REVISIONS

REV.	DESCRIPTION	DATE	APPROVED
-	Released on ECN #E0666	11/10/97	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 V_{DD} and V_{SS}, 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 V_O (contrast) pin and ground. V_{DD} must, at all times, exceed the V_O voltage level. The capacitor combines with the contrast potentiometer to form an R-C network which “holds-up” V_O, 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:	APPROVALS	DATE	DENSITRON INTERNATIONAL PLC.	
Dimensions are mm Tolerances are: X = ± 3 .X = ± 0.5 .XX = ± 0.05 FSCM NO. 62483	DRAWN			
	CHECKED		TITLE: 240 X 320 GRAPHICS LCD MODULE	
	ISSUED		DWG. NO. LM6733	SHEET 1 OF 8

1.0 DESCRIPTION

Dot matrix display module consisting of liquid Crystal Display, CMOS driver and Seiko Epson SED1330 controller LSI, printed circuit board, metal support frame and Cold Cathode Fluorescent (CCFL) backlight.

Available LC fluid type is: NTN (supertwisted nematic), FSTN (film supertwisted nematic).

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

2.0 MECHANICAL CHARACTERISTICS

Item	Specifications	Unit
Package Dimensions	148.0 (W) x 131.7 (H) x 23.1 max (D)	mm
Display format	320 dots (W) x 240 dots (H)	-
Driving method	1/240	duty
Dot size	0.33 (W) x 0.33 (H)	mm
Dot pitch	0.36 (W) x 0.36 (H)	mm
Active display area	115.17 (W) x 86.37 (H)	mm
Viewing area	120.0 (W) x 92.0 (H)	mm
Weight		g

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

3.0 ABSOLUTE MAXIMUM RATINGS

V_{SS}=0V;T_a=25°C

Item	Symbol	NTN		NTN-H		Unit
		Min.	Max.	Min.	Max.	
Logic supply voltage	V_{DD}-V_{SS}	0	7	0	7	V
LC driver supply voltage	V_{DD}-V_O	0	28	0	28	V
Operating temperature Storage temperature (Note 1)	T_{OP} T_{ST}	0 -20	+50 +70	-20 -30	+70 (Note 3) +80	°C
Humidity: Operating (@40°C) Non-operating (@40°C)	- -	- -	85% 95%	- -	85% 95%	RH (Note 2) 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

V_{DD}=5±0.25V;T_a=25°C

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input “High” voltage	V_{IH}	-	0.8V_{DD}	-	V_{DD}	V
Input “Low” voltage	V_{IL}	-	V_{SS}	-	0.2V_{DD}	V
Output “High” voltage	V_{OH}	I_{OH}=0.205mA	2.2	-	-	V
Output “Low” voltage	V_{OL}	I_{OL}=1.2mA	-	-	0.8	V
Power supply current	I_{EE}	V_{EE}=-15V	-	5.0	-	mA
Power supply current	I_{DD}	V_{DD}=5.0V	-	10.0	-	mA

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

V_{DD}=5.0±0.25V

Temperature	NTN	FSTN-H
Ta= -20°C	-	25.8
Ta= 0°C	23.8	23.8
Ta= 25°C	22.4	22.2
Ta= 50°C	21.3	20.6
Ta= 70°C	-	18.8

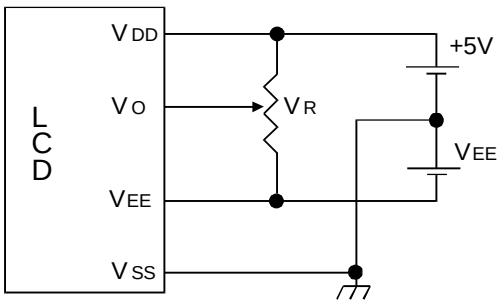
6.0 BACKLIGHT SPECIFICATIONS:

Ta=20°C,60%RH,Darkroom.

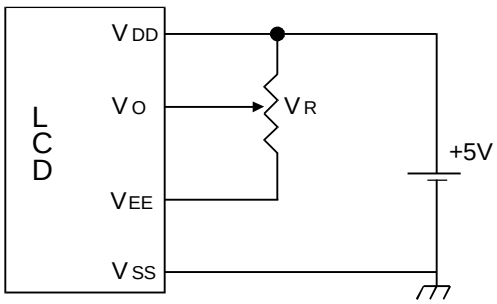
Item	Symbol	Typ.	Max.	Unit
CFL lamp input voltage	V_{CCFL}	300	350	Vrms
CFL input current	I_{CCFL}	5.0	6.0	mA
Life to half initial brightness	-	10000	15000	Hours
CFL lamp input frequency	F_{CCFL}	25	60	KHz
Recommended backlight inverter	-	INV-12	-	-

7.0 POWER SUPPLY

● NTN

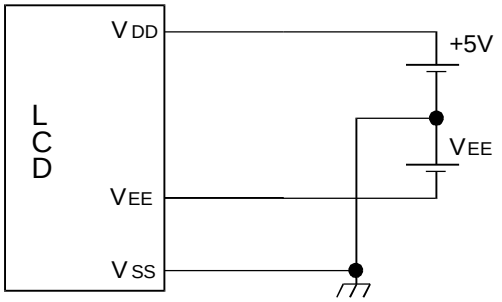


● NTN with on-board negative voltage generator

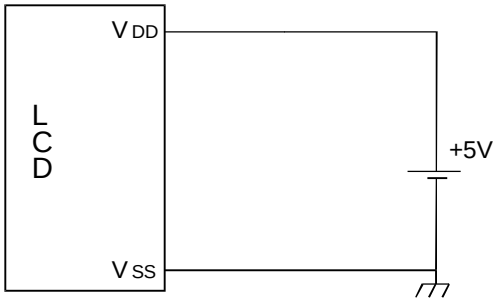


V_R= 10K - 20K ohm

● NTN with temperature compensation



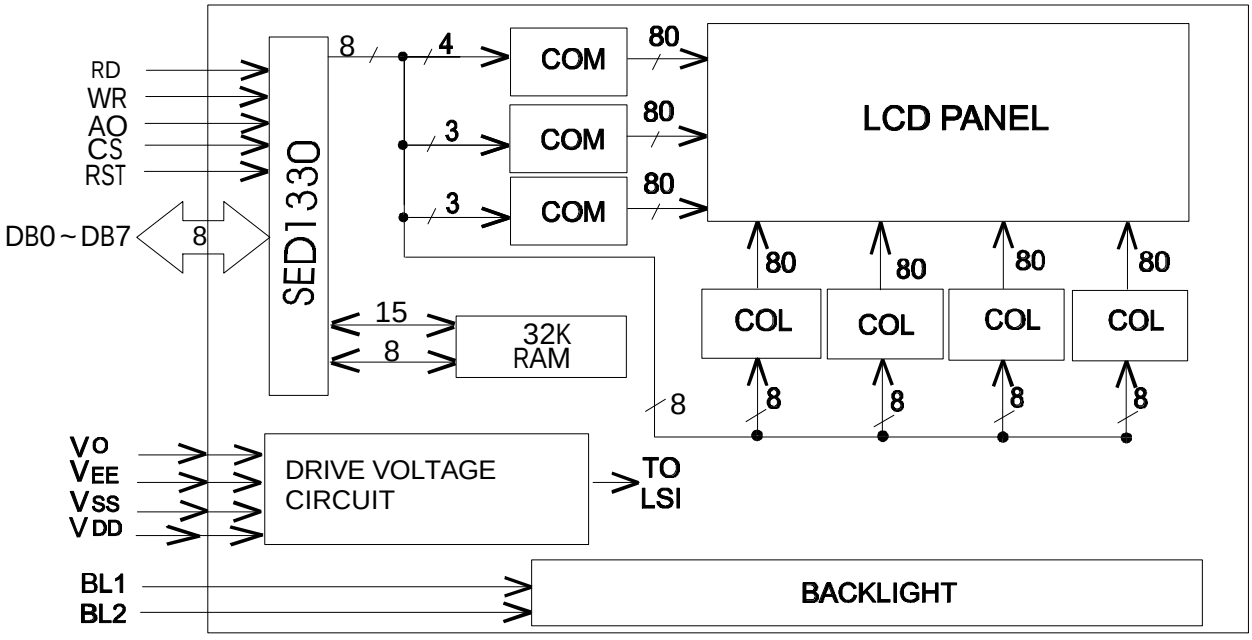
● NTN with on-board negative voltage generator and temperature compensation



8.0 INTERFACE DESCRIPTION

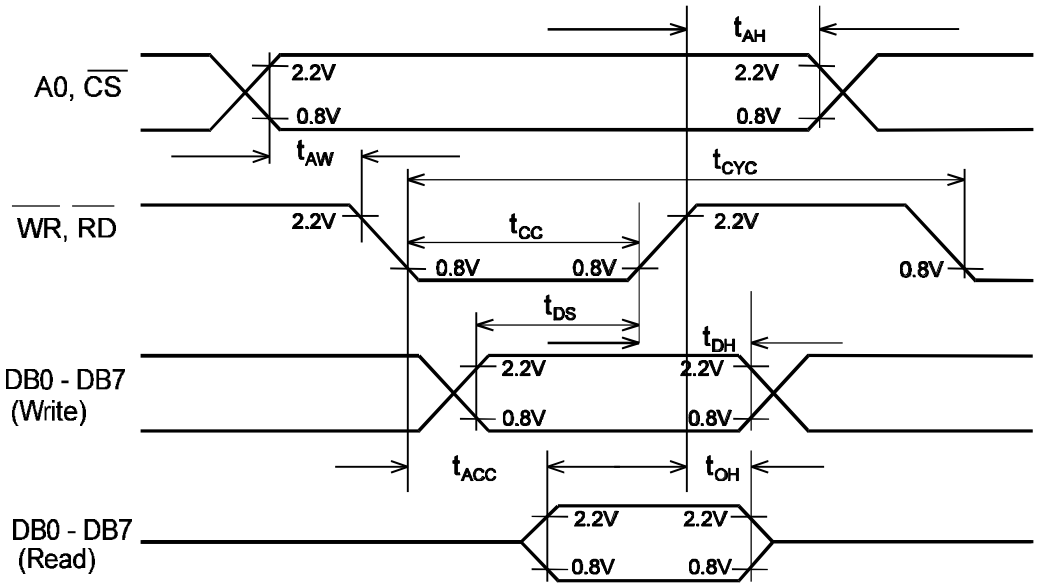
Pin No.	Symbol	I/O	Function
1	V_{SS}	-	Ground (0V)
2	V_{DD}	-	Logic Supply Voltage (+5V)
3	V_O	-	LC drive voltage for contrast adjustment
4	RD	I	Read strobe signal (Active low)
5	WR	I	Write strobe signal (Active low)
6	AO	I	Data type selection
7	DB0	I/O	Bi-directional data bus line 0
8	DB1	I/O	Bi-directional 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 Select (Active low)
16	RST	I	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	FG	-	Frame ground
19	N/C	-	No connection
20	N/C	-	No connection
BL1	V_{CCFL}	-	CCFL backlight input voltage (from output of DC-AC inverter)
BL2	V_{CCFL}	-	CCFL backlight input voltage (from output of DC-AC inverter)

9.0 BLOCK DIAGRAM:



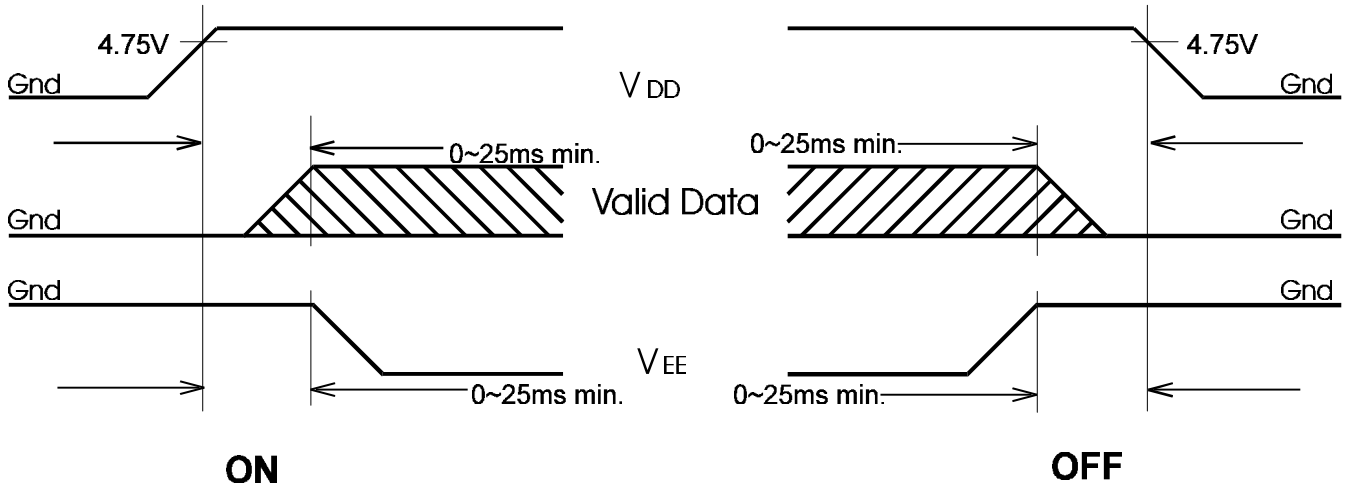
10.0 TIMING CHARACTERISTICS

Item	Symbol	Min.	Typ.	Max.	Unit
System cycle time	t_{CYC}	575	-	-	nS
Control pulse width	t_{CC}	220	-	-	nS
Address setup time	t_{AW}	30	-	-	nS
Address hold time	t_{AH}	10	-	-	nS
Data setup time	t_{DS}	120	-	-	nS
Data hold time	t_{DH}	10	-	-	nS
RD access time	t_{ACC}	-	-	120	nS
Output disable time	t_{OH}	10	-	50	nS



11.0 VOLTAGE SEQUENCING

Always observe the following power supply ON/OFF sequence. Failure to so may cause latch up of CMOS LSI circuits or DC induced damage to LC panel.

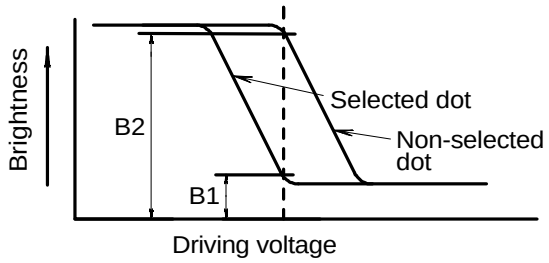


12.0 OPTICAL CHARACTERISTICS

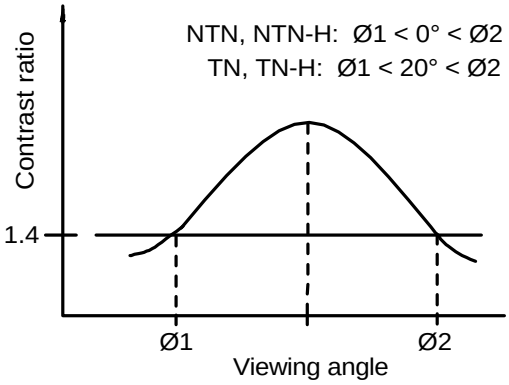
Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Contrast ratio	K	Ø=20° θ=0°	4	-	-	-
Viewing angle	Ø2-Ø1	θ=0° K≥1.4	40	-	-	Deg.
	θ	Ø=20° K=1.4	±30	-	-	Deg.
Response time Rise	t_r	Ø=20° θ=0°	-	150	250	mS
Fall	t_f	Ø=20° θ=0°	-	150	250	mS

DEFINITION OF CONTRAST RATIO (K)

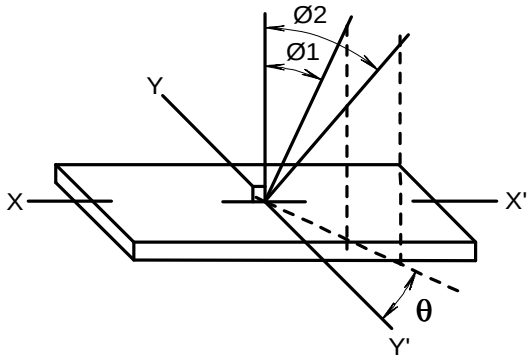
$$K = \frac{\text{Brightness of non-selected dots}}{\text{Brightness of selected dots}}$$



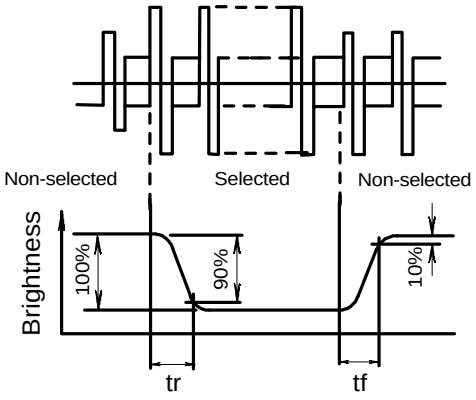
CONTRAST VERSUS VIEWING ANGLE



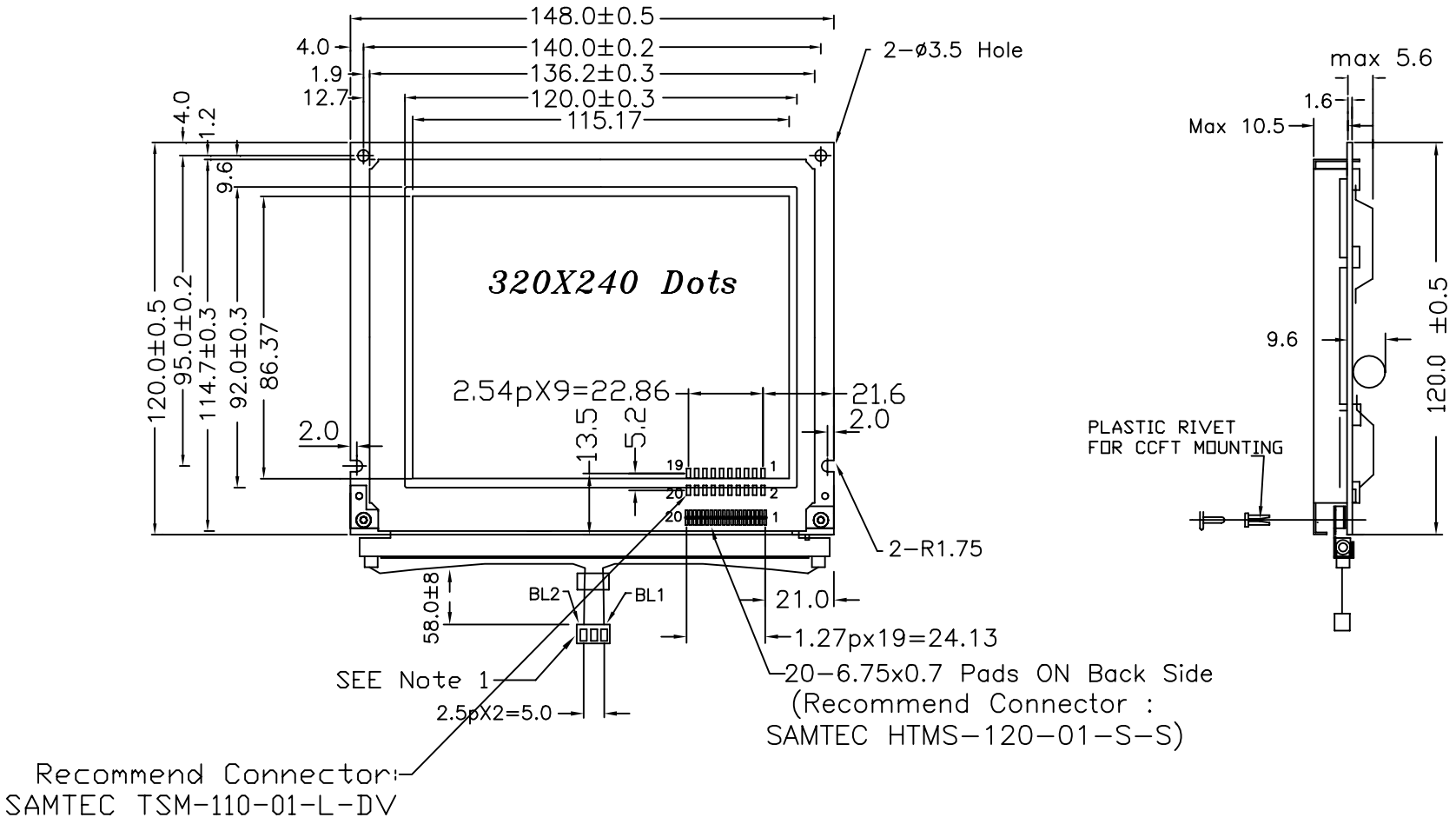
DEFINITION OF ANGLES Ø AND θ

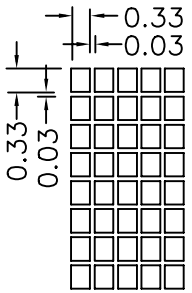


DEFINITION OF OPTICAL RESPONSE



13.0 MODULE DIMENSIONS





NOTE: 1

HOUSING :JST XHP-3
BASE POST:JST B3B-XH-A(180°)
BASE POST:JST S3B-XH-A(90°)

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14.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LM6733①②240G320③④⑤

①

POLARIZER TYPE

B = Transflective: light background with white CFL backlight
E = Transmissive: dark background with white CFL 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 extended temp. with +5VDC and external negative voltage operation
W = NTN extended temp. with +5VDC operation (on-board negative voltage generation)

④

FLUID TYPE

C = NTN with on-board temperatrue compensation circuitry
N = NTN

⑤

COLOR FOR NTN FLUID

B = Blue background
F = Black background