L7: Zener Diodes : PART(1): (11-6-2020)

هاد الصفحة للحلوة فقط

(Voltage Regulator)

R_s , $I_s = \dfrac{V_{in} - V_z}{R_s}$, $I_s = I_z + I_L$

(V_{in} → min, max ; I_z → max, min ; I_L → max, min)

واختيارها جزء مهم.

→ Find Range of acceptable R_s in the voltage Regulator. حكي مجرد ذكر وما راح نتعمق في الحل بهالدرجة.

1) $I_Z = I_S - I_L \geq I_{Z(min)}$

Worst Case: the smallest value of $(I_s - I_L) > I_{Zmin}$

$$I_{S(min)} - I_{L(max)} \geq I_{Zmin}$$

$$\frac{V_{S(min)} - V_Z}{R_s} - I_{L(max)} \geq I_{Z(min)}$$

$$R_s \leq \frac{V_{S(min)} - V_Z}{I_{Z(min)} + I_{L(max)}} \quad \text{(Upper limit)}$$

---

2) $I_Z \leq I_{Z(max)}$

worst case: largest value of $(I_{S(max)} - I_{L(min)}) \leq I_{Z(max)}$

$$\frac{V_{S(max)} - V_Z}{R_s} - I_{L(min)} \leq I_{Z(max)}$$

$$R_s \geq \frac{V_{S(max)} - V_Z}{I_{Z(max)} + I_{L(min)}}$$

* Slides: EXAMPLE: تحويل مباشر

* Variation of V_Z (Using Simplified Method):-

$r_Z = \dfrac{\Delta V_Z}{\Delta I_Z}$

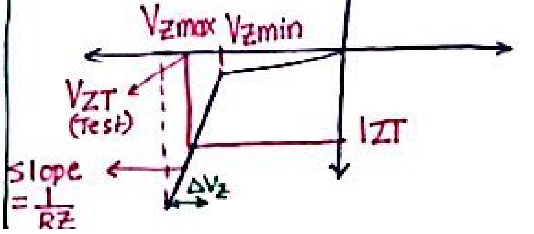
If V_{ZT} & I_{ZT} & r_Z are known

1) $V_{Zmax} = V_{ZM} = V_{ZT} + \Delta I_Z \cdot r_Z$
$= V_{ZT} + (I_{Zmax} - I_{ZT}) \cdot r_Z$

---

2) $V_{Zmin} = V_{ZK} = V_{ZT} - \Delta I_Z \cdot r_Z$
$= V_{ZT} - (I_{ZT} - I_{Z(min)}) \cdot r_Z$.\.

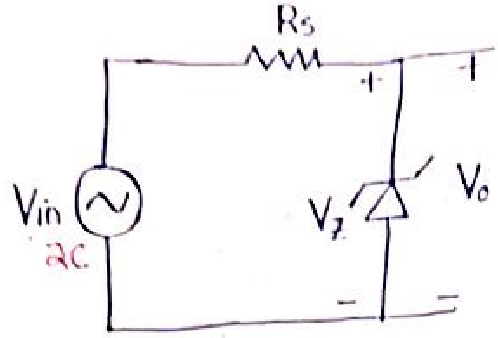
* الرسمة في ال Slides :-
+ example



Scanned with CamScanner

* Clipper Circuits Using Zener Diods:-

- ماذا لو كان المصدر هو sinusoid وبنتي Zener Diode



Analysis:- (Simplified)

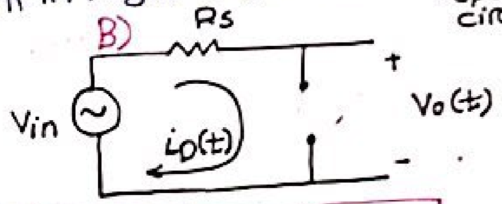
ac voltage → + / −

a) When $V_i(t) < -0.7\,V$ works in region (1) as regulator Diode ON.

$V_{out} = -0.7\,V$

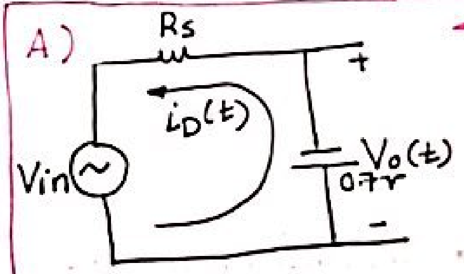
b) When $V_Z > V_i(t) > -0.7\,V$ Zener work in region (2) as diode OFF. "open circuit".

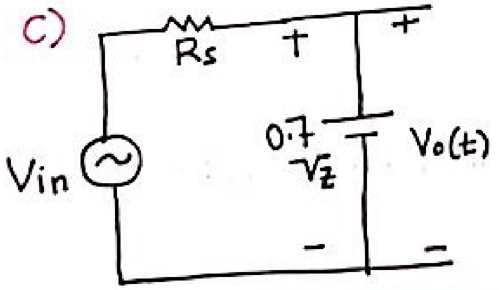
$V_{out} = V_{in}$.



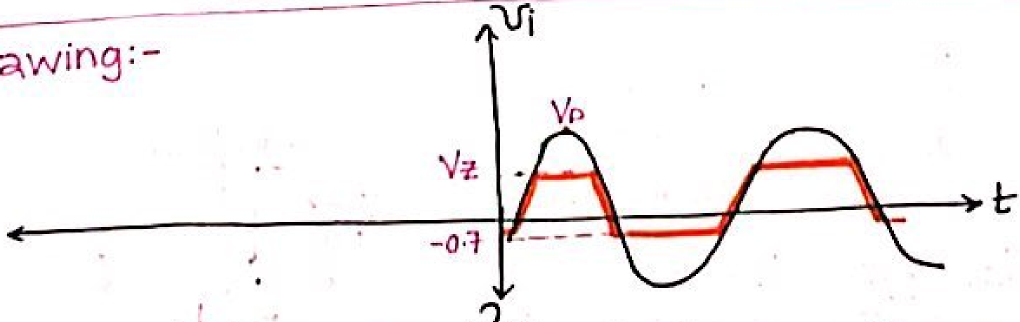
c) When $V_i(t) > V_Z(t)$, Zener work in region (3) as voltag regulator.

$V_o(t) = V_Z$.



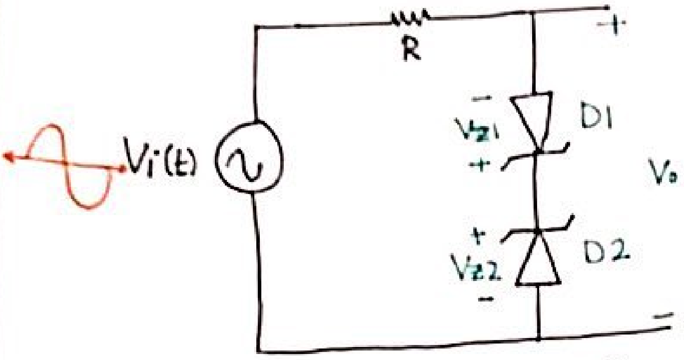


Drawing:-



Scanned with CamScanner

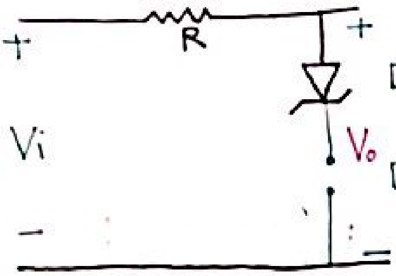
* Clipper circuits using Zeners:-



* FIND AND Sketch $V_o(t)$?

$V_i(t)$

→ 1



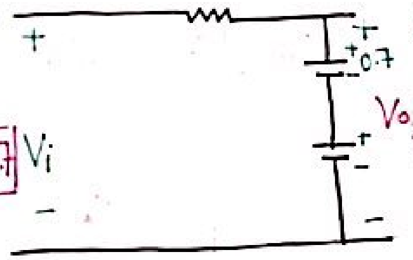
Diode عادي → $\frac{+}{-}$ 0.7 or "short circuit"

Diode "open circuit"
1) $V < V_{z2}$

$0.7 < V_i < V_{z2}$

$\boxed{V_o = V_i}$

2

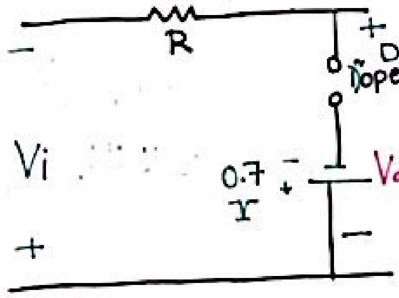


2) $V > V_{z2}$

$V_i > V_{z2}$

$\boxed{V_o = V_{z2} + 0.7}$

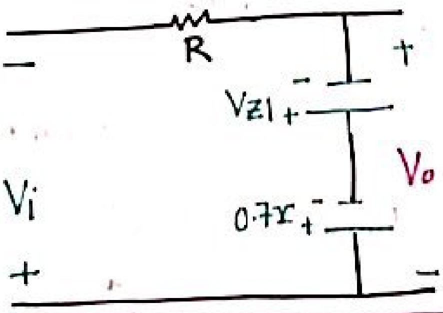
$V_i(t)$ → 1



Diode "open circuite" or

$0.7 < V_i < V_{z1}$

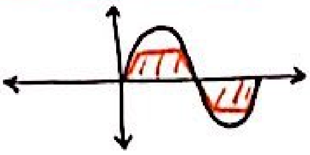
$\boxed{V_o = V_i}$



$V_i > V_{z1}$

$\boxed{V_o = -(V_{z1} + 0.7)}$

Drawing : Clipping Circuit:



Scanned with CamScanner

* two equivalent Clipper Circuits :-
in slides

(1)
أوصلهم اتجاههم
على الـ Vتبار فقط
Zener
diodes

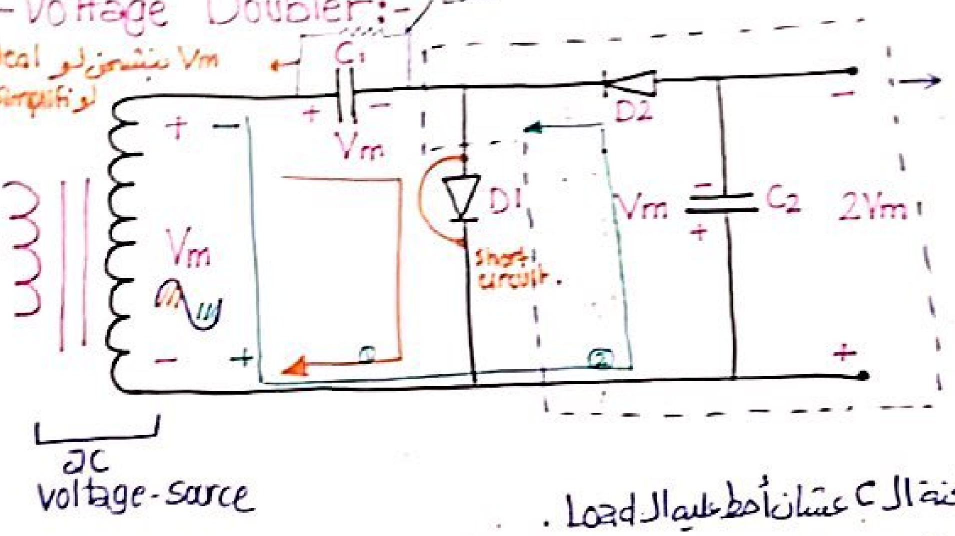
(2)
diodes
+Battery .

* Voltage - Multiplier Circuits:-

- تكون مصدر فولتية ac ولدي أحصل على dc منه فبدي إياه كان الـ Amp تاعه أكبر من Vp للـ ac .

-Voltage Doubler:-

(deal Vm بنشحن لو
Vm-0.7 simplify لو



لو هاد الجزء مش موجود فيه تكون clamping circuit تعمل shift down.

- معني أعرف شحنة الـ C عشان أحط عليها الـ Load .
- C1 بنشحن في Positive half .
- C2 بنشحن negative half بالأخضر، ويكون C1 مشحون و D2 short circuit فتكون C1 + Vm المصدر = C2
= 2Vm .

*Voltage Tripler and Quardrupler:-

* الرسمة فالـ slides .
- كل section فيها (4) بتحتوي على Capacitor والـ Diode .
نطبق على KVL على loops :
- C1 راح تنشحن V_M
- C2 " " $2V_M$ "
- C3 " " 2Vm "
- C4 " " 2Vm "

* لـ 3Vm
4Vm
2Vm
هدول على الرسمة و بنبته حسب الـ Polarity .

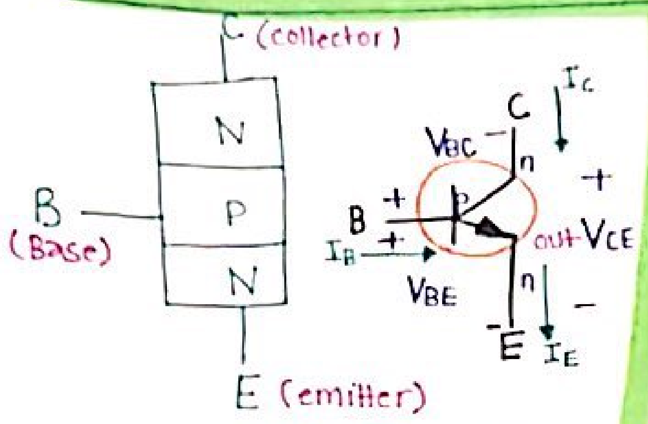
.4.

Scanned with CamScanner

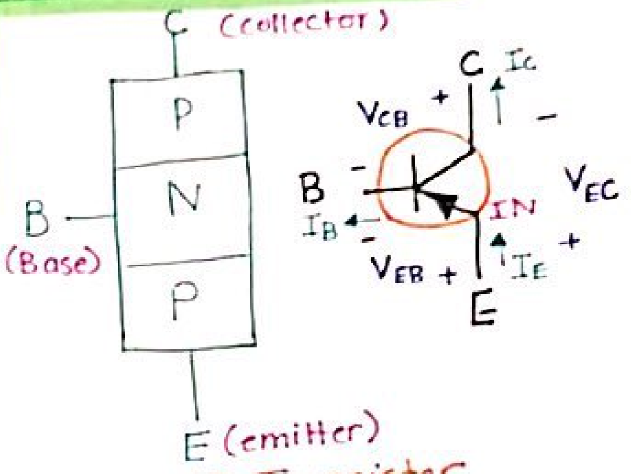
L7: PART(2): Bipolar Junction Transistors:- (BJT):-

- من أهم الـ devices إحدى الـ semi-conductor ، أهم استخدام إله بالـ amplifilors ، وهو مكون
أساسي لأي electronics circuit ، والـ 3 terminals
مهمة للـ IC circuits ، وهو مكون أساسي Logic gates.

npn, pnp > 2TYPES ، Base, Emitter, collector > 3 terminals



NPN-Transistor



PNP-Transistor

1. 2 P-N JUNCTION (2 diodes)
   between B → C
   B → E

2. 3 Currents. وكلها تهم الناحية لسبب تشتغل الـ Transistor كـ amplifire.

* التيارات هم حركة للشحنات الموجبة في الـ device.

* 2-PN JUNCTIONS:-

	BE	BC	Mode	
Amplifire	Forward ON	Reverse OFF	VCE defined by circuit LINEAR/active	لتشتغل amplifier
switch	ON	ON	$V_{CE(sat)} = \sim 0.2V \approx 0$ / $I_C = I_{C(sat)}$ (أقصى قيمة له) Staturation C —o—o— E	close switch between C&E
switch	OFF	OFF	VCE defined by Circuit / $I_C = I_b = 0$ Cut-OFF C —o o— E	open switch between C&E
ما راح نحكي عنها	~~OFF~~	~~ON~~	~~inverse Mode~~	

هدفنا نعمل analyse.

Scanned with CamScanner