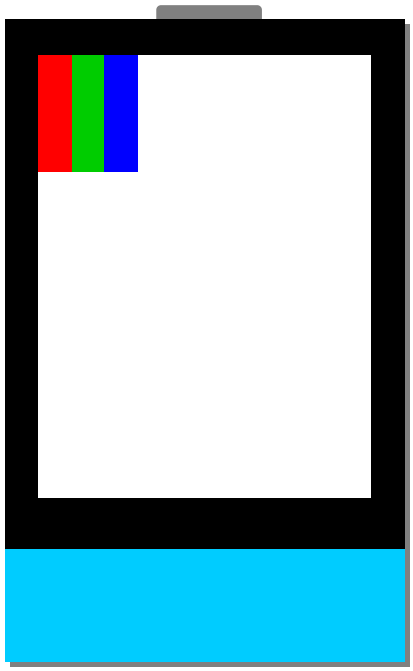
Product Specification

1. General Description

The **LH190Q01-SH02** model is a Thin Film Transistor- Liquid Crystal Display without polarizer.
The matrix compose a-Si Thin Film Transistor as a active element.
It is a transmissive type display operating in the normally black mode. This TFT-LCD has **1.9 inch** diagonally measured active display area with qVGA resolution(240×RGB×320 pixels).
Each pixel is divided into Red, Green and Blue sub-pixels or dots which are arranged in vertical stripes.
The LH190Q01-SH02 has been designed to apply the interface method that enables low power.
The LH190Q01-SH02 is intended to support applications where thin thickness, low power are critical factors and graphic display are important. In combination with the vertical arrangement of the sub-pixels, the LH190Q01-SH02 characteristics provide a high quality display for mobile phone application.



General Features

Active Screen Size	1.9 inch diagonal
Outline Dimension	32.800(H) x 46.080(V) x 0.80(D) mm(Typ.) , Only panel without polarizer
Pixel Pitch	0.040 mm x 0.120mm
Pixel Format	240×RGB×320 Pixels (RGB Stripes Arrangement)
Color Gamut	68%(Typ.) , Only CF
Transmittance (with POL)	4.86% (Typ.) at 4.5 V
Weight (without POL)	2.8g (Typ.)± 0.28g
Rubbing Direction	80/80/80/80 deg (U/D/L/R @ C/R>10)
D-IC	R61505U
Display Operating Mode	Transmissive Mode, Normally black

2. Absolute Maximum Ratings

The following are maximum values which, if exceeded, may cause operation or damage to the unit.

Table 1. ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value		Unit	Notes
		Min.	Max.		
LC Operating Voltage *1)	V_{OP}	4.5 (Typ.)		V	@ 25±5 ℃
Operating Temperature	T_{OP}	-20	70	℃	
Storage Temperature	T_{ST}	-30	80	℃	
Operating Ambient Humidity *2)	H_{OP}	10	*3)	%RH	
Storage Humidity *2)	H_{ST}	10	*4)	%RH	

Notes:

*1) Liquid Crystal driving voltage.
Due to the characteristics of LC Material, this voltage vary with environmental temperature.

*2) Non-condensation.

*3) Temp. ≤ 60℃ , 90% RH MAX.

*4) Temp. > 60℃ , Absolute humidity shall be less than 90% RH at 60℃

3. Electrical Specifications

Table 2. Recommend Parameters for Electrical Characteristics

@ 25 ± 5°C

Parameter	Symbol	Value			Unit	Notes
		Min.	Typ.	Max.		
TFT Gate ON Voltage	VGH *1)	13	15	17	V	*3)
TFT Gate OFF Voltage	VGL *2)	-11.7	-9.7	-7.7	V	
TFT Common Electrode Voltage	VcomH	-	3.65	-	V	
	VcomL	-	-1.35	-	V	
TFT Kick-Back Voltage	ΔV_p	-	1.8	-	V	

Notes:

*1) VGH is TFT Gate Operating Voltage.

*2) VGL is TFT Gate Operating Voltage
The low voltage level of VGL signal must be fluctuated with same phase as Vcom,
in case of Cadd (Storage on Gate) structure.
The storage capacitance structure of LH190Q01-SH02 is Cst (Storage on Common)

*3) Vcom must be adjusted to optimize display quality: Cross-talk, Contrast Ratio and etc.

We just kindly recommend the setting-voltage as the reference value.

In order to get the optimized display quality, the setting-voltage should be changed as based on customer's developing condition.
(The display quality could be changed by customer's setting-voltage.)

4. Optical Specification

Optical characteristics are determined after the unit has been 'ON' and stable for approximately 30 minutes in a dark environment at 25 °C. The values specified are at an approximate distance 50 cm from the TFT-LCD surface at a viewing angle of Φ and θ equal to 0 °.

Measurement condition:

Refer to next pages (LED back light with 20 mA/1 ea)

*1): with Polarizer

cf. Polarizer attachment tolerance + optical axis = ±0.1°

The Tolerance of the angle between Rubbing axis of cell and absorption axis of polarizer is ±0.1°

*2): Only Color Filter glass

Parameter	Symbol	Values			Unit	Notes
		Min	Typ	Max		
*1) Threshold Voltage	Vsat	4.6	4.7	4.8	V	Fig.2
	Vth	1.9	2.0	2.1	V	
*1) Transmittance	T(%)	4.42	4.86	-	%	Fig.1
*1) Contrast Ratio	C/R	350	500	-		
*1) Response Time	Tr+Tf	-	40	60	msec	Fig.3
*2) CIE Color Coordinate	Rx	0.621	0.641	0.661		
	Ry	0.294	0.314	0.334		
	Gx	0.273	0.293	0.313		
	Gy	0.567	0.587	0.607		
	Bx	0.118	0.138	0.158		
	By	0.069	0.089	0.109		
	Wx	0.293	0.313	0.333		
	Wy	0.316	0.336	0.356		
*1) Viewing Angle	Θl	-	80	-	Degree	C/R>10 Fig.4
	Θr	-	80	-		
	Θu	-	80	-		
	Θd	-	80	-		

Notes : 1. Contrast Ratio(CR) is defined mathematically as :

$$\text{Contrast Ratio} = \frac{\text{Surface Luminance with all white pixels}}{\text{Surface Luminance with all black pixels}}$$

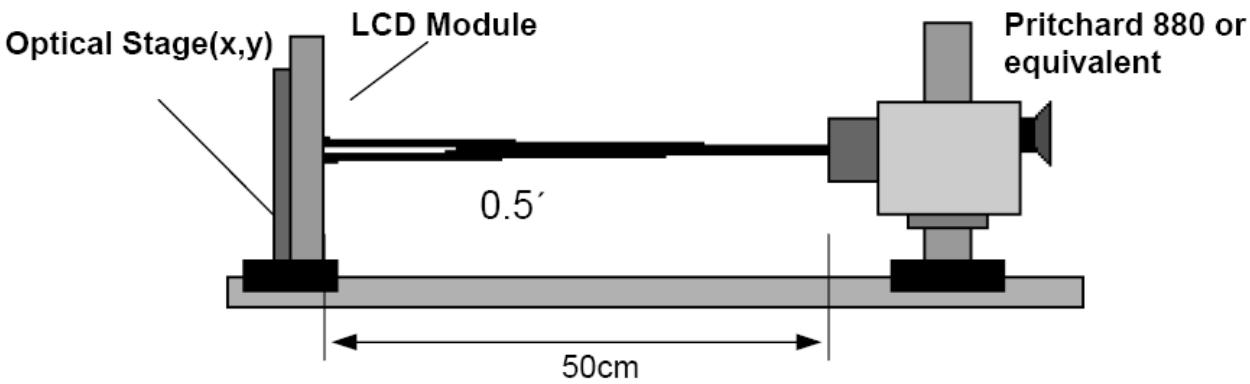
2. Surface luminance is the center point across the TFT-LCD surface 500 mm from the surface with all pixels displaying white. For more information see FIG 1.

3. Response time is the time required for the display to transition from black to white(Rise Time, Tr) and from white to black(Falling Time, Tf). For additional information see FIG 3.

4. Viewing angle is the angle at which the contrast ratio is greater than 10. The angles are determined for the horizontal or x axis and the vertical or y axis with respect to the z axis which is normal to the TFT-LCD surface. For more information see FIG 4.

5. Optimum contrast is obtained by adjusting the TFT-LCD Threshold voltage(Vth & Vsat)

FIG. 1 Optical Characteristic Measurement Equipment and Method



<Transmissive Mode>

FIG. 2 The definition of Vth and Vsat

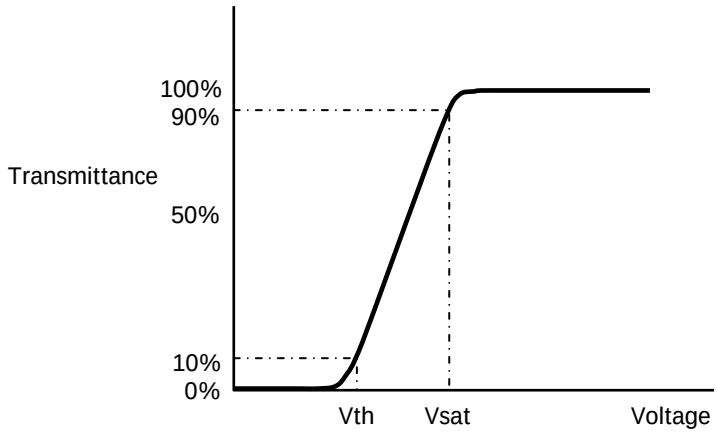
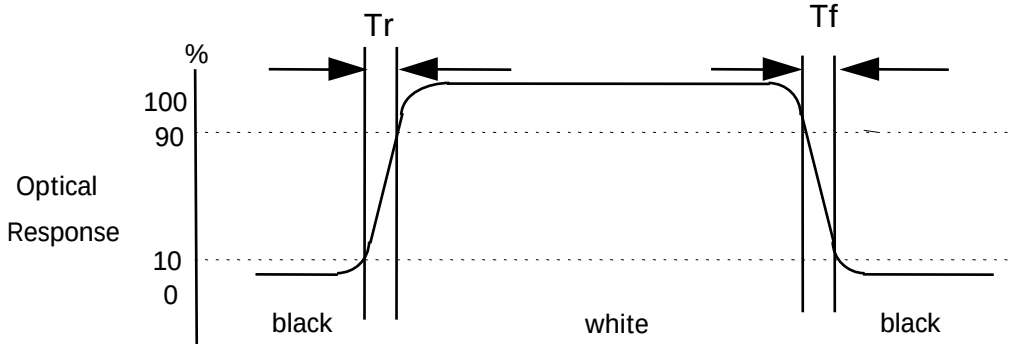


FIG. 3 The definition of Response Time

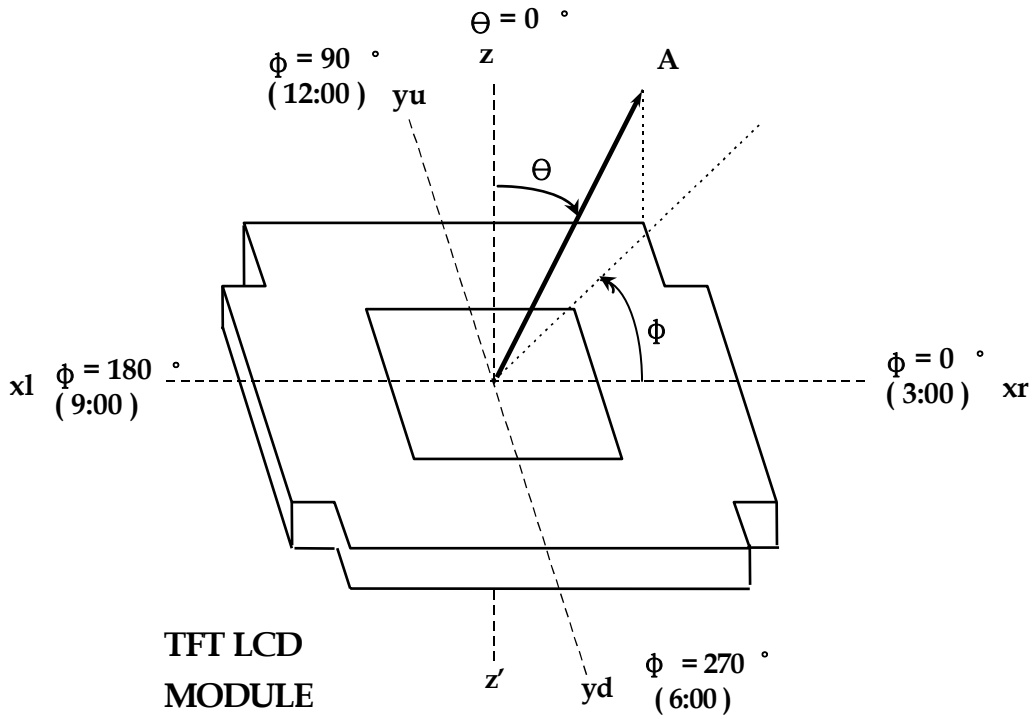
The response time is defined as the following figure and shall be measured by switching the input signal for “black” and “white”.



* Voltage conditions for Response time
Vgate : 22V DC
Vdata : 0V~4.5V DC
Vcom : 0V (Ground)

FIG. 4 The definition of viewing angle

<dimension of viewing angle range>



5. Mechanical Characteristics

The contents provide general mechanical characteristics for the model **LH190Q01-SH02**. In addition the figures in the following page are detailed mechanical drawing of the TFT-LCD.

Parameter	Symbol	Specification	Unit	Notes
Active Area	A	28.800	㎜	
	B	38.400	㎜	
Upper Glass Size	C	32.800±0.2	㎜	
	D	42.500±0.2	㎜	
Bottom Glass Size	E	32.800±0.2	㎜	
	F	46.080±0.2	㎜	
Panel thickness	T	0.8±0.05	㎜	
Cell Margin	G	2.00±0.1	㎜	
	H	2.10±0.1	㎜	
	I	2.00±0.1	㎜	
	J	2.00±0.1	㎜	
COG PAD Area	K	3.58±0.2	㎜	
End Seal Size	L	10.000	㎜	Max.
Glass Edge to End Seal	M	11.40	㎜	Min.
Glass Edge to End Seal Edge	N	21.40	㎜	Max.
Upper Glass Edge to D-IC	P	0.6±0.1	㎜	
Bottom Glass Edge to D-IC	O	1.70±0.1	㎜	
D-IC to FPC	Q	0.50	㎜	
FPC to Glass Edge	R	1.2±0.1	㎜	
End Seal Height	S	0.3	㎜	Max.
FPC Length	U	22.86	㎜	
FPC Pad Length(Metal)	V	0.9	㎜	
FPC Pad(metal area) to Glass Edge	W	0.3±0.1	㎜	
Weight		2.8±0.28	g	

FIG. 5 Outline Dimension of TFT-LCD Cell