APPENDIX

Appendix A

Formula for Analysis the Ideal Theoretical $C-V$ Characteristics of the $n-$Type Si MOS Diode:

$$V_{FB}^{o} = \phi_{Al} - \phi_{Si} = \left\{ \phi_{Al} - \frac{[q\chi + (E_C - E_F)]}{q} \right\}$$

$$C = \frac{1}{\frac{1}{C_o'} + \frac{1}{C_s}}$$

$$C_{acc,dep} = \frac{\varepsilon_s}{\sqrt{2}L_D} \left| \frac{[-1 + \exp(q\psi_s / kT)]}{\left[-\frac{q\psi_s}{kT} + \exp(q\psi_s / kT) - 1 \right]^{1/2}} \right| \quad F/cm^2$$

$$C(FB) = \frac{1}{\frac{d}{\varepsilon_{ox}} + \frac{L_D}{\varepsilon_s}} \quad F/cm^2$$

$$C(acc) = \frac{\varepsilon_{ox}}{d} = C_o' \quad F/cm^2$$

$$V_T = V_{FB}^{o} - 2|\psi_B| - \sqrt{4q\varepsilon_s N_D |\psi_B|} / (\varepsilon_{ox}/d)$$

$$\psi_B = \frac{kT}{q} \ln\left(\frac{N_D}{n_i}\right)$$

$$C_{\min} = \frac{1}{\frac{d}{\varepsilon_{ox}} + \frac{W_m}{\varepsilon_s}} \quad F/cm^2$$

$$W_m = \sqrt{\frac{2\varepsilon_s \psi_s}{qN_D}} = 2L_D \sqrt{\ln\left(\frac{N_D}{n_i}\right)}$$

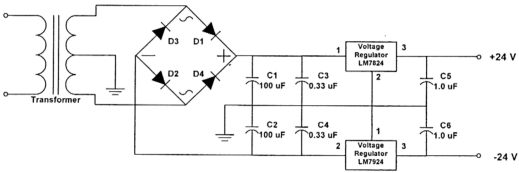
$$V(acc) = V_{FB}^o + \frac{|Q_s|}{C_o'} + \psi_s$$

$$V(dep, inv) = V_{FB}^o - \frac{|Q_s|}{C_o'} + \psi_s$$

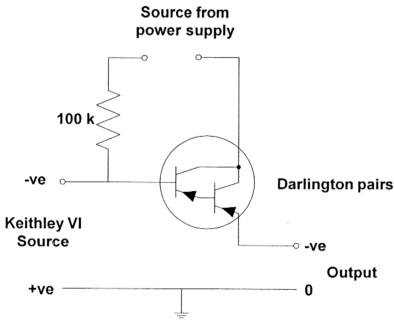
$$Q_s = \mp \sqrt{2\varepsilon_s kTN_D} \left\{ \left[-\frac{q\psi_s}{kT} + \exp(q\psi_s/kT) - 1 \right] + \left(\frac{n_i}{N_D}\right)^2 \left[\exp(-q\psi_s/kT) - 1\right] \right\}^{1/2}$$

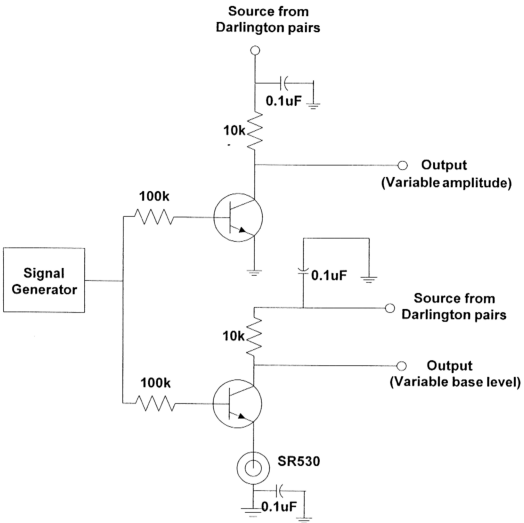
For a $n-$type Si, Q_s is negative sign $(-)$ for accumulation and positive sign $(+)$ for depletion and inversion.

Appendix B



Power Supply Circuit




Source from
Darlington pairs
0.1uF
10k
Output
(Variable amplitude)
100k
Signal
Generator
0.1uF
Source from
Darlington pairs
10k
Output
(Variable base level)
100k
SR530
0.1uF