IC-TO-BOARD SOLUTIONS

CAPABILITIES + DESIGN GUIDE

JUNE 2014

IC-TO-BOARD SOLUTIONS

Samtec combines Advanced IC Packaging and Ultra Micro Interposer technologies to achieve optimized interconnect paths - from the bare die to an interface 100 meters away, and all insertion points in between - with expertise in:

- Package and substrate design
- System modeling and prototyping
- Assembly and electrical testing of finished goods
- Ultra low profile, high density and dual compression contact micro interposers
- Advanced IC packaging, including die attach, wirebond, flip chip, dam and encapsulation, and micro optics

Samtec offers end-to-end signal integrity support including full channel analysis, high data rate simulations, break out routing and application assistance.

Visit SamtecMicroelectronics.com or contact SME@samtec.com for more information.

ADVANCED IC PACKAGING
+
MICRO INTERPOSERS
STREAMLINED INTERCONNECT PATH

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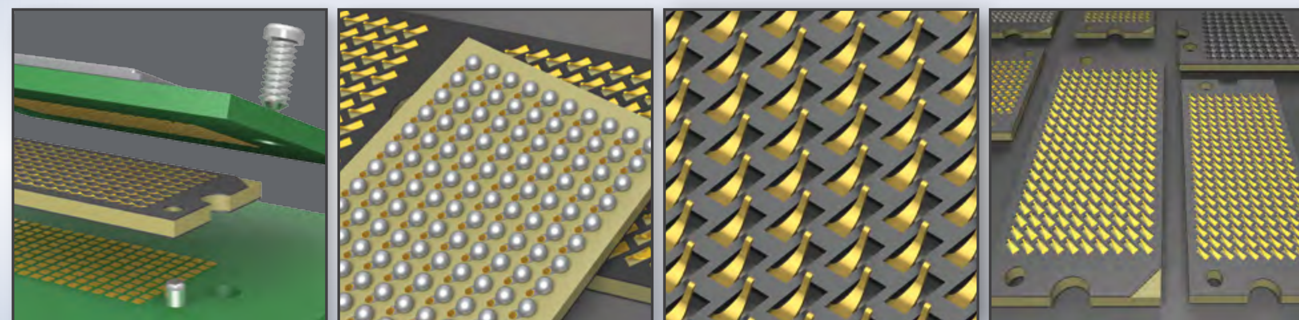
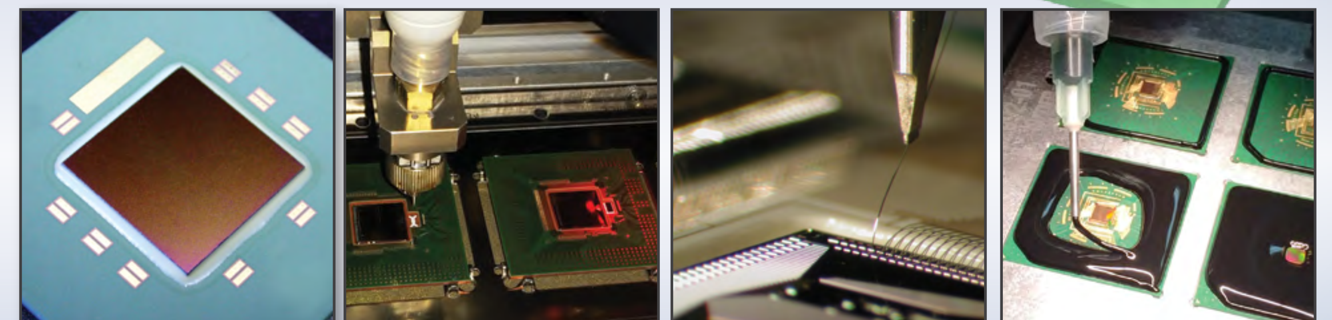
Micro Interposer Technology



Ultra Low Profile | Termination Flexibility | Ultra High Density | Profile & Pitch Flexibility

Advanced IC Packaging



Flip Chip & Underfill | Precision Die Attach | Fine Pitch WIrebond | Dam & Encapsulation

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MICRO INTERPOSER TECHNOLOGY

Samtec's Z-Ray™ micro array interposers are ultra low profile, ultra high density, and highly customizable solutions ideal for complex IC-to-Board applications.

– Ultra low profile, high density arrays, with spring temper BeCu micro-formed contacts on 0,80 mm and 1,00 mm pitches
– Assembled into rugged low profile FR4 substrate under high pressure and temperature
– Ultra flexible, with a variety of standard and custom configurations, including dual compression, solder ball, and an array of sizes and shapes
– Choice of fastener options, including application specific designs, screw downs, quick install (easy on/off), and thermal spreaders

Contact Samtec at zRay@samtec.com for more information.

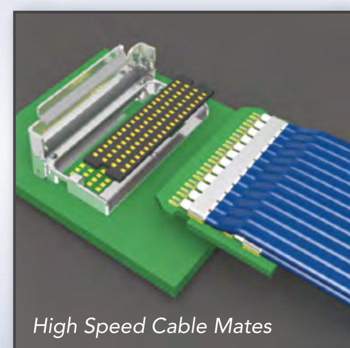
Standard & Custom Z-Ray™ Micro Interposer Capabilities

Series	ZA8	ZA1	Capabilities*
Pitch	0,80 mm	1,00 mm	≥ 0,65 mm
Stack Height	1,00 mm		0,50 mm to 7,00 mm
Total I/Os	100 - 400		1,000+
Ruggedizing	Screw Down Holes, Alignment Holes		Latches, Thermal Spreaders, Quick-Release Spring Constraints
Construction	Single Layer FR4		Multi-layer FR4 (e.g., Pitch Spreaders)
Terminations	Dual Compression, Compression + Solder Ball		

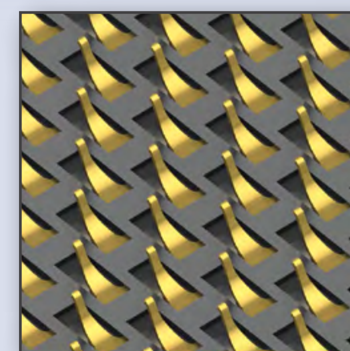
** Z-Ray™ interposers are highly customizable. Contact zRay@samtec.com to discuss your specific application.*

ALSO AVAILABLE: Micro Coax Cable System

– Ultra micro, ultra high density, ultra high speed
– 34 AWG micro twinax cable
– Three-piece system includes high speed cable assembly, Z-Ray™ interposer and housing
– 0,80 mm pitch, 24 pairs standard
– Contact Samtec for other sizes



High Speed Cable Mates

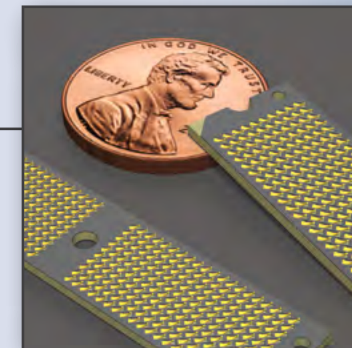


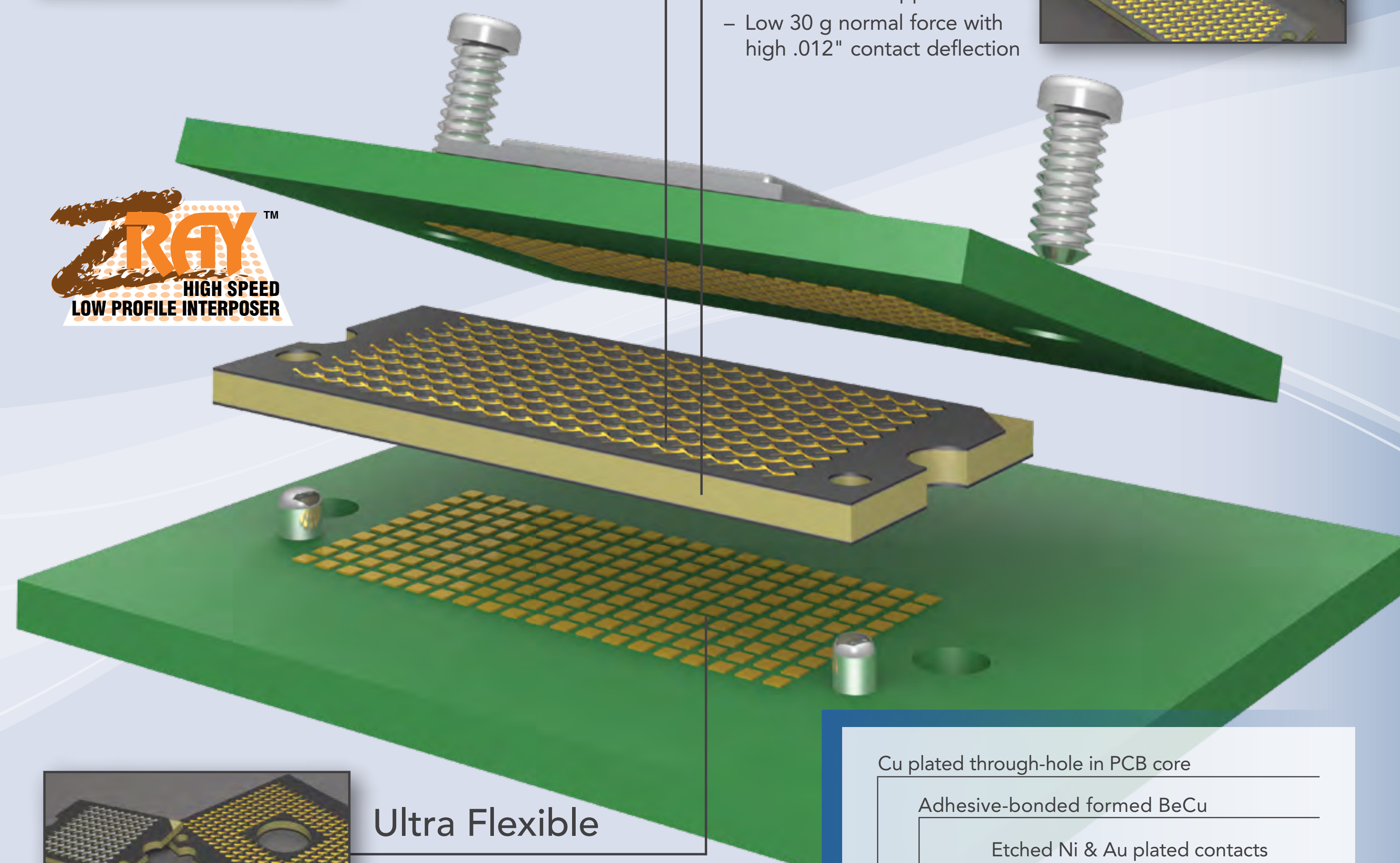
Ultra High Density

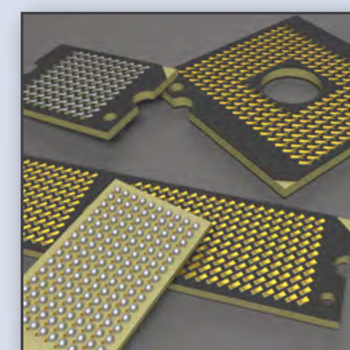
– Customer-specific pin counts for ultimate high density and speed flexibility
– Choice of 0,80 mm or 1,00 mm pitch grid
– ZA8 Series for up to 1,024 contacts per square inch
– ZA1 Series for up to 625 contacts per square inch

Ultra Low Profile

– One piece design
– Low profile 1,00 mm body height
– Customizable in X-Y-Z axes for ultra micro applications
– Low 30 g normal force with high .012" contact deflection

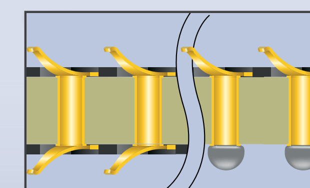






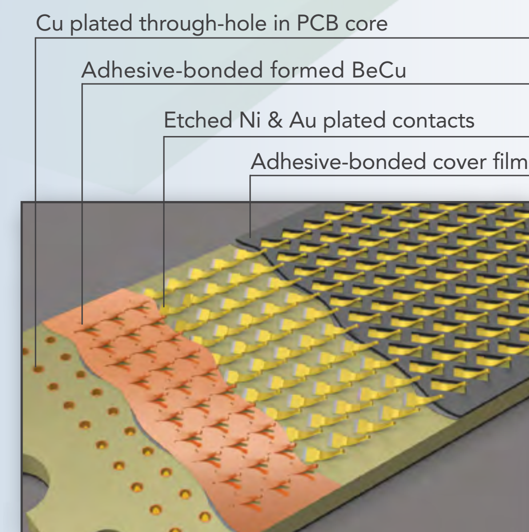
Ultra Flexible

– Customer-specific stack heights, pin counts, pitches, insulator shapes and plating thicknesses
– Alignment and screw options
– Quick-turn customizations with minimal NRE and tooling charges



Dual compression contact system *Single compression with solder balls*

Cu plated through-hole in PCB core
Adhesive-bonded formed BeCu
Etched Ni & Au plated contacts
Adhesive-bonded cover film



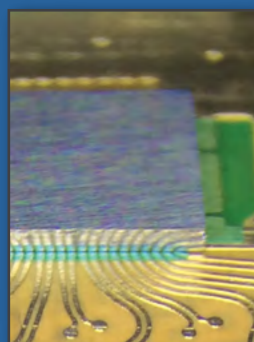
ADVANCED IC PACKAGING

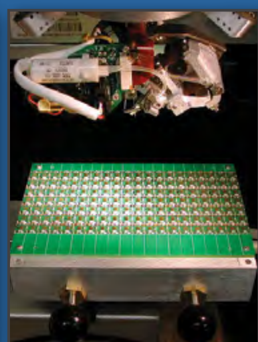
Samtec Microelectronics Group is positioned to provide you with complete signal chain support - from custom package and substrate design, to connector and cable selection, through signal integrity testing and debug of your full system - helping you ensure an optimized signal path.

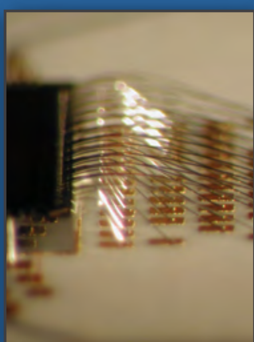
- Advanced IC package and substrate design
- Flip chip, die attach, wirebond, dam, encapsulation and lid attach
- Modeling and prototyping
- Testing and debug
- In-house optical engine design, manufacturing and packaging

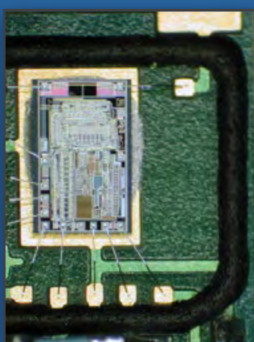
Samtec's worldwide Signal Integrity Group is dedicated to helping you determine and implement the most streamlined signal path possible, with support including full channel analysis, high data rate simulation, break out region design and routing, interconnect selection and application assistance.

Visit SamtecMicroelectronics.com for more information, or contact the Microelectronics or Signal Integrity Groups directly at SME@samtec.com or SIG@samtec.com.


Flip Chip & Underfill

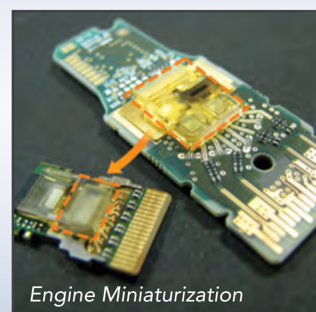

Precision Die Attach


Fine Pitch Wirebond


Dam & Encapsulation

ALSO AVAILABLE: Micro Optics Design & Packaging

- In-house optical engine design, manufacturing and packaging
- On-board and mid-board optical engines
- High speed micro flyover technologies
- Future-proof equalized electrical and optical designs
- Contact optics@samtec.com for more information


Engine Miniaturization

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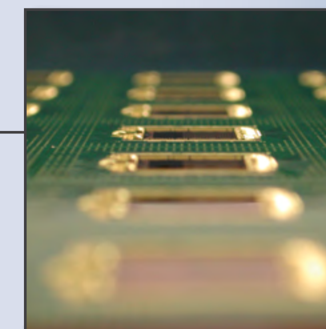
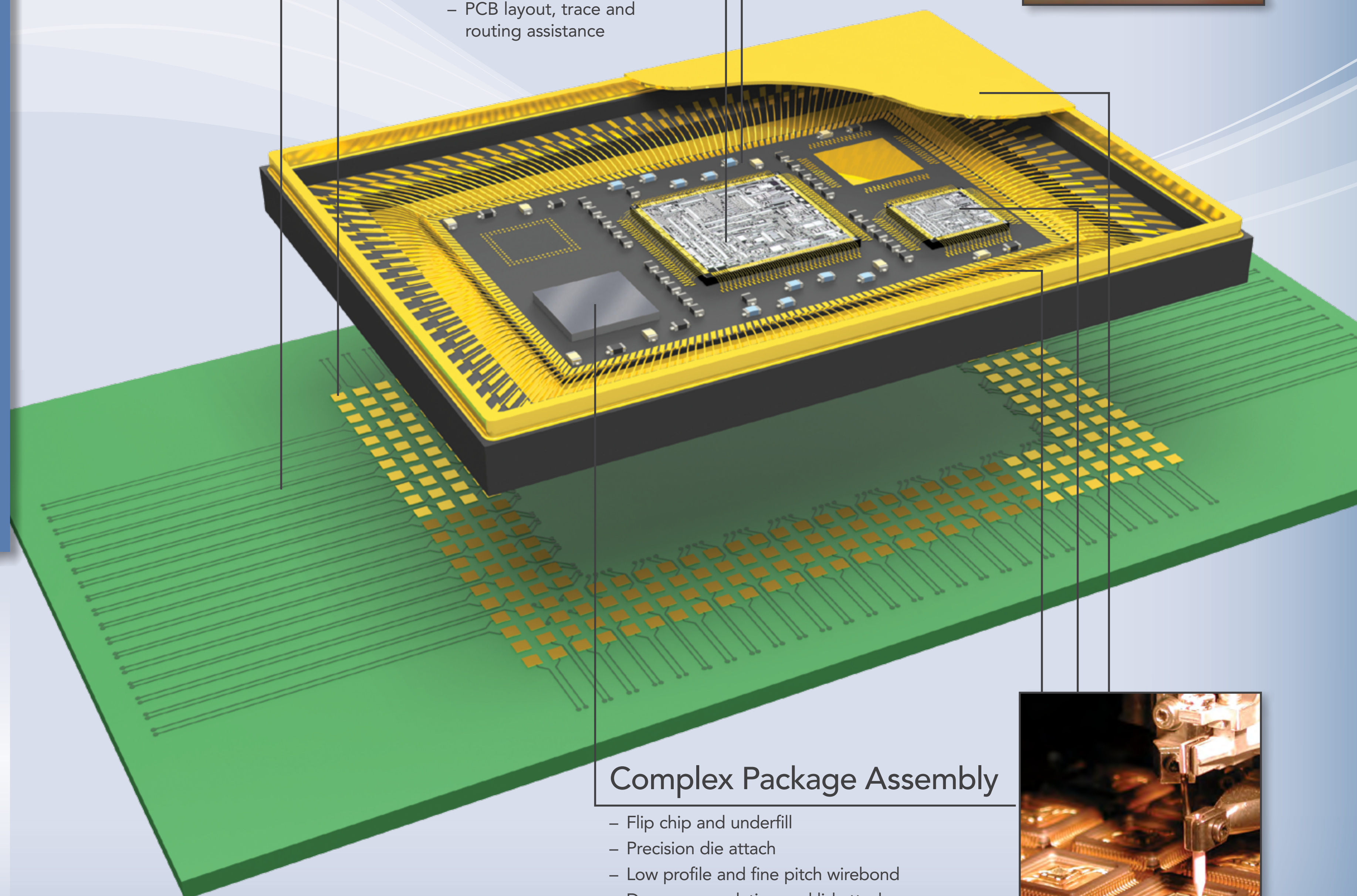
Full Signal Chain Support

- Modeling and mechanical packaging expertise
- Extensive testing, analysis and debug capabilities
- Interpretation of test data and performance results
- Connector selection assistance
- Final Inch® pre-optimized break out region reference designs
- PCB layout, trace and routing assistance

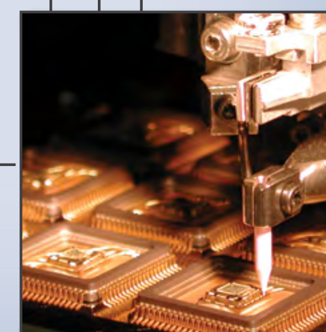
Substrate Design & Manufacturing



- PCB design with SI support
- Integration of interposers with substrates
- Multi-chip modules
- Ceramics and organics



Complex Package Assembly



- Flip chip and underfill
- Precision die attach
- Low profile and fine pitch wirebond
- Dam, encapsulation and lid attach
- Stacked and custom die

INDUSTRY-SPECIFIC APPLICATIONS

Samtec Microelectronics Group is positioned to support many industry-specific IC packaging applications. We provide leading-edge technologies and on-going development to ensure we are on the forefront of advanced IC packaging design and manufacturing.

Our manufacturing facility in Colorado Springs, Colorado, supports all areas of advanced IC packaging design, assembly, testing and manufacturing. Our technologies are supported by a reliable and accessible manufacturing infrastructure, along with full in-house signal integrity and system support.

Samtec adheres to a number of industry standard certifications and practices, including:

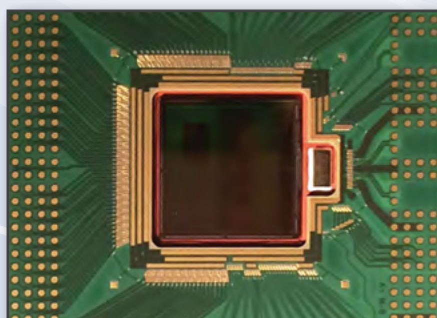
- TS 16949
- ISO 9001
- ISO/TS Quality Manual
- Environmental Compliance (RoHS)
- MIL-STD-883
- ITAR Regulation Compliance

For more information, please contact SME@samtec.com.

Avionics & Defense

TECHNOLOGIES / CAPABILITIES
- Compliant to MIL-STD-883
- ITAR Compliant
- Tin-only and Tin-Lead
- Custom design and assembly

END PRODUCTS
- PAA (Phased Array Antenna)
- Missile control
- Data converters
- Avionic pressure sensors
- Hermetic package assemblies
- Laser modules
- Digital signal processors
- Microcontrollers
- Power management
- Analog to digital converters
- FIFOs
- Autonomous vehicle modules



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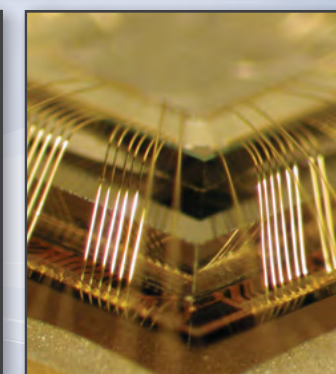
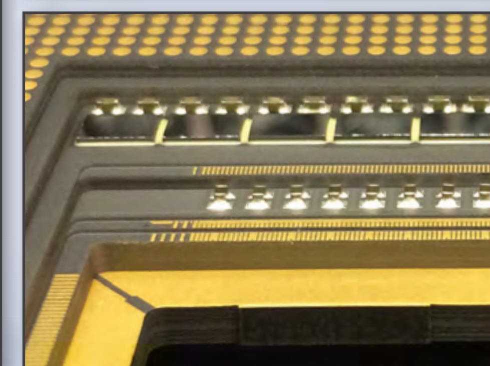
Medical & Healthcare

TECHNOLOGIES / CAPABILITIES
- MEMs
- Image packaging
- Custom IC package design
- Stacked and custom die
- Chip-scale interconnects

END PRODUCTS
- Neuromodulation
- Implantable pressure sensors
- Surgical assistance robotics
- Endoscopes
- Ultrasound
- DNA and blood analyzers
- Control devices
- Ventilators
- Implantable devices
- Diagnostic meters
- Patient monitoring
- Heart rate and fitness monitoring
- Optical 3D surface scanners
- ECG, portable ECG and EEG



Oil, Industrial & Commercial



TECHNOLOGIES / CAPABILITIES
- Micro footprint
- Flip chip, MEMs, BGA
- Thermal management
- Custom design and assembly
- Optics packaging

END PRODUCTS
- Geophone seismic sensors
- Downhole sensor assemblies
- Communications
- Automotive
- Optical assemblies
- Smart grid and energy
- Test and measurement
- Digital storage
- Automation
- Motor drive and control
- Servers

DESIGN RULES & GUIDELINES

Samtec Microelectronics Group has an extensive offering of advanced package design and assembly capabilities as well as the ability to assist in choosing the best technology and materials for your specific application.

In addition to substrate and package design, flip chip, die attach, wirebond and sealing, our capabilities also include thermal management, wafer dicing, lid attach and marking.

The following dimensions are designed to help release product to manufacturing as quickly as possible. Please contact SME@samtec.com if you have tighter requirements.

Flip Chip

Basic guidelines for laying out flip chip substrates including pad design rules, package sizes, solder ball specs, flux, pad pitch and layout, and general structure:

PACKAGE SIZE

- Smallest size (approx.): 10 mm x 10 mm
- Largest size (approx.): 63 mm x 63 mm

SOLDER BALL MATERIAL TYPE

- Eutectic Pb:Sn = 37:63
- Pb-Free

SUBSTRATE BGA SOLDER BALL SIZE

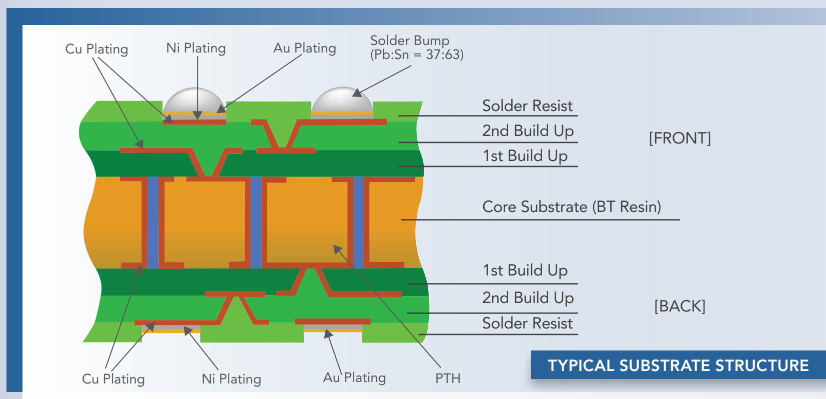
- Smallest (approx.): 0.018" diameter
- Largest (approx.): 0.025" diameter

FLUX

- TacFlux–025
- WS–609
- Other no-clean flux-types, water soluble flux-types

SUBSTRATE BGA PAD PITCH

- Closest pitch (approx.): 0,80 mm x 0,80 mm
- Furthest pitch: no constraint
- Any configuration of the pad layout is acceptable

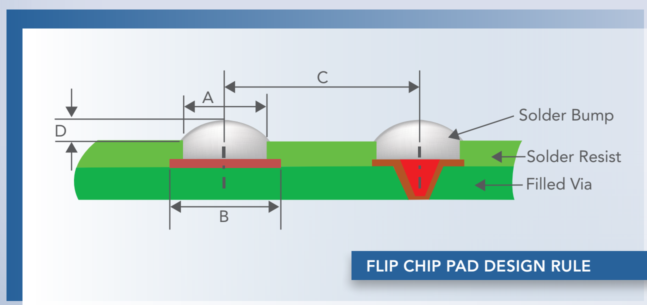


TYPICAL SUBSTRATE STRUCTURE

Layer Thickness (Typical)

Location	Standard (µm)	Custom (µm)
Core Substrate	800	400*
Core Cu	25	21
Build Up Cu	14.5	2
Insulation Layer	33	12
Solder Resist Layer	21	18
Nickel Plating	3 ~ 7	
Gold Plating	0.03 ~ 0.12	

No. of Build Up Layers: 1, 2, 3, 4 / Side
No. of Core Layers: 2, 4
**Coreless also available*



FLIP CHIP PAD DESIGN RULE

Specifications (Typical)

	Item	Standard (µm)	Custom (µm)
A	Flip Chip Pad Diameter (Solder Resist Opening)	100	75
B	Flip Chip Pad Metal Land Dia.	145	100
C	Flip Chip Pad Pitch	225	130
D	Solder Bump Height	32 +/- 5	

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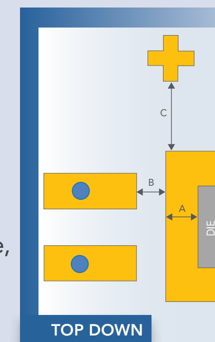
Die Attach

- Minimum distance between surrounding square of fiducial and neighboring objects must be 0,048 mm
- Gray level contrast between background and fiducial must be a minimum of 100 gray levels out of 256
- Background of fiducial must not have a structure and background must be single-colored gray level
- Maximum die size for dipping: 50 mm x 50 mm
- No waffle-pack handling for die <1 mm²
- Maximum length to width ratio for components: 5:1
- Saw kerfs must be at least 25 µm and into the dicing tape (through the entire wafer thickness)
- Die attach materials can be non-conductive, conductive, die-attach-films (DAF) and solder preforms; other processes can be discussed per customer requirements



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Die Attach Requirements

	Description	Organic (min) Inches (µm)	Ceramic (min) Inches (µm)
	Minimum Die Size	0.010" (250)	0.010" (250)
A	Overlap of Die Attach Ground Plane to Die Edge	0.020" (500)	0.020" (500)
B	Space between Die Attach Ground Plane to Wirebond Pad	0.020" (500)	0.020" (500)
C	Space between Fiducial Edge to Die Attach Ground Plane Edge	0.010" (250)	0.006" (150)

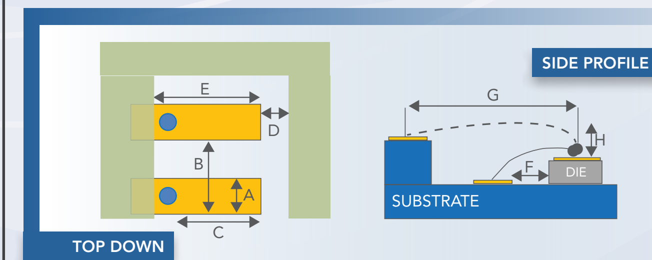
Wirebond

Plating and layout requirements for substrate pad design as well as wire parameters:

- Wedge Bond: ENIG plating is acceptable; typical wire types are Al, Au and Pt
- Ball Bond: ENEPIG plating is recommended; typical wire types are Au and Cu

Processes that use Au ball bond, require Gold plate per MIL–G–45204, Type III, Grade A, Class 1:

- 99.9% Purity minimum
- <90 Knoop hardness
- 50µ" Thick, minimum



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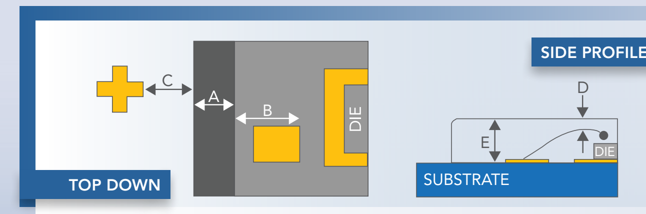
SIDE PROFILE

Wirebond Design Rules

Rule	Description	Organic (min) Inches (µm)	Ceramic (min) Inches (µm)
A	Wirebond Pad	0.004" (100)	0.003" (75)
B	Wirebond Pad Pitch	0.008" (200)	0.006" (150)
C	Overlap of Wirebond Lead Edge to Via	0.008" (200)	0.007" (175)
D	Space Solder Mask to Wirebond Lead Edge	0.004" (100)	-
E	Overlap of Wirebond Lead Edge to Solder Mask	0.008" (200)	-
F	Space of Die Edge to Wirebond Lead Edge (assuming no ground plane for die attach)	0.015" (375) or 2x Die Thickness (whichever is greater)	0.015" (375) or 2x Die Thickness (whichever is greater)
G	Maximum Wire Length	0.250" (6350)	0.250" (6350)
H	Maximum Wire Height	0.100" (2540)	0.100" (2540)

Dam & Encapsulation

- Maximum encapsulation thickness (board surface to top of encapsulation): 0.024" (600)
- Automated dispense tool heated work area: 12" x 16"
- Total work area: 20" x 30"
- Machine positioning accuracy and repeatability: +/- 0.001"



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SIDE PROFILE

Package Encapsulation Rules

Rule	Description	Organic (min) Inches (µm)
A	Dam Width	0.012" (300)
B	Space of Dam to Wirebond Lead Edge	0.012" (300)
C	Space of Fiducial to Dam (must be outside encapsulated region)	0.007" (175)
D	Overlap of Encapsulation to Top of Wirebond Loop	0.007" (175)
E	Height of Encapsulation (board surface to top of encapsulation)	=A/2

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