AMKOR TEST SERVICES

Dedicated to comprehensive quality and customer support
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AMKOR TESTS A VARIETY OF DEVICES, ACROSS MANY MARKETS
A HISTORY OF QUALITY

With knowledge gathered from decades of supporting Tier 1 and emerging industry leaders, Amkor understands that test solutions must address advanced technology, quality, performance and cost of test. Through early engagement in each customer’s product lifecycle, Amkor helps define test strategies and intelligent equipment selection to provide differentiated test solutions.

WHO IS AMKOR?

Amkor provides comprehensive test services that complement wafer-level and package assembly

We are the #1 OSAT supplier for Automotive

Amkor has a vast array of test capabilities and rich experience in device testing

Markets
• Automotive & Industrial, Communications, Networking, Computing and Consumer

Applications
• Analog/Mixed Signal, Digital, Imaging, Memory, Power/Discrete, PMIC, RF, Sensors & Actuators and SoC(s)

Advanced Packages
• 2.5/3D, Cavity MEMS, fine pitch Cu pillar, MCM (Multi-Chip Module), advanced SiP, SWIFT®, WLCSP, WLFO
ACCURATE AND THOROUGH TEST SERVICES
Wafer probe, final test, strip test, film frame test, system level test, post-saw test, opens/shorts test, burn-in and complete end-of-line.

24/7 Operation of fully networked test floors

Full range of test consultation, development and engineering services across our customer’s product lifecycle

IN 2016 WE TESTED >7 BILLION UNITS USING >2,500 TESTERS

OUR SITES ARE STRATEGICALLY LOCATED
near leading foundries, major customer sites and co-located to support probe with bump/WLCSP and test with assembly

Co-location benefits include:
FAST feedback
STREAMLINED logistics and SHORTER cycle times

LOCATIONS & SERVICES

PORTUGAL
- Wafer probe
- Communication, Memory experience, RF
- WLFO
- UFLEX RF, Rack & Stack, T5XXX
- Test development

CHINA
- Wafer probe/Package test, Film frame test, System level test
- Communication, Memory
- Bumping, FC, CSP, MLF®, PBGA
- 93K, UFLEX, FLEX, J750, Magnum, TS5XX
- Test development

KOREA
- Wafer probe/Package test, Film frame test, System level test
- Automotive, Consumer, Communication
- Bumping, FC, CSP, MLF®, TSV, TMVP® TQFP
- 93K, UFLEX, FLEX, J750, TS5XX, T2K
- Test development

JAPAN (J-DEVICES)
- Wafer probe/Package test
- Automotive, Consumer, Memory
- FC, PBGA, QFN
- 93K, UFLEX, FLEX, J750, T2K, Magnum, T65XX
- Test development

TAIWAN
- Wafer probe/Package test, Film frame test
- Communication, Gaming, PC
- Bumping, FC, WL CSP
- 93K, UFLEX, FLEX, J750, T2K, ETS, LTX, T6XXX, STS
- Test development

MALAYSIA
- Package test
- Power, Discrete
- TO-220FP, SO8-FL, SO14-FL, QFN8-FL, TESEC, CATS, ITS, Tsuruga

PHILIPPINES
- Wafer probe/Package test, Film frame test, System level test, MEMS test
- Automotive, Consumer, Memory
- MLF®, Leadframe, QFP, Burn-in
- 93K, FLEX, J750, T2K, Magnum, ETS, LTX, D10, ASLX
- Test development
**ROADMAPS FOR TESTING**

Amkor has an extensive equipment fleet and continues to invest in new capabilities required to test the latest devices.

Primary testers, probers and handlers include:

**TESTERS**

<table>
<thead>
<tr>
<th>APPLICATION</th>
<th>MIXED SIGNAL</th>
<th>POWER ANALOG</th>
<th>RF</th>
<th>MEMORY</th>
<th>CIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PS400/800, T657X, I-FLEX, J750, Catalyst, SX-37XX</td>
<td>PS1600, T2000, UFLEX, Diamond</td>
<td>PS1600 (PS-RF), UFLEX, (UW-12G/24G)</td>
<td>T5503/HS, T5832/33, T5851, Magnum V (VU)</td>
<td>IP750</td>
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<tr>
<td></td>
<td>Chroma 3650</td>
<td>PS1600, T2000 IPS, UFLEX, J750EX/HD</td>
<td>PS1600 (WS-RF), PAX-II</td>
<td>T5503/HS, T5832/33, T5851, Magnum V (VU)</td>
<td>T2000 ISS</td>
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<tr>
<td></td>
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<td>PS1600, T2000 IPS, UFLEX, J750EX/HD</td>
<td></td>
<td></td>
<td>ETS800</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PS1600, T2000 IPS, UFLEX, J750EX/HD</td>
<td></td>
<td>PS1600 (WS-RF), PAX-II</td>
<td>ETS800</td>
</tr>
</tbody>
</table>
TESTERS FOR NAND

![Diagram of testers with data transfer rates and specifications]

PROBERS

![Diagram of probers with application and probe types]

*Tri-Temp option, **Tri-Temp option for FFP
# HANDLERS

## PICK & PLACE

<table>
<thead>
<tr>
<th>Application</th>
<th>Mature</th>
<th>Mainstream</th>
<th>Qualification</th>
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<tbody>
<tr>
<td>&gt;4 SITES</td>
<td></td>
<td></td>
<td>***</td>
</tr>
<tr>
<td>*MT9510</td>
<td></td>
<td></td>
<td>***HT9045</td>
</tr>
<tr>
<td>*CASTLE</td>
<td></td>
<td></td>
<td>***ECLIPSE</td>
</tr>
<tr>
<td>NS70xx</td>
<td></td>
<td></td>
<td>***M4871(G51)</td>
</tr>
<tr>
<td>**NS80xx</td>
<td></td>
<td></td>
<td>TW153</td>
</tr>
<tr>
<td>TW152</td>
<td></td>
<td></td>
<td>**HT1028C</td>
</tr>
<tr>
<td>**HT9045</td>
<td>&gt;16 SITES</td>
<td>**TW153V</td>
<td></td>
</tr>
<tr>
<td>&lt;32 SITES</td>
<td></td>
<td></td>
<td>***HT1028C</td>
</tr>
<tr>
<td>*MATRIX</td>
<td></td>
<td></td>
<td>*NX1016MT</td>
</tr>
<tr>
<td>**TW153V</td>
<td></td>
<td></td>
<td>***HT1028C</td>
</tr>
</tbody>
</table>

## TURRET

<table>
<thead>
<tr>
<th>BOWL</th>
<th>FILM FRAME</th>
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<tbody>
<tr>
<td>NX16/32</td>
<td>NY20 FT2018</td>
</tr>
<tr>
<td>XD248</td>
<td>NY32W PM38</td>
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## GRAVITY

<table>
<thead>
<tr>
<th>&lt;4 SITES</th>
<th>&gt;8 SITES</th>
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<tbody>
<tr>
<td>*SO1000</td>
<td>*SO8000</td>
</tr>
<tr>
<td>*SO2000</td>
<td>*ZEUS</td>
</tr>
</tbody>
</table>

## MEMORY

<table>
<thead>
<tr>
<th>&lt;128 SITES</th>
<th>&lt;256 SITES</th>
<th>&gt;512 SITES</th>
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</thead>
<tbody>
<tr>
<td>HT3309</td>
<td>M6771</td>
<td>M6300</td>
</tr>
<tr>
<td>M6771</td>
<td>M6300</td>
<td>TW350HT M6242 M6243</td>
</tr>
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</table>

## STRIP/FILM FRAME

<table>
<thead>
<tr>
<th>STRIP</th>
<th>FILM FRAME</th>
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</thead>
<tbody>
<tr>
<td>*InStrip HT3323A</td>
<td>FH1200</td>
</tr>
<tr>
<td>SH5000 SH3000 SO3000</td>
<td>InStrip – Accel/Gyro</td>
</tr>
<tr>
<td>Jaguar</td>
<td>OSAI (x140) – Pressure</td>
</tr>
</tbody>
</table>

## SLT

<table>
<thead>
<tr>
<th>HT3016 (x12)</th>
<th>Chroma 3260 (x6)</th>
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</thead>
</table>

## SENSOR/ACTUATOR

<table>
<thead>
<tr>
<th>CUSTOM</th>
<th>TOTAL SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM35 (x8) – microphone</td>
<td>InStrip – Accel/Gyro</td>
</tr>
<tr>
<td>NX32 (x8) – microphone</td>
<td>OSAI (x140) – Pressure</td>
</tr>
<tr>
<td>XD248 (x4) – e-compass</td>
<td></td>
</tr>
<tr>
<td>NX16 (x1) – Hall sensor</td>
<td></td>
</tr>
<tr>
<td>PM35 (x8) – humidity/temp</td>
<td></td>
</tr>
</tbody>
</table>

*Tri-Temp, **Active Thermal Control (ATC), ***Both
AMKOR CAPABILITY HIGHLIGHTS

There are many benefits to partnering with Amkor for full turnkey solutions, including wafer processing, advanced bump, wafer probe, assembly, final test, system level test, burn-in and end-of-line services.

WAFER PROBE

- 25 years experience spanning 4”-12” (300 mm) wafers at 14 nm and below
- Logic, Mixed Signal, Analog and RF including high power (>100A)
- Multiple probe card technologies: cantilever (<1 GHz), vertical (up to 40,000 probes), pogo, membrane (>4 GHz), MEMS and dual-level CoW
- Many topologies: Al pad, fine pitch Cu pillar WLCSP, bump and film frame
- 40 µm pitch and 25 x 25 µm² pads/bumps
- Prober capabilities: alignment to ±1 µm and -55°C to +200°C temperature range

PROBE TECHNOLOGY

<table>
<thead>
<tr>
<th>Cantilever</th>
<th>Cu Pillar Bump</th>
<th>Membrane</th>
<th>MEMS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Cantilever" /></td>
<td><img src="image2.png" alt="Cu Pillar Bump" /></td>
<td><img src="image3.png" alt="Membrane" /></td>
<td><img src="image4.png" alt="MEMS" /></td>
</tr>
</tbody>
</table>

FINAL TEST

- Automatic Test Equipment (ATE)
  - Singulated up to x16/x32 parallelism
  - Massively parallel NAND
  - Strip, massively parallel
    - Leadframe (x308)
    - Saw MLF® film frame
    - InCarrier
- System Level
  - Synchronous & asynchronous
- Specialized Solutions
  - SiP – using distributed test flows
    - 2.5/3D in-situ

BURN-IN

- Development Services
- Automotive (MCC)
- Analog (Shikino Hightech)
- MCU (Shikino Hightech)
- SoC (STK)
- Memory (STK, JEC, AEHR)
  - Small MLF strip (x960)
- NAND
AMKOR LOWERS THE COST OF TEST

In an effort to lower the cost of test, Amkor also offers massively parallel strip test and full test software and hardware development.

MASSIVELY PARALLEL STRIP TEST

For applications with long test times and lifecycles such as serial EEPROM, microcontrollers, power management and op amps, parallel testing in a strip format is cost effective. By utilizing Amkor’s highest density leadframe (XDLF) process, high parallelism is achieved – up to 300 units per touch down.

TEST DEVELOPMENT

Some customers develop their own complete test solutions and offload to Amkor for production. Amkor can enable co-development, or full development, of complete test software and hardware solutions. Engage with us early in the product design for maximum impact, or come to us later in the product lifecycle for significant cost savings with migrations to more cost effective testers and/or higher parallelism.

Working collaboratively with customers, Amkor ensures:

- Novel low cost
- Robust solutions with first-pass yield
- One-stop accountability
- Close linkage to Amkor bump and assembly

Whether a customer needs to bring up NPI or reduce costs and achieve higher throughput, Amkor offers full service test development and draws upon a large existing tester fleet. New testers are only recommended as a last resort.

ASSEMBLY FORMAT

<table>
<thead>
<tr>
<th>Packages</th>
<th>Std Leadframe</th>
<th>Film Frame (FH1200)</th>
<th>InCarrier</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TQFP up to 64 lead, 10 x 10 mm²</td>
<td>Saw MLF® up to 7 x 7 mm²</td>
<td>Saw MLF (including various sensors/actuators (MEMS))</td>
</tr>
<tr>
<td></td>
<td>SOIC (mil): N (150), W (300), Std (208) mil</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TSSOP up to 28 lead (3.0 and 4.4 mm body sizes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PDIP up to 8 lead</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>LGA 12 x 12 mm²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

PACKAGES

TYPICAL TEST DEVELOPMENT CYCLE TIMES

<table>
<thead>
<tr>
<th>Month</th>
<th>Development</th>
<th>SW Development</th>
<th>Program Dev. (3~4+ weeks)</th>
<th>Debug (2~3+ weeks)</th>
<th>Corr/Qual. (1+ weeks)</th>
<th>Release HVM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Month 0</td>
<td>Planning</td>
<td>Proposal S.O.W. P.O.</td>
<td>Socket Load Board Interface (3~4+ weeks)</td>
<td>PIB Probe Card (4~8+ weeks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Month 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

LEAD-TIME PER APPLICATION

- Logic/Mixed: 6 ~ 8 weeks
- Analog: 8 ~ 10 weeks
- RF/MEMS: 12 ~ 14 weeks

Note: Development lead-time can vary depending on customer test requirements.
DIFFERENTIATED TEST BY MARKET

AUTOMOTIVE & INDUSTRIAL

Amkor is the number one automotive OSAT, supporting major Asian, US and European supply chains. Products in this area include infotainment and safety requiring high levels of performance. This requires a much more comprehensive set of test requirements.

- High-quality, standards-compliant processes and systems
- Added inspections and tri-temperature multi-temperature test capabilities
  - Wafer probe at -55°C to +200°C
  - Final test at -55°C to 175°C
  - Burn-in
- Leverage cold wafer probe and perform only room and hot temperature final test
- Supplement post assembly final (functional) test with outgoing post assembly opens/shorts testing, includes 2/4 wire O/S: 2/4 wires Kelvin

CURRENT SOLUTIONS

- Large body SiP (Infotainment) using tri-temperature System Level Test
- ABS & Electronic Control Unit (ECU) test (MLF®, QFP)
- ADAS test (fcBGA)
- IoT (MCU, RF & sensors/actuators)
- Specialized test for electric vehicle components – inverters, converters

IN DEVELOPMENT

- mmWave radar component test – wafer & die-level
- Solutions for LiDAR
- AEC-Q100 grade zero compliant burn-in solutions

AMKOR IS THE NUMBER ONE AUTOMOTIVE OSAT SUPPLIER
COMMUNICATIONS

Over 40% of Amkor’s revenue is derived from Communications (smartphone, tablets and handheld devices). Our leading edge test solutions keep pace with rapid changes in cellular and connectivity technology requirements. Amkor is already well positioned for 5G wireless and its new test requirements – working with leading customers and ATE suppliers, we have next generation RF test capability in place.

- Leverage RF wafer probe capabilities – known good die (KGD) for WLCSP and known tested die (KTD) for SiP
- Multi-site x8 RF test to lower cost
- Augment ATE coverage with SLT (protocol test)
- Address complex SiP with simple SLT
- SoC + memory PoP – double side test/stack
  CSP – memory and logic test
- Advanced ATE w/32 port and 6G
- Local RF shielding -- 60 dBm
- NI-STS for front end RF, SiP and IoT
- Asynchronous test for different RF connectivity standards

CURRENT SOLUTIONS

- Memory interface test through logic or modem die
- DRAM test at system level test and memory fuse blow through logic die
- Top/bottom socket with 0.3 & 0.35 mm pitch respectively
- LTE-A, WLAN, Bluetooth, GPS, Zigbee
- RF front end (Antenna, Switch, Filter, PA, LNA)
- Transceiver, connectivity (Bluetooth, Zigbee, WLAN), GPS
- RF MEMS, Passive On Glass (POG)
- Fine pitch TMV®/MeP
- Mobile AP & BB PoP
- Mobile modem & memory stack CSP
Amkor is a leading provider of high performance test solutions for the demanding networking and computing market – where five nines (99.999%) or higher uptime is expected. We have multiple customers supplying SiP(s), SoC(s) and components into these markets (servers, routers, switches, PCs, laptops and peripherals). Integral to these markets are storage technology and migrations from hard disk drives to solid state drives (SSD). In addition, Amkor has a strong array of NAND test capabilities.

- Distributed test (wafer probe, in-situ test between key assembly steps and final test (SLT and ATE) for 2.5D)
- Active thermal control for 300 watt products across tri-temperature in SLT and ATE test
- Probe solutions and wafer map management for chip on wafer (CoW)
- Dynamic burn-in
- Test during burn-in (TDBI)
- Film frame and strip test (x308 EEPROM)

**CURRENT SOLUTIONS**
- >2 TB bandwidth in package
- High performance
  - >3 GHz DDR4
- Memory interface test through logic die
- UFS Protocol system level test
- PoP, MCP
- eMMC (NAND + controller), MCP (SDRAM + NAND)
- MicroSD, SSD, UFS

**TESTER ROADMAP FOR MEMORY**
DIFFERENTIATED TEST BY MARKET

POWER/DISCRETES

Amkor is a world leader in power discrete devices, with test services that are closely integrated with assembly flow for shorter cycle times and reduced costs. Unique requirements include:

- High current, high voltage
- Adequate thermal capacity
- Kelvin contact-type tests
- Low Rds_on

HIGH-VOLUME PRODUCTS AT AMKOR INCLUDE:

- Intelligent power modules
- Multi-voltage FETs
- Flip-chip MOSFETs
- Insulated-Gate Bipolar Transistors (IGBT)
- Diodes
- Regulators and bipolar transistors for the automotive, power transmission and industrial segments

TEST EQUIPMENT OFFERINGS:

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>MODEL</th>
<th>TEST ITEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesec</td>
<td>881-TT, 351-TT, 341-TT</td>
<td>DC</td>
</tr>
<tr>
<td>ERD</td>
<td>CMS-100S8 Series VS240AN, DTS-241</td>
<td>Rg DC</td>
</tr>
<tr>
<td>Hokuto</td>
<td>AT-999 Series AM-083</td>
<td>VDSX (SUS)/VCEX (SUS)/trr trr/Vsurge</td>
</tr>
<tr>
<td>CATS</td>
<td>DV-240 Series</td>
<td>ΔVDS/ΔVBE</td>
</tr>
<tr>
<td>Minekoon</td>
<td>615-SW</td>
<td>Switching test (trr/rr/t off/t on/Latch)</td>
</tr>
<tr>
<td>ITC</td>
<td>ITC55100C</td>
<td>UIS</td>
</tr>
<tr>
<td>Shibasoku</td>
<td>WL-22, WL-25</td>
<td>IC</td>
</tr>
<tr>
<td>Power Tech</td>
<td>QT-4100 Series QT101 Series</td>
<td>DC UIS</td>
</tr>
<tr>
<td>POWorld</td>
<td>VC6700</td>
<td>Transient test</td>
</tr>
</tbody>
</table>

HANDLERS MANUFACTURER

Gravity TESEC
Ueno Seiki
Turret Sowa
KES SRM
DIFFERENTIATED TEST BY MARKET

SENSORS & ACTUATORS (MEMS)

Products for today’s Internet of Things require an MCU, RF transmitter/receiver, sensors and actuators. The test solution needs to cover conversion of physical real-world analog signals into electrical data and processing of the data to determine if the product is good or not.

<table>
<thead>
<tr>
<th>TYPE</th>
<th>TEST APPLICATION</th>
</tr>
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<tbody>
<tr>
<td>Magnetometer</td>
<td>3-Axis, 0 to 10 gauss, 0.1’ accuracy</td>
</tr>
<tr>
<td>Accelerometer</td>
<td>3-Axis, Low-g, High-g, Strip test</td>
</tr>
<tr>
<td>Gyroscope</td>
<td>3-Axis yaw rate, Gyroscope test</td>
</tr>
<tr>
<td>Microphone</td>
<td>Sound stimulus for both top-port/bottom/port</td>
</tr>
<tr>
<td>Pressure</td>
<td>0 to 20 bar, Strip test, Bench characterization</td>
</tr>
<tr>
<td>Inertial Combos</td>
<td>6-10 Degrees of Freedom (DoF)</td>
</tr>
<tr>
<td>Optical</td>
<td>Auto-focus, Microdisplay, Picoprojectors</td>
</tr>
<tr>
<td>RF Devices</td>
<td>Timing devices, Switch/Varicaps, BFilters, Duplexers</td>
</tr>
<tr>
<td>Emerging MEMS</td>
<td>Energy harvesting, Microfluidics, Ultrasonic gesture recognition</td>
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</table>

INERTIAL

<table>
<thead>
<tr>
<th>Type</th>
<th>Test Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnetometer</td>
<td>x4 3 Gauss, x144 10 Gauss, x256</td>
</tr>
<tr>
<td>Accelerometer</td>
<td>x72 Up to 180°/sec, x144 Up to 90°/sec, x256</td>
</tr>
<tr>
<td>Gyroscope</td>
<td>x72 Accuracy &lt;.5%, x144 &lt;.1%, x256</td>
</tr>
<tr>
<td>6DOF, 9DOF</td>
<td>x72 x144 x256</td>
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OPTIC

<table>
<thead>
<tr>
<th>Type</th>
<th>Test Characteristics</th>
</tr>
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<tbody>
<tr>
<td>IR/RGB/UV</td>
<td>Accuracy &lt;.3%, x32 Accuracy &lt;.1%, x64</td>
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ENVIRONMENT

<table>
<thead>
<tr>
<th>Type</th>
<th>Test Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microphone</td>
<td>x8 SNR 70 dB, THD 130 dB, x35 SNR 73, THD 135 dB, x64</td>
</tr>
<tr>
<td>Humidity/Temperature</td>
<td>x2 Accuracy ±1°C, x144 Accuracy ±0.5°C, x256</td>
</tr>
<tr>
<td>Pressure</td>
<td>x2 Stable time &lt;1 sec, 20 bars, x96 &lt;0.5 sec, 20 bars, x144</td>
</tr>
</tbody>
</table>

MICROFLUIDICS

<table>
<thead>
<tr>
<th>Type</th>
<th>Test Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x2 x4/x8</td>
</tr>
</tbody>
</table>
OTHER AMKOR TEST SERVICES AND PROCESSES

FULL END-OF-LINE PROCESSING
- Bake
- Scan
- Pack
- Ship
- Finished good services

ROBUST FACTORY AUTOMATION (CIM/CAM)
- High levels of quality and efficiency
- RFID and hardware control
- Auto test program loading
- Utilization monitor
- Yield monitor
- Data analysis
- Report automation

OPERATIONAL EXPERIENCE
- Fully automated production environments
- Fast and accurate operation by skilled operator and system

TECHNICAL SUPPORT
- Advanced solution for advanced package (PoP/TSV/fCSP/FCBGA)
- High quality advanced equipment and quick technical support

EXTENSIVE FAILURE ANALYSIS

Non-Destructive Analysis
- E/L Bench Test
- X-ray
- Scanning Acoustic Tomograph

Destructive Analysis
- Decapsulation
- Grinder: X-section
- Microscope
- Field Emission Scanning Electron Microscope

Die-Level Analysis
- Photo Emission and OBIRCH
- Thermal Emission

GLOSSARY
ABS: Anti-lock Braking System
ADAS: Advanced Driver-Assistance Systems
ATE: Automatic Test Equipment
CoW: Chip on Wafer
CSP: Chip Scale Packaging
EEPROM: Electrically Erasable Programmable Read-Only Memory
GPS: Global Positioning System
LIDAR: Light Detection and Ranging
LNA: Low Noise Amplifier
MCP: Multi-Chip Packaging
NAND: Non-volatile storage memory
PMIC: Power Management Integrated Circuit
SiP: System in Package
SLT: System Level Test
SoC: System on Chip
UFS: Universal Flash Storage