2021 Light Control Webinar Agenda

- ❑ DLP Pico Light Control overview
- ❑ DLP 3D Scanners
  - DLP 3D scanner benefits / how it works
  - Applications
  - Light control chipsets overview
- ❑ DLP 3D Printers
  - DLP 3D printer benefits / how it works
  - Introducing the new DLP 3D print chipsets
  - DLP 3D printer overview
  - High level design considerations
- ❑ Ecosystem / resources
  - 3rd party offerings

TI DLP Products | a history of innovation

1987
Dr. Larry Hornbeck **invents DLP technology**

1996
First commercial DLP systems

1998
DLP Products receives first **Emmy® Award** for Outstanding Achievement In Engineering Development

1999
Star Wars: Episode 1 – The Phantom Menace shown on DLP Digital Cinema

2009
Consumer devices ship featuring **DLP Pico™ technology based projectors**

2012
DLP Industrial development kit launches allowing developers to use DLP technology in **new markets**

2015
Dr. Hornbeck receives the **2014 Scientific and Technical Academy Award® of Merit (Oscar® statuette)** for the invention of DMD technology as used in DLP Cinema® projection
Photo credit: Michael Yada / ©A.M.P.A.S.

First **automotive**-qualified DLP chipset for head-up display (HUD) applications

2017
Lincoln Continental, **first automobile with DLP technology based HUD**

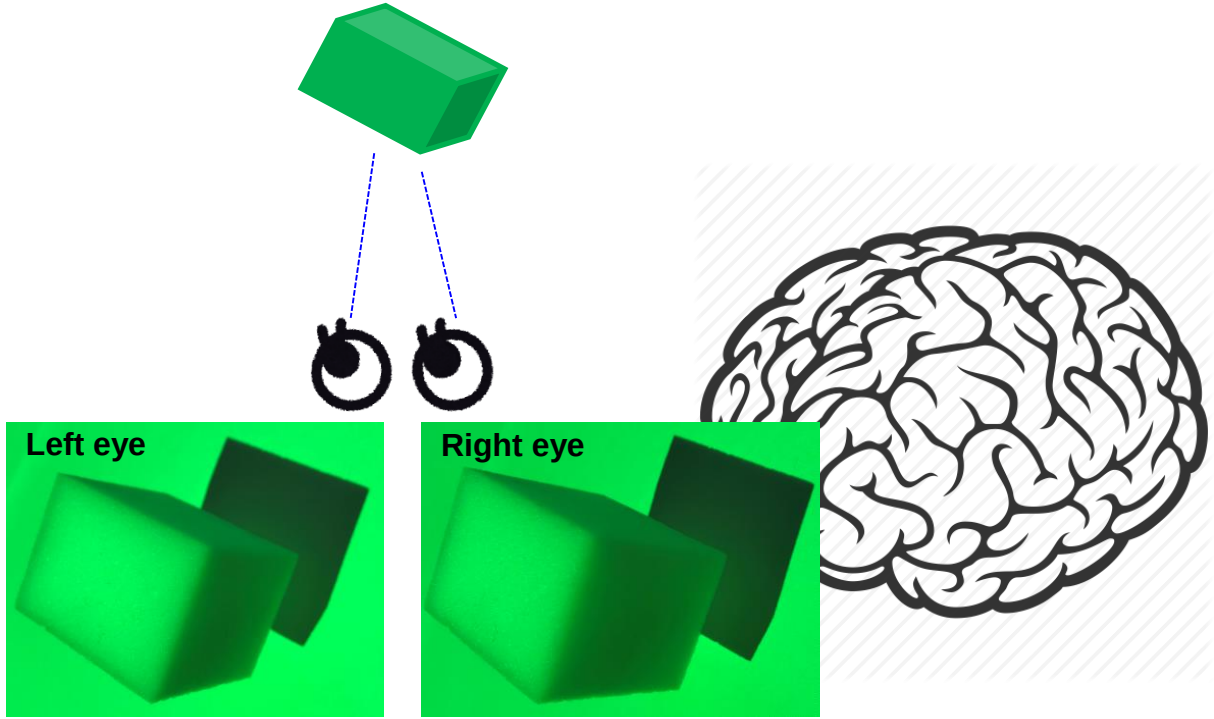
First 4K UHD projector with MSRP < $2000 with DLP 4K UHD chipset

2021
DLP 3D printing expands into consumer market

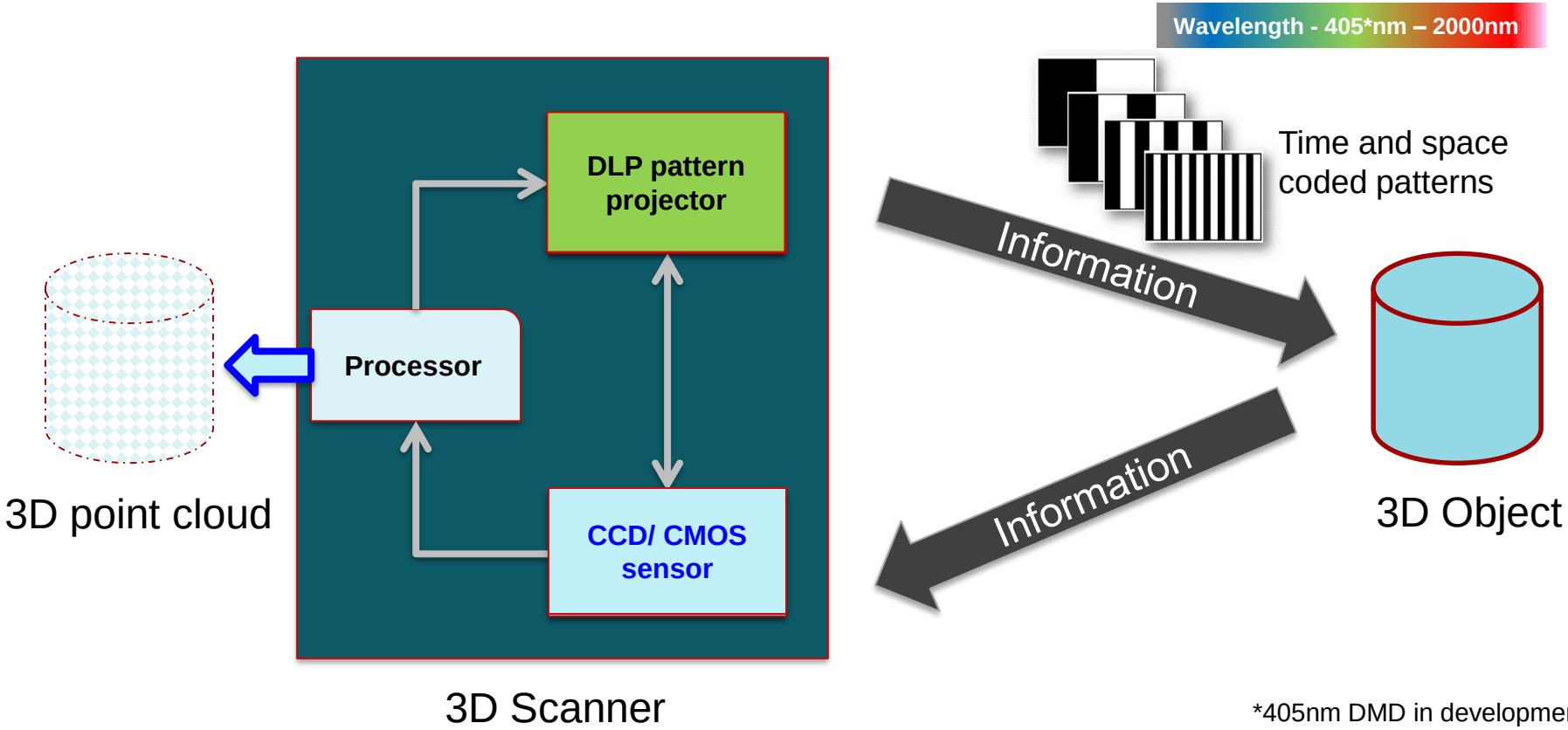
For more than three decades, award-winning DLP Product innovations have solved some of the world's most complex display and light control applications

Texas Instruments

DLP Light Control | Capture by Structured Light

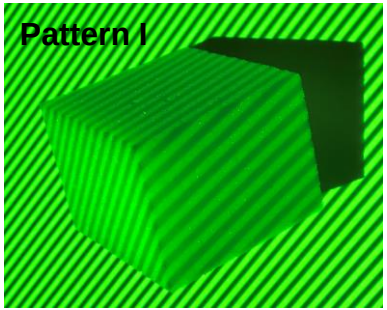


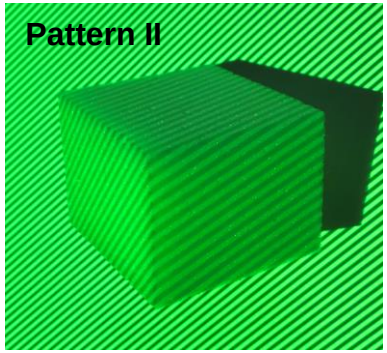
DLP Light Control | 3D scanner system overview



*405nm DMD in development

DLP Light Control | Capture by Structured Light

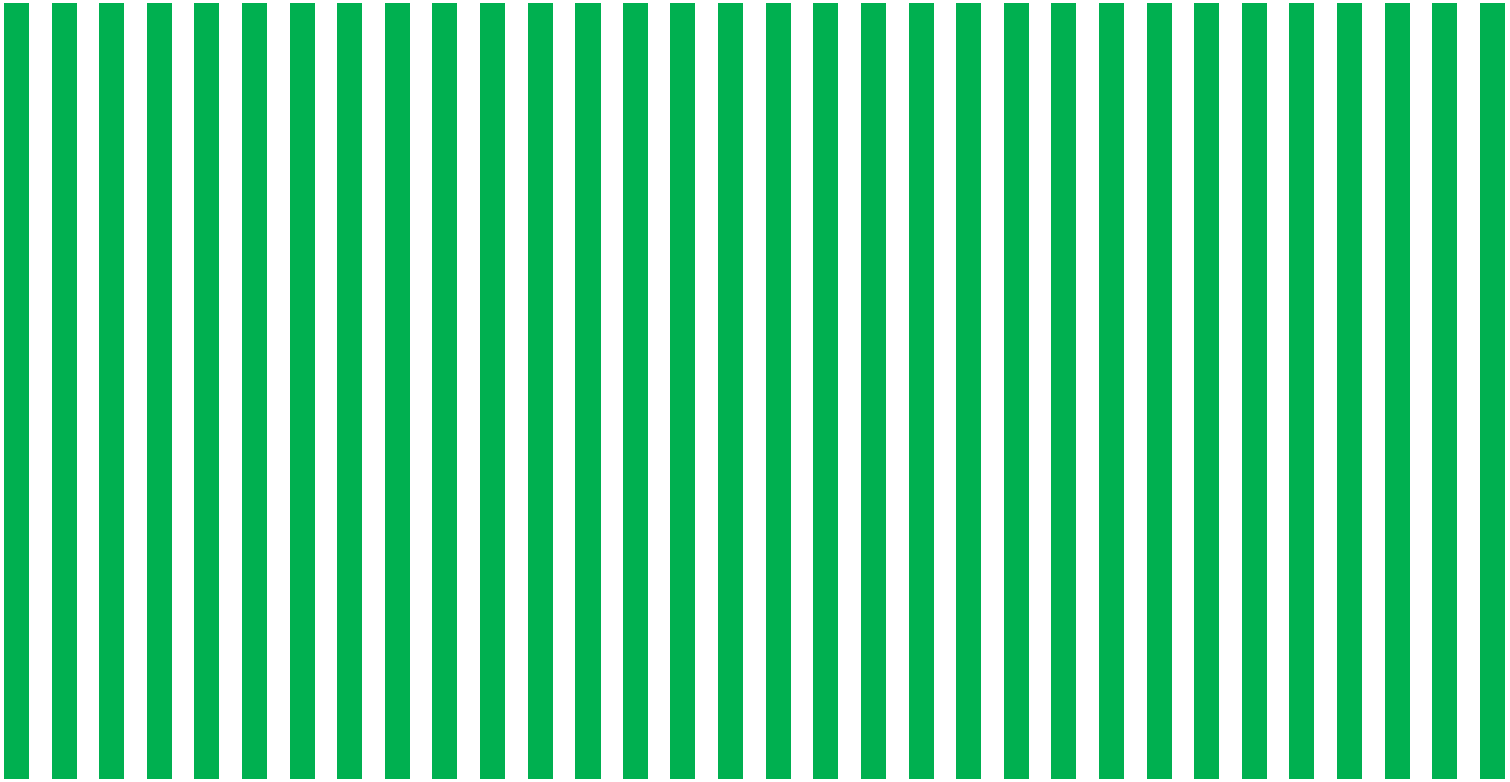




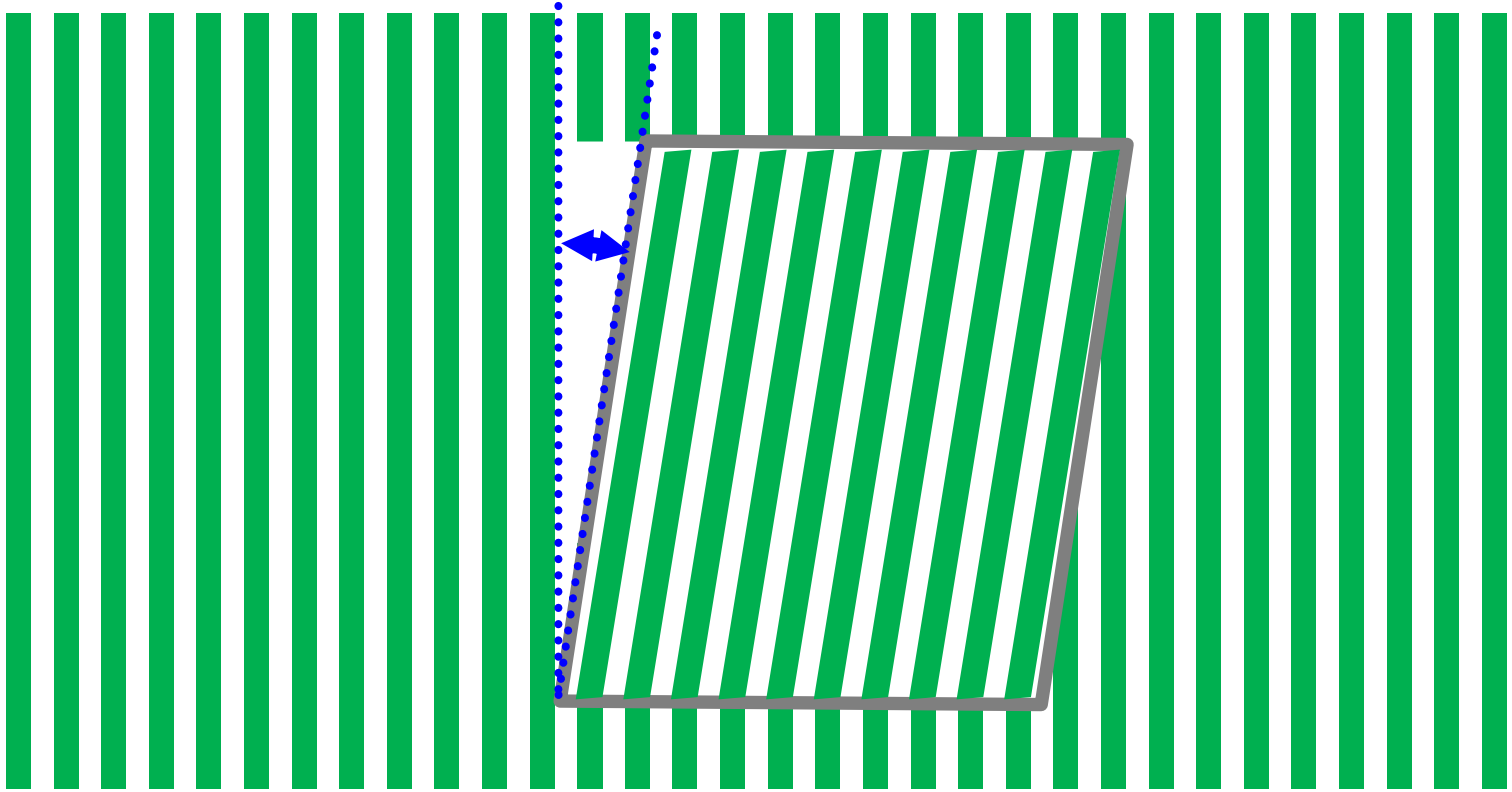
Different stripe pitch

Capture surface curve

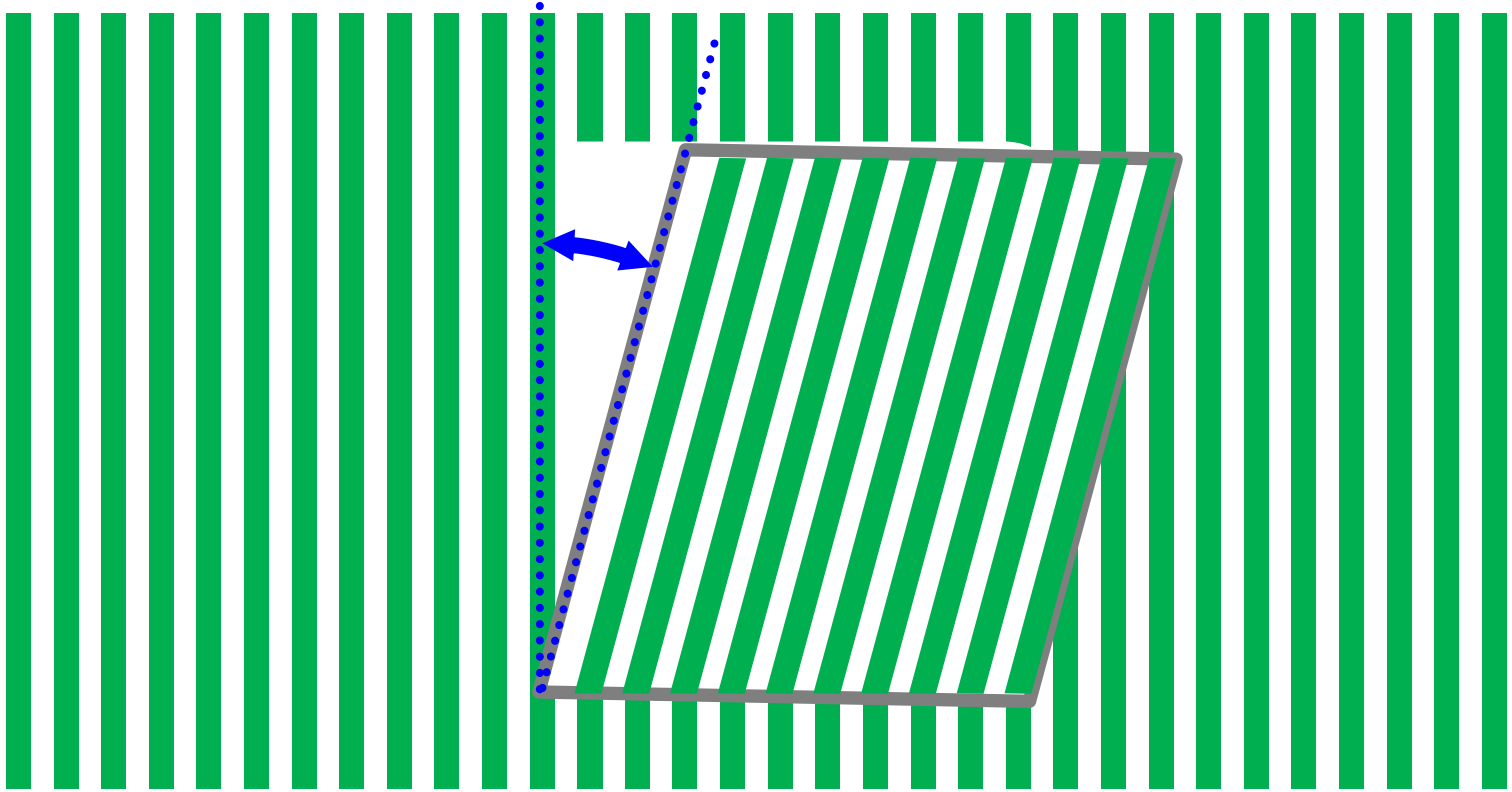
DLP Light Control | Capture by Structured Light



DLP Light Control | Capture by Structured Light

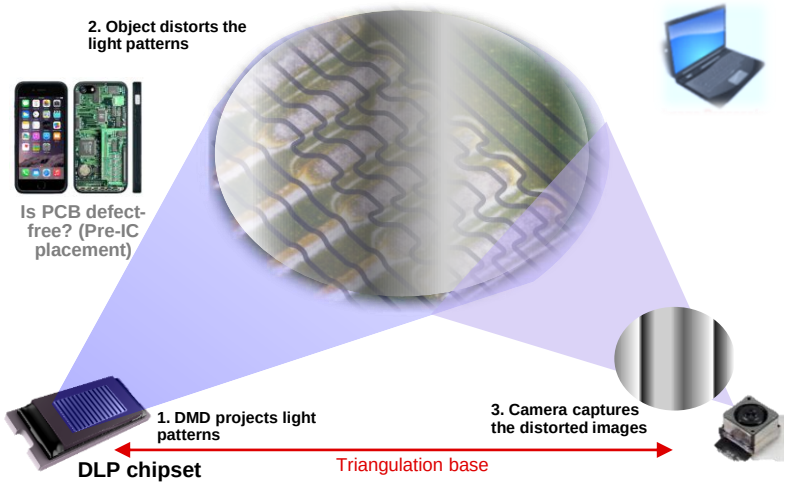


DLP Light Control | Capture by Structured Light



DLP Light Control | DLP technology benefits

Enabling high resolution 3D capture



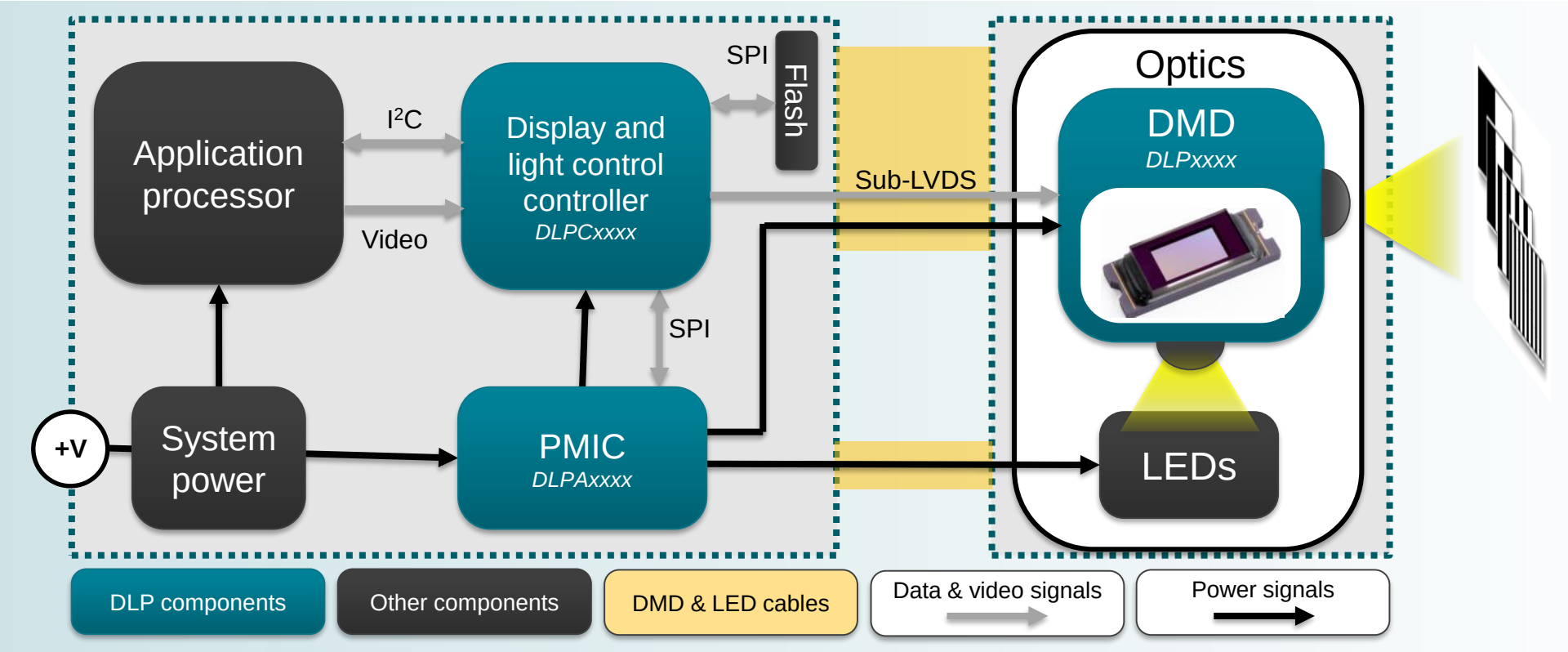
End equipment examples

Factory automation | Dental/medical Scanners | Industrial/metrology

Why choose DLP technology?

DLP Technology Feature	Design Benefit
High speed pattern rates	Real-time 3D acquisition
Flexible pattern control	Micron-level accuracy & resolution
External triggers	Easy sync to cameras
Illumination agnostic	Works with LED, lasers & lamps
Extended wavelength	Diverse applications (UV, VIS, & NIR)
Scalable portfolio	Design scalable solutions (lo/mid/hi)

DLP Light Control | 3D scanner sub-system



DLP Light Control | 3D machine vision opportunities

Scan + display

Use cases

- Retail AR
- Projection mapping
- Smart lighting
- Human-machine interface (HMI)

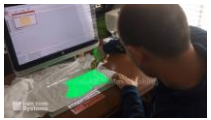


image © Light Guide Systems

Prosumer 3D scanner

Use cases

- 3D Modeling
- Scan-to-print
- 3D animation
- EPOS (biometrics)

image © Shining3D

image © eSun

Medical 3D scanner

Use cases

- Implant surgery
- Mouth rehabilitation
- Dental scans
- Hearing aid

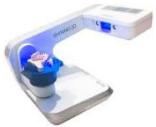


image © Shinning3D

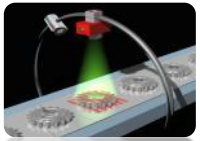
image © Planmeca

Industrial/metrology scanner

Use cases

- Quality control
- Factory automation
- Tool Inspection
- In-process inspection
- Reverse engineering

image © Zividlabs

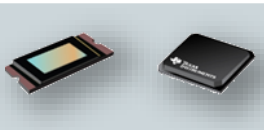
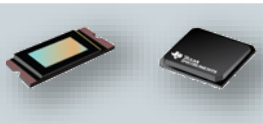
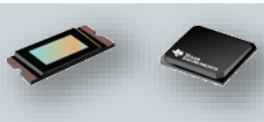
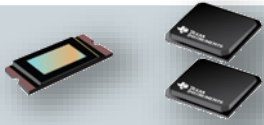


Inline automated optical inspection

Use cases

- PCB solder paste & assembly inspection
- Advanced IC packaging
- Machined parts inspection

DLP Light Control | Pico light control chipset

Chipsets ⟶	DLP4500 DLPC350	DLP2010LC DLPC3470	DLP3010LC DLPC3478	DLP4710LC DLPC3479 x 2
				
Array size | Diagonal # Of pixels	912 × 1140 | 0.45” 1.04 MP	854 x 480 | 0.2” 0.41 MP	1280 x 720 | 0.3” 0.92 MP	1920 x 1080 | 0.47” 2.07 MP
Pitch Orientation	7.6µm ◆ diamond	5.4µm ■ orthogonal	5.4µm ■ orthogonal	5.4µm ■ orthogonal
Max pixel data rate	2.99 Gp/s	1.02 Gp/s	2.29 Gp/s	5.15 Gp/s
Max pattern rate	2880 Hz (1-bit) 120 Hz (8-bit)	2487 Hz (1-bit) 272 Hz (8-bit)	2487 Hz (1-bit) 272 Hz (8-bit)	2487 Hz (1-bit) 437 Hz (8-bit)
Orderable part numbers	DLP4500AFQD DLP4500AFQE DLPC350ZFF	DLP2010LCFQJ DLPC3470CZEZ	DLP3010LCFQK DLPC3478CZEZ	DLP4710LCFQL DLPC3479CZEZ
Chipset price (1ku)	~$216	~$62	~$90	~$190
EVM part numbers	DLPLCR4500EVM	DLP2010EVM-LC	DLP3010EVM-LC	DLP4710EVM-LC

DLP Light Control | Pico EVM and TI design portfolio

Visit Design and Development portal to find the right EVM for your application

Ultra-mobile, Ultra-low power	Mobile low power	Compact high resolution	
DLP2010LC	DLP3010LC	DLP4500	DLP4710LC
TIDA-080001	TIDA-080003	DLP4500-C350REF	TIDA-080005
DLP2010EVM-LC	DLP3010EVM-LC	DLPLCR4500EVM	DLP4710EVM-LC
			

New DLP 3D Print Chipsets

Factory floor performance, at desktop prices

Desktop DLP 3D printing:

Ultra fast print speeds

High efficiency and output

Full layer exposure

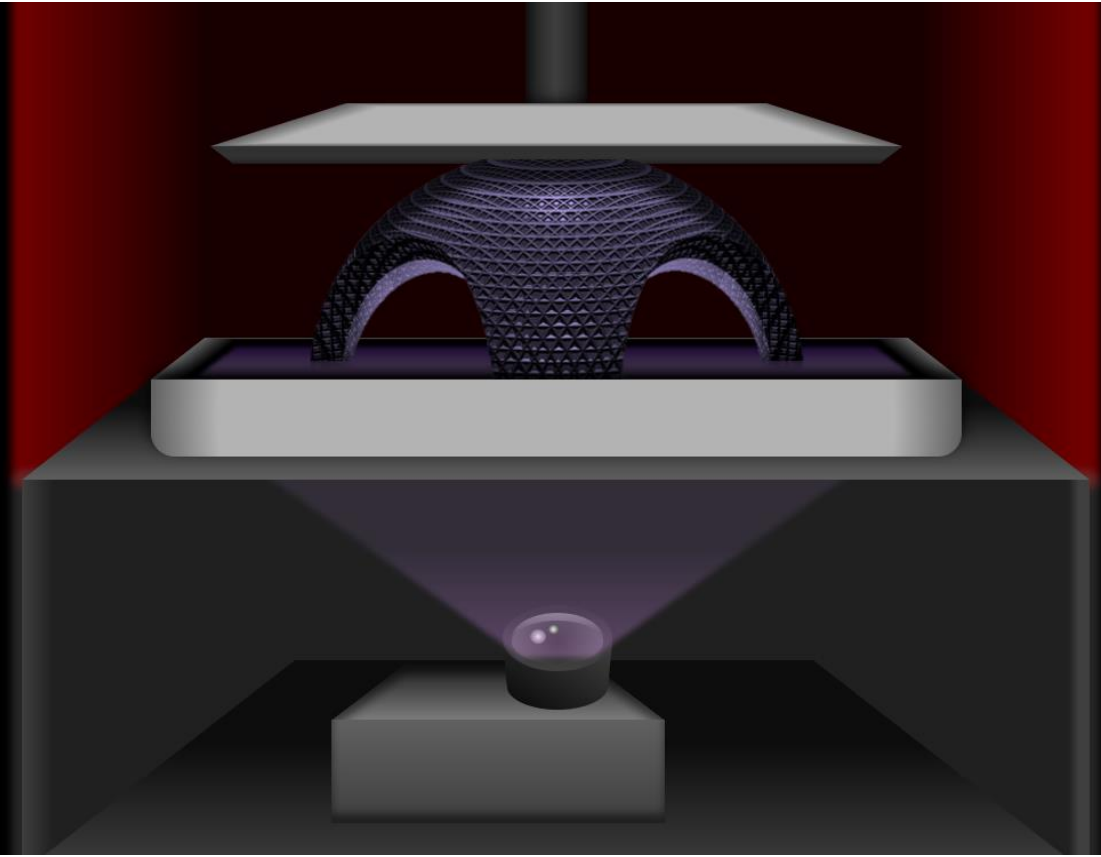
Fine detail, high accuracy

Focused images on resin

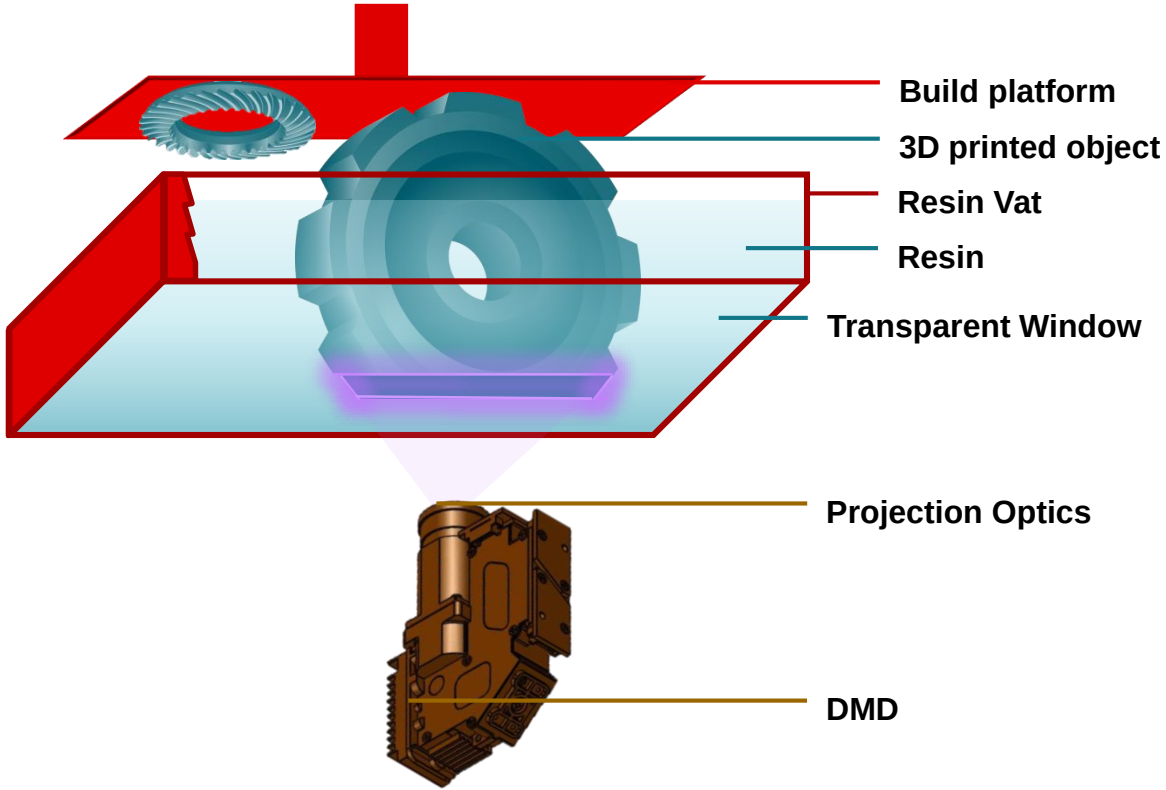
Small features, smooth surface finish

Built to perform

Based on technology used in $100,000+ industrial DLP 3D printers



DLP 3D Printers | System and benefits



Desktop DLP 3D printing means:

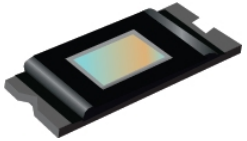
- ❑ Fast print speed
  - Print a **full layer at a time**
  - High optical efficiency and output
- ❑ High resolution
  - DMD speed + pixel actuation
  - Focused image on resin
- ❑ Reliable operation at 405nm
  - Inherent to DLP technology
  - Based on technology used in:
    - PCB lithography
    - Industrial 3D printers

DLP4710LC Chipset | Overview

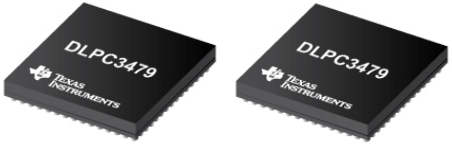
Available now

Chipset

DLP4710LC DMD



2x DLPC3479 controllers



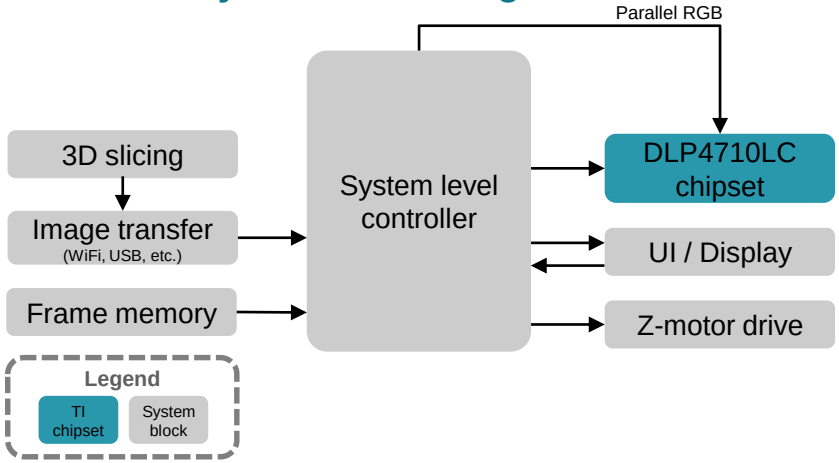
Features

- ❑ **Functionally equivalent –** DLP4710, DLP4711
- ❑ **Process improvements –** for light control applications
- ❑ **High resolution 2.1 MP –** Focused optics, high accuracy

System highlights

- ❑ Functionally equivalent, drop-in replacement to:
  - DLP4710
  - DLP4711
- ❑ Fast DMD switching speed
- ❑ 3rd party optical modules and systems available today
- ❑ Specified wavelengths: 420-700nm

System block diagram



DLP300S Chipset | Overview

Samples Available
Release Target 3Q 2021

Chipset

DLP300S DMD

DLPC1438 controller

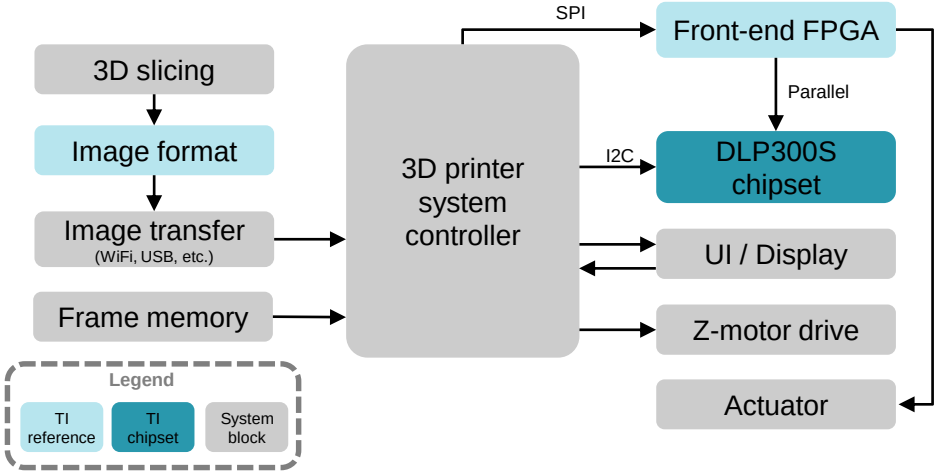
Features

- ❑ **Fast printing speed –** Print a full layer at a time
- ❑ **Reliable operation at 405nm –** >3x output vs RGB LCD
- ❑ **High resolution 3.6 MP –** Focused optics, high accuracy

System highlights

- ❑ Enables <$499 DLP 3D printers
  - ▪ Lowest cost DLP 3D printing chipset
- ❑ Fast DMD switching speed and 4-way actuator
  - ▪ For high accuracy resolution and smooth prints
- ❑ TI reference designs will be available:
  - ▪ DLP subsystem electronics & optics
  - ▪ Reference code:
    - ❑ Image formatting
    - ❑ Actuator logic

System block diagram



DLP301S Chipset | Overview

Samples Available
Release Target 3Q 2021

Chipset

DLP301S DMD

DLPC1438 Controller

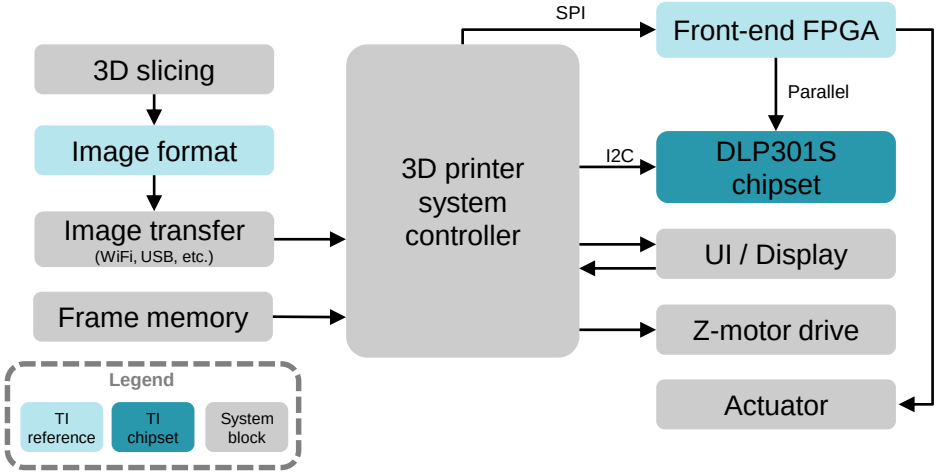
Features

- ❑ **Fast printing speed –** Print a full layer at a time
- ❑ **Reliable operation at 405nm –** >14x output vs RGB LCD
- ❑ **High resolution 3.6 MP –** Focused optics, high accuracy

System highlights

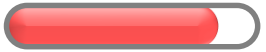
- ❑ Enables low cost, high performance DLP 3D printers
  - Low cost SPI bus instead of parallel RGB
- ❑ 3.6 MP solution in higher power package
  - Increased print speed and material capabilities
- ❑ Fast DMD speed and 4-way actuator
  - For high accuracy resolution and smooth prints
- ❑ TI reference designs will be available:
  - DLP subsystem electronics & optics
  - Reference code:
    - Image formatting
    - Actuator logic

System block diagram

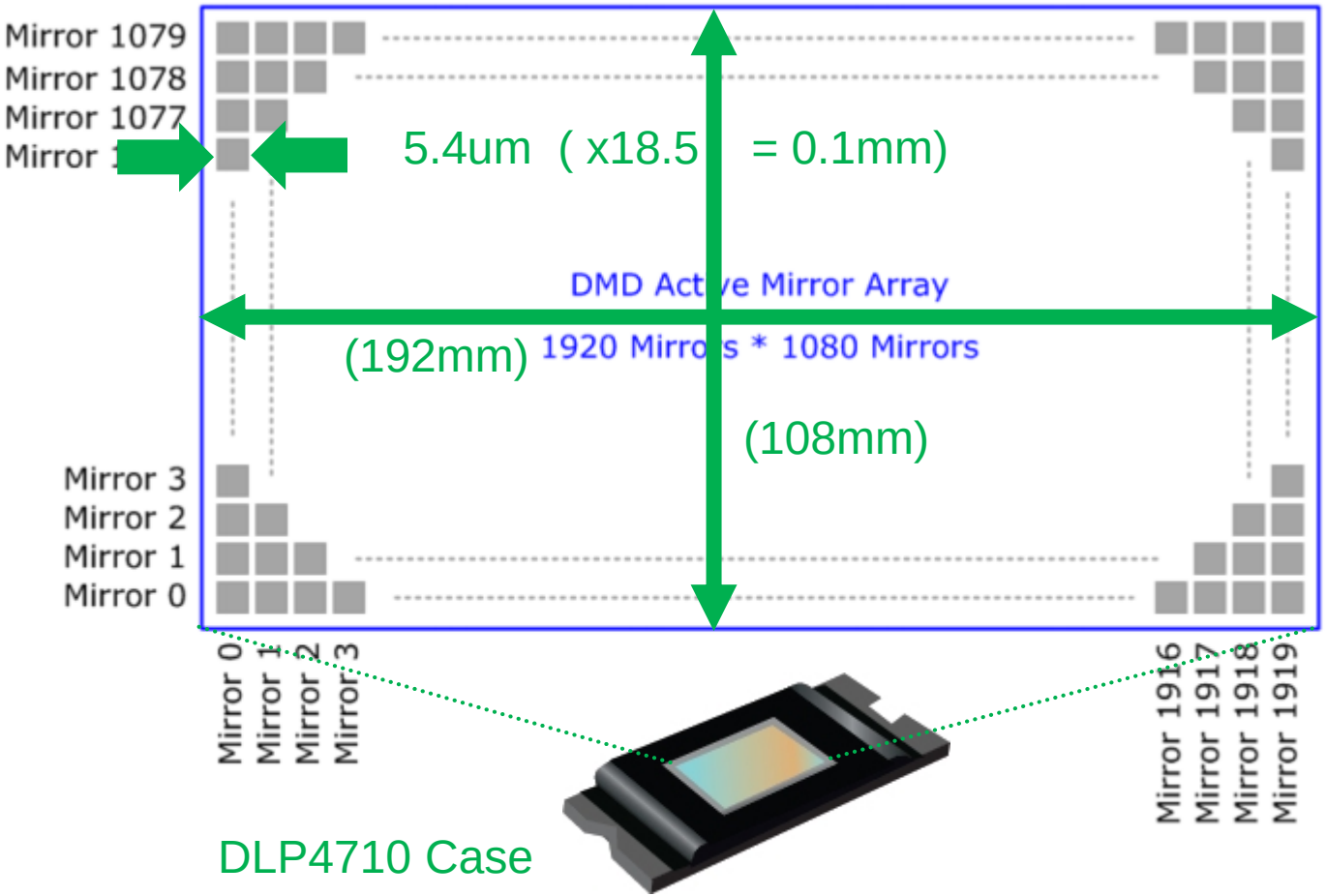


Desktop 3D print chipsets overview*

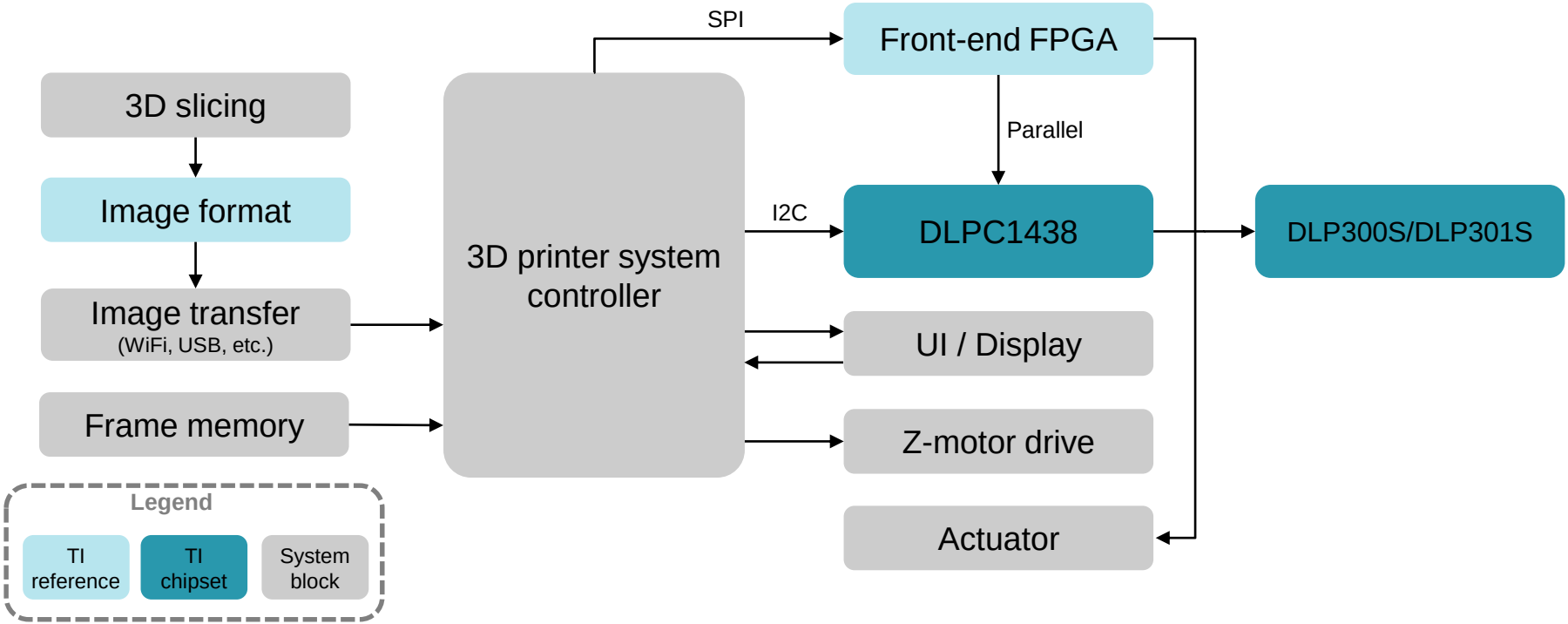
*Specifications are targets and subject to change

	DLP4710LC	DLP300S DLP301S	Future
Availability	 Today	 In Progress	 In Progress
Resolution	2.1 MP	3.6 MP	≥ 3.6 MP
Wavelength	420 – 700 nm	400 – 550 nm	400 – 550 nm

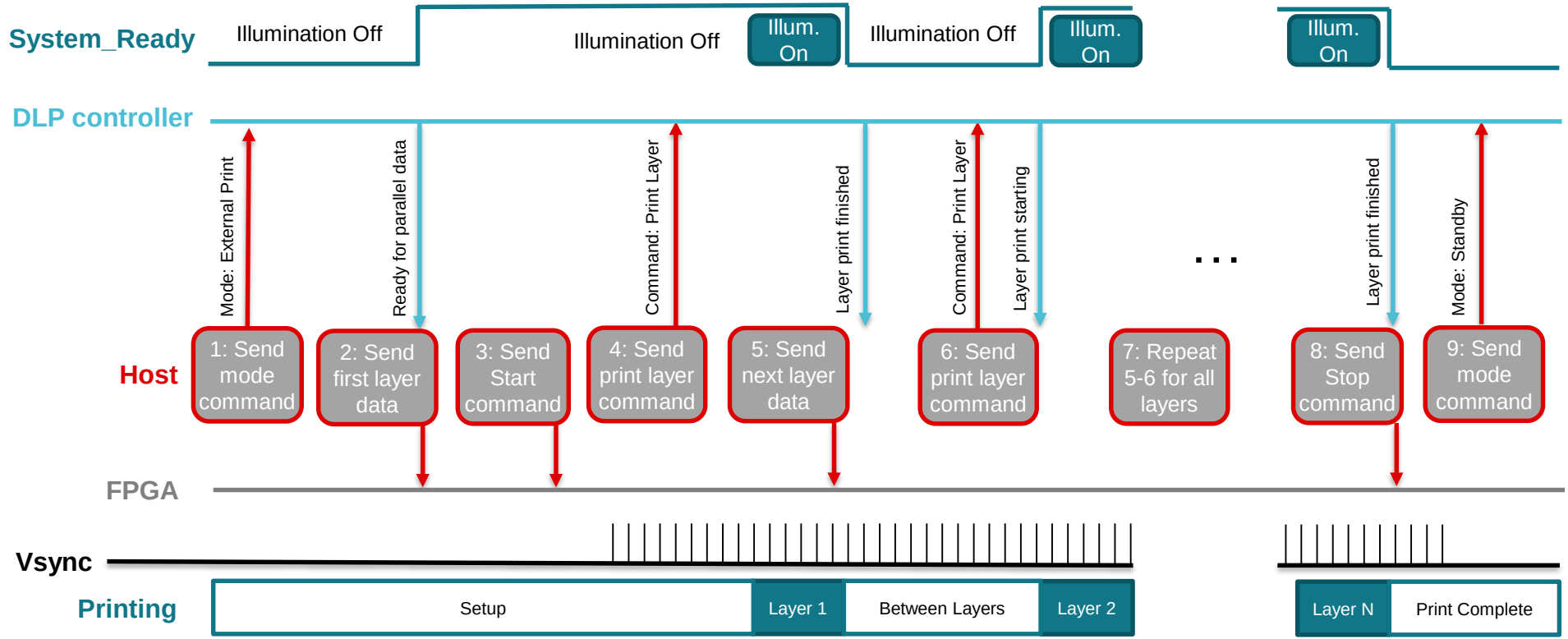
Resolution:


Mirror 1079
Mirror 1078
Mirror 1077
Mirror 1
5.4um (x18.5 = 0.1mm)
DMD Active Mirror Array
(192mm) 1920 Mirrors * 1080 Mirrors
(108mm)
Mirror 3
Mirror 2
Mirror 1
Mirror 0
Mirror 0
Mirror 1
Mirror 2
Mirror 3
Mirror 1916
Mirror 1917
Mirror 1918
Mirror 1919
DLP4710 Case

3D Printer System block diagram

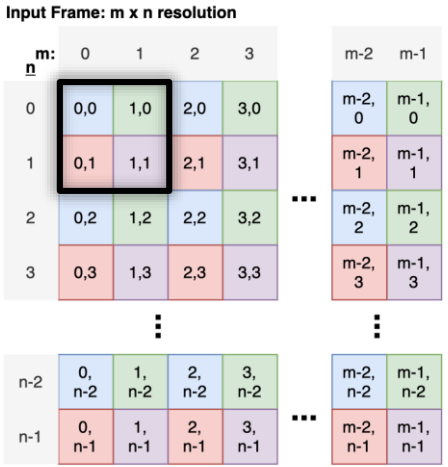


3D Printer operation timeline

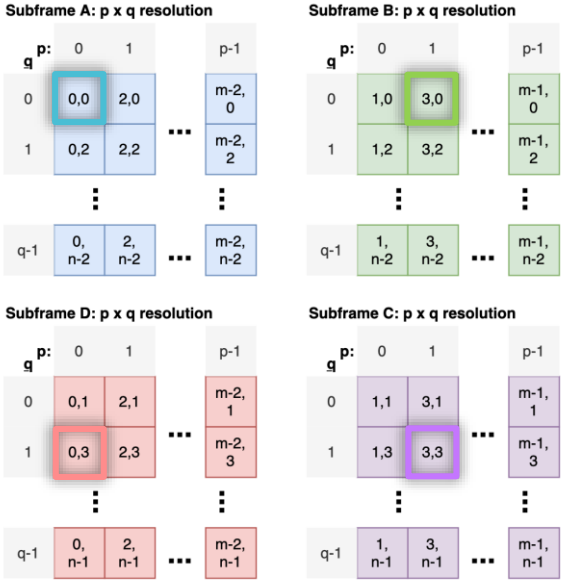


High resolution with actuated pixels on resin

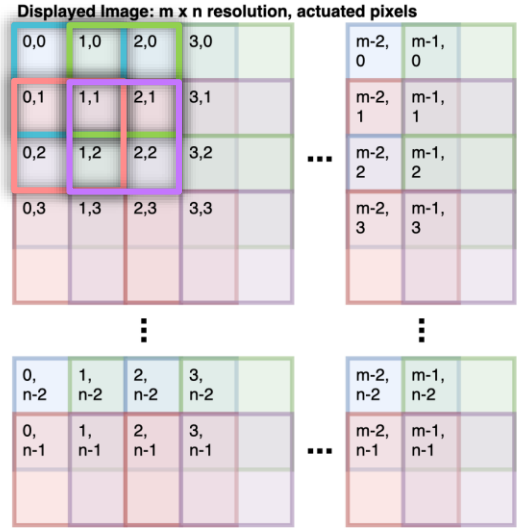
Input image: 2560 x 1440



4 Subframes: 1280 x 720

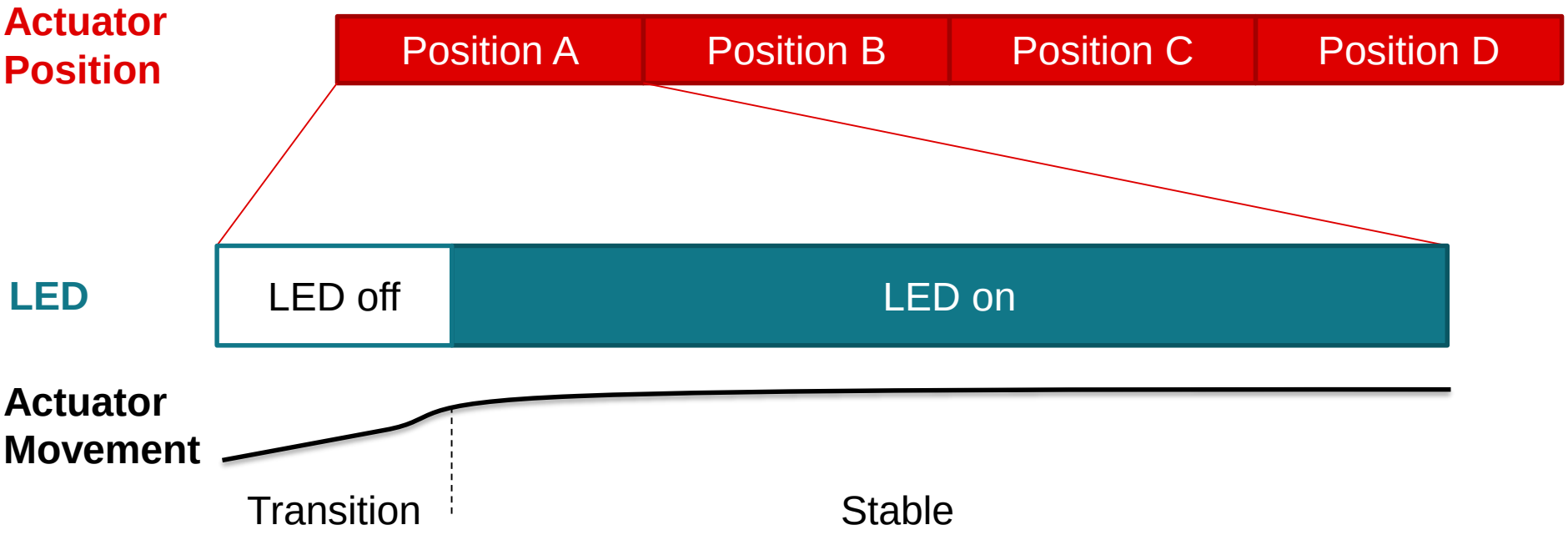


Displayed image: 2560 x 1440



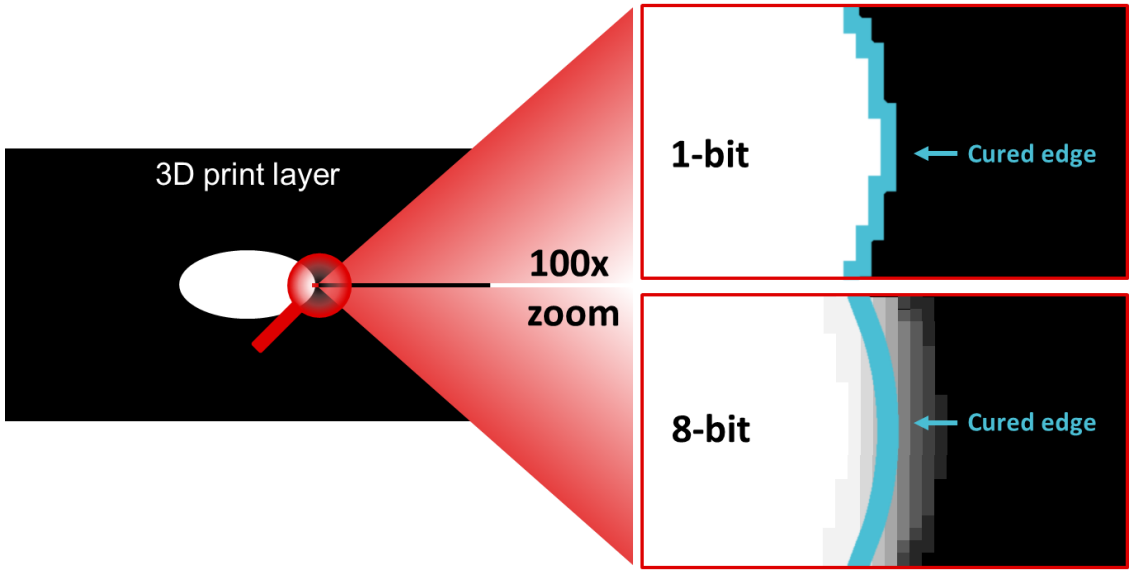
- Same concept as modern displays – optimized for 3D printing
- Print 4 times the number of addressable pixels with no slow down in print speed
- TI will provide easy reference design to get from input resolution to projected images

LED operation during actuation



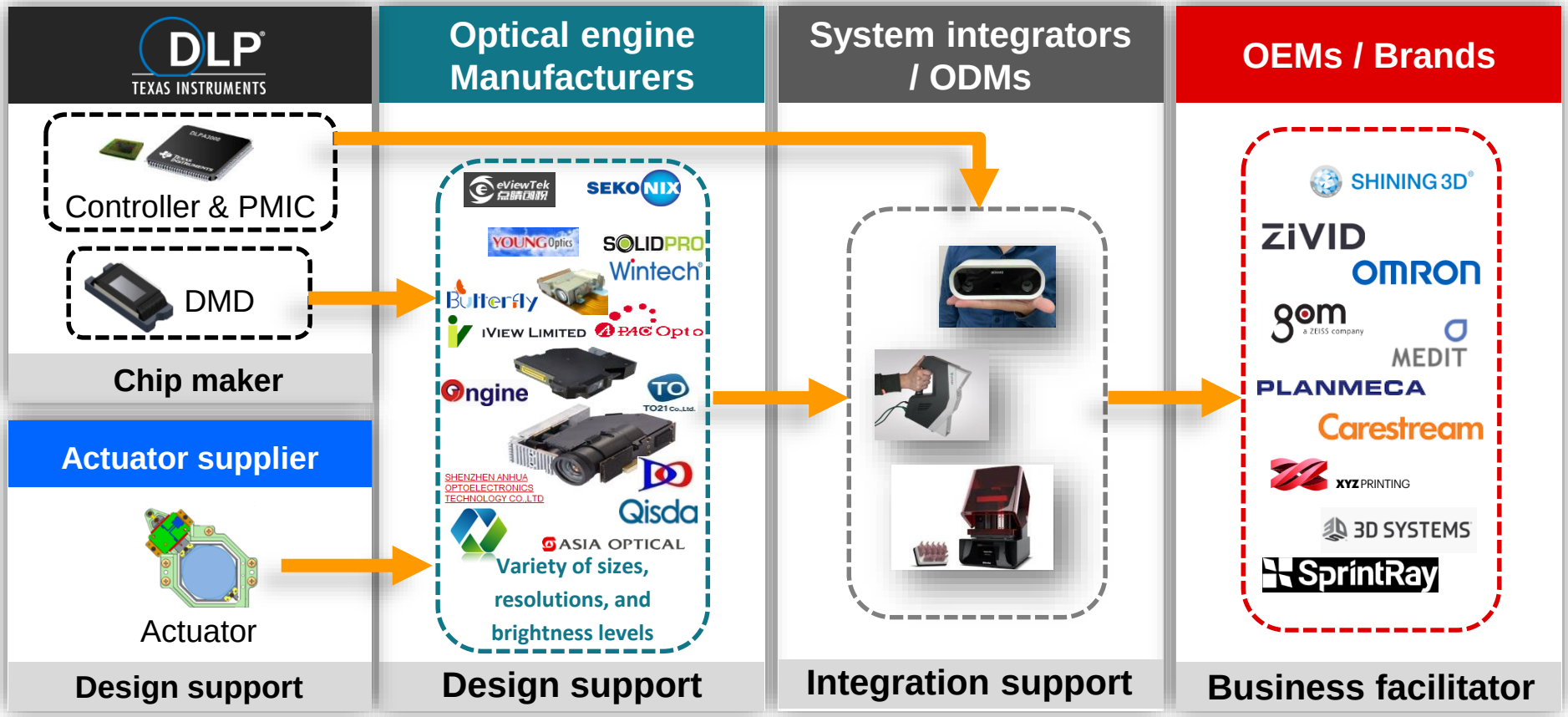
DLP 3D Print with Grayscale

More accurate prints by taking advantage of every pixel



- ❑ DLP 3D printers have light in focus on resin
  - Unlike LCD pixels, which blur together
- ❑ DLP 3D printers can print exactly what you project
  - Smooth, round curves
  - Sharp edges and defined points
- ❑ Use soft grayscale edges for smooth surfaces
  - 8-bit grayscale available
  - Selectable gamma curves for optimization

DLP Pico business model

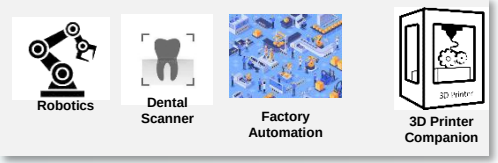


DLP Light Control | Pico system level modules

Chipset

DLP2010LC/
DLPC3470

Applications

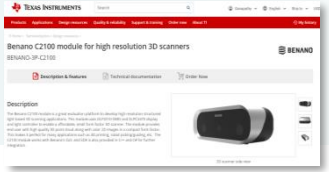


Engaging with BENANO

- ❑ Original Design Manufacturer (ODM)
- ❑ System integrator
- ❑ Design services

Available through TI.com

https://www.ti.com/tool/BENANO-3P-C2100



Simplify & accelerate development path with system level solution from 3rd party design partners

DLP Light Control | Pico system level modules

polyga

Chipset

DLP3010LC/
DLPC3478

Applications


Robotics


Dental Scanner


Factory Automation


3D Printer Companion

Engaging with Polyga

- ❑ Original Design Manufacturer (ODM)
- ❑ System integrator
- ❑ Design services

Available through TI.com

https://www.ti.com/tool/POLYGA-3P-3DEVM3010

Simplify & accelerate development path with system level solution from 3rd party design partners