Sauls Wharf House
Crittens Road
Great Yarmouth
Norfolk
NR31 0AG

Telephone +44 (0)1493 602602
Email:sales@midasdisplays.com
Email:tech@midasdisplays.com
www.midasdisplays.com

MDT101013	1280 x 800	LVDS Interface	TFT Module
Specification			
Version: 1		Date: 15/06/2013	
Revision			
1	13/06/2013	First issue	

Display Features	
Display Size	10.10”
Resolution	1280 x 800
Orientation	Landscape
Appearance	RGB
Logic Voltage	5V
Interface	LVDS
Brightness	2200 cd/m^2
Touchscreen	---
Module Size	230.70 x 152.55 x 7.50 mm
Operating Temperature	-30°C ~ +80°C
Pinout	30 way connector
Pitch	3.50 mm

RoHS compliant

Created By	Checked By
CL	WE
Box Quantity	Weight / Display
---	---

Display Accessories	
Part Number	**Description**
MCIB14/16	HDMI-to-LVDS interface board, with voltage generation.
MDIB-CC1	Interconnect board for standard pitch pinouts to fine pitch wires. Providing pinouts for 2.54 pinout. 1.27, 1, 0.845, 0.8, 0.7, 0.65, 0.62, 0.6, 0.5 & 0.3 pads.

Optional Variants	
Appearances	**Voltage**

1. Handling Precautions

1) Since front polarizer is easily damaged, pay attention not to scratch it.
2) Be sure to turn off power supply when inserting or disconnecting from input connector.
3) Wipe off water drop immediately. Long contact with water may cause discoloration or spots.
4) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
5) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface.
6) Since CMOS LSI is used in this module, take care of static electricity and insure human earth when handling.
7) Do not open or modify the Module Assembly.
8) Do not press the reflector sheet at the back of the module to any directions.
9) At the insertion or removal of the Signal Interface Connector, be sure not to rotate nor tilt the Interface Connector of the TFT Module.
10) After installation of the TFT Module into an enclosure, do not twist nor bend the TFT Module even momentary. At designing the enclosure, it should be taken into consideration that no bending/twisting forces are applied to the TFT Module from outside. Otherwise the TFT Module may be damaged.

2. General Description

2.1 Overview

This specification applies to the Color Active Matrix Liquid Crystal Display composed of a TFT-LCD display a LED backlight system. The screen format is intended to support FHD (1280(H) x 800(V)) screen and 16.7M / 262K (8 / 6 bits) color support.

2.2 Features

- High brightness display, 2200nits by LED backlight.
- Long operation lifetime BLU design
- Wide view angle
- Extra wide operation temperature
- RoHS Compliance

2.3 Application

Industrial applications.

2.4 Display specifications

Items	Unit	Specification
Screen Diagonal	inch	10.1”
Active Area	mm	216.96 (H) X 135.6 (V)
Pixels H x V	pixels	1280 x3(RGB) x 800
Pixels Pitch	um	169.5 (per one triad) x 169.5
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally black
White luminance (center)	Cd/m^2	2200 (Typ)
Contrast ratio		800:1 (Typ.)
Optical Response Time	msec	25 ms (Typ. On/off)
Normal Input Voltage	Volt	5V
Power Consumption (Vcc Line + LED backlight)	Watt	13.0 W (VDD line=1.0 W; LED lines= 12.0 W)
Weight	Grams	315
Physical size	mm	230.7 (W)× 152.55 (H)× 7.5 (D, Max)
Electrical Interface		LVDS
Support colors		16.7M / 262K colors (8 / 6 bits)
Surface Treatment		AG type, 3H hard coating
Temperature range Operating Storage	 ^0C ^0C	 -30 ~ 80 (TFT surface) -40 ~ 85
RoHS Compliance		RoHS Compliance

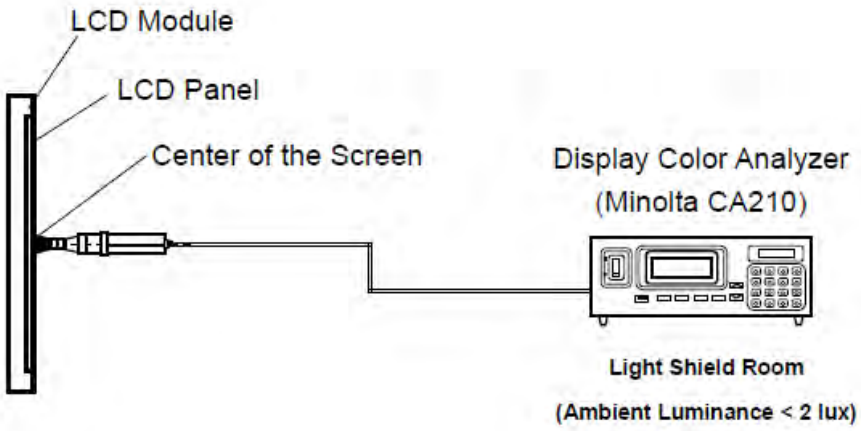
2.5 Optical characteristics

The following optical characteristics are measured under stable condition at 25 ^{0}C

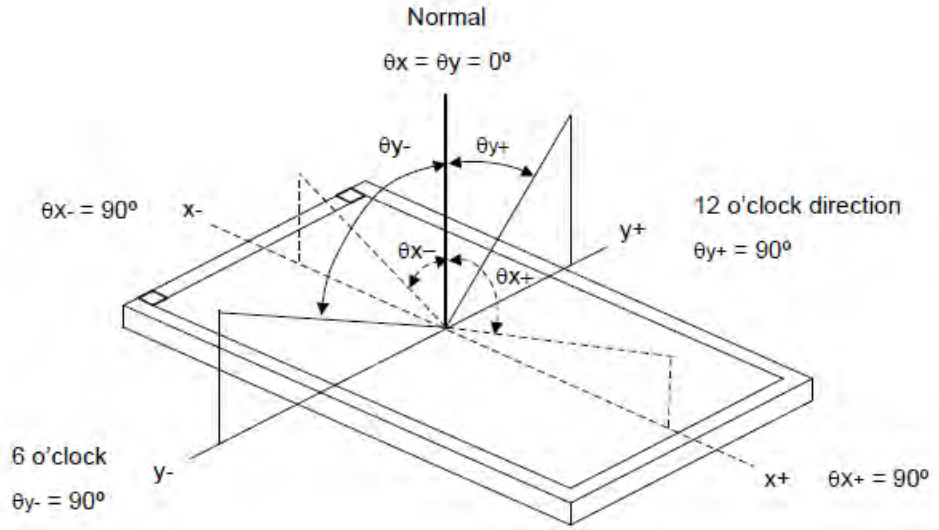
Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right)	80	88		2
		CR=10 (Left)	80	88		
		Vertical (Up)	80	88		
		CR=10 (Down)	80	88		
Contrast Ratio		Normal Direction	600	800		3
Response Time	msec	Raising + Falling		25	35	4
Color coordinates (CIE) White		Red x	-0.05	0.649	+0.05	
		Red y		0.340		
		Green x		0.320		
		Green y		0.606		
		Blue x		0.149		
		Blue y		0.055		
		White x		0.313		5
		White y		0.329		
Center Luminance	Cd/m^2		1760	2200		6
Luminance Uniformity	%		70	75		7
Crosstalk (in 60 Hz)	%				1.5	
Flicker	dB				-20	

Note 1: Measurement method

The LCD module should be stabilized at given temperature for 0.5 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.



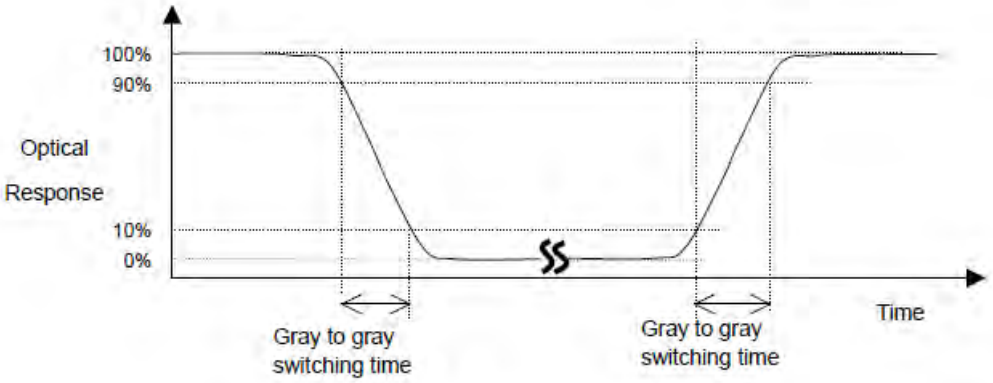
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA310

Note 4: Definition of Response time

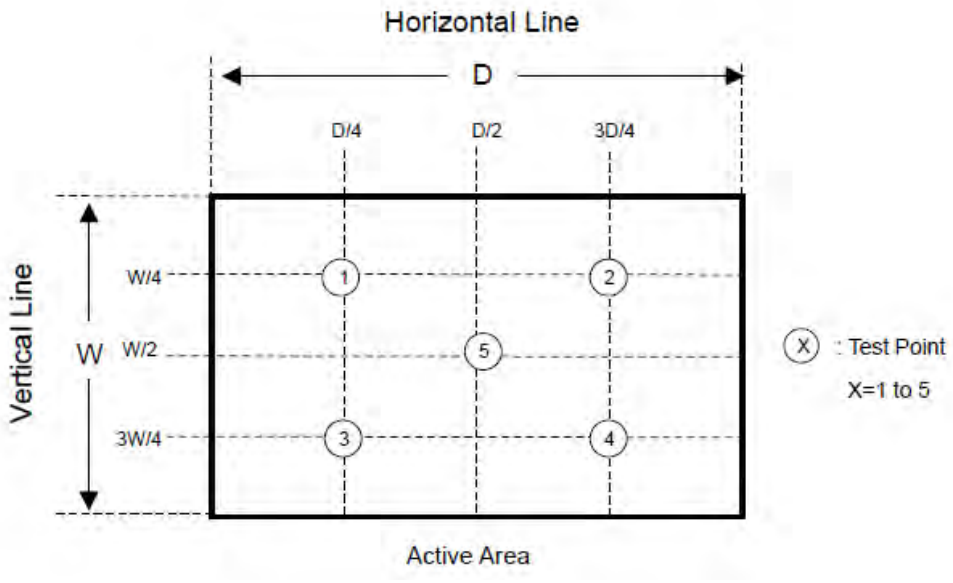
The output signals of photo detector are measured when the input signals are changed from “Full Black” to “Full White” (rising time), and from “Full White” to “Full Black” (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as below.



Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA310

Note 6: Center luminance is measured by Minolta CA310

Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA310



Uniformity = (Min. Luminance of 5 points) / (Max. Luminance of 5 points)

3. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

3.1 TFT LCD module

Items	Symbol	Min	Max	Unit	Conditions
Power supply voltage	V_{DD}	-0.3	5.5	Volt	Note 1, 2

3.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED bar input current			480	mA	

3.3 Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T_{OS}	-30	-	80	^{0}C	Note 3
Operation Humidity	H_{OP}	10		85	%	
Storage temperature	T_{ST}	-40		85	^{0}C	
Storage Humidity	H_{ST}	5		90	%	

Note 1: With in Ta= 25℃

Note 2: Permanent damage to the device may occur if exceed maximum values

Note 3: For quality performance, please refer to IIS (Incoming Inspection Standard).

4. Electrical characteristics

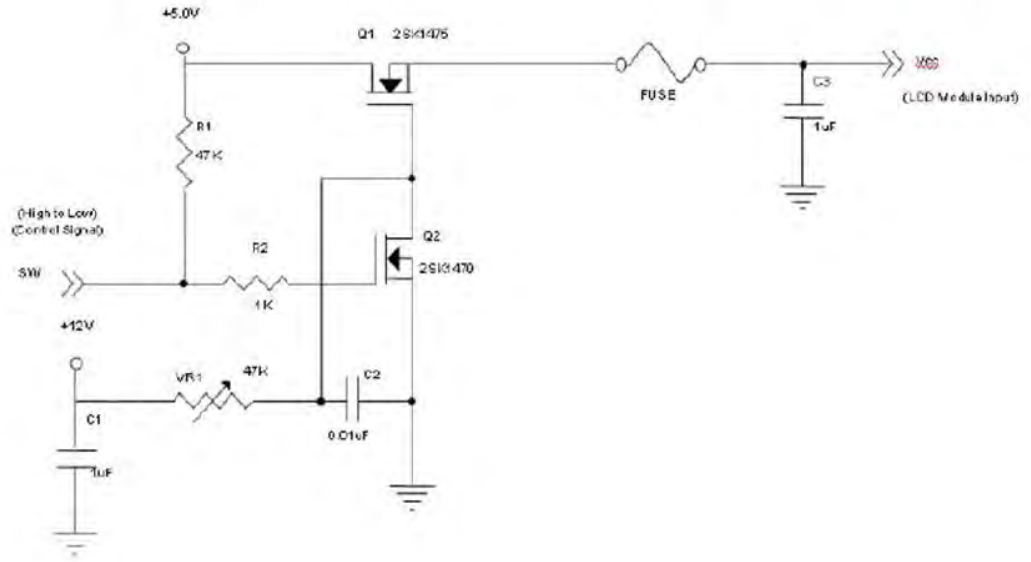
4.1 LCD electronics specification

4.1.1 Power specification

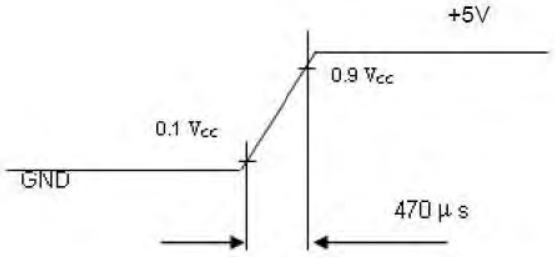
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V_{CC}	4.5	5	5.5	V	-
Ripple Voltage		V_{RP}	-	-	(300)	mVp-p	
Inrush Current		I_{INRUSH}	-	-	(3.0)	A	(2)
Power Supply Current	White	Icc		(150)	(200)	mA	(3)a
	Black			(140)	(190)	mA	(3)b
LVDS differential input voltage		V_{id}	200	-	600	mV	(5)
LVDS common input voltage		V_{ic}	1.0	1.2	1.4	V	(5)
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V_{IH}	-		100	mV	-
	"L" Level	V_{IL}	-100	-		mV	-
Terminating Resistor		R_T	-	100	-	Ohm	-

Note (1)The module should be always operated within above ranges.

Note (2)Measurement Conditions:



Vcc rise time is 470μs



Note (3) The specified power supply current is under the conditions at V_{DD} =5V, Ta = 25 ± 2 ℃, DC Current and f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern

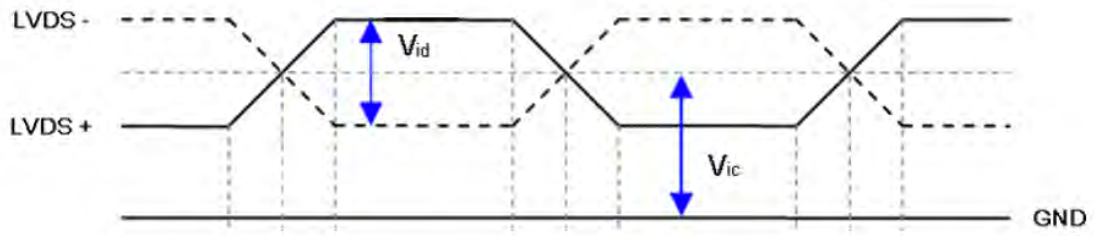
Active Area

b. Black Pattern

Active Area

Note (4) The power consumption is specified at the pattern with the maximum current.

Note (5) VID waveform condition



4.2 Backlight unit

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		30		[V]	2
LED current (IL)		200		[mA]	2
LED power (PL)		12		[W]	
LED lite time (MTBF)		100,000		[Hour]	1

Note 1: The “LED lift time” is defined as the module brightness decrease to 50% original brightness that the ambient temperature is 25℃ and typical LED Current at 200 mA

Note 2: The variance of LED Light Bar power consumption is ±10%. Calculator value for reference (IL × VL x 2 = PLED)

4.3 Interface connector

4.3.1 TFT connector(CN1)

Pin No.	Symbol	Function	Polarity	Note
1	VCC	Power supply 5V		(5)
2	VCC	Power supply 5V		
3	UD/LR	Reverse Scan Control, Low or NC à Normal Mode. High à Reverse Scan		(3)(4)
4	NC	Not connection, this pin should be open		
5	NC	Not connection, this pin should be open		
6	SEL68	LVDS 6/8 bit select function control, Low or NC → 6 bit Input Mode.High → 8bit Input Mode.		(3)(4)
7	NC	Not connection, this pin should be open		
8	NC	Not connection, this pin should be open		
9	NC	Not connection, this pin should be open		
10	NC	Not connection, this pin should be open		
11	NC	Not connection, this pin should be open		
12	NC	Not connection, this pin should be open		
13	NC	Not connection, this pin should be open		
14	NC	Not connection, this pin should be open		
15	NC	Not connection, this pin should be open		
16	NC	Not connection, this pin should be open		
17	NC	Not connection, this pin should be open		
18	NC	Not connection, this pin should be open		
19	GND	Ground		
20	RXO3+	Positive LVDS differential data input. Channel O3	Positive	
21	RXO3-	Negative LVDS differential data input. Channel O3	Negative	
22	RXOC+	Positive LVDS differential clock input.	Positive	
23	RXOC-	Negative LVDS differential clock input.	Negative	
24	GND	Ground		
25	RXO2+	Positive LVDS differential data input. Channel O2	Positive	
26	RXO2-	Negative LVDS differential data input. Channel O2	Negative	
27	RXO1+	Positive LVDS differential data input. Channel O1	Positive	
28	RXO1-	Negative LVDS differential data input. Channel O1	Negative	
29	RXO0+	Positive LVDS differential data input. Channel O0	Positive	
30	RXO0-	Negative LVDS differential data input. Channel O0	Negative	

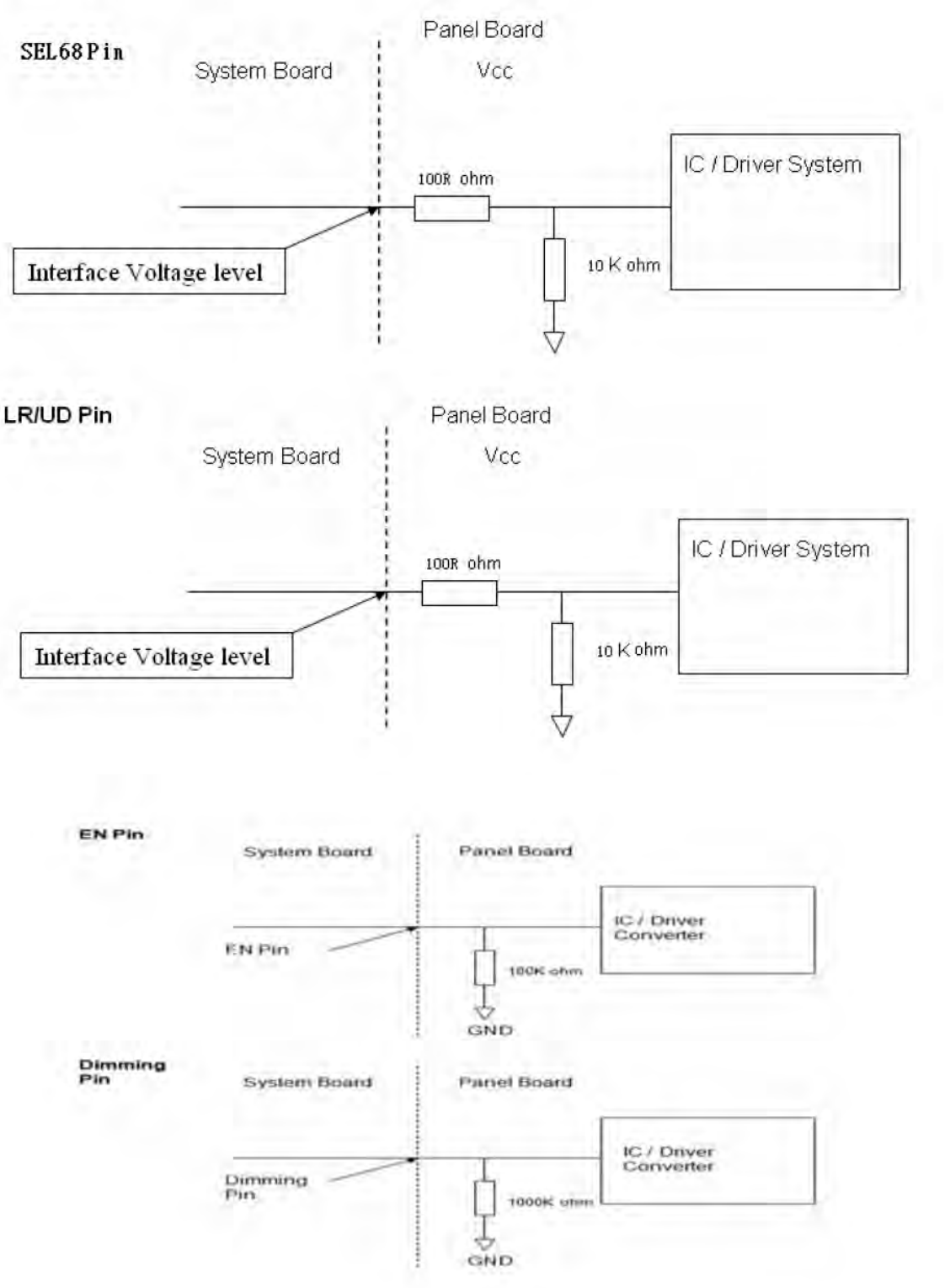
Note (1) Connector Part No.: **STM MSAK24025P30MB or I-PEX 20455-030E-76 or equivalent.**

Note (2) User's connector Part No.: **I-PEX 20453-030T-03 or equivalent**

Note (3) "Low" stands for 0V. "High" stands for 3.3V. "NC" stands for "No Connection".

Note (4) Interface optional pin has internal scheme as following diagram, Customer should keep the interface voltage level requirement which including panel board loading as below.

Note (5) Pin1 location is Power supply 5V to comply with **MECHANICAL CHARACTERISTICS**.



4.3.2 Backlight connector(CN2 CN3)

Recommended connector : BHSR-02VS-1 manufactured by JST

Pin no	Symbol	I/O	Description	Remark
1	VLED+	P	Backlight LED anode	Red
2	VLED-	P	Backlight LED cathode	Black

5. Signal characteristics

5.1 Color data input assignment

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 the assignment of color versus data input.

Color		Data Signal																							
		Red								Green								Blue							
		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 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
	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
	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
	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
	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
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
	Red(1)	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(2)	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(253)	1	1	1	1	1	1	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
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
	Green(1)	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(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(253)	0	0	0	0	0	0	0	0	1	1	1	1	1	1	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
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
	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	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	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(253)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	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

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

6. Interface timing

6.1 Input signal timing specifications

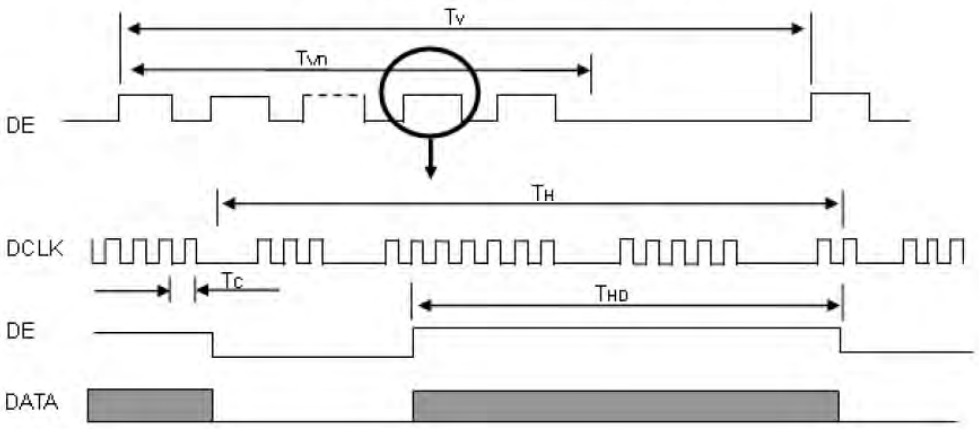
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
LVDS Clock	Frequency	Fc	(60.40)	71.1	(74.7)	MHz	-
	Period	Tc	(16.55)	14.06	(13.38)	ns	
	Input cycle to cycle jitter	T_{rcl}	---	---	200	ns	(a)
	Input Clock to data skew	TLVCCS	-0.02*Tc	-	0.02*Tc	ps	(b)
	Spread spectrum modulation range	F_{clkin_mod}	-	-	1.02*Fc	MHz	(c)
	Spread spectrum modulation frequency	F_{SSM}	-	-	200	KHz	
Vertical Display Term	Frame Rate	Fr	(50)	60	(60)	Hz	Tv=Tvd+Tvb
	Total	Tv	(810)	823	(900)	Th	-
	Active Display	Tvd	800	800	800	Th	-
	Blank	Tvb	10	23	(100)	Th	-
Horizontal Display Term	Total	Th	(1362)	1440	(1480)	Tc	Th=Thd+Thb
	Active Display	Thd	1280	1280	1280	Tc	-
	Blank	Thb	(82)	160	(170)	Tc	-

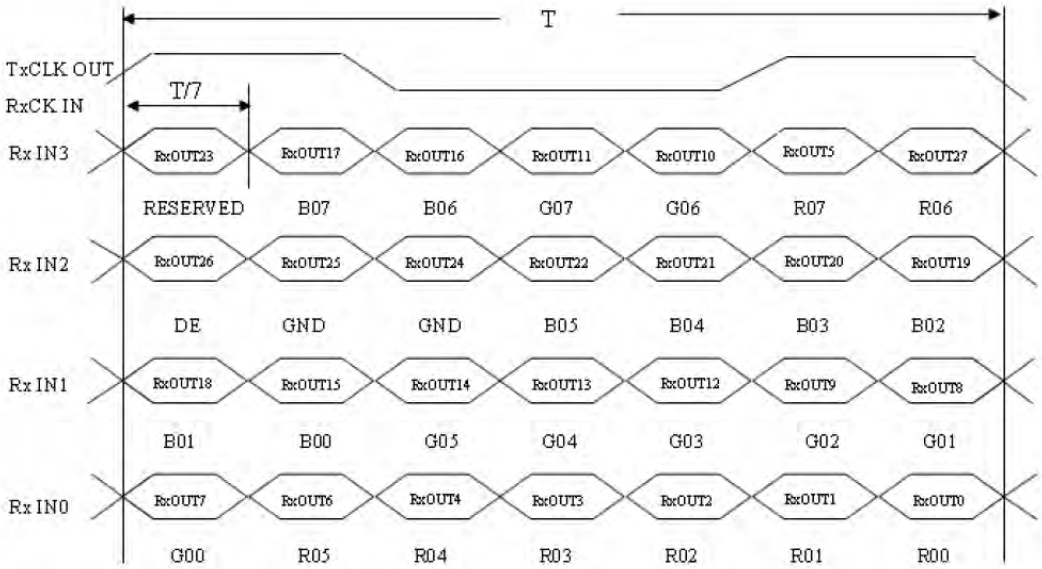
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The Tv(Tvd+Tvb) must be integer, otherwise, the module would operate abnormally.

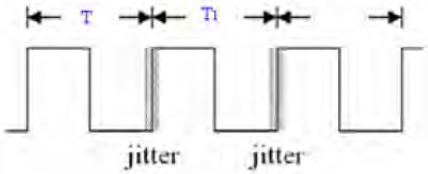
INPUT SIGNAL TIMING DIAGRAM



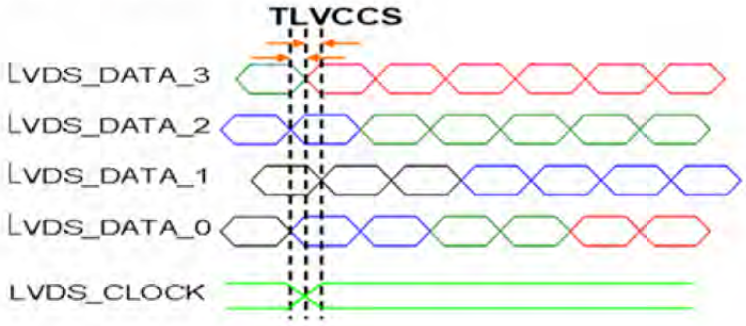
TIMING DIAGRAM of LVDS



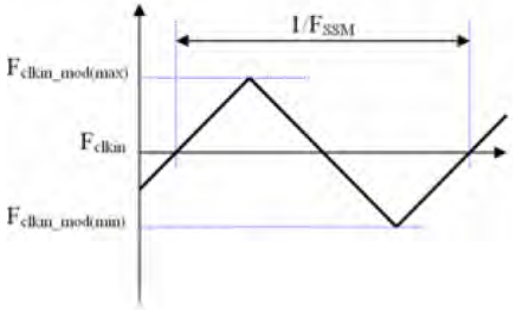
Note (a) The input clock cycle-to-cycle jitter is defined as below figures. T_{rcl} = I T1 – TI



Note (b) Input Clock to data skew is defined as below figures.

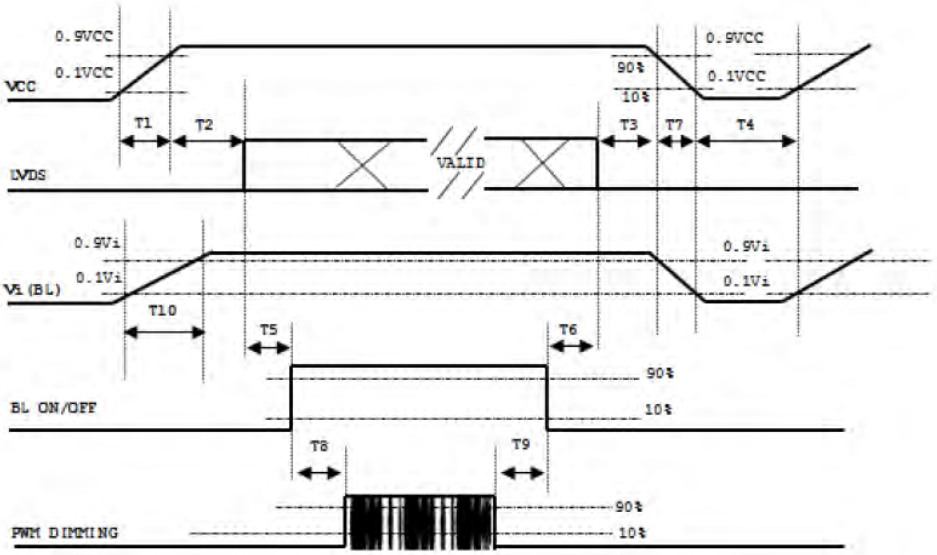


Note (c) The SSCG (Spread spectrum clock generator) is defined as below figures.



6.2 Power ON/OFF sequence

To prevent a latch-up or DC operation of LCD assembly, the power on/off sequence should be as the diagram below.



Parameter	Value			Units
	Min	Typ	Max	
T1	0.5	-	10	ms
T2	0	-	50	ms
T3	0	-	50	ms
T4	500	-	-	ms
T5	450	-	-	ms
T6	200	-	-	ms
T7	10	-	100	ms
T8	10	-	-	ms
T9	10	-	-	ms
T10	20	-	50	ms

Note:
(1) The supply voltage of the external system for the module input should be the same as the definition of Vcc.

(2) When the backlight turns on before the LCD operation of the LCD turns off, the display may momentarily become abnormal screen.

(3) In case of VCC = off level, please keep the level of input signals on the low or keep a high impedance.

(4) T4 should be measured after the module has been fully discharged between power off and on period.

(5) Interface signal shall not be kept at high impedance when the power is on.

(6) INX won't take any responsibility for the products which are damaged by the customers not following the Power Sequence.

(7) There might be slight electronic noise when LCD is turned off (even backlight unit is also off). To avoid this symptom, we suggest "Vcc falling timing" to follow "T7 spec"..

7. Reliability Test

Environment test conditions are listed as following table.

Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta=40℃, 80%RH, 120hours	
High Temperature Operation (HTO)	Ts= 80℃, 120hours	3
Low Temperature Operation (LTO)	Ta= -30℃, 120hours	
High Temperature Storage (HTS)	Ta= 85℃, 120hours	
Low Temperature Storage (LTS)	Ta= -40℃, 120hours	
Thermal Shock Test (TST)	-20℃/30min, 60℃/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 3,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec/cycle	
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec/cycle	

Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -10℃ to 50℃, and back again. Power is not applied during the test. After temperature cycling, the unit is placed in normal room ambient for at least 4 hours before power on.

Note 2: According to EN61000-4-2 , ESD class B: Some performance degradation allowed. No data lost. Self-recoverable. No hardware failures.

Note 3: TFT surface.

Note 4: There should be no condensation on the surface of panel during test.

Note 5: In the standard conditions, there is no function failure issue occurred. All the cosmetic specification is judged before reliability test.

Note 6: Before cosmetic and function test, the product must have enough recovery time, at least 4 hours at room temperature.

9. Mechanical Characteristics