Schwinger-Feynman parametrization

Using Mellin transformation, one can show

$$I(\vec{n}) \sim \prod_{a=1}^{N} \int_0^\infty \frac{dx_a x^{n_a-1}}{\Gamma(n_a)} \mathcal{G}^{-d/2}$$

where

$$\begin{aligned}
\mathcal{G} &:= \mathcal{U} + \mathcal{F} \\
\mathcal{U} &:= \det \begin{pmatrix} A & B \\ B^t & C \end{pmatrix} \\
\mathcal{F} &:= \det A
\end{aligned}$$

and the associated matrices are given in the following quadratic form:

$$\sum_{a}^{N} x_a D_a = l^t A l + 2B^t l + C.$$

This polynomial $\mathcal{G}$ does not depend on $n_1, \cdots, n_N$ and characterizes the family of integrals.