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Hunting a Ghost – DRAM Quality in Supply

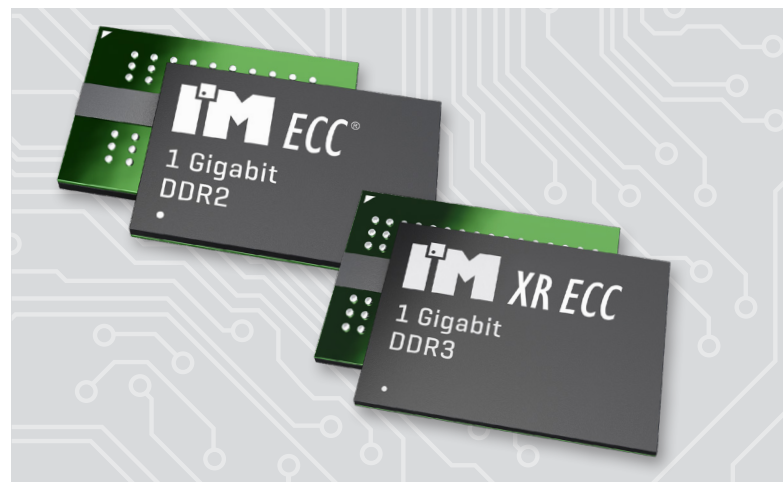
Just three decades ago, DRAM memory production was still at its infancy. The price for a single component was a double-digit dollar value. The package, assembly and testing costs accounted only for a very little portion of the total price of the components. Parts that did not pass all the quality expectations during testing were simply scrapped.

Since these early times, the scale of economy has forced the memory manufacturers to dramatically reduce the sales-prices and margins by exponentially increasing the output. One key-factor to keep the profitability was to avoid scrapping marginal quality parts. Each and every produced component regardless of the quality level should find a customer that can use it.

“Remember that Time is Money”

Benjamin Franklin, 1748

With memory-pricing going down over the years, today the testing-time takes a major share of the DRAM production cost. DRAMs consist of billions of tiny and “leaky” capacitors suffering from degradation over time, while customers expect them to run perfectly well for years at data transfer rates of multiple Gigabits per second with lowest possi-



ble power consumption. The required efforts for testing DRAM components to high quality levels are immense. A high quality industrial grade memory component needs to survive 10 to 30 hours of burn-in testing and must pass hundreds of bit pattern tests for core functions and speed testing together with extra large guard bands for the data retention time and other quality critical values.

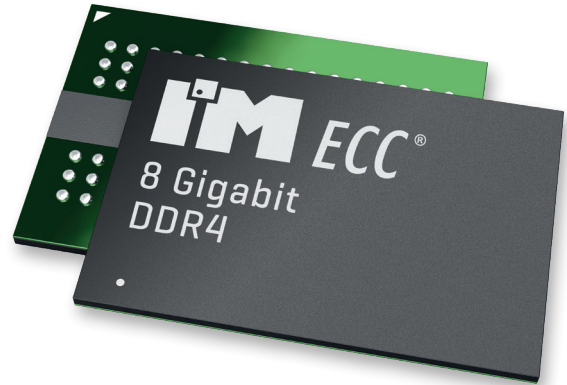
However, as the majority of demand for memory devices originates from consumer products like home computers, tablets, MP3 players, set-top boxes and similar devices which are very cost sensitive, DRAM manufacturers have adapted their testing efforts for a large portion of their production to a minimum testing depth that “just fits” the lower quality requirements for standard consumer applications. Especially the burn-in

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testing, which takes up most of the test time but is important to assure long-term operation, often is shortened as consumer products typically just have a one year warranty. "Remember that Time is Money", a famous expression coined by Benjamin Franklin, abodes well here for DRAM testing time. Consumer products are cost sensitive and to lower DRAM cost the test time is reduced.

Furthermore, parts with partial fails in their memory array get downgraded to a lower capacity and sold to less demanding customers, for example in the toy industry. Parts with a few defective cells spread over the whole chip may be sold into applications that use the memory just for audio data. Every part produced needs to be turned into cash to remain profitability. Scrapping equals a loss!

However, especially for industrial, medical, server, networking, automotive or other critical applications that need a stable 24/7 operation, it is mandatory to use memory components that have passed



Rugged DRAM for temperatures up to 125° C

manufacturers just have no entry to this low cost market as it is completely in the hands of the top 5 suppliers producing memory who pay for their own multi-billion dollar wafer, packaging and testing facilities. So with DRAM manufacturers building DRAM products with BOTH a short test time 'consumer grade quality' and also an extensive test time 'server/industrial/network quality', the key question becomes **"How can you distinguish them apart if the part number on all their parts are identical?"**

Unfortunately, the actual quality of the memory



Automotive



Communication



Industry



Networking



Medical



Optical

the most intensive testing and should come from the best wafer sorts. Many of the smaller fabless DRAM manufacturers still concentrate on industrial memory for high-end applications, performing always deepest testing on their devices and scrapping all non-conforming parts. Even though many of these fails might still be good enough for home PCs or consumer products, the small memory

shipped is kept strictly confidential. The part number marked on the device that the customer sees is the same for all quality levels sold and only differs for the speed and temperature range, making it impossible for customers to find out if the product received was tested intensively or just for consumer applications or maybe even downgraded. Only the DRAM manufacturers themselves can

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look up the quality grade in their internal system by checking the lot codes printed on the components and labels.

When providing the first samples of DRAM memory components for a new project or a new customer, the memory manufacturers expect their distributors to register the end-customer name, CPU and application together with the expected demand quantity. This way the DRAM manufacturers can do their internal selection of the quality grade to be supplied for the specific user/application and organize the allocation of the supply for mass production. The memory manufacturer expects that the same distributor who supplied the samples to the end customer will also serve the customer during mass production. This method

to receive non-conforming product without the manufacturer's knowledge and quality control.

Parts that were originally supplied for the use in toys could easily move into a life saving medical device or an industrial application. There is no doubt the product will initially work as every DRAM gets generally tested before shipping. To be clear: a DRAM with lower testing intensity meaning a lower quality grade does not necessarily result in a noticeable failure rate of the application. Eventually however, customers have more randomly appearing system freezes or erratic behavior of their application that recovers upon a reboot. We all know these kinds of problems from our PCs and laptops. They are typically related to transient memory fails on single data bits. The frequency of

MEMPHIS Linecard 21 different manufacturers



guarantees the correct quality grade is provided to the customer.

In a perfect world this would work, but in reality customers and especially the worldwide EMS companies reserve the right to shop around to optimize their purchase cost. At the same time the majority of suppliers are desperate to grab additional business from customers just to increase their sales volumes, even though they were never involved in the customer's project before and have not registered the business with the memory manufacturer nor sampled the parts. While this is legitimate, it results in a high risk for the customer

these fails increases with the age and intensity of use of the DRAMs. Luckily, customers rarely ever return a product due to transient errors appearing every month or two. Still, it is not the intention of industrial customers to utilize memories with a lower quality grade than they have been originally sampled, especially for liability reasons. Depending on the application, DRAM fails either transient or permanent, can cause field fails, injury, death, massive recall action or in best case just unhappy end customers.

A change of the supplier must require a notification to the DRAM manufacturer as well. To keep the proper quality level it is crucial to make sure that

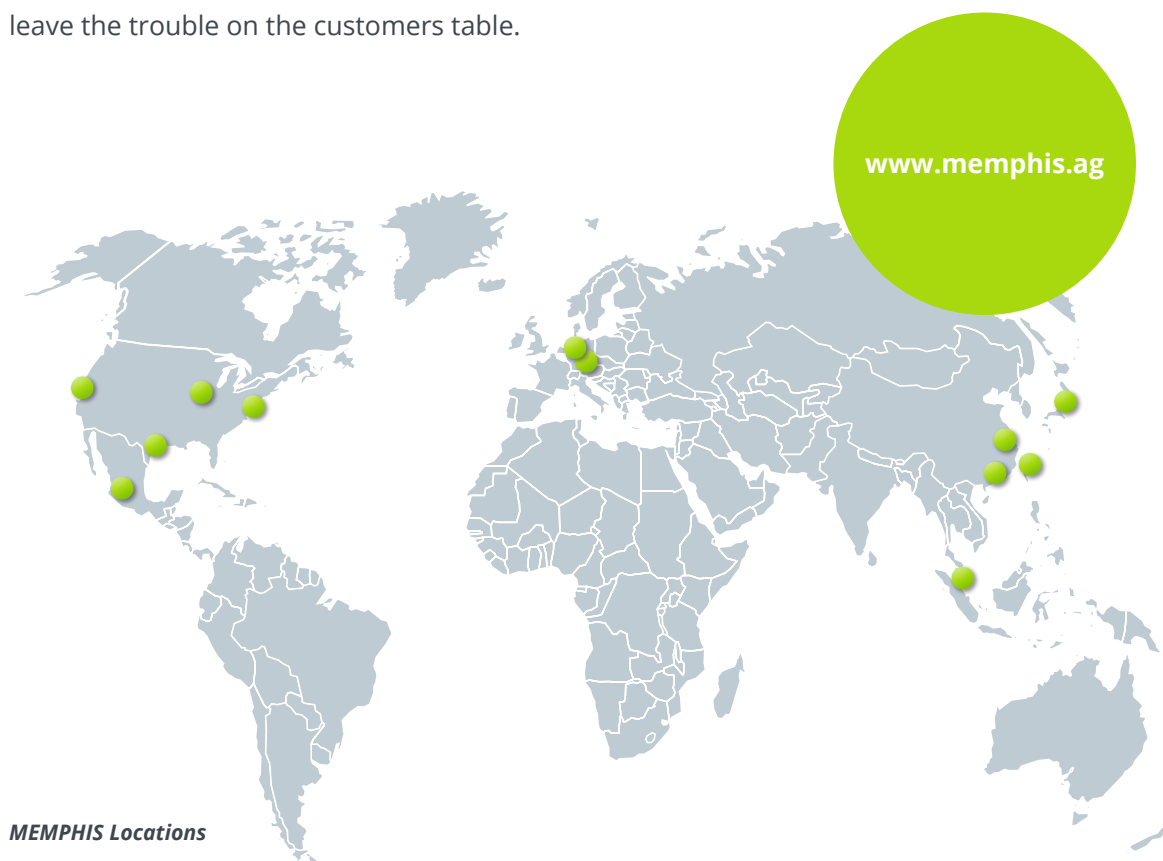
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the new supplier notifies the manufacturer and requests confirmation to support the same level of quality of the DRAM for the specific customer and application. Unfortunately, not all suppliers follow this process and just take orders and fulfill them with any parts they have in stock or regularly get supply of for other customers they serve. Just by purchasing from "any other" franchised distributor does not automatically mean that the parts are of the same quality level as the samples provided before by another distributor.

Without notification and confirmation, the DRAM manufacturers may refuse their support & liability for any quality and performance issues! As a consequence, the distributor who supplied the products without manufacturer confirmation will not be able to request a failure analysis or coverage for any financial claims, which in the end can leave the trouble on the customers table.

The specialized memory distributor **MEMPHIS ELECTRONIC** has sole focus on supplying industrial components from over 20 different memory manufacturers including Nanya, Samsung, Micron, Hynix, Winbond, Intelligent Memory and many more. MEMPHIS Electronic takes highest care about the quality grades supplied in cooperation with the DRAM manufacturers. Also, MEMPHIS Electronic manufactures memory modules utilizing only known high quality DRAM components supplied directly from the DRAM manufacturers and certified to be used for industrial applications.

With sales offices and warehouses all around the globe, MEMPHIS has no regional limitations to ship to EMS companies on all continents with the same quality grades as originally sampled to the OEM customer in any other region.

**MEMPHIS Locations**