

PRISMARK PRESENTATION

PREPARED FOR:

GBC MARKETING FORUM IMAPS 2005

IMPACT OF MANUFACTURING AND DESIGN FOR ELECTRONICS SYSTEMS IN CHINA

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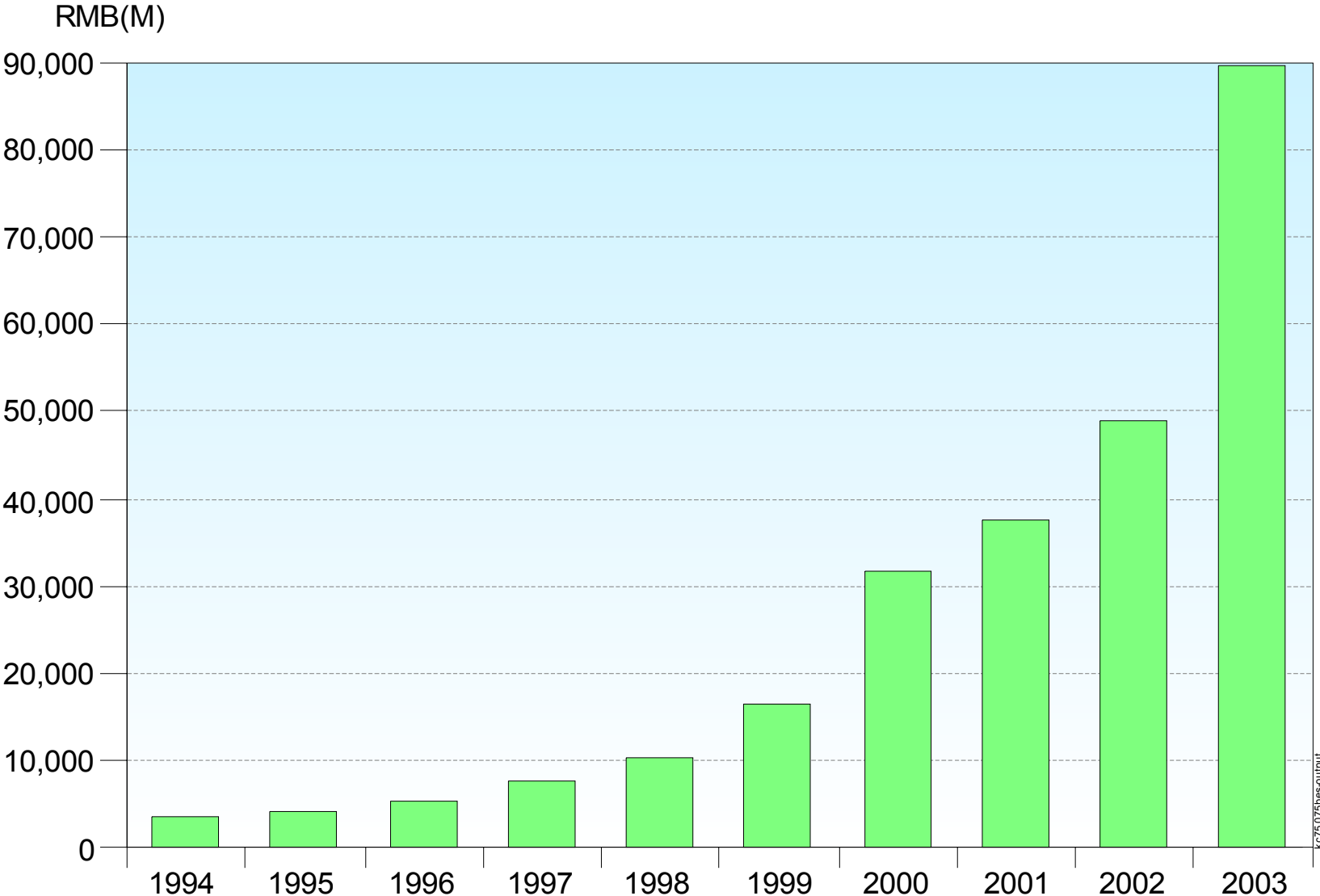
CHINA: THE AWAKENED DRAGON

- China's total population is about 1.3Bn, including 31% from urban and 69% from rural areas.
- There are more than 405M people in the South and East coastal areas, including 73M in Guangdong Province, 15M in Shanghai, and 13M in Beijing.
- Since 1979, China has become the world's fastest growing economy. From 1979 to 1999, China's economy grew at an average rate of 9.7%. China's GDP growth in 2001 and 2002 was 7.6% and 9.6%, respectively, despite a global slowdown.
- Total GDP was \$1.68Trn in 2004, up another 9.5%.
- Prior to 1979, China maintained a centrally planned or command economy. After Mr. Deng's open policy, China adopted a modified socialism with Chinese characteristics.
- Today, China is the seventh-largest economy in the world after the US, Japan, Germany, England, France, and Italy.

CHINA, BREEDING GROUND FOR TOMORROW'S OEMS

- China has emerged as the second leading producer of finished electronic equipment, having grown at a compound rate of over 20% per year in the last five years.
- The vast majority of China's production growth has been fueled by foreign direct investment from Taiwanese, Japanese, North American, and European companies.
- Today, local Chinese companies account for only an estimated 15% of total production.
- Attraction of foreign investment is the result of a successful and calculated strategy of the Chinese government.
- The next phase of China's growth and influence will occur beyond its borders, as local Chinese companies enter the global marketplace and compete head-to-head with its historical benefactors.

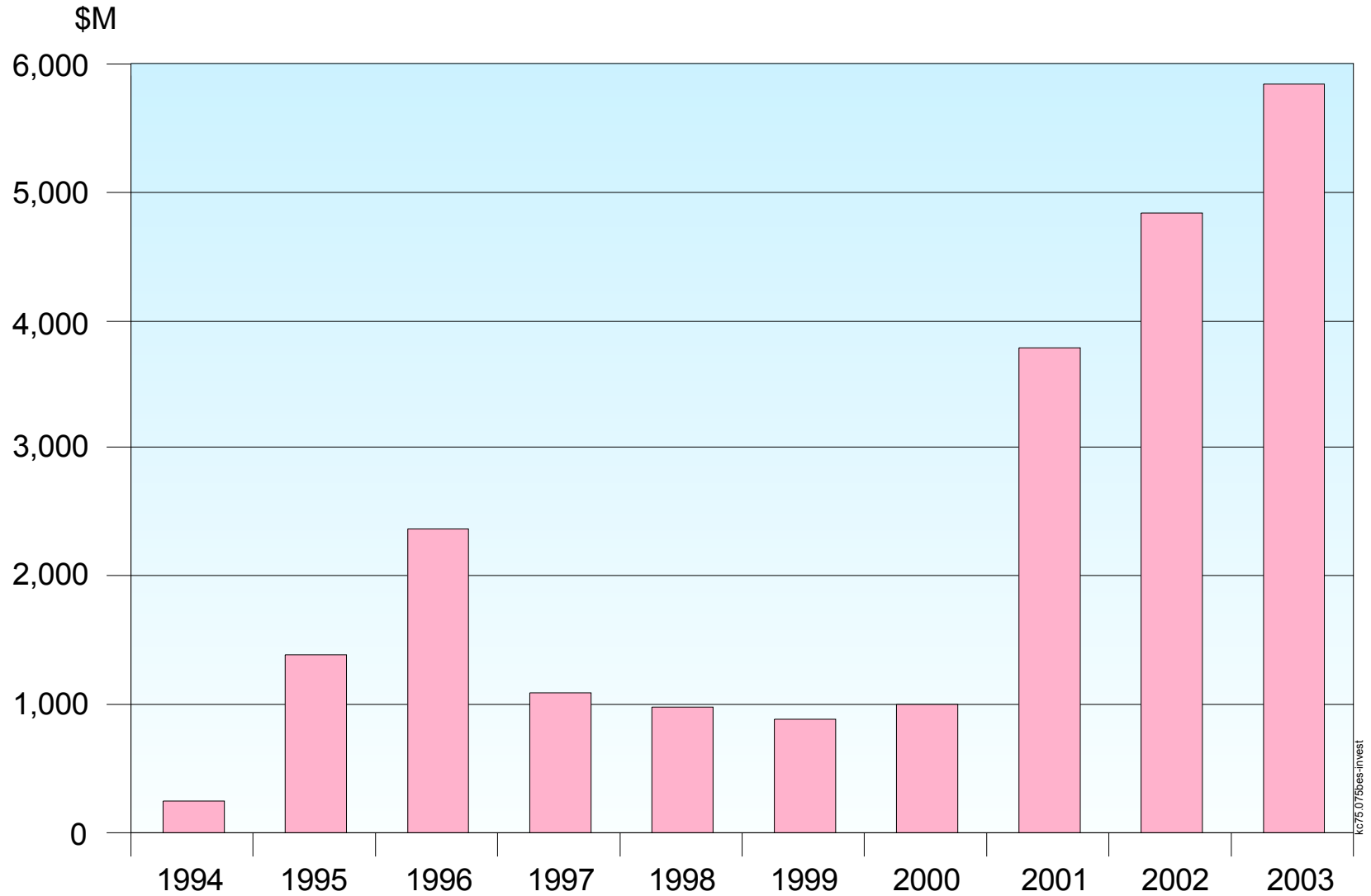
GROSS INDUSTRIAL OUTPUT OF SUZHOU INDUSTRIAL PARK 1994-2003



kc75075bes-output



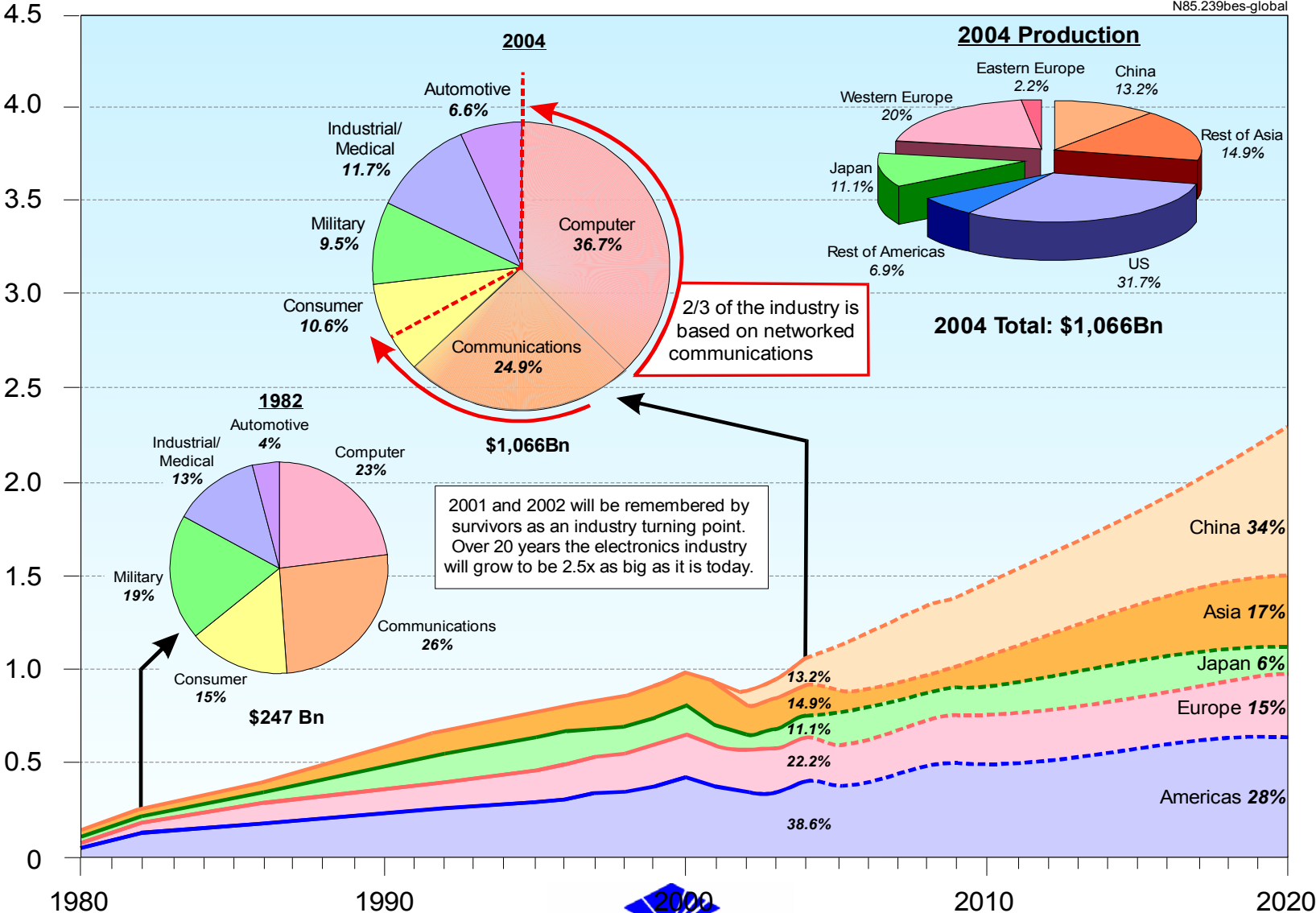
TOTAL INVESTMENT OF SUZHOU INDUSTRIAL PARK 1994-2003



K275.0750es-invest

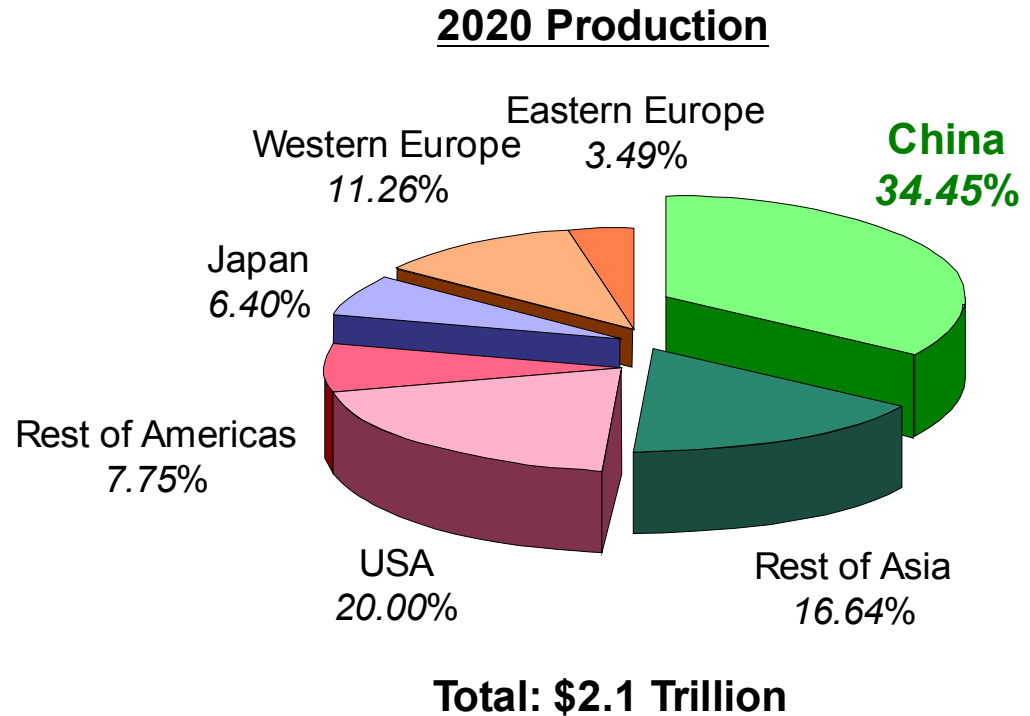
THE GLOBAL ELECTRONICS INDUSTRY

Trillion \$



BOARD AND BOX ASSEMBLY LEADS, COMPONENTS AND SERVICES FOLLOW

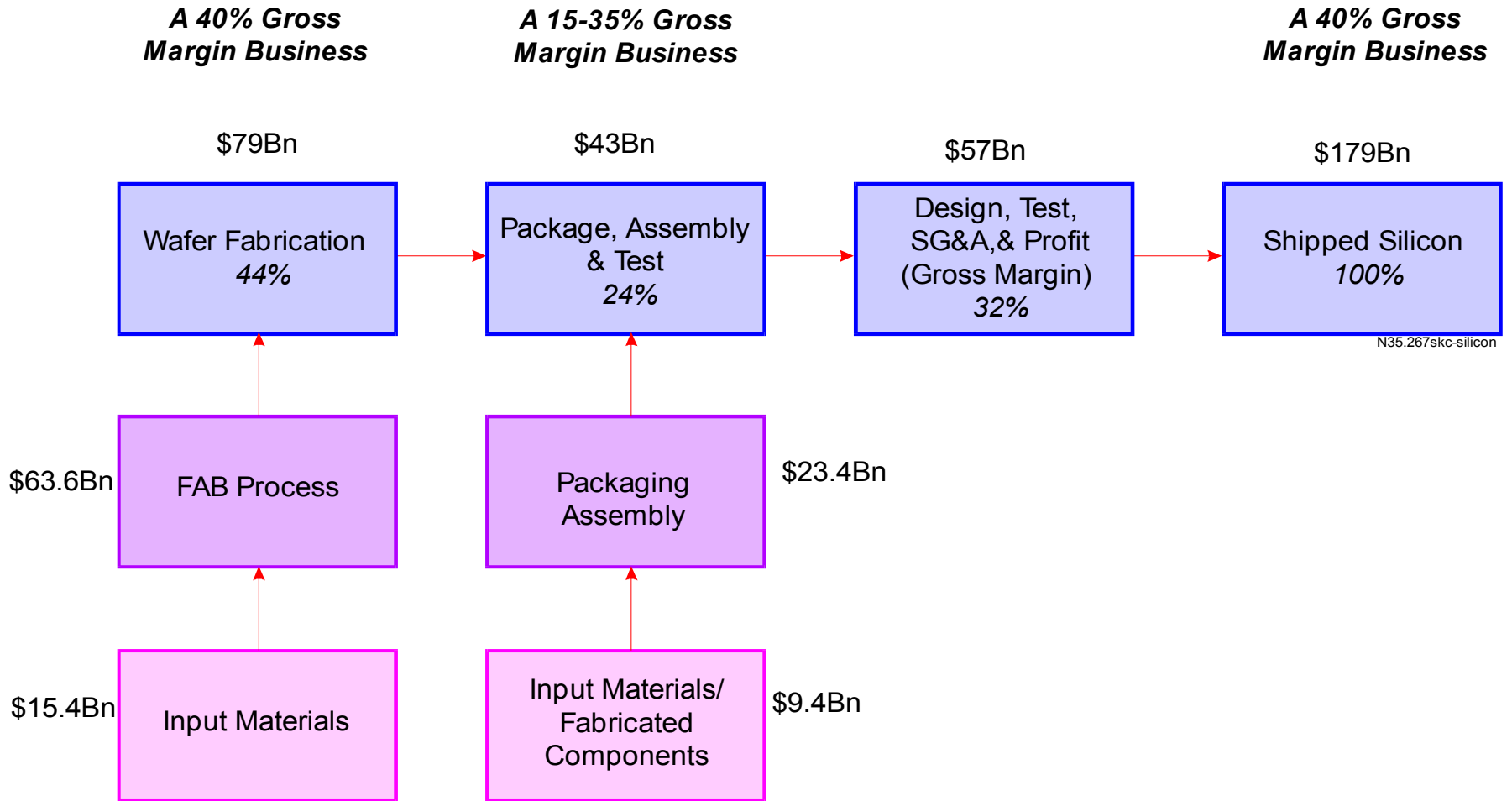
- By 2020, China will produce more than one- third of the world's electronic systems needs, up from 13.2% in 2004
- This is driven by three groups of companies:
 - Domestic OEMs, such as Huawei and Legend
 - Foreign OEMs and ODMs, including IBM, Motorola, Nokia, Hon Hai, and Acer Pacific
 - Global EMS companies: Flextronics, Celestica, Solectron, etc.
- This will require a dramatic increase in local production of:
 - Printed circuit boards
 - Semiconductors
 - Materials and manufacturing equipment



MANUFACTURING IN CHINA

- An abundant, educated, and motivated work force enables extremely fast ramps and high yields in assembly type operations with standardized process equipment. China now graduates 200,000 engineers per year.
- Similarly process based manufacturing such as printed circuit boards, laminate and related materials have been relatively easy to transport from Taiwan, etc.
- The case for capital intensive, materials intensive, lower labor content, process know-how-intensive manufacturing (such as capacitors or engineered materials) is less pervasive on cost and IP grounds. The major reason for Chinese manufacturing of materials and components is for the local assembly market.

INTEGRATED CIRCUIT (IC) FABRICATION VALUE CHAIN (2004)



N35.267skc-silicon

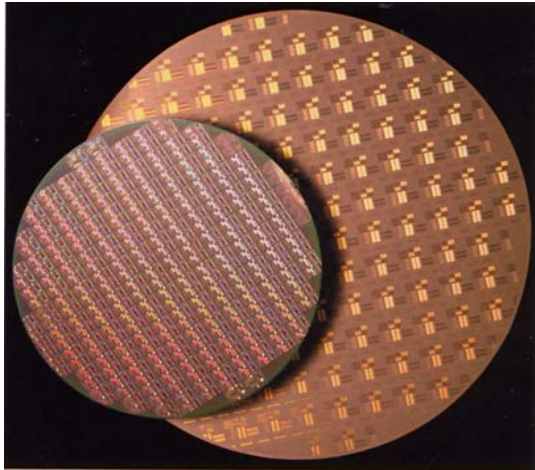
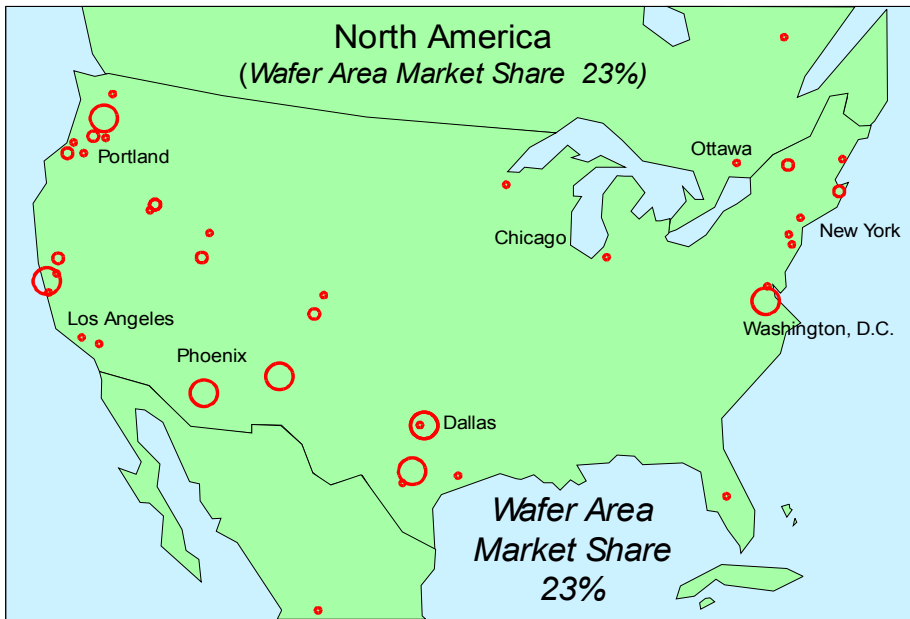
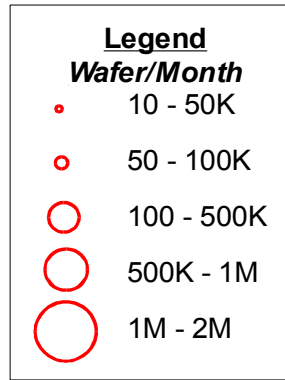
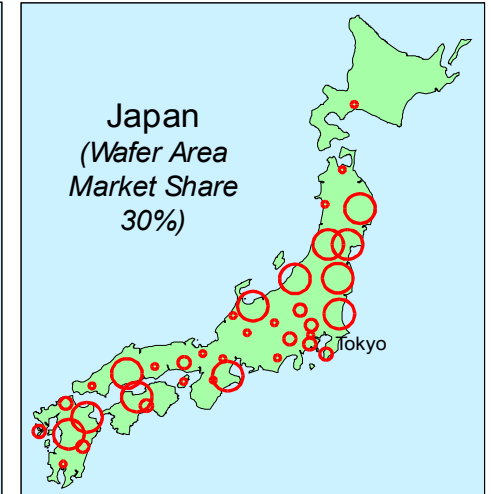


Photo Source: Applied Materials



N72.267-190bp-fab2005



WORLDWIDE SEMICONDUCTOR FAB LOCATION - 2005

CHINA'S SEMICONDUCTOR DEMAND AND PRODUCTION (\$Bn)

	2003	2004	2005 Est.	Growth 2003 – 2004	Growth 2004 – 2005 Est.
Total Semiconductor Market (Front-end, Back-end, IC Design)	16.98	23.77	30	40.0%	26%
Semiconductor Output (Front-end, Back-end, IC Design)	4.8	5.94	8.0	23.8%	34.7%

In 2005, China will account for 13% of worldwide demand and only 3.5% of production, over half of which is package and test.

CHINESE SEMICONDUCTOR FABRICATORS

Company	Facility Location	Technology Capability	Current Capacity/Month (Q1 2005)
TSMC (Shanghai)	Shanghai	0.35 μ m (will adopt 0.25 μ m in Q3 2005)	7,500 8" wafers (since Q4 2004, will reach 15,000 WPM by end of 2005, 30,000 WPM in 2006)
HeJian Technology (Suzhou)	Suzhou	0.5 μ m, 0.35 μ m, 0.25 μ m, 0.18 μ m	32,000 8" wafers/month, 37,000 WPM by end of 2005
SMIC	Shanghai	0.35 μ m, 0.25 μ m, 0.18 μ m, 0.13 μ m, 0.11 μ m	140,000 8" equivalent wafers/month
GSMC	Shanghai	0.25 μ m, 0.22 μ m, 0.18 μ m, 0.15 μ m, 0.13 μ m	27,000 8" wafers
HHNEC	Shanghai	0.35 μ m, 0.18 μ m, 0.13 μ m	40,000 8" wafers (by mid-2004)
CSMC	Wuxi	0.5 μ m, 0.35 μ m	59,200 6" wafers/month
ASMC	Shanghai (5" plant)	3.0 μ m, 0.8 μ m, 0.35 μ m, 0.25 μ m (will adopt 0.18 μ m and 0.13 μ m soon)	40,000 wafers (35,000 for 5", 5,000 for 6")
	Shanghai (6" plant, CMOS)		35,000 6" wafers
	Shanghai (8" plant)		5,000 8" wafers (will reach 30,000 units in the near future)
Zhuhai Nanke	Zhuhai	3.0 μ m, 1.2 μ m, 0.6 μ m, 0.5 μ m	30,000 6" wafers
SIM-BCD	Changzhou	0.25 μ m, 0.5 μ m Bipolar, BiCMOS, Bipolar CMOS	5,000 8" wafers (will double to 10,000 by year-end and to 20,000 by mid-2005)
	Shanghai	Bipolar, BiCMOS, Bipolar CMOS	20,000 6" wafers
	Shanghai	4 μ m, 1 μ m Bipolar, BiCMOS, BCDMOS	40,000 4" wafers
SinoMOS Semiconductor	Ningbo	0.8 μ m, 0.5 μ m, 0.35 μ m high-voltage CMOS and BiCMOS	10,000 6" wafers (will triple to 30,000 by Q1 2006)
Shougang NEC (SGNEC)	Beijing	0.8 μ m, 0.35 μ m	13,500 6" wafers

LOCATIONS OF CHINESE WAFER FABS

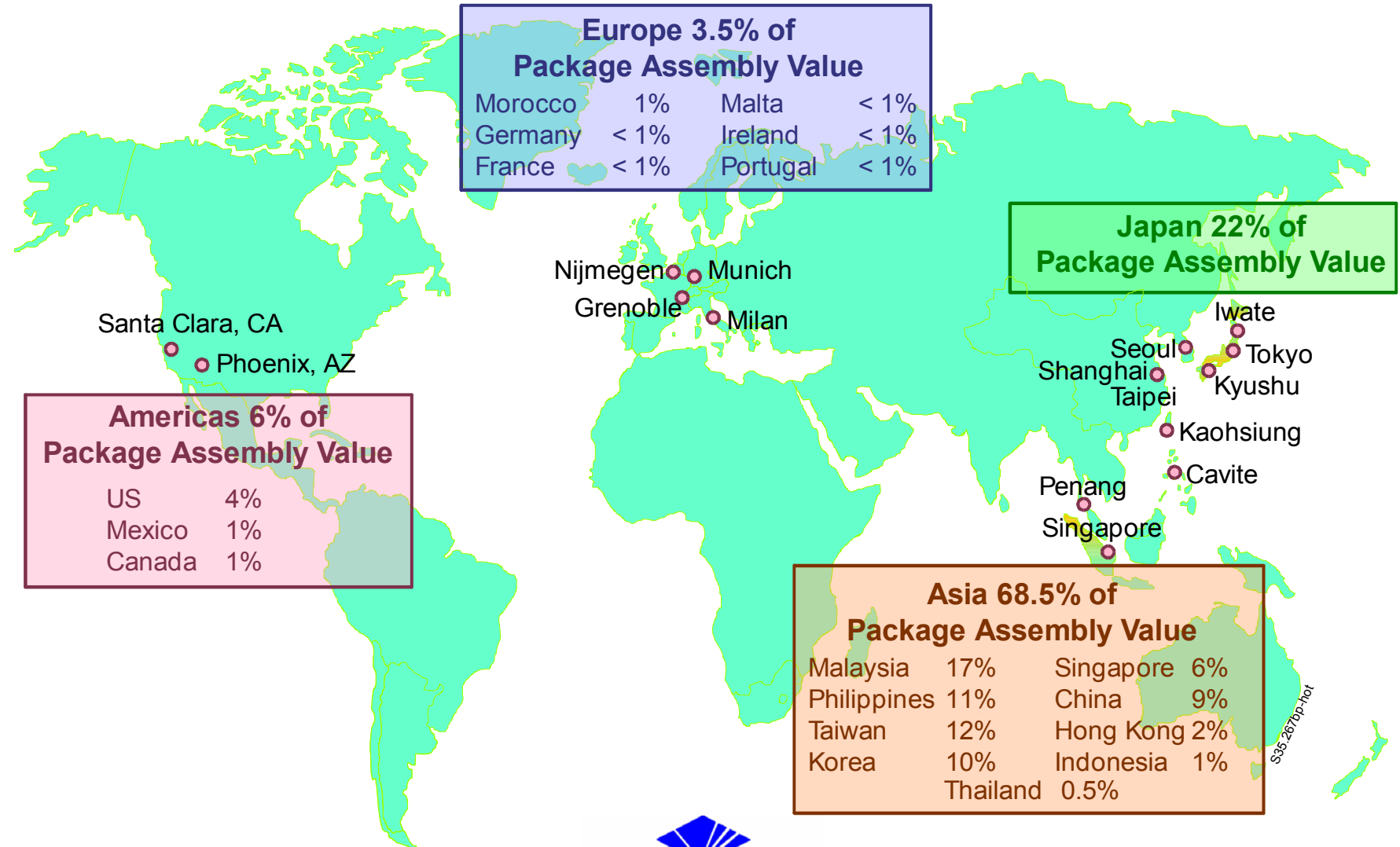
Region	Company
Beijing	SMIC (12-inch), SGNEC, SPS (coming soon)
Tianjin	SMIC (8-inch)
Jiangsu/Zhejiang Provinces	HeJian, SinoMOS, STMicro/Hynix, SIM-BCD (8-inch), Changzhou Nanotech (coming soon)
Shanghai	ASMC, GSMC, HHNEC, SMIC, HHNEC, TSMC, SIM-BCD (6-inch), ProMOS (coming soon), Shanghai Powerchip/BCD (coming soon)
Guangdong Province	Zhuhai Nanke, Si Semiconductor

China has a total of 56 wafer fabs, most using smaller wafers and low-end technology.

THE TOP TEN FABLESS COMPANIES IN CHINA

Company	2004 Sales (US\$M)	Products
Datang	91.5	SIM card
Silan	62.1	MCU, IC card, analog (motor drives)
Action	56.1	MP3 player IC
CIDC	55.4	Smart card, analog (PLL, amplifier)
Vimicro	41.5	PC cam DSP, handset coprocessor
Silicone	30.9	Voice IC, phone IC
Youwang	30.1	Analog (regulator, amplifier)
Semico	27.8	MCU, MP3, player IC
Shanghai Huahong	23.3	Smart card
Sigma-Jinghua	21.2	MCU, voice synthesizer

WORLDWIDE PACKAGE ASSEMBLY DECISION MAKING “HOT SPOTS”



TOP MERCHANT PACKAGE ASSEMBLERS AND THEIR DECISION-MAKING LOCATIONS

Rank	Merchant Package Assembler	Primary Decision-Making Locations	Primary Packaging Facilities Where Decisions are Made
1	ASE	Taiwan	Taiwan
2	Amkor	Korea, Philippines	Korea, Philippines
3	SPIL	Taiwan	Taiwan
4	STATSChipPAC	Singapore/Korea	Singapore/Korea
5	Carsem	Malaysia	Malaysia
6	ASAT	Hong Kong	Hong Kong
7	OSE	Taiwan	Taiwan
8	AIT	Indonesia	Indonesia
9	Signetics	Korea	Korea

TOP TEN SEMICONDUCTOR OEMs AND THEIR PACKAGING DECISION-MAKING LOCATIONS

Rank	Semiconductor OEM	Primary Decision-Making Locations	Main Packaging Facilities Where Decisions Are Made
1	Intel	Arizona	Malaysia, Philippines, China
2	Samsung	Korea	Korea
3	Texas Instruments	Texas, Japan	Texas, Japan
4	Renesas	Japan	Japan
5	Infineon	Germany	Malaysia, Singapore, Indonesia
6	Toshiba	Japan	Japan
7	STMicroelectronics	Italy, France	Singapore, Malaysia, China, Malta, Morocco
8	NEC	Japan	Japan
9	Freescale	Texas, Malaysia	Malaysia, China
10	Philips	Netherlands	Taiwan, Philippines, Thailand

GENERAL TRENDS IN PACKAGE ASSEMBLY FACILITIES

- Overall consolidation of large semiconductor manufacturers over last few years
 - NEC – NSPS (NEC Semicon Package Solutions)
 - Freescale – closing all but two plants
 - Renesas – more efficient use of Hitachi/Mitsubishi facilities
- Some transfer of captive to merchant suppliers
 - ASE – NEC
 - Amkor – Toshiba Iwate, Fujitsu
- Consolidation of leading merchants
 - STATSChipPAC merger
 - OSE, AIT losing share
- **MOVE TO CHINA:** Intel, Infineon, National Semiconductor, Philips, ST, AMD, Renesas, Samsung, Amkor, ASE, SPIL, Fairchild, ON Semi, Micron, Freescale, STATSChipPAC, etc.

CHINA EXPERIENCES

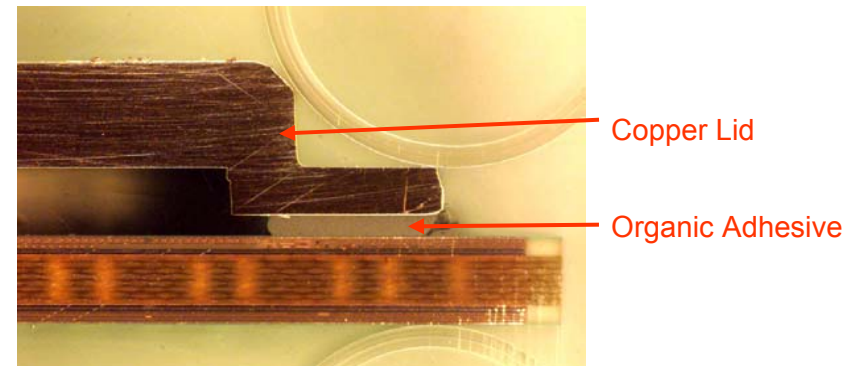
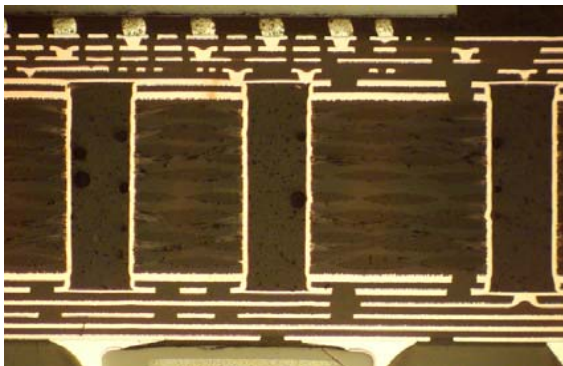
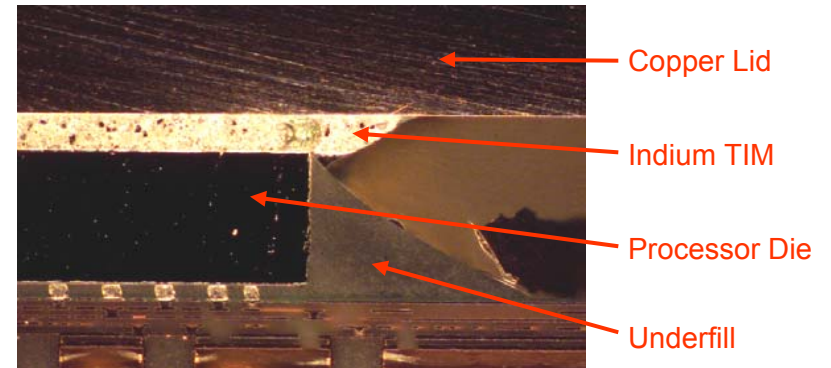
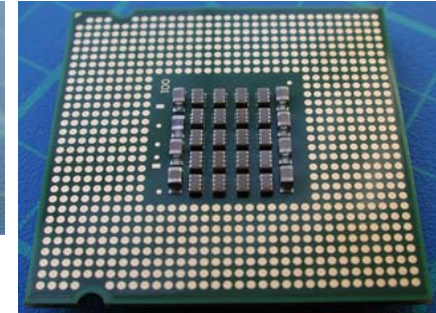
IC PACKAGING AND ASSEMBLY

- The development of IC packaging and assembly in China is more advanced than the IC fab. China now represents close to 10% of the overall packaging industry, and is the only region rapidly gaining share. Expect 15% share within three years.
- Most of the major semiconductor companies or merchant assemblers have or are establishing packaging assembly facilities in China. The leading companies are Intel, Freescale, AMD, Fujitsu, Amkor, STATSChipPAC, ASE, and SPIL.
- Intel is now assembling flip chip packages of chipset products in Shanghai with a capacity of well over 10M/month.
- AMD is planning to double its capacity for MPU and Flash memory packaging in Suzhou.
- STATSChipPAC is assembling high volumes of array packages in Shanghai.
- Other leading companies with IC assembly plants in China:

– ASAT	– Infineon	– Samsung
– Carsem	– National Semiconductor	– Sanyo
– Fairchild	– NEC	
- Many smaller local suppliers also in various stages of production.

INTEL PENTIUM D – DUAL CORE SMITHFIELD MPU

- First use of dual core processor by Intel
 - Actually uses two side-by-side die that are not diced apart
 - 90nm low-k, 10 x 22 x 0.76mm die
 - Approximately 8,400 total electroplated high lead bumps, 213µm pitch
- One piece stamped nickel plated copper lid 34 x 34mm
 - 1.7mm thick over die, 2.4mm total thickness
 - 220mm thick Indium TIM (slightly larger than die area)
- 4+ 4+ 4 microvia substrate 37.5 x 37.5 x 1.4mm
 - 775 LGA substrate
 - Build up layers minimum L/S 25µm (measured), 60µm via diameter (measured), 25µm dielectric thickness, 15 – 18µm copper thickness
 - Core layers: 110µm L/S, 250µm via diameter



THE PCB INDUSTRY OF GREATER CHINA

- China has become the second-largest PCB manufacturer in the world, next only to Japan, and produced \$7.7Bn circuit boards in 2004.
- If Taiwan is included in Greater China, this region produced \$12.8Bn of circuit boards and accounts for 67% of Asian (ex-Japan) production and 33% of the global output.
- Today, there are 850 – 900 board shops in China, and most of the leading suppliers, either in volume, value or technology, are foreign invested companies.
- China, in particular, is the largest manufacturer of paper, rigid, and four- to six- multilayer boards.
- Taiwan has about 150 shops, and has emerged as a key supplier of packaging substrates and microvia boards.

LEADING PCB SUPPLIERS IN CHINA

- Total Value in 2004: \$7.7Bn

Top Tier Sales Range \$250M – \$400M	Second Tier Sales Range \$150M – \$250M	Third Tier Sales Range \$75M – \$150M
Kingboard (E&E) Viasystems Multek OPC (Meadville) Unimicron	Compeq PouChen – GBM TopSearch Ya Hsin Tripod EPC Wus	China Circuit Technology Foxconn Hannstar Broadtech Mektec (Flex) Career (Flex) M-Flex (Flex) Techwise

- Current (2004) estimates of the top twenty companies represents about 50% of the market
- Enormous growth from 2004 over 2003 (> 35%)
- Total number of suppliers likely to exceed 1,000 (lots of smaller companies)

PCB PRODUCTION IN CHINA

- In China, PCB production is grouped in three regions:
 - Southern China: primary Guangdong Province, including Hong Kong
 - Eastern China: including Shanghai, Jiangsu, Zhejiang, and Fujian provinces
 - Northern and the rest: including Beijing, Tianjin, and other areas
- Southern China remains the most significant PCB production hub and hosts about 60% of the shops. Leading ones include Viasystems, Multek, Elec & Eltek, Compeq, etc.
- Eastern China has more than 30% of the PCB shops and they are centered around Shanghai, Kunshan, Suzhou, Wuxi. Leading PCB shops include Nan Ya, Wus, AT&S, etc.

MOBILE PHONE PRODUCTION IN CHINA

- China is the largest mobile phone market in the world with sales of about 100M units in 2004
 - Accounts for 10% of Motorola's sales
- China accounted for about one-third of world mobile phone production in 2004
 - About 60% of the production was exported
- Domestic Chinese manufacturers have been very aggressive
 - Share of Chinese market grew from 5% in 1999 to 50% in 2003
 - About forty manufacturers are registered
 - Exports still very limited
 - Help from IC suppliers and contract design houses
- Foreign brands have staged strong come back in 2004
 - Share of domestic suppliers has dropped to under 40% in 2004
 - Nokia (15%), Motorola (14%), Samsung (11%), Bird (9%)
 - Introduction of new models aimed at Chinese market
 - Price cuts triggered by Nokia
 - Sophisticated models (80% color displays, 25% cameras)
- Industry consolidation forthcoming
 - Foreign companies will retain lead
 - Larger domestic manufacturers holding ground through partnerships and acquisitions
 - Smaller domestic manufacturers will exit business

Domestic Chinese Manufacturers
Bird
TLC
Lenovo
Amoi
Kejian
Konka
Capitel
CEC
Panda

SONY ERICSSON V802 3G/GSM MOBILE PHONE

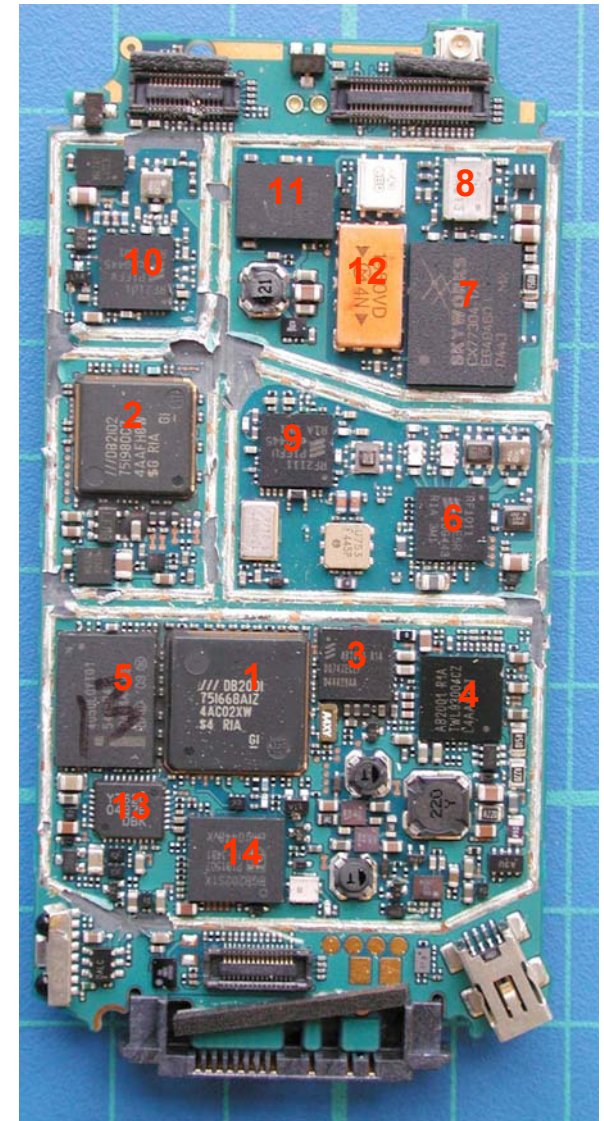
- Quad-Band Dual Mode Mobile Phone
 - 900/1800/1900 MHz GSM/GPRS
 - 2100 MHz WCDMA
 - 102 x 48 x 24mm, 128g

- Multimedia Clamshell Phone
 - 1.3 MP CMOS rotary camera
 - 4x digital zoom
 - 3GPP video recording
 - 2.2", 260k color, 176 x 220 pixel TFT LCD
 - 1.0", 65k color, 80 x 101 pixel CSTN LCD
 - Bluetooth, IrDA, USB, memory stick duo
 - 72 chords polyphonic ringtone
 - 900 mAh Li polymer battery
 - 220 (GSM) – 240 (WCDMA) hr standby
 - 2.5 (WCDMA) – 10 (GSM) hr talk
 - 1.5 hr video call



SONY ERICSSON V802 3G/GSM MOBILE PHONE

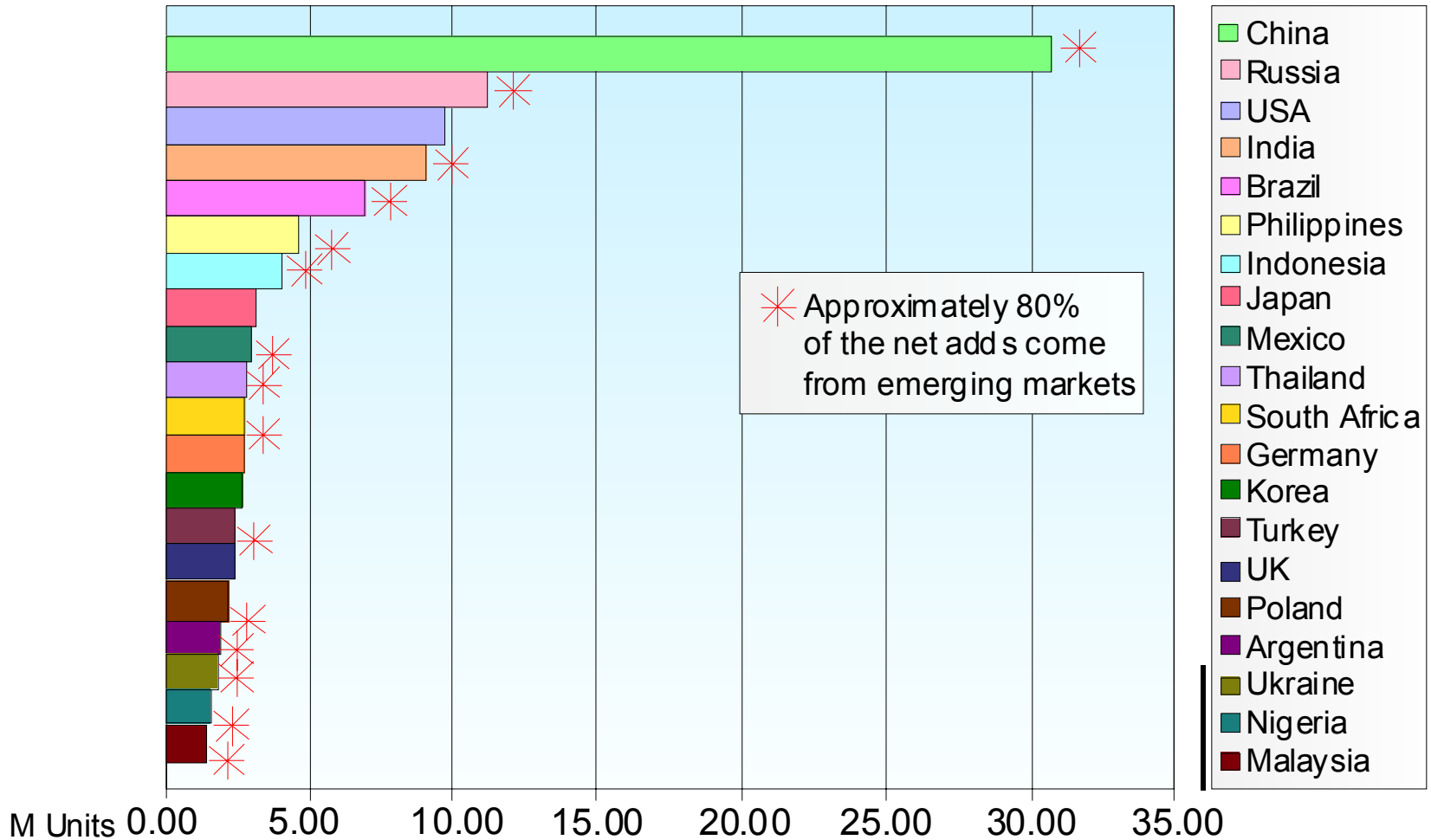
- Main Board Assembly
 - 9 x 4.5 X 1mm, 2+ 4+ 2 Microvia
 - Largely single-sided assembly
 - Lead-free assembly
- Baseband Components
 1. Ericsson GSM digital baseband
 2. Ericsson WCDMA digital baseband
 3. Ericsson GSM analog baseband
 4. Ericsson WCDMA analog baseband
 5. Intel 256M Flash/64M RAM
- RF Components
 6. Ericsson GSM transceiver
 7. Skyworks GSM PA module
 8. Murata antenna switch module
 9. Ericsson WCDMA receiver
 10. Ericsson WCDMA transmitter
 11. RFMD WCDMA PA module
 12. Murata WCDMA duplexer
- Other Components
 13. Yamaha sound generator
 14. Philips Bluetooth module



HANDSET MANUFACTURERS IN CHINA

Company	Location	2004 Volume
Nokia	Dongguan, Beijing	44M
Motorola	Tianjin	42M
Siemens	Shanghai	16M
Compal Communications	Nanjing	15M
SonyEricsson	Beijing	14M
Bird	Ningbo	14M
Arima Communications	Wujiang	11M
BenQ	Suzhou	10M
Lite-On	Guangzhou	Small
Samsung	Shenzhen	?
LG	Yangtai, Qingdao	
TCL	Huhehaote, Huizhou	
Kejian	Shenzhen	
Konka	Shenzhen	
DBTeL	Shanghai	
Ares Communications	Tianjin	
Lenovo	Xiamen (coming soon)	
SK Group	Xinjiang Province	
Total		230M (35% of World Total)

1H2004 SUBSCRIBER GROWTH



Source: EMC/ Nokia

WHAT IT TAKES TO BE A LEADING OEM

- Global Brand Name:** Can Huawei, Bird, or Lenovo develop brand name recognition on the level of Cisco, Samsung, or Nokia?
- Competitive Core Technologies:** This is especially critical in new emerging sectors such as displays, wafer fabrication, and RF, and less important in mature markets such as PCs and consumer devices
- International Presence:** It is one thing to serve local Chinese market, but to expand outside requires full range of development, service, and support to serve consumer preferences
- Cost Competitive Manufacturing:** China is already there, but accessibility to components and subassemblies may play a factor

China's OEMs are already moving in the right direction; what is missing is the global recognition and presence.

THE FUTURE OF CHINA

- China is already becoming a powerhouse
 - EMS/OEM/ODM assembly
 - Semiconductor packaging
 - PCB manufacturing
- China is on its way to developing leading wafer fab and IC design capabilities
- By 2020, Prismark believes that not only will China represent more than one-third of electronics production, but a significant number of leading global OEMs will have their operations based in China