Supplementary Information for

Mid-infrared InAs/InP quantum-dot lasers

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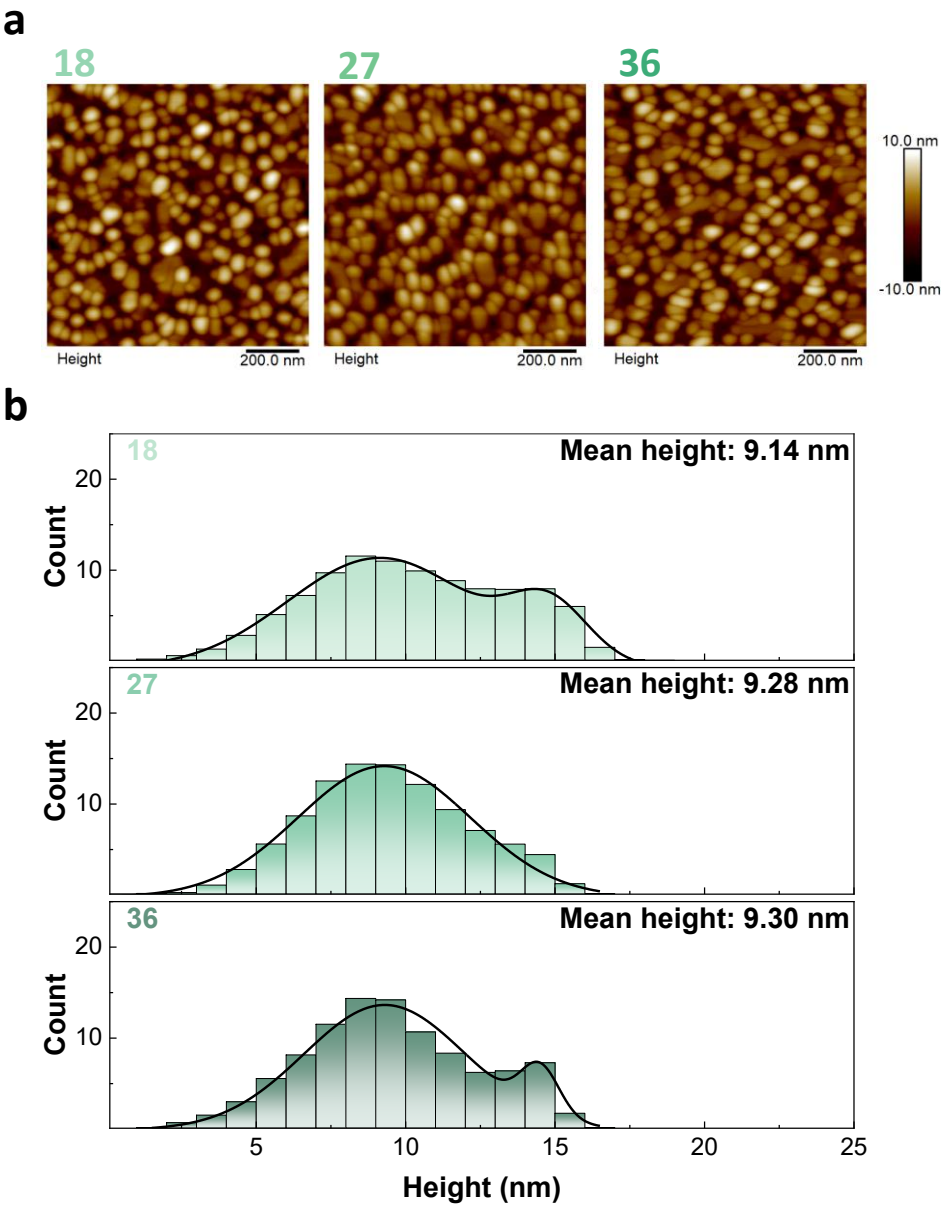

Figure S1. Optimization of dot morphology of single-layer InAs/InP QDs under different V/III ratios. a 1 × 1 μm^2 AFM scans and **b** dot-height distribution for single-layer InAs/InP QDs grown at 485 °C with 7.5 ML of InAs, under V/III ratios of 18, 27, and 36.

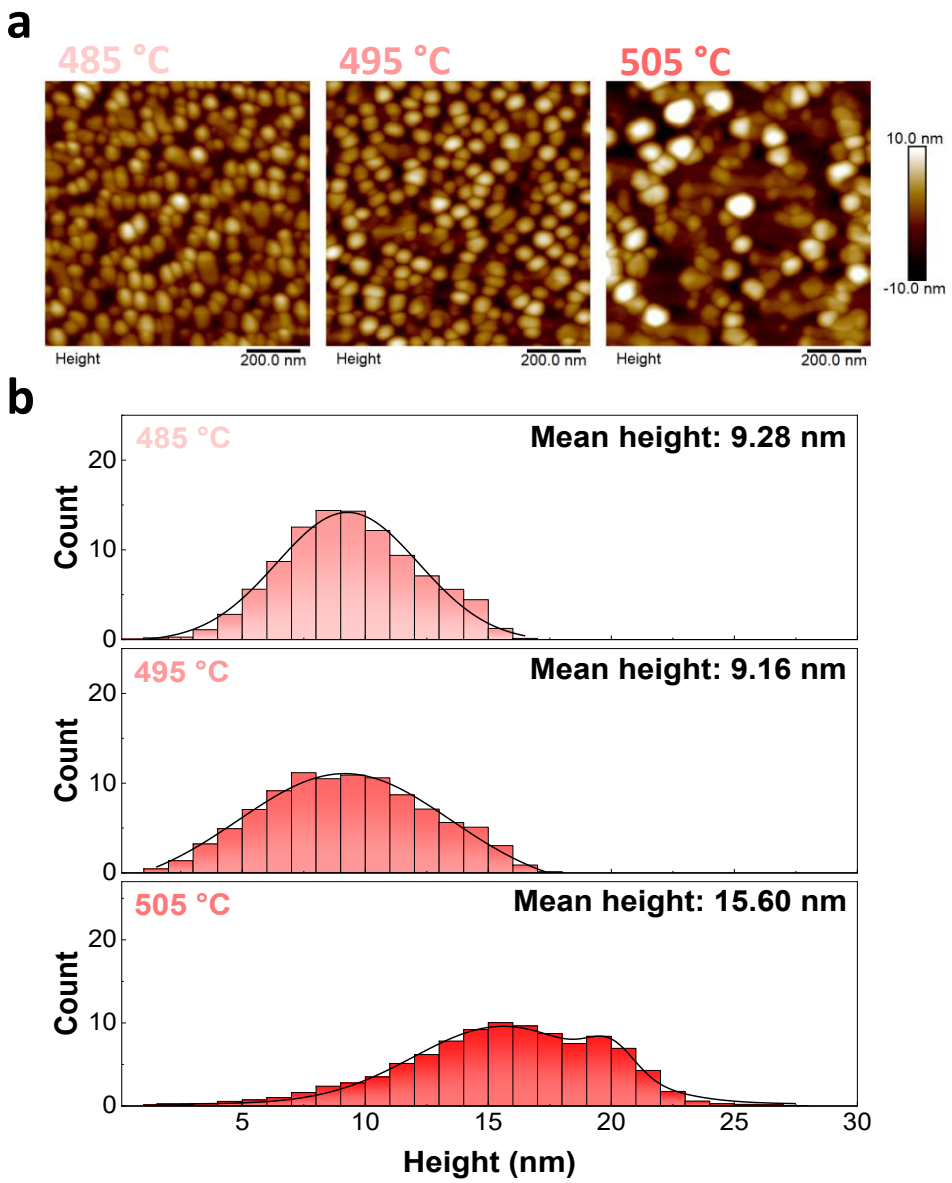

Figure S2. Optimization of dot morphology of single-layer InAs/InP QDs at different QD growth temperatures. a 1 × 1 μm^2 AFM scans and **b** dot-height distribution for single-layer InAs/InP QDs with 7.5 ML of InAs and V/III ratio of 27, grown at temperatures of 485, 495, and 505 °C.

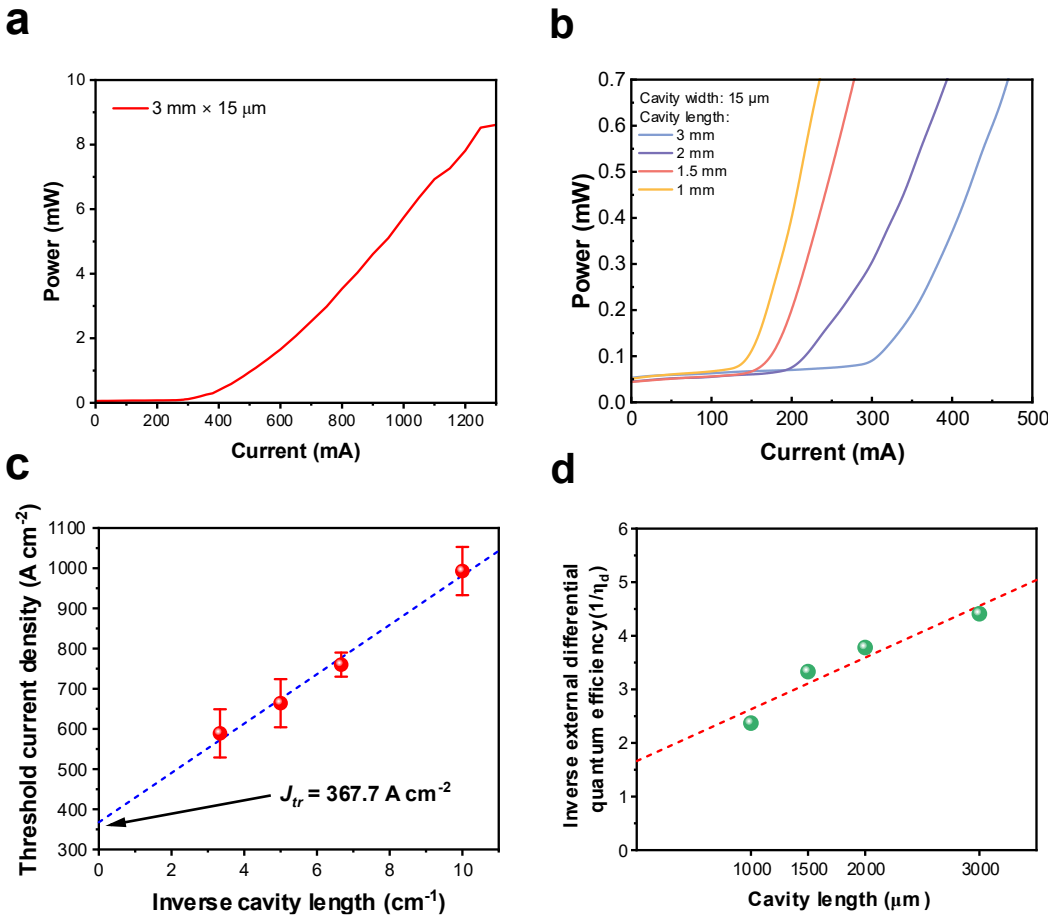

Figure S3. Laser performance characterization with varied cavity lengths. a Power versus current (L-I) curve for the 3 mm × 15 μm device at RT, showing a maximum power of 8.5 mW per facet. **b** RT L-I curves for InAs/InP QD lasers with a cavity width of 15 μm and varied cavity length from 1 to 3 mm. **c** J_{th} versus inverse cavity length for InAs/InP QD lasers, providing transparency current density (J_{tr}). The error bars indicate the total observed range (minimum to maximum) of J_{th} for all measured devices at each cavity length. **d** Inverse external differential quantum efficiency ($1/\eta_d$) versus cavity length for the InAs/InP QD lasers, where internal quantum efficiency (η_i) of 60 % and internal loss (α_i) of 6.7 cm^{-1} were calculated.

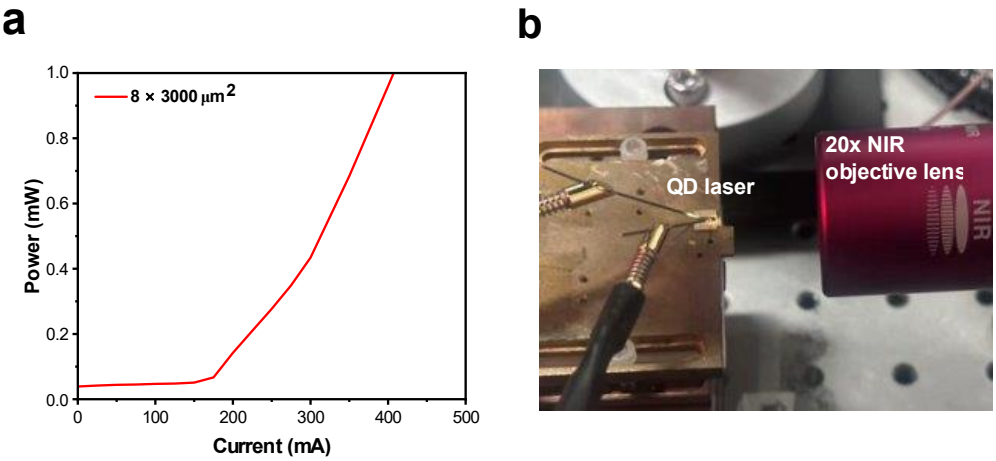

Figure S4. Far-field diffraction pattern measurement. a L-I curve at RT for the 3 mm × 8 μm device used for far-field pattern measurement, showing a I_{th} of ~ 175 mA. **b** The set-up for far-field pattern measurement.