Taipei, Taiwan — Once feted by the likes of Intel Corp. as the best way to bring low-cost, big-screen TVs to the living room, liquid crystal on silicon remains a distant third to other rear-projection TV technologies, such as Digital Light Processing (DLP) and projection LCD. Yet vendors aren't giving up, insisting that LCOS technology is finally ready for prime time.

It had better be, because time is running out for LCOS, not only because of Texas Instruments Inc.’s popular DLP chips, but also because rival technologies in the direct-view space, such as plasma and LCD, are coming on strong with bigger sizes and lower prices.

Proponents of LCOS say this is the year of vindication. Take high-profile LCOS panel maker Brillian Corp. (Tempe, Ariz.), which has seen its share of woes. Losses totaled $18.7 million in 2003 on sales of $2.2 million, and then worsened last year to $32.9 million in losses on $2.7 million in sales.

But Brillian chief executive Vincent Sollitto Jr. remains undeterred. He says kinks in the supply chain and troubles with technology are fading away, giving LCOS one more chance to make a run at other rear-projection TV technologies.

There are plenty of cynics, and Sollitto understands this, noting that three or four years ago, "rational doubt" existed about LCOS' chances due to some unremarkable early results. Since then, a handful of small U.S. and Taiwanese companies have become the last holdouts. They are anxiously awaiting the moves of top-tier Japanese TV suppliers, such as Sony Corp. and JVC, which have indicated they will make a strong push into LCOS this year.

"Have we had some disappointment? Sure," said Sollitto. "If you talk to the pundits out there, they think that LCOS is going to be a niche market. But I think LCOS is going to continue to surprise, and produce higher and higher volumes with better and better quality."

LCOS has been around for more than a decade. It works by projecting a beam of light through polarizers and onto a silicon backplane covered with a layer of liquid crystal. The circuitry embedded in the highly reflective silicon forms the image, which is reflected back through another set of polarizers before projecting onto the TV screen.

Advocates say the technology achieves a less-pixilated image than plasma or LCD. That's because
the circuits are behind the pixels, so they don't interfere with the light source. Backers also claim LCOS is more easily bumped up to higher resolutions than competing technologies because it's easier to shrink the pixel pitch.

Getting the technology to market, however, has been anything but easy. A handful of companies have thought they were on the right track, only to wind up at a dead end. Amid the carnage lie Philips and Intel, which last year made a grand splash into the LCOS space before making an embarrassing exit several months later.

There are a host of reasons why LCOS hasn't caught on and a few persuasive arguments as to why this might just be the breakthrough year. Topping the latter list is the commitment by Sony and JVC.

Until last year, Sony had been using high-temperature polysilicon LCDs as its main rear-projection TV technology, saving its proprietary LCOS design for high-end, superexpensive home theater systems. Although JVC rolled out its first LCOS product in 1998, it too stayed out of the mainstream TV market.

That left LCOS panel designers desperate for top-tier attention and none too impressed with the earnest, yet relatively small-scale, development efforts of a few second-tier TV makers, like Taiwan's Kolin. "Setting aside the merits, or not, of the technology, it's a lot of money to invest in a product from a company you never heard of," said Paul Semanza, a display analyst with market researcher iSuppli Corp.

Late last summer, JVC introduced its first mainstream LCOS-based TV, with a 1,280 x 720-pixel native resolution, based on the company's in-house Direct Drive Image Light Amplifier technology. While the set drew decent reviews, it wasn't considered as good as the more mature DLP-based TVs being marketed by Samsung Electronics — the biggest system proponent of TI's DLP technology.

Still, JVC is promising several more LCOS models this year. "We are in a position now to have this product take on a much larger segment of the market," said Karl Bearnarth, vice president of marketing for JVC Company of America. "We offer the consumer a big advantage in the picture quality and we believe that that's going to be one of the things that helps us stand out on the retailers' floor."

Just getting to that floor can represent a huge hurdle, however. One of the advantages TI enjoys is a smoothly functioning supply chain with light engines based on its reference design and a deep bench of system integrators. Supply chain woes, mostly concentrated around access to quality light engines, have been the bane of the LCOS market.

A lack of light engines hurt Brillian last year, leading to the cancellation of an order with retail giant Sears. Earlier this month, the company said it was working with alternative suppliers, mostly in Asia, in an attempt to increase supply. The company believes its success hinges on this effort.

"There are no less than five unique IP [intellectual-property]-based light engine designs, and as a result we don't have a commonality of parts and the manufacturing methodologies that DLP enjoys,"
said Brillian’s Sollitto. “So the light engine is still a higher-cost, less-volume-available part of the TV.”

During the next year, this problem may prove surmountable as more companies outside Japan start providing engines. “More good ones will be made in Taiwan and China, because the technology is getting more mature,” said Poking Li, a marketing manager at Aurora Systems Inc. (San Jose, Calif.), which supplies ASICs and panels to the industry.

A slip-up in this schedule could be fatal, however. TI’s MEMS-based DLP technology is a major force in rear-projection TV, with a 24 percent revenue share, according to iSuppli. Moreover, direct-view plasma and LCD TVs are coming on strong. “If we don’t become a major player in two or three years, then the economies of scale will blow us out, because TI’s stuff is getting cheaper and cheaper,” Li said. “We need to work hard and work fast.”

Some suppliers see the 1,920 x 1,080 interlaced resolution as the follow-on to 720 progressive as a possible turning point. They argue that it’s easier to shrink pixels in LCOS to increase resolution, which should give LCOS a cost advantage over DLP.

“The players in the area now know how to develop a low-cost LCOS technology for low-end commodity products,” said Warren Shih, chief executive officer of eLCOS Microdisplay Technology (Sunnyvale, Calif.). “We simply have to follow what the PC industry folks have done for the past 20 years.”

Some believe the prices can get as low as $1,500 within a year for a 50-inch LCOS-based display, which would make it very competitive. For 60 to 70 inches, prices could range from $3,000 up to $10,000, depending on the quality of the components and the brand name. Generally, it’s the 50-inch-and-above space that LCOS makers target, because plasma and LCD TVs are harder to compete with in smaller sizes.

Although necessarily optimistic, few LCOS suppliers deny the strength of TI, which made a splash at this year’s Consumer Electronics Show with a 1,080i (interlaced) TV from Samsung that drew a lot of positive reviews. That set comes out in June, a few months before JVC will release its 1,080i LCOS TV but around the same time that LG Electronics is to release its first 1,080i LCOS models, one at 62 inches and the other at 71 inches.

"DLP will still enjoy the biggest market momentum," Shih of eLCOS conceded, "but there won't be any reason why people won't buy LCOS. It's good performance and cheap."

That’s a realistic view, said iSuppli’s Semanza: "LCOS is never as alive as some of its advocates say it is and it’s never as dead as detractors say it is."

A few other LCOS panel suppliers, including eLCOS, say they are working with Japanese top-tier TV makers that want to give the LCOS market another shot. Finding an alternative to TI, the sole DLP supplier, may be one motive. "The CE [consumer electronics] industry does not want a dominant player, hence the CE players will make sure that DLP has competition," said Tony
Whitehead, an executive at United Microdisplay Optronics Corp. (Hsinchu, Taiwan). LCOS will be
that competition, he said, because high-temperature polysilicon is losing momentum — Sony, for
instance, switched to LCOS at 1,080p (progressive).

Chris Chinnock, an analyst at display tracker Insight Media, agreed, but said that a larger issue than
competing with TI is how well system integrators are able to make the TVs. "Learning how to build
that optical system and to optimize it for mass production and for performance have proven to be far
more difficult than people had imagined," he said.

Li, of Aurora, added, "Different parties are doing their own stuff, such as the optical-engine makers
and the electronics houses. Not many people really know how to put everything together and
properly tune the TV. We were successful with JVC because JVC has vertical integration."

**Beyond TV**

Although rear-projection TV is the main target market, LCOS panel makers are also exploring
opportunities in niche applications, which range from near-

eye displays that might be used with a Sony Playstation to pocket projectors or viewfinders in
cameras and camcorders. "I see that as our Step 2," said Sollitto of Brillian. "As we reap a lot of cash
flow out of the TV business, that's exactly where I intend to invest it."

Analyst Chinnock said LCOS has to get a move on, and not only for fear of completely losing out to
DLP. "The smart money is saying the rear-projection TV game is only a four- or five-year game and
then it's all over," he said. "That's because eventually, plasma and LCD are going to eat their lunch."

Said Sollitto: "It's going to be a great time for those five or six years."