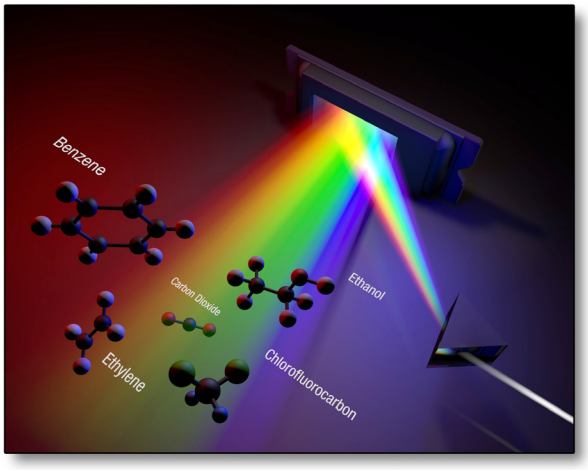
TI DLP® Technology for Spectroscopy

Design high performance systems for spectral analysis of liquids and solids

Spectroscopy is a powerful technique for recognizing and characterizing physical materials through the variations in absorption or emission of different wavelengths of light. Spectroscopy requires the spreading out of light into a rainbow of wavelengths, so that the absorption spectrum of light intensity versus wavelength can be measured and recorded.

In a spectrometer, the TI DLP® DMD (Digital Micromirror Device) acts as a programmable wavelength filter. In a typical configuration, broadband light enters through a slit, and a grating is used to disperse the wavelengths of light across the micromirror array. Columns of micromirrors are then used to select which wavelengths are directed onto a single element detector, and micromirror rows apply an attenuation factor. The DMD facilitates a spectrometer architecture that uses a larger, single detector to displace an expensive array detector.

This powerful design architecture enables analysis of liquids and solids with higher performance at lower price points while using a smaller form factor suited for both field analysis and inline manufacturing processes.



Features and benefits

- Performance:
  - Capture more light from a sample
  - Better signal-to-noise ratio (SNR)
  - Low power, more portable solutions
- Cost:
  - Utilize lower cost single element detectors
  - Consistent unit-to-unit performance in volume production
- Programmability:
  - More flexible, faster, accurate measurements
  - "Optimize as you go" analysis
  - Measure diverse substances with a single end equipment
- Portability:
  - Robust architecture
  - Temperature-independent switching characteristics

Example applications

Gas Detection

Skin Analysis

Chemical Sensing

Material Identification

Oil & Water Quality

DLP solutions for spectroscopy

DLP solutions offer high performance and system programmability to optimize various spectroscopy designs. The best choice for a DLP chipset will depend on the spectroscopy system's requirements like the range of wavelengths to be measured, desired wavelength resolution, and spectrum measurement acquisition speed. TI provides free software and firmware downloads allowing developers to easily create, store, and display high-speed pattern sequences through USB-based application programming interface (API) and easy-to-use graphical user interface (GUI).

Recommended parts

Small Form Factor	Max Performance
DLP2010NIR	DLP4500NIR

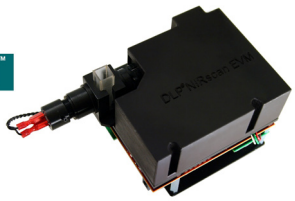
DLP chipsets for spectroscopy

DMD Number	Micromirror Array	Array Diagonal	Controller	Micromirror Driver	Max Pattern Rate	Optimized Wavelengths	Pixel Pitch	Pixel Orientation	EVM	DMD Package Dimensions (lxwxh)	DMD Price	Controller Price ($U.S.)	Micromirror Driver Price ($U.S.)
DLP2010NIR	854 × 480	0.2"	DLPC150	DLPA2000 / DLPA2005	1,500 Hz (binary)	700-2500 nm	5.4 µm	Orthogonal	NIRscan Nano	15.9 x 5.3 x 4 mm	110 (1kµ price)	20 (1kµ price)	5.12 / 7.60 (1kµ price)
DLP4500NIR	912 × 1140	0.45"	DLPC350	—	4,225 Hz (binary)	700-2500 nm	7.6 µm	Diamond	NIRscan	20.7 x 9.1 x 3.33 mm	315 (100µ price)	56 (100µ price)	—

Visit ti.com/dlpSpectroscopy for more information.

Evaluation Modules

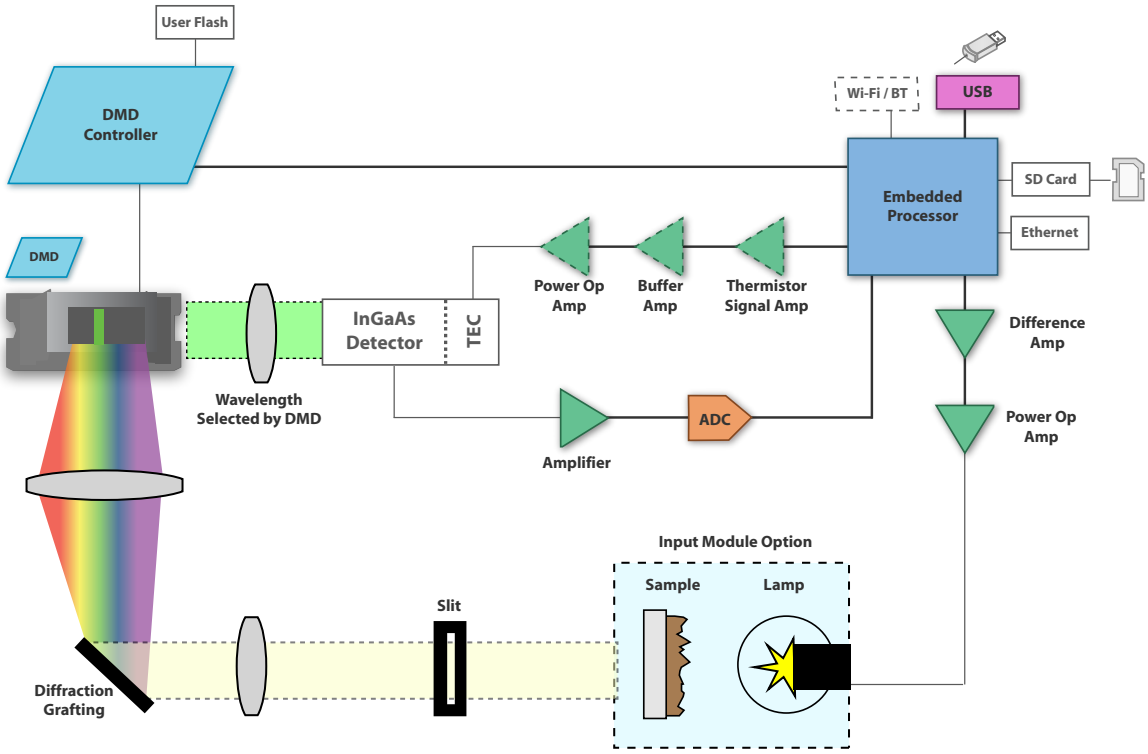
The **DLP NIRscan** is a complete evaluation module (EVM) to design a high performance, affordable near-infrared spectrometer. The EVM features the DLP4500NIR DMD and is optimized for material sensing in the 1350 – 2450nm wavelength range.



The **DLP NIRscan™ Nano** EVM offers a battery-operated portable solution for your spectroscopy system designs. The Bluetooth-enabled EVM features the DLP2010NIR DMD and is optimized for material sensing in the 900 – 1700nm wavelength range.

System Block Diagram

TI components solve many design considerations. The TI embedded processor commands the DMD controller to turn on only the precise mirrors which are illuminated by the specific wavelengths of light to be measured at each instant of time. The easy programmability of the processor allows users to command specific column widths (wavelength ranges) or other patterns for their spectroscopy requirements. The TI TEC driver and ADC are also recommended to achieve high signal-to-noise ratio values.

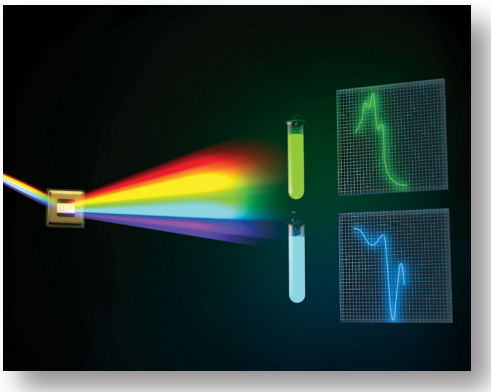


TIDesigns

Optical analysis of liquids and solids

To enable customers to get to market faster, Texas Instruments also provides a TI Design for spectroscopy applications. A TI Design is a comprehensive reference design that includes schematics, block diagrams, bill of materials, design files, software, and test reports. The NIR spectrometer reference design utilizes DLP technology in conjunction with a single-element InGaAs detector to deliver high performance measurements in a portable form factor that is more affordable than expensive InGaAs array detector or fragile rotating grating architectures.

Combined with a powerful Sitara embedded Processor and analog signal chain components, developers are now able to bring the power of high-end laboratory spectrometers to the field and manufacturing line to analyze organic-based liquids and solids. Get started at **ti.com/tool/TIDA-00155.**



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