MULTI-INNO TECHNOLOGY CO., LTD

LCD MODULE SPECIFICATION

Model : MI12864P-G-2

Revision	
Engineering	
Date	
Our Reference	

REVISION RECORD

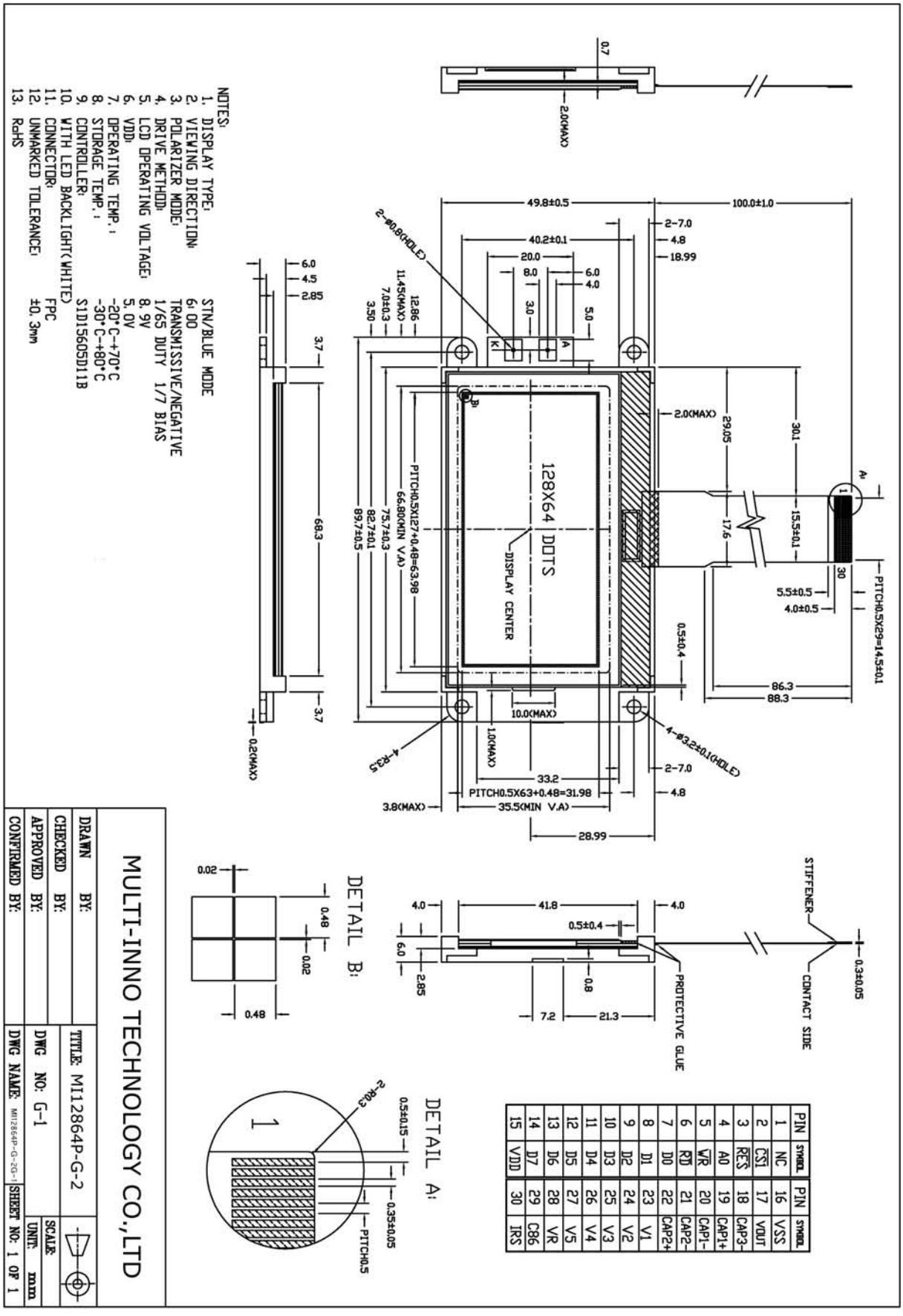
Date	Ver.	Ref. Page	Revision No.	Revision Items
2003-3-29	Ver.1.0			

1 General Specifications:

1.1 Display type: STN
1.2 Display color*[1]:
Display color: White
Background*[2]: Blue
1.3 Polarizer mode: Transmissive/Negative
1.4 Viewing Angle: 6:00
1.5 Driving Method: 1/65 Duty 1/7 Bias
1.6 Logic Voltage: 5.0V
1.7 LCD Operating Voltage: 8.9V
1.8 Backlight: LED(White,5.0V)
1.9 Controller: S1D15605D11D
1.10 Data Transfer: 8 Bit Parallel
1.11 Operating Temperature: -20----+70℃
Storage Temperature: -30----+80℃
1.12 Outline Dimensions: Refer to outline drawing on next page
1.13 Dot Matrix: 128 X 64 Dots
1.14 Dot Size: 0.48X0.48(mm)
1.15 Dot Pitch: 0.5X0.5 (mm)
1.16 Weight: 45g(approx.)

*[1] Color tone is slightly changed by temperature and driving voltage.
*[2] Color tone will be changed by backlight.

2 Outline Drawing

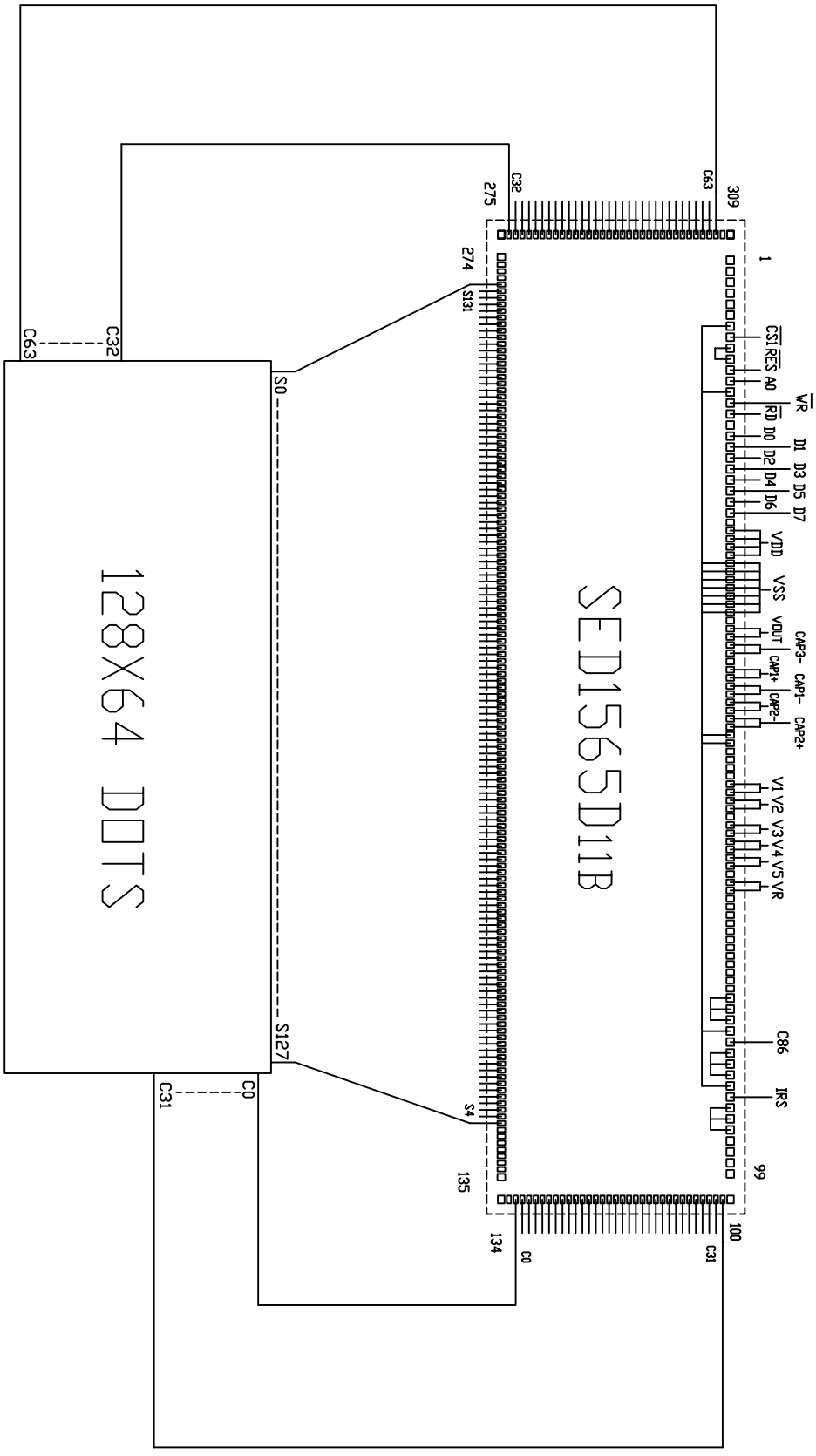


PIN	SYMBOL	PIN	SYMBOL
1	NC	16	VSS
2	CS1	17	VOUT
3	RES	18	CAP3-
4	A0	19	CAP1+
5	WR	20	CAP1-
6	RD	21	CAP2-
7	D0	22	CAP2+
8	D1	23	V1
9	D2	24	V2
10	D3	25	V3
11	D4	26	V4
12	D5	27	V5
13	D6	28	VR
14	D7	29	C86
15	VDD	30	IRS

3 LCD Module Part Numbering System

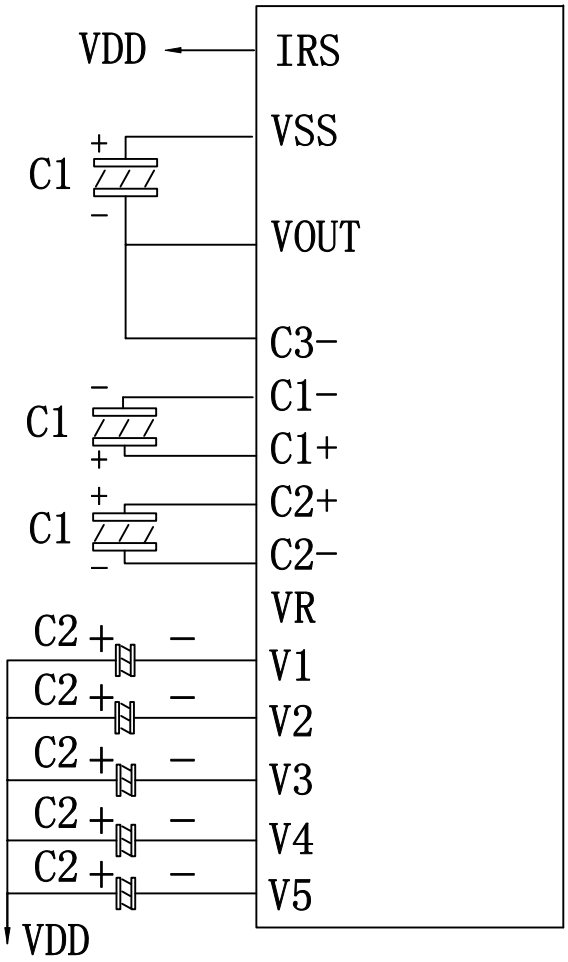
4 Electronic Character

4.1 Circuit Block Diagram

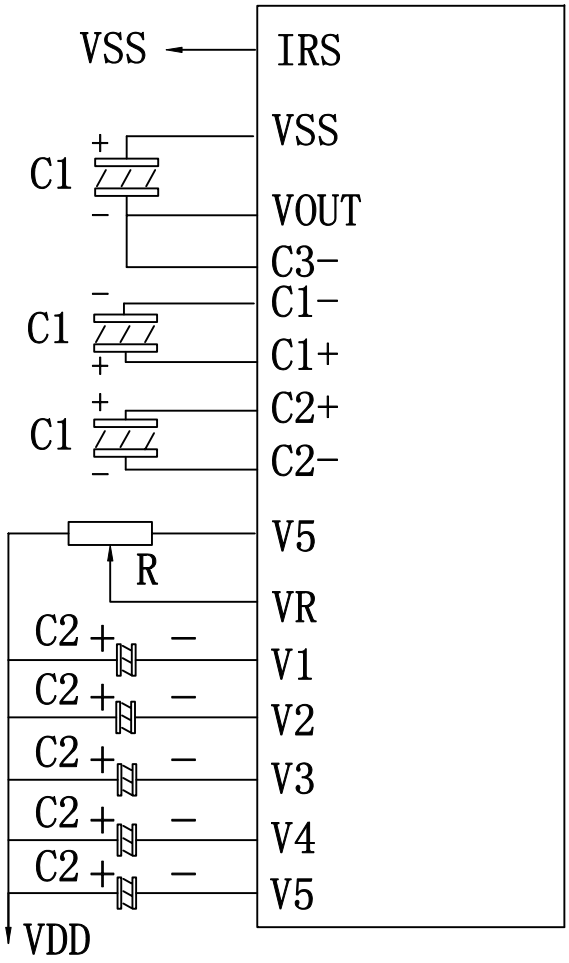


4.2 Power Supply Circuit

When the voltage regulator internal resistor is used



When the voltage regulator internal resistor is not used



VALUE OF EXTERNAL CAPACITANCE

ITEM	VALUE	UNIT
C1	1.0 to 4.7	uF
C2	0.01 to 1.0	

5 Absolute Maximum Ratings

Item	Symbol	Min.	Max.	Unit	Remark
Power Supply Voltage	$V_{DD}-V_{SS}$	-0.3	6.0	V	
LCD Driving Voltage	V_{LCD}	-0.3	25.0		
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

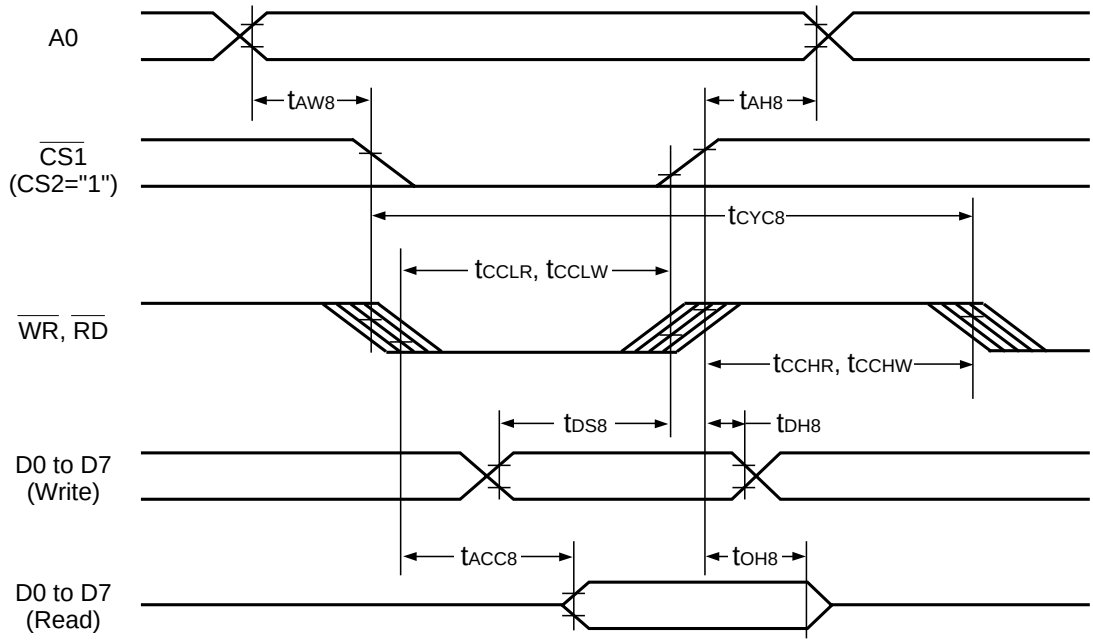
Item		Symbol	Min.	Typ.	Max.	Unit
Supply Voltage (Logic)		$V_{DD}-V_{SS}$	4.5	5.0	5.5	V
Supply Voltage (LCD Drive)		V_{LCD}	-	8.9	25.0	V
Input Signal Voltage	High	V_{IH} (V_{DD}=5.0)	0.8V_{DD}	-	V_{DD}+0.3	V
	Low	V_{IL} (V_{DD}=5.0)	0	-	0.2 V_{DD}	V
Supply current (Logic)		I_{DD} (V_{DD}- V_{SS}=3.0V)	-	-	300	uA
Supply current (LCD Driver)		I_{DD} (V_{DD}- V_{SS}=3.0V)	-	-	500	uA
Supply current (LED)		I_{LED}	-	-	90	mA
Supply Voltage (LED)		V_{LCD}	-	5.0	-	V

6.2 Interface Signals

Pin No.	Symbol	Level	Description
1	NC	-	No connection
2	/CS1	H/L	Chip select input pin (active at low)
3	/RES	H/L	Reset input pin (active at low)
4	A0	H/L	Register select input pin (H: Data, L: control)
5	/WR	H/L	Write enable clock input pin
6	/RD	H/L	Read enable clock input pin
7	DB0	H/L	8-bit bi-directional data bus that is connected to the standard 8-bit microprocessor data bus.
8	DB1	H/L	
9	DB2	H/L	
10	DB3	H/L	
11	DB4	H/L	
12	DB5	H/L	
13	DB6	H/L	
14	DB7	H/L	
15	VDD	5.0V	Power supply
16	VSS	0V	Ground
17	VOUT	-	Voltage converter input / output pin
18	C3-	-	Capacitor connection pin for voltage converter
19	C1+	-	
20	C1-	-	
21	C2+	-	
22	C2-	-	
23	V1	-	LCD driver supply voltages V1= (1/7) x V5 V2= (2/7) x V5 V3= (5/7) x V5 V4= (6/7) x V5
24	V2	-	
25	V3	-	
26	V4	-	
27	V5	-	
28	VR	-	Output voltage regulator terminal
29	C86	H/L	MPU interface switch terminal (H: 6800 Series MPU interface. L: 8080 MPU interface)
30	IRS	H/L	Terminal selects the resistors for the V5 voltage level adjustment

6.3 Interface Timing Chart

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



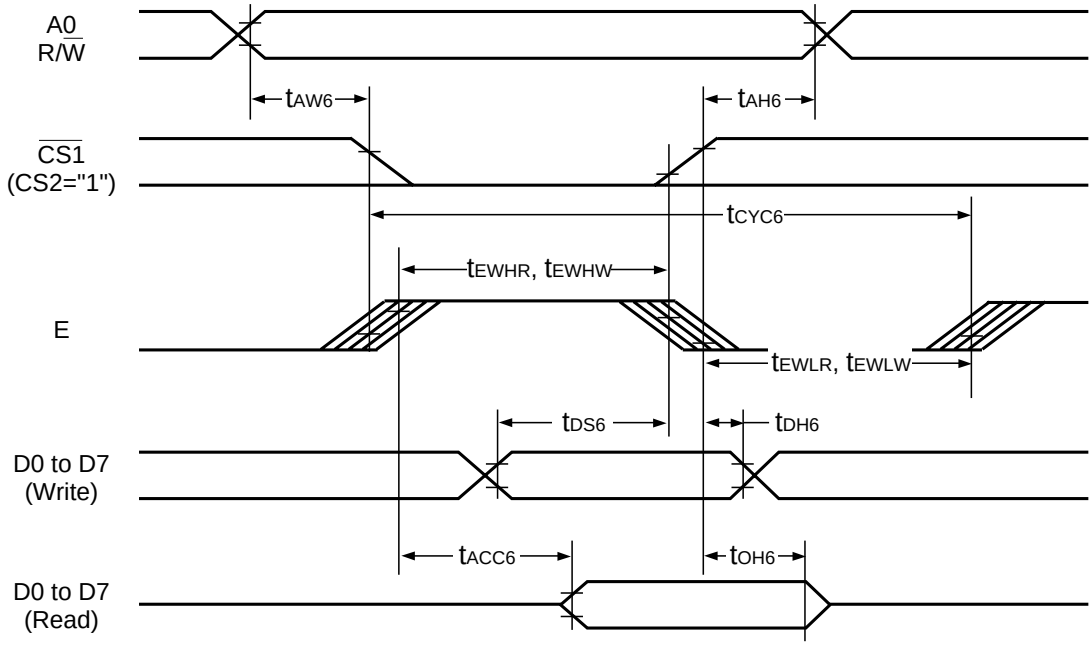
Figure

Table

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

Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Address hold time	A0	t_{AH8}		0	—	ns
Address setup time		t_{AW8}		0	—	ns
System cycle time	A0	t_{CYC8}		166	—	ns
Control LOW pulse width ($\overline{WR}$)	$\overline{WR}$	t_{CCLW}		30	—	ns
Control LOW pulse width ($\overline{RD}$)	$\overline{RD}$	t_{CCLR}		70	—	ns
Control HIGH pulse width ($\overline{WR}$)	$\overline{WR}$	t_{CCHW}		30	—	ns
Control HIGH pulse width ($\overline{RD}$)	$\overline{RD}$	t_{CCHR}		30	—	ns
Data setup time	D0 to D7	t_{DS8}		30	—	ns
Address hold time		t_{DH8}		10	—	ns
$\overline{RD}$ access time		t_{ACC8}	CL = 100 pF	—	70	ns
Output disable time		t_{OH8}		5	50	ns

(2) System Bus Read/Write Characteristics 2 (6800 Series MPU)



Figure

Table

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

Item		Signal	Symbol	Condition	Rating		Units
					Min.	Max.	
Address hold time Address setup time		A0	t_{AH6} t_{AW6}		0 0	— —	ns ns
System cycle time		A0	t_{CYC6}		166	—	ns
Data setup time Data hold time		D0 to D7	t_{DS6} t_{DH6}		30 10	— —	ns ns
Access time Output disable time			t_{ACC6} t_{OH6}	CL = 100 pF	— 10	70 50	ns ns
Enable HIGH pulse time	Read Write	E	t_{EWHR} t_{EWHW}		70 30	— —	ns ns
Enable LOW pulse time	Read Write	E	t_{EWLR} t_{EWLW}		30 30	— —	ns ns

6.4 Instruction code

Table of SED1565 Series Commands

	Command	Command Code A0	$\overline{RD}$	$\overline{WR}$	D7	D6	D5	D4	D3	D2	D1	D0	Function
(1)	Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0 1	LCD display ON/OFF 0: OFF, 1: ON
(2)	Display start line set	0	1	0	0	1	Display start address						Sets the display RAM display start line address
(3)	Page address set	0	1	0	1	0	1	1	Page address				Sets the display RAM page address
(4)	Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				Sets the most significant 4 bits of the display RAM column address.
	Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				Sets the least significant 4 bits of the display RAM column address.
(5)	Status read	0	0	1	Status				0	0	0	0	Reads the status data
(6)	Display data write	1	1	0	Write data								Writes to the display RAM
(7)	Display data read	1	0	1	Read data								Reads from the display RAM
(8)	ADC select	0	1	0	1	0	1	0	0	0	0	0 1	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9)	Display normal/ reverse	0	1	0	1	0	1	0	0	1	1	0 1	Sets the LCD display normal/ reverse 0: normal, 1: reverse
(10)	Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0 1	Display all points 0: normal display 1: all points ON
(11)	LCD bias set	0	1	0	1	0	1	0	0	0	1	0 1	Sets the LCD drive voltage bias ratio SED1565*** ..... 0: 1/9, 1: 1/7 SED1566*** /SED1568*** /SED1569*** ..... 0: 1/8, 1: 1/6 SED1567*** 0: 1/6, 1: 1/5
(12)	Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13)	End	0	1	0	1	1	1	0	1	1	1	0	Clear read/modify/write
(14)	Reset	0	1	0	1	1	1	0	0	0	1	0	Internal reset
(15)	Common output mode select	0	1	0	1	1	0	0	0 1	*	*	*	Select COM output scan direction 0: normal direction, 1: reverse direction
(16)	Power control set	0	1	0	0	0	1	0	1	Operating mode			Select internal power supply operating mode
(17)	V_5 voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			Select internal resistor ratio (Rb/Ra) mode
(18)	Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	1	
	Electronic volume register set	0	1	0	*	*	Electronic volume value						Set the V_5 output voltage electronic volume register
(19)	Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0 1	0: OFF, 1: ON
	Static indicator register set	0	1	0	*	*	*	*	*	*	Mode		Set the flashing mode
(20)	Power saver												Display OFF and display all points ON compound command
(21)	NOP	0	1	0	1	1	1	0	0	0	1	1	Command for non-operation
(22)	Test	0	1	0	1	1	1	1	*	*	*	*	Command for IC test. Do not use this command

(Note) *: disabled data

7 Optical Characteristics

7.1 Optical Characteristics

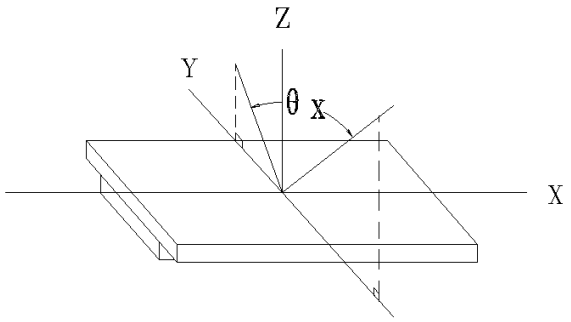
Ta=25℃

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

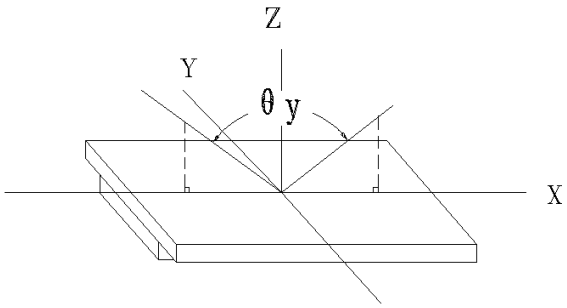
7.2.1 Definition of Viewing Angle

Top



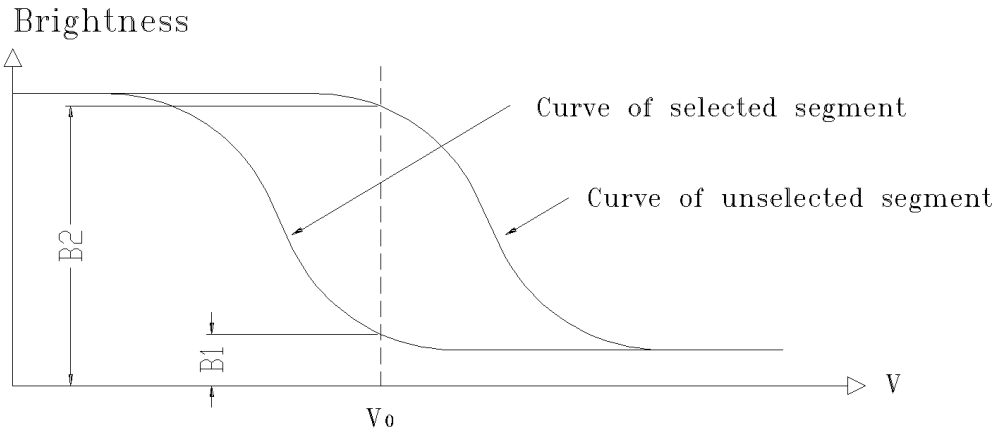
Bottom

Top



Bottom

7.2.2 Definition of Contrast Ratio

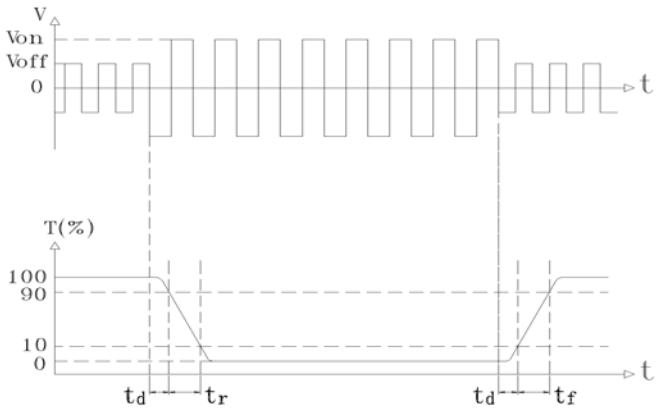


$$\text{Contrast Ratio} = B2/B1 = \frac{\text{unselected state brightness}}{\text{selected state brightness}}$$

Measuring Conditions:

1) Ambient Temperature: 25℃ ; 2) Frame frequency: 84Hz

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:8.9V 2) Frame frequency: 84Hz

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	60℃ 96H Restore 4H at 25℃
2	Low Temperature Storage	Endurance test applying the low storage temperature for a long time	-20℃ 96H Restore 4H at 25℃
3	High Temperature /Humidity Storage	Endurance test applying the high temperature and high humidity storage for a long time	40℃ 90%RH 96H Restore 4H at 25℃
4	Temperature Cycle	Endurance test applying the low and high temperature cycle -20℃←→25℃←→60℃←→25℃ 30min 5min 30min 5min ←——————————→ 1 cycle	-20℃/60℃ 10 cycles Restore 4H at 25℃
5	Vibration Test (package state)	Endurance test applying the vibration during transportation	10Hz~150Hz, 50m/s^2, 40min
6	Shock Test (package state)	Endurance test applying the shock during transportation	Half- sine wave, 100m/s^2, 11ms
7	Atmospheric Pressure Test	Endurance test applying the atmospheric pressure during transportation by air	40kPa 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_a=25℃ (unless otherwise stated)	Inspection				
		Min.	Max.	Unit	IL	AQL
External Visual Inspection	Under normal illumi-nation and eyesight condition, the dis-tance between eyes and LCD is 25cm.	See Appendix A			II	Major 0.65 Minor 1.5
Display Defects	Under normal illumi-nation and eyesight condition, display on inspection.	See Appendix 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℃

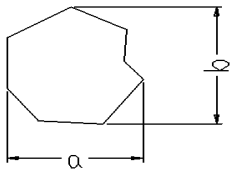
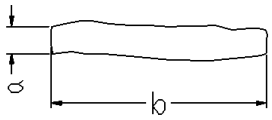
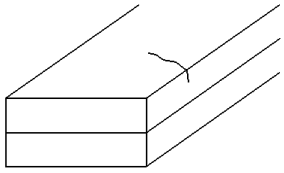
Relatively humidity: ≤80%

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.

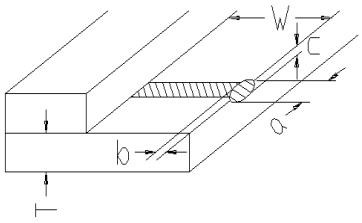
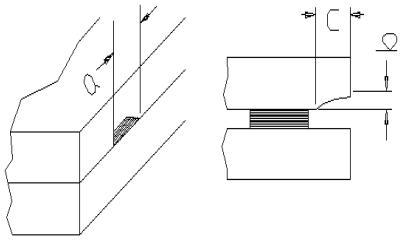
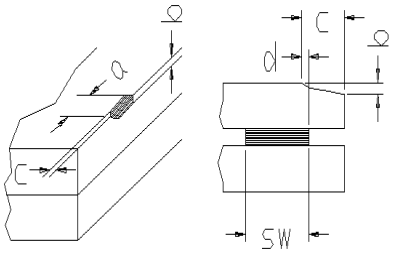
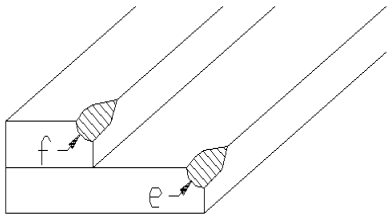
Appendix A

Inspection items and criteria for appearance defects

<table>
<tr><td>Items</td><td>Contents</td><td colspan="3">Criteria</td></tr>
<tr><td>Leakage</td><td></td><td colspan="3">Not permitted</td></tr>
<tr><td>Rainbow</td><td></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>Black spot (in viewing area)</td><td>  </td><td>Not counted</td><td>Max. 3 spots allowed</td><td rowspan="3">Max. 3 spots (lines) allowed</td></tr>
<tr><td rowspan="2">Black line (in viewing area)</td><td rowspan="2">  </td><td>X<0.2mm</td><td>0.2mm≤X≤0.5mm</td></tr>
<tr><td colspan="2">X=(a+b)/2</td></tr>
<tr><td>Progressive cracks</td><td>  </td><td colspan="3">Not permitted</td></tr>
</table>

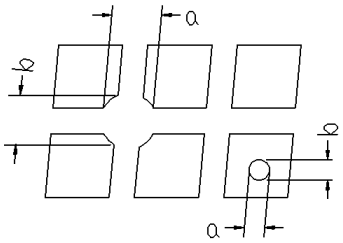
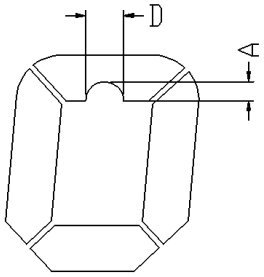
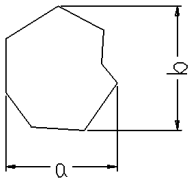
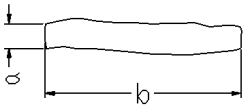
Appendix A

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 colspan="3"><table><tr><td>a</td><td>b</td><td>c</td></tr><tr><td>≤3mm</td><td>≤W/5</td><td>≤T/2</td></tr><tr><td>≤2mm</td><td>≤W/5</td><td>T/2<C<T</td></tr></table></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="3"><table><tr><td>a</td><td>b</td></tr><tr><td>≤3mm</td><td>≤T/2</td></tr><tr><td>≤2mm</td><td>T/2<b<T</td></tr></table>C shall be not reach the seal area</td><td rowspan="3">Max. 2 cracks allowed</td></tr>
<tr><td>Cracks on non-contact side
  </td><td colspan="3"><table><tr><td>a</td><td>b</td></tr><tr><td>≤3mm</td><td>≤T/2</td></tr><tr><td>≤2mm</td><td>T/2<b<T</td></tr></table>C≤0.5mm
d≤SW/3</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>

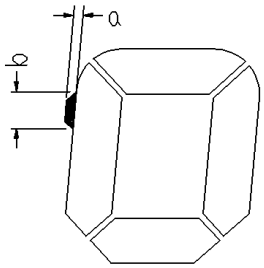
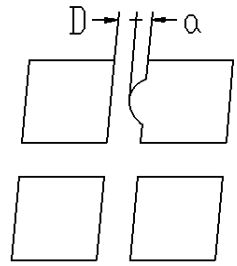
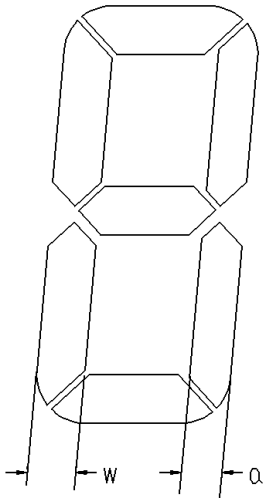
Appendix B

Inspection items and criteria for display defects

<table>
<tr><td colspan="2">Items</td><td>Contents</td><td colspan="3">Criteria</td></tr>
<tr><td colspan="3">Open segment or open common</td><td colspan="3">Not permitted</td></tr>
<tr><td colspan="3">Short</td><td colspan="3">Not permitted</td></tr>
<tr><td colspan="3">Wrong viewing angle</td><td colspan="3">Not permitted</td></tr>
<tr><td colspan="3">Contrast radio uneven</td><td colspan="3">According to the limit specimen</td></tr>
<tr><td colspan="3">Crosstalk</td><td colspan="3">According to the limit specimen</td></tr>
<tr><td rowspan="4">Pin holes and cracks in segment (DOT)</td><td rowspan="3">  </td><td>Not counted</td><td>Max.3 dots allowed</td><td rowspan="4">Max.3 dots 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>  </td><td>Not counted</td><td>Max.2 dots allowed</td></tr>
<tr><td>A<0.1mm</td><td>0.1mm≤A≤0.2mm
D<0.25mm</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<0.1mm</td><td>0.1mm≤X≤0.2mm</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>a<0.02mm</td><td>0.02mm≤a≤0.05mm
b≤0.5mm</td></tr>
</table>

Appendix B

Inspection items and criteria for display defects (continued)

<table>
<tr><td>Items</td><td>Content</td><td colspan="3">Criteria</td></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>  </td><td>Not counted</td><td>Max. 1 defects allowed</td><td rowspan="2">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>