Micro-injection moulding (μIM) is a replication-based process enabling the cost-effective production of complex and net-shaped miniaturized plastic components. The micro-scaled size of such parts poses great challenges in assessing their dimensional quality and often leads to time-consuming and unprofitable off-line measurement procedures. In this work, the authors proposed a novel method to verify the quality of a three-dimensional micro moulded component (nominal volume equal to 0.07 mm³) based on the combination of optical micro metrology and injection moulding process monitoring. The most significant dimensional features of the micro part were measured using a focus variation microscope. Their dependency on the variation of μIM process parameters was studied with a Design of Experiments (DoE) statistical approach. A correlation study allowed the identification of the product fingerprint, i.e., the dimensional characteristic that was most linked to the overall part quality and critical for product functionality. Injection pressure and velocity curves were recorded during each moulding cycle to identify the process fingerprint, i.e., the most sensitive and quality-related process indicator. The results of the study showed that the dimensional quality of the micro component could be effectively controlled in-line by combining the two fingerprints, thus opening the door for future μIM in-line process optimization and quality assessment.