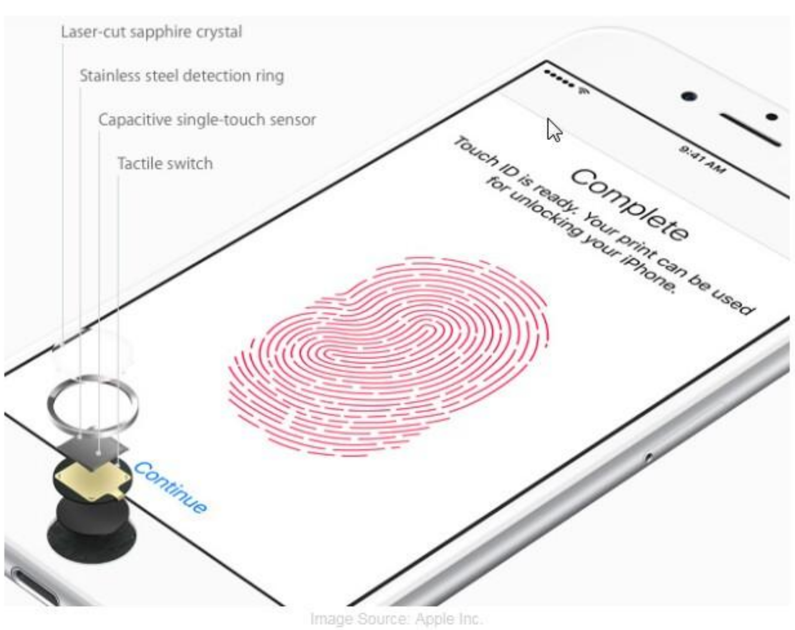
Die Attach Film

for Fingerprint sensor

2018. 02.

[Fingerprint sensor]



Copyright © 2011 by AMC. All rights Reserved

[Type of Fingerprint Identification Devices]

(Source: Fingerprint sensor applications and technologies – Consumer market focus, January 2017, Yole Développement)

Copyright © 2011 by AMC. All rights Reserved

[i-Phone vs Galaxy for Fingerprint sensor]

Fig. 44: 2013 Apple's fingerprint "SiP" vs 2013 Synaptic's fingerprint sensor

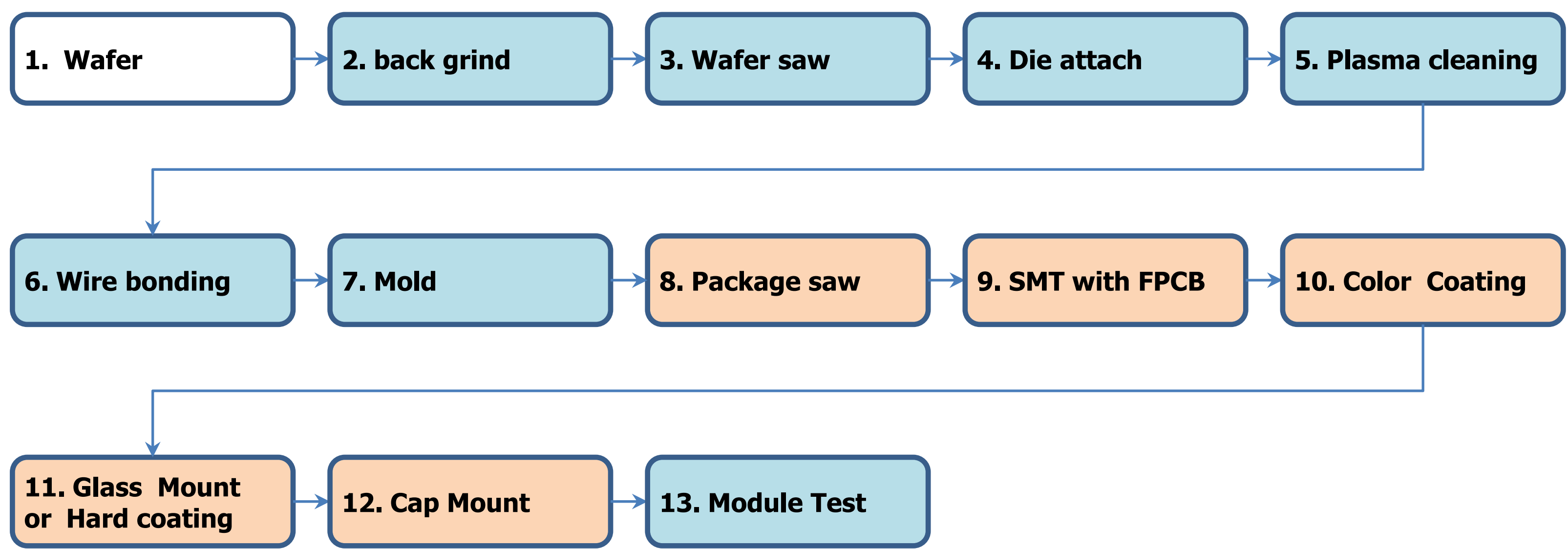
SiP is more area efficient and cost efficient per area

	Authentic fingerprint sensor	Synaptics fingerprint sensor
Technology	Capacitive	Capacitive
Type	Area	Swipe
Cost	Higher (1.5x~2x of Swipe)	Lower
ASP (USD)	8	Less than 5
Die Area	40mm^2	14mm^2
Package Area	121mm^2	52mm^2
Unlock	Touch-based	Swipe-based
Accuracy	High	Low
Speed	Low	High
User-friendly	High	Low
Packaging Technology	SiP from ASE	COF
	Source: iFixit	1 cm
Smartphone representer	iPhone	Samsung Galaxy, HTC One Max
Package area to die area ratio	3x	3.5x~4x
ASP per package area (use SiP as 1x)	1x	0.9x~1.4x

Source: Chipworks, FingerChip, Nomura research

Copyright © 2011 by AMC. All rights Reserved

[The Process of Fingerprint sensor]



1. [white box] means the process is made in Foundry,

2. [blue box] means the process is made in OSAT companies,

3. [orange box] means the process is made in Module companies.

(Source : Nomura Research)

Copyright © 2011 by AMC. All rights Reserved

[Business relationship]

[Fabless Companies]	[Module Companies]	[Packaging Companies]
F P C	O-Film	Signetics
Synaptics	Crucial Tec	Hana Micron
Goodix	Truly	
Egis	PriMax	
	Dream Tec	

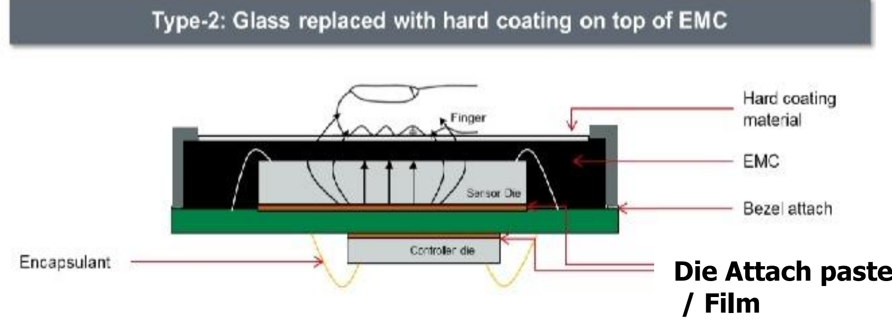
Copyright © 2011 by AMC. All rights Reserved

[Fingerprint sensor assembly]

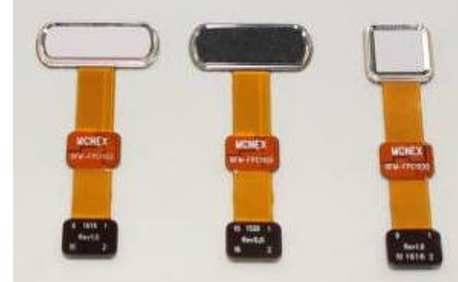
Type-1: Glass attached directly to Sensor die

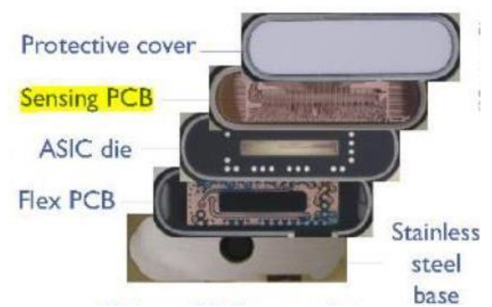
Ring Gap fill
Finger
Glass / Ceramic / Plastic
Encapsulant
Sensor Die
Bezel attach
Encapsulant
Controller die

Die Attach paste / Film



Die Attach paste / Film





Copyright © 2011 by AMC. All rights Reserved

[Protective Cover - Coating Type]

Various coating technologies secured: tempered glass, crystal ceramic, UV

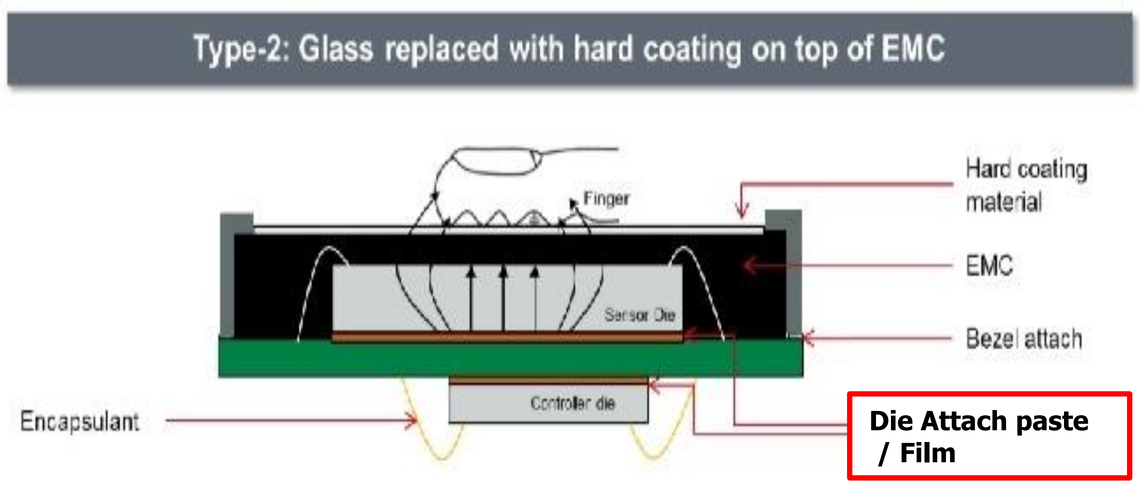
	Sapphire Glass	Tempered Glass	Crystal Ceramic	UV
Shape				
Raw materials	Sapphire Glass	Tempered Glass	Composite Ceramic	Resin
Hardness	★★★	★★★	★★	★☆
Glossy	★★★	★★★	★★☆	★★
Thickness	★ 260㎛	★★ 60~70㎛ (About 1/4 of Sapphire)	★★★ 20~30㎛ (About 1/7 of Sapphire)	★★★ 20~30㎛ (About 1/7 of Sapphire)
Cost	★ About USD1.2 (Based on 260um)	★★☆ About 1/2 of Sapphire	★★★ About 1/4 of Sapphire	★★★ About 1/5 of Sapphire
Characteristic	Only specific IC for thickness issue / Patent issue	Various ICs available in thin thickness	Simple Process	Simple Process
Commercialization	In production (Apple)	2H15	1H15	In production

Copyright © 2011 by AMC. All rights Reserved

Application : Chip to Sub

Copyright © 2011 by AMC. All rights Reserved

[Application : DAF For Fingerprint sensor assembly]



Copyright © 2011 by AMC. All rights reserved

[Normal Process(All-in-One)]

Through DAF application, semiconductor packaging companies can get a 1-step process reducing benefit and overcome the weakness(※) of paste attach process.

Conventional(Paste) Process

Back Grinding
for wafer thinning, thickness control

Dicing(singulation)
for chip size sawing

Use Dicing Tape

Die Attach
for chip bonding to substrate with paste

Use Die Attach Material(Paste)

Final product

Reduce process from 2 steps to 1 step

DAF Process

Back Grinding
for wafer thinning, thickness control

Dicing & Die Attach
for chip size sawing & Die attach with DAF at once

Final product

Use Die Attach Film

※ Die attach paste can flow to the outside of die and contaminate packages.

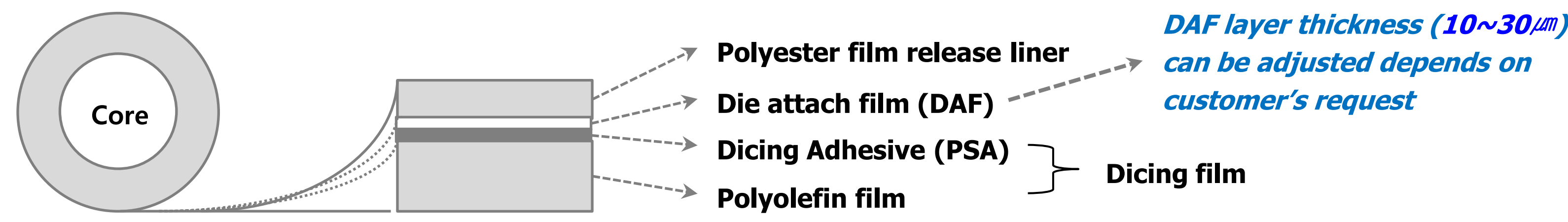
Copyright © 2011 by AMC. All rights Reserved

[Structure & Process(All-in-One)]

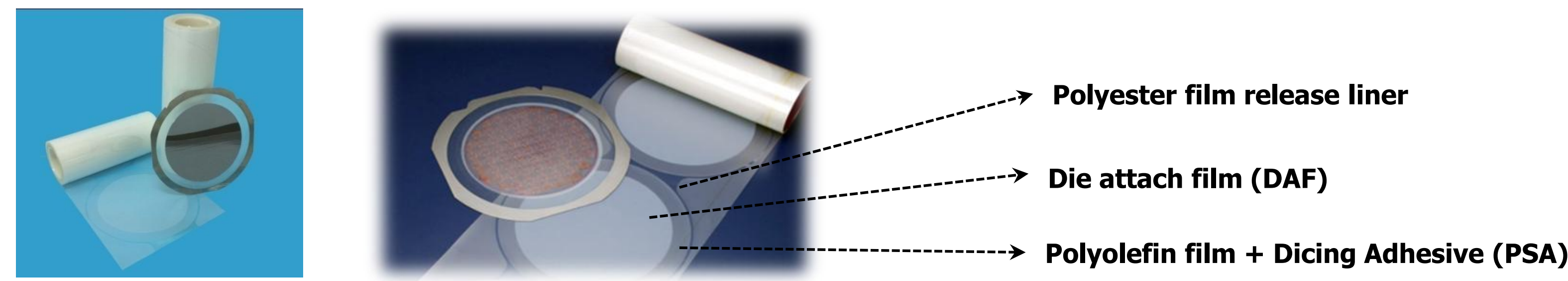
➢ All-in-One type(DAF-Dicing film)

DAF is consist of 4 layers including die attach film(DAF) layer.
And DAF layer has circle shape to fit for ring frame and wafer attachment.

DAF Structure



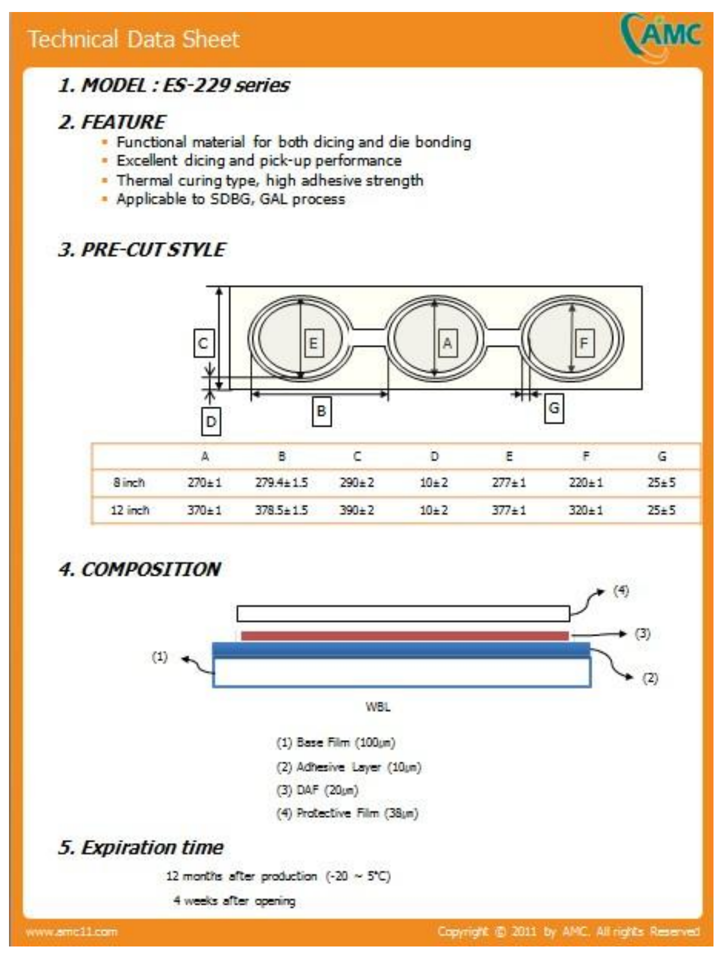
DAF Shape



Copyright © 2011 by AMC. All rights Reserved

[DAF Properties (All-in-One)]

AMC checks and controls other properties even though not included in specification.



Technical Data Sheet

AMC

1. MODEL : ES-229 series

2. FEATURE

- Functional material for both dicing and die bonding
- Excellent dicing and pick-up performance
- Thermal curing type, high adhesive strength
- Applicable to SDBG, GAL process

3. PRE-CUT STYLE

	A	B	C	D	E	F	G
8 inch	270±1	279.4±1.5	290±2	10±2	277±1	220±1	25±5
12 inch	370±1	378.5±1.5	390±2	10±2	377±1	320±1	25±5

4. COMPOSITION

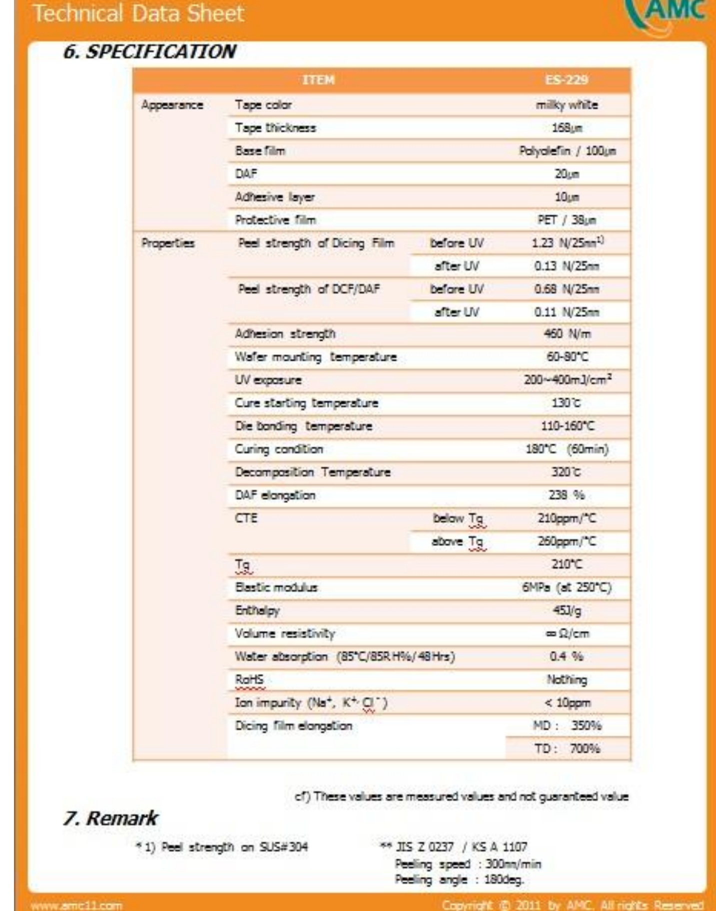
(1) Base Film (100μm)
(2) Adhesive Layer (10μm)
(3) DAF (20μm)
(4) Protective Film (38μm)

5. Expiration time

12 months after production (-20 ~ 5°C)
4 weeks after opening

www.amc11.com

Copyright © 2011 by AMC. All rights Reserved



Technical Data Sheet

AMC

6. SPECIFICATION

ITEM			ES-229
Appearance	Tape color		milky white
	Tape thickness		168μm
	Base film		Polyolefin / 100μm
	DAF		20μm
	Adhesive layer		10μm
	Protective film		PET / 38μm
Properties	Peel strength of Dicing Film	before UV	1.23 N/25mm 1)
		after UV	0.13 N/25mm
	Peel strength of DCF/DAF	before UV	0.68 N/25mm
		after UV	0.11 N/25mm
	Adhesion strength		460 N/m
	Wafer mounting temperature		60-80°C
	UV exposure		200~400mJ/cm²
	Cure starting temperature		130℃
	Die bonding temperature		110-160°C
	Curing condition		180°C (60min)
	Decomposition Temperature		320℃
	DAF elongation		238 %
	CTE	below Tg	210ppm/°C
		above Tg	260ppm/°C
	Tg		210°C
	Elastic modulus		6MPa (at 250°C)
	Enthalpy		45J/g
	Volume resistivity		∞ Ω/cm
	Water absorption (85°C/85R.H%/48Hrs)		0.4 %
	RoHS		Nothing
	Ion impurity (Na^+, K^+, Cl^-)		< 10ppm
	Dicing film elongation		MD : 350%
			TD : 700%

cf) These values are measured values and not guaranteed value

7. Remark

* 1) Peel strength on SUS#304

** JIS Z 0237 / KS A 1107
Peeling speed : 300mm/min
Peeling angle : 180deg.

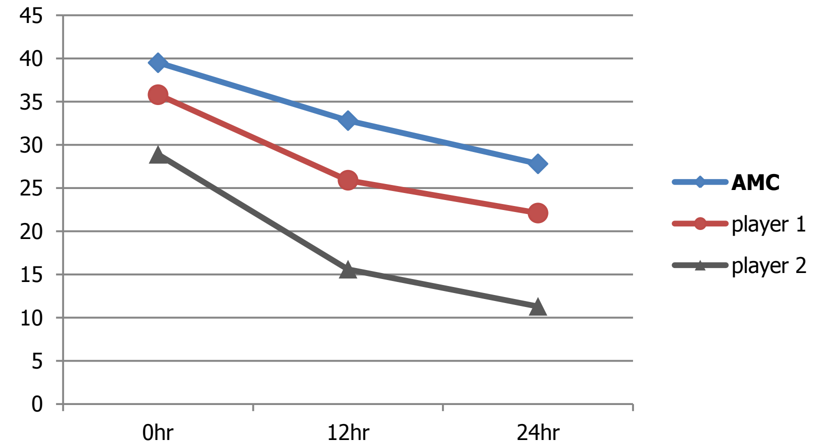
www.amc11.com

Copyright © 2011 by AMC. All rights Reserved

Copyright © 2011 by AMC. All rights Reserved

Compared with other DAF player's Die Shear Strength reliability in harsh condition(MRT(※)),
AMC product shows the best performance.

10㎛ DAF layer Die Shear Strength comparison test



(Unit: MPa)

	ES-229 Series	Player 1	Player 2
0hr	39.5	35.8	28.9
12hr	32.8	25.9	15.6
24hr	27.8	22.1	11.3

(*) Player 1, 2 : Korean major domestic players

(※) MRT : Moisture Resistance Test (85℃, 85% moisture condition during 24hr)

Copyright © 2011 by AMC. All rights Reserved

[Evaluation Results]

Test Product Model

Dummy wafer

Test Parameter

Spindle RPM		Feed Speed	Blade Height	Dicing Blade	Cut Method
Z1	45,000	80 mm/s	155um	ZH05-SD3500-N1-CC	Step Cut
Z2	45,000	80 mm/s	70um	ZH05-SD3500-N1-BB	

Test Result

Sample	Wafer Thick.	Corner burr(%)	Side burr(%)	Bleed(%)
ES-229	50um	0.0	2.7	2.7
Competitor A (Model A)	50um	0.0	42.4	36.3

Copyright © 2011 by AMC. All rights Reserved

[Evaluation Results]

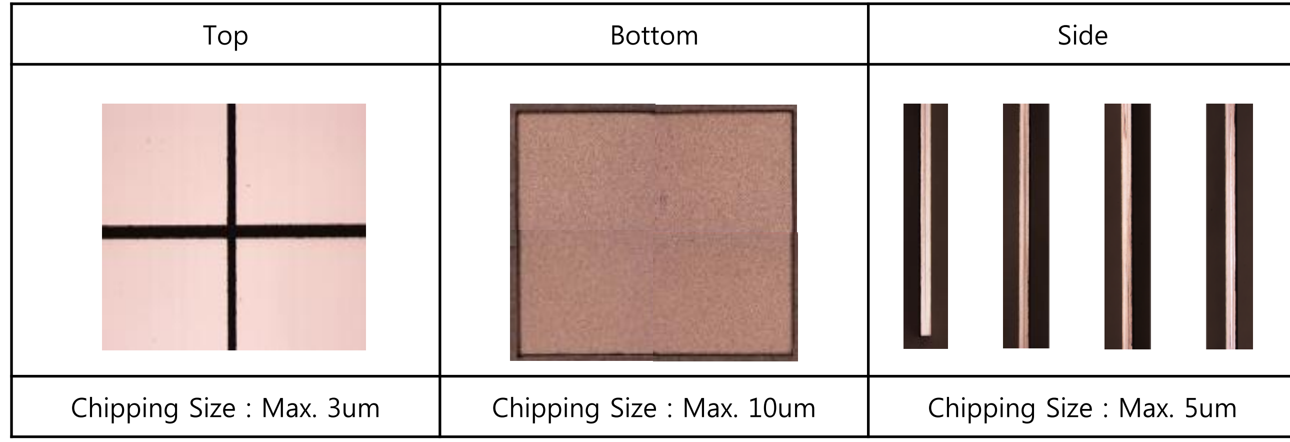
Test Image

※ Test condition : After UV

	Top	Corner	Side	Bleed
ES-229				
Competitor A (Model A)				

Back grind / wafer sawing Process Quality Control Data

Item	S/S	Spec	1	2	3	4	5	6	7	8	9	10	Min.	Max.	Avg.	Result
Kerf Width	Z1 : 8Line	Max 60um	32	35	32	36	34	35	37	32	32	33	32.0	37.0	33.8	Accept
	Z2 : 8Line		30	32	31	32	31	33	31	35	36	35	30.0	36.0	32.6	Accept



Top	Bottom	Side
Chipping Size : Max. 3um	Chipping Size : Max. 10um	Chipping Size : Max. 5um

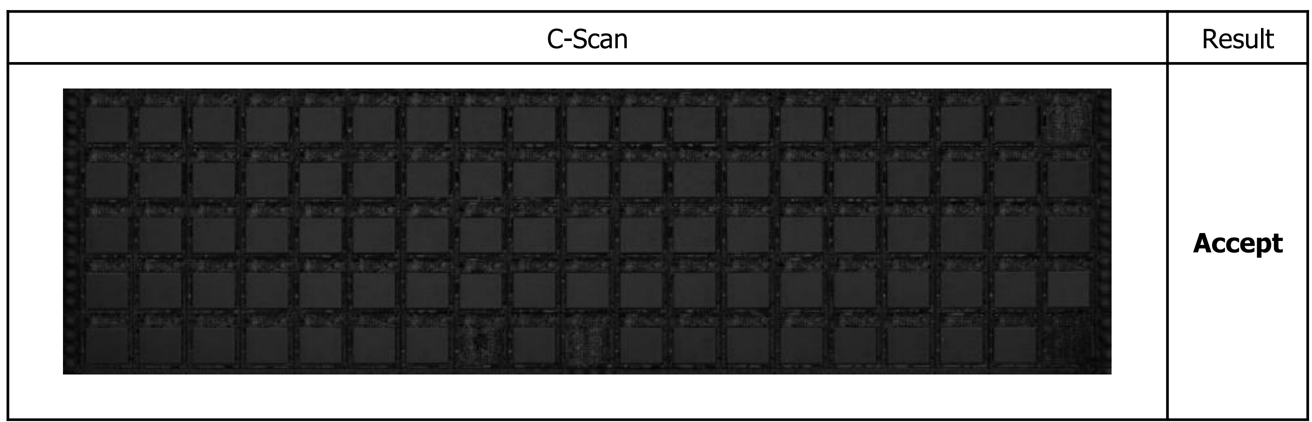
Copyright © 2011 by AMC. All rights Reserved

[Evaluation Results - Workability Test Results]

Back grind / wafer sawing Process Quality Control Data

Item	Die	S/S	Spec.	1	2	3	4	5	6	7	8	9	10	Min.	Max.	Avg.	Result
Die Position	1st Die	X : 10Unit	± 50um	13	16	18	10	16	11	10	15	13	13	10	18	14	Accept
		Y : 10Unit		8	13	10	13	11	11	13	14	13	12	8	14	12	Accept
	2nd Die	X : 10Unit		11	8	8	10	6	11	10	11	11	13	6	13	10	Accept
		Y : 10Unit		13	11	12	10	11	14	15	17	13	11	10	17	13	Accept

Chip to Chip Void

C-Scan	Result
	**Accept**

Copyright © 2011 by AMC. All rights Reserved

[Evaluation Results - Reliability Test Results]

Pre-con Test

Condition	Before Pre-con	After Pre-con	Result
85/85 96hrs			Accept
			Accept

T/C	-55~125℃, 5cycle
Bake	125℃ 24Hrs
T/H	85℃/85% 96Hrs
Reflow	Peak 260℃, 3 cycle

Copyright © 2011 by AMC. All rights Reserved

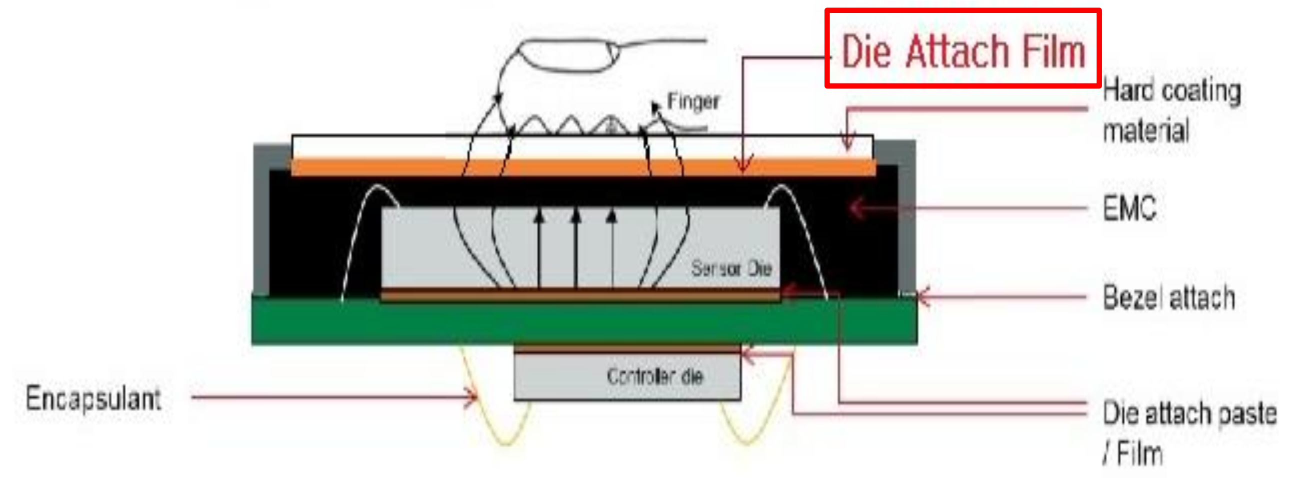
Application :

EMC to Protective Cover

Copyright © 2011 by AMC. All rights Reserved

[Application : EMC to Protective Cover]

[EMC and Protective cover attaching method under development]



Advantage

- JEDEC Level 2
- High adhesive strength
- Various colors

 Copyright © 2011 by AMC. All rights Reserved

Cut Process

AWD series
Cutter
1)Peel off PE

Tool
AWD series
Board
Heat Block

Punch Process

AWD series
Punch
Heat Block(140°C)

Color Film
Heat Block

※ Heat block depend on customer.

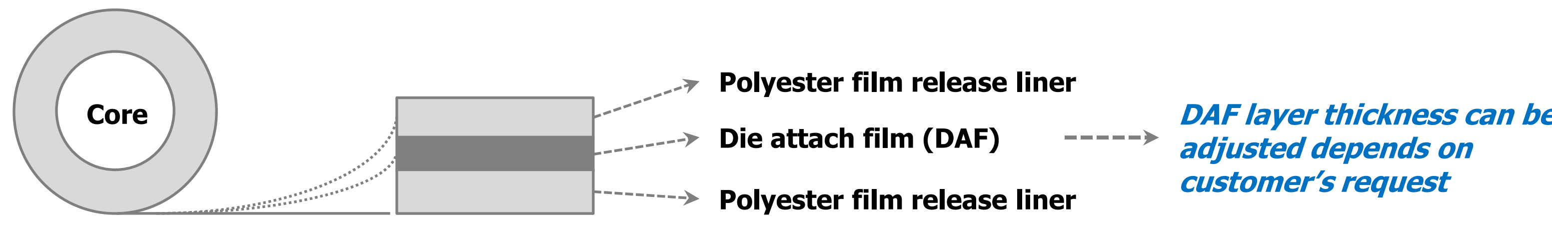
Copyright © 2011 by AMC. All rights Reserved

[Structure & Product]

➢ **Only DAF type**

DAF is consist of 3 layers including die attach film(DAF) layer.

DAF Structure



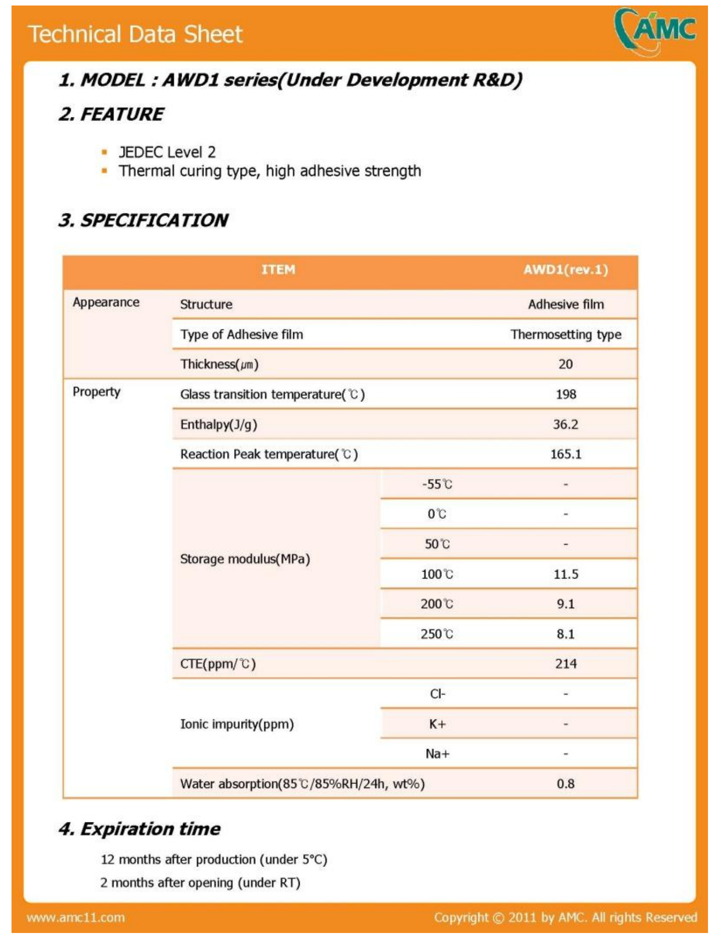
Product line

- AWD1 series
- AWD4 series

Copyright © 2011 by AMC. All rights Reserved

[DAF Properties (Only DAF)]

AMC checks and controls other properties even though not included in specification.



Technical Data Sheet

AMC

1. MODEL : AWD1 series(Under Development R&D)

2. FEATURE

- JEDEC Level 2
- Thermal curing type, high adhesive strength

3. SPECIFICATION

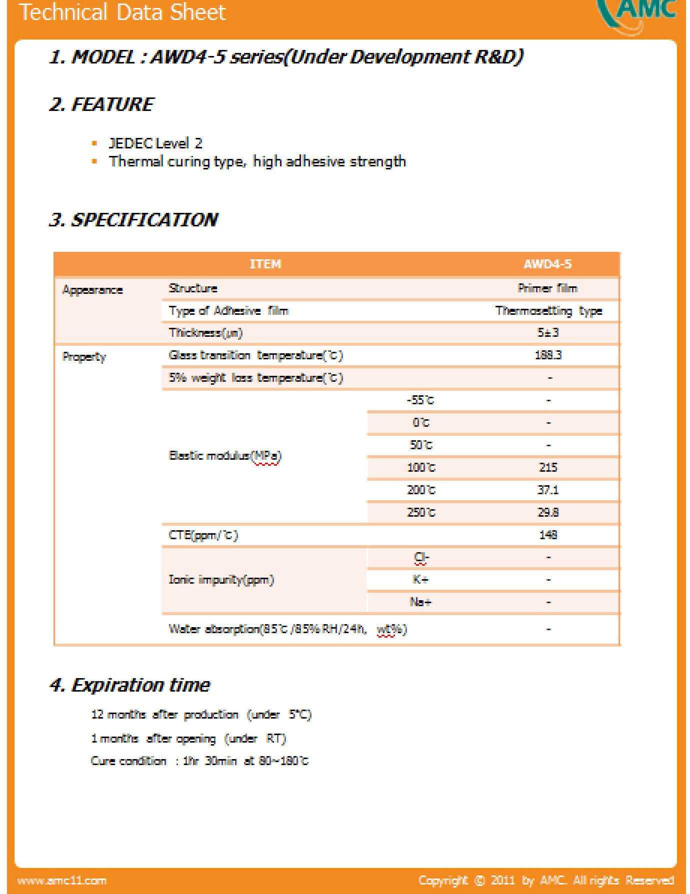
ITEM			AWD1(rev.1)
Appearance	Structure		Adhesive film
	Type of Adhesive film		Thermosetting type
	Thickness(㎛)		20
Property	Glass transition temperature(℃)		198
	Enthalpy(J/g)		36.2
	Reaction Peak temperature(℃)		165.1
	Storage modulus(MPa)	-55℃	-
		0℃	-
		50℃	-
		100℃	11.5
		200℃	9.1
		250℃	8.1
	CTE(ppm/℃)		214
	Ionic impurity(ppm)	Cl-	-
		K+	-
		Na+	-
	Water absorption(85℃/85%RH/24h, wt%)		0.8

4. Expiration time

12 months after production (under 5°C)

2 months after opening (under RT)

www.amc11.com Copyright © 2011 by AMC. All rights Reserved



Technical Data Sheet

AMC

1. MODEL : AWD4-5 series(Under Development R&D)

2. FEATURE

- JEDEC Level 2
- Thermal curing type, high adhesive strength

3. SPECIFICATION

ITEM			AWD4-5
Appearance	Structure		Primer film
	Type of Adhesive film		Thermosetting type
	Thickness(㎛)		5±3
Property	Glass transition temperature(℃)		188.3
	5% weight loss temperature(℃)		-
	Elastic modulus(MPa)	-55℃	-
		0℃	-
		50℃	-
		100℃	215
		200℃	37.1
		250℃	29.8
	CTE(ppm/℃)		148
	Ionic impurity(ppm)	Cl-	-
		K+	-
		Na+	-
	Water absorption(85℃/85%RH/24h, wt%)		-

4. Expiration time

12 months after production (under 5°C)

1 months after opening (under RT)

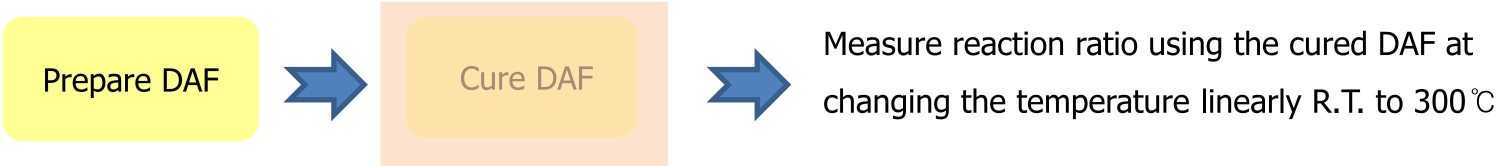
Cure condition : 1hr 30min at 80~180℃

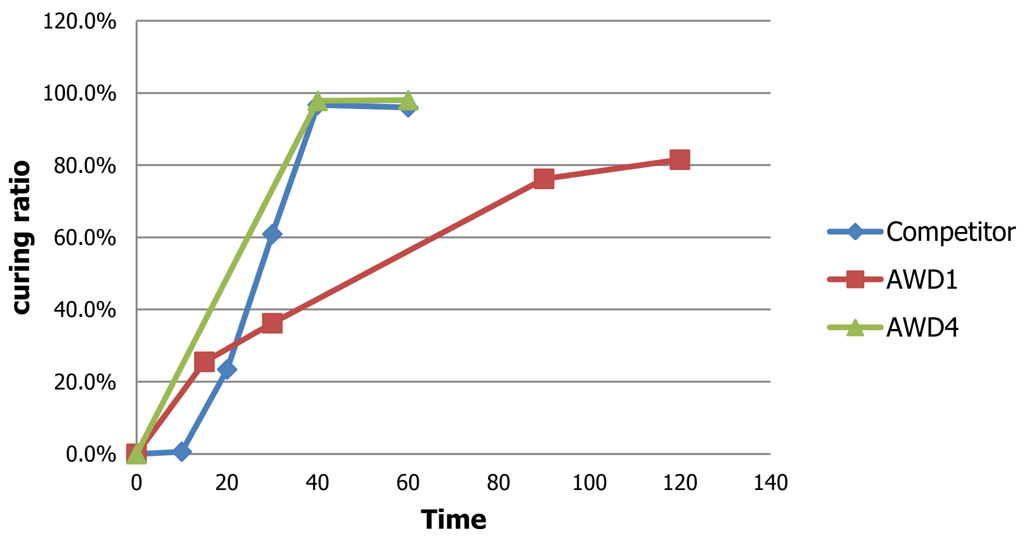
www.amc11.com Copyright © 2011 by AMC. All rights Reserved

Copyright © 2011 by AMC. All rights Reserved

[DAF Properties (Only DAF) - reaction ratio]

AWD1 & AWD4 reaction ratio

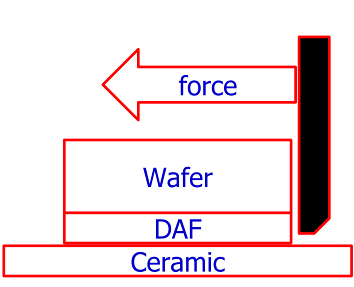


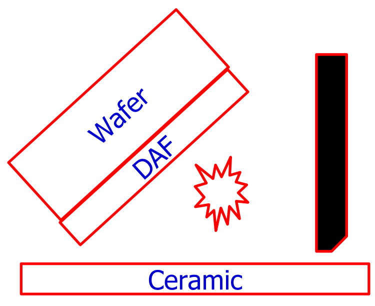


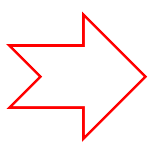
※ Curing Temp. : 150℃

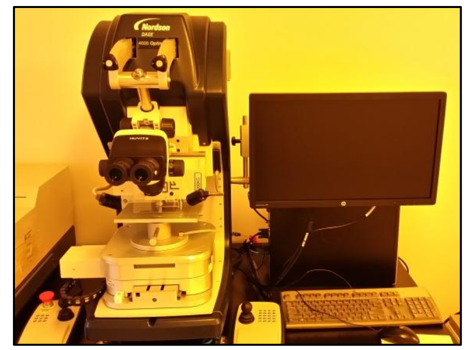
Copyright © 2011 by AMC. All rights Reserved

AWD1 Die Shear Test









	Unit	Competitor	AWD1
① after die bonding	MPa	0.8	1.1
② 85℃,85%, 0hr(after cure)		31.7	50.8
③ 85℃,85%, 24hr(after cure)		35.4	36.2

Process & condition

① wafer dicing → die bonding(1kgf, 10sec, 75℃) → die shear test

② wafer dicing → die bonding(1kgf, 10sec, 75℃) → full cure(@ 1hr at 150℃) → die shear test

③ wafer dicing → die bonding(1kgf, 10sec, 75℃) → full cure(@ 1hr at 150℃)

→ Thermo-hydrostatic(85%, 85℃, 24hr) → die shear test

Copyright © 2011 by AMC. All rights Reserved

Thank You!

Copyright © 2011 by AMC. All rights Reserved