HM280FH111VL

28" Stretch Color TFT-LCD

Release Date
27th Sept 2024

HIGHNESS MICROELECTRONICS LTD.

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1. General Description

Items	Specification	Unit	Note
Active Screen Size	28.0	inch	
Display Area	698.4 (H) x 130.95(V)	mm	
Outline Dimension	734.1 (H) x 162.64 (V) x 17.3 (D)	mm	
Driver Element	a-Si TFT active matrix		
Display Colors	8 bit (16.7 million)	Colors	8 bit selectable
Number of Pixels	1920x360	Pixel	
Pixel Pitch	0.3637 (H) x 0.3637 (W)	mm	
Pixel Arrangement	RGB vertical stripe		
Display Operation Mode	Normally Black		
Surface Treatment	Anti-Glare, 3H		Haze = 28%
Frame Rate	60	Hz	
LED MTTF	70K	hours	

2. Absolute Maximum Ratings

The followings are maximum values which, if exceeded, may cause faulty operation or damage to the unit

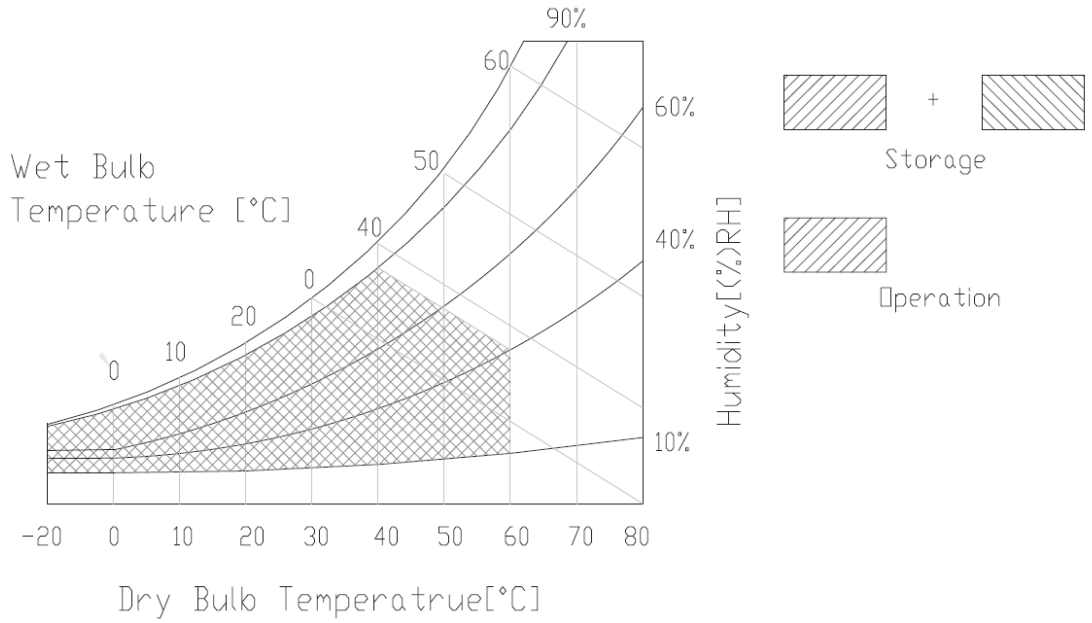
Item	Symbol	Min	Max	Unit	Conditions
Logic/LCD Drive Voltage	V_{DD}	-0.3	14	[Volt]	Note 1
Input Voltage of Signal	Vin	-0.3	4	[Volt]	Note 1
Operating Temperature	TOP	-20	+60	[ºC]	Note 2
Operating Humidity	HOP	10	90	[%RH]	Note 2
Storage Temperature	TST	-20	+60	[ºC]	Note 2
Storage Humidity	HST	10	90	[%RH]	Note 2
Panel Surface Temperature	PST		65	[ºC]	Note 3

Note 1: Duration:50 msec.

Note 2 : Maximum Wet-Bulb should be 39℃ and No condensation.

The relative humidity must not exceed 90% non-condensing at temperatures of 40 ℃ or less. Attemperatures greater than 40℃, the wet bulb temperature must not exceed 39℃.

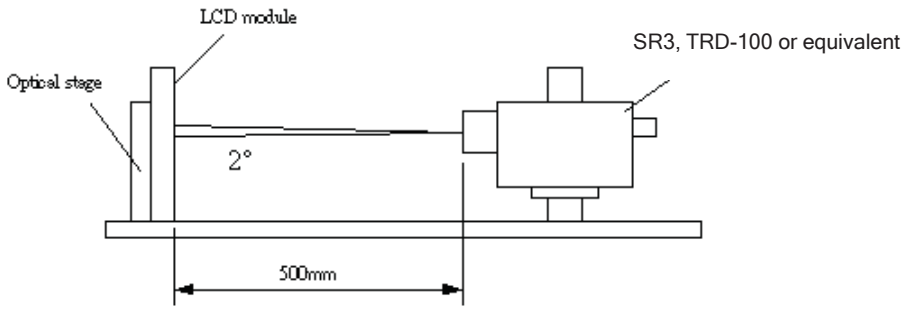
Note 3: Surface temperature is measured at 50℃ Dry condition



3. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 45 minutes in a dark environment at 25°C. The values specified are at an approximate distance 500 mm from the LCD surface at a viewing angle of φ and θ equal to 0°.

Fig.1 presents additional information concerning the measurement equipment and method.



Parameter		Symbol	Values			Unit	Notes
			Min.	Typ.	Max		
Contrast Ratio		CR	3200	4000	--		1
Surface Luminance (White)		L_{WH}	800	1000	--	cd/m^2	2
Luminance Variation		$\delta_{WHITE(9P)}$	--	--	1.33		3
Response Time (G to G)		T_Y	--	8	16	ms	4
Color Gamut		NTSC		72		%	
Gamma		Gma	1.9	2.2	2.5		
Color Coordinates							
	Red	R_X	Typ.-0.03	0.653	Typ.+0.03		
		R_Y		0.336			
	Green	G_X		0.323			
		G_Y		0.615			
	Blue	B_X		0.152			
		B_Y		0.067			
	White	W_X		0.313			
		W_Y		0.329			
Viewing Angle							5
	x axis, right(φ=0°)	θ_r	85	89	--	degree	
	x axis, left(φ=180°)	θ_l	85	89	--	degree	
	y axis, up(φ=90°)	θ_u	85	89	--	degree	
	y axis, down (φ=270°)	θ_d	85	89	--	degree	

Note:

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

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance of } L_{on5}}{\text{Surface Luminance of } L_{off5}}$$

2. Surface luminance is luminance value at point 5 across the LCD surface 50cm from the surface with all pixels displaying white. From more information see FIG 2. LED current I_F = typical value (without driver board), LED input VDDB =24V, I_{DDB}. = Typical value (with driver board), L_{WH}=Lon5 where Lon5 is the luminance with all pixels displaying white at center 5 location.
3. The variation in surface luminance, δWHITE is defined (center of Screen) as:

   $\delta_{WHITE(9P)}$= Maximum(L_{on1}, L_{on2},…,L_{on9})/ Minimum(L_{on1}, L_{on2},…L_{on9})
4. Response time T_γ is the average time required for display transition by switching the input signal for five luminance ratio (0%,25%,50%,75%,100% brightness matrix) and is based on Frame rate = 60Hz to optimize.

Measured Response Time		Target				
		0%	25%	50%	75%	100%
Start	0%		0% to 25%	0% to 50%	0% to 75%	0% to 100%
	25%	25% to 0%		25% to 50%	25% to 75%	25% to 100%
	50%	50% to 0%	50% to 25%		50% to 75%	50% to 100%
	75%	75% to 0%	75% to 25%	75% to 50%		75% to 100%
	100%	100% to 0%	100% to 25%	100% to 50%	100% to 75%	

T_γ is determined by 10% to 90% brightness difference of rising or falling period. (As illustrated)

The response time is defined as the following figure and shall be measured by switching the input signal for "any level of gray(bright) " and "any level of gray(dark)".

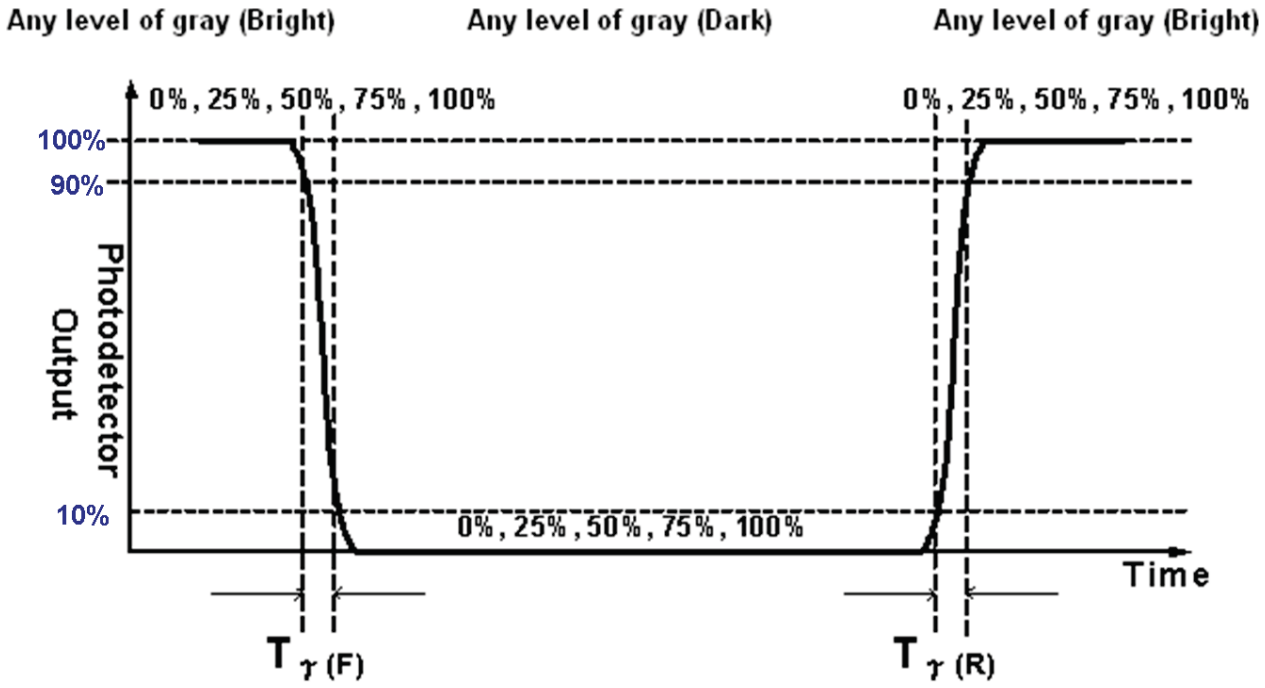
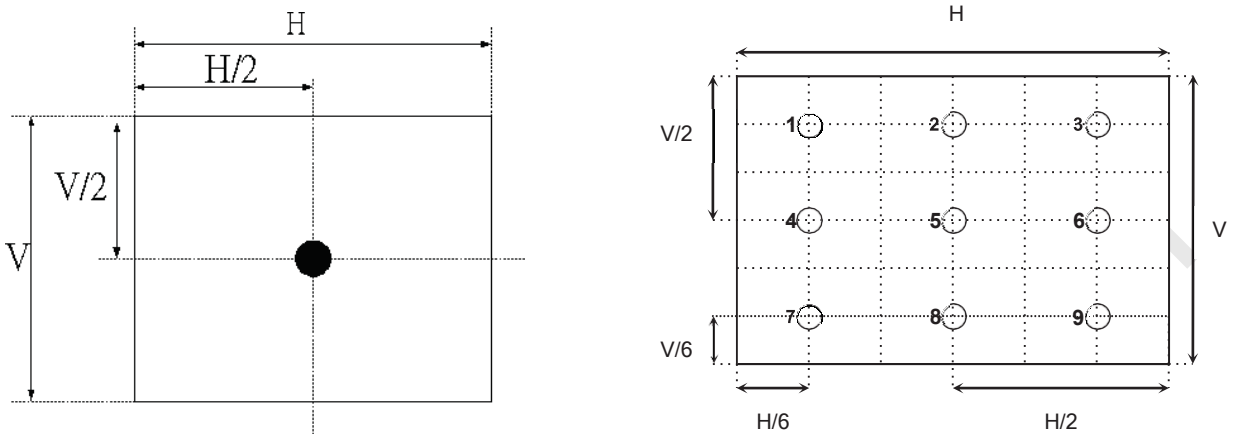
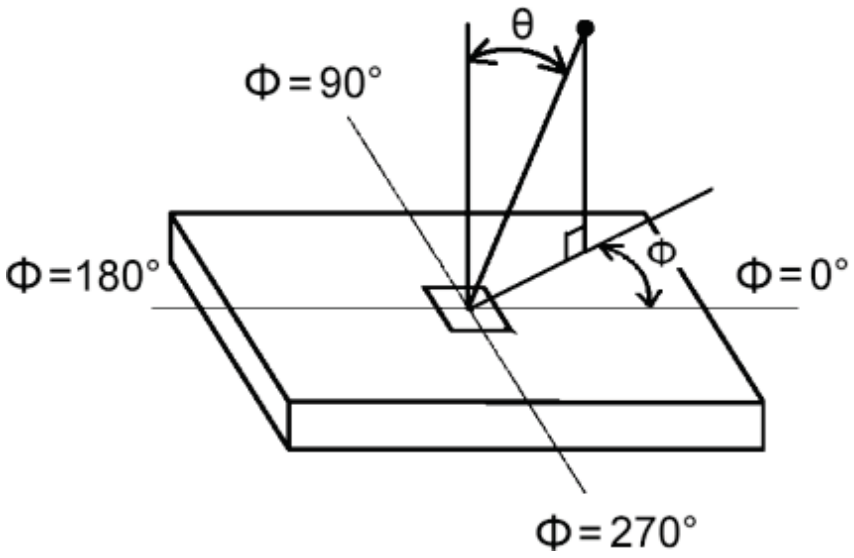


FIG. 2 Luminance



5. 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 surface. For more information see FIG3.

FIG.3 Viewing Angle



4. Interface Specification

4.1 Input power

The HM280FH111VL module requires power inputs which are employed to power the LCD electronics and to drive the TFT array and liquid crystal.

Item		Symbol	Min.	Typ.	Max	Unit	Note
Power Supply Input Voltage		V_{DD}	10.8	12	13.2	V	1
Power Supply Input Current	Black pattern	I_{DD}	--	0.3	0.36	A	2
	White pattern		--	0.42	0.51	A	
Power Consumption	Black pattern	P_C	--	3.6	4.3	Watt	
	White pattern		--	5.1	6.2	Watt	
Inrush Current		I_{RUSH}	--	--	3	A	3

Note1. The ripple voltage should be fewer than 5% of VDD.

Note2. Test Condition:

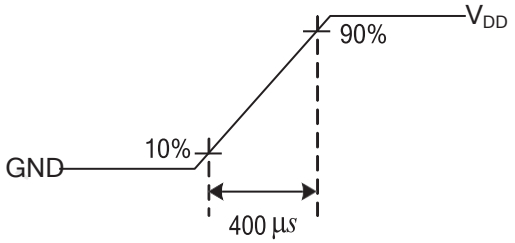
(1) V_{DD} = 12.0V, (2) Fv = 60Hz, (3) Fclk= 74.25MHz, (4) Temperature = 25 ℃

(5) Power dissipation check pattern. (Only for power design)

a. Black pattern

b. White pattern

Note3. Measurement condition: Rising time = 400us



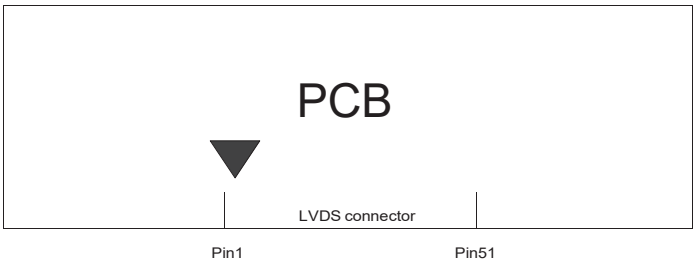
4.2 Input Connection

■ LCD connector: FI-RTE51SZ-HF (JAE, LVDS connector) or compatible (CHIEF LAND 115E51-0000RA -M3-R / P-two 187059-5122)

PIN	Symbol	Description	Note
1	N.C.	No connection	2
2	N.C.	No connection	2
3	N.C.	No connection	2
4	N.C.	No connection	2
5	N.C.	No connection	2
6	N.C.	No connection	2
7	LVDS_SEL	Open/High (3.3V) for NS, Low (GND) for JEIDA	3
8	N.C.	No connection	2
9	N.C.	No connection	2
10	N.C.	No connection	2
11	GND	Ground	
12	CH1_Y0-	LVDS Channel 1, Signal 0-	
13	CH1_Y0+	LVDS Channel 1, Signal	
14	CH1_Y1-	LVDS Channel 1, Signal 1-	
15	CH1_Y1+	LVDS Channel 1, Signal 1+	
16	CH1_Y2-	LVDS Channel 1, Signal 2-	
17	CH1_Y2+	LVDS Channel 1, Signal 2+	
18	GND	Ground	
19	CH1_CLK-	LVDS Channel 1, Clock -	
20	CH1_CLK+	LVDS Channel 1, Clock +	
21	GND	Ground	
22	CH1_Y3-	LVDS Channel 1, Signal 3-	
23	CH1_Y3+	LVDS Channel 1, Signal 3+	
24	N.C.	No connection	2
25	N.C.	No connection	2
26	N.C.	No connection	
27	N.C.	No connection	
28	CH2_Y0-	LVDS Channel 2, Signal 0-	
29	CH2_Y0+	LVDS Channel 2, Signal 0+	
30	CH2_Y1-	LVDS Channel 2, Signal 1-	
31	CH2_Y1+	LVDS Channel 2, Signal 1+	
32	CH2_Y2-	LVDS Channel 2, Signal 2-	
33	CH2_Y2+	LVDS Channel 2, Signal 2+	

34	GND	Ground	
35	CH2_CLK-	LVDS Channel 2, Clock -	
36	CH2_CLK+	LVDS Channel 2, Clock +	
37	GND	Ground	
38	CH2_Y3-	LVDS Channel 2, Signal 3-	
39	CH2_Y3+	LVDS Channel 2, Signal 3+	
40	N.C.	No connection	2
41	N.C.	No connection	2
42	N.C.	No connection	2
43	N.C.	No connection	2
44	GND	Ground	
45	GND	Ground	
46	GND	Ground	
47	N.C.	No connection	2
48	V_{DD}	Power Supply, +12V DC Regulated	
49	V_{DD}	Power Supply, +12V DC Regulated	
50	V_{DD}	Power Supply, +12V DC Regulated	
51	V_{DD}	Power Supply, +12V DC Regulated	

Note1. Pin number start from the left side as the

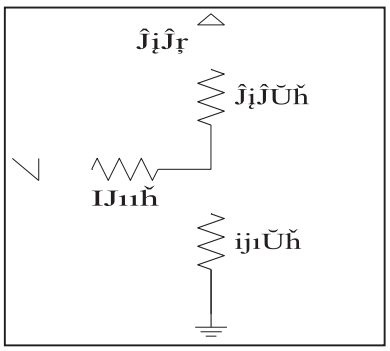


Note2. Please leave this pin unoccupied. It cannot be connected with any signal (Low/GND/High).

Note3. LVDS data format selection

LVDS_SEL	Mode
H or OPEN	NS
L	Jeida

Input equivalent impedance of LVDE_SEL pin

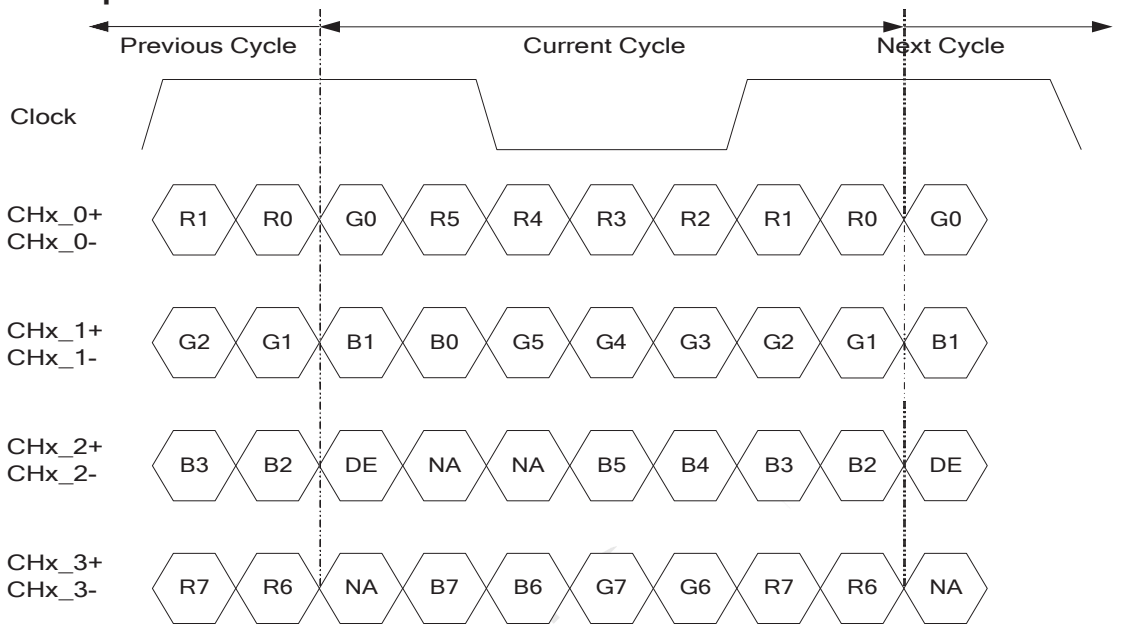


4.3 Input Data Format

4.3.1 LVDS color data mapping

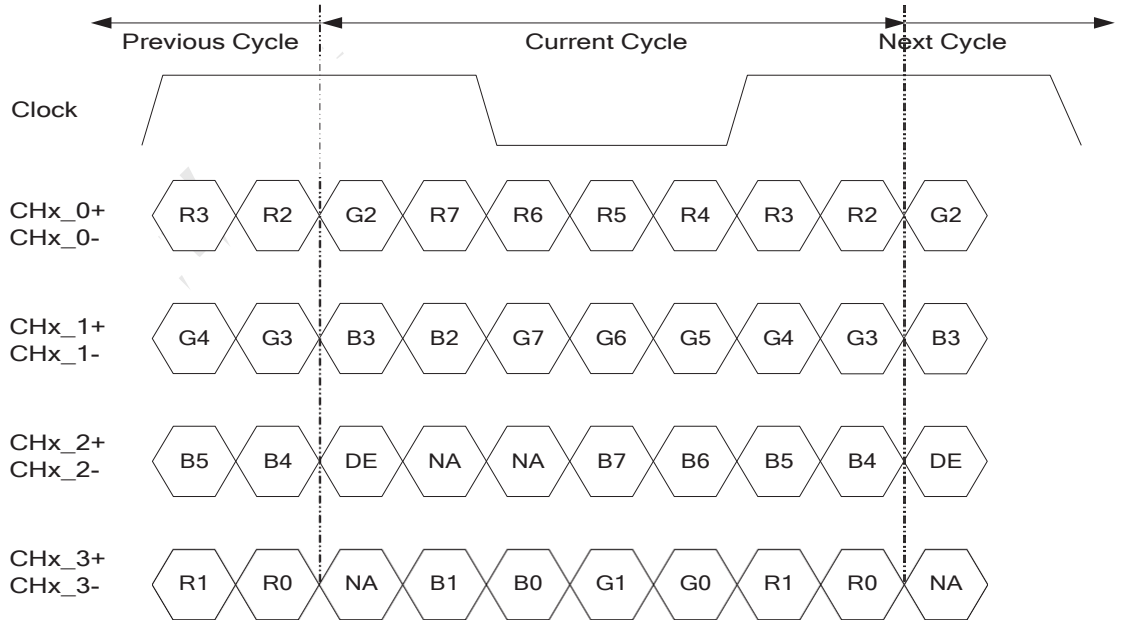
LVDS Option for 8bit

- **LVDS Option NS**



Note: x = 1, 2, 3, 4…

- **LVDS Option JEIDA**



Note: x = 1, 2, 3, 4…

4.3.2 Color Input Data Reference

The brightness of each primary color (red, green and blue) is based on the 8 bit gray scale data input for the color; the higher the binary input, the brighter the color. The table below provides a reference for color versus data input.

COLOR DATA REFERENCE

8bit

Color		Input Color Data																							
		RED								GREEN								BLUE							
		MSB							LSB	MSB							LSB	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
R	RED(000)	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
G	GREEN(000)	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	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
B	BLUE(000)	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

5. Signal Timing Specification

This is the signal timing required at the input of the user connector. All of the interface signal timing should be satisfied with the following specifications for its proper operation.

5.1 Input Timing

5.1.1. Timing table

Timing Table (DE only Mode)

Signal	Item	Symbol	MIN	TYP	MAX	Unit
Vertical Section	Period	Tv	1120	1125	1480	Th
	Active	Tdisp(v)		1080		Th
	Blanking	Tblk(v)	40	45	400	Th
Horizontal Section	Period	Th	1030	1100	1325	Tclk
	Active	Tdisp(h)		960		Tclk
	Blanking	Tblk(h)	70	140	365	Tclk
Vertical Frequency	Frequency	Freq	47	60	63	Hz
Horizontal Frequency	Frequency	Freq	60	67.5	73	KHz
Clock	Frequency	FCLK	53	74.25	82	MHz

Notes:

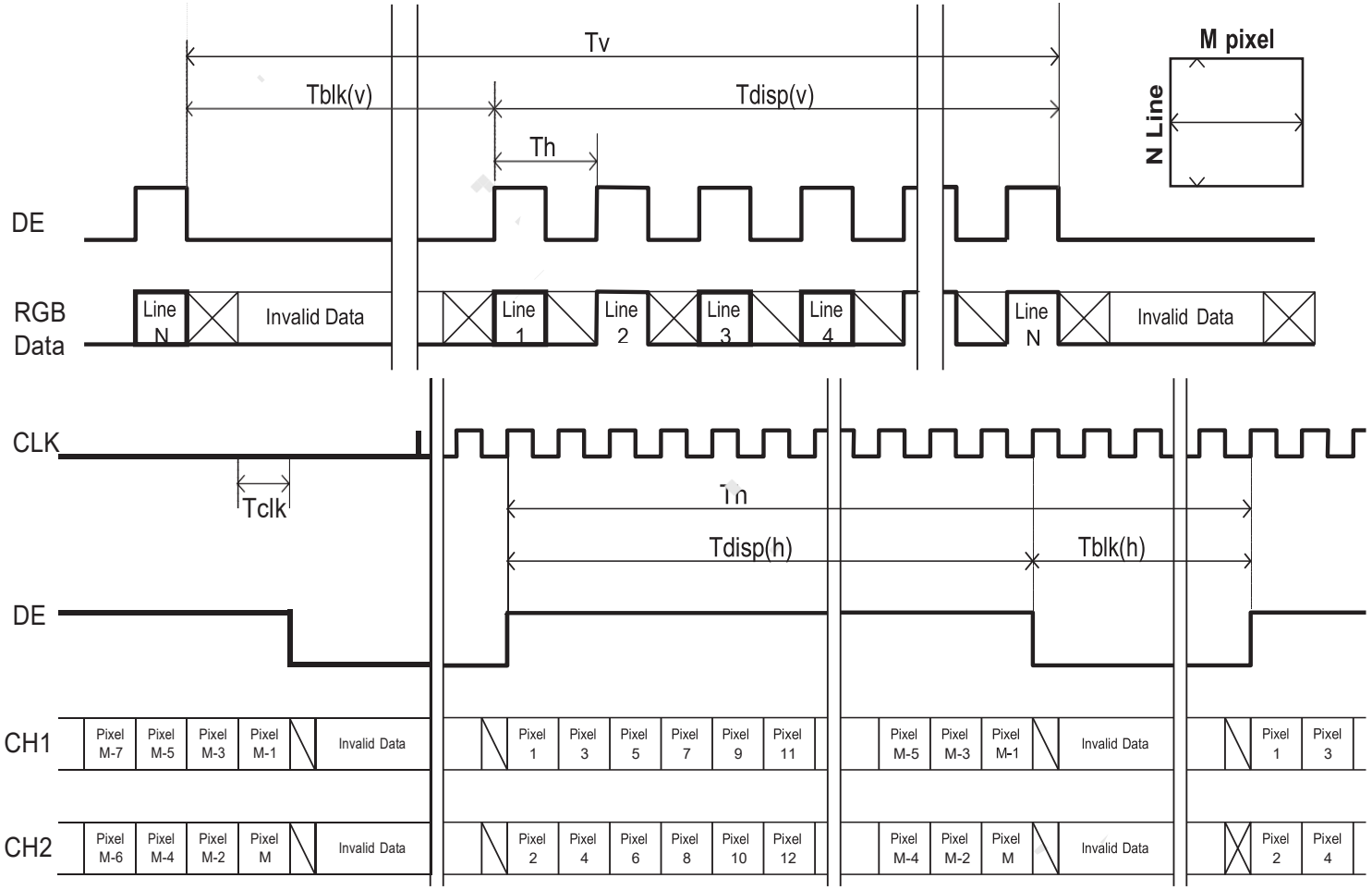
(1) Display position is specific by the rise of DE signal only.
Horizontal display position is specified by the rising edge of 1st DCLK after the rise of 1st DE, is displayed on the left edge of the screen.

(2) Vertical display position is specified by the rise of DE after a “Low” level period equivalent to eight times of horizontal period. The 1st data corresponding to one horizontal line after the rise of 1st DE is displayed at the top line of screen.

(3) If a period of DE “High” is less than 3840 DCLK or less than 2160 lines, the rest of the screen displays black.

(4) The display position does not fit to the screen if a period of DE “High” and the effective data period do not synchronize with each other.

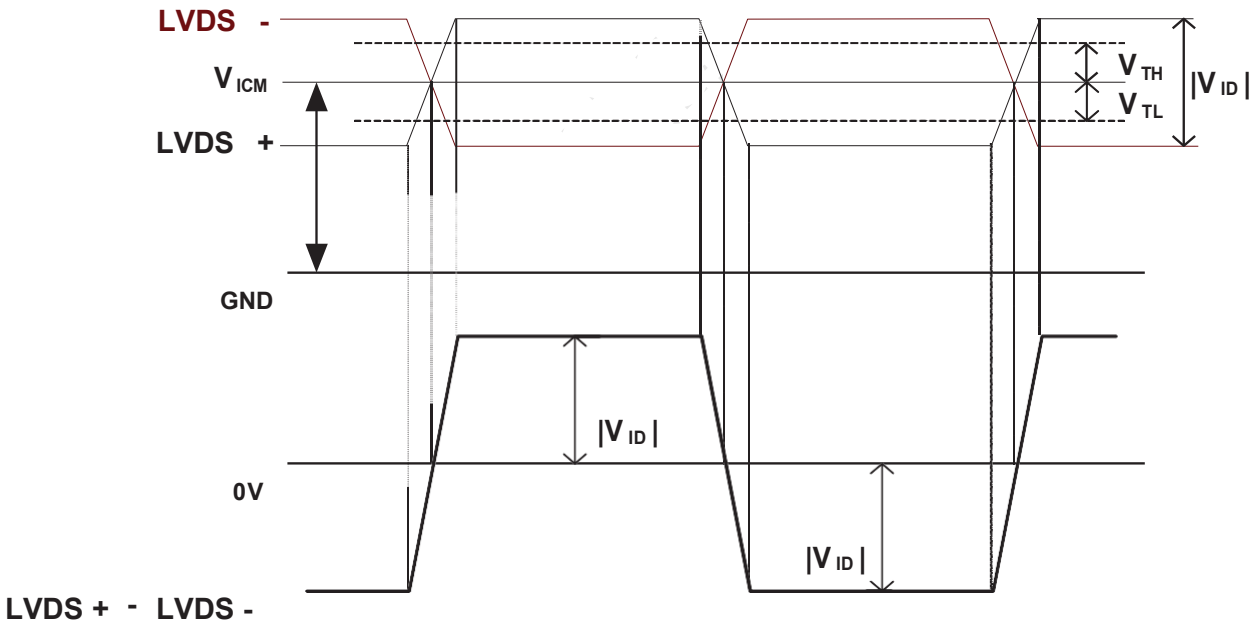
5.1.2. Signal Timing Waveform



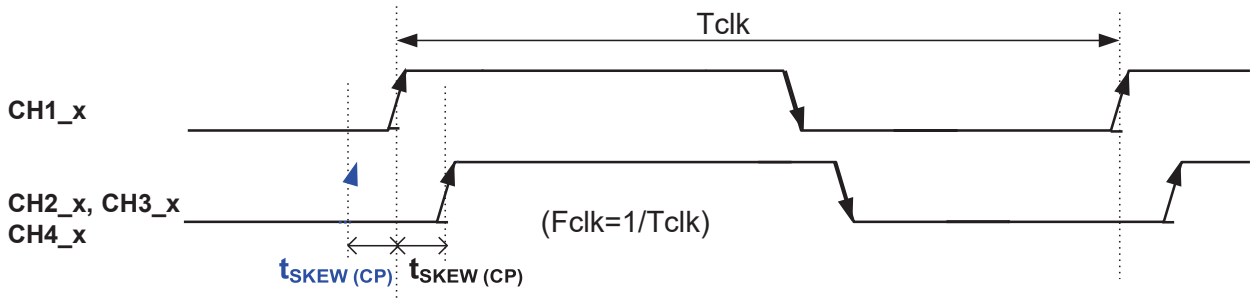
5.2 Input interface characteristics

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max		
LVDS Interface	Input Differential Voltage	$\|V_{ID}\|$	200	400	600	mV_{DC}	1
	Differential Input High Threshold Voltage	V_{TH}	+100	--	+300	mV_{DC}	1
	Differential Input Low Threshold Voltage	V_{TL}	-300	--	-100	mV_{DC}	1
	Input Common Mode Voltage	V_{ICM}	1.1	1.25	1.4	V_{DC}	1
	Input Channel Pair Skew Margin	$t_{SKEW\ (CP)}$	-500	--	+500	ps	2
	Input Channel Pair Skew Margin (only for M'Star MST7428BB)	$t_{SKEW\ (CP)}$	-400	--	+400	ps	2
	Receiver Clock : Spread Spectrum	Fclk_ss	Fclk	--	Fclk	MHz	3
	Modulation range		-3%		+3%		
	Receiver Clock : Spread Spectrum	Fss	30	--	200	KHz	3
	Modulation frequency						
	Receiver Data Input Margin						
	Fclk = 85 MHz	tRMG	-0.4	--	0.4	ns	4
	Fclk = 65 MHz		-0.5	--	0.5		

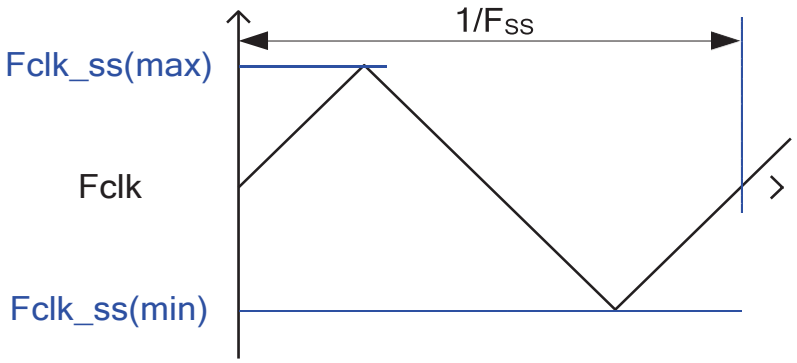
Note1. VICM = 1.25V



Note2. Input Channel Pair Skew Margin

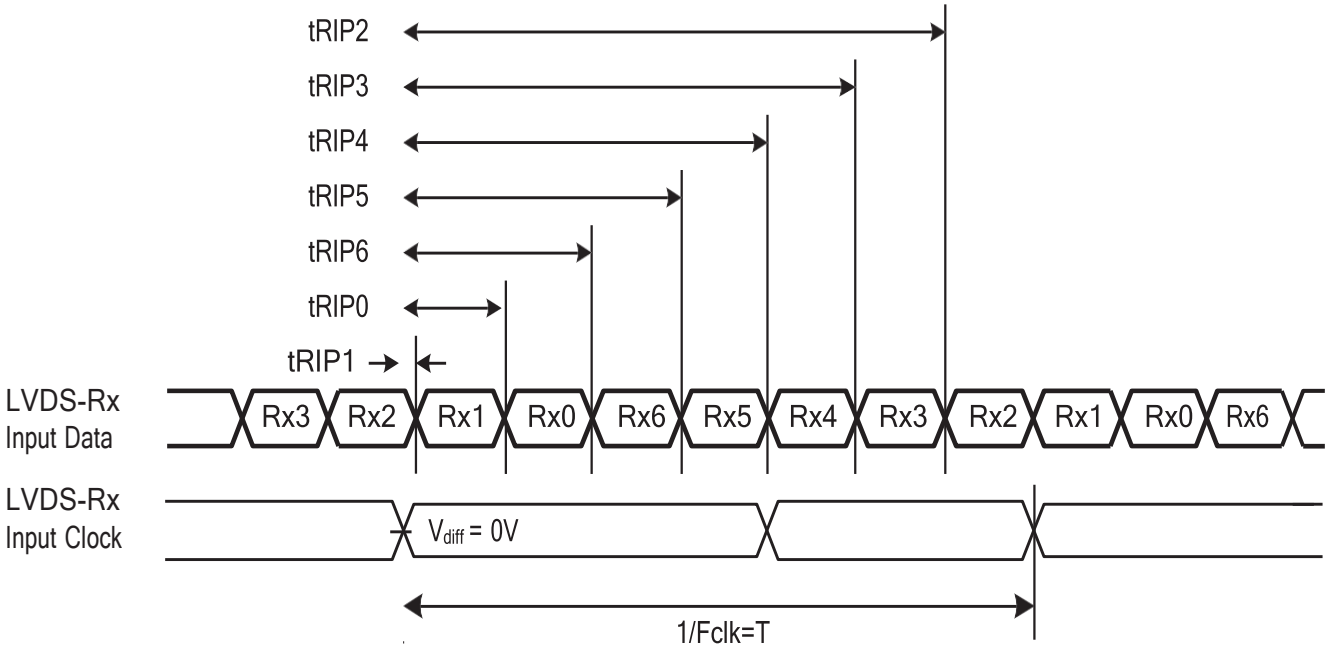


Note3. LVDS Receiver Clock SSCG (Spread spectrum clock generator) is defined as below figures.

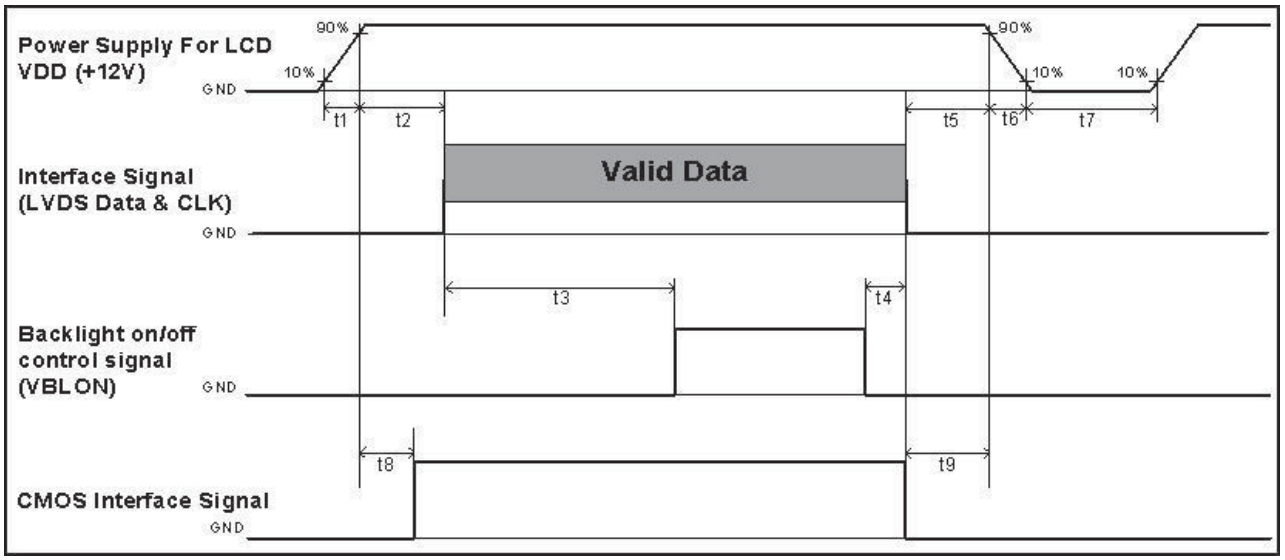


Note4. Receiver Data Input Margin

Parameter	Symbol	Rating			Unit	Note
		Min	Type	Max		
Input Clock Frequency	Fclk	Fclk (min)	--	Fclk (max)	MHz	**T=1/Fclk**
Input Data Position0	tRIP1	-|tRMG|	0	|tRMG|	ns	
Input Data Position1	tRIP0	T/7-|tRMG|	T/7	T/7+|tRMG|	ns	
Input Data Position2	tRIP6	2T/7-|tRMG|	2T/7	2T/7+|tRMG|	ns	
Input Data Position3	tRIP5	3T/7-|tRMG|	3T/7	3T/7+|tRMG|	ns	
Input Data Position4	tRIP4	4T/7-|tRMG|	4T/7	4T/7+|tRMG|	ns	
Input Data Position5	tRIP3	5T/7-|tRMG|	5T/7	5T/7+|tRMG|	ns	
Input Data Position6	tRIP2	6T/7-|tRMG|	6T/7	6T/7+|tRMG|	ns	



5.3 Power Sequence for LCD



Parameter	Values			Unit
	Min.	Type.	Max.	
t1	0.4	---	30	ms
t2	40	---	---	ms
t3	640	---	---	ms
t4	0*1	---	---	ms
t5	0	---	---	ms
t6	---	---	---*2	ms
t7	1000	---	---	ms
t8	20*3	---	50	ms
t9	0	---	---	ms

Note:

(1) t4=0 : concern for residual pattern before BLU turn off.

(2) t6 : voltage of VDD must decay smoothly after power-off. (customer system decide this value)

(3) When user control signal is N.C. (no connection), opened in Transmitted end, t8 timing spec can be negligible.

6. Backlight Specification

6.1 Electrical specification

Back Light Unit

The table shows specifications of a single light bar, the BLU have 2 lightbars.
Total Power Consumption is 25W typ.

Inverter Input Condition & Specification

Items	Symbol	Conditions	Specifications			Unit	Note
			Min.	Typ.	Max.		
Forward current (LED)	I(f)		-	90	-	mA	
Forward voltage (LED)	V(f)		2.9	-	3.3	V	
Current(light bar)	I(L)		-	360	450	mA	
Voltage (light bar)	V(L)		30	-	36.3	V	
Power Consumption	ON			25	33	W	

1. The pin configuration for the connector is shown in the table below
2. The mating connector is PH1.25-3pin.A12511R

Item	Symbol	Min.	Typ.	Max.	Unit	Note
Operating Lifetime	Hr	70,000	-	-	Hour	(1)

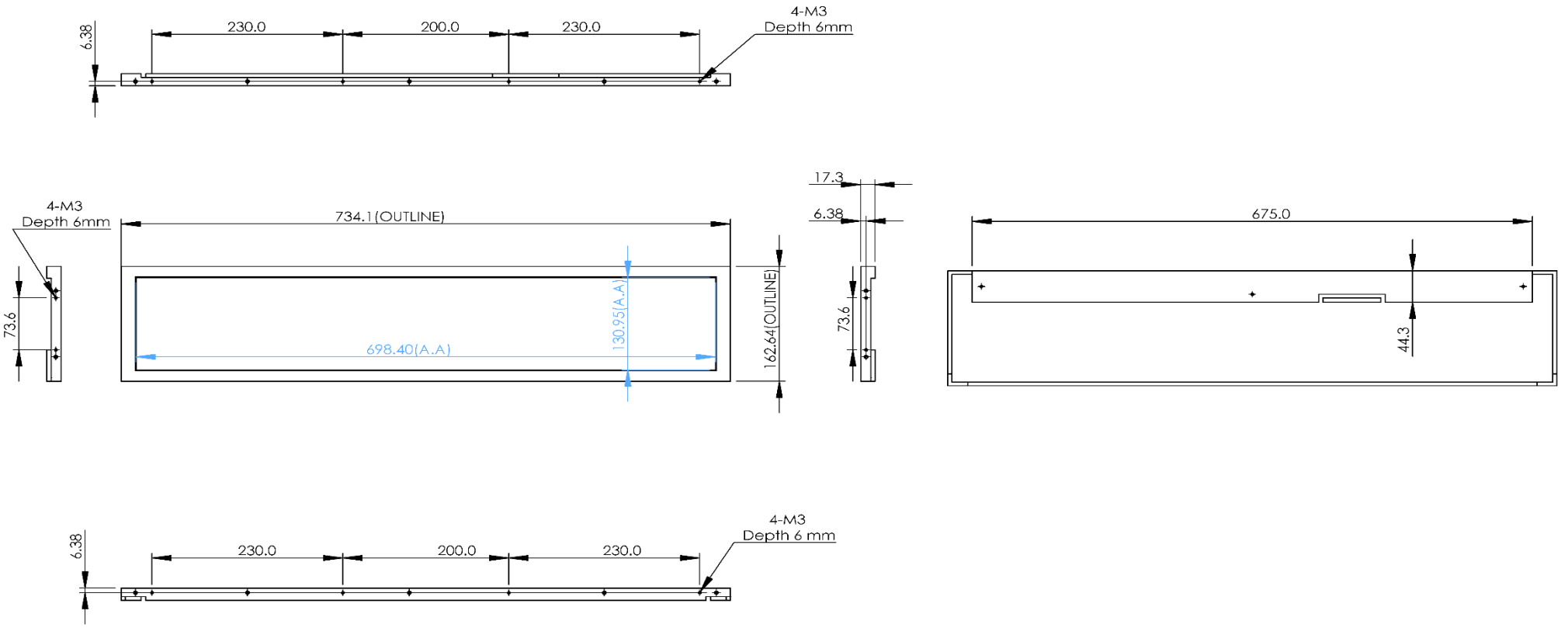
Note (1) It is defined as the time to take until the brightness reduces to 50% of its original value.
[Operating condition: Ta = 25±2℃, I_L = TBD , For single lamp only.]

7. Mechanical Characteristics

The contents provide general mechanical characteristics for the model In addition the figures in the next pageare detailed mechanical drawing of the LCD.

Item		Dimension	Unit	Note
Outline Dimension	Horizontal	734.1	mm	
	Vertical	162.64	mm	
	Depth	17.3	mm	
	Bezel opening	700.4(H) x 133(V)	mm	
	Display Area	698.4(H) x 130.95(V)	mm	
Weight	2.5（TBD）		Kg	

8. Mechanical Drawing



HIGHNESS™ One of a kind	DIMENSIONS ARE IN MM TOLERANCES : ± 0.5		NAME	DATE	HIGHNESS MICROELECTRONICS LTD.
	MATERIAL -	DRAWN	SWAPNIL S. S	28/09/24	MODEL NO. / PRODUCT : HM280FH211VL
		CHECKED	KUSHAL.V	28/09/24	
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