ELECTRONIC DICE

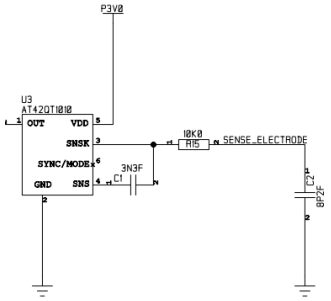
This design is a modernized version of the electronic dice found at
https://www.instructables.com/id/Electronic-Dice-With-Slowdown-NE555-CD4017/

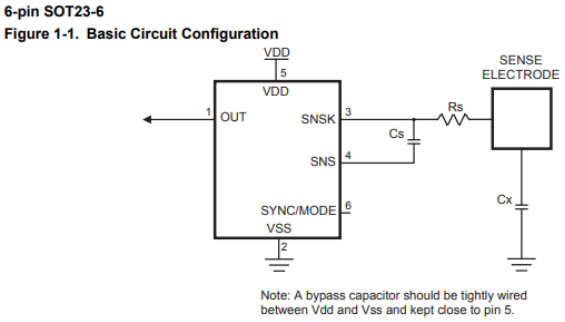
It is modified to run from a single 3V cell. The switch in the original design is replaced with a touch sensor

SENSE ELECTRODE

The schematic net named SENSE_ELECTRODE is where the sense electrode connects to the circuit. Use a template in layout in order to create the physical representation of the sense electrode. Touching the sense electrode triggers a new counting cycle.

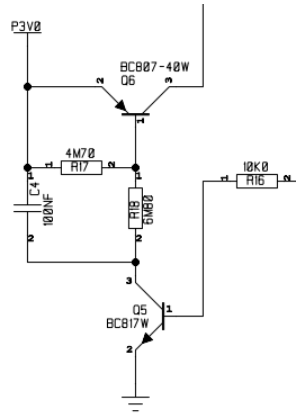
Left image below is from the schematics. Right image below is from the AT42QT1010 datasheet.





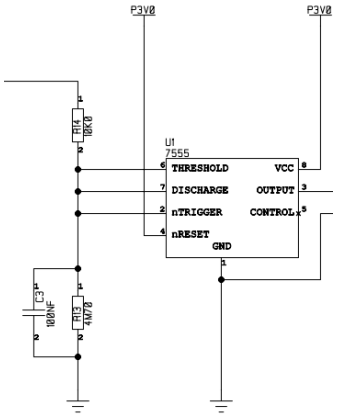
SLOW DOWN

AT42QT1010 output turns Q5 on. When Q5 is conducting, C4 is charged to 3V and Q6 is turned on. When the AT42QT1010 output turns off Q5, the charge stored on C4 keep Q6 fully on for a short while and then gradually turn it off, creating the counter slow down.



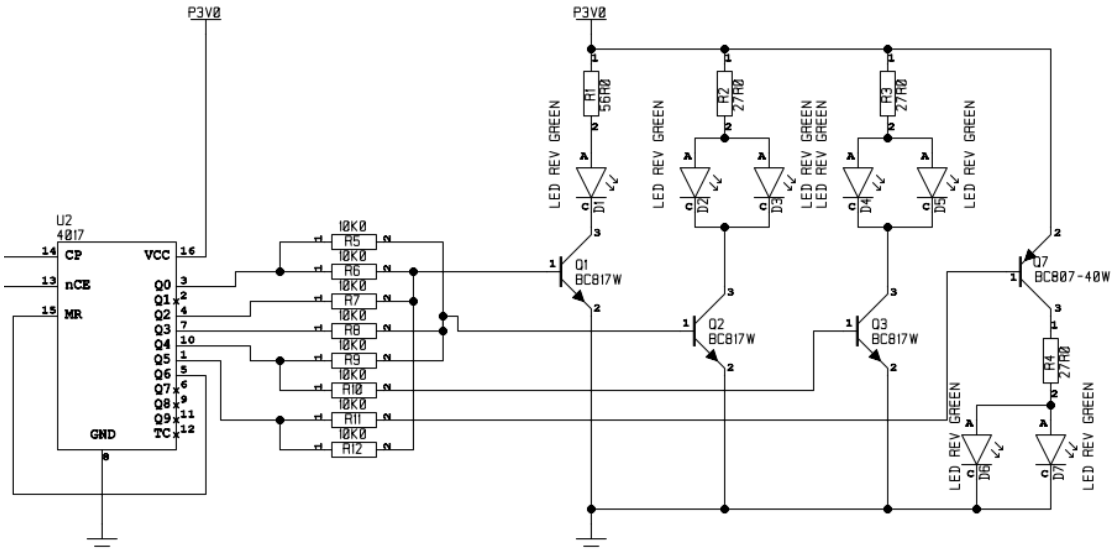
TIMER

7555 timer is a low volt version of the once very popular 555 timer. Output from the 7555 is a clock signal where the voltage from the slow down circuit set the output frequency.



COUNTER / DECODER

The 74HC4017 is a decade counter with 10 outputs. In the schematics Q6 is connected to Master Reset. When toggling the clock input, the counter will count from zero through five before starting at zero again.

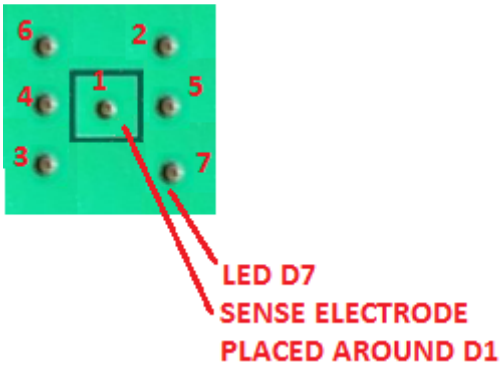


When the counter count is zero, only Q0 output will be high, while the other outputs are low. When the counter count is one, only Q1 output is high, while the other outputs are low, and so on.

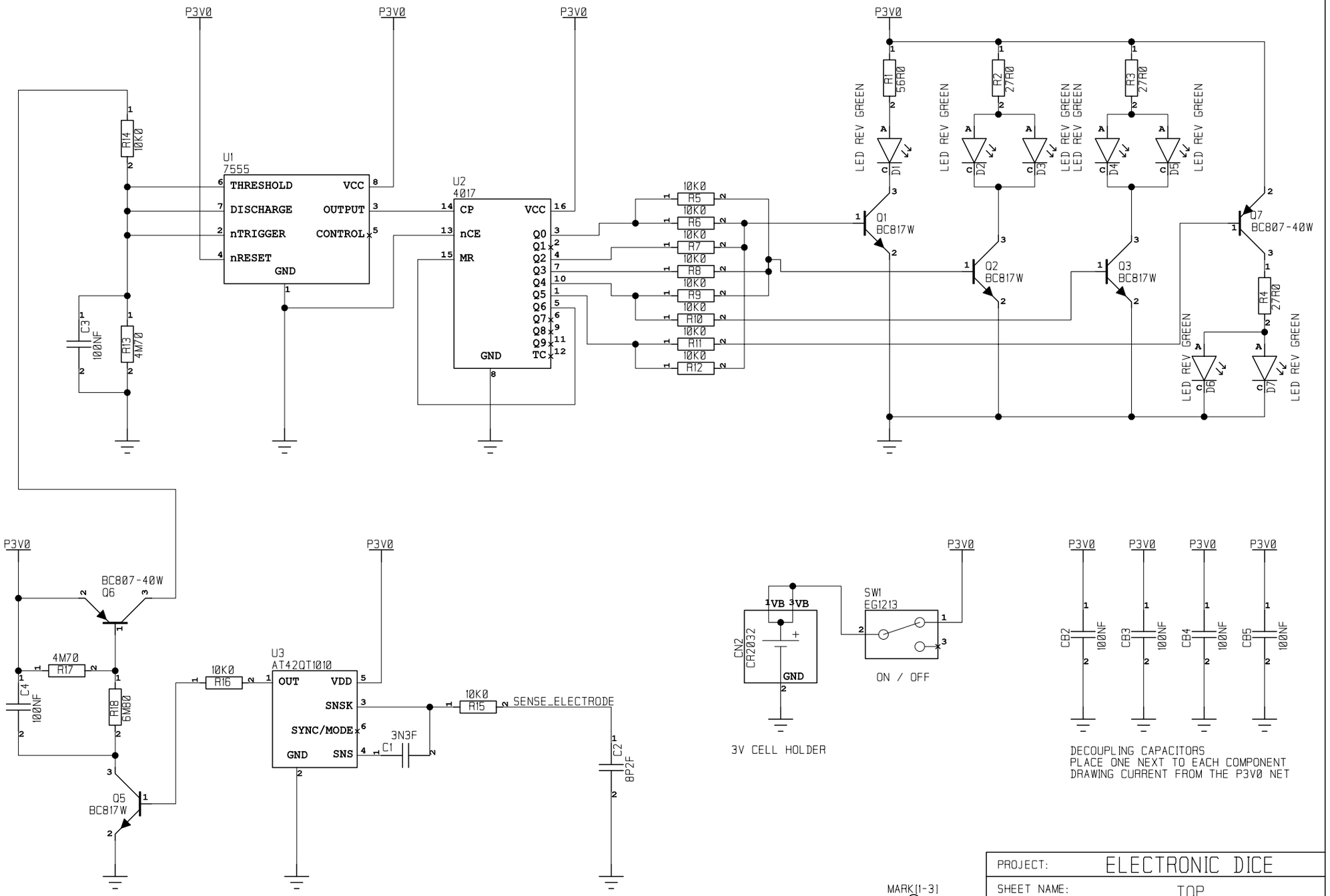
Counter count value is decoded and displayed using LEDs. When counter count is zero, Q0 is high. Then the following LEDs will emit light: D1, D2, D3, D6 and D7. This pattern indicates the number five on the dice.

LAYOUT RECOMMENDATIONS

Assuming the LEDs are annotated in the same way as the reference schematics below, the LEDs on your board should be placed as in the picture below. The board section below is viewed from the bottom side. All components, including the LEDs, are mounted on the top side of the board emitting light through the PCB and out from the bottom side. Remember to mirror the LEDs position relative to each other when working on the top side of the board in layout.



The sense electrode should be 6mm by 6mm or larger.


P3V0
U1
7555
THRESHOLD
DISCHARGE
nTRIGGER
nRESET
VCC
OUTPUT
CONTROL
GND
R14 10K0
C3 100NF
R13 4M70
U2
4017
CP
nCE
MR
VCC
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
TC
GND
R5 10K0
R6 10K0
R7 10K0
R8 10K0
R9 10K0
R10 10K0
R11 10K0
R12 10K0
R1 56R0
R2 27R0
R3 27R0
R4 27R0
LED REV GREEN
D1
D2
D3
D4
D5
D6
D7
Q1 BC817W
Q2 BC817W
Q3 BC817W
Q7 BC807-40W
Q6 BC807-40W
Q5 BC817W
R17 4M70
R18 6M80
C4 100NF
U3
AT42QT1010
OUT
VDD
SNSK
SYNC/MODE
GND
SNS
R16 10K0
R15 10K0
SENSE_ELECTRODE
C1 3N3F
C2 8P2F
CN2
CR2032
VB
GND
3V CELL HOLDER
SW1
EG1213
ON / OFF
CB2 100NF
CB3 100NF
CB4 100NF
CB5 100NF
DECOUPLING CAPACITORS
PLACE ONE NEXT TO EACH COMPONENT
DRAWING CURRENT FROM THE P3V0 NET
MARK[1-3]
FIDUCIAL MARK
PROJECT: ELECTRONIC DICE
SHEET NAME: TOP
DATE: 01.01.2019
SHEET: 1 / 1
USER: user_name
ELAB, Dept. of Physics
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