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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RELEASED ON ECN #E0220	7/13/95	MA

1. **Specification subject to change without notice.**
2. **All dimensions and specifications apply to standard modules. This information may vary for modules with optional features.**
3. **All dimensions are in millimeters.**
4. **Precautions: These precautions apply equally to modules from all makers, not just Densitron. Violation of these guidelines may void the warranty and can cause problems ranging from erratic operation to catastrophic display failure.**

Handling precautions:

- ◆ This device is susceptible to Electro-Static Discharge (ESD) damage. Observe Anti-Static precautions.

Power supply precautions:

- ◆ Identify and, at all times, observe absolute maximum ratings for both logic and LC drivers. Note that there is some variance between models.
- ◆ Prevent the application of reverse polarity to VDD and VSS, however briefly.
- ◆ Use a clean power source free from transients. Power up conditions are occasionally "jolting" and may exceed the maximum ratings of the module.
- ◆ The +5V power of the module should also supply the power to all devices which may access the display. Don't allow the data bus to be driven when the logic supply to the module is turned off.
- ◆ DO NOT install a capacitor between the Vo (contrast) pin and ground. VDD must, at all times, exceed the Vo voltage level. The capacitor combines with the contrast potentiometer to form an R-C network which "holds-up" Vo, at power-down, possibly damaging the module.

Operating precautions:

- ◆ DO NOT plug or unplug the module when the system is powered up.
- ◆ Minimize the cable length between the module and host MPU. (Recommended max. length 30 cm).
- ◆ For models with EL or CCFL backlights, do not disable the backlight by interrupting the HV line. Unloaded inverters produce voltage extremes which may arc within a cable or at the display.
- ◆ Operate the module within the limits of the modules temperature specifications.

Mechanical / Environmental precautions:

- ◆ Improper soldering is the major cause of module difficulty. Use of flux cleaner is not recommended as they may seep under the elastomeric connection and cause display failure. Densitron recommends the use of Kester "245" no-clean solder.
- ◆ Mount the module so that it is free from torque and mechanical stress.
- ◆ Surface of LCD panel should not be touched or scratched. The display front surface is an easily scratched, plastic polarizer. Avoid contact and clean only when necessary with soft, absorbent cotton dampened with petroleum benzene.
- ◆ ALWAYS employ anti-static procedure while handling the module.
- ◆ Prevent moisture build-up upon the module and observe the environmental constraints for storage temperature and humidity.
- ◆ DO NOT store in direct sunlight.
- ◆ If leakage of the liquid crystal material should occur, avoid contact with this material, particularly ingestion. If the body or clothing becomes contaminated by the liquid crystal material, wash thoroughly with water and soap.

Notes: (unless otherwise specified)

Unless otherwise specified: Dimensions are mm Tolerances are: X = ± 3 .X = ± 0.5 .XX = ± 0.05 FSCM NO. 62483	APPROVALS	DATE	DENSITRON INTERNATIONAL PLC.	
	DRAWN			
	MAA		TITLE	
	CHECKED			
	JLH		240 X 128 GRAPHICS LCD MODULE	
	ISSUED		DWG. NO.	
	MAA		LM6129	SHEET 1 OF 8

1.0 DESCRIPTION

Dot matrix display module consisting of liquid Crystal Display, CMOS driver and Hitachi HD61830B printed circuit board, metal support frame and Cold Cathode Fluorescent (CCFL) backlight.

Available LC fluid types are: NTN (supertwisted nematic) and NTN-H (extended temperature range NTN).

Other options include on-board negative voltage generation circuitry and on-board temperature compensation circuitry.

2.0 MECHANICAL CHARACTERISTICS

Item	Specifications	Unit
Package Dimensions	144.0 (W) x 104.0 (H) x 17.8 max (D)	mm
Display format	240 dots (W) x 128 dots (H)	-
Driving method	1/128	duty
Dot size	0.40 (W) x 0.40 (H)	mm
Dot pitch	0.45 (W) x 0.45(H)	mm
Active display area	107.95(W) x 57.55 (H)	mm
Viewing area	114.0 (W) x 64.0 (H)	mm
Weight		g

Notes: W-Width; H-Height; D-Depth.

3.0 ABSOLUTE MAXIMUM RATINGS

VSS=0V; Ta=25°C

Item	Symbol	FSTN,NTN		FSTN-H,NTN-H		Unit
		Min.	Max.	Min.	Max.	
Logic supply voltage	VDD-VSS	0	7	0	7	V
LC driver supply voltage	VDD-VEE	0	-25	0	-25	V
Operating temperature	TOP	0	+50	-20	+70 (Note 3)	°C
Storage temperature (Note 1)	TST	-20	+70	-30	+80	
Humidity: Operating (@40°C)	-	-	85%	-	85%	RH (Note 2)
Non-operating (@40°C)	-	-	95%	-	95%	RH (Note 2)

Notes: 1: Tested to 100 hrs.
2: Refers to non-condensing conditions.
3. It is not recommended to operate CCF lamp below 0°C.

4.0 ELECTRICAL CHARACTERISTICS

VDD=5±0.25V; Ta=25°C

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input "High" voltage	VIH	-	0.8	-	VDD	V
Input "Low" voltage	VIL	-	VSS	-	0.2VDD	V
Output "High" voltage	VOH	IOH=0.205mA	2.2	-	-	V
Output "Low" voltage	VOL	IOL=1.2mA	-	-	0.8	V
Power supply current	IEE	VEE=-20V	-	7.0	-	mA
Power supply current	IDD	VDD=5.0V	-	30.0	-	mA

5.0 RECOMMENDED LC DRIVE VOLTAGE ($V_{DD}-V_O$)

$V_{DD}=5.0\pm0.25V$

Temperature	FSTN	FSTN-H	NTN	NTN-H
Ta= -20°C	-	19.6	-	24.3
Ta= 0°C	18.3	18.3	21.0	21.0
Ta= 25°C	17.3	17.3	18.5	18.5
Ta= 50°C	16.0	16.0	16.8	16.8
Ta=70°C	-	15.0	-	15.7

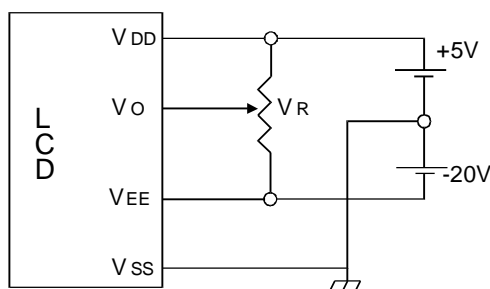
6.0 BACKLIGHT SPECIFICATIONS:

Ta=20°C,60%RH,Darkroom.

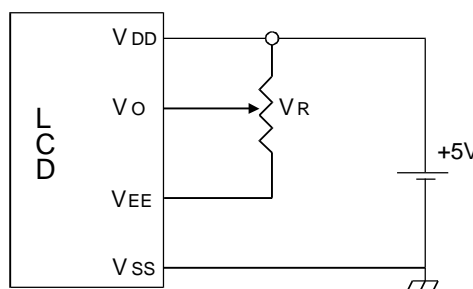
Item	Symbol	Typ.	Max.	Unit
CFL lamp input voltage	VCCFL	235	300	Vrms
CFL input current	ICCFL	5.0	8.0	mA
Life to half initial brightness	-	10000	15000	Hours
CFL lamp input frequency	FCCFL	25	60	KHz
Recommended backlight inverter	-	INV12	-	-

7.0 POWER SUPPLY

NTN, NTN-H

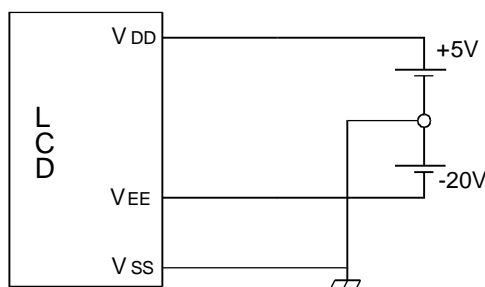


NTN, NTN-H with on-board negative voltage generator

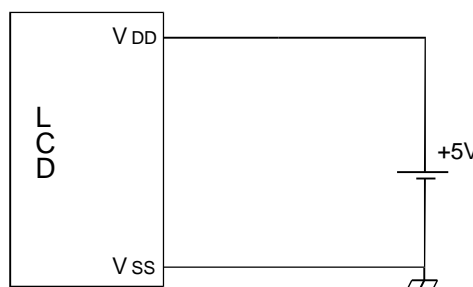


$V_R = 10K - 20K \text{ ohm}$

NTN, NTN-H with temperature compensation



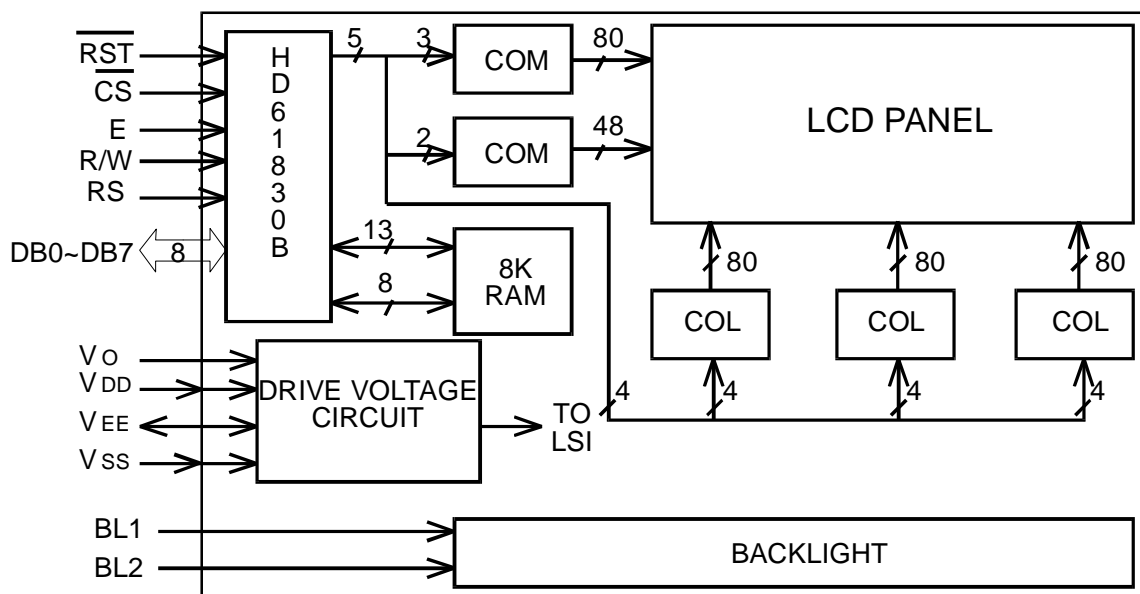
NTN, NTN-H with on-board negative voltage generator and temperature compensation



8.0 INTERFACE DESCRIPTION

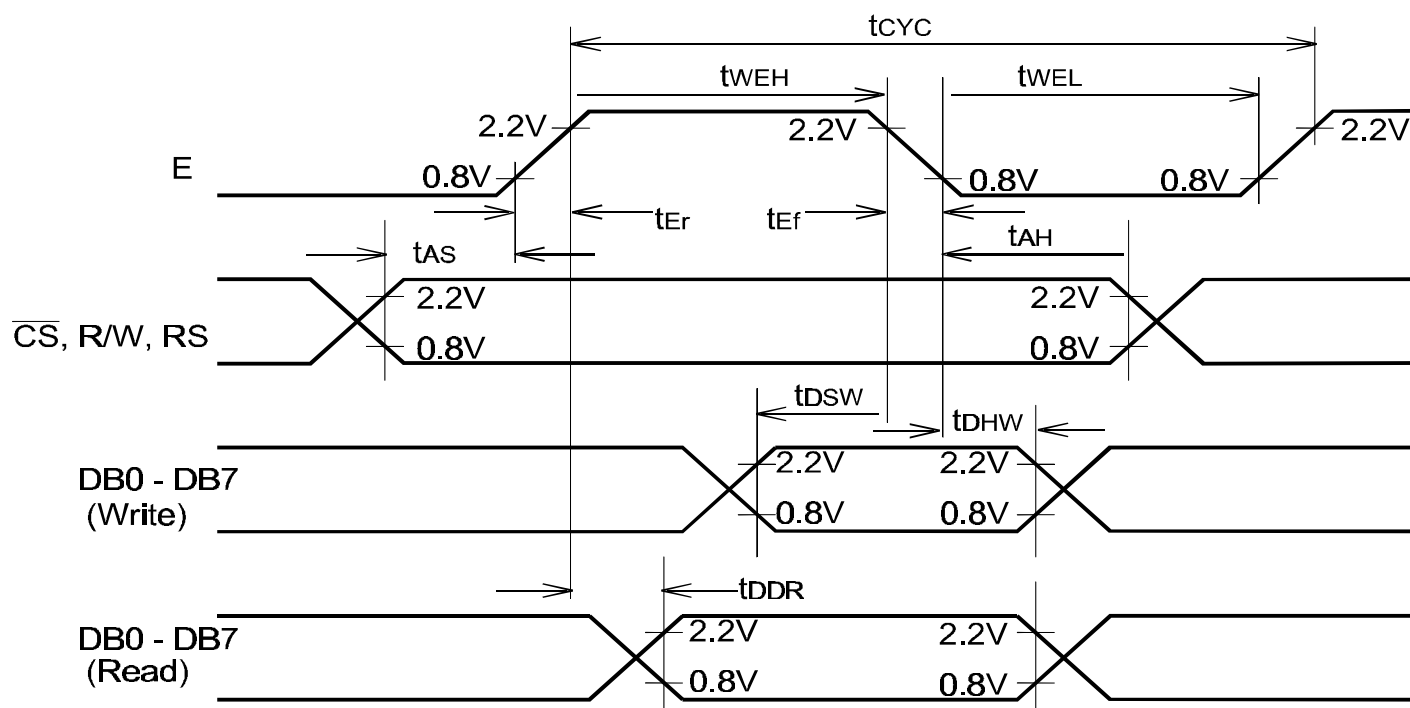
Pin No.	Symbol	I/O	Function
1	V _{SS}	-	Ground (0V)
2	V _{DD}	-	Logic Supply Voltage (+5V)
3	V ₀	-	LC drive voltage for contrast adjustment
4	RS	I	Register Select 0: Instruction Register 1: Data Register
5	R/W	I	Read / Write 0: Data Write (Module ← MPU) 1: Data Read (Module → MPU)
6	E	I	Enable Signal
7	DB0	I/O	Bi-directional data bus line 0
8	DB1	I/O	Bi-directional data bus line 1
9	DB2	I/O	Bi-directional data bus line 2
10	DB3	I/O	Bi-directional data bus line 3
11	DB4	I/O	Bi-directional data bus line 4
12	DB5	I/O	Bi-directional data bus line 5
13	DB6	I/O	Bi-directional data bus line 6
14	DB7	I/O	Bi-directional data bus line 7
15	CS	I	Chip enable Active low
16	RESET	I	Chip reset Active low
17	V _{EE}	I(O)	Negative voltage input for LC drive (Negative voltage output for models with on-board negative voltage generator)
18	N/C	-	No connection
19	N/C	-	No connection
20	N/C	-	No connection
BL1	V _{LED+}	-	Anode (+): LED backlight input voltage
BL2	V _{LED-}	-	Cathode (-): LED backlight input voltage

9.0 BLOCK DIAGRAM:



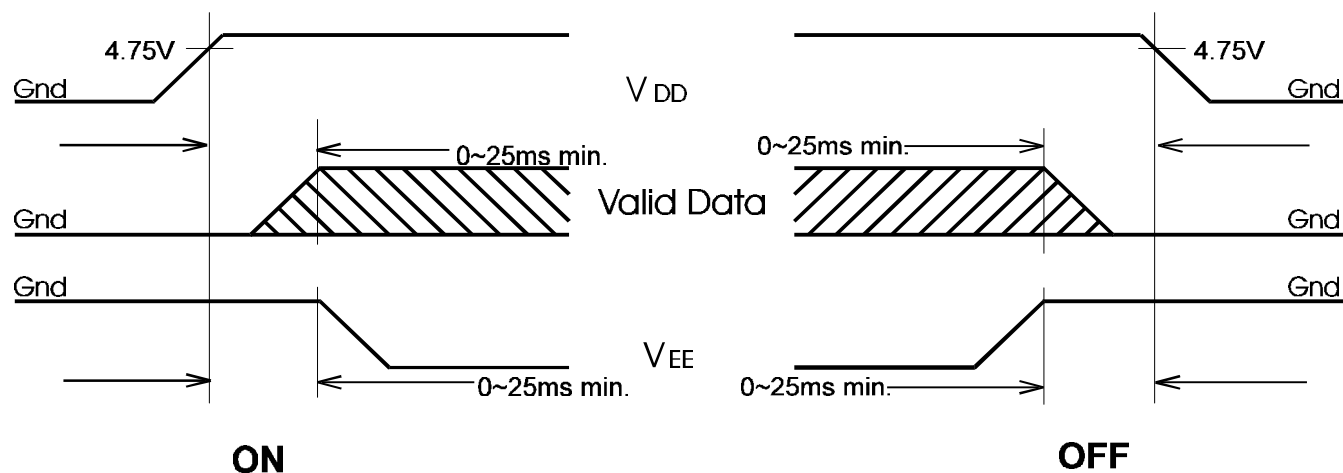
10.0 TIMING CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
Enable cycle time	t_{CYC}	1.0	-	-	μS
Enable pulse width	t_{WEH}, t_{WEL}	450	-	-	nS
Enable rise / fall time	t_{Er}, t_{Ef}	-	-	25	nS
Address set-up time	t_{AS}	140	-	-	nS
Address hold time	t_{AH}	10	-	-	nS
Data delay time	t_{DDR}	-	-	225	nS
Data hold time	t_{DHW}	10	-	-	nS
Data set-up time	t_{DSW}	225	-	-	nS



11.0 VOLTAGE SEQUENCING

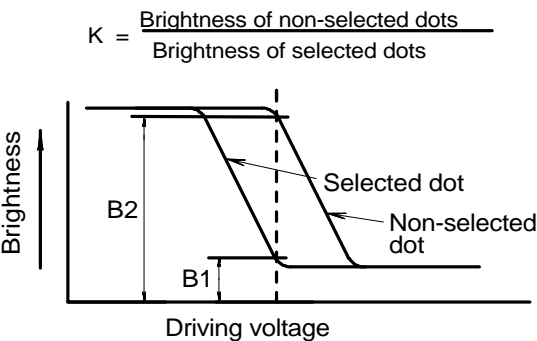
To prevent applying a DC voltage to the LC panel and inducing an electro-chemical effect, please observe the following power supply ON/OFF sequence to prevent DC driving of LC panel or latching-up of CMOS LSI circuits:



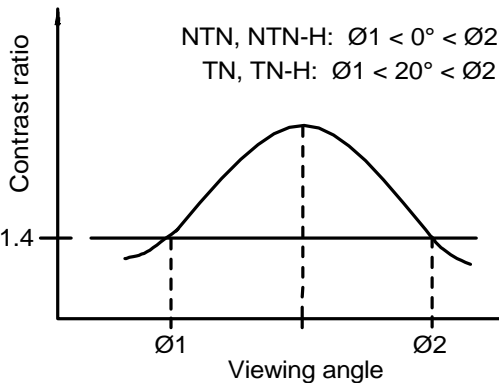
12.0 OPTICAL CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Contrast ratio	K	$\varnothing=20^{\circ} \theta=0^{\circ}$	4	-	-	-
Viewing angle	$\varnothing2-\varnothing1$	$\theta=0^{\circ} K\geq1.4$	40	-	-	Deg.
	θ	$\varnothing=20^{\circ} K=1.4$	±30	-	-	Deg.
Response time	Rise	$\varnothing=20^{\circ} \theta=0^{\circ}$	-	150	250	mS
	Fall	$\varnothing=20^{\circ} \theta=0^{\circ}$	-	150	250	mS

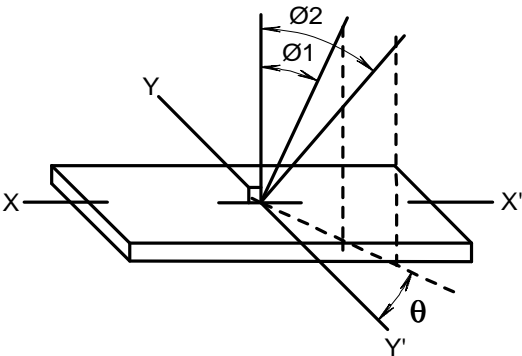
DEFINITION OF CONTRAST RATIO (K)



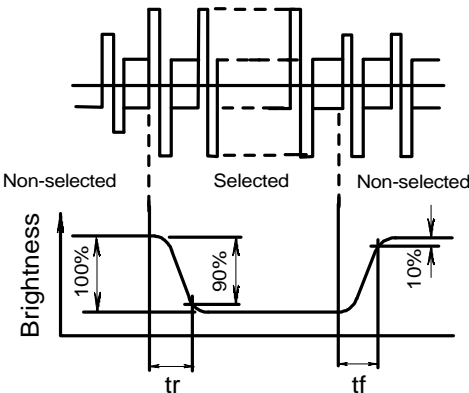
CONTRAST VERSUS VIEWING ANGLE



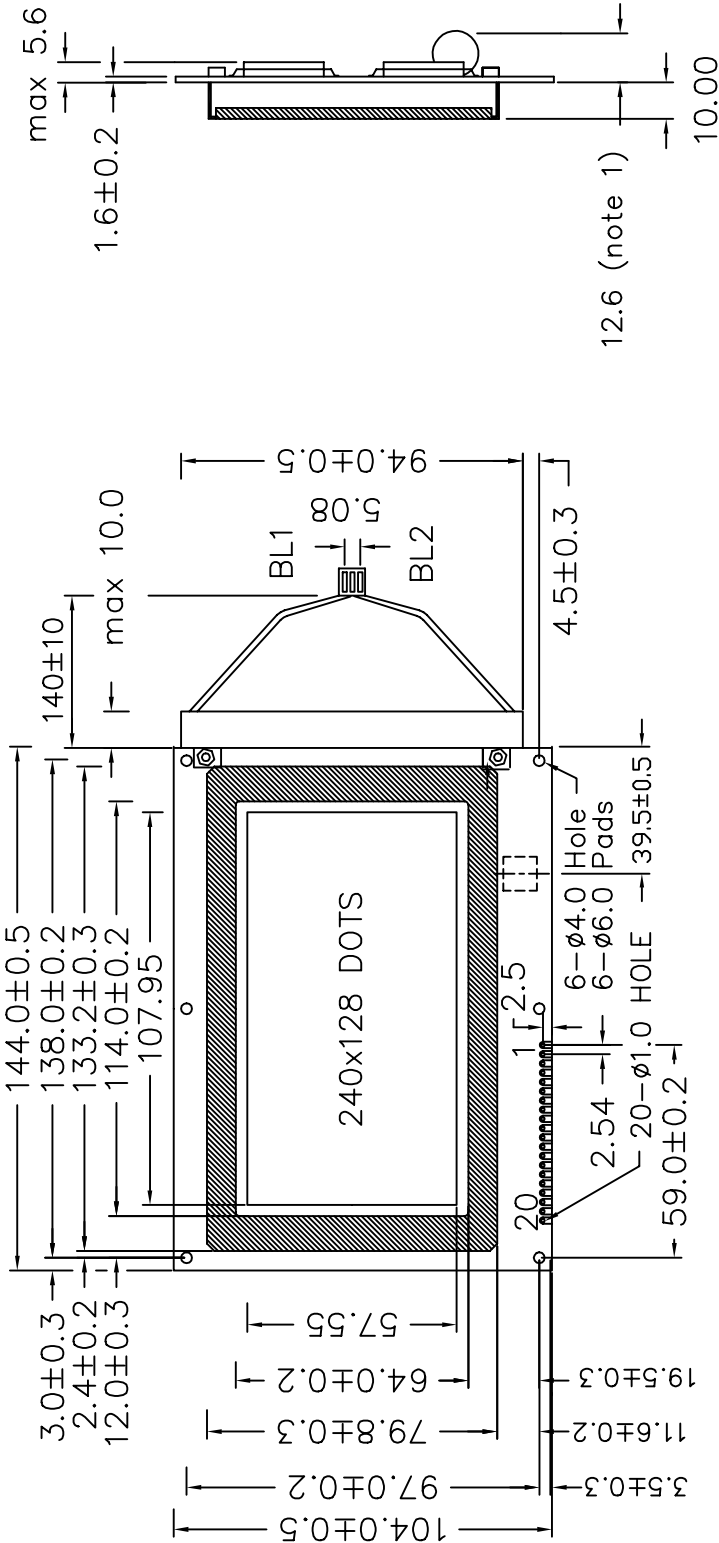
DEFINITION OF ANGLES \varnothing AND θ



DEFINITION OF OPTICAL RESPONSE



13.0 MODULE DIMENSIONS



14.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LM76129①②128G240③④⑤

①

POLARIZER TYPE

B = Transflective: light background , backlit

E = Transmissive: dark background with white CCFL backlight

②

NOT APPLICABLE - LEAVE BLANK

③

FLUID TYPE AND POWER SUPPLY

D = NTN with +5VDC and external negative voltage operation

S = NTN with +5VDC operation (on-board negative voltage generation)

H = NTN-H with +5VDC and external negative voltage operation

W = NTN-H with +5VDC operation (on-board negative voltage generation)

④

FLUID TYPE AND TEMPERATURE COMPENSATION CIRCUIT

C = NTN, NTN-H with on-board temperature compensation circuitry

N = NTN, NTN-H

⑤

COLOR FOR NTN FLUID

B = Blue background (available for E polarizer type only)

G = Gray background (available for B polarizer type only)