

TFT LCM SPECIFICATION
MODEL NO.:
C215F13-E3-P(G2)

Customer/客户	Approved by/核准	Notes/备注

Approved By 核 准	海外技术分部	

Reviewed By 会 签	品质部	工程所/电子所/结构所

海外技术分部/光电研究所	
Checked By 审 查	Prepared By 编 拟

CONTENTS

NO.	DESCRIPTION
	COVER
	CONTENTS
	REVISION History
1	GENERAL DESCRIPTION
1.1	OVERVIEW
1.2	FEATURES
1.3	APPLICATION
1.4	GENERAL SPECIFICATIONS
1.5	MECHANICAL SPECIFICATIONS
2	ABSOLUTE MAXIMUM RATINGS
2.1	ABSOLUTE RATINGS OF ENVIRONMENT
2.2	ELECTRICAL ABSOLUTE RATINGS
2.2.1	TFT LCD MODULE
2.2.2	BACKLIGHT UNIT
3	ELECTRICAL CHARACTERISTICS
3.1	ABSOLUTE MAXIMUM RATING
3.2	CONTROL CIRCUIT DRIVING
3.3	BACKLIGHT UNIT
4	INPUT TERMINAL PIN ASSIGNMENT
4.1	TFT LCD MODULE
4.2	BLOCK DIAGRAM
4.3	LVDS INTERFACE
4.4	COLOR DATA INPUT ASSIGNMENT
4.5	FLICKER ADJUSTMENT
4.6	BACK-LIGHT INTERFACE CONNECTION
5	INTERFACE TIMING
5.1	INPUT SIGNAL TIMING SPECIFICATIONS
6	OPTICAL CHARACTERISTICS
6.1	TEST CONDITIONS
6.2	OPTICAL SPECIFICATIONS
7	INTERNATIONAL STANDARDS
7.1	SAFETY
7.2	EMC
8	RELIABILITY
9	MODULE LABEL
10	PRECAUTIONS
11	MECHANICAL OUTLINE

Ver.	Page	Revised Descriptions	Date	Revision	Approval
------	------	----------------------	------	----------	----------

[illegible]

1. GENERAL DESCRIPTION

1.1 OVERVIEW

C215F13-E3-P(G2) is a 21.5" TFT Liquid Crystal Display module with white LED Backlight unit and 2ch-LVDS interface. This module supports 1920 x 1080 Full HD (16:9 wide screen) model and can display up to 16.7millions colors, Open cell: LC215DT4A (Source: PANDA)

1.2 FEATURES

- Ultra-high contrast ratio
- Fast response time
- Low power consumption
- Full HD(1920 x 1080 pixels) resolution.
- DE (Data Enable) only mode.
- LVDS (Low Voltage Differential Signaling) interface.
- Color Reproduction (Nature Color)
- ROHS compliance

1.3 APPLICATION

- TFT LCD TVs
- Display terminals for AV application

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	476.64 (H) × 268.11(V) (21.5" diagonal)	mm	(1)
Bezel Opening Area	480.20 (H) × 271.70(V)	mm	(1)
Multi-cell glass Size	487.54(H) x 282.91(V) x 1.83(D) Typ	mm	
Driver Element	a-Si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1080	pixel	-
Pixel Pitch	0.24825(H) x 0.24825 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	16.7 millions	color	-
Display Operation Mode	Normally white	-	-
Surface Treatment	Anti-glare,3H	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	495.1	495.6	496.1	mm	(1)
	Vertical(V)	291.7	292.2	292.7	mm	(1)
	Depth(sD)	8.5	9.0	9.5	mm	(1)
Weight			1900		g	-

Note(1) Please refer to the attached drawings for more information of front and back outline dimensions and the dimension of bosses are not included.

2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1), (3)
Operating Ambient Temperature	T _{OP}	0	50	°C	(1), (2), (3)
Altitude Operating	A _{OP}	0	5000	M	(3)
Altitude Storage	A _{ST}	0	12000	M	(3)

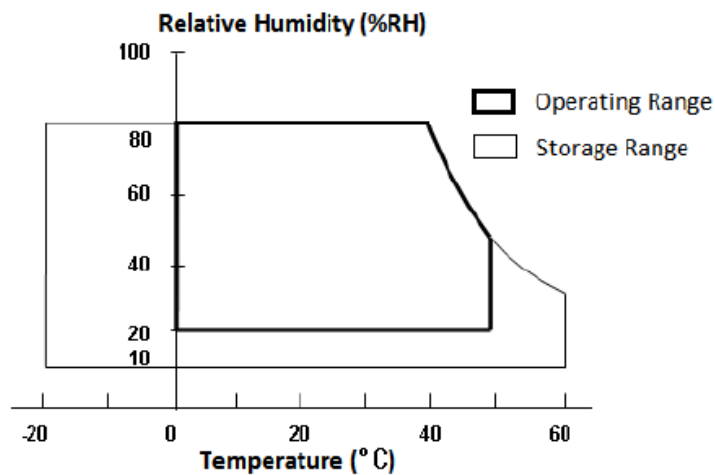
Storage Condition: With shipping package

Shelf life: one year

[Note 1] Temperature and relative humidity range is shown in the figure below.

*1) 80 %RH Max. ($T_a \leq 40\text{ }^{\circ}\text{C}$).

*2) Wet-bulb temperature should be $40\text{ }^{\circ}\text{C}$ Max. ($T_a > 40\text{ }^{\circ}\text{C}$).



*3) No condensation.

[Note 2] The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to $50\text{ }^{\circ}\text{C}$ with LCD module alone in a temperature controlled chamber. Thermal management should be considered in your product design to prevent the surface temperature of display area from being over $60\text{ }^{\circ}\text{C}$. The range of operating temperature may degrade in case of improper thermal management in your product design.

[Note 3] The rating of environment is base on LCD module. Leave LCD cell alone, this environment condition can't be guaranteed. Except LCD cell, the customer has to consider the ability of other parts of LCD module and LCD module process.

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	VCC	-0.3	6.0	V	(1)
Logic Input Voltage	VIN	-0.3	3.6	V	

Note

- (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.
- (2) Backlight input current is measured with current meter as shown below.

3. ELECTRICAL CHARACTERISTICS

3.1 Absolute Maximum Rating

Parameter	Symbol	Condition	Ratings	Unit	Remark
+5V supply voltage	VCC	Ta=25℃	0 ~ +6	V	
Storage temperature	Tstg	-	-20 ~ +60	℃	
Operation temperature	Topa	-	0 ~ +50	℃	

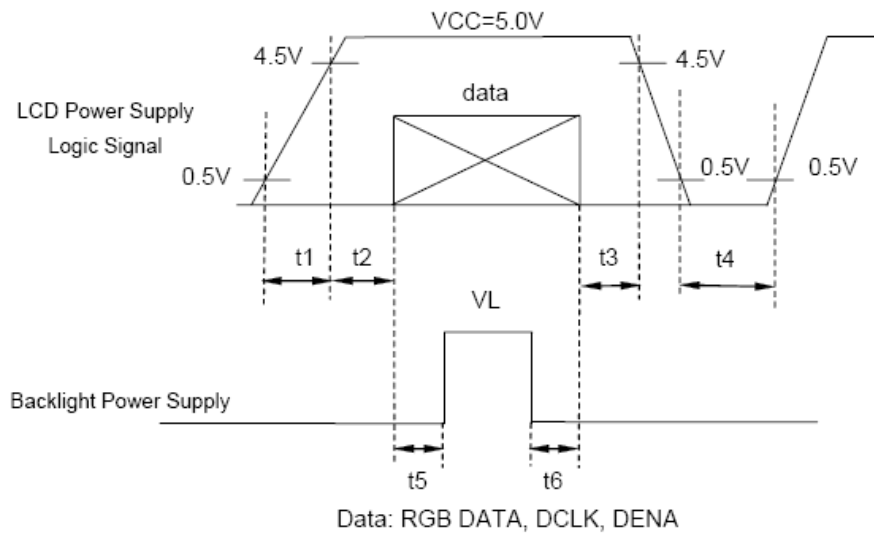
3.2 Control circuit driving

Parameter		Symbol	Min	Typ	Max	Unit	Remark
+5V supply voltage	Supply voltage	VCC	4.5	5.0	5.5	V	[Note 1]
	Current dissipation	ICC	—	820	900	mA	VCC=5.0V,60Hz Black Pattern
		IRush	—	—	3	A	[Note 2]
Permissible input ripple voltage		VRP	—	—	100	mVp-p	VCC=5.0V
Differential Input Threshold Voltage	High	VTH	—	—	100	mV	VCM=1.2V
	Low	VTL	-100	—	—	mV	[Note 3]
Input Differential Voltage		VID	100	—	600	mV	
Differential Input Common Mode Voltage		VCM	1.0	1.2	1.5	V	
Power consumption		P	—	4.1	4.5	W	

[VCM]: Common mode voltage of LVDS driver

[Note1] Power, data sequence

$0.50\text{ms} \leq t_1 \leq 10\text{ms}$	$t_4 \geq 1 \text{ sec}$
$0.01\text{ms} < t_2 \leq 50\text{ms}$	$t_5 \geq 500\text{ms}$
$0.01\text{ms} < t_3 \leq 50\text{ms}$	$t_6 \geq 200\text{ms}$



※ Data: CLKIN $\pm$, RIN0 $\pm$, RIN1 $\pm$, RIN2 $\pm$, RIN3 $\pm$

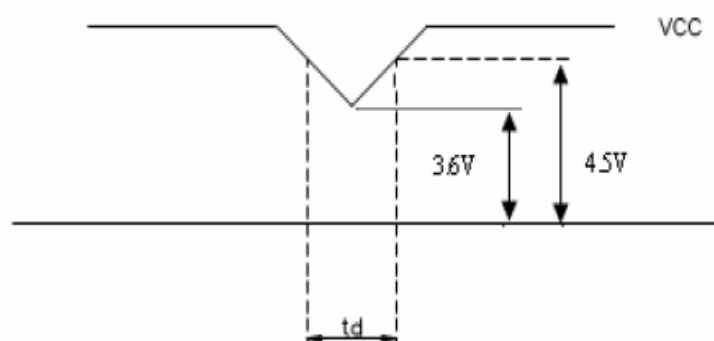
※ About the relation between data input and back light lighting, please base on the above-mentioned input sequence.

※ When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

※ VCC-dip conditions:

(1) When $3.6V \leq VCC(\min) < 4.5V$, $t_d \leq 10\text{ ms}$

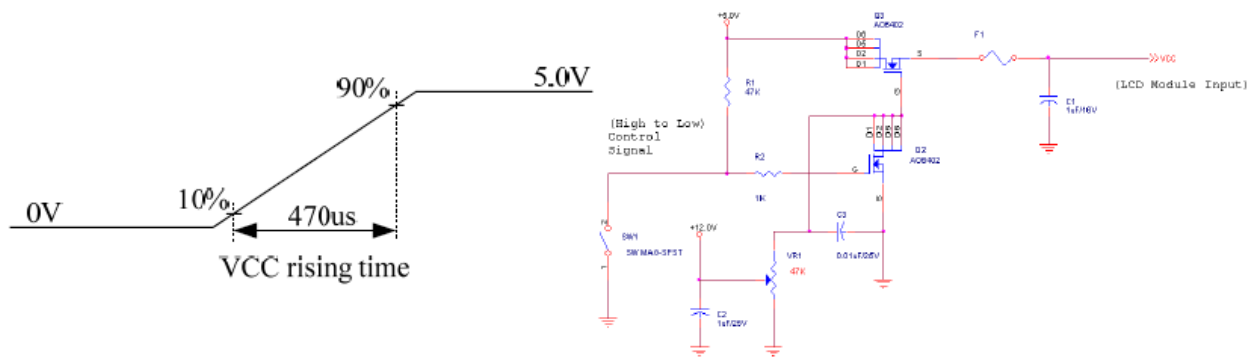
(2) When $VCC < 3.6\text{ V}$, VCC-dip conditions should also follow the VCC-turn-on conditions.



[Note2]

IRush Measurement Condition:

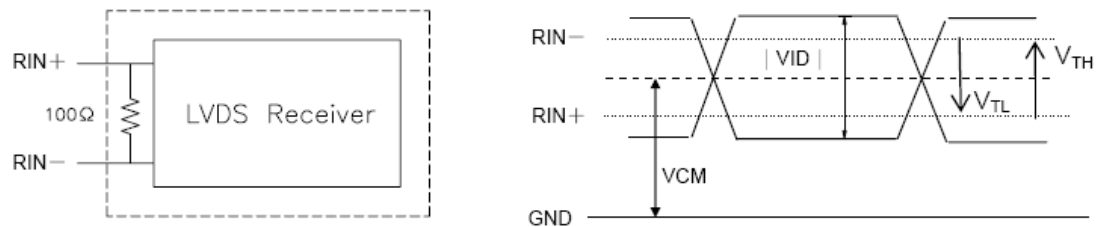
The duration of rising time of power input is 470us.



[Note3]

RIN+: Positive differential DATA & CLK Input

RIN -: Negative differential DATA & CLK Input

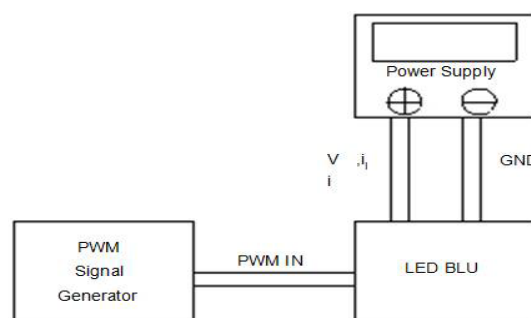


3.3 BACKLIGHT UNIT ($T_a = 25 \pm 2^\circ\text{C}$)

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Converter Input Voltage	V_i	30.8	-	38.5	VDC	Duty 100%
Converter Input Current	I_i	300	310	330	mADC	Duty 100%
Power Consumption	P_i	7.9	9.2	10.5	W	(1)
LED Life Time	LBL	20,000	30,000	-	Hrs	(2)

Note (1) $P_i = I_i \times V_i$

Note (2) The life time of LED is defined as the time when it continues to operate under the condition at $T_a = 25 \pm 2^\circ\text{C}$ and $I = 480\text{ mA}$ (Per EA) until the brightness becomes $\leq 50\%$ of its original value.



4. INPUT TERMINAL PIN ASSIGNMENT

4.1 TFT LCD MODULE

CN1 (Interface signals and +5V DC power supply) Shown on the next table.

Using connector: FI-XB30SSRLA-HF-16 (JAE) or compatible

Matching connector: FI-X30HL(JAE) or compatible

Pin No.	Symbol	Function	Remark
1	RxOIN0-	Negative LVDS DATA input(ODD)	LVDS
2	RxOIN0+	Positive LVDS DATA input(ODD)	LVDS
3	RxOIN1-	Negative LVDS DATA input(ODD)	LVDS
4	RxOIN1+	Positive LVDS DATA input(ODD)	LVDS
5	RxOIN2-	Negative LVDS DATA input(ODD)	LVDS
6	RxOIN2+	Positive LVDS DATA input(ODD)	LVDS
7	GND	Ground	
8	RxOCLK-	Negative LVDS Clock input(ODD)	LVDS
9	RxOCLK+	Positive LVDS Clock input(ODD)	LVDS
10	RxOIN3-	Negative LVDS DATA input(ODD)	LVDS
11	RxOIN3+	Positive LVDS DATA input(ODD)	LVDS
12	RxEIN0-	Negative LVDS DATA input(EVEN)	LVDS

13	RxEIN0+	Positive LVDS DATA input(EVEN)	LVDS
14	GND	Ground	
15	RxEIN1-	Negative LVDS DATA input(EVEN)	LVDS
16	RxEIN1+	Positive LVDS DATA input(EVEN)	LVDS
17	GND	Ground	
18	RxEIN2-	Negative LVDS DATA input(EVEN)	LVDS
19	RxEIN2+	Positive LVDS DATA input(EVEN)	LVDS
20	RxCLK-	Negative LVDS Clock input(EVEN)	LVDS
21	RxCLK+	Positive LVDS Clock input(EVEN)	LVDS
22	RxEIN3-	Negative LVDS DATA input(EVEN)	LVDS
23	RxEIN3+	Positive LVDS DATA input(EVEN)	LVDS
24	GND	Ground	
25	NC	No connection(Do not connect)	
26	NC	No connection(Do not connect)	
27	NC	No connection, This pin should be open	[Note 1]
28	VDD	POWER +5V	
29	VDD	POWER +5V	
30	VDD	POWER +5V	

[Note 1] Built-in Self Test (BIST)

*1) PIN27=NC: Disable BIST function.

Available LVDS Signal input: Display LVDS input Pattern.

No LVDS Signal or unavailable LVDS Signal input: Display Black Pattern.

*2) PIN27=High(2.7V~3.3V): Enable BIST function.

Available LVDS Signal input: Display LVDS input Pattern.

No LVDS Signal or unavailable LVDS Signal input: Display BIST Pattern

4.4 COLOR DATA INPUT ASSIGNMENT

	Colors & Gray scale	Data signal																								
		Gray Scale	R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
Basic Color	Black	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Green	—	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Cyan	—	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Red	—	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Magenta	—	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	Yellow	—	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	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	1	1	1	1	1	1
Gray Scale of Red	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	↓	↓								↓								↓							
	↓	↓	↓								↓								↓							
	Brighter	GS253	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↓	GS254	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	GS255	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale of Green	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	↓	↓								↓								↓							
	↓	↓	↓								↓								↓							
	Brighter	GS253	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	↓	GS254	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Green	GS255	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Gray Scale of Blue	Black	GS0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	↑	GS1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Darker	GS2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	↑	↓	↓								↓								↓							
	↓	↓	↓								↓								↓							
	Brighter	GS253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
	↓	GS254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Blue	GS255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

0: Low level voltage,

1: High level voltage.

Each basic color can be displayed in 256 gray scales from 8 bit data signals. According to the combination of total 24 bit data signals, the 16,7M colors display can be achieved on the screen.

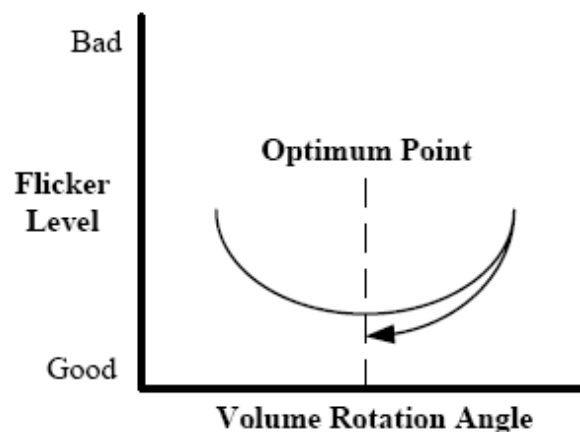
4.5 FLICKER ADJUSTMENT

(a) Adjustment Pattern: 2H1V Checker pattern as follow:

R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127
R	G	B	R	G	B	R	G	B	R	G	B	R	G	B	R	G	B
0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127	0	127

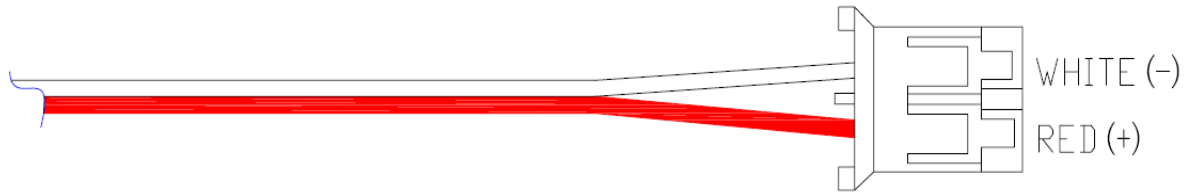
(b) Adjustment Method:

Flicker should be adjusted by turning the volume for flicker adjustment by the ceramic driver. It is adjusted to the point with least flickering of the whole screen. After making it surely overrun at once, it should be adjusted to the optimum point.



4.6 Back-light Interface Connection

Connector type: DH-2Y 2.0mm		Symbol	Feature
Name	Pin No		
CN1	1	LED+	Positive of LED String
	2	LED-	Negative of LED String



5. INTERFACE TIMING

5.1 INPUT SIGNAL TIMING SPECIFICATION

(a) The input signal timing specifications are shown as the following table and timing diagram.

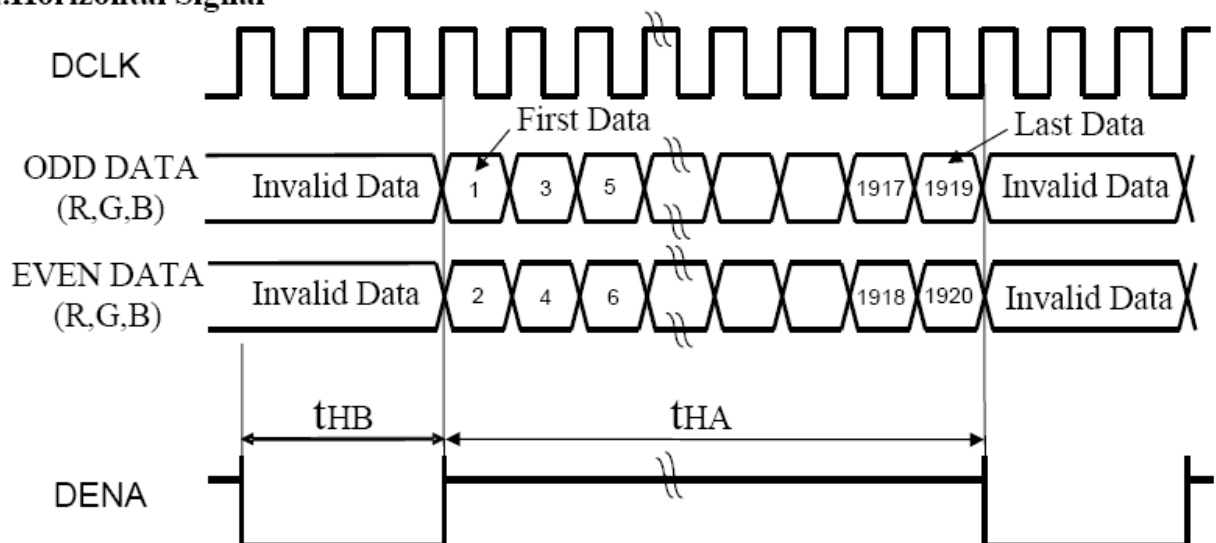
Item			Symbol	Min	Typ.	Max.	Unit
LCD Timing	DCLK	Freq.	fCLK	55	72	90	MHz
		Cycle	tCLK	18.18	13.89	11.11	ns
	DENA	Horizontal	Horizontal effective time	tHA	960	960	tCLK
			Horizontal blank time	tHB	32	100	tCLK
			Horizontal total time	tH	992	1060	tCLK
		Vertical	Vertical frame Rate	Fr	50	60	Hz
			Vertical total time	tV	1084	1130	tH
			Vertical effective time	tVA	1080	1080	tH
			Vertical blank time	tVB	4	50	tH

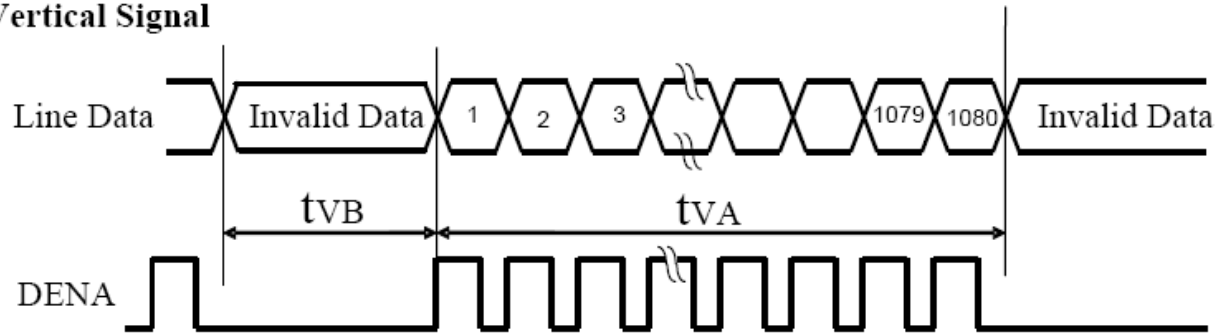
[Note]

- *1) DENA (data enable) usually is positive
- *2) DCLK still inputs during blanking
- *3) DE mode only
- *4) It maybe cause flicker at 50Hz.

(b) Timing Chart

a.Horizontal Signal



b.Vertical Signal

6. OPTICAL CHARACTERISTICS

6.1 TEST CONDITIONS

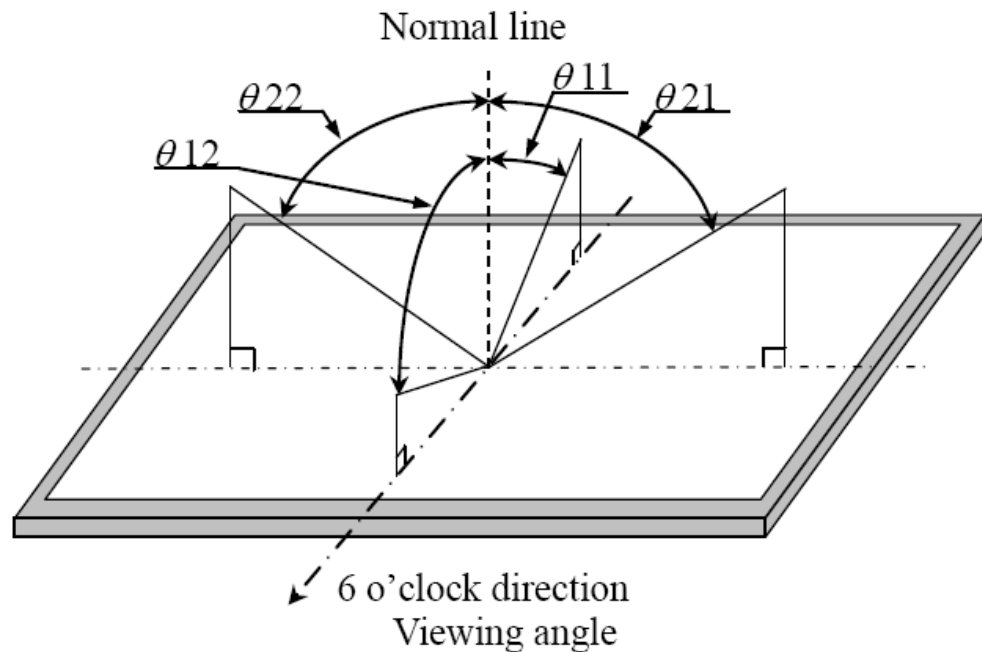
item	Symbol	Value	Unit
Ambient Temperature	Ta	25 ± 2	°C
Ambient Humidity	Ha	50 ± 10	%RH
Supply Voltage	Vcc	5.0	V
Input Signal	According to typical in "3.ELECTRICAL CHARACTERISTICS"		
Light Bar Input Current	ILED	310 ± 10	mA DC (per string)
Duty	D	100	%

6.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 6.2. The following items should be measured under the test conditions described in 6.1 and stable environment shown in Note (6).

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity (CIE 1931)	Red	R _x	$\theta_x = 0^\circ, \theta_y = 0^\circ$ Viewing Angle at Normal Direction	Typ - 0.03	0.636	Typ + 0.03	-	(1)
		R _y			0.348			
	Green	G _x			0.327			
		G _y			0.611			
	Blue	B _x			0.154			
		B _y			0.059			
	White	W _x			0.313			
		W _y			0.329			
	Color Gamut	CG		68	72	-	%	(1)
—Center Luminance of White (Center of Screen)		L _c		-	180	-	cd/m ²	(1)、(4)
Contrast Ratio		CR		700	1000	-	-	(1)、(2)
Response Time		T _R		-	1.5	2.5	ms	(1)、(3)
		T _F			3.5	5.5		
White Variation		δW		70	75%	-	-	(4)、(5)
Viewing Angle	Horizontal	θ +x	CR ≧ 10	80	85	-	Deg.	(1)、(3)
		θ -x		80	85	-		
	Vertical	θ +Y		75	80	-		
		θ -Y		75	80	-		

[Note 1] Definitions of viewing angle range:



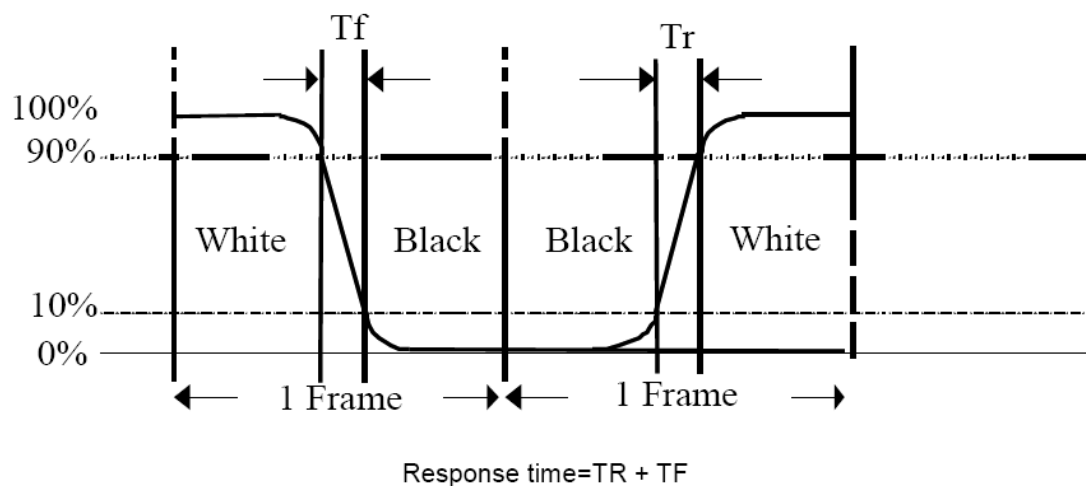
[Note 2] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (Brightness) with white screen}}{\text{Luminance (Brightness) with black screen}}$$

[Note 3] Definition of response time

The output signals of photo detector are measured when the input signals are changed from "Full Black" to "Full White" (rising time, TR), and from "Full White" to "Full Black" (falling time, TF), respectively. The response time is interval between the 10% and 90% (1 frame at 60 Hz) of amplitudes.



[Note 4] This shall be measured at center of the screen.

Note (5) Definition of white variation()

Measure the luminance of gray level 255 at 9 points

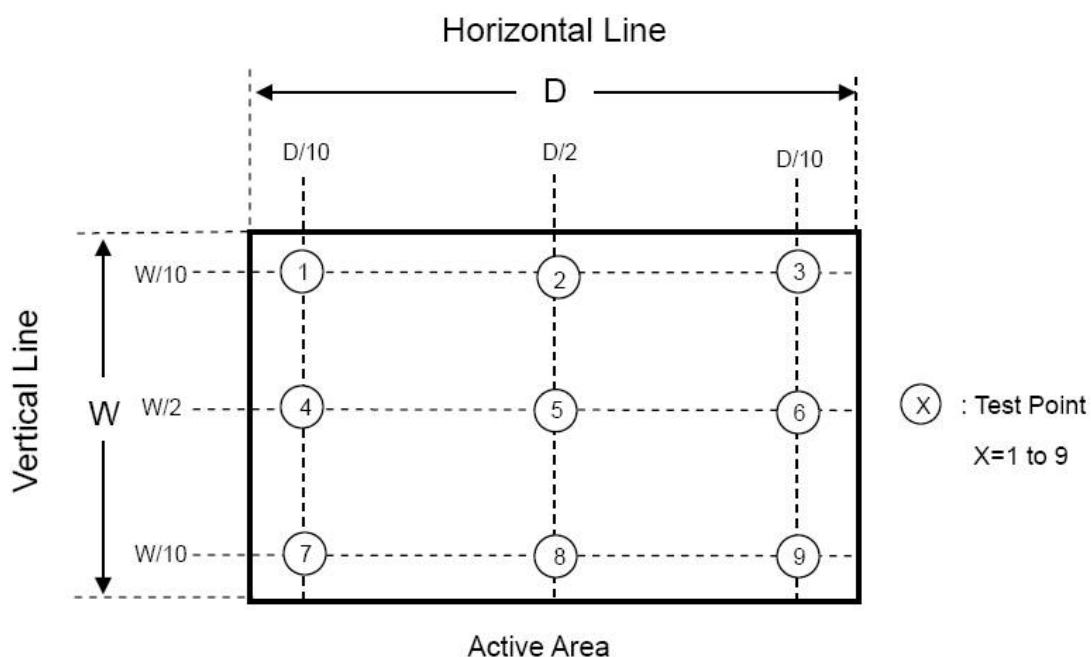
Measurement Setup:

The LCD module should be stabilized at given temperature for 30min to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 30min in a windless room.

Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 255 at 9 points

$\delta W = \text{Minimum [L (1), L (2), L (3), L (4), L (5) ...L (9)]} / \text{Maximum [L (1), L (2), L (3), L (4), L (5) ...L (9)]}$



7.INTERNATIONAL STANDARD

7.1 SAFETY

- (1) UL1950 Third Edition, Underwriters Laboratories, Inc. Jan. 28, 1995 Standard for Safety of Information Technology Equipment Including electrical Business Equipment.
 - (2) CAN/CSA C22.2 No. 950-95/60950 Third Edition, Canadian Standards Association, Standard for Safety of Information Technology Equipment Including Electrical Business Equipment.
 - (3) EN60950 : 1992+A2: 1993+A2: 1993+C3: 1995+A4: 1997+A11: 1997 IEC 950: 1991+A1: 1992+A2: 1993+C3: 1995+A4:1996
- European Committee for Electrotechnical Standardization (CENELEC) EUROPEAN STANDARD for Safety of Information Technology Equipment Including Electrical Business Equipment.

7.2 EMC

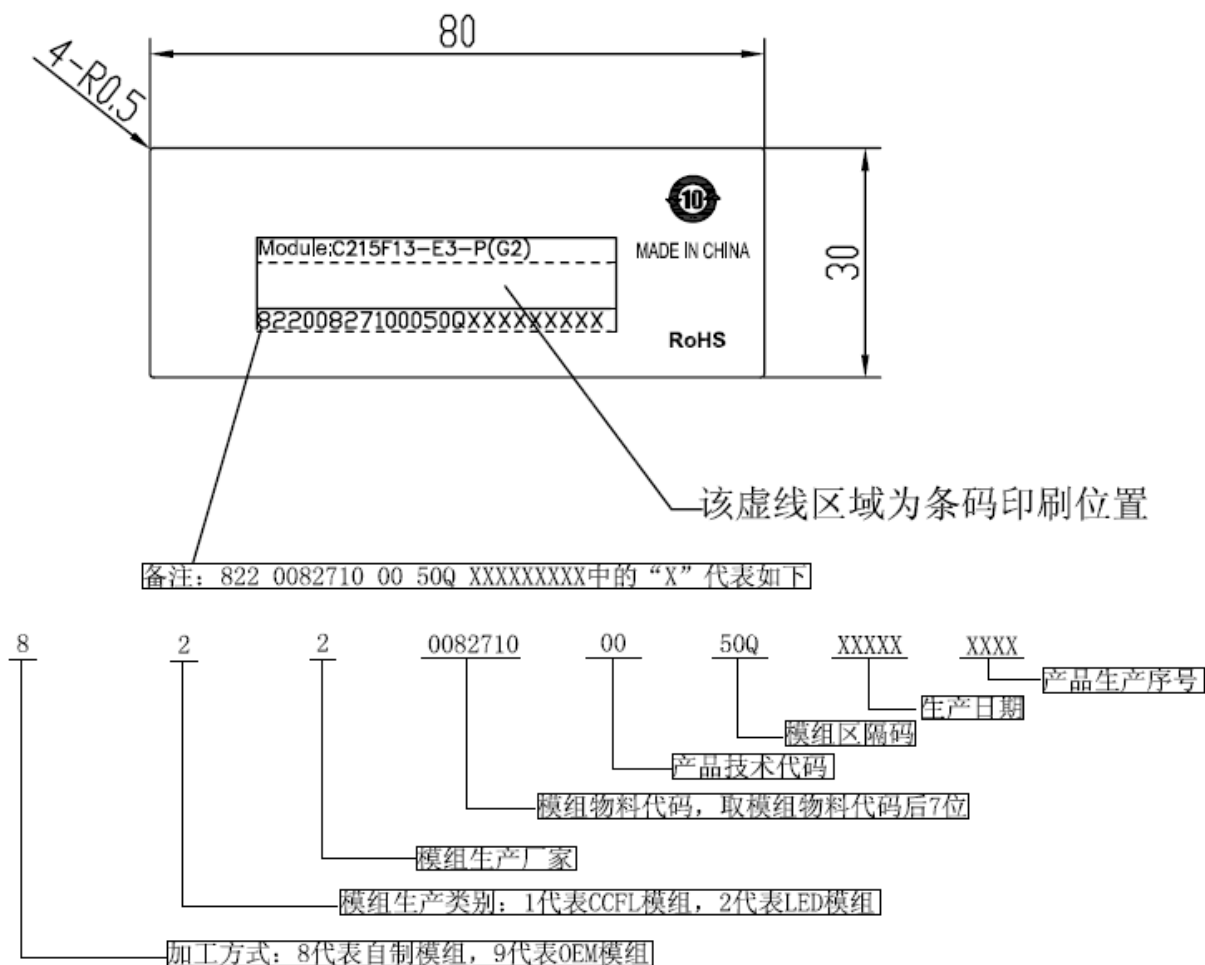
- (a) ANSI C63.4 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electrical Equipment in the Range of 9kHz to 40GHz. "American National standards Institute(ANSI), 1992.
- (b) C.I.S.P.R "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." International Special committee on Radio Interference.
- (c) EN 55022 "Limits and Methods of Measurement of Radio Interface Characteristics of Information Technology Equipment." European Committee for Electrotechnical Standardization. (CENELEC), 1998

8. RELIABILITY

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50°C , 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50°C , 50%RH , 240hours	
Low Temperature Operation (LTO)	Ta= 0°C , 240hours	
High Temperature Storage (HTS)	Ta= 60°C , 240hours	
Low Temperature Storage (LTS)	Ta= -20°C , 240hours	
Vibration Test (Non-operation)	Acceleration: 1.5 Grms Wave: Half-sine Frequency: 10 - 300 Hz Sweep: 30 Minutes each Axis (X, Y, Z)	
Shock Test (Non-operation)	Acceleration: 50 G Wave: Half-sine Active Time: 11 ms Direction : ± X, ± Y, ± Z.(one time for each Axis)	
Thermal Shock Test (TST)	-20°C/30min , 60°C / 30min , 100 cycles	
On/Off Test	25°C , On/10sec , Off /10sec , 30,000 cycles	
ESD (Electro Static Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω)	
	Air Discharge: ± 15KV, 150pF(330Ω)	
Altitude Test	Operation:10,000 ft / 24hours Non-Operation:30,000 ft / 24hours	

9. MODULE LABEL (C215F13-E3-P(G2))



10. PRECAUTIONS

MOUNTING PRECAUTIONS

- (1) You must mount a module using holes arranged in four corners or four sides.
- (2) You should consider the mounting structure so that uneven force (ex. twisted stress) is not applied to module. And the case on which a module is mounted should have sufficient strength so that external force is not transmitted directly to the module.
- (3) Please attach the surface transparent protective plate to the surface in order to protect the polarizer. Transparent protective plate should have sufficient strength in order to resist external force.
- (4) You should adopt mounting structure to satisfy the temperature specification.
- (5) Acetic acid type and chlorine type materials for the cover case are not desirable because the former generates corrosive gas of attacking the polarizer at high temperature and the latter causes circuits break by electro-chemical reaction.
- (6) Do not touch, push or rub the exposed polarizer with glass, tweezers or anything harder than HB pencil lead. And please do not rub with dust clothes with chemical treatment. Do not touch the surface of polarizer for bare hand or greasy cloth. (Some cosmetics are detrimental to the polarizer.)
- (7) When the surface becomes dusty, please wipe gently with absorbent cotton or other soft materials like chamois soaks with petroleum benzene. Normal-hexane is recommended for cleaning the adhesives used to attach front/ rear polarizer. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer.
- (8) Wipe off saliva or water drops as soon as possible. Their long time contact with polarizer causes deformations and color fading.
- (9) Do not open the case because inside circuits do not have sufficient strength.

OPERATING PRECAUTIONS

- (1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage: $V=\pm 200\text{mV}$ (Over and under shoot voltage)
- (2) Brightness depends on the temperature. (In lower temperature, it becomes lower.) And in lower temperature, response time (required time that brightness is stable after turned on) becomes longer.
- (3) Be careful for condensation at sudden temperature change. Condensation makes damage to polarizer or electrical contacted parts. And after fading condensation, smear or spot will occur.
- (4) When fixed patterns are displayed for a long time, remnant image is likely to occur.
- (5) 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 interface.

ELECTROSTATIC DISCHARGE CONTROL

Since a module is composed of electronic circuits, it is not strong to electrostatic discharge. Make certain that treatment persons are connected to ground through wrist band etc. And don't touch interface pin directly.

PRECAUTIONS FOR STRONG LIGHT EXPOSURE

Strong light exposure causes degradation of polarizer and color filter.

STORAGE

When storing modules as spares for a long time, the following precautions are necessary.

- (1) Store them in a dark place. Do not expose the module to sunlight or fluorescent light. Keep the temperature between 5 °C and 35°C at normal humidity.
- (2) The polarizer surface should not come in contact with any other object. It is recommended that they be stored in the container in which they were shipped.

HANDLING PRECAUTIONS FOR PROTECTION FILM

- (1) The protection film is attached to the bezel with a small masking tape. When the protection film is peeled off, static electricity is generated between the film and polarizer. This should be peeled off slowly and carefully by people who are electrically grounded and with well ion-blown equipment or in such a condition, etc. When the module with protection film attached is stored for a long time, sometimes there remains a very small amount of glue still on the bezel after the protection film is peeled off.
- (2) You can remove the glue easily. When the glue remains on the bezel or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.

11. Mechanical Outline

