`

LIQUID CRYSTAL DISPLAY MODULE

Product Specification

CUSTOMER		
PRODUCT NUMBER	**LM4055**	
CUSTOMER APPROVAL		**Date**

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

☐ **Approval for Specification only**

☐ **Approval for Specification and Sample**

Sample no.: Date: ISR no.:

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REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	07/11/03	-	-	New Release	E1548
B	01/19/04	-	-	New Format Configuration	E1509

1 MAIN FEATURES

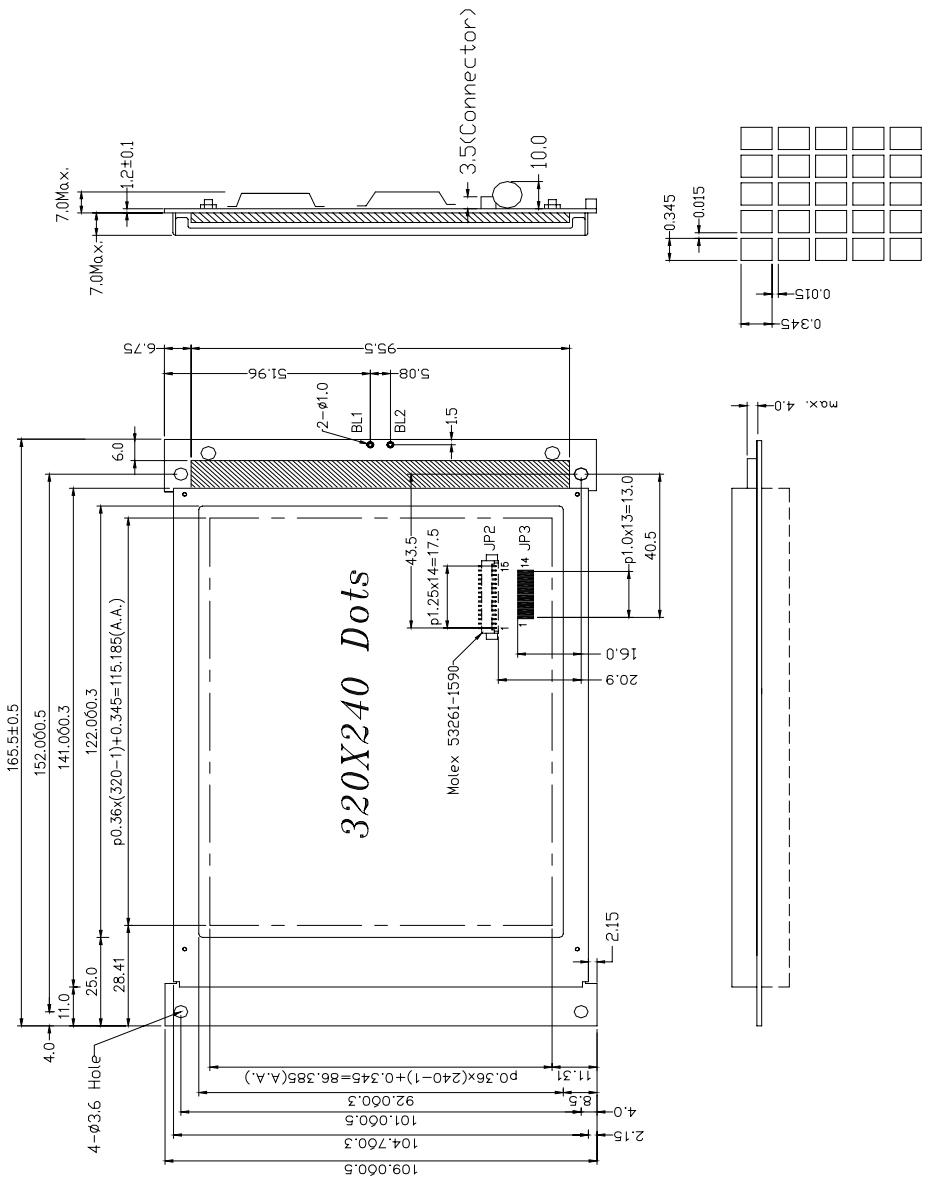
ITEM	CONTENTS
Display Format	320 dots x 240 dots
Colour	Monochrome
Overall Dimensions	173.0(W) x 109.9(H) x 16.0 max. (D)
Viewing Area	122.0 (W) x 92.0 (H)
LCD type	STN-Negative-Transmissive FSTN-Positive-Transflective FSTN-Negative-Transmissive
Mode	Blue
Viewing Angle	6:00 O'Clock
Duty ratio	1/240
Driver IC	N/A
Backlight type	LED
Backlight colour	White
DC/DC converter	Yes (optional)
Operating temperature	-20°C to +70°C
Storage temperature	-30°C to +80°C

2 MECHANICAL SPECIFICATION

2.1 MECHANICAL CHARACTERISTICS

ITEM	CHARACTERISTIC	UNIT
Display Format	320 dots x 240 dots	
Character Format	N/A	
Overall Dimensions	173.0 (W) x 109.0 (H) x 16.0 max (D)	mm
Viewing Area	122.0 x 92.0	mm
Active Area	115.185 x 86.385	mm
Character Size	N/A	mm
Character Pitch	N/A	mm
Dot Size	0.345 x 0.345	mm
Dot Pitch	0.360 x 0.360	mm
Weight	197	g

2.2 MECHANICAL DRAWING



3 ELECTRICAL SPECIFICATION

3.1 ABSOLUTE MAXIMUM RATINGS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	V_{DD}-V_{SS}	0	7.0	V	
Input Voltage	Vin	0	Vdd	V	
Operating Temperature	Top	-20	+70	°C	Note 1
Storage Temperature	Tst	-30	+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

3.2 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	5.25	V
Supply Voltage (V_{EE}) Typ.	V_{EE}	Ta = 25 °C	-	-23	-	
Input Voltage	V_{IL}	Ta = 25 °C	0	-	1.0	V
	V_{IH}	Ta = 25 °C	3.8	-	Vdd	V
Current Consumption	I_{DD}	V_{DD} =5 V Without Negative Voltage		6.5		mA
	I_{DD}	V_{DD} =5 V With Negative Voltage		85		mA

3.3 RECOMMENTED LC DRIVE VOLTAGE (V_{DD-VO})

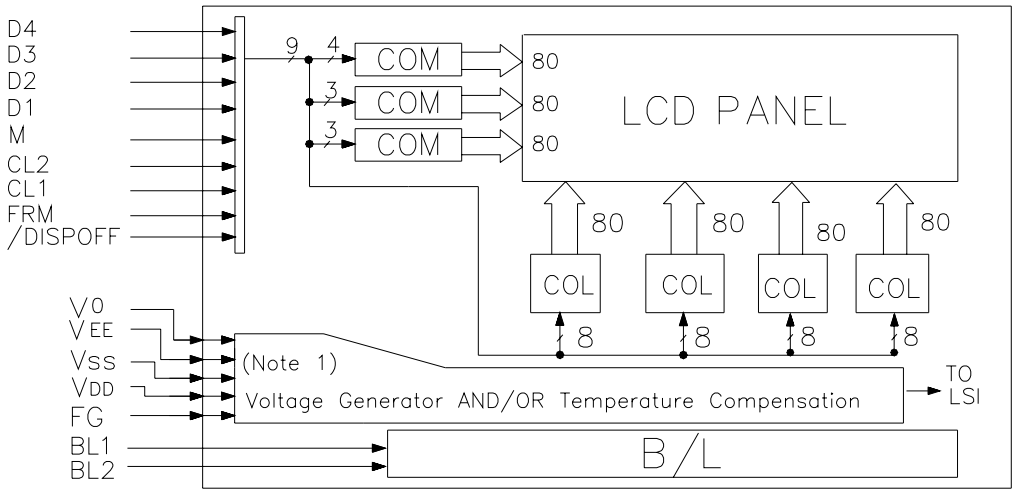
V_{DD}=5.0±0.25V

Temperature	STN	STN-H	FSTN POSITIVE	FSTN-H POSITIVE	FSTN NEGATIVE	FSTN-H NEGATIVE
T_a= -20°C	-	26.5	-	27.0	-	27.5
T_a= 0°C	25.5	25.5	26.2	26.2	26.0	26.0
T_a= 25°C	25.0	25.0	25.5	25.5	25.0	25.0
T_a= 50°C	24.0	24.0	24.0	24.0	24.2	24.2
T_a= 70°C	-	23.0	-	22.5	-	23.0

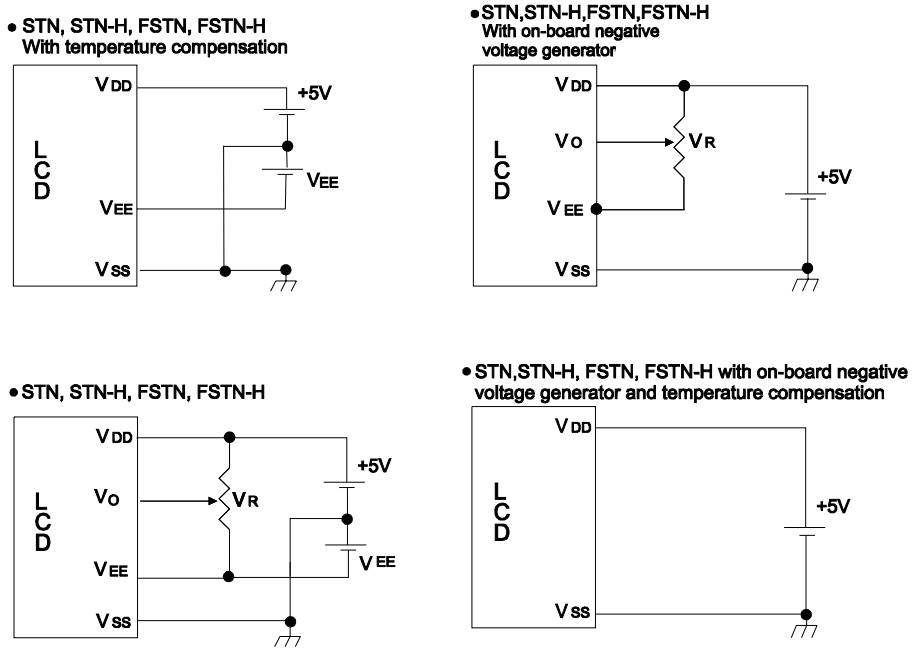
3.4 INTERFACE PIN ASSIGNMENT

Pin No.	Symbol	I/O	Function
1	D1	I/O	Bi directional data bus line 1
2	D2	I/O	Bi directional data bus line 2
3	D3	I/O	Bi directional data bus line 3
4	D4	I/O	Bi directional data bus line 4
5	DISPOFF	I	"L" : Display OFF "H" : Display ON
6	FRM	I	First Row Marker indicates the beginning of each display cycle
7	M	I	Control signal for A.C. drive
8	CL1	I	The CL1 latches the serial data in the shift registers
9	CL2	I	Clock signal for shifting the serial data
10	Vdd	-	Power Supply for logic circuit (+5V)
11	Vss	-	Ground
12	Vee	-	Power Supply for LC drive
13	Vo	-	Operating voltage for LC drive
14	FG	-	Frame Ground
15	N/C	-	No Connection
BL1	VLED+	-	LED+ backlight input voltage (from output of DC-AC inverter)
BL2	VLED-	-	LED- backlight input voltage (from output of DC-AC inverter)

3.5 BLOCK DIAGRAM



3.6 POWER SUPPLY CIRCUIT



3.7 TIMING CHARACTERISTICS

Note: Please reference the manufacturers data sheet for the ASLIC AX6086 controller.

4 OPTICAL SPECIFICATION

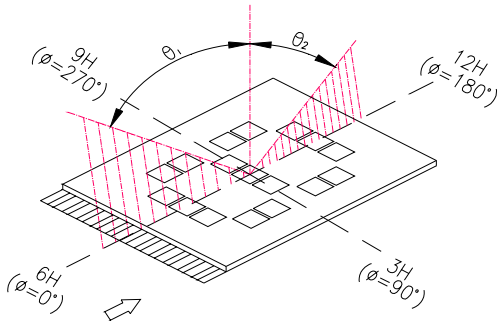
4.1 OPTICAL CHARACTERISTICS

Ta = 25 °C

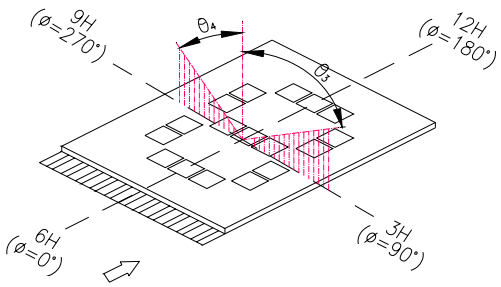
Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle	θ1	Ka=2 θ=0°	20	-	-	deg	1
	θ2	Ka=1.4 θ=0°	40	-	-	deg	1
	θ3	Ka=2 θ=20°	±10	-	-	deg	2
	θ4	Ka=1.4 θ=20°	±30	-	-	deg	2
Contrast Ratio	K	Ø=0° Ka=2 θ=0° Ka=1.4	5 3	- -	- -	-	3
Response Time	Tr	Ø=0°θ=0°Ta = 25 °C		200		ms	4
	Tf	Ø=0°θ=0°Ta = 25 °C		210			
Driving Method	Duty	1/240					
	Bias	1/14					
LCD Type	STN – Negative Transmissive						
Viewing Direction	6:00 O'CLOCK						

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle	θ1	Ka=2 θ=0°	20	-	-	deg	1
	θ2	Ka=1.4 θ=0°	40	-	-	deg	1
	θ3	Ka=2 θ=20°	±10	-	-	deg	2
	θ4	Ka=1.4 θ=20°	±30	-	-	deg	2
Contrast Ratio	K	Ø=0° Ka=2 θ=0° Ka=1.4	5 3	- -	- -	-	3
Response Time	Tr	Ø=0°θ=0 °Ta = 25 °C		130		ms	4
	Tf	Ø=0°θ=0 °Ta = 25 °C		340			
Driving Method	Duty	1/240					
	Bias	1/14					
LCD Type	FSTN- Positive-Transflective						
Viewing Direction	6:00 O'CLOCK						

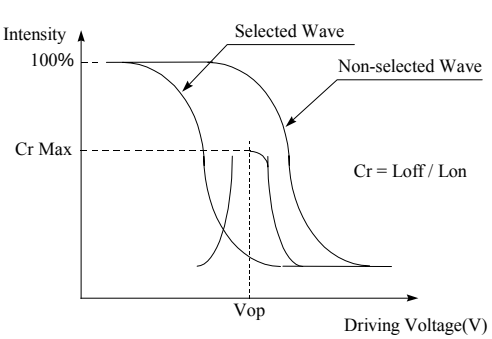
Note 1: definition of viewing angle θ1 & θ2



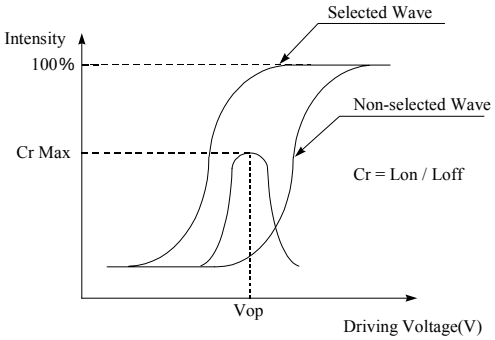
Note 2: definition of viewing angle θ3 & θ4



Note 3: definition of contrast ratio (CR)

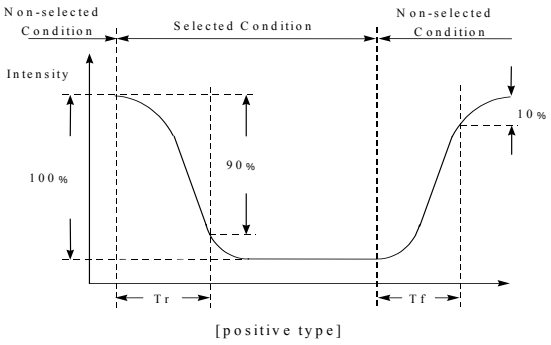


[positive type]

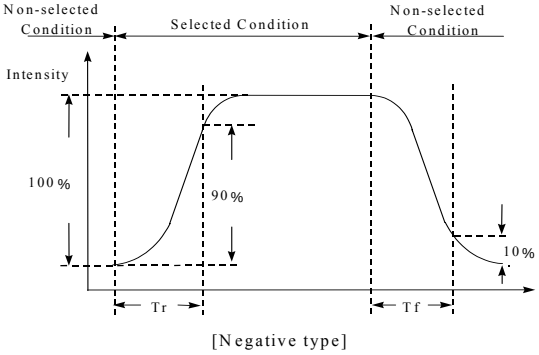


[Negative type]

Note 4: definition of response time



[positive type]



[Negative type]

5 BACKLIGHT SPECIFICATION

5.1 BACKLIGHT CHARACTERISTICS

The backlight comprises of a light guide with LED, three LED emitters left and right.

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Current	I			120		mA	
Forward Voltage	V_F	I_F = 60mA		5		V	
Average Luminous Intensity	STN FSTN-P FSTN-N			28 24 32		cd/m²	1 (on LCD)
Life time		I_F = 120mA	-	40,000	-	hrs	3
Colour	White						

Note:
1. Average luminous intensity of 9 points
2. Brightness uniformity = (MAX-MIN) / MAX x 100
3. Half of the original brightness

5.2 INTERNAL CIRCUIT DIAGRAM

N/A

6 PACKAGING AND LABELLING SPECIFICATION

6.1 LABELLING & MARKING

DENSITRON LM4055 XX XXX TAIWAN YYMM

NOTE: XX XXX Represent options, refer to sheet 17 of 17.

7 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).

8 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LM4055①②240G320③④⑤

① **POLARIZER TYPE**

B = Transflective: light background with white CFL backlight
E = Transmissive: dark background with white CFL backlight

② **BACKLIGHT COLOR AND TYPE**

W = White LED Backlight

③ **FLUID TYPE AND POWER SUPPLY**

D = STN with +5VDC and external negative voltage operation
S = STN with +5VDC operation (on-board negative voltage generation)
H = STN extended temp. with +5VDC and external negative voltage operation
W = STN extended temp. with +5VDC operation (on-board negative voltage generation)

④ **FLUID TYPE**

C = STN with on-board temperatrue compensation circuitry
N = STN
F = FSTN

⑤ **COLOR FOR STN FLUID**

B = Blue background
G = Gray background
Y = Yellow background