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LIQUID CRYSTAL DISPLAY MODULE
MODEL: MTG-S32240QMNHSCW-A
Customer's No.:

Acceptance

Microtips Technology Inc.
12F. No.31 Lane 169, Kang Ning St.,
His-Chih, Taipei Hsien, Taiwan, R.O.C.
FAX: 886-2-26958625

Approved and Checked by

Approved by	Checked by		Made by
			



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Revise Records

Rev.	Date	Contents	Written	Approved
A	2006/11/29	Initial Edition	Sherry Chen	Aron Jau

Special Notes

Note1.	
Note2.	
Note3.	
Note4.	
Note5.	



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1. General Specifications

Operating Temperature	:	Min. -20°C ~ Max. 70°C
Storage Temperature	:	Min. -40°C ~ Max. 80°C
Dot Pixels	:	320 (W) x 240 (H) dots
Dot Size	:	0.345 (W) x 0.345 (H) mm
Dot Pitch	:	0.36 (W) x 0.36 (H) mm
Viewing Area	:	122.0 (W) x 92.0 (H) mm
Outline Dimensions	:	166* (W) x 109.0** (H) x 7.0 max. (D) mm
		* Without Connector Cable
		** Without FFC Connector
Weight	:	N/A
LCD Type	:	STN/ Negative, Blue mode/ Transmissive
Viewing Direction	:	6:00
Data Transfer	:	4-bit parallel data transfer
Backlight	:	With CCFL
Drawings	:	As attached drawings



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2. Electrical Specifications

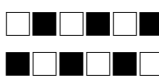
2.1 Absolute Maximum Ratings

$V_{SS} = 0V$

Parameter	Symbol	Conditions	Min.	Max.	Units
Supply Voltage (Logic)	$V_{DD} - V_{SS}$	-	-0.3	5.5	V
Supply Voltage (LCM)	$V_{EE} - V_{EE}$	-	0	27.0	V
Input Voltage	V_I	-	-0.3	V_{DD}	V

2.2 DC Characteristics

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

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	
Supply Voltage (Logic)	$V_{DD} - V_{SS}$	--	4.5	5.0	5.5	V	
Recommended LC Driving Voltage	$V_{EE} - V_{SS}$ (Vop)	Duty=1/240	-20°C	18.9	19.3	19.7	V
			0°C	18.4	18.8	19.2	V
			25°C	17.9	18.3	18.7	V
			50°C	17.5	17.9	18.3	V
			70°C	17.4	17.8	18.2	V
High Level (Input Voltage)	V_{IH}	H level	0.8 V_{DD}	-	V_{DD}	V	
Low Level (Input Voltage)	V_{IL}	L level	0	-	0.2 V_{DD}	V	
Power Supply Current	I_{DD}	FLM=70Hz $V_{DD}=5.0V$ $V_{EE}-V_{SS}=18.3V$	-	1.0	1.5	mA	
	I_{EE}	PATTERN: 	-	5.0	7.5	mA	
LCM	Surface Luminance	L	$I_L=5mA$ Dots ALL ON	100	120	-	cd/m ²
		L	$I_L=5mA$ Dots ALL OFF	-	30	50	



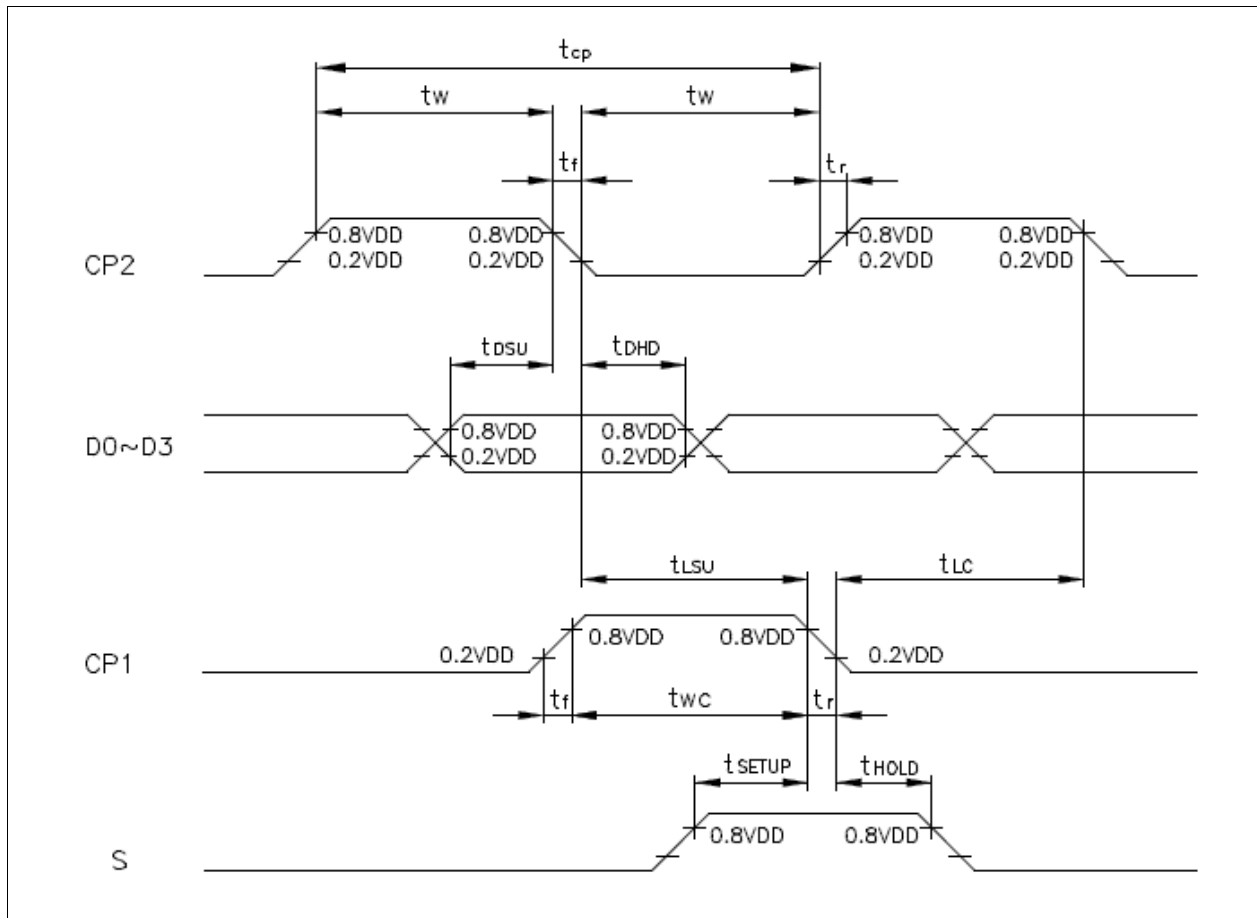
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2.3 AC Characteristics

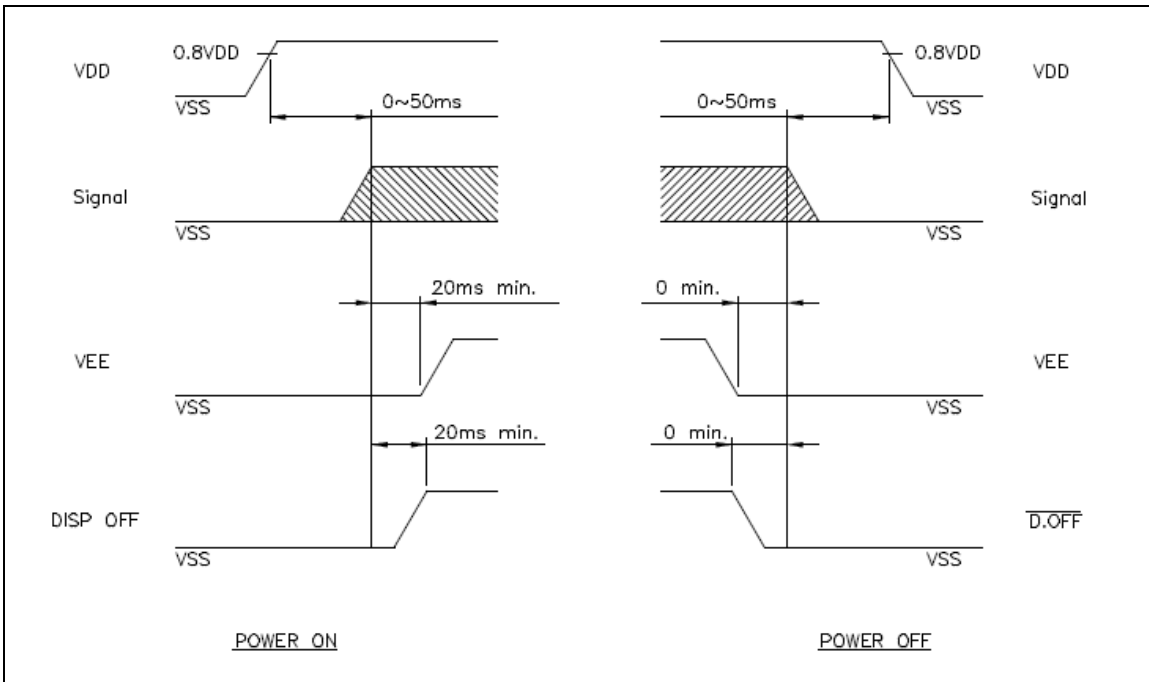
$V_{DD} = 2.5 \sim 5.5V$

Parameter	Symbol	Min.	Max.	Units
Shift Clock Period	t_{CP}	125	-	ns
"CP2" PULSE WIDTH	t_W	51	-	ns
CLOCK RISE, FALL TIME	t_r, t_f	-	20	ns
DATA SETUP TIME	t_{DSU}	40	-	ns
DATA HOLD TIME	t_{DHD}	30	-	ns
"CP1" → "LOAD" FALL TIME	t_{LSU}	51	-	ns
"CP2" → "CP" FALL TIME	t_{LC}	51	-	ns
"S" SETUP TIME	t_{SETUP}	30	-	ns
"S" HOLD TIME	t_{HOLD}	50	-	ns
"LOAD" PULSE WIDTH	t_{WC}	51	-	ns



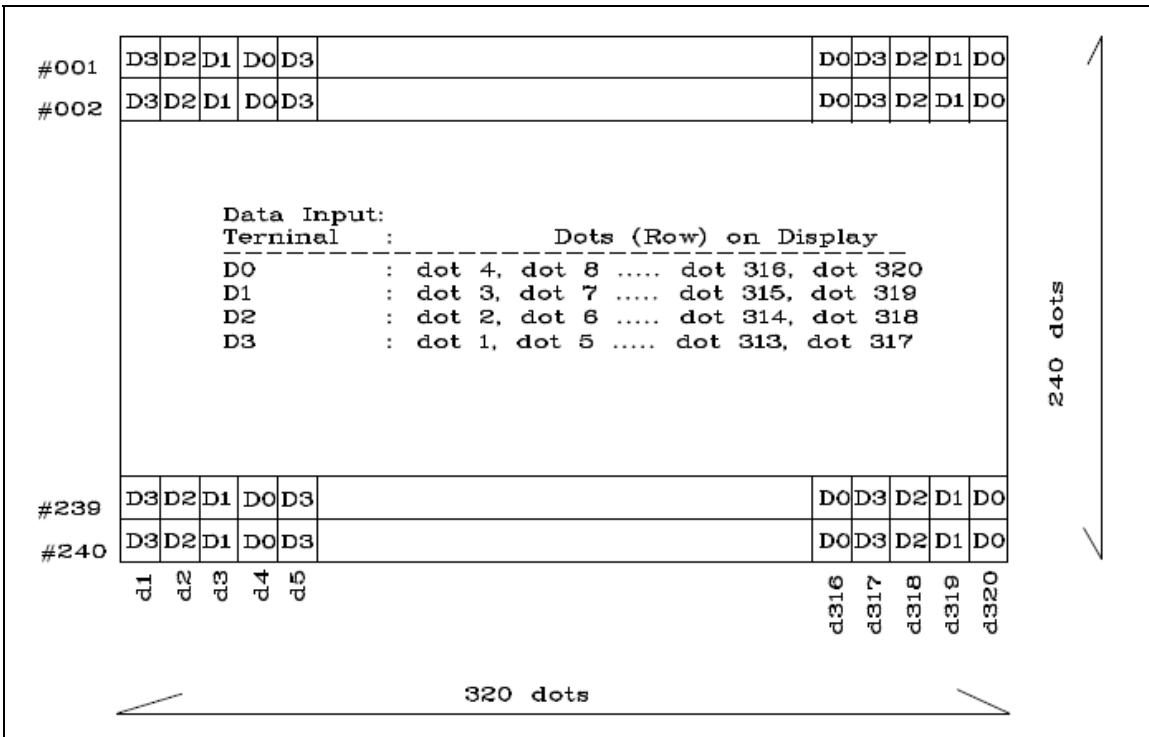
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2.4 Power Supply ON/OFF Sequence



The missing pixels may occur when the LCM is driven beyond above power interface timing sequence.

2.5 Display Pattern



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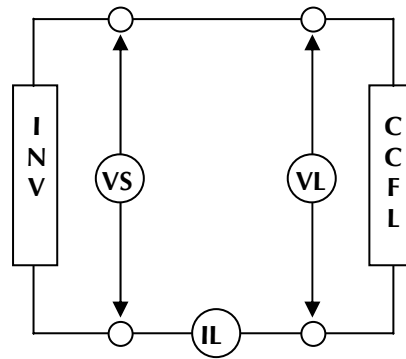
2.6 Spec. for CCFL back-light

Ta = 25 °C

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units	Notes
Lamp Voltage	V_L	IL=5mA	-	301	-	Vrms	-
Lamp Current	I_L	-	3.0	5.0	6.0	mArms	-
Lamp Power Consumption	P_L	IL=5mA	-	1.51	-	W	1)
Starting Voltage	V_S	Ta = 25°C	-	-	850	Vrms	-
		Ta = 0°C	-	-	1110	Vrms	-
Average Life	T_{AL}	IL=5mA	20000	-	-	hrs	2)

Note 1). Power consumption excluded inverter loss.

Note 2). Lamp life time is defined as follows : The final brightness is at 50% of original brightness.



CCFL Testing Circuit



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3. Optical Specifications

3.1 Optical Characteristics

Ta=25 °C, 1/240 Duty, 1/17 Bias, V_{DD} = 5.0V (Note 4), θ = 0°, φ = 270°

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Contrast Ratio Note 1	C	θ = 0°, φ = 0°	5.0	8.0	-	-
Viewing Angle (Shown in 3.3)	Front-Back	θ _f -θ _b , φ = 0°	+40	to	-30	deg.
	Left-Right	θ _l -θ _r , φ = 0°	+35	to	-35	deg.
Response Time (rise)	T _R	Ta = -20 °C	3000	3800	5700	msec
		Ta = 0 °C	650	800	1200	msec
		Ta = 25 °C	190	240	360	msec
		Ta = 50 °C	110	140	210	msec
		Ta = 70 °C	65	80	120	msec
Response Time (fall)	T _F	Ta = -20 °C	1100	1400	2100	msec
		Ta = 0 °C	430	540	810	msec
		Ta = 25 °C	100	130	200	msec
		Ta = 50 °C	55	70	100	msec
		Ta = 75 °C	50	60	90	msec

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

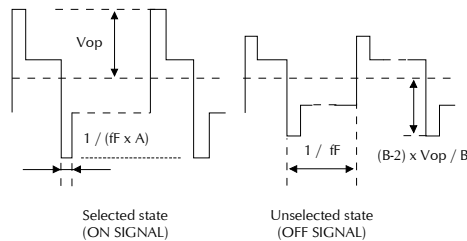
Note 2 : The time that the luminance level reaches 90% of the saturation level from 0% when ON signal is applied.

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 1/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.

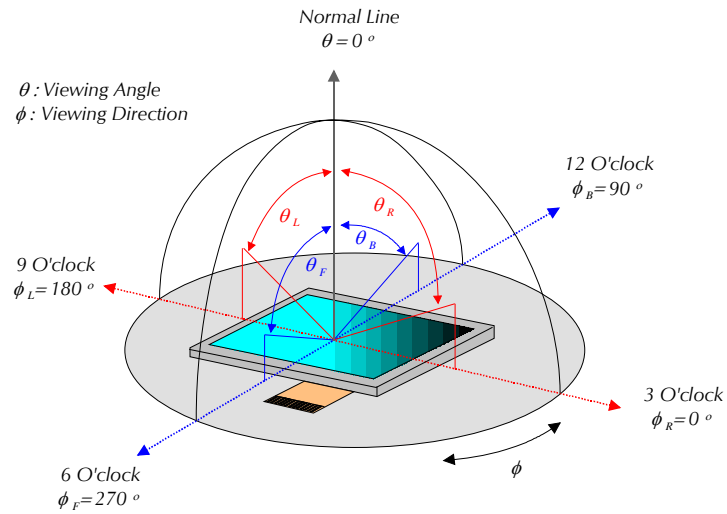
V_{th2} : The voltage VO-P that should provide 50% of the saturation level in the luminance at the segment which the OFF signal is applied to.



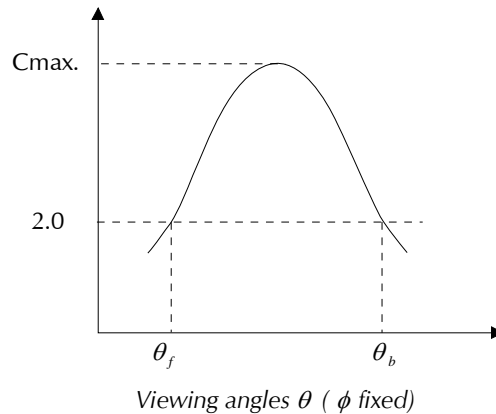
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3.2 Definition of Viewing Angle and Optimum Viewing Area

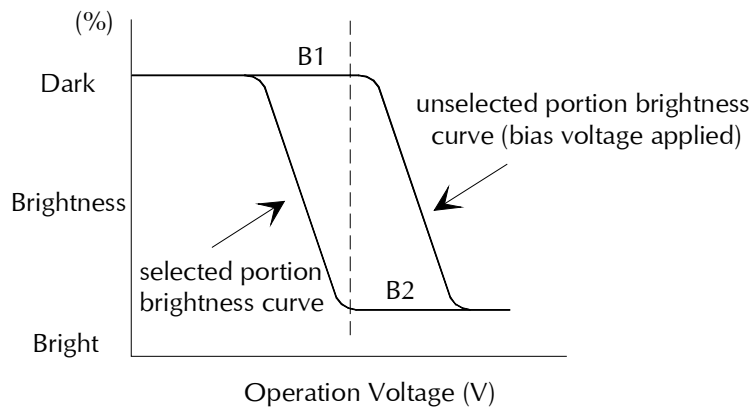


3.3 Definition of Viewing Angle θ_f and θ_b



Optimum viewing angle with the naked eye and viewing angle θ at Cmax. Above are not always the same.

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



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4. I/O Terminal

4.1 Pin Assignment

LCD (CN1)

Pin No.	Symbol	Function
1	S	Scan start-up signal
2	CP1	Input data latch signal
3	CP2	Data input clock signal
4	NC	No-connection
5	/DISPOFF	Display control signal
6	D0	Display Data signal
7	D1	Display Data signal
8	D3	Display Data signal
9	D4	Display Data signal
10	V _{DD}	Power supply for logic
11	V _{SS}	Ground potential
12	V _{EE}	Power supply for LCD drive

CCFL B/L (CN2)

Pin No.	Symbol	Function
1.	VFT1	Power supply for CCFL Backlight (HOT)
2.	NC	No-connection
3.	VFT2	Power supply for CCFL Backlight (GND)

LCD

Used Connector : FFC, P1.25mm N=12

Recommended Connector : 00-6207-34-10-12-000+ (ELCO)

CCFL

Used Connector : BHR-03VS-01 (JST)

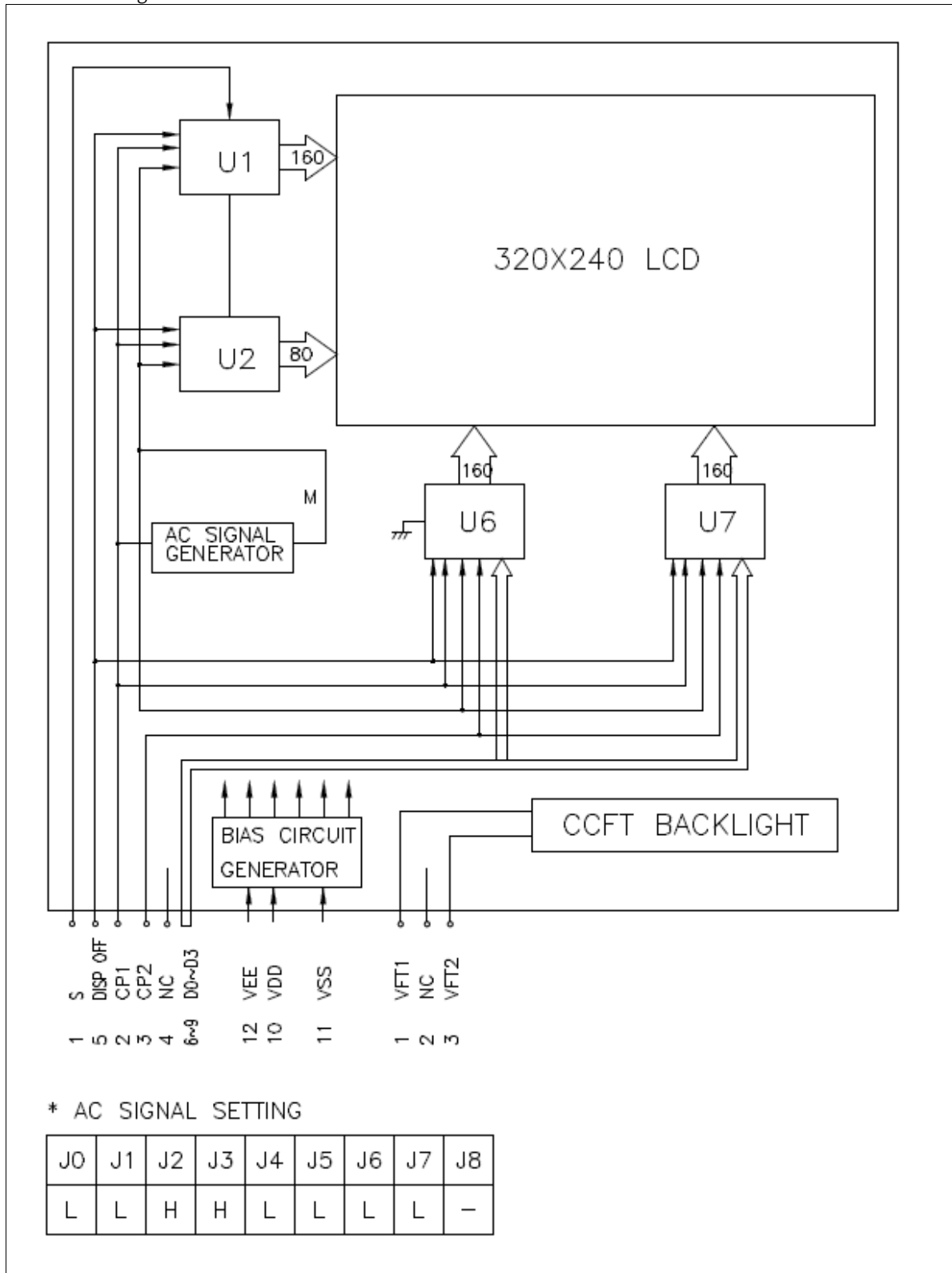
Mating Connector : SM03 (4.0) B-BHS-1-TB OR COMPATIBLE (JST)



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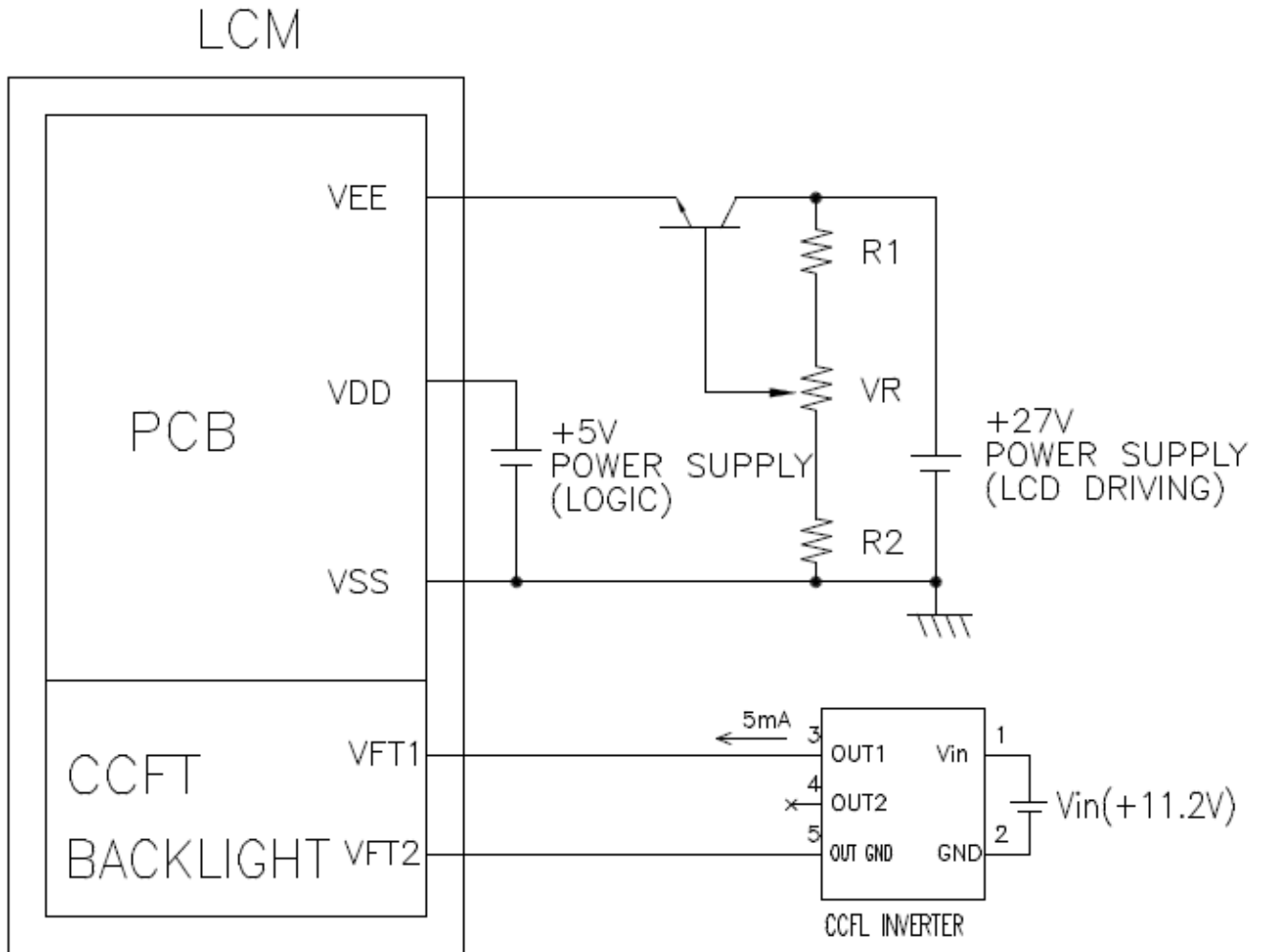
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4.2 Block Diagram



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4.3 Power Supply



1. $R1 + VR + R2 = 10K \sim 20K\Omega$

2. RECOMMENDED CCFT INVERTER : TDK-L10L




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5. Reliability Test

5.1 Wide Temperature Reliability Test

No	ITEM	Conditions		STANDARD	Note
1	HIGH TEMP. STORAGE	80°C	120 HR	Appearance Without defect	
2	LOW TEMP. STORAGE	-40°C	120 HR		
3	HIGH TEMP&HIGH HUMID STORAGE	60°C 90%RH	120 HR		
4	HIGH TEMP OPEROTING DISPLAY	70°C	120 HR		
5	LOW TEMP OPEROTING DISPLAY	-20°C	120 HR		
6	THERMAL SHOCK	-20°C,30min→70°C,30min  (1cycle)			10 Cycles

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.



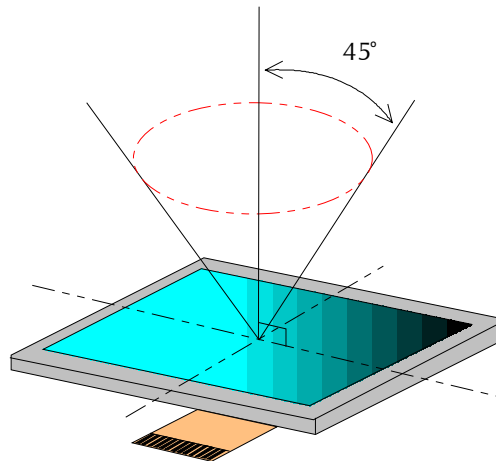
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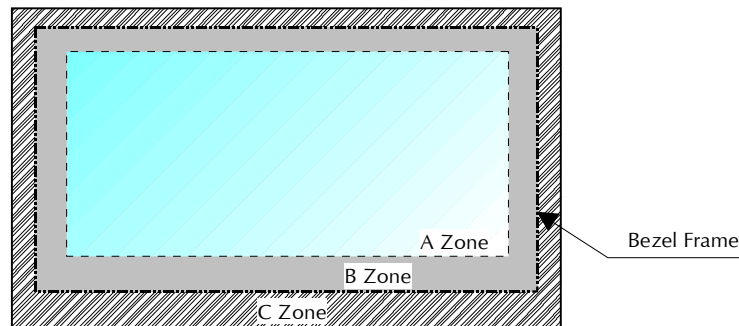
6. Appearance Standards

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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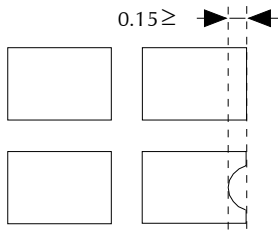
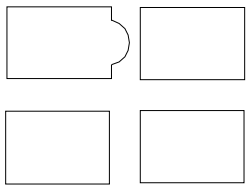
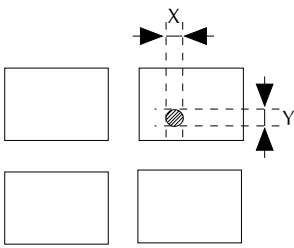
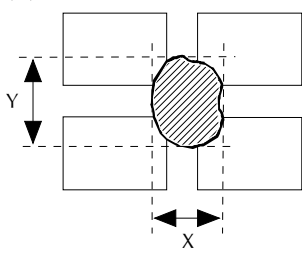
6.3 Standards

No.	Parameter	Criteria																																																							
1.	Black and White Spots, Foreign Substances	<p>(1) Round Shape</p> <table border="1"> <thead> <tr> <th rowspan="2">Dimension (mm) \ Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>D ≤ 0.2</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.2 < D ≤ 0.3</td> <td>3</td> <td>5</td> <td>*</td> </tr> <tr> <td>0.3 < D ≤ 0.4</td> <td>2</td> <td>3</td> <td>*</td> </tr> <tr> <td>0.4 < D ≤ 0.5</td> <td>0</td> <td>1</td> <td>*</td> </tr> <tr> <td>0.5 < D</td> <td>0</td> <td>0</td> <td>*</td> </tr> </tbody> </table> <p>D = (Long + Short)/2 *: Disregard</p> <p>(2) Line Shape</p> <table border="1"> <thead> <tr> <th rowspan="2">Zone \ X (mm)</th> <th rowspan="2">Zone \ Y (mm)</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>--</td> <td>0.03 ≥ W</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>2.0 ≥ L</td> <td>0.05 ≥ W</td> <td>3</td> <td>3</td> <td>*</td> </tr> <tr> <td>1.0 ≥ L</td> <td>0.1 ≥ W</td> <td>3</td> <td>3</td> <td>*</td> </tr> <tr> <td>--</td> <td>0.1 < W</td> <td colspan="3">In the same way (1)</td> </tr> </tbody> </table> <p>X : Length Y: Width *: Disregard</p> <p>Total defects shall not exceed 5.</p>	Dimension (mm) \ Zone	Acceptable Number			A	B	C	D ≤ 0.2	*	*	*	0.2 < D ≤ 0.3	3	5	*	0.3 < D ≤ 0.4	2	3	*	0.4 < D ≤ 0.5	0	1	*	0.5 < D	0	0	*	Zone \ X (mm)	Zone \ Y (mm)	Acceptable Number			A	B	C	--	0.03 ≥ W	*	*	*	2.0 ≥ L	0.05 ≥ W	3	3	*	1.0 ≥ L	0.1 ≥ W	3	3	*	--	0.1 < W	In the same way (1)		
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2.	Air Bubbles (between glass & polarizer)	<table border="1"> <thead> <tr> <th rowspan="2">Dimension (mm) \ Zone</th> <th colspan="3">Acceptable Number</th> </tr> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>D ≤ 0.3</td> <td>*</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.3 < D ≤ 0.4</td> <td>3</td> <td>*</td> <td>*</td> </tr> <tr> <td>0.4 < D ≤ 0.6</td> <td>2</td> <td>3</td> <td>*</td> </tr> <tr> <td>0.6 < D</td> <td>0</td> <td>0</td> <td>*</td> </tr> </tbody> </table> <p>*: Disregard</p> <p>Total defects shall not exceed 3.</p>	Dimension (mm) \ Zone	Acceptable Number			A	B	C	D ≤ 0.3	*	*	*	0.3 < D ≤ 0.4	3	*	*	0.4 < D ≤ 0.6	2	3	*	0.6 < D	0	0	*																																
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To be continued.....



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No.	Parameter	Criteria
3.	The Shape of Dot	<p>(1) Dot Shape (with Dent)</p>  <p>0.15 ≥</p> <p>As per the sketch of left hand.</p> <p>(2) Dot Shape (with Projection)</p>  <p>Should not be connected to next dot.</p> <p>(3) Pin Hole</p>  <p>$(X+Y)/2 \leq 0.2\text{mm}$ (Less than 0.1mm is no counted.)</p> <p>(4) Deformation</p>  <p>$(X+Y)/2 \leq 0.2\text{mm}$</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.



Messrs.					
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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.

