This study reports the development of two innovative paper-based thermal devices—temperature sensors and microheaters—fabricated using two custom-formulated, water-based conductive inks. The first ink consisted of reduced graphene oxide (rGO), while the second comprised a composite of carbon black (CB) and reduced graphene oxide (CB/rGO). Both inks were deposited onto glossy paper substrates via the rod coating technique, with variations in the number of coating passes (single and double) implemented to investigate the influence of film thickness on device performance. Electrical characterization revealed stable, ohmic behavior across all samples, with double-pass coatings exhibiting significantly lower sheet resistance, indicative of improved electrical conductivity. The temperature-sensing capabilities were evaluated through determination of the temperature coefficient of resistance (TCR), yielding values of -7.37×10^{-3} °C^{-1} for rGO-based sensors and -3.94×10^{-3} °C^{-1} for CB/rGO composites, both of which are consistent with theoretical predictions. The CB/rGO ink demonstrated enhanced performance as a printed microheater, exhibiting improved power efficiency and superior thermal uniformity. This enhancement is attributed to the incorporation of larger carbon black particles, which contribute to more effective thermal management and uniform heat distribution. These results underscore the potential of hybrid carbon-based inks for the fabrication of cost-effective, disposable, and environmentally sustainable thermal devices. The utilization of cellulose-based paper substrates in conjunction with graphene-derived functional materials presents a scalable, eco-friendly platform for the development of flexible, printed thermal electronics. The fabrication approach is compatible with large-area, low-cost production methods, thereby advancing the field of printed electronics with respect to performance, environmental compatibility, and manufacturability.