CUSTOMER SERVICE NOTE

MICRON KNOWN GOOD DIE DEFINITIONS

Introduction

Micron performs standard wafer-level known good die testing (KGD-C1) on all DRAM products to determine the functionality of parts to be used in bare die applications. Only those products that meet the stringent quality controls of Micron's wafer-level testing are eligible for KGD applications. For a part to qualify, its parametric data must fall within the predefined criteria for that part to continue as a KGD product. Deviations are prohibited.

Micron also offers enhanced testing (KGD-C2) of certain parts to verify full functionality at the AC and DC specifications published in Micron's data sheets. KGD-C1 addresses reliability, while KGD-C2 addresses quality. Together, the tests enable Micron to produce KGD devices that meet most application requirements. For additional information about Micron's KGD program, refer to TN-00-14, "Understanding the Quality and Reliability Requirements for Bare Die Applications."

KGD-C1 Stress Testing

KGD-C1 testing includes subjecting wafer-level parts to highly accelerated DC voltage stress. Performed at high temperatures, typically, 90°C–105°C, the DC voltage stress test, can detect most memory array defects by applying static bias to the main terminals of the array, the row lines, the digit lines, and the cell plate.

While it is not the same as wafer-level burn-in, the test does help reduce the number of defects that can render a part unusable before it leaves the factory. More importantly, when combined with additional screening, it can be used to identify known good die.

KGD-C2 Stress Testing

Parts that meet all the requirements of KGD-C1 testing undergo additional testing at the C2 level. Micron performs a hot die sort (HDSRT) at the upper temperature limit to ensure devices conform to the full AC and DC parameters of their respective data sheets. Depending on the product, ambient die sort (ADSRT) or cold die sort (CDSRT) testing may be done to screen parts for full conformity to specifications at the lower temperature limit.

KGD-C2 Target Parameters

Micron monitors testing parameters on an ongoing basis through burn-in testing of packaged parts.

- Quality (measured in defective parts per million [DPM])
  - 500 DPM = 99.95% yield at time 0 for all AC and DC parameters across the entire voltage and temperature ranges.
- Reliability (measured in failures in time [FITs])
  - EFR = <500 DPM in the first month of operation.
  - Latent = <200 FITs.

KGD Wafer Flows

- KGD-C1 = hot testing and repair of the memory array utilizing design for test (DFT) techniques. Highly accelerated stress testing is also performed at this step.
- Lot disposition = used to confirm parts meet KGD requirements.
- KGD-C2 Hot = native mode testing of the part to confirm all AC and DC parameters meet data sheet specifications at the upper temperature limit.
- KGD-C2 Cold (or ambient) = native mode testing of the part to confirm all AC and DC parameters meet data sheet specifications at the lower temperature limit.

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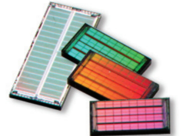
Micron's Known Good Die

Our Highest-Quality Bare Die



Maximize Performance, Board Space, and Confidence

Requirements for smaller form factors and higher memory densities are fueling the need for bare die memory solutions due to their superior flexibility. Bare die can be used in packaging technologies such as systems-in-a-package (SIPs) and multichip packages (MCPs) to reduce the board area required, making them ideal for cell phones, digital cameras, and many other applications. With reduced trace lengths between devices, bare die-based solutions also enable higher-frequency operation as processor and bus speeds increase.

These benefits can come at a cost, however. Because the poorest performing die in the stack determines the quality of an MCP, it is important that customers not be forced to scrap expensive devices due to a nonfunctioning or unreliable part. The burden falls on memory manufacturers to deliver bare die products that maintain reliability and quality levels similar to fully tested and burned-in packaged devices.

An Imperative for Reliability and Quality

Micron's test programs and restrictive screening criteria ensure we only supply bare die that meet rigorous specifications for functionality, quality, and reliability.

Comprehensive functional coverage at wafer test provides high-quality die, while proprietary wafer-level stress is used to reduce infant mortalities. In addition, data from Micron's intelligent AMBYX™ burn-in system provides detailed failure information, which is correlated to abundant wafer parametric and functional data. This enables us to predict failure rates and ensure the highest standards for KGD applications.

Ensuring the Quality of Your End Product

Micron offers two fully developed die test programs to reduce time-to-market and ensure the quality of the end product. Micron's standard wafer-level known good die testing (KGD-C1) is optimized to provide cost-effective test coverage for most memory destined for packaged part applications. While this coverage is more than adequate for most applications, others require a more stringent level of test coverage.

Micron's extensive KGD-C2 program begins with standard (KGD-C1) quality tests, including die stress, and then extends to testing the die for full functionality of published AC/DC and speed specifications. Our enhanced wafer-level testing ensures that Micron's bare die products meet our most rigorous specifications, making them what we believe to be the highest-quality known good die in the industry.

KGD-C1 Tested Products

- Mobile SDRAM: 64Mb, 128Mb, 256Mb, and 512Mb
- Mobile DDR SDRAM: 128Mb, 256Mb, and 512Mb
- Boot Block Flash: 4Mb, 8Mb
- Q-Flash® Memory: 32Mb, 64Mb, and 128Mb
- CellularRAM™: 16Mb, 32Mb, 64Mb, and 128Mb
- CMOS image sensors: 1- and 2-megapixel (1/3-inch) and VGA (1/4- and 1/6-inch)

KGD-C2 Tested Products

- CellularRAM™: 16Mb, 32Mb, 64Mb, and 128Mb
- Mobile SDRAM: 64Mb and 128Mb
- Mobile DDR SDRAM: 128Mb

Learn more about Micron's reliable known good die by visiting ***www.micron.com/baredie***.

www.semidice.com

www.micron.com

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