



13-14 November 2023. Munich, Germany

EPIC Technology Meeting on Microelectronics
& Photonics – Two Sides of One Coin



Malcolm Penn, Founder & CEO, Future Horizons



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ABOUT FUTURE HORIZONS

“No matter how good an organisation, unintended bias is always a risk. All organisations can benefit from an independent reviewer” – University of Washington

Founded In 1989 As The Trusted Independent Industry Guru

(Google “Future Horizons” or “Malcolm Penn Semiconductors” For More Details)

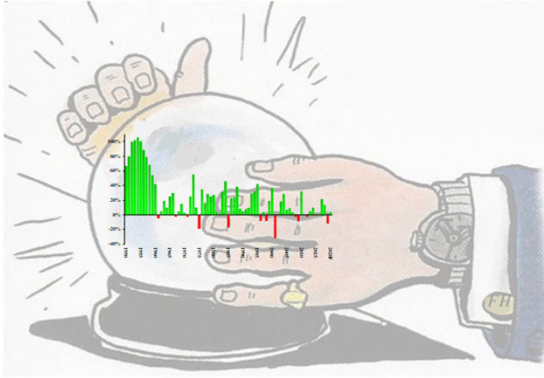
- ◆ **We Value Our Independence & Never Compromise Our Integrity**
- ◆ **Accountability & Consistency Are Fundamental To Our Corporate & Personal Ethos**
- ◆ **We’re Not Corporate ‘Yes Men’ / ‘Hired Gun’, We Tell The Facts & Assumptions Plus Reasons Why**
- ◆ **We Don’t Keep Changing The Goalposts As The Year Progresses, Homing In On The ‘Right Number’**
- ◆ **Unparalleled Industry Acumen & Track Record Second To None**

- ☑ Nov 2016 - Correctly Called Double-Digit Upturn In 2018
- ☑ Apr 2020 - Correctly Called ‘Stay Calm’ Advice Re 2020 Covid-19 Impact
- ☑ Sep 2020 - Correctly Called Double-Digit Growth In 2021, With 24% Upside
- ☑ Sep 2020 - Correctly Called Systemic & Widespread 2021-22 Shortages
- ☑ Dec 2021 - Correctly Called Market Downturn In 2H-2022
- ☑ Mar 2022 - Correctly Warned Of Double Digit Negative Growth In 2023



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ENGINEERING 'PROBLEM SOLVING' APPROACH



Key Driving Influences

- ◆ Technology Push (Moore's Law / Science)
- ◆ Market Pull (Doing The Previously Impossible)
- ◆ Production (Supply / Demand)
- ◆ Economy (Greasing The Wheels)

Analytical Tools Used

- ◆ Economy (IMF) / SC Sales (WSTS) / CapEx & Wafer Production (SEMI) *plus* Company Reports & In-House Proprietary Database
- ◆ Trends Plus Experience (It's Rarely Different This Time)

- ◆ Impartial Analysis Of Whole Forest & The Trees
- ◆ 50+ Years Of SC Industry Experience, From The First Commercial IC



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SILICON VS. PHOTONICS ... TWO SIDES OF ONE COIN

"No Man Is An Island, Entire Of Itself"

(John Donne – 17th Century English Poet)



**No Established Firm Or Start-Up Is Either ...
Like It Or Not Photonics IS Part Of The Semiconductor Market**



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PHOTONICS & SILICON INTER-DEPENDENCY

- ◆ Photonics Is A Critical Part Of The Modern Technological Landscape
- ◆ Key To Innovations In Telecommunications, Healthcare & Energy
- ◆ Currently Very Fragmented & Unstructured
- ◆ Ideally Placed To Draw Lessons From The Well-Established Practices
- ◆ Key Opportunities In Manufacturing, Standardization & Integration



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WITH SYNERGY COMES OPPORTUNITY

Industry Best Practice
(Don't Reinvent The Wheel)



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EXPLOIT PHOTONICS & SILICON INTER-DEPENDENCY

- ◆ **Manufacturing Efficiency & Scalability**
 - Optimized Manufacturing Processes
 - Fabrication Techniques, Wafer-Scale Processes & Automation
 - Reducing Production Costs & Accelerating Time-to-Market
- ◆ **Standardization & Compatibility**
 - Standardized Interfaces & Design Rules
 - Advantages Of Industry-Wide Standards
 - Potential For Seamless Integration & Novel Applications
- ◆ **Education & Workforce Development**
 - Collaboration With Educational Institutions
 - Partnerships & Educational Programs For Nurturing Talent



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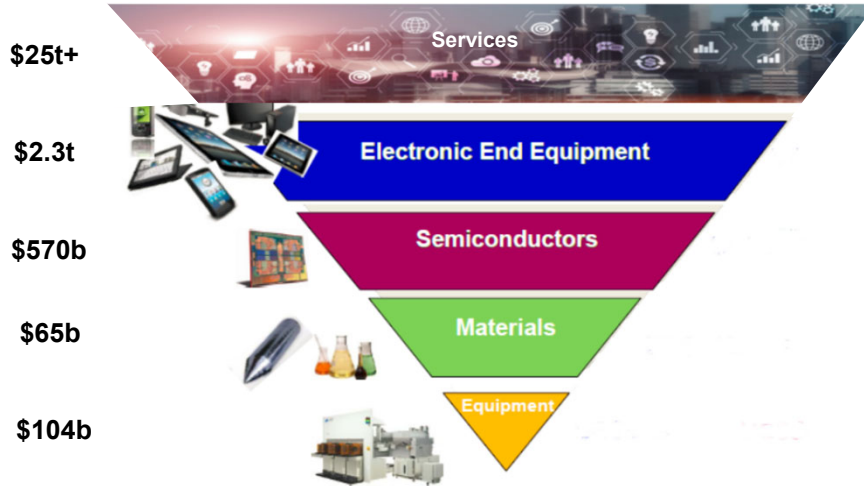
WITH SYNERGY COMES OPPORTUNITY

Market Characteristics
(Embrace It, Don't Fight It)



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ELECTRONICS INDUSTRY VALUE CHAIN - 2022



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INDUSTRY CHARACTERISTICS

Long Term Trends Are 'Constant' (Industry Equivalent of $e=mc^2$)

		CAGR
Economy	World GDP	3.4%
Units	IC Unit Sales	7.7%
	IC's Per Sq In	2.2%
ASPs	IC ASPs	0.0%
Capacity	CapEx % SC Sales	12.5%
	Silicon Sq Ins	5.5%
Market	IC Sales	5.9%

Industry Value Chain (US\$/cm²)

Services	\$450	
End Equipment	\$35	(50x)
Semiconductors	\$9	
Foundry	\$4	(90x)
EDA	\$0.18	
IP	\$0.10	
Materials	\$0.70	
Equipment	\$1.40	

What Moore's Law Giveth (More Bang For The Buck)

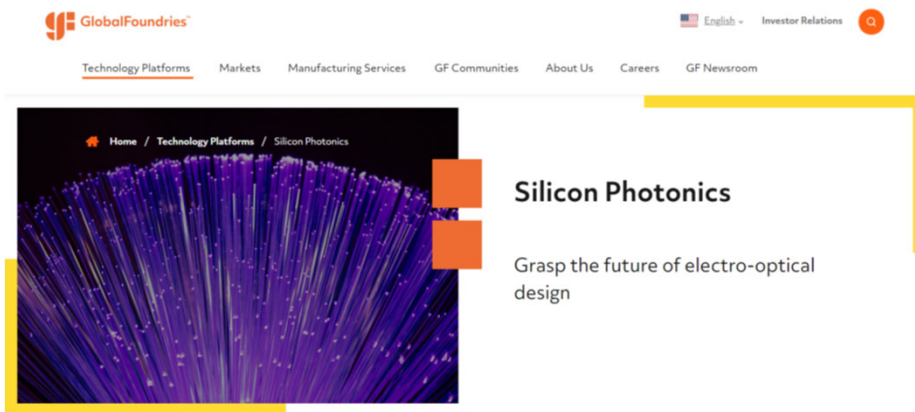


Every New Venture Needs An End Market Champion

Intel Had IBM, ARM Had Nokia & TSMC Had (Has) Apple
(50x Value Power)

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TWO SIDES OF ONE COIN – GLOBALFOUNDRIES

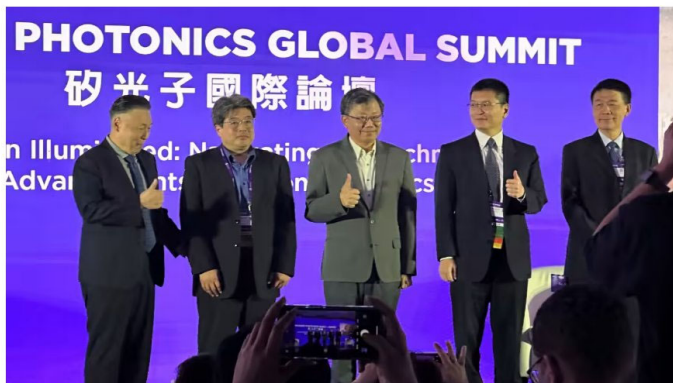


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TWO SIDES OF ONE COIN – TSMC

TSMC bets on silicon photonics to enable more powerful ChatGPT

Emerging field becomes new battleground for major tech players



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CONCLUSION

- ◆ **Key Lessons To Be Learned From The Silicon Semiconductor Industry Best Practices & Behaviour (Good, Bad & Ugly)**
- ◆ **Markets Are Inter-dependent & Symbiotic With Potential For Photonics To Transform Various Sectors**
- ◆ **Collaboration Will Accelerate Photonics' Growth & Innovation At A Lower Overall Cost ... Doing More For Less**



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KEY BENEFITS

- ◆ **Manufacturing Efficiency and Scalability:**
 - Reduce Production Costs, Accelerated Time-to-Market & Improved Competitiveness
- ◆ **Standardization & Compatibility:**
 - Easier Integration Into Existing Systems & Addressing New Novel Applications
- ◆ **Investment in R&D:**
 - Collaboration Can Lead To New Materials, Devices & Photonics Applications
- ◆ **Education & Workforce Development:**
 - Provide A Pool Of Talent Equipped With The Necessary Skills & Knowledge
- ◆ **Intellectual Property Protection:**
 - Adopt Silicon Semiconductor Best Practice & Well-Honed Strategies



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EPIC & FUTURE HORIZONS PARTNERSHIP IS HERE TO HELP ...

FUTURE HORIZONS
Presents

The Global Semiconductor Monthly Report
July 2022

The Storm Clouds Are Gathering ... Are Years Of Plenty Dulling Minds?

Over 33 years As FHE Authoritative Industry Scorekeeper, With An Exemplary Record Of Accuracy & Calling The Trends Right ... We Were The **Only Analyst To:**
 ☐ Correctly Call Double-Digit Upturn In 2018 (Nov 2018)
 ☐ Correctly Call 'Stay Calm' Advice Re 2020 Covid-19 Impact (April 2020)
 ☐ Correctly Call 2021 Double-Digit Growth, With Upturn Of 24% (Sep 2020)
 ☐ Correctly Call Systemic & Widespread Shortages Throughout 2021-22 (Sep 2020)
 ☐ Only Analyst To Warn Of A Market Downturn In 2H-2022 (Dec 2021)

Mark Your Diary NOW! ... IFS2022-MT ... 13 Sep 2022
Mid-Term Industry Forecast
(Visit Our Website www.futurehorizons.com For Further Details & Registration)

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Presents

The Global Semiconductor Monthly Report
November 2022

Q3 Was Down 6.3% vs. Q2 The Market Meltdown Is Now In Full Flow

Over 33 years As FHE Authoritative Industry Scorekeeper, With An Exemplary Track Record Of Accuracy & Calling The Trends Right ...
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 ☐ Sep 2020 – Correctly Called 2021 Double-Digit Growth, With 24% Upturn
 ☐ Sep 2020 – Correctly Called Systemic & Widespread Shortages Throughout 2021-22
 ☐ Dec 2021 – Correctly Warned Of 2H-2022 Market Downturn
 ☐ May 2022 – Warned Of Negative 22% Growth In 2023

Mark Your Diary Now
"IFS2023 Industry Update Webinar" – Jan 17, 2023*
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The Global Semiconductor Monthly Report
February 2023

It's Just A Normal Cycle ... Time For Clear Heads & Calm

Over 33 years As FHE Authoritative Industry Scorekeeper, With A Clean Track Record Of Consistently Calling The Trends Right ...
 ☐ Nov 2018 – Correctly Called Double Digit Upturn In 2018
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Proceedings & Video Link Now Available
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The Global Semiconductor Monthly Report
August 2023

The Recovery Has Started ... And It's Off To A Great Start

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- ◆ **Relaunched** In July 2022, A **C-Suite favourite**, the **Global Semiconductor Monthly Report** provides monthly **analysis** and **commentary** on the **global semiconductor industry**
- ◆ **Everything The Busy Exec Needs To Know About The Industry Pulse In One Convenient Report**

Each Report Typically Consists Of 20 Pages/28 Graphs & Tables

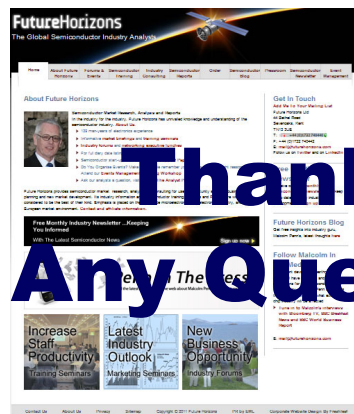
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The Global Semiconductor Industry Analysts

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The Global Semiconductor Industry Analysts

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