

Part 2/2

LC-Displays – Digression in monochrome technologies

ADKOM™ Elektronik GmbH

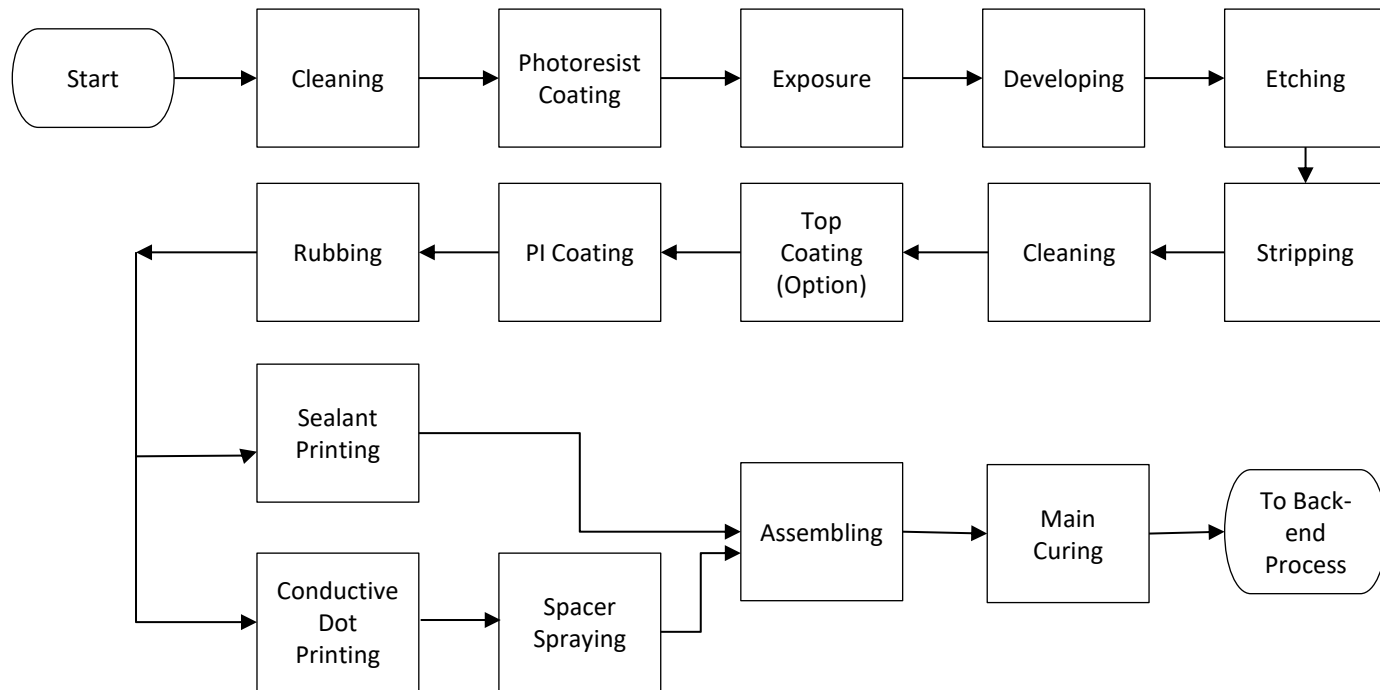
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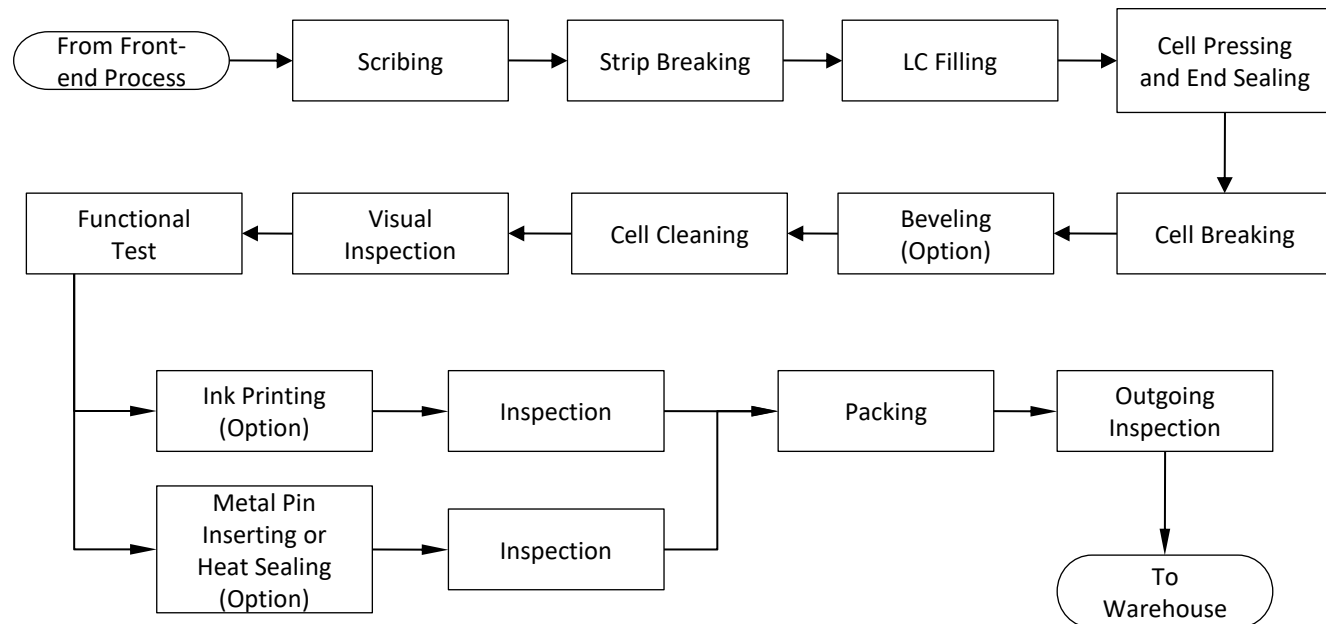
The work steps of an LCD production (example)

1. Section = Front End = Glass processing



The work steps of an LCD production (example)

2. Section = Back End = Assembly LCD



Summary / Technology overview

LCD Technology	LC Twisted Angle	Description	Application
TN (Twisted Nematic)	90°	Ideal for segment type applications. Available in low driving voltage, high contrast ratio and low cost. However, viewing angle and multiplex driving ratio is limited.	Calculator; Time piece; Industrial instrument; Home appliances.
HTN (High Twisted Nematic)	110°	HTN offers a greater viewing angle than TN technologies; Multiplex ratio can be achieved up to 1/16.	Communication; Industrial instrument.
STN (Super Twisted Nematic)	240°- 270°	Greater viewing angles can be provided and high multiplex ratio are achievable. This technology is normally available in yellow-green or grey background with blueish segments.	Various application.

Summary / Technology overview

LCD Technology	LC Twisted Angle	Description	Application
FSTN (Film Compensated STN)	240°- 270°	Encompasses the advantage of STN, FSTN can obtain a black segments on white background result (or white segments on black background in negative mode). Suitable for high multiplex ratio up to 1/240.	Various application.
FFSTN (Film-Film Compensated STN)	240°- 270°	FFSTN can provide a better performance than FSTN, especially in negative mode.	Automotive; Dash board.
ASTN (Advanced STN)	240°- 270°	Minimize the background color deviation at different temperature by using special compensation film. Normally use in automotive product.	Automotive; Dash board. High temperature application.

Summary / Technology overview

LCD Technology	LC Twisted Angle	Description	Application
DSTN (Double STN)	240°- 270°	DSTN is a double layer LCD. A second inactive STN LCD panel is added to the original display, which can be used in high temperature environment without color shifting.	Automotive; Dash board; Instrument that work in high temperature environment.
ABN (Advanced Black Nematic, so called VA)	N/A	Very good contrast ratio. Usually apply in negative mode. Low multiplex ratio and blind spot occurs at counter optimum viewing angle.	Automotive; Dash board; Industrial instrument.

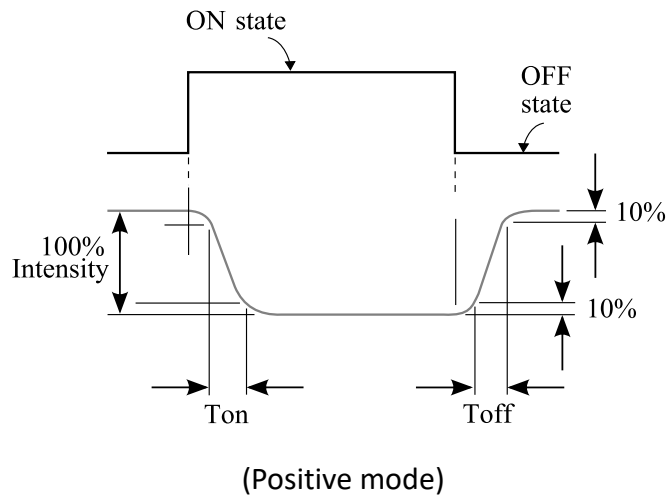
Performance overview

Technology	Contrast ratio	Response time	Viewing angle	Cost
TN	O	OOO	OO	O
HTN	OO	OOO	OO	O
STN	OOO	OO	OOO	OO
FSTN	OOO	OO	OOO	OOO
FFSTN	OOOO	OO	OOO	OOOO
ASTN	OOOO	OO	OOO	OOOO
DSTN	OOOO	OO	OOO	OOOO
ABN	OOOOO	OOOOO	OOO	OOO

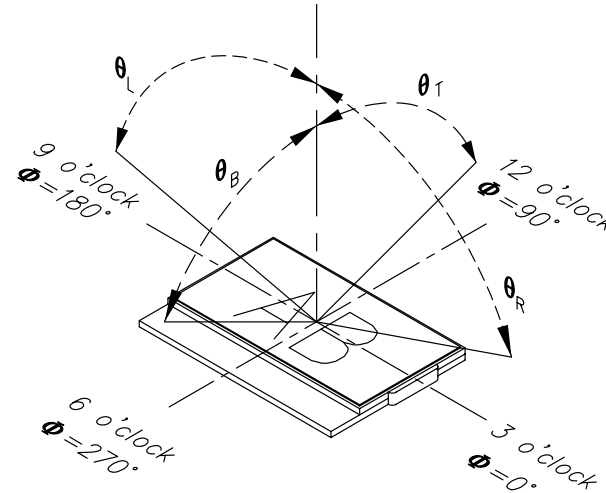
O = Reasonable performance; low cost

OOOOO = Best performance; high cost

Information to response time and viewing angle



Definition of the response time



Definition of viewing angle

Measured values to response time and viewing angle

	Symbol	Unit	TN	HTN	STN	FSTN
Contrast ratio (CR)			5~10	5~10	5~13	5~13
Response time	Ton	msec	100	150	200	200
	Toff	msec	100	100	250	250
Viewing angle CR>2	θ_T	deg	30	35	40	40
	θ_B	deg	15	20	30	30
	θ_L	deg	30	45	60	60
	θ_R	deg	30	45	60	60
Operating temp range		°C	-30~80	-30~85	-20~70	-20~70
Storage temp range		°C	-40~90	-40~90	-30~80	-30~80
Duty ratio			≤1/8	≤1/16	≤1/240	≤1/240

All information to Contrast rates and response times are measured at + 25° C.

Measured values to response time and viewing angle

	Symbol	Unit	FFSTN	ASTN	DSTN	ABN
Contrast ratio (CR)			20~40	40~60	40~50	800~1000
Response time	Ton	msec	200	200	200	80
	Toff	msec	250	250	250	80
Viewing angle CR>2 (for VA, CR>50)	θ_T	deg	40	40	40	40
	θ_B	deg	30	30	30	20
	θ_L	deg	60	60	60	60
	θ_R	deg	60	60	60	60
Operating temp range		°C	-20~70	-30~85	-30~85	-30~85
Storage temp range		°C	-30~80	-40~90	-40~90	-40~90
Duty ratio			≤1/240	≤1/240	≤1/240	≤1/32

All information to Contrast rates and response times are measured at + 25° C.

Viewing angle are defined at 12 o'clock.

The adjoining listed parameters are just average values.

Our elaboration does not raise that entitlement to Completeness.

For special requirements please contact our sales team.