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	REVISIONS		
REV.	DESCRIPTION	DATE	APPROVED
А	RELEASED ON ECN #E0219	7/28/95	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	APPROVALS	DATE				
specified:	DRAWN		DENSITRON INTERNATIONAL PLC.			
Dimensions are mm						
Tolerances are: $X = \pm 3$ $X = \pm 0.5$	s are: CHECKED TITLE 240	240 X 128 GRAPHICS LCD MO	40 X 128 GRAPHICS LCD MODULE			
$.XX = \pm 0.05$ FSCM NO. 62483	ISSUED		DWG. NO. LM4129	SHEET 1 OF 8		

1.0 DESCRIPTION

Dot matrix display module consisting of liquid Crystal Display, CMOS driver and HITACHI HD61830B controller LSI, printed circuit board, metal support frame and Light Emitting Diode (LED) backlight.

Available LC fluid type is: NTN (supertwisted nematic), 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 22.6 max (D)	mm
Display format	128 dots (H) x 240 dots (W)	-
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

					١	/ss=0V;Ta=25°0
Item	Symbol	FSTN,NTN FSTN-H,NTN-H		FSTN,NTN		Unit
		Min.	Max.	Min.	Max.	
Logic supply voltage	VDD-VSS	0	7	0	7	V
LC driver supply voltage	Vdd-Vo	0	-25	0	-25	V
Operating temperature	Тор	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. With backlight off.

4.0 ELECTRICAL CHARACTERISTICS

	+0 2	5\/.1		°C.
VDD=0	±0.2	υv,ι	a=zo	U

ltem	Symbol	Test Condition	Min.	Тур.	Max.	Unit
Input "High" voltage	Vін	-	0.8Vdd	-	Vdd	V
Input "Low" voltage	VIL	-	Vss	-	0.2Vdd	V
Output "High" voltage	Vон	Іон=0.205mA	2.2	-	-	V
Output "Low" voltage	Vol	lol=1.2mA	-	-	0.8	V
Power supply current	IEE	Vee=-15V	-	7.0	-	mA
Power supply current	ldd	VDD=5.0V	-	30.0	-	mA

DWG. NO. LM4129	SHEET 2	of 8	REV.
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5.0 RECOMMENDED LC DRIVE VOLTAGE (VDD-Vo)

		VDD=5.0±0.25V
Temperature	NTN	NTN-H
Ta= -20°C	-	24.3
Ta= 0°C	21.0	21.0
Ta= 25°C	18.5	18.5
Ta= 50°C	16.8	16.8
Ta= 70°C	-	15.7

6.0 BACKLIGHT SPECIFICATIONS:

			Ta=20°C,60%F	RH,Darkroom.
ltem	Symbol	Тур.	Max.	Unit
LED lamp input voltage	Vled	5.0	6.0	Vrms
LED input current	ILED	660	800	mA
Build-in current limit resistor	R1	-	-	Ohms, W
Recommended external current limit resistor	R2	1 Ohms, 1W	-	Ohms, W
Number of Led nodes	N	110	-	-



7.0 POWER SUPPLY



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



DWG. NO. LM4129	SHEET	3	OF 8	REV. A
		-		

8.0 INTERFACE DESCRIPTION

Pin No.	Symbol	I/O	Function
1	Vss	-	Ground (0V)
2	Vdd	-	Logic Supply Voltage (+5V)
3	Vo	-	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 \leftarrow MPU)
			1: Data Read (Module \rightarrow MPU)
6	E		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		Chip enable Active low
16	RESET		Chip reset Active low
17	Vee	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	VLED+	-	Anode (+): LED backlight input voltage
BL2	VLED-	-	Cathode (-): LED backlight input voltage

9.0 BLOCK DIAGRAM:



REV.

А

10.0 TIMING CHARACTERISTICS

Item	Symbol	Min.	Тур.	Max.	Unit
Enable cycle time	tcyc	1.0	-	-	μS
Enable pulse width	tweh,twel	450	-	-	nS
Enable rise / fall time	tEr, t Ef	-	-	25	nS
Address set-up time	tas	140	-	-	nS
Address hold time	tан	10	-	-	nS
Data delay time	tddr	-	-	225	nS
Data hold time	tdнw	10	-	-	nS
Data set-up time	tosw	225	-	-	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

ltem	Symbol	Test Condition	Min.	Тур.	Max.	Unit
Contrast ratio	K	Ø=20° θ=0°	4	-	-	-
Viewing angle	Ø2-Ø1	θ=0° K <u>></u> 1.4	40	-	-	Deg.
	θ	Ø=20° K=1.4	±30	-	-	Deg.
Response time Rise	tr	Ø=20° θ=0°	-	150	250	mS
Fall	tr	Ø=20° θ=0°	-	150	250	mS





DEFINITION OF ANGLES Ø AND θ



CONTRAST VERSUS VIEWING ANGLE



DEFINITION OF OPTICAL RESPONSE



DWG. NO. LM4129	SHEET 6	OF 8	REV. A



14.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LM412912128G240345

POLARIZER TYPE

B = Transflective: light background with LED backlight

E = Transmissive: dark background with LED backlight

BACKLIGHT COLOR

G = Yellow-Green (Standard)

3

(2)

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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 = Wide temperture range: on-board negative voltage generator

4 FLUID TYPE

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



COLOR FOR NTN FLUID

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

G = Gray background (available for B polarizers types only)

Y = Yellow background (available for B polarizers types only)

DWG. NO.	LM4129	SHEET 8	OF 8	REV.
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