

The information disclosed herein was originated by and is the property of Densitron International. Densitron International reserves all patent, proprietary, design, use, sales, manufacturing and reproduction rights thereto.

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
A	Released on ECN #E1505	05/16/03	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 Cage Code #OWS52	APPROVALS	DATE	DENSITRON TECHNOLOGIES PLC.	
	DRAWN			
	CHECKED		TITLE	LCD MODULE 240 X 320 GRAPHICS W TOUCHSCREEN
	ISSUED		DWG. NO.	TS6055

1.0 DESCRIPTION

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

Available LC fluid types are: STN (Supertwisted nematic) and STN-H (Extended temperature range STN), FSTN (Film supertwisted nematic), FSTN-H (Extended Film supertwisted nematic FSTN).

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

2.0 MECHANICAL CHARACTERISTICS

Item	Specifications	Unit
Package Dimensions	165.5 (W) x 109.0 (H) x 17.0 max (D)	mm
Display format	320 dots (W) x 240 dots (H)	-
Driving method	1/240	duty
Dot size	0.345 (W) x 0.345 (H)	mm
Dot pitch	0.360 (W) x 0.360 (H)	mm
Active display area	115.185 (W) x 86.385 (H)	mm
Viewing area	122.0 (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	FSTN,STN		FSTN-H,STN-H		Unit
		Min.	Max.	Min.	Max.	
Logic supply voltage	V _{DD} -V _{SS}	0	7	0	6	V
LC driver supply voltage	V _{DD} -V _O	0	28	0	28	V
Operating temperature	T _{OP}	0	+50	-20	+70 (Note 3)	°C
Storage temperature (Note 1)	T _{ST}	-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

V_{DD}=5±0.25V;T_a=25°C

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input "High" voltage	V _{IH}	-	0.8	-	V _{DD}	V
Input "Low" voltage	V _{IL}	-	V _{SS}	-	0.2V _{DD}	V
Output "High" voltage	V _{OH}	I _{OH} =0.205mA	V _{DD} -0.4	-	-	V
Output "Low" voltage	V _{OL}	I _{OL} =1.2mA	-	-	0.4	V
Power supply current	I _{EE}	V _{EE} =-23V	-	6.0	-	mA
Power supply current	I _{DD}	V _{DD} =5.0V	-	6.5	*100	mA

* With Negative Voltage and Temperature Compensation installed.

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

V_{DD}=5.0±0.25V

Temperature	STN	STN-H	FSTN	FSTN-H
T _a = -20°C	-	26.5	-	27.0
T _a = 0°C	25.5	25.5	26.2	26.2
T _a = 25°C	25.0	25.0	25.5	25.5
T _a = 50°C	24.0	24.0	24.0	24.0
T _a = 70°C	-	23.0	-	22.5

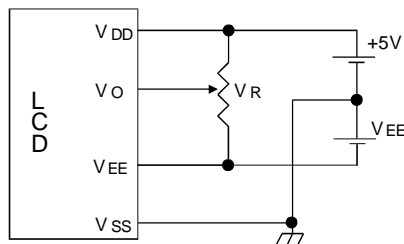
6.0 BACKLIGHT SPECIFICATIONS:

T_a=20°C,60%RH,Darkroom.

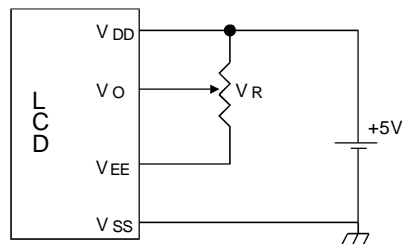
Item	Symbol	Typ.	Max.	Unit
CFL lamp input voltage	V _{CFL}	300	350	V _{rms}
CFL input current	I _{CFL}	5.0	6.0	mA
Life to half initial brightness	-	17000	20000	Hours
CFL lamp input frequency	F _{CFL}	30	60	KHz
Recommended backlight inverter	-	INV-12	-	-

7.0 POWER SUPPLY

- STN

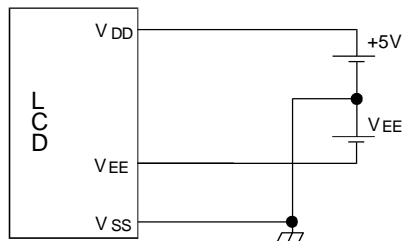


- STN with on-board negative voltage generator

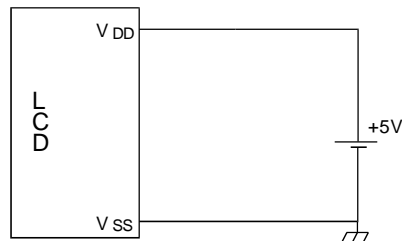


V_R = 10K - 20K ohm

- STN with temperature compensation



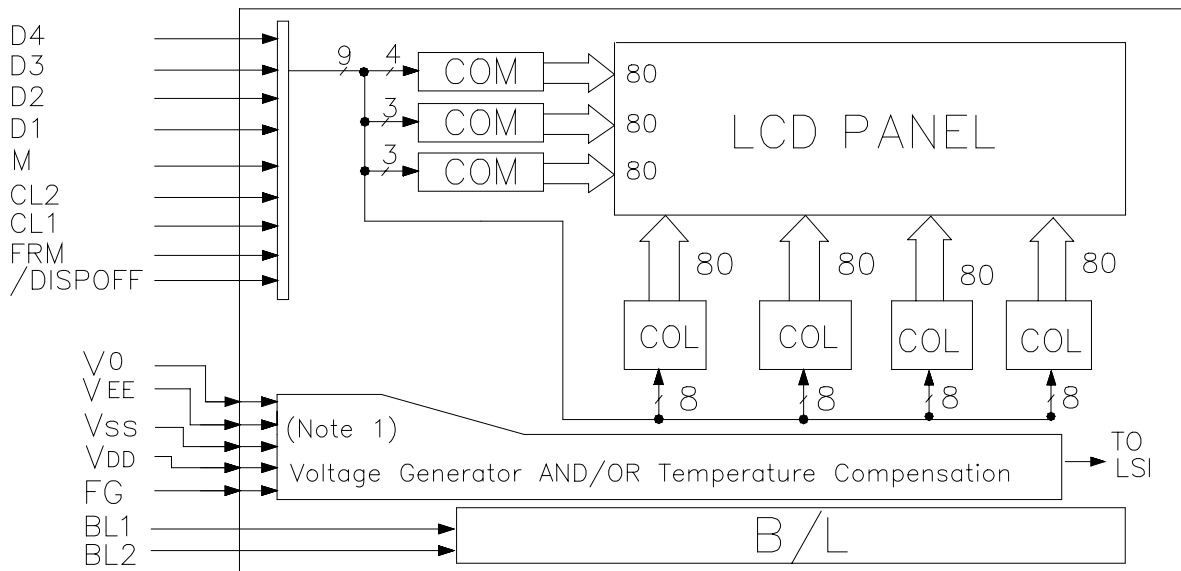
- STN with on-board negative voltage generator and temperature compensation



8.0 INTERFACE DESCRIPTION

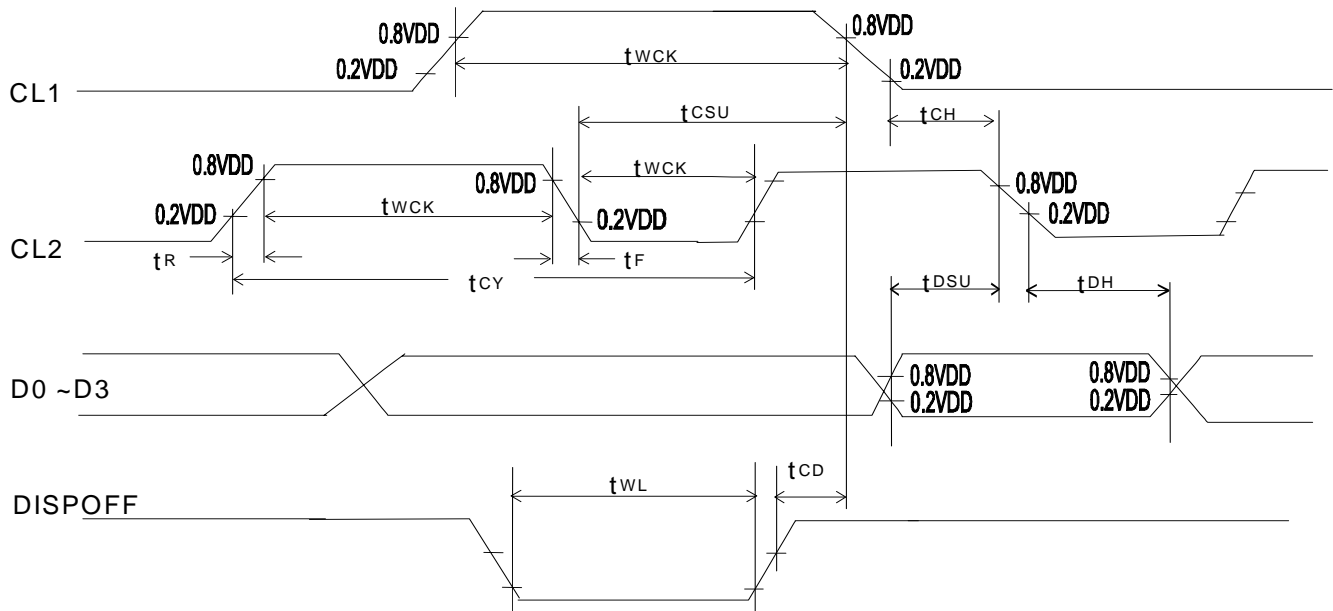
Pin No.	Symbol	I/O	Function
1	D1	I/O	Bi directional data bus line 1
2	D2	I/O	Bi directional data bus line 2
3	D3	I/O	Bi directional data bus line 3
4	D4	I/O	Bi directional data bus line 4
5	DISPOFF	I	"L" : Display OFF "H" : Display ON
6	FRM	I	First Row Marker indicates the beginning of each display cycle
7	M	I	Control signal for A.C. drive
8	CL1	I	The CL1 latches the serial data in the shift registers
9	CL2	I	Clock signal for shifting the serial data
10	Vdd	-	Power Supply for logic circuit (+5V)
11	Vss	-	Ground
12	Vee	-	Power Supply for LC drive
13	Vo	-	Operating voltage for LC drive
14	FG	-	Frame Ground
15	N/C	-	No Connection
BL1	VCCFL	-	CCFL backlight input voltage (from output of DC-AC inverter)
BL2	VCCFL	-	CCFL backlight input voltage (from output of DC-AC inverter)
TS1	X1	I/O	analogue touch screen top bus bar
TS2	X2	I/O	analogue touch screen bottom bus bar
TS3	Y1	I/O	analogue touch screen left bus bar
TS4	Y2	I/O	analogue touch screen right bus bar

9.0 BLOCK DIAGRAM:



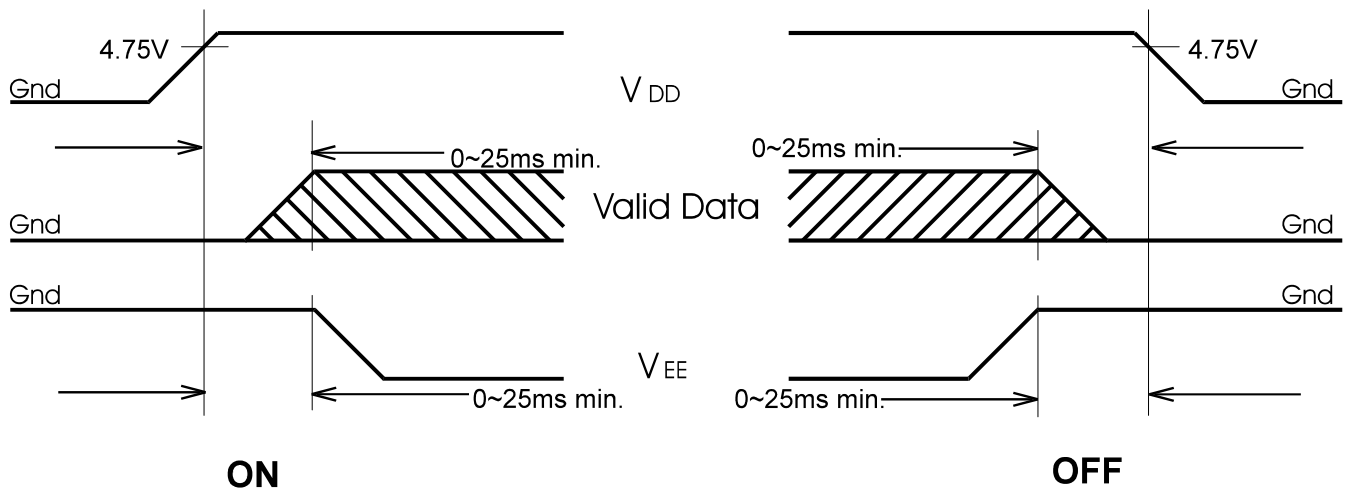
10.0 TIMING CHARACTERISTICS

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Clock Cycle Time	t _{cy}	125	-	-	Duty = 50%
Clock Pulse Width	t _{wck}	45	-	-	nS
Clock Rise/Fall Time	t _r /t _f	-	-	50	nS
Data Set-Up time	t _{dsu}	30	-	-	nS
Data Hold Time	t _{dH}	30	-	-	nS
Clock Set-Up Time	t _{csu}	80	-	-	nS
Clock Hold Time	t _{ch}	80	-	-	nS
DISPOFF Low Pulse Time	t _{wL}	1.2	-	-	μS
DISPOFF Clear Time	t _{cd}	100	-	-	nS



11.0 VOLTAGE SEQUENCING

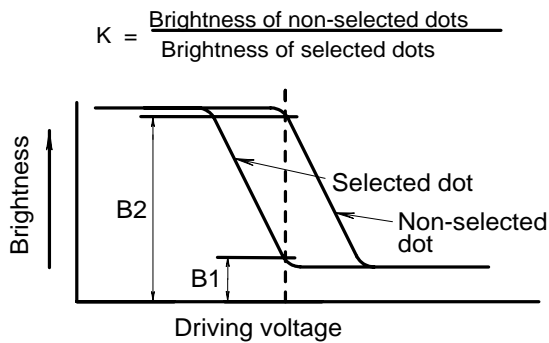
Always observe the following power supply ON/OFF sequence. Failure to so may cause latch up of CMOS LSI circuits or DC induced damage to LC panel.



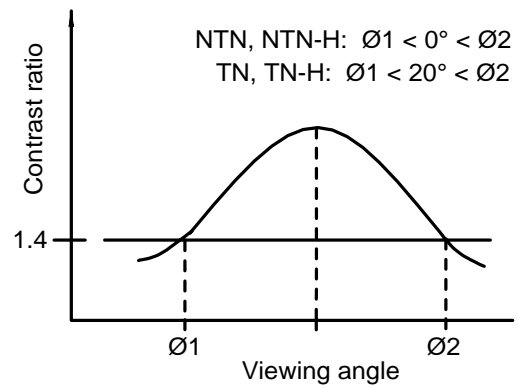
12.0 OPTICAL CHARACTERISTICS

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Contrast ratio	K	$\theta=20^\circ \theta=0^\circ$	4	-	-	-
Viewing angle	$\theta_2-\theta_1$	$\theta=0^\circ K \geq 1.4$	40	-	-	Deg.
	θ	$\theta=20^\circ K=1.4$	± 30	-	-	Deg.
Response time	Rise	$\theta=20^\circ \theta=0^\circ$	-	150	250	mS
	Fall	$\theta=20^\circ \theta=0^\circ$	-	150	250	mS

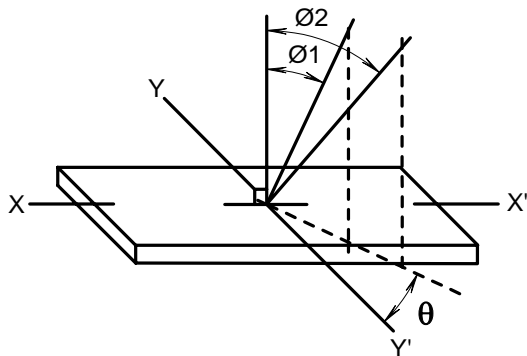
DEFINITION OF CONTRAST RATIO (K)



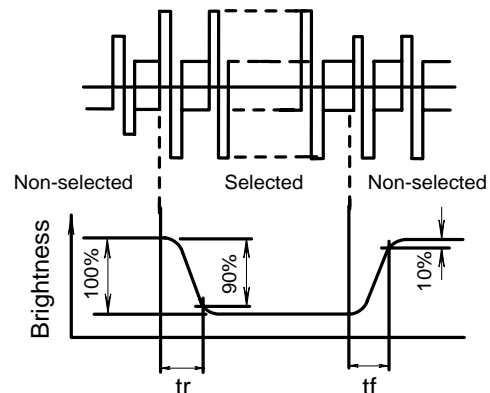
CONTRAST VERSUS VIEWING ANGLE



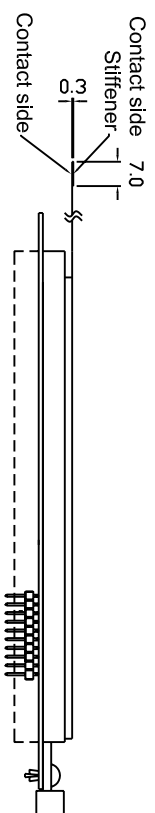
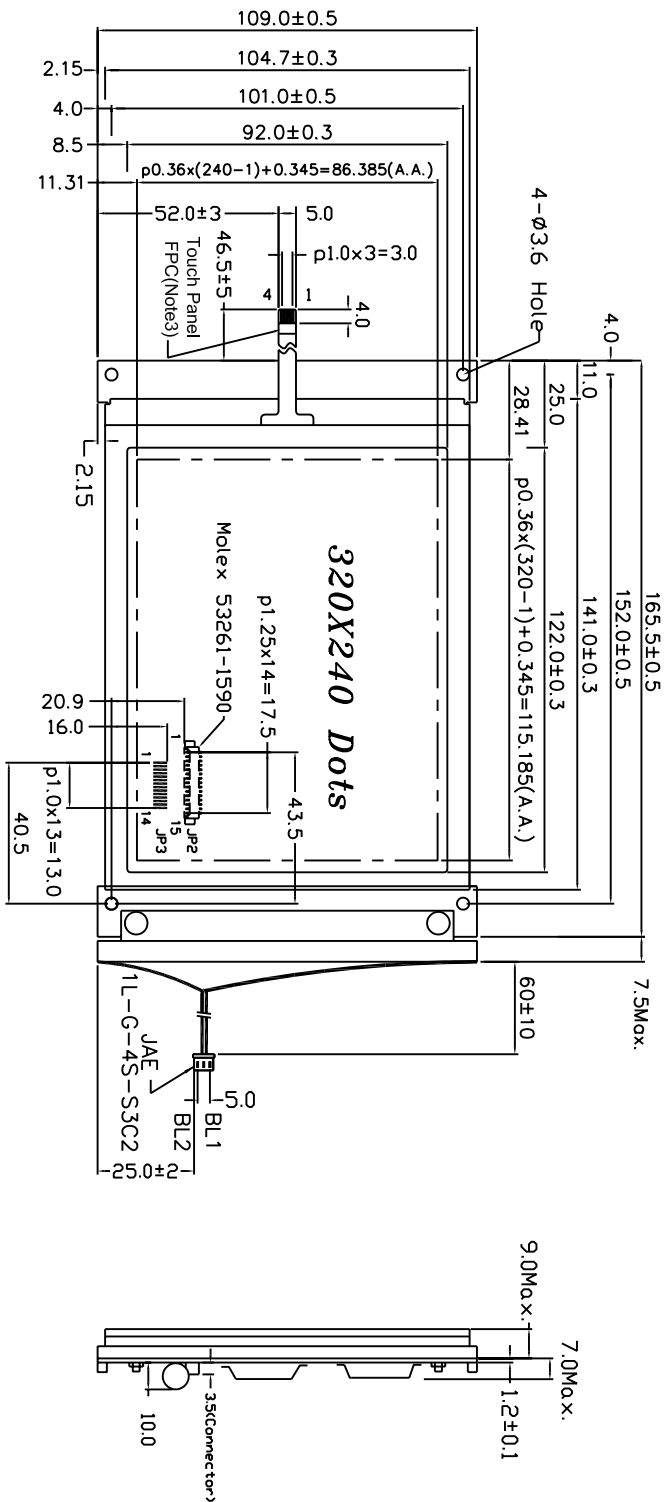
DEFINITION OF ANGLES θ AND θ



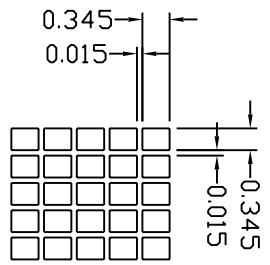
DEFINITION OF OPTICAL RESPONSE



13.0 MODULE DIMENSIONS



Note 3	
Pin	Assignment
1	Right
2	Top
3	Left
4	Bottom



Cage Code #DWSS2

DWG. NO.

TS6055

SHEET 7 OF 8

REV. A

14.0 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

TS6055①②240G320③④⑤

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 = STN with +5VDC and external negative voltage operation

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

H = STN extended temp. with +5VDC and external negative voltage operation

W = STN extended temp. with +5VDC operation (on-board negative voltage generation)

④

FLUID TYPE

C = STN with on-board temperature compensation circuitry

N = STN

F = FSTN

⑤

COLOR FOR STN FLUID

B = Blue background

G = Gray background

Y = Yellow background