# MICROELECTRONIC DEVICE PRINCIPLES
# EQUATIONS SHEET

$$E_C = \frac{\pi}{d}\left(\frac{K_{11}}{\varepsilon_0|\Delta\varepsilon|}\right)^{0.5}$$

$$V_{th} = \pi\left(\frac{K_{11}}{\varepsilon_0|\Delta\varepsilon|}\right)^{0.5}$$

$$V_{th} = \pi\left(\frac{K_{11} + (K_{33} - 2K_{22})/4}{\varepsilon_0|\Delta\varepsilon|}\right)^{0.5}$$

$$\tau_r = \frac{\eta_1 d^2}{\varepsilon_0|\Delta\varepsilon|V^2 - \left(K_{11} + \frac{K_{33} - 2K_{22}}{4}\right)\pi^2}$$

$$\tau_f = \frac{\eta_1 d^2}{\left(K_{11} + \frac{K_{33} - 2K_{22}}{4}\right)\pi^2}$$

$$N_{MAX} = \left(\frac{\left(V_{on}/V_{off}\right)^2 + 1}{\left(V_{on}/V_{off}\right)^2 - 1}\right)^2$$

$$N_{MAX} = \left(\frac{V_S}{V_D}\right)^2$$

$$\left(\frac{V_{on}}{V_{off}}\right)_{MAX} = \sqrt{\frac{\sqrt{N}+1}{\sqrt{N}-1}}$$

$$T_{ON} \le 0.1 T_{frame}/N$$

$$T_{OFF} \ge 200 T_{frame}$$

$$J = AT^2 \exp\left((V_{app} - q\phi_B)/kT\right)$$

$$J = CE^2 \exp(-E_0/E)$$

$$\eta_{eff} = \gamma \; r_{st} q \; \eta_{ext}$$

$$v = \mu E$$

$$\mu = \frac{\varsigma\varepsilon}{\eta}$$

$$\varsigma = \frac{q\lambda_D}{\varepsilon}$$