Electronic Supplementary Information for

Broad-band lead halide perovskite quantum dot single-mode lasers

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Fig. S1. Structure characterization of CsPb($Br_{0.5}I_{0.5}$)₃ CQDs/ZnO composite microcavity. a,b SEM images of pure ZnO microrods and CsPb($Br_{0.5}I_{0.5}$)₃ CQDs/ZnO composite microcavity. c-h, EDS element mapping for CsPb($Br_{0.5}I_{0.5}$)₃ CQDs/ZnO composite microcavity, showing that CQDs are on the microcavity.



Fig. S2. PL spectra of pure ZnO, pure $CsPb(Br_{0.5}I_{0.5})_3$ CQDs and their composite. The PL peak of $CsPb(Br_{0.5}I_{0.5})_3$ CQDs is slightly bule shifted.



Fig. S3. SEM image of ZnO particles. These particles have regular shape which guarantee the application of microcavity. Inset: magnified image of an individual ZnO particles.



Fig. S4. Lasing in a CsPb(Br_{0.5}I_{0.5})₃ CQDs/ZnO particle composite microcavity. a, PL spectra of pure ZnO particle, pure CsPb(Br_{0.5}I_{0.5})₃ CQDs and their composite. b, Power dependent lasing from a single CsPb(Br_{0.5}I_{0.5})₃ CQDs/ZnO particle composite microcavity. c, Integrated emission Intensity as a function of pump density showing lasing threshold at 0.1 μ J.cm⁻². d, Lorentz fitting of a lasing oscillation mode. The corresponding FWHM is ~0.17 nm, and the *Q* factor is ~3700.



Fig. S5. Excitation power-dependent lasing from a single $CsPb(Br_{0.5}I_{0.5})_3$ CQDs/ZnO composite microcavity with CQDs of 5mg/ml (a) and 15mg/ml concentration (b).



Fig. S6. The resonant optical modes of ZnO microrods/CsPb(Br_{0.5}I_{0.5})₃ CQDs with different ZnO sizes.