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PETERS
Speziallacke für die Elektronik

TR TECHNICAL REPORT

2-pack solder resists of the series

ELPEMER® SD 2463 FLEX-HF

(adjustment VSD)

= registered trademark of Lackwerke Peters GmbH + Co KG

compliant: RoHS ✓ WEEE ✓ ELV ✓ lead-free ✓

- application by horizontal (Index **SD**) or vertical double-sided screen printing (Index **VSD**)
- photoimageable
- highest resolution even of finest details (up to 30 µm)
- aqueous-alkaline developable
- excellent **flex**ibility (Index **FLEX**) for "Static Flex" applications
- **h**alogen-**f**ree (Index **HF**) according to JPCA-ES01-2003 / IEC 61249-2-21
- thermal cycling resistance:
  -40 °C or -65 °C up to +125 °C
  [-40 °F or -85 °F up to +257 °F]
- very good resistance to galvanic and electroless Ni/Au (ENIG) and electroless Sn baths (CSN) as well as OSP processes (Organic Solder Preservative)
- compatible with lead-free soldering processes
- fulfil/exceed among others
  IPC-SM-840D
  UL 94 V-0, UL File No. E80315

This technical report is valid for the following adjustments:

- **SD 2423 FLEX-HF (VSD),** amber transparent
- **SD 2463 FLEX-HF (VSD),** green transparent

Contents

Please read this technical report, the corresponding material safety data sheet, the process data sheet and the application information sheet AI 2/1 (see item 3) carefully before using the product.

LP 082310 E-1 / 0253201d.001

1. General information

The 2-pack solder resists of the series **ELPEMER® SD 2463 FLEX-HF (VSD)** are solder masks in the sense of VDI/VDE 3710, sheet 4: "Fabrication of printed circuit boards; printing processes". They are permanent solder masks that are applied to those parts of the printed circuit board which are not to be tinned during subsequent soldering processes.

They are photoimageable solder resists that are applied by screen printing and developed in aqueous-alkaline solutions.

All symbols that are used in this technical data sheet and on our containers, such as , are explained on our website www.peters.de in the section "Service – Symbols on labels".

2. Application

The 2-pack solder resists of the series **ELPEMER® SD 2463 FLEX-HF (VSD)** are highly flexible photoimageable solder resists. On account of their high resolution (up to 30 µm) and excellent dielectric properties they can be used as a progressive alternative to flexible cover foils in fine and superfine line technology and SMD technology.

3. Special notes/ application information

To complement this technical report you will find product-specific data such as characteristics and recommendations for process parameters in the process data sheets (PD) of each solder resist. Further and detailed general information and notes that need to be observed to achieve an optimum processing result are indicated in the **Application Information** sheet **AI 2/1** "Processing information for photoimageable **ELPEMER®** solder resists".

In our report manual the **Application Information sheet AI 2/1** is filed under group 2. On our report manual CD and on our website you will find application information sheets in the "Service" section. The process data sheets will be supplied together with your initial order.

Please note that flexible photoimageable solder resists such as the ELPEMER® solder resists of the series SD 2463 FLEX-HF (VSD) exhibit some specialities during processing: The lacquers are particularly sensitive to contamination (dust, residues of other products on tools, abrasion from gloves, etc.) as well as to static charging of the substrates, which may lead to wetting problems and dewetting.
The excellent flexibility and scratch resistance that is necessary for "static flex" applications is reached only after curing.
The flexible circuits must be treated carefully before final curing because otherwise cracks may form.
Generally, thin lacquer layers are more flexible than thicker ones. On the other hand a thicker lacquer layer (minimum dry film thickness 10 µm) is required in order to achieve a sufficient edge coverage particularly for chemical finish processes. For this purpose a double coating of two thin lacquer layers is recommended instead of printing one thick lacquer layer.

4. Safety recommendations

➔ Please read the corresponding material safety data sheet where you will find detailed specifications of safety precautions, environmental protection, waste disposal, storage, handling, transport as well as other characteristics.

➔ When using chemicals, the common precautions should be carefully noted.

➔ Solvent vapours are heavier than air, thus when planning workplace ventilation arrangements, ensure that extractor units are positioned at worktop height.

5. Characteristics

The characteristics are indicated in the product-specific process data sheets. We will gladly provide you with the process data sheets upon request.

6. Properties

The solder resists of the series **ELPEMER® SD 2463 FLEX-HF (VSD)** are distinguished by the following properties:

6.1 General properties

- application by horizontal or vertical, double-sided screen printing
- effective processing due to long screen-open times
- high productivity due to short processing times
- a high solids content and an optimum thixotropy enable an excellent conductor edge coverage at a low wet ink weight as well as a favourable ratio of lacquer to pad height
- broad processing window in the process step “pre-drying“
- tack-free ink film after pre-drying
- low exposure energy, thus short exposure time
- highest resolution: virtually vertical side walls enable the representation of finest details. e.g. 30 µm
- high pencil hardness and excellent scratch resistance after final cure protect against mechanical damage during handling
- excellent adhesion to standard flexible base materials

  (The multitude of partly highly specialised base materials/glues available require an individual consideration of the performance over the total process.)
- excellent resistance to galvanic and electroless nickel/gold (ENiG) processes and electroless Sn baths (CSN) as well as to OSP processes (Organic Solderability Preservative)
- excellent compatibility with no-clean fluxing agents
- strongly solder-repellent ink surface thus minimum solder ball adhesion
- with a solder bath resistance of 20 s at 288 °C [550.4 °F] acc. to UL 94 fulfil the required temperature resistance for lead-free soldering
- very low ionic contamination values after HAL
- thermal cycling resistance: -40 °C or –65 °C to +125 °C [-40 °F or –85 °F up to 257 °F] (100 cycles)
- fulfil/exceed the requirements of **IPC-SM-840D** (**Trace Lab Report** on www.peters.de in the section “Service – Certificates“)
- best flame class V-0 according to UL 94, UL File No. E80315, Registered trademark of ® Underwriters Laboratories Inc.; Northbrook, Illinois 60062
- free of halogenated flame retardants
- halogen-free according to JPCA-ES01-2003 / IEC 61249-2-21
- silicone-free
- do not contain substances listed in the RoHS directive 2002/95/EC, EU End-Of-Life Vehicle directive 2000/53/EC and WEEE directive 2002/96/EC.

6.2 Physical and mechanical properties

Property	Test method	Result
Adhesion	IPC-SM-840D, 3.5.2.1	class H and T
	IPC-SM-840D, 3.5.2.6 (ink on ink)	class H and T
Adhesion to flexible circuits	IPC-TM-650, 2.4.29B 10 cycles, bent 20 times around mandrel, 3 mm diameter, 180°	no cracks or delamination
Cross hatch	DIN EN ISO 2409 on copper	Gt 0
Pencil hardness	IPC-SM-840D, 3.5.1	6 H
Scratch hardness	Simex scratch resistance test device type RH 3, scoring needle with ball-tip (1 mm diameter)	weight load: 1500 g
Flexibility	Mandrel bending DIN 53152 polyimide foil, thickness: 50 µm; ink film thickness: ≤ 15 µm	diameter: ≥ 1.5 mm
Solder bath resistance	IPC-SM-840D, 3.6.1.1 Isopropanol Isopropanol : deionised water (75 : 25) 10% alkaline cleaning agents Monoethanolamine Deionised water D-Limonene	passed passed passed passed passed passed
	test boards, dipped in dichloromethane (30 min at room temperature)	no swelling
Hydrolytic stability	IPC-SM-840D, 3.6.2 28 days/97 ± 2 °C [206.6 ± 35.6 °F] 90 to 98 % rel. humidity	passed
Solder bath resistance	IPC-SM-840D, 3.7.2 IPC-SM-840D, 3.7.3 (lead-free) IPC-TM-650, 2.6.8 UL 94	10 s at 260 °C [500 °F] 10 s at 260 °C [500 °F] 10 s at 288 °C [550.4 °F] 20 s at 288 °C [550.4 °F]*
Simulated lead-free reflow soldering	IPC-SM-840D, 3.7.3.1	5 x 10 s at 260 °C [500 °F]
Thermal shock	IPC-SM-840D, 3.9.3 –65 °C up to +125 °C [-85 up to 257 °F], 100 cycles, 15 min, shift time < 2 min	class H and T
	-40 °C up to +125 °C [-40 up to 257 °F], 100 cycles, 15 min, shift time < 10 s	passed
Permanent temperature resistance	2000 h storage at 150 °C [302 °F]	> 5.0 x 10^8 Ohm (IPC threshold)
Thermal class	based on DIN IEC 60 085	F = 155 °C [311 °F]
TG_5 (5% mass loss)	Thermo gravimetric analysis (TGA)	approx. 330 °C [626 °F]

* With a solder bath resistance of 20 s at 288 °C [550.4 °F] acc. to UL 94 the solder resists of the series **ELPEMER® SD 2463 FLEX-HF (VSD)** fulfil the required temperature resistance for lead-free soldering.

6.3 Electrical properties

Property	Test method	Result
Dielectric strength	VDE 0303, part 21/DIN EN 60243-1	96 kV/mm
	IPC-SM-840D, 3.8.1	passed
Surface resistance	VDE 0303, part 30/DIN IEC 60093 IPC-TM-650, 2.5.17.1	2 x 10^{14} Ohm
Specific volume resistivity	VDE 0303, part 30/DIN IEC 60093 IPC-TM-650, 2.5.17.1	5 x 10^{15} Ohm x cm
Insulation resistance	IPC-SM-840D, 3.8.2	class H and T
Pressure Cooker Test	50 h, 130 °C [266°F], 100% r. h., 2 atm	passed
	85/85 test; ramp formed storage at high air moisture and high temperature, amongst others 3 days at 85 °C [185 °F] and 85 % r. h.	1.0 x 10^{9}Ohm
Moisture and insulation resistance	IPC-SM-840D, 3.9.1	class H and T
Electromigration	IPC-SM-840D, 3.9.2	class H and T
Comparative Tracking Index (CTI, Tracking resistance)	DIN EN 60112, on FR 4 base material with CTI 250 polyimide foil (50 µm) with CTI 175	CTI 275* CTI 200*
Dielectric constant ε_r	based on IPC 4101 A 1 MHz 100 MHz	4.9 4.6
Dielectric loss factor tan δ	based on IPC 4101 A 1 – 100 MHz	0.072 ± 0.008

* The CTI value of the coating depends, among others, on the tracking resistance values of the base material. The CTI value of the base material is normally maintained when the 2-pack solder resists of the series **ELPEMER® SD 2463 FLEX-HF (VSD)** are used.

Note: Optimum electrical insulation values can only be achieved when all flux residues are removed thoroughly from the printed circuit boards.

7. Processing

➔ You will find product-specific recommendations for process parameters in the process data sheets of each solder resist as well as the **Application Information** sheet **AI 2/1** “Processing information for photoimageable **ELPEMER®** solder resists“. In our report manual the **Application Information sheet AI 2/1** is filed under group 2. On our report manual CD and on our website you will find application information sheets in the "Service" section.

Since the many different permutations make it impossible to evaluate the whole spectrum (parameters, reactions with materials used, chemical processes and machines) of processes and subsequent processes in all their variations, the parameters we recommend are to be viewed as guidelines only. We advise you to determine the exact process limitations within your production environment, in particular as regards compatibility with your specific follow-up processes, in order to ensure a stable fabrication process and products of the highest possible quality.

The specified product data is based upon standard processing/test conditions of the mentioned norms and must be verified observing suitable test conditions on processed printed circuit boards.

Feel free to contact our application technology department (ATD) if you have any questions or for a consultation.

Protect opened containers from UV light.

7.1 Auxiliary products

We recommend the following auxiliary products for the **ELPEMER®** process:

- **Cleaning and deoxidising agent HP 5625 for conveyorised spraying units**
  for the pre-treatment of Cu pcbs prior to ink/resist application, deoxidises and degreases without copper degradation; minimum foaming.
- **Screen opener HP 5200**
  The screen opener **HP 5200** is a highly active spray for dissolving dried screen printing inks immediately and safely from clogged screens. **HP 5200** is silicone-free and does not contain oils or oily substances, so that no smearing occurs.
- **Anti-static spray HP 5500**
  The anti-static spray **HP 5500** prevents and eliminates any electrostatic discharge that occurs during screen printing. **HP 5500** is silicone- and grease-free.
- **Defoamant HP 5911**
  for fast and safe defoaming of aqueous-alkaline developing media, silicone-free, completely biologically degradable, quantity to be added 0.02 up to 0.05%.
- **Cleaning agents R 5899, R 5821 and R 5817**
  The cleaning agent **R 5899** does not have to be marked according to German dangerous goods regulations and can be handled simply and safely. Owing to its high flash point (> 100 °C [> 212 °F]) it is especially suitable for use in screen washing equipment. The cleaning agent **R 5899** is particularly distinguished by a low vapour pressure (< 0.1 hPa at 20 °C [68 °F]) and thus is not affected by the EU-VOC regulation 1999/13/EG which judges solvents by their percentage of volatile organic compounds (VOC = volatile organic compounds).
  Furthermore, the cleaning agent **R 5821** is available which, owing to its high flash point of +32 °C [89.6 °F], is also suitable for use in screen washing equipment as well as for cleaning work tools. For the manual cleaning of screens and tools we recommend our cleaning agent **R 5817** with its fast and thorough cleaning properties.

Do not use cleaning agent as a thinner or for washing hands since solvents remove the natural grease from skin.

Special technical reports for these products are available upon request. Further information regarding the content and consequences of the EU-VOC regulation can be found in our **t**echnical **i**nformation **sheet TI 15/110 E "EU-VOC regulations – Content and consequences for the PCB industry"**. In our report manual these technical publications are filed under group 5 and 15. On our report manual CD you will find technical reports in the "Products" section and technical information sheets in the "Service" section.

8. Drying/curing

There are 3 drying steps in the standard processing of **ELPEMER®** of the **series SD 2463 FLEX-HF (VSD)**:

- Pre-drying – prior to exposure and developing
- Drying of the pcb after developing and rinsing
- Curing as the final process step.

Further information regarding the above mentioned steps can be found in the corresponding process data sheets of each solder resist.

9. Standard packaging

ELPEMER® of the **series SD 2463 FLEX-HF (VSD)** are packed for delivery as follows:

Component A	Component B	Selling unit [kg]
10 tins of 0.8 kg	10 tins of 0.2 kg	10 kg
10 buckets of 4.8 kg	10 tins of 1.2 kg	60 kg

The corresponding thinner **V 2463 HF** is available in cans of 25 kg.

Partial lots of the selling unit may be ordered but will entail surcharges to cover repackaging costs.

10. Shelf life and storage conditions

The shelf life / minimum shelf life and storage conditions are indicated in the product-specific product data sheets (PD) and shown on the container labels.

11. Further literature/ technical publications

In addition to the recommendations given in this technical report, we can provide technical papers and information sheets written and compiled by members of our staff. A list of the technical publications available can be found in **TI 15/101 E** (technical papers) and **TI 15/100 E** (technical information sheets).

In our report manual all **t**echnical **i**nformation sheets **(TI's)** are filed under group 15. Alternatively, visit our website at **http://www.peters.de** or click on the "Service" section on our report manual CD.

12. Further products for the production of pcbs

We offer a wide range of **etch resists (photoimageable, UV curing, conventional curing), plating resists, solder resists (photoimageable, UV curing, conventional curing) as well as peelable solder masks, marking inks (photoimageable, UV curing, conventional curing), carbon-conductive inks, via hole fillers (purely thermal curing), thick film fillers, plugging pastes, heatsink pastes, special strippers for solder resists and further auxiliary products for screen printing (e. g. cleaning agents, thinners).**

Special technical reports are also available for these products and can be provided on request. On our report manual CD you will find technical reports in the "Products" section.

13. Further products for the electronics/electrical engineering industries

We boast a wide range of **conformal coatings, thick film lacquers, casting compounds, casting resins, electro pastes, insulating lacquers, impregnating varnishes, adhesive lacquers and auxiliary products for electronics.**

Special technical reports are also available for these products and can be provided on request. On our report manual CD you will find technical reports in the "Products" section.

Any questions?

We would be pleased to offer you advice and assistance in solving your problems. Free samples and technical literature are available upon request.

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