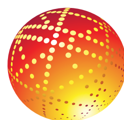
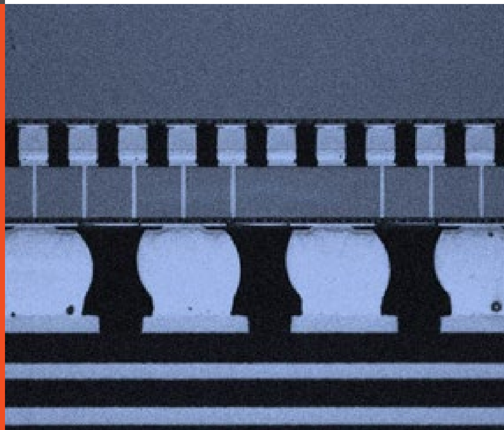


GLOBALFOUNDRIES®



Advanced Packaging Solutions

Highlights

- Advanced packaging capabilities in 2.5D, 3D, HD_FO and Silicon Photonics
- Power, performance, cost and form-factor optimized solutions
- Industry leader in smart interposers
- In-house bump and wafer probe capabilities
- Advanced memory integration with stacked memories
- Ownership and process maturity for HVM
- Advanced silicon node CPI and qualification
- RF system-in-package and mmWave packaging capability
- Partnerships and strong relationships with leading-edge OSATs
- Flexible supply chain and collaborative business models

Enabling Connected Intelligence

Providing silicon-scaling solutions for tomorrow's applications

GLOBALFOUNDRIES post-fab services provide complementary and extended solutions with complete supply chain management including bump, probe, packaging and final test. The flexible supply chain model is tailored to your needs with services ranging from bump and probe only to a more comprehensive spectrum of services including package design, assembly and test.

In addition to in-house bump and probe capabilities, we provide packaging services in collaboration with a network of established OSAT partners, including 2D packages as well as 2.5D and 3D advanced package technologies. Test development and capabilities include RF, analog, embedded memory, and mmWave applications, with wide array of tester platforms for wafer sort operations.

Packaging Requirements

Package types are selected based on performance requirements and optimized for market segments including IoT, RF, Automotive, Mobile, High-end Computing, Networking and Storage.

	Mobile	IoT	RF	Automotive	Computing	Networking	Storage
QFN		●	●	●			
FBGA		●	●	●			
WLCSP		●	●				
FOWLP	●	●	●	●			
SiP	●	●	●	●			●
fcCSP	●		●	●			
FCBGA				●	●	●	
2.5D					●	●	
3D					●	●	
Si-PH					●	●	●

Packaging Technologies

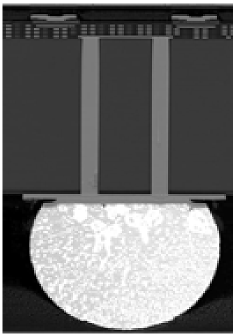
GF Si nodes are qualified in a wide range of package technologies including 2D wirebond designs, flip chip, WLCSP and FOWLP configurations, as well as 2.5D, 3D and Si-Photonics. The 2.5D package technologies leverage GF TSV Si interposer technology using 65nm and 32nm process node design rules, while 3D technologies utilize TSV technologies developed for 14nm and 7nm FinFET logic nodes.

TSV Si Interposer		Availability
Full Reticle	26x33mm²	●
Stitched Interposer	>1300 mm²	○
10:1 Aspect Ratio TSV	10um Dia./ 100um Depth	●
TSV Pitch	40um	●
L/S	0.8/ 0.8um	●
Deep Trench Capacitors	400nF/mm²	●
BEOL Layers	4 Metal Layers	●
	5 Metal Layers	○

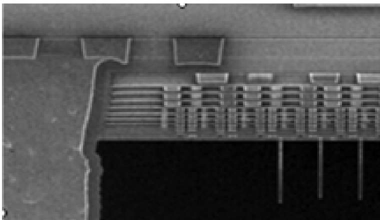
● *Available* ○ *In Development*

GF's in-house capabilities for process development, silicon validation and quick turn assembly of 2.5D and 3D package technologies provide differentiating technologies that result in a shorter time to end- product qualification and faster product ramp at OSAT partners.

	GF	OSAT
TSV Interposer Fabrication	●	
TSV reveal – MEOL	●	
u-Bumping	●	
D2W assembly	●	●
W2W assembly	●	
Package Assembly	●	●
Test	●	
Package REL	●	
Product Qual		●
HVM Ramp		●



Si Interposer

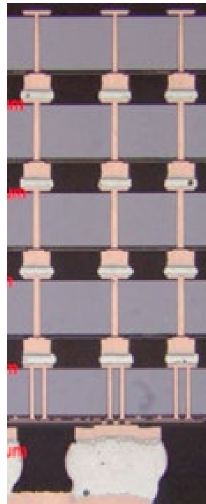


Deep Trench (DT) Capacitor

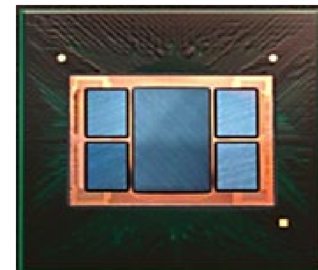
4 stack TSV DRAM (HBM)

32nm Logic with TSV

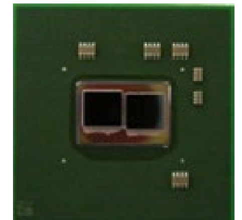
C4 Bumps



3D Logic + HBM



2.5D — Si Interposer, HBM



3D Package

Package Roadmap

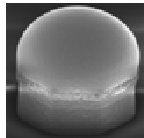
	GF Technology Node (nm)										
	180	130	65	55	45	40	32	28	22	14	7
QFN	●	●	●	●	●	●	●	●			
FBGA	●	●	●	●	●	●	●	●	○		
fcCSP (SnAg)	●	●	●	●	●	●	●	●	●	●	○
fcCSP (Cu)	●	●	●	●	●	●	●	●	●	●	○
FCBGA (SnAg)	●	●	●	●	●	●	●	●	○	●	○
FCBGA (Cu)	●	●	●	●	●	●	●	●	○	●	○
WLCSP	●	●	●	●	●	●	●	●	○		
FOWLP	●	●	●	●	●	●	●	●	○		
HD-FO										●	○
TSV			●				●			○	○
2.5D							●	●		○	○
3D							●			○	○

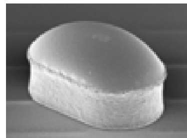
● *Available* ○ *In Development*

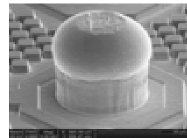
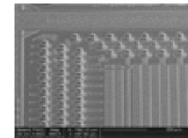
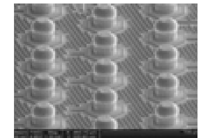
Bump capabilities include lead-free solder bump qualified down to 130µm and Cu pillar down to 80µm bump pitch. Cu pillar is also qualified and available in both round and oblong configuration. Wafer probe capabilities include both probe on bump as well as probe on pad with various tester platforms.

	GF Technology Node (nm)					
	40	32	28	22	14	7
Solder Bump	● 130um	●	●	●	●	
Cu Pillar	● 80um	●	●	●	●	○
u-Cu Pillar	○ 40um				○	○

SnAg Solder Bump


Round Cu Bump


Oblong Cu Bump

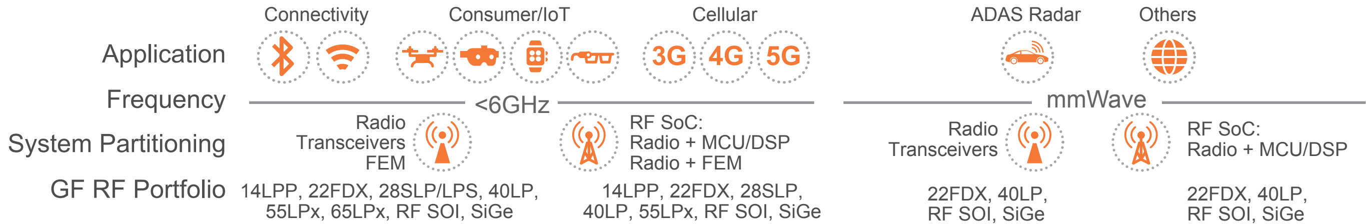



Micro pillar Bump

Chip-Package Interaction (CPI) characterizations are carried out across all nodes, with package configurations that ensure the compatibility of GF Si with customer-specified package types. Package Test Vehicle (TV) design in connection with the CPI test chip enables package assembly at OSATs, followed by reliability stressing at GF toward the qualification of package and Si node. Back-End-of-Line (BEOL) Si stack skews are designed and selected for CPI qualifications based on customer requirements.

	GF	OSAT
Package TV Design	●	
CPI Test Chip Design	●	
Package Assembly		●
Final Test Development	●	
REL Stressing	●	●
REL Readouts / FT	●	●
FA	●	●

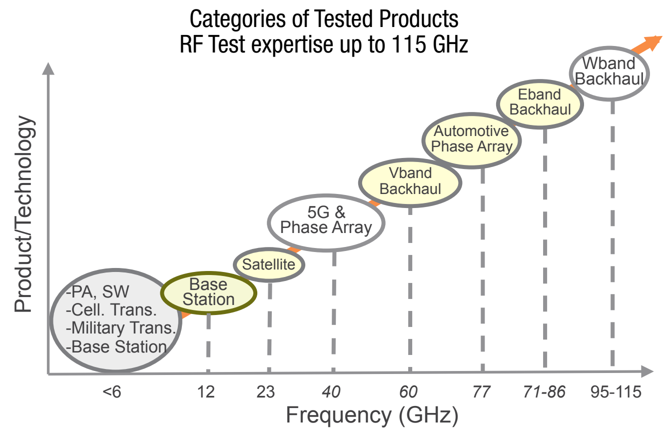
RF and mmWave

Advanced RF and mmWave packaging and test capabilities are under development for CMOS, RF SOI and SiGe. RF test expertise extends up to 115GHz with numerous products being developed and manufactured under the package turnkey service and business model. A whole range of product applications, frequencies and system partitioning schemes are being addressed and enabled as follows:



Package Qualification Reliability Tests:

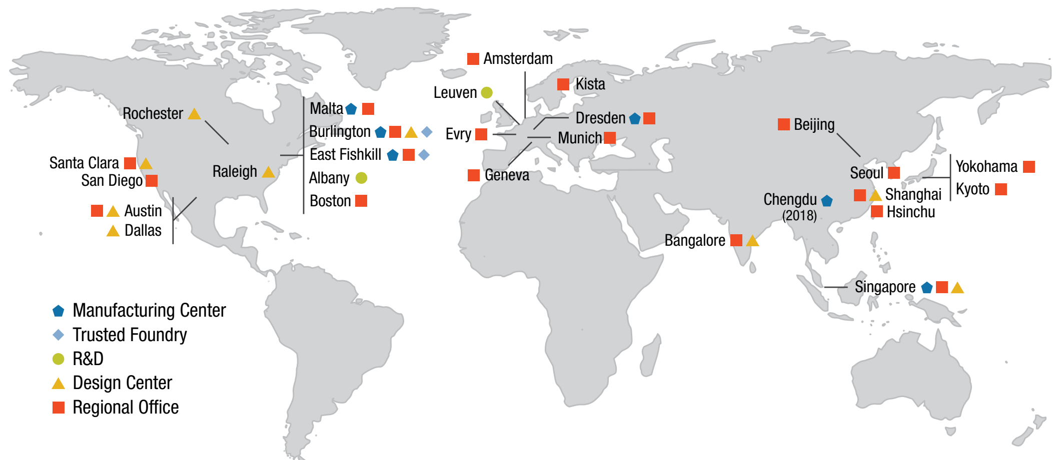
Resource Name	Stresses
Preconditioning	Reflow (240°C to 260°C), 3X
Hammer test	Reflow (240°C to 260°C), 1X, 5X, 10X, 15X, 20X
Quick Temperature Cycling	–40°C to +60°C, 1X, 10X, 20X, 40X
Thermal cycle	Conditions (B: –55°C to +125°C, G: –45°C to +125°C)
HAST	Bias HAST, HAST 130°C, 85% RH
Thermal shock	Thermal Shock (B, G), X cycles
Temperature Humidity	TH Bias, TH 85°C, 85% RH
High Temperature Storage	150°C, 1000 hrs
Board Level Reliability	Thermal Cycle, Shock test, Bend test, Vibration test



Post-Fab Worldwide Locations

Bump and wafer probe are offered in GF Post-Fab operations located in Dresden, Germany. OSAT partners are located in Korea, China, Taiwan, Singapore, and in Bromont, Canada. Test development and final test are available as part of post-fab operations in Singapore and Burlington, VT.

- Complete Turnkey offering in collaboration with leading OSATs
- Existing supply agreements for high-end FC solutions from IBM Bromont



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