



Chapter 1

半導體元件及基本運用

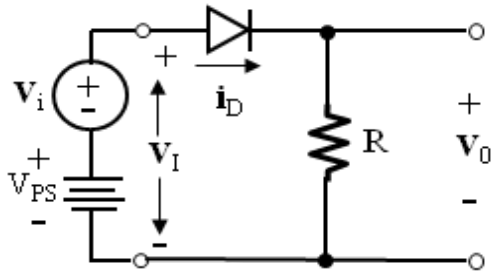
1.4 二極體電路:交流等效電路

南方科技大學

Southern Taiwan University

1.4 二極體電路:交流等效電路

當 PN 接面二極體用在線性放大電路中時，PN 接面的交流特性相形重要



$$V_I = V_i + V_{PS}$$

1. 直流分析
2. 交流分析

$$i_D \cong I_S e^{\frac{V_D}{V_T}} = I_S e^{\frac{v_d + V_{DQ}}{V_T}}$$

$$= I_S \left[e^{\frac{V_{DQ}}{V_T}} + e^{\frac{v_d}{V_T}} \right]$$

$$\text{When } v_d \ll V_T \rightarrow e^{\frac{v_d}{V_T}} = 1 + \frac{v_d}{V_T}$$

$$= I_S \left[e^{\frac{V_{DQ}}{V_T}} \right] \left(1 + \frac{v_d}{V_T} \right)$$

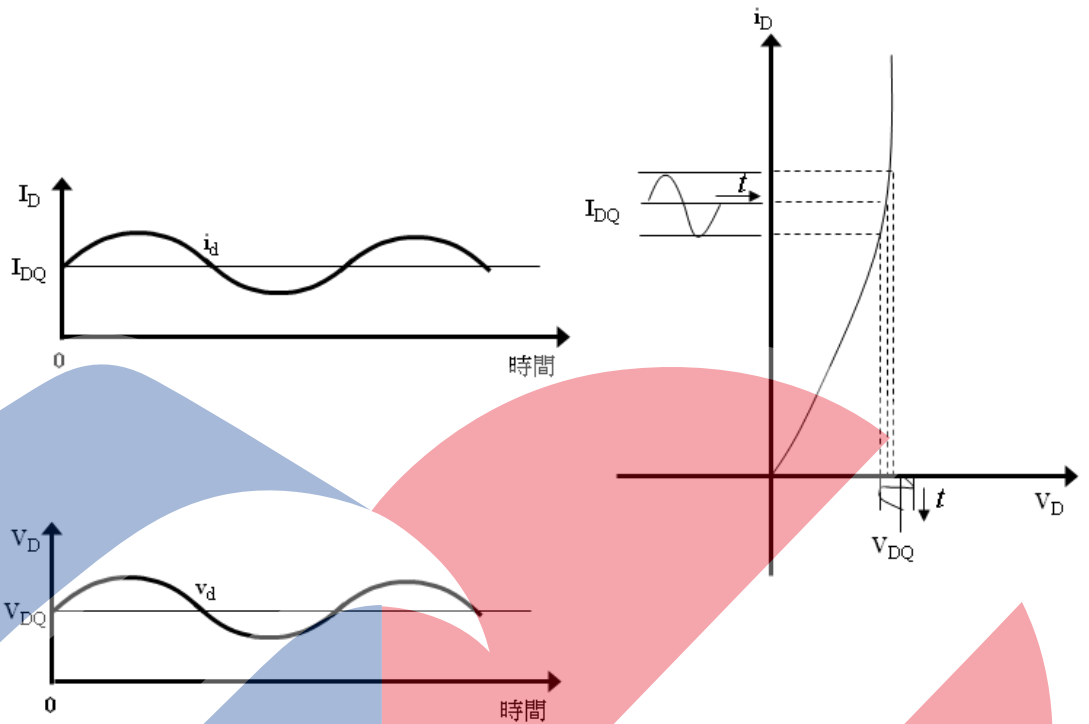
$$\rightarrow I_{DQ} \left[e^{\frac{v_d}{V_T}} \right] = I_{DQ} + I_{DQ} \frac{v_d}{V_T}$$

$$i_d = \frac{I_{DQ}}{V_T} v_d = g_d v_d \quad \therefore g_d = \frac{I_{DQ}}{V_T}$$

$$\rightarrow v_d = \frac{V_T}{I_{DQ}} i_d = r_d i_d \quad \therefore r_d = \frac{V_T}{I_{DQ}}$$

g_d 、 r_d 分別為二極體小訊號增量電導電阻
(Small-Signal Incremental Conductance and Resistance)
或稱擴散增量電導電阻(Diffusion Conductance and Diffusion Resistance)

Southern Taiwan University



南台科技大學
Southern Taiwan University