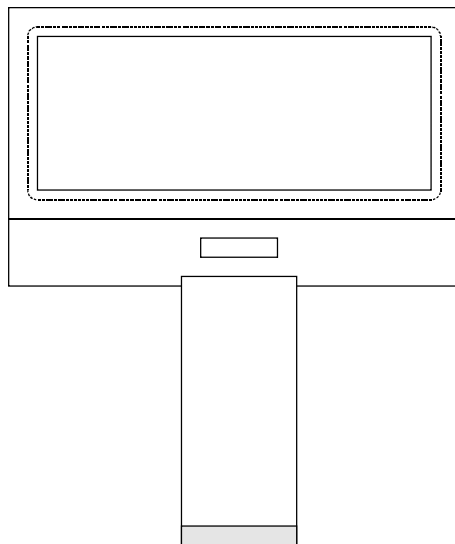




PRODUCT SPECIFICATION

HDG12864L-7

128x64 GRAPHICS
Chip-On-Glass
LCD DISPLAY MODULE



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1. General Specifications

1-1.Features

- A. Drive Method: 1/65 Duty, 1/9 Bias
- B. The Module Operating Voltage: 3V;
- C. The LCD Operating Voltage : 9.0V;
- D. Viewing Direction: 6:00
- E. Operating Temperature: 0°C~50°C
- F. Storage Temperature: -20°C~70°C
- G. Display type: FSTN Positive
- H. 4 times Voltage Converter Circuit ($V_{out} = 4 \times V_{CI}$)

1-2.Mechanical Data:

- (1) Module Size ----- 70.0 w * 43.0 h mm
- (2) Viewing Area ----- 59.0 w * 30.5 h mm
- (3) Dot Size ----- 0.39 w * 0.39 h mm
- (4) Number of Dots ----- 128 * 64 Dots

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1-3.Pin Connections:

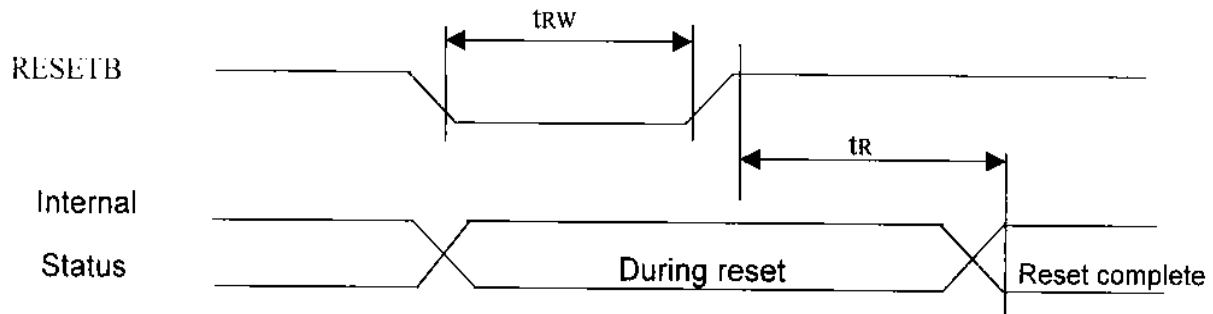
Pin No.	Symbol	Function
1	NC	No Connect
2	V0	LCD driver supply voltages
3	V4	LCD driver supply voltages
4	V3	LCD driver supply voltages
5	V2	LCD driver supply voltages
6	V1	LCD driver supply voltages
7	C2-	Capacitor 2- connection pin for voltage converter
8	C2+	Capacitor 2+connection pin for voltage converter
9	C1+	Capacitor 1+ connection pin for voltage converter
10	C1-	Capacitor 1- connection pin for voltage converter
11	C3+	Capacitor 3+connection pin for voltage converter
12	Vout	Voltage converter input/ output pin
13	VSS	Ground
14	VDD	Power supply
15	SI	Serial input data
16	SCL	Serial input clock
17	RS	Register select input pin
18	/RES	Reset input pin
19	/CS1	Chip select input pins
20	NC	No Connect

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1-4. Absolute Maximum Ratings:

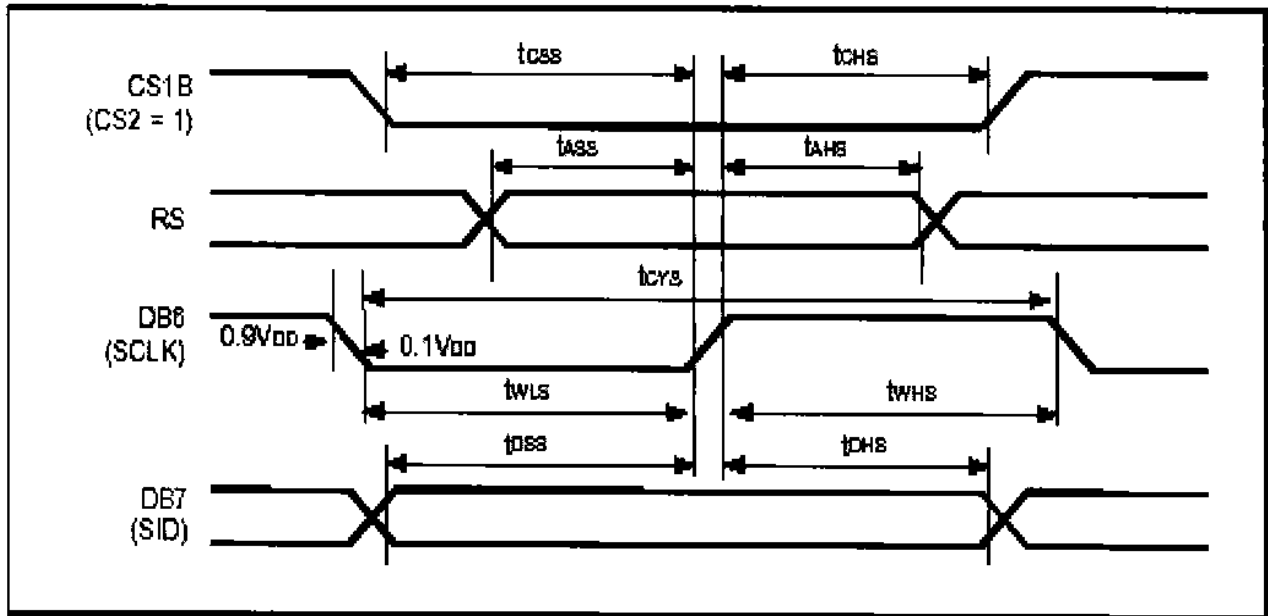
Characteristics	Symbol	Ratings
Supply Voltage	VDD	-0.3V to +7.0V
Supply Voltage	VLCD	-0.3V to +17.0V
Input Voltage	V _{IN}	-0.3V to V _{dd} +0.3V

1-5. Reset Input Timing:



Item	Signal	Symbol	Min.	Typ.	Max.	Unit
Reset low pulse width	RESETB	t_{RW}	1.0	-	-	us
Reset time	-	t_R	-	-	1.0	us

1-6. Serial Interface Characteristics



Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Serial clock cycle		tcys	250	-	-		
SCLK high pulse width	DB6 (SCLK)	twhs	100	-	-	ns	
SCLK low pulse width		twls	100	-	-		
Address setup time	RS	tass	150	-	-	ns	
Address hold time		tahs	150	-	-		
Data setup time	DB7 (SID)	tdss	100	-	-	ns	
Data hold time		tdhs	100	-	-		
CS1B setup time	CS1B	tcss	150	-	-	ns	
CS1B hold time		tchs	150	-	-		

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1-7. Instruction Table

Instruction	RS	RW	BD7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Display ON/OFF	0	0	1	0	1	0	1	1	1	DON	Turn on/off LCD panel when DON=0: display OFF when DON=1: display ON
Initial display line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify DDRAM line for COM0
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
Read status	0	1	BUSY	ADC	ONOFF	RESETB	0	0	0	0	Read the internal status
Write display data	1	0	Write data								Write data into DDRAM
Read display data	1	1	Read data								Read data from DDRAM
ADC select	0	0	1	0	1	0	0	0	0	ADC	Select SEG output direction When ADC=0: normal direction(SEG0-SEG131) When ADC=1: reverse direction (SEG131-SEG0)
Reverse display ON/OFF	0	0	1	0	1	0	0	1	1	REV	Select normal/reverse display When REV=0: normal display When REV=1: reverse display
Entire display ON/OFF	0	0	1	0	1	0	0	1	0	EON	Select normal/entire display ON When EON=0: normal display When EON=1: entire display ON
LCD bias select	0	0	1	0	1	0	0	0	1	BIAS	Select LCD bias
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	Release modify-read mode
Reset	0	0	1	1	1	0	0	0	1	0	Initialize the internal functions
SHL select	0	0	1	1	0	0	SHL	*	*	*	Select COM output direction When SHL=0: normal direction(COM0-COM63) When SHL=1: reverse direction (COM63-COM0)
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage mode
Set reference voltage register	0	0	*	*	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode
Set static indicator register	0	0	*	*	*	*	*	*	S1	S0	Set static indicator register
Power save											Compound instruction of display OFF and entire display ON
NOP	0	0	1	1	1	0	0	0	1	1	Non-Operation command
Test instruction-1	0	0	1	1	1	1	*	*	*	*	Don't use this instruction
Test instruction-2	0	0	1	0	0	1	*	*	*	*	Don't use this instruction

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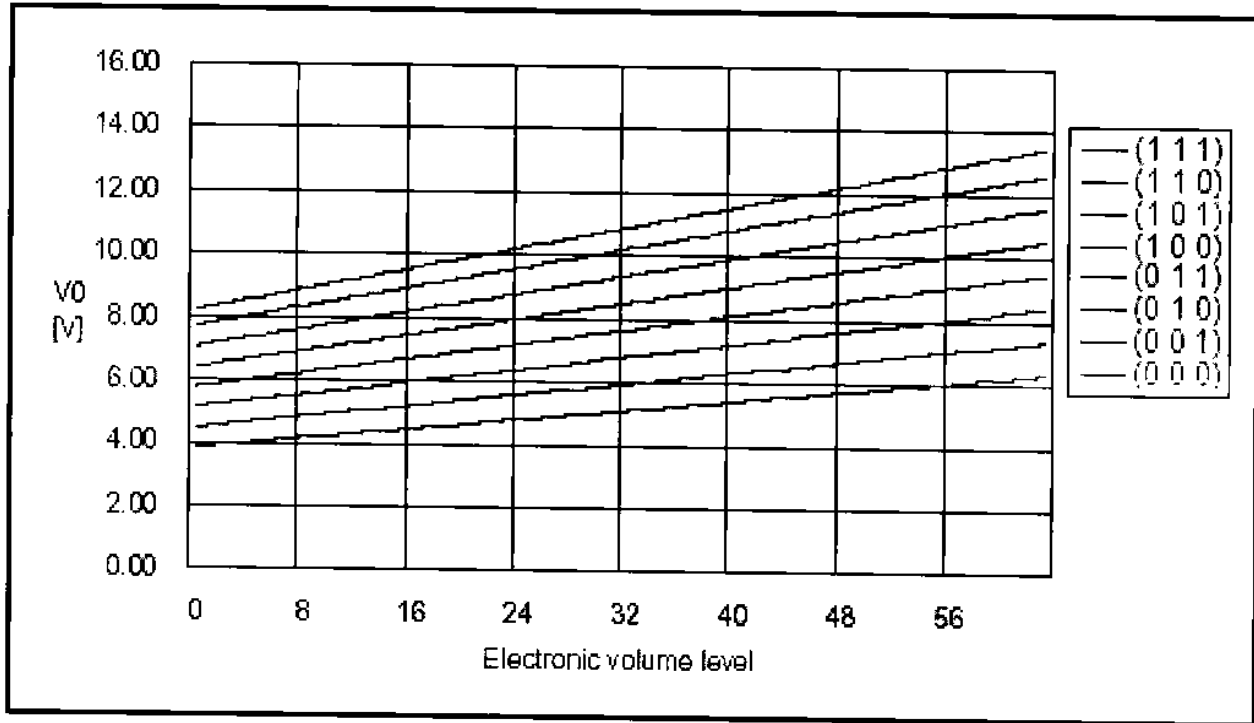
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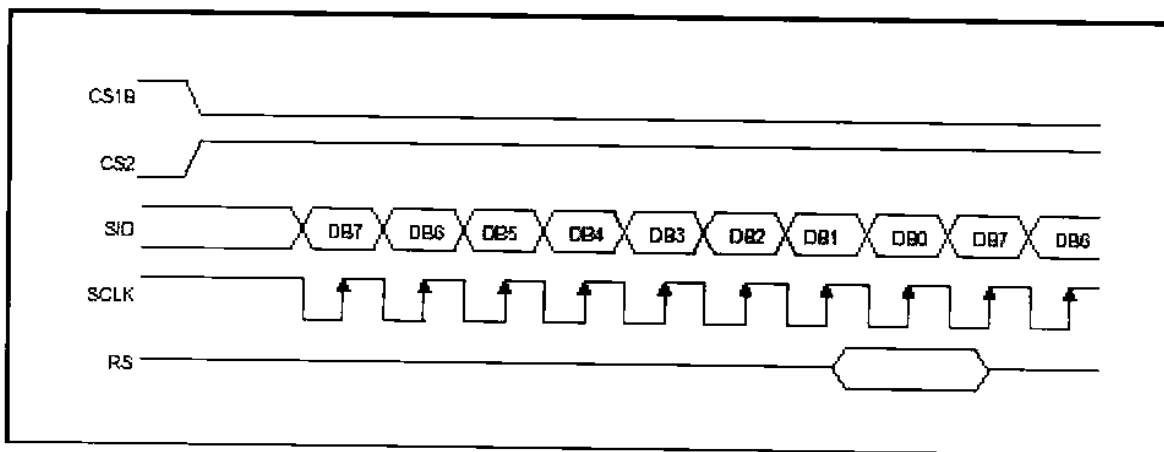
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1-8. Electronic Volume Level

The following figure shows V_O voltage measured by adjusting internal regulator resistor ratio (R_b / R_a) and 6-bit electronic volume registers for each temperature coefficient at T_a = 25 °C.

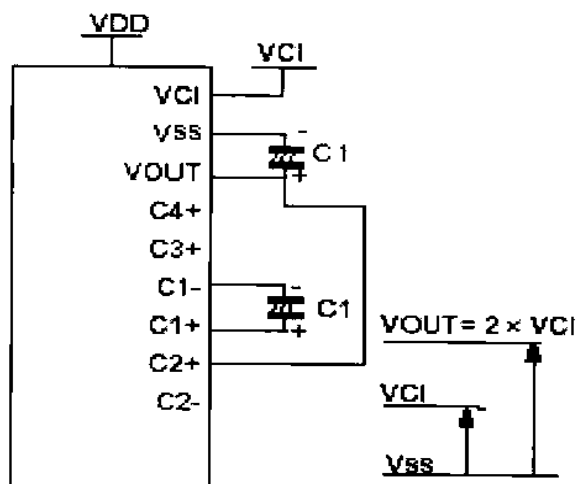


1-9. Serial Interface Timing

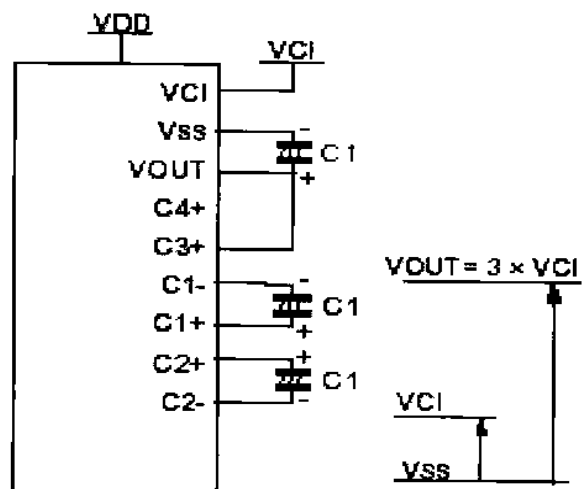


1-10. Voltage Converter Circuits

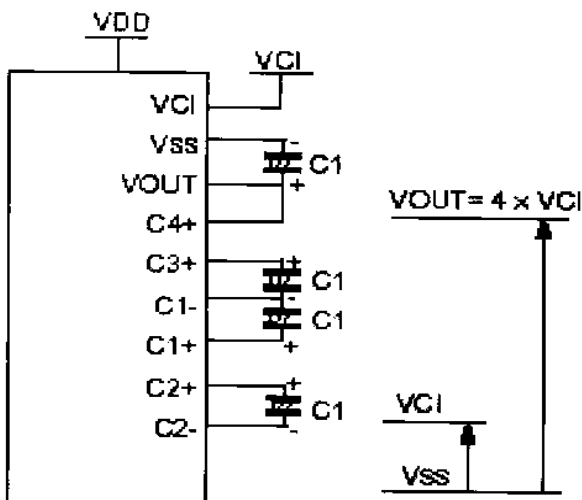
These circuits boost up the electric potential between VCI and VSS to 2, 3, 4 or 5 times toward positive side and boosted voltage is outputted from VOUT pin.



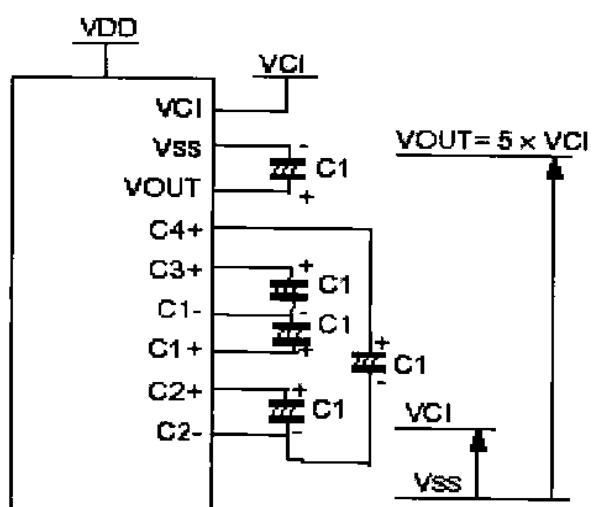
Two Times Boosting Circuit



Three Times Boosting Circuit



Four Times Boosting Circuit



Five Times Boosting Circuit

2.The Characteristics and The Reliability Test

1.Electro-Optic Characteristics:

Condition:TEMP=(23±3)°C

NO	Item	Symbol	Min	Typ.	Max	Unit	Condition
1	Supply Voltage(Logic)	Vdd-Vss		3.0		V	
2	LCD Operating Voltage	Vdd-V ₀		9.2		V	0°C
				9.0		V	25°C
				8.8		V	50°C
3	Response Time	Ton		112		ms	
		Toff		80		ms	
4	Contrast	CR	3				
5	Viewing Angel	12H	θ1		59	Deg	(CR≥3.0)
		6H	θ2		70		
		3H	θ3		60		
		9H	θ4		60		
6	LCD Threshold Voltage	Vth		7.01		V	25°C

2. Characteristics of backlight (LED unit)

2.1 White LED

(1).Absolute Maximum Ratings:

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward Current	IFM		30	40	mA	Ta=25°C
Reverse Voltage	VR		5		V	Ta=25°C
Power Dissipation	PD		0.135		W	Ta=25°C

(2).Electrical-optical Characteristics:

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward Voltage	VF		4.5		V	
Reverse current	IR		0.2		mA	
Luminous	LV		50		cd/m ²	VF=4.5V
Color	WHITE					

2.2 Yellow-green LED

(1).Absolute Maximum Ratings:

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward Current	IFM		60	120	mA	Ta=25°C
Reverse Voltage	VR		10		V	Ta=25°C
Power Dissipation	PD		0.27		W	Ta=25°C

(2).Electrical-optical Characteristics:

Item	Symbol	Min	Typ	Max	Unit	Condition
Forward Voltage	VF		4.5		V	
Reverse current	IR		0.6		mA	
Luminous	LV		50		cd/m ²	VF=4.5V
Color	YELLOW-GREEN					

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3. Reliability Test

No	Items	Test Condition	Equipment	Test Result
1	High TEMP Storage	TEMP: $70 \pm 2^\circ\text{C}$ Time: 96h Restore: 24h	Tenny	Passed
2	Low TEMP Storage	TEMP: $-20 \pm 3^\circ\text{C}$ Time: 96h Restore: 24h	Tenny	Passed
3	High TEMP Operating	TEMP: $50 \pm 2^\circ\text{C}$ Vop: 3V Timp: 24h Restore: 24h	Tenny	Passed
4	Low TEMP Operating	TEMP: $0 \pm 2^\circ\text{C}$ Vop: 3V Timp: 24h Restore: 24h	Tenny	Passed
5	High TEMP High Hum Storage	TEMP: $40 \pm 2^\circ\text{C}$ Hum: 95%Rh Time: 96h Restore: 24h	Tenny	Passed
6	Thermal Shock	<p>TEMP: ($^\circ\text{C}$)</p> <p>The diagram shows a thermal shock profile with 5 cycles. Each cycle consists of a 30-minute ramp from 25°C to 70°C, a 5-minute dwell at 70°C, a 30-minute ramp from 70°C to -20°C, and a 5-minute dwell at -20°C. The temperature starts at 25°C and ends at -20°C. The total duration of the 5 cycles is indicated as 5 Cycles.</p> <p>Restore: 24h</p>	Tenny	Passed

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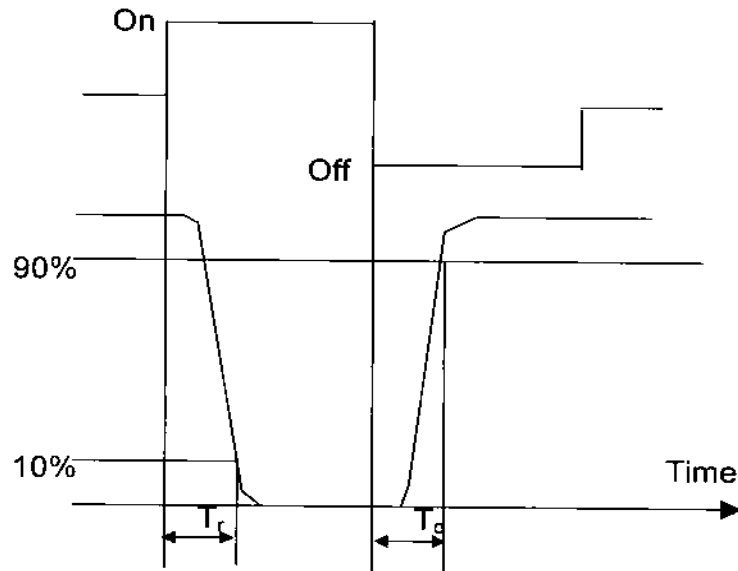
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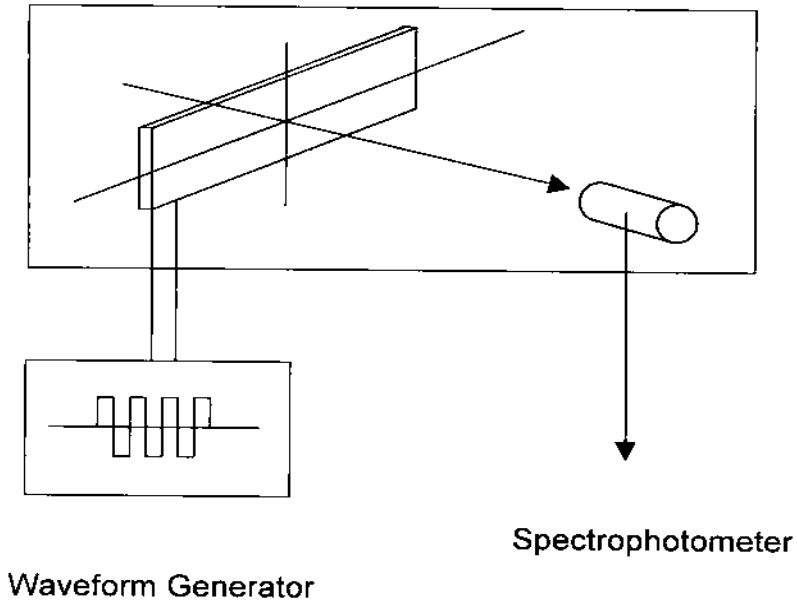
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B. Response Time



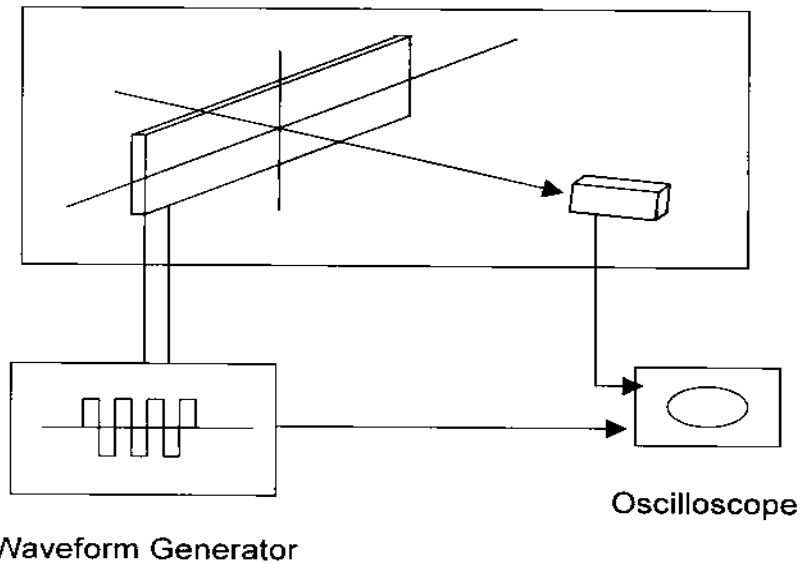
2. Contrast Measuring (1) Equipment



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3.The LCD Measuring Method and Equipment

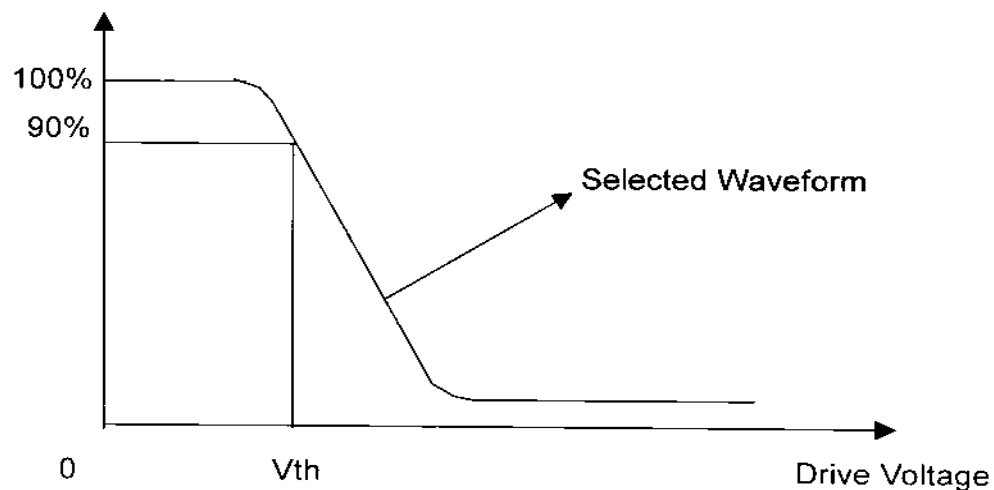
1. Threshold Voltage and Response Time Measuring
 - (1) Equipment



- (2) Definition

A. Threshold Voltage (V_{th})

Brightness



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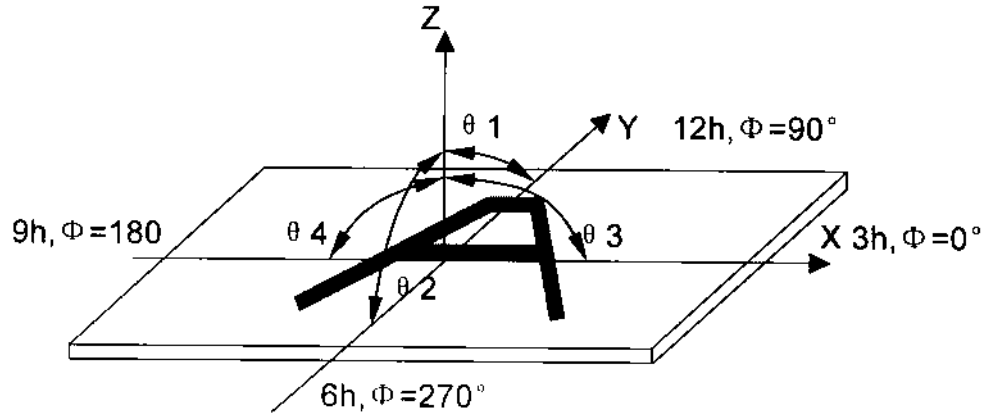
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(2) Definition:

A. Viewing Angle:



B. Contrast Ratio (Positive)

$$CR = \frac{\text{Brightness of non-selected wave-form}}{\text{Brightness of selected wave-form}}$$

3. Reliability Test:

Equipment : TENNY

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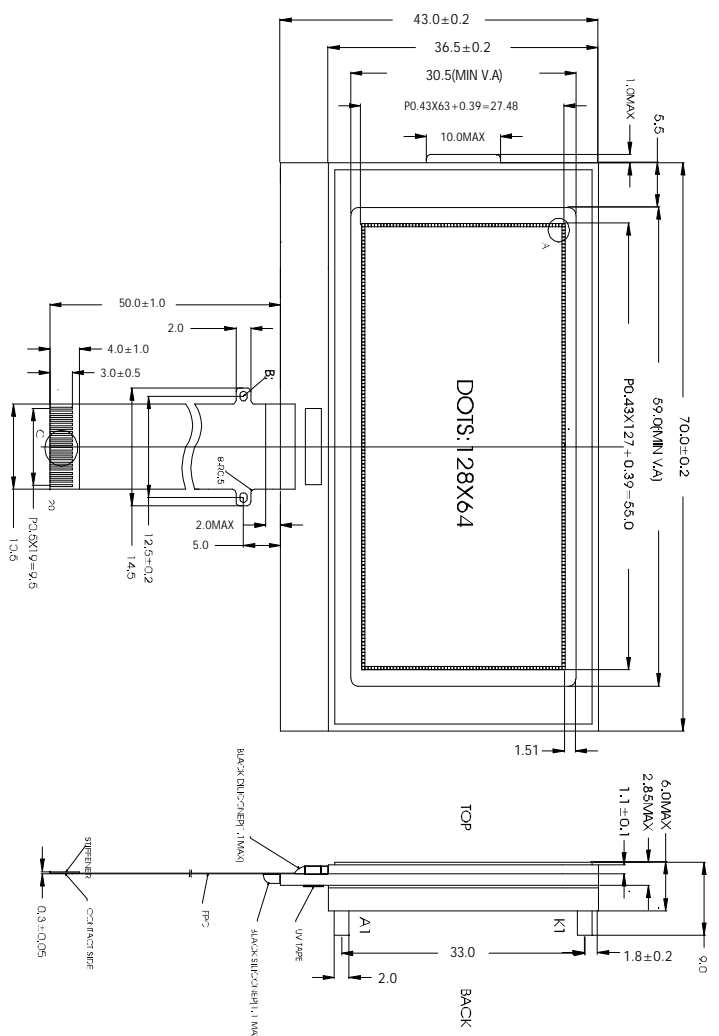
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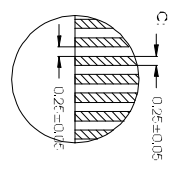
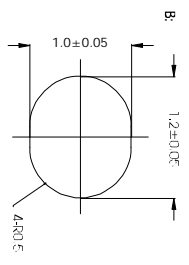
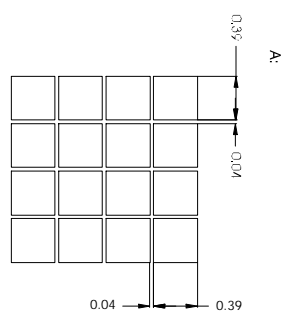
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Pin	Symbol	Pin	Symbol
1	NC	11	C3+
2	V0	12	VOUT
3	V4	13	VSS
4	V3	14	VDD
5	V2	15	S1
6	V1	16	SCL
7	C2-	17	RS
8	C2+	18	/RES
9	C1+	19	/CS1
10	C1-	20	NC

Note:

1. Display Type: FSIN
2. Polarizer Mode: Transmissive/Positive
3. Drive Method: 1/65 Duty 1/9 Bias
4. Viewing Direction: 6:00
5. Operating Temp: 0°C--50°C
Storage Temp: -20°C--70°C
6. Controller: S680724A01-BOCY
7. Resolution: 128X64 Dots
8. Logic Voltage: 3.0V
LCD Operating Voltage: 9.0V
9. Backlight: LED White ; VOLTAGE: 4.5V
10. Unmarked Tolerances: ±0.3



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