

**Customer :**

**SPECIFICATION  
OF  
AG2406401**

NOV. 17, 1996

**AGENA DISPLAYTECH LTD**

## 1. Display Specifications

- 1) STN Mode                      Display Type: Reflective or Transflective
- 2) Viewing Angle                : 6 O'clock direction
- 3) Driving Duty                 : 1/64 Duty, 1/9 Bias
- 4) Display Format                : 240 x 64 Dot Matrix Graphic
- 5) Display Colour               : Background : Yellow-Green, Display : Blue
- 6) Interface Input Data        : 8 Bits
- 7) Back Lighting                : EL backlight (White color) ; LED Backlight (Yellow/Green color)

## 2. Mechanical Specifications

- 1) Outline Dimensions        : Refer to attached Outline Dimensions figure (page 9)
- 2) Viewing Area                : 132.0 (W) x 39.0 (H)
- 3) Dot Size                      : 0.48 (W) x 0.48 (H)
- 4) Dot Pitch                     : 0.53 (w) x 0.53 (H)
- 5) Weight                        : 155 g (Approx.)

## 3. Electrical Specifications

### 3-1. Absolute Maximum Ratings

Item	Symbol	Value			Unit	Condition	Remark
		Min	Typ	Max			
Supply Voltage (Logic)	Vdd	- 0.3		7.0	V	Ta = 25 °C	
Supply Voltage (LCD Drive)	Vdd-Vo	Vdd - 0.3		Vdd - 30	V	Ta = 25 °C	
Input Voltage	Vi	- 0.3		Vdd + 0.3	V	Ta = 25 °C	
Operating Temp	Ta	0		+50	°C	-	
Storage Temp	Tstg	-20		+70	°C	-	

## 3-2. Electrical Characteristics

NO	ITEM	SYMBOL	SPEC. VALUE			UNIT	CONDITION
			Min	Typ	Max		
1	Supply Voltage (Logic)	Vdd-Vss	4.5	5.0	5.5	V	
2	Supply Current (Logic)	Idd	-	11.0	13.0	mA	Vdd = 5 V Vee = 14.7 V Ta = 25 °C
3	Supply Current (LCD)	Iee	-	2.0			
4	LCD Operating Voltage	Vdd-Vo	15.7 14.7 13.7	16.0 15.0 14.0	16.3 15.3 14.3	V	Ta = 0 °C Ta = 25 °C Ta = 50 °C
4	Input Voltage -HIGH LEVEL-	Vih	0.7 Vdd	-	Vdd	V	
5	Input Voltage -LOW LEVEL-	Vil	0		0.7 Vdd	V	

## 3-3. Backlit - EL Unit

## 3-3-1. Absolute Maximum Ratings (Ta = 25 °C)

Characteristics	Symbol	Max	Unit
EL Voltage	Vel	150	Vrms
EL Frequency	f el	800	Hz

## 3-3-2. Electro-Optical Characteristics (Ta = 25 °C)

Item	Symbol	Standard Value			Unit	Applicable Terminal	Condition
		Min	Typ	Max			
EL Voltage	Vel		100		Vrms		
EL Frequency	f el		400		Hz		
EL Current	I el		12.3	15.7	mA		*2)

\*2) Operation at AC100Vrms, 400Hz

The Life of Half Brightness is 3,500 Hours(20 °C, 60%RH)

## 3-4. Backlit - LED Unit

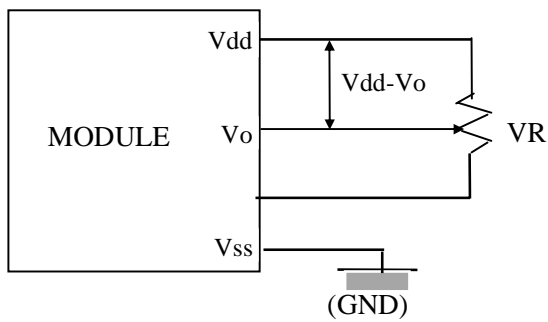
## 3-4-1. Absolute Maximum Ratings (Ta = 25 °C)

Characteristic	Symbol	Max.	Unit
Continuous Forward Current	If	300	mA
Reverse Voltage	Vr	1.3	V
Operating Temperature	Toper	-20 ~ 70	°C
Storage Temperature	Tstrg	-30 ~ 80	°C
Solder Temperature for 3 sec. at 2mm from the reflector edge		260	°C

## 3-4-2. Electro-Optical Characteristics (Ta = 25 °C)

Characteristics	Symbol	Condition	Min	Typ	Max	Unit
Forward Voltage	Vf	If = 120mA		4.2	4.6	V
Reverse Current	Ir	Vr = 5V			0.2	mA
Luminous Intensity	Iv	If = 120mA		150		MCD
Peak Emmission Wave Length		If = 120mA		570		nm
Spectral Line Half Width		If = 120mA		30		nm

## 4. Power Supply



Vdd-Vo : LCD driving voltage

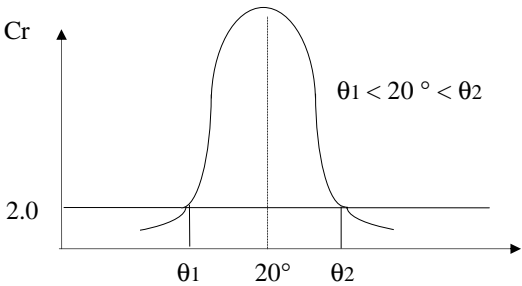
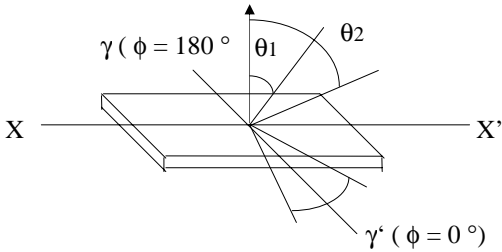
**5. Electro-Optical Characteristics**

Item	Symbol	Min.	Typ.	Max.	Unit	Condition	Note
Viewing Angle	$\theta_2 - \theta_1$	70	-		deg.	Cr = 2.0	1.2
Angle	$\phi$	- 90		+ 90			
Contrast Ratio	Cr	-	4	-	-	$\theta = 20^\circ$ $\phi = 0^\circ$	3
Response Time(Rise)	Tr	-	150	200	ms	$\theta = 20^\circ$ $\phi = 0^\circ$	4
Response Time(Fall)	Tf	-	160	230	ms	$\theta = 20^\circ$ $\phi = 0^\circ$	4

\* Above data are measured under STN mode.  
 \*  $\phi = 0$  means viewing direction.

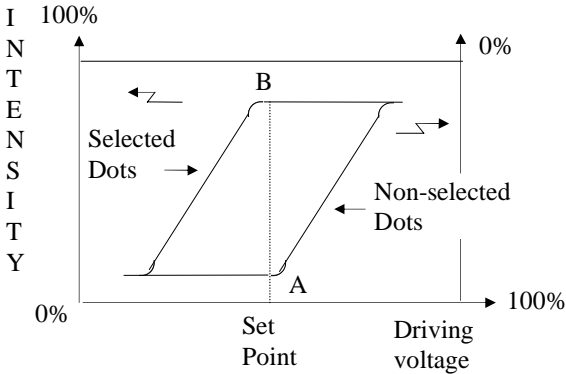
Note 1: Definition of angle  $\theta$  &  $\phi$ .

Note 2: Definition of viewing angle  $\theta_1$  &  $\theta_2$ .

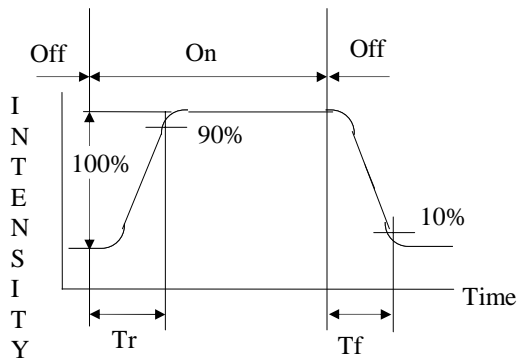


Note 3: Definition of contrast Cr

Note 4: Definition of optical response



$$Cr = (A/B)^P \begin{cases} \text{Negative : } P = -1 \\ \text{Positive : } P = +1 \end{cases}$$



## 6. Pin Assignment

\* CONTROLLER I.C. : TOSHIBA T6963C

Pin No.	Symbol	Level	Description
1	FG	0 V	Frame Ground
2	Vss(GND)	0 V	Ground
3	Vdd	5.0 V	Power Supply Voltage for Logic & LCD(+)
4	Vo	-	Operating Voltage For LCD(Variable)
5	/WR	L	Write Signal
6	/RD	L	Read Signal
7	/CE	L	Chip Enable Signal
8	C/D	H/L	H : Instruction Code, L : Data
9	NC	-	No Connection
10	/RESET	L	Reset Signal
11	DB0	H/L	Data bus bit 0
12	DB1	H/L	Data bus bit 1
13	DB2	H/L	Data bus bit 2
14	DB3	H/L	Data bus bit 3
15	DB4	H/L	Data bus bit 4
16	DB5	H/L	Data bus bit 5
17	DB6	H/L	Data bus bit 6
18	DB7	H/L	Data bus bit 7
19	FS	H/L	Font Select Signal (H : 6 x 8 Dots, L : 8 x 8 Dots)
20	NC	-	No Connection
21	+		LED Backlight or EL backlight
22	-		LED Backlight or EL backlight

## 7. Timing Characteristics

7-1. Interface Timing Characteristics (Refer to Fig. 1)

Parameter	Symbol	Value			Unit
		Min.	Typ.	Max.	
C/D hold time	t CDH	10	-	-	ns
C/D set up time	t CDS	100	-	-	ns
/CE, /RD, /WR pulse width	t CE, t RD, t WR	80	-	-	ns
Data Setup Time	t DS	80	-	-	ns
Data Hold Time	t DH	40	-	-	ns
Access Time	t ACC	-	-	150	ns
Output Hold Time	t DH	10	-	50	ns

Condition : Vdd = + 5.0 V ±10%, Vss = 0 V

FIG.1

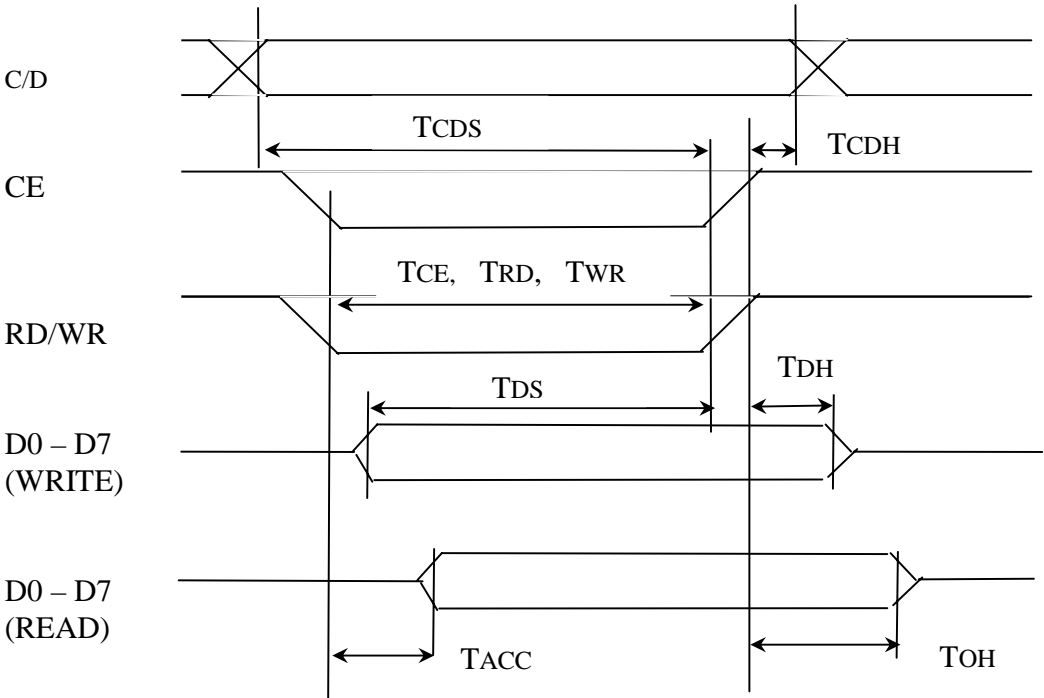
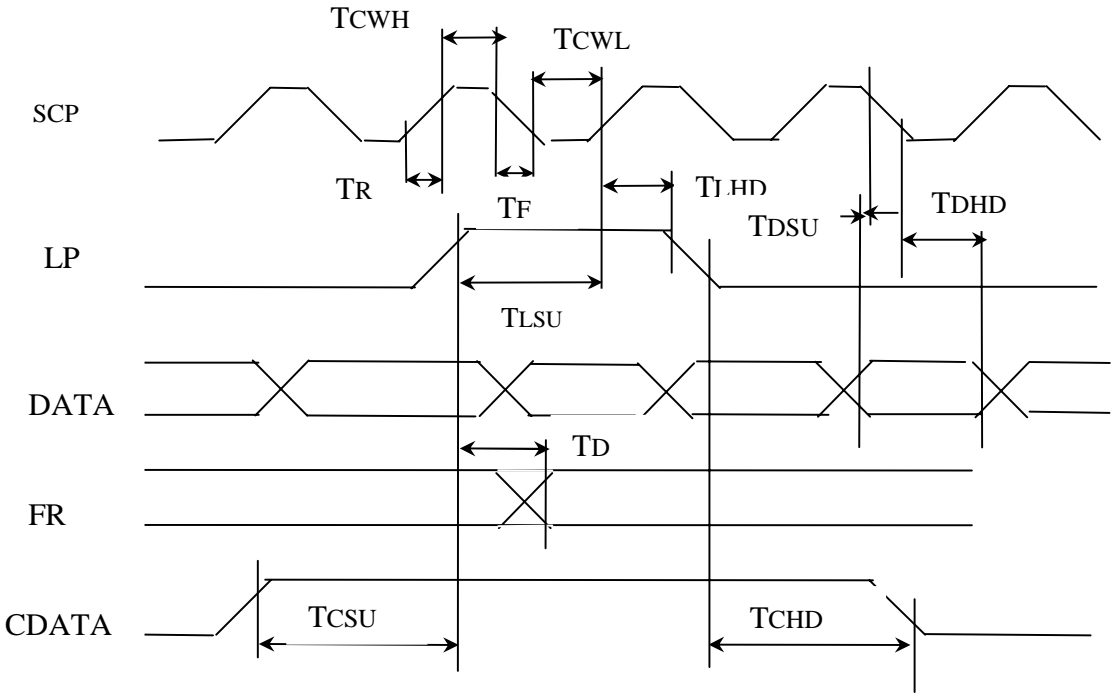


FIG.2



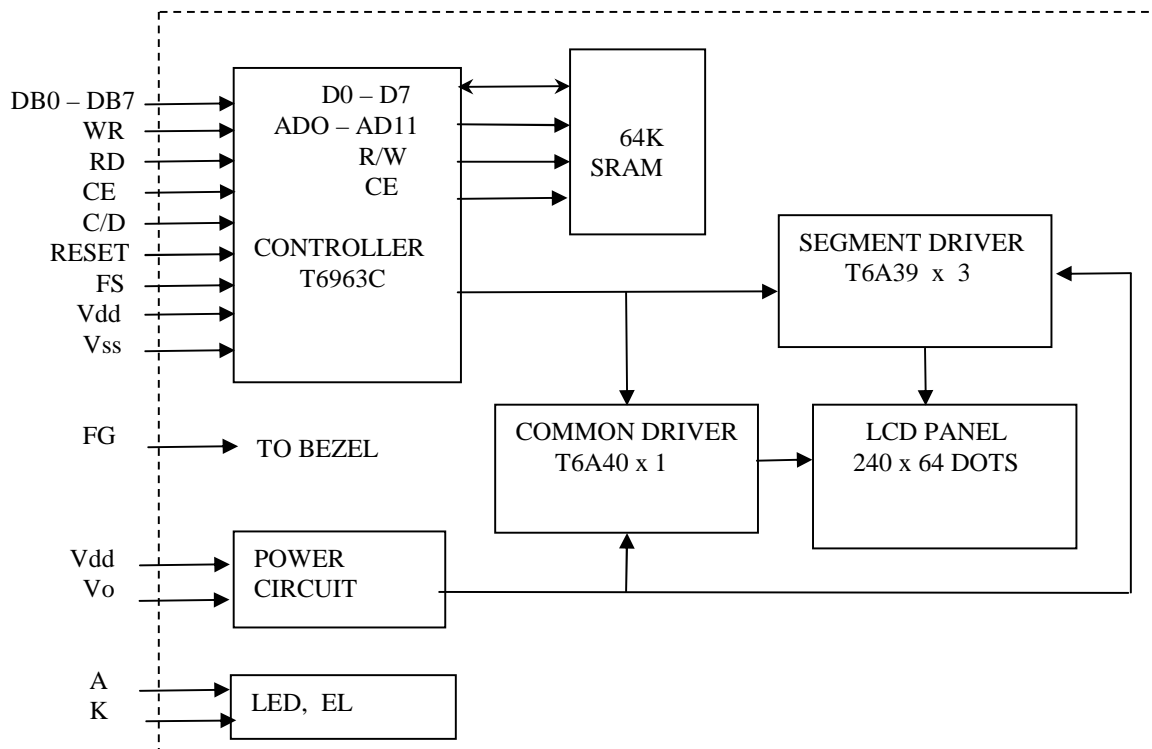
## 7-2. Switching Timing Characteristics

(Condition :  $V_{dd} = + 5.0 \text{ V} \pm 10\%$ ,  $V_{ss} = 0 \text{ V}$ )

Parameter	Symbol	Min.	Max	Unit
Operating Frequency	f SCP	-	2.75	MHz
SCP Pulse Width	tCWH, tCWL	150	-	ns
SCP Rise/Fall Time	t <sub>r</sub> , t <sub>f</sub>		30	ns
LP Set Up Time	t <sub>LSU</sub>	150	290	ns
LP Hold Time	t <sub>lhd</sub>	5	40	ns
Data setup time	t <sub>DSU</sub>	170	-	ns
Data hold time	t <sub>DHD</sub>	80	-	ns
FR Delay time	t <sub>d</sub>	0	90	ns
Clock hold time	t <sub>HCL</sub>	80		ns
CDATA setup time	t <sub>CSU</sub>	450	850	ns
CDATA hold time	t <sub>CHD</sub>	450	950	ns

\* refer to Fig. 2

## 8. Block Diagram





## 9. Instruction Set

COMMAND	CODE	D1	D2	FUNCTION
RESISTER SET	00100001	X address	Y address	Cursor point set
	00100010	Data	00H	Offset resister set
	00100100	Low address	High address	Address pointer set
CONTROL WORD SET	01000000	Low address	High address	Text home address set
	01000001	Columns	00H	Text area set
	01000010	Low address	High address	Graphic home address set
	01000011	Columns	00H	Graphic area set
MODE SET	1000X000	-	-	“OR” mode
	1001X001	-	-	‘EXOR” mode
	1000X011	-	-	“AND’ mode
	1000X100	-	-	Text attribute” mode
	10000XXX	-	-	Internal CG ROM mode
	10001XXX	-	-	External CG ROM mode
DISPLAY MODE	10010000	-	-	Display off
	1001XX10	-	-	Cursor on, blink off
	1001XX11	-	-	Cursor on, blink on
	100101XX	-	-	Text on, graphic off
	100110XX	-	-	Text off, graphic on
	100111XX	-	-	Text on, graphic on
CURSOR PATTERN SELECT	10100000	-	-	1 Line cursor
	10100001	-	-	2 Lines cursor
	10100010	-	-	3 Lines cursor
	10100011	-	-	4 Lines cursor
	10100100	-	-	5 Lines cursor
	10100101	-	-	6 Lines cursor
	10100110	-	-	7 Lines cursor
	10100111	-	-	8 Lines cursor
DATA AUTO READ/WRITE	10110000	-	-	Data auto write set
	10110001	-	-	Data auto read set
	10110010	-	-	Auto reset
DATA READ WRITE	11000000	Data	-	Data write and ADP increment
	11000001	-	-	Data read and ADP increment
	11000010	Data	-	Data write and ADP decrement
	11000011	-	-	Data read and ADP decrement
	11000100	Data	-	Data write and ADP nonvariable
	11000101	-	-	Data read and ADP nonvariable
SCREEN PEEK	11100000	-	-	Screen peek
SCREEN COPY	11101000	-	-	Screen copy
BIT SET/RESET	11110XXX	-	-	bit reset
	11111XXX	-	-	bit set
	1111X000	-	-	bit 0 (LSB)
	1111X001	-	-	bit 1
	1111X010	-	-	bit 2
	1111X011	-	-	bit 3
	1111X100	-	-	bit 4
	1111X101	-	-	bit 5
	1111X110	-	-	bit 6
1111X111	-	-	bit 7 (MSB)	



## 11. Numbering System (Graphic Modules)

**AG**            -      -  -

(1)                      (2)                      (3)                      (4)                      (5)                      (6) (7) (8) (9) (10)                      (11)                      (12)

(1): Number of Row Dots

(2): Number of Column Dots

(3): Serial Number of Models

(4): Viewing Angle

NIL: 6 O'clock

U: 12 O'clock

(5): Optional Items

T: Controller included

V: DC-DC Converter included

(6): Display Mode

NIL: TN

S: STN

K: FSTN

(7): Temperature Range

NIL: Normal

W: Extended Temperature

(8): LCD Color mode

NIL: Natural

Y: Yellow/Green

G: Grey

B: Blue

(9): Backlit

NIL: Without Backlit (Transflective LCD)

D: LED Backlit (Transflective LCD)

L: LED Backlit (Transmissive LCD)

EL: EL Backlit

P: CCFL Backlit

(10): Backlit Color

NIL: Without Backlit

B: Blue

R: Red

W: White

Y: Yellow/Green

(11): Connector Type in Connecting Pins

C: Flat Cable

H: Header

N: Connector

(12): Client Code for Custom Design