Address: Midas Components Limited, Electra House, 32 Southdown Road, Great Yarmouth, Norfolk, NR31 0DU
Telephone: +44 (0)1493 602602
Fax: +44 (0)1493 665111
Email: sales@midascomponents.co.uk
Website: www.midascomponents.co.uk

Specification

MCCOG128128A6W-FPTLW

Address: Midas Components Limited, Electra House, 32 Southdown Road, Great Yarmouth, Norfolk, NR31 0DU
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Midas LCD Part Number System

MC	COG	132033	A	*	6	W	*	*	-	S	N	T	L	W	*	*
1	2	3	4	5	6	7	8	9	-	10	11	12	13	14	15	16

1 = **MC:** Midas Components

2 = **Blank:** COB (chip on board) **COG**: chip on glass

3 = **No of dots** (e.g. 240064 = 240 x 64 dots) (e.g. 21605 = 2 x 16 5mm C.H.)

4 = **Series**

5 = **Series Variant:** A to Z – see addendum

6 = **3:** 3 o'clock **6:** 6 o'clock **9**: 9 o'clock **12**: 12 o'clock

7 = **S**: Normal (0 to + 50 deg C) **W:** Wide temp. (-20 to + 70 deg C) **X:** Extended temp (-30 + 80 Deg C)

8 = **Character Set**

Blank: Standard (English/Japanese)
C: Chinese Simplified (Graphic Displays only)
CB: Chinese Big 5 (Graphic Displays only)
H: Hebrew
K: European (std) (English/German/French/Greek)
L: English/Japanese (special)
M: European (English/Scandinavian)
R: Cyrillic
W: European (English/Greek)
U: European (English/Scandinavian/Icelandic)

9 = **Bezel Height** (where applicable / available)

	Top of Bezel to Top of PCB	Common (via pins 1 and 2)	Array or Edge Lit
Blank	9.5mm / not applicable	Common	Array
2	8.9 mm	Common	Array
3	7.8 mm	Separate	Array
4	7.8 mm	Common	Array
5	9.5 mm	Separate	Array
6	7 mm	Common	Array
7	7 mm	Separate	Array
8	6.4 mm	Common	Edge
9	6.4 mm	Separate	Edge
A	5.5 mm	Common	Edge
B	5.5 mm	Separate	Edge
D	6.0mm	Separate	Edge
E	5.0mm	Separate	Edge
F	4.7mm	Common	Edge
G	3.7mm	Separate	EL

10 = **T:** TN **S**: STN **B:** STN Blue **G:** STN Grey **F:** FSTN **F2:** FFSTN

11 = **P:** Positive **N**: Negative

12 = **R:** Reflective **M**: Transmissive **T:** Transflective

13 = **Backlight: Blank:** Reflective **L:** LED

14 = **Backlight Colour: Y:** Yellow-Green **W:** White **B:** Blue **R:** Red **A:** Amber **O:** Orange **G:** Green **RGB:** R.G.B.

15 = **Driver Chip: Blank:** Standard **I:** I²C **T:** Toshiba T6963C **A:** Avant SAP1024B **R:** Raio RA8835

16 = **Voltage Variant**: e.g. **3** = 3v

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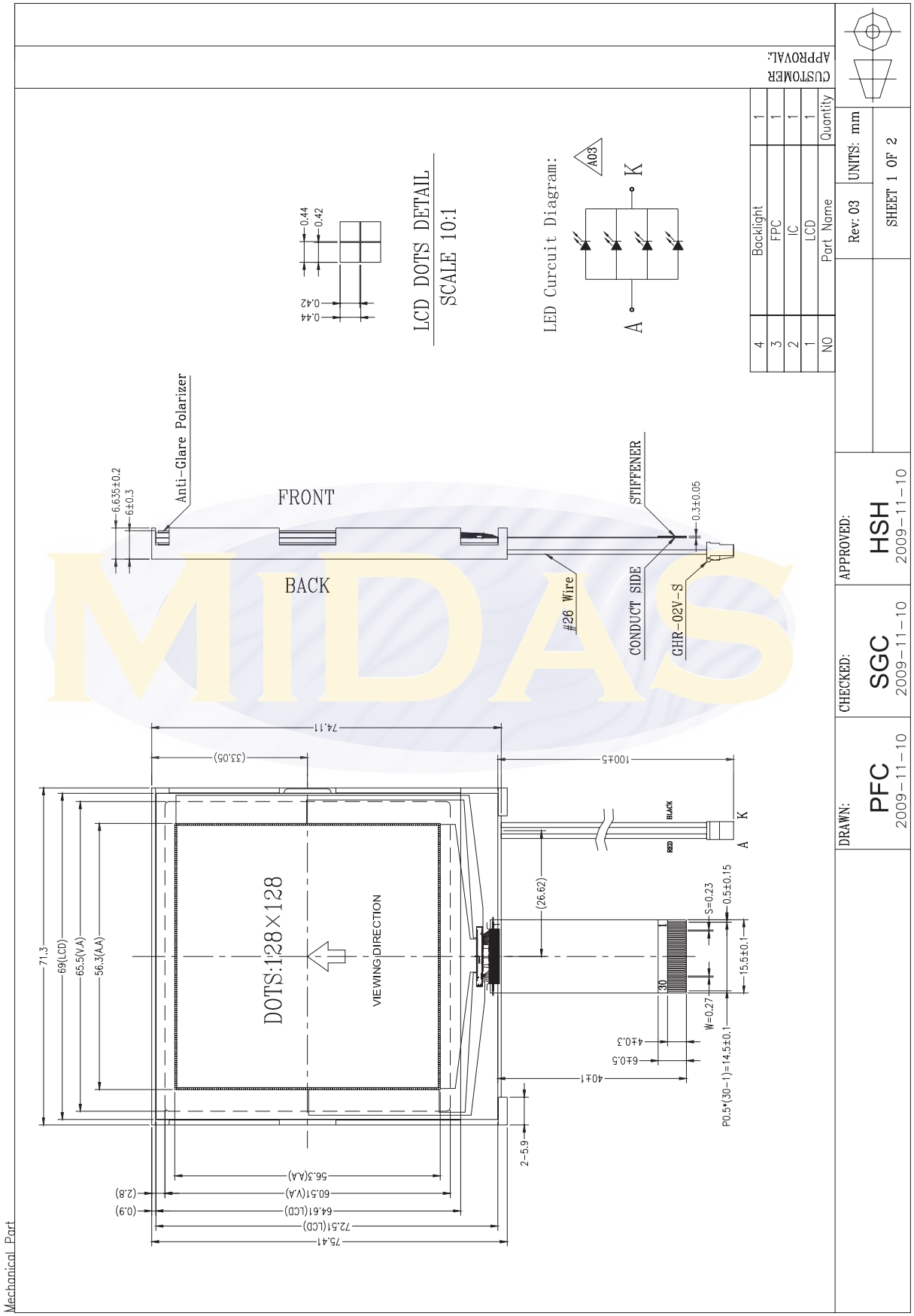
Revision History

Rev.	Comment	Date
A00	Original Version	2009-11-10

1 General Specifications

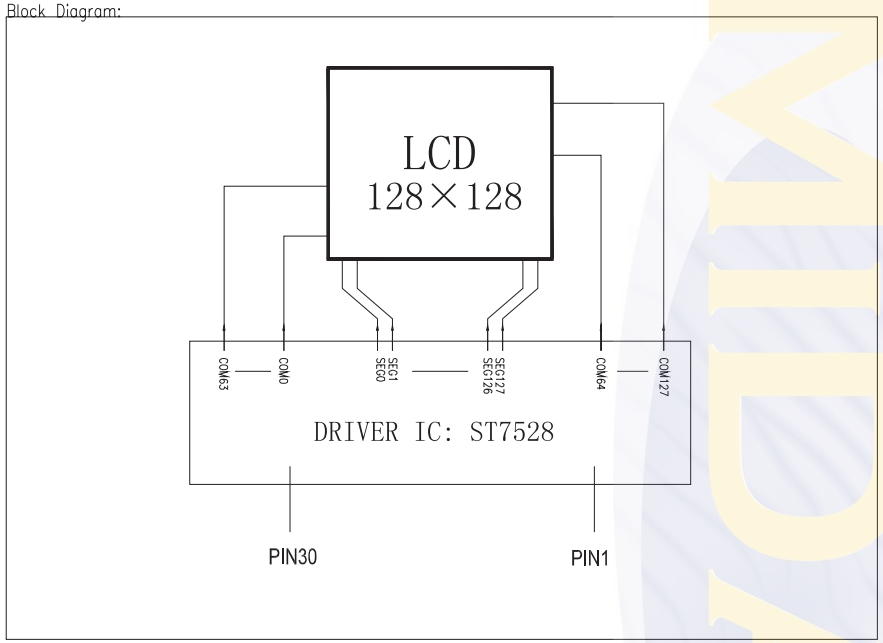
Item	☑Standard Value	Unit
Display Pattern	☑Graphic ☐Character ☐Segment ☐_____ ☐with ICON	
Color	☐Mono. ☑Grayscale ☐_____	
Module Dimension (W x H x T)	71.3（W）×173.41(H)×6.635（T）	mm
Viewing Area (W x H)	65.5×60.51	mm
Active Area (W x H)	56.3×56.3	mm
Character Size (W x H)	\	mm
Character Pitch (W x H)	\	mm
DOT Size (W x H)	0.42×0.42	mm
DOT Pitch (W x H)	0.44×0.44	mm
LCD Type	☐TN, Positive ☐TN, Negative ☐HTN, Positive ☐HTN, Negative	
	☐S TN, Yellow-Green ☐ STN, Gray ☐STN, Blue ☑FSTN, Positive ☐FSTN, Negative	
	☐_____ ☐FM LCD ☐Color STN	
Polarizer Type	☑Transflective ☐Transmissive ☐Reflective ☑Anti-Glare	
View Direction	☑6H ☐12H ☐____	
LCD Controller & Driver	NT7528	
LCD Driving Method	1/128duty, 1/12bias	
Interface Type	Serial ☑I^{2}C ☑4-line SPI ☑3-line SPI ☐____	
	Parallel ☑6800 ☑8080 ☐4-bit ☐_____	
Backlight Type	☑LED ☐Bottom ☑Single Side ☐Dual Side	
	☐_____ ☐EL ☐CCFL	
Backlight Color	☐Yellow-Green ☑White ☐Amber ☐Blue ☐Red ☐_____	
EL/CCFL Driver type	☐Build-in ☐External	
DC-DC Converter	☐Build-in ☐External	
Operation Temperature	T_{OPL} = -20 T_{OPH} = +70	°C
Storage Temperature	T_{STL} = -25 T_{STH} = +75	°C

2 Mechanical Diagram



Electrical Part

Block Diagram:



Pin Description:

PIN	Symbol
1	PS0
2	PS1
3	PS2
4	CSB
5	RST
6	A0
7	RW-WR
8	E-RD
9	DB0
10	DB1
11	DB2
12	DB3
13	DB4
14	DB5
15	DB6
16	DB7
17	VDD
18	VDD
19	VSS
20	VSS
21	VOUT-OUT
22	VOUT-IN
23	V4
24	V3
25	V2
26	V1
27	V0
28	VR
29	INTRS
30	NC

DISPLAY TYPE: FSTN,Transflective,Positive
VIEWING DIRECTION: 6:00
DRIVER IC: ST7528
LOGIC VOLTAGE: 3.0±0.3V
LCD DRIVE VOLTAGE(Vlcd): 13.5V
DRIVING METHOD: 1/128 DUTY, 1/12 BIAS
BACKLIGHT: 4-White LEDs
VLED=3.2±0.2V A03
ILED=45mA
OPERATING TEMPRATURE: -20° ~ +70°C
STORAGE TEMPRATURE: -25° ~ +75°C
INTERFACE CONNECTOR: FPC
All UNMARKED TOLERANCE: ±0.3mm

Revison History:
A03: Modify LED Curcuit Diagram.
A02: Modify ITO Layout.
A01: Modify Backlight and FPC interface.
A00: Original Edition

CUSTOMER APPROVAL:

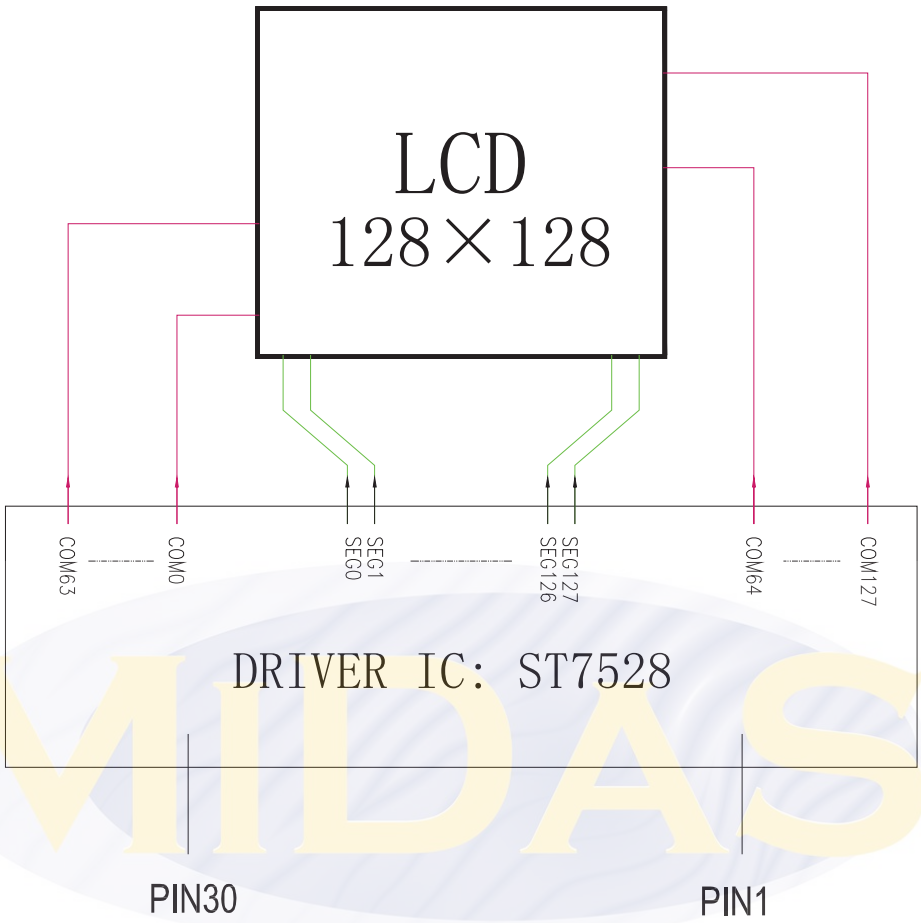
	DRAWN:	CHECKED:	APPROVED:		Rev: 03	UNITS: mm
	PFC 2009-11-10	YHW 2009-11-10	HSH 2009-11-10		SHEET 2 OF 2	

3 I/O Terminal

3.1 Pin Description

Pin NO.	Symbol	Function Description
1	PS0	Parallel / Serial data input select input
2	PS1	
3	PS2	
4	CSB	Chip select input pins
5	RST	Reset input pin
6	A0	Register select input pin
7	RW-WR	Read / Write execution control pin
8	E-RD	Read / Write execution control pin
9~16	D0~D7	8-bit bi-directional data bus
17~18	VDD	Power supply
19~20	VSS	Ground
21	VOUT-OUT	Supply Step-up output voltage
22	VOUT-IN	Voltage regulator Circuit Operating Voltage
23	V4	LCD driver supply voltages
24	V3	
25	V2	
26	V1	
27	V0	
28	VR	V0 voltage adjustment pin
29	INTRS	Internal resistor select pin
30	NC	Non connection

3.2 Block Diagram



4. Electro-optical Specifications

4.1 Absolute Maximum Ratings

No	Item	Symbol	Min.	Max.	Unit
1	Supply Voltage For Logic	V_{DD}	-0.5	3.6	V
2	Supply Voltage For LCD Driver	V_{LCD}	3.5	15	V
3	Input Voltage range	V_I	-0.5	V_{DD}+0.5	V

Note: (1) VDD and V_{LCD} are based on VSS = 0V.

(2 Operating Temperature and Storage Temperature can be found in *1.General Specifications.*

4.2 Optical Characteristics(1)

No	Item		Symbol	Condition	Min.	Typ.	Max.	Unit
1	Contrast Ratio		Cr	Ta=23±3°C V_{LCD} = Typ. (2)	-	3.96	-	-
2	Response time		Rise time	Ta=23±3°C	-	197	-	ms
3			Fall time		-	213	-	ms
4	Viewing Angle	3H	θ 3	Cr = 2 Ta=23±3 °C	-	23	-	Deg.
5		9H	θ 4		-	24	-	Deg.
6		6H	θ 1		-	31	-	Deg.
7		12H	θ 2		-	29	-	Deg.
8	Brightness		Lv	Ta=23±3°C V_{LCD} = Typ. (2)	-	TBD	-	cd/m2
6	Luminance uniformity		Lu		75	-	-	%

Note:

(1) See Appendix Definition of Optical Characteristics for detail.

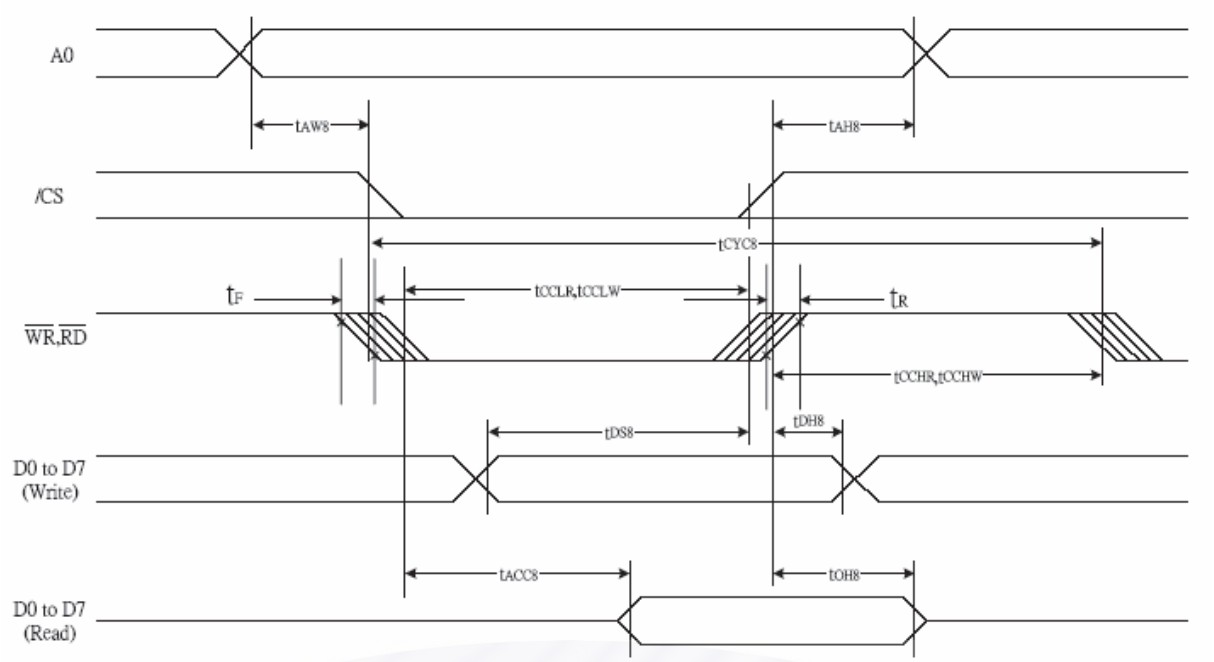
(2) V_{LCD} can be found in 4.2 Electrical Characteristics *Supply Voltage for LCD Driver*

4.3 Electrical Characteristics

No	Item	Symbol	Condition	Min.	Typ.	Max.	Unit
1	Supply Voltage for Logic	V_{DD}-V_{SS}	-	2.7	3.0	3.3	V
2	Supply Voltage for LCD Driver	V_{LCD}	Ta=23±3°C	13.3	13.5	13.7	V
3	Supply Current for Logic	I_{DD}	-….	-	-	TBD	mA
5	Input High Voltage	V_{IH}	-	0.7VDD	-	VDD	V
6	Input Low Voltage	V_{IL}	-	0	-	0.3VDD	V
7	Output High Voltage	V_{OH}	-	0.7VDD	-	VDD	V
8	Output Low Voltage	V_{OL}	-	0	-	0.3VDD	V
9	Supply Current for LED Backlight	I_{LED}	V_{LED} = Typ. Ta=23±3°C	-	45	-	mA
10	Supply Voltage for LED Backlight	V_{LED}	I_{LED} = Typ. Ta=23±3°C	3.0	3.2	3.4	V

4.4 Timing Characteristics

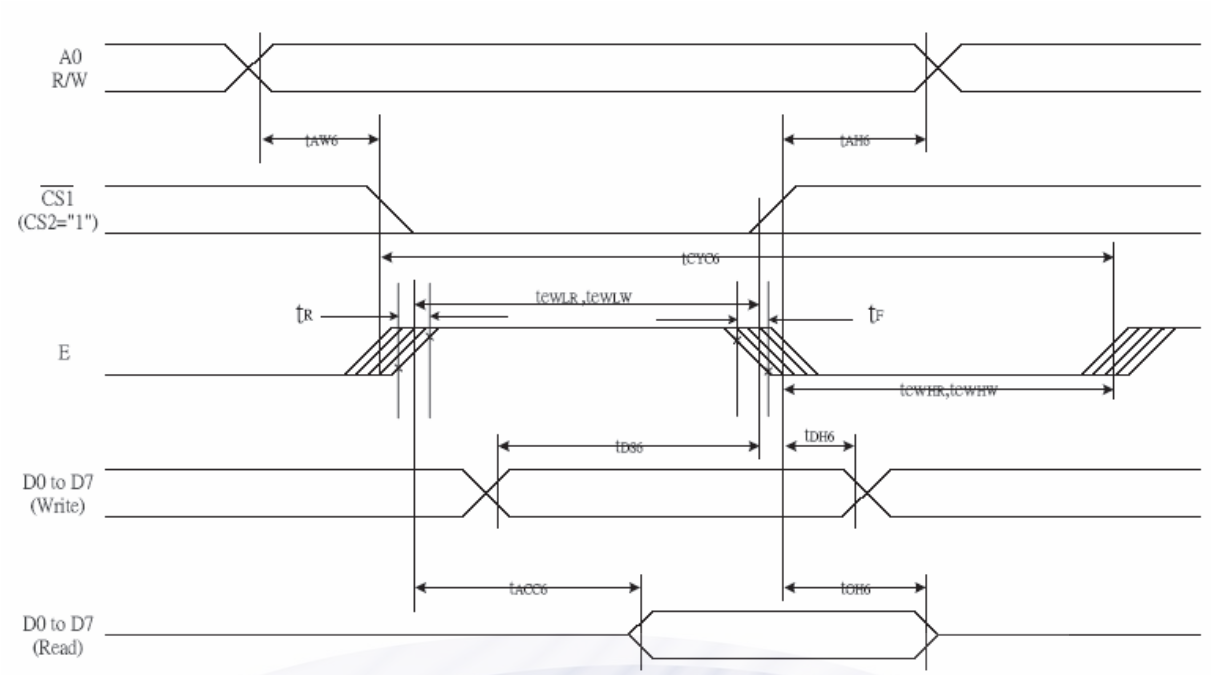
4.4.1 System Bus Read/Write Characteristics 1 (For the 8080 Series MPU)



(VDD = 3.3V , Ta =-30~85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH8		0	—	ns
Address setup time		tAW8		0	—	
System cycle time		tCYC8		240	—	
Enable L pulse width (WRITE)	WR	tCCLW		80	—	
Enable H pulse width (WRITE)		tCCHW		80	—	
Enable L pulse width (READ)	RD	tCCLR		140	—	
Enable H pulse width (READ)		tCCHR		80		
WRITE Data setup time	D0 to D7	tDS8		40	—	
WRITE Data hold time		tDH8		10	—	
READ access time		tACC8	CL = 100 pF	—	70	
READ Output disable time		tOH8	CL = 100 pF	5	50	
tF				—	10	
tR				—	10	

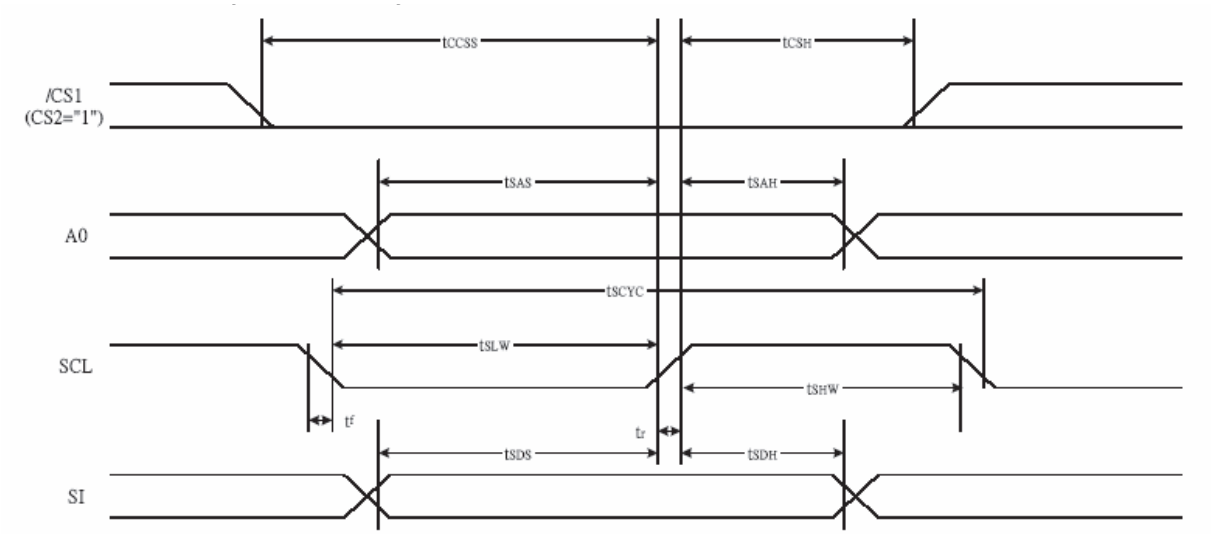
4.4.2 System Bus Read/Write Characteristics 1 (For the 6800 Series MPU)



(VDD = 3.3 V, Ta = -30~85°C)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	tAH6		0	—	ns
Address setup time		tAW6		0	—	
System cycle time		tCYC6		240	—	
Enable L pulse width (WRITE)	E_WR	tEWLW		80	—	
Enable H pulse width (WRITE)		tEWHW		80	—	
Enable L pulse width (READ)	E_RD	tEWLR		80	—	
Enable H pulse width (READ)		tEWHR		140		
WRITE Data setup time	D0 to D7	tDS6		40	—	
WRITE Data hold time		tDH6		10	—	
READ access time		tACC6	CL = 100 pF	—	70	
READ Output disable time		tOH6	CL = 100 pF	5	50	
tF				—	10	
tR				—	10	

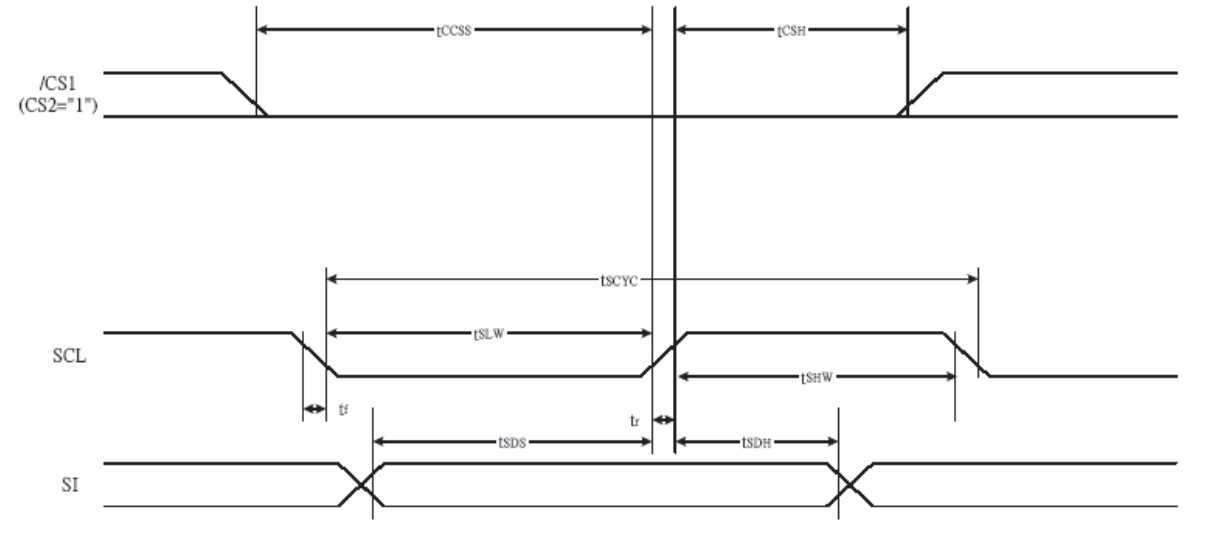
4.4.3 SERIAL INTERFACE (4-Line Interface)



(V_{DD}=3.3V,Ta=-30~85℃)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	tSCYC		50	—	ns
SCL “H” pulse width		tSHW		25	—	
SCL “L” pulse width		tSLW		25	—	
Address setup time	A0	tSAS		20	—	
Address hold time		tSAH		10	—	
Data setup time	SI	tSDS		20	—	
Data hold time		tSDH		10	—	
CS-SCL time	CSB	tCSS		20	—	
CS-SCL time		tCSH		40	—	

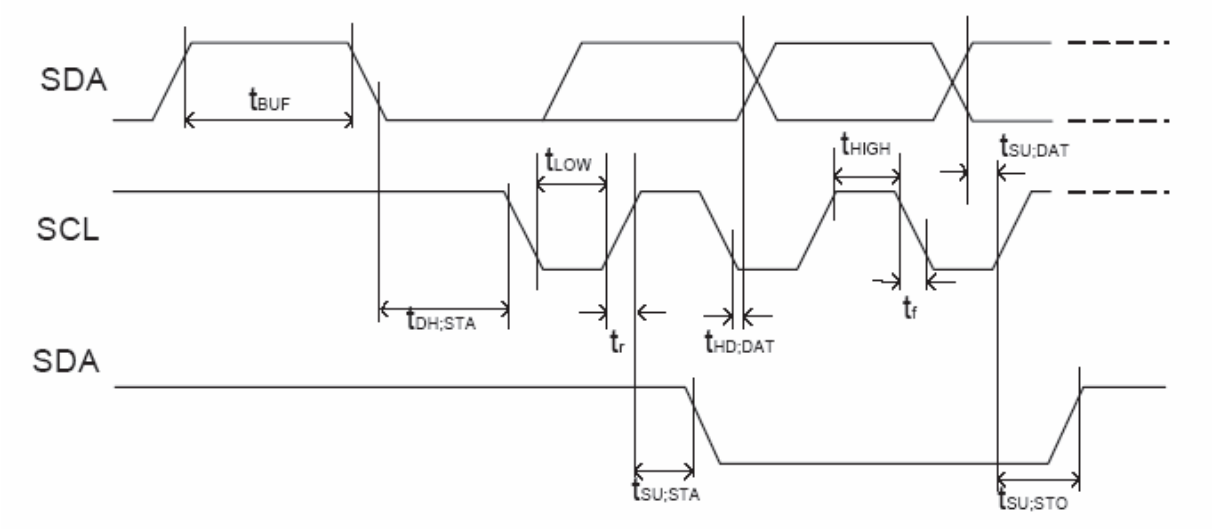
4.4.4 SERIAL INTERFACE(3-Line Interface)



(V_{DD}=3.3V,Ta=-30~85℃)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	tSCYC		50	—	ns
SCL “H” pulse width		tSHW		25	—	
SCL “L” pulse width		tSLW		25	—	
Data setup time	SI	tSDS		20	—	
Data hold time		tSDH		10	—	
CS-SCL time	CSB	tCSS		20	—	
CS-SCL time		tCSH		40	—	

4.4.5 SERIAL INTERFACE(IIC Interface)



(V_{DD}=3.3V,Ta=-30~85℃)

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
SCL clock frequency	SCL	FSCLK		-	400	kHZ
SCL clock low period	SCL	TLOW		1.3	-	us
SCL clock high period	SCL	THIGH		0.6	-	us
Data set-up time	SI	TSU;Data		100	-	ns
Data hold time	SI	THD;Data		0	0.9	us
SCL,SDA rise time	SCL	TR		20+0.1Cb	300	ns
SCL,SDA fall time	SCL	TF		20+0.1Cb	300	ns
Capacitive load represented by each bus line		Cb		-	400	pF
Setup time for a repeated START condition	SI	TSU;SUA		0.6	-	us
Start condition hold time	SI	THD;STA		0.6	-	us
Setup time for STOP ondition		TSU;STO		0.6	-	us
Tolerable spike width on bus		TSW		-	50	ns
BUS free time between a STOP and StART condition	SCL	TBUF		1.3		us

5 Programming

5.1 Instruction Table:

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
EXT=0 or 1											
Mode Set	0	0	0	0	1	1	1	0	0	0	2-byte instruction to set Mode and FR(Frame frequency control) BE(Booster efficiency control)
	0	0	FR3	FR2	FR1	FR0	0	BE	x'	EXT	
EXT=0											
Read display data	1	1	Read data								Read data into DDRAM
Write display data	1	0	Write data								Write data into DDRAM
Read status	0	1	BUSY	ON	RES	MF2	MF1	MF0	DS1	DS0	Read the internal status
ICON control register ON/OFF	0	0	1	0	1	0	0	0	1	ICON	ICON=0: ICON disable(default) ICON=1: ICON enable & set the page address to 16
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	Y9	Y8	Y7	Y6	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y5	Y4	Y3	Y2	Set column address LSB
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
Display ON/OFF	0	0	1	0	1	0	1	1	1	D	D=0: Display OFF D=1: Display ON
Set initial display line register	0	0	0	1	0	0	0	0	x'	x'	2-byte instruction to specify the initial display line to realize vertical scrolling
	0	0	x'	S6	S5	S4	S3	S2	S1	S0	
Set initial COM0 register	0	0	0	1	0	0	0	1	x'	x'	2-byte instruction to specify the initial COM0 to realize window scrolling
	0	0	x'	C6	C5	C4	C3	C2	C1	C0	
Select partial display line	0	0	0	1	0	0	1	0	x'	x'	2-byte instruction to set partial display duty ratio
	0	0	D7	D6	D5	D4	D3	D2	D1	D0	
Set N-line inversion	0	0	0	1	0	0	1	1	x'	x'	2-byte instruction to set N-line inversion register
	0	0	x'	x'	x'	N4	N3	N2	N1	N0	
Release N-line inversion	0	0	1	1	1	0	0	1	0	0	Release N-line inversion mode
Reverse display ON/OFF	0	0	1	0	1	0	0	1	1	REV	REV=0: normal display REV=1: reverse display
Entire display ON/OFF	0	0	1	0	1	0	0	1	0	EON	EON=0: normal display EON=1: entire display ON

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Ext=0											
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Select DC-DC step-up	0	0	0	1	1	0	0	1	DC1	DC0	Select the step-up of internal voltage converter
Select regulator register	0	0	0	0	1	0	0	R2	R1	R0	Select the internal resistance ratio of the regulator resistor
Select electronic volumn register	0	0	1	0	0	0	0	0	0	1	2-byte instruction to specify the reference voltage
	0	0	x'	x'	EV5	EV4	EV3	EV2	EV1	EV0	
Select LCD bias	0	0	0	1	0	1	0	B2	B1	B0	Select LCD bias
Set Bias Power Save Mode	0	0	1	1	1	1	0	0	1	1	Bias Power save Save the Bias current consumption
	0	0	0	0	0	0	0	0	0	0	
Release Bias Power Save Mode	0	0	1	1	1	1	0	0	1	1	Bias Power save release set the Bias power to normal
	0	0	0	0	0	0	0	1	0	0	
SHL select	0	0	1	1	0	0	SHL	x'	x'	x'	COM bi-directional selection SHL=0: normal direction SHL=1: reverse direction
ADC select	0	0	1	0	1	0	0	0	0	ADC	SEG bi-direction selection ADC=0: normal direction ADC=1: reverse direction
Oscillator on start	0	0	1	0	1	0	1	0	1	1	Start the built-in oscillator
Set power save mode	0	0	1	0	1	0	1	0	0	P	P=0: normal mode P=1: sleep mode
Release power save mode	0	0	1	1	1	0	0	0	0	1	release power save mode
Reset	0	0	1	1	1	0	0	0	1	0	initial the internal function
Set data direction & display data length(DDL)	x'	x'	1	1	1	0	1	0	0	0	2-byte instruction to specify the number of data bytes. (SPI mode)
	x'	x'	D7	D6	D5	D4	D3	D2	D1	D0	
Select FRC and PWM mode	0	0	1	0	0	1	0	FRC	PWM1	PWM0	FRC(1:3FRC, 0:4FRC) PWM1 PWM0 0 0 45PWM 0 1 45 PWM 1 0 60PWM 1 1 ---
NOP	0	0	1	1	1	0	0	0	1	1	*No operation*
Test Instruction	0	0	1	1	1	1	x'	x'	x'	x'	*Don't use this instruction*

Instruction	A0	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
EXT=1											
Set white mode and 1st frame,	0	0	1	0	0	0	0	0	0	0	Set white mode and 1st frame
set pulse width	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set white mode and 2nd frame,	0	0	1	0	0	0	0	0	0	1	Set white mode and 2nd frame
set pulse width	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set white mode and 3rd frame,	0	0	1	0	0	0	0	0	1	0	Set white mode and 3rd frame
set pulse width	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set white mode and 4th frame,	0	0	1	0	0	0	0	0	1	1	Set white mode and 4th frame
set pulse width	0	0	X'	X'	GA05	GA04	GA03	GA02	GA01	GA00	
Set gray level 1 mode	0	0	84H~87H (4 bytes)								Set gray level1
Set gray level 2 mode	0	0	88H~8BH (4 bytes)								Set gray level2
Set gray level 3 mode	0	0	8CH~8FH (4bytes)								Set gray level3
Set gray level 4 mode	0	0	90H~93H (4bytes)								Set gray level4
Set gray level 5 mode	0	0	94H~97H (4bytes)								Set gray level5
Set gray level 6 mode	0	0	98H~9BH (4 bytes)								Set gray level6
Set gray level 7 mode	0	0	9CH~9FH (4 bytes)								Set gray level7
Set gray level 8 mode	0	0	A0H~A3H (4 bytes)								Set gray level8
Set gray level 9 mode	0	0	A4H~A7H (4 bytes)								Set gray level9
Set gray level 10 mode	0	0	A8H~ABH (4 bytes)								Set gray level10
Set gray level 11mode	0	0	ACH~AFH (4 bytes)								Set gray level11
Set gray level 12 mode	0	0	B0H~B3H (4 bytes)								Set gray level12
Set gray level 13 mode	0	0	B4H~B7H (4 bytes)								Set gray level13
Set gray level 14 mode	0	0	B8H~BBH (4 bytes)								Set gray level14
Set Dark mode and 1st frame,	0	0	1	0	1	1	1	1	0	0	Set Dark mode and 1st frame, set pulse width
set pulse width	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	
Set Dark mode and 2nd frame,	0	0	1	0	1	1	1	1	0	1	Set Dark mode and 2nd frame, set pulse width
set pulse width	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	
Set Dark mode and 3rd frame,	0	0	1	0	1	1	1	1	1	0	Set Dark mode and 3rd frame, set pulse width
set pulse width	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	
Set Dark mode and 4th frame,	0	0	1	0	1	1	1	1	1	1	Set Dark mode and 4th frame, set pulse width
set pulse width	0	0	X'	X'	GAF5	GAF4	GAF3	GAF2	GAF1	GAF0	

Appendix

1 Packing Method （TBD）

□Method 1

ESD Bag + Product Box + Plastic Bag + Carton

1. Quantity

QUANTITY	UNIT
	PCS / ESD Bag
	PCS / Box
	Box / Carton
	PCS / Carton

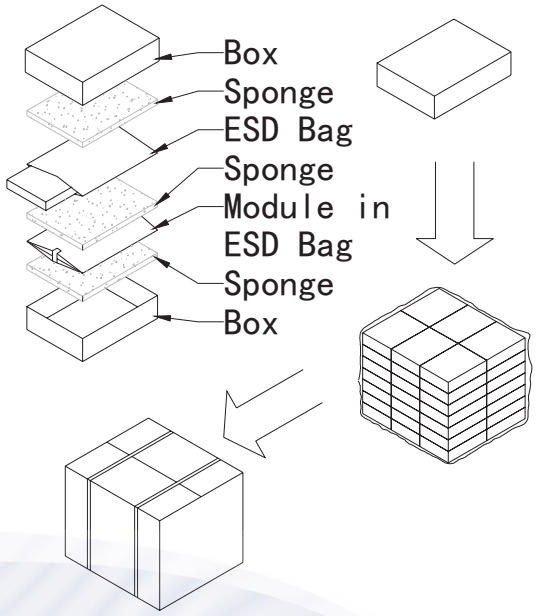
2. Material

Material	Size (LXWXH) mm
ESD Bag	
Product Box	
Carton	

3. Label

PRODUCT ID:
PART NO:
QUANTITY:
GROSS WEIGHT:
MEASUREMENTS:

4. Packing Method



Note: see *table 1. Quantity* for detail.

☑Method 2

ESD Tray + Plastic Bag + Carton

1. Quantity

QUANTITY	UNIT
	PCS / Tray
	Tray / Carton
	PCS / Carton

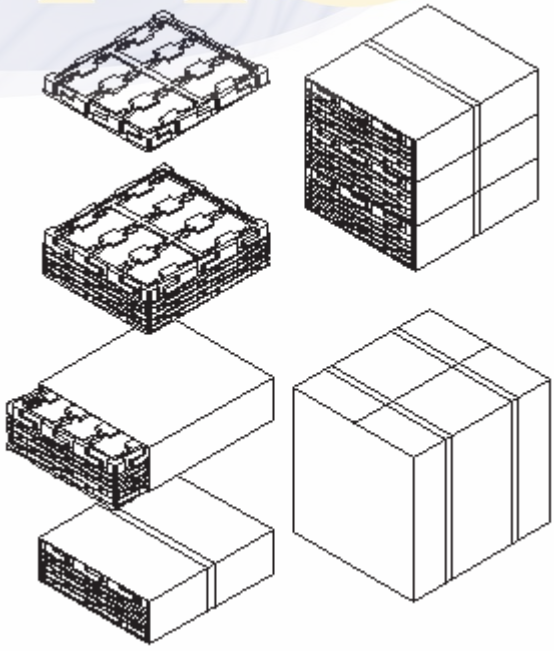
2. Material

Material	Size (LXWXH) mm
ESD Tray	
Carton	

3. Label

PRODUCT ID:
PART NO:
QUANTITY:
GROSS WEIGHT:
MEASUREMENTS:

4. Packing Method



Note: see *table 1. Quantity* for detail.

Note:

2 Definitions of Optical Characteristic

2.1 Contrast Ratio Test

A) Contrast ratio is calculated by the following formula when the output voltage is obtained from the electro-optical test system.

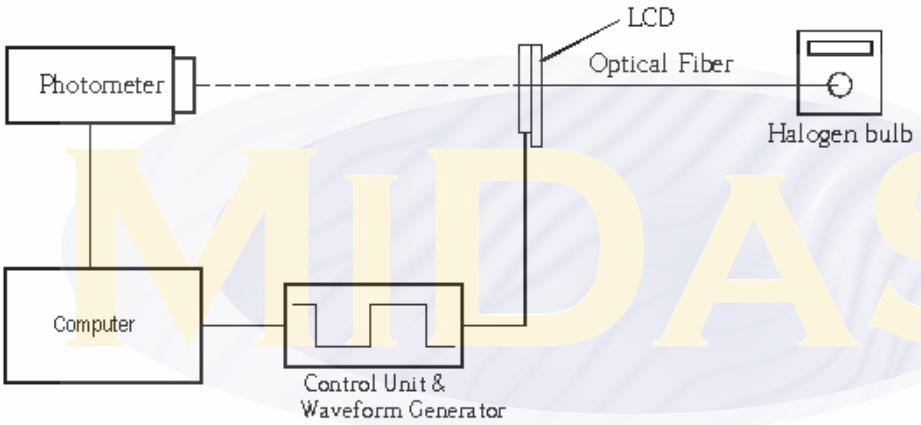
B) Test Condition: Accord to the LCD's driving method and operating voltage (V_{LCD}).

C) Formula:

$$\frac{Contrast\ \ Ratio}{(Positive\ \ type)} = \frac{Photometer\ \ output\ \ voltage\ \ when\ \ non-select\ \ waveform\ \ is\ \ applying}{Photometer\ \ output\ \ voltage\ \ when\ \ select\ \ waveform\ \ is\ \ applying}$$

$$\frac{Contrast\ \ Ratio}{(Negative\ \ type)} = \frac{Photometer\ \ output\ \ voltage\ \ when\ \ select\ \ waveform\ \ is\ \ applying}{Photometer\ \ output\ \ voltage\ \ when\ \ non-select\ \ waveform\ \ is\ \ applying}$$

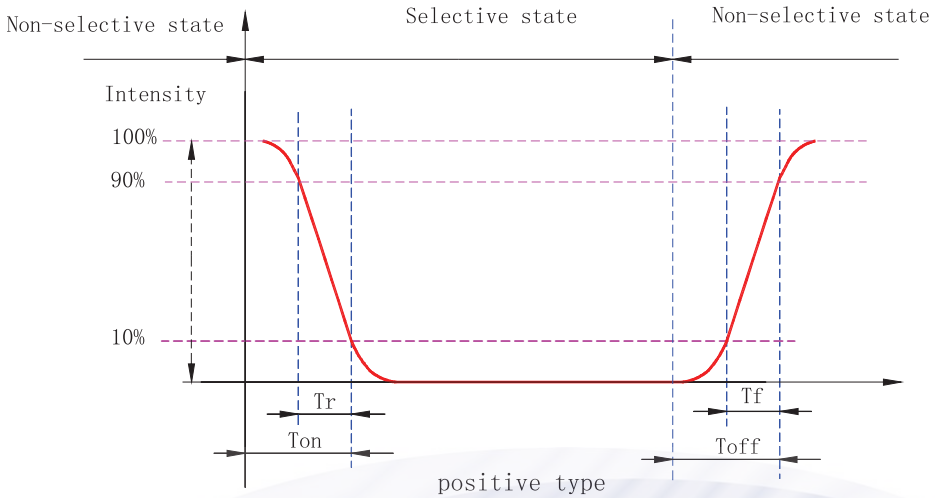
D) Test system:



2.2 Response time

2.2.1 Positive type

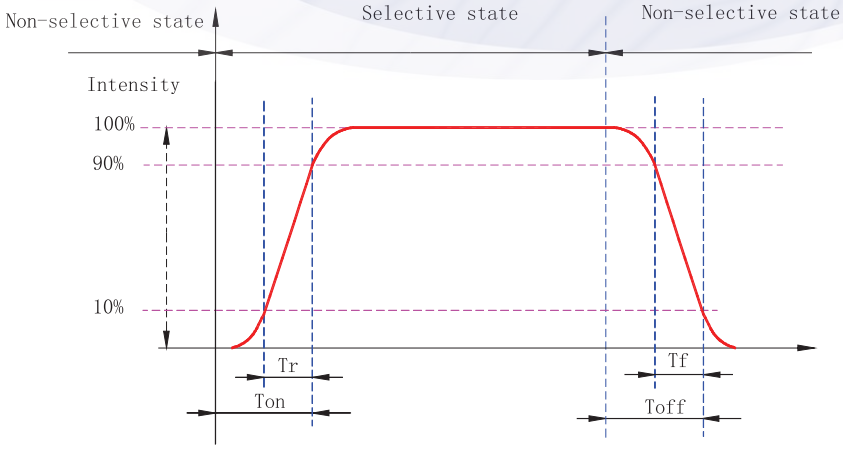
A) Rise time is defined as the time required for the transmission to change from 90% to 10%.
B) Fall time is defined as the time required for the transmission to change from 10% to 90%.
C) On time is defined as the time required for the transmission to change from 100% to 10%.
D) Off time is defined as the time required for the transmission to change from 0% to 90%.



positive type

2.2.2 Negative type

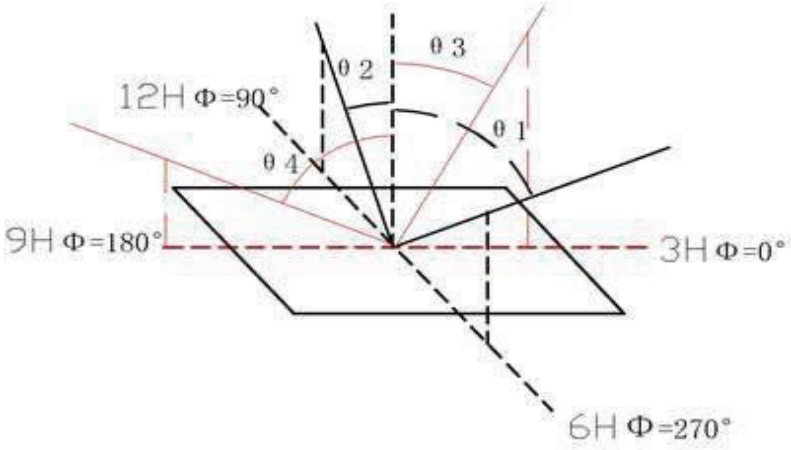
A) Rise time is defined as the time required for the transmission to change from 10% to 90%.
B) Fall time is defined as the time required for the transmission to change from 90% to 10%.
C) On time is defined as the time required for the transmission to change from 0% to 90%.
D) Off time is defined as the time required for the transmission to change from 100% to 10%.



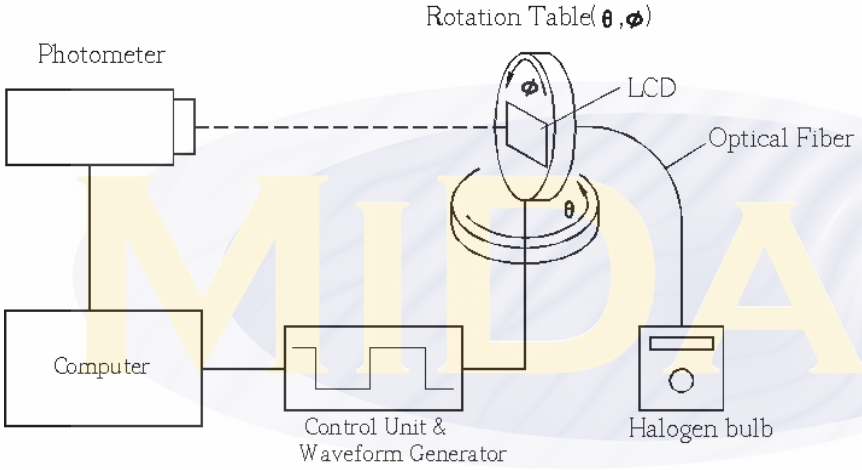
negative type

2.3 Viewing Angle

A) Viewing angle is definition



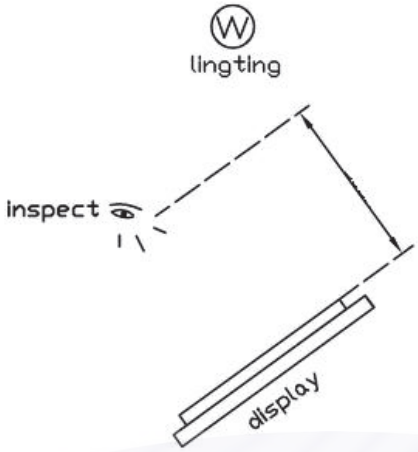
B) System Block Diagram



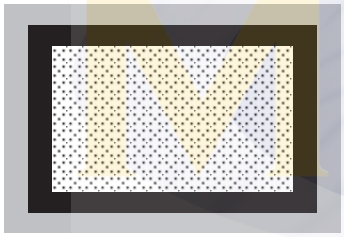
3 Quality Units

3.1 Visual and Technological Inspection

- Inspection direction should be perpendicular to LCD surface;
- Inspection should be performed under the condition of 20~40W fluorescent lamp;
- The distance between inspector's eyes & product surface should be 30cm~50cm when inspection.



Definition of LCD area



A: Active Area

B: Viewing Area

C: Invisible Area (It is invisible after assembly; any defects in this area should be ignored.)

3.2 Sampling Plan

3.2.1 Sampling Method

According to GB2828.1-2003 (Equivalent to MIL-STD-105/E) General inspection level II.

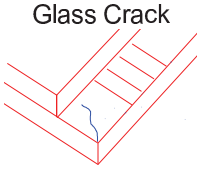
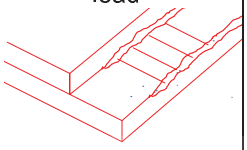
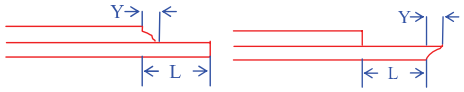
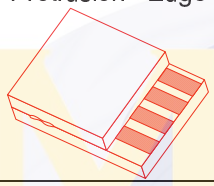
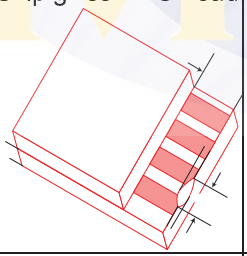
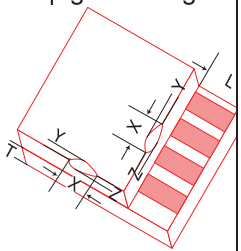
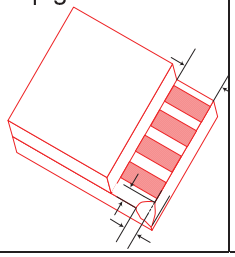
3.2.2 AQL Definition

Major: AQL=0.65 (Please refer to the definition in "5. Inspection Criteria")

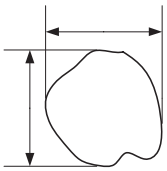
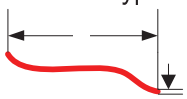
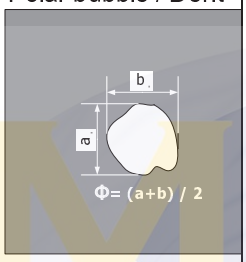
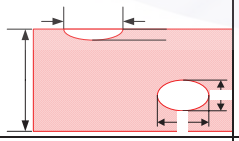
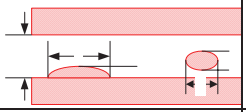
Minor: AQL=1.0 (Please refer to the definition in "5. Inspection Criteria")

4 Inspection Criteria

4.1 Appearance Criteria (Not energized)

<table>
<tr><th>NO.</th><th>Defect Name & Illustration</th><th>Criteria</th><th>Class</th></tr>
<tr><td>4.1.1</td><td>Light Leakage</td><td>Not allowed</td><td>Major</td></tr>
<tr><td>4.1.2</td><td>Vacuum Bubble</td><td>Not allowed</td><td>Major</td></tr>
<tr><td>4.1.3</td><td>Rainbow</td><td>According to Limit Sample</td><td>Minor</td></tr>
<tr><td>4.1.4</td><td>Glass Crack
  </td><td>Not allowed</td><td>Minor</td></tr>
<tr><td>4.1.5</td><td>Protrusion - ITO lead
  </td><td> 
Y≤L/4, allowed quantity:2</td><td>Minor</td></tr>
<tr><td>4.1.6</td><td>Protrusion - Edge
  </td><td>Allowed if protrusion didn’t affect dimension.</td><td>Minor</td></tr>
<tr><td>4.1.7</td><td>Chip glass - ITO Lead
  </td><td>Unit: mm<table><tr><th>X</th><th>Y</th><th>Z</th><th>Allowed Qty.</th></tr><tr><td>Random</td><td>≤0.5. if L/3>0.5</td><td>≤T/2</td><td>NC[1]</td></tr><tr><td>≤4.0</td><td>≤L/3</td><td>≤T</td><td>3</td></tr></table></td><td>Minor</td></tr>
<tr><td>4.1.8</td><td>Chip glass - Edge
  </td><td>Unit: mm<table><tr><th>X</th><th>Y*</th><th>Z</th><th>Allowed Qty.</th></tr><tr><td>Random</td><td>≤1.5, if L/3>1.5</td><td>≤T/2</td><td>NC</td></tr><tr><td>≤5.0</td><td>≤1.5</td><td>≤T</td><td>3</td></tr><tr><td>Random</td><td>≤0.5</td><td>≤T/2</td><td>NC</td></tr></table>Remark: Y didn’t reach A area & 1/3 seal line.</td><td>Minor</td></tr>
<tr><td>4.1.9</td><td>Chip glass - Corner
  </td><td>Unit: mm<table><tr><th>X</th><th>Y</th><th>Z</th><th>Allowed Qty.</th></tr><tr><td>≤4</td><td>≤L</td><td>≤T</td><td>2</td></tr></table>Remark: If X reach ITO lead, according to the criteria of “4.1.7”.</td><td>Minor</td></tr>
</table>

[1] NC = Not Count

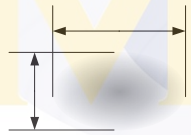
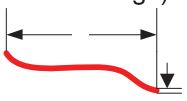
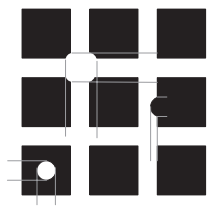
<table>
<tr><td>4.1.10</td><td>Circular type
  </td><td>Suppose S[2]= The area of A, the criteria in A&B is as below,
<table><tr><td>S (cm²)
Φ (mm)</td><td>S≤4</td><td>4<S≤12</td><td>12<S≤50</td><td>50<S≤150</td><td>S>150</td></tr><tr><td>Φ≤0.10</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.10<Φ≤0.20</td><td>1</td><td>2</td><td>2</td><td>3</td><td>3</td></tr><tr><td>0.20<Φ≤0.30</td><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td></tr><tr><td>Φ>0.30</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Remark: Bubble, dirt spot, concavo-convex spot & stab spot should be regarded as circular defect.
Maximum defect number in 1cm2 is 1.
Please refer to footmark for the conversion between S & Diagonal.</td><td>Minor</td></tr>
<tr><td>4.1.11</td><td>Linear type
  </td><td>Suppose S= The area of A, the criteria in A&B is as below,
<table><tr><td>S (cm²)
a&b (mm)</td><td>S≤4</td><td>4<S≤12</td><td>12<S≤50</td><td>50<S≤150</td><td>S>150</td></tr><tr><td>a≤0.03</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.03<a≤0.05, b≤3</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>a>0.05</td><td colspan="5">According to the criteria of <4.1.10></td></tr></table>Remark: Linear scratch, dirt line should be regarded as linear defect.
Maximum defect number in 1cm2 is 1.</td><td>Minor</td></tr>
<tr><td>4.1.12</td><td>Polar bubble / Dent
  </td><td>Suppose S= The area of A, the criteria in A&B is as below,
<table><tr><td>S (cm²)
Φ (mm)</td><td>S≤4</td><td>4<S≤12</td><td>12<S≤50</td><td>50<S≤150</td><td>S>150</td></tr><tr><td>Φ≤0.15</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td><td>NC</td></tr><tr><td>0.15<Φ≤0.25</td><td>1</td><td>2</td><td>2</td><td>3</td><td>3</td></tr><tr><td>0.25<Φ≤0.35</td><td>1</td><td>1</td><td>2</td><td>2</td><td>3</td></tr><tr><td>Φ>0.35</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>Remark: Maximum defect number in 1cm2 is 1.</td><td>Minor</td></tr>
<tr><td>4.1.13</td><td>Polarizer Stab</td><td>According to the criteria of <5.1.10></td><td>Minor</td></tr>
<tr><td>4.1.14</td><td>Polarizer Scratch</td><td>According to the criteria of <5.1.11></td><td>Minor</td></tr>
<tr><td>4.1.15</td><td>FPC Pinhole
  </td><td><table><tr><td>a</td><td>b</td><td>Allowed Qty.</td></tr><tr><td>≤W/3</td><td>≤W</td><td>NC</td></tr><tr><td>>W/3</td><td>>W</td><td>Not allowed</td></tr></table></td><td>Minor</td></tr>
<tr><td>4.1.16</td><td>FPC Copper Residue
  </td><td><table><tr><td>a</td><td>b</td><td>Allowed Qty.</td></tr><tr><td>≤W/3</td><td>≤W</td><td>NC</td></tr><tr><td>>W/3</td><td>>W</td><td>Not allowed</td></tr></table></td><td>Minor</td></tr>
<tr><td>4.1.17</td><td>FPC Impress / Crease</td><td><table><tr><td>Shape</td><td>Allowed Qty.</td></tr><tr><td>Moulage / Impress</td><td>NC</td></tr><tr><td>Crease with a sharp angle</td><td>Not allowed</td></tr></table></td><td>Minor</td></tr>
</table>

[2] Suppose Length:Width = 4:3, The conversion between S & diagonal length is as below table,

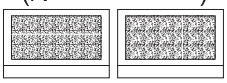
S (cm²)	Diagonal Length (Inch)
4	1.13
12	1.95
50	3.99
150	6.91

4.1.18	Soldering defect	Accroding to the criteria of IPC-A-610C	Minor
4.1.19	TP [3] : black/white spot	According to the criteria of <4.1.10>	Minor
4.1.20	TP: Dent	According to the criteria of <4.1.12>	Minor
4.1.21	TP: Scratch	According to the criteria of <4.1.11>	Minor
4.1.22	TP: Newton Ring 	13.1 Regular shape Newton ring area ≤ 1/3 Total display area，Neglect。 Newton ring area > 1/3 Total display area，NG。 13.2 Irregular shape Newton ring area ≤ 1/2 Total display area，Neglect。 Newton ring area > 1/2 Total display area，NG。 Remark: If Newton ring caused pattern distortion, NG.	Minor

4.2 Defect when display (Energized)

NO.	Defect Name & Illustration	Criteria	Class
4.2.1	Circular type when display (Not change along with voltage)	According to the criteria of <4.1.10>	Minor
4.2.2	Circular type when display (Change along with voltage) 	Suppose S= The area of A, the criteria in A&B is as below, S (cm²) / Φ (mm): S≤4 | 4<S≤12 | 12<S≤50 | 50<S≤150 | S>150 Φ≤0.30: NC | NC | NC | NC | NC 0.30<Φ≤0.50: 1 | 2 | 2 | 3 | 3 0.50<Φ≤0.80: 1 | 1 | 2 | 2 | 3 Φ>0.80: 0 | 0 | 0 | 0 | 0 Remark: Maximum defect number in 1cm2 is 1.	Minor
4.2.3	Linear type when display (Not change along with voltage)	According to the criteria of <4.1.1>	Minor
4.2.4	Linear type when display (Change along with voltage) 	Suppose S= The area of A, the criteria in A&B is as below, S (cm²) / a&b (mm): S≤4 | 4<S≤12 | 12<S≤50 | 50<S≤150 | S>150 a≤0.05: NC | NC | NC | NC | NC 0.05<a≤0.10, b≤5: 2 | 3 | 4 | 5 | 6 a>0.10: According to the criteria of <4.2.2> Remark: Maximum defect number in 1cm2 is 1.	Minor
4.2.5	Pinhole 	Suppose S= The area of A, the criteria in A&B is as below, S (cm²) / Φ (mm): S≤4 | 4<S≤12 | 12<S≤50 | 50<S≤150 | S>150 Φ≤0.10: NC | NC | NC | NC | NC 0.10<Φ≤0.15: 1 | 2 | 2 | 3 | 3 0.15<Φ≤0.25: 1 | 1 | 2 | 2 | 3 Φ>0.25: 0 | 0 | 0 | 0 | 0 Remark: Maximum defect number in 1cm2 is 1.	Major

[3] TP=Touch Panel

4.2.6	Segment Distortion	More than 1/5 size in spec is not allowed.	Major
4.2.7	Missing Segment (Row or column) 	Not allowed	Major
4.2.8	Abnormal Display	Not allowed	Major
4.2.9	Display inhomogeneity / CR inhomogeneity	According to the approved sample by both sides	Minor
4.2.10	Too much current	Not allowed	Major
4.2.11	No display	Not allowed	Major
4.2.12	No backlight / flicking	Not allowed	Major

5 Caution for using

5.1 Recommended storage condition: 50~60%RH, 25+/-5℃;

5.2 Avoid direct sunlight. Avoid operating or storage under the temperature which exceeds the standard for a long time;

5.3 Avoid driving LCD with DC (Direct Current);

5.4 LCD was made of glass, please avoid any impact or pressure on surface;

5.5 If the skin contact with liquid crystal incautiously, wash with water for more than 15 minutes. If you feel uncomfortable, please see the doctor immediately;

5.6 It is prohibited to clean polarizer by ethanol or acetone. Clean polarizer by pure water is recommended;

5.7 The products should be used within 6 month. Otherwise, the ITO pad and FPC pad maybe be oxidized and cause poor contact, etc.;

5.8 ESD: TFT module or COG module is sensitive to ESD, effective action should be taken before you touch the products;

5.9 Avoid contacting the ITO pad by hand and pressing the surface of the LCD. Please take the both sides when you fetch the LCD.

6 Reliability-TEST

6.1. Standard Specifications for Reliability

6.1-1Test method

There should be no existing conspicuous failure of functions and appearance in LCD after the following tests.

NO	Item	Description
1	Low Temperature Operating	The sample should be allowed to stand at (-20±2)℃ for 96 Hours under driving condition.
2	High Temperature Operating	The sample should be allowed to stand at (+70±2)℃ for 96 Hours under driving condition.
3	Low Temperature Storage	The sample should be allowed to stand at (-25±3)℃ for 96 Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours
4	High Temperature Storage	The sample should be allowed to stand at (+75±2)℃ for 96Hours under no-load condition, and then returning it to normal temperature condition, and allowing it stand for 24 hours
5	Moisture resistance	The sample should be allowed to stand at (40±2)℃, (95±2)%RH for 96Hours under no-load condition excluding the polarizer, then taking it out and drying it at normal temperature, and allowing it stand for 24 hours

Note:

T_{STL}: Lowest Storage Operation Temperature.

T_{STH}: Lowest Storage Temperature.

6.1-2 Testing Conditions and Inspection Criteria:

For the final test, the testing sample must be stored at room temperature for 24 hours, after the tests listed above; Standard specifications for Reliability have been executed in order to ensure stability.

NO	Item	Inspection Criteria
1	Current Consumption	The current consumption should be under double of initial test.
2	Contrast	The contrast must be larger than half of initial test.
3	Appearance	Appearance defects should not happen.

6.2 Life Time

Functions, performance, appearance, etc. shall be free from remarkable deterioration within 50,000 hours under ordinary operating and storage conditions room temperature (25±10°C), normal humidity (45±20%RH), and in area not exposed to direct sunlight.