

## Military & Space Upscreening

Mimix performs Class KC, K, HC, H, S and B space and military die and package upscreening in accordance with customer specifications (source control drawings (SCD)) or if not specified, to the standard die, package or group screening/inspection tables found in MIL-STD-19500, MIL-PRF-38534, or MIL-STD-883. If the final application requires Hi-Rel product upscreening for military or space end-use, please contact one of our sales representatives and specify complete screening criteria. Mimix has the capability to upscreen both standard catalog die and packaged product to the following Hi-Rel standards:

### MIL-STD-19500 (Class KC, HC, JANS/TXV/TX)

- o Table G-II Die Element Evaluation (LAT - Class KC, HC)
- o Table E-IV Package Screening (LAT - JANS/TXV/TX)
- o Table E-V Group A Inspections
- o Table E-VI Group B Inspections
- o Table E-VII Group C Inspections
- o Table E-VIII Group D Inspections

### MIL-PRF-38534 (Class K, H)

- o Table C-II Microcircuit/Semiconductor Die Evaluation (LAT - Class K, H)
- o Table C-VI Package Evaluation
- o Table C-VII Substrate/Package Element Evaluation
- o Table C-IX Packaged Device Screening
- o Table C-Xa Group A Electrical Test
- o Table C-Xb Group B Testing
- o Table C-Xc Group C Testing
- o Table C-Xd Group D Testing

### MIL-PRF-38535

- o Table III Group A Electrical Test
- o Table II Group B Testing
- o Table IV Group C Testing
- o Table V Group D Testing

### MIL-STD-883 (Class S, B)

- o 5007 Table I Wafer Lot Acceptance Tests (WLAT)
- o 5004 Table I Class Level S and Level B Screening
- o 5005 Table I Group A Electrical Tests
- o 5005 Table II Group B Testing
- o 5005 Table III Group C Testing
- o 5005 Table IV Group D Testing
- o 5005 Table V Group E Testing

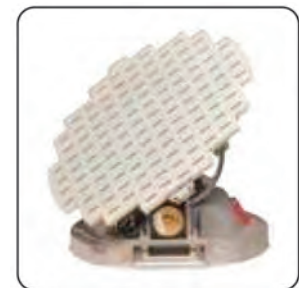
## High Reliability Heritage/Experience

Mimix first Hi-Rel die qualification program started over 20 years ago. Since 1988, Mimix has developed a high-reliability capability and experience to serve the growing market for space qualified microwave and millimeter-wave die and packaged products. Shipping both die and packaged products, Mimix military and space upscreening qualification programs occur on a regular basis with many qualifications adding to our ever increasing die bank inventory and space flight heritage. Mimix product flight heritage includes many well-known and classified satellite programs.

Mimix has developed and established the controls and processes necessary to supply the demanding Hi-Rel marketplace. With a product base featuring inherently reliable GaAs-based devices, circuits, and processes, Mimix is capable of meeting the most stringent Hi-Rel requirements. Typical Hi-Rel products are based on the following technologies:

- GaAs epitaxial material based FETs and MMICs
- Access to and experience with multiple foundries and foundry processes that have space heritage/flight time
- In-house high magnification QC/QA inspection
- Multi-level thin film circuit metal technology
- Hermetic sealing and laser welding technology
- Vast experience with all Hi-Rel standards listed herein
- Established close relationships with several outsource screening suppliers
- Providing many packaged products utilizing on-board device ESD protection

Additionally, based on our many years of experience, the Mimix design team, when designing products for new applications, pays particular attention to past device failure modes, utilizes internal thermal imaging capability and imaging history for thermally efficient designs, and thoroughly considers DC power efficiency and performance tradeoffs.



## Qualification Basics

Mimix starts with an underlying foundation of reliability by using GaAs materials created with foundry processes that have proven space heritage. Each wafer received from the foundry is 100% DC and RF tested on-wafer (contact factory as some products are not conducive to on-wafer RF testing, i.e. FETs, etc.) using in-factory developed automated test systems. Automated DC or RF on-wafer testing can be custom tailored to specific performance requirements as required by the end use application. Each parameter tested is reviewed using in-factory statistical data analysis tools and compared to previous wafer runs. Many of the larger die products also include serialization allowing increased traceability not only to wafer material and wafer manufacture date, but to specific on-wafer DC and RF performance.

Mimix high magnification inspection capability goes up to 1000X satisfying MIL-STD-883 Class S inspection requirements. Wafers are subjected to bond pull, die shear and SEM analysis. Element evaluation, final package parts and production modules are assembled using space grade design, assembly and handling techniques. Mimix capabilities and experience include Class H, K and S die element evaluations and JANS/TXV/TX and Class B and S packaged screening and group level inspection requirements. Additionally, Mimix can accommodate on-site die selection, pre-element eval and final package precap customer source inspections.

## Hydrogen Poisoning

Hermetic microwave and millimeter-wave packages and modules typically employ iron- and nickel-based alloys with plated layers that contain or use hydrogen in the manufacturing process. Usually, the hydrogen will outgas and not cause a problem, but in a hermetically sealed package, hydrogen is known to cause degradation in some types of GaAs devices. Hydrogen poisoning of GaAs devices is manifested by a sudden and dramatic change in device electrical properties, which can occur after several hundred to several thousand hours of hydrogen exposure at elevated temperatures.

While there are a number of options for dealing with this problem two of the most common include reducing the hydrogen to some extent by vacuum baking the package parts just before assembly and seal; however, care must be taken to not impact other package properties. Another option is to use an in-package hydrogen getter to reducing the hydrogen amount to safe levels. The use of getters in semiconductor packaging for substances such as water vapor and particulates is common, and there are several commercial as well as proprietary hydrogen getters that can be employed in microwave packaging. To be effective, the sensitivity of the device technology to hydrogen must be determined to ensure that the getter has adequate capacity to maintain a safe hydrogen level within the package during the expected lifetime of the device.

Hydrogen poisoning studies are available from each of Mimix's foundry partners. Additionally, many Mimix products have been designed and fabricated using a proprietary material stackup and processing allowing the devices to be virtually insensitive to hydrogen poisoning effects. Contact one of our sales representatives for a complete product listing.

## Program Management

Mimix has an experienced program management team providing support for Hi-Rel orders. This expertise includes significant experience working with and expediting government DX rated orders. From the quoting cycle to the final shipment of an order, program managers provide coordination, contact and control for all Hi-Rel orders. These qualified professionals, have significant experience in working closely with external outsourced screening suppliers and Mimix internal operations and quality resources to schedule, expedite and manage Hi-Rel orders, as necessary. The program manager serves as the project leader and manages each Hi-Rel order to insure on-time delivery and excellent customer interface.

## Documentation

All design, processing, upsampling and testing phases of Mimix military and space device manufacture and qualification are fully documented. Mimix step-by-step flow diagrams for each class level qualification type and group inspection are readily available for review at any time. Upon order receipt the customer order and SCD are reviewed against our standard internal class level and group inspection qualification plans. If a standard Mimix qualification plan does not fit the requirements as outlined by the customer purchase order and/or SCD then a new qualification plan will be custom tailored to meet those specific requirements. All standard or custom qualification plans require customer approval before proceeding.

Mimix standard and custom qualification plans include all the necessary information to inspect, assemble, test and screen each specific set of devices undergoing upsampling qualification. All internal assembly and test methods used during qualification are fully documented processes and procedures. A qualification plan traveler will accompany each lot of devices throughout the complete upsampling flow with signoffs required by all involved parties including Mimix internal resources, external suppliers and the customer when required.

At the end of the upsampling qualification a final report will be submitted. This report will include serialized initial, interim and final DC and RF electrical test results, environmental screening results from both internal Mimix resources and external suppliers, complete wafer lot acceptance (WLAT) analysis including all SEM photographs, a serialized device status spreadsheet indicating any failures and failure points and if required DPA and RGA analysis results. These reports can be supplied in either hard copy or electronic formats.

**Hi-Rel Screening Flows – See Separate Pages**