

**DISPLAY Elektronik GmbH**

# DATA SHEET

**LCD MODULE**

**DEM 097032A SGH-PY**

*Product Specification*

*Version: 4*

**22.May.2015**

# GENERAL SPECIFICATION

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MODULE NO. :

## DEM 097032A SGH-PY

CUSTOMER: P/N

VERSION NO.	CHANGE DESCRIPTION	DATE
0	ORIGINAL VERSION	23.03.2015
1	Update Spec	24.03.2015
2	Update Spec	30.03.2015
3	Update Spec	01.04.2015
4	Change Backlight Characteristics	22.05.2015

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DATE: 22.05.2015

APPROVED BY: MHO

DATE: 22.05.2015

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**1. FUNCTIONS & FEATURES**

MODULE MODEL	LCD TYPE	REMARK
DEM 097032A SGH-PY	STN-GRAY TRANSFLECTIVE POSITIVE	—

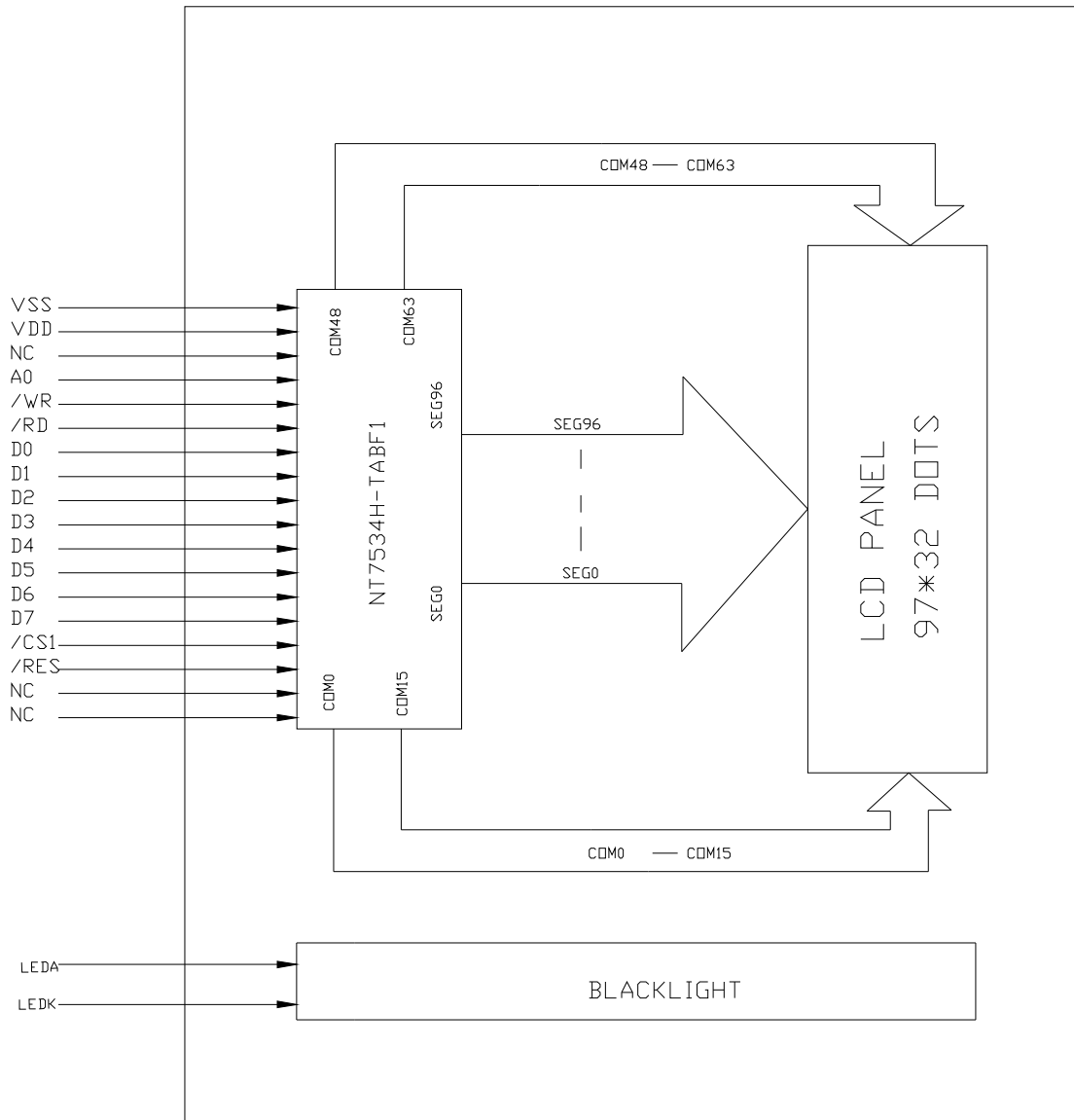
- Viewing Direction : 6 O'clock
- Driving Scheme : 1/33 Duty, 1/6Bias
- Power Supply For Logic : 3.0 Volt (typ.)
- LCD voltage : 6.2 Volt (typ.)
- Interface : 8-Bit-Parallel-MCU Interface (8080)
- Driver IC : NT7534H-TABF1
- Operating Temperature : -30°C to +75°C
- Storage Temperature : -30°C to +80°C
- RoHS : Compliant

**2. MODULE ARTWORK**

- Module Size : 49.70 x 31.30 x 6.10 mm
- Viewing Area : 43.50 x 21.50 mm
- Active Area : 35.87 x 14.38 mm
- Dot Size : 0.35 x 0.43 mm
- Dot Gap : 0.02 mm



4. BLOCK DIAGRAM

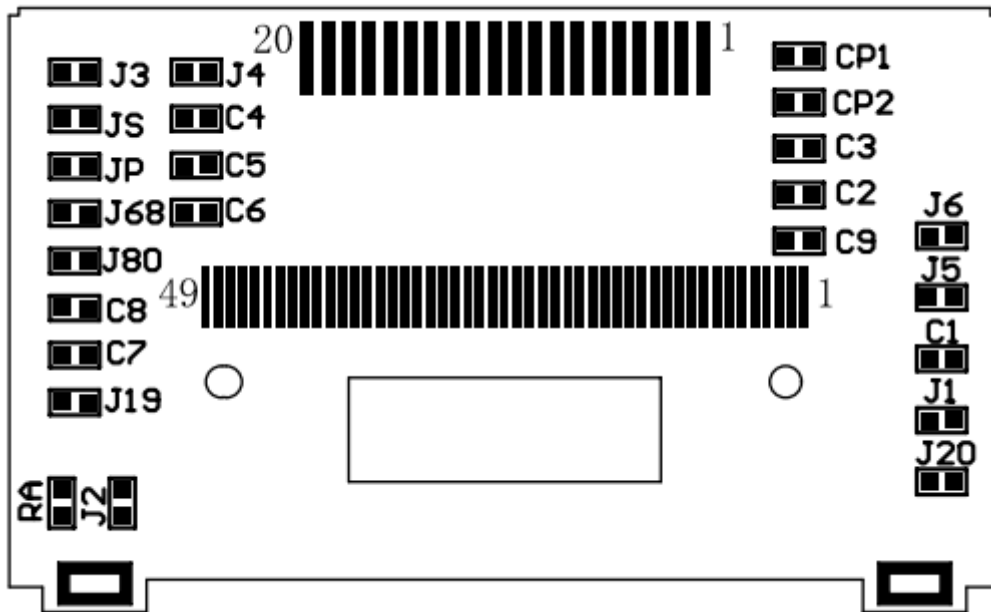


## 5. PIN ASSIGNMENT

N0.	SYMBOL	FUCTION
1	VSS	Ground output for pad option.
2	VDD	Power supply output for pad option
3	NC	No connection
4	A0	This is connected to the least significant bit of the normal MPU address bus, and it determines whether the data bits are data or a command. A0 = "H": Indicate that D0 to D7 are display data A0 = "L": Indicates that D0 to D7 are control data
5	/WR	When connected to an 8080 MPU, this is active LOW. This terminal connects to the 8080 MPU /WR signal. The signals on the data bus are latched at the rising edge of the /WR signal. When connected to a 6800 Series MPU, this is the read/write control signal input terminal. When R/W = "H": Read When R/W = "L": Write
6	/RD	When connected to an 8080 MPU, it is active LOW. This pad is connected to the /RD signal of the 8080MPU, and the NT7534 data bus is in an output status when this signal is "L". When connected to a 6800 Series MPU, this is active HIGH. This is used as an enable clock input of the 6800 series MPU
7	D0~D7	This is an 8-bit bi-directional data bus that connects to an 8-bit or 16-bit standard MPU data bus. When the serial interface is selected (P/S="L"), then D7 serves as the serial data input terminal (SI) and D6 serves as the serial clock input terminal (SCL). When the serial interface is selected, fix D0~D5 pads to VDD or VSS level. When the chip select is inactive, D0 to D7 are set to high impedance.
8		
9		
10		
11		
12		
13		
14		
15	/CS1	Chip select signal.
16	/RES	When /RES is set to "L", the settings are initialized. The reset operation is performed by the /RES signal level.
17	NC	No connection
18	NC	No connection
19	A	LED A(+)
20	K	LED K(-)

**6. PCB DRAWING**

**6.1 PCB DRAWING**



Note: The PCB drawing is just for reference!!

**6.2 THE DESCRIPTION OF THE JUMPER**

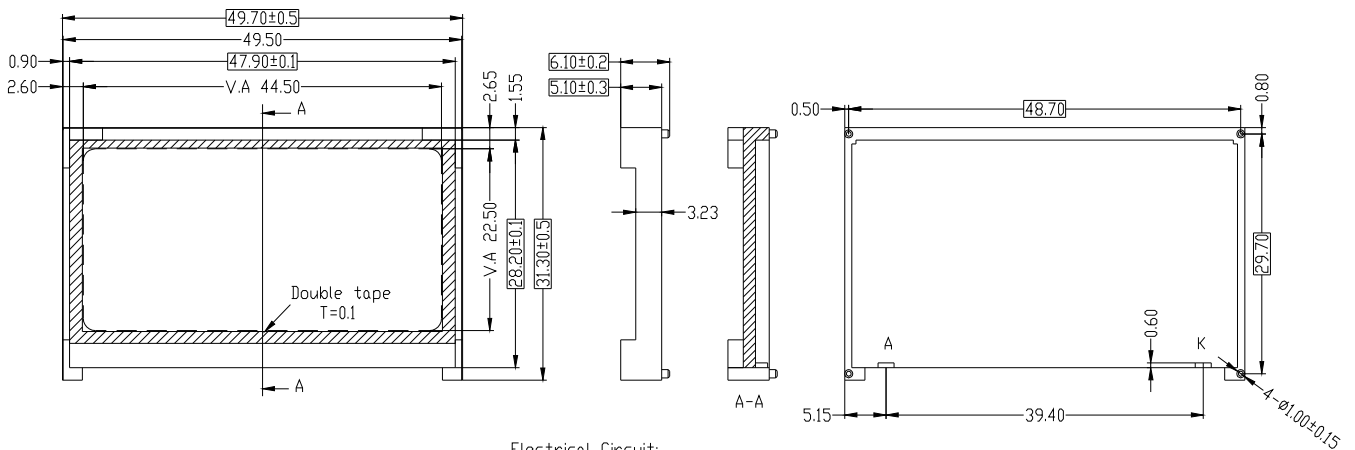
SYMBOL	FUNCTION	In Application Module
J1 J20	It control the driving voltage of the LED at negative frame: J1=closed and J20=open: LED(-) connect to Vss; J1=open and J20=closed: LED(-) connect to the negative of a external power.	J1=open and J20=closed
J2 J19	It control the driving voltage of the LED at positive frame: J2=closed and J19=open: LED(+) connect to VDD; J2=open and J19=closed: LED(+) connect to the positive of a external power.	J2=open and J19=closed
J3 J4	This is the power control terminal for the power supply circuit for liquid crystal drive: J3=closed and J4=open: High power mode. J3=open and J4=closed: Normal power mode.	J3=open and J4=closed
J68 J80	This is the MPU interface switch terminal: J68=closed and J80=open: 6800 Series MPU interface. J68=open and J80=closed: 8080 Series MPU interface.	J68=open and J80=closed
JS JP	This is the parallel data input/serial data input switch terminal: JP=closed and JS=open: Parallel data input. JP=open and JS=closed: Serial data input.	JP=closed and JS=open



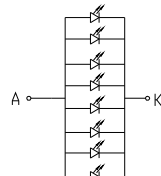
**7. BACKLIGHT CHARACTERISTICS**

ELECTRICAL-OPTICAL CHARACTERISTICS:

Item	Symbol	MIN.	TYP.	MAX.	Unit	Condition
Forward Voltage	V <sub>f</sub>	1.9	2.1	2.3	V	I <sub>f</sub> = 80 mA
Luminance	L <sub>v</sub>	32	44	--	cd/m <sup>2</sup>	
Uniformity	Avg	70			%	
Dominant Wave Length	λ <sub>D</sub>	565	570	575	nm	



Electrical Circuit:



8PCS Yellow-Green LED

- Remarks:  
 1. Unmarked tolerance is ±0.3  
 2. All materials comply with RoHS  
 3. [ ] ...critical dimension.

## 8. MAXIMUM ABSOLUTE POWER RATINGS.

Item	Symbol	Standard value	Unit
Power supply voltage(1)	V <sub>DD</sub>	-0.3 ~ +4.0	V
Power supply voltage(2)	V <sub>LCD</sub>	-0.3 ~ +15.0	V
Input voltage	V <sub>I</sub>	-0.3V~V <sub>DD</sub> +0.3	V
Operating temperature	T <sub>opr</sub>	-30~+75	°C
Storage temperature	T <sub>stg</sub>	-30~+80	°C

## 9. ELECTRICAL CHARACTERISTICS

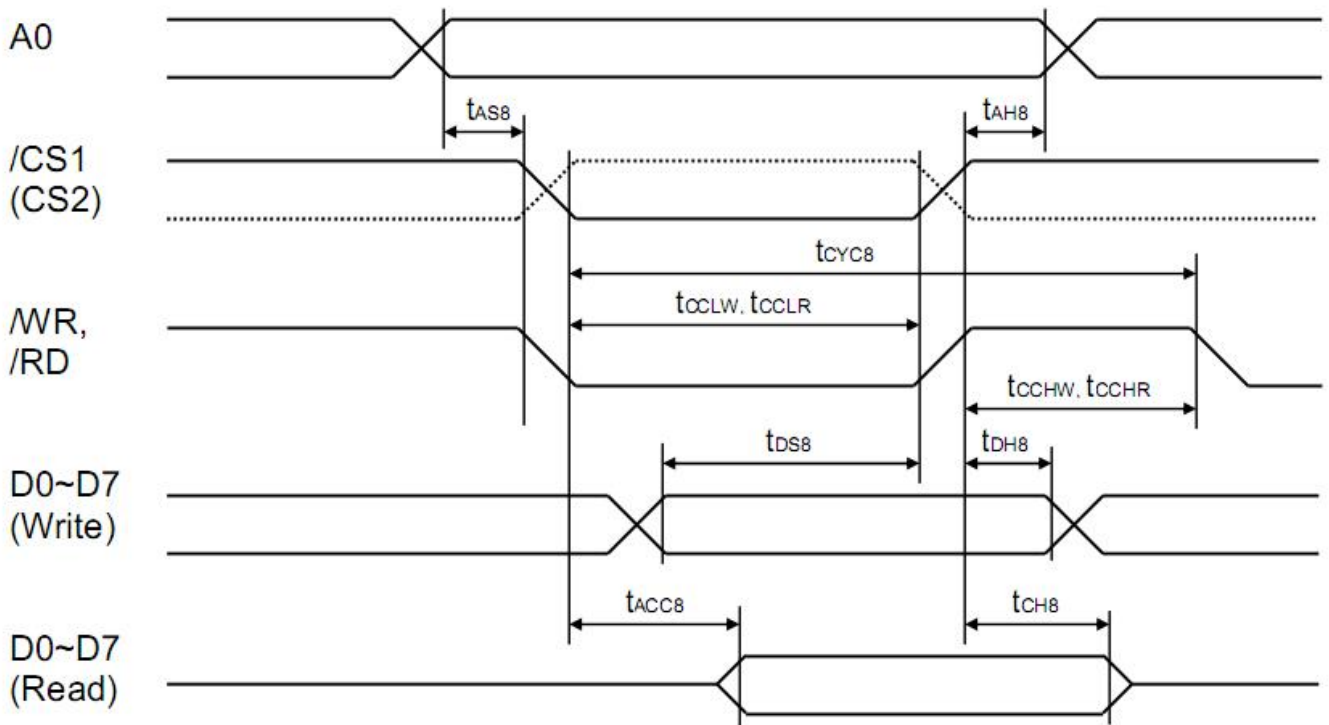
## 9.1 DC Characteristics

ITEM	Symbol	STANDARD VALUE			TEST CONDITION	UNIT
		MIN	TYP	MAX		
Supply Voltage For Logic	V <sub>DD</sub>	2.4	3.0	3.6		V
Supply Voltage For LCD	V <sub>LCD</sub>	5.9	6.2	6.5		
Current Consumption	I <sub>DD</sub>		TBD			mA
High-Level Input Voltage	V <sub>IHC</sub>	0.8xV <sub>DD</sub>	-	V <sub>DD</sub>		V
Low-Level Input Voltage	V <sub>ILC</sub>	V <sub>SS</sub>	-	0.2xV <sub>DD</sub>		
High-Level Output Voltage	V <sub>OHC</sub>	0.8xV <sub>DD</sub>	-	V <sub>DD</sub>		
Low -Level Output Voltage	V <sub>OLC</sub>	V <sub>SS</sub>	-	0.2xV <sub>SS</sub>		

## 9.2 AC Characteristics

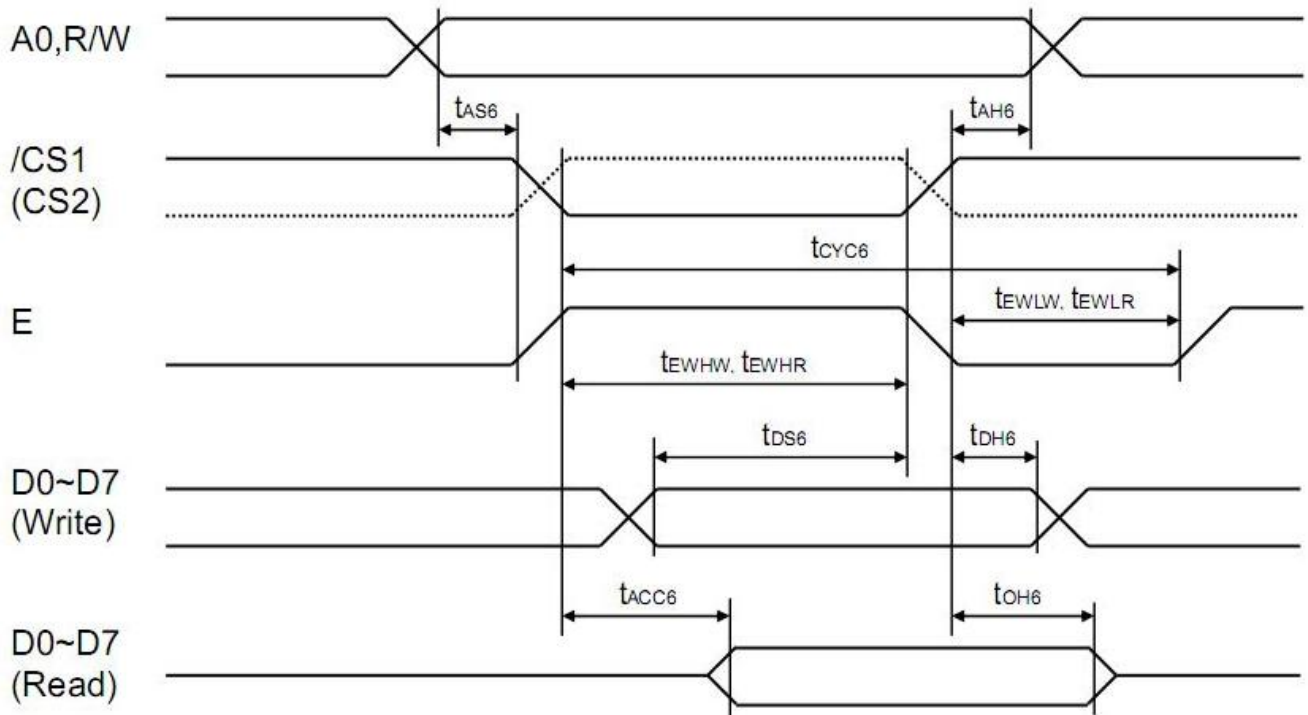
## 9.2.1 System Buses Read/Write Characteristics (for 8080 Series MPU)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
T <sub>AH8</sub>	Address hold time	0	-	-	ns	A0
T <sub>AS8</sub>	Address setup time	0	-	-	ns	
t <sub>CYC8</sub>	System cycle time	240	-	-	ns	
t <sub>CCLW</sub>	Control low pulse width (write)	90	-	-	ns	/WR
t <sub>CCLR</sub>	Control low pulse width (read)	120	-	-	ns	/RD
t <sub>CCHW</sub>	Control high pulse width (write)	100	-	-	ns	/WR
t <sub>CCHR</sub>	Control high pulse width (read)	60	-	-	ns	/RD
T <sub>DSS8</sub>	Data setup time	40	-	-	ns	D0~D7
T <sub>DH8</sub>	Data hold time	10	-	-	ns	
t <sub>ACC8</sub>	/RD access time	-	-	140	ns	D0~D7,CL=100pF
T <sub>CH8</sub>	Output disable time	5	-	50	ns	



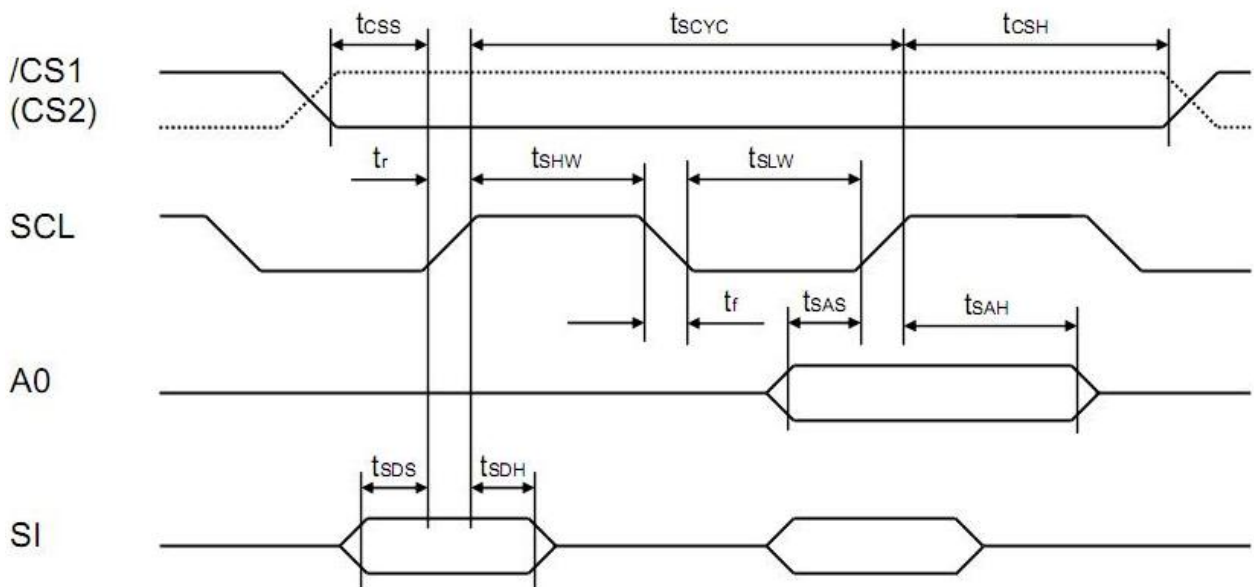
9.2.2 System Buses Read/Write Characteristics (for 6800 Series MPU)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
$t_{AH6}$	Address hold time	0	-	-	ns	A0, R/W
$t_{AS6}$	Address setup time	0	-	-	ns	
$t_{CYC6}$	System cycle time	240	-	-	ns	
$t_{EWHW}$	Control high pulse width (write)	90	-	-	ns	E
$t_{EWHR}$	Control high pulse width (read)	120	-	-	ns	E
$t_{EWLW}$	Control low pulse width (write)	100	-	-	ns	E
$t_{EWLR}$	Control low pulse width (read)	60	-	-	ns	E
$t_{DS6}$	Data setup time	40	-	-	ns	D0~D7
$t_{DH6}$	Data hold time	10	-	-	ns	
$t_{ACC6}$	/RD access time	-	-	140	ns	D0~D7, CL=100pF
$t_{OH6}$	Output disable time	5	-	50	ns	



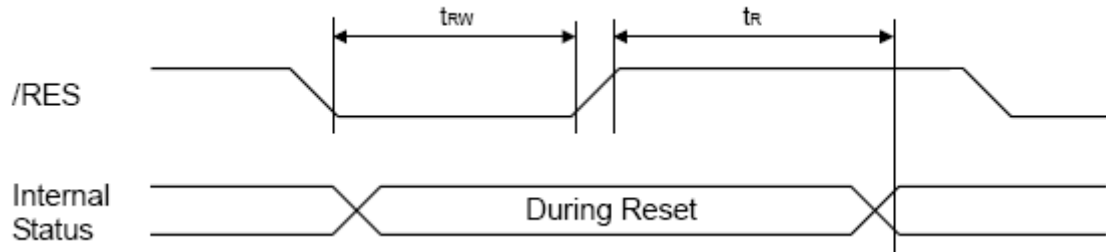
9.2.3 Serial Interface Timing

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
$t_{SCYC}$	Serial clock cycle	120	-	-	ns	SCL
$t_{SHW}$	Serial clock H pulse width	60	-	-	ns	SCL
$t_{SLW}$	Serial clock L pulse width	60	-	-	ns	SCL
$t_{SAS}$	Address setup time	30	-	-	ns	A0
$t_{SAH}$	Address hold time	20	-	-	ns	A0
$t_{SDS}$	Data setup time	30	-	-	ns	SI
$t_{SDH}$	Data hold time	20	-	-	ns	SI
$t_{CSS}$	Chip select setup time	20	-	-	ns	/CS1, CS2
$t_{CSH}$	Chip select hold time	40	-	-	ns	/CS1, CS2



**9.2.4 Reset Timing**

Symbol	Parameter	Min.	Typ.	Max.	Unit	Condition
$t_R$	Reset time	--	--	1.0	$\mu\text{s}$	
$t_{RW}$	Reset low pulse width	10	--	--	$\mu\text{s}$	/RES



10. INSTRUCTION TABLE

Command	A0	/RD	/WR	Code									Hex	Function
				D7	D6	D5	D4	D3	D2	D1	D0			
(1) Display OFF	0	1	0	1	0	1	0	1	1	1	0	1	AEh AFh	Turn on LCD panel when high, and turn off when low
(2) Display Start Line Set	0	1	0	0	1	Display Start Address						40h to 7Fh	Specifies RAM display line for COM0	
(3) Page Address Set	0	1	0	1	0	1	1	Page Address				B0h to B8h	Set the display data RAM page in Page Address register	
(4) Column Address Set	0	1	0	0	0	0	1	Higher Column Address				00h to 18h	Set 4 higher bits and 4 lower bits of column address of display data RAM in register	
	0	1	0	0	0	0	0	Lower Column Address						
(5) Read Status	0	0	1	Status				0	0	0	0	XX	Reads the status information	
(6) Write Display Data	1	1	0	Write Data								XX	Write data in display data RAM	
(7) Read Display Data	1	0	1	Read Data								XX	Read data from display data RAM	
(8) ADC Select	0	1	0	1	0	1	0	0	0	0	0	1	A0h A1h	Set the display data RAM address SEG output correspondence
(9) Normal/Reverse Display	0	1	0	1	0	1	0	0	1	1	0	1	A6h A7h	Normal indication when low, but full indication when high
(10) Entire Display ON/OFF	0	1	0	1	0	1	0	0	1	0	0	1	A4h A5h	Select normal display (0) or entire display on
(11) LCD Bias Set	0	1	0	1	0	1	0	0	0	1	0	1	A2h A3h	Sets LCD driving voltage bias ratio
(12) Read-Modify-Write	0	1	0	1	1	1	0	0	0	0	0	0	E0h	Increments column address counter during each write
(13) End	0	1	0	1	1	1	0	1	1	1	0	0	EEh	Releases the Read-Modify-Write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	0	E2h	Resets internal functions
(15) Common Output Mode Select	0	1	0	1	1	0	0	0	1	*	*	*	C0h to CFh	Select COM output scan direction *: invalid data
(16) Power Control Set	0	1	0	0	0	1	0	1	Operation Status			28h to 2Fh	Select the power circuit operation mode	
(17) V0 Voltage Regulator Internal Resistor ratio Set	0	1	0	0	0	1	0	0	Resistor Ratio			20h to 27h	Select internal resistor ratio Rb/Ra mode	
(18) Electronic Volume mode Set Electronic Volume Register Set	0	1	0	1	0	0	0	0	0	0	0	1	81h	
	0	1	0	*	*	Electronic Control Value					XX	Sets the V0 output voltage electronic volume register		
(19) Set Static indicator ON/OFF Set Static Indicator Register	0	1	0	1	0	1	0	1	1	0	0	1	ACh ADh	Sets static indicator ON/OFF 0: OFF, 1: ON
	0	1	0	*	*	*	*	*	*	Mode		XX	Sets the flash mode	
(20) Power Save	0	1	0	-	-	-	-	-	-	-	-	-	-	Compound command of Display OFF and Entire Display ON
(21) NOP	0	1	0	1	1	1	0	0	0	1	1	1	E3h	Command for non-operation

Command Table (continue)

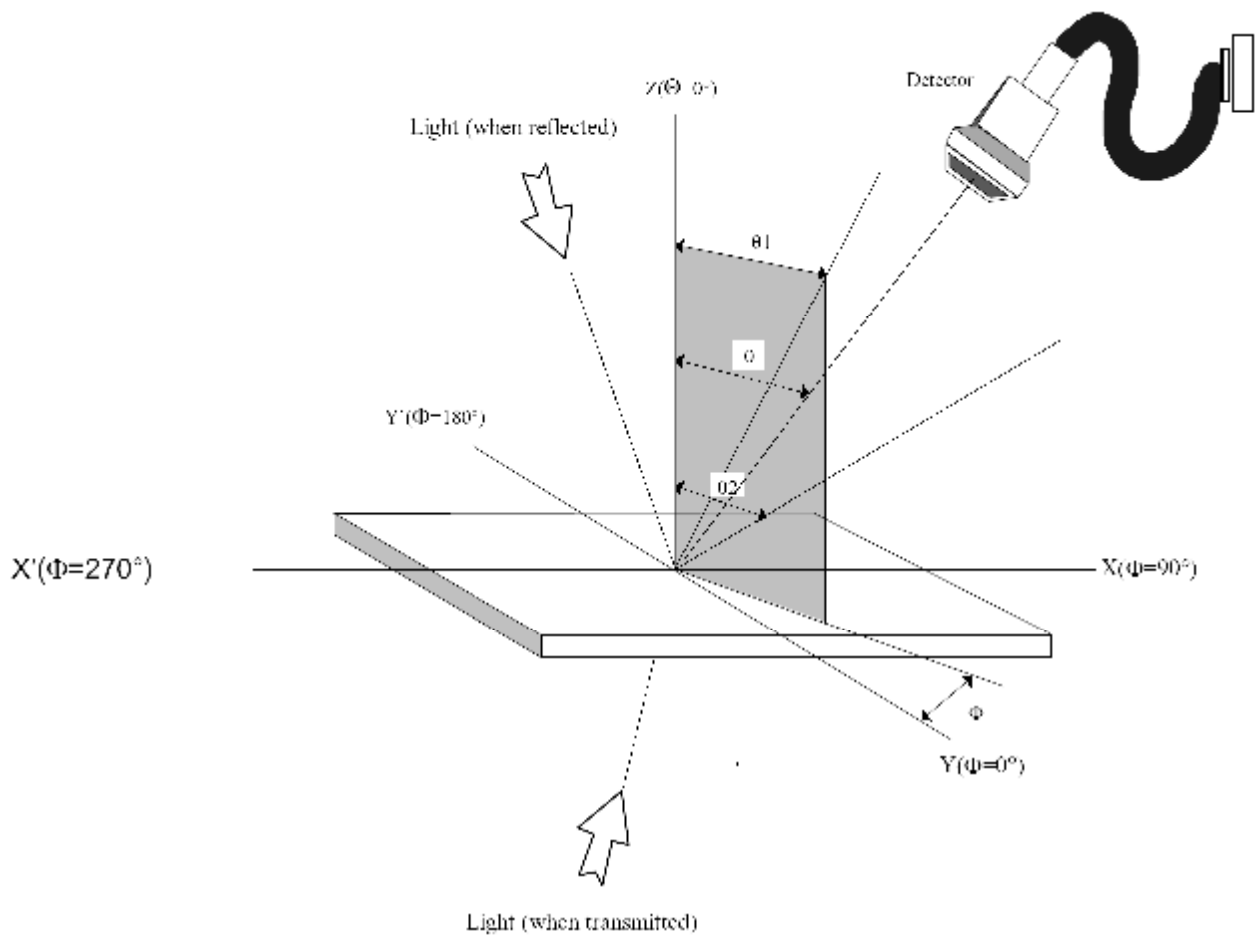
Command	A0	/RD	/WR	Code									Function	
				D7	D6	D5	D4	D3	D2	D1	D0	Hex		
(22)Oscillation Frequency Select	0	1	0	1	1	1	0	0	1	0	0	1	E4h E5h	Select the oscillation frequency
(23)Partial Display mode Set	0	1	0	1	0	0	0	0	0	1	0	1	82h 83h	Enter/Release the partial display mode
(24)Partial Display Duty Set	0	1	0	0	0	1	1	0	Duty Ratio			30h 37h	Sets the LCD duty ratio for partial display mode	
(25)Partial Display Bias Set	0	1	0	0	0	1	1	1	Bias Ratio			38h 3Fh	Sets the LCD bias ratio for partial display mode	
(26)Partial Start Line Set	0	1	0	1	1	0	1	0	0	1	1	D3h	Enter Partial Start Line Set	
Partial Start Line Set	0	1	0	1	1	Partial Start Line					XX	Sets the LCD Number of partial display start line		
(27)N-Line Inversion Set	0	1	0	1	0	0	0	0	1	0	1	85h	Enter N-Line inversion	
Number of Line Set	0	1	0	*	*	*	Number of Line				XX	Sets the number of line used for N-Line inversion		
(28)N-Line Inversion Release	0	1	0	1	0	0	0	0	1	0	0	84h	Exit N-Line Inversion	
(29)DC/DC Clock Set	0	1	0	1	1	1	0	0	1	1	0	E8h	Set DC/DC Clock Frequency	
DC/DC Clock Division Set	0	1	0	1	1	0	0	Clock Division			XX	Set the Division of DC/DC Clock Frequency		
(30)Test Command	0	1	0	1	1	1	1	*	*	*	*	F1h to FFh	IC test command. Do not use!	
(31)Test Mode Reset	0	1	0	1	1	1	1	0	0	0	0	F0h	Command of test mode reset	

Note: Do not use any other command, or system malfunction may result.

**11. LCD ELECTRICAL & OPTICAL CHARACTERISTICS**

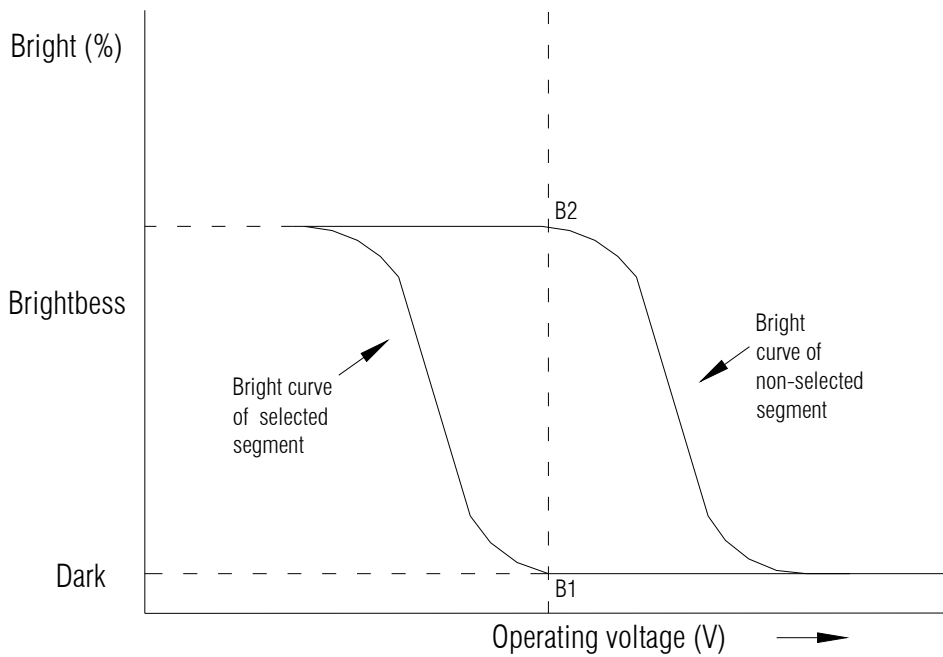
Item	Symbol	Description	Condition	Temp.	Min.	Typ.	Max.	Unit
Contrast	Cr		$\theta=10^\circ, \Phi=0^\circ$ $V_{CC}=3.0V\pm3\%$	25°C	-	4	-	-
Viewing angle	$\theta$	6 o'clock axis	$C_r \geq 2.0$ $V_{CC}=3.0V\pm3\%$	25°C	35	40	-	°
		12 o'clock axis			30	35	-	
		3 o'clock axis			30	35	-	
		9 o'clock axis			30	35	-	
Response time	$T_r$	Rise	$V_{CC}=3.0V\pm3\%$	25°C	-	200	300	ms
	$T_f$	Fall	$V_{CC}=3.0V\pm3\%$	25°C	-	200	300	

**11.1 Definition of characteristics.**



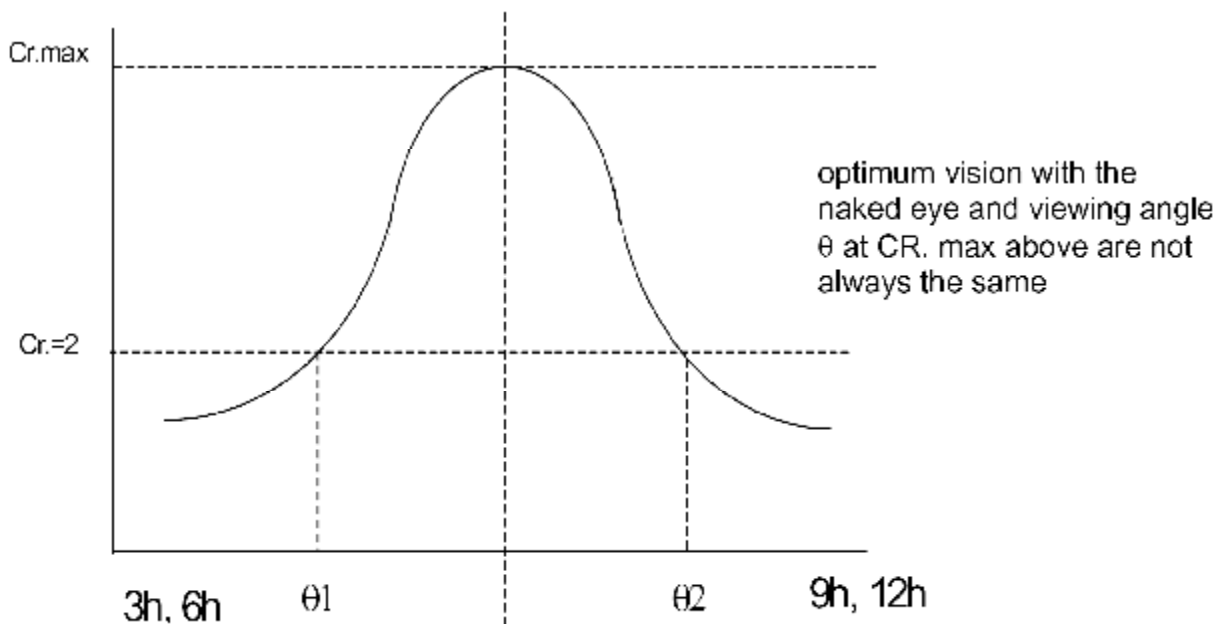


Definition of contrast  $Cr. = \frac{B2}{B1} = \frac{\text{Bright curve of not selected segment}}{\text{Bright curve of selected segment}}$

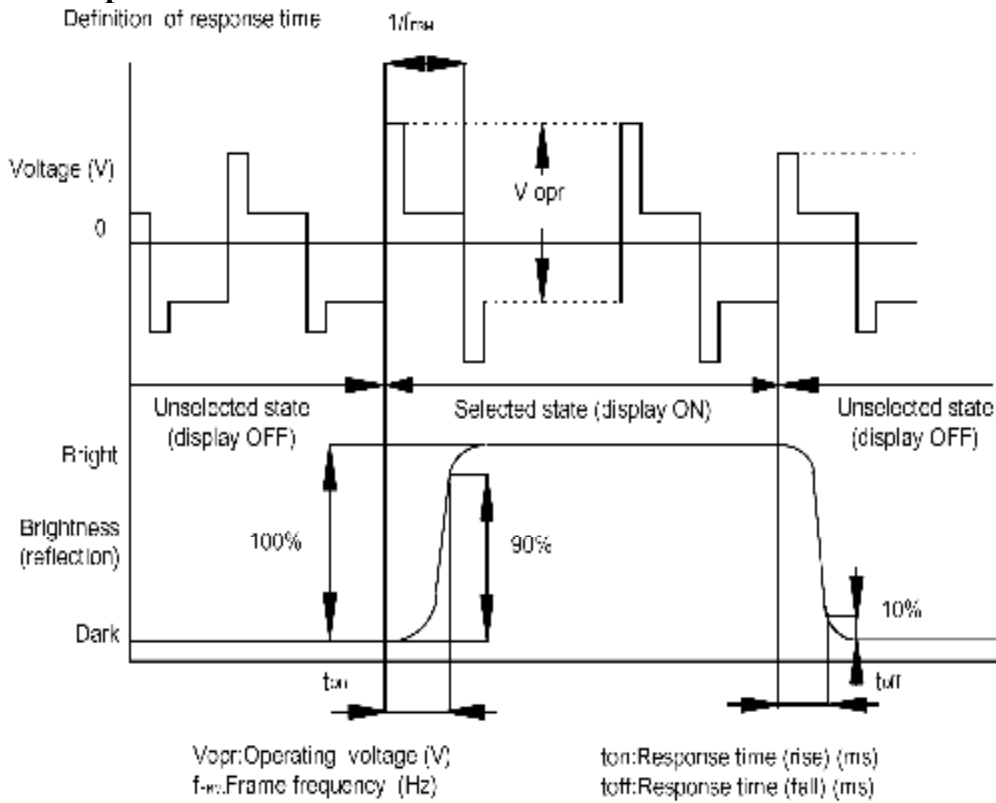


**11.2. Definition of viewing angle**

Definition of viewing angle  $\theta 1$  and  $\theta 2$



**11.3 Definition of response time**



**12. LCD MODULES HANDLING PRECATIONS**

- Please remove the protection foil of polarizer before using.
- The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.
- If the display panel is damaged and the liquid crystal substance inside it leaks out, do not get any in your mouth. If the substance come into contact with your skin or clothes promptly wash it off using soap and water.
- Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.
- The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarize carefully.
- To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.
  - Be sure to ground the body when handling the LCD module.
  - Tools required for assembly, such as soldering irons, must be properly grounded.
  - To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
  - The LCD module is coated with a film to protect the display surface. Exercise care when peeling off this protective film since static electricity may be generated.

- Storage precautions

When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps. Keep the modules in bags designed to prevent static electricity charging under low temperature / normal humidity conditions (avoid high temperature / high humidity and low temperatures below 0°C). Whenever possible, the LCD modules should be stored in the same conditions in which they were shipped from our company.

**13. OTHERS**

- Liquid crystals solidify at low temperature (below the storage temperature range) leading to defective orientation of liquid crystal or the generation of air bubbles (black or white). Air bubbles may also be generated if the module is subjected to a strong shock at a low temperature.
- If the LCD modules have been operating for a long time showing the same display patterns may remain on the screen as ghost images and a slight contrast irregularity may also appear. Abnormal operating status can be resumed to be normal condition by suspending use for some time. It should be noted that this phenomena does not adversely affect performance reliability.
- To minimize the performance degradation of the LCD modules resulting from caused by static electricity, etc. exercise care to avoid holding the following sections when handling the modules:
  - Exposed area of the printed circuit board
  - Terminal electrode sections.