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Abstract:This Letter proposes a realistic design of a single-molecule quantum-interference-based transistor. The transistor consists of a cross-conjugated donor-bridge-acceptor molecule and is chemically gated by a functional group that can be charged. Numerical simulations indicate that the device properties can be tuned to desired specifications by the choice of its constituting functional groups. The transistor does not require external contacts to control its operation. However, it can be chemically functionalized for easy integration into molecular electonic circuits, especially because its operation does not involve any conformational changes in the molecule. The upper operational frequency limit of the proposed device is found to be in the terahertz range.