

Recommended pick and place tools of LEDs

Application Note

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Recommended pick and place tools of LEDs

Application Note No. AN037



Valid for:
all SMT LEDs

Abstract

SMT devices are developed for assembly by automatic placement machines. To achieve a damage-free processing of LEDs, appropriate and individual pick and place tools (the nozzles) must be used.

The following pages provide information about important parameters that should be considered for LED assembly. Furthermore a recommended nozzle design for each SMT LED in the portfolio is given.

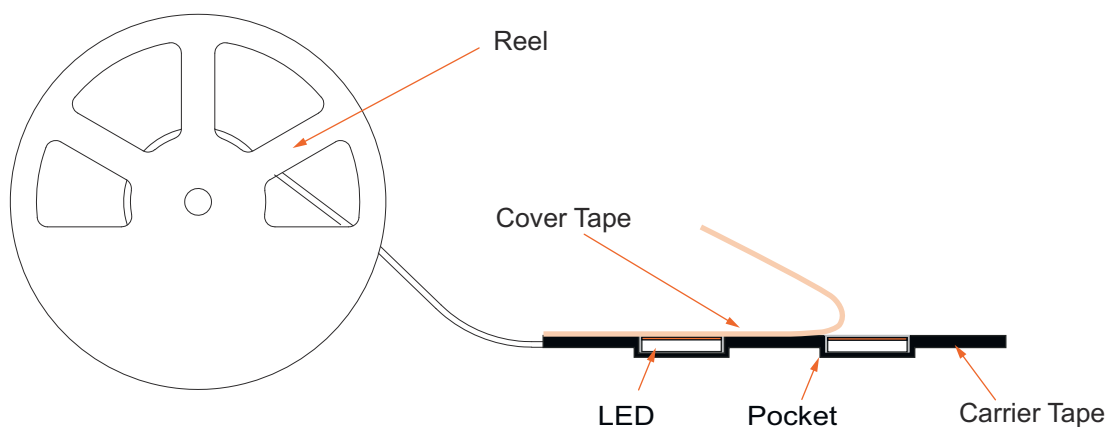
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1 Automated LED placement

Most LEDs from ams-OSRAM are delivered on tape and reel. Figure 1 shows the principle structure of LEDs in tape on reel with cover tape.

Figure 1: LEDs on tape and reel



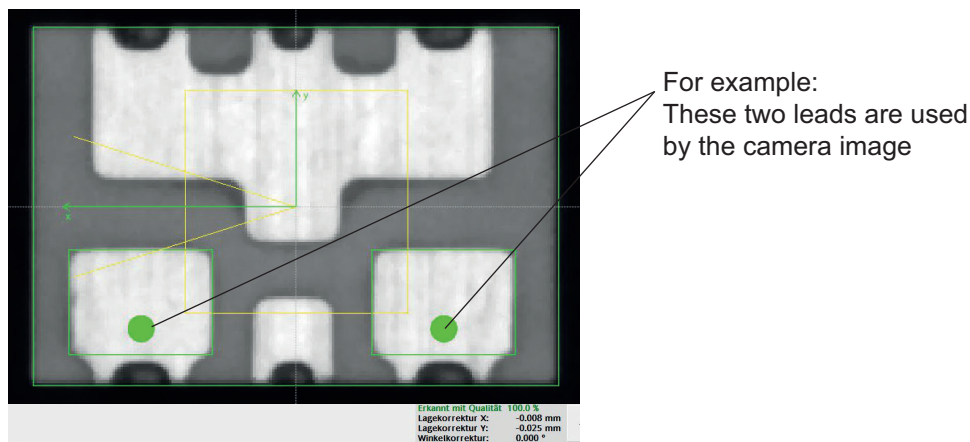
Automated placement systems usually offer the best placement accuracy for LEDs. In this process, a placement head picks up the LEDs from the feeder and places them on the PCB. To avoid damage to the LED, the placement process must be strictly controlled by using an appropriate pick and place tool and to ensure that the process parameters conform with the

1.1.1 Vision System

A high component placement accuracy can be achieved with component placement machines that use vision systems. This enables exact placement of the LEDs at their beforehand programmed positions. Reference points, so-called fiducials, which are located on the PCB, are used for orientation. These are recognized by the vision system camera before starting the assembly process. Furthermore, most vision systems have special contrast illumination and algorithms in order to recognize the contours and component-specific markers more easily for further improving the assembly precision. The vision system uses the "look-up" method, which means that the component is viewed from the bottom side. For this, the component is first picked up from the tape and then the bottom side of the component is checked with a camera. With the help of an image processing system (into which the LED-specific data have been programmed) the footprint and the polarity are detected. This can significantly improve the quality of the assembly.

For a good placement result, especially with more complex footprints, it is recommended to use a pick-and-place machine with integrated vision system. Figure 4 shows an example of how to teach-in the footprint to the ASM Assembly Systems GmbH & Co. KG Vision System. For recognition purposes, it is recommended to teach in the pads of the component backside and not the outline of the part.

Figure 4: Teaching the ASM Assembly Systems GmbH & Co. KG Vision System



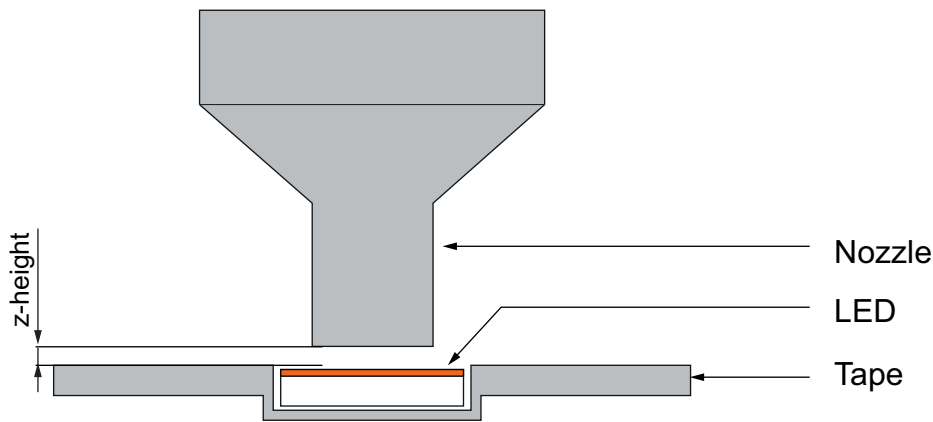
Z-height

Regarding the pickup of the components from the carrier tape, the Z-height (see Figure 5) also influences the process. This allows two different ways of picking up the components with the nozzle:

- With contact
- Contact-less (harvesting method)

In order to reduce the mechanical stress on the component to a minimum and to avoid possible damage to the LED, it is important to place the nozzle correctly when picking up the component from the tape. Particularly with lightweight components, it should be noted that the vacuum of the nozzles can lift the component before the nozzle has reached its final position. To avoid errors, it is essential to check the component-specific z-height.

Figure 5: Nozzle pick-up with z-height definition



Placement force

The placement force applied to the top of the package should be kept to minimum. For example, it can be tested with the standard default setting (2.0 N in most cases) at the beginning and should be then further reduced, if possible.

1.2 Tape feeder

Automatic placement machines are usually equipped with specific feeder units (pneumatic or electric) which transport the tape. Electric feeders have the advantage that they generate less vibration during the placement process and are therefore preferably recommended for the pick and placement of LEDs. Figure 6 shows an electric feeder.

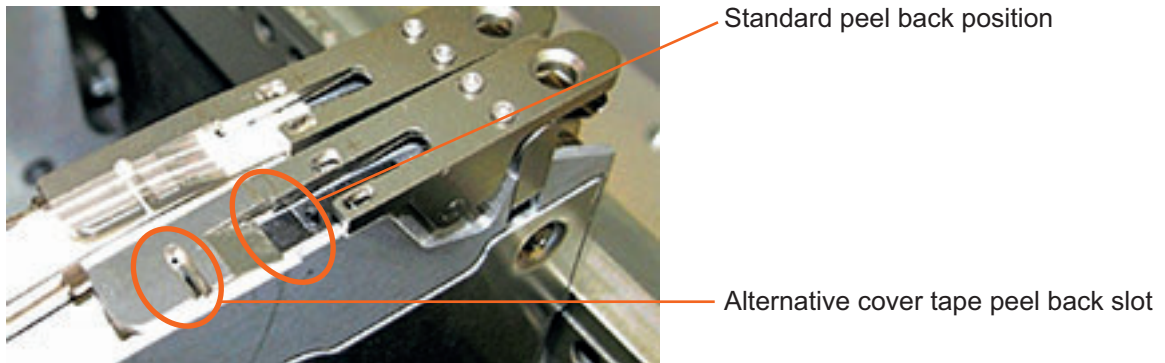
Figure 6: Electric feeder



In some cases, the indexing process, the process when the tape in the feeder is moved to the next pick-up position, can cause problems. It may happen that some LEDs in the pocket get misaligned, tilted or twisted. It is also possible for the LEDs to “jump” out of the tape pocket, resulting in pick-up errors, wrong placement position and damage of the LED package or bond wire. To avoid this the nozzle pick-up position should be directly after the cover tape peel off position. It is recommended that tape pockets are not be left open or uncovered before pick-up.

Additionally, the angle at which the cover tape is peeled back should be as small as possible to reduce the pulling force of the LED during indexing. Depending on the feeder design and construction there is an optional peel back slot / position with reduced risk of misaligned LEDs, see Figure 7.

Figure 7: Feeder peel back position



1.3 Nozzle set-up

Nozzles are individually manufactured for the various placement machines and are usually only developed for a specific component shape or component geometry. The right nozzle selection, combined with a proper set-up, helps to pick the components from the tape for a proper placement without risk of pre-damage or tilting. Therefore, ams-OSRAM AG provides an overview of most products in the portfolio with corresponding nozzle recommendation in chapter "2 Overview of recommended nozzle designs". Since most of the in-house tests are performed with a system from ASM Assembly Systems GmbH & Co. KG, mainly nozzles from this company are recommended. If nozzles of other manufacturers are used, it is always important that the geometry is according to the recommended nozzle. If you have any questions, please contact ams-OSRAM AG.

Non touch area

For some products non touch areas are defined and they vary depending on the design of the LED. Non touch area describes the area, in which the nozzle is not allowed to touch the LED. It is important that this non-touch area is taken into account if a nozzle other than the recommended one is used.

2 Overview of recommended nozzle designs

For the processing of LEDs it must be ensured that the process parameters conform to the package characteristics during assembly. If nozzles or nozzle designs other than the recommendations are used, it must be strictly observed that especially the critical and optical relevant area (area over die/s and wire bond/s) is not loaded.

If further information or support regarding the processing of LEDs is needed please contact ams-OSRAM AG.

A catalog with a linkage of the tools to the associated LED product family is listed in Table 1. This table shows the LED product families and the recommended nozzle design with the nozzle number and a dimension drawing of the nozzle. Alternative nozzles are indicated for some products. Since most products were tested with SIPLACE pick and place machines, SIPLACE nozzles are often recommended. If other types of pick and place machines are used in the field, please use modified tools according to the given dimensions and body structure for the mounting.

Table 1: Recommended nozzle designs for the SMT portfolio

Product family	Recommended nozzle design	
Advanced Power TOPLED® Lx GxxP		SIPLACE 3121424
Power TOPLED® Lx E6xx / Lx Exxx / Lxx T67x SFH 4250 / SFH 4240 / SFH 4250S /		SIPLACE 3121424
Power TOPLED® Lens Lx E63x / Lx E65x SFH 4258 / SFH 4259 / SFH 4248 / SFH 4249 / SFH 4258S / SFH 4259S		SIPLACE 3082992
TOPLED® Lx T67x / Lx T68xx SFH 320 FA / SFH 320 / SFH 4243 / SFH 4257		SIPLACE 3121424

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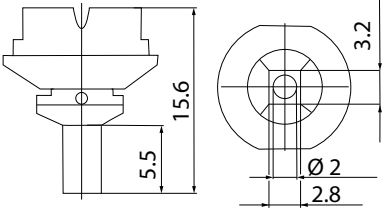

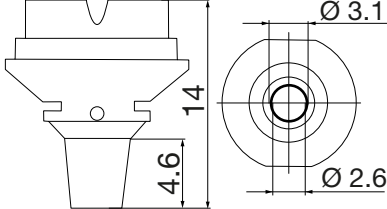

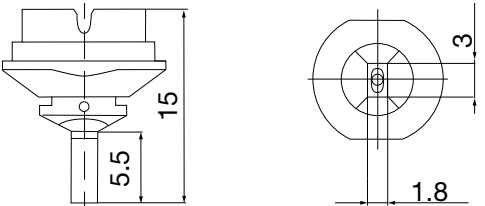

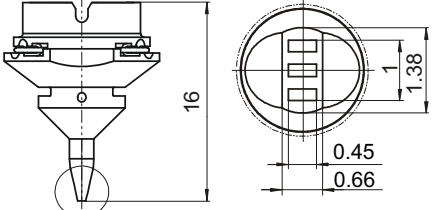
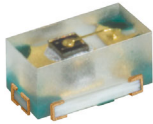
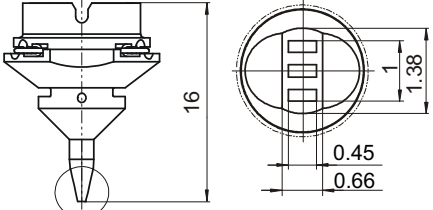
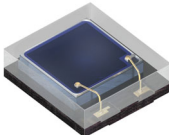
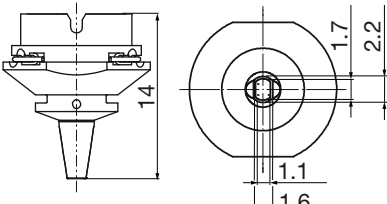
Product family	Recommended nozzle design	
TOPLED® Reverse Gullwing SFH 3211 FA SFH 2270 R		SIPLACE 3121424 
TOPLED® Lens SFH 3219		SIPLACE 3082992 
TOPLED® E3014 LUW JLSH KW DCLMS11.PC		SIPLACE 03090143 
TOPLED® E1608 Kx DELxS1		SIPLACE 2007 
CHIPLLED® SFH 4053 SFH 4043		SIPLACE 2007 
CHIPLLED® SFH 2704		SIPLACE 933 / 2033 

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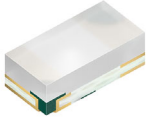
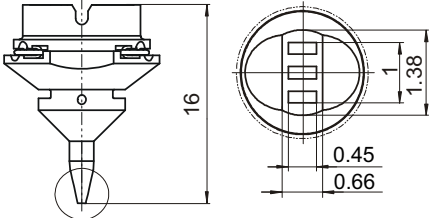

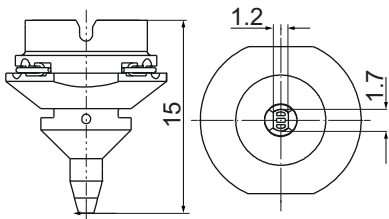

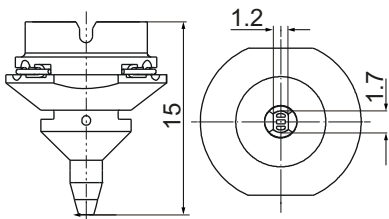
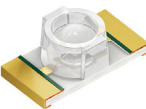
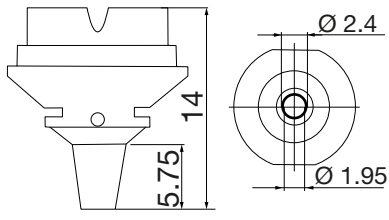

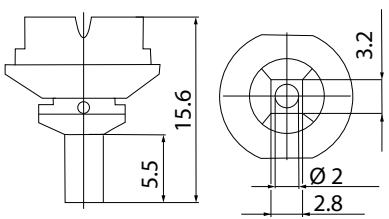

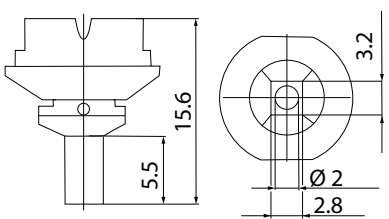
Product family	Recommended nozzle design	
CHIPLLED® 0402 Lx QHxG		SIPLACE 2007 
CHIPLLED® 0603 Lx Q3xx Lx Q976		SIPLACE 2004 
CHIPLLED® 0805 Lx R97x		SIPLACE 2004 
CHIPLLED® with Lens SFH 4052 SFH 4056		SIPLACE 3085131 
DISPLIX® P2828 KRTBLFLP71.32 KRTB LFLM71.32		SIPLACE 3121424 
DISPLIX® P3333 KRTBLSLPS1.32 KRT LSLPS1.32		SIPLACE 3121424 

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Product family	Recommended nozzle design	
FIREFLY® Lx VHxx SFH 4030 SFH 4060		SIPLACE 2007
FIREFLY® E1608 Cx DELSS1.x2		SIPLACE 2007
Micro SIDELED® Lx Y87x LW Y1SG KRBTQCLP61 SFH 4254 / SFH 3204 CUW Y3SH.B2 KRTB AILMS1		SIPLACE 2004
Mini TOPLED® Lx M67x / Lx Mxxx LCB M67x SFH 4247		SIPLACE 2004
Mini TOPLED® Lx MxSG		SIPLACE 2033
MULTILED® SFH 7018		SIPLACE 03120648-01

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Product family	Recommended nozzle design	
MULTILED® Lxxx Gxxx		SIPLACE 3121424
Multi CHIPLED® LRTB RxxG		SIPLACE 3146362
Multi CHIPLED® LTRB RxSx		SIPLACE 2033
Multi TOPLED® Lxx T67x LxG T77x SFH 7252 / SFH 331 / SFH 7251 / SFH 7250		SIPLACE 3121424
OSIRE® E3323 KRTBDWLM32.32 KRTBDWLM31.32		SIPLACE 2035
OSIRE® E3635 LRTBGVSR		SIPLACE 3121424

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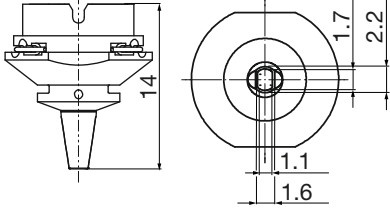

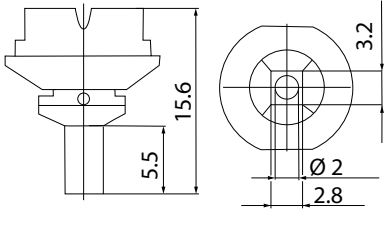
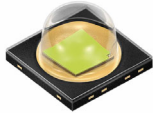
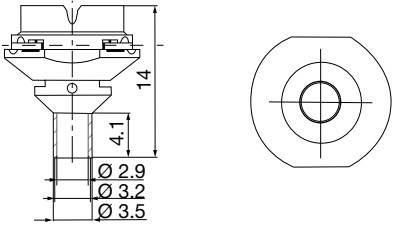
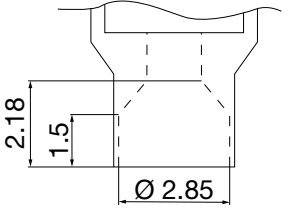
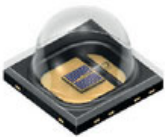
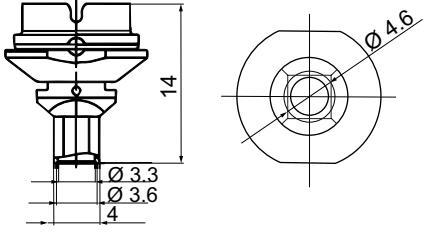
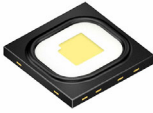
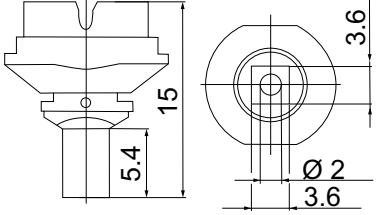
Product family	Recommended nozzle design
OSIRE® E5515 KRTBAELPS1.32	SIPLACE 2033  
OSIRE® E3731i	SIPLACE 3121424  
OSLON® Black Lx H9GP SFH 47xx	SIPLACE 3090409   Essemtec paraquda SP26/BN15 
OSLON® Black SFH 4728 SFH 4718 SFH 47267 SFH 47278	SIPLACE 3245614  
OSLON® Black Flat LUW HxxP Lx H9PP SFH 4735	SIPLACE 3124628  

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Product family	Recommended nozzle design
OSLON® Black Flat KW H2L531.TE	SIPLACE 3124628
OSLON® Black Flat KW H3L531.TE	SIPLACE 3110067 Essentec paraquda SP26/BN36
OSLON® Black Flat KW H4L531.TE	SIPLACE 3110067
OSLON® Black Flat KW H5L531.TE	SIPLACE 3110071
OSLON® Black Flat S KW HHL532.TK	SIPLACE 3124628

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Product family	Recommended nozzle design	
OSLON® Black Flat S KW2 HIL532.TK		SIPLACE 3110067
OSLON® Black Flat S KW HJL531.TE		SIPLACE 3081896
OSLON® Black Flat S KW HKL531.TE		SIPLACE 3271548
OSLON® Black Flat S KW HLL531.TE		SIPLACE 3081899
OSLON® Black Flat X KW HHL631.TK		SIPLACE 03120648-01
OSLON® Black Flat X KW2 HNL632.TK		SIPLACE 3110067

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Product family	Recommended nozzle design
OSLON® Black Flat X KW3 HML631.TK	SIPLACE 3110071
OSLON® Black Flat X KW4 HPL631.TK	SIPLACE 3271548
OSLON® Black Flat X KW5 HQL631.TK	SIPLACE 3271553
OSLON® Boost KW CULPM1	SIPLACE 3124628
OSLON® Compact CM LUW CEUN.CE	SIPLACE 2004
OSLON® Compact CL / OSLON® PL single / OSLON® Boost HM LCY CEUP LUW CEUP.xx KW CELNm1.TG KY CELNMx.FY KW CELMM1.TG	SIPLACE 2004

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Product family	Recommended nozzle design
OSLON® Compact PL KW2 CFLNM1.TG	SIPLACE 3124628
OSLON® Compact PL KW4 CHLNM1.TG	SIPLACE 3110067-01
OSLON® PURE 1010	SIPLACE 2031
	JUK-0166/18 Top view: 0.60 x 0.60, hole diameter 0.2 Side view: 90° angle, thickness 0.075
OSLON® SX / OSLON® MX / OSLON® LX / OSLON® Signal Lx Cxxx / Lxx Cxxx / LxW Cxxx	SIPLACE 3086301
	Essemtec paraquda SP26/BN04

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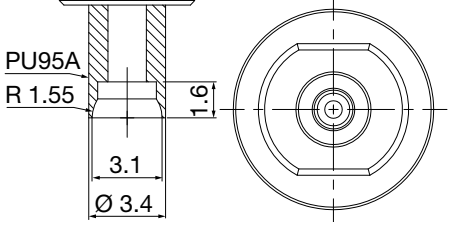
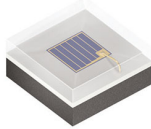
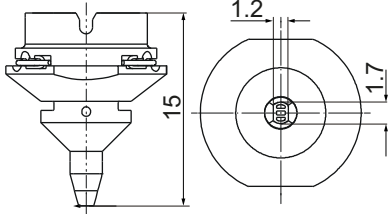
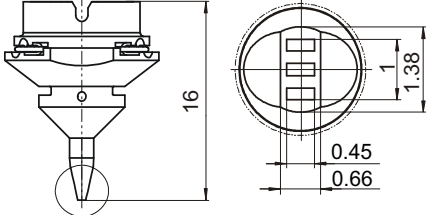
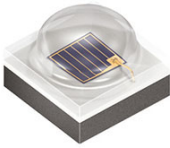
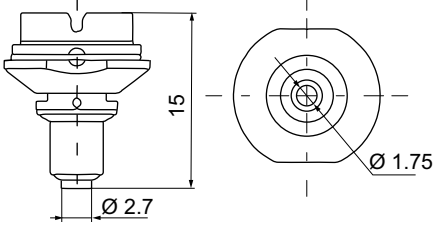
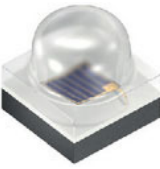
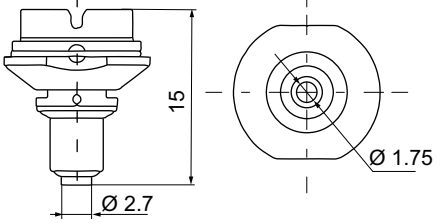
Product family	Recommended nozzle design	
OSLON® Signal Lx CRBP.01		<p data-bbox="887 416 1177 443">ChingYi: P/N: JUK-0400/19</p>  <p data-bbox="887 674 1129 725">Alternative nozzle: SIPLACE 0309409</p>
OSLON® P1616 Flat SFH 4170S SFH 4180S SFH 4170S A01 SFH 4180S A01		<p data-bbox="887 752 1050 779">SIPLACE 2004</p>  <p data-bbox="887 1025 1050 1052">SIPLACE 2007</p> 
OSLON® P1616 SFH 4172 SFH 4182S		<p data-bbox="887 1308 1091 1335">SIPLACE 3148796</p> 
OSLON® P1616 SFH 4171 SFH 4171S SFH 4181S A01 SFH 4181S		<p data-bbox="887 1585 1091 1612">SIPLACE 3148796</p> 

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Product family	Recommended nozzle design	
OSLON® Square Flat KW CSLPM2		<p data-bbox="887 416 1086 443">SIPLACE 3112054</p>
OSLON® Square GW CSSRM1.xx LCW CQAR.xx		<p data-bbox="887 692 1086 719">SIPLACE 3086301</p>
OSLON® Square GW CSSRM2.xx		<p data-bbox="887 958 1102 985">SIPLACE 03090409</p> <p data-bbox="887 1234 1177 1261">ChingYi: P/N: JUK-0381/15</p>
OSLON® Square Gx CSBRMx.xx		<p data-bbox="887 1576 1129 1603">ChingYi: PAN-0636/20</p> <p data-bbox="887 1608 1177 1635">ChingYi: P/N: JUK-0635/20</p>

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Product family	Recommended nozzle design		
OSOLON [®] SSL 80 White / Colors GW CS8PM1.xM LCW CR7P.xC Cx CS8pMx.xx Lx Cx7P		SIPLACE 3086301	
OSOLON [®] SSL 150 White / Colors GW CSHOM1.xM LCW CRDP.xC Gx CSHPMx.xx Lx CxDP		SIPLACE 3086301	
OSOLON [®] SSL 120 Gx CSSPM1.xx		SIPLACE 3086301	
		ChingYi: P/N: JUK-0778/16	
OSOLON [®] Optimal GF CSSRML.24 GH CSSRML.24 GD CSSRML.24 GW CSSRML.24		ChingYi: P/N: JUK-0312/22	
OSOLON [®] UV 3535		SIPLACE 3077709	

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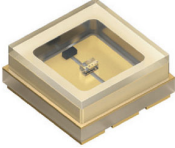
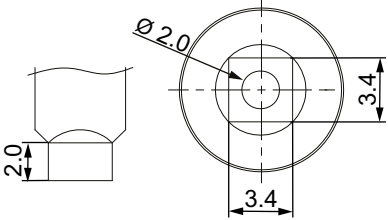
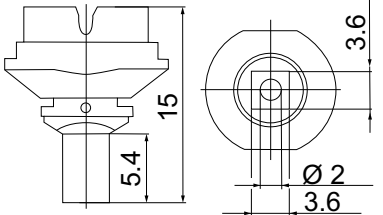
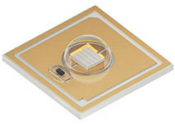
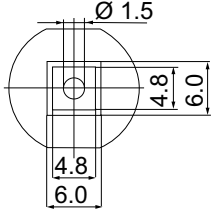

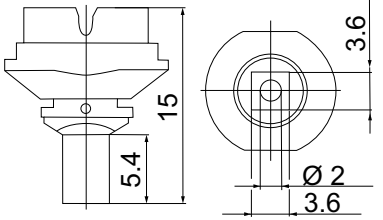
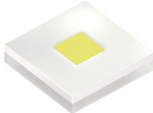
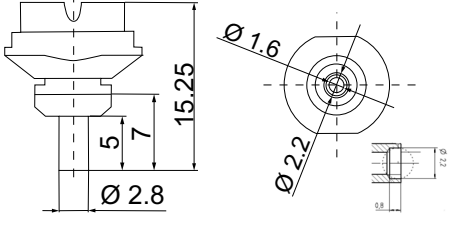
Product family	Recommended nozzle design
OSOLON® UV 3636 SU CULBN1.VC SU CULCN1.VC SU CULDN1.VC	 <p data-bbox="887 421 1182 501">ChingYi: P/N: JUK-0149/22 or PANASONIC: PAN 0150/22</p>  <p data-bbox="887 730 1090 757">SIPLACE 3124628</p> 
OSOLON® UV 6060	 <p data-bbox="887 1010 1182 1090">ChingYi: P/N: JUK-0562/20 or PANASONIC: PAN 0563/20</p> 
OSLUX® SFH 4780S SFH 4786S SFH 4796S SFH 4787S	<p data-bbox="887 1346 1090 1373">SIPLACE 3124628</p>  
OSRAM OSTAR® Projection Compact KW CSLxx1	<p data-bbox="887 1626 1090 1653">SIPLACE 3112054</p>  

Table 1: Recommended nozzle designs for the SMT portfolio

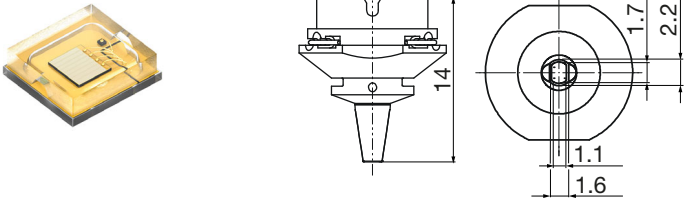
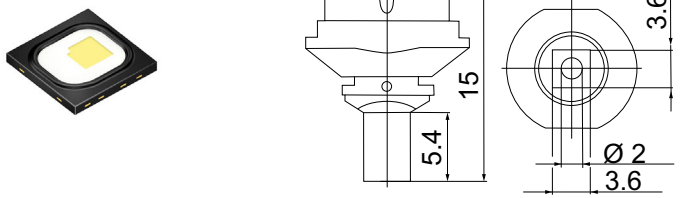
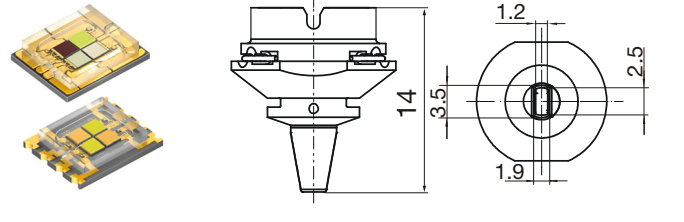
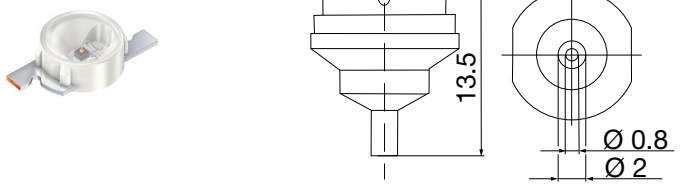
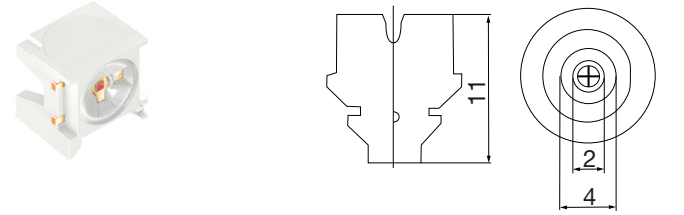
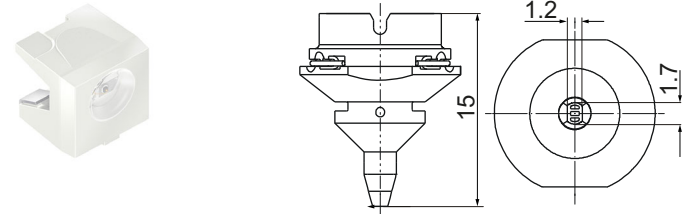
Product family	Recommended nozzle design
OSRAM OSTAR® Projection Compact LE x Q9Wx LE BA Q6WM LCR H9RN LE x Q8WP LE x Q7WP	SIPLACE 2033 
OSRAM OSTAR® Projection Cube LCG H9Rx	SIPLACE 3124628 
OSRAM OSTAR® Stage LE RTDUW S2Wx LE x Q8WP	SIPLACE 2035 
PointLED® Lx P4xx	SIPLACE 3096148 
Power SIDELED® Lx B6SP	SIPLACE 2038 
SIDELED® Lx A67x SFH 4256 SFH 325 SFH 4244 SFH 4255	SIPLACE 2004 

Table 1: Recommended nozzle designs for the SMT portfolio

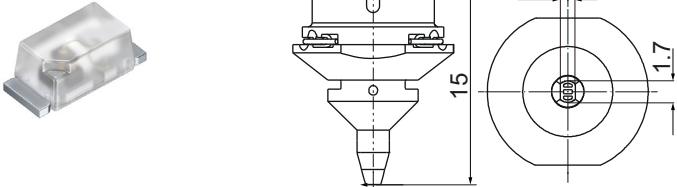
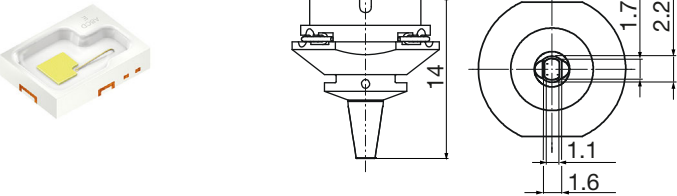
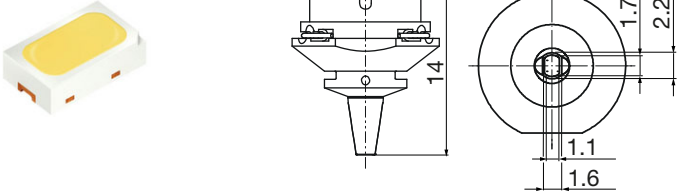
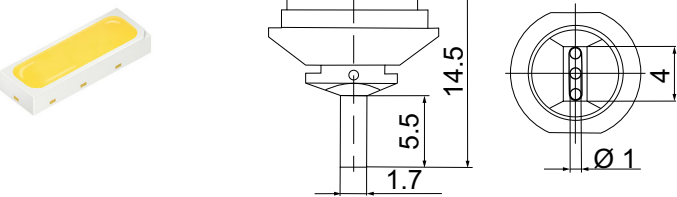
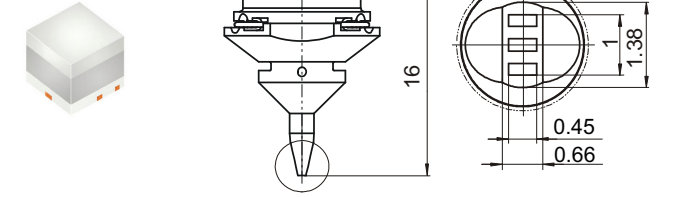
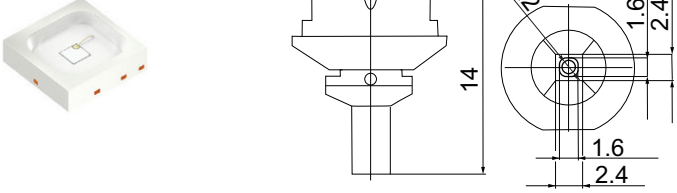
Product family	Recommended nozzle design
SMARTLED® 0603 Lx L2xx SFH 4050 / SFH 3010	SIPLACE 2004 
SYNIOS® P2720 Kx DMLx31 SFH 4770S / SFH 4775S SFH 4776	SIPLACE 2033 
SYNIOS® E2314 KW DNLS31.RA	SIPLACE 2033 
SYNIOS® E4014 KW DPLS3x	SIPLACE 03085846-02 
SYNIOS® E1515 KW SITQA1.Kx	SIPLACE 2007 
SYNIOS® S2222 KT DDLM31.13	SIPLACE 3120648-01 

Table 1: Recommended nozzle designs for the SMT portfolio


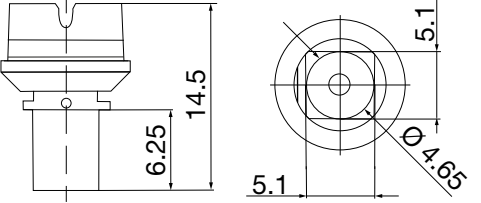

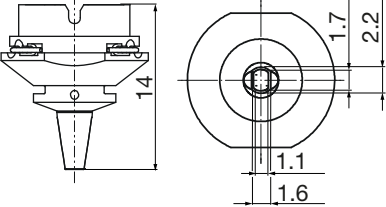

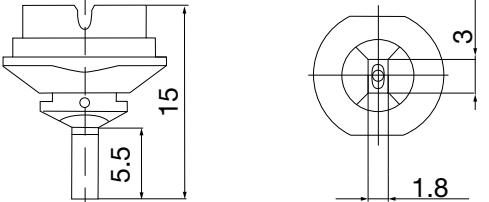

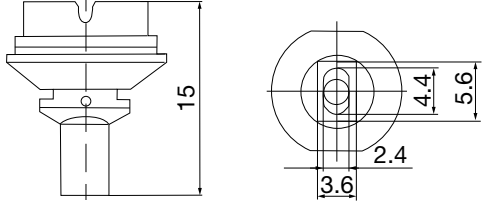

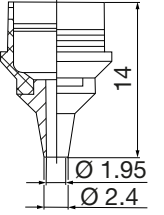
Product family	Recommended nozzle design	
DURIS® E5050 GW J9LHSx.4M		SIPLACE 3083400 
DURIS® E 2835 GW JBLMSxEM		SIPLACE 2033  <p data-bbox="887 969 1217 1025">Alternative nozzle: ChingYi: P/N: JUK-0344/17</p>
DURIS® E 3 GW JCLPSx.Ex LUW JNSH.xC		SIPLACE 3090143  <p data-bbox="887 1328 1217 1384">Alternative nozzle: ChingYi: P/N: JUK-0436/15</p>
DURIS® E 5 GW JDSxS1.xC GW JDSxSx.EM		SIPLACE 3081896  <p data-bbox="887 1686 1217 1742">Alternative nozzle: ChingYi: P/N: JUK-0436/15</p>
DURIS® P 5 GWDASPA1.EC Gx DASPA1.xx		

Table 1: Recommended nozzle designs for the SMT portfolio

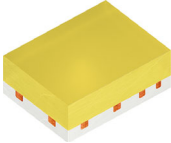
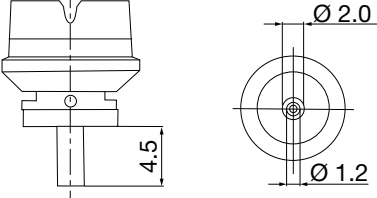
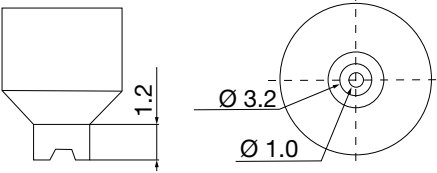

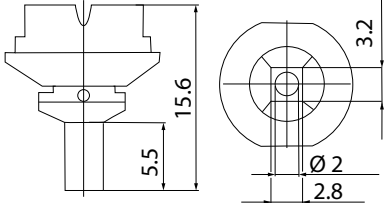

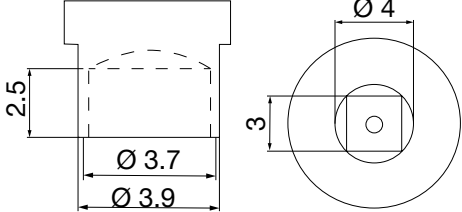

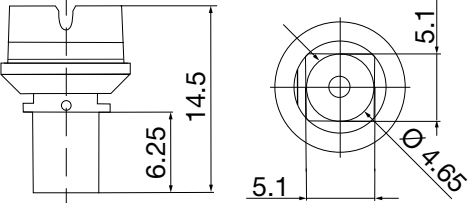
Product family	Recommended nozzle design
DURIS® S 2 GW SBLMAx.EM	 <p data-bbox="887 421 1086 443">SIPLACE 3117100</p>  <p data-bbox="887 674 1315 696">ChingYi: P/N: "KE-2080RL"; Nozzle 503</p>  <p data-bbox="887 927 1305 1043">Alternative nozzles: Essentec paraquada SP26/BN39 Ching Yi Nozzle JUK-0049/15 Ching Yi Nozzle 104590801403 (D)</p>
DURIS® S 5 Gx PSLx31.xx GW PSLPS1.xC GW PSLRS1.xC	 <p data-bbox="887 1070 1086 1093">SIPLACE 3121424</p>  <p data-bbox="887 1323 1214 1406">Alternative nozzle dimensions: Outer dimension: Ø 3.0mm Inner dimension: Ø 1.5mm</p>
DURIS® S 5E GW JSLPS1.EM	<p data-bbox="887 1435 1177 1458">ChingYi: P/N: JUK-0130/17</p>  
DURIS® S 8 GW P9Lx3x.xM	<p data-bbox="887 1711 1086 1733">SIPLACE 3083400</p>   <p data-bbox="887 1966 1214 2051">Alternative nozzle dimensions: Outer dimension: Ø 5,0mm Inner dimension: Ø 3,2mm</p>

Table 1: Recommended nozzle designs for the SMT portfolio


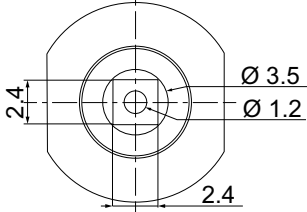
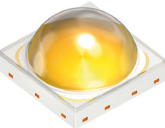
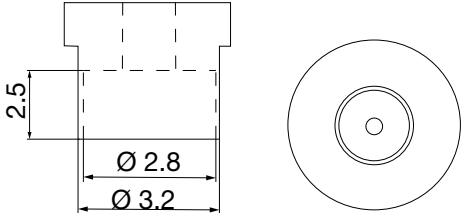
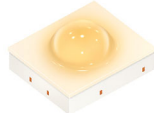
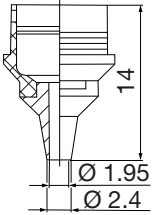
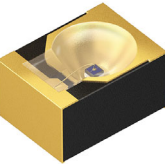
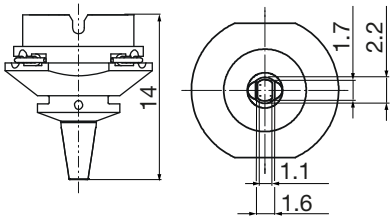
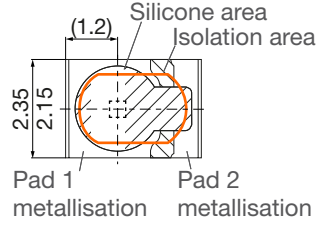

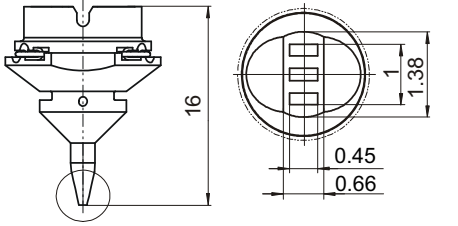
Product family	Recommended nozzle design	
OSCONIQ® C 2424		<p>ChingYi: P/N: JUK-0530/19</p> 
OSCONIQ® P 3737 GW PUSRA1.PM		<p>ChingYi: P/N: JUK-0461/15</p> 
OSCONIQ® P 2226 GWDASPA1.EC Gx DASPA1.xx		<p>SIPLACE 0328149</p> 
MIDLED® Toplooker SFH 4651 SFH 4641 SFH 4650 SFH 4640 SFH 3600		<p>SIPLACE 2033</p> 
		<p>Recommended Nozzle-Design</p> 
MIDLED® Sidelooker SFH 4656 SFH 4646 SFH 4655 SFH 4645 SFH 4647 SFH 3605		<p>SIPLACE 2007</p> 

Table 1: Recommended nozzle designs for the SMT portfolio


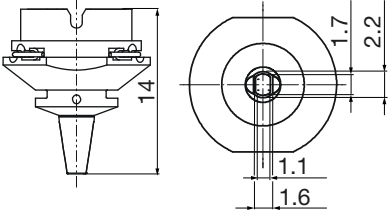
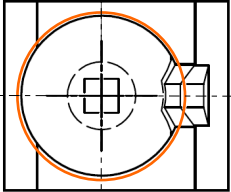
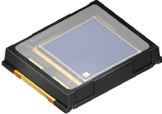
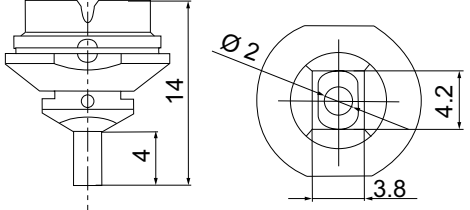
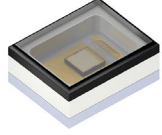
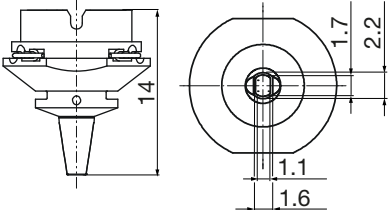
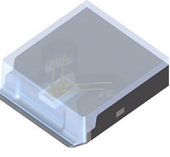
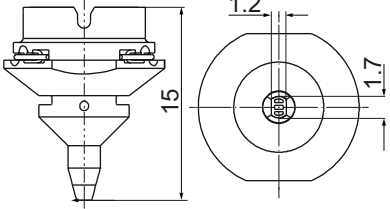
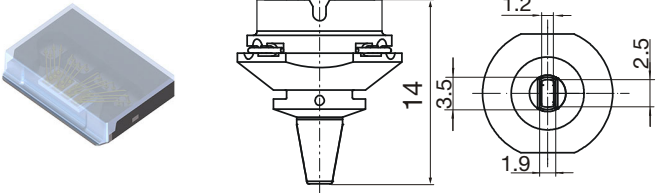
Product family	Recommended nozzle design	
Mini MIDLED® SFH 4451 SFH 4441		SIPLACE 2033  Recommended Nozzle-Design  min. inner diameter: Ø 1.7mm
IR TOPLED® D5140 SFH 2200 / SFH 2201 SFH 2240		SIPLACE 3110067 
BIDOS® P2835 C V102C021A-850 V102C121A-850 V102C021A-940 V102C121A-940 V105C121A-940 V105C131A-940 V105C141A-940 V107C000A-850 V107C021A-850 V107C021A-940		SIPLACE 2033 
SMT Laser SPL S1L90A_3 SPL S1L90H_3		SIPLACE 2004 

Table 1: Recommended nozzle designs for the SMT portfolio

Product family	Recommended nozzle design
SMT Laser SPL S4L90A_3	SIPLACE 2035 

3 General recommendation

Before the assembly process, the nozzle tip should be checked to ensure that it is clean and free of dust. Residues could interact with the LED surface during pickup and placement. The equipment used should be well maintained to avoid faults.

4 Solution proposals for potential issues

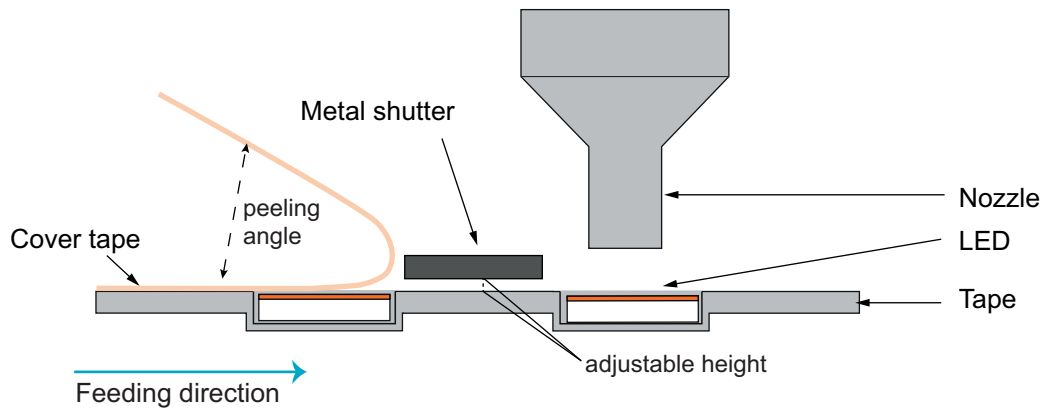
4.1 Components tilting due to vibration

As already mentioned, electric feeders are preferred because they reduce the move out of components in tape pocket due to their lower vibration. A further reduction in vibration can be achieved by installing a special spacer adapter in the feeder unit to adjust for the dedicated tape pocket height.

4.2 Feeder with metal shutter

It is possible to use feeders with a metal shutter. This metal shutter releases the LED-pocket or closes it mechanically by moving back and forward. One setting option is to specify how many LEDs are released (Figure 8). However, it must be ensured that this metal shutter does not touch the components, as otherwise mechanical damages may occur.

Figure 8: Feeder with metal shutter



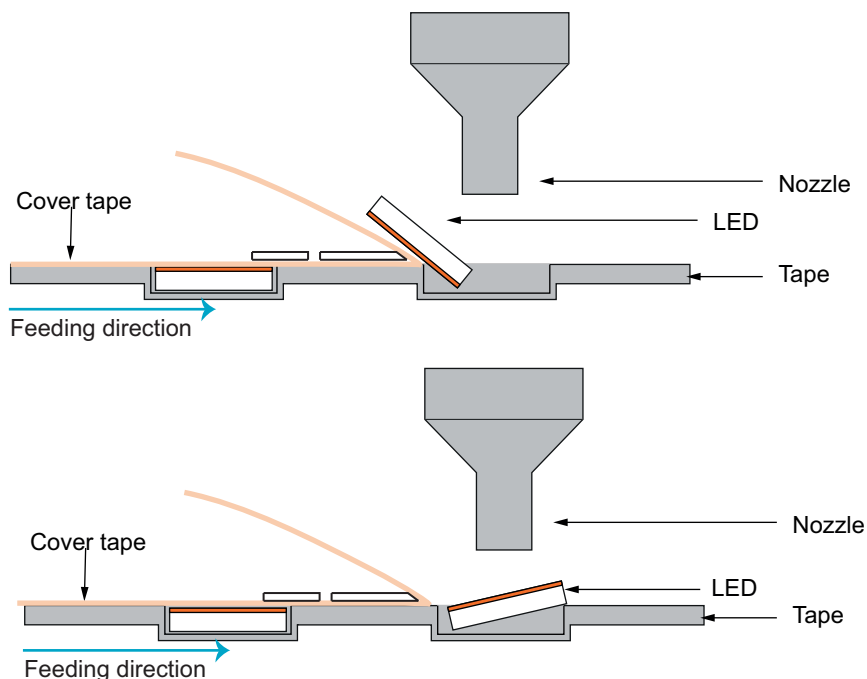
4.3 Stick on tape

As the potting material for LEDs often silicones are used, which might be "sticky" depending on the ambient temperature and humidity. They can be lifted during covertape removal (Figure 9).

This can lead to the following problems:

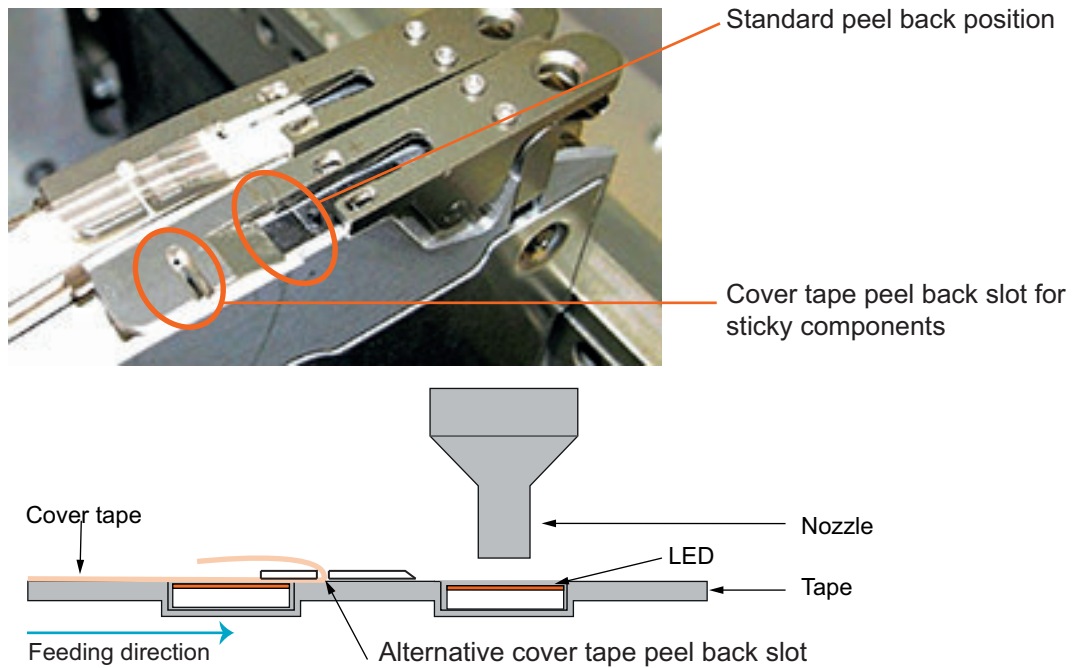
- The LED touches the nozzle while it is lifted from the tape
- The LED falls back "tilted" into the tape and cannot be picked up accurately by the nozzle

Figure 9: Lifted LED during cover tape removal



In these cases it is recommended to use the alternative pull back position of the cover tape as shown in Figure 10. Furthermore, we recommend controlling the humidity and providing an antistatic environment, e.g. with an ionizer.

Figure 10: Feeder peel back position



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