Product Overview

TI DLP Technology for Lithography

Deliver high-speed, high-precision maskless lithography with scalable, programmable light control from Texas Instruments DLP® technology.

TI DLP technology enables maskless lithography designs for PCB patterning, solder masks, flat panel displays, laser marking, and other digital exposure systems requiring high-speed and precision.

Programmable light steering DLP technology is used to directly expose patterns onto photoresist films without the need for contact masks. This reduces material cost, improves production rates, and allows for rapid changes of the pattern, which is good when minimum feature sizes require double patterning.

Direct imaging increases productivity compared to narrow laser beam or masked systems. A key advantage of maskless lithography is the ability to change lithography patterns from one run to the next, without incurring the cost of generating a new photomask.

1 Why Use DLP Technology for Lithography?

- Maskless Flexibility: Program and modify digital patterns instantly; no physical masks needed, enabling rapid design changes, small-batch production, and double patterning.
- High Throughput and Speed: Simultaneously expose wide areas at binary pattern rates up to 32kHz and pixel rates up to 61 GHz for fast, precise patterning.
- Achieve micron level features and fine structures suitable for PCBs, flat panels, laser marking, and computer-to-plate printing.
- Material Versatility: Compatible with 363nm – 700nm light sources, supporting a broad range of photosensitive materials, including UV requirements.
- Cost and Process Efficiency: Eliminate photomask costs and retooling delays and realize direct digital workflows from design to exposure.

2 DLP Designs for Lithography

DLP designs are available with different DMD (Digital Micromirror Device) speed, pixel pitches, and resolutions. DLP products also offer devices targeted for use with UV exposure. The best choice for a DLP chipset can depend on the desired feature size, patterning speed, system form factor, and wavelength range. DMDs optimized for direct imaging designs are available with one, two, and four-megapixel arrays.

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).

3 Example applications

- PCB manufacturing
- Flat panels
- Computer-to-plate printing
- Laser Marking
- Direct Imaging

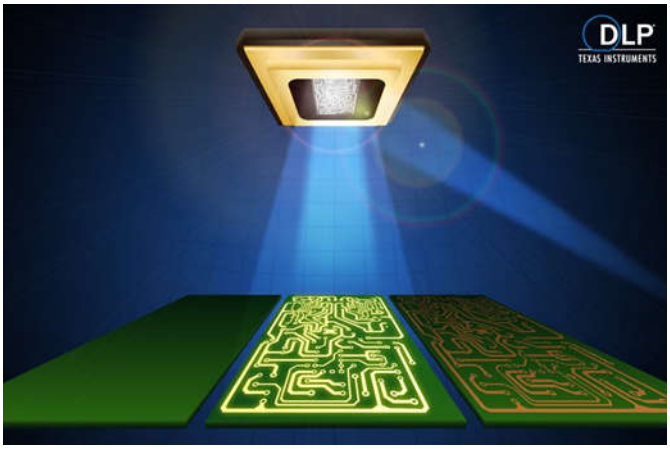

Figure 1. TI DLP Technology for Lithography

4 Evaluation Modules

Accelerate your design cycle by evaluating DLP technology with any of the evaluation modules (EVMs). Our portfolio of EVMs offer a compelling combination of resolution, brightness, pattern speed, and programmability of DLP technology.

DLPLCR70UVEVM, DLPLCR95UVEVM, and DLPLCR65NEVM are high performance and highly flexible development kits recommended for lithography designs. All of these offer exceptionally fast pattern rates for light exposure and image capture that enable competitive cycle times in industrial markets.

5 System Block Diagram

A DLP-based digital lithography system could consist of machines with multiple DMD print heads to simultaneously expose a wide production surface. The below block diagram shows how a DLP chipset is incorporated into such a system with a DLP controller for each DMD and a master processor to coordinate the exposure and alignment of the patterns on the production surface. The high-speed pixel data rate and micromirror timing control enables rapid exposure of boards with synchronization of print heads for a continuous production flow.

6 High-Speed DLP Sub-System for Industrial 3D Printing and Digital Lithography

To accelerate customers time to market, Texas Instruments also provides a TI Design suitable for digital lithography. This TI Design is a comprehensive electronics reference design that includes schematics, layout files, bill of materials, and a test report. This provides a system-level DLP development board with maximum throughput by integrating the highest resolution DLP digital micromirror device, the DLP9000X, with more than 4 million micromirrors, and the fastest digital controller, the DLPC910. Get started at ti.com/tool/TIDA-00570.

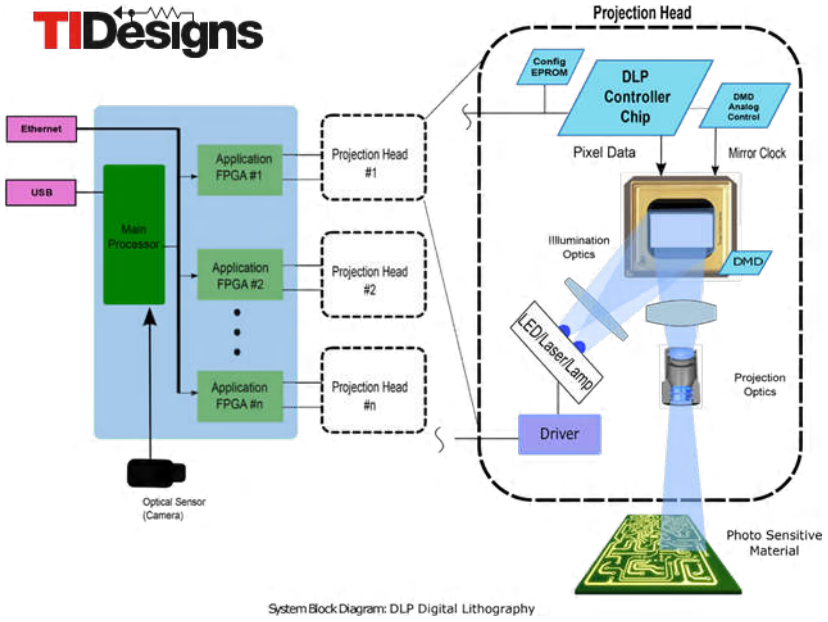

Figure 2. Example System Architecture

Table 1. Table : TI DLP versus Other Lithography Technologies

Feature	TI DLP® Maskless Digital	Laser Scanning	Mask Aligner
Pattern Change Time	Instant (digital load)	Slow/manual	Hours/days (new mask)
Exposure Speed	Very high (full area)	Slower (spot only)	Mid (full mask, fixed)
Resolution/Feature Size	Micron-level, flexible	low	low
Cost of Design Change	Negligible	Significant	High (new mask required)
Materials Support	UV/Vis, wide range	Good	Good

Table 2. Table : TI DLP Chipsets For Maskless Lithography

Product or Part Number	Subcategory	Display Resolution (max)	Array Diagonal (in)	Operating Temperature Range (°C)	Controller	EVM
DLP9000XUV	UV	WQXGA (2560x1600)	0.9	20 to 30	DLPC910	DLPLCR90XUVEVM
DLP650LNIR	NIR	WXGA (1280x800)	0.65	0 to 70	DLPC410	DLPLCR65NEVM
DLP9000X	Near-UV	WQXGA (2560x1600)	0.9	0 to 70	DLPC910	DLPLCR90XEVM
DLP9000	Near-UV	WQXGA (2560x1600)	0.9	0 to 70	DLPC900	DLPLCRC900DEVM
DLP6500FLQ	Near-UV	1080p (1920x1080)	0.65	0 to 65	DLPC900	DLPLCR65FLQEVM
DLP9500	Near-UV	1080p (1920x1080)	0.95	20 to 70	DLPC410	DLPLCR95EVM
DLP7000	Near-UV	XGA (1024x768)	0.7	10 to 65	DLPC410	DLPLCR70EVM
DLP7000UV	UV	XGA (1024x768)	0.7	20 to 30	DLPC410	DLPLCR70UVEVM
DLP9500UV	UV	1080p (1920x1080)	0.95	20 to 30	DLPC410	DLPLCR95UVEVM
DLP991U	Near-UV	4K (2176 x 4096)	0.99	*-40 to 90	DLPC964	DLPLCR99EVM
DLP991UUV	UV	4K (2176 x 4096)	0.99	*-40 to 90	DLPC964	DLPLCR99UVEVM

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