

CUSTOMER :
MODEL : MOG-64GB24B-4 Series
DESCRIPTION : LCD MODULE

◆ CUSTOMER APPROVAL

	CHECKED	CHECKED	APPROVAL
APPROVAL			
REMARK			

◆ SUPPLIER APPROVAL

PREPARED	CHECKED		APPROVAL

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1. General Specification

(1) Mechanical Dimension

Item	Standard Value	Unit
Number of dots	240 × 64	dots
Module dimension (L x W x H)	180.0 x 65.0 x 15.1(Max)-LED array B/L 187.0 x 65.0 x 11.9(Max)-LED white B/L, CCFL 180.0 x 65.0 x 9.2(Max)- E/L or No B/L	mm
View area	133.0(W) × 39.0(H)	mm
Active area	127.16(W) × 33.88(H)	mm
Dot size	0.49(W) × 0.49(H)	mm
Dot pitch	0.53(W) × 0.53(H)	mm

(2) Controller IC: **T6963C controller**

(3) Temperature Range

	Normal	Wide
Operating	0 ~+50°C	-20 ~+70°C
Storage	-10 ~+60°C	-30 ~+80°C

2. Absolute Maximum Ratings

Item	Symbol	Min	Typ	Max	Unit
Operating Temperature	T _{OP}	-20	—	+70	°C
Storage Temperature	T _{ST}	-30	—	+80	°C
Input Voltage	V _I	VSS	—	Vdd	V
Supply Voltage For Logic	Vdd-Vss	0	—	+7	V
Supply Voltage For LCD	Vdd-Vo	0	—	15	V
LED Forward Current(array)	I _F	—	—	900	mA
LED Forward Current(white LED)	I _F	—	—	100	mA

3. Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply Voltage For Logic	Vdd-Vss	—	4.75	5.0	5.5	V
Supply Voltage For LCD	Vdd-Vo	Ta=-20°C	—	14.5	—	V
		Ta=25°C	—	12.5	—	V
		Ta=+70°C	—	10.5	—	V
Input High Vol	V _{IH}	—	2.2	—	Vdd	V
Input Low Vol	V _{IL}	—	0	—	0.8	V
Output High Vol	V _{OH}	—	2.4	—	Vdd	V
Output Low Vol.	V _{OL}	—	—	—	0.4	V
Supply Current(no N.V built in)	I _{dd}	Vdd=5V	—	20.0	—	mA
Supply Current(with N.V built in)	I _{dd}	Vdd=5V	—	40.0	—	mA

4. Optical Characteristics

a. STN

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR \geq 2	10		45	deg
	(H) φ	CR \geq 2	-30		30	deg
Contrast Ratio	CR	—		3		—
Response Time 25°C	T rise	—		100	150	ms
	T fall	—		150	200	ms

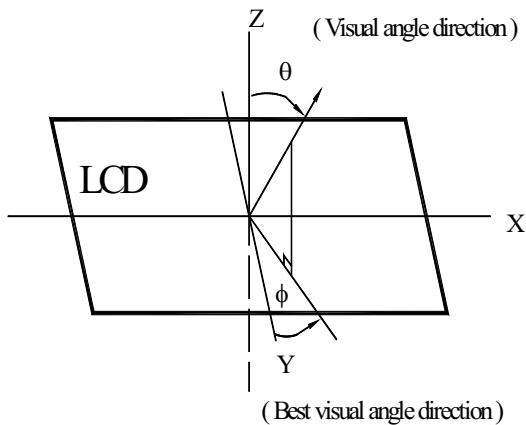
b. FSTN

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
View Angle	(V) θ	CR \geq 3	10		60	deg
	(H) φ	CR \geq 3	-45		45	deg
Contrast Ratio	CR	—		5		—

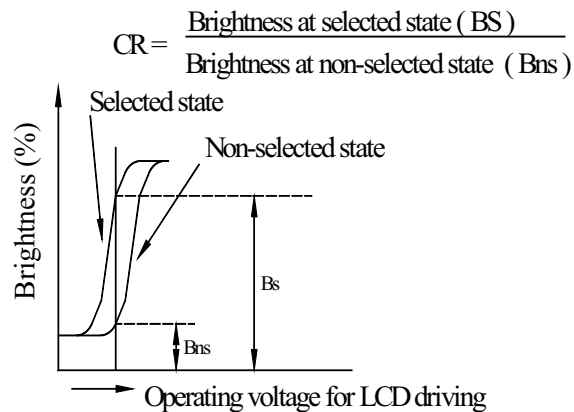
Response Time 25°C	T rise	—		100	150	ms
	T fall	—		150	200	ms

5.1 Definitions

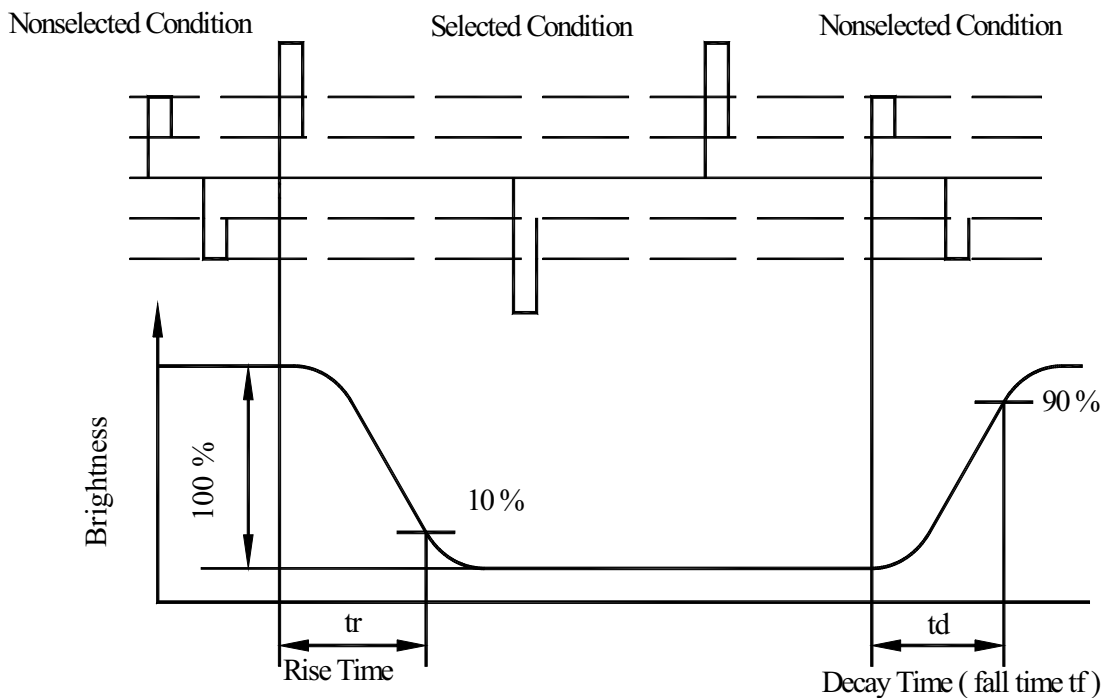
■ View Angles



■ Contrast Ratio



■ Response time

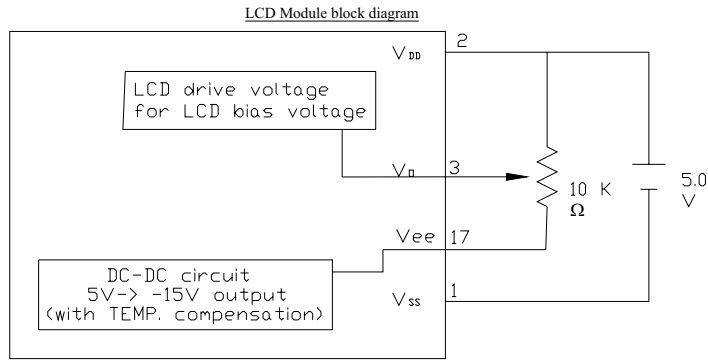


5. Interface Pin Function

Pin No.	Symbol	Level	Description
1	FG		Frame ground (Connected to bezel)
2	Vss		GND
3	Vdd		Power supply (+5 V)
4	Vo		Power supply for LCD driver
5	WR	L	Data write. Write data into T6963C when WR = L
6	RD	L	Data read. Read data from T6963C when RD = L
7	CE	L	L: Chip enable
8	C/D	H / L	WR=L, C/D=H: Command Write C/D=L: Data write RD=L, C/D=H: Status Read C/D=L: Data read
9	Vee		Negative Voltage output -13.6 V
10	RESET	H / L	H: Normal; L: Initialize T6963C
11	DB0	H / L	Data bus line
12	DB1	H / L	Data bus line
13	DB2	H / L	Data bus line
14	DB3	H / L	Data bus line
15	DB4	H / L	Data bus line
16	DB5	H / L	Data bus line
17	DB6	H / L	Data bus line
18	DB7	H / L	Data bus line
19	FS	H / L	Pins for selection of font; H: 6 * 8, L: 8 * 8
20	N.C		No connection

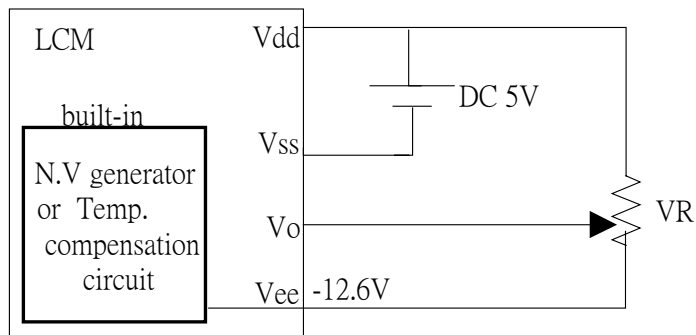
6. Power Supply for LCD Module and LCD Operating Voltage a Adjustment

* LCM operating on " DC 5V " input with built-in negative voltage and temperature compensation circuit

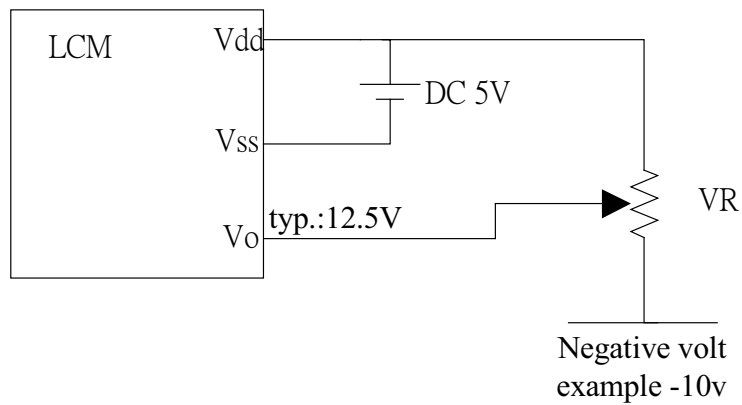


V_{ee} voltage will be adjusted automatically on different temperature

LCM operating on " DC 5V " input with built-in negative voltage



* (Option) LCM operating on " DC 5V " input with external negative voltage



7. Backlight Information

7.1 Specification

(1) LED array / yellow-green

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	I _{LED}	—	450	680	mA	V=4.2V
Supply Voltage	V	—	4.2	4.3	V	
Reverse Voltage	V _R	—	—	8	V	
Luminous Intensity	I _V	—	—	—	cd/m ²	I _{LED} =450mA
Wave Length	λ _p		575		nm	I _{LED} =450mA
Life Time		—	100000	—	Hr.	V ≤ 4.2V
Color	Yellow Green					

(2) LED edge / white

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Supply Current	I _{LED}	—	80		mA	V=3.5V
Supply Voltage	V	—	3.5	3.7	V	—
Reverse Voltage	V _R	—	—	8	V	—
Luminous Intensity	I _V	—	80	—	cd/m ²	I _{LED} =80mA
Wave Length	λ _p	—		—	nm	I _{LED} =80mA
Life Time	—	—	15000	—	Hr.	V ≤ 3.7V
Color	White					

(3) EL / white

Parameter	Symbol	Min	Typ	Max	Unit	Test Condition
Drive Voltage	Vmax	—	110	170	Vrms	25°C
Drive Wave	Fmax	—	400	1000	Hz	25°C
Brightness		48	60	—	cd/m ²	110V/400Hz
Power Consumption		—	80	—	mW	110V/400Hz
Chromatism	X	—	0.3173	—	—	110V/400Hz
	Y	—	0.3995	—	—	110V/400Hz
Life time		5000			hour	110V/400Hz
Color		White			—	Light on 110V/400Hz

(4) CCFL

No.2 3 4 5 shall be lighted at constant lamp current (IL : 5.0 mA) and shall be measured 3 minutes after the table below. The measurement shall be conducted on the condition that ambient temperature : 25 ± 2 °C humidity : 30 ~ 85%, with no wind.

NO	Items	Requirements	Remarks
1	Lamp Current (IL)	5.0 ± 0.5 (mArms)	
2	Lamp Voltage (VL)	205 ± 20 (Vrms)	
3	Lamp Power (P) (Reference Value)	1.03 (Wrms)	VL * IL
4	Luminance	250 min (cd/m)	Note 1
5	Chromaticity (X) (Y)	0.308 ± 0.01 0.330 ± 0.01	Note 2
6	Starting Voltage (VS)	400 MAX (25°C) (Vrms) 600 MAX (0°C) (Vrms)	Note 3
7	Life time	10000 min (h)	Note 4

Note 1. The average value is measured though the glass.

Note 2. The tube center / center point shall be measured.

Note 3. All the tubes shall be lighted. Slidein method shall be used for voltage application.

Note 4. Life

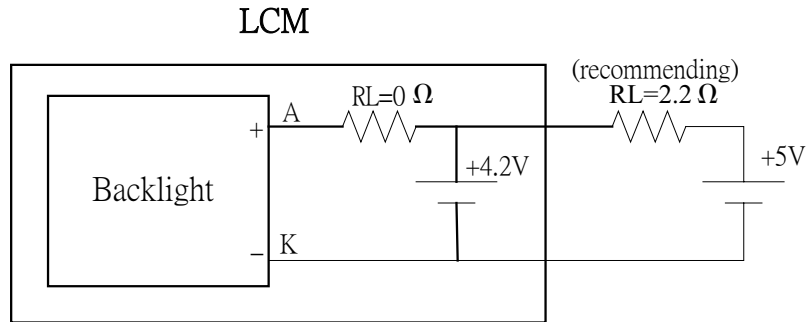
Judgement conditions.

- A The luminance becomes 50% of the initial luminance.
- B Not normal lighting.
- C When a severe appearance failure is found.

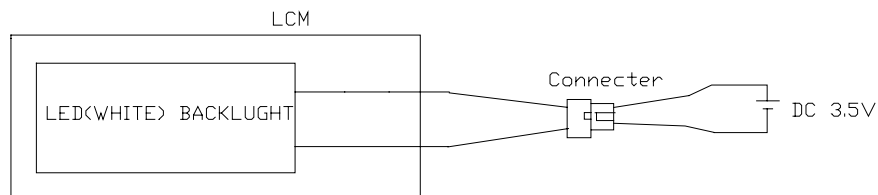
7.2 Backlight driving methods

a. LED B/L drive from A.K directly

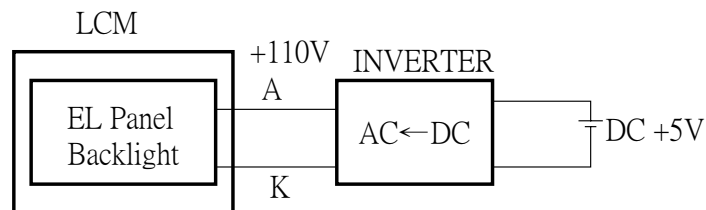
a.1 array (yellow-green)



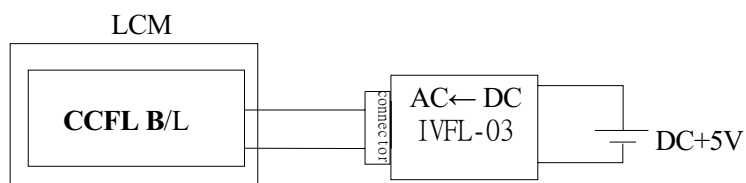
a.2 edge / white



b. E/L B/L driven from A.K cable directly



c. CCFL B/L drive directly from connector



8. Quality Assurance

◆ Screen Cosmetic Criteria

No.	Defect	Judgement Criterion	Partition
1	Spots	<p>A)Clear</p> <p><u>Size:d mm</u> <u>Acceptable Qty in active area</u></p> <p>$d \leq 0.1$ Disregard</p> <p>$0.1 < d \leq 0.2$ 6</p> <p>$0.2 < d \leq 0.3$ 2</p> <p>$0.3 < d$ 0</p> <p>Note:Including pin holes and defective dots which must be within one pixel size.</p> <p>B)Unclear</p> <p><u>Size:d mm</u> <u>Acceptable Qty in active area</u></p> <p>$d \leq 0.2$ Disregard</p> <p>$0.2 < d \leq 0.5$ 6</p> <p>$0.5 < d \leq 0.7$ 2</p> <p>$0.7 < d$ 0</p>	Minor
2	Bubbles in Polarizer	<p><u>Size:d mm</u> <u>Acceptable Qty in active area</u></p> <p>$d \leq 0.3$ Disregard</p> <p>$0.3 < d \leq 1.0$ 3</p> <p>$1.0 < d \leq 1.5$ 1</p> <p>$1.5 < d$ 0</p>	Minor
3	Scratch	In accordance with spots cosmetic criteria. When the light reflects on the panel surface, the scratches are not to be remarkable.	Minor
4	Allowable Density	Above defects should be separated more than 30mm each other.	Minor
5	Coloration	Not to be noticeable coloration in the viewing area of the LCD panels. Back-light type should be judged with back-light on state only.	Minor

9. Reliability

*Content of Reliability Test

Environmental Test				
No.	Test Item	Content of Test	Test Condition	Applicable Standard
1	High Temperature storage	Endurance test applying the high storage temperature for a long time.	60°C 200hrs	—
2	Low Temperature storage	Endurance test applying the high storage temperature for a long time.	-10°C 200hrs	—
3	High Temperature Operation	Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time.	50°C 200hrs	—
4	Low Temperature Operation	Endurance test applying the electric stress under low temperature for a long time.	0°C 200hrs	—
5	High Temperature/ Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time.	70°C,90%RH 96hrs	—
6	High Temperature/ Humidity Operation	Endurance test applying the electric stress (Voltage & Current) and temperature / humidity stress to the element for a long time.	40°C,90%RH 96hrs	—
7	Temperature Cycle	<p>Endurance test applying the low and high temperature cycle.</p> <p style="text-align: center;"> ← → </p> <p style="text-align: center;"> 30min 5min 30min </p> <p style="text-align: center;">————— 1 cycle</p>	-10°C/60°C 10 cycles	—
Mechanical Test				
8	Vibration test	Endurance test applying the vibration during transportation and using.	10~22Hz→1.5mmp-p 22~500Hz→1.5G Total 0.5hrs	—
9	Shock test	Constructional and mechanical endurance test applying the shock during transportation.	50G Half sign wave 11 msdc 3 times of each direction	—
10	Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air.	115mbar 40hrs	—
Others				
11	Static electricity test	Endurance test applying the electric stress to the terminal.	VS=800V,RS=1.5kΩ CS=100pF 1 time	—

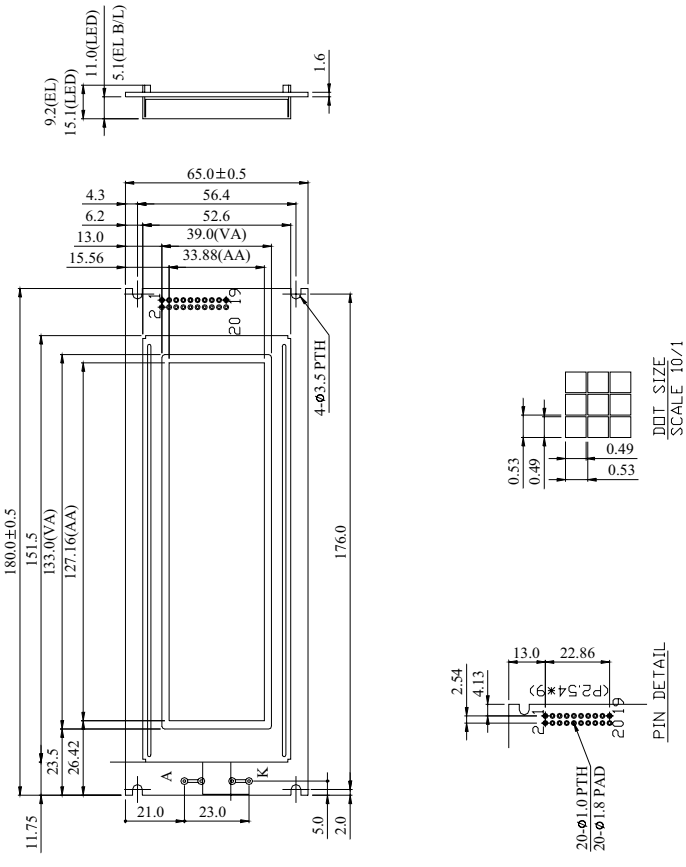
***Supply voltage for logic system=5V. Supply voltage for LCD system = Operating voltage at 25°C

10. Appendix (Drawing , EL , CCFL inverter data)

10-1 Drawing

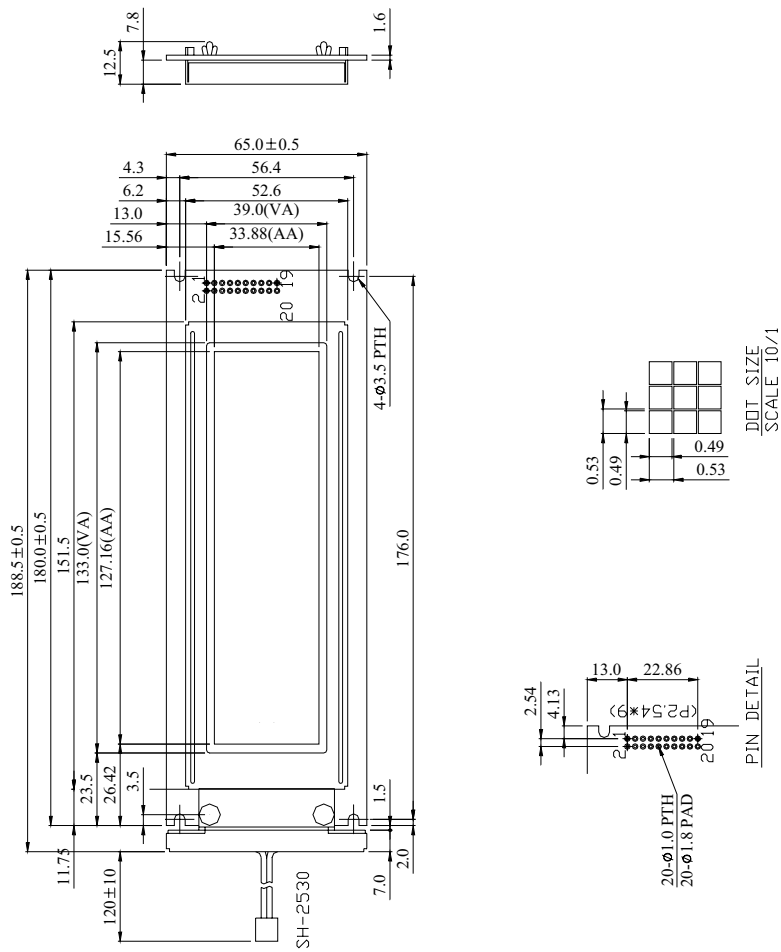
LED array backlight and EL backlight

PIN NO	SYMBOL
1	FGND
2	V _{SS}
3	V _{DD}
4	V _O
5	WR
6	RD
7	CE
8	C/D
9	NV
10	RESET
11	DB0
12	DB1
13	DB2
14	DB3
15	DB4
16	DB5
17	DB6
18	DB7
19	FS
20	NC



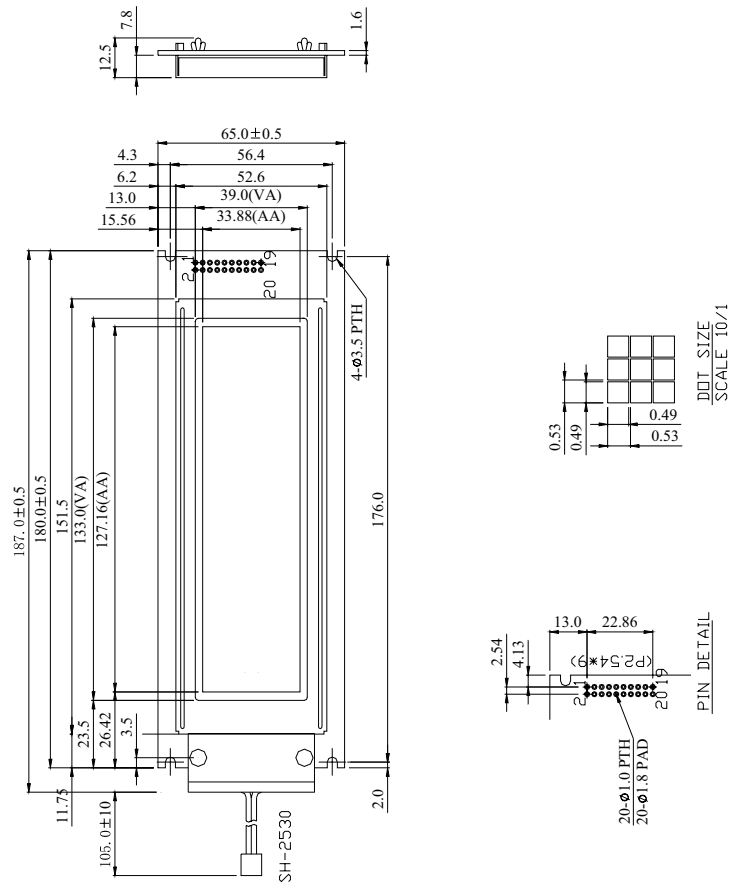
CCFL backlight

PIN NO	SYMBOL
1	FGND
2	V _{SS}
3	V _{DD}
4	V _O
5	WR
6	RD
7	CE
8	C/D
9	NV
10	RESET
11	DB0
12	DB1
13	DB2
14	DB3
15	DB4
16	DB5
17	DB6
18	DB7
19	FS
20	NC



LED(white) backlight

PIN NO	SYMBOL
1	FGND
2	V _{SS}
3	V _{old}
4	V _O
5	WR
6	RD
7	CE
8	C/D
9	NV
10	RESET
11	DB0
12	DB1
13	DB2
14	DB3
15	DB4
16	DB5
17	DB6
18	DB7
19	FS
20	NC



10-2 Character code

Upper 4 bit Lower 4 bit	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH
LLLL		0	1	2	3	4	5	6
LLLH	.	7	8	9	A	B	C	D
LLHL	"	E	F	G	H	I	J	K
LLHH	#	L	M	N	O	P	Q	R
LHLL	\$	S	T	U	V	W	X	Y
LHLH	%	Z	[\]	^	_	~
LHHL	^	7	8	9	A	B	C	D
LHHH	"	E	F	G	H	I	J	K
HLLL	<	=	>	?	@	A	B	C
HLLH	>	9	0	1	2	3	4	5
HLHL	*	#	\$	%	&	'	()
HLHH	+	#	K	L	M	N	O	P
HHLL	^	<	L	\	I	I	E	E
HHLH	-	=	M	N	M	N	S	S
HHHL	#	>	N	^	n	n	A	A
HHHH	/	>	O	_	o		A	A

10-3 Timing characteristics

Bus Timing

($V_{SS} = 0\text{ V}$, $V_{DD} = 5\text{ V}$)

Item	Symbol	Min	Typ	Max	Unit
C/D Set-up Time	tCDS	100	—	—	ns
C/D Hold Time	tCDH	10	—	—	ns
CE,RD,WR Pulse Width	tCDS,tRD,tWR	80	—	—	ns
Data Set-up Time	tDS	80	—	—	ns
Data Hold Time	tDH	40	—	—	ns
Access Time	tACC	—	—	150	ns
Output Hold Time	tOH	10	—	50	ns

