High-Accuracy and High-Throughput Placement Systems
GSM.xs™ Small Footprint Linear Motor Platform
GSM.x™ Linear Motor Platform

Universal’s patented Variable Reluctance Motor Technology brings new levels of accuracy and efficiency to the GSM® Platform
The GSMx™ Small Footprint Linear Motor Platform

The GSMx Platform is perfect for advanced semiconductor assembly. It features a linear motor positioning system, a footprint 40% smaller than the GSMx and Class 1000 clean room compatibility.

The GSMx™ Linear Motor Platform

The GSMx Platform gives you the best of both worlds — the accuracy required for placing flip chips and the feeder capacity necessary for placing standard components. This is the machine of choice for assemblies with flip chip devices placed alongside active discretes and passive components.

Accuracy

The accuracy you need...

- The GSMxs and GSMx are built to provide accuracy of ±24 microns @ ±6 sigma.*
- Patented Variable Reluctance Motor Technology
- High performance vision systems
- 1 micron Encoder Resolution (0.000039"

The throughput you want...

- Universal’s linear motor assembly platforms are built to perform at 1,500-4,700 placements per hour.**
- Gang processing ability
- Vision-on-the-fly technology
- Large field of view with the MegaView™ Camera (available for semiconductor assembly)

Flexibility

The flexibility to configure application-specific solutions

- The GSMxs and GSMx Platforms are designed to adapt to your changing needs. Our wide range of options work together to address both the accuracy and throughput issues of present and future application challenges.
- Flexible die feeding solutions
- Advanced vision and lighting features
- Fluxing and dispensing alternatives
- Variable placement force options
- Custom substrate handling solutions

* Specification for a four-spindle Flex Head configuration. Accuracy is measured by Universal’s standard method, using glass slugs and glass slides.

** Actual throughputs are application dependent. Estimates available upon application review.
Linear motors offer many benefits over lead-screw systems, but they are not new to the field of automated electronic assembly. What is new, however, is the Variable Reluctance Motor Technology, introduced and patented by Universal. Variable Reluctance Motor Technology allows for higher precision placement, even at faster speeds.

**Patented Variable Reluctance Motor Technology**

**Competitive Advantages**
- Class 1000 clean room compatibility
- High accuracy with high speed
- Superior thermal performance
- Advanced stability and repeatability
- Increased reliability

**Thermal Performance**
- Nonpermanent magnet system brings 20%* reduction in power dissipation
- Reduced power dissipation lowers core operating temperature**
- Reduced core operating temperatures eliminate the need for cooling and calibration
- No thermal compensation requirements (frame fiducials, thermal coupling)

**Repeatability and Reliability**
- Dual-drive Y-axis improves positioning accuracy and settle times
- Settle times reduced to <30 milliseconds @ ±10 microns
- Settle times reduced to <100 milliseconds @ ±1 micron
- Fewer piece parts reduce friction and maintenance, lowering operating costs

**Dual-Drive Y-Axis**
Linear scale encoders provide 1-micron resolution on both the X and Y-axis.

**The Linear Motor Module**
Laminated E-core utilizes alternating currents to control movement along the stator bar in minute increments for maximum precision.

* Percentage is based on a comparison to permanent magnetic motors.
** Internal temperature rises just 1° over ambient temperature.
Throughput
How we achieve the speed

High Accuracy with High Speed

Achieving volume production of advanced assemblies without sacrificing quality has been a continuous challenge throughout the industry. Universal offers the options necessary to achieve the highest possible throughput for your specific application.

Gang Processing
The GSMx and GSMx Platforms enable you to achieve volume production of flip chip assemblies through a combination of the multiple-spindle head, gang picking and gang dipping capabilities.

- Pick four components simultaneously with the four-spindle Flex Head technology
- Dip four components in flux simultaneously with the Linear Thin Film Applicator
- Dip three components in flux simultaneously with the Rotary Thin Film Applicator

MegaView™ Camera
Improve throughput by imaging large components only once with the MegaView camera’s large field of view. The MegaView .8 mil per pixel camera is Universal’s new high-resolution vision inspection camera for semiconductor assembly. The large field of view is a significant improvement over current technology.

Key Benefits
- On-the-fly vision for die sizes below 18mm and bump diameters up to 75 microns
- Up to 60% improvement in tact time for flip chips larger than .550" x .425"
- Digital 640 vision system provides up to 30% improvement in assembly time over analog systems

The MegaView Camera Advantage

<table>
<thead>
<tr>
<th></th>
<th>.000&quot; per Pixel</th>
<th># of Pixels</th>
<th>Minimum Bump Size</th>
<th>Field of View (approx.)</th>
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<tbody>
<tr>
<td>MegaView Camera</td>
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<td>1,024 x 1,024</td>
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<td>20 mm (0.787&quot;)</td>
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<td>Specifications</td>
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<td>5 mm (0.2&quot;)</td>
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</table>
How we provide application-specific solutions

Options for the GSM$_{xs}$ and GSM$_x$ Platforms

Production lines are no longer dedicated to a single product. New products are always being introduced and high product mix is often the norm. As a result, adaptability of assembly equipment is critical to permit maximum flexibility, optimum cost of ownership and long-term investment protection. With a wide range of options, the GSM$_{xs}$ or GSM$_x$ Platforms can be configured for the task at hand, both today and in the future.

Placement Heads
- High Force Head delivers a placement force range of 175 to 2,500 grams
- Low Force Head delivers a placement force range of 40 to 2,500 grams
- Custom Nozzles cater to special needs applications

Vision/Lighting
- MegaView Camera enlarges field of view to 1,024 x 1,024 pixels while maintaining high resolution (available for semiconductor assembly)
- Pad Site Find goes beyond global and local fiducials, using the circuitry itself for pattern recognition
- UniversaLight™ illumination module uses blue or red lighting to provide high-contrast imaging of low-contrast substrates

Fluxing/Dispensing
- Micro Dispense II precisely dispenses low solids flux onto the center of the placement site
- Rotary Thin Film Applicator provides reliable flux thickness control while enabling high throughput by dip fluxing three components simultaneously
- Linear Thin Film Applicator reduces space required for flux application while increasing surface area for gang dipping four components simultaneously
- Archimedes Metering Valve used to dispense solder paste, silver epoxy, and other adhesives

Substrate Handling
- Precision Board Lifter provides precise registration of the substrate when presenting singulated substrates for placement
- Custom Board Supports and Pallets designed to each application to secure singulated substrates during placement

Die Feeding
- JEDEC Trays
- Precision Slide-Top Feeder locates multiple matrix trays in pick-up area
- Wafer Handler enables die to be picked directly from the wafer
- SurfTape™ provides an open carrier for surface mount devices packages in tape and reel
- Multi-tube Feeder delivers a variety of components from tubes to the pick position
- TrayStak™ Feeder stacks up to 50 matrix trays for automatic feeding

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Application-Specific Configuration Examples

Universal's continuous analysis of industry trends and advances in technology has led to an emphasis on designing flexibility into our equipment. We've developed a wide range of options to ensure ongoing adaptation to ever changing semiconductor assembly processes. Universal Application Engineers will help you decide which configuration will produce the best accuracy and throughput for your specific application. Here are a few examples of configurations we recommend for flip chip on flex, flip chip in package and hybrid assemblies.

Flip Chip on Flex
The GSMx and GSMx Platforms can handle your entire flip chip on flex assembly on one machine, including capacitors and connectors. While giving you this flexibility, we've also developed solutions for improving accuracy, yield and throughput.

Flip Chip on Flex Challenges
- Low-contrast substrates pose imaging problems
- Substrates can be difficult to accurately secure
- Difficult to achieve entire assembly with one machine

Key Options for Machine Configuration
- Blue UniversalLight illumination module to clearly see low-contrast copper-on-polyimide traces
- Custom pallets designed to secure the flexible substrate
- Capability of placing passive components, connectors and bumped devices on one machine

Standard Lighting

Blue UniversalLight Illumination Module

Obscure details of flexible circuit substrates (left) are enhanced (right) by the blue UniversalLight™ illumination module.
Flip Chip in Package
Flip chip ball grid array packages require high-accuracy and high-speed placement of the most advanced flip chip devices. The small footprint GSM.xs Platform configured to manage large dies is a perfect fit.

Flip Chip in Package Challenges
- Achieving high throughput without sacrificing quality
- Meeting advanced precision requirements for die placement
- Ensuring die stability prior to curing or reflow

Key Options for Machine Configuration
- A MegaView camera and a 640 Vision System for large die processing
- Specific vision algorithms for flip chip such as Pad Site Find
- Both dip fluxing and flux dispensing capabilities

Hybrid Assemblies
High volume telecommunications and automotive applications require the placement of active and passive components on advanced hybrid circuits. Universal offers options for the GSM.xs and GSM.x Platform that address both the accuracy and throughput issues of these challenging applications.

Hybrid Assembly Challenges
- Precisely securing and presenting singulated substrates for placement
- Handling of fragile Gallium Arsenide components
- Placing the required range of components with one machine
- Achieving volume production of high-accuracy assemblies

Key Options for Machine Configuration
- Precision board handling permits processing of singulated substrates
- Low force placement for fragile Gallium Arsenide devices
- Tape feeders, waffle packs, and wafer handling all on the same machine
- Multi-spindle placement heads for maximum throughput
### SPECIFICATIONS

<table>
<thead>
<tr>
<th>GSMxs Small Footprint Linear Motor Platform</th>
<th>GSMxs Linear Motor Platform</th>
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</table>

#### Application Capabilities
- Flip Chip in Package (FCHIP)
- Flip Chip on Board (FCOB)
- Flip Chip on Flex (FCOF)
- Chip on Board (COB)
- Chip on Board (COB) Chip on Board (COB)
- Hybrid Assembly
- Standard Surface Mount Type I, II, & III

#### Component Capabilities
- Standard active SM packages
- Bare Die
- Flip Chip
- CSP
- Passives
- Shields
- Connectors

#### Component Feeding Options
- Tape and Reel
- Tubes
- JEDEC Trays
- Waffle Packs
- Wafer
- SurfTape™

#### Component Characteristics

<table>
<thead>
<tr>
<th>Bare Die / Flip Chip</th>
<th>Minimum</th>
<th>Maximum</th>
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<tbody>
<tr>
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<td>0.50 mm (0.02&quot;)</td>
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<tr>
<td>Length</td>
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<td>0.50 mm (0.02&quot;)</td>
</tr>
<tr>
<td>Thickness</td>
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<table>
<thead>
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<th>General Surface Mount Components</th>
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<tr>
<td>Width</td>
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<tr>
<td>Length</td>
</tr>
<tr>
<td>Thickness</td>
</tr>
<tr>
<td>Weight</td>
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<table>
<thead>
<tr>
<th>Board/Substrate Characteristics</th>
<th>Minimum</th>
<th>Maximum</th>
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<tr>
<td>Width</td>
<td>50.8 mm (2.00&quot;)</td>
<td>254.0 mm (10.00&quot;)</td>
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<tr>
<td>Length</td>
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<td>390.2 mm (13.00&quot;)</td>
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<td>Thickness</td>
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<td>5.08 mm (0.20&quot;)</td>
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<tr>
<td>Weight</td>
<td>2.72kg (6 lbs.)</td>
<td>2.72kg (6 lbs.)</td>
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#### Placement Specification
- Placement Rate*: 1,500 to 4,700 cph
- Placement Tact Time: 0.77 seconds
- Accuracy**: ±24µ @ ±6σ, φ±0.2 degree @ ±6σ
- Component Placement Force: 175 to 2,500 grams
- Placement Performance: 50 dpm
- Intrinsic Availability: 98%

1 Boards and substrates below minimum specification require application review.
2 Boards and substrates thicker than maximum specification require application review.
3 Placement forces below or above stated range require application review.
4 Actual throughputs are application dependent. Estimates available upon application review.
5 Specification for a four-spindle flex head configuration.
6 Accuracy is measured by Universal's standard method, using glass slugs and glass slides.