Application of the optical scanning technique for express measurements of thermal properties (thermal conductivity (TC) and volumetric heat capacity (VHC)) on full-size core samples provided unique information for oil and gas shale. More than 25,000 core samples from 28 wells from 17 hydrocarbon fields were studied in 2015-2017 using continuous non-destructive non-contact profiling on all core samples from every well. High-resolution (1 mm) profiles of the TC tensor component parallel to a rock bedding plane and VHC were recorded for every core sample. TC tensor components perpendicular and parallel to the bedding plane, thermal anisotropy coefficient, thermal rock heterogeneity coefficient, and VHC were determined for every core sample. TC varies essentially (by dozens percent) within every core sample that strongly restricts the application of traditional techniques for comprehensive characterization of the rock thermal properties. The shale thermal anisotropy coefficient is significant (up to 3) and has a strong zonality along every well that is caused by structural and textural peculiarities of rocks. The approach was suggested (and tested successfully using measurements with a pyrolysis technique) to transform TC profiles into detailed continuous profiles of total organic carbon along every well with a spatial resolution of ∼1 mm. The correlations established allowed a transform from the profiles of TC and thermal anisotropy coefficient into profiles of rock density, sonic P- and S-velocities, Young modulus, and Poisson’s coefficient with average spatial resolution of ∼10 cm. A way was suggested and tested to characterize acoustic anisotropy from the thermal anisotropy coefficient data. Our measuring technique and experimental thermal data are being used today in oil and gas companies for basin and petroleum system modeling, development and optimization of thermal methods of EOR, analysis of hydrocarbon reservoir heterogeneity, geochemistry and geomechanics. As a result, thermal petrophysics becomes an important scientific and practical direction for investigations and development of hydrocarbon fields.