The bulk resistivity of silicon is related to the concentration of n-dopants, the electron mobility, the concentration of p-dopants, and the hole mobility. For n-type bulk, containing only n-dopants, the resistivity is given in terms of the dopant concentration (N_{eff}), the electron mobility μ_e, and the electron charge (q) by:

$\rho = 1/(q\mu_e N_{eff})$

With q=1.6E-19C & μ_e = 1300 cm^2/V-sec, this is $\rho = (4.63E15/ N_{eff})\Omega cm$ (N_{eff} in number/cm^3).

Equivalently, $N_{eff} = 4.63E15/\rho$.

As a charge collecting diode is reverse biased, mobile charge is drawn into the diode from the nearby bulk silicon. This leaves the bulk silicon electrically charged. This space charge reduces the electric field (due to the bias on the diode) at points away from the junction. At some point the electric field is reduced to zero and mobile charges are no longer attracted towards the diode junction. This "depletion depth" is easy to calculate for a simple planar diode geometry. In this case, everywhere the electric field is nonzero its direction is perpendicular to the diode junction. With this geometry the depletion depth is easy to calculate (ignoring diffusion); it is the depth at which the field due to the uniform space charge in the depleted region exactly balances the field due to the applied voltage. For this simple case, the relationship between the applied voltage (V) and the depletion depth d is:

$V = (q\, d^2 N_{eff})/2\varepsilon$ or $d = \mathrm{sqrt}(2\varepsilon V/qN_{eff})$

ε is the permittivity of silicon and is given in terms of the dielectric constant of silicon and the permittivity of free space by $\varepsilon = k\varepsilon_0$. k(silicon) = 11.68; ε_0=8.85E-12 F/m → $\varepsilon \approx$ 1E-12 F/cm.

For d in microns, ρ in Ωcm, and V in volts, $d \approx .5\mathrm{sqrt}(\rho V)$.

Depletion Depth as a function of diode reverse bias (planar geometry)

Inputs are filled green			
n- bulk resistivity (ohm-cm)	700		
N_eff	6.61E+12		
Permittivity of silicon (F/cm)	1.00E-11		
Voltage (V)	Depletion Depth (microns)	resistivity	N_eff
1	14	700	6.61E+12
2	19	700	6.61E+12
3	24	700	6.61E+12
4	27	700	6.61E+12
5	31	700	6.61E+12
6	34	700	6.61E+12
7	36	700	6.61E+12
8	39	700	6.61E+12
9	41	700	6.61E+12
10	43	700	6.61E+12
11	46	700	6.61E+12
12	48	700	6.61E+12
13	50	700	6.61E+12
14	51	700	6.61E+12
15	53	700	6.61E+12
16	55	700	6.61E+12
17	57	700	6.61E+12
18	58	700	6.61E+12
19	60	700	6.61E+12
20	61	700	6.61E+12