

# LIQUID CRYSTAL DISPLAY MODULE

## Product Specification

<b>CUSTOMER</b>		
<b>PRODUCT NUMBER</b>	<b>TS4055</b>	
<b>CUSTOMER APPROVAL</b>		<b>Date</b>

INTERNAL APPROVALS				
Quality Mgr	Product Mgr	Project Leader	Mech. Eng	Electr. Eng
Date:	Date:	Date:	Date:	Date:

- Approval for Specification only**
- Approval for Specification and Sample**

Sample no.:

Date:

ISR no.:

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REVISION RECORD

Rev.	Date	Page	Chapt.	Comment	ECR no.
A	03/24/04			New Release	E1672

# 1 MAIN FEATURES

ITEM	CONTENTS
Display Format	320 dot x 240 dot matrix
Colour	Monochrome
Overall Dimensions	173.0 (W) x 109.0 (H) x 20.2 (D)
Viewing Area	122.0 (W) x 92.0 (H)
LCD type	STN-Negative Transmissive or FSTN-Positive Transflective
Mode	Blue or Black
Viewing Angle	6:00 O'Clock
Duty ratio	1/240
Driver IC	N/A (4-bit parallel interface)
Backlight type	LED
Backlight colour	White
DC/DC converter	Yes (Optional)
Operating temperature	0°C to +50°C or -20°C to +70°C
Storage temperature	-10°C to +60°C or -30°C to +80°C

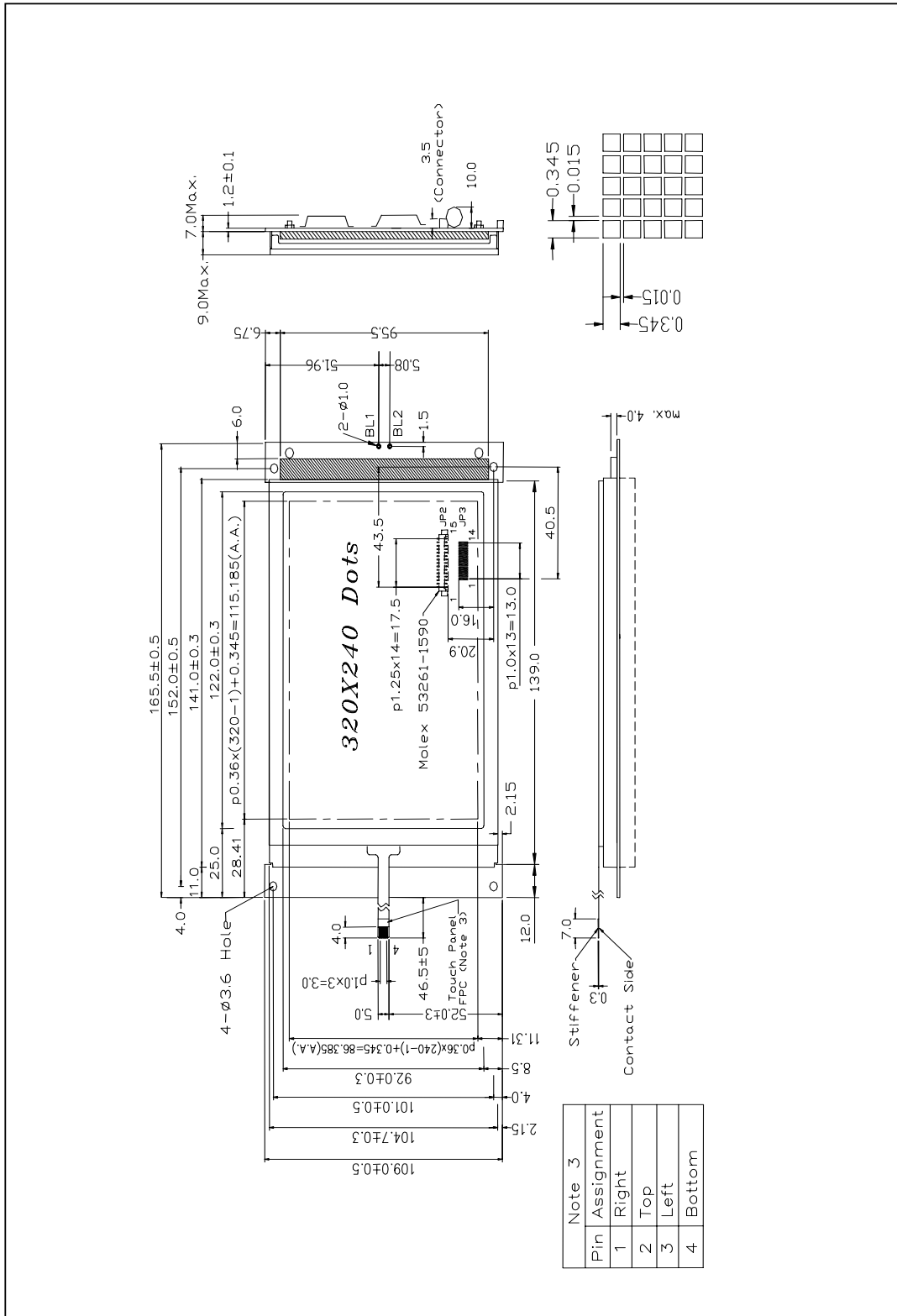
## 2 MECHANICAL SPECIFICATION

### 2.1 MECHANICAL CHARACTERISTICS

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ITEM	CHARACTERISTIC	UNIT
Display Format	320 dot x 240 dot matrix	
Character Format	N/A	
Overall Dimensions	173.0 (W) x 109.0 (H) x 20.2 (D)	mm
Viewing Area	122.0 x 92.0	mm
Active Area	115.185 x 86.385	mm
Character Size	N/A	mm
Character Pitch	N/A	mm
Dot Size	0.345 x 0.345	mm
Dot Pitch	0.36 x 0.36	mm
Weight	259	g

## 2.2 MECHANICAL DRAWING



### 3 ELECTRICAL SPECIFICATION

#### 3.1 ABSOLUTE MAXIMUM RATINGS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Min	Max	Unit	Note
Power Supply Voltage	V <sub>DD</sub> -V <sub>SS</sub>	0	7.0	V	
Input Voltage	V <sub>in</sub>	0	V <sub>dd</sub>	V	
Operating Temperature	Top	-20	+70	°C	Note 1
Storage Temperature	T <sub>st</sub>	-30	+80	°C	Note 2
Static Electricity	Be sure that you are grounded when handling displays.				

Note 1: Background colour changes slightly depending on ambient temperature. This phenomenon is reversible. Ta ≤ 70 °C: 75% RH max

Note 2: Ta ≤ 80 °C: 75% RH max

#### 3.2 ELECTRICAL CHARACTERISTICS

VSS = 0 V, Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit
Power Supply for Logic	V <sub>DD</sub> -V <sub>SS</sub>	Ta = 25 °C	4.75	5	5.25	V
Supply voltage (V <sub>EE</sub> ) TYP.	V <sub>EE</sub>	Ta = 25 °C	-	-23	-	
Input Voltage	V <sub>IL</sub>	V <sub>dd</sub> =5.0±5%	0	-	1.0	V
	V <sub>IH</sub>	V <sub>dd</sub> =5.0±5%	3.8	-	V <sub>dd</sub>	V
Current Consumption	I <sub>DD</sub>	V <sub>DD</sub> = 5V Without Negative Voltage		6.5		mA
	I <sub>DD</sub>	V <sub>DD</sub> = 5V With Negative Voltage		85		mA

### **3.3 RECOMMENDED LC DRIVE VOLTAGE (VDD-VO)**

V<sub>DD</sub>=5.0±0.25V

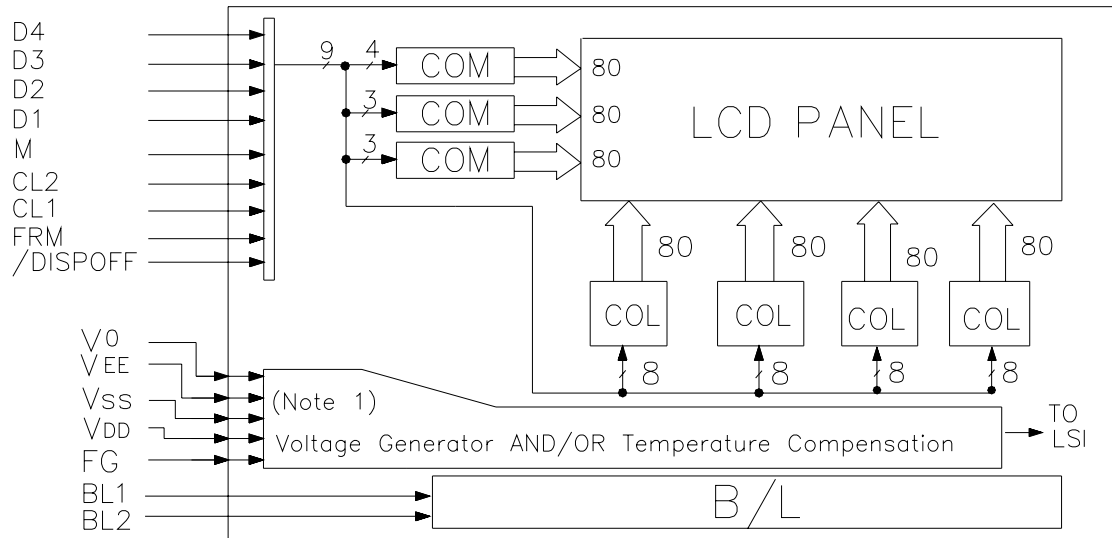
<b>Temperature</b>	<b>STN</b>	<b>STN-H</b>	<b>FSTN</b>	<b>FSTN-H</b>
Ta= -20°C	-	26.5	-	27.0
Ta= 0°C	25.5	25.5	26.2	26.2
Ta= 25°C	25.0	25.0	25.5	25.5
Ta= 50°C	24.0	24.0	24.0	24.0
Ta= 70°C	-	23.0	-	22.5



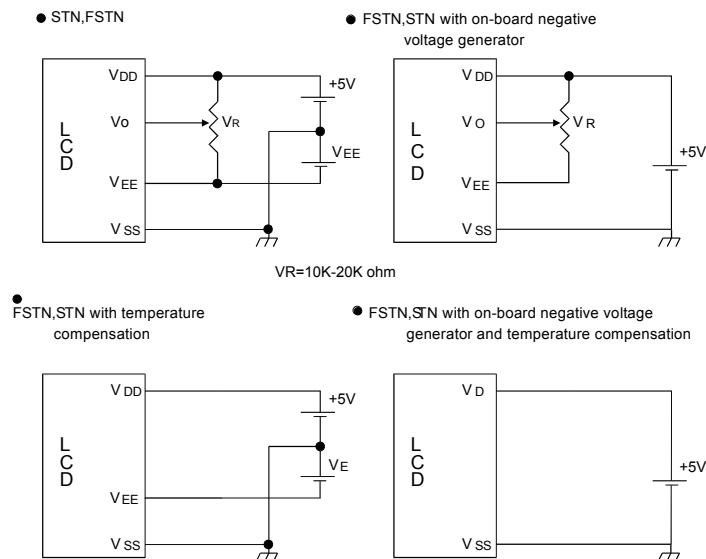
### 3.4 INTERFACE PIN ASSIGNMENT

No.	Symbol	I/O	Function
1	D1	H/L	Display Data 1
2	D2	H/L	Display Data 2
3	D3	H/L	Display Data 3
4	D4	H/L	Display Data 4
5	/DISPOFF	H/L	Display ON/OFF control signal (“L”: Display OFF)
6	FRM	H/L	Frame signal
7	NC	-	No connection
8	CL1	H->L	Data Latch Signal
9	CL2	H->L	Data Shift Clock Signal
10	Vdd	-	Power Supply for logic
11	Vss	-	Power Supply (OV,GND)
12	Vee	-	Alternative Power Supply
13	Vo	-	Voltage Level for LCD Control Adjustment
14	FG	-	Frame GND
15	N/C	-	No connection
BL1	V <sub>LED+</sub>	-	Anode (+); LED backlight input voltage
BL2	V <sub>LED-</sub>	-	Cathode (-); LED backlight input voltage

### 3.5 BLOCK DIAGRAM



### 3.6 POWER SUPPLY CIRCUIT



### **3.7 TIMING CHARACTERISTICS**

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N/A

Note: Please reference the manufacturers data sheet for the ASLIC AX6086 Drivers.

## 4 OPTICAL SPECIFICATION

### 4.1 OPTICAL CHARACTERISTICS

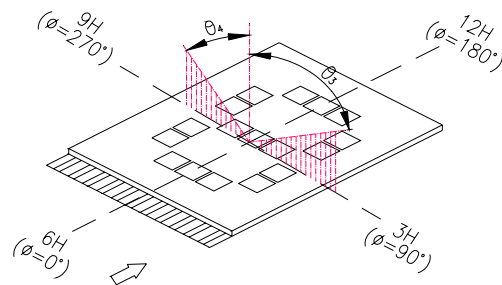
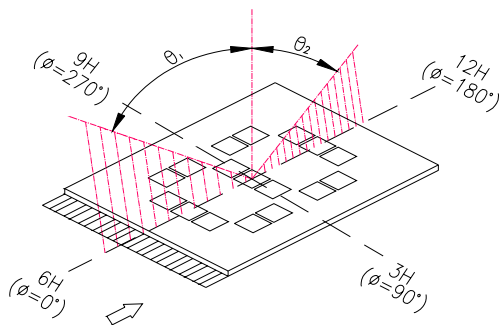
Ta = 25 °C

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle	θ1	Ka=2 θ=0°	20	-	-	deg	1
	θ2	Ka=1.4 θ=0°	40	-	-	deg	1
	θ3	Ka=2 θ=20°	±10	-	-	deg	2
	θ4	Ka=1.4 θ=20°	±30	-	-	deg	2
Contrast Ratio	K	∅=0° Ka=2 θ=0° Ka=1.4	5 3	- -	- -	-	3
Response Time	Tr	∅=0°θ=0° Ta = 25 °C		200		ms	4
	Tf	∅=0°θ=0° Ta = 25 °C		210			
Driving Method	Duty	1/240					
	Bias	1/14					
LCD Type	STN – Negative Transmissive						
Viewing Direction	6:00 O’CLOCK						

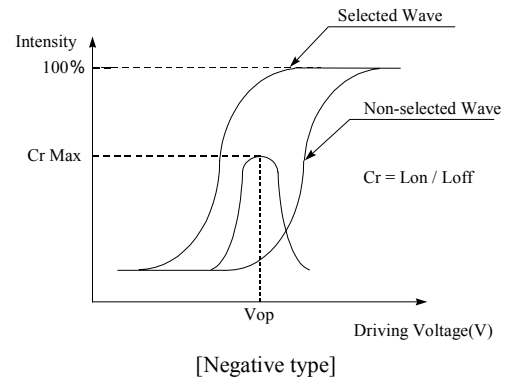
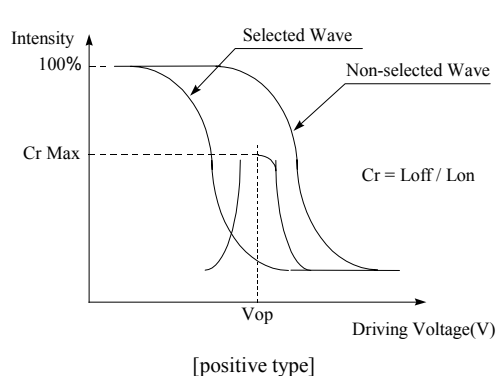
Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Viewing Angle	$\theta_1$	$Ka=2$ $\theta=0^\circ$	20	-	-	deg	1
	$\theta_2$	$Ka=1.4$ $\theta=0^\circ$	40	-	-	deg	1
	$\theta_3$	$Ka=2$ $\theta=20^\circ$	$\pm 10$	-	-	deg	2
	$\theta_4$	$Ka=1.4$ $\theta=20^\circ$	$\pm 30$	-	-	deg	2
Contrast Ratio	K	$\varnothing=0^\circ$ $Ka=2$ $\theta=0^\circ$ $Ka=1.4$	5 3	- -	- -	-	3
Response Time	Tr	$\varnothing=0^\circ \theta=0^\circ$ $Ta = 25^\circ C$		130		ms	4
	Tf	$\varnothing=0^\circ \theta=0^\circ$ $Ta = 25^\circ C$		340			
Driving Method	Duty	1/240					
	Bias	1/14					
LCD Type	FSTN- Positive-Transflective						
Viewing Direction	6:00 O'CLOCK						

Note 1: definition of viewing angle  $\theta_1$  &  $\theta_2$

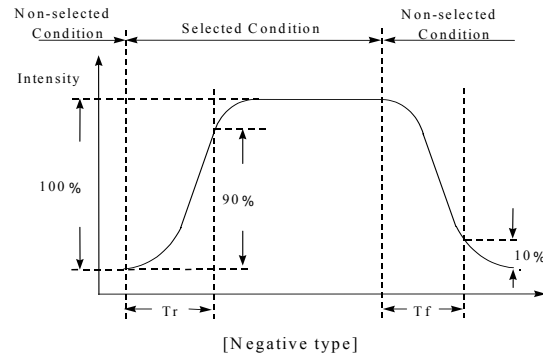
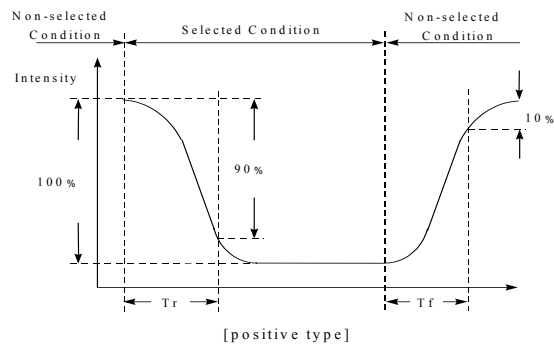
Note 2: definition of viewing angle  $\theta_3$  &  $\theta_4$



Note 3: definition of contrast ratio (CR)



Note 4: definition of response time



## 5 BACKLIGHT SPECIFICATION

### 5.1 BACKLIGHT CHARACTERISTICS

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The backlight comprises of a light guide with LED, three LED emitters left and right.

Item	Symbol	Condition	Min	Typ	Max	Unit	Note
Supply Current	I			120		mA	
Input Voltage	V <sub>F</sub>			5		V	
Average Luminous Intensity	STN FSTN-P FSTN-N			28 24 32		cd/m <sup>2</sup>	1 (on LCD)
Life time		I <sub>F</sub> = 120mA	-	40,0 00	-	hrs	3
Colour	White						

Note:

1. Average luminous intensity of 9 points
2. Brightness uniformity = (MAX-MIN) / MAX x 100
3. Half of the original brightness

### 5.2 INTERNAL CIRCUIT DIAGRAM

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N/A

## 6 PACKAGING AND LABELLING SPECIFICATION

### 6.1 LABELLING & MARKING

DENSITRON TS4055 XX XXX TAIWAN YYMM
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NOTE: XX XXX Represent options, refer to sheet 18 of 18.

## 7 Touch Screen Characteristics

### 7.1 Mechanical

Description	Specification	Remark
View Area	93.85 mm x 122.0 mm	
Active Area	87.37 x 116.17	
Input method	Finger or Pen	
Activation force	20 gf ~ 100 gf	Test Condition : End shape : R0.8 mm Resistance between X and Y axis must be equal or lower than 2K ohm , the test voltage=DC 5V.
Hardness of surface	3H	JIS K 5400
FPC Bending Resistance	Meet electrical spec. after testing	Bending degree : 180 degree Bending times : 10 times

### 7.2 Electrical

Description	Specification	Remark
Insulation	$\geq 20M$ ohm	At DC 25V , $\geq 60$ sec
Linearity	$\leq \pm 1.5\%$	Material of Pen : Poly-acetal End shape : R0.8 mm Test Point : 100 Points Test Force : 80 gF

### 7.3 Optical

Description	Specification	Remark
Transmittance	$\geq 80\%$	ASTM D1003 Wavelength = 550 nm



## 8 HANDLING PRECAUTIONS

### *Safety*

If the LCD panel breaks, be careful not to get the liquid crystal fluid in your mouth or in your eyes. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and plenty of water.

### *Mounting and Design*

Place a transparent plate (e.g. acrylic, polycarbonate or glass) on the display surface to protect the display from external pressure. Leave a small gap between the transparent plate and the display surface.

When assembling with a zebra connector, clean the surface of the pads with alcohol and keep the surrounding air very clean.

Design the system so that no input signal is given unless the power supply voltage is applied.

### *Caution during LCD cleaning*

Lightly wipe the display surface with a soft cloth soaked with Isopropyl alcohol, Ethyl alcohol or Trichlorotrifluoroethane.

Do not wipe the display surface with dry or hard materials that will damage the polariser surface.

Do not use aromatic solvents (toluene and xylene), or ketonic solvents (ketone and acetone).

### *Caution against static charge*

As the display uses C-MOS LSI drivers, connect any unused input terminal to VDD or VSS. Do not input any signals before power is turned on.

Also, ground your body, work/assembly table and assembly equipment to protect against static electricity.

### *Packaging*

Displays use LCD elements, and must be treated as such. Avoid strong shock and drop from a height. To prevent displays from degradation, do not operate or store them exposed directly to sunshine or high temperature/humidity.

### *Caution during operation*

It is indispensable to drive the display within the specified voltage limit since excessive voltage shortens its life.

Direct current causes an electrochemical reaction with remarkable deterioration of the display quality.

Give careful consideration to prevent direct current during ON/OFF timing and during operation.

Response time is extremely delayed at temperatures lower than the operating temperature range while, at high temperatures, displays become dark. However, this phenomenon is reversible and does not mean a malfunction or a display that has been permanently damaged.

If the display area is pushed on hard during operation, some graphics will be abnormally displayed but returns to a normal condition after turning off the display once.

Even a small amount of condensation on the contact pads (terminals) can cause an electro-chemical reaction which causes missing rows and columns. Give careful attention to avoid condensation.

### *Storage*

Store the display in a dark place where the temperature is  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$  and the humidity below 50%RH.

Store the display in a clean environment, free from dust, organic solvents and corrosive gases.

Do not crash, shake or jolt the display (including accessories).

## 9 PART NUMBER DESCRIPTION FOR AVAILABLE OPTIONS

### TS4055 ① ② 240G320 ③ ④ ⑤

①

#### **POLARIZER TYPE**

B = Transflective: light background with white CFL backlight  
 E = Transmissive: dark background with white CFL backlight

②

#### **BACKLIGHT COLOR AND TYPE**

W = White LED Backlight

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