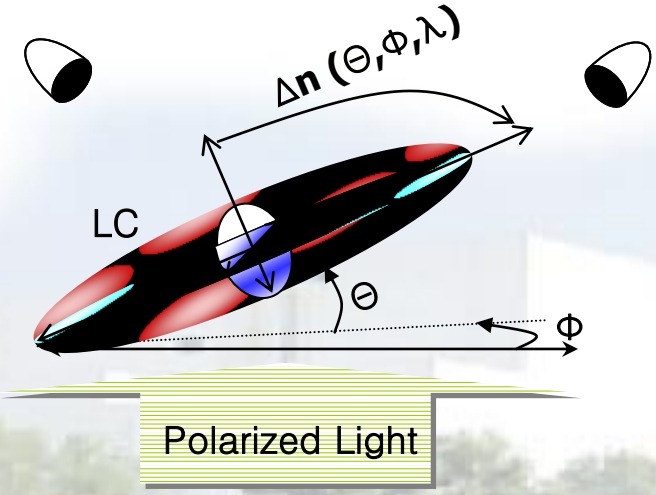
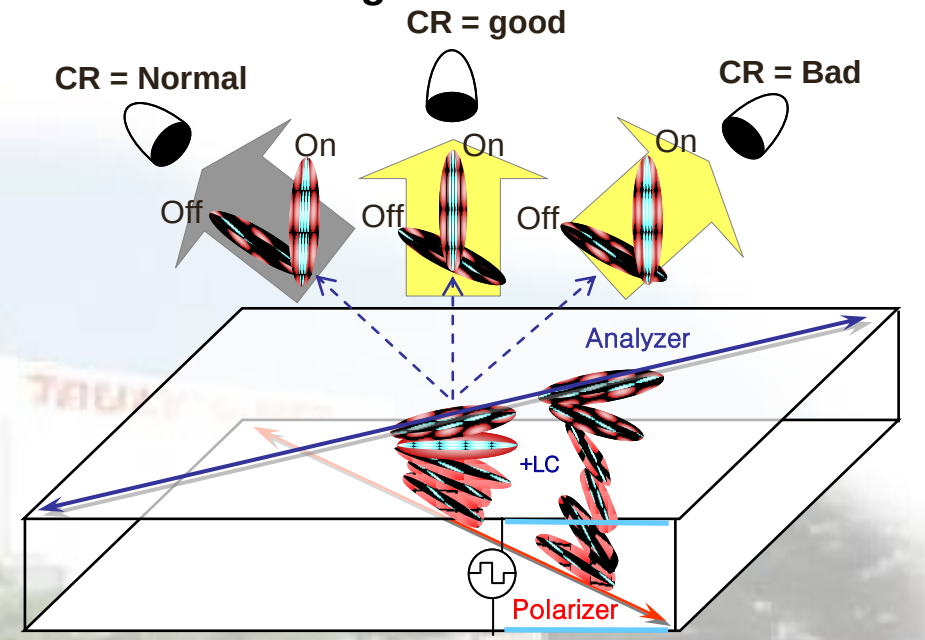
TFT New Technology Introduction
AFFS = Advanced Fringe Field Switching

Viewing Angle Problem of LCD

- Narrow Viewing Angle due to
- 1) Anisotropy of liquid crystal (Δn, Δε)
- 2) Different Transmittance with view angle
- 3) Imperfect light control by Polarized and Refracted Light





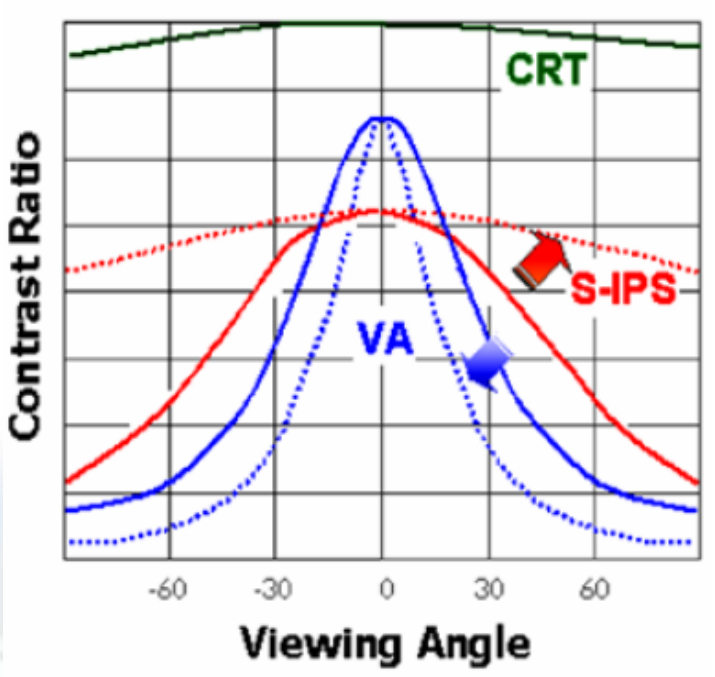
To Solve these problems,

*** In Plane Driving such as FFS, IPS**

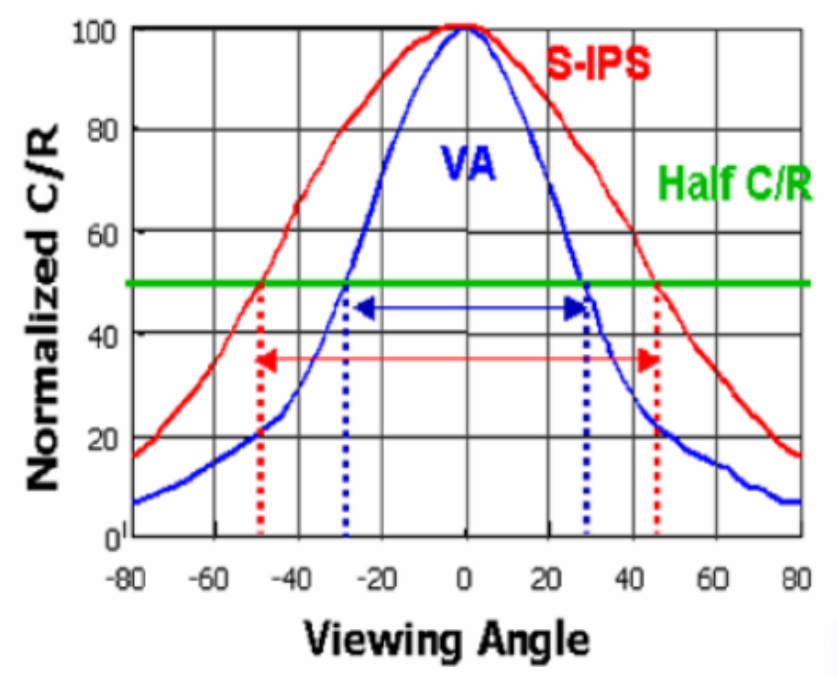
*** VA, OCB… with Compensation Film**

*** Dual ~ multi domain**

Contrast Ratio with View Angle



[Contrast Ratio]

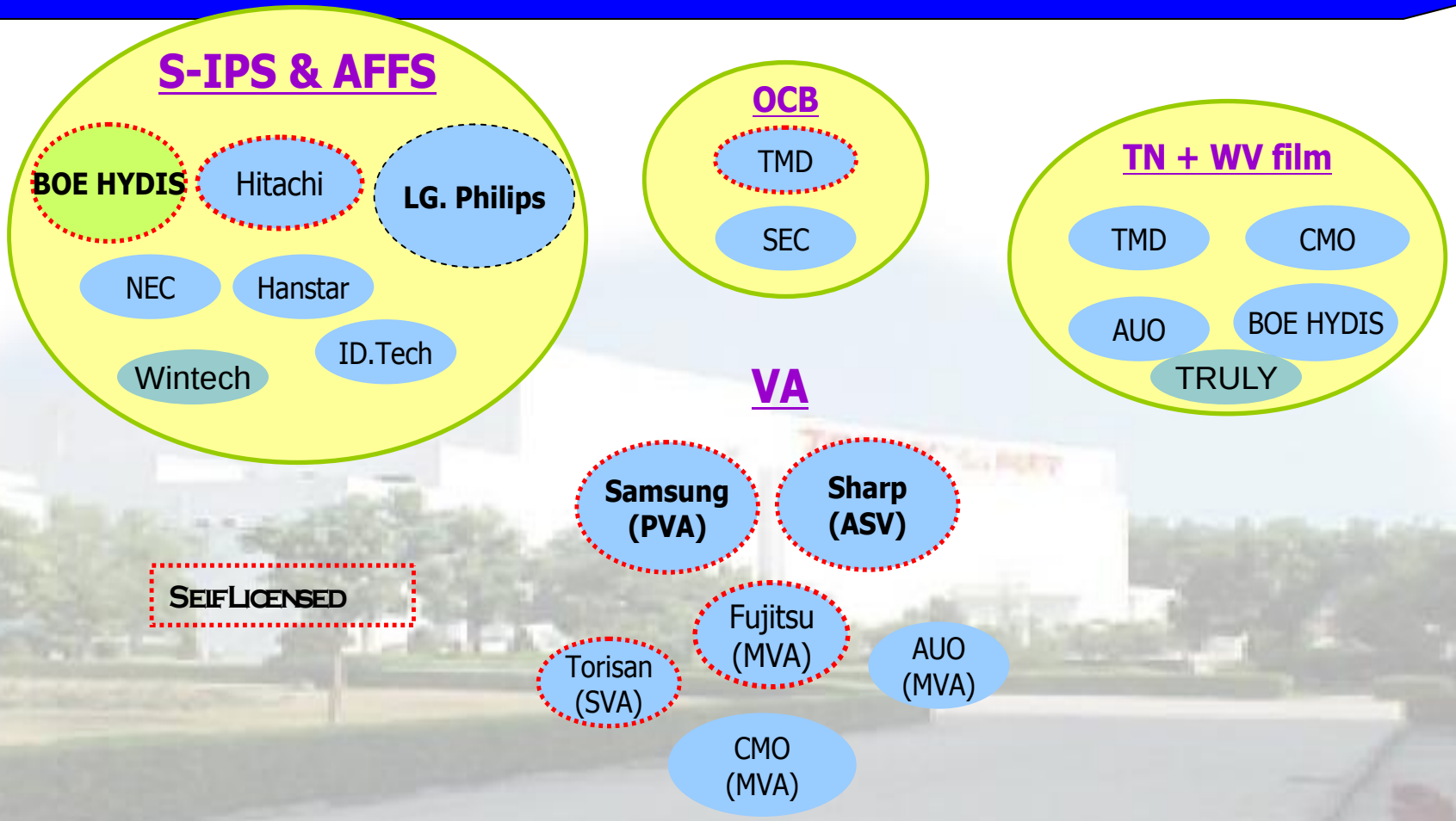


[Half Contrast Ratio]

IPS mode : Slight dependency of Contrast Ratio (G127/G63)
VA mode : Steep decrease with increasing viewing angle
Half Contrast Ratio of IPS mode is much wider than that of VA mode

Trend of Wide View Technology

The Main Stream of Wide View Technology is IPS Camp & VA Camp

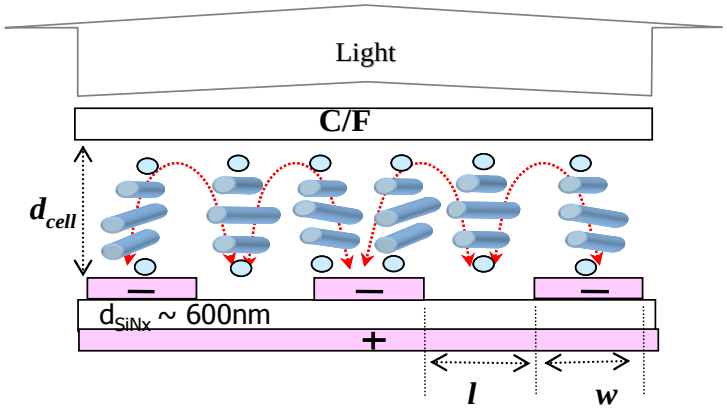


Mode Comparison of AFFS and Others

Transmittance
$= T_o \sin^2 2\Phi \sin^2(\pi d \Delta n/\lambda)$

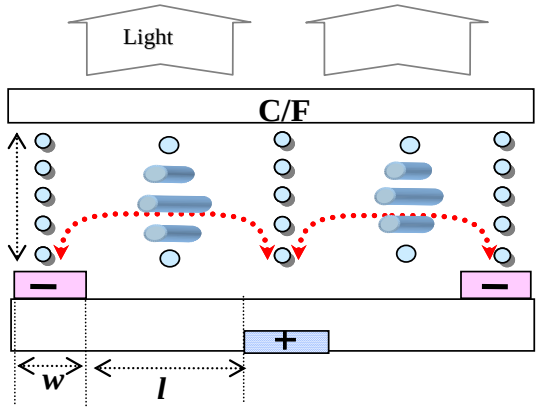
Electric Field
Metal electrode
ITO electrode

AFFS (Adv. Fringe Field Switching)



- High Transmittance (Transparent Electrode)
- Low_ Driving Voltage & _Power Consumption
- Higher Contrast Ratio
- **Co-plane Fringe Field (Ey, Ez)**

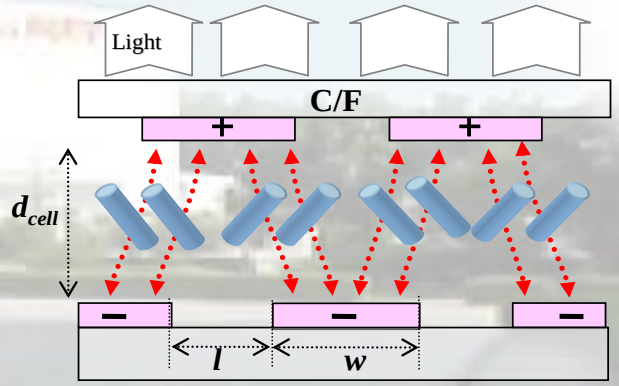
S-IPS (In Plane Switching)



- Higher_ Driving Voltage & _ Power Consumption
- **Higher Contrast Ratio**
- **Vertical Field (Ez)**

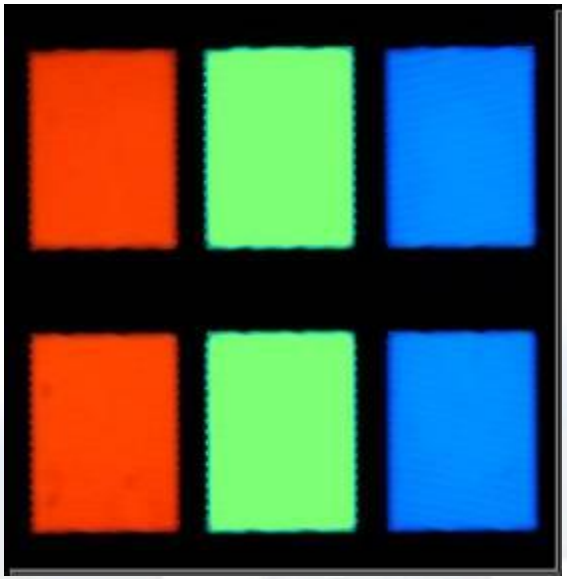
$d_{field} > 3.5\mu m$ (d_{cell})

PVA (Vertical Alignment)

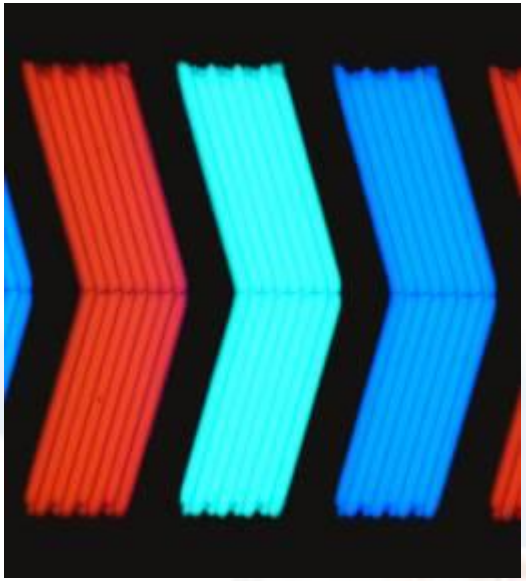


Pixel Image Comparison of AFFS and others

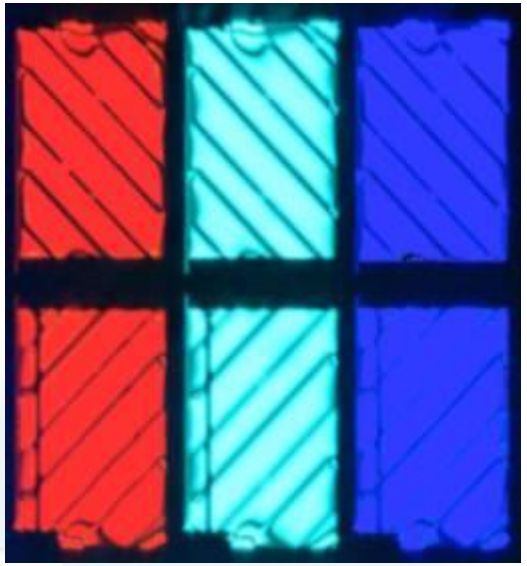
AFFS



AS-IPS

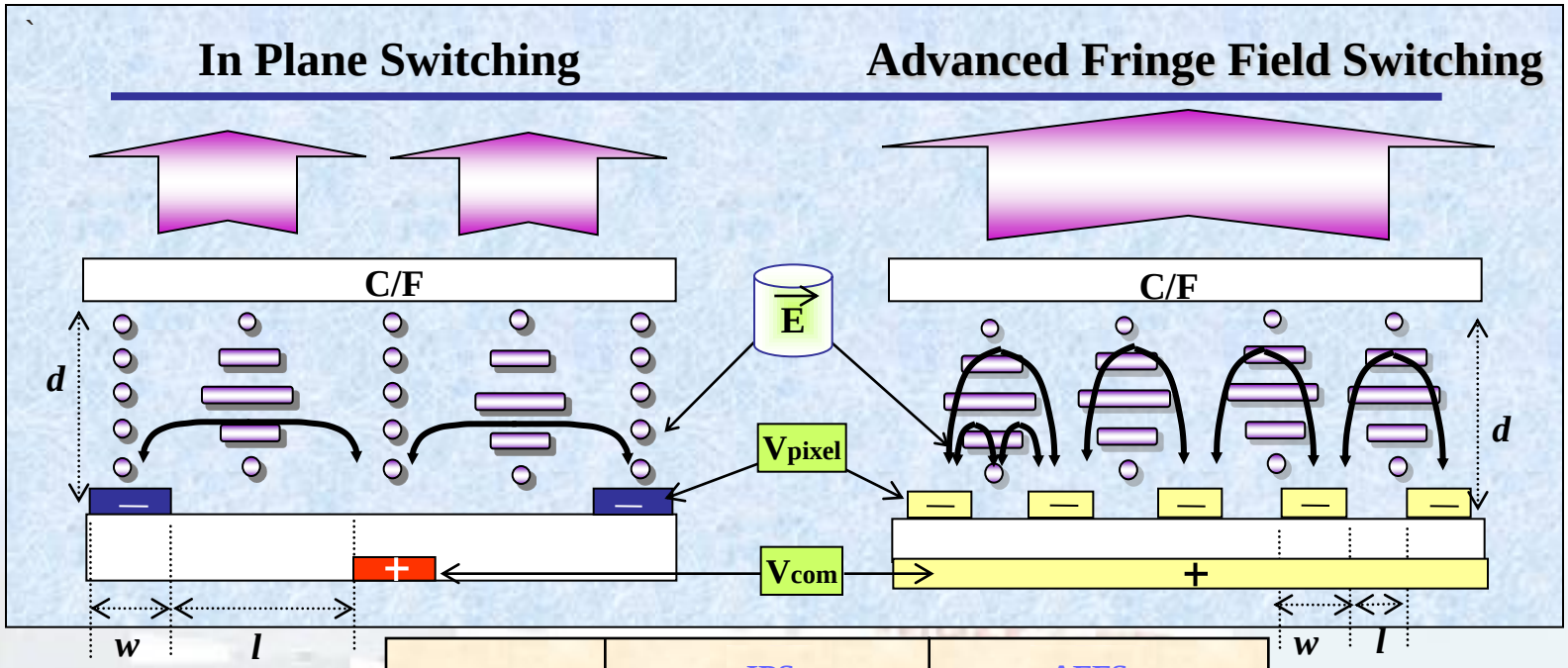


S-PVA



	AFFS (measured)	AS-IPS(S-IPS) (Reference)	S-PVA(PVA) (Reference)
	Clean Image Vivid Moving Color	Good Color High Dynamic CR	High Static CR Fast on/off
Transmittance	5%	3.8%(<3.4%)	4.9%(4.1 %)
Contrast Ratio	~800:1	~650:1	~900:1

Feature of AFFS vs. IPS

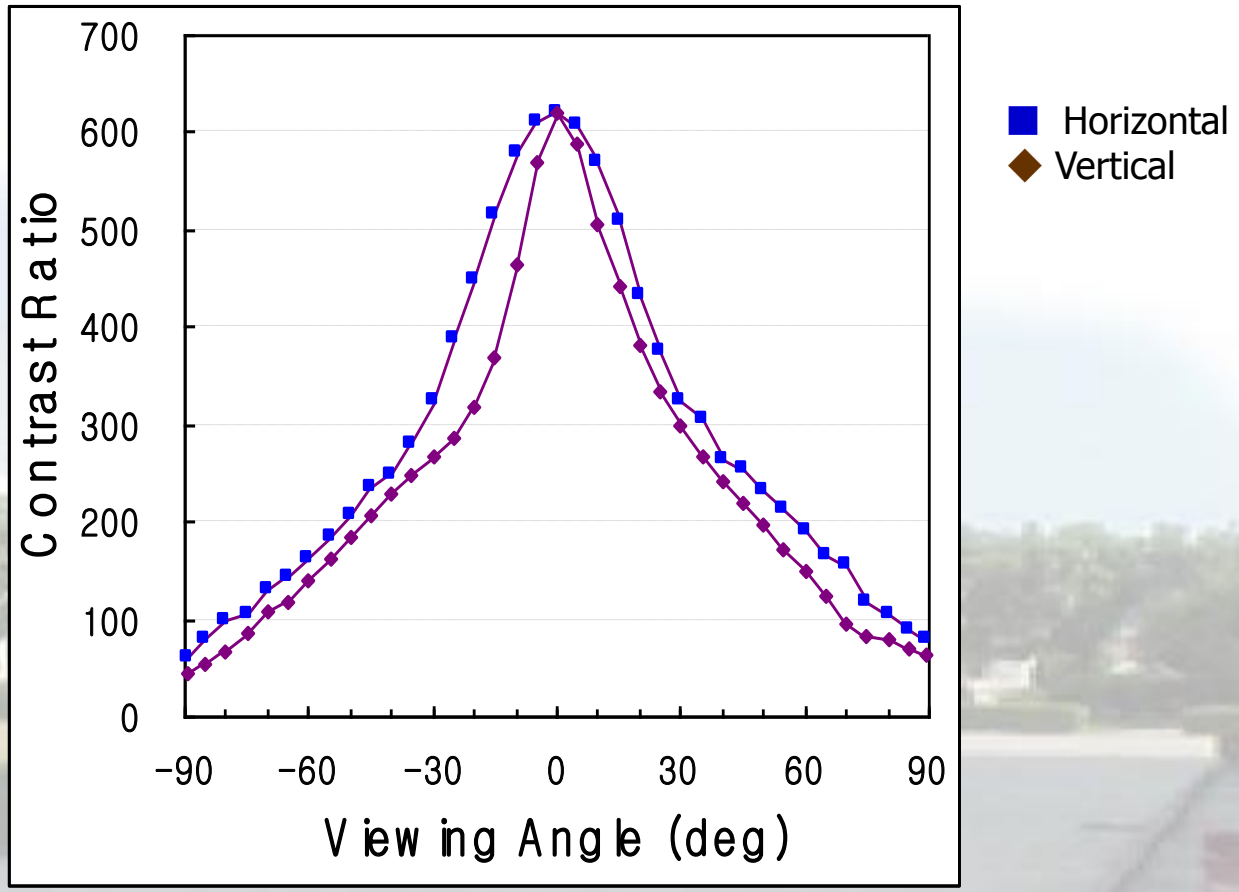


	IPS	AFFS
l/d	>1	≤ 1
l/w	>1	≤ 1
Field	Ey (In Plane)	Ey, Ez (Fringe Field)
Electrodes	Metals	Folded ITO

- AFFS : High Transmittance by transparent electrode and low Vop
- IPS: Low Transmittance by metal electrode and high Vop

Wide View & High CR at any Point

AFFS can make High CR & Wide View at any Point without any other Tech.



Low Driving Voltage

The Lowest Driving Voltage among the other Normally Black modes
AFFS → Low Power Consumption

AFFS → Drive IC 20~30% Cost competitiveness from Low driving Voltage

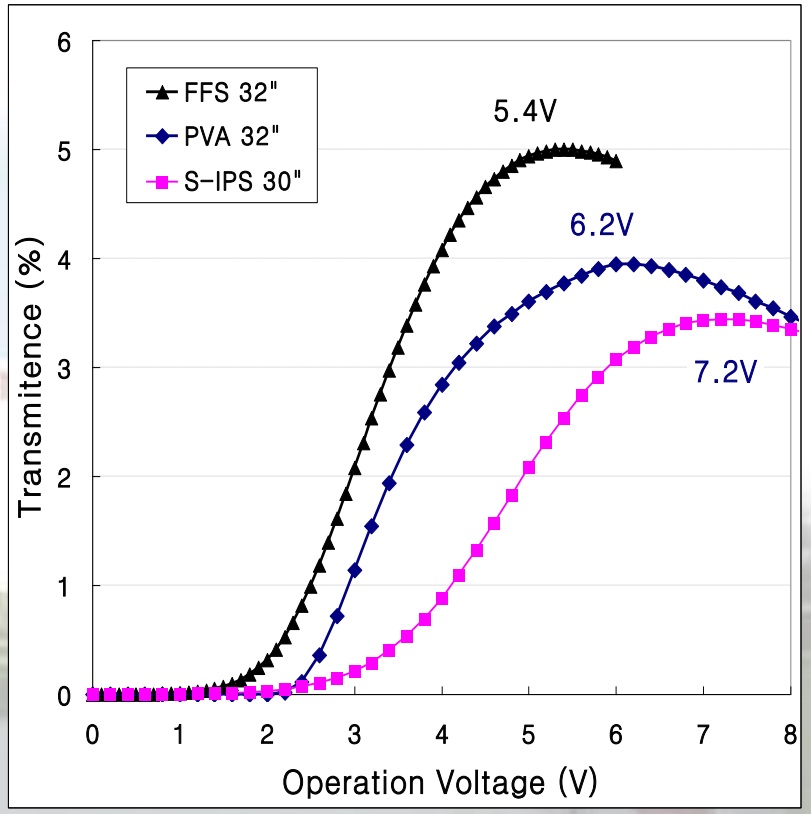
Advantage of AFFS(Low Driving)

Tech	AVDD	Chip Size	Price	IC Power
AFFS	<12V	100%	100%	-60%
S-IPS	<15V	120%	120%	80%
PVA	<18V	140%	140%	100%

- More Shrinkage Drive IC than High Voltage Drive IC
  - Cost competitiveness by 10~20%

Operation Voltage

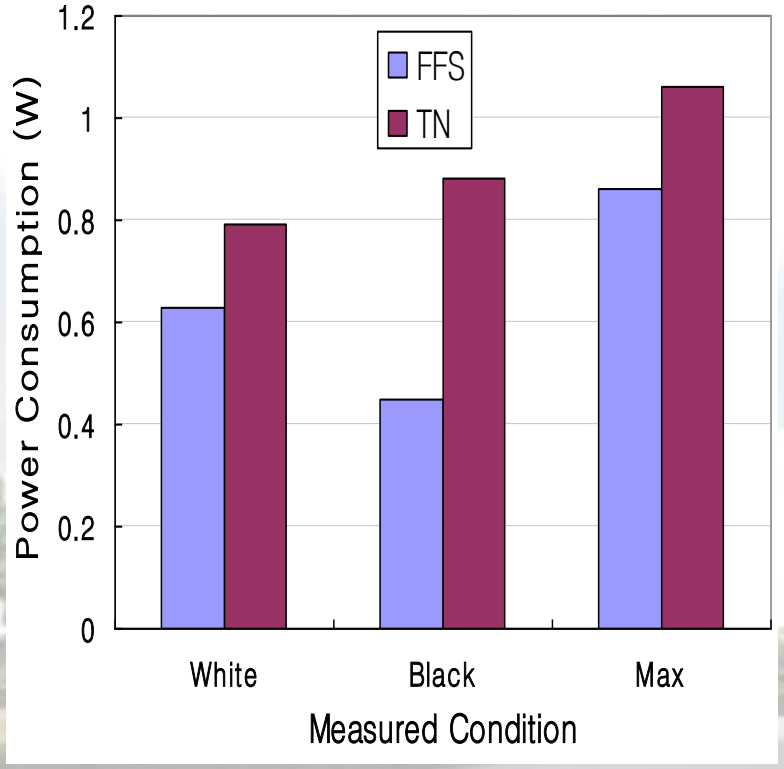
AFFS → Need 12V Drive IC (Low Driving)
→ Low Power Consumption
S-IPS, VA → Need 15~18V IC (High Driving)
→ Power Consumption Increase



Low Power Consumption

Power consumption of 12.1” XGA with AFFS is 20% lower

⇒ Maximize Portability & Green Compliance



Comparison of the power consumption AFFS vs TN (in 12.1” XGA)

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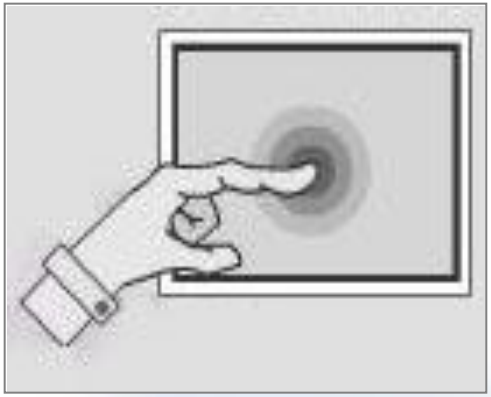
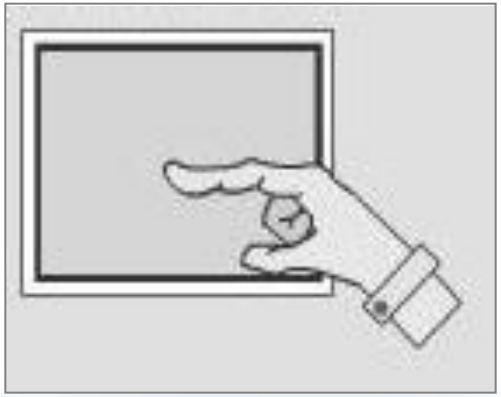
Co-plane aligned LC molecules leave no ripples when the display is touched and pressurized



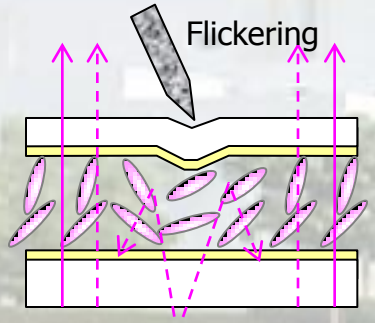
Other Display (TN, VA…)



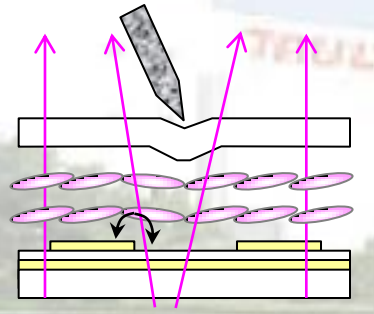
AFFS Display

Pooling (Pen Pressing)

Cause of Ripple/Pooling Free



Distorted LCs can't be recovered By the propagation of E field via vertical electrode, low field and vertical align.~ 0.8V/μm



Distorted LCs can be fast recovered by high fringe electric (magnetic) field and horizontal alignment ~ 6.2V/μm (IPS ~ 0.8V/μm)

Pooling (pushing) Trace ⇒ Disappear

weighting of 500g	White	Black
*Normally White (TN)	< 1s	> 2s
*Normally Black (VA, IPS)	< 3s	<1s
***AFFS Mode**	**<1s**	**<1s**

Thanks!