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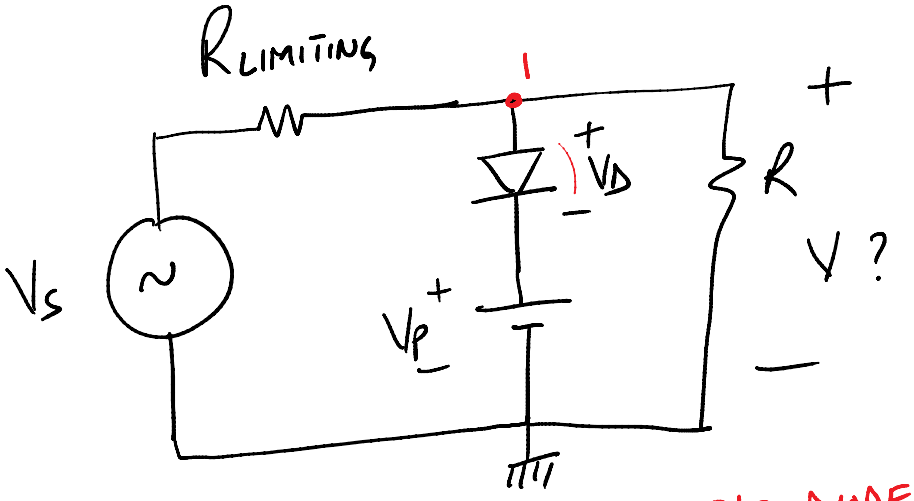
LECTURE-19

DIODE AS A CLIPPER OR LIMITER

DIODE → TURN ON VOLTAGE V_{to}
REVERSE SAT. CURRENT I_o
$-I_o$



WHEN THE DIODE ~~IS~~ IS TURNED ON
$V_D = V_{to}$

1) $V_s < (V_{to} + V_p)$ → DIODE AND V_p ACT AS OPEN CIRCUIT ∴ V FOLLOWS V_s
(V)

2) $V_s > (V_{to} + V_p)$ + SOME DROP ACROSS R LIMITING

DIODE IS ON → OUTPUT IS CLIPPED TO
$V_{to} + V_p = V$

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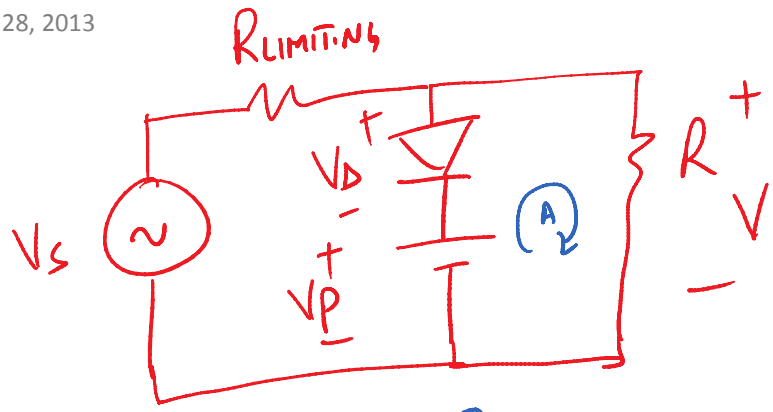


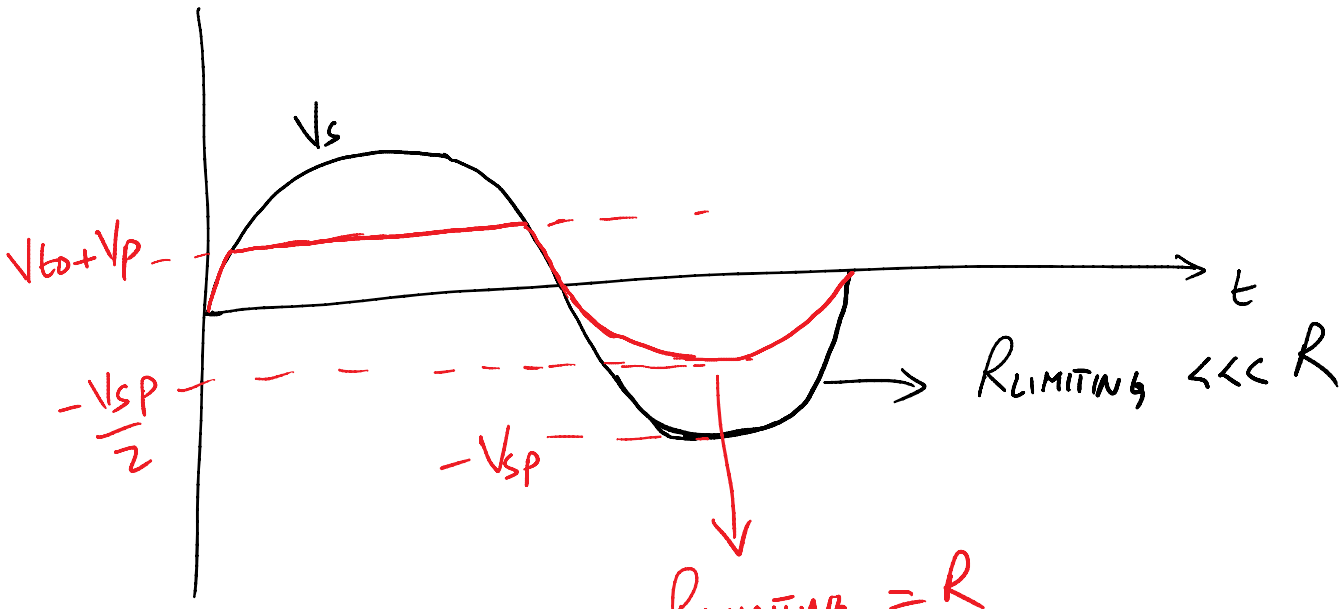
KVL

$-V_P - V_D + V = 0$

$V = V_P + V_D$

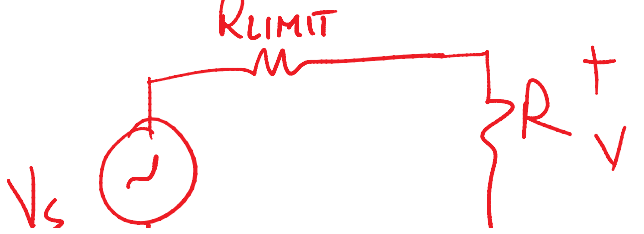
IF DIODE IS ON $\therefore V_D = V_{to}$

$\therefore V = V_{to} + V_P$



$R_{LIMITING} = R$

WHEN DIODE IS OFF



$V = \frac{V_S R}{R_{LIMIT} + R}$

$\therefore V \approx V_S$

KLIMA

$V = \frac{1}{2} V_s$

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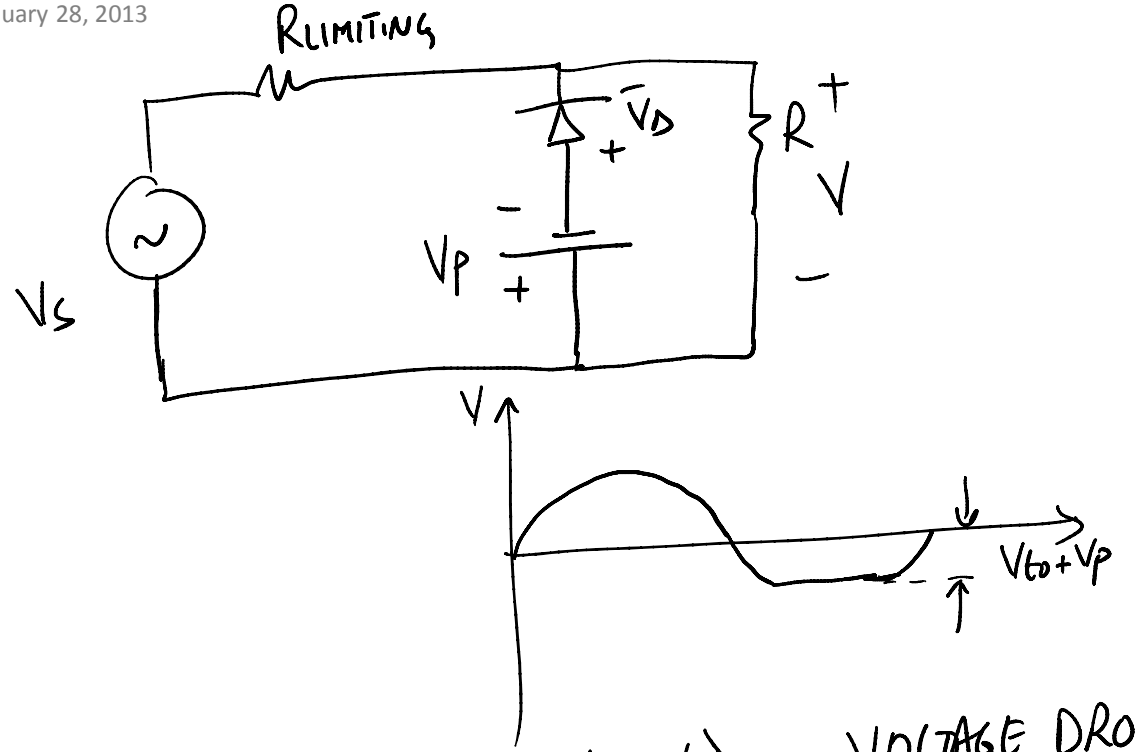

* IF $V_S < -(V_\gamma + V_P)$ – VOLTAGE DROP ACROSS R_{LIMIT}

o/p IS CLIPPED TO $-(V_\gamma + V_P)$

* IF $V_S > -(V_\gamma + V_P)$ THEN DIODE IS OFF!

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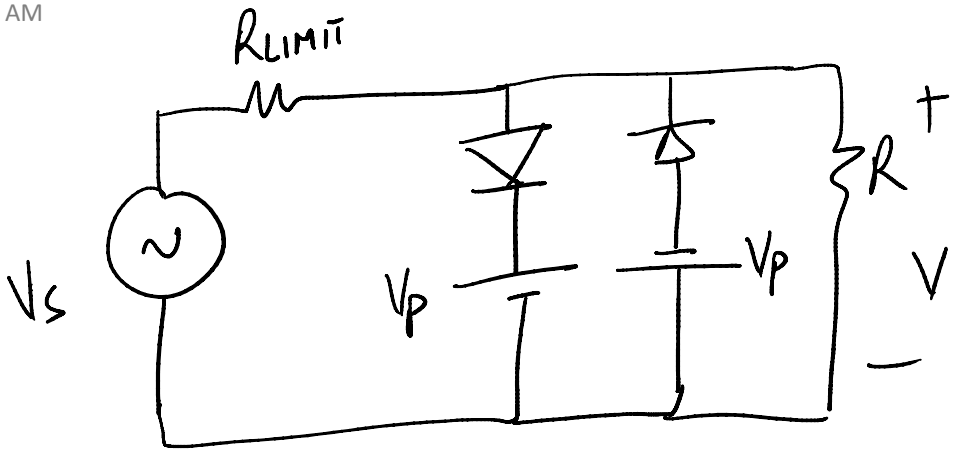

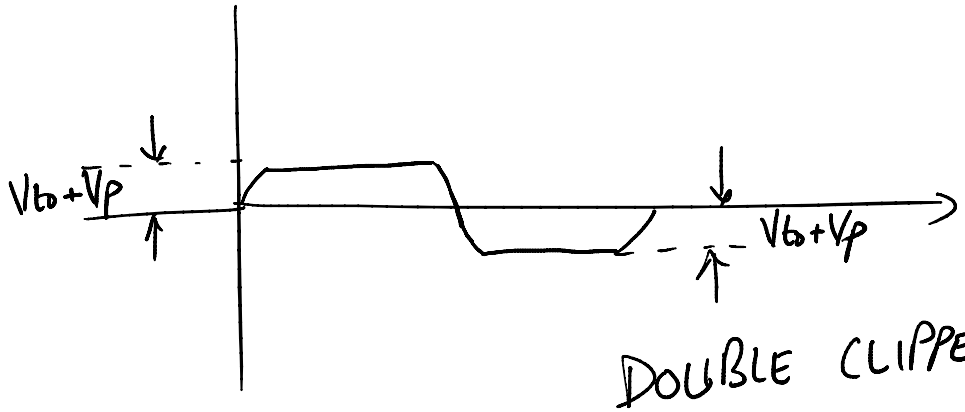

DOUBLE CLIPPER/LIMITER

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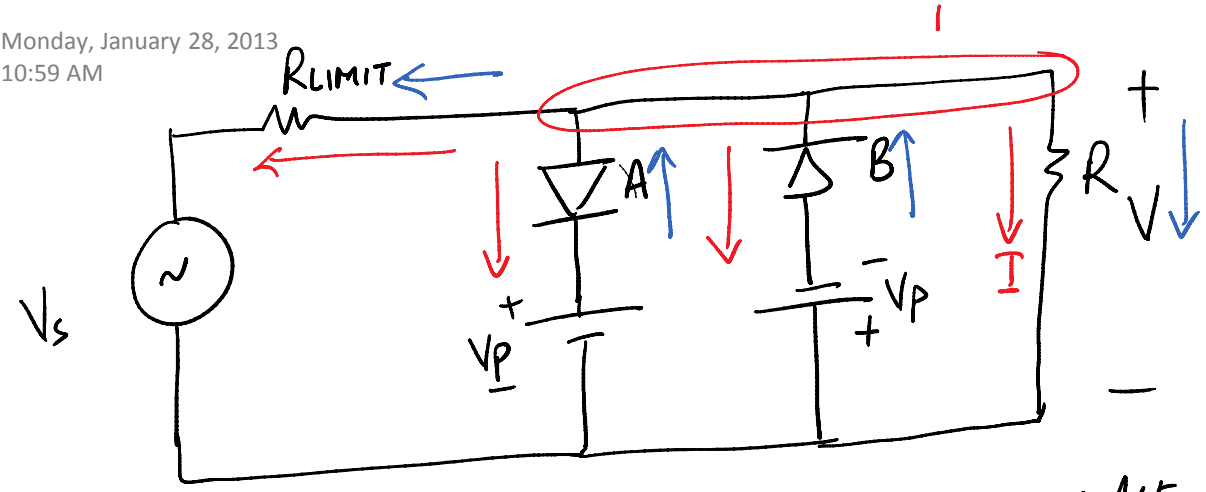

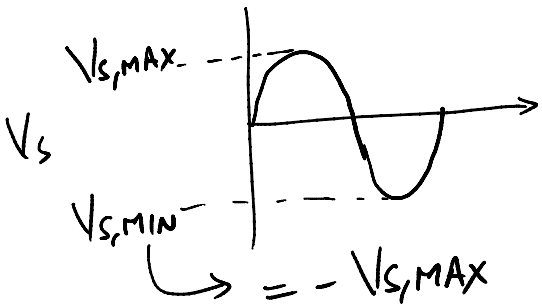

TURN-ON VOLTAGE = V_{to}

REVERSE SAT. CURRENT = $-I_o$

DIODE IS ON IF $|V| = |V_{to}+V_P|$

DIODE IS OFF IF $|V| < |V_{to}+V_P|$

SOURCE $|V_s| > |V_{to}+V_P|$

① $V_{s,MAX}$ $\Rightarrow$ $V_s = V_{s,MAX}$

A IS FB

B IS RB

$V_{D,A} = V_{to,A} \Rightarrow V = V_{to,A} + V_P$

$I_{D,B} = -I_{o,B}$

$I = V/R = \dfrac{(V_{to,A}+V_P)}{R}$

KCL NODE 1

$$\frac{V - V_{s,MAX}}{R_{LIMIT}} + I_{D,A} + I_{o,B} + \frac{V}{R} = 0$$

$$I_{D,A} = -\left(\frac{V - V_{s,MAX}}{R_{LIMIT}}\right) - I_{o,B} - \frac{V}{R}$$

2) FOR $V_S = -V_{S,MAX}$

DIODE A IS RB, DIODE B IS FB

$I_{D,A} = -I_{O,A}$

$V_{D,B} = V_{to,B}$

$$V = -(V_{to,B} + V_P)$$

$$I = \frac{V}{R} = -\frac{(V_{to,B} + V_P)}{R}$$

KCL AT NODE 1 TO FIND $I_{D,B}$

$$\frac{V + V_{S,MAX}}{R_{LIMIT}} - I_{D,B} - I_{O,A} + \frac{V}{R} = 0$$

$$I_{D,B} = \frac{V + V_{S,MAX}}{R_{LIMIT}} - I_{O,A} + \frac{V}{R}$$

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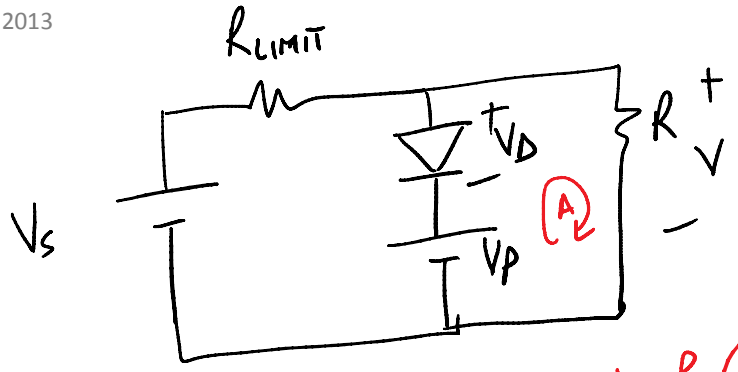
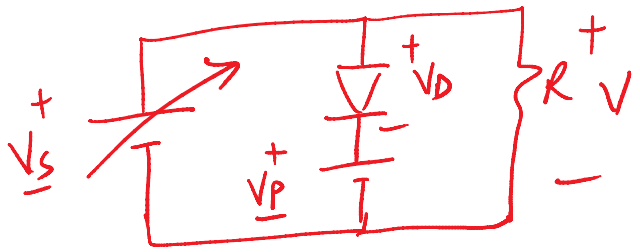


KVL LOOP (A)

$-V_P - V_D + V = 0$

$V = V_P + V_D$

(1) $R_{LIMIT} = 0$



$V_{to} = 0.7V$

IF $V_S > 0.7 + V_P$ $\therefore V = V_P + 0.7V$

$V_S < 0.7 + V_P$ → DIODE IS OF (OPEN CIRCUIT)

$V = V_S$

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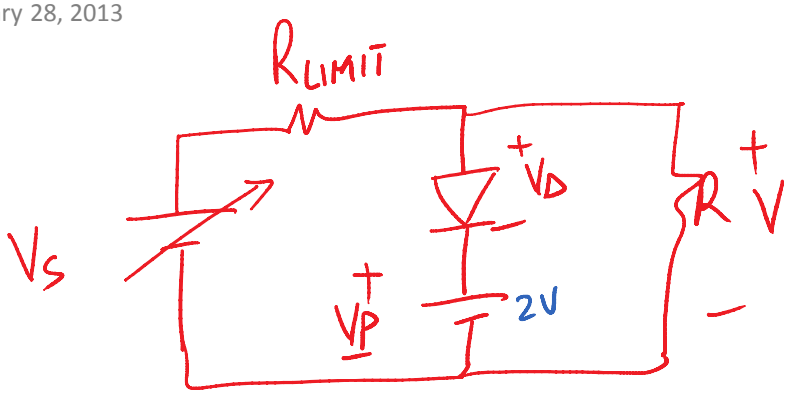
(2)



$V_{D0} = 0.7V$

$V = V_{D0} + V_P = 2.7V$

$R_{LIMIT} = R$

V_S	V	V_D	$V_{R_{LIMIT}}$
0	0		0
0.5	0.25		0.25
2	1		1
6	2.7	0.7	3.3
10V	2.7	0.7	7.3