The electrochemical reduction of CO2 into multi-carbon containing products with high activity and selectivity still remains a big challenge. Herein, we propose a novel Cu-SACs (Cu single atoms catalyst) supported on tin-tin oxide (CuSA-Sn-SnO2) synthesized following a simple wetness impregnation and sequential reduction method for the direct conversion of CO2 into ethanol, which shows good product selectivity, activity, and stability. It is confirmed that the copper single atoms with an oxidation state close to 1 are stabilized on the Sn-SnO2 substrates. The electrochemical analysis of Sn-SnO2 displays selectivity towards other products apart from CO and H2. With the impregnation with Cu single atoms, the products on the Sn-SnO2 surface shifts from HCOOH to ethanol. With the increase in Cu content, the ethanol production increases at the expense of CO, pointing towards dimerization of C1 products. The synthesized catalyst exhibited a remarkable selectivity towards ethanol production with high stability.