FORDATA
FOR DATA DISPLAY

Classic LCDs & LEDs

LCD MODULE SPECIFICATION

ITEM NUMBER:	**FG128128A01-FSWFBW-51YN**
ESTABLISHED DATE:	**2013.05.15**
DATASHEET VERSION:	**2013 VERSION**

ISSUED BY: FDZ81 **CHECKED BY:** **APPROVED BY:**

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AMENDMENT RECORD

MARK	DATE	DESCRIPTION	ITEM	PAGE	APPROVED
1	2013.05	INITIAL ISSUED	ALL	ALL	

1. The following icons are absolutely designed by FORDATA independently in 2007-SEP. They are not in common use in the LCD industry yet but just used for marking out FORDATA products' characteristics quickly and simply without any special meaning. FORDATA reserves the composing right and copyright. No one else is allowed to adopt these icons without FORDATA's approval.

2. The ISO9001 logo used in this document is authorized by SGS (www.sgs.com). FORDATA had already successfully passed the strict and professional ISO9001:2000 Quality Management System Certification and got the certificate. (No.: CN07/00404)

3. The technologies/techniques/crafts which denoted by the following icons are not exclusively owned by FORDATA but also shared by FORDATA's LCD strategic cooperators, however all these technologies/techniques/crafts have been finally confirmed by FORDATA's professional engineers and QC department.

4. As the difference in test standard and test conditions, also FORDATA's insufficient familiarity with the actual LCD using environment, all the referred information in this DATASHEET (including the icons) only have two functions:
   4.1: providing quick reference when you are judging whether or not the product meets your requirements.
   4.2: listing out definitely the tolerance.
   FORDATA declares seriously: you should first test the corresponding sample(s) before signing the formal FORDATA SAMPLE APPROVAL document rather than consider this DATASHEET as the standard for judging whether or not the LCD meets your requirements. Once you instruct FORDATA to a mass-production without definite demand for providing sample before, FORDATA will disclaim all responsibility if the mass-production is proved not meeting with your requirements.

5. The sequence of the icons is random and doesn't indicate the importance grade.

6. Icons explanation

2000 Version: FORDATA FOR DATA DISPLAY

2006 Version: FORDATA FOR DATA DISPLAY classic mono LCDs

2012 Version: FORDATA FOR DATA DISPLAY Classic LCDs & LEDs

FORDATA is an integrated manufacturer of flat panel display (FPD). All above listed icons and words compses FORDATA's logo.
From 2000, FORDATA supplies LCD module
From 2006, FORDATA supplies TN, HTN, STN, FSTN monochrome LCD panel
From 2012, FORDATA supplies all kinds of LED backlight.

FAST RESPONSE TIME
This icon on the cover indicates the product is with high response speed; Otherwise not.

HIGH CONTRAST
This icon on the cover indicates the product is with high contrast; Otherwise not.

WIDE VIEWING SCOPE
This icon on the cover indicates the product is with wide viewing scope; Otherwise not.

RoHS COMPLIANCE
This icon on the cover indicates the product meets ROHS requirements; Otherwise not.

3TIMEs 100% QC EXAMINATION
This icon on the cover indicates the product has passed FORDATA's thrice 100% QC. Otherwise not.

Vlcm = 3.0V
This icon on the cover indicates the product can work at 3.0V exactly; otherwise not.

PROTECTION CIRCUIT
This icon on the cover indicates the product is with protection circuit; Otherwise not.

LONG LIFE VERSION
This icon on the cover indicates the product is long life version (over 9K hours guaranteed); Otherwise not.

Anti UV VERSION
This icon on the cover indicates the product is against UV line. Otherwise not.

EASY OPERATION TEMPERATURE
This icon on the cover indicates the product can have good contrast on one driving voltage in indicated operation temperature range .

TWICE SELECTION OF LED MATERIALS
This icon on the cover indicates the LED had passed FORDATA's twice strict selection which promises the product's identical color and brightness; Otherwise not.

N SERIES TECHNOLOGY (2008 developed)
FORDATA adopts new structure, new craft, new technology and new materials inside both LCD module and LCD panel to improve the "RainBow"

1	2	3	4	5	6	—	7	8	9	10	11	12	—	13	14	15	16
F	G	128	128	A	01	—	F	S	W	F	B	W	—	5	1	Y	N

No.	REMARKS	DESCRIPTION
1	COMPANY ABBRAVIATED	F = FORDATA
2	STANDARD MODULE TYPE	C = Character type standard LCD module (COB version) G = Graphic type standard LCD module (COB version)
3	Character (FC series)	08, 10, 12, 16, 20, 24, 40, = Character number Per line
	Graphic (FG series)	80, 100, 120, 122, 128, 160 ... ... = Row Dots Quantity
4	Character (FC series)	01, 02, 04, = Character Lines
	Graphic (FG series)	32, 64, 80, 128, 160 ... ... =Column Dots Quantity
5	Serial Number	A~Z which is decided by the sizes of viewing area
6	Identifying Code	00~99 which is decided by all the other aspects for the same viewing area
7	Polarizer type	R = Positive Reflective F = Positive Transflective M = Positive Transmissive N = Negative Transmissive B = Super Black technology New!
8	Backlight type	N = No Backlight L = Array Type LED Backlight S = Edge Type LED Backlight (Standard version) H = Edge Type LED Backlight (Long life span version) New! E = EL backlight without Invertor F = EL backlight with Invertor C = CCFL backlight without Invertor T = CCFL backlight with Invertor
9	Backlight color	N = No Backlight Y = Yellow-Green W = White R = Red A = Amber C = Blue-Green B = Blue G = Green Q = RedGreenBlue three color New!
10	LCD panel type	T = TN H = HTN Y = Yellow-Green STN G = Gray STN B = Blue STN F = FSTN
11	Viewing angle	B = Bottom 6:00 T = Top 12:00 R = Right 3:00 L = Left 9:00
12	Operation temperature range	S = 0℃ ~ 50℃ (Single Supply Voltage) D = 0℃ ~ 50℃ (Dual Supply Voltage) W = -20℃ ~ 70℃ (Single Supply Voltage) H = -20℃ ~ 70℃ (Dual Supply Voltage) T = -30℃ ~ 80℃ (Single Supply Voltage) E = -30℃ ~ 80℃ (Dual Supply Voltage)
13	Driving Voltage	1 : Vlcm = 3.0V, No / EL / CCFL Backlight or Vlcm = 3.0V, Vled = LED voltage, (Via AK) 2 : Vlcm = 3.6V, Vled = 5.0V (Not via AK) 3 : Vlcm = 3.6V, Vled = LED voltage, (Not via AK) 4 : Vlcm = 5.0V, Vled = LED voltage, (Not via AK) 5 : Vlcm = 5.0V, Vled = 5.0V (Not via AK) 6 : Vlcm = 5.0V, No / EL / CCFL Backlight or Vlcm = 5.0V, Vled = LED voltage, (Via AK) 7 : Vlcm = 3.6V, No / EL / CCFL Backlight or Vlcm = 3.6V, Vled = LED voltage, (Via AK) 8 : Vlcm = 3.0V, Vled = 5.0V 9 : Vlcm = 3.0V, Vled = LED voltage, (Not via AK)
14	Backlight Connect Method	0 = PIN1 LED-, PIN2 LED+ 1 = PIN15(17/19) LED+, PIN16(18/20) LED- 2 = PIN15(17/19) LED-, PIN16(18/20) LED+ 3 = PIN15(17/19) LED+, PIN16(18/20) NC 4 = PIN15(17/19) NC, PIN16(18/20) LED+ 5 = PINA LED+, PINK LED- 6 = No / EL / CCFL Backlight
15	IC Manufacturer Code	A~Z or 01~99 which is decided by different IC manufacturers
16	Font Set	A~Z or 01~99 which is decided by different font maps

FEATURES

AVAILABLE OPTIONS	CHARACTERISTICS	CODE	No.
DISPLAY FORMAT	128 Characters by 128 Lines	FG128128A01	1~6
POLARIZER OPTIONS	Positive, Transflective	F	7
BACKLIGHT TYPE OPTIONS	Edge type (Standard brightness and standard life)	S	8
BACKLIGHT COLOR OPTIONS	White color	W	9
LCD PANEL OPTIONS	FSTN (Silver-gray color)	F	10
VIEWING ANGLE OPTIONS	6:00 (Bottom)	B	11
TEMPERATURE RANGE OPTIONS	-20°C ~ 70°C	W	12
SUGGESTED DRIVING VOLTAGE	Vlcm = 5.0V Vled = 5.0V	5	13
SUGGESTED LED DRIVING MODE	PIN19: LED+, PIN20:LED-	1	14
CONTROLLER ▲1	RA6963(RAIO)	Y	15
FONT MAP CODE	NO FONT SET	N	16
DRIVING DUTY	1/128	—	—
DRIVING BIAS	1/12	—	—

▲1 Please ask for datasheet of the mentioned controller from FORDATA or FORDATA's authorized distributors. You can find the related information including AC & DC characteristics, Write & Read Timing diagram, Instruction table and descriptions, DDRAM & CGRAM, Rest Function and so on from the datasheet of controller.

▲1 You can ask for the example of software program (C language) from FORDATA or FORDATA's authorized distributors.

MECHANICAL SPECIFICATIONS

OVERALL SIZE	92.0W x 106.0H	mm	THICKNESS	max 16.5	mm
VIEWING AREA	73.0W x 73.0H	mm	HOLE-HOLE	85.0W x 99.0H	mm
DOT SIZE	0.50W x 0.50H	mm	DOT PITCH	0.05W x 0.05H	mm
WEIGHT (EL BKL)	—	g	WEIGHT (LED BKL)	—	g

ABSOLUTE MAXIMUM RATINGS

ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
POWER SUPPLY (LOGIC)	Vdd	25°C	-0.3	—	7.0	V
POWER SUPPLY (LCD)	V0	25°C	Vdd -13.5	—	Vdd +0.3	V
INPUT VOLTAGE	Vin	25°C	-0.3	—	Vdd +0.3	V
OPERATING TEMPERATURE	Vopr	—	-20	—	70	°C
STORAGE TEMPERATURE	Vstg	—	-30	—	80	°C

ELECTRONIC CHARACTERISTICS*

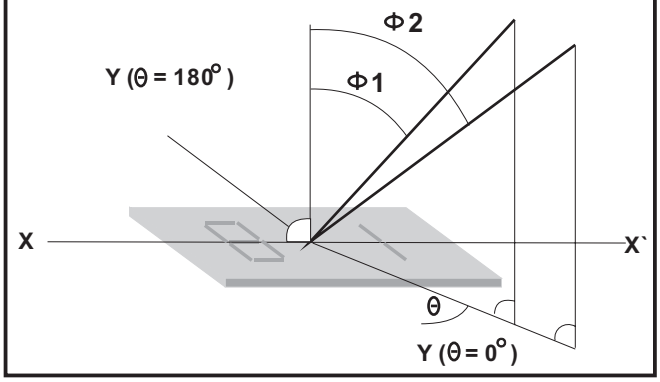
ICONS	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
	INPUT VOLTAGE	Vlcm = Vdd	—	4.7	5.0	5.5	V
	SUPPLY CURRENT	Idd	Vdd=5V	—	26.5	—	mA
	DRIVING VOLTAGE FOR LCD PANEL	Vlcd = (Vdd - V0)	-20°C	19.85	—	20.35	V
			0°C	17.90	—	18.45	
			25°C	16.50	17.00	17.05	
			50°C	13.85	—	14.35	
			70°C	12.75	—	13.25	

* All data are recorded from TEST REPORT #FWQC01678

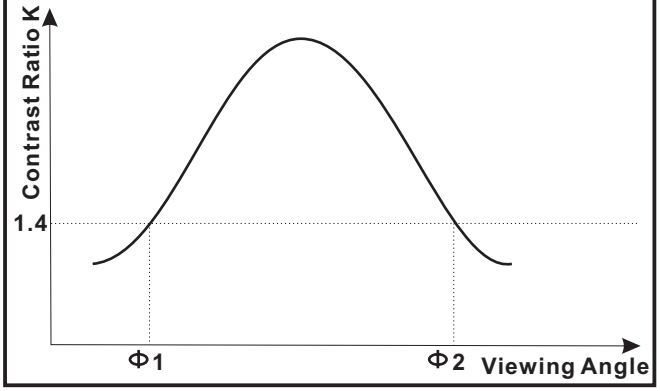
FOR TN TYPE LCD MODULE (TA=25°C, Vdd=5.0V ± 0.5V)							
ICONS	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
	VIEWING ANGLE	Φ2 − Φ1	K=4	30	—	—	deg
		θ		25			
	CONTRAST RATIO	K	—	—	2	—	—
	RESPONSE TIME(RISE)	TR	—	—	120	150	ms
	RESPONSE TIME(FALL)	TF	—	—	120	150	ms

FOR STN TYPE LCD MODULE (TA=25°C, Vdd=5.0V ± 0.5V)							
ICONS	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
	VIEWING ANGLE	Φ2 − Φ1	K=4	40	—	—	deg
		θ		60			
HC	CONTRAST RATIO	K	—	—	6	—	—
F	RESPONSE TIME(RISE)	TR	—	—	150	250	ms
	RESPONSE TIME(FALL)	TF	—	—	150	250	ms

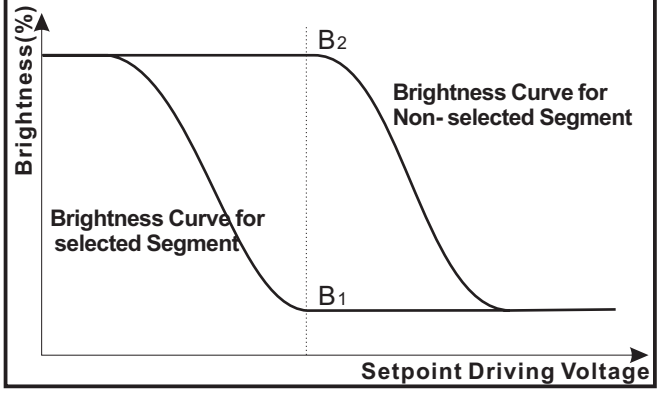
DEFINITION OF ANGLE Φ & θ



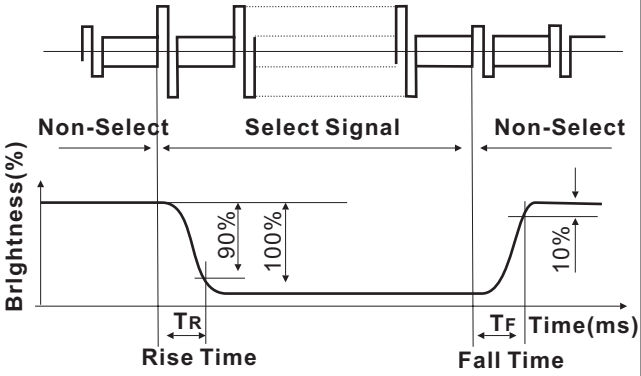
DEFINITION OF VIEWING ANGLE Φ1 &Φ2



DEFINITION OF CONTRAST RATIO K(=B2/B1)



DEFINITION OF OPTICAL RESPONSE TIME TR & TF



ICONS	ITEM	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
	LED FORWARD VOLTAGE	Vf	25°C	—	3.0	—	V
	LED FORWARD CURRENT ▲2	If	25°C	—	90	102	mA
	LED REVERSE CURRENT	Ir	25°C	—	60	—	μA
	LED COLOR RANGE	X coordinate	25°C If = 90mA	0.25	—	0.29	—
		Y coordinate		0.26	—	0.30	—
	LED BRIGHTNESS (WITHOUT LCD)	Lv	25°C If = 90mA	560	700	—	cd/m^2
	LED BRIGHTNESS UNIFORMITY	Lvmin/Lvmax	25°C If = 90mA	—	90	—	Ratio
	LED LIFE TIME ▲3	—	25°C If = 90mA	9K	—	—	Hours

▲2 请注意, 驱动背光考虑的是恒流而不是恒压. 所以, 这个数值非常重要!
Please notice that it is constant current (not constant voltage) that should be applied when driving LED backlight. Therefore, this data is very important!

* 当工作温度高于25°C时, Ifm,Ifp和Pd必须降低; 电流降低率是 -0.36*6mA/°C (直流驱动), 或-0.86*6 mA/°C (脉冲驱动), 功率降低率是-75*6mW/°C.
产品工作电流不能大于对应的工作条件温度Ifm或Ifpr的 60%.
For operation above 25°C,The Ifm Ifp & Pd must be derated,the Curent derating is -0.36*6mA/°C for DC drive and -0.86*6 mA/°C for Pulse drive, the power dissipation is -75*6 mW/°C The product working current must not be more than 60% of the Ifm ir Ifp according to the working temperature.

▲3 如果您需要让背光连续不间断工作超过12小时/天, 那么不建议您采用这款背光. 福德电子可以提供您长寿背光的解决方案.
If you want to drive the LED BKL uninterruptedly exceed 12hours/day, you are not suggested this version. FORDATA can offer you long life design solution.

* 注意: 保存条件不好时, 会降低反光膜(扩散膜)导光片(反射壳)的粘附力. 推荐保存条件: 温度 25°C ± 10°C 湿度: 65%RH ± 20%RH
Wrong storage condition will decrease the adhesive power of film and shell. Suggested Storage Condition: Temperature (25°C + 10°C) and Humidity (65%RH ± 20%RH)

LED BACKLIGHT COMPARASION*1

PRODUCT VERSION*2	DESCRIBED VERSION	SUBSTITUTED VERSION
PRODUCT CODE	FG128128A01-FSWFBW-51YN	FDCG128128A-FSWFBW-51YN
LED manufacturer*3	FORDATA	FORDATA's former LED vendor
BRIGHTNESS (cd / m^2)	700	657
UNIFORMITY*4(ratio)	90	78
Suggested CURRENT (mA)	90	128

备注 Remark*1

以上表格是本款背光与其它供应商提供的背光的参数对比。从该表格对比您可以看出，与其它供应商的背光相比，福德电子自己生产的LED背光具有亮度更高, 均匀度更好, 且功耗更低的特点。

Above table shows the parameter contrasts of LED backlight between this described module's and the substituted module's. Viewing from the listed contrasts, you can draw the conclusion that the LED backlight produced by FORDATA has the features of higher brightness, better uniformity and lower power consumption.

备注 Remark*2

DESCRIBED VERSION 指本规格书所提的模块产品. 该模块产品采用福德电子自己生产的背光

SUBSITUTED VERSION 指福德电子的原模块产品. 该模块产品采用福德电子的原背光供应商生产的背光

DESCRIBED VERSION refers to the described module in this datasheet which adopts LED BKL made by FORDATA.

SUBSITUTED VERSION refers to the old version module (made by FORDATA too) which adopts LED BKL produced by FORDATA's former LED vendors.

备注 Remark*3

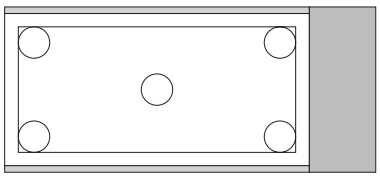
福德电子原来的背光供应商同样提供好品质的背光. 实际上, 福德电子采用这些供应商的背光的模块产品已超过十年获得市场的高度认可. 因此, 这张表格的比较不是为了说明他们的背光质量不好. 只是为了说明福德电子生产的背光的品质更好.

The former LED vendors of FORDATA also provide high quality backlight. Actually, FORDATA's original LCD modules adopting these vendors 'backlights have received high recognition in the market for more than 10 years. Therefore, the comparison in this table does not mean that the quality of their backlight is poor, but to illustrate that the backlight produced by FORDATA has a better quality with some better features

备注 Remark*4

该均匀度的数据是将左边图纸中相关点的亮度进行平均而得出的. 在LED行业, 70%均匀度被认为是合格的均匀度. 换句话说, FORDATA生产的LED可以保证超高的均匀度.

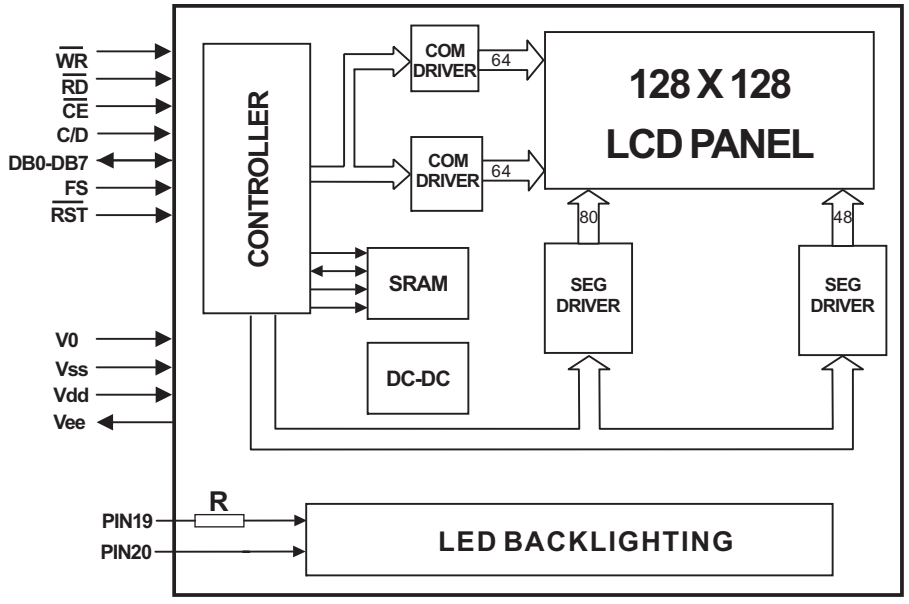
The data of uniformity is obtained by averaging the brightness of relevant dots on left drawing. In LED industry, 70% is acknowledged to be a qualified uniformity. In other words, The LED produced by FORDATA can promise a super high uniformity.



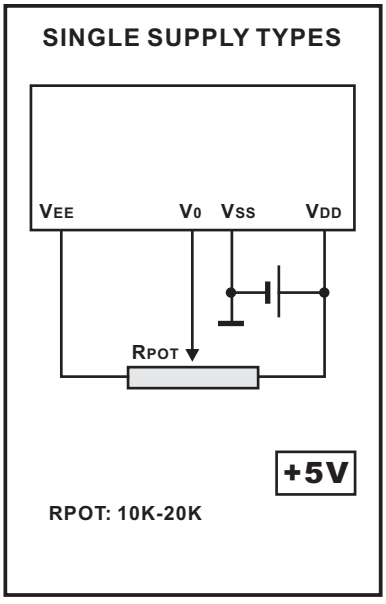
PIN ASSIGNMENT

PIN	SYMBOL	DESCRIPTION	REMARKS
1	Vee	Operating voltage for LCD	
2	Vss	Power supply for LCM	0V
3	Vdd	Power supply for LCM	5.0V
4	V0	Contrast Adjust	
5	$\overline{WR}$	Data Write	
6	$\overline{RD}$	Data Read	
7	$\overline{CE}$	Chip Enable	
8	C/D	Command/Data Select	
9	$\overline{RST}$	Reset Signal	
10	DB0	Data bus line	
11	DB1	Data bus line	
12	DB2	Data bus line	
13	DB3	Data bus line	
14	DB4	Data bus line	
15	DB5	Data bus line	
16	DB6	Data bus line	
17	DB7	Data bus line	
18	FS	Font Selection	
19	LED+	Power supply for BKL	5.0V
20	LED-	Power supply for BKL	0V
21	NC	No Connection	

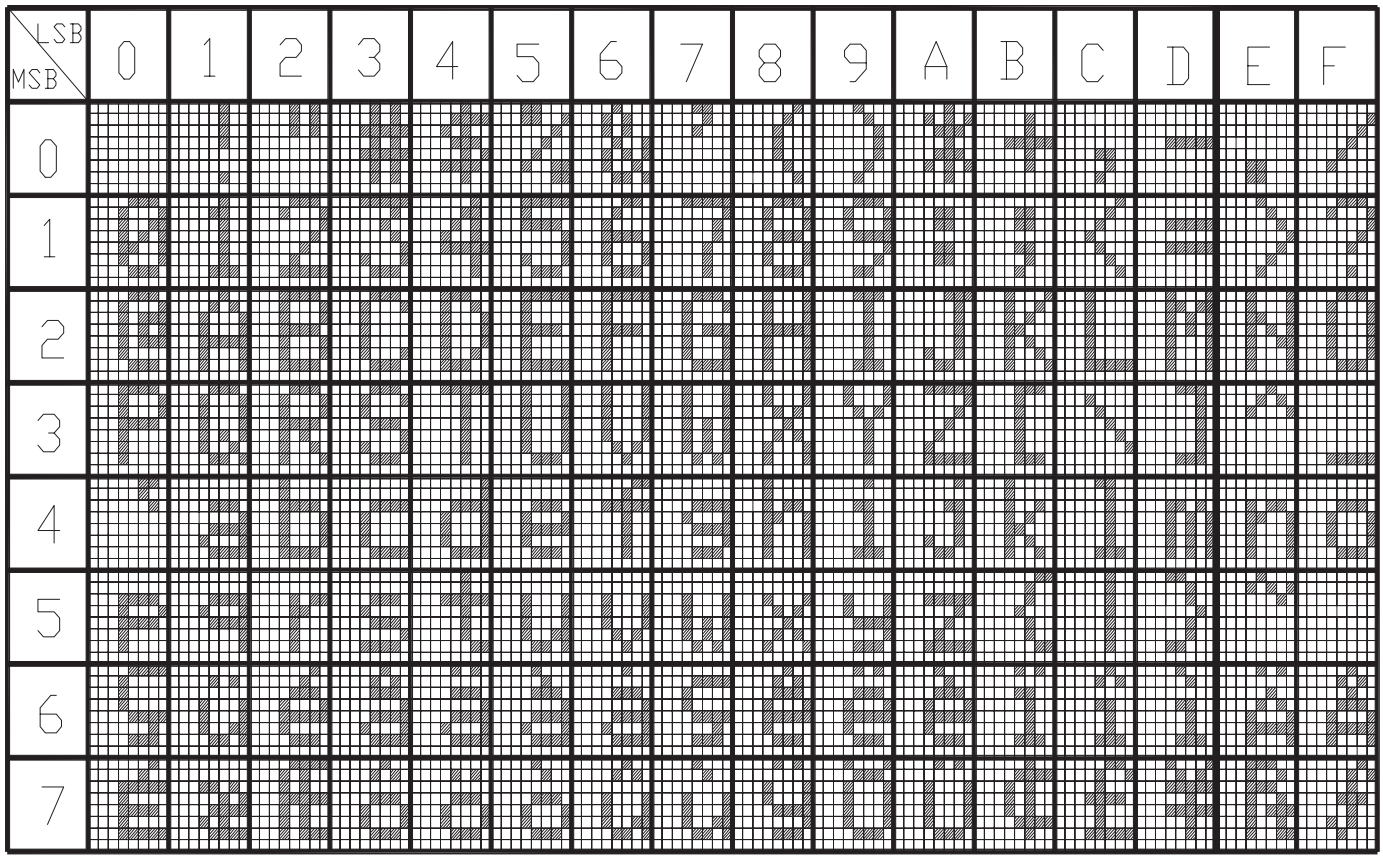
BLOCK DIAGRAM

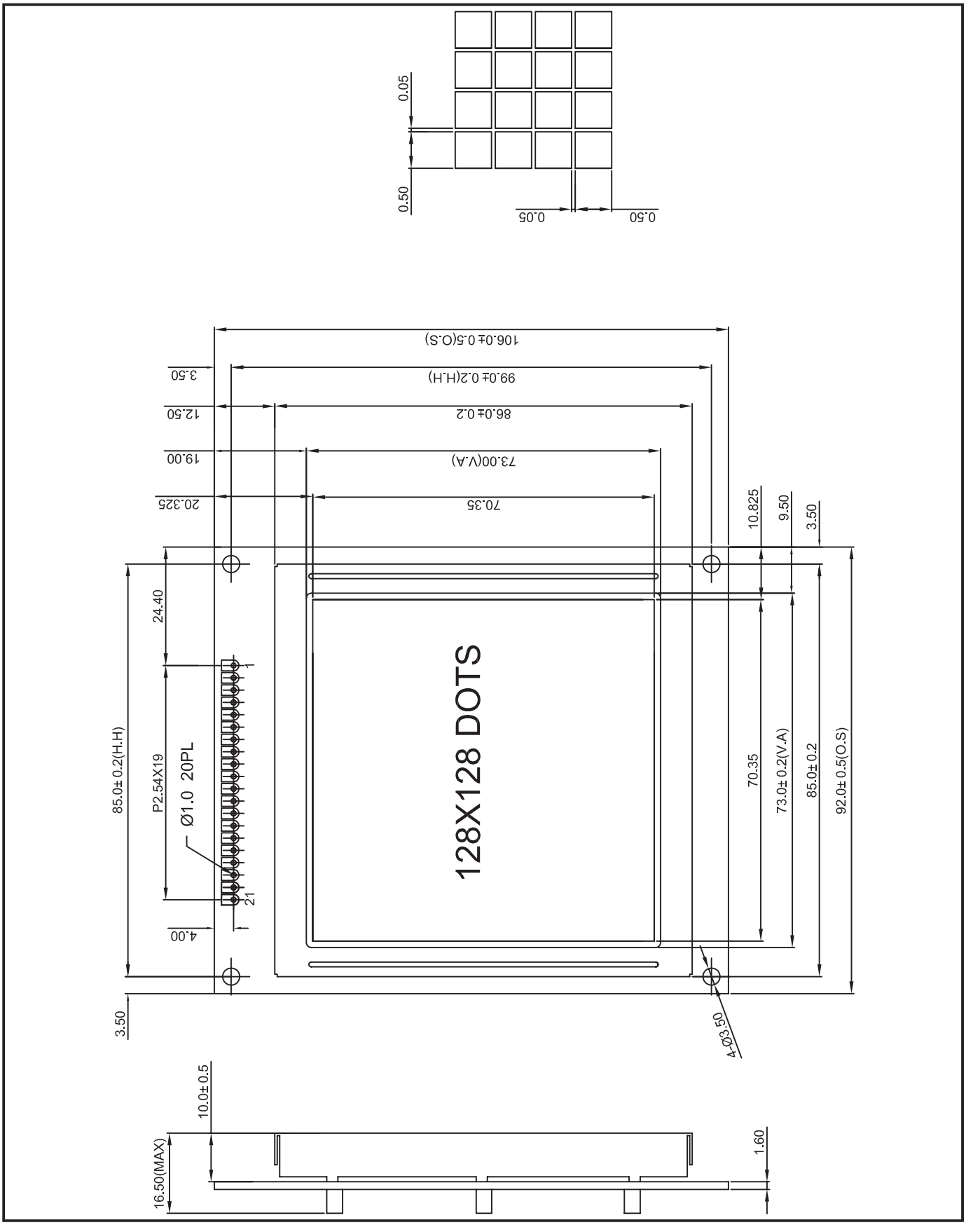


POWER SUPPLY DIAGRAM



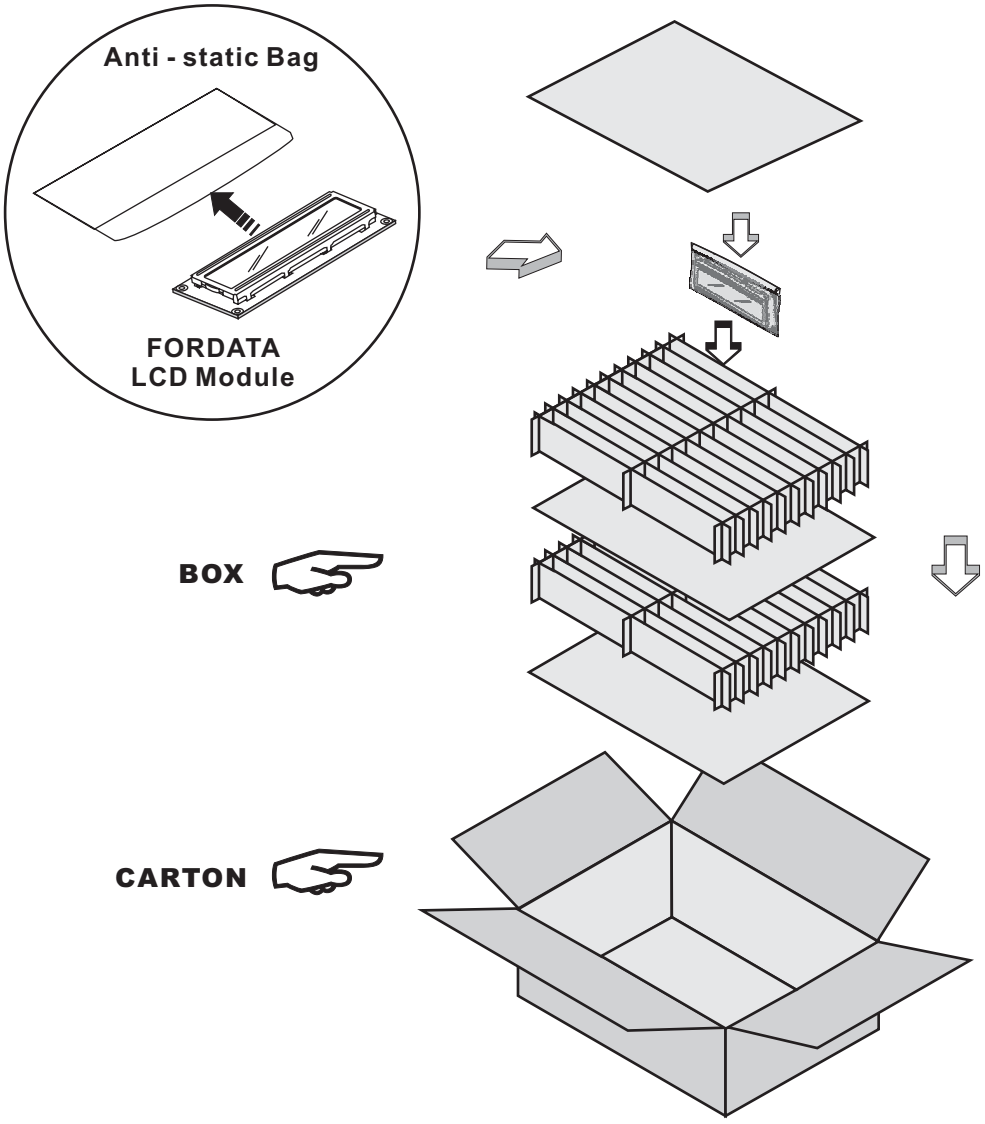
ROM Code 0101




0.05
0.50
0.05
0.50
106.0± 0.5(O.S)
99.0± 0.2(H.H)
86.0± 0.2
73.00(V.A)
70.35
3.50
12.50
19.00
20.325
10.825
9.50
3.50
24.40
128X128 DOTS
85.0± 0.2(H.H)
P2.54X19
Ø1.0 20PL
21
4.00
70.35
73.0± 0.2(V.A)
85.0± 0.2
92.0± 0.5(O.S)
3.50
4-Ø3.50
10.0± 0.5
16.50(MAX)
1.60

FULL-SIZED PACKAGE
16 PCS/BOX
8 BOXES/CARTON
128 PCS/CARTON
18.00 KGS/CTN(G.W.)
0.054 M^3/CARTON

HALF-SIZED PACKAGE
16 PCS/BOX
4 BOXES/CARTON
64 PCS/CARTON
9.00 KGS/CTN(G.W.)
0.027 M^3/CARTON

PACKING DECLARATION

1. This packaging information is for reference only. The actual information is subject to the actual packaging. Especially for packaging of LCL, tolerances may exist.
2. FORDATA will not be responsible for quality problems caused by unnormal transportation conditions (including but not limited to climate factors or human factors, such as improper handling).