Using $\int_0^\infty d\alpha . \alpha^{\gamma-1} e^{-\alpha p^2} = \Gamma(\gamma)(p^2)^{-\gamma}$ (twice), one can easily show that

$$\int d^D p \, |p^2|^{-\gamma} e^{i(px)}$$

$$= \frac{(4\pi)^{D/2}\,\Gamma\left(\frac{D}{2}-\gamma\right)}{4^\gamma\,\Gamma(\gamma)} |x^2|^{\gamma-\frac{D}{2}} .$$

First use this with $\gamma = 1$ to get the massless propagator in x-space

$$\Delta \sim |x^2|^{1-\frac{D}{2}} .$$

Now in

the parallel x-space propagators multiply to give

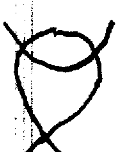
$$\sim |x^2|^{3-\frac{3D}{2}}$$

Then use the formula with $\gamma = \frac{3D}{2} - 3$ to get in p-space

$$\sim \Gamma(3-D) . |p^2|^{D-3} ,$$

multiplied by easily calculable trivial factors, such as $(2\pi)^{-D}$.

This trick can also be used to calculate  $\sim \Gamma(2-\frac{D}{2})|p^2|^{\frac{D}{2}-2}$; and reduce

 to 

General rule: series multiply in p-space, parallel in x-space.

[There is also a trick for turning some loops into trees by writing rules for the dual diagram, ie. vertices $\rightleftharpoons$ loops, lines rotated 90°.]