HEATSEAL & ACF TECHNOLOGY

OVERVIEW

- ACF bonding technology
- Heating processes
- Interposer modules
- Pre-tack systems
- Bonding systems

BONDING TECHNIQUES

- **ACF Laminating / Pre-tack Bonding**
  (Pulsed Heat Technology/Constant Heat Technology
  (AC past for larger / less accurate connections)

- **Final Heat Seal Bonding**
  (Pulsed Heat Technology/Constant Heat Technology)

- **Hot Bar Reflow Soldering**
  (Pulsed Heat Technology)

PROCESS CONTROL

Bonding Process

- Process temperature, time control
- Force control
- Planarity of parts

Parts handling in system

- Parts positioning
- Parts alignment (fixed, manual, automatic)

Automation

- Needs for loading, alignment, unloading
- Parts movements

PROCESS TYPES

	HBR Soldering	**Final Heatseal Bonding**	**ACF Laminating / Pre-tack**
FR4 (PCB) – Flex connection	Good	Good	Good
Glass (LCD) – Flex connection	**Not possible !**	Good	Good
Minimum pitch size [μ]	250	200	**30**
Resistance [Ω]	< 0,001	< 0.5	0,01 – 1.0
Peel force [N / cm]	45	5	12
Process times [seconds]	5- 15	5 – 15	20 – 30
Bonding forces [MPA]	0.3 - 0.4	3 – 4	3 - 4
Process temperatures [º C] [Hotbar temperature]	200 - 250 [300 – 500]	160 - 190 [220 – 275]	**130 - 180** [300 – 400]

ACF-BONDING

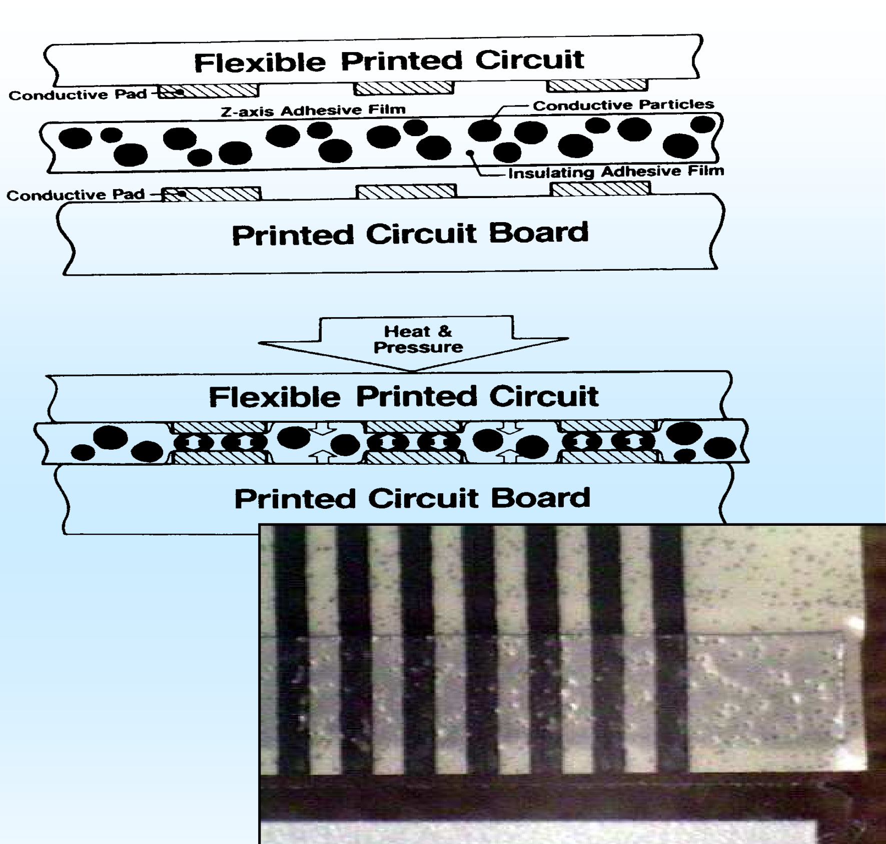
An electro-mechanical connection is created between two components using anisotropic conductive film.

ACF-Bonding can be split up into laminating (pre-bonding) and end sealing

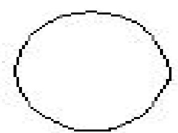
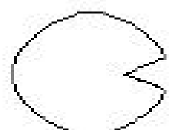
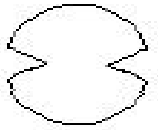
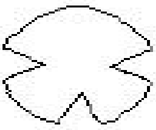
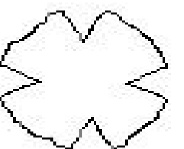
The conductive particles in the film make contact in the **Z- direction only** when heat and pressure are applied.

A minimum contact time is required to ensure the adhesive cures properly.

ACF-bonding is mostly used to create flexible connections between components such as flexfoil to LCD and flexfoil to PCB.



Conductive Particle
Flip Chip or Flex. Circuit
Anisotropic Adhesive (Film or Paste)
Conductive Pad
Substrate (FR4, ITO glass or Flex)
Insulating Matrix
Heat + Pressure
Flip Chip or Flex. Circuit
Substrate (FR4, ITO glass or Flex)

Degree of compression	Slightly deformed	Pacman	Crushed	Heavily crushed	Flattened
Constant connection reliability	NO; bond force is to low	Possible; slight increase of bond force	Yes; bond force is correct	Yes; slight decrease of bond force	Possible; bond force is too high
Initial Electrical conductivity	NO	NO	YES	YES	NO
Conclusion	Not acceptable	Acceptable but not desireable	Preferred		Not acceptable

ACF Laminating / Pre-tack process

ACF pre-tacking, cutting & protection film removal	Flex loading, alignment	Final Heatseal bonding

The complete ACF bonding process is a 2-step process.

- Step 1: ACF pre-tack cycle
- Step 2: ACF final Heatseal bonding

Final Heatseal process

Flex loading, alignment → Final bonding

The Final Heatseal bonding process is a single-step process.

Process Development : ACF Bonding Process Flow

1. ACF Tacking

Unwind
Bonding Head
Wind-up
ACF
Release Liner
Kiss Cut tool
Circuit 1 (PWB)

2. Alignment

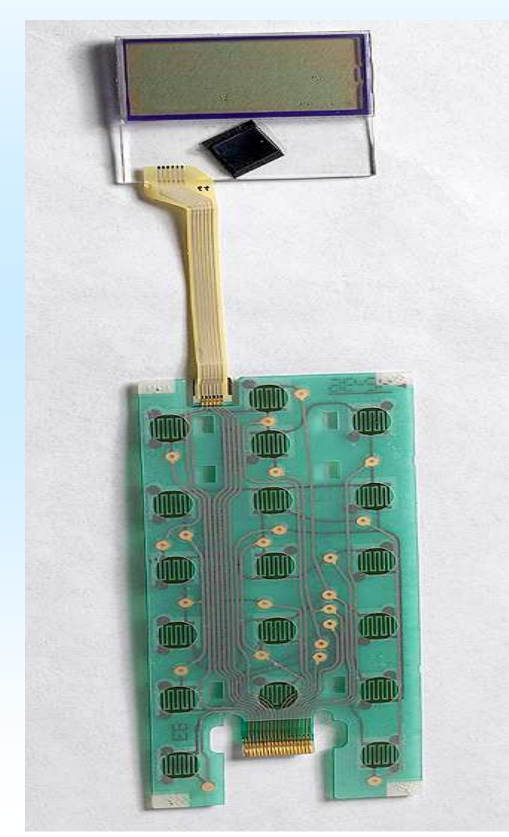
Alignment
θ
x
y
Bonding Head
Circuit 2 (FPC)
Circuit 1 (PWB)

3. Final Bonding

Compliant Material
Bonding Head
Fully Assembled Circuits

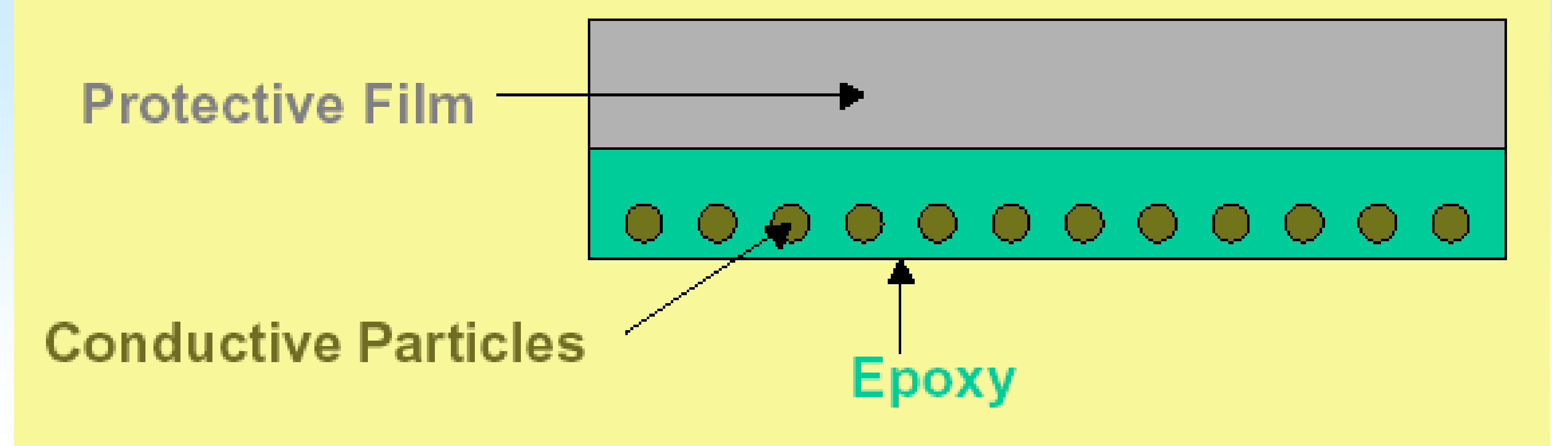
ACF – why use this technology ?

- Non-solderable substrates
  - temperature sensitive
  - substrate metallization
- Lead Free process
- Flux free process
- Fine pitch



ACF materials & Suppliers

- Hitachi
- 3M
- Sony Chemical
- Tesa AG
- Loctite



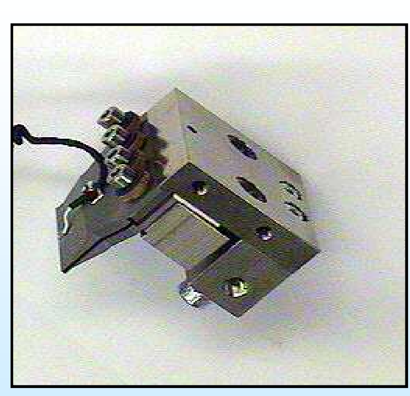
HEATING PROCESSES

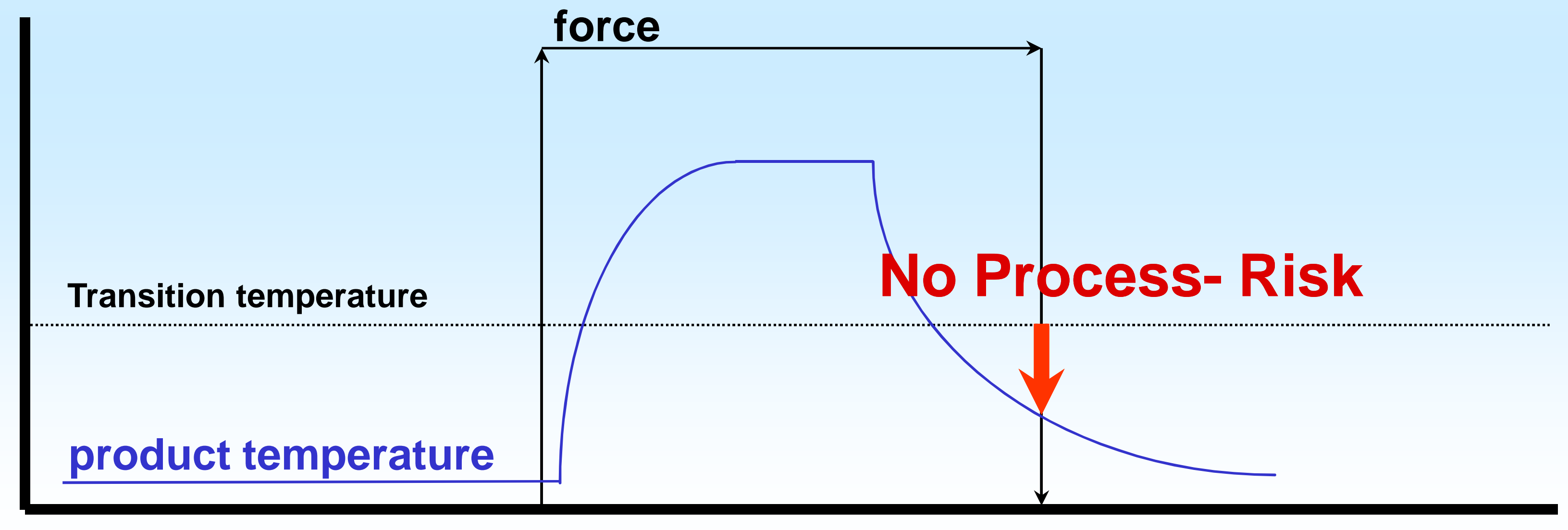
	HBR Soldering	Heat-seal/ACF Bonding	
		Laminating / Pre-tack	Final Heatseal Bonding
Pulsed Heat Bonding	Good	Good	Good
Constant Heat Bonding	Not possible	Good	Less controlled

PULSED HEAT PROCESS

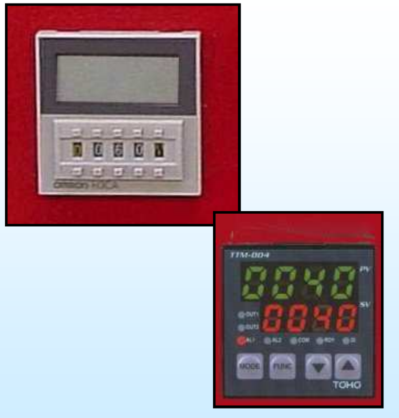
Timer 0,1 – 99,9 seconds
Temperature 30 – 650 degrees C

Hotbar length 50 mm / width 5.0 mm
Options on request



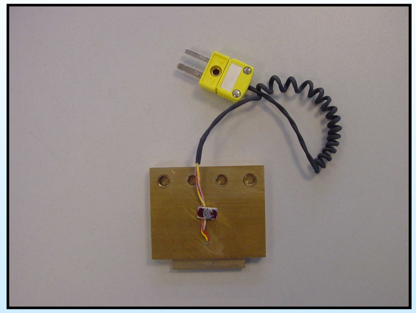


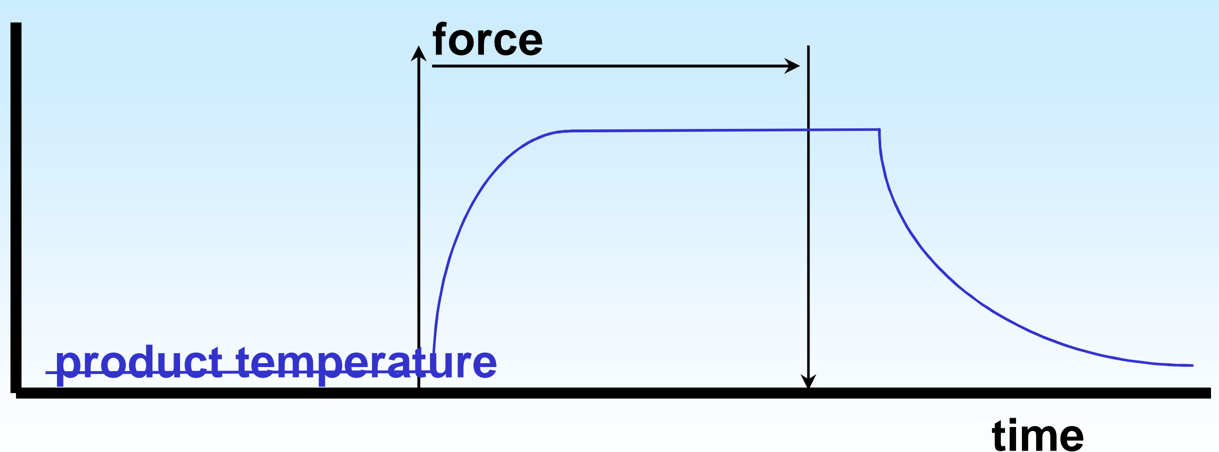
CONSTANT HEAT PROCESS



Timer 0,1 – 99,9 seconds
Temperature 30 – 150 degrees C

Hotbar length 50 mm / width 5.0 mm
Options on request





Adjuster for right hand side position of ACF

Protection tape winding

Motorisedbonding head

ACF on Reel

ACF tape unwinding

Carrier Tape winding

Balancers for constant tension

Adjuster for left hand side position of ACF

Balancer for constant tension

Knife
(half – cutting method)

Hot – Bar (pulsed heat)

ACF separator finger

ACF waste material
remover

Protective Film

Conductive Particles

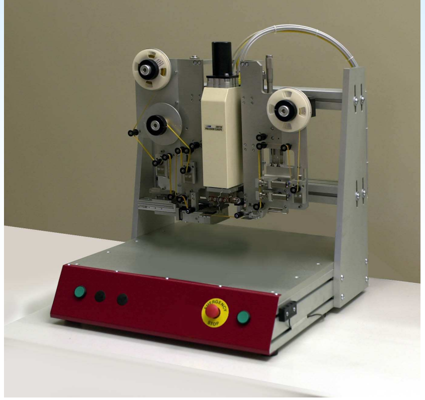
Epoxy

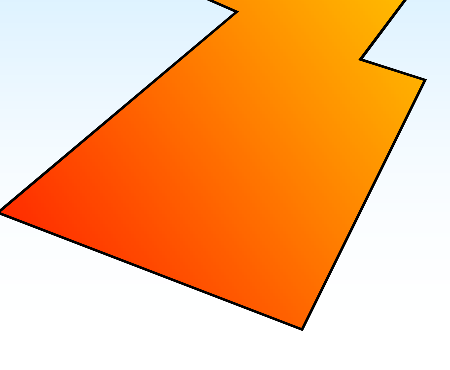
ACF Laminating / Pre-tack systems

- Manual / pneumatic 360º rotary
  DT-440 – 450

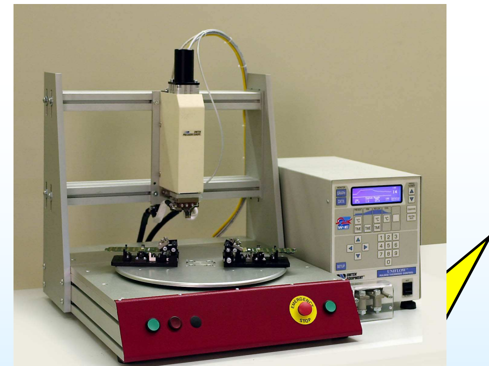
- Manual / pneumatic front-rear slide
  DT250 – 260 – 350 – 360

- No product movement
  DT-150

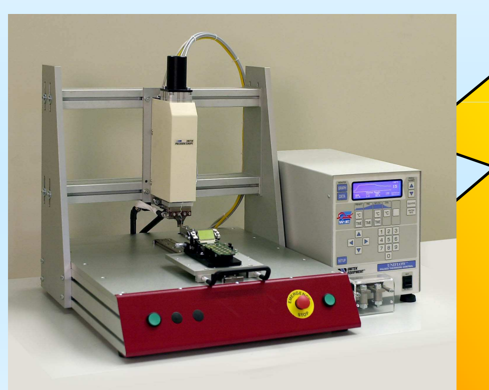




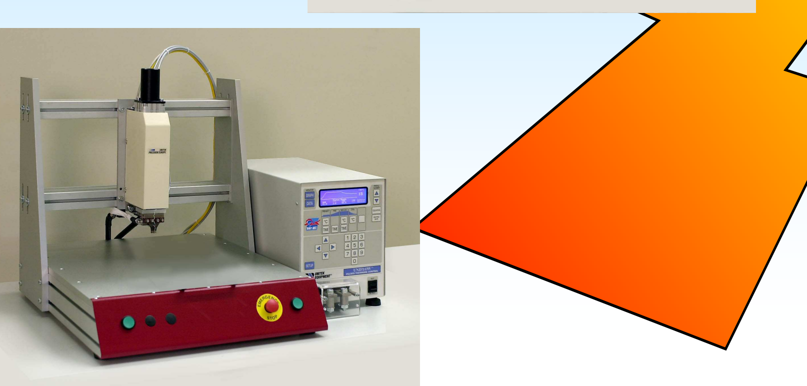
Final Heatseal bonding systems



- Manual / pneumatic 360º rotary
  DT-440 – 450



- Manual / pneumatic front-rear slide
  DT250 – 260 – 350 – 360

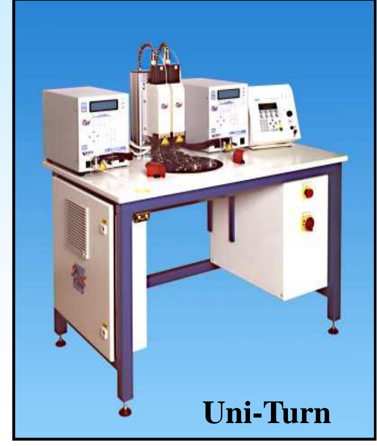


- No product movement
  DT-150

Final Heatseal bonding systems

Emerald Series

Stand-alone Series



ACF system specifications

- ACF tape length [3,0-50,0 mm] / width [1,0-3,0 mm]
- 2-Layer ACF tape as standard
- Tape position accuracy X: 0,2 / Y: 0,1 mm
- Bonding parameters
  - Temperature: max 150 degrees
  - Time: 0,1 - 99 seconds
  - Force: 30 - 500 N

ACF system specifications

OPTIONS

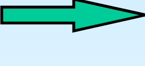
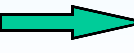
- ACF tape / Hotbar size
  - length upto 100 mm
  - width 20 mm
- Options
  - pulsed heat control [uniflow]
  - motorized ACF feeding
  - customization on request

INTERPOSER MATERIALS

Interposer is the tape material in between the Hot Bar and the parts to be bonded

- Eliminate roughness products/fixture (in the micron range)
- Equalizing bond pressure
- Enlarging bonded surface (bonding between tracks) = increasing peel-strength
- Protecting Hot Bar against glass splinters

PROPERTIES

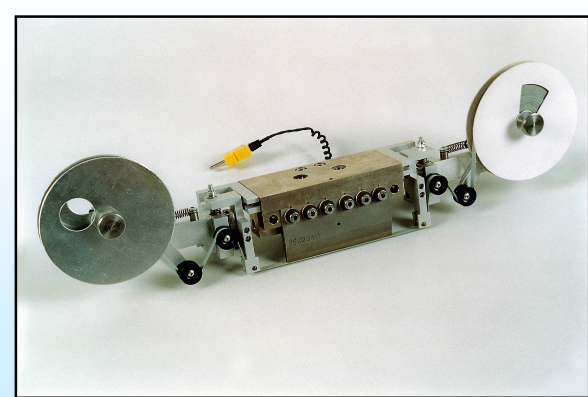
- heat resistant  silicon rubber
- heat conductive → aluminum oxyde filled
  low thickness
- height difference  high thickness

ALUMINUM OXYDE FILLED SILICON RUBBER WITH THICKNESS OF 0.45 MM

INTERPOSER FEEDERS

Advanced Manual Interposer

- Manual feeding of tape
- Tension control of interposer material
- Mechanism to prevent stick to Hot Bar



Advanced Motorized Interposer

- Automated feeding of interposer material
- Tension control of the interposer material
- Sensor control for the feeding mechanism
- Mechanism to prevent stick to Hot Bar