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	REV.	DESCRIPTION	DATE	APPROVED

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 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	APPROVALS	DATE	DENSITRON INTERNATIONAL PLC	
	DRAWN			
	CHECKED		TITLE 100 X 64 PIXEL MINI-GRAPHIC ARRAY WITH EDGELIT LED BACKLIGHT	
	ISSUED		DWG. NO. LM4064	SHEET 1 OF 8

## 1.0 DESCRIPTION

Graphic matrix display module consisting of a Liquid Crystal Display, CMOS driver and controller LSI, printed circuit board and edgelit Light Emitting Diode (LED) backlight.

Available LC fluids types are: STN (supertwisted nematic) yellow.

Options include on-board negative voltage generation and software contrast control, serial or 8-bit parallel interface.

## 2.0 MECHANICAL CHARACTERISTICS

Item	Specifications	Unit
Package Dimensions	52.0 x 47.5 x 7.5	mm
Display format	100 x 64	-
Character font format	defined by on-board controller (SED1560)	dots
Driving method	1/64	duty
Dot size	0.35 x 0.40	mm
Dot pitch	0.38 x 0.43	mm
Character Size	2.98	mm
Active display area	38.0 x 27.5	mm
Viewing area	48.0 x 32.0	mm
Weight	15 approx	g

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

## 3.0 ABSOLUTE MAXIMUM RATINGS

VSS=0V; Ta=25°C

Item	Symbol	STN		Unit
		Min.	Max.	
Logic supply voltage	VDD-VSS	0	7	V
LC driver supply voltage	VDD-VO	0	6	V
Operating temperature	TOP	0	+60	°C
Storage temperature (Note 1)	TST	-20	+70	
Humidity: Operating (@40°C)	-	-	85%	RH (Note 2)
Non-operating (@40°C)	-	-	95%	RH (Note 2)

Notes: 1: Tested to 100 hrs.  
2: Refers to non-condensing conditions.  
3. With backlight off.

4.0 RECOMMENDED LC DRIVE VOLTAGE (V<sub>DD</sub>-V<sub>O</sub>)

V<sub>DD</sub>=5.0±0.25V

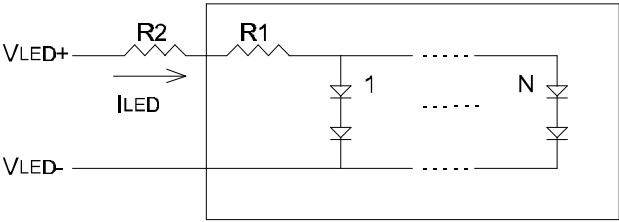
Temperature	TN	TN-H	STN	NTN-H
T <sub>a</sub> = -20°C			-	
T <sub>a</sub> = 0°C			9.2	
T <sub>a</sub> = 25°C			8.9	
T <sub>a</sub> = 50°C			8.6	
T <sub>a</sub> =70°C			-	

Note: DC is generated on-board

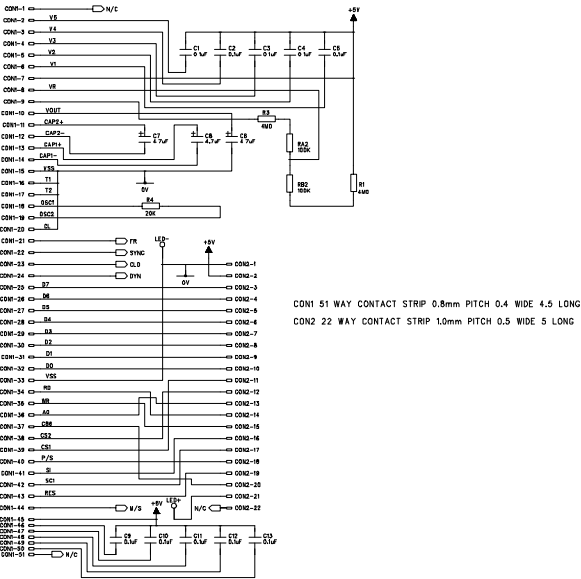
5.0 BACKLIGHT SPECIFICATIONS:

T<sub>a</sub>=20°C,60%RH,Darkroom.

Item	Symbol	Typ.	Max.	Unit
LED input voltage	V <sub>LED</sub>	4.2		V
LED input current	I <sub>LED</sub>	40		mA
Built-in current limiting resistor	R1	n/a		Ohms, W
External current limiting resistor (recommended)	R2	10		Ohms, W
Number of nodes	N	4		-



6.0 BLOCK DIAGRAM



## 7.0 INTERFACE DESCRIPTION

Pin No.	Symbol	I/O	Function																					
1	Vss	-	Ground (0V)																					
2	VDD	-	Logic Supply Voltage (+5V)																					
3	D7	I/O	Bi-directional data bus line 7																					
4	D6	I/O	Bi-directional data bus line 6																					
5	D5	I/O	Bi-directional data bus line 5																					
6	D4	I/O	Bi-directional data bus line 4																					
7	D3	I/O	Bi-directional data bus line 3																					
8	D2	I/O	Bi-directional data bus line 2																					
9	D1	I/O	Bi-directional data bus line 1																					
10	D0	I/O	Bi-directional data bus line 0																					
11	CS1	I/O	Chip select inputs. Data input/output is enabled when CS1 is LOW and CS2 is HIGH.																					
12	CS2	I/O	Chip select inputs. Data input/output is enabled when CS1 is LOW and CS2 is HIGH.																					
13	A0	I/O	Control/display data flag input. This is connected to the LSB of the microprocessor address bus. • When LOW, the data on D0 to D7 is command data • When HIGH, the data on D0 to D7 is display data																					
14	RD	I/O	Read																					
15	WR	I/O	Write																					
16	SI	I	Serial data input																					
17	SCL	I	Serial clock input. Data is read on the rising edge of SCL and converted to 8-bit parallel data.																					
18	P/S	I	Parallel/serial data input select  In serial mode, data cannot be read from the RAM, and D0 to D7, HZ, RD and WR must be HIGH or LOW. In parallel mode, SI and SCL must be HIGH or LOW. <table><tr><td>P/S</td><td>Operating Mode</td><td>Chip Select</td><td>Data/Command</td><td>Data I/O</td><td>Read / Write</td><td>Serial Clock</td></tr><tr><td>HIGH</td><td>Parallel</td><td>CS1, CS2</td><td>A0</td><td>D0 to D7</td><td>RD, WR</td><td>-</td></tr><tr><td>LOW</td><td>Serial</td><td>CS1, CS2</td><td>A0</td><td>D0 to D7</td><td>Write Only</td><td>SCL</td></tr></table>	P/S	Operating Mode	Chip Select	Data/Command	Data I/O	Read / Write	Serial Clock	HIGH	Parallel	CS1, CS2	A0	D0 to D7	RD, WR	-	LOW	Serial	CS1, CS2	A0	D0 to D7	Write Only	SCL
P/S	Operating Mode	Chip Select	Data/Command	Data I/O	Read / Write	Serial Clock																		
HIGH	Parallel	CS1, CS2	A0	D0 to D7	RD, WR	-																		
LOW	Serial	CS1, CS2	A0	D0 to D7	Write Only	SCL																		
19	RES	I	Reset input. Setting this pin low initializes the SED156X.																					
20	C86	I	Microprocessor interface select input. • LOW when interfacing to 8080-series • HIGH when interfacing to 6800-series																					
21	N/C	-	Not connected																					
22	N/C	-	Not connected																					

## 8.0 ELECTRICAL CHARACTERISTICS

### DC Characteristics

(VDD = 0V, VSS = -5 ± 10%, Ta = -30 to + 85°C unless otherwise noted)

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	Pin used
Power Voltage (1)	Recommen ded Operation	Vss	-5.5	-5.0	-4.5	V	Vss
	Operational		-6.0		-2.4		1
Operating Voltage (2)	Operational	V5	-16.0		-4.0	V	V5, 2
	Operational	V1, V2	0.4xV5		VDD	V	V1, V2
	Operational	V3, V4	V5		0.6xV5	V	V3, V4
High Level input voltage	VIHC1		0.3xVss		VDD	V	*3
	VIHC2		0.15xVss		VDD		*4
	VIHC1	Vss=-2.7V	0.3xVss		VDD		*3
	VIHC2	Vss=-2.7V	0.2xVss		VDD		*4
Low Level input voltage	VILC1		Vss		0.7xVss	V	*3
	VILC2		Vss		0.85xVss		*4
	VILC1	Vss=-2.7V	Vss		0.7xVss		*3
	VILC2	Vss=-2.7V	Vss		0.8xVss		*4
High Level output voltage	VOHC1	IOH=-1mA	0.2xVss		VDD	V	*5
	VOHC2	IOH=-120µA	0.2xVss		VDD		OSC2
	VOHC1	Vss=-2.7V IOH=-1mA	0.2xVss		VDD	V	*5
	VOHC2	Vss=-2.7V IOH=-50µA	0.2xVss		VDD		OSC2
Low Level Output Voltage	VOLC1	IOL=-1mA	Vss		0.8xVss	V	*5
	VOLC2	IOL=-120µA	Vss		0.8xVss		OSC2
	VOLC1	Vss=-2.7V IOL=-1mA	Vss		0.8xVss	V	*5
	VOLC2	Vss=-2.7V IOL=-50µA	Vss		0.8xVss		OSC2
Input leakage current	ILI	VIN = VDD or VSS	-1.0		1.0	µA	*6
Output leakage current	ILO		-3.0		3.0	µA	*7
LCD driver ON resistance	RON	Ta=25°C	V5=-14.0V	2.0	3.0	KΩ	O0 to 0166
			V5=-8.0V	3.0	4.5		*8
Static power consumption	ISSQ			0.00	5.0	µA	Vss
	I5Q	V5=-18.0V		0.01	15.0	µA	V5
Input terminal capacity	CIN	Ta=25°C f=1MHz		5.0	8.0	pF	3 4
Oscillation frequency	fosc	Rf=1MΩ	Vss=-5V	15	18	22	kHz
			Vss=-2.7V	11	16	21	

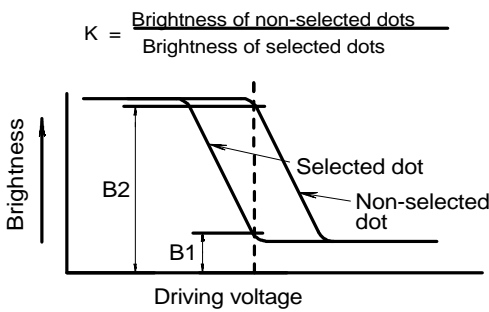
Reset time	tr		1.0			µS	*10
Reset "L" pulse width	trw		1.0			µS	*11

Built in power circuit	Input voltage	Vss		-6.0		-2.4	V	*12
	Amplified output voltage	Vout	triple voltage boosting	-18.0			V	Vout
	Voltage reg-ulator circuit operation voltage	Vout		-18.0		-6.0	V	
	Voltage follower operation voltage	V5 1	Supplied to SED 1560Dob	-16.0		-6.0	V	*13
		V5 2	Supplied to SED 1561Dob	-16.0		-5.0	V	
		V5 3	Supplied to SED 1561Dob	-16.0		-4.0	V	
		V5 4	Supplied to SED 1562Dob	-16.0		-4.5	V	
	Reference voltage	Vreg	Ta=25°C	-2.35	-2.5	-2.65	V	

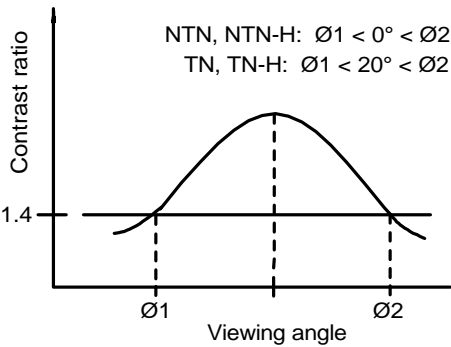
9.0 OPTICAL CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Contrast ratio TN, TN-H	K	$\varnothing=20^{\circ}$ $\theta=0^{\circ}$	3	-	-	-
Contrast ratio STN	K	$\varnothing=20^{\circ}$ $\theta=0^{\circ}$	4	-	-	-
Contrast ratio NTN-H	K	$\varnothing=20^{\circ}$ $\theta=0^{\circ}$	5	-	-	-
Viewing angle TN, TN-H	$\varnothing 2-\varnothing 1$ $\theta$	$\theta=0^{\circ}$ $K \geq 1.4$ $\varnothing=20^{\circ}$ $K=1.4$	20 $\pm 30$	- -	- -	Deg. Deg.
Viewing angle STN	$\varnothing 2-\varnothing 1$ $\theta$	$\theta=0^{\circ}$ $K \geq 1.4$ $\varnothing=20^{\circ}$ $K=1.4$	40 $\pm 30$	- -	- -	Deg. Deg.
Viewing angle NTN-H	$\varnothing 2-\varnothing 1$ $\theta$	$\theta=0^{\circ}$ $K \geq 1.4$ $\varnothing=20^{\circ}$ $K=1.4$	40 $\pm 40$	- -	- -	Deg. Deg.
Response time Rise	$t_r$	$\varnothing=20^{\circ}$ $\theta=0^{\circ}$	-	150	240	mS
Fall	$t_f$	$\varnothing=20^{\circ}$ $\theta=0^{\circ}$	-	350	360	mS

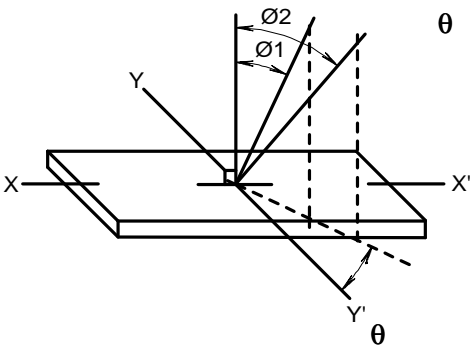
DEFINITION OF CONTRAST RATIO (K)



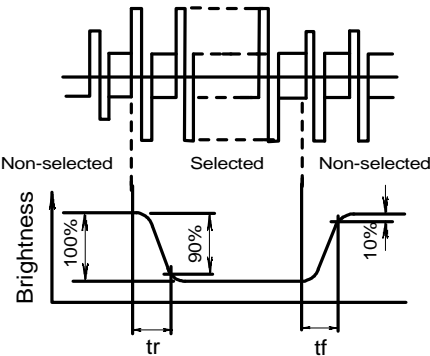
CONTRAST VERSUS VIEWING ANGLE



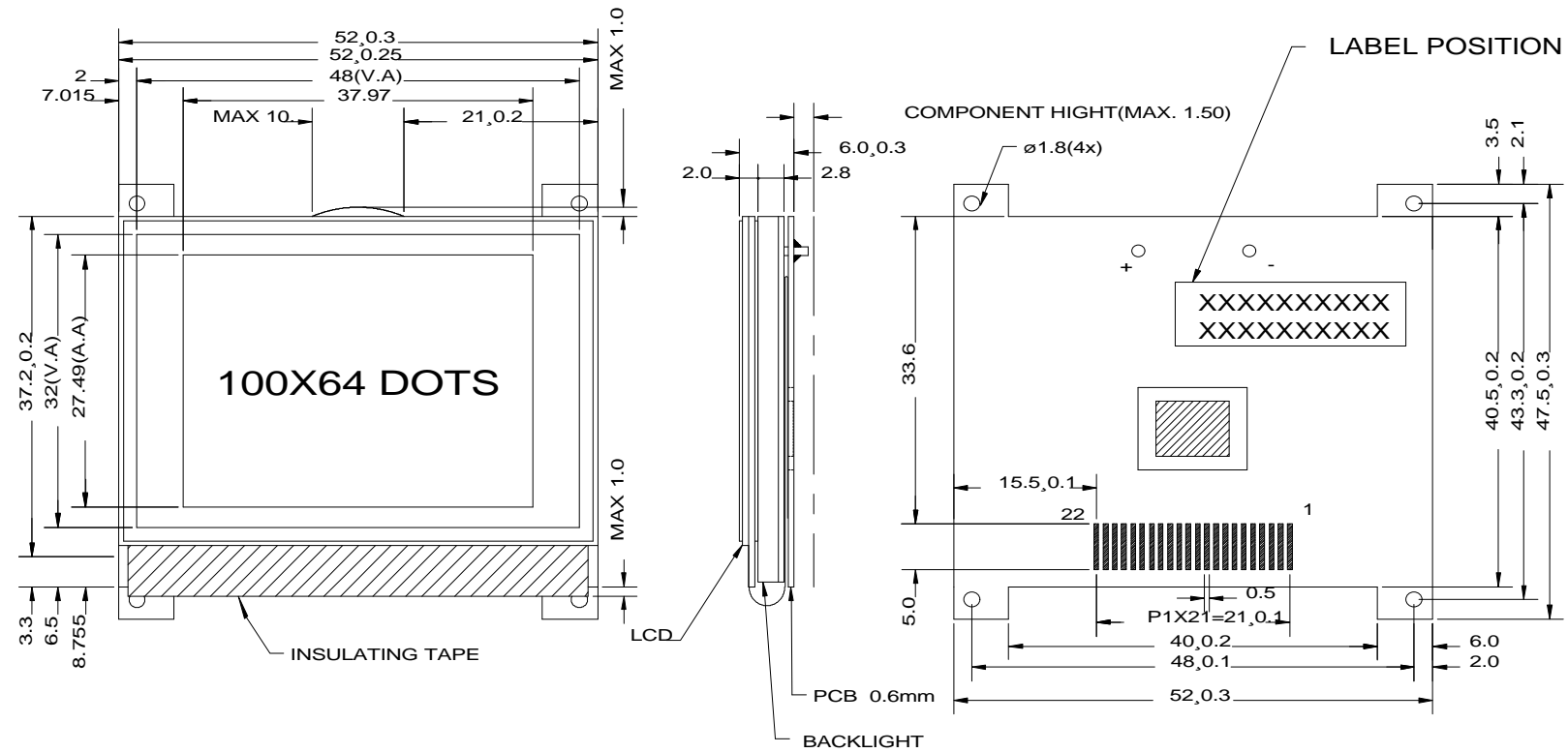
DEFINITION OF ANGLES  $\varnothing$  AND  $\theta$



DEFINITION OF OPTICAL RESPONSE



10.0 MODULE DIMENSIONS



11.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

LM4064①②64G100③④⑤

- ①

**Polarizer Type**  
B = Transflective LED backlight
- ②

G = Green Colour
- ③

**Fluid Type and Power Supply**  
S = NTN with +5VDC operation
- ④

**Fluid Type/TN Viewing Direction**  
N = STN
- ⑤

**Background Color for NTN Fluid**  
G = Gray background  
Y = Yellow background