ELECTRONIC'S WORKSHOP

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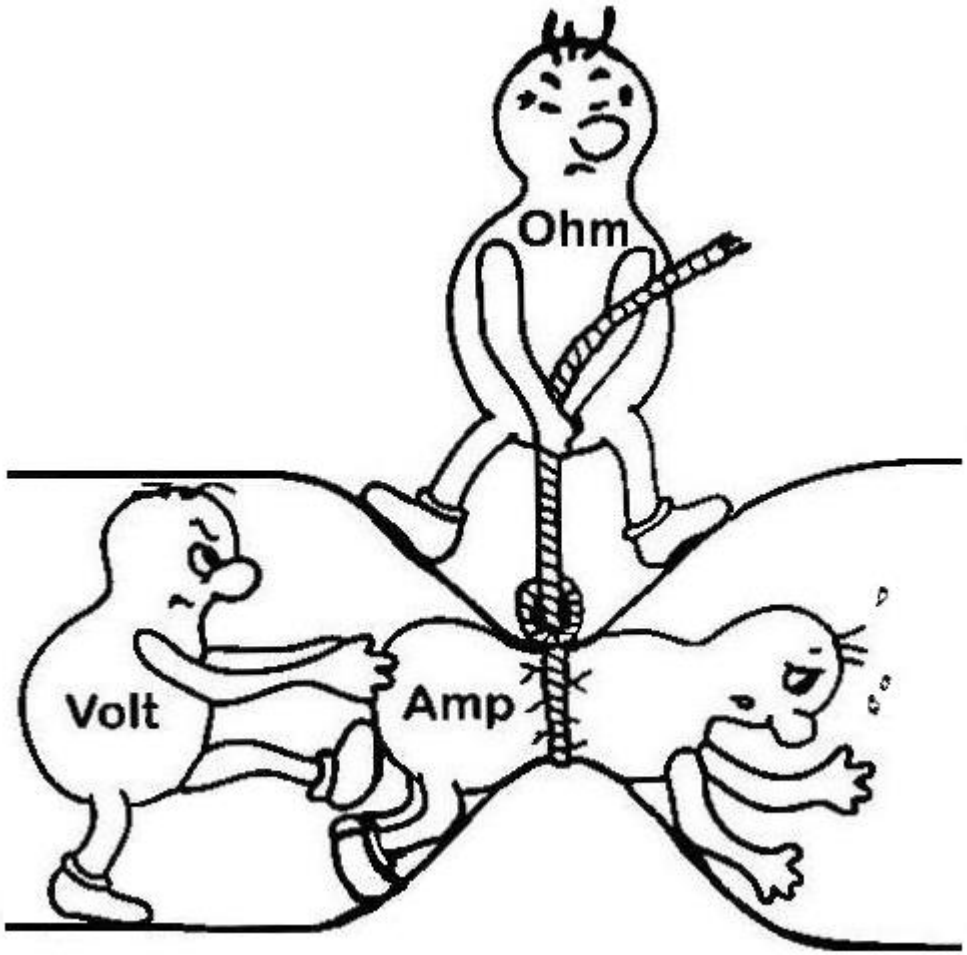
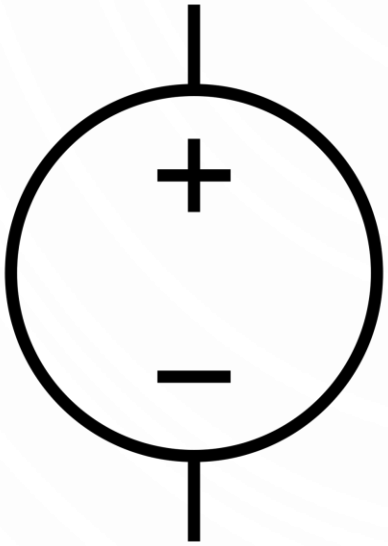
HACKER {school}

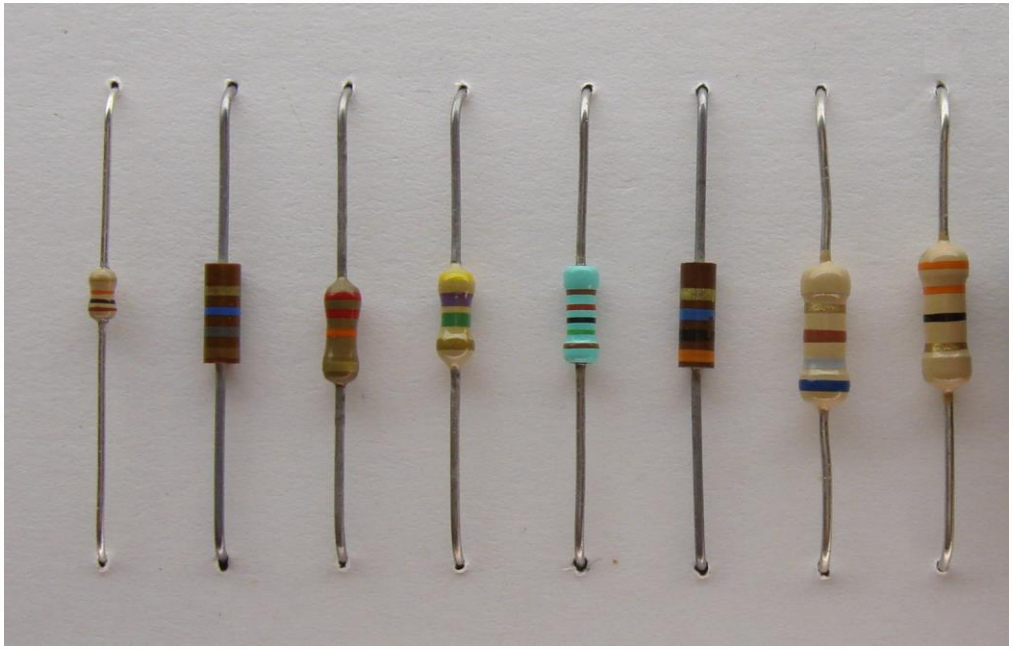
Resistor, Voltage and Current



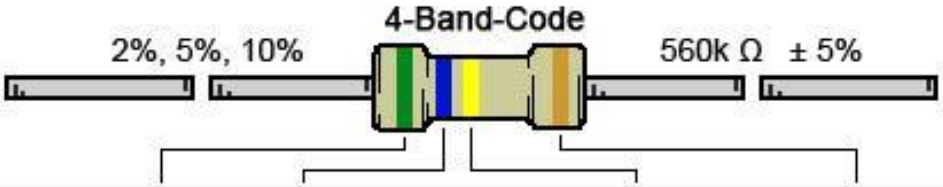
VOLTAGE SOURCE



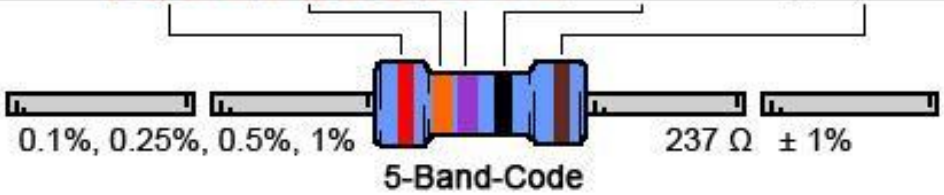
RESISTORS - OHM



COLOUR CODE



COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black	0	0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8		± 0.05%
White	9	9	9		
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)



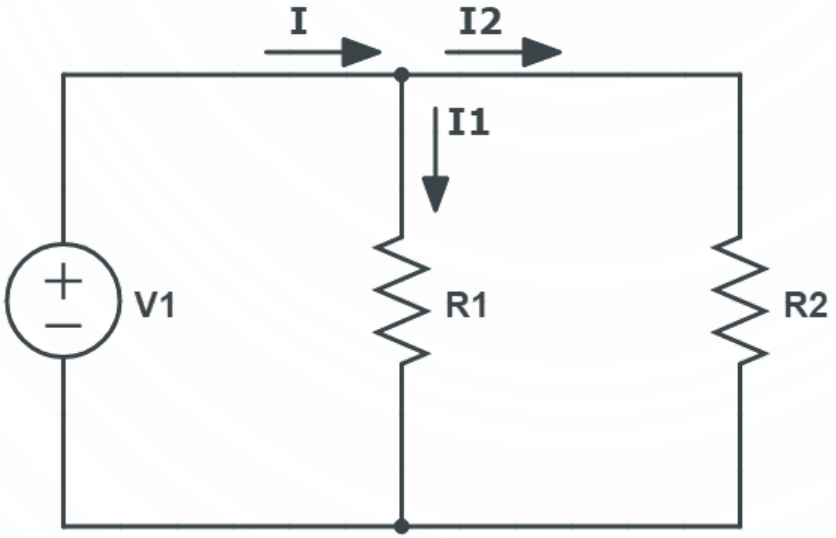
OHM'S LAW

$$R = \frac{U}{I}$$

R – ohm (Ω)
U – volt (V)
I – ampere (A)

KIRCHOFF'S CURRENT LAW

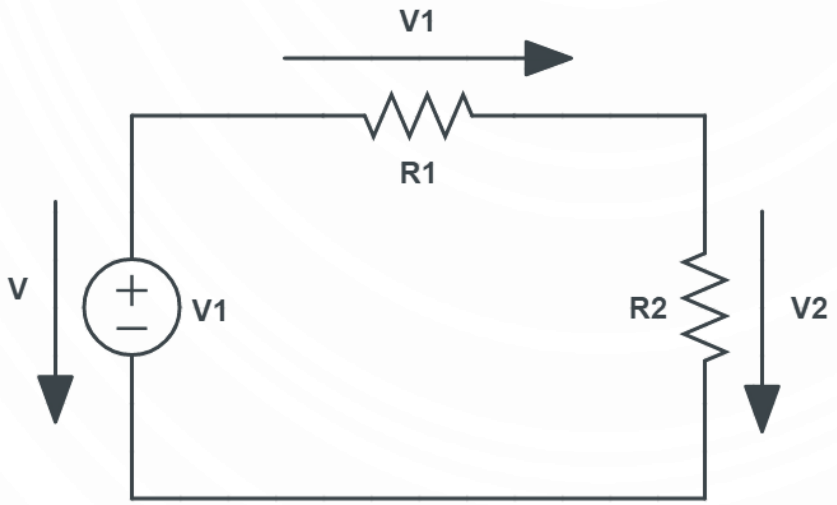
For each node, the sum of the currents that go in that node is equal to the sum of the currents that leave that same node.



$$\sum_{k=1}^{n} I_k = 0$$

KIRCHOFF'S VOLTAGE LAW

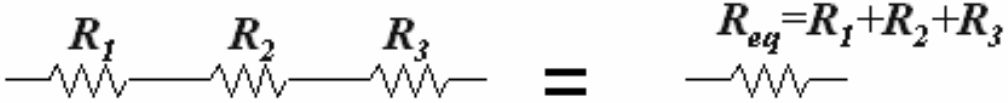
The sum of the voltages around a mesh is zero.



$$\sum_{k=1}^{n} V_k = 0$$

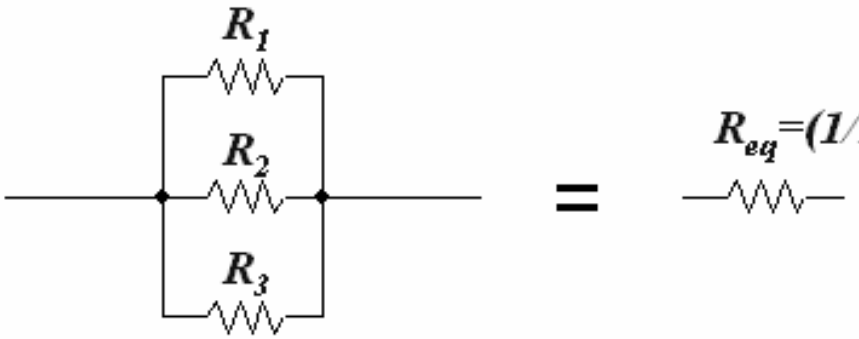
SERIE AND PARALLEL

Series:



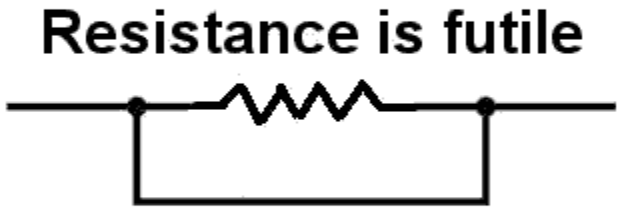
$$R_{eq}=R_1+R_2+R_3$$

Parallel:

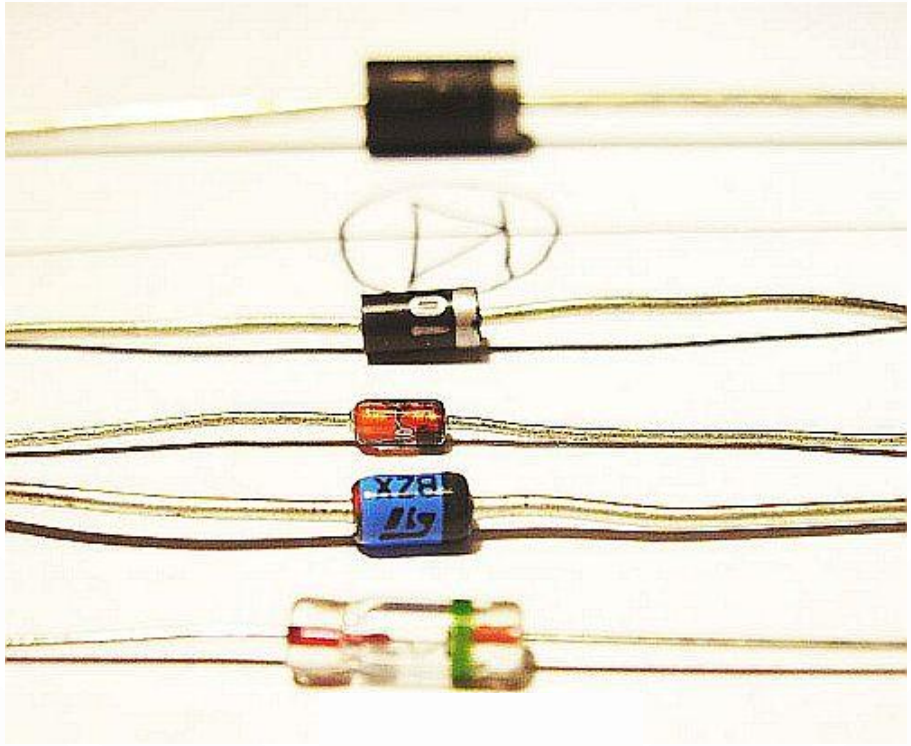


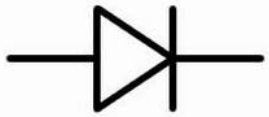
$$R_{eq}=(1/R_1+1/R_2+1/R_3)^{-1}$$

SHORT CIRCUIT

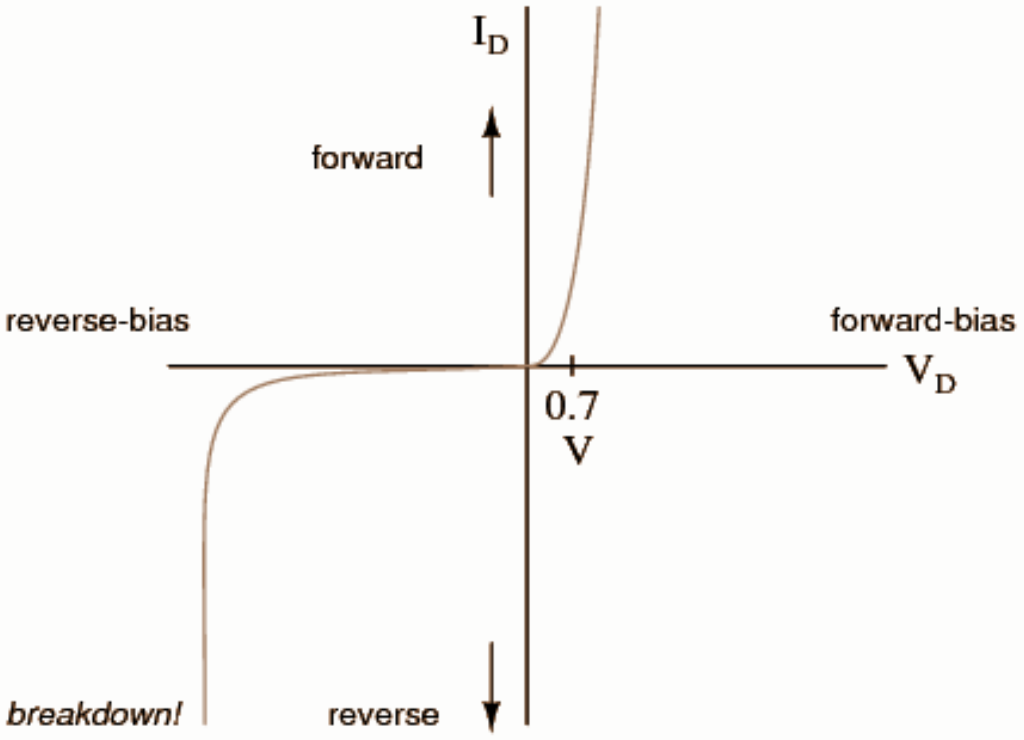


DIODES

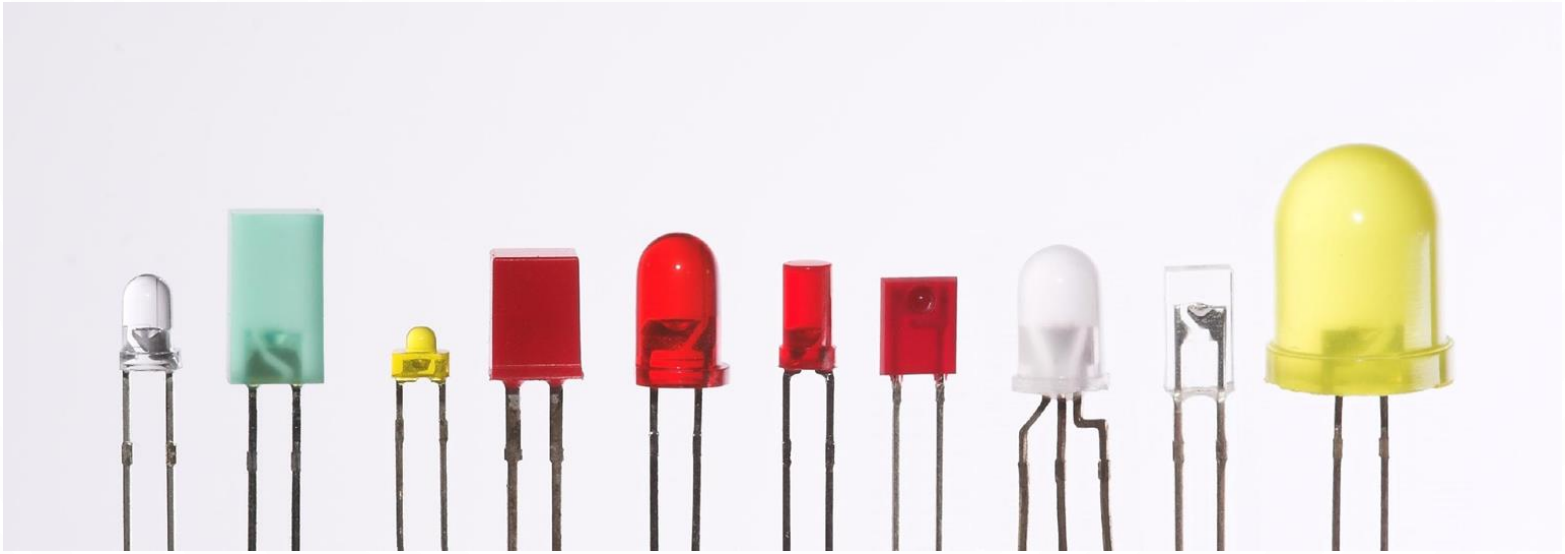


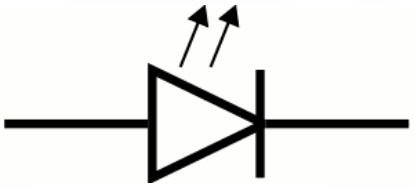


DIODE'S CHARACTERISTICS



LED – LIGHT EMITTING DIODE





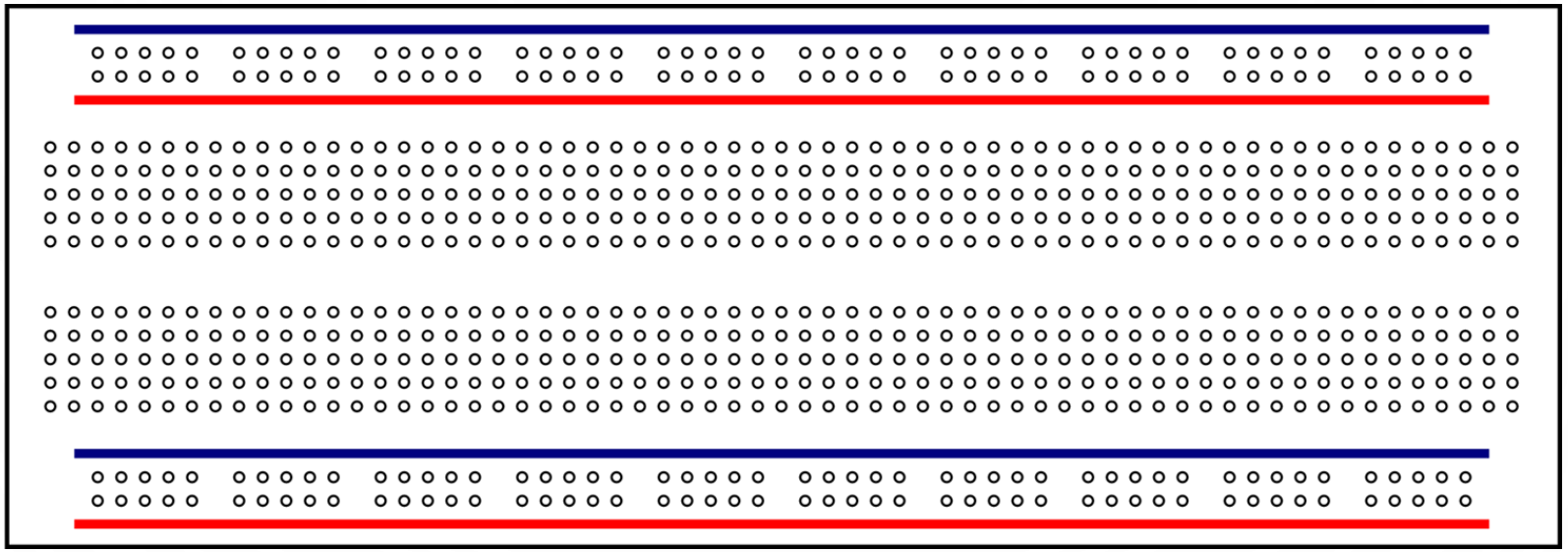
LED – THRESHOLD VOLTAGE

Colour	Approx. Forward Voltage Vf (V)
Red	1.7
HE Red*	2.0
Bright Red	2.3
Orange	2.0
Yellow	2.1
Green	2.2
Blue	3.2
White	3.2

*HE - High Efficiency

103SV

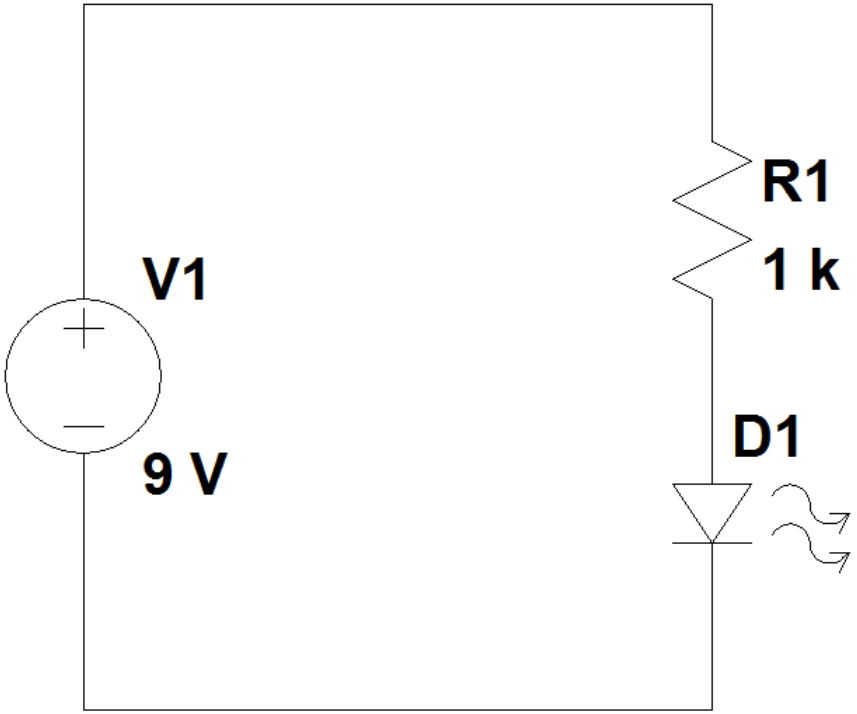
BREADBOARDS



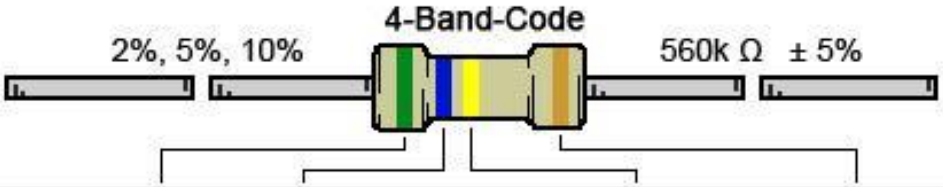
V+

V-

EXPERIENCE 1 – LED AND RESISTOR



COLOUR CODE



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Violet	7	7	7	10MΩ	± 0.10% (B)
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White	9	9	9		
Gold				0.1Ω	± 5% (J)
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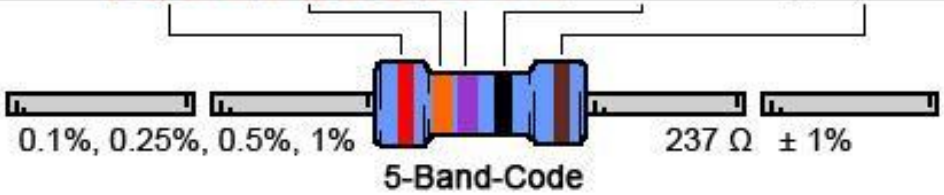


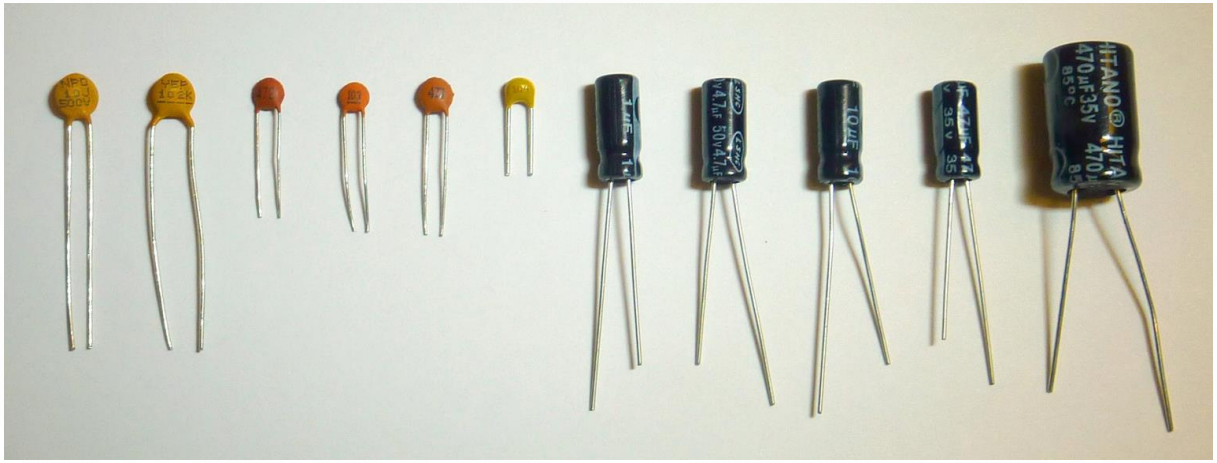
HOW TO DIMENSION A RESISTOR TO A LED

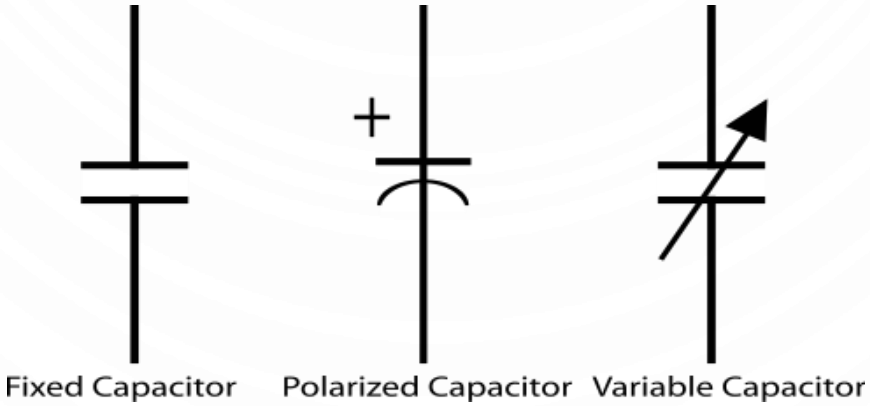
We want to connect a LED, using a 9 V battery and a resistor. What's the appropriate resistor value to the following LEDs, in order to turn up the LED with maximum intensity?

- Red LED, Vf = 1,7 V, Imax = 10 mA
- Yellow LED, Vf = 2,1 V, Imax = 20 mA
- White LED, Vf = 3,2 V, Imax = 20mA

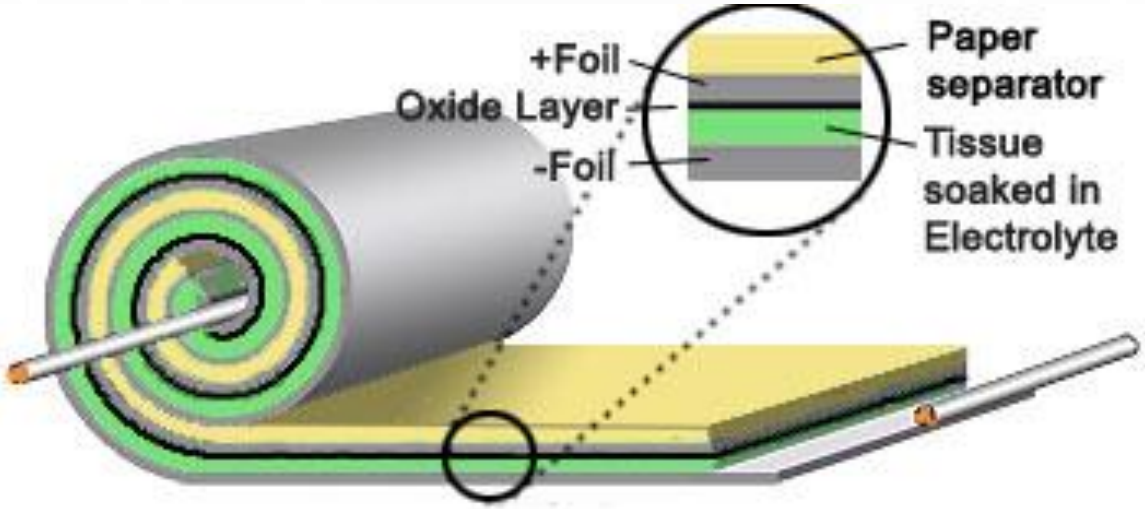
MULTIMETERS

CAPACITORS

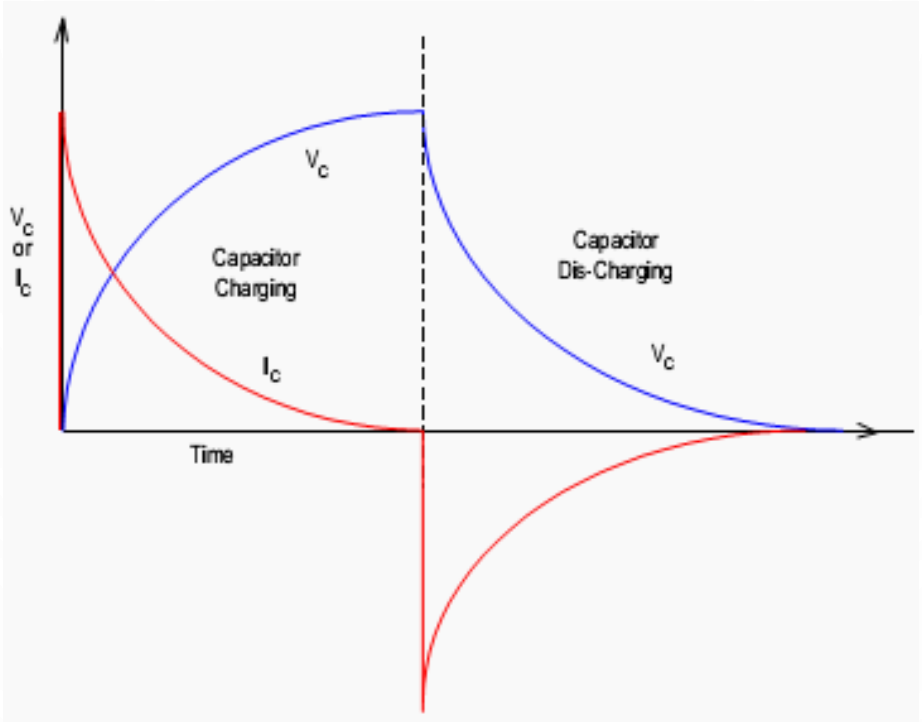

HITANO HITA
470uF35V
85°C


+
Fixed Capacitor
Polarized Capacitor
Variable Capacitor

CAPACITORS


+Foil
Oxide Layer
-Foil
Paper separator
Tissue soaked in Electrolyte

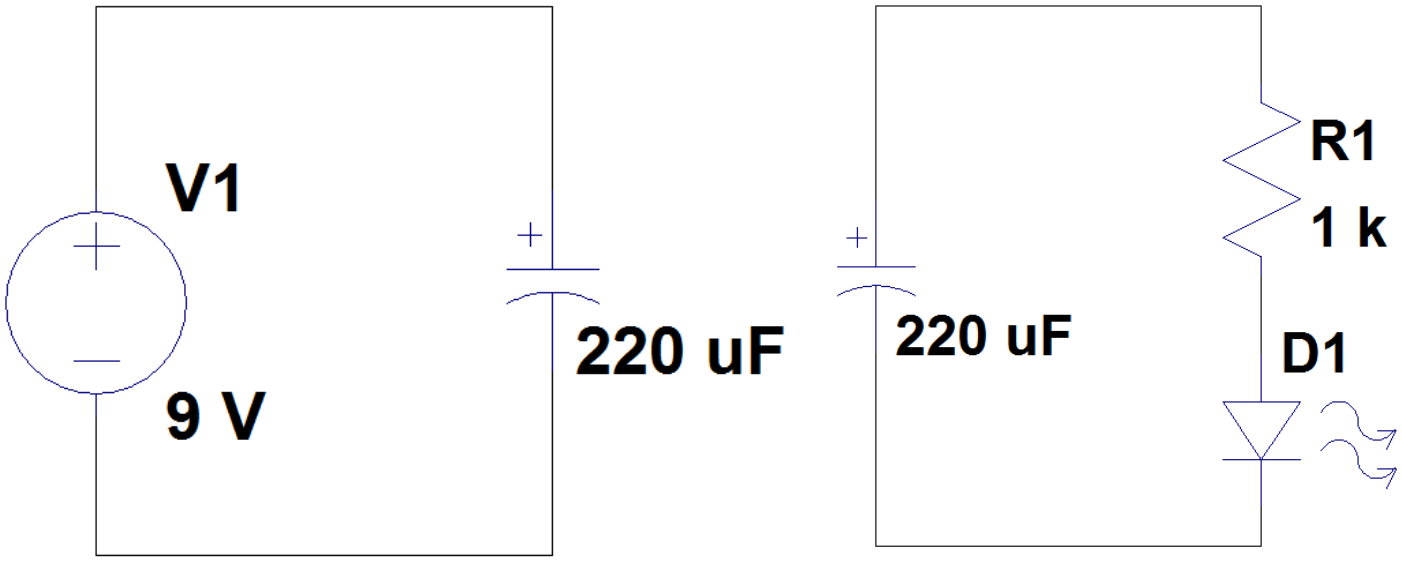
CAPACITORS



$$C = \frac{Q}{V}$$

$$I(t) = \frac{\mathrm{d}Q(t)}{\mathrm{d}t} = C\frac{\mathrm{d}V(t)}{\mathrm{d}t}$$

EXPERIENCE 3 – CHARGE A CAPACITOR

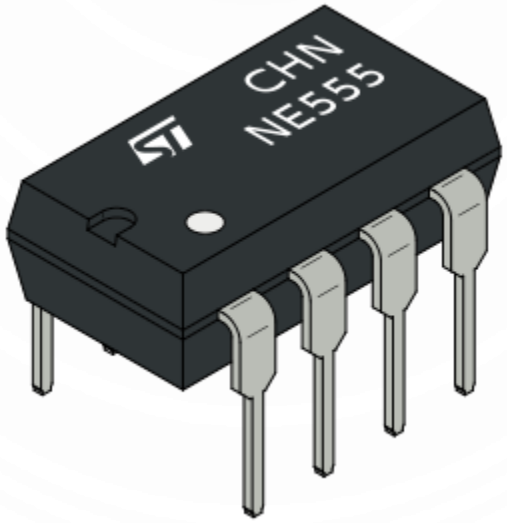


charging...

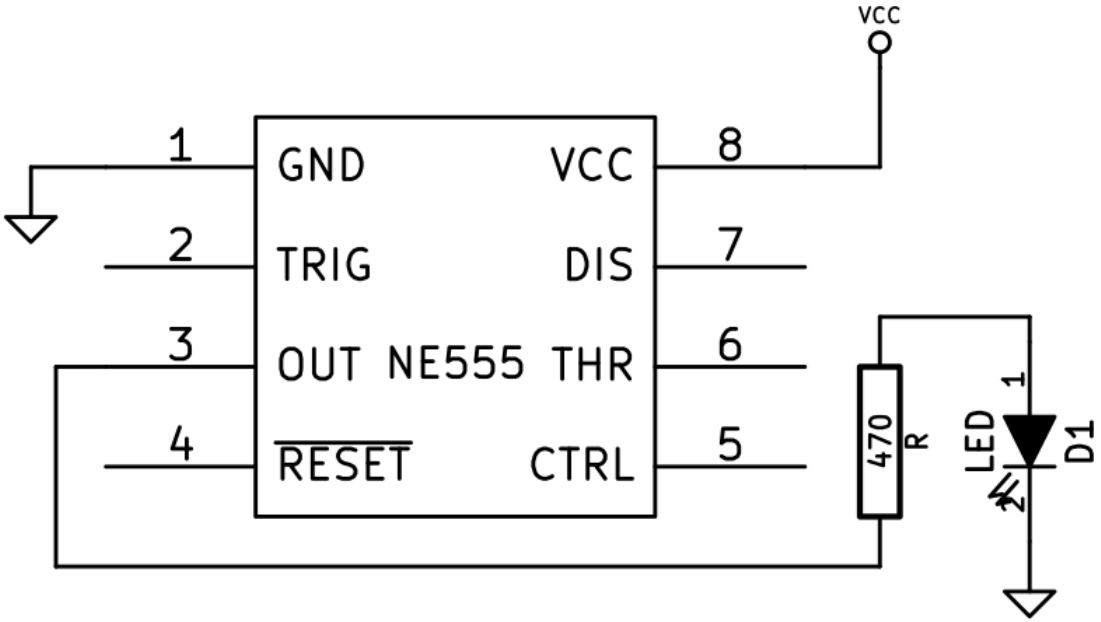
discharging

The capacitor is electrolytic. Don’t forget it has polarity!

INTEGRATED CIRCUITS

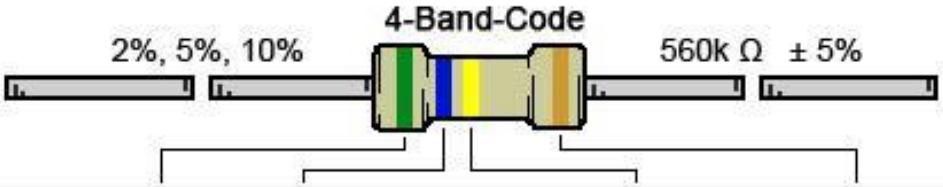


EXPERIENCE 4 – CREATE A SQUARE WAVEFORM



The remaining connections can be seen in the datasheet, circuit for astable operation

COLOUR CODE



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White	9	9	9		
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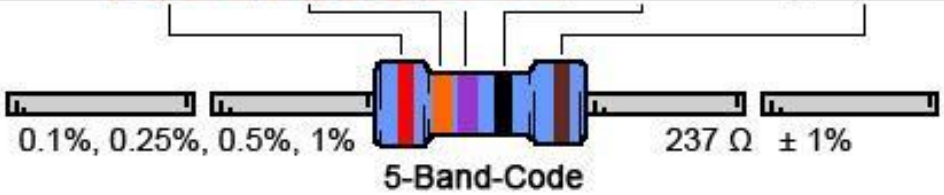
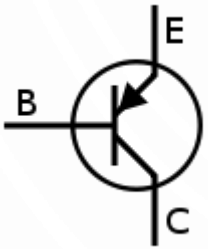
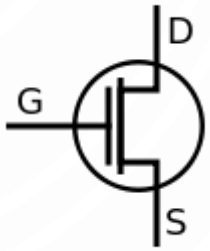


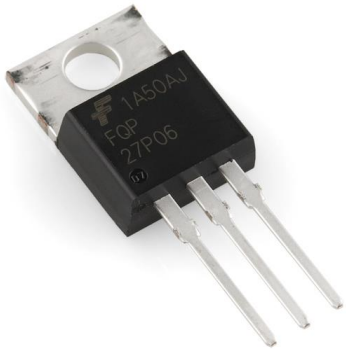
TRANSISTOR



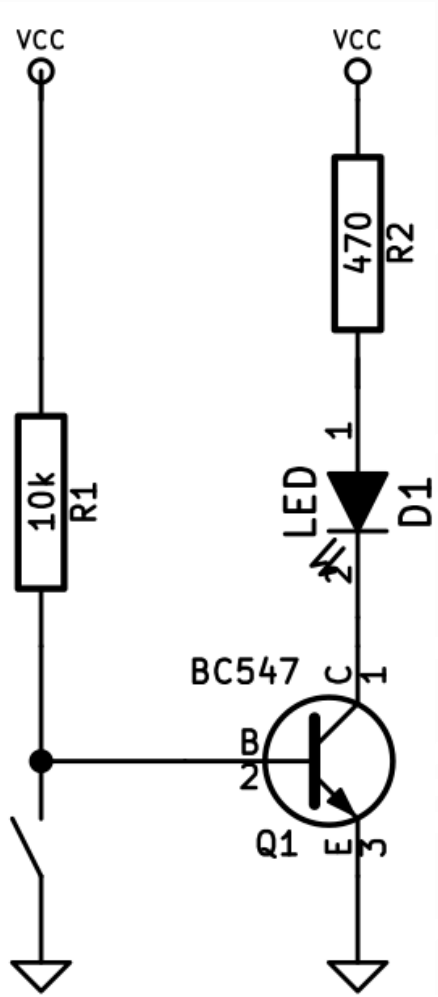
BJT



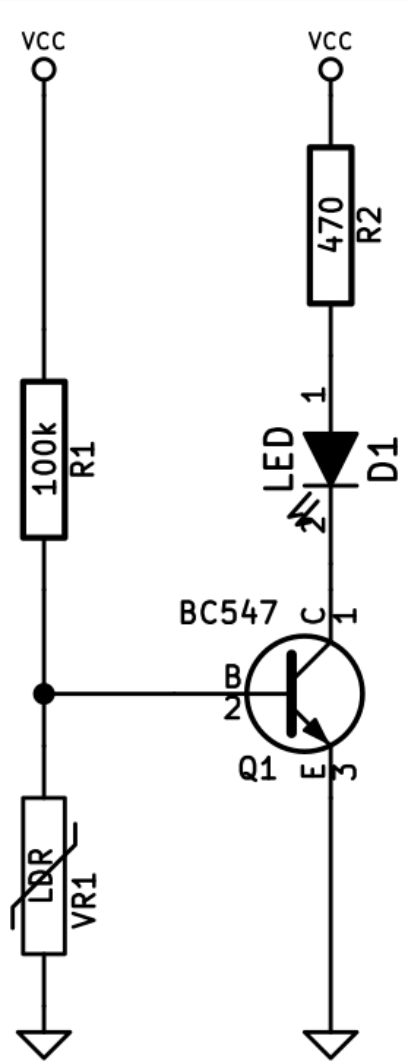
MOSFET



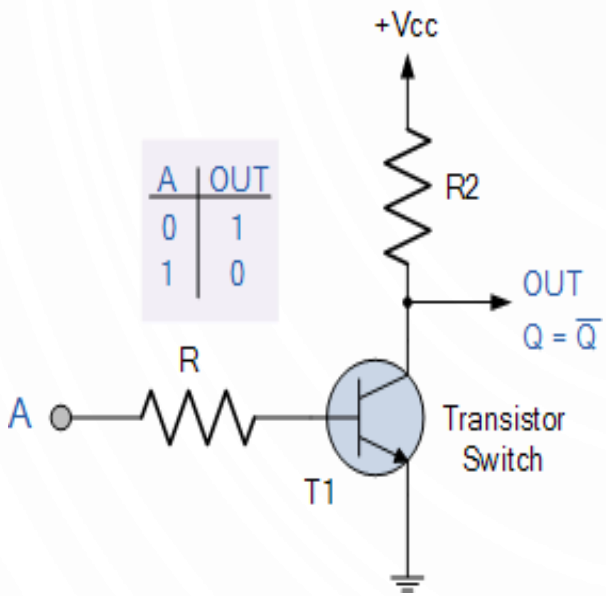
EXPERIENCE 6



EXPERIENCE 7 – LIGHT SENSOR

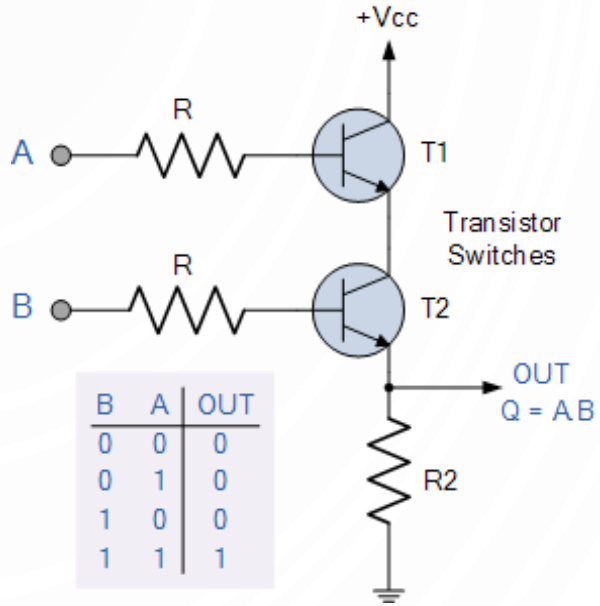


TRANSISTORS AS LOGIC GATES



A	OUT
0	1
1	0

NOT

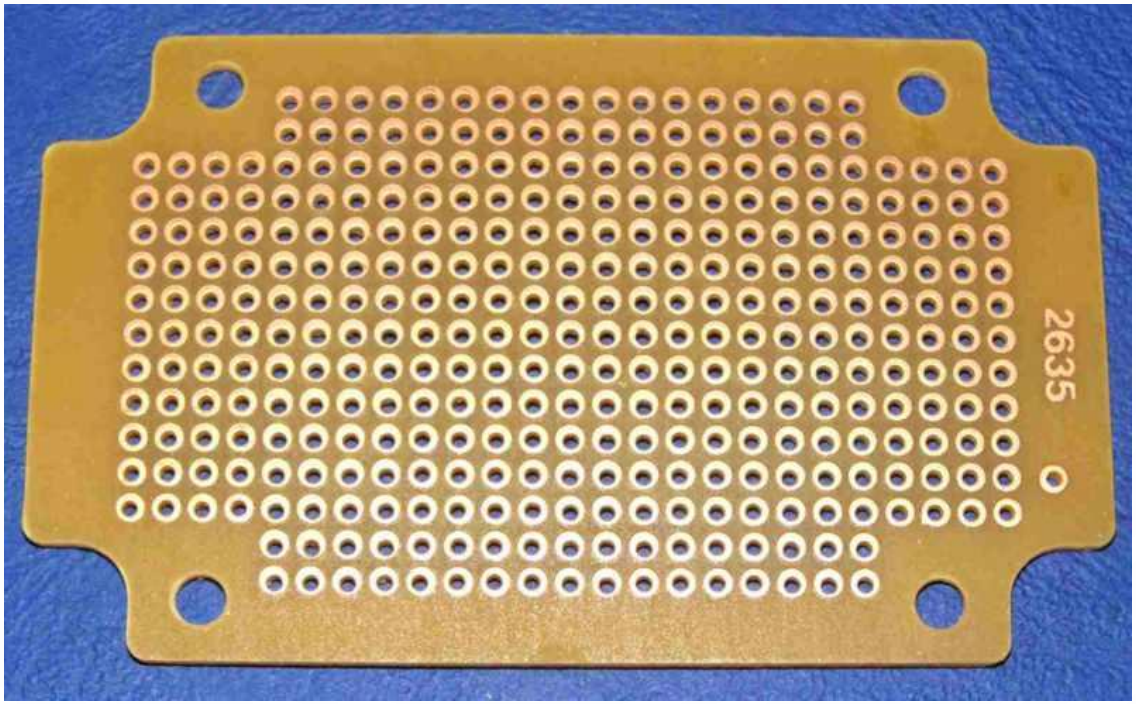


B	A	OUT
0	0	0
0	1	0
1	0	0
1	1	1

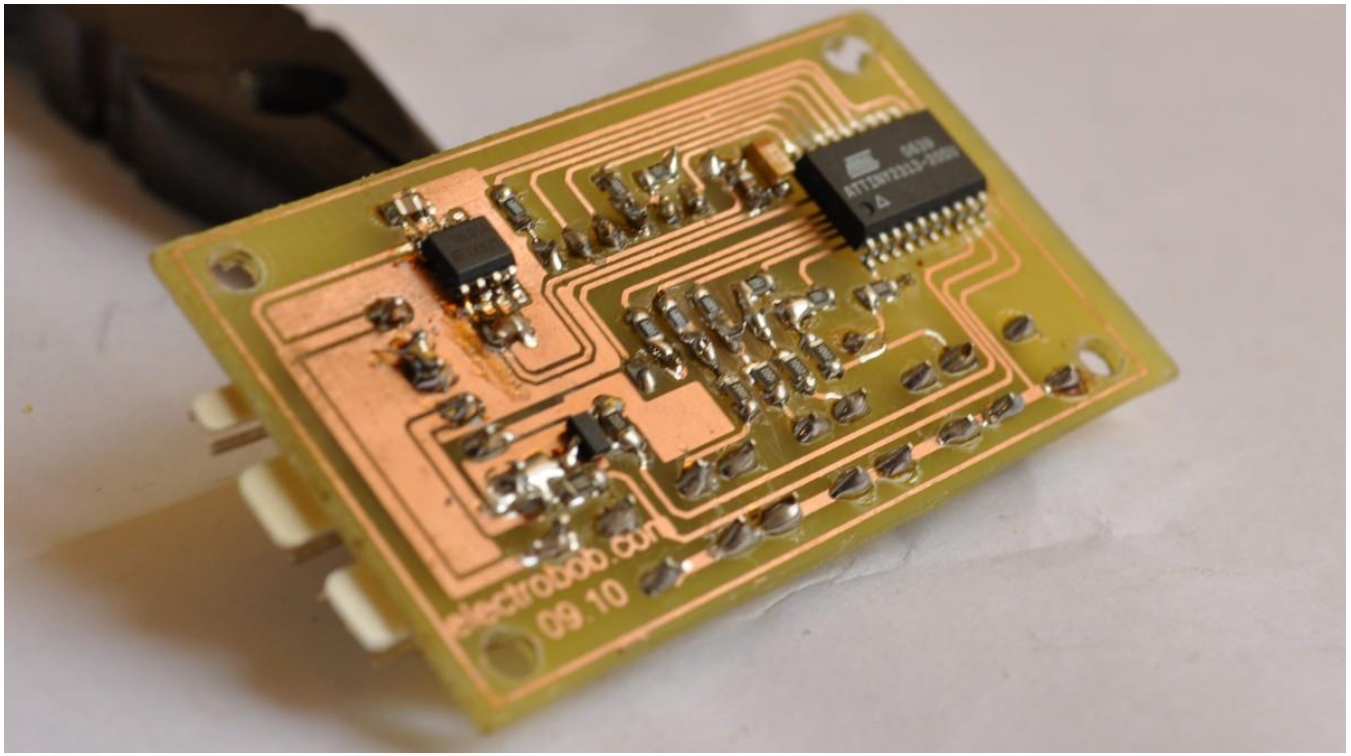
AND

Exemplo:
R = 10 kΩ
R2 = 1 kΩ

PERFURATED BOARDS



PRINTED CIRCUIT BOARDS

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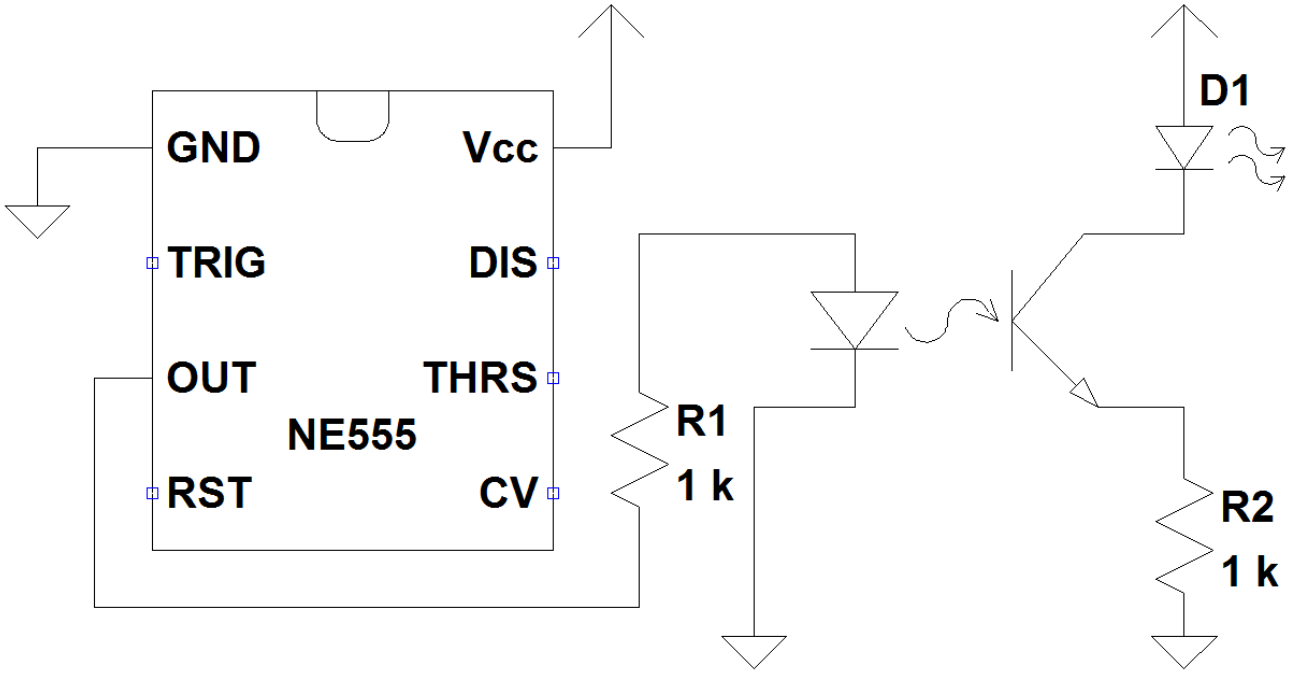
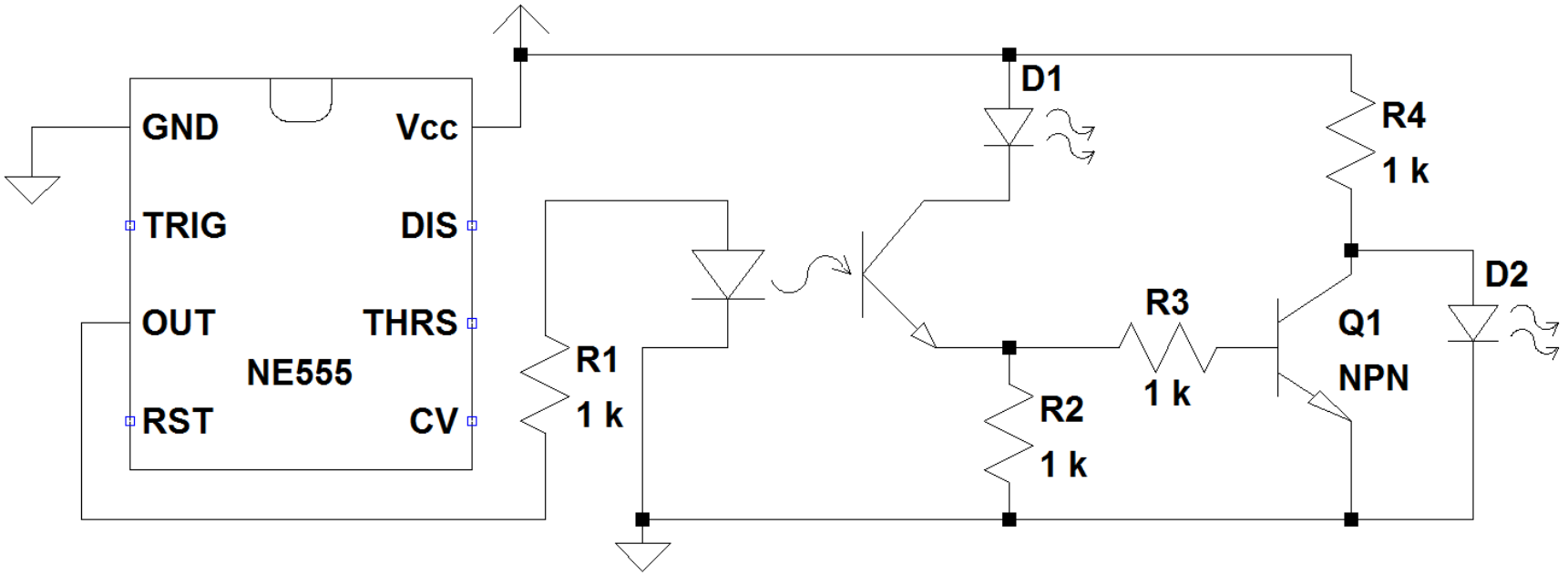
EXTRA EXPERIENCES

CREATE AN INFRA-RED RECEPTOR



The remaining connections can be seen on the datasheet, astable circuit

LOGIC GATES (NOT)



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