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LIQUID CRYSTAL DISPLAY MODULE  
MODEL: MTV-C32240AMNNSCW-H-1  
Customer's No.:

Acceptance

*Microtips Technology Inc.  
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Approved and Checked by

Approved by	Checked by	Made by
		



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Revise Records

Rev.	Date	Contents	Written	Approved
A	09/27/2004	Initial Release	David Ma	Garry Chen

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	



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## 1. General Specifications

Operating Temperature	:	Min. 0°C ~ Max. 50°C
Storage Temperature	:	Min. -10°C ~ Max. 60°C
Dot Pixels	:	320 (W) RGB x 240 (H) dots
Dot Size	:	0.105 (W) x 0.345 (H) mm
Dot Pitch	:	0.120 (W) RGB x 0.360 (H) mm
Viewing Area	:	118.2 (W) x 89.4 (H) mm
Active Area	:	115.19 (W) x 86.39 (H) mm
Outline Dimensions	:	154.6* (W) x 114.8 (H) x 8.5** (D) mm
		* Without cable/connector
		** Without CCFL cable/connector
Weight	:	None
LCD Type	:	Color STN/ Negative / Transmissive
Viewing Direction	:	6:00
Data Transfer	:	8-bit parallel data transfer
Backlight	:	CCFL B/L x1
Drawings	:	As attached drawings



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## 2. Electrical Specifications

### 2.1 Absolute Maximum Ratings

$V_{SS} = 0V$

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage (Logic)	$V_{DD} - V_{SS}$	--	-0.3	7.0	V
Supply Voltage (LCD Drive)	$V_{EE} - V_{SS}$	--	0	40.0	V
Input Voltage	$V_I$	--	-0.3	$V_{DD}+0.3$	V

### 2.2 DC Characteristics

$T_a = 25^\circ C, V_{SS} = 0V$

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Supply Voltage (Logic)	$V_{DD} - V_{SS}$	--	2.5	5.0	5.5	V
Supply Voltage (LCD)	$V_{LCD} - V_{SS}$	Shown in 3.1				V
High Level Input Voltage	$V_{IH}$	$V_{DD} = 2.7V - 5.0V$	$0.8V_{DD}$	--	--	V
Low Level Input Voltage	$V_{IL}$		--	--	$0.2V_{DD}$	V
High Level Output Voltage	$V_{OH}$	$I_{DD} = 0.5mA$	$V_{DD}-0.4$	--	--	
Low Level Output Voltage	$V_{OL}$	$I_{DD} = -0.5mA$	--	--	0.4	
Supply Current	$I_{DD}$	$V_{DD} = 5.0V$	--	0.5	1.0	mA
	$I_{EE}$		--	7.0	13.0	mA

Note1:  $V_{DD} = 5.0V$ , Data, SCP, LP, FP are concerned.

Note2: Measuring Condition :

Temperature =  $25^\circ C$

Vop = Vop at optimum Contrast

Frame = 70Hz

Display pattern = Checkered pattern



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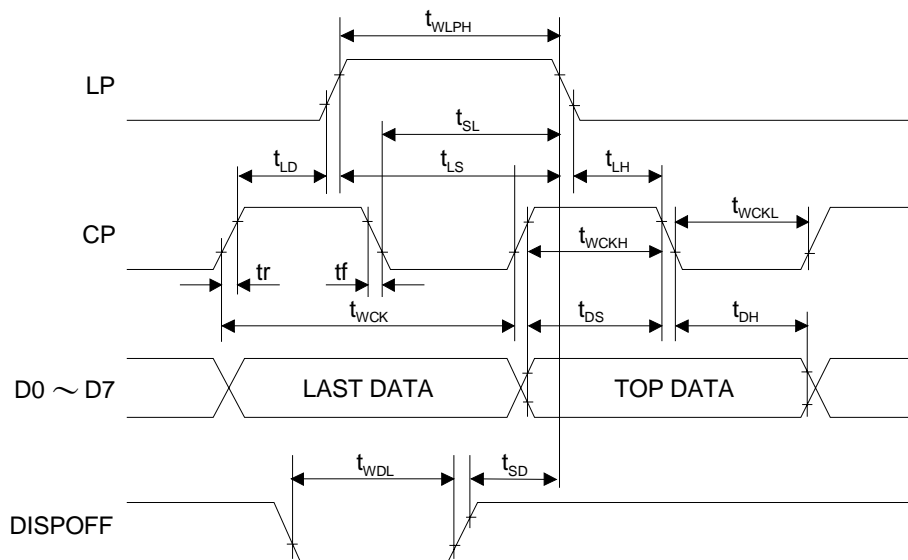
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### 2.3 AC Characteristics

$V_{DD} = 5.0V \pm 10\%$

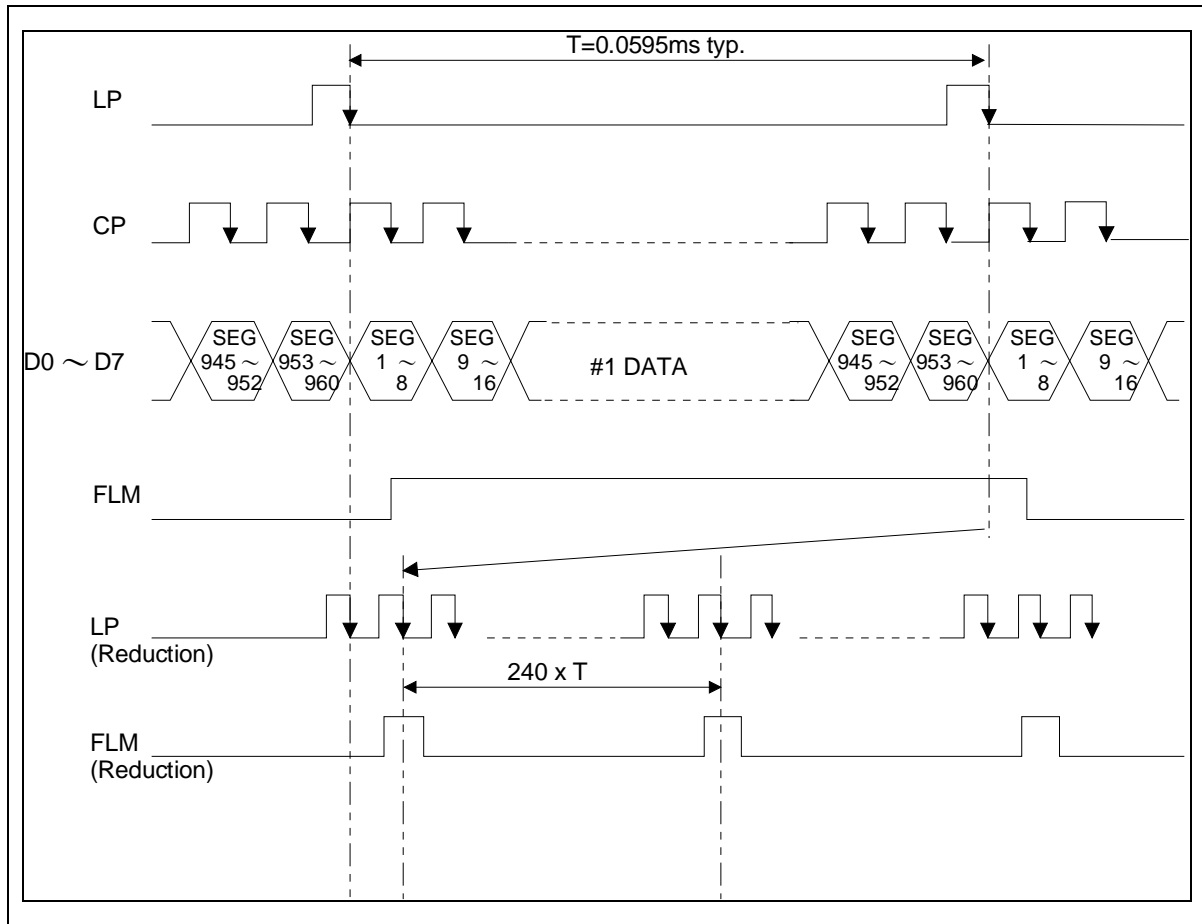
Parameter	Symbol	Min.	Max.	Units
Clock Pulse Cycle Time	$t_{WCK}$	25	--	ns
Clock Pulse High Level Width	$t_{WCKH}$	10	--	ns
Clock Pulse Low Level Width	$t_{WCKL}$	10	--	ns
Latch Pulse High Level Width	$t_{WLPH}$	25	--	ns
CP → LP Rise Time	$t_{LD}$	20	--	ns
CP → LP Fall Time	$t_{SL}$	20	--	ns
LP → CP Rise Time	$t_{LS}$	50	--	ns
LP → CP Fall Time	$t_{LH}$	50	--	ns
Clock Pulse Rise/Fall Time	$t_r, t_f$	--	20	ns
Data Setup Time	$t_{DS}$	6	--	ns
Data Hold Time	$t_{DH}$	6	--	ns
DISPOFF Low Level Width	$t_{WDL}$	1.2	--	$\mu s$
DISPOFF Cancellation Time	$t_{SD}$	--	500	ns

Note: During Latch Pulse is "H" level. Please make sure to keep Clock Pulse in "L" level.

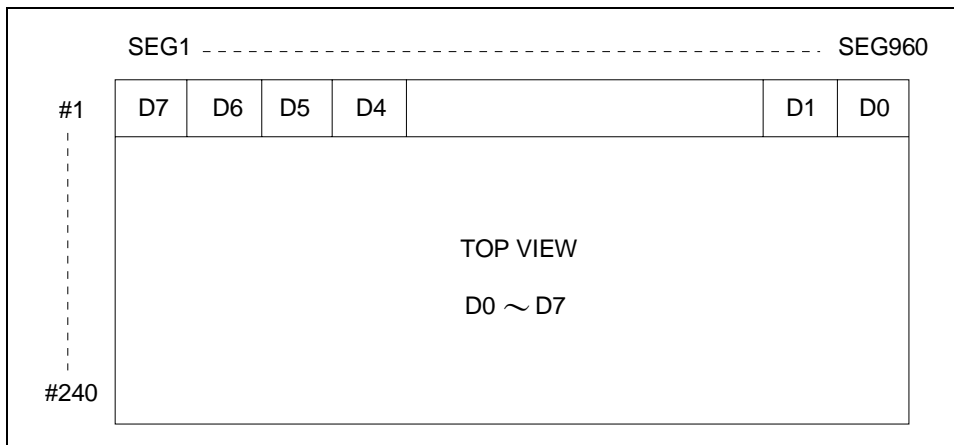


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### 2.4 Interface Timing



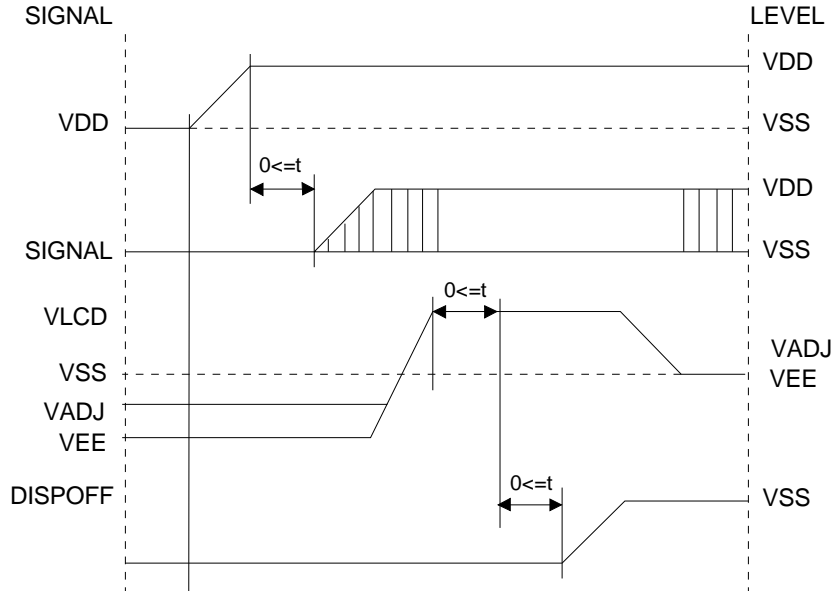
### 2.5 Display Pattern



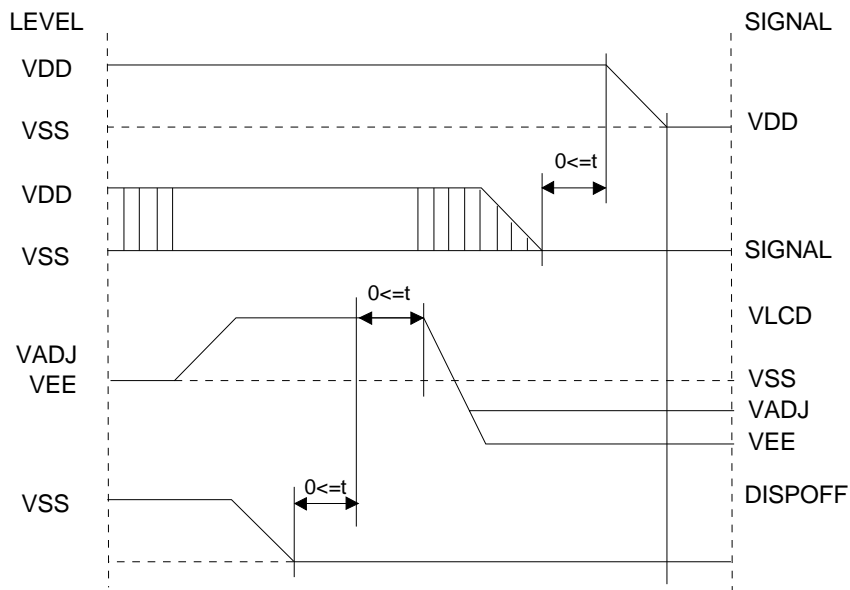
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## 2.6 Power Supply ON/OFF Sequence

### 2.6.1 ON Sequence



### 2.6.2 OFF Sequence



Please maintain the above sequence when turning on and off the power supply of the module. If VEE is supplied to the module while internal alternate signal for LCD driving (M) is unstable or RESET is active, DC component will be supplied to the LCD panel. This may cause damage to the LCD module.



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## 2.7 Lighting Specifications

Ta = 25 °C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Notes
Luminance Frequency	$F_L$	--	45	50	60	KHz	--
Tube Voltage	$V_{LOAD}$	$I_L = 5mA$	--	335	--	Vrms	1
Tube Current	$I_L$	--	3.5	5.0	6.5	mArms	2
Open Voltage	$V_{OPEN}$	Ta=25°C	--	--	460	Vrms	3
Output Voltage	$V_{OUTPUT}$	Ta=25°C	--	--	370	Vrms	3
Surface Luminance	L	$I_L = 5mA$	2,500	--	--	cd/m <sup>2</sup>	4
Average Life	$T_{AL}$	$I_L = 5mA$	40,000	--	--	hrs	5
Brightness Uniformity	$B_U$	$I_L = 5mA$	75	--	--	--	6

Note 1 : The voltage (r.m.s.) to maintain the electric discharge of the lamp. It is measured after lighting for 3 minutes .

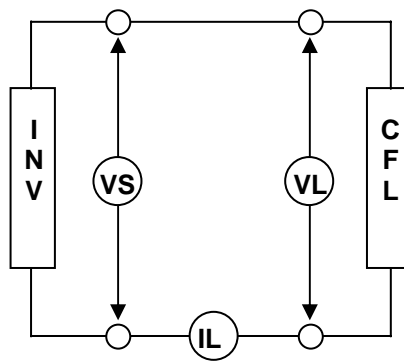
Note 2 : The current (r.m.s.) to flow through the lamp with the electric discharge. It is measured after lighting for 3 minutes.

Note 3 : The voltage at starting the electric discharge when the voltage is increased gradually from 0V.

Note 4 : Surface Luminance is specified by the initial data of luminance measured from the surface of the backlight unit after 20 minutes power on.

Note 5 : CFL life is defined as the time for which the initial luminance is attenuated by 50% of the luminance value. Average Life represents the time elapsed at the point of time when the residual ratio becomes below 50% when plural lamps are lighted in comparison with the definition of life mentioned above.

Note 6 : Brightness Uniformity = Luminance (Min / Max) x 100%.



**CFL Testing Circuit**



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### 3. Optical Specifications

#### 3.1 LCD Driving Voltage Recommended

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
LCD Driving Voltage Note 1	$V_{LCD} - V_{SS}$	Ta = 0 °C	--	25.8	--	V
		Ta = 25 °C	--	25.3	--	V
		Ta = 50 °C	--	24.1	--	V

Note 1 : Voltage (Applied actual waveform to LCD Module) for the best contrast. The range of minimum and maximum shows tolerance of the operating voltage. The specified contrast ratio and response time are not guaranteed over the entire range.

#### 3.2 Optical Characteristics

Ta=25 °C, 1/240 Duty, 1/16 Bias, (Note 4),  $\theta = 0^\circ$ ,  $\phi = 270^\circ$  with backlight on

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1	C	$\theta = 0^\circ, \phi = 0^\circ$	--	25	--	--
Viewing Angle (Shown in 3.3)	Front-Back	$\theta_f - \theta_b, \phi = 0^\circ$	+30	to	-10	deg.
	Left-Right	$\theta_l - \theta_r, \phi = 0^\circ$	+25	to	-25	deg.
Module Chromaticity (white)	Wx	Ta=25 °C	0.25	0.30	0.35	
	Wy		0.27	0.32	0.37	
Module Chromaticity (red)	Rx		0.48	0.53	0.58	
	Ry		0.26	0.31	0.36	
Module Chromaticity (green)	Gx		0.24	0.29	0.34	
	Gy		0.48	0.53	0.58	
Module Chromaticity (blue)	Bx		0.10	0.15	0.20	
	By		0.08	0.13	0.18	
Brightness	Y		--	130	--	cd/m <sup>2</sup>
Response Time	Rise Note 2		T <sub>ON</sub>	--	140	280
	Decay Note 3	T <sub>OFF</sub>	--	80	160	msec



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Note 1 : Contrast ratio is defined as follows.

$$CR = L_{OFF} / L_{ON}$$

$L_{ON}$  : Luminance of the ON segments,  $L_{OFF}$  : Luminance of the OFF segments

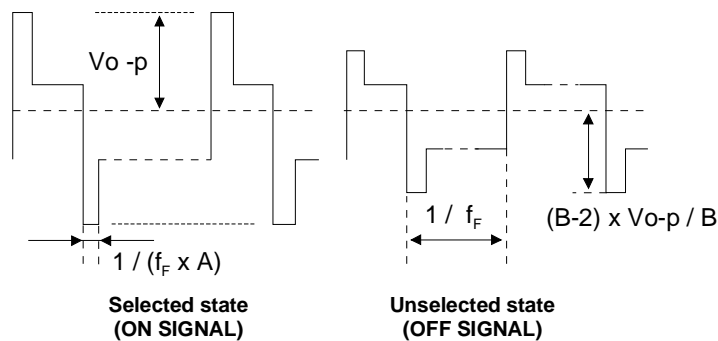
Note 2 : The time that the luminance level reaches 90% of the saturation level from 0% when ON signal is applied.

Note 3 : The time that the luminance level reaches 10% of the saturation level from 100% when OFF signal is applied.

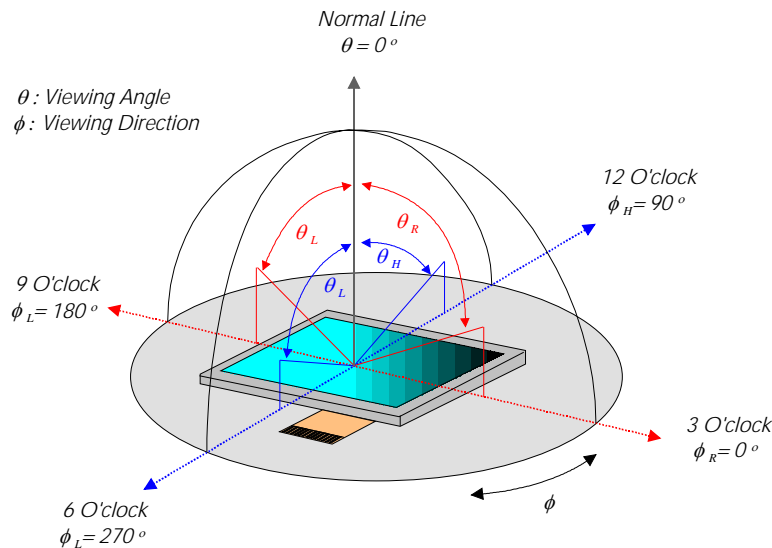
Note 4 : Definition of Driving Voltage  $V_D$ . Assuming that the typical driving waveforms shown below are applied to the LCD Panel at /A Duty - 1/B Bias ( A : Duty Number, B : Bias Number ). Driving voltage  $V_D$  is defined as follows:  $V_D = (V_{th1} + V_{th2}) / 2$

$V_{th1}$  : The voltage VO-P that should provide 50% of the saturation level in the luminance at the segment which the ON signal is applied to.

$V_{th2}$  : The voltage VO-P that should provide 50% of the saturation level in the luminance at the segment which the OFF signal is applied to.



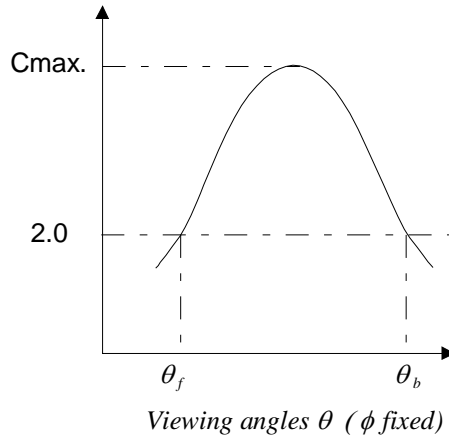
### 3.3 Definition of Viewing Angle and Optimum Viewing Area



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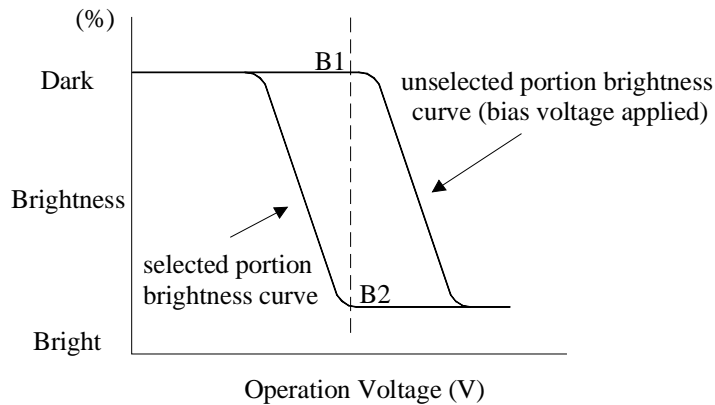
3.4 Definition of Viewing Angle  $\theta_f$  and  $\theta_b$



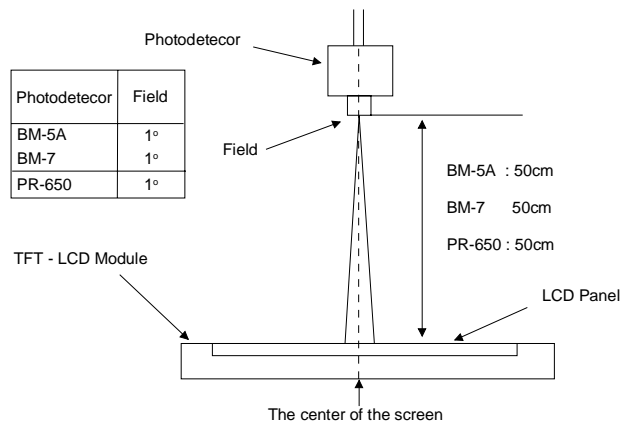
Optimum viewing angle with the naked eye and viewing angle  $\theta$  at  $C_{max}$ .  
Above are not always the same.

3.5 Definition of Contrast C

$C = \text{Brightness of selected dot (B1)} / \text{Brightness of unselected dot (B2)}$



3.6 Definition of measurement of Color Chromaticity and Brightness



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#### 4. I/O Terminal

##### 4.1 Pin Assignment

###### LCD

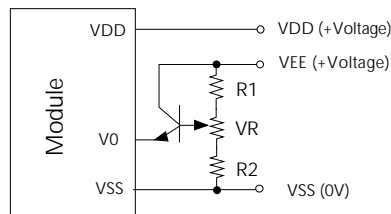
Pin No.	Signal	Function
1	FRM	SCAN START-UP SIGNAL
2	CL1 (LP)	Data Latch Pulse
3	CL2 (CP)	Data Shift Clock Pulse
4	/DISPOFF	Sequence Signal of Power Supply ("L":OFF)
5	VDD	Power Supply for Logic(+5V)
6	VSS	Ground(0 V)
7	VLCD (Vo)	Power Supply for Contrast Control(+V)
8	D7	Data Input for Upper Screen
9	D6	Data Input for Upper Screen
10	D5	Data Input for Upper Screen
11	D4	Data Input for Upper Screen
12	D3	Data Input for Lower Screen
13	D2	Data Input for Lower Screen
14	D1	Data Input for Lower Screen
15	D0	Data Input for Lower Screen

###### CCFL B/L

Pin No.	Signal	Function
1	HOT	Power Supply for CCFL (Hot)
2	NC	No Connection
3	GND	Power Supply for CCFL (Ground)

##### 4.2 Example of Power Supply

It is recommended to apply a potentiometer for the contrast adjust due to the tolerance of the driving voltage and its temperature dependence.



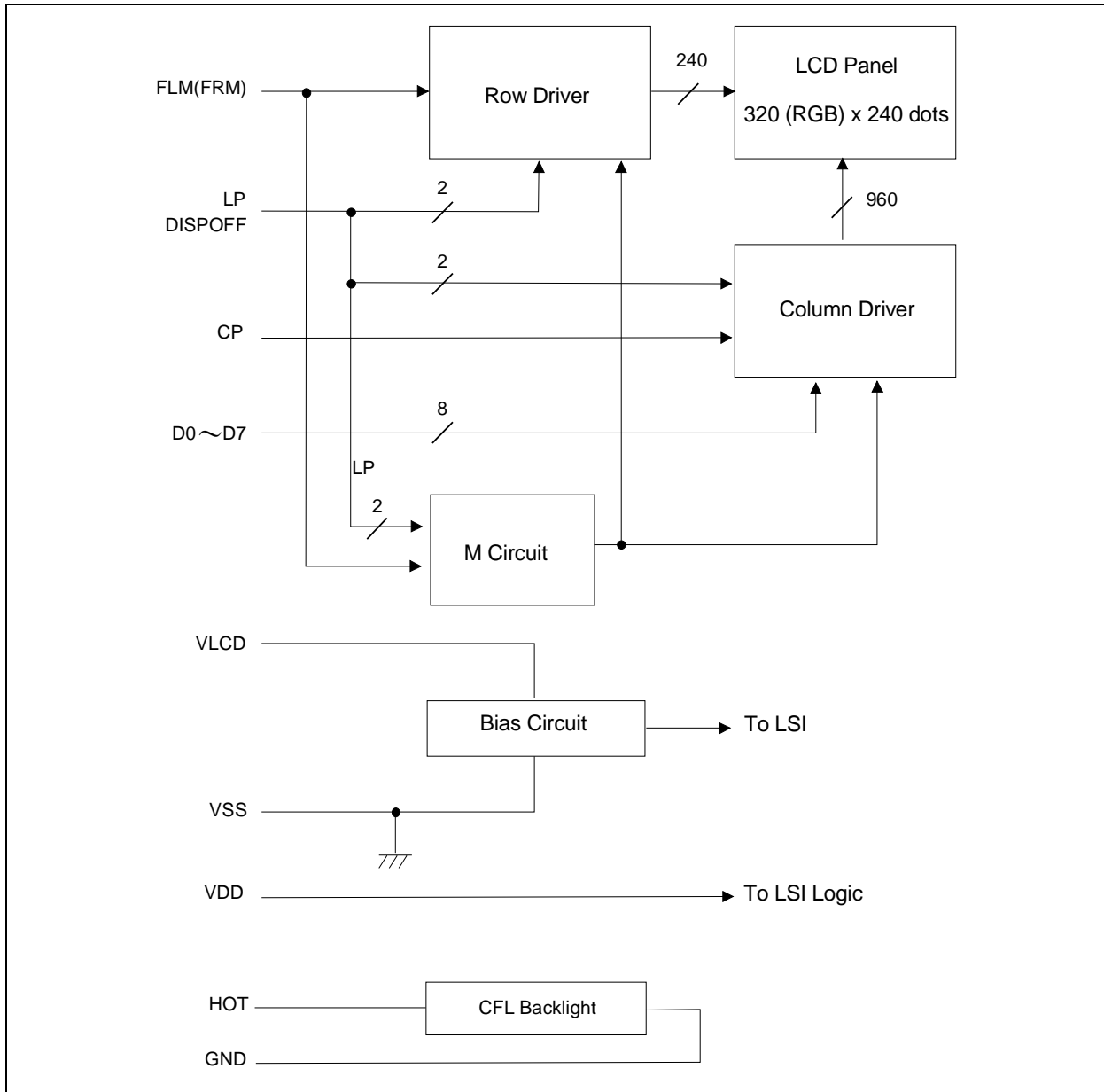
$R1+R2+VR=10 \sim 20K \Omega$   
 $Tr = 2SA1202$  or equivalent



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4.3 Block Diagram



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## 5. Reliability Test

### 5.1 Test Item

No change on display and in operation under the following test condition.

No.	Test Item	Description	Condition	Note
1.	High Temperature (Operation)	Durability test under long time high temperature with electrical stress (voltage, current)	50°C ± 2°C 200hrs	1
2.	High Temperature (Storage)	Durability test under long time high temperature storage	60°C ± 2°C 200hrs	4
3	Low Temperature (Operation)	Durability test under long time low temperature with electrical stress (voltage, current)	0°C ± 2°C, 200hrs	3
4	Low Temperature (Storage)	Durability test under long time low temperature storage	-10°C ± 2°C, 200hrs	3, 4
5	Damp Proof Test	Durability test under long time high temperature and high humidity	40°C ± 2°C, 90% RH 100hrs	3, 4
6	Thermal Shock (Non-Operation)	-10 ← → 60°C, 10 cycles 30min 30min	--	--
7.	Vibration Test	Total fixed amplitude: 1.5mm Frequency: 10~55~10Hz, within 1 min. One cycle 60 seconds to 3 directions of X, Y, Z for each 15 minutes	--	5
8	Drop Test	Packed, 100CM free fall, 6 sides, 1 corner, 3 edges.	--	
9	Life Time	50,000 hours Specification condition driving.	25°C, under 70% RH	

Note 1: Unless otherwise specified, tests will be conducted under the following condition,

Temperature : 25°C ± 2°C

Humidity : 65% ± 5%

Note 2: Unless otherwise specified, tests will be not conducted under functioning state.

Note 3: No dew condensation to be observed.

Note 4: The function test shall be conducted after 4 hours storage at the normal temperature and humidity after removed from the test chamber.

Note 5: Vibration test will be conducted to the product itself without putting it in a container.



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## 5.2 Judgment Standard

	Failure Mode	Test Item							Judgment Standard
		1	2	3	4	5	6	7	
	Orientation	*	*	*	*	*			No remarkable degradation of appearance under bias/ non-bias condition
	Current Value (IAC)	*	*	*	*	*			No remarkable increase
	Contrast	*		*	*	*			No remarkable poor contrast
	Domain	*	*	*	*	*			Less than 20% of all dots have reverse tilt of more than on third of one dot area.
	Bubble (Inside Cell)	*	*	*	*	*	*		As per "Appearance Standard" (Note. including one which disappear after 25°C 2H)
	Polarizer	*				*	*		As per "Appearance Standard" no remarkable appearance change
	Glass Damage							*	As per "Appearance Standard"

- Note.1. \* is strong linkage between Failure Mode and Test Item.  
 2. Number of Test Item should be referred to former page.  
 3. Judgment and Standard value should be fixed by other inspection standard and criteria samples.



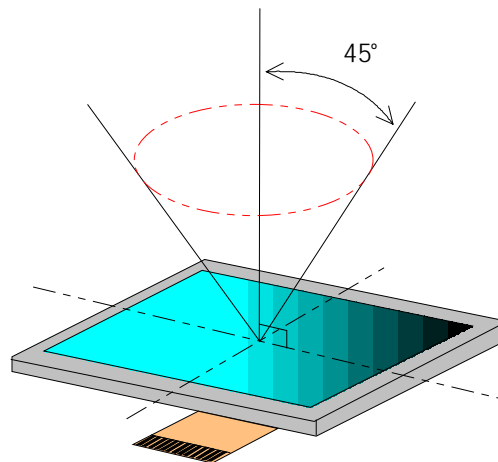


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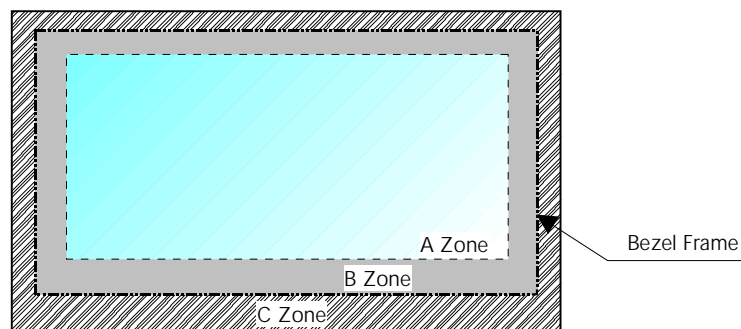
## 6. Appearance Standards

### 6.1 Inspection Conditions

The LCD shall be inspected under 40W white fluorescent light. The distance between the eyes and the sample shall be more than 30cm. All directions for inspecting the sample should be within 45° against perpendicular line.



### 6.2 Definition of Applicable Zones



A Zone : Active display area

B Zone : Area from outside of "A Zone" to validity viewing area

C Zone : Rest parts

A Zone + B Zone = Validity viewing area



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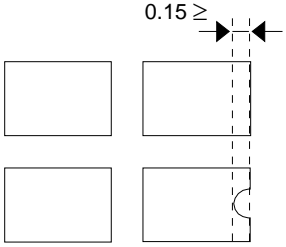
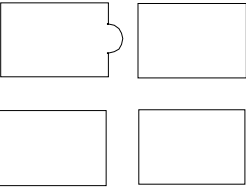
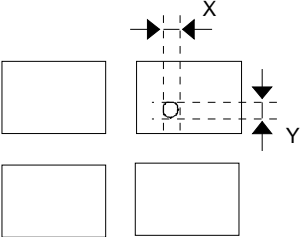
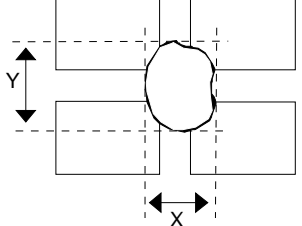
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### 6.3 Standards

No.	Parameter	Criteria																																			
1.	Black and White Spots, Foreign Substances	(1) Round Shape																																			
		<table border="1"> <thead> <tr> <th colspan="2">Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th colspan="2">Dimension (mm)</th> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td></td> <td>D ≤ 0.2</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.2 &lt;</td> <td>D ≤ 0.3</td> <td>5</td> <td>6</td> <td>*</td> </tr> <tr> <td>0.3 &lt;</td> <td>D ≤ 0.5</td> <td>3</td> <td>4</td> <td>*</td> </tr> <tr> <td>0.5 &lt;</td> <td>D</td> <td>0</td> <td>1</td> <td>*</td> </tr> </tbody> </table>	Zone		Acceptable Number			Dimension (mm)		A	B	C		D ≤ 0.2	*	*	*	0.2 <	D ≤ 0.3	5	6	*	0.3 <	D ≤ 0.5	3	4	*	0.5 <	D	0	1	*					
		Zone		Acceptable Number																																	
		Dimension (mm)		A	B	C																															
			D ≤ 0.2	*	*	*																															
		0.2 <	D ≤ 0.3	5	6	*																															
		0.3 <	D ≤ 0.5	3	4	*																															
		0.5 <	D	0	1	*																															
		D = (Long + Short)/2    *: Disregard																																			
		(2) Line Shape																																			
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--	0.1 < W	In the same way (1)																																			
X : Length    Y: Width    *: Disregard																																					
2.	Air Bubbles (between glass & polarizer)	(1) Round Shape																																			
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No.	Parameter	Criteria
3.	The Shape of Dot	(1) Dot Shape (with Dent)  <p>0.15 ≥</p> <p>As per the sketch of left hand.</p>
		(2) Dot Shape (with Projection)  <p>Should not be connected to next dot.</p>
		(3) Pin Hole  <p><math>(X+Y)/2 \leq 0.2\text{mm}</math> (Less than 0.1mm is no counted.)</p>
		(4) Deformation  <p><math>(X+Y)/2 \leq 0.2\text{mm}</math></p> <p>Total acceptable number: 1/dot, 5/cell (Defect number of (4): 1pc.)</p>
4.	Polarizer Scratches	Not to be conspicuous defects.
5.	Polarizer Dirts	If the stains are removed easily from LCDP surface, the module is not defective.
6.	Complex Foreign Substance Defects	Black spots, line shaped foreign substance or air bubbles between glass & polarizer should be 5pcs maximum in total.
7.	Distance between different Foreign Substance defects	$D \leq 0.2$ : 20mm or more $0.2 < D$ : 40mm or more



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## 7. Handling and Precautions

The Following precautions will guide you in handling our product correctly.

- 1 Liquid crystal display devices
  - 1.1 The liquid crystal display device panel used in the liquid crystal display module is made of plate glass. Avoid any strong mechanical shock. Should the glass break handle it with care.
  - 1.2 The polarizer adhering to the surface of the LCD is made of a soft material. Guard against scratching it.
- 2 Care of the liquid crystal display module against static electricity discharge.
  - 2.1 When working with the module, be sure to ground your body and any electrical equipment you may be using. We strongly recommend the use of anti static mats ( made of rubber ), to protect work tables against the hazards of electrical shock.
  - 2.2 Avoid the use of work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.
  - 2.3 Slowly and carefully remove the protective film from the LCD module, since this operation can generate static electricity.
- 3 When the LCD module alone must be stored for long periods of time:
  - 3.1 Protect the modules from high temperature and humidity.
  - 3.2 Keep the modules out of direct sunlight or direct exposure to ultra-violet rays.
  - 3.3 Protect the modules from excessive external forces.
- 4 Use the module with a power supply that is equipped with an over current protector circuit, since the module is not provided with this protective feature.
- 5 Do not ingest the LCD fluid itself should it leak out of a damaged LCD module. Should hands or clothing come in contact with LCD fluid, wash immediately with soap.
- 6 Conductivity is not guaranteed for models that use metal holders where solder connections between the metal holder and the PCB are not used. Please contact us to discuss appropriate ways to assure conductivity.



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8. Warranty:

This product has been manufactured to your company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

- 1 We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
- 2 We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
- 3 We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product has passed your company's acceptance inspection procedures.
- 4 We cannot accept responsibility for industrial property, which may arise through the use of your product, with exception to those issues relating directly to the structure or method of manufacturing of our product. Microtips-origin longer than one year from Microtips production.

9. Dimensional Outlines

- See the next page.....



*Microtips Technology Inc.*

Messrs.

Product Specification

Model:

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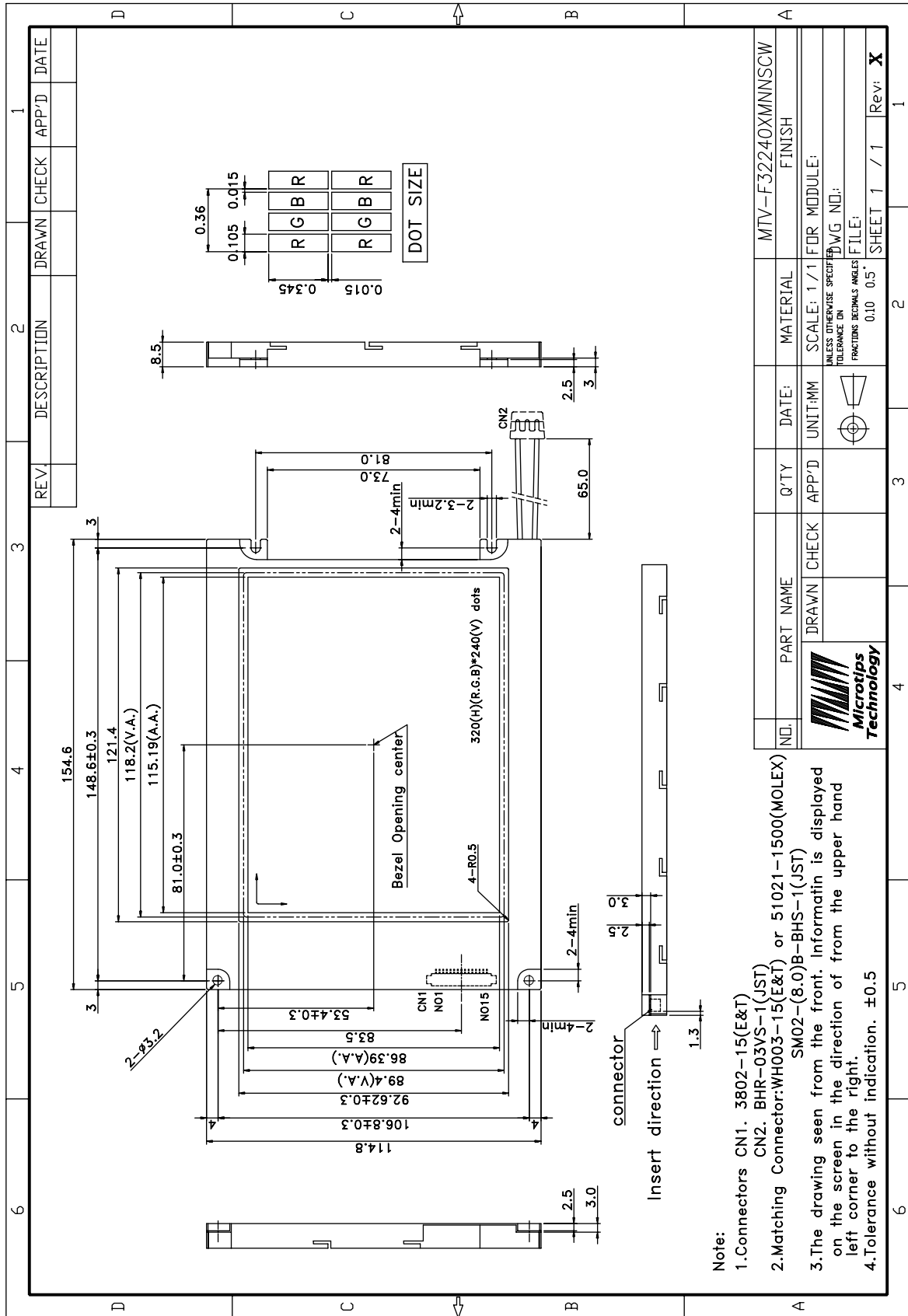
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- Note:
- Connectors CN1. 3802-15(E&T)
  - Connectors CN2. BHR-03VS-1(JST)
  - Matching Connector: WH003-15(E&T) or 51021-1500(MOLEX) SM02-(8.0)B-BHS-1(JST)
  - The drawing seen from the front. Information is displayed on the screen in the direction of from the upper hand left corner to the right.
  - Tolerance without indication. ±0.5

NO.	PART NAME	Q'TY	DATE:	MATERIAL	MTV-F32240XMNNSCW
		APP'D		FINISH	
DRAWN CHECK		UNIT:MM		SCALE: 1/1 FOR MODULE:	
				UNLESS OTHERWISE SPECIFIED TOLERANCE ON DIMENSIONS IS:	
				FRACTIONS DECIMALS ANGLES	
				FILE:	
				SHEET 1 / 1	
				Rev: X	



Microtips Technology Inc.