

## Industrial Solutions Flatpanel Technology

### DESIGN FOR TFT COLOR LCD MODULE

Design No.	doh116_150
<b>Revision</b>	<b>i-sft ↔ Rev. 0.3</b>
Type	15" 1024 x 768
	SPECIFICATIONS
Version	Internal Revision 0.2
Date	07.09.2005
Preliminary <input checked="" type="checkbox"/>	
Final <input type="checkbox"/>	

**This typical design can be used to manufacture dedicated products at i-sft according to the mentioned specification. Please send us a RFQ for this design and stating the number of displays to be build. We will send a formal quote including a final specification. With your formal order please also send a written approval of the final specification. No further activities will start before formal order is processed and written approval of final specification is in!**

## Records of Revisions

<b>Revision</b>	<b>Date</b>	<b>Description</b>
<b>0.1</b>	Jun. 2005	First Draft
<b>0.2</b>	July 2005	E. Proposal
<b>0.3</b>	Sep 2005	E. Proposal

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## 1 DESCRIPTION

**I-SFT doh116\_150** is a TFT(thin film transistor) active matrix color liquid crystal display (LCD) comprising amorphous silicon TFT attached to each signal electrode, a driving circuit.

**I-SFT doh116\_150** is a **i-sft** GmbH specific design consisting out of a **i-sft** GmbH specific third party manufactured LCD-Glass-Matrix with backlight (which is NOT available in retail), a specific backlight to drive the panel to surface 1600 nit and an integrated inverter. This model is fixed at 500nit.

The 15 inch diagonal display area contains 1024x768 pixels and can display 16.777.216 colors. 6 o'clock direction is the optimum viewing angle.

This custom made model will be delivered with a DVI-I Controller-Card and temperature controlled fans. These units are separately mounted on the back of the Display.

The brightness is adjusted to 500cd/m<sup>2</sup> and same special parts are additional saved for shock and vibration.

## 2 FEATURES

15" (diagonal)display area	Long life lamp system with 6 tubes
High brightness	Color temperature 9000K
High Contrast ratio	Integrated Inverter
Low power consumption	Extended Temperature Range
XGA physical resolution (1024x768)	Rugged System (Shock, Vibration)
Added DVI-I interface system	

## 3 APPLICATIONS

Industrial application

POI / POS

## 4 STRUCTURE AND FUNCTIONS

A TFT color LCD module comprises a TFT LCD panel, LSIs for driving liquid crystal. The TFT LCD panel is composed of a TFT array glass substrate superimposed on a color filter glass substrate with liquid crystal filled in the narrow gap between two substrates.

RGB (Red, Green, Blue) data signals are sent to LCD panel drivers after modulation into suitable forms for active matrix addressing through signal processor.

Each of the liquid crystal cells acts as an electro-optical switch that controls the incident light transmission by a signal applied to a signal electrode through the TFT switch.

The user interface is usual DVI-I (VGA and Digital Video Interface). The i-sft converter card is designed to convert the input signals to high quality digital flat panel output signals. The integrated auto-sampling feature scale the input signals automatically to the flat panel resolution, in this case to 1024\*768 pixel. The sophisticated auto-tracking and auto-phasing logic adjust the input picture automatically to the flat panel resolution and timing, no manual picture positioning adjustment is necessary.

## 5 OUTLINE OF CHARACTERISTICS

Activ area	304.128 mm(H) × 228.096 mm(V)
Drive system	a-Si TFT active matrix
Display colors	16.777.216 colors
Number of pixels	1024 × 768
Pixel arrangement	RGB, vertical stripe
Pixel pitch	0.297 mm(H) × 0.297 mm(V)
Module size	353.7 mm(H) × 264.0 mm(V) × 47.80 mm(D)
Weight	2850 g (typ.)
Luminance	500 cd/m <sup>2</sup> customer requirement ( max. 1600cd/m <sup>2</sup> )
Contrast ratio	350:1 (typ.)
Response time	45 ms (typ.), "white" to "black"
Signal system	DVI – I (VGA and Digital Video Interface are implemented)
Supply voltage	24 VDC for integrated Inverter & controller
Scanning direction	vertical scanning is normal Horizontal scanning is normal
MTTH	50.000 hours (Meantime to half brightness)

## 6 RESOLUTION

Resolution	Hz	
640 x 480	60	
640 x 480	67	
640 x 480	72	
640 x 480	75	
720 x 400	70	
720 x 400	88	
800 x 600	56	
800 x 600	60	
800 x 600	72	
800 x 600	75	
1024 x 768	60	phys. resolution
1024 x 768	70	phys. resolution
1024 x 768	75	phys. resolution
1024 x 768	75	phys. resolution

The integrated DVI-I controller has a DDC module for the recognition of the automatic Plug and Play function.

For other resolutions the display has auto-scaling.

## 7 SPECIFICATIONS

### 7-1 GENERAL SPECIFICATIONS

Item	Specifications	Unit
Module size	264 (H) × 353.7 (V) × 47.8 (D)	mm
Active area	304.128 (H) × 228.096 (V)	mm
Number of pixels	1024×3 (H) × 768 (V)	pixel
Pixel pitch	0.297 (H) × 0.297 (V)	mm
Pixel arrangement	RGB (Red, Green, Blue) vertical stripe	-
Display colors	16.7 mio	color
Weight	2850 (typ.)	g

#### 7-1-1 Connector

Type	Item	Pin assignment
Molex 39-29-1027	Power connector	Pin 1 = Vin Pin 2 = GND
DVI-I connector	Standard DVI-I	DDWG Rev. 1.0

### 7-2 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Ratings	Unit	Remarks
Supply voltage	V <sub>inv</sub>	typ. 24 VDC	V	T <sub>a</sub> = 25°C
Storage temp.	T <sub>st</sub>	-25 to 75	°C	
Operation temp.	T <sub>op</sub>	-10 to 65 *1	°C	at max 500cd/m <sup>2</sup>
Shock (operating)		35g / 6ms (Shock 30g / 18ms) *2		
Vibration (operating)		3g / 10 to 2000 Hz (Vibration 0,7mm (pp) / 0-50Hz; 5g / 50 - 500Hz) *2		

\*1: measured at center display area (Front side)

\*2 : E. spezifikation with E. - Frame EC 001119:



### 7-3 ELECTRICAL CHARACTERISTICS

(1) Logic, LCD driving

Ta = 25°C

Parameter	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply voltage	Vin	22.8	24	25.2	V	500cd/m <sup>2</sup>
Supply current	Iin	-	1.45 *1	-	A	

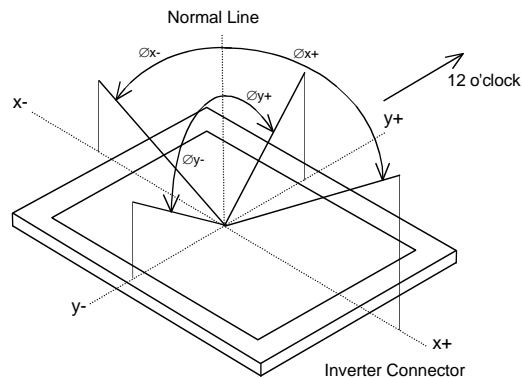
\*1 please notes that the peak current / inrush current are max 2.7A.

### 7-4 OPTICAL CHARACTERISTICS

Ta = 25°C ± 5°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing angle range	Horizontal	∅x+	CR>10, ∅y = ±0°	-	80	-	deg.	note 1
		∅x-	CR>10, ∅y = ±0°	-	80	-	deg.	note 1
	Vertical	∅y+	CR>10, ∅x = ±0°	-	60	-	deg.	note 1
		∅y-	CR>10, ∅x = ±0°	-	60	-	deg.	note 1
Contrast ratio	CR	∅y=0°, ∅x=±0°	-	350	-	-	note 2	
Response time	tpd	white to black	-	45	-	ms	note 3	
		black to white	-	45	-			
Luminance (center of screen)	Lw	at center		500		cd/m <sup>2</sup>	note 4	

note 1: Definitions of viewing angle are as follows. (matrix facing up, connector on the right side)



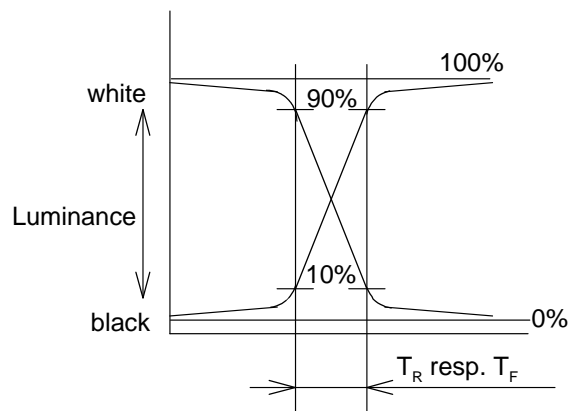
note 2: The contrast ratio is calculated by using the following formula:

$$\text{Contrast ratio} = \frac{\text{Brightness (Luminance) with all pixels in "White"}}{\text{Brightness (Luminance) with all pixels in "Black"}}$$

the brightness is measured in darkroom.

note 3: Definition of response time is as follows.

Photodetector output signal is measured when the brightness changes "white" to "black". Response time is the time between 10% and 90% of the photodetector output amplitude.



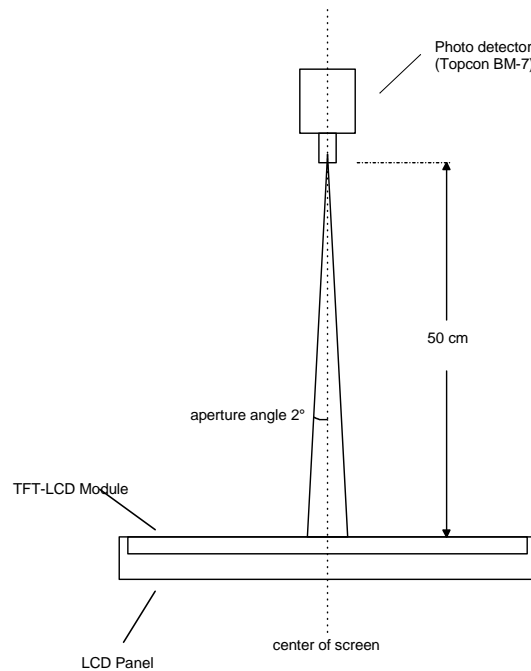
note 4: Brightness measurements setup.

Measurement should be executed in a dark room 30 min.

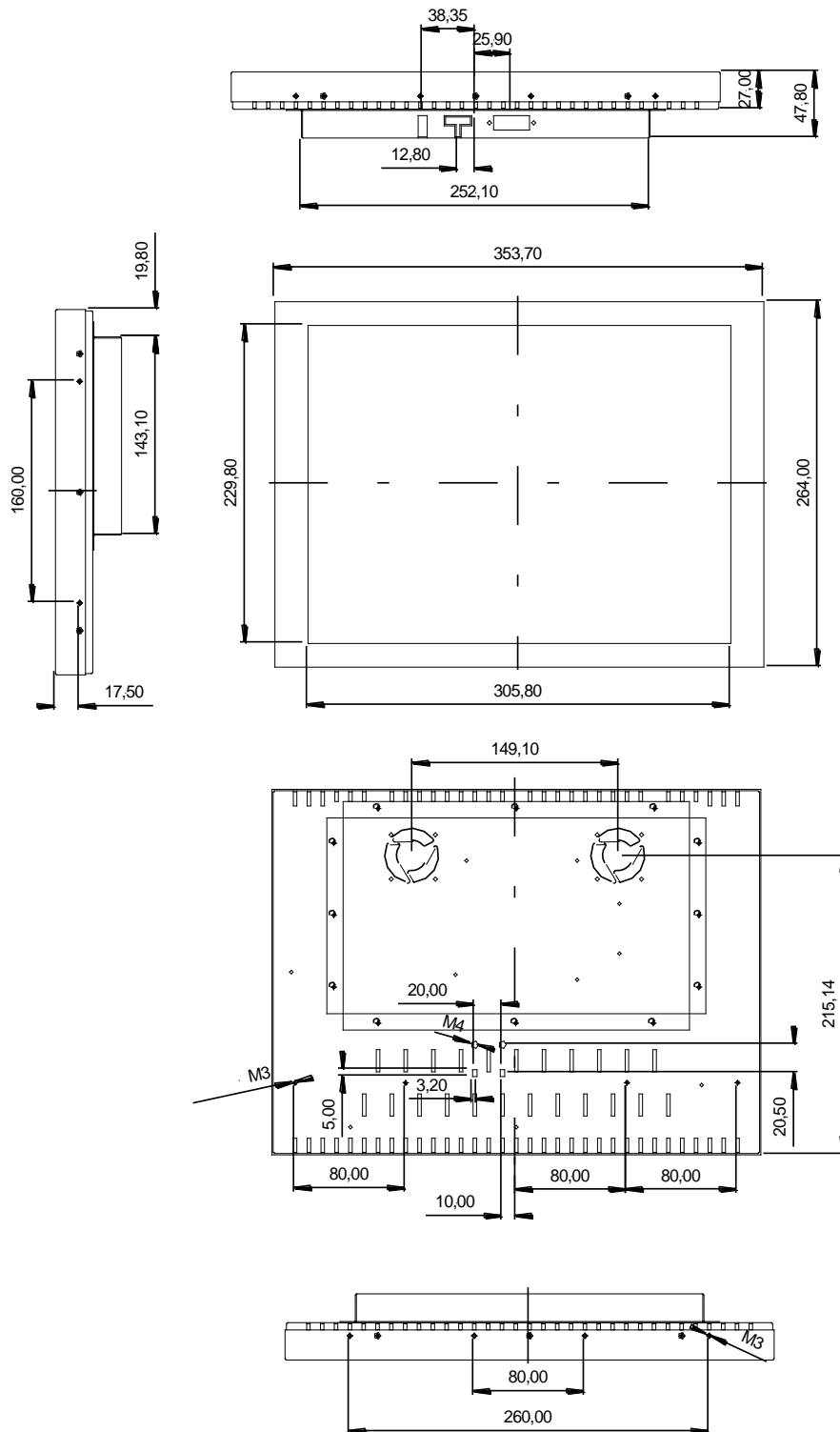
After lightning the backlight. Matrix: off state.

The brightness is measured in the center of the screen.

Environment condition:  $T = 25 \pm 2 \text{ }^\circ\text{C}$ , it has to be assured that a sufficient heat flow / air circulation is given

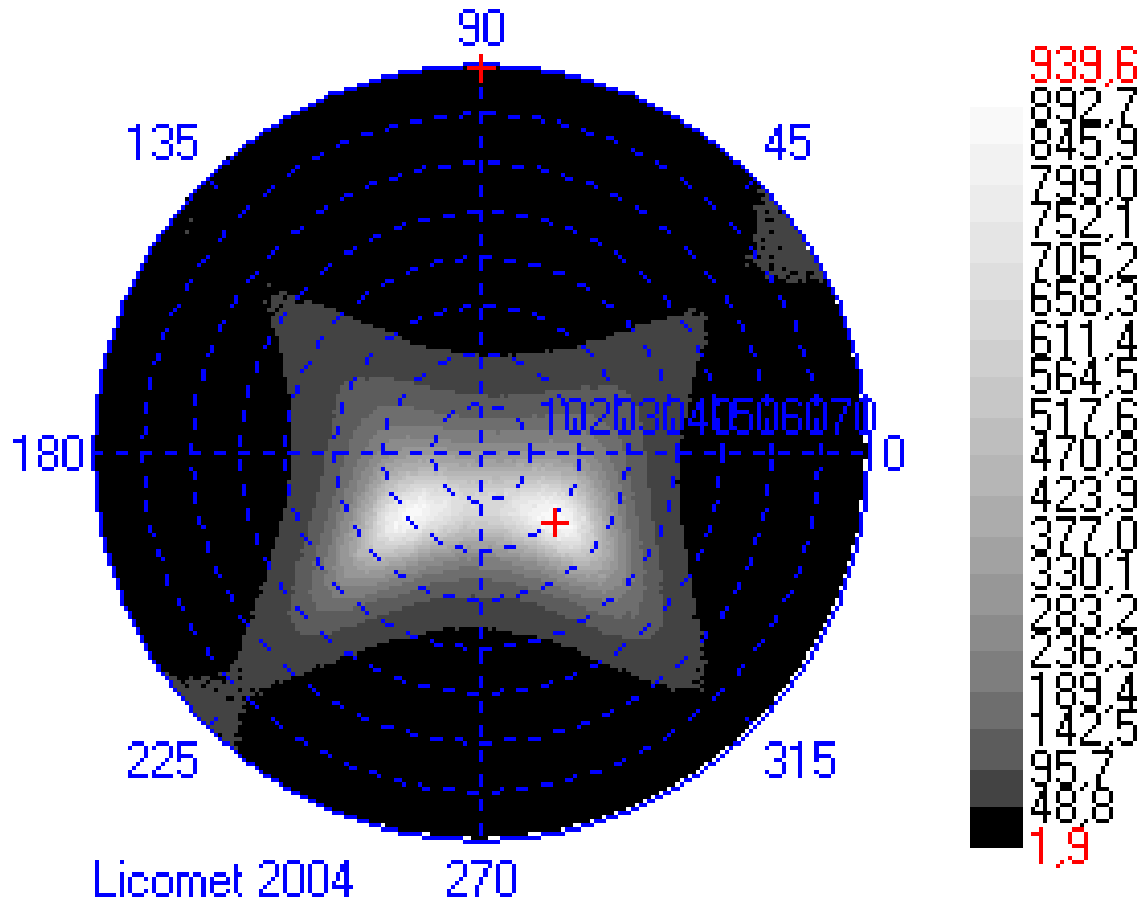


7-5 OUTLINE DIMENSIONS



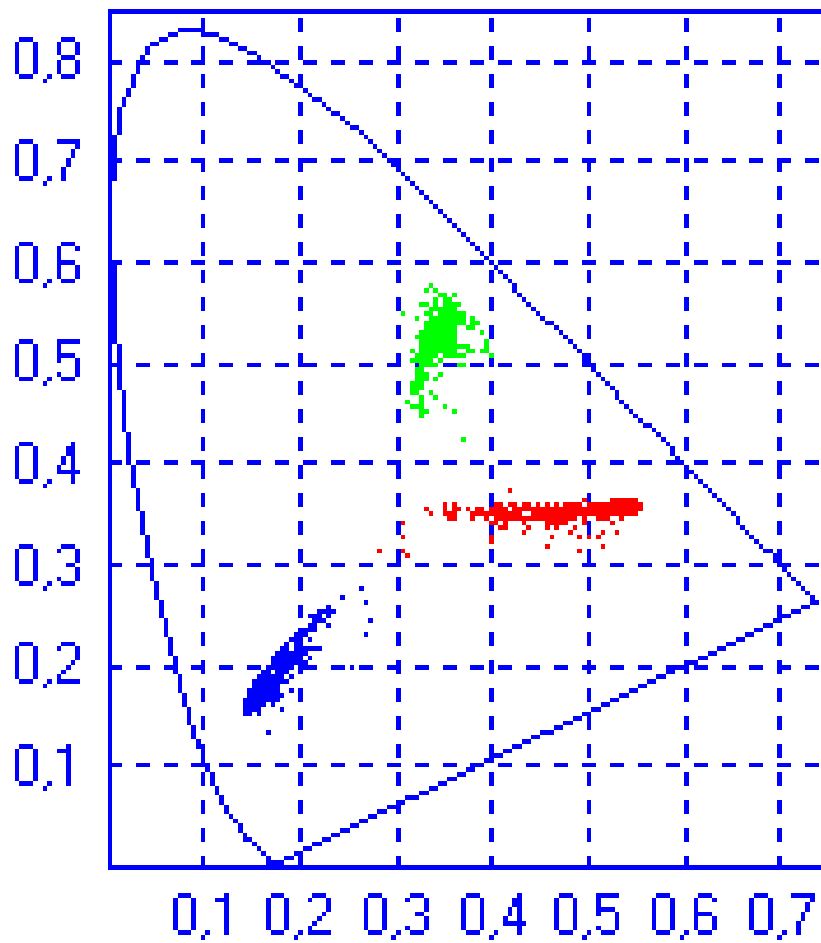
7-6 MEASUREMENTS

7-6-1 CONTRAST



7-6-2 COLOR DISPERSION

xy COLOR DISPERSION (1931 System)



## 7-7 DEFECT SPECIFICATIONS

### a) Inspection conditions

Distance : the distance between the inspector's eye and the LCD panel is 20cm.

Luminance : the distance between a 20-W fluorescent lamp and the LCD panel is 25-30 cm.

Temperature: Room temperature is  $25\text{C}^{\circ}\pm 5\text{C}^{\circ}$ .

Viewing angle:

Display specifications :  $-20^{\circ} \leq \theta x \leq +20^{\circ}$ ,  $0^{\circ} \leq \theta y \leq +20^{\circ}$

Appearance specifications:  $-45^{\circ} \leq \theta x \leq +45^{\circ}$ ,  $-45^{\circ} \leq \theta y \leq +45^{\circ}$

Measuring light conditions: for Cold Cathode Fluorescent Lamp

Chromaticity coordinates ( $x = 0.320$ ,  $y = 0.325$ ) typ.

Luminance of backlight surface for inspection:  $1200 \text{ cd/m}^2$

### b) Display specifications

Item	Specifications			
Line defect	Not allowed			
Luminous dots *1	Color	Brightness	Distance between same color dots	Quantity
	Red, Green	F + H	-	$R + G \leq 6$
		F	-	$R \leq 6$ , $G \leq 3$
	Blue	F + H	-	$\leq 6$
		F	-	$\leq 6$
	Red, Green, Blue	F	$\leq 6.5 \text{ mm}$ *4	$R, G, B \leq 0$
Linked two or *3 more dots			$R, G, B \leq 0$	
Dark dots *2	Color	Distance between dark dots		Quantity
	Black	-		$R + G + B \leq 16$ $R, G, B \leq 7$
		Linked two dots	*3	$\leq 1 \text{ pair}$
		Linked three or more dots	*3	$\leq 0$
		$\leq 6.5 \text{ mm}$	*4	$\leq 0$

\*1 F: Full luminous dots (Bright point independent of viewing angle)

H: Half luminous dots (Bright point dependent on viewing angle)

Luminous dots are measured while the screen is black.

\*2 Dark dots are measured while the screen is illuminated with Red, Green, or Blue.

\*3 Linkage means linked two or more dots.

■ ( : Luminous or Dark dot)

To be counted

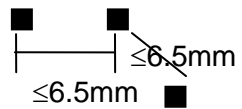


To be uncounted



\*4  $\leq 6.5 \text{ mm}$  is considered with:

■ ( : Luminous or Dark dot)



	To be counted	To be uncouncted
Luminous dots	Same color	Different color
Dark dots	Same screen	Different screen

\*5 The dot-amounts of linkage and <6.5 mm are counted when the dots are only full luminous.

### c) Appearance specifications

Item	Specifications		
	Measurement criteria	Quantity	
Other objects Stains Dust (dot shape)	Average diameter( $\varnothing$ ) mm		
	$\varnothing \leq 0.2$	Allowed value	
	$0.2 < \varnothing < 0.3$	all allowed	
	$0.3 < \varnothing \leq 0.5$	$\leq 10$ points	
	$0.5 < \varnothing$	$\leq 3$ points	
	Linked other objects		
Other objects Stains Dust (line shape)	Width(W) mm	Length(L) mm	
	$W \leq 0.05$	-	
	$0.05 \leq W \leq 0.1$	$L < 0.7$	all allowed
		$0.7 \leq L \leq 1.0$	$\leq 4$ points
	$0.1 < W$	$1.0 < L$	0 point
Polarizer Bubbles	Average diameter( $\varnothing$ ) mm		
Wrinkles Dent	$\varnothing \leq 0.5$		
Panel dent	$\varnothing \leq 0.5$		
Polarizer scratch	Remarkable scratches		
Form	Specified labels and parts are put		

The relevant data for the values above are only valid under the conditions described in 7-9 "a".



## 8 GENERAL PRECAUTIONS

### 8-1 HANDLING

- (a) When the module is assembled, it should be attached to the system firmly using every mounting holes. Be careful not to twist and bend the modules.
- (b) Length of fixation screws for the housing should not exceed 5 mm on the top and the bottom. Length of fixation screws on the sides of the housing should not exceed 5 mm and the length of the screws for the back-plate max. 5 mm.
- (c) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and CCFT backlight.
- (d) Note that the polarizer is very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (e) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, staining and discoloration may occur.
- (f) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (g) The desirable cleaners are water, IPA (Isopropyl Alcohol) or Hexane. Do not use Ketone type materials (ex. Acetone) Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might produce a permanent damage to the polarizer due to chemical reaction.
- (h) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (i) Protect the module from static, it may cause damage to the C-MOS Gate Array IC.
- (j) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (k) Do not disassemble or tamper with the module!  
This will result in loss of guarantee when within the period.**
- (l) Pins of connector shall not be touched directly with bare hands.

### 8-2 STORAGE

- (a) Do not store the TFT-LCD module in direct sunlight.
- (b) The module shall be stored in a dark place. It is prohibited to apply sunlight fluorescent light during the store.

### **8-3 OPERATION**

- (a) Module has high frequency circuits. Sufficient suppression to the electromagnetic interference shall be done by system manufacturers. Grounding and shielding methods may be important to minimize the interference.

### **8-4 OTHERS**

- (a) Ultra-violet ray filter is necessary for outdoor operation.
- (b) Avoid condensation. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating values (the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, so on). Otherwise the module may be damaged.
- (d) If the module produces the same pattern continuously for a long period of time, it can cause image “sticking” on the screen.
- (e) This module has its circuitry PCB's on the rear side and should be handled carefully in order not to cause stress.

## 9 COSMETIC SPECIFICATIONS

### 9-1 VISUAL INSPECTION

#### 1) INSPECTED AREA

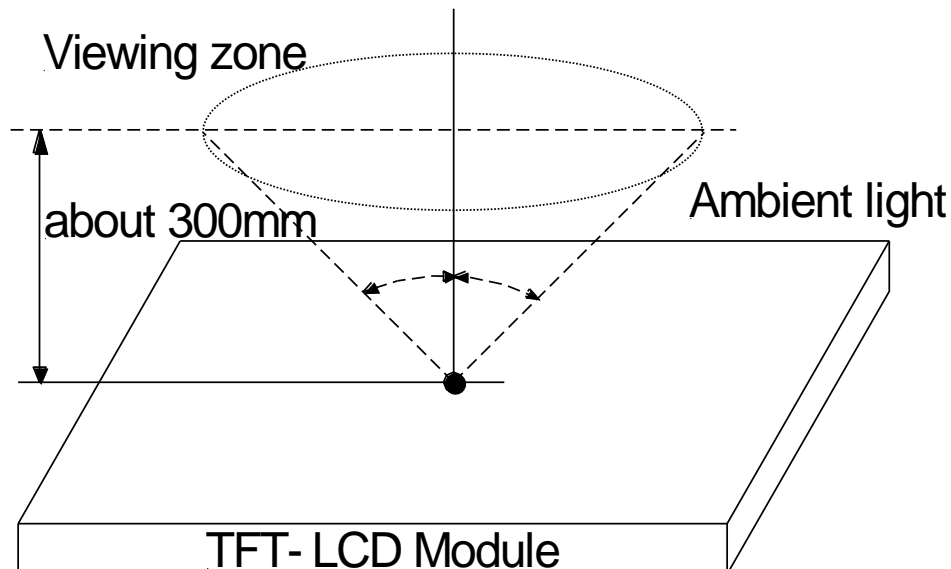
- i) The distance between inspector's eyes and the module is around 300 mm.  
Viewing angle for inspection is as follows:  
 $q \leq 45^\circ$  when non-operating inspection.  
 $q \leq 5^\circ$  when operating inspection.
- ii) Inspection should be executed only from front side, and only for A-zone. The visual defects of B & C-zone are ignored (refer to 9.2 DEFINITION OF ZONE)

#### 2) ENVIRONMENTAL

- i) Ambient temperature: 25°C
- ii) Illumination for inspection should be around 2000 (lx) in the module operation and around 1000 (lx) in non-operation.
- iii) Back-light is powered on in the inspection for module operation.

#### 3) OPERATING INSPECTION

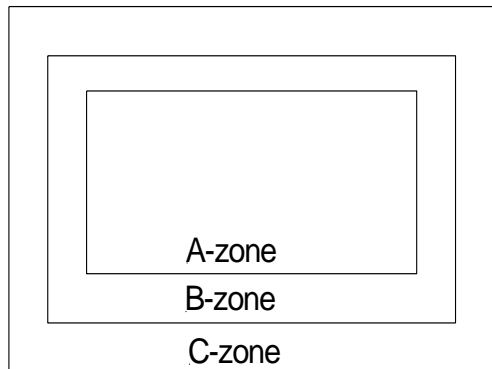
Number of display colors in the inspection is 8 only (Gray scale 0 and 255 for each Red, Green, Blue and White).



## 9-2 DEFINITION OF ZONE

Each zone is defined as follows. The visual defects are specified at A-zone and the specification is not applicable to B & C-zone. (Defects in B & C-zone are disregarded.)

- A-zone: Display area (pixel area)
- B-zone: Area between A-zone and C-zone
- C-zone: Metallic bezel area (include I/F connector)



### 9-3 COSMETIC SPECIFICATION

The following are inspected at the module stable operation and defects appearing at powered on & off is disregard.

	No.	ITEM		Maximum Acceptable Number		Note		
				A-zone	Unit			
Operating Inspection	1	Dot Defect	Sparkle Mode	1 dot	7	pcs	1),2),4)	
				2 dot	3	Unit	1),2),5)	
				3 dot	0			
				4 dot	0			
				Density	0	pcs/∅20mm	1),2),6)	
			Total	7	pcs	1),2)		
			Black Mode	1 dot	7	pcs	1),3),4)	
				2 dot	3	Unit	1),3),5)	
				3 dot	0			
				4 dot	0			
	Density	3		pcs/∅30mm	1),3),6)			
	Total	7	pcs	1),3)				
	Total	7	pcs	1)				
	2	Line Defect			Serious one is Not allowed		-	-
	3	Uneven brightness					-	-
	4	Stain Inclusion	Line shape W: width(mm) L: length(mm)	$W \leq 0.02$	L:ignore	Ignore	pcs	7)
				$W \leq 0.04$	$L \leq 2.0$	10		
$L > 2.0$					0			
$W \leq 0.08$				$L \leq 1.0$	10			
				$L > 1.0$	0			
$W > 0.08$	-	see Dot shape						
5	Stain Inclusion	Dot shape D: average dia.(mm)	$D \leq 0.24$	Ignore	pcs	7)		
			$D \leq 0.4$	5				
			$D > 0.4$	0				
6	Scratch on polarizer	Line shape W: width(mm) L: length(mm)	$W \leq 0.01$	L:ignore	Ignore	Pcs	8)	
			$W \leq 0.02$	$L \leq 40$	10			
				$L > 40$	0			
			$W \leq 0.04$	$L \leq 20$	10			
				$L > 20$	0			
7	Scratch on polarizer	Dot shape D: average dia.(mm)	$D \leq 0.2$	Ignore	pcs	8)		
			$D \leq 0.4$	10				
			$D > 0.4$	0				
8	Bubbles, Peeling in Polarizer	D: average dia.(mm)	$D \leq 0.3$	Ignore	pcs	8)		
			$D \leq 0.5$	10				
			$D \leq 1.0$	5				
			$D > 1.0$	0				
9	Wrinkles on Polarizer			Serious one is Not allowed		-	-	

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**Note**

- (1) If the defective area per pixel dot is over 50%, is this regarded as a dot defect.
- (2) If the defective pixel area on a black screen is more than 30%, this is regarded as a bright dot defect.
- (3) If the defective pixel area on a white screen is less than 70%, this is regarded as a dark dot defect.
- (4) Defect dots not adjacent to each other are regarded as single dot defects.
- (5) Two or more Adjacent Defect dots is regarded as n (number)-Adjacent Dot Defect.
- (6) Defect density is defined by the number of defects existing in a 20 mm Ø.
- (7) Defect which can be easily wiped off is disregarded.
- (8) The specification is applicable only to A-zone and if these defects are in B-zone, they are disregarded.
- (9) In case of gray scale pattern, obvious defects are to be rejected.