$$G_{12} = \langle \mathcal{T}\psi_2\psi_1^\dagger\rangle_0 - V_{34}\langle \mathcal{T}\psi_2\psi_3^\dagger\psi_4^\dagger\psi_4\psi_3\psi_1^\dagger\rangle_0 - V_{34}\langle \mathcal{T}\psi_2\psi_3^\dagger\psi_4^\dagger\psi_4\psi_3\psi_1^\dagger\rangle_0$$

$$+ V_{34}V_{56}\langle \mathcal{T}\psi_2\psi_3^\dagger\psi_4^\dagger\psi_4\psi_3\psi_5^\dagger\psi_6^\dagger\psi_6\psi_5\psi_1^\dagger\rangle_0 + V_{34}V_{56}\langle \mathcal{T}\psi_2\psi_3^\dagger\psi_4^\dagger\psi_4\psi_3\psi_5^\dagger\psi_6^\dagger\psi_6\psi_5\psi_1^\dagger\rangle_0 + \cdots$$

$$= g_{12} + (-1)^2 V_{34}\, g_{13}\, g_{32}\, g_{44} + (-1) V_{34}\, g_{13}\, g_{34}\, g_{42}$$

$$+ (-1)^3 V_{34}V_{56}\, g_{13}\, g_{35}\, g_{52}\, g_{46}\, g_{64} + (-1)^2 V_{34}V_{56}\, g_{13}\, g_{35}\, g_{54}\, g_{46}\, g_{62} + \cdots$$

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