

Liquid Crystal Display

Product Catalog

Components Headquarters Product Catalog

CMOS IC
Quartz Crystals
Micro Batteries
Fiber Optics
MATERIALS

Liquid Crystal Display
Custom LCD Module



Dot Matrix Liquid Crystal Display Modules

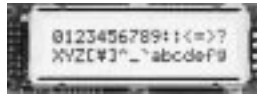
CHARACTER TYPE

■ FEATURES

- Slim, light weight and low power consumption
- High contrast and wide viewing angle
- Built-in controller for easy interfacing
- LCD modules with built-in LED backlight



L1671



L1672



L1682



L1692



L1634

■ SPECIFICATIONS

Character format (character x line)		16 x 1	16 x 2	16 x 2	16 x 2	16 x 4
Model		L1671	L1672	L1682	L1692	L1634
STN type (gray)	Reflective	L167100J000	L167200J000	L168200J000	L169200J000	L163400J000
	Transflective With LED backlight (yellow-green)	L1671B1J000	L1672B1J000	L1682B1J000	L1692B1J000	L1634B1J000
Character font		5 x 7 dots + cursor	5 x 7 dots + cursor	5 x 7 dots + cursor	5 x 7 dots + cursor	5 x 7 dots + cursor
Module size (H x V x T) mm	Reflective	80.0 x 36.0 x 11.3	85.0 x 30.0 x 10.1	80.0 x 36.0 x 11.3	122.0 x 44.0 x 11.3	87.0 x 60.0 x 11.6
	With LED backlight	80.0 x 36.0 x 15.8	85.0 x 30.0 x 15.8	80.0 x 36.0 x 15.8	122.0 x 44.0 x 15.8	87.0 x 60.0 x 15.8
Viewing area (H x V) mm		64.5 x 13.8	62.0 x 16.0	64.5 x 13.8	99.0 x 24.0	61.8 x 25.2
Character size*1 (H x V) mm		3.07 x 5.73	2.78 x 4.27	2.95 x 3.80	4.84 x 8.06	2.95 x 4.15
Dot size (H x V) mm		0.55 x 0.75	0.50 x 0.55	0.55 x 0.50	0.92 x 1.10	0.55 x 0.55
Power supply voltage (V _{DD} -V _{SS})V		+ 5.0	+ 5.0	+ 5.0	+ 5.0	+ 5.0
Current consumption (mA, typ.)	I _{DD}	1.5	2.0	1.6	2.0	2.7
	I _{LC}	0.2	0.2	0.3	0.4	1.1
Driving method (duty)		1/16	1/16	1/16	1/16	1/16
Built-in LSI		KS0066U/HD44780U or equivalent	KS0066U/HD44780U KS0065B or equivalent	KS0066U/HD44780U KS0065B/MSM5839CGS or equivalent	KS0066U/HD44780U KS0065B/MSM5839CGS or equivalent	KS0066U/HD44780U MSM5839CGS or equivalent
Operating temperature*2 (°C)		0 to +50	0 to +50	0 to +50	0 to +50	0 to +50
Storage temperature (°C)		-20 to +60	-20 to +60	-20 to +60	-20 to +60	-20 to +60
Weight (g, typ.)	Reflective	25	25	25	50	50
	With LED backlight	35	40	35	65	65
LED backlight	Forward current consumption (mA)	100	112	100	240	200
	Forward input voltage (V, typ.)	+ 4.1	+ 4.1	+ 4.1	+ 4.1	+ 4.1

★1: Excluding the cursor

★2: Used with external temperature compensation circuit

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H : Horizontal, V : Vertical, T : Thickness (max.)



L2032



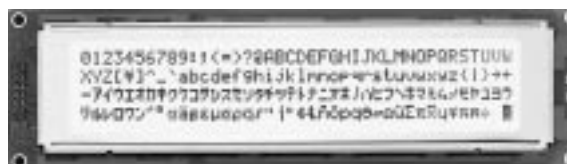
L2462



L2034



L4052



L4044

SPECIFICATIONS

Character format (character x line)		20 x 2	20 x 4	24 x 2	40 x 2	40 x 4
Model		L2032	L2034	L2462	L4052	L4044
STN type (gray)	Reflective	L203200J000	L203400J000	L246200J000	L405200J000	L404400J000
	Transflective With LED backlight (yellow-green)	L2032B1J000	L2034B1J000	L2462B1J000	L4052B1J000	L4044B1J000
Character font		5 x 7 dots + cursor	5 x 7 dots + cursor	5 x 7 dots + cursor	5 x 7 dots + cursor	5 x 7 dots + cursor
Module size (H x V x T) mm	Reflective	116.0 x 37.0 x 11.3	98.0 x 60.0 x 11.6	118.0 x 36.0 x 11.3	182.0 x 33.5 x 11.3	190.0 x 54.0 x 10.1
	With LED backlight	116.0 x 37.0 x 15.8	98.0 x 60.0 x 15.8	118.0 x 36.0 x 15.8	182.0 x 33.5 x 16.3	190.0 x 54.0 x 16.3
Viewing area (H x V) mm		83.0 x 18.6	76.0 x 25.2	94.5 x 17.8	154.4 x 15.8	147.0 x 29.5
Character size*1 (H x V) mm		3.20 x 4.85	2.95 x 4.15	3.20 x 4.85	3.20 x 4.85	2.78 x 4.27
Dot size (H x V) mm		0.60 x 0.65	0.55 x 0.55	0.60 x 0.65	0.60 x 0.65	0.50 x 0.55
Power supply voltage (V _{DD} -V _{SS})V		+ 5.0	+ 5.0	+ 5.0	+ 5.0	+ 5.0
Current consumption (mA, typ.)	I _{DD}	2.0	2.9	2.5	3.0	8.0
	I _{LD}	0.4	1.2	0.5	1.0	3.0
Driving method (duty)		1/16	1/16	1/16	1/16	1/16
Built-in LSI		KS0066U/HD44780U KS0063/HD66100F or equivalent	KS0066U/HD44780U MSM5839CGS or equivalent	KS0066U/HD44780U KS0063/HD66100F or equivalent	KS0066U/HD44780U KS0063/HD66100F or equivalent	KS0066U/HD44780U MSM5839CGS or equivalent
Operating temperature*2 (°C)		0 to +50	0 to +50	0 to +50	0 to +50	0 to +50
Storage temperature (°C)		-20 to +60	-20 to +60	-20 to +60	-20 to +60	-20 to +60
Weight (g, typ.)	Reflective	40	55	40	70	90
	With LED backlight	60	70	60	95	140
LED backlight	Forward current consumption (mA)	154	240	150	260	480
	Forward input voltage (V, typ.)	+ 4.1	+ 4.1	+ 4.1	+ 4.1	+ 4.1

H : Horizontal, V : Vertical, T : Thickness (max.)

★1: Excluding the cursor

★2: Used with external temperature compensation circuit

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Dot Matrix Liquid Crystal Display Modules

GRAPHIC TYPE

■ FEATURES

- Wide viewing angle and high contrast
- Full dot configuration fits any application
- Slim, light weight and low power consumption
- Available in STN and FSTN

■ SPECIFICATIONS

Dot format (H x V, dot)			128 x 32	128 x 64	128 x 128		192 x 128
Model			G1213	G1216	G121C		G191C
STN type (gray)	Reflective Wide temperature range	Built-in RAM	G121300N000	G121600N000			
	Transflective With LED backlight (yellow-green) Wide temperature range	—			G121CB1P000		
		Built-in RAM	G1213B1N000	G1216B1N000			
		Built-in controller				G121CB1P00C	
FSTN type (black and white)	Transflective With EL backlight*1 (white)	—					G191C21R0A0*2
Module size (H x V x T) mm	Reflective		75.0 x 41.5 x 6.8	75.0 x 52.7 x 6.8			
	With EL backlight						98.0 x 86.0 x 13.4
	With LED backlight		75.0 x 41.5 x 8.9	75.0 x 52.7 x 8.9	86.0 x 95.0 x 9.0	86.0 x 95.0 x 10.0	
Viewing area (H x V) mm			60.0 x 21.3	60.0 x 32.5	67.4 x 67.4		77.5 x 54.0
Dot size (H x V) mm			0.40 x 0.48	0.40 x 0.40	0.46 x 0.46		0.33 x 0.33
Dot pitch (H x V) mm			0.43 x 0.51	0.43 x 0.43	0.49 x 0.49		0.37 x 0.37
Power supply voltage (V)		(VDD-VSS)	+ 5.0	+ 5.0	+ 5.0		+ 5.0
		(VLC-VSS)	−8.0*3	- 8.2*3(G121600N) - 8.0*3(G1216B1N)	−24.0		−12.4*3
Current consumption (mA, typ.)		IDD	2.0	2.0	4.3	10.0	3.1
		ILC	1.7(G121300N) 1.8(G1213B1N)	1.8	4.1	4.1	2.9
Driving method (duty)			1/64	1/64	1/128		1/128
Built-in LSI		Driver	HD61202 HD61203 or equivalent	HD61202 HD61203 or equivalent	HD66204 HD66205 or equivalent		HD61104 HD61105 or equivalent
		Controller				SED1335F	
Operating temperature range (°C)			−20 to + 70*4	−20 to + 70*4	−20 to + 70*4		0 to + 50*4
Storage temperature range (°C)			−30 to + 80	−30 to + 80	−30 to + 80		−20 to + 60
Weight (g, typ.)	Reflective		23	35			
	With EL backlight						100
	With LED backlight		35	45	75	81	
Inverters for EL	Model						SKI-050-05H
	Power supply voltage (V)						+ 5.0
	Current consumption*5 (mA, typ.)						120
LED backlight	Forward current consumption (mA)		40	90	100		
	Forward input voltage (V, typ.)		3.8	4.1	4.1		
Suitable controller*6			Built-in RAM	Built-in RAM	MSM6255GS(OKI) SED1335F (EPSON) HD64646FS (HITACHI)	Built-in controller	MSM6255GS(OKI) SED1335F (EPSON) HD64646FS (HITACHI)

H : Horizontal, V : Vertical, T : Thickness (max.)

*1: We produce the module after we get the order to prevent the EL from absorbing moisture.

*2: Anti-glare polarizer

*3: Ta=25°C

*4: Used with external temperature compensation circuit.

*5: Including the EL backlight

*6: Module with built-in RAM or with built-in controller does not require an external controller.

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SPECIFICATIONS

Dot format (H x V, dot)			192 x 192	240 x 64	320 x 240	640 x 200
Model			G191D	G2436	G321E	G649D
STN type (gray)	Reflective			G243600J000		
	Transflective, With LED backlight (yellow-green) Wide temperature range		G191DB1P000			
STN type (blue)	Transmissive With CFL backlight	—			G321EV5B000	G649DX5B010
		With touch panel			G321EV5B00X	
FSTN type (black and white)	Transmissive With CFL backlight	—			G321EV5R000	G649DX5R010
		With touch panel			G321EV5R00X	
Module size (H x V x T) mm	Reflective			180.0 x 75.0 x 11.3		
	With LED backlight		86.0 x 95.0 x 9.0			
	With CFL backlight	—			150.0 x 96.0 x 14.0	260.0 x 121.7 x 15.7
		With touch panel			150.0 x 96.0 x 16.0	
Viewing area (H x V) mm			67.4 x 67.4	134.0 x 41.0	103.0 x 80.0	216.0 x 83.2
Dot size (H x V) mm			0.30 x 0.30	0.49 x 0.49	0.27 x 0.27	0.30 x 0.366
Dot pitch (H x V) mm			0.33 x 0.33	0.53 x 0.53	0.30 x 0.30	0.33 x 0.396
Power supply voltage (V)		V _{DD} –V _{SS}	+ 5.0	+ 5.0	+ 5.0	+ 5.0
		V _{LC} –V _{SS}	–24.0	—*1	–24.0	–24.0
Current consumption (mA, typ.)		I _{DD}	5.0	8.0	6.4	11.0
		I _{LC}	4.5	—*1	5.7	9.0
Driving method (duty)			1/192	1/64	1/240	1/200
Built-in LSI			HD66204 HD66205 or equivalent	MSM5298GS MSM5299BGS or equivalent	MSM6599B MSM6698 or equivalent	MSM5298GS MSM5299BGS or equivalent
Operating temperature (°C)			–20 to + 70*2	0 to +50	0 to + 50*2	0 to +50*2
Storage temperature (°C)			–30 to + 80	–20 to + 60	–20 to + 60	–20 to + 60
Weight (g, typ.)	Reflective			140		
	With LED backlight		80			
	With CFL backlight	—			195	420
		With touch panel			240	
LED backlight	Forward current consumption (mA)		100			
	Forward input voltage (V, typ.)		4.1			
Inverters for CFL	Model				INVC303	HIU - 168
	Power supply voltage (V)				+ 24.0	+ 12.0
	Current consumption (mA, typ.)				60	320
Suitable controller		MPU signal	MSM6255GS(OKI) SED1335F (EPSON) HD64646FS (HITACHI)	MSM6255GS(OKI) SED1335F (EPSON) HD64646FS (HITACHI)	MSM6255GS(OKI) SED1335F (EPSON) HD64646FS (HITACHI)	MSM6255GS(OKI) SED1335F (EPSON) HD64646FS (HITACHI)
		Video signal				SED1341F(EPSON)

*1: G2436 operates with a single power source.

*2: Used with external temperature compensation circuit.

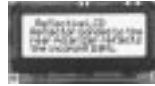
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H : Horizontal, V : Vertical, T : Thickness (max.)

Dot Matrix Liquid Crystal Display Modules



G121C



G1213



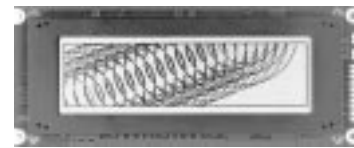
G191C



G191D



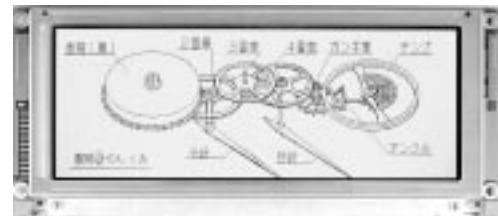
G1216



G2436



G321E



G649D

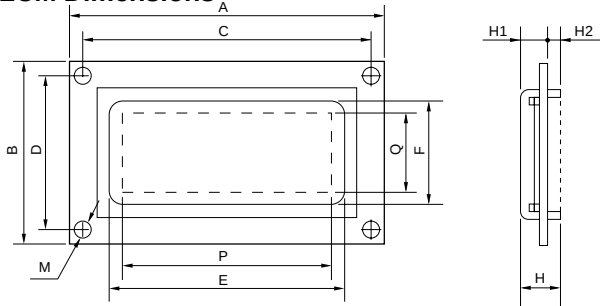
CHECK LIST FOR CUSTOM DESIGNED LCD MODULE

1. Company _____ 2. Application _____ 3. Customer Specified Part No. _____

4. Design

☐ New ☐ Modified : Manufacturer _____, Part No. _____, Remarks _____
☐ Equivalent: Manufacturer _____, Part No. _____, Remarks _____

5. LCM Dimensions



A x B : Module size _____ x _____ mm
E x F : Viewing area _____ x _____ mm
P x Q : Active display area _____ x _____ mm
C : Length between mounting holes _____ mm
D : Length between mounting holes _____ mm
M : Diameter of mounting hole _____ mm
H : Total thickness _____ mm
H1 : Upper thickness _____ mm
H2 : Lower thickness _____ mm

6. Display Contents

☐ Character type: _____ characters _____ lines
Character font _____ x _____ dots + cursor
Character pitch _____ x _____ mm
Dot pitch _____ x _____ mm
Dot size _____ x _____ mm
☐ Graphics (Full dot) type: _____ x _____ dots
Dot pitch _____ x _____ mm
Dot size _____ x _____ mm
☐ Segment type: _____ digits _____ lines
☐ Others _____

7. LCD Panel

Viewing angle: ☐ 6 o'clock ☐ 12 o'clock ☐ _____ o'clock
Type: ☐ TN ☐ FSTN (Black and white)
☐ STN (☐ Yellow green ☐ Gray ☐ Blue)
Chromaticity coordinates
(_____ ≤ x ≤ _____, _____ ≤ y ≤ _____)
Color difference ($\Delta E \leq$ _____)
☐ Positive type ☐ Negative type
☐ Reflective ☐ Transflective ☐ Transmissive
Background color : ☐ SII STD ☐ _____
Gray scale: ☐ Yes _____ gray scale ☐ No
Preferential specifications:
☐ Response time t_{on} _____ ms (_____ °C) t_{off} _____ ms (_____ °C)
☐ Viewing angle _____ deg. (_____ °C) ☐ Contrast _____ (_____ °C)
☐ Others _____
LCD surface finishing:
☐ Normal ☐ Anti-glare ☐ _____
Polarizer color: ☐ Normal (neutral gray) ☐ Red
☐ Green ☐ Blue ☐ _____

8. Driving Method

Multiplexing: 1/ _____ duty, 1/ _____ bias
Frame frequency: _____ Hz

9. IC

LCD driver: ☐ Specified ☐ Unspecified
Segment driver _____ (Manufacturer _____)
Common driver _____ (Manufacturer _____)
Controller: ☐ Internal ☐ External
Type No. _____ (Manufacturer _____)
MPU: ☐ Internal ☐ External
Type No. _____ (Manufacturer _____)
RAM: ☐ Internal ☐ External
Type No. /Memory size _____ (Kbit) (Manufacturer _____)

10. Power Supply

☐ Single power supply: ☐ 5V ☐ _____ V
☐ 2 power supplies
For logic: ($V_{DD}-V_{SS}$) : ☐ 5V ☐ _____ V
For LC drive: ($V_{LC}-V_{SS}$) : ☐ _____ V ☐ _____ V ~ _____ V

11. Current Consumption

For logic: typ. _____ mA, max. _____ mA
For LC drive: typ. _____ mA, max. _____ mA
Others (_____) : typ. _____ mA, max. _____ mA

12. Temperature Range

Operating temperature range: ☐ 0°C to 50°C ☐ _____ °C to _____ °C
Storage temperature range: ☐ - 20°C to 60°C ☐ _____ °C to _____ °C

13. Contrast Adjustment

☐ Internal ☐ External ☐ Unnecessary
Method: ☐ Temp. compensation circuit ☐ Volume ☐ _____

14. Temperature Compensation Circuit

☐ Internal ☐ External ☐ Unnecessary
Compensation range: ☐ 0°C to 50°C ☐ _____ °C to _____ °C

15. Input/Output Terminals

Specifying allocation: ☐ Yes ☐ No
Specifying position: ☐ Yes ☐ No

16. Weight

typ. _____ g, max. _____ g

17. Connector

☐ Internal ☐ External ☐ Unnecessary
Type No. _____ (Manufacturer _____)

18. Backlight

☐ Internal ☐ External ☐ Unnecessary
☐ EL: ☐ Green ☐ White ☐ _____
☐ LED: ☐ Yellow green ☐ Amber ☐ _____
☐ CFL: ☐ White ☐ _____
☐ Incandescent lamp ☐ Others _____
☐ Backlight type ☐ Edge backlight type
Brightness: _____ cd/m²
Inverter: ☐ Internal ☐ External ☐ Unnecessary
Power supply voltage _____ V
Current consumption (backlight included) _____ mA
Brightness control: ☐ Yes ☐ No

19. Others

20. Schedule

Estimate: _____
Sample: Delivery _____, Quantity: _____ pcs
Mass production: Target price: _____
Delivery _____, Total quantity: _____ pcs
Quantity per month _____ pcs

STANDARD PRODUCTS

Unit : mm

Model	Display contents	Panel size (H1 x V1)	Viewing area (H2 x V2)	Digit size (H3 x V3)	T	H4	H5	Suitable LSI
SP501P	4 ½ digits ÷ LOBAT	50.80 x 30.48	45.72 x 17.78	5.50 x 12.00	1.10	1.65	2.54	ICM7224, MSM5221
SP503P	3 ½ digits ÷ ←	50.80 x 30.48	45.72 x 17.78	7.00 x 12.70	1.10	1.27	2.54	ICL7106
SP505P	4 digits	50.80 x 30.48	45.72 x 17.78	7.00 x 12.70	1.10	1.27	2.54	ICM7224, MSM5221, μPD7225
SP511P	6 digits	93.85 x 38.10	88.90 x 25.40	8.50 x 17.78	1.10	16.45	2.54	MSM5221, LC7582
SP513P	4 digits	93.85 x 38.10	88.90 x 25.40	14.00 x 17.78	1.10	1.27	2.54	MSM5265
SP516P	4 ½ digits ÷ ←	50.80 x 22.86	45.72 x 12.70	4.50 x 7.62	1.10	1.27	2.54	ICM7224, MSM5221
SP521P/SP521	3 ½ digits ÷ LOBAT	50.80 x 30.48	45.72 x 17.78	7.00 x 12.70	1.10	1.27	2.54	ICL7106
SP530P/SP530	3 ½ digits ÷ ←	50.80 x 22.86	45.72 x 12.70	5.59 x 8.89	1.10	1.65	2.54	ICL7106
SP531P	4 digits	50.80 x 22.86	45.72 x 12.70	5.59 x 8.89	1.10	1.65	2.54	ICM7224, MSM5221, μPD7225
SP532P	6 digits	69.85 x 30.48	64.77 x 17.78	6.60 x 12.70	1.10	5.72	2.54	MSM5221, LC7582
SP538P	5 digits	81.28 x 38.10	76.20 x 25.40	9.14 x 17.78	1.10	10.16	2.54	MSM5221, LC7582

*T: Glass thickness H4: Glass edge to center of first contact pad H5: Terminal pitch

SP□□□ P: Pin (DIL) type, SP□□□ : Rubber (zebra) connector type

STANDARD SPECIFICATIONS

(1) Driving method

- Static drive
- Operating voltage*: 3.0V typ.
- Operating frequency*: 32Hz typ.

(2) Environmental condition

- Operating temperature range: - 10 °C to + 60 °C
- Storage temperature range: - 20 °C to + 60 °C

(3) Connector •Rubber (zebra) connector type or pin type

(4) Viewing angle •6 o'clock

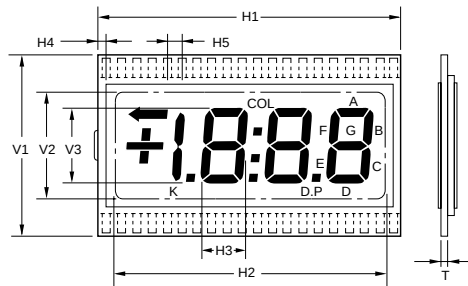
(5) Polarizer •Normal color •Reflective type

(6) LCD •TN LCD

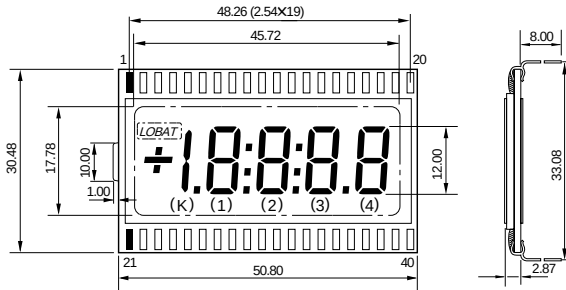
* At 3 V, 32 - 128 Hz drive is possible. At 5V, 32 Hz drive is possible
(any drive above 32 Hz needs to be confirmed with the actual product).

DRAWINGS Unit: mm (typ.)

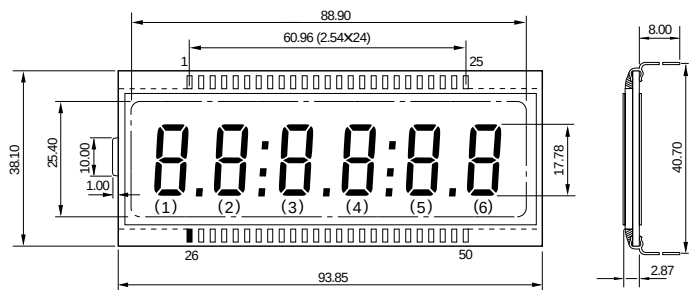
DIMENSIONS INDEX



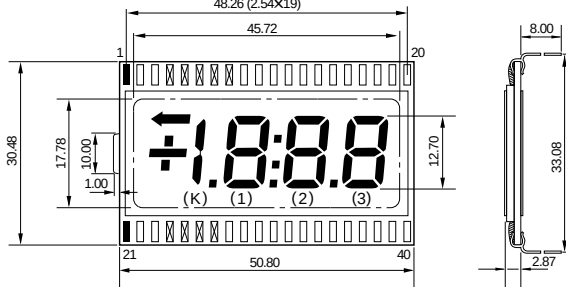
1 SP501P



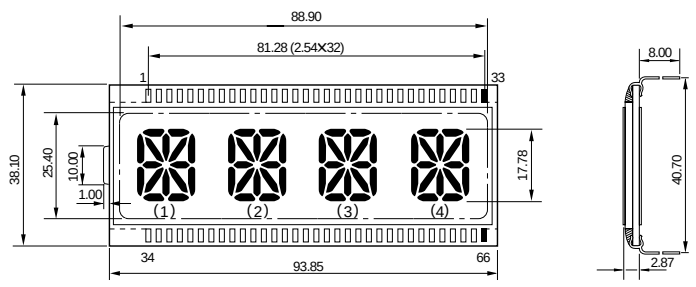
4 SP511P



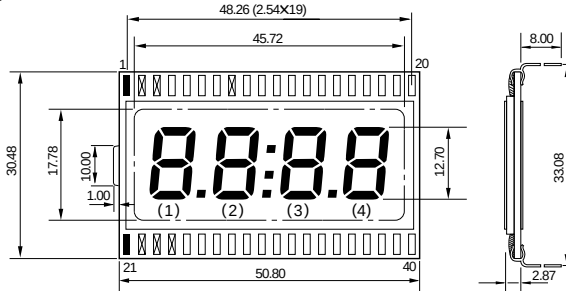
2 SP503P



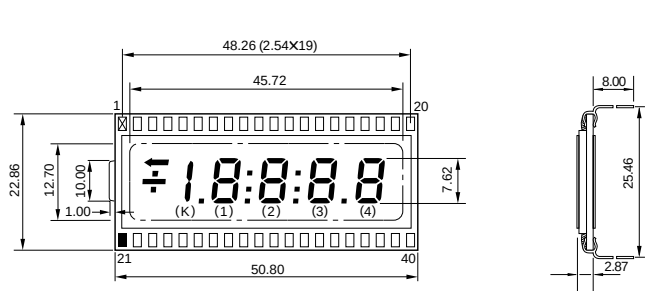
5 SP513P



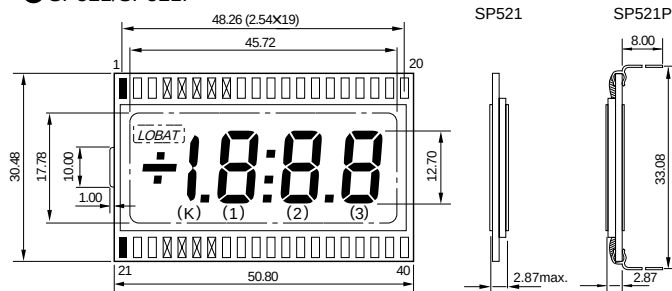
3 SP505P



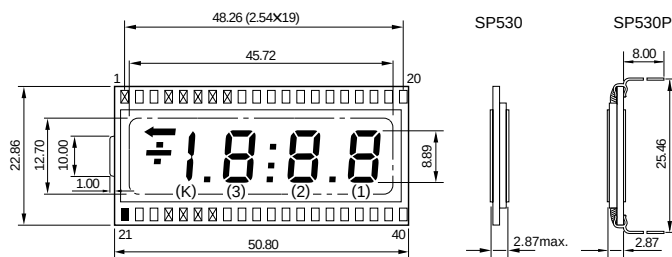
6 SP516P



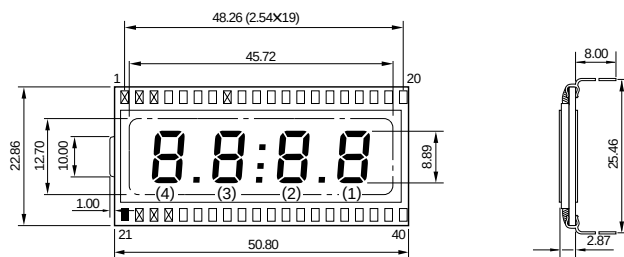
7 SP521/SP521P



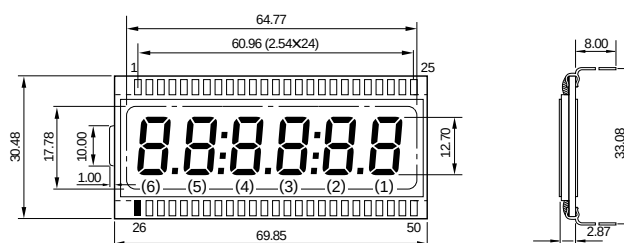
8 SP530/SP530P



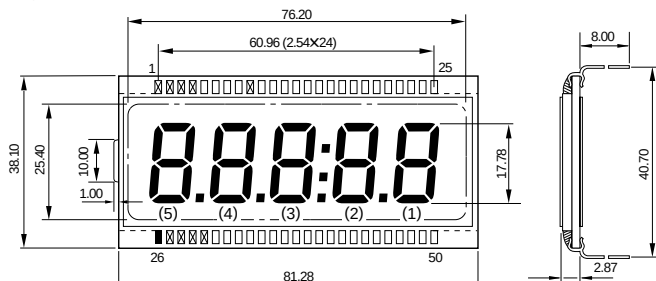
9 SP531P



10 SP532P



11 SP538P



No.	SP501P	SP503P	SP505P	SP511P	SP513P	SP516P	SP521P	SP530P	SP531P	SP532P	SP538P
1	B.P	B.P	B.P	1G	1S	N.C	B.P	N.C	N.C	6G	N.C
2	■	■	N.C	1F	1H	■	■	■	N.C	6F	N.C
3	LOBAT	■	N.C	1A	1J	■	LOBAT	■	N.C	6A	N.C
4	1G	N.C	1G	1B	1A	1G	N.C	N.C	4G	6B	N.C
5	1F	N.C	1F	2G	1K	1F	N.C	N.C	4F	5G	5G
6	1A	N.C	1A	2F	1B	1A	N.C	N.C	4A	5F	5F
7	1B	N.C	1B	2A	1L	1B	N.C	N.C	4B	5A	5A
8	COL1	N.C	N.C	2B	1C	COL1	N.C	N.C	N.C	5B	5B
9	2G	1G	2G	COL1	2S	2G	1G	3G	3G	COL2	N.C
10	2F	1F	2F	3G	2H	2F	1F	3F	3F	4G	4G
11	2A	1A	2A	3F	2J	2A	1A	3A	3A	4F	4F
12	2B	1B	2B	3A	2A	2B	1B	3B	3B	4A	4A
13	COL2	COL	COL	3B	2K	COL2	COL	COL	COL	4B	4B
14	3G	2G	3G	4G	2B	3G	2G	2G	2G	3G	3G
15	3F	2F	3F	4F	2L	3F	2F	2F	2F	3F	3F
16	3A	2A	3A	4A	2C	3A	2A	2A	2A	3A	3A
17	3B	2B	3B	4B	3S	3B	2B	2B	2B	3B	3B
18	4G	3G	4G	COL2	3H	4G	3G	1G	1G	COL1	COL
19	4F	3F	4F	5G	3J	4F	3F	1F	1F	2G	2G
20	4A	3A	4A	5F	3A	4A	3A	1A	1A	2F	2F
21	B.P	B.P	B.P	5A	3K	B.P	B.P	B.P	B.P	2A	2A
22	■	■	N.C	5B	3B	■	■	■	N.C	2B	2B
23	K	K	N.C	6G	3L	K	K	K	N.C	1G	1G
24	1DP	N.C	N.C	6F	3C	1DP	N.C	N.C	N.C	1F	1F
25	1E	N.C	1E	6A	4S	1E	N.C	N.C	4E	1A	1A
26	1D	N.C	1D	B.P	4H	1D	N.C	N.C	4D	B.P	B.P
27	1C	N.C	1C	1E	4J	1C	N.C	N.C	4C	6E	N.C
28	2DP	1DP	1DP	1D	4A	2DP	1DP	3DP	3DP	6D	N.C
29	2E	1E	2E	1C	4K	2E	1E	3E	3E	6C	N.C
30	2D	1D	2D	1DP	4B	2D	1D	3D	3D	5DP	N.C
31	2C	1C	2C	2E	4L	2C	1C	3C	3C	5E	5E
32	3DP	2DP	2DP	2D	4C	3DP	2DP	2DP	2DP	5D	5D
33	3E	2E	3E	2C	B.P	3E	2E	2E	2E	5C	5C
34	3D	2D	3D	2DP	1G	3D	2D	2D	2D	4DP	4DP
35	3C	2C	3C	3E	1R	3C	2C	2C	2C	4E	4E
36	4DP	3DP	3DP	3D	1F	4DP	3DP	1DP	1DP	4D	4D
37	4E	3E	4E	3C	1P	4E	3E	1E	1E	4C	4C
38	4D	3D	4D	3DP	1E	4D	3D	1D	1D	3DP	3DP
39	4C	3C	4C	4E	1N	4C	3C	1C	1C	3E	3E
40	4B	3B	4B	4D	1D	4B	3B	1B	1B	3D	3D
41				4C	1M					3C	3C
42				4DP	2G					2DP	2DP
43				5E	2R					2E	2E
44				5D	2F					2D	2D
45				5C	2P					2C	2C
46				5DP	2E					1DP	1DP
47				6E	2N					1E	1E
48				6D	2D					1D	1D
49				6C	2M					1C	1C
50				6B	3G					1B	1B
51					3R						
52					3F						
53					3P						
54					3E						
55					3N						
56					3D						
57					3M						
58					4G						
59					4R						
60					4F						
61					4P						
62					4E						
63					4N						
64					4D						
65					4M						
66					B.P						

B.P:Common

OPTION SPECIFICATIONS

- Environmental Condition
(Wide temperature range: High reliability type)
●Operating temperature range: - 30°C to + 80°C
●Storage temperature range: - 40°C to + 85°C
- Viewing angle ●12 o'clock
- Polarizer ●Color: Gold, Red, Blue, Green
●Type: Transmissive, Transflective

SOLDERING REQUIREMENTS FOR PIN TYPE

Position: 2.5 mm or more away from the pin bonded part
Time: 5 seconds*
Temperature: 260°C**
* 10 seconds or less **265°C or less

Liquid Crystal Displays

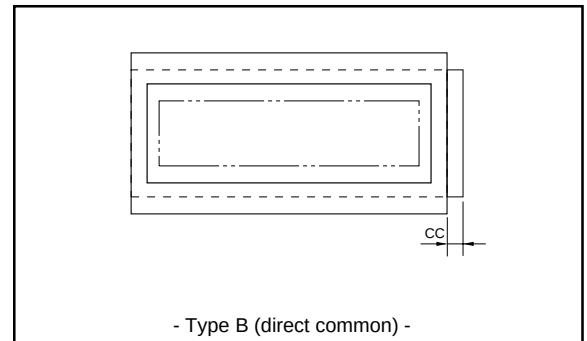
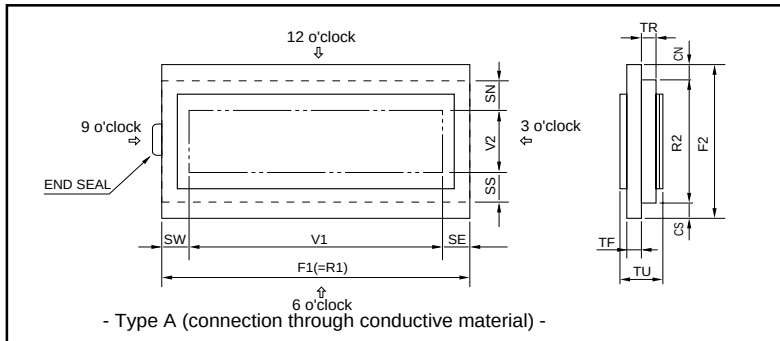
CHECK LIST FOR CUSTOM DESIGNED LCD

1. Company _____ 2. Application _____ 3. Customer Specified Part No. _____

4. Design

☐ New ☐ Modified: Manufacturer _____, Part No. _____, Remarks _____
☐ Equivalent: Manufacturer _____, Part No. _____, Remarks _____

5. Panel Dimensions

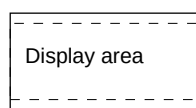


F1: Horizontal length of upper glass _____ mm
 F2: Vertical length of upper glass _____ mm
 R1: Horizontal length of lower glass _____ the same as F1
 R2*: Vertical length of lower glass _____ mm
 *R2 is generally longer than F2 when terminals are with pin.
 TF, TR***: Thickness of glass _____ mm
 ***Standard type: 1.1 mm or 0.7 mm
 TU: Thickness of LCD _____ mm
 End seal: ☐ Right ☐ Left ☐ Right or Left

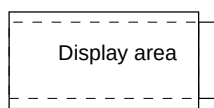
V1: Horizontal length of viewing area _____ mm
 V2: Vertical length of viewing area _____ mm
 CN**: Terminal length _____ mm
 CS**: Terminal length _____ mm
 **CN or CS=0 in case of one side terminal type.
 CC: Terminal length _____ mm
 SE, SW, SN, SS: Seal width
 (According to design or manufacturing condition:
 about 2.0 mm to 4.0 mm)

6. Panel Form

• Terminal ☐



- Type A -



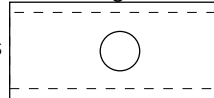
- Type B -

• Chamfering ☐

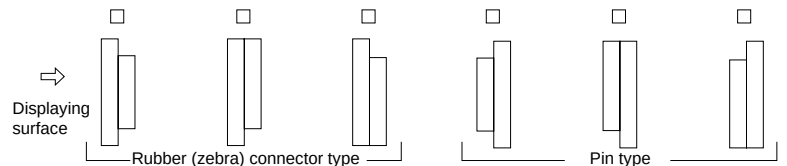


☐ Yes
☐ No

• Drilling ☐



☐ Yes
☐ No



10. Temperature Range

Operating temperature range

☐ With temperature compensation circuit (or volume)
☐ 0°C to 50°C ☐ _____°C to _____°C

☐ Without temperature compensation circuit
☐ 0°C to 50°C ☐ _____°C to _____°C

Storage temperature range

☐ - 20°C to 60°C ☐ _____°C to _____°C

11. Terminal Connecting Method

☐ Rubber connector (Zebra rubber)

☐ Pin: ☐ DIL ☐ SIL ☐ _____ mm Length (_____ mm)

☐ Heat seal: ☐ Equipped ☐ Unnecessary

☐ FPC: ☐ Equipped ☐ Unnecessary

12. Others

Print (Characters, lines, masks etc.): ☐ Yes ☐ No

Protective film:

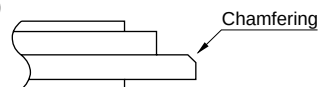
☐ Yes (Color: ☐ Red ☐ Translucent ☐ Transparent) ☐ No

Chamfering (for heat-seal connector):

☐ Yes (Position: _____)

(Quantity: _____)

☐ No



Marking ☐ No ☐ Yes (_____, color: _____)

13. Schedule

Estimate: _____

Sample: Delivery _____, Quantity: _____ pcs

Mass production: Target price: _____

Delivery _____, Total quantity: _____ pcs

Quantity per month: _____ pcs

7. Display Mode

Viewing angle: ☐ 6 o'clock ☐ 12 o'clock ☐ _____ o'clock

Type: ☐ TN ☐ FSTN (Black and white)

☐ STN: (☐ Yellow green ☐ Gray ☐ Blue)

Chromaticity coordinates (_____ ≤ x ≤ _____, _____ ≤ y ≤ _____)

Color difference (ΔE ≤ _____)

☐ Positive type ☐ Negative type

☐ Reflective ☐ Transflective ☐ Transmissive

Background color: ☐ SII STD ☐ _____

Preferential specifications:

☐ Response time t_{on} ms (_____°C) t_{off} ms (_____°C)

☐ Viewing angle _____ deg. (_____°C) ☐ Contrast _____ (_____°C)

☐ Others _____

8. Polarizer

Surface finishing: ☐ Normal ☐ Anti-glare ☐ _____

Color: ☐ Normal (neutral gray) ☐ Red ☐ Green

☐ Blue ☐ _____

Front polarizer: ☐ Attached type ☐ Separate type

Rear polarizer: ☐ Attached type ☐ Separate type

9. Driving Method

☐ Static ☐ Multiplexing: (1/_____ duty, 1/_____ bias)

Operating voltage (V_{opr}): ☐ _____ V ☐ _____ V to _____ V

Frame frequency: _____ Hz

Driving IC: _____ (Manufacturer _____)

Current consumption: _____ μ A

■ BASIC SPECIFICATIONS (TN LCD)

1. Standard Type

1.1 Maximum ratings

D:duty

Item	Static	1/2D	1/3D	1/4D	1/8D	1/16D	Unit
AC applied voltage	15						V
Residual DC element	150						mV
Storage temperature range	- 20 to + 60						°C
Operating temperature range	-10 to + 60	0 to + 50		- 10 to + 50*			°C

* With temperature compensation circuit.

1.2 Operating conditions

Item	Symbol	Static	1/2D	1/3D	1/4D	1/8D	1/16D	Unit
Operating voltage	V _{opr}	3 to 6**	3 ± 0.15			4.5±0.15*	4.8±0.15*	V
Operating frequency	f _{opr}	32 to 128**	-					Hz
Frame frequency	f _{FRM}	-	32 to 128					Hz

* When Ta=25°C

** Although the f_{opr} is 32 to 128 Hz when 3 V LCD is driven at 3 V, it becomes 32 Hz typ. when driven at 5 V. Use the 5 V LCD when driving at 5 V.

1.3 Standard operating characteristics

Item		Symbol	Static	1/2D	1/3D	1/4D	1/8D	1/16D	Unit
Contrast		C	20	15	15	15	10	8	-
Response time 25°C	Rise	ton	100	120	120	150	120	60	ms
	Fall	toff	80	50	50	80	80	150	ms
Response time 0°C	Rise	ton	500	650	700	1000	750	250	ms
	Fall	toff	300	200	200	300	250	500	ms
Current consumption		I	0.7	0.7	0.7	1.2	1.0	2.0	μA/cm ²

2. Wide Temperature Range Type

2.1 Maximum ratings

D:duty

Item	Static	1/2D	1/3D	Unit
AC applied voltage	15			V
Residual DC element	150			mV
Storage temperature range	- 40 to + 85			°C
Operating temperature range	- 30 to + 80	- 30 to + 70		°C

2.2 Operating conditions

Item	Symbol	Static	1/2D	1/3D	Unit
Operating voltage	V _{opr}	3 to 6*	3 ± 0.15 5 ± 0.15	4.5 ± 0.15	V
Operating frequency	f _{opr}	32 to 128*	-		Hz
Frame frequency	f _{FRM}	-	32 to 128		Hz

* Although the f_{opr} is 32 to 128 Hz when 3 V LCD is driven at 3 V, it becomes 32 Hz typ. when driven at 5 V. Use the 5 V LCD when driving at 5 V.

2.3 Standard operating characteristics

Item		Symbol	Static	1/2D	1/3D	Unit
Contrast		C	7	5	5	-
Response time 25°C	Rise	ton	40	40	70	ms
	Fall	toff	40	30	35	ms
Response time 0°C	Rise	ton	150	200	250	ms
	Fall	toff	150	100	150	ms
Response time - 10°C	Rise	ton	350	500	700	ms
	Fall	toff	250	200	250	ms
Current consumption		I	0.9	0.9	0.8	μA/cm ²

■ RELIABILITY (TN LCD)

1. Standard Type

Test item	Test conditions
High temperature and humidity operation	40°C ± 2°C, 90%RH, 240hrs
High temperature operation	60°C ± 2°C, 240 hrs
Temperature cycle	$\left. \begin{array}{l} -20^{\circ}\text{C} \rightarrow +60^{\circ}\text{C} \rightarrow -20^{\circ}\text{C} \dots \\ 1\text{hr} \quad 1\text{hr} \quad 1\text{hr} \dots \\ (5\text{min}) \quad (5\text{min}) \quad \dots \end{array} \right\} 10 \text{ cycles}$
Low temperature storage	- 20°C ± 2°C, 240 hrs

2. Wide Temperature Range Type

Test item	Test conditions
High temperature and humidity operation	60°C ± 2°C, 90%RH, 240 hrs
High temperature operation	80°C ± 2°C, 240 hrs
Temperature cycle	$\left. \begin{array}{l} -20^{\circ}\text{C} \rightarrow +85^{\circ}\text{C} \rightarrow -20^{\circ}\text{C} \dots \\ 1\text{hr} \quad 1\text{hr} \quad 1\text{hr} \dots \\ (5\text{min}) \quad (5\text{min}) \quad \dots \end{array} \right\} 10 \text{ cycles}$
Low temperature storage	- 40°C ± 2°C, 240 hrs

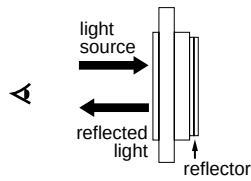
Notes: Test condition may be different by LCD size. The tables above are applied to SP516 size LCD or larger.
We will present you the reliability test report on your request.

Liquid Crystal Display Modules

REFLECTIVE/TRANSFLECTIVE/TRANSMISSIVE LCD

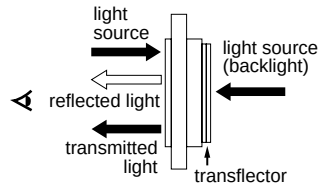
1 Reflective LCD

Reflector bonded to the rear polarizer reflects the incoming ambient light. Low power consumption because no backlight is required.



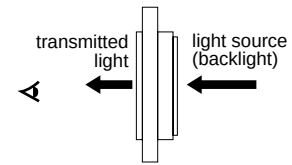
2 Transflective LCD

Transflector bonded to the rear polarizer reflects light from the front as well as enabling lights to pass through the back. Used with backlight off in bright light and with it on in low light to reduce power consumption.



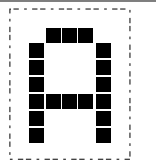
3 Transmissive LCD

Without reflector or transflector bonded to the rear polarizer. Backlight required. Most common is transmissive negative image.

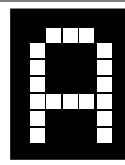


POSITIVE/NEGATIVE MODE

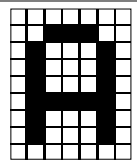
Positive type



Negative type



Negative type (inverse image) (when data is inverted)



TN TYPE/STN TYPE/FSTN TYPE

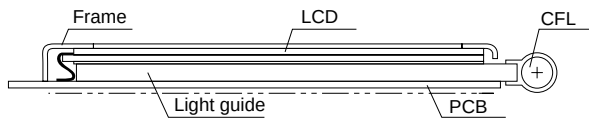
TN	(Background/dot color) Gray/Black	TN (Twisted Nematic) type is most conventional and economical. It is used for static drive LCD and low-duty drive LCD (watch, calculator, etc.)
STN	Yellowgreen/Dark blue Gray/Dark blue White/Blue	STN (Super Twisted Nematic) type has a higher twist angle, and thus provides clear visibility and wider viewing angle. This is suitable especially for high-duty drive LCD.
FSTN	White/Black	FSTN (Film Super Twisted Nematic) type utilizes RCF (Retardation Control Film) to remove the coloring of STN LCD. Thus FSTN type provides easy-to-read black-and-white display.

STRUCTURE AND FEATURE OF LCD MODULE WITH BACKLIGHT

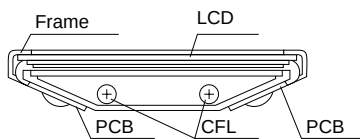
CFL (Cold Cathode Fluorescent Lamp) backlight

Features: high brightness, long service life, inverter required

- Edge backlight type (G321E) (G649D)



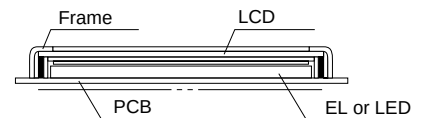
- Backlight type



EL (Electroluminescent Lamp) backlight LED (Light Emitting Diode) backlight

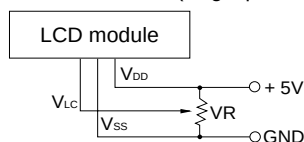
Features: EL: thin, inverter required

LED: long service life, low voltage driving, no inverter required

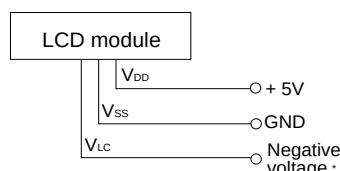


POWER SUPPLY

- Character modules (single power supply)

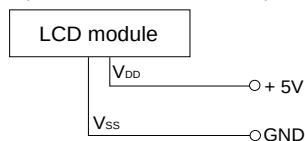


- G191C, G1213 and G1216

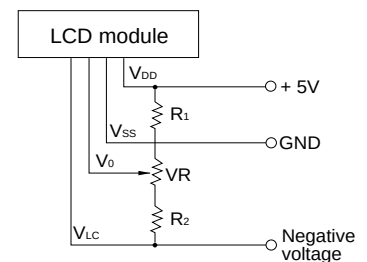


• Negative voltage should be variable for contrast adjustment.

- G2436 (Built-in DC-DC converter)



- G121C, G191D, G321E and G649D



Note 1: Contrast can be adjusted by VR.
Note 2: For module with backlight, power supply for backlight is necessary.

CAUTION

- If the LCD panel is damaged, be careful not to get the liquid crystal in your mouth and not to be injured by crushed glasses.
- If you should swallow the liquid crystal, first, wash your mouth thoroughly with water, then, drink a lot of water and induce vomiting, and then, consult a physician.
- If the liquid crystal should get in your eye, flush your eye with running water for at least fifteen minutes.
- If the liquid crystal touches your skin or clothes, remove it and wash the affected part of your skin or clothes with soap and running water.
- EL or CFL backlight is driven by a high voltage with an inverter. Do not touch the connection part or the wiring pattern of the inverter.
- Do not use inverters without a load or in the short-circuit mode.
- Use the LCD module within the rated voltage to prevent overheating and/or damage. Also, take steps to ensure that the connector does not come off.

Handling Precautions

- Since the LCD panel has glass substrate, avoid applying mechanical shock or pressure on the module. Do not drop, bend, twist or press the module.
- Do not soil or damage LCD panel terminals.
- Since the polarizer is made of easily-scratched material, be careful not to touch or place objects on the display surface.
- Keep the display surface clean. Do not touch it with your skin.
- CMOS LSI is used in the LCD module. Be careful of static electricity.
- Do not disassemble the module or remove the liquid crystal panel or the panel frame.
- Do not damage the film surface of the EL lamp; otherwise the lamp will be damaged by humidity.
- To set an EL lamp in an LCD module, push the EL lamp with its emitting side up, without pushing the rubber connectors too hard. If you damage them, the LCD module may not work properly.

Mounting and Designing

- To protect the polarizer and the LCD panel, cover the display surface with a transparent plate (e.g., acrylic or glass) with a small gap between the transparent plate and the display surface.
- Keep the module dry. Avoid condensation to prevent the transparent electrodes from being damaged.
- Drive LCD panel with AC waveform in which DC element is not included to prevent deterioration in the LCD panel.
- Contrast of LCD varies depending on the ambient temperature. To offer the optimum contrast, LC drive voltage should be adjusted. LCD driven in a high duty ratio must be provided with drive voltage adjustment method.
- Mount a LCD module with the specified mounting part/holes.

- Design the equipment so that input signal is not applied to the LCD module while power supply voltage is not applied to it.
- Do not locate the CFL tube and the lamp lead wire close to a metal plate or a plated part inside the equipment. Otherwise stray capacity causes a drop in voltage, decreasing the brightness and the ability to start-up.

Cleaning

- Do not wipe the polarizer with a dry cloth, as it may scratch the surface.
- Wipe the LCD panel gently with a soft cloth soaked with a petroleum benzine.
- Do not use ketonic solvents (ketone and acetone) or aromatic solvents (toluene and xylene), as they may damage the polarizer.

Storing

- Store the LCD panel in a dark place, where the temperature is $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ and the relative humidity below 65%. If possible, store the LCD panel in the packaging situation when it was delivered.
- Do not store the module near organic solvents or corrosive gases.
- Keep the module (including accessories) safe from vibration, shock and pressure.
- Use an LCD module with built-in EL backlight within six months of delivery.
- EL backlight is easily affected by environmental conditions such as temperature and humidity; the quality may deteriorate if stored for an extended period of time. Contact Seiko Instruments Inc. for details.
- Some parts of the backlight and the inverter generate heat. Take care so that the heat does not affect the liquid crystal or any other parts.
- Dust particles attached to the surface of the LCD or the surface of the backlight degrade the display quality. Be careful to keep dust out in designing the structure as well as in handling the module.
- Black or white air-bubbles may be produced if the LCD panel is stored for long time in the lower temperature or mechanical shocks are applied onto the LCD panel.



memo

A series of horizontal dashed lines for writing a memo.

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