



1 General Specifications:

1.1 Display type: STN

1.2 Display color*:

Display color: Blue-Black

Background: Yellow-Green

1.3 Polarizer mode: Transflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Method: 1/128 Duty 1/12 Bias

1.6 Backlight: LED

* Color tone is slightly changed by temperature and driving voltage.

1.7 Controller: T6963C

1.8 Data Transfer: 8 Bit Parallel

1.9 Operating Temperature: -20----+70°C

Storage Temperature: -30----+80°C

1.10 Outline Dimensions: Refer to outline drawing on next page

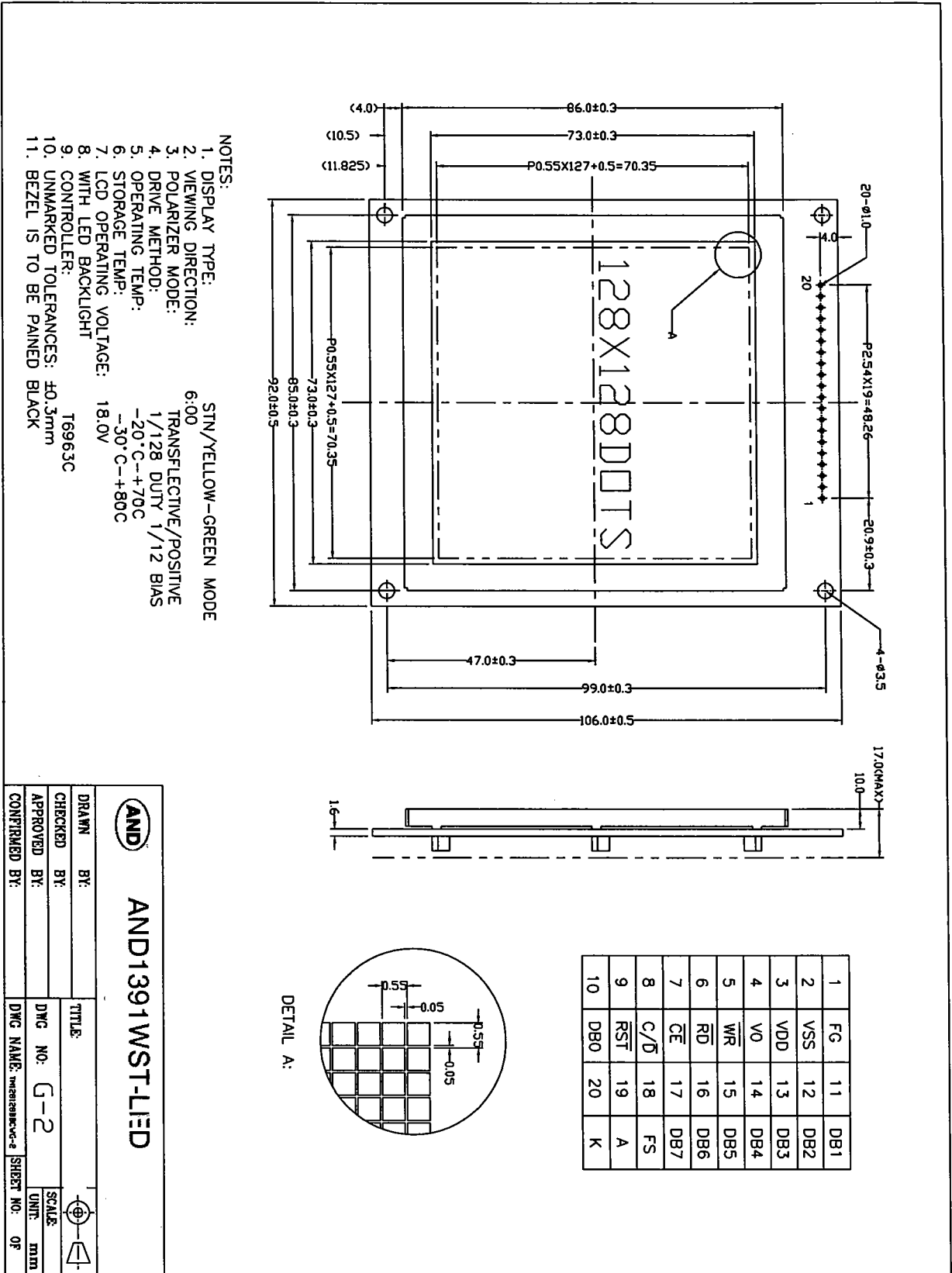
1.11 Dot Matrix: 128X128Dots

1.12 Dot Size: 0.50X0.50(mm)

1.13 Dot Pitch: 0.55X0.55 (mm)

1.14 Weight: 210g

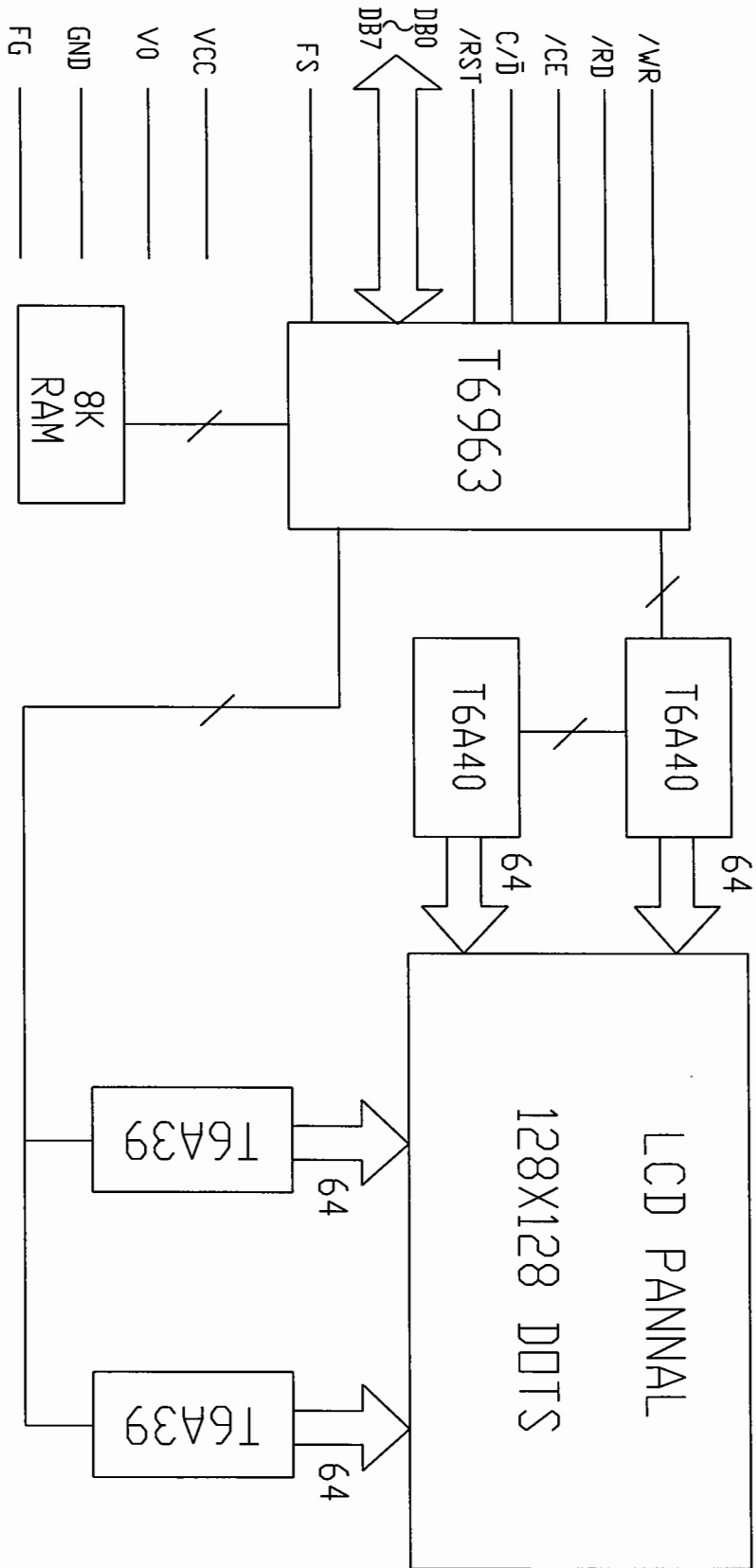
2 Outline Drawing





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4 Circuit Block Diagram





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5 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	V_{DD-VSS}	0	6.0	V	
LCD Driving Voltage	V_{LCD}	0	25.0		
Operating Temperature Range	T_{OP}	-20	+70	°C	No Condensation
Storage Temperature Range	T_{ST}	-30	+80		



6 Electrical Specifications and Instruction Code

6.1 Electrical characteristics

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)	$V_{DD}-V_{SS}$	4.75	5.0	5.25	V
Supply Voltage (LCD Drive)	V_{LCD}	-	18.0	-	V
Input Signal Voltage	High V_{IH} ($V_{DD}=5.0$)	$0.8V_{DD}$	-	$V_{DD}+0.3$	V
	Low V_{IL} ($V_{DD}=5.0$)	0	-	$0.2 V_{DD}$	V
Supply current (Logic)	I_{DD} ($V_{DD}-V_{SS}=5.0V$)	-	10.0	-	mA
Supply current (LCD Drive)	I_{EE}	-	3.0	-	mA
Supply current (LED)	I_{LED}			800	mA



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6.2 Interface Signals

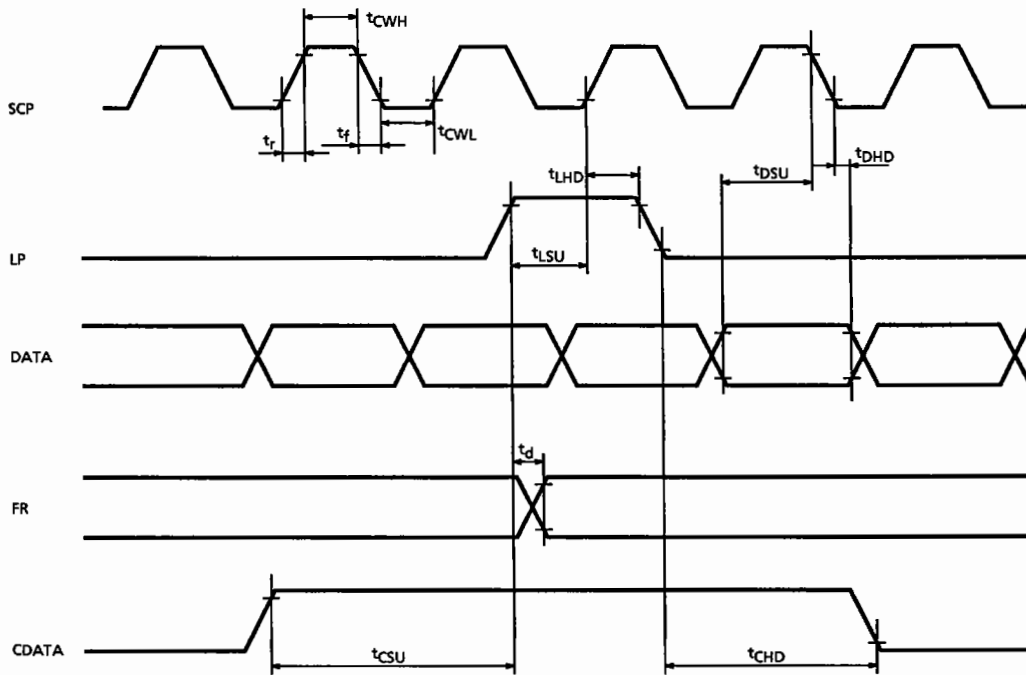
Pin No.	Symbol	Level	Description
1	FG	0V	Frame Ground
2	Vss	0V	Ground
3	Vcc	5.0V	Power supply voltage for logic and LCD(+)
4	Vo	--	Operating Voltage for LCD(-)(variable)
5	$\overline{\text{WR}}$	L	Write Enable Signal
6	$\overline{\text{RD}}$	L	Read Enable Signal
7	$\overline{\text{CE}}$	L	Chip Enable Signal
8	$\overline{\text{C/D}}$	H/L	H:Instruction;L:Data
9	RST	L	Reset Signal
10	DB0	H/L	Data bit0
11	DB1	H/L	Data bit1
12	DB2	H/L	Data bit2
13	DB3	H/L	Data bit3
14	DB4	H/L	Data bit4
15	DB5	H/L	Data bit5
16	DB6	H/L	Data bit6
17	DB7	H/L	Data bit7
18	FS	H/L	Font Selection
19	A	4.2V	Power Supply for LED(+)
20	K	0V	Power Supply for LED(-)



6.3 Interface Timing Chart

AC CHARACTERISTICS

● Switching Characteristics (1)



TEST CONDITIONS (Unless otherwise noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $70^{\circ}C$)

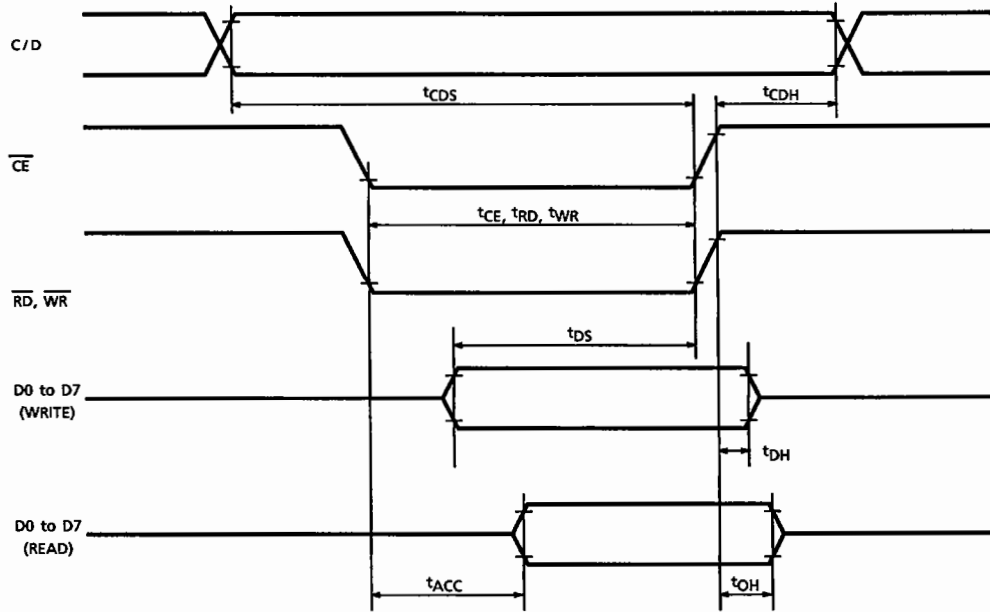
ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
Operating Frequency	f_{scp}	$T_a = -10 \sim 70^{\circ}C$	—	2.75	MHz
SCP Pulse Width	t_{CWH}, t_{CWL}	—	150	—	ns
SCP Rise / Fall Time	t_r, t_f	—	—	30	ns
LP Set-up Time	t_{LSU}	—	150	290	ns
LP Hold Time	t_{LHD}	—	5	40	ns
Data Set-up Time	t_{DSU}	—	170	—	ns
Data Hold Time	t_{DHD}	—	80	—	ns
FR Delay Time	t_d	—	0	90	ns
CDATA Set-up Time	t_{CSU}	—	450	850	ns
CDATA Hold Time	t_{CHD}	—	450	950	ns



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● Switching Characteristics (2)

Bus Timing



TEST CONDITIONS (Unless otherwise noted, $V_{DD} = 5.0V \pm 10\%$, $V_{SS} = 0V$, $T_a = -20$ to $75^\circ C$)

ITEM	SYMBOL	TEST CONDITIONS	MIN	MAX	UNIT
C/D Set-up Time	t_{CDS}	—	100	—	ns
C/D Hold Time	t_{CDH}	—	10	—	ns
\overline{CE} , \overline{RD} , \overline{WR} Pulse Width	t_{CE}, t_{RD}, t_{WR}	—	80	—	ns
Data Set-up Time	t_{DS}	—	80	—	ns
Data Hold Time	t_{DH}	—	40	—	ns
Access Time	t_{ACC}	—	—	150	ns
Output Hold Time	t_{OH}	—	10	50	ns



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6.4 Instruction Code

COMMAND	CODE	D1	D2	FUNCTION
REGISTERS SETTING	00100001	X address	Y address	Set Cursor Pointer
	00100010	Data	00H	Set Offset Register
	00100100	Low address	High address	Set Address Pointer
SET CONTROL WORD	01000000	Low address	High address	Set Text Home Address
	01000001	Columns	00H	Set Text Area
	01000010	Low address	High address	Set Graphic Home Address
	01000011	Columns	00H	SetGraphic Area
MODE SET	1000X000	--	--	OR mode
	1000X001	--	--	EXOR mode
	1000X011	--	--	AND mode
	1000X100	--	--	Text Attribute mode
	10000XXX	--	--	Internal CG ROM mode
	10001XXX	--	--	External CG RAM 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-line cursor
	10100010	--	--	3-line cursor
	10100011	--	--	4-line cursor
	10100100	--	--	5-line cursor
	10100101	--	--	6-line cursor
	10100110	--	--	7-line cursor
	10100111	--	--	8-line cursor
DATAAUTO READ/WRITE	10110000	--	--	Set Data Auto Write
	10110001	--	--	Set Data Auto Read
	10110010	--	--	Set Reset
DATA READ/WRITE	11000000	Data	--	Data Write and increment ADP
	11000001	--	--	Data Read and increment ADP
	11000010	Data	--	Data Write and Decrement ADP
	11000011	--	--	Data Read and Decrement ADP
	11000100	Data	--	Data Write and Nonvariable ADP
	11000101	--	--	Data Read and Nonvariable ADP
SCREEN PEEK	11100000	--	--	Screen Peek
SCREEN COPY	11101000			Screen Copy
BIT SET/RESET	11110XXX	--	--	bit reset
	11111XXX	--	--	bit set
	1111X000	--	--	bit0(LSB)
	1111X001	--	--	bit1
	1111X010	--	--	bit2
	1111X011	--	--	bit3
	1111X100	--	--	bit4
	1111X101	--	--	bit5
	1111X110	--	--	bit6
	1111X111	--	--	bit7(MSB)

X:invalid



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6.5 Character generator ROM code 0101

LSB MSB	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0		!	"	#	\$	%	&	'	()	*	+	,	-	.	/
1	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
2	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	
3	p	q	r	s	t	u	v	w	x	y	z	[\]	^	_
4	~	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
5	p	q	r	s	t	u	v	w	x	y	z	[]	^	_	
6	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
7	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	



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7 Optical Characteristics

7.1 Optical Characteristics

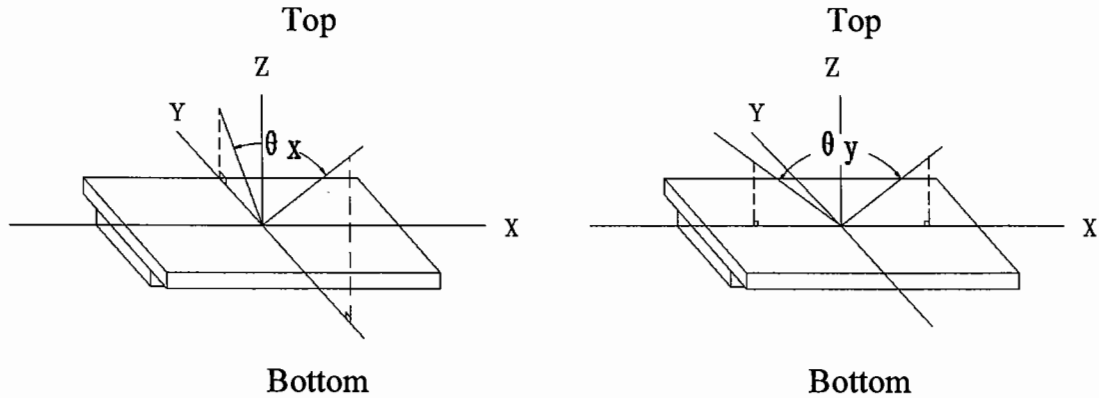
Ta=25°C

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Viewing Angle	θ_x	$Cr \geq 2$	-30	--	20	Deg
	θ_y		-30	--	30	
		$\theta_x = 0^\circ$ $\theta_y = 0^\circ$	3.0	-	-	
Response Time	Turn on	T_{on}	-	-	300	ms
	Turn off	T_{off}				
		$\theta_x = 0^\circ$ $\theta_y = 0^\circ$	-	-	300	

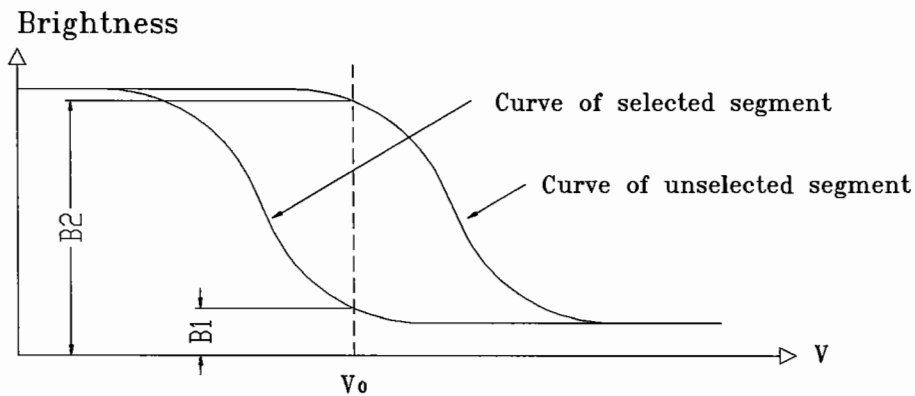


7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle



7.2.2 Definition of Contrast Ratio

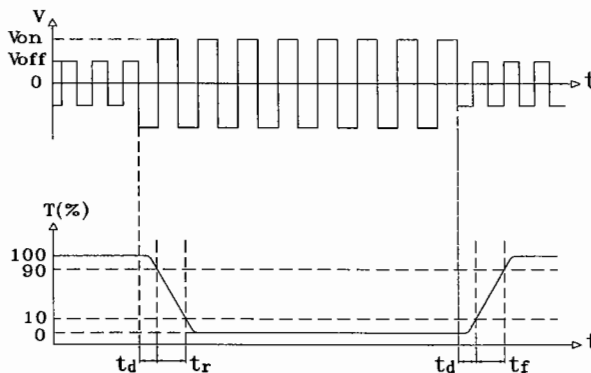


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

- 1) Ambient Temperature: 25°C ;
- 2) Frame frequency: 64Hz

7.2.3 Definition of Response time



Turn on time: $t_{on} = t_d + t_r$ Turn off time: $t_{off} = t_d + t_f$

Measuring Condition:

- 1) Operating Voltage: 18.0V
- 2) Frame frequency: 64Hz

**8 Reliability****8.1 Content of Reliability Test**

Ta=25°C

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	80°C 240H
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30°C 240H
3	High Temperature Operation	Endurance test applying the electric stress (voltage & current) and the thermal stress to the element for a long time	70°C 240H
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time	-20°C 240H
5	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	60°C 95%RH 240H
6	Temperature Cycle	Endurance test applying the low and high temperature cycle $\begin{array}{ccccccc} -30^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} & \longleftrightarrow & 80^{\circ}\text{C} & \longleftrightarrow & 25^{\circ}\text{C} \\ 30\text{min} & & 5\text{min} & & 30\text{min} & & 5\text{min} \\ \longleftarrow & & & & & & \longrightarrow \\ & & & & & & 1 \text{ cycle} \end{array}$	-30°C/80°C 10 cycles
7	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~500Hz, 100m/s ² , 120min
8	Shock Test (package state)	Endurance test applying the shock during transportation	Half- sine wave, 300m/s ² , 18ms
9	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 16H



8.2 Failure Judgment Criterion

Criterion Item	Test Item No.									Failure Judgement Criterion
	1	2	3	4	5	6	7	8	9	
Basic Specification	√	√	√	√	√	√	√	√	√	Out of the basic Specification
Electrical specification	√	√	√	√	√					Out of the electrical specification
Mechanical Specification							√	√		Out of the mechanical specification
Optical Characteristic	√	√	√	√	√	√			√	Out of the optical specification
Note	For test item refer to 8.1									
Remark	Basic specification = Optical specification + Mechanical specification									



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9 QUALITY LEVEL

Examination or Test	At $T_a=25^\circ\text{C}$ (unless otherwise stated)	Inspection				
		Min.	Max.	Unit	IL	AQL
External Visual Inspection	Under normal illumination and eyesight condition, the distance between eyes and LCD is 25cm.	See Appendix A			II	Major 1.0 Minor 2.5
Display Defects	Under normal illumination and eyesight condition, display on inspection.	See Appendix B			II	Major 1.0 Minor 2.5
<p>Note: Major defects: Open segment or common, Short, Serious damages, Leakage Miner defects: Others Sampling standard conforms to GB2828</p>						