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	SPECIFICATION	APPLICABLE GROUP DISPLAY DEVICE BUSINESS DIVISION

DEVICE SPECIFICATION FOR

TFT-LCD Module

MODEL No.

LQ156M1JW31

DP/N : 1203M

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☐ CUSTOMER'S APPROVAL

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RECORDS OF REVISION

LQ156M1JW31

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			P24	Label modified	

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1. Application

This publication applies to a color TFT-LCD module, LQ156M1JW31.

2. Overview

This module is a color active matrix LCD module incorporating Oxide TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, a control circuit and power supply circuit, and a backlight unit. Graphics and texts can be displayed on a 1920×3×1080 dots panel with 16,777,216 colors by using eDP (Embedded Display Port) Ver1.3 interface and supplying +3.3V DC supply voltage for TFT-LCD panel driving and applying DC supply voltage for LED backlight-driving DC/DC converter.

In this TFT-LCD panel, color filters for excellent color performance and backlights for high brightness are incorporated to realize brighter and clearer pictures, making this model optimum for use in multi-media applications.

Optimum viewings are in all directions.

Backlight-driving LED controller is built in this module.

eDP Transfer rate Specification : 2.7Gbps / 2 lane

3. Mechanical Specifications

Parameter	Specifications	Unit
Display size	39.652 (15.6") Diagonal	cm
Active area	345.60(H)×194.40 (V)	mm
Pixel format	1920(H)×1080 (V)	pixel
	(1 pixel = R+G+B dots)	
Pixel pitch	0.18 (H) × 0.18(V)	mm
Pixel configuration	R,G,B vertical stripe	
Display mode	Normally black	
Surface treatment of front polarizer	Anti-glare coating (Haze value (25)%) Hard coating (3H)	

Outline dimensions

Parameter		Min.	Typ.	Max.	Unit	Remark
Unit outline dimensions [Note 3-1]	Width	351.65	351.9	352.15	mm	w/o bracket
	Height	219.8	220.2	220.6	mm	w/o bracket
	Depth	2.318	2.468	2.618	mm	w/ Fix tape
Mass		—	295	315	g	w/o Protection film 5g

[Note 3-1] Outline dimensions is shown in Fig.2

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4. Input Terminals

4 - 1. Symbol

CN1 (eDP signals, +3.3V DC power supply, and B/L power supply)

Pin No.	Symbol	I/O	Function	Remark
1	NC	-	Reserved for LCD	[Note4-1-1]
2	H_GND	P	High Speed Ground	[Note 4-1-2]
3	Lane1_N	I	Complement Signal Link Lane 1	
4	Lane1_P	I	True Signal Link Lane 1	
5	H_GND	P	High Speed Ground	[Note 4-1-2]
6	Lane0_N	I	Complement Signal Link Lane 0	
7	Lane0_P	I	True Signal Link Lane 0	
8	H_GND	P	High Speed Ground	[Note 4-1-2]
9	AUX_CH_P	I	True Signal Auxiliary Channel	
10	AUX_CH_N	I	Complement Signal Auxiliary Channel	
11	H_GND	P	High Speed Ground	[Note 4-1-2]
12	VDD	P	LCD logic and driver power(3.3V)	
13	VDD	P	LCD logic and driver power(3.3V)	
14	BIST _ENABLE	I	LCD Panel Self Test Enable	[Note 4-1-6]
15	LCD_GND	P	LCD logic and driver ground	
16	LCD_GND	P	LCD logic and driver ground	
17	HPD	O	HPD signal pin	[Note 4-1-3]
18	BL_GND	P	Backlight ground	
19	BL_GND	P	Backlight ground	
20	BL_GND	P	Backlight ground	
21	BL_GND	P	Backlight ground	
22	BL_ENABLE	I	Backlight On/Off	[Note 4-1-4]
23	BL_PWM_DIM	I	System PWM	[Note 4-1-5]
24	NC	-	Reserved for LCD	[Note4-1-8]
25	SDA	I	Serial data signal for I2C	[Note 4-1-7]
26	VBL	P	Backlight power	
27	VBL	P	Backlight power	
28	VBL	P	Backlight power	
29	VBL	P	Backlight power	
30	SCL	I	Serial clock signal for I2C	[Note 4-1-7]

*1 P : Power , I : Input , O : Output

[Note 4-1-1] Don't input any signals or any powers into a NC pin. Keep the NC pin open.

[Note 4-1-2] The shielding case is connected with signal GND.

- Connector used : 20455-030E-76
- Corresponding connector : 20453-030T

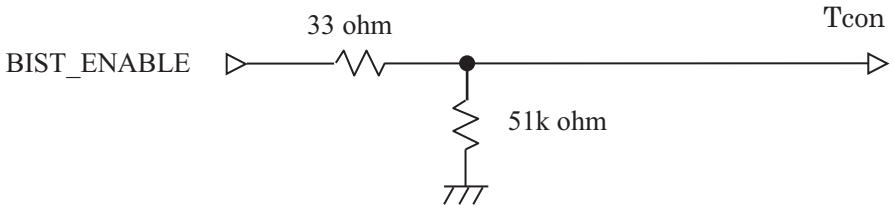
(Sharp is not responsible to its product quality, if the user applies a connector not corresponding to the above model.)

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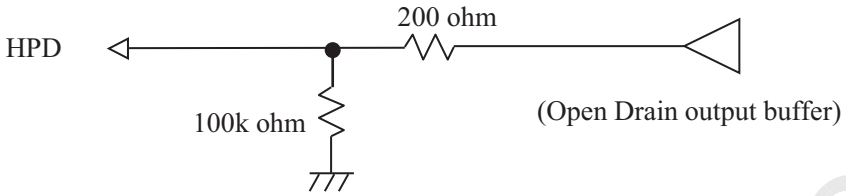
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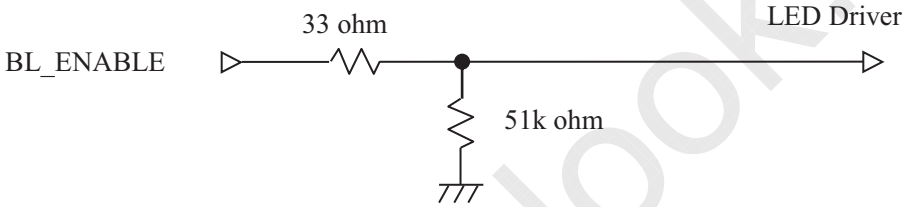
[Note 4-1-3] Input circuit is as below.



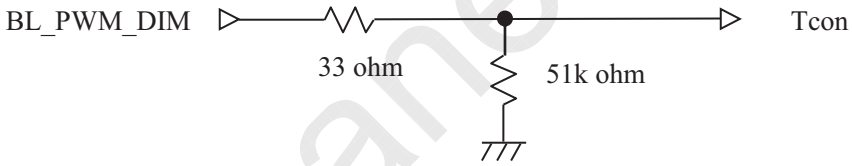
[Note 4-1-4] Output circuit is as below.



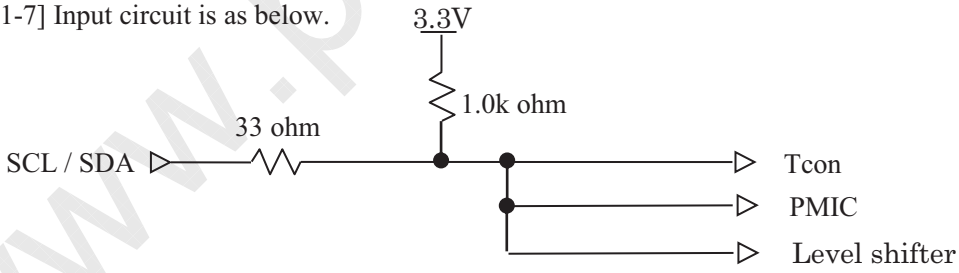
[Note 4-1-5] Input circuit is as below.



[Note 4-1-6] Input circuit is as below.



[Note 4-1-7] Input circuit is as below.



[Note 4-1-8] All terminals except NC terminal must be connected to input signal described as above or supply voltage or GND each.

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4 - 2. eDP interface

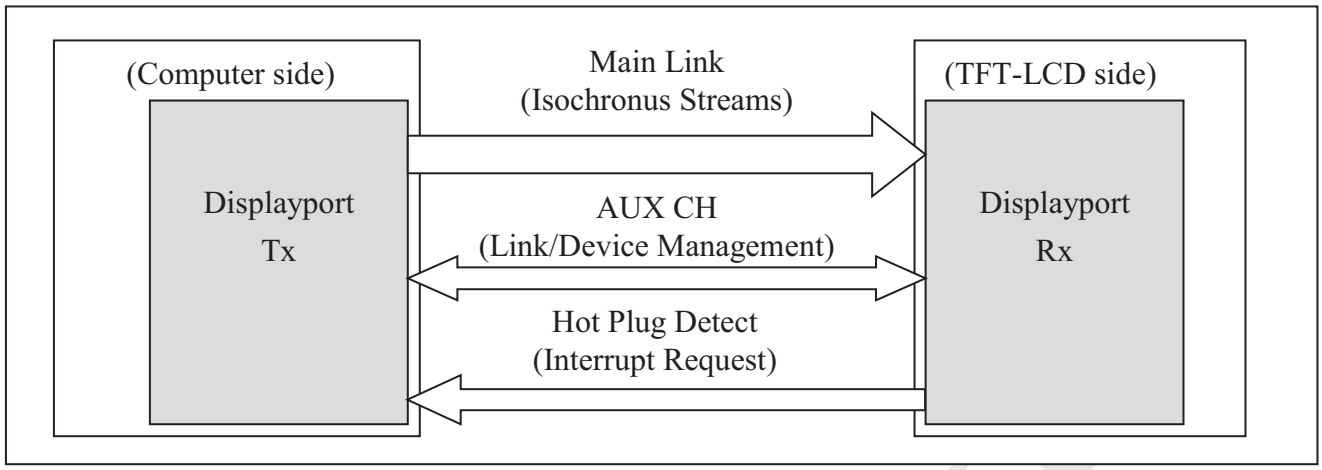


Fig.4-2-1 DP architecture.

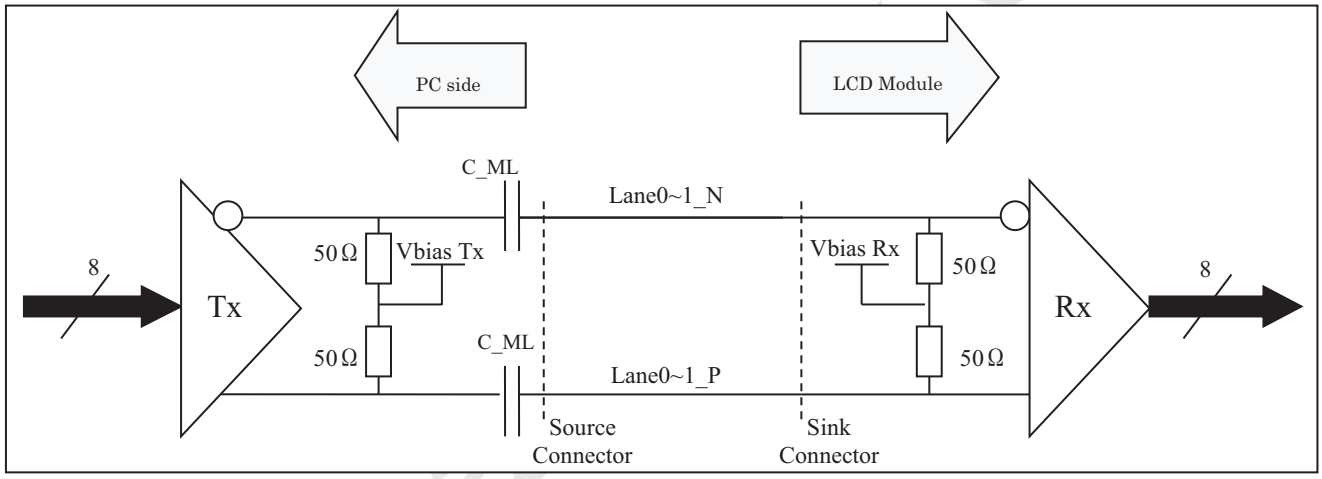


Fig.4-2-2 Main Link differential pair.

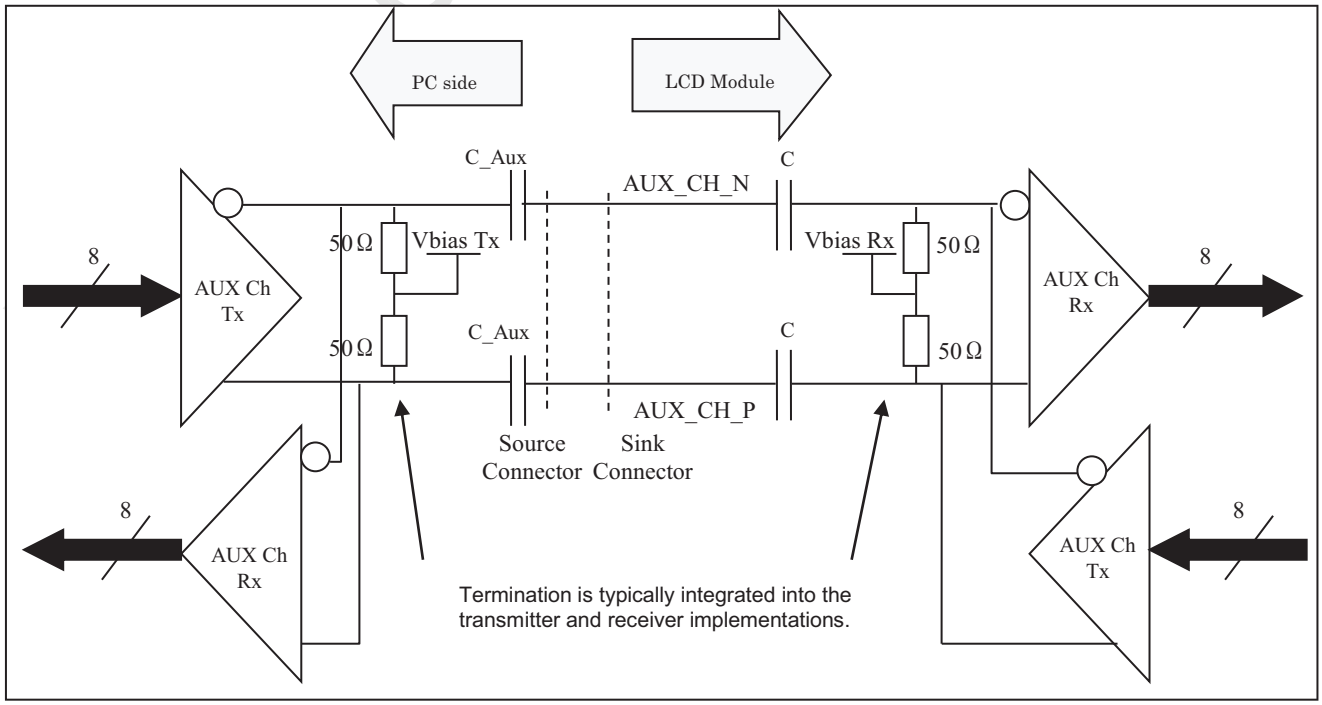


Fig.4-2-3 AUX Link differential pair.

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Lane0	Lane1
R0-7:0	R1-7:0
G0-7:0	G1-7:0
B0-7:0	B1-7:0
R2-7:0	R3-7:0
G2-7:0	G3-7:0
B2-7:0	B3-7:0
R4-7:0	R5-7:0
G4-7:0	G5-7:0
B4-7:0	B5-7:0

Fig.4-2-4 eDP 2lane 8 bit input data mapping.

5. Absolute Maximum Ratings

Parameter	Symbol	Condition	Ratings		Unit	Remark
			Min.	Max.		
+3.3V supply voltage	VDD	Ta=25℃	-0.3	+4.0	V	
Back Light supply voltage	VBL	Ta=25℃	-0.3	+26.5	V	
Input voltage(eDP)	VI	Ta=25℃	-0.3	+1.8	V	[Note 5-1]
Input voltage(BL)	BL_I	Ta=25℃	-0.3	VDD+0.3	V	[Note 5-2]
Input voltage(I2C)	I2C_I	Ta=25℃	0	3.7	V	[Note 5-4]
Storage temperature (ambient)	Tstg	—	-25	+60	℃	[Note 5-3]
Operating temperature(ambient)	Topa	—	0	+50	℃	

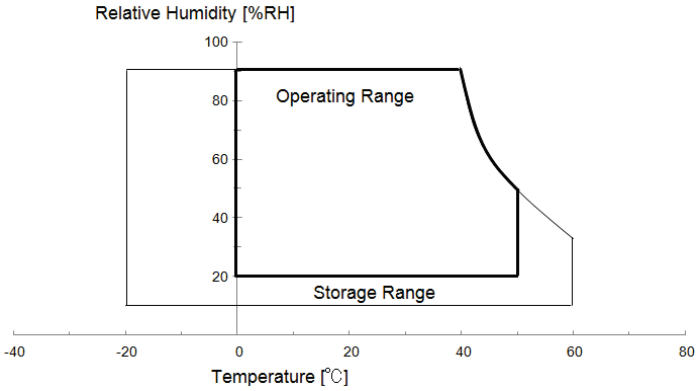
[Note 5-1] eDP signals

[Note 5-2] Back light control signals (BL_ENABLE, BL_PWM_DIM)

[Note 5-3] Humidity : 90%RH Max. at Ta≦+40℃.

Maximum wet-bulb temperature at +39℃ or less at Ta>+40℃.

No condensation.



[Note 5-4] I2C signals (SDA, SCA)

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6. Electrical Characteristics

6 - 1. TFT-LCD panel driving

Ta=25℃

DC Electrical Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Supply voltage	VDD	+3.0	+3.3	+3.6	V	[Note 6-1-1]
Current dissipation	IDD	—	272	333	mA	[Note 6-1-2]
Power dissipation	PDD	—	0.9	1.1	W	[Note 6-1-2]
		—	—	1.7	W	[Note 6-1-3]
Permissive input ripple voltage	V_{RP}	—	—	100	mV_{P-P}	VDD = +3.3V
BIST_ENABLE High voltage	VBISTH	2.2	—	3.6	V	[Note 6-1-4]
BIST_ENABLE Low voltage	VBISTL	—	—	0.7	V	[Note 6-1-4]
Input signal pin current	I_{IN}	—	V_{IN}/51KΩ	—	μA	BIST_ENABLE

eDP AUX Channel Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Unit Interval for AUX channel	UI_{AUX}	0.4	0.5	0.6	μs	
AUX peak-to-peak voltage at a transmitting device	$V_{AUX-DIFFp-p}$	0.39	0.6	1.38	V	
AUX peak-to-peak voltage at a receiving device		0.32	0.6	1.32	V	
AUX DC Common Mode Voltage	$V_{AUX-DC-CM}$	—	0.5	—	V	
AUX Short Circuit Current Limit	I_{AUX_SHORT}	—	—	90	mA	
AUX CH termination DC resistance	R_{AUX-_TERM}	—	100	—	Ω	
AUX AC Coupling Capacitor	C_{AUX}	75	—	200	nF	
Number of pre-charge pulses	Pre-charge pulses	10	—	16	—	

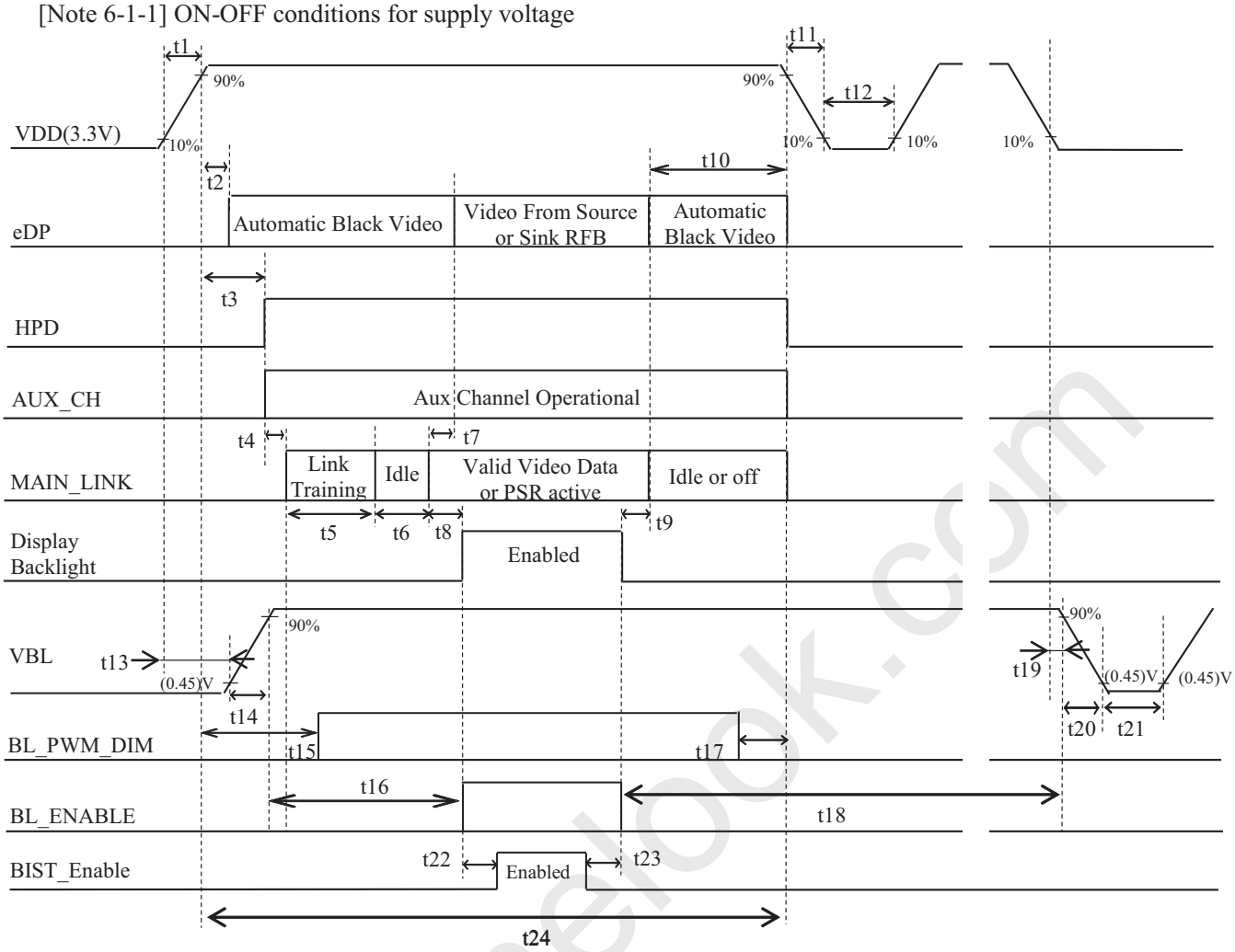
eDP Main Link Receiver Characteristics						
Parameter	Symbol	Min.	Typ.	Max.	Unit	Remark
Link clock down spreading	Down_Spread_Amplitude	—	—	0.5	%	
Differential Peak-to-peak Input Voltage at RX package pins	$V_{RX-DIFFp-p}$	90	—	1200	mV	
Differential Return Loss at 1.35 GHz at RX package pins	$RL_{RX-DIFF}$	9	—	—	dB	
RX DC Common Mode Voltage	$V_{RX-DC-CM}$	0	—	2.0	V	
Differential termination resistance	$V_{RX-TERM}$	—	100	—	Ω	
RX Short Circuit Current Limit	$I_{RX-SHORT}$	—	—	50	mA	
Lane Intra-pair Skew at RX package pins	$L_{RX-SKEW-INTRA-PAIR-High-Bit-Rate}$	—	—	50	ps	

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[Note 6-1-1] ON-OFF conditions for supply voltage



[Note] Do not keep the interface signal high-impedance or unusual signal when power is on.

Symbol	Min	Max	Unit	Note
t1	0.5	10	ms	
t2	0	100	ms	
t3	0	100	ms	
t4	-	-	ms	allows for the source to read link capability and initialize
t5	-	-	ms	[Note 3]
t6	-	-	ms	[Note 3]
t7	0	50	ms	
t8	-	-	ms	[Note 4]
t9	-	-	ms	[Note 5]
t10	0	500	ms	
t11	1	50	ms	[Note 1]
t12	500	-	ms	[Note 2]
t13	-	-	ms	[Note 6]
t14	1	10	ms	
t15	100		ms	
t16	0	-	ms	[Note 7]
t17	0	-	ms	
t18	0	-	ms	[Note 7]
t19	-	-	ms	
t20	0.1	-	ms	
t21	100		ms	
t22	0	-	ms	
t23	0	-	ms	
t24	300	-	ms	

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[Note 1] As for the power off sequence for VDD (t11), Be sure to keep above mentioned timing.
If the VDD power off sequence timing is other than shown above, LCD may cause permanent damage.
As for the power sequence for backlight, it is recommended to apply above mentioned input timing.
If the backlight is light on and off at a timing other than shown above, displaying image may get disturbed.

[Note 2] As for the power off-on sequence for VDD (t12), Be sure to keep above mentioned timing.
If the VDD power off-on sequence timing is other than shown above, LCD may cause permanent damage.

[Note 3] Dependant on the Source Link training protocol and Link idle.

[Note 4] The Source must assure display video is stable.

[Note 5] The Source must assure backlight is no longer illuminated.

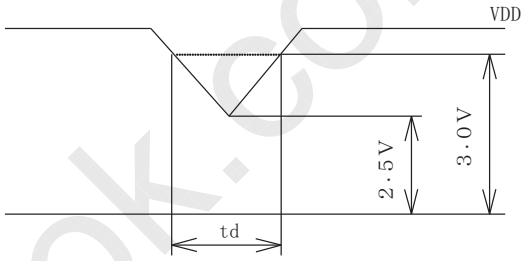
[Note 6] Even if VBL Power is on earlier than VDD, It is not have any problem.

[Note 7] Prohibit the BL_ENABLE input of the period when it is not VBL Power on.

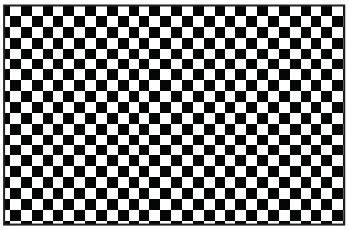
VDD-dip conditions

1) 2.5 V≦VDD＜3.0 V
td≦10 ms
Under above condition, the display image should return to an appropriate figure after VDD voltage recovers.

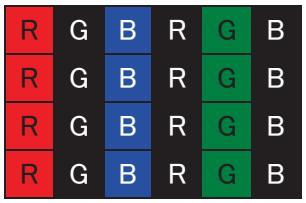
2) VDD＜2.5 V
VDD-dip conditions should also follow the ON-OFF conditions for supply voltage



[Note 6-1-2] Typical current condition: 32 x 36 Mosaic pattern.
VDD=+3.3V



【Note6-1-3】 Maximum current condition: Vertical stripe pattern.
VDD=+3.3V



【Note6-1-4】 BIST_ENABLE Input : High = BIST driving on, Low or OPEN =BIST driving off

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6 - 2. Backlight driving

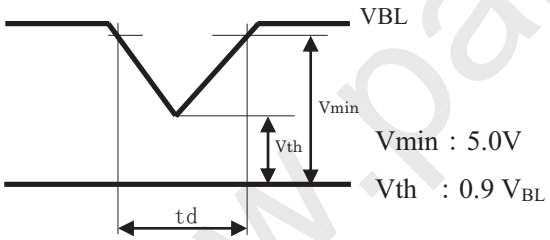
The backlight system is an edge-lighting type with white-LED.
(It is usually required to measure under the following condition. : Ta=25℃±2℃)

Parameter	Symbol	Min.	Typ.	Max	Unit	Remark
Supply voltage	VBL	5.0	12.0	21.0	V	
Current dissipation	I_{BL}	—	244	268	mA	VBL=12V
Power dissipation	P_{BL}	—	2.92	3.22	W	VBL=12V
Modulated light signal voltage	VPWMH	2.2	3.3	3.6	V	
	VPWML	0	—	0.7	V	
Brightness Control Duty Ratio	Duty	5	—	100	%	[Note6-2-1]
Brightness Control pulse width	T_{PWM}	5	—	—	us	[Note6-2-2]
Brightness Control frequency	f_{PWM}	200	—	16000	Hz	△1
LED-BL ON/OFF High voltage	VCNTH	1.8	3.3	3.6	V	[Note6-2-3]
LED-BL ON/OFF Low voltage	VCNTL	—	—	0.5	V	[Note6-2-3]
Input signal pin current	I_{IN}	—	V_{IN}/51KΩ	—	μA	BL_ENABLE
Input signal pin current	I_{IN}	—	V_{IN}/51KΩ	—	μA	BL_PWM_DIM
LED lifetime	-	—	15,000	—	h	LED

[Note6-2-1] BL_PWM_DIM : 100%= Max luminance 5%= Min luminance
[Note6-2-2] The minimum value of the dimming signal pulse width is assumed regulations of the width of high and the width of low.

[Note6-2-3] BL_ENABLE Input : High = BL turn on, Low or OPEN =BL turn off

VBL-dip conditions



Vmin : 5.0V
Vth : 0.9 V_{BL}

1) Vth ≦ V_{BL} < Vmin : td ≦ 20ms
2) V_{BL} < Vth : The condition of instantaneous voltage drop is apply to input voltage sequences

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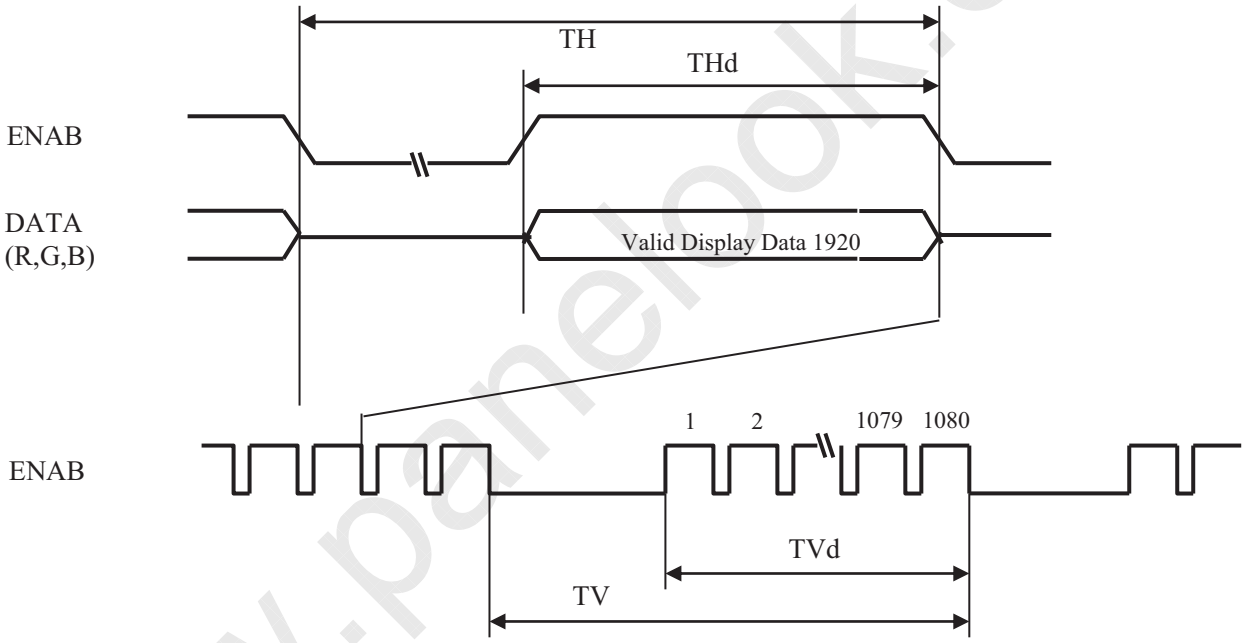
7. Timing Characteristics of Input Signals

7 - 1. Timing characteristics

60Hz VDD=+3.0V～+3.6V, Ta＝0℃～+50℃

Parameter		Symbol	Min.	Typ.	Max.	Unit	Remark
Clock	Frequency	1/Tc	—	138.5	—	MHz	[Note 7-1-1]
Data enable Signal	Horizontal period	TH	—	2080	—	clock	
				15.02		μs	
	Horizontal period (High)	THd	—	1920	—	clock	
	Vertical period	TV	—	1111	—	Line	
			—	16.685	—	ms	
	Vertical period (High)	TVd	—	1080	—	line	

[Note 7-1-1] In case of using the long vertical period, the deterioration of display quality, flicker, etc, may occur.



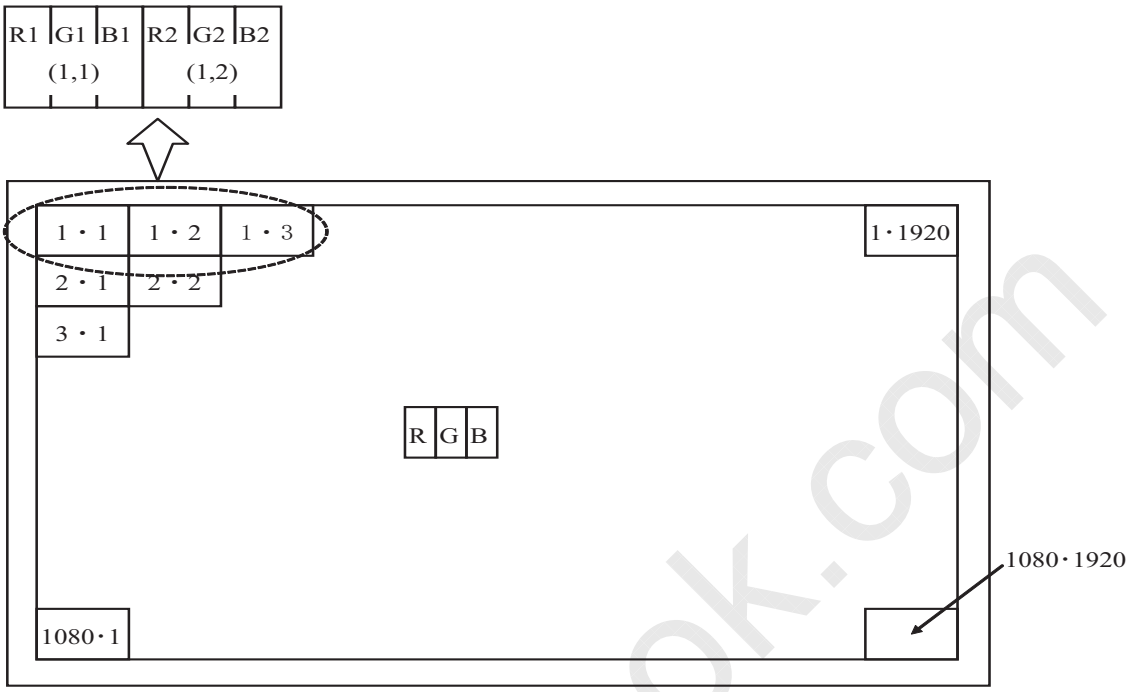
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7 - 2. Input data signals and display position on the screen



Display position of input data(V・H)

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8. Input Signals, Basic Display Colors and Gray Scale of Each Color

	Colors & Gray Scale	Gray Scale	Date signal																							
			R0	R1	R2	R3	R4	R5	R6	R7	G0	G1	G2	G3	G4	G5	G6	G7	B0	B1	B2	B3	B4	B5	B6	B7
			LSB							MSB	LSB							MSB	LSB							MSB
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 24 bit data signals, the 16.7M color display can be achieved on the screen.

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9. EDID Specifications

9 - 1. EDID data structure △1△3

This is the EDID(Extended Display Identification Data) data formats to support displays as defined in the VESA Plug & Display

Byte (decimal)	Byte (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA manufacture code =3 Character ID " SHP"	4D	01001101
9	9	EISA manufacture code (Compressed ASCII)	10	00010000
10	0A	Panel Supplier Reserved - Product code (LQ156M1JW31 : 5023)	53	01010011
11	0B	Panel Supplier Reserved - Product code (hex,LSB first)	14	00010100
12	0C	LCD module Serial No	00	00000000
13	0D	LCD module Serial No	00	00000000
14	0E	LCD module Serial No	00	00000000
15	0F	LCD module Serial No	00	00000000
16	10	Week of manufacture	28	00101000
17	11	Year of manufacture	19	00011001
18	12	EDID structure version # = 1	01	00000001
19	13	EDID revision # = 4	04	00000100
20	14	Video I/P definition = Digital I/P(A5h)	A5	10100101
21	15	Max H image size = (Rounded to cm)=34.56cm=23h	23	00100011
22	16	Max V image size = (Rounded to cm)=19.44cm=13h	13	00010011
23	17	Display gamma=(gamma×100)-100= (2.2×100) – 100 = 120=78h	78	01111000
24	18	Feature support(no DPMS,Active off, sRGB,Prefer Time)	0E	00001110
25	19	Red/Green Low bit(RxRy/GxGy)	DE	11011110
26	1A	Blue/White Low bit(BxBy/WxWy)	50	01010000
27	1B	Red X Rx = 0.64	A3	10100011
28	1C	Red Y Ry = 0.33	54	01010100
29	1D	Green X Gx = 0.3	4C	01001100
30	1E	Green Y Gy = 0.6	99	10011001

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31	1F	Blue X Bx = 0.15	26	00100110
32	20	Blue Y By = 0.06	0F	00001111
33	21	White X Wx = 0.313	50	01010000
34	22	White Y Wy = 0.329	54	01010100
35	23	Established timings 1 (00h if not used)	00	00000000
36	24	Established timings 2 (00h if not used)	00	00000000
37	25	Manufacture's timings (00h if not used)	00	00000000
38	26	Standard timing ID1 (01h if not used)	01	00000001
39	27	Standard timing ID1 (01h if not used)	01	00000001
40	28	Standard timing ID2 (01h if not used)	01	00000001
41	29	Standard timing ID2 (01h if not used)	01	00000001
42	2A	Standard timing ID3 (01h if not used)	01	00000001
43	2B	Standard timing ID3 (01h if not used)	01	00000001
44	2C	Standard timing ID4 (01h if not used)	01	00000001
45	2D	Standard timing ID4 (01h if not used)	01	00000001
46	2E	Standard timing ID5 (01h if not used)	01	00000001
47	2F	Standard timing ID5 (01h if not used)	01	00000001
48	30	Standard timing ID6 (01h if not used)	01	00000001
49	31	Standard timing ID6 (01h if not used)	01	00000001
50	32	Standard timing ID7 (01h if not used)	01	00000001
51	33	Standard timing ID7 (01h if not used)	01	00000001
52	34	Standard timing ID8 (01h if not used)	01	00000001
53	35	Standard timing ID8 (01h if not used)	01	00000001
54	36	Pixel clock/10000 (LSB) (138.5MHz : 13850 = 361Ah)	1A	00011010
55	37	Pixel clock/10000 (MSB)	36	00110110
56	38	Horizontal active =3840 pixels(lower 8bits) (1920 = 780h)	80	10000000
57	39	Horizontal blanking(Thbp)=xxxx pixels(lower 8bits)(Thbp=160=0A0h)	A0	10100000
58	3A	Horizontal active/Horizontal blanking (Thbp) (upper4:4 bits)	70	01110000
59	3B	Vertical active =2160 lines(lower 8bits) (1080 = 438h)	38	00111000
60	3C	Vertical blanking (Tvbp) =62 lines(DE Blanking min for DE only panels)	1F	00011111
61	3D	Vertical active:Vertical blanking (Tvbp) (upper4:4bits)	40	01000000
62	3E	Horizontal sync , offset (Thfp) =48 pixels (48 = 30h)	30	00110000
63	3F	Horizontal sync , Pulse Width = 32 pixels (32 = 20h)	20	00100000
64	40	Vertical Sync,Offset(Tvfp) = 3 lines : Sync Width = 5 lines	35	00110101
65	41	Horizontal Vertical Sync Offset/Width upper 2 bits	00	00000000
66	42	Horizontal image size = 345.6 mm (lower 8bits)(345.6mm = 15Ah)	5A	01011010
67	43	Vertical image size = 194.4 mm (lower 8bits)(194.4mm = 0C2h)	C2	11000010
68	44	Horizontal image size / Vertical image size (upper 4bits)	10	00010000

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69	45	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
70	46	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000
71	47	Non-interlaced,Normal,Digtal without Serrations,Negative	18	00011000
72	48	Pixel clock/10000 (LSB)	00	00000000
73	49	Pixel clock/10000 (MSB)	00	00000000
74	4A	Horizontal active =3840 pixels(lower 8bits)	00	00000000
75	4B	Horizontal blanking(Thbp)= 160 pixels(lower 8bits)	00	00000000
76	4C	Horizontal active/Horizontal blanking (Thbp) (upper4:4 bits)	00	00000000
77	4D	Vertical active = 2160 lines(lower 8bits)	00	00000000
78	4E	Vertical blanking (Tvbp) = 268 lines(DE Blanking min for DE only panels)	00	00000000
79	4F	Vertical active:Vertical blanking (Tvbp) (upper4:4bits)	00	00000000
80	50	Horizontal sync , offset (Thfp) = 48 pixels	00	00000000
81	51	Horizontal sync , Pulse Width = 32 pixels	00	00000000
82	52	Vertical Sync,Offset(Tvfp) = 3 lines:Sync Width = 5 lines	00	00000000
83	53	Horizontal Vertical Sync Offset/Width upper 2 bits	00	00000000
84	54	Horizontal image size = 345.60 mm (lower 8bits)	00	00000000
85	55	Vertical image size = 194.40 mm (lower 8bits)	00	00000000
86	56	Horizontal image size / Vertical image size (upper 4bits)	00	00000000
87	57	Horizontal Border = 0 (Zero for Notebook LCD)	00	00000000
88	58	Vertical Border = 0 (Zero for Notebook LCD)	00	00000000
89	59	Flags	00	00000000
90	5A	Flag	00	00000000
91	5B	Flag	00	00000000
92	5C	Flag	00	00000000
93	5D	Dummy Descriptor	FE	11111110
94	5E	Flag	00	00000000
95	5F	Dell P/N 1st Character (1 = 31h)	31	00110001
96	60	Dell P/N 2nd Character (2 = 32h)	32	00110010
97	61	Dell P/N 3rd Character (0 = 30h)	30	00110000
98	62	Dell P/N 4th Character (3 = 33h)	33	00110011
99	63	Dell P/N 5th Character (M = 4Dh)	4D	01001101
100	64	LCD supplier EEDID revision #	82	10000010
101	65	Manufacture P/N (L = 4Ch)	4C	01001100
102	66	Manufacture P/N (Q = 51h)	51	01010001
103	67	Manufacture P/N (1 = 31h)	31	00110001
104	68	Manufacture P/N (5 = 35h)	35	00110101

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105	69	Manufacture P/N (6 = 36h)	36	00110110
106	6A	Manufacture P/N (M = 4Dh)	4D	01001101
107	6B	Manufacture P/N (1 = 31h)	31	00110001
108	6C	Flag	00	00000000
109	6D	Flag	00	00000000
110	6E	Flag	00	00000000
111	6F	Data Type Tag: Manufacture Specified Data 00	00	00000000
112	70	Flag	00	00000000
113	71	Color Management	02	00000010
114	72	Panel Type and Revision	41	01000001
115	73	Frame Rate	03	00000011
116	74	Light Controller Interface and Maximum Luminance	28	00101000
117	75	Outdoor Features and Polarizer	00	00000000
118	76	Multi-Media Features	12	00010010
119	77	Multi-Media Features	00	00000000
120	78	Special Features	00	00000000
121	79	Special Features	0A	00001010
122	7A	Special Features	01	00000001
123	7B	(If<13 char,then terminate with ASCII code 0Ah,set remaining char 20h)	0A	00001010
124	7C	(If<13 char,then terminate with ASCII code 0Ah,set remaining char 20h)	20	00100000
125	7D	(If<13 char,then terminate with ASCII code 0Ah,set remaining char 20h)	20	00100000
126	7E	Extension flag (# of optional 128 EDID extension blocks to follow, Typ=0)	00	00000000
127	7F	Checksum(The 1-byte sum of all 128 bytes in this EDID block shall=0)	49	01001001

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10. Optical Characteristics

Ta=+25℃, VDD=+3.3V, VBL=+12.0V

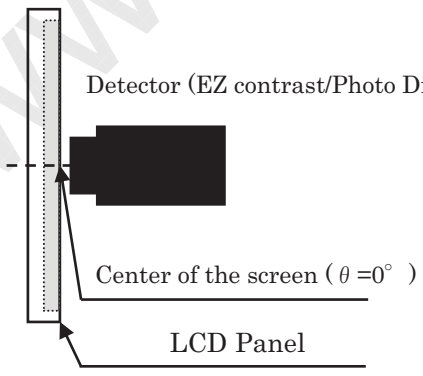
Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit	Remark
Viewing angle range	Horizontal	θ21,θ22	CR>10	80	89	—	deg.	[Note 10-1, 10-3, 10-4, 10-6]
	Vertical	θ11		80	89	—	deg.	
		θ12		80	89	—	deg	
Contrast ratio		CR	θ=0°	800	1000	—		[Note 10-2, 10-4, 10-6]
Response time		τr+τd	θ=0°	—	30	—	ms	[Note 10-1, 10-5, 10-6]
Chromaticity of white		x		0.283	0.313	0.343		[Note 10-2, 10-6] Normal operation (PWM Duty=100%)
		y		0.299	0.329	0.359		
Chromaticity of red		x		—	0.640	—		
		y		—	0.330	—		
Chromaticity of green		x		—	0.300	—		
		y		—	0.600	—		
Chromaticity of blue		x		—	0.150	—		
		y		—	0.060	—		
NTSC ratio				68	72	—	%	
Luminance of white		Y_{LI}		340	400	—	cd/m^2	[Note 10-2, 10-7] Normal operation (PWM Duty=100%)
White Uniformity		δ_{W5}	θ=0°	—	-	1.25		[Note 10-2, 10-8] Normal operation (PWM Duty=100%)
		δ_{W13}		—	-	1.53		

※ The measurement shall be taken 30 minutes after lighting the module at the following rating:

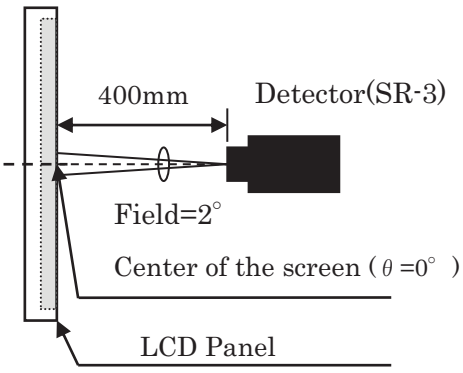
Condition: PWM Duty = 100%

The optical characteristics shall be measured in a dark room or equivalent.

[Note 10-1] Measurement of viewing angle range and Response time.



[Note 10-2] Measurement of luminance and Chromaticity and Contrast



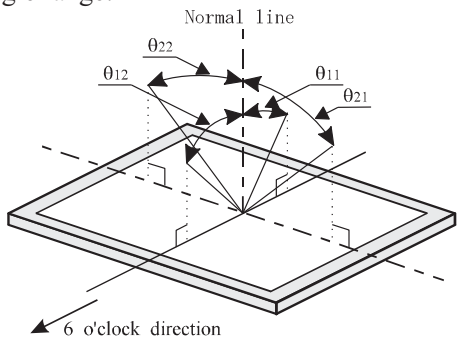
Viewing angle range:EZ-CONTRAST
/ Response time: Photo diode

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[Note 10-3] Definitions of viewing angle range:



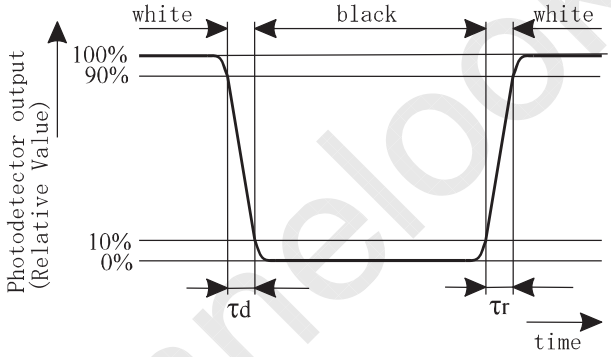
[Note 10-4] Definition of contrast ratio:

The contrast ratio is defined as the following.

$$\text{Contrast Ratio (CR)} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

[Note 10-5] Definition of response time:

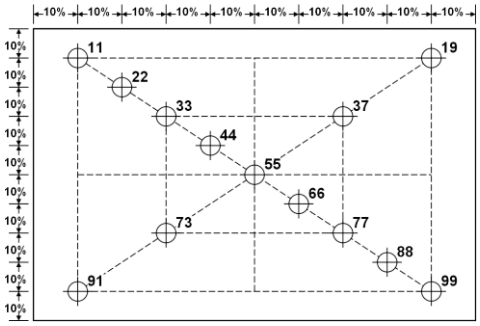
The response time is defined as the following figure and shall be measured by switching the input signal for "black" and "white" .



[Note 10-6]This shall be measured at center of the screen.

[Note 10-7] Average Luminance of five points:

five points : (33,37,55,73,77) in the right figure



[Note 10-8] Definition of white uniformity:

White uniformity is defined as the following measurements.

$$\delta w5 = \frac{\text{Maximum Luminance of five points (brightness)}}{\text{Minimum Luminance of five points (brightness)}}$$

five points : (33,37,55,73,77) in the right figure

$$\delta w13 = \frac{\text{Maximum Luminance of thirteen points (brightness)}}{\text{Minimum Luminance of thirteen points (brightness)}}$$

thirteen points : (11,19,22,33,37,44,55,66,73,77,88,91,99) in the right figure

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11. Display Quality

The display quality of the color TFT-LCD module shall be in compliance with the Incoming Inspection Standard.

12. Handling Precautions

a) Be sure to turn off the power supply when inserting or disconnecting the cable.
Please insert for too much stress not to join a connector in the case of insertion of a connector.

b) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.

c) Since the front polarizer is easily damaged, pay attention not to scratch it.

d) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.

e) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.

f) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.

g) Since CMOS LSI is used in this module, take care of static electricity and injure the human earth when handling. Observe all other precautionary requirements in handling components.

h) This module has its circuitry PCBs on the side and should be handled carefully in order not to be stressed.

i) Protect sheet(Laminate film) is attached to the module surface to prevent it from being scratched. Peel the sheet off slowly just before the use with strict attention to electrostatic charges. Ionized air shall be blown over during the action. Blow off the 'dust' on the polarizer by using an ionized nitrogen gun, etc. Working under the following environments is desirable.

- All workers wear conductive shoes, conductive clothes, conductive fingerstalls and grounding belts without fail.
- Use Ionized blower for electrostatic removal, and peel of the protect sheet with a constant speed. (Peeling of it at over 2 seconds)

j) The polarizer surface on the panel is treated with Anti Glare . In case of attaching protective board over the LCD, be careful about the optical interface fringe etc. which degrades display quality.

k) Do not expose the LCD module to a direct sunlight, for a long period of time to protect the module from the ultra violet ray.

l) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.

m) Liquid crystal contained in the panel may leak if the LCD is broken. Rinse it as soon as possible if it gets inside your eye or mouth by mistake.

n) Disassembling the module can cause permanent damage and should be strictly avoided.
Please don't remove the fixed tape, insulating tape etc that was pasted on the original module.
(Except for protection film of the panel.)

o) Be careful when using it for long time with fixed pattern display as it may cause afterimage.
(Please use a screen saver etc., in order to avoid an afterimage.)

p) If a minute particle enters in the module and adheres to an optical material, it may cause display non-uniformity issue, etc. Therefore, fine-pitch filters have to be installed to cooling and inhalation hole if you intend to install a fan.

q) Epoxy resin (amine series curing agent), silicone adhesive material (dealcoholization series and oxime series),
tray forming agent (azo compound) etc, in the cabinet or the packing materials may induce abnormal display with polarizer film deterioration regardless of contact or noncontact to polarizer film.
Be sure to confirm the component of them.

r) Do not use polychloroprene. If you use it, there is some possibility of generating Cl_2 gas that influences the reliability of the connection between LCD panel and driver IC.

s) Do not put a laminate film on LCD module, after peeling of the original one. If you put on it, it may cause

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discoloration or spots because of the occurrence of air gaps between the polarizer and the film.

t) Ground module bezel to stabilize against EMI and external noise.

u) When you peel off the protection film,

-Be sure to peel off slowly (recommended more than 5sec) and constant speed.

-Peeling direction shows the following Figure.

-Be sure to ground person with adequate methods such as the anti-static wrist band.

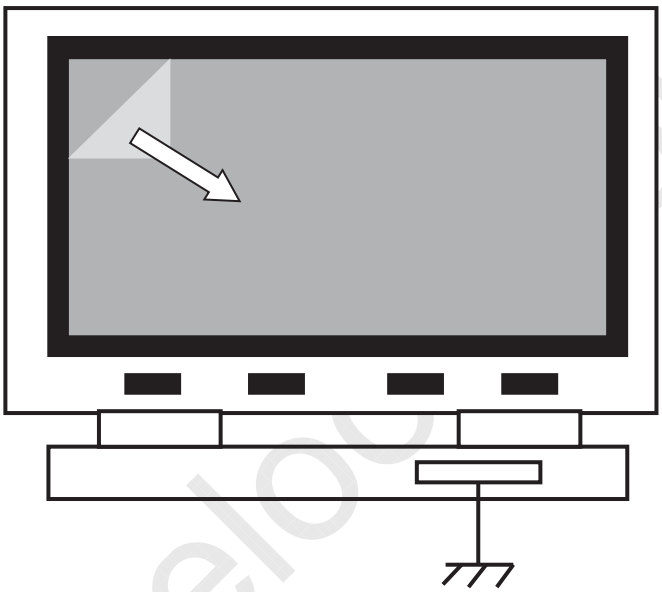
-Be sure to ground all terminals of the PWB connector while peeling of the protection film.

-Ionized air should be blown over during peeling action.

-The protection film must not touch driver-ICs, PWB and all components on PWB.

-If adhesive may remain on the polarizer after the protection film peeling off, please remove with isopropyl-alcohol.

Front view



v.)The glass of display is bigger than Back-light, so please be careful of below points(especially about 4 corners.)

-Don't hit LCD module with hard solid to prevent glass cracking.

-Please wear the gloves etc. to protect hands when handling LCD module.

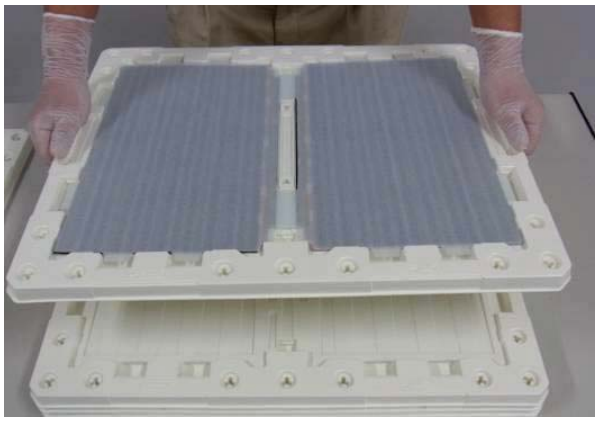
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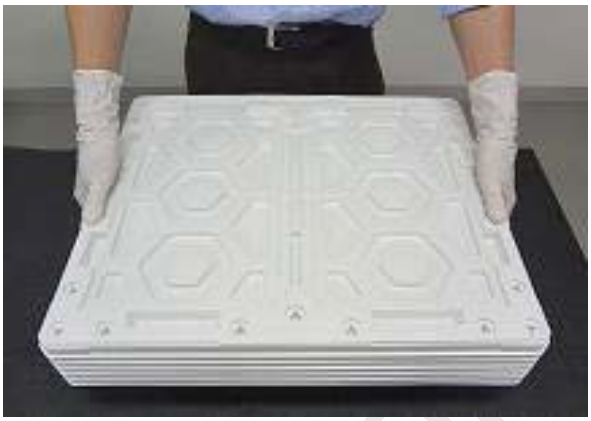
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13. Precautions for Handling Tray

a.) Hold center of short side of tray with both hands when handling one or more trays.





Caution：Do not handle with only one hand .

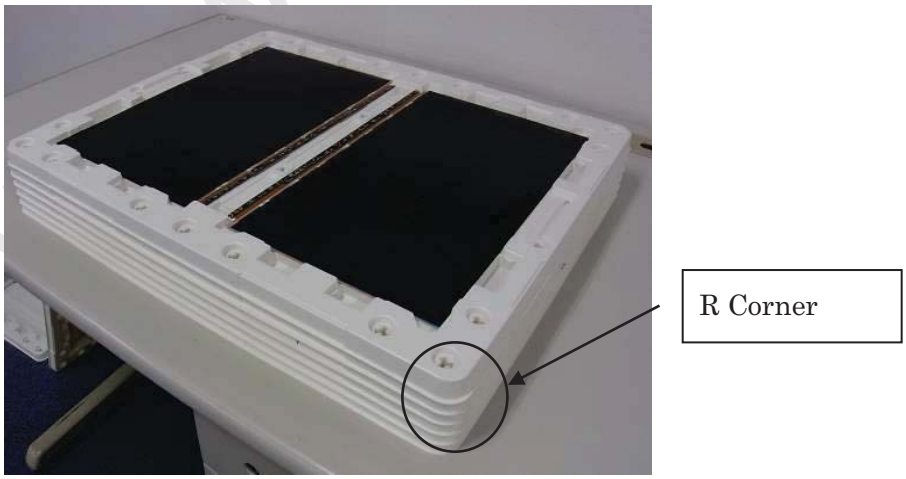




b.) Always place tray on flat surface.

c.) When stacking trays, please align same shape corner of each tray.
One corner is R corner. (Ref. Pic. 1)

d.) Maximum stacking quantity is the number of trays inside one box.
Ex.：In case of 20pcs LCD module per box (2pcs LCD module per tray), maximum stacking is 10 trays.



Pic.1 Stacking tray

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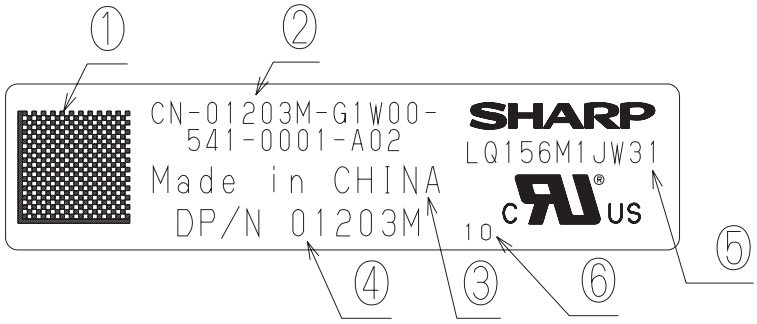
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14. Packaging Condition

Piling number of cartons	6
Package quantity in one carton	40pcs.
Carton size	565 x 475 x 289 mm
Total mass of one carton filled with full modules	21kg
Packing form	Fig.1

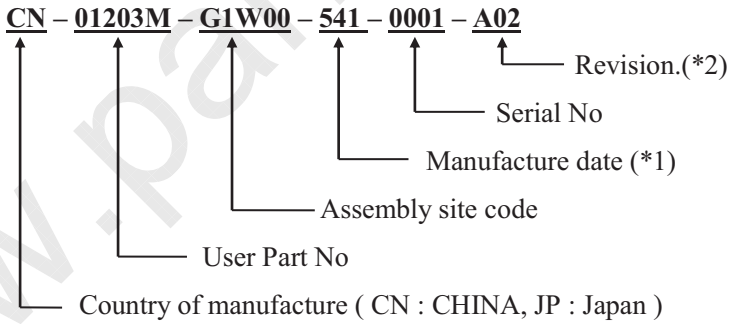
15. Label △1,△3

1) Module barcode label:



①Barcode(User code) ②User code ③Country of manufacture ④User Part No
⑤SHARP Model No ⑥Factory code

②User code contents



(*1) Manufacture date

1st digit : year (The last one digit of the year)

2nd digit : month (Jan:"1", Feb:"2", Oct:"A")

3rd digit : day (1st : "1", 2nd :"2", 11th : "A" 31st : "V")

(*2) Revision

Event production	Rev0	Rev1	•••
SSI (TS)	X00	X01	•••
PT (ES)	X10	X11	•••
ST (CS)	X20	X21	•••
XB (MP)	A00	A01	•••

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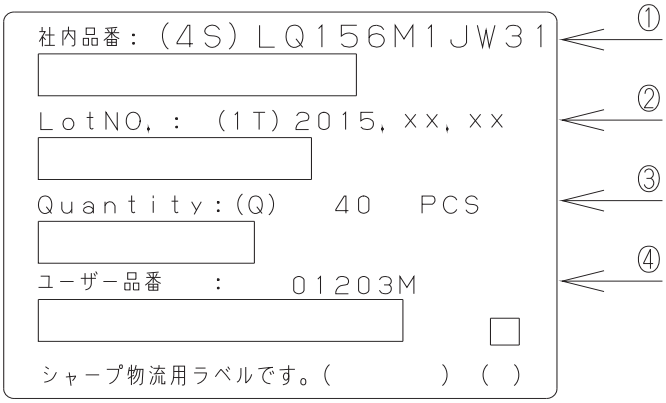
2) Packing bar code label

①SHARP Model No.

②Date

③Quantity (40 pcs / Carton)

④USER Model No.



16. RoHS Directive

This LCD module is compliant with RoHS Directive.

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17. Reliability Test Items

No.	Test item	Conditions
1	High temperature storage test	Ta = 60℃ 240h
2	Low temperature storage test	Ta = -25℃ 240h
3	High temperature & high humidity operation test	Ta = 40℃ ; 90%RH 240h (No condensation)
4	High temperature operation test	Ta = 50℃ 240h
5	Low temperature operation test	Ta = 0℃ 240h
6	Vibration test (non- operating)	Frequency:10~57Hz/Vibration width (one side):0.076mm :57~500Hz/Acceleration:9.8m/s² Sweep time: 11minutes Test period: 1 hour for each direction of X,Y,Z
7	Shock test (non- operating)	Max. gravity : 490 m/s² Pulse width : 11 ms, half sine wave Direction : ±X,±Y,±Z once for each direction.
8	ESD	Panel center, Around the module : One time for each position Contact discharging method:C=150pF,R=330Ω (non-operating) Pass +/- 10kV (operating) Pass +/- 8kV Air discharge method:C=150pF,R=330Ω (non-operating) Pass +/- 20kV (operating) Pass +/- 15kV ※If LCM can self-recover,temporary degradation of performance is allowed

[Result Evaluation Criteria] Under the display quality test conditions with normal operation state. Do not change these conditions as such changes may affect practical display function.

[Normal operation state] Temperature : +15～+35℃, Humidity : 45～75%, Atmospheric pressure : 86～106kPa

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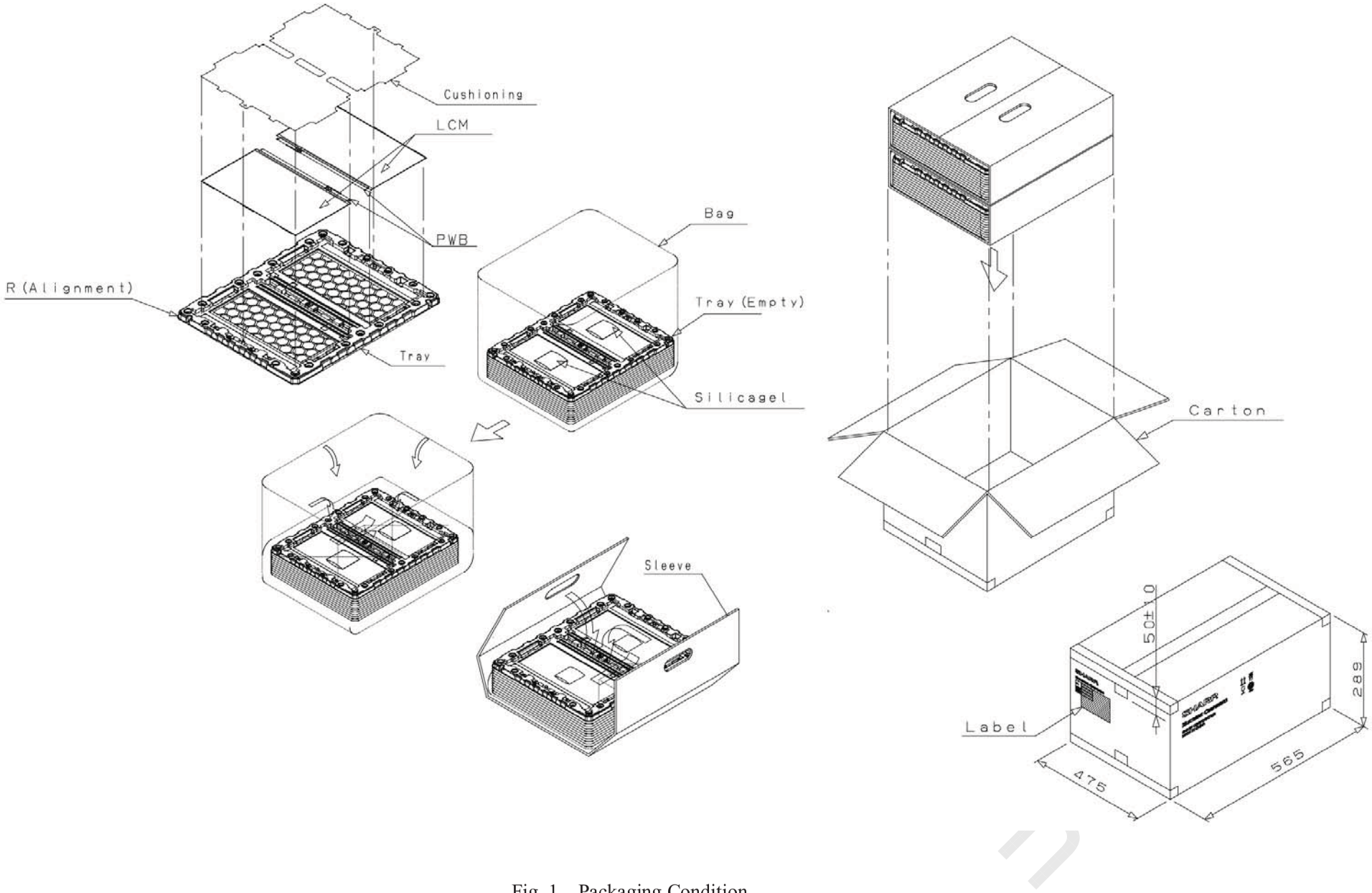


Fig. 1 Packaging Condition

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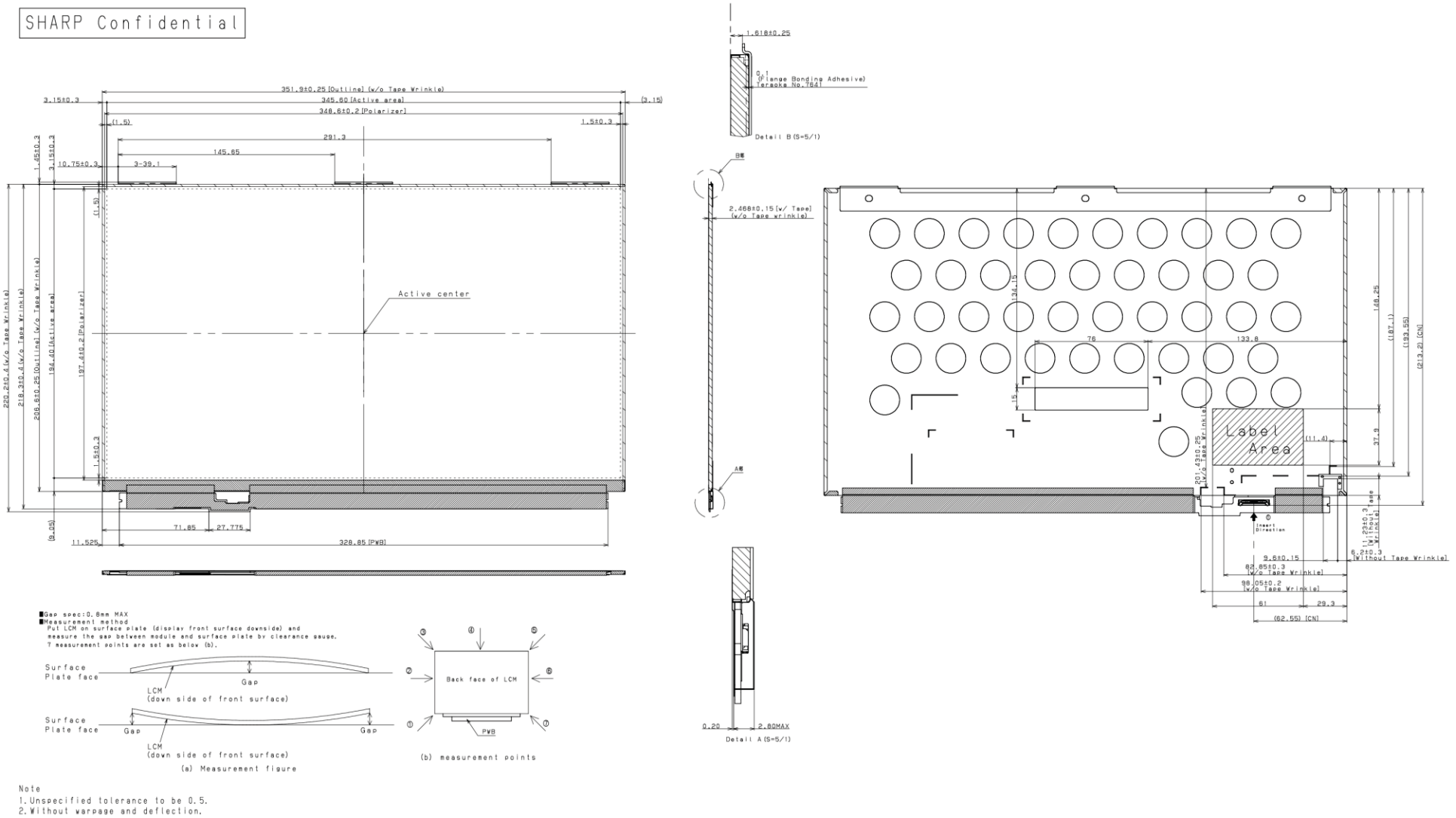


Fig. 3 Outline Dimension △2

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