SPECIFICATION FOR LCD MODULE

Model No. TM12864D6CIWG

Prepared by:	**Date:**
Checked by :	**Date:**
Verified by :	**Date:**
Approved by:	**Date:**

TIANMA MICROELECTRONICS CO., LTD

Ver.1. 1

REVISION RECORD

Date	Ver.	Ref. Page	Revision No.	Revision Items
05-11-11	Ver.1.1	26		

1 General Specifications:

1.1 Display type: FSTN

1.2 Display color*[1]:

Display color: Black

Background*[2]: White

1.3 Polarizer mode: Transflective/Positive

1.4 Viewing Angle: 6:00

1.5 Driving Method: 1/65 Duty 1/9 Bias

1.6 LCD Operating Voltage: 9.5V VDD: 3.0V

1.7 Without Backlight.

1.8 Controller: S6B0724A01-BOCY

1.9 Data Transfer: 8 bits Parallel

1.10 Operating Temperature: -20----+70℃

Storage Temperature: -30----+80℃

1.11 Outline Dimensions: Refer to outline drawing on next page

1.12 Dot Matrix: 128X 64 DOTS

1.13 Dot Size: 0.138X0.158 (mm)

1.14 Dot Pitch: 0.15X0.17 (mm)

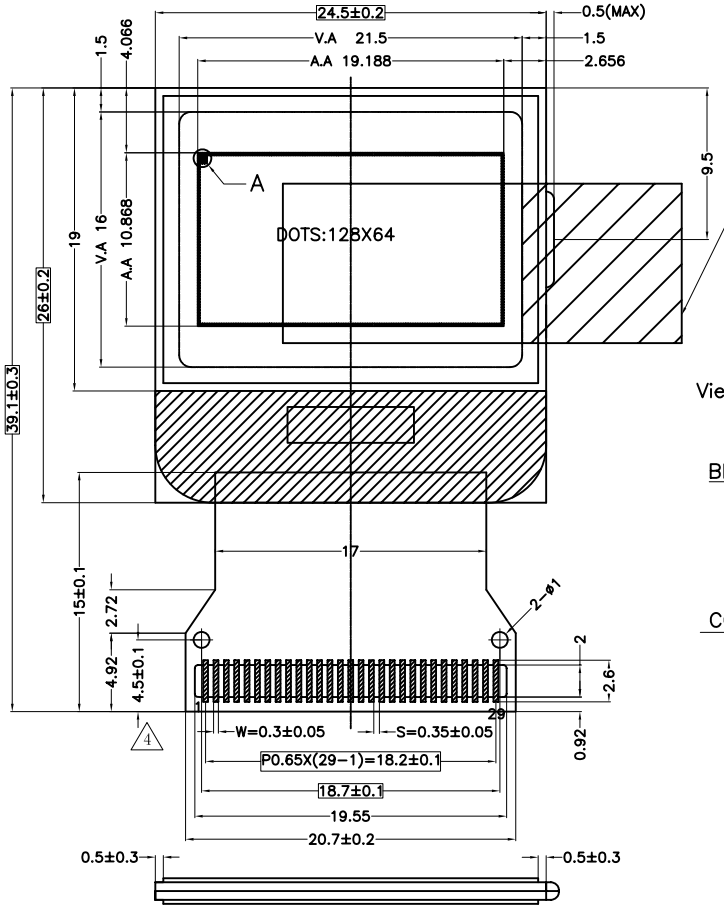
1.15 Weight: Approx 10g

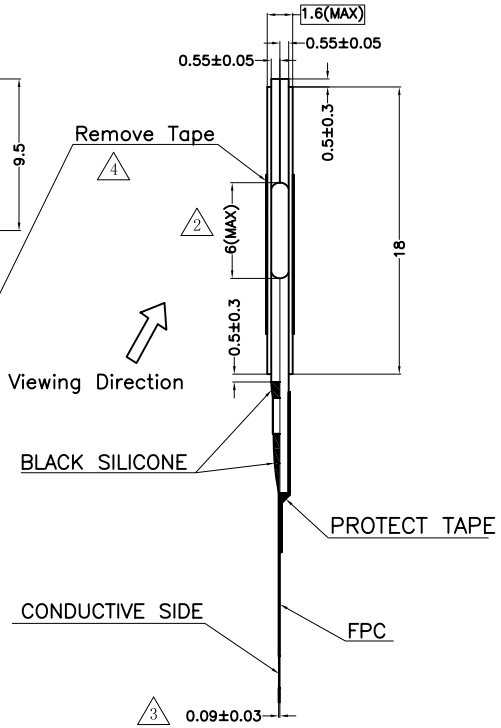
1.16 REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS

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

*[2] Color tone will be changed by backlight.

2. Outline Drawing

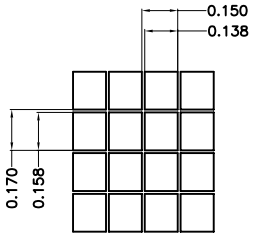




PIN CONNECTION △1

NO	SYMBOL	NO	SYMBOL
1	DUMMY	16	DB7(SI)
2	V0	17	DB6(SCL)
3	V4	18	DB5
4	V3	19	DB4
5	V2	20	DB3
6	V1	21	DB2
7	C2-	22	DB1
8	C2+	23	DB0
9	C1+	24	E/RD
10	C1-	25	RW/WR
11	C3+	26	A0(RS)
12	C4+	27	/RES
13	VOUT	28	/CS1B
14	VSS	29	DUMMY
15	VDD		

NOTES:
1. DISPLAY TYPE: FSTN △2
2. VIEWING DIRECTION: 6:00
3. POLARIZER MODE: TRANSFLECTIVE/POSITIVE
4. LOGIC VOLTAGE: 3.0V △1
5. LCD OPERATING VOLTAGE: 9.5V △1 △2
6. DRIVE METHOD: 1/65 DUTY 1/9 BIAS △1
7. OPERATING TEMP: −20°C−+70°C
8. STORAGE TEMP: −30°C−+80°C
9. CONTROLLER: S6B0724A01−BOCY
10. WITHOUT BACKLIGHT
11. UNMARKED TOLERANCES: ±0.2mm
12. THE CONTROLLED DIMENSIONS TO BE
13. REQUIREMENTS ON ENVIRONMENTAL PROTECTION: RoHS
14. REMARK:PARALLEL MODE,8080 MODE △1



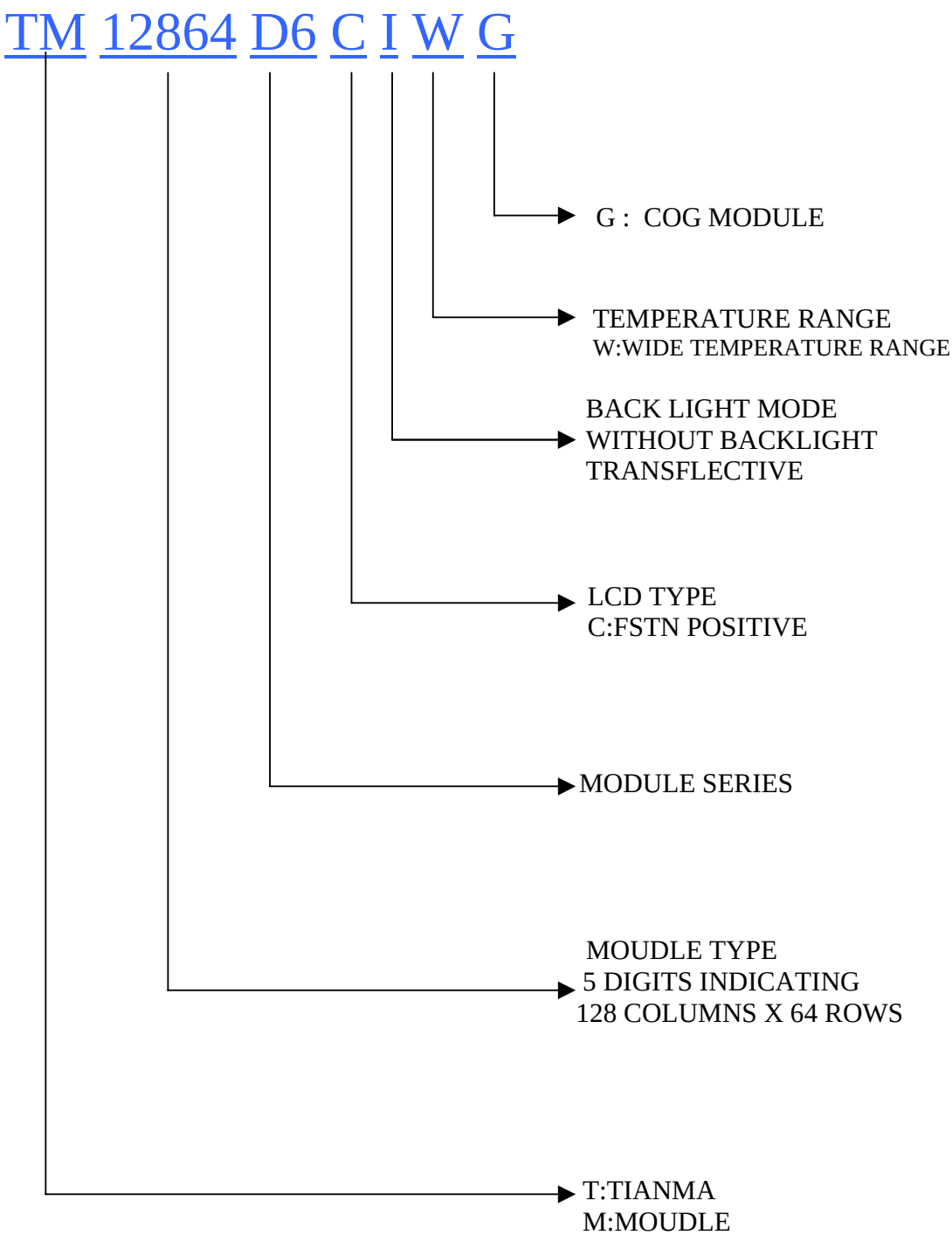
DETAIL A:

NO	MARK	DESCRIPTION
4	△4	按客户要求更改撕膜标签位置,更改FPC定位孔的位置
3	△3	按照客户要求更改撕膜标签位置,更改FPC厚度
2	△2	按照客户要求更改技术要求,并更改玻璃封口尺寸
1	△1	按照客户要求更改PIN MAP和撕膜标签位置，并更改技术要求

TIAN-MA MICROELECTRONICS CO.
22/F., HANGDU Building, Shennan Road, Central, Shenzhen, China

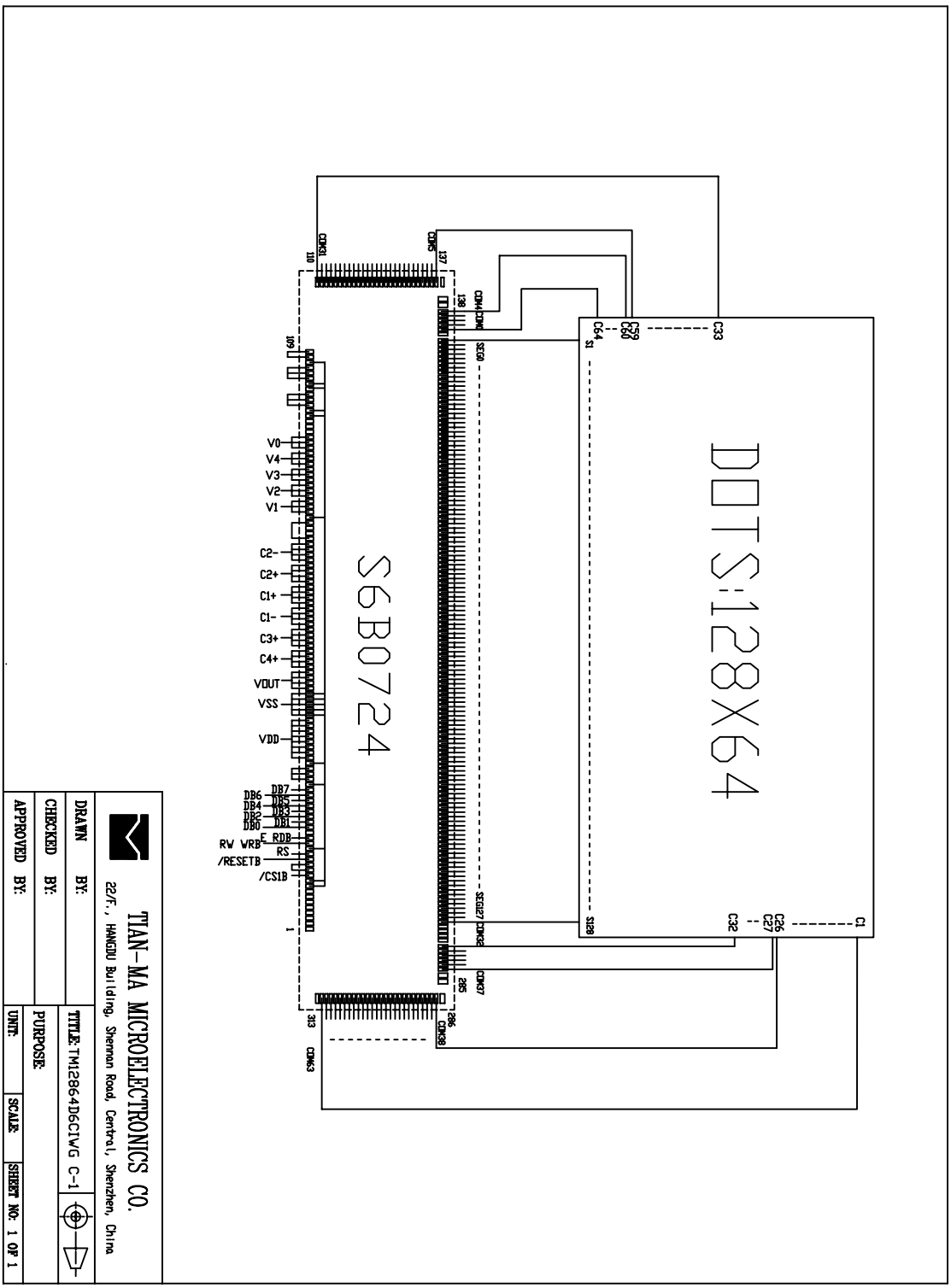
DRAWN BY:	TITLE: TM12864D6CIWG	
CHECKED BY:		
APPROVED BY:	DWG NO: G−5	SCALE: 1:1
CONFIRMED BY:	DWG NAME: TM12864D6CIWG G−5	UNIT: mm
		SHEET NO: 1 OF 1

3 LCD Module Part Numbering System

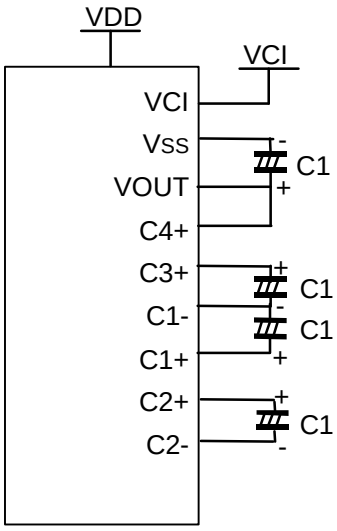


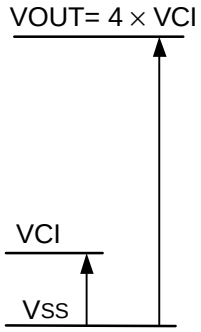
4 Circuit Block Diagram

4.1 Circuit Block Diagram



4.2 Power Supply Circuit





*Value of External Capacitance		
Item	Value	
C1	1.0~4.7	μF
C2	0.47~2.2	

5 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	-0.3	7.0	V	
LCD Driving Voltage	V_{LCD}	-0.3	17.0		
Operating Temperature Range	T_{OP}	-20	+70	℃	No Condensation
Storage Temperature Range	T_{ST}	-30	+80		

6 Electrical Specifications and Instruction Code

6.1 Electrical characteristics

Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	2.4	3.0	3.6	V
Supply Voltage (LCD Drive)		V_{LCD}	9.0	9.5	10.0	V
Input Signal Voltage	High	V_{IH} (V_{DD}=3.0)	0.8V_{DD}	-	V_{DD}	V
	Low	V_{IL} (V_{DD}=3.0)	0	-	0.2 V_{DD}	V
Supply current (Logic) (Display Character)		I_{DD} ($V_{DD}-V_{SS}$ =3.0)	-	-	500	uA

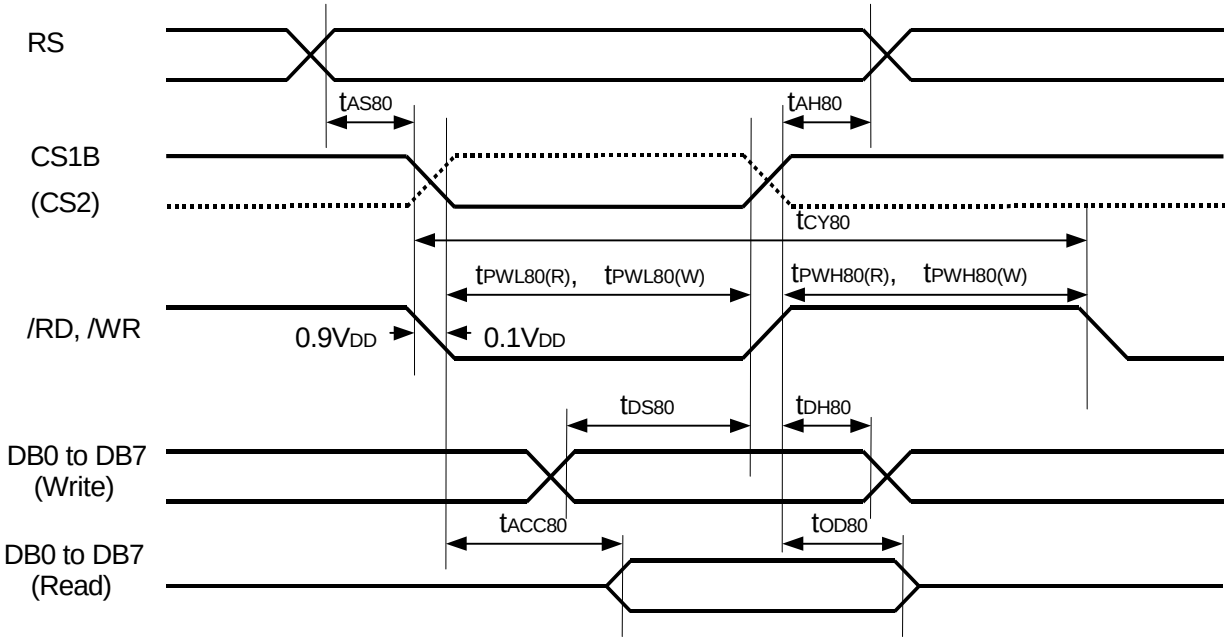
6.2 Interface signal

Pin No.	Symbol	Level	Description
1	DUMMY	--	NOT CONNECT
2	V0	--	LCD Driver supply voltages.
3	V4	--	LCD Driver supply voltages.
4	V3	--	LCD Driver supply voltages.
5	V2	--	LCD Driver supply voltages.
6	V1	--	LCD Driver supply voltages.
7	C2-	--	Capacitor 2 negative connection pin for voltage converter.
8	C2+	--	Capacitor 2 positive connection pin for voltage converter.
9	C1+	--	Capacitor 1 positive connection pin for voltage converter.
10	C1-	--	Capacitor 1 negative connection pin for voltage converter.
11	C3+	--	Capacitor 3 positive connection pin for voltage converter.
12	C4+	--	Capacitor 4 positive connection pin for voltage converter.
13	VOUT	--	Voltage converter input/output pin.
14	VSS	0V	Ground
15	VDD	3.0V	Power Supply.
16	DB7	H/L	Data bit 7
17	DB6	H/L	Data bit 6
18	DB5	H/L	Data bit 5
19	DB4	H/L	Data bit 4
20	DB3	H/L	Data bit 3
21	DB2	H/L	Data bit 2
22	DB1	H/L	Data bit 1
23	DB0	H/L	Data bit 0
24	E/RD	H/L	When connected to an 8080 MPU, it is active LOW. The NT7502 data bus is in an output status when this signal is “L”. When connected to a 6800 MPU, it is active HIGH. This is used as an enable clock input of the 6800

			MPU.
25	RW/WR	H/L	When connected to an 8080 MPU, it is active LOW. The signals on the data bus are latched at the rising edge of the WRB signal. When connected to a 6800 MPU, it is active HIGH. This is the R/W control signal input.
26	A0(RS)	H/L	H: Input data are display data. L: Input data are control data.
27	/RES	H/L	Reset Signal. L: Initialization is executed.
28	/CS1B	H/L	Chip selects signal. L: Active
29	DUMMY	H/L	Not connect.

6.3 Interface Timing Chart

1). System Buses Read/Write Characteristics (for 8080 Series MPU)



** $t_{PWL80(W)}$ and $t_{PWL80(R)}$ is specified in the overlapped period when CS1B is low (CS2 is high) and /WR(/RD) is low.

(V_{DD} = 2.4 to 3.6V, Ta = -40 to +85°C)

Item		Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time		RS,RW	t_{AS68} t_{AH68}	0 0	-	-	ns	
System cycle time		E	t_{CY68}	300	-	-	ns	
Enable Pulse High Width	Read	E	$t_{PWH68\ (R)}$	120			ns	
	Write		$t_{PWH68\ (W)}$	60				
Enable Pulse Low Width	Read	E	$t_{PWL68\ (R)}$	60			ns	
	Write		$t_{PWL68\ (W)}$	60				
Data setup time Data hold time		DB7 To DB0	t_{DS68} t_{DH68}	40 15	-	-	ns	
Access time Output disable time			t_{ACC68} t_{OD68}	- 10	-	140 100	ns	C_L = 100 pF

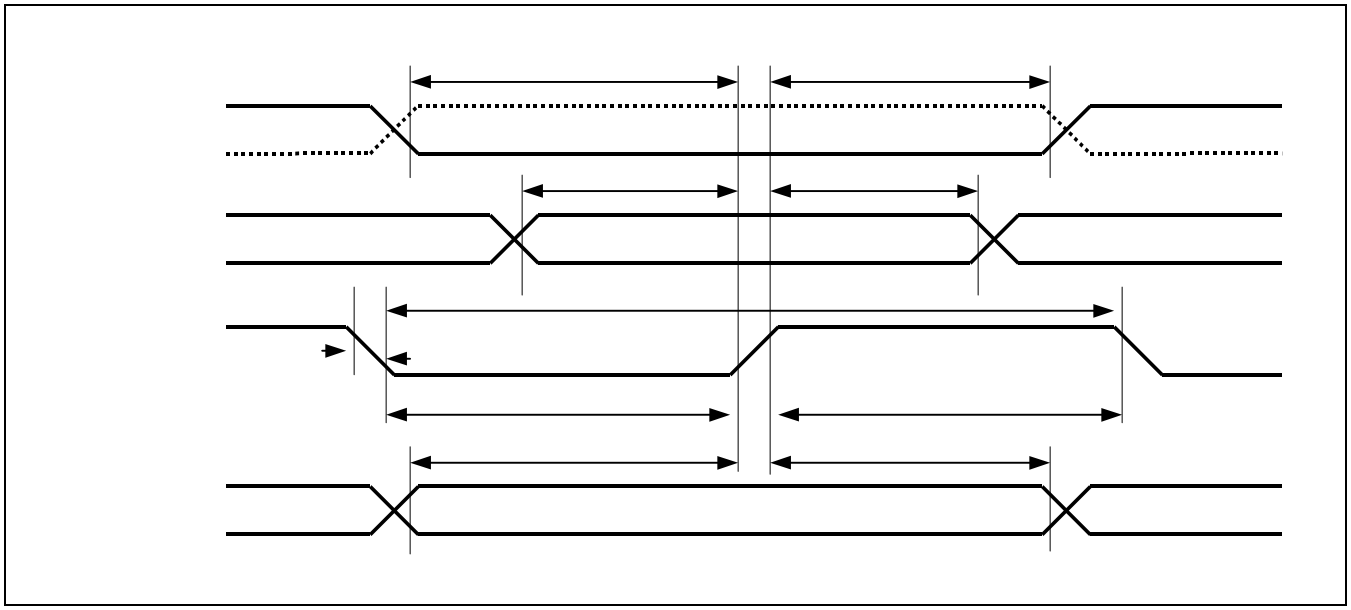
System Buses Read/Write Characteristics (for 8080 Series MPU) (continued)

(V_{DD} = 4.5 to 5.5V, Ta = -40 to +85°C)

Item		Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Address setup time Address hold time		RS,RW	t_{AS68} t_{AH68}	0 0	-	-	ns	
System cycle time		E	t_{CY68}	166	-	-	ns	
Enable Pulse High Width	Read	E	$t_{PWH68\ (R)}$	70			ns	
	Write		$t_{PWH68\ (W)}$	30				
Enable Pulse Low Width	Read	E	$t_{PWL68\ (R)}$	30			ns	
	Write		$t_{PWL68\ (W)}$	30				
Data setup time Data hold time		DB7 To DB0	t_{DS68} t_{DH68}	30 10	-	-	ns	
Access time Output disable time			t_{ACC68} t_{OD68}	- 10	-	70 50	ns	C_L = 100 pF

Note: 1. The input signal rising time and falling time (tr, tf) is specified at 15ns or less. Or (tr + tf) < (t_{CY68} – $t_{PWL68\ (W)}$ – $t_{PWH68\ (W)}$) for write, (tr + tf) < (t_{CY68} – $t_{PWL68\ (R)}$ – $t_{PWH68\ (R)}$) for read.

2). System Buses Read/Write Characteristics (for 6800 Series MPU)



(V_{DD} = 2.4 to 3.6V, Ta = -40 to +85°C)

			Min.	Typ.	Max.	Unit	Remark
Serial clock cycle SCLK high pulse width SCLK low pulse width	DB6 (SCLK)	t_{CYS} t_{WHS} t_{WLS}	250 100 100	- - -	- - -	ns	
Address setup time Address hold time	RS	t_{ASS} t_{AHS}	150 150	- -	- -	ns	
Data setup time Data hold time	DB7 (SID)	t_{DSS} t_{DHS}	100 100	- -	- -	ns	
CS1B setup time CS1B hold time	CS1B	t_{CSS} t_{CHS}	150 150	- -	- -	ns	

(V_{DD} = 4.5 to 5.5V, Ta = -40 to +85°C)

Item	Signal	Symbol	Min.	Typ.	Max.	Unit	Remark
Serial clock cycle SCLK high pulse width SCLK low pulse width	DB6 (SCLK)	t_{CYS} t_{WHS} t_{WLS}	200 75 75	- - -	- - -	ns	
Address setup time Address hold time	RS	t_{ASS} t_{AHS}	50 100	- -	- -	ns	
Data setup time Data hold time	DB7 (SID)	t_{DSS} t_{DHS}	50 50	- -	- -	ns	
CS1B setup time CS1B hold time	CS1B	t_{CSS} t_{CHS}	100 100	- -	- -	ns	

6.4 Instruction Code

	RS	RW	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	Description
Display ON / OFF	0	0	1	0	1	0	1	1	1	DON	Turn on/off LCD panel When DON = 0: display OFF When DON = 1: display ON
Initial display line	0	0	0	1	ST5	ST4	ST3	ST2	ST1	ST0	Specify DDRAM line for COM0
Set page address	0	0	1	0	1	1	P3	P2	P1	P0	Set page address
Set column address MSB	0	0	0	0	0	1	Y7	Y6	Y5	Y4	Set column address MSB
Set column address LSB	0	0	0	0	0	0	Y3	Y2	Y1	Y0	Set column address LSB
Read status	0	1	BUSY	ADC	ONOFF	RESETB	0	0	0	0	Read the internal status
Write display data	1	0	Write data								Write data into DDRAM
Read display data	1	1	Read data								Read data from DDRAM
ADC select	0	0	1	0	1	0	0	0	0	ADC	Select SEG output direction When ADC = 0: normal direction (SEG0→SEG131) When ADC = 1: reverse direction (SEG131→SEG0)
Reverse display ON / OFF	0	0	1	0	1	0	0	1	1	REV	Select normal / reverse display When REV = 0: normal display When REV = 1: reverse display
Entire display ON / OFF	0	0	1	0	1	0	0	1	0	EON	Select normal/entire display ON When EON = 0: normal display. When EON = 1: entire display ON
LCD bias select	0	0	1	0	1	0	0	0	1	BIAS	Select LCD bias
Set modify-read	0	0	1	1	1	0	0	0	0	0	Set modify-read mode
Reset modify-read	0	0	1	1	1	0	1	1	1	0	release modify-read mode
Reset	0	0	1	1	1	0	0	0	1	0	Initialize the internal functions
SHL select	0	0	1	1	0	0	SHL	×	×	×	Select COM output direction When SHL = 0: normal direction (COM0→COM63) When SHL = 1: reverse direction (COM63→COM0)
Power control	0	0	0	0	1	0	1	VC	VR	VF	Control power circuit operation
Regulator resistor select	0	0	0	0	1	0	0	R2	R1	R0	Select internal resistance ratio of the regulator resistor
Set reference voltage mode	0	0	1	0	0	0	0	0	0	1	Set reference voltage mode
Set reference voltage register	0	0	×	×	SV5	SV4	SV3	SV2	SV1	SV0	Set reference voltage register
Set static indicator mode	0	0	1	0	1	0	1	1	0	SM	Set static indicator mode
Set static indicator register	0	0	×	×	×	×	×	×	S1	S0	Set static indicator register
Power save	-	-	-	-	-	-	-	-	-	-	Compound Instruction of display OFF and entire display ON
NOP	0	0	1	1	1	0	0	0	1	1	*Non-Operation command*
Test Instruction_1	0	0	1	1	1	1	×	×	×	×	*Don't use this instruction*
Test Instruction_2	0	0	1	0	0	1	×	×	×	×	*Don't use this instruction*

Note: Do not use any other command, or the system malfunction may result.

7 Optical Characteristics

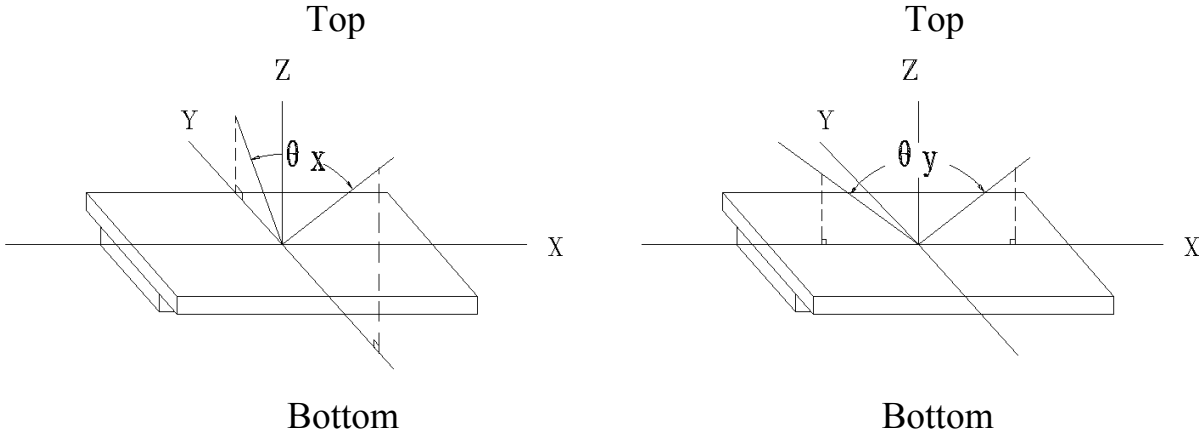
7.1 Optical Characteristics

Ta=25℃

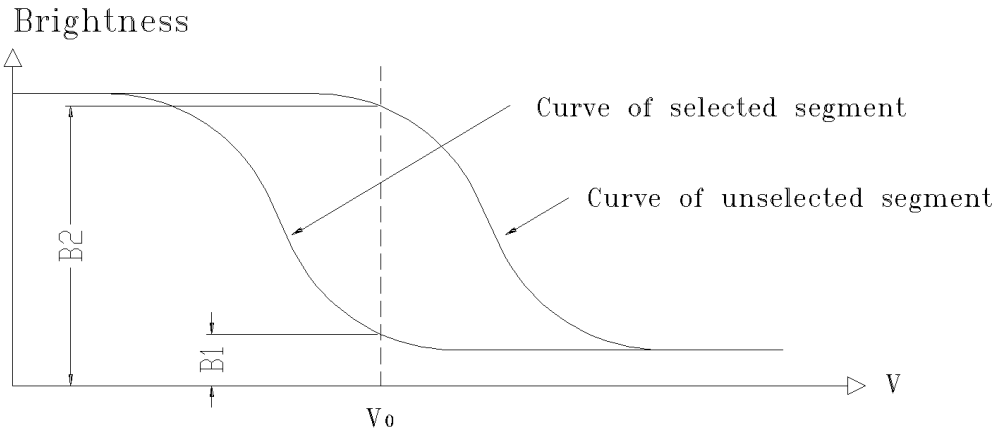
Item		Symbol	Condition		Min.	Typ.	Max.	Unit
Viewing Angle		θ_x	$C_r \geq 2$	$\theta_y=0°$	-30 -- 20			Deg
		θ_y		$\theta_x=0°$	-30 -- 30			
Contrast Ratio		C_r	$\theta_x=0°$ $\theta_y=0°$		3.0	-	-	
Response Time	Turn on	T_{on}	$\theta_x=0°$ $\theta_y=0°$		-	-	300	ms
	Turn off	T_{off}			-	-	300	

7.2 Definition of Optical Characteristics

7.2.1 Definition of Viewing Angle



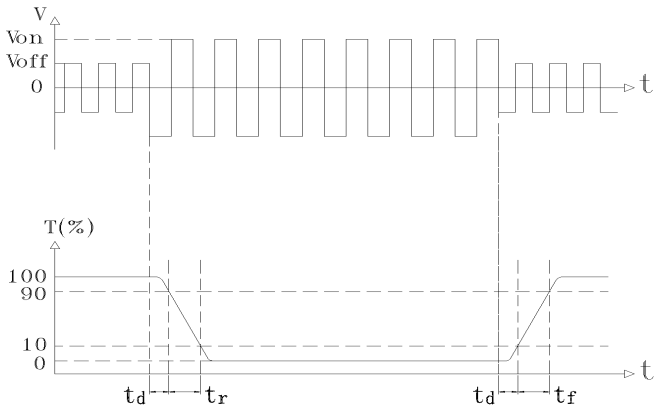
7.2.2 Definition of Contrast Ratio



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

Measuring Conditions:

1) Ambient Temperature: 25℃ 2) Frame frequency: 100.0Hz



7.2.3 Definition of Response time

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

Measuring Condition:

1) Operating Voltage: 9.0V 2) Frame frequency: 100.0Hz

8 Reliability

8.1 Content of Reliability Test Ta=25℃

No.	Test Item	Content of Test	Test condition
1	High Temperature Storage	Endurance test applying the high storage temperature for a long time	80℃ 240H Restore 4H at 25℃
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-30℃ 240H Restore 4H at 25℃
3	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	60℃ 90%RH 240H Restore 4H at 25℃
4	Temperature Cycle	Endurance test applying the low and high temperature cycle -30℃←→25℃←→80℃←→25℃ 30min 5min 30min 5min ←——————————→ 1 cycle	-30℃/80℃ 10 cycles Restore 4H at 25℃
5	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 100m/s^2, 120min
6	Shock Test (package state)	Endurance test applying the shock during transportation	Half- sine wave, 300m/s^2, 18ms
7	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	25kPa 16H Restore 2H

8.2 Failure Judgment Criterion

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

9 QUALITY LEVEL

Examination or Test	At T_{amb}=25℃ (unless otherwise stated)	Inspection				
		Min.	Max.	Unit	IL	AQL
External Visual Inspection	Under normal illumination and eyesight condition, the distance between eyes and LCD is 25cm.	See annex A			II	Major 0.65 Minor 1.5
Display Defects	Under normal illumination and eyesight condition, display on inspection.	See annex B			II	Major 0.65 Minor 1.5
Note: Major defects: Open segment or common, Short, Serious damages, Leakage Miner defects: Others Sampling standard conforms to GB2828						

10 Precautions for Use of LCD Modules

10.1 Handling Precautions

10.1.1 The display panel is made of glass. Do not subject it to a mechanical shock by dropping it from a high place, etc.

10.1.2 If the display panel is damaged and the liquid crystal substance inside it leaks out, be sure not to get any in your mouth, if the substance comes into contact with your skin or clothes, promptly wash it off using soap and water.

10.1.3 Do not apply excessive force to the display surface or the adjoining areas since this may cause the color tone to vary.

10.1.4 The polarizer covering the display surface of the LCD module is soft and easily scratched. Handle this polarizer carefully.

10.1.5 If the display surface is contaminated, breathe on the surface and gently wipe it with a soft dry cloth. If still not completely clear, moisten cloth with one of the following solvents:

— Isopropyl alcohol
— Ethyl alcohol

Solvents other than those mentioned above may damage the polarizer. Especially, do not use the following:

— Water
— Ketone
— Aromatic solvents

10.1.6 Do not attempt to disassemble the LCD Module.

10.1.7 If the logic circuit power is off, do not apply the input signals.

10.1.8 To prevent destruction of the elements by static electricity, be careful to maintain an optimum work environment.

a. Be sure to ground the body when handling the LCD Modules.
b. Tools required for assembly, such as soldering irons, must be properly ground.
c. To reduce the amount of static electricity generated, do not conduct assembly and other work under dry conditions.
d. The LCD Module is coated with a film to protect the display surface. Be care when peeling off this protective film since static electricity may be generated.

10.2 Storage precautions

10.2.1 When storing the LCD modules, avoid exposure to direct sunlight or to the light of fluorescent lamps.

10.2.2 The LCD modules should be stored under the storage temperature range. If the LCD modules will be stored for a long time, the recommend condition is:

Temperature : 0℃ ～ 40℃

Relatively humidity: ≤80%

10.2.3 The LCD modules should be stored in the room without acid, alkali and harmful gas.

10.3 The LCD modules should be no falling and violent shocking during transportation, and also should avoid excessive press, water, damp and sunshine.

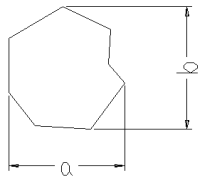
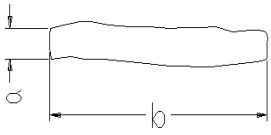
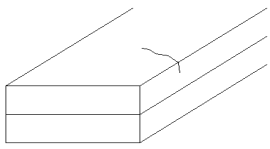
11.Packing Details

We pack 30 modules per plastic tray.
There are 14 plastic trays in a single color box, and the top one is empty.
After pile up the plastic trays, put an antistatic pearl cotton at the top side and the bottom with another.
A single carton can load three of the color boxes.

The size of antistatic pearl cotton is:
336mm X 246mm X 4mm (L X W X H)
The size of single color box is:
363mm X 263mm X 95mm (L X W X H)
The size of single carton is:
395mm X 290mm X 315mm (L X W X H)

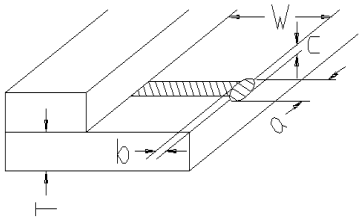
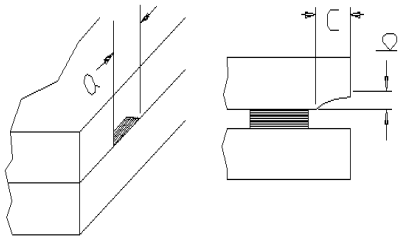
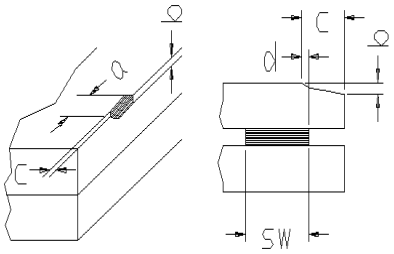
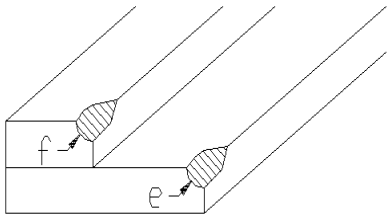
Appendix A

Inspection items and criteria for appearance defects

<table>
<tr><th>Items</th><th>Contents</th><th colspan="3">Criteria</th></tr>
<tr><td colspan="2">Protective Glue</td><td colspan="3">No clear defects</td></tr>
<tr><td colspan="2">Cover Tape</td><td colspan="3">Covering all of the chip and no clear crimple</td></tr>
<tr><td colspan="2">Leakage</td><td colspan="3">Not permitted</td></tr>
<tr><td colspan="2">Rainbow</td><td colspan="3">According to the limit specimen</td></tr>
<tr><td rowspan="4">Polarizer</td><td>Wrong polarizer attachment</td><td colspan="3">Not permitted</td></tr>
<tr><td rowspan="2">Bubble between polarizer and glass</td><td>Not counted</td><td colspan="2">Max. 3 defects allowed</td></tr>
<tr><td>ϕ<0.3mm</td><td colspan="2">0.3mm≤ϕ≤0.5mm</td></tr>
<tr><td>Scratches of polarizer</td><td colspan="3">According to the limit specimen</td></tr>
<tr><td rowspan="3">Black spot (in viewing area)</td><td rowspan="3">  </td><td>Not counted</td><td>Max. 3 spots allowed</td><td rowspan="4">Max. 3 spots (lines) allowed</td></tr>
<tr><td>X<0.20mm</td><td>0.20mm≤X≤0.5mm</td></tr>
<tr><td colspan="2">X=(a+b)/2</td></tr>
<tr><td>Black line (in viewing area)</td><td>  </td><td>Not counted</td><td>Max. 3 lines allowed</td></tr>
<tr><td>Progressive cracks</td><td>  </td><td>a<0.02mm</td><td>0.02mm≤a≤0.05mm
b≤2.0mm</td><td></td></tr>
<tr><td>Progressive cracks</td><td></td><td colspan="2">Not permitted</td><td></td></tr>
</table>

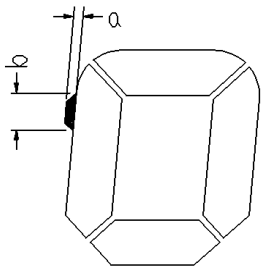
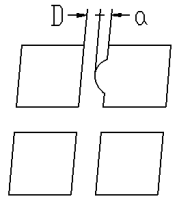
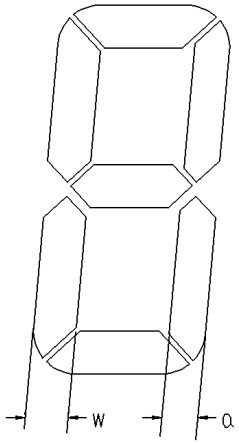
Appendix A

Inspection item and criteria for appearance defects (continued)

<table>
<tr><th>Items</th><th>Contents</th><th colspan="4">Criteria</th></tr>
<tr><td rowspan="4">Glass Cracks</td><td>Cracks on pads
 
</td><td>a
≦3mm
≦2mm</td><td>b
≦W/5
≦W/5</td><td>c
≦T/2
T/2<C<T</td><td>Max. 2 Cracks allowed</td><td rowspan="4">Max. 5 cracks allowed</td></tr>
<tr><td>Cracks on contact side
 
</td><td colspan="2">a
≦3mm
≦2mm
C shall be not reach the seal area</td><td>b
≦T/2
T/2<b<T</td><td rowspan="2">Max. 2 cracks allowed</td></tr>
<tr><td>Cracks on non-contact side
 
</td><td colspan="2">a
≦3mm
≦2mm
C≦0.5mm
d≦SW/3</td><td>b
≦T/2
T/2<b<T</td></tr>
<tr><td>Corner cracks
 
</td><td colspan="3">e<2.0mm^2
f<2.0mm^2</td><td>Max. 3 cracks allowed</td></tr>
</table>

Appendix B

Inspection items and criteria for display defects (continued)

<table>
<tr><th>Items</th><th>Content</th><th colspan="3">Critera</th></tr>
<tr><td rowspan="3">Transfor-
mation
of segment</td><td rowspan="2">  </td><td>Not counted</td><td>Max. 2 defects allowed</td><td rowspan="3">Max.3
defects
allowed</td></tr>
<tr><td>x＜0.1mm</td><td>0.1mm≤x≤0.2mm</td></tr>
<tr><td colspan="2">x=(a+b)/2</td></tr>
<tr><td rowspan="2">  </td><td>Not counted</td><td>Max. 1 defects allowed</td></tr>
<tr><td>a＜0.1mm</td><td>0.1mm≤a≤0.2mm
D>0</td></tr>
<tr><td>  </td><td colspan="3">Max.2 defects allowed
0.8W≤a≤1.2W

a=measured value of width
W=nominal value of width</td></tr>
</table>

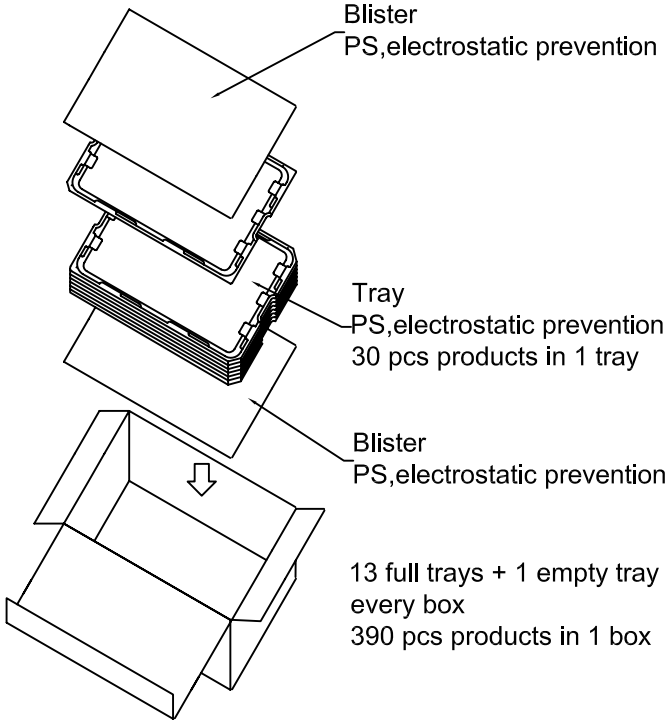
TIANMA MICROELECTRONICS CO.

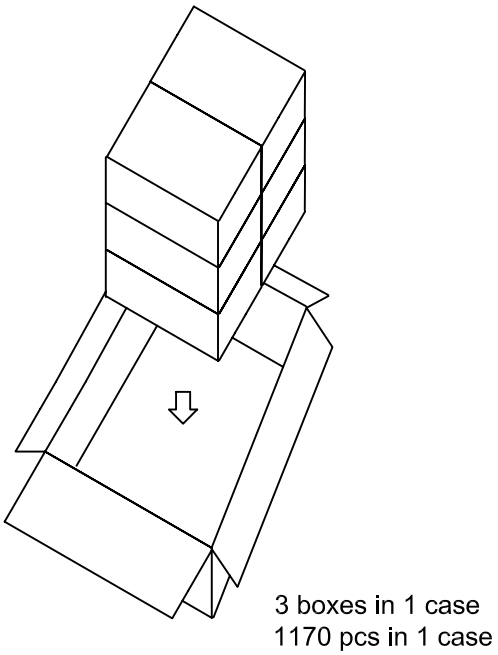
Packing Standards:

Quantity of products to be packaged in a case: 1170 pcs

Outlook size(Carton size):395×290×315mm

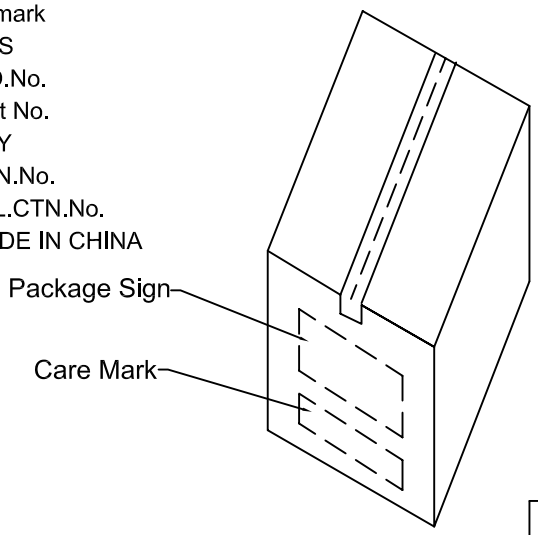
Gross weight: About 20000g



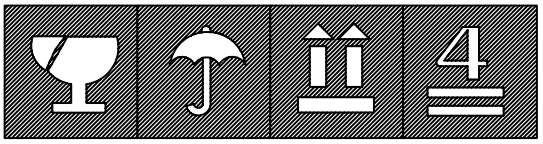


Package Sign:

Case Mark
Remark
BMS
P.O.No.
Part No.
QTY
CTN.No.
TTL.CTN.No.
MADE IN CHINA



Care Mark:



TIAN-MA MICROELECTRONICS CO. 22/F., HANGDU Building, Shennan Road, Central, Shenzhen, China			
DRAWN BY:		TITLE: TM12864D6CIWG	
CHECKED BY:			
APPROVED BY:		DWG NO: PACKAGE METHOD	SCALE: UNIT: mm
CONFIRMED BY:		DWG NAME:	SHEET NO: 1 OF 1