Meeting Full Technology Cycle Requirements

Three Fabs, One Mission

Semefab (www.semefab.com) is a silicon wafer foundry operation manufacturing microelectronics and MEMS in Glenrothes, Scotland. It accomplishes this with three fabs:

- The newest is Fab3, which supports 150mm MOS and Bipolar volume foundry requirements with leading edge geometries of 0.8µm.
- Fab1 supports 100mm MOS and Bipolar requirements down to 2-3µm.
- Fab2 is a 600 square meter class 100 operation (class 10 Photo) for MEMS supporting Fab1 and Fab3. It is completely autonomous with independent air and waste stream handling, thus eliminating any risk of cross-contamination.

This infrastructure investment enables Semefab to work with customers, large and small. Clients can choose to utilize standard process building blocks, or to implement custom processing steps as required.

Semefab actively supports a cost-effective development business model that makes it possible for R&D efforts from industry and academia to have low volume foundry capacity available, necessary to validate new concepts, prototypes, and feasibility studies.

Having both development and volume business models allows Semefab to support its customers throughout the full technology cycle and with their volume needs.

Figure 1 - Aerial View of Semefab, Glenrothes, UK

Fast Facts

Headquarters:	Glenrothes, Scotland UK
Web Site:	www.semefab.com
Founded:	1986
Employees:	95
Major Markets	Foundry for MEMS and microelectronics
Technologies:	MEMS, MOS, Bipolar, Opto-CMOS, ASIC, and Discrete Technologies
Parametric Testers:	Reedholm (3)

And there is quite a bit of volume. As of 2011, Semefab ships more than 200M die per year with about 75% exported to accounts throughout Europe, Israel, North America and Asia.

MEMS Volume Foundry

Semefab supports several volume foundry agreements for pressure sensors, thermopiles, gas sensors, bolometers, and medical MEMS devices.

The MEMS fab makes use of Deep Reactive Ion Etching (DRIE) to create thin membranes and similar features. Semefab is capable of through wafer etching for membrane structures at very high etch rates, double-sided silicon on insulator (SOI) processing as well as trench etching with varying smoothness and aspect ratios.

MOS/Bipolar Model

Semefab works with a number of design houses to put together the device structures from which Semefab can develop and induct a process flow. It also can develop process flows directly from a customer device structure, or directly induct a customer process flow.

As with the MEMS model, this enables technology commercialization and a seamless transition to volume. And in the unlikely event that a customer has extreme volume requirements that cannot be met with the three fabs, Semefab supports technology transfers for use of non-Semefab foundries.

Silicon Glen Leader

Over the history of semiconductor manufacturing, lots of bigger and better-known companies have come, and then shuttered fabs throughout the Silicon Glen region in Scotland. Yet Semefab has been able to tap into the engineering talent in the area and carve out a profitable niche for 25+ years.

There are fabs that run one or two key processes and huge volumes of wafers. That is not Semefab. Instead, they have the knowhow to provide an array of process flows. This forces creativity and cost effectiveness, and enables Semefab to work from the ground up in bringing products to market.

Semefab succeeds in part because they do not have billions to spend outfitting a fab. They have to procure the tools that give them the most utility, reliability and flexibility to run lean. In this regard, they have found a good match with Reedholm test systems.

Parametric Test at Semefab

Semefab has a wealth of experience in supporting process inductions. With a defined process flow, and in collaboration with customers, the Semefab team adds their own process know-how to induct an optimized process flow within the Semefab equipment set. It delivers prototypes against defined parameters for qualification, which is where parametric test comes in.

Figure 2 - Alan Forsythe at Test System

Parametric test is under the Product & Device engineering umbrella headed by Alan Forsyth. He has worked within this area for 20 years and with Reedholm test systems for the last 15 years. Alan points out that Semefab has a distinct competitive advantage by having those in charge of dc test wear two hats – that of process/device and test engineering. "We understand the process technology and what it takes to build a functioning product, as well as what it takes to test it to make sure it works correctly – which is more than Pass/Fail results."

Testers Have Two Main Roles

Process Monitoring

Semefab is open 24 hours a day. Lot size ranges from 25 to 50 wafers, and every wafer is subjected to PCM test. Critical and non-critical data is taken on five sites per wafer. The parameter count can range from a handful of parameters to 100 or more, with roughly 1/3 of the total being critical tests.

JFET DC Sort

Besides PCM testing, the Reedholm systems do double-duty as DC Sort systems. Semefab performs full functional probing of 15/16 million JFET die per month, with 50k JFET die on a 4" wafer.

Figure 3 – JFET Probing

The Reedholm flexible multi-channel architecture enables Semefab to test 10 die in parallel (using 31 channels). This means that the prober only has to step 5k times, rather than 50k times per wafer, which reduces probe time from what would be >5 hours to about 1 hour 20 minutes per wafer.

Semefab then post-processes the resultant test result FMT file to enable off-line inking of failing die. This has enabled Semefab to grow the JFET business from 1M to 15/16M die per month, without having to acquire more probers and systems.

MEM and Discrete Device DC Sort

Semefab builds several MEM devices – pressure sensors, gas sensors, thermopiles – as well as ESD diodes, photodiodes, and other discrete products.

One Reedholm system is interfaced to an automatic probe station outfitted with a porous ceramic chuck. That made it possible to do dc screening measurements with pressure applied. This gives Semefab engineers an early indicator of possible issues with the functionality of a given device.

It is the sheer diversity of possibilities with MEMS devices that keeps things fresh for Alan Forsyth and his team. "It's tough to have a standard MEMS process – there are simply too many process iterations available that when implemented, will make that device work or yield better." On rare occasions, customers have been enticed to have high runners fabricated elsewhere – only to have them return to Semefab because they understand the specialized foundry and MEMS business.