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We study the asymptotic behavior at small diffusivity of solutions to a convection-diffusion equation in a rectangular domain. The diffusive equation is supplemented with a Dirichlet boundary condition, which is smooth along each edge, but only continuous at the corners. To resolve the discrepancy between the diffusive and corresponding limit solutions, we construct an asymptotic expansion of the diffusive solution at any arbitrary, but fixed, order with respect to the small diffusivity parameter. Here, to manage some singular effects near the corners, the so-called elliptic and ordinary corner correctors are added in the asymptotic expansions as well as the parabolic and classical boundary layer functions. The validity of our asymptotic expansions is established in suitable Sobolev spaces. (Received September 01, 2014)