

The Global MEMS Supply Chain: A Foundry's Perspective

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According to one global-reaching MEMS foundry, there are currently five primary trends that are propelling the MEMS market. We take a look at the effects that these issues - such as the rise of increasingly cheaper competition in China and Asia - will have on companies operating in the MEMS industry, and some of the steps they may need to take in order to preserve their competitiveness.

Micralyne is a MEMS foundry that has been active worldwide for the past 25 years. Looking back over the past five years, Micralyne has identified five major trends or themes that are driving the MEMS industry and that will reshape the industry

in the future. These themes are:

- MEMS as an enabling technology not a product;
- The changing nature of MEMS product development;
- MEMS is now a global business;
- Pace of change is accelerating;
- The increasing role of China and Asia.

An enabling technology, not a product

In the late 1990s and the early 2000s, the MEMS industry achieved a very high profile and was recognised as a “world-changing technology” that, in essence, could make industrial components smaller, faster and less

expensive. As a result, many venture capitalists invested in MEMS start-up companies in the hope of commercialising these “world-changing” products.

The term “MEMS” was consequently front and centre and prominently included in business plans and product descriptions. Unfortunately, many companies forgot that end-users do not buy “MEMS”, but rather products. These products not only include a MEMS die, but also need packaging, distribution channels, warranty and service, a brand and all of the other elements of a complete product. Today, in contrast, there is now the realisation that MEMS is an enabling technology and therefore just a single piece of the puzzle.

Changing nature of MEMS product development

The overall activity of a new technology industry such as MEMS is often driven by the availability of venture capital. The more dollars available, the more money is invested in product development activities.

This was especially true again in the late 1990s and the early 2000s when there was a confluence of three factors that impacted how MEMS products were developed. First, a huge amount of venture capital was available to the MEMS industry, when total VC dollars jumped from around \$20 billion to over \$100 billion in the 1998-2001 timeframe. Second, the Internet was starting to hit its stride and bandwidth demand was experiencing exponential growth. Telecom firms were investing billions into infrastructure, but bottlenecks kept on appearing along the way.



Third, MEMS technology emerged as a potential solution to these bottlenecks in the form of large-scale MEMS optical switch devices.

As a result, MEMS technology became the forefront of a hot industry that was aggressively pursued by venture capitalists. A massive amount was invested and many MEMS optical switch companies, for example, were valued – at least on paper – at multi-hundred million or billion dollar levels. This resulted in a spill over effect on the rest of the MEMS industry as the venture capital funds were looking for places to invest their dollars.

Overall, it was a period defined by excess and euphoria, which unfortunately for many turned to failure. Companies with sky rocketing valuations at that time experienced spectacular failures, leaving the MEMS industry with a black eye. The positive side to this, a half decade later, is that the industry has learned from this experience and commercial expectations have been reset accordingly. Overall, companies have a stronger focus on bottom line profitability and cost containment.

Today venture capital firms have less to invest into recipient companies, which in turn have, for the most part, forced MEMS product development to first pursue fabless business models. That is, they must work with independent foundries like Micralyne, to manufacture their parts as opposed to building their own production capacity.

On the whole, these factors have encouraged the MEMS industry to be more financially conservative and to focus on partnerships making it more effective to get their product developed, manufactured and distributed to target markets.

Now a global business

MEMS industry conferences are a strong indication that MEMS has always had a global focus. Conference attendees travel in from all

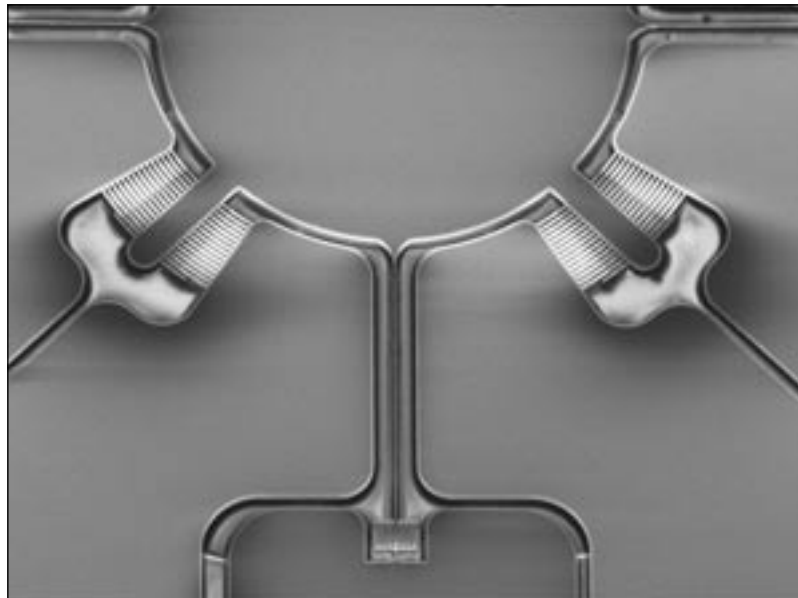
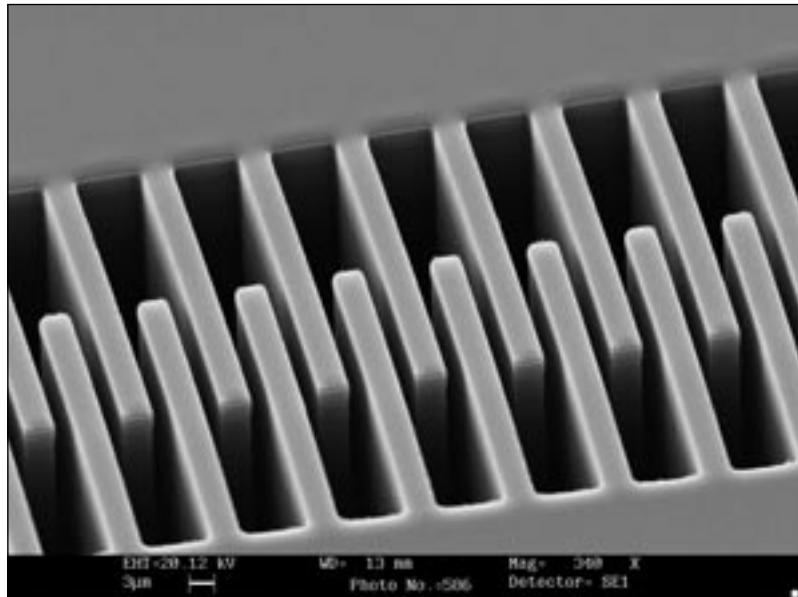


Figure 1 (above) - MEMS optical switch mirror

Figure 2 (below) - MEMS comb drive



over the world to exchange ideas and present their product technologies. But for the most part, the industry has been centred around North America and Europe. Most technologies coming from universities, research institutions, and successful companies are based in these regions.

Some companies have chosen to shift their production to Asian countries to take advantage of lower costs. For the most part, that would be the extent of it. Today, however, this is changing – and changing rapidly. More and more regions around the world are developing local comparative advantages that are becoming world

class. Micralyne, for example, has customers who are taking advantage of this emerging global supply chain and experiencing excellent results. The company now has customers who receive their venture capital financing in the United States, undertake their software modelling and design work in India, have the MEMS component manufactured in Canada, marry the MEMS component to a CMOS wafer fabricated in Taiwan, have the final product assembled in China, and then sell it to their lead customer in Europe. This is a supply chain scenario that is being played out in many industries but which has only recently gained traction in MEMS.

Pace of change accelerating

In relation to the previous statement, the emergence of a global MEMS supply chain is happening very quickly and is accelerating at an unprecedented pace. Only two years ago, our trips to Asia were merely an investigation on how to lower production costs. In the last 12 months, companies from all over the world have emerged offering viable options for a global product supply chain. More importantly, there is no relief in sight. As more money is invested, more companies are starting up, and markets are maturing at a pace that threatens to fundamentally change the way we operate our businesses.

Increasing role of China and Asia

Asia, and in particular China, is central to the changes in the MEMS industry. Asia has long offered a lower cost manufacturing environment. Typical operations staff are paid one-sixth to one-tenth that which their counterparts in North America and Europe receive. This cost advantage has also been enhanced with the emergence of an engineering and research infrastructure within which scientists and engineers are paid a fraction of the going rate elsewhere. There has been a perception that these engineers are inexperienced and less efficient than their Western counterparts, which in turn minimises any cost differences. Clearly this perception is incorrect. One well-known CEO who established a major manufacturing operation in China, claimed he was "stunned" by the quality of the development work being undertaken. Furthermore, by carrying out work in China targeted at defence and aerospace applications, his company is not disadvantaged by government export restrictions facing his facility in the United States. Micralyne also has several other customers now establishing research and development centres in China and other parts of Asia. On visiting these facilities it is clear they are achieving comparable, and in some cases superior,

results with their next generation product development activities as compared to their US counterparts. The hungriness of Chinese companies and employees is also very evident. They see a bright future for themselves and their hard work is paying off in terms of increased productivity. Adding to all of this is the growth of home grown Chinese companies who are now competing on the world scale. Companies like Huawei, ZTE and Lenovo are most notable although others are also emerging in the area of MEMS.

What lies ahead?

With these five major trends in mind, what lies ahead for companies operating in the MEMS industry? For some it will mean opportunity, for others trouble. Companies

are now facing new competitors who have an inherently lower cost base yet can now offer, or will soon offer, equivalent products of same quality. Can you compete with this? Some companies are aware of this challenge and are taking specific actions today. Others believe it will be several years before they need to worry about this. Some unfortunately are doing nothing at all.

Although nobody knows how quickly things will change, there is no doubt that change is coming, and sooner rather than later. Micralyne has realised that they have to be world-class in their manufacturing competencies and continually reinvest in their capabilities. They must also look at new partnerships with companies who can offer a better comparative advantage in their specific geographic region.



In particular, Micralyne is developing relationships with established companies in Asia who offer world-class packaging and other labour intensive product offerings at a much lower cost. The company is keeping an eye open for new and non-traditional forms of competition. This could be the emergence of another MEMS foundry established in China or the acquisition of existing MEMS fabs by larger

companies with deeper pockets, broader distribution and marketing channels (such as happened in Taiwan recently with UMC's acquisition of Asia-Pacific Microsystems and investment in ChipSense).

Micralyne is also taking a fresh look at how they market their products and services. They have found that investments in Internet marketing offer much greater returns than

tradeshows. At the same time, however, nothing replaces the need for personal, face-to-face relationships with potential customers in all parts of the world, especially Asia.

Whatever you do, its important to take a new look at all aspects of your operation while keeping the prospects of a global MEMS supply chain in the back of your mind. There's no turning back.

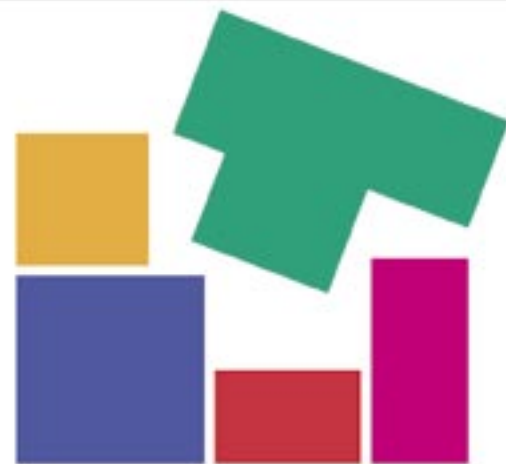
SiTime Partners With Micro Crystal

SiTime, a privately held Silicon Valley startup bringing the first MEMS-based, all silicon timing solutions to market, and Micro Crystal, a European leader in the frequency control market, have begun a strategic partnership to develop, promote, and distribute next-generation MEMS First and EpiSeal oscillator products. SiTime introduced its first MEMS-based silicon oscillator product to the market in April 2006 using proprietary processing technology licensed from Robert Bosch GmbH. Founded in 1978 in Grenchen, Switzerland, as a producer of watch crystals, Micro

Crystal has become a leading supplier of miniature quartz crystals for virtually every kind of electronic appliances. The company, which has three plants in Switzerland, Thailand and China and more than 850 employees, is part of the Swatch group of companies.

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