

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

PRODUCT NUMBER	84-0172-000T
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PRODUCT DESCRIPTION	7" RipDraw, 1024x600, LCD Module, TRMNS, WHT LED B/L, TFT, RoHS, ARM Board
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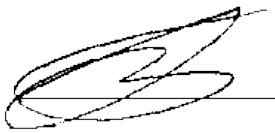
INTERNAL APPROVALS		
Product Manager	Engineering	Document Control
Gregory Hayes 		
Date:11-30-2014	Date:	Date:

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REVISION RECORD

Rev.	Date	Page	Par.	Comment	ECN no.
A	1/23/13	--	--	Preliminary DCA Release	E4750
B	2/18/13	8,9,10	--	Block diagram updated and PCB layout added.	E4769
C	4/5/13	5	--	PCB location updated.	E4789
D	4/24/13	5	--	Power connector details added.	E4791
E	5/28/13	4,9	--	Brightness and thickness updated.	E4807
F	10/28/13	4,5,13	--	Remove reference to parallel ports	E4877
G	11/14/13	13	--	SPI Ext IO Change to J9.	E4888
H	5/7/14	5	--	Recommended Mating screw added.	E4968
I	11/30/2014	6,16	--	Temperature Ratings corrected	E5043

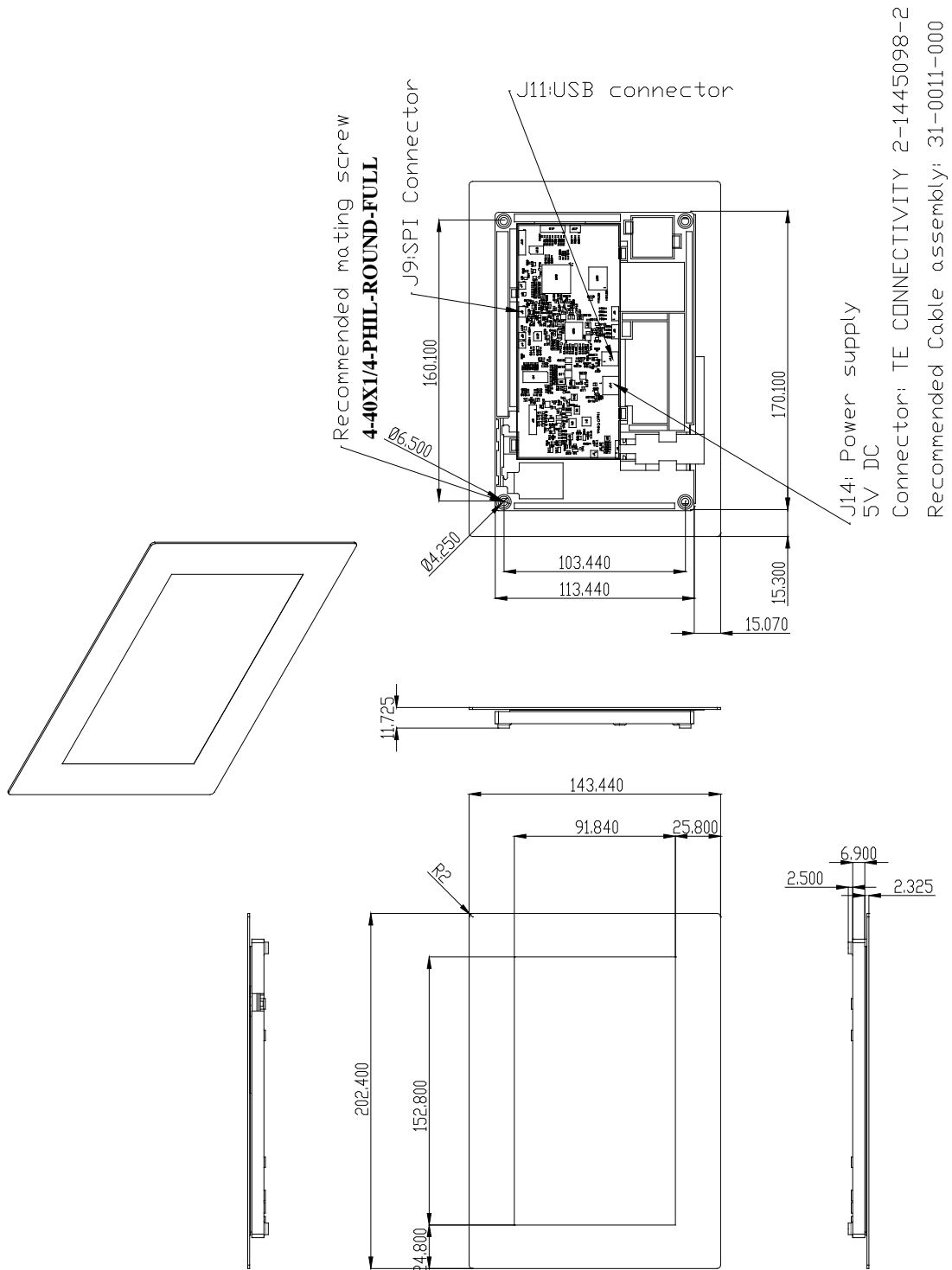
1 GENERAL SPECIFICATIONS

ITEM	DESCRIPTION	UNIT
Module Outline Dimensions	202.4 (H) x 143.44(V) x 11.725 (T) (Not including cable)	mm
Active Display Area	153.6(H) x 90.0 (V)	mm
Pixel Configuration Format / Resolution	1024 (H) x 600 (V)	pixels
LCD Type	Transmissive / Normally Black	--
Backlight Type	LED	--
Interface	SPI 2Mhz, Serial 115200 Hz, USB 2.0	--
Luminance, White	352	cd/m2
Dot Pitch	0.050 x 0.150	mm
Color Depth	6-bit + 2-bit FRC, 16.7M Colors	--
RoHS Compliant	Yes	--
Surface Treatment	Clear coating, 7H	--

2 FEATURES

- The display module is a 7” diagonal WSVGA supported TFT-LCD and can display 16.7M colors (Hi FRC).
- Glass-film-film PCT, with USB interfaces.
- Ripdraw smart board
- Solidworks model available with Densitron NDA on file.

3 MECHANICAL DRAWING



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4 ABSOLUTE MAXIMUM RATINGS

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

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Values		Units	Notes
		Min	Max		
Power Input Voltage	VCC	-0.5	5.0	Vdc	at 25 ± 5°C
Operating Temperature	T _{OP}	-10	65	°C	[Note 2-1,2,3,4]
Storage Temperature	HST	-20	70	°C	[Note 2-1,2]

[Note 2-1] This rating applies to all parts of the module and should not be exceeded.

[Note 2-2] Maximum wet-bulb temperature is 46°C. Condensation of dew must be avoided as electrical current leaks will occur, causing a degradation of performance specifications.

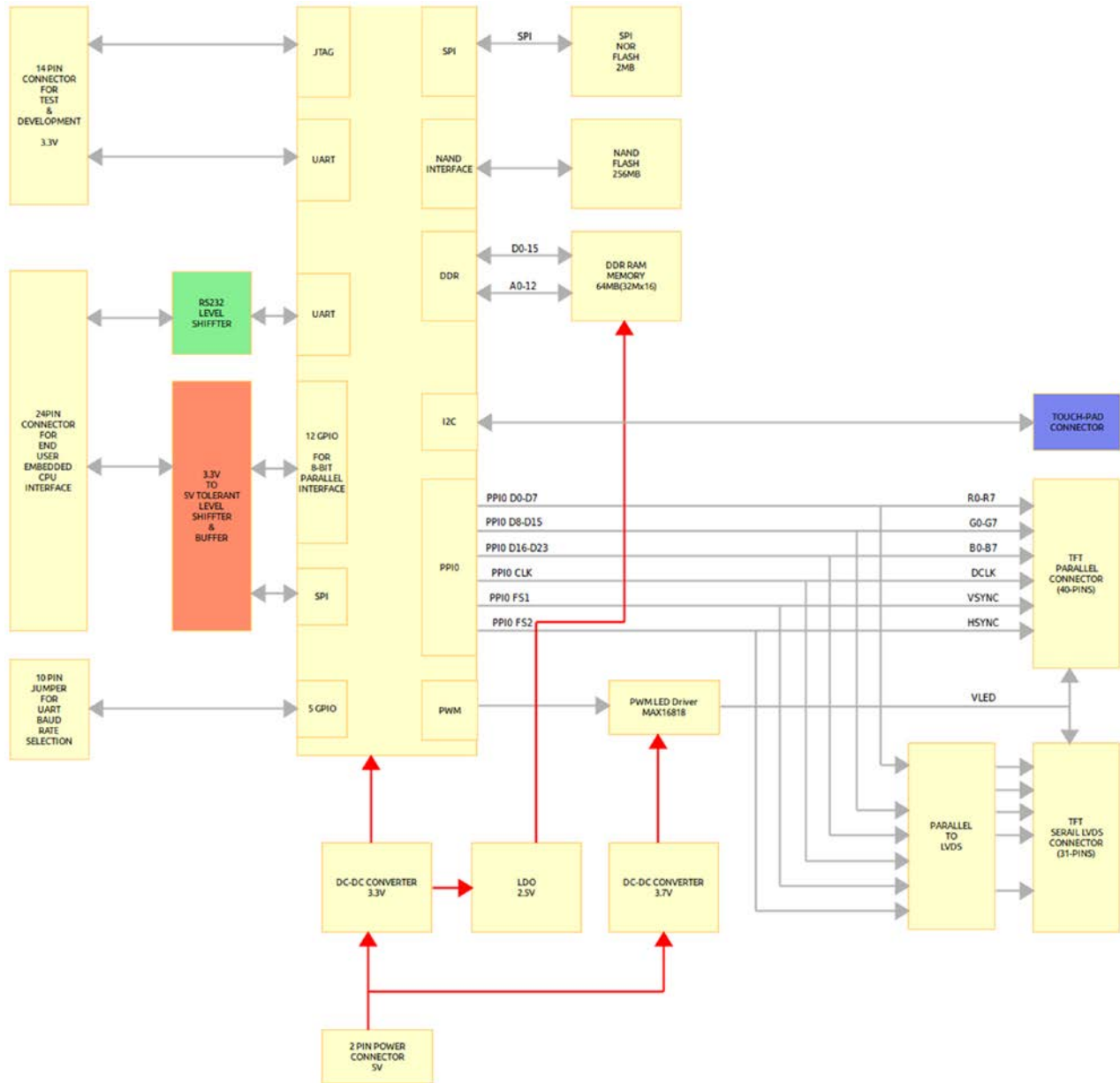
[Note 2-3] The operating temperature only guarantees operation of the circuit and doesn't guarantee all the contents of Electro-optical specification.

[Note 2-4] Ambient temperature when the backlight is lit (reference value).

5 ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Values			Unit
		Min	Typ	Max	
Power Supply Input Voltage	V _{CC}	4.9	5.0	5.1	V
Power Supply Input Current	I _{CC}	--	TBD	--	mA
Power Consumption	P _c	--	TBD	--	W

6 BLOCK DIAGRAM

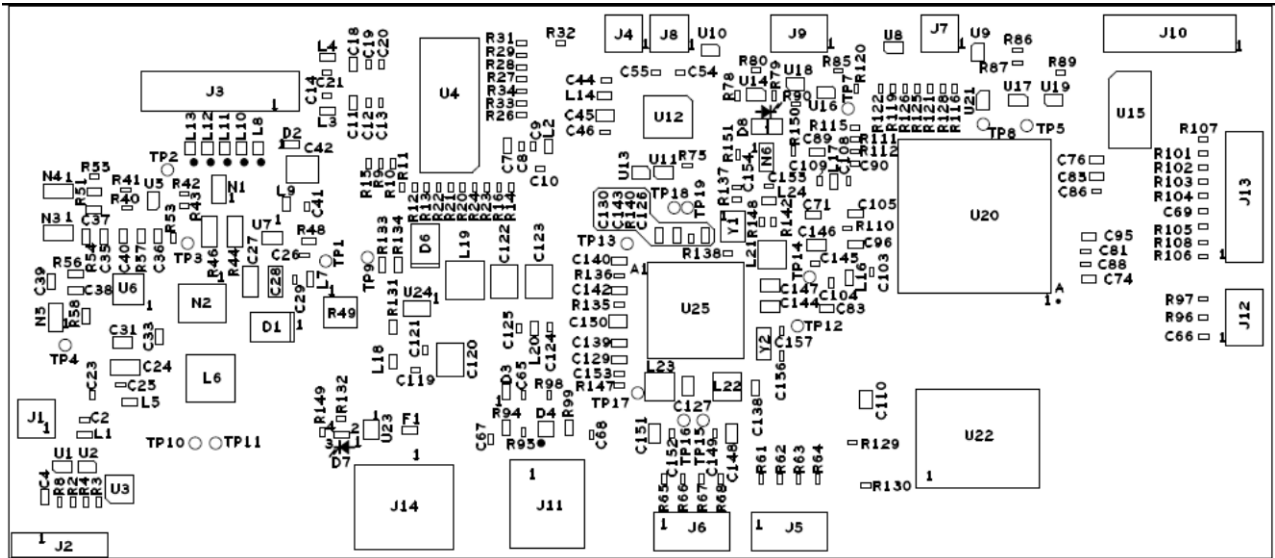


7 PCB LAYOUT

Assembly Top

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8 ELECTRO-OPTICAL CHARACTERISTICS

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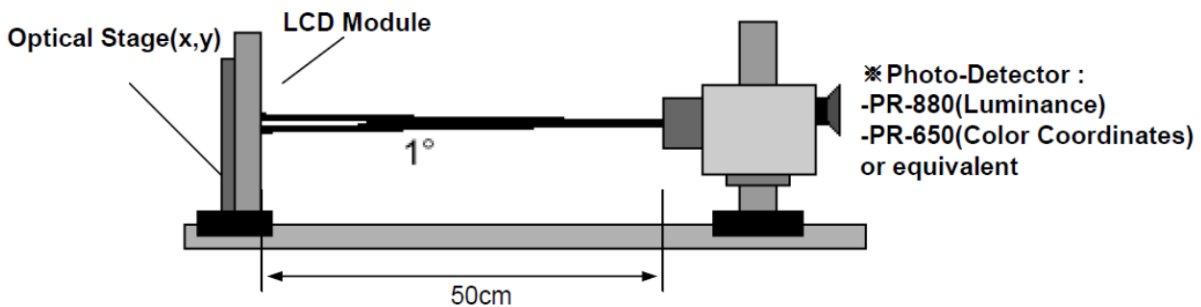
Ta=25°C, VCC=3.3V, fv=60Hz, f_{CLK}= 51.2MHz

Parameter	Symbol	Values			Units	Notes
		Min	Typ	Max		
Contrast Ratio	CR	640	800	-		1
Surface Luminance, white	L _{WH}	-	352	-	cd/m ²	@20mA, 2
Luminance Variation	δ _{WHITE}		1.18	1.34		3
Response Time(Rise Time + Decay Time)	Tr _R + Tr _D	-	-	40	ms	4
Color Coordinates						2
Red	RX	0.572	0.607	0.642		
	RY	0.317	0.352	0.387		
Green	GX	0.294	0.329	0.364		
	GY	0.539	0.574	0.609		
Blue	BX	0.121	0.156	0.191		
	BY	0.102	0.137	0.172		
White	WX	0.270	0.310	0.350		
	WY	0.300	0.340	0.380		
Viewing Angle						5
x axis, right(Φ=0°)	θ _r	75	85	-	degree	3 o'clock
x axis, left (Φ=180°)	θ _l	75	85	-	degree	9 o'clock
y axis, up (Φ=90°)	θ _u	75	85	-	degree	12 o'clock
y axis, down (Φ=270°)	θ _d	75	85	-	degree	6 o'clock

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 5 minutes in a dark environment at 25°C. The values specified are at an approximate distance 50cm 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.

FIG. 1 Optical Characteristic Measurement Equipment and Method



[Note 4-1] Contrast Ratio(CR) is defined mathematically as

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

[Note 4-2] Surface luminance is measured at the center point(L₁) of the LCD with all pixels displaying white at the distance of 50cm by PR-880. Color Coordinates are measured at the center point(L₁) of the LCD with all pixels displaying red, green, blue and white at the distance of 50cm by PR-650. For more information, refer to the FIG 1 and FIG 2.

[Note 4-3] Luminance uniformity is measured for 9 point For more information see FIG 2.

$$\delta_{\text{WHITE}} = \text{Maximum}(L_1, L_2, \dots, L_9) \div \text{Minimum}(L_1, L_2, \dots, L_9)$$

[Note 4-4] Response time is the time required for the display to transition from white to black (Rise Time, Tr_R) and from black to white(Decay Time, Tr_D). For additional information see FIG 3.

[Note 4-5] 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 FIG 4.

FIG. 2 Luminance

<measuring point for surface luminance & measuring point for luminance variation>

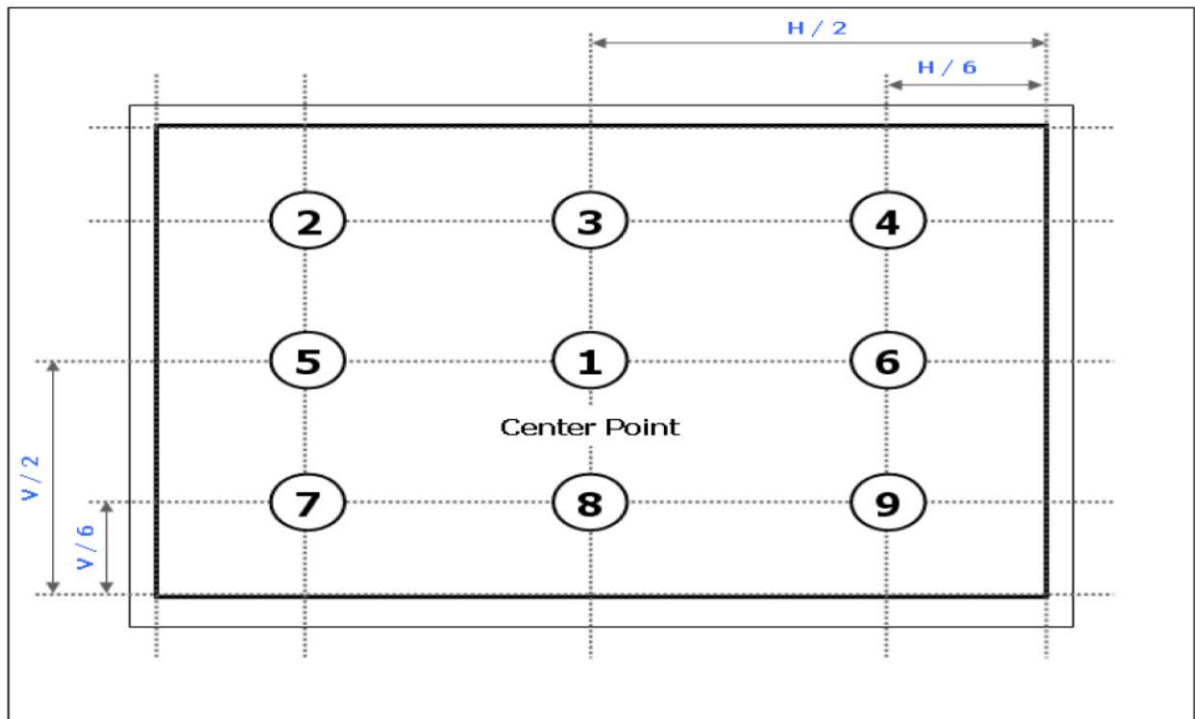


FIG. 3 Response Time

The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.

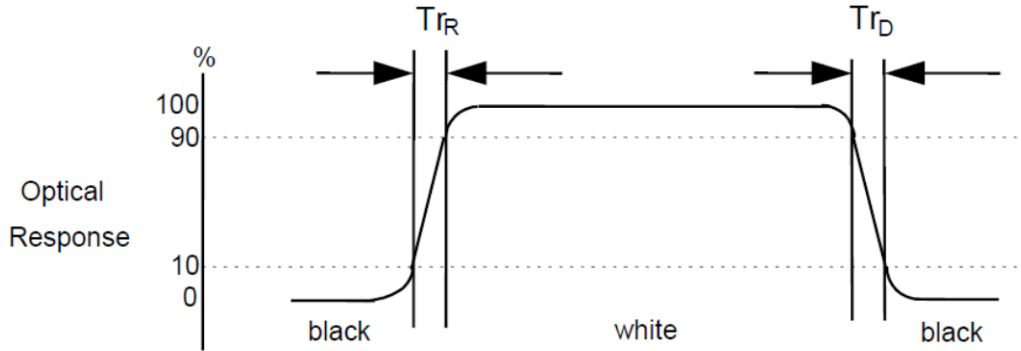
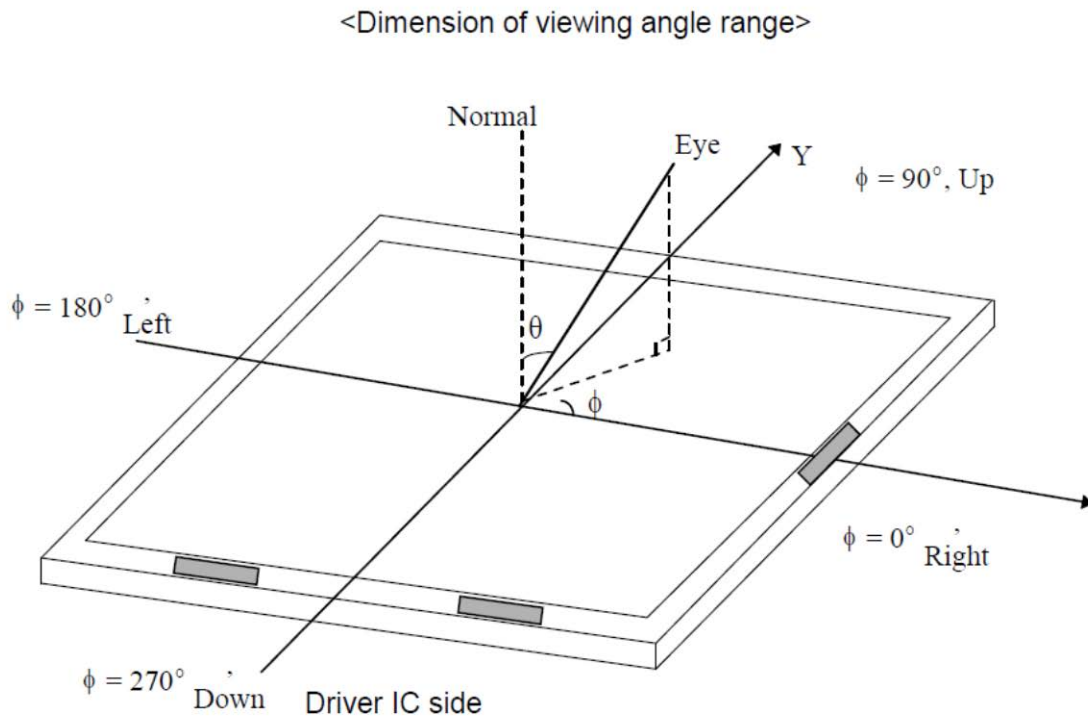


FIG. 4 Viewing angle



9 JUMPERS CONFIGURATION

9.1 Touch Voltage Selection (J1)

This jumper is used to set the Touch Panel operating voltage selection.

Pin	Description
1-2	Close for 5V touch panel
3-4	Close for 3.3V touch panel

9.2 Interface Voltage Selection for Commands (J4)

This jumper used to set the Interface IO voltage selection for:

1. Serial Interface (Low Voltage) for commands (J7)
2. SPI (Serial Peripheral Interface) for commands (J9)

Pin	Description
1-2	Close for 3.3V IO voltage
3-4	Close for 5V IO voltage

9.3 Serial Interface Baud Rate Selection (J5)

The jumper used to select the baud rate for below serial interface. - Serial Interface (Low Voltage) for commands (J7) - Serial Interface (RS232) for commands (J8).

Pin	Description
1-2	57600
3-4	38400
4-6	19200
7-8	9600
NONE	All options are open then 115200 baud rate selected.

9.4 Interface Selection for Commands (J6)

The jumper used to set the command interface for the application. The RipDraw board application will selected interface to listen for incoming commands.

Pin	Description
1-2	Serial Interface (Low Voltage) for commands (J7)
3-4	Serial Interface (RS232) for commands (J8)
5-6	SPI (Serial Peripheral Interface) for commands (J9)
7-8	Unused.
NONE	All options are open then USB Device Interface (J11)

10 CONNECTORS

10.1 Touch (J2)

10.2 LCD (J3)

10.3 Serial Interface (Low Voltage) for Commands (J7)

The Serial Interface UART for commands. The voltage level of the signal can be configured using jumper J4.

Pin	Name	Description
1	5V	5V power
2	D-	Data differential pair minus
3	D+	Data differential pair plus
4	ID	On the Go Identification
5	GND	Ground
Electrical		
For cable length and propagation delays calculation, add the buffer/driver delay * For VCC = 5V, it is 5ns/V * For VCC = 3.3V, it is 10ns/V		
ESD details of the voltage level translation/buffer/drivers Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II ESD Protection Exceeds JESD 22 * 2000-V Human-Body Model (A114-A) * 200-V Machine Model (A115-A) * 1000-V Charged-Device Model (C101)		

10.4 Serial Interface for Commands (J8)

The Serial Interface for commands. The voltage level of RS-232 standard.

Pin	Name	Description
1	TX	Serial data output signal
2	RX	Serial data input signal
3	RESET	Active low to reset the RipDraw board
4	GND	Ground
Electrical		
Cable length as per standard		
ESD Protection for RS-232 Pins * ±15-kV Human-Body Model (HBM) * ±8-kV IEC 61000-4-2 Contact Discharge * ±15-kV IEC 61000-4-2 Air-Gap Discharge		

Note: For pin no. 3, voltage level can be configured using jumper J4.

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10.5 SPI (Serial Peripheral Interface) for Commands (J9)

Pin	Name	Description
1	CLK	Serial clock
2	MISO	Master Input, Slave Output
3	SIMO	Slave Input, Master Output
4	CS	Chip Select
5	RESET	Active low to reset the RipDraw board
6	GND	Ground

Electrical

For cable length and propagation delays calculation, add the buffer/driver delay

* For VCC = 5V, it is 5ns/V

* For VCC = 3.3V, it is 10ns/V

ESD details of the voltage level translation/buffer/drivers

Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II

ESD Protection Exceeds JESD 22

* 2000-V Human-Body Model (A114-A)

* 200-V Machine Model (A115-A)

* 1000-V Charged-Device Model (C101)

Note: The voltage level of the signal can be configured using jumper J4.

10.6 USB Device Interface (J11)

The mini AB connector used to connect the board with PC as USB device. It emulates the USB to virtual serial, see [USB Device Driver Installation](#).

Pin	Name	Description
1	5V	5V power
2	D-	Data differential pair minus
3	D+	Data differential pair plus
4	ID	On the Go Identification
5	GND	Ground

10.7 Serial Interface for Development (J12)

10.8 JTAG Interface for Development (J13)

10.9 Power Supply (J14)

The board requires a 5V 2A DC power supply.

Pin	Name	Description
1	5V	5V 2A DC
2	GND	Ground

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11 TEST POINTS

Test Point	Description
TP1	+ve Test Point to check the Back-light LED Voltage
TP2	-ve Test Point to check the Back-light LED Voltage
TP3	Test Point to Track the Back-light-Clock Out Pulse Signals.
TP4	For testing Back-light PWM signal Amplitude, Duty cycle, frequency, time and Voltage waveforms for the desired Output.
TP5	System Clock Out Test Point, here the clock is controlled through software
TP6	System External Clock Out to check the High Frequency external Crystal Oscillator Frequency (26MHz) given to the CPU
TP7	Test Point For Flashing the Board from GPMC (NAND)
TP8	System Power ON Reset here the processor generates the Reset signal when power is applied to the Device. It indicates that the device is operating in a known state.
TP9	Test Point to determine the Output 3.3V from the Voltage Regulator LMR10515XMF
TP10	Test point for Ground Reference
TP11	Test point for Ground Reference
TP12	Test Point to check the 1.8V input power given to the VDDA_DPLLS_DLL(Digital Phase Locked Loops and Delay Locked Loop) pin on the CPU
TP13	1.8V Test Point For CPU Vdds_MMC1 and Vdd_x input Voltage Supply
TP14	Used to Check the VDD1 1.2V CPU Core Supply
TP15	Used to Check the VDD2 1.2V CPU Core Supply
TP16	Test Point for 1.8V Selection for Board Flashing through Sys_Boot5
TP17	Test Point for 1.8V Selection for Board Flashing through Sys_Boot5
TP18	To Check CLKEN (Clock Enable) Signal is enabled to 1 to activate High frequency Clock Out when a device needs a clock other than 32.768KHZ.
TP19	REGEN Enable signal for External Low-Dropout

12 RELIABILITY TEST

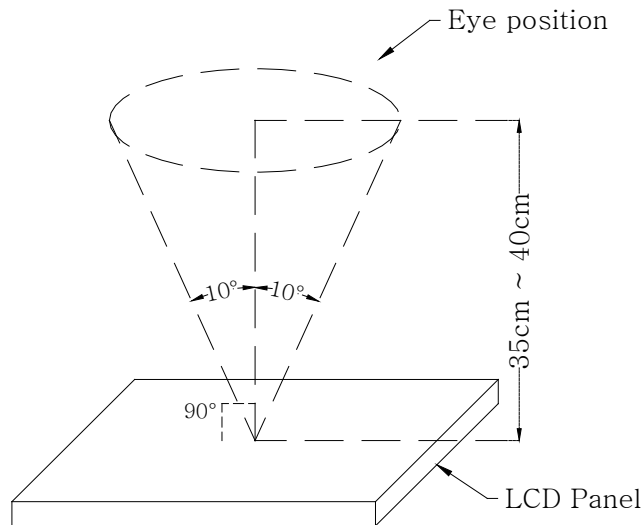
No.	Test Item	Test Condition
1	High Temperature Storage	70 ± 2 °C / 240 hours
2	Low Temperature Storage	-20 ± 2 °C / 240 hours
3	High Temperature Operation	65 ± 2 °C / 240 hours
4	Low Temperature Operation	-10 ± 2 °C / 240 hours
5	Temperature Cycle	-20 ± 2 °C ~ 70 °C (0.5hr.) X 50 Cycles
6	Proof against Dampness	50 ± 5 °C X 90% RH / 120 hours; Pure Water Used (Resistance > 10 MΩ)
7	Vibration Test	Frequency: 10 Hz ~ 55 Hz ~ 10 Hz Amplitude: 1.5 mm X,Y & Z directions for a total of 3 hours
8	Dropping Test	Dropped to the ground from 1 m height, one time and test ed on all sides of the carton when packed.
9	ESD Test	-Panel Surface/Top Case : 150pF, 150Ω (Air: ±15kV, Contact: ±8kV) -FPC input terminal: 100pF ±200V 0Ω
Inspection after Test		The sample is tested for the following defects after 2 ~ 4 hours of storage at room temperature: <ul style="list-style-type: none"> 1. Air bubbles in the LCD 2. Leaking Seal 3. No Display 4. Missing Segments 5. Glass Cracks 6. Idd current is higher than twice the initial value
Remarks: <ul style="list-style-type: none"> 1. The test samples are applicable to only one test group. 2. Sample size for each test group is 5 ~ 10 pieces. 3. In case of a malfunction caused by ESD test, if it recovers to the normal state after resetting, it would be judged as a good part. 4. EL backlights can produce black spots/blemishes in humidity and temperature test due to natural chemical reactions and fluorescence. This is checked for. 5. Please use automatic switch menu (or roll menu) in test mode. 		

13 INCOMING INSPECTION STANDARDS

13.1 The Environmental Condition for Inspection

The environmental condition and visual inspection shall be conducted as below.

- (1) Ambient temperature: 25 ± 5 °C
- (2) Humidity: 60 ± 5 % RH
- (3) Viewing distance: 35 ~ 40 cm approx.
- (4) Viewing angle: Normal to the LCD panel as shown below
- (5) Ambient Illumination: 300 ~ 500 Lux. for external appearance inspection.



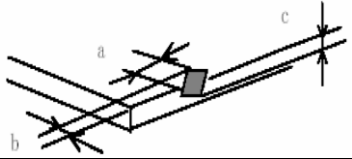
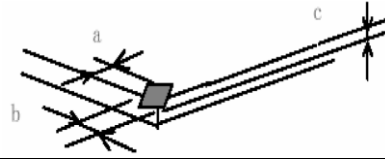
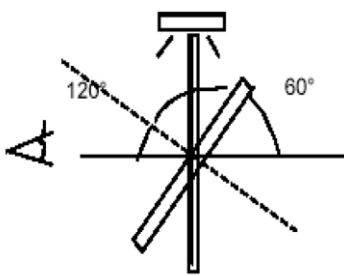
13.2 Classification of Defects and AQL

Class of defects	AQL	Definition
Major	1.0%	It is a defect that is likely to result in failure or to reduce materially the usability of the intended function.
Minor	1.5%	It is a defect that will not result in a functioning problem with deviation classified.

Note: Sampling plan according to GB / T2828.1-2003 / ISO 2859-1:1999 and ANSI/ASQC Z1.4-1993, Normal level 2.

13.3 Inspection Parameters

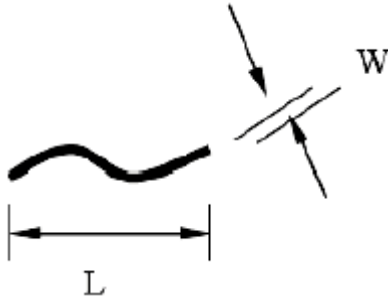
Item		Specification / Description			Note	
Display	Function	No display			-	
		Malfunction			-	
Operating	Contrast ratio	Out of spec.			-	
	Line defect	No obvious Vertical and Horizontal line defects for the bright, dark and colored.			-	
	Point defect (red, green, blue, black, white)	Item	Acceptable number			1, 4, 5, 6
			A	B	Total	
		Bright dot	$N \leq 2$	$N \leq 2$	$N \leq 7$	
		Black / dark dot	$N \leq 3$	$N \leq 4$		
		Total dots	$N \leq 4$	$N \leq 5$		
		Two adjacent dots	Not allowed			
Three or more adjacent dots	Not allowed					
External Inspection (Non-operating)	Scratch on the Polarizer	L (mm)	W (mm)	Acceptable number	2	
		$L \leq 2.5$	$W \leq 0.1$	4		
		$L > 2.5$	$W > 0.1$	0		
	Dent or bubble on the polarizer	Dimension (mm)		Acceptable number	3	
		$D \leq 0.5$		4		
		$D \leq 0.15$		Disregard		
	Foreign material on the polarizer	Dimension (mm)		Acceptable number	3	
		$D \leq 0.5$		4		
		$D \leq 0.15$		Disregard		

Item		Specification / Description			Note
Touch Panel (If Present)	Scratch	L (mm)	W (mm)	Acceptable number	2
		$L \leq 10$	$W < 0.05$	Disregard	
			$0.05 \leq W < 0.1$	$N \leq 4$	
			$W \geq 0.1$	0	
	Foreign materials (Linear shape)	$L \leq 10$	$W < 0.05$	Disregard	2
			$0.05 \leq W < 0.1$	$N \leq 3$	
			$W \geq 0.1$	0	
	Foreign materials (Circular shape)	Dimension (mm)		Acceptable number	3
		$D \leq 0.25$		Disregard	
		$0.25 < D \leq 0.5$		$N \leq 6$	
$D > 0.5$		0			
Glass chips			$a \leq 5\text{mm}$ $b \leq 3\text{mm}$ $c \leq t$ (t: Glass Thickness)	7	
			$a \leq 3\text{mm}$ $b \leq 3\text{mm}$ $c \leq t$ (t: Glass thickness)		
Newton's rings	(In case of doubtful situations only) Observe at 60° from the product surface for a while under a Fluorescent lamp. (3-Wavelength lamp)			If Average Diameter $\leq (1/3)$ Touch Panel Area, Disregard.	7

Notes:

1. The definition of dot defect: The dot defect was judged after repair and the size of a defective dot with size over 1/2 of one standard dot is regarded as one defective dot.

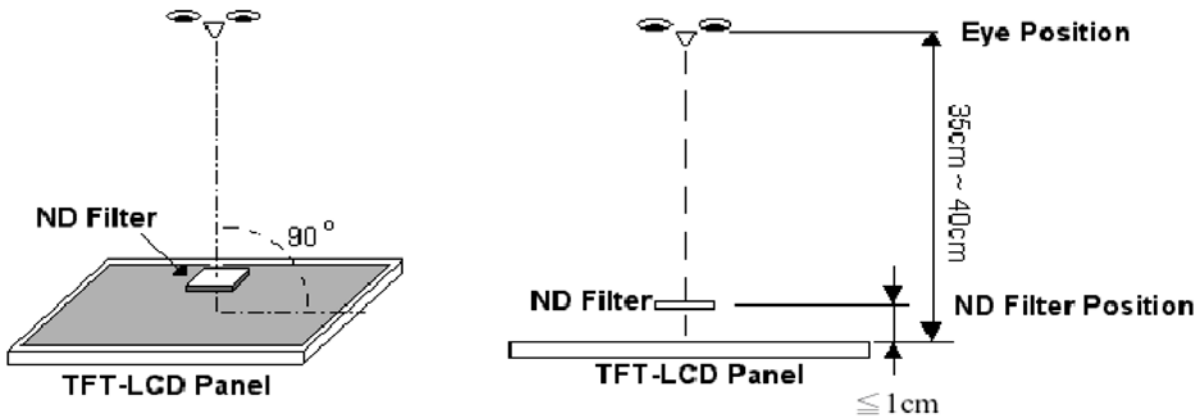
2.



3. Diameter - $D = (a + b) / 2$



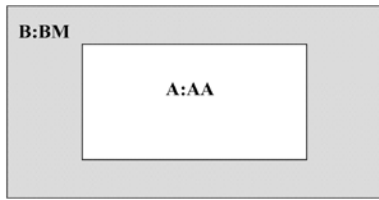
4. A bright dot is defined with 6% transmission ND filter as shown below:



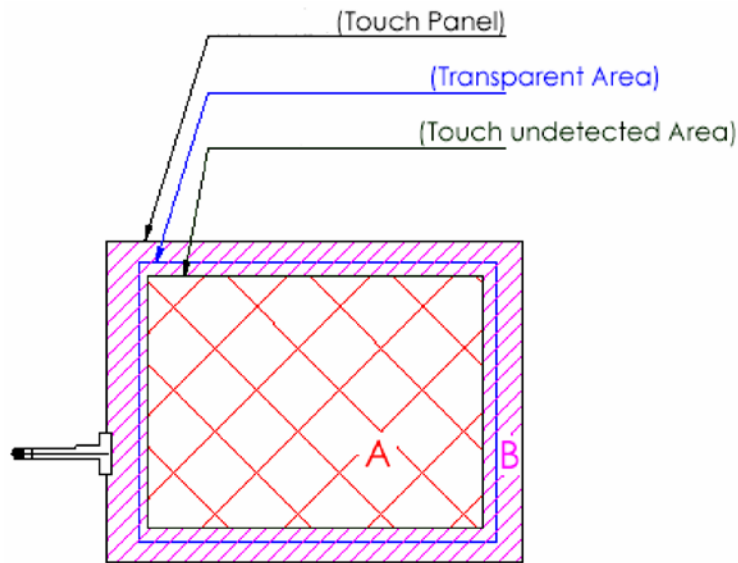
5. Adjacent Dots:



6.

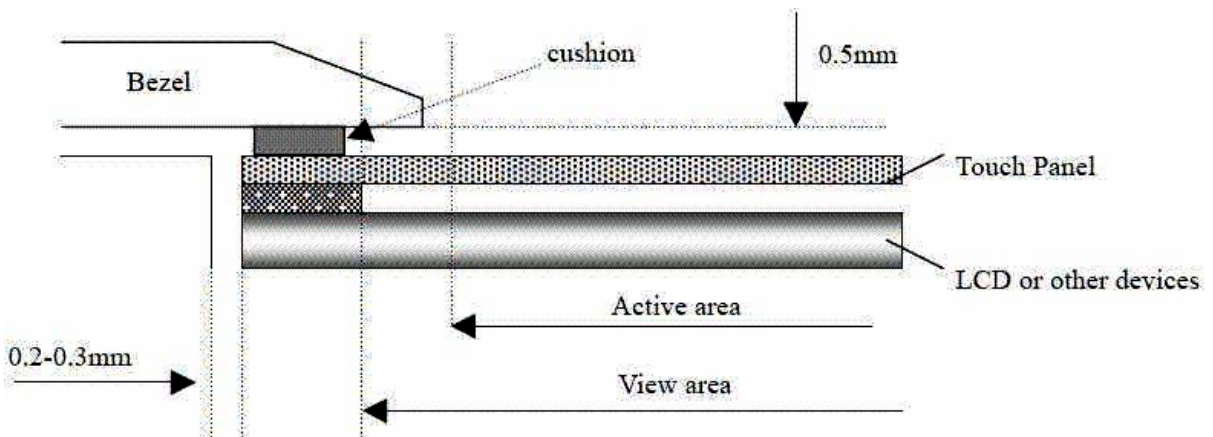


7.



A: Area without any defect point effect on normal operation
B: Defects are not specified in this area

GENERAL INSTALLATION AND ASSEMBLY DIAGRAM:



14 HANDLING PRECAUTIONS

Safety

If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes.
If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

Mounting and Design

Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.
When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean. Design the system so that no input signal is given unless the power supply voltage is applied.

Caution during LCD cleaning

Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotrifluoroethane. Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

Caution against static charge

As the display uses C-MOS LSI drivers, connect any unused input terminals to VDD or VSS. Do not input any signals before power is turned on. Also, ground your body, work / assembly table and assembly equipment to protect against static electricity.

Packaging

Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height.
To prevent displays from degradation, do not operate or store them exposed directly to sunlight or high temperature / humidity.

Caution during operation

It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life. Direct current causes an electrochemical reaction with remarkable deterioration of the display quality. Give careful consideration to prevent direct current during ON/OFF timing and during operation.
Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged. If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once. Even a small amount of condensation on the contact pads (terminals) can cause an electrochemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

Storage

Store the display in a dark place where the temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and the humidity below 50% RH.
Store the display in a clean environment, free from dust, organic solvents and corrosive gases.
Do not crash, shake or jolt the display (including accessories).

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