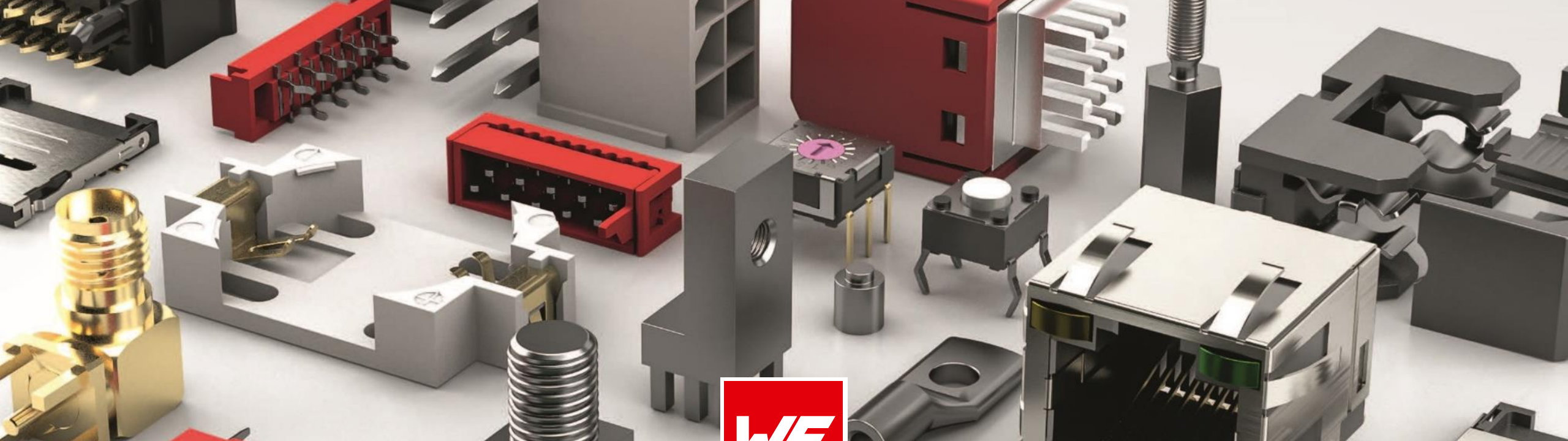




SMARTER DESIGNS WITH SMT SPACERS

Goetz Schattmann
Field Application Engineer eiCan

HAVE YOU EVER SCREWED TOGETHER A DIY SHELF....ALONE?

Then you know what it's about

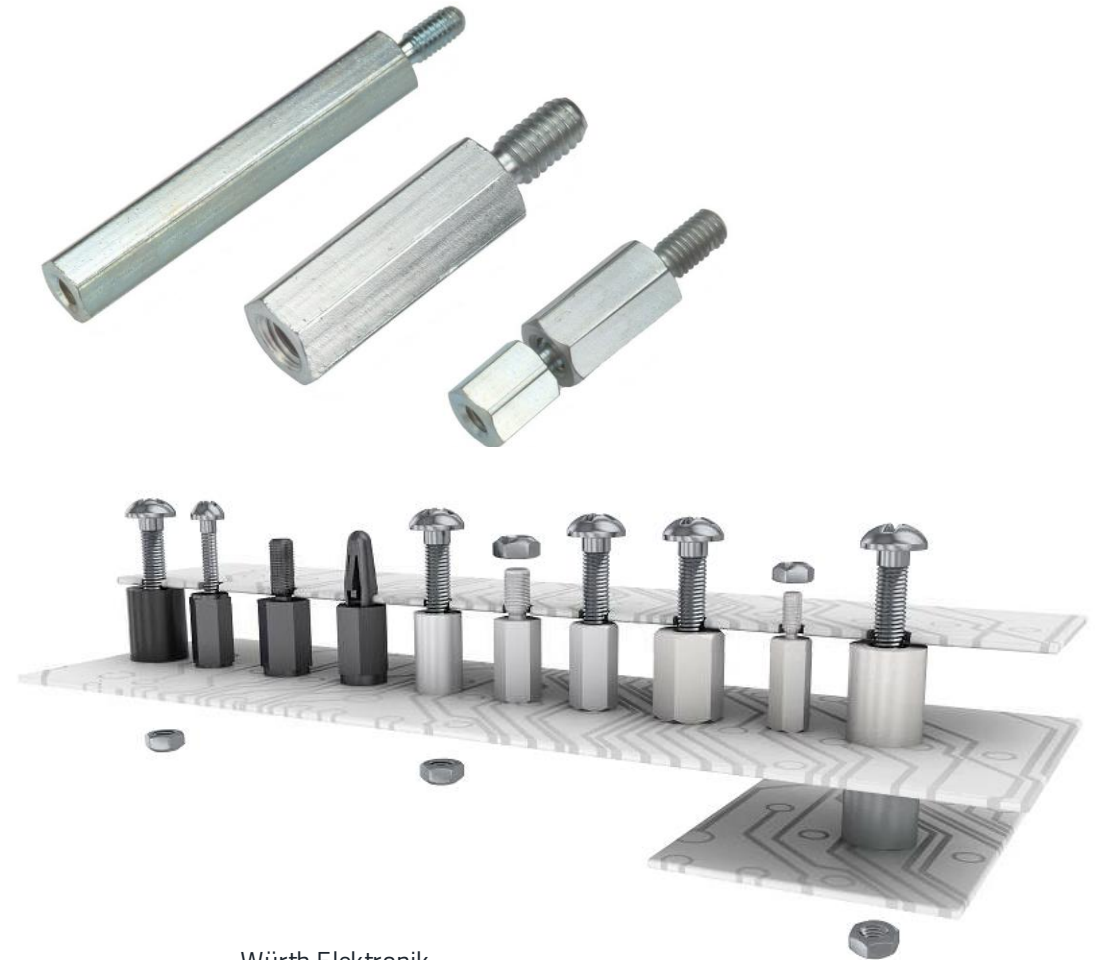
SMT Spacers

- Introduction
- Types of SMT Spacers
- Design and Processing
- Application Examples
- Economic Comparison



A brief history of spacers

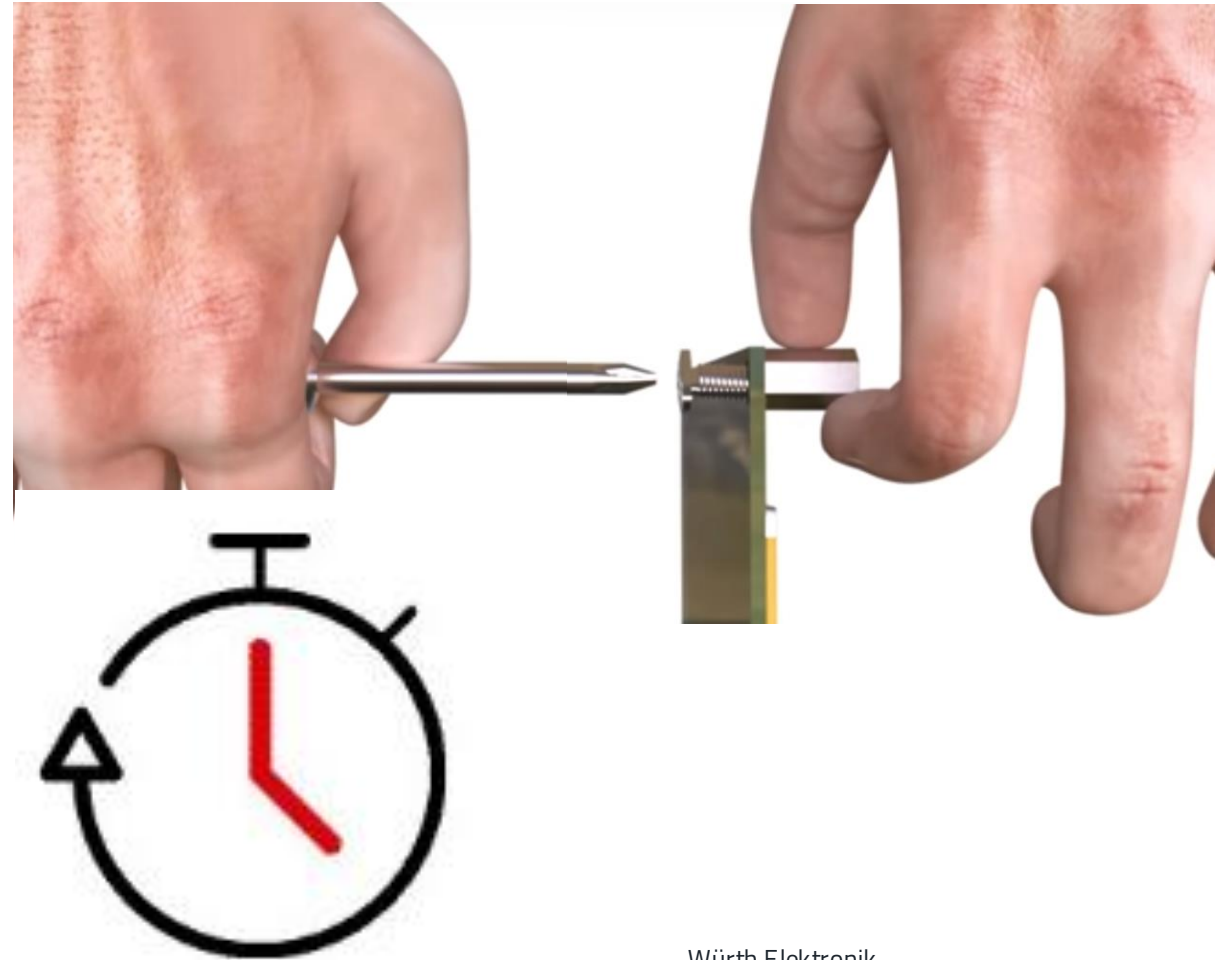
- Spacers are commonly used in electronics
- Achieve different Board-to-Board heights
- PCB mounting
- Fastening components to PCBs
- Numerous variations available
- Stable attachment



Würth Elektronik

Any Obstacles ?

- High manual effort
- Difficult handling
- Time-consuming
- Limited flexibility
- Procurement and warehousing
- Costly



Würth Elektronik

Improvement of Spacers

how can we achieve:

- Better handling?
- Less manual effort?
- Cost efficiency?

■ **Solution:**

**solderable
SMT Spacers!**



Würth Elektronik

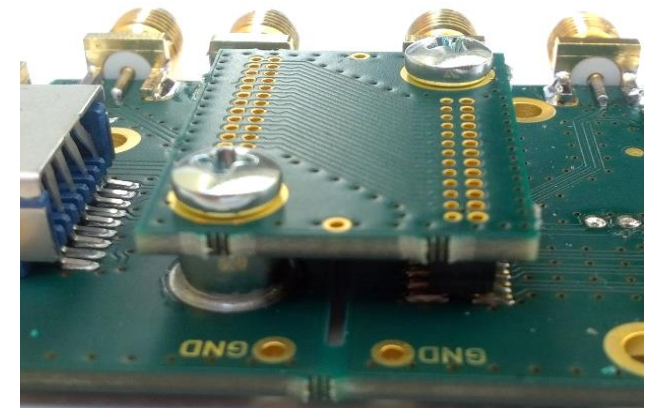
Improvement of Spacers

how can we achieve:

- Better handling?
- Less manual effort?
- Cost efficiency?

■ **Solution:**

solderable SMT Spacers!



Würth Elektronik

General benefits of solderable SMT Spacers

Scope

- Fully automatic assembly
 - Fast and precise processing
 - Highest process reliability
 - Strong holding forces and torques
 - Large selection of types and shapes
-
- **Additionally**
 - *Custom lengths available upon customer request (MOQ)*



Würth Elektronik

WE SMT Spacer Portfolio - let's take a closer look



WA-SMSE ext. thread



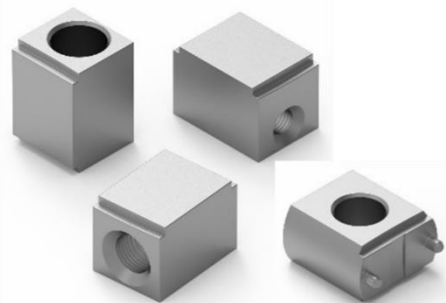
WA-SMSI int. thread



WA-SMST no thread



WA-SMSR reverse



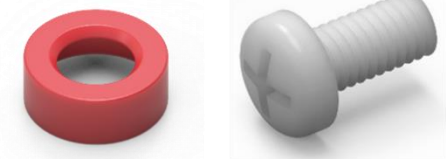
WP-SMRA right angled



WA-SMSSR snap rivet



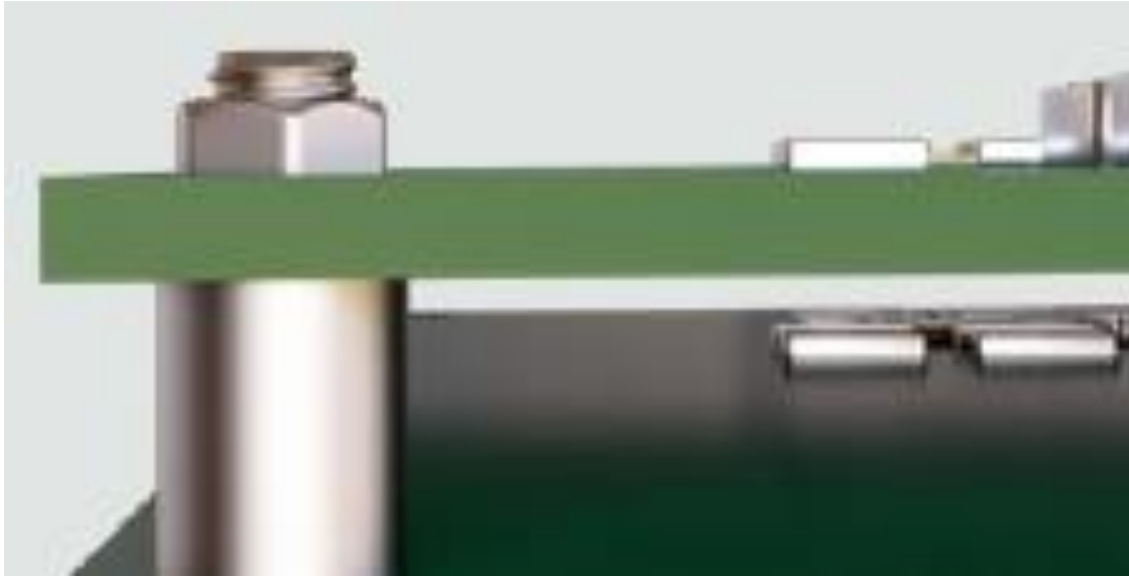
**WA-EXRX
Mounting Button**



**WA-SCAP Cap
WA-SCRW Screw**

Types of SMT Spacers

WA-SMSE SMT Spacer with external thread



Würth Elektronik

- SMT Spacer with external thread for attachment above the PCB, using a nut



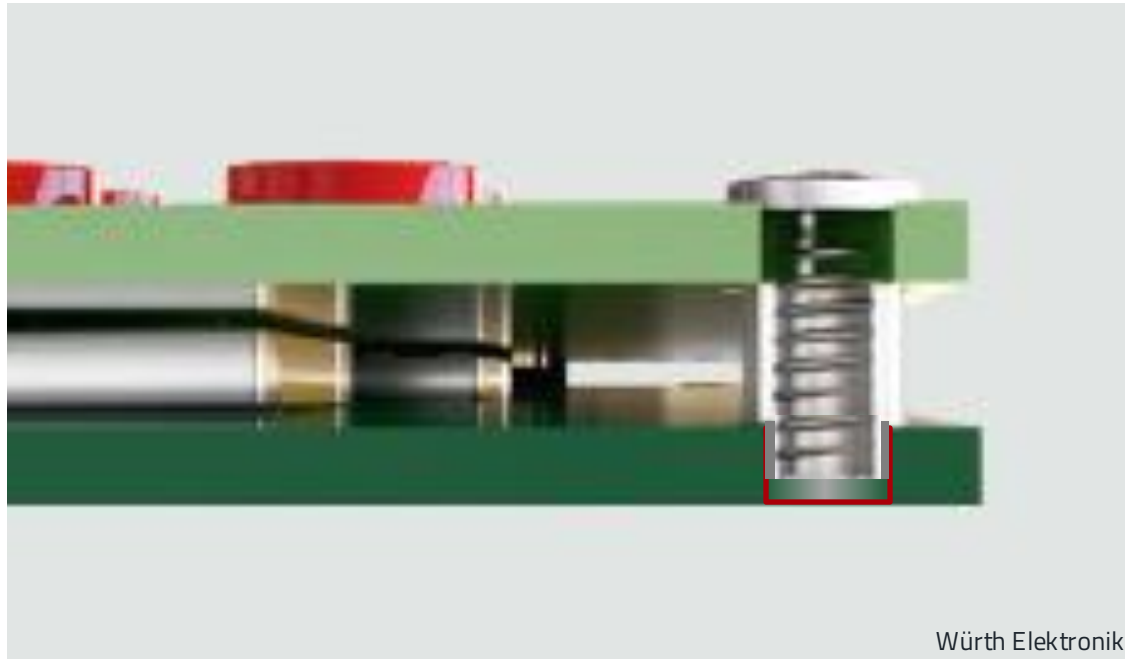
Pick'n Place cap



Würth Elektronik

Types of SMT Spacers

WA-SMSI SMT Spacer with internal thread

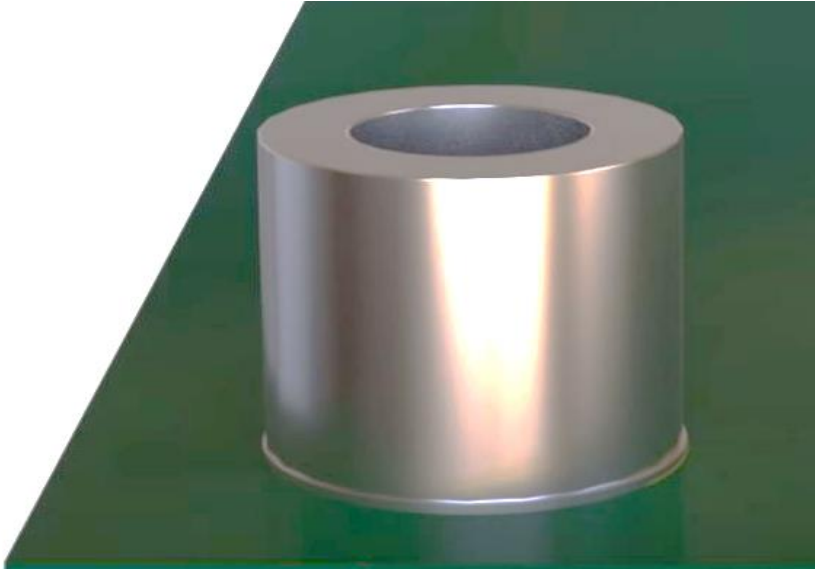


- SMT Spacer with internal thread for attachments above the PCB – or installation in housings or on ground plates



Types of SMT Spacers

WA-SMST SMT Spacer with internal through-hole



Würth Elektronik

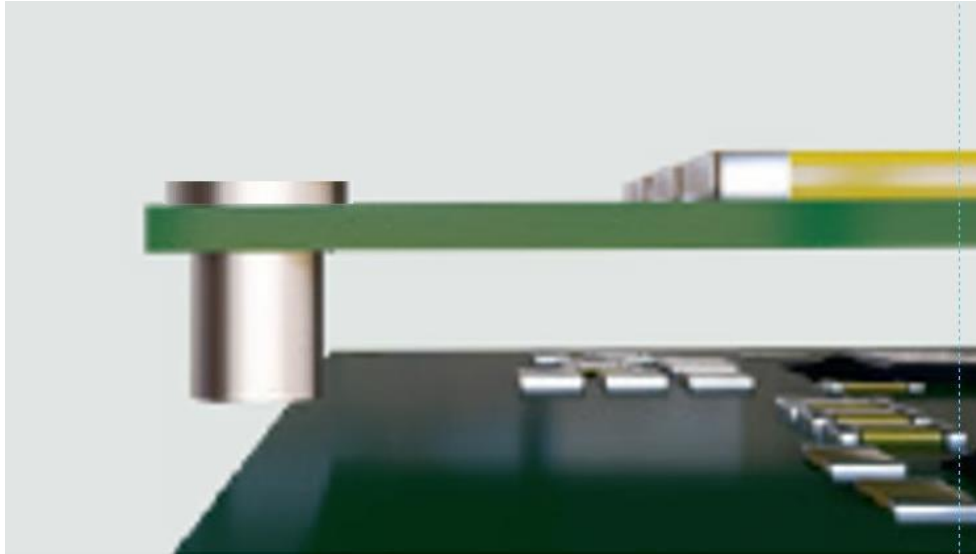
- SMT Spacer with internal through-hole
- Fits for different screw sizes



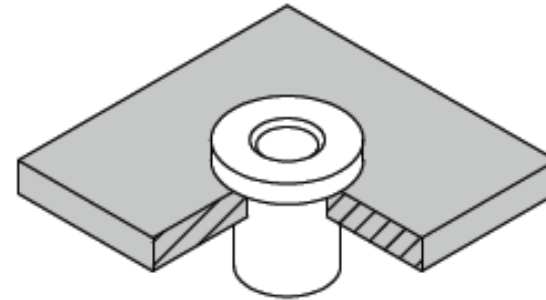
Würth Elektronik

Types of SMT Spacers

WA-SMSR Reverse Type



Würth Elektronik



Würth Elektronik

- Assembled from topside > distance on bottomside
- Save a 2nd reflow process
- Use: PCB to PCB stacks,
PCB to housing or to groundplate

Types of SMT Spacers

WP-SMRA SMT Spacer Right Angled



- Two different types: Block / Upright with pins
- Threaded or through-hole

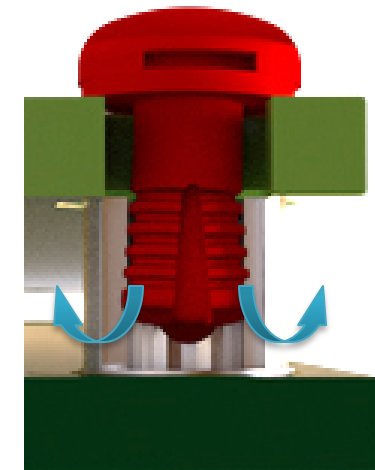
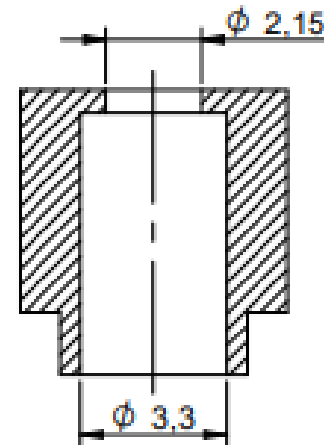


Würth Elektronik

Types of SMT Spacers

WA-SMSSR SMT Spacer with Snap Rivet mounting

- SMD Spacer + Snap Rivet combination
- Screwless assembling
- Distance 2-10mm
- Detachable
- Min. extraction force **76Nm**
- UL94-V0

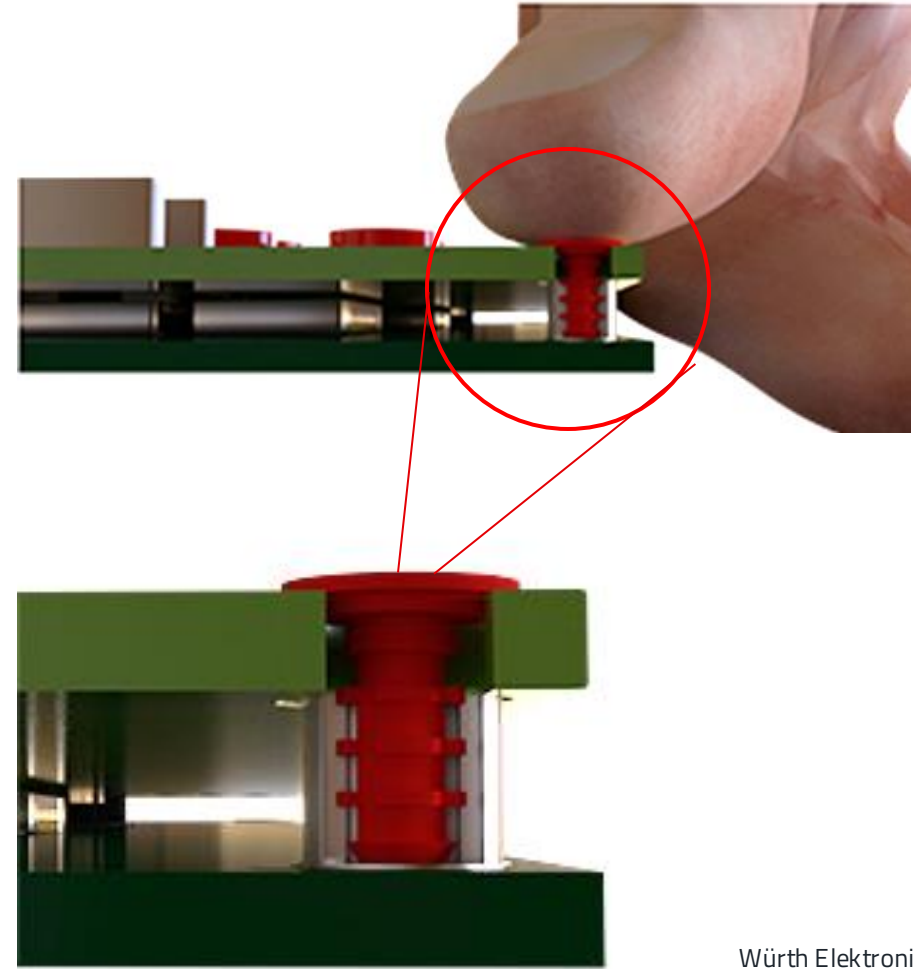


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Types of SMT Spacers

WA-EXRV Mounting Button

- Mounting Button for tool-free mounting
- For all **M3** types
- High retention force (min. 68Nm)
- Unscrew with Philips screwdriver
- UL94-V0

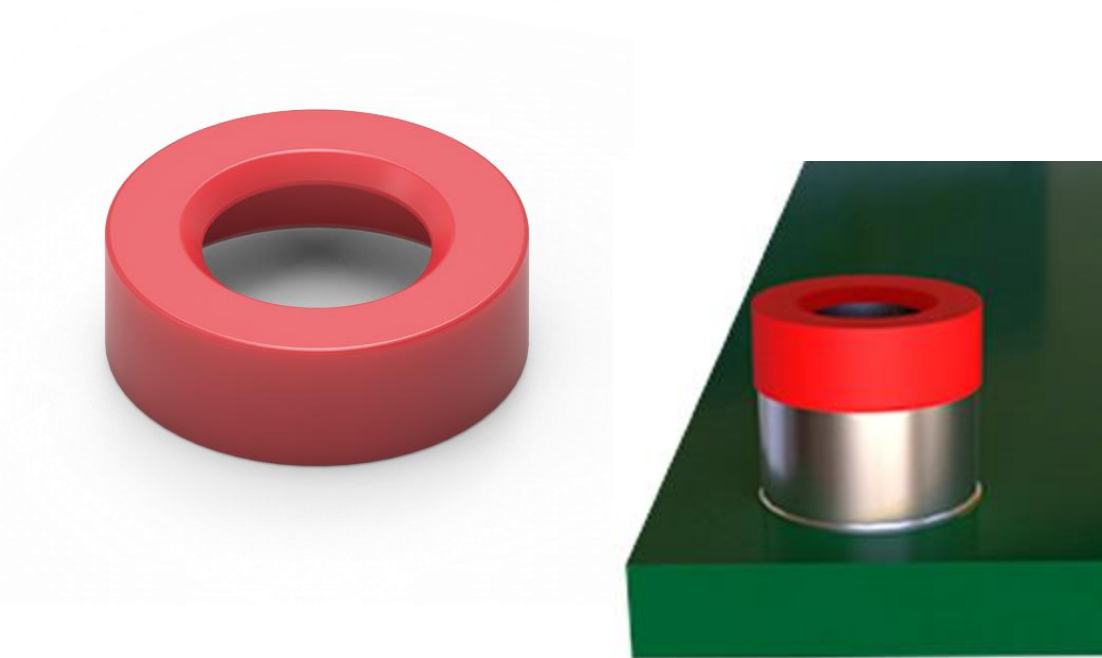


Würth Elektronik

Types of SMT Spacers

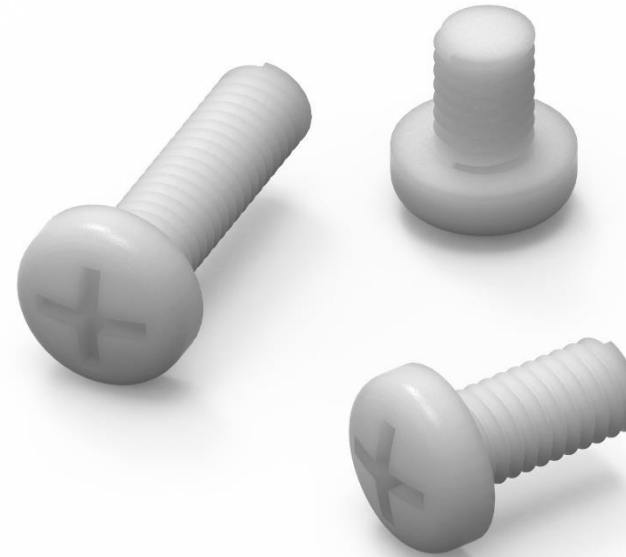
WA-SCAP Distance Cap

- Electrical insulation
- Intermediate heights
- UL94-V0



WA-SCRW Plastic Screw

- Electrical insulation
- M3
- UL94-V2 or V0



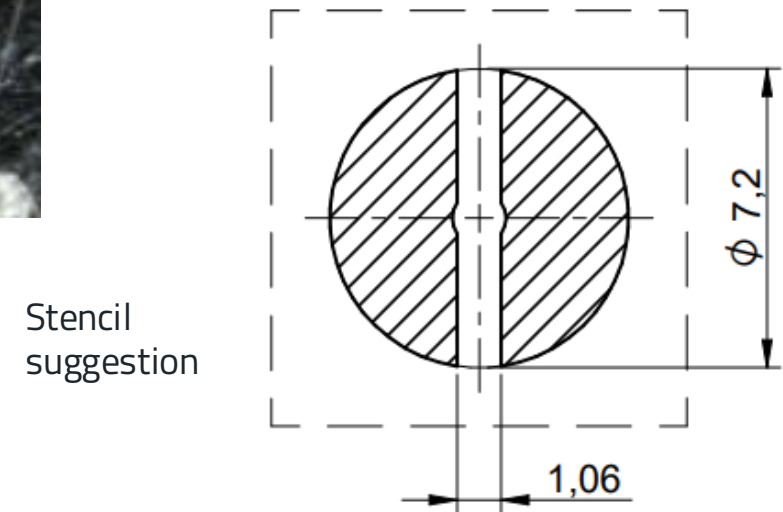
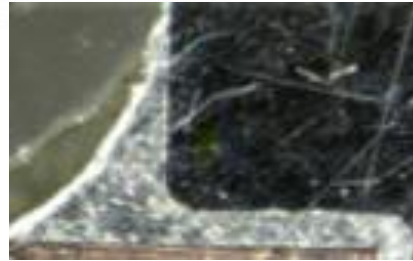
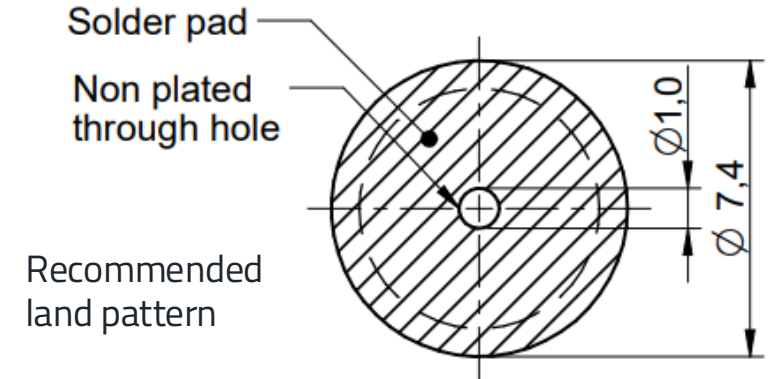
Würth Elektronik

DESIGN & PROCESSING

Design and Processing

Footprint for SMT-Spacer

- SMT Spacer with external thread
- Full bottom surface
- Body $\varnothing$ 6mm
- Center pin for accurate positioning
- Solder-meniskus important for high retention and torques
- Stencil 150 μ m
- Optional without center pin

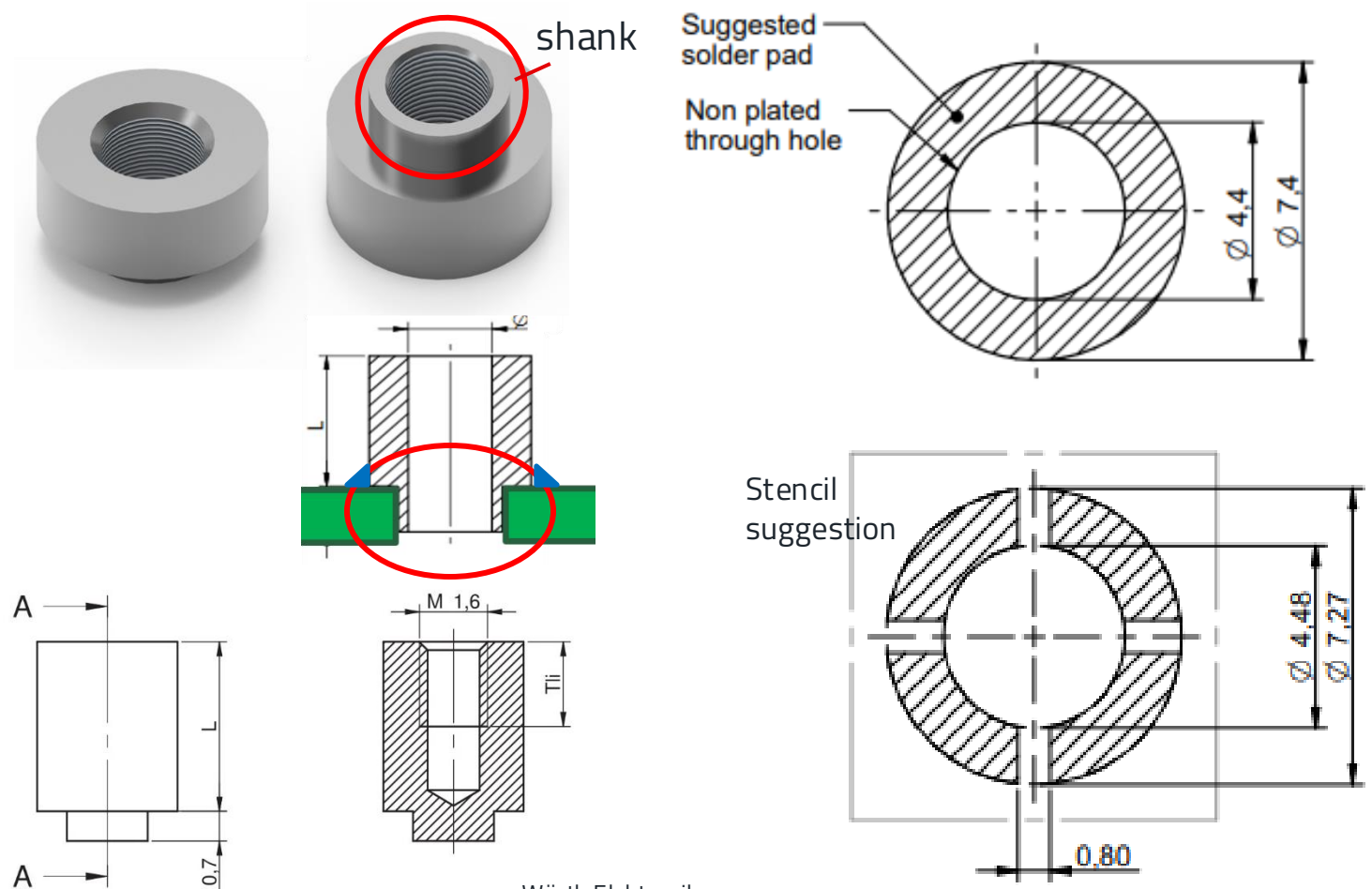


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Design and Processing

Footprint for SMT Spacer

- SMT Spacer with internal thread
- Body $\varnothing$ 6mm (e.g. for M3 types)
- Drillhole required for shank
- Solder meniskus for high retention and torque
- Non plated through hole
- Stencil 150 μ m
- Optional with bottom closed

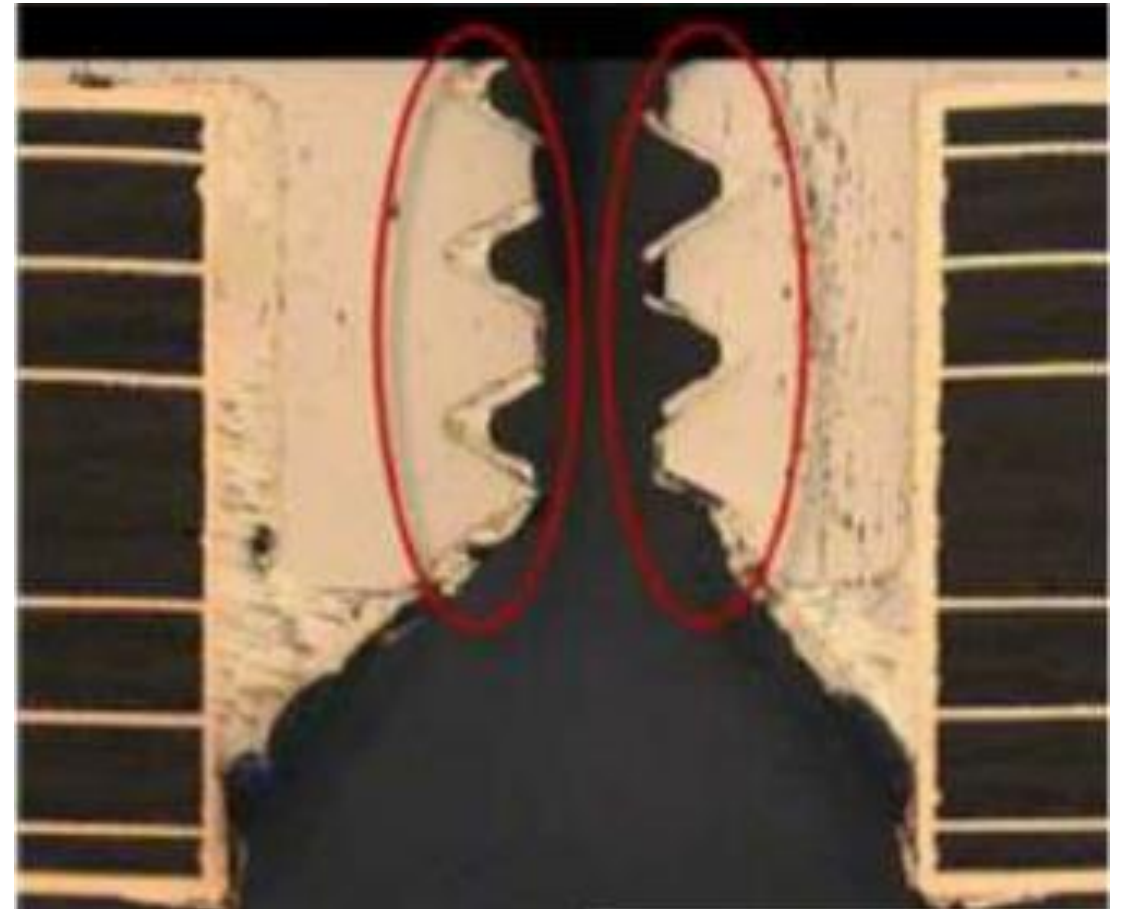


Würth Elektronik

Design and Processing

Why Non-Plated Through Holes for SMT-Spacers

- Potential problems
 - Tin draws into thread by capillary-effect
 - hard to screw in
 - loss of solderpaste
 - reduced retention of SMT-Spacer



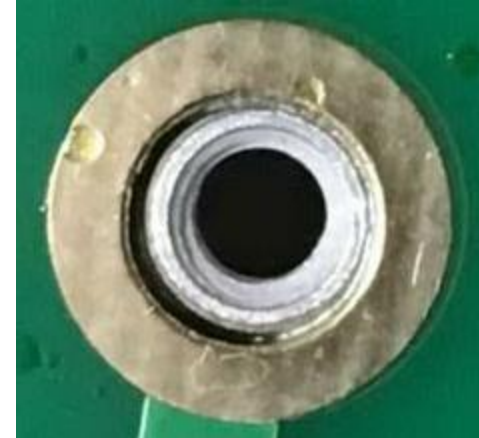
Würth Elektronik

Design and Processing

Why **Non-Plated** Through Holes for SMT-Spacers

- Potential problems
 - Tin draws into thread by capillary-effect
 - hard to screw in
 - loss of solderpaste
 - reduced retention of SMT-Spacer
 - SMT-Spacer moves out of center during reflow process
 - missalignment
 - loss of solderpaste due to big gaps
 - reduced retention of SMT-Spacer

NPTH is recommended !



Würth Elektronik

Design and Processing

Why Non-Plated Through Holes for SMT-Spacers

- Qualification Testing

Performance Testing

SMT Spacer
WA-SMSI, WA-SMST, WA-SMSE, WA-SMSR,
WA-SMSSR, WP-SMRA & WA-EXRV

Checkmate.
SMT Spacer wins!



Content

1. Shear Force
2. Pull Strength
3. Extraction Force
4. Breaking Torque
5. Additional Information
6. Test Conditions

receive the full Test Report upon request

Shear Force
Distance pressure point 1mm



Shear Force WP-SMRA
(in screw direction)



Pull Strength



Extraction Force WA- EXRV

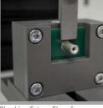


Performance Testing with lead-free solder paste



Performance Testing

Test Sample	external Thread M3	internal Thread M5
1	655	
2	563	
3	564	
4	652	
5	633	
6	762	
7	799	
8	654	
9	686	
10	669	
11	715	
12	678	
13	812	
14	700	
15	602	
16	702	
17	570	
18	772	
19	634	
20	729	
21	614	
22	668	
23	601	
24	631	
25	727	
26	647	
27	713	
28	804	
29	657	
30	676	
Min.	563	
Max.	812	
Average	677	



Checking fixture Shearforce

Performance Testing

Test Sample	external Thread M3	internal Thread M5
1	500	771
2	450	684
3	580	599
4	600	778
5	620	678
6	630	654
7	570	724
8	690	678
9	710	799
10	800	675
11	550	634
12	620	780
13	610	687
14	650	740
15	630	728
16	500	760
17	620	592
18	610	714
19	520	641
20	630	677
21	570	719
22	640	691
23	600	678
24	700	656
25	780	789
26	780	604
27	640	707
28	740	639
29	620	641
30	650	718
Min.	450	592
Max.	800	799
Average	627	695

Screw fixed with distance
The Pull Strength is active
itself

The Data is only for reference. The parts
application. The parts are tested under
specification of Würth Elektronik close
samples for testing.

Extraction Force (in N)

Test Sample	Extraction Force (in N)
1	69
2	73
3	81
4	80
5	85
6	83
7	95
8	80
9	92
10	68
11	93
12	80
13	75
14	80
15	90
16	90
17	75
18	80
19	81
20	76
21	81
22	81
23	77
24	79
25	76
26	78
27	77
28	78
29	79
30	82
Min.	68
Max.	95
Average	80

PCB Thickness 1,6mm





The Mounting Button is only qualified for one-time
use. The Mounting Button is used with our SMT
Spacer with internal Thread M3.

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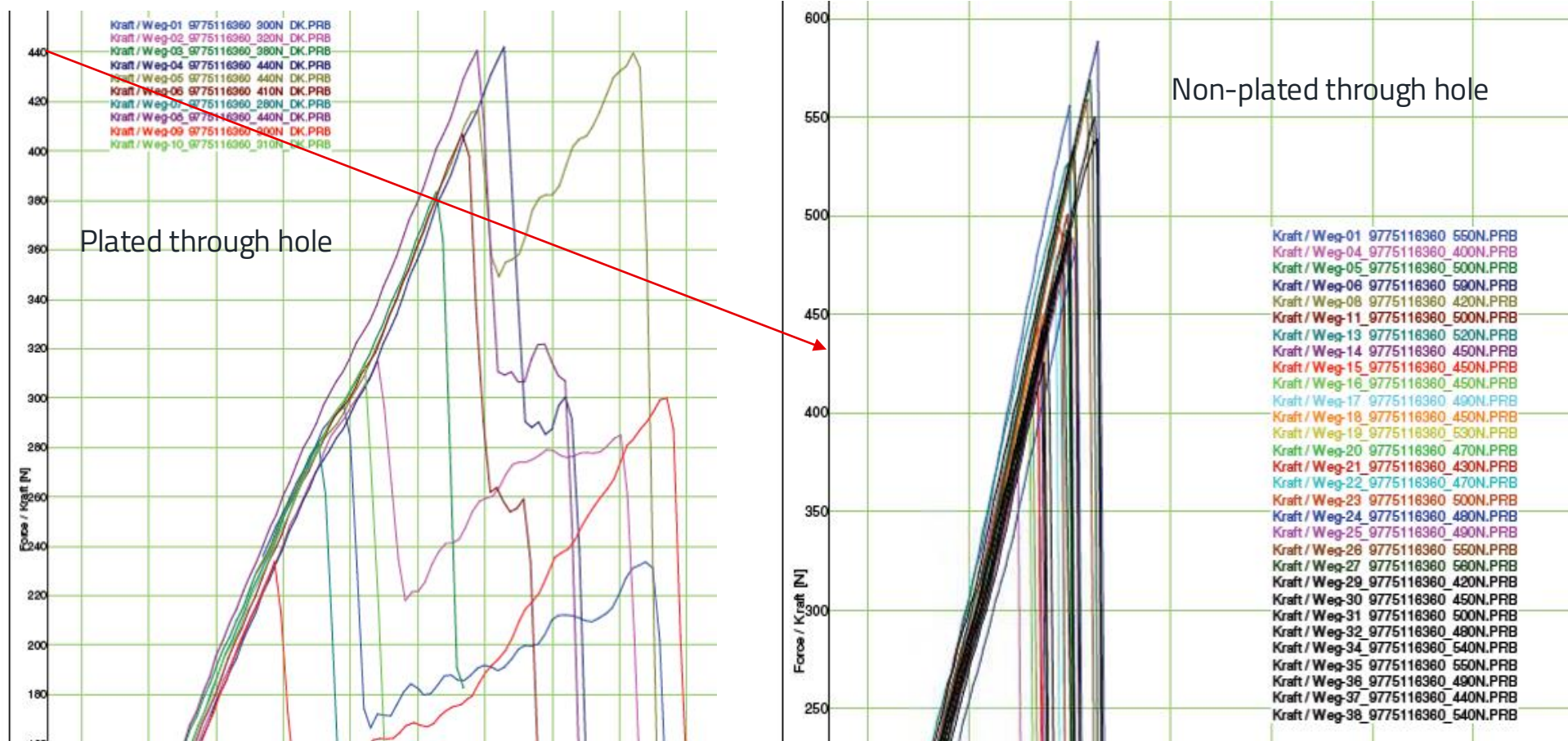
25

SMARTER DESIGNS WITH SMT SPACERS
PUBLIC | GSCH | MAI2025



Design and Processing

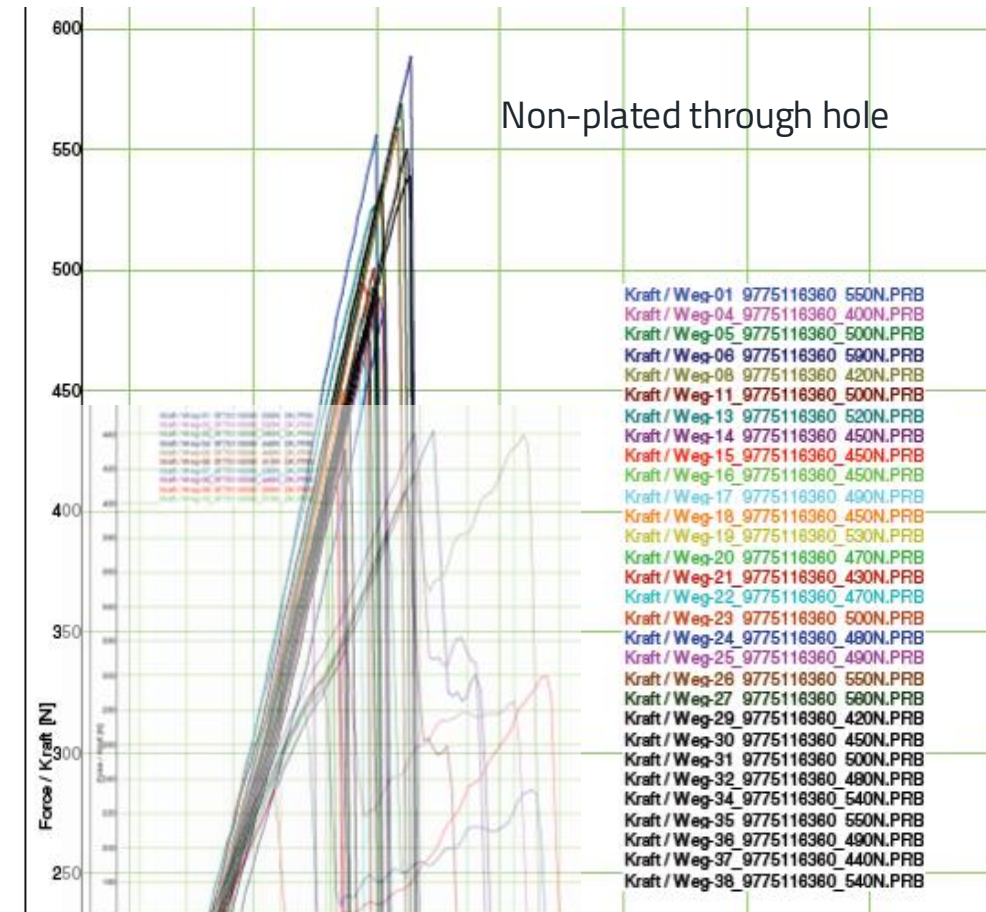
Comparison Plated Through Holes vs Non-Plated Through Holes



Würth Elektronik

Design and Processing

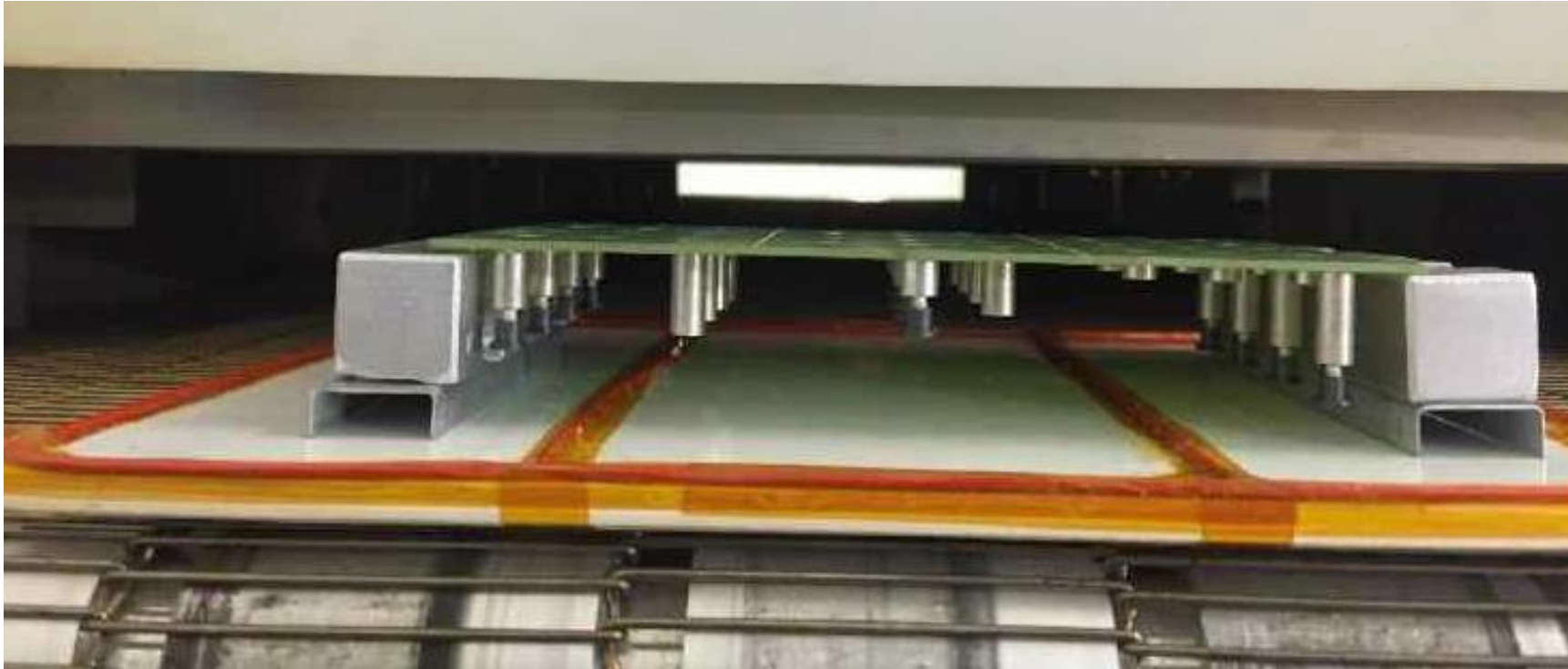
Comparison Plated Through Holes vs Non-Plated Through Holes



Würth Elektronik

Design and Processing

Upside-down solder test



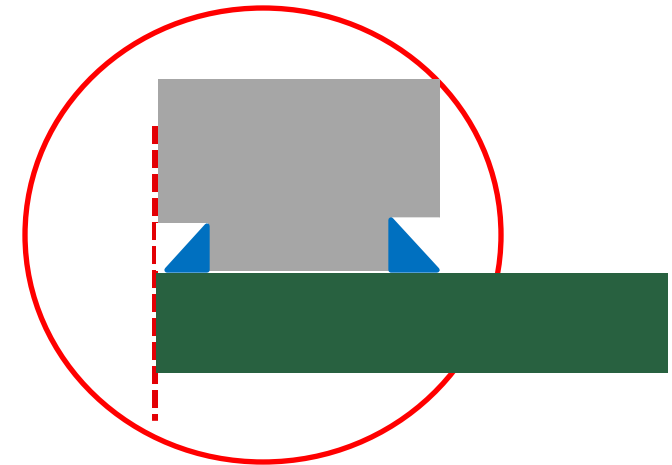
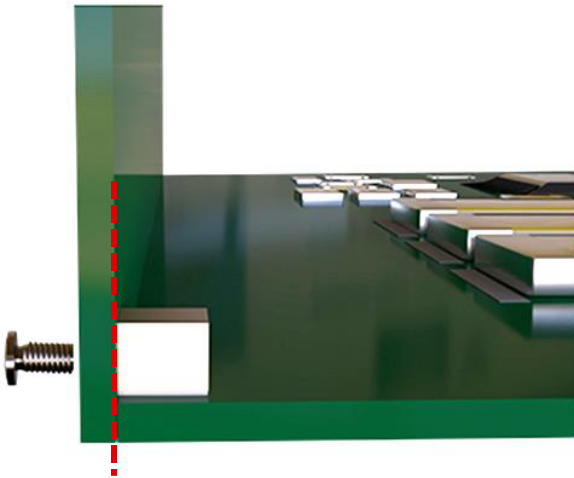
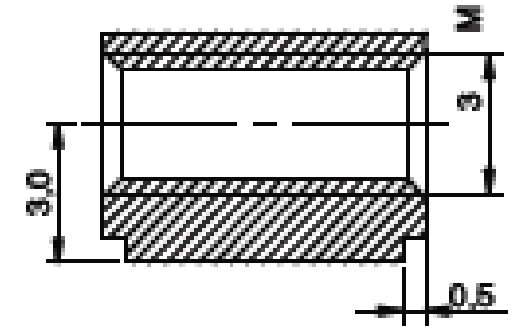
Würth Elektronik

Spacers don't fall off in 2nd reflow run upside down

Design and Processing

Foofprint for SMT Spacer Right Angled

- Special component design for perfect alignment

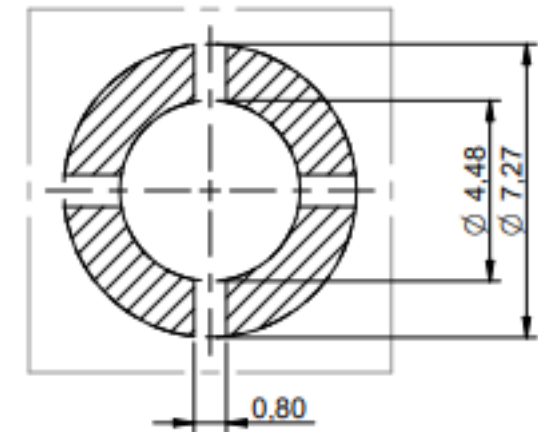
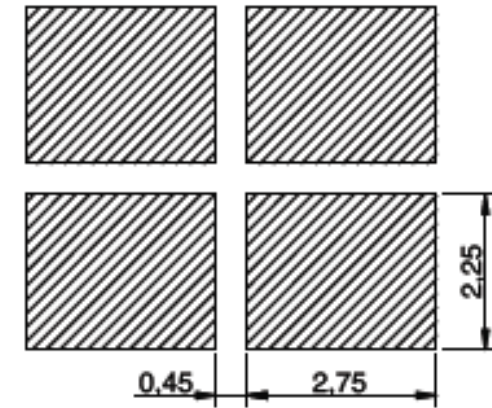
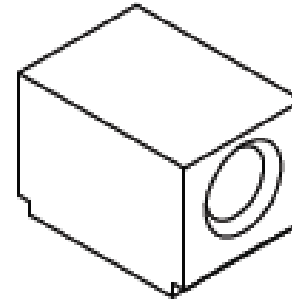
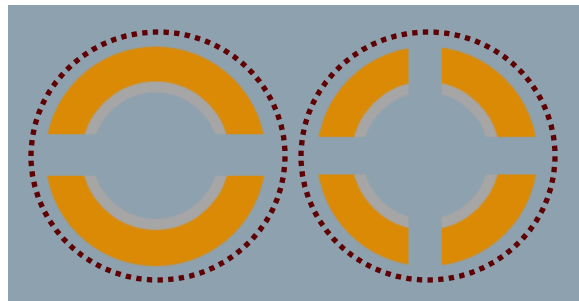
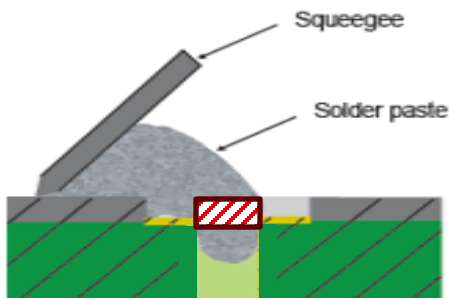


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Design and Processing

Foofprint for SMT Spacer Right Angled

- Stencil design
 - Support centering of SMT Spacer during soldering
 - Keep path for activators and flux to disappear
 - Avoiding lunkers and voids
- No solderpaste in drill holes

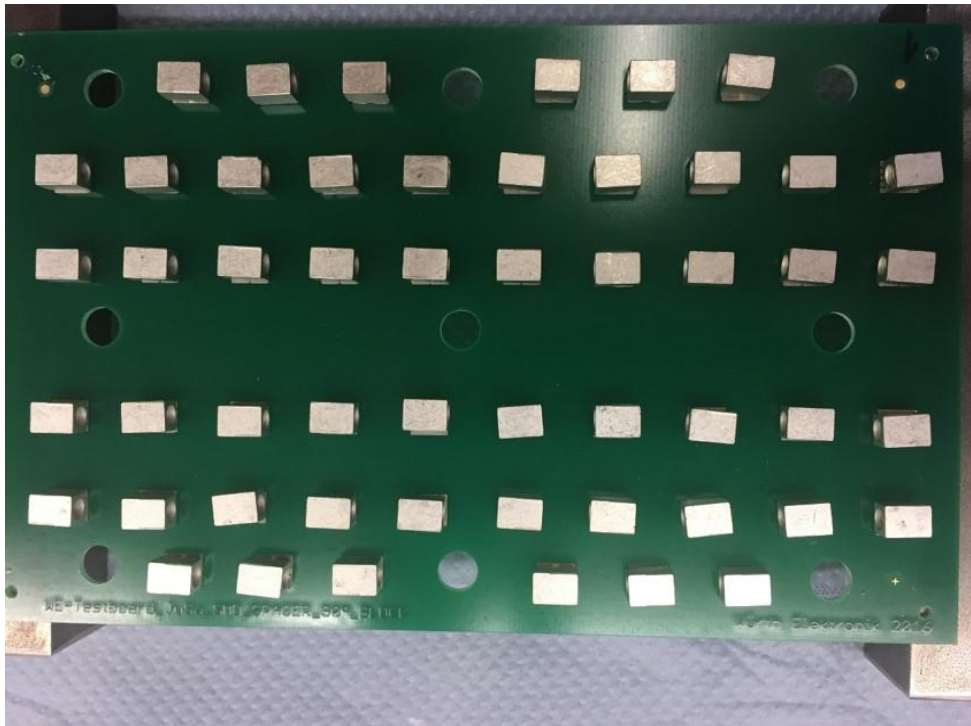


Würth Elektronik

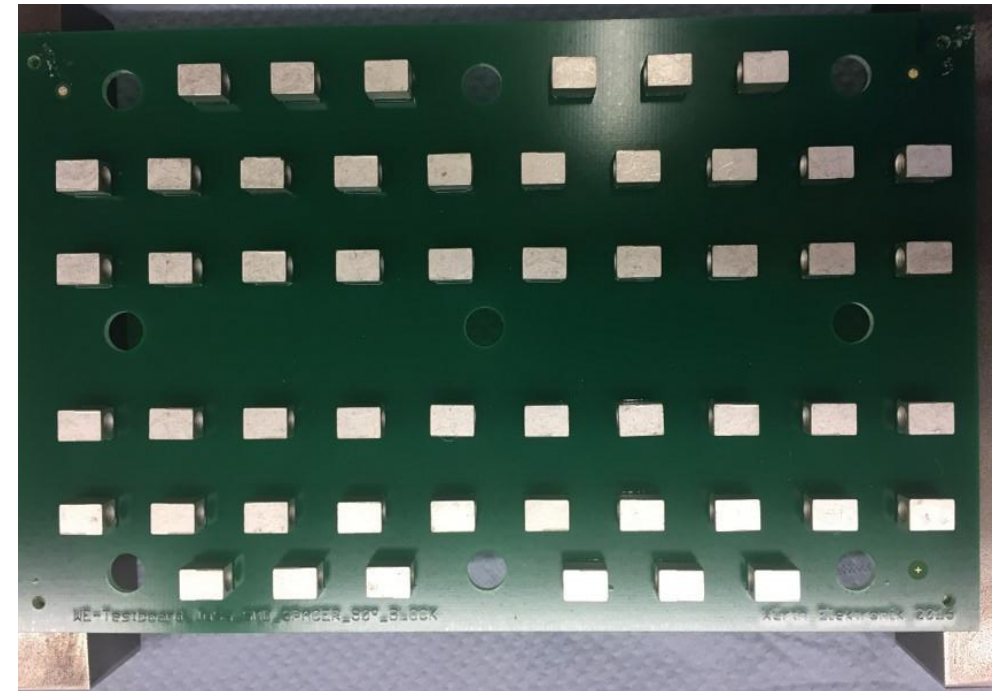
Design and Processing

SMT Spacer Right Angled – self alignment test

before soldering



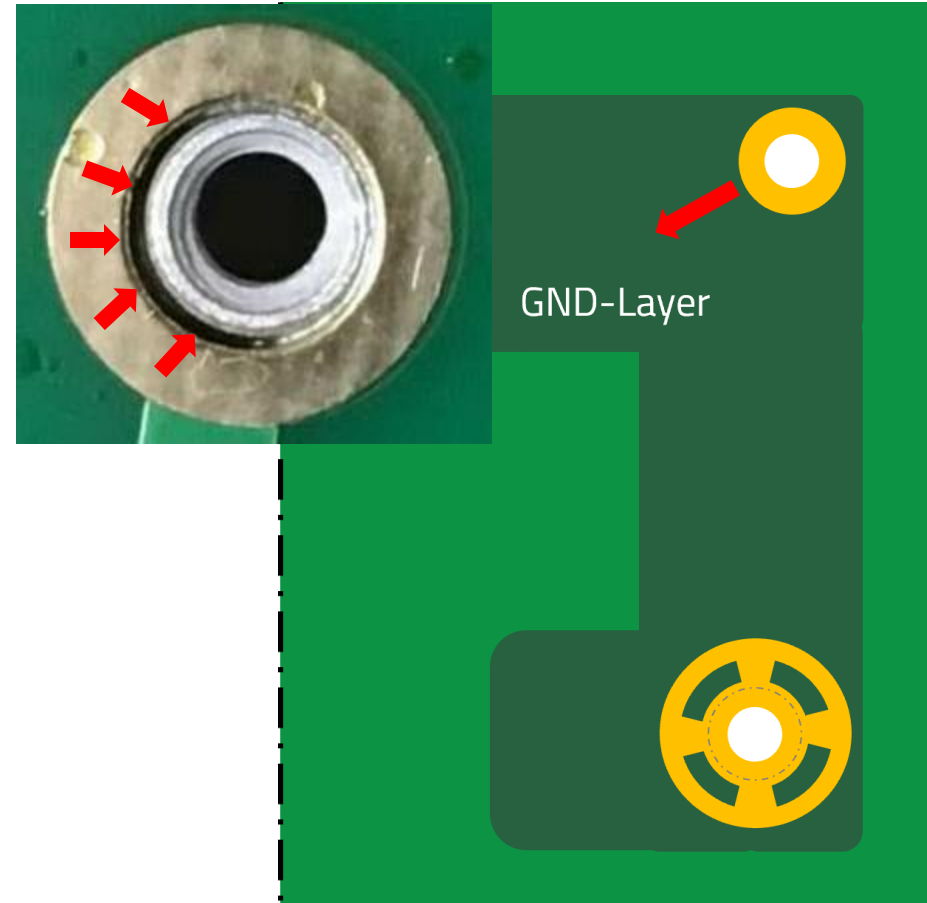
after reflow soldering



Design and Processing

Positioning

- Accurate position after soldering
 - Respect NPTH
 - Minimize floating effects
 - Avoid thermal centering effects
- Remedial actions
 - Adjust solder-profile
 - Change solder paste
 - Change soldering direction
 - Change stencil design
 - Increase distance to big components
 - Adjust opening of solder resist
 - Minimize solder pad
 - Thermal relief (within EDA-tools)

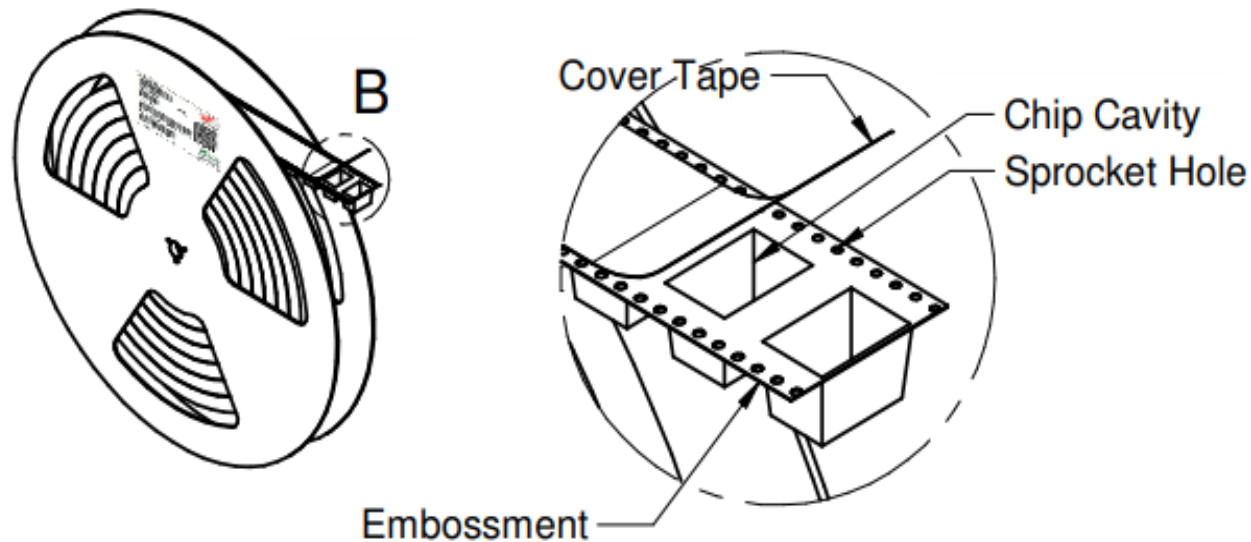


Würth Elektronik

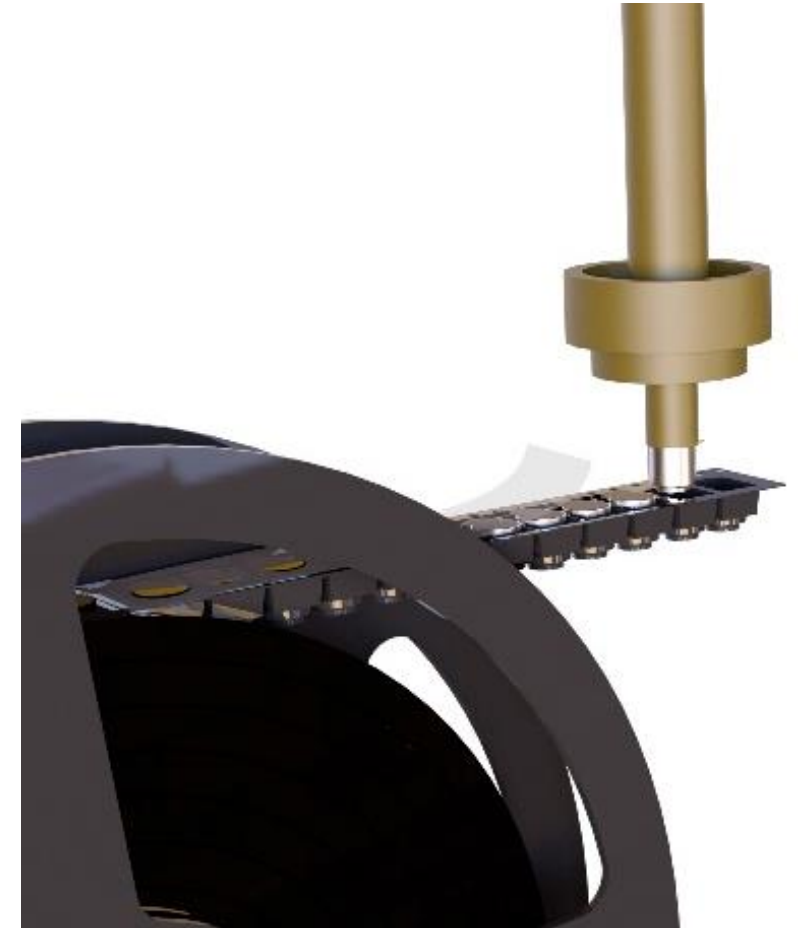
Design and Processing

Tape & Reel with Polyimid tape

- SMT-Spacers are supplied in tape on reels
- Perfect for automated processing with pick'n'place machinery
- Polyimid tape on SMT-Spacer for suction with vacuum-pipette



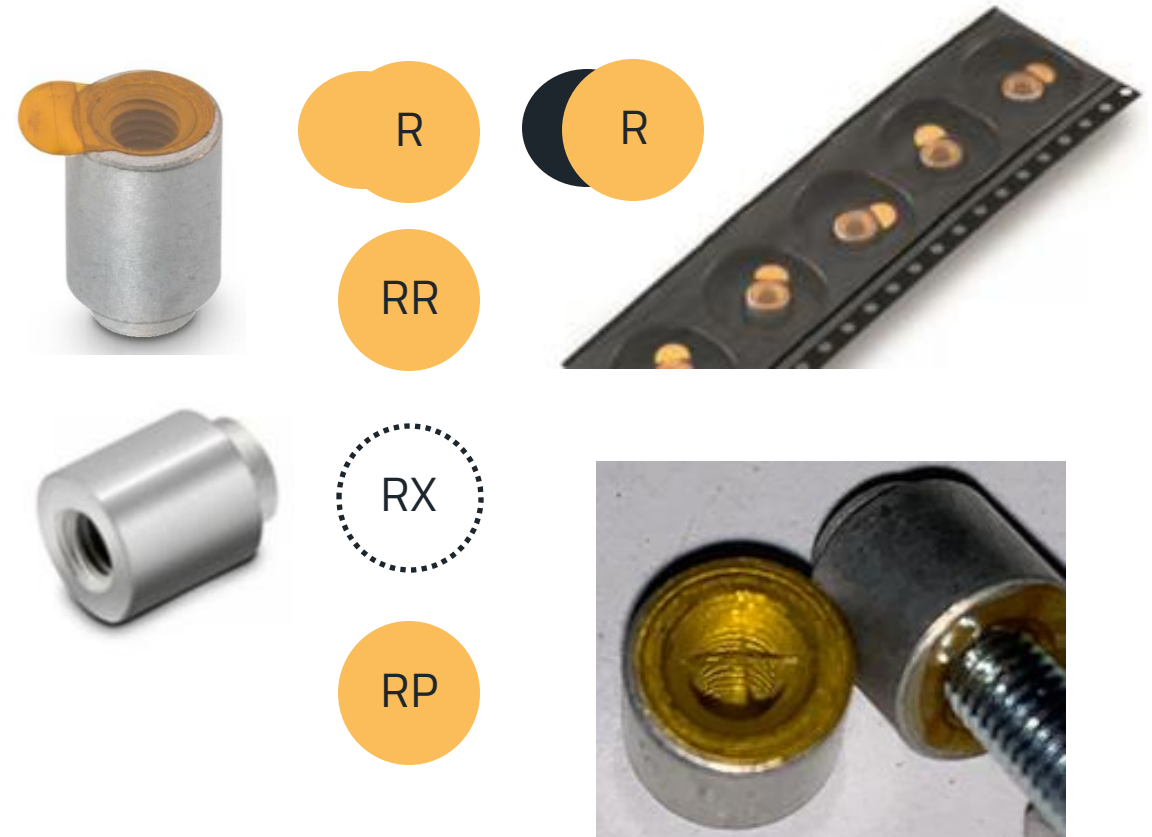
Würth Elektronik



Design and Processing

Tape & Reel with Polyimid tape

- SMT-Spacers are supplied in tape on reels
- Perfect for automated processing with pick'n'place machinery
- Polyimid tape on SMT-Spacer for vacuum pickup
- Support-tape available in different shapes
 - With latch PN 9xxxxxx-R
 - Round, without Latch PN 9xxxxxx-RR
 - Without foil PN 9xxxxxx-RX
 - With perforated foil PN 9xxxxxx-RP



Design and Processing

Tape & Reel with Polyimid tape

- SMT-Spacers are supplied in tape on reels
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- Polyimid tape on SMT-Spacer for vakuum pickup
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 - With latch PN 9xxxxxx-R
 - Round, without Latch PN 9xxxxxx-RR
 - Without foil PN 9xxxxxx-RX
 - With perforated foil PN 9xxxxxx-RP



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Design and Processing

Reflow-Soldering

- SMT spacers to be reflow-soldered
 - IPC / JEDEC J-STD-020E compliant
 - Can be processed together with any other SMT components
 - 5 time reflow tested
 - 2nd pass upside down tested
-
- RoHS and REACH compliant (6a-1)
 - Lookout: ZeroPB in preparation

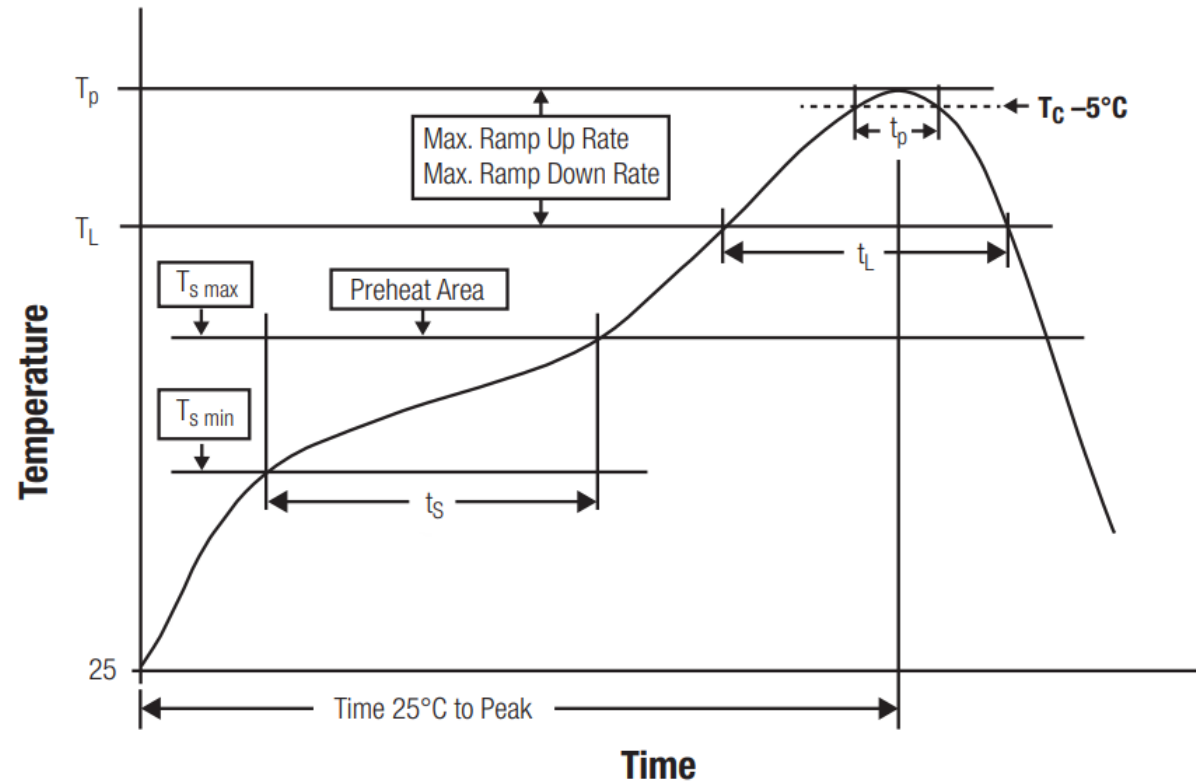


RoHS
COMPLIANT



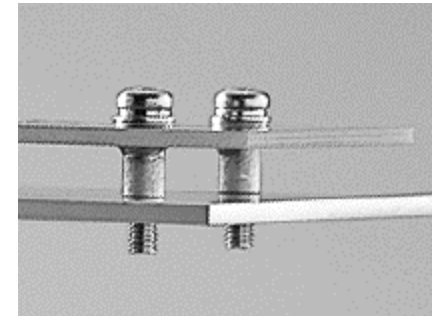
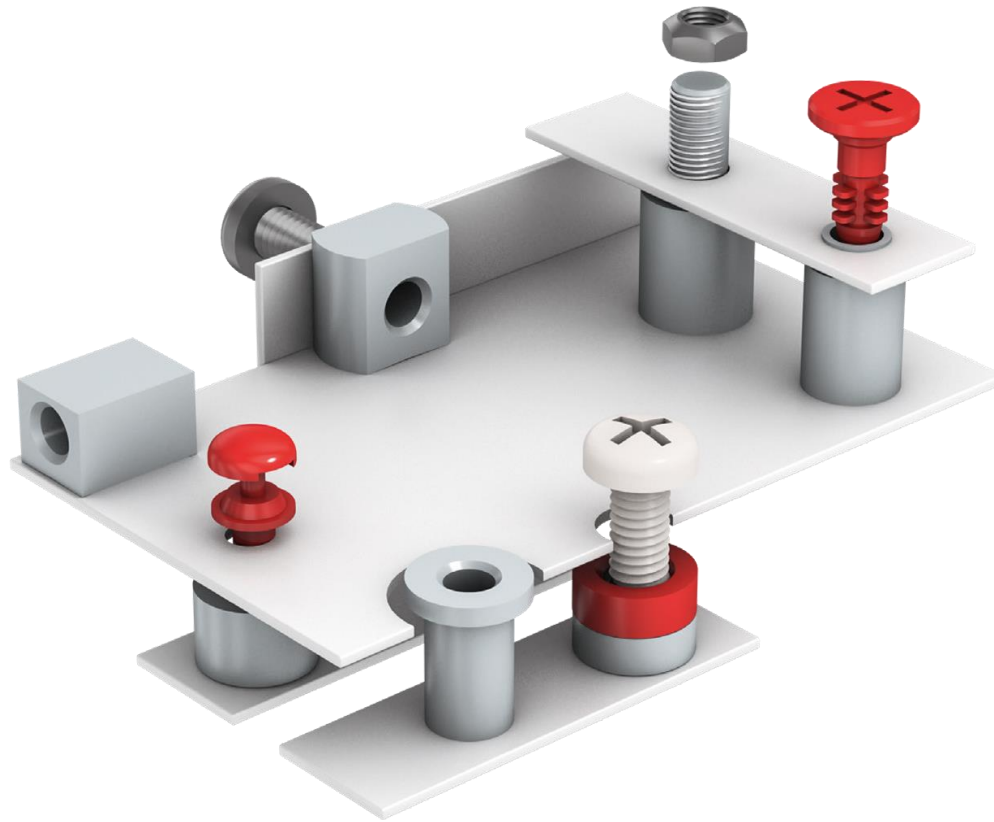
REACH
COMPLIANT

Classification Reflow Profile for SMT components:



Würth Elektronik

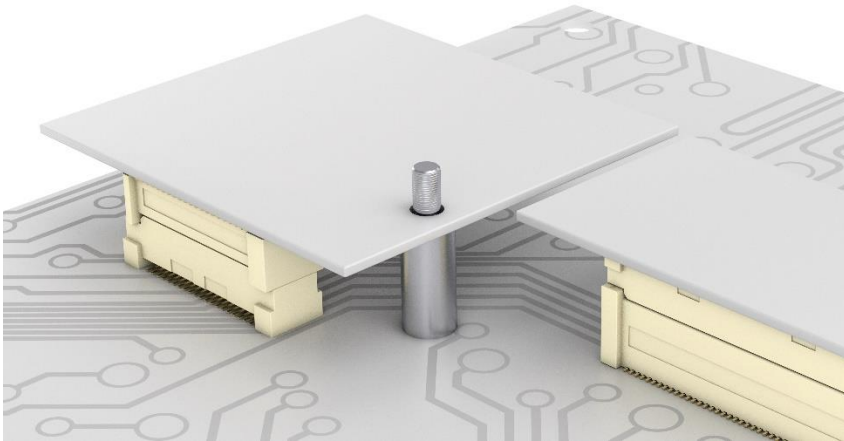
Application Examples



Würth Elektronik

Application Examples

- WE Demo-Board
 - Different types and sizes
 - Assembling examples
 - Vertical and 90°
 - Horizontal 180°



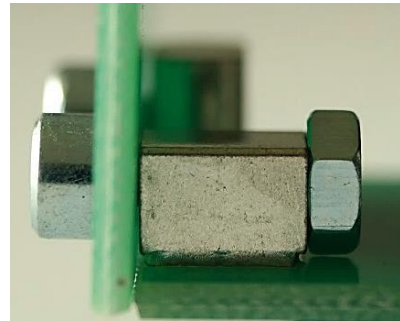
Würth Elektronik



Application Examples

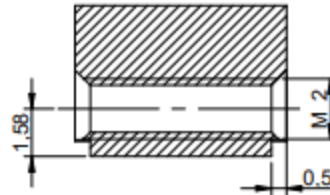
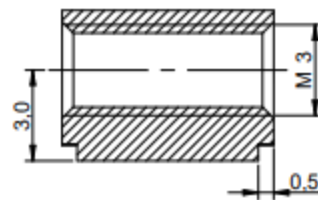
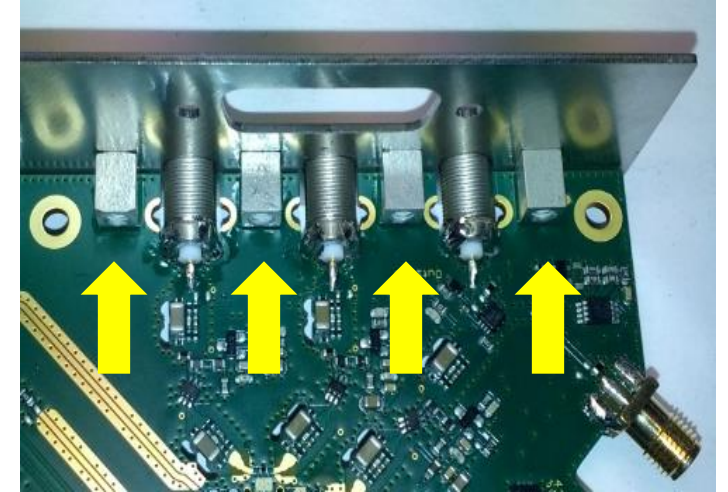
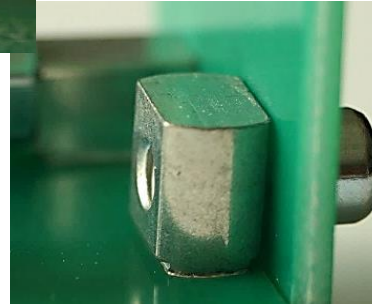
WP-SMRA SMT Spacer Right Angled

- SMD Spacer for 90° mounting
- Panel mounting, 19" backplane
- Board to board
- Features:
 - Material: brass
 - Surface: matte tin
- Special feature:
different positioning of center
thread for USB-C locking



block-type

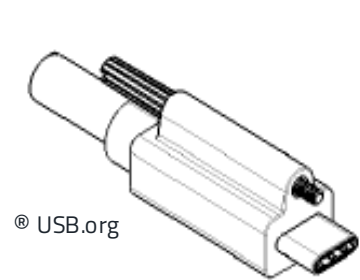
upright
w/pins



Würth Elektronik

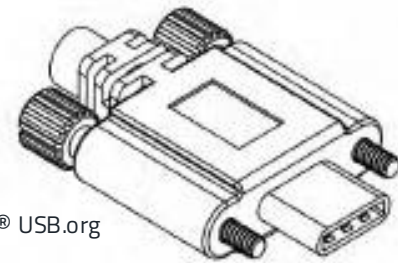
Application Examples

Solution for USB-C with locking screws



® USB.org

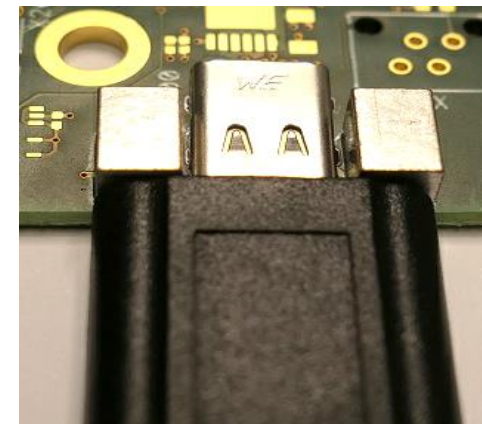
Single Screw Plug



® USB.org

Dual Screw Plug

- Footprints available on request



Würth Elektronik

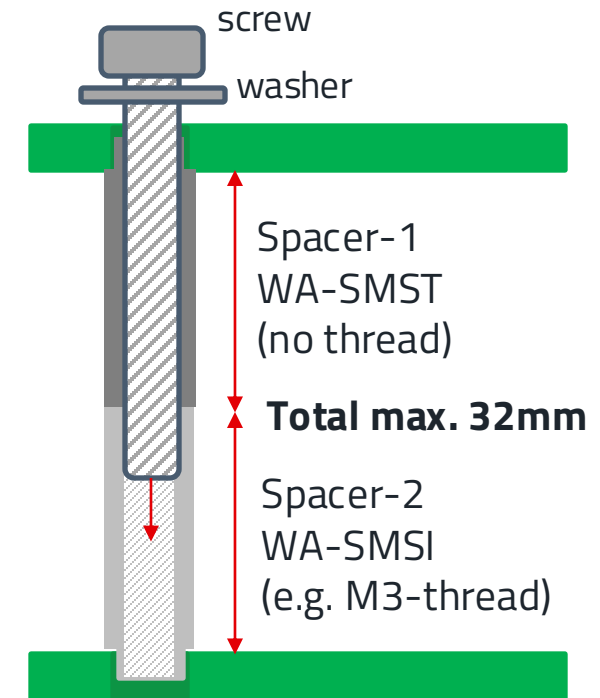
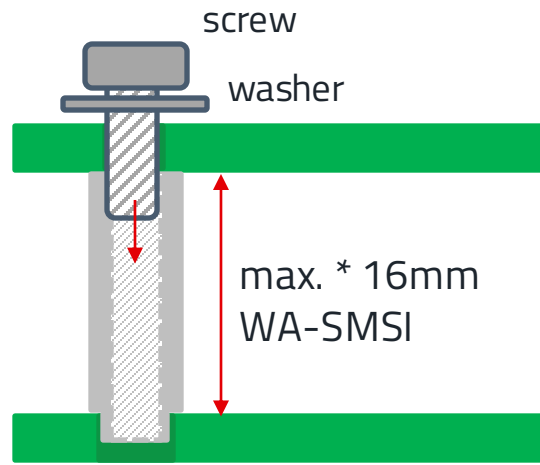
Application Examples

Height Limitation by T&R

- SMT-Spacers are available up to 16mm length max. for T&R*
- Example WA-SMSI
- Combination of two SMT-Spacers may double the height
- Always use combination of a threaded + through-hole type!

i.e.

- SMSI + SMST (upside down)
- SMSI + SMSR reverse type
- many other combinations possible

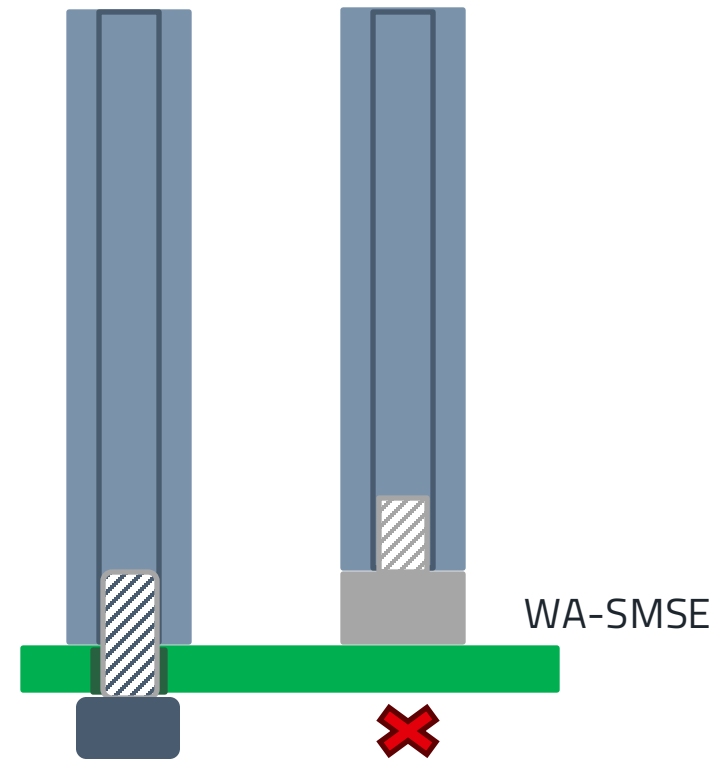


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Application Examples

Improvement for procesability

- Normally using standard spacer-studs for bigger heights
- or use SMT-Spacer with external thread and use standard spacer-stud on top
- easier assembling
- no manipulation from underneath of the PCB needed



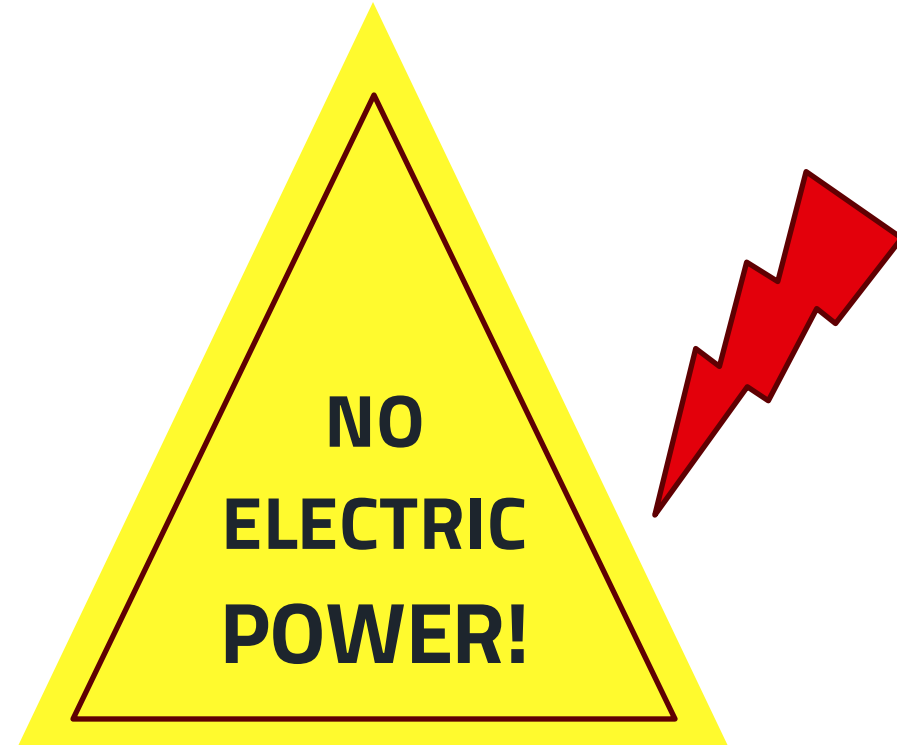
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SMD-SPACER ON POWER ?

SMT-Spacer on Power ?

Electrical Statement

- **SMT-Spacers are NOT designed for electrical purposes!**
- NO electrical specifications can be provided
- Electrical qualification is your responsibility



HOLDING FORCE INFLUENCES

What is the best way ?

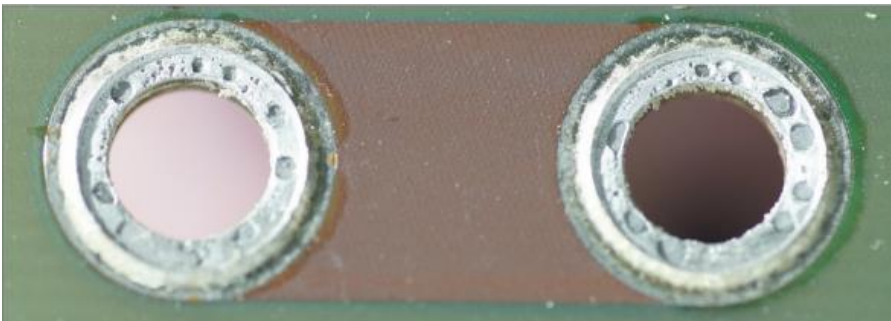
Holding Force Influences

The perfect solder joint

- Mandatory
 - Effective wetting of PCB & component
 - Well formed meniscus after soldering
 - Inspection and test



Too much tin



Too little tin

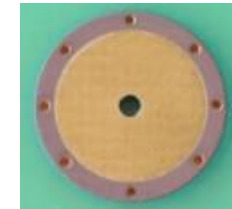
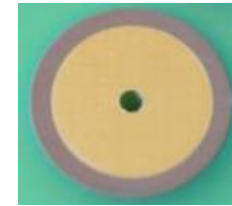
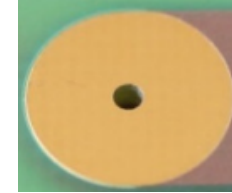


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Pad-Geometry

How to increase holding force

- Standard solder-pad rely on adhesive strength of copper layer on FR4
- Bigger pad increases total holding force
(Pad can be covered with solder-resist on the extended area)
- Copper layer configured with additional vias for "rivet-effect"
- Vias placed in the pad-area
(ideally copper-filled-vias / thermal vias)



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ECONOMIC COMPARISON

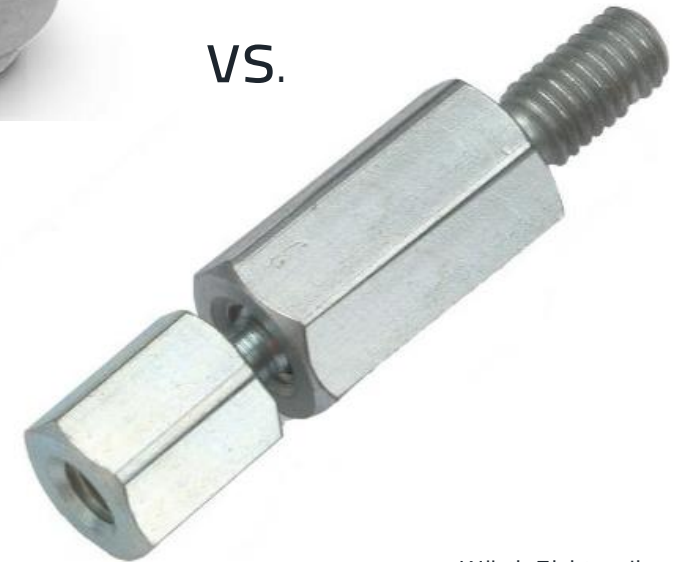
Economic Comparison

SMT-Spacer vs. HexSpacer-Stud comparison example

Example	SMT Spacer		Standard Spacer	
Component	SMT-Spacer SMRI M3x5		Hex-Spacer M3x5	
Price	340	€	175	€
UPE	1000	pcs	1000	pcs
Assembly cost /h	205	€/h	36	€/h
	0,046	€/pcs	0,3	€/pcs
	45,56	€/UPE	300	€/UPE
Time calculation				
SMT Spacer	0,8	sec.	6	sec.
screw	-		6	sec.
PCB	-		6	sec.
Drill	-		6	sec.
fix screw	-		6	sec.
Total	0,8	sec.	30	sec.
Total time 1000pcs	13,3	Min.	8,33	h
Assembly cost	356,89	€	416,67	€
Break even	765 pcs			



VS.



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Economic Comparsion

Procurement / Warehousing

- Part on BOM
- Procurement via EMS
 - No warehouse handling / logistics
 - No storage space requiremnts
 - No dead assets
- High savings by automated assembly
- Optimized further processing of the electronic assembly
- Fast and time saving

Technical

- Many variations / combinations possible
- Solution oriented
- Lower thermal stress for SMT components

Conclusion

General benefits of solderable SMT Spacers

- Fully automatic assembly
- Fast and precise processing
- Highest process reliability
- Strong holding forces and torques
- Large selection of types and shapes
- Custom lengths available
- **Faster assembly**
- **More economic than traditional spacers**



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