

# SEMICON, PACKAGING & ASSEMBLY REPORT

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## BUSINESS NEWS

**China Semiconductors** - China-based chip production will rise to \$12.1 billion by 2010, from \$2.6 billion in 2005, IC Insights said in a report published last year. China will only account for 4% of global chip production in 2010, the research firm said. The country's chipmakers including Semiconductor Manufacturing International Corp. face obstacles when buying equipment from the U.S. that may be used for military purposes. Under the Wassenaar Arrangement, equipment vendors and Chinese companies need to get government approval for sale of advanced technologies. Semiconductor Manufacturing, China's biggest chipmaker, is still awaiting approval from the U.S. Export-Import Bank for its application for a loan guarantee to buy equipment worth \$750 million from Applied Materials Inc. ``Intel would have to lobby the U.S. government to free up regulations to allow for them to export advanced nanotechnology to China. The company, whose processor chips power more than 70 % of all personal computers, employs 6,800 people in China. The company has invested more than \$1.3-billion in China since 1985, when it began operating in the country.



**New China Packaging Plant** - NXP and ASE are doing a JV in Suzhou, China for semiconductor testing and packaging. NXP will hold a 40 percent share while chip testing and packaging specialist ASE retains 60%. The JV will serve the international and domestic Chinese markets and will be located at NXP's existing manufacturing site in Suzhou and begin operations in Q2. NXP said it will contribute its existing testing and packaging operation in Suzhou as its initial investment and noted that this agreement does not affect the other testing and packaging sites for NXP in Asia and Europe.



**Tessera Buys More Opto Packaging Technology** - Tessera is paying \$18 million for Eyesquad, a developer of micro-imaging products, only a year after the Israeli company was established. Eyesquad's technology allows cellular phones with cameras to provide features found today only in digital cameras. The features include improved image quality, continuous optical zoom, built-in auto-focus and a close-up imaging capability. The Eyesquad (Tel Aviv, Israel) technology can be used without changing the cellphone camera's lens. Companies, including Nokia and Samsung, are testing the technology and looking to integrate it into future products. Other applications suitable for the company's products and technology include barcode scanners, endoscopes, and various security applications for miniature cameras. Tessera is expected to sell licenses for the newly acquired technology to makers of image sensors, lenses and digital cameras.



The Israeli startup was founded by its CEO David Gasul, David Mendlovic, a former Tel Aviv University professor, and CTO Dr. Gal Shabtay. Eyesquad has 15 employees and the company said it would continue its development activity in Israel. At the end of 2005, Tessera purchased the IP rights of Israel-based **Shellcase** for \$33 million.

## **MEMS & BIO-CHIPS**

**Don't Throw Away Those MEMS Chip** - Kodak's new Easyshare all-in-one inkjet printers generate superb quality but their ink cartridges are cheaper. They have moved the most expensive part of the cartridge, the print head, into the printer [where it belongs]. The print head uses a MEMS device, just like virtually all ink jet machines. In other printers, like HP, you throw away the printer chip, some flexible circuitry, and the empty cartridge. The replacement can cost \$30 or more for a dollar's worth of ink. The low and mid-end models (\$149 and \$199) will appear in March with the high-end with fax and document feeder in May. Consumables packaging is one area where Kodak has put in serious thought. The company has put together grab bags containing a stack of 4x6 inch photo paper, a color cartridge, and a black cartridge for under \$20. You can get 180 prints on "standard" for \$17.99 or go upscale to thicker paper, but only 135 prints for \$19.99. The \$17.99 package delivers prints at 10-cents U.S. a copy while the \$19.99 package breaks down to 15-cents U.S. a copy. The printer has a built-in scanner to determine the type of photo paper inserted in it, and adjusts accordingly.



**Chip Detects Avian Flu** - A micro-array-based influenza detection technology, named "MChip," has been developed by the University of Colorado in close collaboration with the CDC) and could soon be standard at medical clinics worldwide. Quidel Corp (San Diego), a based provider of rapid point-of-care (POC) diagnostic tests. Quidel said its intent is to develop and market molecular-based diagnostic tests featuring the MChip for use in pandemic surveillance, as a tool for the clinical laboratory and at the point-of-care in the physician office laboratory, holds the worldwide license to make and distribute the MChip. The MChip offers several advantages. The majority of molecular-based arrays use sequences from three influenza genes while the MChip exploits sequences from the matrix genes. A diagnostic test based on this relatively stable gene segment should be more robust because it will continue to provide accurate results even if disease genes mutate. The MChip offers the advantage of simultaneously typing and subtyping the flu virus in a single procedure, avoiding the need for additional subtyping of the virus. The MChip has been validated in collaboration with the CDC by testing H5N1 samples collected over a three-year period from people and animals around the world and to date has correctly identified 24 different H5N1 flu strains at 97 percent sensitivity and 100 percent specificity, with no reported false positives.



**More MEMS Mics** - MEMS Tech (Malaysia) makes components for consumer electronic products and expects its income for the next 2-years to be driven by the sale of

silicon microphones. Silicon microphones are used in mobile phones and notebook computers, among others. Last year, MEMS Tech's earnings were driven by sensors for medical equipments. But growth in revenue will also be driven from new deals expected from clients in the automotive and other industries worldwide. The company is finalizing a contract with a major automotive player to produce silicon microphones for audio systems in cars but nothing more can be divulged. MEMS Tech is optimistic that its performance for its current financial year ending July 31 2007 will surpass last year's results since many negotiations are ongoing. They currently produce about 10-million silicon microphones monthly and expect to double it to keep up with growth, mainly in the mobile phone industry. The company plans to expand its assembly and testing plant in Johor Baru and a sister plant in Penang early this year. The plant will be in Penang's Free Industrial Zone in Bayan Lepas with about 40K to 50K sq. ft, for producing silicon microphones. In addition to silicon microphones, MEMS Tech products include industrial, commercial and medical pressure sensors, thermopile arrays, infrared cameras and accelerometers.



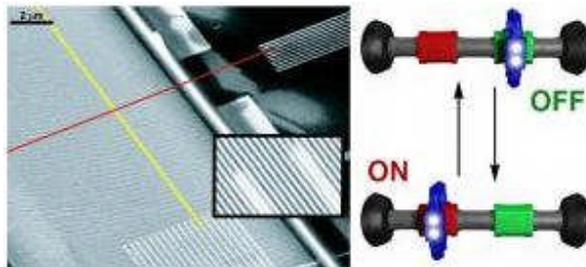
**Wolfson Microelectronics** acquired a Scottish company and design team with MEMS technology. Wolfson is paying \$5.7-million for Oligon, a MEMS sensor startup located at the Scottish Microelectronics Centre (SMC) in Edinburgh. The attraction is a proprietary process that allows the fabrication of MEMS transducers using CMOS techniques. Oligon has six engineers and has been developing products called Active ICs that combine MEMS transducer technology and CMOS processing electronics. Its first application was an audio IC to provide chip level and package level silicon microphones (Electronics Weekly)

## **NANO-ELECTRONICS**

**Silicon Lives on in the Nano-Scale World** - Intel and IBM separately claim to have solved a puzzle perplexing the semiconductor industry about how to reduce energy loss in microchip transistors as the technology shrinks. Each has devised a way to replace problematic materials in transistors that now leak too much current at the present nano-scale level. Advanced Micro Devices is also in the game and claims to have helped IBM develop the technology along with electronics makers Sony and Toshiba Corp. While feature size shrinks are on schedule (Moore's Law track), there are increasingly serious problems in stopping electric current from leaking. The problem is that the silicon dioxide (used for more than 40 years) has been shaved so thin that an increasing amount of current is seeping through, wasting electricity and generating unnecessary heat. But now, Intel and IBM have discovered a way to replace that material with various metals in the gates that turn the transistor on and off. Intel expects to launch new low-loss microprocessors using the new materials in Q3-2007. Intel also said the chips will be built using its new manufacturing process that involves shrinking parts of the chips down to 45 nanometers, or billionths of a meter, from the 65-nanometer now in use. While IBM won't sell the chips by themselves, they expect to begin selling servers with chips using the technology in 2008. AMD expects to use the technology in its own chips at 45-

nanometer in mid-2008. [Many would not consider this to be Nanoelectronics since conventional inorganic materials are still used, but it is right in the middle of Nano-scale].

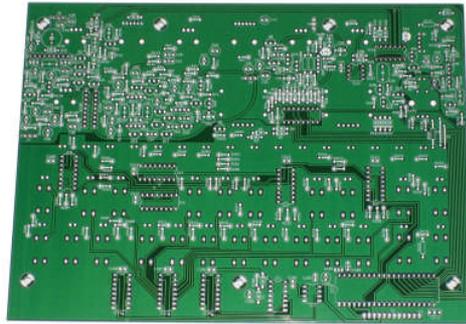
**Below the Nanotech Scale - Molecular Electronics** - A team of UCLA and California Institute of Technology chemists reported the successful demonstration of a large-scale, "ultra-dense" memory device that stores information using reconfigurable molecular switches. This research represents an important step toward the creation of molecular electronics that are much smaller and could be more powerful than today's silicon-based computers. Two-state rotaxane molecules designed in the UCLA laboratory act as switches to store information in an ultra-dense 160-kilobit memory made up of a 400 x 400 grid of nanowires. The 160-kilobit memory device uses interlocked molecules. The memory is based on a series of perpendicular, crossing nanowires, similar to a tic-tac-toe board, with 400 bottom wires and another 400 crossing top wires. Sitting at each crossing of the tic-tac-toe structure and serving as the storage element are approximately 300 bistable rotaxane molecules. These molecules may be switched between two different states, and each junction of a crossbar can be addressed individually by controlling the voltages applied to the appropriate top and bottom crossing wires, forming a bit at each nanowire crossing. A rotaxane is a molecule in which a dumbbell-shaped component, made up of a rod section and terminated by two stoppers, is encircled by a ring. It has the potential to be a molecular abacus. The bistable rotaxanes behave as switches by incorporating two different recognition sites for the ring, and the ring sits preferentially at one of the two. The molecule can act as a switch provided the ring can be induced to move from one site to the other site and then reside there for many minutes. The bistable rotaxane molecules used in the crossbar memory can be switched at very modest voltages from an "off" (low conductivity) to an "on" (high conductivity) state. The stoppers for the rotaxane molecules are designed to allow the molecules to be organized into single-molecule-thick layers, after which they are incorporated into the memory device. [We chemists have long practiced our trade in the sub-nano-word and wonder what all the fuss is about with in the Nanotech world]



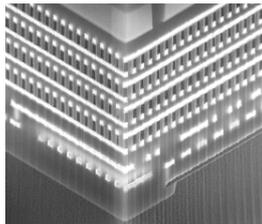
## PCBs PACKAGING & ASSEMBLY

**PCB-Assembly Survey** - A reader survey, by Circuits Assembly, reveals 2007 will be an important year microvias and embedded passives. A survey of some 5,100 designers and assemblers undertaken by UP Media Group in late 2006, indicated that 2007 will be the year when 0201s and embedded passives become mainstream and Pb-free processing provides a major boost to high Tg laminates. Laminate Trends: The majority of respondents expect to continue to use rigid materials. The trend is toward higher Tg laminates, probably because of increased use of Pb-free solder alloys, which have higher melting points than their SnPb counterparts. Design Trends: For the time being, lines and spaces of 4-mil to 6-mil remain predominant, while 3-mil lines and spaces inch toward

mainstream use. No major changes in Cu foil thickness are anticipated. Layer counts are rising incrementally, but single- and especially double-sided boards are still common. Perhaps the next data point explains why: More than half of those responding said they expect to use microvias in their designs within 18 months, up from 34% currently. Embedded passive use will jump markedly as well. Finish Trends: ENIG will remain the preferred final finish among North American companies, the survey found. Pb-free hot air leveling will supplant HASL during the next 18 months, again thanks to implementation of Pb-free designs. Liquid photoimageable will remain the dominant soldermask choice, with 81.6% of respondents indicating use in 12 to 18 months. Use of dry film (17.6%) and screen-defined masks (13.1%) will remain constant. Component Trends: The minimum size of passives will shrink appreciably in the coming months. While 0201s have for years been mainstream in cellphones and other devices such as GPS systems, engineers expect their use to jump during the next year. And the smallest available package style – 01005 – will begin to come into play. In all, nearly 31% of respondents predict they will use 0201 or smaller devices, double the current mark. Board Quality: While most respondents indicated a greater than 95% acceptance rate for bare PCBs from their primary supplier, 13.5% pegged the rate at between 70 and 90%. The most common defects reported on bare PCBs centered on the laminate, followed by solderability and plating. This may be remembered as the year HDI finally joined the ranks of conventional technology in North America. If embedded passive use rises in line with what respondents indicated, that too will boost HDI use, as the two technologies go hand in hand. The reverberation of Pb-free will show up across many new product lines as well.



### **What's the End Game for Memory Packaging?** - Some call it Chip-on-Chip (CoC),



but I prefer C2C, but stacking is the main game in memory and all the memory fabs are playing judging from the large number of patent applications showing up. Earlier systems mounted memory and logic in the same package using system-on-chip (SoC) using dynamic random access memory (DRAM) technology, or a system-in-package (SiP) solution connecting the chips to each other with wire bonding. Each of the several approaches has their

own advantages and disadvantages, but it has been difficult to achieve both large-capacity memory and high-speed data transfer between memory and logic. Stacked memory packaging seems likely to make great strides in commercial use in 2007. Renesas Technology Corp of Japan was planning to adopt the technology in products in the fourth quarter of 2006, and NEC Electronics Corp of Japan in the first quarter of 2007. Both firms plan to offer C2C technology as one of their packages manufactured in-house. Fabless memory manufacturer System Fabrication Technologies Inc of Japan is expected to use C2C technology in digital household appliances in 2007. Sony Corp of Japan began volume production in 2005, but has no plans for sale to the merchandise market. It's possible to achieve both large-capacity memory and high-speed data transfer with

CoC technology because the memory chip is stacked with the logic IC, interconnected to each other with microbumps. Individual memory chips are used, essentially eliminating the memory capacity limitations of merged DRAM. The higher data transfer rate is made possible by the greater bitwidth, achieved by a larger quantity of microbumps. The microbumps are in an array, providing more interconnects than wire bonding, and because they are only several dozen microns in diameter, they offer low parasitic capacitance, resistance, inductance and other characteristics, making it easier to raise the operating frequency. So what's the end game? I think that its wafer-to-wafer (W2W) using through-silicon vias. While the those using wire bond stacking interconnect say that TSV is "too hard", the big guys are working out the processes and filing IP. But it may take until 2008 - 9 to see much commercial action. Ultimately, W2W TSV will win and there can plenty of materials and equipment opportunities.

**Is it TVS Semiconductor, Packaging, or Both?** - Through-silicon vias (TSVs) are pivotal in thermally conscious packaging, and a budding consortium pledges to address the technical and cost issues of creating 3-D interconnects using TSV technology for chip stacking and MEMS/sensors packaging. Semiconductor 3-D Equipment and Materials Consortium, EMC3D, unites equipment and materials companies, researchers, and other interested parties in developing processes for creating micro-vias between 5 and 30  $\mu\text{m}$  on thinned 50- $\mu\text{m}$ , 300-mm wafers using both via-first and via-last techniques. Bioh Kim, based in Montana, serves as program director. For more information on the project, visit their website, [www.emc3d.org](http://www.emc3d.org).*[I met with Bioh, and others from the consortium and will report more later].*

**Phase Change Memory Deal** - Qimonda AG has entered a long-term cross license agreement with Ovonyx Inc. for discrete memory products using Ovonyx's and Qimonda's patents and intellectual property relating to Phase Change Random Access Memory (PCRAM) technology. The agreement also provides that Ovonyx will actively support Qimonda's program to develop phase change memory products. Ovonyx PCRAM technology uses a reversible phase-change memory process that provides for high performance, dense, array-addressed semiconductor memory technology that can be used as flash and DRAM memory replacements, as well as in embedded applications such as microcontrollers and reconfigurable MOS logic. Qimonda, formerly the memory division of Infineon Technologies, has experience and a significant portfolio of intellectual property relating to phase change memories through its research and development in the general field, including its present joint research program with IBM and Macronix. Indeed, the trio in December demonstrated a prototype phase-change memory device that switched more than 500 times faster than flash while using less than one-half the power to write data into a cell. The Ovonyx PCRAM technology has the potential to revolutionize the flash and DRAM businesses according to Kin Wah Loh, president and CEO of Qimonda, who intends to expand the program to exploit this emerging technology into commercialization.

