



# DM6030 Series

HIGH THERMAL CONDUCTIVITY  
EPOXY ADHESIVE PASTES

DM6030Hk / DM6030Hk-PT /  
DM6030SF

## PRODUCT DATA SHEET

### I. DESCRIPTION

The DM6030 products are silver-loaded epoxy adhesives with high thermal and electrical conductivity. A unique, patented organic system enables high filler loading of Ag powder/flake combinations. This technology provides a highly conductive polymer matrix when cured, which yields excellent thermal transfer properties. Unlike typical epoxy systems, all DM6030 products can be shipped and stored at room temperature. All DM6030 products are lead (Pb) free and RoHS compliant.

The various family members have properties optimized specifically for different applications. With a k higher than most solders, the DM6030Hk can replace metallic solder die attach. The DM6030Hk-PT has slightly lower k but superior pin-transfer characteristics, including slower dryout tendency and lower thixotropy. The DM6030SF is solvent-free, allowing environment-friendly processing and very long staging time while eliminating cure-induced shrinkage and outgassing.

### II. KEY FEATURES

FEATURE	DM6030 type		
	Hk	Hk-PT	SF
Unmatched <b>thermal conductivity</b> – 60 W/m <sup>°K</sup>	√		
<b>Replaces solder</b> – eliminates Pb metal and plating requirements	√	√	
Electrical resistivity as low as 6 μΩ-cm	√	√	
Slow drying – <b>long staging time</b> and stable viscosity		√	√
<b>Solvent-free</b> – extremely long staging times			√
<b>Excellent rheology</b> for dispensing and screen printing	√	√	√
Minimal <b>bleed-out</b>	√	√	√
Room temperature shipping and storage in jars – <b>no dry ice necessary</b>	√	√	√

### III. APPLICATIONS

DM6030 Ag/epoxy adhesives are designed for attaching devices in high power density applications such as:

- Power semiconductors
- RF power devices
- Laser diodes
- GaAs devices
- Power LEDs
- MMICs
- Power hybrids
- Solder replacement

### IV. TYPICAL PROPERTIES

Parameter	DM6030Hk	DM6030Hk-PT	DM6030SF	Unit	Note / Condition
<b>PASTE PROPERTIES (before curing)</b>					
Viscosity	30,000	30,000	185,000	cP	25 °C, 10 rpm, Brookfield RVT viscometer, T spindle
Thixotropic index	2.3	2.1	2.4	--	10/50 rpm, 25 °C
Shelf life	6	6	6	months	25 °C
	12	12	12	months	-40 °C
Silver content	85	84	85	%	By weight
Total solids content	91	90	100	%	By weight
Density	4.5	4.3	4.9	g/cc	
<b>CURED PROPERTIES (after 110°C, 60 minute pre-bake and 200°C, 30 minute cure)</b>					
Thermal conductivity	60	45	12	W/m <sup>2</sup> K	
Electrical resistivity	8	9	35	μΩ-cm	
Adhesion	3,200	2,200	4,000	PSI	250-mil silicon die shear, bare ceramic
Thermal expansion	26	26	35	ppm/°C	
Flexural modulus	600,000	500,000	800,000	PSI	
Ionic impurities	<30	<30	<30	ppm	Total of Cl-, F-, K+, and Na+
Silver content	93	93	85	%	By weight
Density	6.7	6.7	4.9	g/cc	

### V. PACKAGING, STORAGE AND HANDLING

These materials are available in jars or syringes (see Ordering Information, below).

Jars are shipped without dry ice. Cold storage is not necessary or recommended. Storage on a jar roller, such as the Diemat model 8010, at 1 to 5 rpm at room temperature is recommended. Failure to roll the jars adequately could result in non-homogeneity and inconsistent dispensing. If not jar-rolled, gentle and complete stirring with a square-bladed metal spatula (such as the Fisher Scientific 14-375-20) is recommended before use. If any material remains in the jar after use, return the jar to the jar roller or stir again before next use. If the paste is homogeneous (no solvent on top or thick solid felt in bottom of the jar), it can be poured into a syringe and used immediately. Please refer to the document "Manual Filling of Syringes".

Syringes are packed in dry ice and shipped at  $-40^{\circ}\text{C}$  to prevent separation of ingredients. For more information, please refer to the document "Syringe-Packaged Adhesive Pastes".

## VI. PROCESSING GUIDELINES

### Application

The DM6030 rheology has been designed for use in automated high-speed dispensing equipment with minimal or no tailing or dripping. The DM6030 should be uniform and essentially free of air bubbles prior to use.

A 22 gage needle (16 mil or 0.41 mm ID) is recommended to dispense the DM6030 products. Needles smaller than 25 gage (10 mil or 0.25 mm ID) may not produce uniform dispense weights. The material should be dispensed in an "X" pattern with sufficient quantity to produce fillets halfway up the side of the attached component. Deposition weights will vary according to component size. Typical dispense quantities are 75  $\mu\text{L}$  per square inch of die area (12  $\mu\text{L}$  per square cm of die area).

The DM6030 products can also be screen printed. Squeegee pressure and speed will vary depending on the application. A 200 mesh screen (1.6 mil wire) with a 1 mil emulsion thickness is recommended. This will produce a deposition thickness of approximately 2-3 mils.

For all DM6030 types, components should be pressed into the material wet deposit with fillet formation around the perimeter. For the Hk and Hk-PT types, the wet bondline thickness should be in the range of 1.3 to 1.9 mils, and for the SF type, the wet bondline should be 0.8 to 1.2 mils. The cured bondline should be 0.8 to 1.2 mils for all types.

Because DM6030SF contains no solvents, dryout time at room temperature is very long and component placement can follow material application after a considerable time.

For DM6030Hk and Hk-PT, the **open time** (the time between material application and component placement) can be important in the attachment of small components. Open times for very small components (less than 2 x 2 mm or 80 x 80 mils) should not exceed 30 minutes for DM6030Hk or 40 minutes for DM6030Hk-PT. If greater open times are required before placing these small components, please contact Diemat for specific deposition options or use DM6030SF.

**Staging time** (the time between component placement and start of cure or pre-bake) is not as critical as open time, but should also be limited. See Table 1, below.

**Table 1:** Maximum staging time for DM6030 (estimated; varies with ambient conditions)

Die length (shorter side)	DM6030Hk	DM6030Hk-PT	DM6030SF
<80 mils (2 mm)	30 minutes	45 minutes	2 hours
250 mils (6 mm)	2 hours	2.5 hours	4 hours
>250 mils (6 mm)	3 hours	4 hours	6 hours

An exception to these guidelines is when the die is thin (less than 4 mils) *and* has gold-metallized bond pads. In this case, the resin can migrate from the bondline to the surface of the die, and staging time should be kept as short as possible.

Curing Profiles

The DM6030 family offers a range of curing temperatures to accommodate various process requirements. Higher temperatures allow shorter cure times as shown in Tables 3 and 4 below.

A temperature ramp-up before curing is required to prevent voiding. Because they contain solvents, the DM6030Hk and DM6030 Hk-PT require a pre-bake step for larger die before the main curing period. After curing, the product may be transferred to room temperature immediately. The ramp-down rate does not affect bond integrity and is not specified.

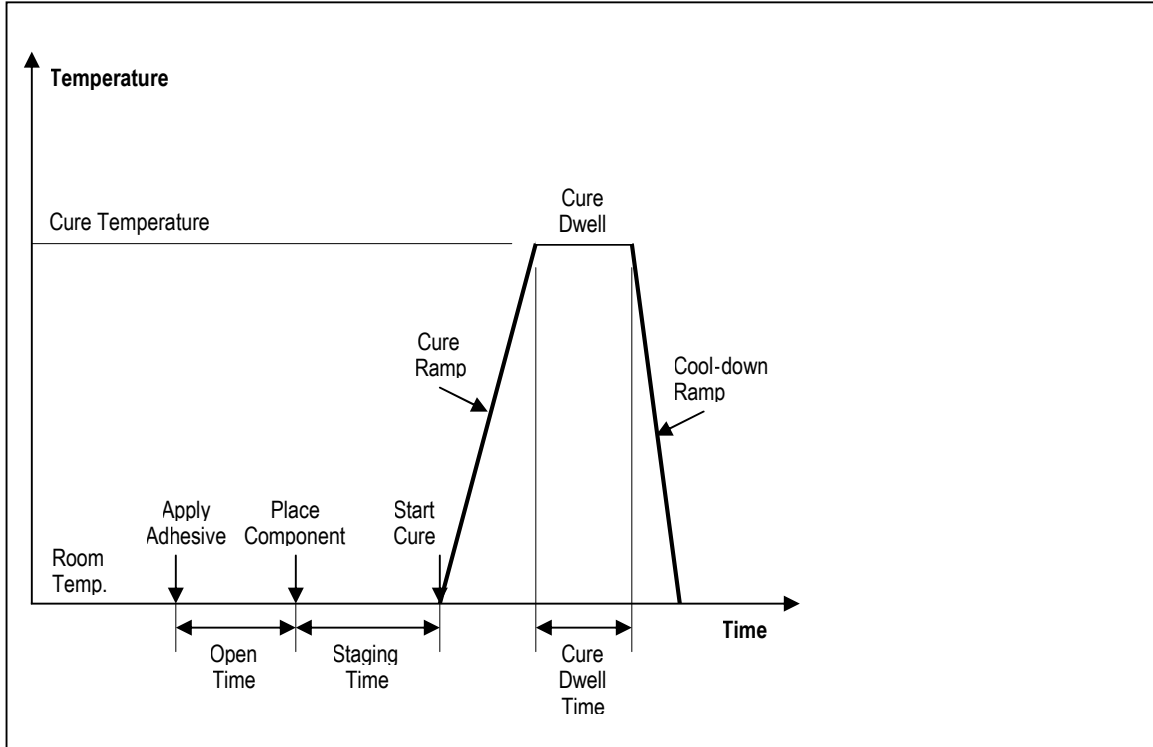
To cure DM6030 adhesives, simply place attached materials into a room temperature circulating oven and set your desired dwell temperature(s), time(s) and ramp rate(s). The oven or furnace must provide forced-air convection and ventilation (exhaust) to remove solvent and/or reaction byproducts and enable optimum curing.

Table 2 below shows that the standard curing profile “A” can be used with die size below 250 mils (6 mm) with all DM6030 types, and with the solvent-free DM6030SF for die size up to 400 mils (10 mm). When curing DM6030Hk or DM6030Hk-PT with die size larger than 250 mils, use curing profile “B”, which includes a pre-bake step. Profiles A and B are detailed below in Figures 1 and 2 and Tables 3 and 4, respectively.

**Table 2:** Curing profile selection based on DM6030 type and die size

DM6030 type	Die length on shorter side	
	0-250 mils	250-400 mils
Hk	A	B
Hk-PT	A	B
SF	A	A

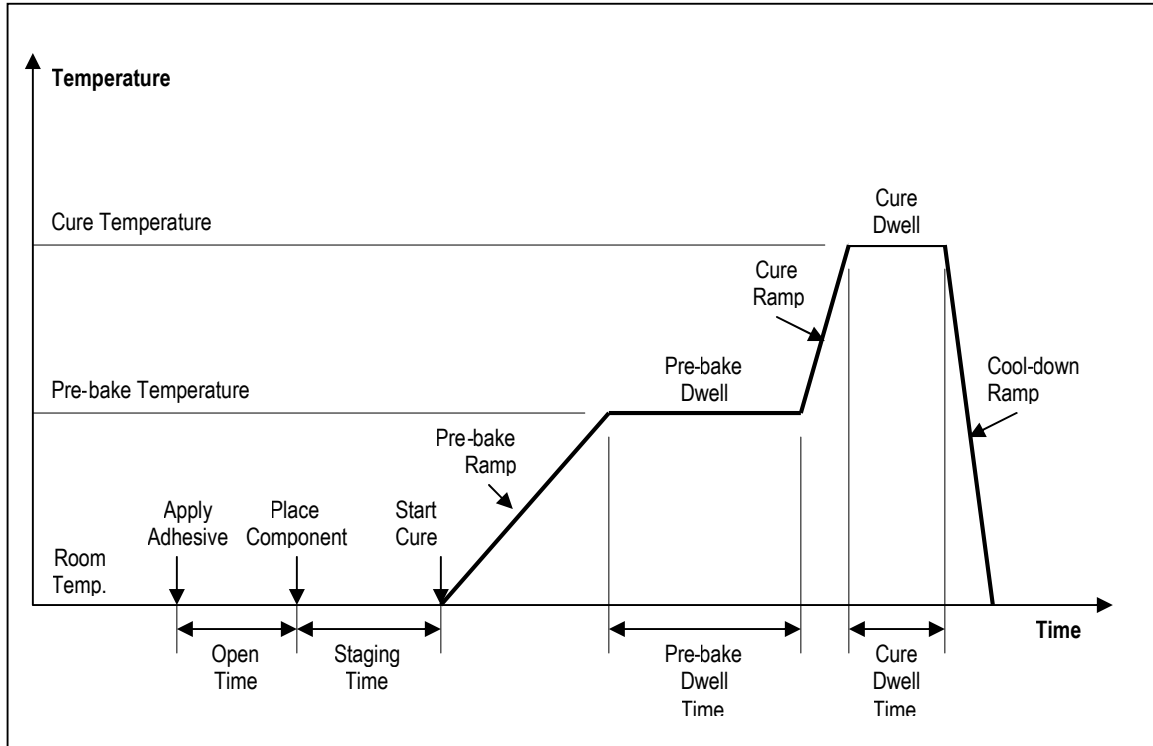
**Figure 1: Curing Profile “A”:** for die size up to 250 mils per side (DM6030Hk and DM6030Hk-PT) or 400 mils per side (DM6030SF)



**Table 3: Parameters for Curing Profile “A”**

Ramp Rate	Cure Temp.	Dwell Time
5-10 °C / minute	175 °C	45 minutes
	200 °C	30 minutes
	225 °C	15 minutes
<b>Note:</b> Use only one cure temperature/time combination		

**Figure 2:** Curing Profile “B” with pre-bake step for die size from 250 to 400 mils per side (DM6030Hk and DM6030Hk-PT)



**Table 4:** Parameters for Curing Profile “B”

Pre-bake Ramp Rate	Pre-bake Temp.	Pre-bake Dwell Time	Cure Ramp Rate	Cure Temp.	Cure Dwell Time
5 – 10 °C/minute	100 °C	75 minutes	5 – 10 °C/minute	175 °C	45 minutes
	110 °C	60 minutes		200 °C	30 minutes
	125 °C	30 minutes		225 °C	15 minutes
<b>Note:</b> Use only one pre-bake temperature/time combination and one cure temperature/time combination					

Due to its high flexural modulus, DM6030 types require special consideration for attaching components larger than 400 mils. Please consult Diemat for recommendations. Note that for attaching large components, Diemat offers a range of optimized adhesives, including DM4030LD, DM4130HT and DM5030P.

## VII. ORDERING INFORMATION

Product Type	Key Product Characteristics	Ordering Number
<b>DM6030Hk</b>	Highest thermal and electrical conductivity	DM6030Hk/F954
<b>DM6030Hk-PT</b>	High thermal conductivity; optimized for pin transfer and attaching small die	DM6030Hk-PT/H579
<b>DM6030SF</b>	Moderately high thermal conductivity; solvent-free; long staging time	DM6030SF/H822

Specify container type and size when ordering. All products are available in jars and syringes. Standard jar sizes are 50, 100, and 200 grams. Standard syringe sizes are 3, 5, and 10 cc, and may hold volumes in increments of 0.5 cc from 0.5 cc to 100% full.

## VIII. CONTACT INFORMATION

For more information on DM6030 and other Diemat products contact:

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U.S. Patent 6,265,471. Other U.S. and foreign patents pending.

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