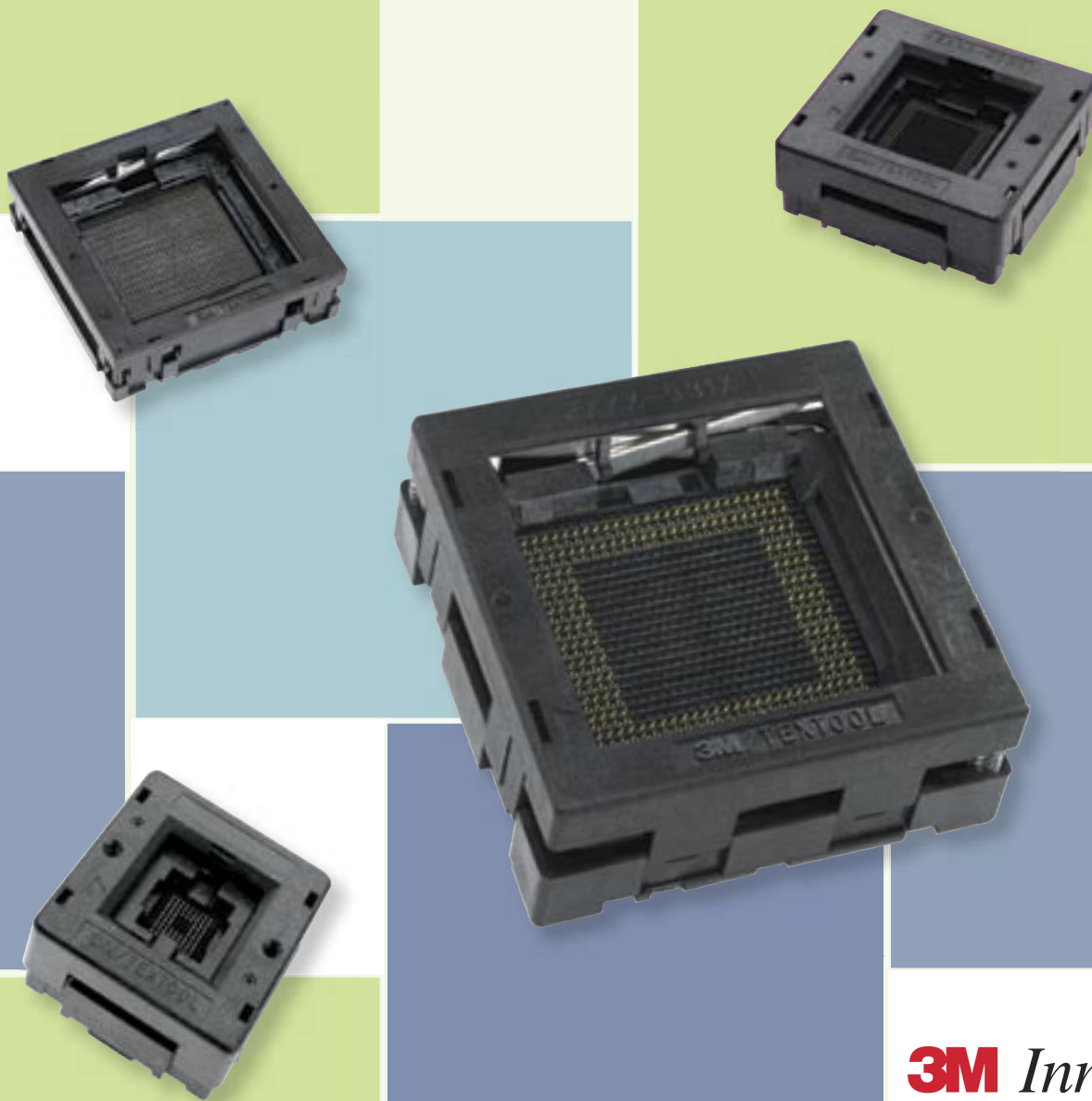


# 3M™ Textool™ Open-Top Test and Burn-In Sockets for Ball Grid Array Packages



**3M** *Innovation*

# 3M™ Textool™ Open-Top Sockets for BGA Packages

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For the most current product and technical information, click on the product names within this PDF, which will take you to the specific 3M Textool Test and Burn-In Sockets product page on the website.

# 3M™ Textool™ Open-Top Sockets for BGA Packages

First to market in 1992 with BGA sockets, 3M continues to expand our product range and available options. The versatile product design and four product platforms enable quick-turn and low cost proliferation of new sizes. 3M provides reliable performance for test and burn-in applications, with a proven design perfected with years of customer experience. 3M provides sockets for most types of BGA packages, standard or custom, in a variety of pitches, including 0.65 mm, 0.80 mm, 1.00 mm and 1.27 mm.

## 3M Textool Open-Top Test and Burn-in Sockets provide the following benefits:

### Dual-Beam Contact Design

- Minimizes ball deformation with low actuation force, minimal shear stress and contact points above center plane
- Maximizes contact durability due to lower stress per contact beam
- Enhances electrical reliability by expanding contact interface zone

### Micro-Wiping Effect

- Optimizes contact interface by removing oxide build-up
- Minimizes solder transfer to contact tips

### Open-Top Socket Design

- Accommodates a wide range of package dimensions
- Compatible with most automated device loaders
- Enables easy manual operation with low actuation force
- Can reduce lead time and cost with modular tooling and optimal footprint density

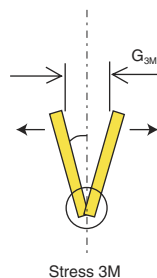
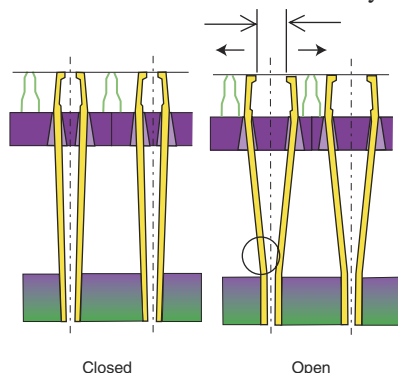
### Global Support

- Local sales and technical service personnel in all major markets worldwide
- Design resources and materials expertise in both the United States and Japan
- Quick-turn product samples shipped anywhere in the world
- Website provides easy access to technical information worldwide

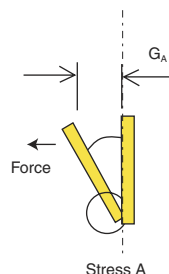
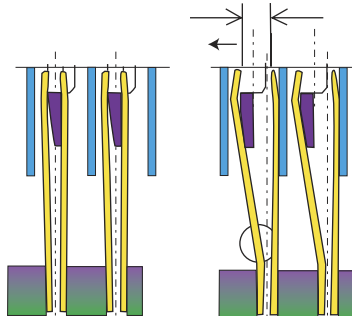
## 3M Contact Durability

3M's dual-beam contact increases socket durability with its patented dual-beam motion.

### 3M's Dual-Beam Contact Motion



### Single-Beam Contact Motion



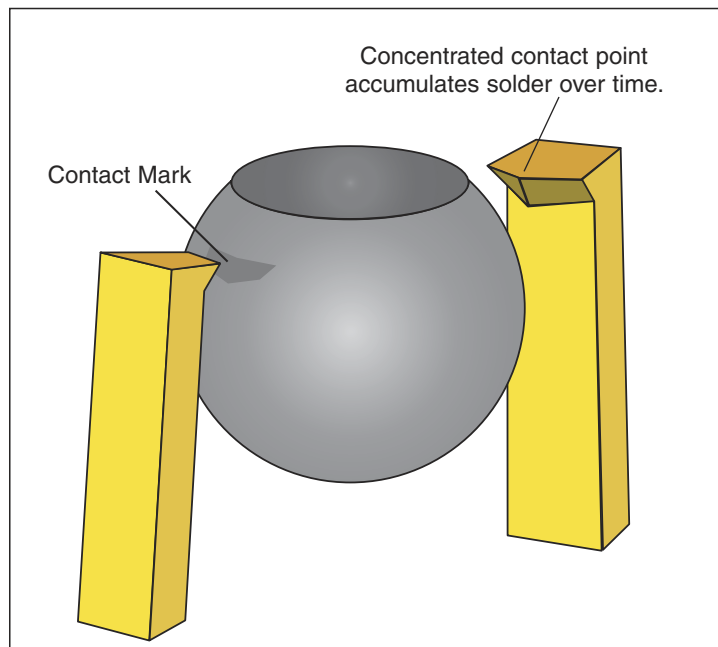
- Since both beams of the 3M contact are moving, each one only has to move  $G_{3M}/2$ .
- For a single beam contact to accommodate the same ball ( $G_{3M} = G_A$ ), one beam must cover the entire gap, thus accelerating the force applied to the beam in motion as the contact travels.
- The added stress of additional travel in the single beam contact increases the likelihood of fatigue-related failures.
- The dual-beam motion of the 3M Textool socket contact prolongs socket mechanical life cycle, which may decrease total cost of ownership.

# 3M™ Textool™ Open-Top Sockets for BGA Packages

## 3M Contact Reliability

3M's micro-wiping contact increases electrical reliability and is intended to decrease total cost of ownership.

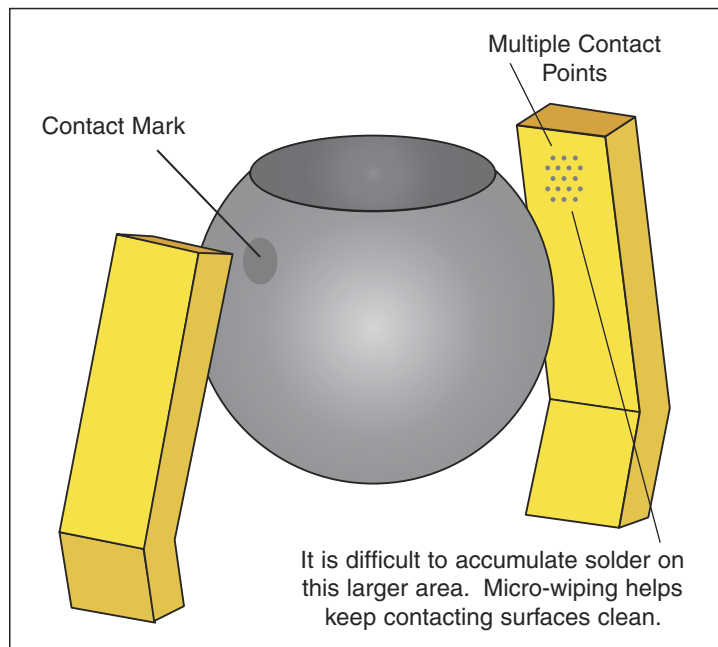
### Competition's Edge-Point Contact



### Piercing Contact

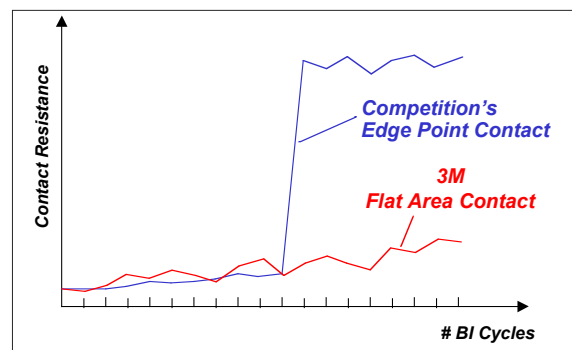
- Encourages solder build-up over time, which in turn increases long-term electrical resistance and decreases reliability.
- Can reduce socket total life cycle and may increase total cost of ownership.
- Expensive cleaning and restoration procedures are sometimes necessary, requiring added cost and board downtime.

### 3M's Micro-Wiping Contact



### 3M's Dual-Beam Micro-Wiping Contact

- Provides larger contact area and micro-wiping motion to reduce solder build-up over time, thus maintaining long-term electrical resistance, increasing reliability and prolonging the life cycle of the socket.
- Can decrease total cost of ownership.



# 3M™ Textool™ Open-Top Sockets for BGA Packages

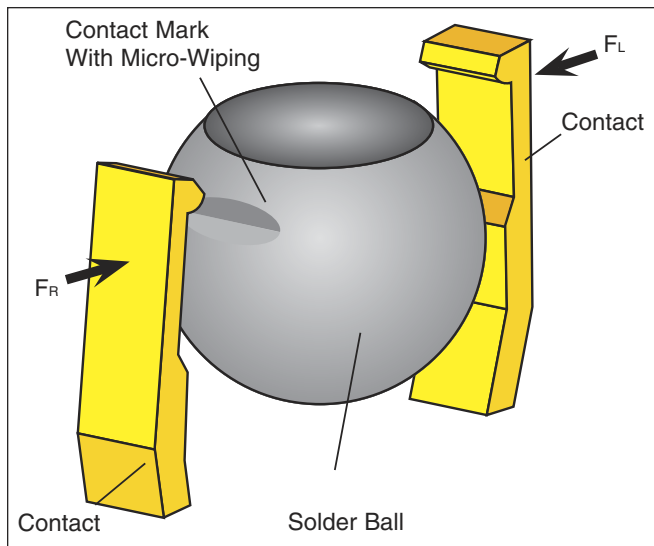
## Micro-Wiping and Solder Ball Deformation

- The contact arms grasp the solder ball above its center. The shape of the contact arm exerts a component of the applied force in a downward direction, enhancing package retention.
- The dual-beam contact provides balanced forces, reducing the shear stress on the solder ball.

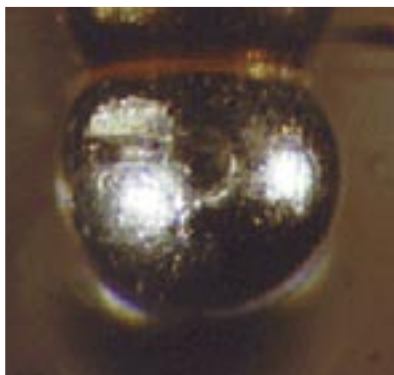
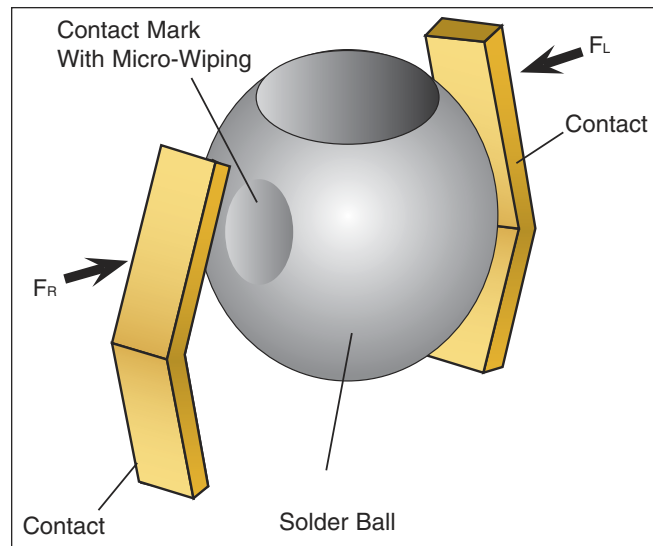
$$F_R = F_L$$

Note:  $F_L$  = Force Left,  $F_R$  = Force Right

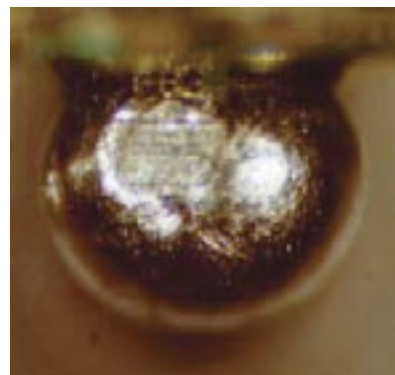
**1.27 mm**



**1.00 mm, 0.80 mm, 0.65 mm**

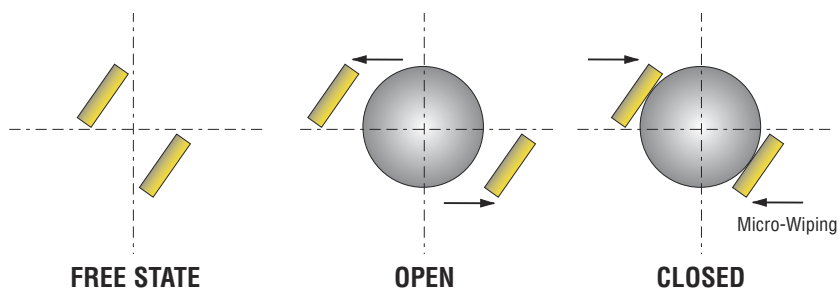


**1.27 mm Solder Ball Deformation  
After 48 Hours at 125°C**



**1.0 mm Solder Ball Deformation  
After 24 Hours at 125°C**

The 3M Textool Open-Top BGA Socket contact is designed to minimize deformation of the solder ball. This is achieved by means of a low-force, dual-beam design that touches the ball at two opposing points away from the BGA seating plane. The result is a system producing only minor indentations which have no effect on solder ball coplanarity.



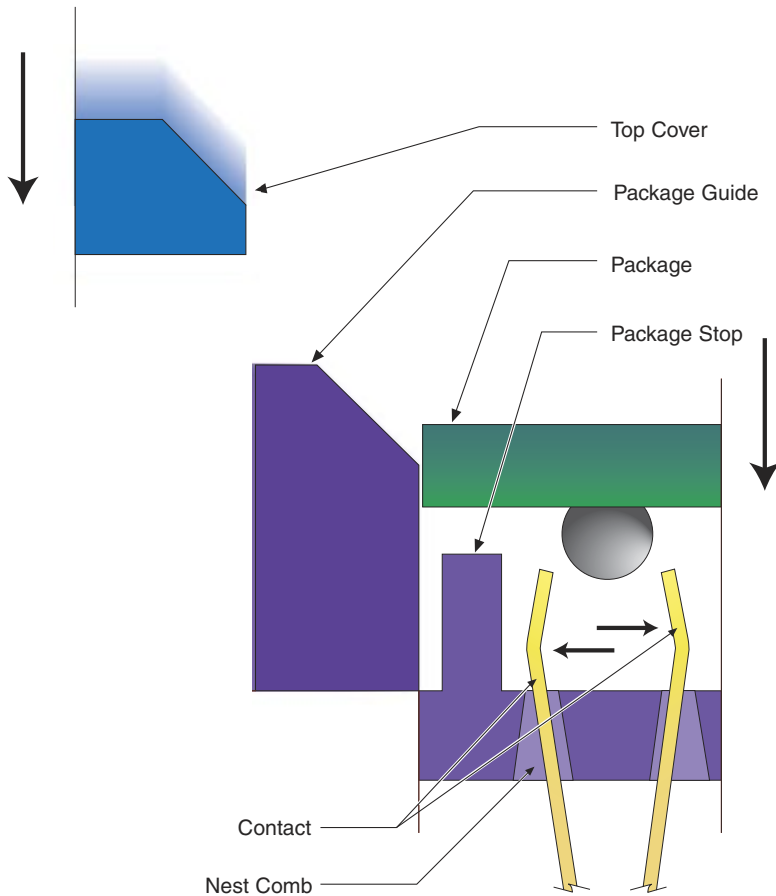
# 3M™ Textool™ Open-Top Sockets for BGA Packages

## Package Alignment

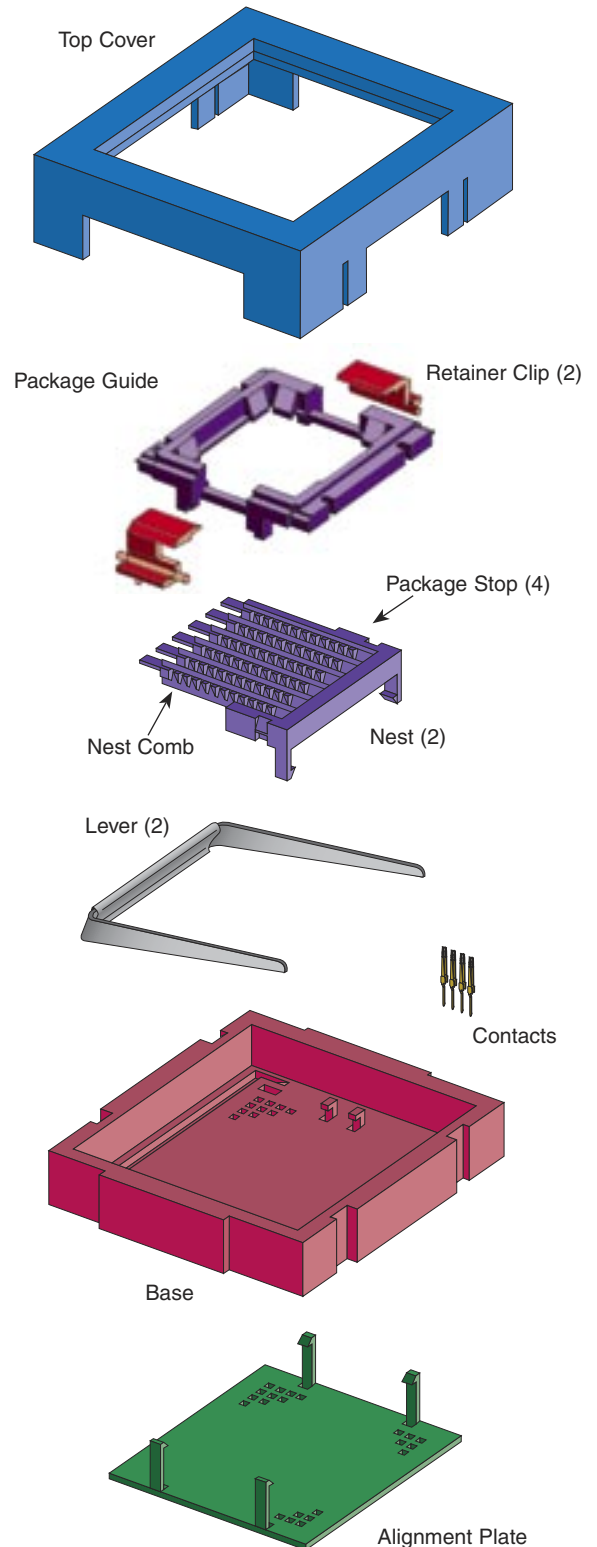
### Loading Sequence

See Illustration Below

1. The top cover is pushed down until fully depressed.
2. The downward motion of the top cover is translated to lateral motion bringing the package guides to the loading position. Concurrently, the nest combs move to open the contact arms to the open position.
3. A BGA package is loaded between the guides to achieve proper alignment of solder balls with socket contacts.
4. Raised features on the nest serve as physical stops that control package entry to the correct depth for proper socket operation.



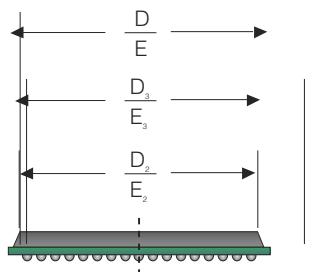
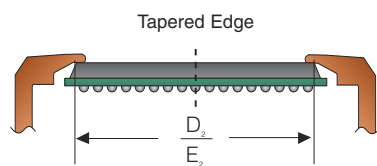
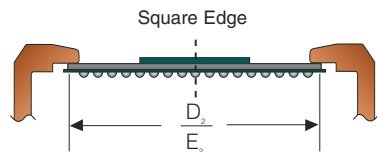
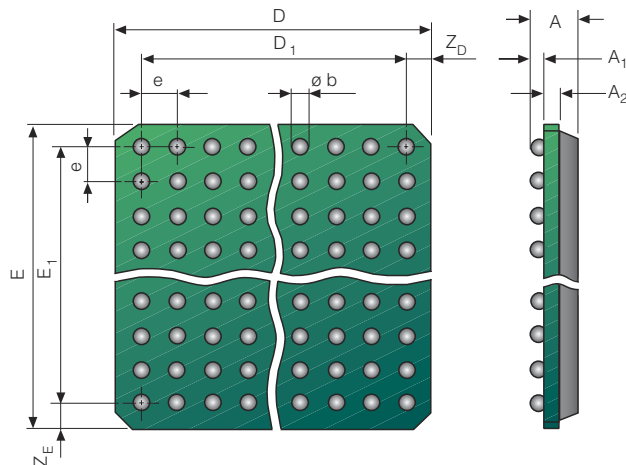
## Socket Construction



# 3M™ Textool™ Open-Top Sockets for BGA Packages

## BGA Packages and Relation to Socket

BGA packages are available from multiple sources in a wide variety of designs, materials, body sizes, matrices, pin pattern configurations, pitches and thicknesses. To assure proper mating of package to socket and reliable socket performance, all package parameters must be precisely specified and the corresponding socket feature designed to match the package specification. **To properly select or design a socket, the following package dimensions must be specified accurately.**



## Essential BGA Package Dimensions

| Dimensions                                       |                |                      |
|--------------------------------------------------|----------------|----------------------|
| Overall Height                                   | A              |                      |
| Ball Height                                      | A <sub>1</sub> | ±                    |
| Substrate Thickness                              | A <sub>2</sub> | ±                    |
| Ball Diameter                                    | øb             | ±                    |
| Body Size                                        | D              | ±                    |
|                                                  | E              | ±                    |
| Total Pitch                                      | D <sub>1</sub> | ±                    |
|                                                  | E <sub>1</sub> | ±                    |
| † Minimum Mold Cap<br>(If Retainer Clip is Used) | D <sub>2</sub> | ±                    |
|                                                  | E <sub>2</sub> | ±                    |
| † Maximum Mold Cap<br>(If Retainer Clip is Used) | D <sub>3</sub> | ±                    |
|                                                  | E <sub>3</sub> | ±                    |
| Ball Pitch                                       | e              |                      |
| Number of Rows                                   | M <sub>D</sub> |                      |
|                                                  | M <sub>E</sub> |                      |
| Number of Balls                                  | n              |                      |
| Package Overhang                                 | Z <sub>D</sub> | ±                    |
|                                                  | Z <sub>E</sub> | ±                    |
| Pattern                                          | —              | Need Pattern Drawing |

† If retainer clip is specified, style of clip depends on package profile. The dimensions D<sub>2</sub> & E<sub>2</sub> and D<sub>3</sub> & E<sub>3</sub> noted at right are required to select the proper clip design.

**Note:** To assure proper match of socket to package, the preferred information is the latest revision of the customer package drawing. The package drawing should contain all of the information in the above table. Send the current package drawing to 3M Customer Service.

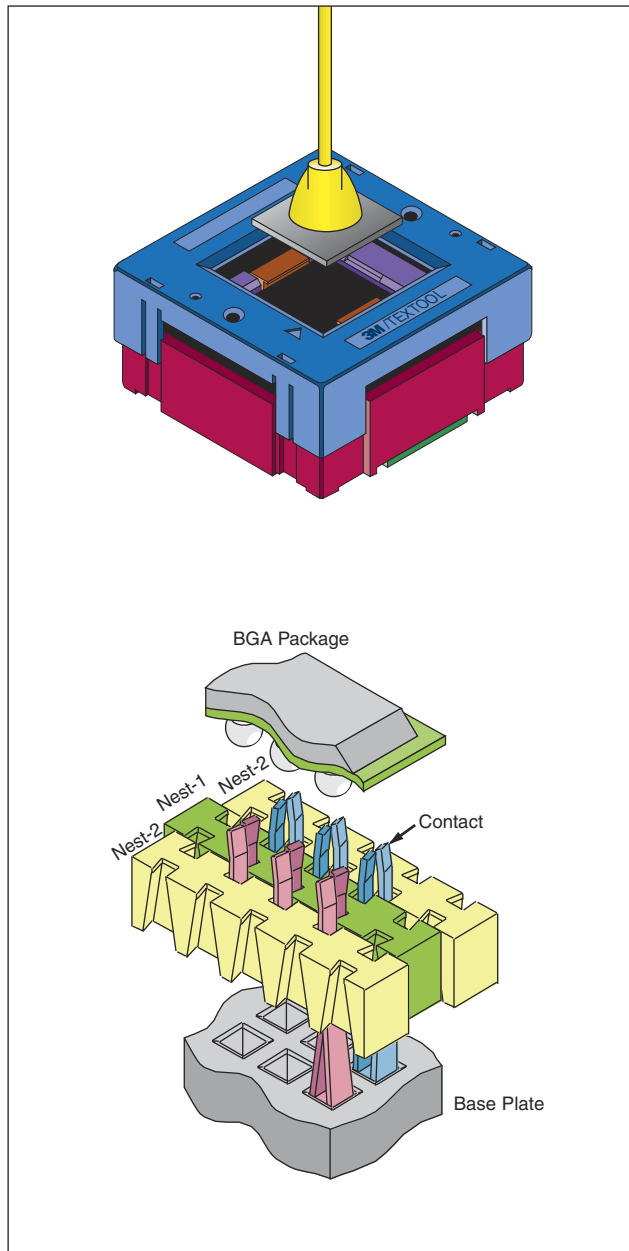
## Contact Gap Adjustment

3M Textool Open-Top BGA Sockets are designed to function with common solders under normal production burn-in conditions. In addition, for customers using eutectic solder-balls in long-term testing and/or high-stress environments such as “life testing” and “HAST,” 3M can customize sockets to control solder ball deformation by making an adjustment of the socket contact gap. This adjustment is called “custom gapping” and is based on actual measurement of BGA samples that are provided by the customer. This disclaimer is intended to cover eutectic and other low melt-point solder applications only. Higher melt-point solders, such as 90/10 and lead-free, do not require custom gapping. Please contact 3M Customer Service with your specific needs and conditions. Custom gapping tailors the socket for an exact solder ball diameter and should only be considered for stable production applications where solder ball dimensions are not expected to vary.



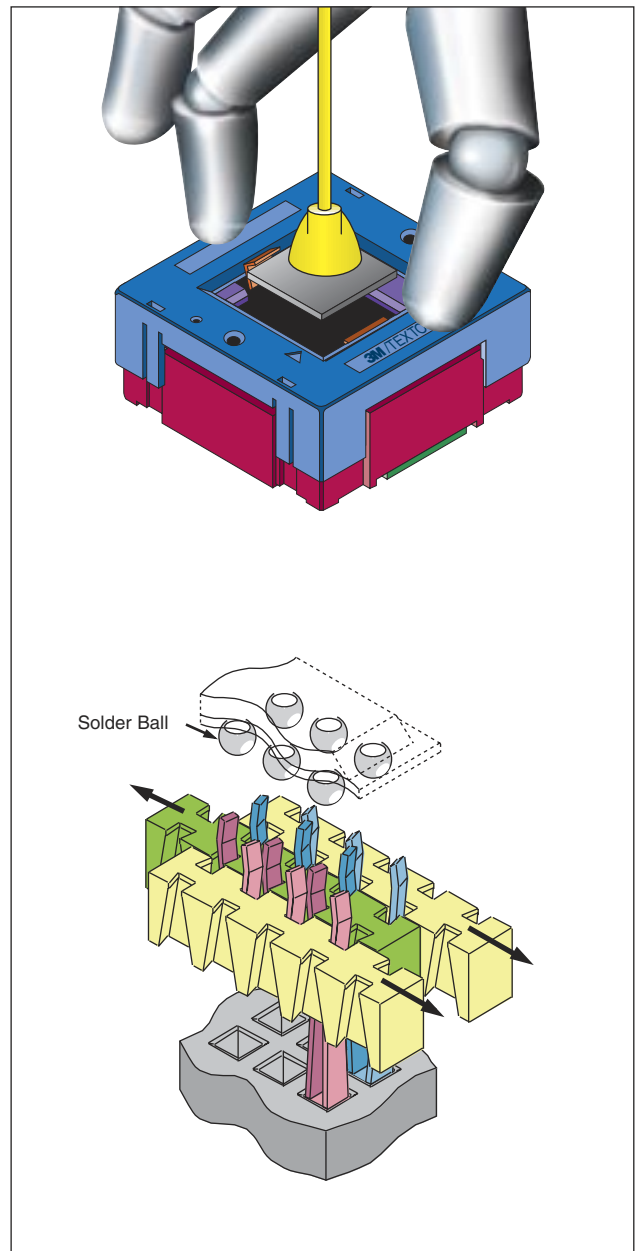
# 3M™ Textool™ Open-Top Sockets for BGA Packages

## Socket Mechanism and Operating Instructions



### Stage 1

**Free State.** Socket, with normally closed contacts, in free state, ready for actuation.



### Stage 2

**Contacts Open.** A downward force is applied to the top plate, which translates to a lateral motion of the nest combs, and opens the contacts to receive the solder ball.

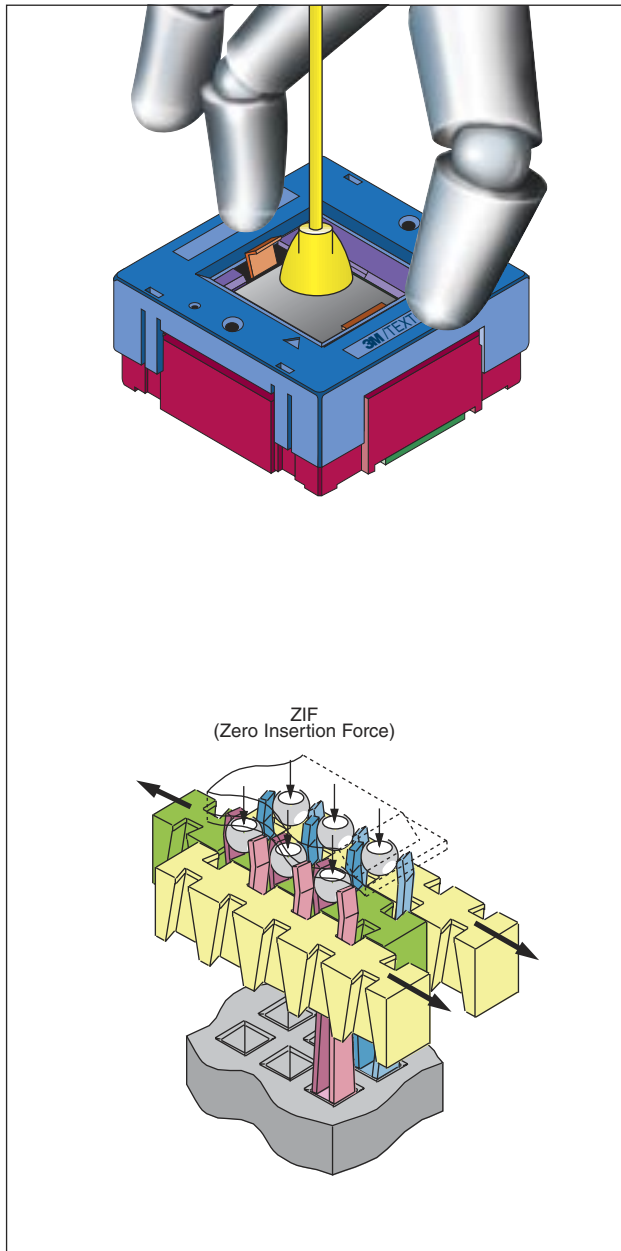
#### Note:

Depress top cover before inserting package.



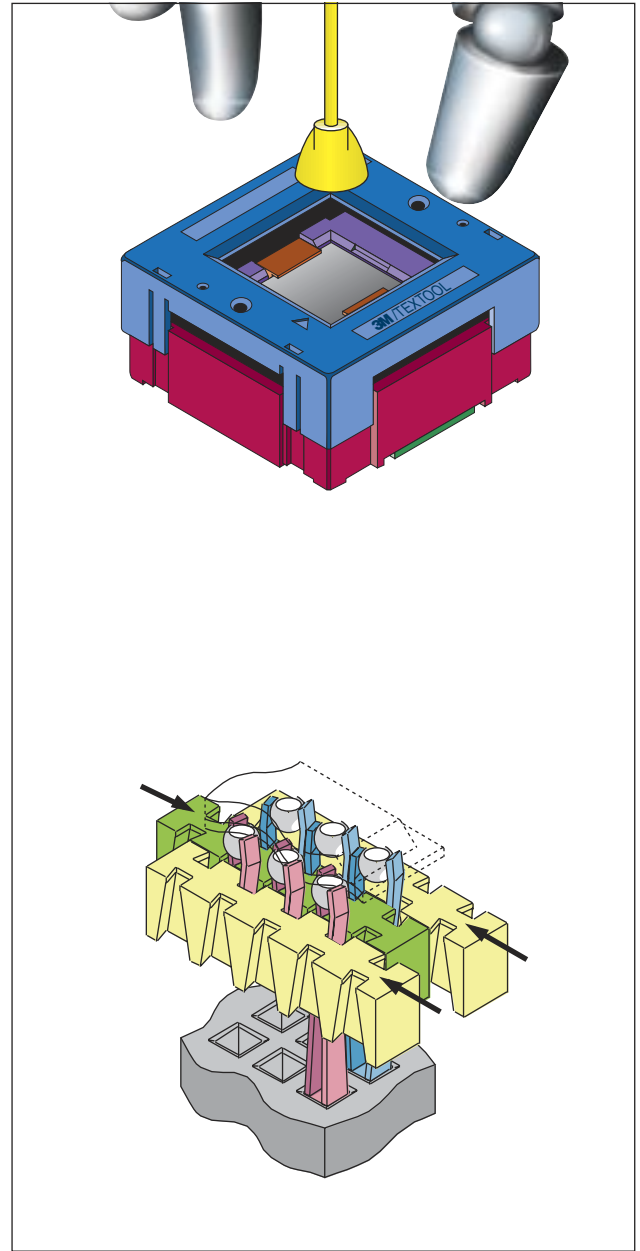
# 3M™ Textool™ Open-Top Sockets for BGA Packages

## Socket Mechanism and Operating Instructions



### Stage 3

A BGA device is placed into the top opening. Alignment features guide the package into proper position so each ball rests between the open contact arms.



### Stage 4

The vertical actuation force is removed, the contacts close and each ball is gripped above its horizontal center.

# 3M™ Textool™ Open-Top Sockets for BGA Packages

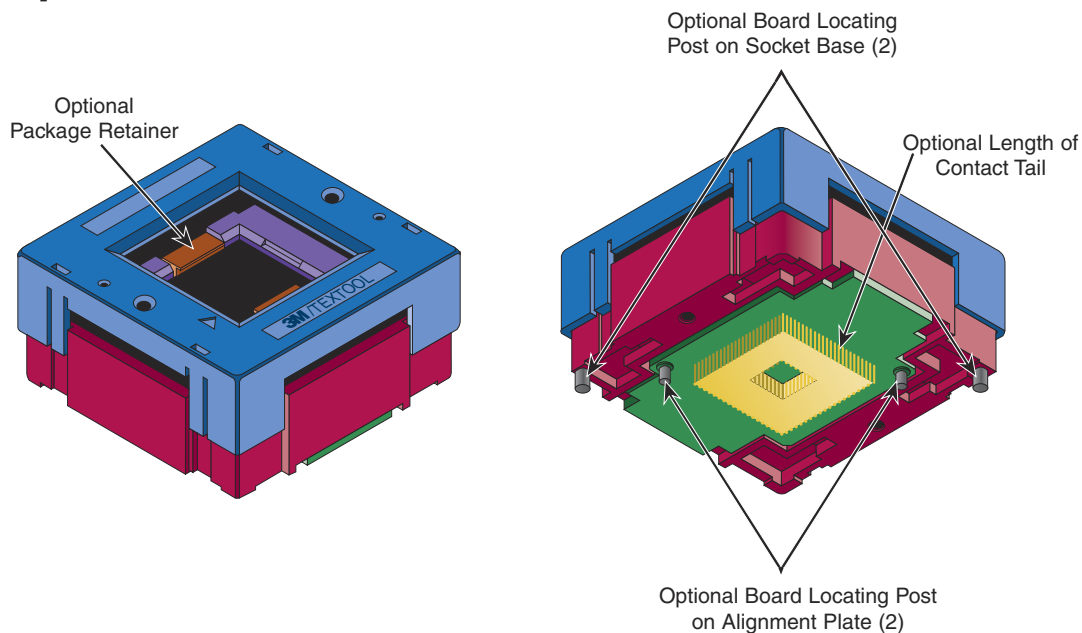
## Ordering Information

1. Submit your detailed package drawing to 3M Customer Service.
2. Specify optional features desired:
  - With or without board locating posts
  - With or without retainer
3. 3M Customer Service will assign complete part number.

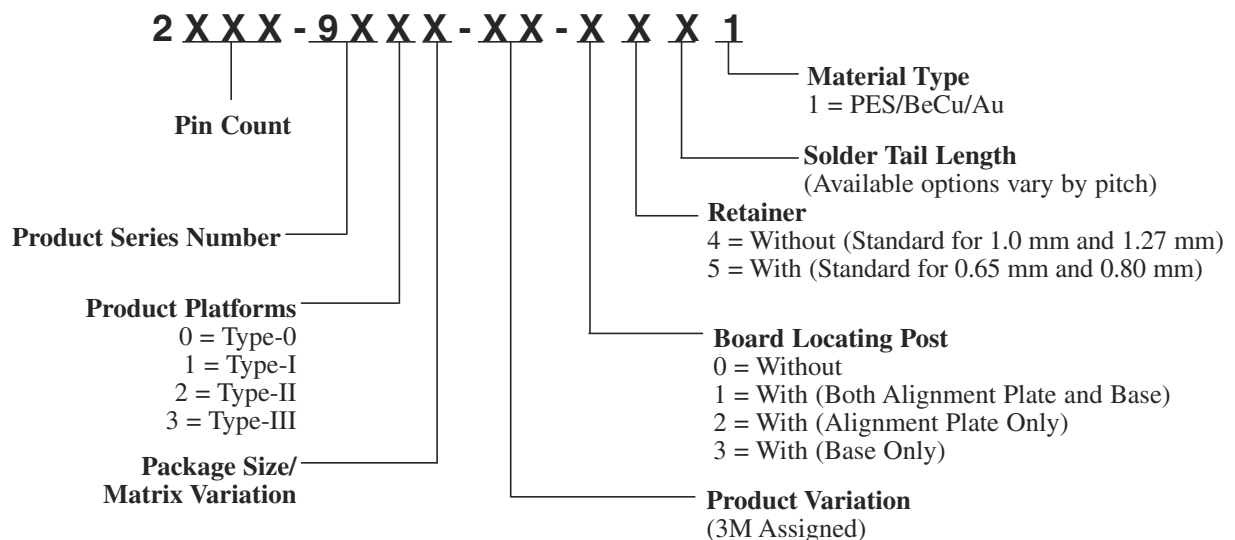
## Retainer Clip Feature

3M Textool sockets are designed to function properly without the use of retainer clips. The retainer clip feature is desirable for high vibration/shock applications and with small or non-spherical solder balls or to serve as a visual aid during package loading. The purpose of the retainer clip feature is to retain the DUT in the socket should there be an event or conditions leading to dislodgement of the solder balls from the socket contacts. Retainer clips are custom-designed based on specific package dimensions and should only be considered for stable production applications where package dimensions are not expected to vary. In cases of non-spherical and small solder balls, 3M Technical Service may request package samples for fit analysis.

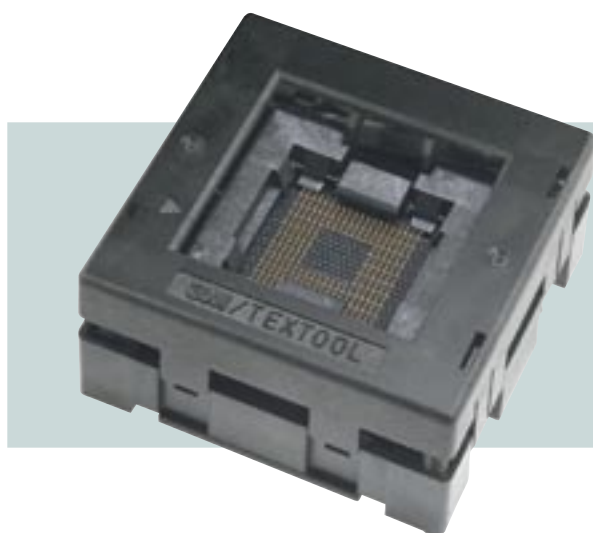
## Socket Options



## Socket Part Numbering System



# 3M™ Textool™ Open-Top BGA Sockets 0.65 mm



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## BGA 0.65 mm Pitch Socket Platforms

| Type | Maximum Body Size (mm) | Maximum Matrix | Maximum Ball Count | Status    |
|------|------------------------|----------------|--------------------|-----------|
| I    | 12x12                  | 17x17          | 289                | Available |
| II   | 17x17                  | 25x25          | 625                | Available |
| III  | 21x21                  | 31x31          | 961                | Inquire*  |

**\*Note:** At time of publication, Type III was not released for sale. Please contact 3M Customer Service for current availability.

## BGA 0.65 mm Pitch Socket Available Package Guide Sizes

| Socket Type | Series Number | Package Body Size (mm) | Matrix Count | Maximum Pin Count |
|-------------|---------------|------------------------|--------------|-------------------|
| I           | 9610          | 8x8                    | 10x10        | 100               |
|             | 9611          | 8x8                    | 11x11        | 121               |
|             | 9612          | 9x9                    | 12x12        | 144               |
|             | 9613          | 9x9                    | 13x13        | 169               |
|             | 9614          | 10x10                  | 13x13        | 169               |
|             | 9615          | 10x10                  | 14x14        | 196               |
|             | 9616          | 11x11                  | 15x15        | 225               |
|             | 9617          | 11x11                  | 16x16        | 256               |
|             | 9618          | 12x12                  | 16x16        | 256               |
|             | 9619          | 12x12                  | 17x17        | 289               |
| II          | 9671          | 9x9                    | 13x13        | 169               |
|             | 9620          | 13x13                  | 18x18        | 324               |
|             | 9621          | 13x13                  | 19x19        | 361               |
|             | 9670          | 13x13                  | 20x20        | 400               |
|             | 9622          | 14x14                  | 19x19        | 361               |
|             | 9623          | 14x14                  | 20x20        | 400               |
|             | 9625          | 15x15                  | 20x20        | 400               |
|             | 9624          | 15x15                  | 21x21        | 441               |
|             | 9672          | 15x15                  | 22x22        | 484               |
|             | 9626          | 16x16                  | 22x22        | 484               |
|             | 9627          | 16x16                  | 23x23        | 529               |
|             | 9628          | 17x17                  | 24x24        | 576               |
|             | 9629          | 17x17                  | 25x25        | 625               |

**Note:** Contact 3M Customer Service Rep or 3M Authorized Distributor for information on sizes not listed on the above chart. Contact patterns can be customized to match the package.

# 3M™ Textool™ Open-Top BGA Sockets 0.80 mm



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## BGA 0.80 mm Pitch Socket Platforms

| Type | Maximum Body Size (mm) | Maximum Matrix | Maximum Ball Count | Status    |
|------|------------------------|----------------|--------------------|-----------|
| I    | 12x12                  | 13x13          | 169                | Available |
| II   | 17x17                  | 19x19          | 361                | Available |
| III  | 21x21                  | 25x25          | 625                | Available |
| IV   | 24x24                  | 31x31          | 961                | Inquire*  |

## BGA 0.80 mm Pitch Socket Available Package Guide Sizes

| Socket Type | Series Number | Package Body Size (mm) | Matrix Count | Maximum Pin Count |
|-------------|---------------|------------------------|--------------|-------------------|
| I           | 9014          | 9x9                    | 9x9          | 81                |
|             | 9015          | 9x9                    | 10x10        | 100               |
|             | 9016          | 10x10                  | 10x10        | 100               |
|             | 9017          | 10x10                  | 11x11        | 121               |
|             | 9016          | 10x10                  | 12x12        | 144               |
|             | 9018          | 11x11                  | 11x11        | 121               |
|             | 9019          | 11x11                  | 12x12        | 144               |
|             | 9018          | 11x11                  | 13x13        | 169               |
|             | 9010          | 12x12                  | 13x13        | 169               |
| II          | 9026          | 12x12                  | 14x14        | 196               |
|             | 9027          | 13x13                  | 14x14        | 196               |
|             | 9028          | 13x13                  | 15x15        | 225               |
|             | 9029          | 14x14                  | 15x15        | 225               |
|             | 9020          | 14x14                  | 16x16        | 256               |
|             | 9029          | 14x14                  | 17x17        | 289               |
|             | 9021          | 15x15                  | 16x16        | 256               |
|             | 9022          | 15x15                  | 17x17        | 289               |
|             | 9021          | 15x15                  | 18x18        | 324               |
|             | 9023          | 16x16                  | 18x18        | 324               |
|             | 9024          | 16x16                  | 19x19        | 361               |
|             | 9025          | 17x17                  | 19x19        | 361               |
| III         | 9030          | 17x17                  | 20x20        | 400               |
|             | 9031          | 18x18                  | 20x20        | 400               |
|             | 9032          | 18x18                  | 21x21        | 441               |
|             | 9031          | 18x18                  | 22x22        | 484               |
|             | 9033          | 19x19                  | 21x21        | 441               |
|             | 9034          | 19x19                  | 22x22        | 484               |
|             | 9033          | 19x19                  | 23x23        | 529               |
|             | 9035          | 20x20                  | 23x23        | 529               |
|             | 9036          | 20x20                  | 24x24        | 576               |
|             | 9037          | 21x21                  | 24x24        | 576               |
|             | 9038          | 21x21                  | 25x25        | 625               |

**Note:** Contact 3M Customer Service Rep or 3M Authorized Distributor for information on sizes not listed on the above chart.  
Contact patterns can be customized to match the package.

# 3M™ Textool™ Open-Top BGA Sockets 1.0 mm



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## BGA 1.0 mm Pitch Socket Platforms

| Type | Maximum Body Size (mm) | Maximum Matrix | Maximum Ball Count | Status    |
|------|------------------------|----------------|--------------------|-----------|
| 0    | 19x19                  | 17x17          | 289                | Available |
| I    | 29x29                  | 27x27          | 729                | Available |
| II   | 40x40                  | 39x39          | 1521               | Available |
| III  | 45x45                  | 45x45          | 2025               | Available |

## BGA 1.0 mm Pitch Socket Available Package Guide Sizes

| Socket Type | Series Number | Package Body Size (mm) | Matrix Count | Maximum Pin Count |
|-------------|---------------|------------------------|--------------|-------------------|
| 0           | 9342          | 6x6                    | 6x6          | 36                |
|             | 9348          | 11x11                  | 10x10        | 100               |
|             | 9340          | 12x10                  | 10x8         | 80                |
|             | 9300          | 12x12                  | 11x11        | 121               |
|             | 9301          | 13x13                  | 11x11        | 121               |
|             | 9302          | 13x13                  | 12x12        | 144               |
|             | 9303          | 14x14                  | 12x12        | 144               |
|             | 9304          | 14x14                  | 13x13        | 169               |
|             | 9305          | 15x15                  | 13x13        | 169               |
|             | 9306          | 15x15                  | 14x14        | 196               |
|             | 9307          | 17x17                  | 15x15        | 225               |
|             | 9308          | 17x17                  | 16x16        | 256               |
|             | 9344          | 18x12                  | 16x10        | 160               |
|             | 9343          | 18x18                  | 15x15        | 225               |
|             | 9309          | 19x19                  | 17x17        | 289               |
| I           | 9352          | 14x10                  | 13x9         | 117               |
|             | 9355          | 15x15                  | 14x14        | 196               |
|             | 9356          | 17x17                  | 15x15        | 225               |
|             | 9357          | 17x17                  | 16x16        | 256               |
|             | 9358          | 19x19                  | 17x17        | 289               |
|             | 9310          | 19x19                  | 18x18        | 324               |
|             | 9311          | 21x21                  | 19x19        | 361               |
|             | 9312          | 21x21                  | 20x20        | 400               |
|             | 9313          | 23x23                  | 21x21        | 441               |
|             | 9314          | 23x23                  | 22x22        | 484               |
|             | 9315          | 25x25                  | 23x23        | 529               |
|             | 9316          | 25x25                  | 24x24        | 576               |
|             | 9317          | 27x27                  | 25x25        | 625               |
|             | 9318          | 27x27                  | 26x26        | 676               |
|             | 9319          | 29x29                  | 27x27        | 729               |
| II          | 9360          | 29x29                  | 28x28        | 784               |
|             | 9320          | 31x31                  | 29x29        | 841               |
|             | 9321          | 31x31                  | 30x30        | 900               |
|             | 9322          | 33x33                  | 31x31        | 961               |
|             | 9323          | 33x33                  | 32x32        | 1024              |
|             | 9324          | 35x35                  | 33x33        | 1089              |
|             | 9325          | 35x35                  | 34x34        | 1156              |
|             | 9326          | 37.5x37.5              | 36x36        | 1296              |
|             | 9327          | 37.5x37.5              | 37x37        | 1369              |
|             | 9328          | 40x40                  | 38x38        | 1444              |
|             | 9329          | 40x40                  | 39x39        | 1521              |
|             |               |                        |              |                   |
| III         | 9331          | 42.5                   | 41           | 1681              |
|             | 9332          | 42.5                   | 42           | 1764              |
|             | 9333          | 45                     | 43           | 1849              |
|             | 9334          | 45                     | 44           | 1936              |
|             | 9335          | 47.5                   | 45           | 2025              |

**Note:** Contact 3M Customer Service Rep or 3M Authorized Distributor for information on sizes not listed on the above chart. Contact patterns can be customized to match the package.

# 3M™ Textool™ Open-Top BGA Sockets 1.27 mm



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## BGA 1.27 mm Pitch Socket Platforms

| Type | Maximum Body Size (mm) | Maximum Matrix | Maximum Ball Count | Status    |
|------|------------------------|----------------|--------------------|-----------|
| II   | 35x35                  | 27x27          | 729                | Available |
| III  | 45x45                  | 35x35          | 1225               | Available |

**\*Note:** At time of publication, Type I was not released for sale. Please contact 3M Customer Service for current availability.

## BGA 1.27 mm Pitch Socket Available Package Guide

| Socket Type | Series Number | Package Body Size (mm) | Matrix Count | Maximum Pin Count |
|-------------|---------------|------------------------|--------------|-------------------|
| II          | 9222          | 29 x 29                | 21 x 21      | 441               |
|             | 9223          | 29 x 29                | 22 x 22      | 484               |
|             | 9224          | 31 x 31                | 23 x 23      | 529               |
|             | 9225          | 31 x 31                | 24 x 24      | 576               |
|             | 9226          | 33 x 33                | 24 x 24      | 576               |
|             | 9227          | 33 x 33                | 25 x 25      | 625               |
|             | 9228          | 35 x 35                | 26 x 26      | 676               |
|             | 9229          | 35 x 35                | 27 x 27      | 729               |
| III         | 9232          | 37.5 x 37.5            | 28 x 28      | 784               |
|             | 9233          | 37.5 x 37.5            | 29 x 29      | 841               |
|             | 9234          | 40 x 40                | 30 x 30      | 900               |
|             | 9235          | 40 x 40                | 31 x 31      | 961               |
|             | 9236          | 42.5 x 42.5            | 32 x 32      | 1024              |
|             | 9237          | 42.5 x 42.5            | 33 x 33      | 1089              |
|             | 9238          | 45 x 45                | 34 x 34      | 1156              |
|             | 9239          | 45 x 45                | 35 x 35      | 1225              |

**Note:** Contact 3M Customer Service Rep or 3M Authorized Distributor for information on sizes not listed on the above chart. Contact patterns can be customized to match the package.

.65 mm



Type II

1.00 mm



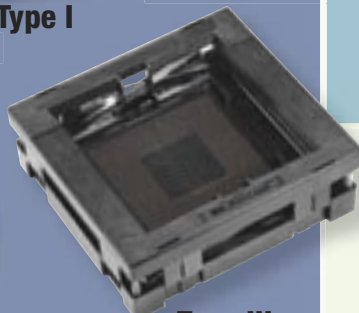
Type 0



Type I



Type II



Type III

.80 mm



Type II



Type I

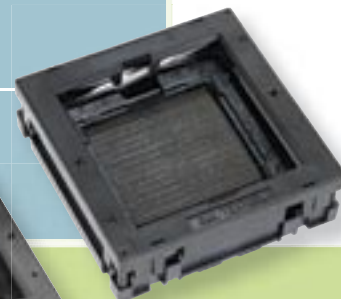


1.27 mm

Type II



Type III



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