SPECIFICATIONS FOR LCD MODULE

DS-G240128A-BTSSWE-YAA

PIXELS: 240 X 128 DOTS
OUTLINE DIMENSION: 144.0 X 104.0 MM
VIEWING AREA: 114.0 X 64.0 MM
DOT SIZE: 0.40 X 0.40 MM
DOT PITCH: 0.45 X0.45 MM

REVISION RECORD

REV.	DATE	PAGE	CONTENT
1.0	2008-12-17		NEW RELEASE

CONTENTS

■ LCD MODULE NUMBERING SYSTEM

DS-G240128A-__ __ __ __ __ __ -__ __ __

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DS DISTAR TECHNOLOGY LIMITED

G GRAPHIC TYPE

240128 SERIALS NUMBER FOR SM 240 COLUMNS Vs. 128 ROWS

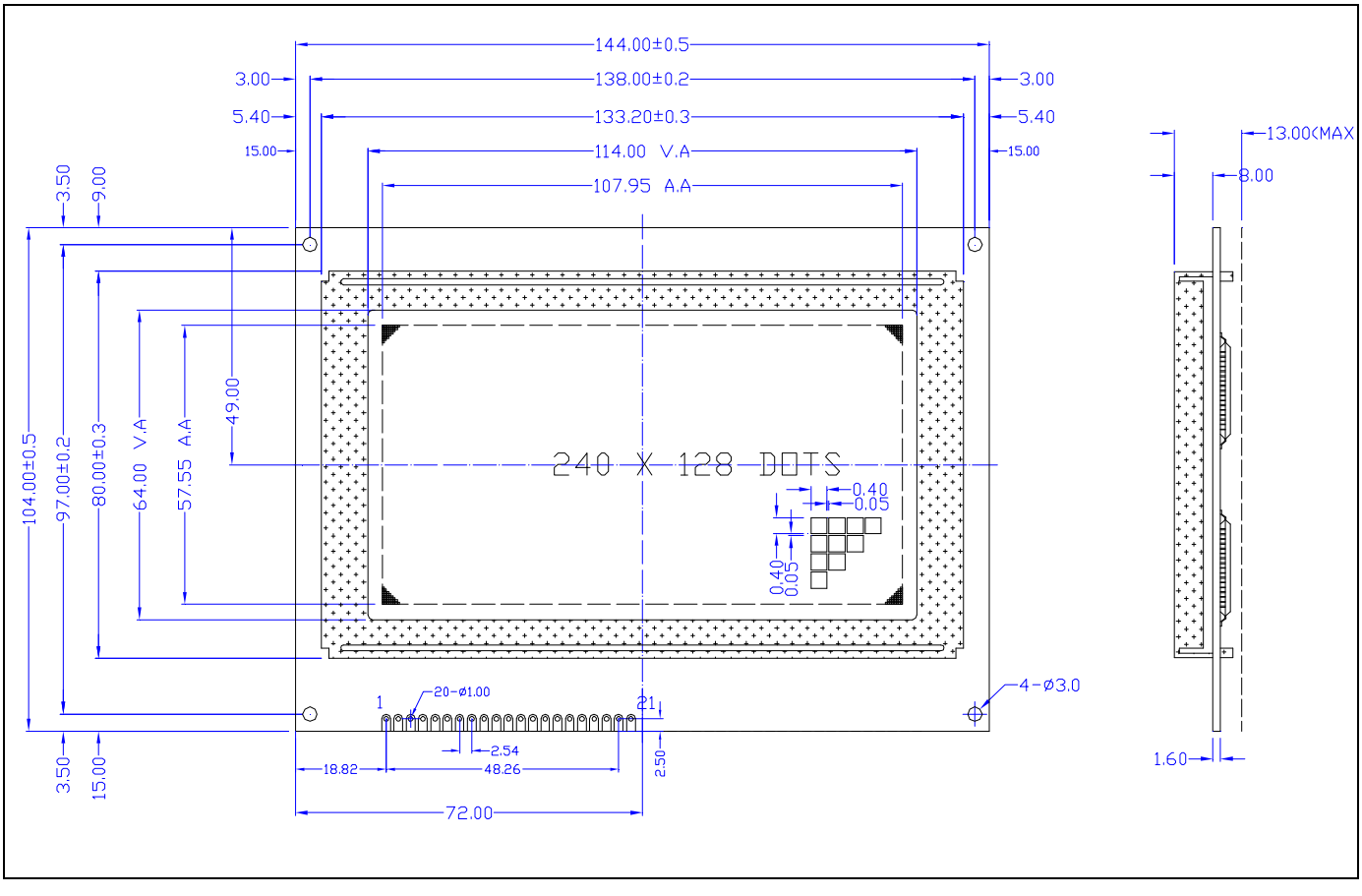
A VERSION OF PCB

N0	Remark	Code Value	Description
①	LCD Type	Y	STN yellow/green type LCD
		B	STN blue type LCD
		G	STN gray type LCD
		F	FSTN positive type LCD
		N	FSTN negative type LCD
		P	TN positive type LCD
		E	TN negative type LCD
②	Polarizer Type	R	Reflective type
		F	Transflective type
		T	Transmissive type
③	Viewing Angel	S	Six o'clock
		T	Twelve o'clock
④	Backlight Type	N	Without backlight
		E	EL backlight
		C	CCFL backlight
		D	Bottom LED backlight
		S	Side LED backlight
⑤	Backlight Colour	N	Without backlight
		Y	Yellow/green
		W	White
		G	Green
		B	Blue
		A	Amber
		0	Orange
⑥	LCM Temperature Type	N	Normal
		E	Extended
		S	Super extended
⑦	DC-DC Converter Circuit	N	Without
		Y	With
⑧	Power Supply For Logic	A	5.0V
		B	3.3V
⑨	Power Supply For Backlight	A	5.0V
		B	4.2V
		C	3.3V

■ PHYSICAL DATA

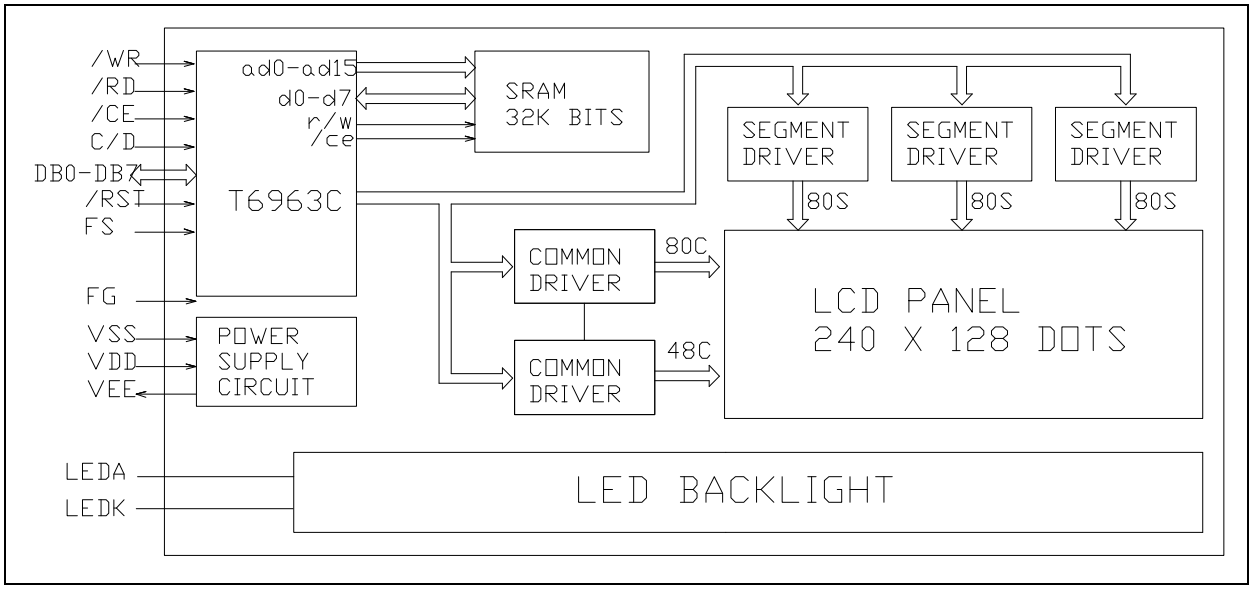
Item	Content	Unit
LCD type	Blue STN,negative,transmissive	---
LCD duty	1/128	---
LCD bias	1/12	---
Viewing direction	6	o'clock
Module size	144.0 x 104.0 x 13.0 (max)	mm
Viewing area	114.0 x 64.0	mm
Number of dots	240 x 128	dots
Dot size	0.40 x 0.40	mm
Dot pitch	0.45 x 0.45	mm
Backlight type	Side LED backlight	---
Colour of backlight	White	---
MCU Interface	INTEL8080	---
Driver IC	T6963C	---

■ EXTERNAL DIMENSIONS



■ CIRCUIT BLOCK DIAGRAM

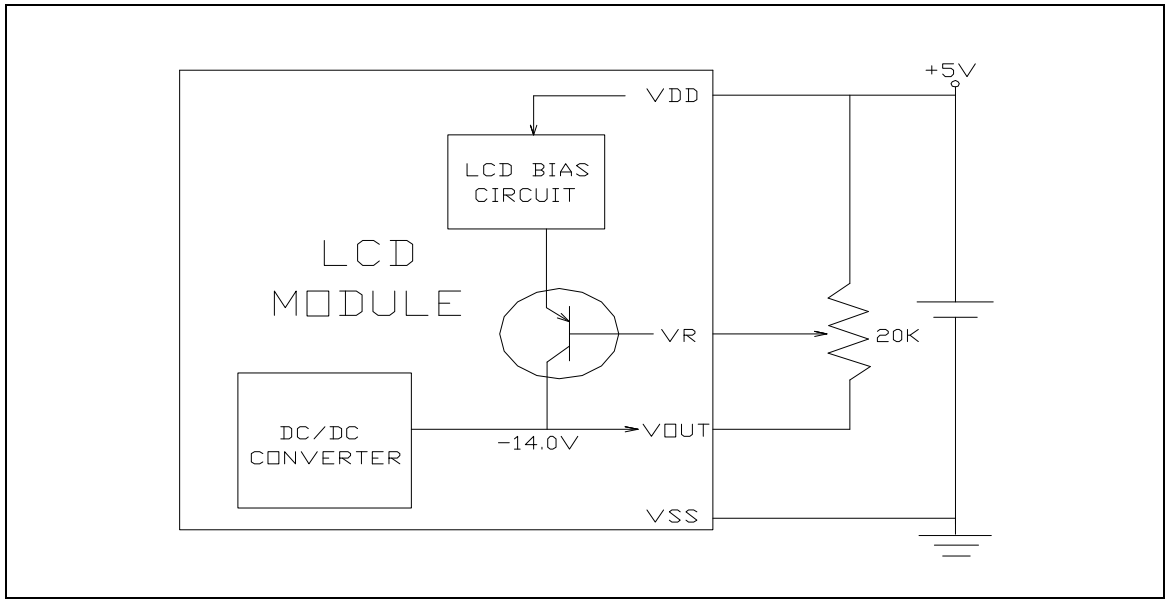
◇ Electrical Block Diagram



◇ Pins Definition

PIN	SYMBOL	LEVEL	FUNCTION
1	FG	0	Frame Ground
2	V_{SS}	0	Power Supply(GND)
3	V_{DD}	5.0V	Power Supply For Logic(+5.0v)
4	V_R	—	LCD Contrast Adjust
5	/WR	L	Write Signal
6	/RD	L	Read Signal
7	/CE	L	Chip Select Signal
8	C/D	H	Command/Data Select Signal
9	/RES	L	Reset Signal(Low Effective)
10	DB_0	H / L	Data Bus Lines
11	DB_1	H / L	
12	DB_2	H / L	
13	DB_3	H / L	
14	DB_4	H / L	
15	DB_5	H / L	
16	DB_6	H / L	
17	DB_7	H / L	
18	FS	H / L	Font Selection(H:6X8,L:8X8)
19	VOUT	-14.0V	LCD Module Negative Output (-14.0V)
20	A	+5.0V	Power Supply For LED Backlight (+) (5.0v)
21	K	0 V	Power Supply For LED Backlight (-) (0v)

◇ **Power supply**



■ ABSOLUTE MAXIMUM RATINGS(Ta=25℃)

◇ **Electrical Absolute Maximum Ratings**

ITEM	SYMBOL	CONDITON	MIN	MAX	UNIT
Supply Voltage For Logic	Vdd – Vss	-	-0.3	7.0	V
Supply Voltage For LCD	Vdd – Vr	-	0	26	V
Input Voltage	Vi	-	-0.3	Vdd +0.3	V

◇ **Enviromental Absolute Maximum Ratings**

ITEM	SYMBOL	CONDITON	MIN	MAX	UNIT
Operating temperature	Topr	-Normal temp. version-	-20	70	deg C
Operating temperature	Ttsg		-30	80	deg C
Humidity Endurance	RH	no ondensation Ta<=40 deg	-	95	%
Vibration	-	100-300Hz, X/Y/Z directions, 1 hour	-	4.9m/ss 0.5g	-
Shock	-	10 mS X/Y/Z direction 1 time each		29.4m/ss 3.0g	-

■ ELECTRICAL CHARACTERISTICS

◇ DC Characteristics

Electrical Characteristics at Ta=25 deg C, Vdd = 5V + / - 5%

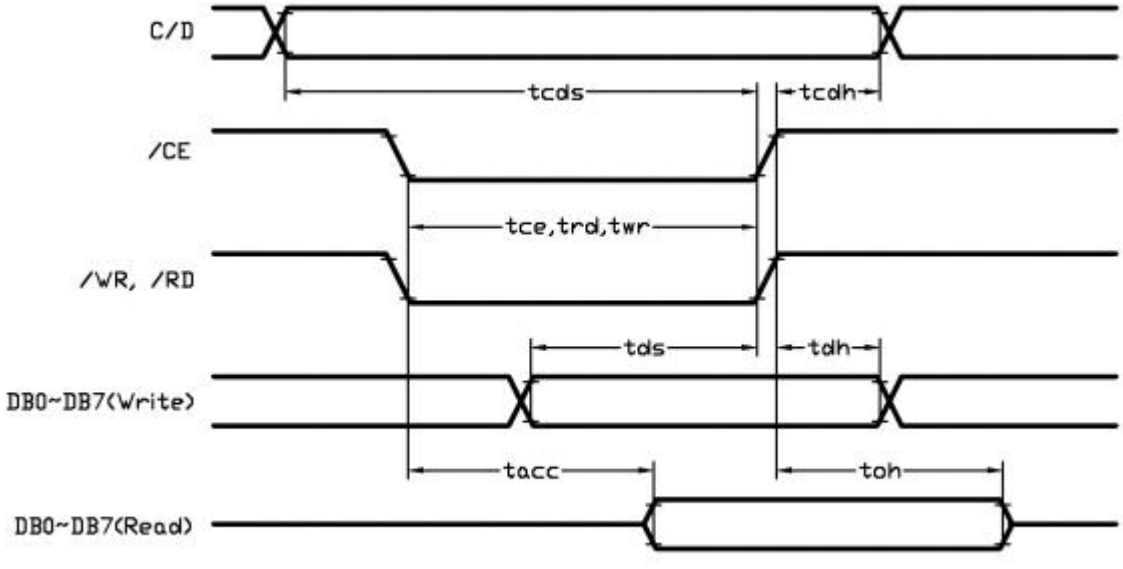
ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
Supply Voltage For Logic	Vdd-Vss	-	4.5	5.0	5.5	V
Supply Voltage For LCD	Vdd-Vr	Vdd = 5V	-	17.4	-	V
Input Voltage(for CD, DB0-7,/WR,/RDS)	V-ih	"H"level	2.2	-	Vdd	V
	V-il	"L"level	0	-	0.6	V
Supply Current For Logic	Icc	-	-	15.5	37	mA
Supply Current For LCD	Io	-	0.15	0.22	0.27	mA

◇ AC Characteristics

◆ MPU Interface

TIMING SPECIFICATIONS at Ta = 25 deg C, Vdd = 5V+/-10%, Vss =0V

ITEM	SYMBOL	MIN	MAX	UNIT
C/D Set-up Time	T_{CDS}	13	-	ns
C/D Hold Time	T_{CDH}	13	-	ns
/CE，/RD，/WR Pulse Width	T_{CE}, T_{RD}, T_{WR}	100	-	ns
Data Set-up Time	T_{DS}	100	-	ns
Data Hold Time	T_{DH}	50	-	ns
Access Time	T_{ACC}	-	190	ns
Output Hold Time	T_{OH}	-	65	ns



Bus Timing Diagram

Note：

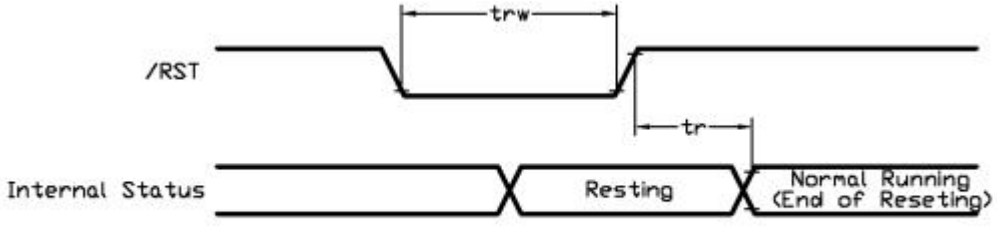
*1. Input signal rise/fall time should be less than 20 ns

*2. Please see The T6963C sheet for details

◆ Reset Time

Timing Specifications at Ta = 25 deg C, Vdd = 5V+/-10%, Vss =0V

ITEM	SYMB0L	MINI	MAX	UNIT
Reset Plus	Trw	100	-	us
Reset Time	Tr	-	100	us

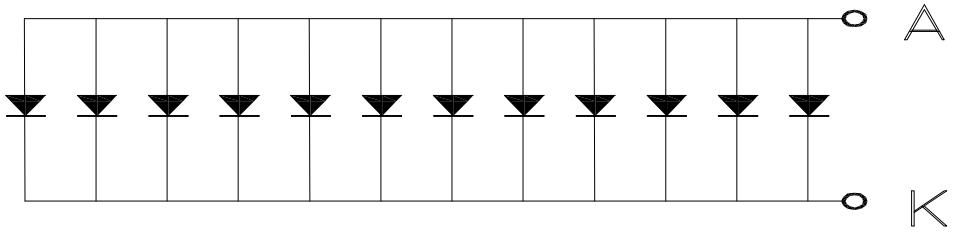


Reset Timing Diagram

■ BACKLIGHT CHARACTERISTICS

Unless specified, the Ambient temperature Ta=25 ℃

ITEM	SYMBOL	MIN	TYP	MAX	UNIT	CONDITION
Supply Voltage	Vf	4.0	5.0	5.5	V	
Forward Current	Ifm		240		mA	Vf=5.0V
Reverse Voltage	Vr		1.0		V	
Power Dissipation	Pd				mW	Vf=5.0V
Operation temperature Range	Topr	-10		+50	℃	
Storage temperature Range	Tstg	-20		+60	℃	
Peak Wavelength	λp				nm	Vf=5.0V
Luminance	Lv	500	750		Cd/m m	Vf=5.0V



LED CIRCUIT DIAGAM(LED 1X12=12 dies)

■ ELECTRO-OPTICAL CHARACTERISTICS

ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT	REF.
Contrast	CR	25℃	--	12	--		Note1
Rise Time	tr	25℃	--	160	240	ms	Note2
Fall Time	tf	25℃	--	100	150	ms	note 2
Viewing Angle	θ1-θ2	25℃	--	--	60	DEG	Note 3
	Ø1, Ø2		-40	--	40		
Frame Frequency	Ff	25℃	--	70	--	Hz	note 2

Note(1): Contrast ratio is defined under the following condition:

CR= brightness of selected condition
brightness of non-selected condition

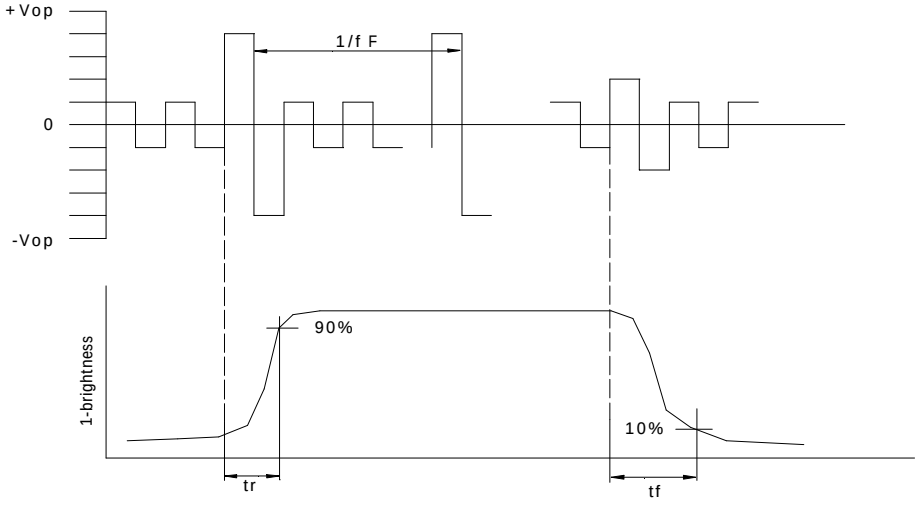
(a). Temperature----------25C

(b). Frame Frequency------64Hz

(c). Viewing angle----------θ=0, Ø=0

(d). Operating Voltage---5.0V

Note(2): definition of response time:



Condition:

(a). Temperature----------25C

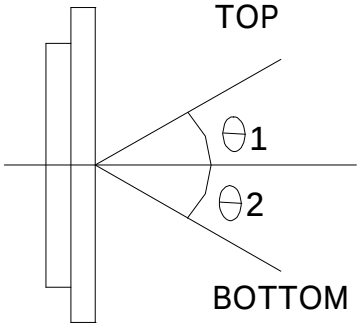
(b). Frame Frequency------64Hz

(c). Viewing angle----------θ=0, Ø=0

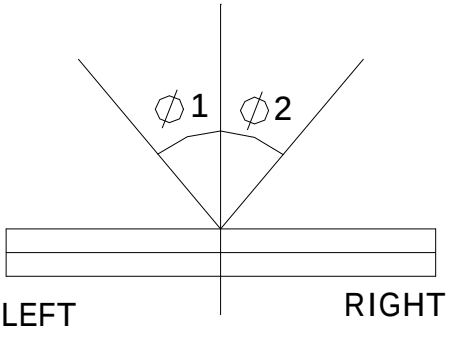
(d). Operating Voltage---5.0V

Note(3): definition of view angle:

TOP-BOTTOM DIRECTION



RIGHT-LEFT DIRECTION



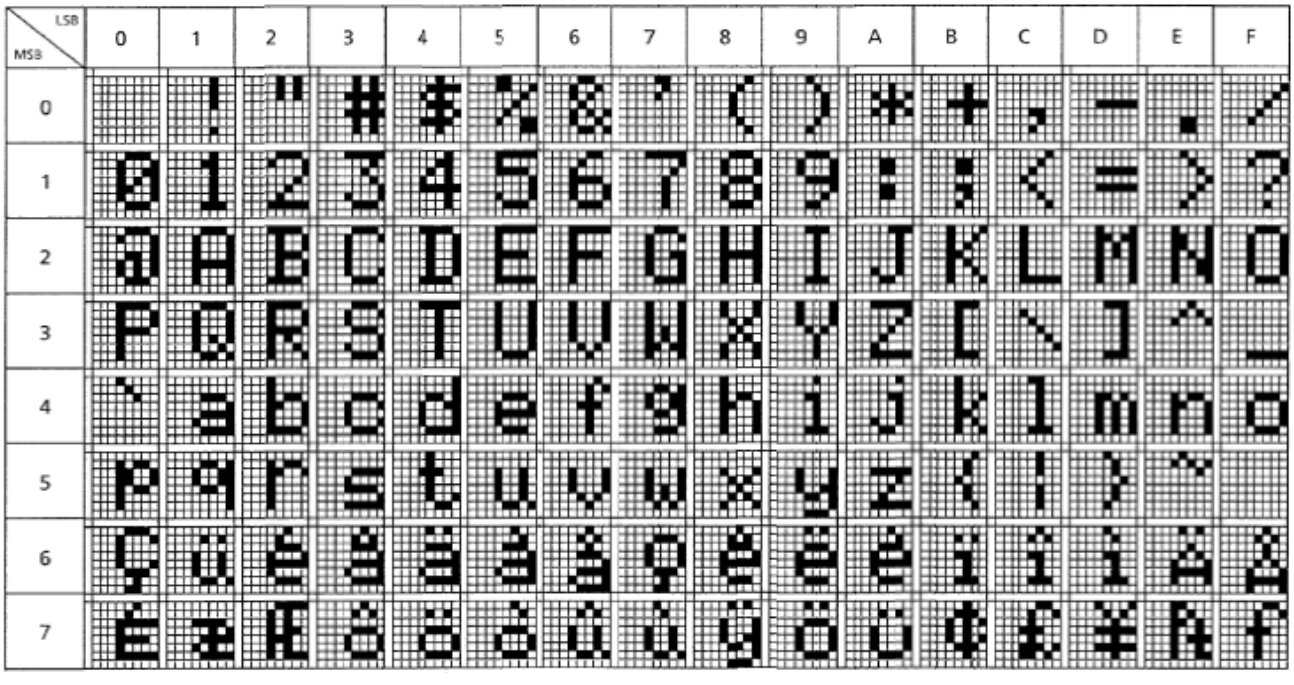
■ DISPLAY CONTROL INSTRUCTION

◆ Instruction Table

COMMAND	CODE								PARA	FUNCTION	EXECU TIME
	D7	D6	D5	D4	D3	D2	D1	D0			
REGISTERS SETTING	0	0	1	0	0	N2	N1	N0	2	N2 N1 N0 0 0 1 SET CURSOR POINTER 0 1 0 SET OFFSET REGISTER 1 0 0 SET ADDRESS POINTER	STATUS CHECK
SET CONTROL WORD	0	1	0	0	0	0	N1	N0	2	N1 N0 0 0 SET TEXT HOME ADDRESS 0 1 SET TEXT AREA 1 0 SET GRAPHIC ADDRESS 1 1 SET GRAPHIC AREA	STATUS CHECK
MODE SET	1	0	0	0	CG	N2	N1	N0	-	CG=0：CGROM MODE CG=1：CGTAM MODE N2 N1 N0 GRAPHIC AND TEXT 0 0 0 “OR” 0 0 1 “EXOR” 0 1 1 “AND” 1 0 0 TEXT ATTRIBUTE MODE	
DISPLAY MODE	1	0	0	1	N3	N2	N1	N0	-	N3=0：GRAPHIC OFF N3=1：GRAPHIC ON N2=0：TEXT OFF N2=1：TEXTON N1=0：CURSOR OFF N1=1：CURSOR ON N0=0：BLINK OFF N0=1：BLINK ON	32x1/fosc
CURSOR PATTERN SELECT	1	0	1	0	0	N2	N1	N0	-	N2，N1，N0 SET THE LINES OF CURSOR N2 N1 N0 0 0 0 1-LINE CURSOR . . . 1 1 1 8-LINE CURSOR	
DATA AUTO	1	0	1	1	0	0	N1	N0	-	N1 N0 0 0 SET DATA AUTO WRITE	

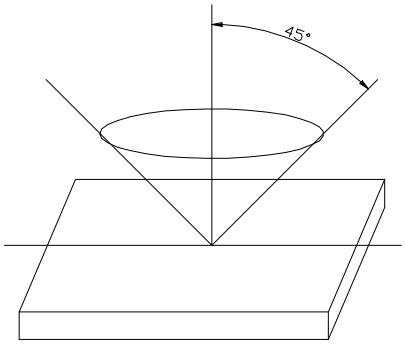
READ/ WRITE										0 1 SET DATA AUTO READ 1 * AUTO RESET	
DATA READ/ WRITE	1	1	0	0	0	N2	N1	N0	1	DATA WRITE AND READ BY 1 N2=0：INCREMENT /DECREMENT ADP =1：NONVARIABLE ADP N1=0：INCREMENT ADP 1 =1：DECREMENT ADP 1 N0=0：DATA WRITE =1：DATA READ	
SCREEN PEEK	1	1	1	0	0	0	0	0	-	SCREEN PEEK	
SCREEN COPY	1	1	1	0	1	0	0	0	-	SCREEN COPY	
BIT SET/RESET	1	1	1	1	N3	N2	N1	N0	-	BIT RESET N3=0：BIT 0 =1：BIT 1	

◆ Character Generator Table

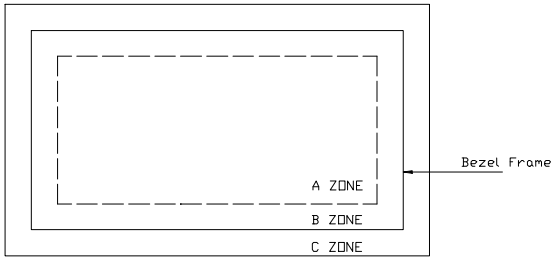


■ INSPECTION STANDARDS

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



◇ Definition of Applicable Zone

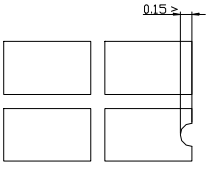


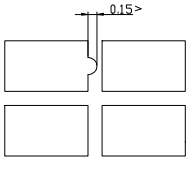
A Zone: Active Display Area
B Zone: Area from Bezel Frame to A Zone
C Zone: Rest Area of Bezel
A Zone + B Zone=Effective Viewing Area

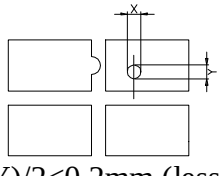
◇ Standards

<table>
<tr><th>NO</th><th>PARAMETER</th><th>CRITERIA</th></tr>
<tr><td>1</td><td>Black and White Spots, Foreign Substances</td><td>
Round Shape
<table>
<tr><th>Zone
DIMENSION(MM)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>D≤0.1</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.1<D≤0.2</td><td>5</td><td>5</td><td>*</td></tr>
<tr><td>0.2<D≤0.3</td><td>0</td><td>1</td><td>*</td></tr>
<tr><td>0.3<D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
D=(long+short)/2 * Disregard

Line Shape
<table>
<tr><th colspan="2">Zone
X(mm) Y(mm)</th><th colspan="3">Acceptable Number</th></tr>
<tr><th></th><th></th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>-</td><td>0.02≥W</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>2.0≥L</td><td>0.03≥W</td><td>3</td><td>3</td><td>*</td></tr>
<tr><td>1.0≥L</td><td>0.04≥W</td><td>1</td><td>2</td><td>*</td></tr>
<tr><td>1.0≥L</td><td>0.05≥W</td><td>0</td><td>2</td><td>*</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td></td><td>X: Length Y: Width * Disregard
Total defects shall not exceed 5.</td></tr>
<tr><td>2</td><td>Air Bubbles (Between glass and polarizer)</td><td>
<table>
<tr><td rowspan="2">Zone
Dimension(mm)</td><td colspan="3">Acceptable Number</td></tr>
<tr><td>A</td><td>B</td><td>C</td></tr>
<tr><td>D≤0.1</td><td>*</td><td>*</td><td>*</td></tr>
<tr><td>0.1<D≤0.2</td><td>5</td><td>5</td><td>*</td></tr>
<tr><td>0.2<D≤0.3</td><td>0</td><td>1</td><td>*</td></tr>
<tr><td>0.3<D</td><td>0</td><td>0</td><td>*</td></tr>
</table>
*: Disregard
Total defects shall not exceed 3.</td></tr>
<tr><td>3</td><td>The Shape of Dot</td><td>(1) Dot Shape(with dent)
 
As per the sketch of left hand.

(2) Dot Shape(with Projection)
 
Should not connect to next dot.

(3) Pin Hole
 
(X+Y)/2<0.2mm (less than 0.1mm is not counted

Total defects shall not exceed 5.</td></tr>
<tr><td>4</td><td>Polarizer Scratches</td><td>Not to be conspicuous defects.</td></tr>
<tr><td>5</td><td>Polarizer Dirts</td><td>If the stains are removed easily from LCD surface, the module is not defective.</td></tr>
<tr><td>6</td><td>Color Variation</td><td>Not to be conspicuous defects.</td></tr>
</table>

■ PRECAUTIONS IN USING LCM

◇ LIQUID CRYSTAL DISPLAY (LCD)

LCD is made up of glass, organic sealant, organic fluid, and polymer based polarizers. The following precautions should be taken when handing,

(1). Keep the temperature within range of use and storage. Excessive temperature and humidity could cause polarization degredation, polarizer peel off or bubble.
(2). Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface. Wipe gently with cotton. Chamois or other soft material soaked in petroleum benzin.
(3). Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
(4). Glass can be easily chipped or cracked from rough handing. especially at corners and edges.
(5). Do not drive LCD with DC voltage.

◇ **Liquid Crystal Display Modules**

◆ Mechanical Considerations

LCM are assembled and adjusted with a high degree of precision. Avoid excessive shocks and do not make any alterations or modifications. The following should be noted.

(1). Do not tamper in any way with the tabs on the tabs on the metal frame.
(2). Do not modify the PCB by drilling extra holes, changing its outline, moving its components or modifying its pattern.
(3). Do not touch the elastomer connector, especially insert an backlight panel (for example, EL).
(4). When mounting a LCM make sure that the PCB is not under any tress such as bending or twisting. Elastomer contacts are very delicate and missing pixels could result from slight dislocation of any of the elements.
(5). Avoid pressing on the metal bezel, otherwise the elastomer connector could be deformed and lose contact, resulting in missing pixels.

◆ Static Electricity

LCM contains CMOS LSI's and the same precaution for such devices should apply, namely

(1). The operator should be grounded whenever he/she comes into contact with the module. Never touch any of the conductive parts such as the LSI pads, the copper leads on the PCB and the interface terminals with any parts of the human body.
(2). The modules should be kept in antistatic bags or other containers resistant to static for storage.
(3). Only properly grounded soldering irons should be used.
(4). If an electric screwdriver is used, it should be well grounded and shielded from commutator sparks.
(5). The normal static prevention measures should be observed for work clothes and working benches; for the latter conductive (rubber) mat is recommended.
(6). Since dry air is inductive to statics, a relative humidity of 50-60% is recommended.

◆ Soldering

(1). Solder only to the I/O terminals.
(2). Use only soldering irons with proper grounding and no leakage.
(3). Soldering temperature: 280 ℃±10℃
(4). Soldering time: 3 to 4 sec.
(5). Use eutectic solder with resin flux fill.
(6). If flux is used, the LCD surface should be covered to avoid flux spatters. Flux residue should be removed after wards.

◆ Operation

(1). The viewing angle can be adjusted by varying the LCD driving voltage V0.
(2). Driving voltage should be kept within specified range; excess voltage shortens display life.
(3). Response time increases with decrease in temperature.
(4). Display may turn black or dark blue at temperatures above its operational range; this is (however not pressing on the viewing area) may cause the segments to appear “fractured”.
(5). Mechanical disturbance during operation (such as pressing on the viewing area) nay cause the segments to appear “fractured”.

◆ Storage

If any fluid leaks out of a damaged glass cell, wash off any human part that comes into contact with soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all the time.

◆ Limited Warranty

Unless otherwise agreed between DISTAR and customer, DISTAR will replace or repair any of its LCD and LCM, which is found to be defective electrically and visually when inspected in accordance with DISTAR acceptance standards, for a period on one year from data of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of DISTAR is limited to repair and/or replacement on the terms set forth above. DISTAR will not responsible for any subsequent or consequential events.

END