PRICING GUIDELINES

NHanced Semiconductors, Inc. Internal Pricing Guidelines for Standard Services and 3D Assembly Flows

This list is the minimum price permitted for these items. Non-standard flows and other processing must be quoted on a per process step basis. NHanced reserves the right to review customer's needs, materials, and requirements and may require additional fees and/or processing steps. Further, NHanced may refuse any purchase order or request to process or provide materials at its sole discretion. Customers should request a formal quote for services.

SURFACE PREPARATION (WAFERS WITH <2UM OF SURFACE TOPOLOGY)

DBI: Copper plug fabrication, surface polish and mask for plug. Price is inclusive of all masks and processing for up to 6 wafers with 300 to 200mm cut down.	$37,500
Additional wafers:	$2,800 each
Without cut down.	$35,000
Additional wafers:	$2,650 each
3/5 (or other non-silicon) Wafer materials processing surcharge:	30%

DBI: Nickel plug fabrication, surface polish and mask for plug. Price is inclusive of all masks and processing for up to 6 wafers with 300 to 200mm cut down.	$55,000
Additional wafers:	$4,500 each
Without cut down.	$52,000
Additional wafers:	$4,350 each
3/5 (or other non-silicon) Wafer materials processing surcharge:	30%

DBI: Wafer clean, inspect and surface touch polish. Price is inclusive of processing for up to 6 wafers with 300 to 200mm cut down.	$12,000
Additional wafers:	$1,400 each
Without cut down.	$9,000
Additional wafers:	$1,250 each

3D ASSEMBLY

Wafer-to-Wafer Assembly with NO Backside Processing – DBI

DBI bonding including wafer bow correction. Minimum bonding pitch is 5um. Price is inclusive of all processing for up to 6 wafer pairs.	$70,000
Additional wafer pairs (2 layer):	$7,500 each bond
Wafer bonding beyond 2 layers:	$12,500 each bond
3/5 (or other non-silicon) Wafer materials processing surcharge:	30%

300mm cut-down bonding (additional bow adjustment)	$80,000
Additional wafer pairs (2 layer):	$9,500 each bond
Wafer bonding beyond 2 layers:	$15,500 each bond
3/5 (or other non-silicon) Wafer materials processing surcharge:	30%

PRICING GUIDELINES

Wafer-to-Wafer Assembly with Backside Processing – DBI

NOTE: Copper minimum geometry is 0.80um. Aluminum minimum geometry is 1um.
A 30% surcharge applies to the incorporation of 3/5 (or other non-silicon) materials into any of the assembly options in this section.
Front side to front side bonding is assumed. The back side to front side wafer bonding surcharge is $3,500 per wafer that is temporarily bonded and flipped. The back side to back side wafer bonding surcharge is 2 x $3,500 per wafer pair that is temporarily bonded and flipped.

DBI bonding including wafer bow correction and wafer thinning. Minimum bonding pitch is 5um. Price is inclusive of all processing for up to 6 wafer pairs. $85,000

Additional wafer pairs (2 layer):	$8,500 each bond
Wafer bonding beyond 2 layers:	$12,000 each bond
With L1 Backside Pad open	$100,000
Additional wafer pairs:	$10,000 each
With backside Al metal pattern and etch	$105,000
Additional wafer pairs:	$10,500 each
With backside backside Cu metal DBI formation -- Single metal layer	$110,000
Additional wafer pairs:	$11,000 each
With backside Al metal, passivation deposition and pad opening	$125,000
Additional wafer pairs:	$12,500 each
With L1 Backside Pad open and Al metal	$115,000
Additional wafer pairs:	$11,500 each
With L1 Backside Pad open, backside Al metal, passivation deposition and second pad opening	$130,000
Additional wafer pairs:	$13,000 each
With L1 Backside Pad open and backside Cu metal DBI formation Single metal layer	$125,000
Additional wafer pairs:	$12,500 each
With L1 Backside Pad open and backside Cu metal DBI formation Double metal layer	$140,000
Additional wafer pairs:	$14,000 each
With Pin Hole Etch, Mesa Etch and L1 Backside Pad open	$112,500
Additional wafer pairs:	$11,250 each
With Mesa Etch and L1 Backside Pad open	$105,000
Additional wafer pairs:	$10,500 each
With Mesa Etch	$95,000
Additional wafer pairs:	$9,500 each
With Al metal, L1 Backside Pad open, and Mesa Etch	$125,000
Additional wafer pairs:	$12,500 each

Backside Processing NO TSV

NOTE: Copper minimum geometry is 0.80um. Aluminum minimum geometry is 1um.
A 30% surcharge applies to the incorporation of 3/5 (or other non-silicon) materials into any of the assembly options in this section.
Front side to front side bonding is assumed. The back side to front side wafer bonding surcharge is $3,500 per wafer that is temporarily bonded and flipped. The back side to back side wafer bonding surcharge is 2 x $3,500 per wafer pair that is temporarily bonded and flipped.

PRICING GUIDELINES

Backside processing including backside thinning and oxide deposition. Price is inclusive of all masks and processing for up to 6 wafer pairs.	$65,000
Additional wafer pairs:	$6,500 each
With L1 Backside Pad open	$70,000
Additional wafer pairs:	$7,000 each
With backside Al metal pattern and etch	$85,000
Additional wafer pairs:	$8,500 each
With L1 Backside Pad open and Al metal	$95,000
Additional wafer pairs:	$9,500 each
With L1 Backside Pad open, backside Al metal, passivation deposition and second pad opening	$110,000
Additional wafer pairs:	$11,000 each
With L1 Backside Pad open and backside Cu metal DBI formation Single metal layer	$105,000
Additional wafer pairs:	$10,500 each
With L1 Backside Pad open and backside Cu metal DBI formation Double metal layer	$120,000
Additional wafer pairs:	$12,000 each
With Pin Hole Etch, Mesa Etch and L1 Backside Pad open	$92,500
Additional wafer pairs:	$9,250 each
With Mesa Etch and L1 Backside Pad open	$90,000
Additional wafer pairs:	$9,000 each
With Mesa Etch	$75,000
Additional wafer pairs:	$7,500 each
With Al metal, L1 Backside Pad open, and Mesa Etch	$105,000
Additional wafer pairs:	$10,500 each

Backside Processing with W/TSV - Silicon Wafers Only

Backside processing including backside thinning, oxide deposition, 6x1.2um tungsten TSV insertion, and either single damascene copper or Al padout with passivation. Copper minimum geometry is 0.80um. Aluminum minimum geometry is 1um. Price is inclusive of all masks and processing for up to 6 wafers.	$575,000
Additional wafers:	$15,500 each

Die-to-Wafer Assembly Single Donor/Host Type (Donor size >3x3mm) DBI

DBI, minimum bonding pad pitch is 5um for DBI. This package includes singulation of die on two donor wafers. Price is inclusive of all masks and processing for up to 2 host and 2 donor wafers and bonding of up to 100 dies.	$230,000
3/5 (or other non-silicon) Wafer materials processing surcharge:	40%

Die-to-Wafer Assembly Dual Donor/Single Host Type (Donor size >3x3mm) DBI

DBI only, minimum bonding pad pitch is 5um. This package includes singulation of die on two sets of donor wafers. Price is inclusive of all masks and processing for up to 2 host wafers, 2 sets of 2 donor wafers and bonding of up to 100 dies.	$300,000
Each additional Donor wafer type (includes processing of 2 wafers)	$75,000
3/5 (or other non-silicon) Wafer materials processing surcharge:	40%

PRICING GUIDELINES

Additional Die-to-Wafer Assemblies

Each additional host wafer or 50 die is $25,000.
3/5 (or other non-silicon) Wafer materials processing surcharge: 40%

Die-to-Wafer Assembly Single Donor/Host Type (Donor size >3x3mm) ZiBond

ZiBond only; This package includes singulation of die on two donor wafers. Price is inclusive of all masks and processing for up to 2 host and 2 donor wafers and bonding of up to 100 dies.

	$75,000
3/5 (or other non-silicon) Wafer materials processing surcharge:	40%

Die-to-Wafer Assembly Dual Donor/Single Host Type (Donor size >3x3mm) ZiBond

ZiBond only; This package includes singulation of die on two sets of donor wafers. Price is inclusive of all masks and processing for up to 2 host wafers, 2 sets of 2 donor wafers and bonding of up to 100 dies.

	$100,000
Each additional Donor wafer type (includes processing of 2 wafers)	$40,000
3/5 (or other non-silicon) Wafer materials processing surcharge:	40%

Additional Die-to-Wafer Assemblies

Each additional host wafer or 50 die is $20,000.
3/5 (or other non-silicon) Wafer materials processing surcharge: 40%

Temporary Probe Metal for 3D Assemblies

Deposit and pattern 5000A Al metal with no passivation followed by post probe Al metal removal and touch polish. The Al metal should be deposited on either tungsten or copper plugs. Price is inclusive of a single I-Line metal mask and processing for up to 6 wafers. $30,000
Each additional wafer is $3,000

Wafer-to-Wafer Assembly with No Backside Processing - Aligned

ZiBond oxide bonding with no thinning or backside processing. Price is inclusive of all processing for up to 3 wafer pairs (2 layer only). $40,000

Additional wafer pairs (2 layer):	$2,250 each bond
Wafer bonding beyond 2 layers:	$4,500 each bond
3/5 (or other non-silicon) Wafer materials processing surcharge:	25%

Front side to front side bonding is assumed. The back side to front side wafer bonding surcharge is $3,500 per wafer that is temporarily bonded and flipped. The back side to back side wafer bonding surcharge is 2 x $3,500 per wafer pair that is temporarily bonded and flipped.

Wafer-to-Wafer Assembly with No Backside Processing – Un-Aligned

ZiBond oxide bonding with no thinning or backside processing. Price is inclusive of all processing for up to 3 wafer pairs. $22,500

Additional wafer pairs (2 layer):	$1,500 each bond
Wafer bonding beyond 2 layers:	$3,250 each bond
3/5 (or other non-silicon) Wafer materials processing surcharge:	25%

PRICING GUIDELINES

Front side to front side bonding is assumed. The back side to front side wafer bonding surcharge is $3,500 per wafer that is temporarily bonded and flipped. The back side to back side wafer bonding surcharge is 2 x $3,500 per wafer pair that is temporarily bonded and flipped.

Wafer-to-Wafer Assembly with Backside Processing - Aligned

ZiBond oxide bonding with wafer thinning. Price is inclusive of all processing for up to 3 wafer pairs.

	$55,000
Additional wafer pairs (2 layer):	$5,500 each bond
Wafer bonding beyond 2 layers:	$7,500 each bond
With L1 Backside Pad open	$70,000
Additional wafer pairs:	$6,000 each
3/5 (or other non-silicon) Wafer materials processing surcharge:	25%

Front side to front side bonding is assumed. The back side to front side wafer bonding surcharge is $3,500 per wafer that is temporarily bonded and flipped. The back side to back side wafer bonding surcharge is 2 x $3,500 per wafer pair that is temporarily bonded and flipped.

Wafer-to-Wafer Assembly with Backside Processing – Un-Aligned

A 25% surcharge applies to the incorporation of 3/5 (or other non-silicon) materials into any of the assembly options in this section.
Front side to front side bonding is assumed. The back side to front side wafer bonding surcharge is $3,500 per wafer that is temporarily bonded and flipped. The back side to back side wafer bonding surcharge is 2 x $3,500 per wafer pair that is temporarily bonded and flipped.

ZiBond oxide bonding with wafer thinning. Price is inclusive of all processing for up to 3 wafer pairs.

	$40,000
Additional wafer pairs (2 layer):	$4,000 each bond
Wafer bonding beyond 2 layers:	$6,000 each bond
With L1 Backside Pad open	$55,000
Additional wafer pairs:	$5,500 each
With backside Al metal pattern and etch	$70,000
Additional wafer pairs:	$7,000 each
With backside Al metal, passivation deposition and pad opening	$85,000
Additional wafer pairs:	$8,500 each
With L1 Backside Pad open and Al metal	$80,000
Additional wafer pairs:	$8,000 each
With L1 Backside Pad open, backside Al metal, passivation deposition and second pad opening	$95,000
Additional wafer pairs:	$9,500 each
With L1 Backside Pad open and backside Cu metal DBI formation Single metal layer	$90,000
Additional wafer pairs:	$9,000 each
With L1 Backside Pad open and backside Cu metal DBI formation Double metal layer	$105,000
Additional wafer pairs:	$10,500 each
With Pin Hole Etch, Mesa Etch and L1 Backside Pad open	$77,500
Additional wafer pairs:	$7,750 each
With Mesa Etch and L1 Backside Pad open	$70,000

Additional wafer pairs:	$7,000 each
With Mesa Etch	$60,000
Additional wafer pairs:	$6,000 each
With Al metal, L1 Backside Pad open, and Mesa Etch	$90,000
Additional wafer pairs:	$9,000 each

Advanced Wafer Planarization for Wafer Surface Topology >2um and <5um

This package includes additional wafer planarization to remove surface topology when it exceeds 2um. NHanced will use reverse mask etching provided the GDS data is available. Generally, NHanced will deposit 1um of oxide followed by CMP in multiple steps until the wafer meets planarity specification for bonding or other designated purpose. 3 wafer lot $12,000

Additional wafers	$2,500 each
3/5 (or other non-silicon) Wafer materials processing surcharge:	35%

Transfer Printing Die-to-Wafer

This package includes undermining of die on two donor wafers. Minimum die size is 100x100um. Post attach metallization is not included. Price is inclusive of all masks, stamp tooling, and processing for up to 2 wafers or 100 dies, whichever is less. $110,000

3/5 (or other non-silicon) Wafer materials processing surcharge:	35%

Additional Die-to-Wafer Assemblies

Each additional wafer or 50 die is $10,000.
3/5 (or other non-silicon) Wafer materials processing surcharge: 35%

HDI PACKAGING

Copper Edge Interconnect Generation – Silicon Only

3/5 (or other non-silicon) Wafer materials (if available) processing surcharge: 35%
RIE deep trench cut and copper fill with minimum pitch of 10um.

First Lot (up to 6 wafers)	$90,000
Additional Wafers	$11,000 each

Plasma Singulation

3/5 (or other non-silicon) Wafer materials (if available) processing surcharge: 35%

Plasma etching of up to 6 wafers including masking.	$35,000
Additional Wafers	$3,500 each

Solder Plating for HDI

Lead-Free solder plating of up to 6 wafers including masking.	$35,000
Additional Wafers	$3,500 each

Planar HDI Assembly (Minimum pitch 40um)

3/5 (or other non-silicon) Wafer materials (if available) processing surcharge: 35%

Assembly of 50 tiles	$50,000
Each Additional 50 tiles	$5,000 each

Additional Wafer Volume Discounts for Wafer Stacking Services

1-9 Additional Wafers: 0% discount
10-19 Additional Wafers: 10% discount

PRICING GUIDELINES

20-50 Additional Wafers: 25% discount
51-100 Additional Wafers: 35% discount
101+ Additional Wafers: 45% discount – for planning only at this time

Run-Plus Discounts for Wafer Stacking

Applicable when additional wafers are run separate from first lots but the flow is substantially the same.
3 Wafer lot: 33% discount
2 Wafer lot: 40% discount

Lot Splits for 3D Assembly Services

The lot split fee is 15% of the base module cost plus any additional wafer services amount.

PRICING GUIDELINES

WAFER RECONSTITUTION

DECA Technology

Single Die Packaging: (Max die size is 26x33mm)
DECA M-Series assembly. Package includes fabrication of organic substrate (>=2mill L/S), wafer copper studding, adaptive patterning of RDL, substrate bumping and over mold tooling

First Lot (up to 50 pieces)	$650,000
Additional die in same lot	$150
New lot start	15% Original NRE + per die cost

Multi-die Packaging (Up to 4 die. Up to 50x50mm substrate. Max Die size is 26x33mm):
DECA M-Series assembly. Package includes fabrication of organic substrate (>=2mill L/S), wafer copper studding, adaptive patterning of RDL, substrate bumping and over mold tooling

First Lot (up to 50 pieces)	$950,000
Additional die in same lot	$400
New lot start	15% Original NRE + per die cost

PRICING GUIDELINES

OTHER PROCESSING

TSV Insertion – Silicon Only

NOTE: Backside TSV insertion has many factors that affect quality and insertion success. These include field oxide thickness, landing metal material and thickness, thermal constraints, and final aspect ratio. These variables may drive the need for additional process steps or elimination of some alternatives.

Backside TSV Insertion (1.2um x 6um deep Tungsten). This includes the TSV mask, carrier attach, and wafer thinning.

This is for up to 3 wafers with 2 wafers for setup.	$275,000
New lot starts	$67,500
Additional wafers are	$25,500 each

Backside TSV Insertion (3um x 7um deep Copper). This includes the TSV mask, carrier attach, and wafer thinning.

This is for up to 3 wafers with 2 wafers for setup.	$190,000
New lot starts	$45,000
Additional wafers are	$15,000 each

Backside TSV Insertion (10um x 100um deep Copper). This includes the TSV mask, carrier attach, and wafer thinning.

This is for up to 3 wafers with 2 wafers for setup.	$250,000
New lot starts	$65,000
Additional wafers are	$22,000 each

Backside TSV Insertion (50um x 400um deep Copper). This includes the TSV mask and wafer thinning.

This is for up to 3 wafers with 2 wafers for setup.	$235,000
New lot starts	$55,000
Additional wafers are	$20,000 each

Backside TSV Insertion landing on TSV middle stub (such as iDSV) (50um x 400um deep Copper). This includes the TSV mask and wafer thinning.

This is for up to 3 wafers with 2 wafers for setup.	$170,000
New lot starts	$40,000
Additional wafers are	$12,500 each

Backside Shallow TSV Insertion (10um x 10um deep Copper). This includes the TSV mask, carrier attach, and wafer thinning (bulk or SOI).

This is for up to 3 wafers with 2 wafers for setup.	$80,000
New lot starts	$15,500
Additional wafers are	$7,500 each

Backside Shallow TSV Insertion (10um x 10um deep Copper). This includes the TSV mask, carrier attach, wafer thinning (bulk or SOI), and DBI formation.

This is for up to 3 wafers with 2 wafers for setup.	$95,000
New lot starts	$18,500
Additional wafers are	$9,000 each

PRICING GUIDELINES

PRICING GUIDELINES

NOTE: Frontside TSV insertion has many factors that affect quality and insertion success. These include oxide thickness, dielectric materials and thicknesses, thermal constraints, and final aspect ratio. These variables may drive the need for additional process steps or elimination of some alternatives.

Frontside TSV Insertion (10um x 100um deep Copper). This includes the TSV mask, TSV reveal, and carrier attach. Insertion through <3um of frontside oxide.

This is for up to 3 wafers with 2 wafers for setup.	$195,000
New lot starts	$68,000
Additional wafers are	$18,500 each

Frontside TSV Insertion (50um x 400um deep Copper). This includes the TSV mask and TSV reveal. Insertion through <3um of frontside oxide.

This is for up to 3 wafers with 2 wafers for setup.	$165,000
New lot starts	$52,500
Additional wafers are	$15,500 each
Base Cost Adder: Each additional 5um of frontside oxide to etch through	$25,000
Additional per wafer oxide etch cost (per 5um increment)	$2,800 each

PRICING GUIDELINES

Copper Single Damascene 193i DP

Standard 40nm design rules per layer costing (up to 6 layers). Price is inclusive of one pair of 193i mask and processing for up to 6 wafers. $200,000

Additional wafers are	up to 20 additional	$5,000 each
Additional wafers are	21-60	$4,000 each
Additional wafers are	61-100	$2,500 each

Copper Single Damascene 193i

Standard 45nm design rules per layer costing (up to 6 layers). Price is inclusive of one 193i mask and processing for up to 6 wafers. $100,000

Additional wafers are	up to 20 additional	$3,000 each
Additional wafers are	21-60	$2,500 each
Additional wafers are	61-100	$2,000 each

Copper Single Damascene 193nm PSM

Standard 65nm design rules per layer costing (up to 6 layers). Price is inclusive of one 193nm PSM mask and processing for up to 6 wafers. $45,000

Additional wafers are	up to 20 additional	$3,000 each
Additional wafers are	21-60	$2,500 each
Additional wafers are	61-100	$2,000 each

Copper Single Damascene 193nm

Standard 0.28um design rules per layer costing (up to 6 layers). Price is inclusive of one 193nm mask and processing for up to 6 wafers. $25,000

Additional wafers are	up to 20 additional	$1,500 each
Additional wafers are	21-60	$1,050 each
Additional wafers are	61-100	$900 each

Copper Single Damascene 248nm

Standard 0.5um design rules per layer costing (up to 6 layers). Price is inclusive of one 248nm mask and processing for up to 6 wafers. $25,000

Additional wafers are	up to 20 additional	$1,500 each
Additional wafers are	21-60	$1,050 each
Additional wafers are	61-100	$900 each

Copper Single Damascene No mask

Standard 0.28um design rules per layer costing (up to 6 layers). Price is exclusive of masks and inclusive of processing for up to 6 wafers. $20,000

Additional wafers are	up to 20 additional	$1,500 each
Additional wafers are	21-60	$1,050 each
Additional wafers are	61-100	$900 each

Copper Dual Damascene 193i DP

Standard 40nm design rules per layer costing (up to 6 layers). Price is inclusive of one pair of 193i mask and processing for up to 6 wafers. $450,000

Additional wafers are	up to 20 additional	$10,000 each
Additional wafers are	21-60	$8,000 each
Additional wafers are	61-100	$5,000 each

PRICING GUIDELINES

Copper Dual Damascene 193i

Standard 45nm design rules per layer costing (up to 6 layers). Price is inclusive of one 193i mask and processing for up to 6 wafers. $200,000

Additional wafers are	up to 20 additional	$6,000 each
Additional wafers are	21-60	$5,000 each
Additional wafers are	61-100	$4,000 each

Copper Dual Damascene 193nm PSM

Standard 65nm design rules per layer costing (up to 6 layers). Price is inclusive of one 193nm PSM mask and processing for up to 6 wafers. $100,000

Additional wafers are	up to 20 additional	$6,000 each
Additional wafers are	21-60	$5,000 each
Additional wafers are	61-100	$4,000 each

Copper Dual Damascene 193nm

Standard 0.28um design rules per layer costing (up to 4 layers). Price is inclusive of two 193nm masks and processing for up to 6 wafers. $55,000

Additional wafers are	up to 20 additional	$2,500 each
Additional wafers are	21-60	$1,800 each
Additional wafers are	61-100	$1,500 each

Copper Dual Damascene 248nm

Standard 0.5um design rules per layer costing (up to 4 layers). Price is inclusive of two 248nm masks and processing for up to 6 wafers. $55,000

Additional wafers are	up to 20 additional	$2,500 each
Additional wafers are	21-60	$1,800 each
Additional wafers are	61-100	$1,500 each

Copper Dual Damascene No mask

Standard 0.28um design rules per layer costing (up to 4 layers). Price is exclusive of masks and inclusive of processing for up to 6 wafers. $27,000

Additional wafers are	up to 20 additional	$2,500 each
Additional wafers are	21-60	$1,800 each
Additional wafers are	61-100	$1,500 each

Copper Single Damascene 1X wafer mask

Standard 10um design rules per layer costing (up to 6 layers). Price is inclusive of one 1X wafer mask and processing for up to 6 wafers. $22,500

Additional wafers are	up to 20 additional	$1,500 each
Additional wafers are	21-60	$1,050 each
Additional wafers are	61-100	$900 each

Copper Dual Damascene 1X wafer mask

Standard 10um design rules per layer costing (up to 4 layers). Price is inclusive of two 1X wafer masks and processing for up to 6 wafers. $40,000

Additional wafers are	up to 20 additional	$2,100 each
Additional wafers are	21-60	$1,700 each
Additional wafers are	61-100	$1,400 each

PRICING GUIDELINES

Copper Single Damascene G/I-line wafer mask

Standard 1um design rules per layer costing (up to 6 layers). Price is inclusive of one G/I-line wafer mask and processing for up to 6 wafers. $22,500

Additional wafers are	up to 20 additional	$1,500 each
Additional wafers are	21-60	$1,050 each
Additional wafers are	61-100	$900 each

Copper Dual Damascene G/I-line wafer mask

Standard 1um design rules per layer costing (up to 4 layers). Price is inclusive of two G/I-line wafer masks and processing for up to 6 wafers. $45,000

Additional wafers are	up to 20 additional	$3,100 each
Additional wafers are	21-60	$2,300 each
Additional wafers are	61-100	$2,000 each

Copper Single Layer Plate Through Resist 1X wafer mask

Standard 10um design rules per layer costing (up to 3 layers). Price is inclusive of one 1X wafer mask and processing for up to 6 wafers. $35,000

Additional wafers are	up to 20 additional	$3,500 each
Additional wafers are	21-60	$3,100 each
Additional wafers are	61-100	$2,750 each

Copper Single Layer Plate Through Resist G/I-line wafer mask

Standard 3um design rules per layer costing (up to 6 layers). Price is inclusive of one G/I-line wafer mask and processing for up to 6 wafers. $37,500

Additional wafers are	up to 20 additional	$3,700 each
Additional wafers are	21-60	$3,300 each
Additional wafers are	61-100	$2,900 each

Mixed Metal Stacks ≥6 mask layers ≥100 wafer

Using earlier developed masks and processes, NHanced will produce qualification and characterization wafers in 25 wafer lot quantities with a minimum of 4 lots.

Cost is per mask layer per wafer: $2,500 each

Pad Opening Etch G/I-line

Standard G/I-line 0.8um design rules. Price is inclusive of one G/I-line mask and processing for up to 6 wafers. $15,000

Additional wafers are	up to 20 additional	$1,000 each
Additional wafers are	21-60	$800 each
Additional wafers are	61-100	$500 each

Metal Dep and Etch G/I-line

Standard 3um design rules per layer costing (up to 6 layers). Price is inclusive of one G/I-line mask and processing for up to 6 wafers. $20,000

Additional wafers are	up to 20 additional	$1,200 each
Additional wafers are	21-60	$950 each
Additional wafers are	61-100	$800 each

PRICING GUIDELINES

Via cut prior to dep. Price is inclusive of one G/I-line mask and processing for up to 6 wafers.

		$15,000
Additional wafers are	up to 20 additional	$1,200 each
Additional wafers are	21-60	$950 each
Additional wafers are	61-100	$800 each

Patterned Metal Wet Etch

Price is for processing for up to 6 wafers. (no mask)		$10,000
Additional wafers are	up to 20 additional	$1,200 each
Additional wafers are	21-60	$950 each
Additional wafers are	61-100	$800 each

SiN Waveguide

Standard G/I-line 1um design rules. Price is inclusive of one G/I-line mask and processing for up to 6 wafers.		$35,000
Additional wafers are	up to 20 additional	$2,000 each
Additional wafers are	21-60	$1600 each
Additional wafers are	61-100	$1200 each

Deep Oxide Etch G/I-line or 1X

3um design rule with <1:1 aspect ratio. Price is inclusive of one mask and processing for up to 3 wafers.

First 3um etch	$17,500
Each additional 5um etch	$22,500
Additional wafer cost first etch	$2,500
Additional wafer cost each additional etch	$2,750

Bosch Etch G/I-line or 1X

10um design rule with =<10:1 aspect ratio. Price is inclusive of one mask and processing for up to 3 wafers.	$25,000
Additional wafer cost	$3,500

ALD Deposit and Etch G/I-line or 1X

3um design rule. Price is inclusive of one mask and processing for up to 3 wafers.

	$40,000
Additional wafer cost	$2,500

PRICING GUIDELINES

Wafer Bumping No Lead

Standard 200mm or 300mm wafer bumping with 150um or greater bump pitch. <=20,000 bumps. This package includes up to 12 wafers and all masks for UBM and bump formation. Assumed starting pad finish is Al. $20,000

Additional wafers are $1,200 each

Wafer Bumping No Lead

Standard 200mm or 300mm wafer bumping with 100um to 150um bump pitch. <=50,000 bumps. This package includes up to 12 wafers and all masks for UBM and bump formation. Assumed starting pad finish is Al. $25,000

Additional wafers are $1,250 each

Wafer MicroBumping No Lead

Standard 200mm or 300mm wafer bumping with 50um to 100um bump pitch. <=100,000 bumps. This package includes up to 12 wafers and all masks for UBM and bump formation. Assumed starting pad finish is Al. $35,000

Additional wafers are $1,500 each

Wafer Bumping High Lead

Standard 200mm or 300mm wafer bumping with 150um or greater bump pitch. <=20,000 bumps. This package includes up to 12 wafers and all masks for UBM and bump formation. Assumed starting pad finish is Al. $22,500

Additional wafers are $1,350 each

Wafer Bumping Lead

Standard 200mm or 300mm wafer bumping with 150um or greater bump pitch. <=20,000 bumps. This package includes up to 12 wafers and all masks for UBM and bump formation. Assumed starting pad finish is Al. $25,000

Additional wafers are $1,250 each

Wafer Bumping Lead Low Alpha

Standard 200mm or 300mm wafer bumping with 150um or greater bump pitch. <=20,000 bumps. This package includes up to 12 wafers and all masks for UBM and bump formation. Assumed starting pad finish is Al. $50,000

Additional wafers are $2,000 each

Wafer Bumping Indium

Standard up to 200mm wafer bumping with 25um or greater bump pitch. <=250,000 bumps. This package includes up to 6 wafers and all masks for UBM and bump formation. Assumed starting pad finish is Al. $30,000

Additional wafers are $2,500 each

With attach $47,500

Additional wafers are $4,500 each

Wafer UBM Only

Standard 200mm or 300mm wafer bumping with 50um or greater bump pad pitch. This package includes up to 3 wafers and all masks for UBM processing. Assumed starting pad finish is Al. $12,000

PRICING GUIDELINES

Additional wafers are	$1000 each

Wafer Bumping Tooling Only

Standard 200mm or 300mm wafer bump tooling and receipt setup	
2 masks	$12,500

Die Bumping

Only for prototyping C4 ≥150um pitch	
Gold stud bumping ($1,500 lot charge)	$1/bump
Solder bumping ($8,500 lot charge)	$0.58/bump

INEG Pad Finish

NiAu with TiN adhesion layer UBM 200mm or 300mm	
(First wafer)	$38,000
Additional wafers are	$3,500 each

EPEG Pad Finish

NiPdAu with TiN adhesion layer UBM 200mm or 300mm	
(First wafer)	$35,000
Additional wafers are	$3,500 each

PRICING GUIDELINES

Standard Organic Die Substrate

Acquisition of 5 panels or 50 pieces which ever more. The package includes all prototype production costs.

2 planes + 4 wiring layers organic substrate	$25,000
4 planes + 4 wiring layers organic substrate	$35,000
4 planes + 8 wiring layers organic substrate	$45,000
Low CTE 4 planes + 4 wiring layers organic substrate	$60,000
Substrate design base cost	$4,000
Substrate design per sqmm cost	+$6/sqmm
High speed nets substrate design per sqmm cost	+$12/sqmm

Standard Organic Interposer/Module Substrate

Design

Substrate design base cost	$5,000
Substrate design per sqmm cost	+$6/sqmm
High speed nets substrate design per sqmm cost	+$12/sqmm

Tooling

Acquisition of tooling and test panel (up to 150x150mm ≥5mil L/S).
The package includes all prototype production costs.

Electrical Joiners (Top pads, Bottom pads and Via)	$7,800
Lid Spacers (Bottom Pads)	$7,800
2 planes + 4 wiring layers organic substrate tooling	$40,000
4 planes + 4 wiring layers organic substrate tooling	$50,000
4 planes + 8 wiring layers organic substrate tooling	$65,000

Low Volume Production
(Up to 150x150mm ≥5mil L/S)

2 planes + 4 wiring layers organic substrate	
10 pieces, lot cost	$2,500
100 pieces, lot cost	$5,000
4 planes + 4 wiring layers organic substrate	
10 pieces, lot cost	$2,500
100 pieces, lot cost	$5,000
4 planes + 8 wiring layers organic substrate	
10 pieces, lot cost	$3,000
100 pieces, lot cost	$6,000

Single Die Packaging (Low Volume)

Prototype package assembly up to 50 pieces	$20,000 lot minimum
Additional per die package same lot (flip-chip or wire bond)	$50
Photonic Wirebond Setup	$50,000
Photonic Wirebond (per device or 10 connections)	$150
Basic electrical test (go/no-go, dc)	$50
Basic Photonic test (go/no-go, dc)	$500

PRICING GUIDELINES

Multi-Die or Device Packaging (Low Volume)

Prototype package assembly up to 50 pieces	$45,000 lot minimum
Per die (flip-chip or wire bond)	$50
Per die (copper pillar)	$85
Per capacitor/resistor (including component acquisition)	$10
Silicon interposer attachment	$150
Microbump die attachment	$75
Photonic Wirebond Setup	$50,000
Photonic Wirebond (per device or 10 connections)	$150
Basic electrical test (go/no-go, dc)	$50
Basic Photonic test (go/no-go, dc)	$500

Standard Organic Interposer/Module Substrate Assembly (Low Volume)

(Organic substrates with ≤15 ICs or sub modules, ≤50 passives, ≤150x150mm, min component space 1mm)

Production setup	$25,000
Production (≤250 units)	
Base cost (≤50 passives)	$225
Flip-Chip (≤15 ICs or sub modules)	$250
Wire bonding (≥100um pitch)	$15+0.05/bond
Photonic Wirebond Setup	$50,000
Photonic Wirebond (per device or 10 connections)	$150
Chip attach	$25+5.00/each additional dev
Connectors/joiners/spacers	$50+10.00/each additional dev
Snap lid attach	$15
Solder lid attach	$35
Electrical lid attach	$75
Heat spreader attach (thermal epoxy)	$25
Heat spreading lid attach (thermal compound added), soldered	$75
Basic electrical test (go/no-go, dc)	$50
Basic Photonic test (go/no-go, dc)	$500

Device Lid

Metal lid design and 50 piece production lot (soft tool)	$4,500
Heat spreading metal lid design and 50 piece production lot (soft tool)	$8,500
Metal lid design and low volume production tooling	$4,500
Heat spreading metal lid design and low volume production tooling	$8,500

Wafer probe card

Standard wafer probe card for either manual or Electroglass handler with up to 400 pins at a minimum pitch of 150um or greater. (No analog or RF signals) $25,000

PRICING GUIDELINES

Substrate Bumping

No-lead 300-500um solder bumps (10-500 bumps)

Setup (First 50 pieces or 25,000 bumps)	$25,000
Additional 50-piece lots	$250/1,000 bumps

Lot Splits for Other Processing

The lot split fee is 15% of the base module cost unless otherwise specifically specified in the pricing table.

PRICING GUIDELINES

FIXED MODULE SERVICES

These services are available ala carte as off the shelf process modules on a per wafer basis min of 6 wafer lots. Subject to fab approval of materials and flows:

3/5 (or other non-silicon) Wafer materials processing surcharge:	35%
General lot/process setup	$6,000/run
Wafer bow adjustment:	$5,000/wafer
Back grinding Silicon wafer, no handle, finish >100um:	$1,000/wafer
Back grinding Silicon wafer, no handle, finish >50um:	$1,750/wafer
Back grinding Non-Si wafer, no handle, finish >100um:	$2,500/wafer
Back grinding Non-Si wafer, no handle, finish >50um:	$4,000/wafer
Back grinding Si wafer, w tmp carrier, finish >100um:	$2,000/wafer
Back grinding Si wafer, w tmp carrier, finish >50um:	$2,750/wafer
Back grinding Non-Si wafer, w tmp carrier, finish >100um:	$3,500/wafer
Back grinding Non-Si wafer, w tmp carrier, finish >50um:	$5,000/wafer
Stacked Si wafer back grinding:	$2,500/wafer
Stacked Si wafer edge grinding:	$2,000/wafer
Stacked Si wafer grinding prep, backside protective oxide:	$3,500/wafer
Stacked Non-Si wafer back grinding:	$4,000/wafer
Stacked Non-Si wafer edge grinding:	$3,500/wafer
Stacked Non-Si wafer grinding prep, backside protective oxide:	$3,000/wafer
Wafer 1x litho, mask not included:	$2,000/wafer
Backside wafer polishing:	$500/wafer
Si CMP single wafer, no handle, finish >100um:	$1,000/wafer
Si CMP single wafer, no handle, finish >50um:	$1,750/wafer
Stacked wafer Si CMP:	$3,000/wafer
Cu CMP:	$1,500/wafer
W CMP:	$1,500/wafer
Custom material CMP:	$10,000/6 wafers
Si dry etch:	$2,000/wafer
SiO dry etch:	$2,000/wafer
ALD tungsten blanket film:	$2,000/wafer
Copper blanket film:	$1,000/wafer
Ta, TaN blanket film:	$1,000/wafer
Ti, TiN blanket film:	$1,000/wafer
SiO blanket film:	$1,000/wafer
SiN blanket film:	$1,000/wafer
SiO blanket film with surface CMP:	$2,500/wafer
SiN blanket film with surface CMP:	$2,500/wafer
Backside Al Pad:	$1,500/wafer
SiO blanket dry etch:	$1,000/wafer
SiN blanket dry etch:	$1,000/wafer
SiO patterned dry etch:	$1,500/wafer
SiN patterned dry etch:	$1,500/wafer
Metal blanket dry etch:	$1,000/wafer
Al blanket wet etch	$1,000/wafer
Metal patterned wet etch no mask:	$1,500/wafer
Si TMAH wet etch:	$1,000/wafer

PRICING GUIDELINES

Si grind, CMP and TMAH wet etch:	$5,000/wafer
Plasma Die Singulation:	$3,500/wafer
Plasma Die Singulation with stealth cut (min 70um street):	$5,000/wafer
Thinning with TSV reveal:	$7,500/wafer
Thinning with stop >=10um of Si. Including CMP:	$7,500/wafer
Si Bosch trench etch:	$2,500/wafer
Thermal oxide growth 0.2-1um:	$1,000/wafer
Backside Si etch for key (mask not included):	$2,500/wafer
ZiBond Wafer Prep for Carrier:	$1,500/wafer
ZiBond Wafer Polish:	$2,500/wafer
ZiBond Carrier:	$2,500/wafer
ZiBond Carrier Removal:	$2,500/wafer
3M glass carrier attach:	$1,000/wafer
3M glass carrier removal:	$800/wafer
Adhesive (Syagrus) carrier attach:	$1,000/wafer
Adhesive (Syagrus) carrier removal:	$800/wafer
Polymer Deposition (BCB, Others available) (Spray coating):	$2,000/wafer
Wafer cut down:	$2,500/6 wafers
Die singulation (diamond saw, min 70um street)	$8,000/12 wafers
Die attach film lamination:	$500/wafer
Wafer cut down:	$2,500/6 wafers
Custom PVD target setup:	$30,000
Custom material PVD deposition:	$10,000+$10,000/5 wafers
Custom material RIE etching:	$10,000+$10,000/5 wafers
G/I-Line Lithograph	$1,000/wafer
G/I-Line Lithograph Stitching	$1,000+$500 each additional field/wafer
TSV barrier / seed	$2,750/wafer
TSV Cu plating (10x100um, 50x400um)	$2,500/wafer
Si wafers – 200mm	$100/wafer
Si wafers – 150mm, 100mm	$60/wafer
Fused silica wafers – 200mm	$500/wafer
Borosilicate glass wafers – 200mm	$150/wafer
Si wafers with 50x400um or 10x100um TSVs – 200mm	$1250/wafer
Fuse silica wafers with 10x100um TSVs – 200mm	$2,500/wafer
Borosilicate glass wafers – 200mm	$2,200/wafer
Glass on silicon wafer debonding	$250/wafer

Volume discounts for unit processing:	15-25 wafers	10%
	26-40 wafers	15%
	41-60 wafers	25%
	61-100 wafers	35%

PRICING GUIDELINES

Per Fab "Move" Pricing

1-100 moves	$350/move
101-250 moves	$250/move
251-500 moves	$200/move
501-1000 moves	$180/move
1001-2000 moves	$160/move
2001-5000 moves	$140/move
5001-10,000 moves	$130/move
>10,001 moves	$120/move

Simple Analytical Services

Typical SEM cut away:	$2,500/sample
24 point parametric probe ($5,000 min):	$2,000 setup + $5/site
Bond strength test -Sonogram, bond energy	$5,000/sample

Mask Cost

1X nominal (cd ≥2.0um)	$2,000
G-Line nominal (cd ≥1.0um)	$2,500
G-Line best (0.6≤cd≤1.0um)	$3,000
G-Line best (0.6≤cd≤1.0um) stitched mask	$4,000
I-Line nominal (cd ≥0.5um)	$2,500
I-Line best (0.35≤cd≤0.5um)	$5,000
I-Line best (0.35≤cd≤0.5um) stitched mask	$6,000
248nm nominal (cd ≥0.5um)	$2,500
248nm best (0.35≤cd≤0.5um)	$5,000
193nm nominal (cd ≥0.35um)	$3,500
193nm best binary (0.24≤cd≤0.35um)	$5,500
193nm nominal P-shift (0.20≤cd<0.24um)	$7,500
193nm best P-shift (0.12≤cd<0.20um)	$12,500

INTERPOSERS AND OTHER INTERPOSER SERVICES

Simple Interposer (Thin Copper)

2 layers of dual damascene copper on top of single damascene copper metal layer (3 metal layers) with 10umx100um, copper TSVs. NHanced standard design rules. Metal is 2/2/2/1um L/W/S/T. Backside bump metal pad finish. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers. $225,000

New lot starts with 2 wafers are	$100,000
Additional 200mm wafers are	$12,500 each
PDK and design support for interposer	$25,000
Additional metal layers (Mx and Vx), base lot, are	$40,000 each
Additional metal layers (Mx and Vx), add-on wafers, are	$1,750 each per wafer

Simple Interposer (Thin Copper)

4 layers of single damascene copper interconnect with copper vias (4 metal layers) and 10umx100um, copper TSVs. NHanced standard design rules. Metal is 1/1/1/1um L/W/S/T. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers.

$300,000

PRICING GUIDELINES

PDK and design support for interposer	$25,000
New lot starts with 2 wafers are	$115,000
Additional 200mm wafers are	$14,000 each
Additional metal layers (Mx and Vx), base lot, are	$50,000 each
Additional metal layers (Mx and Vx), add-on wafers, are	$2,000 each per wafer

Simple Interposer (Thick Copper)

4 layers of single damascene copper interconnect with copper vias (4 metal layers) and 10umx100um, copper TSVs. NHanced standard design rules. Metal is 2/2/2/2um L/W/S/T. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers.

	$300,000
PDK and design support for interposer	$25,000
New lot starts with 2 wafers are	$115,000
Additional 200mm wafers are	$14,000 each
Additional metal layers (Mx and Vx), base lot, are	$50,000 each
Additional metal layers (Mx and Vx), add-on wafers, are	$2,000 each per wafer

RF (Analog) Interposer (Thick Copper)

4 layers of single damascene copper interconnect with copper vias (4 metal layers) and 10umx100um, copper TSVs. NHanced standard design rules. Metal is 2/2/2/2um L/W/S/T. Includes SiN dielectric MIM capacitor and high resistance poly silicon resistors. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers.

	$385,000
PDK and design support for interposer	$25,000
New lot starts with 2 wafers are	$130,000
Additional 200mm wafers are	$16,000 each
Additional metal layers (Mx and Vx), base lot, are	$50,000 each
Additional metal layers (Mx and Vx), add-on wafers, are	$2,000 each per wafer
Additional extra thick copper (6-10um) metal layer for inductors, base lot, are	$85,000 each
Additional extra thick copper (6-10um) metal layer for inductors, add-on wafers, are	$4,500 each per wafer

TSV Interposer Wafer

50x400um TSVs in silicon wafer. No RDL. No Pads. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers.

	$55,000
New lot starts with 2 wafers are	$35,000
Additional 200mm wafers are	$6,000 each

Simple TSVless Interposer (Thin Copper)

2 layers of dual damascene copper on top of single damascene copper metal layer (3 metal layers) with no TSVs. NHanced standard design rules. Metal is 2/2/2/1um L/W/S/T. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers.

	$150,000
New lot starts with 2 wafers are	$45,000
Additional 200mm wafers are	$9,500 each
PDK and design support for interposer	$25,000
Additional metal layers (Mx and Vx), base lot, are	$40,000 each

Additional metal layers (Mx and Vx), add-on wafers, are	$1,750 each per wafer

Simple TSVless Interposer (Thin Copper)

4 layers of single damascene copper interconnect with copper vias (4 metal layers) and no TSVs. NHanced standard design rules. Metal is 1/1/1/1um L/W/S/T. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers.

	$225,000
PDK and design support for interposer	$25,000
New lot starts with 2 wafers are	$65,000
Additional 200mm wafers are	$14,000 each
Additional metal layers (Mx and Vx), base lot, are	$50,000 each
Additional metal layers (Mx and Vx), add-on wafers, are	$2,000 each per wafer

Simple TSVless Interposer (Thick Copper)

4 layers of single damascene copper interconnect with copper vias (4 metal layers) and no TSVs. NHanced standard design rules. Metal is 2/2/2/2um L/W/S/T. No bumping is included. Price is inclusive of all masks and processing for two 200mm wafers.

	$225,000
PDK and design support for interposer	$25,000
New lot starts with 2 wafers are	$65,000
Additional 200mm wafers are	$11,000 each
Additional metal layers (Mx and Vx), base lot, are	$50,000 each
Additional metal layers (Mx and Vx), add-on wafers, are	$2,000 each per wafer

Other Interposer Options

With TSVs:

Field stitching for interposers. (Thick or Thin metals, 4/3-layer metal baseline process)

Base lot NRE per stitched field:	$50,000
Per additional wafer:	$5,000

Field stitching for Additional metal layers (Thick or Thin metals, beyond 4/3-layer metal baseline process)

Base lot NRE addition:	$10,000
Per additional wafer:	$1,000
Use of borosilicate wafers:	
Base lot additional cost	$10,000
Per wafer for additional wafers	$2,500
Use of fused silica wafers:	
Base lot additional cost	$12,000
Per wafer for additional wafers	$2,700
Use of metal wafers:	
Base lot additional cost	$35,000
Per wafer for additional wafers	$4,000
5x50um, 25x200um or 50x400um TSV instead of 10x100um TSV	No Charge
300mm wafers if available	1.35 x 200mm rate for wafers

Without TSVs:

Field stitching for interposers. (Thick or Thin metals, 4/3-layer metal baseline process)

Base lot NRE per stitched field:	$36,000
Per additional wafer:	$5,000
Field stitching for Additional metal layers (Thick or Thin metals, beyond 4/3-layer metal baseline process)	
Base lot NRE addition:	$10,000
Per additional wafer:	$1,000
Use of borosilicate wafers:	
Base lot additional cost	$6,000
Per wafer for additional wafers	$1,500
Use of fused silica wafers:	
Base lot additional cost	$7,500
Per wafer for additional wafers	$2,850
300mm wafers if available	1.35 x 200mm rate

Metal Stack Splitting

Option for splitting metal stack with half on top side of wafer and half on bottom side of wafer All variations	
Base lot NRE:	$15,000
Per additional wafer:	$1,000

Interposer UBM and Bumping

NiPdAu with TiN adhesion layer UBM on thinned wafer	$35,000 first 6 wafers $3,500 each additional wafer
Low alpha lead (63/37) bumping with NiCu UBM and TiN adhesion layer	$25,000 first 6 wafers $1,500 each additional wafer
Lead free bumping with NiCu UBM and TiN adhesion layer	$20,000 first 6 wafers $1,200 each additional wafer
Lead free µbumping (20-50um Diameter) with NiCu UBM and TiN adhesion layer	$25,000 first 3 wafers $1,500 each additional wafer
Temporary wafer bonding (6 wafer lot)	$6,000
DBI handle removal (6 wafer lot)	$12,600
Additional wafer DBI handle removal	$2,100
Interposer topside UBM and bottom side bumping (3 wafer lot) package	$38,000 $3,200 each additional wafer
Interposer singulation (6 wafer lot)	$8,000
Copper pillar formation, 51-100um diameter, 1:1 aspect ratio, Sn Cap	$30,000 first wafer $2,500 each additional wafer
Copper pillar formation, 20-50um diameter, 1:1 aspect ratio, Sn Cap	$50,000 first wafer $3,500 each additional wafer
Copper pillar formation, 51-100um diameter, 1:1 aspect ratio, LF Cap	$30,000 first wafer $2,500 each additional wafer
Copper pillar formation, 20-50um diameter, 1:1 aspect ratio, LF Cap	$50,000 first wafer $3,500 each additional wafer
Copper pillar formation, 20-50um diameter, 1:1 aspect ratio, Au Cap	$85,000 first wafer $7,000 each additional wafer

PRICING GUIDELINES

X-ray Micro CT for Electronics (Interposer Devices)

CT scan 3D x-ray inspection – up to 50x50x2mm First device	$4,500
Additional devices (1-5)	$1,100 each
Additional devices (6-10)	$900 each
Additional devices (11+)	$750 each

Expedite Services

Expedited processing may be available for any of the services listed above. The production speed up is a best effort as factors such as equipment failures and other things beyond our control might ultimately delay lots. NHanced will make all reasonable efforts to quickly remedy any issues and meet the targeted expedites. With factory approval the following order modifiers are available:

Hot Lot:

25% reduction in production time	+33% of standard cost

Hot lot service moves the materials to the head of the standard production queues.

Bullet Lot:

50% reduction in production time	+100% of standard cost

Bullet lot service moves the materials to the head of the standard and hot lot queues. Factory tool mode changes will be expedited to permit little or no queue time as possible.

PRICING GUIDELINES

PDK Support Development

PDK support development will vary based on the exact tool support and the foundry supplied starting data and files. However, as a guideline for development the following can be used:

Support for adding TSVs and 4 layers of metal, such as would be associated with superimposing the NHanced interposer rules on another process;

Standalone minimum charge	$25,000
130nm node technology and above	$65,000
<130-90nm node technology	$70,000
<90nm-55nm node technology	$85,000
<55nm-40nm node technology	$100,000
<40nm-28nm node technology	$120,000
<28nm node technology	$140,000

NHanced Hourly Engineering Effort

The minimum charge for hourly engineering work is as follows:

General Engineering:

0 to 40 hours of total monthly effort	$325.00/hr
41 to 160 hours of total monthly effort	$300.00/hr
161 to 480 hours of total monthly effort	$275.00/hr
481 to 2080 hours of total quarterly effort	$250.00/hr
>2080 hours of total yearly effort	$235.00/hr

Engineering Project Management:

0 to 40 hours of total monthly effort	$350.00/hr
41 to 160 hours of total monthly effort	$315.00/hr
161 to 480 hours of total monthly effort	$290.00/hr
481 to 2080 hours of total quarterly effort	$270.00/hr
>2080 hours of total yearly effort	$250.00/hr

Specialty (Design and Fab) Engineering:

0 to 40 hours of total monthly effort	$400.00/hr
41 to 160 hours of total monthly effort	$360.00/hr
161 to 480 hours of total monthly effort	$310.00/hr
481 to 2080 hours of total quarterly effort	$275.00/hr
>2080 to 5400 hours of total yearly effort	$255.00/hr
>5400 hours of total yearly effort	$250.00/hr

Entry (Layout) Engineering:

0 to 40 hours of total monthly effort	$250.00/hr
41 to 160 hours of total monthly effort	$225.00/hr
161 to 480 hours of total monthly effort	$200.00/hr
481 to 2080 hours of total quarterly effort	$190.00/hr
>2080 hours of total yearly effort	$170.00/hr

PRICING GUIDELINES

Technician – Unskilled labor:	
0 to 40 hours of total monthly effort	$225.00/hr
41 to 160 hours of total monthly effort	$200.00/hr
161 to 480 hours of total monthly effort	$190.00/hr
481 to 2080 hours of total quarterly effort	$180.00/hr
>2080 hours of total yearly effort	$170.00/hr

NHanced Foundry Standard Engineering Rate

This is for standard foundry engineering effort. Specialized work, production work, design engineering or other labor must be quoted based on loaded costs.

All hourly rates must conform to this pricing:	
0 to 40 hours of total monthly effort	$400.00/hr
41 to 160 hours of total monthly effort	$360.00/hr
161 to 480 hours of total monthly effort	$310.00/hr
481 to 2080 hours of total quarterly effort	$275.00/hr
>2080 hours of total yearly effort	$255.00/hr

Dedicated Wafer Runs

This includes maskset and wafers for dedicated processing using 3rd party wafer foundry services. Wafer run services also include mask and process setup documentation, foundry interfacing, scribelane generation or review and mask fracture data review. Other options may be available by request.

350nm 4M1P RVT, Single gate with 12 wafers	$95,000
90nm 6M1P RVT, RH, Dual gate with 5 wafers	$750,000
65nm 8M1P RVT, LVT, MIM, Dual gate with 12 wafers	$1,250,000
55nm 8M1P RVT, LVT, MIM, Dual gate with 12 wafers	$1,650,000
40nm 8M1P RVT, LVT, MIM, Dual gate with 12 wafers	$2,450,000
28nm 8M1P RVT, LVT, MIM, Dual gate with 12 wafers	$3,850,000
12nm 8M1P RVT, LVT, MIM, Dual gate with 12 wafers	$8,200,000

Additional Wafers: (per wafer)

350nm 4M1P RVT, Single gate	$1600
90nm 6M1P RVT, RH, Dual gate	$70,000
65nm 8M1P RVT, LVT, MIM, Dual gate	$8600
55nm 8M1P RVT, LVT, MIM, Dual gate	$9400
40nm 8M1P RVT, LVT, MIM, Dual gate	$10,500
28nm 8M1P RVT, LVT, MIM, Dual gate	$18,500
12nm 8M1P RVT, LVT, MIM, Dual gate	$55,000

Standard Revision Plan

This is a nominal revision cost. The changes must be to less than 30% of the maskset by cost. New masks and a new dedicated wafer run are included as well as these items; mask revision review, foundry interfacing, scribelane generation or review and mask fracture data review.

350nm 4M1P RVT, Single gate with 12 wafers	$55,000
90nm 6M1P RVT, RH, Dual gate with 12 wafers	$470,000
65nm 8M1P RVT, LVT, MIM, Dual gate with 12 wafers	$750,000

PRICING GUIDELINES

Tester Time Rate

Parametric tester	$250.00/hr
“Brass Board” test setup	$250.00/hr
Agilent 83000 200pin/120MHz	$375.00/hr
Teradyne J750 500pin/800Mb/s	$900.00/hr

Engineering meeting support with travel

Inclusive of domestic travel within continental US	$2,500/day/person

X-ray Micro CT for Electronics (Single Devices)

CT scan 3D x-ray inspection – up to 35x35x1mm First device	$3,000
Additional devices (1-5)	$800 each
Additional devices (6-10)	$700 each
Additional devices (11-20)	$600 each

Customer Required External Material

Direct material cost plus 15%

Customer Required External Service

Direct service cost plus 15%

Lot Splits

Unless stated otherwise with the specific service, the lot split fee is 15% of the base module cost plus any additional added processing costs.

New Lot Starts

Unless stated otherwise with the specific service, the new lot start fee is 15% of the base module cost plus the per additional item amount.

PRICING GUIDELINES

This supersedes any previous pricing information and is valid as of August 1, 2025.