the DC/DC converter.

MAC 228 – Triac switch. This is a high current switch. When the pulse from the timer turns on the switch it momentarily connects the camera trigger to ground. When the camera trigger is grounded the light will flash.

How the complete circuit works

There are two trigger signals we have to deal with and they are both independent of one another.

The first is the 555 timer trigger, which is controlled by the action of the phototransistor.

The second is the camera trigger signal. The camera trigger signal is created within the camera body and is completely separate from the timer trigger signal.

When light shines on the phototransistor the 8+ volts at the collector will be connected to the timer trigger input. This is because when light hits the phototransistor it goes into saturation and acts like a closed switch. With the timer trigger input held high at a constant 8+ volts the trigger input never cycles to allow the timer to function. With the trigger to the timer held constant it essentially shuts off the timer.

When no light shines on the phototransistor the transistor is in cutoff and acts like an open circuit. Now that the phototransistor is shut off the trigger input of the timer is connected to the threshold pin, pin 2 to pin 6. The timer is in astable mode and is sending out a continuous stream of pulses approximately every 7 seconds. In astable mode the voltage at pin 6 is always increasing and decreasing. Since pin 6 is connected to pin 2 the timer trigger input is now also increasing and decreasing. As the timer trigger input goes up and down the timer will output a pulse.

The output pulse of the timer closes the SCR switch momentarily. This allows the camera trigger signal to go to ground. When the camera trigger signal goes to

ground the xenon bulb will flash. The button at the top of the camera body grounds the camera trigger signal just like the SCR switch does.

How to solder

Contrary to popular opinion you need to have the tip of the iron wet with solder whether you are trying to attach a component or remove it. This is because you need good heat transfer for either function other wise you may burn up the device you are applying the heat to.

After the iron is hot stab it several times into the brass sponge to remove any contamination from the tip. Tin the tip by applying a small amount of solder to the tip.

Before attempting to solder wire to the camera circuit, strip away about one-half inch of insulation. Melt enough solder on the tip to create a large drop. Slide the exposed wire through the solder to coat the wire. You do not have to see solder clinging to the wire in order to have it tinned. Run it through once or twice and the solder will cling to it. The insulation will no doubt shrink back due to the heat. Hold the wire in place on the camera and use the diagonal cutters to trim away any excess wire. Ideally when the wire is attached to the camera the insulation ends at the solder joint.

Tin all the wires. REMEMBER – use red wire for camera power and black for ground.

Clean off the iron tip with the brass sponge. Tin the tip of the iron and place the wire in position on the camera circuit. Hold the iron against the wire. You want the heat to go through the tip then the wire and finally to the camera solder dot. Do not put the iron on the wire and then plunge the solder against the tip. This will create a cold solder joint and the wire will break away. The tip, wire, and solder dot must all be at the same temperature to get a good connection. Once you see that the connection is covered with liquid solder remove the iron and DO NOT let go of the wire. The solder is still molten and if you let go of the wire it may pop off. Continue to hold onto the wire until the solder solidifies. You can blow on it to cool off the solder quicker.

Many students make a solder bridge at the camera trigger point. Emphasize that you can’t have the solder flow all over the camera. The connections must be neat.

When you are finished clean off the iron tip and melt a big glob of solder onto the tip and then turn off the iron. This will save the tip for future use.

In this laboratory, you will learn:

- How to solder
- How to trigger a flash circuit in a disposable camera

Introduction

- This lab is designed to teach you how to trigger the flash in a disposable camera with a light detecting circuit. When operating properly, the flash should go off every 7 seconds for as long as no light is getting into the IR detector.

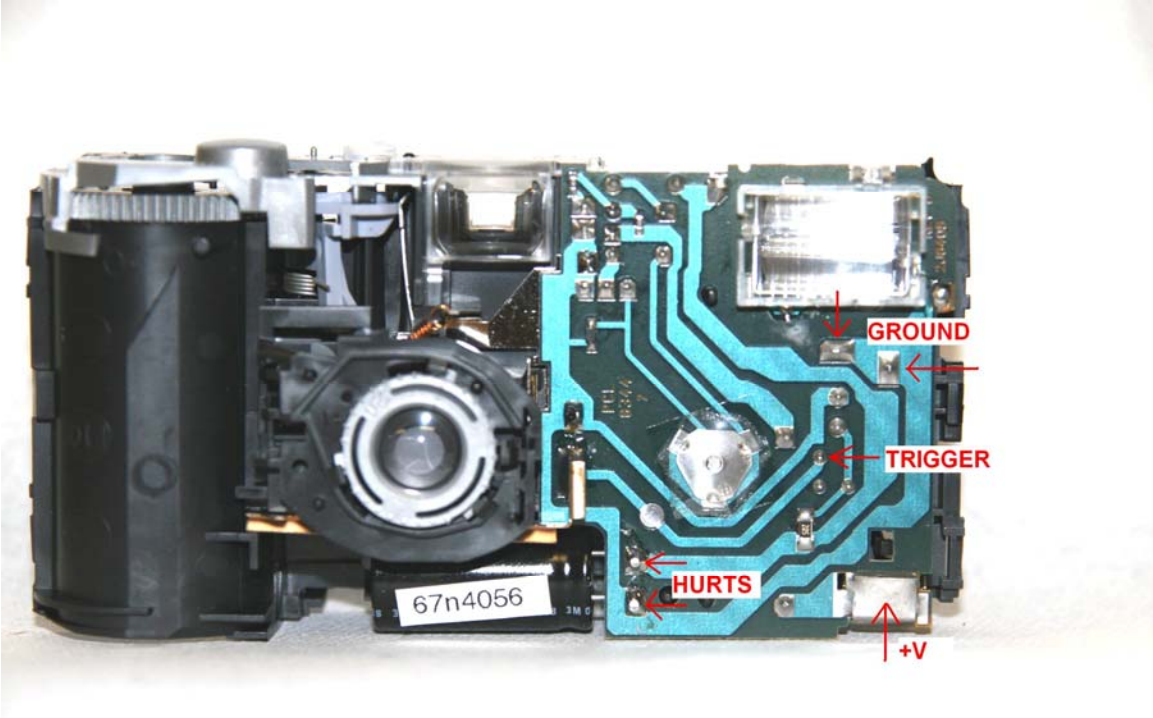
Background

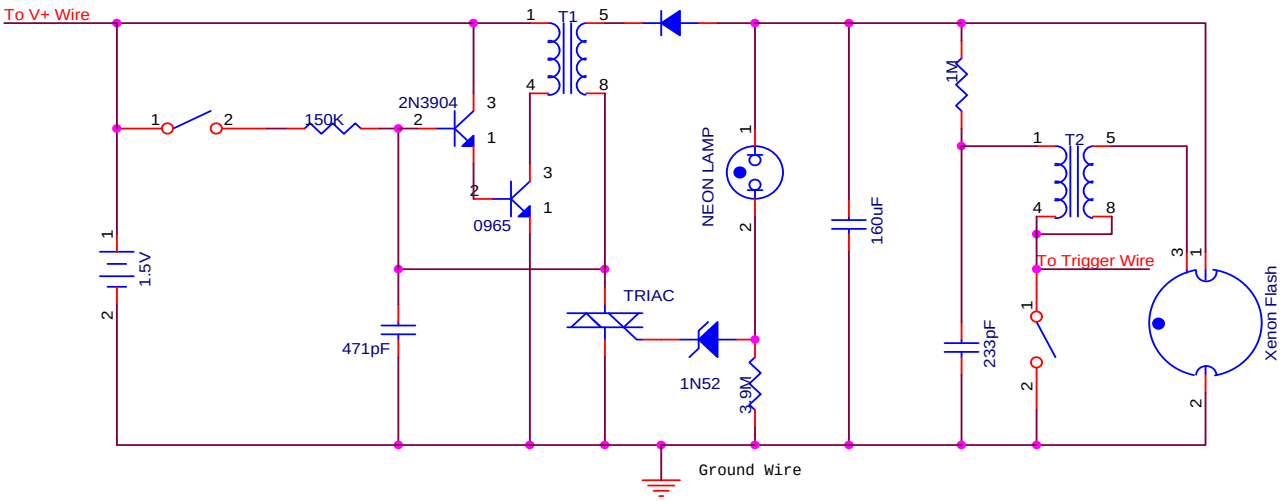
In lecture you learned that a transformer could be used to take a small AC signal and create a large one, or vice-versa. The Flash camera uses this property to create a large rectified AC signal to charge a capacitor to 320 volts. The energy from this cap is used to ignite the gas in the Xenon flash. Xenon is normally a good insulator, however when it is charged separately by another high voltage field it starts to become more of a conductor which then allows the field around it to be come grater, which in turn makes it even more of a conductor. This avalanche effect eventually brings the resistance down so low (to around 1 ohm) that the large capacitor that was holding 320V discharges and causes a bright light. After all the current has dissipated, the Xenon gas acts like an insulator again and the process can start over again.

The charge time for the capacitor is around 7 seconds, so a 555 timer will be used to trigger the flash every seven seconds.

WARNING: The TA's will show you how much energy the capacitor holds. **320 DC volts will not kill you, but it will hurt if it burns you.** Solder the circuit without the battery in place. Remember to discharge the circuit (the TA will show you how) before the TA helps you. The TA will also show you how to prevent accidental pain by insulating the camera with electrical tape after you do your soldering.

At the end of this lab, you may keep your camera and protoboard.





PART 1: Soldering wire to the camera

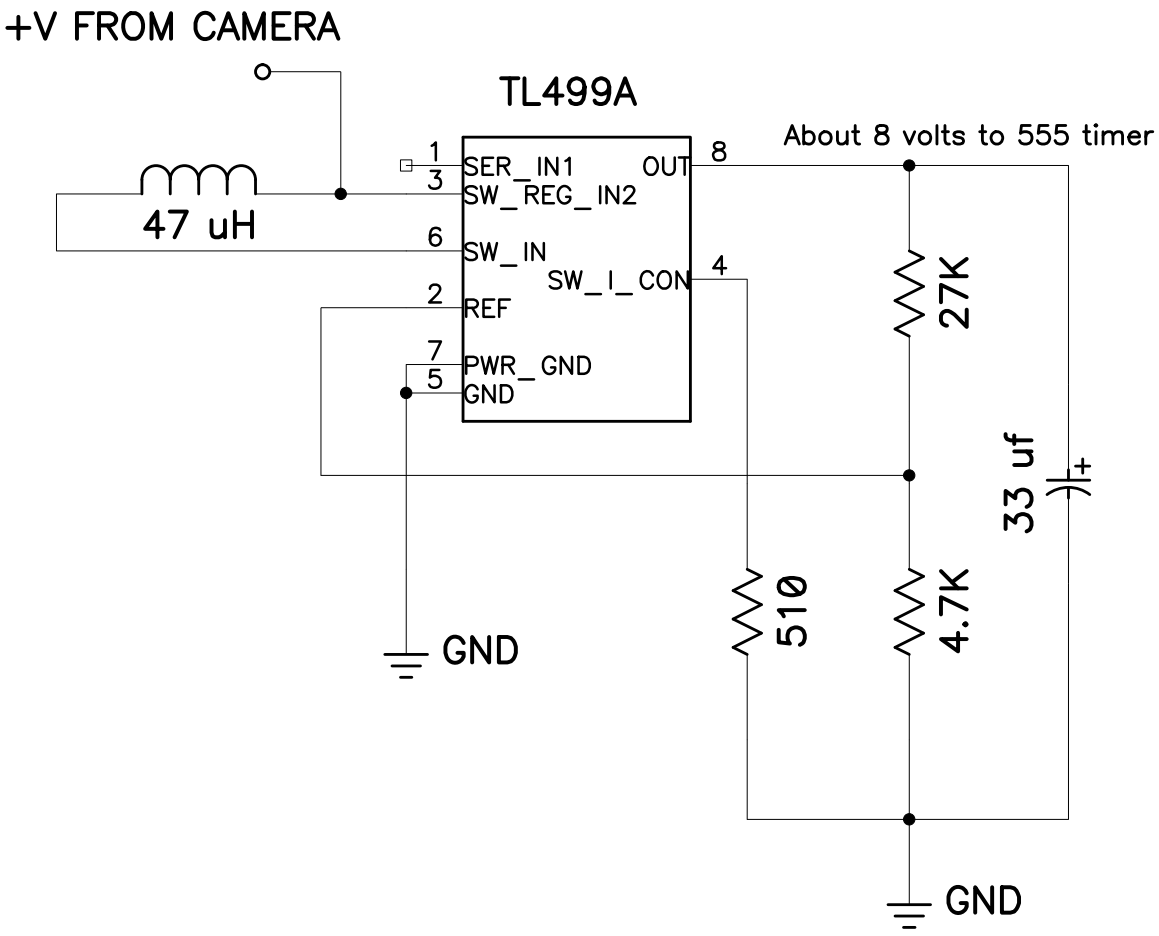
The photo above shows where you need to solder the wires. Please choose appropriate color for each wire. Make Red the V+ wire and Black the GND wire. This will avoid confusion. The trigger wire may be any color you wish.

A good solder joint is created by heating the parts you want to connect before applying the solder. Tin the iron tip before applying solder to the joint. Place the solder iron tip on both the pad on the circuit board and the wire end. Place solder near the soldering iron tip and the pad and wire. You should be making a

neat solder blob that covers the pad and the wire. Pull away the solder and the iron. Let it cool and test the connection by pulling on the wire lightly.

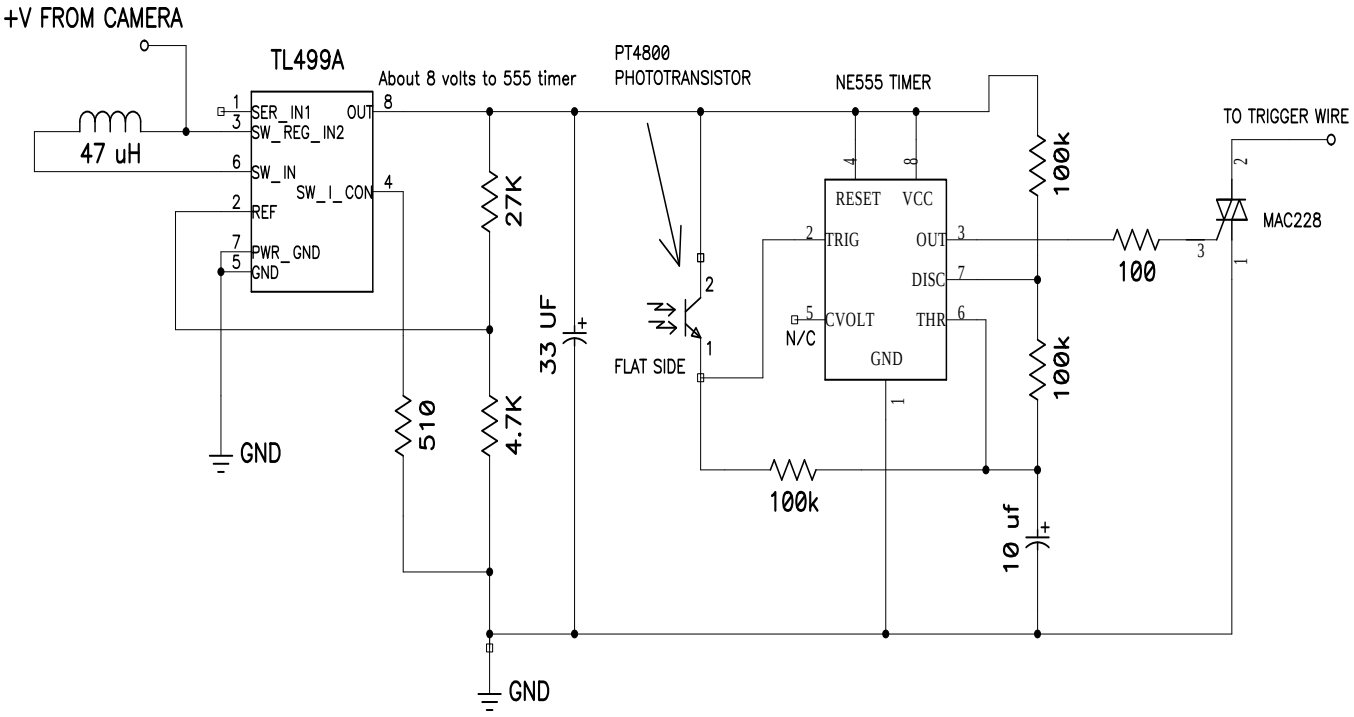
PART 2: The DC-DC converter

Build this circuit:



PART 3: The Trigger Circuit

Build this circuit:



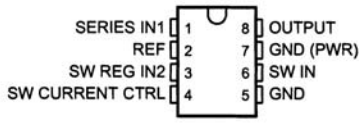
You should read the data sheet for the MAC228 triac for how to hook it up. Basically it is a high voltage switch. When a small current from the output of the 555 timer goes into the gate (pin 3) of the switch, it connects the camera trigger signal to ground and allows the flash to occur. A large AC current flows through the switch at this time.

TL499A
WIDE-RANGE POWER-SUPPLY CONTROLLERS

SLVS029G – JANUARY 1984 – REVISED SEPTEMBER 2001

- **Internal Series-Pass and Step-Up Switching Regulator**
- **Output Adjustable From 2.9 V to 30 V**
- **1-V to 10-V Input for Switching Regulator**
- **4.5-V to 32-V Input for Series Regulator**
- **Externally Controlled Switching Current**
- **No External Rectifier Required**

P OR PS PACKAGE
(TOP VIEW)



description

The TL499A is an integrated circuit designed to provide a wide range of adjustable regulated supply voltages. The regulated output voltage can be varied from 2.9 V to 30 V by adjusting two external resistors. When the TL499A is ac-coupled to line power through a step-down transformer, it operates as a series dc voltage regulator to maintain the regulated output voltage. With the addition of a battery from 1.1 V to 10 V, an inductor, a filter capacitor, and two resistors, the TL499A operates as a step-up switching regulator during an ac-line failure.

The adjustable regulated output voltage makes the TL499A useful for a wide range of applications. Providing backup power during an ac-line failure makes the TL499A extremely useful in microprocessor memory applications.

The TL499AC is characterized for operation from –20°C to 85°C.

AVAILABLE OPTIONS

T_A	PLASTIC DIP (P)	PLASTIC SMALL-OUTLINE (PS)
–20°C to 85°C	TL499ACP	TL499ACPS

The PS package is available taped and reeled. Add the suffix R to device type (e.g., TL499ACPSR).

TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

MAC228A Series

Preferred Device

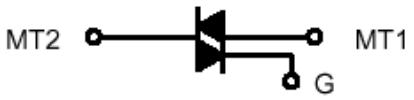
Sensitive Gate Triacs

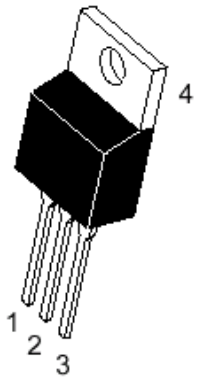
Silicon Bidirectional Thyristors

Designed primarily for industrial and consumer applications for full wave control of ac loads such as appliance controls, heater controls, motor controls, and other power switching applications.

- Sensitive Gate Triggering in 3 Modes for AC Triggering on Sinking Current Sources
- Four Mode Triggering for Drive Circuits that Source Current
- All Diffused and Glass–Passivated Junctions for Parameter Uniformity and Stability
- Small, Rugged, Thermowatt Construction for Low Thermal Resistance and High Heat Dissipation
- Center Gate Geometry for Uniform Current Spreading
- Device Marking: Logo, Device Type, e.g., MAC228A4, Date Code

TRIACS
8 AMPERES RMS
200 thru 800 VOLTS





TO–220AB
CASE 221A
STYLE 4

PIN ASSIGNMENT	
1	Main Terminal 1
2	Main Terminal 2
3	Gate
4	Main Terminal 2

PT4800/PT4800F/PT4810 PT4810F/PT4850F

Thin Type Phototransistor

■ Features

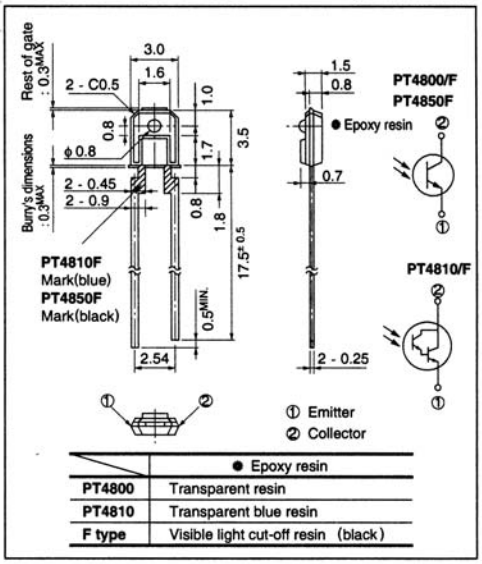
1. Thin type package (Thickness : 1.5mm)
2. Visible light cut-off type :
   PT4800F/PT4810F/PT4850F
3. Single phototransistor output :
   PT4800/PT4800F/PT4850F
   Darlington phototransistor output:
   PT4810/PT4810F
4. Thin type

■ Applications

1. VCRs
2. Floppy disk drives

■ Outline Dimensions

(Unit : mm)



	● Epoxy resin
PT4800	Transparent resin
PT4810	Transparent blue resin
F type	Visible light cut-off resin (black)

■ Absolute Maximum Ratings

(Ta = 25°C)

Parameter		Symbol	Rating	Unit
Collector-emitter voltage		V_{CEO}	35	V
Emitter-collector voltage		V_{ECO}	6	V
Collector current	PT4800/PT4800F/PT4850F	I_C	20	mA
	PT4810/PT4810F		50	
Collector power dissipation		P_C	75	mW
Operating temperature		T_{opr}	- 25 to + 85	°C
Storage temperature		T_{stg}	- 40 to + 85	°C
*1Soldering temperature		T_{sol}	260	°C

*1 For 3 seconds at the position of 1.8mm from the bottom face of resin package