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How to anticipate and prepare for the ongoing changes in the semiconductor device and manufacturing industries

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Please refer to page 8 for important disclosures and certifications.

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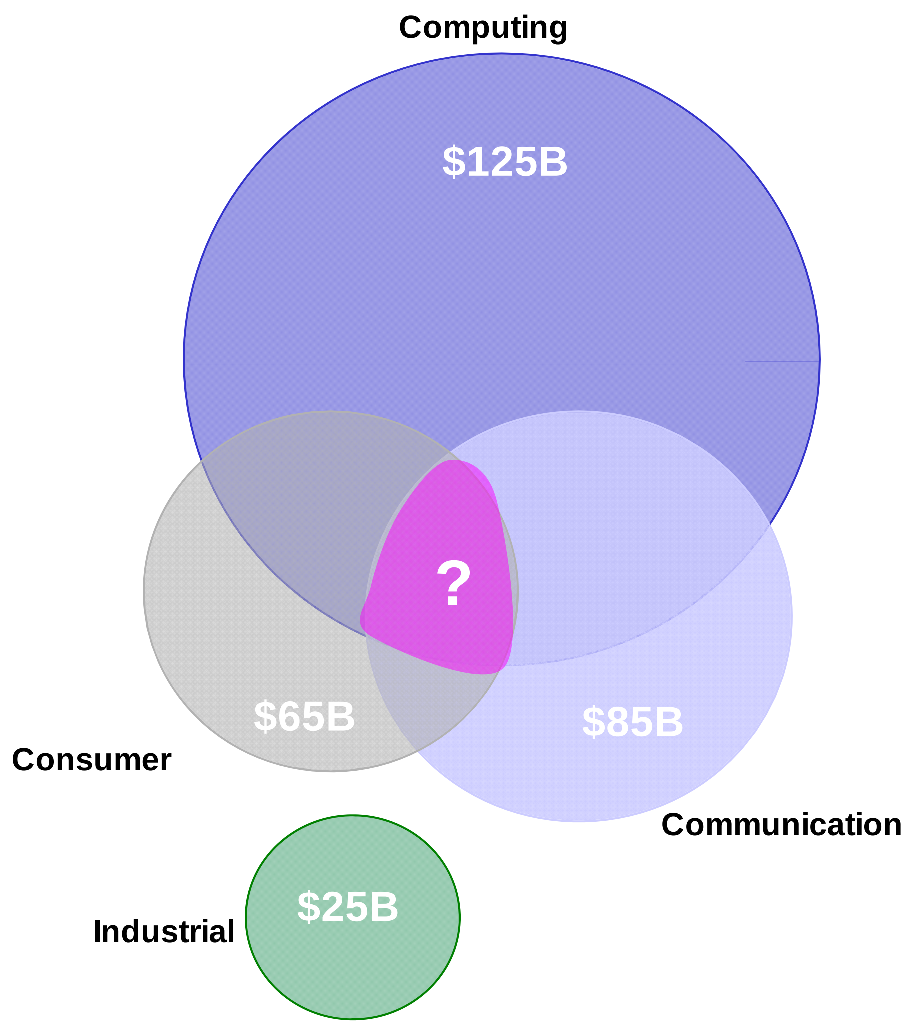
Electronics Industry Has Changed, Research Coverage Has NOT!

Convergence of the Three Cs:

- **Convergence of Computing, Communication, Consumer into single mobile device**
- **More integration, adversely impacting units**
- **Lower semi content (PC vs. Tablet) while the Display content (including touch) is on the rise**

Trends to watch:

- **Single-chip solution, where AP and Memory are interconnected via TSV**
- **Increased number of the cores in one chip**
- **System-in-Package (SiP) may finally be here (after many false starts over past two decades)**
- **Continued changes to the Display Technology**
- **Controller chip is becoming increasingly critical**



Source: SFG Research

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The BOM Factor!

Components	Traditional NB	Ultrabook *(hybrid)*	Tablet	Smartphone Avg	Smartphone GS4	Smartphone iPhone5	eReader AMZN	
Processor	$ 120	$ 150	$ 25	$ 15	$ 25	$ 18	$ 15	**Samsung, TSM**
Memory:								
NAND	7	40	27	10	13	13	7	
DRAM	30	40	10	1	20	10	1	**Samsung, MU, Hynix, SNDK**
HDD	50	50	-	-	-	-	-	
WLAN/wifi/bluetooth/GPS	8	12	30	5	9	5	5	
Power Management/Other Semis	15	15	5	25	23	43	5	**Samsung, TSM**
Screen								
Display	20	60	50	28	55	30	33	
Touch	0	40	40	15	15	15	15	**Samsung, TSM, GLW**
Camera	10	15	8	15	20	18	-	
Sensor	-	-	15	6	10	8	15	**Samsung, TSM**
Battery	30	25	25	6	5	5	15	
Casings	20	50	5	5	5	5	3	
Others	20	20	20	25	15	32	20	
TOTAL	**$ 330**	**$ 516**	**$ 259**	**$ 156**	**$ 215**	**$ 202**	**$ 133**	
Total Semi Content	**$ 180**	**$ 256**	**$ 96**	**$ 56**	**$ 90**	**$ 89**	**$ 32**	
% of BOM	**55%**	**50%**	**37%**	**36%**	**42%**	**44%**	**24%**	
% Change(vs. NB)		**42%**	**-46%**	**-69%**	**-50%**	**-50%**	**-82%**	
Mix of BOM								
AP Processor	**36%**	**29%**	**10%**	**10%**	**12%**	**9%**	**11%**	
NAND	**2%**	**8%**	**10%**	**6%**	**6%**	**7%**	**5%**	
DRAM	**9%**	**8%**	**4%**	**0%**	**9%**	**5%**	**0%**	
Display	**6%**	**19%**	**35%**	**28%**	**33%**	**22%**	**36%**	

Source: SFG Research

Trends Behind the BOM Factor:

- **Semiconductor content declining, increased ASP pressure to help reduce cost**
- **Display budget increasing (including the Touch)**
- **A few manufacturers increasingly dominating manufacturing/cost of next-generation electronic gadgets**
- **Can TSM (upstream) and AAPL (downstream) squeeze the guys in the middle?**

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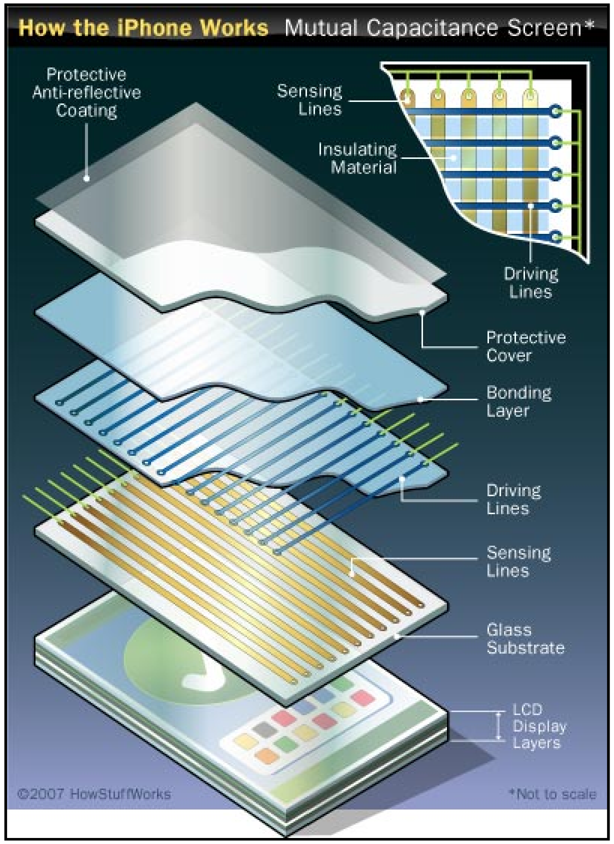
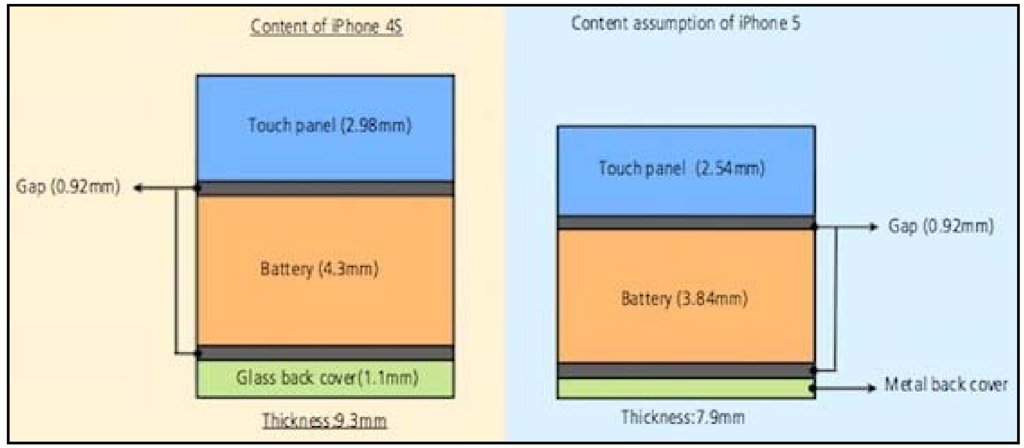
The BOM Factor! *(cont'd)*

Changes in the Display Technology Are Unprecedented and Expected to Continue



Source: HowStuffWorks, SFG Research



Source: Macrumors

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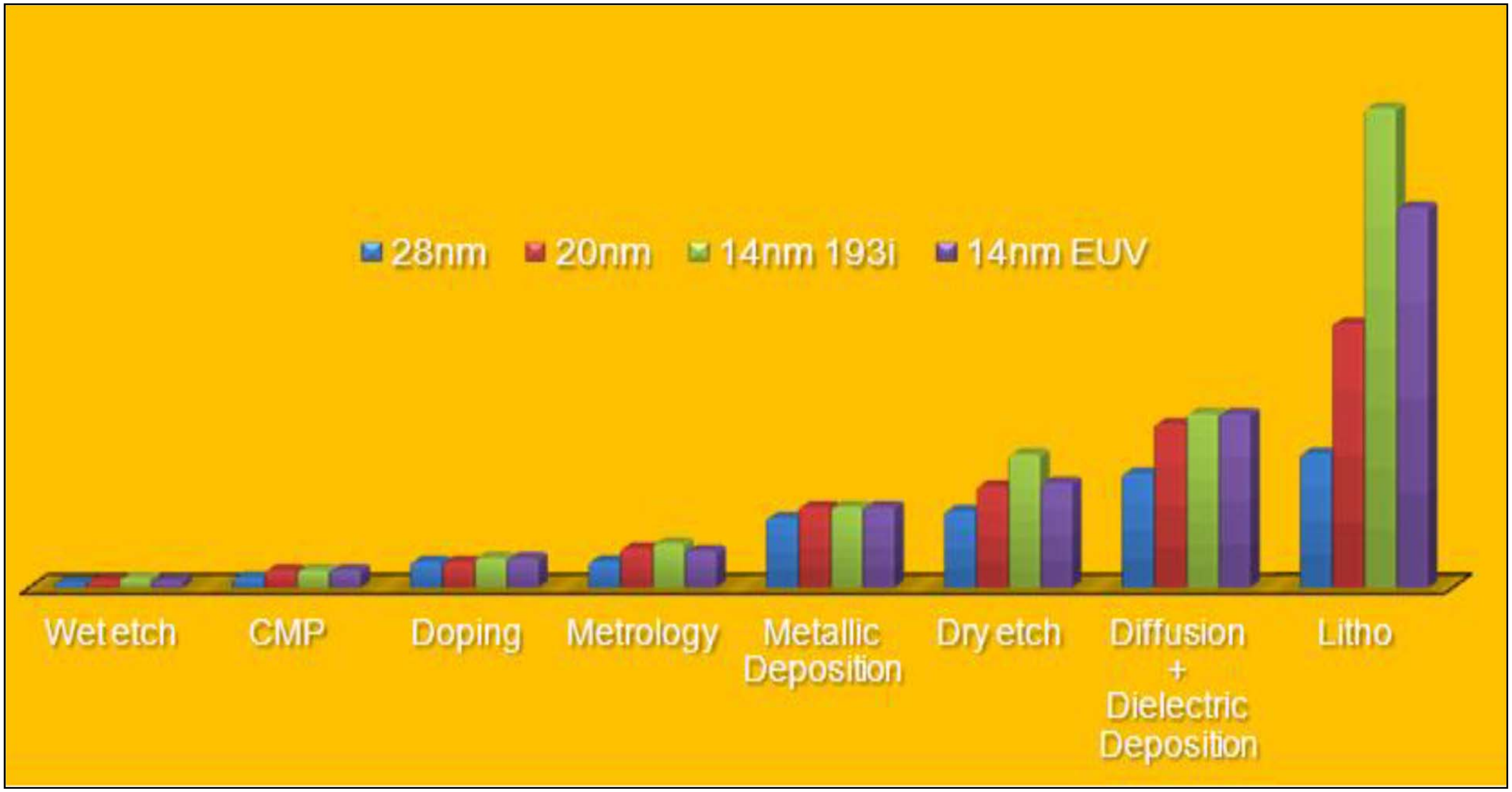
Litho Intensity Increasing

Advanced Logic/Foundry Capital Intensity for Select Sectors in the Semi Cap Universe



Source: Global Foundries

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Increased Capital Intensity by Device Type

Device Type	Process Node	Capital Intensity ($M per 1k wpm)
Advanced Logic	60/65nm	$ 70
	40/45nm	$ 85
	28nm	$ 100
	20nm	$ 125
	16/14nm	>$135
DRAM	4x	$ 25
	3x	$ 28
	2x	$ 30
	1x	$ 35
Conversion		
DRAM	5x to 4x conversion	<$5
	4x to 3x conversion	<$5
	3x to 2x conversion	$5-10
	2x to 1x conversion	$10-$15
NAND	4x	$20
	3x	$22
	2x	$25
	1x	$30-33
Conversion		
NAND	5x to 4x conversion	<$5
	4x to 3x conversion	<$5
	3x to 2x conversion	$5-10
	2x to 1x conversion	$10-$15

Source: SFG Research

- Capital intensity increases as process node migrates to advanced nodes
- Migrating to lower-x nodes costs more than before
  - DRAM: It costs 17% more to migrate from 3x to 2x, vs. 7% from 3x to 2x, and 12% from 4x to 3x
  - NAND: It costs 26% more to migrate from 3x to 2x, vs. 14% from 3x to 2x, and 10% from 4x to 3x

Killer App: Mobile Electronics That Cost Less, Has a Smaller Form Factor, With Longer Battery Life

- **The trend is towards innovating more and faster all while there is fewer $ of operating profit to go around**
- **Yes, next mobile gadget will require transistors less than 20nm, new material like (HKMG) and even 3D structure**
  - **But, this does not mean the $2B of CMP market is poised for above avg growth and margin profile**
- **It is more than ever critical to be well entrenched among customers and equipment vendors as the concept of "value creation" is increasingly used as a means to justify margin sharing which consequently impacts ASPs and thus CAGR of 5% and below growth prospects**

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