

Flash KGD Assembly

About this document

Scope and purpose

AN99112 discusses the shipment methods, constraints regarding UV erase, plasma and radiation for die products not packaged and at risk of exposure to UV light, plasma clean or X-ray during module assembly.

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Introduction

1 Introduction

Infineon ships a number of devices in die form. These products are referred to as Known Good Die (KGD). Infineon has offered KGD since 1990, with over 200 million sold since 1990. This application note is relevant for any die product not packaged and at risk of exposure to UV light, plasma clean, or X-ray during module assembly. In addition to KGD, Known Tested Die (KTD) and Non-Singulated Wafers are available for commercial and industrial applications. Special storage and handling conditions expected for KGD, KTD, and wafer products are outlined in application note [Long Term Storage of Wafer and Die Semiconductor IC Products](#). This includes storage, handling, and processing issues that need to be considered.

For more information about KGD offerings, consult the [Flash Memory Roadmap](#) or contact your Infineon representative.

KGD, KTD, and wafer shipment methods

2 KGD, KTD, and wafer shipment methods

KGD, KTD, and wafer products are shipped using one of four methods (see [Figure 1](#)):

- GDP = Waffle Pack
- GDT = Surftape and Reel
- GDE = Embossed Tape and Reel
- GWJ = Wafer Jar

Many customers prefer Surftape due to ease of assembly and the fact that Surftape sticky tape can hold each die in place to allow for easy and safe removal of die in the pick-and-place operation. [Figure 2](#) is an example of die ejector equipment used to push and place packaged KGD or KTD in Surftape. [Figure 3](#) is an example of Surftape sticky tape design to hold the die in place. See [Packing and Packaging Handbook](#) for further specifications.

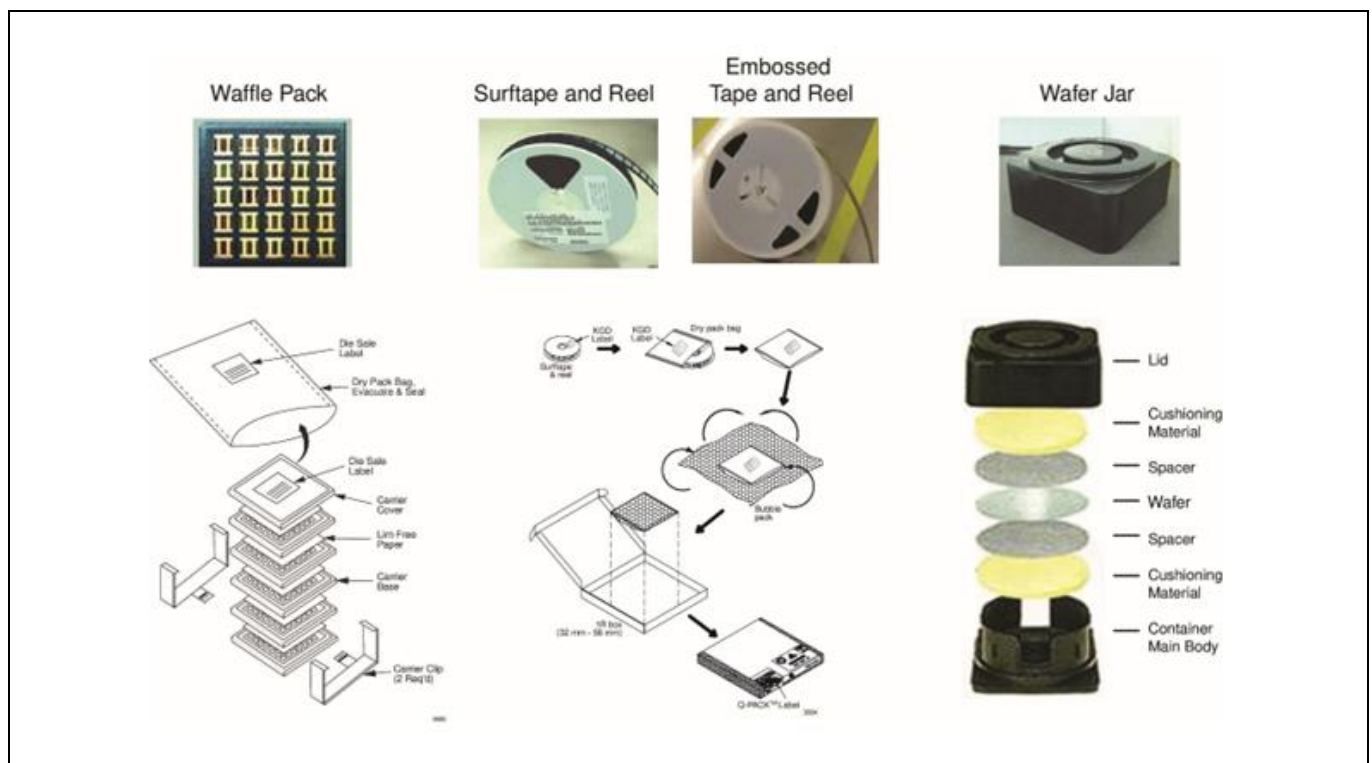


Figure 1 KGD and KGW shipping methods

In the following example of a die ejector system ([Figure 2](#)), die on the Surftape are dispensed with active side facing up. A push-up tool in the Surftape feeder lifts the chip from the sticky tape rails for transfer to the pick head on the assembly placement machine.

KGD, KTD, and wafer shipment methods

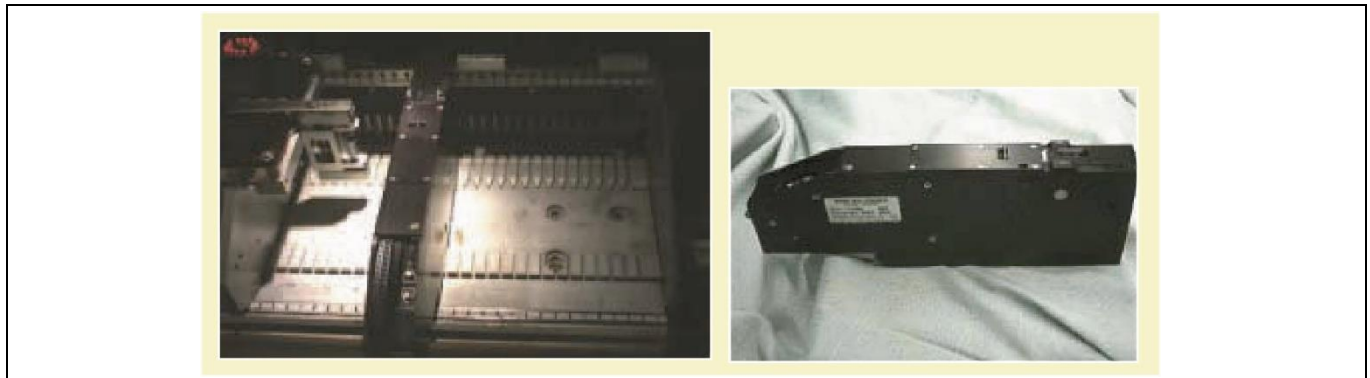


Figure 2 Example of die ejector system

In the following example of Surftape sticky design, sticky tape runs along the two sides of each window (opening pocket) of the Surftape to hold the die in place. At the assembly pick-and-place operation, it is essentially important to prevent both sticky tapes from peeling when cutting off some window pockets of the Surftape at assembly placement machine. [Figure 4](#) is an example of the correct tape cutting handling method for Surftape.

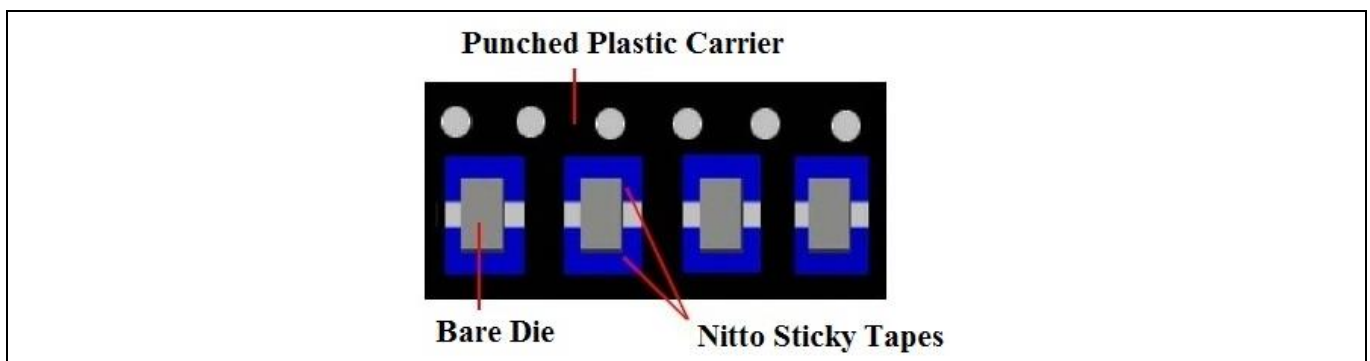


Figure 3 Surftape sticky design

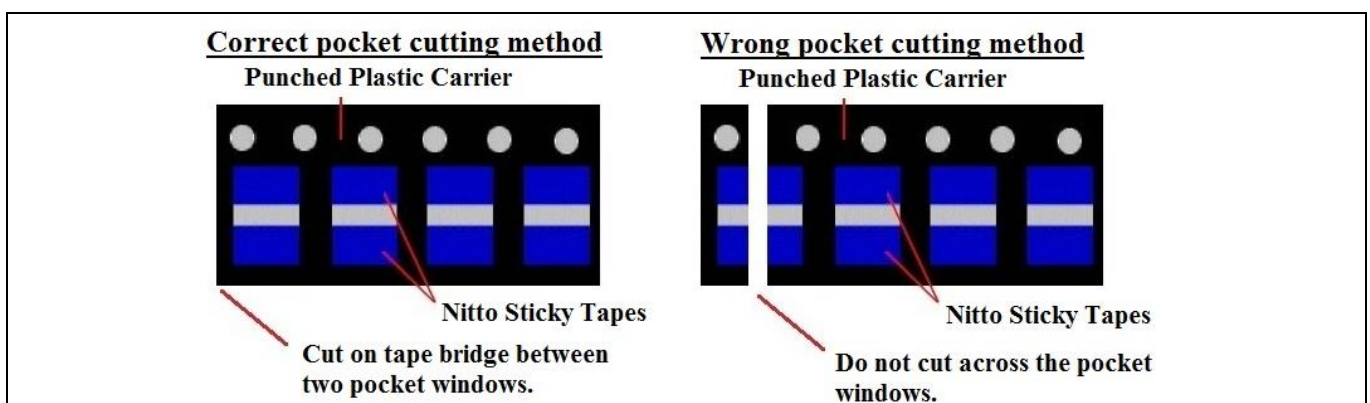


Figure 4 Example of correct tape cutting method on Surftape

Constraints regarding UV erase, plasma and radiation

3 Constraints regarding UV erase, plasma and radiation

Caution is necessary when using UV machines for curing or plasma equipment for cleaning. Most die or wafer products are only protected by a topside nitride passivation layer. KGD, KTD, and wafer products have the same constraints as SMT packages for X-Ray inspection.

UV equipment could cause erase

4 UV equipment could cause erase

Use only a 15 W sec/cm² dosage to completely UV erase the contents of a KGD, KTD, or wafer. Obtain this dosage by exposure to an ultraviolet lamp wavelength of 2537 with intensity of 12,000 μW/cm² for 15 to 20 minutes. The EPROM should be directly under and 1 inch from the source. Flash and EPROM are subject to the same guidelines.

Below is a generic list of UV erasers that use the standard wavelength of 2537 Å. Using the lowest Wattage of 32 μW/cm² at 1 meter, a conversion for intensity at 1 in is computed by the following equation:

$$I_1 \times D_{12} = I_2 \times D_{22}, \text{ where } D_1 \text{ is 1 m or 100 cm and } D_2 \text{ is 1 in or 2.54 cm.} \quad (\text{EQ 1})$$

$$I_2 = I_1 \times D_1^2 / D_2^2 \quad (\text{EQ 2})$$

So,

$$I_2 = ((32 \mu\text{W}/\text{cm}^2) \times (100 \text{ cm})^2) / (2.54 \text{ cm})^2 = 49,600 \mu\text{W}/\text{cm}^2. \quad (\text{EQ 3})$$

So,

$$I_2 = ((32 \mu\text{W}/\text{cm}^2) * (100 \text{ cm})^2) / (2.54 \text{ cm})^2 = 49,600 \mu\text{W}/\text{cm}^2 \quad (\text{EQ 4})$$

This result is greater than four times the intensity needed to UV erase. Infineon flash is fully erased at these intensities and wavelengths. More importantly, partial erasure and loss of chip functionality and/or any stored data could occur at significantly lower, as low as 10% of the above exposure doses and higher (up to 4000A) UV light wavelengths. Therefore, care should be taken to protect flash KGD, KTD, or wafers from exposure to UV radiation.

Table 1 UV radiation rates

Lamp number	Lamp (Watts)	Approximate lamp current (425 mA)	Ultraviolet output	
			Total (1)	Microwatts @ 1 meter (2)
UV1	10	425	3.1	32
UV2	16	425	5.3	55
UV3	17	425	5.8	59
UV4	25	425	8.5	82
UV5	32	425	11.2	101

Note:

1. Ultraviolet output at 254 nanometers.
2. Microwatts per square centimeter at one meter from lamp.

Plasma equipment

5 Plasma equipment

Plasma equipment used to clean modules during assembly also poses an erasure risk to flash KGD, KTD, or wafers. Some of the gas mixtures and times ([Table 2](#)) used by Infineon for routine package assembly are known to erase KGD, KTD, or wafer reference cells.

Infineon corrects this erasure during after-assembly test. If plasma clean is necessary during customer KGD, KTD, or wafer assembly, equipment parameters must be relaxed. Infineon has conducted a small sample of experiments to verify that exposures of less than 20 seconds minimize impact to KGD, KTD, or wafer reference cells. Parameters are listed in [Table 3](#).

Table 2 Plasma clean parameters

Plasma clean before WireBond				
Power (W)	Time (sec)	Oxygen (SCCM)	Argon (SCCM)	Pressure (mT)
450	295	1	2	90
400	500	1	2	80
Plasma clean before mold				
Power (W)	Time (sec)	Oxygen (SCCM)	Argon (SCCM)	Pressure (mT)
415	450	6	10	115
390	190	3	5	95

Table 3 Recommendations for 20 seconds exposure

Power (W)	Time (sec)	Oxygen (SCCM)	Argon (SCCM)	Pressure (mT)
200	20	8	8	240
100	20	17	17	240

6 Erasure risk

X-Ray equipment used to inspect modules and/or boards during assembly also poses an erasure risk. Application note, [AN98547 - Dose Minimization During X-ray Inspection of Surface-Mounted Flash ICs](#) address this issue. This application note emphasizes the importance of minimizing X-ray dosage.

Conclusion

7 Conclusion

This application note will be updated with further guidance as study of these issues progress. Given the sensitivity of die to UV, plasma, or radiation, however, extreme care should be taken to avoid damaging the die.

For further information on these issues, refer to the following:

- Larry Gilg, *Challenges in Bare Die Mounting*. Die Products Consortium, Austin, Texas;
- Raymond A. Pearson, *Crack Initiation at Underfill/Passivation Interfaces*. Lehigh University, October 2002.

Revision history**Revision history**

Document revision	Date	Description of changes
**	2005-10-14 to 2014-03-28	Initial version Removed the confidential mark Updated entire application note
*A	2015-10-27	Updated in template
*B	2017-01-25	Added advise for Surftape handling Updated template
*C	2017-07-06	Updated logo and copyright
*D	2021-03-30	Updated to Infineon template
*E	2024-02-22	Updated Figure 1 . Completing sunset review.

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