Sherlock Parts Build Guide

ANSYS, Inc.
Southpointe
2600 Ansys Drive
Canonsburg, PA 15317
ansysinfo@ansys.com
http://www.ansys.com
(T) 724-746-3304
(F) 724-514-9494

Release 2025 R1
January 2025

Copyright and Trademark Information

© 2025 ANSYS, Inc. Unauthorized use, distribution or duplication is prohibited.

ANSYS, Ansys Workbench, AUTODYN, CFX, FLUENT and any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries located in the United States or other countries. ICEM CFD is a trademark used by ANSYS, Inc. under license. CFX is a trademark of Sony Corporation in Japan. All other brand, product, service and feature names or trademarks are the property of their respective owners. FLEXlm and FLEXnet are trademarks of Flexera Software LLC.

Disclaimer Notice

THIS ANSYS SOFTWARE PRODUCT AND PROGRAM DOCUMENTATION INCLUDE TRADE SECRETS AND ARE CONFIDENTIAL AND PROPRIETARY PRODUCTS OF ANSYS, INC., ITS SUBSIDIARIES, OR LICENSORS. The software products and documentation are furnished by ANSYS, Inc., its subsidiaries, or affiliates under a software license agreement that contains provisions concerning non-disclosure, copying, length and nature of use, compliance with exporting laws, warranties, disclaimers, limitations of liability, and remedies, and other provisions. The software products and documentation may be used, disclosed, transferred, or copied only in accordance with the terms and conditions of that software license agreement.

ANSYS, Inc. and ANSYS Europe, Ltd. are UL registered ISO 9001: 2015 companies.

U.S. Government Rights

For U.S. Government users, except as specifically granted by the ANSYS, Inc. software license agreement, the use, duplication, or disclosure by the United States Government is subject to restrictions stated in the ANSYS, Inc. software license agreement and FAR 12.212 (for non-DOD licenses).

Third-Party Software

See the legal information in the product help files for the complete Legal Notice for ANSYS proprietary software and third-party software. If you are unable to access the Legal Notice, contact ANSYS, Inc.

Published in the U.S.A.

Table of Contents

Chapter 1: Introduction to the Sherlock Part Build Guide

Introduction

1.1. How to Use this Guide

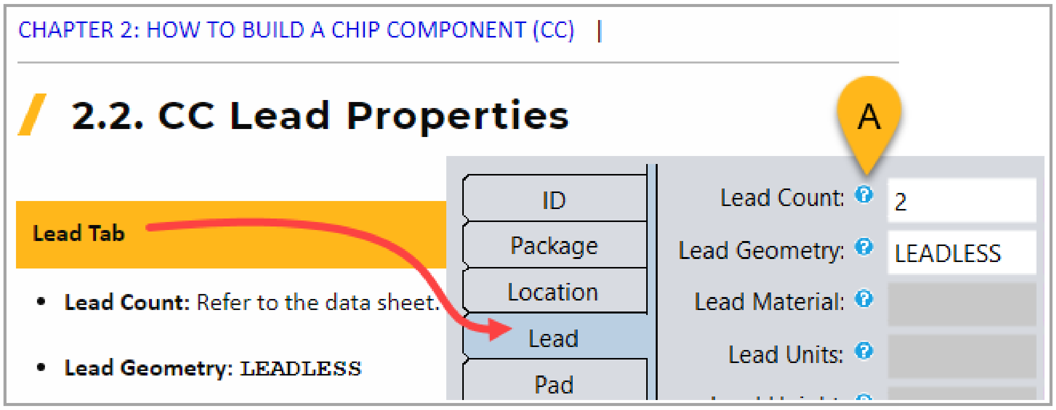
The Ansys Sherlock™ electronics reliability prediction software has a vast and growing library of pre-built electronic parts for populating the circuit boards in your Sherlock project. But for those times you must build your own part, this *Sherlock Parts Build Guide* provides the information and tips to make the job easier.

The image below illustrates how the guide is organized. Each chapter is dedicated to a specific type of part. The screenshot below, for example, comes from chapter two which covers CC's (chip components). Each subsection is dedicated to a specific properties tab in the Sherlock **Part Properties Viewer**. The name of the tab is highlighted in Ansys gold. Relevant properties are listed beneath, marked by bullet points. Explanatory comments appear in plain text ("Refer to the part data sheet.") while verbatim inputs are styled like this: `LEADLESS`.

When building a part, use the navigation pane to find the relevant chapter. Then work your way through each section of the chapter in sequence. Each section provides tips and information to help you define the part properties.

Tip:

In many sections of *Sherlock Parts Build Guide*, only the part properties that require special explanation are listed. Properties which are obvious such as **Packge Weight**, for example, may not be listed, but you are still required to enter the relevant value. If you wish to distinguish between relevant and non-relevant properties for a given part, refer to the section below, Part Property Viewing/Editing Options (p. 3).



CHAPTER 2: HOW TO BUILD A CHIP COMPONENT (CC) |

2.2. CC Lead Properties

Lead Tab

- **Lead Count:** Refer to the data sheet.
- **Lead Geometry:** LEADLESS

Lead Count: 2
Lead Geometry: LEADLESS
Lead Material:
Lead Units:

1.2. Help in Understanding Sherlock's Part Properties

Sherlock tracks nearly a hundred part properties. If you need help understanding what a specific property represents, you can find answers several ways:

- Click the **Tool Tip** icon (A in the image above) to view the part property definition.
- Refer to Sherlock Part Properties in the *Sherlock User's Guide*. (This same information is also available in PDF format within Sherlock. Click **Part Properties** in Sherlock's **Help** menu.) You can also find help in the user's guide chapter on FEA modeling, specifically the sections on FEA- Part Modeling and FEA- Lead Modeling.
- The *Sherlock User's Guide* contains tables that show which part properties are used in each analysis type. See Tables: Required Part Properties per Analysis Type.

1.3. Important Tips Before You Get Started

Before you begin building your part, review the following helpful tips:

- The Ansys Sherlock team is continually adding new parts to the Sherlock Parts Library. So, keep your Part Library up to date. They may have already built the component for you. See Updating Your Sherlock Part Library (p. 4).
- By default, the **Part Properties Viewer** and **Editor** display all properties whether they are relevant to the selected part or not. If you prefer, you can adjust how Sherlock displays unused part properties. Sherlock's ability to hide or gray out properties that do not apply to a part is a very helpful feature (introduced in version 24 R1). It can save you from the mistake of researching a part property that does not apply to a given part. See below, Part Property Viewing/Editing Options (p. 3).
- For help in assigning proper materials to a new part, use the Common Materials Quick Reference (p. 3).
- After you build your part, refer to Checking Your Work (p. 71). It provides helpful advice for using some of Sherlock's features to help you identify part property input errors.

1.4. Part Property Viewing/Editing Options

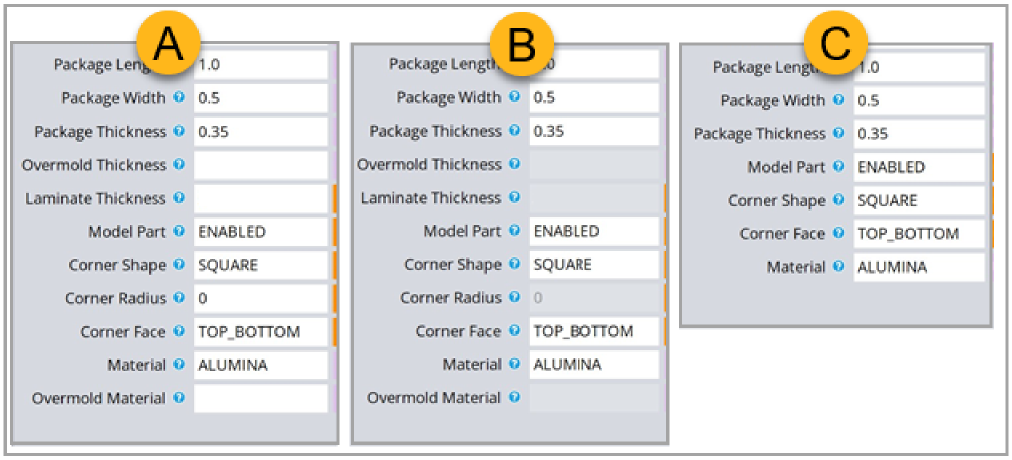
Note:

The ability to hide non-relevant part properties was introduced in version 2024 R1 of Sherlock.

Not all part properties apply to all parts. By default, the **Part Properties Viewer** and **Editor** display all properties whether they are applicable to the selected part or not. You can even edit these unused properties, although it has no effect on how Sherlock handles the part in its analyses. If you prefer, you can adjust how Sherlock displays unused part properties. There are three **Unused Part Properties** options:

- **ENABLED** (default): Unused properties are visible for a given part and are editable. In the images below, package properties are shown for the same part. Although **Overmold Thickness**, **Laminate Thickness**, **Corner Radius**, and **Overmold Material** do not apply to this part, Sherlock displays these properties and allows you to edit them when **ENABLED** is selected. See image A.
- **DISABLED**: Unused properties are visible for a given part but may not be edited. Note the grayed out fields in image B.
- **HIDDEN**: Unused properties are not visible at all, as shown in image C.

You can find the **Unused Part Properties** setting in Sherlock's **Main Menu** > **Settings** > **Advanced Settings** > **Unsused Part Properties**.



	A
Package Len	1.0
Package Width	0.5
Package Thickness	0.35
Overmold Thickness	
Laminate Thickness	
Model Part	ENABLED
Corner Shape	SQUARE
Corner Radius	0
Corner Face	TOP_BOTTOM
Material	ALUMINA
Overmold Material	

	B
Package Length	0
Package Width	0.5
Package Thickness	0.35
Overmold Thickness	
Laminate Thickness	
Model Part	ENABLED
Corner Shape	SQUARE
Corner Radius	0
Corner Face	TOP_BOTTOM
Material	ALUMINA
Overmold Material	

	C
Package Leng	1.0
Package Width	0.5
Package Thickness	0.35
Model Part	ENABLED
Corner Shape	SQUARE
Corner Face	TOP_BOTTOM
Material	ALUMINA

1.5. Common Materials Quick Reference

Often, manufacturer data sheets do not specify the materials used in an electronic package's construction. When this happens, refer to the table below to select the material based on part type and package style.

Warning:

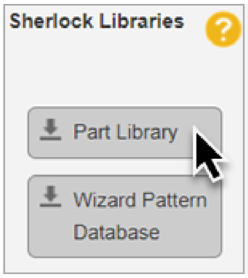
The materials listed in the table below are likely correct. But when specifying part properties in Sherlock, always defer to the best information available. Look first to the manufacturer's data sheet for material specifications or to the supporting technical documentation.

Part Type	Type Package	Material	Notes
Capacitor Ceramic	CC	Calcium Zirconate	Class I type (C0G, NP0)
Capacitor Ceramic	CC	Barium titanate	Class II type (X7R, Z5U, Y5V)
Capacitor Aluminum Polymer	VCHIP / RADIAL	Aluminum	See Electrolytic Capacitor- SMT (VCHIP) Style (p. 43) for custom material recommendation
Resistor	CC	Alumina	
Ferrite Bead	CC	Ferrite	
Current Sense Resistors		Nickle chrome/ Copper alloy/Alumina	
Inductor	Various	Ferrite	See page How to Build an SMT Inductor (p. 55) for custom material recommendation and package style discussion
Thermistor	CC / Disc	Barium Titanate	Composed typically of various oxides, Barium Titanate is a reasonable approximation of mechanical properties
Current Sense Resistors	CC	Nickle chrome/ Copper alloy/Alumina	
Crystal Oscillators	LCCC	Alumina	
MEMS Oscillators	CC	Overmold Leaded	
Varistor	CC / Disc	Zinc Oxide	

1.6. Updating Your Sherlock Part Library

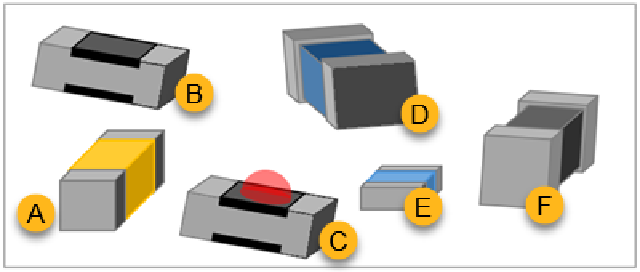
Ansys is continually updating and expanding Sherlock's part database which you can automatically search, match, and obtain properties for the parts in your part list—reducing model build time and improving accuracy. Ansys releases new database versions approximately every two months. For the most current release of the part database, download and add the new file from the Ansys Customer Portal:

```
Customer Portal > Current Release > Add-On Packages Sherlock Libraries
> Part Library
```



Chapter 2: How to Build a Chip Component (CC)

Chip Components (CC) are leadless packages which include resistors, ceramic capacitors, ferrite beads, and diodes.



A- Capacitor • B- Diode • C- LED • D- Inductor • E- Thermistor • F- Capacitor

Note:

There are special considerations for resistor networks or capacitor arrays. See the section below Resistor Networks and Capacitor Arrays (p. 9).

ID Tab

- **Part Type**: Refer to the part data sheet. Typical **Part Type** for the CC include **`CAPACITOR CERAMIC`**, **`RESISTOR`**, **`FERRITE BEAD`**, and **`DIODE`** (for LEDs).
- **Failure Class**: This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

Chip Component Properties:

2.1. CC Package Properties

Package Tab

- **Package Name**: Refer to the part data sheet. Example: **`0402`**.
- **Package Type**: **CC**
- **Package Mount**: **SMT**

- **Package Length:** Refer to the part data sheet. If not listed, use the default package dimension in the table below.

Tip:

Always give priority to the part data sheet. However, if the dimensions are not listed, use the default dimensions from the table below. The CC package name is an industry standard numeric code based on part dimensions. Cross reference the part code with its default dimensions.

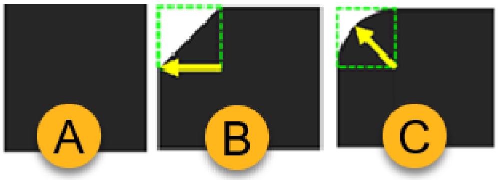
Code		Length (l)		Width (w)		Height (h)		Power
Imperial	**Metric**	**inch**	**mm**	**inch**	**mm**	**inch**	**mm**	**W**
0201	0603	0.024	0.6	0.012	0.3	0.01	0.25	1/20
0402	1005	0.04	1.0	0.02	0.5	0.014	0.35	1/16
0603	1608	0.06	1.55	0.03	0.85	0.018	0.45	1/10
0805	2012	0.08	2.0	0.05	1.2	0.018	0.45	1/8
1206	3216	0.12	3.2	0.06	1.6	0.022	0.55	1/4
1210	3225	0.12	3.2	0.10	2.5	0.022	0.55	1/2
1812	3246	0.12	3.2	0.18	4.6	0.022	0.55	1
2010	5025	0.20	5.0	0.10	2.5	0.024	0.6	3/4
2512	6332	0.25	6.3	0.12	3.2	0.024	0.6	1

- **Package Width:** Refer to the part data sheet. If not listed, use the default dimension in the table above.

- **Package Thickness:** Refer to the part data sheet. If not listed, use the default height dimensions in the table above.

- **Model Part**: **ENABLED**

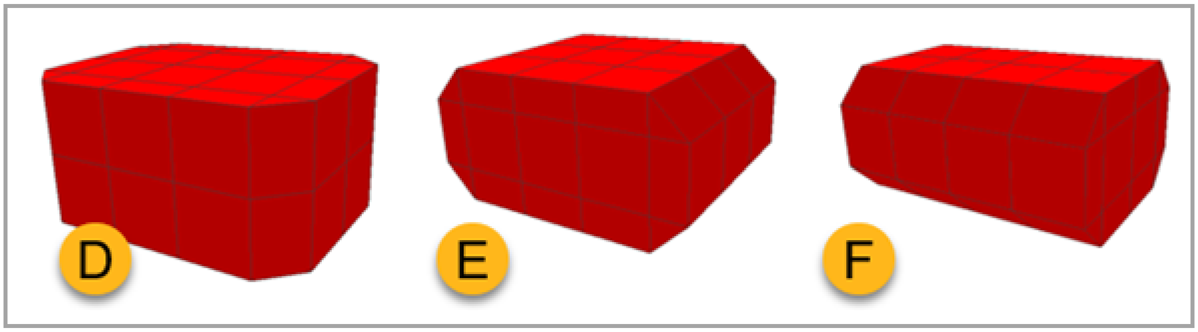
- **Corner Shape:** Typically, **SQUARE**.



A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius.

- **Corner Radius**: For **SQUARE**, radius does not apply. See image above for **`MITER`** and **ROUND** corners.

- **Corner Face**: Typically, **TOP_BOTTOM**.



D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Material:** Refer to the part data sheet. If the material is not listed, use the following guidelines.
  - **Ceramic Capacitors:** Material is based off the dielectric. If dielectric is C0G or NP0, then enter **`CALCIUM ZIRCONATE`**. Otherwise the material is typically **`BARIUMTITANATE`**.
  - **Resistors:** Material is typically **`ALUMINA`** unless data sheet states otherwise.
  - **Ferrite Beads:** Material is typically **`FERRITE`** unless the data sheet states otherwise.
  - **Diodes:** Material is typically **`ALUMINA`** unless the data sheet states otherwise.
- **Junction Res (C/W):** This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

2.2. CC Lead Properties

Lead Tab

- **Lead Count:** Refer to the part data sheet. In the case of CC's, **Lead Count** refers to the number terminations soldered to the board.
- **Lead Geometry: `LEADLESS`**

2.3. CC Pad Properties

Pad Tab

PCB artwork, when available, supercedes pad dimensions given by a data sheet or a standard.

Tip:

If you have a completed Sherlock model, use the Update Pad Properties Tool in Sherlock which is designed to automate entering pad properties.

This table shows recommended pad dimensions for CC Resistor, Inductor, and Capacitor parts. It is included for reference. *PCB artwork should be used as the input!*

CC Component	Length	Width	Pad Length	Pad Width	Pitch
01005	0.4	0.2	0.18	0.2	0.3
0201	0.6	0.3	0.3	0.3	0.6
0306	0.8	1.6	0.5	1.6	0.8
0402	1	0.5	0.5	0.5	1
0508	1.2	2	0.8	2	1.2
0603	1.6	0.8	0.8	0.9	1.6
0612	1.6	3.2	1	3.2	1.6
0805	2	1.2	1.3	1.3	2
1008	2.7	2	2	1	2.7
1020	2.5	5	1.3	5.5	2.5
1206	3.2	1.6	1.6	1.6	3.2
1210	3.2	2.5	1.6	2.5	3.2
1218	3.2	4.5	1	4.6	3.2
1225	3.2	6.4	1.7	6.4	3.2
1806	4.5	1.6	1.7	1.6	4.5
1812	4.5	3.2	2	3.2	4.5
1825	4.5	6.4	2	6.4	4.5
2010	5	2.5	2	2.6	5
2030	5.1	7.6	2	7.8	5.1
2220	5.7	5	2	4.2	5.7
2225	5.7	6.35	2	6.35	5.7
2512	6.4	3.2	2	3.2	6.4

2.4. CC Solder Properties

Solder Tab

- **Solder Material**: Typically, **`DEFAULT`**

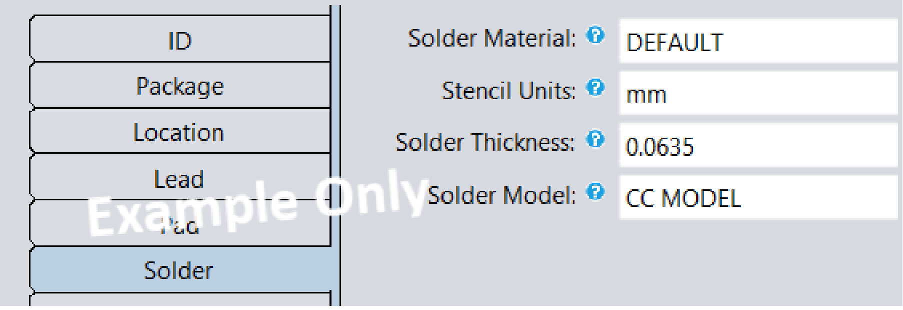
  When set to **`DEFAULT`**, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

  If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

- **Solder Model: `CC MODEL`.** This model is valid for all Ceramic Chips.

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

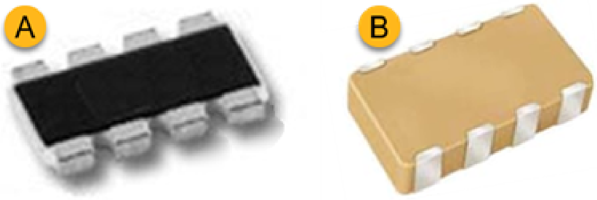
To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.



Solder Material: DEFAULT
Stencil Units: mm
Solder Thickness: 0.0635
Solder Model: CC MODEL

2.5. Resistor Networks and Capacitor Arrays

There are variations of CC resistors and capacitors that combine multiple devices into a single SMT package. They are often called arrays or networks.

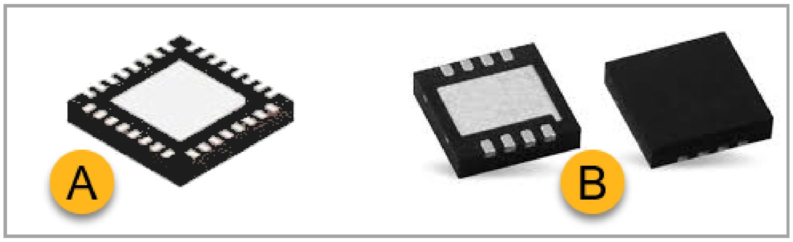


A = Resistor Network • B = Capacitor Array

In Sherlock, these are defined in a manner similar to how standard two-lead CC resistors and capacitors are defined. The main difference is seen when the number of leads increases. A four-element capacitor array, for example, has eight leads. You would still use the package dimensions provided by the datasheet, and you would follow the standard assumptions used for CC resistors and capacitors—such as assigning materials when that information is not provided by the manufacturer.

Chapter 3: How to Build a QFN/DFN

QFN's (Quad Flat No Leads) and DFN's (Dual Flat No Leads) are leadless IC packages. Typically, they have low CTE properties in the range from 10 to 14 ppm. They are sensitive to thermal cycling loads which cause them to accumulate solder fatigue quickly.



A = QFN • B = DFN

ID Tab

- **Part Type**: **`IC`**

- **Failure Class**: This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

QFN/DFN Part Properties:

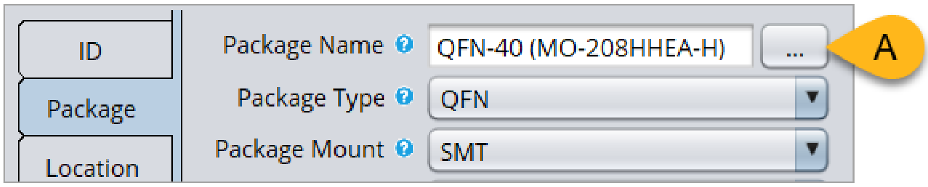
3.1. QFN/DFN Package Properties

Package Tab

- **Package Name**: **`QFN`** or **`DFN`**.

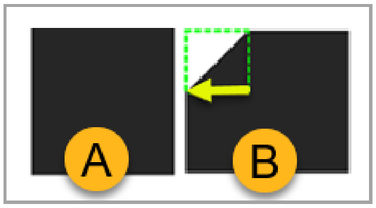
Tip:

You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.

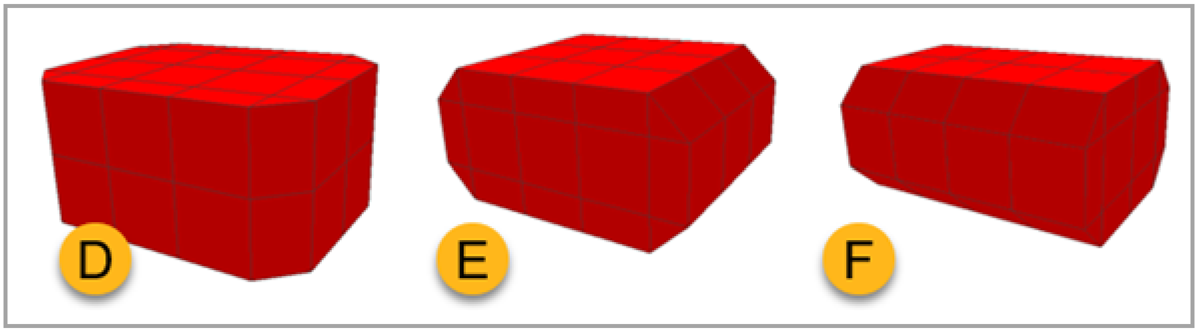


Package Name: QFN-40 (MO-208HHEA-H)
Package Type: QFN
Package Mount: SMT

- **Package Type**: **QFN** or **DFN**
- **Package Mount**: **SMT**
- **Package Length:** Refer to data sheet drawing.
- **Package Width:** Refer to data sheet drawing.
- **Package Thickness:** Refer to data sheet drawing.
- **Corner Shape:** Typically, either **SQUARE** (A, below) or **MITER** (B).
- **Corner Radius:** For **SQUARE** (A, in the image below), the **Corner Radius** is **0**. For **MITER** (B), the radius is represented by the arrow.



- **Model Part**: **ENABLED**
- **Corner Face**: Typically, **TOP_BOTTOM**



D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Material: `OVERMOLD-QFN`**

Note:

Manufacturers typically do not provide package material for these parts. You can use the **`OVERMOLD-QFN`** material from the Sherlock Library. This material represents a generic assumption for mechanical properties that Ansys has found matches average effective properties for a range of QFN packages.

3.2. QFN/DFN Lead Properties

Lead Tab

- **Lead Count:** Refer to the part data sheet.
- **Lead Geometry: LEADLESS**

3.3. QFN/DFN Pad Properties

Pad Tab

Tip:

Do not use the PCB side pad geometry or land pattern for this part definition. For QFNs, enter the *component* side pad geometry.

- **Pad Length:** Refer to the part data sheet.
- **Pad Width:** Refer to the part data sheet.

Tip:

On a data sheet, when a dimension is given with a min and max, calculate a nominal value halfway between.

3.4. QFN/DFN Solder Properties

Solder Tab

- **Solder Material**: Typically, **`DEFAULT`**

  When set to **`DEFAULT`**, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

  Tip:

  QFNs are sensitive to solder thickness. Increasing this solder thickness increases fatigue life.

- **Solder Model: `QFN MODEL`** (This model is valid for both QFN and DFN packages.)

3.5. QFN/DFN Die Properties

Tip:

In addition to the information below, refer to the Die Properties Guide (p. 37).

Die Tab

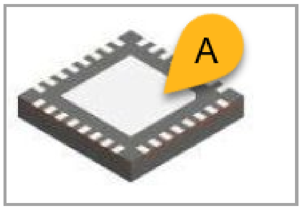
- **Die Length:** Assume 0.1 mm smaller than the flag length.
- **Die Width:** Assume 0.1 mm smaller than the flag width.
- **Die Thickness:** Assume **`0.185`** mm.

Tip:

- Typically, manufacturers do no state the die outline dimensions. When it is not known, Ansys recommends assuming the die outline should be slightly smaller than the flag dimensions. See QFN/DFN Flag Properties (p. 15).
- If the device has no flag, it should be built as a SON. (See How to Build a SON Part (p. 17).)
- Manufacturers usually do not state **Die Thickness**. Typical values for a package thickness of 1.0 mm and below are between 0.185 and 0.2 mm. For packages thicker than 1.0 mm, you may assume a die thickness of 0.4 mm if it's not stated on the datasheet. For memory devices, **Die Thickness** is generally between 0.2 and 0.25 mm.
- For packages thicker than 1.0 mm, assume a **Die Thickness** of 0.4 mm if it's not stated on the data sheet.

- For memory devices, **Die Thickness** is generally between 0.2 and 0.25 mm.

3.6. QFN/DFN Flag Properties

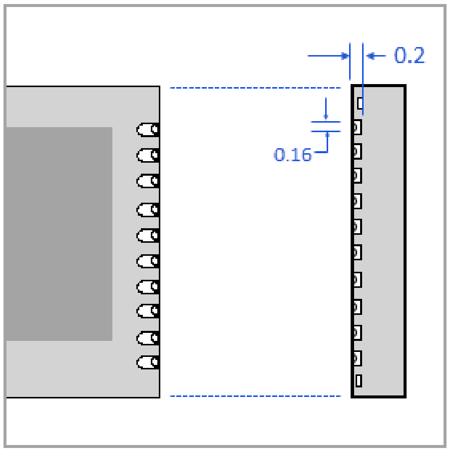


The flag (A) is shown here.

Flag Tab

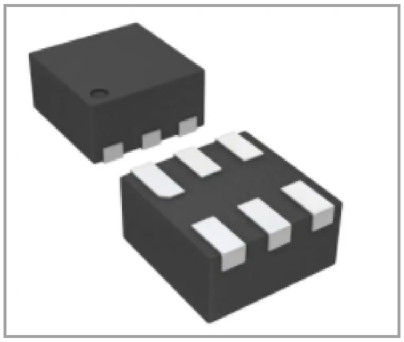
- **Flag Length:** Refer to part data sheet drawing.
- **Flag Width:** Refer to part data sheet drawing.
- **Flag Thickness:** Assume `0.2` mm.

  Data sheets rarely provide flag thickness explicitly. Usually it is between 0.2 and 0.25 mm. In the example below, the package drawing shows an exposed edge of the component with a 0.2 mm dimension indicated for the lead frame. Since that is the best information available, 0.2 mm would be used.



Flag Units: MM
Flag Length: 3.52
Flag Width: 3.52
Flag Thickness: 0.2

Chapter 4: How to Build a SON Part



Stub Leaded SON (Small Outline No Lead)

ID Tab

- **Part Type**: Typically **`IC`**, **`INDUCTOR`**, **`DIODE`**, **`TRANSDUCER`**, or **`TRANSISTOR`**. Refer to the part data sheet.

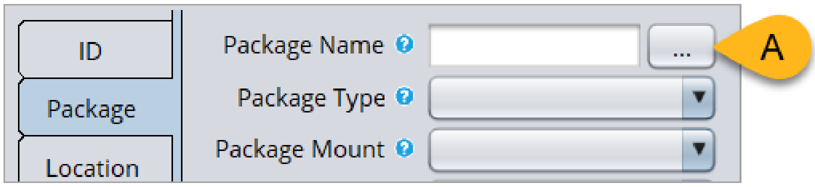
SON Part Properties:

4.1. SON Package Properties

Package Tab

- **Package Name**: Example: **`SON`**. Refer to the part data sheet. Supported values are defined in the package data files provided by Sherlock or user-defined package data files. See Package Management in the *Sherlock User's Guide*.

> **Tip:**
>
> You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.

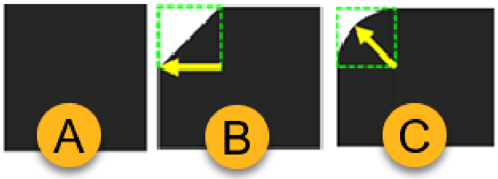


- **Package Type**: **SON**

Note:

If a flag is present, set **Package Type** to **DFN**.

- **Package Mount**: **SMT**
- **Package Length:** Refer to data sheet drawing.
- **Package Width:** Refer to data sheet drawing.
- **Package Thickness:** Refer to data sheet drawing.
- **Model Part**: **ENABLED**
- **Corner Shape:** Typically, **SQUARE**.



A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius.

- **Corner Radius**: Does not apply to **SQUARE Corner Shape**. See image above for **MITER** and **ROUND** corners.
- **Corner Face**: **TOP_BOTTOM**
- **Material:** For IC's and Diodes, **Material** can be set to **OVERMOLD-QFN**. For all other **Part Types**, refer to the part data sheet.

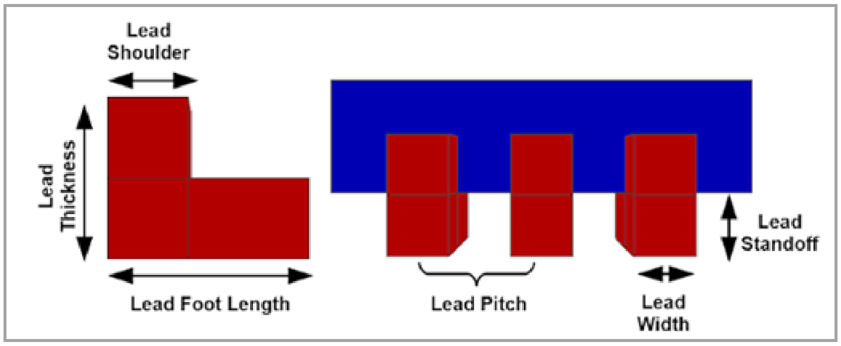
4.2. SON Lead Properties

Tip:

The content below assumes you are using Sherlock's default lead modeling. If you have enabled Advanced Lead Meshing, refer to Advanced Lead Meshing in the *Sherlock User's Guide* for additional information on how lead properties are defined.

Lead Tab

- **Lead Count**: Refer to part data sheet.
- **Lead Geometry**: `STUB`
- **Lead Material**: Typically, `COPPER`.
- **Lead Frame Percentage**: This is the percentage of lead material in the layer of the package beneath the die. This is only used when exporting a project to Ansys Electronics Desktop for thermal conductivity calculations.
- **Lead Height**: Refer to data sheet drawing.



- **Lead Width**: Refer to data sheet drawing.
- **Lead Thickness**: Refer to data sheet drawing.
- **Lead Foot Length**: Refer to data sheet drawing.
- **Lead Modeling**: `ENABLED`
- **Lead Layout**: `DUAL_LONG`
- **Lead Pitch**: Refer to data sheet drawing.
- **Lead Shoulder**: `0`

Tip:

Stub-leaded parts do not have a lead shoulder. Set the value to `0`.

- **Lead Standoff**: Refer to the data sheet drawing, but often this information is not provided. In that case, Ansys recommends entering `0.1` mm.

4.3. SON Solder Properties

Solder Tab

- **Solder Material**: Typically, `DEFAULT`.

When set to `DEFAULT`, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

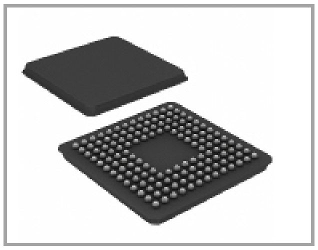
- **Solder Model**: `LEADED MODEL`

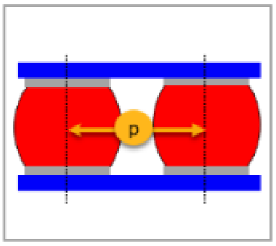
4.4. SON Die Properties

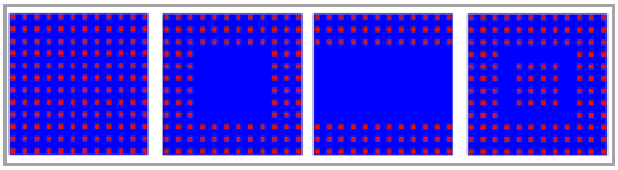
Refer to the section Die Properties Guide (p. 37).

Chapter 5: How to Build a BGA Part

BGA (Ball Grid Array) IC packages are often a critical component in a circuit, one of the more expensive parts in a BOM, and one of the package styles most sensitive to thermal and mechanical loads. Common types are standard overmolded BGAs, flip chip BGAs (lidded, unlidded, or with stiffener rings), or ceramic BGAs. Because these parts are so important, Ansys recommends characterizing a sample part to determine CTE to correlate predictions with qualification data if available.







ID Tab

- **Part Type**: Typically, `IC`. Less commonly: `VOLTAGE REGULATOR` or `TRANSDUCER`—which are made with this form factor. Refer to the part data sheet.

- **Failure Class**: This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

BGA Part Properties:

- 5.1. BGA Package Properties
- 5.2. BGA Ball Properties
- 5.3. BGA Solder Properties
- 5.4. BGA Die Properties

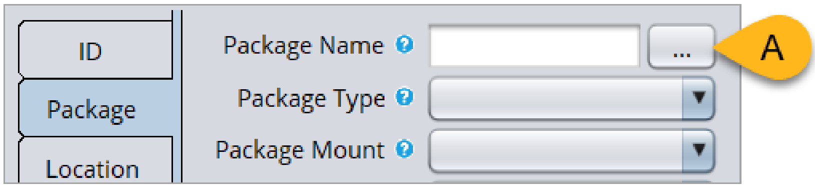
5.1. BGA Package Properties

Package Tab

- **Package Name**: Example: **BGA-24**. Refer to the part data sheet. Supported values are defined in the package data files provided by Sherlock or user-defined package data files. See Package Management in the *Sherlock User's Guide*.

Tip:

You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.



- **Package Type**: **BGA**

- **Package Mount**: **SMT**

- **Package Length**: Refer to the part data sheet drawing.

- **Package Width**: Refer to the part data sheet drawing.

- **Overmold Thickness**: Refer to the part data sheet drawing.

Tip:

If the data sheet does not specify **Laminate** and **Overmold Thickness** separately, you can assume about two thirds of the overall package thickness is the overmold and one third is the laminate.

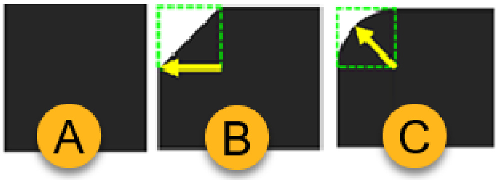
- **Laminate Thickness**: From datasheet drawing

Tip:

See tip above under **Overmold Thickness**.

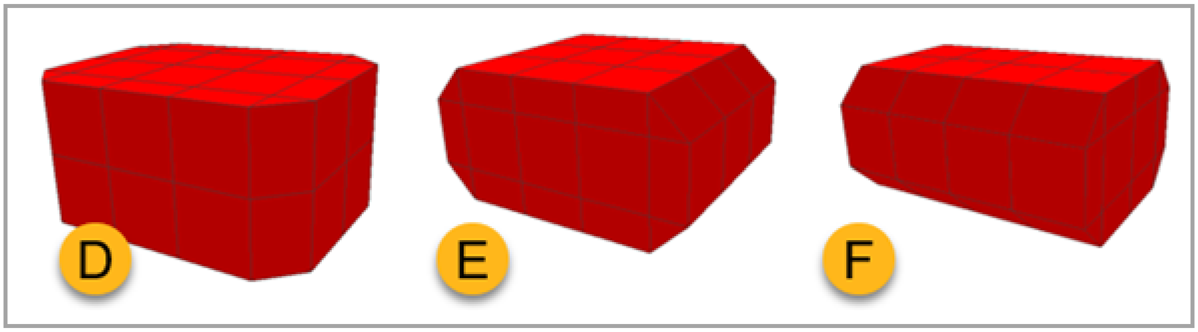
- **Model Part**: **ENABLED**

- **Corner Shape:** Typically, **SQUARE**.



A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius.

- **Corner Radius**: For **`SQUARE`**, the radius is **`0`**. See image above for **`MITER`** and **`ROUND`** corners.
- **Corner Face**: **`TOP_BOTTOM`**. See image below.



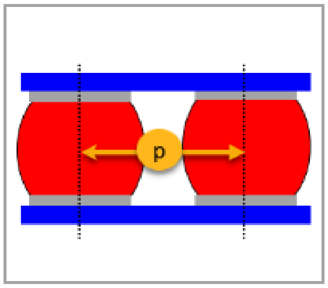
D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Substrate Material**: Usually **`LAMINATE-BGA`**, but see notes below.
  - The **`LAMINATE-BGA`** material from the Sherlock library represents a generic assumption for mechanical properties that Ansys has found match average effective properties for a range of BGA packages. *However,* if component CTE data is available, a custom laminate material should be entered. See Laminate Management in the *Sherlock User's Guide*.
  - CBGAs, or ceramic BGAs, require a ceramic substrate. **`ALUMINA`** is often used.
- **Overmold Material**: **`OVERMOLD-BGA`**
  - For unlidded flip-chip BGAs, no overmold material is necessary
  - For lidded components or those with stiffener rings, **`COPPER`** is the typical material. The overmold thickness in those cases should be adjusted so the prediction matches qualification test data which requires a thickness of around 0.4 or 0.6 mm.

5.2. BGA Ball Properties

Ball Tab

- **Ball Pattern**: Refer to part data sheet drawing.
- **Ball Count**: Refer to part data sheet drawing.
- **Ball Pitch**: Refer to part data sheet drawing.

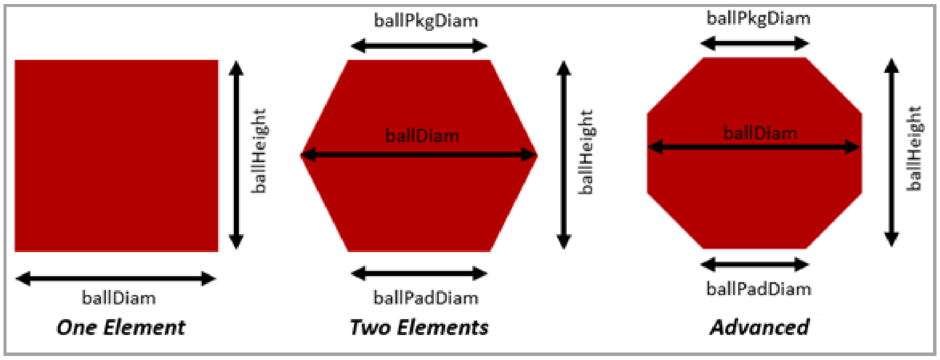


Ball Pitch: Distance between adjacent solder balls for a BGA component

- **Ball Diameter**: Refer to part data sheet drawing.

Tip:

The image below illustrates **Ball Diameter**, **Ball Package Diameter**, **Ball Diameter**, **Ball Pad Diameter**, and **Ball Height**. For a detailed discussion on these properties, see Solder Ball Modeling in the *Sherlock User's Guide*.



- **Ball Package Diameter**: Refer to part data sheet drawing.
- **Ball Pad Diameter**: Refer to part data sheet drawing.

Tip:

Often, data sheets do not provide **Ball Package Diameter** or **Pad Diameter**. As an approximation, use 90% of the **Ball Diameter**.

- **Ball Height**: Refer to part data sheet drawing.

Tip:

- For **Ball Height**, use *max* dimension, not nominal.
- Datasheet dimensions for solder balls show the geometry of the loose component before reflow with solder paste. Add 70 to 100 µm to the stated ball height. For

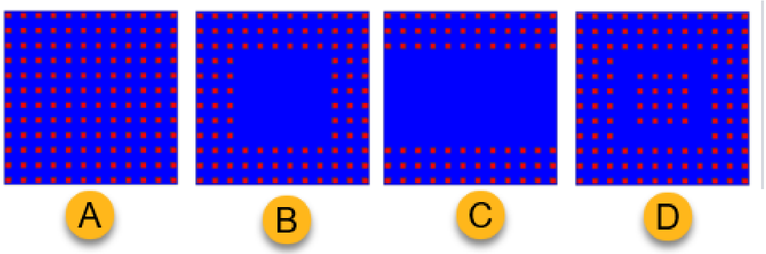
larger BGAs (40 x 40 mm), the high mass of the component will cause the solder balls to collapse slightly, so this edit is not needed.

- For Ball Grid Layout Properties (**Ball Chan Width**, **Ball Modeling**, **Ball Perimeter Rows**, **Ball Perimeter Cols**, **Ball Island Rows**, **Ball Island Cols**), refer to the datasheet drawing, and see notes below.

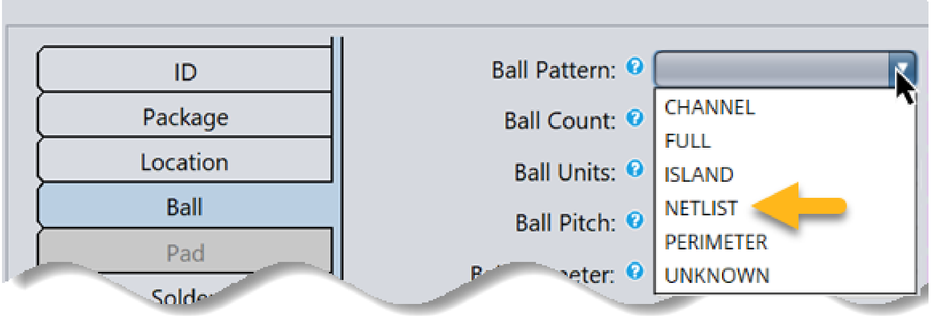
Tip:

The solder ball modeling properties mentioned in this section are discussed in detail in Solder Ball Modeling in the *Sherlock User's Guide*.

  - Ball layouts often come in standard patterns that are defined in Sherlock: **`FULL`** (A, below), **`PERIMETER`** (B), **`CHANNEL`** (C), or **`ISLAND`** (D).



  - For non-standard layouts, the **`NETLIST` Ball Pattern** option will extract ball location information from the PCB design files. **`NETLIST`** will also correctly populate ball locations for standard grid layouts.

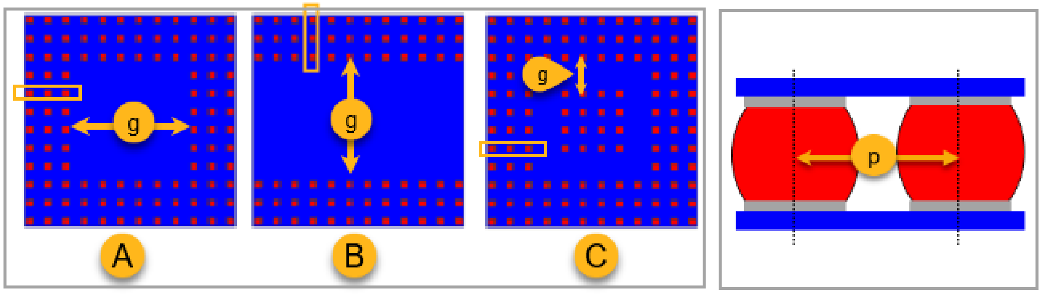


  - To correctly populate **Ball Chan Width**, **Rows**, and **Columns** for standard BGA layouts, remember:

    → **Ball Channel Width** applies only to **`Perimeter`** (A in the image below), **`Channel`** (B), and **`Island`** (C) patterns.

    → **To Calculate Ball Channel Width**

    Ball Channel Width = [ball pitch] x [the number of ball columns on one side of the gap]



g = gap • gold rectangle = ball columns (three columns in each example) • p = ball pitch

---

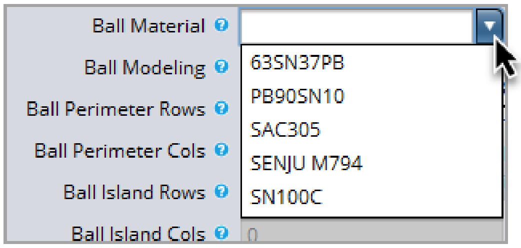
Tip:

In some cases, setting the correct ball pattern properties can be confusing. To confirm your work is correct, view the component in Sherlock's 3D Viewer to verify the accuracy of the model. See Checking Your Work (p. 71).

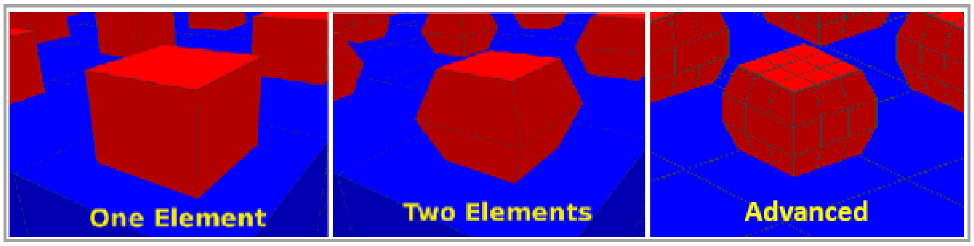
- **Ball Material**: Refer to the part data sheet. **Ball Material** is the type of solder ball used to connect the BGA to the PCB. Supported values are defined in the solder data file provided by Sherlock and/or a user-defined data file.

Tip:

BGA components may be assembled with solder balls composed of a different alloy than what was selected for the PCB solder paste.



- **Ball Modeling**: **`NONE`**, **`ONE ELEMENT`**, **`TWO ELEMENT`**, or **`ADVANCED`**. For a detailed discussion on ball modeling types, see Solder Ball Modeling in the *Sherlock User's Guide*.



5.3. BGA Solder Properties

Solder Tab

- **Solder Material**: Typically, **`DEFAULT`**

  When set to **`DEFAULT`**, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

  If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

- **Solder Model**: **`BGA Model`**. This solder model is valid for all BGAs.

5.4. BGA Die Properties

Tip:

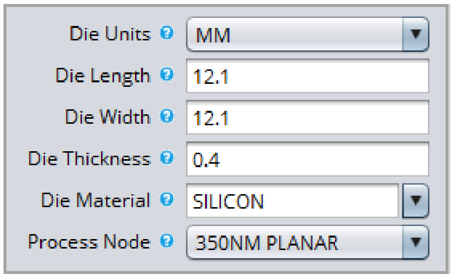
In addition to the information below, refer to the Die Properties Guide (p. 37).

Die Tab

Tip:

Manufacturers rarely provide die dimensions. When this is the case, Ansys recommends assuming half the package outline.

- **Die Length**: Assume half **Package Length**.
- **Die Width**: Assume half **Package Width**.
- **Die Thickness**: If not provided by the manufacturer, assume the following:
  - For a package thickness of 1.0 mm and below, **Die Thickness** is between 0.185 and 0.2 mm.
  - For packages thicker than 1.0 mm, assume a **Die Thickness** of 0.4 mm.
  - For memory devices, **Die Thickness** is generally between 0.2 and 0.25 mm.
- **Die Material**: This is the primary material of the die. Material names are defined in the material data file provided by Sherlock and/or a user-defined data file.

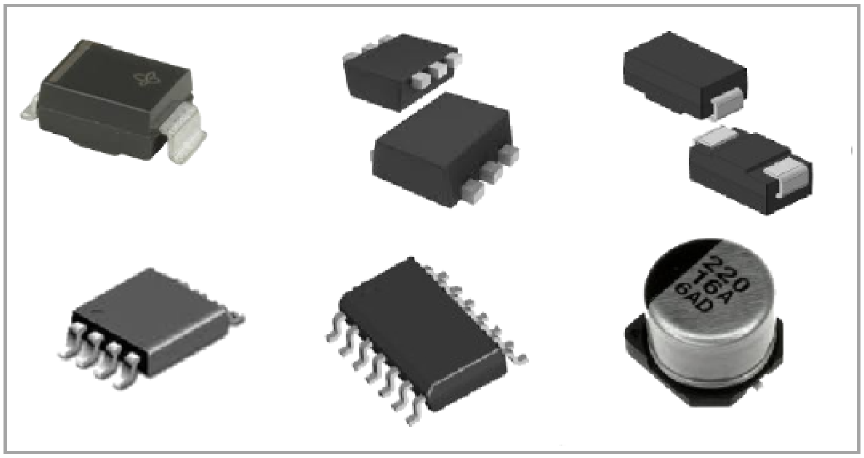


Die Units	MM
Die Length	12.1
Die Width	12.1
Die Thickness	0.4
Die Material	SILICON
Process Node	350NM PLANAR

- **Process Node**: This field is for informational purposes only. The property is not used in any of Sherlock's standard analyses.

Chapter 6: How to Build an SMT Leaded Package

A variety of part types and package styles use leads that extends out from the side or bottom of the package body which are soldered to the PCB. These leads offer some compliance to the solder joint, meaning that in general leaded parts have improved thermal cycling solder fatigue performance.



ID Tab

- **Part Type**: Surface mount leaded packages are a common style for components with a silicon die. **Part Types** include `Diode`, `IC`, `Transistor`, `Transducer`, and so on.

Tip:

Lead geometries vary within this category. Expect to see gullwing, C-bend, L-lead, stub, and so on. See below, SMT Leaded- Lead Geometry (p. 32).

- **Failure Class**: This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

SMT Leaded Part Properties:

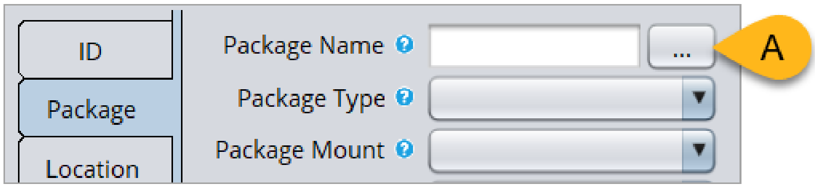
6.1. SMT Leaded Package Properties

Package Tab

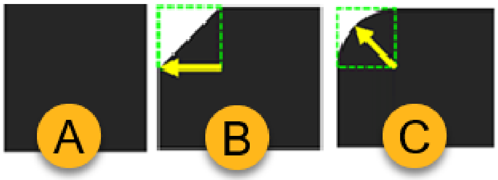
- **Package Name**: Refer to the part data sheet. Supported values are defined in the package data files provided by Sherlock or user-defined package data files. See Package Management in the *Sherlock User's Guide*.

Tip:

You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.

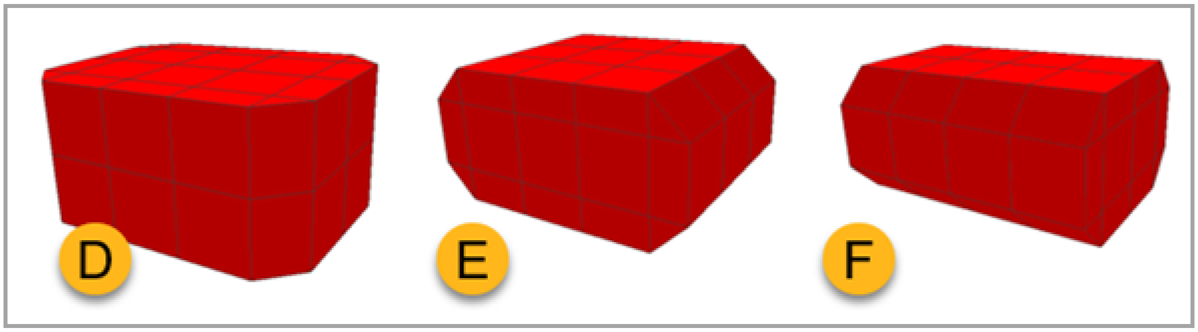


- **Package Type**: Refer to the part data sheet.
- **Package Mount**: **SMT**
- **Package Length**: Refer to the part data sheet drawing.
- **Package Width**: Refer to the part data sheet drawing.
- **Package Thickness**: Refer to the part data sheet drawing.
- **Model Part**: **ENABLED**
- **Corner Shape**: Typically, **SQUARE** but refer to the part data sheet drawing.

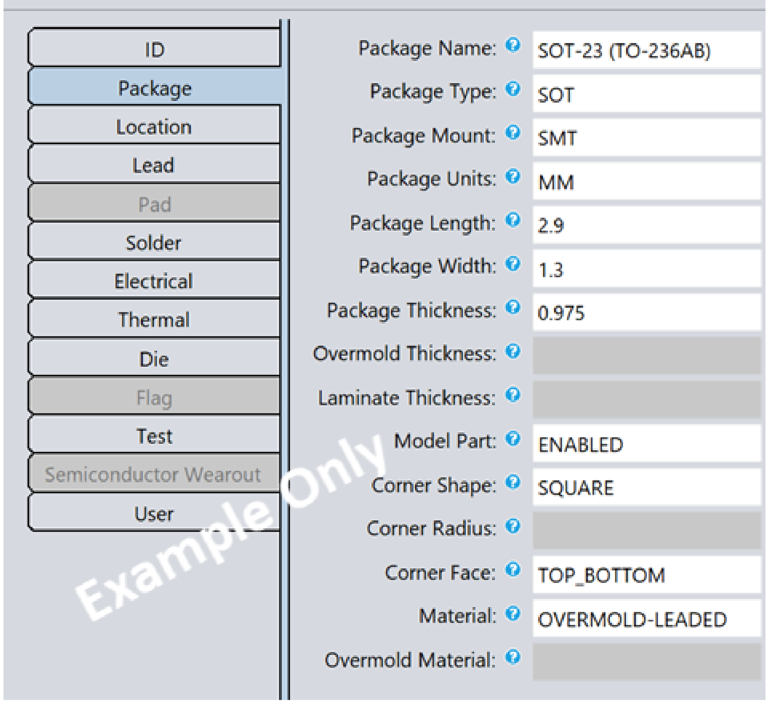
  A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius.

- **Corner Radius**: Does not apply to **SQUARE**. See image above for **MITER** and **ROUND** corners.
- **Corner Face**: **TOP_BOTTOM**, **FRONT_BACK**, or **LEFT_RIGHT**



D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Material**: **`OVERMOLD-LEADED`**. See notes below.
  - Most SMT leaded parts consist of a copper lead frame, connected internally to a silicon die, and overmolded with an epoxy resin.
  - Manufacturers usually do not provide details on the overmold materials. As a general rule, you can use the **`OVERMOLD-LEADED`** material from the Sherlock library. It approximates the effective properties of the copper/epoxy content of the package.
  - Military or aerospace rated SMT leaded parts are often constructed with a ceramic package body.



Package Name: SOT-23 (TO-236AB)
Package Type: SOT
Package Mount: SMT
Package Units: MM
Package Length: 2.9
Package Width: 1.3
Package Thickness: 0.975
Overmold Thickness:
Laminate Thickness:
Model Part: ENABLED
Corner Shape: SQUARE
Corner Radius:
Corner Face: TOP_BOTTOM
Material: OVERMOLD-LEADED
Overmold Material:

Example only. Refer to manufacturer's part data sheet.

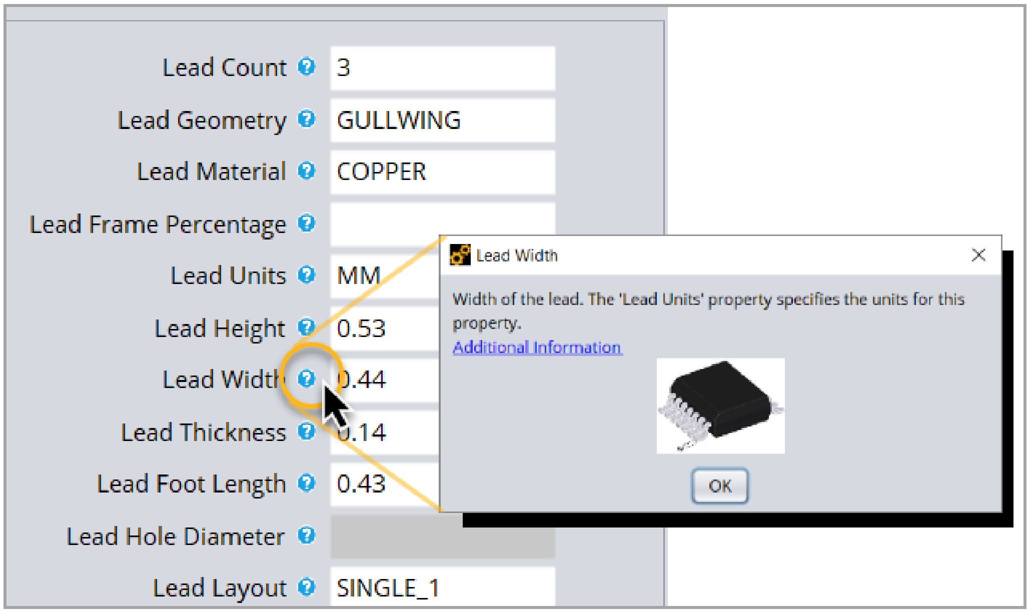
6.2. SMT Leaded- Lead Geometry

Tip:

The content below assumes you are using Sherlock's default lead modeling. If you have enabled Advanced Lead Meshing, refer to Advanced Lead Meshing in the *Sherlock User's Guide* for additional information on how lead properties are defined.

Most lead geometry inputs are clearly stated on the data sheet. The sections below explain the various dimensions Sherlock requires for each lead type. You can also find this information in the following places:

- Click the blue question mark in the **Part Properties Editor** to view the **Tool Tip** as shown in the image below.
- See Surface Mount Lead Modeling in the *Sherlock User's Guide*.



Lead Count: 3
Lead Geometry: GULLWING
Lead Material: COPPER
Lead Frame Percentage:
Lead Units: MM
Lead Height: 0.53
Lead Width: 0.44
Lead Thickness: 0.14
Lead Foot Length: 0.43
Lead Hole Diameter:
Lead Layout: SINGLE_1

Lead Width

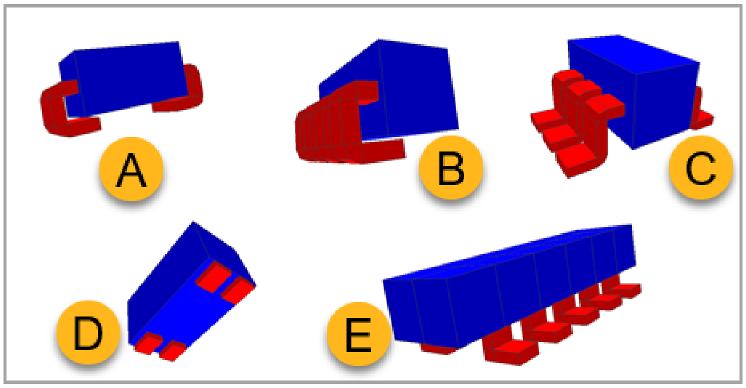
Width of the lead. The 'Lead Units' property specifies the units for this property.
Additional Information

Lead Tab

Tip:

You will find **Lead Frame Percentage** among the **Lead** properties for SMTs. This is the percentage of lead material in the layer of the package beneath the die. It is only used when exporting a project to Ansys Electronics Desktop for thermal conductivity calculations.

- **Lead Count**: Refer to the part data sheet.
- **Lead Geometry**: Refer to the diagram below. Options are `C-LEAD`, `J-LEAD`, `GULLWING`, `STUB`, `L-LEAD`.



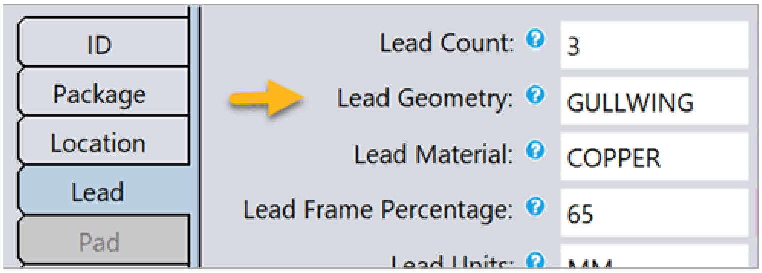
A = C-Lead • B = J-Lead • C = Gullwing • D = Stub • E = L-Lead

- **Lead Material**: Typically **COPPER** unless otherwise specified on the part data sheet.
- For the various lead dimensions (**Lead Height**, **Lead Width**, and so on), refer to the relevant Lead Geometry in the subsections below.

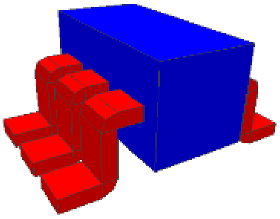
Lead geometry subsections:

6.2.1. Gullwing Lead Geometry
6.2.2. C-Lead/J-Lead Geometry
6.2.3. L-Lead Lead Geometry
6.2.4. Stub Lead Geometry

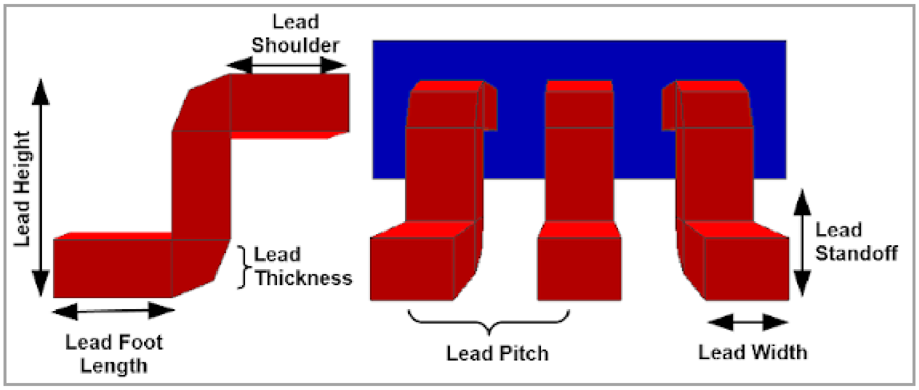
6.2.1. Gullwing Lead Geometry



Lead Count: 3
Lead Geometry: GULLWING
Lead Material: COPPER
Lead Frame Percentage: 65
Lead Units: MM

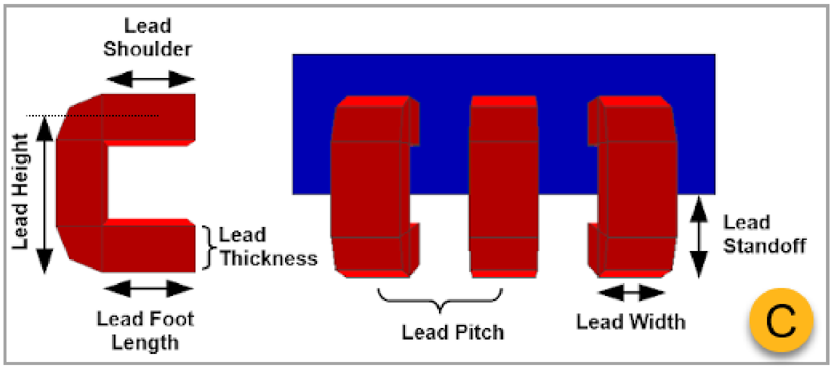


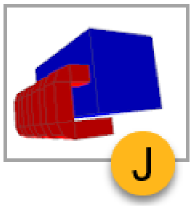
- **Lead Height**: If not provided by the data sheet, use this approximation: half the package thickness plus the standoff.



6.2.2. C-Lead/J-Lead Geometry

Sherlock models C and J leads using the same basic elements (Shoulder, Leg, and Foot for example) in the same relative arrangement, with the Foot tucked back under the part. In practice, C leads usually have equal Shoulder and Foot lengths (C, below), whereas the Foot is usually longer than the Shoulder in J leads (J, below). In the real world, J leads also have a toe that curls toward the bottom of the part, but for simplicity and ease of modeling, Sherlock ignores the toe when modeling the J lead. The following diagram depicts how each of the lead properties are used by Sherlock to construct a C_Lead or J_Lead model.





When incorporated into the FEA model, each C or J lead is bonded to the part using the side Shoulder face and bonded to the PCB using the bottom Foot face.

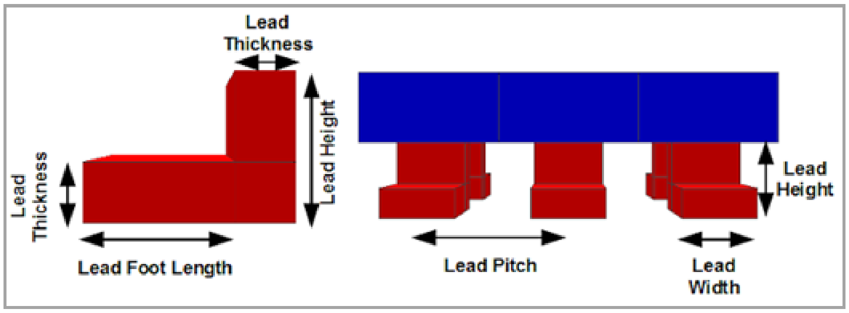
Lead Height is measured from the Foot of the Lead to the center of the Lead Thickness at the shoulder.

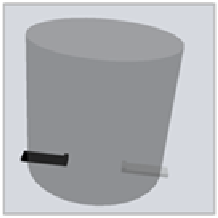
- **Lead Height**: If the mechanical drawing does not provide this, use the following formula:

  Lead Height = Lead Standoff + 0.5(Package Thickness)

- **Lead Shoulder** and **Lead Standoff**: Leads are often molded into a package body or closely folded around it. In those cases, you can set the **Lead Shoulder** and **Lead Standoff** to a small nominal value of `0.1`.
- **Lead Standoff** = Lead Thickness

6.2.3. L-Lead Lead Geometry



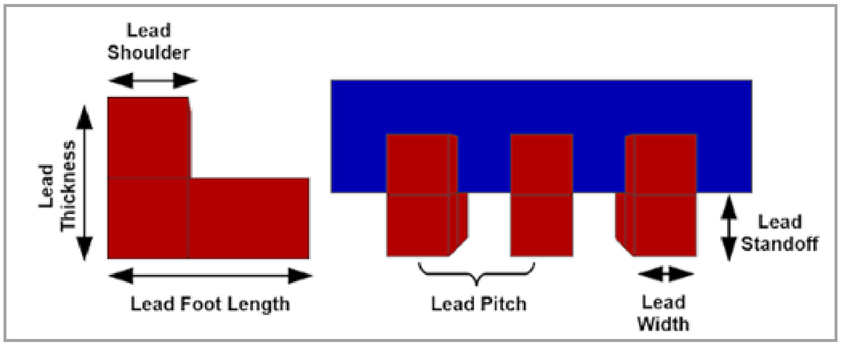


Tip:

Lead height is often not given for L-Leads, particularly for V-Chip electrolytic capacitors. In these cases, 1 mm is a good estimate.

6.2.4. Stub Lead Geometry

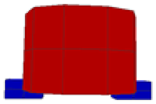
- **Lead Standoff**: Refer to the data sheet drawing, but often this information is not provided. If the stub lead protrudes from the bottom of the package, a dimension between `0.05` and `0.1` mm is a good estimate.
- **Lead Shoulder**: Typically equals **Lead Foot Length**.



The following list provides guidance for the different stub lead types:

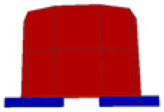
Stub Foot Only

- **Lead Shoulder** = `0`
- **Lead Standoff** = Lead Thickness



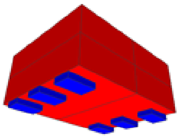
Stub Extended Foot

- **Lead Shoulder** < Lead Foot Length
- **Lead Standoff** = Lead Thickness



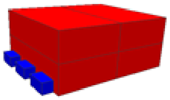
Stub Shoulder Only

- **Lead Shoulder** = Foot Length
- **Lead Standoff** = 0



Stub Foot & Shoulder

- **Lead Shoulder** > 0
- **Lead Shoulder** < Foot Length
- **Lead Standoff** > 0
- **Lead Standoff** < Thickness



6.3. SMT Lead- Solder Properties

Solder Tab

- **Solder Material**: Typically, **`DEFAULT`**

  When set to **`DEFAULT`**, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

  If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

- **Solder Model: `LEADED MODEL`**

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

6.4. SMT Leaded- Die Properties

Refer to the section Die Properties Guide (p. 37).

Chapter 7: Die Properties Guide

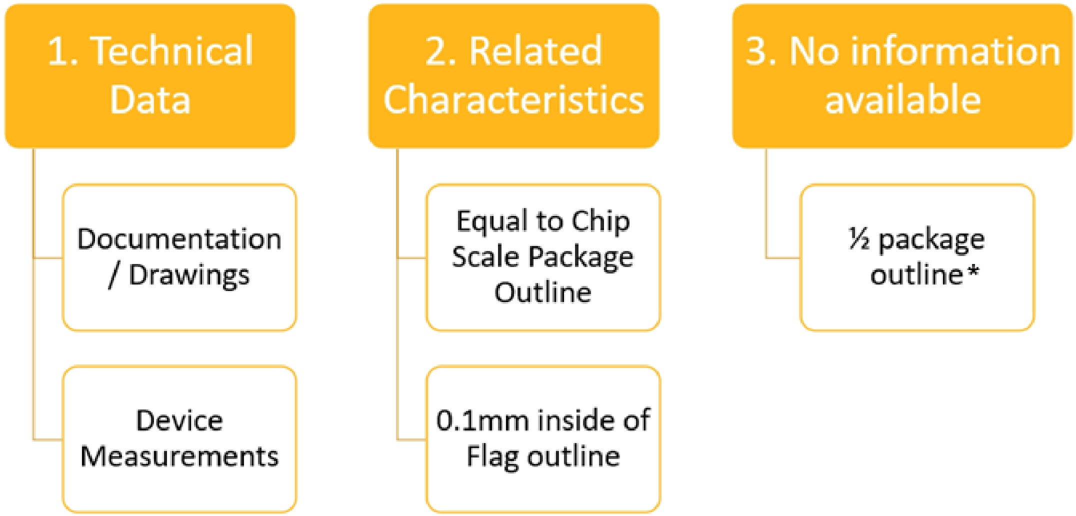
Links:

7.1. Die Dimensions - Best Practices for Making Assumptions

- Most device manufacturers do not publish internal die dimensions. However, Sherlock requires them as inputs because they have a significant impact on the reliability of any IC package.
- The IC manufacturer is always the best source of information for die geometry properties. If possible, you should inquire directly with the manufacturer if no technical documentation is available.
- For critical components, especially those that contain or might contain large die elements, consider physically analyzing a sample to obtain the die measurements.
- If no data is available on the die size and you must estimate die dimensions, Ansys recommends the practices documented in the sections which follow. When considering which method to use, always use the method which supplies the strongest evidence possible, whether it comes from technical information or package geometry and related details.

7.2. Hierarchy of Die Assumption Practices

Always use the best data available when assigning die geometry in Sherlock.



*You should only use the half-package outline approximation in the absence of any other technical information regarding package geometry or part type.

Note:

When a device comes in multiple package styles, they are typically using the same die. For datasheets with multiple package options shown, use the strongest evidence overall. Do not necessarily limit yourself to the part number of interest.

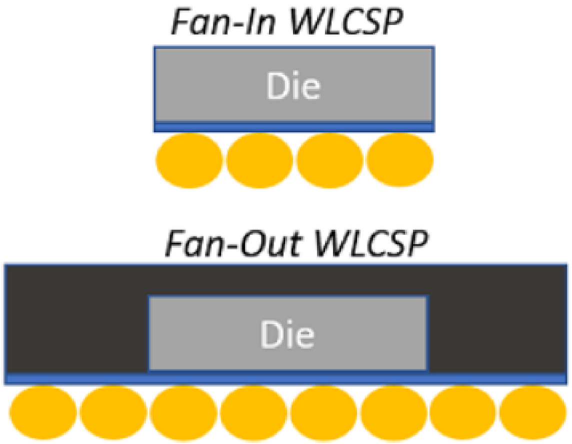
7.3. Chip Scale Devices (CSP)

- When determing die size, the Chip Scale Package (CSP) is one of the most straightforward packages to work with. These packages are designed to be compact, so they are only slightly larger than the actual die. Other terminology that indicates this packaging approach includes DSBGA (Die Size BGA), WSBGA (Wafer Size BGA), WLP (Wafer Level Package), and similar terms.

- For CSP packages, setting the die outline equal to the package outline is a reasonable assumption.

- CSP-style packages include multiple form factors such as flip-chip, non-flip chip, wire bonding, ball grid array, and leaded packaging. For CSP parts, the parameters, other than die geometry, should be set based on the form factor being used.

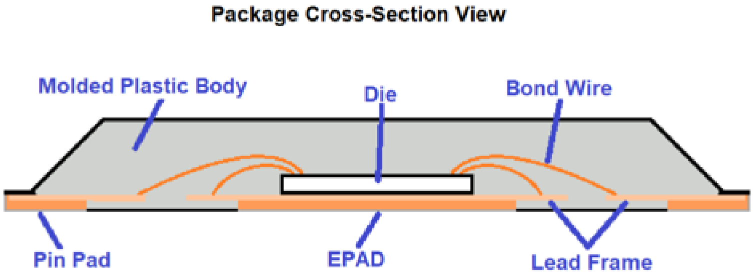
- Two of the most common CSP types are fan-in and fan-out.



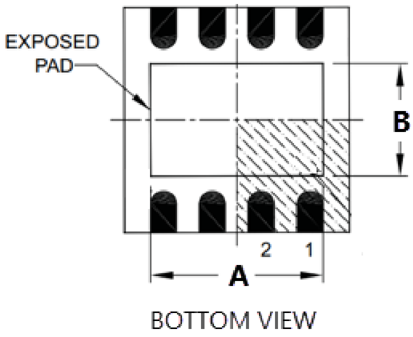
- For fan-out, the part definition follows a standard BGA approach with a substrate and overmold.
- With the fan-in style, you should define a thin substrate, often as thin as 0.05 mm. The remaining material selection should be silicon. With this approach, you should set the inputs in the die geometry tab to negligible values, such as 0.001 mm so the silicon volume in the package is not defined twice.

7.4. Assuming Die Geometry using Flag Geometry

- If no other die data is available, devices with a large central pad (flag or EPAD) provide a clue to the die size. The flag, which can either be exposed or soldered to the PCB, is usually sized larger than the die. This flag is used to control heat dissipation of the device.

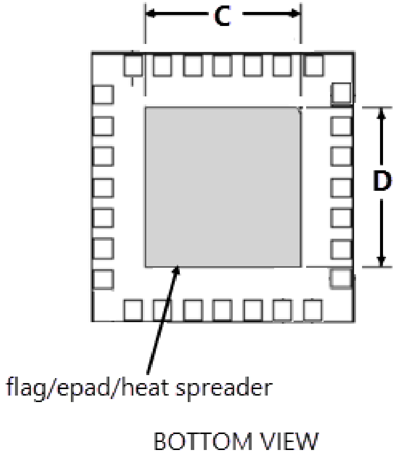


- In general, you can assume the length and width of the die is equal to the length and width of the flag minus 0.1 mm.



Die Length = A – 0.1 mm

Die Width = B – 0.1 mm

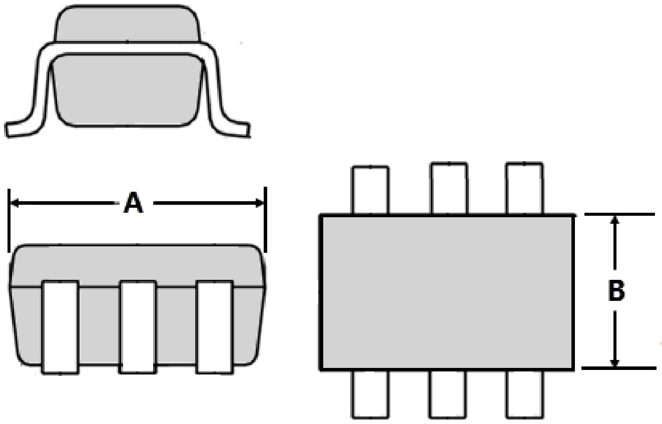


Die Length = C – 0.1 mm

Die Width = D – 0.1 mm

7.5. Assuming Die Geometry using Package Outline

- If absolutely no other information is available, Ansys makes the standard assumption that the die outline is half the length and width of the overall package body.
- The standard rule for determining die dimensions is that the length and width of the die is half the length and width of the package, while the thickness is 0.185 mm.
- With diode parts, it is more common to have a smaller, square die. You can assume the die length and width to be half of the package width. In chip style LED packages, you can assume a small square die to have dimensions of 0.5 mm x 0.5 mm x 0.185 mm.



Die Length = A/2 • **Die Width** = B/2

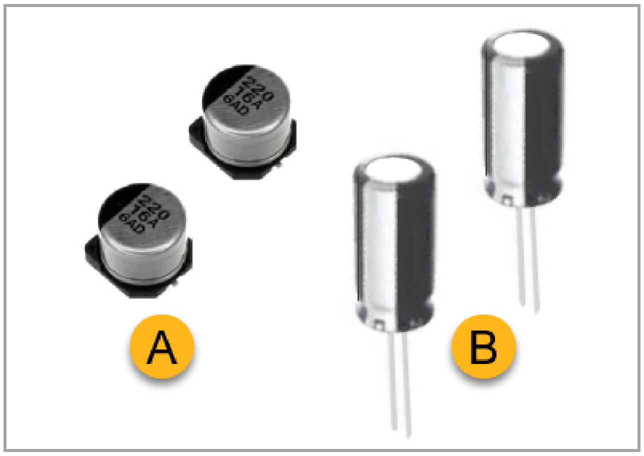
7.6. Assuming Die Geometry Thickness Values

- Once you have determined or assumed the die outline (length and width), follow the guidelines below for die thickness.
  - Typical values for a package thickness of 1.0 mm and below are between 0.185 and 0.2 mm.
  - For packages thicker than 1.0 mm, you can assume a 0.4 mm die thickness if it is not stated on the datasheet.
  - For memory devices, die thickness is generally between 0.2 and 0.25 mm.

Chapter 8: How to Build an Electrolytic Capacitor

The SMT Electrolytic Capacitor (V-Chip), overall, is a reliable package in thermal cycling. Most interconnect reliability issues come from mechanical loads in-plane with the part, particularly where a rocking mode exists.

Package construction consists of an aluminum can surrounding a rolled metal foil / dielectric material. The leads extend down from the roll through a rubber bung in the bottom of the package. Due to the composite structure of these packages, a custom material is best used for these parts which, currently, are not included in the standard Sherlock Material Library.



A = SMT Electrolytic Capacitor • B = Thru Hole Electrolytic Capacitors

For the remaining properties, refer to the relevant style:

- 8.1. Electrolytic Capacitor- SMT (VCHIP) Style
- 8.2. Electrolytic Capacitor- Thruhole Style

8.1. Electrolytic Capacitor- SMT (VCHIP) Style

Tip:

Simulation of vibration-proof electrolytic capacitors may require additional modeling steps in Sherlock, depending on the package geometry.

ID Tab

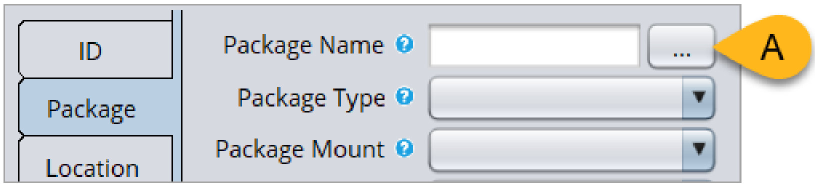
- **Part Type**: `CAPACITOR ELECTROLYTIC`
- **Failure Class**: This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

Package Tab

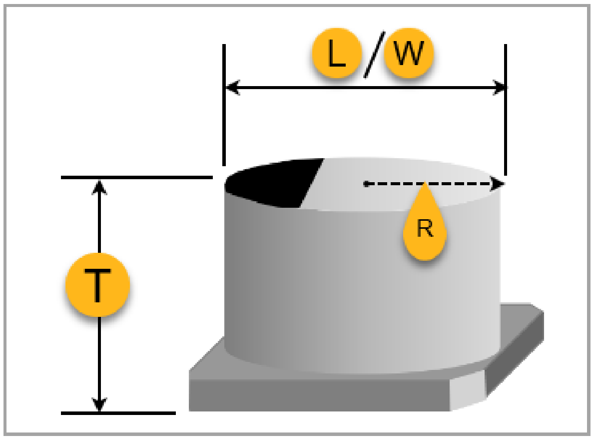
- **Package Name**: **`VCHIP`** (an industry term for SMT electrolytic caps)

Tip:

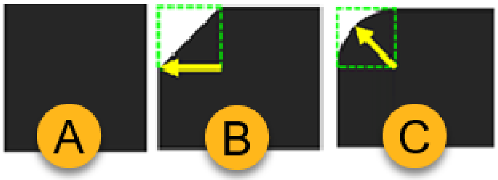
You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.



- **Package Type**: **`VCHIP`**
- **Package Mount**: **`SMT`**
- **Package Length/Width**: Refer to the package diameter on the data sheet drawing. See L/W in the image below.
- **Package Thickness**: Refer to the package length/height on the data sheet drawing. See T in the image below.

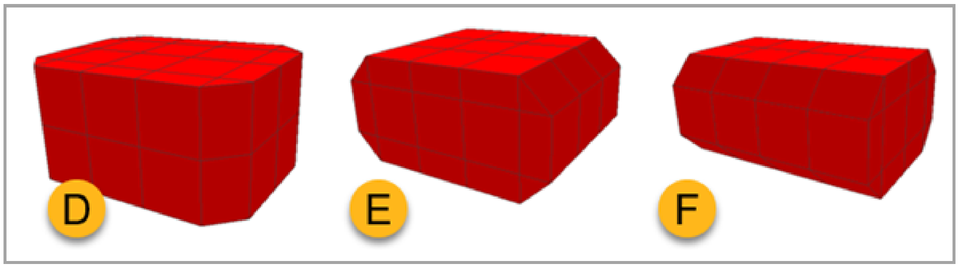


- **Corner Shape**: Typically, **ROUND**



A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius. Square radius = 0.

- **Corner Radius**: For a **ROUND Corner Shape**, the **Corner Radius** is half the **Package Length/Width**. See R in the image above.
- **Corner Face**: Typically, **TOP_BOTTOM** (D, below)



D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Material**: Due to the composite structure of these packages, a custom material, **ALUMINUM ELECTROLYTIC**, is best used for these parts.

  ALUMINUM is the closest choice in the Sherlock Library, but it results in a package body that is too stiff and heavy, leading to overly conservative failure predictions. Ansys recommends the following custom material properties:

  - Density: 1.35 g/cc
  - Modulus: 1000 MPa
  - Material CTE: 24.0 ppm/C

Tip:

For information on editing materials in Sherlock, see Material Management in the *Sherlock User's Guide*.

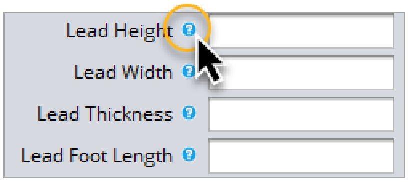
Lead Tab

- **Lead Count**: **2**
- **Lead Geometry**: **L_LEAD**
- **Lead Material**: If not in the data sheet, assume **STEEL**.
- **Lead Frame Percentage**: This is the percentage of lead material in the layer of the package beneath the die. This is only used when exporting a project to Ansys Electronics Desktop for thermal conductivity calculations.

- **Lead Height**: If not in the data sheet, assume **1** mm.

Tip:

For **Lead Height** and the other dimensions listed below, click Sherlock's **Tool Tip** icon for an explanation of each property.



- **Lead Width**: Refer to the part data sheet drawing.
- **Lead Thickness**: Refer to the part data sheet drawing.
- **Lead Foot Length**: Refer to the part data sheet drawing.
- **Lead Modeling**: `ENABLED`
- **Lead Layout**: `SIP`
- **Lead Pitch**: Refer to the part data sheet drawing.
- **Lead Shoulder**: Refer to the part data sheet drawing.

Solder Tab

- **Solder Material**: Typically, `DEFAULT`

  When set to `DEFAULT`, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

  If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

- **Solder Model**: `LEADED MODEL`

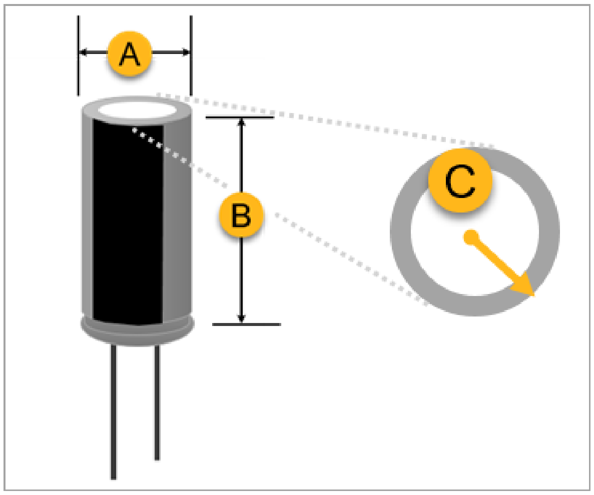
8.2. Electrolytic Capacitor- Thruhole Style

ID Tab

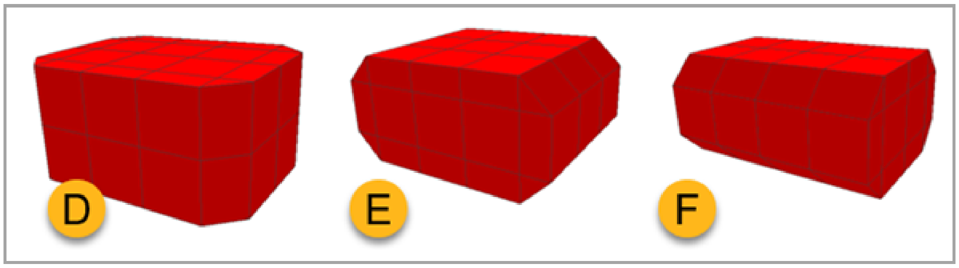
- **Part Type**: `CAPACITOR ELECTROLYTIC`
- **Failure Class**: This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

Package Tab

- **Package Name**: Typically, **`RADIAL`**. Refer to the part data sheet.
- **Package Type**: **`RADIAL`**
- **Package Length**: Refer to the part data sheet drawing. **Package Length** is represented by A in the image below.



- **Package Width**: Refer to the part data sheet drawing. For a radial package (shown in the image above), **Package Width** equals **Package Length** (A).
- **Package Thickness**: Refer to the part data sheet drawing. Thickness is represented by B in the image above.
- **Corner Shape**: Typically, **`ROUND`**
- **Corner Radius**: For a radial package, the corner radius is equal to half the **Package Width/Length**, C in the image above.
- **Corner Face**: Typically, **`TOP_BOTTOM`** (D, below)



D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Material**: Due to the composite structure of these packages, a custom material, **`ALUMINUM ELECTROLYTIC`**, is best used for these parts.

  `ALUMINUM` is the closest choice in the Sherlock Library, but it results in a package body that is too stiff and heavy, leading to overly conservative failure predictions. Ansys recommends the following custom material properties:

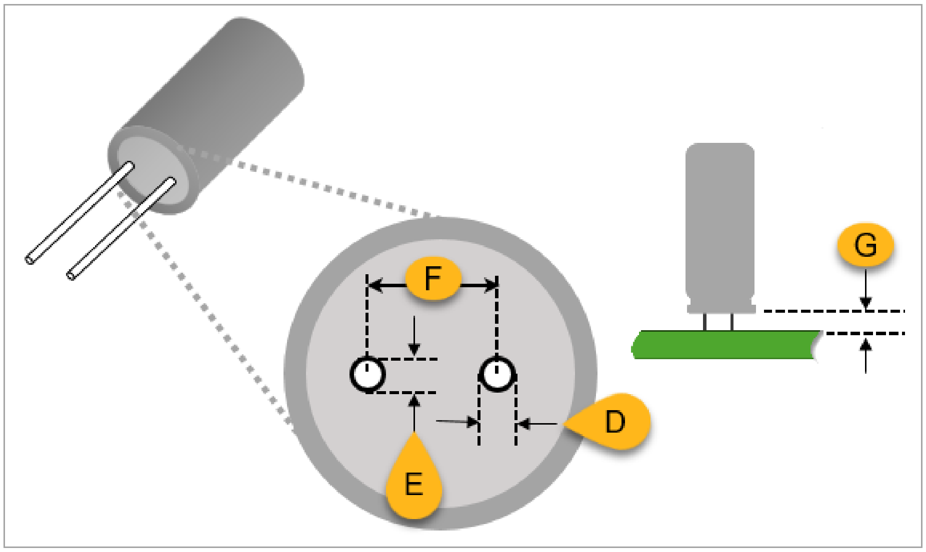
  - Density: 1.35 g/cc
  - Modulus: 1000 MPa
  - Material CTE: 24.0 ppm/C

  Tip:

  For information on editing materials in Sherlock, see Material Management in the *Sherlock User's Guide*.

Lead Tab

- **Lead Count**: **2**
- **Lead Geometry**: **THRUHOLE**
- **Lead Material**: Refer to the part data sheet.
- **Lead Height**: (G in the image below) This portion of the lead is measured from the PCB surface to the bottom of the package and is determined during PCBA assembly. In most cases 1 mm is a good estimate, although you should confirm this based on the manufactured PCBA.



- **Lead Width**: (D in the image above) Refer to the part data sheet drawing.
- **Lead Thickness**: (E in the image above) Refer to the part data sheet drawing.
- **Lead Hole Diameter**: This is not a part property but a PCB property based on the PCB design information. If unavailable, assume the **Lead Hole Diameter** is 20% larger than the lead diameter.
- **Model Leads**: **`ENABLED`**
- **Lead Layout**: **`SIP`**
- **Lead Pitch**: (F in the image above) Refer to the part data sheet drawing.
- **Lead Bend (degrees)**: **`0`**

Solder Tab

- **Solder Material**: Typically, **`DEFAULT`**

  When set to **`DEFAULT`**, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

  If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

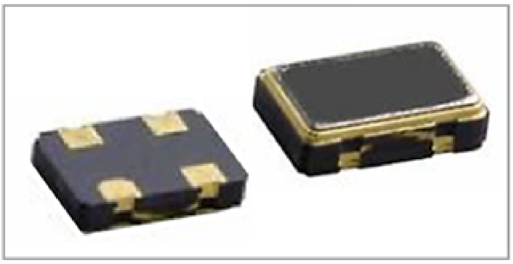
- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

- **Solder Model**: **`THRUHOLE MODEL`**

Chapter 9: How to Build a Ceramic Oscillator

Compared to other types of components, the leadless oscillator package performs at or near the top in resisting solder fatigue due to its stiff, low-CTE ceramic body and small solder joints.



ID Tab

- **Part Type**: `OSCILLATOR`
- **Failure Class**: This can be left blank. The property is not used in any Sherlock stand-alone analysis. It is only used when Sherlock is part of a multi-tool analysis workflow.

Ceramic Oscillator Part Properties:

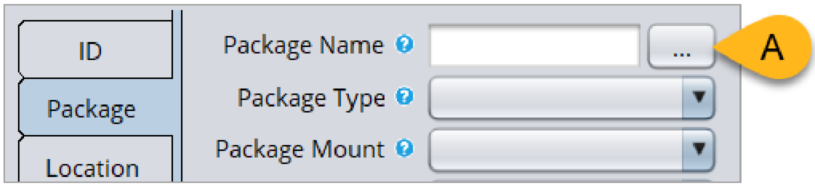
9.1. Ceramic Oscillator Package Properties

Package Tab

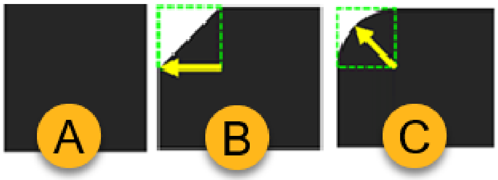
- **Package Name**: Example: **`LCCC-4`**. Supported values are defined in the package data files provided by Sherlock or user-defined package data files. See Package Management in the *Sherlock User's Guide*.

Tip:

You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.

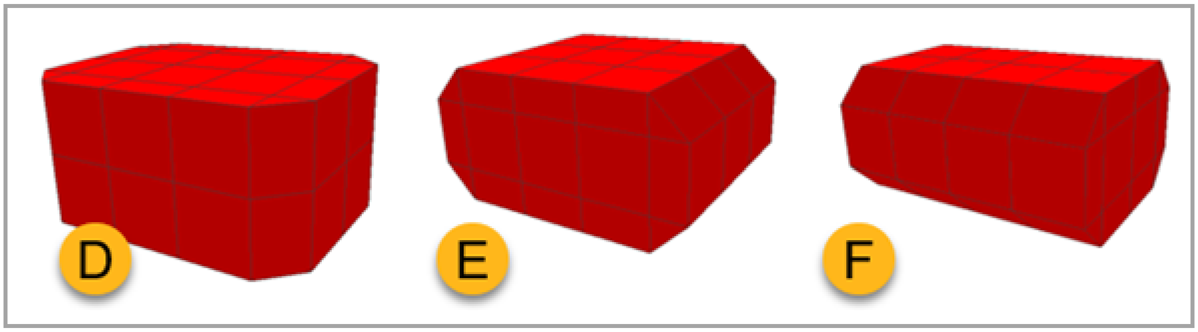


- **Package Type**: **LCCC**
- **Package Mount**: **SMT**
- **Package Length**: Refer to the part data sheet drawing.
- **Package Width**: Refer to the part data sheet drawing.
- **Package Thickness**: Refer to the part data sheet drawing.
- **Corner Shape**: Typically, **SQUARE**

  A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius.

- **Corner Radius**: Does not apply to **SQUARE Corner Shape**. See image above for **`MITER`** and **`ROUND`** corners.
- **Corner Face**: Typically, **`TOP_BOTTOM`**.

  D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Material**: **`ALUMINA`**. Alumina is the typical material for oscillator parts unless stated otherwise on the data sheet.

9.2. Ceramic Oscillator Lead Properties

Lead Tab

- **Lead Count**: Refer to the part data sheet drawing.
- **Lead Geometry**: **LEADLESS**

9.3. Ceramic Oscillator Pad Properties

Pad Tab

For LCCCs, the PCB pad sizes should be entered. You can do this by using the Update Pad Properties Tool in Sherlock or by measuring the pads in the Layer Viewer.

- **Pad Length**: Refer to the PCB artwork.
- **Pad Width**: Refer to the PCB artwork.
- **Pad Pitch**: Refer to the PCB artwork.

9.4. Ceramic Oscillator Solder Properties

Solder Tab

- **Solder Material**: Typically, **`DEFAULT`**.

  When set to **`DEFAULT`**, Sherlock uses the **Default Solder Type** specified in the **Circuit Card Properties**. To view or edit these properties, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

  If a solder other than the default is used for this part, you may enter the name of the solder in the **Solder Material** field. To add a custom solder to the Solder Library, see Solder Management in the *Sherlock User's Guide*.

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.

- **Solder Model**: **`LCCC MODEL`**

Chapter 10: How to Build an SMT Inductor

Inductor components come in an array of package form factors and materials that vary according to their function and application. This group of parts is unique due to its use of a dense ferrite core which has a strong impact on reliability and mechanical behavior. This requires some unique best practices when defining different inductor styles in Sherlock.

			
Leadless[a] Molded Inductor	Leaded Molded Inductor	Coil Power Inductor	Wirewound Chip Inductor
CC	CBEND	STUB LEAD	CC

[a] If the package is larger than 5 mm, model it with stub leads.

10.1. Inductor Package Material Properties

- Package construction consists of a ferrite core, wrapped in a copper coil. Depending on the package style, this basic construction might be covered in a plastic mold or metal shielding.
- For molded or shielded styles, Ansys recommends a custom material that is currently not included in the standard Sherlock Material Library. Selecting ferrite as the package material would result in excessive part weight, skewing mechanical analysis results. Recommended custom material properties:
  - Density: 3.0 g/cc
  - Modulus: 90000 MPa
  - Material CTE: 12.0 ppm/C
- For simpler styles and smaller packages, ferrite is a good material selection.

10.2. Inductor Styles

Links to Inductor Types:

10.2.1. Leadless Molded Inductor

10.2.2. Leaded Molded Inductor

10.2.3. Coil Power Inductor

10.2.4. Wirewound Chip Inductor

10.2.1. Leadless Molded Inductor

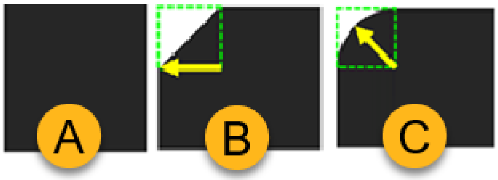
Package Tab

Tip:

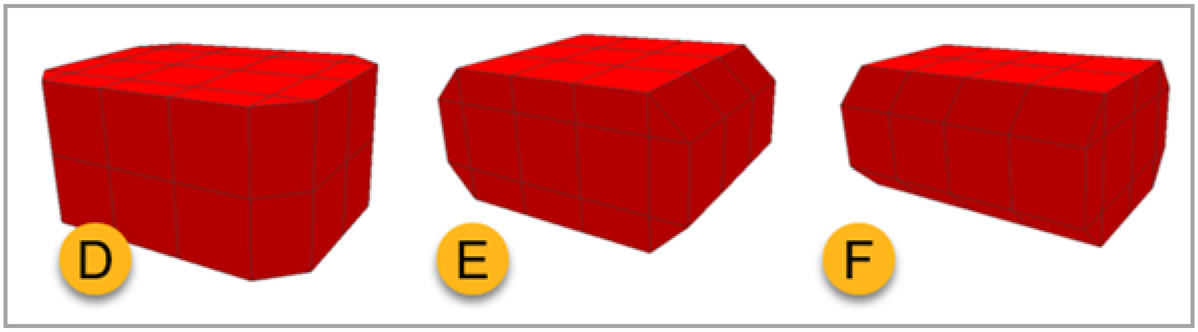
For packages smaller than 5 mm, use the CC package style. Larger packages give more accurate reliability predictions with a leaded package definition

---

- **Package Name**: **SON**
- **Package Type**: **SON**
- **Package Mount**: **SMT**
- **Package Length**: Refer to the part data sheet drawing.
- **Package Width**: Refer to the part data sheet drawing.
- **Package Thickness**: Refer to data sheet drawing.
- **Corner Shape**: Typically, **SQUARE**

  A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius.
- **Corner Radius**: Does not apply to **SQUARE Corner Shape**. See image above for **`MITER`** and **ROUND** corners.
- **Corner Face**: Typically, **TOP_BOTTOM**.



D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT

- **Material**: `Ferrite_Composite` (Composite is selected due to the overmolded construction.)

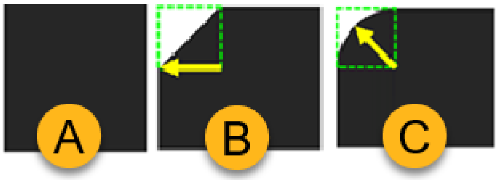
Lead Tab

- **Lead Count**: **2**
- **Lead Geometry**: **STUB**
- **Lead Material**: **COPPER**
- **Lead Height**: For this package style, a lead height of one-third the package height is recommended.
- **Lead Width**: Refer to the part data sheet drawing.
- **Lead Thickness**: Equal to **Lead Foot Length**.
- **Lead Foot Length**: Refer to the part data sheet drawing.
- **Lead Modeling**: **ENABLED**
- **Lead Layout**: **DUAL_LONG**
- **Lead Pitch**: Refer to the part data sheet drawing.
- **Lead Shoulder**: Refer to the part data sheet drawing.
- **Lead Standoff**: Refer to the part data sheet drawing.

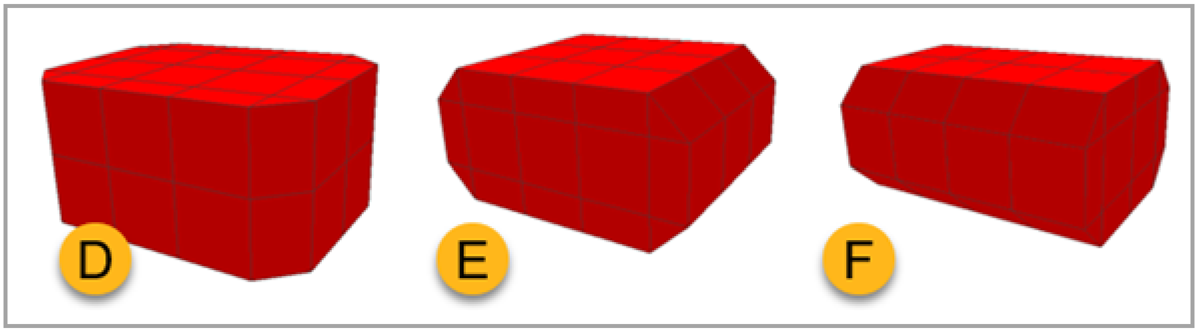
10.2.2. Leaded Molded Inductor

Package Tab

- **Package Name**: **CBEND**
- **Package Type**: **CBEND**
- **Package Mount**: **SMT**
- **Length**: Refer to the part data sheet drawing.
- **Package Width**: Refer to the part data sheet drawing.
- **Package Thickness**: Refer to data sheet drawing.
- **Corner Shape**: Typically, **SQUARE**

  A = Square Corner • B = Miter Corner • C = Round Corner • Arrows show corner radius.
- **Corner Radius**: Does not apply to **SQUARE Corner Shape**. See image above for **MITER** and **ROUND** corners.
- **Corner Face**: Typically, **TOP_BOTTOM**.

  D = TOP_BOTTOM • E = FRONT_BACK • F = LEFT_RIGHT
- **Material**: **`Ferrite_Composite`** (Composite is selected due to the overmolded construction.)

Lead Tab

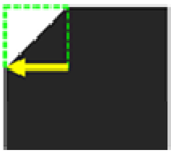
- **Lead Count**: **2**
- **Lead Geometry**: **C_LEAD**
- **Lead Material**: **COPPER**
- **Lead Height**: Refer to the part data sheet drawing.
- **Lead Width**: Refer to the part data sheet drawing.
- **Lead Thickness**: **`0.1`**

- **Lead Foot Length**: Refer to the part data sheet drawing.
- **Lead Modeling**: **`ENABLED`**
- **Lead Layout**: **`DUAL_LONG`**
- **Lead Pitch**: Refer to the part data sheet drawing.
- **Lead Shoulder**: Refer to the part data sheet drawing.
- **Lead Standoff**: Refer to the part data sheet drawing.

10.2.3. Coil Power Inductor

Package Tab

- **Package Name**: **`SON`**
- **Package Type**: **`SON`**
- **Package Length**: Refer to the part data sheet drawing.
- **Package Width**: Refer to the part data sheet drawing.
- **Package Thickness**: Refer to data sheet drawing.
- **Corner Shape**: **`MITER`**, best approximation.

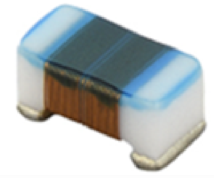
  Miter Corner, Arrow shows corner radius.
- **Corner Radius**: See image above.
- **Corner Face**: **`TOP_BOTTOM`**.
- **Material**: **`FERRITE_COMPOSITE`** (Lower density custom material selected to account for empty volume of the complex shape.)

Lead Tab

- **Lead Count**: **2**

- **Lead Geometry**: **`STUB`**
- **Lead Material**: **`COPPER`**
- **Lead Height**: **2** (mm, approximated)
- **Lead Width**: Refer to the part data sheet drawing.
- **Lead Thickness**: Equal to **Lead Foot Length**.
- **Lead Foot Length**: Refer to the part data sheet drawing.
- **Lead Modeling**: **`ENABLED`**
- **Lead Layout**: **`DUAL_SHORT`**
- **Lead Pitch**: Refer to the part data sheet drawing.
- **Lead Shoulder**: Refer to the part data sheet drawing.
- **Lead Standoff**: Refer to the part data sheet drawing.

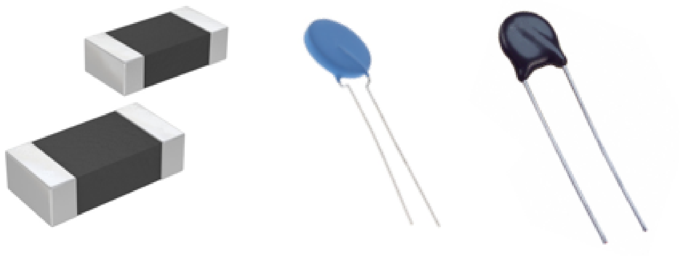
10.2.4. Wirewound Chip Inductor



- **Package Name**: Refer to the part data sheet. Typically, the name is a four digit sequence (example: 0603). For a non-standard component (one that is not in the Sherlock Library), enter **CC** followed by a space and the four digit code. Example: **`CC 0000`**
- **Package Type**: **CC**
- **Package Mount**: **`SMT`**
- **Length**: Refer to the part data sheet drawing.
- **Package Width**: Refer to the part data sheet drawing.
- **Package Thickness**: Refer to data sheet drawing.
- **Corner Shape**: **`SQUARE`**
- **Corner Face**: **`TOP_BOTTOM`**.
- **Material**: **`FERRITE`**

Chapter 11: How to Build Varistor and Thermistor Components

Varistor and thermistor components are offered in an array of package form factors according to their function and application. They are most commonly packaged as CC components or through hole Disc packages. Axial-leaded glass-encapsulated packages can also be found in these part types.



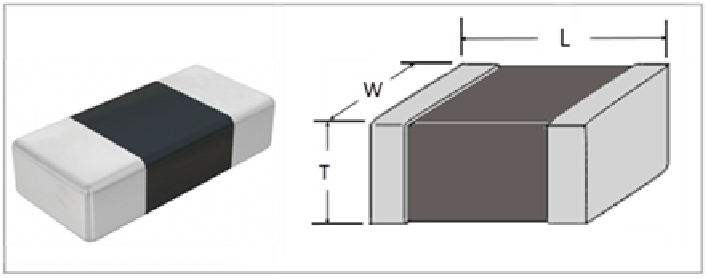
Varistors are resistor components that vary their resistance based on applied voltage. They can be made with a range of materials. The most common is some variety of Zinc Oxide. Unless otherwise noted by the manufacturer, Zinc Oxide is a good material assumption for Varistors.

Thermistors are resistor components whose resistance varies based on temperature. There are two types, based on the materials used. NTC thermistors decrease resistance as temperature rises. PTC thermistors increase resistance as temperature rises. Both are made with metal oxides of various types. Unless otherwise noted by the manufacturer, you can assume Barium Titanate when selecting the material.

Section Links:

- 11.1. CC Varistor/Thermistor
- 11.2. Disc Varistor/Thermistor

11.1. CC Varistor/Thermistor



ID Tab

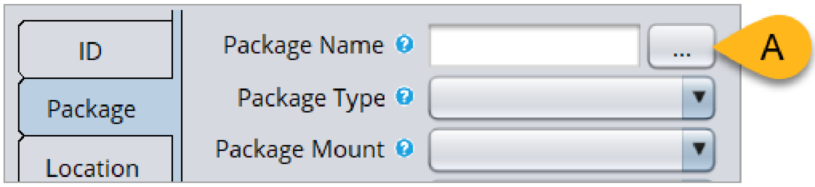
- **Part Type**: `Thermistor` or `Varistor`

Package Tab

- **Package Name**: **`0201`**

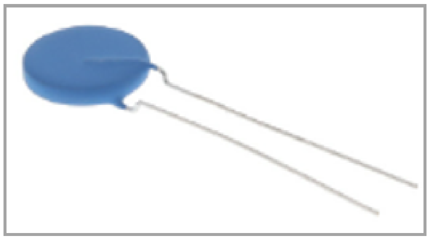
Tip:

You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.



- **Package Type**: **`CC`**
- **Package Mount**: **`SMT`**
- **Package Length:** Refer to data sheet drawing.
- **Package Width:** Refer to data sheet drawing.
- **Package Thickness:** Refer to data sheet drawing.
- **Model Part**: **`ENABLED`**
- **Corner Shape:** **`SQUARE`**.
- **Corner Face**: **`TOP_BOTTOM`**
- **Material:** Thermistors: **`Barium Titanate`**. Varistors: **`Zinc Oxide`**.

11.2. Disc Varistor/Thermistor



ID Tab

- **Part Type**: **`Thermistor`** or **`Varistor`**

Disc Varistor/Thermistor Properties:

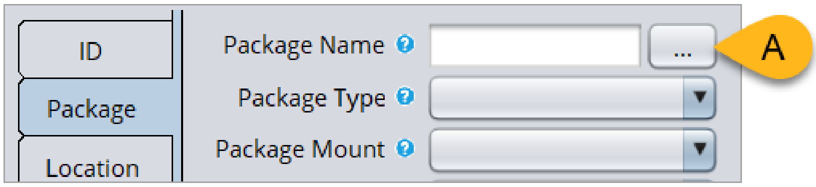
11.2.1. Disc Varistor/Thermistor Package Properties

Package Tab

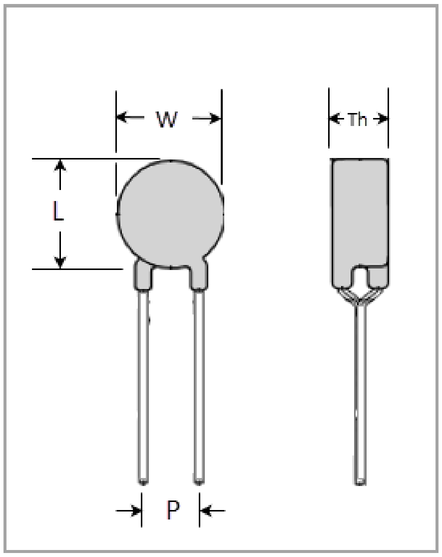
- **Package Name**: **`DISC`**

Tip:

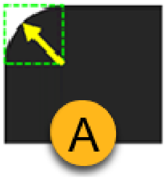
You can enter the **Package Name** manually, or you can use Sherlock's **Package Chooser** which helps you select a prebuilt part that approximates the one you are building. Sherlock then auto-populates all the relevant properties. These package properties are based on industry standards, so you may have to edit the properties to match the part you are building. To open the **Chooser**, click the **...** icon (A, below). See The Package Chooser in the *Sherlock User's Guide* for more information.



- **Package Type**: **`DISC`**
- **Package Mount**: **TH**
- **Package Length:** Refer to data sheet drawing.



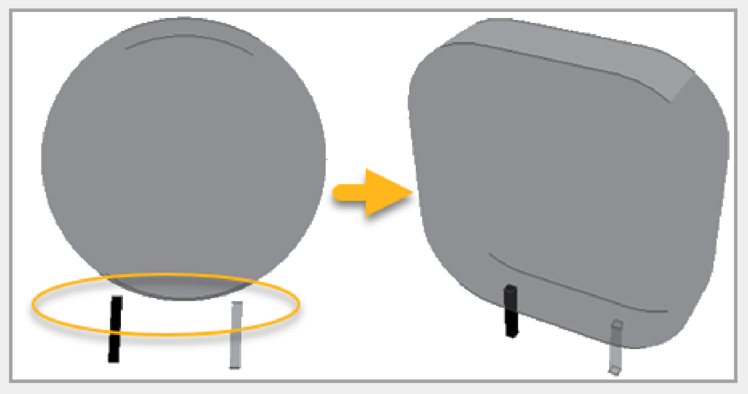
- **Package Width:** Refer to data sheet drawing.
- **Package Thickness:** Refer to data sheet drawing.
- **Model Part**: **ENABLED**
- **Corner Shape: ROUND**
- **Corner Radius**: See note below.



A = Round Corner. Arrow shows corner radius.

Note:

Perfectly round packages in Sherlock will generate floating leads. You must reduce the Corner Radius so the leads are attached to the body of the package.



- **Corner Face**: `FRONT_BACK`
- **Material:** Thermistors: `Barium Titanate`. Varistors: `Zinc Oxide`.

11.2.2. Disc Varistor/Thermistor Lead Properties

Lead Tab

- **Lead Count**: `2`
- **Lead Geometry**: `TH`
- **Lead Material**: `COPPER`
- **Lead Height**: See note below.

> **Note:**
>
> After assembly, you can approximate Lead Height to be about 1 mm. In cases where the leads have been formed to support the package body during reflow, the lead height will be greater.

- **Lead Width**: Equal to lead diameter.
- **Lead Thickness**: Refer to data sheet drawing.
- **Lead Modeling**: `ENABLED`
- **Lead Layout**: `SIP`

> **Note:**
>
> Disc packages often have staggered lead placement: One lead will be closer to a particular side of the disc than the other lead. Sherlock is not able to capture that level of detail, so a linear layout is used as an approximation.

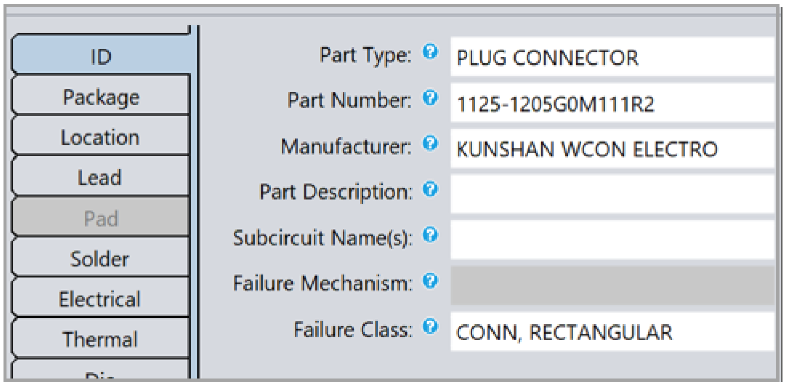
- **Lead Pitch**: Refer to data sheet drawing.

Chapter 12: How to Build a Connector

Connector packages for the most part do not have a supported package style in Sherlock and are the most challenging part to simulate in the software. For simpler package geometries, a supported package type that is close to the connector form factor can be selected as an approximation in the Sherlock model.

For this example, the connector will be the L_LEAD 20 Pin Dual Header Connector shown below.

ID Tab



Part Type: PLUG CONNECTOR

Part Number: 1125-1205G0M111R2

Manufacturer: KUNSHAN WCON ELECTRO

Part Description:

Subcircuit Name(s):

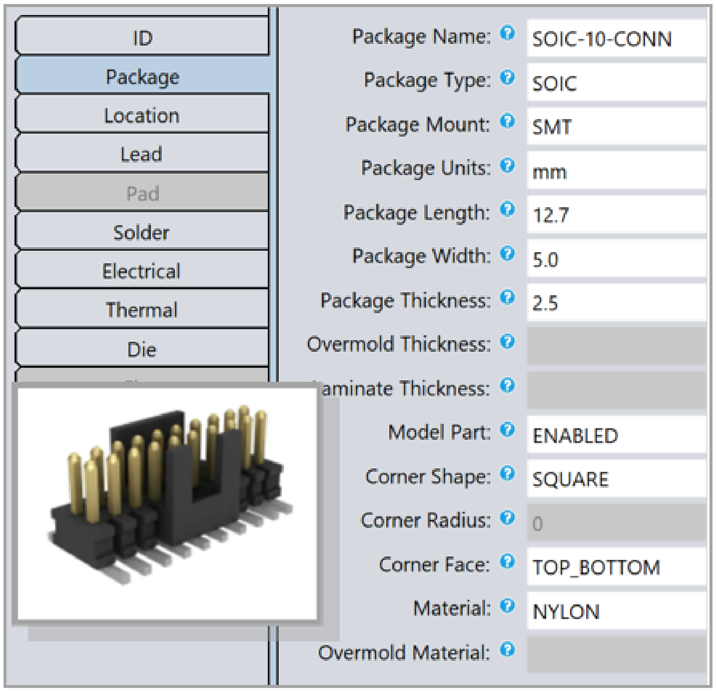
Failure Mechanism:

Failure Class: CONN, RECTANGULAR

12.1. Connector Package Properties

Package Tab

The part data sheet provides the package dimensions and the **Material**.



Package Name: SOIC-10-CONN
Package Type: SOIC
Package Mount: SMT
Package Units: mm
Package Length: 12.7
Package Width: 5.0
Package Thickness: 2.5
Overmold Thickness:
aminate Thickness:
Model Part: ENABLED
Corner Shape: SQUARE
Corner Radius: 0
Corner Face: TOP_BOTTOM
Material: NYLON
Overmold Material:

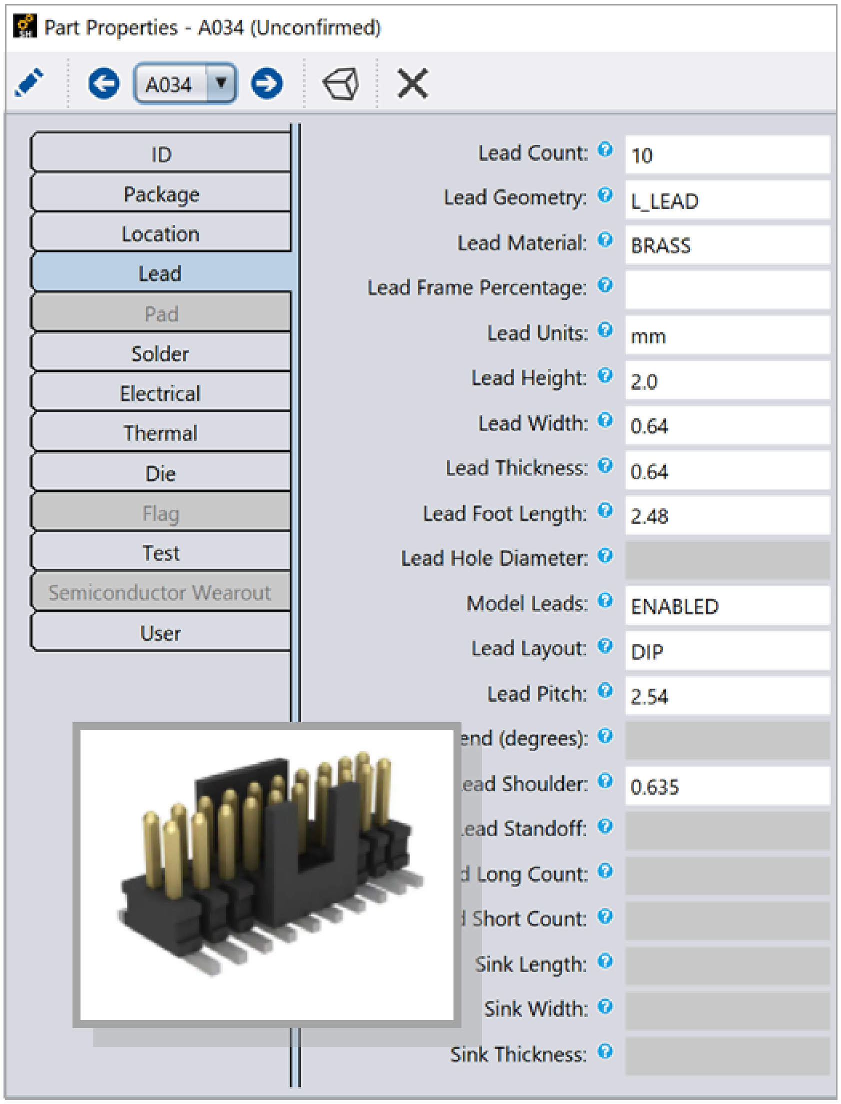
Tip:

Connector datasheets often provide information for an entire part series. Note the option in your part number code and the number of positions to accurately identify the geometry and lead style.

12.2. Connector Lead Properties

Lead Tab

The part data sheet provides information on the leads.



Lead Count: 10
Lead Geometry: L_LEAD
Lead Material: BRASS
Lead Frame Percentage:
Lead Units: mm
Lead Height: 2.0
Lead Width: 0.64
Lead Thickness: 0.64
Lead Foot Length: 2.48
Lead Hole Diameter:
Model Leads: ENABLED
Lead Layout: DIP
Lead Pitch: 2.54
end (degrees):
ead Shoulder: 0.635
.ead Standoff:
d Long Count:
l Short Count:
Sink Length:
Sink Width:
Sink Thickness:

Tip:

Lead Height is typically provided. When it is not, 1 mm is a good estimate.

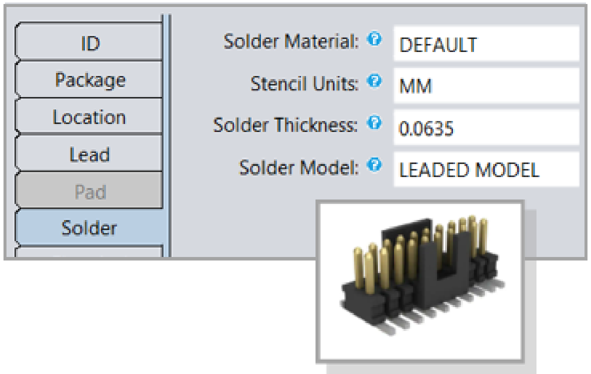
12.3. Connector Solder Properties

12.3.1. Solder Properties

Solder Tab

- **Solder Thickness**: Sherlock calculates this value. It is based on the stencil thickness as recorded in the **Circuit Card Properties** and is assumed to be half that value.

  To view or edit **Circuit Card Properties**, right-click the circuit card in the **Project Tree** and select **Circuit Card Properties** in the context menu.



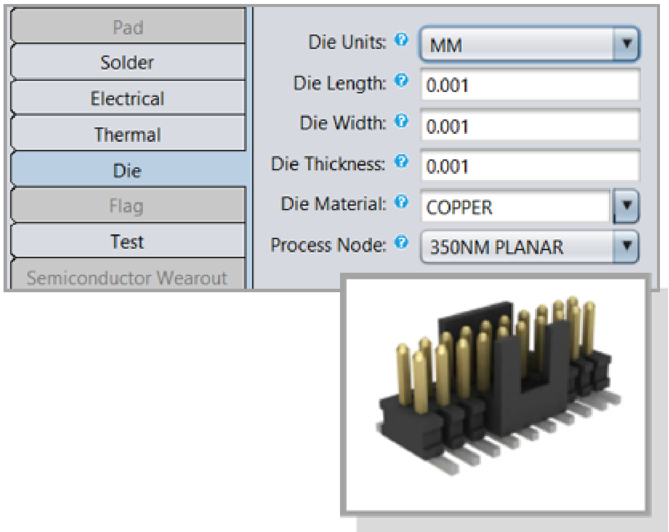
Solder Material: DEFAULT
Stencil Units: MM
Solder Thickness: 0.0635
Solder Model: LEADED MODEL

12.3.2. Connector Die Properties

Die Tab

- Connectors do not have dies, but in this case Sherlock is asking for die dimensions because an IC package has been chosen to approximate the connector. Generally, it is best to enter a small value for die dimensions so that the die effects will be negligible in any reliability analysis.

- Connector geometries and internal structures vary widely. In some cases, a homogenous material selection can cause invalid reliability predictions. In these cases, the **Part Type** should be set to **`MECHANICAL PART`** to remove it from reliability calculations. Another option is to change the die size and material in order to modulate the part CTE and modulus. Or you can create and use a custom package material.



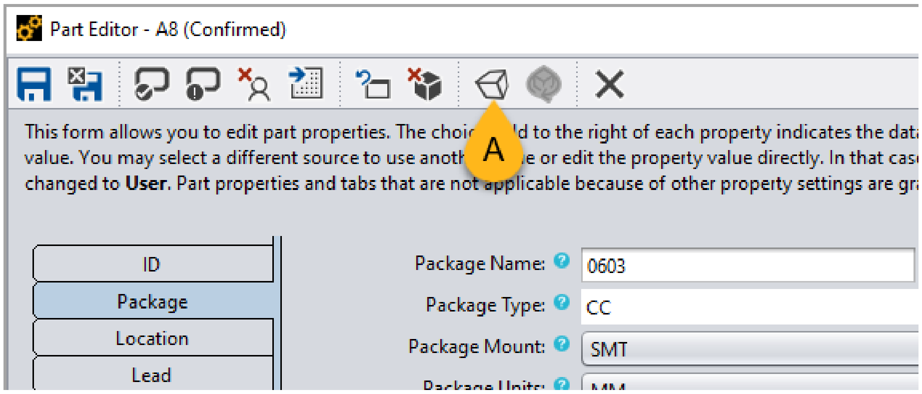
Die Units: MM
Die Length: 0.001
Die Width: 0.001
Die Thickness: 0.001
Die Material: COPPER
Process Node: 350NM PLANAR

Chapter 13: Checking Your Work

Sections:

13.1. Use the 3D Viewer to Check Work

Visually examining each part in Sherlock's **3D Viewer** is a quick and easy way to spot mistakes in parameter entries, especially for leaded parts. With the relevant part loaded in the **Part Properties Viewer**, click the **View 3D Model** icon (A, in the image below) to view its 3D geometry.



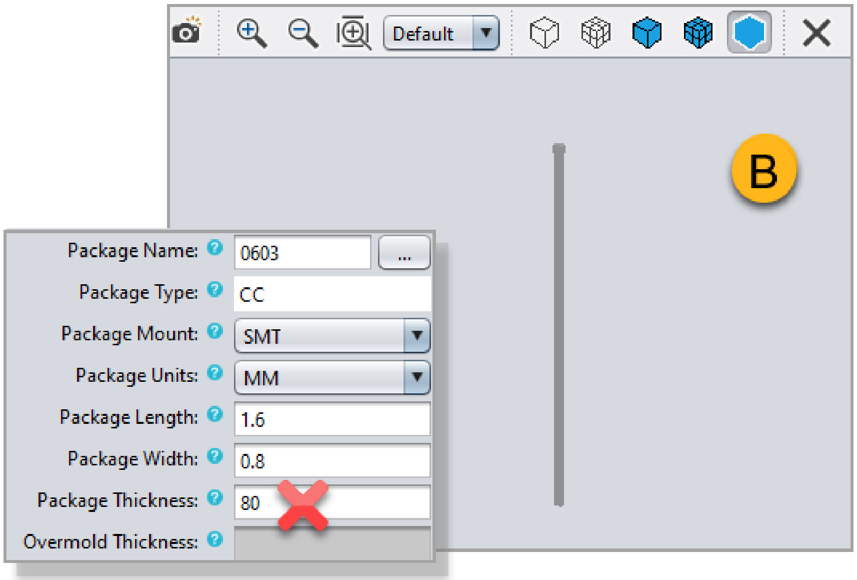
This form allows you to edit part properties. The choic ld to the right of each property indicates the dat value. You may select a different source to use anoth e or edit the property value directly. In that cas changed to **User**. Part properties and tabs that are not applicable because of other property settings are gr

Package Name: 0603

Package Type: CC

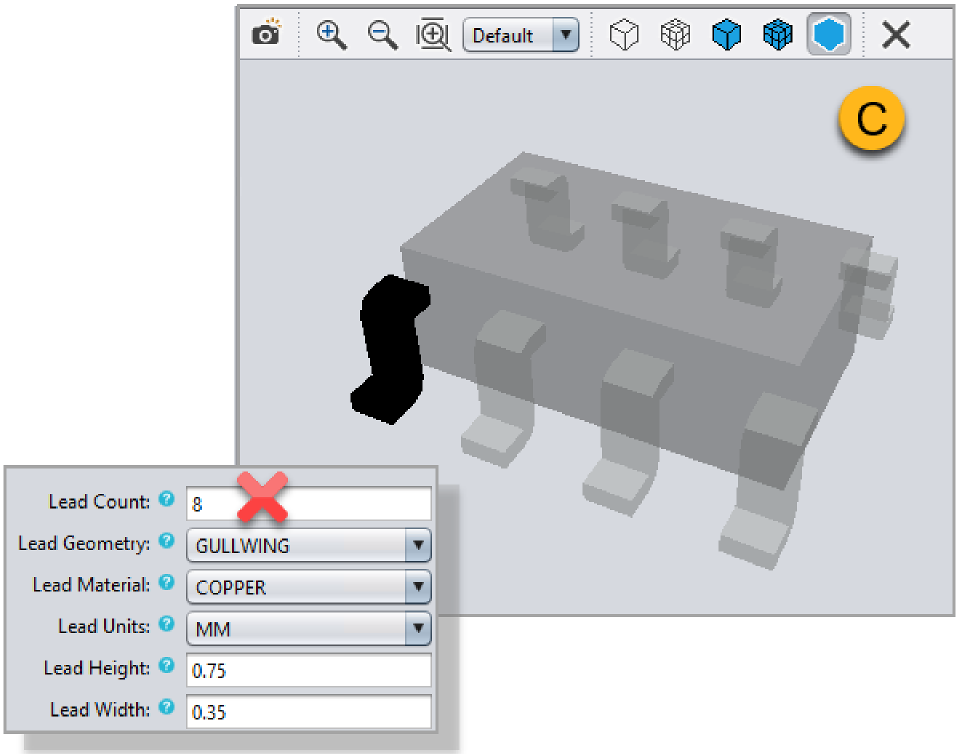
Package Mount: SMT

As you can see below (B), the **3D Viewer** makes certain mistakes obvious. In this example, the **Package Thickness** of a 0603 chip capacitor was mistakenly entered as 80 mm instead of the correct value, 0.8 mm



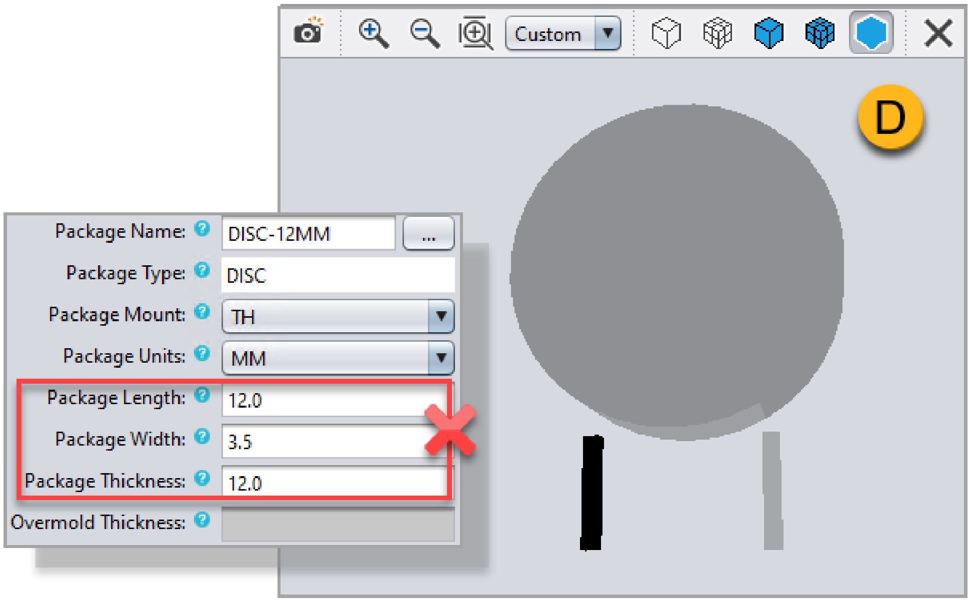
Package Name: 0603
Package Type: CC
Package Mount: SMT
Package Units: MM
Package Length: 1.6
Package Width: 0.8
Package Thickness: 80
Overmold Thickness:

Likewise, in this TSOP-6 package (C), the outer leads are not fully connected to the package body, indicating an error. As it turns out, the lead count was mistakenly entered as 8 instead of 6.



Lead Count: 8
Lead Geometry: GULLWING
Lead Material: COPPER
Lead Units: MM
Lead Height: 0.75
Lead Width: 0.35

In the TH Disc package below (D), the leads do not connect to the package body. This would generate an error in an FEA analysis. In this case, the package dimensions should be edited to get the leads connected.



Package Name: DISC-12MM

Package Type: DISC

Package Mount: TH

Package Units: MM

Package Length: 12.0

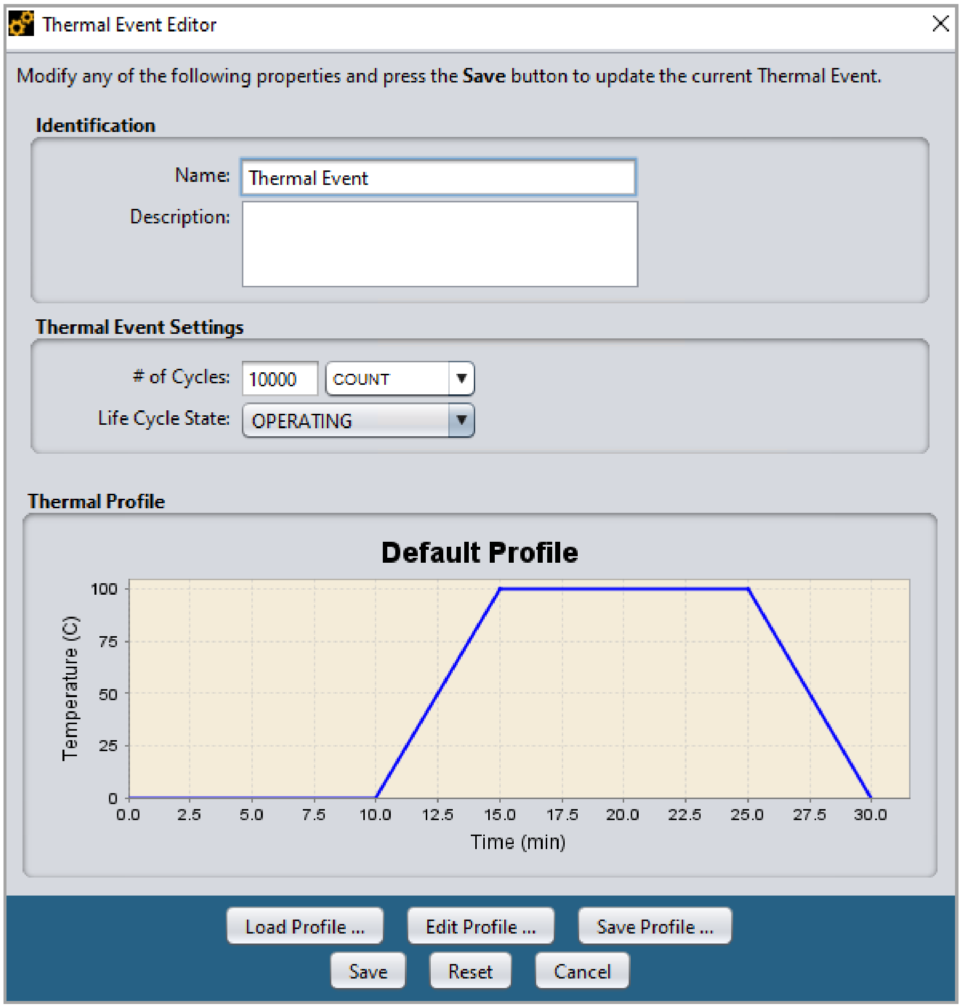
Package Width: 3.5

Package Thickness: 12.0

Overmold Thickness:

13.2. Use the Solder Fatigue Analysis to Check Work

For a new project, running a Solder Fatigue analysis using Sherlock's default Thermal Event environment can also reveal errors in part design, thanks to Sherlock's predefined design rules. Extremely short cycles-to-failure predictions (for example, failing after zero or one cycle or failing below a thousand cycles) usually indicates an improperly defined part.



Modify any of the following properties and press the **Save** button to update the current Thermal Event.

Identification

Name: Thermal Event

Description:

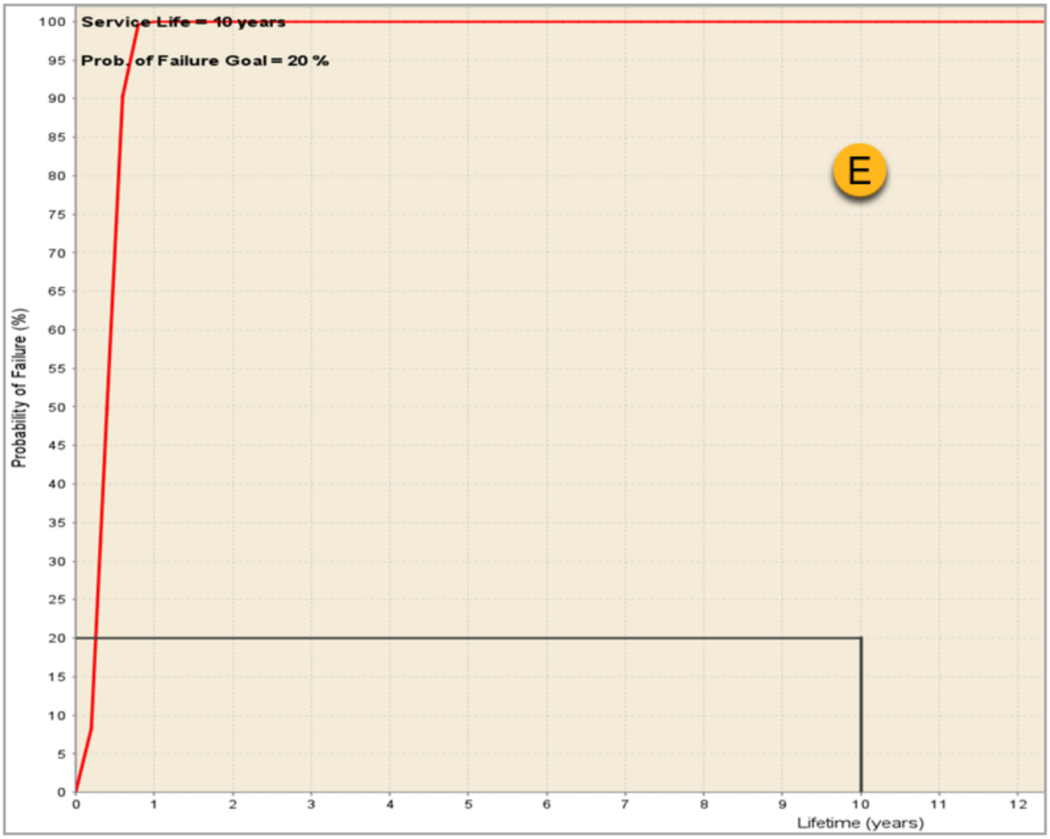
Thermal Event Settings

# of Cycles: 10000 COUNT

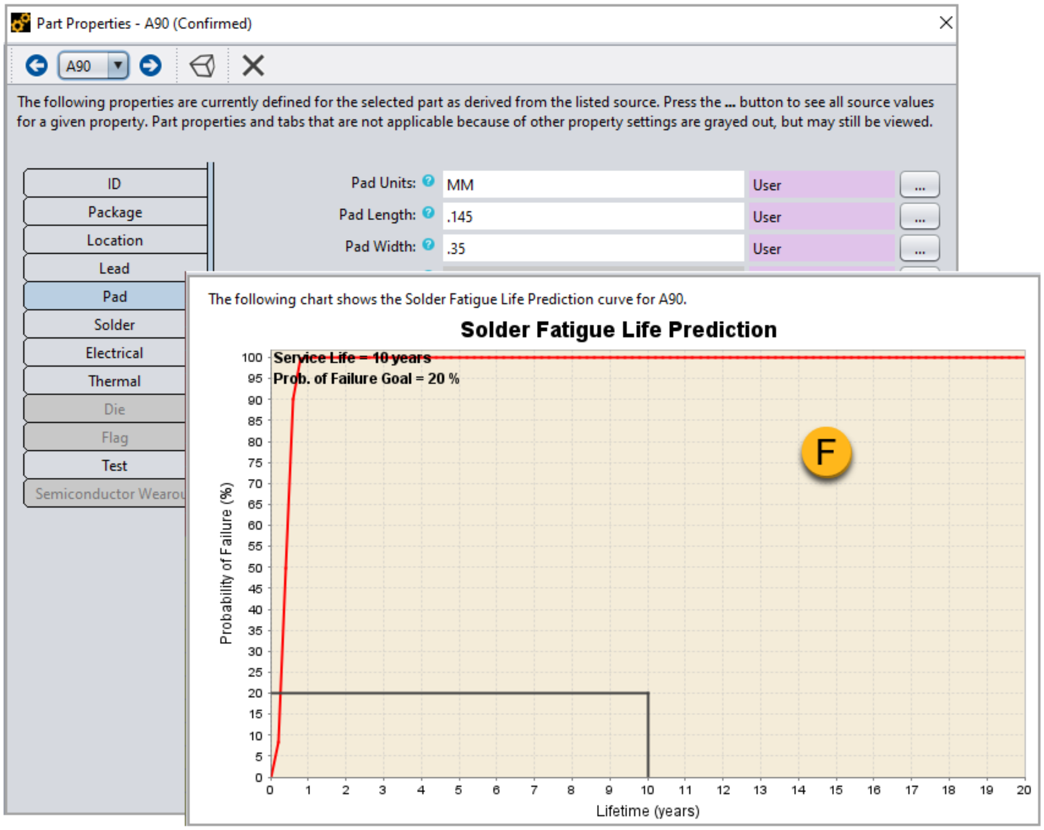
Life Cycle State: OPERATING

Thermal Profile

If the Life Prediction Curve is similar to the one below (E), reaching 100% probability of failure immediately or very quickly, check the part definitions of the most critical components



For this 2512 chip resistor shown below (F), the pad dimensions are too small. The package is 6.3 mm x 3.15 mm. Usually a pad width equal to or greater than the package width should be used.



Part Properties - A90 (Confirmed)

The following properties are currently defined for the selected part as derived from the listed source. Press the ... button to see all source values for a given property. Part properties and tabs that are not applicable because of other property settings are grayed out, but may still be viewed.

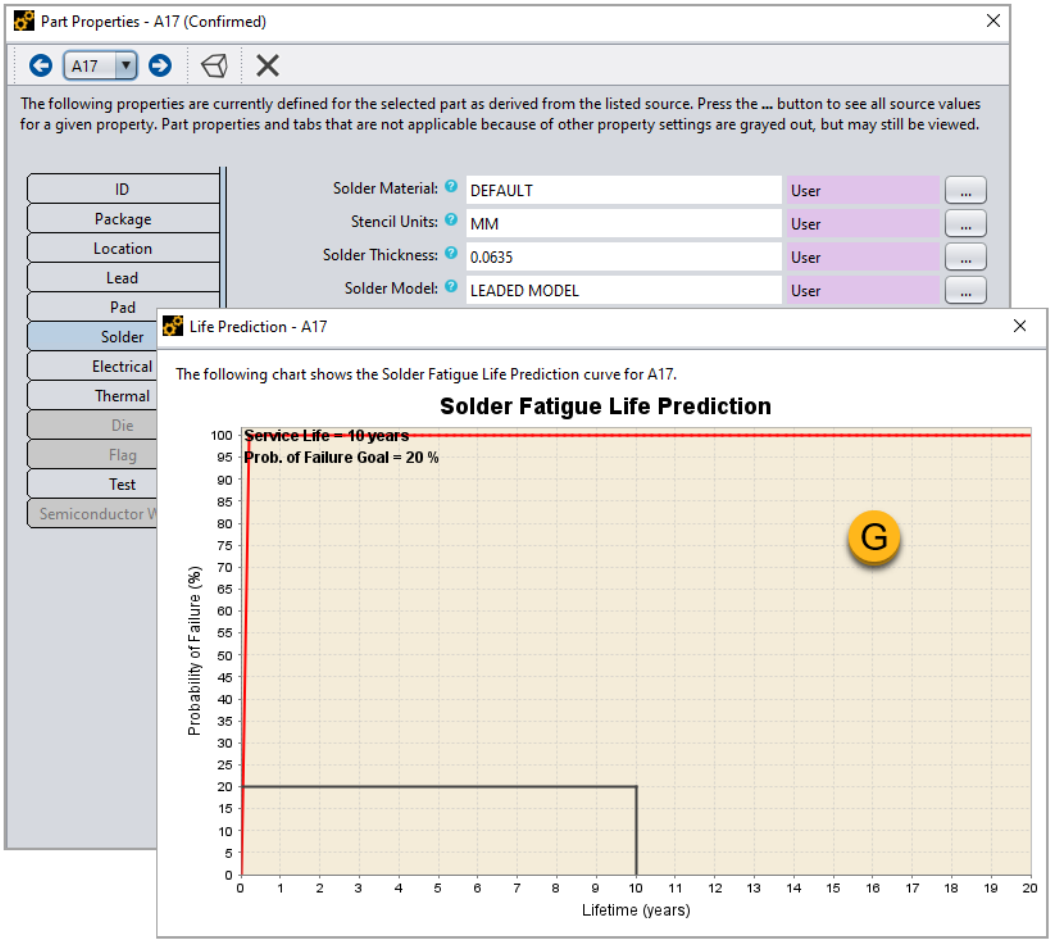
Pad Units: MM User

Pad Length: .145 User

Pad Width: .35 User

The following chart shows the Solder Fatigue Life Prediction curve for A90.

For this 1206 chip capacitor (G), the wrong solder model has been selected. CC model should be used.



The following properties are currently defined for the selected part as derived from the listed source. Press the ... button to see all source values for a given property. Part properties and tabs that are not applicable because of other property settings are grayed out, but may still be viewed.

Solder Material:	DEFAULT	User
Stencil Units:	MM	User
Solder Thickness:	0.0635	User
Solder Model:	LEADED MODEL	User

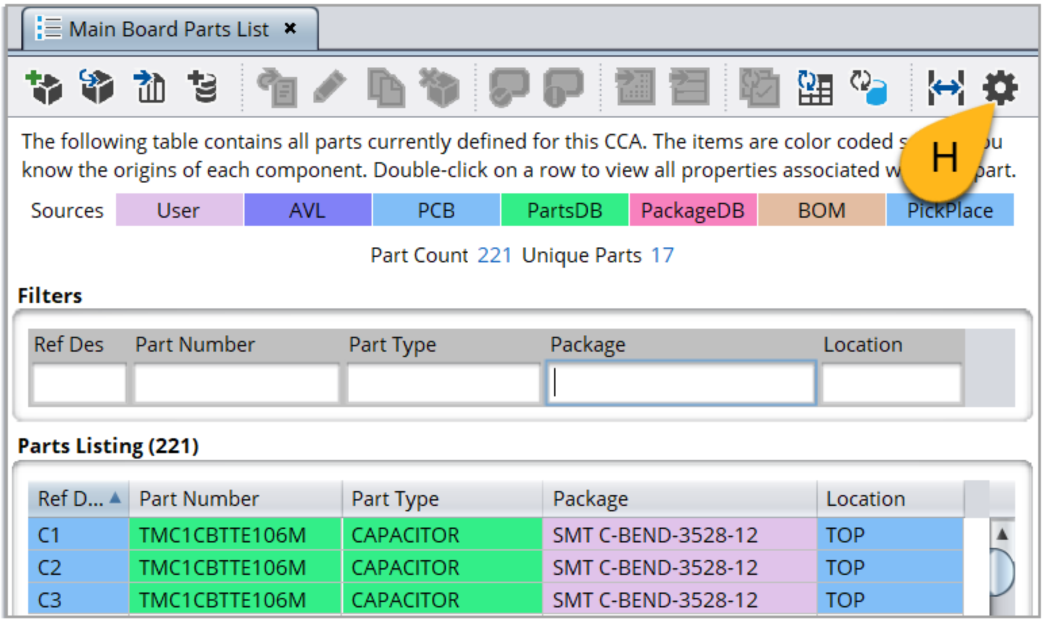
The following chart shows the Solder Fatigue Life Prediction curve for A17.

13.3. Use the Part List Filter to Check Work

You can customize Sherlock's **Parts List** to display or exclude any properties you wish. (Click the gear icon, H, to open the **Customize Parts Listing** window.) This feature, along with the **Parts List** sorting tools, can help you screen for common part-build errors.

Tip:

For a full explanation of how you can customize the **Parts List**, see Parts List Overview in the *Sherlock User's Guide*.



The following table contains all parts currently defined for this CCA. The items are color coded s ou know the origins of each component. Double-click on a row to view all properties associated w part.

Sources	User	AVL	PCB	PartsDB	PackageDB	BOM	PickPlace

Part Count 221 Unique Parts 17

Filters

Ref Des	Part Number	Part Type	Package	Location

Parts Listing (221)

Ref D... ▲	Part Number	Part Type	Package	Location
C1	TMC1CBTTE106M	CAPACITOR	SMT C-BEND-3528-12	TOP
C2	TMC1CBTTE106M	CAPACITOR	SMT C-BEND-3528-12	TOP
C3	TMC1CBTTE106M	CAPACITOR	SMT C-BEND-3528-12	TOP

To screen for part errors, add the following properties to the **Parts List** display:

- Material
- Package Type
- Package Length
- Package Width
- Package Thickness
- Pad Length
- Pad Width
- Solder Model
- Lead Count
- Lead Material

By sorting and filtering the parts list, the following common errors can be identified and corrected:

- **Material**
  - Chip capacitors set to ALUMINA.
  - Leaded IC packages set to EPOXYENCAPSULANT.
- **Package Length, Width, Thickness**: Sort to identify gross errors (Example: 6 instead of 0.6).
- **Pad Length, Width**
  - Sort by **Package Name** to identify parts where **Pad Width** is set to less than the **Package Width**.

  - Look for inconsistencies in pad geometries for the same **Package Style**.
- **Part Type, Package Type, and Solder Model Errors**: Sort by **Part Type**, **Package Type**, and **Solder Model** to identify inconsistent selections within a part.
- **Lead Count**
  - Check for parts where **Lead Count** is set to 0.
  - Check for non-network or array chip components with a **Lead Count** other than 2.
- **Lead Material**: Check for **Lead Materials** other than copper, steel, or brass.