RANDOM LED BLINKER USING ARDUINO UNO DESIGNED ON TINKERCAD

WITH HOME-MADE MULTI-CHANNEL LED DRIVER SHIELD

- FIVE CHANNELS
- EACH CHANNEL IS 10 EACH 0402 LEDS OF A SINGLE COLOR
- RED, BLUE, GREEN, YELLOW, WHITE
- RANDOM RANGE 100ms TO 500ms
- RANDOM ON-OFF TIME, RANDOM TIMING BETWEEN CHANNELS – “THE TWINKLE EFFECT”
- ADJUSTABLE BRIGHTNESS – EACH CHANNEL
- 12 VDC POWER SUPPLY

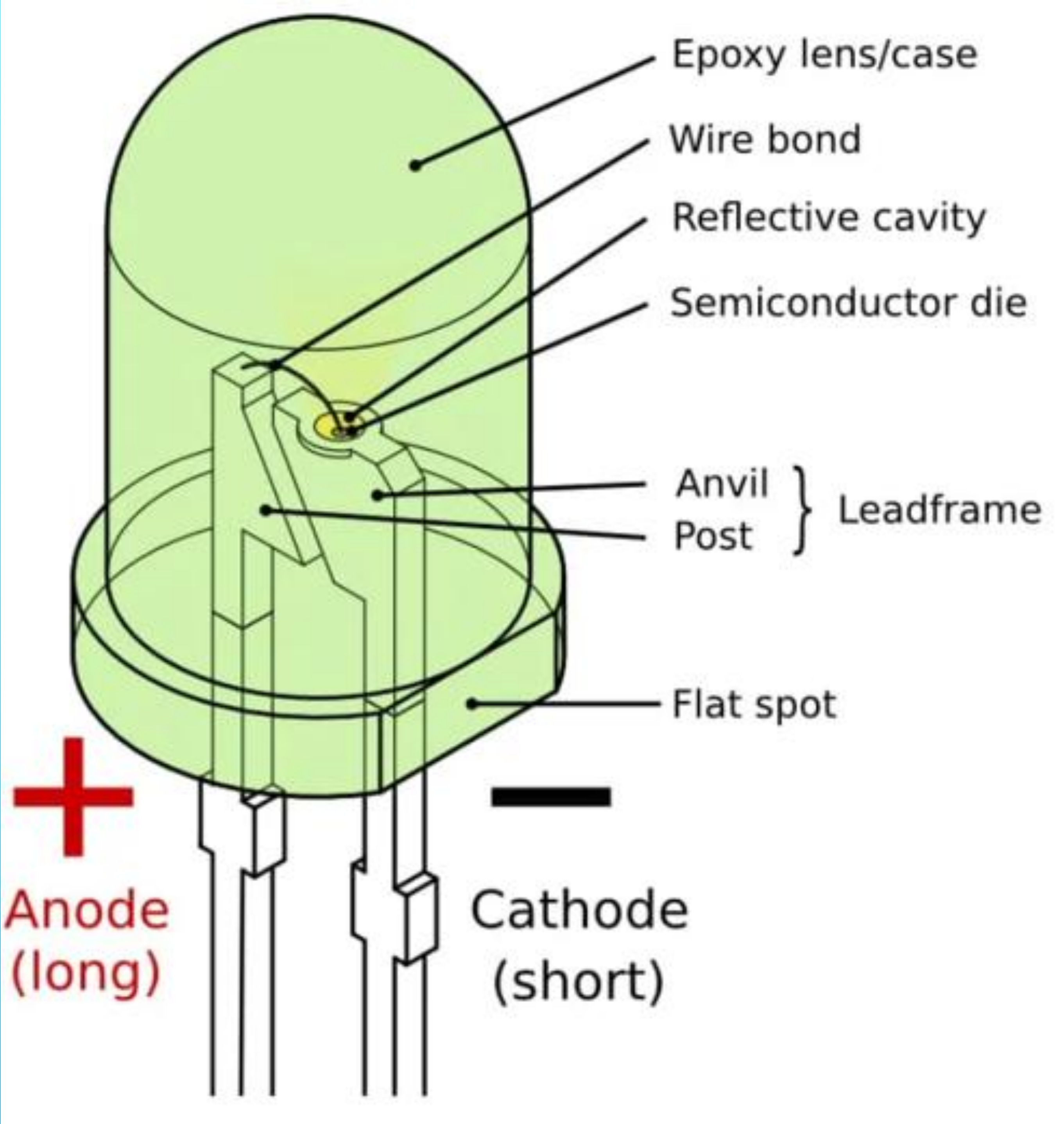
SPECIFICATIONS

- LEDs 0402 AS SPECIFIED [0.O4” X 0.02” X 0.017” WIDE ANGLE, NO LENS. 10 EA COMMON ANODE PER CHANNEL.
- CONTROLLER ARDUINO UNO R3 OR ABOVE OR ARDUINO MEGA (OR RASPBERRY PI OR OTHERS)
- POWER SUPPLY – 12 VDC @ 5 ADC
- POWER SUPPLY LED POWER SHIELD 7 VDC @ 5 AAC (USE STEP DOWN REGULATOR)
- 2N2222A SWITCHING TRANSISTORS
- 10KΩ FILM POTENTIOMETERS
- 1/4W METAL FILM RESISTORS

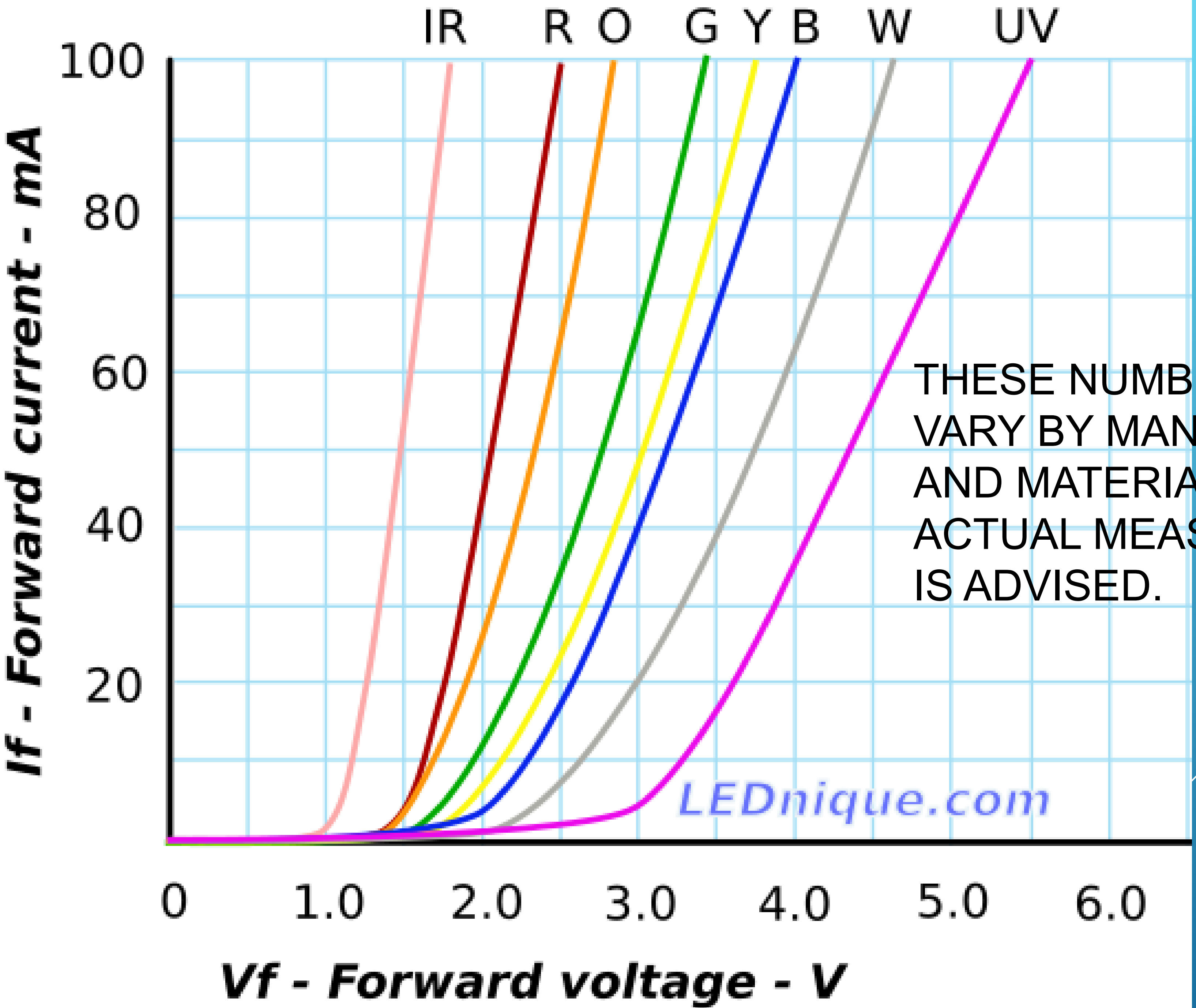
COMPONENT SELECTION

- EACH “COLOR” OF LED HAS ITS OWN V-I CHARACTER
- THEY ARE “SIMILAR” FOR 20ma MAX CURRENT – THEN POOF.
- PRECEIVED BRIGHTNESS IS MORE EVEN AROUND 10ma.
- DESIGN FOR 10 LEDs IN PARALLEL ≈ 100ma

LED CHARACTERISTICS



Epoxy lens/case
Wire bond
Reflective cavity
Semiconductor die
Anvil
Post
Leadframe
Flat spot
+
−
Anode
(long)
Cathode
(short)



THESE NUMBERS WILL VARY BY MANUFACTURER AND MATERIAL FORMULA. ACTUAL MEASUREMENT IS ADVISED.

- ARDUINO DIGITAL OUTPUTS ARE 5VDC = ON AND 0VDC = OFF. ARDUINO HAS A 5VDC REGULATOR (ALSO A 3.3VDC REGULATOR)
- OUR SUPPLY IS 12VDC AS SPECIFIED.
- WE WANT THE LED POWER SUPPLY TO BE AS LOW AS POSSIBLE BUT ABOVE 5VDC. 5VDC WILL BE USED FOR THE BASE VOLTAGE SUPPLY OF THE TRANSISTORS.
- ARDUINO OUTPUT CAN ONLY HANDLE 20ma – WE NEED 100ma
- USUAL AND CUSTOMARY DESIGN IS TO AVOID DUELING REGULATORS BY +2VDC OR MORE, ∴ LED SUPPLY IS 7VDC.
- USE MULTIPLE ¼ WATT DROPPING RESISTORS FOR DESIRED RESISTANCE – MORE SURFACE AREA = LESS TEMPERATURE RISE

DESIGN NOTES:

- POWER AN LED
- BLINK AN LED WITHOUT DELAY() FUNCTION
- RANDOM BLINK LED ON TIME = OFF TIME
- VARIABLE INTENSITY FOR EACH COLOR LED BY PWM
- PUT IT ALL TOGETHER 5 CHANNELS X 10 LED / CHANNEL
- DESIGN / BUILD 5 CHANNEL LED POWER DRIVER USING HI-SPEED TRANSISTORS IN SWITCHING MODE.
- USE A POTENTIOMETER TO VARY LED BRIGHTNESS PER CHANNEL

ARDUINO DESIGN STEPS

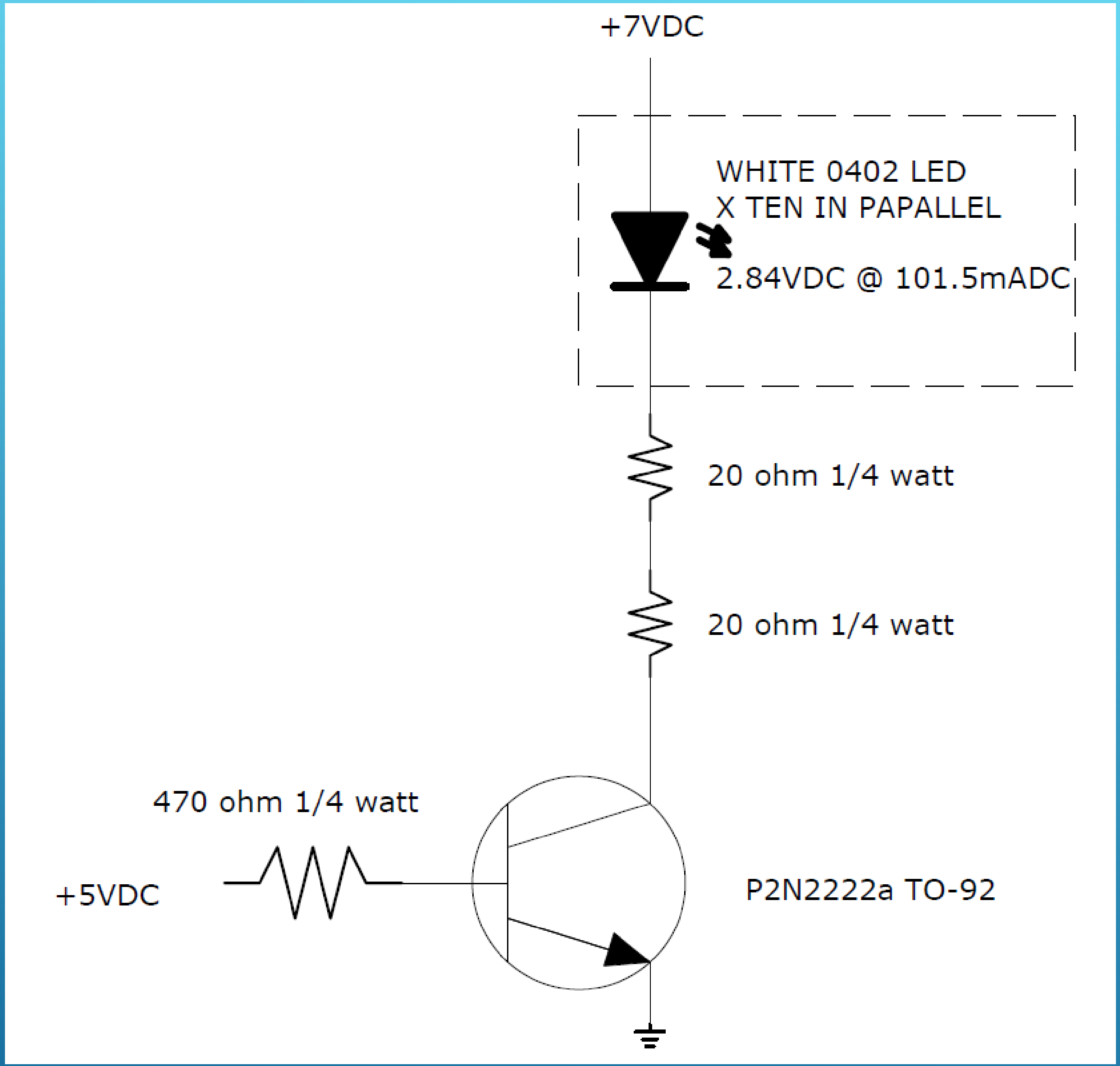
- ARDUINO UNO R3 IS A RISC – REDUCED INSTRUCTION SET COMPUTER.
- VIRTUALLY ALL RISC COMPUTERS HAVE A VERY SIMPLE DELAY(XXms) FUNCTION USED FOR TIMING, DELAYS, DEBOUNCING, ETC.
- ALSO VIRTUALLY ALL RISC COMPUTERS STOP THE PROGRAM COUNTER DURING THE "DELAY". THAT MEANS NO OTHER TIMING OR PROGRAMMING ON OTHER CHANNELS CAN TAKE PLACE.
- WITH 5 CHANNELS OF RANDOM ON – OFF AND RANDOMNESS BETWEEN CHANNELS, WE MUST HAVE THE PROGRAM COUNTER RUNNING ALL THE TIME.
- THIS IS ACHIEVED BY STARTING A ms OR µs COUNTER AND USING LESS THAN, EQUAL TO, AND GREATER THAN COMPARISONS WITHIN THE PROGRAM STEPS USING THE millis() AND/OR micros() FUNCTIONS.

ARDUINO PROGRAMMING NOTE

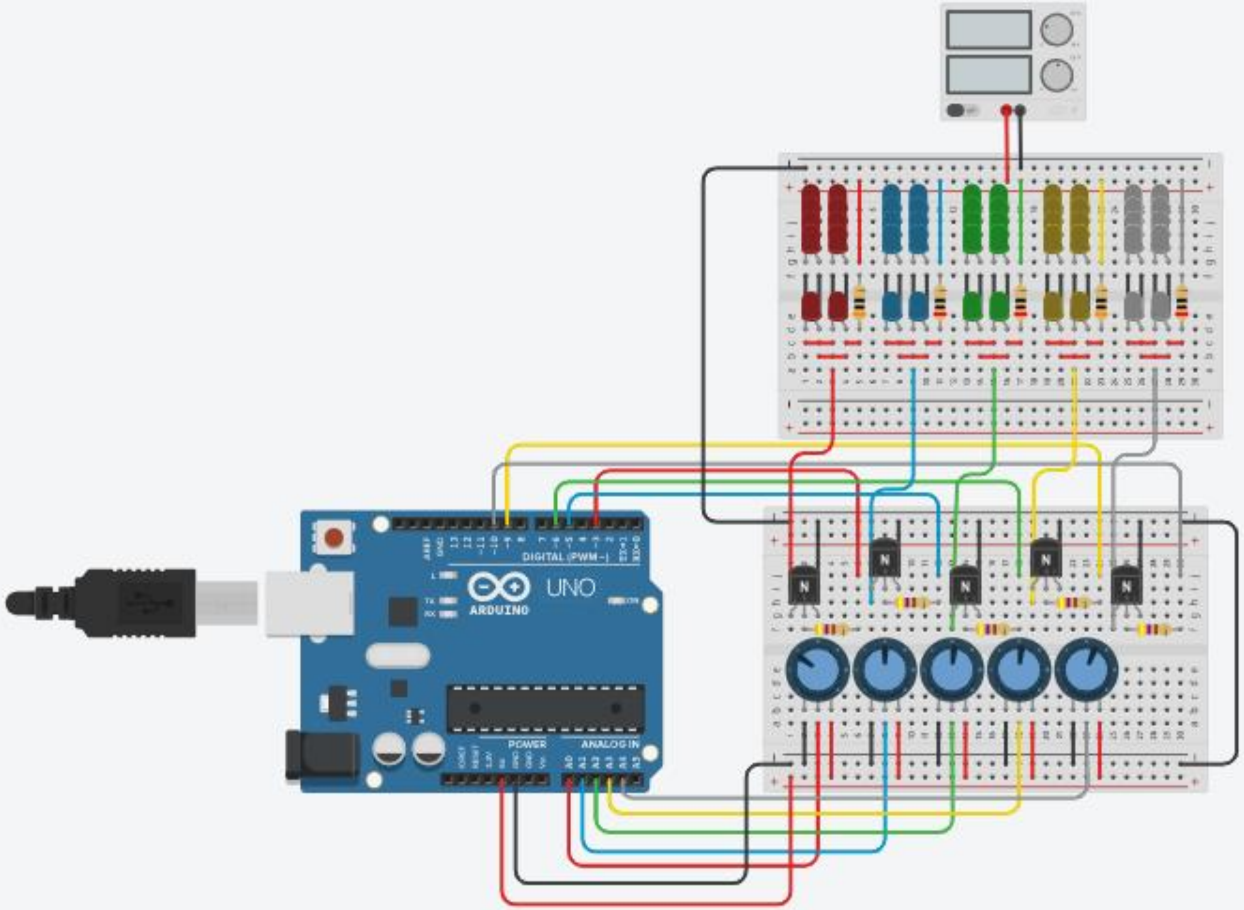
- TO FACILITATE HAVING TO CONSTANTLY RE-WIRE ARDUINO BREADBOARDS TO TEST VARIOUS CONFIGURATIONS, I CHOSE TO UTILIZE A VIRTUAL CAD SYSTEM OFFERED BY AUTODESK® . . .

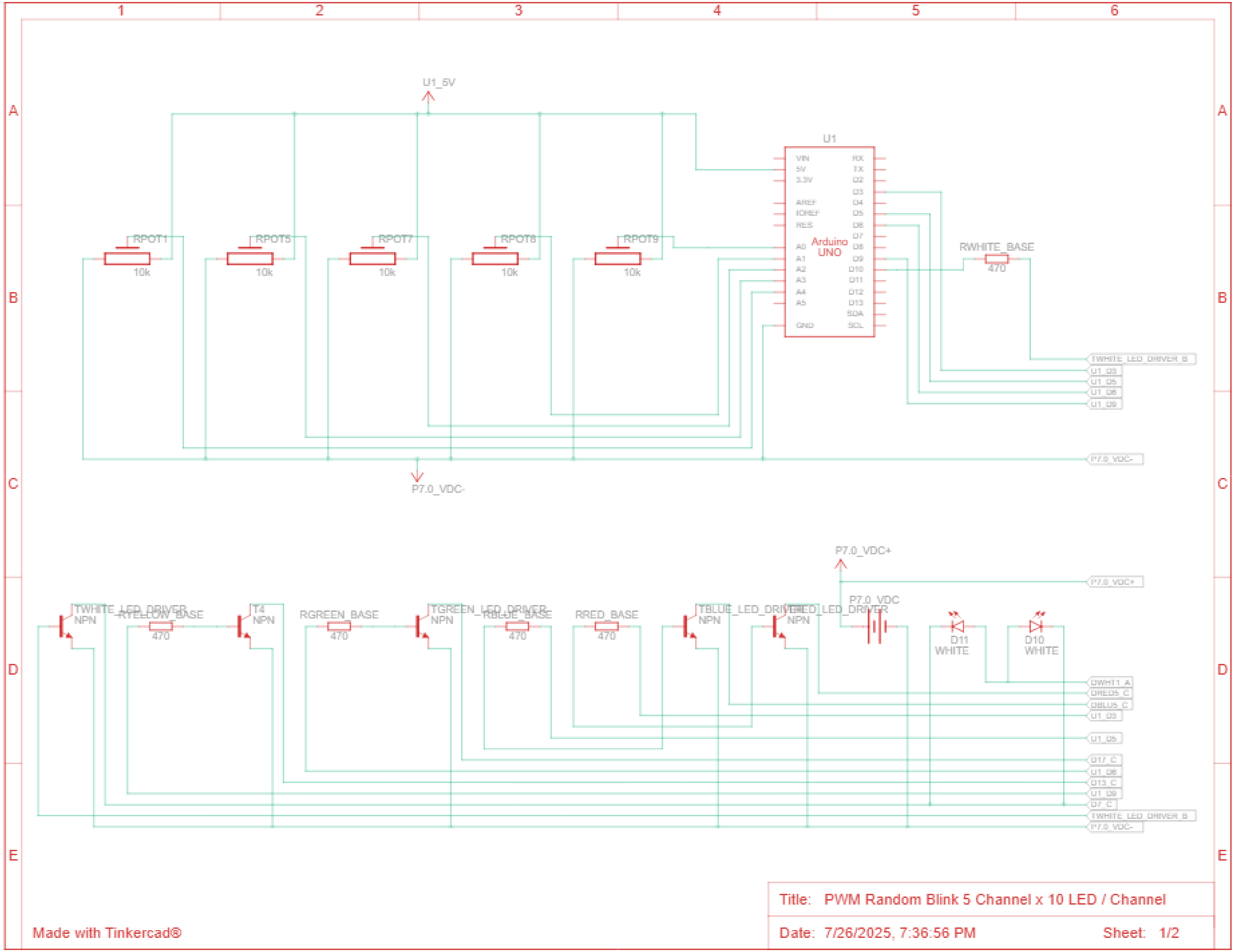
DESIGN PROTOTYPING AND DRAWINGS


TIN
KER
CAD



TYPICAL LED POWER DRIVER CHANNEL


UNO
ARDUINO
DIGITAL (PWM~)
POWER
ANALOG IN


U1_5V
U1
Arduino UNO
RPOT1
RPOT5
RPOT7
RPOT8
RPOT9
10k
RWHITE_BASE
470
P7.0_VDC-
P7.0_VDC+
P7.0_VDC
D11 WHITE
D10 WHITE
Title: PWM Random Blink 5 Channel x 10 LED / Channel
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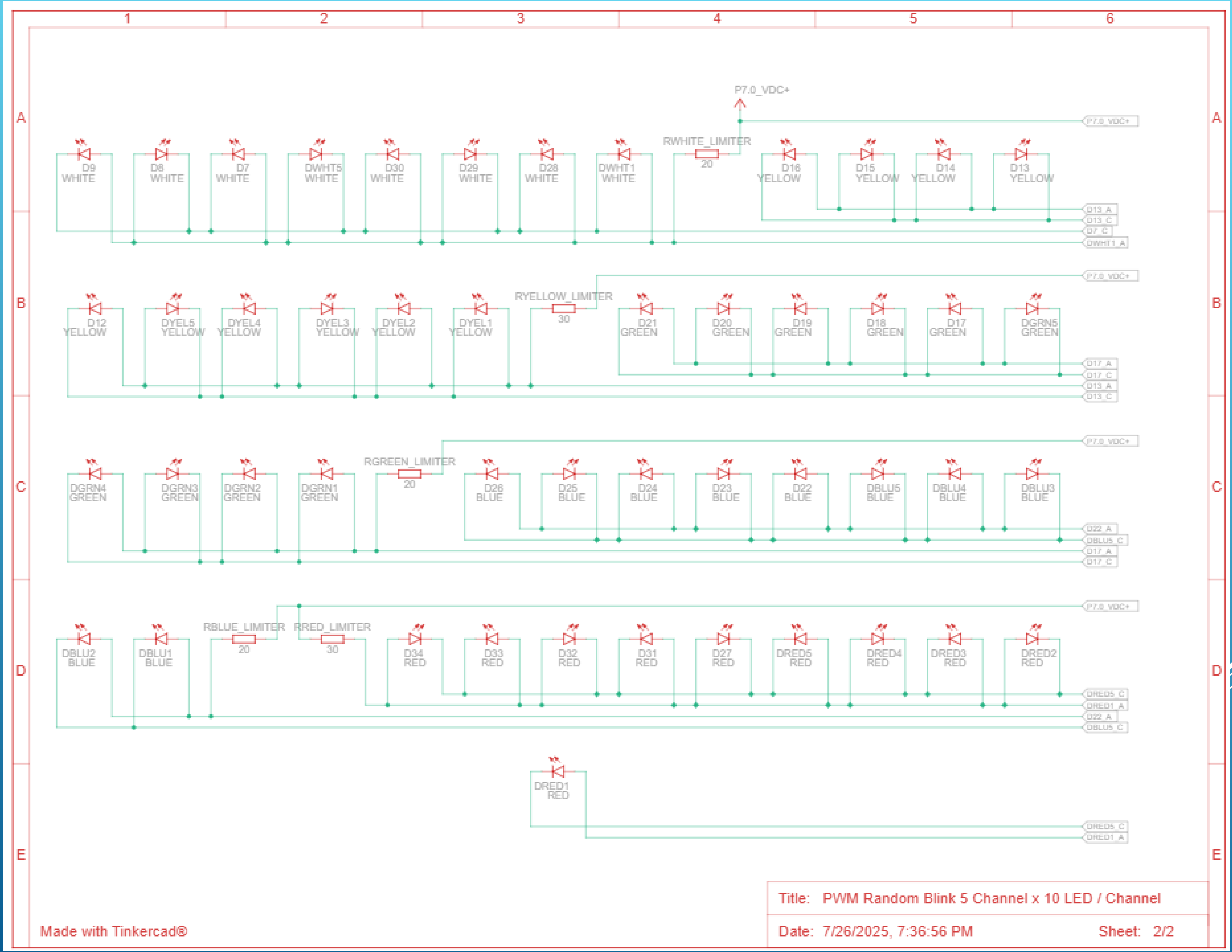
Sheet: 1/2
Made with Tinkercad®


P7.0_VDC+
D9 WHITE
D8 WHITE
D7 WHITE
DWHT5 WHITE
D30 WHITE
D29 WHITE
D28 WHITE
DWHT1 WHITE
RWHITE_LIMITER 20
D16 YELLOW
D15 YELLOW
D14 YELLOW
D13 YELLOW
D12 YELLOW
DYEL5 YELLOW
DYEL4 YELLOW
DYEL3 YELLOW
DYEL2 YELLOW
DYEL1 YELLOW
RYELLOW_LIMITER 30
D21 GREEN
D20 GREEN
D19 GREEN
D18 GREEN
D17 GREEN
DGRN5 GREEN
DGRN4 GREEN
DGRN3 GREEN
DGRN2 GREEN
DGRN1 GREEN
RGREEN_LIMITER 20
D26 BLUE
D25 BLUE
D24 BLUE
D23 BLUE
D22 BLUE
DBLU5 BLUE
DBLU4 BLUE
DBLU3 BLUE
DBLU2 BLUE
DBLU1 BLUE
RBLUE_LIMITER 20
RRED_LIMITER 30
D34 RED
D33 RED
D32 RED
D31 RED
D27 RED
DRED5 RED
DRED4 RED
DRED3 RED
DRED2 RED
DRED1 RED
Made with Tinkercad®
Title: PWM Random Blink 5 Channel x 10 LED / Channel
Date: 7/26/2025, 7:36:56 PM
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BILL OF MATERIAL

Name	Quantity	Component
U1	1	Arduino Uno R3
Rpot9, Rpot8, Rpot7, Rpot5, Rpot1	5	10 kΩ Potentiometer MF
TRed LED Driver, TBlue LED Driver, TGreen LED Driver, T4, TWhite LED Driver	5	NPN Transistor (BJT) 2N2222A
RRed Base, RBlue Base, RGreen Base, RYellow Base, RWhite Base	5	470 Ω Resistor MF
DRed1, DRed2, DRed3, DRed4, DRed5, D27, D31, D32, D33, D34	10	Red LED
RRed Limiter, RYellow Limiter	2	30 Ω Resistor MF
DBlu1, DBlu2, DBlu3, DBlu4, DBlu5, D22, D23, D24, D25, D26	10	Blue LED
RBlue Limiter, RGreen Limiter, RWhite Limiter	3	20 Ω Resistor MF
DGrn1, DGrn2, DGrn3, DGrn4, DGrn5, D17, D18, D19, D20, D21	10	Green LED
DYel1, DYel2, DYel3, DYel4, DYel5, D12, D13, D14, D15, D16	10	Yellow LED
DWht1, D28, D29, D30, DWht5, D7, D8, D9, D10, D11	10	White LED
P7.00VDC	1	7.00 VDC Power Supply

Thank you for your attention

ANY QUESTIONS?