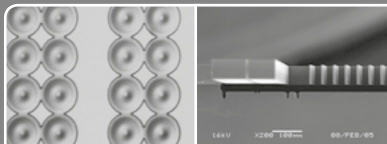
TECHNOLOGY PORTFOLIO

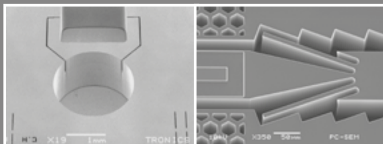
Tronics offers a broad range of manufacturing building blocks and continuously expands its technology portfolio to support the success of your product.

C-SOI & SOI LAYER TRANSFER



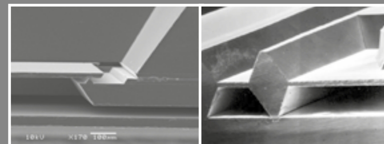
SOI Layer Transfer | Release on C-SOI

HIGH ASPECT RATIO DRIE



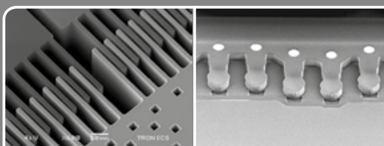
Through Wafer Etch | DRIE on Thick SOI

ANISOTROPIC WET ETCHING



KOH | TMAH

STICKING-FREE MEMS RELEASE

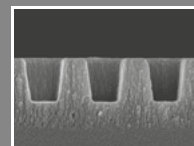


HF Release | Polymer Release

FUNCTIONAL LAYERS

Thin Film PZT | Thick NiFe and Cu Plating | Stress Controlled Au Plating | Bulk PZT Actuator Assembly

SUBMICRON LITHOGRAPHY

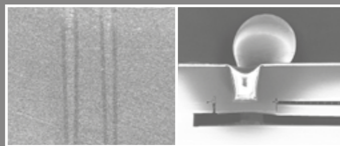


Submicron Patterning

WAFER BONDING & WAFER STACKING

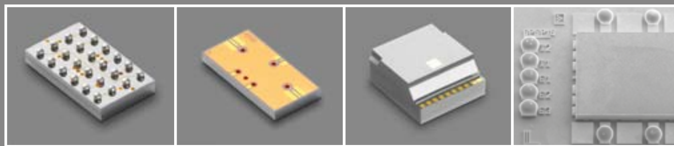
Eutectic and Fusion Bonding | Anodic and Polymer Bonding

TSVS & INTERCONNECTS



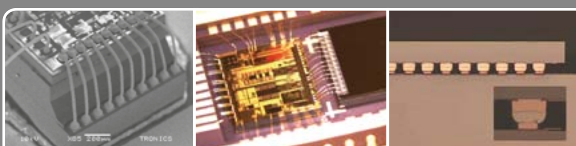
TSV Via First (Poly Si) | Cu TSV Via Last with Balling

WAFER LEVEL PACKAGING



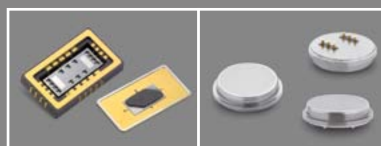
Vacuum WLP with Cu TSV and Bumps | Hermetic WLP with Cu TSV | Vacuum WLP with Integrated Getters (<5mTorr) | Hermetic WLP with Bumps

MEMS & IC ASSEMBLY



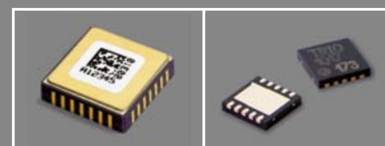
Stacked Die Assembly | Side by Side Assembly | Flip-Chip IC Assembly with Cu Pillars

CUSTOM ASSEMBLY & PACKAGING



High Vacuum Package (<1mTorr) with Getter | Oil Filled Titanium Packaging

STANDARD PACKAGING



Ceramic and Metal Packaging | Plastic Packaging

Discover the Tronics Difference

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Dallas, TX, USA
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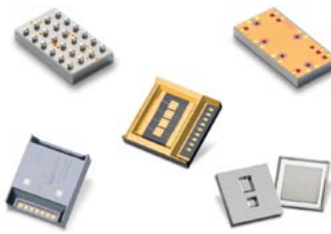
www.tronicsgroup.com

Full service MEMS manufacturing

DESIGN - DEVELOPMENT - PROTOTYPING - INDUSTRIALIZATION - PRODUCTION

MUCH MORE THAN A MEMS FOUNDRY

TESTED WAFERS



MEMS TRANSDUCERS IN WAFER LEVEL PACKAGING

PACKAGED COMPONENTS

DUAL SOURCING WITH FABS IN THE USA AND EUROPE

- → Capacity of 60,000 wafers per year (10 mask levels), scalable to higher volumes
- → ISO 9001 certified facilities, adaptation to customer quality standards

GRENOBLE, FRANCE

- Small and medium volumes
- 2,500m² buildings
- 400m² class 10 to 1000 MEMS processing line
- 200m² assembly and packaging line
- 200m² reliability test lab

DALLAS, TX, USA

- Medium and high volumes
- 13,000m² building
- 1,850m² class 100 MEMS processing line
- 24/7 operation

ENVISION MEMS | DELIVER MEMS

tronics

MEMS PRODUCTION CAPABILITIES

Our process capabilities cover the whole manufacturing chain, from front end processing to back end assembly and packaging, including calibration, testing and reliability. We continuously invest in our capabilities to meet our customers' needs.

FRONT END: WAFER PROCESSING

SUBSTRATES	
150 mm / 6 inches	Si, SOI, Quartz, Fused Silica, Borosilicate glass
PHOTOLITHOGRAPHY	
Exposure	
Stepper	Min CD = 350 nm, FS overlay +/- 70 nm
Double Side Aligner	Min CD = 2 µm, FS overlay +/- 2 µm, BS overlay <+/- 5 µm
NanoImprint Lithography System	Min CD = <320 nm
Scanner Aligner	Min CD = 1 µm, FS overlay +/- 0.1 µm
Coating	
Positive Resist	- 0.12 to 20 µm (single coat)
Negative Resist	0.5 to 55 µm (single coat)
Lift-Off	Negative and positive masking
Polyimide	13 µm cured (single coat), more on demand
Dry Laminate	Single film thick. >30 µm, more on demand
Development	Positive / Negative
WET ETCHING	
Bulk Si & Glass Etching	
Anisotropic Silicon Etch	KOH, TMAH Electrochemical end point
Isotropic Glass Etch	HF
Thin & Thick Film Etching	
Dielectrics Etching	HF, HF Vapor, BOE
Metals Etching	Cr, Au, W, WN, Ni, Al, Ti, Pt, Cr, Pd, TiW, NiFe
Ceramics Etching	PZT, $CrSiO_2$, HfO_2
Resist Stripping	Hot Nitric, NMP, Solvent+IPA
Wafer Cleaning	Piranha, SC1
DRY ETCHING	
DRIE Deep Reactive Ion Etching	Silicon, SOI, C-SOI, Glass substrates A/R max ~ 40:1, sidewalls 90° +/- 0.5°
ICP Dry Etch	Metals (Al, Ti, W, Cr...), Si, Polysilicon, Oxide, Glass, Nitride
RIE Reactive Ion Etching	Oxide, Nitride, Polysilicon, Parylene, Polyimide
Ion Milling	Yes
Polymer Removal	Post DRIE C/U (O_2,CF_4), Resist Ash

STRUCTURES RELEASE	
Release with anti-stiction design and process	HF Oxide release, HF vapor Oxide release, Polymer release, Supercritical drying
FILM DEPOSITION	
Polysilicon & Amorphous Silicon	
Furnace Processes	LPCVD PolySi Amorphous and Thick PolySi (>3 µm) available
DC magnetron sputtering	A-Si
Dielectrics	
Furnace Processes	LPCVD Nitride (low stress available), Dry and Wet Oxidation
Plasma Enhanced Deposition	Si_3N_4 (incl. low stress), SiON, SiC
RF Sputtering	$CrSiO_2$, CrSiN, Si_3N_4
Evaporation (e-beam)	SiO_2, Al_2O_3
Spin-coating	Epoxy-based spin-on InterVia photo-dielectric
Metals	
DC Sputtering	Ti, Ni, Au, Cr, Al, AlCu, Cu, W, TiN, TiW, WN, NiFe, Ta, TaN, CrSi, Pt, Pd, more on demand
Evaporation	Ti, TiW, Au, Pt, Cr, Al, Sn, In, Ru,Ta, more on demand
Electroplating	Au, Cu, NiFe
Film Annealing (controlled atmosphere)	O_2, N_2, N_2H_2
Ceramics	
Thick Film PZT	Bulk PZT actuator assembly by Serigraphy
Thin Film PZT	Outsourced
Miscellaneous Layers	
Biocompatible Layers	Parylene, PEEK, Polyimide, Liquid Crystal Polymer (LCP)
DOPING	
Doping	$POCl_3$, BBr_3, more on demand (outsourcing)
WAFER BONDING	
Wafer Bonding	
Fusion Bonding	Si-SiO_2, Si-Si
Thermo-Compression Bonding	Au-Au, Low temperature
Eutectic Bonding	Au-Si, Au-Sn, Au-In
Intermediate Sealing Layer	Polymer, Glass-Frit
Anodic Bonding	Si-Glass

Tronics also has comprehensive **MEMS design and simulation** capabilities: FEM simulation with Comsol Multiphysics, Ansys Multiphysics - Modeling and Simulation with Matlab Simulink - Design and Layout with KLayout and Mentor Graphics - PCB design with DesignSpark PCB.

METROLOGY & WAFER LEVEL TESTS

WAFER LEVEL TEST	
Parametric & Static Tests	
Automated Parametric Tests	R, L, C, I(V), C(V) Sheet Resistance R^2
Product Specific Tests	Dedicated burn-in test
RF Tests	S-Parameters from DC to 40GHz
Dynamic Testing	
Automated Dynamic Tests	Resonant frequency Q-factor: Low Q < 10'000 High Q > 10'000
Customer Specific Test Benches	Custom designed or consigned by customer: Fluidic, Optical, ...

METROLOGY	
Dimensional	
	SEMs 3D Optical Microscope / Profilometer Mechanical Profilometers Automatic CD Control Microscopes
Visual	
	SAM IR Microscopes Inspection Microscopes
Characterization	
	EDX Material Analysis Defectivity Measurement Ellipsometer White Light Interferometer

BACK END: ASSEMBLY AND PACKAGING

BACK END	
Thinning / Polishing	CMP Oxide / Metal / Silicon Backgrinding
Dicing	Si and Glass (150 mm)
Laser Marking	Wafer / Die
MEMS & IC ASSEMBLY	
Pick-and-Place Die Attach	
Solder	AuSn, PbAgIn
Glue	Epoxy
Wire Bonding	
Ball-Stitch on Ball (BSOB)	Au
Ball-Stitch	Au
Wedge-Wedge	Al
3D Interconnections and Flip-Chip Assembly	
SMT Balling	SAC balls
Flip-Chip Interconnects	Cu pillars

COATING & PACKAGING	
GlobTop & Protecting Layer	
GlopTop	Epoxy
Protective Coating	Parylene (outsourced)
Standard Packaging	
Hermetic Packaging	Ceramic, Metal
Plastic Packaging	QFN, LGA (outsourced)
Specialized Packaging	
High Vacuum Packaging	Ceramic packaging with integrated getter
Biocompatible Packaging	Oil filled Titanium package with hermetic ceramic feedthrough
Application Specific Packaging	On demand
Component Traceability	Laser marking, sticker labels

COMPONENT LEVEL TEST, CALIBRATION & RELIABILITY

RELIABILITY TEST	
Environmental Tests	
Shock / Acceleration	Drop Tower for shock up to 5000 G, 0.3 ms half sinus
Vibration	Electro Dynamic Shaker 5 to 4500 Hz, up to 100 G
Humidity / Temperature	Climatic Chamber 3°/mn, -40 up to +180°C
Mechanical Reliability Tests	
Bond and Break Tests	Centrifuge up to 15 000 G
Pull Tests	Wire strength Die attach and getter solder strength Wafer bonding strength
Shear Tests	Wafer bonding strength Die attach strength
Aging & Hermeticity Tests	
Aging and Life Cycling	Temperature and humidity cycling Aging in oven Actuators cycling test
Hermeticity Tests	Vacuum hermeticity and leak test

FUNCTIONAL TEST & CALIBRATION	
Inertial Tests	
1-Axis Rotation Stage	High precision angle control, inclination under 1G
1-Axis Rate Table in Climatic Chamber	2000°/s, - 55°C up to +100°C
Pressure Tests	
Temperature Controlled Pressure Chamber	10 mT - 20 bar (vacuum, argon, compressed air)
Customer Specific Test Rigs	
	Supplied or co-developed with customers (Fluidics, Optics, Actuators,...)
	Test boards and bench developments
	Labview programming