

MDT140001C	1920x1080	eDP Interface	TFT Module
Specification			
Version: 1		Date: 18/11/2017	
Revision			
1	16/11/2017	First issue	

Display Features			
Display Size	14"		
Resolution	1920x1080		
Orientation	Landscape		
Appearance	RGB		
Logic Voltage	3.3V		
Interface	eDP		
Brightness	900 cd/m ²		
Touchscreen	CTP		
Module Size	320.80 x 187.50 x 4.70 mm		
Operating Temperature	-0°C ~ +50°C	Created By	Checked By
Pinout	30 way connector	CL	TSB
Pitch	0.5 mm	Box Quantity	Weight / Display
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Display Accessories	
Part Number	Description
MBID-30FP	30 way FFC/FPC 0.5mm to 30 way JST 1mm crimp header
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 is a 14" TFT Liquid Crystal Display module with LED Backlight unit and 30 pins eDP interface. This module supports 1920 x 1080 FHD mode and can display 262,144 colors.

LED driving board for backlight unit is not included.

2.2 Features

- High brightness display, 900 nits by LED backlight.
- Long operation lifetime
- RoHS Compliance

2.3 Application

Industrial application.



2.4 Display Specifications

Items	Unit	Specification
Screen Diagonal	inch	14
Active Area	mm	309.312 (H) x 173.988 (V)
Pixels H x V	pixels	1920 x3(RGB) x 1080
Pixels Pitch	um	161.1 (per one triad) x 161.1
Pixel Arrangement		RGB Vertical stripe
Display mode		Normally black
White luminance (center)	Cd/m ²	900 (Typ.)
Contrast ratio		700 (Typ.)
Optical Response Time	msec	25 ms (Typ. on/off)
Normal Input Voltage Vcc	Volt	3.3
Power Consumption (Vcc Line + LED backlight)	Watt	8.795 (Vcc line=0.776 ; LED line=8.019 W)
Weight	Grams	TBD (max.)
Physical size	mm	320.8(H) x 187.5(V) (205.49 w PCBA & Bracket) x 4.7 (D) (typ.)
Electrical Interface		eDP
Support Colors		262k (6-bit) /16.7M (8bit) colors
Surface Treatment		Anti-glare, 3H
Temperature range		
Operating	°C	-0 ~ 50
Storage	°C	-20 ~ 60
RoHS Compliance		RoHS Compliance



2.5 Optical Characteristics

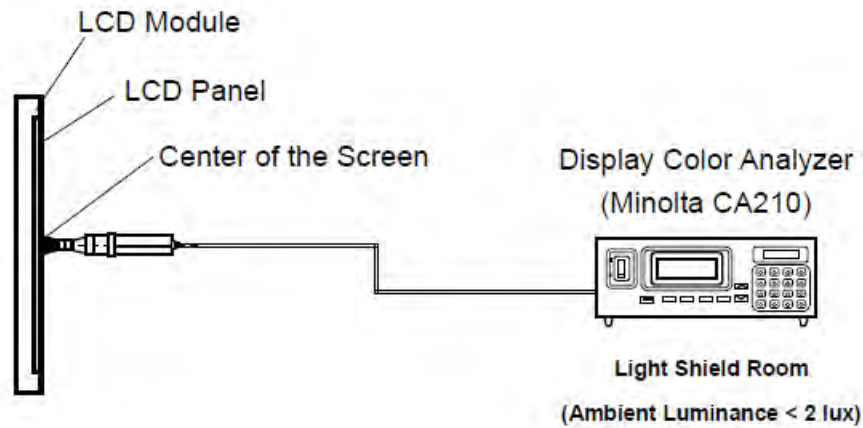
The following optical characteristics are measured under stable condition at 25 °C

Items	Unit	Conditions	Min.	Typ.	Max.	Note
Viewing angle	Deg.	Horizontal (Right) CR=10 (Left)	160	178		2
		Vertical (Up) CR=10 (Down)	160	178		
Contrast Ratio		Normal Direction	500	700		3
Response Time	msec	Raising time (T_{rR})		14		4
		Falling time (T_{rF})		11		
		Raising + Falling		25		
Color / Chromaticity Coordinates (CIE)		Red x	-0.05	0.59	+0.05	5
		Red y		0.35		
		Green x		0.33		
		Green y		0.56		
		Blue x		0.15		
		Blue y		0.12		
Color coordinates (CIE) White		White x		0.31		
		White y		0.34		
Center Luminance	Cd/m ²		800	900		6
Luminance Uniformity	%		70	75		7
Crosstalk (in 60 Hz)	%				1.5	
Flicker	dB				-20	

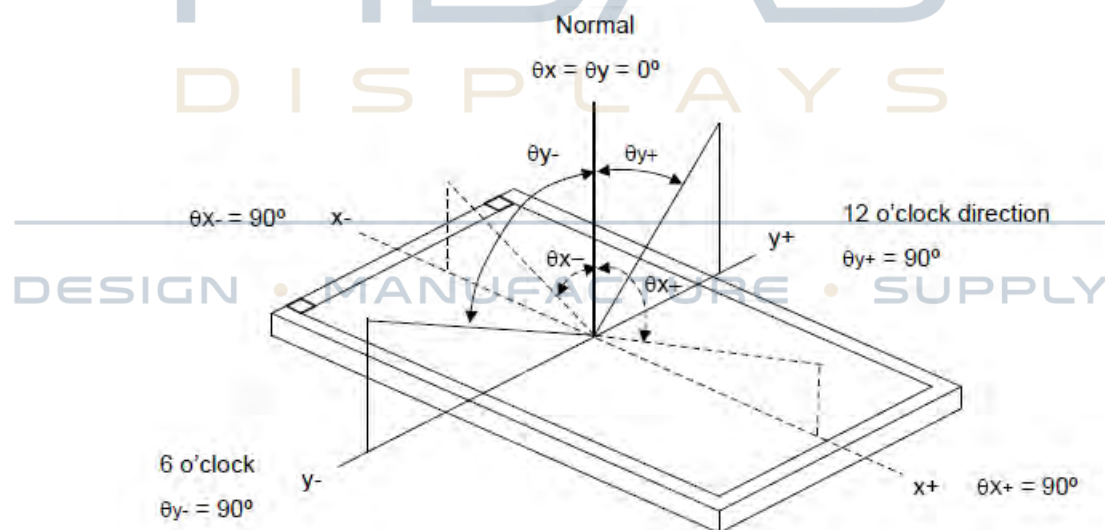


Note 1: Measurement method

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.



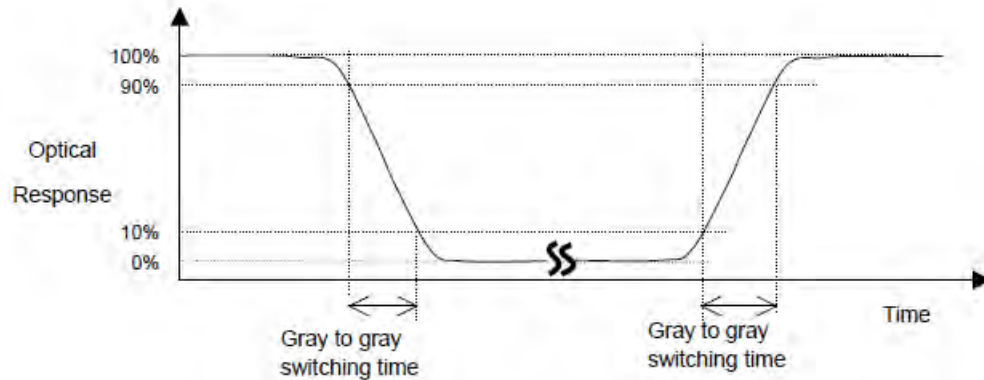
Note 2: Definition of viewing angle



Note 3: Contrast ratio is measured by Minolta CA210

Note 4: Definition of Response time

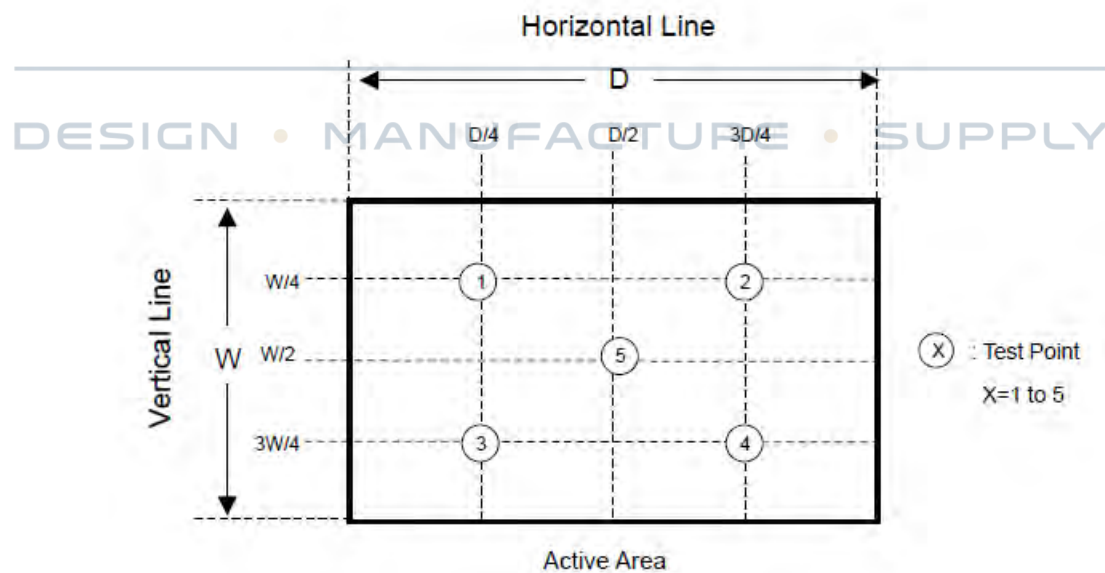
The output signals of photo detector are measured when the input signals are changed from "Full Black" to "Full White" (rising time), and from "Full White" to "Full Black" (falling time), respectively. The response time is interval between the 10% and 90% of amplitudes. Please refer to the figure as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



Note 5: Color chromaticity and coordinates (CIE) is measured by Minolta CA210

Note 6: Center luminance is measured by Minolta CA210

Note 7: Luminance uniformity of these 5 points is defined as below and measured by Minolta CA210

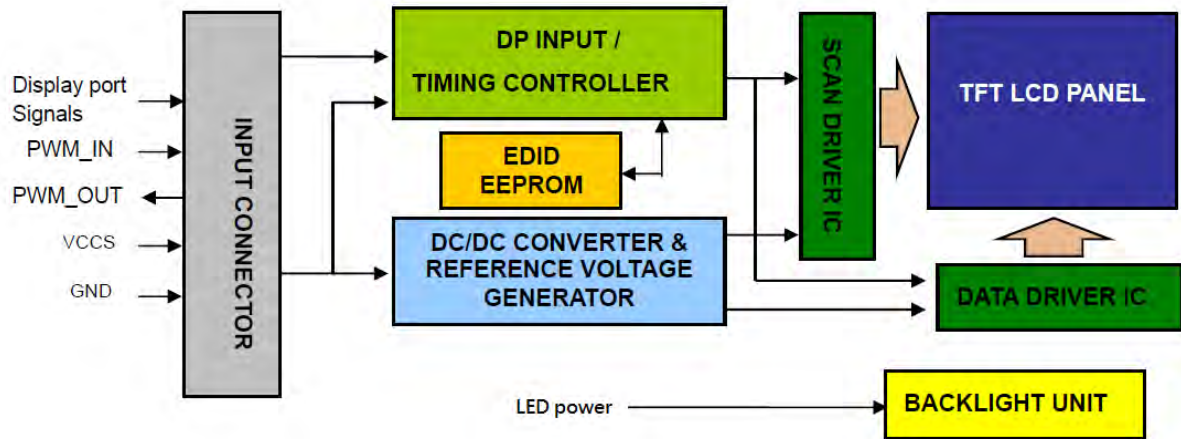


$$\text{Uniformity} = (\text{Min. Luminance of 5 points}) / (\text{Max. Luminance of 5 points})$$

3. Functional Block Diagram

3.1 FUNCTION BLOCK DIAGRAM

The following diagram shows the functional block of the 14 inches Color TFT-LCD Module:

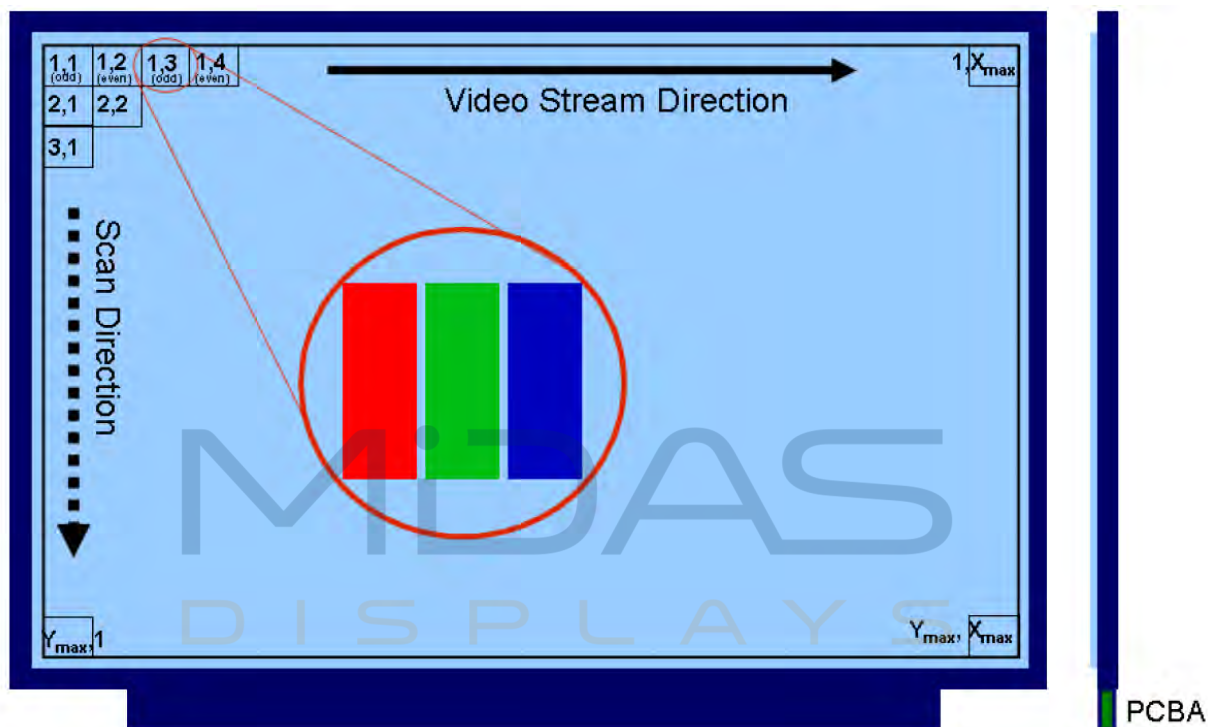


3.2 INTERFACE CONNECTIONS

PIN ASSIGNMENT

Pin	Symbol	Description	Polarity	Remark
1	NC	No Connection (Reserved for LCD test)		
2	H_GND	High Speed Ground		
3	ML1-	Complement Signal-Lane 1	-	
4	ML1+	True Signal-Main Lane 1	+	
5	H_GND	High Speed Ground		
6	ML0-	Complement Signal-Lane 0	-	
7	ML0+	True Signal-Main Lane 0	+	
8	H_GND	High Speed Ground		
9	AUX+	True Signal-Auxiliary Channel	+	
10	AUX-	Complement Signal-Auxiliary Channel	-	
11	H_GND	High Speed Ground		
12	VCCS	Power Supply +3.3 V (typical)		
13	VCCS	Power Supply +3.3 V (typical)		
14	NC	No Connection (Reserved for INX test)		
15	GND	Ground		
16	GND	Ground		
17	HPD	Hot Plug Detect		
18	NC	No Connection		
19	NC	No Connection		
20	NC	No Connection		
21	NC	No Connection		
22	NC	No Connection		
23	NC	No Connection		
24	NC	No Connection (Reserved for LCD test)		
25	NC	No Connection (Reserved for LCD test)		

26	NC	No Connection		
27	NC	No Connection		
28	NC	No Connection		
29	NC	No Connection		
30	NC	No Connection (Reserved for LCD test)		



Note (2): connector

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Please refer Appendix Outline Drawing for detail design.

Connector Part No.: IPEX-20455-030E-76

User's connector Part No: IPEX-20453-030T-03



4. Absolute Maximum Ratings

Absolute maximum ratings of the module are as following:

4.1 TFT LCD Module

Items	Symbol	Min	Max	Unit	Conditions
Power supply voltage	V _{CCS}	-0.3	4.0	Volt	
Logic input voltage	V _{IN}	-0.3	V _{CCS} +0.3	Volt	

4.2 Backlight unit

Items	Symbol	Min	Max	Unit	Conditions
LED Current	I _{LED}	--	560	mA	Note 1, 2

4.3 Absolute Ratings of Environment

Items	Symbol	Values			Unit	Conditions
		Min.	Typ.	Max.		
Operation temperature	T _{OP}	-0	-	50	°C	No condensation Note 3
Operation Humidity	H _{OP}	5		90	%	
Storage temperature	T _{ST}	-20		60	°C	
Storage Humidity	H _{ST}	5		90	%	

Note 1: With in T_a= 25°C

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).

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5. Electrical characteristics

5.1 TFT LCD Module Power Specification

Input power specifications are as follows

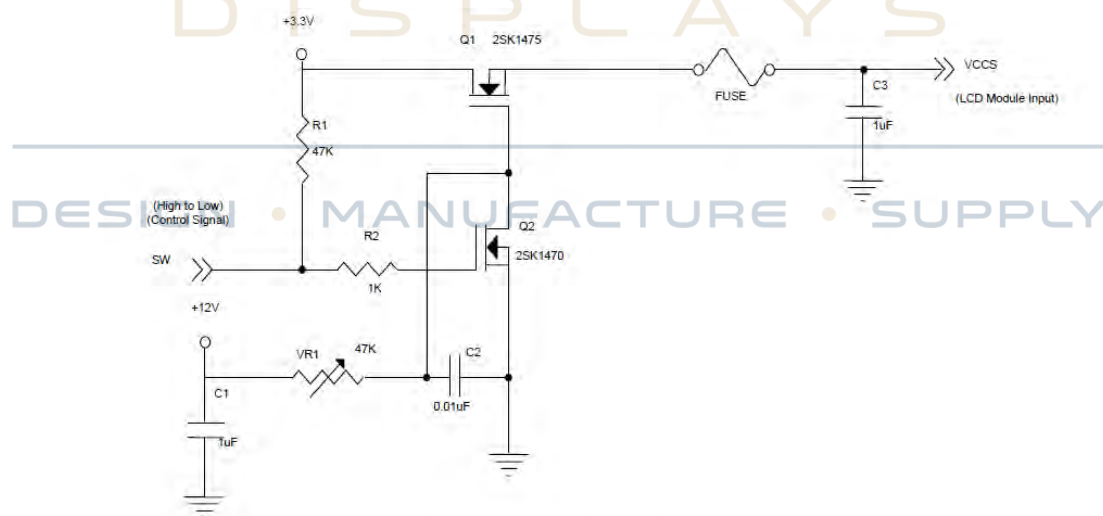
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		VCCS	3.0	3.3	3.6	V	(1)
HPD	High Level		2.25	-	2.75	V	(5)
	Low Level		0	-	0.4	V	(5)
HPD Impedance		R _{HPD}	30K			ohm	(4)
Ripple Voltage		V _{RP}	-	50	-	mV	(1)
Inrush Current		I _{RUSH}	-	-	1.5	A	(1),(2)
Peak Current		I _{Peak}			1.5	A	(1),(2)
Power Supply Current	Mosaic	I _{CC}		201	235	mA	(3)a
	White			195	223	mA	(3)

Note (1) The ambient temperature is $T_a = 25 \pm 2^\circ\text{C}$.

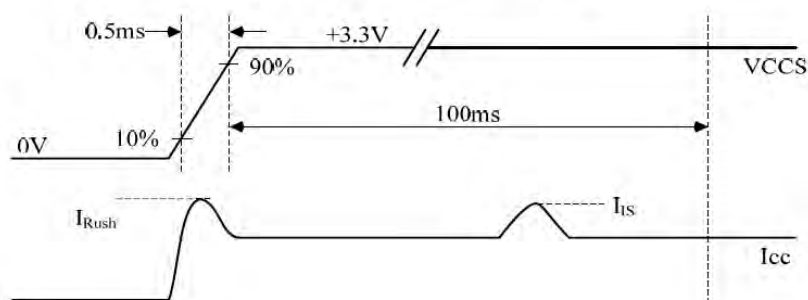
Note (2) I_{RUSH}: the maximum current when VCCS is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.:

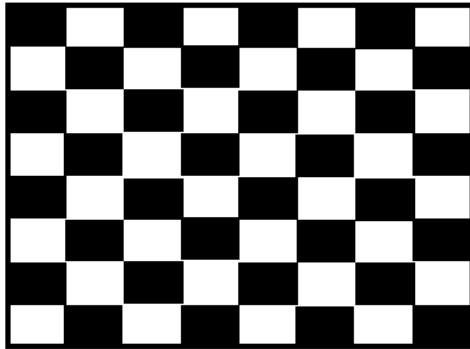


VCCS rising time is 0.5ms



Note (3) The specified power supply current is under the conditions at $V_{CCS} = 3.3 \text{ V}$, $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$, DC Current and $f_v = 60 \text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. Mosaic Pattern



Active Area

b. White Pattern



Active Area

5.2 Backlight Unit

Parameter guideline is under stable conditions at 25°C (Room Temperature):

Parameter	Min	Typ	Max	Unit	Note
LED voltage (VL)		29.7		[V]	2
LED current (IL)		270		[mA]	2,
LED Power (PL)		8.019		[W]	
LED Life Time(LTLED)		50,000		[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°C and typical LED Current at 270 mA.

Note 2: $PL = VL \times IL \times 1$

LED Light bar connector

Connector : JOIN TEK JT1025-1021

(The recommended model is BHSR-02VS-1 manufactured by JST)

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

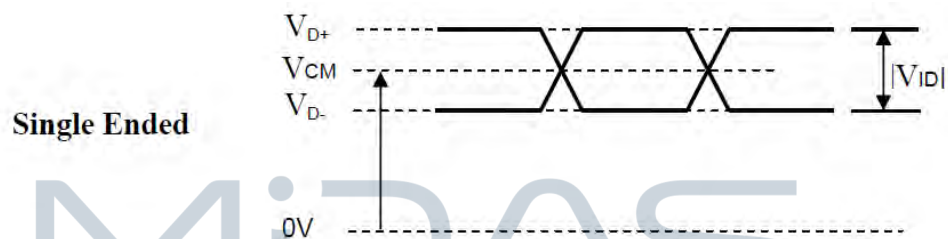


5.3 DISPLAY PORT SIGNAL TIMING SPECIFICATION

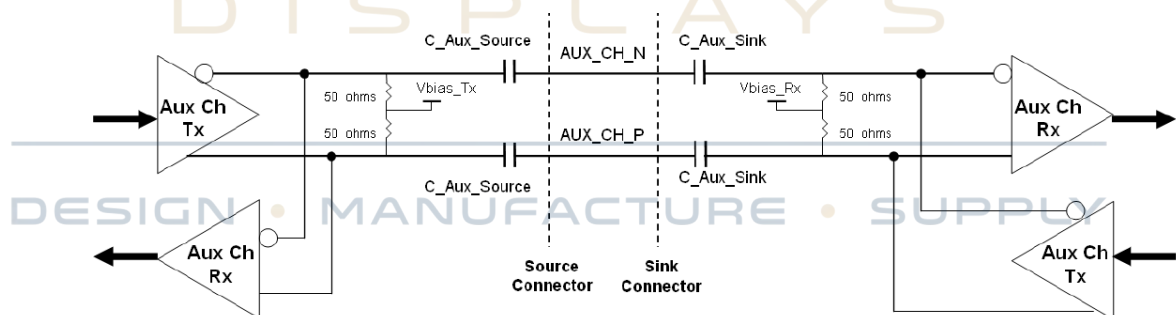
DISPLAY PORT INTERFACE

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Differential Signal Common Mode Voltage(MainLink and AUX)	VCM	0		2	V	(1)(4)
AUX AC Coupling Capacitor	C_Aux_Source	75		200	nF	(2)
Main Link AC Coupling Capacitor	C_ML_Source	75		200	nF	(3)
DPCD Version (Address 00000h)	-	0x11h			-	(5)

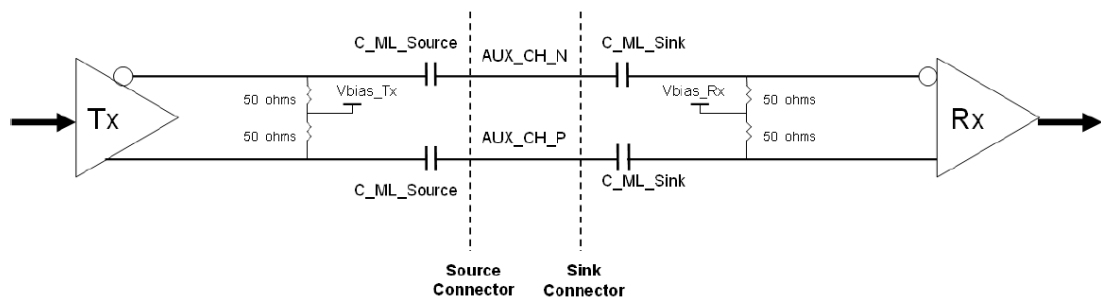
Note (1) Display port interface related AC coupled signals should follow VESA DisplayPort Standard Version1. Revision 1a and VESA Embedded DisplayPort™ Standard Version 1.2. There are many optional items described in eDP1.2. If some optional item is requested, please contact us.



(2) Recommended eDP AUX Channel topology is as below and the AUX AC Coupling Capacitor (C_Aux_Source) should be placed on the source device.



(3) Recommended Main Link Channel topology is as below and the Main Link AC Coupling Capacitor (C_ML_Source) should be placed on the source device.



(4) The source device should pass the test criteria described in DisplayPortCompliance Test Specification (CTS) 1.1

(5) The DPCD revision number is specified at DPCD address 00000h, and its detail definition is listed as the following table according to the above documents about DP and eDP.

(6) This Panel does not support PSR/MBO Function.

(7) This Panel does not enable SSC (Spread-Spectrum clocking) function internally.

COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-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					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	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
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	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
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
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green(0)/Dark	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	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
Gray Scale Of Blue	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue(0)/Dark	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	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

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



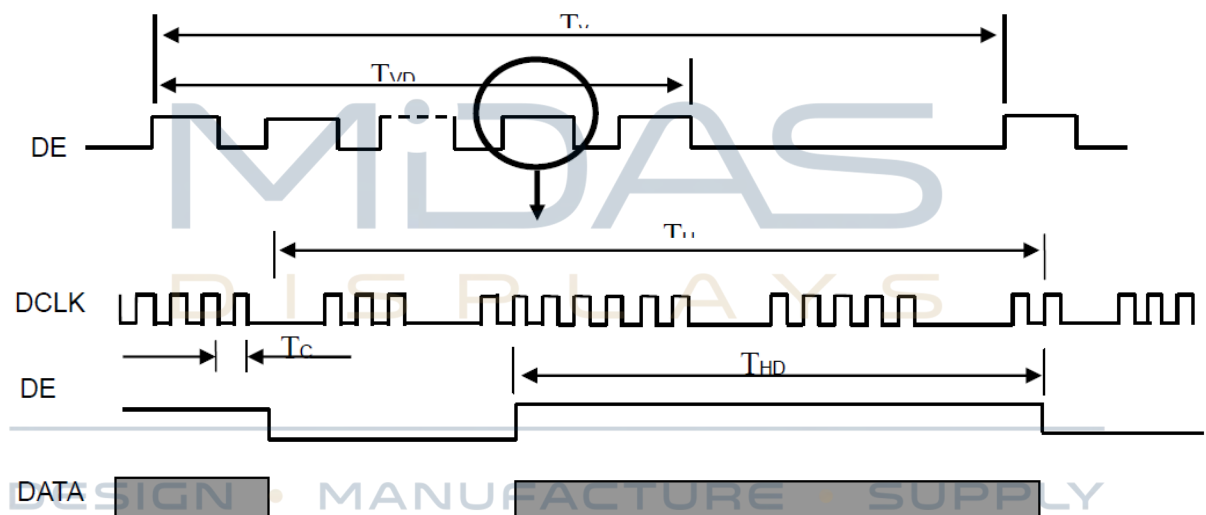
5.4 DISPLAY TIMING SPECIFICATIONS

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

Refresh rate 60Hz

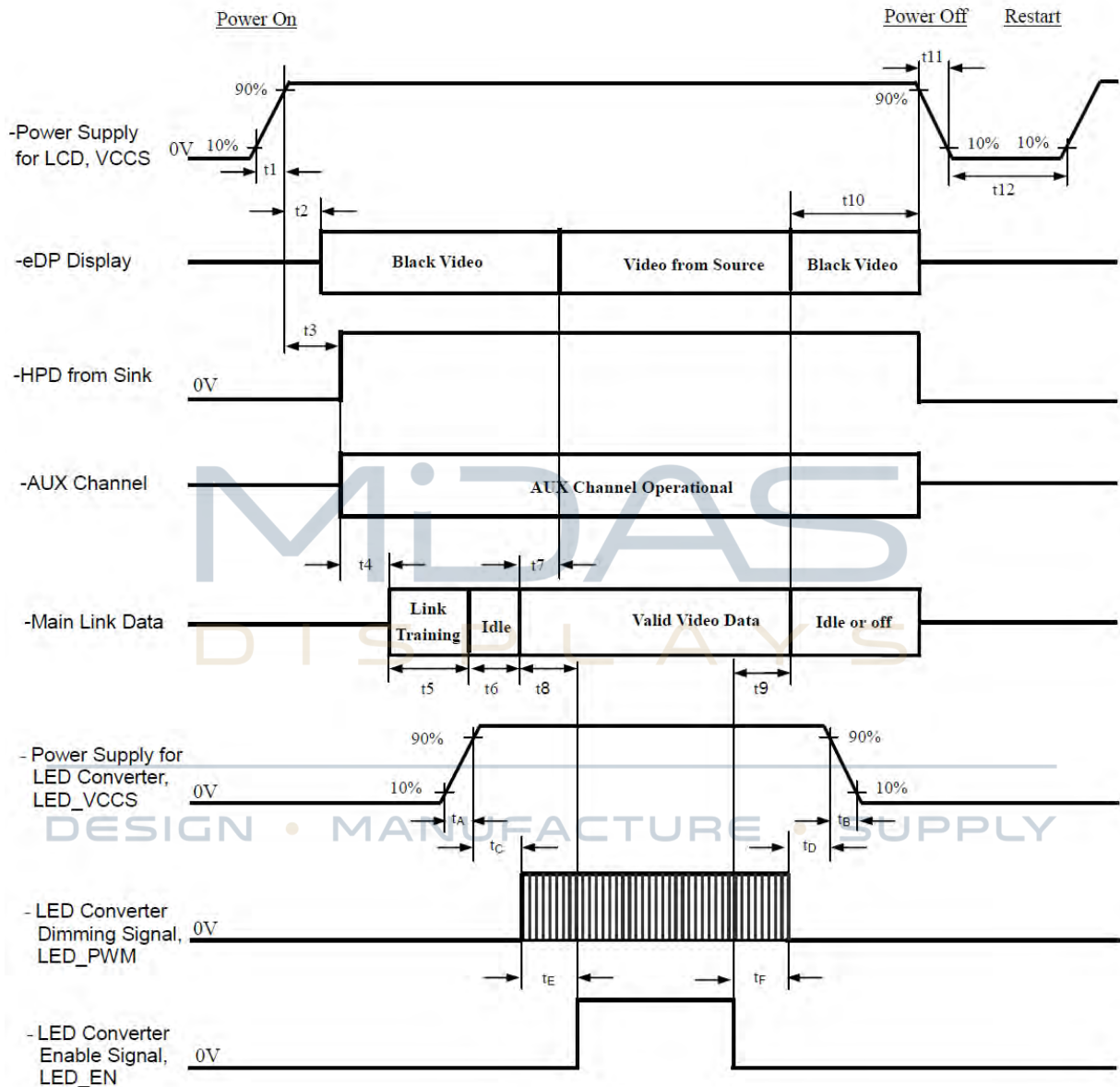
Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	152.08	152.84	153.6	MHz	-
DE	Vertical Total Time	TV	1128	1132	1136	TH	-
	Vertical Active Display Period	TVD	1080	1080	1080	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	52	TV-TVD	TH	-
	Horizontal Total Time	TH	2230	2250	2270	Tc	-
	Horizontal Active Display Period	THD	1920	1920	1920	Tc	-
	Horizontal Active Blanking Period	THB	TH-THD	330	TH-THD	Tc	-

INPUT SIGNAL TIMING DIAGRAM



5.5 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.



Timing Specifications:

Parameter	Description	Reqd. By	Value		Unit	Notes
			Min	Max		
t1	Power rail rise time, 10% to 90%	Source	0.5	10	ms	-
t2	Delay from LCD,VCCS to black video generation	Sink	0	200	ms	Automatic Black Video generation prevents display noise until valid video data is received from the Source (see Notes:2 and 3 below)
t3	Delay from LCD,VCCS to HPD high	Sink	0	200	ms	Sink AUX Channel must be operational upon HPD high (see Note:4 below)
t4	Delay from HPD high to link training initialization	Source	0	-	ms	Allows for Source to read Link capability and initialize
t5	Link training duration	Source	0	-	ms	Dependant on Source link training protocol
t6	Link idle	Source	0	-	ms	Min Accounts for required BS-Idle pattern. Max allows for Source frame synchronization
t7	Delay from valid video data from Source to video on display	Sink	0	50	ms	Max value allows for Sink to validate video data and timing. At the end of T7, Sink will indicate the detection of valid video data by setting the SINK_STATUS bit to logic 1 (DPCD 00205h, bit 0), and Sink will no longer generate automatic Black Video
t8	Delay from valid video data from Source to backlight on	Source	80	-	ms	Source must assure display video is stable *: Recommended by INX. To avoid garbage image.
t9	Delay from backlight off to end of valid video data	Source	50	-	ms	Source must assure backlight is no longer illuminated. At the end of T9, Sink will indicate the detection of no valid video data by setting the SINK_STATUS bit to logic 0 (DPCD 00205h, bit 0), and Sink will automatically display Black Video. (See Notes: 2 and 3 below) *: Recommended by INX. To avoid garbage image.
t10	Delay from end of valid video data from Source to power off	Source	0	500	ms	Black video will be displayed after receiving idle or off signals from Source
t11	VCCS power rail fall time, 90% to 10%	Source	0.5	10	ms	-



t ₁₂	VCCS Power off time	Source	500	-	ms	-
t _A	LED power rail rise time, 10% to 90%	Source	0.5	10	ms	-
t _B	LED power rail fall time, 90% to 10%	Source	0	10	ms	-
t _C	Delay from LED power rising to LED dimming signal	Source	1	-	ms	-
t _D	Delay from LED dimming signal to LED power falling	Source	1	-	ms	-
t _E	Delay from LED dimming signal to LED enable signal	Source	0	-	ms	-
t _F	Delay from LED enable signal to LED dimming signal	Source	0	-	ms	-

Note (1) Please don't plug or unplug the interface cable when system is turned on.

Note (2) The Sink must include the ability to automatically generate Black Video autonomously. The Sink must automatically enable Black Video under the following conditions:

- Upon LCDVCC power-on (within T2 max)
- When the "NoVideoStream_Flag" (VB-ID Bit 3) is received from the Source (at the end of T9)

Note (3) The Sink may implement the ability to disable the automatic Black Video function, as described in Note (2), above, for system development and debugging purposes.

Note (4) The Sink must support AUX Channel polling by the Source immediately following LCDVCC power-on without causing damage to the Sink device (the Source can re-try if the Sink is not ready). The Sink must be able to response to an AUX Channel transaction with the time specified within T3 max.

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6. Reliability Test

Environment test conditions are listed as following table.

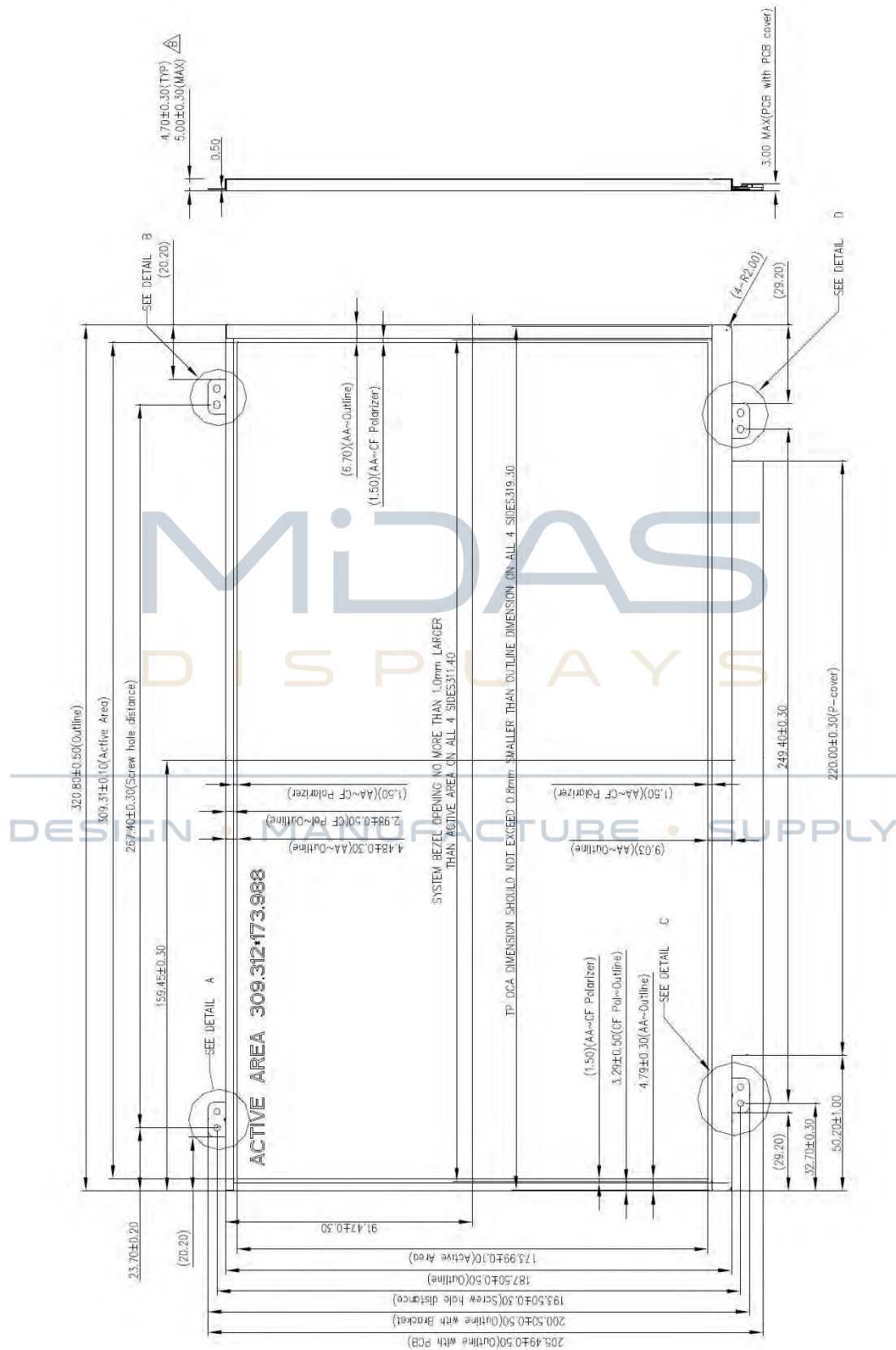
Items	Required Condition	Note
Temperature Humidity Bias (THB)	Ta= 50°C, 80%RH, 240hours	
High Temperature Operation (HTO)	Ta= 50°C, 240hours	3
Low Temperature Operation (LTO)	Ta= 0°C, 240hours	
High Temperature Storage (HTS)	Ta= 60°C, 240hours	
Low Temperature Storage (LTS)	Ta= -20°C, 240hours	
Drop Test	Height: 60 cm, package test	
Thermal Shock Test (TST)	-20°C/30min, 60°C/30min, 100 cycles	
On/Off Test	On/10sec, Off/10sec, 30,000 cycles	
ESD (ElectroStatic Discharge)	Contact Discharge: ± 8KV, 150pF(330Ω) 1sec, 9 points, 25 times/ point.	
	Air Discharge: ± 15KV, 150pF(330Ω) 1sec 9 points, 25 times/ point.	

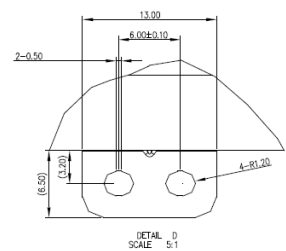
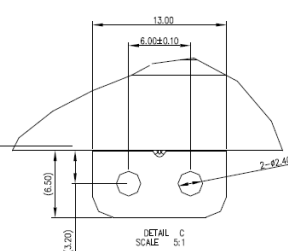
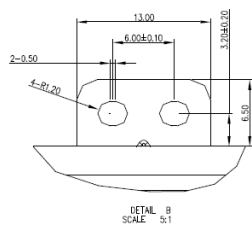
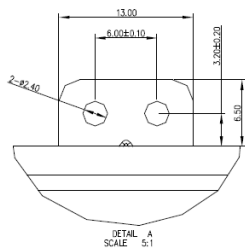
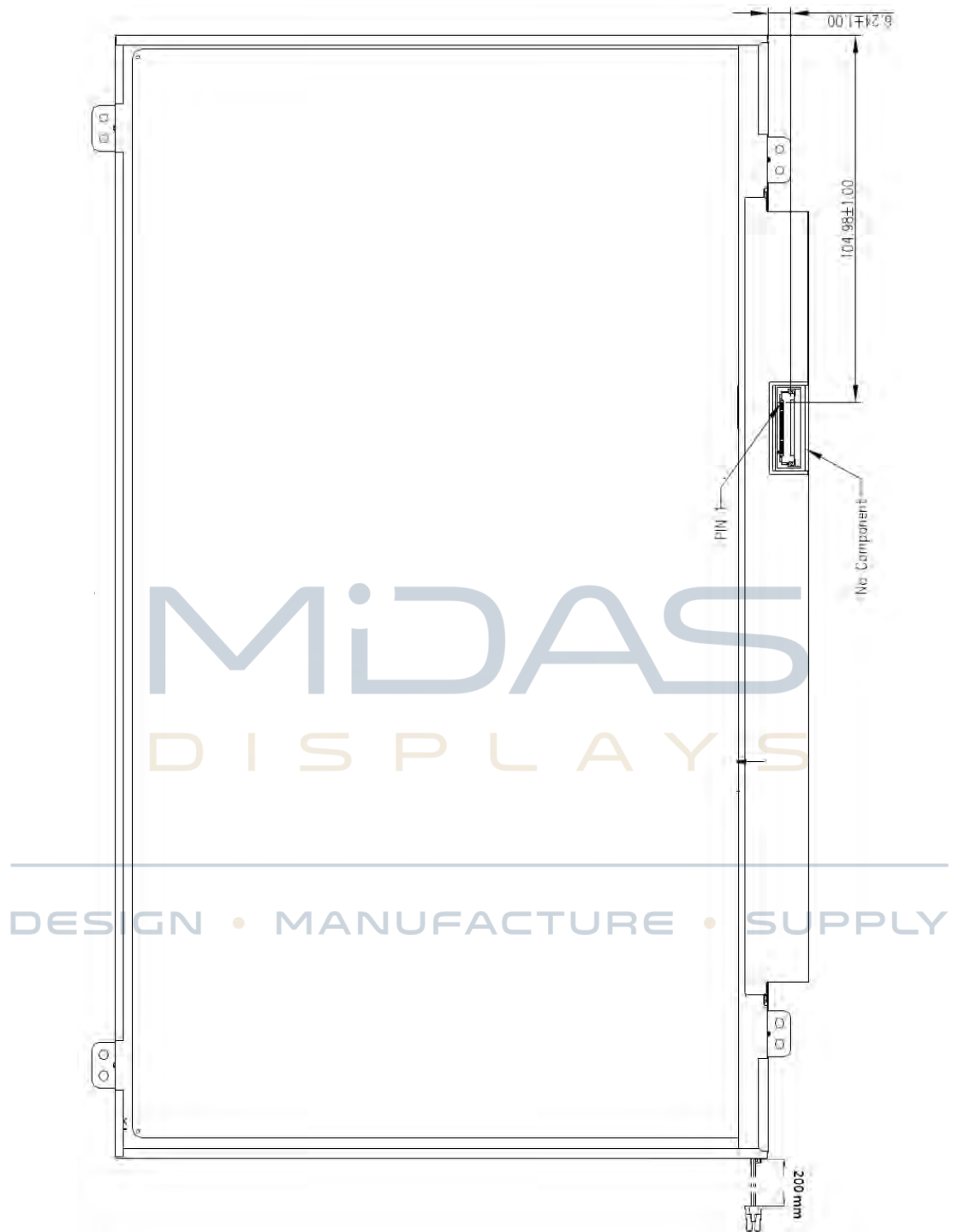
Note 1: The TFT-LCD module will not sustain damage after being subjected to 100 cycles of rapid temperature change. A cycle of rapid temperature change consists of varying the temperature from -20°C to 60°C, and back again. Power is not applied during the test. After temperature cycling, the unit is 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: The test items are tested by open frame type chassis.

MDT140001C





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DESIGN • MANUFACTURE • SUPPLY



9. PRECAUTIONS

9.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the LED wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

9.2 STORAGE PRECAUTIONS

- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of LED will be higher than the room temperature.

9.3 OPERATION PRECAUTIONS

- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.

