$v_d = \frac{\Delta x}{\Delta t}$, $\Delta Q = (n \cdot A \cdot \Delta x)\, q$ (n = 電荷載子數, A = 截面積, q = 基本電量)

$\Rightarrow \frac{\Delta Q}{\Delta t} = I = nqA\frac{\Delta x}{\Delta t} = (nq)Av_d$

其實就是電荷密度 (e)

$\frac{I}{A} = (nq)v_d = e \cdot v_d = J$

current density (J) 的定義

$\Rightarrow$ Ohm's Law: $J = \sigma E = (\frac{1}{\rho})E$

σ = 電導率, 物質材料本身特性

ρ = 電阻率, 由查表得知, 跟型號一樣, 不是電荷密度

$R = \frac{V}{I} = \rho\frac{L}{A}$ (ρ = 電阻率, L ⇒ 長度)

$\Rightarrow$ 深入推導: $\vec{F_e} = q\vec{E}$, $\vec{a} = \frac{\vec{F}}{m}$,

thus 載子流動的加速度 (電子) $= \frac{qE}{m_e}$

knowing $v_{s,avg} = v_d$ (平均速度 = v_{drift})

$\Rightarrow v_{s,avg} = v_d = \frac{qE}{m_e}\cdot\tau$ (τ = average time interval between successive collisions.)

(recall $I = nqAv_d$)

$I_{avg} = nqA\left(\frac{qE}{m_e}\tau\right) = \frac{nq^2E}{m_e}\cdot\tau A$ (平均電流)

(recall $J = \frac{I}{A}$, $J = \sigma E = \frac{1}{\rho}E$)

$J = \frac{nq^2E}{m_e}\tau$ i.e. 即 $\sigma \Rightarrow \rho = \frac{m_e}{nq^2\tau}$

電導率. 實際的測量法.