 **SMD**

3° jaar Industrieel Ingenieur
afdeling elektronica

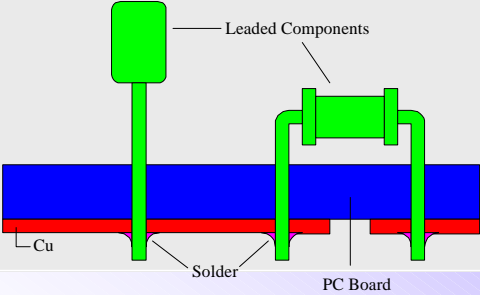
Elektronica - Ontwerpen

SMD
Surface Mounted Devices

Ing. Dirk Smets

Klassieke PCB assemblage **SMD**

- **Klassieke PCB assemblage = 'through hole'**
 - gaten door dragerplaat boren (+ doormetalliseren)
 - aansluitdraden door gaten steken
 - onderzijde (+eventueel bovenzijde) solderen

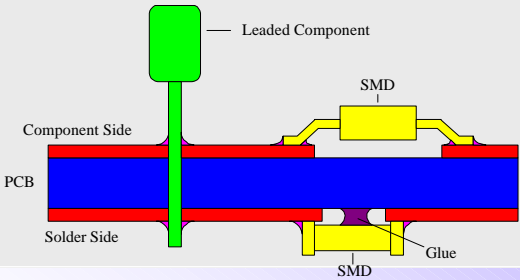


The diagram illustrates a through-hole assembly on a PCB. A green component with leads is inserted into a hole in a blue PCB. The leads are soldered to the bottom surface of the board. A red layer at the bottom is labeled 'Cu'. Labels include 'Leaded Components', 'Solder', and 'PC Board'.

Surface Mounting SMD

■ Surface Mounting assemblage :

- geen gaten
- componenten rechtstreeks op de kopervlakken lijmen en/of solderen



Voordelen van SMA SMD

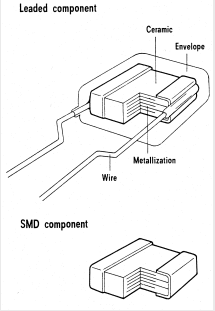
■ SMA = *Surface Mounting Assembly*

- PCB met minder boringen en doormetallisaties
- SMD componenten zijn kleiner, dus totale PCB-oppervlakte wordt kleiner
- productie kan nagenoeg volledig automatisch en dus sneller
- betrouwbaarheid stijgt
- beter HF-gedrag
- kostprijs daalt

SMD-componenten

SMD

- **Opbouw**
 - zelfde basistechnologie als voor de klassieke componenten
 - geen aansluitdraden, maar contactvlakken
 - volume wordt aanzienlijk kleiner

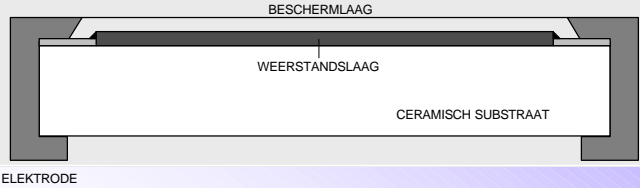


The diagram illustrates the difference between a traditional leaded component and an SMD component. The 'Leaded component' is shown with a 'Ceramic Envelope' containing internal 'Metallization' and 'Wire' connections. The 'SMD component' is a smaller, surface-mounted version of the same structure.

SMD-weerstanden

SMD

- **Opbouw**
 - rechthoekige ceramische drager
 - laag weerstandspasta
 - weerstandwaarde wordt met laser getrimd
 - beschermende glazuurlaag
 - dekselvormige contactvlakken



The diagram shows a cross-section of an SMD resistor. It consists of a 'CERAMISCH SUBSTRAAT' (ceramic substrate) with a 'WEERSTANDSLAAG' (resistive layer) on top. A 'BESCHERMLAAG' (protective glaze layer) covers the resistive layer. 'ELEKTRODE' (electrode) contacts are located on the sides of the substrate.

SMD-weerstanden

SMD

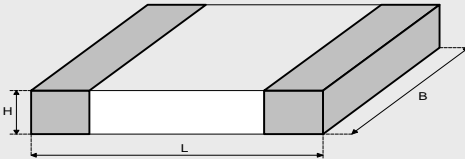
■ Uitzicht



SMD-weerstanden

SMD

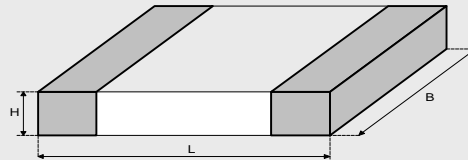
■ Behuizing



- Type-aanduiding : **1206** :
L=0.12" en B=0.06" (3.2 x 1.6 mm)
- Algemeen : **xyyy**
met xx = lengte in hondersten inch
en yy = breedte in hondersten inch

SMD-weerstanden

SMD



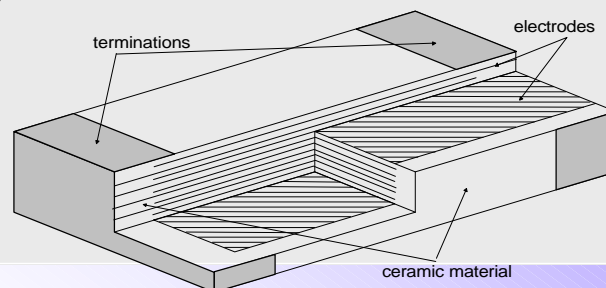
	typenr.	L	x	B	x	H	Pmax	Umax
standaard	1206	3,2	x	1,6	x	0,6	1/4W	200V
	0805	2,0	x	1,25	x	0,5	1/8W	150V
	0603	1,6	x	0,8	x	0,4	1/16W	75V
	0402	1,0	x	0,5	x	0,35	1/16W	75V
!!!	0201	0,6	x	0,3	x	0,25	1/20W	15V
vermogen	2520							
	1812							
	1206							
	0830							

SMD-cerco's

SMD

■ CERCO = ceramische condensatoren

- ceramische film als diëlectricum
- elektrodes d.m.v. zeefdruk
- gestapeld onder druk



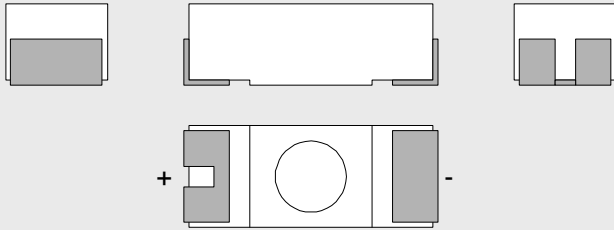
SMD-elco's SMD

- ELCO = elektrolytische condensatoren
 - twee lagen geëtst aluminiumfolie, gescheiden door een laag met in elektrolyet geïmpregneerd papier
 - kunststof behuizing met afgeschuinde anode



SMD tantalum SMD

- tantalum condensatoren
 - anode = gesinterd tantalium
 - diëlektricum = oxidelaag
 - omgeven door halfgeleidende laag bruinsteen



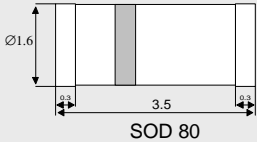
SMD tantalium SMD

- tantalium condensatoren



SMD halfgeleiders SMD

- SMD diode en transistor
 - diode soms in cilindrische behuizing SOD80



SMD halfgeleiders

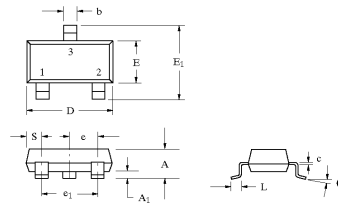
SMD

■ SMD diode en transistor

- diode soms in cilindrische behuizing SOD80
- meestal SOT-behuizing (*Small Outline Transistor*) met 3 aansluitpennen : SOT-23 of ...



TO-236 (SOT-23)



SMD halfgeleiders

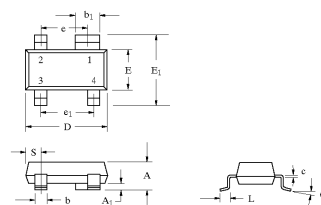
SMD

■ SMD diode en transistor

- diode soms in cilindrische behuizing SOD80
- meestal SOT-behuizing (*Small Outline Transistor*) met 3 of 4 aansluitpennen : SOT-23, SOT-143



TO-253 (SOT-143)



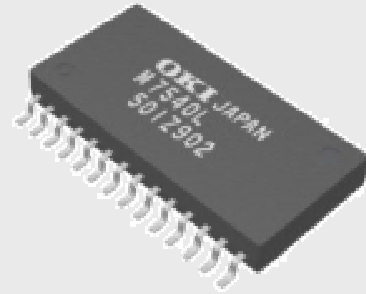
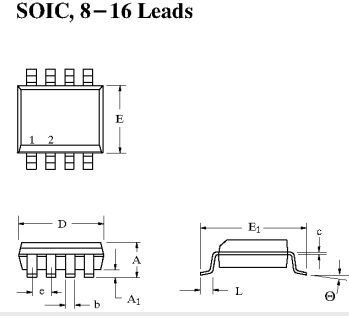
SMD

SMD-IC's (1)

■ Small Outline IC : **SOIC-nn**

- pinafstand = 1.27 mm (d.i. 2.54mm / 2)

SOIC, 8-16 Leads



SMD

SMD-IC's (1)

■ Small Outline IC : **SOIC-nn**

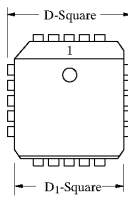
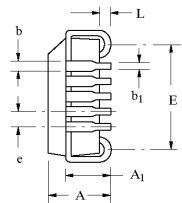
- pinafstand = 1.27 mm (d.i. 2.54mm / 2)
- verder verkleinde pinafstanden:
 - VSO = Very Small Outline
 - SSOP = Shrink Small Outline Package


⇒ pitch = 1,0 - 0,95 - 0,8 - 0,76 - 0,65 mm

SMD-IC's (2) SMD

- Small Outline IC : **SOIC**
- Plastic Leaded Chip Carrier : **PLCC-nn**
 - J-leads, 4 zijden, afstand 1.27 mm
 - QFJ=Quad Flat J-lead

PLCC, 20-44 Leads

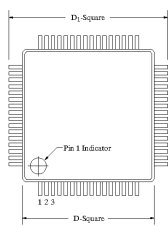
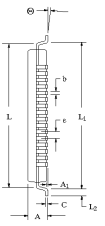






SMD-IC's (3) SMD

- Small Outline IC : **SOIC**
- Plastic Leaded Chip Carrier : **PLCC**
- Quad Flat Pack : **QFP-nn**
 - 4 zijden, afstand tot 0,5 mm (!), tot >300 pinnen (!!)

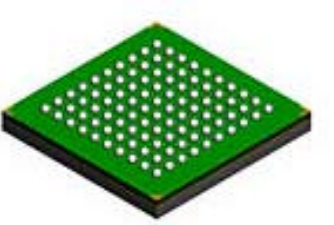
SQFP, 48 Leads



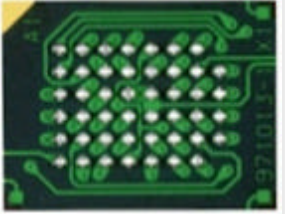
SMD-IC's (4) SMD

- Small Outline IC : **SOIC**
- Plastic Leaded Chip Carrier : **PLCC**
- Quad Flat Pack : **QFP**
- Ball Grid Array : **BGA-nn**
 - matrix van soldeerballetjes
 - 144 ... 324 aansluitingen
 - pitch: 1,5 - 1,27 - 1,0 mm
 - controle: X-stralen
 - μ BGA: pitch tot 0,65 mm



SMD-IC's (5) SMD

- Small Outline IC : **SOIC**
- Plastic Leaded Chip Carrier : **PLCC**
- Quad Flat Pack : **QFP**
- Ball Grid Array : **BGA**
- Chip Size Package : **CSP**
 - minimale behuizing
 - aansluitingen rechtstreeks op chip



SMD

Verpakking (1)

- Verpakking van de SMD componenten
 - miniatuur-afmetingen vereisen nieuwe verpakkingsmethode voor toelevering
 - blistertape met afdekbands
 - beschermt component
 - voorkomt vuil en stof
 - zorgt voor juiste oriëntatie
 - maakt componenten herkenbaar
 - verschillende breedtes

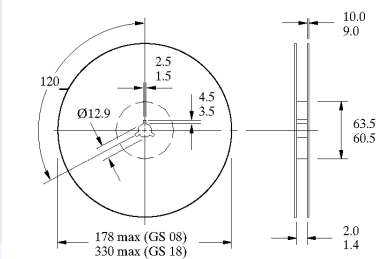


The diagram illustrates three types of SMD packaging tapes. The top one is Paper tape (IEC) with a width of 8 mm. The middle one is Blister tape (IEC) with widths of 8, 12, 16, and 24 mm. The bottom one is Blister tape (JEDEC) with widths of 32, 44, and 56 mm. Each tape is shown with a component mounted on it, demonstrating how the tape protects and organizes the components.

SMD

Verpakking (2)

- Verpakking van de de SMD componenten
 - blistertape op haspels ('reel')
 - verschillende haspeldiameters
 - noodzakelijk voor automatische bestukking

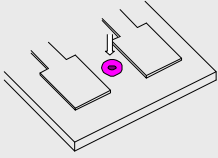


The technical drawing shows a reel with various dimensions. The outer diameter is 120 mm. The inner diameter is 12.9 mm. The width of the reel is 178 mm for GS 08 and 330 mm for GS 18. The thickness of the reel is 10.0 mm and 9.0 mm. The distance between the two sides of the reel is 63.5 mm and 60.5 mm. The distance between the two sides of the reel is 2.0 mm and 1.4 mm. The distance between the two sides of the reel is 2.5 mm and 1.5 mm. The distance between the two sides of the reel is 4.5 mm and 3.5 mm.

Figure 7. Dimensions of the reel in mm

SMD-assemblage (1a) SMD

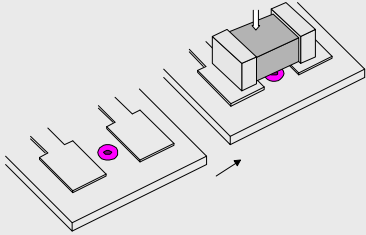
- SMD-assemblagetechniek 1 : **goldsolderen**
 - lijm aanbrengen (met spuitje of zeefdruk)



The diagram shows a top-down view of a PCB pad. A small, pink circular spot of adhesive is being applied to the center of the pad. A thin, grey rectangular component is positioned above the pad, ready to be placed.

SMD-assemblage (1b) SMD

- SMD-assemblagetechniek 1 : **goldsolderen**
 - lijm aanbrengen
 - SMD component plaatsen

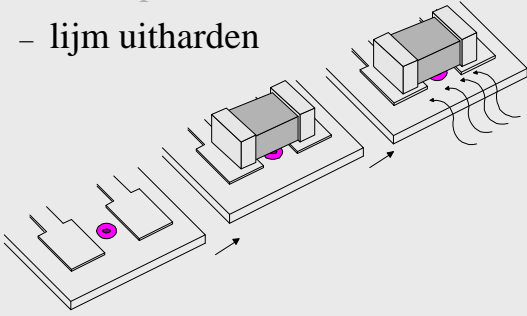


The diagram shows two stages of the assembly process. On the left, a PCB pad has a pink circular spot of adhesive. On the right, a grey rectangular SMD component is being placed onto the pad, with its legs resting on the pad's edges. An arrow points from the left stage to the right stage, indicating the sequence of operations.

SMD-assemblage (1c) SMD

■ SMD-assemblageteknik 1 : **golfsolderen**

- lijm aanbrengen
- SMD plaatsen
- lijm uitharden

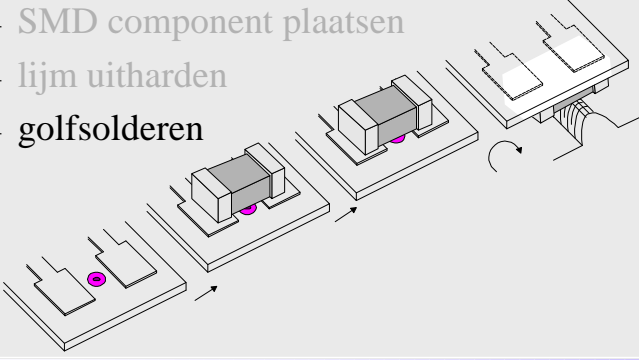


The diagram illustrates the reflow soldering process in three stages. 1. A PCB with a pre-applied adhesive pad and an SMD component is shown. 2. The component is placed on the adhesive. 3. The assembly is heated, causing the adhesive to melt and form a solder joint, indicated by wavy lines representing heat.

SMD-assemblage (1d) SMD

■ SMD-assemblageteknik 1 : **golfsolderen**

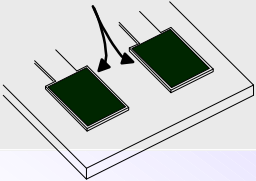
- lijm aanbrengen (met spuitje of zeefdruk)
- SMD component plaatsen
- lijm uitharden
- golfsolderen



The diagram illustrates the reflow soldering process in four stages. 1. A PCB with a pre-applied adhesive pad and an SMD component is shown. 2. The component is placed on the adhesive. 3. The assembly is heated, causing the adhesive to melt and form a solder joint. 4. The assembly is then passed through a wave soldering process, indicated by a curved arrow and a wave of solder, to complete the soldering.

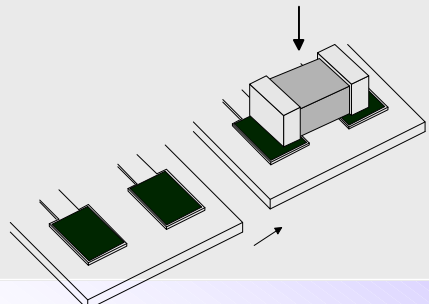
SMD-assemblage (2a) SMD

- SMD-assemblageteknik 2 : **reflow**
 - soldeerpasta aanbrenge met zeefdruk



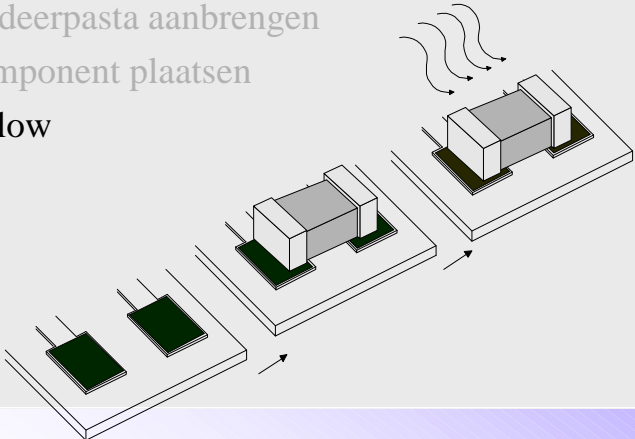
SMD-assemblage (2b) SMD

- SMD-assemblageteknik 2 : **reflow**
 - soldeerpasta aanbrenge
 - component plaats



SMD-assemblage (2c) SMD

- SMD-assemblagetechniek 2 : **reflow**
 - soldeerpasta aanbrenge
 - component plaats
 - reflow

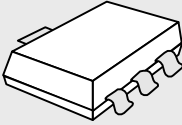


SMD-bestukingsautomaten SMD

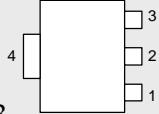
- sequentiële automaat : één na één
- parallel automaat : tegelijkertijd
- gecombineerd :
 - 'batch' in één keer
 - verschillende 'batches' na elkaar

PCB-layout SMD

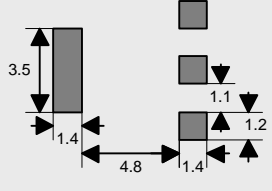
■ Soldeereilanden op PCB afhankelijk van de solderingstechniek



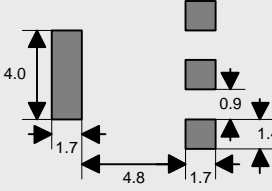
SOT223



Device/Pin	1	2	3	4
Bipolar	B	C	E	C
MOSFET	G	D	S	D



PCB pad layout for reflow soldering



PCB pad layout for wave soldering