

SWTW -- June 2009

Test Economics Driving Test Technology



A storm blowing into Lake McDonald. Waterton-Glacier International Peace Park World Heritage Site, Montana

VLSIresearch

VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Market Observations

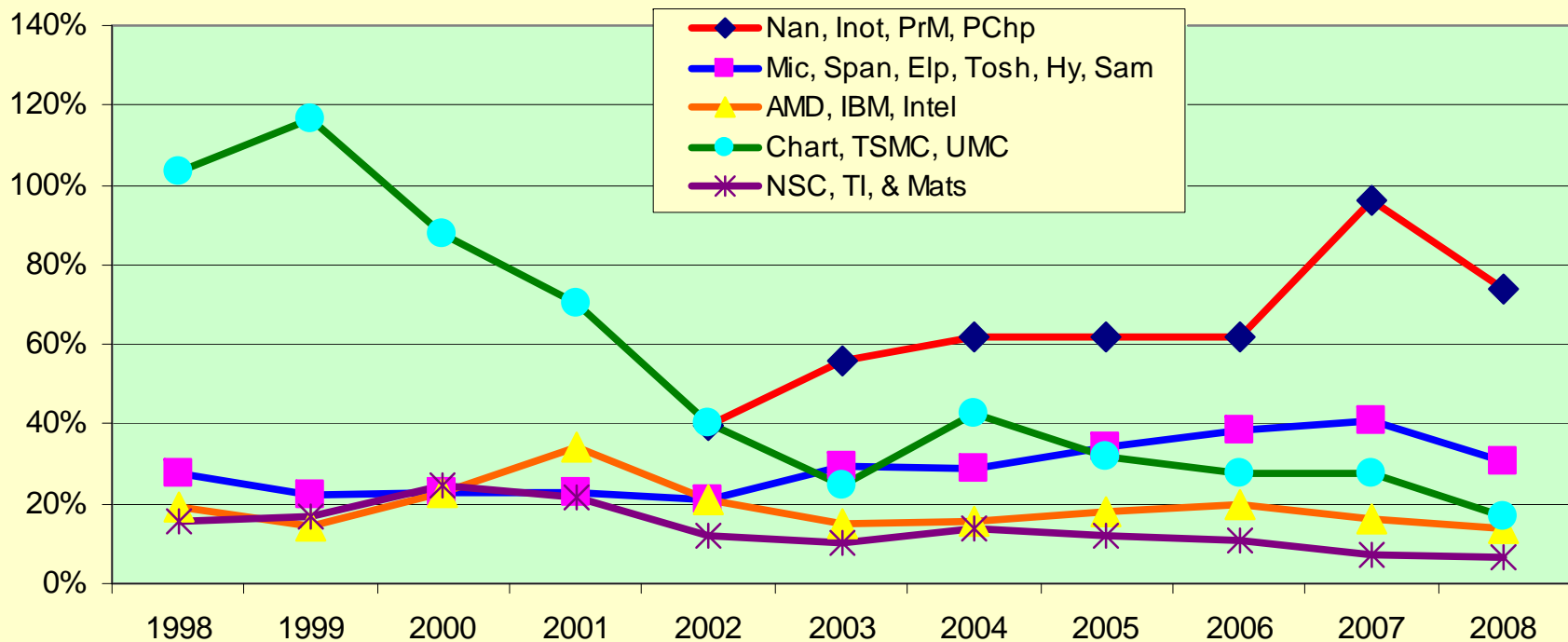
VLSIresearch.com

weSRCH.com

chiphistory.org

Half of The Chip Recession Was Caused by Overspending in Taiwan Memory

Capital Expenditure Ratio by Market Type



Copyright © 2009 by VLSI RESEARCH INC. All rights reserved.

VLSIresearch.com

weSRCH.com

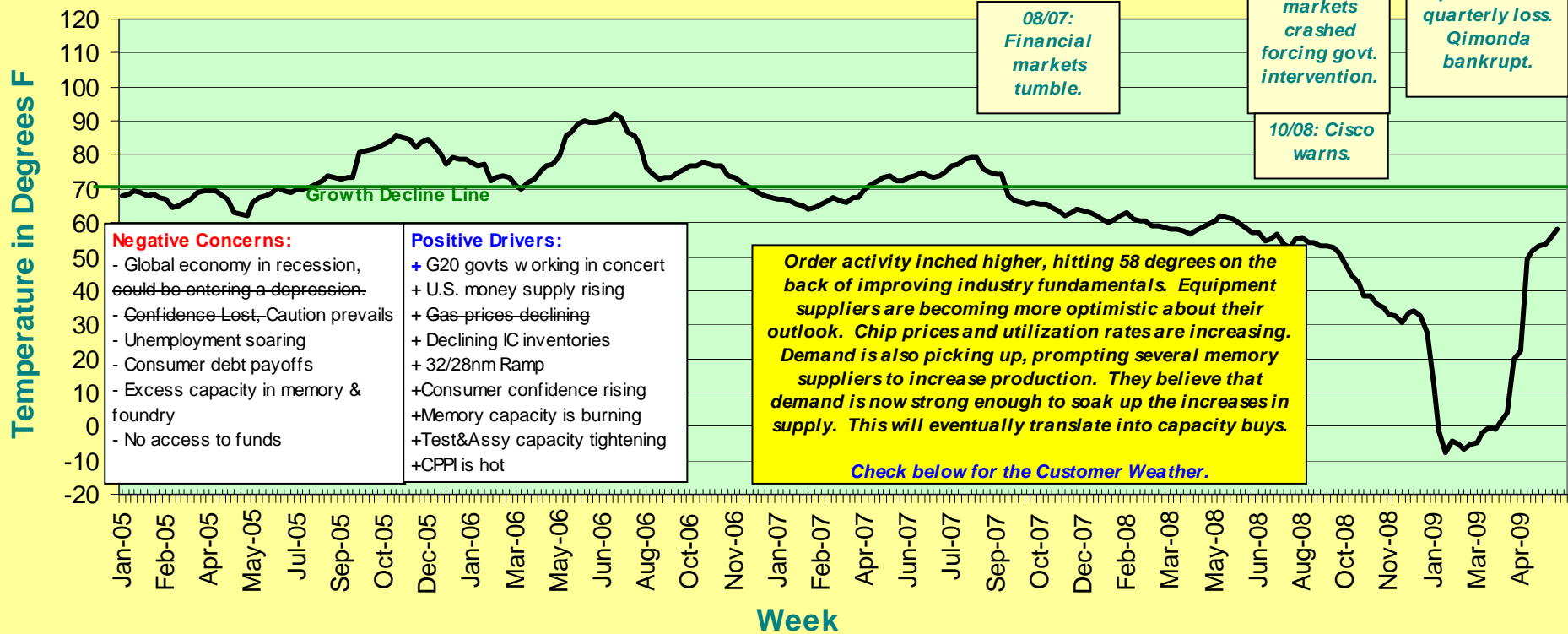
chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Deep-Freeze Has Subsided

VLSI's GLOBAL CHIP MAKING CLIMATE TREND INDEX

(Average of Regional Order Activity Patterns in Chip Equipment)



RESTRICTED DATA: for access and use only within your company. Copyright © 2009 by VLSI Research Inc. All rights reserved.

VLSIresearch.com

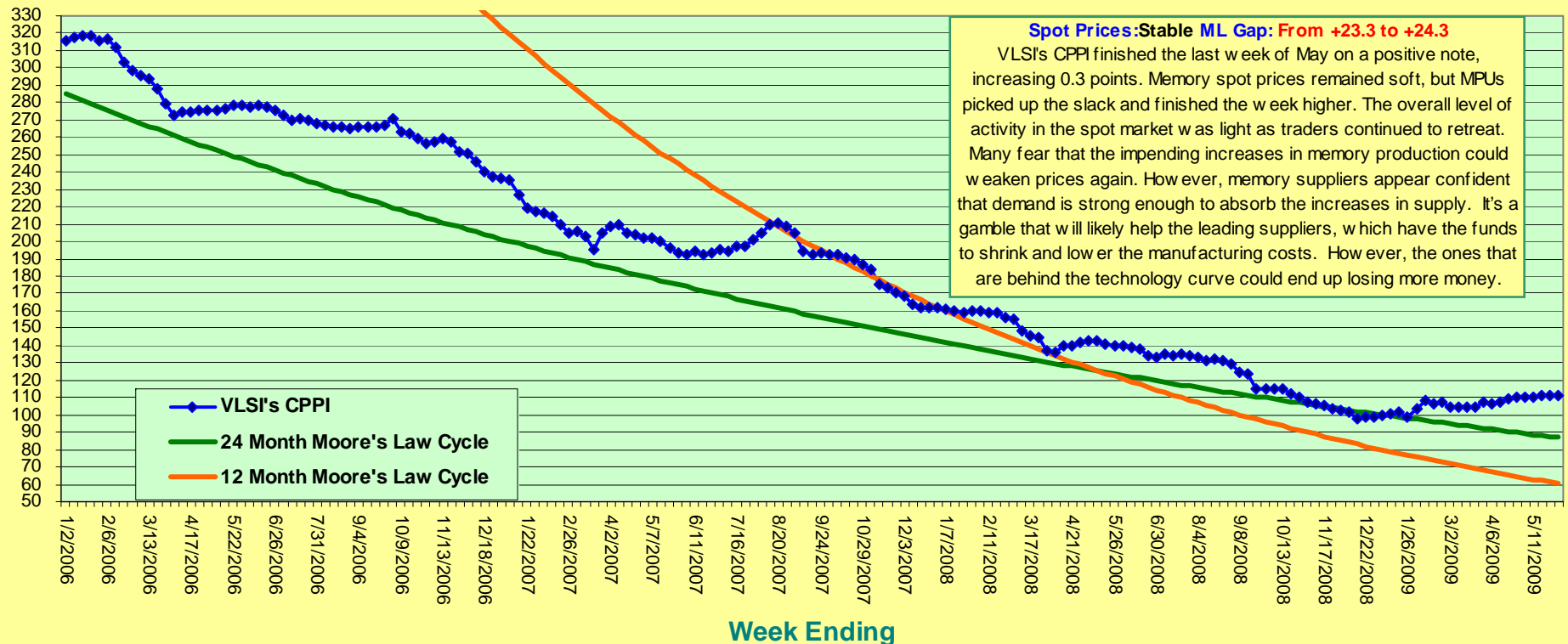
weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

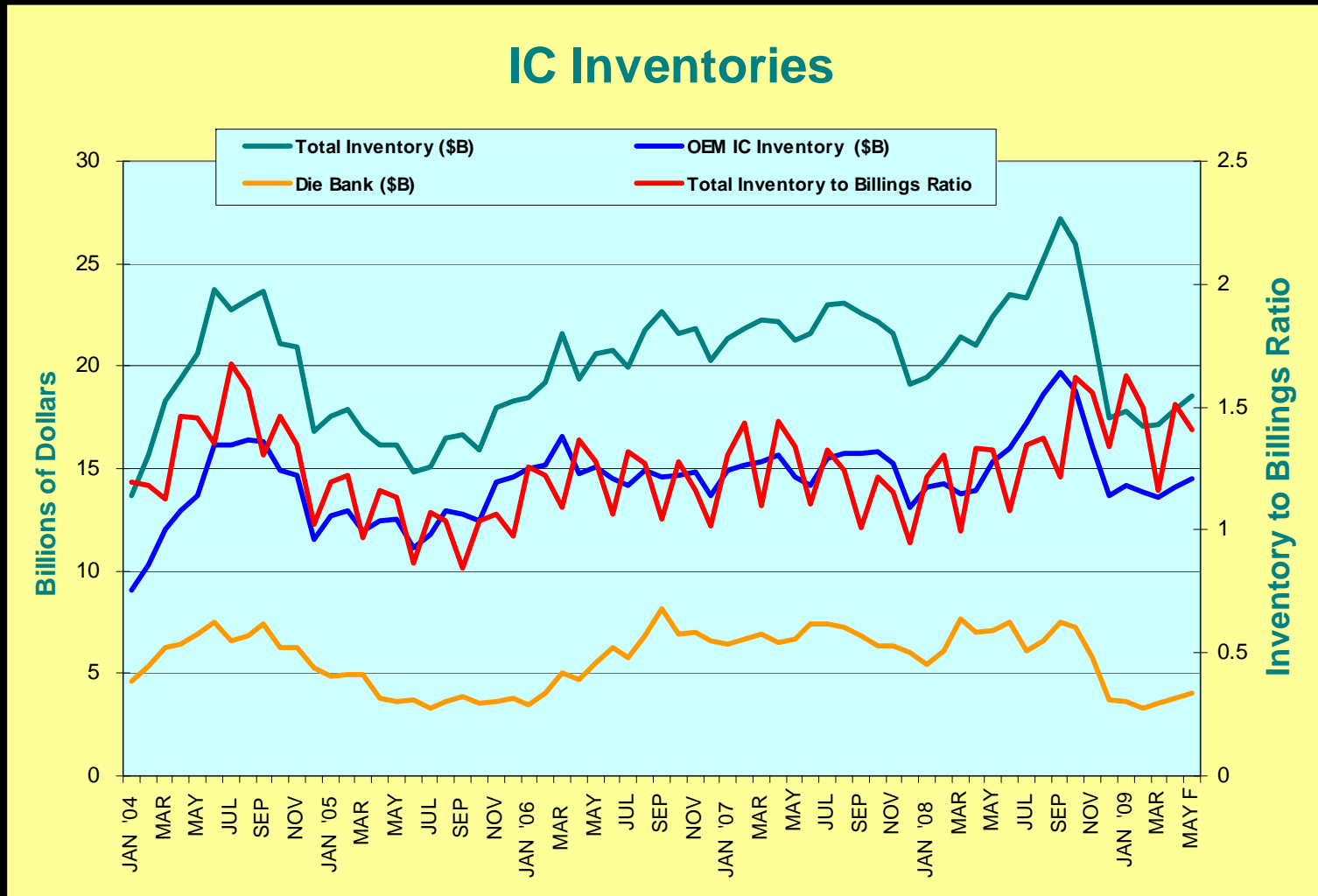
Six Month Improvement in Spot Prices

VLSI's Spot Market Chip Price Performance Index



RESTRICTED DATA: for access and use only within your company. Copyright © 2009 by VLSI Research Inc. All rights reserved.

Inventories Are at Normal Levels



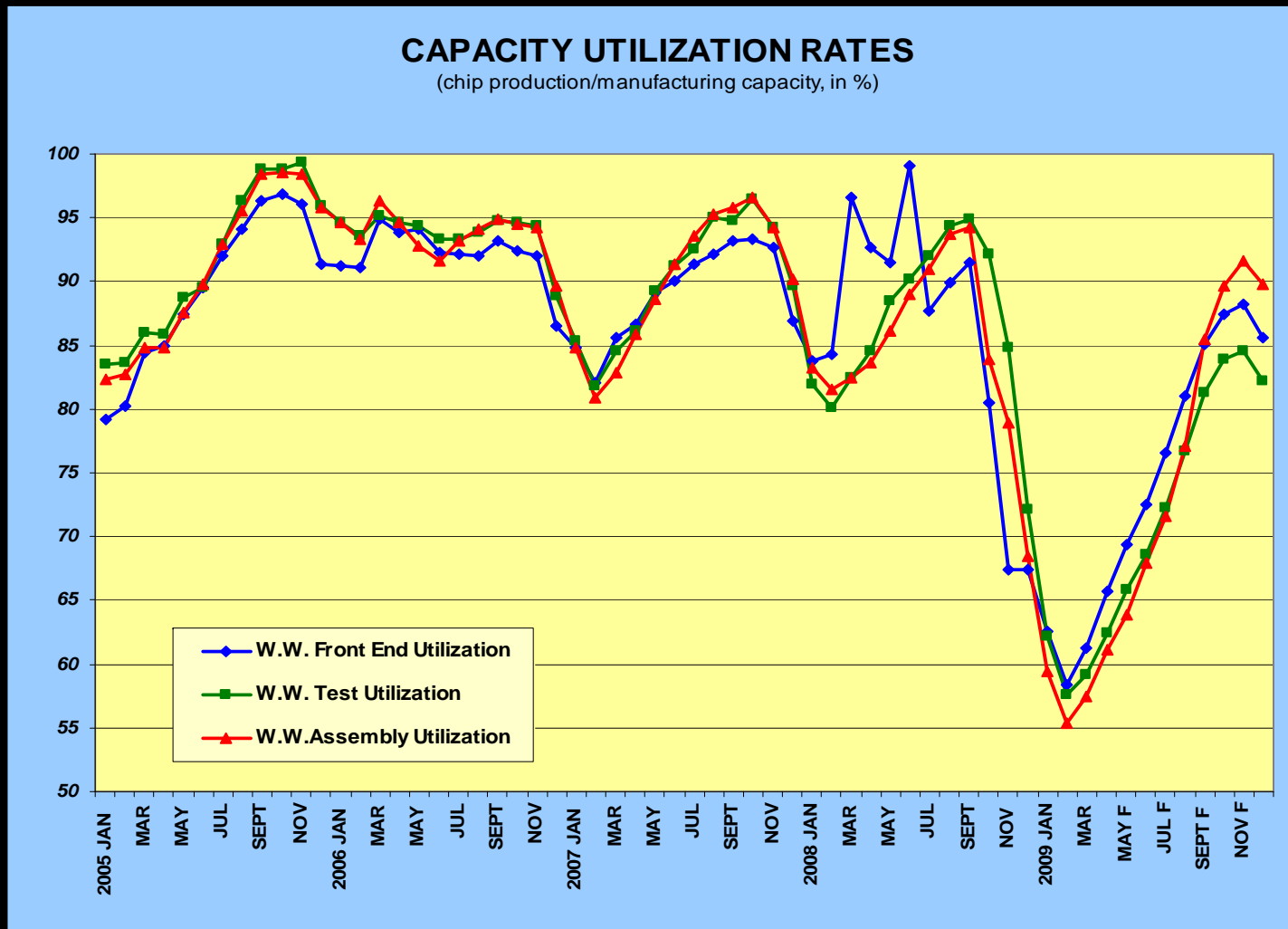
VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Utilization Rates Recovering



VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Semiconductor Business is Improving

	08-09	09-10	CAGR 08-13	2008 Sales (\$B)
Electronics	-6.9%	8.5%	5.2%	1569.8
IC Market	-11%	-16.4%	15.3%	208.7
IC & Related Mfg Equipment	-44.8%	45.0%	5.8%	40.6
ATE	-45.9%	57.6%	9.9%	2.5

Drivers for Next Upturn

- Mobile Internet Device (MID)
- Windows 7
- SSDs

Questions

- Does this economic downturn affect Moore's law?
 - Not really
- When do you think the industry will be moving to 450mm diameter wafer?
 - 2020
- Do you predict more consolidation in big companies especially in Memory market?
 - Absolutely
- Can you comment on the current trend of smart phones taking on more personal computer characteristics and what that means for the various semiconductor market segments?
 - Processors alone can be \$20 – \$30B

Market Summary

- Semiconductor industry was healthy entering into this recession.
- Semiconductor business is returning to normal but lower operating levels.
- Spot prices improving.
 - Production cuts help tremendously
- Capex still remains very low.

Probe Card Market

VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Top Probe Card Suppliers

Presentation - a

TOP 10 Semiconductor Probe Card Vendors - 2008 (Including Service & Spares)

2008 Rank	Company	2008 \$M	2007* Rank	2007* \$M
1	FormFactor	210.2	1	462.2
2	Micronics Japan Co., Ltd (MJC)	193.3	2	162.2
3	JEM: Japan Electronic Materials	132.9	3	130.1
4	SV Probe Inc	41.8	5	54.4
5	Technoprobe	37.0	7	36.3
6	MPI	36.9	8	35.5
7	Phicom Corporation	36.3	4	56.2
8	Tokyo Cathode Laboratories Inc	34.4	6	49.0
9	Microprobe	31.2	14	25.5
10	TSE Co., Ltd	26.7	9	33.3

* 2007 rank based on latest revisions.

Copyright © 2009 by VLSI RESEARCH INC. All rights reserved.

Source: VLSI RESEARCH INC

Doc: 458089v3.04, April '09,

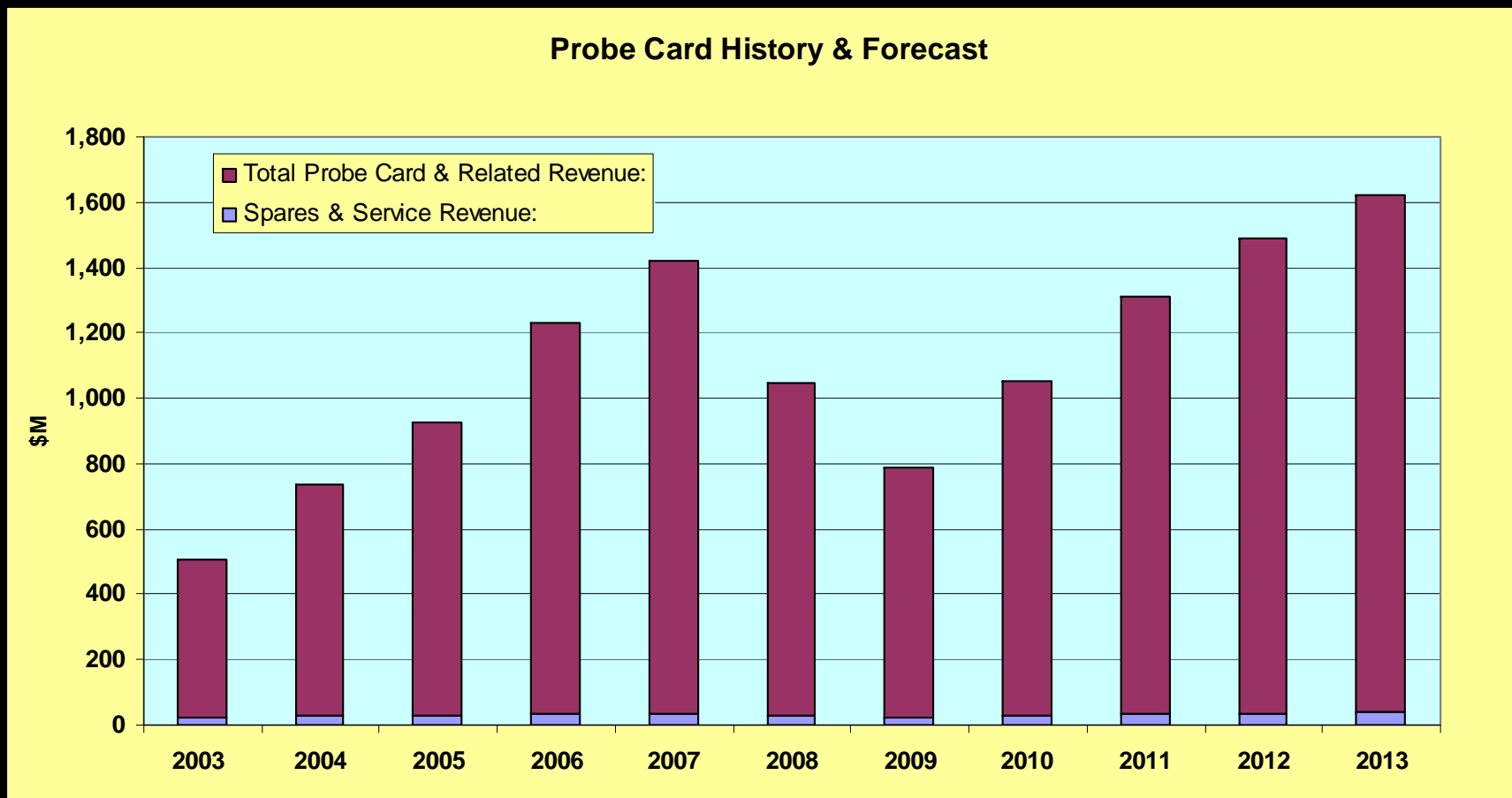
Reprinted for South West Test Workshop with permission from VLSI RESEARCH INC. Further distribution requires written approval of VLSI RESEARCH INC.

VLSIresearch.com

weSRCH.com

chiphistory.org

Probe Card Forecast



VLSIresearch.com

weSRCH.com

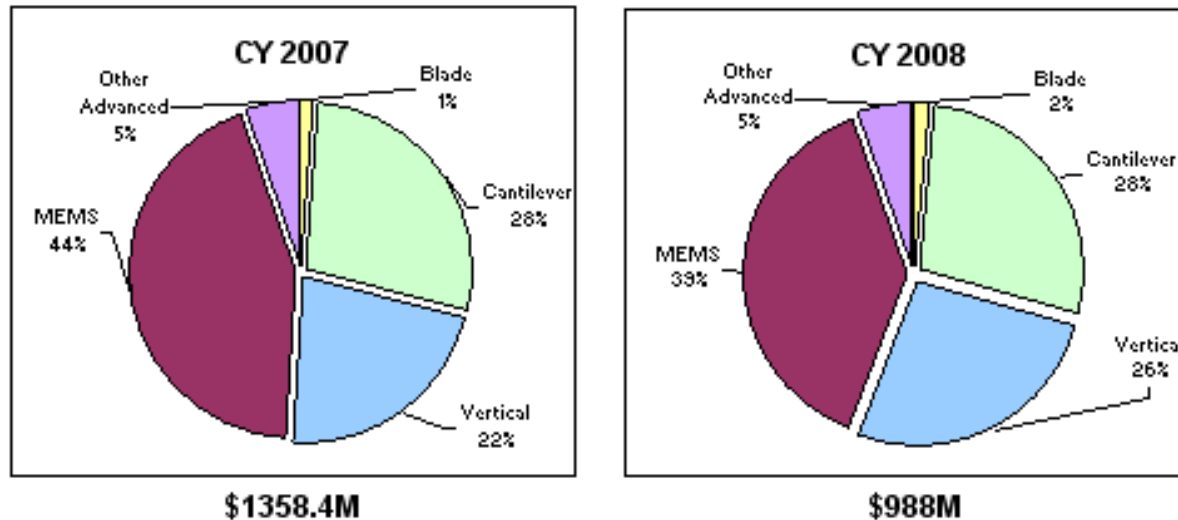
chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Probe Card Revenue Distribution

Presentation - c

Probe Card Revenue by Technology *Semiconductor*



Copyright © 2009 by VLSI RESEARCH INC. All rights reserved.

Reprinted for South West Test Workshop with permission from VLSI RESEARCH INC. Further distribution requires written approval of VLSI RESEARCH INC.

Source: VLSI Research Inc

Doc: 458084, v9.4, April '09,

VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

And The Data

Presentation - d

Technology Mix - \$M. Semiconductor

	<u>CY 2008</u>	<u>CY 2007</u>	<u>Change 2008/2007</u>
Blade	17.7	17.9	-1.3%
Cantilever	274.4	377.1	-27.2%
Vertical	257.6	297.2	-13.3%
MEMS	386.3	593.0	-34.9%
Other Advanced	52.0	73.1	-28.8%
<u>Total SC Card Revenue:</u>	<u>988.0</u>	<u>1358.4</u>	<u>-27.3%</u>
<u>Memory as % of total:</u>	<u>54%</u>	<u>60%</u>	

Source: VLSI Research Inc

Copyright © 2009 by VLSI RESEARCH INC. All rights reserved.

Doc: 458208, v9.04, April '09, swtw

Reprinted for South West Test Workshop with permission from VLSI RESEARCH INC. Further distribution requires written approval of VLSI RESEARCH INC.

VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Questions

- With so many private companies supplying 'front-end' hardware (probes, boards, sockets, etc.) for test & burn-in, what is the reliability of collected market information; how are 'blind spots' mitigated?
 - We drive to about 80% survey response coverage (revenues), probe card report was close to 90%
- And more and more we see semiconductor manufacturers transferring test coverage complexity into the tester interface (probe card) thereby increasing the cost of the cards and making the conscience decision to not upgrade testers. - The long-term implications of this trend are thought provoking.
 - I can not tell but see the data in next few slides

Challenges in Test

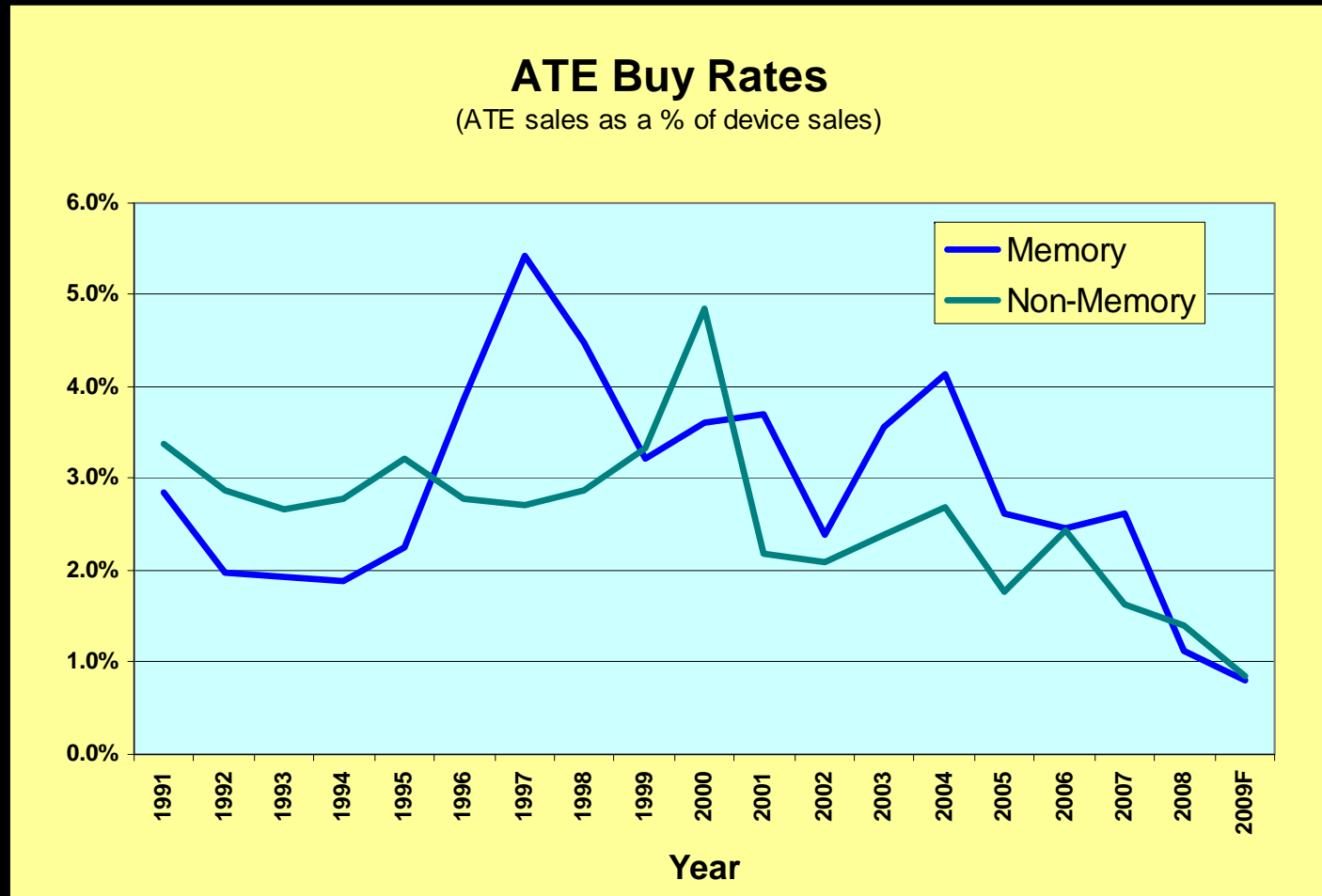
VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Buy Rates Show That No Glut in ATE



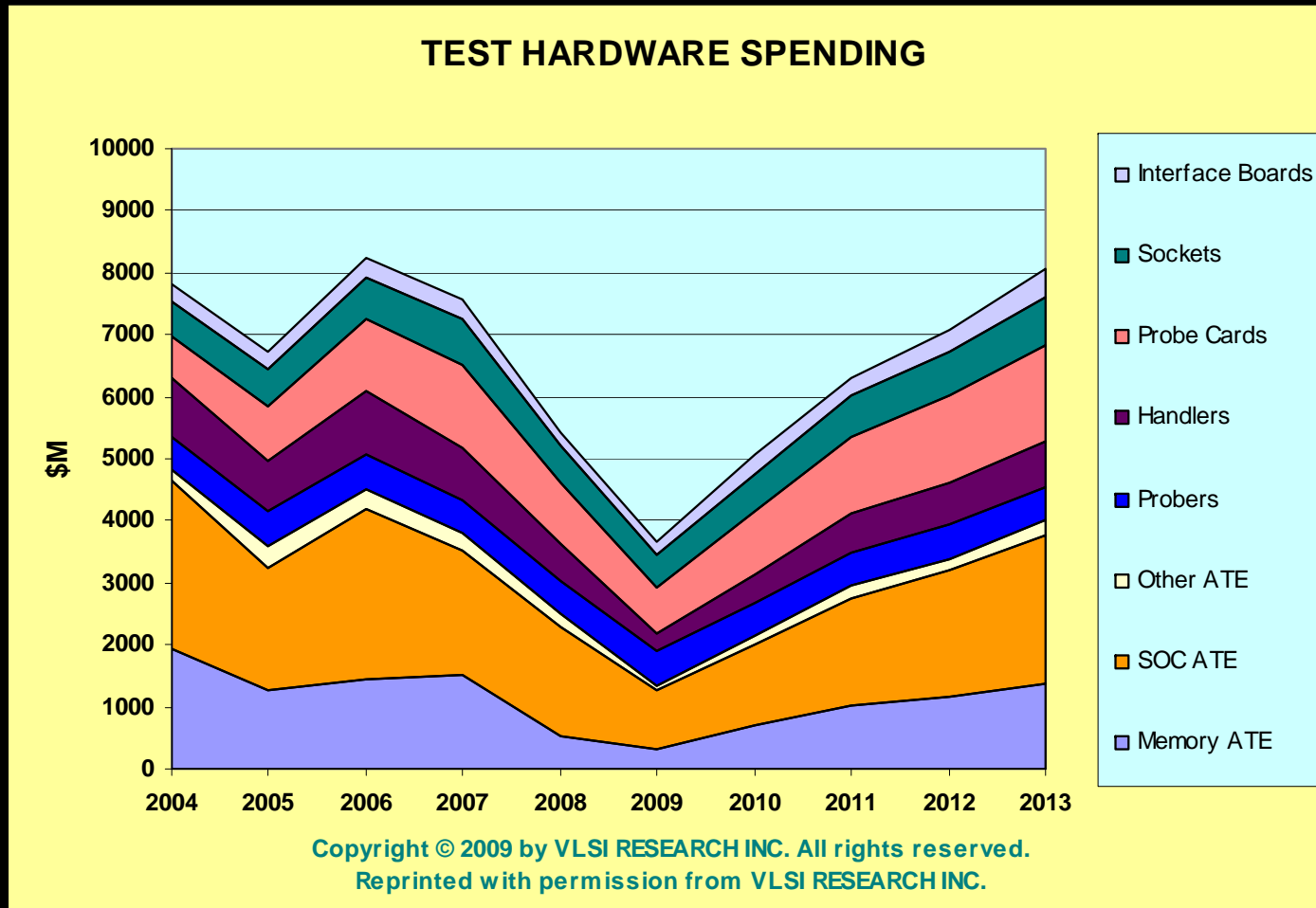
VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

ATE is Less Than Half of Total Test Hardware Spending



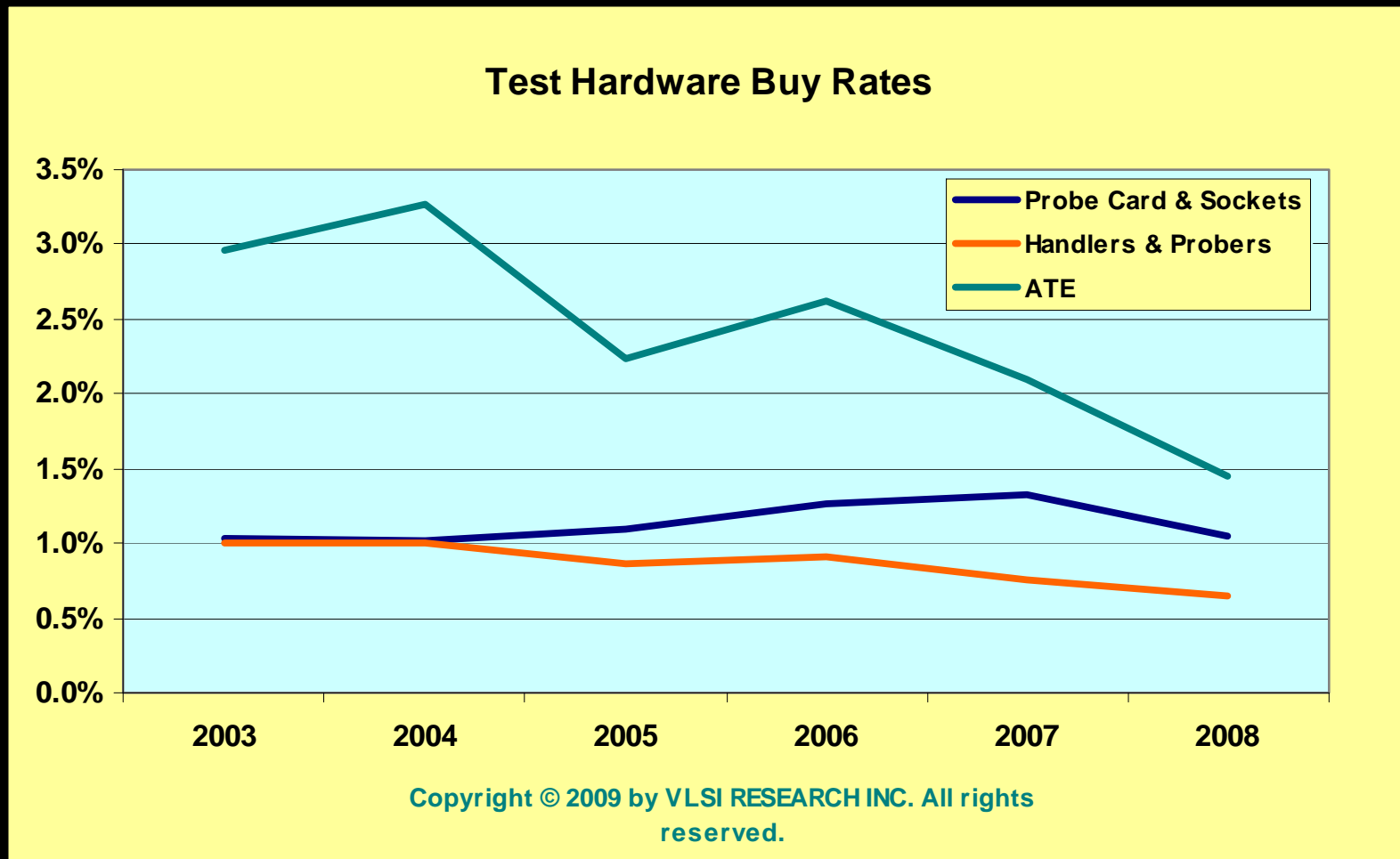
VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Rapid Decline in ATE Buy Rate



VLSIresearch.com

weSRCH.com

chiphistory.org

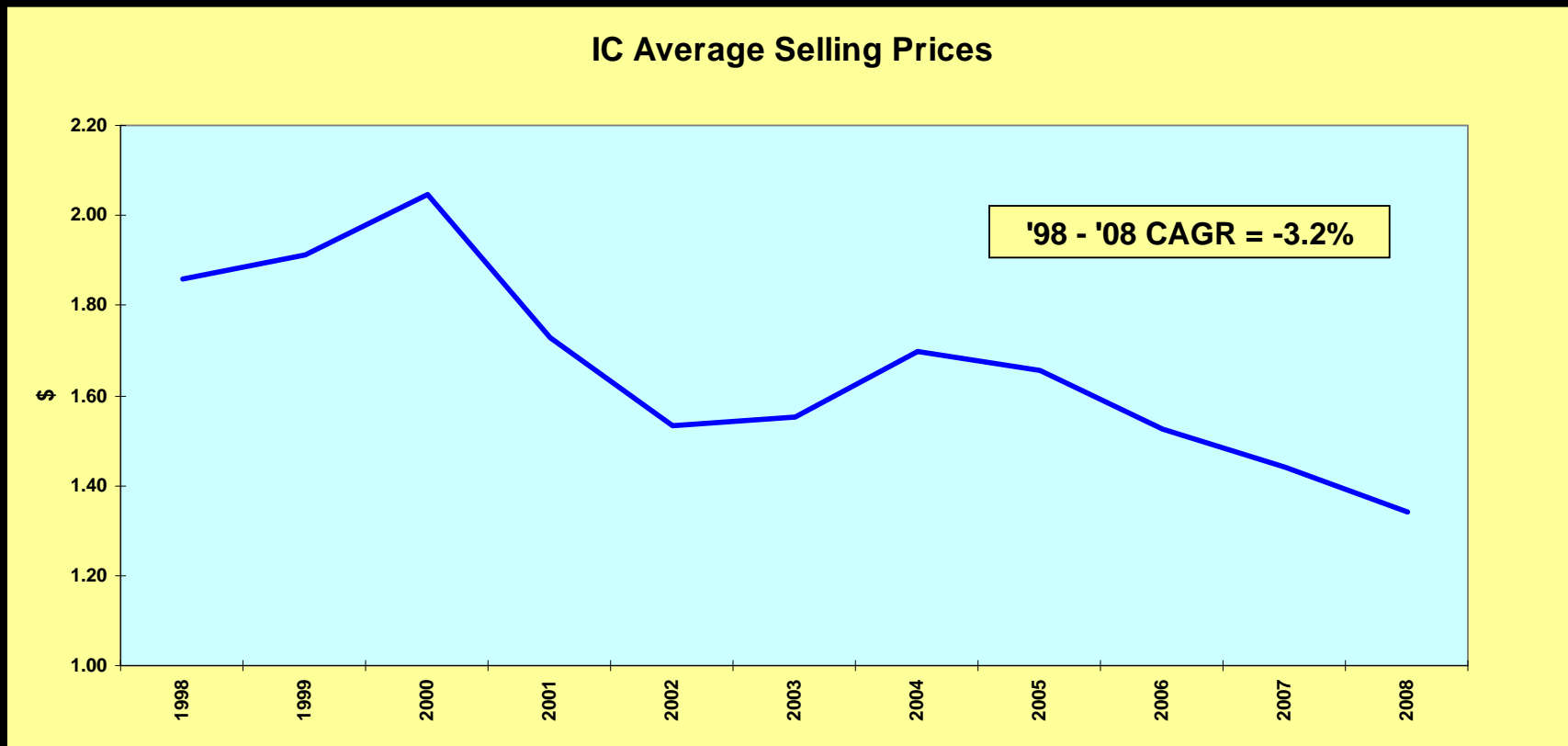
Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Drivers for Declining ATE & Material Handling Buy Rates

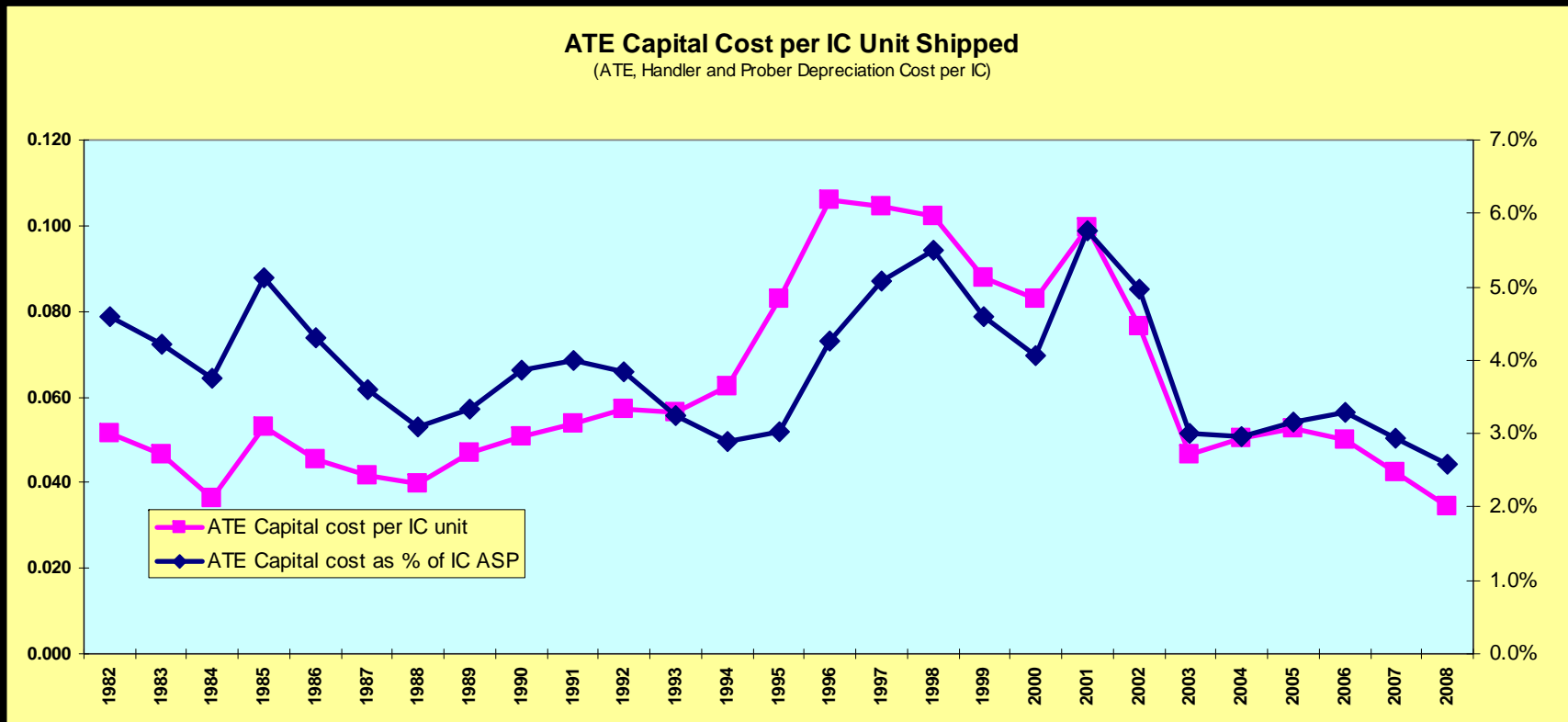
- End of Functional Testing Era.
 - Testers cost less.
- Large Scale Implementation of DFT.
- Modular Tester
 - Upgrade cards only, higher utilization
- Parallel Testing
- OSATs increasing share of testing.
 - Higher utilization, efficiencies due to business model.
- Testing less
 - Probe card & socket data does not agree.

Problem of The Last Decade

– IC ASPs



Test Has Responded to the Challenge



VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.

Questions

- Relative test costs per unit are increasing, what are the best ways to reduce them?
 - Data shows that hardware cost portion has declined
- Regarding trend of outsourcing test to subcons, which difficulties do you expect for the "old fashioned" manufacturers?
 - Product differentiation is the key
- How will things shake out w/r/t the juggling/changes in the top suppliers?
 - ATE & probers are ok w/ 3 suppliers. Others will see number of suppliers to decline.

Summary

- Deep freeze in semiconductor manufacturing is easing.
- Expect probe card and socket business recovers sooner than ATE.
 - Back-end consumables/materials are already bouncing back.
- Test hardware is \$6 - \$7B business.
 - Understanding the dynamics of the industry helps both the suppliers and chip makers.
- Test has responded to declining ASPs and continues to do so



Thank You

VLSIresearch

VLSIresearch.com

weSRCH.com

chiphistory.org

Copyright © 2009 VLSI Research Inc. All rights reserved. Reprinted with permission from VLSI RESEARCH INC.