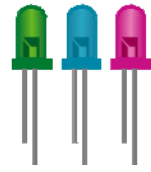
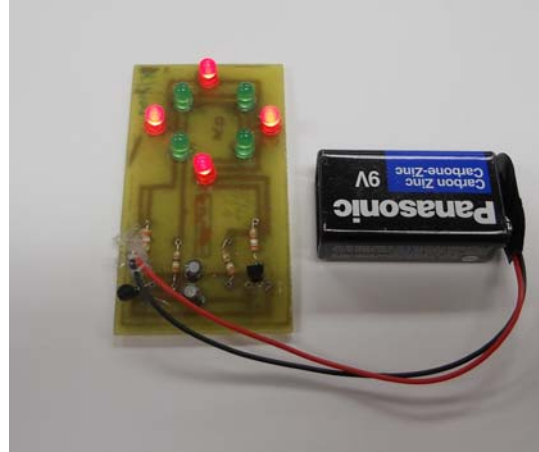


LED Flasher Project



Procedure

1. Obtain from the teacher a piece of copper board and an image.
2. Using the image as a gauge, cut the copper board to the correct size using the sheet metal shear. (***Review the safe operation of the shear.***) Then scour the copper board with a copper scrub pad.
3. At the back table and place a couple of pieces of brown paper towel down on the bench. Place the copper board on top with the copper face up. Then place another piece of paper towel on top of the copper board.
4. Using a clothes iron placed on the highest setting, start to iron the board (through the paper towel) for 4 minutes moving in a circular pattern.
5. Peel back the paper towel and place the image on the hot copper board so that the text can read. Be sure not to smudge the image. Then return the paper towel on top of the image and board and heat for another 2 minutes, continuing the circular movement.
6. Remove the paper towel and place the copper board in dish of cold water (this helps the transfer of toner from the image to the board).
7. At a corner, grab the image and lift straight up while keeping the image taught. (*Like opening a door rather than rolling back covers on a bed.*)
8. Hopefully most of the toner has been left on the board. If 80% is still there, take a permanent marker and fill in the missing parts. **Note:** All parts that should be covered (protected) must be coloured in or the etchant solution will eat away the copper. Make sure you write your name on the board. Make sure the letters are thick.
9. Give the board to your instructor and the board will be place in ferric chloride where the exposed copper will be etched away leaving the text, pads and pathways.
10. The toner and marker have done their job. Take the copper scrub pad and scrub off the toner and marker.
11. Give the board to your instructor so that the board can be tinned. This takes around 30 seconds, so stick around.

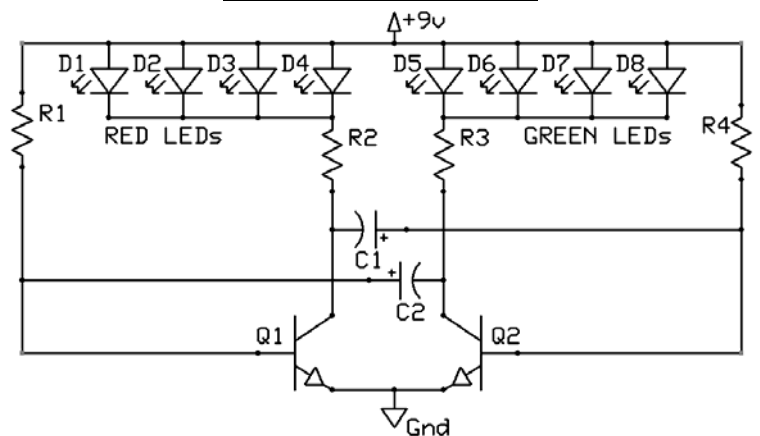


12. Using the marker, place a dot in the center of all the pads on the board. Using the drill press, drill a hole through the pad. (***Review the safe operation of the drill press. Make sure you wear your safety glasses!***)
13. Get the components from the instructor and start populating the board. Make sure the components are neatly placed close to the printed circuit board with leads bent at 90° if required.
14. Solder the components to the board. (***Review how to safely operate a soldering iron. Make sure you wear your safety glasses!***)
15. Trim the leads and test the board.

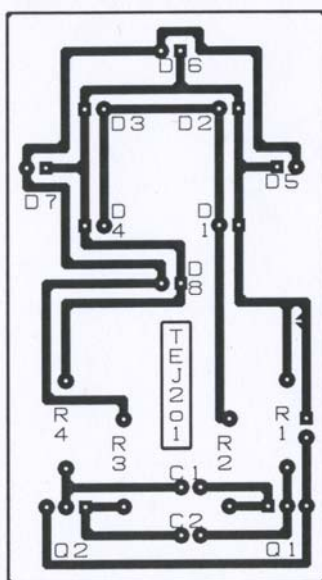
Components

- C1 10uF Capacitor
- C2 10uF Capacitor
- D1 – D4 Green Diode
- D5 – D8 Red Diode
- Q1 – 2N3904 Transistor
- Q2 – 2N3904 Transistor
- R1 – 390Ω Resistor
- R2 – 39KΩ Resistor
- R3 – 39KΩ Resistor
- R4 – 390Ω Resistor





Schematic Diagram



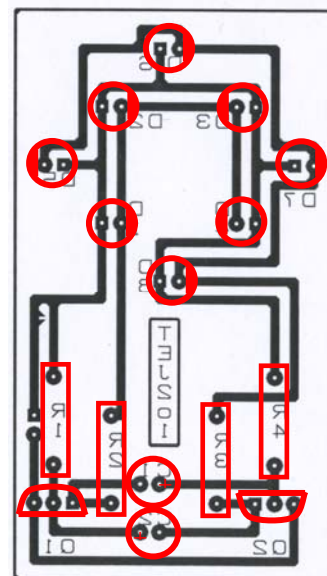
Solder Side



Legend

- Resistor 
- Capacitor 
- Transistor 
- LED 
 LEAD CLOSEST TO THE FLAT EDGE OF DIODE IS THE CATHODE

Component Side



Name: _____

Project Evaluation Sheet

Comments:

Category	Level 1	Level 2	Level 3	Level 4	Mark
KNOWLEDGE					
• Works in a Safe Manner	Rarely	Somewhat	Usually	Always	/10
THINKING					
• Proper Placement of Components	Rarely	Somewhat	Usually	Always	/10
COMMUNICATION					
• Ability to Identify Components on Schematic	Rarely	Somewhat	Usually	Always	/10
APPLICATION					
• Drilling Holes Accurately	Rarely	Somewhat	Usually	Always	/5
• Solder is the Right Amount, Shiny and properly shaped	Rarely	Somewhat	Usually	Always	/5
				Total:	/40

**** NOTE: This rubric must be handing in with your final project before it will be marked. ****