



# **Integrating the North American Electronics Industry Supply Chain:**

## **IC Packaging in Mexico**

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# Agenda

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- I. Background
- II. Problem Description



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# PART I: Background

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- ◆ Importance of Industry
- ◆ Manufacturing Processes
- ◆ Supply Chain

# Importance of Electronics Industry

- ◆ 3% of the world's GDP (\$1,026 Billion)\*
- ◆ 2.6% of US's GDP
- ◆ Higher in Asia:
  - 12% in Singapore
  - 8% in China

# Manufacturing Processes

- IC Fabrication
- IC packaging & test (AKA assembly & test)
- PCB and final assembly



# Process 1: IC Fabrication

- ◆ Turning high-grade silicon wafers into thousands of integrated circuits
- ◆ Layering processes:
  - Adding
  - Altering
  - Removing (etching)

# Process 2: IC Packaging & Testing

- ◆ Transforming a wafer with thousands of ICs into thousands of usable components
- ◆ Purposes of encapsulation processes:
  - Protect IC from “dirty room” environments
  - Provide interface to PCB



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# Process 3: PCB & Final Assembly

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- ◆ Building even larger integrated circuits on PCBs and creating the final product.



# Electronics Industry Supply Chain

- ◆ Asia centric

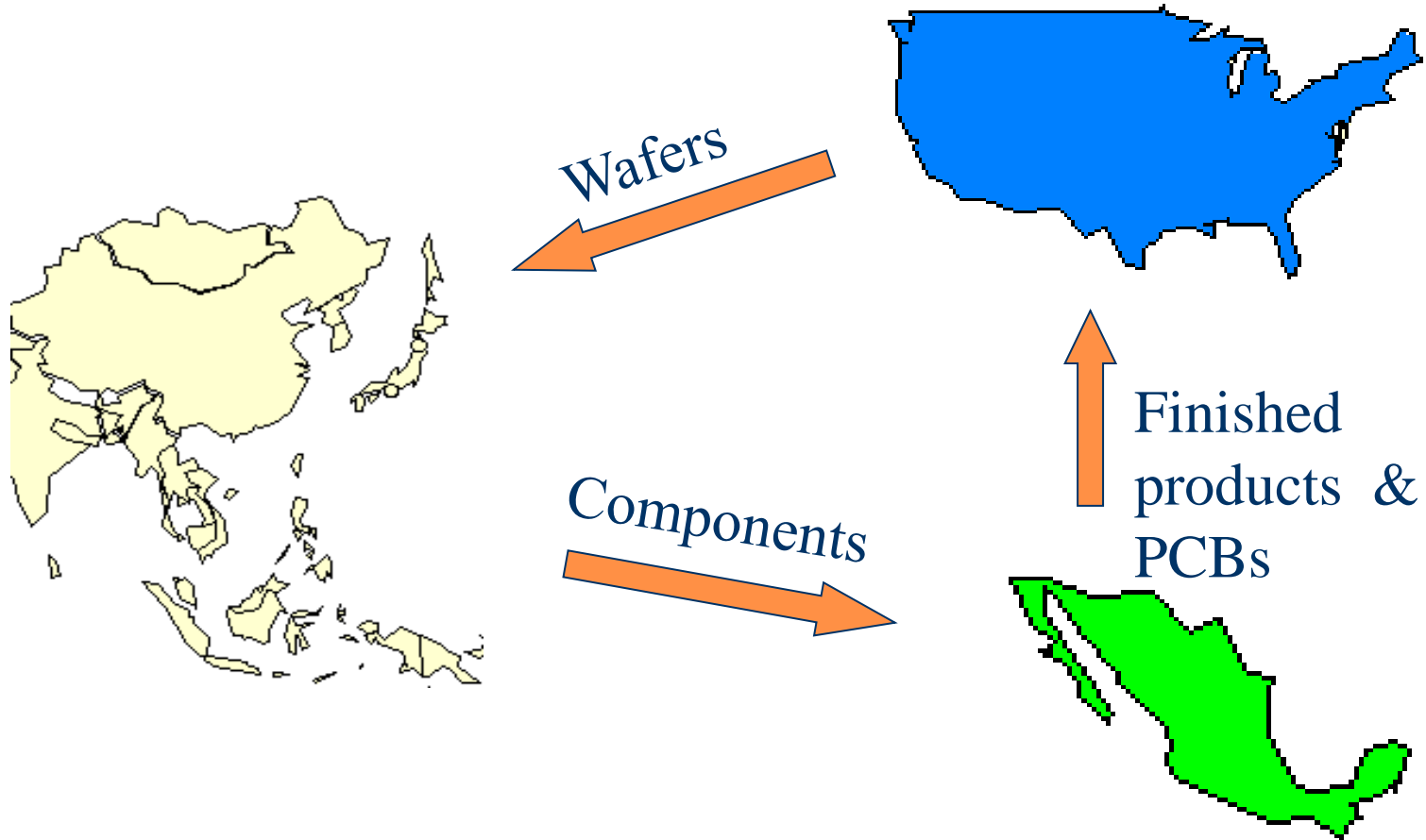
	Exporter		
	Asia	Europe	NAFTA
Asia	75.35%	8.65%	15.30%
Europe	30.52%	53.93%	13.77%
NAFTA	53.40%	9.13%	28.50%

Origin of Electronics Imports by Region

# North American Electronics Industry Supply Chain

- ◆ IC Fabrication – US & Asia
- ◆ IC Packaging and Test – Asia
- ◆ PCB & Final Assembly – World
- ◆ Final Product Demand – World

# North American Electronics Industry Supply Chain





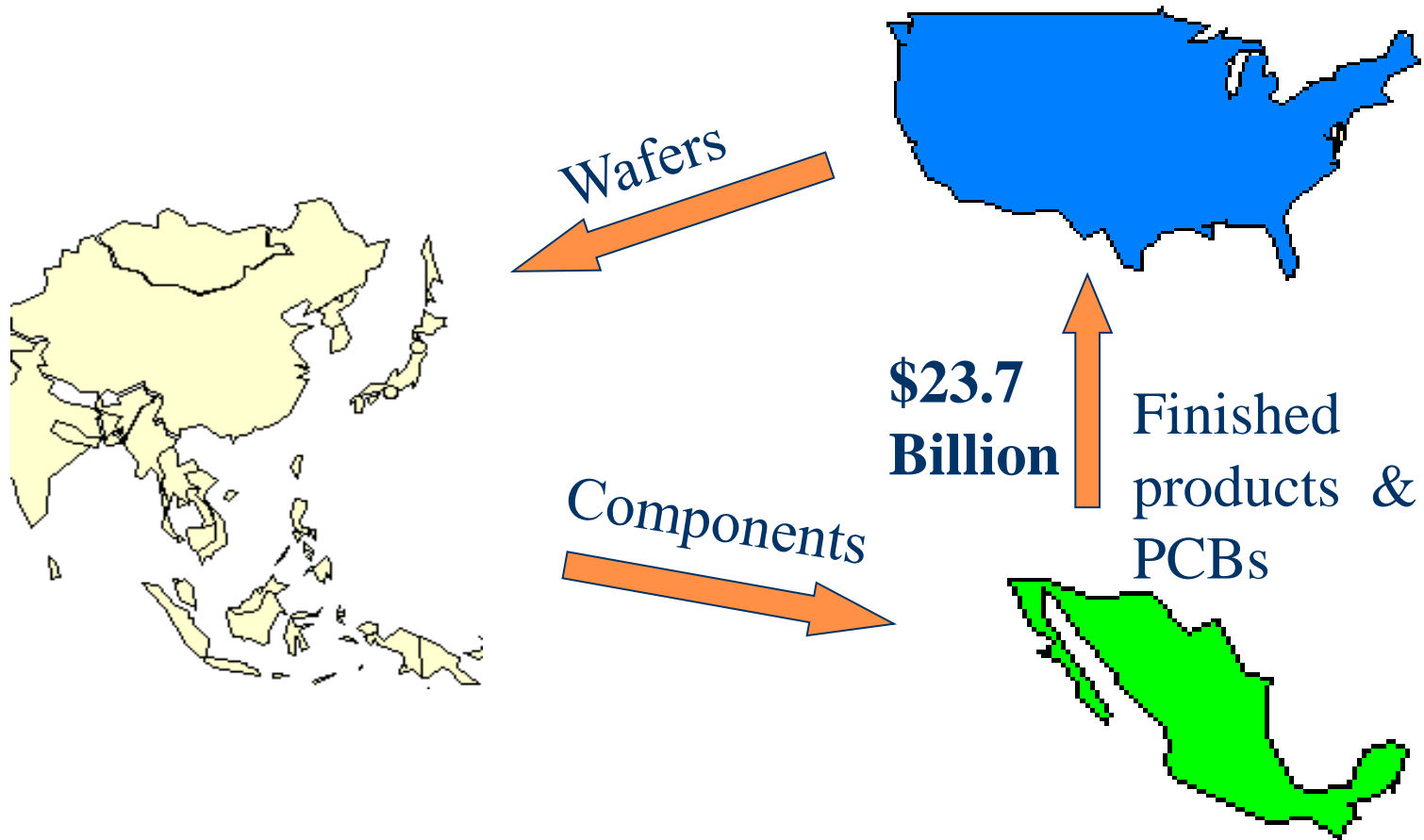
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# Part II: Problem Description

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- ◆ Industry Segment
- ◆ Current Deficiencies
- ◆ Proposed Solution
- ◆ Methodology
- ◆ Delimitations

# Industry Segment



# Current Deficiencies

- ◆ Distance
  - Transportation, travel, level of control, language barriers
- ◆ Reduced manufacturing in North America
- ◆ Intellectual property infringements
- ◆ Not viable for defense (aerospace, military)
- ◆ Risk from lack of geographic diversification



# Proposed Solution

IC Packaging & Test in Mexico

# Methodology

- ◆ Research
  - Understand industry and supply chain
  - Investigate why this has not been done in grand scale yet
- ◆ Assess feasibility of establishing a plant
- ◆ Draw conclusions from this plant



# Part III: Packaging in Mexico

- ◆ Package types
- ◆ Packaging Operations Currently in Mexico
- ◆ Product selection
- ◆ Costs
- ◆ Other factors of competitiveness
- ◆ Mexicali vs Juarez vs Guadalajara

# Package Types

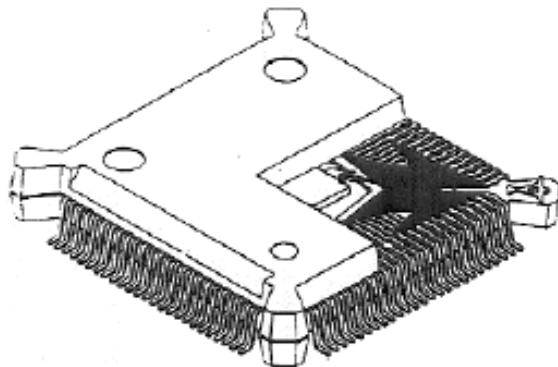
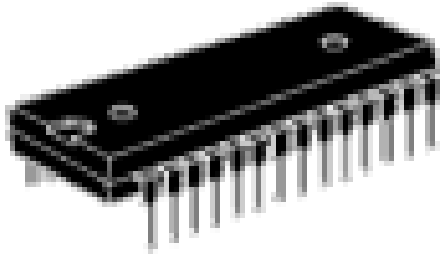


FIG.5.9: PQFP with gull wing leads

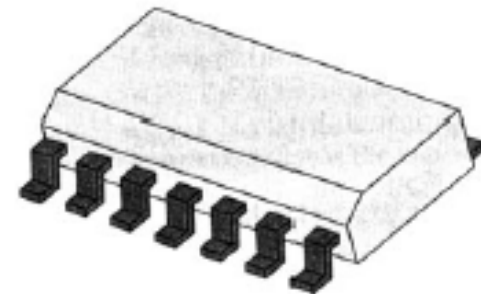


FIG.5.7: Gull wing SOP

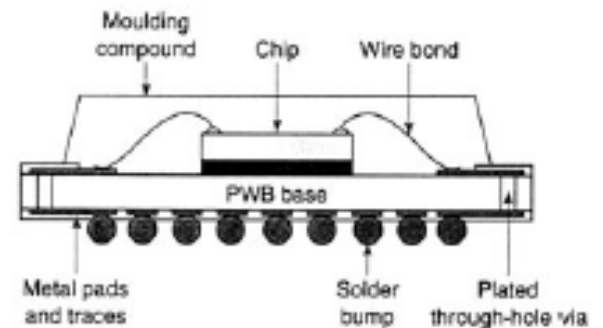


FIG.5.14: BGA

# IC Packaging Processing

- ◆ Dicing
- ◆ Die bond
- ◆ Wire bond
- ◆ Mold
- ◆ Ball attach
- ◆ Singulation



- ◆ Testing!
  - Ask Hugo!!!!

# Who's already there?

- ◆ Motorola (ON Semi) (Guadalajara)
  - Closed in 2002
- ◆ TI (Aguascalientes)
  - No info
- ◆ Skyworks (Mexicali)
  - COO loves it
  - Manufactures 85% of all Skyworks components

# Product Selection

- ◆ Desired characteristics:
  - High tech
  - Future growth
  - Demand in Mexico
- ◆ Product chosen:
  - BGA 128 IO, 10mm X 10mm

# Costs: Capital

<b>Machine</b>	<b>Quantity</b>	<b>Tot Cost</b>
Saw	3	\$1,500,000
Die Bond	5	\$1,000,000
Wire Bond	64	\$4,800,000
Automold	1	\$400,000
Ball Attach	1	\$400,000
Singulation/Sort	4	\$1,000,000
Testing	2	3,000,000
<i>Extras</i>	<i>10</i>	<i>\$1,000,000</i>
<b>TOTALS</b>	<b>90</b>	<b>\$13,100,000</b>

# Costs: Labor (monthly)

Type	Monthly Salary	Quantity	Total Cost
Operators (skilled)	\$432.86	100	\$43,286.00
Technicians	\$1,588.00	35	\$55,580.00
Engineers	\$1,935.50	1	\$1,935.50
Plant Manager	\$5,153.00	1	\$5,153.00
		<b>TOTAL</b>	<b>\$105,954.50</b>



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# Costs: Raw Materials (monthly)

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# Costs: Miscellaneous (monthly)

<b>Category</b>	<b>Cost</b>	<b>Unit</b>	<b>Monthly Quantity</b>	<b>Total Cost</b>
Power	\$0.11	\$/Kwh	114,336 Kwh	\$12,600
Land	\$5.05	\$/sq.ft.	14,000 sq. ft.	\$70,700
Transportation	-	-	14.4 mil BGA	\$43,233
			<b>TOTAL</b>	<b>\$126,533</b>



# Costs: Still Missing

- ◆ Purchase land (option)
- ◆ Machine maintenance
- ◆ Taxes, incentives

# Where in Mexico?

- ◆ Juarez: \$332,366.89
- ◆ Guadalajara: \$431,765.50
- ◆ Mexicali: **\$313,213.98**

Taken into account:

Transportation, rent, labor, electricity



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# Other stuff to add

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- ◆ 2 day lead times
- ◆ Customer Service
- ◆ Time to market
  
- ◆ Supply Chain Optimization, not plant-centered



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# Part IV: Conclusions

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- ◆ Conclusions
- ◆ Recommendations for Future Research



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# Conclusions

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TBD!