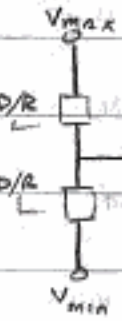
• VOLTAGES IN PARALLEL ARE EQUAL

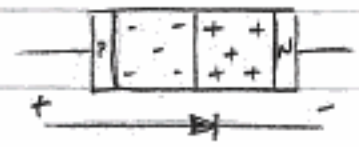
DIODES AND DIODE CIRCUITS

DIODE TREES

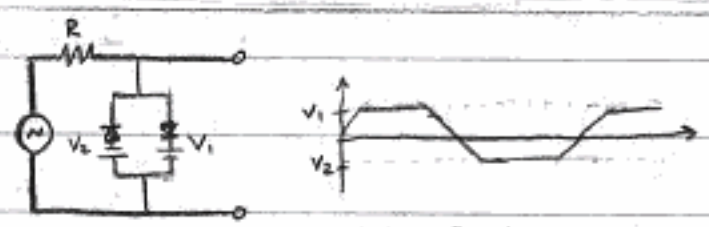


- DIODE POINTS AWAY FROM NODE: $V_o = V_{min}$
- DIODE POINTS TOWARD NODE: $V_o = V_{max}$
- $I_D = \left(\frac{V_{source} - V_o}{R}\right)$ (MULTIPLE DIODES AIMED FROM NODE)
- $I_D = \frac{V_i - V_o}{R_i}$ (IF CONDUCTING) SINGLE DIODE
- $I_D = \left(\frac{V_o - V_{sink}}{R}\right)$ (MULTIPLE DIODES AIMED TO NODE)
- MULTIPLE DIODES: MIN/MAX FROM A DIODED LEG

PN JUNCTION



BILATERAL LIMITER

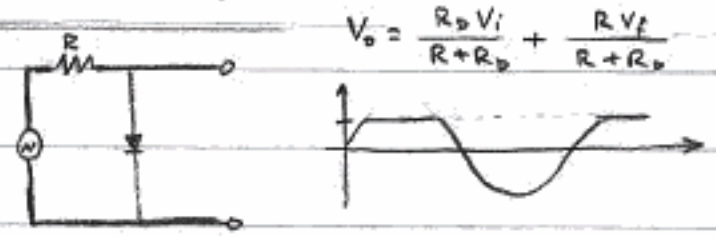


R_f = DIODE PROJECTED CUT-IN VOLT.

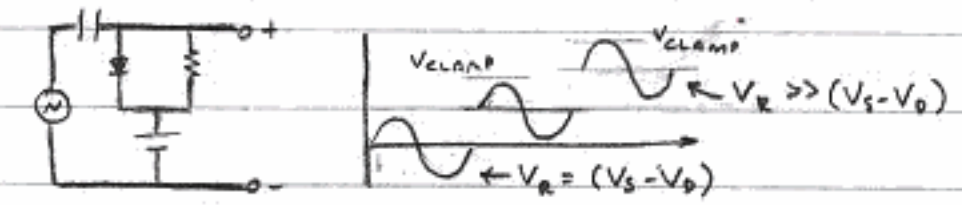
R_D = DIODE FORWARD RESISTANCE

$$V_o = \frac{R_D V_i}{R + R_D} + \frac{R V_f}{R + R_D}$$

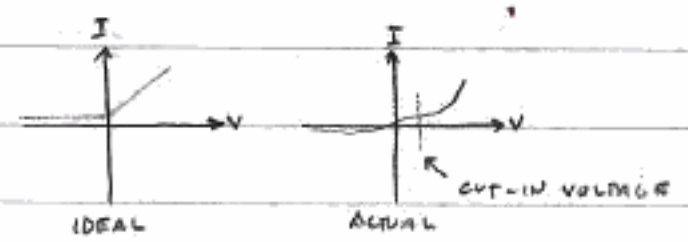
DIODE CLIPPING



VOLTAGE CLAMP



IDEAL VS. ACTUAL



PEAK DETECTOR

$$I_c(t) = \frac{\partial V}{\partial t}$$

FACTS

SCHOTTKY DIODE: SWITCHES FASTER
LOWER VOLTAGE DROP

LED: CURRENT → LIGHT
HIGHER V_F

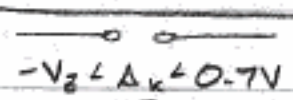
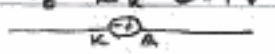
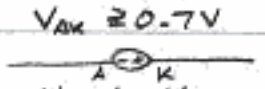
PHOTODIODE: LIGHT → CURRENT
· ELECTRON RELEASED

BRIDGE RECTIFIER IS PREFERRED B/C SMALLER CAPACITOR (CHEAPER)

ZENER DIODES WILL PULL WHATEVER I NECESSARY TO MAINTAIN V

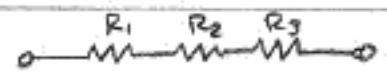
CHECKS

ASSUMPTIONS

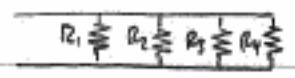
REVERSE BIAS	 $-V_z < \Delta_K < 0.7V$
FORWARD BIAS	 $V_{AK} \geq 0.7V$
ZENER	 $V_{AK} \leq -V_z$

WHEN CHOOSING DIODES, TWO MAIN CONSIDERATIONS:

1. CURRENT HANDLING CAPABILITIES
2. PEAK INVERSE VOLTAGE

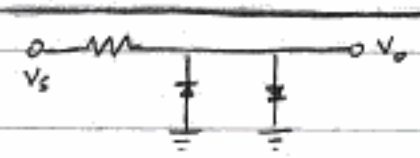
VOLTAGE DIVIDER: 

$$V_n = \frac{V_s \cdot R_n}{\sum R}$$

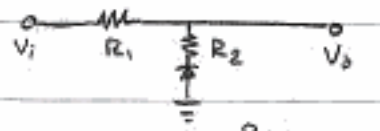
CURRENT DIVIDER: 

$$I_n = \frac{I_s R_n}{\sum R}$$

MISC CIRCUITS

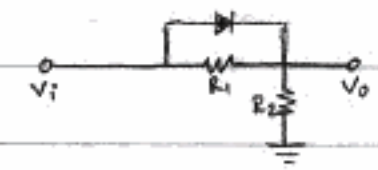


$V_o = \emptyset$



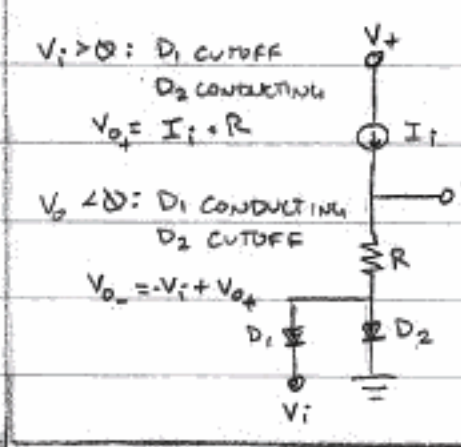
$V_i < \emptyset$: $V_o = \left(\frac{R_2}{R_1 + R_2}\right) V_i$

$V_i > \emptyset$: $V_o = V_i$



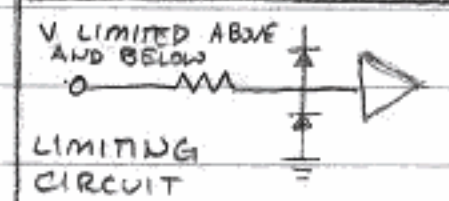
$V_i > \emptyset$: $V_o = V_i$

$V_i < \emptyset$: $V_o = \left(\frac{R_2}{R_1 + R_2}\right)$

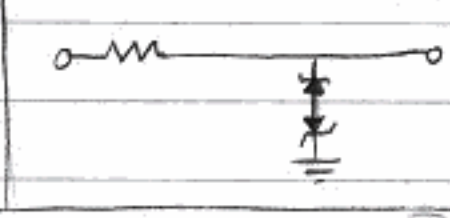


$V_i > \emptyset$: D_1 CUTOFF
D_2 CONDUCTING
$V_{o+} = I_i \cdot R$

$V_o < \emptyset$: D_1 CONDUCTING
D_2 CUTOFF
$V_{o-} = -V_i + V_{o+}$



ZENER LIMITING CIRCUIT

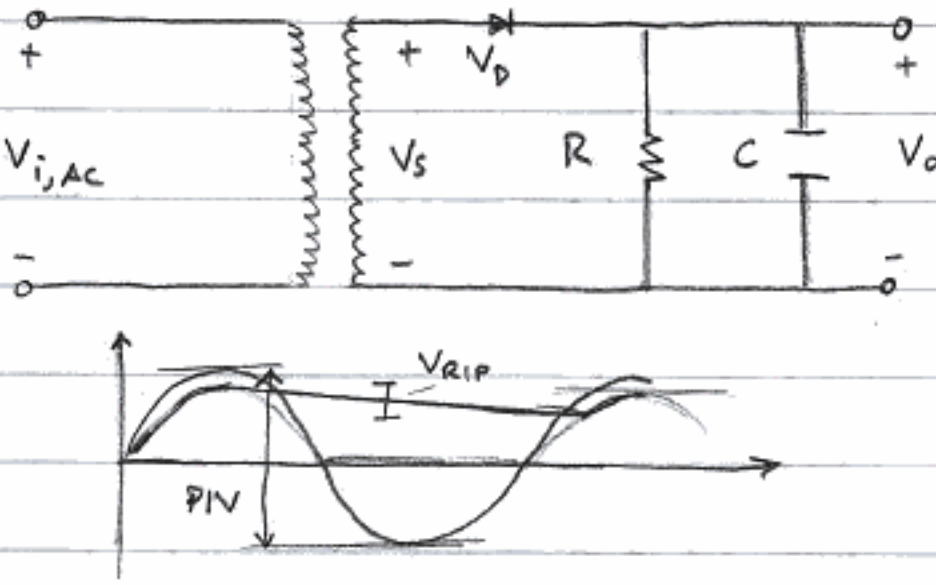


M. Nash
2010

$$V = \sqrt{2} \cdot V_{rms}$$

PEAK RECTIFIER CIRCUITS

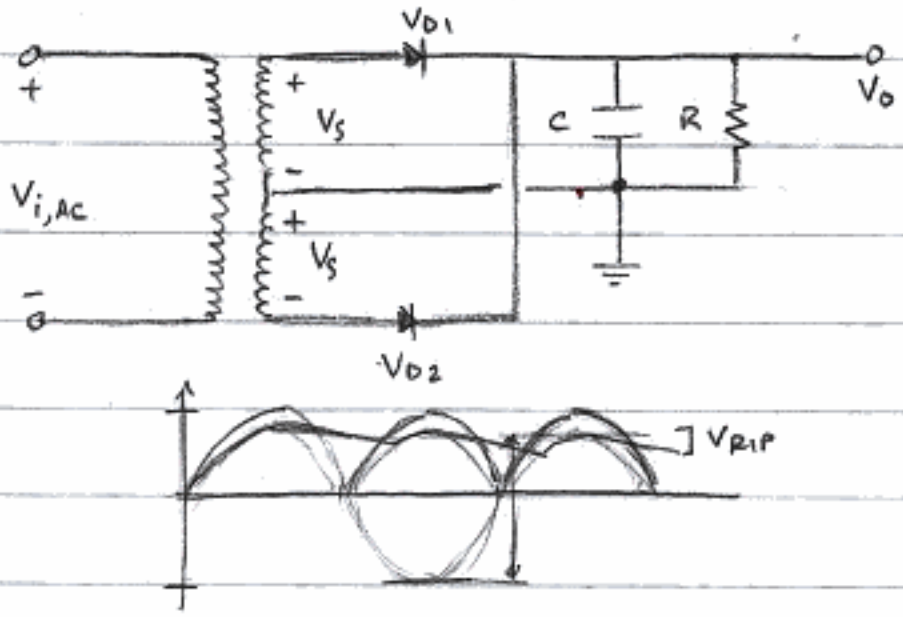
TEST 2 NOTE SHEET NASH



HALF-WAVE PEAK RECTIFIER

- $V_{RIP} = \frac{V_{max}}{fR \cdot C}$
- $V_{max} = \frac{1}{2} V_{RIP} + V_o$
- $V_{PK} = V_o + \frac{1}{2} V_{RIP} + |V_D|$
- $V_{S,rms} = \frac{V_{PK}}{\sqrt{2}}$
- $V_{PK-PK} = |V_{+,PK}| + |V_{-,PK}| + |V_D| + |\frac{1}{2} V_{RIP}|$
- $PIV = (100\% + x\%)(V_{PK-PK})$
- $I_{D,AVG} = \left(\frac{V_o}{R}\right)\left(1 + \pi\sqrt{\frac{2V_{max}}{V_{RIP}}}\right)$
- $I_L = \frac{V_o}{R}$
- $I_{o,max} = \left(\frac{V_o}{R}\right)\left(1 + 2\pi\sqrt{\frac{2V_{max}}{V_{RIP}}}\right)$

* PIV = PEAK INVERSE VOLTAGE ACROSS DIODE (MAX REVERSE)

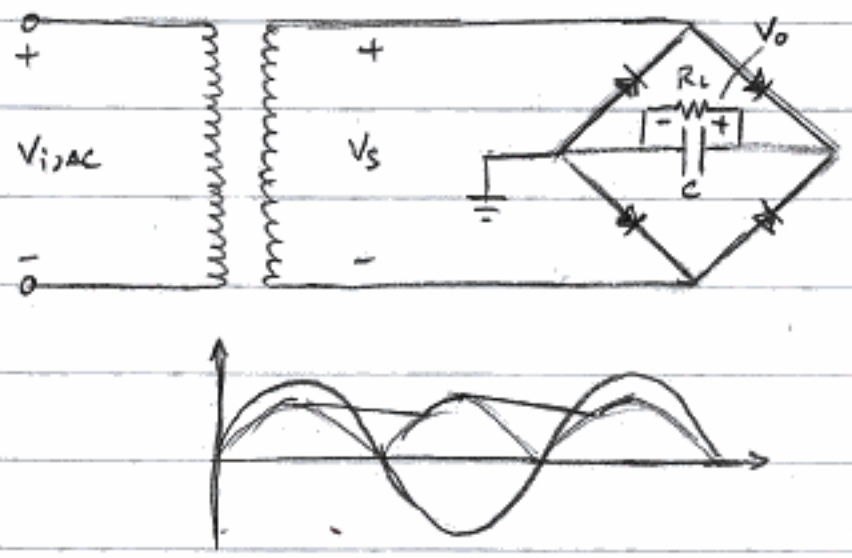


FULL-WAVE PEAK RECTIFIER

- $V_{RIP} = \frac{V_{max}}{2fRC}$
- $V_{max} = \frac{1}{2} V_{RIP} + V_o$
- $V_S = V_{MAX} + V_D$
- $V_{PK-PK} = 2V_S - V_D$
- $PIV = (100\% + x\%)(V_{PK-PK})$
- $I_{D,AVG} = \left(\frac{V_o}{R}\right)\left(1 + \pi\sqrt{\frac{V_{max}}{2V_{RIP}}}\right)$
- $V_{S,rms} = \frac{2V_S}{\sqrt{2}}$
- $I_{D,max} = \left(\frac{V_o}{R}\right)\left(1 + 2\pi\sqrt{\frac{V_{max}}{2V_{RIP}}}\right)$

EX VALUES:

$V_o = 15V$
$V_{max} = 16V$
$V_S = 16.7V$
$V_{PKPK} = 32.7V$



FULL-WAVE BRIDGE PEAK RECTIFIER

- $V_S = V_o + \frac{1}{2} V_{RIP} + 2V_D$
- $V_{S,rms} = \frac{V_S}{\sqrt{2}}$
- $V_{RIP} = \frac{V_{max}}{2fCR}$
- $V_{max} = \frac{1}{2} V_{RIP} + V_o$
- $V_{-PK} = -V_{max} - V_D = V_{max,REVERSE}$
- $PIV = (100\% + x\%)|V_{-PK}|$
- $I_{D,AVG} = \left(\frac{V_o}{R_L}\right)\left(1 + \pi\sqrt{\frac{V_{max}}{2V_{RIP}}}\right)$
- $I_{D,max} = \left(\frac{V_o}{R_L}\right)\left(1 + 2\pi\sqrt{\frac{V_{max}}{2V_{RIP}}}\right)$

* $I_{D,AVG}$ = AVG I THROUGH DIODE DURING CONDUCTION