

Industrial Solutions Flatpanel Technology

DESIGN FOR TFT COLOR LCD MODULE

Design No.	doh233_100
Revision	i-sft ↔ Rev. 02
Type	10" 1280 x 600
	SPECIFICATIONS
Version	Internal Revision 0.2
Date	18.03.2004
Preliminary <input checked="" type="checkbox"/>	
Final <input type="checkbox"/>	

Buyer	
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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!

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1 DESCRIPTION

I-SFT doh233_100 is a color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses poly silicon TFT as switching devices. This model is composed of a TFT LCD panel, a driver circuit and a back-light system. The 10,0" display has a resolution of 1280 x 600 pixels and can display up to 262,144 colors.

2 FEATURES

- 12.1" SVGA for Highbright Applications
- DVI interface system
- Long life lamp system
- Color temperature 9000K

3 APPLICATIONS

- Monitors for industrial use

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.

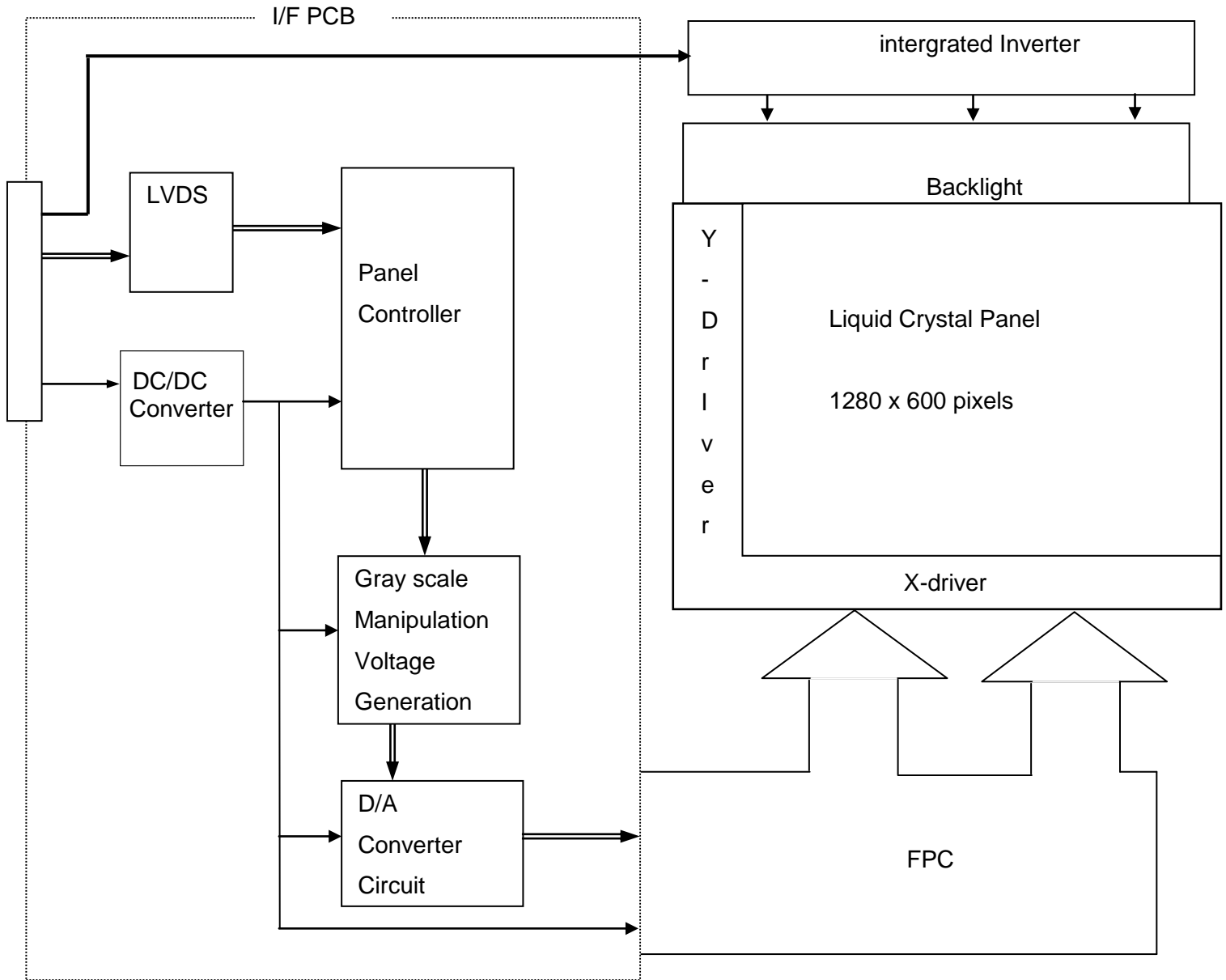
Each of the liquid crystal cells acts as an electro-optical switch that controls the incident light transmission by a signal applied to a signal electrode through the TFT switch.

5 OUTLINE CHARACTERISTICS

ITEM	SPECIFICATION	UNIT	NOTE
Display area	230.4(H) x 124.5(V)(10,0 inch diagonal)	mm	
Driver element	p-Si TFT active matrix		
Display colors	262,144		
Number of pixels	1280 x 600	pixel	
Luminance (typ.)	700	cd/m ²	*1
Dimming ratio	tbd		
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.180(H) x 0.180(W)	mm	
Display Mode	Normally White		

Note *1: Luminance after 10 min.

6 BLOCK DIAGRAM



7 SPECIFICATIONS

7-1 MECHANICAL INFORMATION

ITEM		TYP.	UNIT
Module size	Horizontal (H)	283	mm
	Vertical (V)	128	mm
	Depth (D)	35	mm
Weight		2005	g

7-2 ABSOLUTE MAXIMUM RATINGS OF ENVIRONMENT

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	T_{STG}	tbd	tbd	°C	(1)
Operating temperature (Surface of Glass)	T_{OPR}	tbd	tbd	°C	(1)
Shock (operating)	S_{nop}	-	tbd	g	(2)
Vibration (operating)	V_{nop}	-	tbd	g	(3)

Note

(1) See wet bulb temperature chart.

(2)

(3)

7-3 ELECTRICAL ABSOLUTE RATINGS

TFT LCD MODULE

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage for logic	V_{DD}	-0.3	4.0	V	
Input signal Voltage for logic	V_I	-0.3	$V_{DD}+0.3$	V	

7-4 ELECTRICAL CHARACTERISTICS

TFT LCD MODULE

Ta=25±2°C

ITEM	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V _{DD}	3.0	3.3	3.6	V	
Power Supply Current	I _{DD}	-	250	-	mA	(1)

Note

1) 8 color bars pattern

INVERTER

Ta=25±2°C

ITEM	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V _{inv}	10.8	12	13.2	V	
Power Supply Current	I _{inv}	1.50	1.70	1.80	A	

7-5 INTERFACE PIN CONNECTION

TFT LCD MODULE (Interface Signal)

Connector: Hirose DF19L-14P-1H, Mating Connector: Hirose DF19G-14S-1C

PIN	Symbol	Function
1	V _{DD}	Power supply +3.3 V
2	V _{DD}	Power supply +3.3 V
3	GND	
4	GND	
5	IN0-	Transmission data of pixels 0 (negative: -)
6	IN0+	Transmission data of pixels 0 (positive: +)
7	IN1-	Transmission data of pixels 1 (negative: -)
8	IN1+	Transmission data of pixels 1 (positive: +)
9	IN2-	Transmission data of pixels 2 (negative: -)
10	IN2+	Transmission data of pixels 2 (positive: +)
11	CLK-	Sampling clock (negative: -)
12	CLK+	Sampling clock (positive: +)
13	GND	
14	GND	
15	GND	

Inverter

Connector: JST PHR-6, Mating Connector: JST S 6B-PH-SM3-TB

PIN	Symbol	Function
1	V _{SS}	Power supply +12 V (1)
2	V _{SS}	Power supply +12 V (1)
3	GND	(1)
4	GND	(1)
5	PWM	PWM-Signal: 0 – 100%
6	PWM	PWM-Signal: 0 – 100%

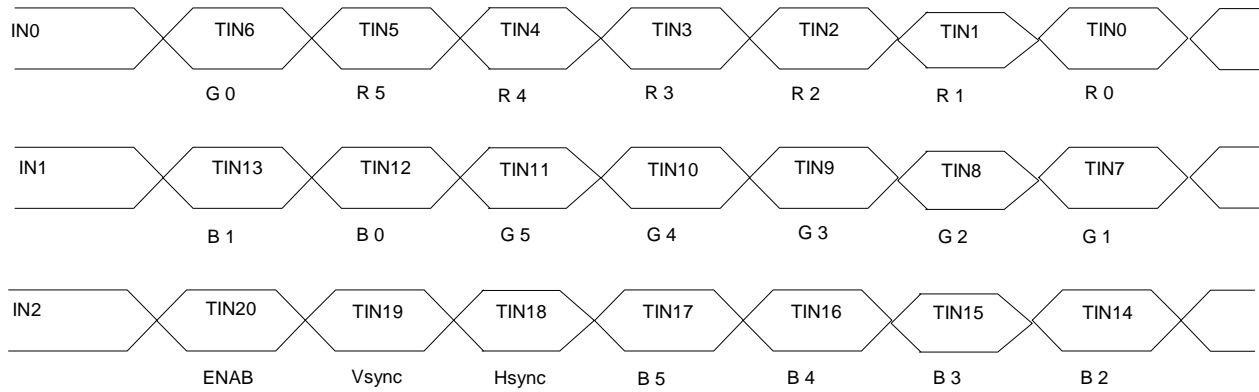
Note

(1) for best connection use pin 1 and 2 parallel and pin 3 and 4 parallel

7-5-1 RECOMMENDED TRANSMITTER (DS90CF363) TO I-SFT INTERFACE ASSIGNMENT

CASE 1: 6 bit transmitter

DS90CF363				I-SFT		
Input terminal No.		Input signal (graphics controller output signal)		Output signal symbol	Interface	
Symbol	DS90CF363	Symbol	Function		Pin	Symbol
TIN0	44	R0	red pixels display data (LSB)	TOUT0- TOUT0+	No. 5 No. 6	IN0- IN0+
TIN1	45	R1	red pixels display data			
TIN2	47	R2	red pixels display data			
TIN3	48	R3	red pixels display data			
TIN4	1	R4	red pixels display data			
TIN5	3	R5	red pixels display data (MSB)			
TIN6	4	G0	green pixels display data (LSB)	TOUT1- TOUT1+	No. 7 No. 8	IN1- IN1+
TIN7	6	G1	green pixels display data			
TIN8	7	G2	green pixels display data			
TIN9	9	G3	green pixels display data			
TIN10	10	G4	green pixels display data			
TIN11	12	G5	green pixels display data (MSB)			
TIN12	13	B0	blue pixels display data (LSB)	TOUT2- TOUT2+	No. 9 No. 10	IN2- IN2+
TIN13	15	B1	blue pixels display data			
TIN14	16	B2	blue pixels display data			
TIN15	18	B3	blue pixels display data			
TIN16	19	B4	blue pixels display data			
TIN17	20	B5	blue pixels display data (MSB)			
TIN18	22	Hsync	horizontal synchronization signal	TCLK OUT- TCLK OUT+	No. 11 No. 12	CK- CK+
TIN19	23	Vsync	vertical synchronization signal			
TIN20	25	ENAB	compound synchronization signal			
CLK IN	26	NCLK	data sampling clock			

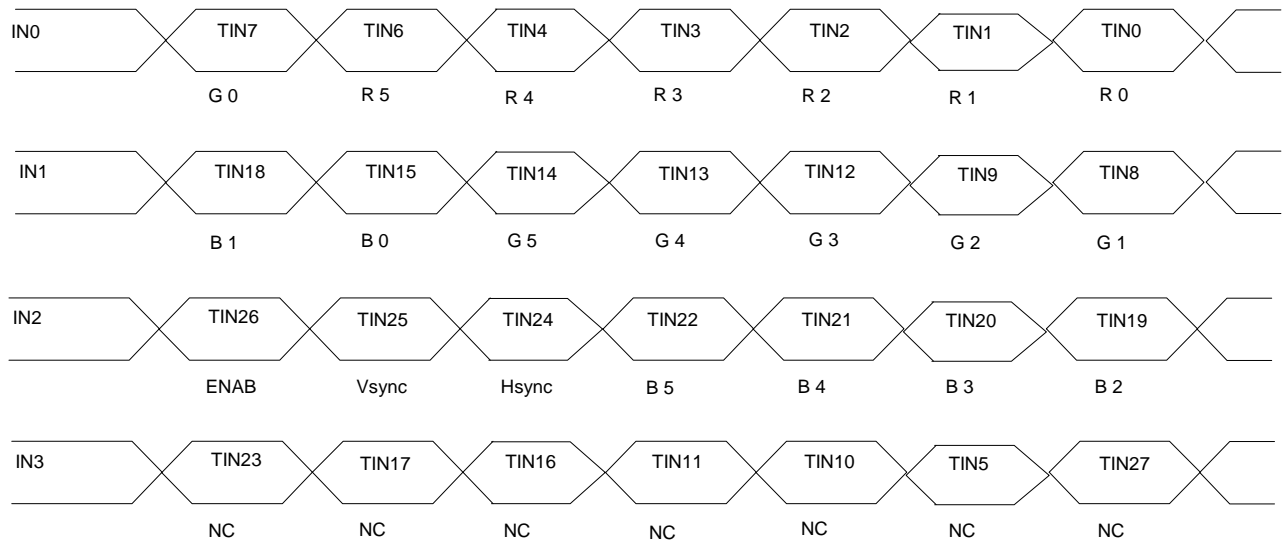


CASE 2: 8 bit transmitter

DS90CF383				I-SFT		
Input terminal No.		Input signal (graphics controller output signal)		Output signal	Interface	
Symbol	DS90CF363	Symbol	Function	symbol	Pin	Symbol
TIN0	51	R0	red pixels display data (LSB)	TOUT0-	No. 5	IN0-
TIN1	52	R1	red pixels display data	TOUT0+	No. 6	IN0+
TIN2	54	R2	red pixels display data			
TIN3	55	R3	red pixels display data			
TIN4	56	R4	red pixels display data			
TIN6	3	R5	red pixels display data (MSB)			
TIN7	4	G0	green pixels display data (LSB)			
TIN8	6	G1	green pixels display data	TOUT1-	No. 7	IN1-
TIN9	7	G2	green pixels display data	TOUT1+	No. 8	IN1+
TIN12	11	G3	green pixels display data			
TIN13	12	G4	green pixels display data			
TIN14	14	G5	green pixels display data (MSB)			
TIN15	15	B0	blue pixels display data (LSB)			
TIN18	19	B1	blue pixels display data			
TIN19	20	B2	blue pixels display data	TOUT2-	No. 9	IN2-
TIN20	22	B3	blue pixels display data	TOUT2+	No. 10	IN2+
TIN21	23	B4	blue pixels display data			
TIN22	24	B5	blue pixels display data (MSB)			
TIN24	27	Hsync	horizontal synchronization signal			
TIN25	28	Vsync	vertical synchronization signal			
TIN26	30	ENAB	compound synchronization signal			
TIN27	50	NC	not connected (open)	TOUT3-	-----	-----
TIN5	2	NC	not connected (open)	TOUT3+		
TIN10	8	NC	not connected (open)			
TIN11	10	NC	not connected (open)			
TIN16	16	NC	not connected (open)			
TIN17	18	NC	not connected (open)			
TIN23	25	NC	not connected (open)			
CLK IN	31	NCLK	data sampling clock	TCLK OUT-	No. 11 No. 12	CK- CK+

Typical Design

				TCLK OUT+		
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7-6 DISPLAY COLOR vs INPUT DATA SIGNAL

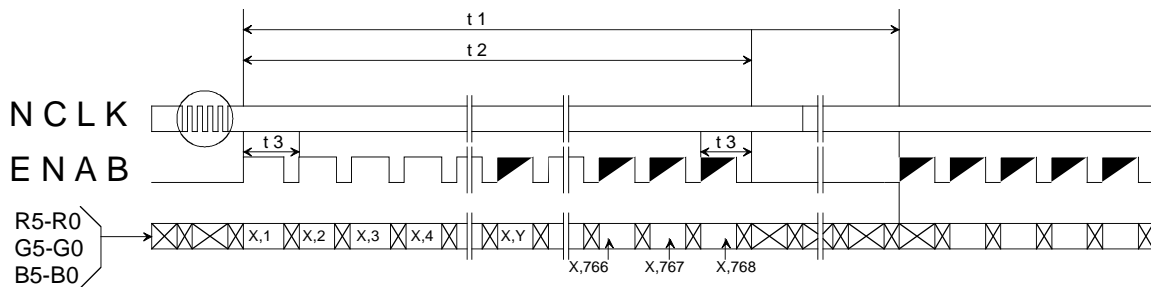
Input		Red Data						Green Data						Blue Data					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Color	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Red	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red (254)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (255)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Green	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green (254)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Blue	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue (1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue (254)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

7-7-1 RELATIONSHIP BETWEEN INPUT DATA AND SCREEN IMAGE

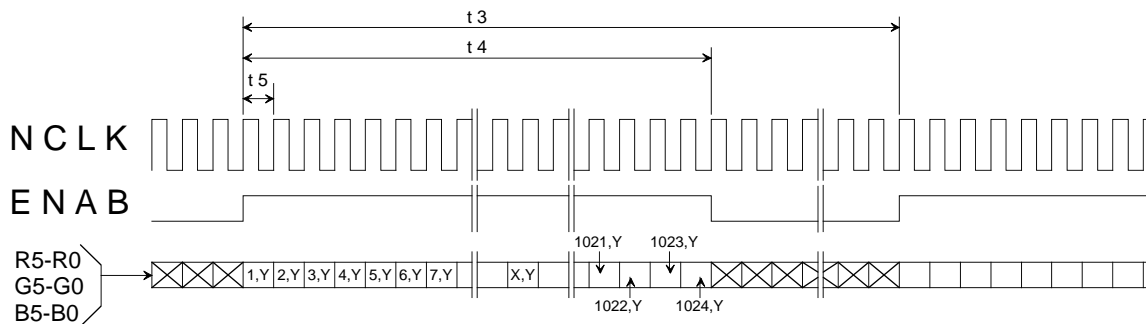
1,1	2,1	3,1		1280,1
1,2	2,2	3,2	_____	1280,2
1,3	2,3	3,3	_____	1280,3
1,600	2,600	3,600	_____	1280,600

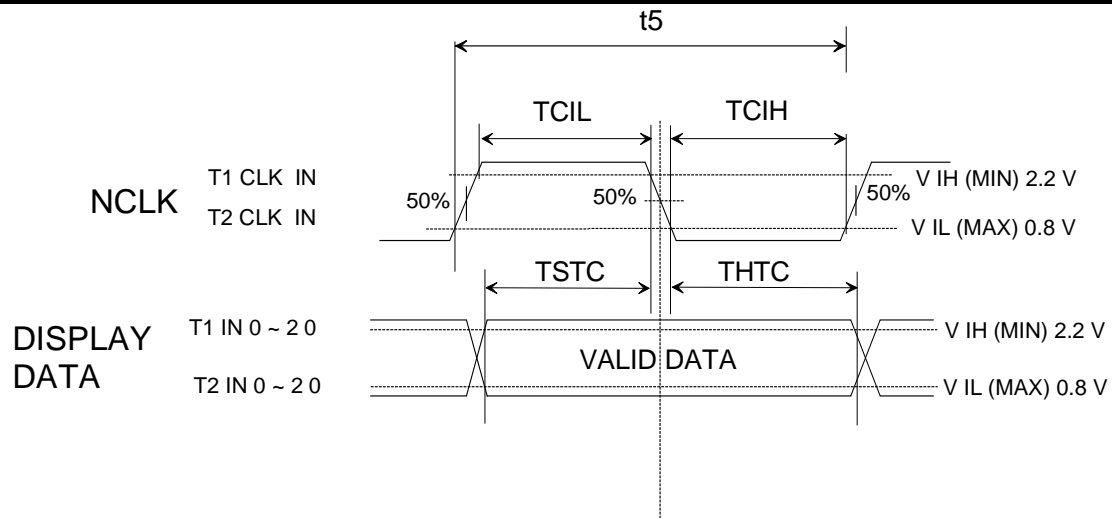
7-7-2 TIMING DIAGRAMS OF INTERFACE SIGNAL

(1) Vertical Timing



(2) Horizontal Timing





7-8 TIMING PARAMETERS

Item	Symbol	MIN	TYP	MAX	Unit	Note
Frame Period	t_1	778xt3 -	806xt3 16.67	860xt3 17.25	- ms	
Vertical Display Term	t_2	768xt3	768xt3	768xt3	-	
One Line Scanning Time	t_3	1319xt5 20.04	1344xt5 20.68	1462xt5 -	- μs	
Horizontal Display Term	t_4	1024xt5	1024xt5	1024xt5	-	
Clock Period	t_5	15.0	15.38	-	ns	

Note

- 1) Refer to „TIMING CHART“ and LVDS (DF90CF364MTD) specifications by National Semiconductor.

2)If ENAB is fixed to “H” or “L” level for certain period while NCLK is supplied, the panel displays black with some flicker.

3)If NCLK is fixed to “H” or “L” level for certain period while ENAB is supplied, the panel may be damaged.

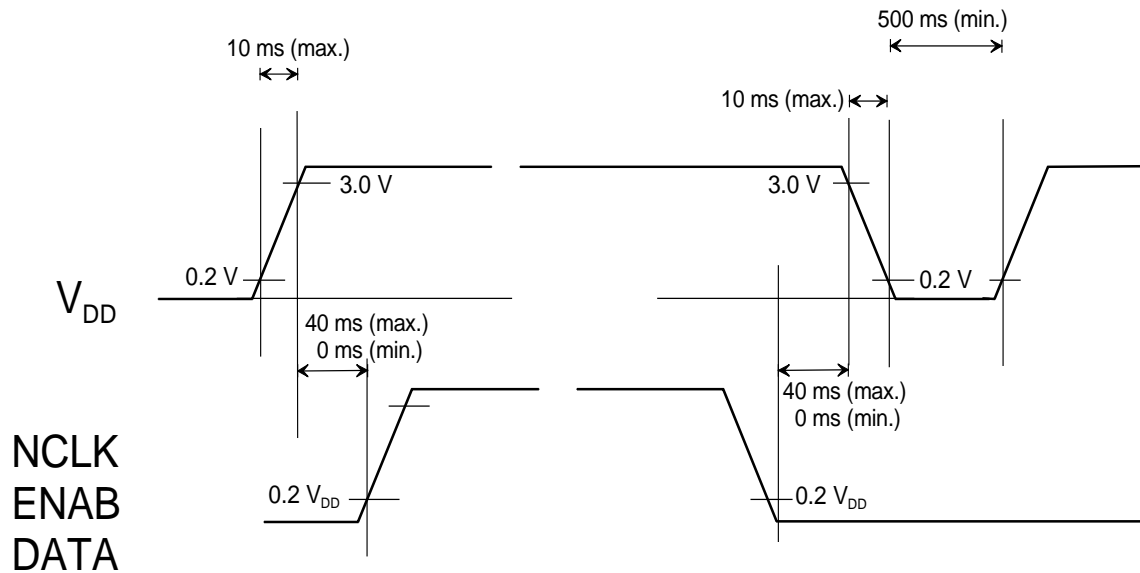
4)Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality.

There is a possibility that flicker is observed by the interference of LCD operating signal timing and FL driving Condition (especially driving frequency), even if the condition satisfies above timing specifications and recommended operating conditions shown in 3. (will be added)

5)Do not make t_1 , t_2 and t_3 fluctuate.

If t_1 , t_2 and t_3 fluctuate, the panel goes black.

7-9 SUPPLY VOLTAGE SEQUENCE



7-10 OPTICAL CHARACTERISTICS

Measuring equipment:

Luminance: TOPCON BM-7; Gossen Mavolux

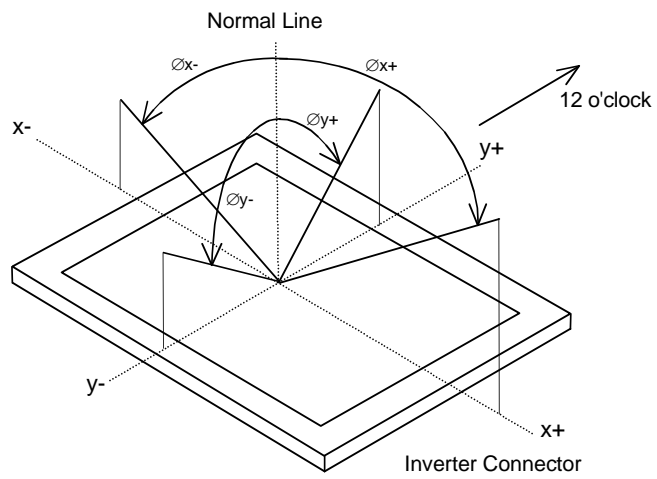
Viewing Angle, Contrast: ELDIM EZContrast

Ta = 25°C ± 2°C

Parameter		Symbol	Condition	Min.	Typ.	Max.	Remark
Viewing Angle	Horizontal	Øx+	CR>10, Øy = ±0°		55		(1), (4)
		Øx-	CR>10, Øy = ±0°		55		
	Vertical	Øy+	CR>10, Øx = ±0°		20		
		Øy-	CR>10, Øx = ±0°		50		
Contrast ratio		CR	Øy=±0°, Øx=±0°	-	500:1	-	(1), (2), (4)
Response time		T _R T _F	rising falling	- -	- -	ms	(1), (3)
Luminance (center of screen)		Lw	at center	-	700 (10 min)	-	(1), (4)
Dimming range		DR			tbd		(1), (4)
Luminance Uniformity				-	84	%	
Chromaticity	Red	R _x R _y	at center	- -			
	Green	G _x G _y	at center	- -			
	Blue	B _x B _y	at center	- -			
	white	W _x W _y	at center	- -	0,31 0,36		

note (1):

Definition of viewing angle

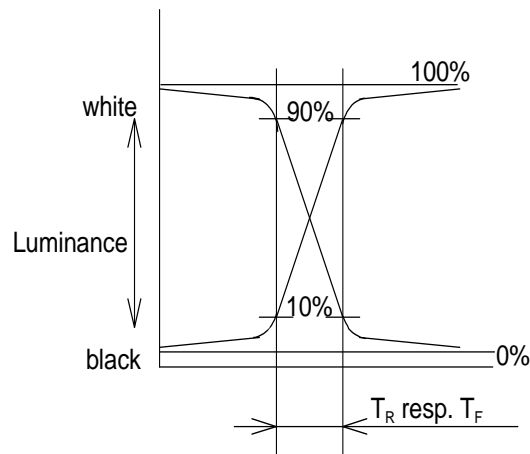


note (2): The contrast ratio is calculated by using the following formula:

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

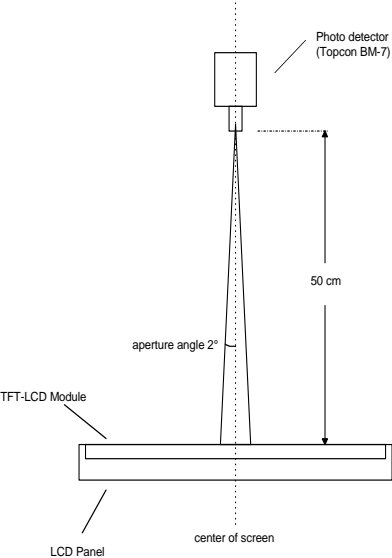
the brightness is measured in a darkroom.

note (3): Definition of the response time:
Photodetector output signal is measured when the brightness changes from "white" to "black" or "black" to "white" respectively. The response time is the time between 10% and 90% of the photodetector output.

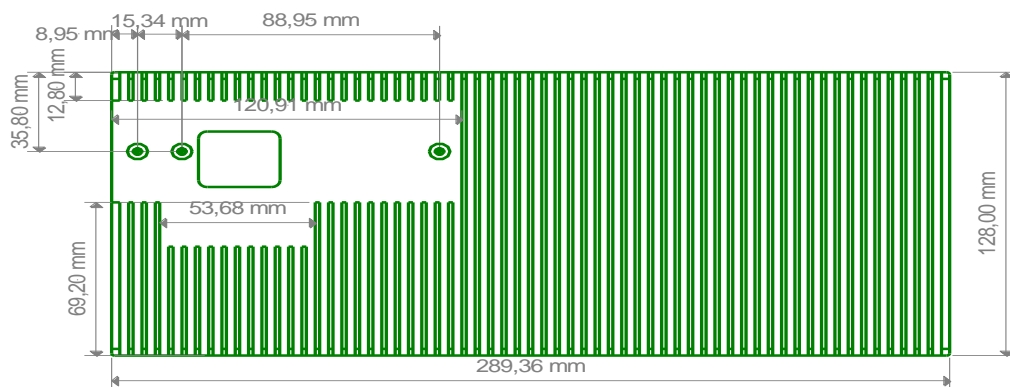
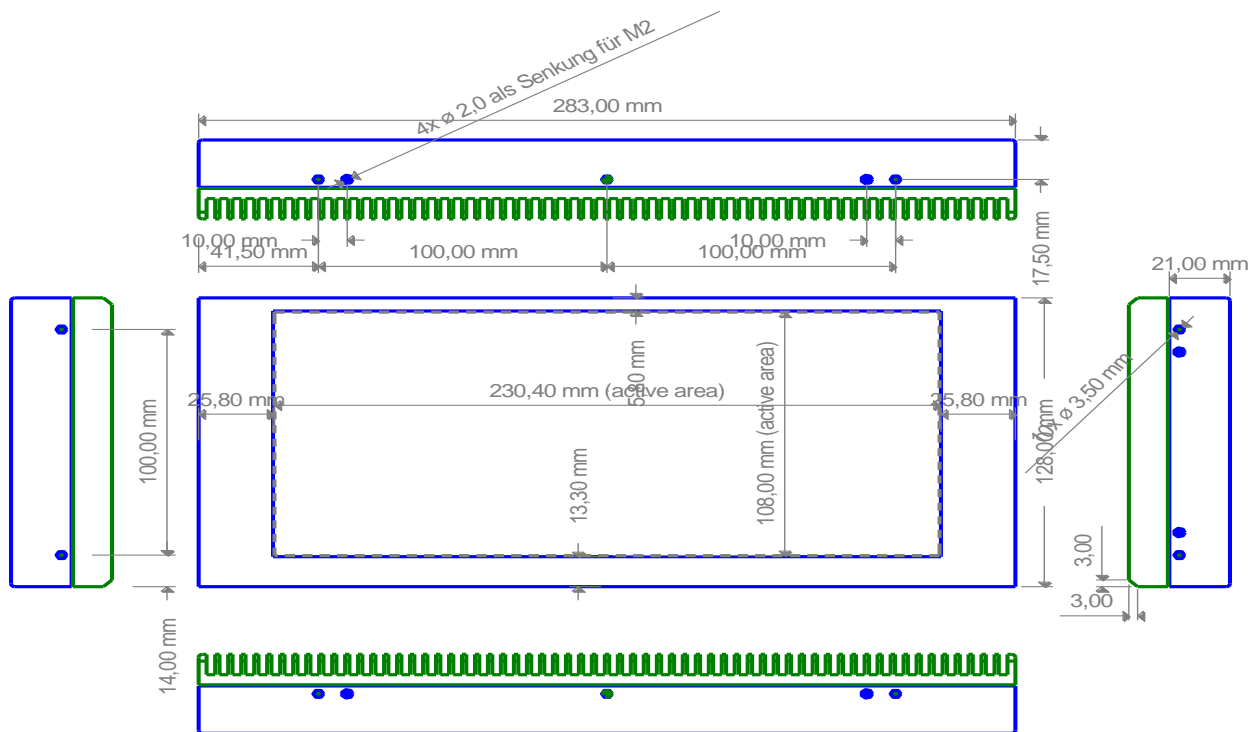


note (4): Brightness measurements setup
The measurement should be executed in a dark room 10 min. after lighting the backlight. Matrix: off state. The brightness is measured in the center of the screen.

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



7-12 OUTLINE DIMENSION



7-13 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 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	-	≤ 6
		F	-	≤ 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	≤ 0
		$\leq 6.5 \text{ mm}$	*4	≤ 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

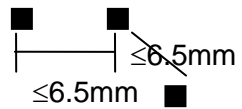


To be uncounted



*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		Quantity
	Measurement criteria		
Other objects Stains Dust (dot shape)	Average diameter(\varnothing) mm		Allowed value
	$\varnothing \leq 0.2$		all allowed
	$0.2 < \varnothing < 0.3$		≤ 10 points
	$0.3 < \varnothing \leq 0.5$		≤ 3 points
	$0.5 < \varnothing$		0 point
Other objects Stains Dust (line shape)	Linked other objects		
	Width(W) mm	Length(L) mm	all allowed
	$W \leq 0.05$	-	
	$0.05 \leq W \leq 0.1$	$L < 0.7$	≤ 4 points
		$0.7 \leq L \leq 1.0$	0 point
$0.1 < W$	-		
Polarizer Bubbles	Average diameter(\varnothing) mm		
Wrinkles Dent	$\varnothing \leq 0.5$		< 2 points
Panel dent	$\varnothing \leq 0.5$		< 2 points
Polarizer scratch	Remarkable scratches		0 point
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.
Keep at least 8 mm space on back of display for air convection.
- (b) Length of fixation screws for the housing should not exceed 4mm on the top and the bottom. Length of fixation screws on the sides and the backplate should not exceed 10mm.
- (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 polarizers are 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 the module.
- (l) Pins of I/F 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 or fluorescent light during the store.

8-3 OPERATION

- (a) Do not connect, disconnect the module in the “Power On” mode.
- (b) Power supply should always be turned on/off by following item 7.9 “ SUPPLY VOLTAGE SEQUENCE “.
- (c) 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 of water. It may result in improper operation or disconnection of lectrode.
- (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 displays the same pattern continuously for a long period of time, it can be the situation when the image “sticks” to the screen.
- (e) This module has its circuitry PCB’s on the rear side and should be handled carefully in order not to be stressed.