

SWISSDIS



Swissdis AG
Grasweg 7
CH-4911 Schwarzhäusern

Tel.: +41 62 919 44 00
Fax: +41 62 919 44 01
info@swissdis.ch
www.swissdis.ch



SPECIFICATIONS

SD12888-FTRE-06-W00B

Swissdis 109150

LCD Module Graphic 128x88 Dots
With LED Backlight white
Interface Input Data: I²C

Version August 2014

REVISION RECORD MODEL NO.: SD12888-FTRE-06-W00B

Revision	Revision Date	Page	Contents
A	2014/07/01		Initial Release and Issue Full Specification.



CONTENTS

※ CONTENTS

1. FEATURES
2. MECHANICAL SPECIFICATIONS
3. ELECTRICAL SPECIFICATIONS
4. POWER SUPPLY AND BLOCK DIAGRAM
5. ELECTRO-OPTICAL CHARACTERISTICS
6. PIN FUNCTION
7. AC CHARACTERISTICS
8. COMMAND LIST
9. RELIABILITY
10. HANDLING PRECAUTIONS
11. OUTLINE DIMENSION

- ※
1. SAMPLES OUTGOING INSPECTION REPORT
 2. REVISION RECORD
 3. QUALITY SPECIFICATIONS

MODEL	SD12888-FTRE-06-W00B	1/13	PRODUCT SPECIFICATIONS	REV: A
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1. FEATURES

The features of LCD are as follows

- * Display mode : FSTN, Positive, Transflective
- * Color : Display dot : Black
Background: White
- * Display Format : 128 X 88 Dots
- * IC : UltraChip UC1617S
- * Interface Input Data : **2-Wire I²C**
- * Driving Method : 1/88 Duty, 1/10 Bias
- * Viewing Direction : 6 O'clock
- * Backlight : LED(White)
- * LCM technological conditions: **RoHS**

2. MECHANICAL SPECIFICATIONS

Item	Specification	Unit
Module Size	47.9(W) x 81.7(H) x 4.1(T)	mm
Viewing Area	42.7MIN(W) x 32.46MIN(H)	mm
Effective Display Area	39.025(W) x 29.465(H)	mm
Character Font	128 x 88 Dots	-
Dot Size	0.29(W) X 0.32(H)	mm
Dot Pitch	0.305(W) X 0.335(H)	mm

3. ELECTRICAL SPECIFICATIONS

3-1. Absolute Maximum Ratings (V_{SS}=0V)

Item	Symbol	Standard Value			Unit
		Min.	Typ.	Max.	
Supply Voltage For Logic	V _{DD} -V _{SS}	-0.3	-	+4.0	V
Supply Voltage For LCD Drive	V ₀ -V _{SS}	-0.3	-	+19.8	V
Input Voltage	V _{IN}	-0.4	-	V _{DD} +0.5	V
Operating Temp.	T _{OP}	-20	-	+70	°C
Storage Temp.	T _{ST}	-30	-	+80	°C

MODEL	SD12888-FTRE-06-W00B	2/13	PRODUCT SPECIFICATIONS	REV: A
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3. ELECTRICAL SPECIFICATIONS (Continued)

3-2. Electrical Characteristics (V_{SS}=0V)

Item	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Logic Supply Voltage	V _{DD} - V _{SS}	Ta=0~ 50°C	2.6	3.3	3.45	V
LCD Positive Drive Voltage (Recommended Voltage)	V _{OP} =V _O -V _{SS}	Ta=25°C	13.2	13.5	13.8	V
Input Voltage	"H" Level	V _{DD} =3.3V±5%	-	-	0.2V _{DD}	V
	"L" Level		0.8 V _{DD}	-	-	V
Output Voltage	"H" Level	V _{DD} =3.3V±5%	-	-	0.2V _{DD}	V
	"L" Level		0.8 V _{DD}	-	-	V
Current Consumption	I _{DD}	V _{DD} -V _{SS} =3.3V	-	2.1	3.0	mA

NOTE: 1) Duty Ratio=1/88, Bias Ratio=1/10 2) Measuring in Dots ON-state

3-3.BACK LIGHT

3-3-1. Absolute Maximum Ratings at Ta=25°C

Item	Symbol	Rating	Unit
Forward Current	I _f	50	mA
Reverse Voltage (Per Chip)	V _r	5	V
Power Dissipation	P _d	170	mW
Storage Temperature Range	T _{stg}	-30~+80	°C
Soldering Temperature	350°C for 3 seconds		

3-3-2. Electronic Characteristics

(Unless otherwise specified, the ambient temperature Ta = 25°C)

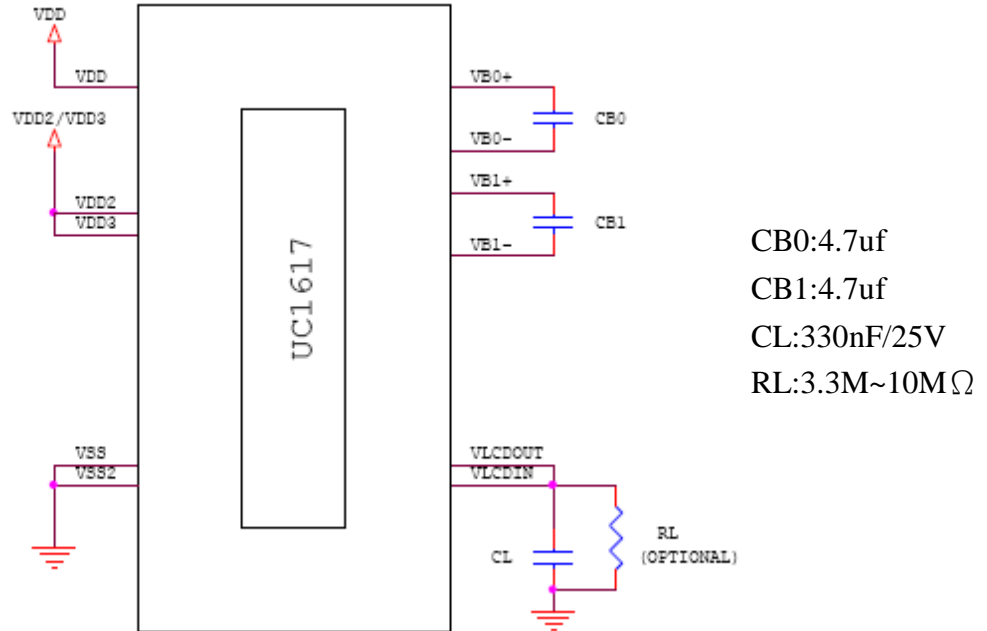
Item	Symbol	Min.	Typ.	Max	Unit	Condition
Forward Voltage	V _F	2.8	3.1	3.4	V	I _f =30mA
Reverse Current	I _R	-	-	30	uA	V _r =5V
Forward Current	I _F	-	30	-	mA	I _f =30mA
Peak wave length	λ _P	0.27	0.30	0.33	X	I _f =30mA
		0.27	0.30	0.33	Y	
Luminance	L _v	800	-	-	cd/m ²	I _f =30mA
Uniformity	△	70	-	-	%	MIN/MAX*100%

* The brightness is measured without LCD panel

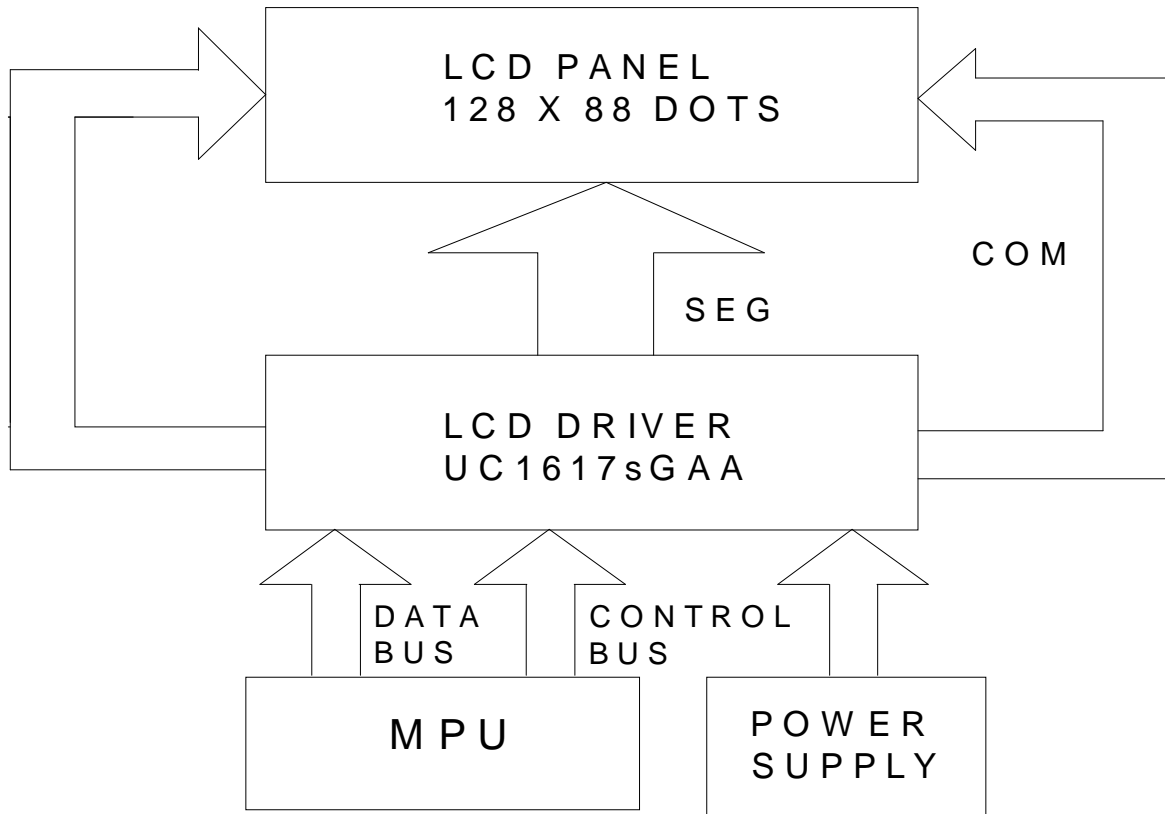
MODEL	SD12888-FTRE-06-W00B	3/13	PRODUCT SPECIFICATIONS	REV: A
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4. POWER SUPPLY AND BLOCK DIAGRAM

4-1. Power Supply



4-2. Block Diagram



MODEL

SD12888-FTRE-06-W00B

4/13

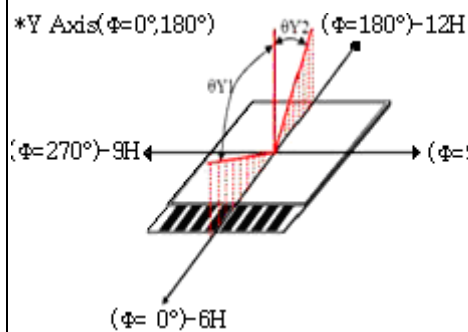
PRODUCT SPECIFICATIONS

REV: A

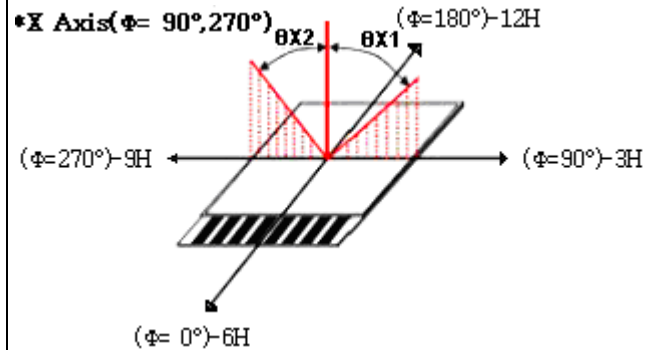
5. ELECTRO – OPTICAL CHARACTERISTICS

Item	Symbol	Temp.	Min.	Typ.	Max.	Unit	Conditions	Note	
Viewing Angle $Cr \geq 2$	$\Phi = 0^\circ$	$\Theta Y1$	25°C	--	33	--	Deg.	-	1,2
	$\Phi = 180^\circ$	$\Theta Y2$		--	30	--			
	$\Phi = 90^\circ$	$\Theta X1$		--	28	--			
	$\Phi = 270^\circ$	$\Theta X2$		--	31	--			
Viewing Direction		6 O'clock							
Contrast Ratio	Cr	25°C	2.0	2.38	2.68	-	$\Theta = 0^\circ$ $\Phi = 0^\circ$	3	
Response Time(rise)	Tr	25°C	-	141	250	ms	$\Theta = 0^\circ$ $\Phi = 0^\circ$	4	
		0°C	-	950	1150				
Response Time(fall)	Tf	25°C	-	198	250	ms	$\Theta = 0^\circ$ $\Phi = 0^\circ$	4	
		0°C	-	950	1150				

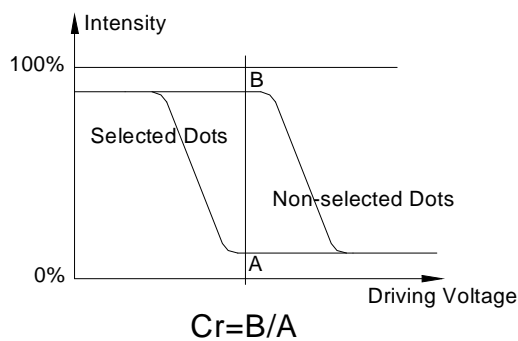
Note1. Definition of Angle $\Theta Y1$ & $\Theta Y2$



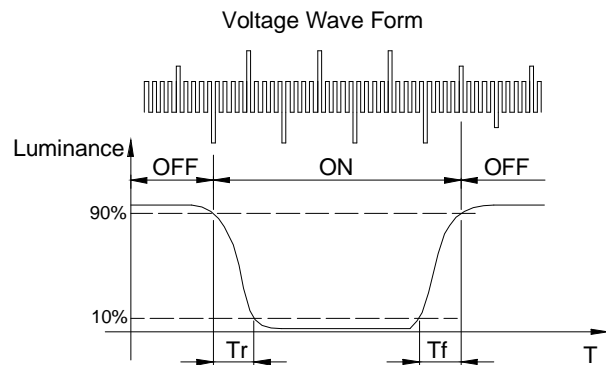
Note2. Definition of Viewing Angle $\Theta X1$ & $\Theta X2$



Note3. Definition of Contrast Cr



Note4. Definition of Optical Response



MODEL

SD12888-FTRE-06-W00B

5/13

PRODUCT SPECIFICATIONS

REV: A

6. PIN FUNCTION

Pin NO.	Symbol	I / O	Functions
1	SCK (D0)	I/O	In serial modes, connect D[0] to SCK, D[3] to SDA.
2	SDA (D3)	I/O	
3	RST	I	When RST="L" all control registers are re-initialized by their default states Since UC1617 has built-in Power-ON Reset and Software Reset command, RST pin is not required for proper chip operation. An RC Filter has been included on-chip. There is no need for external RC noise filter. When RST is not used, connect the pin to VDD.
4	TST4	I / HV	Test control. This pin has on-chip pull-up resistor. Leave it open during normal operation.
5	VSS	GND	Ground. Connect VSS and VSS2 to the shared GND pin Minimize the trace resistance for this node
6	VDD	PWR	VDD is the digital power supply and it should be connected to a voltage source that is no higher than VDD2/VDD3. VDD2/VDD3 is the analog power supply and it should be connected to the same power source.
7	VB0+	PWR	LCD Bias Voltages. These are the voltage sources to provide SEG driving currents. These voltages are generated internally. Connect capacitors of CBX value between VBX+ and VBXL. The resistance of these traces directly affects the driving strength of SEG electrodes and impacts the image of the LCD Module. Minimize the trace resistance is critical in achieving high quality image.
8	VB1+		
9	VB1-		
10	VB0-		
11	VLCD	PWR	High voltage LCD Power Supply. Connect these pins together By-pass capacitor CL is optional. It can be connected between VLCD and VSS. When CL is used, keep the trace resistance under 50Ω
12	LED A+	-	LED Backlight (+).
13	LED K-		LED Backlight (-).

MODEL

SD12888-FTRE-06-W00B

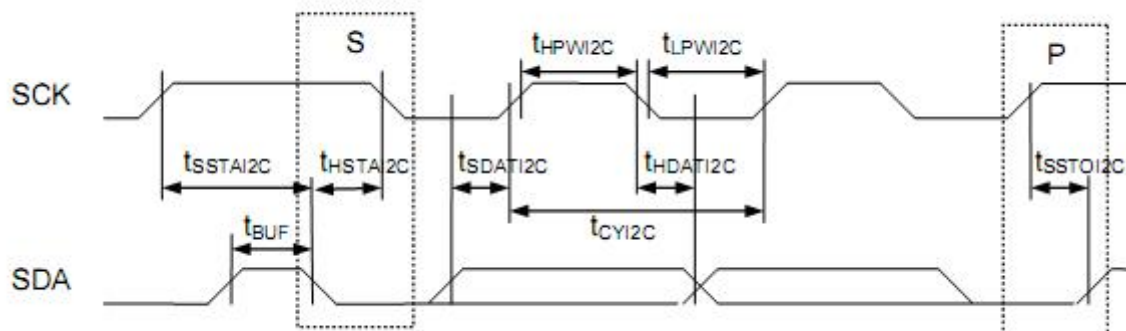
6/13

PRODUCT SPECIFICATIONS

REV: A

7.AC CHARACTERISTICS

Serial bus timing characteristics (for I²C)



($2.5V \leq V_{DD} < 3.465V$, $T_a = -30$ to $+85^\circ C$)

Symbol	Signal	Description	Condition	Min.	Max.	Units
t_{CYI2C}	SCK	SCK cycle time (read) (write)	$t_r + t_f \leq 100nS$	580 275	–	nS
t_{LPWI2C}		Low pulse width (read) (write)		290 137	–	nS
t_{HPWI2C}		High pulse width (read) (write)		290 137	–	nS
t_r, t_f	SCK SDA	Rise time and fall time		–	–	nS
$t_{SSDAI2C}$		Data setup time		28	–	nS
t_{HDAI2C}		Data hold time		11	–	nS
$t_{SSTAI2C}$		START Setup time		28	–	nS
$t_{HSTAI2C}$		START Hold time		28	–	nS
$t_{SSTOI2C}$		STOP setup time		28	–	nS
T_{BUF}		Bus Free time between STOP and START condition		165	–	nS

8.COMMAND LIST

The following is a list of host commands supported by UC1617

C/S: 0: control 1:Data

W/R: 0: Write Cycle 1:Read Cycle

Useful Data bits

- Don't Care

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Active	Default	
1	Write Data Byte	1	0	#	#	#	#	#	#	#	#	Write 1 byte	N/A	
2	Read Data Byte	1	1	#	#	#	#	#	#	#	#	Read 1 byte	N/A	
3	Get Status	0	1	1	MX	MY	WA	DE	WS	MD	MS	Get{ Status, Ver, PMO, Product Code, PID,MID}	N/A	
				Ver		PMO[5:0]								
				Product Code			PID		MID					
4	Set Page_ C Address	0	0	0	0	0	#	#	#	#	#	Set CA [4:0]	0H	
5	Set Temp. Compensation	0	0	0	0	1	0	0	1	#	#	Set TC [1:0]	00b	
6	Set Panel Loading	0	0	0	0	1	0	1	0	#	#	Set PC[1:0]	10b	
7	Set Pump Control	0	0	0	0	1	0	1	1	#	#	Set PC [3:2]	11b	
8	Set Adv. Product Control (double-byte command)	0	0	0	0	1	1	0	0	R	R	Set APC[R][7:0], R=0,1,or 2	N/A	
		0	0	#	#	#	#	#	#	#	#			
9	Set Scroll Line LSB	0	0	0	1	0	0	#	#	#	#	Set SL [3:0]	0H	
	Set Scroll Line MSB	0	0	0	1	0	1	-	#	#	#	Set SL [6:4]	0H	
10	Set Row Address LSB	0	0	0	1	1	0	#	#	#	#	Set RA[3:0]	00H	
	Set Row Address MSB	0	0	0	1	1	1	-	#	#	#	Set RA[6:4]	00H	
11	Set VBIAS Potentiometer (Double-byte command)	0	0	1	0	0	0	0	0	0	1	Set PM [7:0]	4EH	
		0	0	#	#	#	#	#	#	#	#			
12	Set Partial Display Control	0	0	1	0	0	0	0	1	#	#	Set LC[9:8]	00b: Disable	
13	Set RAM Address Control	0	0	1	0	0	0	1	#	#	#	Set AC [2:0]	001b	
14	Set Fixed Lines	0	0	1	0	0	1	0	0	0	0	Set {FLT,FLB}	0	
15	Set Lines Rate	0	0	1	0	1	0	0	0	#	#	Set LC[4:3]	00b	
16	Set All-Pixel-ON	0	0	1	0	1	0	0	1	0	#	Set DC [1]	0b	
17	Set Inverse Display	0	0	1	0	1	0	0	1	1	#	Set DC [0]	0b	
18	Set Display Enable	0	0	1	0	1	0	1	1	#	#	Set DC [3:2]	10b	
19	Set LCD Mapping Control	0	0	1	1	0	0	0	#	#	#	Set LC[2:0]	000b	

MODEL

SD12888-FTRE-06-W00B

8/13

PRODUCT SPECIFICATIONS

REV: A

8.COMMAND LIST (Continued)

	Command	C/D	W/R	D7	D6	D5	D4	D3	D2	D1	D0	Active	Default
20	Set N-Line Inversion	0	0	1	1	0	0	1	0	0	0	Set NIV[3:0]	6H
21	Set LCD Gray Shade	0	0	1	1	0	1	0	#	#	#	Set LC [7:5]	001b
22	System Rest	0	0	1	1	1	0	0	0	1	0	System Rest	N/A
23	NOP	0	0	1	1	1	0	0	0	1	1	No operation	N/A
24	Set Test Control (double byte command)	0	0	1	1	1	0	0	1	TT		For testing only. Do not use,	N/A
		0	0	#	#	#	#	#	#	#	#		
25	Set LCD Bias Ration	0	0	1	1	1	0	1	0	#	#	Set BR[1:0]	11b:11
26	Rest Cursor Update Mode	0	0	1	1	1	0	1	1	1	0	AC[3]=0,CA=CR	AC[3]=0
27	Set Cursor Update Mode	0	0	1	1	1	0	1	1	1	1	AC[3]=1,CR=CA	AC[3]=1
28	Set COM End	0	0	1	1	1	1	0	0	0	1	Set CEN[6:0]	127
		0	0	-	#	#	#	#	#	#	#		
29	Set Partial Display Start	0	0	1	1	1	1	0	0	1	0	Set DST[6:0]	0
		0	0	-	#	#	#	#	#	#	#		
30	Set Partial Display End	0	0	1	1	1	1	0	0	1	1	Set DEN[6:0]	127
		0	0	-	#	#	#	#	#	#	#		
31	Set Window Program Starting Page_C Address	0	0	1	1	1	1	0	1	0	0	Set WPC0[4:0]	0
		0	0	-	-	-	#	#	#	#	#		
32	Set Window Programming Starting Row Address	0	0	1	1	1	1	0	1	0	1	Set WPC0[6:0]	0
		0	0	-	#	#	#	#	#	#	#		
33	Set Window Programming Ending Page_C Address	0	0	1	1	1	1	0	1	1	0	Set WPC1[4:0]	31
		0	0	-	-	-	#	#	#	#	#		
34	Set Window Programming Ending Row Address	0	0	1	1	1	1	0	1	1	1	Set WPP1[6:0]	127
		0	0	-	#	#	#	#	#	#	#		
35	Enable window program	0	0	1	1	1	1	1	0	0	#	Set AC[4]	0:Display
36	Set MTP operation control	0	0	1	0	1	1	1	0	0	0	Set MTPC[5:0]	10H
		0	0	-	-	#	#	#	#	#	#		
37	Set MTP write Mask	0	0	1	0	1	1	1	0	0	1	Set MTPM[7:0]	0
		0	0	#	#	#	#	#	#	#	#		
38	Set V _{MTP1} Potentiometer	0	0	1	1	1	1	0	1	0	0	Shared with Window Programming commands	N/A
		0	0	#	#	#	#	#	#	#	#		
39	Set V _{MTP2} Potentiometer	0	0	1	1	1	1	0	1	0	1		
		0	0	#	#	#	#	#	#	#	#		
40	Set MTP Write Timer	0	0	1	1	1	1	0	1	1	0		
		0	0	#	#	#	#	#	#	#	#		
41	Set MTP Read Timer	0	0	1	1	1	1	0	1	1	1		
		0	0	#	#	#	#	#	#	#	#		

MODEL

SD12888-FTRE-06-W00B

9/13

PRODUCT SPECIFICATIONS

REV: A

9. RELIABILITY

NO.	Item	Condition	Criterion
1	High Temperature Operating	70°C, 96Hrs	No defect in cosmetic and operational function allowable.
2	Low Temperature Operating	-20°C, 96Hrs	
3	High Humidity	60°C, 90%RH, 96Hrs	
4	High Temperature Storage	80°C, 96Hrs	
5	Low Temperature Storage	-30°C, 96Hrs	
6	Vibration	Random wave 10 ~ 100Hz Acceleration: 2G 60 Minute	Total current Consumption should be below double of initial value.
7	Thermal Shock	0°C to 25°C to 50°C (60Min) (15Min) (60Min) 10Cycles	
8	ESD Testing	Contract Discharge Voltage: +1 ~ 8kV and -1 ~ -8kV	There will be discharged ten times at every discharging voltage cycle. The voltage gap is 1kV.
		Air Discharge Voltage: +1 ~ 10kV and -1 ~ -10kV	

- Note:
- 1) Above conditions are suitable for GOLDENTEK standard products.
 - 2) For restrict products, the test conditions listed as above must be revised.

MODEL

SD12888-FTRE-06-W00B

10/13

PRODUCT SPECIFICATIONS

REV: A

10. HANDLING PRECAUTIONS

(1) Mounting Method

The panel of the LCD Module consists of two thin glass plates with polarizers which easily get damaged since the Module is fixed by utilizing fitting holes in the printed circuit board. Extreme care should be taken when handling the LCD Modules.

(2) Caution of LCD handling & cleaning

When cleaning the display surface, use soft cloth with solvent (recommended below) and wipe lightly.

- Isopropyl alcohol
- Ethyl alcohol
- Trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface.

Do not use the following solvent:

- Water
- Ketone
- Aromatics

(3) Caution against static charge

The LCD Module use C-MOS LSI drivers, so we recommend that you connect any unused input terminal to VDD or VSS, do not input any signals before power is turned on. And ground your body, Work/assembly table. And assembly equipment to protect against static electricity.

(4) Packaging

- Modules use LCD elements, and must be treated as such. Avoid intense shock and falls from a height.
- To prevent modules from degradation. Do not operate or store them exposed directly to sunshine or high temperature/humidity.

(5) Caution for operation

- It is indispensable to drive LCD's within the specified voltage limit since the higher voltage than the limit shorten LCD life. An electrochemical reaction due to direct current causes LCD deterioration, Avoid the use of direct current drive.

MODEL

SD12888-FTRE-06-W00B

11/13

PRODUCT SPECIFICATIONS

REV: A

10. HANDLING PRECAUTIONS (Continued)

- Response time will be extremely delayed at lower temperature than the operating temperature range and on the other hand at higher temperature LCD's show dark color in them.

However those phenomena do not mean malfunction or out of order with LCD's.

Which will come back in the specified operating temperature range.

- If the display area is pushed hard during operation, some font will be abnormally displayed but it resumes normal condition after turning off once.
- A slight dew depositing on terminals is a cause for electro-chemical reaction resulting in terminal open circuit.

Usage under the relative condition of 40°C, 80%RH or less is required.

(6) Storage

In the case of storing for a long period of time (for instance ,for years) for the purpose or replacement use, The following ways are recommended.

- Storage in a polyethylene bag with sealed so as not to enter fresh air outside in it, And with no desiccant.
- Placing in a dark place where neither exposure to direct sunlight nor light is. Keeping temperature in the specified storage temperature range.
- Storing with no touch on polarizer surface by the anything else. (It is recommended to store them as they have been contained in the inner container at the time of delivery)

(7) Safety

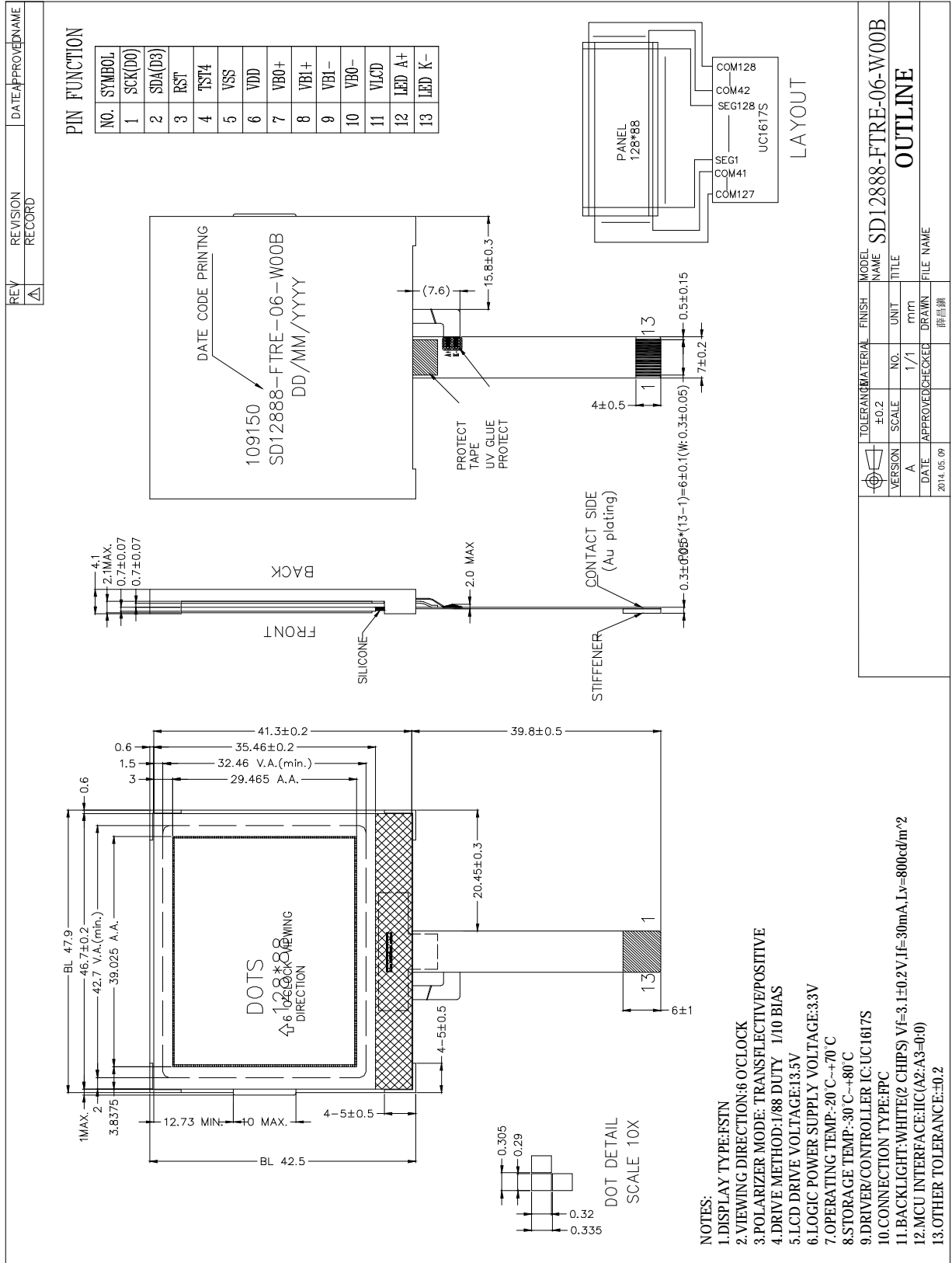
- It is recommendable to crash damaged or unnecessary LCD into pieces and wash off liquid crystal by using solvents such as acetone and ethanol.

Which should be burned up later.

- When any liquid crystal leaked out of a damaged glass cell comes in contact with your hands, please wash it off well with soap and water.

MODEL	SD12888-FTRE-06-W00B	12/13	PRODUCT SPECIFICATIONS	REV: A
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11. OUTLINE DIMENSION



MODEL

SD12888-FTRE-06-W00B

13/13

PRODUCT SPECIFICATIONS

REV: A