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Title:Limiting Factors to the Temperature Performance of THz Quantum Cascade Lasers Based on the Resonant-Phonon Depopulation Scheme
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Abstract:We analyze the temperature performance of five terahertz (THz)-frequency quantum cascade lasers based on a three-quantum-well resonant-phonon depopulation design as a function of operating frequency in the 2.3-3.8-THz range. We find evidence that the device performance is limited by the interplay between two factors: 1) optical phonon scattering of thermal electrons, which dominates at shorter wavelengths, and 2) parasitic current, which dominates at longer wavelengths. We present a simple model that provides an accurate estimate of the parasitic current in these devices and predicts the dependence of the threshold current density on temperature.
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