Resistor Sizes and Packages

Chapter 2 - Resistor Standards and Codes

Resistors are available in a large number of different package styles and sizes. The most commonly used today are the rectangular surface mount (SMD) resistors, but also the good old axial resistor is still used extensively in through-hole designs. This page provides information on the dimensions of SMD, axial, and MELF packages. It also provides some recommended land patterns for SMD components for solder attach to PCBs.

SMD Resistor Sizes

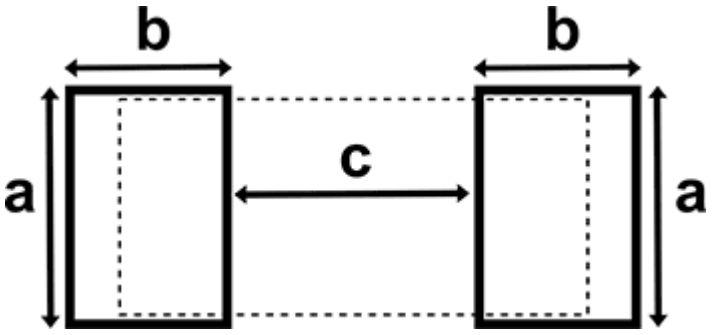
The shape and size of surface mount resistors are standardized, with most manufacturers using the JEDEC standards. The size of SMD resistors is indicated by a numerical code, such as 0603. This code contains the width and height of the package. So, the imperial code 0603 indicates a length of 0.060" and a width of 0.030".

The SMD package code can be given in either imperial or metric units. In general, the imperial code is used more often to indicate the package size. Confusingly, even when the imperial naming convention is used, the metric dimensions are often used during the design of the printed circuit boards (PCBs). In general, you can assume the code is in imperial units, but the dimensions used are in mm. The SMD resistor size used depends primarily on the required power rating, the minimum feature size of the PCB manufacturing, and the limitations of the pick-and-place equipment. The following table lists the dimensions and specifications of commonly used surface mount packages.

Code		Length (l)		Width (w)		Height (h)		Power
Imperial	Metric	inch	mm	inch	mm	inch	mm	Watt
0201	0603	0.024	0.6	0.012	0.3	0.01	0.25	1/20 (0.05)
0402	1005	0.04	1.0	0.02	0.5	0.014	0.35	1/16 (0.062)
0603	1608	0.06	1.55	0.03	0.85	0.018	0.45	1/10 (0.10)
0805	2012	0.08	2.0	0.05	1.2	0.018	0.45	1/8 (0.125)
1206	3216	0.12	3.2	0.06	1.6	0.022	0.55	1/4 (0.25)
1210	3225	0.12	3.2	0.10	2.5	0.022	0.55	1/2 (0.50)
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 (0.75)
2512	6332	0.25	6.3	0.12	3.2	0.024	0.6	1

Solder Pad Land Pattern

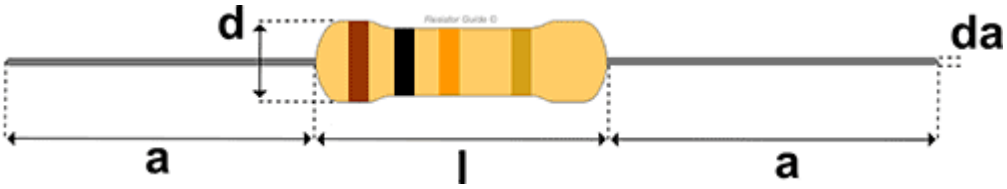
When designing with surface mount components, the right solder pad size and land pattern should be used. The following table shows recommended dimensions of the land pattern for common surface mount packages. The table lists the dimensions for reflow soldering. For wave soldering, smaller pads are used.



Code		Pad length (a)		Pad width (b)		Gap (c)	
Imperial	Metric	inch	mm	inch	mm	inch	mm
0201	0603	0.012	0.3	0.012	0.3	0.012	0.3
0402	1005	0.024	0.6	0.020	0.5	0.020	0.5
0603	1608	0.035	0.9	0.024	0.6	0.035	0.9
0805	2012	0.051	1.3	0.028	0.7	0.047	1.2
1206	3216	0.063	1.6	0.035	0.9	0.079	2.0
1812	3246	0.19	4.8	0.035	0.9	0.079	2.0
2010	5025	0.11	2.8	0.059	0.9	0.15	3.8
2512	6332	0.14	3.5	0.063	1.6	0.15	3.8

Axial Resistor Sizes

The size of axial resistors is not as standardized as the SMD resistors, and different manufacturers often use slightly different dimensions. Furthermore, the size of an axial resistor depends on the power rating and the type of resistor such as carbon composition, wirewound, carbon film, or metal film. The following drawing and table give an indication of the dimensions of common carbon film and metal film axial resistors. Whenever the exact size needs to be known, always check the manufacturer datasheet of the component.



Power rating	Body length (l)	Body diameter (d)	Lead length (a)	Lead diameter (da)
Watt	mm	mm	mm	mm
1/8 (0.125)	3.0 ± 0.3	1.8 ± 0.3	28 ± 3	0.45 ± 0.05
1/4 (0.25)	6.5 ± 0.5	2.5 ± 0.3	28 ± 3	0.6 ± 0.05
1/2 (0.5)	8.5 ± 0.5	3.2 ± 0.3	28 ± 3	0.6 ± 0.05
1	11 ± 1	5 ± 0.5	28 ± 3	0.8 ± 0.05

MELF Resistor Package Sizes

Metal electrode leadless face (MELF) is another type of surface mount resistor package.. The main advantage of using MELF instead of standard SMD packages is the lower thermal coefficient and better stability. The temperature coefficient of resistance (TCR) of thin film MELF resistors is often between 25-50 ppm/K while standard thick film SMD resistors often have a TCR of > 200 ppm/K. The lower TCR of MELF resistors is due to their cylindrical construction. This cylindrical construction also gives the package distinct disadvantages, mainly when the components have to be placed using pick and place machines. Because of their round shape a special suction cup and more vacuum is required.

There are three common MELF package sizes: MicroMELF, MiniMELF and MELF. The following table lists the characteristics of these types.

Name	Abbr.	Code	Length	Diameter	Power
			mm	mm	Watt
MicroMELF	MMU	0102	2.2	1.1	0.2 - 0.3
MiniMELF	MMA	0204	3.6	1.4	0.25 - 0.4
MELF	MMB	0207	5.8	2.2	0.4 - 1.0

Resources

Online

- JEDEC : JEP95 - standardized component outlines

- Resistor SMD Code
- Resistor Guide Index
- Resistor Symbols

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