A glow discharge, slit supersonic expansion in conjunction with direct infrared laser absorption have been utilized to record high resolution vibration-rotation spectra of the C₃H₅ allyl radical. The slit supersonic expansion results in efficient rotational cooling ($T_{rot} \leq 20$K), thereby facilitating assignment. Specifically, approximately 50 transitions are assigned for both the in-phase ($\nu_A$) and out-of-phase ($\nu_B$) CH₂ antisymmetric vibrations. Least squares fits of the transition frequencies to an asymmetric top Hamiltonian provide both ground and excited state rotational constants. While the overall quality of the fits ($\sigma \approx 5 \times 10^{-4}$ cm⁻¹) are good, residuals do indicate perturbations in the vibrationally excited state. Due to the high instrumental resolution (slit supersonic Doppler width $\approx 70$ MHz) spin-rotation broadening is observed in several low J transitions. Small step size (4 MHz) scans over selected transitions coupled with a detailed lineshape analysis indicate a spin-rotation constant $\xi_{aa}$ of $-47(4)$ MHz.