

# Silicone Solutions for Optical Bonding





# Optical Bonding Advantages

Optical Bonding offers many advantages over air gap bonding and most other bonding materials for display manufacturing. What makes optical bonding better?

## Advanced display performance

- Fast and accurate touch response time
- Can enable larger display sizes than alternative bonding methods
- Silicone optical bonding adhesives remain clear over time
- Generate high contrast displays using less device power at lower operating temperatures

## Supports durable and rugged displays

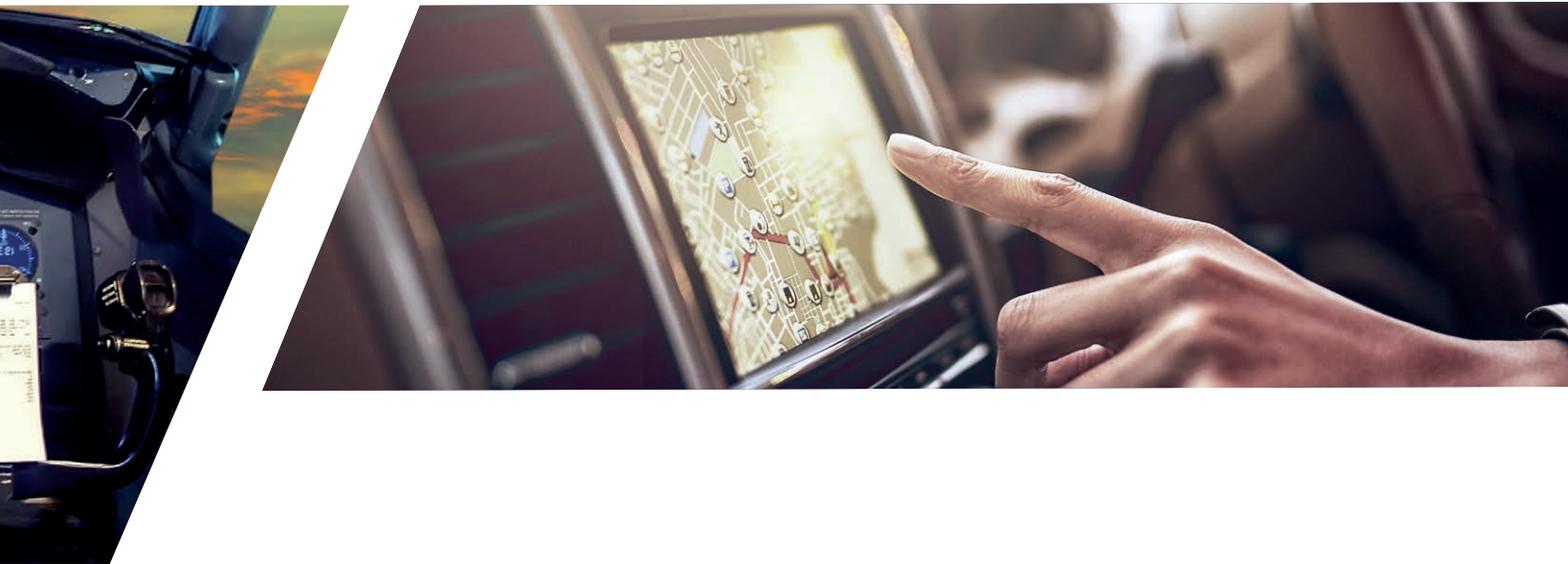
- Prevents condensation and fogging in humid environments
- Scratch and dirt resistance in environments where air quality is an issue
- Reduces or eliminates the need for custom protective enclosures or heavy soda-lime cover glass
- Withstands use in high-traffic public environments
- Vibration and shock resistant seals

## Enhances display images

- Higher resolution and clearer display
- Low surface and ambient light reflection
- Wider viewing angle
- Reduces eye strain from reflections

## Improves user experience

- Fewer layers allow for a slimmer device design
- Enables the creation of lighter weight displays for easier integration, installation and servicing
- Enables multi-touch display interaction
- Reduces parallax effects decreasing display lag and providing precise touch alignment in touch-based systems



# Advanced Silicone Solutions for Optical Bonding Applications

Momentive is a pioneer in developing solutions for optical bonding. Our portfolio of InvisiSil\* Optical Bonding silicones is used in many different types of optical bonding applications worldwide. InvisiSil silicones offer long-term reliability for display components that operate in extreme conditions. They are available in many formulations that can integrate seamlessly into modern assembly systems. With low conductivity and chemical reactivity, thermal stability and the ability to form watertight seals, InvisiSil silicones are ideal for optical bonding. They are available in a range of curing formulations to allow maximum design flexibility while offering long-term reliability to manufacturers of optical displays.

## **InvisiSil UV Cure Silicone**

One part silicones that cure rapidly with UV light and remain flexible after curing to help protect against thermal shock, CTE mismatch and impact.

## **InvisiSil Thermal Cure Silicones**

Two part, transparent gels that can cure with low heat even in shadowed areas. High elongation properties allow them to retain their shape and resist tearing.

## **InvisiSil Snap Cure Silicones**

Two part, fast-curing silicones with a typical cure time of 10 to 30 minutes at room temperature. Non-yellowing, shadow curability and less than .5% shrinkage rate to help reduce CTE mismatch.

## **InvisiSil UV Delay Cure Silicones**

Two-part silicone adhesives featuring delayed, UV light activated curing. Curing delay times can be controlled by UV intensity and/or duration.

## **InvisiSil Silicones for dam and fill**

One and two-part silicones with high dimensional stability, strong sealing and adhesive grip to help display manufacturers encapsulate and protect critical electronic components.



# Optical Bonding for Automotive Displays

Modern vehicles have become showcases for the latest in electronic technologies. From fully digital dashboards to individual rear seat entertainment, the role of displays in the automotive industry continues to grow. Vehicle screens face challenging conditions that include high temperatures and bright sunlight on a daily basis. Momentive's InvisiSil® Optical Bonding silicones can help automotive displays perform in these tough conditions. InvisiSil Silicones' flexibility allows touchscreens to absorb the shock of harsh road conditions while their outstanding sealing capabilities enable glare reduction and enhance screen readability in bright light. To ensure the best performance from automotive displays, count on Momentive's InvisiSil Optical Bonding silicones.

## TYPICAL BENEFITS

- Protects against high and low temperatures
- Creates vibration and shock resistant seals
- Protects displays from condensation in humid environments
- Reduces reflections and enhances readability in bright light
- Enables high resolution displays



- 1 Instrument panel
- 2 Navigation screens and in-dash entertainment systems
- 3 Rear-view mirrors
- 4 Seat-back and flip-down video screens



# Optical Bonding for Electronic Applications

High quality displays are in ever-increasing demand. Users today spend significant amounts of time with electronic devices under many different conditions. Devices have to function whether indoors or outdoors. At a time when having information translates into competitiveness, high quality displays that enhance the user's experience are critical. Displays bonded with Momentive's InvisiSil® Optical Bonding silicones can help improve readability in bright light. They can also help improve display responsiveness and enable higher resolution screens. With screens such an integral part of daily life, count on Momentive's InvisiSil Optical Bonding silicones to help displays perform at their best.

## TYPICAL BENEFITS

- Fast and accurate touchscreen response
- Enables multi-touch displays
- Protects from condensation in humid environments
- Reduces reflections and enhances readability in bright light



- 1 Marine navigation, sonar and instrumentation displays
- 2 Mobile phones, tablets and eBook readers
- 3 Digital signage and large screen displays



# Optical Bonding for Marine and Defense Applications

In marine and defense applications, displays are often subjected to extreme conditions that could cause standard displays to fail. From exposure to moisture and chemicals to readability in bright light to scratch resistance and thermal protection, Momentive's InvisiSil® Optical Bonding silicones offer the flexibility and sealing capability required to help keep displays working under the toughest conditions around. They can bond a wide range of overlays to help provide rugged, weather-resistant displays for industrial, and military applications. And with Momentive's wide range of optical bonding silicones there's a solution to fit almost any existing assembly process. When displays have to function no matter the conditions, count on Momentive's Optical Bonding silicones to deliver.



- 1 Ruggedized tablets and wearable displays
- 2 Marine-grade displays and instruments
- 3 Law enforcement and military grade computers

# Product Highlights and Specifications

## InvisiSil\* UV Cure Silicones

One-part silicones that cure rapidly with UV light to help decrease cycle times in bonding operations. They remain flexible after curing to help protect against thermal shock and impact. They feature high light transmittance and reduced surface glare that can result in displays and touch-screen units that are more easily readable in sunlight or bright indoor light. InvisiSil UV Cure silicones are ideal for bonding outers layers to touch sensors in LCD touchscreen displays.

### KEY FEATURES

Cures with longer wavelengths than other UV Cure silicones ( $\geq 365\text{nm}$ )

Strong adhesion to polycarbonate, PMMA and others

Optically clear with a refractive index of 1.4

Non-yellowing

### TYPICAL APPLICATIONS

Bonding outer layers with touch sensors in touch screen assemblies

### PRODUCTS

OP2131SD

OP2831D(DAM)

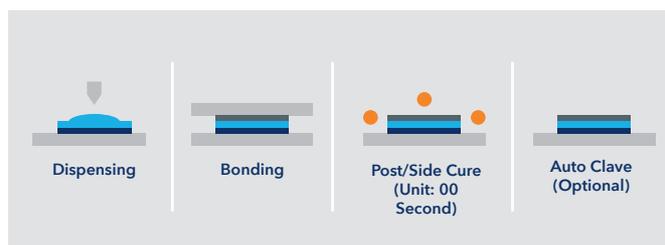
## PRODUCT SPECIFICATIONS

		OP2131SD
<b>Uncured Properties</b> (Cure-type)		1P UV
Appearance		Transparent
Mix Ratio by weight/volume		1:1
Percent transmittance (1mm thickness 400nm) %		>99
Percent transmittance (1mm thickness 800nm) %		>99
<b>Cured Properties</b> (Cure condition *1)		3000 mJ/cm <sup>2</sup>
Viscosity	mPa.s	2,300
Adhesion	(MPa)*2	0.3
Hardness	Shore	7 (E)
Transmittance (%) *3	400nm	>99
	800nm	>99
Color coordinate (D65)	L*	99.89
	a*	-0.14
	b*	0.08
Haze (%)		0.2

Product Specifications are average data and are not to be used as or to develop specifications.

\*1 Metal halide/Oven  
\*2 GL-GL 100um thickness  
\*3 1mm thickness

## PROCESS





## InvisiSil<sup>®</sup> Thermal Cure Silicones

Two-part, transparent gels that can cure with low heat—as low as 60°C (140°F)—in as little as 30 minutes even in shadowed areas. High elongation properties allow them to be stretched and pulled yet retain their shape and resist tearing. With excellent optical properties that help provide high light transmission, InvisiSil Thermal Cure silicones can help protect displays and touch screens from moisture and chemical agents in harsh environments while preserving clarity.

### KEY FEATURES

High elongation

Low shrinkage

Excellent adhesion

30 minute cure capability at 60°C (140°F)

Optically clear with a refractive index of 1.4

Non-yellowing

### TYPICAL APPLICATIONS

High performance sealing for electronic equipment

### PRODUCTS

OP1112

OP1012

OP2012S/L

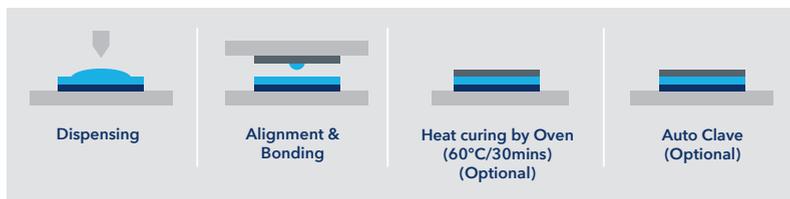
OP1912(DAM)

### PRODUCT SPECIFICATIONS

		OP2012S	OP2012L	OP1012	OP1112
<b>Uncured Properties</b> (Cure-type)		2P Thermal	2P Thermal	2P Thermal	2P Thermal
Appearance		Transparent	Transparent	Transparent	Transparent
Mix Ratio by weight/volume		1:1	1:1	1:1	1:1
Percent transmittance (1mm thickness 400nm) %		>99	>99	>99	>99
Percent transmittance (1mm thickness 800nm) %		>99	>99	>99	>99
<b>Cured Properties</b> (Cure condition *1)		60°C 30min	60°C 30min	60°C 30min	60°C 30min
Viscosity	mPa.s	800	100	800	3,000
Adhesion	(MPa)*2	0.4	0.4	0.2	0.3
Hardness	Shore	25(E)	5(E)	Gel	Gel
Transmittance (%) *3	400nm	>99	>99	>99	>99
	800nm	>99	>99	>99	>99
Color coordinate (D65)	L*	99.83	99.80	99.96	99.96
	a*	0.18	0.10	-0.16	0.01
	b*	0.02	0.01	0.01	0.00
Haze (%)		0.05	0.05	0.01	0.13

Product Specifications are average data and are not to be used as or to develop specifications.

### PROCESS



### INJECTION





## InvisiSil\* Snap Cure Silicones

Two-part, fast-curing silicones that can cure within 10 to 30 minutes at room temperature. Non-yellowing with shadow curability. Can be reworked for up to two days. Ideal for rapid curing without heat to help mitigate CTE mismatch. Typical shrinkage of less than 0.5% during cure, helps to reduce the chance of warpage and mura defects when used for thin film transistor (TFT) LCD panels. Offers excellent design flexibility and long-term reliability under harsh conditions.

### KEY FEATURES

- Repairable
- Cures in shadow areas
- Room temperature cure
- Excellent leveling ability
- Optically clear with a refractive index of 1.4
- Non-yellowing

### TYPICAL APPLICATIONS

- Automotive navigation screens
- Curved design lamination

### PRODUCTS

- SN1001
- SN3001

## PRODUCT SPECIFICATIONS

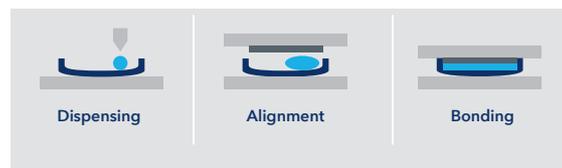
		SN3001	SN1001
<b>Uncured Properties</b> (Cure-type)		2P Snap cure	2P Snap cure
Appearance		Transparent	Transparent
Mix Ratio by weight/volume		1:1	1:1
Percent transmittance (1mm thickness 400nm) %		>99	>99
Percent transmittance (1mm thickness 800nm) %		>99	>99
<b>Cured Properties</b> (Cure condition *1)		Tack-free time 23°C x 30min Full adhesion 2 days	Tack-free time 23°C x 10min Full adhesion 2 days
Viscosity	mPa.s	1,000	1,000
Adhesion	(MPa)*2	0.6	0.6
Hardness	Shore	Gel	Gel
	Transmittance (%) *3		
Color coordinate (D65)	400nm	>99	>99
	800nm	>99	>99
	L*	99.88	99.88
Haze (%)	a*	-0.15	-0.15
	b*	0.05	0.05
		0.05	0.05

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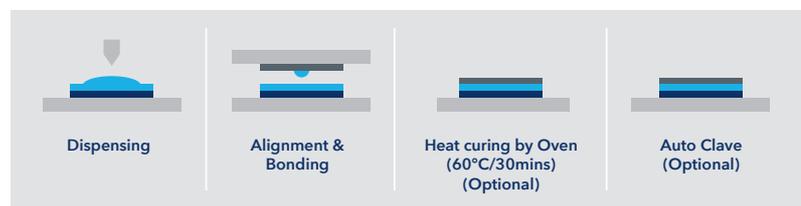
\*1 Metal halide/Oven  
\*2 GL-GL 100um thickness  
\*3 1mm thickness

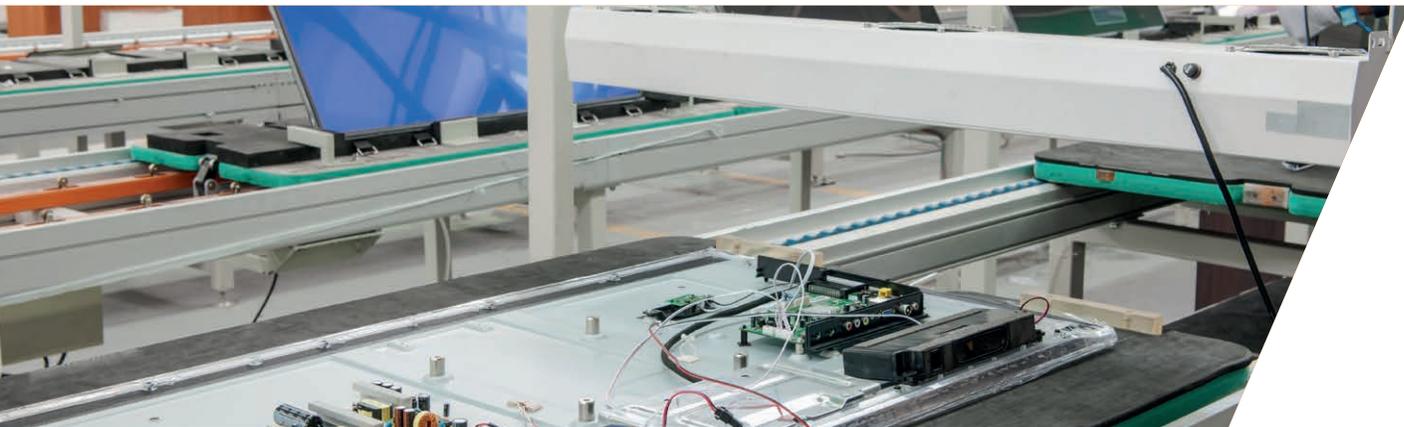
## PROCESS

### Flat to Curved



### Flat to Flat





## InvisiSil\* UV Delay Cure Silicones

Two-part silicone adhesives that activate with UV light. Delayed curing can allow two shadow areas where UV light cannot reach to be adhered or enables component alignment prior to final curing. Curing delay times can be controlled with UV intensity and/or duration. Final curing can be rapidly achieved with heat or more slowly attained at room temperature.

### KEY FEATURES

- UV curing of shadow parts
- Delayed curing enables component alignment
- Adjustable curing time
- Optically clear with a refractive index of 1.4
- Non-yellowing

### TYPICAL APPLICATIONS

- Bonding non-light transmitting components
- Assemblies that require alignment of components before final cure

### PRODUCTS

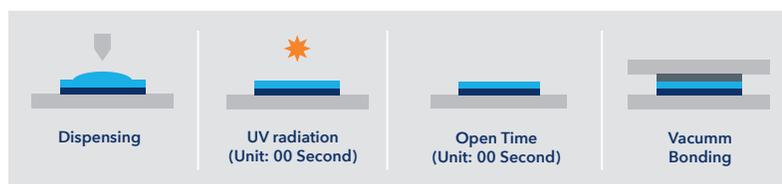
UV Gel100

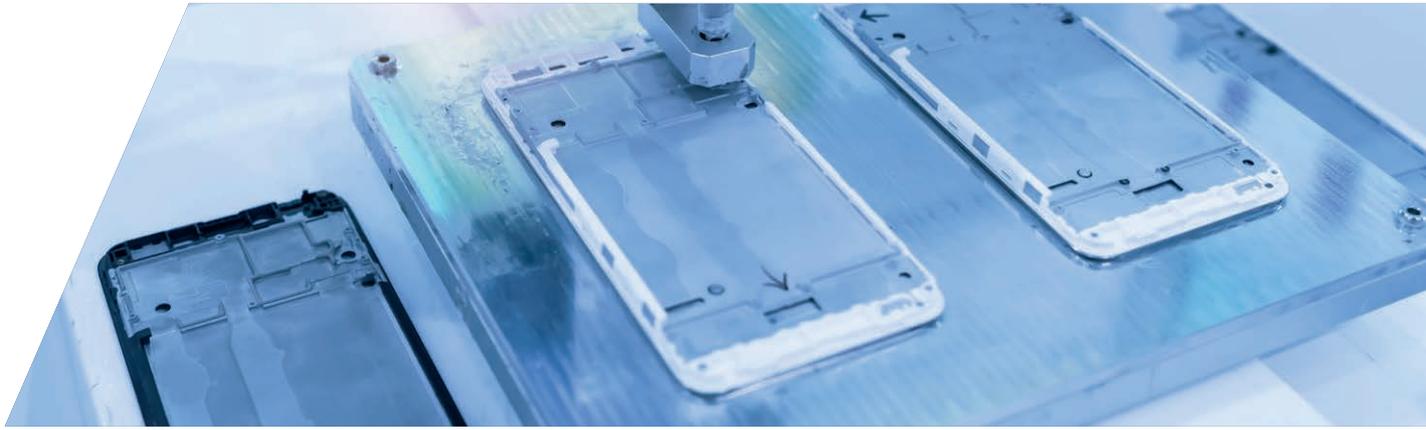
## PRODUCT SPECIFICATIONS

		UV Gel100
<b>Uncured Properties</b> (Cure-type)		2P UV delay cure
Appearance		Transparent
Mix Ratio by weight/volume		10:1
Percent transmittance (1mm thickness 400nm) %		>99
Percent transmittance (1mm thickness 800nm) %		>99
<b>Cured Properties</b> (Cure condition *1)		(30 minutes after radiation with 1200mJ/cm <sup>2</sup> UVA and UVB light) 2)
Viscosity	mPa.s	1,000
Adhesion	(MPa)*2	0.3
Hardness	Penetration (0.1 mm Hollow cone 62.5 g; reading 5 sec)	120
Volume resistivity, ohm.cm		3x10 <sup>14</sup>
Dielectric strength kV/mm		34
Dielectric constant (50 Hz)		2.9

Product Specifications are average data and are not to be used as or to develop specifications.

## PROCESS





## InvisiSil\* Silicones for dam and fill applications

One-part and two-part silicones that offer the high dimensional stability, strong sealing and adhesive grip typically required to create the border in dam and fill operations. InvisiSil dam and fill silicones cure quickly with heat and adhere well to a variety of substrates. They can be filled with any other InvisiSil product.

### KEY FEATURES

- High dimensional stability
- Strong sealing and gasketing
- Strong adhesion to most substrates without primer
- Compatible with other InvisiSil Silicones to fill the dam

### PRODUCT SPECIFICATIONS

		OP1912	OP1922-B	OP2831D	TN8000
Function		Dam	Dam	Dam	Sealing
Uncured Properties (Cure-type)		2P Thermal	2Part UV-Pt	1Part UV cure	1Part Condensation
Appearance		Translucent	Black	Translucent	Black, White, Gray
Mix Ratio by weight/volume		1:1	1:1	1	1
Cured Properties (Cure condition *1)		60°C 30min	4000 mJ/cm <sup>2</sup>	3000 mJ/cm <sup>2</sup>	23°C/7days
Viscosity	Pa.s	98	66	35	Non Flowable
Hardness	Shore	Gel (Penetration 57)	Gel (Penetration 45)	E13	A33

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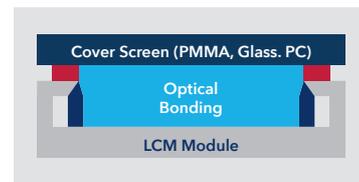
### TYPICAL APPLICATIONS

Dam and fill assembly and encapsulation of electronic components and modules

### PRODUCTS

- OP1912
- OP1922-B
- OP2831D
- TN8000

### PROCESS





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