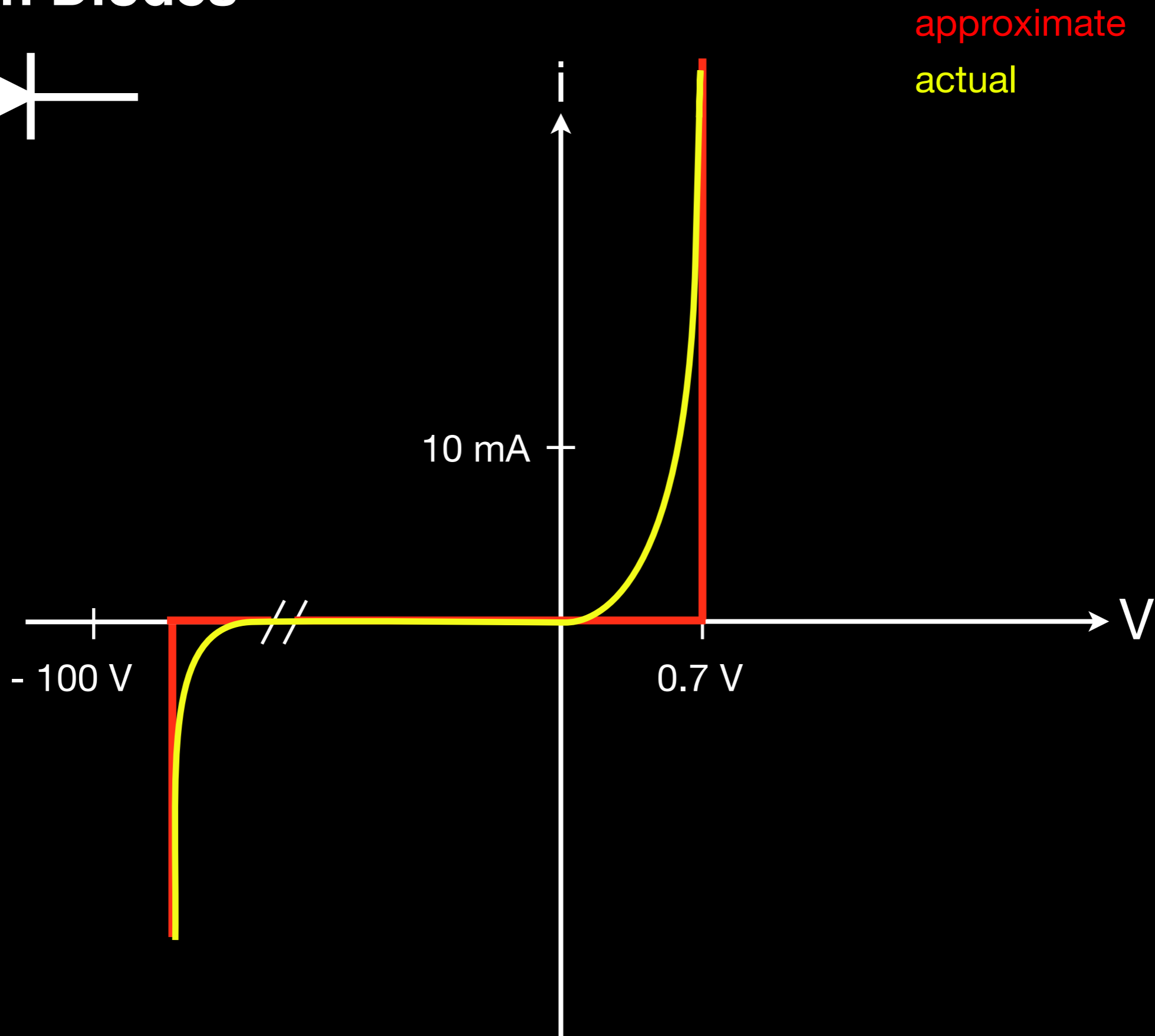
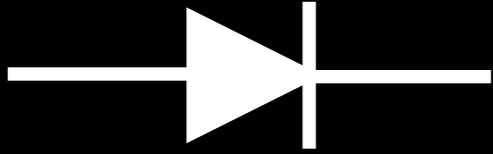


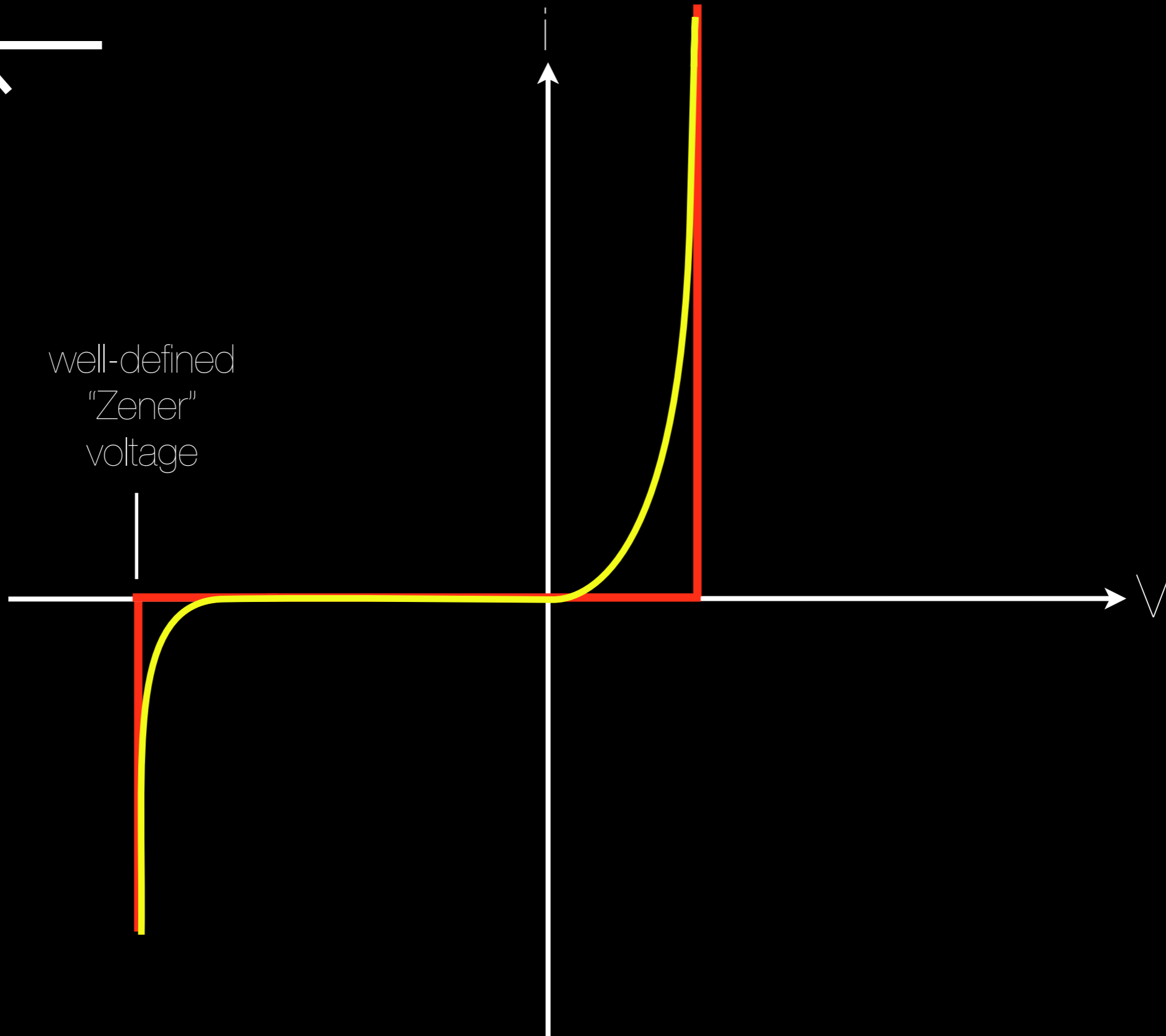
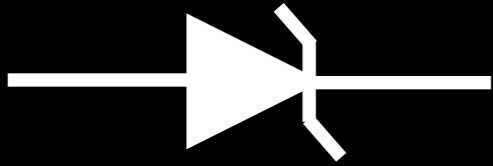


Semiconductors

Junction Diodes



The Zener Diode

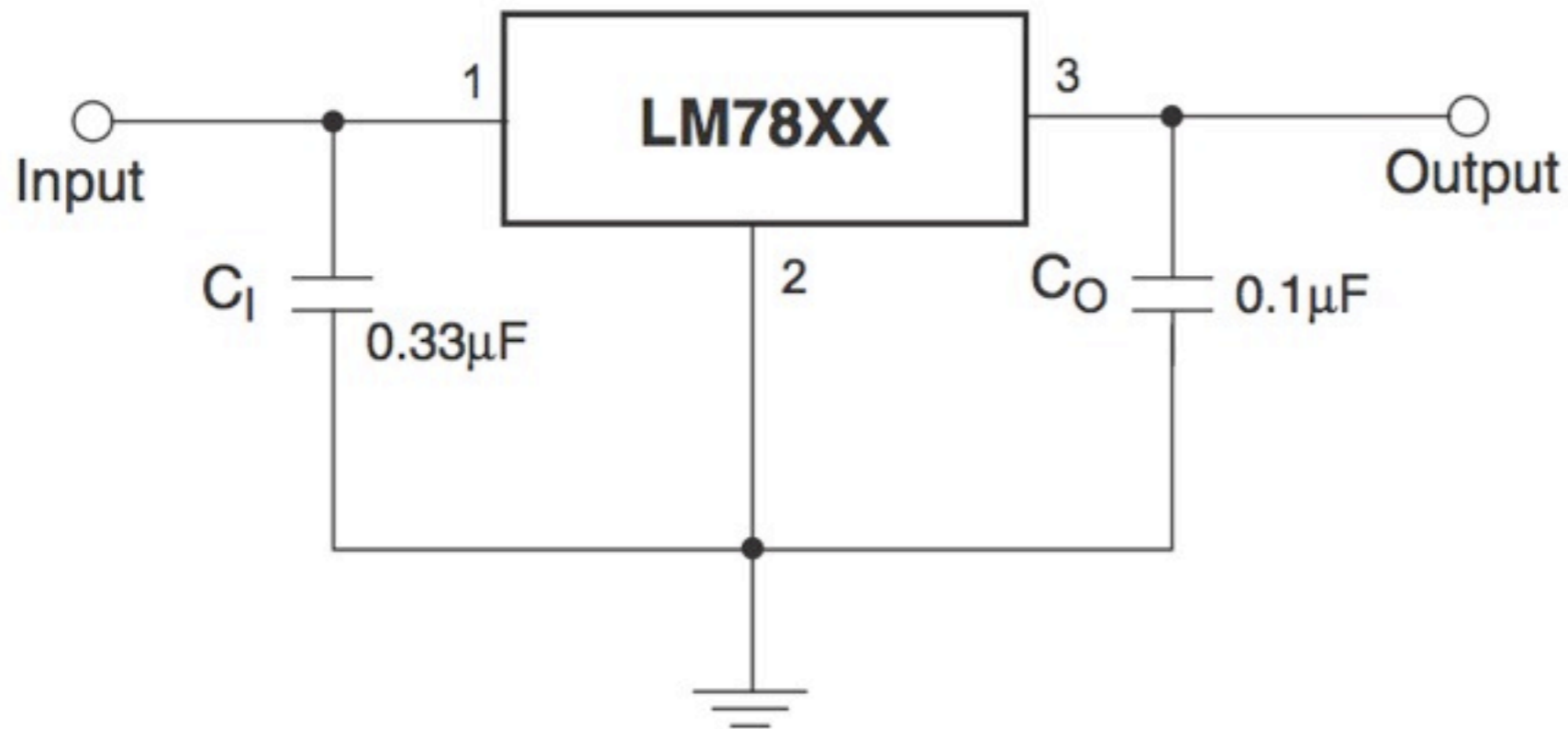
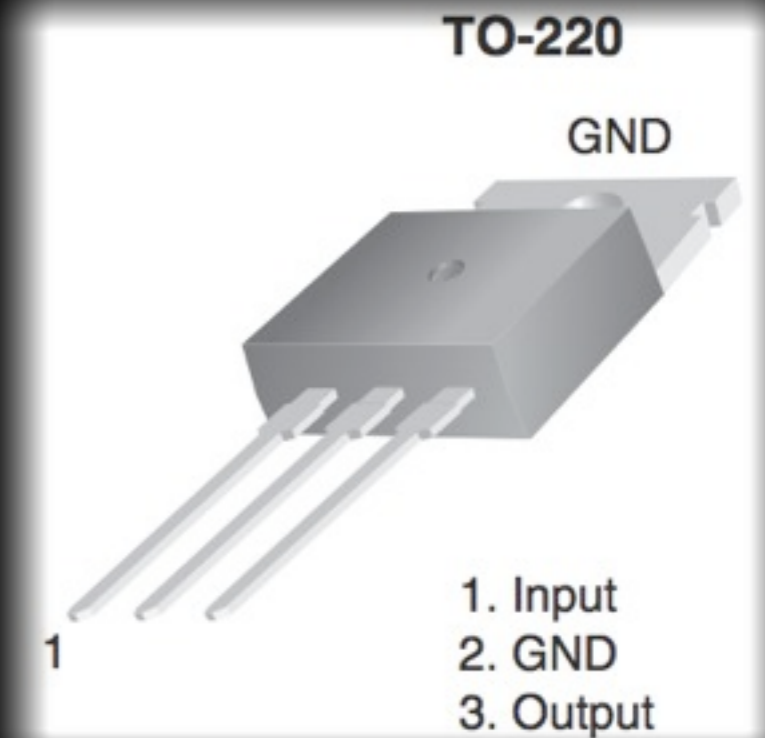


Voltage Regulator ICs

fixed-output

LM78XX (positive)

LM79XX (negative)

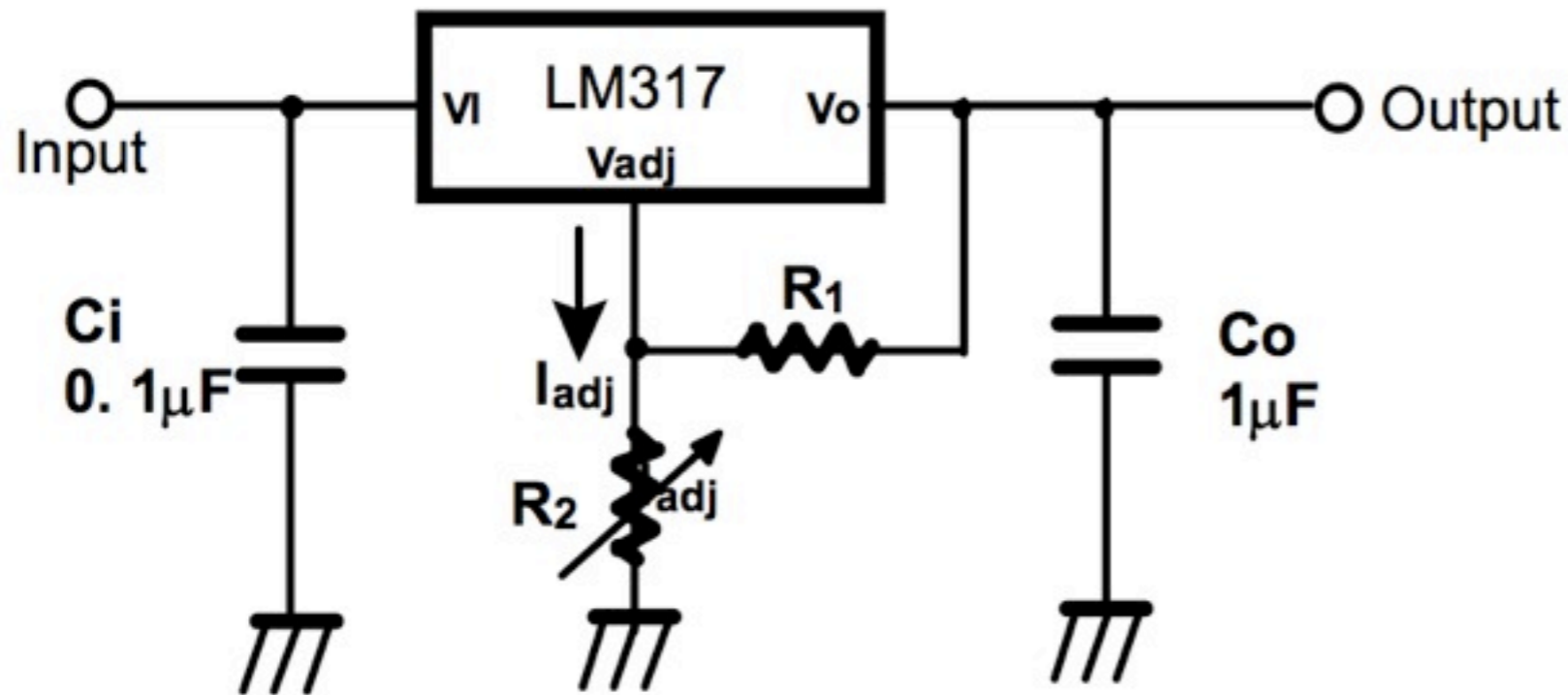


Voltage Regulator ICs

adjustable-output (1.2-25V)

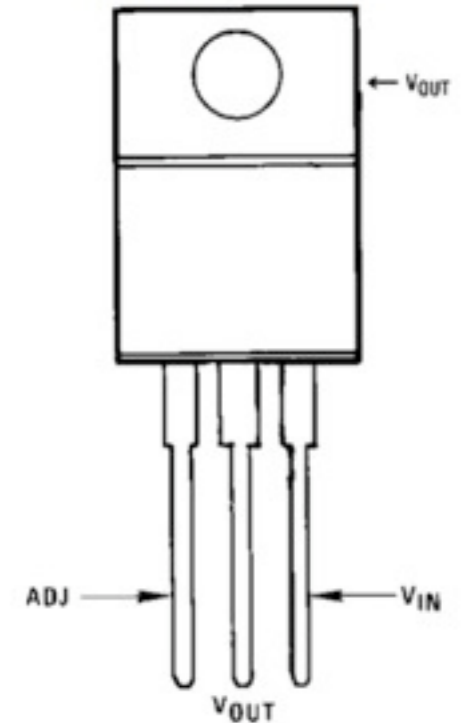
LM317 (positive)

LM337 (negative)



$$V_o = 1.25V (1 + R_2 / R_1) + I_{adj} R_2$$

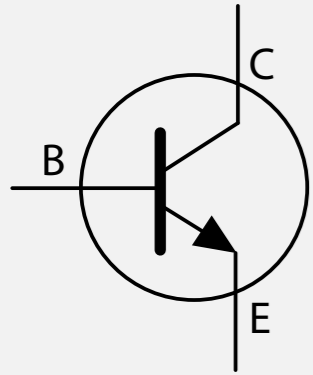
TO-220 (T)
Plastic Package



906332
Front View
NS Package Number T03B

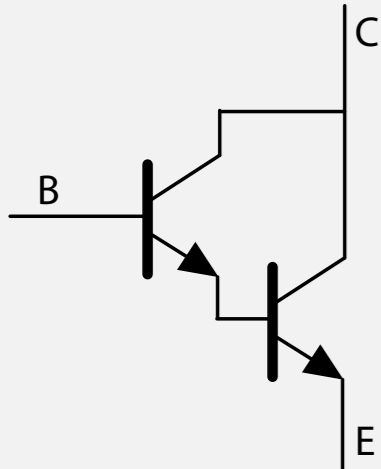


semiconductor switches



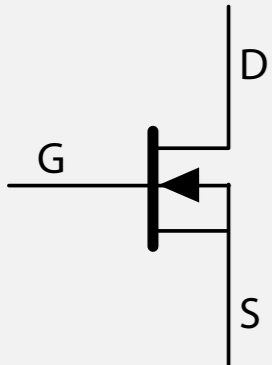
Bipolar Junction Transistor (BJT)

rules of thumb : current gain = $\sim 10x$, $V_{be} = \sim 0.7V$



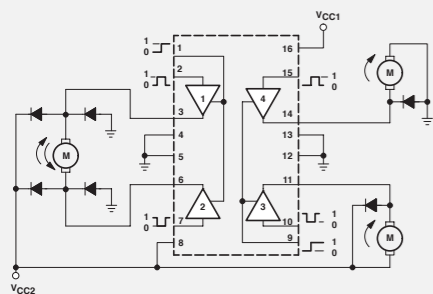
Darlington (cascaded BJTs)

rules of thumb : current gain = $\sim 100x$, $V_{be} = \sim 1.4V$



Metal-Oxide Semiconductor Field-Effect Transistor (MOSFET)

requires higher gate-source voltage, but “no” gate current



Driver ICs

integrated darlington, etc. with logic-level inputs

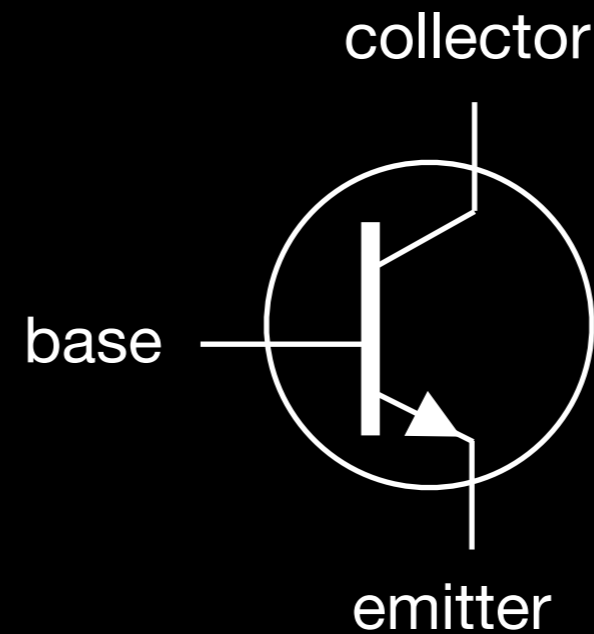
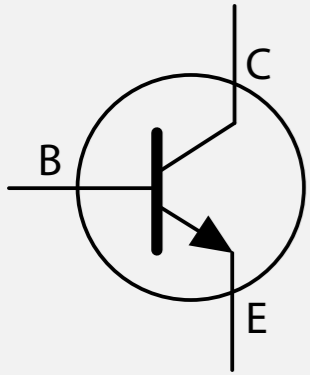
NPN Bipolar Junction Transistor (BJT)

(current controlled gate valve)

current gain $\sim 10x$

$V_{be} > 0.6V$

$V_{ce,sat} > 0.2V$



TIP 31C (NPN Epitaxial Silicon Transistor):

collector-emitter breakdown = 100V

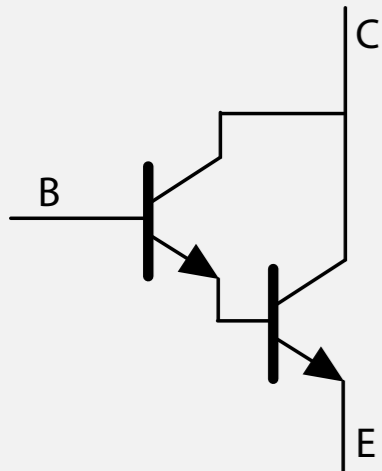
current gain = 10-50x



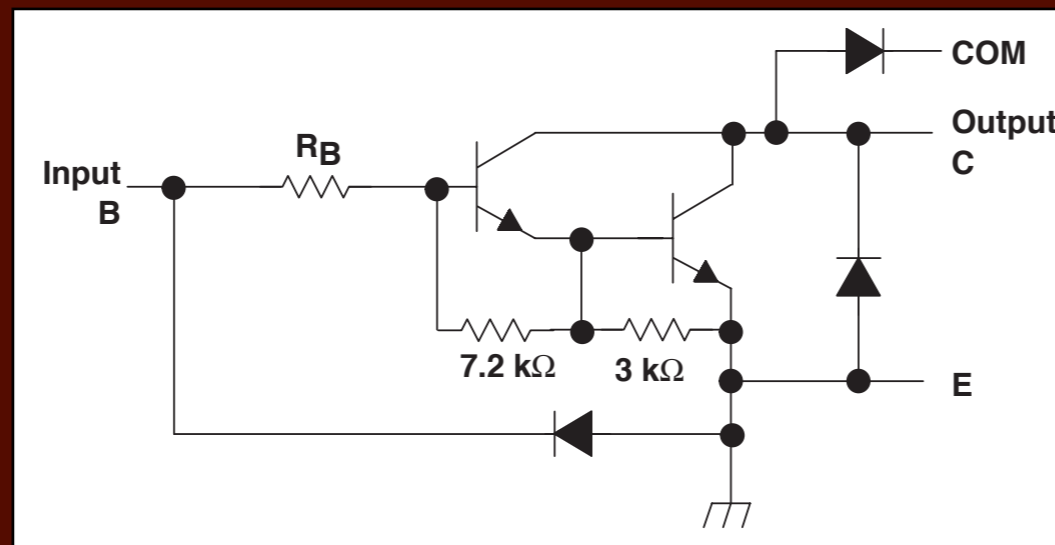
Darlington

(cascaded current controlled gate valves)

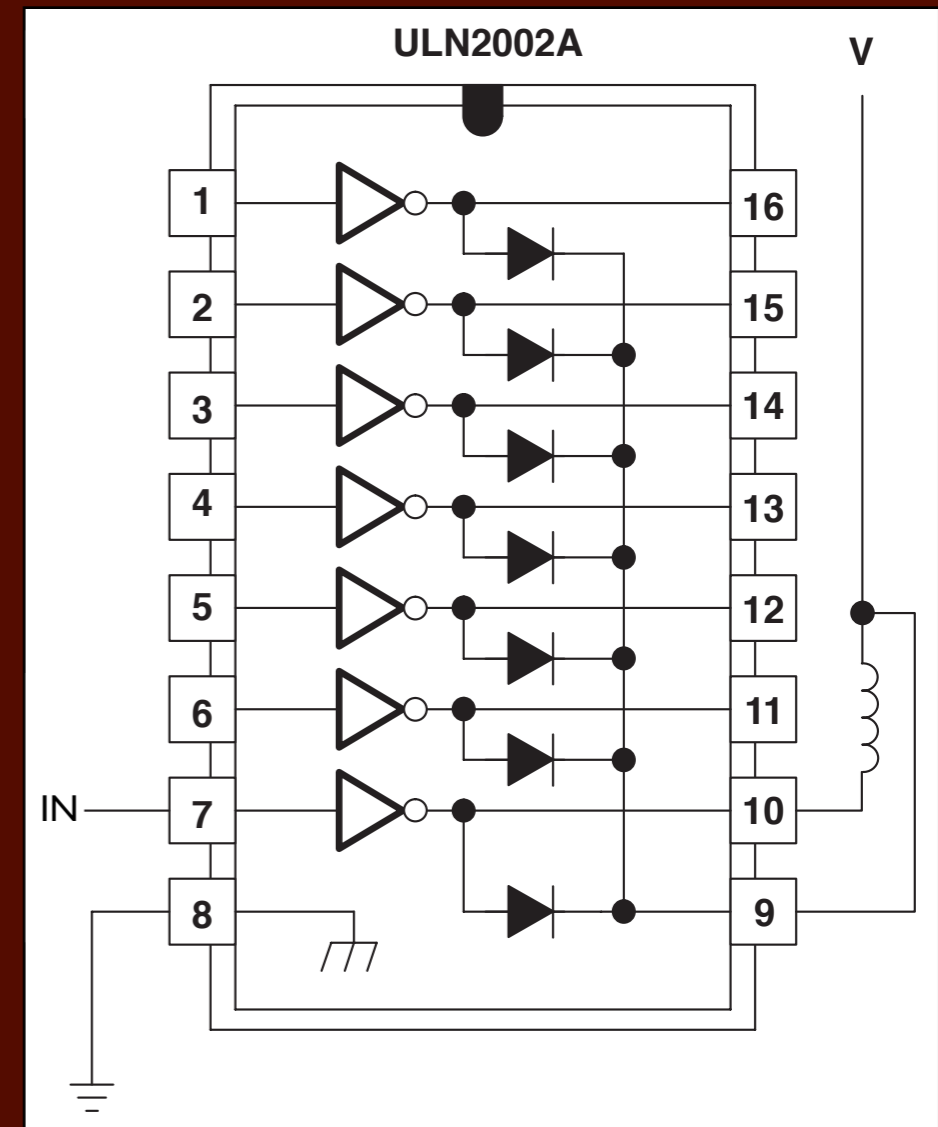
current gain $\sim 100x$ | $V_{be} > 1.2V$ | $V_{ce,sat} > 0.8V$



ULN2003A Darlington Array



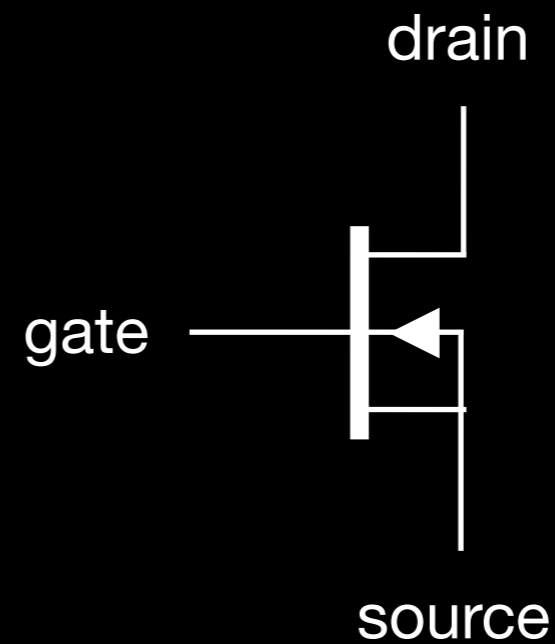
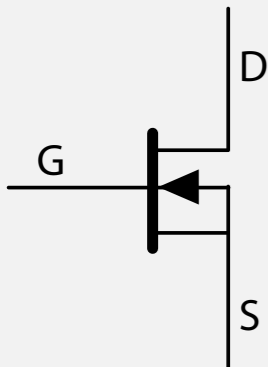
common-emitter configuration
500mA single output maximum
internal snubber diodes



N-channel MOSFETs

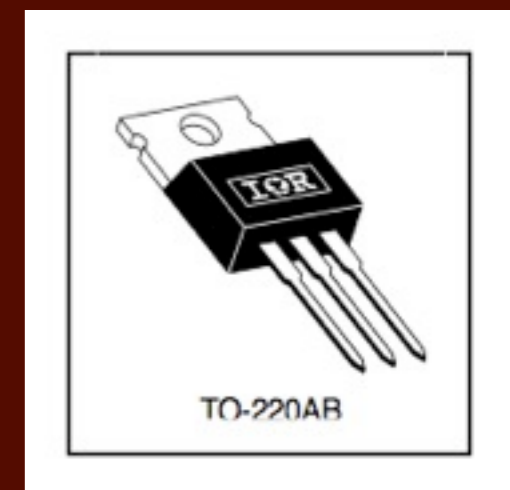
(voltage controlled gate valve)

$V_{gs,on} > 1V$ | $R_{ds} > 0$

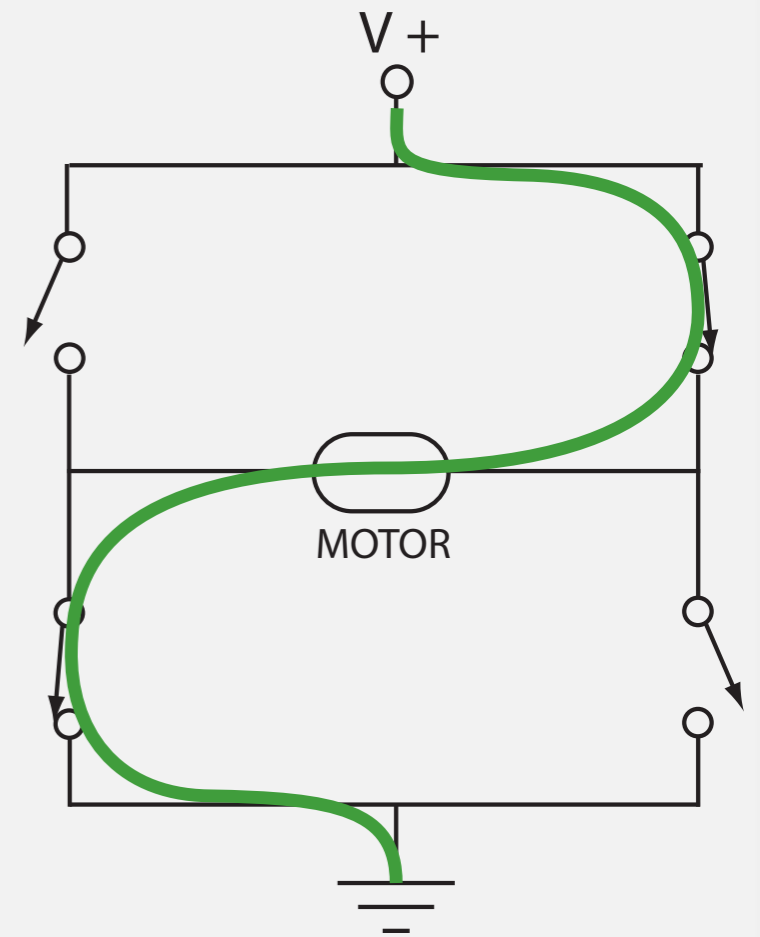
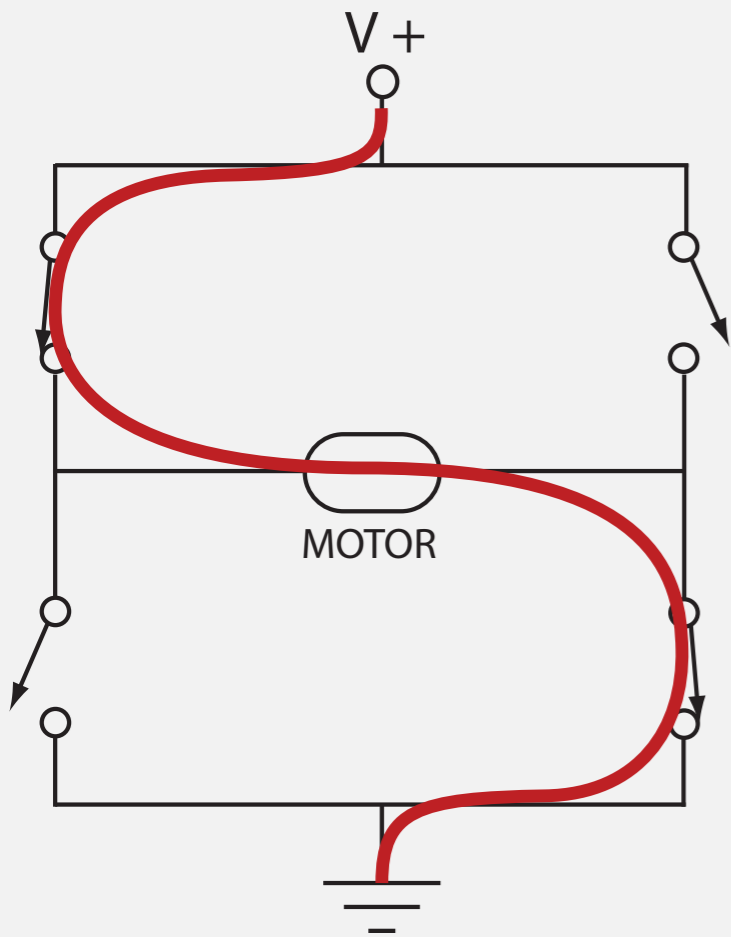
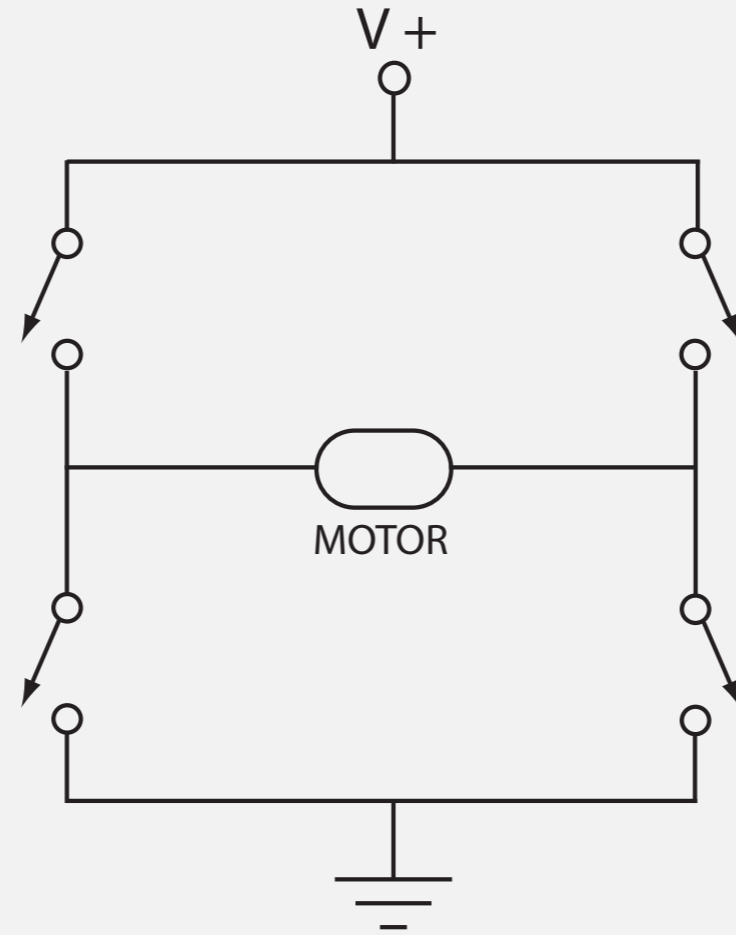


IRLZ34N (N-channel Power MOSFET)

gate threshold voltage = 1-2V
on resistance = 0.035Ω
max drain current = 30A
drain-source breakdown = 55V



The H-bridge



Driver ICs

L293d (Quad Half-H Driver)

V_{CC1} (logic supply) = 4.5V - 7.0V
 V_{CC2} (motor supply) = V_{CC1} - 36V
input high = 2.3V - V_{CC1}
input low < 1.5V
600mA (1.2A peak) per channel
internal protection diodes

