截波電路

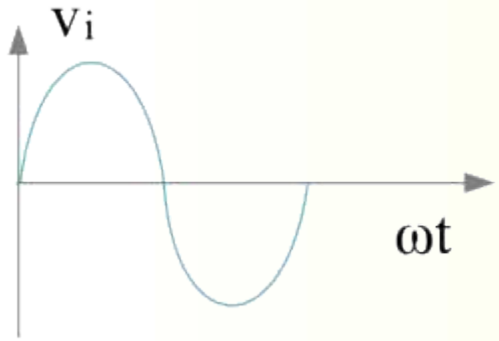
- 又稱為截波器
- **截波器**是將輸入訊號電壓在某一位準以上或以下的部分截掉
- 可限制輸出波形在某個範圍之內，又稱限制器
- **箝位器**則能將輸出訊號定在與輸入訊號不同的直流準位上

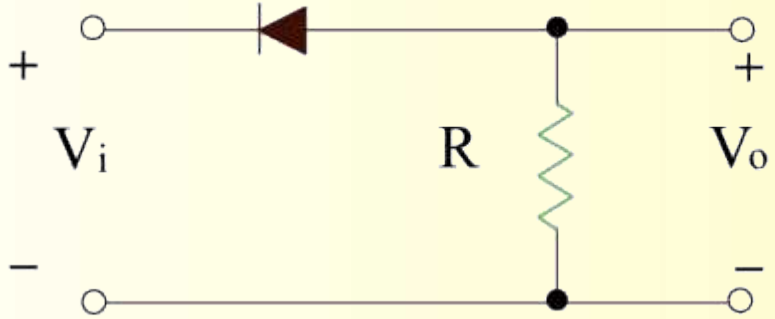
截波器

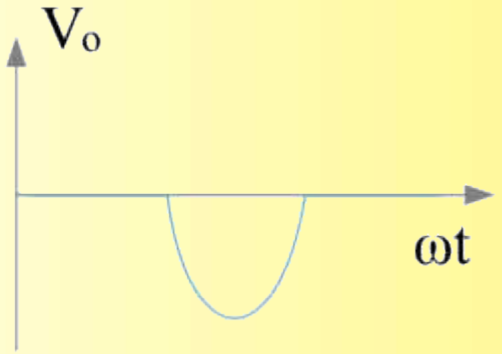
- 截波器最少需要兩種元件：
  - ❖二極體
  - ❖電阻器
- 直流電源也時常會被用到，而成為一個帶有偏壓的截波器

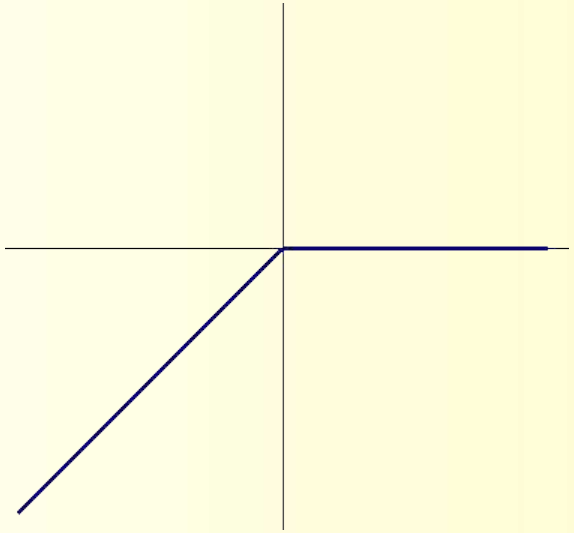
- 依輸出波形可分：
  - ❖上截波器：
    - 截去某一直流準位以上的波形
  - ❖下截波器：
    - 截去某一直流準位以下的波形
- 依電路可分為
  - ❖串聯截波器：二極體導通時有訊號
  - ❖並聯截波器：二極體不導通時有訊號

簡單的串聯截波電路

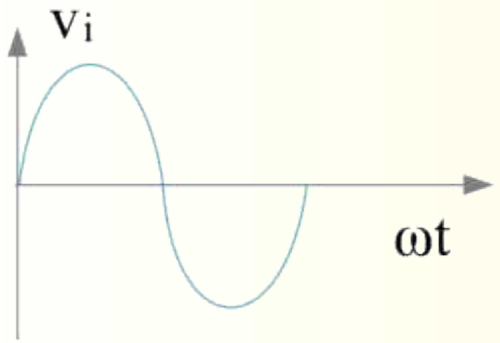


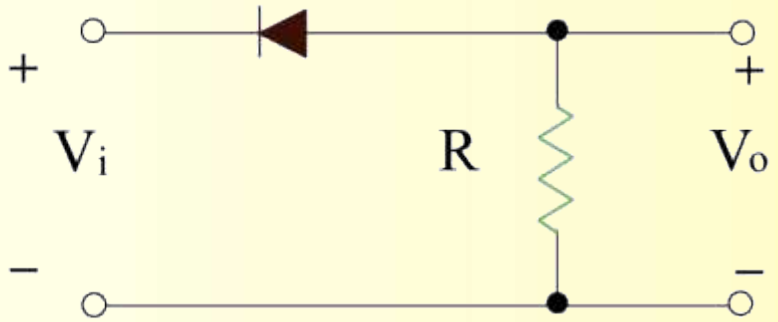


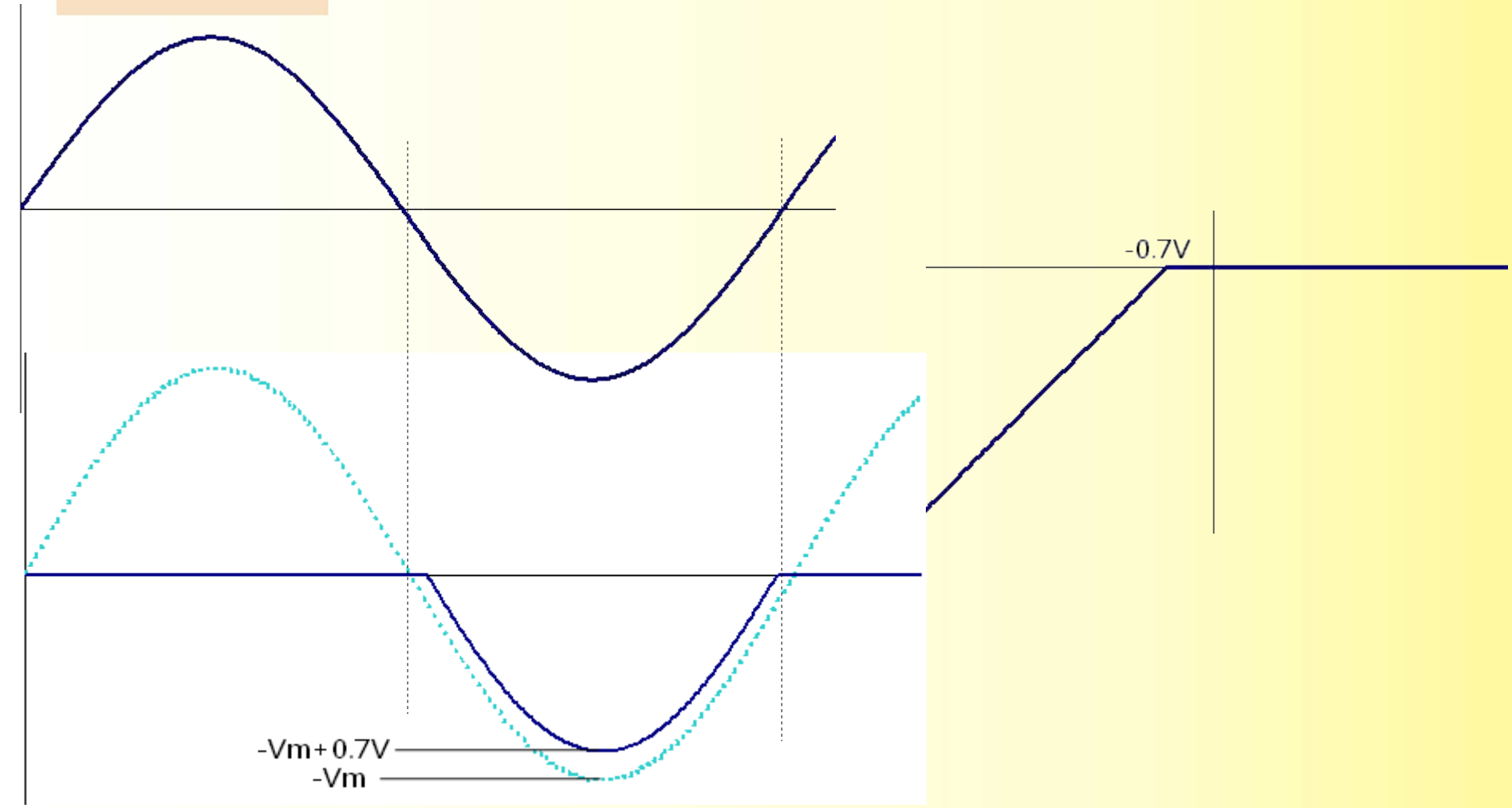




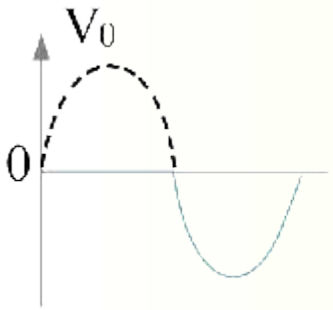
如圖，若其中的二極體為矽質二極體，則實際的輸出波形為何？

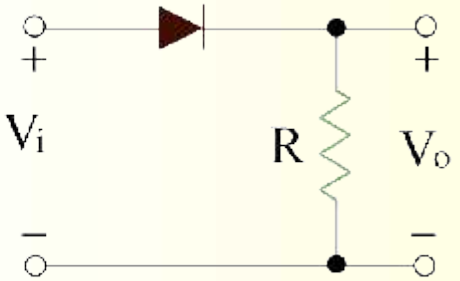


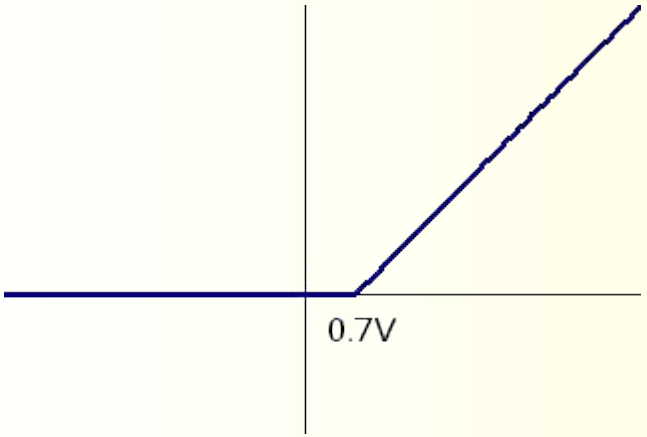


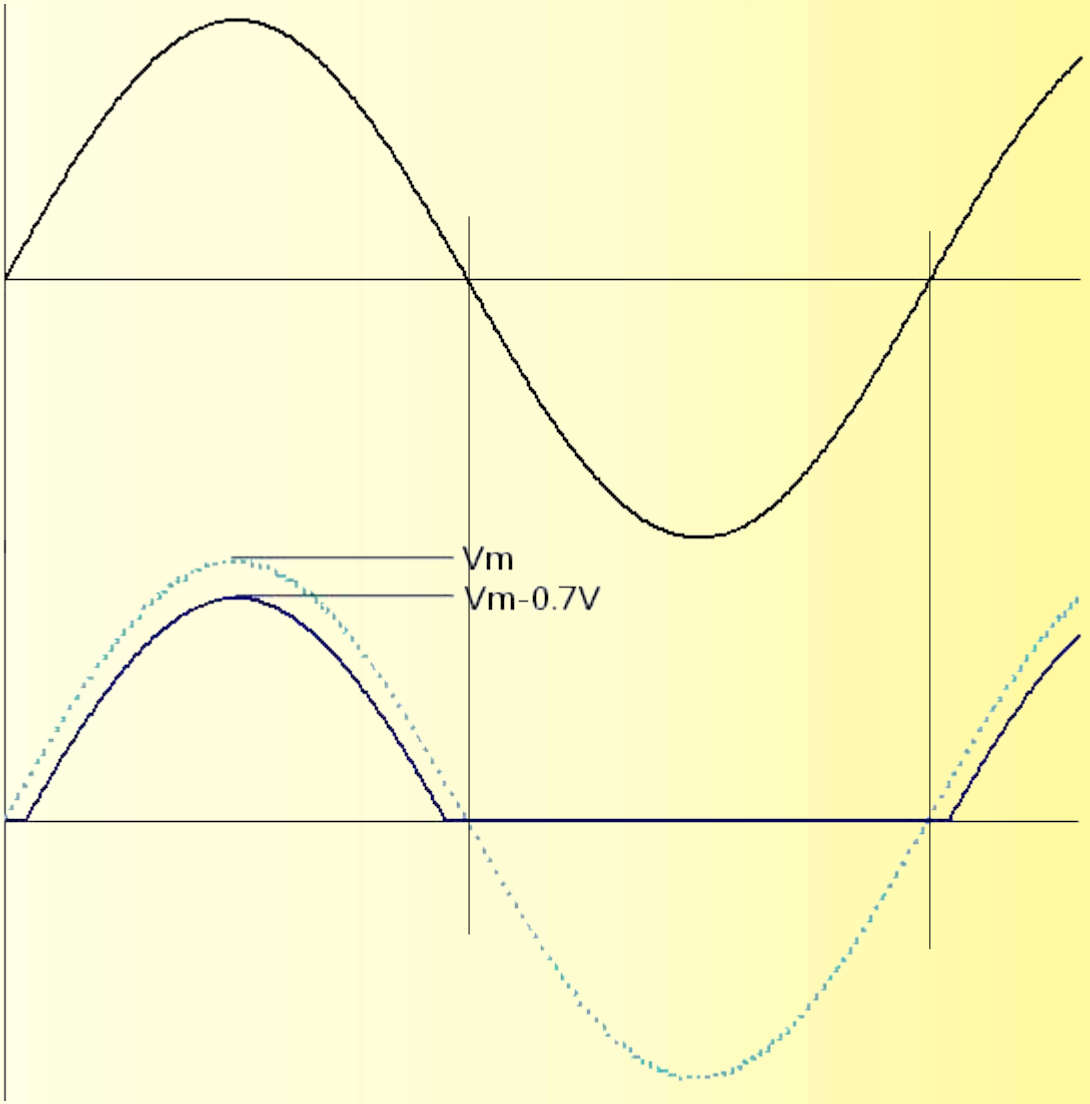

-0.7V
-Vm+0.7V
-Vm

如圖，若其中的二極體為矽質二極體，則實際的輸出波形為何？

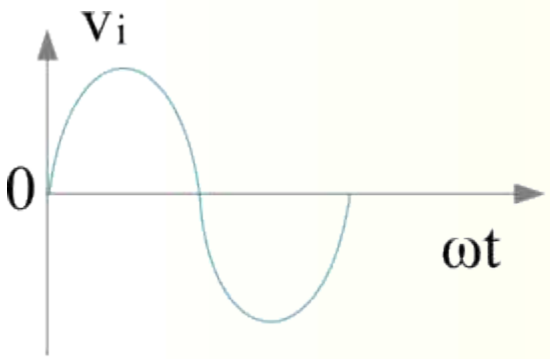


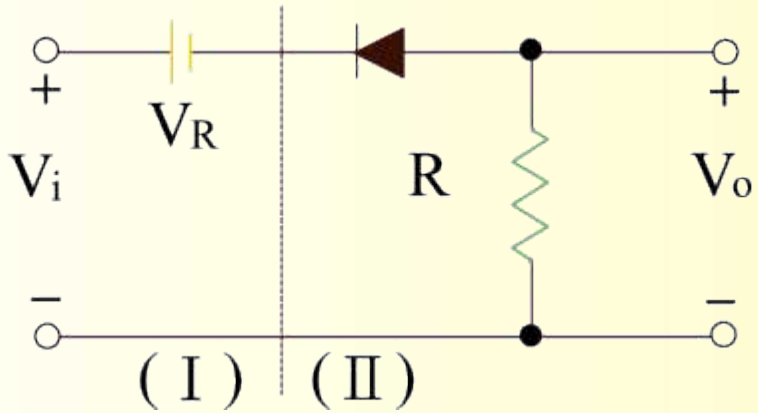


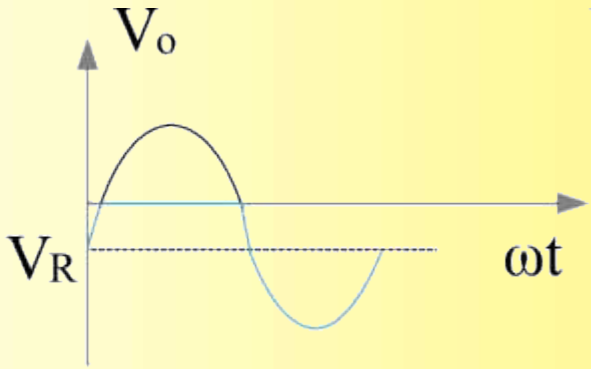


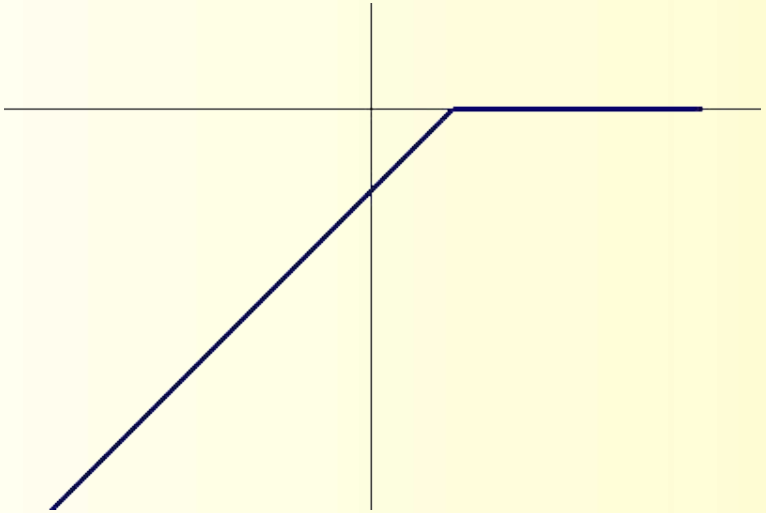


加偏壓的串聯截波器

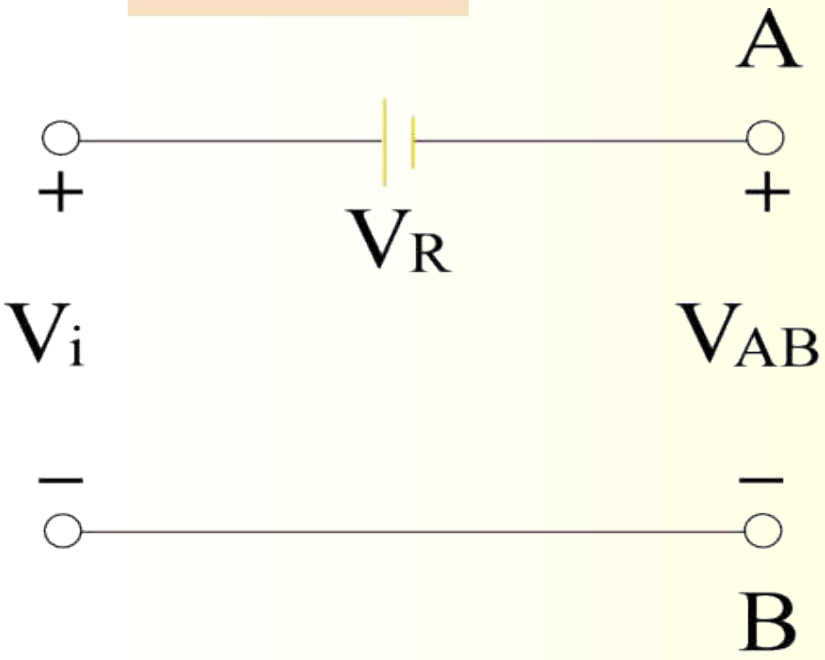




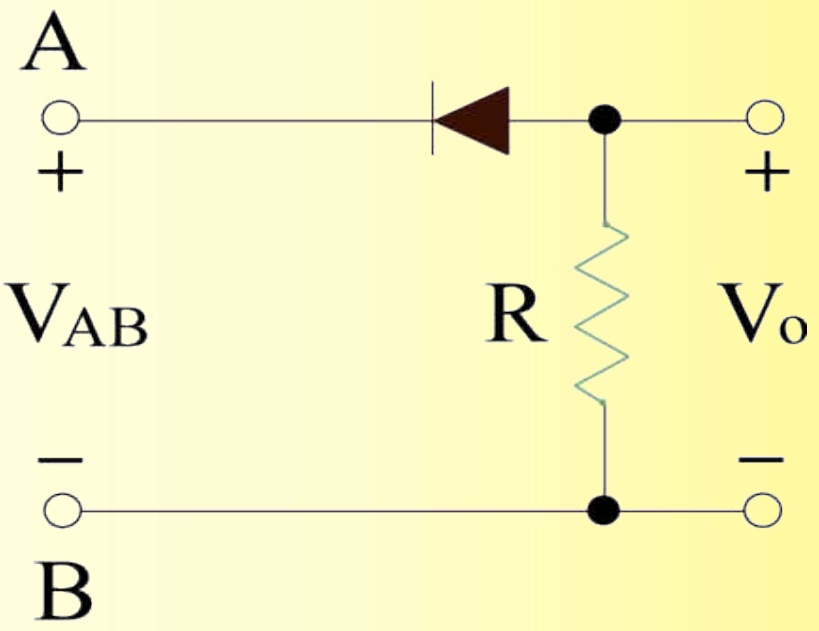




分段網路及各段網路之輸出波形

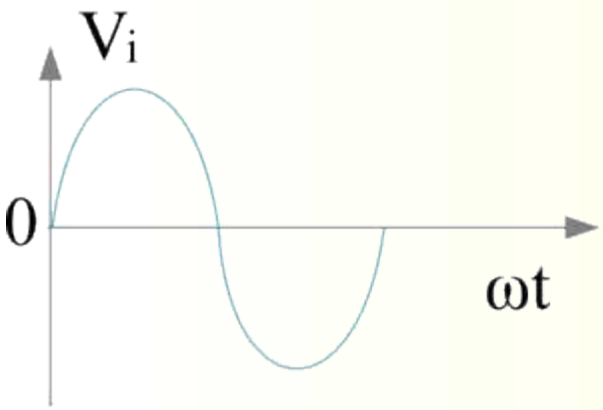


(Ⅰ)

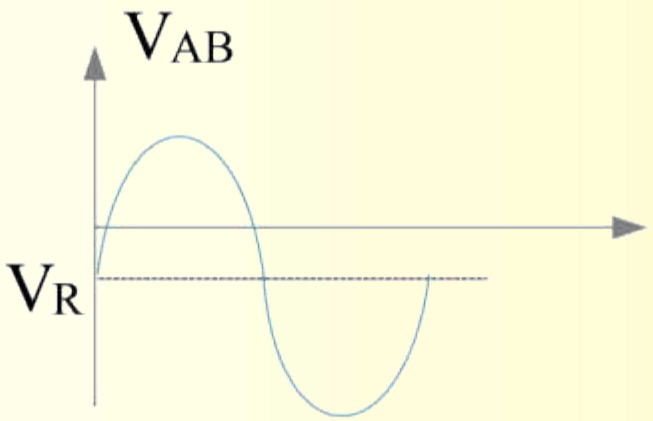


(Ⅱ)

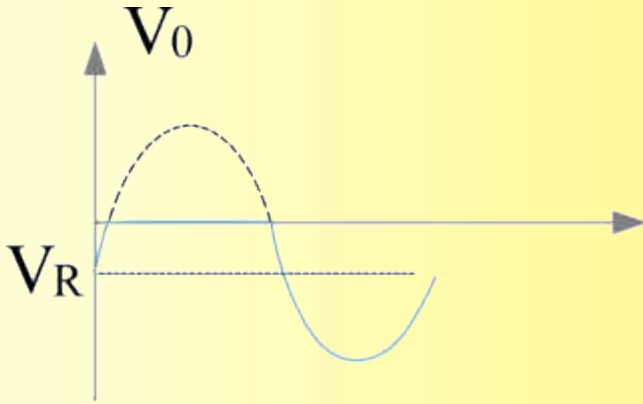
分段網路及各段網路之輸出波形



(a)

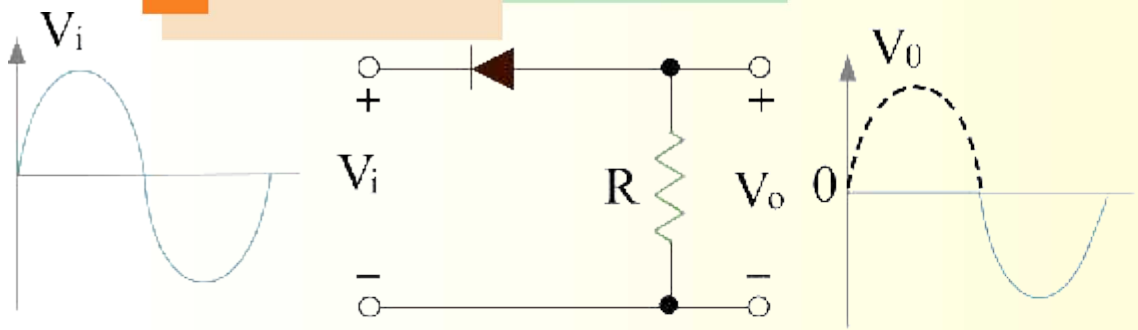


(b)

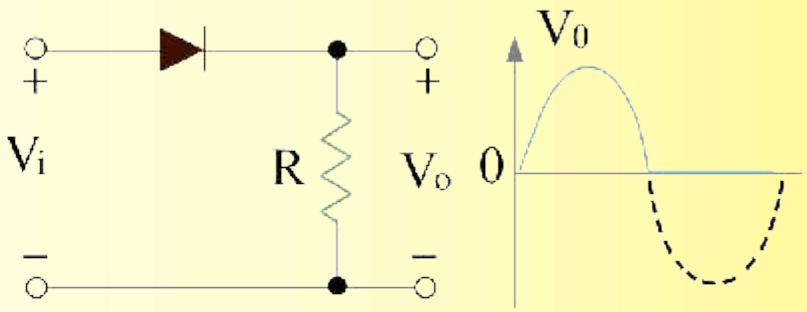


(c)

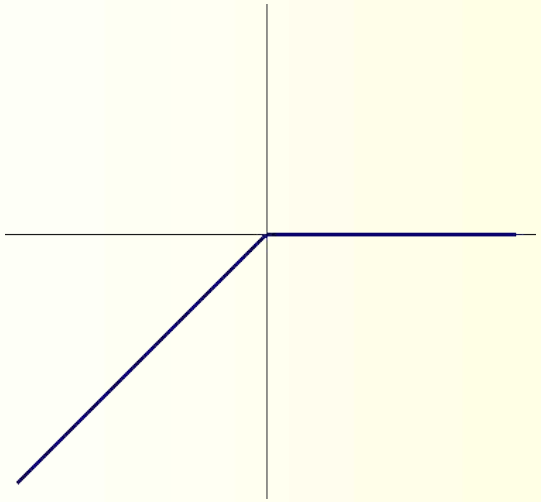
數種基本的串聯截波電路

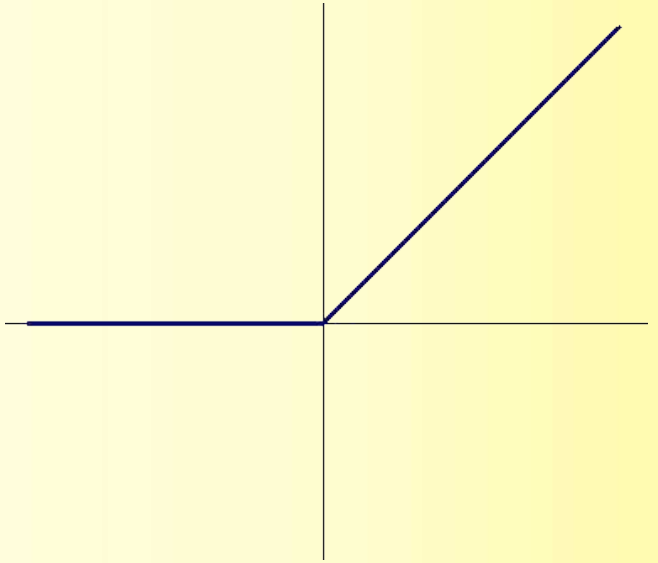


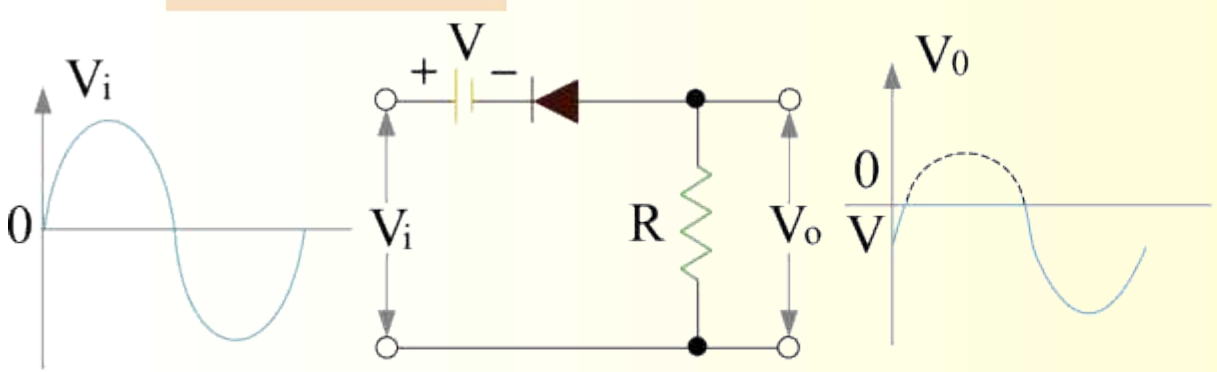
(1)正截波器



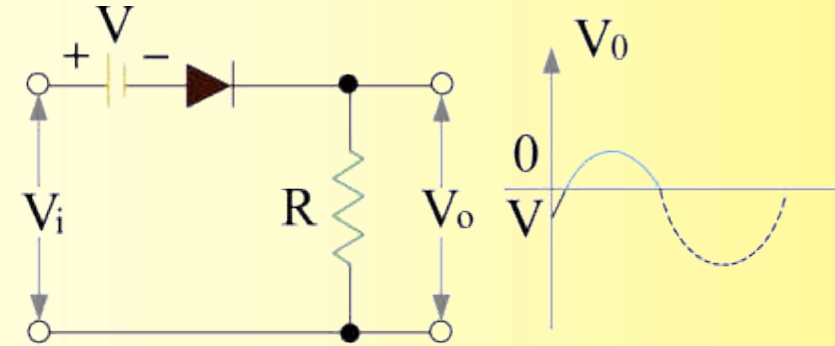
(2)負截波器



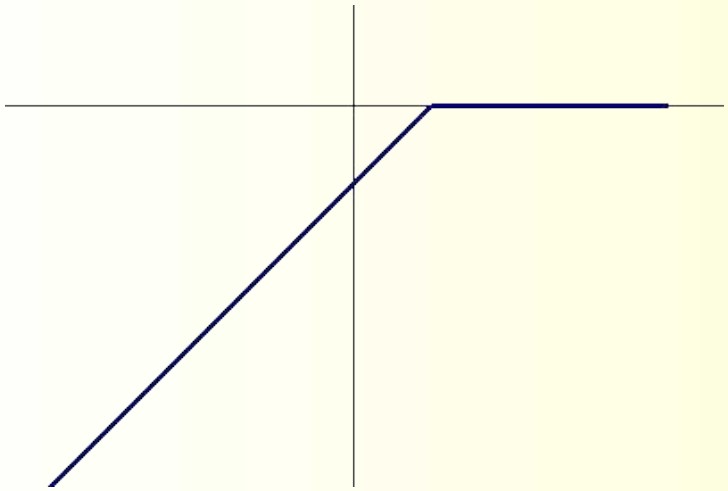


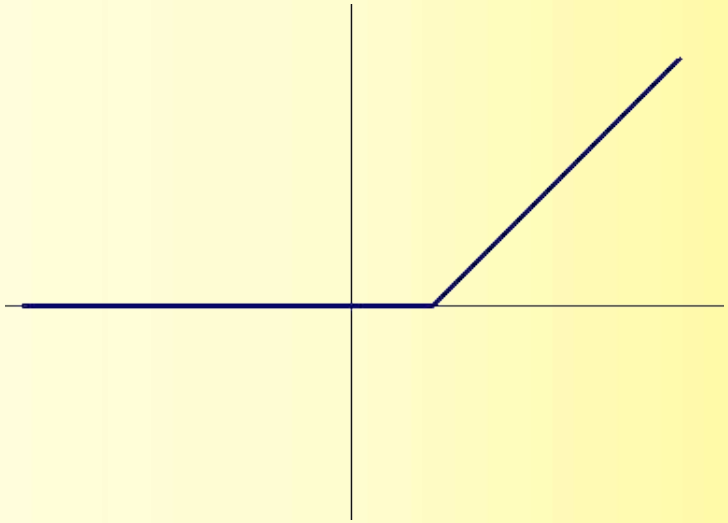


(3)順偏正截波器

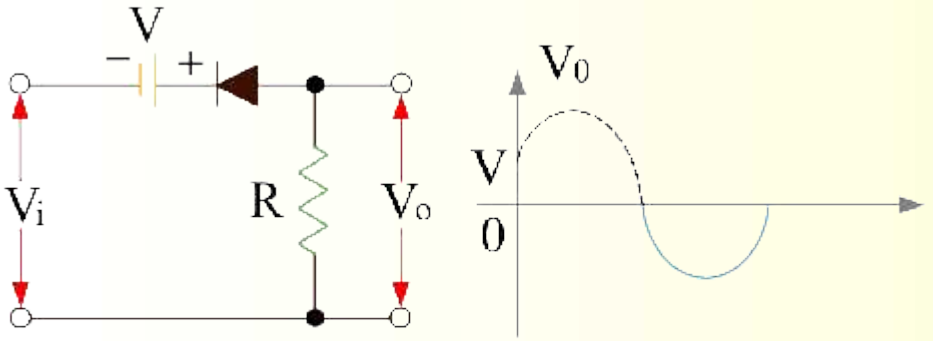


(4)逆偏負截波器

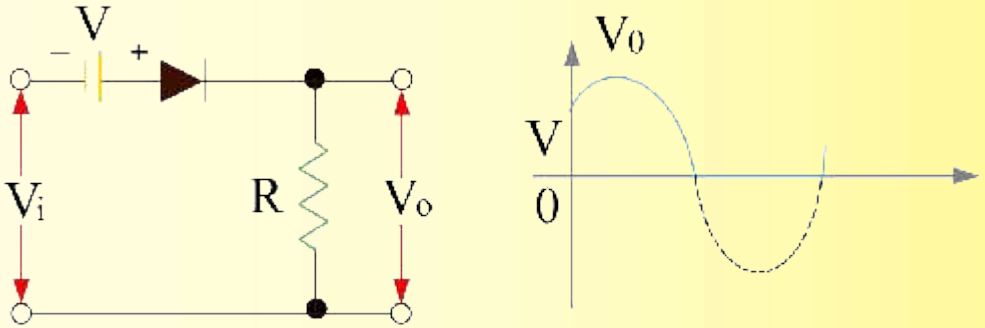




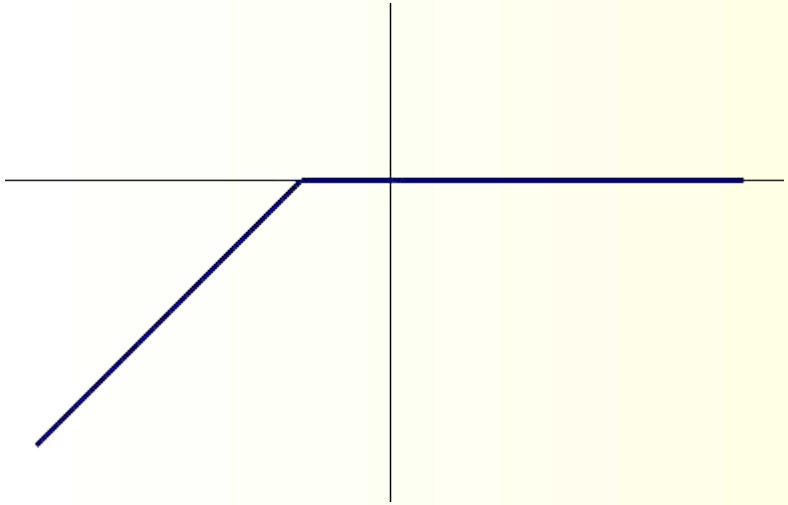
數種基本的串聯截波電路

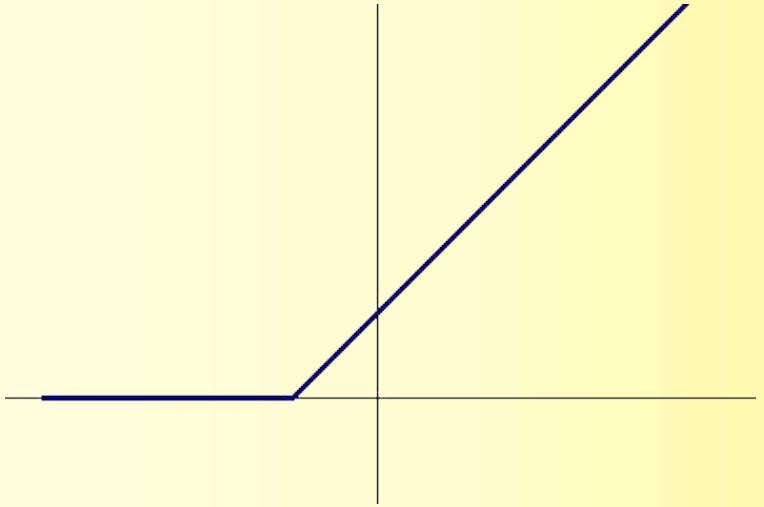


(5)逆偏正截波器

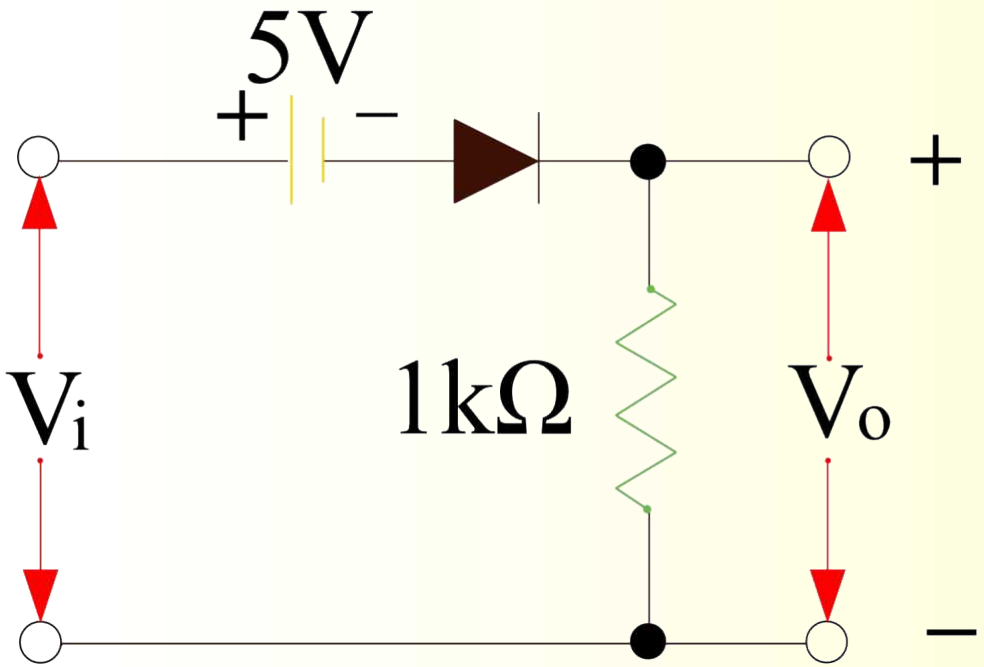


(6)順偏負截波器





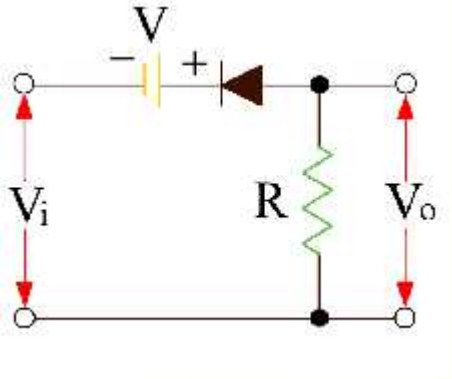
如圖所示，所有的元件皆為理想，則當 Vi=10sinωt V 時，則輸出電壓之峰值為多少？

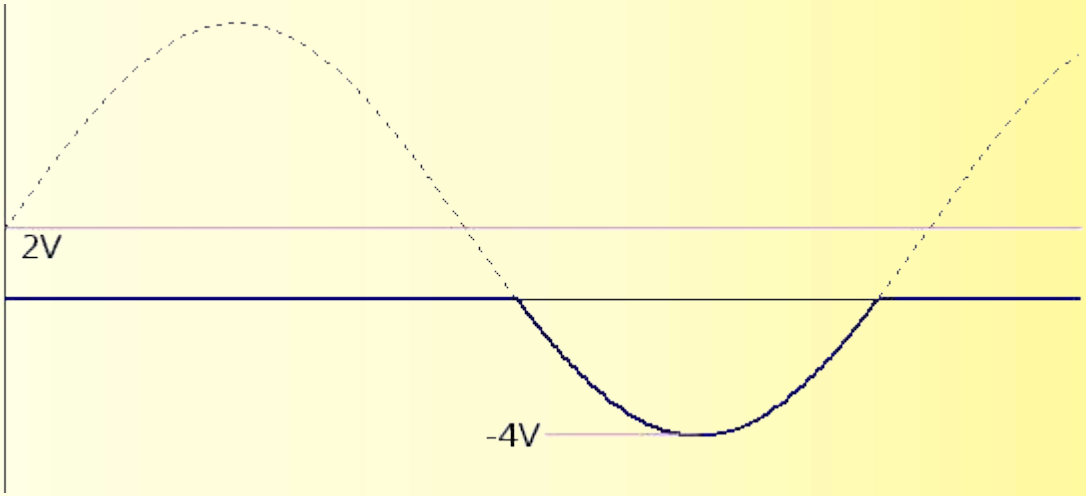


(1)當V_i<0V時，V_O=0V

(2)當V_i≥5V時，$V_{O(P)}$=−5V+10V=5V

如圖， **V=2V** ，若輸入電壓 v_i**=6sinωt** ，則輸出波形為何 **?(** 二極體為理想 **)**



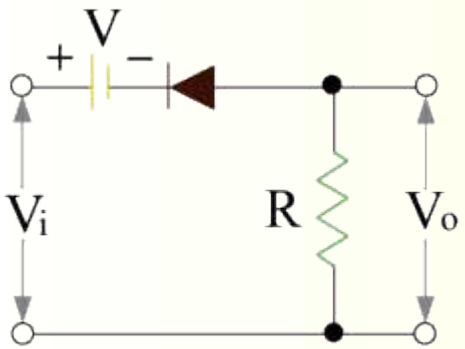


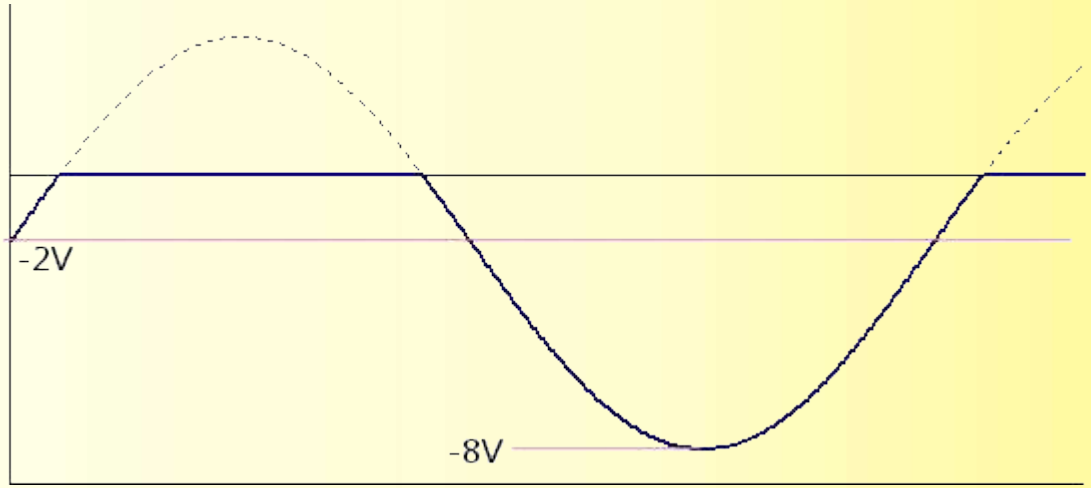
$V_m = 6\text{V}$、$V_1 = 2\text{V}$

$-V_m + V_1 = -6\text{V} + 2\text{V} = -4\text{V}$

所以 ，輸出電壓為 $-4\text{V} \leqslant v_o \leqslant 0\text{V}$

如圖，V=2V，若輸入電壓 $v_i=6\sin\omega t$，則輸出波形為何?(二極體為理想)



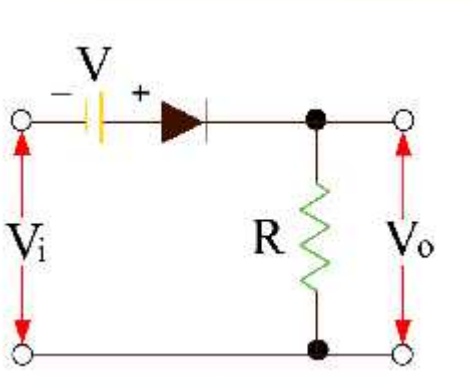


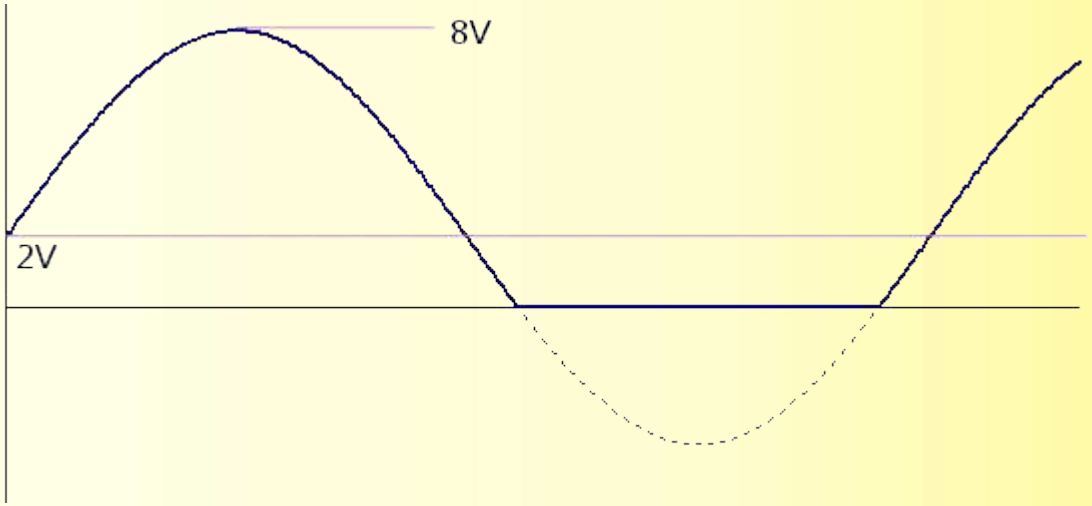
$V_m=6\text{V}$、$V_1=2\text{V}$

$-V_m-V_1=-6\text{V}-2\text{V}=-8\text{V}$

所以，輸出電壓為 $-8\text{V}\leqslant v_o\leqslant 0\text{V}$

如圖， **V=2V** ，若輸入電壓 v_i**=6sinωt** ，則輸出波形為何 **?(** 二極體為理想 **)**



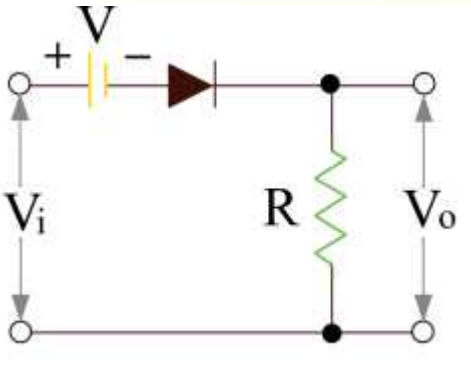


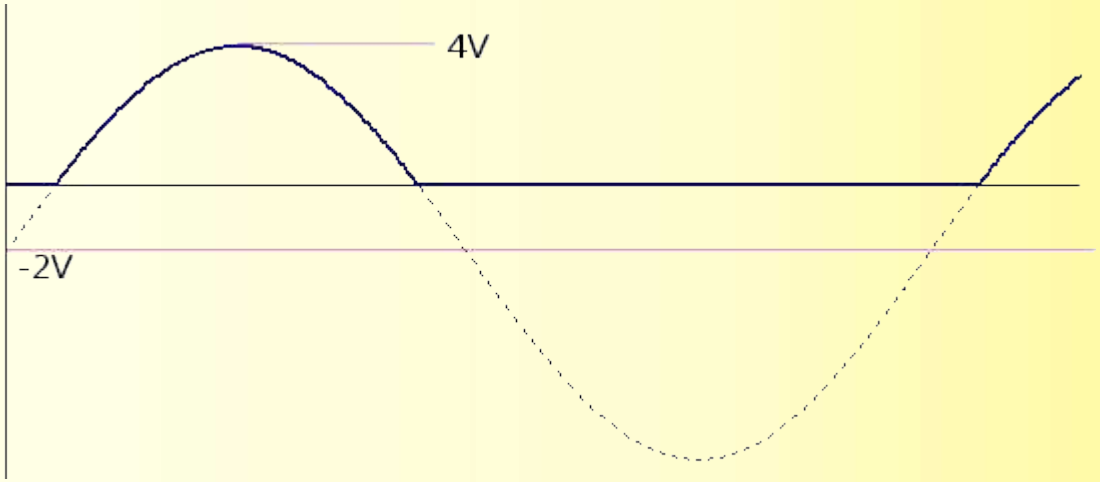
$V_m = 6\text{V}$、$V_1 = 2\text{V}$

$V_m + V_1 = 6\text{V} + 2\text{V} = 8\text{V}$

所以 ， 輸出電壓為$0V \leqslant v_o \leqslant 8\text{V}$

如圖， **V=2V** ，若輸入電壓 $v_i=6\sin\omega t$ ，則輸出波形為何 **?(** 二極體為理想 **)**



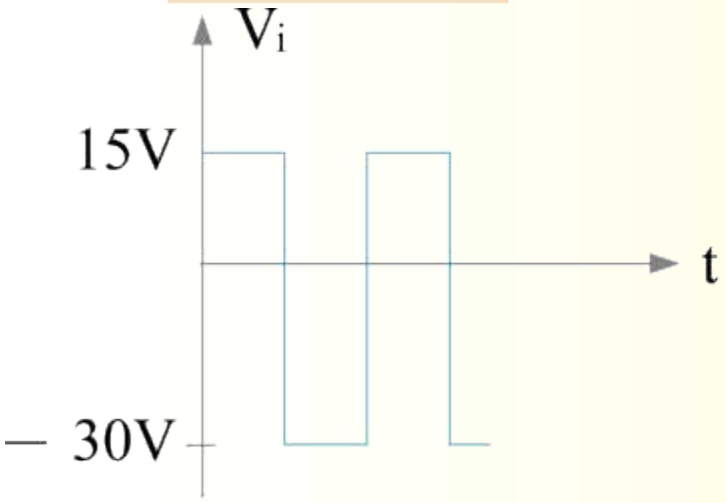


$V_m=6\text{V}$、$V_1=2\text{V}$

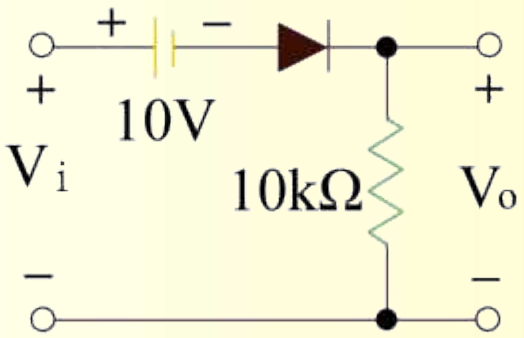
$V_m-V_1=6\text{V}-2\text{V}=4\text{V}$

所以 ，輸出電壓為$0V\leqslant v_o\leqslant 4\text{V}$

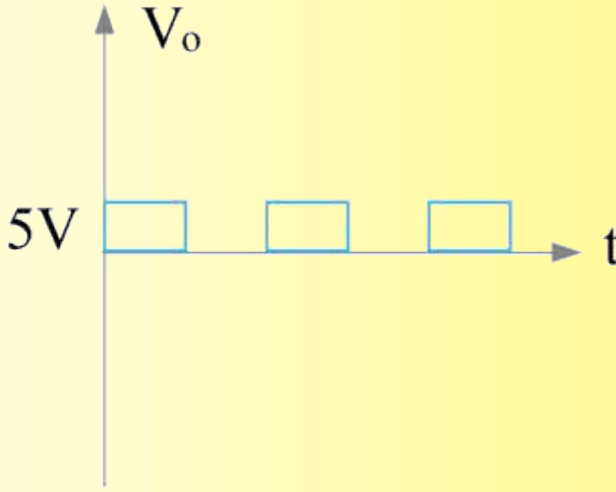
如圖所示，當輸入為方波訊號時，試分析其輸出波形。



(a)



(b)

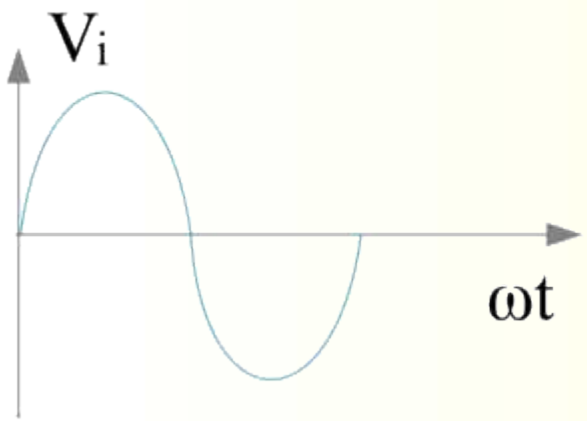


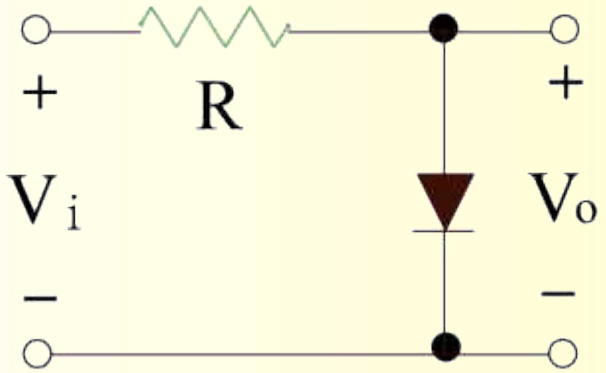
(c)

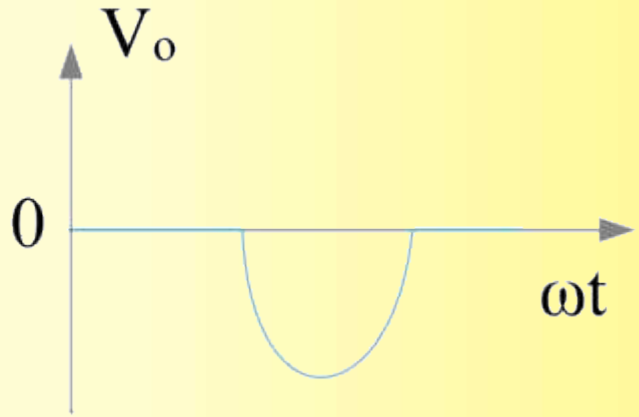
(1)當$V_i<0$時，$V_O=0\text{V}$

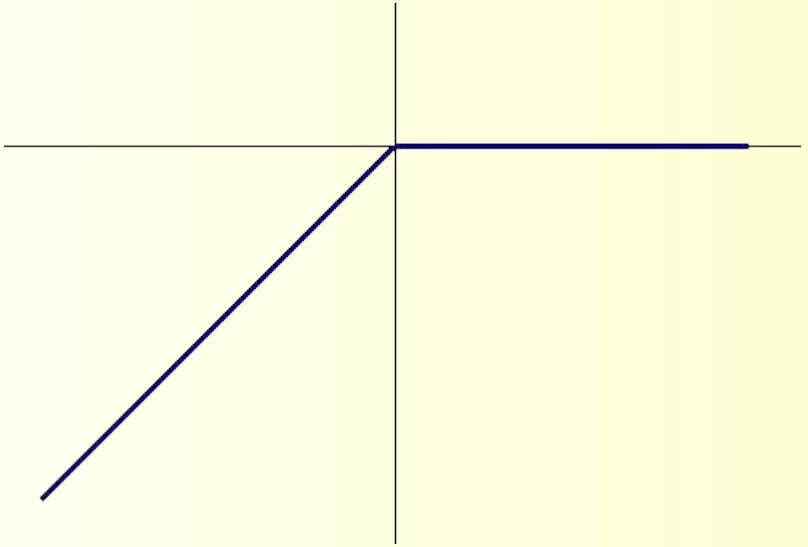
(2)當$V_i\geqslant 10\text{V}$，$V_O=-10\text{V}+15\text{V}=5\text{V}$

並聯型正截波器

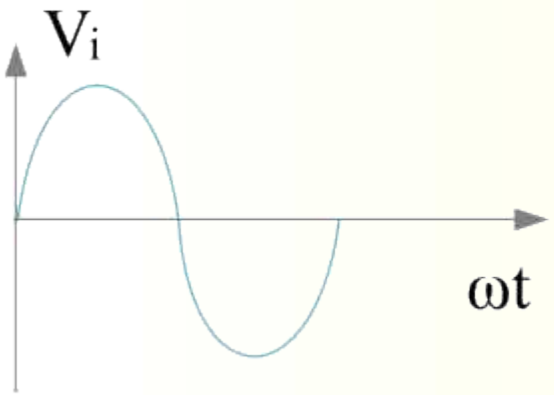


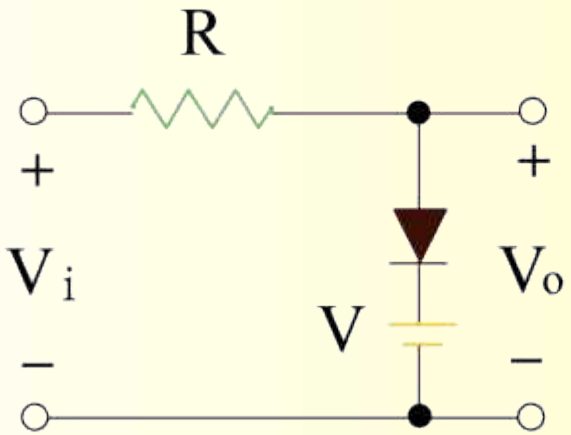


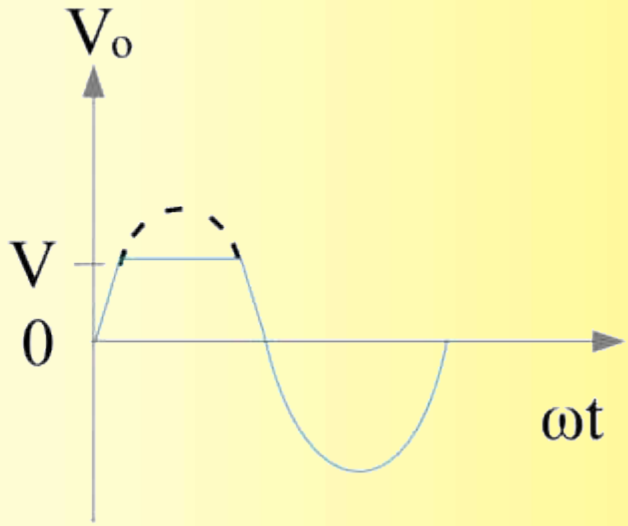


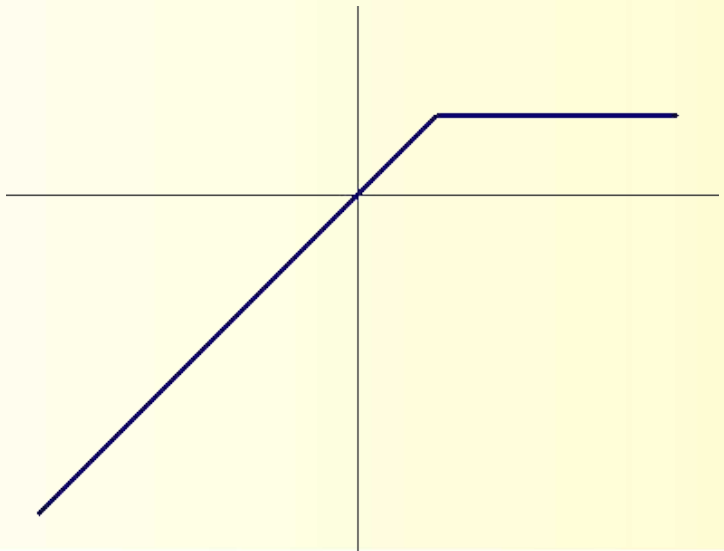


順偏並聯正截波器

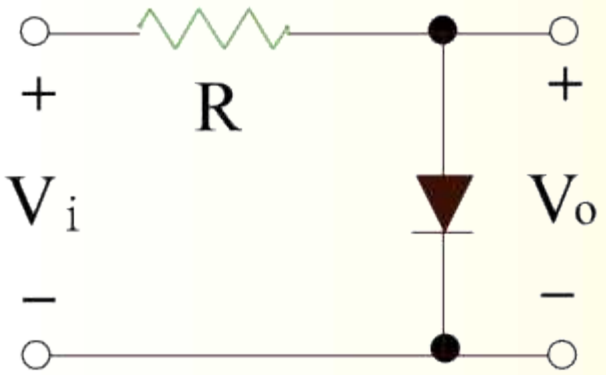


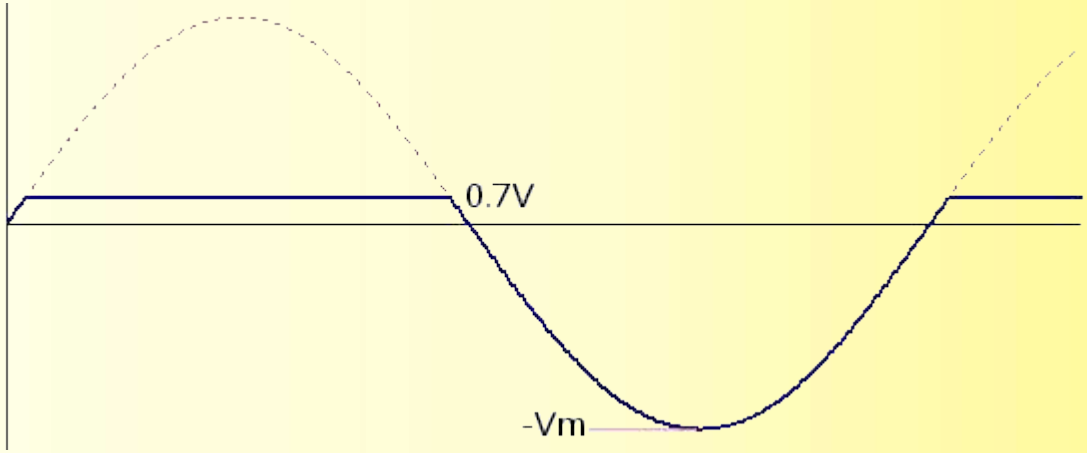






如圖，若其中二極體為矽質二極體，則實際的輸出波形為何？





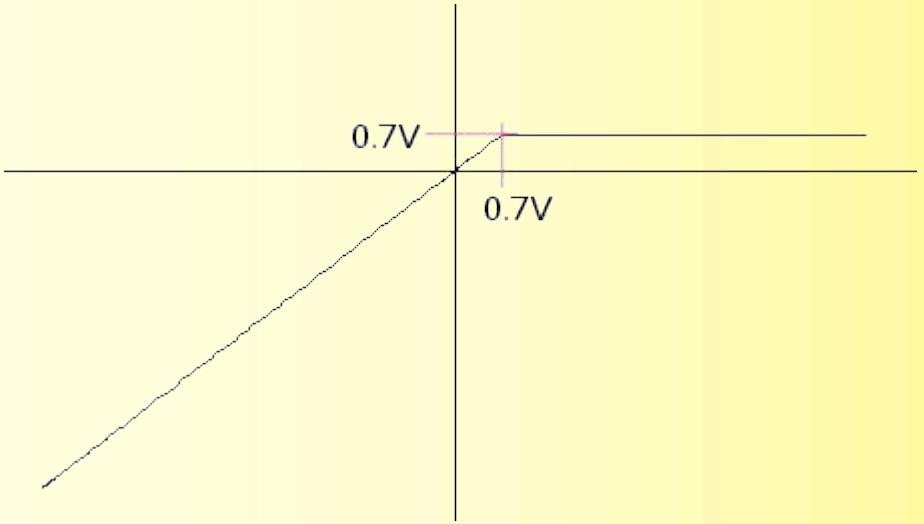
(1)當輸入電壓在正半週時：

$0<V_i<0.7\text{V}$，D Off，$V_O=V_i$

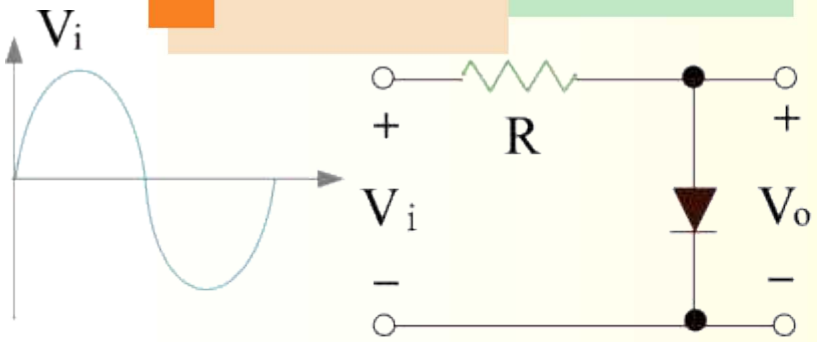
$V_i>0.7\text{V}$，D On，$V_O=0.7\text{V}$

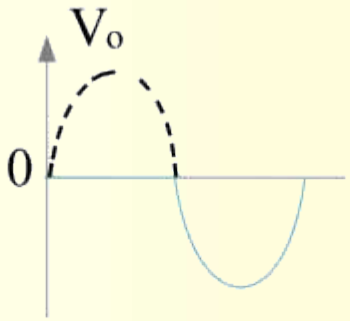
(2)當輸入電壓在負半週時：

D Off，$V_O=V_i$

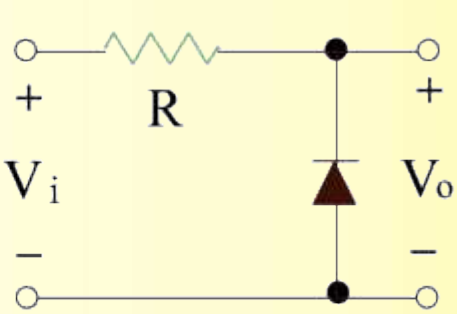


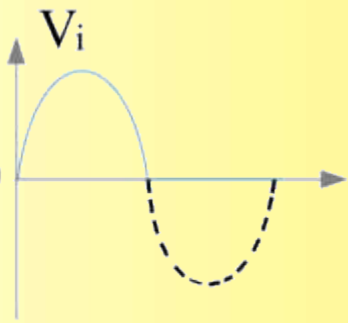
數種基本的並聯截波電路



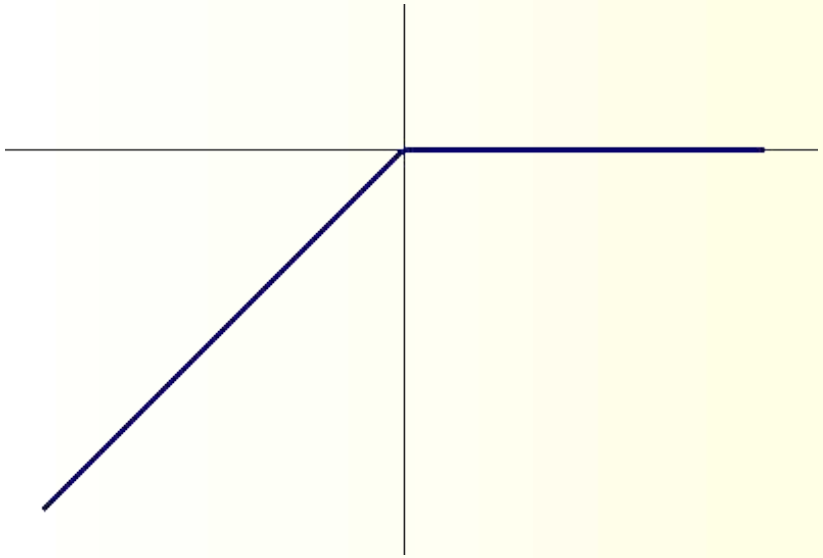


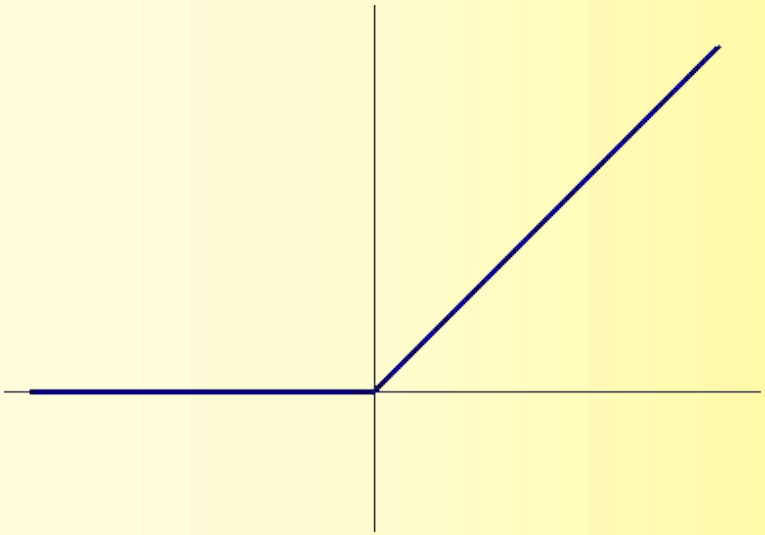
(1)並聯型正截波器

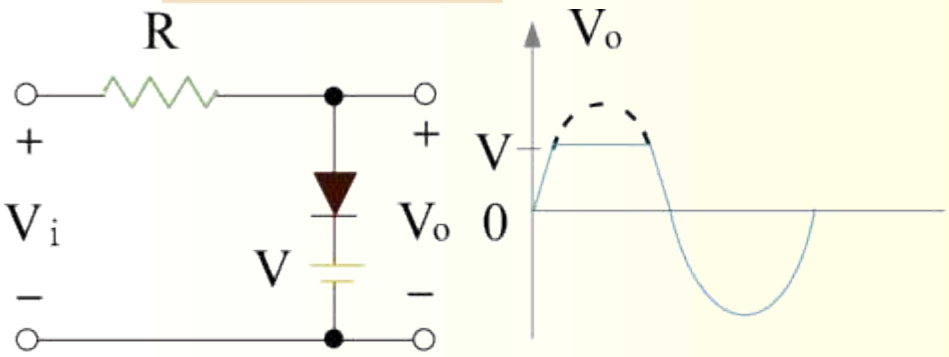




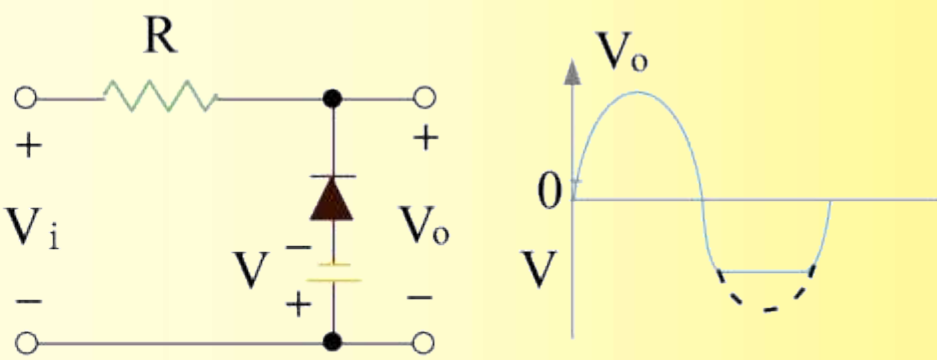
(2)並聯型負截波器



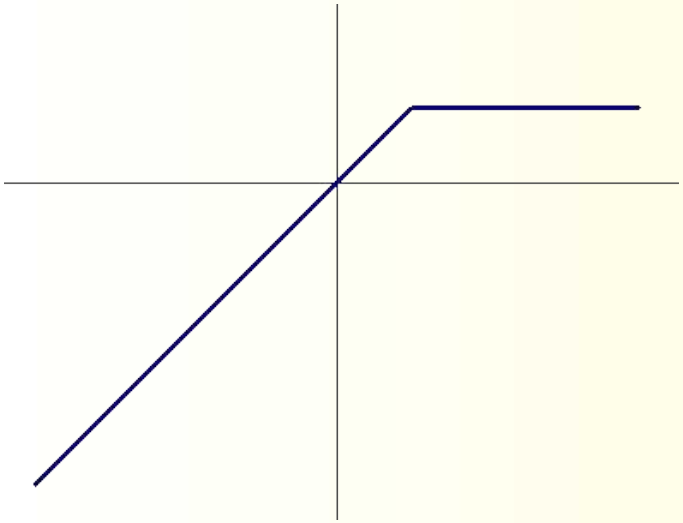


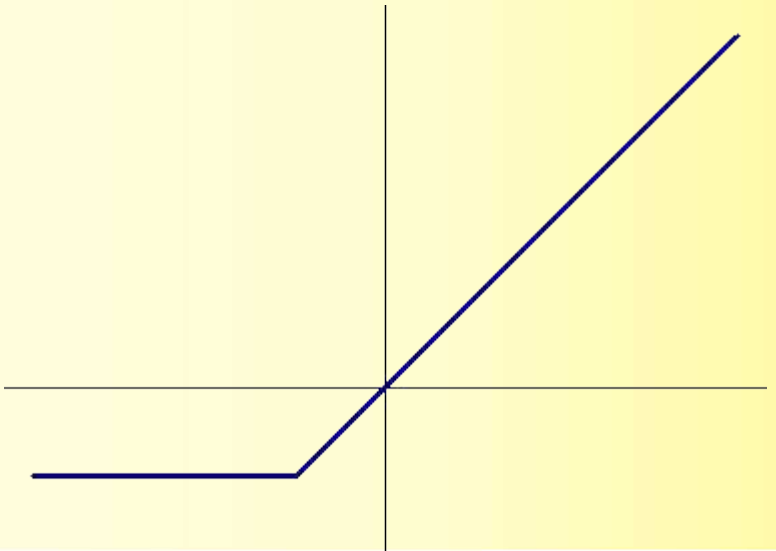


(3)順偏並聯正截波器

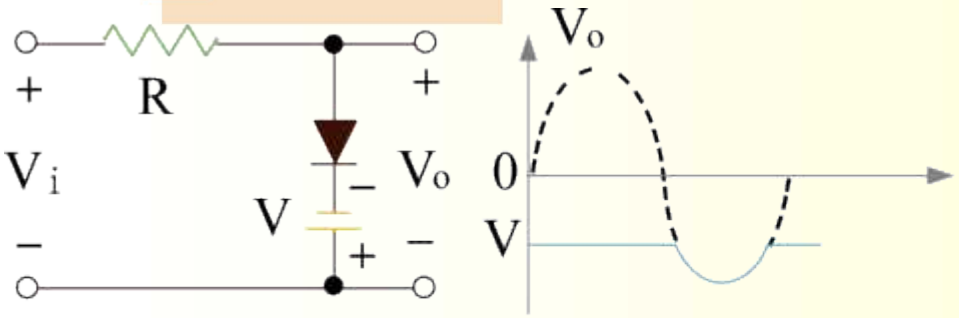


(4)逆偏並聯負截波器

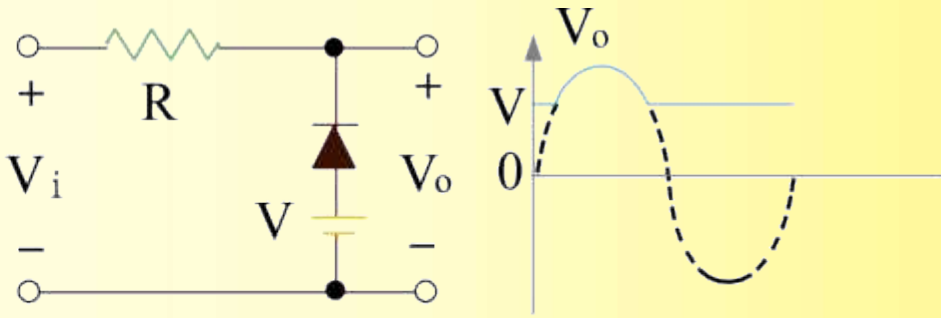




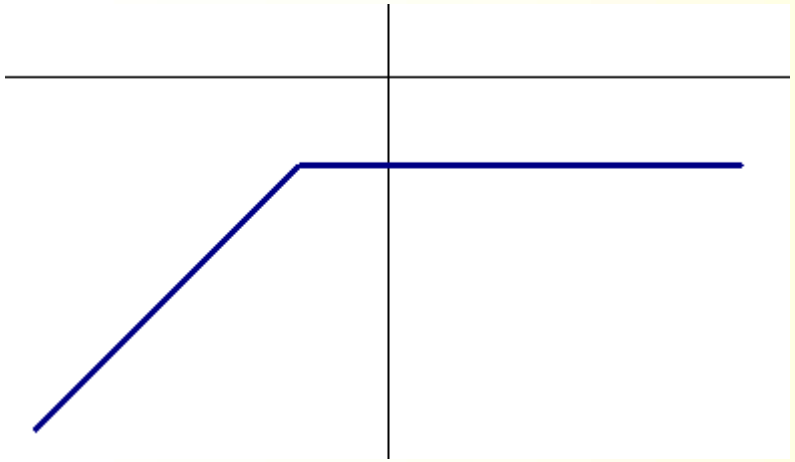
數種基本的並聯截波電路

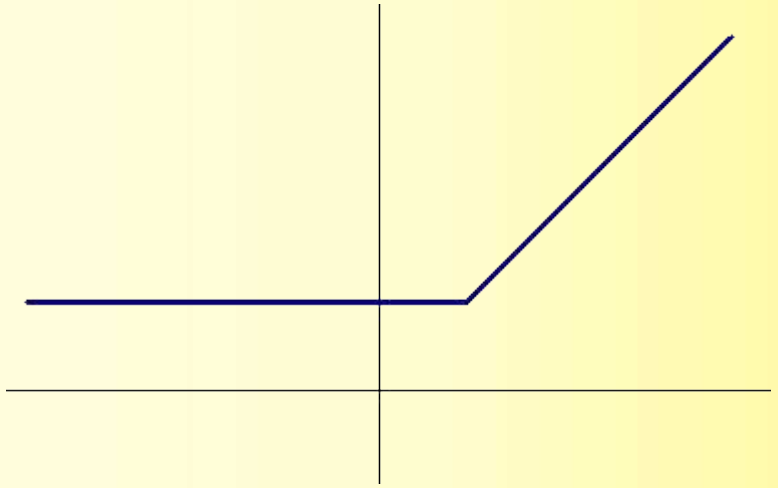


(5)逆偏並聯正截波器

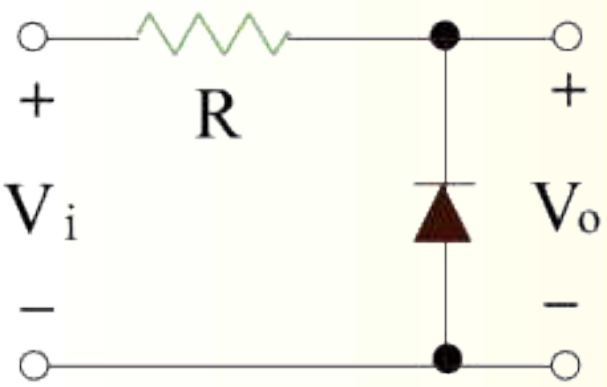


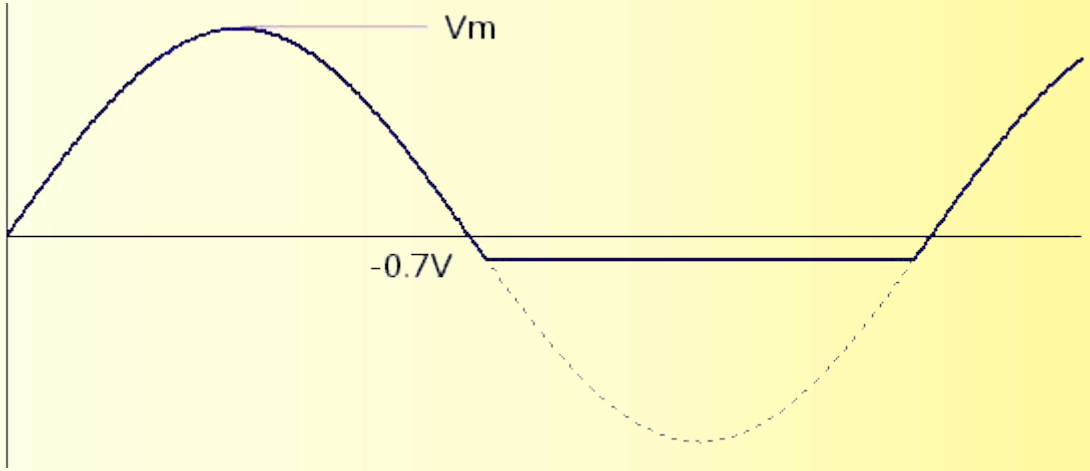
(6)順偏並聯負截波器





如圖，若其中二極體為矽質二極體，則實際的輸出波形為何？





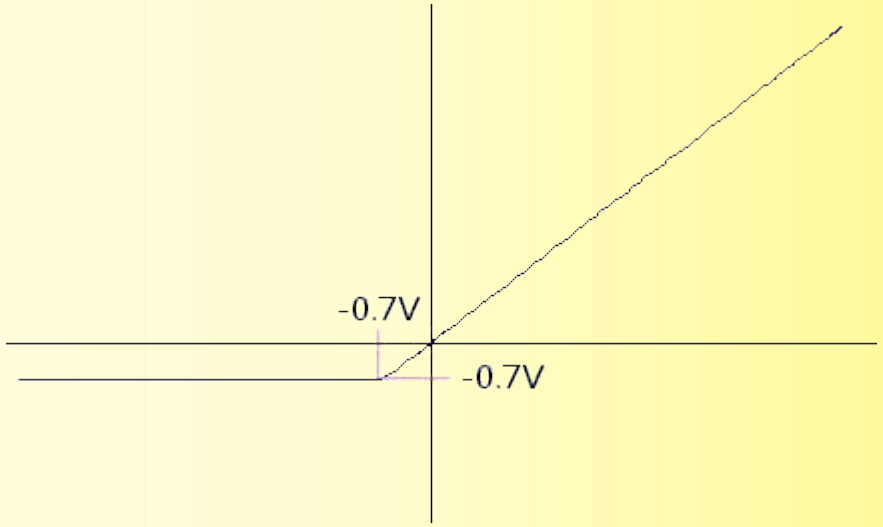
(1)當輸入電壓在正半週時：

D Off , $V_O = V_i$

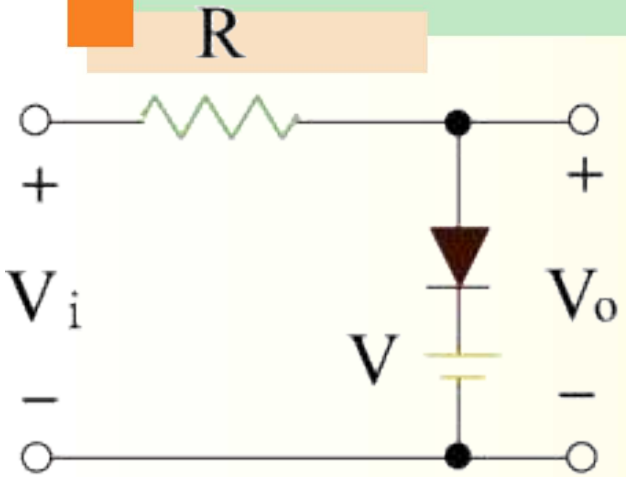
(2)當輸入電壓在負半週時：

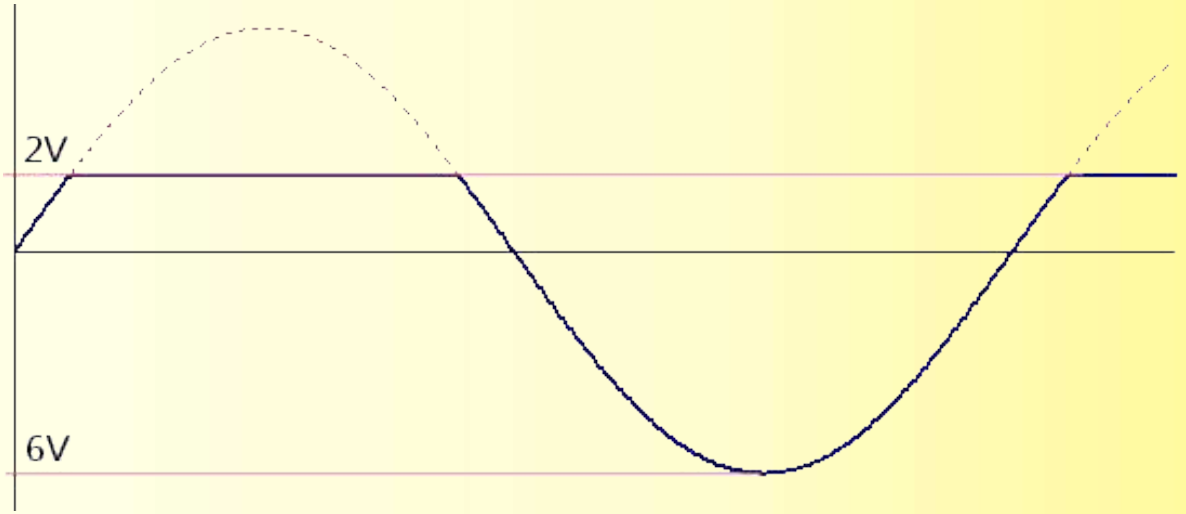
$-0.7\text{V} < V_i < 0, D$ Off , $V_O = V_i$

$V_i < -0.7\text{V}$ ， D On ， $V_O = -0.7\text{V}$



如圖，若其外加直流電壓為 **2V** ，輸入電壓為 **Vi=6sinωt** ，則輸出波形為何 **?(** 二極體為理想二極體 **)**

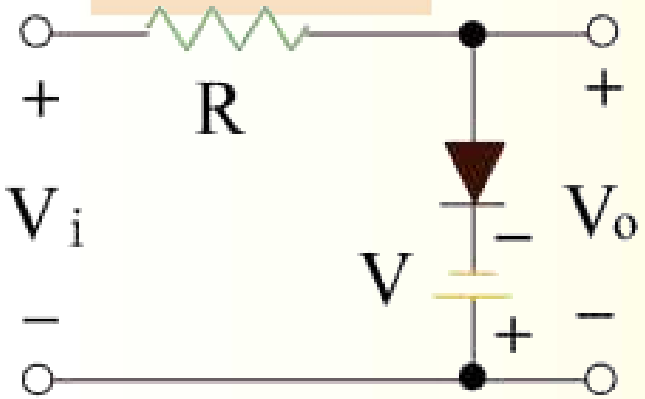


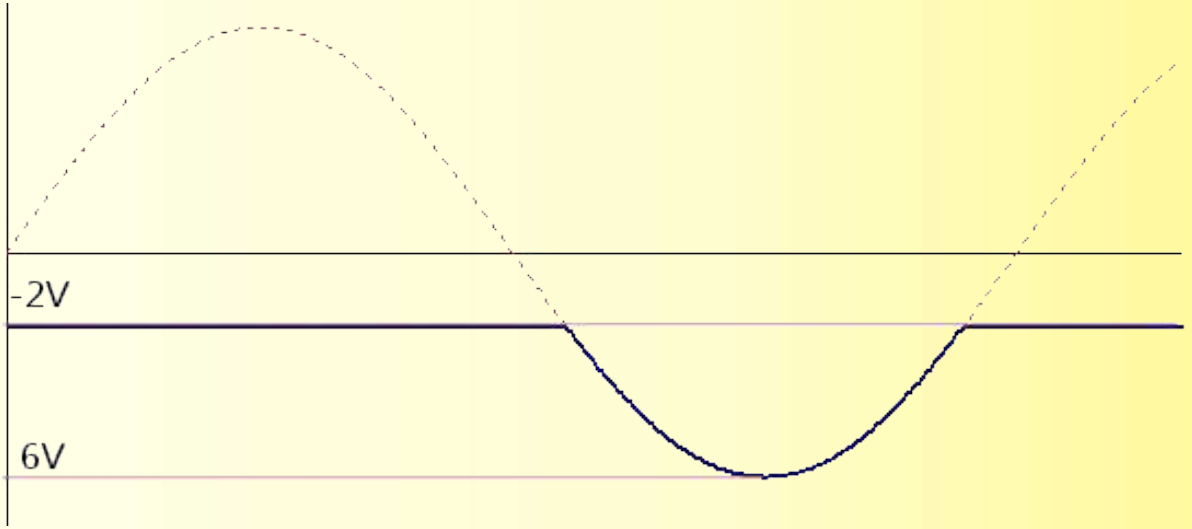


$V_m = 6\text{V}$、$V_1 = 2\text{V}$

所以輸出電壓為 $-6\text{V} \leqslant V_o \leqslant 2\text{V}$

如圖，若其外加直流電壓為 **2V** ，輸入電壓為 **Vi=6sinωt** ，則輸出波形為何 **?(** 二極體為理想二極體 **)**

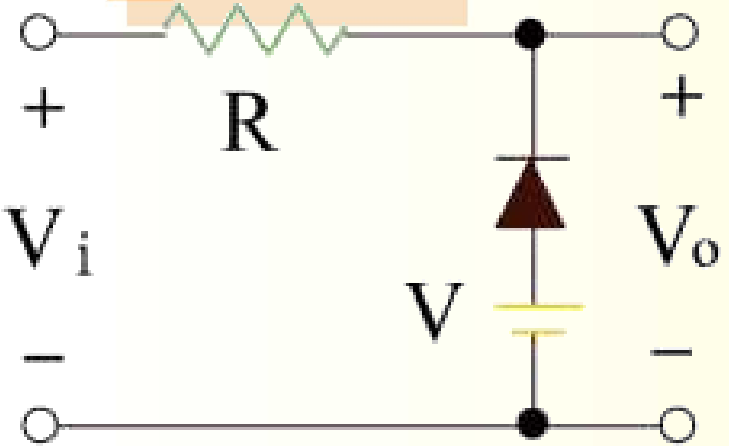


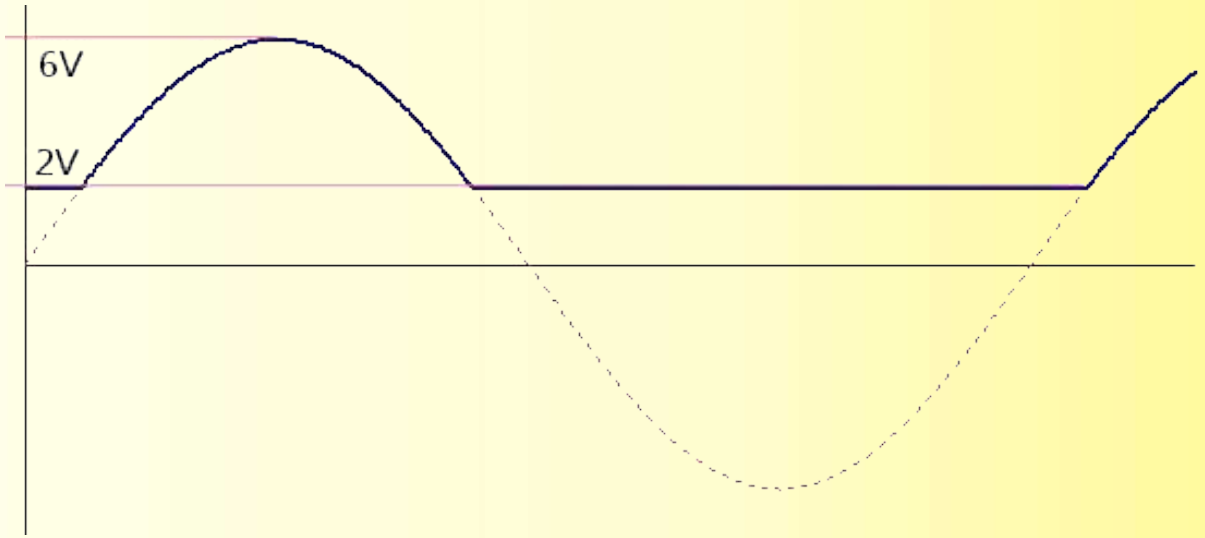


$V_m = 6\text{V}$、$V_1 = 2\text{V}$

所以輸出電壓為 $-6\text{V} \leqslant V_o \leqslant -2\text{V}$

如圖，若其外加直流電壓為 **2V** ，輸入電壓為 **Vi=6sinωt** ，則輸出波形為何 **?(** 二極體為理想二極體 **)**

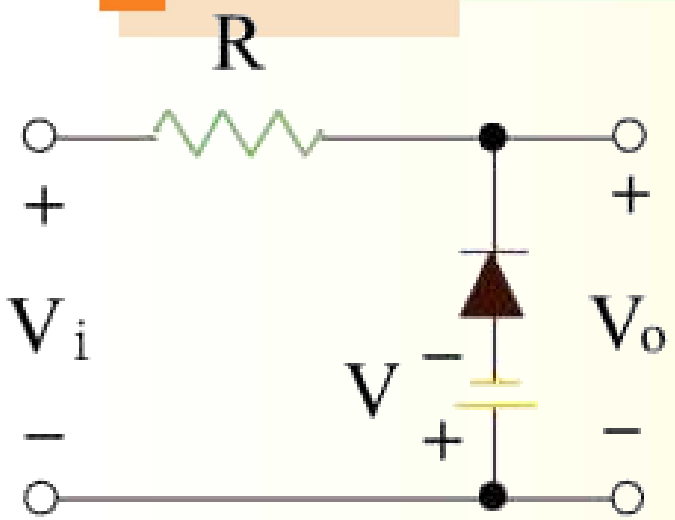


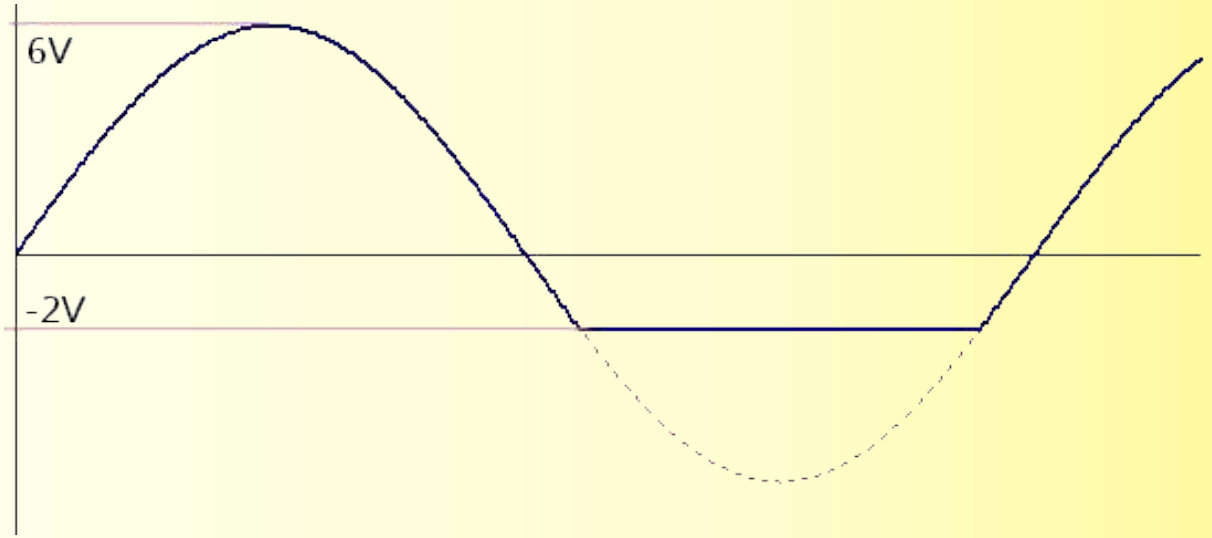


$V_m = 6\text{V}$、$V_1 = 2\text{V}$

所以輸出電壓為$2V \leqslant V_o \leqslant 6\text{V}$

如圖，若其外加直流電壓為 **2V** ，輸入電壓為 **Vi=6sinωt** ，則輸出波形為何 **?(** 二極體為理想二極體 **)**

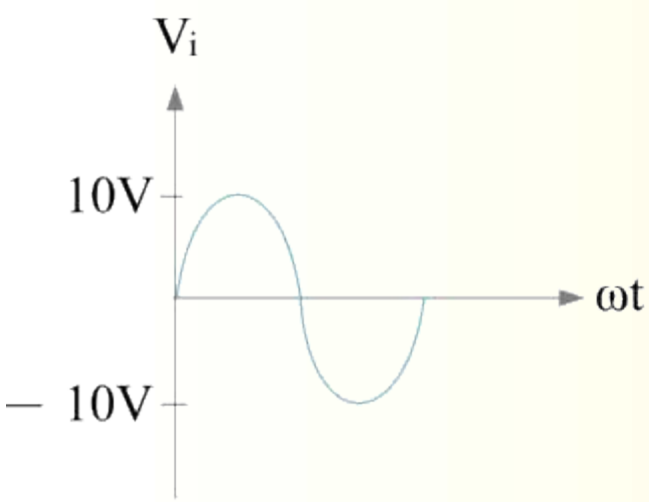




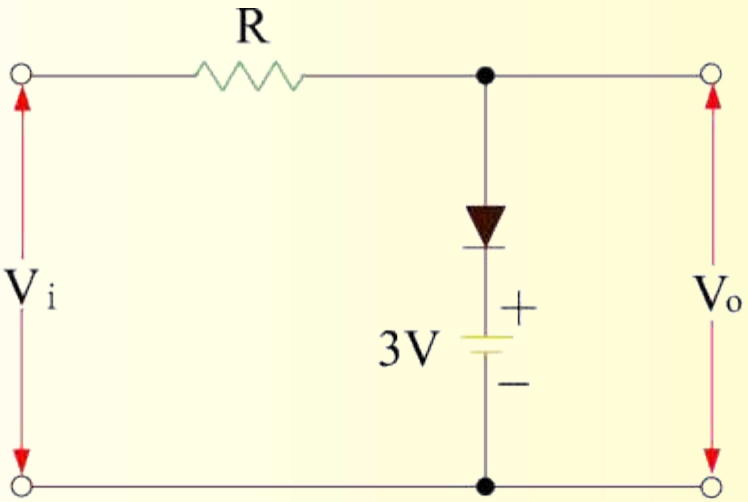
$V_m = 6\text{V}$、$V_1 = 2\text{V}$

所以輸出電壓為 $-2\text{V} \leqslant V_o \leqslant 6\text{V}$

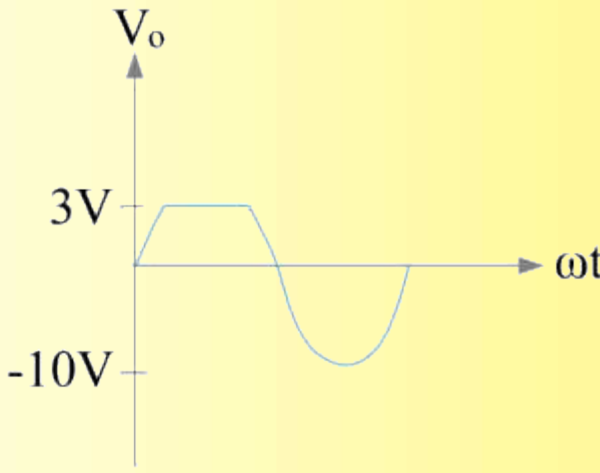
有一正弦波，其振幅峰至峰值為 ±10V ，經圖之截波電路，試分析輸出波形



(a)



(b)

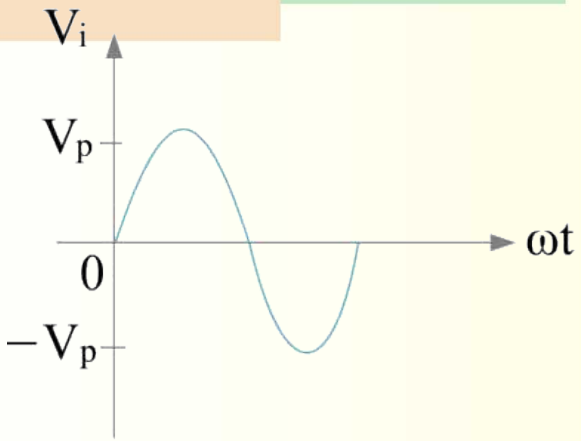


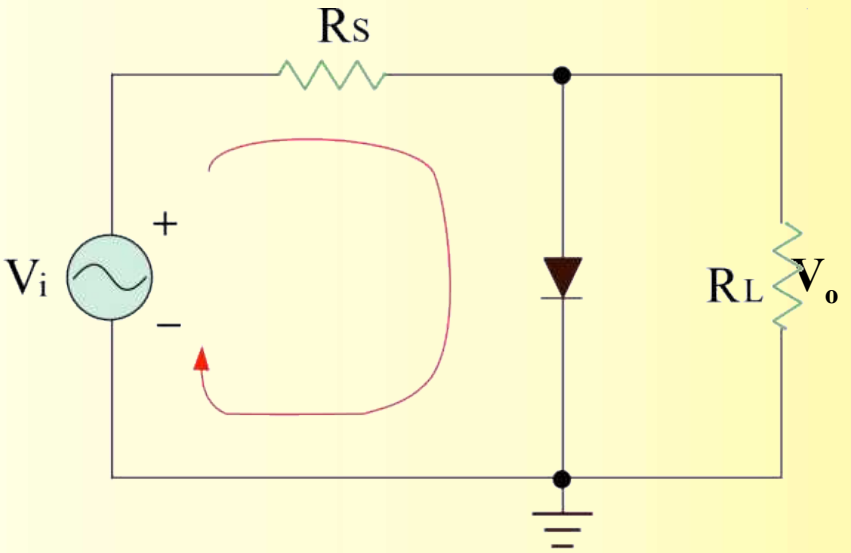
(c)

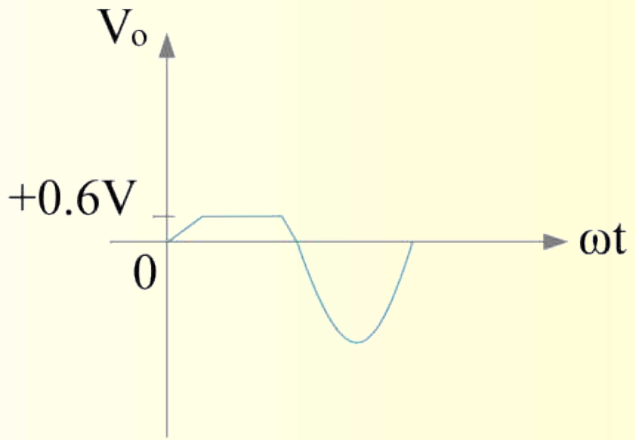
(1)當$V_i \geq 3V$時，$V_O = 3V$

(2)當$V_i < 3V$時，$V_O = V_i$

二極體截波器(考慮障壁電壓)



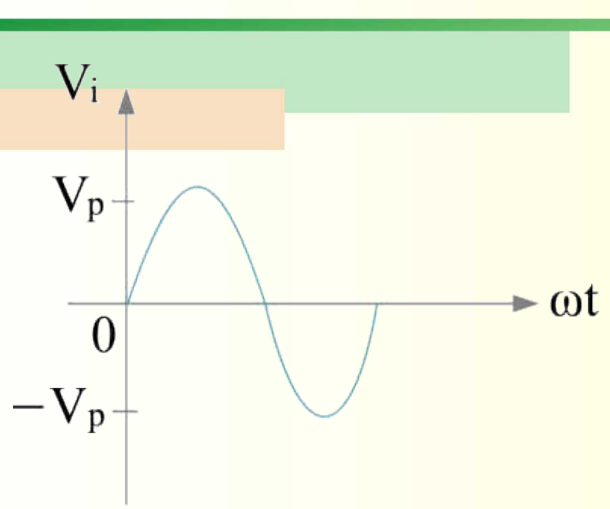


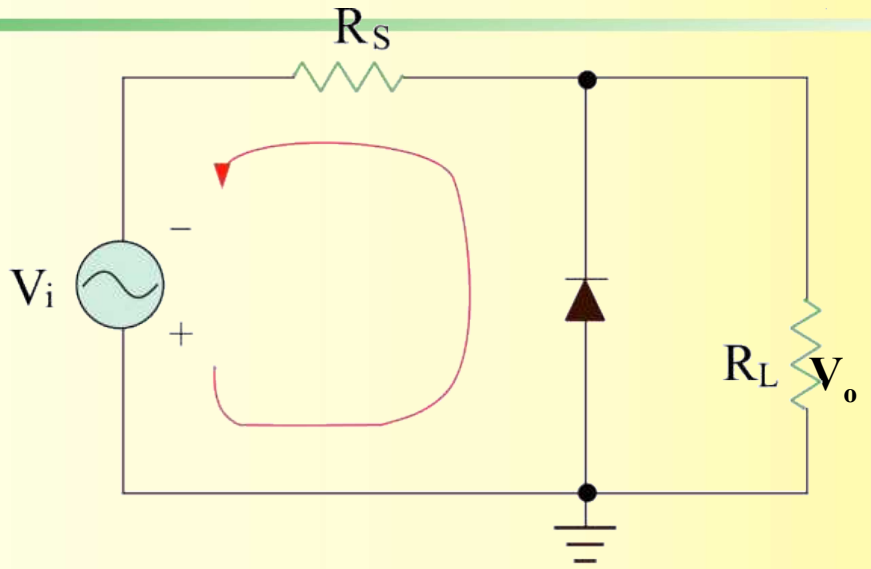


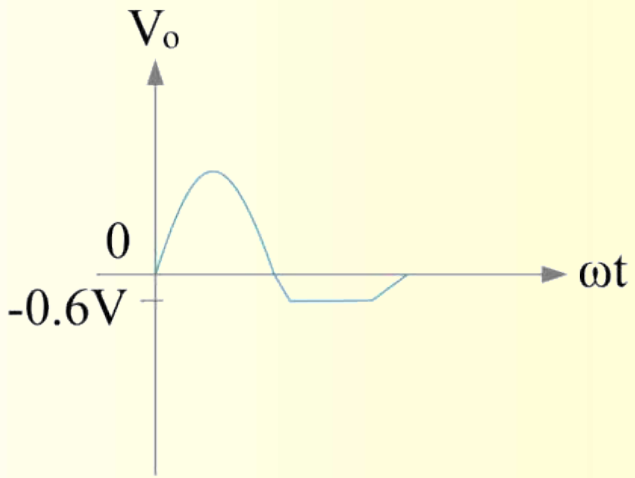
(a) 正半週截波器

$$V_O = \frac{R_L}{(R_S + R_L)} V_i$$

二極體截波器(考慮障壁電壓)



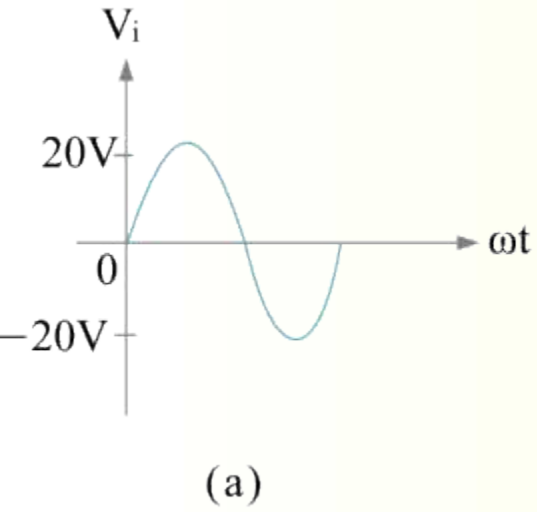


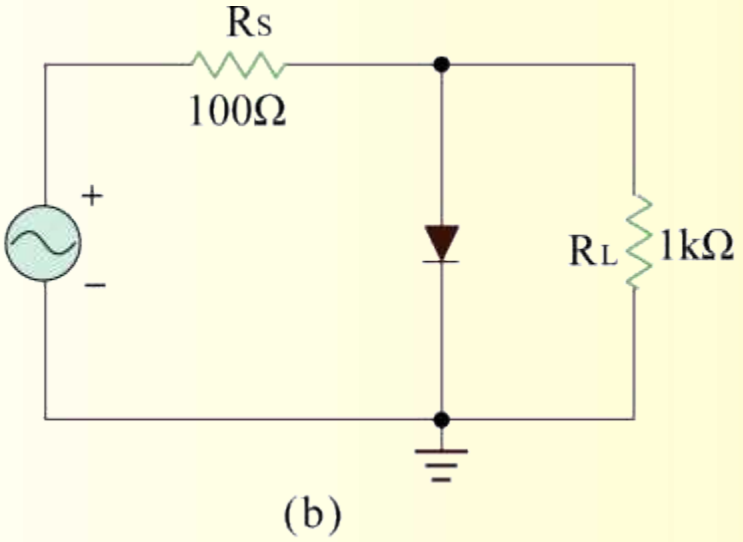


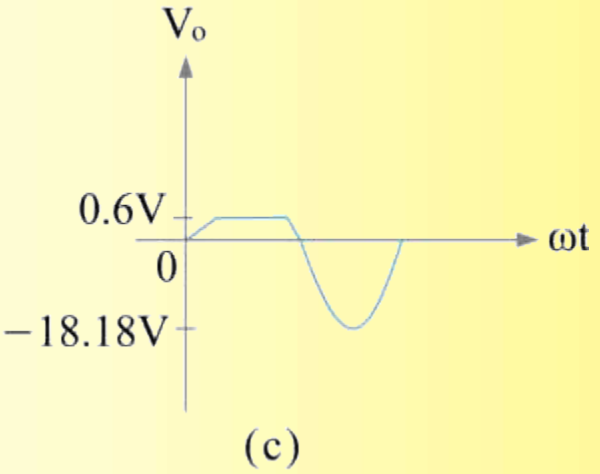
(b) 負半週截波器

$$V_O = \frac{R_L}{(R_S + R_L)} V_i$$

設二極體為矽二極體，試分析其輸出波形

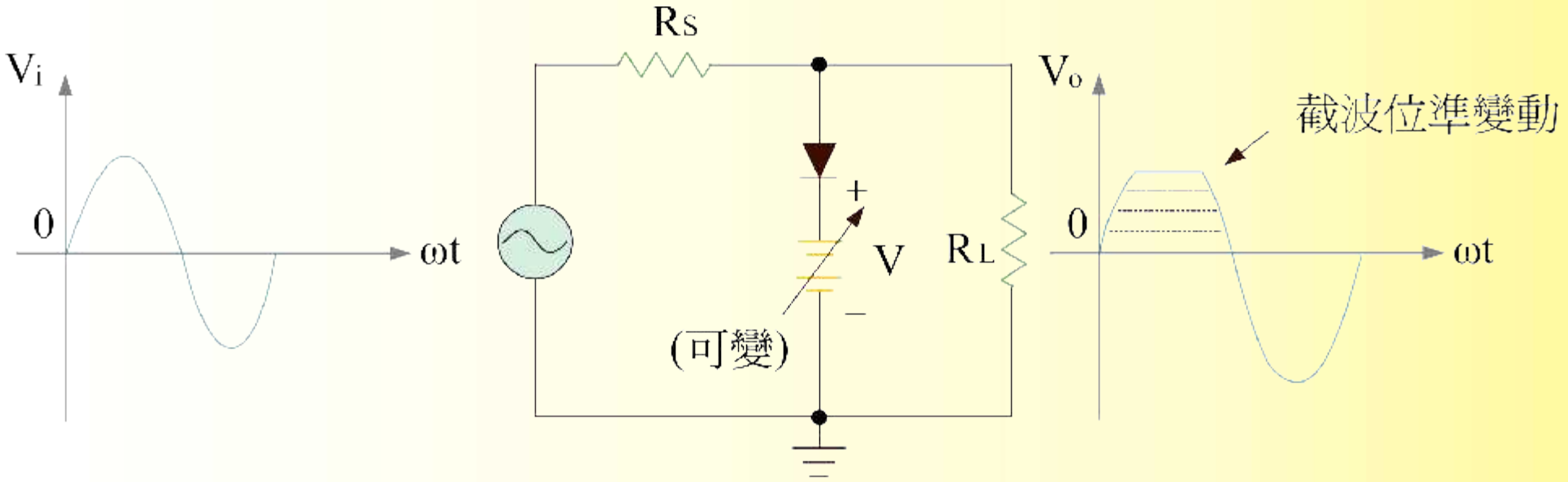




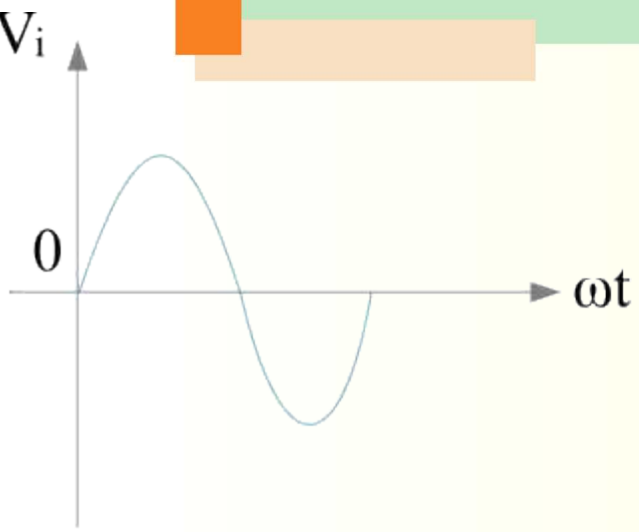


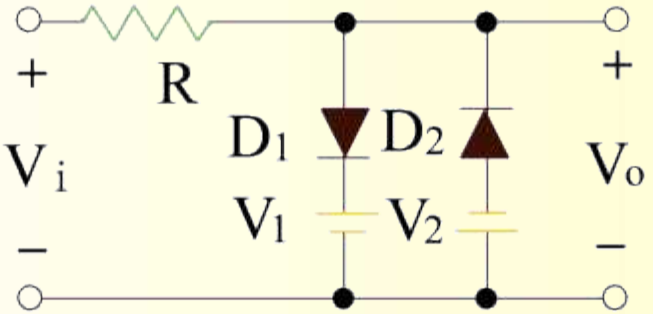
$$V_{O(P)}=\frac{R_L}{R_S+R_L}V_{i(P)}=\frac{1\text{K}\,\Omega}{100\,\Omega+1\text{K}\,\Omega}-20\text{V}=-18.18\text{V}$$

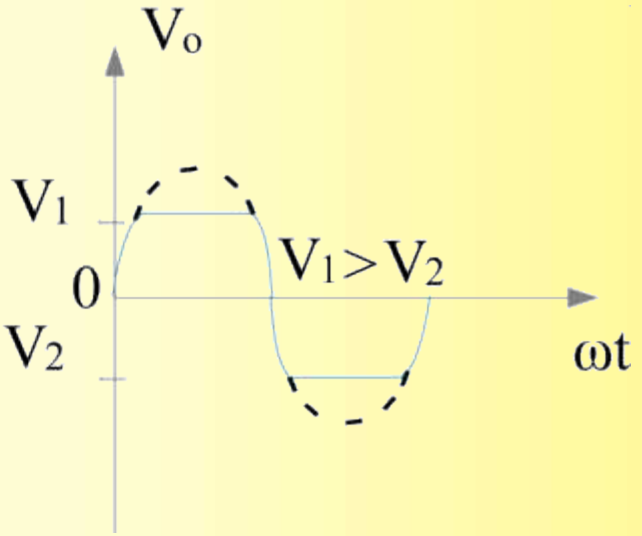
可變偏壓的正截波器



有兩個參考電壓的並聯式混合型截波器







1.當V_i為正半週時 ， $D_2 OFF$

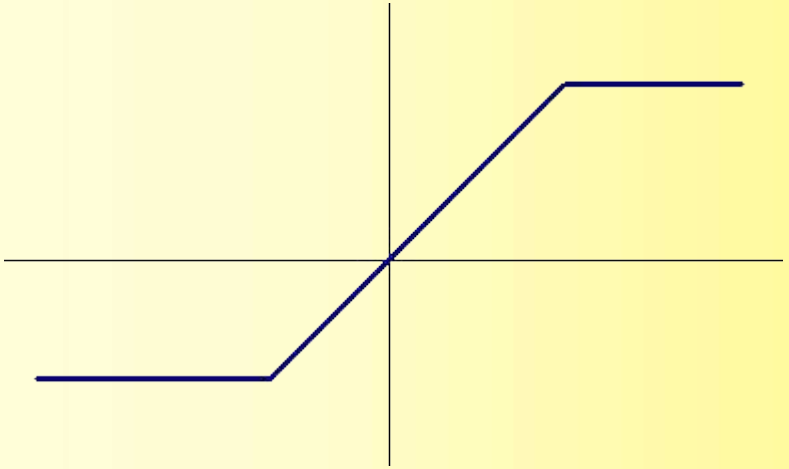
(1)當$V_i < V_1$時 ， $D_1 OFF$ ， $V_O = V_i$

(2)當$V_i > V_1$時 ， $D_1 ON$ ， $V_O = V_1$

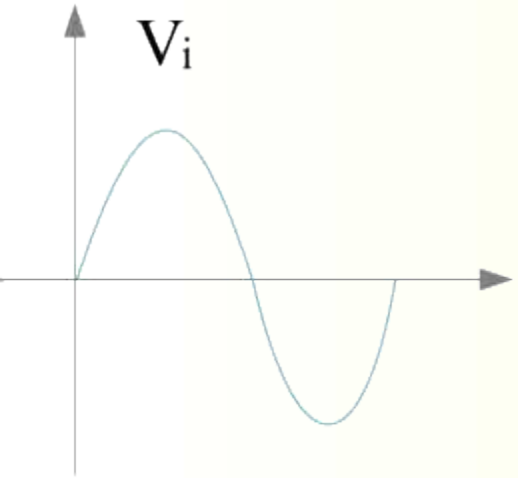
2.當V_i為負半週時 ， $D_1 OFF$

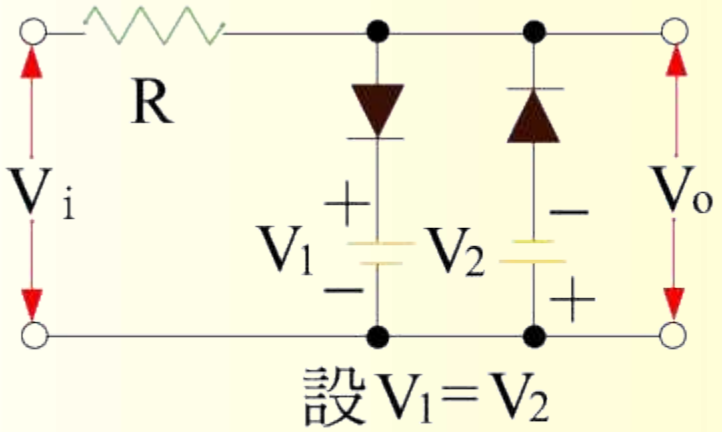
(1)當 $|V_i| < |V_2|$時 ， $D_2 OFF$ ， $V_O = V_i$

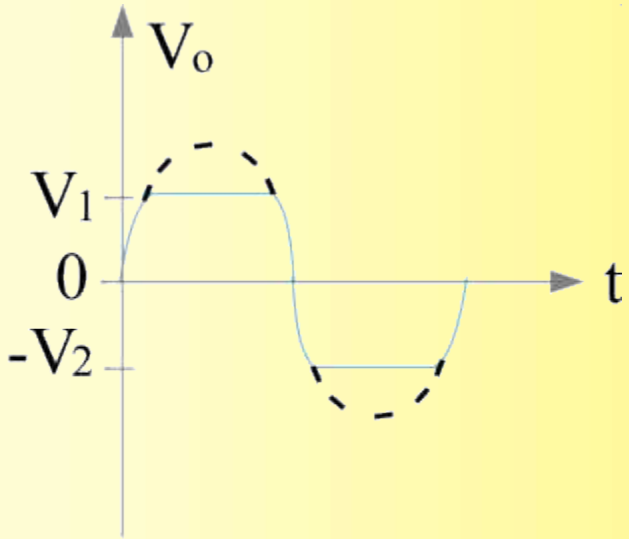
(2)當 $|V_i| > |V_2|$時 ， $D_2 ON$ ， $V_O = V_2$



數種基本的雙向截波器

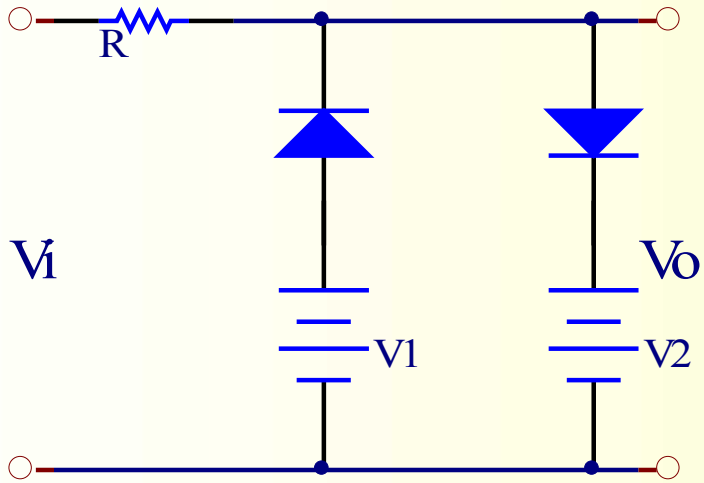


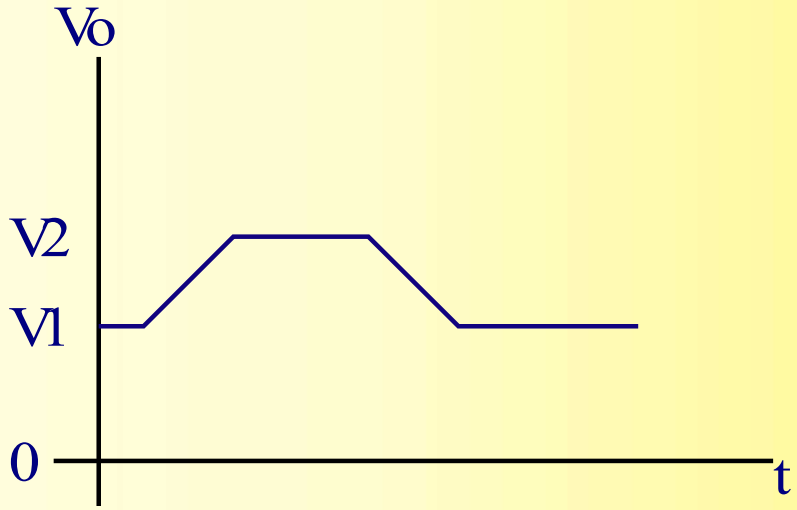




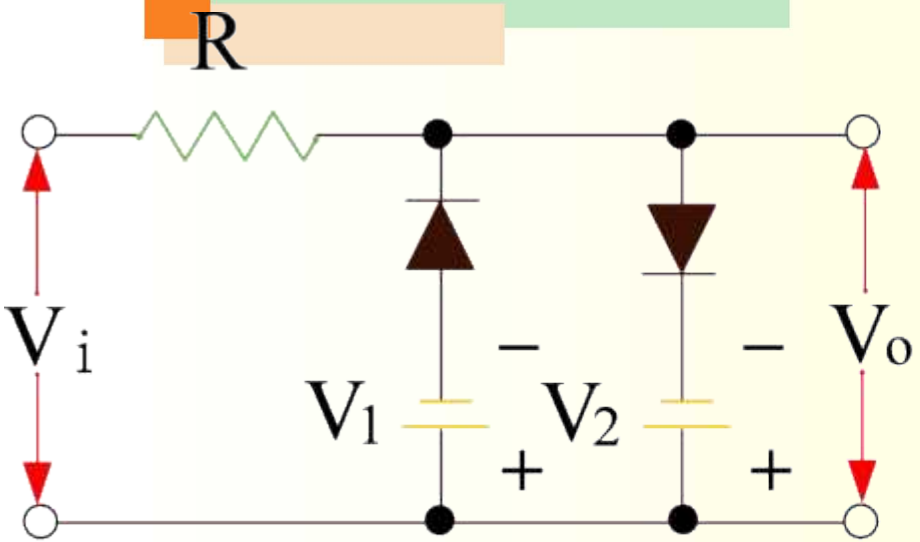
(1)

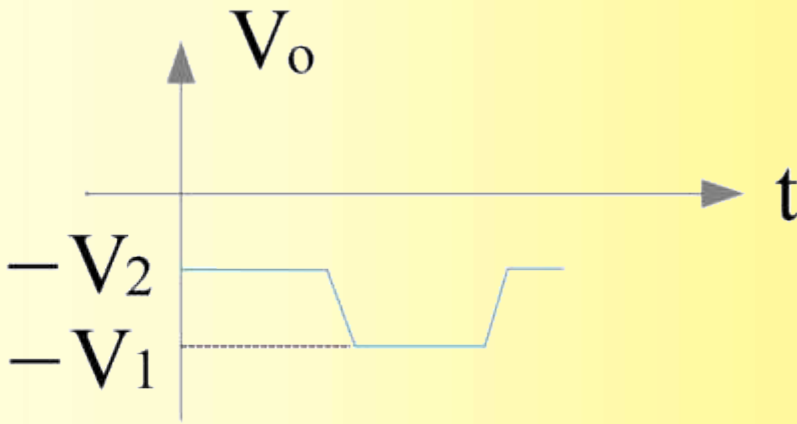
數種基本的雙向截波器





數種基本的雙向截波器

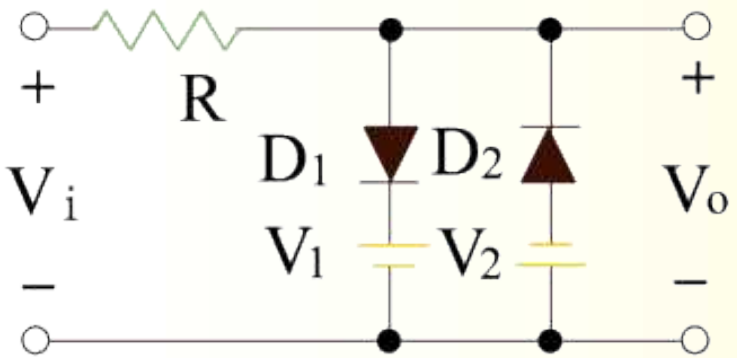


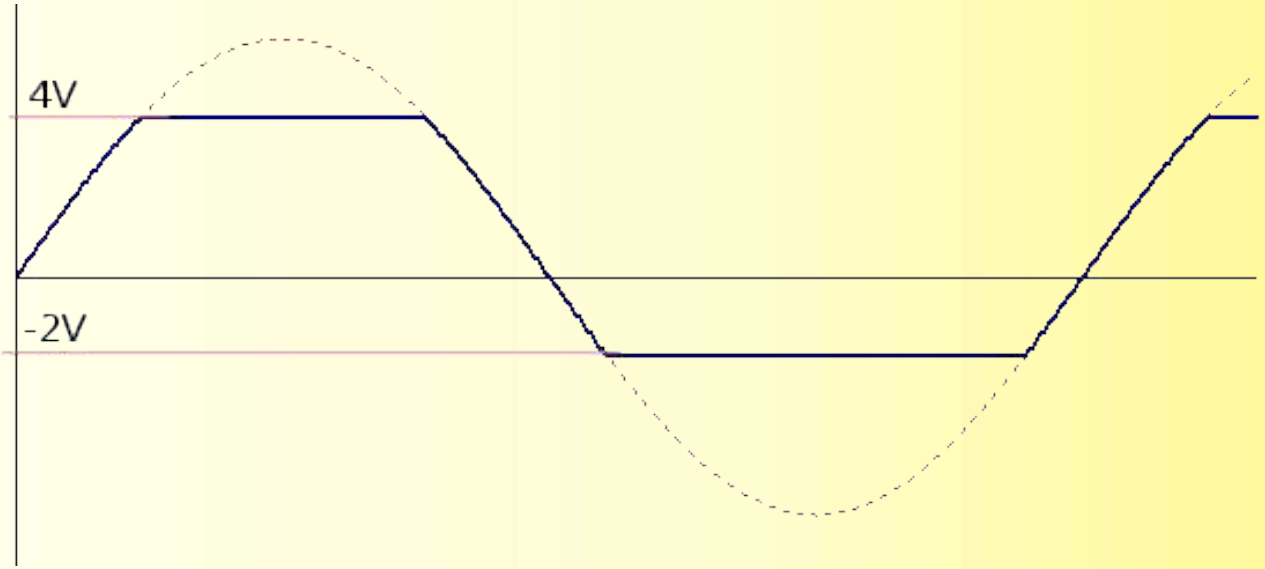


設 $-V_1 < -V_2$

(3)

如圖，若 **V1=4V ， V2=2V** ，輸入電壓為
Vi=6sinωt ，則輸出波形為何 **?(** 二極體為理想二極體 **)**

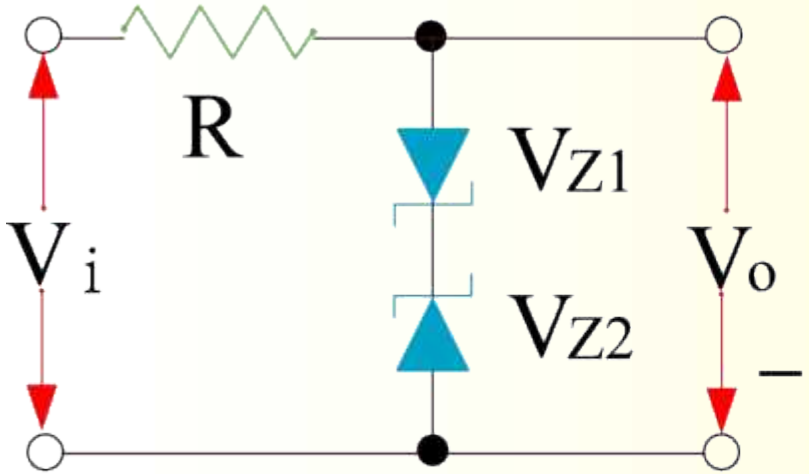


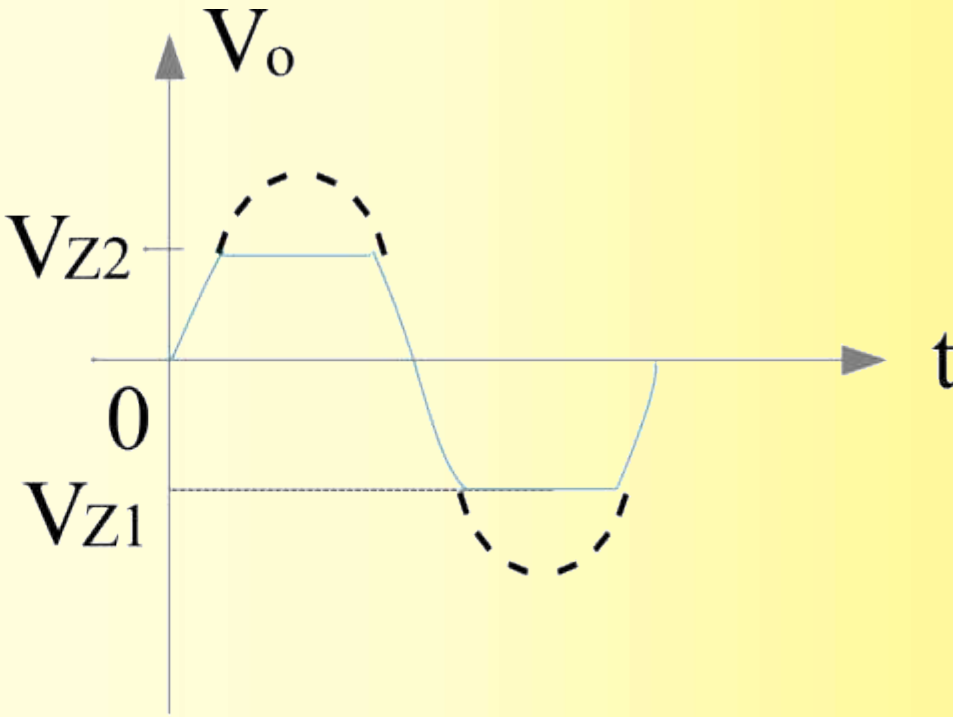


$V_1 = 4\text{V}$、$V_2 = 2\text{V}$

所以輸出電壓為 $-2\text{V} \leqslant V_o \leqslant 4\text{V}$

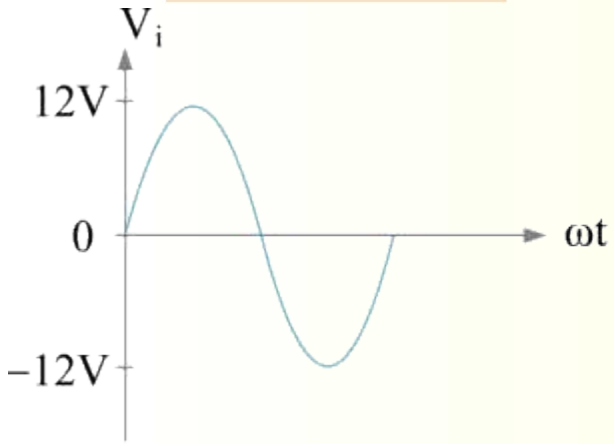
數種基本的雙向截波器



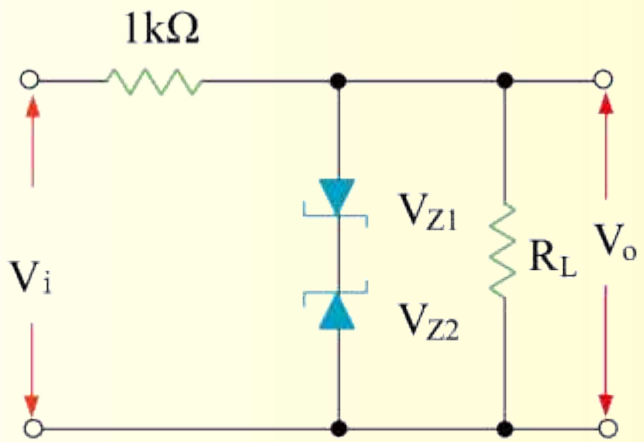


(4)

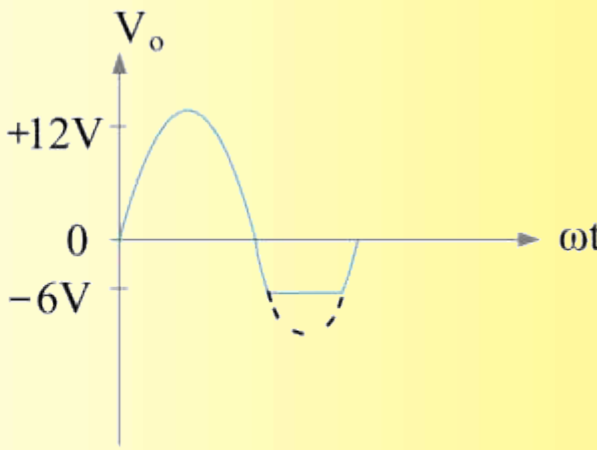
Vi(t)=12sinωt ，稽納二極體的崩潰電壓 V_{Z1}=6V ，V_{Z2}=15V ，順向電壓降為 0V ，試分析其輸出波形



(a)



(b)

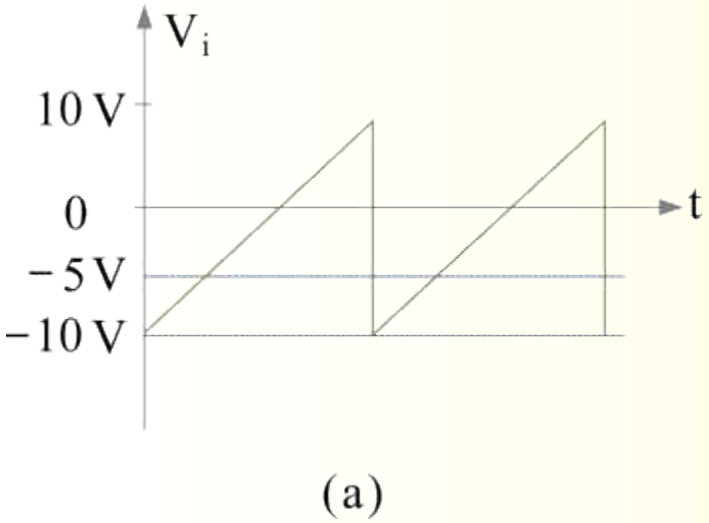


(c)

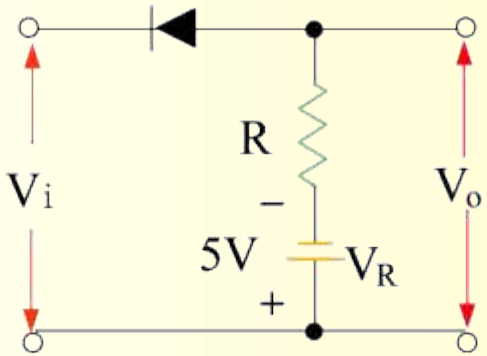
(1)當輸入為正半週時 ，若$V_i < V_{Z2}$ ，則D_{Z2}截止 ，$V_O = V_i$。

(2)當輸入為負半週時 ，若 $-V_i < V_{Z1}$ ，則D_{Z1}截止 ，$V_O = V_i$。

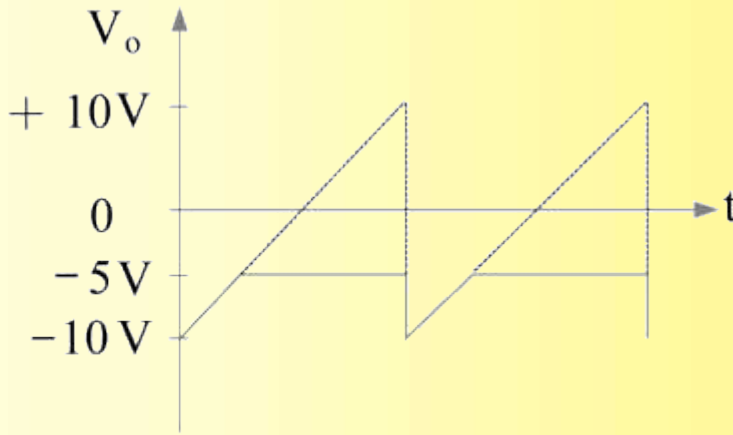
圖為加上偏壓型截波器，其輸入波形如圖所示，試分析輸出波形。



(a)



(b)

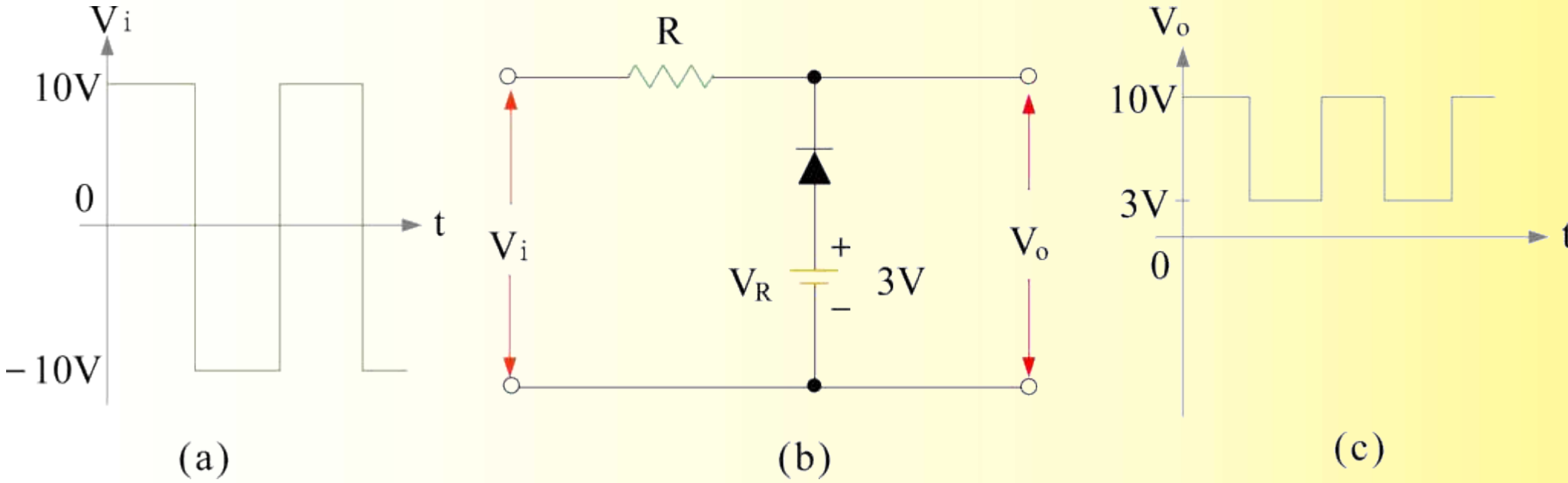


(c)

(1)當$V_i \geqslant -5V$時，$V_O = V_R$。

(2)當$V_i < -5V$時，二極體導通，$V_O = V_i$。

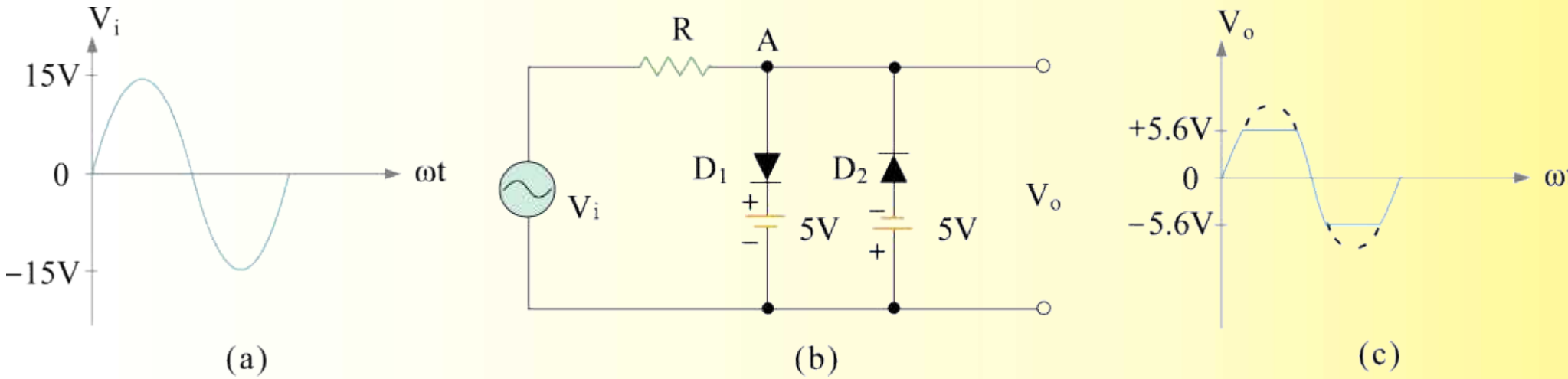
如圖所示電路，當輸入為方波訊號時，試分析其輸出波形。



(1)當$V_i > 3V$時，$V_O = V_i$。

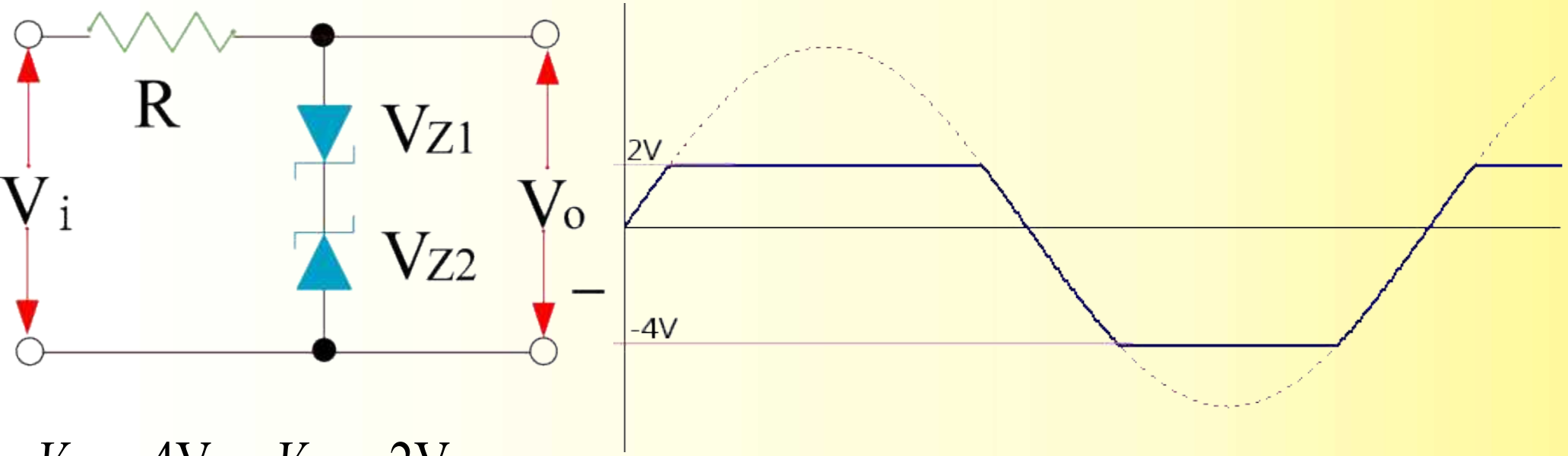
(2)當$V_i \leq 3V$時，二極體導通，$V_O = V_R = 3V$。

如圖所示雙向截波器，D1 、D2 為矽質二極體，試分析其輸出波形。



(1)當輸入為正半週 ，*A*點電壓達到 +5.6V ，*D1*導通 ，輸出保持於 +5.6V
(2)當輸入為負半週 ，*A*點電壓達到 −5.6V ，*D2*導通 ，輸出保持於 −5.6V

如圖，若 V_{z1}=4V ， V_{z2}=2V ，輸入電壓為 Vi=6sinωt ，則輸出波形為何 ?(二極體為理想二極體)



$V_{Z1}=4\text{V}$、$V_{Z2}=2\text{V}$

所以輸出電壓為 $-2\text{V} \leqslant V_o \leqslant 4\text{V}$