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REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	RoHS compliant version	28/06/06	BR

- 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  
 Cage Code #OWS52

**DENSITRON TECHNOLOGIES PLC.**

TITLE

LCD MODULE COB 4 LINE X 16 CHARACTERS

## 1.0 DESCRIPTION

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

Available LC fluids types are: STN and STN-H (extended temperature range STN).

## 2.0 MECHANICAL CHARACTERISTICS

Item	Specifications	Unit
Package Dimensions	87.0 (W) x 60 (H) x 14.0 max. (D)	mm
Display format	4 line x 16 characters	-
Character font format	5 (W) x 7 (H) with attached cursor	dots
Driving method	1/16	duty
Dot size	0.55 (W) x 0.55 (H)	mm
Dot pitch	0.6 (W) x 0.6 (H)	mm
Character Size	2.95 (W) x 4.75 (H)	mm
Active display area	56.2 (W) x 20.8 (H)	mm
Viewing area	61.8 (W) x 25.2 (H)	mm
Weight		g

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

## 3.0 ABSOLUTE MAXIMUM RATINGS

V<sub>SS</sub>=0V; T<sub>a</sub>=25°C

Item	Symbol	STN-H		Unit
		Min.	Max.	
Logic supply voltage	V <sub>DD</sub> -V <sub>SS</sub>	0	7	V
LC driver supply voltage	V <sub>DD</sub> -V <sub>O</sub>	0	10	V
Operating temperature STN	TOP	0	50	°C
Storage temperature STN	TST	-20	70	
Operating temperature STN-H	TOP	-20	+70 (Note 3)	°C
Storage temperature STN-H (Note 1)	TST	-30	+80	
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 ELECTRICAL CHARACTERISTICS

V<sub>DD</sub>=5±0.25V; T<sub>a</sub>=25°C

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Operating Voltage	V <sub>DD</sub>		4.75		5.25	V
Input "High" voltage	V <sub>IH</sub>	-	0.7 V <sub>DD</sub>	-	V <sub>DD</sub>	V
Input "Low" voltage	V <sub>IL</sub>	-	-	-	0.6	V
Output "High" voltage	V <sub>OH</sub>	I <sub>OH</sub> =0.205mA	2.4	-	-	V
Output "Low" voltage	V <sub>OL</sub>	I <sub>OL</sub> =1.2mA	-	-	0.4	V
Power supply current	I <sub>DD</sub>	V <sub>DD</sub> =5.0V	-	3	-	mA

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

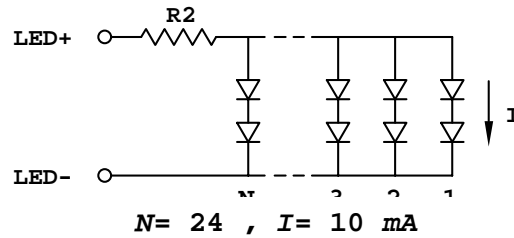
$V_{DD}=5.0\pm 0.25V$

Temperature	STN	NTN-H
$T_a = -20^\circ C$	-	4.7
$T_a = 0^\circ C$	4.3	4.3
$T_a = 25^\circ C$	4.2	4.2
$T_a = 50^\circ C$	4.1	4.1
$T_a = 70^\circ C$	-	3.9

## 6.0 BACKLIGHT SPECIFICATIONS:

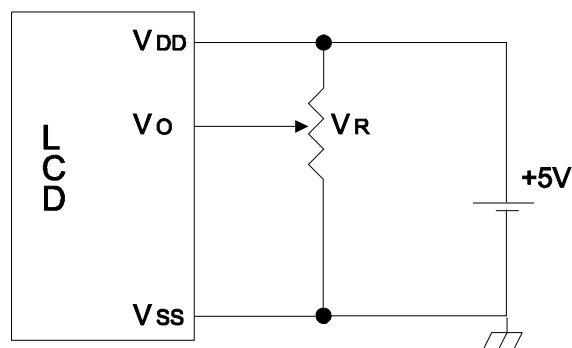
$T_a=20^\circ C, 60\%RH, Darkroom.$

Item	Symbol	Typ.	Max.	Unit
LED lamp input voltage	VLED	5	6	Vrms
LED lamp input current	ILED	240	250	mA
Build-in current limiting resistor	R1	-	-	Ohms, W
External current limiting resistor (recommended)	R2	3.3 Ohm 1/2W	-	Ohms, W
Number of nodes	N	24	-	-



## 7.0 POWER SUPPLY

STN and STN-H

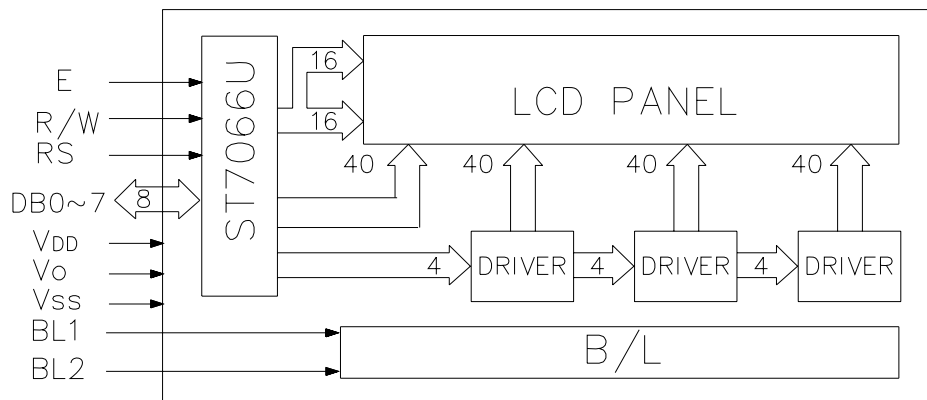


$V_R = 10K - 20K \text{ ohm}$

## 8.0 INTERFACE DESCRIPTION

Pin No.	Symbol	I/O	Function
1	VSS	-	Ground (0V), VLED-
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←MPU) 1: Data Read (Module→MPU)
6	E	I	Enable Signal Active High (H→L)
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	VLED+	-	Anode (+): LED backlight input voltage
16	VLED-	-	Cathode (-): LED backlight input voltage
BL1	VLED+	-	Anode (+): LED backlight input voltage
BL2	VLED-	-	Cathode (-): LED backlight input voltage

## 9.0 BLOCK DIAGRAM:

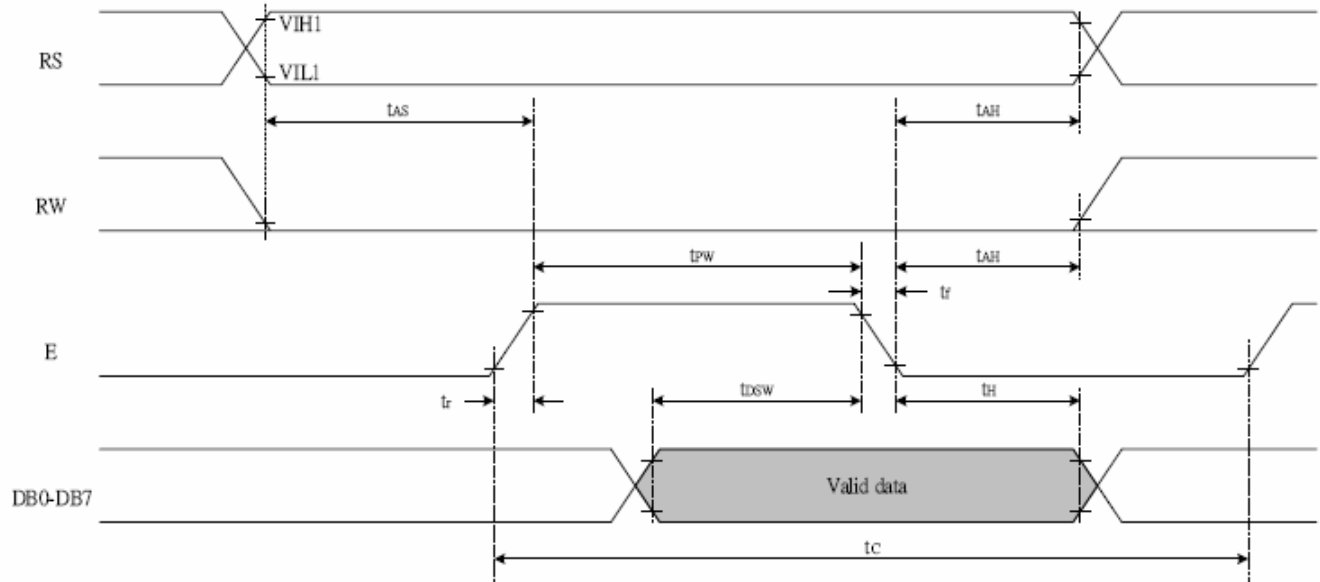


## 10 AC CHARACTERISTICS

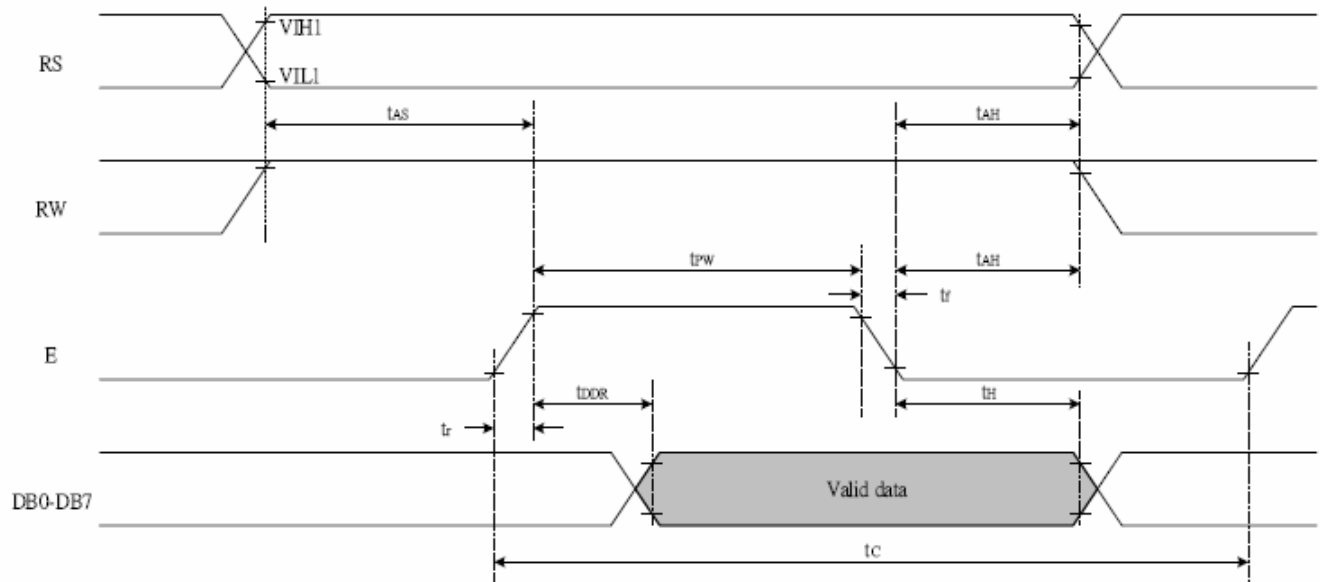
Ta = 25°C, VCC = 5V

Symbol	Characteristics	Test Condition	Min.	Typ.	Max.	Unit
<i>Internal Clock Operation</i>						
f <sub>OSC</sub>	OSC Frequency	R = 91KΩ	190	270	350	KHz
<i>External Clock Operation</i>						
f <sub>EX</sub>	External Frequency	-	125	270	410	KHz
	Duty Cycle	-	45	50	55	%
T <sub>R</sub> ,T <sub>F</sub>	Rise/Fall Time	-	-	-	0.2	μs
<i>Write Mode (Writing data from MPU to ST7066U)</i>						
T <sub>C</sub>	Enable Cycle Time	Pin E	1200	-	-	ns
T <sub>PW</sub>	Enable Pulse Width	Pin E	140	-	-	ns
T <sub>R</sub> ,T <sub>F</sub>	Enable Rise/Fall Time	Pin E	-	-	25	ns
T <sub>AS</sub>	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T <sub>AH</sub>	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T <sub>DSW</sub>	Data Setup Time	Pins: DB0 - DB7	40	-	-	ns
T <sub>H</sub>	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
<i>Read Mode (Reading Data from ST7066U to MPU)</i>						
T <sub>C</sub>	Enable Cycle Time	Pin E	1200	-	-	ns
T <sub>PW</sub>	Enable Pulse Width	Pin E	140	-	-	ns
T <sub>R</sub> ,T <sub>F</sub>	Enable Rise/Fall Time	Pin E	-	-	25	ns
T <sub>AS</sub>	Address Setup Time	Pins: RS,RW,E	0	-	-	ns
T <sub>AH</sub>	Address Hold Time	Pins: RS,RW,E	10	-	-	ns
T <sub>DDR</sub>	Data Setup Time	Pins: DB0 - DB7	-	-	100	ns
T <sub>H</sub>	Data Hold Time	Pins: DB0 - DB7	10	-	-	ns
<i>Interface Mode with LCD Driver(ST7065)</i>						
T <sub>CWH</sub>	Clock Pulse with High	Pins: CL1, CL2	800	-	-	ns
T <sub>CWL</sub>	Clock Pulse with Low	Pins: CL1, CL2	800	-	-	ns
T <sub>CST</sub>	Clock Setup Time	Pins: CL1, CL2	500	-	-	ns
T <sub>SU</sub>	Data Setup Time	Pin: D	300	-	-	ns
T <sub>DH</sub>	Data Hold Time	Pin: D	300	-	-	ns
T <sub>DM</sub>	M Delay Time	Pin: M	0	-	2000	ns

- Writing data from MPU to ST7066U



- Reading data from ST7066U to MPU



# 11 Character Codes

NO.7066-0A

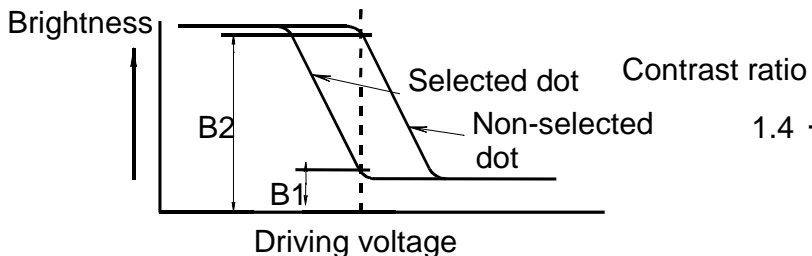
b7-b4 b3-b0	0000	0001	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111	
0000	CG RAM (1)			0	1	A	P	\	P				-	9	E	0	P
0001	(2)		!	1	A	0	a	A			.	7	#	4	3	q	
0010	(3)		"	2	B	R	b	r			7	4	9	x	p	0	
0011	(4)		#	3	C	S	c	s			J	0	T	E	E	*	
0100	(5)		\$	4	D	T	d	t			\	I	t	k	u	a	
0101	(6)		%	5	E	U	e	u			.	7	7	1	0	0	
0110	(7)		&	6	F	V	f	v			7	0	2	3	p	E	
0111	(8)		'	7	G	W	g	w			7	7	x	7	g	n	
1000	(1)		(	8	H	X	h	x			4	0	*	9	J	x	
1001	(2)		)	9	I	Y	i	y			9	7	J	u	'	y	
1010	(3)		*	*	J	Z	j	z			E	0	n	v	j	7	
1011	(4)		+	3	K	L	k	l			*	7	E	0	*	n	
1100	(5)		,	<	L	*	l	l			0	0	7	7	0	n	
1101	(6)		-	=	M	I	m	i			u	x	\	7	E	7	
1110	(7)		.	>	N	^	n	^			3	0	0	'	n		
1111	(8)		/	?	O	_	o	*			0	9	7	'	0	■	

## 12.0 OPTICAL CHARACTERISTICS

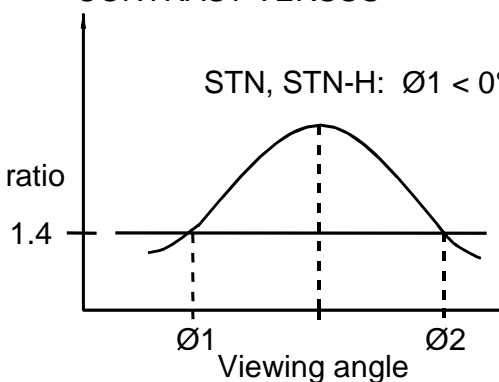
Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Contrast ratio STN-H & STN	K	$\varnothing=20^\circ \theta=0^\circ$	5	-	-	-
Viewing angle STN-H & STN	$\varnothing2-\varnothing1$ $\theta$	$\theta=0^\circ K \geq 1.4$ $\varnothing=20^\circ K=1.4$	40 $\pm 40$	-	-	Deg. Deg.
Response time Rise	$t_r$	$\varnothing=20^\circ \theta=0^\circ$	-	150	250	mS
Fall	$t_f$	$\varnothing=20^\circ \theta=0^\circ$	-	150	250	mS

### DEFINITION OF CONTRAST

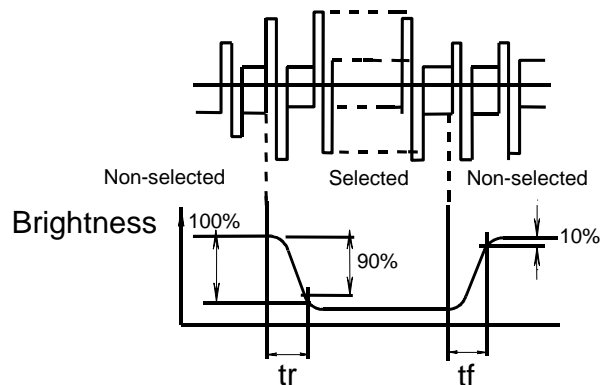
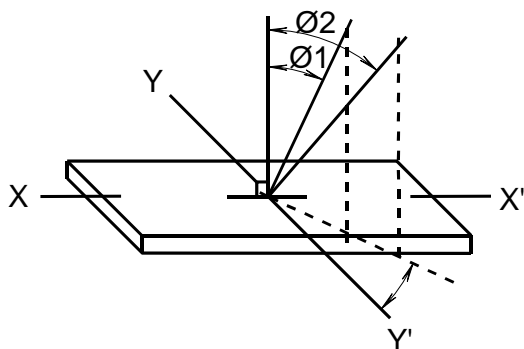
$$K = \frac{\text{Brightness of non-selected}}{\text{Brightness of selected}}$$



### CONTRAST VERSUS



### DEFINITION OF ANGLES $\varnothing$ AND DEFINITION OF OPTICAL RESPONSE







## 14.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

# LR4416<sup>①</sup> <sup>②</sup>4C16<sup>③</sup> <sup>④</sup> <sup>⑤</sup>

①

### **Polarizer Type**

B = Transflective: light background with LED backlight

②

### **Backlight Color**

G = Yellow-green (standard)

③

### **Fluid Type and Power Supply**

H = STN-H with +5VDC operation ( wide temp range )

S = STN ( standard temp range )

④

### **Fluid Type Viewing Direction**

N = STN

⑤

### **Background Color for STN**

G = Gray background

Y = Yellow background