Revisiting 116 hot and warm Jupiters with new TESS sectors: updated physical properties and ephemeris

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Transiting hot and warm Jupiters orbiting bright stars provide a unique opportunity to refine planetary properties with high precision and to lay the groundwork for atmospheric follow-up. However, many of these systems still lack accurate ephemerides and updated parameters despite the wealth of data available from ongoing TESS monitoring. In this study, we present a systematic reanalysis of 116 hot and warm Jupiters using multi-sector TESS photometry. We employ robust detrending techniques through our in-house pipeline ExoELF, which incorporates wavelet-based denoising, Gaussian Process regression, and Bayesian inference using dynesty. Our approach yields substantial improvements in the precision of orbital and physical parameters. Key quantities such as orbital period, planet-to-star radius ratio, scaled semi-major axis (a/R*), inclination, and transit mid-times are improved, in several cases by factors of 2–3 compared to literature values. For instance, the orbital period of TOI-257 is refined with an 1800% gain in precision. In some systems, discovery papers were found to have overestimated a/R* and inclination, which we now constrain more reliably. These refinements are crucial for efficient scheduling of ground-based follow-up and future spectroscopic studies like JWST. A manuscript reporting these results is in preparation and will be submitted to The Astrophysical Journal by September 2025.