LG Display

LC260EXN

Product Specification

SPECIFICATION
FOR
APPROVAL

(●) **Preliminary Specification**

(   ) **Final Specification**

Title	26.0" WXGA TFT LCD

BUYER	General
MODEL	

SUPPLIER	LG Display Co., Ltd.
*MODEL	LC260EXN
SUFFIX	SCB1

*When you obtain standard approval,
 please use the above model name without suffix

APPROVED BY	SIGNATURE DATE
/	
/	
/	

Please return 1 copy for your confirmation with
your signature and comments.

APPROVED BY	SIGNATURE DATE
H.S.SONG / Team Leader	
REVIEWED BY	
S.S.KIM / Project Leader	
PREPARED BY	
Y.J.KIM / Engineer	

TV Product Development Dept.
LG Display Co., Ltd

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RECORD OF REVISIONS

| Revision No.	Revision Date	Page	Description
0.0	Aug. 27, 2009	-	Preliminary Specification (First Draft)

LC260EXN

1. General Description

The LC260EXN is a Color Active Matrix Liquid Crystal Display with an integral Light Emitting Diode(LED) backlight system. The matrix employs a-Si Thin Film Transistor as the active element. It is a transmissive display type which is operating in the normally black mode. It has a 26.01 inch diagonally measured active display area with WXGA resolution (768 vertical by 1366 horizontal pixel array). Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in Horizontal stripes. Gray scale or the luminance of the sub-pixel color is determined with a 8-bit gray scale signal for each dot, thus presenting a palette of more than 16.7M(true) colors.
It has been designed to apply the 8-bit 1-port LVDS interface.
It is intended to support LCD TV, PCTV where high brightness, super wide viewing angle, high color gamut, high color depth and fast response time are important.
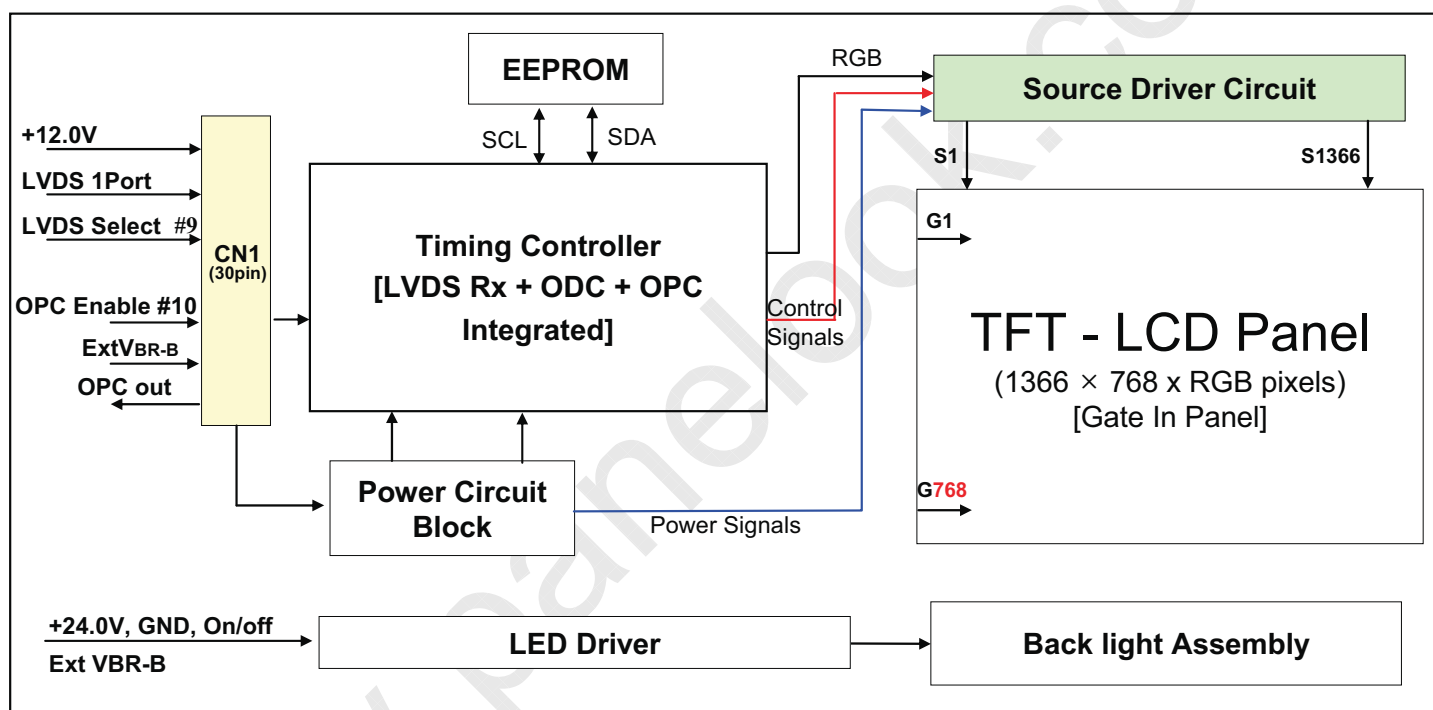
General Features

Active Screen Size	26.01 inches(660.6mm) diagonal
Outline Dimension	613 mm(H) x 361.0 mm(V) x 14.9 mm(D) (Typ.)
Pixel Pitch	$421.5 \mu m$ x $140.5 \mu m$ x RGB
Pixel Format	1366 horiz. by 768 vert. pixels RGB stripe arrangement
Color Depth	8bit, 16,7 M colors
Luminance, White	400 cd/m^2 (Center 1 point) (Typ.)
Viewing Angle (CR>10)	Viewing angle free (R/L 178(Min.), U/D 178(Min.))
Power Consumption	Total 35.66 Watt (Logic=3.66 W , LED Driver = 32(TBD)W @ [ExtVbr_B=100%])
Weight	2,860(TBD)g(Typ.)
Display Operating Mode	Transmissive mode, normally black
Surface Treatment	Hard coating(3H), Anti-glare treatment of the front polarizer (Haze 10%)

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2. Absolute Maximum Ratings

The following items are maximum values which, if exceeded, may cause faulty operation or damage to the LCD module.

Table 1. ABSOLUTE MAXIMUM RATINGS

| Parameter		Symbol	Value		Unit	Note
			Min	Max		
Power Input Voltage	LCD Circuit	V_{LCD}	-0.3	+14.0	V_{DC}	1
	Driver	V_{BL}	-0.3	+ 27.0	V_{DC}	
Driver Control Voltage	ON/OFF	V_{OFF} / V_{ON}	-0.3	+5.5	V_{DC}	
	Brightness	V_{BR}	0.0	+5.5	V_{DC}	
T-Con Option Selection Voltage		V_{LOGIC}	-0.3	+4.0	V_{DC}	
Operating Temperature		T_{OP}	0	+50	°C	2,3
Storage Temperature		T_{ST}	-20	+60	°C	
Panel Front Temperature		T_{SUR}	-	+68	°C	4
Operating Ambient Humidity		H_{OP}	10	90	%RH	2,3
Storage Humidity		H_{ST}	10	90	%RH	

Note1. Ambient temperature condition (Ta = 25 ± 2 °C)
   2. Temperature and relative humidity range are shown in the figure below.
      Wet bulb temperature should be Max 39°C, and no condensation of water.
   3. Gravity mura can be guaranteed below 40°C condition.
   4. The maximum operating temperatures is based on the test condition that the surface temperature
      of display area is less than or equal to 68°C with LCD module alone in a temperature controlled chamber.
      Thermal management should be considered in final product design to prevent the surface temperature of
      display area from being over 68℃. The range of operating temperature may degraded in case of
      improper thermal management in final product design.
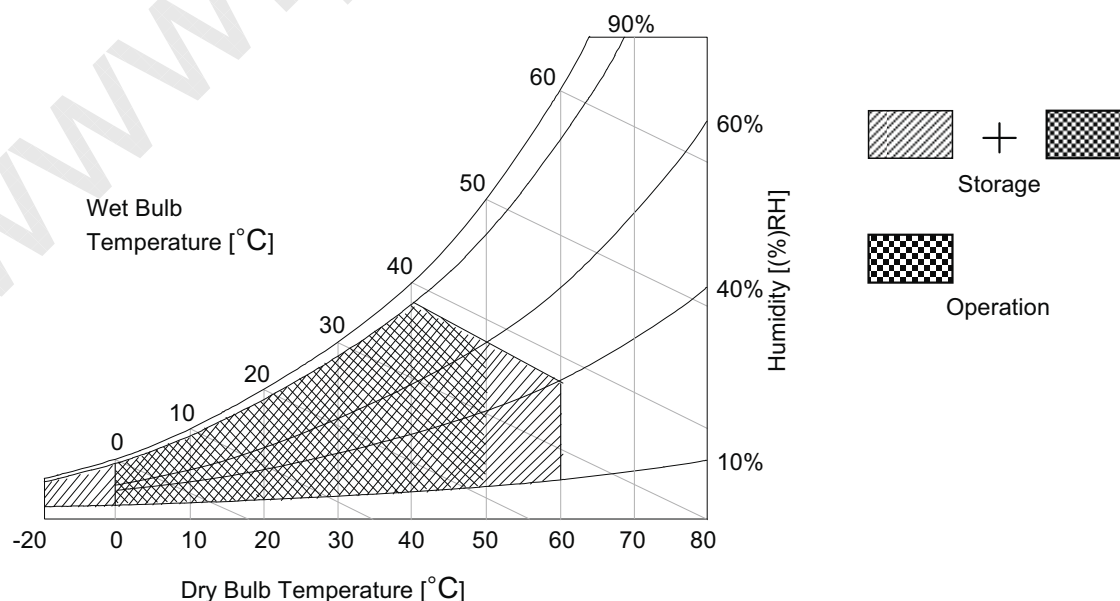
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3. Electrical Specifications

3-1. Electrical Characteristics

It requires two power inputs. One is employed to power for the LCD circuit. The other Is used for the LED backlight and LED Driver circuit.

Table 2. ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Value			Unit	Note
		Min	Typ	Max		
Circuit :						
Power Input Voltage	V_{LCD}	10.8	12.0	13.2	V_{DC}	
Power Input Current	I_{LCD}	-	305	396	mA	1
		-	390	507	mA	2
Power Consumption	P_{LCD}	-	3.66	5.27	Watt	1
Rush current	I_{RUSH}	-	-	3.0	A	3

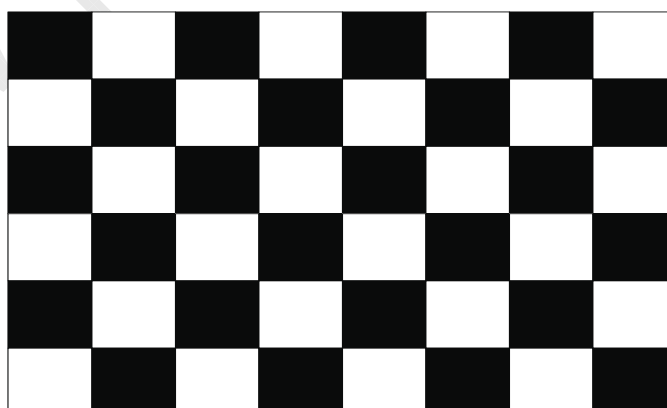Notes : 1. The specified current and power consumption are under the V_{LCD}=12.0V, $25 \pm 2°C$, f_V=60Hz

     condition whereas mosaic pattern(8 x 6) is displayed and f_V is the frame frequency.

     2. The current is specified at maximum current pattern.

     3. The duration of rush current is about 2ms and rising time of power input is 0.5ms (min.).

White : 255 Gray
Black : 0 Gray

Mosaic Pattern(8 x 6)

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Table 3. ELECTRICAL CHARACTERISTICS (Continue)

Parameter			Symbol	Values			Unit	Notes
				Min	Typ	Max		
LED Driver :								
Power Supply Input Voltage			VBL	22.8	24.0	25.2	Vdc	1
Power Supply Input Current			IBL_A	-	1.20(TBD)	TBD	A	1
Power Supply Input Current (In-Rush)			Irush	-	-	TBD	A	V_{BL} = 22.8V Ext V_{BR-B} = 100%
Power Consumption			PBL	-	28.8(TBD)	TBD	W	1
Input Voltage for Control System Signals	On/Off	On	V on	2.5	-	5.0	Vdc	
		Off	V off	-0.3	0.0	0.8	Vdc	
	Brightness Adjust		ExtV_{BR-B}	10	-	100	%	On Duty
	PWM Frequency for NTSC & PAL	PAL			100		Hz	4
		NTSC			120		Hz	4
	Pulse Duty Level (PWM)	High Level		2.5	-	5.0	Vdc	HIGH : on duty LOW : off duty
		Low Level		0.0	-	0.8	Vdc	
LED :								
Life Time					30,000		Hrs	3

Notes :

1. Electrical characteristics are determined after the unit has been 'ON' and stable for approximately 60 minutes at 25±2°C. The specified current and power consumption are under the typical supply Input voltage 24Vand V_{BR} (ExtV_{BR-B} : 100%), it is total power consumption.
2. Electrical characteristics are determined within 30 minutes at 25±2°C.
   The specified currents are under the typical supply Input voltage 24V.
3. The life time(MTTF) is determined as the time which luminance of the LED is 50% compared to that of initial value at the typical LED current (ExtV_{BR-B} :100%) on condition of continuous operating in LCM state at 25±2°C.
4. LGD recommend that the PWM freq. is synchronized with One time harmonic of Vsync signal of system.
   Though PWM frequency is over 120Hz (max 252Hz), function of LED Driver is not affected.
5. The duration of rush current is about 10ms.
6. Even though inrush current is over the specified value, there is no problem if I^2T spec of fuse is satisfied.

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3-2. Interface Connections

This LCD module employs two kinds of interface connection, a 30-pin connector is used for the module electronics and 14-pin connector is used for the integral backlight system.

3-2-1. LCD Module

- LCD Connector(CN1) : KDF71G-30S-1H(Hirose) or FI-X30SSL-HF(JAE)
- Mating Connector : : FI-X30C2L (Manufactured by JAE) or Equivalent

Table 4. MODULE CONNECTOR(CN1) PIN CONFIGURATION

Pin No.	Symbol	Description	Note
1	VLCD	Power Supply +12.0V	
2	VLCD	Power Supply +12.0V	
3	VLCD	Power Supply +12.0V	
4	VLCD	Power Supply +12.0V	
5	GND	Ground	
6	GND	Ground	
7	GND	Ground	
8	GND	Ground	
9	LVDS Select	'H' =JEIDA , 'L' or NC = VESA	Appendix IX
10	OPC_Enable	'H' = Enable , 'L' or NC = Disable	Appendix V, VII
11	GND	Ground	
12	RA-	LVDS Receiver Signal(-)	
13	RA+	LVDS Receiver Signal(+)	
14	GND	Ground	
15	RB-	LVDS Receiver Signal(-)	
16	RB+	LVDS Receiver Signal(+)	
17	GND	Ground	
18	RC-	LVDS Receiver Signal(-)	
19	RC+	LVDS Receiver Signal(+)	
20	GND	Ground	
21	RCLK-	LVDS Receiver Clock Signal(-)	
22	RCLK+	LVDS Receiver Clock Signal(+)	
23	GND	Ground	
24	RD-	LVDS Receiver Signal(-)	
25	RD+	LVDS Receiver Signal(+)	
26	GND	Ground	
27	OPC OUT	OPC output (From LCM)	
28	Ext V_{BR-B}	External VBR (From System)	
29	Reserved	'H' : Interlace Free Mode , 'L' or NC : Normal Operation	
30	GND	Ground	

Notes :　1. All GND (Ground) pins should be connected together to the LCD module's metal frame.

2. All VLCD (power input) pins should be connected together.

3. All Input levels of LVDS signals are based on the EIA 644 Standard.

4. Specific pins (Pin No. #10, #27~#28) are used for OPC function of the LCD module.
  If not used, these pins are no connection.

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3-2-2. Backlight Inverter

- LED Connector : SM14B-SRSS-TB(Manufactured by JST)
- Mating Connector : SHR-14V-S-B(With protrusions) or SHR-14V-S(Without protrusions) ; (Manufacture by JST)

Table 5. INVERTER CONNECTOR PIN CONFIGULATION

Pin No	Symbol	Description	Note
1	V$_{BL}$	Power Supply +24.0V	
2	V$_{BL}$	Power Supply +24.0V	
3	V$_{BL}$	Power Supply +24.0V	
4	V$_{BL}$	Power Supply +24.0V	
5	V$_{BL}$	Power Supply +24.0V	
6	GND	Backlight Ground	
7	GND	Backlight Ground	
8	GND	Backlight Ground	1
9	GND	Backlight Ground	
10	GND	Backlight Ground	
11	NC	No Connection	
12	V$_{ON/OFF}$	Backlight ON/OFF control	
13	EXTVBR-B	External PWM	2
14	Status	LED Status	

Notes :
1. GND should be connected to the LCD module's metal frame.
2. Normal : Low (under 0.7V) / Abnormal : High (upper 3.0V)
   Please see Appendix VIII for more information.
3. Each impedance of 12 and 13 is over 100[TBD][KΩ] and over 50[TBD][KΩ].

◆ **Rear view of LCM**
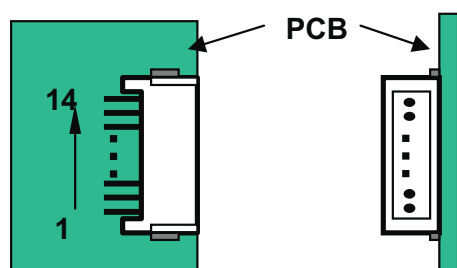
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3-3. Signal Timing Specifications

Table 6 shows the signal timing required at the input of the LVDS transmitter. All of the interface signal timings should be satisfied with the following specification for normal operation.

Table 6. TIMING TABLE for NTSC & PAL

[DE (Data Enable) Only]

| ITEM	Symbol		Min	Typ	Max	Unit	Note
DCLK	Period	t_{CLK}	12.5	13.8	15.8	ns	
	Frequency	-	63	72.4	80	MHz	
Hsync	Period	t_{HT}	1456	1528	1920	t_{CLK}	
	Horizontal Valid	t_{HV}	1366	1366	1366	t_{CLK}	
	Horizontal Blank	-	t_{HP}- t_{HV}	162	t_{HP}- t_{HV}		
	Frequency	f_H	45	47.4	50	KHz	
	Width	t_{WH}	-	32	-	t_{CLK}	
	Horizontal Back Porch	t_{HBP}	24	48	-		
	Horizontal Front Porch	t_{HFP}	40	80	-		
Vsync	Period	t_{VT}	776 (894)	790 (948)	1008 (1063)	t_{HP}	Note 1) NTSC : 57~63Hz (PAL : 47~53Hz)
	Vertical Valid	t_{VV}	768	768	768	t_{HP}	
	Vertical Blank	-	t_{VP}- t_{VV}	22	t_{VP}- t_{VV}	t_{HP}	
	Frequency	f_V	57 (47)	60 (50)	63 (53)	Hz	
	Width	t_{WV}	-	5 (12)	-	t_{HP}	
	Vertical Back Porch	t_{VBP}	5	15 (128)	-	Hz	
	Vertical Front Porch	t_{VFP}	1	2 (40)	-	t_{HP}	

Note :
1. The input of HSYNC & VSYNC signal does not have an effect on normal operation (DE Only Mode). If you use spread spectrum of EMI, add some additional clock to minimum value for clock margin.
2. The performance of the electro-optical characteristics may be influenced by variance of the vertical refresh rate and the horizontal frequency
3. Timing should be set based on clock frequency.
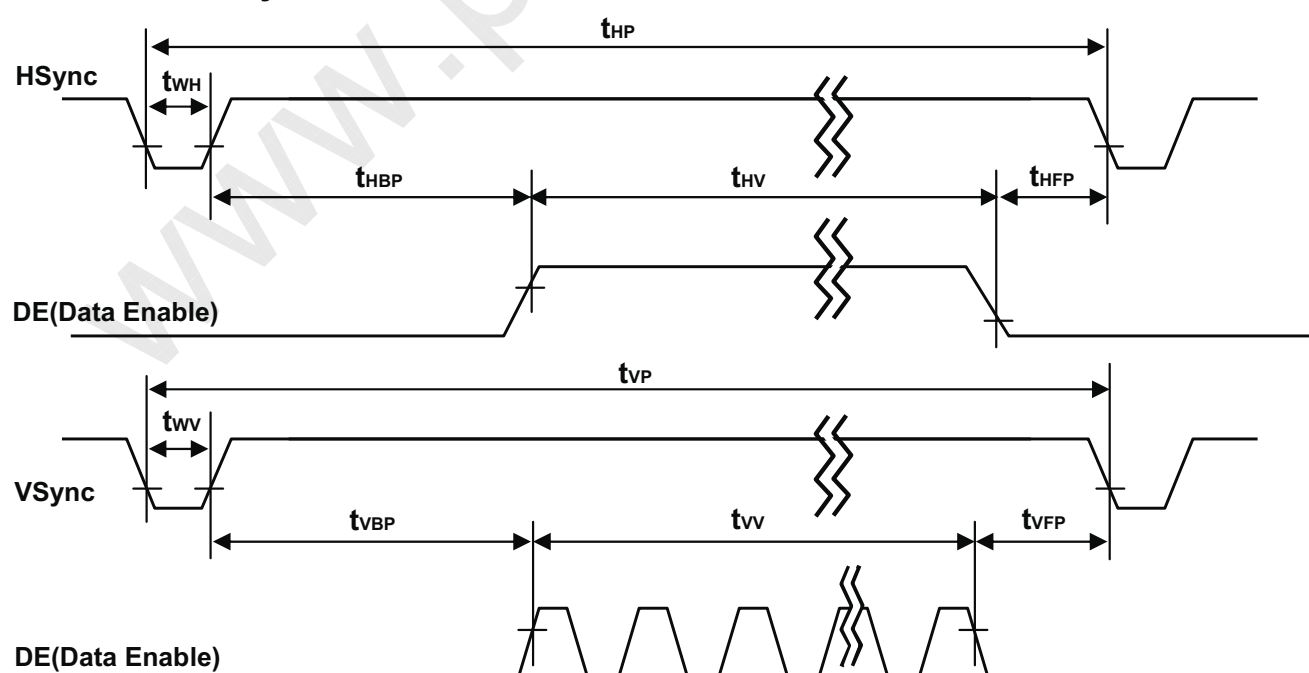
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3-4. Signal Timing Waveforms

3-4-1. LVDS Input Signal Timing Diagram

* $t_{HP} = t_{HFP} + t_{WH} + t_{HBP}$
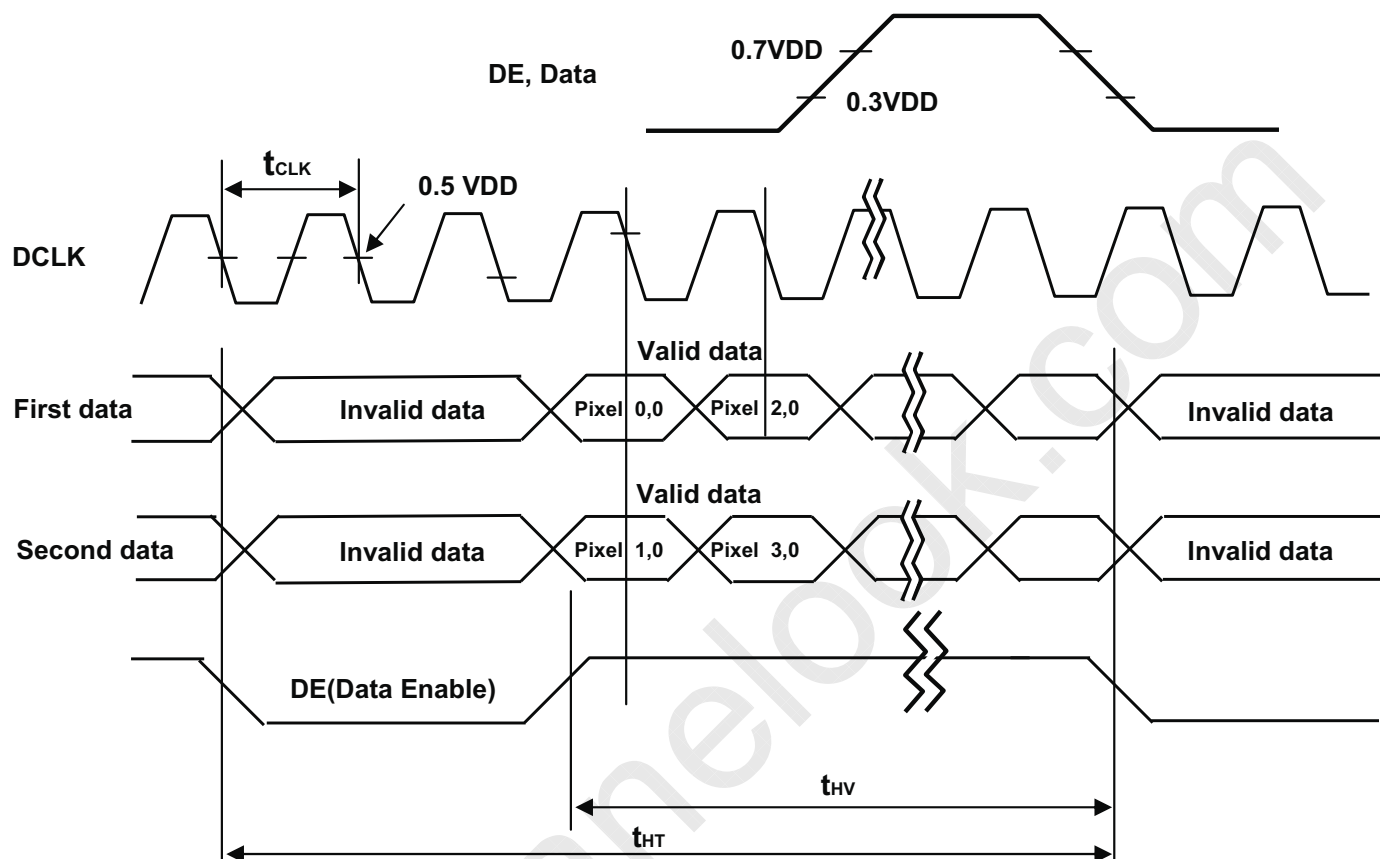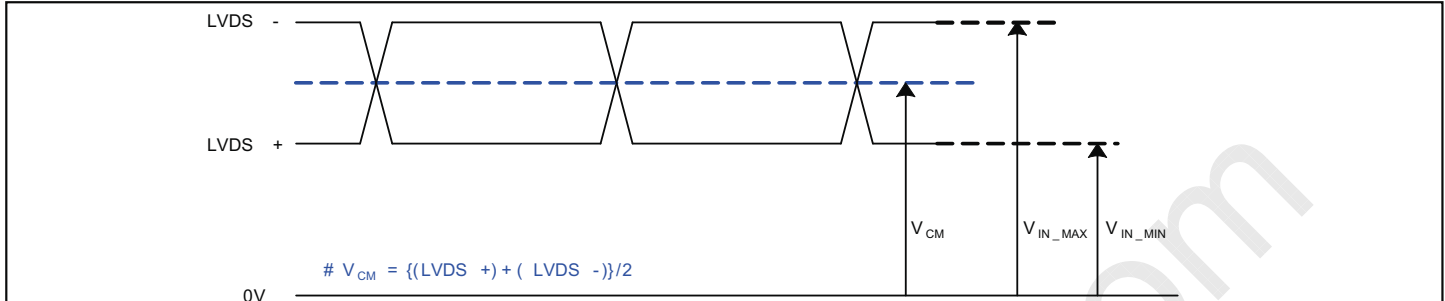
* $t_{VP} = t_{VFP} + t_{WV} + t_{VBP}$

* Reference : Sync. Relation

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3-4-2. LVDS Input Signal Characteristics

1) DC Specification

LVDS -

LVDS +

V_{CM} V_{IN_MAX} V_{IN_MIN}

$V_{CM} = \{(LVDS\ +) + (\ LVDS\ -)\}/2$

0V

Description	Symbol	Min	Max	Unit	Note
LVDS Common mode Voltage	V_{CM}	1.0	1.5	V	-
LVDS Input Voltage Range	V_{IN}	0.7	1.8	V	-
Change in common mode Voltage	$\triangle VCM$		250	mV	-

2) AC Specification

T_{clk}

LVDS Clock

LVDS Data   A

t_{SKEW} t_{SKEW} (F_{clk} = 1/T_{clk})

A

T_{clk}

LVDS 1'st Clock

LVDS 2nd / 3rd / 4th Clock

80%

20%

t_{RF}
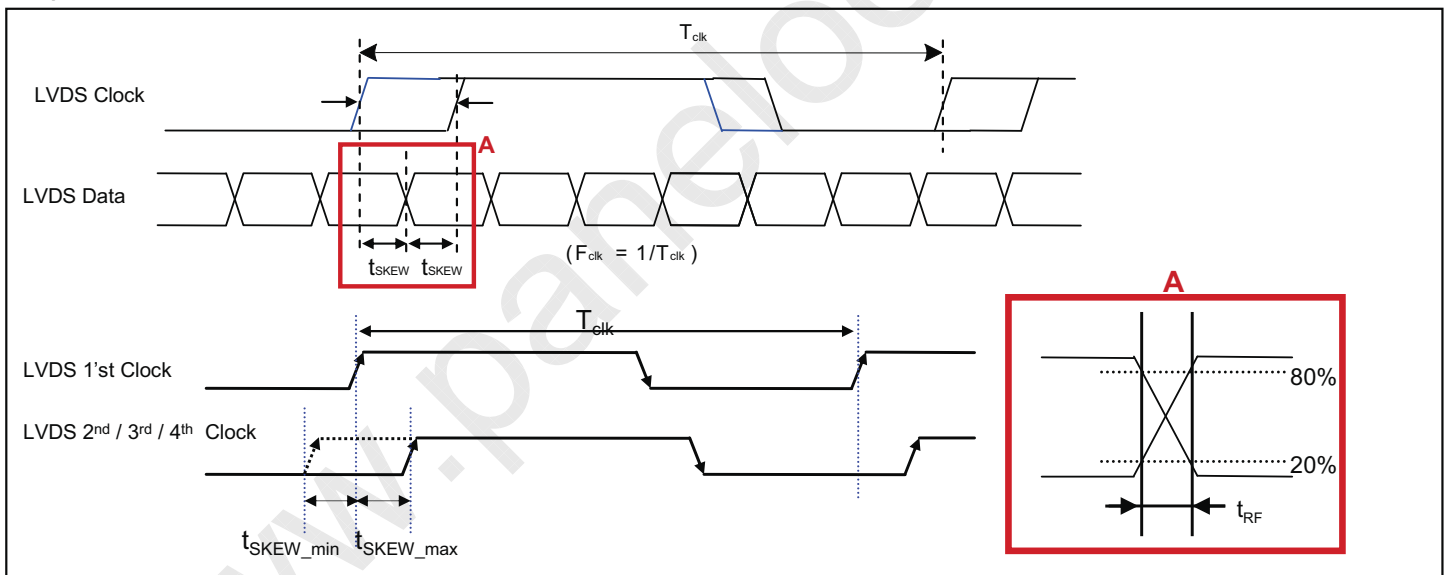
t_{SKEW_min} t_{SKEW_max}

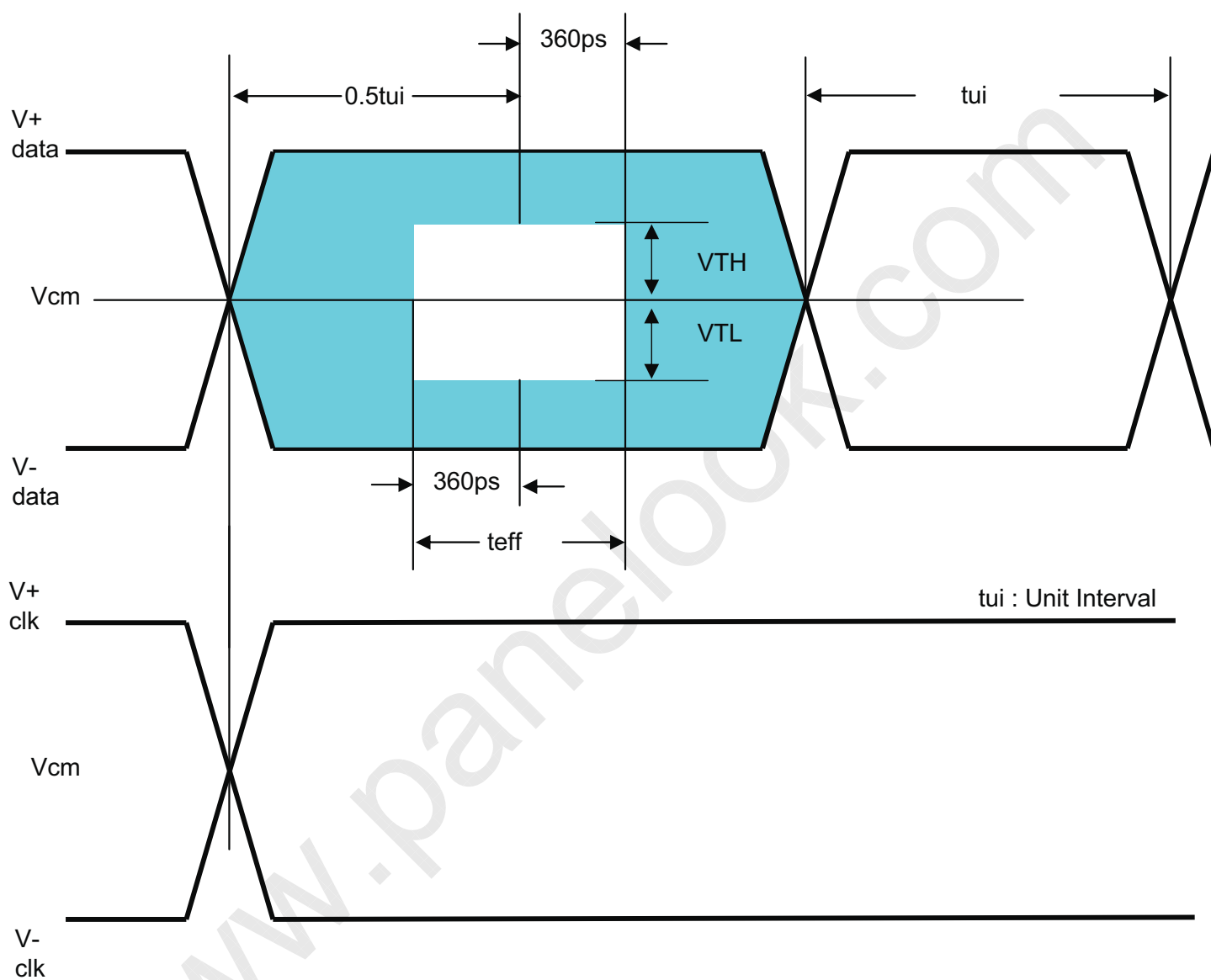| Description		Symbol	Min	Max	Unit	Note
LVDS Differential Voltage	High Threshold	V_{TH}	100	300	mV	3
	Low Threshold	V_{TL}	-300	-100	mV	
LVDS Clock to Data Skew Margin		t_{SKEW}		$|(0.25*T_{clk})/7|$	ps	-
LVDS Clock/DATA Rising/Falling time		t_{RF}	260	$(0.3*T_{clk})/7$	ps	2
Effective time of LVDS		t_{eff}	±360		ps	-
LVDS Clock to Clock Skew Margin (Even to Odd)		t_{SKEW_EO}		$1/7* T_{clk}$	T_{clk}	-

Note 1. All Input levels of LVDS signals are based on the EIA 644 Standard.
    2. If t_{RF} isn't enough, t_{eff} should be meet the range.
    3. LVDS Differential Voltage is defined within t_{eff}

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V+
data

Vcm

V-
data

V+
clk

Vcm

V-
clk

0.5tui

360ps

tui

VTH

VTL

360ps

teff

tui : Unit Interval

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3-5. Color Data Reference

The brightness of each primary color (Red, Green, Blue) is based on the 8-bit gray scale data input for the color. The higher binary input, the brighter the color. Table 7 provides a reference for color versus data input.

Table 7. COLOR DATA REFERENCE

Color		Input Color Data																						
		RED MSB							LSB	GREEN MSB							LSB	BLUE MSB							LSB
		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	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 (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
	Blue (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
	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
	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
RED	RED (000)　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
	RED (001)	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	...			...								...								...					
	RED (254)	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	RED (255)	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GREEN	GREEN (000) 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
	GREEN (001)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
	...			...								...								...					
	GREEN (254)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0
	GREEN (255)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0
BLUE	BLUE (000)　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
	BLUE (001)	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 (254)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0
	BLUE (255)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

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3-6. Power Sequence
3-6-1. LCD Driving circuit
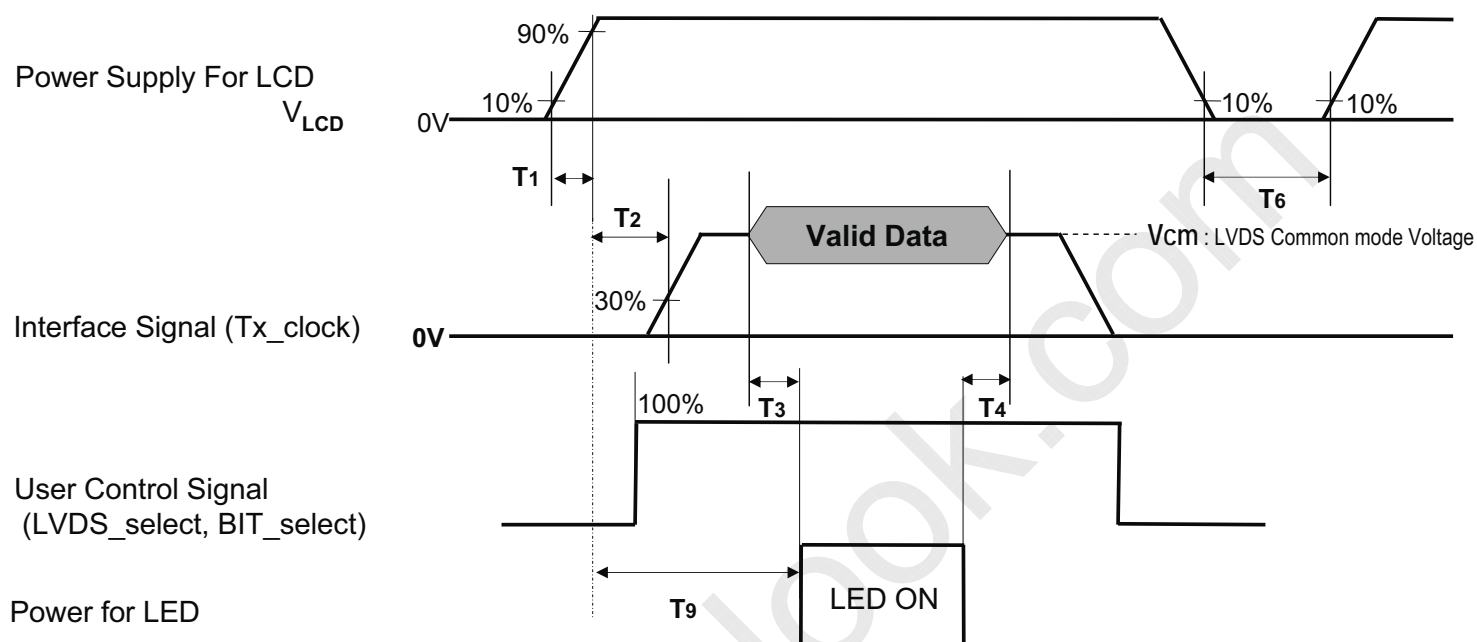
Table 9. POWER SEQUENCE

Parameter	Value			Unit	Notes
	Min	Typ	Max		
T1	0.5	-	20	ms	
T2	0	-	-	ms	4
T3	200	-	-	ms	3
T4	200	-	-	ms	3
T6	1.0	-	-	s	5
T9	500	-	-	ms	

Note :   1. Please avoid floating state of interface signal at invalid period.
2. When the power supply for LCD (V_{LCD}) is off, be sure to pull down the valid and invalid data to 0V.
3. The T3 / T4 is recommended value, the case when failed to meet a minimum specification, abnormal display would be shown. There is no reliability problem.
4. T6 should be measured after the Module has been fully discharged between power off and on period.

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3-6-2. Sequence for LED Driver

Power Supply For LED Driver
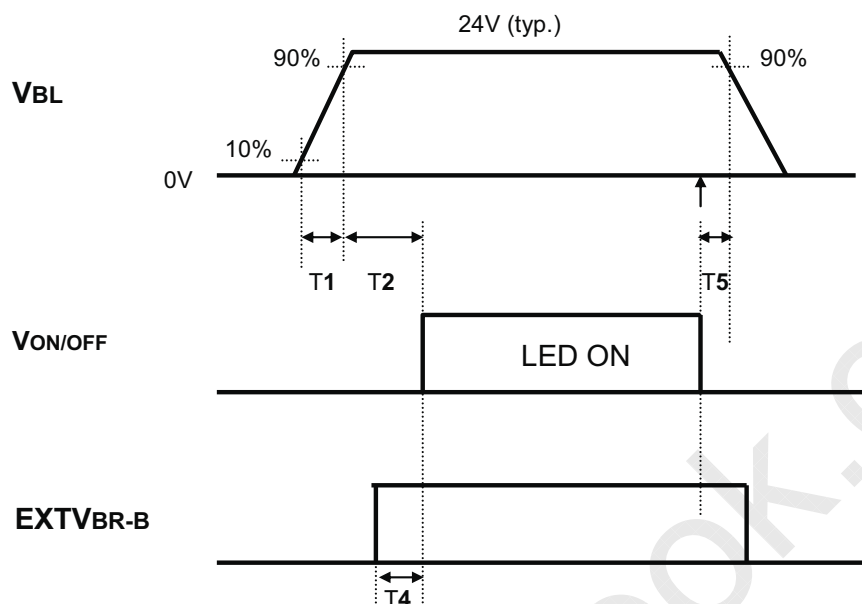
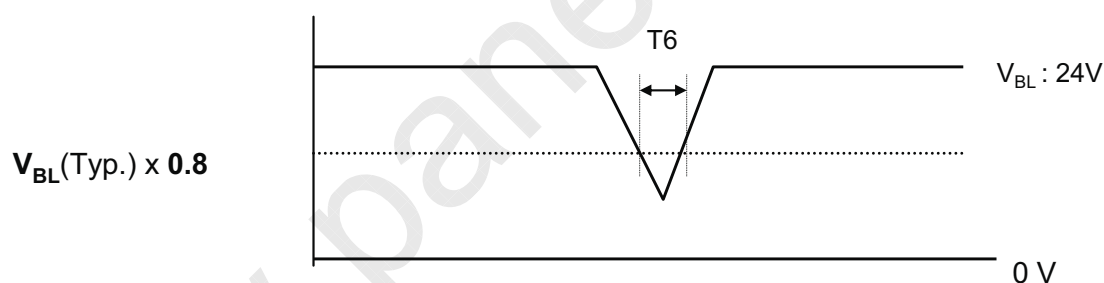## 3-6-3. Dip condition for LED Driver

Table 9. Power Sequence for Inverter

Parameter	Values			Units	Remarks
	Min	Typ	Max		
T1	20	-	-	ms	1
T2	500	-	-	ms	
T4	0		-	ms	
T5	10	-	-	ms	
T6	-	-	10	ms	V_{BL}(Typ) x 0.8

Notes : 1. T1 describes rising time of 0V to 24V and this parameter does not applied at restarting time.
Even though T1 is over the specified value, there is no problem if I^2T spec of fuse is satisfied.

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4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable in a dark environment at $25\pm2°C$. The values are specified at an approximate distance 50cm from the LCD surface at a viewing angle of Φ and θ equal to 0 °.

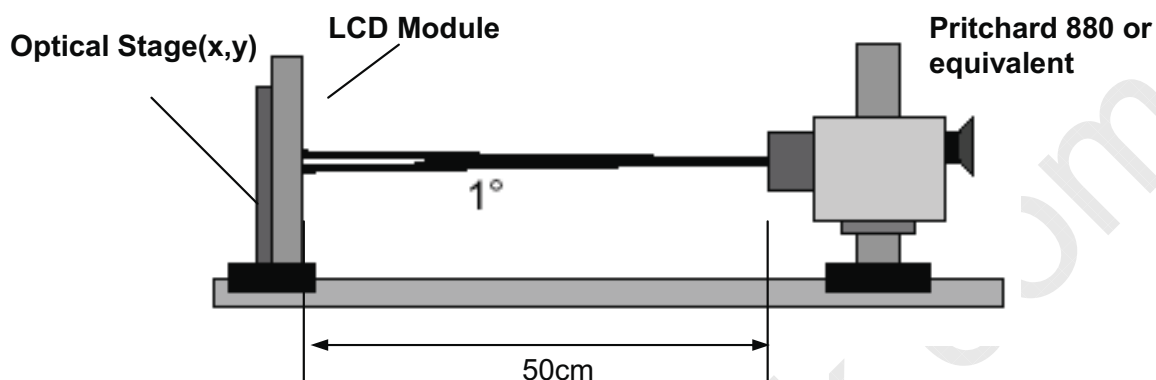FIG. 1 shows additional information concerning the measurement equipment and method.

Optical Stage(x,y)　**LCD Module**　**Pritchard 880 or equivalent**

1°

50cm

FIG. 1 Optical Characteristic Measurement Equipment and Method

Table 10. OPTICAL CHARACTERISTICS

Ta= $25\pm2°C$, V_{LCD}=12.0V, f_V=60Hz, Dclk=72.4MHz, $EXTV_{BR\_B}$=100%

Parameter		Symbol		Value			Unit	Note
				Min	Typ	Max		
Contrast Ratio		CR		700	1000	-		1
Surface Luminance, white		L_{WH}		320	400		cd/m^2	2
Luminance Variation		δ_{WHITE}	5P	-	-	1.3		3
Response Time	Gray-to-Gray	G to G		-	8	12	ms	4
	Uniformity	$\delta_{G\ TO\ G}$		-	-	1		5
Color Coordinates [CIE1931]	RED	Rx			TBD			
		Ry			TBD			
	GREEN	Gx			TBD			
		Gy		Typ -0.03	TBD	Typ +0.03		
	BLUE	Bx			TBD			
		By			TBD			
	WHITE	Wx			0.279			
		Wy			0.292			
Viewing Angle (CR>10)								
	x axis, right(ϕ=0°)	θr		89	-	-		
	x axis, left (ϕ=180°)	θl		89	-	-	degree	6
	y axis, up (ϕ=90°)	θu		89	-	-		
	y axis, down (ϕ=270°)	θd		89	-	-		
Gray Scale					-			7

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Notes : 1. Contrast Ratio (CR) is defined mathematically as :

$$CR = \frac{\text{Surface Luminance at all white pixels}}{\text{Surface Luminance at all black pixels}}$$

It is measured at center 1-point.

2. Surface luminance is determined after the unit has been 'ON' and 1Hour after lighting the backlight in a dark environment at $25\pm2°C$. Surface luminance is the luminance value at center 1-point across the LCD surface 50cm from the surface with all pixels displaying white. For more information see the FIG. 2.

3. The variation in surface luminance , δ WHITE is defined as :

δ WHITE(5P) = Maximum($L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}$) / Minimum($L_{on1}, L_{on2}, L_{on3}, L_{on4}, L_{on5}$)

Where L_{on1} to L_{on5} are the luminance with all pixels displaying white at 5 locations . For more information, see the FIG. 2.

4. Response time is the time required for the display to transit from G(N) to G(M) (Rise Time, Tr_R) and from G(M) to G(N) (Decay Time, Tr_D). For additional information see the FIG. 3. (N<M)
　※ G to G Spec stands for average value of all measured points.
　　Photo Detector : RD-80S / Field : 2 °

5. Gray to Gray Response time uniformity is Reference data. Please see Appendix XI.

6. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the LCD module surface. For more information, see the FIG. 4.

7. Gray scale specification
　Gamma Value is approximately 2.2. For more information, see the Table 11.

Table 11. GRAY SCALE SPECIFICATION

Gray Level	Luminance [%] (Typ.)
L0	0.10
L15	0.27
L31	1.04
L47	2.49
L63	4.68
L79	7.66
L95	11.5
L111	16.1
L127	21.6
L143	28.1
L159	35.4
L175	43.7
L191	53.0
L207	63.2
L223	74.5
L239	86.7
L255	100

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Product Specification

Measuring point for surface luminance & measuring point for luminance variation.

A : H / 4 mm
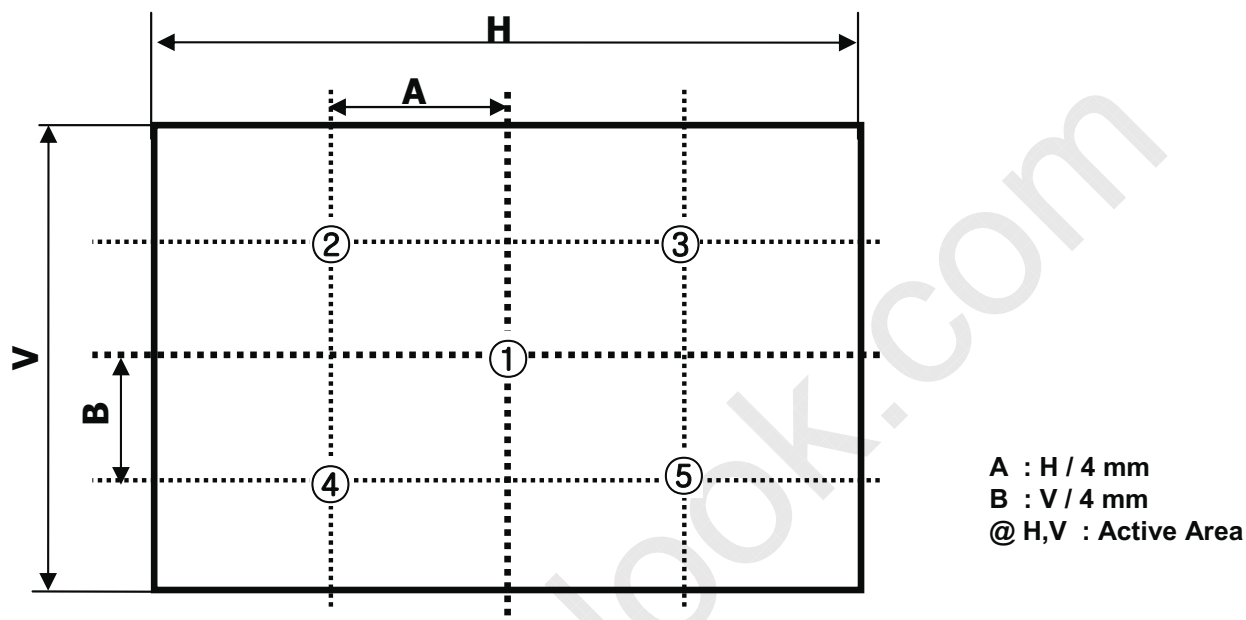B : V / 4 mm
@ H,V : Active Area

FIG. 2 5 Points for Luminance Measure

Response time is defined as the following figure and shall be measured by switching the input signal for "Gray(N)" and "Gray(M)".
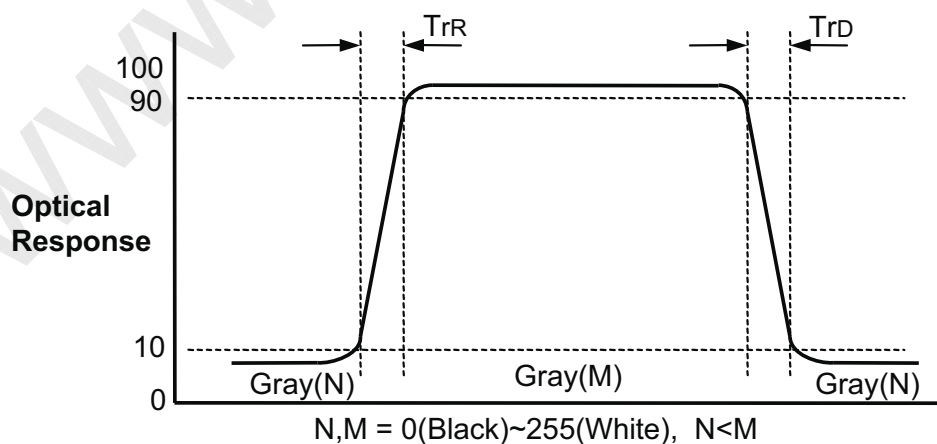

N,M = 0(Black)~255(White), N<M

FIG. 3 Response Time

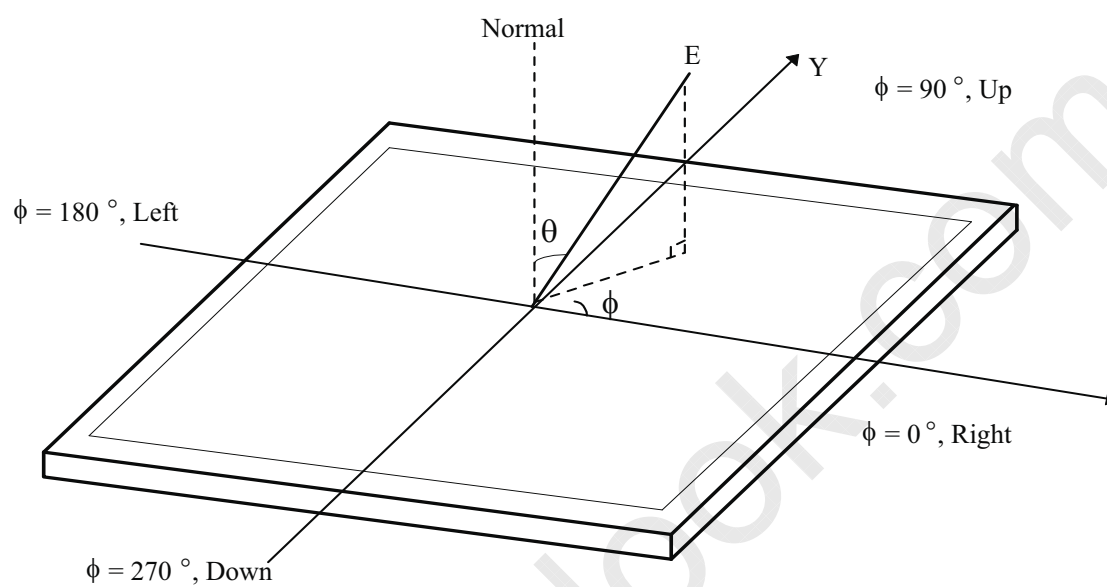## Product Specification

Dimension of viewing angle range

FIG. 4 Viewing Angle

Product Specification

5. Mechanical Characteristics

Table 12 provides general mechanical characteristics.

Table 12. MECHANICAL CHARACTERISTICS

Item	Value	
	Horizontal	613.0mm
Outline Dimension	Vertical	361.0 mm
	Depth	14.9 mm
Bezel Area	Horizontal	580.2mm
	Vertical	328.2mm
Active Display Area	Horizontal	575.769mm
	Vertical	323.712mm
Weight	2,860g (Typ.), TBDg (Max.)	

Note : 1.Please refer to a mechanical drawing in terms of tolerance at the next page.

LC260EXN

Product Specification

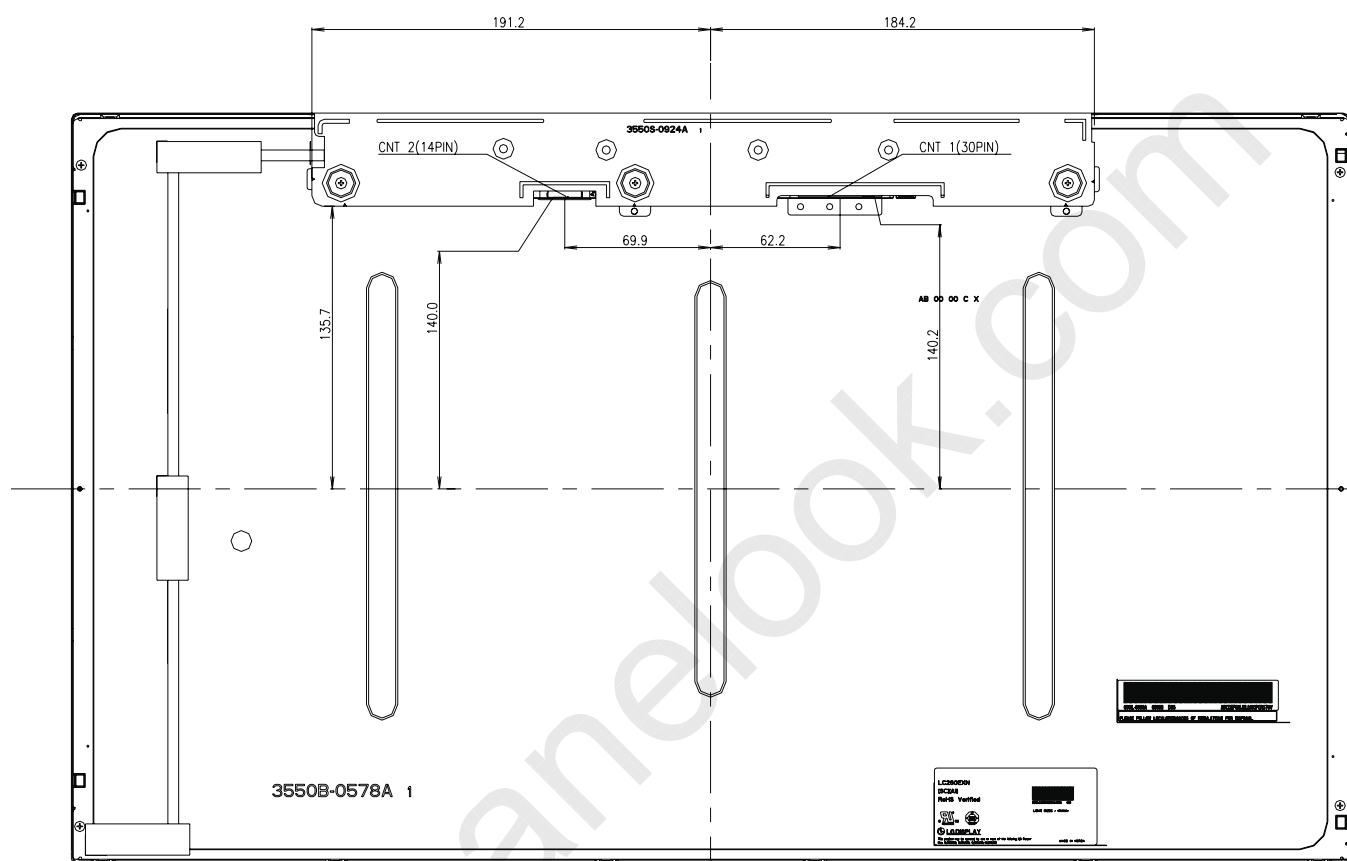<FRONT VIEW>
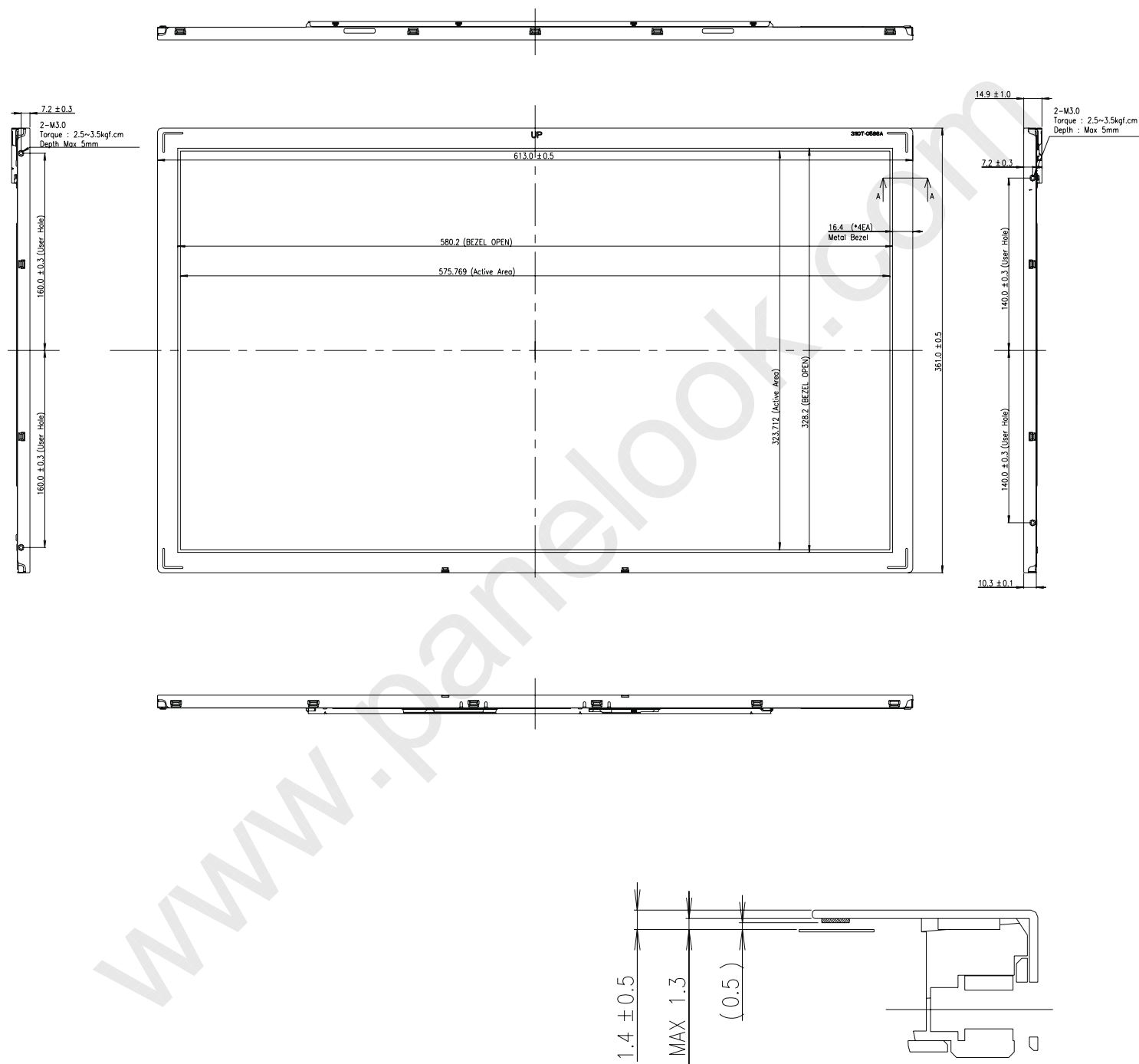
SECTION A-A
SCALE 2/1

LC260EXN

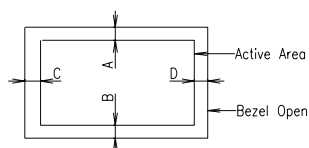## Product Specification

<REAR VIEW>

NOTES
1. Unspecified tolerances to be ±0.5
2. Tilt and partial disposition tolerance of display area as following.
  (1) Y-Direction : IA-BI ≤ 1.4
  (2) X-Direction : IC-DI ≤ 1.4

LC260EXN

Product Specification

6. Reliability

Table 13. ENVIRONMENT TEST CONDITION

No.	Test Item	Condition
1	High temperature storage test	Ta= 60°C, 240h
2	Low temperature storage test	Ta= -20°C 240h
3	High temperature operation test	Ta= 50°C 50%RH 240h
4	Low temperature operation test	Ta= 0°C 240h
5	Vibration test (non-operating)	Wave form : random Vibration level : 1.0Grms Bandwidth : 10-300Hz Duration : X,Y,Z, 30 min Each direction per 10 min
6	Shock test (non-operating)	Shock level : 100Grms Waveform : half sine wave, 2ms Direction : ±X, ±Y, ±Z One time each direction
7	Humidity condition Operation	Ta= 40 °C ,90%RH
8	Altitude operating storage / shipment	0 - 15,000 ft 0 - 40,000 ft

Note : Before and after Reliability test, LCM should be operated with normal function.

Product Specification

7. International Standards

7-1. Safety

a) UL 60065, Seventh Edition, Underwriters Laboratories Inc.
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.

b) CAN/CSA C22.2 No.60065:03, Canadian Standards Association.
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.

c) EN 60065:2002 + A11:2008, European Committee for Electrotechnical Standardization (CENELEC).
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.

d) IEC 60065:2005 + A1:2005, The International Electrotechnical Commission (IEC).
   Audio, Video and Similar Electronic Apparatus - Safety Requirements.
   (Including report of IEC60825-1:2001 clause 8 and clause 9)

   Notes
     1. Laser (LED Backlight) Information

```
┌─────────────────────────────────────┐
│        Class 1 LED Product           │
│        IEC60825-1 : 2001             │
│    Embedded LED Power (Class 1)      │
└─────────────────────────────────────┘
```

7-2. EMC

a) ANSI C63.4 "American National Standard for Methods of Measurement of Radio-Noise
   Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."
   American National Standards Institute (ANSI), 2003.

b) CISPR 22 "Information technology equipment – Radio disturbance characteristics – Limit and
   methods of measurement." International Special Committee on Radio Interference
   (CISPR), 2005.

c) CISPR 13 "Sound and television broadcast receivers and associated equipment – Radio disturbance
   characteristics – Limits and method of measurement." International Special Committee on Radio
   Interference (CISPR), 2006.

7-3. Environment

a) RoHS, Directive 2002/95/EC of the European Parliament and of the council of 27 January 2003

LC260EXN

Product Specification

8. Packing

8-1. Information of LCM Label

a) Lot Mark

A	B	C	D	E	F	G	H	I	J	K	L	M

A,B,C : SIZE(INCH)　　　　　　　　　　　　D : YEAR
E : MONTH　　　　　　　　　　　　　　　　　F ~ M : SERIAL NO.

Note
1. YEAR

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Mark	1	2	3	4	5	6	7	8	9	0

2. MONTH

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mark	1	2	3	4	5	6	7	8	9	A	B	C

b) Location of Lot Mark

Serial No. is printed on the label. The label is attached to the backside of the LCD module.
This is subject to change without prior notice.

8-2. Packing Form

a) Package quantity in one box : 8 pcs

b) Box size : 690mm(W) X 350mm(D) X 442mm(H)

Product Specification

9. Precautions

Please pay attention to the followings when you use this TFT LCD module.

9-1. Mounting Precautions

(1) You must mount a module using specified mounting holes (Details refer to the drawings).

(2) You should consider the mounting structure so that uneven force (ex. Twisted stress) is not applied to the 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 the resist external force.

(4) You should adopt radiation 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 circuit break by electro-chemical reaction.

(6) Do not touch, push or rub the exposed polarizers 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 benzine. Normal-hexane is recommended for cleaning the adhesives used to attach front / rear polarizers. Do not use acetone, toluene and alcohol because they cause chemical damage to the polarizer. * There is no problem of Panel crack under 5kgf / φ10mm

(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.

9-2. Operating Precautions

(1) The spike noise causes the mis-operation of circuits. It should be lower than following voltage :
V=±200mV(Over and under shoot voltage)

(2) Response time depends on the temperature.(In lower temperature, it becomes longer.)

(3) 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.

(4) 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.

(5) When fixed patterns are displayed for a long time, remnant image is likely to occur.

(6) 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 minimized the interference.

(7) Please do not give any mechanical and/or acoustical impact to LCM. Otherwise, LCM can't be operated its full characteristics perfectly.

(8) A screw which is fastened up the steels should be a machine screw.
(if not, it causes metallic foreign material and deal LCM a fatal blow)

(9) Please do not set LCD on its edge.

(10) It is recommended to avoid the signal cable and conductive material over the LED driver inductor for it can cause the abnormal display and temperature rising.

(11) Partial darkness may happen during 3~5 minutes when LCM is operated initially in condition that luminance is under 40% at low temperature (under 5℃). This phenomenon which disappears naturally after 3~5 minutes is not a problem about reliability but LCD characteristic.

Product Specification

9-3. 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.

9-4. Precautions for Strong Light Exposure

Strong light exposure causes degradation of polarizer and color filter.

9-5. 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.

9-6. 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.
(2) 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.
(3) You can remove the glue easily. When the glue remains on the bezel surface or its vestige is recognized, please wipe them off with absorbent cotton waste or other soft material like chamois soaked with normal-hexane.
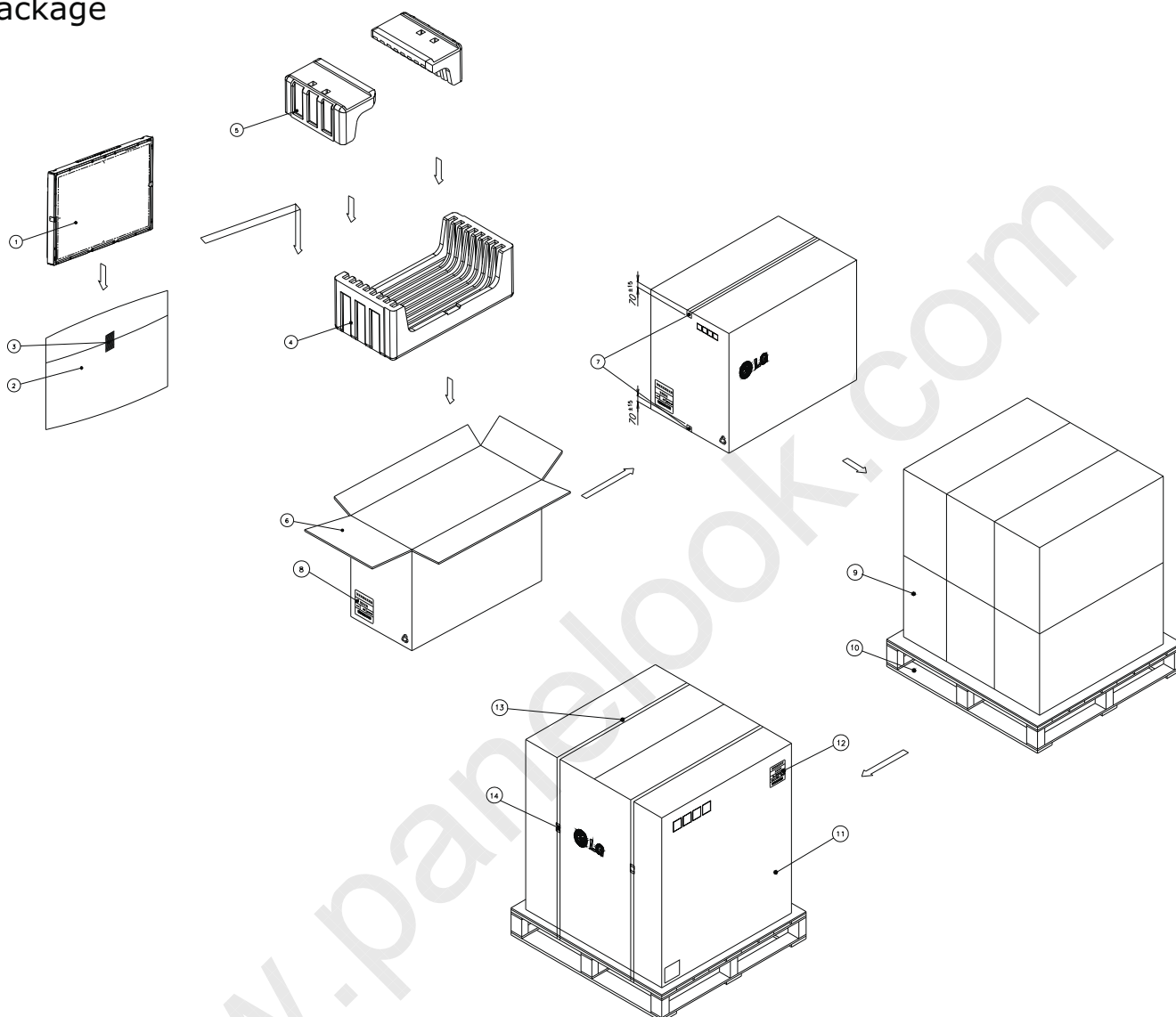
LC260EXN

Product Specification

APPENDIX- I

■ Package

※ Packing Ass`y

NO.	DESCRIPTION	MATERIAL
1	LCD Module	
2	BAG	PE
3	TAPE	MASKING 20MMX50M
4	Packing	EPS
5	Packing	EPS
6	BOX	PAPER_SWR4
7	TAPE	OPP 70MMX300M
8	Label	ART 100X70

※ Pallet Ass`y

NO.	DESCRIPTION	MATERIAL
9	PACKING ASS'Y	
10	PALLET	Plywood
11	ANGLE, PACKING	PAPER (SWR4)
12	LABEL	PAPER
13	BAND	PP
14	CLIP, BAND	STEEL

Ver. 0.0

Product Specification

APPENDIX- II-1

■ LCM Label

Model → **LC260EXN (SC)(B1)**

RoHS Verified

Serial No.

************* ***

LIGHT GUIDE : >PMMA<

UL, TUV Mark

LGD Logo → **LG Display**

US PATENT No. This product may be covered by one or more of the following
US Patent Nos. 5,041,823 ; 5,061,920 ; 5,280,371 ; 5,835,139

MADE IN KOREA ← **Origin**
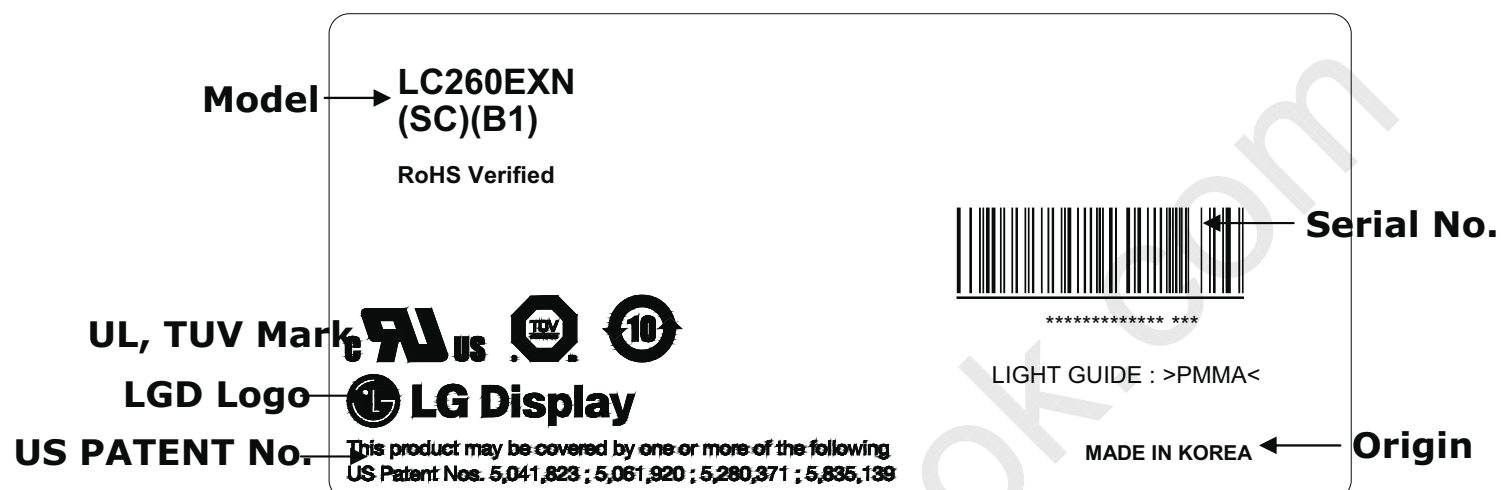
LC260EXN

Product Specification

APPENDIX- II-2

■ Box Label

LC260EXN		
SCB1		
8 pcs	001/01-01	
MADE IN KOREA		RoHS Verified

■ Pallet Label

LC260EXN		
SCB1		
48 pcs	001/01-01	
MADE IN KOREA		RoHS Verified

LC260EXN

Product Specification

APPENDIX-III-1

■ **Required signal assignment for Flat Link Transmitter(Pin9="L" or NC)**

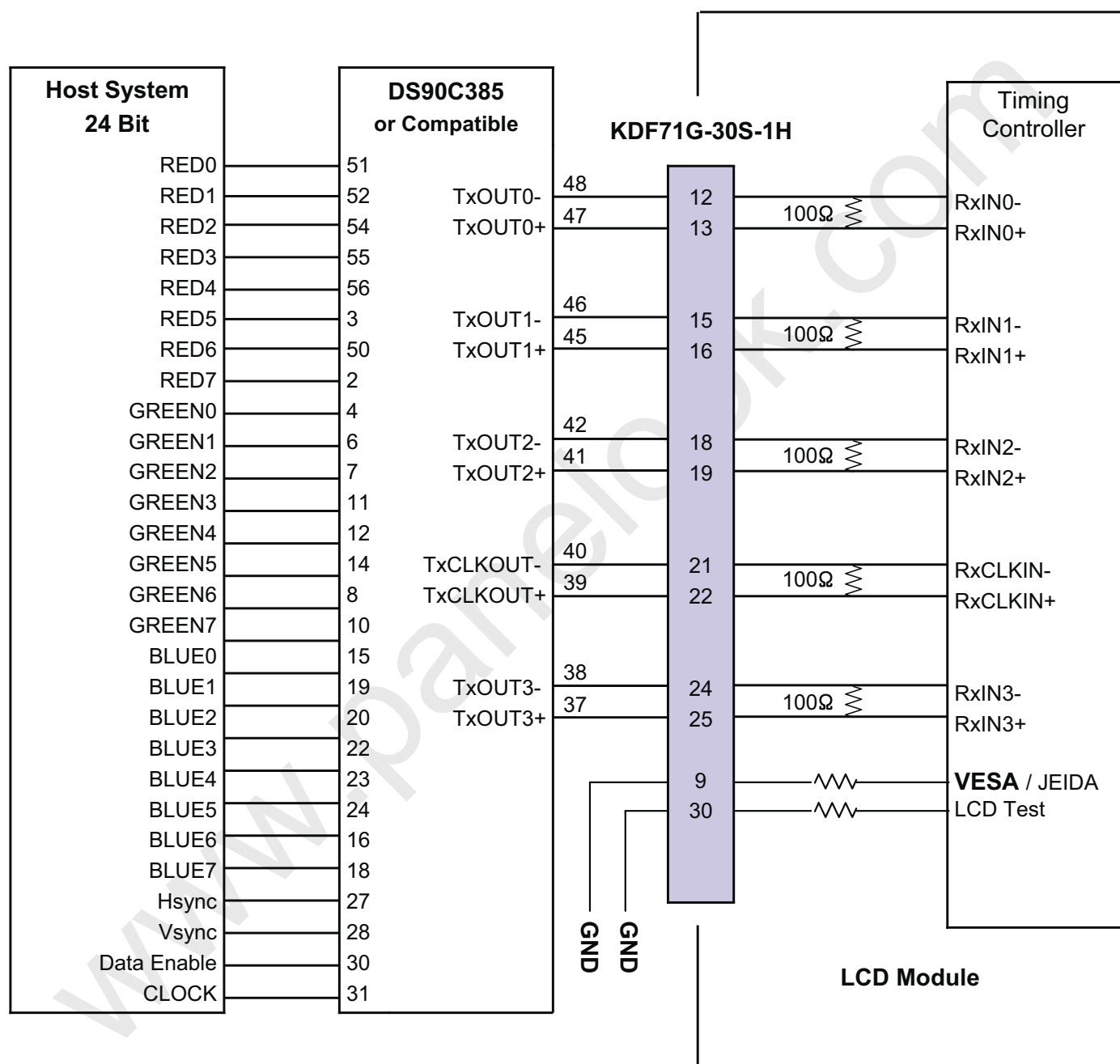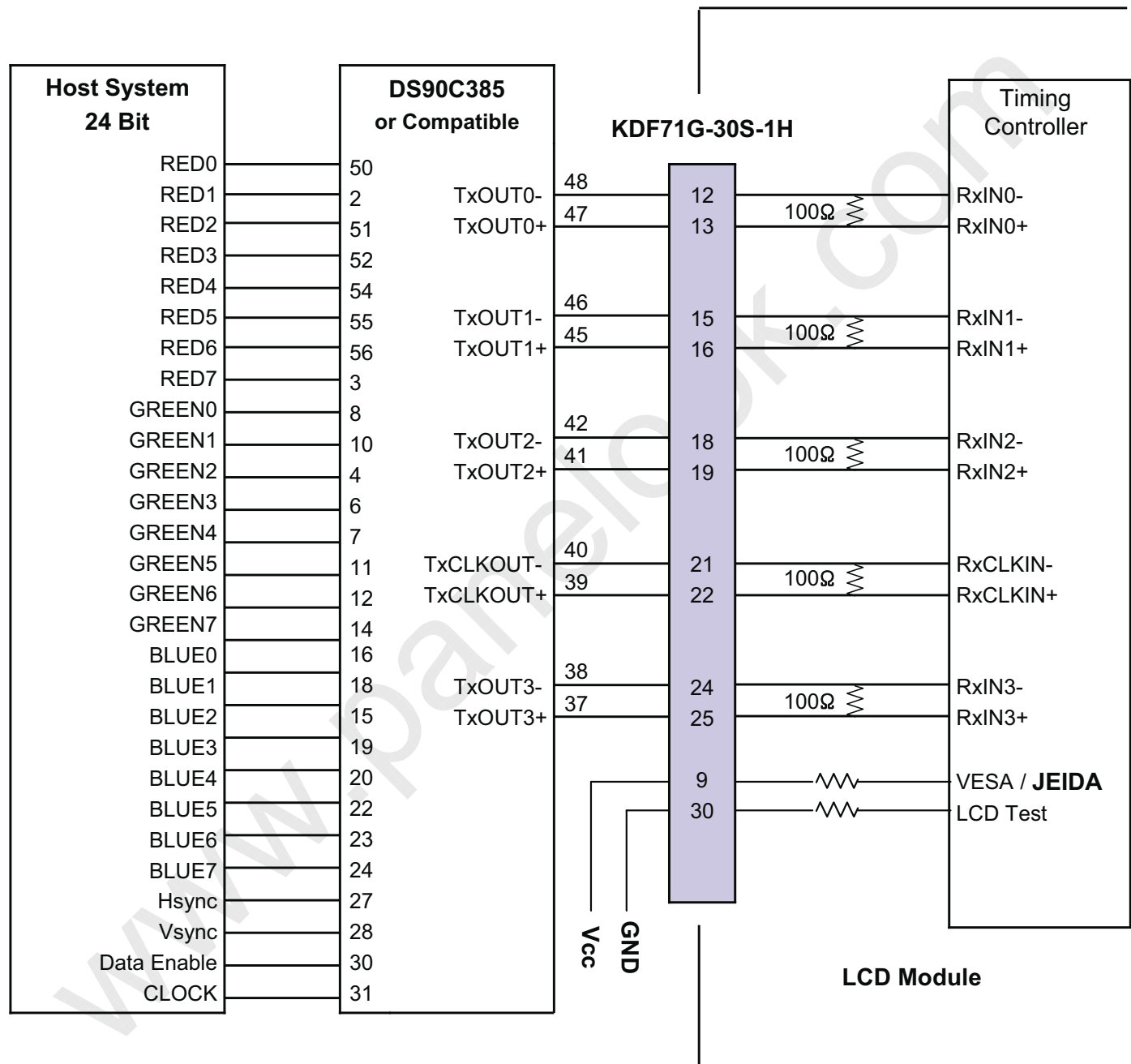| Host System 24 Bit		DS90C385 or Compatible	KDF71G-30S-1H		Timing Controller
RED0	51				
RED1	52	TxOUT0-	48 / 12	100Ω	RxIN0-
RED2	54	TxOUT0+	47 / 13		RxIN0+
RED3	55				
RED4	56		46 / 15		
RED5	3	TxOUT1-	45 / 16	100Ω	RxIN1-
RED6	50	TxOUT1+			RxIN1+
RED7	2				
GREEN0	4		42 / 18		
GREEN1	6	TxOUT2-	41 / 19	100Ω	RxIN2-
GREEN2	7	TxOUT2+			RxIN2+
GREEN3	11				
GREEN4	12		40 / 21		
GREEN5	14	TxCLKOUT-	39 / 22	100Ω	RxCLKIN-
GREEN6	8	TxCLKOUT+			RxCLKIN+
GREEN7	10				
BLUE0	15		38 / 24		
BLUE1	19	TxOUT3-	37 / 25	100Ω	RxIN3-
BLUE2	20	TxOUT3+			RxIN3+
BLUE3	22				
BLUE4	23		9		**VESA** / JEIDA
BLUE5	24		30		LCD Test
BLUE6	16				
BLUE7	18				
Hsync	27		GND GND		
Vsync	28				
Data Enable	30				**LCD Module**
CLOCK	31				

Notes:
1. The LCD module uses a 100 Ohm(Ω) resistor between positive and negative lines of each receiver input.
2. Refer to LVDS transmitter data sheet for detail descriptions. (DS90C385 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

LC260EXN

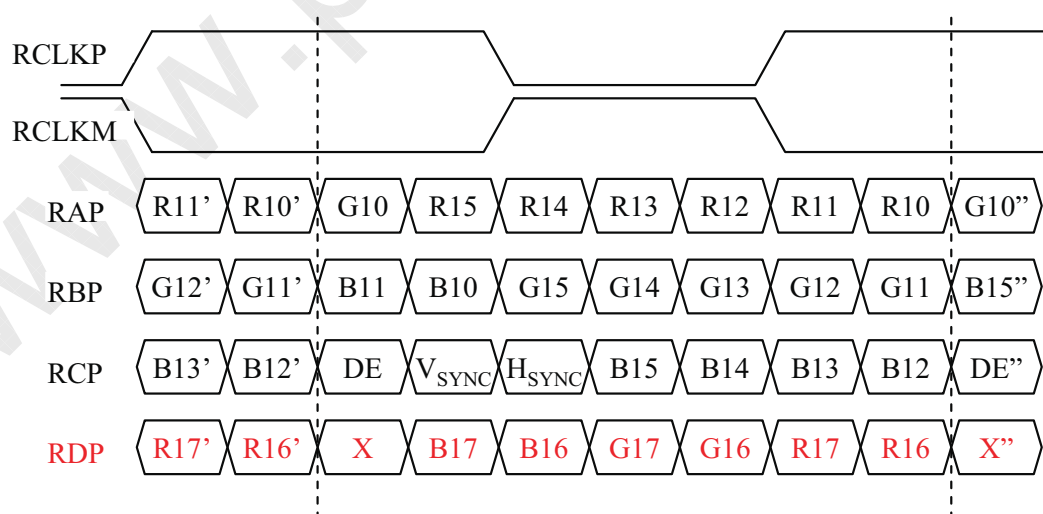## Product Specification

APPENDIX-III-1

■ Required signal assignment for Flat Link Transmitter(Pin9="H")

Host System 24 Bit		DS90C385 or Compatible	KDF71G-30S-1H			Timing Controller
RED0		50				
RED1		2	TxOUT0-	48	12	RxIN0-
RED2		51	TxOUT0+	47	13	100Ω RxIN0+
RED3		52				
RED4		54				
RED5		55	TxOUT1-	46	15	RxIN1-
RED6		56	TxOUT1+	45	16	100Ω RxIN1+
RED7		3				
GREEN0		8				
GREEN1		10	TxOUT2-	42	18	RxIN2-
GREEN2		4	TxOUT2+	41	19	100Ω RxIN2+
GREEN3		6				
GREEN4		7				
GREEN5		11	TxCLKOUT-	40	21	RxCLKIN-
GREEN6		12	TxCLKOUT+	39	22	100Ω RxCLKIN+
GREEN7		14				
BLUE0		16				
BLUE1		18	TxOUT3-	38	24	RxIN3-
BLUE2		15	TxOUT3+	37	25	100Ω RxIN3+
BLUE3		19				
BLUE4		20			9	VESA / **JEIDA**
BLUE5		22			30	LCD Test
BLUE6		23				
BLUE7		24				
Hsync		27				
Vsync		28		Vcc GND		LCD Module
Data Enable		30				
CLOCK		31				

Notes:
1. The LCD module uses a 100 Ohm(Ω) resistor between positive and negative lines
   of each receiver input.
2. Refer to LVDS transmitter data sheet for detail descriptions. (DS90C385 or Compatible)
3. '7' means MSB and '0' means LSB at R,G,B pixel data.

Ver. 0.0

Product Specification

APPENDIX- IV

LVDS Data-Mapping info. (8bit)

■ LVDS Select : "H" Data-Mapping (JEIDA format)
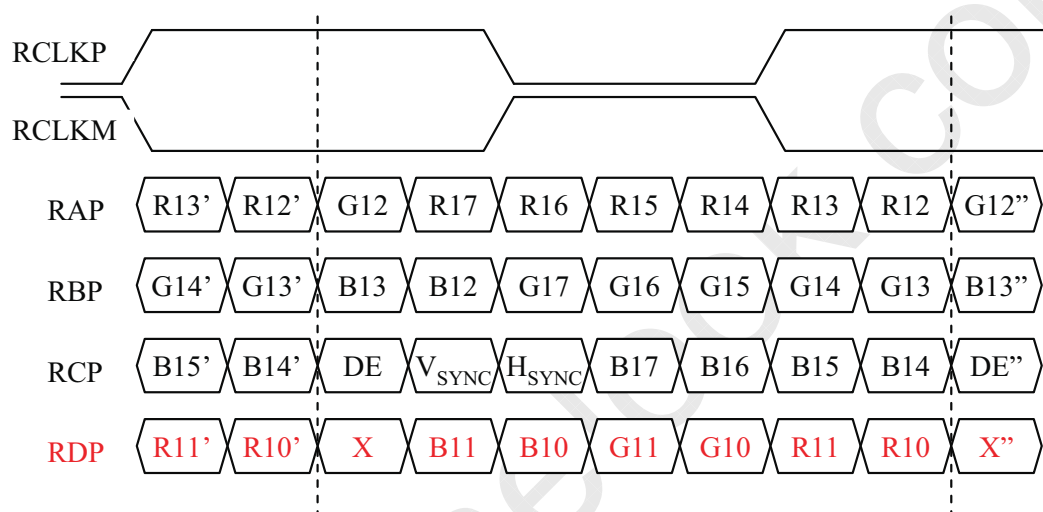
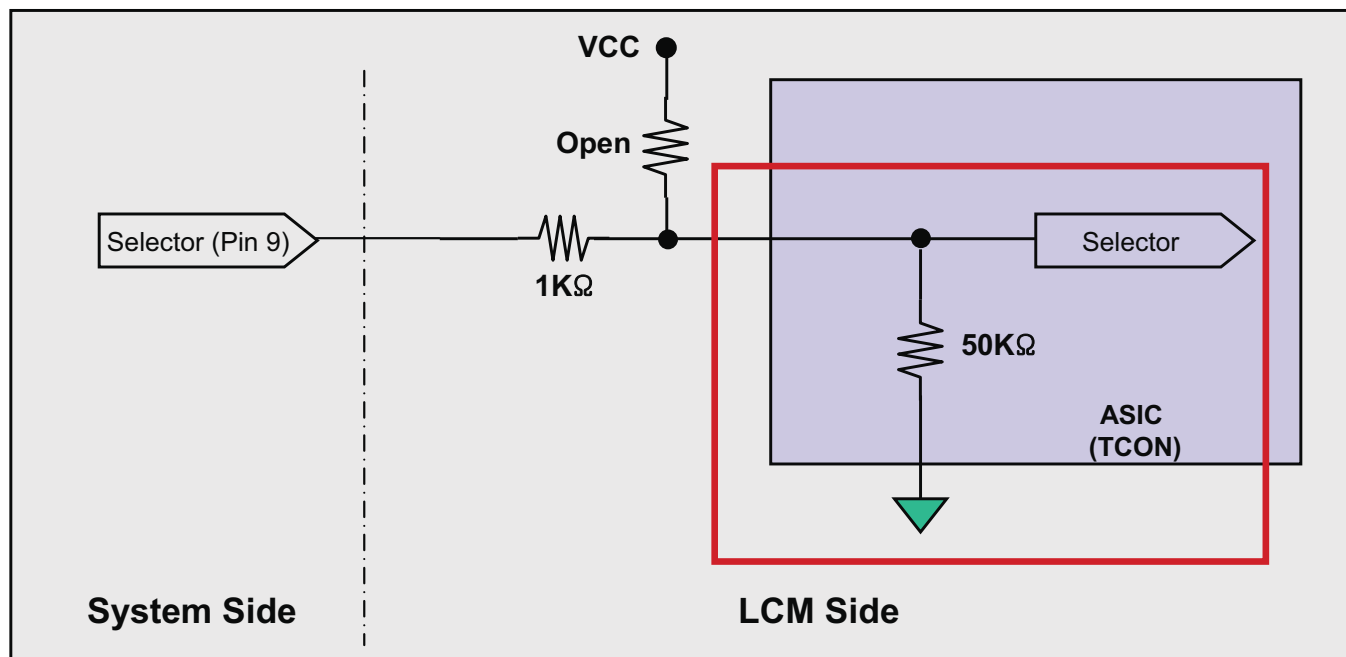

■ LVDS Select : "L" Data-Mapping (VESA format)
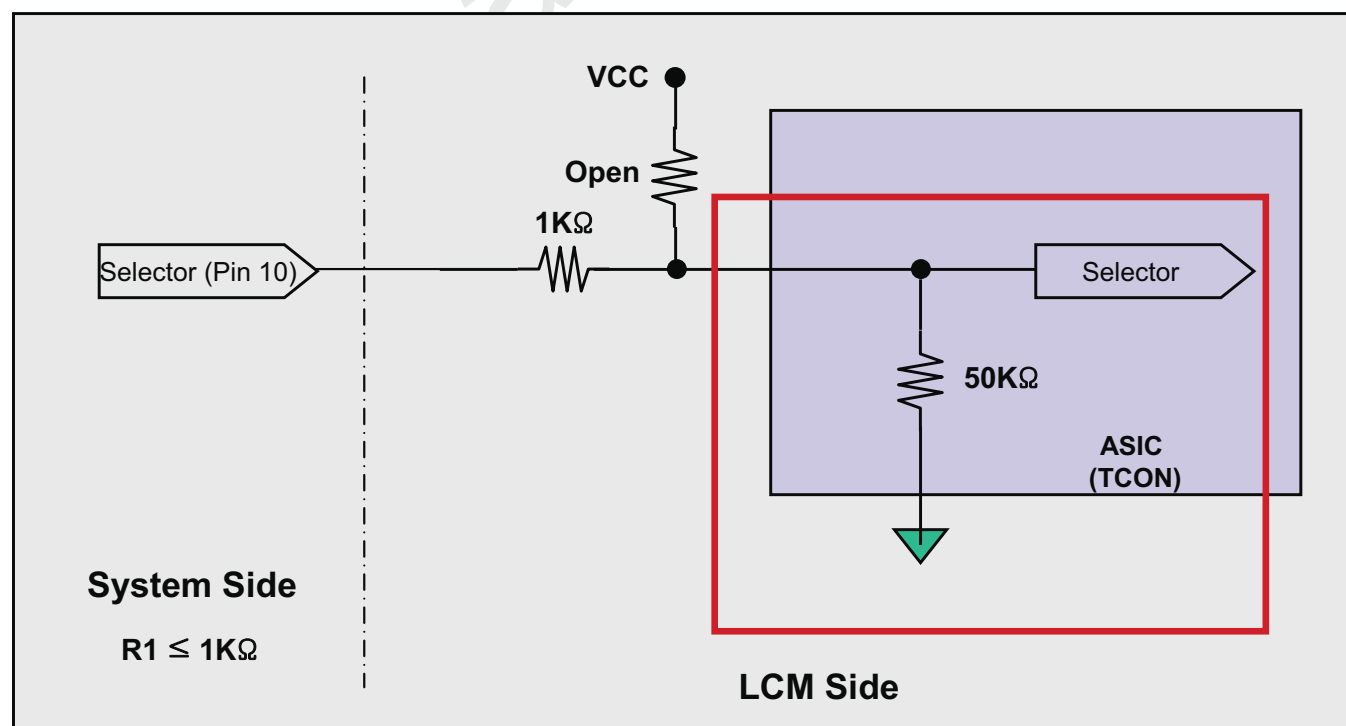
Product Specification

APPENDIX- V

Option Pin Circuit Block Diagram

Circuit Block Diagram of LVDS Format Selection pin


Circuit Block Diagram of OPC Enable pin
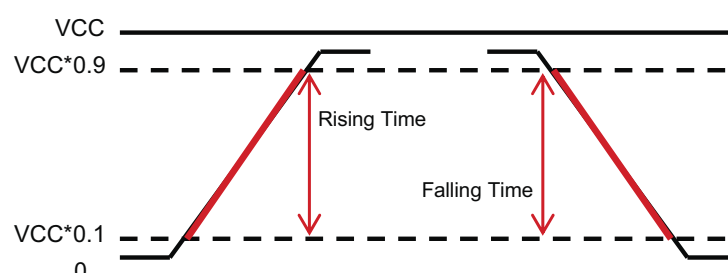
Product Specification

APPENDIX- VI

■ **EXTV**BR-B & **OPC** Design Guide

1）When OPC Enable is "L", OPC Output = System Dimming.

2) OPC Output(PWM Signal) is synchronized with V-Sync Freq. of System in T-Con Board.

3）Regardless of OPC, System should always give dimming Signal (**EXTV**BR-B) to T-con.

4) PWM Specification (VCC = 3.3V) @ OPC

    a) PWM High Voltage Range : 2.5 V ~ 3.6 V

    b) PWM Low Voltage Range : 0.0 V ~ 0.8 V
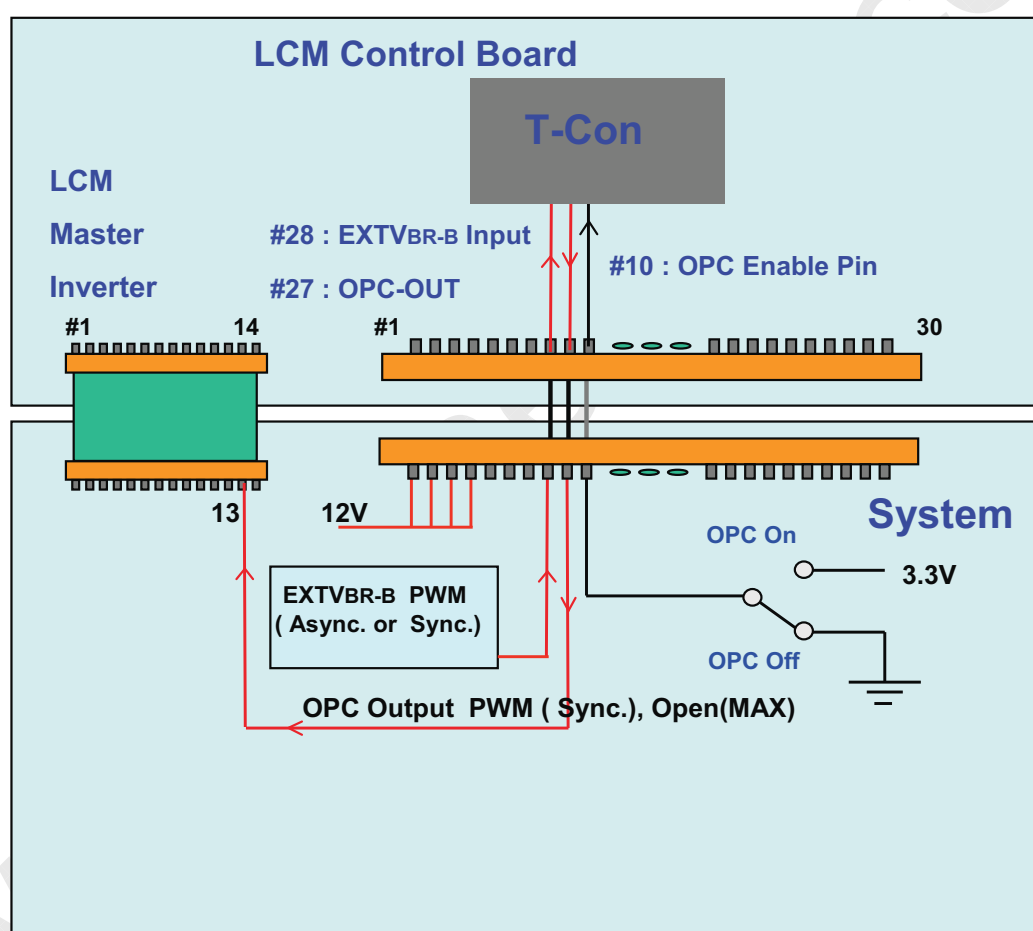
Input Frequency	MAX 1Khz (Recommendation: 50~300Hz)
Rising Time	MAX 10.0 μs
Falling Time	MAX 10.0 μs

LC260EXN

Product Specification

APPENDIX- VII

Gray to Gray Response Time Uniformity

This is only the reference data of G to G and uniformity for LC260EXN-SCA1 model.

1. G to G Response Time :
   Response time is defined as Figure3 and shall be measured by switching the input signal for
   "Gray (N) " and "Gray(M)".(32Gray Step at 8bit)

2. G to G Uniformity
   The variation of G to G Uniformity , δ G to G is defined as :

$$G \text{ to } G \text{ Uniformity } = \frac{Maximum(GtoG) - Typical(GtoG)}{Typical(GtoG)} \leq 1$$

   *Maximum (GtoG) means maximum value of measured time (N, M = 0 (Black) ~ 255(White), 32 gray step).

|	0Gray	32Gray	64Gray	…	223Gray	255Gray
0Gray		TrR:0G→32G	TrR:0G→64G	…	TrR:0G→223G	TrR:0G→255G
32Gray	TrD:32G→0G		TrR:32G→64G	…	TrR:32G→223G	TrR:32G→255G
64Gray	TrD:64G→0G	TrD:64G→32G		…	TrR:64G→223G	TrR:64G→255G
…	…	…	…		…	…
223Gray	TrD:223G→0G	TrD:223G→32G	TrD:223G→64G	…		TrR:223G→255G
255Gray	TrD:255G→0G	TrD:255G→32G	TrD:255G→64G	…	TrD:255G→223G	

3. Sampling Size : 2 pcs

4. Measurement Method : Follow the same rule as optical characteristics measurement.

5. Current Status

   Below table is actual data of production on **11. 27, 2008 (LGD RV Event Sample)**

	G to G Response Time [ms]		Uniformity
	Min.	Max.	
# 1	5.16	11.19	0.35
# 2	5.44	11.25	0.32

< # 1 >　　　　　　　　　　　　< # 2 >
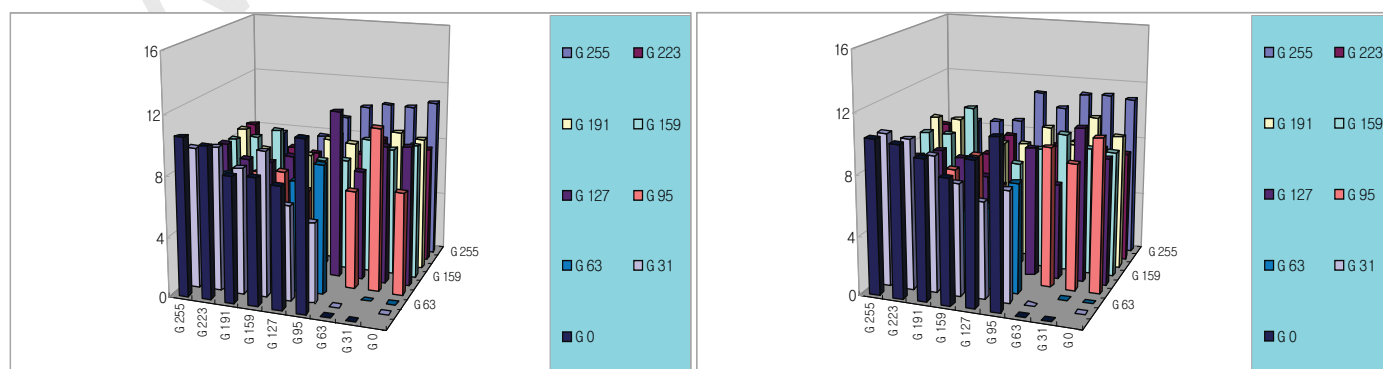
Product Specification

APPENDIX- XIII

■ Humming Noise Level

These are measurement method and condition of Humming Noise Level for LC260EXN-SCA1 model of RV sample conditions

Type of room		Anechoic
Distance to display		0.5m (Typical)
Measurement Point		@ LCM Center
Humming Noise Level	Front	Typ 19dBA, Max 20dBA
	Rear	Max 25dBA