$$\left(\frac{\ae^2}{k^2+\ae^2}\right)^n \, , \tag{19}$$

where k - the transferred momentum, $n>1$. In the BCS equation this factor will lead to the replacement, compared to the previous section:

$$\frac{g\, P_{y0}}{(2\pi)^2 d} \rightarrow \frac{g\, \ae^2}{8\pi^2 (n-1)} \, .$$

Let us first consider the vicinity of the singularity. Substituting the modified phonon mediated interaction into the BCS equation we obtain

$$\frac{1}{\lambda} = \frac{1}{2} \int_{-\mu_1}^{\infty} \frac{d\xi\, \mu_1^{1/2}}{(\xi+\mu_1)^{1/2}} \frac{th[(\xi^2+\Delta_o^2)^{1/2}/2T]}{(\xi^2+\Delta_o^2)^{1/2}} \, , \tag{20}$$

where $\mu_1 = \mu - \xi_0 \ll \mu$, Δ_o is the large gap in the vicinity of the singularity, and

$$\lambda = \frac{g\ae^2 (2m_x)^{1/2}}{(2\pi)^2 (n-1)\, \mu_1^{1/2}} \, . \tag{21}$$

At $T=0$ we obtain from eq. (20) in the limit $\mu_1 \gg \Delta_0$

$$\frac{1}{\lambda} = ln \frac{8\mu_1}{\Delta_o} \, , \; or \;\; \Delta_o = 8\, \mu_1\, e^{-1/\lambda} \tag{22}$$

The order parameter not in the vicinity of the singularity is small for the following qualitative reasons. In the BCS equation (16) the integration can be split in two regions. If we integrate over the vicinity of the singularity, the density of states (per unit angle) is high but the interaction is weakened by the large momentum difference $\boldsymbol{p'}$-$\boldsymbol{p}$. If, however we integrate over $\boldsymbol{p'}$ close to $\boldsymbol{p}$ the density of states is small. Assuming isotropy outside of the singular points we get the equation

$$\frac{\Delta_1}{\Delta_o}\left(1 - \lambda_1 ln\frac{2\omega_D}{\Delta_1}\right) = \frac{2(n-1)\ae^{2(n-1)} P_{y0}}{p^{2n} d} \tag{23}$$

where Δ_1 is the order parameter far from the singularity, p - the distance from the singularity in the plane (p_x, p_y),

$$\lambda_1 = \frac{g\, m\, \ae^2}{(2\pi)^2 (n-1)\, p_o} \tag{24}$$