NORTH CORPORATION

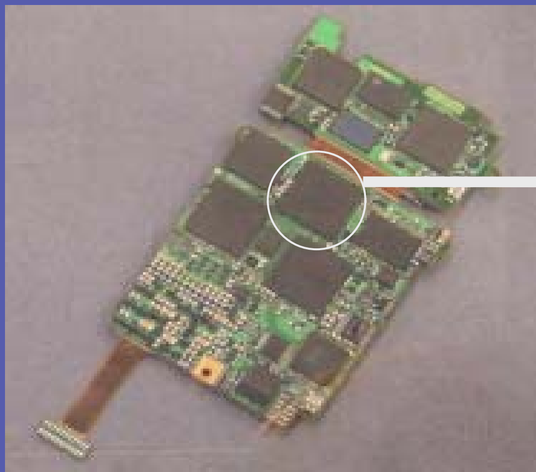
Development of IC Packaging Components Enabling Increasing Product Functionality

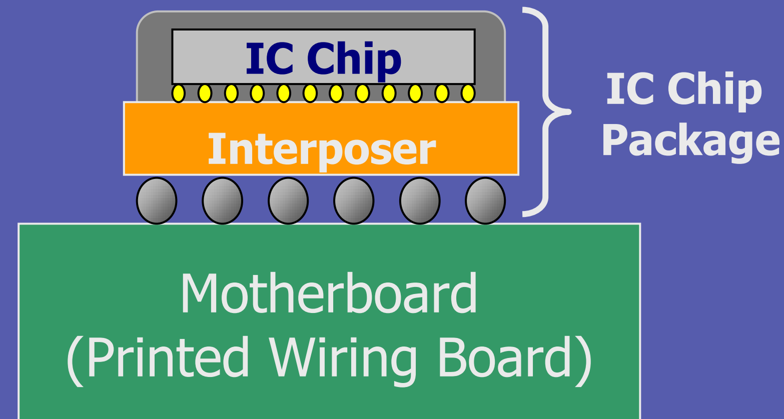
I. Bump Interconnection (NMBI) Business

PWB technology shift toward increased circuit layer count and high density component assembly

II. Interposer (UFPL, NMTI) Business

IC packaging technology shift toward 3-D stacking of chips for efficient use of surface mount area





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Technology Development Distribution

Location	Role
Tokyo HQ	PWB/3-D IC Packaging Design
Yokohama R&D Center	3-D IC Packaging Research & Development
Iwaki TechnoCenter	NMBI Manufacturing
Silicon Valley Office	Market Research Business Planning

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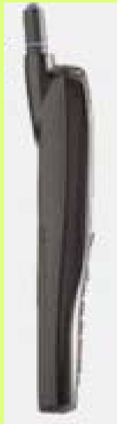
Trends for 2.5G & 3G Mobile Phones
Thinner - Lighter - Increased Functionality

2000

"Candy Bar" Type



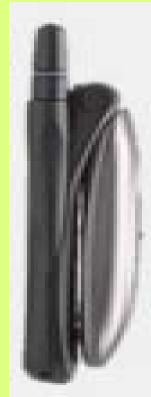
17.0mm thickness

PWB Type: 1-Piece Rigid

IC Package Type: 2-D

2001

Folding Type



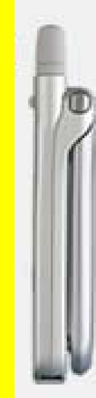
27.0mm thickness

PWB Type: 2-Piece Rigid, Flex Interconnect

IC Package Type: 2-D

2002

Folding Type with Built-in Camera



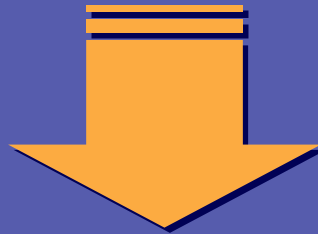
16.8mm thickness

PWB: 1-Piece Rigid and 1- Piece Multilayer Flex

IC Package Type: 3-D Stack

NMBI and the Changing PWB Market

- PWBs used in next-generation mobile phones will shift from multi-layer rigid boards to multi-layer flex circuits to allow for increased density while maintaining a thin, light form factor
- Increasing number of circuit layers and higher density components are difficult to accommodate using traditional PWB manufacturing technologies



NMBI is an enabling technology for high layer count, high component density flexible circuits

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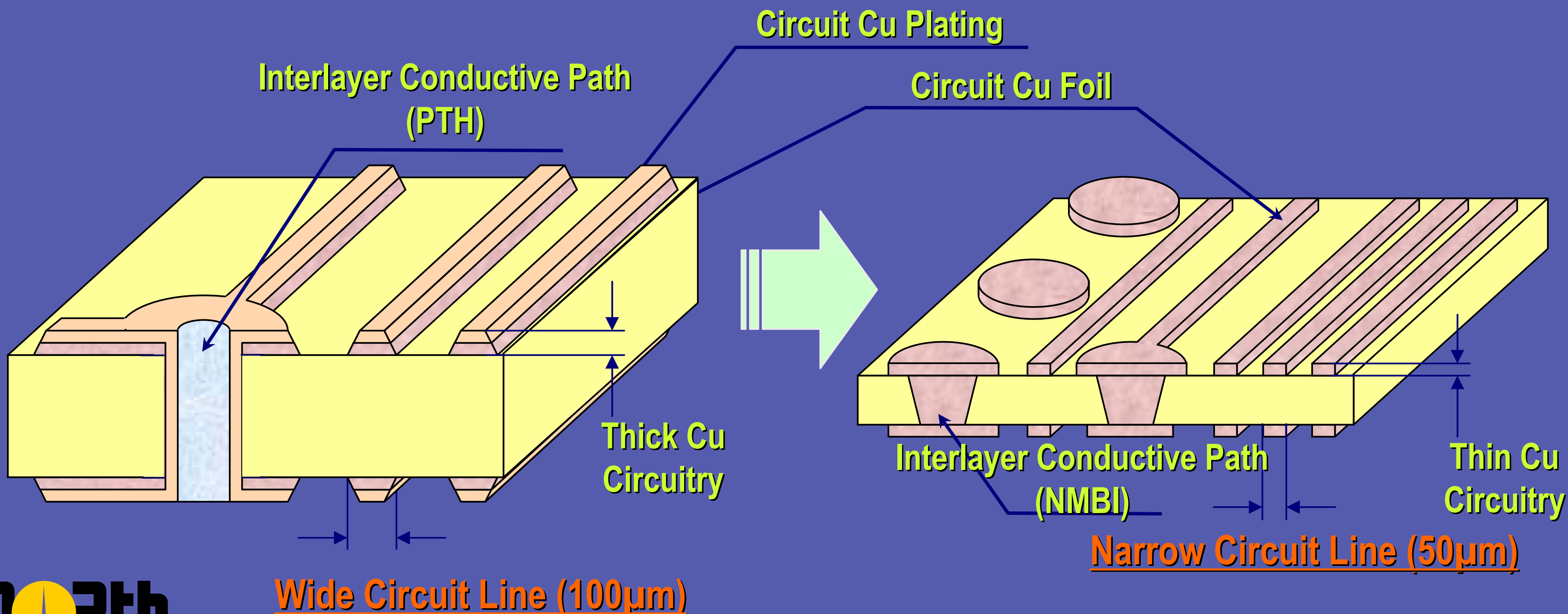
Comparison of PWB Technologies

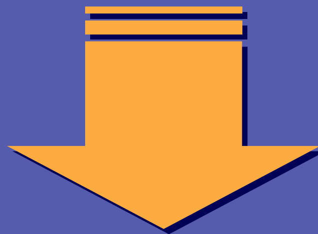
Standard PWB
Plated Through Hole (PTH) Construction

NORTH PWB
Copper Bump (NMBI) Construction



IC Packaging Market

- System-on-Chip (SoC) technology, with highly integrated functionality on a single chip, faces numerous cost and production lead-time issues
- As a result, there is a shift toward System-in-Package (SiP) technology, with individual functions on multiple chips (including 3-D stacking), which helps to solve these issues



North has developed an ultra-thin interposer that can enable and accelerate the market transition to SiP and 3-D package stacking

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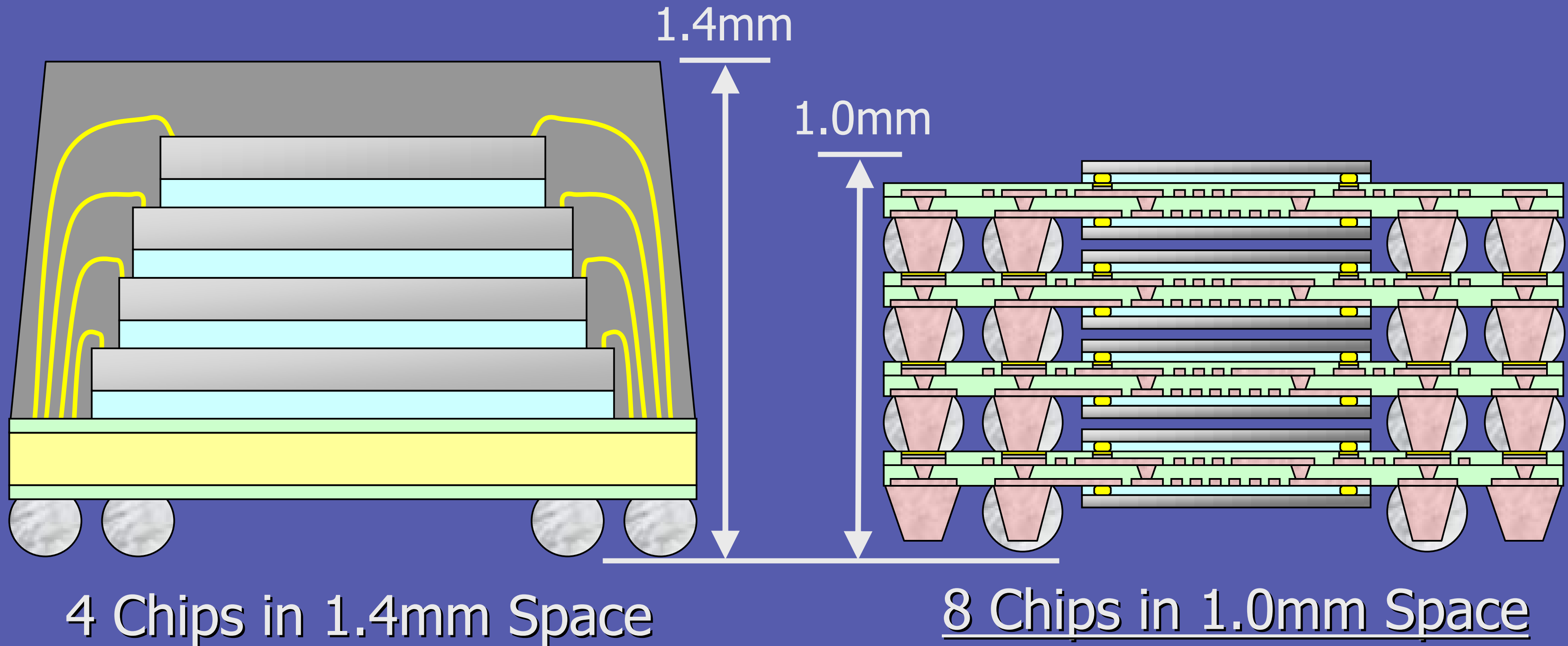
3-D IC Packaging Comparison

3-D Chip Stack
Present-Day Technology

NMTI



4 Chips in 1.4mm Space

8 Chips in 1.0mm Space

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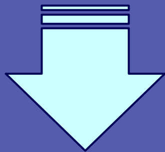
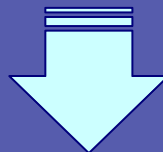
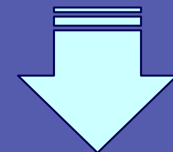
Fundamental Concepts

Co-Operative Relationships	Total Control	Material Supply
Establish Co-Operative Business Relations with OEMs and PWB Manufacturers	Cooperate with Materials and Equipment Manufacturers to Prevent Technology Disclosure	Manufacture Semi-Finished Products to Avoid Competing with Licensees

License Business

Generate Royalty Revenue through Patented Technology and Manufacturing Know-How

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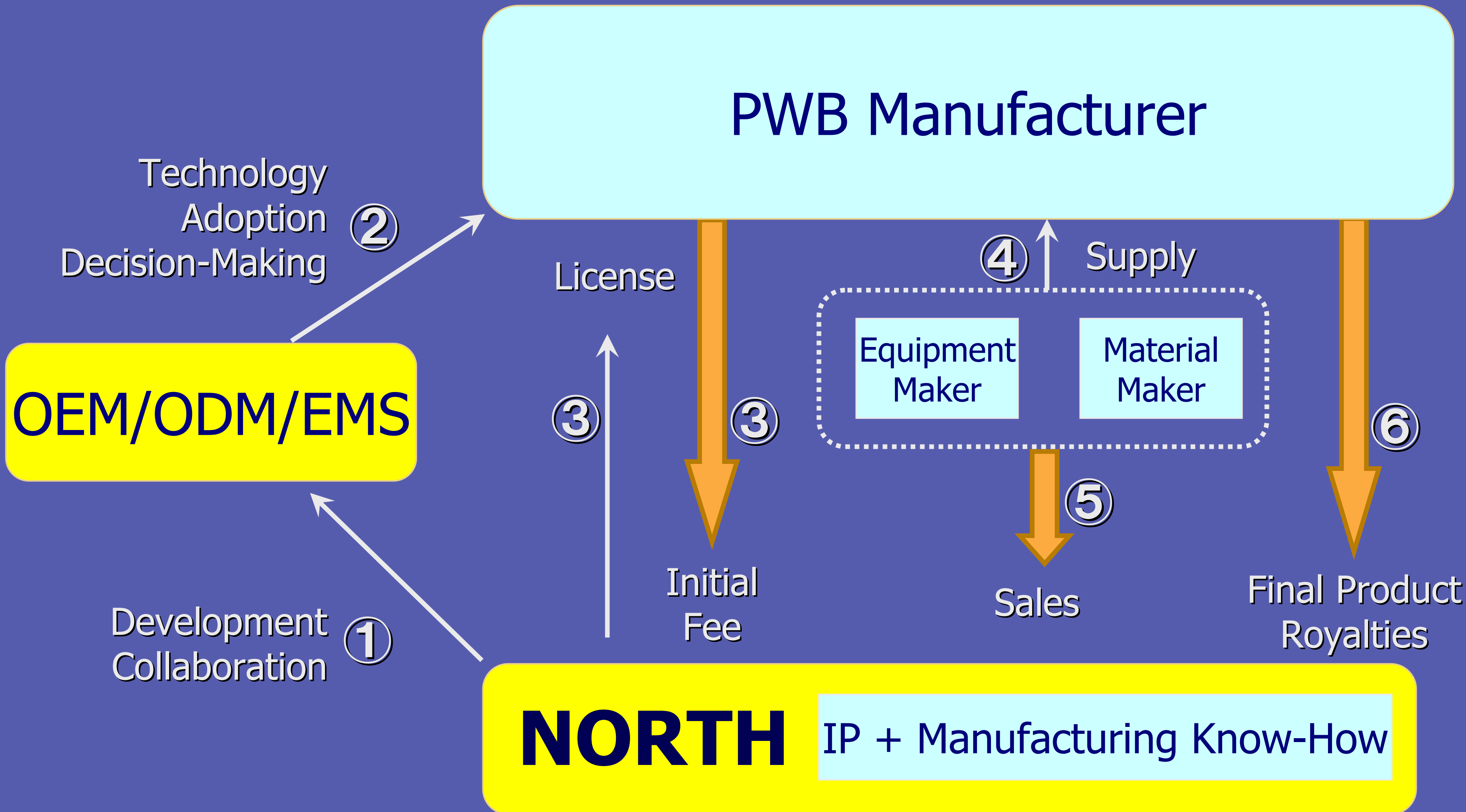
Strategic Cooperation Model



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Growth in Number of NMBI Licensees Leading to De Facto Technology Standard

Targeting the Top 200 PWB Companies (74% market share*)

6 Licensees To-Date (market ranking)

Nippon Mektron, Japan (#4)

Fujikura Ltd., Japan (#27)

LG Electronics Inc., South Korea (#46)

Santa Light Metals Industries Ltd., Japan (#96)

Mitsui & Co., Ltd., Japan

NMBG (H.K.) Limited, China

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* source: PC Fab and 中国信息産業部

NORTH's 21st Century Vision

Research & Development Venture Business Model Based Upon an Intellectual Property & Manufacturing Know-How Foundation

Leverage Leading-Edge Atmospheric Cu-Cu Direct Bonding Technology to Revolutionize the Semiconductor Industry Business

Restoration of the "Made in Japan" Product Strength