Chips to make life easier & safer

The Power of One Roof

The ELMOS formula for success is based on three pillars: unique CMOS technology, chip design, and proprietary wafer production. All of it is combined under one roof, with outstanding application know-how and close cooperation. This is how products come into being, made to be there for the things you touch and use every day—be it in your car, washing machine, or lawn sprinkler.

ELMOS semiconductor chips make life easier and safer. Inside your car, for instance, they measure and control the air-conditioning system plus ignite airbags in case of emergency. Their chips help you conserve the environment by optimizing engine fuel consumption. The idea is to always be two steps ahead, and give more function in less space.

More than 500 successful products bear witness to a job well done. Ever since 1984, ELMOS has been coming up with complex semiconductors that facilitate intelligent and cost-efficient solutions based on robust and diverse functions.

ELMOS produces over 120 million chips a year. At any one time, more than 150 different products are being processed. Computer aided process management guarantees minimum cycle times in which all relevant quality parameters are continually monitored and saved in databanks.

Fast Facts

Headquarters:	Dortmund, Germany
Founded:	1984
Sales/Revenues:	~$240M (2015)
Employees:	~ 1100
Major Markets:	Automotive Consumer Industrial
Processes:	High Voltage CMOS
Parametric Testers:	Reedholm (6)

ASSP's & ASICs Rule

ELMOS is a developer and producer of semiconductor based system solutions. In doing this, they always offer the customer a product that is just the right answer. ELMOS chips measure, control, and regulate numerous comfort, safety, and engine functions in a vehicle. Its chips can be found inside almost every European car, and many Asian and American brands, which explains why 85% of revenues are automotive. Industrial and consumer markets form additional revenue pillars with ELMOS addressing a variety of sophisticated control functions.

Power of High Voltage CMOS

Why is the ELMOS high voltage CMOS technology so well suited for vehicle applications? Consider the example of the power window lifter. It has a relay driver, analog components, and a micro-controller. While none are difficult to implement, putting them into a car is difficult, particularly the micro-controller—mainly because the nominal 12V power supply has 120V pulses riding on it.

Vehicle electronics must withstand harsh environmental factors—freezing in the winter and glaring hot in the summer. For instance, individual chips in the throttle flap must withstand temperatures of up to 160ºC from heat accumulation during driving.

Moreover, ELMOS must prevent damage due to ESD discharge during garage mechanic servicing.

Parametric Test at ELMOS

ELMOS tests functions and parameters of IC's through efficient use of modern test systems. That core strength has been maintained in transitioning from 100mm to 150mm, and now to 200mm wafers.

The Secret of PT Structures

After having left the front-end production area, wafers are systematically scrutinized in the Backend division. The first step is parameter test (PT), where standard structures for each technology are laid in the gaps between the single chips (scribe line). In PT test, resistors, capacitors, diodes and transistors are individually contacted and measured on a parametric test system like the one below.

"Empirical values" serve to assess measurement results. If results comply with expectations, the wafer is released to subsequent testing. However, wafers that do not fulfill these expectations are scrapped.

The Biggest Change is Testing Volume

Except for the addition of Flash measurements, from a test system perspective there has been virtually no change for more than a decade. That is, measurement quality has been more than sufficient and no improvement is needed to ensure process control.

What has changed is the sheer quantity of tests. For each new technology, there are more tests and more devices to be tested to provide feedback to designers. But the same Reedholm testers meet the needs of those generations of technologies.

A technology from two generations ago had 5 major test programs for a 24-pad-PCM module to handle variants for custom ASIC requirements. A technology now has 10 programs, and the latest will need 20 major test programs. In addition to running more programs, the quantity of parameters has increased in order to meet the demands of designers.

Two generations ago, 115 parameters were routinely monitored in production. Now 230 are being tracked, and the latest technology will need 360 parameters. The quantity of important parameters for Front End (FE) process monitoring, i.e., those directly linked to a finalized process step or layer, is not increasing significantly. For example, all parameters are evaluated for lot release in the latest technology. However, not all are measured to the same extent.

Smart Testing

To keep up with growing volumes, ELMOS has developed smart testing strategies in which the quantity of parameters and sites measured per wafer is altered according to identified requirements. This varies with technology and product. When process upsets occur, sample rates can be increased instantaneously by measuring FE parameters on more sites per wafer.

Last year, ELMOS parametric test engineers became members of the SPC system team. Born out of necessity during the downturn, they have come to realize the benefits of wearing two hats, so the SPC team is now comprised of front and back end engineers. That linkage allows them to share thoughts about matters such as oxide thickness differences between E-Test Evaluation and FE. In short, they have learned and applied what it takes to make better product wafers.

Helping Ensure Uptime

Reedholm systems work around the clock. Uptime is maintained with a set of spare modules and no-charge phone support. Plus, Reedholm makes applications trips to make sure little problems do not become big ones.

Wafer probing is highly automated and takes place in clean room conditions. For nearly ten years, every ELMOS wafer has been parametrically classified under direction of Bernhard Gottmann. His previous work as a finished electronics quality engineer gave him good insight into what is important to the end customer. After spending his first few years at ELMOS creating standard MOS cell layouts, he volunteered for an opening in parametric test.

What surprised him most about parametric test was the measurement precision, and the great efforts taken to exactly match results between systems.