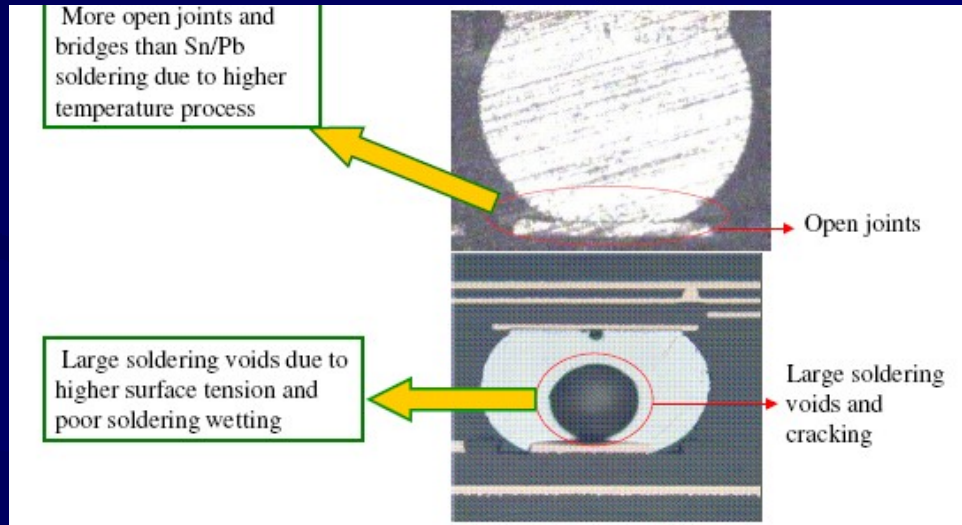


# *Reains Underfilm*

# *Introduction*

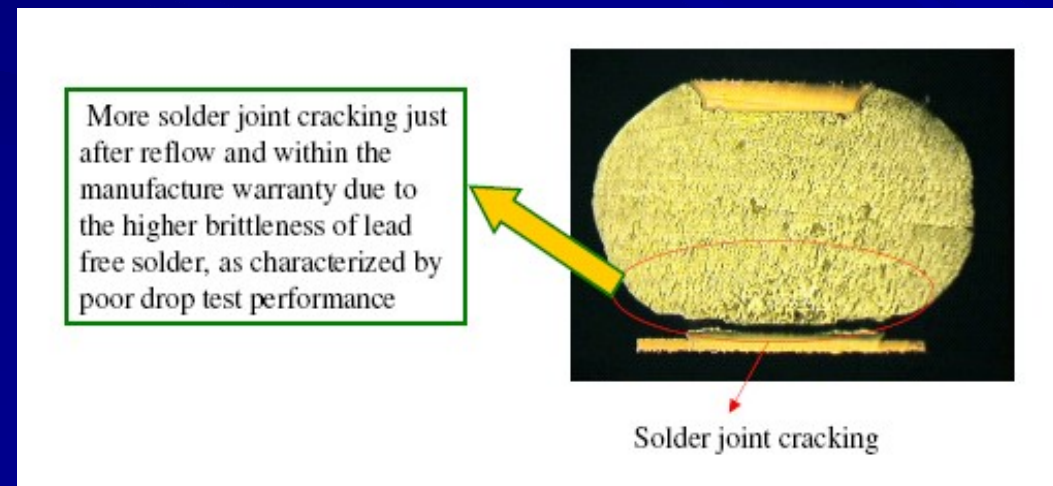
MPM

# Why Underfill/Underfilm



Solder joint  
Cracking due to  
Pb-free solder application

Must apply underfill or  
underfill film to enhance  
the solder reliabilities



# Thermal Bond UF Advantage

- Efficiency Application

1. Reflowable thermal bonding film are easily chip on the circuit board use standard SMT machine and reflow profile, No extra space, equipment and manpower required.
2. Improve productivity and lower misplacement.
3. Lower melting temperature and fast rework process on failure PCB, 100% repair yield with no residua left and **Zero** scrap during rework.
4. Better capillary and wetting performance under the BGA/POP.
5. Applied selectively only on where they are needed.

- Quality

1. High strength for lead free solder joint enhancement and passed reliability testing in mobile phone manufacturing 7 years.

# Thermal Bond UF Advantage

- Cost
  1. Medium level component and low operation cost.
  2. No extra equipment, space and manpower investment, High efficiency SMT process makes low conversion cost for manufacturing.
  3. 100% rework and **Zero** scrap during rework make the lowest scrap cost.
  4. Better capillary and wetting performance under the BGA/POP.
- Storage

Long shelf life for room temperature storage.
- Shipment

Over 900 million components be applied in the past 8 years.

# Thermal Bond UF Disadvantage

- Limited volume of adhesive

Narrow edge of NSP or POP cause less capillary of underfilm adhesive. Require different shape, length and thickness underfilm be mounted to ensure the strength.

- Material handling

Small piece of underfilm increasing difficulties and cost on product manufacturing and application, Compatible choice of underfilm material

# Functionality Comparison

Performance	WL-underfill	Capillary-underfill	No-flow underfill	Corner bond	Underfilm
Solder voids	Yes	Yes	Yes	Yes	Less
Solder open	Yes	Yes	Yes	Yes	Less
Joint crack	Yes	Yes	Yes	Yes	Yes
Pull strength	Good	Good	Good	Good	Good
Process compability	Difficult	More steps	Difficult	Okay	Good
Process Yield	Low	Okay	Low	Low	High
Reworkability	Difficult	Difficult	Difficult	Difficult	Easy
Drop Performance	Excellent	Excellent	Excellent	Excellent	Excellent
Thermal cycling performance	800-900	800	2000	400-600	over 1000
Operation Cost	High	High	High	High	Low

# Cost Analysis

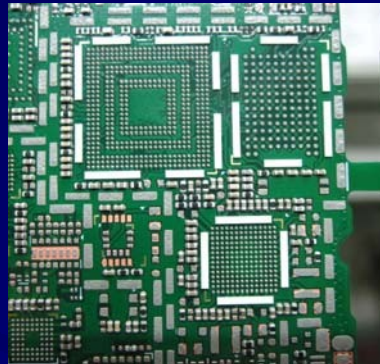
Underfill		Remark	Underfilm		Remark	
Raw Material	0.0844	Dispenser usage 800pcs/30ml underfill	Raw Material	0.150	Average 6 pcs apply qty per BGA	
Equipment and Facility	Dispenser	0.0305	Machine investment/years/day s/capacity	Chip mounter and reflow oven	0.002	Machine investment/years/days/capaci ty/part count*usage
	Oven	0.0114	Machine investment/years/day s/capacity	Facility	0.007	Facility rent/capacity/part count*usage
	Facility	0.0857	Facility daily rent cost/capacity			
Conversion Cost	Labor Cost	0.2571	Daily labour*headcount/dail y capacity	Labor Cost	0.000	usage*operator salary*operator number/capacity/part count
	Electrial Power	0.0048	Daily power usage/capacity	Electrial Power	0.005	usage*power cost/capacity/part count
Rework Cost	IC Rework	0.0225	Rework rate*rework cost/hourly rework qty	IC Rework	0.014	Rework rate*rework cost/hourly rework qty
	PCB Scrp	0.1200	Scrap rate*PCB & material cost	PCB Scrp	0.040	Scrap rate*PCB & material cost
Sub-Total (US\$)		0.6165	Sub-Total (US\$)		0.2183	



# Underfilm Application Process



PCB Printing



Film Placement



BGA Placement

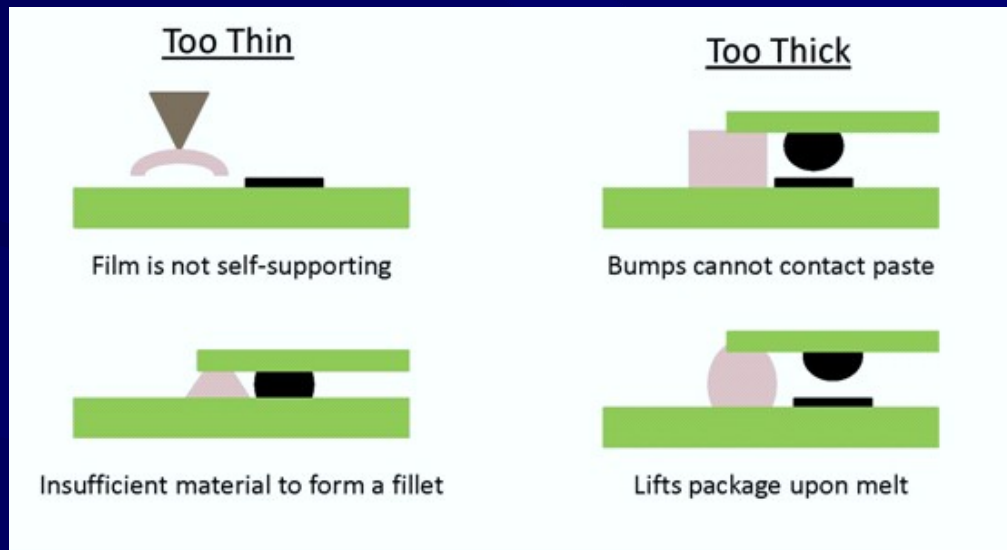


Reflow

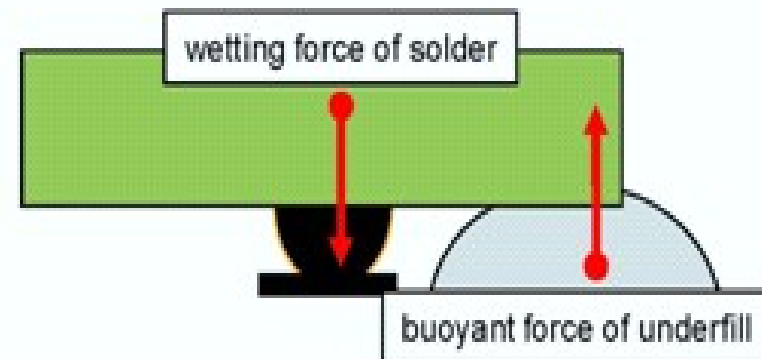
- Finish reflow soldering and curing at the same time
- No need of additional process, H/C and equipment
- Simple to balance cycle time



# Underfilm Application Issues

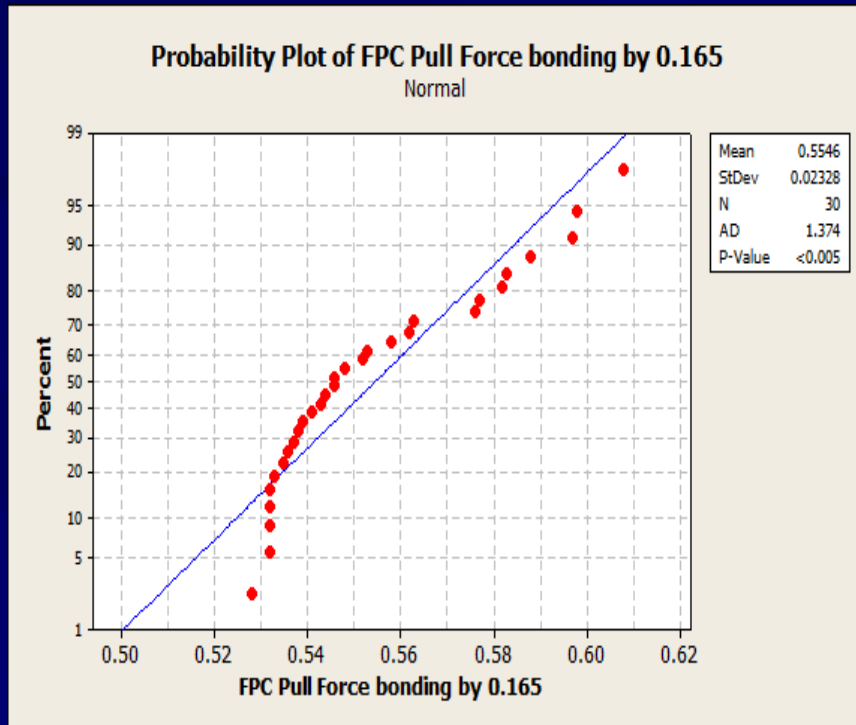


Raw material thickness control

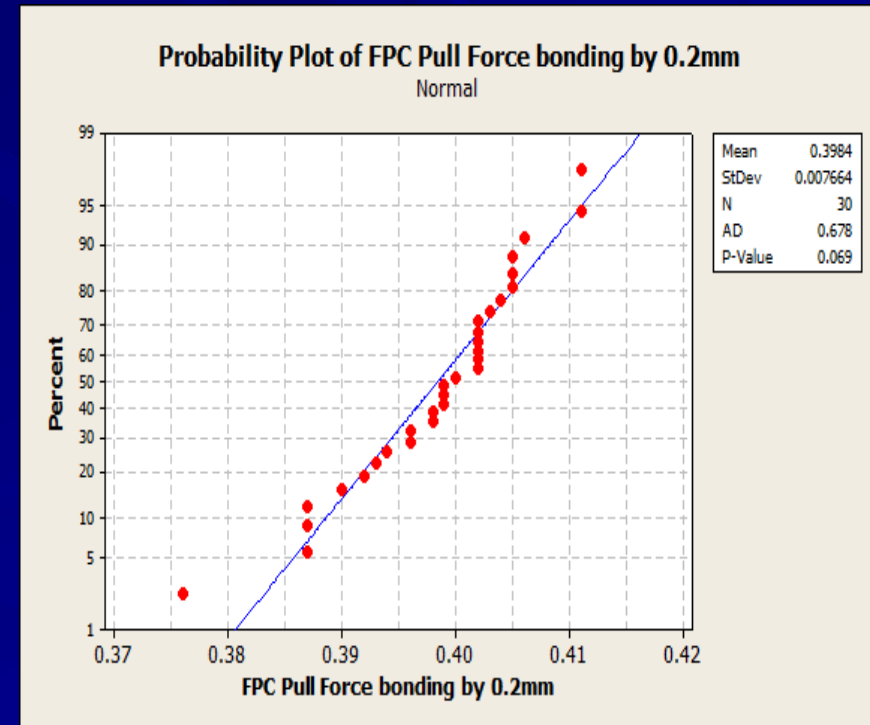


Solder wetting force > Upward force of film

# Underfilm Pull Force Testing



3x0.5x0.165mm  
Underfilm pull force



3x0.5x0.21mm  
Underfilm pull force

# Thermal Bond UF Application

- **Smart phones**  
Memory and Processor solder joint strength enhancement
- **Tablet PC**  
Memory and Processor solder joint strength enhancement
- **Digital Imager**  
Imager Chip Soldering and Assembly strength enhancement
- **Other Applications**

# Reains UF Dimension

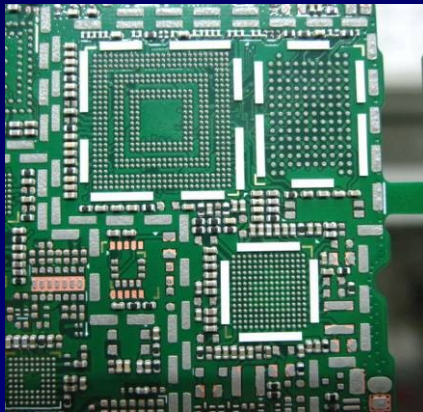
Reains White I Underfilm Dimension								
Reains Part Number	Raw material Thickness	T=Thickness mm	Thickness tolerance mm	W=Width mm	Width tolerance mm	L=Length mm	Length tolerance mm	Carrier Tape Packaging Per EIA 481D width and pitch
RE-123718-01	10 mils	0.254	±0.025	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-02	9 mils	0.229	±0.025	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-03	8 mils	0.205	±0.025	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-04	8 mils	0.205	±0.025	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-05	6.5 mils	0.165	±0.025	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-06	6.5 mils	0.165	±0.025	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-07	16 mils	0.406	±0.025	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-08	18 mils	0.457	±0.025	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-09	20 mils	0.508	±0.025	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-10	20 mils	0.508	±0.025	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-11	12 mils	0.305	±0.025	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-12	12 mils	0.305	±0.025	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-13	6.5 mils	0.165	±0.025	1.000	±0.051	5.000	±0.178	12mmx4mm
RE-123718-14	6 mils	0.152	±0.025	0.762	±0.051	3.000	±0.178	8mmx4mm
RE-123718-15	6.5 mils	0.165		0.500		3.000		8mmx4mm
RE-123718-16	6.5 mils	0.165		0.400		4.000		12mmx4mm

# Reains UF Dimension

RE-123718-17	6.5 mils	0.165	±0.025	0.762	±0.051	7.000	±0.178	16mmx4mm
RE-123718-18	6 mils	0.152	±0.025	0.762	±0.051	7.000	±0.178	16mmx4mm
RE-123718-19	5 mils	0.127	±0.013	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-20	5 mils	0.127	±0.013	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-21	6.5 mils	0.165	±0.025	0.500	±0.051	4.000	±0.178	12mmx4mm
RE-123718-22	6.5 mils	0.165	±0.013	0.500	±0.051	5.842	±0.178	12mmx4mm
RE-123718-23	5 mils	0.127	±0.013	0.500	±0.051	5.842	±0.178	12mmx4mm
RE-123718-24	5 mils	0.127	±0.025	0.500	±0.051	4.000	±0.178	12mmx4mm
RE-123718-25	6.5 mils	0.165	±0.013	0.762	±0.051	3.500	±0.178	12mmx4mm
RE-123718-26	4 mils	0.101	±0.013	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-27	4 mils	0.101	±0.013	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-28	4 mils	0.101	±0.013	0.500	±0.051	5.842	±0.178	12mmx4mm
RE-123718-29	4 mils	0.101	±0.013	0.500	±0.051	4.000	±0.178	12mmx4mm
RE-123718-30	4 mils	0.101	±0.013	0.500	±0.051	3.000	±0.178	8mmx4mm
RE-123718-31	3 mils	0.080	±0.013	0.762	±0.051	5.842	±0.178	12mmx4mm
RE-123718-32	3 mils	0.080	±0.013	0.762	±0.051	4.000	±0.178	12mmx4mm
RE-123718-33	3 mils	0.080	±0.013	0.500	±0.051	5.842	±0.178	12mmx4mm
RE-123718-34	3 mils	0.080	±0.013	0.500	±0.051	4.000	±0.178	12mmx4mm
RE-123718-35	3 mils	0.080		0.500		3.000		8mmx4mm
RE-123718-36	5 mils	0.127		0.500		3.000		8mmx4mm

# UF Application In Mobile phone

Over 900 million underfilm be applied into a famous brand mobile phone from Year 2004, The usage was from 4 to 22pcs per Phone. Peak demand was 350M in Y2008.



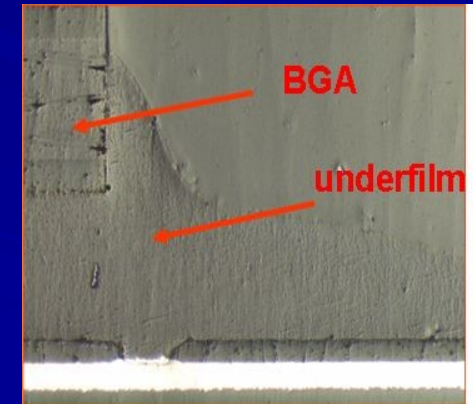
Chip UF On Board



BGA/POP Placement



After Reflow



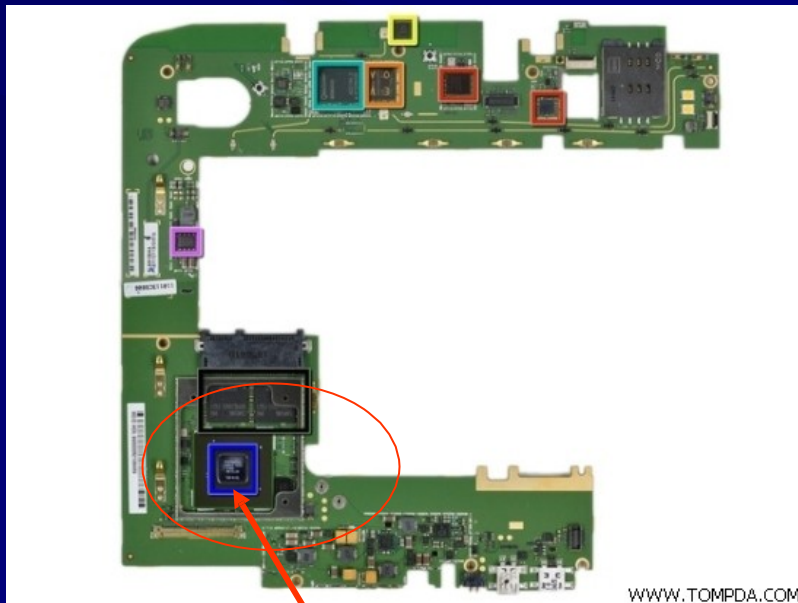
Cross section testing



# Application In The Latest Product

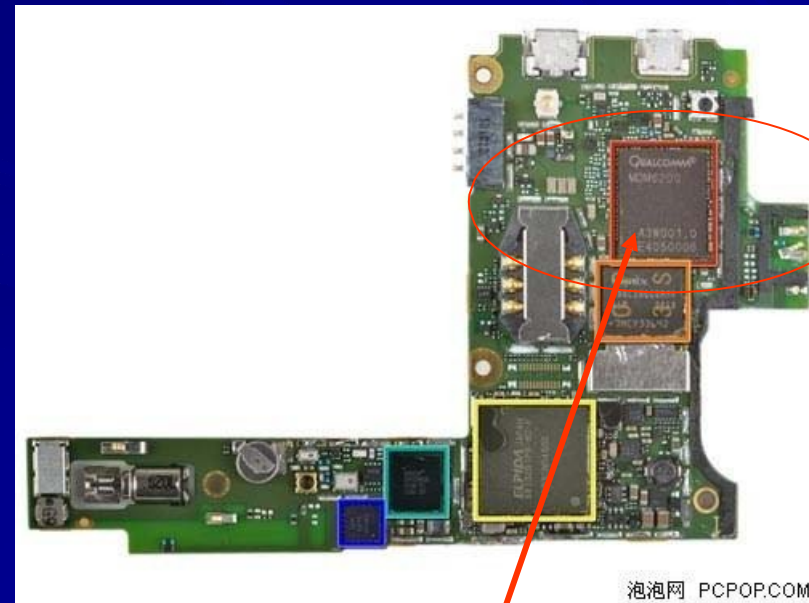
## Customer Application

- Delivered 5 size over 120M Underfilms to customer in the past 2.5 years.



6pcs Underfilm Be chipped under The Dual-core BGA Confidential

7/27/2013

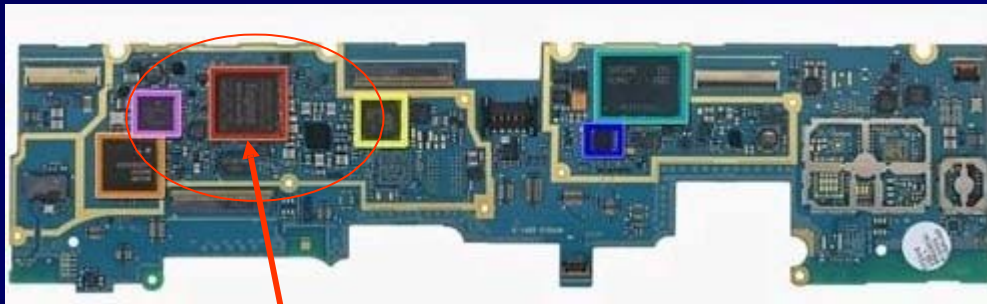


4pcs Underfilm be chipped Under the Qualcomm BGA

15



# UF Application In Tablet PC

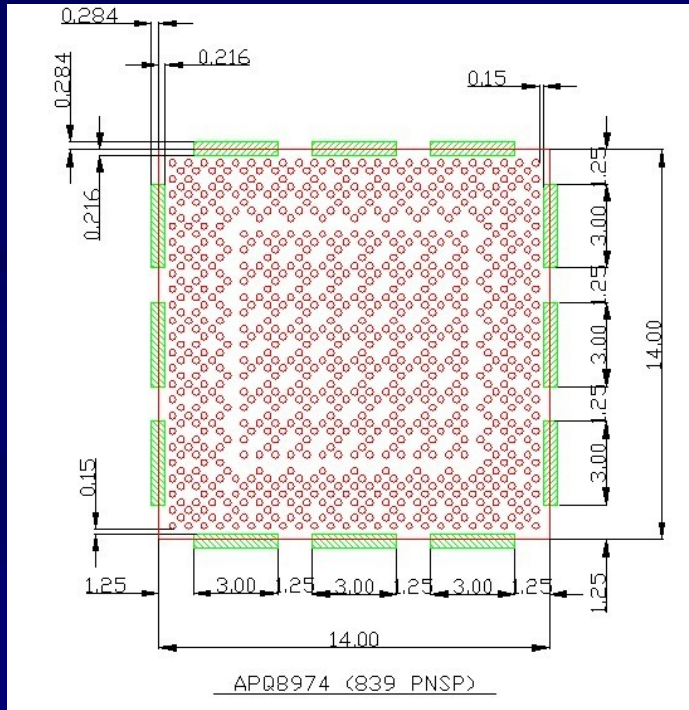


**16pcs Underfilm be chipped under the BGA in a 10.1 inches Tablet PC**

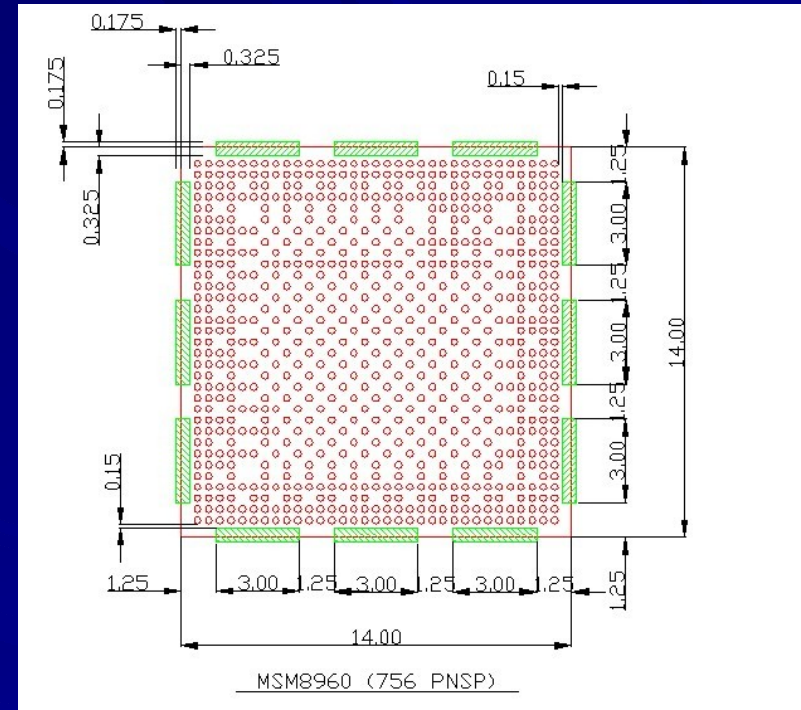


**1pcs Underfilm be used for battery flex board bonding in a 7.9 inches pad product**

# UF Application In Smart Phone

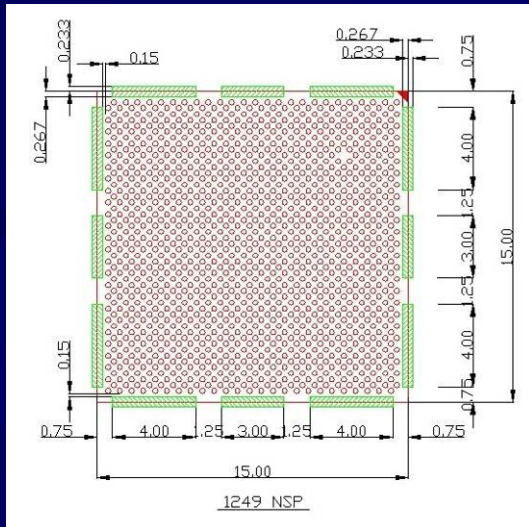


3x0.4x0.15mm UF apply On  
Qualcomm APQ8974(839 PNSS)

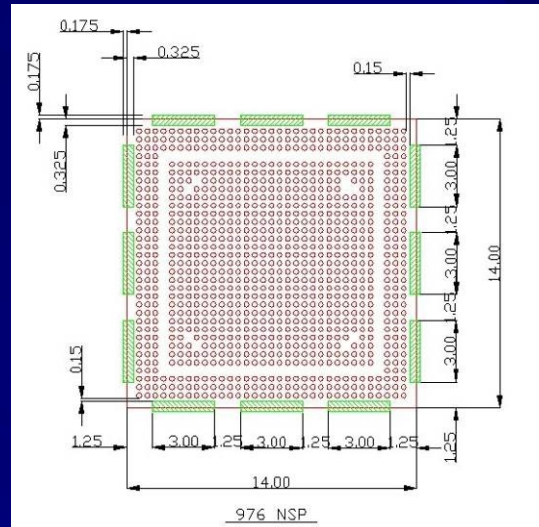


3x0.4x0.15mm UF apply On  
Qualcomm MSM8960(756 PNSS)

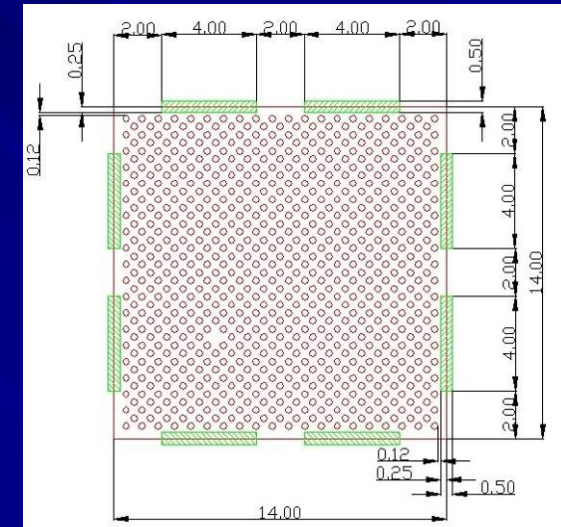
# UF Application In Smart Phone



3x0.4x0.15mm UF apply  
On Qualcomm 1249NSP

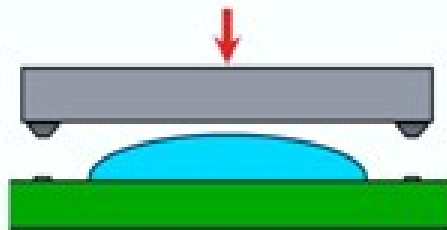


3x0.4x0.15mm UF apply  
On Qualcomm 976NSP

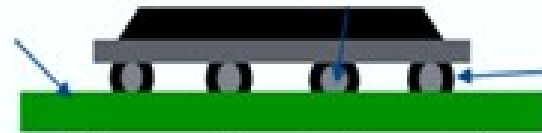


4x0.4x0.125mm UF apply  
On LG FCMB4/POP

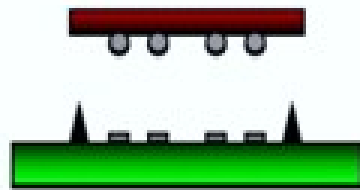
# Competitive Process



No-Flow Underfill



Epoxy Flux (dipped)



Corner Bond



Post-Reflow Edge Bond

# Underfilm Competitor

- Underfill process

Epoxy base underfill manufacture



Henkle (German)– Loctite 3508, 3513, 3563...

Lord (American) – Thermoset ME-531, 532, 541, 542..

Namics (Japan) – LGF6070

Won Chemical (Korea)– WE-1007, 3008



# Issues On Underfill

- Difficultly rework and higher scrap rate.
- Extra equipment, space and manpower.
- Longer curing time and lower productivity.
- PCB require pre-heating.
- Contaminate components next to the underfill parts.
- Short shelf life and refrigeratory storage.
- Wickless underfill cause by the less dispensing under mounted metal shield.

# Reains Underfilm Advantage

- Minimum 0.4mm width for NSP, FBGA and POP application.
- Accuracy film thickness eliminate soldering failure.
- Precision cutting and automatic T & R packaging make no contamination on the underfilm manufacturing.
- Precision dimension perform a lowest drop rate during the SMT production.
- Automatic manufacturing process ensure low product cost to customer.
- Global technical support for customer application.



*Thank you!*