

DIGITAL WE DAYS

2023



ALL ABOUT ELECTRICAL SWITCHES: NEW:
VAPOR PHASE SOLDERING / WASHING / LLCR
AND MIN. RATINGS / DESIGN-TIPS

WÜRTH ELEKTRONIK MORE THAN YOU EXPECT

TODAY'S SPEAKERS



PRESENTATION

Götz Schattmann
Field Application Engineer



MODERATION

Silas Zorn
Marketing Department

INFORMATION ABOUT THE WEBINAR

You are muted during the webinar.

However, you can ask us questions using the chat function.

Duration of the presentation 30 Min
Q&A: 10 – 15 Min

Any questions?
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On our channel Würth Elektronik Group
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AGENDA

Digital WE Days 2023 – All About Electrical Switches

- NEW: Switches in Vapor Phase Soldering Process
- Washability of Switches
- Minimum Ratings for electrical Switches
- LLCR Low Level Contact Resistance
- Design Tips

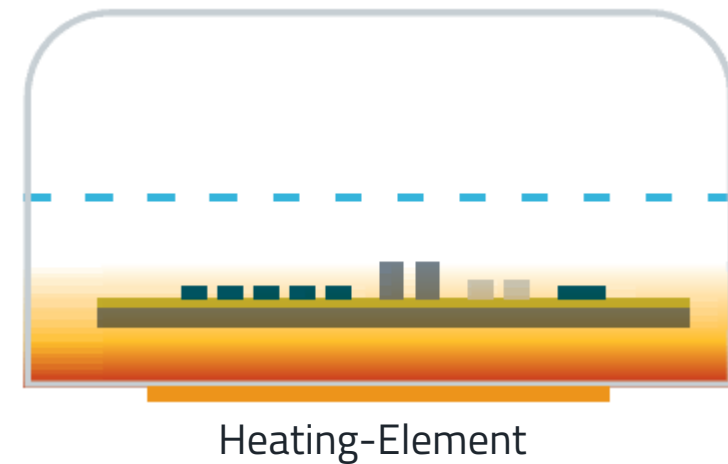


SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Is this possible ?

- VapourPhase is reflow-soldering technology
- Use of VapourPhase has increased
- Demand of VapourPhase compliant components is rising

- Switches are critical to use with VapourPhase !
- Residues may lead to malfunction or increase of CR



SWITCHES IN VAPOR PHASE SOLDERING PROCESS

WE + IBL

■ Qualification SMT Components

SMT Switches

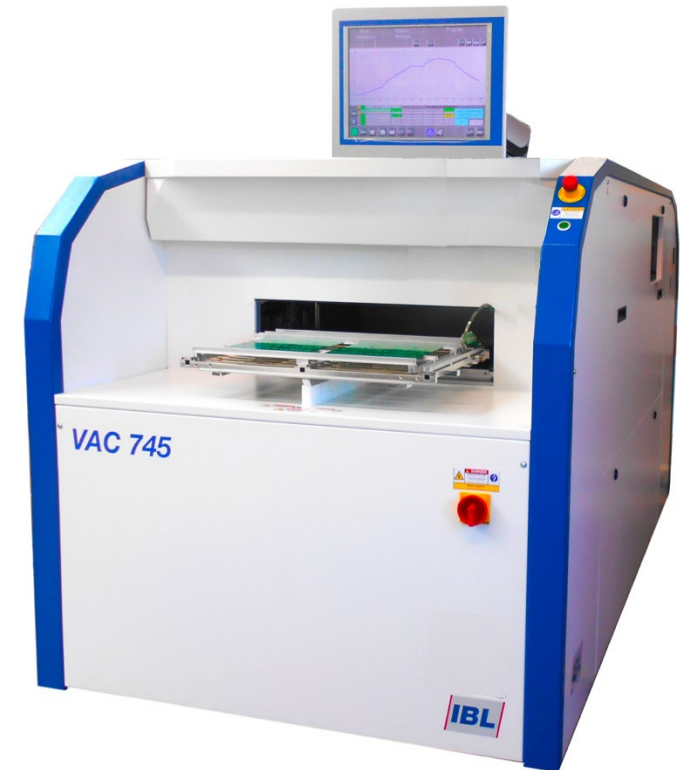
DIP-Switch, Tact-Switch, Detection Switch, Rotary Switch

Solderability in a Vaporphase System



IBL-Löttechnik GmbH
Messerschmittring 61-63
86343 Königsbrunn,
Deutschland

Vaporphase: VAC745
Galden: HS235



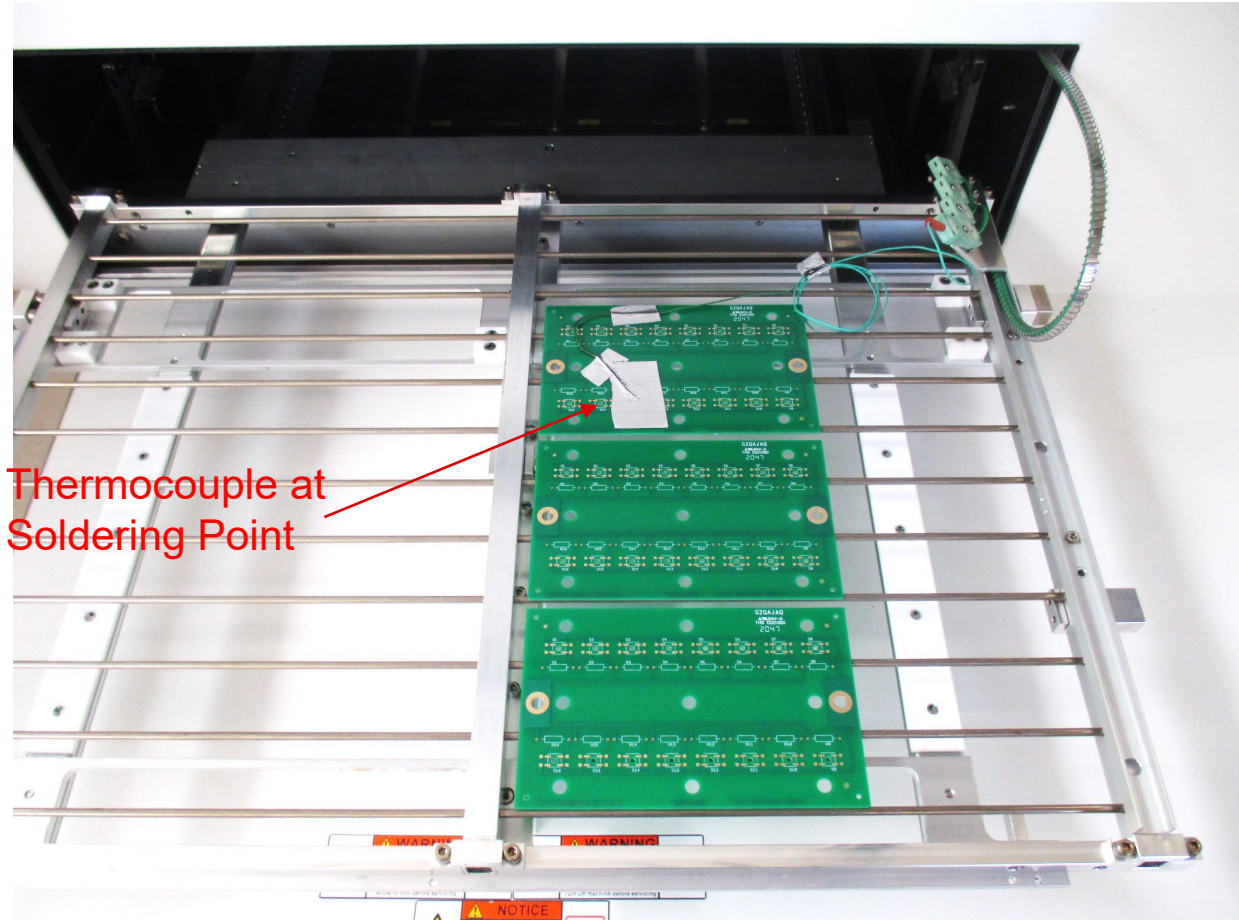
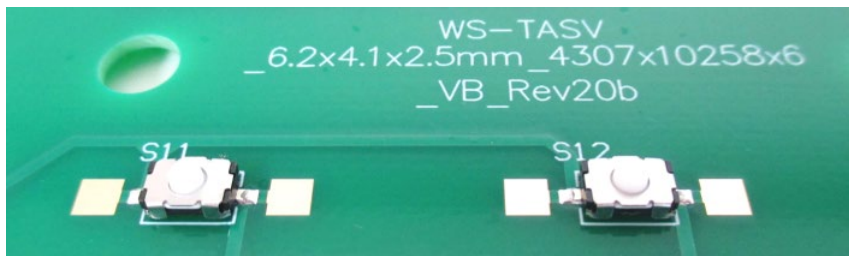
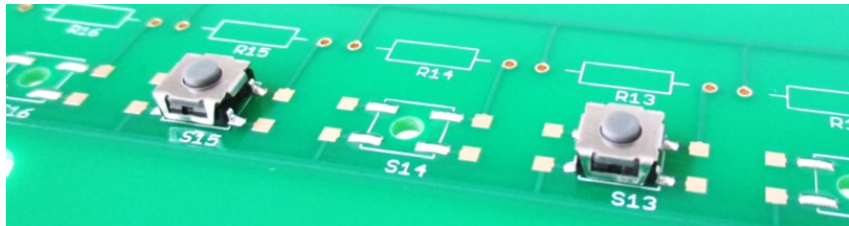
SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Examination and Test

- WE and IBL Löttechnik tested and qualified switch products
- Execution in several batches
- Two different soldering profiles
 - Standard profile
 - Maximum load limit (time and temperature)
- Up to 3 soldering passes in the VaporPhase
- Subsequent measurement in the Würth laboratory
 - correct soldering and
 - consequences on the electrical characteristics

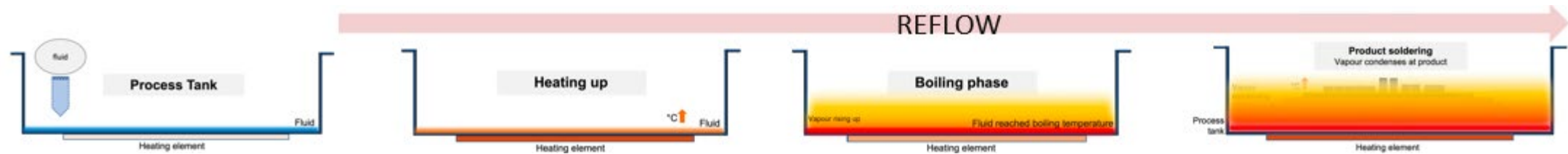
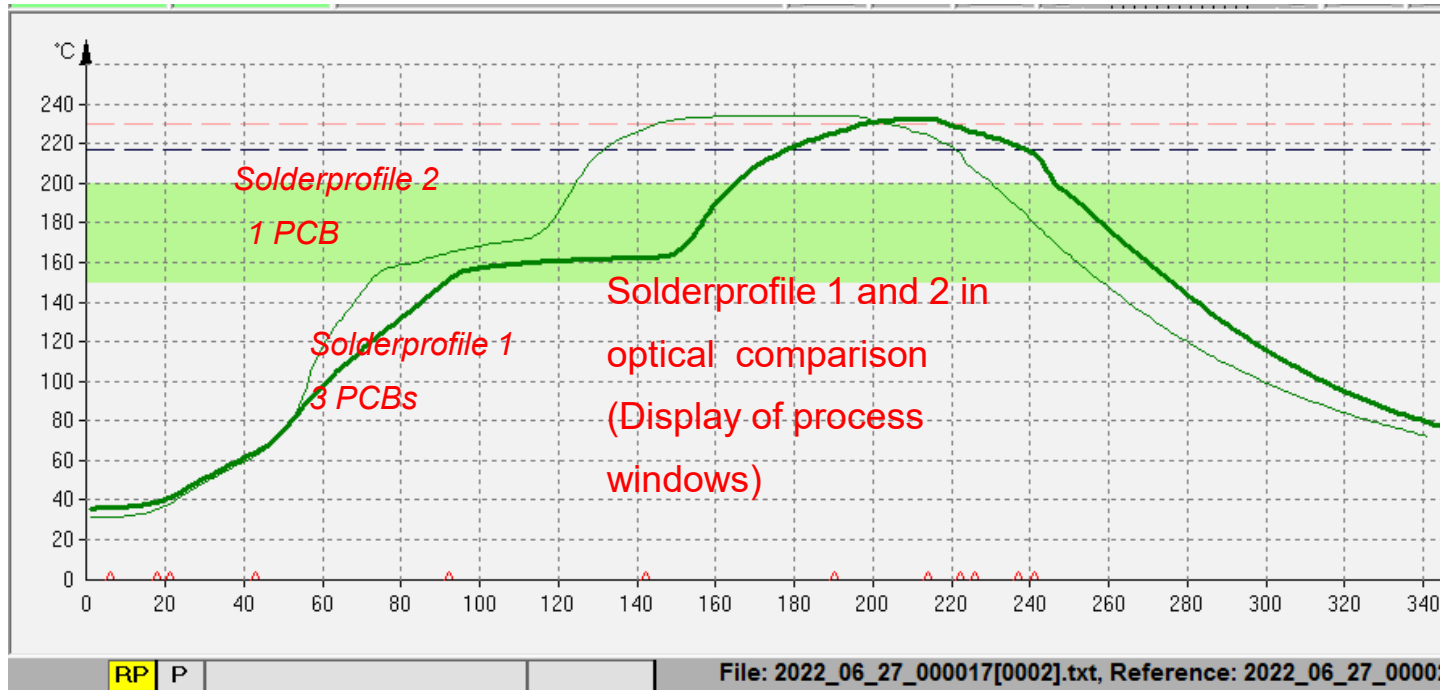
SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Examination and Test



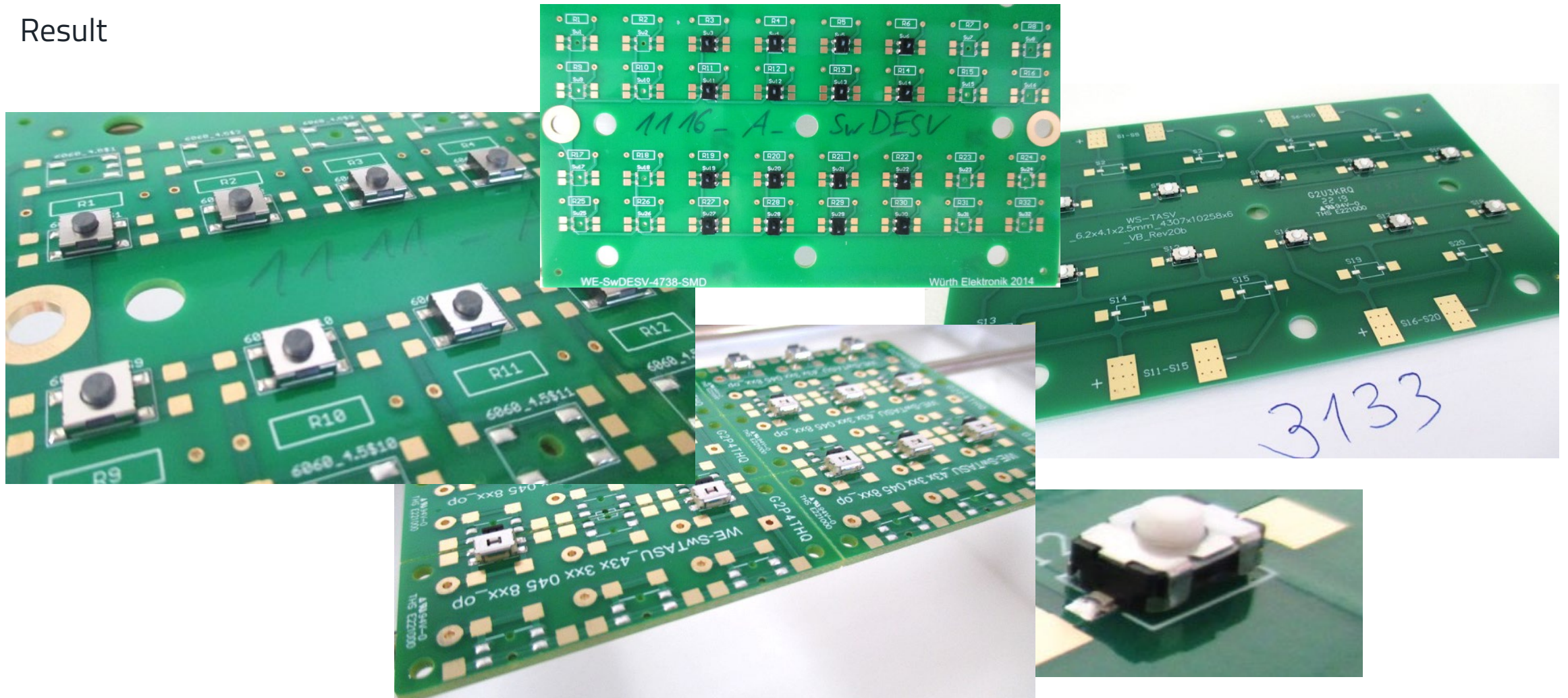
SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Solder Profiles



SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Result



SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Qualification

- Tact-SW 430773034825 _ 6x6x3.4mm, IP67 series
- Tact-SW 434771025826 _ 6.2x4.1x2.5mm, IP67 series
- Tact SW 430481031816 _ 6x6x3.1mm, Washable type
- Tact SW 434331045822 _ 4.7x3.5x1.65mm, RA
- DIP WS-DISV 416131160805 / 416131160805
- DIP WS-DISV 418121160804/ 418121160804
- Rotary WS-ROSV 428542320816 _ 7x7mm

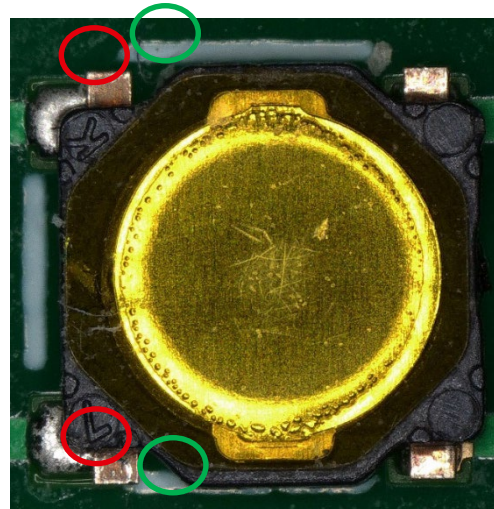
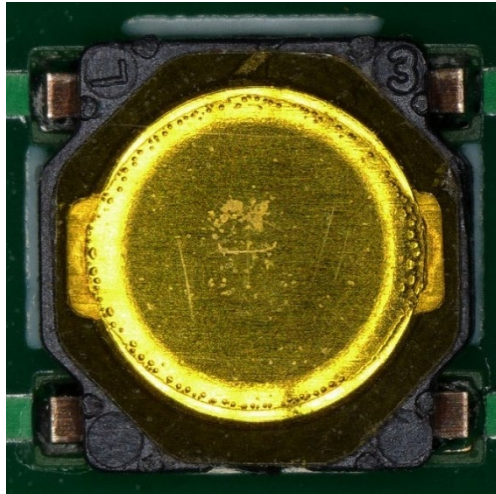
PASSED

SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Qualification

- Tact SW WS-TASV 430173003816 _3.7x3.7x0.3mm
- Compare with reliability test, the CR higher then 5 times reflow.

DOUBT



Red : Solder Pad
Green: Terminal

S/N	Part nr.	sample1	sample2	sample3	sample4	sample5	sample6	sample7	sample8	sample9	sample10	Avg	max	min
1135_A	430173003816	37.68	40.40	38.55	35.50	36.54	36.34	38.88	36.31	35.10	35.56	37.09	40.40	35.10
1136_A	430173003816	NA	36.57	35.27	37.56	37.25	38.00	37.24	36.04	37.70	34.39	36.67	38.00	34.39
1137_A	430173003816	37.22	41.96	37.55	45.86	39.17	39.37	39.62	38.78	36.00		39.50	45.86	36.00
1238_A	430173003816	36.63	40.68	37.25	38.75	196.62	40.45	40.03	NA	NA		57.20	166.62	36.63
1239_A	430173003816	NA	41.64	36.25	37.27	38.12	NA	40.15	40.77	36.72		38.70	41.64	36.25
3140_A	430173003816	36.86	29.28	39.53	41.78	39.72	45.54	38.61	42.90	37.90		39.12	45.54	29.28
5141_A	430173003816	45.15	44.09	49.41	38.22	48.24	40.77	46.73	65.26	41.14		46.56	65.26	38.22

SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Qualification

- Rotary SW 428521420910 _ 10x10mm
- Detector SW





FAILED

SWITCHES IN VAPOR PHASE SOLDERING PROCESS

Resume

- Qualified for Vapour Phase

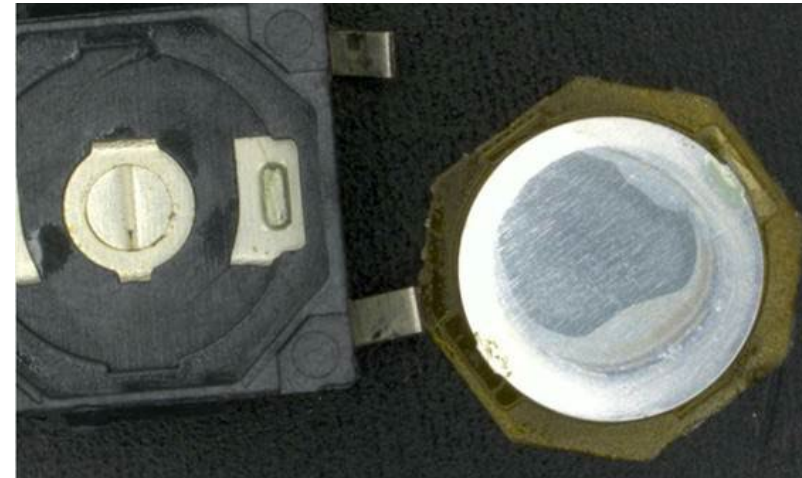
PASSED

Produkt	Artikelnummer	Verfügbare Dokumentation
 Tact Switch 6x6 mm IP67	430 7X3 0XX 8XX	Korrosions-Report IP Report
 Tact Switch 6.2x4.1 mm IP67	434 7X1 025 8X6	
 DIP Switch	416 131 XXX XXX	Korrosions-Report
	418 121 160 XXX	
 Rotary Switch 7x7 mm	428 542 320 8XX	Korrosions-Report IP Report

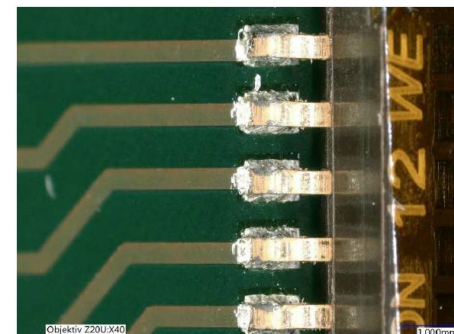
WASHABILITY OF SWITCHES

WHY WASHING PCBs?

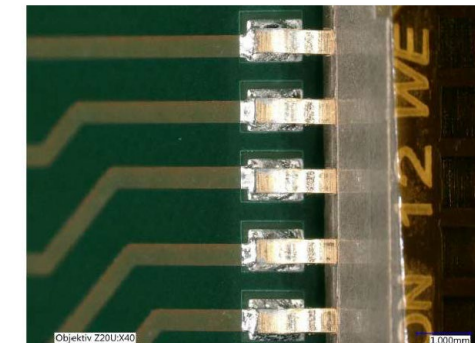
- Removal of resin and fluxes
- Agressive cleaners could affect plating
- Unobstructed inspection by AOI
- Quality control
- PCBs w/ Microstructures and small components like QFN-, uBGA-, CSP-housing
- Applications where absolute cleanliness ist crucial
- Aesthetical reasons
- Significant influence on following process-steps



Before



After



WASHABILITY OF SWITCHES

- Washing machine „Miele IR6002“: Spray application
- Washing agent „Zestron Vigon A201“:
 - Water-based alkaline agent
 - ~30% concentration
- Defoamer „DF30“



Image by MIELE ®

MINIMUM RATINGS FOR ELECTRICAL SWITCHES

DIFFICULTIES OF WASHING SWITCHES

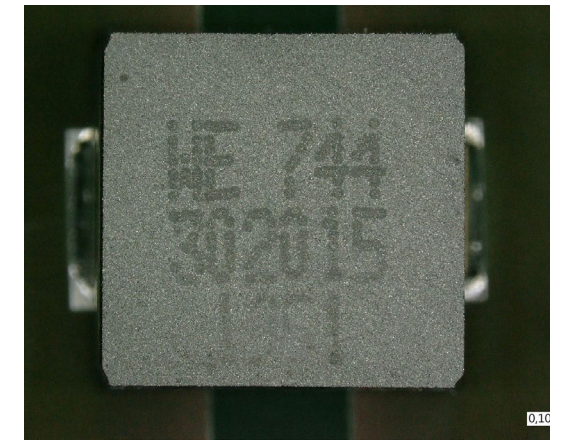
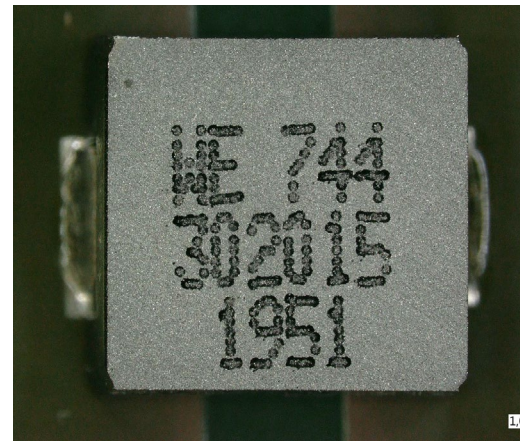
- Components not qualified for washing
- Reducing lifetime
- Corrosion
- Change color or markings
- Washability does not include submersion

- **WASHABILITY is not the same as IP67 !**

WASHABLE DEFINITION

Please do not submerge washable products into water or cleaning agents or put them in locations exposed to water or liquids completely. When cleaning by hand (brushing), please do not use excessive force on our switch to avoid malfunction afterwards, because you could deform function relevant areas or you could damage sealing functions. Do not clean washable series immediately after soldering. The cleaning agent may be absorbed into the switch through respiration while the switch cools.

Marking after washing process:



MINIMUM RATINGS FOR ELECTRICAL SWITCHES

Whats up ?

- What is the minimum rating to activate an electrical switch ?
- Bad contacts are the main cause of failure
 - Residues of contact burning
 - Corrosion
 - Dust layers
 - Oxide films
- Leads to
 - High ECR > poor performance
 - Heating
 - Interruption

LLCR LOW LEVEL CONTACT RESISTANCE

Theorem

- Switches in circuits for low power signals >> LLCR
- Definition: electrical resistance between two conductors at open circuit
- Not high enough to break-through a resistive film or oxide-layers
- Minimum Test Procedure for WE-Switches
 - **Abstract**
 - This document is an internal standard of Würth Elektronik and a guideline to determine the minimum [electric current](#) and voltage needing to flow through a contact to break through the surface film resistance.
 - Background: The film of oxidation occurs often in areas with high [humidity](#). It might result in switches remaining electrically "open" when pressed, due to contact oxidation.

MINIMUM RATINGS FOR ELECTRICAL SWITCHES

Outcome

- Minimum electrical rating for electrical switches :

Not lower than 1mA @ 5VDC

- **IMPORTANT:** we observe the CR behavior can raise over the years (by untouched status).

DESIGN TIPS

Could a standard tact-switch be used like a detect-switch?

- This is absolutely **not** recommended
- Tact-switches are not designed to be held in activated position over a long time
- Relaxation of the spring-material could lead to malfunction
- Travel might be too short
- Detect-switches available in either NO and NC



or ?



DESIGN TIPS

What maximum force can be applied to a tact-switch?

- Suggestion is **not to exceed** the testing conditions of the specific switch, i.e. $260 \pm 50\text{g} = 310\text{g}$

Properties	Value	Unit	Tol.
Operation Force	260	g	± 50

Thread:

- Operating instructions may ignored by user
- Risk of over-forcing
- Damage on switch
- Reduced lifetime

How to prevent?

- Mechanical end-stop to limit the max. travel/stroke



Questions

& Answers



We are here for you now!
Ask us directly via our chat or via E-Mail.

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