We introduce the quantum toroidal superalgebras $E_{m|n}(q_1, q_2, q_3)$, which are affinizations of the quantum affine algebras $U_q\widehat{\mathfrak{gl}}_{m|n}$. We give an evaluation map from $E_{m|n}(q_1, q_2, q_3)$ to the quantum affine algebra $U_q\widehat{\mathfrak{gl}}_{m|n}$ with $q^2 = q_2$ at level $c = q_3^{(m-n)/2}$, and a bosonic realization of level one $E_{m|n}(q_1, q_2, q_3)$-modules. (Received September 17, 2019)