



Chapter 2

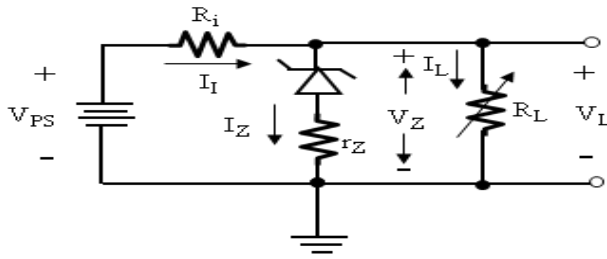
二極體電路

2.2 齊納二極體電路

南方科技大學

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When $I_L \uparrow$ $V_{PS} \downarrow$ 時 $\rightarrow I_Z \downarrow$

When $I_L \downarrow$ $V_{PS} \uparrow$ 時 $\rightarrow I_Z \uparrow$

由 KCL:

$$V_{PS} - I_R R_i - V_Z = 0$$

$$R_i = \frac{V_{PS} - V_Z}{I_R} \quad \text{①}$$

$$V_O = I_L R_L \rightarrow I_L \frac{V_O(V_Z)}{R_L} \quad \text{②}$$

$$I_Z + I_L = I_R \quad \text{③}$$

③代入①

$$R_i = \frac{V_{PS} - V_Z}{I_Z + I_L}$$

$$I_Z = \frac{V_{PS} - V_Z}{R_i} - I_L$$

代入條件①:

$$I_{L(\max)} \frac{V_{PS(\min)} - V_Z}{I_{Z(\min)} + I_{L(\max)}} = I_{Z(\min)}$$

$$R_i = \frac{V_{PS(\min)} - V_Z}{I_{Z(\min)} + I_{L(\max)}} \quad \text{①}$$

條件②:

$$I_{L(\min)} \frac{V_{PS(\max)} - V_Z}{I_{Z(\max)} + I_{L(\min)}} = I_{Z(\max)}$$

$$R_i = \frac{V_{PS(\max)} - V_Z}{I_{Z(\max)} + I_{L(\min)}} \quad \text{②}$$

①=②交叉相乘

$$(V_{PS(\min)} - V_Z)(I_{Z(\max)} + I_{L(\min)}) = (V_{PS(\max)} - V_Z)(I_{Z(\min)} + I_{L(\max)})$$

假設 $I_{Z(\min)} = 0.1 I_{Z(\max)}$ 代入

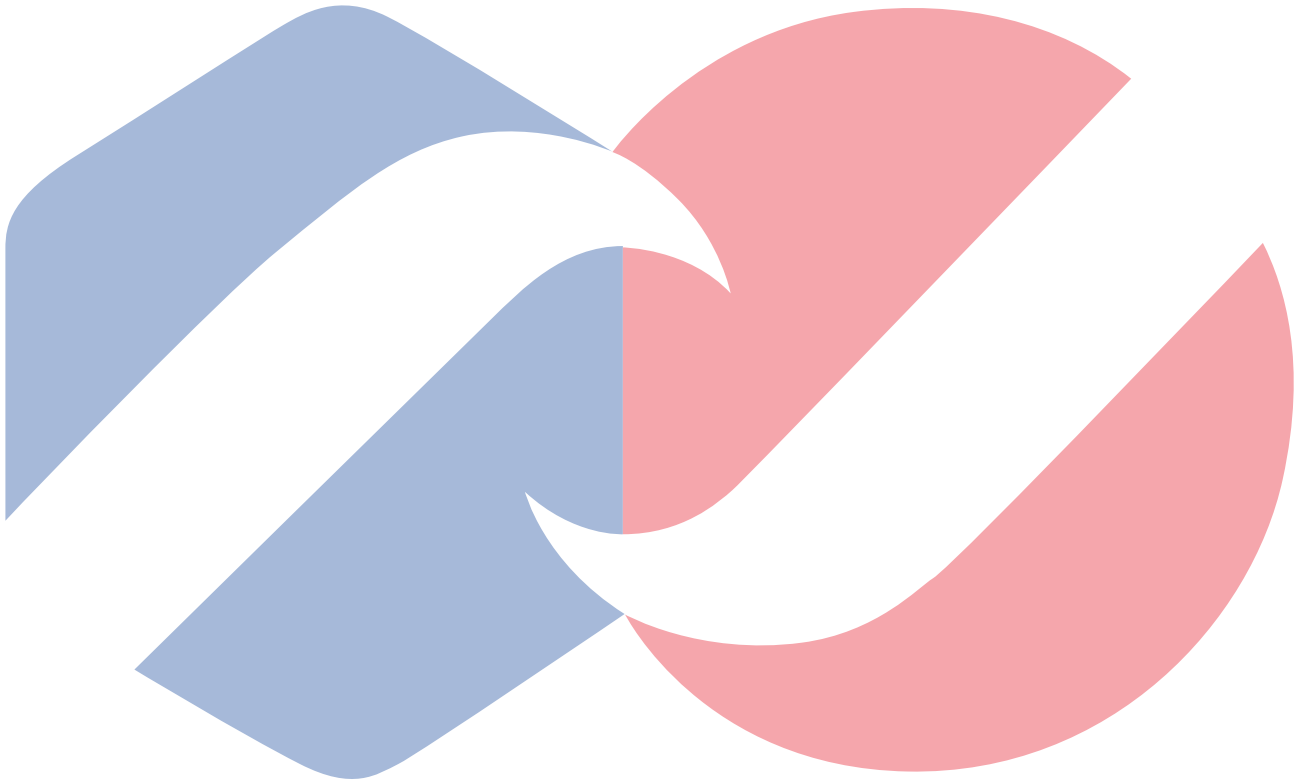
$$(V_{PS(\min)} - V_Z)(I_{Z(\max)} + I_{L(\min)}) = (V_{PS(\max)} - V_Z)(0.1 I_{Z(\max)} + I_{L(\max)})$$

$$I_{Z(\max)} = \frac{I_{Z(\max)}(V_{PS(\max)} - V_Z) - I_{L(\min)}(V_{PS(\min)} - V_Z)}{V_{PS(\min)} - 0.9V_Z - 0.1V_{PS(\max)}}$$

將 $I_{Z(\max)}$ 代入①得 R_i

- ◆ 調節百分率(Source Regulation)及 Zener 電阻
非理想 Zener Diode 包含 V_Z r_Z 的函式

$$\text{調節百分率(Source Regulation)} = \frac{V_{L(\max)} - V_{L(\min)}}{V_{L(\min)}}$$



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