# **Evolving tech DNA in mobile era**

# I. Semiconductor: To continue benefiting from dawning of mobile device era

II. Smartphone: Round two begins

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III. Rechargeable battery: Heart of mobile device growth

IV. Key word for display industry: 'Organic'

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#### Smartphone + media tablet PC sales CAGR to reach 35% through 2015



Source: Gartner

- 310mn smartphone units were sold in 2010. This number is expected to rise to roughly 460mn units in 2011 and 650mn units in 2012.
- We estimate roughly 1.15bn smartphones will be sold in 2015 (projected worldwide 2015 smartphone shipments, by OS — Android: 40.3%; Microsoft (MS): 20.8%; iOS: 18.1%).





Source: Gartner

- In 2010, 17.61mn media tablet PCs were sold, with 'iPads' accounting for 14.67mn units (83.4%).
- Media tablet PCs equipped with MS's OS are scheduled to roll out in 2012—shipments of slightly more than 4mn units are forecasted during the year.



Global memory semiconductor market trend and outlook

# Fueled by rapid NAND industry expansion, memory semiconductor market to see continued growth

Clobal memory Sc	meenaact			outiook							
(Unit: US\$mn, %)	2005	2006	2007	2008	2009	2010	2011E	2012F	2013F	2014F	2015F
DRAM	25,596	33,665	31,275	24,021	22,420	39,287	28,063	29,675	32,523	29,954	31,482
Growth	-4.7	31.5	-7.1	-23.2	-6.7	<i>75.2</i>	-28.6	5.7	9.6	-7.9	5.1
NAND flash	11,534	14,092	15,714	11,690	15,031	21,789	25,928	28,266	31,856	34,914	36,486
Growth	79.6	22.2	11.5	-25.6	28.6	45.0	19.0	9.0	<i>12.</i> 7	9.6	4.5
NOR flash	7,114	7,393	6,817	5,374	4,504	4,259	4,123	3,999	3,899	3,782	3,650
Growth	-15.7	3.9	-7.8	-21.2	-16.2	-5.4	-3.2	-3.0	-2.5	-3.0	-3.5
Others	5,530	5,641	5,119	4,301	3,454	3,316	3,458	3,569	3,615	3,729	3,815
Growth	-12.3	2.0	-9.3	-16.0	-19.7	-4.0	4.3	3.2	1.3	3.2	2.3
Memory total	49,774	60,791	58,925	45,386	45,409	68,650	61,572	65,510	71,893	72,380	75,433
Growth	3.7	22.1	-3.1	-23.0	0.1	<i>51.2</i>	-10.3	6.4	9.7	0.7	4.2

Source: Gartner

- Along with the NAND market, we expect the DRAM market to resume growth in 2012. We estimate the total memory semiconductor market will expand 6.4% y-y from US\$61.6bn in 2011 to US\$65.5bn in 2012.
- Backed by the increased market penetration of smart mobile devices and the release of promising new device offerings, the global memory semiconductor market is projected to grow to US\$75.4bn in 2015. In addition, we expect the portion of NAND to surpass that of DRAM in the global memory semiconductor market by 2014.



## iPhone 4S



Source: Gartner, Woori I&S Research Center estimates

#### iPhone gains further popularity

- With early adopters having spurred the mass-market acceptance of its 'iPhone', Apple now seems to be focusing on increasing its user base.

# Price of iPhone8GB16GB32GB64GBiPhone4S-US\$199US\$299US\$399iPhone4US\$99---iPhone3GSUS\$0---source: Apple

Note: Based on 24-month contract

- iPhone 4S sales should total 30mn units in 4Q11 alone.
- iPhone shipment volume surpassed 10mn units in 2008.
   Shipment volume should reach 91.10mn units in 2011 and surpass 100mn units in 2012.



## Galaxy S and Tab series

#### SEC's smartphone and media tablet lineup

	Galaxy S2 LTE	Galaxy S2	GalaxyNote	GalaxyTab 7.7	GalaxyTab10.1
Standard	3G, 4G LTE	3G	4G LTE	3G	3G
OS	Android 2.3	Android 2.3	Android 2.3	Android 3.2(Honeycomb)	Android 3.1
CPU	1.5Ghz Dual Core	1.2 Ghz Dual Core	1.4Ghz Dual Core	1.4Ghz Dual Core	1GHz Dual Core
Display	4.5" Super AMOLED+ (800x480)	4.3" Super AMOLED+	WXGA 5.3 HD Super AMOLED	WXGA 7.7 Super AMOLED+	WXGA 1280X800
Capacity	16GB	16, 32GB	16, 32GB	16, 32, 64GB	16, 32GB
Size	130.6X69.6mm (135.5g)	125.3X66.1X8.89 (121g)	146.85X82.95X9.65 (178g)	196.7X133X7.89 (335g)	265.7X175.3X8.6 (575g)
Camera	8mn pixel	8mn pixel	8mn pixel	3mn pixel	3mn pixel

Source: SEC

- In light of the release of the 'Galaxy S2' in Mar 2011, SEC's smart mobile device shipments should surpass 100mn units in 2011, with shipments hovering over 150mn units in 2012.
- Despite having a less competitive application store than the iPhone, SEC has been enjoying rapid shipment growth backed by its diversified product lineup and the appealing flexible user interface used in its Galaxy series.



## **Kindle Fire**

Kindle Fire specifications

	-		
	OS	OS	Android
	Processor	CPU	OMAP Dual Core Mobile Processor
System		Clock Speed	1GHz
System	Memory	Main	8GB
		Туре	DDR3 512MB
	Display	LCD	7.7-inches, LED Backlight LCD (1024 x 600)
Input device Weight			Touch pad (multi-touch)
			413g

Source: Amazon.com

#### Kindle Fire, leader of media tablet

- Rolled out at a price of US\$199, Amazon.com's new e-book reader, the 'Kindle Fire', appears set to become the leader in the low-priced media tablet PC market.

#### Amazon's Kindle Fire



Source: Amazon.com

- Amazon predicts that it will be able to sell about 2.5mn Kindle Fires in the first month of its roll-out (December).



## Windows 8



Source: Microsoft

In 1Q12, MS is due to unveil its next major release, 'Windows 8'. MS says that it has "reimagined Windows" adopting reimagining as the theme for the new operating system, which promises to be an entirely new form of platform for the company, designed with support for both media tablet PCs and Ultrabooks (very thin, light notebooks) and a new generation of PCs (including touch screens) in mind.

#### Media tablet with Windows 8



Source: Microsoft

 For hardware industry analysts, the key aspect of the Windows 8 roll-out is the fact that it will likely lead to the introduction of Windows OS-based media tablets, which we believe will serve to further broaden the range of media tablet PCs available to consumers.



#### Ultrabooks

#### Windows version of Macbook Air

- In 4Q11, ASUS, Toshiba, Lenovo, and Acer all plan to release Ultrabooks

**Ultrabook and Mobile PC shipment forecasts** 

Widely expected to become an alternative to notebook
 PCs, the demand for which has been gradually waning,
 Ultrabooks are designed to be the Windows-based answer
 to the 'MacBook Air' (rolled out in 2009).

	Annual shipment forecasts						Shipment growth			
	Ultra book (mn)	Growth (%)	Mobile PC (mn)	Growth (%)	Ultra book (%)	Ultra book (mn)	Mobile PC (mn)	Ultra book's contribu tion (%)		
2011E	0.9		189.1		0.5					
2012F	19.5	1,977.8	220.8	16.8	8.8	18.6	31.7	58.7		
2013F	35.5	82.0	268.4	21.5	13.2	16.0	47.6	33.7		
2014F	64.5	81.3	318.6	<i>18.7</i>	20.2	28.9	50.2	57.6		
2015F	118.0	83.0	371.5	16.6	31.8	53.5	52.9	101.2		

#### Source: Woori I&S Research Center estimates

#### ASUS's UX21vs Toshiba's Portege Z830



Source: Company data

#### "Next-generation notebooks"

- Most PC makers are expected to launch Ultrabooks either in 2011 or in 2012. We estimate combined shipments of 19.5mn in 2012, accounting for 8.8% of total mobile PC shipments.
- The biggest selling point of Ultrabooks is that they are ultra light, thin mobile devices like the MacBook Air, but with enhanced computing capability.



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#### Near term (4Q11): DRAM prices to remain flat



Source: DRAMeXchange

#### DRAM prices to remain flat in 4Q11

- Wafer input for DRAM should fall from 1.34mn sheets per month in 4Q10 to 1.09mn sheets in 4Q11 (down 18.9% y-y).





Source: DRAMeXchange

 While prices declined only slightly in the first half of November, prices should continue to fall in the near term, given: 1) reduced capacity for PCs following the flooding in Thailand; 2) downward pricing pressure due to an increase in HDD prices; and 3) the sooner-than-expected fading of seasonality.



# DRAM industry conditions to be solid in 2012 given weak capex and reduced capacity in 2011



Source: DRAMeXchange

#### Industry conditions to improve on soft facility investment

- Given that weak earnings at DRAM makers led to lower facility investment (down 38.1% y-y to US\$8.4bn) in 2011, industry supply-demand conditions should pick up y-y in 2012.



**Global annual DRAM shipment growth** 

Source: DRAMeXchange

#### Rise in supply to hinge on tech migration in 2012

- In the wake of decreased facility investment in 2011, capacity expansion will likely be limited in 2012.
- Any rise in supply will hinge on technology migration.



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## Long-term momentum: Rise in mobile DRAM demand to help stabilize DRAM market

2005         2006         2007         2008         2009         2010         2011E         2012F         2013F         2014F         2015F         CAGR(%) 2005-2010         CAGR(%) 2012-20'           Electronic data processing Communications         1,441         2,639         3,287         3,399         3,278         3,921         3,480         4,184         5,171         5,152         5,698         67.8         67           Consumer         2,020         3,467         3,547         2,885         2,563         3,516         2,384         2,179         1,707         1,499         56.2         23           Automotive         115         165         228         223         164         1140         125         137         90         76         38.6         111           Industrial         2,470         2,744         1,798         1,456         1,112         2,047         2,803         29,675         32,523         29,954         31,482         52.5         50           Change(%)         Electronic data processing         -8.7         30.8         -8.9         -28.8         -3.9         89.1         -30.3         4.7         9.1         -7.8         52         50           Com	DRAM consumptio	on, by app	lication										(U	nit: US\$mn)
Image: bit with the second s								,						
Electronic data processing       19,197       24,272       22,118       15,808       15,042       29,276       20,402       21,366       23,319       21,507       22,635       53.1       51         Communications       1,441       2,639       3,287       3,399       3,278       3,921       3,480       4,184       5,171       5,152       5,698       6,78       67         Consumer       20,200       3,467       3,547       2,885       2,583       3,516       2,385       2,344       2,179       1,707       1,499       56.2       23         Automotive       115       165       228       223       164       161       140       125       137       90       76       38.6       11         Industrial       2,470       2,744       1,798       1,456       1,112       2,047       1,431       1,424       1,464       1,288       1,354       32.3       50         Millitary/Civil Aerospace       33,665       31,275       24,021       22,402       39,287       28,063       29,675       32,523       29,954       31,482       52.5       50         Communications       0.1       83.2       24.5       3.4       -3.6		2005	2006	2007	2008	2009	2010	2011E	2012F	2013F	2014F	2015F	CAGR(%) 2005-2010	CAGR(%) 2010-2015
Communications         1,441         2,639         3,287         3,399         3,278         3,921         3,480         4,184         5,171         5,152         5,698         67.8         67.7           Consumer         2,020         3,467         3,547         2,885         2,583         3,516         2,385         2,344         2,179         1,707         1,499         56.2         23           Automotive         115         165         228         223         164         161         140         125         137         90         76         38.6         11           Industrial         2,470         2,744         1,798         1,456         1,112         2,047         1,431         1,424         1,464         1,288         1,354         32.3         50           Millary/Civil Aerospace         351         377         300         250         242         366         225         231         254         210         220         38.4         34           Total         25,59         33,65         31,275         24,021         22,402         39,67         32,52         29,954         31,482         52.5         50           Communications         0.1	Electronic data processing	19,197	24,272	22,118	15,808	15,042	29,276	20,402	21,366	23,319	21,507	22,635	53.1	51.0
Consumer       2,020       3,467       3,547       2,885       2,583       3,516       2,385       2,344       2,179       1,707       1,499       56.2       233         Automotive       115       165       228       223       164       161       140       125       137       90       76       38.6       111         Industrial       2,470       2,774       1,798       1,456       1,112       2,047       1,431       1,424       1,464       1,288       1,354       32.3       500         Willtary/Civil Aerospace       351       377       300       220       224,20       39,287       28,063       29,675       32,523       29,954       31,482       52.5       50         Consumer       21.1       71.7       2.3       -18.7       -10.5       35.9       -32.2       -1.7       -7.0       -21.6       -12.2       -15.9       -11.2       20.2       23.6       -0.4       10.6       -12.2       -11.5       -12.2       -11.7       -7.0       -21.6       -12.2       -15.9       -14.4       -14.8       -3.1       50.6       -3.1       -6.6       -7.7       9.6       -7.9       5.1       -4.7       -5.2	Communications	1,441	2,639	3,287	3,399	3,278	3,921	3,480	4,184	5,171	5,152	5,698	67.8	67.0
Automotive       115       165       228       223       164       161       140       125       137       90       76       38.6       11         Industrial       2,470       2,744       1,798       1,456       1,112       2,047       1,431       1,424       1,464       1,288       1,354       32.3       50         Military/Civil Aerospace       351       377       300       250       242       365       225       231       254       210       220       38.4       34         Total       25,596       33,665       31,77       24,021       22,420       39,287       28,063       29,675       32,523       29,954       31,482       52.5       50         Change(%)       Electronic data processing       -8.7       30.8       -8.9       -28.8       -3.9       89.1       -3.0.3       4.7       9.1       -7.8       5.2       50         Communications       0.1       83.2       24.5       3.4       -3.6       19.4       -11.2       20.2       23.6       -0.4       10.6       -12.2       -11.7       -7.0       -21.6       -12.2       -11.2       9.6       -34.2       -15.9       -11.2       -11.2<	Consumer	2,020	3,467	3,547	2,885	2,583	3,516	2,385	2,344	2,179	1,707	1,499	56.2	23.8
Industrial       2,470       2,744       1,798       1,456       1,112       2,047       1,431       1,424       1,464       1,288       1,354       32.3       50         Military/Civil Aerospace       351       377       300       250       242       365       225       231       254       210       220       38.4       34         Total       25,596       33,665       31,275       24,021       22,420       39,287       28,063       29,675       32,523       29,954       31,482       52.5       50         Change(%)       Electronic data processing       -8.7       30.8       -8.9       -28.8       -3.9       89.1       -11.2       20.2       23.6       -0.4       10.6         Communications       0.1       83.2       24.5       3.4       -3.6       19.4       -11.2       20.2       23.6       -0.4       10.6         Consumer       21.1       71.7       2.3       -18.7       -10.5       35.9       -32.2       -17.7       -7.0       -21.6       -12.2       -11.1       -12.9       -11.2       9.6       -34.2       -15.9       -15.1         Military/Civil aerospace       -8.0       7.5       -20.4 </td <td>Automotive</td> <td>115</td> <td>165</td> <td>228</td> <td>223</td> <td>164</td> <td>161</td> <td>140</td> <td>125</td> <td>137</td> <td>90</td> <td>76</td> <td>38.6</td> <td>11.8</td>	Automotive	115	165	228	223	164	161	140	125	137	90	76	38.6	11.8
Military/Civil Aerospace       351       377       300       250       242       365       225       231       254       210       220       38.4       34         Total       25,596       33,665       31,275       24,021       22,420       39,287       28,063       29,675       32,523       29,54       31,482       52.5       50         Change(%)       Electronic data processing       8.7       30.8       -8.9       -28.8       -3.9       89.1       -30.3       4.7       9.1       -7.8       5.2         Communications       0.1       83.2       24.5       3.4       -3.6       19.4       -11.2       20.2       23.6       -0.4       10.6         Consumer       21.1       71.7       2.3       -18.7       -10.5       35.9       -32.2       -1.7       -7.0       -21.6       -12.2         Automotive       -8.7       43.2       38.4       -2.2       -26.7       -1.8       -12.9       -11.2       9.6       -34.2       -15.9         Military/Civil aerospace       -8.0       7.5       -20.4       -16.8       -3.1       50.6       -38.6       5.7       9.6       -7.9       5.1         Tota	Industrial	2,470	2,744	1,798	1,456	1,112	2,047	1,431	1,424	1,464	1,288	1,354	32.3	50.9
Total       25,596       33,665       31,275       24,021       22,420       39,287       28,063       29,675       32,523       29,954       31,482       52.5       50         Change(%)       Electronic data processing       -8.7       30.8       -8.9       -28.8       -3.9       89,1       -30.3       4.7       9.1       -7.8       5.2       50         Communications       0.1       83.2       24.5       3.4       -3.6       19.4       -30.3       4.7       9.1       -7.8       5.2       50         Communications       0.1       83.2       24.5       3.4       -36.6       19.4       -10.2       20.2       23.6       -0.4       10.6 <td< td=""><td>Military/Civil Aerospace</td><td>351</td><td>377</td><td>300</td><td>250</td><td>242</td><td>365</td><td>225</td><td>231</td><td>254</td><td>210</td><td>220</td><td>38.4</td><td>34.6</td></td<>	Military/Civil Aerospace	351	377	300	250	242	365	225	231	254	210	220	38.4	34.6
Change(%)         Electronic data processing         -8.7         30.8         -8.9         -28.8         -3.9         89.1         -30.3         4.7         9.1         -7.8         5.2           Communications         0.1         83.2         24.5         3.4         -3.6         19.4         -11.2         20.2         23.6         -0.4         10.6           Consumer         21.1         71.7         2.3         -18.7         -10.5         35.9         -32.2         -1.7         -7.0         -21.6         -12.2           Automotive         -8.7         43.2         38.4         -2.2         -26.7         -1.8         -12.9         -11.2         9.6         -34.2         -15.9           Industrial         -2.4         11.1         -34.5         -19.1         -23.6         83.7         -30.1         -0.5         2.8         -12.0         5.1           Industrial         -2.4         13.5         -7.1         -23.2         -6.7         74.9         -28.6         5.7         9.6         -7.9         5.1           Portion(%)         Electronic data processing         75.0         72.1         70.7         65.8         67.1         74.5         72.7         72.0	Total	25,596	33,665	31,275	24,021	22,420	39,287	28,063	29,675	32,523	29,954	31,482	52.5	50.7
Electronic data processing       -8.7       30.8       -8.9       -28.8       -3.9       89.1       -30.3       4.7       9.1       -7.8       5.2         Communications       0.1       83.2       24.5       3.4       -3.6       19.4       -11.2       20.2       23.6       -0.4       10.6         Consumer       21.1       71.7       2.3       -18.7       -10.5       35.9       -32.2       -1.7       -7.0       -21.6       -12.2         Automotive       -8.7       43.2       38.4       -2.2       -26.7       -1.8       -12.9       -11.2       9.6       -34.2       -15.9         Industrial       -2.4       11.1       -34.5       -19.1       -23.6       83.7       -30.1       -0.5       2.8       -12.0       5.1         Military/Civil aerospace       -8.0       7.5       -20.4       -16.8       -3.1       50.6       -38.6       5.7       9.6       -7.9       5.1         Portion(%)       Electronic data processing       75.0       72.1       70.7       65.8       67.1       74.5       72.7       72.0       71.7       71.8       71.9         Communications       5.6       7.8       10.5	Change(%)						1	i						
Communications       0.1       83.2       24.5       3.4       -3.6       19.4       -11.2       20.2       23.6       -0.4       10.6         Consumer       21.1       71.7       2.3       -18.7       -10.5       35.9       -32.2       -1.7       -7.0       -21.6       -12.2         Automotive       -8.7       43.2       38.4       -2.2       -26.7       -1.8       -12.9       -11.2       9.6       -34.2       -15.9         Industrial       -2.4       11.1       -34.5       -19.1       -23.6       83.7       -30.1       -0.5       2.8       -12.0       5.1         Military/Civil aerospace       -8.0       7.5       -20.4       -16.8       -3.1       50.6       -38.6       3.1       9.6       -17.3       5.1         Total       -4.7       31.5       -7.1       -23.2       -6.7       74.9       -28.6       5.7       9.6       -7.9       5.1         Portion(%)       Electronic data processing       75.0       72.1       70.7       65.8       67.1       74.5       72.7       72.0       71.7       71.8       71.9         Communications       5.6       7.8       10.5       14.2	Electronic data processing	-8.7	30.8	-8.9	-28.8	-3.9	89.1	-30.3	4.7	9.1	-7.8	5.2		
Consumer       21.1       71.7       2.3       -18.7       -10.5       35.9       -32.2       -1.7       -7.0       -21.6       -12.2         Automotive       -8.7       43.2       38.4       -2.2       -26.7       -1.8       -12.9       -11.2       9.6       -34.2       -15.9         Industrial       -2.4       11.1       -34.5       -19.1       -23.6       83.7       -30.1       -0.5       2.8       -12.0       5.1         Military/Civil aerospace       -8.0       7.5       -20.4       -16.8       -3.1       50.6       -38.6       3.1       9.6       -17.3       5.1         Total       -4.7       31.5       -7.1       -23.2       -6.7       74.9       -28.6       5.7       9.6       -7.9       5.1         Portion(%)       Electronic data processing       75.0       72.1       70.7       65.8       67.1       74.5       72.7       72.0       71.7       71.8       71.9         Communications       5.6       7.8       10.5       14.2       14.6       10.0       12.4       14.1       15.9       7.7       4.8         Automotive       0.5       0.5       0.7       0.9 <th< td=""><td>Communications</td><td>0.1</td><td>83.2</td><td>24.5</td><td>3.4</td><td>-3.6</td><td>19.4</td><td>-11.2</td><td>20.2</td><td>23.6</td><td>-0.4</td><td>10.6</td><td></td><td></td></th<>	Communications	0.1	83.2	24.5	3.4	-3.6	19.4	-11.2	20.2	23.6	-0.4	10.6		
Automotive       -8.7       43.2       38.4       -2.2       -26.7       -1.8       -12.9       -11.2       9.6       -34.2       -15.9         Industrial       -2.4       11.1       -34.5       -19.1       -23.6       83.7       -30.1       -0.5       2.8       -12.0       5.1         Military/Civil aerospace       -8.0       7.5       -20.4       -16.8       -3.1       50.6       -38.6       3.1       9.6       -17.3       5.1         Total       -4.7       31.5       -7.1       -23.2       -6.7       74.9       -28.6       5.7       9.6       -7.9       5.1         Portion(%)       Electronic data processing       75.0       72.1       70.7       65.8       67.1       74.5       72.7       72.0       71.7       71.8       71.9         Communications       5.6       7.8       10.5       14.2       14.6       10.0       12.4       14.1       15.9       17.2       18.1         Consumer       7.9       10.3       11.3       12.0       11.5       9.0       8.5       7.9       6.7       5.7       4.8         Automotive       0.5       0.5       0.7       0.9       0.7	Consumer	21.1	71.7	2.3	-18.7	-10.5	35.9	-32.2	-1.7	-7.0	-21.6	-12.2		
Industrial       -2.4       11.1       -34.5       -19.1       -23.6       83.7       -30.1       -0.5       2.8       -12.0       5.1         Military/Civil aerospace       -8.0       7.5       -20.4       -16.8       -3.1       50.6       -38.6       3.1       9.6       -17.3       5.1         Total       -4.7       31.5       -7.1       -23.2       -6.7       74.9       -28.6       5.7       9.6       -7.9       5.1         Portion(%)       Electronic data processing       75.0       72.1       70.7       65.8       67.1       74.5       72.7       72.0       71.7       71.8       71.9         Communications       5.6       7.8       10.5       14.2       14.6       10.0       12.4       14.1       15.9       17.2       18.1         Consumer       7.9       10.3       11.3       12.0       11.5       9.0       8.5       7.9       6.7       5.7       4.8         Automotive       0.5       0.5       0.7       0.9       0.7       0.4       0.5       0.4       0.4       0.3       0.2         Industrial       9.7       8.2       5.8       6.1       5.0       5.2<	Automotive	-8.7	43.2	38.4	-2.2	-26.7	-1.8	-12.9	-11.2	9.6	-34.2	-15.9		
Military/Civil aerospace       -8.0       7.5       -20.4       -16.8       -3.1       50.6       -38.6       3.1       9.6       -17.3       5.1         Total       -4.7       31.5       -7.1       -23.2       -6.7       74.9       -28.6       5.7       9.6       -7.9       5.1         Portion(%)       Electronic data processing       75.0       72.1       70.7       65.8       67.1       74.5       72.7       72.0       71.7       71.8       71.9         Communications       5.6       7.8       10.5       14.2       14.6       10.0       12.4       14.1       15.9       17.2       18.1         Consumer       7.9       10.3       11.3       12.0       11.5       9.0       8.5       7.9       6.7       5.7       4.8         Automotive       0.5       0.5       0.7       0.9       0.7       0.4       0.5       0.4       0.4       0.3       0.2         Industrial       9.7       8.2       5.8       6.1       5.0       5.2       5.1       4.8       4.5       4.3       4.3         Military/Civil aerospace       1.4       1.1       1.0       1.0       100.0       10	Industrial	-2.4	11.1	-34.5	-19.1	-23.6	83.7	-30.1	-0.5	2.8	-12.0	5.1		
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Electronic data processing75.072.170.765.867.174.572.772.071.771.871.9Communications5.67.810.514.214.610.012.414.115.917.218.1Consumer7.910.311.312.011.59.08.57.96.75.74.8Automotive0.50.50.70.90.70.40.50.40.40.30.2Industrial9.78.25.86.15.05.25.14.84.54.34.3Military/Civil aerospace1.41.11.01.01.10.90.80.80.80.70.7Total100.0100.0100.0100.0100.0100.0100.0100.0100.0100.0	Portion(%)						1							
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Consumer7.910.311.312.011.59.08.57.96.75.74.8Automotive0.50.50.70.90.70.40.50.40.40.30.2Industrial9.78.25.86.15.05.25.14.84.54.34.3Military/Civil aerospace1.41.11.01.01.10.90.80.80.80.70.7Total100.0100.0100.0100.0100.0100.0100.0100.0100.0100.0	Communications	5.6	7.8	10.5	14.2	14.6	10.0	12.4	14.1	15.9	17.2	18.1		
Automotive       0.5       0.5       0.7       0.9       0.7       0.4       0.5       0.4       0.4       0.3       0.2         Industrial       9.7       8.2       5.8       6.1       5.0       5.2       5.1       4.8       4.5       4.3       4.3         Military/Civil aerospace       1.4       1.1       1.0       1.1       0.9       0.8       0.8       0.8       0.7       0.7         Total       100.0       100.0       100.0       100.0       100.0       100.0       100.0       100.0       100.0       100.0	Consumer	7.9	10.3	11.3	12.0	11.5	9.0	8.5	7.9	6.7	5.7	4.8		
Industrial         9.7         8.2         5.8         6.1         5.0         5.2         5.1         4.8         4.5         4.3         4.3           Military/Civil aerospace         1.4         1.1         1.0         1.0         1.1         0.9         0.8         0.8         0.8         0.7         0.7           Total         100.0         100.	Automotive	0.5	0.5	0.7	0.9	0.7	0.4	0.5	0.4	0.4	0.3	0.2		
Military/Civil aerospace         1.4         1.1         1.0         1.1         0.9         0.8         0.8         0.8         0.7         0.7           Total         100.0         100.	Industrial	9.7	8.2	5.8	6.1	5.0	5.2	5.1	4.8	4.5	4.3	4.3		
Total 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0 100.0	Military/Civil aerospace	1.4	1.1	1.0	1.0	1.1	0.9	0.8	0.8	0.8	0.7	0.7		
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0		

Source: Gatner, Woori I&S Research Center estimates

- We forecast that the DRAM industry will see markedly reduced volatility going forward, and that moderate growth will continue through 2015.
- Specifically, we project mobile DRAM consumption by smartphones and media tablet PCs to rise at CAGRs of 89.8% and 172.2%, respectively, through 2015.



# Top pick: SEC (005930.KS); Target price of W1,200,000

-		•		•
(Wbn)	2010	2011E	2012F	2013F
Sales	154,630	162,659	184,944	199,322
Adj. operating profit	16,621	15,662	20,665	22,107
Adj. OP margin (%)	10.7	9.6	11.2	11.1
Operating profit	17,297	16,094	20,798	22,240
Net profit	16,147	14,763	19,105	20,225
Net profit excluding minority interests	15,799	14,445	18,693	19,789
EPS (won)	105,903	97,317	124,872	132,313
P/E (x)	9.0	10.1	7.9	7.4
P/B (x)	1.9	1.7	1.5	1.3
ROE (%)	20.4	15.6	17.6	16.4
Net debt (-cash)	-11,705	-14,772	-19,870	-29,349
Current price (11/11, won)	983,000	Foreign ow	nership	50.9%
Market can (Wbn)	144 795 2	Dividend vi	1 05%	

Earnings forecasts and valuations (IFRS consolidated)

Note: 1. Adj. operating profit = sales-COGS-SG&A expense

2. EPS, BPS, ROE based on net profit excluding minority interests Source: Woori I&S Research Center estimates

 We expect SEC to post record OP of W20tn in 2012 thanks to a moderate DRAM industry recovery, the semicon division's stable NAND-related earnings, the growing system-LSI division, improved earnings at the telecommunications division, the recovery of the digital media division's TV unit (back to BEP), and sound AMOLED-related earnings at the display division.





Source: SEC, Woori I&S Research Center

#### Leading driver and primary beneficiary of mobile device era

- SEC's semiconductor memory and system LSI divisions stand to be the foremost beneficiaries from sharply increasing smart mobile device sales. In particular, the Galaxy series should see steadily expanding popularity, setting the stage for further smart mobile device offerings in the future.





#### Tech

# **Evolving tech DNA in mobile era**

I. Semiconductor: To continue benefiting from dawning of mobile device era

# II. Smartphone: Round two begins

III. Rechargeable battery: Heart of mobile device growth IV. Key word for display industry: 'Organic'

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# Continued demand for smartphones to lead IT industry growth



Source: Gartner, Woori I&S Research Center estimates

#### Smartphone demand outpacing feature phone demand

- Global smartphone market to expand from 31% in 2011 to 39% in 2012 and 46% in 2013
- Demand for feature phones to gradually weaken from peak in 2010 (feature phone market to post growth of -3% in 2011 and -5% in 2012)
- Sony Ericsson and Motorola announced they would stop selling feature phones and focus on smartphones from 2012

#### Rules of game changing upon wider smartphone penetration

- Over next two~three years, emergence of devices as innovative as Apple's 'iPhone' unlikely (new innovative devices to be seen following forecasted advent of cloud-based computing in 2015)
- 'iOS' and 'Android' phone makers to continue to compete for M/S



Tech

#### Smartphone market enters expansion phase as penetration rate surpasses 30%

Initially, market demand focused on iPhones, but smartphone market began to grow sharply upon wider penetration of Android phones



Source: Woori I&S Research Center

- Handset market began to center on smartphones upon emergence of iPhone 3GS in 3Q08
- Domestic handset makers were in a relatively weak position when smartphones were first introduced, unveiling full-touch phones (feature phones) to compete in the market; however, domestic players' competitiveness gradually strengthened
- In 3Q11, SEC took No.1 spot (in terms of M/S) from Apple (17mn units), with smartphone shipment volume of 28.5 units



#### II. Smartphone: Round two begins

# Demand for affordable Android phones to grow rapidly, centering on emerging markets



Source: Gartner

- In the global handset market, phones priced below US\$75 account for 9% of total handset shipments, US\$75~300 51%, and above US\$300 39% (as of 2Q11)
- In order to see demand increase for low- to mid-priced smartphones, penetration rate needs to surpass 30%





Source: Gartner

- Smartphone penetration in developed markets (North America, Western Europe) exceed 50%
- Smartphone penetration in emerging markets such as Asia (excluding Korea and Japan), Latin America, and the Middle East is below 20%: China's penetration rate stands at 14%
- Annual smartphone growth in developed and emerging markets to reach 24% pa and 50% pa by 2015



# Price cuts alone will be insufficient for Apple to increase M/S in emerging nations



Source: Comscore

- In terms of market share based on data traffic, iOS accounts for 58.5% of market whereas Android takes up 31.9%
- This implies the chance of iOS phone users jumping to Android phones is low

iPhone gets highest subsidy among smartphone models (Verizon)



Source: Deutche Bank, Apple Insider

- Among smartphone models, iPhone receives highest subsidy; high ARPU is guaranteed for mobile operators
- In emerging countries with limited 3G networks and low subsidies, it may be hard for Apple to expand its market share sharply



# Android, best solution for domestic plays that possess weak competitiveness in OS

System stabilization of Android 2.2 widened market share of Android-based smartphone makers



Source: SA, Woori I&S Research Center

- Demand centered on iPhones during initial phases of smartphone market, but market share of Android phones widened upon system stabilization
- Leading mobile device plays (HTC and SEC) played a huge role in Android's system stabilization



## Nokia Mango phone or Galaxy Nexus with Ice Cream Sandwich?



Source: Nokia SEC

- Rather than paying it royalties, MS likely to pressure Androidbased smartphone makers into installing Windows phone OS
- However, it will take some time for MS to build an ecosystem that can compete with iOS or Android

New features of 'Windows 8'			
Touch-friendly user interface	<ul> <li>Metro UI in square (tile) shape</li> </ul>		
Communication between content synchronization applications	<ul> <li>Real-time synchronization of photos, email, schedules, and phonebook; space to save (Skydrive)</li> </ul>		
Integrated Windows Live ID	<ul> <li>Same setting and files can be used on other computers</li> </ul>		
Support for various systems and sizes	<ul> <li>Previous versions of Windows supported X86- based CPUs, but Windows 8 to also support ARM-based CPUs</li> </ul>		
Lowered HW required	<ul> <li>Operates on 1G Atom CPU and 1GB memory</li> </ul>		
Source: MS			

Source: MS

- MS's ecosystem to expand in earnest, with its M/S rising to meaningful level after launch of Windows 8
- Office programs (Word/Excel) expected to be killer application for tablet PCs



# Full-fledged cloud computing service unlikely to negatively impact handset makers



#### Cloud computing service overview

	Remark	Examples
SaaS (Software as a service)	<ul> <li>A software delivery model in which email, word processing, spread sheet, database, and presentation software are accessed by users via the Internet</li> </ul>	Gmail, Google Docs Salesforce.com's CRM service
laaS (Infra as a service)	<ul> <li>Virtualized server, storage, and network environment allows users to have access to various infra sources and to use applications</li> </ul>	Amazon's AWS
PaaS (Platform as a service)	<ul> <li>Delivery of all platform-related services and infrastructure which are required to develop, test, and drive online applications via Internet</li> </ul>	Google's App Engine, Microsoft's Window Azure

Source: Google

Source: Industry data, Woori I&S Research Center

- LTE barely meets pre-conditions for cloud streaming (such as 4.4Mbps transmission speed (at minimum) and 20ms or less network delay time)
- When new era of full-fledged cloud services begins, handset specifications might become less important, but number of mobile devices owned by one person likely to increase sharply
- Realization of cloud streaming, which will enable users to store and execute applications on the Internet, might make a company's competitiveness in mobile ecosystems (based on different OSs) meaningless



## More opportunities to exist for domestic handset plays in the future



Source: Woori I&S Research Center

#### Weak OS competitiveness – potential risk factor

- While SEC has its own OS, its market share is negligible; as for LGE, it does not have its own OS
- Thus, change in OS competition landscape could raise uncertainties for Korean handset makers

# However, smartphone market environment likely to turn favorable for domestic handset makers

- Expected rapid increase in smartphone demand—in particular, demand for low-priced models in emerging markets—should be favorable for domestic companies, the market strategies of which are based on offering a full range of products (vs Apple's single-model (iPhone)-focused strategy)
- Compared to competitors, Korean handset makers boast stronger distribution channels in emerging markets



#### Korean handset makers boast superior competitiveness in Android market

Major smartphone comparison: Competition to enhance AP (duel core > quad core), display quality, and size to continue













Model	SEC Galaxy S2 LTE	iPhone 4S	LG Optimus LTE	HTC Rader 4G	HTC Amaze 4G	Moto Droid Bionic
Network	4G LTE	3G	4G LTE	4G LTE	4G LTE	4G LTE
Processor	1.5GHz dual-core	1 GHz dual-core	1.5GHz dual-core	1.2GHz dual-core	1.5GHz dual-core	1.0GHz dual-core
OS	Android 2.3	iOS 5	Android 2.3	Android 2.3	Android 2.3	Android 2.3
Display	4.5-inch super AMOLED plus 800x480	3.5-inch IPS TFT 640 x 960	4.5-inch IPS-True HD 1280x720	4.5-inch qHD TFT-LED 940x540	4.3-inch S-LCD 540x960	4.3-inch 540x960
Camera	8.0 Mega Pixel	8.0 Mega Pixel	8.0 Mega Pixel	8.0 Mega Pixel	8.0 Mega Pixel	8.0 Mega Pixel
Battery	1850 mAh	1432 mAh	1830 mAh	1620 mAh	1730 mAh	1735 mAh

Source: Woori I&S Research Center

- Compared to SEC and LGE, HTC is weak in wireless communication-related patents; thus, HTC exposed to patent-related risk
- Chinese companies such as ZTE and Huawei have grown rapidly, but they have yet to prepare for LTE market



#### II. Smartphone: Round two begins

Enhanced smartphone functions and rising smartphone penetration to benefit related part suppliers



Source: SEC, : Joongang

- Competition in smartphone market to focus on handset functions; thus, suppliers of mobile chips, mainboards, FPCBs, camera modules, and saw filters to benefit
- Accordingly, we recommend Interflex (FPCB supplier for No.1 smartphone company), Daeduck Electronics (supplier of mainboards and mobile chip package substrate), and Iljin Display (supplier of GFF-type touch panel) as our small- and mid-cap top picks. However, following the recent surge in handset part suppliers' share prices, additional upside momentum could be limited over the short term. Accordingly, we recommend investors hold a mid- to long-term investment perspective on these companies



## Top picks: LGE (066570.KS); Target price of W96,000

•		•		•
(Wbn)	2010	2011E	2012F	2013F
Sales	55,754	54,421	58,025	62,377
Adj operating profit	88	192	873	1,747
Adj OP margin (%)	0.2	0.4	1.5	2.8
Operating profit	176	310	952	1,827
Net profit	1,282	-231	800	1,501
Net profit excl. minority interests	1,227	-222	766	1,437
EPS (won)	8,453	-1,561	5,264	9,903
P/E (x)	14.0	-41.4	12.3	6.5
Р/В (х)	1.5	0.8	0.8	0.7
ROE (%)	10.0	-1.8	6.0	10.4
Net debt (-cash)	5,142	5,423	5,575	5,339
Current price (11/11)	64,600	Foreign ov	vnership	28.5%
Market cap (Wbn)	9.344.2	Dividend v	vield (2010)	0.17%

Earnings forecasts and valuation (IFRS consolidated)

Note: 1) Adj operating profit = sales-COGS-SG&A expense; 2) EPS, BPS, and ROE based on net profit excluding minority interest; 3) Earnings forecasts yet to be diluted, in reflection of rights offering announced on Nov 4

Source: Woori I&S Research Center estimates

- LGE to post top operating profit growth among IT large-caps in 2012, backed by improving handset earnings
- Narrowed gap in smartphone functions and rising importance of patent in smartphone market to offer opportunity to LGE

#### LGE's share price closely tied to handset division's OP



Source: LGE, Woori I&S Research Center

- Thanks to LGE's R&D efforts over past two years, the gap between LGE and industry leaders in terms smartphone functions has narrowed
- While not having too high expectations for LTE phones, we recommend focusing on whether LGE will be able to restore its brand image in high-end smartphone market via its recent new foray into LTE smartphone market



# **Evolving tech DNA in mobile era**

I. Semiconductor: To continue benefiting from dawning of mobile device era

II. Smartphone: Round two begins

Tech

# III. Rechargeable battery: Heart of mobile device growth

IV. Key word for display industry: 'Organic'

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# 2. Market environment turning favorable for rechargeable battery industry growth





Source: Durian Soft

# Requirements for rechargeable battery industry growth almost primed

- Rising demand for LTE phones combined with fierce competition for low-priced smartphones has resulted in smartphone line-up expansion at set makers
- Heightened demand for high-capacity rechargeable batteries (largecapacity prismatic batteries and large-sized polymer batteries) being witnessed in line with increased market penetration of high-capacity battery devices (eg, smartphones, media tablet PCs, and 'Ultrabooks'
- Domestic battery makers market share recently widened compared to Japanese competitors
- Electrical vehicle (EV), hybrid electrical vehicle (HEV), and energy storage system (ESS) markets to grow, securing stable long-term growth platforms for Korean makers

# Increased functionality of mobile devices to boost energy consumption

- With energy consumption in mobile devices expected to steadily grow, rechargeable batteries should draw further attention as: 1) speed of clocks in application processors (APs) continually rising; and 2) memory usage steadily increasing



# Small-sized rechargeable battery market: Expect to see mobile device shipment growth



Source: Gartner, Woori I&S Research Center estimates

#### Mobile device shipment growth to continue

- Smartphone market penetration to widen from early adopters to lowend and low-feature handset users
- LTE smartphone competition to heat up following Apple's roll-out of 'iPhone 4S' (which runs on 3G)
- Media tablet PC competition to stiffen as rival companies seek to go up against Apple's 'iPad'

# Smartphone and media tablet PC shipment volume to rise 39.9% y-y and 63.9% y-y, respectively, in 2012

- Smartphones and media tablet PCs to drive mobile device shipment volume growth; 2012 shipment volume for smartphones and media tablet PCs to total 639.26mn units (up 39.9% y-y) and 110mn units (up 63.9% y-y), respectively
- As smartphone and LTE phone competition heats up, shipment volume growth will likely continue, boosting battery demand





Smartphones and media tablet PCs drive battery

### Small-sized rechargeable battery market: Expect to see capacity growth per device



Source: Woori I&S Research Center estimates

- Higher battery usage per device to further boost battery shipment volume (capacity based), strengthening growth potential of battery makers
- Battery market expansion to be spurred by fact that media tablet PCs and slim notebooks (Macbook, Ultrabooks, etc) which are likely to drive mobile device shipment growth—are expected to require adoption of high-capacity batteries

# Battery shipments (in terms of capacity) to increase rapidly



Note: Based on the 'number of shipments per device x average battery capacity per device' Source: Woori I&S Research Center estimates

- Thanks to increasing shipment portion of devices using highcapacity batteries, battery shipment growth (capacity based) likely to outpace device shipment growth
- Polymer battery market dominated by oligopoly composed of Samsung SDI, LG Chem (Korea), Sony (Japan), and ATL (China; subsidiary of Japan's TDK); domestic plays to post strong performance going forward



# Mid- to large-sized rechargeable battery market: Environment-friendly policies to generate growth

#### EV/HEV-related government support measures and regulations

Country	Support measures	Regulations
Japan	<ul> <li>Provision of subsidies (about 50.0% of price difference between eco- and gasoline-powered cars) for eco-friendly car buyers</li> <li>Weight tax and acquisition tax exemption through 2012</li> </ul>	<ul> <li>Gas mileage guideline revised up to 16.8km/L in 2015 and 20km/L in 2020 from current 13km/L</li> </ul>
Europe	<ul><li>Tax exemption and subsidy for eco-friendly car buyers</li><li>Realize EV penetration by country</li></ul>	- Stricter set of vehicle $\rm CO_2$ emission guidelines: 25% reduction planned by 2020
US	<ul> <li>US\$50bn loans program to support eco-friendly vehicle production</li> <li>Annual subsidy for eco-friendly vehicle development at W300bn</li> </ul>	Gas mileage guideline strengthened to 39mpg from 27.5mpg
Korea	<ul><li>Hybrid car subsidy of up to W3.1mn</li><li>Environmentally-friendly vehicle development support</li></ul>	To raise fuel efficiency 16.5% from 2012
China	<ul> <li>RMB20bn for development of environmentally-friendly vehicles through 2012</li> <li>Subsidy of up to RMB60,000 for EVs and up to RMB50,000 for HEVs</li> </ul>	<ul> <li>Lower taxes for small cars (1,000cc and below)</li> <li>Raise taxes for large cars (3,000cc and above)</li> </ul>

Source: Korea Environmental Industry & Technology Institute (KEITI), Woori I&S Research Center

- Major economies—including US, EU, Korea, China, and Japan—support sales of environmentally-friendly vehicles as a means of coping with global warming
- As vehicles are believed to account for around 20% of green house gas emissions, major global economies have been supporting EV market growth
- Related regulatory measures have included tougher regulations on gas mileage and CO<sub>2</sub> emissions for automakers and higher taxes on high-emission vehicles



# Mid- to large-sized battery market: Car makers to expand EV lineup to secure upper hand



Growth of mid- to large-sized rechargeable battery market to accelerate from 2013

Source: CEIC, Woori I&S Research Center estimates

- Automakers expected to release around 12 EV/HEV models in 2011 and 16 new models in 2012
- Of note, automakers likely to focus on plug-in hybrid vehicles (PHEV) and EVs instead of HEV, implying sharp increase in battery demand per vehicle, which bodes well for battery makers
- EV/HEV battery market to grow 76.5% in 2012 and 55.5% in 2015, recording 2012~2020 CAGR of 30.0% and generating growth momentum for rechargeable battery makers



## **Development direction (by type) of rechargeable battery materials**

# Rechargeable batteries account for 45% of EV manufacturing costs



Source: Korea Automotive Technology Institute (KATECH), Pike Research

- Key factors associated with developing next-generation rechargeable batteries: 1) developing rechargeable battery materials without using high-cost raw materials; and 2) ensuring capacity and power applicable for EVs
- Given that rechargeable batteries account for roughly 45% of EV manufacturing cost (56% including battery management systems (BMS)), use of high-cost raw materials needs to decline

# Cathode materials represent largest portion of rechargeable battery costs



Source: Korea Electronics Association (KEA)

- Voltage or current need to be increased in order to expand battery power (P=VI)
  - 1) Method for increasing voltage (V): Escalate voltage difference between cathode and anode materials by increasing voltage level for cathode materials
  - Method for increasing current (I): Ensure mobility of ions and electrons between cathode and anode materials via technological improvements in electrolytes and separators



### Cathode materials: Use of low-cost raw materials; securing stability



LCO-based cathode materials represent largest demand

- Lowering cost of cathode materials viewed as key to reducing Li-ion battery prices
- Cost of LCO (first—and still most-widely used—cathode material to be developed for Li-ion batteries) high as it contains cobalt (used in precursors; rare metal)
- Thus, development of substitute is fundamental in order to lower cathode material costs

#### Comparison of characteristics by precursor: Combination of three components



Source: National IT Industry Promotion Agency (NIPA)

- LNO using nickel-based precursors and NCA using aluminum nickel cobalt-based precursors were developed as possible substitutes; however, both were deemed inadequate due to unstable crystal structure and short battery life
- Next substitute to be developed was NCM using manganese; however, due to its low energy density, it is only used in mobile devices and small-sized electronic devices



Note: As of 2009 Source: Industry data

# Cathode materials: Use of low-cost cathode materials and securing stability when developing EV lithium batteries

# LMO-based cathode materials enable superior power vs LFP-based materials



Source: National Institute of Advanced Industrial Science & Technology, Woori I&S Research Center

# LMO draws attention as cathode material for EVs thanks to manganese stability

- With regards to developing Li-ion batteries for EVs, stability tends to take precedence over efficiency and price competitiveness
- LMO garnering attention as suitable cathode material for EV batteries; of note, LMO using manganese-based precursors considered a substitute for cobalt (which is explosive in nature) thanks to its stability
- While LMO lacks efficiency versus LCO, technological development continues to progress

#### Efforts toward enhancing LMO capacity

- Developing high-capacity LMO by changing layered manganese structure to spinel structure
- Given that Li-ion mobility is shorter within the three-dimensional spinel structure (vs layered structure), charging and discharging is easier and more resistant to heat

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Strengths and weaknesses of various cathode materials

## Cathode materials: Pay attention to LCO, NCM, and LMO cathode materials makers

U				
LC0	LiCoO2	Superior power compared to other precursors	Instable structure; low capacity	Umicore Korea, COSMO AM&T, L&F
LNO	LiNiO2	Cobalt substitute	Instable crystal structure; low storage stability; weak stability at high temperature	
NCA	LiNi0.8Co0.15Al0.05O2	Cobalt substitute; improvement from LNO- based cathode materials	High temperature storage; short life	Ecopro
NCM	LiNixMnyCozO2	Cobalt substitute; improvement from NCA Stability secured for high voltage batteries	Low energy density; impossible to be adopted in mid- to large-sized batteries	L&F, Ecopro
LMO	LiMn2O4	Stable; cheaper than LCO	Lower power versus LCO	Phoenix Materials
LFP	LiFePO4	Cheaper than LMO	Lower power versus LMO	BYD

Source: Woori I&S Research Center

- Among cathode materials makers, we recommend investors monitor LCO, NCM, and LMO-based cathode materials makers
- LCO most commonly used Li-ion battery cathode material; thus, boasts broad range of applications
- NCM market expanding as NCM cited as strongest rival to LCO for usage in Li-ion batteries for mobile devices
- LMO-based cathode materials also warrant focus as they are expected to be adopted for large-and mid-sized EV/HEV batteries
- In Korea, COSMO AM&T and L&F produce LCO-based materials, Ecopro and L&F manufacture NCM-based materials, and Phoenix Materials makes LMO-based cathode materials



# Anode materials: Efforts continue to reduce production cost and enhance energy density

# Artificial graphite market dominated by Japanese companies



Source: KAIT

#### Energy density improvement efforts needed

- There are four ways to enhance energy density of anode materials: 1) switch electrode materials; 2) improve spreading technology; 3) improve packing technology; and 4) increase anode materials' lithium absorption rate
- However, three of these methods (excluding change in electrode materials) have reached their limit in terms of improving energy density through structural changes
- Thus, only remaining method is to switch electrode materials; Si and Sn (alloy) cited as possible substitutes for carbon
- Moreover, carbon nanotube under development

#### Korean companies target artificial graphite market

- POSCO Chemtech signed a strategic alliance with Mitsubishi Chemical to enter anode materials market; GS-Caltex to move into this domain; SK Innovation to set up JV with AK Petrochem in order to enter anode materials field
- In light of these aggressive entry attempts, we predict Korean companies will establish a clear presence in oligopolistic anode materials market





## Separator: Thinner separators facilitate higher power



Source: Woori I&S Research Center

# Separator represents second-highest portion of material costs following cathode materials

- Separator accounts for 19% of Li-ion battery material costs
- Separator key factor in battery power; also swiftly blocks ion and electron transfer in event of battery short, thereby preventing explosions

# Thin-film separator helps development of high-power batteries

- Thinner separator improves current, enabling higher battery power
- Separator produced using PE (polyethylene) or PP (polypropylene); separator contains pores to allow passage of lithium ions, but as separator becomes thinner, it becomes increasingly difficult to control size of pores
- Thus, efforts being made to thin separator while maintaining pore size





## Separator: Coating technology enhances stability



Source: KAIT

# Efforts underway to promptly block potential explosions upon battery shorts

- Battery shorts drive ions towards separator, increasing ampere and causing explosions; to prevent such explosions, separator designed to melt when shorts occur, thereby filling pores
- Important to develop separator coating technology capable of more swiftly and efficiently filling pores
- To this end, aramid resin often coated on polyolefin separator. Of note, LG Chem applies ceramic coating to enhance power by creating more pores

#### Separator made by wet processing applied to IT products; separator made by dry processing applied to larger-sized batteries

- Separator produced either through wet or dry processing
- Wet processing adopted by Asahi Kasei and Tonen (Japan) and SK Innovation (Korea), while dry processing utilized by Ube Industries (Japan) and Celgard (US)
- SB Limotive and LG Chem have made inroads into large-sized Li-ion battery separator market; Cheil Ind also considering entry into market



# Electrolyte: Localization of lithium salt (LiPF6) and stability of electrolyte

#### Electrolyte material cost breakdown: LiPF6 represents maiority of costs



Source: Industry data

- Electrolyte composed of lithium salt, solvent, and additive
- Lithium salt usually refers to LiPF6, which increases mobility of Li-ion in electrolyte
- Ethylene carbonate (EC) and propylene carbonate (PC) employed as organic solvents; such solvents necessary as lithium and cobalt (raw materials for cathode materials) explode upon contact with water
- Additives utilized in order to improve stability, battery life, and voltage





Source: IIT

- Efforts underway to development both flame resistant gel-type electrolytes and ionic liquids for purpose of replacing organic liquid electrolytes, but development to be difficult
- Korean electrolyte makers: Panax E-Tec, Soulbrain, LG Chem -
- Korean LiPF6 maker: Foosung -
- Korean organic solvent makers: Leechem, Ecopro, Daelim -Chemical
- Korean additive makers: Leechem, Nepes, and Foosung -



Earnings forecasts and valuations (IFRS consolidated)

## Top picks: Samsung SDI (006400.KS); Target price of W190,000

(Wbn)	2010	2011E	2012F	2013F
Sales	5,124	5,310	5,422	5,787
Adj operating profit	234	220	288	369
Adj OP margin (%)	4.6	4.1	5.3	6.4
Operating profit	287	242	308	394
Net profit	385	379	474	563
Net profit excl. minority interests	356	350	438	521
EPS (won)	7,762	7,633	9,561	11,381
P/E (x)	21.6	17.2	13.7	11.5
Р/В (х)	1.3	0.9	0.8	0.7
ROE (%)	6.5	5.4	5.9	6.3
Net Debt(-Cash)	-780	-791	-1,280	-2,052
Current price (Nov 11)	130,000	Foreign ownership 15		15.5%
Market cap (Wbn)	5,922.6	Dividend yield (2010) 0.9		0.95%

Note: 1. Adjusted operating profit = Sales – COGS – SG&A expense

2. EPS, BPS, and ROE based on NP and shareholder's equity excluding minority interests Source: Woori I&S Research Center estimates

- Lion's share of global small-sized battery market; wellpositioned to see continual shipment volume growth for mobile device batteries
- Solar division to focus on developing highly-efficient cells from 2012; thus, reducing operating loss to roughly W43bn

#### Focus on increasing polymer battery shipment growth



Source: Samsung SDI, Woori I&S Research Center estimates

- Focus on increasing polymer M/S on aggressive expansion of Li-ion polymer battery production capacity
- In line with smart mobile device market growth, demand for large-capacity cylinder and large-area polymer batteries to increase; stronger polymer battery competitiveness to drive growth of small-sized battery makers



# **Evolving tech DNA in mobile era**

I. Semiconductor: To continue benefiting from dawning of mobile device era

II. Smartphone: Round two begins

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III. Rechargeable battery: Heart of mobile device growth

IV. Key word for display industry: 'Organic'

Analyst: Nick Park tel 822) 768-7462 e-mail nick.park@wooriwm.com

# Identifying pros and cons of rising demand for mobile devices



Source: DisplaySearch, Woori I&S Research Center

- While higher demand for mobile devices may bolster the profitability of display makers to some extent, it tends to lead to reduced potential purchasing power for TVs and PCs
- In terms of 2010 panel shipments, monitors and notebooks expanded 12.6% and 25.0% y-y, respectively. Given 'Ipad' rollouts, 2011 growth for both monitors and notebooks will likely slow to 1.2% and 8.3% y-y, respectively

Notebook and PC shipment volume after launch of iPad



Source: DisplaySearch, Woori I&S Research Center

- Considering that media tablet PC panel prices should be higher than prices for other devices, we expect media tablet PCs to contribute strongly to LCD industry earnings
- However, given that competition with AMOLED-based products should continue to intensify, maintaining sustainable profit margins will likely prove to be difficult



## TV demand represents critical factor for LCD industry recovery



Source: DisplaySearch, Woori I&S Research Center

- Area shipments represent a key variable in the LCD industry, as exemplified in the term 'Art of Area'. Among LCD applications, TVs accounted for 66.6% of sales in 2010
- Given this importance, the slowdown in TV demand over the last couple of years has negatively affected the sector
- Thus, we remain conservative toward the LCD industry Unless a game-changing technological development appears or global demand surges, another industry boom is unlikely

LCD panel makers' average quarterly operating margin trend



Source: Bloomberg, Woori I&S Research Center

- Upon the breakout of the global financial crisis in 2008, the industry's established cyclical pattern began collapsing
- Before 2008, changes in supply (ie, shortage or excess) represented the main catalysts for the cycle reaching inflection points. However, we mainly attribute the current industry recession to sluggish demand; thus, it is difficult to predict when the LCD industry will rebound



# Need for groundbreaking applications



Source: DisplaySearch, Woori I&S Research Center

- We believe that industry-changing demand triggers are needed if an industry turnaround is to be possible
- Game changers could possibly include TVs boasting significantly improved existing functions (higher resolution, faster signal speed, and revamped designs) and genrecrossing special function TVs (eg, cloud computing TVs)
- Intel's 'Ultrabook' to boost demand in the notebook market

#### LCD TV sales volume in China



Source: DisplaySearch, Woori I&S Research Center

- One of the key variables is the global economic recovery
- China's policies to boost electronics purchases significantly impacted consumer goods markets. As the policies are phased out, Chinese LCD TV market growth should slow
- Global demand triggers—eg, China's new policies or US QE—are needed



# LCD technology to continue to steadily improve

Resolution comparison: FHD, UD, Super Hi-Vision

1920 x 1080 (FHD)	3840 x 2160 (UD)	7680 x 4320 (SHV)

Source: ChoongNam Display Center, Woori I&S Research Center

#### **Development direction**

- 1) Enlarged size; 2) Higher resolution; 3) Faster signal speed; 4) sophisticated designs
- Enlarged size : If the size of LCD TVs widens from 70" to 100", the field of view would increase from 35 degrees to 49 degrees, making images appear more real
- Higher resolution : LCD TV image quality should continue to improve via upgrading from the current full high definition displays (FHD; 1920 × 1080) to ultra definition displays (UD; 3840 × 2160) and to 'super hi-vision' displays (SHV; 7680 × 4320)
- Faster signal speed : If response time is to increase from 60Hz to 240Hz, image overlapping and image sticking will need to be reduced. To provide better image quality, it will be necessary for signal speed to quicken

In light of these considerations, we believe that the offering of low-priced products with high specifications and sophisticated designs has become a necessity for the industry. We would view the offering of such products in and of itself as representing the next 'killer application' for the industry



## **OLED** enables better operation of flexible displays

#### Flexible display development, by stage: To offer many advantages



Source: Industry data, Woori I&S Research Center

- As the name suggests, flexible displays are displays which are bendable or rollable. Flexible displays tend to be thin and resistant to external shocks. As limitations in design decline, flexible displays should result in the increased application of displays—eg, bendable electronic newspapers and notebooks, clothing
- OLED is thin, bendable, self light emitting, and offers high picture quality. As the applications of OLED increase to large-sized panels, expectations are likely to rise for flexible OLED



## **OLED** demand originates from mobile devices



Source: DisplaySearch, Woori I&S Research Center

- We attribute the rapid growth of the AMOLED industry to SEC's release of AMOLED handsets in order to combat the rapidly expanded market share of the 'iPhone' series
- We expect OLED applications in handsets to increase from 1.4% in 2009 to 6.3% in 2011 and to 11.1% in 2012

#### OLED market growth to be led by mobile devices and TVs



Source: DisplaySearch, Woori I&S Research Center

 According to Display Search, the total sales revenue of the AMOLED industry will climb from US\$1.25bn in 2010 and US\$4.22bn in 2011 to US\$19.16bn in 2015 (2010~2015 CAGR of 95.7%)



## Mobile devices widening OLED applications; to tap into TV market

**OLED smartphones (SEC)** 

Model	Nokla N9	Samsung Galaxy S II Epic 4G	Samsung Galaxy Note	Sony DSC-TX100V	Samsung NX100	Sony PS-Vita	SONY OLED Monitor BVM-E250
Display Size (in)	3.9	4.5	5.3	4.0	3.0	5.0	24.5
Display Resolution (dot)	480 x 854	480 x 800	800 x 1280	820K pixe (eq 854x480dot)	614K pixel (eq 640x480dot)	960x544	1920 x 1080
Comment	Released 2011, September	Exp. Release 2011 Septembe	Exp. Release 2011, Q4	Released 2011. March	Released 2010. September	Exp. Release 2011, December	Released 2011. May

Source: DisplaySearch, homepages

- Given the competitiveness of OLED in terms of width and weight, we believe the application range for OLED will widen to applications other than just smartphones. Among media tablet PCs, SEC's 'Galaxy Note' (5.3") and 'Galaxy Tab' (7.7") have adopted OLED
- Digital still camera makers such as Nikon, Sony and Olympus also produce cameras with AMOLED. In addition, Sony plans to apply 5" AMOLED to its next generation game console, the 'PS-Vita'
- Expecting the OLED supply shortage witnessed in 2011 to ease from 2012, we believe technological advances should result in adoption of OLED in more diversified applications



## **AMOLED: Technological advances underway**

#### **Transparent displays**



Source: Hankyoreh Newspaper

- In line with growing usage of AMOLED in mobile devices as a next-generation display, picture quality competition between AMOLED-based displays and LCD has intensified
- LCD lacks flexibility due to the use of backlight. Given low light penetration, flexible and transparent LCD is not possible; however, this possibility does exist for AMOLED

#### Flexible Displays



Source: SMD

- In the TV market (unlike the mobile device market), power consumption, flexibility, and high-definition resolution displays represent less important factors in differentiating product offerings than slimness and weight—two factors that are critical in TV industry competition
- Competition between AMOLED-focused players and LCDfocused players will likely center on TVs, which represent the industry's most crucial market



# OLED TV market outlook

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lechnological is	sues and possibility of commercialization
Application	Details
TVs	<ul> <li>Applicable in TVs thanks to superior color, short response time, and wide viewing angle</li> <li>In particular, short response time effective in easing image sticking problems faced by 3D TVs</li> <li>Mass production of 31-55" AMOLED TV to be witnessed from 2013</li> </ul>
Notebook monitors	<ul> <li>Commercialization to be possible after developing technology for display stabilization and product lifecycle improvement</li> <li>In contrast to TVs, relatively low demand exists for high-end AMOLED-based monitors and notebooks</li> </ul>
Tablet PCs	<ul> <li>Mass production is highly likely given that the production yield for media tablet PCs is higher than that for notebooks and monitors, and further given that panel prices are cheaper for media tablet PCs than those for notebooks and monitors</li> <li>7~9inch products to be rolled out from 2H12</li> </ul>
Mobile devices	<ul> <li>Wider applications, including various types of game devices and cameras (DSC and PMP) from 2H11</li> <li>Roll-out of smartphones and watches with flexible AMOLED displays from 2H11</li> </ul>

Source: Displaybank, Woori I&S Research Center

- Following the introduction of LED TVs in 2009, the portion of LED TV sales reached 3% of total TV sales in 4Q09
- As OLED TVs are expected become an elite type of TV, the OLED TV market should display a similar growth pattern to that seen for LED TVs during the initial stage of their release. Assuming that upon the launch of OLED TVs in 2013, the portion of sales also represents 3.0% of total sales, 2013 demand should reach 7.95mn units (forecasted total 2013 TV sales: 270mn units).
- To produce 7.95mn units of 46" TV units via 8G lines, a production capacity of 83,000 units/month (83K) is needed
- OLED-based TV models will likely enjoy a competitive edge in terms of weight and width (super slim), which should facilitate easy wall-mounted installation



# Investment in 8G production line: Need to develop panel enlargement technology

#### OLED deposition method : variety of evaporation technology development and application under review

Method	Description
FMM (Fine Metal Mask)	<ul> <li>A process for the evaporation of organic thin film for use in small-sized AMOLED panels</li> <li>A method for laminating organic materials, which are heated and evaporated only within patterned masks</li> <li>Deposition of organic materials with intrinsic patterns difficult for 6G-and-above production lines</li> </ul>
LITI (Laser Induced Thermal Imaging)	A process of irradiating a laser on the donor film and glass substrate to fabricate OLED
HPS (Hybrid Patterning System)	Combination of the FMM and LITI methods
SMS (Small Mask Scanning)	A method of deposition by dividing and moving areas
WOLED (White OLED)	<ul> <li>A method using color filters on WOLED</li> <li>Patterning is not required if only white organic layers are formed, so balanced fabrication is possible on large areas</li> <li>Use of color filters can decrease color purity and brightness</li> </ul>
Inkjet printing	A method of colored patterning using ink made from high-polymer materials

Source: Display Bank, Woori I&S Research Center

- The key factors behind the 8G production line investment being witnessed in the industry are the needs to achieve: 1) the ability to produce large-sized TFT substrates; and 2) the ability to secure OLED deposition processing technology
- TFT deposition:TFT poly-si substrates required to mass produce eighth-generation lines (2.5m × 2.2m). In order to produce large-sized TFT using 5.5G production lines, possible processes include laser processing, heat treating, or oxide-based methods
- OLED deposition: It is very difficult to use the fine metal mask (FMM) method (used for 5.5G production lines) in the deposition of AMOLED on large-sized substrates as the mask becoming thinner than the aluminum foil, which causes bending if used on large areas. Alternatives methods being discussed include the small mask scanning (SMS), laser induced thermal imaging (LITI), hybrid patterning system (HPS), WOLED, and inkjet methods



#### Panel makers' investment pattern draws attention

# Material/equipment-related strategic alliances among panel makers aimed at: 1) securing technology; 2) securing patents; and 3) building barriers to inhibit the entry of competitors

Company	Material/equi pment	Date	Detail
	Material	Jun 2009	Formed strategic alliance with Japan's Idemitsu Kosan related to OLED technology development
LGD	Material	Dec 2009	LG's Global OLED Technology acquired Kodak's OLED business and patent license (Idemitsu Kosan acquired 33% stake in Jun 2010)
	Material	Jan 2001	Partnership between Samsung SDI and NEC to develop and produce small-sized OLED
CMD	Equipment	Dec 2010	Invested W29.4bn in SNU (rights offering: W14.2bn, acquisition of convertible bonds: W15.2bn)
	Equipment	Feb 2011	Invested in AP System's convertible bonds (W27.6bn)
SIVID	Material	Jul 2011	Signed contract to establish a joint venture (plastic PI film) with Japan's Ube Industries
	Material	Aug 2011	Partnership with SFC (subsidiary of Hodogaya Chemical, Japan's OLED maker)
	Material	Aug 2011	Formed a patent and technology alliance with UDC (OLED maker)
Samsung Venture Investment	Material	Sep 2011	Invested in NOVALED (OLED maker)
SEC	Equipment	May 2010	Invested in SFA's stake (911,000 shares)

Source: LG Business Insights, Press reports, Woori I&S Research Center

- The rapid growth of OLED industry should induce strong growth in the material and equipment industries. Assuming applications to TVs, related components players should also experience growth
- We draw attention to the investment pattern of panel makers, which is aimed at: 1) securing technology; 2) securing patents; and 3) building barriers to inhibit the entry of competitors



Value chain for materials suppliers: supplier diversification underway

## OLED materials: Diversification and low power consumption to be major variables

				Domestic materials market size	
			Suppliers	2011	2012
			Dukaan Hi matal Daagan (CE Jaalar (Chail Ind)	2011	2012
	HII	-	Duksan HI-metal, Doosan-CSEIsolar (Chell Ind)		
Charge laver	HIL		Duksan Hi-metal	Around W200hn	Around W/400hn
Charge layer	ETL		LG Chem (Cheil Ind)		
	EIL		(Lithium-quinolate used)		
	Red	Host	DOW Graclel		Around W/400hp
	Phosphorescent	Dopant	UDC		
Emissive layer	Green	Host	Doosan-CSElsolar	Around W/200hn	
	Fluorescent	Dopant	UDC		
	Blue	Host	SFC		
	Fluorescent	Dopant	SFC		

Note: Companies within () refer to those that are expected to enter the market Source: Woori I&S Research Center estimates

- Charge layer: Regarding charge layers—the role of which is to transfer electric current—HTL and ETL represent the two materials most important to the industry. For now, SMD uses an exclusive vendor for each of these materials; however, starting from 2H11, SMD will likely diversify its HTL and ETL vendors (new HTL vendors to be added in 2H11)
- Emissive layer: Red, green, and blue (RGB) is aligned continually on emissive layers, which are essential for light emission. Presently, both phosphorescent and fluorescent materials are used for emissive layers; however, going forward, the method for producing green material (out of RGB) is expected to be switched to a method involving low-power-consuming phosphorescent material (fluorescent material is used at present



# OLED equipment industry: Korea's equipment makers to benefit in line with technological advances

#### Value chain for equipment maker: Domestic equipment makers to benefit from adoption of new deposition technology

тст	LTPS tran	sformation equipment	Overseas	JSW (Japan Steel Works), ULVAC, SHI (Su	mitomo Heavy Inc.), TCZ
(ELA: Excimer L	imer Laser Annealing)	Domestic	APSystem		
Denocition	Evaporation	Overseas	Tokki, Hitachi, ULVA	С	
	Deposition	Evaporation	Domestic	YAS, Jusung Engineering, DMS, Avaco, LIG ADP, DongA Eltek (Sunic System)	SFA, SNU, Wonik IPS
	Deposition	HPS laser (yet to be	Overseas		ULVAC
OLED		decidĕd)	Domestic		AP System
		Donor film operator	Domestic		SFA
		Glass	Domestic	Avaco, Jusung Engineering	AP System, SFA
		Film (vot to be decided)	Domestic	Unidentified	Wonik IPS, SNU
	Encapsulation	Film (yet to be decided)	Overseas		ULVAC
		Metal spraying (R&D)	Domestic		Tess, AP System
		Laser lift off (LLO)	Domestic		AP System
Glass cutting system		Domestic	Top Engineering	Rorze Systems	
Backend process		Domestic		SFA, Toptec	

Source: Woori I&S Research Center estimates

- We believe the following three OLED equipment-related technological changes warrant strong investor attention
- 1) The adoption of one shot evaporator in the deposition process: One shot evaporator to replace the dissection of glass substrate for evaporation (applied to 4G and 5.5G); development through government-led projects highly likely
- 2) The introduction of laser processing to enable higher resolution in the deposition process: Aimed at enhancing low resolution compared to LCD
- 3) The shift from the current glass-based encapsulation method to a film-based encapsulation method: Aimed at producing thinner and lighter products



## **OLED** parts industry: Parts supply to grow in line with TV production

Value chain for parts suppliers					
Part	LGD	SMD			
Donor Film		3M, Cheil Ind			
Driver IC					
T-con	Silconworks	, TEI, SEC, Allapass			
Polarizer	LG Chem	Cheil Ind			
Driver IC backend	Nepes, LB Semicon				

Source: Woori I&S Research Center estimates

- As back light unit (BLU) not required in OLED-related technology, not as many parts needed vs LCD-related technology
- But, some parts used in LCD-related technology remain necessary in OLED-related technology, including driver IC, timing controller (T-con), polarizer, and PCB. We expect demand for these kinds of parts to rise sharply in line with the introduction of OLED TVs



## Top picks 1: Cheil Ind (001300.KS) – TP W130,000

(Wbn)	2010	2011E	2012F	2013F
Sales	5,121	5,629	6,335	6,873
Adj operating profit	335	244	440	490
Adj OP margin (%)	6.5	4.3	6.9	7.1
Operating profit	314	309	457	490
Net profit	269	249	372	399
Net profit excl. minority interests	269	249	372	399
EPS (won)	5,371	4,886	7,088	7,606
P/E (x)	20.7	20.9	14.4	13.4
P/B (x)	2.0	1.8	1.6	1.5
ROE (%)	11.4	8.7	11.8	11.4
Net Debt(-Cash)	286	425	590	461
Current price (11/11 upp)	102 000	Consign of	unarahin	22 / 0/
Current price (11/11, won)	102,000	Foreign o	whership	23.0%
Market cap (Wbn)	5,348.6	Dividend y	0.68%	

Earnings forecasts and valuation (IFRS consolidated)

Note 1: Adj operating profit = sales-COGS-SG&A expense

Note 2: EPS, BPS, and ROE based on net profit and shareholder's equity excluding minority interests Source: Woori I&S Research Center estimates

- Cheil Ind's electronic materials division should continue to see lofty growth thanks to new product offerings, led by semiconductor materials such as patterning materials (2012 semiconductor material sales to grow 37.7%, and electronic material sales to rise 39.8% in 2012)
- Cheil Ind plans to the enter water treatment membrane industry in 2012

#### 2009~2011 sales forecasts, by division



Source: Cheil Ind, Woori I&S Research Center

- Although the IT industry is unlikely to recover rapidly, we expect the chemical division to record stable earnings on a stabilizing chemical spread (chemical division to make operating profit contribution of 29.7% in 2012)
- The fashion division should also boost top-line growth backed by: 1) the steady growth of its flagship brand 'Bean Pole'; and 2) increased 2012 sales in China (to grow 7.1% y-y)



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# Top picks 2: DS Hi-Metal (077360.KQ) – TP W40,000

#### Earnings forecasts and valuation (IFRS nonconsolidated)

(Wbn)	2010	2011E	2012F	2013F
Sales	72	135	192	230
Adj operating profit	13	34	51	59
Adj operating margin (%)	18.1	25.6	26.6	25.6
Operating profit	13	34	51	59
Net profit	10	28	41	48
Net profit excl. minority interests	10	28	41	48
EPS (won)	409	941	1,408	1,648
P/E (x)	49.6	30.4	20.4	17.4
P/B (x)	6.3	7.0	5.2	4.0
ROE (%)	12.4	25.7	29.2	26.0
Net debt (-cash)	6	0	-25	-63
Current price (11/11, won)	28,650	Foreign ownership		22.7%
Market cap (Wbn)	842.1	Dividend yield (2010)		0.0%

Note 1: Adj operating profit = Sales-COGS-SG&A expense

Note 2: EPS, BPS, and ROE based on net profit and shareholder's equity excluding minority interests

Source: Woori I&S Research Center estimates

 AMOLED-related sales growth has been accelerating since 2Q11. This strong sales growth momentum should be sustainable given that SMD's production line expansion (5.5G and 8G) is likely to continue through 2013. OLED sales estimated at W78.7bn in 2011 and W128.8bn in 2012

#### Sales, operating profit, and operating margin trends



Source: DS Hi-Metal, Woori I&S Research Center

- Sound growth to continue at the semiconductor division thanks to product mix and industry improvements
- Semiconductor division to post 2011 sales of W55.8bn and 2012 sales of W63.1bn



## Top picks 3: LG Display (034220.KS) – TP W31,000

#### Earnings forecasts and valuation (IFRS consolidated)

(Wbn)	2010	2011E	2012F	2013F
Sales	25,512	24,351	27,228	29,270
Adj operating profit	1,689	-756	563	980
Adj operating margin (%)	6.6	-3.1	2.1	3.3
Operating profit	1,310	-791	584	980
Net profit	1,159	-647	504	882
Net profit excl. minority interests	1,156	-646	503	880
EPS (won)	3,232	-1,804	1,404	2,459
P/E (x)	12.3	-12.5	16.0	9.2
P/B (x)	1.4	0.8	0.8	0.7
ROE (%)	11.0	-6.1	4.8	8.1
Net Debt(-Cash)	1,389	2,621	1,530	520
Current price (11/11)	22,400	Foreign ownership		29.8%
Market cap (Wbn)	8,015.1	Dividend y	1.26%	

Note 1: Adj operating profit = Sales-COGS-SG&A expense

Note 2: EPS, BPS, and ROE based on net profit and shareholder's equity excluding minority interests Source: Woori I&S Research Center estimates

 Expecting panel prices to remain firm and shipment volume to increase slightly, we believe operating loss will shrink in 4Q11. While we expect the operating loss trend to continue (estimate 4Q11 adjusted operating loss of W100bn), we estimate the actual operating loss to come to W11.5bn in line with the likely booking of forex translation gains

#### 2010~2012 operating profit and operating margin trends



Source: LGD, Woori I&S Research Center

#### Turnaround likely in 2Q12

- LGD should post a operating loss again in 1Q12 due to effects of low seasonality; however, from 2Q12, the company should make a turnaround thanks to an improved product mix and rising shipment volume



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