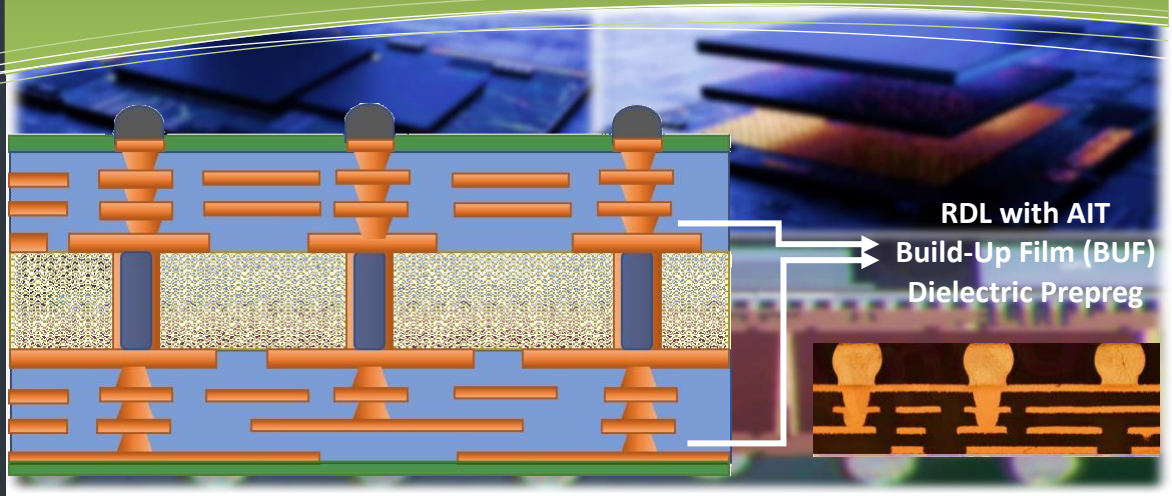
NANO-FILLER BUILD-UP FILM AND BEYOND
A NEW CLASS OF 3-D WAFER BUILDUP PREPREGS

- *NANO-FILLER WITH MOLECULARLY ENGINEERED STRESS-RELIEF HIGH T_G MODIFIED CYANATE ESTER*
- *ENGINEERED CTE TO MATCH COPPER OR HDI CORE BOARD FOR BUILD-UP FLEXIBILITY*
- *LOW MOISTURE ABSORPTION AND LOW DIELECTRIC CONSTANT FOR RELIABILITY AND PERFORMANCE*



AIT Build-Up Film Prepregs advancing 3-D heterogenous chip Integrations:

- AIT build-up film represents a new class of build-up film adhesive prepregs with **nano-fillers** (BUF-NP product line) to advance the micron-sized lines and micro-vias in the 3-D wafer heterogenous integration.
- BUF-FP build-up film prepreg lines with 10µm cut-off filler size is designed to supplement the current 3-D integration supply shortages.
- Ideal for core and coreless build-up and integration.
- AIT has expanded its film production capability in two locations in United States while working on additional production capacity in China in meeting the buildup film shortage challenges.

AI Technology (AIT) pioneered the first self-supporting (**no glass-mesh)** film adhesives in 1980s for semiconductor applications. AIT has since developed film adhesives for different applications from die-attach to flexible circuits and now to build-up film with much more stringent controlled CTE matching 3-D core boards, copper traces and:

- **AIT BUF** is molecularly engineered to have the following unparalleled and balanced properties of high Tg with stress absorption along with low moisture absorption and low dielectric Dk and Df for reliability and performance.
- Much lower lamination temperature and pressure for higher productivity.
- The modified cyanate ester based BUF is a proven technology that is now expanded to for use in electronic sheet and liquid molding-encapsulation.

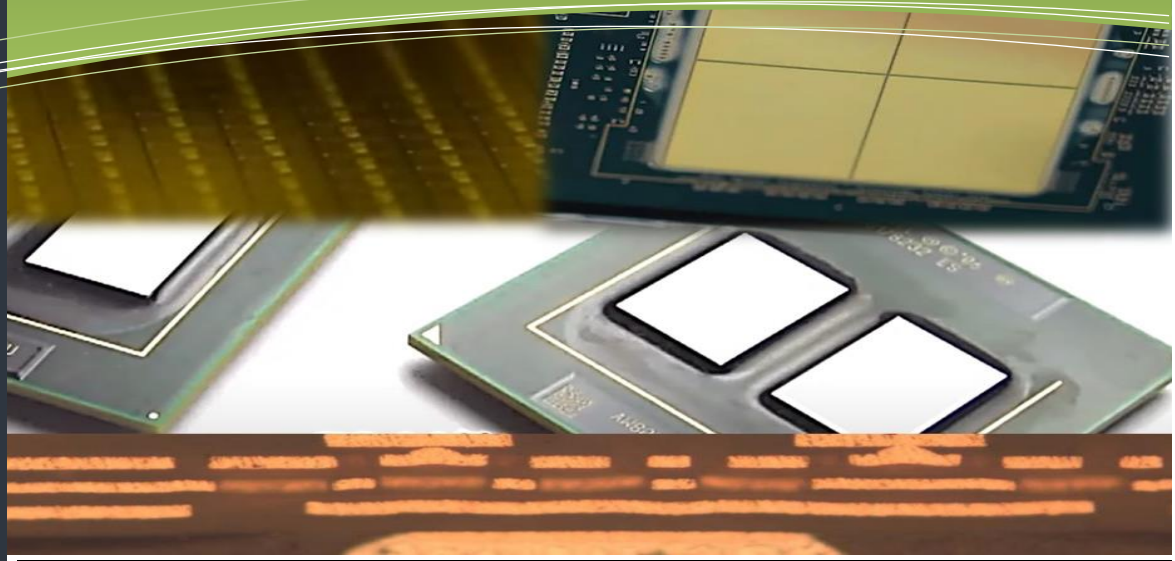
AIT BUILD-UP FILM DIELECTRIC PREPREGS

Build-Up Film (BUF) Properties	BUF7883 -NP-8	BUF7889 -NP-12	BUF7883 -FP-8	BUF7889 -FP-12
Coefficient of Thermal Expansion (CTE, ppm/°C, 25°C to 150°C)	8-12	13-18	8-12	13-18
Filler Size Max Cut (µm)	0.5	0.5	5	5
Moisture Absorption and Retention (%, 85%RH/85°C/168hr)	<0.5	<0.5	<0.5	<0.5
HAST Reliability (85%RH/ 130°C)	336Hr, Pass	336Hr, Pass	336Hr, Pass	336Hr, Pass
Electrical Resistivity (Ω-cm)	$>10^{14}$	$>10^{14}$	$>10^{14}$	$>10^{14}$
Dielectric Strength @ 25 Micron Thickness (Volts/mil)	>1000	>1000	>1000	>1000
Dielectric Constant (D_k>1 MHz)	3.2	3.6	3.2	3.6
Dielectric Loss Factor (D_f>1 MHz)	<0.01	<0.01	<0.01	<0.01
Surface Roughness (nm)	<500 nm	<500 nm	<1 µm	<1 µm
Peel Strength (Pound/inch)	8	9	8	9
Device Push-off Strength (psi)	>3000	>3500	>4000	>4500
Hardness (Type D)	90 (D)	86 (D)	90 (D)	86 (D)
Cured Density (gm/cc)	2.5	2.4	2.5	2.4
Thermal Conductivity (W/m-°K)	>0.5 W/m-°K	>8.0 W/m-°K	>0.5 W/m-°K	>8.0 W/m-°K
Modulus of Elasticity (GPa)	8	7	8	7
Maximum Continuous Operation Temp/Glass Transition Temp(°C)	>180/220	>180/220	>180/220	>180/220
Decomposition Temperature @5% weight loss (°C)	>450	>450	>450	>450
Recommended Lamination Pressure/Temperature/Time for Multi-layer Build-Up (psi/°C/min)	15/150/5	15/150/5	15/150/5	15/150/5
Max. Film Width (mm)	550	550	550	550
Available Film Thicknesses (µm)	10-100	10-100	20-100	20-100

AI Technology, Inc. (©2025, V 3.3) 70 Washington Rd., Princeton Junction, NJ 08550 | www.aitechnology.com
18 Roszel Rd, Princeton NJ 08540, USA Tel: +1-609-799-9388 | ait@aitechnology.com

LOW D_k and D_f BUILD-UP FILMS and BEYOND
A NEW CLASS OF 3-D WAFER BUILDUP PREPREGS

- *PROVEN MOLECULAR ENGINEERED CTE TO MATCH COPPER FOR BUILD-UP FLEXIBILITY*
- *PROVEN MOLECULARLY ENGINEERED STRESS-RELIEF HIGH T_G MODIFIED CYANATE ESTER*
- *LOW MOISTURE ABSORPTION AND LOW DIELECTRIC CONSTANT FOR RELIABILITY AND PERFORMANCE*



Low Dielectric Constant (Dk) and Loss (Df) while Maintaining Low CTE with Molecular Engineering:

In meeting the challenge of achieving higher electrical signal transmission at 5 to 6G frequencies, there is a difficult compromise between achieving controlled low CTE with quartz filling and still lowering the dielectric constant and loss from typical high Tg polymers. With proven polymer molecular engineering that AIT had achieved for other applications, a series of low Dk, low Df and low CTE are now developed for build-up film prepreg applications.

Features and Distinctions

- Engineered CTE to less than 20 ppm/°C from 25°C to 150°C. Curing and laminating with copper and board substrate create no warpage or shear stress along the XY-plane and minimal Z-axis stress on copper stud and solder bumps.
- Modified cyanate ester to achieve less than 2.7 Dk for the low thermal dissipation applications while keeping it below 3.2 for those applications requiring thermal dissipation
- Industry first 3 µm build-up film thickness for even higher integration possibilities
- Molecularly engineered to absorb stresses inherently to prevent stress concentrations induced cracking and delamination
- Ultra-low moisture absorption for superior moisture resistance
- Low melt-bonding lamination temperature-pressure and shorter dwell time for high productivity
- High temperature stability to withstand soldering at 300°C
- Max Op Temp: >175°C
- Designed for fan-out wafer level processing (FOWLP) and fan-out panel-level processing (FOPLP) 3D devices
- Ideal for coreless build-up in 3-D and chiplets integration

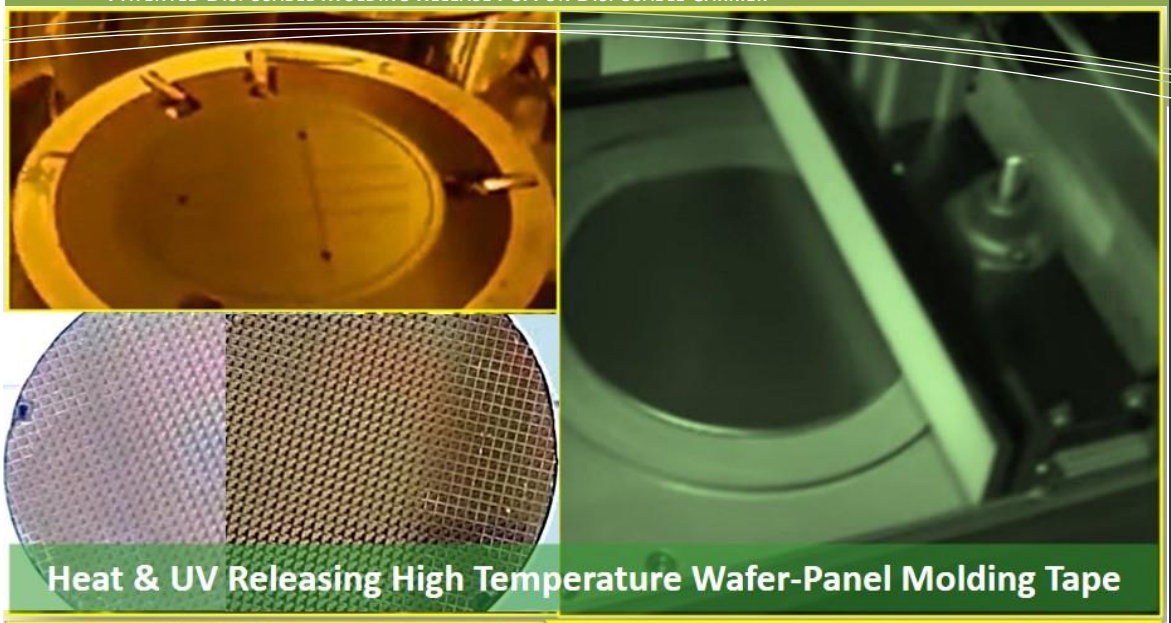
LOW D_k and D_f BUILD-UP FILMS and PREPREGS

Build-Up Film (BUF) Properties	BUF7850 -18	BUF7853 -NP-8	BUF7869 -NP-18	BUF7869 -NP-8
Coefficient of Thermal Expansion (Average CTE, ppm/°C, 25°C to 150°C)	18	8	18	8
Filler Size Max Cut (µm)	<<0.3µm	<<0.3µm	<<0.3µm	<<0.3µm
Moisture Absorption and Retention (%, 85%RH/85°C/168hr)	<0.3	<0.3	<0.3	<0.3
HAST Reliability (85%RH/ 130°C)	336Hr, Pass	336Hr, Pass	336Hr, Pass	336Hr, Pass
Electrical Resistivity (Ω-cm)	$>10^{14}$	$>10^{14}$	$>10^{14}$	$>10^{14}$
Dielectric Strength @25µm Thick (Volts/mil)	>1000	>1000	>1000	>1000
Dielectric Constant (D_k>1 GHz)	**2.6**	**2.9**	**3.6**	**3.8**
Dielectric Loss Factor (D_f>1 GHz)	<0.001	<0.001	<0.001	<0.001
Surface Roughness (nm)	<200	<200	<500	<500
Peel Strength (Pound/inch)	8	9	8	9
Device Push-off Strength (psi)	>3000	>3500	>4000	>4500
Hardness (Type D)	65 (D)	80 (D)	90 (D)	95 (D)
Cured Density (gm/cc)	1.1	1.2	2.2	2.4
Thermal Conductivity (W/m-°K)	<0.2	<0.2	**>8.0**	**>10.0**
Modulus of Elasticity (GPa)	<2	<3	6	8
Maximum Continuous Operation Temp and Glass Transition (°C)	>180/>180	>180/>180	>180/>180	>180/>180
Decomposition Temperature @5% weight loss (°C)	>450	>450	>450	>450
Recommended Lamination Pressure/Temperature/Time for Multi-layer Build-Up (psi/°C/min)	15/130/5	15/130/5	15/150/5	15/150/5
Available Film Thicknesses (µm)	**2 to 100**	**5 to 100**	10 to 100	10 to 100

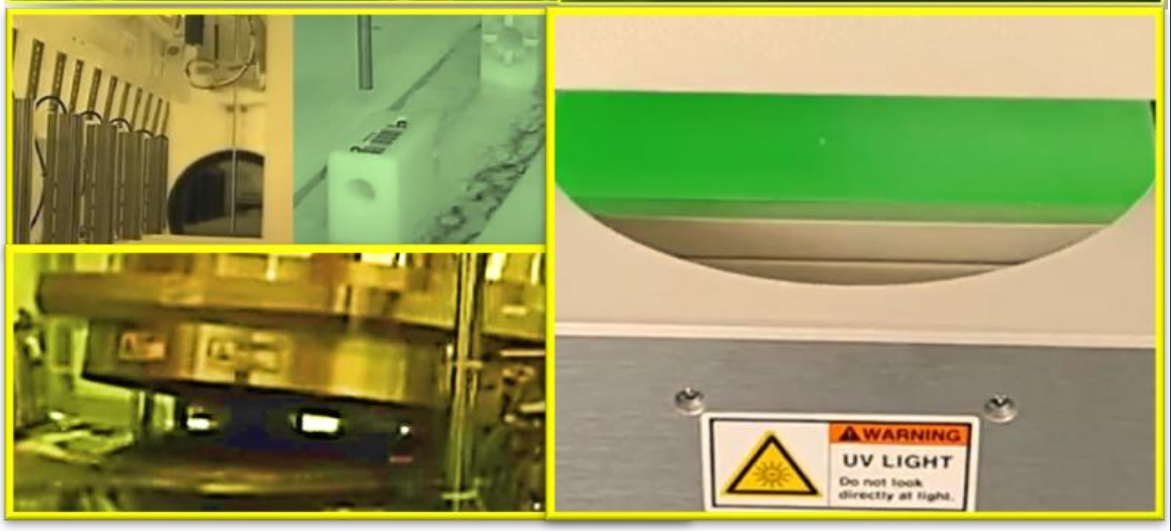
AI Technology, Inc. (©2025, V 3.3) 70 Washington Rd., Princeton Junction, NJ 08550 | www.aitechnology.com
18 Roszel Rd, Princeton NJ 08540, USA Tel: +1-609-799-9388 | ait@aitechnology.com

WAFER-PANEL LEVEL PROCESSING (FOWLP-FOPLP) TEMPORARY BONDING MOLD RELEASE TAPES

- *Wafer and Panel Level Processing for Fan-Out and Heterogeneous Integration Molding Release*
- *Novel Heat and/or UV Releasing without Heat Generated "Bubbling"*
- *Patented Disposable Molding Release PSA on Disposable Carrier*



Heat & UV Releasing High Temperature Wafer-Panel Molding Tape



Heat, Peel and UV Releasing Wafer-Panel Molding Tapes

PARAMETER	WPA-UVR-265 WPA-HR-265-DS WPA-PRCL-265	GD-UVR-265-PET GD-UVR-265-DS GD-UVR-265-CXP	GD-PRCL-265-PET GD-HR-265-DS GD-PRCL-265-KP
Releasing Adhesive Configuration and Application Process	• PSA film adhesive on release liners • WPA-UVR for UV and/or heat releasing • WPA-PRCL supports any suitable carriers	• PSA on disposable carrier (PET or CXP) • UV and/or heat releasing with 0% residual for processing to 265°C	• PSA on disposable carrier (PET or KP) • Peel Release with 0% residual for processing to 265°C
Adhesive Thickness	• 20-200µm	• 20-200µm	• 20-200µm
Temperature Capability	• Up to 265°C with 0% residual • Up to 350°C with cleaning	• Up to 180°C with 0% residual for -PET • Up to 265°C with 0% residual for -CXP	• Up to 180°C with 0% residual for -PET • Up to 265°C with 0% residual for -KP
Peel Strength in Operation (ppi)	• >300 ppi (300gm/25mm)	• >300 ppi (300gm/25mm)	• >300 ppi (300gm/25mm)

Novel and patented (US 11,222,864) temporary bonding and releasing adhesive technology for wafer and panel level processing in fan-out and heterogeneous integration. Ideal for large area wafer and panel molding encapsulation.

Temporary Bonding and Releasing Film and Liquid

- PSA film on release liners for use with glass or other carriers.
- Proven applicable for processing up to 265°C and yet release clean for no-clean processing. Minor cleaning for processing up to 350°C
- Available on flexible disposable carriers for ultimate productivity

Precision Chip-Component Placement and Positioning

- Pressure-sensitive at ambient temperature for ease of chip positioning
- High shear bonding for molding stability

Compatible with Wet and Dry Processing

- Acid plating bath and water-based cleaning
- Maintain high shear bonding for drilling and mechanical grinding

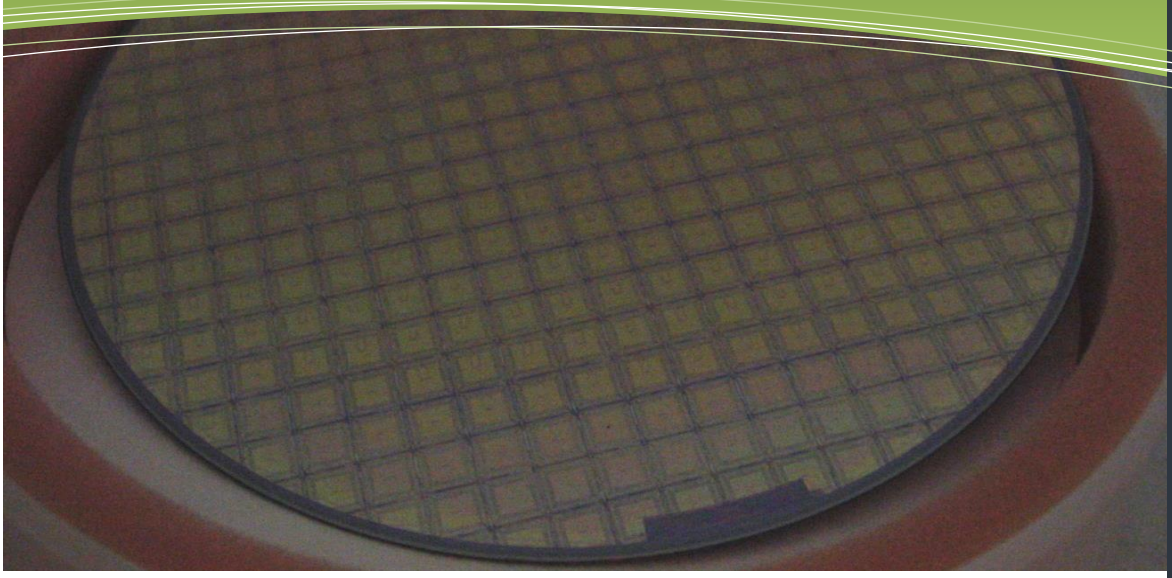
Fast and Residual-Free No-Clean Releasing

- Compatible with molding compound in post-molding releasing
- PRCL-series for peel release on carriers including metal foils with 7-11ppm/°C CTE
- UVR-series for rapid UV flash release without residual on glass or PET UV transparent carriers.
- HR-series for heat-releasing after molding

AI Technology, Inc. (©2025, V 3.3) 70 Washington Rd., Princeton Junction, NJ 08550 | www.aitechnology.com
18 Roszel Rd, Princeton NJ 08540, USA Tel: +1-609-799-9388 | ait@aitechnology.com

INTEGRATED MATERIAL TECHNOLOGIES FOR WAFER AND PANEL LEVEL PROCESSING

- *Over 35 Years of Proven History of Performance and Innovation in Electronic Packaging*
- *World First in Self-Supporting Epoxy Film Technology for Semiconductor Bonding Applications*
- *Accelerated Worldwide Expansion in Manufacturing and Service Capacity*



COMPLEMENTARY AIT UNDERFILLS, COATINGS AND ADHESIVES FOR BUILD-UP 3-D CIRCUIT AND DEVICE APPLICATIONS

FUNCTION	AIT PART#	THERMAL, ELECTRICAL, & Other RELEVANT PROPERTIES
Molded Underfill (MUF) Film-Sheets	UF-MF-7883-FP UF-MF-7883-NP	• Underfill film for compression molding for flip chip and board level protection • -FP and -NP for 10 µm and 500 nano cut-off fillers respectively • Engineered with 23 ppm/C CTE to provide compressive stress protection for solder bumps and shear stress for board level devices.
Molded Underfill (MUF) Liquids	UF-ML-7883-FP UF-ML-7883-NP	• Underfill liquids for molding for flip chip and board level underfilling protection • -FP and -NP for 10 µm and 500 nano cut-off fillers respectively • Engineered with 23 ppm/C CTE to provide compressive stress protection for solder bumps and shear stress for board level devices.
Capillary Underfill (CUF) Liquids	UF-MC7883-FP UF-MC-7883-NP	• Capillary flip chip and board level underfill protection • -FP and -NP for 10 µm and 500 nano cut-off fillers respectively • Engineered with 23 ppm/C CTE to provide compressive stress protection for solder bumps and shear stress for board level devices.
Corner-Edge Underfill (UF) Paste	UF-MC7883-CE	• High bond strength corner and edge chip on board positioning and protection • Controlled thixotropic index and green strength in fixing the chips on board • Engineered with 23 ppm/C CTE to minimize shear stress
Conductive Die-Attach Adhesive	ME8412	• Snap curing, electrically conductive die-attach for power devices • Low thermal resistance, ambient storable single component silver paste
Insulating Die-Attach Adhesive	ME7410-SSC	• Snap curing, electrically insulating die-attach for power devices • Outstanding high temperature stability and low moisture absorption • Ideal for stiffener bonding
Conformal Coating	SC7130-CC	• Proven for sulfur, acid gases, moisture laden corrosion protection • Moisture, salt-fog and salt-spray protection for aeronautic and automotive electronics
UV-Corrosion Protection Coating	SC7130-UVB	• Integrating UV blocking with the proven sulfur, acid gases, moisture laden corrosion protection • Moisture, salt-fog and salt-spray protection for aeronautic and automotive electronics exposed to direct outside exposure
Thermal Interface	COOL-PAD™ CPR7158	• Low thermal resistance interface, electrical insulating pad • Compressible, phase-change interface pad
Thermal Interface	COOL-SILVER™ PAD CPR8850-LB	• Lowest thermal resistance, electrically non-conductive interface pad • Compressible, phase-change interface pad
Masking Tape	MT300-S	• Circuit board masking tape for use up to 260°C reflow soldering • Anti-static and clean release without cleaning
Masking Film Forming Liquid	ML-150 ML-150-S	• Dispensable liquid that dried to peel-release masking film • Withstand soldering operations to 300°C • ML-150-S is an anti-static version of ML-150

About AI Technology, Inc.

Since pioneering the use of self-supporting film and flexible epoxy technology for microelectronic packaging in 1985, AI Technology has been one of the leading forces in developing advanced materials and adhesive solutions for electronic interconnection and packaging.

The same stress-free dielectric adhesives are now adapted for use in flexible circuit copper clad laminates. This proprietary high temperature dielectrics are molecularly engineered to have lower dielectric constant and loss for faster circuit at microwave frequencies for communications devices.

With over 35 years of innovations in serving our customers, AIT has a full line of materials for high performance electronics:

- Die and substrate attach films and pastes
- Die-Attach Film on Dicing Tape
- Wafer Processing Temporary Bonding Adhesive
- Thermal interface adhesives, grease, gel and pads
- Conformal coatings of class of its own in protecting electronics from corrosion from moisture, sulfur, salt, acid gases laden air
- EMI/RFI coating and caulks
- Insulated metal substrates

AIT is located in an ISO 9001:2015 certified manufacturing and R&D facilities on a 16-acre and 18-acre campus in Princeton Junction, and Princeton, NJ.

Sales and supply support includes company direct offices in Shenzhen-HK China and sales reps in Europe and Asia.

AI Technology, Inc. (©2025, V 3.3) 70 Washington Rd., Princeton Junction, NJ 08550 | www.aitechnology.com
18 Roszel Rd, Princeton NJ 08540, USA Tel: +1-609-799-9388 | ait@aitechnology.com