

# DLP Pico Kit allows dev

The Texas Instruments DLP Pico Projector Development Kit and chipset has already attracted massive interest at trade shows in the US and Europe this year. **Jacqueline Hewett** asks Arun Chhabra of TI to explain why the technology has got the pulse of the photonics community racing.

The launch of Texas Instruments' (TI) first DLP Pico Projector Development Kit was enough to lure many a delegate to the company's booth at the Photonics West exhibition back in January. Based on TI's established digital light projection (DLP) technology and with a retail price of just \$349 (€272), the kit is an easy way for developers to embed light manipulation technology into their applications.

One month on and TI was in the headlines again, this time making a big splash at Mobile World Congress, which was held in Barcelona, where it unveiled the first mobile phone with embedded projection technology. Developed in conjunction with Samsung, the phone uses the TI DLP Pico chipset and is set to hit the European market this summer.

Hard to believe, but it doesn't end there. TI also announced a new addition to its DLP Pico family in Barcelona with availability slated for late 2009. The second chipset will have a higher resolution than its predecessor. All things considered, it seems like 2009 is set to be a big year for TI and for the wider photonics and projection communities in general.

## What is DLP?

TI has been shipping its DLP technology for over 12 years now and has deployed an impressive 20 million units in that time. The initial target markets were conference- and office-room projectors, high-definition television and digital cinema, and indeed those businesses remain stable for TI to this day.

The core DLP technology has not changed over time and remains as reliable as ever. The starting point is a CMOS substrate on top of which is an array of anywhere between 250 000 to over two million individually and independently hinged micromirrors, each around 10µm in size.

"Each mirror can switch to one of two states," Arun Chhabra, TI's business development manager for DLP products, told *OLE*. "They essentially have digital 'on' and 'off' positions in either a 12° or -12° angle

off of the horizontal."

And that basic but robust device is a DLP chip. When it comes to embedding a DLP chip in a specific application, it is combined with an optical assembly and an illumination source, and becomes part of a light projection block or subsystem.

"Light reflected from the DLP chip will either go into an active optical path or if the mirror is in the 'off' position, then light will be routed out of the optical path and absorbed," explained Chhabra. "It all depends on the position of each individual mirror. The mirrors can switch as fast as every 10µs to support video projection rates."

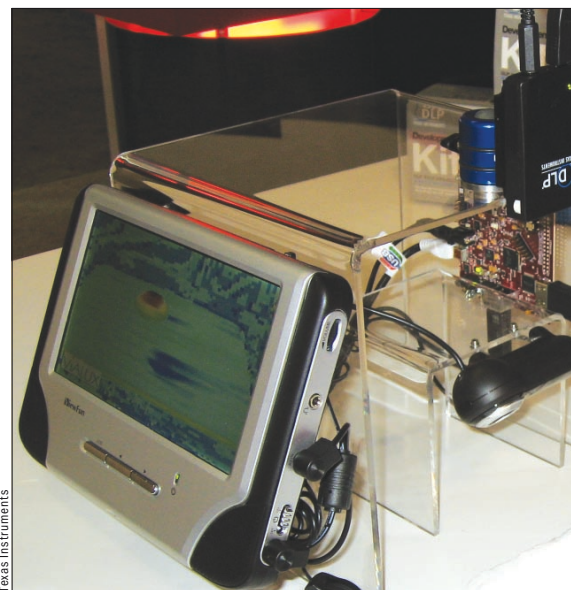
During the last 12 years, TI has received more and more enquiries from innovators seeking access to its core DLP technology. "Developers used to buy projectors and rip them apart just to get access to the DLP chip," said Chhabra. "In an effort to make the technology more accessible to developers, we created a family of development kits to promote the development and deployment of new applications. These are in areas that are completely different to the originally conceived video projection markets."

## The baby of the DLP family

DLP is offered across a number of resolutions and chip sizes, depending on the application. "The Pico chip represents the latest node of development," said Chhabra. "It has a resolution of 480 × 320 and the Pico chip mirrors are 7.56µm. The size of the mirrors and chip are the primary differentiators. The core DLP technology remains the same."

While the DLP Pico chipset is of obvious interest to suppliers of hand-held consumer devices such as mobile phones and PDAs, the DLP Pico Projector Development Kit has been produced with non-video projection applications in mind.

"The Pico Kit is specifically designed to interface to the BeagleBoard, a signal processing board supported by the open source community," explained Chhabra. "Since its launch about six months ago, the



Texas Instruments (TI) officially launched its DLP Pico Projector Development Kit. Samsung and TI have unveiled the first mobile phone with embedded projection technology.

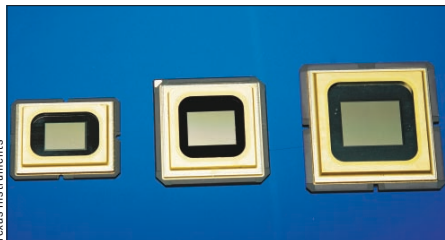
BeagleBoard has been exercised in novel new ways by the open source community. By designing the Pico Kit to work specifically with the BeagleBoard, TI is looking forward to the exciting new ways in which the open source community will experiment with embedded light manipulation."

With a price tag of around \$149 for the BeagleBoard combined with the \$349 for the Pico Projector Development Kit, customers essentially have access to an embedded signal processing projection kit for under \$500. But what do you get for your money and what applications might emerge?

The DLP Pico Projector Development Kit is described as a fully enclosed projection system. It contains the DLP Pico projection engine, miniaturized optics and a light source comprising three LEDs. It also comes with a universal power supply cable and a video cable that runs a DVI-D signal with I2C capability to connect with the BeagleBoard.

"We were running a basic structured light demonstration at Photonics West," said Chhabra. "A pattern of fringes was projected by the Pico Kit and 3D point cloud software generated an x-y-z map of the object. 12 years ago, when we commercialized the original DLP technology, our core focus was video display. Today, our customers have opened up many high-growth segments. It's happening again with the DLP Pico Projector Development Kit and

# Developers to get creative



Development Kit at Photonics West and was running a basic structured lighting demonstration (left) on its booth. Added projection technology (top right). DLP is offered across a number of resolutions and chip sizes (bottom right).

this is an exciting time for us. We believe that it will stimulate a wide range of compelling industrial, medical and consumer solutions to address real-world problems.”

## Applying the original technology

TI has built its DLP business around three target markets centred on video display: projectors, high-definition television and digital cinema. “Over time, other new non-display applications have emerged such as PCB lithography, 3D structured lighting, spectroscopy and optical networking,” said Chhabra. “Each of these application areas has opened our eyes to the added potential of DLP technology in areas outside video projection.”

Take PCB lithography for example, where traditionally a printed circuit board was created using an expensive mask-based approach. “Using DLP technology, our customers have been able to develop a maskless/direct imaging approach to PCB lithography using ultraviolet (UV) light,” said Chhabra. “This effectively removes the expensive mask layer and enables a quick turnaround when the pattern changes. In essence, a new pattern can be exposed on to the PCB by directing a new software file to the projection unit.”

Chhabra adds that the DLP technology is the only spatial light modulator in mass production today that can work with visible and non-visible [UV] wavelengths. “We

are looking to address deeper into the UV. Our existing devices are being used in the 365 nm range. We have customers who are requesting products that go down to 266 nm. We are actively working on enabling a deeper UV offering,” he said.

Another broad market that could turn out to have applications ranging from quality control to biometrics, is structured lighting. The idea here is to project light on to an object, capture the reflection and then process the reflection to create a 3D point cloud representation of the object. This gives the user valuable shape information about the object in all three dimensions: x, y and z.

“Because the mirrors in the DLP chip are independently and individually controlled, it allows specific ‘structured’ patterns of light to be projected depending on the application need – fringes for example,” commented Chhabra. “Wherever a fringe is bent or distorted, the nature of the surface has changed and the ability to rapidly measure this change is extremely valuable. In biometrics, you could quickly scan a person passing through an enclosed area to see if their face matches a database. This is where the fast switching nature of the mirrors is so important.”

This fast switching capability is also crucial for future optical communication networks, where DLP technology is adding value as customers design next-generation reconfigurable optical add-

drop multiplexers (ROADMs). “Optical wavelengths traversing the network need to be switched between different paths and ROADMs make this possible,” said Chhabra. “The fast switching speeds of the DLP chip allow it to comfortably satisfy the redundant path reconfiguration requirements of a SONET network.”

According to Chhabra, DLP boasts several other advantages that make it well suited for this application. A typical optical networking application using a DLP chip would allocate multiple mirrors per wavelength. This configuration can be placed under software control and support reconfiguration of the channel plan as it evolves over time.

Because DLP is an inherently digital MEMS chip that can be in one of two states, Chhabra says that it does not suffer from analogue drift, an attribute found in other spatial light modulators. “The positional accuracy of where light is directed does not get compromised over time and temperature,” he commented. “Polarization independence is another key attribute of the DLP chip that simplifies the optics related to the application.”

Another market that fits Chhabra’s “high-growth” criteria is spectroscopy. In this application, a user can disperse a visible spectrum of light across the micromirrors and effectively create columns of wavelengths across the array. By virtue of the mirrors being independently and individually controlled, the user can select the wavelength of light that they want to reflect off of the chip in a targeted manner simply by turning columns of mirrors on or off.

“We have customers that have deployed and created ‘dynamic’ spectral engines that can output a tunable wavelength of light through control of the DLP mirrors,” explained Chhabra.

## Where next?

TI brands its DLP chip online as “the semiconductor that changed everything” and when you consider the varied list of markets that can be addressed with the original DLP technology, it certainly seems like a valid claim. Now, with the release of the new DLP Pico Projector Development Kit, TI is back at the beginning of the development and innovation cycle. Who knows what applications will emerge over the coming years. □