LIQUID CRYSTAL DISPLAY MODULE

Product Specification

DENSITRON	**STANDARD LCD MODULE**	
PRODUCT NUMBER	**LM/TS 3769 – LM/TS4769 – LM/TS6769**	
DEFINITION	**Display 320*240 dots with S1D13700 Controller**	**Date 18/07/05**

INTERNAL APPROVALS				
Quality Mgr	**Product Mgr**	**Project Leader**	**Mech. Eng**	**Electr. Eng**
Date:	**Date:**	**Date:**	**Date:**	**Date:**

TABLE OF CONTENTS

REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
1	19/04/04			Initial Specification	
2	20/05/05			Update S1D13700 Controller documentation	
3	06/06/05			Update LCD Pinout and SED1335/S1D13700 differences	
4	06/06/05			Update Backlight definitions	
5	18/07/05			Correction Signal “WAIT” on pin 18 instead of pin 20	

1 PART NUMBERING SYSTEM

LM ①769②③- ④⑤⑥ ⑦

① **BACKLIGHT TYPE**
3 = Module without Backlight or with EL Backlight
4 = Module with LED Backlight
6 = Module with CCFL Backlight

② **POLARIZER TYPE**
B = Transflective: light background
E = Transmissive: dark background

③ **BACKLIGHT COLOR**
G = Yellow-Green (Standard)
W = White LED
None if CCFL Backlight

④ **FLUID TYPE AND POWER SUPPLY**
D = Standard temperature range with external negative voltage operation
S = Standard temperature range with on-board negative voltage generation
H = Wide temperature range with external negative voltage operation
W = Wide temperature range with on-board negative voltage generator

⑤ **TEMPERATURE COMPENSATION CIRCUIT**
N = Without on board temperature compensation circuit
C = With on board temperature compensation circuit

⑥ **COLOR FOR STN FLUID**
B = STN Blue background (available for E polarizer type only)
G = STN Blue Pixels on Gray background for B polarizer types only
Y = STN Blue Pixels on Yellow background for B polarizer types only
F = FSTN Black Pixels or background depending on B or E polarizer type

⑦ **ADDITIONNAL OPTIONS**

12 = it is mentioned if top view angle is needed
HL = High Luminosity for White LED Backlight if avaible

"LM" AT THE BEGINNING OF THE PART NUMBER IS REPLACED BY "TS" IF THE MODULE HAS A TOUCH PANNEL

2 MAIN FEATURES

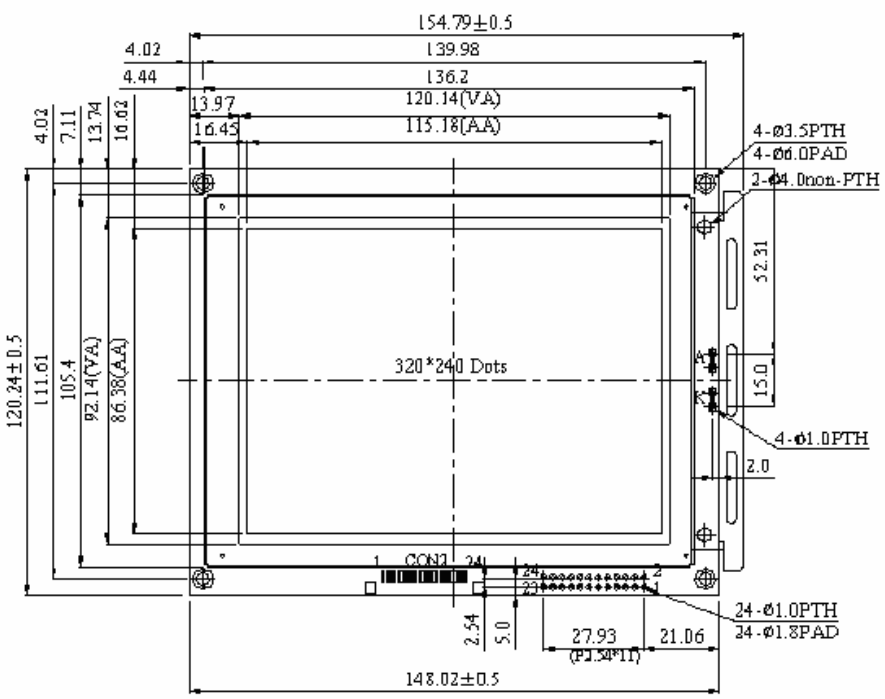
ITEM	CONTENTS
Display Format	320 * 240 dos
Overall Dimensions	154.79×120.24×15.6(MAX)mm
Viewing Area	120.14×92.14mm
LCD type	STN / FSTN
Mode	Avaible in Reflective / Transflective / Transmissive
Viewing Angle	6 o'clock
Duty ratio	1/240
Driver IC	S1D13700
Backlight type	None / LED / CCFL
Backlight colour	White
DC/DC converter	None or Included
Operating temperature	From 0/+50°C to -20°/+70°C
Storage temperature	From -20°/+70°C to -30°/+80°C

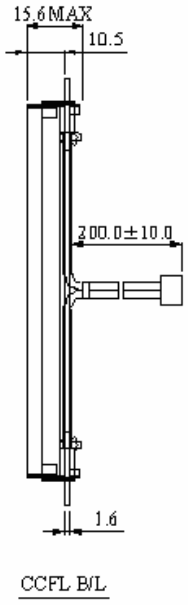
3 MECHANICAL SPECIFICATION

3.1 MECHANICAL CHARACTERISTICS

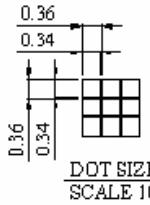
ITEM	CHARACTERISTIC	UNIT
Display Format	320 * 240 dots	
Overall Dimensions	154.79×120.24×15.6(MAX)mm	mm
Viewing Area	120.14×92.14mm	mm
Active Area	115.18×86.38	mm
Dot Size	(L)0.34×(W)0.34	mm
Dot Pitch	(L)0.36×(W)0.36	mm
IC Controller/Driver	S1D13700	

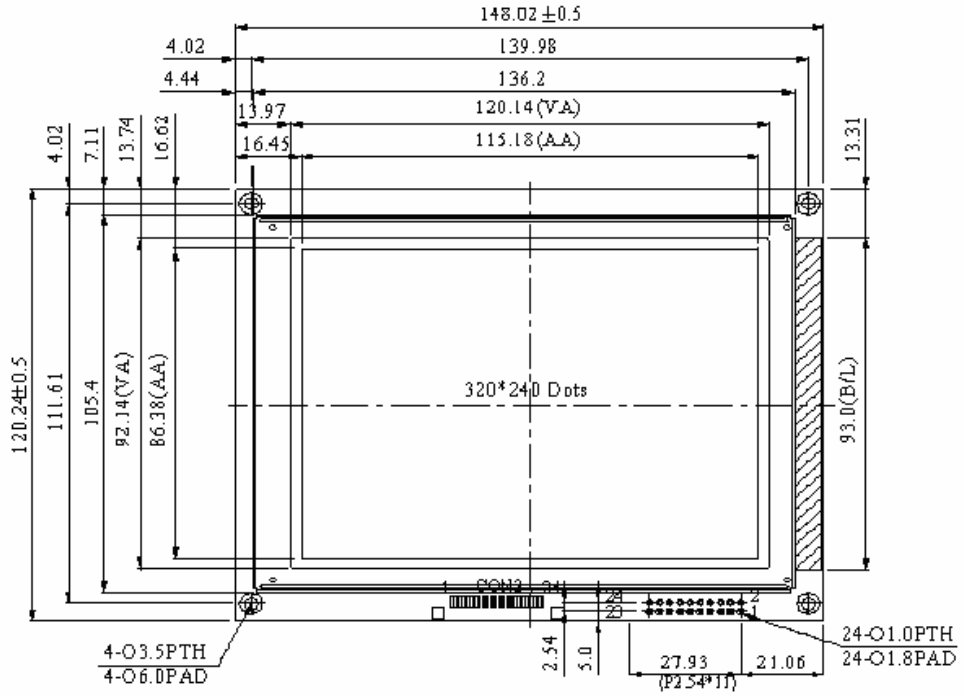
3.2 MECHANICAL DRAWING

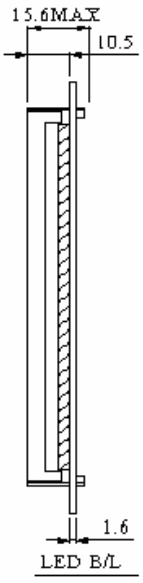




PIN NO.	SYMBOL
1	Vss
2	Vdd
3	Vo
4	$\overline{RD}$
5	$\overline{WR}$
6	A0
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	$\overline{CS}$
16	$\overline{RES}$
17	Vcc
18	FG/WAIT
19	NC/A
20	NC/K
21	X1
22	X2
23	Y1
24	Y2







The non-specified tolerance of dimension is ±0.3mm.

4 ELECTRICAL SPECIFICATION

4.1 ABSOLUTE MAXIMUM RATINGS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Min	Typ	Max	Unit	Note
Power Supply Voltage	V_{DD}-V_{SS}	0	-	+6,5	V	
Power Supply for LCD	V_{DD}-V_0	0	-	32	V	
Input Voltage	Vin	V_{SS}	-	V_{DD}	V	
Operating Temperature	Top	0 -20	-	+50 +70	°C	Note 1
Storage Temperature	Tst	-20 -30	-	+70 +80	°C	Note 2
Static Electricity	Be sure that you are grounded when handling displays.					

Note 1: Background colour changes slightly depending on ambient temperature. This phenomenon is reversible. Ta≤70 °C: 75% RH max

Note 2: Ta≤80 °C: 75% RH max

4.2 ELECTRICAL CHARACTERISTICS

VSS = 0 V, Ta = 25 °C

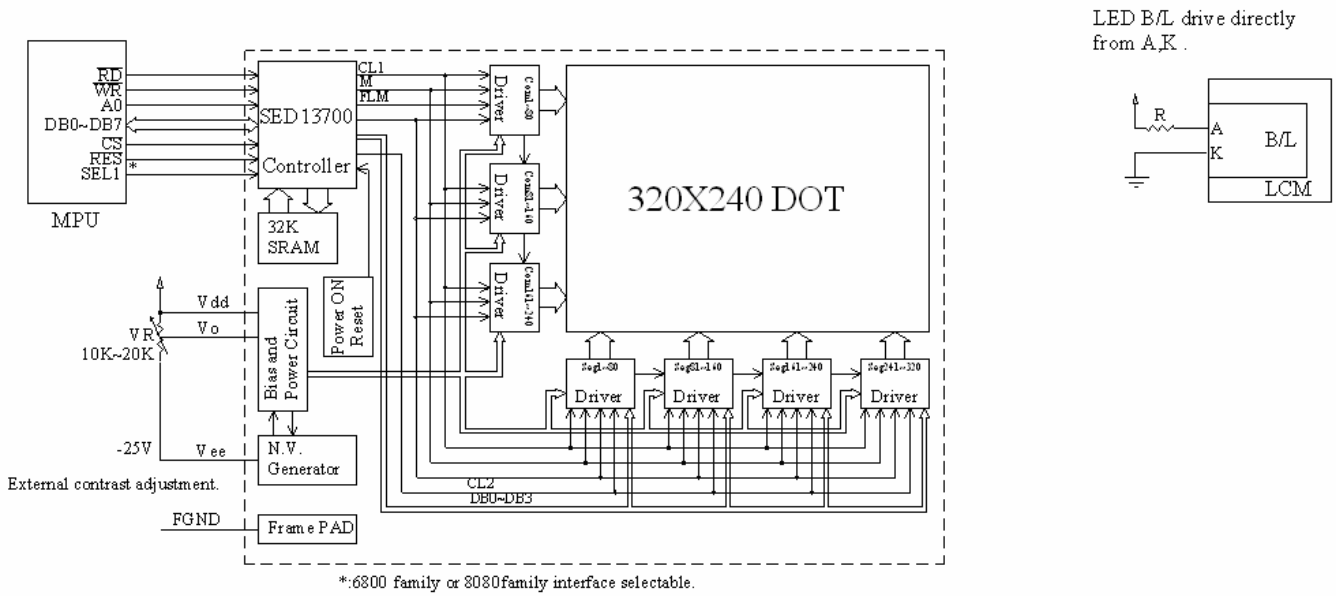
Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply for Logic	V_{DD}-V_{SS}	Ta = 25 °C	4,75	5,0	5, 25	V
Input Voltage	V_{IL}	Ta = 25 °C	0	-	0,2V_{DD}	V
	V_{IH}	Ta = 25 °C	0,8V_{DD}	-	V_{DD}	V
Output Voltage	V_{OL}	Ta = 25 °C	0	-	0,4	V
	V_{OH}	Ta = 25 °C	V_{DD}-0.4	-	V_{DD}	V
LCD Module Driving Voltage	V_{DD}-V_O	Ta = -20 °C	-	-	25	V
		Ta = 25 °C	-	23,8	-	V
		Ta = 70 °C	23	-	-	V
Current Consumption	* I_{DD}	V_{DD} = 5V V_{LCD} = -24V	95	100	105	mA

* I_{DD} measurement condition is for all pattern ON

4.3 INTERFACE PIN ASSIGNMENT

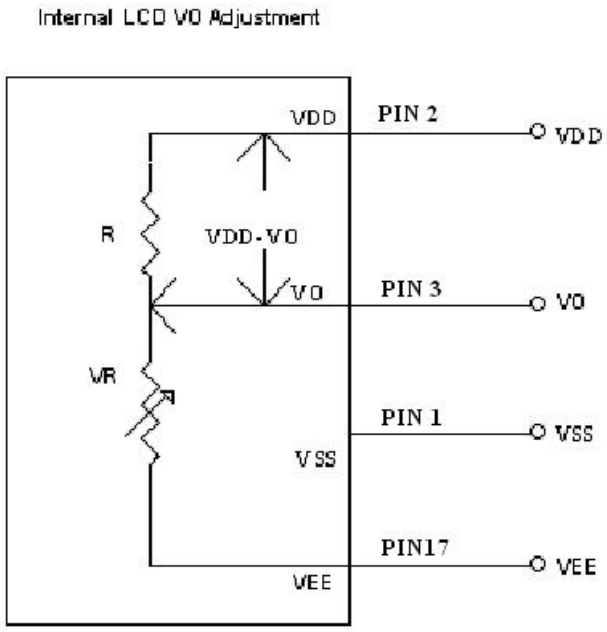
No.	Symbol	I/O	Function
1	V_{SS}	0V	Ground
2	V_{DD}	5.0V	Power supply for Logic
3	V_O	(Variable)	Driving voltage for LCD
4	E	H/L	6800 family: Enable clock
5	R/W	H/L	6800 family: R/W signal
6	A0	H/L	R/W=L, A0=H: Command Write A0=L: Data Write R/W=H, A0=H: Status Read A0=L: Data Read
7~14	DB0~DB7	H/L	Data bus
15	/CS	H/L	Chip select ,Active L
16	/RES	H/L	Controller reset signal, Active L
17	V_{EE}	-25V	Negative voltage output (Optional)
18	FG/WAIT		Frame Ground or Pin WAIT of S1D13700 Controller
19	NC / A		No connection or LED Anode
20	WAIT / K		No connection or LED Kathode
21	X1		NC
22	X2		NC
23	Y1		NC
24	Y2		NC

4.4 BLOCK DIAGRAM



INTEL 8080 or MOTOROLA 68000 Bus Protocol selectable by PCB Jumper

4.5 POWER SUPPLY CIRCUIT

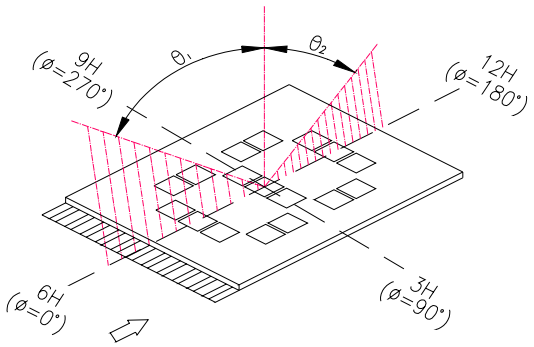


5 OPTICAL SPECIFICATION

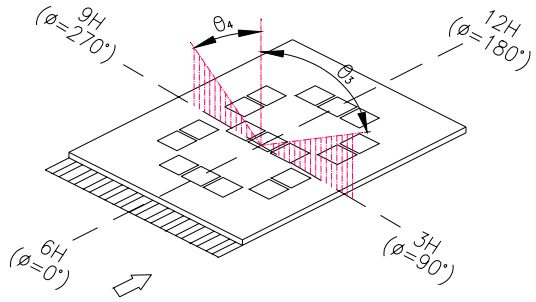
Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle in STN	θ1	CR≥2	-	40	-	deg	1
	θ2	CR≥2	-	20	-	deg	1
	θ3	CR≥2	-	30	-	deg	2
	θ4	CR≥2	-	30	-	deg	2
Viewing Angle in FSTN	θ1	CR≥2	-	60	-	deg	1
	θ2	CR≥2	-	30	-	deg	1
	θ3	CR≥2	-	45	-	deg	2
	θ4	CR≥2	-	45	-	deg	2
Contrast Ratio	CR	Ta = 25 °C	3	5	-	-	3
Response Time	Tr	Ta = 25 °C	-	200	300	ms	4
	Tf	Ta = 25 °C	-	150	200		
Driving Method	Duty	1/240					
Viewing Direction	6 O'CLOCK						

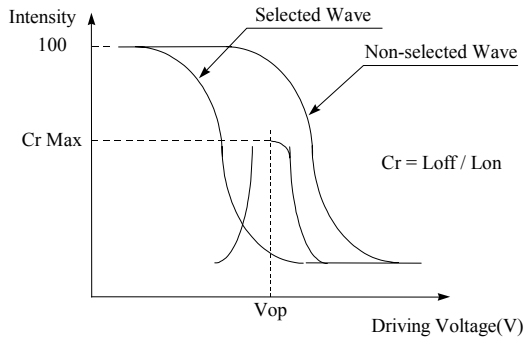
Note 1: definition of viewing angle θ1 & θ2



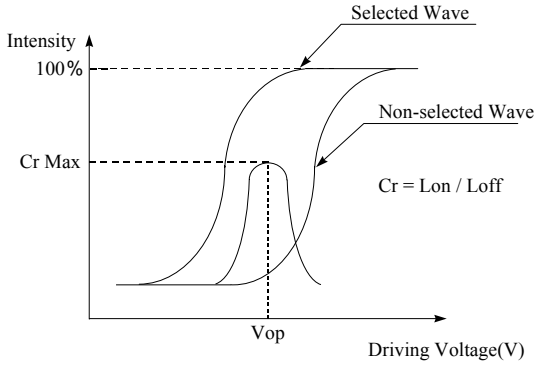
Note 2: definition of viewing angle θ3 & θ4



Note 3: definition of contrast ratio (CR)

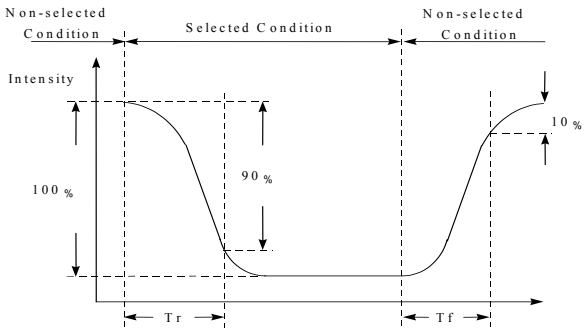


[positive type]

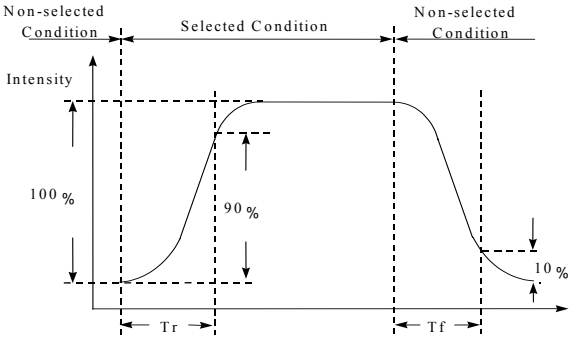


[Negative type]

Note 4: definition of response time



[positive type]



[Negative type]

6 BACKLIGHT SPECIFICATION

6.1 WHITE LED EDGE BACKLIGHT CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Current	I	V = 3,5V	-	160	-	mA
Forward Voltage	V_F	I_F = 160mA	-	3,5	3,6	V
Reverse Voltage	V_R		-	-	10	V
Luminous Intensity before through LCD	I_V	I_F = 160mA	-	23	-	cd/m²
Life time		I_F = 160mA	-	50K	-	hrs
Colour	WHITE					

6.2 YELLOW GREEN LED BACKLIGHT CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Current	I	V = 4,2V	-	360	-	mA
Forward Voltage	V_F	I_F = 360mA	-	4,2	4,6	V
Reverse Voltage	V_R		-	-	10	V
Luminous Intensity before through LCD	I_V	I_F = 360mA	-	23	-	cd/m²
Life time		I_F = 160mA	-	100K	-	hrs
Colour	YELLOW GREEN / 571nm					

6.3 CCFL BACKLIGHT CHARACTERISTICS

Item	Symbol	Condition	Min	Typ	Max	Unit
Supply Voltage	V	I = 5mA	-	278	-	V
Starting Voltage	Vs	25°C	-	-	530	V
Supply Current	I		3	5,0	6	mA
Lamp Power	P	I x V	-	1,35	-	Wrms
Luminous Intensity	I_V	I = 5mA	-	550	-	cd/m^2 Before through LCD
Chromaticity	(X) (Y)		- -	0,340 0,370	- -	
Life time		I_F = 5mA	-	20K	-	hrs
Colour	WHITE					

7 TIMING CHARACTERISTICS

7.1 TIMING OF S1D13700 CONTROLLER BUS

For the relative timing diagram, please see the spec of S1D13700.

7.2 DIFFERENCES BETWEEN SED1335 AND S1D13700

1． S1D13700 almost can replace SED1335，and it can drive 240*160 dots in 16 gray level,or 320*240 dots in 4 gray level.

2． There are 3 Main differences and being described as below:

(1)．The Check Busy method of SED1335 is reading the D6 of **STATUS resister.**

14. STATUS FLAG

The SED1335 series has a single bit status flag.
D6: X line standby

D7							D0	
X	D6	X	X	X	X	X	X	X: Don't care

The D6 status flag is HIGH for the TC/R-C/R cycles at the end of each line where the SED1335 series is not reading the display memory. The microprocessor may use this period to update display memory without affecting the display, however it is recommended that the display be turned off when refreshing the whole display.

Figure 53. Status flag

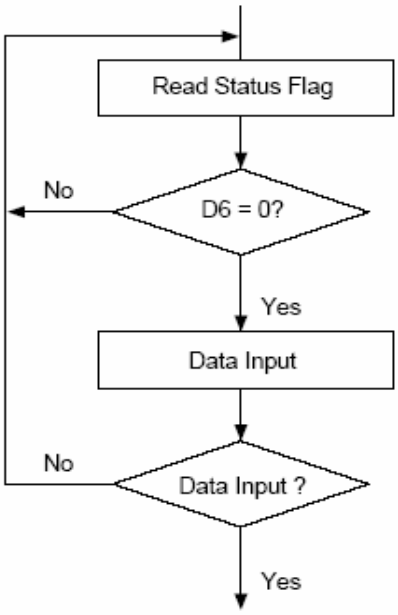


Figure 55. Flowchart for busy flag checking

The Check Busy method of S1D13700 is checking the “WAIT” pin directly. The “wait pin” of LMx769 is defaulted to pin 18 of the PCB Interface. It uses hardware to sensor “Busy Status.” We recommend you to use this function because it will not make your data sending/receiving get lost.。

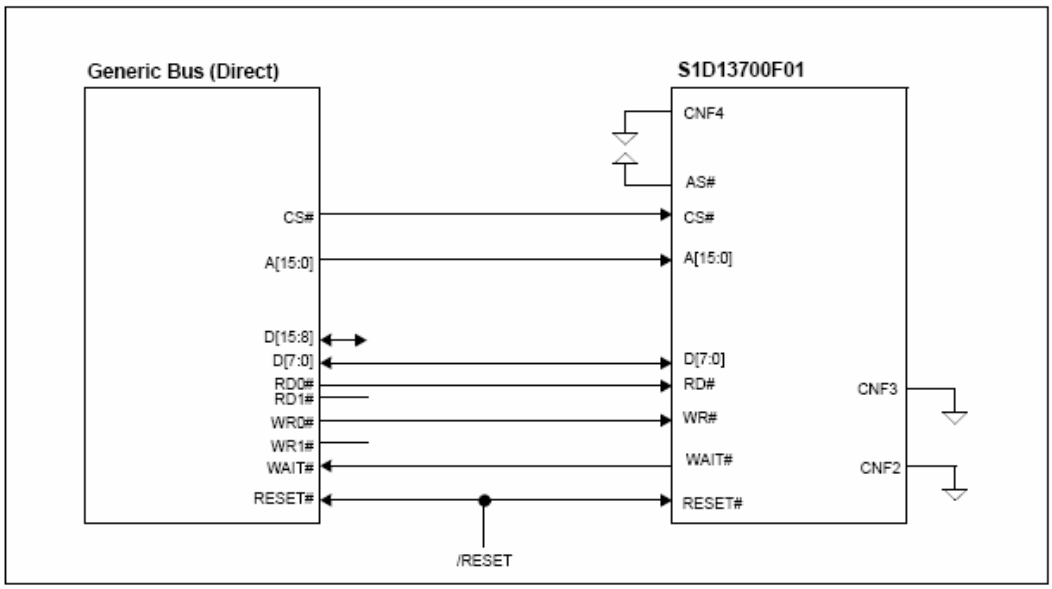


Figure 3-2 Direct Generic to S1D13700F01 Interface Example

(2) Owing to S1D13700 having 32K*8 SRAM inside,so It doesn’t need to set the bit “M1” in “SYSTEM SET”. For S1D13700, we doesn’t set M1(bit1) the setting for SED 1335 is shown as below:

8.2.1.1. C

This control byte performs the following:
1. Resets the internal timing generator
2. Disables the display
3. Cancels sleep mode

Parameters following P1 are not needed if only canceling sleep mode.

8.2.1.2. M0

Selects the internal or external character generator ROM. The internal character generator ROM contains 160, 5 × 7 pixel characters, as shown in figure 70. These characters are fixed at fabrication by the metallization mask. The external character generator ROM, on the other hand, can contain up to 256 user-defined characters.
M0 = 0: Internal CG ROM
M0 = 1: External CG ROM

Note that if the CG ROM address space overlaps the display memory address space, that portion of the display memory cannot be written to.

8.2.1.3. M1

Selects the memory configuration for user-definable characters. The CG RAM codes select one of the 64 codes shown in figure 46.
M1 = 0: No D6 correction.
The CG RAM1 and CG RAM2 address spaces are not contiguous, the CG RAM1 address space is treated as character generator RAM, and the CG RAM2 address space is treated as character generator ROM.
M1 = 1: D6 correction.
The CG RAM1 and CG RAM2 address spaces are contiguout and are both treated as character generator RAM

The setting of S1D13700 will show as follow:

bit 1	Reserved The default value for this bit is 0.
bit 0	Character Generator Select (M0) This bit determines whether characters are generated by the internal character generator ROM (CGROM) or character generator RAM (CGRAM). The CGROM contains 160, 5x7 pixel characters which are fixed at fabrication. The CGRAM can contain up to 256 user-defined characters which are mapped at the CG Start Address (REG[1Ah] - REG[19h]). However, when the CGROM is used, the CGRAM can only contain up to 64, 8x8 pixel characters. When this bit = 0, the internal CGROM is selected. When this bit = 1, the internal CGRAM is selected. **Note** If the CGRAM is used (includes CGRAM1 and CGRAM2), only 1 bpp is supported.

(3) Reset Timing:

If you originally adopts 1335, and use the same "reset timing" to your new S1D13700-based LCD module, you might have some problem when you power on your 13700-based LCD module. You may reset this model and get back to normal operation status. This means you have to modify your new S1D13700-based module for adequate program. Please refer to S1D13700 spec. for the detailed modification.

(4) ROHS Standard:

S1D13700 is required for ROHS standard, but 1335 not.

Item	Sub-Item	S1D1335	S1D13700
Display Memory	Buffer RAM(Ext'l)	Max 64Kbytes SRAM(Control pins, I/F pin available)	No need, because of built-in RAM
	Buffer RAM (Built-in)	None	32Kbytes SRAM
Character Generator	CGROM (built-in)	160char. (5x7 dots)	Same as 1335
	CGROM (ext'l)	256 char. (8x 16 dots) (M0=1)	No need, because of int'l ROM
	CGRAM(ext'l)	64 char. (8x 16dots) (M0=0)	No need, because of int'l RAM
	CGRAM (Display memory)	None	64 char.(8x16dots) (M0=0) 256char.(8x16dots)(M0=1)
HOST Interface	Data Bus width	8bit	Same as 1335
	Hardware Config.	80/68 series CPU	1. 80/68 (6800,MC68K) series CPU 2. Pixel lock, req. divider(1/4, 1/8, 1/16) 3. Direct/ Indirect interface
Display Mode	Display Mode	1. Character mode 2. Graphic mode 3. Character/ Gracphic mode (5 options)	1. same as 1335 2. same as 1335 3. character/ graphic mode (16 options)
	Gray Scale	None	Selectable 1bpp/ 2bpp/ 4bpp
Display Dot #	Character mode	80clms.x32rows (monochrome 1bpp)+Graphic	1. 80cx30r (monochrome 1bpp) + Grphaic 2. 40cx30r (4 GrayShade 2bpp) + Graphic 3. 30cx20r (16 GrayShade 4bpp) +Graphic

	Graphics mode	**640x256dots(Monochrome 1bpp) x 3 displays**	**1. 640x240dots(Monochrome 1bpp) x 3displays** **2. 320x240dots(4 GrayShade 2bpp) x 3displays** **3. 240x160dots(16 GrayShade 4bpp) x3 displays**
Display functions	**Command /Parameter set, Command code**	**---**	**S1D1335 Upper Compatibility** **(add. Command:GRAY SCALE(Code 60h) 1 command)**
	Cursor shift(Indirect Mode)	**Automatic cursor shift (up, down, left, right)**	**Same as 1335**
	Cursor shift (Direct mode)	**None**	**Automatic shift to address of disply memory access**
	Smooth scroll function	**Horizontal**	**Same as 1335** **(no support of Gray scale mode)**
Supply voltage		**2.7V~5.5V (single voltage operation)**	**3.3V single operation / Core=3.3V, I/O=5V dual supply** **Host, Panel, 3.0V~3.6V or 4.5V~5.5V(selectable respectively)**
Max. operation freq		**10MHz at 5V, 8MHz at 3V**	**60MHz@3.3V or 5V/3.3V**
PKG		**QFP5-60pin, QFP6-60pin**	**TQFP13-64pin** **(pin layout incompatible with 1335)**

8 QUALITY ASSURANCE SPECIFICATION

8.1 CONFORMITY

The performance, function and reliability of the shipped products conform to the Product Specification.

8.2 DELIVERY ASSURANCE

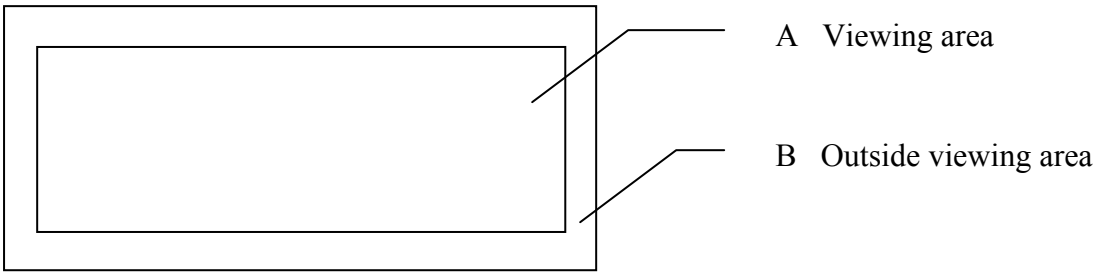
8.2.1 Delivery inspection standards.

- MIL-STD-105E, general inspection level II, single sampling level;
- IPC-AA610 rev. C, class 2 electronic assemblies standard

The quality assurance levels are shown below:

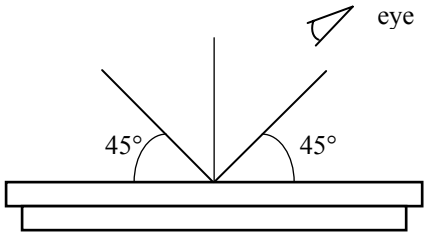
Rank	Item Inspected	Defect type	AQL	Remark
Critical defect	Display	Non display	0.65%	Display malfunction
		Over current		
		Missing segment		
		Wrong viewing direction		
		Backlight OFF		
	Dimension	PCB and bezel out of specification	0.65%	Assembly failure
Major defect	Display	Incorrect operating	1.0%	
	Backlight	Flashing, dust		
		Wrong colour		
Minor defect	LCD	Black and white spot	2.5%	Appearance defect
		Black and white lines		
		Polariser scratch		
		Bubbles in polariser		
		Segment deformation, pin hole		
		Colour uniformity		
		Glass chip		
	COB	Wire bond pad exposed		
		Insufficient covering with resin (wire bond line exposed)		
		Bubble, dust on COB		
	PCB	Dust, solder ball on PCB		
		Pad scratch		
		Total	2.5%	

8.2.2 Zone definition



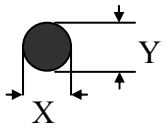
8.2.3 Visual inspection

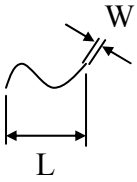
- Inspect under 2x20W or 40W fluorescent lamp (approximately 3000 lux) leaving 25 to 30 cm between the module and the lamp and 30 cm between the module and the eye (measuring position).
- Appearance is inspected at the best contrast voltage (best contrast is adjusted considering clearness and crosstalk on screen).
- Inspect the module at 45° right and left, top and bottom.
- Use the optimum viewing angle during the contrast inspection.

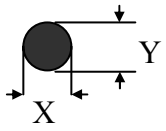


8.2.4 Standard of appearance inspection

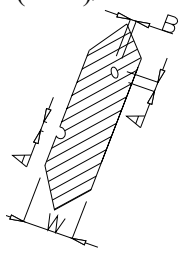
Units: mm

<table>
<tr><th>No</th><th>Item</th><th>Criteria</th></tr>
<tr><td>1</td><td>Black spot,
white spot, dust</td><td>
Round type: as per following drawing
∅ = (X+Y)/2


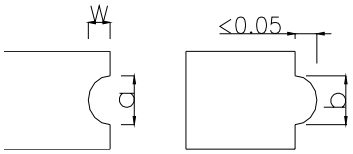
<table>
<tr><th colspan="3">Acceptable quantity</th></tr>
<tr><td>Size</td><td>Zone A</td><td>Zone B</td></tr>
<tr><td>∅<0.1</td><td>Any number</td><td rowspan="4">Any number</td></tr>
<tr><td>0.1<∅<0.2</td><td>6</td></tr>
<tr><td>0.2<∅<0.3</td><td>2</td></tr>
<tr><td>0.3<∅</td><td>0</td></tr>
</table>
Line type: as per following drawing


<table>
<tr><th colspan="4">Acceptable quantity</th></tr>
<tr><td>Length</td><td>Width</td><td>Zone A</td><td>Zone B</td></tr>
<tr><td>- -</td><td>W≤0.02</td><td>Any number</td><td rowspan="4">Any number</td></tr>
<tr><td>L≤3.0</td><td>0.02<W≤0.03</td><td rowspan="2">2</td></tr>
<tr><td>L≤2.5</td><td>0.03<W≤0.05</td></tr>
<tr><td>- -</td><td>0.05<W</td><td>As round type</td></tr>
</table>
Total acceptable quantity: 3
</td></tr>
<tr><td>2</td><td>Polariser scratch</td><td>Scratch on protective film is permitted
Scratch on polariser: same as No. 1</td></tr>
<tr><td>3</td><td>Polariser bubble</td><td>
∅ = (X+Y)/2


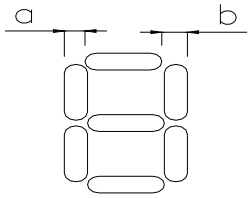
<table>
<tr><th colspan="3">Acceptable quantity</th></tr>
<tr><td>Size</td><td>Zone A</td><td>Zone B</td></tr>
<tr><td>∅<0.3</td><td>Any number</td><td rowspan="4">Any number</td></tr>
<tr><td>0.3<∅<1.0</td><td>3</td></tr>
<tr><td>1.0<∅<1.5</td><td>1</td></tr>
<tr><td>1.5<∅</td><td>0</td></tr>
</table>
Total acceptable quantity: 4
</td></tr>
<tr><td>4</td><td>Segment
deformation</td><td>
1.a. Pin hole on segmented display

W: segment width
∅ = (A+B)/2


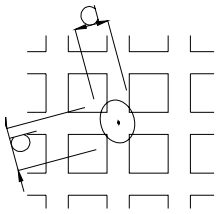
<table>
<tr><th colspan="2">Acceptable quantity</th></tr>
<tr><td>Width</td><td>∅</td></tr>
<tr><td>W≤0.4</td><td>∅≤0.2 and ∅≤1/2W</td></tr>
<tr><td>W>0.4</td><td>∅≤0.25 and ∅≤1/3W</td></tr>
</table>
Total acceptable quantity: 1 defect per segment
Pin holes with ∅ under 0.10 mm are acceptable
</td></tr>
</table>

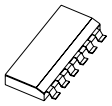
<table>
<tr><th>No</th><th>Item</th><th>Criteria</th></tr>
<tr><td>4</td><td>Segment deformation</td><td>
1b. Pin hole on dot matrix display


<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>a,b<0.1</td><td>Any number</td></tr>
<tr><td>(a+b)/2≤0.1</td><td>Any number</td></tr>
<tr><td>0.5<∅<1.0</td><td>3</td></tr>
</table>
Total acceptable quantity: 7

2. Segments / dots with different width


<table>
<tr><td colspan="2">Acceptable</td></tr>
<tr><td>a≥b</td><td>a/b≤4/3</td></tr>
<tr><td>a<b</td><td>a/b>4/3</td></tr>
</table>

3. Alignment layer defect
∅ = (a+b)/2


<table>
<tr><td colspan="2">Acceptable quantity</td></tr>
<tr><td>Size</td><td></td></tr>
<tr><td>∅≤0.4</td><td>Any number</td></tr>
<tr><td>0.4<∅≤1.0</td><td>5</td></tr>
<tr><td>1.0<∅≤1.5</td><td>3</td></tr>
<tr><td>1.5<∅≤2.0</td><td>2</td></tr>
</table>
Total acceptable quantity: 7
</td></tr>
<tr><td>5</td><td>Colour uniformity</td><td>Level of sample for approval set as limit sample</td></tr>
<tr><td>6</td><td>Backlight</td><td>The backlight colour should correspond to the product specification
Flashing and or unlit backlight is not allowed
Dust larger than 0.25 mm is not allowed</td></tr>
<tr><td>7</td><td>COB</td><td>Exposed wire bond pad is not allowed
Insufficient covering with resin is not allowed (wire bond line exposed)
Dust or bubble on the resin are not allowed</td></tr>
<tr><td>8</td><td>PCB
  </td><td>No unmelted solder paste should be present on PCB
Cold solder joints, missing solder connections, or oxidation are not allowed
No residue or solder balls on PCB are allowed
Short circuits on components are not allowed</td></tr>
</table>

9 RELIABILITY SPECIFICATION

Test Item	Test Condition	Description
High Temperature Operation	50°C or 70℃ 200hrs	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.
Low Temperature Operation	0°C or -20℃ 200hrs	Endurance test applying the electric stress under low temperature for a long time.
High Temperature Storage	70°C or 80℃ 200hrs	Endurance test applying the high storage temperature for a long time.
Low Temperature Storage	-20°C or -30℃ 200hrs	Endurance test applying the high storage temperature for a long time.
High Temperature & High Humidity Storage	80℃,90%RH 96hrs	Endurance test applying the high temperature and high humidity storage for a long time.
Thermal Shock Test	-30℃ 25℃ 80℃ 30min 5min 30min For 10 cycles	Endurance test applying the low and high temperature cycle. Burn In Test.
Vibration	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs	Endurance test applying the vibration during transportation and using.
ESD	VS=800V,RS=1.5kΩ CS=100pF	Endurance test applying the electric stress to the terminal.
Shock Test	50G Half sign wave 11 msed 3 times of each direction	Constructional and mechanical endurance test applying the shock during transportation.

10 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 Trichlorotriflorothane.
Do not wipe the display surface with dry or hard materials that will damage the polariser 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 terminal 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 sunshine 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 electro-chemical 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°C ± 10°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).