CUSTOMER APPROVE

SPECIFICATION

FOR
TFT-LCD MODULE

LED65Q-OD28

Edition : Preliminary spec 1.0

Date of issue : 2017-03-21

Product No. : V650DJ4-QS5

APPROVED	CHECKED	PREPARED

Revision History

Date	Rev.	Page	Old Description	New Description	Remark
2016-04-06	1.0	All	The specification was first issued		

CONTENTS

1.Scope

This specifications is applicable to double lin digital technology LTD. 's 65" diagonal module :"65Q "designed for TFT-LCD TV.

1.1 Features

--Super Wide viewing angle
--Super High contrast ratio
--Super Fast response time
--High color saturation
--DE(Data Enable) only mode
--LVDS Interface
--RoHS compliance

1.2 Application

TFT-LCD TV
Multi-Media Display

1.3 General Specifications

Item	Specifications	Unit	Note
Driving Method	a-Si TFT active matrix		Note 1
Active Area	1428.48(H) x 803.52(V)	mm	
Screen diagonal(in)	65	mm	
Number of Pixels	3840 x R.G.B.x2160	pixel	
sub-Pixel Pitch	0.124(H) x 0.374V)	mm	
Pixel Arrangement	RGB Vertical Stripe		
Transmissive Mode	Normally black		
Surface Treatment	Anti-Glare coating, (Haze 1%)		
Display Colors	Product No. :	color	

1.4 Mechanical Specification

Item		Min	Typ	Max	Unit	Note
Weight		-	TBD	-	g	-
Module Size	Horizontal(H)	(TYP)-0.5	1514.4	(TYP)+0.5	mm	verter c
	Vertical (V)		873.5		mm	
	Depth(D)		TBD		mm	

Note 1: Please refer to the"outline dimension" for more information of back and front outline dimensions.

2. Absolute Maximum Ratings

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1), (3)
Operating Ambient Temperature	T_{OP}	0	50	ºC	(1), (2), (3)

Note (1) Temperature and relative humidity range is shown in the figure below.

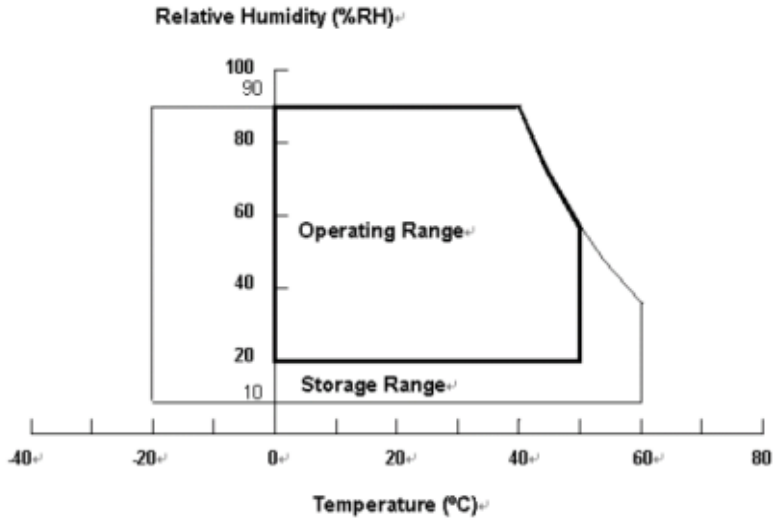
(a) 90 %RH Max. (Ta ≦ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 ºC. The range of operating temperature may degrade in case of improper thermal management in final 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	13.5	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.

2.2.2 Backlight Unit

Item	**Symbol**	**Value**		**Unit**	**Note**
		Min	**Max**		
Backlight Voltage	VL	-	112	V	Note 1,2
Backlight Current	IL	-	1540	mA	

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.

Note 2: Specified values are for input of LED lightbar at Ta=25±2 ℃ (Refer to 3.2 for further Information).

3. Electrical Specifications

3.1 TFT LCD Module

(Ta = 25 ± 2 ºC)

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	10.8	12	13.2	V	(1)
Rush Current		I_{RUSH}	–	–	4.5	A	(2)
Power Consumption	White Pattern	P_T	–	15.732	17.305	W	(3)
	Black Pattern	P_T	–	15.735	17.308	W	
	Horizontal Stripe	P_T	–	42.780	47.058	W	
Power Supply Current	White Pattern	–	–	1.311	1.442	A	
	Black Pattern	–	–	1.312	1.443	A	
	Horizontal Stripe	–	–	3.565	3.922	A	
VbyOne HS	Differential Input High Threshold Voltage	VLVTH	–	–	+50	mV	
	Differential Input Low Threshold Voltage	VLVTL	-50	–	–	mV	
	Differential input voltage (single-end)	|VID|	200	–	600	mV	
	Differential Input Resistor	RRIN	80	100	120	ohm	
CMOS interface	Input High Threshold Voltage	V_{IH}	2.7	–	3.3	mV	
	Input Low Threshold Voltage	V_{IL}	0	–	0.7	mV	

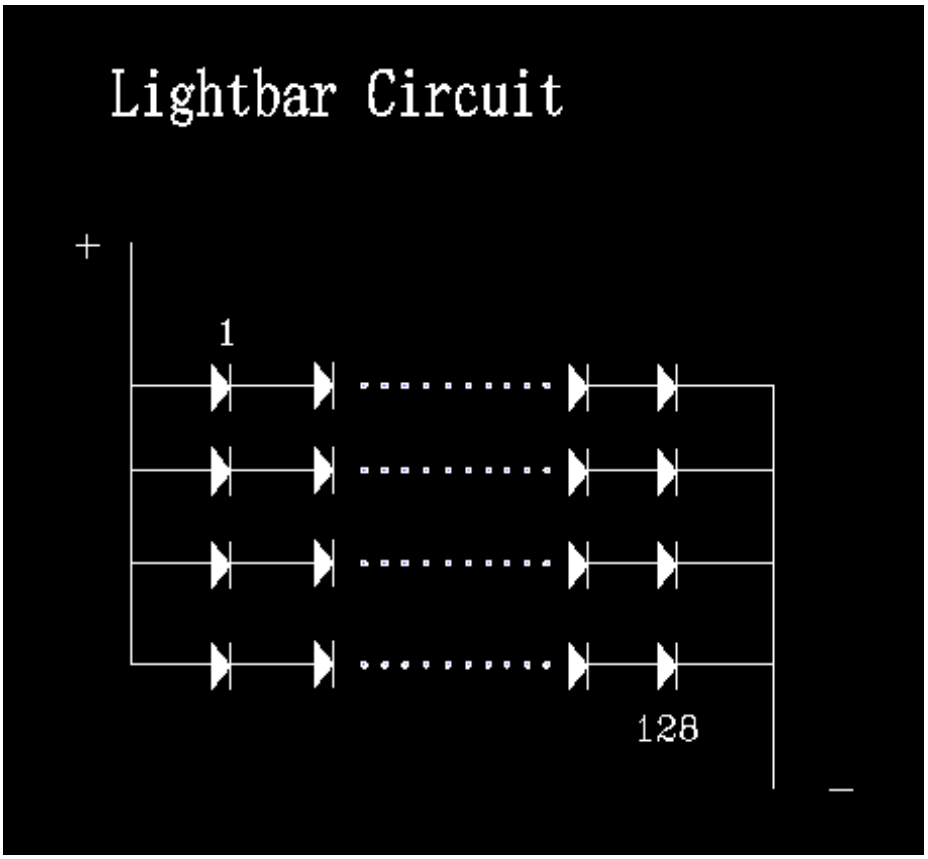
Note (1) The module should be always operated within the above ranges. The ripple voltage should be controlled under 10% of Vcc (Typ.).

3.2 Backlight Unit

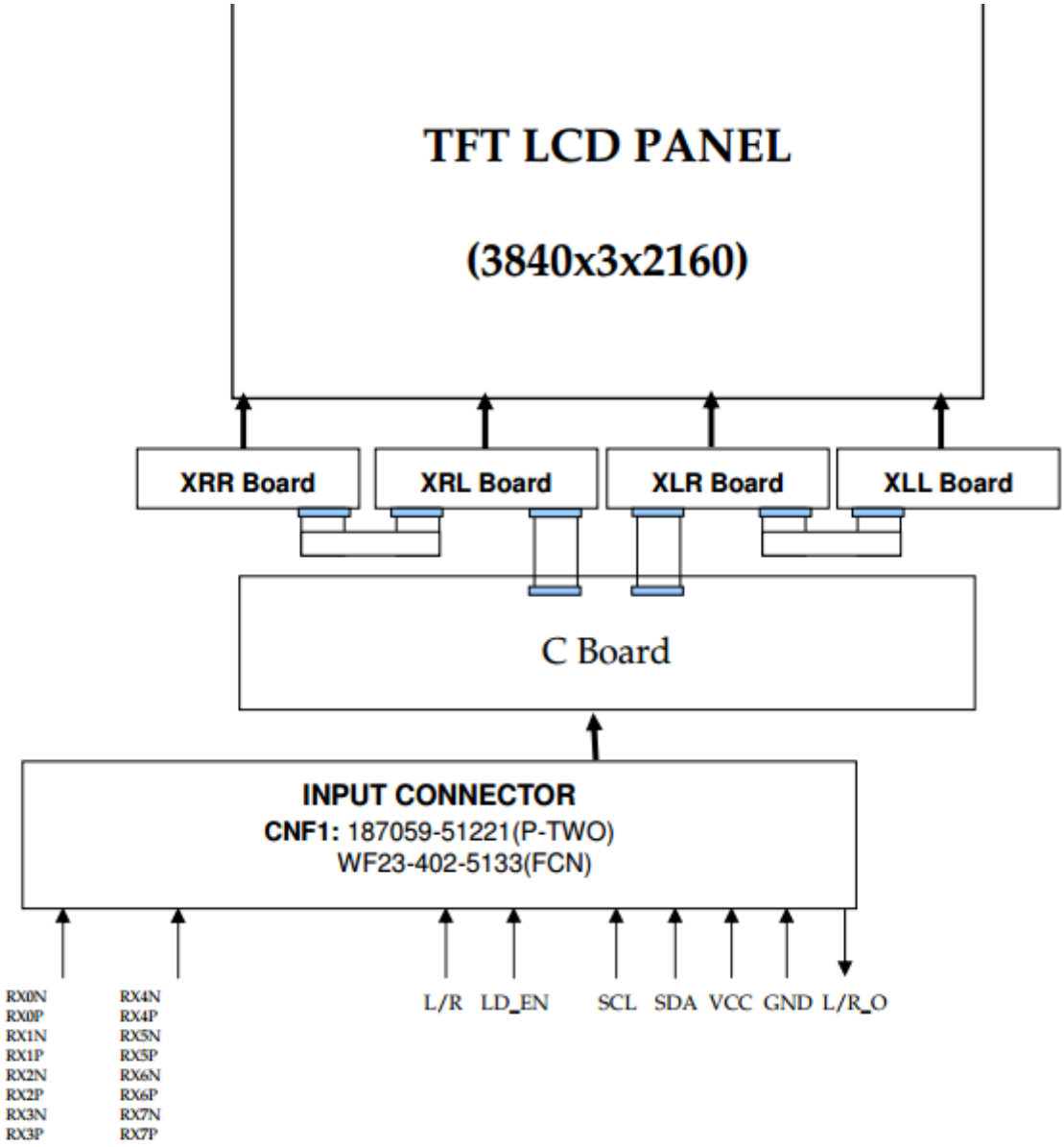
3.2.1

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	Remark
LightBar Voltage	V_L	92.8	102.4	108.8	V	Note 1
LightBar Current	I_L	—	1400	1540	mA	
Power Consumption	P_{BL}	—	143	—	W	LightBar
LED Life Time	L_{BL}	30000	—	—		

3.2.2 背光电路



4. BLOCK DIAGRAM OF INTERFACE



5.Input Termianl Pin Assignment

5.1 Interface pin assignment

CNF1 Connector Pin Assignment (187059-51221(P-TWO), WF23-402-5133(FCN))

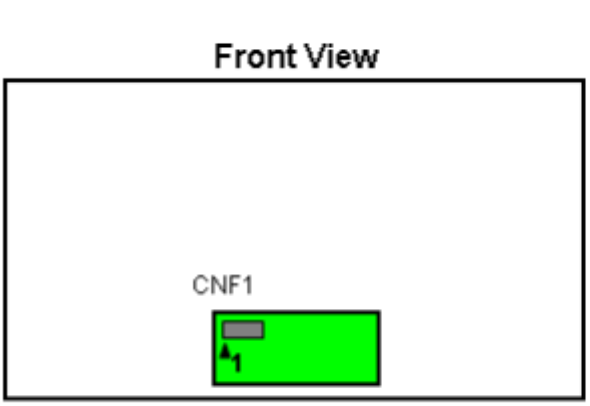
Matting connector : FI-RE51HL (JAE)

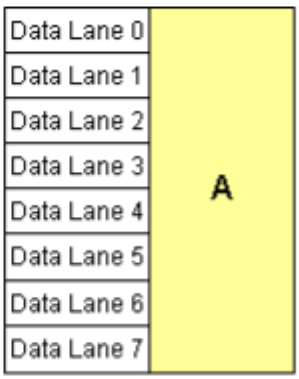
Pin	Name	Description	Note
1	Vin	Power input (+12V)	
2	Vin	Power input (+12V)	
3	Vin	Power input (+12V)	
4	Vin	Power input (+12V)	
5	Vin	Power input (+12V)	
6	Vin	Power input (+12V)	
7	Vin	Power input (+12V)	
8	Vin	Power input (+12V)	
9	N.C.	No Connection	(8)
10	GND	Ground	
11	GND	Ground	
12	GND	Ground	
13	GND	Ground	
14	GND	Ground	
15	L/R_O	Output signal for Glasses Left Right signal,	(4)
16	L/R	Input signal for Left/Right synchronous signal.	(2)
17	N.C.	No Connection	(8)
18	SDA	I2C Data signal	(9)
19	SCL	I2C Clock signal	(9)
20	N.C.	No Connection	
21	N.C.	No Connection	(8)
22	LD_EN	Local Dimming Mode Enable.	(3) (5)
23	N.C.	No Connection	(8)
24	N.C.	No Connection	(8)
25	HTPDN	Hot plug detect output, Open drain.	
26	LOCKN	Lock detect output, Open drain.	
27	GND	Ground	
28	RX0N	1ST Pixel Negative V-by-One differential data input in area A. Lane 0	(1)
29	RX0P	1ST Pixel Positive V-by-One differential data input in area A. Lane 0	
30	GND	Ground	
31	RX1N	2ND Pixel Negative V-by-One differential data input in area A. Lane 1	(1)
32	RX1P	2ND Pixel Positive V-by-One differential data input in area A. Lane 1	

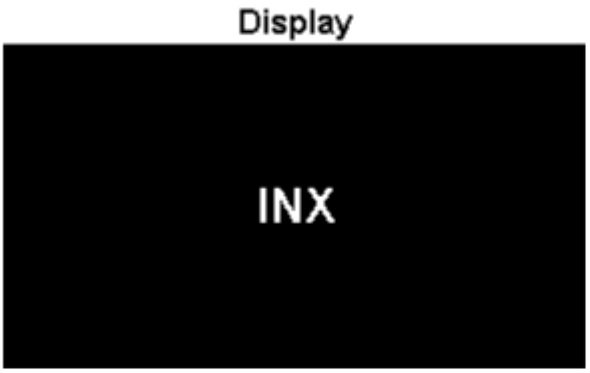
33	GND	Ground	
34	RX2N	3RD Pixel Negative V-by-One differential data input in area A. Lane 2	(1)
35	RX2P	3RD Pixel Positive V-by-One differential data input in area A. Lane 2	
36	GND	Ground	
37	RX3N	4TH Pixel Negative V-by-One differential data input in area A. Lane 3	(1)
38	RX3P	4TH Pixel Positive V-by-One differential data input in area A. Lane 3	
39	GND	Ground	
40	RX4N	5TH Pixel Negative V-by-One differential data input in area A. Lane 4	(1)
41	RX4P	5TH Pixel Positive V-by-One differential data input in area A. Lane 4	
42	GND	Ground	
43	RX5N	6TH Pixel Negative V-by-One differential data input in area A. Lane 5	(1)
44	RX5P	6TH Pixel Positive V-by-One differential data input in area A. Lane 5	
45	GND	Ground	
46	RX6N	7TH Pixel Negative V-by-One differential data input in area A. Lane 6	(1)
47	RX6P	7TH Pixel Positive V-by-One differential data input in area A. Lane 6	
48	GND	Ground	
49	RX7N	8TH Pixel Negative V-by-One differential data input in area A. Lane 7	(1)
50	RX7P	8TH Pixel Positive V-by-One differential data input in area A. Lane 7	
51	GND	Ground	

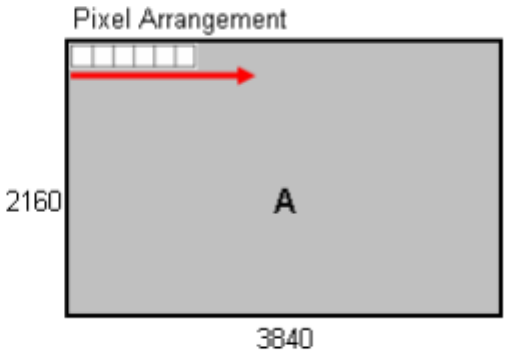
Note (1) V-by-One[6] HS Data Mapping

Area	Lane	Data Stream
A	Lane 0	1, 9, 17, ..., 3825, 3833
	Lane 1	2, 10, 18, ..., 3826, 3834
	Lane 2	3, 11, 19, ..., 3827, 3835
	Lane 3	4, 12, 20, ..., 3828, 3836
	Lane 4	5, 13, 21, ...,3829, 3837
	Lane 5	6, 14, 22, ..., 3830, 3838
	Lane 6	7, 15, 23, ..., 3831, 3839
	Lane7	8, 16, 24, ..., 3832, 3840





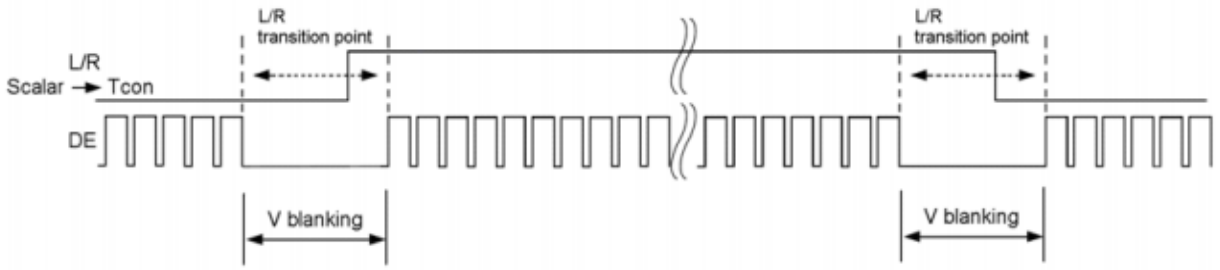




Note (2) Input signal for Left Right eye frame synchronous

V_{IL}=0~0.8 V, V_{IH}=2.0~3.3 V

L/R	Note
L	Right synchronous signal
H	Left synchronous signal



Note (3) Local dimming enable selection. (Default: enable)

L= Connect to GND, H=Connect to +3.3V or Open

LD_EN	Note
L	Local Dimming Disable
H or Open	Local Dimming Enable

LD_EN enable pin should be set in power on stage.

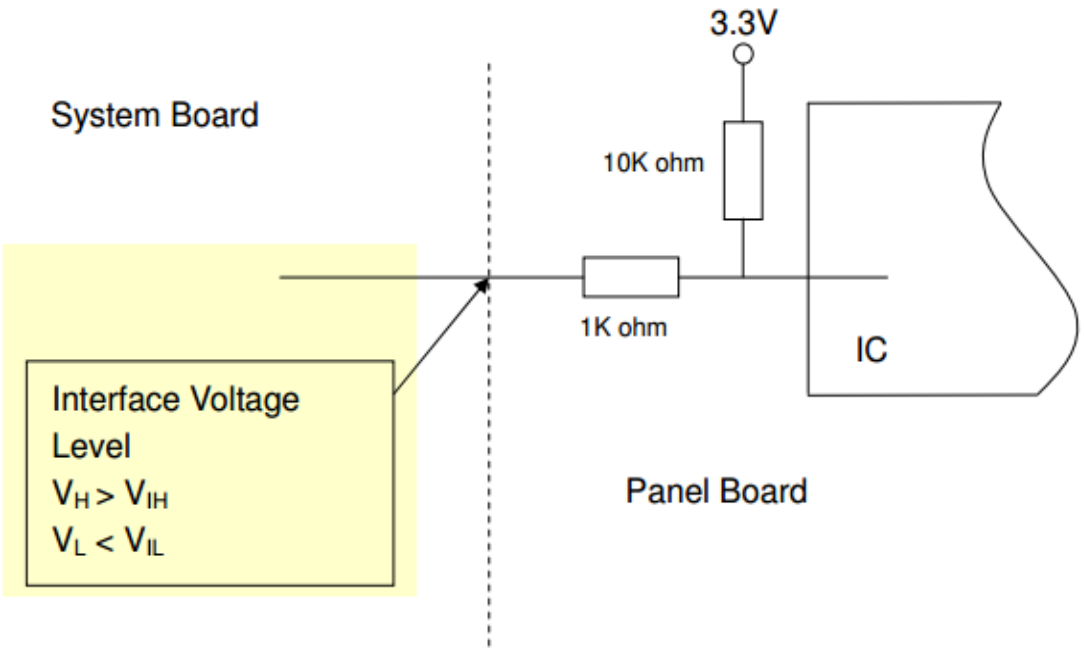
Backlight should be turned off in the period of changing original setting after power on.

Note (4) The definition of L/R_O signal as follows

L= 0V , H= +3.3V

L/R_O	Note
L	Right glass turn on
H	Left glass turn on

Note (5) Interface optional pin has internal scheme as following diagram. Customer should keep the interface voltage level requirement which including Panel board loading as below.



5.2 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 10-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																															
		Red										Green										Blue											
		R9	R8	R7	R6	R5	R4	R3	R2	R1	R0	G9	G8	G7	G6	G5	G4	G3	G2	G1	G0	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
Basic Colors	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	0	0	0	0	0	0
	Red	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	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	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	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	1	1	1	1	0	0	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	1	1	1	1	1	1
Gray Scale Of Red	Red (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (2)	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red (1021)	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1022)	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red (1023)	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green (0) / Dark	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
	Green (2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
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	Green (1021)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0
	Green (1022)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
	Green (1023)	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Blue	Blue (0) / Dark	0	0	0	0	0	0	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 (1)	0	0	0	0	0	0	0	0	0	0	0	0	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	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	Blue (1021)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	1	
	Blue (1022)	0	0	0	0	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	1
	Blue (1023)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

Note (1) 0: Low Level Voltage , 1: High Level Voltage

6 Interface Timing

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram. (Ta = 25 ± 2 ºC)

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Frequency	Data Clock	1/Tc	69	74.25	79	MHz	(1)
V-by-One Receiver	Intra-Pair skew		-0.3	–	0.3	UI	(2)
	Inter-pair skew		-5	–	5	UI	(3)
	Spread spectrum modulation range	F_{clkin_mod}	1/Tc-0.5%	–	1/Tc+0.5%	MHz	(4)
	Spread spectrum modulation frequency	F_{SSM}	–	–	30	KHz	

6.1.1 Input Timing spec for QFHD Frame Rate = 50Hz

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame Rate	2D Mode		F_r	49	50	51	Hz	(8),(9)
Vertical Active Display Term (8 Lane,3840X2160 Active Area)	2D Mode	Total	Tv	2240	2250	2450	Th	Tv=Tvd+Tvb
		Display	Tvd	2160			Th	
		Blank	Tvb	80	90	290	Th	
Horizontal Active Display Term (8 Lane,3840X2160 Active Area)	2D Mode	Total	Th	530	550	590	Tc	Th=Thd+Thb
		Display	Thd	480			Tc	
		Blank	Thb	50	70	110	Tc	

6.1.2 Input Timing spec for QFHD Frame Rate = 60Hz

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame Rate	2D Mode		F_r	59	60	61	Hz	(8),(9)
	3D Mode			60			Hz	(6)
Vertical Active Display Term (8 Lane,3840X2160 Active Area)	2D Mode	Total	Tv	2230	2250	2350	Th	Tv=Tvd+Tvb
		Display	Tvd	2160			Th	
		Blank	Tvb	70	90	190	Th	
	3D Mode	Total	Tv	2250			Th	
		Display	Tvd	2160			Th	(7)

		Blank	Tvb	90			Th	
Horizontal Active Display Term (8 Lane,3840X2160 Active Area)	2D Mode	Total	Th	530	550	600	Tc	Th=Thd+Thb
		Display	Thd	480			Tc	
		Blank	Thb	50	**70**	120	Tc	
	3D Mode	Total	Th	530	550	600	Tc	Th=Thd+Thb
		Display	Thd	480			Tc	
		Blank	Thb	50	**70**	120	Tc	

6.1.3 Input Timing Spec for FHD, Frame Rate = 50Hz

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame Rate	2D Mode		F_r	49	50	51	Hz	(8),(9)
Vertical Active Display Term (2 Lane,1920X1080 Active Area)	2D Mode	Total	Tv	1104	1350	1395	Th	Tv=Tvd+Tvb
		Display	Tvd	1080			Th	
		Blank	Tvb	24	270	315	Th	
Horizontal Active Display Term (2 Lane,1920X1080 Active Area)		Total	Th	1060	1100	1150	Tc	Th=Thd+Thb
		Display	Thd	960			Tc	
		Blank	Thb	100	140	190	Tc	

6.1.4 Input Timing Spec for FHD, Frame Rate = 60Hz

Signal	Item		Symbol	Min.	Typ.	Max.	Unit	Note
Frame Rate	2D Mode		F_r	59	60	61	Hz	(8),(9)
	3D Mode			60			Hz	(6)
Vertical Active Display Term (2 Lane,1920X1080 Active Area)	2D Mode	Total	Tv	1104	1125	1395	Th	Tv=Tvd+Tvb
		Display	Tvd	1080			Th	
		Blank	Tvb	24	45	315	Th	
	3D Mode	Total	Tv	1125			Th	
		Display	Tvd	1080			Th	(7)
		Blank	Tvb	45			Th	
Horizontal Active	2D Mode	Total	Th	1060	1100	1150	Tc	Th=Thd+Thb

7 Optical Characteristics

7.1 Test Condition

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25 ±2	℃
Ambient Humidity	Ha	50 ±10	%RH
Supply Voltage	Vcc		V
Input Signal	According to typical value in "3. Electrical characteristics		
LED LightBar Current	I_L		mA

7.2 Optical Characteristics

The relative measurement methods of optical characteristics are shown in the 7.2. The following items should be measured under the test condition in 7.1 and the stable environment shown in the in 7.1.

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	T θx=0,θy=0, viewing normal angle	2800	4000	—	—	—
Response Time		Gray to gray average		—	9.5	19	ms	Note 3
Transmittance				4.2	4.7	—	%	
Brightness uniformity		BU		—	1.33	1.42	—	Note 2
Center Luminance of White		Lc		300	350	—	cd/m2	—
The color chromaticity	Red	Rx		-0.03	0.636	+0.03	—	Note 0
		Ry			0.334		—	
	Green	Gx			0.293		—	
		Gy			0.633		—	
	Blue	Bx			0.153		—	
		By			0.064		—	
	White	Wx			0.268		—	
		Wy			0.306		—	
Viewing Angle	Horizontal	θx+	CR≧10		89	—	Deg	Note 1、2
		θx-			89	—		
	Vertical	θy+			89	—		
		θy-			89	—		

Note 0: Light source is the standard light source ”C” which is defined by CIE and driving voltage are based on suitable gamma voltages. The calculating method is as following:

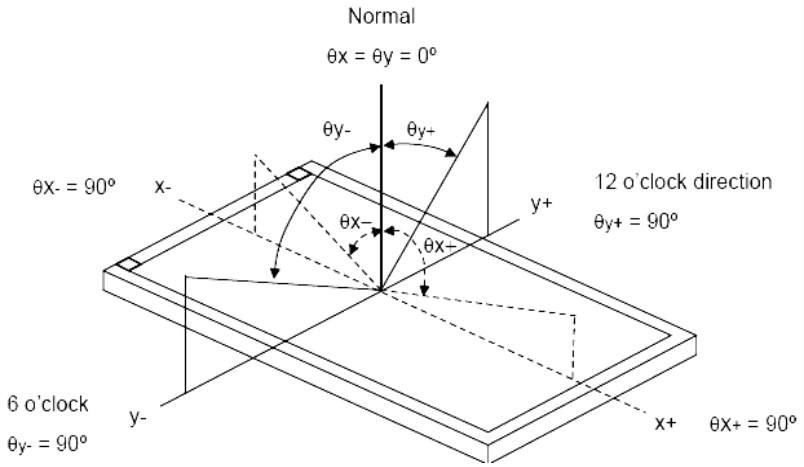
1. Measure Module’s and BLU’s spectrum at center point. White and R,G,B are with signal input. BLU (for V500HK3-L01) is supplied by CMI.
2. Calculate cell’s spectrum.
3. Calculate cell’s chromaticity by using the spectrum of standard light source “C”.

Note 1: Light source is the BLU which supplied by CMI and driving voltage are based on suitable gamma voltages.

Note 2: Definition of Viewing Angle (x, y):

Viewing angles are measured by Autronic Conoscope Cono-80

Note 1: The definition of viewing angle



Note 2: Definition of luminance , CR measured positions and brightness uniformity

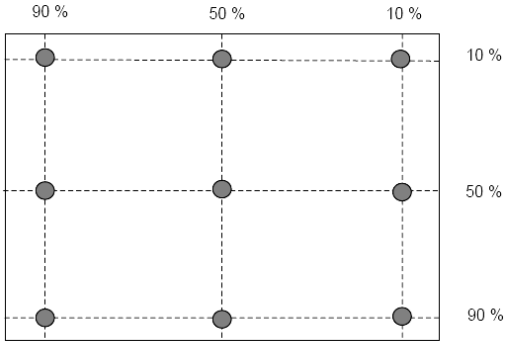
(a) Measure White luminance on the below 9 points and take the average value .

(b) CR : measures the same 9 points and take the average value .The Definition of Contrast Ratio is as folows :

CR = ON(white)Luninance / OFF (Black)Luminance

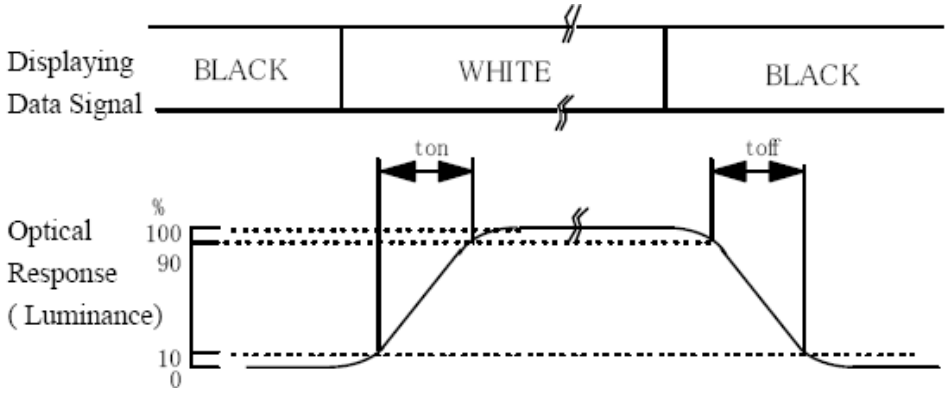
(c) The definition of White Vibration

$$\frac{\text{The maximum brightness of 9 dot}}{\text{The minimum brightness of 9 dot}} \times 100\%$$

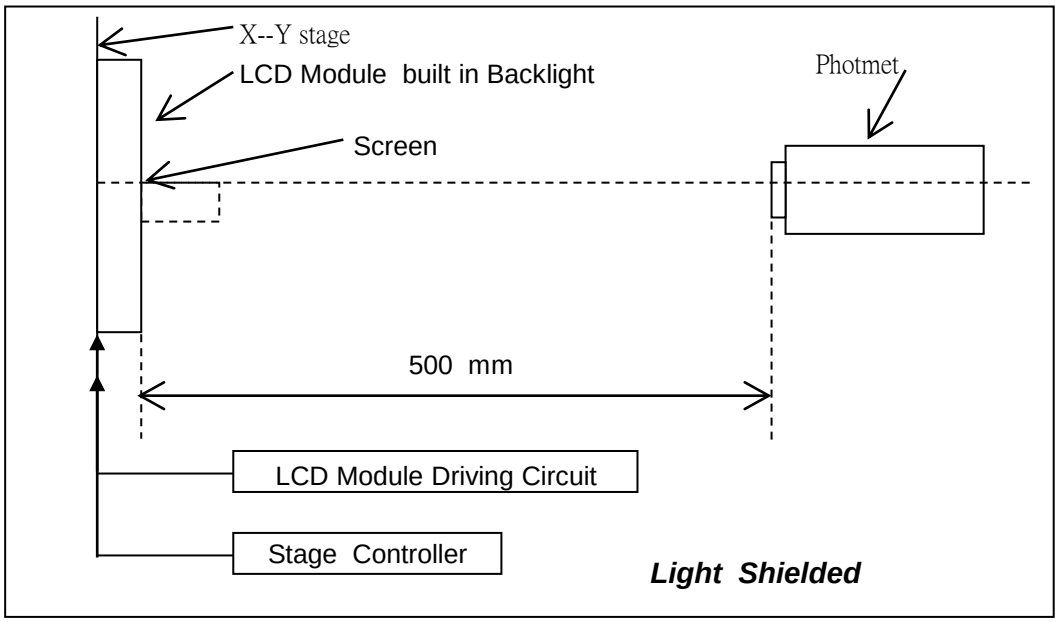


The luminance and contrast must to 100%.

Note 3: Definition of Response Time.



Note 4: The measure method



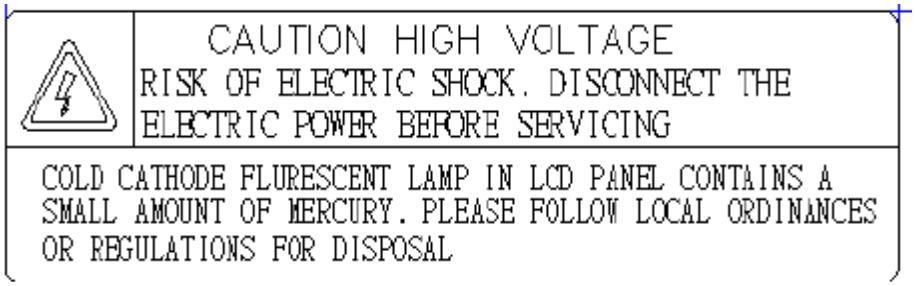
Note 1: The measurement point is the center of the active area except for the measurement of Luminance Uniformity

Note 2: Photometer :BM-7 TOPCON (Aperture 2deg.)

8. Labels

8.1 Panel Label:

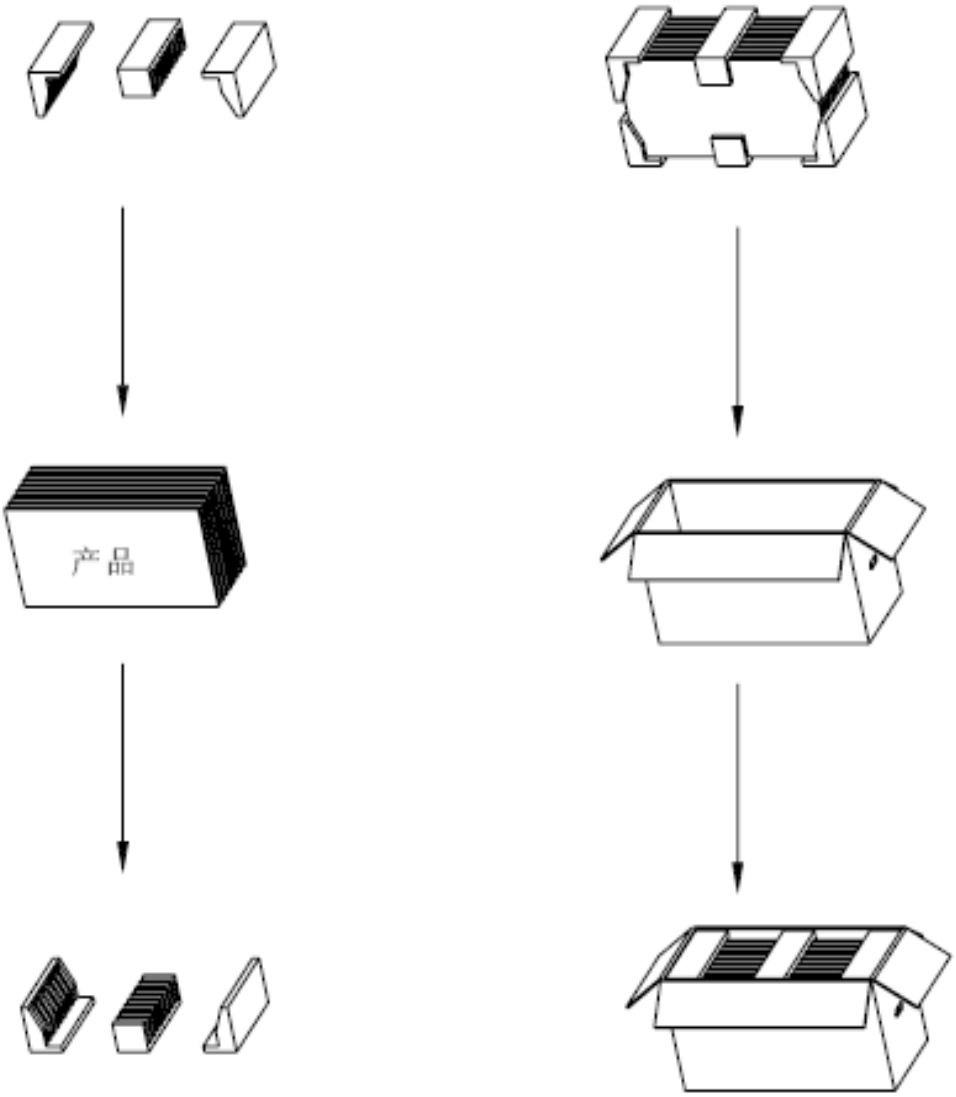
8.2 Caution Label:



9. Packaging

9.1 Carton(internal package)

(TWO pcs product in the box)



9.2 Pakaging Mark

10. PRECAUTION

10.1 ASSEMBLY AND HANDLING PRECAUTIONS

1 Do not apply rough force such as bending or twisting to the module during assembly.
2 To assemble or install module into user's system can be in clean working areas. The dust and oil may cause electrical short or worsen the polarizer.
3 It's not permitted to have pressure or impulse on the module because the LCD panel and Backlight will will be damaged.
4 Always follow the correct power sequence when LCD module is connecting and operating. This can prevent damage to the CMOS LSI chips during latch-up.
5 Do not pull the I/F connector in or out while the module is operating .
6 Do not disassemble the module.
7 Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
8 It is dangerous that moisture come into or contacted the LCD module, because moisture may damage LCD module when it is operating.
9 High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storaged conditions.
10 When ambient temperature is lower than 10 ℃ may reduce the display quality. For example, the response time will become slowly, and the starting voltage of CCFL will be higher than room temperature.

10.2 SAFETY PRECAUTIONS

1 The startup voltage of Backlight is approximately 2000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.
2 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, skin or clothes, it has to be washed away thoroughly with soap.
3 After the modlule's end of life, it is not harmful in case of normal operation and storage.

Outline dimension

Front dimension

Unit :mm

Standard Tolerance : ±0.5