




DOT MATRIX LIQUID CRYSTAL DISPLAY MODULE

COMPANY NAME : Mc'Tronic

USER 'MANUAL

SO24080A1 Serial

LCD Module Description: SOS24080A1JEW01

PROPOSED BY		APPROVED
Design	Approved	
		

Sample Delivery Date:2017.04.17

SDEC TECHNOLOGY CORP.

***ADDRESS: 10F, No. 98, Shing De Rd., Sanchong Dist. 241
New Taipei City, Taiwan R.O.C.***

TEL: 886-2-2999-2512/886-2-8512-1288

FAX: 886-2-2999-2510/886-2-8512-2828

EMAIL:sdec8405@ms6.hinet.net/sdec@sdec.com.tw

<http://www.sdec.com.tw>





LCM SAMPLE APPROVAL

(液晶顯示模組樣品確認書)

1 · PART A: FILLED BY SDEC TECH (由 SDEC 填寫)

1) COMPANY NAME (客戶名稱) : Mc'Tronic

2) SDEC ITEM NO. (產品型號) : SOS24080A1JEW01

3) CUSTOMER ITEM NO. (客戶產品型號) : _____

4) LCM Function (LCM 內容) :

A	LCD TYPE (LCD 種類) : <input type="checkbox"/> TN, <input type="checkbox"/> HTN, <input checked="" type="checkbox"/> STN, <input type="checkbox"/> FSTN (<input type="checkbox"/> POSITIVE/正向, <input checked="" type="checkbox"/> NEGATIVE/反向, <input type="checkbox"/> BLACK MASK/內黑絲印)
B	VIEWING AREA (視角方向) : <input type="checkbox"/> 3H, <input checked="" type="checkbox"/> 6H, <input type="checkbox"/> 9H, <input type="checkbox"/> 12H
C	POLARIZER COLOR (偏光板顏色) : <input type="checkbox"/> GRAY/灰色, <input type="checkbox"/> YELLOW GREEN/黃綠色, <input checked="" type="checkbox"/> BLUE/藍色, <input type="checkbox"/> BLACK/黑色
D	BACKLIGHT COLOR (背光顏色) : <input type="checkbox"/> YELLOW GREEN/黃綠光, <input type="checkbox"/> ORANGE/橘光 <input type="checkbox"/> RED/紅光, <input type="checkbox"/> BLUE/藍光, <input type="checkbox"/> GREEN/翠綠光, <input checked="" type="checkbox"/> WHITE/白光
E	TEMPERATURE (溫度) : <input type="checkbox"/> NORMAL/常溫, <input checked="" type="checkbox"/> WIDE/廣溫
F	CONTROL IC (控制 IC) : ST7529

SAMPLE DELIVERY DATE (出樣日期) : 2017.04.17

2 · PART B: FILLED BY CUSTOMER (請客戶填寫)

CHECK LIST ITEMS (檢查項目) :	OK	NG	REASON (原因)
1).LCM SIZE AND THICKNESS:(LCM 尺寸及厚度):	<input type="checkbox"/>	<input type="checkbox"/>	_____
2).POLARIZER COLOR : (偏光板色澤) :	<input type="checkbox"/>	<input type="checkbox"/>	_____
3).ELECTRO CHARACTERISTIC : (電氣特性) :	<input type="checkbox"/>	<input type="checkbox"/>	_____
4).VIEWING AREA (視角範圍) :	<input type="checkbox"/>	<input type="checkbox"/>	_____
5).BACKLIGHT ILLIMINATION (背光亮亮度) :	<input type="checkbox"/>	<input type="checkbox"/>	_____
6).TEMPERATURE RANGE (溫度範圍) :	<input type="checkbox"/>	<input type="checkbox"/>	_____

APPROVED BY (批准) :

DATE OF APPROVAL (批准日期) :



REVISION RECORD

Revision	Page	Contents
2010.05		First Release Version
2012.06.08	2	Sample Delivery Date
2013.06A		Change LCD supplier
	2	Item No: SOS24080A1JEW00 Change to SOS24080A1JEW01
	7	Fixed supply Voltage For LCD Symbol, Condition and Voltage Rating.
2013.08.07	2	New Sample Delivery Date
2017.04.17	2	New Sample Delivery Date

SDEC LCD Module Numbering System

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S	C	S		040		04		A0		H	L	T	1	0
S	G	F		320		24		A0		J	C	W	1	0
S	D	H		007		08		A0		B	N	N	0	0

Numbering System			Code Value	Description	Remark
1	Company	S	S	Company name abbreviated	SDEC CO.,LTD
2	LCM type	G	B C G O T S D	B:Big Character C:Character G:Graphic O:COG T:TAB S:Seven Segment D:Customer Design	LCM type
3	LCD type	S	T H S F D R M V A L	TN type LCD HTN type LCD STN type LCD FSTN type LCD DFSTN type LCD Color TN / Color STN TFT LCD VFD VATN OLED	LCD type
4,5,6	Row dots number Characters per line Year	128	122,128,240,320... 008,016,020,040... 006,007...	Row dots number Characters per line Year	Graphic Character Seven Segment
7,8	Column dots number Lines Month	64	32,64,128,240... 01,02,04... 01,02..12	Column dots number Lines Month	Graphic Character Seven Segment
9,10	LCD module serial number	A0	A0~ZZ	LCD module serial number	Ux -> USB Port Interface Sx -> Series Port Interface Rx -> RS-232 Port Interface
11	Polarizer Color & Viewing angle type	I	A B C D E F G H I J K L M	Gray Mode/3:00view Gray Mode/6:00view Gray Mode/9:00view Gray Mode/12:00view Yellow Green Mode/3:00view Yellow Green Mode/6:00view Yellow Green Mode/9:00view Yellow Green Mode/12:00view Negative type/3:00view Negative type/6:00view Negative type/9:00view Negative type/12:00view Other	Polarizer Color & Viewing angle type
12	Backlight type	L	N L E C F	Without backlight Array LED Edge LED C.C.F.L EL	Backlight type
13	Backlight color (VFD color)	Y	N O A B G R Y W P D T	Without backlight Orange Amber Blue Green Red Yellow-green White White(Patent) Double Color(Y-G&R) R G B	Backlight color
14	Font Code Type	0	0 1 2 3 A B C F U Z	No Font Table English-Japanese Font Code English-Europe Font Code English-Russian Font Code BIG-5 Chinese Font Code GB Chinese Font Code ST7920-0C Font Code ST7920-0F Font code (Korean) Unicode Other Font Code	Font Table Code Type
15	Series Code	0	0~Z		Series Code

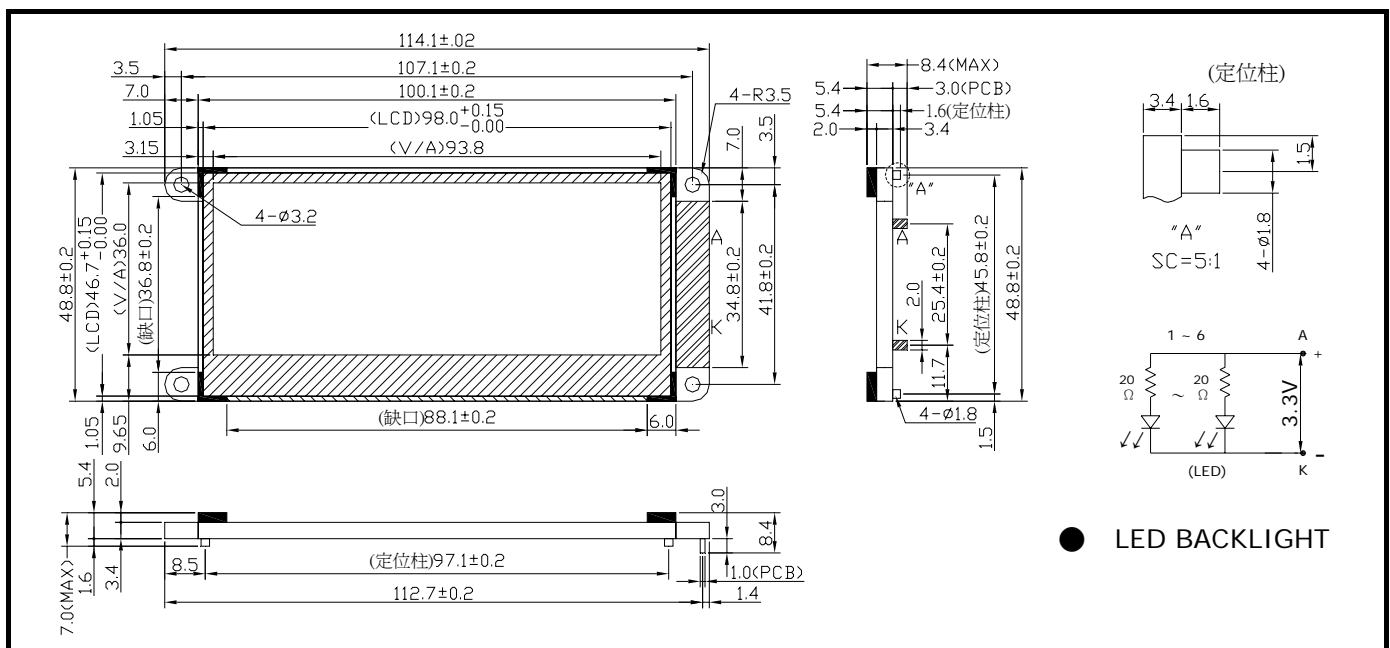
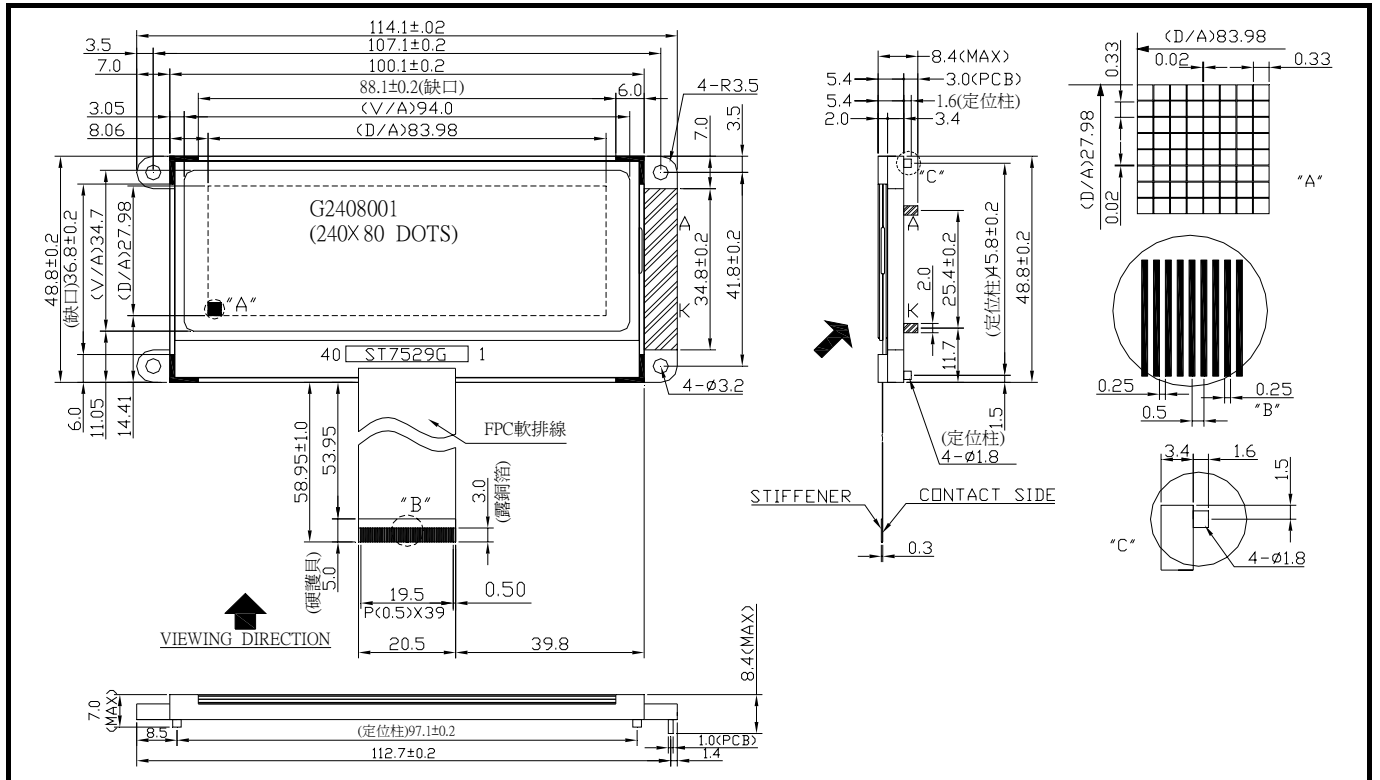
CONTENTS

	PAGE
● LCM Sample Approval	2
● REVISION RECORD	3
● LCD Module Number System	4
1. Mechanical Specification	6
2. Mechanical Diagram	6
3. Interface Pin Connections	7
4. Black And Power Supper Diagram	7
5. Environmental absolute maximum Ratings	7
6. Electrical Characteristics	7
7. Optical Characteristics	7
8. Optical Definitions	7
9. Timing Control	8
10. Application Circuit	8
11. Instruction Set	8
12. Description Of Instructions	9
13. Memory Map	15
14. Initializing And Programming	16
15. Functional Test & Inspection Criteria	17
16. Test – Normal Temperature	19
17. Test – Wide Temperature	20
18. Precautions Against Product Handling	21
19. Warranty	22

1. Mechanical Specification

ITEM	STANDARD VALUE			UNIT
DOT MATRIX FORMAT	240 X 80 DOTS			--
CONTROLLER IC	ST7529 or equivalent			--
MODULE DIMENSION	114.1 (W) X 48.8 (H) X 8.4 (T)			mm
VIEWING DISPLAY AREA	94.0 (W) X 34.7 (H)			mm
ACTIVE DISPLAY AREA	83.98 (W) X 27.98 (H)			mm
DOT SIZE	0.33 (W) X 0.33 (H)			mm
DOT PITCH	0.35 (W) X 0.35 (H)			mm
LCD Type				
EDGE LED BACKLIGHT COLOR	WHITE			
BACKLIGHT INPUT	DC+3.3V	V	78(Type)	mA
BACKLIGHT LIFT TIME	20,000 (AVOID LIGHTING CONTINUOUSLY · Ta=25°C)			HR.

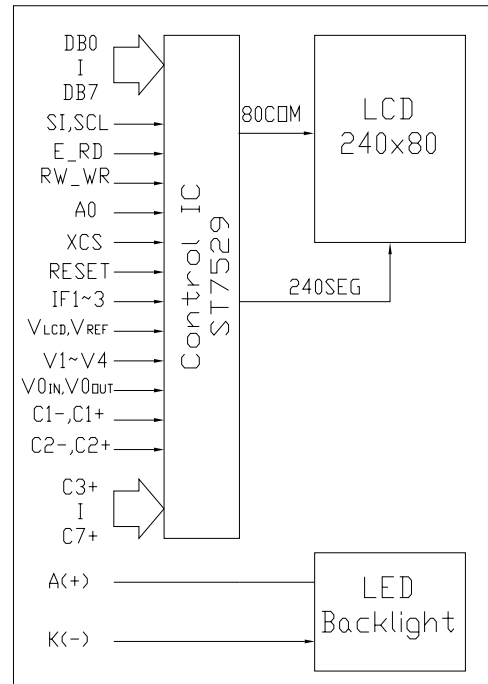
2. Mechanical Diagram



3. Interface Pin Connections

NO	SYM	LEVEL	FUNCTION
1	VSS	--	0V
2	VDD	--	+3.3V
3	A0	H/L	A0 = H : Data , A0 = L : Command
4	RW_WR	L	68 Series : RW ; 80 Series : /WR
5-12	DB0-DB7	H/L	DATA Bus BIT0 ~ BIT7
13	E_RD	L	68 Series : E ; 80 Series : /RD
14	RESET	L	CONTROLLER RESET
15-17	IF1~IF3	H/L	Interface Mode Select
18	SI	H/L	Series Data Input
19	SCL	H/L	Series Clock Input
20	XCS	L	CHIP ENABLE SIGNAL
21	VDD	--	+3.3V
22	C7+	--	The Step-up Voltage Capacitance
23	C1-	--	The Step-up Voltage Capacitance
24	C5+	--	The Step-up Voltage Capacitance
25	C3+	--	The Step-up Voltage Capacitance
26	C1-	--	The Step-up Voltage Capacitance
27	C1+	--	The Step-up Voltage Capacitance
28	C2+	--	The Step-up Voltage Capacitance
29	C2-	--	The Step-up Voltage Capacitance
30	C4+	--	The Step-up Voltage Capacitance
31	C2-	--	The Step-up Voltage Capacitance
32	C6+	--	The Step-up Voltage Capacitance
33	VLCD	--	LCD Driver Supply Voltages
34	VREF	--	Reference Voltage Output For Monitor Only. Leave it Open
35-38	V4~V1	--	LCD Driver Supply Voltages
39	V0OUT	--	LCD Driver Supply Voltages
40	V0IN	--	LCD Driver Supply Voltages

4. Block And Power Supper Diagram



5. Environmental absolute maximum ratings

ITEM	OPERATING		STORAGE		REMARKS
	MIN.	MAX.	MIN.	MAX.	
Ambient Temperature	-20°C	+70°C	-30°C	+80°C	NOTE 1
Humidity	NOTE 1		NOTE 2		Without Condensation
Vibration	--	4.9m/s ²	--	19.6m/s ²	XYZ Directions
Shock	--	29.4m/s ²	--	490.0m/s ²	XYZ Directions

Remarks:

NOTE (1) : Ta at 60 °C : 50 HR Max.

NOTE (2) : Ta < 40 °C : 95% RH Max.

Ta > 40 °C : Absolute humidity must be lower than the humidity of 95% at 40 °C.

6. Electrical Characteristics

ITEM	SYN	CONDITION	MIN.	TYPE	MAX.	UNIT
SUPPLY VOLTAGE FOR LOGIC	VDD-VSS	--	2.4	3.3	3.6	V
SUPPLY VOLTAGE FOR LCD	V0IN	Ta= 25°C, 1/10Bias	10.0	11.0	12.0	V
INPUT HIGH VOLTAGE	VIH	--	0.7VDD	--	VDD	V
INPUT LOW VOLTAGE	VIL	--	0	--	0.3VDD	V

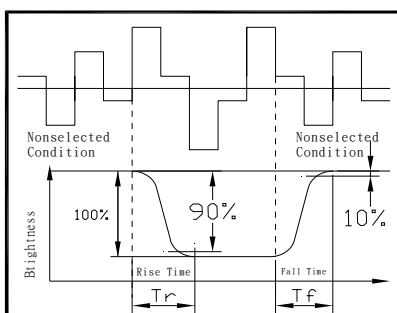
7. Optical Characteristics

Ta at 25°C

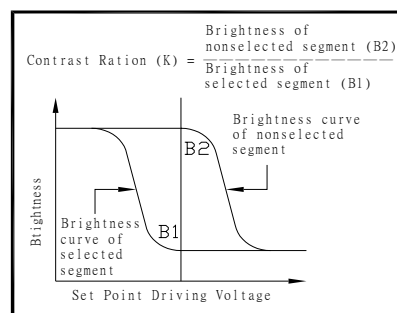
ITEM	SYM	CONDITION	MIN.	TYPE	MAX.	UNIT
VIEW ANGLE (TOP/BOTTOM)	$\theta 1 \sim \theta 2$	CR ≥ 3	-30	—	40	deg.
VIEW ANGLE (LEFT/RIGHT)	$\varphi 1 \cdot \varphi 2$	CR ≥ 3	-30	—	30	deg.
CONTRAST RATIO	CR	—	—	22.8	—	—
RESPONSE TIME (RISE)	TON/Tr	—	—	204	--	mS
RESPONSE TIME (DECAY)	TOFF/Tf	—	—	100	--	mS

8. Optical Definitions

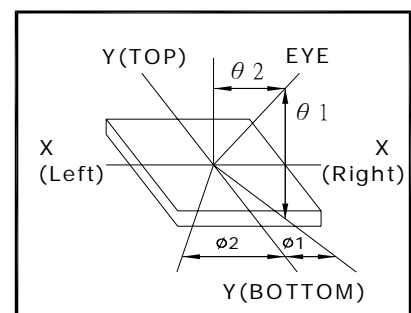
Response Time



Contrast Ratio

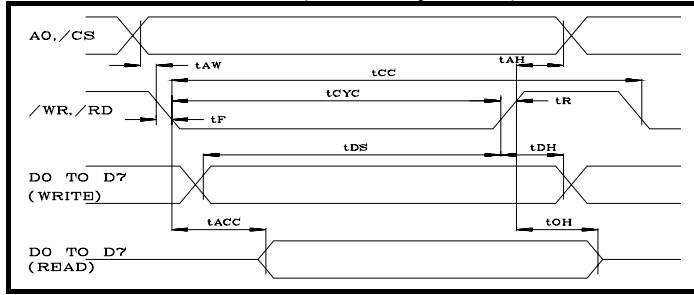


View Angle

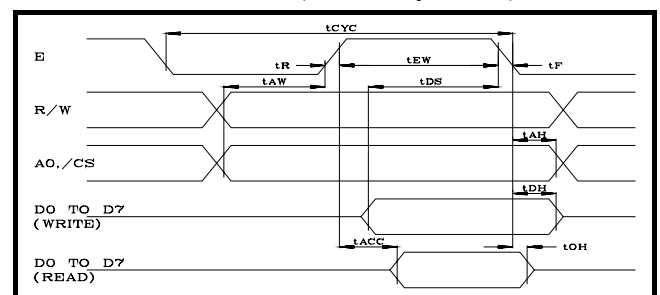


9. Timing Control

MPU Bus Read/Write (80-family MPU)



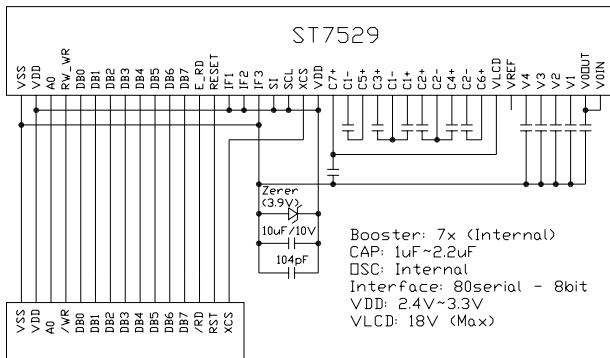
MPU Bus Read/Write(68-family MPU)



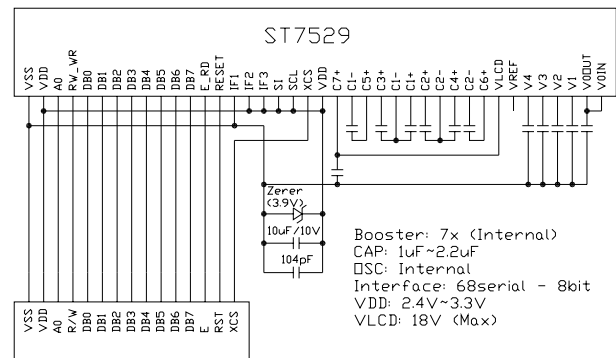
Item	Symbol	Limit (Min.)	Limit (Max.)	Unit	
System cycle time	tCYC	240	--	ns	
Address setup time	tAW	0	--	ns	
Address hold time	tAH	0	--	ns	
Control pulse width	tCC	240	--	ns	
Data setup time	tDS	40	--	ns	
Data hold time	tDH	10	--	ns	
Output disable time	tOH	5	50	ns	
READ access time	tACC	--	70	ns	
Enable Pulse width	Read	tEW	140	--	ns
	Write		80	--	ns
Rise and Fall time	tR,tF	--	10	ns	

10. Application Circuit

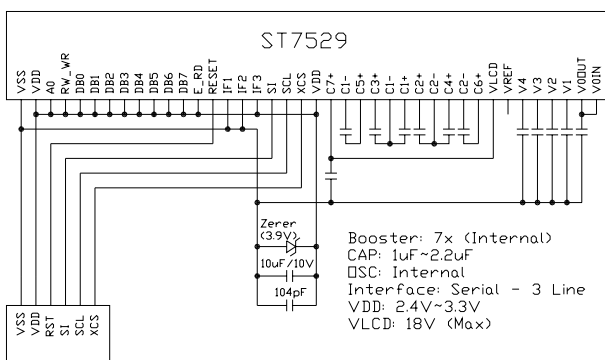
80-Series Interface



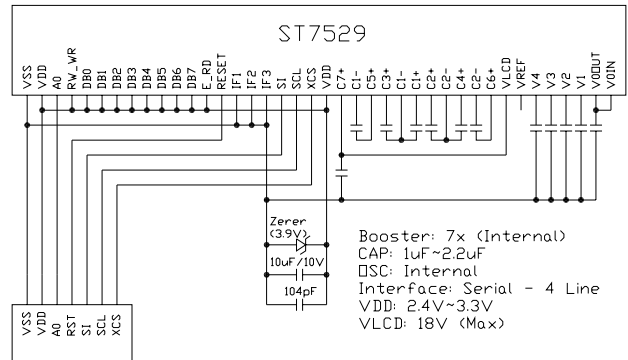
68-Series Interface



3-Line Series Interface



4-Line Series Interface



11. Instruction Set

Ext=0 or Ext=1

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	Ext In	0	1	0	0	0	1	1	0	0	0	0	Ext=0 Set	30	None
2	Ext Out	0	1	0	0	0	1	1	0	0	0	1	Ext=1 Set	31	None

Ext=0

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	DISON	0	1	0	1	0	1	0	1	1	1	1	Display On	AF	None
2	DISOFF	0	1	0	1	0	1	0	1	1	1	0	Display Off	AE	None
3	DISNOR	0	1	0	1	0	1	0	0	1	1	0	Normal Display	A6	None

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
4	DISINV	0	1	0	1	0	1	0	0	1	1	1	Inverse Display	A7	None
5	COMSCN	0	1	0	1	0	1	1	1	0	1	1	COM Scan Direction	BB	1 byte
6	DISCTRL	0	1	0	1	1	0	0	1	0	1	0	Display Control	CA	3 bytes
7	SLPIN	0	1	0	1	0	0	1	0	1	0	1	Sleep In	95	None
8	SLPOUT	0	1	0	1	0	0	1	0	1	0	0	Sleep Out	94	None
9	LASET	0	1	0	0	1	1	1	0	1	0	1	Line Address Set	75	2 bytes
10	CASET	0	1	0	0	0	0	1	0	1	0	1	Column Address Set	15	2 bytes
11	DATSDR	0	1	0	1	0	1	1	1	1	0	0	Data Scan Direction	BC	3 bytes
12	RAMWR	0	1	0	0	1	0	1	1	1	0	0	Writing to Memory	5C	Data
13	RAMRD	0	1	0	0	1	0	1	1	1	0	1	Reading from Memory	5D	Data
14	PTLIN	0	1	0	1	0	1	0	1	0	0	0	Partial display in	A8	2 bytes
15	PTLOUT	0	1	0	1	0	1	0	1	0	0	1	Partial display out	A9	None
16	RMWIN	0	1	0	1	1	1	0	0	0	0	0	Read and Modify Write	E0	None
17	RMWOUT	0	1	0	1	1	1	0	1	1	1	0	RMW end	EE	None
18	ASCSET	0	1	0	1	0	1	0	1	0	1	0	Area Scroll Set	AA	4 bytes
19	SCSTART	0	1	0	1	0	1	0	1	0	1	1	Scroll Start Set	AB	1 byte
20	OSCON	0	1	0	1	1	0	1	0	0	0	1	Internal OSC on	D1	None
21	OSCOFF	0	1	0	1	1	0	1	0	0	1	0	Internal OSC off	D2	None
22	PWRCTRL	0	1	0	0	0	1	0	0	0	0	0	Power Control	20	1 byte
23	VOLCTRL	0	1	0	1	0	0	0	0	0	0	1	EC control	81	2 bytes
24	VOLUP	0	1	0	1	1	0	1	0	1	1	0	EC increase 1	D6	None
25	VOLDOWN	0	1	0	1	1	0	1	0	1	1	1	EC decrease 1	D7	None
26	RESERVED	0	1	0	1	0	0	0	0	0	1	0	Not Use	82	0
27	EPSRRD1	0	1	0	0	1	1	1	1	1	0	0	READ Register1	7C	None
28	EPSRRD2	0	1	0	0	1	1	1	1	1	0	1	READ Register2	7D	None
29	NOP	0	1	0	0	0	1	0	0	1	0	1	NOP Instruction	25	None
30	STREAD	0	1	1	Read Data							Status Read			
31	EPINT	0	1	0	0	0	0	0	0	1	1	1	Initial code(1)	07	1 byte

Ext=1

Index	Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function	Hex	Parameter
1	Gray 1 Set	0	1	0	0	0	1	0	0	0	0	0	FRAME 1 Gray PWM Set	20	16 bytes
2	Gray 2 Set	0	1	0	0	0	1	0	0	0	0	1	FRAME 2 Gray PWM Set	21	16 bytes
3	Wt. Set	0	1	0	0	0	1	0	0	0	1	0	Weight Set	22	3 bytes
4	ANASET	0	1	0	0	0	1	1	0	0	1	0	Analog Circuit Set	32	3 bytes
5	DITHOFF	0	1	0	0	0	1	1	0	1	0	0	Dithering Circuit Off	34	None
6	DITHON	0	1	0	0	0	1	1	0	1	0	1	Dithering Circuit On	35	None
7	EPCTIN	0	1	0	1	1	0	0	1	1	0	1	Control EEPROM	CD	1 byte
8	EPCOUT	0	1	0	1	1	0	0	1	1	0	0	Cancel EEPROM	CC	None
9	EPMWR	0	1	0	1	1	1	1	1	1	0	0	Write to EEPROM	FC	None
10	EPMRD	0	1	0	1	1	1	1	1	1	0	1	Read from EEPROM	FD	None

Note: The table above is for 8-bit interface. For the application of 16-bit interface, fill D15~8 with 0, and other bits are just the same with the table above.

12. Description Of Instructions

EXT= "0" or "1"

(1) Extension instruction disable (EXT IN) - Parameter Byte: None (30H)

Use the "EXT=0" command table

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	0	0	1	1	0	0	0	0

(2) Extension instruction enable (EXT OUT) - Parameter Byte: None (31H)

Use the extended command table EXT="1"

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	0	0	1	1	0	0	0	1

EXT= "0"

(1) Display ON (DISON) - Parameter Byte: None (AFH)

It is to turn the display on. When the display is turned on, segment and common outputs are generated at the level corresponding to the display data and display timing. As long as the sleep mode is selected, the display cannot be turned on. Thus, whenever using this command, the sleep mode must be cancelled first.

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	1	0	1	1	1	1

(2) Display OFF (DISOFF) - Parameter Byte: None (AEH)

It is to forcibly turn the display off. As long as the display is turned off, every segment and common outputs are forced to VSS level.

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	1	0	1	1	1	0

(3) Normal display (DISNOR) - Parameter Byte: None (A6H)

It is to normally highlight the display area without modifying contents of the display data RAM.

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	1	0	0	1	1	0

(4) Inverse display (DISINV) - Parameter Byte: None (A7)

It is to inversely highlight the display area without modifying contents of the display data RAM. This command does not invert non-display areas in case of using partial display.

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	1	0	0	1	1	1

(5) Common scan (COMSCN) – Parameter Byte : 1 (BBH)

It specifies the common output scan direction. This command is for the convenience of wiring on the LCD panel.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	1	0	1	1	1	0	1	1	--
Parameter Byte 1 (PB1)	1	1	0	*	*	*	*	*	CD2	CD1	CD0	Common Scan direction

When 1/160 is selected for the display duty, pins and common output are scanned in the order shown below.

CD2 CD1 CD0	Common scan direction			
	COM0 pin	COM79 pin	COM80 pin	COM159 pin
0 0 0	0	-> 79	80	-> 159
0 0 1	0	-> 79	159	-> 80
0 1 0	79	-> 0	80	-> 159
0 1 1	79	-> 0	159	-> 80

(6) Display control (DISCTRL) – Parameter Byte : 3 (CAH)

This command and succeeding parameters are used to perform the display timing-related setups. This command must be selected before using SLPOUT. Do not change this command while the display is turned on.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	1	0	1	1	1	0	1	1	--
Parameter Byte 1 (PB1)	1	1	0	*	*	*	0	0	CLD	0	0	CL dividing ratio. F1 and F2 drive pattern
Parameter Byte 1 (PB2)	1	1	0	*	*	DT5	DT4	DT3	DT2	DT1	DT0	Drive duty
Parameter Byte 1 (PB3)	1	1	0	*	*	*	FI	LF3	LF2	LF1	LF0	DR inverse-set value

PB1 specifies the CL dividing ratio.

CLD: CL dividing ratio. They are used to change number of dividing stages of external or internal clock.

CLD=0 : not divide. CLD=1 : 2 divisions.

PB2 specifies the duty of the module on block basis. Initial: 00H

$$(\text{Numbers of display lines})/4-1=DT5*2^5+DT4*2^4+DT3*2^3+DT2*2^2+DT1*2^1+DT0*2^0$$

For example, 1/128 duty -> 128/4-1=31 -> (DT5,DT4,DT3,DT2,DT1,DT0) = (0,1,1,1,1,1)

PB3 specifies number of line cycles (range from 2 to 16) in a frame.

$$\text{Numbers of line cycles}-1=LF3*2^3+LF2*2^2+LF1*2^1+LF0*2^0$$

For example, 11 line cycles in a frame -> 11-1=10 -> (LF3,LF2,LF1,LF0) = (1,0,1,0), In the default, 11 line cycles in a frame is selected.

FI decides the inversion type of frame at the end of common scan cycle while the number of duty is not divisible by the number of line cycles per frame. For example, in the application of 1/m duty and n line cycles in a frame set, the difference of the choice in FI is shown as the following figure. $M = n*k+r$, where m, n, k and r are all whole numbers, and r is the remainder of m divided by n ($r < n$).

(7) Sleep in (SLPIN) – Parameter Byte : None (95H)

This command is to enter the SLEEP MODE.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	0	1	0	1	0	1

(8) Sleep out (SLPOUT) – Parameter Byte : None (94H)

This command is to exit the SLEEP MODE.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	0	1	0	1	0	0

(9) Line address set (LASET) – Parameter Byte : 2 (75H)

This command is to specify the line address area when MPU makes access to the display data RAM. As the addresses are increased from the start to the end line in the line-direction scan, the column address is increased by 1 and line address return to the start line. Note that the start and end line must be a pair. Moreover, the relation “start line<end line” must be maintained.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	1	1	1	0	1	0	1	--
Parameter Byte 1 (PB1)	1	1	0	SL7	SL6	SL5	SL4	SL3	SL2	SL1	SL0	Common Scan direction
Parameter Byte 1 (PB2)	1	1	0	EL7	EL6	EL5	EL4	EL3	EL2	EL1	EL0	

Note: The range of line address is 0 ~ 159.

(10) Column address set (CASET) – Parameter Byte : 2 (15H)

This command is to specify the column address area when MPU makes access to the display data RAM. As the addresses are increased from the start to the end column in the column-direction scan, the line address is increased by 1 and column address returned to the start column. Note that the start and end line must be a pair. Moreover, the relation “start column<end column” must be maintained.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	0	0	1	0	1	0	1	--
Parameter Byte 1 (PB1)	1	1	0	SC7	SC6	SC5	SC4	SC3	SC2	SC1	SC0	Common Scan direction
Parameter Byte 1 (PB2)	1	1	0	EC7	EC6	EC5	EC4	EC3	EC2	EC1	EC0	

Note: The range of column address is 0 ~ 84.

(11) Data scan direction (DATSDR) – Parameter Byte : 3 (BCH)

This command is to setup various parameters in the operations of display data stored on the built-in RAM by MPU.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	1	0	1	1	1	1	0	0	--
Parameter Byte 1 (PB1)	1	1	0	*	*	*	*	*	C/L	CI	LI	Normal/inverse display of address and address scan direction
Parameter Byte 1 (PB2)	1	1	0	*	*	*	*	*	*	*	0	Not used, D0 must be 0.
Parameter Byte 1 (PB3)	1	1	0	*	*	*	*	*	GS2	GS1	GS0	Gray-scale setup

PB1 is to specify the normal/inverse display of the line and column address and the address scanning direction.

LI : Normal/inverse direction of the line address. LI=0 : Normal, LI=1 : Inverse.

CI : Normal/inverse direction of the column address. CI=0 : Normal, CI=1 : Reverse.

C/L : Address-scan direction. C/L=0 : In the column direction, C/L=1 : In the line direction.

PB2 is not used, D0 must be 0.

PB3 is to select desired gray scale display mode 2B3P or 3B3PD1 or 3B3PD2 mode.

GS2	GS1	GS0	Numbers of gray-scale
0	0	1	32 gray-scale 2Byte 3Pixel mode
0	1	0	32 gray-scale 2Byte 3Pixel dither 1 mode
1	0	0	32 gray-scale 3Byte 3Pixel dither 2 mode

2B3P 32 Gray Scale Display

D7	D6	D5	D4	D3	D2	D1	D0	
P0	P0	P0	P0	P0	P1	P1	P1	1 st write
P1	P1	D	P2	P2	P2	P2	P2	2nd write

A single pixel of data is read after the second write operation as shown, and it is written in the display RAM. "X" are dummy bits, which are ignored for display, "D" are dither bits, which are used for dither.

3B3PD1 32 Gray Scale Display

D7	D6	D5	D4	D3	D2	D1	D0	
P0	P0	P0	P0	P0	D	X	X	1 st write
P1	P1	P1	P1	P1	D	X	X	2nd write
P2	P2	P2	P2	P2	D	X	X	3rd write

A single pixel of data is read after the third write operation as shown, and it is written in the display RAM. "X" are dummy bits, which are ignored for display, "D" are dither bits, which are used for dither.

3B3PD2 32 Gray Scale Display

D7	D6	D5	D4	D3	D2	D1	D0	
P0	P0	P0	P0	P0	D	D	D	1 st write
P1	P1	P1	P1	P1	D	D	D	2nd write
P2	P2	P2	P2	P2	D	D	D	3rd write

A single pixel of data is read after the third write operation as shown, and it is written in the display RAM. "X" are dummy bits, which are ignored for display, "D" are dither bits, which are used for dither.

(12) Memory write (RAMWR) – Parameter Byte : Numbers of data written (5CH)

This command turns on the data entry mode when MPU writes data to the display memory. This command will always sets the line and column address at the start address while executed. The following parameter byte rewrites contents of the display data RAM and increases the line or column address automatically. The write mode is automatically cancelled if any other command is entered.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	1	0	1	1	1	0	0	--
Parameter Byte 1 (PB1)	1	0	1	Data to be written							Data to be written	

(13) Memory read (RAMRD) – Parameter Byte : Numbers of data read (5DH)

This command turns on the data entry mode when MPU read data to the display memory. This command will always sets the line and column address at the start address while executed. The contents of the display data RAM will be read in following parameter byte and increases the line or column address automatically. The data read mode is automatically cancelled if any other command is entered.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	1	0	1	1	1	0	1	--
Parameter Byte 1 (PB1)	1	0	1	Data to be read							Data to be read	

(14) Partial in (PTLIN) - Parameter Byte: 2 (A8H)

This command is to specify the partial display area. It will turn on partial display of the screen (dividing screen by lines) to save power. Since ST7529 processes the liquid crystal display signal on 4-line basis (block basis), the display and no-display areas are also specified on 4-bit line (block basis).

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	1	0	1	1	1	0	1	1	--
Parameter Byte 1 (PB1)	1	1	0	*	*	PTS5	PTS4	PTS3	PTS2	PTS1	PTS0	Start block address
Parameter Byte 2 (PB2)	1	1	0	*	*	PTE5	PTE4	PTE3	PTE2	PTE1	PTE0	End block address

Only the address of the display block can be specified for the partial display. Do not specify an address not to be displayed when scrolled.

(15) Partial out (PTLOUT) - Parameter Byte: none (A9H)

This command is to exit the PARTIAL DISPLAY MODE.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	1	0	1	0	1	0

(16) Read modify write in (RMWIN) - Parameter Byte: none (E0H)

This command is used along with the (9) line address set command (LASET), (10) column address set command (CASET), and (17) read modify write out command (RMWOUT). This function is for frequently modified data on a specific area, such as blinking cursor. First, set a specific display area using the column and line address commands. Then, execute this command to set the column and line addresses as the start address of the specific area. When this operation is complete, the column and line address will not be modified by the display data read command. It is increased only when the display data write command is executed. You can cancel this mode by entering the read modify write out or any other command.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	1	0	0	0	0	0

(17) Read modify write out (RMWOUT) - Parameter Byte: none (EEH)

This command cancels the read modify write mode.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	1	0	1	1	1	0

(18) Area scroll set (ASCSET) - Parameter Byte: 4 (AAH)

It is to scroll only the specified portion of the screen (dividing the screen by lines). This command specifies the scrolling type of area, fixed area and scrolled area.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	1	0	1	0	1	0	1	0	--
Parameter Byte 1 (PB1)	1	1	0	*	*	TB5	TB4	TB3	TB2	TB1	TB0	Top block address
Parameter Byte 2 (PB2)	1	1	0	*	*	BB5	BB4	BB3	BB2	BB1	BB0	Bottom block address
Parameter Byte 3 (PB3)	1	1	0	*	*	NSB5	NSB4	NSB3	NSB2	NSB1	NSB0	Number of specified blocks
Parameter Byte 4 (PB4)	1	1	0	*	*	*	*	*	*	SCM1	SCM0	Area scroll mode

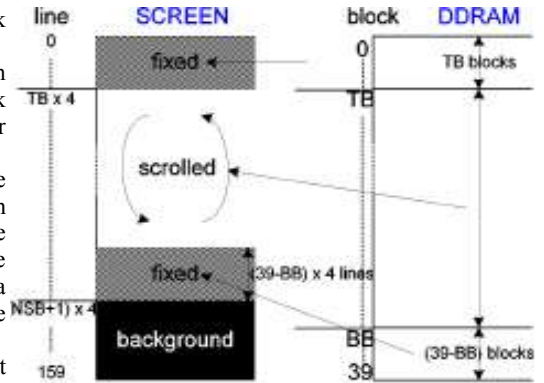
PB4: It is used to specify the scrolling mode.

SCM1	SCM0	Scrolling Mode	Settings		
			Top block address (TB)	Bottom block address (BB)	Number of specified blocks (NSB)
0	0	Center mode	Top(fixed area) height = Top address	Bottom(fixed area) height = 39-Bottom address	Bottom start address = Specified number
0	1	Top mode	0	Bottom(fixed area) height = 39-Bottom address	Bottom start address = Specified number
1	0	Bottom mode	Top(fixed area) height = Top address	39	39
1	1	Whole mode	0	39	39

Since ST7529 processes the liquid crystal display signals on the four-line basis (block basis), fixed and scrolled areas are also specified on the four-line basis (block basis). DDRAM address of the top fixed area is set in the block address increasing direction starting with the 0th block. DDRAM address of the bottom fixed area is set in the block address decreasing direction starting with 39st block. The DDRAM address of other blocks fixed areas are assigned to the scrolled + background areas.

PB1 is to specify the top block address of the scrolled + background areas. Specify the 0th block for the top screen scroll or whole screen scroll. PB2 specifies the bottom address of the scroll + background areas. Specify the 39th block for the bottom or whole screen scroll. The relation that top block address < bottom block address must be maintained. PB3 specifies a specific number of blocks {Numbers of (Top fixed area + Scroll area) block-1}. In the case of the bottom scroll or whole screen scroll, the value is identical with PB2.

The user can turn on the area scroll function by executing the area scroll set command first and then specifying the display start block of the scroll area with the scroll start set command.



(19) Scroll start address set (SCSTART) - Parameter Byte: 1 (ABH)

This command is to specify which line address of DDRAM to be the start line content shown on screen. Note that you must execute this command after executing the area scroll set command. Scroll becomes available by dynamically changing the start block address.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	1	0	1	0	1	0	1	1	--
Parameter Byte 1 (PB1)	1	1	0	*	*	SB5	SB4	SB3	SB2	SB1	SB0	Start block address

Note : Don't repeat "Area scroll set(AAH)" instruction when "Scroll start address set" is executed.

(20) Internal oscillation on (OSCON) - Parameter Byte: none (D1H)

This command turns on the internal oscillation circuit. It is valid only when the internal oscillation circuit CLS = HIGH.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	0	1	0	0	0	1

(21) Internal oscillation off (OSCOFF) - Parameter Byte: none (D2H)

It turns off the internal oscillation circuit. The circuit is also turned off in the reset mode.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	0	1	0	0	1	0

(22) Power control set (PWRCTRL) - Parameter Byte: 1 (20H)

This command is used to turn on or off the Booster circuit, voltage regulator circuit, and reference voltage.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	0	1	0	0	0	0	0	--
Parameter Byte 1 (PB1)	1	1	0	*	*	*	0	VB	0	VF	VR	LCD drive power

VR turns on/off the reference voltage generation circuit. VR = "1": ON, VR = "0": OFF

VF turns on/off the circuit voltage follower. VF = "1": ON, VF = "0": OFF

VB: It turns on or off the Booster. VB = "1": ON, VB = "0": OFF

(23) Electronic volume control (VOLCTRL) - Parameter Byte: 2 (81H)

The command is used to program the optimum LCD supply voltage V0. Refer to 7.10.2.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	1	0	0	0	0	0	0	1	--
Parameter Byte 1 (PB1)	1	1	0	*	*	VPR5	VPR4	VPR3	VPR2	VPR1	VPR0	VPR[5:0]
Parameter Byte 2 (PB2)	1	1	0	*	*	*	*	*	VPR8	VPR7	VPR6	VPR[8:6]

With the VOLUP and VOLDOWN command the V0 voltage and therewith the contrast of the LCD can be adjusted.

(24) Increment electronic control (VOLUP) - Parameter Byte: none (D6H)

This command increments electronic control offset value of voltage regulator (V0) circuit by 1. Each step is 0.04V.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	0	1	0	1	1	0

If you set the electronic control value to 111111, the control value is set to 000000 after this command has been executed.

(25) Decrement electronic control (VOLDDOWN) - Parameter Byte: none (D7H)

This command decrements electronic control offset value of voltage regulator (V0) circuit by 1. Each step is 0.04V.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	0	1	0	1	1	1

If you set the electronic control value to 000000, the control value is set to 111111 after this command has been executed.

(26) Reserved (82H)

Do not use this command.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	0	0	0	0	0	1	0

(27) Read Register 1 (EPSRRD1) Command: 1 Parameter Byte: none (7CH)

Execute the EPSRRD1 and STREAD (Status Read) commands in succession to read the Electronic Control value.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	0	1	1	1	1	1	0	0

Execute the Status Read command immediately after this command and execute the NOP command after the STREAD (Status Read) command.

(28) Read Register 2 (EPSRRD2) Command: 1 Parameter Byte: none (7DH)

Execute the EPSRRD2 and STREAD (Status Read) commands in succession to read the built-in resistance ratio.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	0	1	1	1	1	1	0	1

Execute the Status Read command immediately after this command and execute the NOP(Reset) command after the STREAD (Status Read) command.

(29) Non-operating (NOP) - Parameter Byte: none (25H)

This command does not affect the operation but has the function of canceling the IC test mode. Thus, it is recommended to enter it periodically to prevent malfunctioning due to noise and so on.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	0	0	1	0	0	1	0	1

(30) Status read (STREAD) - Parameter Byte: none

The command is to read the internal condition of the IC. One status can be displayed depending on the setting status after reset or after NOP operation.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	Status Data							

- D7: Area scroll mode Refer to SCM1 (ASCSET)
- D6: Area scroll mode Refer to SCM0 (ASCSET)
- D5: RMW on / off 0: Out 1: In
- D4: Scan direction 0: Column 1: Line
- D3: Display on / off 0: Off 1: On
- D2: EEPROM access 0: OutAccess 1: InAccess
- D1: Display normal/inverse 0: Inverse 1: Normal
- D0: Partial display 0: Off 1: On

(31) Initial code (1) (EPINT) Command 1; Parameter : 1 (07H)

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	0	0	0	0	1	1	1	07H
Parameter Byte 1 (PB1)	1	1	0	0	0	0	1	1	0	0	1	19H

This command is used for EEPROM internal ACK signal generating ,suggest using this command before EEPROM read/write operation . This command improve the EEPROM internal ACK signal under unstable power system.

EXT="1"

The ST7529 applies 16-gray level and 2 FRC to achieve 32-gray scale display. Every gray level is in the strength controlled by 31-PWM (5-bit). The following 2 commands are to set the gray scale value.

(1) Set Gray 1 value (Gray 1 set) - Parameter Byte: 16 (20H)

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Gray1 Set	0	1	0	0	0	1	0	0	0	0	0	ODD FRAME Gray PWM Set
Parameter Byte 1 (PB1)	1	1	0	*	*	*	G0F14	G0F13	G0F12	G0F11	G0F10	Set Gray level 0 at odd frames
Parameter Byte 2 (PB2)	1	1	0	*	*	*	G1F14	G1F13	G1F12	G1F11	G1F10	Set Gray level 1 at odd frames
:	:	:	:	:	:	:	:	:	:	:	:	:
Parameter Byte 14 (PB14)	1	1	0	*	*	*	G13F14	G13F13	G13F12	G13F11	G13F10	Set Gray level 13 at odd frames
:	:	:	:	:	:	:	:	:	:	:	:	:
Parameter Byte 16 (PB16)	1	1	0	*	*	*	G15F14	G15F13	G15F12	G15F11	G15F10	Set Gray level 15 at odd frames

(2) Set Gray 2 value (Gray 2 set) - Parameter Byte: 16 (21H)

Command	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0	Function
Gray1 Set	0	1	0	0	0	1	0	0	0	0	0	EVEN FRAME Gray PWM Set
Parameter Byte 1 (PB1)	1	1	0	*	*	*	G0F24	G0F23	G0F22	G0F21	G0F20	Set Gray level 0 at even frames
Parameter Byte 2 (PB2)	1	1	0	*	*	*	G1F24	G1F23	G1F22	G1F21	G1F20	Set Gray level 1 at even frames
:	:	:	:	:	:	:	:	:	:	:	:	:
Parameter Byte 14 (PB14)	1	1	0	*	*	*	G13F23	G13F23	G13F22	G13F21	G13F20	Set Gray level 13 at even frames
:	:	:	:	:	:	:	:	:	:	:	:	:
Parameter Byte 16 (PB16)	1	1	0	*	*	*	G15F24	G15F23	G15F22	G15F21	G15F20	Set Gray level 15 at even frames

(3) Weight Set (Wt. set) - Parameter Byte: 3 (22H)

	A0	RD	RW	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	0	1	0	0	0	1	0	—
Parameter Byte 1 (PB1)	1	1	0	*	*	*	*	*	WT2	WT1	WT0	
Parameter Byte 2 (PB2)	1	1	0	*	*	*	ED4	ED3	ED2	ED1	ED0	set edge detector detect value
Parameter Byte 3 (PB3)	1	1	0	*	*	*	*	*	*	EE	WE	

(4) Analog circuit set (ANASET) - Parameter Byte: 3 (32H)

	A0	RD	RW	D7	D6	D5	D4	D3	D2	D1	D0	Function
Command	0	1	0	0	0	1	1	0	0	1	0	—
Parameter Byte 1 (PB1)	1	1	0	*	*	*	*	*	OSF2	OSF1	OSF0	OSC frequency
Parameter Byte 2 (PB2)	1	1	0	*	*	*	*	*	*	BE1	BE0	Booster Efficiency Set
Parameter Byte 3 (PB3)	1	1	0	*	*	*	*	*	BS2	BS1	BS0	Bias setting

PB1: Oscillator frequency adjustment

OSF2	OSF1	OSF0	Frequency (KHz)
0	0	0	12.7 (Default)
0	0	1	13.2
0	1	0	14.3
0	1	1	15.7
1	0	0	17.3
1	0	1	19.3
1	1	0	21.9
1	1	1	25.4

Condition ; 1/160 duty, $f_{CL}(Hz) = \text{Frame frequency} * (\text{duty} + 1 \text{ dummy})$

PB2: Booster Efficiency set

BE1	BE0	Booster On booster capacitors (Hz)
0	0	3K
0	1	6K (Default)
1	0	12K
1	1	24K

PB3: Select LCD Bias ratio of the voltage required for driving the LCD.

BS2	BS1	BS0	LCD Bias
0	0	0	1/14
0	0	1	1/13
0	1	0	1/12
0	1	1	1/11
1	0	0	1/10
1	0	1	1/9
1	1	0	1/7
1	1	1	1/5

(5) Color Dither OFF (DITHOFF) - Parameter Byte: None (34H)

Turn off dithering circuit.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	0	0	1	1	0	1	0	0

(6) Color Dither ON (DITHON) - Parameter Byte: None (35H)

Turn on dithering circuit.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	0	0	1	1	0	1	0	1

(7) Control EEPROM (EPCTIN) - Parameter Byte: 1 (CDH)

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	0	0	1	1	1	1
Parameter Byte 1 (PB1)	1	1	0	0	0	EEWR	0	0	0	0	0

When EEWR = "1", EEPROM will be Write Enable; when EEWR = "0", EEPROM will be Read Enable.

(8) Cancel EEPROM Command (EPCOUT) - Parameter Byte: None (CCH)

This command is to cancel the EEPROM Read/Write Enable.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	0	0	1	1	0	0

(9) Write data to EEPROM (EPMWR) - Parameter Byte: None (FCH)

This command is to Write data to EEPROM.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	1	1	1	1	0	0

(10) Read data from EEPROM (EPMRD) - Parameter Byte: None (FDH)

This command is to Read data from EEPROM.

	A0	RD	WR	D7	D6	D5	D4	D3	D2	D1	D0
Command	0	1	0	1	1	1	1	1	1	0	1

13. Memory Map

Memory Map (2B3P, 8-bit mode)														
		Column												
LCD read direction	CI = 0		0					1					84	
	CI = 1		84					83					0	
	Pixel		P0	P1	P2	P3	P4	P5		P252	P253	P254		
Block	Data Line		D7 _{1,0}	D2 _{1,0}	D4 _{2,0}	D7 _{1,1}	D2 _{1,1}	D4 _{2,1}		D7 _{1,84}	D2 _{1,84}	D4 _{2,84}		
	LI = 0	LI = 1	D6 _{1,0}	D1 _{1,0}	D3 _{2,0}	D6 _{1,1}	D1 _{1,1}	D3 _{2,1}		D6 _{1,84}	D1 _{1,84}	D3 _{2,84}		
			D5 _{1,0}	D0 _{1,0}	D2 _{2,0}	D5 _{1,1}	D0 _{1,1}	D2 _{2,1}		D5 _{1,84}	D0 _{1,84}	D2 _{2,84}		
			D4 _{1,0}	D7 _{2,0}	D1 _{2,0}	D4 _{1,1}	D7 _{2,1}	D1 _{2,1}		D4 _{1,84}	D7 _{2,84}	D1 _{2,84}		
			D3 _{1,0}	D6 _{2,0}	D0 _{2,0}	D3 _{1,1}	D6 _{2,1}	D0 _{2,1}		D3 _{1,84}	D6 _{2,84}	D0 _{2,84}		
0	0	159												
	1	158												
	2	157												
	3	156												
1	4	155												
	5	154												
	6	153												
2	7	152												
	8	151												
38	9	150												
	152	7												
	153	6												
	154	5												
39	155	4												
	156	3												
	157	2												
	158	1												
	159	0												
SEGout			0	1	2	3	4	5		252	253	254		

Memory Map (3B3PD1 / 3B3PD2, 8-bit mode)														
		Column												
LCD Read direction	CI = 0		0					1					84	
	CI = 1		84					83					0	
	Pixel		P0	P1	P2	P3	P4	P5		P252	P253	P254		
Block	Data Line		D7 _{1,0}	D7 _{2,0}	D7 _{3,0}	D7 _{1,1}	D7 _{2,1}	D7 _{3,1}		D7 _{1,84}	D7 _{2,84}	D7 _{3,84}		
	LI = 0	LI = 1	D6 _{1,0}	D6 _{2,0}	D6 _{3,0}	D6 _{1,1}	D6 _{2,1}	D6 _{3,1}		D6 _{1,84}	D6 _{2,84}	D6 _{3,84}		
			D5 _{1,0}	D5 _{2,0}	D5 _{3,0}	D5 _{1,1}	D4 _{2,1}	D5 _{3,1}		D5 _{1,84}	D5 _{2,84}	D5 _{3,84}		
			D4 _{1,0}	D4 _{3,0}	D4 _{5,0}	D4 _{1,1}	D3 _{2,1}	D4 _{3,1}		D4 _{1,84}	D4 _{2,84}	D4 _{3,84}		
			D3 _{1,0}	D3 _{5,0}	D3 _{3,0}	D3 _{1,1}		D3 _{3,1}		D3 _{1,84}	D3 _{2,84}	D3 _{3,84}		
0	0	159												
	1	158												
	2	157												
	3	156												
1	4	155												
	5	154												
	6	153												
2	7	152												
	152	7												
38	153	6												
	154	5												
	155	4												
	156	3												
39	157	2												
	158	1												
	159	0												
	SEGout			0	1	2	3	4	5		252	253	254	

14. Initializing And Programming

Mode : ST7529

Interface : 80-8bit

```

;-----
write_inst(0x30);           //EXT = 0
write_inst(0x04);           //
write_data(0x3E);           //
write_inst(0x94);           //sleep out
write_inst(0xD1);           //OSC on
write_inst(0xCA);           //display control
write_data(0x04);           //CL dividing ratio = 2
write_data(0x1D);           //duty
write_data(0x00);           //N-Line
write_inst(0xBB);           //com scan direc. = 0~65 / 131~66
write_data(0x01);           //
write_inst(0x31);           //EXT = 1
write_inst(0x32);           //analog
write_data(0x00);           //OSC freq
write_data(0x01);           //booster effic.
write_data(0x04);           //bias, 04: 1/10 Bias
write_inst(0x30);           //EXT = 0
write_inst(0x81);           //EC control
write_data(0x2F);           //vop[5:0]
write_data(0x02);           //vop[8:6]
write_inst(0x20);           //power control
write_data(0x0B);           //D0 = regulator / D1 = follwer / D3 = booster
write_inst(0x07);           //
write_data(0x19);           //
write_inst(0x31);           //EXT = 1
write_inst(0xCD);           //
write_data(0x00);           //EEPROM Enable
delay(100);                 //delay 100mS
write_inst(0xFD);           //EEPROM read
delay(100);                 //delay 100mS
write_inst(0xCC);           //EEPROM disable
write_inst(0x30);           //EXT = 0
write_inst(0xA6);           //normal display
write_inst(0xBC);           //data scan direc.
write_data(0x02);           //address direc.
write_data(0x01);           //BGR
write_data(0x01);           //gray scale
write_inst(0xAF);           //display on
write_inst(0x15);           //column range
write_data(000);           //start
write_data(239);           //end
write_inst(0x75);           //page range
write_data(040);           //start
write_data(119);           //end
write_inst(0x31);           //EXT = 1
write_inst(0x34);           //dither off
write_inst(0x22);           //weight
write_data(0x00);           //
write_data(0x00);           //
write_data(0x00);           //
write_inst(0x20);           //gamma
write_data(00);           //
write_data(03);           //
write_data(06);           //

```


15. Functional Test & Inspection Criteria

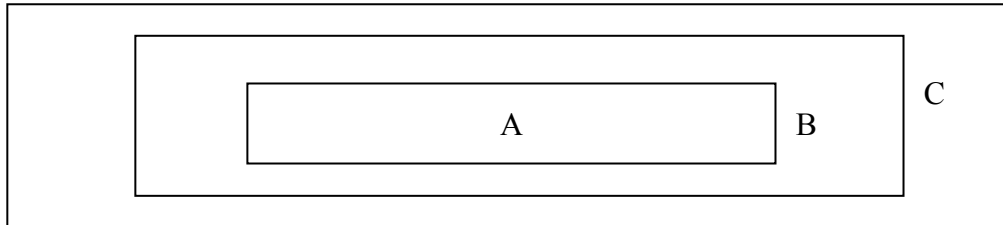
15.1 Sample plan

Sample plan according to MIL-STD-105D level 2, and acceptance/rejection criteria is.
 Base on : Major defect : AQL 0.65 Minor defect : AQL 2.5

15.2 Inspection condition

Viewing distance for cosmetic inspection is 30cm with bare eyes, and under an environment of 800 lus (20W) light intensity. All direction for inspecting the sample should be within 45° against perpendicular line.

15.3 Definition of Inspection Zone in LCD



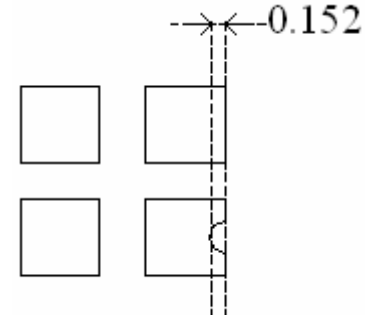
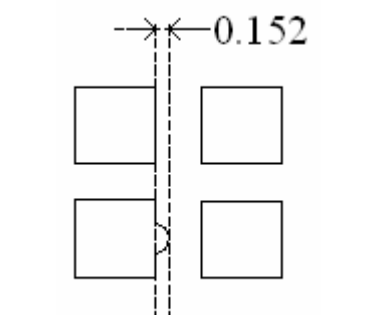
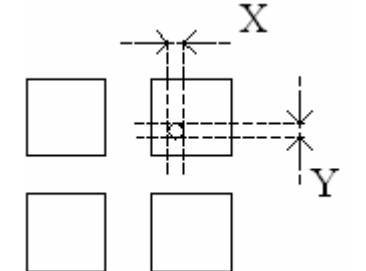
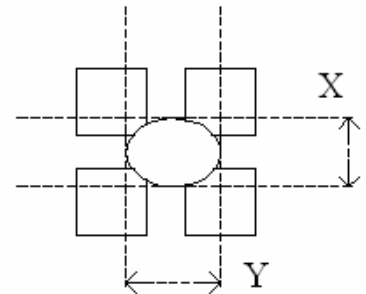
- Zone A : Character / Digit area
- Zone B : Viewing area except Zone A (Zone A + Zone B = minimum Viewing area)
- Zone C : Outside viewing area (invisible area after assembly in customer's product)
- Note : As a general rule, visual defects in Zone C are permissible, when it is no trouble for quality and assembly of customer's product.

15.4 Major Defect

All functional defects such as open (or missing segment), short, contrast differential, excess power consumption, smearing, leakage, etc. and overall outline dimension beyond the drawing. Are classified as major defects.

15.5 Inspection Parameters And Glass Pixel(偏光板和玻璃圖像檢驗)

No	Polarizer (偏光片)	Criteria				
1	Black or White spots and Piercing (黑/白點和刺孔)	Zone		Acceptable number (可接受數量)		
		Dimension (mm)		A	B	C
		D ≤ 0.15		*	*	*
		0.15 < D ≤ 0.2		4	6	*
		0.2 < D ≤ 0.3		2	2	*
		0.3 < D		0	0	*
D[面積]=(Length[長度]+Width[寬度])/2 * : Disregard(忽略)						
2	Scratch (刮傷)	Zone	Zone	Acceptable number (可接受數量)		
		X(mm)	Y(mm)	A	B	C
		*	0.04 ≥ W	*	*	*
		3.0 ≥ L	0.06 ≥ W	4	4	*
		2.0 ≥ L	0.08 ≥ W	2	2	*
		--	0.10 ≥ W	0	0	*
X : Length[長度] Y : Width[寬度] * : Disregard(忽略)						
3	Air Bubbles (between glass & polarizer) 氣泡 (玻璃跟偏光板之間)	Zone		Acceptable number (可接受數量)		
		Dimension (mm)		A	B	C
		D ≤ 0.20		*	*	*
		0.20 < D ≤ 0.50		2	2	*
		0.50 < D		0	0	*
* : Disregard(忽略)						

<p>4</p>	<p>Glass of Pixel (玻璃的圖像)</p>	<p>(1)Pixel shape (with Dent)/圖像凹度</p>  <p>•Less than 0.152 mm is no counted (小於 0.152mm 者不計)</p> <p>(2)Pixel shape (with Projection)/圖像凹度</p>  <p>Should not be connected next pixel (點與點間不可先連接)</p> <p>(3)Deformation/變形</p>  <p>$(X + Y) / 2 \leq 0.15\text{mm}$ •Less than 0.1 mm is no counted (小於 0.15mm 者不計)</p> <p>(4) Deformation/變形</p>  <p>$(X + Y) / 2 \leq 0.3\text{mm}$ •Less than 0.3 mm is no counted (小於 0.3mm 者不計)</p>
----------	-----------------------------------	---

16. Reliability Test (測試條件) – Normal Temperature (常溫)

No change no display and in operation under the following text condition.

(在不改變原先顯示下進行以下測試操作)

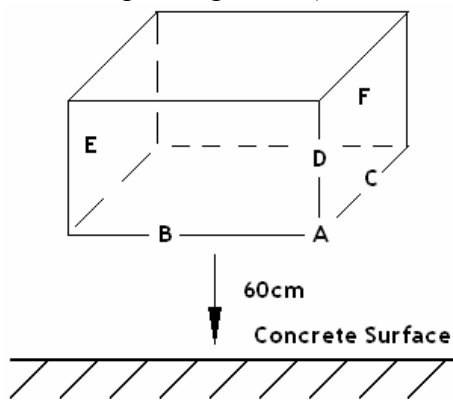
Conditions : Unless otherwise specified, test will be conducted under the following condition.

Temperature : $20\pm 5^{\circ}\text{C}$

Humidity : $40\pm 5\%RH$

Tests will be not conducted under functioning state.

(條件：除非其他特殊情況，否則測試將以溫度： $20\pm 5^{\circ}\text{C}$ ，濕度： $40\pm 5\%RH$ 為主)

NO	Parameter	Conditions	Notes
1	High Temperature Operating	$50^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (operation state) (96 小時，溫度 $50^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源開啟的操作情況下)	
2	Low Temperature Operating	$0^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (operation state) (96 小時，溫度 $0^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源開啟的操作情況下)	1
3	High Temperature Storage	$60^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (96 小時，溫度 $60^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源關閉靜態操作下)	2
4	Low Temperature Storage	$-10^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (96 小時，溫度 $-10^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源關閉靜態操作下)	1, 2
5	Damp Proof Test	$40^{\circ}\text{C}\pm 2^{\circ}\text{C}$, $85\sim 90\%RH$, 96hr (96 小時，溫度： $40^{\circ}\text{C}\pm 2^{\circ}\text{C}$ ，濕度： $85\sim 90\%RH$ 電源關閉靜態操作下)	1, 2
6	Vibration Test	Total fixed amplitude : 1.5 mm (完全固定輻射：1.5mm) Vibration Frequency : 10 ~ 55 Hz (震動頻率：10~55 Hz) One cycle 60 seconds to 3 directions of X, Y, Z for each 15 minutes (每一個循環 X, Y, Z 軸方向各做 60 秒，連續做 5 次，共計 15 分鐘)	3
7	Shock Test	To be measured after dropping from 60cm high on the concrete surface in packing state. (包裝材從 60 公分高的地方向地面落下)  Dropping method comer dropping (角落落下方式) A comer : once Edge dropping (側邊落下) B, C, D edge : once Face dropping (表面落下) E, F, G face : once	

Note 1 : No dew condensation to be observed. (不要在”水氣凝結點”下觀察)

Note 2 : The function test shall be conducted after 4 hours storage at the normal

Temperature and humidity after removed from the test chamber

(從實驗室移出後，放在一般常溫 (溫度： 25°C ，濕度： $45\%RH$)，

且四小時後通電流或電壓，看它是否能正常動作)

Note 3 : Vibration test will be conducted to the product itself without putting it in a container.

(在震動測試下，產品本身不需容器即能自行傳導)

17. Reliability Test (測試條件) – Wide Temperature (廣溫)

No change no display and in operation under the following text condition.

(在不改變原先顯示下進行以下測試操作)

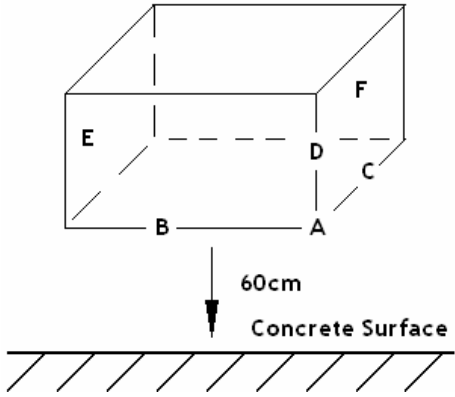
Conditions : Unless otherwise specified, test will be conducted under the following condition.

Temperature : $20\pm 5^{\circ}\text{C}$

Humidity : $40\pm 5\%\text{RH}$

Tests will be not conducted under functioning state.

(條件：除非其他特殊情況，否則測試將以溫度： $20\pm 5^{\circ}\text{C}$ ，濕度： $40\pm 5\%\text{RH}$ 為主)

NO	Parameter	Conditions	Notes
1	High Temperature Operating	$70^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (operation state) (96 小時，溫度 $70^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源開啟的操作情況下)	
2	Low Temperature Operating	$-20^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (operation state) (96 小時，溫度 $-20^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源開啟的操作情況下)	1
3	High Temperature Storage	$80^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (96 小時，溫度 $80^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源關閉靜態操作下)	2
4	Low Temperature Storage	$-30^{\circ}\text{C}\pm 2^{\circ}\text{C}$, 96 hrs (96 小時，溫度 $-30^{\circ}\text{C}\pm 2^{\circ}\text{C}$ 電源關閉靜態操作下)	1, 2
5	Damp Proof Test	$40^{\circ}\text{C}\pm 2^{\circ}\text{C}$, $85\sim 90\%\text{RH}$, 96hr (96 小時，溫度： $40^{\circ}\text{C}\pm 2^{\circ}\text{C}$ ，濕度： $85\sim 90\%\text{RH}$ 電源關閉靜態操作下)	1, 2
6	Vibration Test	Total fixed amplitude : 1.5 mm (完全固定輻射：1.5mm) Vibration Frequency : 10 ~ 55 Hz (震動頻率：10~55 Hz) One cycle 60 seconds to 3 directions of X, Y, Z for each 15 minutes (每一個循環 X, Y, Z 軸方向各做 60 秒，連續做 5 次，共計 15 分鐘)	3
7	Shock Test	To be measured after dropping from 60cm high on the concrete surface in packing state. (包裝材從 60 公分高的地方向地面落下)  Dropping method comer dropping (角落落下方式) A comer : once Edge dropping (側邊落下) B, C, D edge : once Face dropping (表面落下) E, F, G face : once	

Note 1 : No dew condensation to be observed. (不要在”水氣凝結點”下觀察)

Note 2 : The function test shall be conducted after 4 hours storage at the normal

Temperature and humidity after removed from the test chamber

(從實驗室移出後，放在一般常溫 (溫度： 25°C ，濕度： $45\%\text{RH}$)，

且四小時後通電流或電壓，看它是否能正常動作)

Note 3 : Vibration test will be conducted to the product itself without putting it in a container.

(在震動測試下，產品本身不需容器即能自行傳導)

18. Precautions Against Product Handling [產品使用注意事項]：

The following precautions will guide you in handling our product correctly.

[下列警戒引導正確地使用產品]

18.1 Care of the LCD module against static electricity discharge. [LCD 模組靜電注意事項]

18.1.1 When working with the module, be sure to ground your body and any electrical equipment you may be using. We strongly recommend the use of anti static mats (made of rubber), to protect work tables against the hazards of electrical shock.

[操作模組時，避免操作者身體接地及任何造成靜電的設備同時使用，強烈建議(橡膠製)抗靜電墊的使用，以免工作台面遭受到電氣干擾]

18.1.2 Slowly and carefully remove the protective film from the LCD module, since this operation can generate static electricity.

[緩慢小心地移除 LCD 模組上的保護膜，以防靜電產生]

18.1.3 Avoid the use of work clothing made of synthetic fibers. We recommend cotton clothing or other conductivity-treated fibers.

[避免穿著人造合成的工作服，建議棉質或是有傳導性的纖維質料]

18.2 Liquid crystal display devices (LCD devices) [液晶螢幕顯示器的組成]

18.2.1 The polarizer adhering to the surface of the LCD is made of a soft material.

Guard against scratching it. [偏光板是軟性原料製成，請勿刮傷]

18.2.2 The LCD device panel used in the LCM is made of plate glass. Avoid any strong mechanical shock. Should the glass break handle it with care.

[模組使用的玻璃為平面玻璃，避免任何強烈的機械撞擊，且觸碰時請小心]

18.3 When the LCD module alone must be stored form long periods of time

[當 LCD 模組須長時間存放時]

18.3.1 Protect the modules from excessive external forces. [避免外力壓迫]

18.3.2 Protect the modules from high temperature and humidity. [避免處於高溫高濕下]

18.3.3 Keep the modules out of direct sunlight or direct exposure to ultraviolet rays.

[遠離陽光曝曬或直接曝露在紫外線下]

18.4 Use the module with a power supply that is equipped with an over current protector circuit, since the module is not provided with this protective feature.

[因為模組本身沒有防護，所以模組的供應器應配有過高電流的保護迴路]

18.5 Do not ingest the LCD fluid itself should it leak out of a damaged LCD module. Should hands or clothing come in contact with LCD fluid, wash immediately with soap.

[LCD 破裂液晶外漏時，切勿食下液晶；若手或衣服接觸到液晶，請立刻用肥皂清洗]

18.6 Conductivity is not guaranteed for models that use metal holders where solder connections between the metal holder and the PCB are not used. Please contact us to discuss appropriate ways to assure conductivity.

[當金屬框並沒焊接於 PCB 板上時，無法保證使用金屬框是具有傳導性，請連絡我們商討適當方式傳導]

18.7 For models which use CCFL [CCFL 的模組]:

18.7.1 High voltage of 1000V or greater is applied to the CCFL cable connector area.

[CCFL 排線連接器用於 1000V 以上的高電壓]

18.7.2 Protect CCFL cables from rubbing against the unit and thus causing the wire jacket to become worn. [CCFL 排線必須有保護 CCFL 與模組磨擦，以防 CCFL 外殼受到損害]

18.7.3 The use of CCFLs for extended periods of time at low temperatures will significantly shorten their service life. [長時間低溫使用 CCFL 會明顯縮減其使用壽命]

18.8 For models which use touch panels [觸控式面板模組]:

18.8.1 Do not stack up modules since they can be damaged by components on neighboring modules.
[勿堆疊模組以防損壞]

18.8.2 Do not place heavy objects on top of the product. This could cause glass breakage.
[勿將重物放置在產品上，會導致玻璃破損]

18.9 For models which use COG & TAB [COG 及 TAB 模組]:

18.9.1 The mechanical strength of the product is low since the IC chip is faces out unprotected from the rear. Be sure to protect the rear of the IC chip from external forces.
[由於 IC 晶片表面無防護，所以抗壓力有限，須加強保護以防外力]

18.9.2 Given the fact that the rear of the IC chip is left exposed, in order to protect the unit from electrical damage, avoid installation configurations in which the rear of the IC chip runs the risk of making any electrical contact.
[勿暴露 IC 晶片以防電氣干擾，且避免安裝 IC 時有任何電子接觸]

18.10 Models which use flexible cable, heat seal, or TAB [加有軟排線、熱封條或 TAB 的模組]:

18.10.1 In order to maintain reliability, do not touch or hold by the connector area.
[以維持產品信賴度，請勿觸碰或握住連接器]

18.10.2 Avoid any bending, pulling, or other excessive force, which can result in broken connections. [避免彎曲、拉扯或過度力量，會造成連接器損壞]

18.11 In case of acrylic plate is attached to front side of LCD panel, cloudiness (very small cracks) can occur on acrylic plate, being influenced by some components generated from polarizer film.

Please check and evaluate those acrylic materials carefully before use.

[貼在 LCD 玻璃前面的壓克力板若有模糊情況(微小裂縫)，即會影響偏光板；使用前請仔細確認壓克力材質]

18.12 In case of buffer material such as cushion/gasket is assembled into LCD module, it may have an adverse effect on connecting parts (LCD panel-TCP/ HEAT SEAL/ FPC, PCB-TCP/HEAT SEAL/FPC, TCP-HEAT SEAL, TCP-FPC, HEAT SEAL-FPC) depending on its materials.

Please check and evaluate these materials carefully before use.

[緩衝原料像是減震墊/襯墊，或許會對連接器(LCD panel-TCP/ HEAT SEAL/ FPC, PCB-TCP/HEAT SEAL/FPC, TCP-HEAT SEAL, TCP-FPC, HEAT SEAL-FPC)造成反效果，使用前請仔細確認材料]

19. Warranty [保證]:

This product has been manufactured to your company's specifications as a part for use in your company's general electronic products. It is guaranteed to perform according to delivery specifications. For any other use apart from general electronic equipment, we cannot take responsibility if the product is used in medical devices, nuclear power control equipment, aerospace equipment, fire and security systems, or any other applications in which there is a direct risk to human life and where extremely high levels of reliability are required. If the product is to be used in any of the above applications, we will need to enter into a separate product liability agreement.

[此產品的製造是依照客戶的規格，被使用於客戶的一般電子產品上，保證產品製作根據出貨的規格，若產品的使用不是在一般電子設備，而組裝於下列產品上則無法受理（如醫療產品、核心電源控制設備、航空設備、防火及保全系統，或任何相關儀器會直接影響人類生命等），若模組使用於上述的儀器，則需商討各別產品責任義務的協定]

- 19.1 We cannot accept responsibility for any defect, which may arise after the application of strong external force to the product.
[不受理因強大外力衝擊造成產品的缺陷]
- 19.2 We cannot accept responsibility for any defect, which may arise from additional manufacturing of the product (including disassembly and reassembly), after product delivery.
[不受理產品出貨後，因額外加工(包含拆裝及重新封包)造成的缺陷]
- 19.3 We cannot accept responsibility for any defect, which may arise due to the application of static electricity after the product, has passed your company's acceptance inspection procedures.
[不受理通過貴公司檢驗流程後，由於靜電造成產品的缺陷]
- 19.4 We cannot accept responsibility for intellectual property of a third party, which may arise through the application of our product to your assembly with exception to those issues relating directly to the structure or method of manufacturing of our product.
[不受理因在客戶產品生產線端所產生的第三人智慧財產權責任，除非與我司生產製造方法有直接關係的問題]
- 19.5 When the product is in CCFL models, CCFL service life and brightness will vary according to the performance of the inverter used, leaks, etc. We cannot accept responsibility for product performance, reliability, or defect, which may arise.
[產品是 CCFL 模組時，CCFL 的壽命及亮度將取決於連接器的性能、漏電量等；無法受理因 CCFL 造成產品性能的缺陷]
- 19.6 SDEC will not be held responsible for any quality guarantee issue for defect products longer than 1(one) year from SDEC production which ever comes later.
[出廠超過一年的瑕疵品，任何品質擔保則不受理]