

Siemens Flatpanel-Display Technology

A&D IB SFT

TFT COLOR LCD MODULE

Type No. G23916-B65-H068

I-SFT 100i.10X

I-SFT Ô Rev. I

10,4“ 1024 x 768

SPECIFICATIONS

Internal Revision 0.1

11.03.2003

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1 DESCRIPTION

I-SFT 100i.10X (G23916-B65-H068) 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 10,4" display has a resolution of 1024 x 768 pixels and can display up to 262,144 colors.

2 FEATURES

- High brightness 1000 cd/m²
- Extended temperature range
- Integrated inverter for driving backlight
- High contrast ratio, high aperture structure
- XGA (1024x768 pixels) resolution
- Low power consumption
- 4 CCFTs (Cold Cathode Fluorescent Tube)
- LVDS Interface

3 APPLICATIONS

- Point of Information / Point of Sales
- Monitors for industrial use

4 STRUCTURE AND FUNCTIONS

A TFT color LCD module comprises a TFT LCD panel and LSIs for driving the 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.

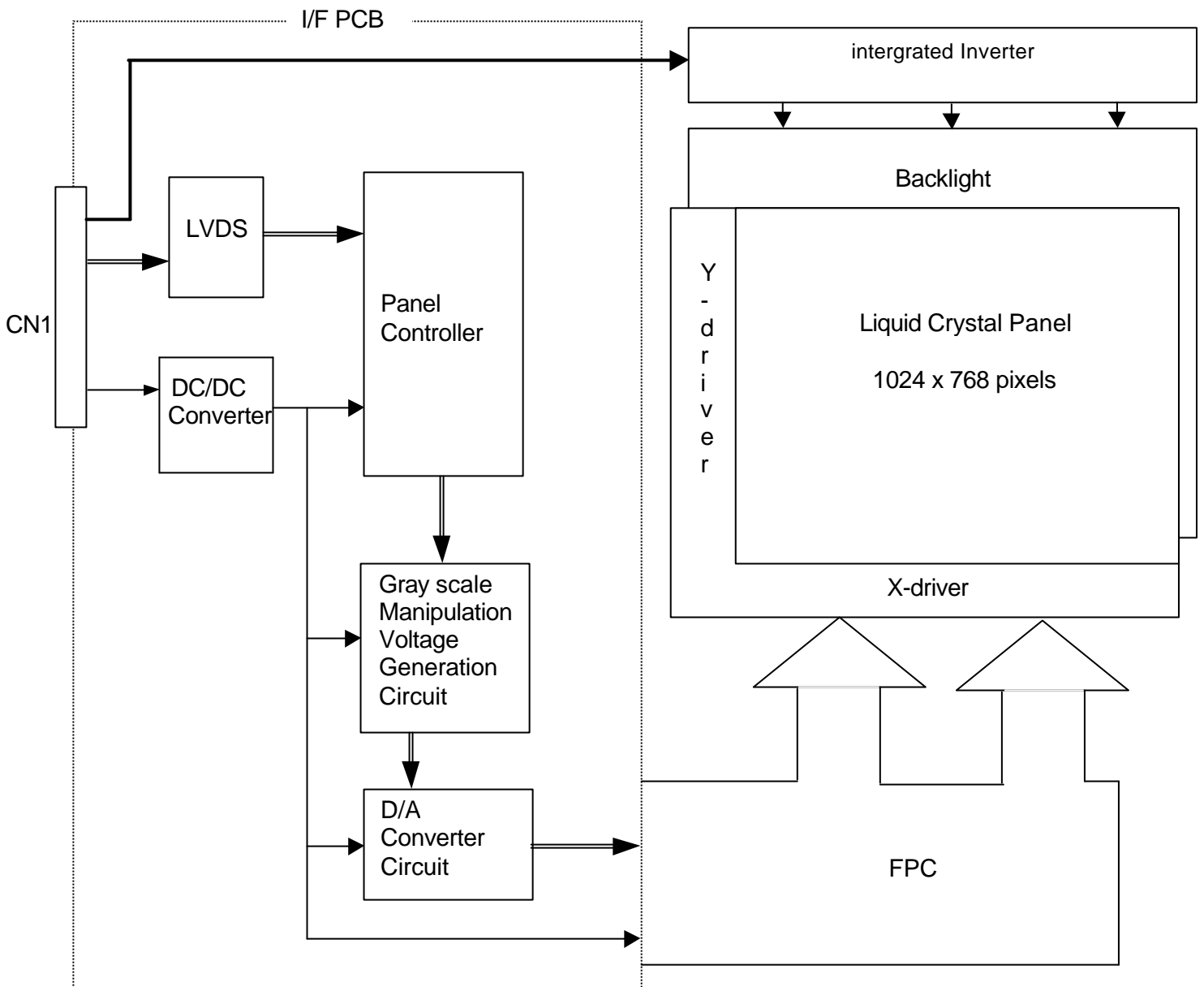
RGB (Red, Green, Blue) data signals are sent through a signal processor to the LCD panel drivers after modulation into suitable forms for active matrix addressing.

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

5 OUTLINE OF CHARACTERISTICS

ITEM	SPECIFICATION	UNIT	NOTE
Display area	210.432(H) x 157.824(V) (10,4 inch diagonal)	mm	
Driver element	p-Si TFT active matrix		
Display colors	262,144		
Number of pixels	1024 x 768	pixel	
Luminance (typ.)	1000	cd/m ²	
Dimming ratio	1:1000		
Pixel arrangement	RGB vertical stripe		
Pixel pitch	0.2055(H) x 0.2055(W)	mm	
Display Mode	Normally White		

6 BLOCK DIAGRAM



7 SPECIFICATIONS

7.1 MECHANICAL INFORMATION

ITEM		TYP.	UNIT
Module size	Horizontal (H)	251.5	mm
	Vertical (V)	177.6	mm
	Depth (D)	23.7	mm
Weight		990	g

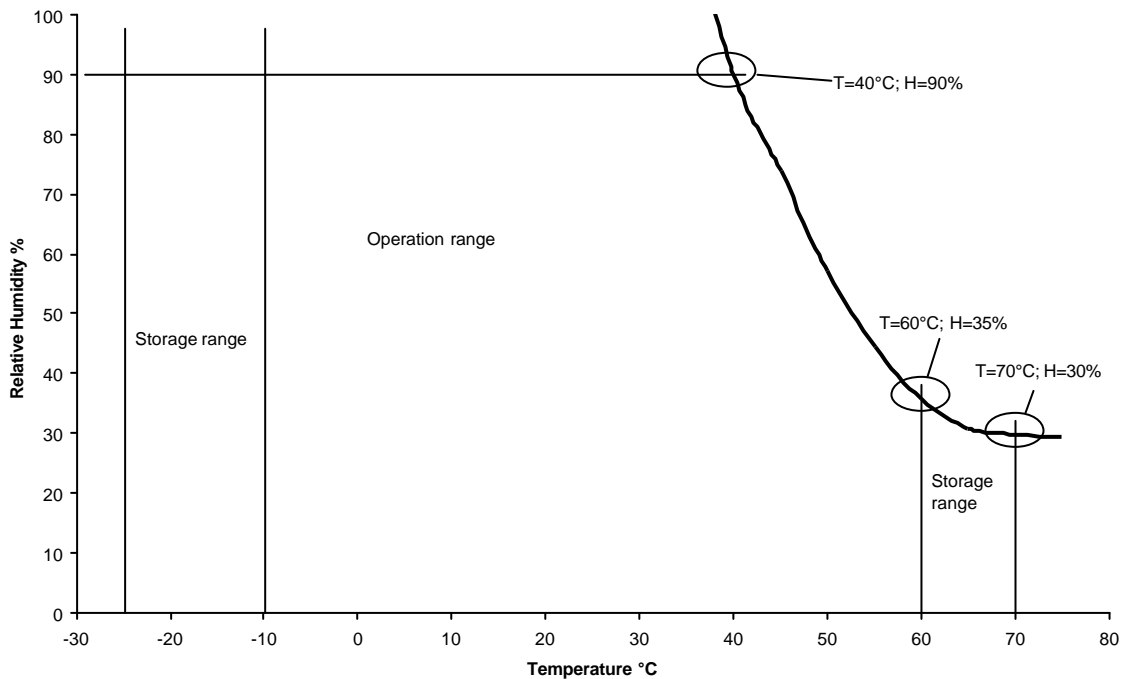
7.2 ABSOLUTE MAXIMUM RATINGS OF ENVIRONMENT

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Storage temperature	T _{STG}	-25	70	°C	(1)
Operating temperature (Surface of Glass)	T _{OPR}	-10	60	°C	(1)
Shock (operating)	S _{nop}	-	35	g	(2)
Vibration (operating)	V _{nop}	-	3	g	(3)

Note

- (1) See wet bulb temperature chart.
- (2) 6 ms.
- (3) 10 - 2000Hz.

Wet bulb temperature chart



7.3 ELECTRICAL ABSOLUTE RATINGS

TFT LCD MODULE

ITEM	SYMBOL	MIN.	MAX.	UNIT	NOTE
Power Supply Voltage for logic	V_{DD}	-0.3	4.5	V	
Input signal Voltage for logic	V_I	-0.3	$V_{DD}+0.3$	V	

7.4 ELECTRICAL CHARACTERISTICS

TFT LCD MODULE

$T_a=25\pm 2^\circ\text{C}$

ITEM	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V_{DD}	3.0	3.3	3.6	V	
Power Supply Current	I_{DD}	-	360	-	mA	(1)

Note

1) 8 color bars pattern

Inverter

$T_a=25\pm 2^\circ\text{C}$

ITEM	Symbol	Min.	Typ.	Max.	Unit	Note
Power Supply Voltage	V_{inv}	10.8	12	13.2	V	
Power Supply Current	I_{inv}	1.60	1.65	1.70	A	

7.5 INTERFACE PIN CONNECTION

TFT LCD MODULE (Interface Signal & Power)

Connector: Hirose DF14A-25P-1.25H, Matching Socket: Hirose DF14-25S-1.25C

PIN	Symbol	Function
1	V _{DC}	Power supply +12 V (1)
2	V _{DC}	Power supply +12 V (1)
3	V _{DC}	Power supply +12 V (1)
4		Power limit signal (only control signal) low -> limiter on (Do not connect an external signal!) high -> limiter off
5		Remote on / off GND -> off Digital dimming input PWM not connected -> on
6		Reference current output (2.5 mA) for dimming with variable resistor (1 kΩ)
7	V _{DC}	Analog dimming input 0 - 2.5 V
8	GND	(1)
9	GND	(1)
10	GND	(1)
11		not connected
12	V _{DD}	Power supply +3.3 V
13	V _{DD}	Power supply +3.3 V
14	GND	
15	GND	
16	CK+	Sampling clock (positive: +)
17	CK-	Sampling clock (negative: -)
18	IN2+	Transmission data of pixels 2 (positive: +)
19	IN2-	Transmission data of pixels 2 (negative: -)
20	IN1+	Transmission data of pixels 1 (positive: +)
21	IN1-	Transmission data of pixels 1 (negative: -)
22	IN0+	Transmission data of pixels 0 (positive: +)
23	IN0-	Transmission data of pixels 0 (negative: -)
24	GND	
25	GND	

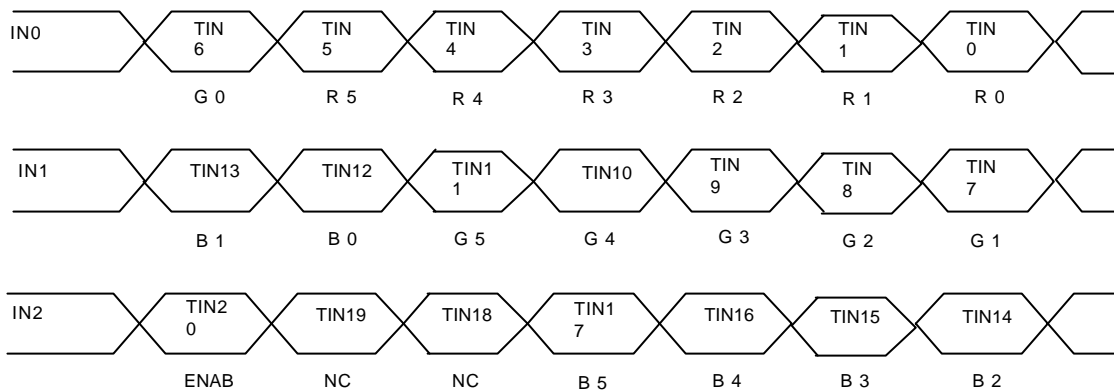
Note

(1) for best connection use pin 1,2 and 3 parallel and pin 8,9 and 10 parallel

7.5.1. RECOMMENDED TRANSMITTER (DS90CF363) TO I-SFT 100i.10X INTERFACE ASSIGNMENT

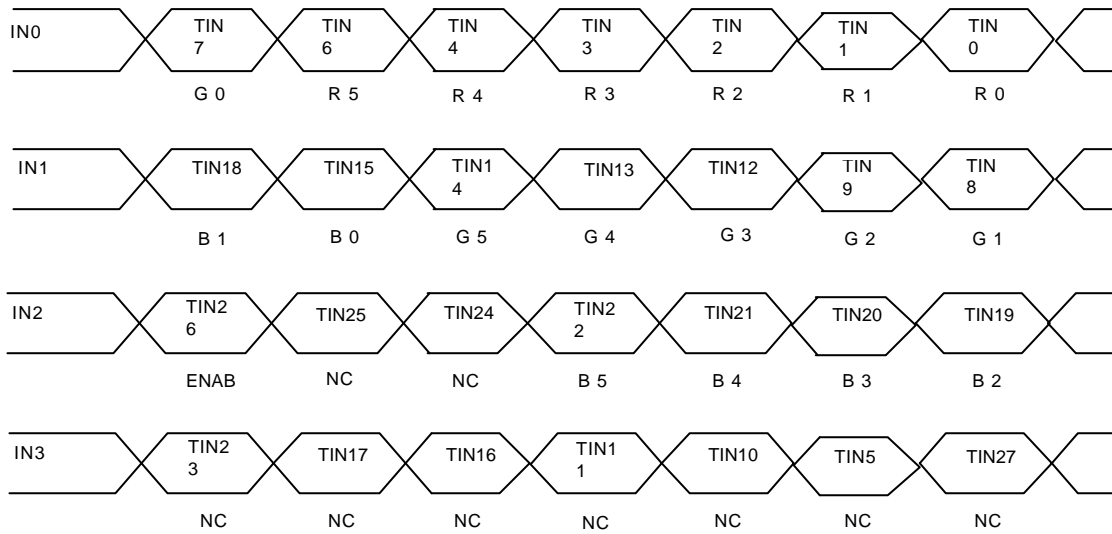
CASE 1: 6 bit transmitter

DS90CF363				I-SFT 100i.10X Interface		
Input terminal No.		Input signal (graphics controller output signal)		Output signal symbol		
Symbol	DS90CF363	Symbol	Function		Pin	Symbol
TIN0	44	R0	red pixels display data (LSB)	TOUT0- TOUT0+	No. 23	IN0-
TIN1	45	R1	red pixels display data		No. 22	IN0+
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)			
TIN7	6	G1	green pixels display data	TOUT1- TOUT1+	No. 21	IN1-
TIN8	7	G2	green pixels display data		No. 20	IN1+
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)			
TIN13	15	B1	blue pixels display data			
TIN14	16	B2	blue pixels display data	TOUT2- TOUT2+	No. 19	IN2-
TIN15	18	B3	blue pixels display data		No. 18	IN2+
TIN16	19	B4	blue pixels display data			
TIN17	20	B5	blue pixels display data (MSB)			
TIN18	22	NC	not connected (open)			
TIN19	23	NC	not connected (open)			
TIN20	25	ENAB	compound synchronization signal			
CLK IN	26	NCLK	data sampling clock	TCLK OUT- TCLK OUT+	No. 17 No. 16	CK- CK+



CASE 2: 8 bit transmitter

DS90CF383				I-SFT 100i.10X		
Input terminal No.		Input signal (graphics controller output signal)		Output signal symbol	Interface	
Symbol	DS90CF363	Symbol	Function		Pin	Symbol
TIN0	51	R0	red pixels display data (LSB)	TOUT0- TOUT0+	No. 23	IN0-
TIN1	52	R1	red pixels display data		No. 22	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- TOUT1+	No. 21	IN1-
TIN9	7	G2	green pixels display data		No. 20	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- TOUT2+	No. 19	IN2-
TIN20	22	B3	blue pixels display data		No. 18	IN2+
TIN21	23	B4	blue pixels display data			
TIN22	24	B5	blue pixels display data (MSB)			
TIN24	27	NC	not connected (open)			
TIN25	28	NC	not connected (open)			
TIN26	30	ENAB	compound synchronization signal			
TIN27	50	NC	not connected (open)	TOUT3- TOUT3+	-----	-----
TIN5	2	NC	not connected (open)			
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- TCLK OUT+	No. 17 No. 16	CK- CK+



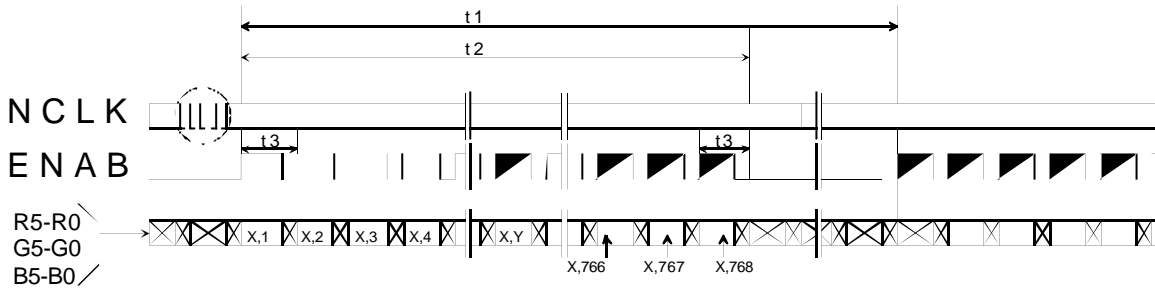
7.6 DISPLAY COLOR vs INPUT DATA SIGNAL

Color		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
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	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
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	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
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	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

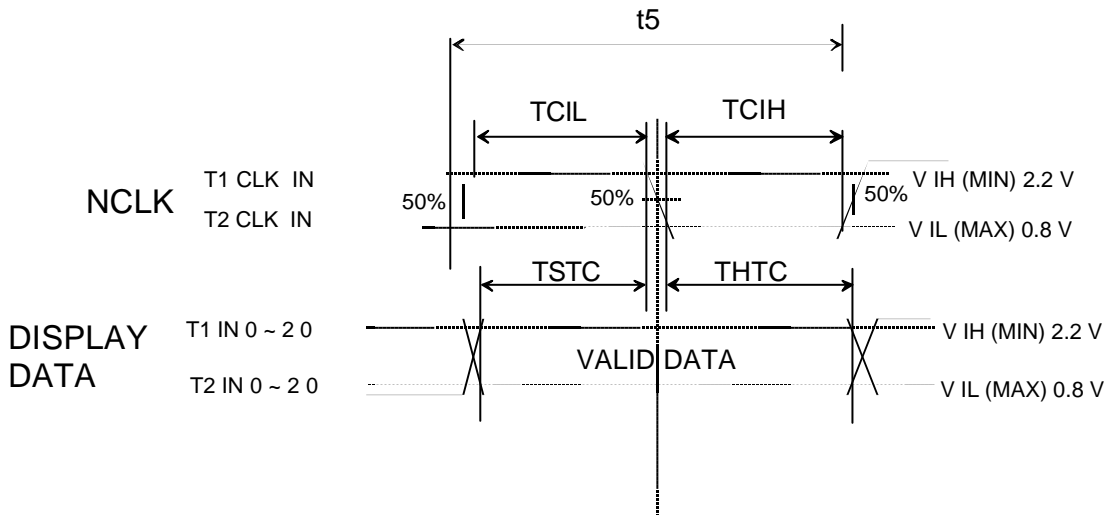
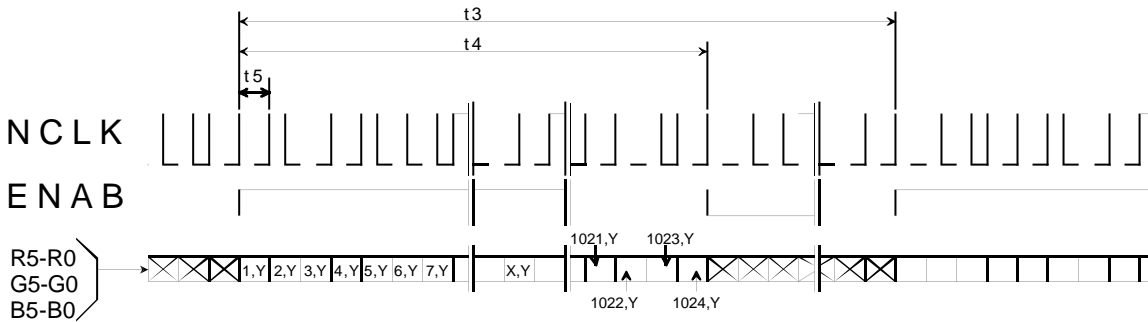
7.7.1 RELATIONSHIP BETWEEN INPUT DATA AND SCREEN IMAGE

1,1	2,1	3,1	_____	1024,1
1,2	2,2	3,2	_____	1024,2
1,3	2,3	3,3	_____	1024,3
1,768	2,768	3,768	_____	1024,768

(1) Vertical Timing



(2) Horizontal Timing



7.8 TIMING PARAMETERS

Item	Symbol	MIN	TYP	MAX	Unit	Note
Frame Period	t1	778xt3 -	806xt3 16.67	860xt3 17.25	- ms	
Vertical Display Term	t2	768xt3	768xt3	768xt3	-	
One Line Scanning Time	t3	1319xt5 20.04	1344xt5 20.68	1462xt5 -	- µs	
Horizontal Display Term	t4	1024xt5	1024xt5	1024xt5	-	
Clock Period	t5	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.

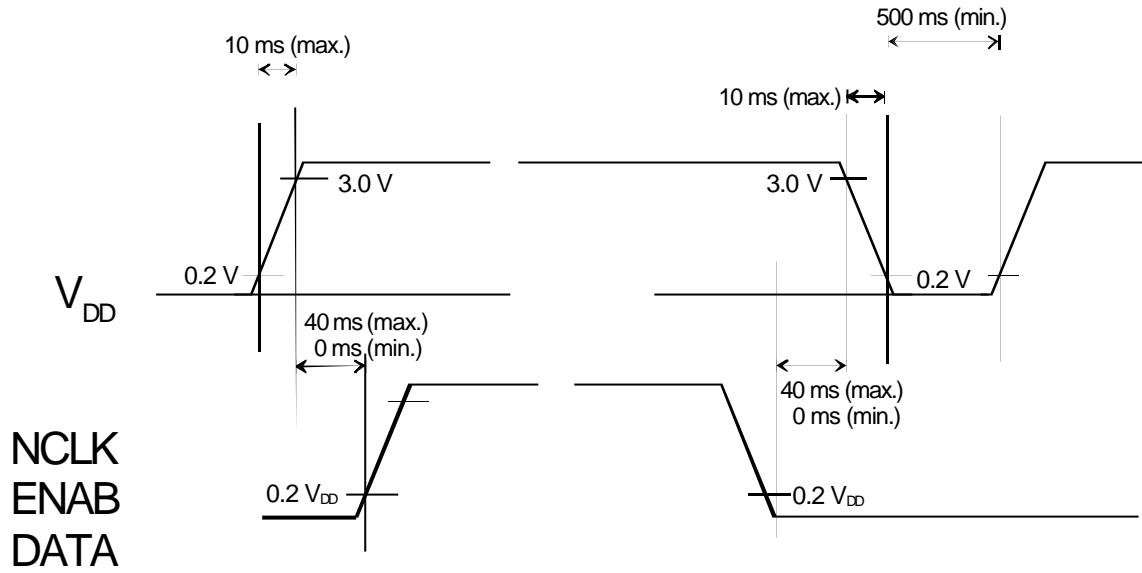
4) Please adjust LCD operating signal timing and FL driving frequency, to optimize the display quality.

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 t1, t2 and t3 fluctuate.

If t1, t2 and t3 fluctuate, the panel goes black.

7.9 SUPPLY VOLTAGE SEQUENCE



7.10 OPTICAL CHARACTERISTICS

Measuring equipment:

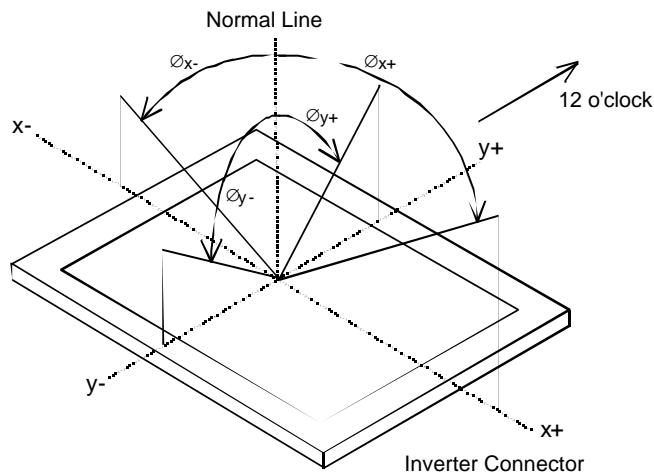
Luminance: TOPCON BM-7

Viewing Angle, Contrast: ELDIM EZContrast

Ta = 25°C ± 2°C

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remark	
Viewing Angle	Horizontal	\varnothing_{x+}	CR>10, $\varnothing_y = \pm 0^\circ$	-	50	-	deg.	(1), (4)
		\varnothing_{x-}	CR>10, $\varnothing_y = \pm 0^\circ$	-	50	-	deg.	
	Vertical	\varnothing_{y+}	CR>10, $\varnothing_x = \pm 0^\circ$	-	25	-	deg.	
		\varnothing_{y-}	CR>10, $\varnothing_x = \pm 0^\circ$	-	45	-	deg.	
Contrast ratio	CR	$\varnothing_y = -5^\circ, \varnothing_x = \pm 0^\circ$	-	250:1	-	-	(1), (2), (4)	
Response time	T_R	rising	-	-	50	ms	(1), (3)	
	T_F	falling	-	-	50	ms		
Luminance (center of screen)	Lw	at center	-	1000	-	cd/m ²	(1), (4)	
Dimming range	DR			1:1000			(1), (4)	

note (1): Definition of viewing angle



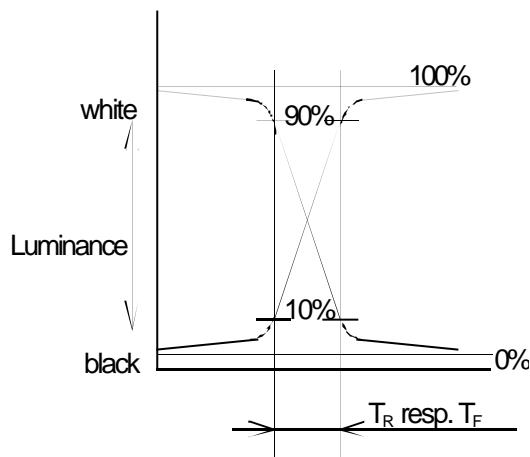
note (2): The contrast ratio is calculated by using the following formula:

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

the brightness is measured in a darkroom.

note (3): Definition of the response time:

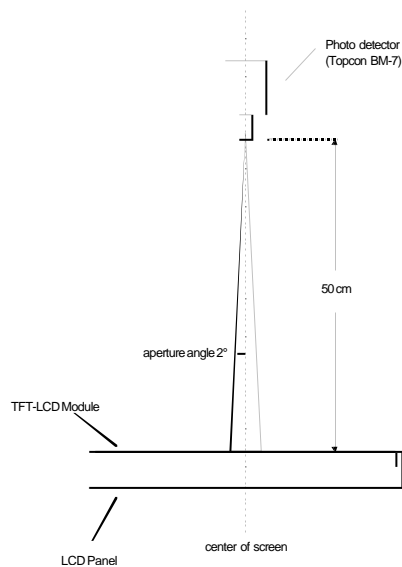
Photodetector output signal is measured when the brightness changes from "white" to "black" or "black" to "white" respectively. The response time is the time between 10% and 90% of the photodetector output.



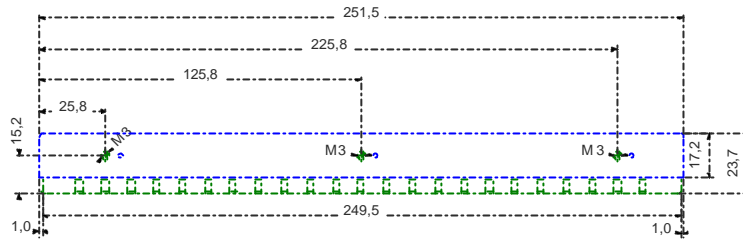
note (4): Brightness measurements setup

The measurement should be executed in a dark room 30 min. after lightning the backlight. Matrix: off state. The brightness is measured in the center of the screen.

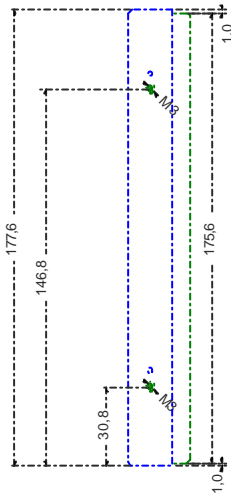
Environment condition: $T = 25 \pm 2 \text{ } ^\circ\text{C}$, it has to be assured that a sufficient heat flow / air circulation is given



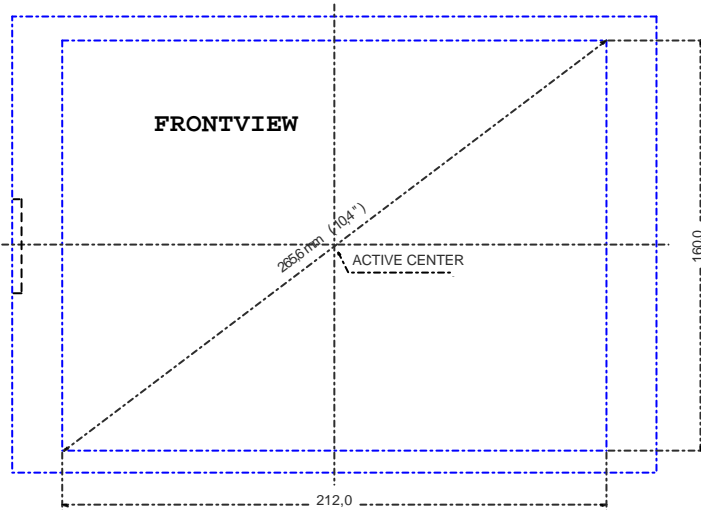
BOTTOM



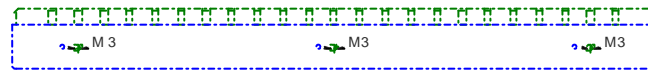
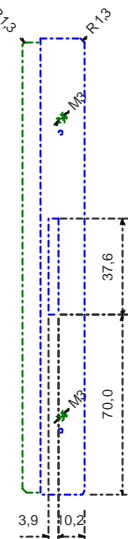
RIGHT



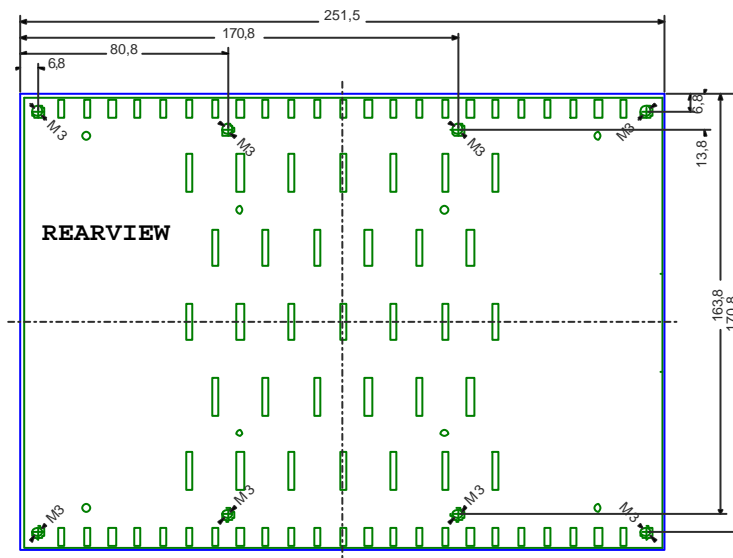
FRONTVIEW



LEFT



TOP



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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 SEQUENZE ".
- (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 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 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.