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We review experimental and theoretical results on thermal transport in semiconductor nanostructures (multilayer thin films, core/shell and segmented nanowires), single- and few-layer graphene, hexagonal boron nitride, molybdenum disulfide, and black phosphorus. Different possibilities of phonon engineering for optimization of electrical and heat conductions are discussed. The role of the phonon energy spectra modification on the thermal conductivity in semiconductor nanostructures is revealed. The dependence of thermal conductivity in graphene and related two-dimensional (2D) materials on temperature, flake size, defect concentration, edge roughness, and strain is analyzed.