Wedge-Wedge Ultrasonic Bonding

Wedge-wedge wire bonding is the oldest semiconductor assembly process dependent solely on acoustic energy. There are a few exceptions where thermal energy (heat) is combined to further improve the welding action.

The dominant ultrasonic frequency has been for many years 60kHz. It is even lower on some applications where larger diameter wire (>38µm) is used. This was until the early 1990’s when Japanese researchers, following the development and publications of Texas-based researchers, learned about the process improvements when higher ultrasonic frequencies (>60kHz) are used to bond gold wire to aluminum bond pads. Their investigation confirmed the improvements in weld reactivity (less open bond) and faster bond cycles. The major discovery was the fact that welding begins as soon as the wire contacts the surface to be bonded, creating a new welding pattern characterized by a series of parallel welding lines.

The new welding pattern does not follow the traditional low frequency pattern where the center of the bond is voided and surrounded by a welded ring. It has been published that during the welding process, lower ultrasonic frequencies begin utilizing some of the energy on wire deformation, followed by the actual welding process therefore the voided center.

Higher frequencies have lower vibratory amplitude, but a much higher speed of vibration that allows a great deal of energy to concentrate at the interface of the bond. The lower mechanical amplitude as reported by the Japanese researcher and confirmed by the Texas-based researchers, produce lower deformation of the weld with reduced stresses providing a much larger cross-section area that reduces heal cracks, and improves bond pull values and overall weld strength.

Gaiser Products Group has taken this knowledge a step further by improving its materials and geometrical design to maximize acoustical efficiency so that any of our tools can either be used by standard low ultrasonic frequencies or by higher frequencies. We recommend you contact the factory for suggested information that might help improve tool set-up for those dealing with higher ultrasonic frequencies for the first time.
Small Wire Wedge Bonding

In wedge bonding, both aluminum and gold wire may be bonded. Historically, the disadvantages of wedge bonding vs. ball bonding have been speed (wires per second) and the need to rotate the work due to wedge bonders being unidirectional. Modern wedge bonders have made significant improvements in both areas. Semi-automatic and fully automatic wedge bonders have substantially increased the speed and versatility of the bonders. The “rotating head” wedge bonder has enabled 360° omnidirectional bonding, similar to ball bonding.

With capillary ball bonding, time, force, ultrasonic energy, and heat are the primary components used to form a wire bond. With wedge bonding, however, both gold and aluminum wire may be bonded and no electronic flame off (EFO) is employed. The minimum requirement for gold wire wedge bonding is force to make a compression bond. For aluminum wire, both force and ultrasonic energy are necessary. Additionally, the component of heat may be available in the form of a heated stage or tool heat. Wedge bonding is generally referred to as Ultrasonic Bonding.

Ultrasonic Bonding: Ultrasonic energy is applied to the wedge tool through an ultrasonic transducer. The ultrasonic energy provides a mechanical scrubbing action which breaks through the surface oxide film and also generates frictional heat. Heat in the form of a heated tool or device may or may not be available.

Wedge bonding is commonly used for aluminum wire chip-on-board (COB) applications, and gold wire for microwave and hybrid devices. In addition to gold wire, gold ribbon is becoming increasingly more popular for high frequency devices.

Aluminum wire wedge bonding offers better cost benefits than that of gold wire. In general, wedge bonding allows bonds to be placed on small, narrow pads at fine pitches in a cost-effective manner.

For microwave devices, wedge bonding offers a low, flat, short loop for maximum high-frequency electrical performance. Additionally, the wire loop shape may be controlled to a specific profile to “tune” a microwave device. Ribbon bonding makes use of the “skin-effect” observed in high-frequency telecommunications, microelectronics, and antenna technology.

Wedge Design

Wedge tip designs for many years have been limited to two types, the V-notch and the Maxiguide(or pocket type). The V-notch was developed first and had largely been obsoleted by the Maxiguide, which provides superior wire centering. The V-notch however, allows for a minimum “W” dimension for access into small recessed pads and a complete back radius (BR) which provides good 1st bond heels and 2nd bond tailing. Gaiser’s new patent pending MaxiBond™ design actually provides the positive aspects of both the V-notch and the Maxiguide in one new architecture, the MaxiBond.
The wedge shank is generally 1/16 inch diameter (1.58mm) with a shank flat secured by a set screw. Lengths are available in industry standard sizes up to 1.078 in./27.38mm and longer (by special order).

In addition to being longer than a capillary, a significant advancement in wedge design has been the vertical feed, deep access wedge. Most wedge bonders feed wire into the tool at 30°, 38°, 45°, or 60° wire feed angles (relative to the horizon). Deep access, vertical feed wedge bonders are able to initially feed the wire vertically, like a capillary. The wire either passes vertically through a hollow (tubular construction) wedge, or through the transducer via a double shank flat design. Such vertical feed designs allow access into packages where a conventional 30° or 45° wire feed angle may have an interference problem.

The “bond foot” is the portion of the wedge that makes the impression in the bonded wire. The entire feature is comprised of the front radius (FR), the bond length (BL), and the back radius (BR). These individual features have tolerances and therefore potential tolerance stack.

To prevent the individual FR, BL, & BR tolerances from accumulating to form a too small or too large overall condition, Gaiser employs a control dimension called the foot length (FL) dimension. The FL has an individual tolerance that prevents tolerance stack of the FR, BL, & BR.

The FL dimension is measured from the FR to the theoretical intersection of the back radius angle and the plane of the bond foot, as shown above. The bond flat (BF) is the flat portion of the bond foot. On a flat face tool, the BF is the distance between the FR and the BR.
Wedge Bonding

Bond Length (BL)

The bond length (BL) for a flat-face wedge (see Figure 10) includes 25% of the BR, 25% of the FR, and the BF. For a concave wedge (see Figure 11), the BL begins where the concavity depth truncates the FR in the center of the BF and includes 25% of the BR.

Choosing the BL is driven by the wire diameter and the size of the bond pad. Typical bond lengths are 1.5 to 2.5 times the wire diameter. Occasionally, the bond pad may be so small that it forces the use of a very small bond length. Bond lengths as small as 0.0010 in./25µm to 0.0007 in./18µm or 0.0005 in./13µm are used on small components and microwave devices.

<table>
<thead>
<tr>
<th>Bond Pad Size</th>
<th>Bond Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>in. / µm</td>
<td>in. / µm</td>
</tr>
<tr>
<td>0.0030 / 76</td>
<td>0.0020 / 51</td>
</tr>
<tr>
<td>0.0035 / 89</td>
<td>0.0020 / 51 to 0.0022 / 56</td>
</tr>
<tr>
<td>0.0040 / 102</td>
<td>0.0025 / 64</td>
</tr>
<tr>
<td>0.0050 / 127</td>
<td>0.0030 / 76</td>
</tr>
</tbody>
</table>

Front Radius (FR)

The front radius (FR) provides the transition from the wire to the second bond. This transition, commonly referred to as the toe of the second bond, varies in size depending on the size of the FR. Most of the standard series of wedges, designed for aluminum wire, have an FR of 0.0010 in./25µm or larger to minimize second bond toe cracks. Gaiser designs the aluminum wire wedge FR to be the same size or larger than the wire diameter to be bonded.

For gold wire applications, particularly when the wire diameters are 0.0010 in./25µm or smaller, the FR can be smaller than the wire diameter. A 0.0004 in./10µm FR is available in the microwave wedge series.

Figure 13 – Gold wire lead bond formed with a wedge having a 0.0004 in./10µm FR

Gaiser has specified the appropriate front radius values for various aluminum and gold wire wedge series that are available in our catalog for numerous applications. Modifications to the existing FR values is seldom necessary.

BACK RADIUS (BR)

The back radius (BR) has two functions:

1. To provide the transition between the wire and the first bond or die bond
2. To provide the area on the wedge where the wire will terminate on the lead bond

Figure 14 – Die bond made with part number 2130-2525-L with a standard BR. The length of wire not bonded on the left side is referred to as the tail. The tail length should not extend beyond the pad due to shorting problems. The standard BR helps provide for very consistent tailing.
Heel crack problems are more commonly associated with aluminum wire than with gold. They are also more frequent with 30° wire feed angle bonding than with steeper wire feed angles. This is due to the wire being worked more during looping. The wire starts out at a 30° angle, is flexed to 90° during the beginning of the loop, and is then returned to approximately 30° after the lead bond is made.

The amount of heel cracking allowed depends on the quality standards of the end customer. In some cases, minor heel cracking is acceptable. BR shape and size may help to eliminate or reduce heel cracking.

The elliptical back radius (ELBR) provides a stronger bond by increasing the amount of cross-sectional area of the heel but may cause inconsistent tailing as it creates a stronger heel area. This helps to reduce heel cracks often associated with standard wedges. The ELBR, generally used for aluminum wire, is standard for the 2131 series and available as an option on other Gaiser wedges.

A chamfer back radius (CBR) produces an angled transition as opposed to a radiused BR and helps to reduce heel cracks. As with the ELBR, the CBR is generally used with aluminum wire and may cause inconsistent tailing due to the stronger heel area.

The polished back radius (PBR) and polished front radius (PFR) help reduce the amount of aluminum build-up on the bond foot but may reduce the ultrasonic energy transmission from the tool to the wire. These options produce a smooth appearance at the heel of the first bond and the toe of the second bond. The PBR may also help to reduce heel cracks.
**Wedge Bonding**

Figure 19 – Typical wedge lead bond. Tail length is minimal because the wire is terminated at this bond.

Figure 20 – Example of a smashed wedge bond

A smashed bond may occur if there is insufficient tail length under the bond. This is often caused when the BR does not break the wire correctly. There must be enough wire under the FR and the BR to equalize the extrusion forces during bonding or overbonding and/or a weak heel may result.

**Hole Diameter (H)**

The general design rule for the wedge hole diameter (H) is that the hole size should be 1.5-2 times the wire diameter. A tighter wire to hole size relationship will improve bond placement accuracy. If the hole is too small, wire scratch may result.

Possible causes for a scratched wire:

1. Wire is being fed into the hole of the wedge at an incorrect angle
2. Wire is already scratched as it comes off the spool
3. Wire clamp system not adjusted correctly
4. Foreign material is present inside the wedge due to the bonding conditions
5. Wedge has wire build-up and needs to be replaced
6. Rough edge exists in the hole
7. Hole is too small for the wire diameter

Gaiser polishes the wedge wire feed hole as a standard manufacturing operation on all wedges.

Figure 21 – Example of a scratched wire

Figure 22 – Hole polish detail of a 30° wire feed angle wedge

Figure 22 – Hole polish detail of a 30° wire feed angle wedge

- Polished
- Polish

Holes

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Table-Tear & Clamp-Tear

There are two methods used to terminate the wire after the second bond. These methods are bonding machine dependent and are commonly called, “table-tear” and “clamp-tear.” Most deep access bonders and some conventional bonders utilize the table-tear method.

The clamp-tear method is the standard method of termination for conventional bonding. In this method, the clamp remains open during completion of the lead bond. While the wedge is still on the wire, the clamp closes and pulls back away from the wedge. This motion causes the wire to terminate at the BR. The wedge then rises and the clamp system moves down. This forces the wire to feed out leaving the tail under the bond foot for the next bond.

One benefit of the clamp-tear method is that the bond is not stressed (lifted) when terminating the wire. Another benefit is that there is no nick in the wire above the heel which may be present when using the table-tear method. The biggest disadvantage of the clamp-tear method is that the clamp system can interfere with the package wall or other devices thereby restricting deep-access use.

Also available, and primarily used in fine pitch applications, is an oval hole design. The oval hole provides the lateral (side to side) bond placement accuracy of a smaller hole relative to the wire diameter while maintaining the wire feed and looping characteristics of a larger hole diameter.

Figure 23 – Hole polish and exit hole relief of 60° wire feed angle wedge

Figure 24 – Oval Hole design

Figure 25 – Table-tear bond - The clamp is closed shortly after the second bond. The tool then moves upward and back to break the tail. Note: Nick in wire caused by BR during termination.
Wedges

Wedge Bonding Process

1. The bonding process begins with a threaded wedge.

2. Force and Ultrasonic Energy are applied to form the 1st Bond.

3. The Looping Sequence

4. Force and Ultrasonic Energy are applied to form the 2nd Bond.

5. The wedge rises before the tear method is engaged.

6. The Clamp-Tear or Table-Tear methods are used to break the wire and the cycle begins again.

Preferred Failure Modes
- Mid-Span Break (Bond Strength exceeds Wire Tensile Strength)
- 2nd Bond Break
- Heel Break

Undesirable Failure Modes
- Low-Strength Heel Breaks
- Lifted Bond
Materials & Tip Configurations

The wire material (gold or aluminum) being bonded generally determines the material specified for the wedge and the bond foot configuration. Tungsten Carbide (WC) combined with a concave bond foot is the industry standard for small aluminum wire. For gold wire, Titanium Carbide (TiC) or a "Cermet" material combined with a flat face and possibly a cross groove, are the standards.

The cross groove feature also provides a mechanical coupling for ultrasonic energy transmission between the wedge and the wire. As the wire is extruded up into the cross groove, it is "gripped" during bonding. A bond length of at least 0.0015 in./38µm is necessary to allow for enough space for a cross groove. The cross groove and cermet combination have proven to be highly effective for gold wire bonding.

In addition to the traditional gold color cermet (CER), Gaiser has introduced black cermet. Black cermet (BKCER) exhibits improved dimensional stability and smoother holes for reduced wire scratch while still providing a rough, aggressive finish on the bond foot. When compared to a competitor's standard gold cermet, Gaiser black cermet has demonstrated improved pull strengths. Additionally, the visual contrast between the black cermet and gold wire is helpful to operators during set-up and operation.

Cermet is a ceramic-metal alloy that exhibits a very rough and aggressive surface finish. This rough finish provides a mechanical coupling with the wire and effectively transmits ultrasonic energy at reduced power settings. Additionally, cermet material generally provides a longer tool life than carbide materials.
Wedge Bonding

Gaiser wedges typically default to tungsten carbide (WC) material and a concave face which is best suited for aluminum wire. Titanium carbide (TiC), cermet (CER), a flat face (F), and a cross groove (CG) are all options that must be specified in the part number and are generally affiliated with gold wire bonding. The 2MXX and 2GXX series wedges are standard with flat faces (both) and cross grooves (2GXX only) as they are designed for small geometry microwave and/or gold wire applications.

Chip On Board Bonding (COB)

The majority of chip on board (COB) products require a 30° wire feed. Gaiser 2130 series wedge has gained the most acceptance in the industry for these applications by offering low cost, accurate wire placement, and consistently small tails.

For standard applications using 0.0010 in./25µm to 0.00125 in./32µm diameter aluminum wire, Gaiser part number 2130-2025-L has proven to be an effective, easy to tune, and long lasting wedge. At 100µm pitch, the 2130-2020-L-W=003 has become a commonly used part number. For below 100µm pitch, the 2130-2020-L-DSR(004x010)-ELBR-W=003 has gained popularity. This wedge features the double side relief (DSR) and a narrower foot width (W) for the close bond pad pitch requirements. The elliptical back radius (ELBR) feature is also added to this wedge to aid in directing the wire to the center of the bond pad for superior wire placement.
Important Elements for Determining the Proper Tools in Fine-Pitch Wedge Bonding Applications

**Bond Pad Pitch:** The distance between the centers of the bond pads.

**Bond Pad Width:** Affects the selection of the tool “W” dimension.

**Bond Pad Length:** Affects the selection of the tool Bond Length (BL).

**Loop Height:** The most important height is the critical loop height directly adjacent to the side of the wedge.

**Clearance:** This is determined by bonder accuracy, pad pitch, tool selection, and customer preference. The most common minimum clearance is 0.0005 in./13µm.

\[
\text{CLEARANCE} = \frac{\text{PITCH} - \text{DSR WIDTH} - \text{WIRE DIAMETER}}{2}
\]
Fine-Pitch Wedge Bonding

The key to achieving fine-pitch wedge bonding is to provide clearance between the already bonded wire's adjacent critical loop height and the wedge itself as it performs the next bond. Reducing the tip width (the "W" dimension) will allow bonding at a smaller pitch with a given part number. However, to truly achieve very fine pitch wedge bonding, a double side relief (DSR) is necessary.

<table>
<thead>
<tr>
<th>Pitch (µm)</th>
<th>Wire Diameter in. / µm</th>
<th>DSR</th>
<th>W</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>0.00125 / 32</td>
<td>N/A</td>
<td>0.004+</td>
</tr>
<tr>
<td>125</td>
<td>0.00125 / 32</td>
<td>N/A</td>
<td>0.004</td>
</tr>
<tr>
<td>100</td>
<td>0.00125 / 32</td>
<td>(0.005x0.010)</td>
<td>0.003</td>
</tr>
<tr>
<td>80</td>
<td>0.00125 / 32</td>
<td>(0.004x0.010)</td>
<td>0.003</td>
</tr>
<tr>
<td>60</td>
<td>0.00125 / 32</td>
<td>(0.003x0.008)</td>
<td>0.0025</td>
</tr>
<tr>
<td>50</td>
<td>0.0010 / 25</td>
<td>Special Design</td>
<td></td>
</tr>
</tbody>
</table>

N/A = not applicable, unnecessary

The previous page shows the relationship between the bond pad pitch, the bond pad size (sometimes called the bond pad opening), the wedge tool with a DSR, the wire (both the critical adjacent and maximum loop heights), and the clearance. The necessary clearance is somewhat arbitrary with the bonder accuracy playing a large role in how small the clearance may be – minimal clearance is desirable because then a maximum DSR width can be used. A maximum DSR width provides the strongest wedge tool and maintains better ultrasonic energy transmission characteristics as well as a larger countersink for easier threading.

Fine-Pitch Wedge -

Hole Size (H)

As stated earlier in the wedge bonding section of this catalog, the general design rule is that the hole size should be 1.5-2 times the wire diameter. Fine-pitch wedges may require a tighter hole to wire relationship, such as 1.4-1.8 times the wire diameter. Additionally, the oval hole option may be beneficial in fine-pitch bonding for a very tight lateral (side to side) relationship for bond placement while still maintaining low wire drag for looping and bonder speed (wires per second).

Fine-Pitch Wedge -

Bond Length (BL)

The general design rule for bond length (BL) is 2 times the wire diameter. Fine-pitch wedges, however, may require 1.5-1.8 times the wire diameter due to reduced bond pad openings. The expected deformed bonded wire width is 1.3-1.8 times the original wire diameter. Longer bond lengths tend to produce more narrow bond widths.
The double side relief (DSR) option is designed to provide the clearance necessary when bonding down inside a cavity, between an obstruction, package wall, or other device. The DSR modification must be specified in the part number as "DSR (Width x Height)."

The 45° side chamfer modification is beneficial in fine pitch bonding because it allows the wedge to maintain most of its mass resulting in efficient transfer of ultrasonic energy. It allows the use of a larger "W" dimension while still maintaining clearance to the adjacent bond. The 45° side chamfer can be added to the maxiguide style wedge without weakening the guiding slot walls. Specify this option in the part number as "45SC(W=specify)."

Also see MaxiBond™ Series pages 80 and 81
Large Wire Wedge Bonding

“Large wire” wedge bonding generally refers to wire diameters of 0.004 in./100µm to 0.030 in./760µm with 0.005/127µm to 0.015 in./380µm being the most common. Because the range for “small wire” is usually defined from 0.0007 in./18µm to 0.002 in./50µm, this leaves 0.003 in./76µm wire in the middle. This is most likely the reason for so few 0.003 in./76µm wire applications. Virtually all large wire wedge applications utilize aluminum wire for cost reasons with the exception of certain “exotic” applications.

Most large wire wedge bonders use a single groove wedge tool and a separate cutter blade while some bonders utilize a wire feed hole at the tip with the same configuration as a small wire wedge. A patented design by Orthodyne Electronics incorporates a cutter blade at the tip in a groove parallel to the groove used for making the wire bond (see Figure 45).

Figure 44 – Wire feed hole style large wire wedge

Figure 45 – Patented Orthodyne cut-off ridge design

Figure 46 – Drawing shows a typical U-groove style wedge

Figure 47 – Bonds made with a U-groove wedge may exhibit surrounding wire smash-out. Also called “wings” or “ears”

Figure 48 – Drawing shows a typical V-groove style wedge

Figure 49 – Bonds made with a V-groove wedge exhibit minimum smash-out
**Wedge Bonding**

**Ribbon Wedge Bonding**

Ribbon bonding is accomplished using a wedge-style tool that is designed essentially the same as a small wire wedge except the wire feed hole is a horizontal slot, not a round hole. This is needed to facilitate the feeding of a flat ribbon as opposed to conventional wire. Many high-frequency devices utilize ribbon bonding due to the “skin affect” of a high-frequency signal.

Gaiser offers ribbon bonding version of wedge tools for virtually all wire bonders, both standard and deep access.

Ribbon wedges are available in all standard wedge materials for both gold and aluminum ribbon (WC, TiC, and cermet).

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**Figure 50** – Example of aluminum ribbon bonds. Note the cross groove impressions in the bonds.

**Figure 51** – Device bonded with gold ribbon

**Figure 52** – Standard EDM matte finish

**Figure 53** – Example of a polished bond foot

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**Wedge Finish**

All of the Gaiser wedges come standard with an EDM matte finish. The standard EDM matte finish is commonly used for both aluminum and gold wire.

In some cases, the entire bond foot is polished (PBF) in an attempt to minimize build-up on the wedge. As the polishing of the bond foot inhibits good transfer of ultrasonic energy, the polished bond foot is not recommended, unless other options fail to provide the desired results. The PBF may also be called out if having shiny bonds instead of matte finish bonds is required.
Aluminum Wedge Cleaning

Aluminum build-up occurs on the bonding foot of the wedge after a period of usage. Polishing the FR and BR, using a fine matte finish (FMF), or changing styles of wedge can aid in reducing the quickness of this build-up.

Eventually, the aluminum deposits left on the surfaces of the wedge will require the wedge to be cleaned or replaced.

Aluminum can be etched away from the bond foot of the wedge by using a 20% by weight solution of sodium hydroxide (NaOH). An ultrasonic cleaner should be used, if available, to speed up the etching process. Using an ultrasonic cleaner, the process takes about 10 minutes. Without the aid of an ultrasonic cleaner, the process may take up to two hours. A plastic block with holes drilled to hold the wedges is necessary to keep the tool tips from vibrating together in the ultrasonic cleaner as shown above.

After the wedges are removed from the solution of NaOH, they should be rinsed in deionized water and blown dry for at least two cycles. Each wedge cleaned should then be inspected for cleanliness and wear. For stubborn aluminum deposits, this process can be repeated. In addition to the above cleaning procedure, if the wedge has aluminum build-up in the hole, a piece of tungsten wire or an unplugging probe can be used. If a wire or probe is used, the NaOH cleaning procedure should be repeated. This will assure that no flakes of metal are lodged in the hole, countersink, or maxiguide slot area that could cause wire feeding problems or device contamination.

Figure 54 – MaxiGuide™ wedge with aluminum build-up accumulated after 100,000 bonds.

Figure 55 – Slightly deformed bond surface caused by using a wedge with aluminum build-up. A similar appearance may be caused by a worn wedge.

Figure 56 – Aluminum cleaning set-up

Figure 57 – The same MaxiGuide wedge as seen in Figure 54 after the sodium hydroxide cleaning. Note the small amount of wear.
Wedge Part Number System

How To Order

Specify based on bond pad size and wire diameter.

XX = 0.00XX
15 = 0.0015 in./38µm

Specify in alphabetical order in part number after the length designation.

Example Part Number:
Gold Wire

2130-2025-L-CG-F-TiC

F. Optional Cross Groove
Optional Flat Face
(standard on some series)

G. Optional Material

A. & B. Series & Wire Feed Angle:
See the following catalog pages for various styles of wedges for aluminum and gold wire.
*Except the 2131 series where the 31 designates a 38° wire feed angle wedge with an elliptical back radius.

C. Hole Size:
Specify based on wire size and wire feed angle.
See the tables for each series for recommended wire diameters.
XX = 0.00XX
20 = 0.0020 in./51µm

E. Tool Length:
Specify based on bonder requirement. See following page for industry standard lengths.

F. Options:
Specify in alphabetical order in part number after the length designation.

"-F" = Flat Face
"-CG-F" = Cross Groove & Flat Face
"-CC-CG" = Concave Face & Cross Groove
"-LG" = Longitudinal Groove
"-PBR" = Polished Back Radius**
"-PFR" = Polished Front Radius**
"-PBF" = Polished Front & Back Radius & Bond Length**
"-PCS" = Polished Countersink
"-V" = Vertical Back Grind

"-10DBA" = 10° Back Angle
"-20DBA" = 20° Back Angle
"-CSF" = Concave Side Flats
"-45SC(W=Specify)" = 45° Side Chamfers
"-ELBR" = Elliptical Back Radius
"-CBR(Specify)" = Chamfered Back Radius
"-MOD C" = Maximized C Clearance
"-180 REV" = 180° Reverse Shank

**Not available with Cermet material option
See the Modifications page for illustrations and more options.
Some of the above features are standard on some series and do not need to be specified.

G. Material:
Tungsten Carbide: Recommended for Aluminum wire. Standard, do not specify in part number.
Titanium Carbide: Recommended for Gold wire. Specify "-TiC" at the end of the part number.
Cermet-Tipped: Recommended for Gold wire. Specify "-BKCER" at the end of the part number.

We reserve the right to change the design or specification of any catalog item without notice. Such changes will be in the interest of improving design.
Standard 1/16 inch Diameter Shank Designs

SD = Shank Diameter
0.0624/1.58mm
+0.001/0.003mm
-0.0002/0.005mm

SDF = Shank Diameter Flat
0.0460/1.17mm
±0.0005/0.013mm

Length Specified in Part Number

0.437/11.1mm = "-S"
0.625/15.88mm = "625"
0.750/19.05mm = "3/4"
0.828/21.03mm = "L"
1.000/25.4mm = "1.0"
1.078/27.38mm = "1.078"
±0.005/0.13mm

W Dimension

T Dimension

Standard 10° Back Grind Shank

Optional Vertical Grind Shank

180° Reverse Shank* (Not available Vertical Feed Style Tools)

Note: Small wire wedge shank styles vary slightly based on intended use and wire bonder design. For other shank characteristics, if any, see the catalog page for each series.


Dimensions in inches unless otherwise specified.
Optional Double Side Relief
*Specified in part number*

-DSR("W"x"H")

Example:
For a double side relief 0.004 inch wide x 0.010 inch high, specify "-DSR(004x010)"

Optional Oval Hole
*Specified in part number*

Width x Height

Example:
For an oval hole 0.0015 inch wide x 0.0020 inch high, specify "15x20" for hole size in part number (e.g. 2145-15x2015-L-F-CER)

Optional 30° W Angle
*Specified in part number*

-30DG

Optional Cross Groove
*Specified in part number*

-CG

Standard in some series
Enhances the transfer of ultrasonic energy in situations of poor bondability
Recommended for flat face gold wire tools

Optional Vertical Back Grind
*Specified in part number*

-V

Standard in some series
The vertical back grind is 0.040 inch high
Optional Concave Side Flats
*Specified in part number*

-**CSF**

Optional 45° Side Chamfers
*Specified in part number*

-**45SC(W=“Chamfered W”)**

For fine-pitch wire bonding

Example part number:

2145-2020-3/4-F-45SC(W=003)-TiC

Optional T Size
*Specified in part number*

-**T=“Optional T”**

For a T=0.010 inch, specify “-T=010”

Optional Modified C Dimension
*Specified in part number*

-**MOD C**

For maximum rear clearance

Optional Chamfered Back Radius
*Specified in part number*

-**CBR**

Note: The CBR option defaults to 0.0010 in./25µm, CBR(001), unless otherwise specified. For other CBR sizes, specify CBR(0008), CBR(0012), etc.