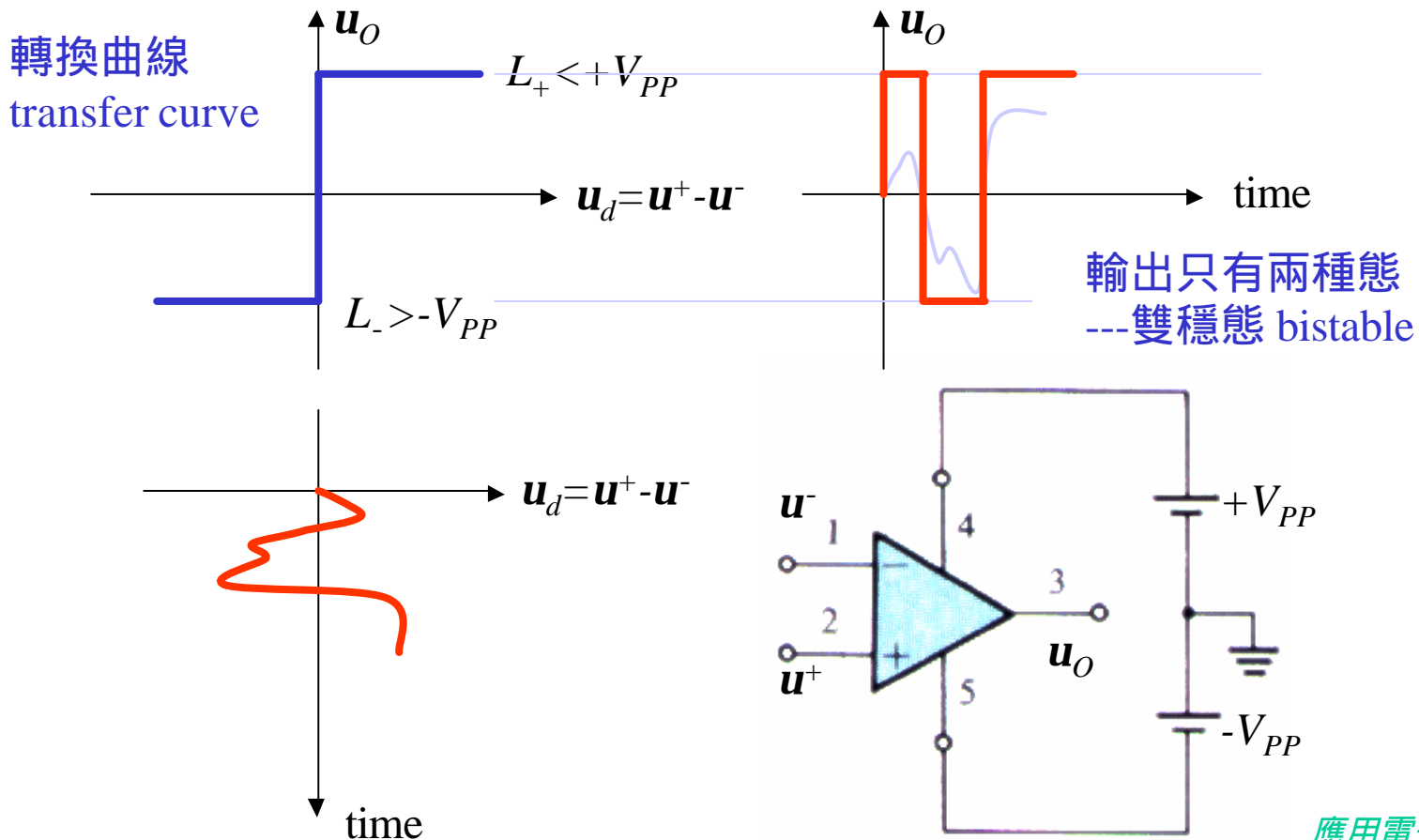


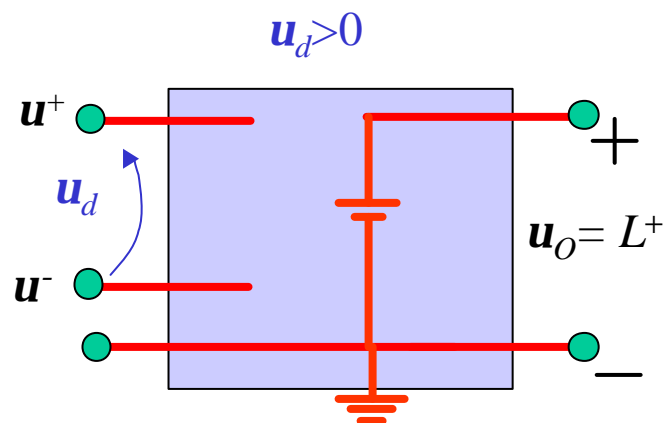
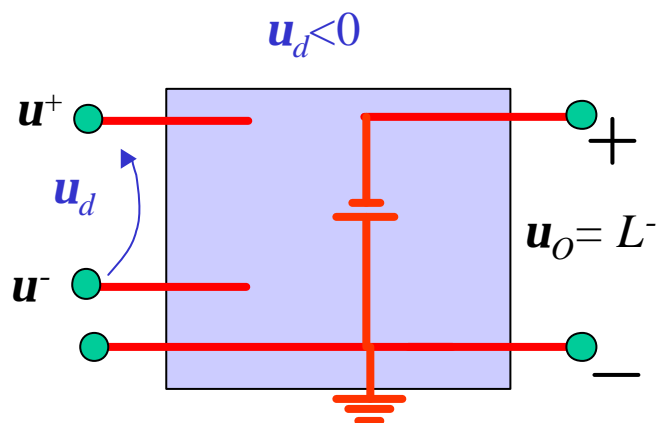
# 實密特觸發---正回授的例子

## 比較器 Comparator

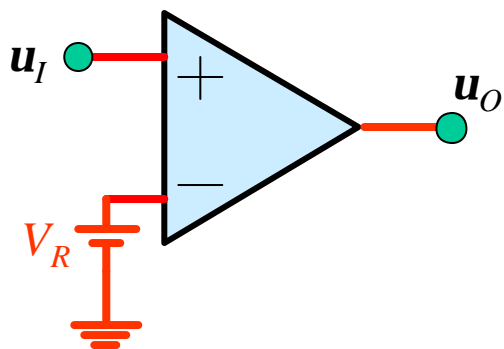
當op amp.無負回授時，Golden Rules不成立



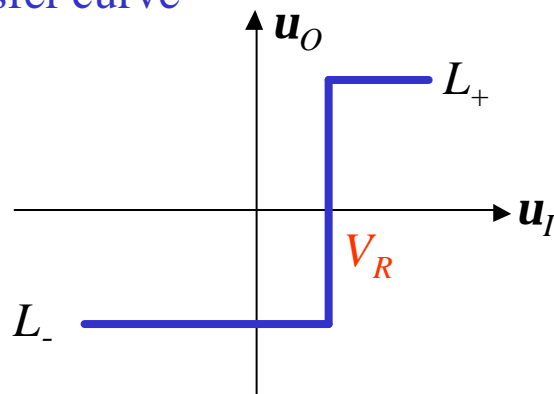
## 比較器的電路模型



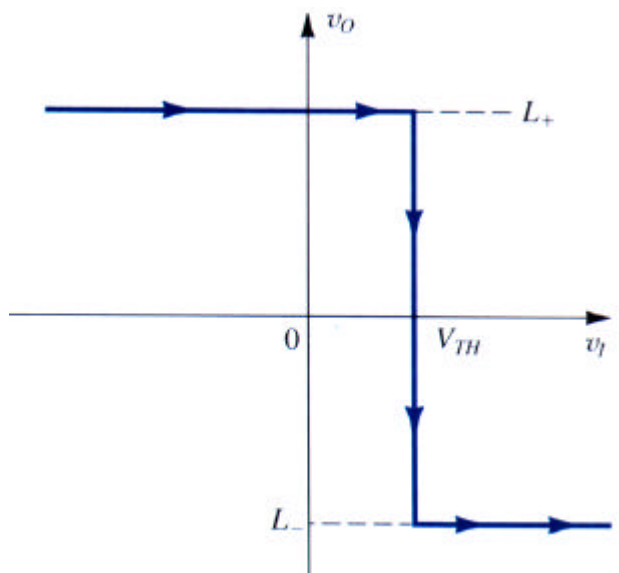
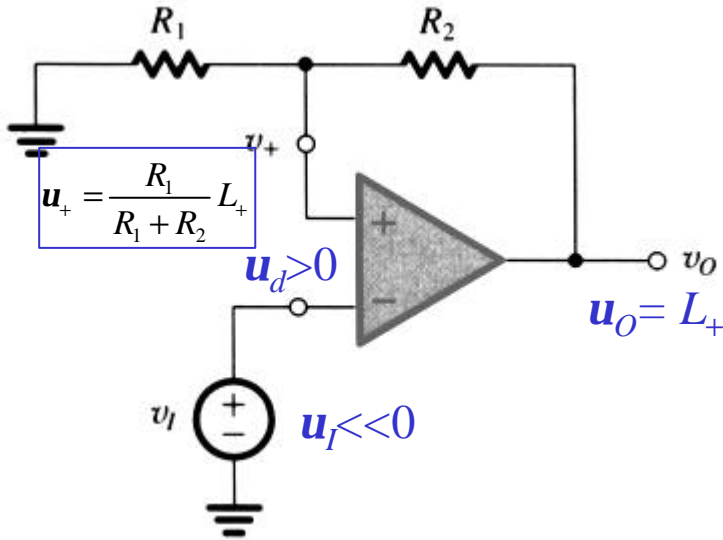
## 有參考電壓的比較器



transfer curve



## 基本實密特觸發 Schmitt trigger



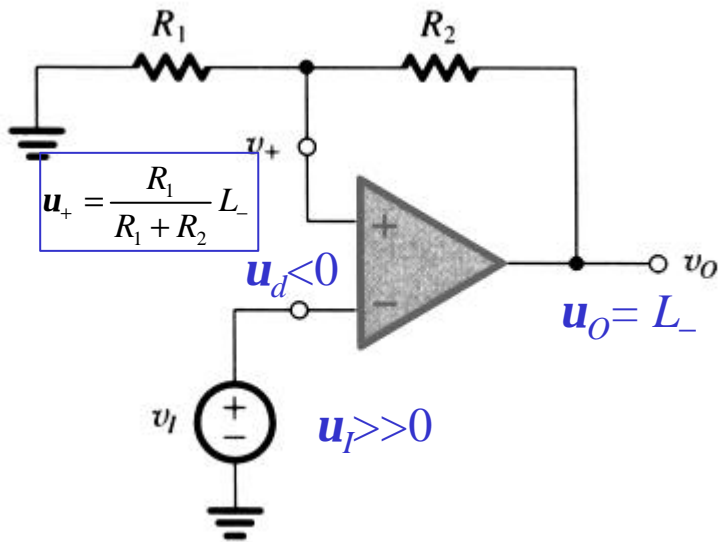
**注意！** 回授接在正端，沒有負回授！

• 當  $u_i \ll 0$  ,  $u_d > 0$  ,  $u_o = L_+$  , 此時

$$u_+ = \frac{R_1}{R_1 + R_2} L_+$$

• 當  $u_i$  慢慢增加至  $V_{TH} = u_+ = \frac{R_1}{R_1 + R_2} L_+$   
 $u_d = 0$

• 當  $u_i$  略大於  $V_{TH}$  時 ,  $u_d < 0$  , 輸出  $u_o$  變為  $L_-$ 。

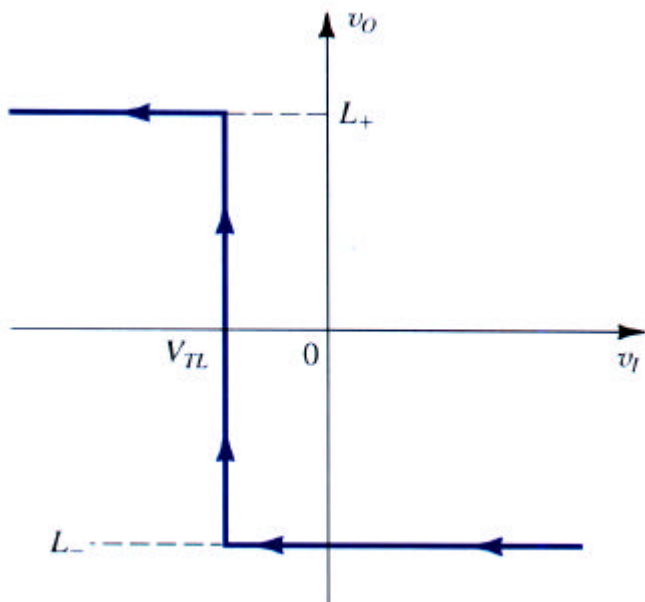


• 當  $u_I \gg 0$  ,  $u_d < 0$  ,  $u_O = L_-$  , 此時

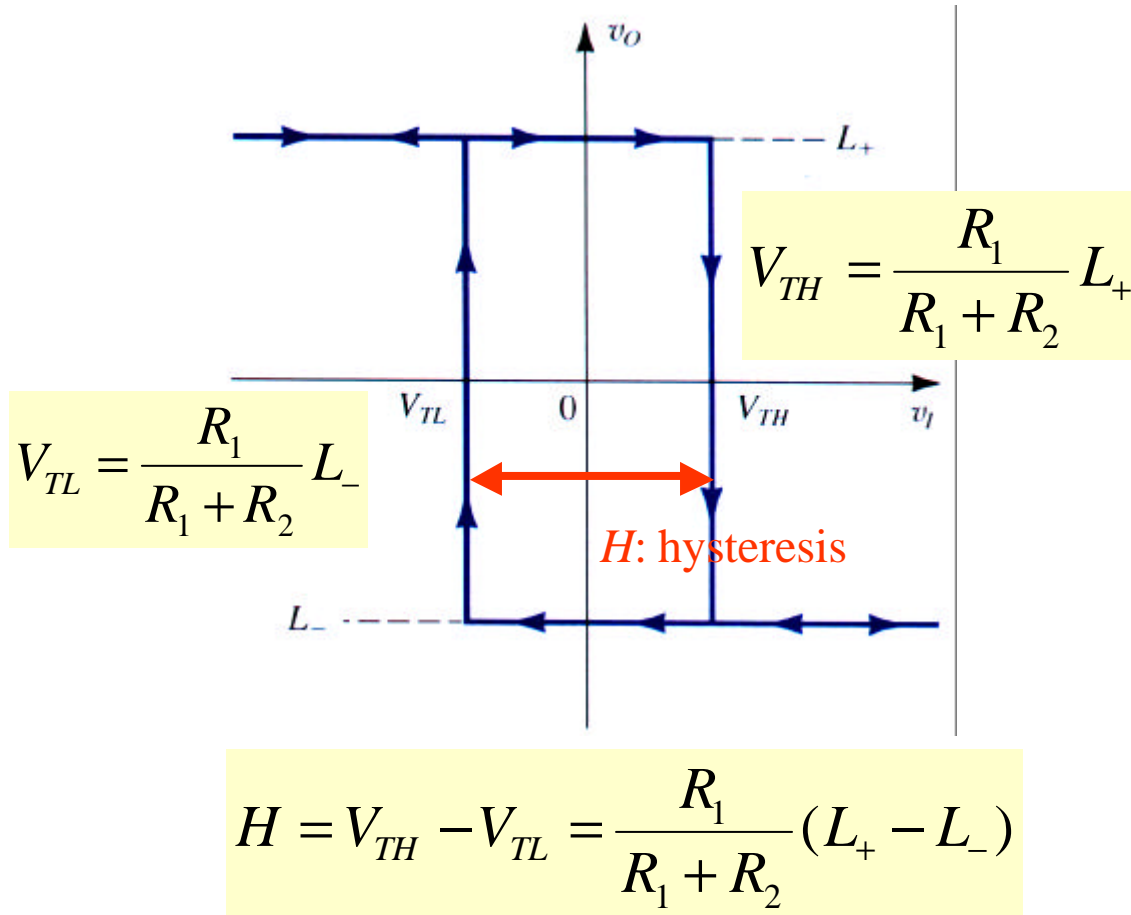
$$u_+ = \frac{R_1}{R_1 + R_2} L_-$$

• 當  $u_I$  慢慢減小至  $V_{TL} = u_+ = \frac{R_1}{R_1 + R_2} L_-$   
 $u_d = 0$

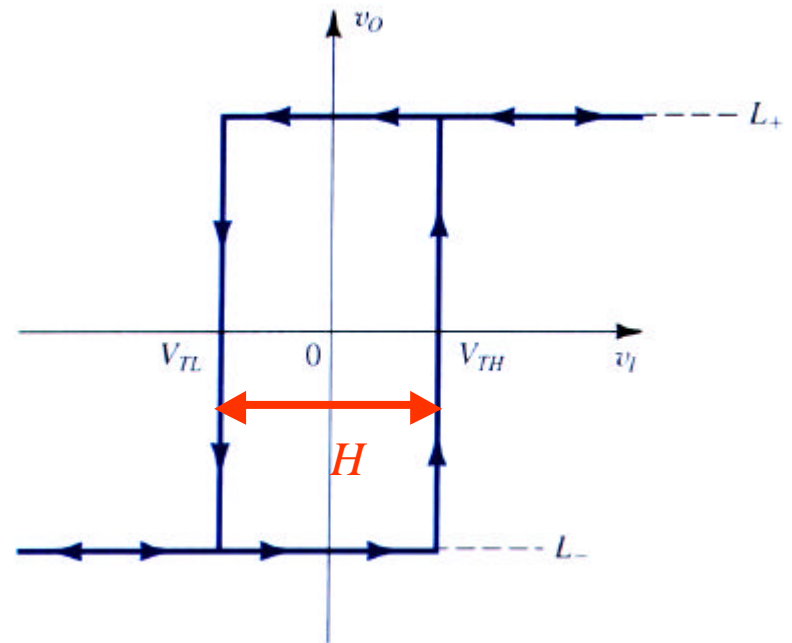
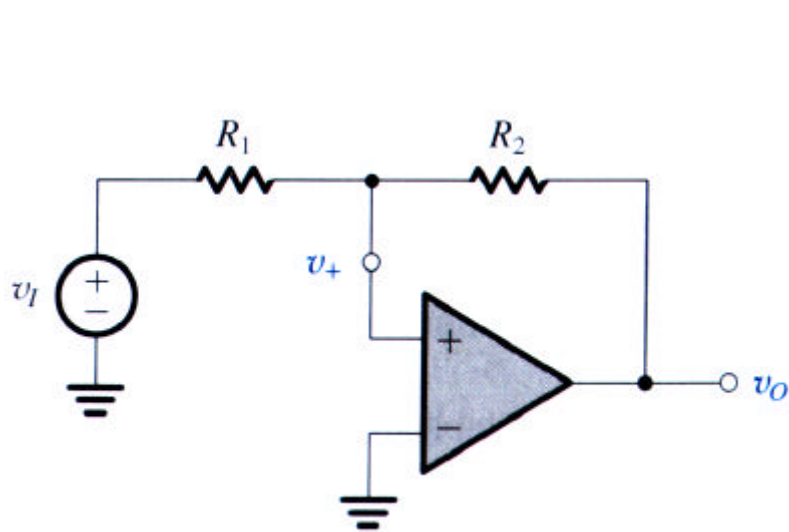
• 當  $u_I$  略小於  $V_{TL}$  時 ,  $u_d > 0$  , 輸出  $u_O$  變為  $L_+$ 。



## 反相接法的Schmitt trigger



## 非反相接法的Schmitt trigger



同學自行練習

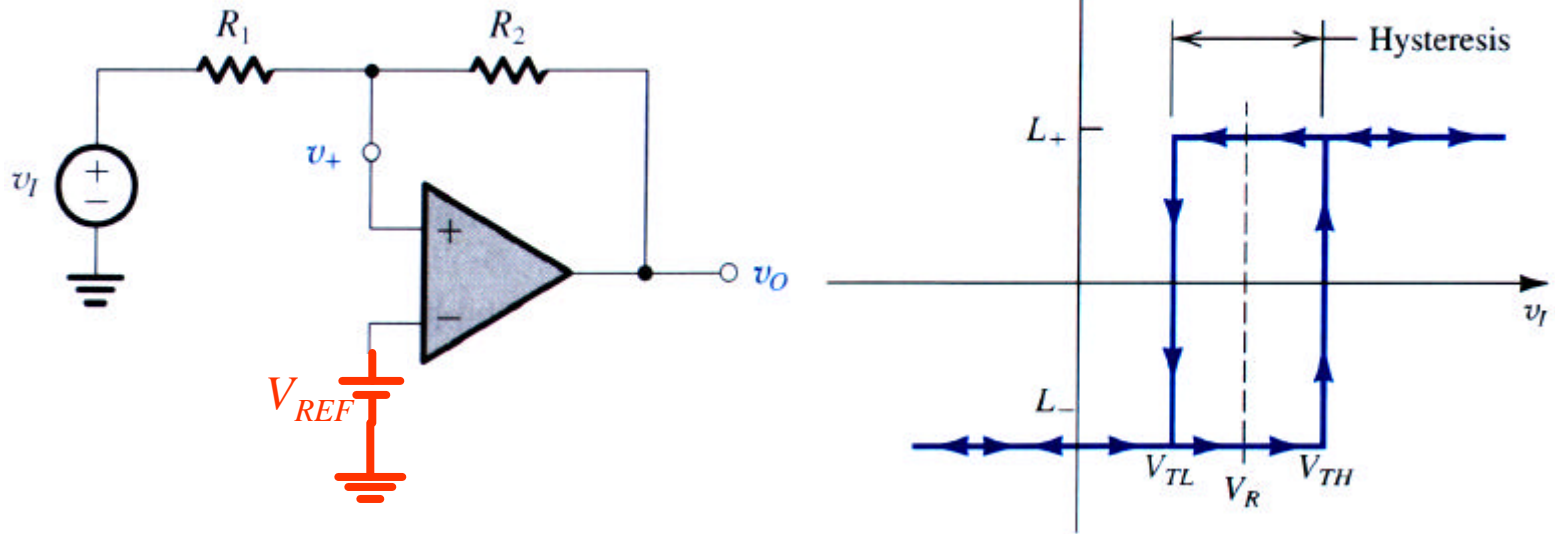
$$u_+ = \frac{R_2}{R_1 + R_2} u_I + \frac{R_1}{R_1 + R_2} u_O$$

$$V_{TH} = -\frac{R_1}{R_2} L_- \quad V_{TL} = -\frac{R_1}{R_2} L_+$$

$$H = V_{TH} - V_{TL} = \frac{R_1}{R_2} (L_+ - L_-)$$

# Schmitt trigger with a voltage reference

非反相接法

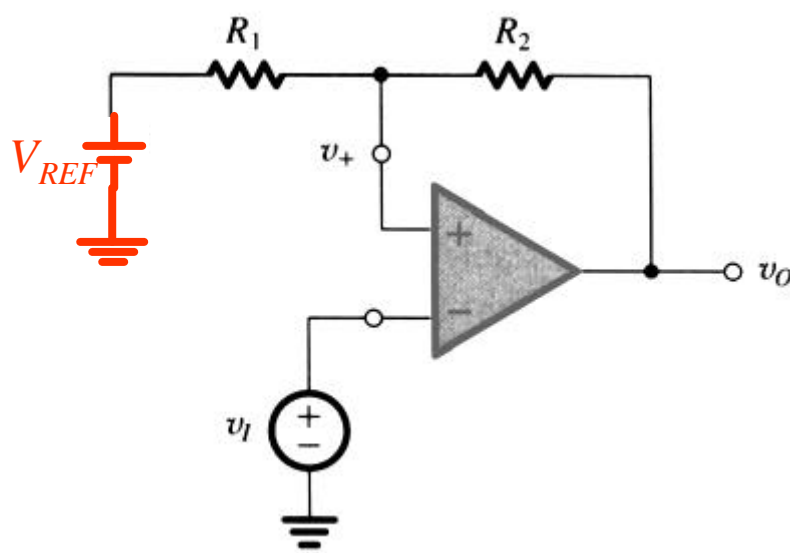


同學自行練習

$$V_{TH} = -\frac{R_1}{R_2} L_- + V_R \quad V_{TL} = -\frac{R_1}{R_2} L_+ + V_R$$
$$V_R = \frac{R_1 + R_2}{R_2} V_{REF}$$

# 反相接法

## 同學自行練習



$$V_{TH} = \frac{R_1}{R_1 + R_2} L_+ + V_R$$

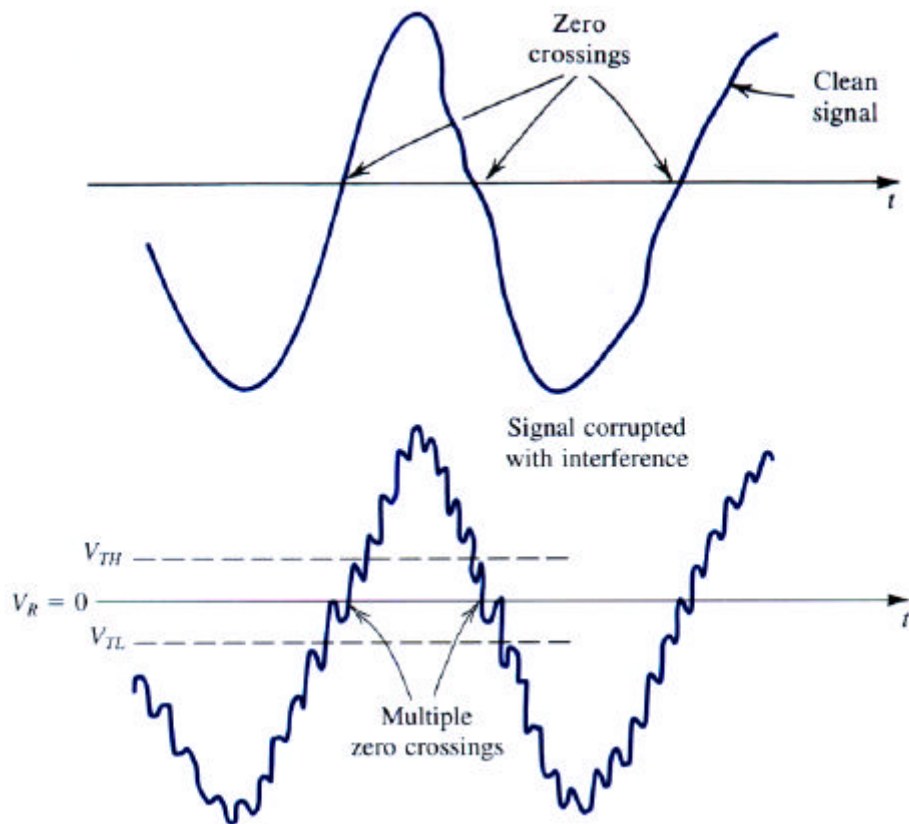
$$V_{TL} = \frac{R_1}{R_1 + R_2} L_- + V_R$$

$$V_R = \frac{R_2}{R_1 + R_2} V_{REF}$$



## Schmitt trigger 的用途

防止雜訊的比較器  
波形產生器



防止由雜訊造成之多次  
觸發