Product Overview

TI DLP® Technology For 3D Printing

Design faster, more detailed and reliable 3D printed parts with scalable, programmable light control from TI DLP® technology .

3D Printing or additive manufacturing is the process of building a three-dimensional object by laying down successive layers of material. A 3D Computer Aided Design (CAD) model of the object is converted into a series of cross-sectional slices that are sent to the 3D printer. This process allows manufacturers to speed up development cycles, make quick adjustments to molds and prototypes, and create highly detailed and customizable parts.

These printers make use of liquid photopolymer resins to build objects. For each cross-sectional slice of the object, the TI DLP® DMD (Digital Micromirror Device) projects patterned light that selectively exposes and hardens the resin. Since an entire layer is exposed with a single pattern, fast build speeds are achieved independent of layer complexity. Projection optics can also be used to control the resolution on the image plane and adjust the layer thickness, leading to smooth and accurate finished parts. These benefits, combined with proven reliability, make DLP technology the best design for stereolithography 3D printing systems.

1 Features and Benefits

- Programmable micromirrors expose an entire layer in one shot
  - Faster build speed than point-by-point technologies
  - Large throughput
  - Eliminate need for print heads
  - Print speed is independent of design complexity or number of parts
- High-resolution patterns with compact micromirror size (7, 10, 13µm)
  - Achieve micron-level features for high accuracy
  - Easily adjust layer thickness
- Optically efficient from 363nm to 700nm
  - Cure a wide range of photo-polymers and resins
- Proven Reliability
  - DLP based technology delivers durability and consistent results over extended duty cycles

2 DLP Designs for 3D Printing

DLP chipsets are available with different DMD sizes, pixel pitches, resolutions, and other specifications. DLP products also offer devices targeted for use with UV exposure. The best choice for a DLP chipset depends on the desired object feature size, patterning speed, and necessary wavelengths to cure the resin.

3 Example Applications

- Rapid prototyping
- Molds for tooling and casting
- Direct part manufacturing

4 Evaluation Modules

Accelerate your design cycle by evaluating DLP technology with any of the evaluation modules (EVMs). The development modules provide flexible light steering designs with high brightness and resolution for industrial, medical and scientific applications. Our portfolio of EVMs offer a compelling combination of resolution, brightness, pattern speed, and programmability of DLP technology.

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).

5 System Block Diagram

In a DLP 3D printing design, the object is specified by a 3D CAD model produced with software running on a PC then converted into 2D cross-section layers generated by an image slicing tool. The best choice for a DLP chip-set depends on the desired object feature size, resolution, printing speed and exposure wavelength. The system control and signal processing is accomplished by the embedded processor, such as TI MSP430™. Power is provided by TI Power device.

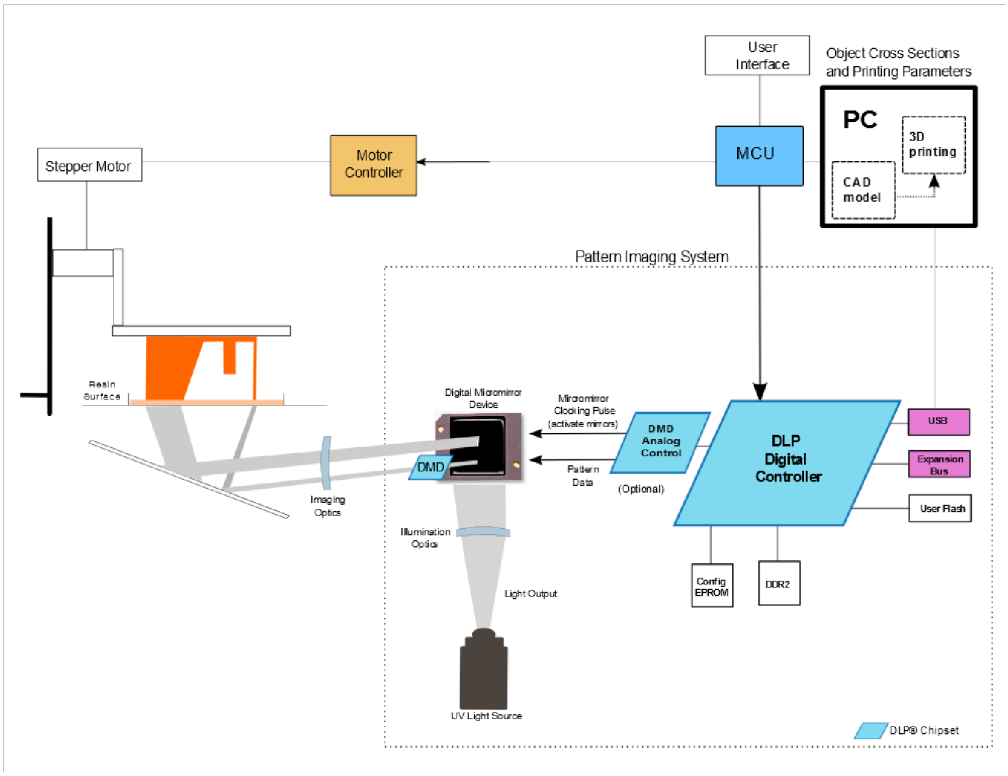

Figure 1. Example System Architecture

To enable customers to get to market faster, Texas Instruments also provides a TI Design for 3D printing applications. A TI Design is a comprehensive reference design that includes schematics, block diagrams, bill of materials, design files, software, and test reports. The 3D printer development platform employs the DLP 3D structured light software development kit and enables developers to build high resolution 3D objects. The free TI Design features the DLP LightCrafter 4500 EVM, showcasing the DLP4500 DMD, to accurately expose object layers. The system also uses TI's low power MSP430 embedded processor to synchronize layer exposure with motor control for precise incremental 3D builds. Get started at ti.com/tool/TIDA-00293.

Table 1. TI DLP Versus Other 3D Print Technologies

Feature	TI DLP® Structured Light	Point-by-Point Laser SLA	LCD Masking (MSLA)
Exposure Method	All-pixel, single flash	Single spot, scanning	Area by LCD pixels
Print Speed	Highest	Slower	High, but lower UV efficiency
Resolution/Flexibility	Custom patterns/micron	Limited by laser spot	Limited by LCD panel
Maintainability	No print head/mechanism	Galvo/lens wear	Efficiency loss over time
Typical Uses	Industrial & prototyping	Jewelry, dental, prototyping	Entry/prototype

Table 2. TI DLP Chipsets For 3D Printing

Product or Part number	Subcategory	Display Resolution (max)	Operating Temperature Range (°C)	Array Diagonal (in)	Controller	EVM
DLP301S	Near-UV	WQHD (2560x1440)	0 to 40	0.3	DLPC1438	
DLP670S	Visible	WQXGA (2716 x 1600)	0 to 70	0.67	DLPC900	DLPLCR67EVM
DLP9000XUV	UV	WQXGA (2560x1600)	20 to 30	0.9	DLPC910	DLPLCR90XUVEVM
DLP650LNIR	Infrared	WXGA (1280x800)	0 to 70	0.65	DLPC410	DLPLCR65NEVM
DLP9000X	Near-UV	WQXGA (2560x1600)	0 to 70	0.9	DLPC910	DLPLCR90XEVM
DLP6500FYE	Near-UV	1080p (1920x1080)	0 to 90	0.65	DLPC900	DLPLCR65NEVM
DLP6500FLQ	Near-UV	1080p (1920x1080)	0 to 65	0.65	DLPC910	DLPLCR65FLQEVM
DLP9000	Near-UV	WQXGA (2560x1600)	0 to 70	0.9	DLPC900	DLPLCRC900DEVM
DLP9500	Near-UV	1080p (1920x1080)	20 to 70	0.95	DLPC410	DLPLCR95EVM
DLP7000	Near-UV	XGA (1024x768)	10 to 65	0.7	DLPC410	DLPLCR70EVM
DLP7000UV	UV	XGA (1024x768)	20 to 30	0.7	DLPC410	DLPLCR70UVEVM
DLP9500UV	UV	1080p (1920x1080)	20 to 30	0.95	DLPC410	DLPLCR95UVEVM

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