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    "c0 = 3e10 # [cm/s] velocidad de la luz en el vacío\n",
    "h = 6.623e-34 # [J/s] Constante de Planck\n",
    "m0 = 9.1e-31 # [kg] masa del electrón en reposo\n",
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    "NSi = 5e22 # [m^3] Átomos por unidad de volumen\n",
    "rhoSi =  2.33 # [g/cm^3] densidad\n",
    "EgSi = 1.12 # [eV] energía de banda prohibida\n",
    "niSi = 1e10 # [m^3] concentración intrínseca\n",
    "munSi = 1430; mupSi = 480 # [cm^2/Vs] movilidad Nd,a < 1e15\n",
    "ErupSi = 3e5 # [V/cm] Campo eléctrico para ruptura dieléctrica\n",
    "kapaSi = 1.5 # [W/cm°C] conductividad térmica\n",
    "CpSi = 0.7 # [J/gK] Calor específico \n",
    "DthSi = 0.87 # [cm^2/s] Difusividad térmica\n",
    "epsSi = 11.7*eps0 # [F/cm] Permitividad eléctrica\n",
    "nSi = 3.44 # indice de refracción \n",
    "chiSi = 4.05 # [eV] Afinidad electrónica\n",
    "men = 0.867*m0; meng = 1.08*m0*1.07  # [kg] masa efectiva electrones para cálculo en conductividad y densidad, respectivamente.\n",
    "mep = 1.156*m0; mepg = 0.81*m0*1.07  # [kg] masa efectiva huecos para cálculo en conductividad y densidad, respectivamente."
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    "EgSiO2 = 3.9 # [eV] energía de banda prohibida\n",
    "munSiO2 = 20; mupSiO2 = 1e-8 # [cm^2/Vs] \n",
    "ErupSiO2 = 1e7 # [V/cm] Campo eléctrico para ruptura dieléctrica (es mayor a este valor!!!)\n",
    "kapaSiO2 = 0.014 # [W/cm°C] conductividad térmica\n",
    "CpSiO2 = 1.0 # [J/gK] Calor específico \n",
    "DthSiO2 = 0.006 # [cm^2/s] Difusividad térmica\n",
    "epsSiO2 = 3.9*eps0 # [F/cm] Permitividad eléctrica\n",
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    "Nd = 1e16 # [cm**-3]\n",
    "Wmp = 10e-4 # [cm] ancho región tipo p\n",
    "Wmn = 10e-4 # [cm] ancho región tipo n\n",
    "T = 300 # [K] temperatura de trabajo"
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    "muPn = muminN + (mumaxN - muminN)/(1+(Na/NrefN))**aN # Minoritarios lado P\n",
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lado N\n",
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P\n",
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    "JonD = q*niSi**2*DPn/((Wmp-WdnD)*Na) # Corriente de saturación\n",
    "JopD = q*niSi**2*DNp/((Wmn-WdpD)*Nd) # Corriente de saturación\n",
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ancho lado N\n",
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ancho lado P\n",
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    "JopD2 = q*niSi**2*DNp/((Wmn-WdpD2)*Nd) # Corriente de saturación\n",
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     "for i in range(len(Na)):\n",
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     "    Wdp = np.sqrt(2*epsSi*(VR)/(q*Na[i])) # ancho lado P\n",
     "    muPn = muminN + (mumaxN - muminN)/(1+(Na[i]/NrefN))**aN # Minoritarios lado P\n",
     "    Jbo[i,:] = q*niSi**2*muPn*Vtha/((Wmp-Wdp)*Na[i])\n",
     "    Em = np.sqrt(2*q*Na[i]*np.abs(VR)/epsSi)*100 # campo eléctrico máximo (x=0)\n",
     "    Tt = np.exp(-8*np.pi*np.sqrt(2*meef)*((EgSi*q)**(3/2))/(3*q*Em*h))\n",
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    "Wdn = np.sqrt(2*epsSi*Na*(Vbi-Vapp)/(q*(Na+Nd)*Nd)) #  ancho lado N\n",
    "Wdp = np.sqrt(2*epsSi*Nd*(Vbi-Vapp)/(q*(Na+Nd)*Na)) # ancho lado P\n",
    "Wd0 = np.sqrt(2*epsSi*(Na+Nd)*Vbi/(q*Na*Nd)) # [cm] en ETD\n",
    "Wdn0 = np.sqrt(2*epsSi*Na*Vbi/(q*(Na+Nd)*Nd)) #  ancho lado N en ETD\n",
    "Wdp0 = np.sqrt(2*epsSi*Nd*Vbi/(q*(Na+Nd)*Na)) # ancho lado P en ETD\n",
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