Low Temperature Sealing Glass 1

Low temperature sealing glass is a composite material made by blending matrix powder glass with a low softening temperature and specially synthesized ceramic filler powder. The sealing temperature and coefficient of thermal expansion (CTE) of sealing glass can be adjusted by changing the kind and blending ratio of the glass and filler.

LS-2010 is widely used for DIP and QFP made of alumina (CTE: approximately 70 × 10^{-7}/K).

LS-1401S's low sealing temperature of 380˚C makes it suitable for SMD packages for quartz oscillators.

LS-3051S is used for sealing low-expansion ceramics such as AIN (CTE: approximately 45 × 10^{-7}/K).

LS-1301 and BF-0901 are suitable for sealing silicon (CTE: approximately 35 × 10^{-7}/K).

Properties

Usage			Alumina		AIN, Mullite, Silicon		
Properties/Glass Code			**LS-1401S**	**LS-2010**	**LS-3051S**	**LS-1301**	**BF-0901**
Sealing temperature		˚C	380	435	430	450	560
Dielectric constant	1MHz, 25˚C		45.0	12.5	16	45.5	11.1
tan δ	1MHz, 25˚C	$\times 10^{-4}$	38	34	41	60	19
Coefficient of thermal expansion	30-250˚C	$\times 10^{-7}$/K	71*1	65	51	41	49*2
Transformation point		˚C	258	313	303	315	430
Softening point		˚C	355	400	390	390	528
Density		$\times 10^{3}$kg/m^{3}	7.02	5.67	5.95	6.77	4.69
Volume resistivity Log ρ	150˚C	Ω·cm	6.2	12.4	12.7	12.0	13.3
Thermal conductivity		W/m·K	0.98	1.45	1.24	0.84	1.47
Specific heat		$\times 10^{3}$J/kg·K	0.34	0.41	0.38	0.35	0.46
Acid durability	20% H_2SO_4, 70˚C, 1min	mg/cm^2	—	0.8	1.1	0.1	—
	10% H_2SO_4, 20˚C, 10min	mg/cm^2	—	0.5	0.9	0.1	—
	10% HCl, 20˚C, 10min	mg/cm^2	—	1.9	2.7	0.5	—
	10% HNO_3, 20˚C, 10min	mg/cm^2	—	120	120	123	—
Color			Black	Dark brown	Black	Black	Green
Glass type			$PbO \cdot B_2O_3$(COM)*3				$Bi_2O_3 \cdot B_2O_3$ (COM)*3

*1 This figure was measured at 30 to 200˚C.
*2 This figure was measured at 30 to 300˚C.
*3 COM: Composite sealing glass
Please contact us about other types of Pb-free glass.

Application Examples

1. Printing and Drying (except LS-1401S)

The paste for printing is prepared by adding vehicle to the powder glass and mixing them well.

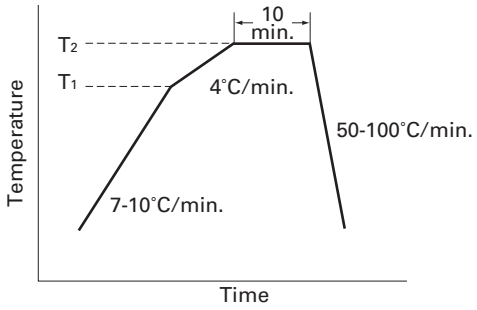
The vehicle is obtained by dissolving a low molecular weight acrylic resin in terpineol at a concentration of 5%. The paste obtained is printed on ceramic parts with an 80-100 mesh stainless screen. Printing and drying are repeated in order to increase the glass thickness of the film layer.

Drying is carried out at 120°C for 10-20 minutes.

2. Pre-firing

In order to eliminate the resin in the film layer pre-firing is done in an oxidizing atmosphere such as oxygen or air. Decomposition and firing of the resin takes place most actively at 320-380°C, so gradual heating is necessary in this temperature range.

Sintering of the powder glass is also carried out.



Glass Code	T_1 (°C)	T_2 (°C)
LS-1401S	250	350
LS-2010	320	390
LS-3051S	310	380
LS-1301	310	400
BF-0901	350	530

Fig. 1 Pre-firing profile

3. Lead-Frame Attaching

Lead-frame attaching is carried out in the air, and maintain the attaching temperature (T) for 5 to 7 minutes. When a heater block is used, the surface temperature of the block is kept higher than the attaching temperature by 30-50°C. Soak time is 1 to 2 minutes.

Glass Code	T (°C)
LS-2010	435
LS-3051S	430
LS-1301	450

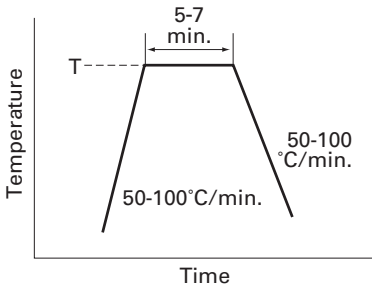


Fig. 2 L/A profile

4. Sealing

Sealing is carried out in either an air or a nitrogen atmosphere. Soak time is approximately 10 minutes and temperature is the same as lead-frame attaching temperature. Heating up rate is 50 to 100°C/min. and cool down rate is 20 to 40°C/min.

Low Temperature Sealing Glass 2

Low temperature sealing glass is a composite material made by blending matrix powder glass with a low softening temperature and specially synthesized ceramic filler powder. By changing the blending ratio and the kinds of glass and ceramics used, it is possible to change its sealing temperature and coefficient of thermal expansion.

- Composite sealing glass has a short sealing time and excellent ability to seal glass and metal.
- Devitrifiable glass can be re-fired without deformation.
- When a devitrifiable glass is heated, crystals form in the resulting melt, which then solidifies to produce a highly heat-resistant seal.

Properties

Properties/Glass Code			LS-3075	LS-3081	LS-0118	LS-0206	LS-7105	BF-0606
Sealing temperature		°C	450	410	430	450	450	485
Coefficient of thermal expansion	30-250°C	$\times 10^{-7}$/K	36.5	74	72.5	72	85*1	73*1
Density		$\times 10^{3}$kg/m^{3}	6.91	6.89	7.05	6.82	6.37	6.05
Transformation point		°C	300	300	317	325	—	365
Deformation point		°C	330	320	337	353	—	393
Softening point		°C	—	365	390	410	400	450
Volume resistivity Log ρ	150°C	Ω·cm	10.8	12.2	11.2	13.2	10.4	12.0
Color			Black	Black	Black	Black	Black	Green
Glass type			$PbO \cdot B_2O_3$ (COM)*2	$PbO \cdot B_2O_3$ (COM)*2			$PbO \cdot ZnO \cdot B_2O_3$ (DEV)*3	$Bi_2O_3 \cdot B_2O_3$ (COM)*2
Application			Alkali-free glass	Window glass, 50 Alloy, 426 Alloy				

* 1 This figure was measured at 30 to 300°C.
* 2 COM : Composite sealing glass
* 3 DEV : Devitrifiable sealing glass

Please contact us about other types of Pb-free glass.

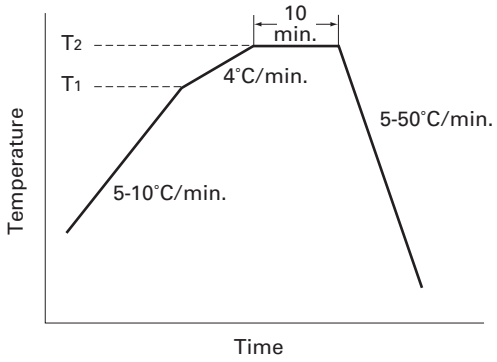
Application Examples

1. Printing and Drying

The paste for printing is prepared by adding a vehicle to the sealant and mixing them well. The vehicle is obtained by dissolving acrylic resin in terpineol at a concentration of 5%. The paste obtained is printed on the substrates with 80-100 mesh stainless screen. Drying is carried out at 120°C for 10-20 minutes.

2. Pre-firing

In order to eliminate the resin in the film layers, pre-firing is done in an oxidizing atmosphere such as oxygen or air. Decomposition and firing of resin take place most actively at 320-380°C, so gradual heating is necessary in this temperature range.

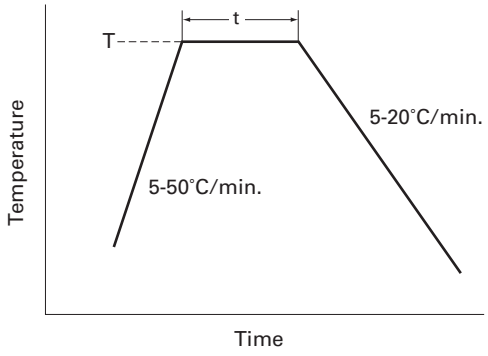


Glass Code	T_1 (°C)	T_2 (°C)
LS-3075	320	380
BF-0606	350	450
LS-3081	320	380
LS-0118	320	380
LS-0206	320	400
LS-7105	320	390

Fig. 1 Pre-firing profile

3. Sealing

Sealing is carried out in either an air or a nitrogen atmosphere.



Glass Code	T (°C)	t (min.)
LS-3075	450	10
BF-0606	485	10
LS-3081	410	10
LS-0118	430	10
LS-0206	450	15
LS-7105	450	20

Fig. 2 Sealing profile