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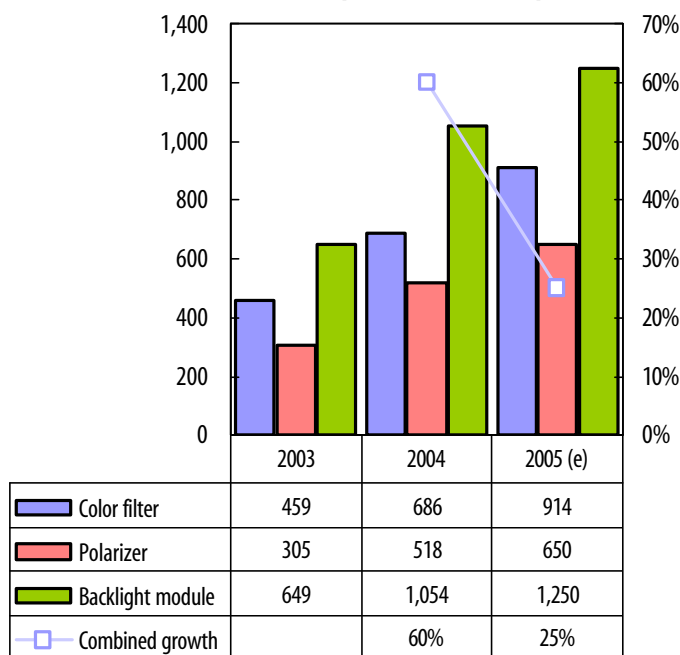
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Introduction

TFT-LCD panel prices started to decline in the second quarter of 2004. In the fourth quarter, quotes for 15- and 17-inch LCD panels were even lower than production costs. The prices for the panels' key components – color filters, polarizers, and backlight modules – also dropped as a result. However, thanks to increased shipments, the combined production value of Taiwan's LCD component makers in 2004 still managed to grow 60% from 2003.

Shipments from the component makers in 2005 are expected to grow 35% as a result of the panel makers' next-generation plants coming online. However, the component makers remain under pressure from price cuts in the first half of 2005 as demand for panels is expected to still fall slightly short of supply. The combined production value of component makers in 2005 will grow only 25%, a substantial decrease from the 60% growth recorded in 2004. Their 2005 gross margins are expected to remain flat.

Chart 1: Taiwan TFT-LCD component makers' production value 2003-2005 (m US\$)



Note: LCD panel makers' in-house component production not included

Source: DigiTimes Research, February 2005

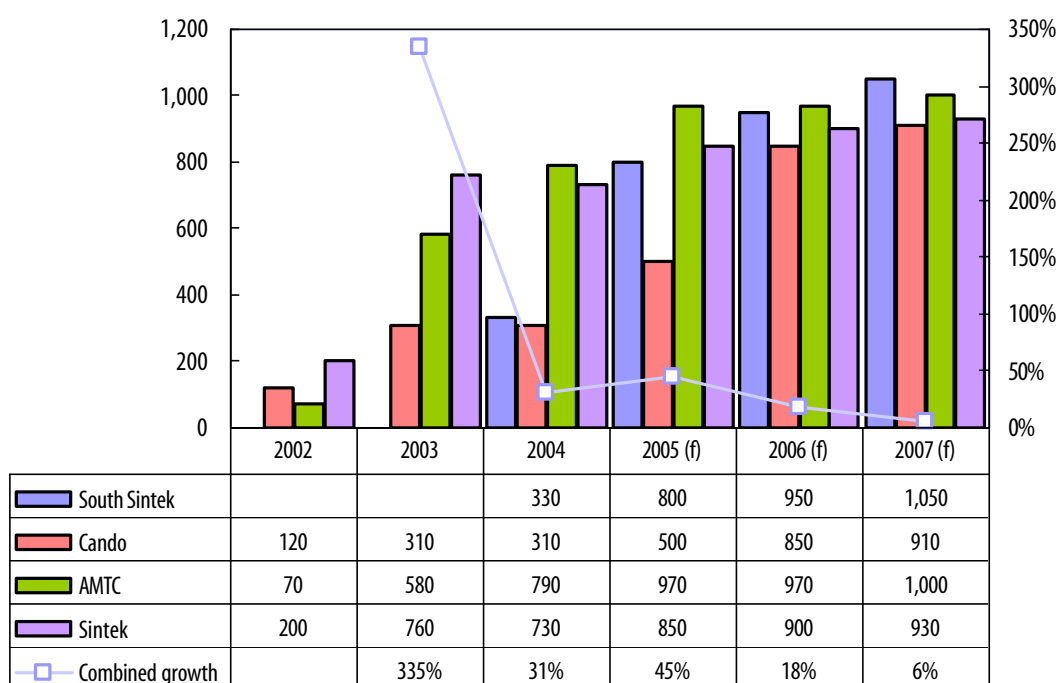
Color filters

In addition to the panel makers' in-house color filter (CF) operations, there were five dedicated CF makers working in Taiwan during 2004. The Taiwan-based players were Sintek Photronic, Allied Material Technology Corporation (AMTC), Cando and South Sintek Photronic. Toppan CFI (Taiwan), a subsidiary of Japan-based Toppan Printing, began production at the Tainan Science Park (TSP).

CFs are a key component accounting for almost 30% of the TFT-LCD panel's manufacturing cost. Most of Taiwan's TFT-LCD makers used to import CFs from Japan, except Chi Mei Optoelectronics (CMO), who has always insisted on in-house CF production since its business started. Currently, Taiwan has yet to be fully self-sufficient in terms of CF supply. Panel makers still rely at least in part on Japanese imports.

Starting from scratch in 2002, Taiwan's CF sector enjoyed high growth in 2003, but as expansion plans were mostly completed in 2004, there was only 31% growth during the year.

Chart 2: Taiwan-based CF makers' output 2002-2007 (k m²)

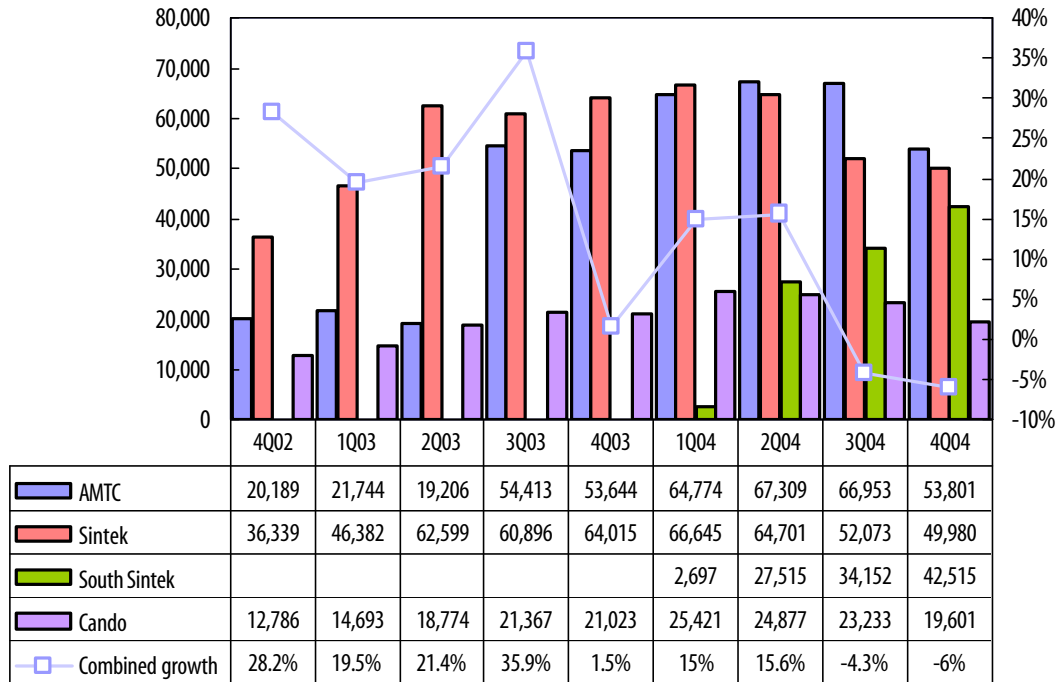


Note: LCD panel makers' in-house CF production not included

Source: DigiTimes Research, February 2005

South Sintek, a newcomer to the sector in 2004, will ramp up its production in 2005 as demand from clients grows. Sintek is expected to be able to double its shipments after completing its plan to merge with affiliate South Sintek. Cando's 4.5G line is scheduled to come online in the fourth quarter of 2005. AMTC has suspended its 6G project, planning to redirect investment into expanding its 5G line.

The growth in Taiwan-based CF makers' production value (calculated from revenues) began to decline in the second quarter of 2004. In the third quarter, growth fell below zero, and in the fourth quarter, it further dropped 13% over the third quarter. The quick decline was in line with the price drops hitting the LCD panel makers.

Chart 3: Taiwan-based CF makers' production value 4Q02-4Q04 (k US\$)

Note: Production value refers to makers' revenues; Cando's 2002 production value is a quarterly average.

Source: DigiTimes Research, February 2005

3.5G lines

AMTC is the only Taiwan-based maker who can supply small-to-medium-size CFs in volume. When it was established, AMTC received technological transfer from Toppan Printing, and its 3.5G line processing 620x750mm substrates was modeled on the Japan maker's H7 plant, which produced both small-to-medium-, and large-size CFs.

Sintek obtained its technology from Japan's Dai Nippon Printing (DNP), a company with a strong focus on large size applications. As a result, Sintek chiefly caters to notebook- and monitor-use panels, but it is also developing a 3.5G line for small-to-medium-size CFs.

Table 1: CF shipments from Taiwan's 3.5G plants in 2004 (k substrates [620x750m])

Sintek			AMTC			Cando		
Chief client	Monthly shipment	Max. monthly capacity	Chief client	Monthly shipment	Max. monthly capacity	Chief client	Monthly shipment	Max. monthly capacity
AUO	25-30	60	Quanta Display	30	70	AUO	50	60
Toppoly	20		AUO	25-30		Hydis	5-10	
CPT	10		Others	10-15		-	-	

Source: DigiTimes Research, February 2004

After its management was taken over by LCD panel maker AU Optonics (AUO) last year, Cando has enjoyed steady shipments. Its maximum monthly output in 2004 reached 60,000 substrates, of which 50,000 were shipped to AUO. Although Cando continues supplying to South Korea-based LCD panel maker BOE Hydis, shipments are limited. Cando once tried to develop small-to-medium-size CFs, but as its equipment was designed for large-size panels, it decided in the second half of 2004 to stay focused on notebook- and monitor-use CFs.

4-4.5G lines

The 4G and 4.5G lines of Sintek, AMTC, and Toppan CFI can all make smaller-size CFs. Sintek's 4.5G line, which can also process 4G and 3.5G substrates in 680x880mm and 620x750mm sizes respectively, had a maximum monthly output of 75,000 4G and 4.5G substrates in 2004, most which were shipped to HannStar.

AMTC's 4G line also processes 3.5G 620x750mm substrates for HannStar Display and Chunghwa Picture Tubes (CPT). AMTC's maximum monthly output at its 4G line in 2004 was 80,000 substrates. Toppan CFI operates two CF lines, numbered H10 and H11, at the Tainan TSP, the former being a 4.5G line supplying mainly to AUO and CPT, and the latter a 5G line.

Sintek			AMTC			Toppan CFI's H10 line		
680x880mm (4G), 730x920mm (4.5G)			680x880mm (4G), 620x750mm (3.5G)			680x880mm (4G), 730x920mm (4.5G)		
Chief client	Monthly shipment	Max. monthly capacity	Chief client	Monthly shipment	Max. monthly capacity	Chief client	Monthly shipment	Max. monthly capacity
AUO	10	75	Toppoly	20	80	AUO	40	90
Toppoly	20-25		HannStar	20		CPT	35	
HannStar	40		CPT	20-30		Toppan Printing	10-15	
-	-		Others	10-20		-	-	

Note: 4G and 4.5G plants also process smaller-size CF substrates.

Source: DigiTimes Research, February 2005

5G lines

South Sintek, a joint venture of HannStar and Sintek, was built with the aim to meet half of the demand from HannStar's 5G LCD panel-making plant at TSP. HannStar's 5G plant has a monthly capacity of 120,000 substrates, with half of the CF supply coming from in-house production. As South Sintek is merging with Sintek, the other half of HannStar's CFs will be coming from Sintek.

South Sintek's 5G line tested production in February 2004, with an initial yield of less than 10%. Not until May was South Sintek able to say its yield had reached 80%. Its May output also amounted to 35,000 substrates, half of the production line's full capacity of 70,000 substrates per month.

In the third quarter, however, declining prices began to take their toll on both HannStar and South Sintek. HannStar's 5G line, which suffered an extra blow because of equipment problems, saw its production drop drastically, which in turn caused a reduction in its CF demand from South Sintek. It is estimated that South Sintek's shipments to Hannstar for the third and fourth quarters amounted to only 65,000 and 70,000 substrates respectively.

HannStar's 5G LCD panel output rebounded to 42,000 substrates in January 2005, and was expected to reach 50,000 in February, more than double the 24,000 shipped in September 2004. The increase in HannStar's shipments came as good news for South Sintek. Meanwhile, South Sintek also has been actively developing new clients. It has shipped samples to AUO and Quanta Display.

Toppan CFI's H11 Plant suspended operation in December 2003 to make way for new equipment installation. It restarted production in February 2004, with an increase in monthly capacity to 85,000 substrates from the original 40,000.

Table 3: CF shipments from Taiwan's 5G plants in 2004 (k substrates)					
South Sintek			Toppan CF's H11 line		
1,200x1,300mm			1,100x1,250mm and 1,100x1,300mm		
Chief client	Monthly shipment	Max. monthly capacity	Chief client	Monthly shipment	Max. monthly capacity
HannStar	8-50	70	AUO	20-40	85
CMO	5-10		Quanta Display	20-40	
Quanta Display	1-2		Toppan Printing (OEM)	10-25	

Source: DigiTimes Research, February 2004

Next-generation CF production lines

As it is a growing trend among panel makers to run their own in-house CF production, dedicated CF makers are faced with a bottleneck in their development. They have become cautious about expanding beyond the 5G production.

As Taiwan-based panel makers will all have in-house CF production at their 6G plants, Sintek has said it will not rush to build a 6G CF plant, and AMTC has suspended its 6G project. Cando, now under the control of AUO, is focusing on expanding its 4.5G line, and it is unlikely to move on to build a next-generation CF plant. Toppan CFI, the Taiwan-based subsidiary of Toppan Printing, is the only exception: it is constructing a 6G CF line in Taiwan.

Table 4: Taiwan's 5G CF production and next-generation projects					
Company	Generation	Substrate size	Online time	Max. monthly capacity (substrates)	Note
AUO	5	1,100x1,250mm	4Q03	120,000	TFT-LCD panel makers' in-house facilities
	6	1,500x1,850mm	1Q05	120,000	
CMO	5	1,100x1,250mm	4Q03	120,000	
	5.5	1,300x1,500mm	1Q05	120,000	
HannStar	5	1,200x1,300mm	1Q04	60,000	
CPT	6	1,500x1,850mm	4Q05	45,000	
Sintek	6	Undecided	Undecided	Undecided	Project suspended
South Sintek	5	1,200x1,300mm	1Q04	60,000	To be merged with Sintek
AMTC	5	1,100x1,300mm	2Q06	Undecided	6G plant project suspended

Source: DigiTimes Research, February 2005

Polarizers

Optimax Technology is the only Taiwan-based maker that can volume produce polarizers for TFT-LCD panels. Daxon Technology's polarizer line for TFT-LCD panels has yet to start volume production. There is a third Taiwan-based polarizer maker, Jantex Technology, but it only makes polarizers for low-end twisted nematic (TN) displays.

Company	2002	2003	2004	2005	Application
Optimax	13,600	20,600	36,000	51,400	TFT, STN, TN
Jantex	750	750	4,000	4,000	TN
Daxon	0	0	4,000	4,000	TFT
Total	14,350	21,350	44,000	59,400	-
Y/Y combined growth	-	49%	106%	35%	-

Source: DigiTimes Research, February 2005

With all shipments going to the domestic Taiwan market, Optimax had a 50-55% share of the Taiwan market in 2004. The shipments represented a 29% share of the global market. Optimax's shares of the Taiwan market in 2002 and 2003 were 49% and 55% respectively, and its shares of the world market in 2002 and 2003 were 15% and 20% respectively.

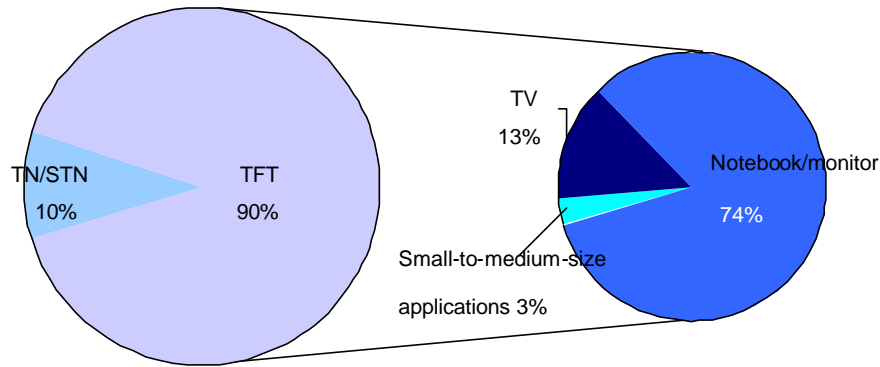
Optimax currently has five operational production lines, numbered L1 to L5. L1 caters to TN and STN panels, while L2 to L5 produce TFT-LCD-use polarizers. The capacity of its L6 line is yet to be in use, while its L8 line is expected to be ready to come online in April 2005.

In the fourth quarter of 2004, Optimax's monthly capacity for TFT-LCD-use polarizers amounted to 2.7 million square meters, but only 60% of the capacity was in use, processing substrates of about 1.4 million meters.

Production line	Monthly capacity (square meters)	Online	Width	Application
L1	300,000	May 1999	1,080mm	TN, STN
L2	420,000	May 2001	1,330mm	TFT-LCD
L3	420,000	March 2002	1,330mm	TFT-LCD
L4	580,000	Dec. 2003	1,330mm	TFT-LCD
L5	640,000	July 2004	1,470mm	TFT-LCD
L6	640,000	Planned for Nov. 2004, but delayed	1,470mm	TFT-LCD
L7	For experimental use	-	-	-
L8	640,000	April 2005	1,470mm	TFT-LCD

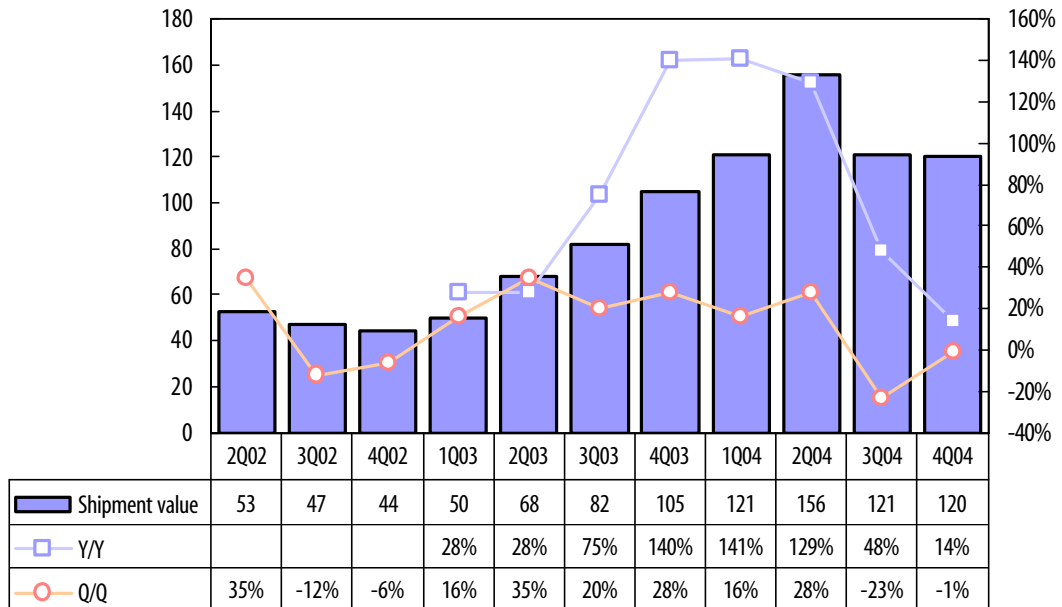
Source: DigiTimes Research, February 2005

In the fourth quarter of 2004, Optimax's shipments of TFT-LCD-use polarizers accounted for 90% of the company's entire shipment value. Of this 90 percentage points for TFT-LCD-use polarizers, 74 percentage points were for notebook- and monitor-use panels, and 13 percentage points for TVs.

Chart 4: Optimax's CF shipment value by application 4Q04

Source: DigiTimes Research, February 2005

To fend off Nitto Denko's pricing campaign in Taiwan in the fourth quarter, Optimax lowered the prices for its polarizers, resulting in on-quarter drops in both revenues and gross margins.

Chart 5: Optimax's polarizer shipment value 2Q02-4Q04 (m US\$)

Source: DigiTimes Research, February 2005

Optimax may not be able to clear its inventory until after the second quarter of 2005 because of the LCD sector's slow recovery from the doldrums. However, it already received more orders in January over December. It hopes to minimize polarizer price drops to within 10% for 2005.

Triacetyl cellulose (TAC) films

Fujifilm has 80% of the TAC (a chief component for polarizers) world market, and is investing 100 billion yen to build a new plant making the material. Construction of the new plant is scheduled to begin in 2005, and it will be operational at the end of 2006.

Fujifilm currently has two plants in Japan. The company's TAC outputs in 2003 amounted to 180 million square meters, and reached 280 million square meters in 2004. The new plant's initial annual output will be 50 million square meters, ramping up to 300 million square meters in 2010. Fujifilm's total capacity in 2010 is expected to reach 600 million square meters, more than double the capacity of 2004.

As current TAC output is limited, suppliers impose a quota system that forms a barrier to newcomers to the polarizer sector. However, when Fujifilm's plants reach their full capacities, the game may be played in a different way.

Backlight modules

Radiant Opto-Electronics, the largest backlight module maker in Taiwan, has the facilities to make its own plastic injection molds and light guide panels. Its shipments are chiefly higher-margin notebook-use modules. Monitor-use backlight modules, whose margins are slim because of fierce competition, are only a minor business for Radiant. The company is expanding production of LCD-TV-use backlight modules. Except for its LCD-TV-use backlight module production line, Radiant has moved its other production lines for notebook- and monitor-use backlight modules to China.

Coretronic chiefly supplies backlight modules for monitors, but LCD-TV-use backlight modules account for 20% of its backlight module shipments, a higher proportion than any other Taiwan maker.

Forhouse makes backlight modules solely for monitors, and 90% of its shipments are delivered to AUO. As its subsidiary in China came online in the third quarter of 2004, Forhouse's revenues grew substantially in the fourth quarter. Forhouse is also developing new clients, with Quanta Display possibly being one of them.

Monitor-use backlight modules are K-Bridge's chief products, followed by notebook-use backlight-modules. K-Bridge started delivering samples of LCD-TV-use backlight modules in the beginning of 2005.

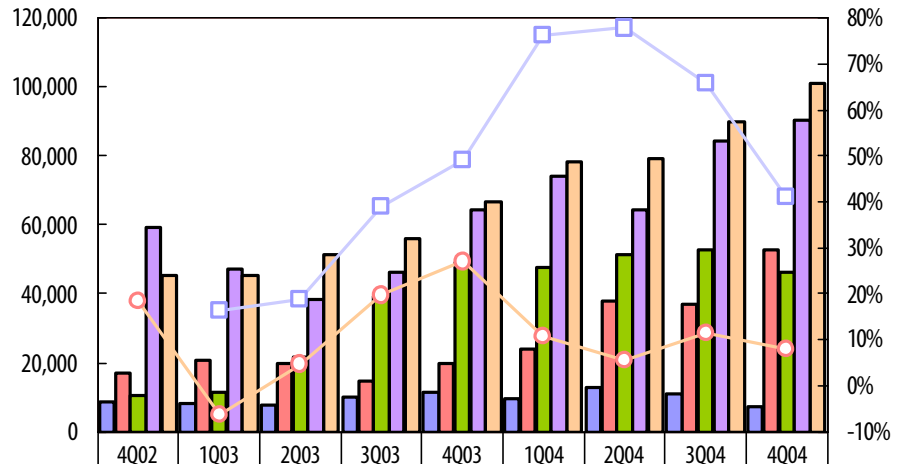
Company	Monthly output (k units)	TV	Notebook	Monitor	Others	Chief client
Radiant	1,500	5%	60%	25%	10%	CMO, CPT, HannStar, AUO, QDI
Coretronic	1,400	18%	30%	50%	2%	CMO, AUO, HannStar
Forhouse	800	0%	0%	100%	0%	AUO, CPT, Sanyo
K-Bridge	600	0%	20%	70%	10%	CPT, QDI, AUO, Fujitsu, Sharp

Source: DigiTimes Research, February 2005

As backlight-module making is a labor-intensive sector, Taiwan makers' expansion projects mostly take place in China to take advantage of the cheap labor there, and to shorten delivery time to LCD module (LCM) plants in China.

The business of the backlight-module sector is tied up with the fast growing TFT LCD sector. As LCD prices continue dropping, revenues for backlight-module makers are expected to decline in 2005.

Chart 6: Taiwan backlight module makers' shipment value 1Q02-4Q04 (k US\$)



Forward Electronics	8,702	8,198	7,848	9,896	11,424	9,422	12,646	11,071	7,108
Forhouse	16,973	20,513	19,776	14,547	19,725	24,179	37,976	36,806	52,691
K-Bridge	10,830	11,387	21,804	39,473	49,195	47,521	51,433	52,986	46,447
Coretronics	59,426	47,076	38,207	46,140	64,226	74,289	64,428	84,411	90,457
Radiant	45,534	45,421	51,187	56,065	66,483	78,400	79,406	89,976	100,941
Y/Y combined growth		16.4%	18.9%	39%	49.2%	76.3%	77.8%	65.7%	41%
Q/Q combined growth	18.3%	-6.3%	4.7%	19.7%	27%	10.8%	5.6%	11.5%	8.1%

Source: DigiTimes Research, February 2005