

TFT Product Specification

- ◇ PRELIMINARY SPECIFICATION
- ◆ APPROVED SPECIFICATION

Part Number: FLC-070DMTK000SA1

Description : TFT 7''W, 800(H)*480(V), Full Viewing Angle , TTL 8 bit,
1000CD

Prepared by : Renee

Approved by : David

Version : V7.1

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Renee	David

Revision History

Version	Date	Page	Description	Note
V1.0	2019/3/05		Preliminary	
V2.0	2019/3/10		Approved Spec	
V3.0	2019/3/13	4 5 7 17	1.2 Product Summary 2.2 Environment Absolute Rating 3.3.1 ELECTRICAL CHARACTERISTICS 7. OPTICAL CHARACTERISTIC	
V4.0	2019/5/10		Update Edition	
V5.0	2019/09/03		Update Edition	
V6.0	2019/09/10		Update Storage	
V7.0	2019/10/20		Update Temperature OT + Reliability	
V7.1	2022/11/16	P6/P7 P12 P15 P21	1.electrical characteristics 2.Power Sequence 3.pin define 4.Drawing	

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1. GENERAL DESCRIPTION

1.1 Description

7 inch is a Color Active Matrix Liquid Crystal Display Module composed of a TFT LCD panel and LED backlight system. The screen format is intended to support the 800(H) x480(V) screen and 16.7M colors.

1.2 Product Summary

The following items are summary on the table under Ta=25 °C condition:

No.	Item	Specification	Unit
1	Display Size	7.0	Inch
2	Pixel Number	800(H) x (R,G,B) x 480(V)	Pixels
3	Outline Dimension	165(H) x 104(V) x 6.8(D)	mm
4	Active Area	152.4 (H) x 91.44 (V)	mm
5	Pixel Pitch	0.1905(H) x 0.1905(V)	mm
6	Display Colors	16.7M	--
7	Display Format	RGB vertical stripe	--
8	Display Mode	Normally Black	--
9	Electrical Interface	TTL	
10	Surface Treatment	Antiglare, Hard-Coating (3H)	--
11	Brightness	1000 (central) (Typ)	cd/m2
12	Contrast Ratio	1000 (Typ.)	--
13	Consumption of Power	LCD Module: 0.55W (Max) Backlight: 3.808 (Max.)	W
14	Module Weight	153	g



2. ABSOLUTE MAXIMUM RATING

2.1 Electrical Absolute Rating

Item	Symbol	Values		Unit	Remark
		Min	Max		
LCD Power Voltage	Vcc	-0.3	4.5	V	GND=0
	VGH	-0.3	VGL+35.0	V	GND=0
	VGL	-15	+0.3	V	GND=0
	AVDD	-0.3	14.5	V	AGND=0
	VCOM	4.0	6.0	V	
Logic Signal Input Level	VI	-0.3	4.5	V	

Note 1. Permanent damage may occur to the LCD module if beyond this specification. Functional operation should be restricted to the conditions described under normal operating conditions.

Note 2. Ta= 25±2°C

2.2 Environment Absolute Rating

Item	Symbol	Values		Unit	Remark
		Min	Max.		
Operating Temperature	Top	-40	85	°C	
Storage Temperature	Tstg	-40	95	°C	



3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	NOTE
Supply Voltage	Vcc	3.0	3.3	3.6	V	
	VGH	-	19	-	V	
	VGL	-	-10	-	V	
	AVDD	-	12.4	-	V	
VCOM	VCOM	-	5.5	-	V	
Input signal voltage	ViH	0.7*Vcc	-	Vcc	V	Note(1)
	ViL	0	-	0.3*Vcc	V	
Current of power supply	IvCOM	0.2	0.6	1	mA	
	IvCC	-	15	-	mA	Vcc=3.3V, White pattem
	IvAVDD	-	20	-	mA	AVDD=12.5V, White pattem
	IvGH	-	0.25	-	mA	VGH=19V, White pattem
	IvGL	-	0.5	-	mA	VGL=10V, White pattem

Note (1): HSYNC, VSYNC, DE, Digital Data

Note (2): Be sure to apply the power voltage as the power sequence spec.

Note (3): GND=AGND=0V



3.2 BACK LIGHT

3.2.1 ELECTRICAL CHARACTERISTICS

Ta=25°C

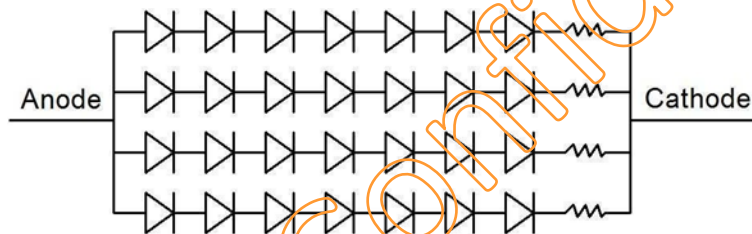
ITEM	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNIT
LED current	IL	Ta=25°C	--	160	--	mA
LED voltage	V _F	Ta=25°C	20.3	21.7	23.8	V
LED Lifetime	N/A	Ta=25°C	--	40.000		Hr

Note (1) LED life time (Hr) can be defined as the time in which it continues to operate under the condition: Ta=25±3 °C, typical IL value indicated in the above table until the brightness becomes less than 50%.

Note (2) The “LED life time” is defined as the module brightness decrease to 50% original brightness at Ta=25°C . and IL=160mA. The LED lifetime could be decreased if operating IL is larger than 160mA.

The constant current driving method is suggested.

Note (3) LED Light Bar Circuit



4. SIGNAL CHARACTERISTICS

4.1 LCD Interface Timing

Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK cycle time	Tcph	20		220	ns	
DCLK pulse duty	Tcwh	35	50	65	%	
VSD setup time	Tvst	8			ns	
VSD hold time	Tvhd	8			ns	
HSD setup time	Thst	8			ns	
HSD hold time	Thhd	8			ns	
Data setup time	Tdsu	8			ns	
Data hold time	Tdhd	8			ns	
DE setup time	Tesu	8			ns	
DE hold time	Tehd	8			ns	
DCLK frequency	fclk	28	30	32	MHz	
Horizontal display area	thd	800			Tcph	
HSD period time	th	899	902	915	Tcph	
HSD pulse width	thpw	5	10	15	Tcph	
HSD back porch	thb	32			Tcph	
HSD front porch	thfp	52	60	68	Tcph	
Vertical display area	tyd	480			th	
VSD period time	tv	546	555	564	th	
VSD pulse width	tvpw	6	10	14	Th	
VSD back porch	tvb	5			th	
VSD front porch	tvfp	55	60	65	th	

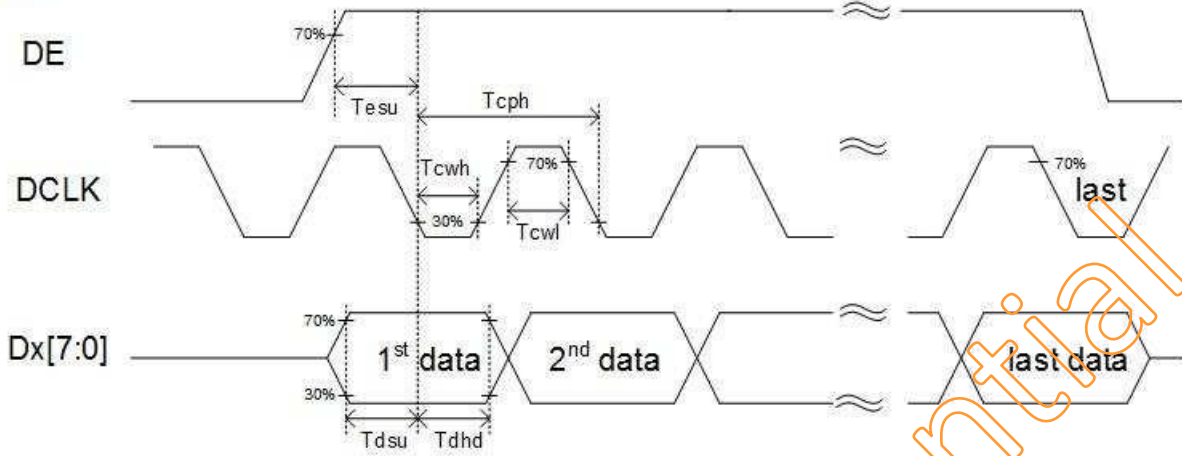
4.1.1 Data mapping

Display	MS B				LSB				MS B				LSB				MS B				LSB				Gray scale Level	
	R7	R6	R5	R4	R3	R2	R1	R0	G7	G6	G5	G4	G3	G2	G1	G0	B7	B6	B5	B4	B3	B2	B1	B0		
Basic color	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	Light Blue	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	-
	Purple	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	-
	Yellow	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	-
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	-
Gray scale of Red	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	L	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:	:	:	L3...L251																					
	Light	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L252
		H	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L253
		H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L254
	Red	H	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	Red L255
Gray scale of Green	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:	:	:	L3...L251																					
	Light	L	L	L	L	L	L	L	L	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L252	
		L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	L	L	L	L	L	L	L	L	L253	
		L	L	L	L	L	L	L	L	H	H	H	H	H	L	L	L	L	L	L	L	L	L	L	L254	
	Green	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	L	L	L	L	L	L	L	L	Green L255	
Gray scale of Blue	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L1
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2
		:	:	:	L3...L251																					
	Light	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	L	L	L252
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	H	L253	
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	L	L	L254	
	Blue	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	Blue L255
Gray scale of White & Black	Black	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L0
	Dark	L	L	L	L	L	L	L	H	L	L	L	L	L	L	H	L	L	L	L	L	L	L	H	L1	
		L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L2	
		:	:	:	L3...L251																					
	Light	H	H	H	H	H	L	L	H	H	H	H	H	L	L	H	H	H	H	H	L	L	L	L252		
		H	H	H	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	L	H	L	L253		
		H	H	H	H	H	L	L	H	H	H	H	H	L	L	H	H	H	H	H	L	L	L	L254		
	White	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	White L255	

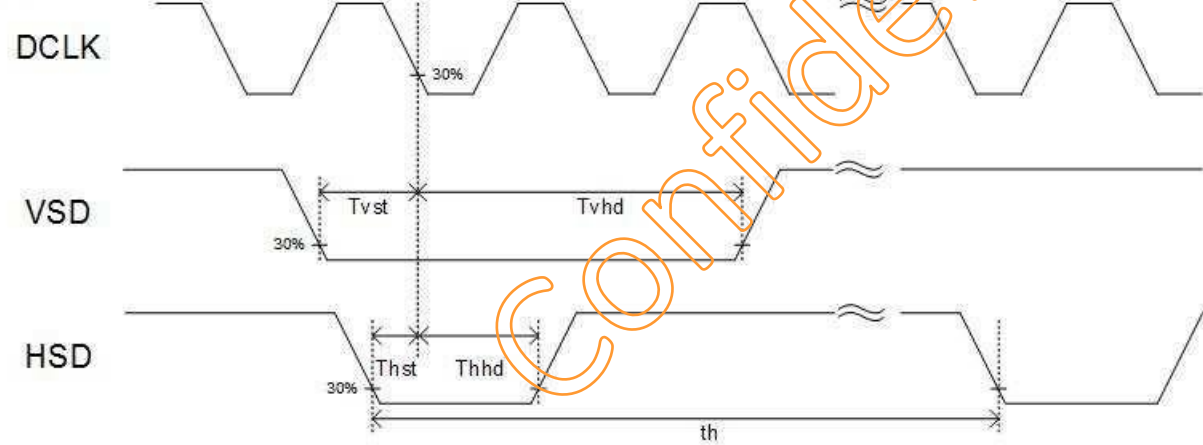
4.2 Timing Chart

4.2.1 Input clock and data timing diagram

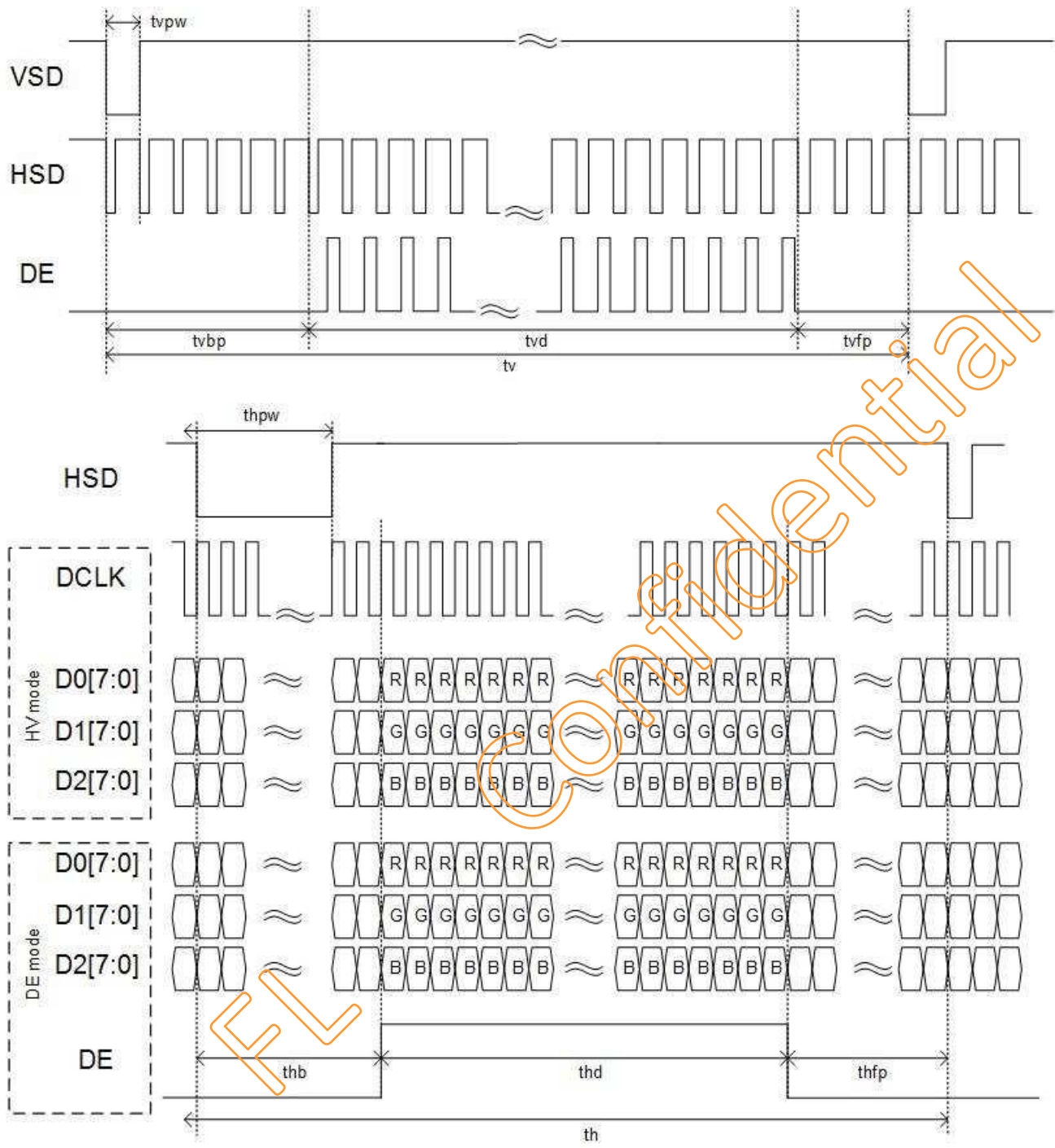
DE mode



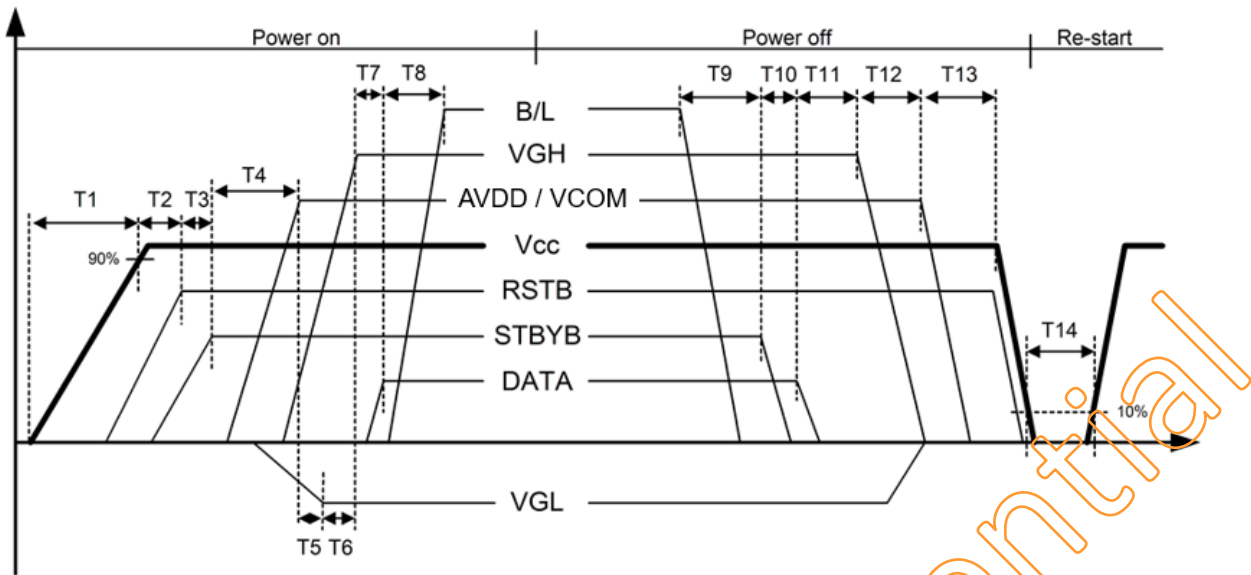
HV mode



4.2.2 Data Input Format



4.2.3 Power Sequence



Item	Min	Typ.	Max.	Unit
T1	--	--	20	ms
T2	1	--	--	ms
T3	1	--	--	ms
T4	50	--	--	ms
T5	32	--	--	ms
T6	16	--	--	ms
T7	16	--	--	ms
T8	32	--	--	ms
T9	32	--	--	ms
T10	32	--	--	ms
T11	50	--	--	ms
T12	16	--	--	ms
T13	32	--	--	ms
T14	1000	--	--	ms

The Data are included in the R0~R7, G0~G7, B0~B7, HSD, VSD, DCLK, DE, MODE, SHLR, and UPDN.

5. INTERFACE PIN DESCRIPTION

FPC1: signal and power input. (Connector: HIROSE FH52-60S-0.5SH)

Terminal no.	Symbol	I/O	Function
1	AGND	P	Analog Ground
2	AVDD	P	Analog Power
3	VCC	P	Digital Power
4	R0	I	Data Input (LSB)
5	R1	I	Data Input
6	R2	I	Data Input
7	R3	I	Data Input
8	R4	I	Data Input
9	R5	I	Data Input
10	R6	I	Data Input
11	R7	I	Data Input (MSB)
12	G0	I	Data Input (LSB)
13	G1	I	Data Input
14	G2	I	Data Input
15	G3	I	Data Input
16	G4	I	Data Input
17	G5	I	Data Input
18	G6	I	Data Input
19	G7	I	Data Input (MSB)
20	B0	I	Data Input (LSB)
21	B1	I	Data Input
22	B2	I	Data Input
23	B3	I	Data Input
24	B4	I	Data Input
25	B5	I	Data Input
26	B6	I	Data Input
27	B7	I	Data Input (MSB)
28	DCLK	I	Clock input
29	DE	I	Data enable signal
30	HSD	I	Horizontal sync input. Negative polarity
31	VSD	I	Vertical sync input. Negative polarity
32	MODE	I	DE/SYNC mode select normally pull low H: HV mode L: DE mode
33	RSTB	I	Global reset pin. Normally pull high. H: normal operation. L: the controller is in reset state. Suggest to connecting with an RC (10KΩ, 0.1μF) reset circuit for stability.
34	STBYB	I	Standby mode. Normally pull low. H: normal operation. L: the controller and source driver will turn off. Suggest to connecting with an RC (10KΩ, 0.47μF) reset circuit for stability.
35	SHLR	I	Left or Right Display Control. Note1.

36	VCC	P	Digital Power
37	UPDN	I	Up / Down Display Control. Note1.
38	GND	P	Digital Ground
39	AGND	P	Analog Ground
40	AVDD	P	Analog Power
41	VCOM	I	For external VCOM DC input
42	N/C	-	Not connect
43	BIST	-	Aging mode on/off control. Please float this pin.
44	N/C	-	Not connect
45	N/C	-	Not connect
46	N/C	-	Not connect
47	N/C	-	Not connect
48	CSB	-	Serial communication chip selection. Please float this pin.
49	SCL	-	Serial communication clock pin. Please float this pin.
50	SDO	-	Serial communication data out pin. Please float this pin.
51	SDI	-	Serial communication data pin. Please float this pin.
52	N/C	-	Not connect
53	VPP_T	-	Power supply for trim function. Please float this pin.
54	N/C	-	Not connect
55	N/C	-	Not connect
56	VGH	P	Positive Power for TFT
57	VCC	P	Digital Power
58	VGL	P	Negative Power for TFT
59	GND	P	Digital Ground
60	N/C	-	Not connect

Note1 : SHLR and UPDN control function

SHLR	UPDN	Data shifting
H	H	Left →Right, Up →Down
L	H	Right →Left, Up →Down
L	L	Right →Left, Down →Up
H	L	Left →Right, Down →Up

LED FPC Pin Assignment:

(Connector: HIROSE FH19SC-10S-0.5SH)

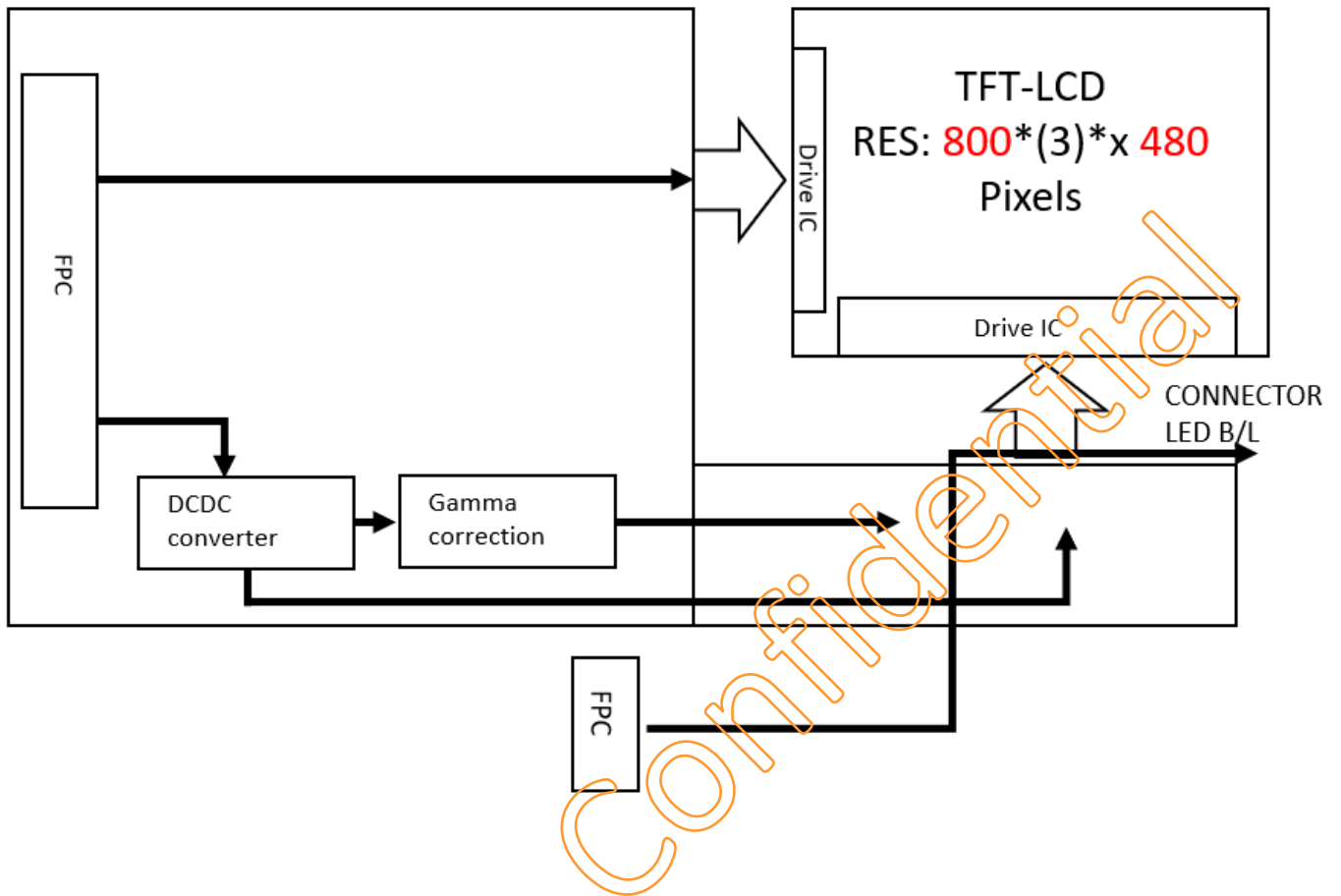
Terminal no.	Symbol	Function
1	A	Anode
2	A	Anode
3	A	Anode
4	NC	No connect
5	K	Cathode
6	K	Cathode
7	K	Cathode
8	K	Cathode
9	NC	No connect
10	NC	No connect



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6. BLOCK DIAGRAM

The following diagram shows the functional block of the TFT module:



7. OPTICAL CHARACTERISTIC

The optical characteristics are measured under stable conditions at room temperature.

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Viewing Angle	Horizontal	θ_{x+}	Center $CR \geq 10$	80	85	--	Deg.	
		θ_{x-}		80	85	--		
	Vertical	θ_{Y+}		80	85	--		
		θ_{Y-}		80	85	--		
Contrast Ratio		CR	$\theta_x = \theta_y = 0^\circ$	700	1000	--		Note 1,2
Response time		Rising +Falling	Center $\theta_x = \theta_y = 0^\circ$	--	30	40	ms	Note 5
Uniformity (9P)		YU	$\theta_x = \theta_y = 0^\circ$	70	80	--	%	Note 1,3
Brightness		L	$\theta_x = \theta_y = 0^\circ$	750	1000	--	cd/m ²	Note 1
Chromaticity	xW	Center $\theta_x = \theta_y = 0^\circ$	-0.04		0.31	+0.04		Note 1,2
	yW				0.33			
	xR				0.650			
	y R				0.334			
	xG				0.292			
	y G				0.611			
	xB				0.147			
	y B				0.061			

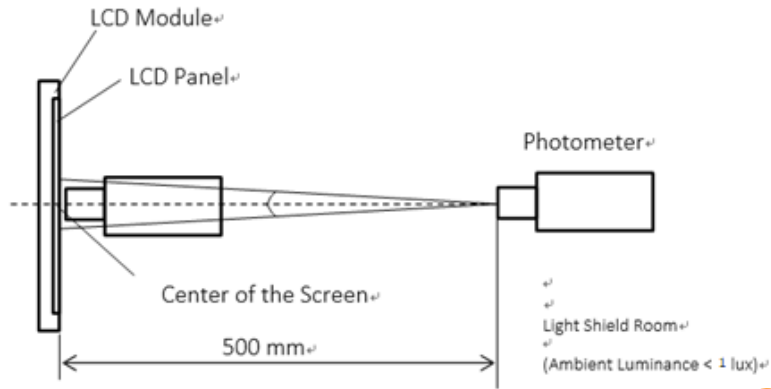
The following optical specifications shall be measured in a darkroom or equivalent state (ambient luminance ≤ 1 lux, and at room temperature).

The operation temperature is $25^\circ\text{C} \pm 2^\circ\text{C}$ and LED current IL : 160mA



Note 1: The method of optical measurement

The LCD module should be turn-on to a stable luminance level to be reached. The measurement should be executed after lighting Backlight for 20 minutes and in a dark room.

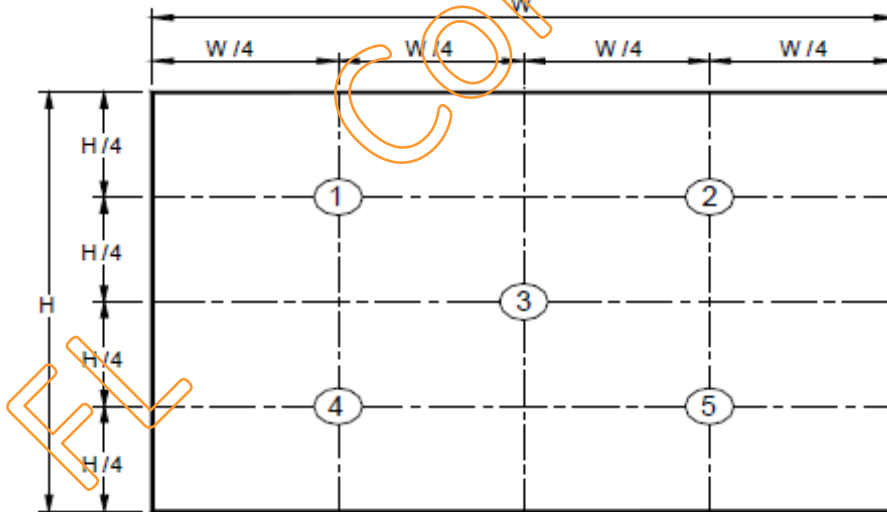


Note 2: Definition of Contrast Ratio

Measure the viewing angle of $\Theta = 0$ and at the center of the LCD surface. Luminance with all pixels in white state divide by Luminance with all pixels in Black state

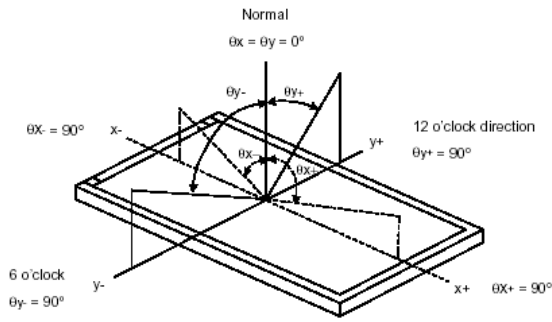
Note 3: Definition of Luminance and Luminance uniformity

$$\delta W = (\text{Maximum } [L(1), L(2), L(3), L(4) \sim L(5)] / \text{Minimum } [L(1), L(2), L(3), L(4) \sim L(5)]) \times 100\%$$



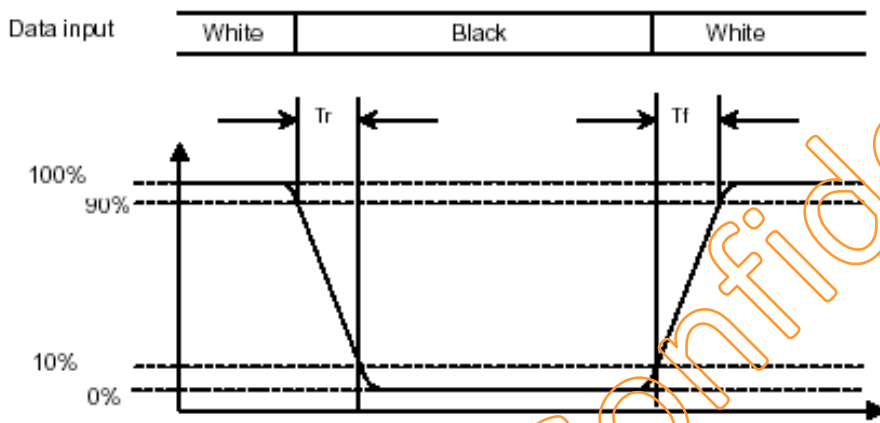
Note 4. Definition of view angle

Viewing angle is the angle at which the contrast ratio is greater than 10. The viewing angles are determined for the horizontal or the vertical clock direction with respect to the optical axis which is normal to the LCD surface.



Note 5. Definition of Response time

The response time is set initially by defining the “Rising Time (T_r)” and the “Falling Time (T_f)” respectively. The response time interval is between 10% and 90% of amplitudes, please refer the figure to the followings:



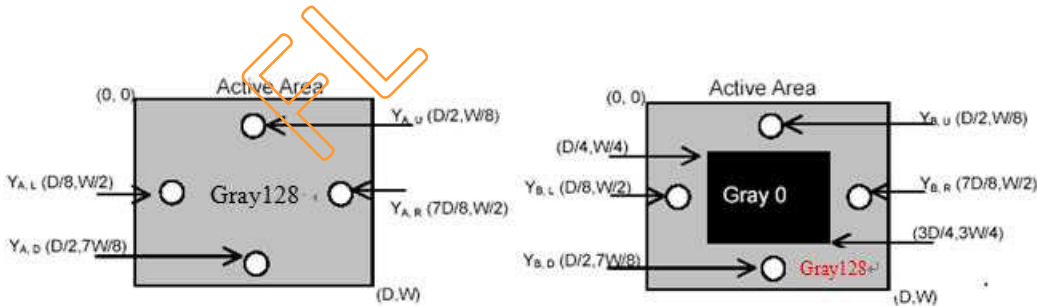
Note 6: Crosstalk Modulation Ratio

$$CT = (Y_B - Y_A) / Y_A \times 100\%$$

Y_A 、 Y_B measure position and definition

Y_A means luminance at gray level 128(exclude gray level 0 pattern)

Y_B means luminance at gray level 128(include gray level 0 pattern)



8. Reliability Test

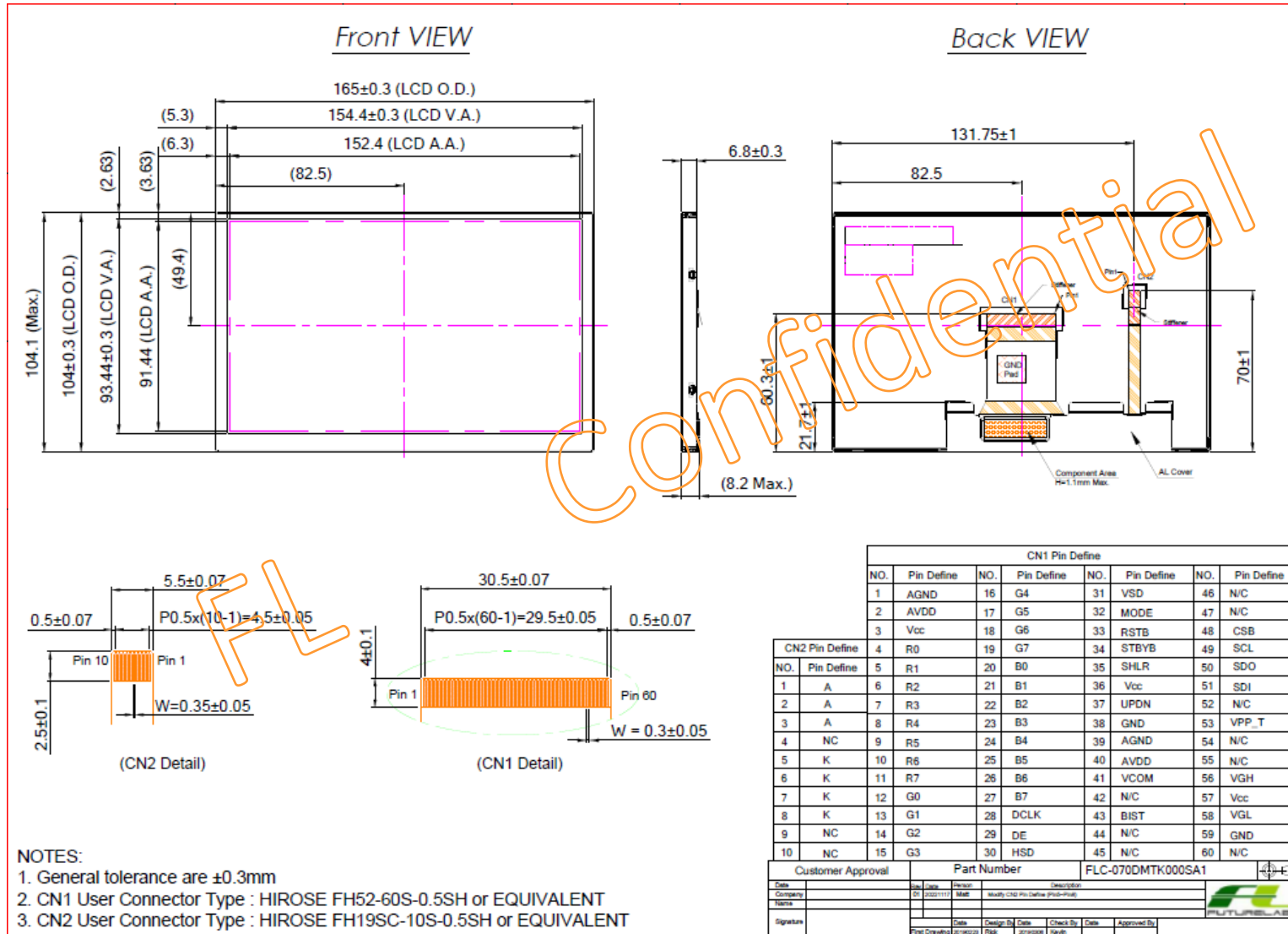
No.	Item	Conditions	Remark
1	High Temperature Storage	Ta=+95°C, 504hrs (1000hrs reference)	Note 1,2,3
2	Low Temperature Storage	Ta=-40°C, 504hrs (1000hrs reference)	Note 1,2,3
3	High Temperature Operation	Ta=+85°C, 504hrs (1000hrs reference)	Note 1,2,3
4	Low Temperature Operation	Ta=-40°C, 504hrs (1000hrs reference)	Note 1,2,3
5	High Temperature and High Humidity (operation)	Ta=+65°C, 90%RH, 504hrs (1000hrs reference)	Note 1,2,3
6	Thermal Cycling Test (non operation)	-40°C(30min) → +85°C(30min), 100 cycles	Note 1,2,3
7	Electrostatic Discharge	Contact = ± 8 kV, class B;(R=330Ω,C=150pF) Air = ± 15 kV, class B;(R=330Ω,C=150pF) 1 time for each point.	
8	Vibration	1.Random: 1.04G, 5~500Hz, XYZ, 30min/each direction 2.Sine: Freq. Range: 8~33.3Hz, Stoke: 1.3mm Sweep: 2.9G, 33.3~400Hz X/Z: 2hrs, Y:4hrs	
9	Shock	Half-Sine, 100G, 6ms, ±XYZ, 1time	

Note1 : There is no display function NG issue occurred, all the cosmetic specification is judged before the reliability stress.

Note2 : The test result shall be evaluated after the sample has been left at room temperature and humidity for 2 hours without load. No condensation shall be accepted. The sample shall be free from defects: Air bubble in the LCD 、 Seal leak 、 Non-display 、 Missing segments 、 Glass crack

Note3 : The test condition definition panel's surface temperature.

8. Outline dimension



9. PRECAUTION AND PRODUCT HANDLING

- Do not apply the external force such as bending or twisting to the LCD panel and backlight during assembly.
- Do not insert and plug out the input connector while the LCD panel is operating.
- Do not take apart the panel or frame from LCD module assembly or insert anything into the backlight unit.
- Do not keep the same pattern in a long period of time, it may cause image sticking on LCD panel. Can use shuffle content periodically if fixed pattern is displayed on the screen.
- Do not touch the display area with bare hands, this will stain the display area.
- Pay attention to handle lead wire of backlight, that is not tugged in connect with LED driver.
- Do not change variable resistance settings in LCD panel, it may cause not satisfy of LCD characteristics specification.
- The surface of LCD panel's polarizer is very soft and easily scratched, please use a very soft dry cloth without chemicals for cleaning.
- To avoid the static electricity to damage the CMOS LSI, the operator should be grounded when in contact with the LCD panel, and also to all electrical equipment.
- Need to follow the correct power frequency when LCD panel is connecting and operating, this can avoid damage to CMOS LSI during latch-up.
- Need to store the LCD panel indoor without the exposure of sunlight where the temperature is $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ and the humidity is below 60% RH.

