# Creating a SMD Footprint in Cadence Allegro



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#### Abstract

This minimul presents a tutorial for creating a footprint for a surface mount device (SMD), specifically a surface mount capacitor. At relevant steps, there are explanations of the specific features of the footprint. The software package Cadence Allegro will be used for this tutorial.

### Introduction

Printed circuit board (PCB) design is a skill that all electrical engineers obtain in their careers. One of the most important processes of PCB design is creating footprints, an arrangement of pads on a PCB used for attaching electronic components to the circuit board. The process can be broken down into three simple steps, as shown in figure 1.



**Fig. 1 Footprint Creation Steps** 

Footprints cannot be created using any arbitrary shapes and sizes. The design specifications, including pad dimensions, are in the component's datasheet. This tutorial uses a two pin SMD capacitor as an example. The dimensions are listed in figure 2.



Fig. 2 SMD Capacitor Dimensions

## Tutorial

#### 1. Getting Started

The following programs must be installed onto your computer and opened before starting this tutorial:

- Pad Designer (Cadence SPB 16.5/16.6 -> PCB Editor Utilities -> Pad Designer)
- PCB Editor (Programs -> Cadence -> Release 16.6)

#### 2. Create Pads in Pad Designer

1. Click the Units drop-down menu and select millimeters in the 'Units' section of the 'Parameters' tab.

**NOTE:** The unit mils (1/1000 of an inch) is another common unit of measurement.

- 2. Check the box next to 'Single Layer Mode' in the 'Layers' tab. Checking this box will limit the number of layers between the top and bottom copper layers to one layer.
- 3. Select the 'BEGIN LAYER' row. Click the 'Geometry' drop-down menu and select 'Rectangle'. Input 0.2 in the 'Width' box and 0.8 in the 'height' box.

**TIP**: The begin layer is the top copper layer of the PCB.

4. Right click 'Bgn' button and click copy. Right click 'SOLDERMASK\_TOP' row and click paste. Paste onto the 'PASTEMASK\_TOP' row.



#### Fig. 3 Copy/Paste

**TIP:** The 'SOLDERMASK\_X' and 'PASTEMASK\_X' widths and heights can be 0.1 mm bigger than the 'BEGIN\_LAYER'.

5. Save the pad and name it GRM188R61C474KA93.

The file should be named GRM188R61C474KA93.pad. The final pad configuration should look like Fig. 4.

Pads	tack layers				Views
	🔽 Single layer mode				Type: Single
	Layer	Regular Pad	Thermal Relief	Anti Pad	C XSection @ Top
Bgn	BEGIN LAYER	Rect 0.2 × 0.8	Null	Null	<u> </u>
·>	SOLDERMASK_TOP	Rect 0.2 × 0.8	N/A	N/A	
	SOLDERMASK_BOTTOM	Null	N/A	N/A	
	PASTEMASK_TOP	Rect 0.2 × 0.8	N/A	N/A	
	PASTEMASK_BOTTOM	Null	N/A	N/A	
	FILMMASK_TOP	Null	N/A	N/A	
	FILMMASK_BOTTOM	Null	N/A	N/A	×
eome iape: ish: idth:	0.2		hermal Relief Null	•	Anti Pad
idin. eight: ifset ≻ ifset ∖			0.0		0.0

Fig. 4 Pad Configuration

- 3. Arrange Pads in PCB Editor
- 1. Click File -> New.
- 2. Choose 'Package Symbol', input 'cap0603' in the 'Drawing Name' box.
- 3. Set the folder that the footprint will be saved.

New Drawing			×
Project Directory	: J:/Projects_WH/Cadence/	Footprints_Lib	ОК
Drawing Name:	cap0603.dra	Browse	Cancel
Drawing Type:	Package symbol	Template	Help
	Board (wizard) Module		
	Package symbol Package symbol (wizard) Mechanical symbol		

Fig. 5

- 4. Click Setup -> Design Parameters. Click the 'Design' tab. Change the 'User units' to millimeters.
- 5. Click the 'Display' tab and click \_\_\_\_\_ to set up the grids.
- 6. Change all 'x' and 'y' boxes to 0.0254.

Changing the 'x' and 'y' values makes each dot on the grid 0.0254 mm (1 mil) apart.

- 7. Click 'OK' to close the 'Define Grid' window. Close the 'Design Parameter Editor'.
- 8. Click Layout -> Pins. Click 'Options' on the right side of the window, as shown in Fig. 6.



Fig. 6.

**9.** Choose GRM188R61C474KA93 for 'padstack', input 1.6 in the 'Spacing' box in the 'x' row, and 0.5 in the 'Spacing' box in the 'y' row, as shown in fig. 7.

: Options		ţ.	Ŧ				
<ul> <li>Connect</li> </ul>	<ul> <li>Mechanical</li> </ul>						
Padstack:	Rx0_95Y1_0						
Copy mode:	Rectangular 💌						
Qty X: 2 Y: 1	Spacing   Order     1.6000   Right •     0.5000   Down •						
Rotation:	0.000 💌						
Pin #: Text block:	1 inc: 1						
Text name:	-						
Offset X:	0.0000 Y: 0.0000						
<b>Fig. 7</b>							

10. Click anywhere on the workspace (black grid) to place the pads.

**NOTE**: The black grid is the area of the PCB Editor program where the footprint is placed.

11. Save the file as GRM188R61C474KA93.dra.

**WARNING**: Several windows will pop up warning you that the footprint is missing features. Close the windows and continue to the next section.

- 4. Add Layers/Labels
- 1. Click Shape -> Rectangular. Click Options on the right side of the window.
- 2. Choose 'Package Geometry' from the top drop-down menu and choose 'Place\_Bound\_Top' in the bottom drop-down menu, as shown in fig. 8.



Fig. 8

**3.** Place the rectangle onto the workspace so that the rectangle is surrounding the pads, as shown in fig. 9.





- 4. Click Add ->Line. Click Options on the right side of the window.
- **5.** Choose 'Package Geometry' from the top drop-down menu and choose 'Silkscreen\_Top' from the bottom drop-down menu.
- 6. Set Line lock: line , 90
- 7. Set Line width: 0.05
- **8.** Draw the lines around the pads, leaving 0.05 mm between the pad edge and the line, as shown in fig. 10.



Fig. 10

- 9. Repeat steps 1 and 2, except choose 'Assembly Top' from the bottom drop-down menu.
- **10.** In 'Shape Creation', Select 'Place Rectangle' and set the width and height to be 1.8 mm and 1 mm, respectively.



Fig. 11

**11.** Place the rectangle in the workspace as shown in fig. 12.

**NOTE:** The center of the rectangle should be aligned with the origin.



Fig. 12

**12.** Click Layout -> Labels -> RefDes



Fig. 13

- **13.** In Options, select 'Assembly Top' from the drop-down menu.
- **14.** Click anywhere in the workspace and type 'C\*'.



15. Repeat steps 12-14 for 'Silkscreen Top'. The symbol should look like fig. 14.



**16.** Save the file.

**NOTE:** The footprint is finished when the following layers are present:

- Bound\_Top
- Silkscreen\_Top
- Assembly\_Top
- RefDes Silkscreen
- RefDes Assembly Top

# Tips and Tricks

- Practice undoing actions by right-clicking and pressing 'oops'.
- The black grid workspace can be moved by pressing and holding the middle button on the mouse and moving the mouse.
- Use the visibility tab on the right side of the screen to show and hide desired layers.
- The options tab can be pinned to the workspace by clicking the thumbnail button.



# Glossary

**Assembly Layer:** layer that contains the information about the placement and orientation of all the components on the circuit board.

**Bound Layer:** layer that contains the outline of the footprint.

**Footprint**: graphical symbol composed of pads used for connecting electronic devices to a circuit board.

**Pad:** also known as pins; surface of the circuit board designated for soldering electronic components.

**Pastemask Layer:** layer that contains information about the places on the circuit board where there should be no pastemask.

**Pins:** leads on an electronic device for connecting to other circuit components; **pin** is also used interchangeably with **pad** when referring to the footprints.

**Reference Designator (RefDes):** A standardized method of identifying a device on a printed circuit board. Typical reference designators begin with a letter, followed by a number.

Silkscreen Layer: layer that contains the labels and outlines of every component.

**Soldermask Layer:** layer that contains the information about the places on the circuit board where there should be no soldermask.

# References

"Capacitor Data Sheet". GRM188R61C474KA93. Murata. April, 2016

"Complete PCB Design Using OrCAD Capture and PCB Editor". Mitzner, Kraig. Elsevier, 2009. Print.

"GRM Series" Murata April 30, 2016. < http://www.murata.com/en-us/products/capacitor/mlcc>

# Appendix

Additional resources

http://www.referencedesigner.com/tutorials/allegro/allegro\_page\_1.php

http://www.referencedesigner.com/tutorials/allegro/allegro\_page\_5.php