Electro sinter forging (ESF) represents an innovative manufacturing process dealing with high electrical currents. Classified in the category of electrical current assisted sintering (ECAS) processes, the main principle is that Joule heating is generated inside the compacted powder, while the electrical current is flowing. The process is optimized through the analysis of the main process parameters, namely the electrical current density, sintering time, and compaction pressure, which are also evaluated as process fingerprints. The analysis was conducted on commercially pure titanium powder. Small discs and rings were manufactured for testing. The influence of the process parameters was analysed in terms of the final material properties. The relative density, microstructures, hardness, and tensile and compressive strengths were analysed concerning their validity as product fingerprints. Microstructural analyses revealed whether the samples were sintered or if melting had occurred. Mechanical properties were correlated to the process parameters depending on the material. The different sample shapes showed similar trends in terms of the density and microstructures as a function of the process parameters.