

TRULY®



TRULY SEMICONDUCTORS LIMITED
LCD PRODUCT CATALOG



TRULY SEMICONDUCTORS LIMITED



TRULY SEMICONDUCTORS LIMITED

INTRODUCTION

Truly Semiconductors Limited is a subsidiary company of Truly International Holdings Limited, a multi divisional conglomerate involved in the design and manufacture of an abundant number of electronic component products along with numerous consumer electronics and telecommunications goods. Since 1991, Truly International Holdings Limited has been a publicly listed and traded company on the Hong Kong Stock Exchange.

Since its founding in 1991, Truly Semiconductors Limited (hereafter referred to as “Truly”) has exhibited technology and production capabilities that are unequalled amongst other liquid crystal display (LCD) manufacturers. With the ever-changing demands of the marketplace, for fresh and innovative designs, Truly remains in the forefront by continuously upgrading its technology offerings and production processes.

Truly is continually expanding its resources to meet demands for conventional twist nematic (TN), super twist nematic (STN) and film compensated super twist nematic (FSTN) panels and modules. In addition, Truly is making significant commitments in the development and manufacture of color super twist nematic (CSTN), organic light emitting diodes (OLED) and thin film transistor (TFT) technologies. Given this breadth of technology and product offerings, Truly has a unique distinction in its ability to address “**all** LCD technologies and manufacturing processes available in the market today”. This differentiation sets Truly apart from vast majority of LCD manufacturers.

Truly remains dedicated to expanding its production capabilities to keep astride the increased requirements for product designs specifying tape-automated-bonding (TAB) and chip-on-glass (COG). Truly has full production capabilities to manage the desires for chip-on-film (COF), and with the ever-increasing popularity of color LCD products, is making substantial investments to aggressively expand its production capabilities in support of CSTN, OLED and TFT technologies. To further achieve full LCD module integration, Truly has full design engineering and manufacturing capacities for both digital and analog resistive touch panels.

Through the immense manufacturing resources of Truly International Holdings Limited subsidiary companies, Truly is supplied with all of their required needs for print circuit boards (PCB's), bezels and elastomer strips for LCD module assembly. Truly also works in conjunction with another subsidiary companies of Truly International Holdings Limited which designs and manufactures silicon rubber keypads, while another group is dedicated to designing and manufacturing plastic housings and enclosures; with the combined efforts of these subsidiary companies, Truly can assure ongoing quality and timely delivery of products. Also, due to the unparalleled depth of in-house engineering, manufacturing processes and capabilities, Truly remains extremely price competitive within today's global market.

Truly puts tremendous focus on and is continuously striving to advance both quality and environmental management. As a result of these efforts Truly has achieved ISO 9001, TL 9000, ISO 14001 and ISO/TS 16949 certification.

Through the close cooperative manufacturing efforts of the various divisions of Truly International Holdings Limited, coupled with production space totaling in excess of 600,000 square meters and a dedicated LCD engineering and production staff that exceeds 2800 employees, Truly is extremely successful in controlling product quality and delivery while keeping their production costs to a minimum. Given the versatility of manufacturing processes that comprise LCD module and sub-assembly production, together with the depth of technology offerings, there is no better choice in meeting your LCD panel and module requirements than Truly Semiconductors Limited.

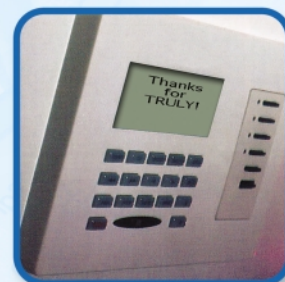
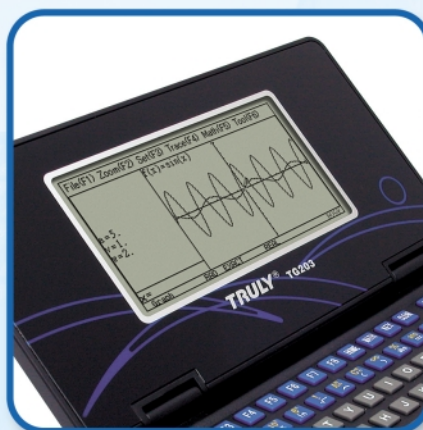


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APPLICATIONS

CUSTOM-MADE LCD PANELS / MODULES FOR VARIOUS APPLICATIONS



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TRULY SEMICONDUCTORS LIMITED

FUTURE TECHNOLOGY DEVELOPMENT

As part of an expanding effort to address the vast growing number of application requirements for color displays, Truly Semiconductors is moving rapidly into both Organic Light Emitting Diodes (OLED) and Thin Film Transistor (TFT) technology fields.

Recently Truly Semiconductors has built new factory facilities and taken delivery of all production equipment necessary to address the growing popularity of OLED displays. Over the next several months Truly Semiconductors will design and manufacture a number of standard displays in addition to focusing on the growing needs for custom designed products.

Truly Semiconductors is also establishing production facilities for the design and manufacture of TFT panels and modules. These manufacturing facilities will provide support for the ever-increasing requirements for active matrix color displays.

With the addition of OLED and TFT displays Truly Semiconductors will be in the unique position of having the expertise to address all established LCD technologies and manufacturing processes in the World today.



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STANDARD LCD MODULE NUMBERING SYSTEM

M T C – C 16 1 D P L Y – 1 N – TP
1 2 3 4 5 6 7 8 9 10 11 12 13

1 LIQUID CRYSTAL DISPLAY MODULE

2 LCD TYPE

T – TN LCD H – HTN LCD S – STN LCD F – FSTN C – Color STN

3 IC PACKING

P – Packing type G – Chip on glass N – Without IC C – Chip on board T – TCP

4 LCD MODE

C – Characters G – Graphic Z – Other

5 LCD OF FUNCTION

Characters model : Number of characters
 Graphic model : Number of colum dots

6 LCD OF FUNCTION

Characters model : Number of lines
 Graphic model : Number of row dots

7 VIEWING ANGLE

U – Upper 12 o' clock R – Right 3 o' clock Z – Others
 D – Lower 6 o' clock L – Left 9 o' clock

8 COLOR MODE

HTN / TN : P – Positive STN : G – Grey FSTN (F) : P – Positive CSTN : F – Negative / Tranflective
 N – Negative Y – Yellow green N – Negative type T – Negative / Transmissive
 B – Blue

9 BACKLIGHT MODE

Without backlight : R – Reflective Backlight : L – LED (Transflective)
 F – Transflective C – CCFL (Transmissive)
 T – Transmissive E – EL (Transflective)
 S – Side lit LED

10 BACKLIGHT COLOR

B – Blue A – Amber Y – Yellow green R – Red W – White N – Without backlight

11 VERSION

12 TEMPERATURE

N – Normal temperature W – Wide temperature S – Super wide temperature Z – Others

13 SPECIAL REMARKS

TP – With touch panel

■ CHARACTER DISPLAY MODULES :

Unit : mm

NO. OF DISPLAY CHAR. x LINE	MODEL NO.	MODULE SIZE (W x H x T)	VIEWING AREA (W x H)	CHARACTER SIZE (W x H)	DOT SIZE (W x H)	DRIVING METHOD DUTY	CONTROLLER LSI OR EQUIV	IC PACKAGE	BACK - LIGHT				REFERENCE PAGE	
									TN	LED	NONE	STN		
									NONE	EL	LED	NONE	EL	LED
8 x 1	MCB1-1	100 x 42 x (11/12.5)	80 x 20.5	8.3 x 14	---	1/16	UPD7225GB	QFP	*		*			NOTE 1
8 x 1	MCB1-2	100 x 42 x (11/12.5)	80 x 20.5	8.3 x 14	---	1/16	UPD7225G-01	QFP	*		*			9
12 x 2	MC122-3	39.8 x 31 x 2.1	34 x 16	2.35 x 3.31	0.44 x 0.44	1/16	SPLC781A-01B-C	COG			*	*		NOTE 1
16 x 1	MC161-1	80 x 36 x (10.5/12/14.5)	64.5 x (13.8/14.8)	3.2 x 6.35	0.6 x 0.75	1/16	56A0069	COB			*	*		10
16 x 1	MC161-2	80 x 36 x (10.5/12/14.5)	64.5 x (13.8/14.8)	3.2 x 6.35	0.6 x 0.75	1/16	56A0069	COB		*	*	*		11
16 x 1	MC161-4	122 x 33 x (9.5/14.5)	99 x 13	4.84 x 8.06	0.92 x 1.1	1/16	56A0069	COB		*	*	*		12
16 x 1	MC161-5	70 x 26.85 x 2.8	64 x 11.35	3.2 x 6.35	0.6 x 0.75	1/16	56A0072X01-BOCZ	COG		*	*	*		13
16 x 2	MC162-1	80 x 36 x (10.5/12/14.5)	64.5 x (13.8/14.8)	2.95 x 4.35	0.55 x 0.5	1/16	56A009	COB			*	*		NOTE 1
16 x 2	MC162-2	80 x 36 x (10.5/12/14.5)	64.5 x (13.8/14.8)	2.95 x 4.35	0.55 x 0.5	1/16	56A0070	COB		*	*	*		NOTE 1
16 x 2	MC162-3	122 x 44 x 11 (11/14.5)	99 x 24	4.84 x 9.66	0.92 x 1.1	1/16	56A0070	COB		*	*	*		14
16 x 2	MC162-4	84 x 44 x 11 (10.5/12/14.5)	65.6 x 16	2.95 x 5.55	0.55 x 0.65	1/16	56A0070	COB		*	*	*		15
16 x 2	MC162-5	77 x 35 x 6.1	67 x 17	2.95 x 5.55	0.55 x 0.65	1/16	56A0070	COB		*	*	*		NOTE 1
16 x 2	MC162-7	80 x 36 x 11 (10.5/14)	64.5 x (13.8/14.8)	2.96 x 4.35	0.55 x 0.5	1/16	56A0070	COB		*	*	*		NOTE 1
16 x 2	MC162-8	80 x 36 x 14	61 x 14	2.95 x 5.55	0.55 x 0.65	1/16	56A0070	COB		*	*	*		NOTE 1
16 x 2	MC162-9	80 x 36 x 14	61 x 14	2.95 x 5.55	0.55 x 0.65	1/16	56A0070	COB		*	*	*		NOTE 1
16 x 2	MC162-14	65 x 27.7 x 3.4	61 x 15.7	2.95 x 5.15	0.55 x 0.6	1/16	SPLC782A-01-C	COG		*	*	*		16
16 x 2	MC162-15	65 x 27.7 x 3.8	61 x 15.7	2.95 x 5.15	0.55 x 0.6	1/16	NT7603H-BDT01	COG		*	*	*		17
16 x 4	MC164-2	87 x 60 x (10.5/12.5/14)	61.8 x 25.2	2.95 x 4.75	0.55 x 0.55	1/16	56A0070, 56A2067	COB		*	*	*		NOTE 1
20 x 1	MC201-2	116 x 37 x (10.5/12.5/14)	85 x 19.8	2.95 x 4.75	0.6 x 0.7	1/16	56A0070	COB		*	*	*		18
20 x 2	MC202-1	76 x 26.5 x 2.85	85 x 19.8	3.2 x 5.55	0.6 x 0.65	1/16	56A0069, 56A2067	COB		*	*	*		NOTE 1
20 x 2	MC202-2	76 x 26.5 x 2.85	72 x 15	2.95 x 4.99	0.55 x 0.58	1/16	56A0069, 56A2067	COG		*	*	*		19
20 x 2	MC202-4	76 x 26.5 x 2.85	72 x 15	2.95 x 4.99	0.55 x 0.6	1/16	NT7605-BDT01	COG		*	*	*		20
20 x 4	MC204-1	98 x 60 x (10.5/12.5/14)	76 x 25.2	2.95 x 4.75	0.55 x 0.55	1/16	NT7605-BDT01	COB		*	*	*		21
20 x 4	MC204-2	98 x 60 x (10.5/12.5/14)	76 x 25.2	2.95 x 4.75	0.55 x 0.55	1/16	56A0069, 56A2067	COB		*	*	*		NOTE 1
24 x 2	MC242-1	118 x 36 x (11/14)	93.5 x 15.8	3.2 x 5.55	0.6 x 0.65	1/16	56A0075	COB		*	*	*		22
40 x 1	MC401-1	182 x 33.5 x (9.5/14)	154.5 x 15.8	3.2 x 6.35	0.6 x 0.75	1/16	56A0069, 56A2067	COB		*	*	*		NOTE 1
40 x 2	MC402-1	182 x 33.5 x (9.5/14)	154.5 x 15.8	3.2 x 5.55	0.6 x 0.65	1/16	56A0069, 56A2067	COB		*	*	*		NOTE 1
40 x 4	MC404-1	190 x 54 x (10/12.5)	147 x 29.5	2.78 x 4.89	0.5 x 0.55	1/16	56A0069, 56A2067	COB		*	*	*		23
40 x 4	MC404-1	190 x 54 x (10/12.5)	147 x 29.5	2.78 x 4.89	0.5 x 0.55	1/16	56A0069, 56A2067	COB		*	*	*		24

NOTE 1 : For further information, on this particular LCD module, please contact our Hong Kong headquarters.

■ MONOCHROME LCD MODULES :

Unit : mm

NO. OF DOTS (H x V) (W x H)	MODEL NO.	MODULE SIZE (W x H x T)	VIEWING AREA (W x H)	DOT PITCH (W x H)	DOT SIZE (W x H)	DRIVING METHOD DUTY	SUPPLY VOLTAGE	CONTROLLER WITH BUILT-IN DRIVER LSI OR EQUIV	IC PACKAGE	BACK - LIGHT				TOUCH PANEL	REFERENCE PAGE
										STN	FSTN	CCFL	COLOR LED	CCFL	
										NONE	EL	LED	NONE	EL	
100 x 32	MG10032-1	44 x 29.9 x 9.05	37 x 20.4	0.34 x 0.4	0.3 x 0.36	1/32	3	SED1530TAA	TAB	*		*			NOTE 1
100 x 32	MG10032-2	37.6 x 24.5 x 9	32.6 x 17.8	0.3 x 0.35	0.26 x 0.31	1/32	3	S6B0715A01	TAB	*		*			NOTE 1
112 x 64	MG11264-3	35.8 x 47.7 x 1.7	31.5 x 20.3	0.25 x 0.26	0.22 x 0.23	1/65	2.4~3.6	S6B1713D01	TAB	*		*			25
120 x 64	MG12064-1	74 x 76.9 x 2.9	70 x 38	0.53 x 0.53	0.49 x 0.49	1/65	2.4~3.6	S6B1713A01	TAB	*		*			26
122 x 32	MG12232-2	65.6 x 29.2 x 5.5	54.8 x 19.1	0.4 x 0.45	0.36 x 0.41	1/32	3	SED1520	COB	*		*			27
122 x 32	MG12232-3	56.1 x 29.2 x 5.5	49.1 x 19	0.37 x 0.4	0.33 x 0.36	1/32	3	SED1520	COB	*		*			28
122 x 32	MG12232-5	76.4 x 29.1 x 5.7	54.8 x 19.1	0.4 x 0.45	0.36 x 0.41	1/32	3	SED1520	COB	*		*			NOTE 1
122 x 32	MG12232-6	45.05 x 22.32 x 6.3	38.56 x 13.16	0.3 x 0.32	0.26 x 0.28	1/32	3	SED1520	COB	*		*			NOTE 1
122 x 32	MG12232-7	84 x 44 x 12	60.5 x 18.5	0.44 x 0.49	0.4 x 0.45	1/32	5	SED1520	COB	*		*			29
122 x 32	MG12232-8	56.1 x 29.2 x 5.5	49.1 x 19	0.37 x 0.4	0.33 x 0.36	1/32	3	SED1520	COB	*		*			NOTE 1
128 x 64	MG12864-1	93 x 70 x (10/13/14.5)	70.7 x 38.8	0.52 x 0.52	0.48 x 0.48	1/64	5	S6B0107B, S6B0108A	COB	*		*			NOTE 1
128 x 64	MG12864-2	113 x 65 x (10/13/14.5)	73.4 x 38.8	0.52 x 0.52	0.48 x 0.48	1/64	5	S6B0107B, S6B0108A	COB	*		*			NOTE 1
128 x 64	MG12864-4	93 x 70 x 13	70.7 x 38.8	0.52 x 0.52	0.48 x 0.48	1/64	5	S6B0107B, S6B0108A	COB	*		*			30
128 x 64	MG12864-5	78 x 70 x (10/13/14.5)	62 x 44	0.44 x 0.6	0.39 x 0.55	1/64	5	S6B0107B, S6B0108A	COB	*		*			31
128 x 64	MG12864-6	54 x 54.5 x 10	44.5 x 29.5	0.33 x 0.43	0.3 x 0.4	1/64	5	S6B0107B, S6B0108A	COB	*		*			32
128 x 64	MG12864-7	54 x 54.5 x 6.5	43.5 x 29	0.32 x 0.39	0.28 x 0.35	1/64	5	S6B0107B, S6B0108A	COB	*		*			NOTE 1
128 x 64	MG12864-8	59 x 39.5 x 2	54 x 31	0.37 x 0.41	0.34 x 0.38	1/65	5	S6B0107B, S6B0108A	COB	*		*			33
128 x 64	MG12864-10	113 x 65 x 11	73.4 x 38.8	0.52 x 0.52	0.48 x 0.48	1/64	5	S6B0107B, S6B0108A	COB	*		*			34
128 x 64	MG12864-11	100 x 58.5 x 11.8	54 x 31	0.37 x 0.41	0.34 x 0.38	1/64	3.3	S6B1713A01	TAB	*		*			NOTE 1
128 x 64	MG12864-12	54 x 54.5 x 10	44.5 x 29.5	0.33 x 0.43	0.3 x 0.4	1/64	5	S6B0107B, S6B0108A	COB	*		*			35
128 x 64	MG12864-13	100 x 58.5 x 11.8	54 x 31	0.37 x 0.41	0.34 x 0.38	1/65	3.3	S6B1713A01	TAB	*		*			NOTE 1
128 x 64	MG12864-15	78 x 70 x 14.5	62 x 44	0.44 x 0.6	0.39 x 0.55	1/64	5	T6963C, T6A39, T6A40	QFP	*		*			36
128 x 64	MG12864-23	93 x 70 x 13	70.5 x 38.5	0.52 x 0.52	0.48 x 0.48	1/65	3.3	S6B1713A01	TAB	*		*			37
128 x 64	MG12864-24	78 x 70 x (10/13/14.5)	62 x 44	0.44 x 0.6	0.39 x 0.55	1/64	5	S6B0107B, S6B0108A	COB	*		*			38
128 x 64	MG12864-26	35.5 x 56.4 x 1.54	31.5 x 20.5	0.21 x 0.27	0.185 x 0.245	1/64	1.8~3.3	LH155KF1	COF	*		*			39
128 x 64	MG12864-27	93 x 70 x 14	70.7 x 38.8	0.52 x 0.52	0.48 x 0.48	1/64	5	S6B0107B, S6B0108A	COB	*		*			40
128 x 64	MG12864-28	80 x 44 x 12	54 x 31	0.37 x 0.41	0.34 x 0.37	1/65	3	SPLC501C	COG	*		*			NOTE 1
128 x 64	MG12864-29	58 x 42 x 2.85	54 x 31	0.37 x 0.41	0.34 x 0.38	1/65	3	SPLC501C	COG	*		*			41
128 x 64	MG12864-30	93 x 70 x 13	70.5 x 38.5	0.52 x 0.52	0.48 x 0.48	1/64	3.3	SSD1815Z	COG	*		*			NOTE 1
128 x 64	MG12864-31	93 x 70 x 13	70.5 x 38.5	0.52 x 0.52	0.48 x 0.48	1/64	3.3	SSD1815Z	COG	*		*			NOTE 1
128 x 64	MG12864-32	93 x 70 x 11	70.7 x 38.8	0.52 x 0.52	0.48 x 0.48	1/32	5	ST7920, ST7921	COB	*		*			42

All unit measurements are in mm's.

MONOCHROME LCD MODULES :

Unit : mm

NO. OF DOTS OR PIXEL (W x H)	MODEL NO.	MODULE SIZE (W x H x T)	VIEWING AREA (W x H)	DOT PITCH (W x H)	DOT SIZE (W x H)	DRIVING METHOD DUTY	SUPPLY VOLTAGE	BUILT-IN CONTROLLER LSI OR EQUIV	IC PACKAGE	BACK - LIGHT				TOUCH PANEL	REFERENCE PAGE
										STN/ FSTN	LED	CCFL	COLOR STN LED		
128 x 128	MG128128-1	85 x 100 x (10/12.5)	62 x 62	0.43 x 0.43	0.39 x 0.39	1/64	5	S680107B, S680108A	COB						43
128 x 128	MG128128-2	65.4 x 70 x (7/12.3)	49 x 49	0.35 x 0.32	0.32 x 0.32	1/128	5	T6963C, T6A39, T6A40	QFP	*	*	*			NOTE 1
128 x 128	MG128128-5	36.3 x 43.2 x 2.1	30.5 x 32	0.213 x 0.233	0.199 x 0.219	1/128	2.4-3.3	UC1607	COG	*	*	*			44
128 x 128	MG128128-14	65.4 x 70 x 12.3	49 x 49	0.35 x 0.32	0.32 x 0.32	1/128	5	T6963C, T6A39, T6A40	QFP	*	*	*			45
132 x 65	MG13265-3	57 x 39 x 2.8	42 x 24	0.32 x 0.35	0.27 x 0.27	1/65	2.4-3.6	S681713A01-BOCZ	COG	*	*	*			46
132 x 65	MG13265-4	34.7 x 46.7 x 1.7	31 x 25.3	0.19 x 0.29	0.16 x 0.26	1/65	3-3.3	SSD1815BZ	COG	*	*	*			47
160 x 96	MG16096-1	64.8 x 65.6 x 7	58.6 x 54.9	0.35 x 0.42	0.33 x 0.4	1/96	5	SED1670, SED1606	COB	*	*	*		*	NOTE 1
160 x 160	MG160160-1	67.5 x 86 x 9	58.5 x 66.5	0.34 x 0.39	0.31 x 0.36	1/160	3.3	NT7701F3	TAB	*	*	*		*	NOTE 1
160 x 160	MG160160-2	67.5 x 86 x 9	58.5 x 66.5	0.35 x 0.4	0.31 x 0.36	1/160	3.3	S680086	COB	*	*	*		*	48
160 x 160	MG160160-3	67 x 85.5 x 7.4	60 x 68	0.35 x 0.4	0.335 x 0.385	1/160	3.3	S680086	COB	*	*	*		*	49
160 x 160	MG160160-6	67 x 85.5 x 7.5	60 x 68	0.35 x 0.4	0.335 x 0.385	1/160	3	SED1335FBA, NT7701F3	TAB	*	*	*		*	50
160 x 160	MG160160-7	60.2 x 62.6 x 4.5	46.2 x 49.4	0.27 x 0.29	0.25 x 0.275	1/160	5	EC7011CG	COG	*	*	*		*	NOTE 1
160 x 240	MG160240-1	75.6 x 53.1 x 5	61.6 x 42.5	0.24 x 0.24	0.23 x 0.23	1/160	5	NT7701F3, NT7702F4	TAB	*	*	*		*	52
160 x 240	MG160240-2	63 x 74.8 x 8	42.5 x 61.6	0.24 x 0.24	0.23 x 0.23	1/240	3.3	SED1335FOA, NT7701F3, NT7702F4	TAB	*	*	*		*	53
160 x 240	MG160240-6	52.9 x 70.6 x 5.2	41.4 x 60.6	0.24 x 0.24	0.22 x 0.22	1/240	5	EC7010, EK7011	COG	*	*	*		*	54
192 x 64	MG19264-1	100 x 60 x (10/12)	84 x 31	0.41 x 0.41	0.36 x 0.36	1/64	5	S680107B, S680108A	COB	*	*	*		*	55
192 x 64	MG19264-2	100 x 60 x (10/12)	84 x 31	0.41 x 0.41	0.36 x 0.36	1/64	5	S680107B, S680108A	COB	*	*	*		*	56
192 x 64	MG19264-3	120 x 62 x (9.5/13)	100 x 37	0.5 x 0.5	0.46 x 0.46	1/64	5	S680107B, S680108A	COB	*	*	*		*	NOTE 1
192 x 64	MG19264-5	100 x 60 x 13	84 x 31	0.41 x 0.41	0.36 x 0.36	1/64	3.3	TL0313	COG	*	*	*		*	57
192 x 64	MG19264-6	100.4 x 63 x 9.8	82 x 39	0.41 x 0.41	0.36 x 0.36	1/64	5	S680107B, S680108A	COB	*	*	*		*	NOTE 1
240 x 64	MG24064-1	180 x 75 x (10/12.5)	132.6 x 39	0.53 x 0.53	0.48 x 0.48	1/64	5	T6963C, T6A39, T6A40	QFP	*	*	*		*	58
240 x 64	MG24064-2	180 x 65 x (10/12.5)	132.6 x 39	0.53 x 0.53	0.48 x 0.48	1/64	5	S680107B, S680108A	COB	*	*	*		*	NOTE 1
240 x 64	MG24064-3	180 x 75 x (11/14)	132.6 x 39	0.53 x 0.53	0.48 x 0.48	1/64	5	T6963C, T6A39, T6A40	QFP	*	*	*		*	NOTE 1
240 x 64	MG24064-4	180 x 65 x (10/12.5)	132.6 x 39	0.53 x 0.53	0.49 x 0.49	1/64	5	T6963C, T6A39, T6A40	QFP	*	*	*		*	59
240 x 64	MG24064-5	179.7 x 64.7 x 21	132.6 x 39	0.53 x 0.53	0.48 x 0.48	1/64	5	T6963C, T6A39, T6A40	QFP	*	*	*		*	60
240 x 64	MG24064-6	180 x 65 x 11	132.6 x 39	0.53 x 0.53	0.48 x 0.48	1/64	5	S680107B, S680108A	COB	*	*	*		*	61
240 x 128	MG240128-1	144 x 104 x (11/14.5/16)	114 x 64	0.45 x 0.45	0.4 x 0.4	1/128	5	T6963C, T6A39, T6A40	QFP	*	*	*		*	NOTE 1
240 x 128	MG240128-2	156.3 x 104 x 14	114 x 64	0.45 x 0.45	0.4 x 0.4	1/128	5	T6963C, T6A39, T6A40	QFP	*	*	*		*	62
240 x 128	MG240128-3	144 x 104 x (11/14.5/16)	114 x 64	0.45 x 0.45	0.4 x 0.4	1/128	5	T6963C, T6A39, T6A40	QFP	*	*	*		*	63
240 x 128	MG240128-5	105 x 75 x 11	84 x 49.3	0.3 x 0.3	0.28 x 0.28	1/128	3	UC1608	COF	*	*	*		*	64
240 x 128	MG240128-6	15.63 x 104 x 14	114 x 64	0.45 x 0.45	0.4 x 0.4	1/128	5	T6963C, S680086	COB	*	*	*		*	65
240 x 160	MG240160-1	74.6 x 56.1 x 4.5	61.6 x 42.5	0.24 x 0.24	0.23 x 0.23	1/160	3.3	NT7701F3, NT7702F4	TAB	*	*	*		*	66
240 x 160	MG240160-2	74.6 x 56.1 x 5.3	61.6 x 42.5	0.24 x 0.24	0.23 x 0.23	1/160	3.3	NT7701F3, NT7702F4	TAB	*	*	*		*	67
240 x 320	MG240320-1	70.5 x 89 x 5.4	61.1 x 80.55	0.24 x 0.24	0.225 x 0.225	1/320	5	SED1351FOA, NT7701F3, NT7702F4	TAB	*	*	*		*	68
320 x 240	MG320240-4	70.5 x 89 x 7.3	61.1 x 80.55	0.24 x 0.24	0.225 x 0.225	1/240	5	NT7701F3, NT7702F4	TAB	*	*	*		*	NOTE 1
320 x 240	MG320240-10	93.8 x 75.1 x 5	82.6 x 63.4	0.24 x 0.24	0.23 x 0.23	1/240	5	NT7701F3, NT7702F4	TAB	*	*	*		*	69
320 x 240	MG320240-11	167 x 109 x 12	122 x 92	0.36 x 0.36	0.33 x 0.33	1/240	5	S680086	QFP	*	*	*		*	70
320 x 240	MG320240-13	70.5 x 89 x 7.3	61.1 x 80.55	0.24 x 0.24	0.225 x 0.225	1/240	3	SSD1870, SSD1882	TAB	*	*	*		*	71
320 x 240	MG320240-14	122 x 83.3 x 11.5	87.9 x 69.8	0.265 x 0.27	0.245 x 0.25	1/240	3-5	NT7701F3, NT7702F4	TAB	*	*	*		*	72
320 x 240	MG320240-19	144.8 x 104 x 7.5	100 x 75	0.36 x 0.36	0.28 x 0.28	1/240	5	LH1530F, LH1542F	TAB	*	*	*		*	73
320 x 240	MG320240-20	268 x 190 x 7.5	121 x 91.6	0.36 x 0.36	0.33 x 0.33	1/240	5	LH1530F, LH1542F	TAB	*	*	*		*	74
320 x 240	MG320240-21	167 x 109 x 12	122 x 92	0.36 x 0.36	0.33 x 0.33	1/240	5	SED1335FOA, SPLC086A	QFP	*	*	*		*	NOTE 1
320 x 240	MG320240-22	167 x 109 x 12	122 x 92	0.36 x 0.36	0.33 x 0.33	1/240	5	S682086X01-TO	QFP	*	*	*		*	75
320 x 240	MG320240-23	139 x 120 x 13.2	103 x 79	0.3 x 0.3	0.27 x 0.27	1/240	5	S682086X01-TO	QFP	*	*	*		*	NOTE 1
320 x 240	MG320240-27	130 x 120 x 13.2	103 x 79	0.3 x 0.3	0.27 x 0.27	1/240	5	S682086X01-TO	QFP	*	*	*		*	76
320 x 240	MG320240-171	53.75 x 68.1 x 5.2	45.4 x 59.6	0.18 x 0.18	0.165 x 0.165	1/240	3	IST3031T1A0, IST30321B0	TAB	*	*	*		*	77
320 x 240	MG320240-211	167 x 109 x 12	122 x 92	0.36 x 0.36	0.33 x 0.33	1/240	5	SED1335FOA, SPLC086A	QFP	*	*	*		*	78
480 x 64	MG48064-1	260 x 58 x 11	229.5 x 36	0.47 x 0.47	0.43 x 0.43	1/64	5	S680086	COB	*	*	*		*	79
480 x 320	MG480320-1	155 x 94.9 x 11.5	119.2 x 80.4	0.24 x 0.24	0.228 x 0.228	1/320	3.3	NT7701F1, NT7701H-18A	TAB	*	*	*		*	80
640 x 480	MG640480-2	268 x 190 x 7	215.2 x 162.4	0.33 x 0.33	0.3 x 0.3	1/240	5	LH1532F, LH1542F	TAB	*	*	*		*	81

NOTE 1 : This catalog does not include these drawings. Please contact your local TRULY representative, distributor or TRULY Semiconductors directly for further information.

All unit measurements are in mm's.

MOBILE (COLOR) LCD MODULES :

DOTS	MODEL NO.	MODULE SIZE (W x H x T)	DISPLAY FORMAT/ COLORS	MAIN DISPLAY			DRIVING METHOD/ DUTY	BUILT-IN CONTROLLER LSI OR EQUIV	BACK- LIGHT	REF. PAGE				
				VIEWING AREA (W x H)	DOT PITCH (W x H)	DOT SIZE (W x H)								
CSTN														
128 x 128	MG128128-6	36.4 x 49.5 x 5.2	128 x 128/CS/TA/4K	31.22 x 29.9	0.072 x 0.216	0.062 x 0.206	1/128	PCF8833/2DA/COG	LED	96 x 32/FS/STN	1/32	SSD18152G/COG	EL	82
128 x 128	MG128128-7	38.0 x 58.0 x 5.75	128 x 128/CS/TA/4K	29.0 x 29.0	0.07 x 0.21	0.06 x 0.2	1/128	HM17CM4096-06MT/CP	LED	96 x 64/FS/STN	1/64	SSD1828Z/COG	EL	83
128 x 128	MG128128-9	36.18 x 38.7 x 4.5	128 x 128/CS/TA/4K	29.0 x 29.0	0.07 x 0.21	0.06 x 0.2	1/128	HM17CM4096-06MT/CP	LED	---	---	---	---	84
128 x 128	MG128128-10	37.2 x 49.5 x 5.2	128 x 128/CS/TA/6K	31.22 x 29.9	0.072 x 0.216	0.062 x 0.206	1/128	PCF8833/2DA/COG	LED	96 x 64/CS/TA/4K	1/64	SSD1780Z/COG	LED	85
128 x 128	MG128128-11	36.4 x 49.5 x 5.2	128 x 128/CS/TA/6K	31.22 x 29.9	0.072 x 0.216	0.062 x 0.206	1/128	5683380A-BOCY/COG	LED	96 x 32/FS/STN	1/32	SSD18152G/COG	LED	86
128 x 128	MG128128-12	38.2 x 50.7 x 5.2	128 x 128/CS/TA/6K	31.22 x 29.9	0.072 x 0.216	0.062 x 0.206	1/128	5683380A-BOCY/COG	LED	96 x 64/CS/TA/4K	1/64	SSD1780Z/COG	LED	87
128 x 128	MG128128-13	36.4 x 49.5 x 5.0	128 x 128/CS/TA/6K	31.8 x 29.9	0.072 x 0.216	0.062 x 0.206	1/128	5683380A-BOCY/COG	LED	96 x 62B/D COLOR OLED	1/64	SSD1780Z/COG	LED	88
128 x 128	MG128128-14	36.4 x 49.5 x 5.2	128 x 128/CS/TA/6K	31.22 x 29.9	0.072 x 0.216	0.062 x 0.206	1/128	5683380A-BOCY/COG	LED	48 x 64/FS/STN	1/64	STW5655/COG	LED	89
128 x 128	MG128128-15	33.35 x 49.77 x 4.8	128 x 128/CS/TA/6K	28.3 x 30.17	0.068 x 0.22	0.056 x 0.210	1/128	5683380A-BOCY/COG	LED	96 x 64/CS/TA/4K	1/64	HL3035SA	LED	90
128 x 128	MG128128-17	32.1 x 46.1 x 3.7	128 x 128/CS/TA/4K	26.0 x 25.0	0.06 x 0.18	0.05 x 0.17	1/128	HM17CM4096	LED	---	---	---	---	91
128 x 128	MG128128-18	32.1 x 46.1 x 5.0	128 x 128/CS/TA/4K	26.0 x 25.0	0.06 x 0.18	0.05 x 0.17	1/128	HM17CM4096	LED	72 x 24/FS/STN	1/24	STW5658	LED	92
128 x 160	MG128160-3	40.8 x 58.0 x 5.2	128 x 160/CS/TA/6K	34.5 x 39.3	0.079 x 0.223	0.069 x 0.215	1/160	5683380A-BOCY/COG	LED	96 x 64/FS/STN	1/64	SSD1828Z/COG	EL	93
128 x 160	MG128160-4	35.4 x 41.04 x 1.6	128 x 160/CS/TA/6K	30.54 x 36.04	0.071 x 0.213	0.061 x 0.203	1/160	SSD17833C/CP/5683380D/COG	---	---	---	---	---	94
128 x 160	MG128160-5	38.5 x 51.9 x 5.2	128 x 160/CS/TA/6K	34.5 x 39.3	0.079 x 0.223	0.069 x 0.215	1/160	5683380A-BOCY/COG	---	96 x 64/OLED	1/64	SSD1301/TA/AB	---	95
128 x 160	MG128160-6	38.5 x 51.9 x 5.2	128 x 160/CS/TA/6K	34.5 x 39.3	0.079 x 0.223	0.069 x 0.215	1/160	5683380A-BOCY/COG	LED	96 x 64/CS/TA/4K	1/64	SSD1780Z/COG	LED	96
128 x 160	MG128160-8	38.5 x 51.9 x 5.0	128 x 160/CS/TA/6K	34.5 x 39.3	0.079 x 0.223	0.069 x 0.215	1/160	5683380A-BOCY/COG	LED	96 x 64/FS/STN	1/64	SSD1828Z/COG	LED	97
128 x 160	MG128160-22	34.7 x 53.6 x 5.0	128 x 160/CS/TA/6K	30.54 x 36.04	0.071 x 0.213	0.061 x 0.203	1/160	5683380A-BOCY/COG	LED	96 x 64/FS/STN	1/64	PCF8833/COG	LED	98
320 x 240	MG320240-15	158.5 x 109 x 8.5	320 x 240/CS/TA/564K/65K	119.18 x 90.38	0.12 x 0.36	0.105 x 0.345	1/240	LH1562F4/INT7702F4 (No Built-in controller)	LED	96 x 64/CS/TA/4K	1/64	---	---	99

MAIN-DISPLAY (COLOR)

128 x 128	TSE1588	31.0 x 30.05 x 1.5	128 x 128/CS/TA/4K	26.0 x 25.0	0.06 x 0.18	0.05 x 0.168	1/128	AR3301-08 (COF)	LED	---	---	---	---	100
128 x 128	TSE6258	36.4 x 40.5 x 3.4	128 x 128/CS/TA/6K	31.82 x 29.9	0.072 x 0.216	0.062 x 0.206	1/128	PCF8833/2DA/COG	LED	---	---	---	---	101
128 x 128	TSE1540	33.98 x 35.5 x 1.6	128 x 128/CS/TA/6K	29.0 x 29.0	0.071 x 0.213	0.060 x 0.2	1/128	SSD1781U/COF	LED	---	---	---	---	102
128 x 160	TSE6298	33.54 x 45.6 x 1.6	128 x 160/CS/TA/4K	30.54 x 36.04	0.071 x 0.213	0.061 x 0.203	1/160	5683380A-BOCY	LED	---	---	---	---	103
128 x 128	TSE6276	40.0 x 49.5 x 3.4	128 x 128/CS/TA/6K	34.5 x 39.9	0.079 x 0.223	0.069 x 0.215	1/160	5683380A-BOCY/COG	LED	---	---	---	---	104
128 x 128	TSE1536	33.54 x 45.6 x 1.6	128 x 128/CS/TA/6K	30.54 x 36.04	0.071 x 0.213	0.061 x 0.203	1/160	SSD1783U/COF	LED	---	---	---	---	105

SUB-DISPLAY (COLOR)

96 x 64	TSD6311	26.76 x 25.6 x 1.5	---	---	---	---	---	---	---	---	---	---	---	---
96 x 64	TSD6339	26.76 x 25.6 x 1.5	---	---	---	---	---	---	---	---	---	---	---	---
96 x 64	TSE6288	26.76 x 25.6 x 1.5	---	---	---	---	---	---	---	---	---	---	---	---
96 x 64	TSE6312	23.92 x 28.9 x 1.5	---	---	---	---	---	---	---	---	---	---	---	---
96 x 64	TSE6328	23.92 x 28.9 x 1.5	---	---	---	---	---	---	---	---	---	---	---	---

TFT

128 x 160	MG128160-16	34.0 x 55.0 x 4.5	128 x 160/TF/65K	28.416 x 35.52(A-A)	0.074 x 0.222	0.07 x 0.214	1/160	HCD667873BP	LED	22.96 x 16.48	0.07 x 0.21	0.058 x 0.2	LED	111
128 x 160	MG128160-17	37.23 x 56.0 x 5.3	128 x 160/TF/65K	28.416 x 35.52(A-A)	0.074 x 0.222	0.07 x 0.214	1/160	HCD667873BP	LED	21.18 x 14.14	0.22 x 0.22	0.2 x 0.2	LED	112
128 x 160	MG128160-20	34.0 x 55.0 x 4.5	128 x 160/TF/65K	28.416 x 35.52(A-A)	0.074 x 0.222	0.07 x 0.214	1/160	HCD667873BP	LED	20.92 x 20.4	0.065 x 0.195	0.055 x 0.185	LED	113
128 x 160	MG128160-21	34.0 x 55.0 x 4.5	128 x 160/TF/65K	28.416 x 35.52(A-A)	0.074 x 0.222	0.07 x 0.214	1/160	HCD667873BP	LED	20.92 x 20.4	0.065 x 0.195	0.055 x 0.185	LED	114
128 x 160	MG128160-26	34.0 x 47.25 x 5.2	128 x 160/TF/65K	28.416 x 35.52(A-A)	0.074 x 0.222	0.07 x 0.214	1/160	HCD667873BP	LED	23.0 x 16.7	0.2 x 0.204	0.172 x 0.172	LED	115
128 x 160	MG128160-27	38.2 x 55.8 x 5.5	128 x 160/TF/65K	28.416 x 35.52(A-A)	0.074 x 0.222	0.07 x 0.214	1/160	HCD667873BP	LED	22.96 x 16.48	0.07 x 0.21	0.058 x 0.2	LED	116
176 x 220	MG176220-1	37.2 x 58.75 x 5.0	176 x 220/TF/65K	31.68 x 39.60(A-A)	0.06 x 0.18	0.058 x 0.172	1/220	H066789	LED	20.92 x 20.4	0.065 x 0.195	0.055 x 0.185	LED	117

OLED

132 x 16	TS13216-1	43.06 x 11.75 x 1.6	132 x 16/OLED/MONO	39.64 x 6.81	0.29 x 0.29	0.275 x 0.275	1/16	SSD1301	---	---	---	---	---	118
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* Note 2 : The MG320240-15 is a TAB module.

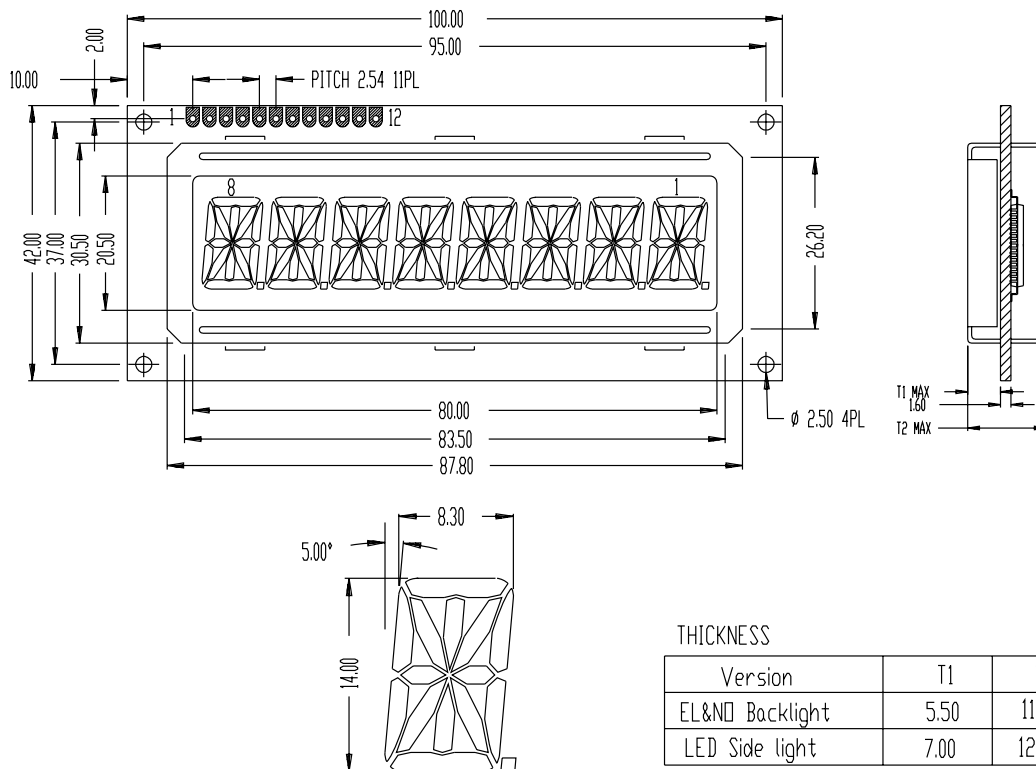
TYPE		OPERATING TEMPERATURE (°C)		STORAGE TEMPERATURE (°C)	
TN	NORMAL	EXTENDED	0 ~ 50 -20 ~ 70	-10 ~ 60 -30 ~ 80	
	NORMAL				
STN	NORMAL	EXTENDED	0 ~ 50 -30 ~ 70	-10 ~ 60 -30 ~ 80	
	NORMAL				
CSTN	NORMAL	EXTENDED	0 ~ 50 -20 ~ 70	-10 ~ 60 -30 ~ 80	
	NORMAL				
TFT	NORMAL	EXTENDED	0 ~ 50 -20 ~ 70	-10 ~ 60 -30 ~ 80	
	NORMAL				
OLED	NORMAL	EXTENDED	0 ~ 50 -20 ~ 70	-10 ~ 60 -30 ~ 80	
	NORMAL				

* Wide temperature version may not available for some products.

All unit measurements are in mm's.

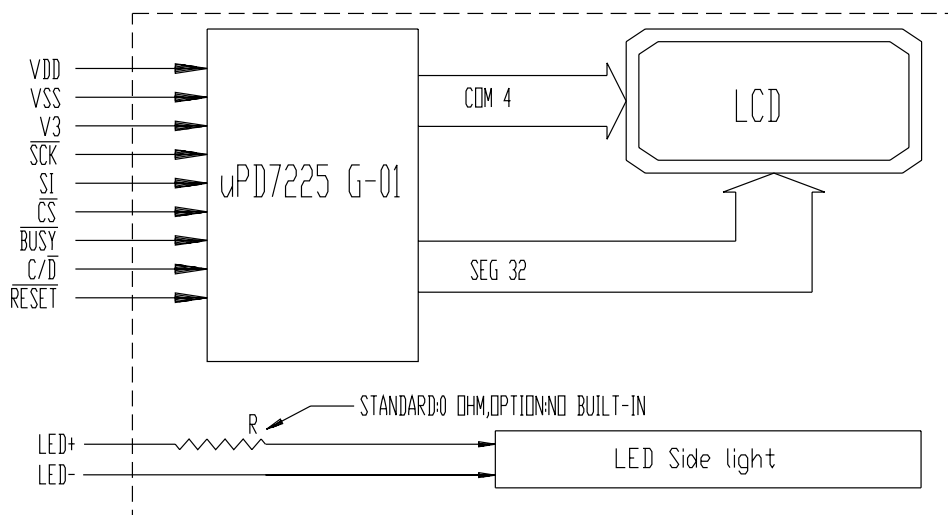
MC81-2

• **EXTERNAL DIMENSIONS :**



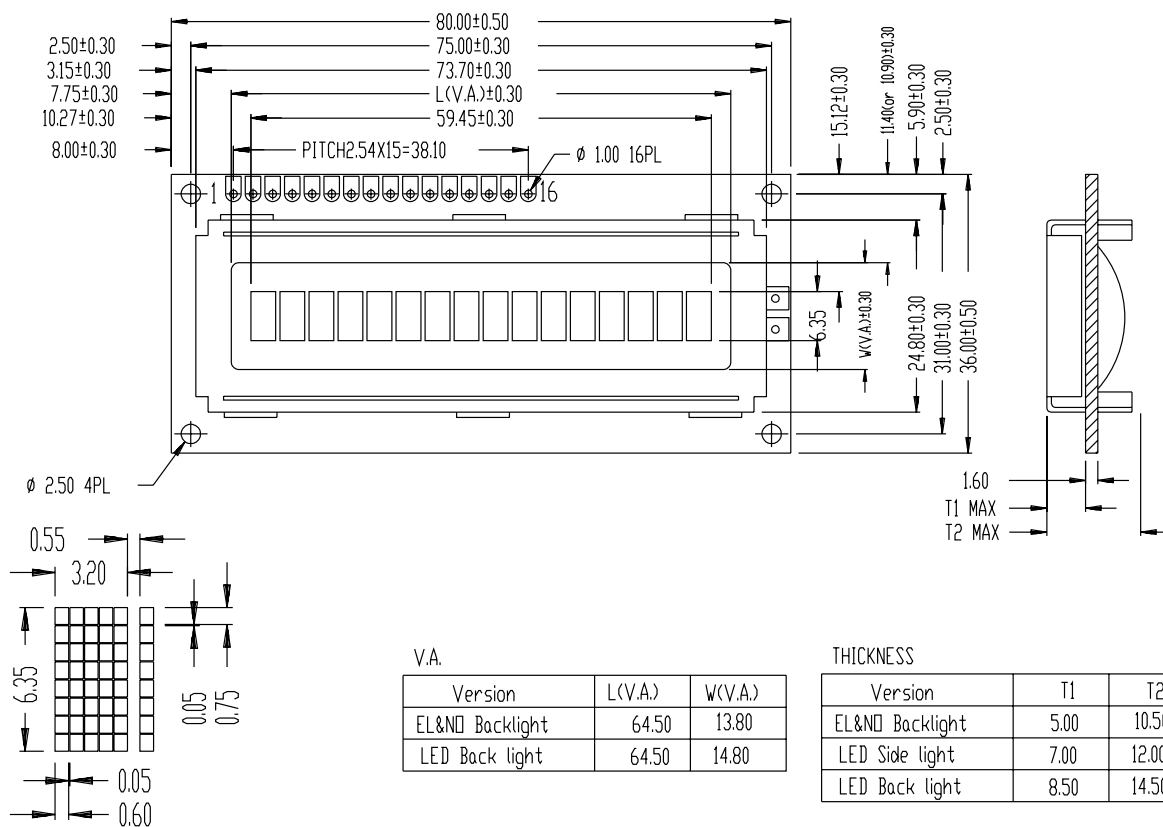
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12
GND	VDD	V3	$\overline{SCK}$	SI	$\overline{CS}$	$\overline{BUSY}$	C/ $\overline{D}$	$\overline{RESET}$	NC	LED-	LED+



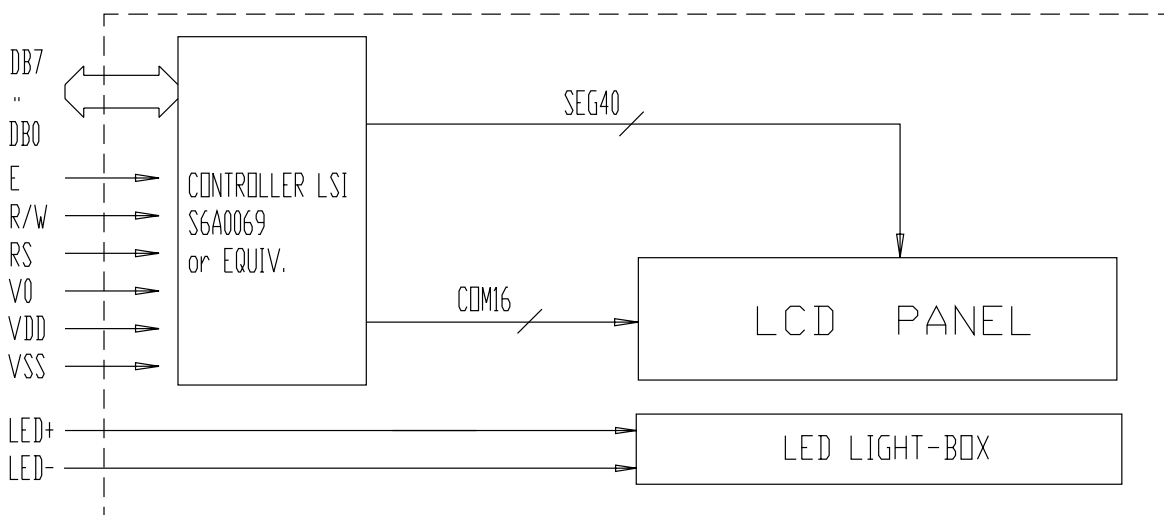
MC161-1

• EXTERNAL DIMENSIONS :



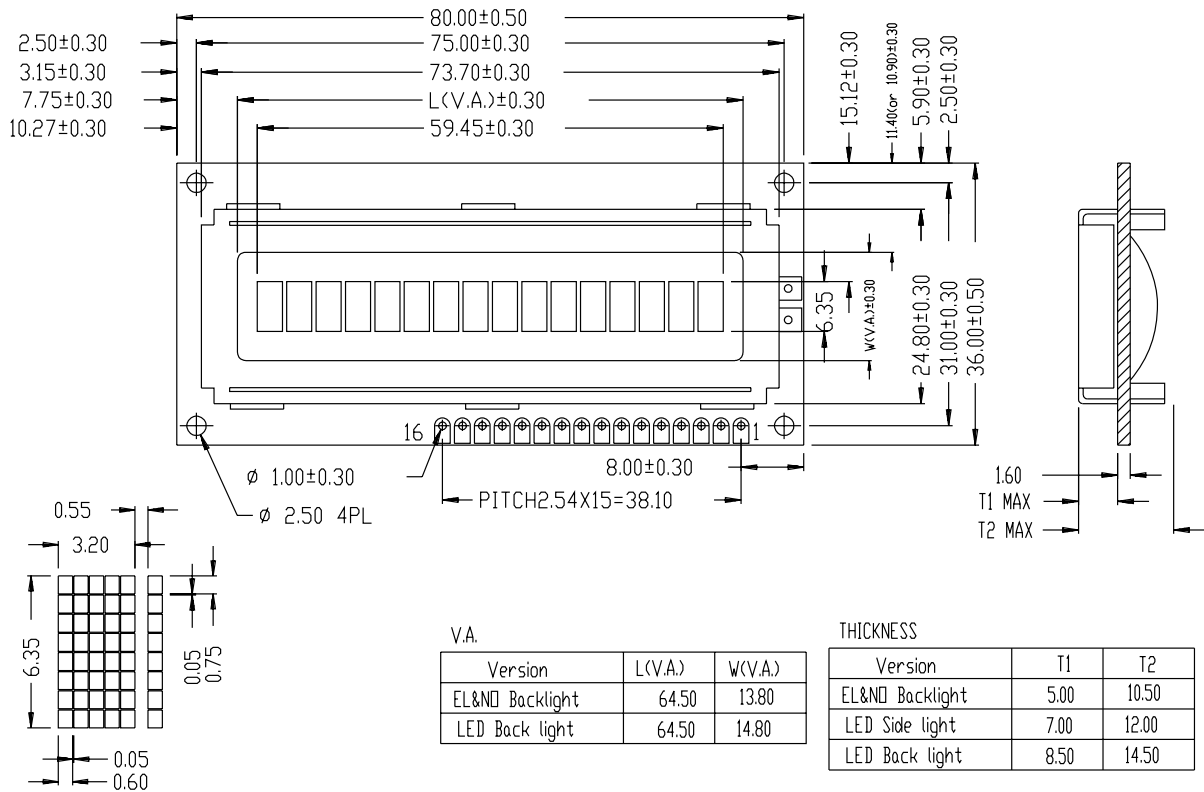
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	V0	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



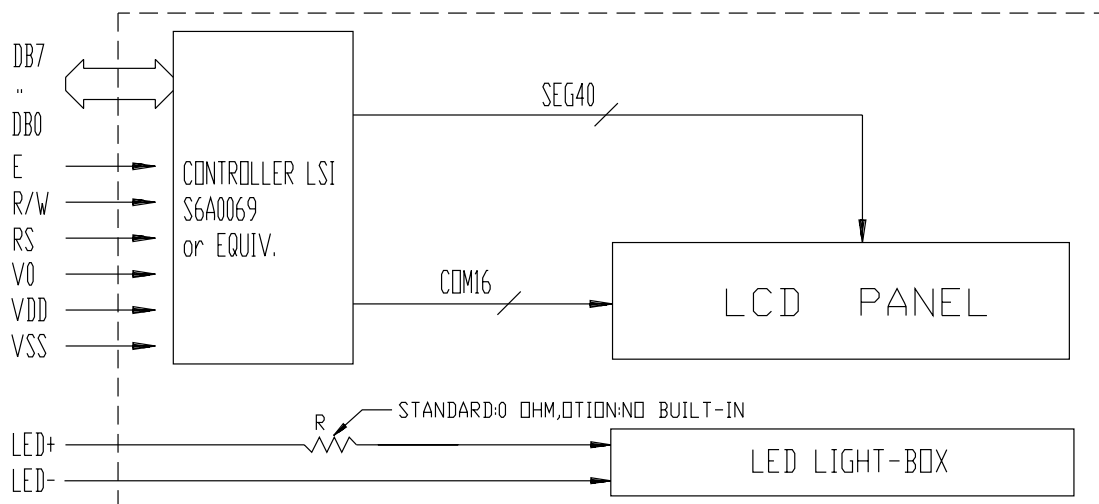
MC161-2

• EXTERNAL DIMENSIONS :



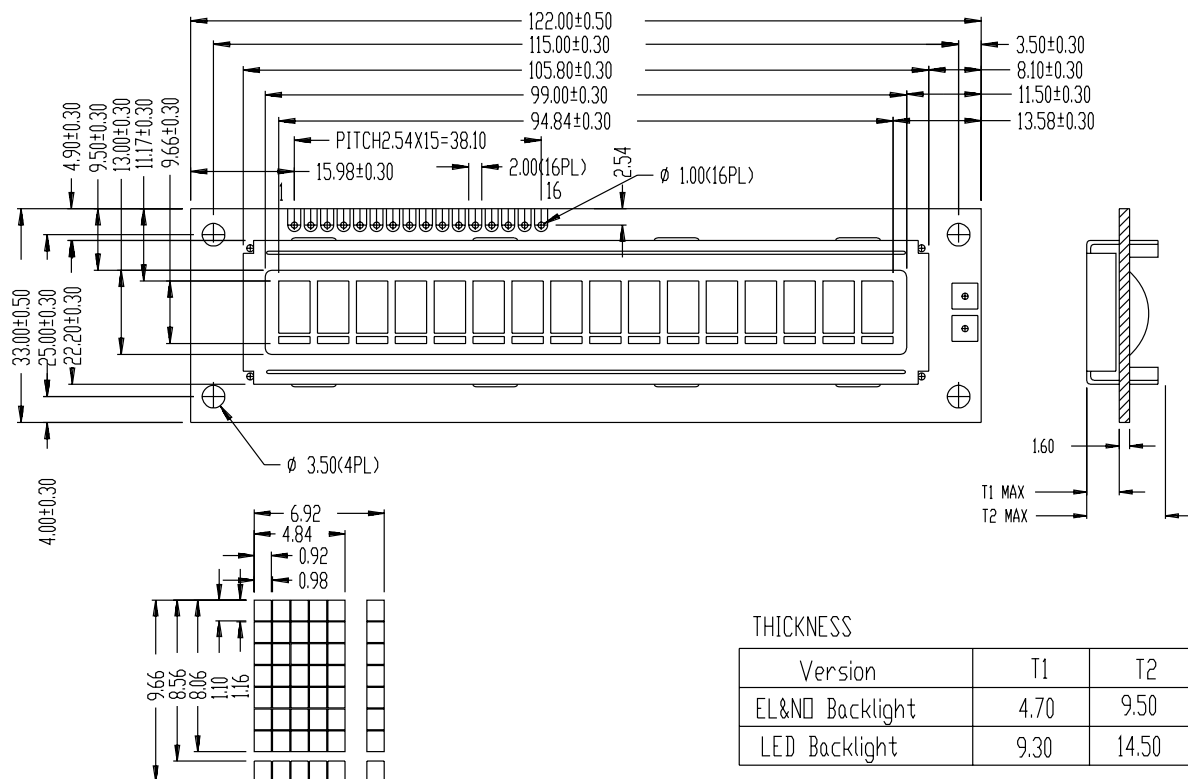
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	V0	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



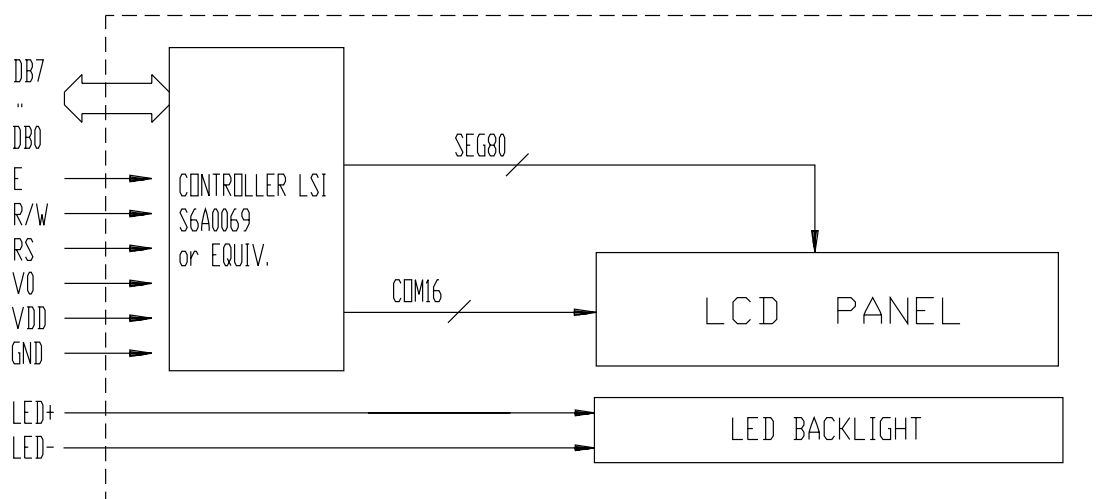
MC161-4

• EXTERNAL DIMENSIONS :



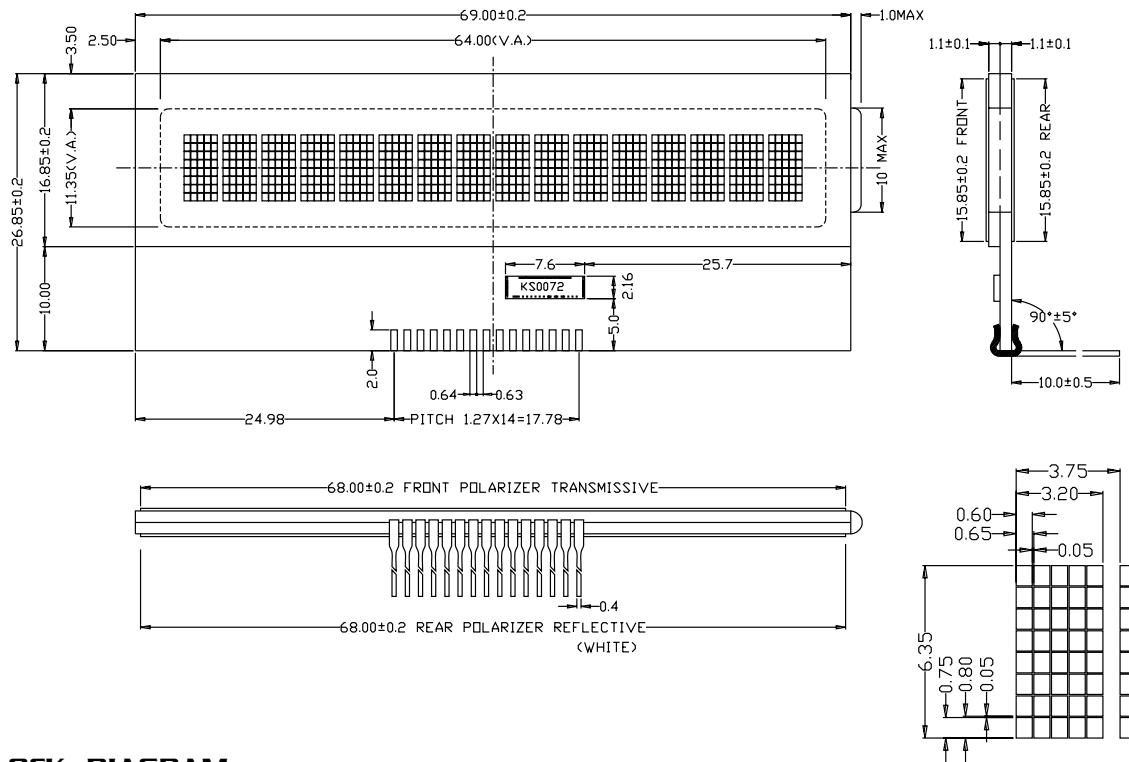
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GND	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



MC161-5

• EXTERNAL DIMENSIONS :



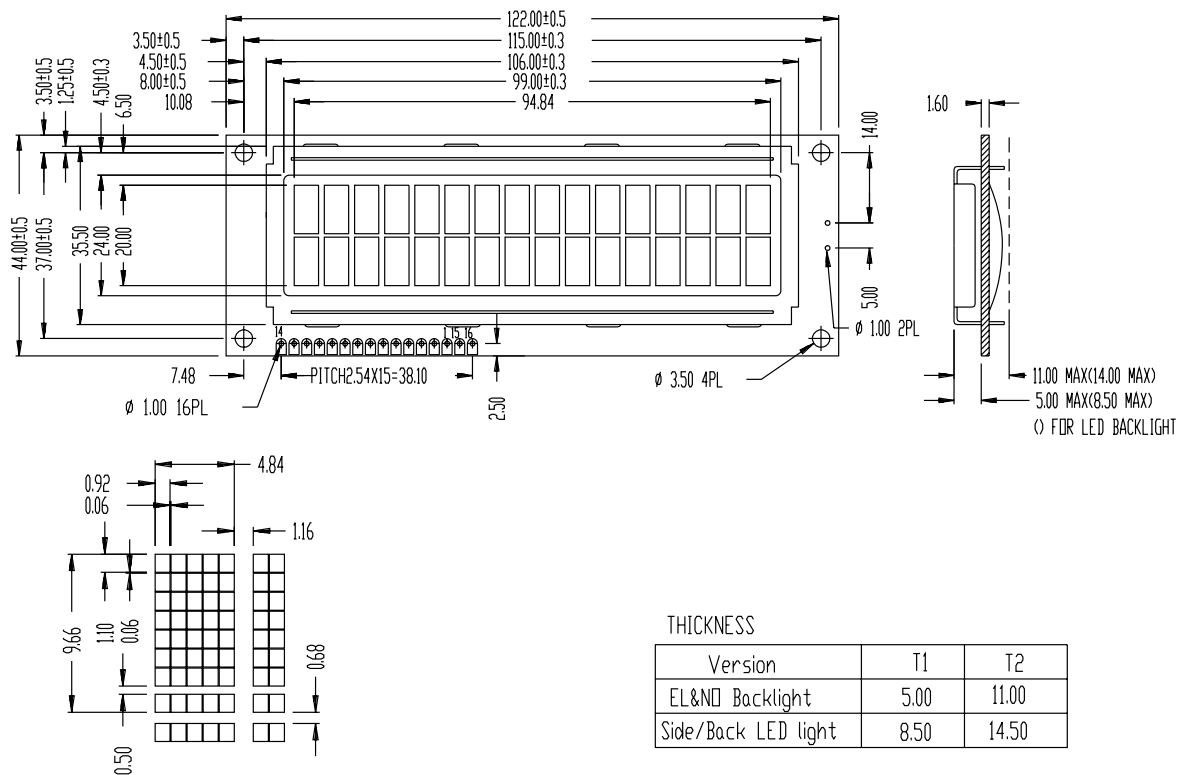
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VSS	VDD	V0	RESET	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7

IC: S6A0072X01-B0CZ

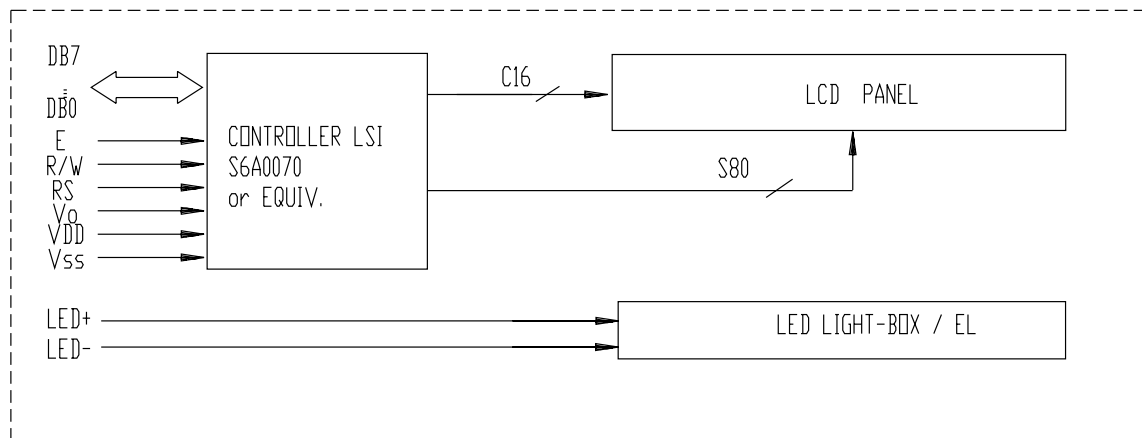
MC162-3

• EXTERNAL DIMENSIONS :



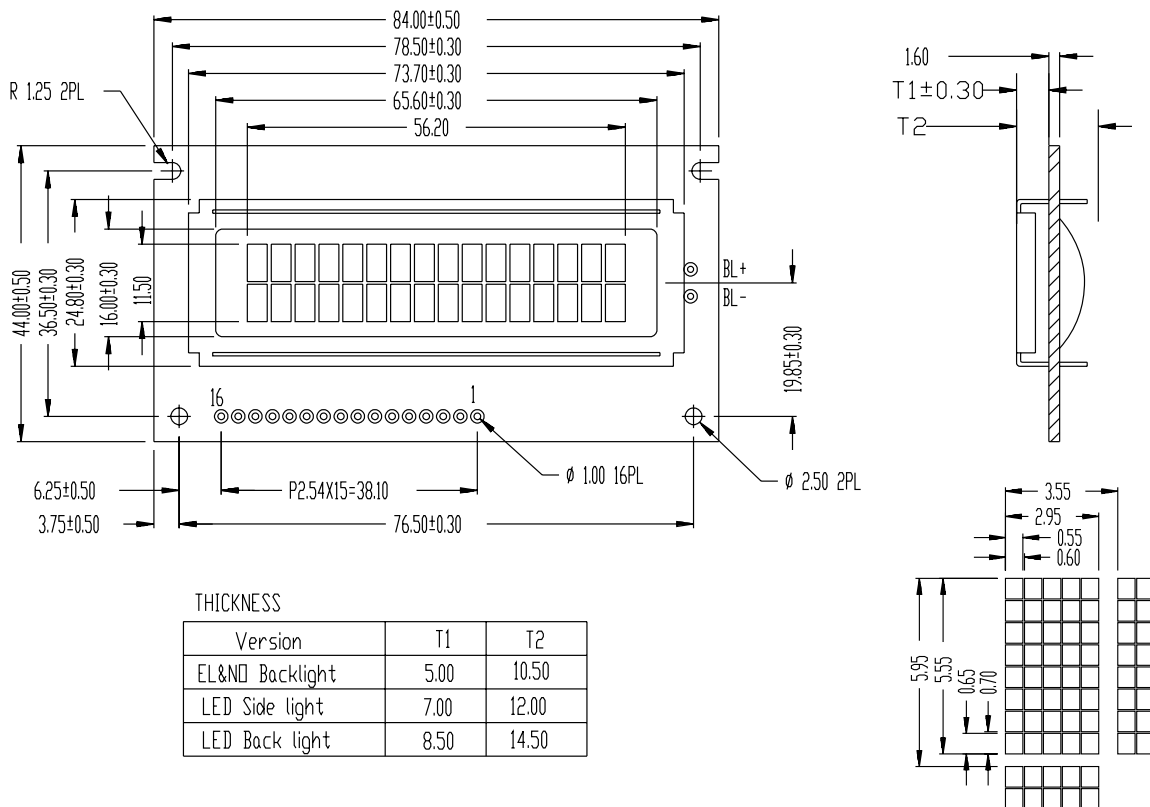
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GND	VDD	V0	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



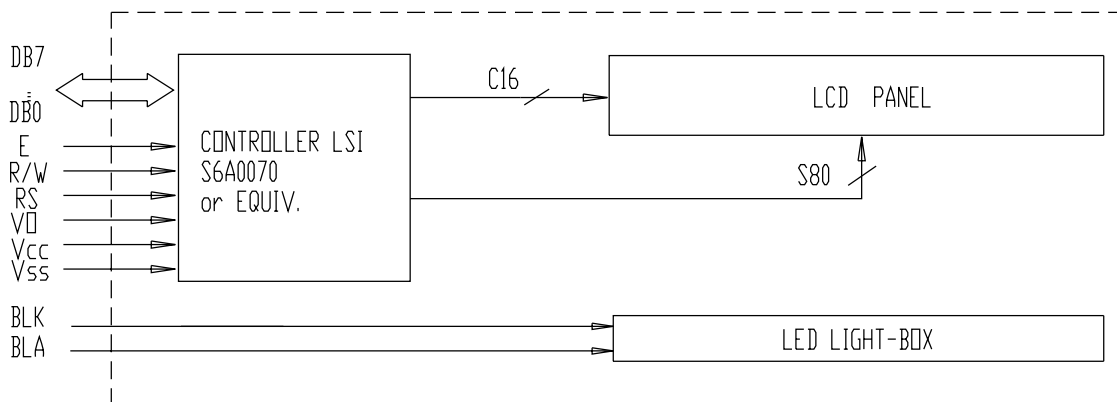
MC162-4

• **EXTERNAL DIMENSIONS :**



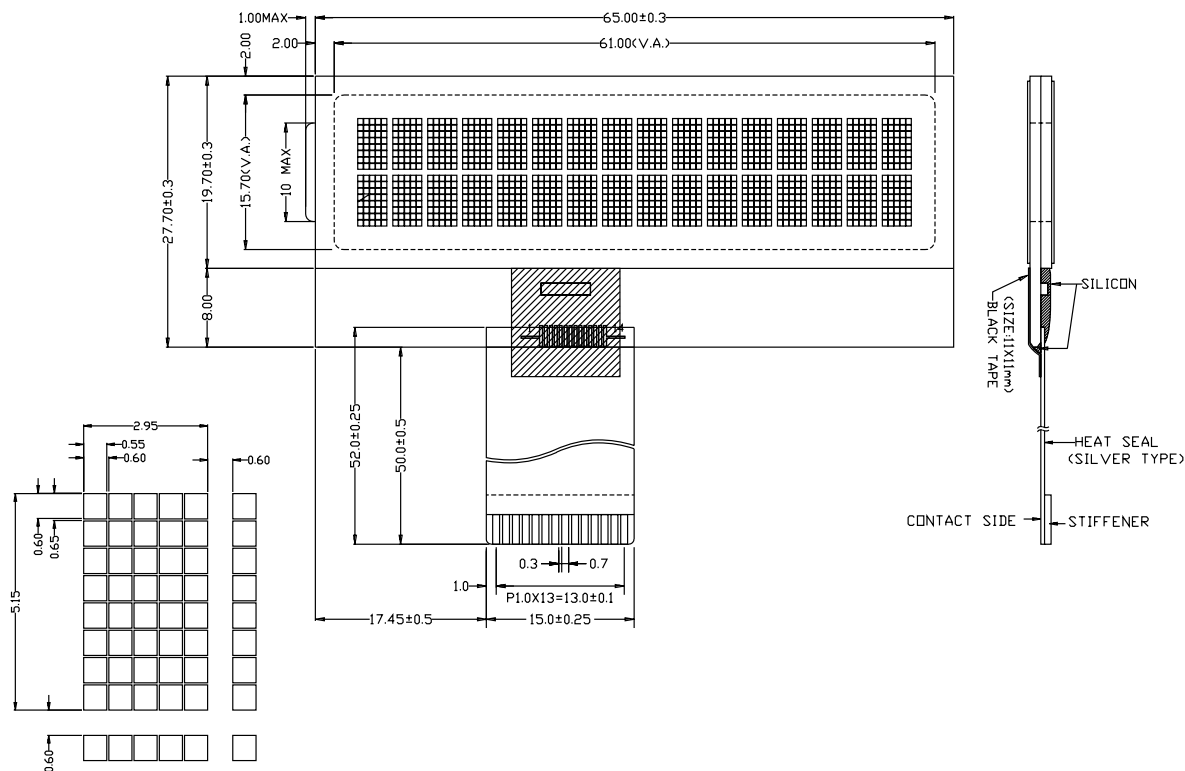
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
BLA	BLK	VSS	VCC	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7



MC162-15

• **EXTERNAL DIMENSIONS :**



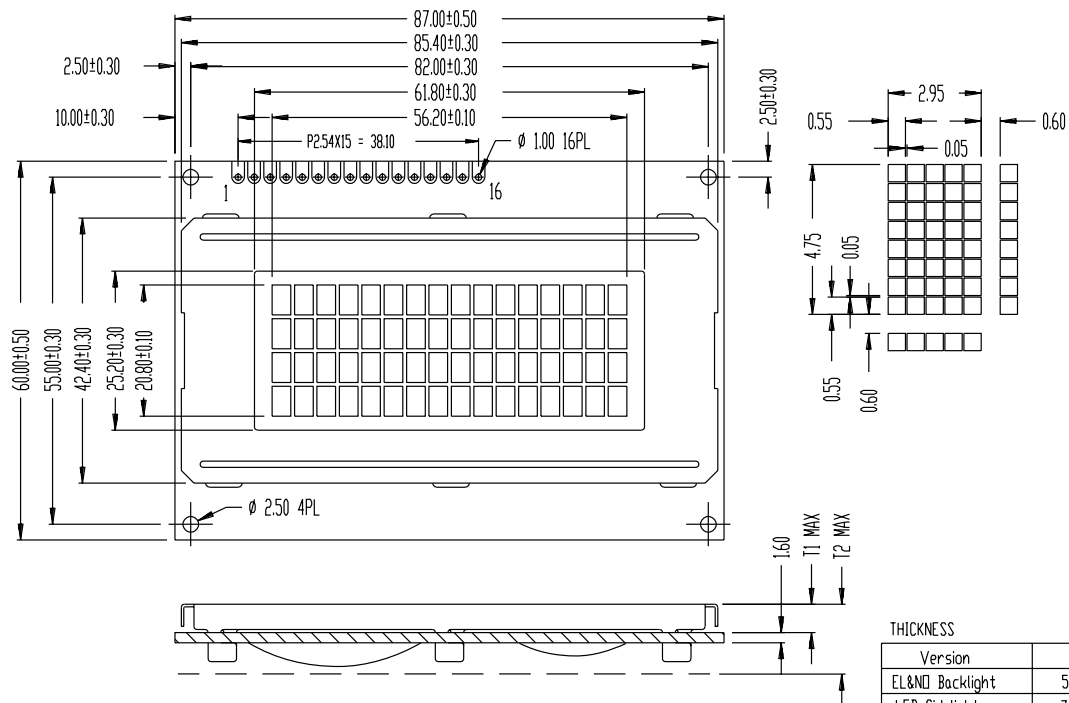
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12	13	14
VSS	V _{DD}	VDD	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7

IC:NT7603H-BDT01

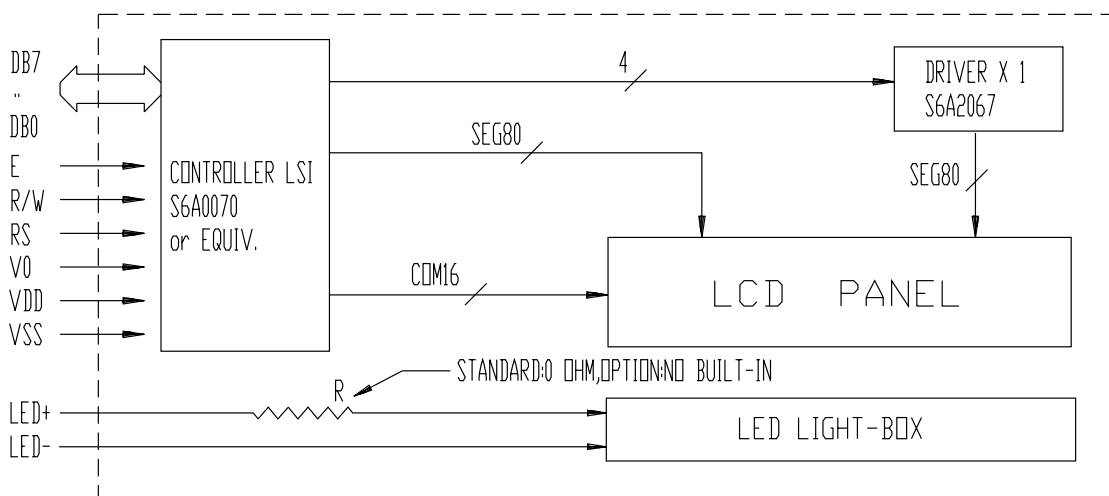
MC164-2

• EXTERNAL DIMENSIONS :



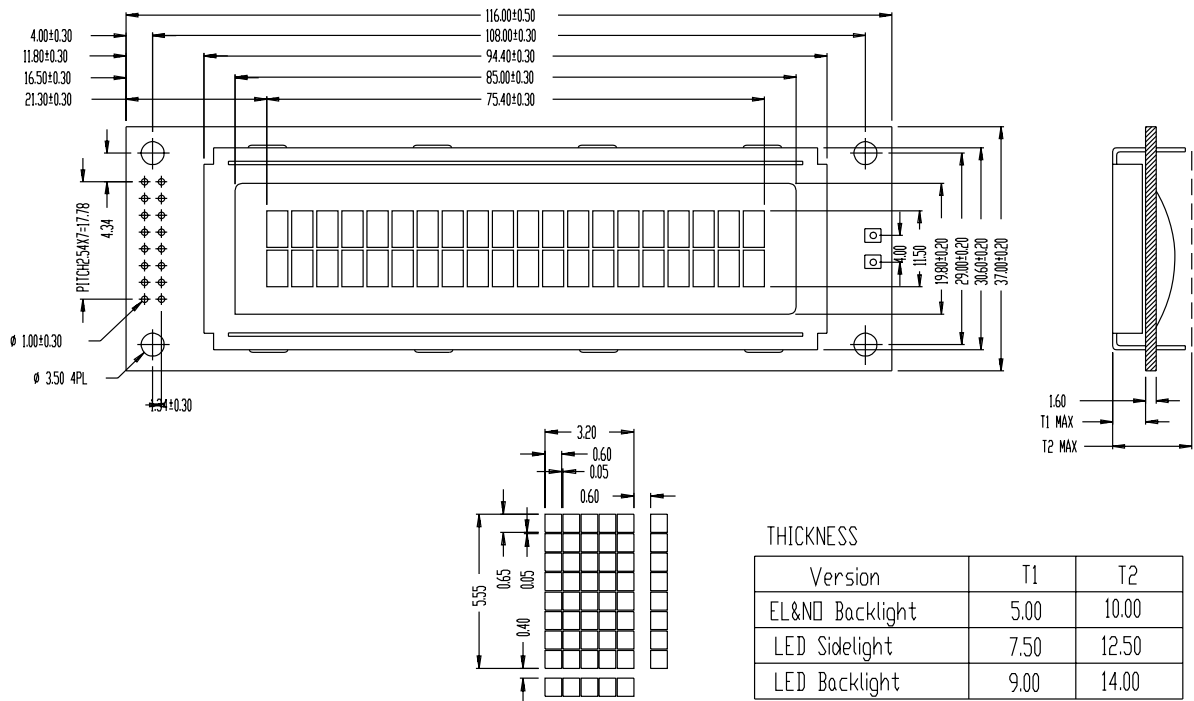
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LCD+	LCD-



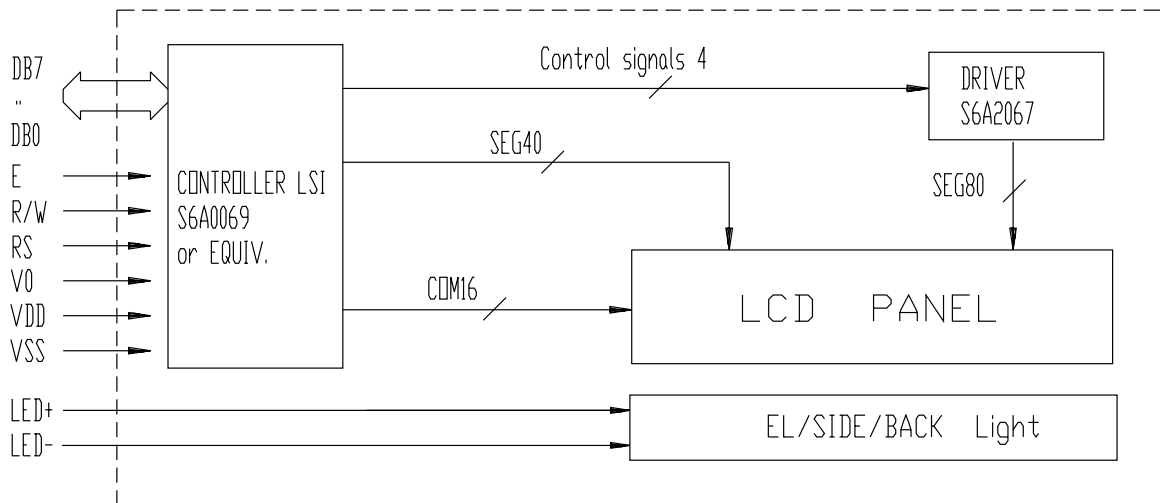
MC202-1

• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	V0	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-

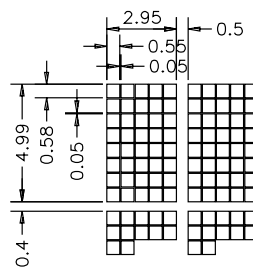


• **EXTERNAL DIMENSIONS :**



IC NAME : NT7605H-BDT01(COG)

• EXTERNAL DIMENSIONS :

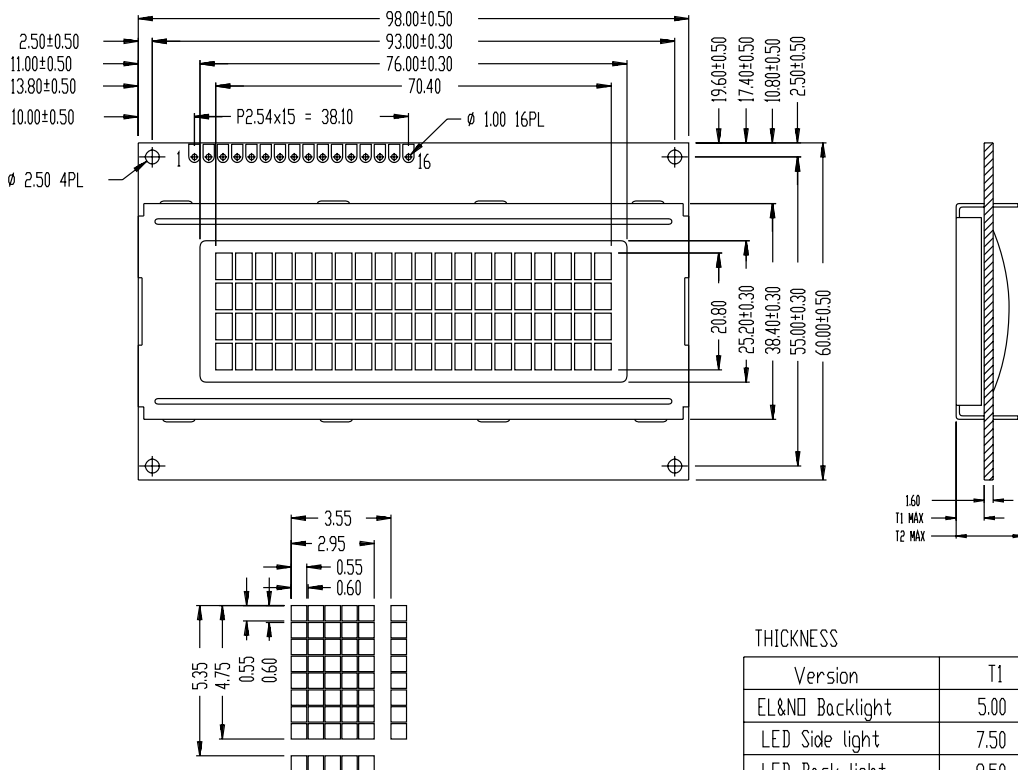


• **BLOCK DIAGRAM :**

IC NAME : NT7605H-BDT01

MC204-1

• EXTERNAL DIMENSIONS :

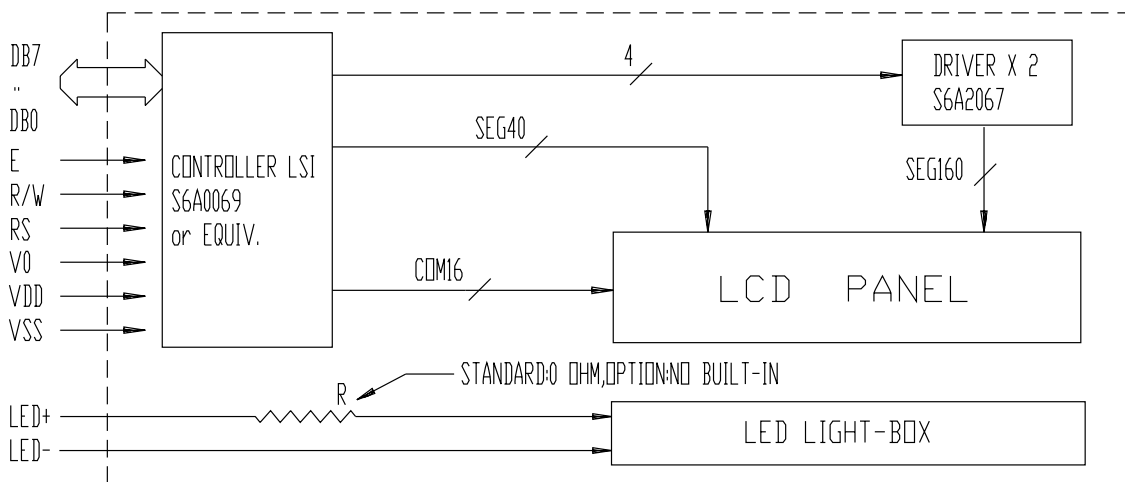


THICKNESS

Version	T1	T2
EL&NO Backlight	5.00	10.50
LED Side light	7.50	12.50
LED Back light	8.50	14.50

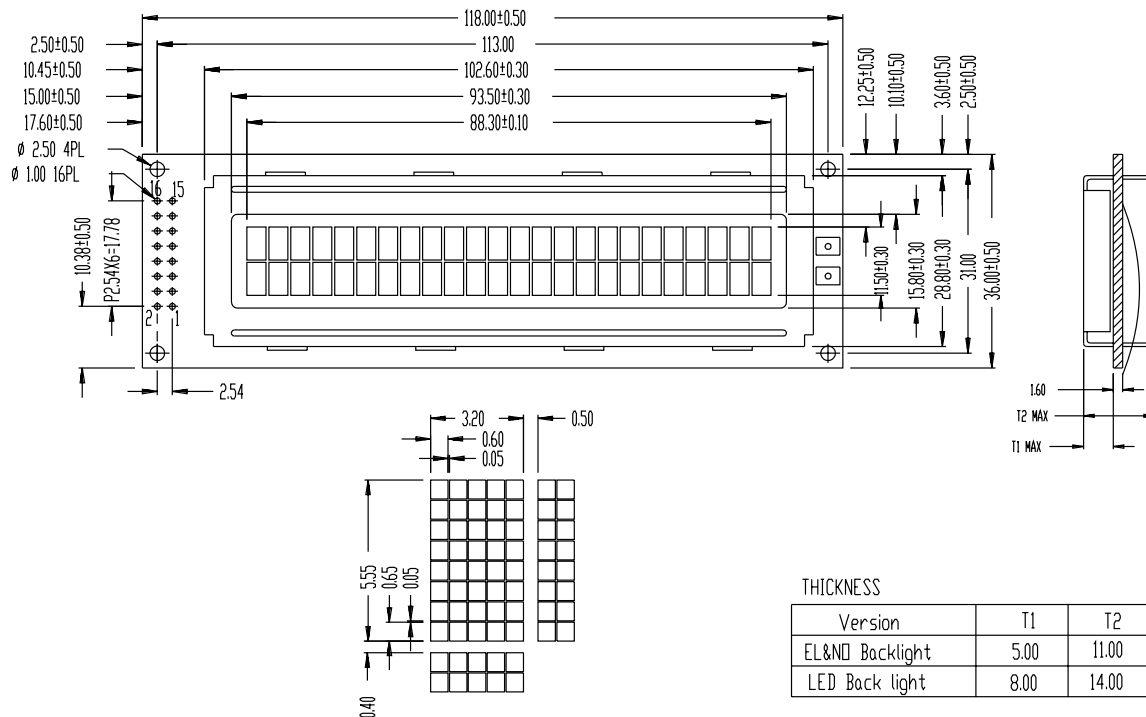
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	V0	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



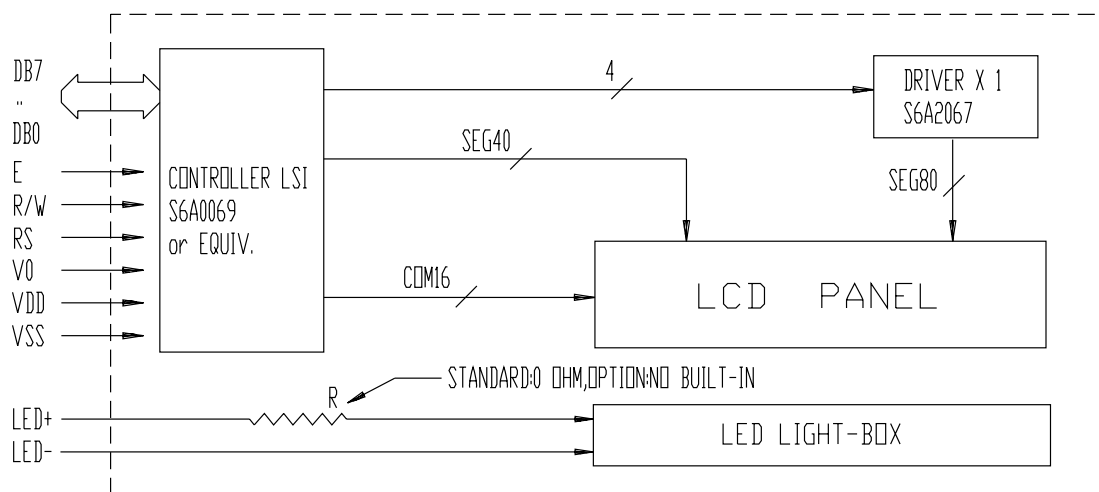
MC242-1

• **EXTERNAL DIMENSIONS :**



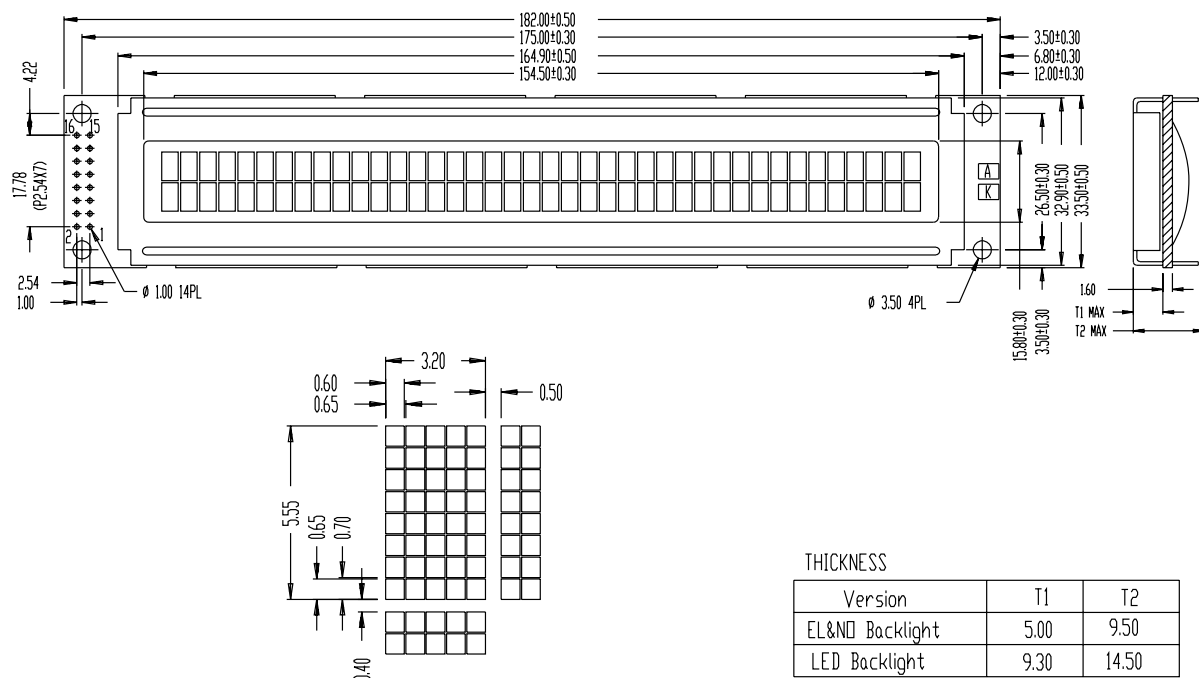
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	V0	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



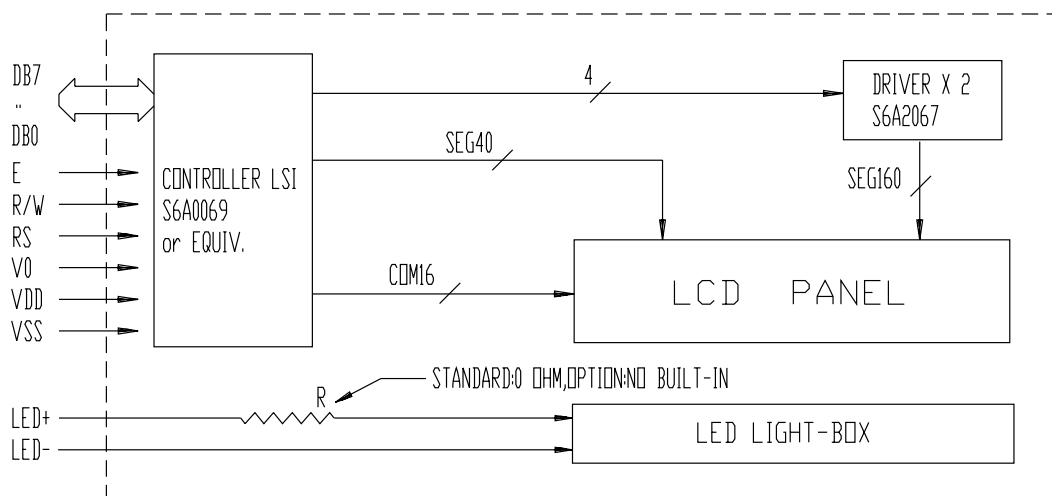
MC402-1

• **EXTERNAL DIMENSIONS :**



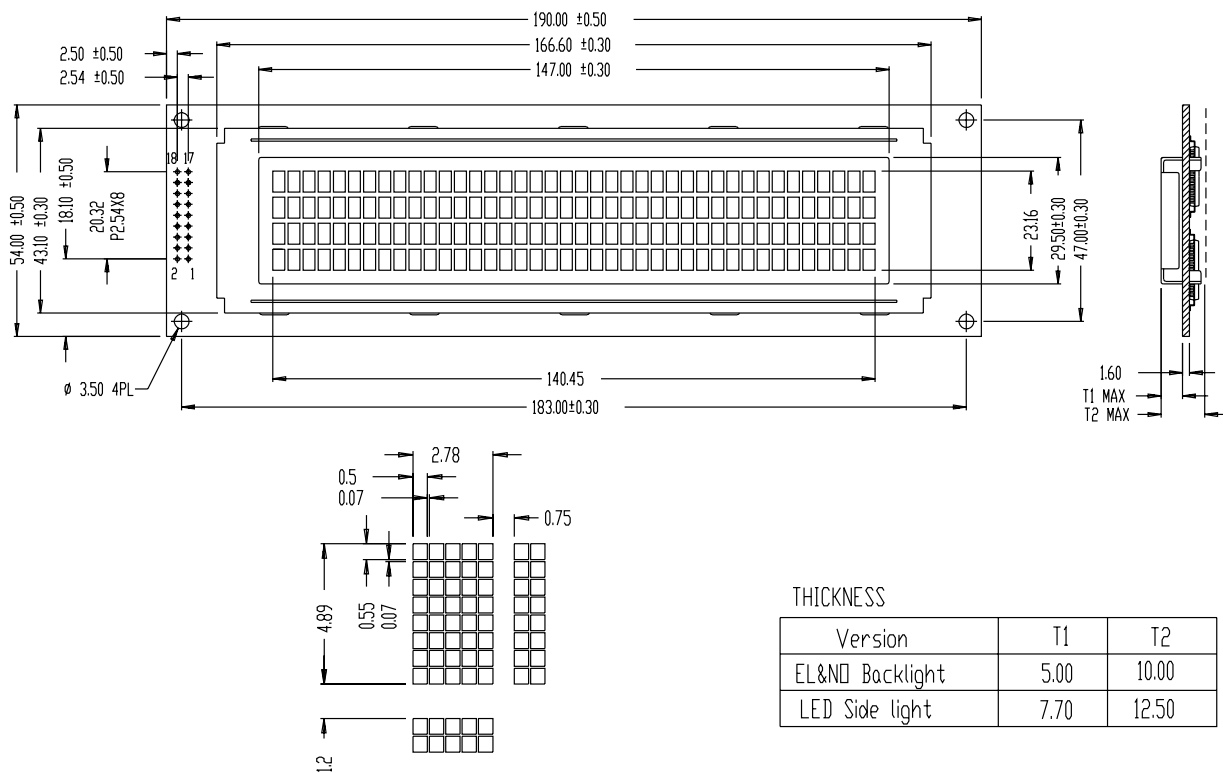
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VDD	V0	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



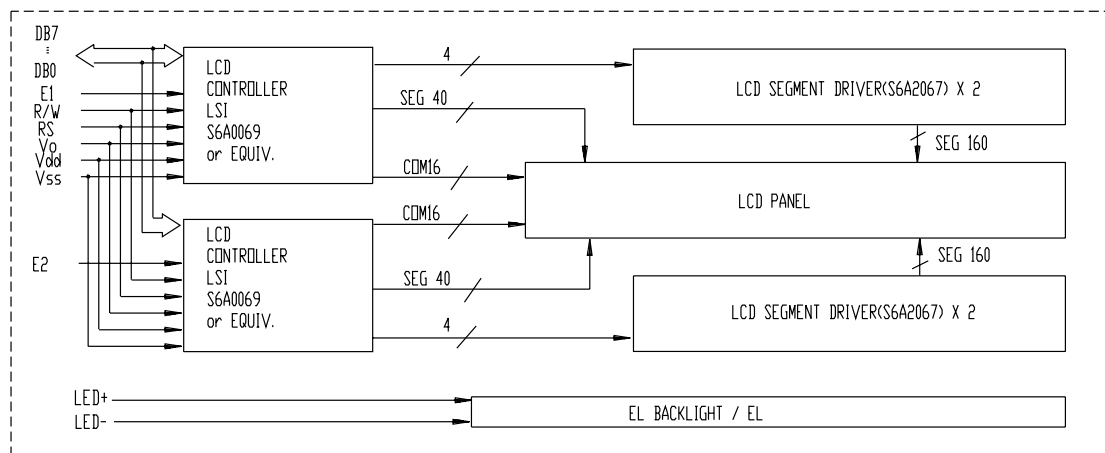
MC404-1

• EXTERNAL DIMENSIONS :



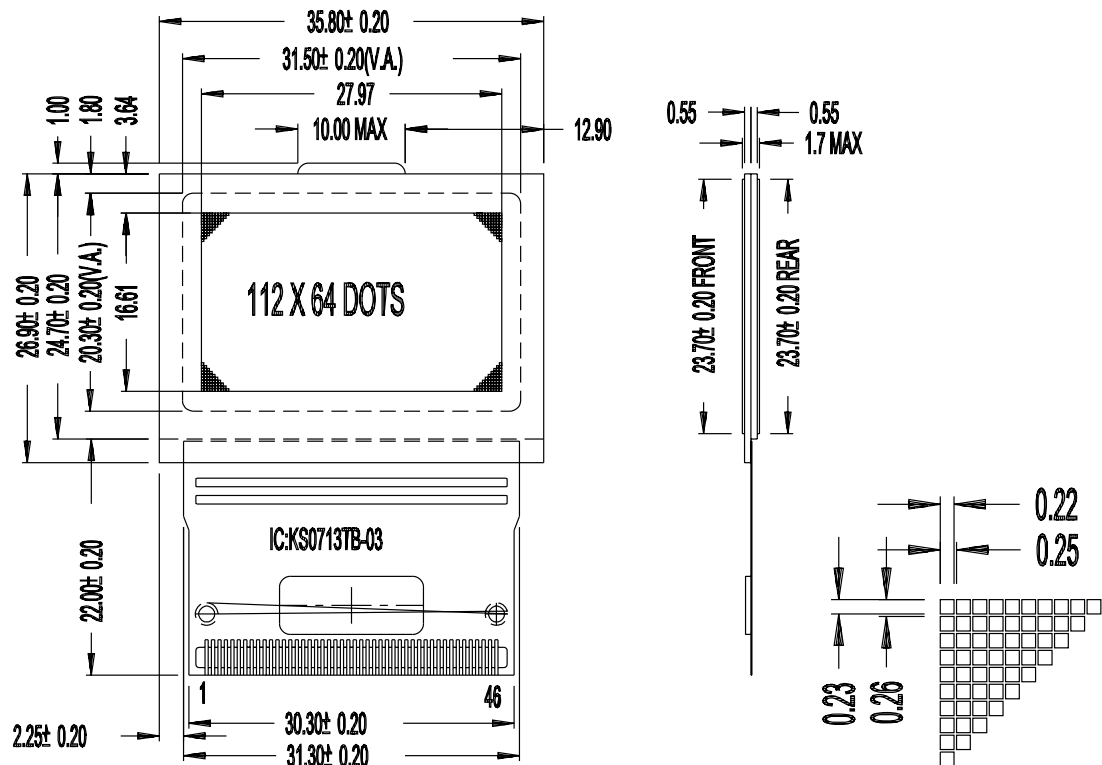
• BLOCK DIAGRAM :

PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
SYMBOL	V _{SS}	V _{DD}	V _O	RS	R/W	E1	E2	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	NC	LED+	LED-



MG11264-3

• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14
DUMMY	TEMPS	INTRS	HPM	DCDC5B	BSTS	V4	V3	V2	V1	V0	VR	C2-	C2+
15	16	17	18	19	20	21	22	23	24	25	26	27	28
C1-	C1+	C3-	C3+	VOUT	VDD	VSS	PS	MI	CLS	MS	DUTY1	DUTY0	DB7_SID
29	30	31	32	33	34	35	36	37	38	39	40	41	42
DB6_SCLK	DB5	DB4	DB3	DB2	DB1	DB0	E_RD	RW_WR	RS	RESETB	CS2	CS1B	DISP
43	44	45	46										
CL	M	FRS	DUMMY										

• **EXTERNAL DIMENSIONS :**

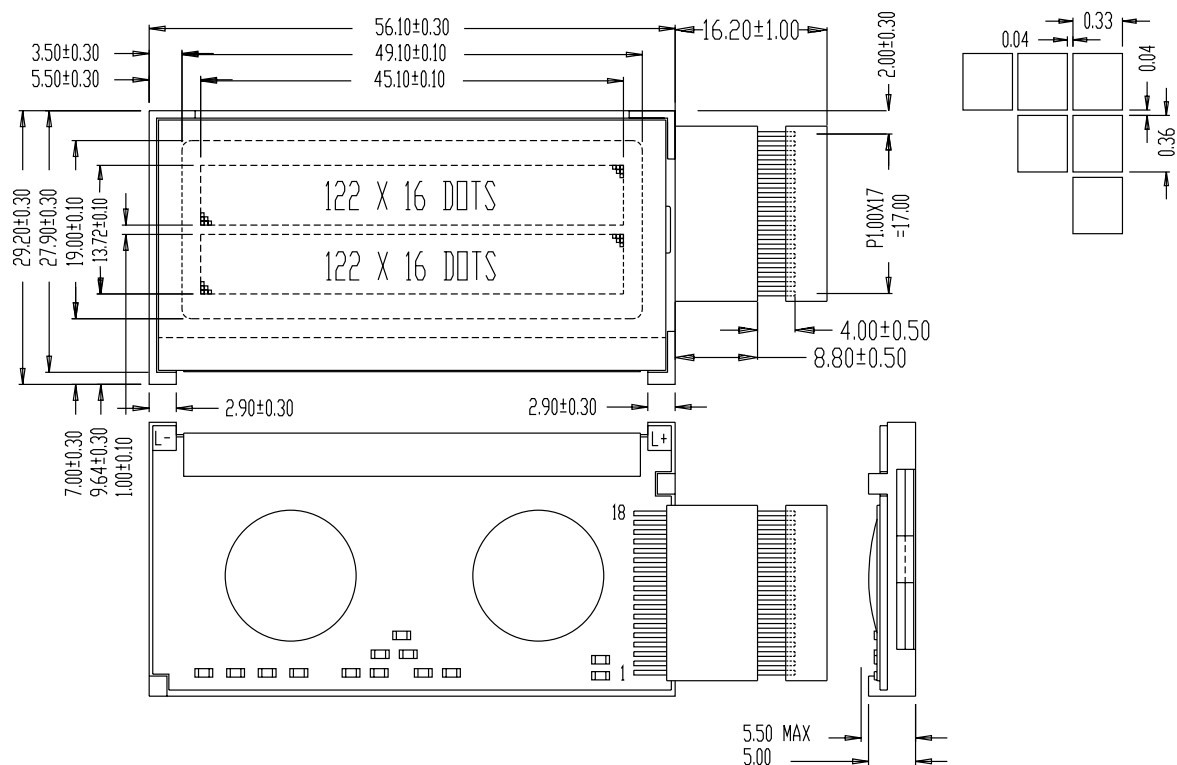
26

• **EXTERNAL DIMENSIONS :**



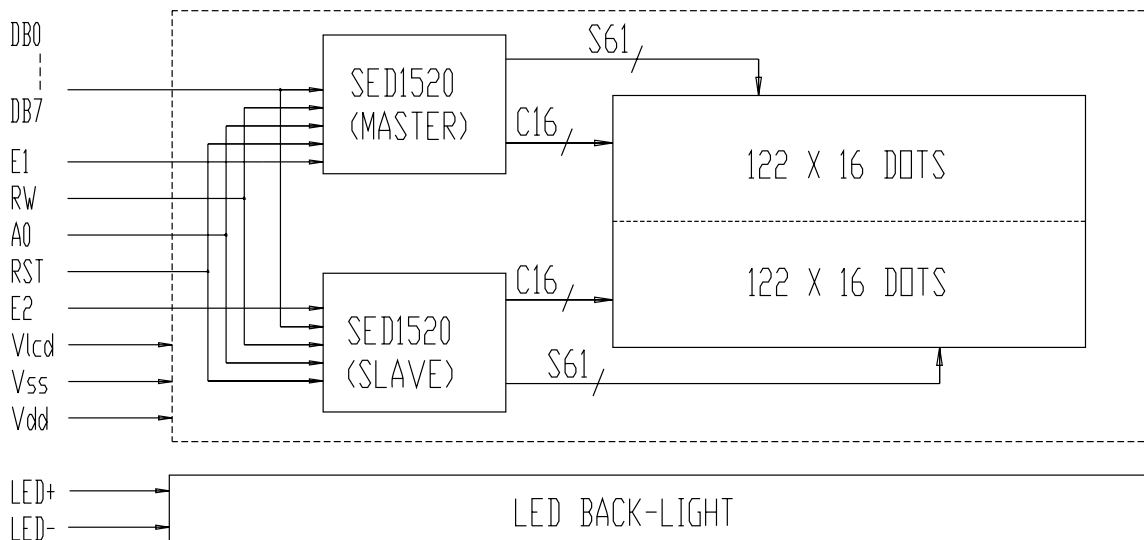
MG12232-3

• EXTERNAL DIMENSIONS :



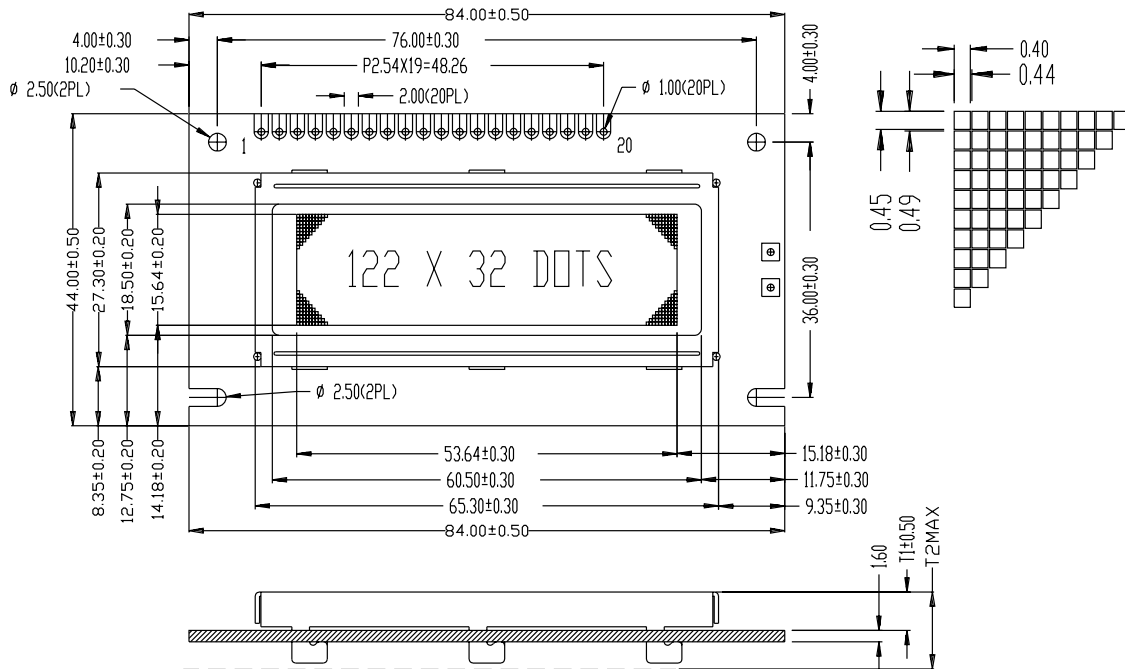
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
V _{DD}	V _{SS}	V _{Lcd}	RST	E1	E2	RW	A0	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-



MG12232-7

• **EXTERNAL DIMENSIONS :**

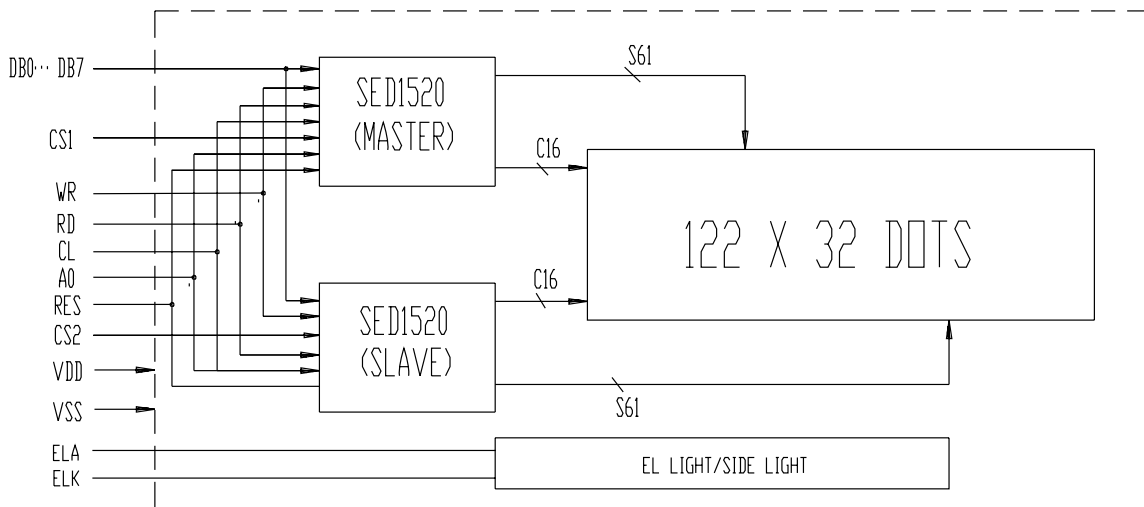


THICKNESS

Version	T1	T2
EL&ND Backlight	5.40	10.00
LED Backlight	7.50	12.00

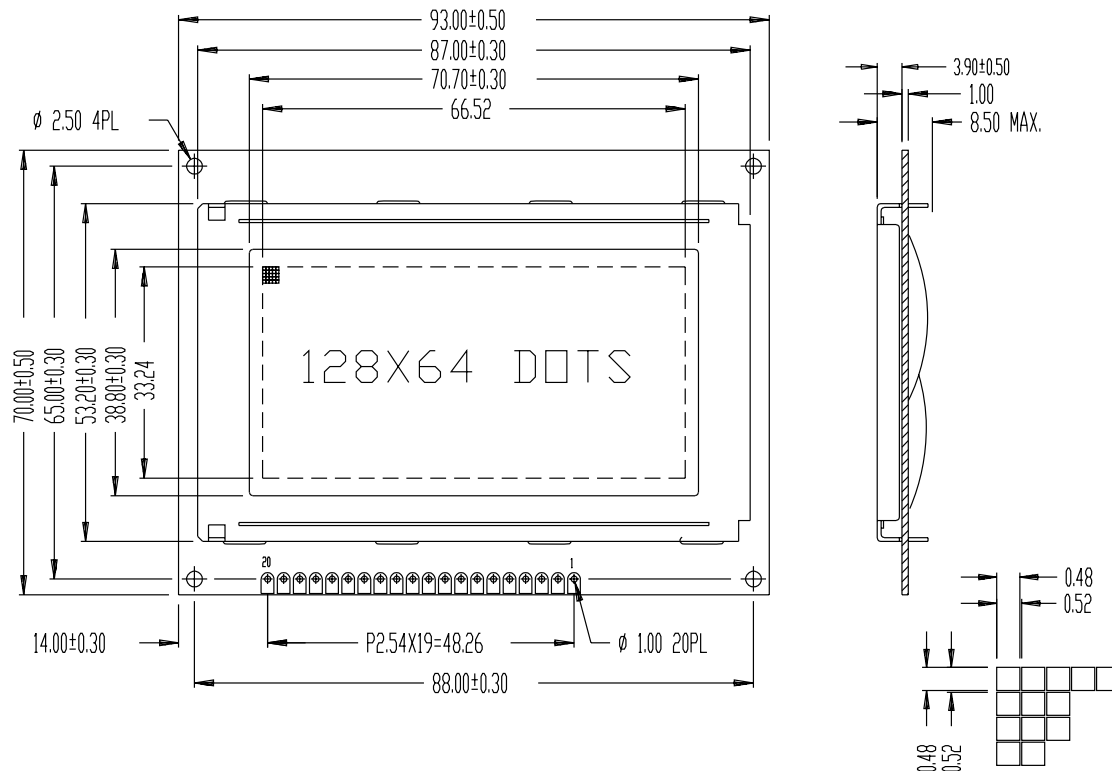
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	NC	A0	CS1	CS2	CL	RD	WR	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	RES	ELA	ELK



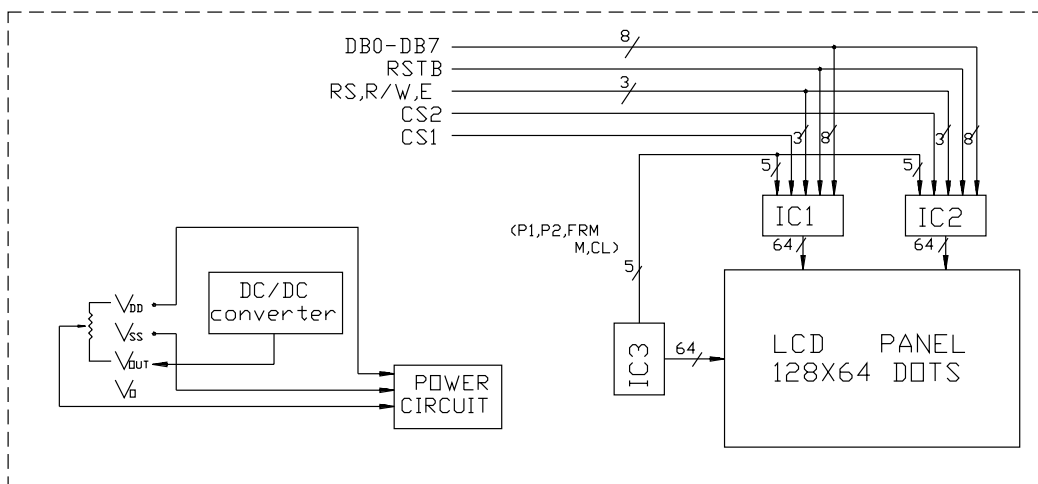
MG12864-4

• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

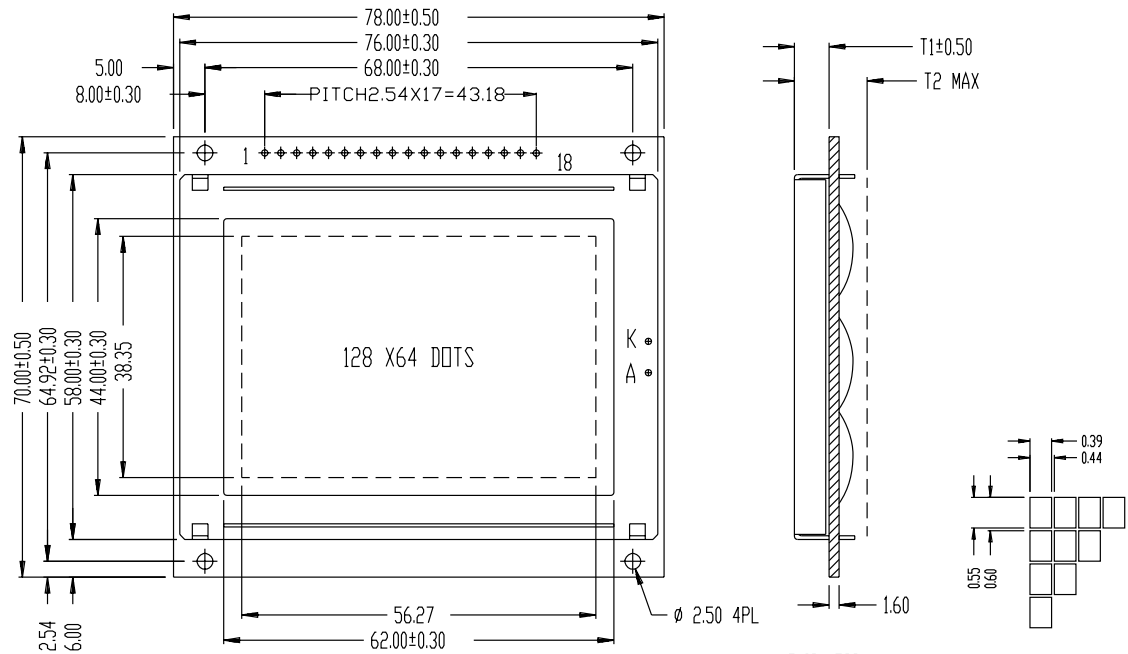
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	RSTB	VDUT	NC	NC



COMMON DRIVER : S6B0107B or EQUIV.
SEGMENT DRIVER : S6B0108A or EQUIV.

MG12864-5

• EXTERNAL DIMENSIONS :

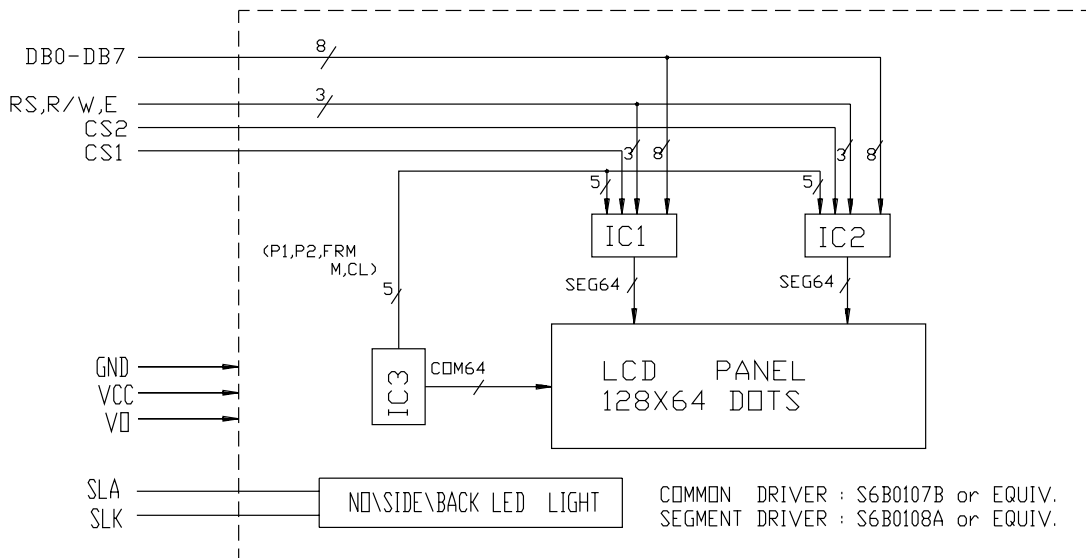


THICKNESS

Version	T1	T2
EL&NO Backlight	5.50	10.00
LED Side Light	8.00	13.00
LED Back Light	9.90	14.50

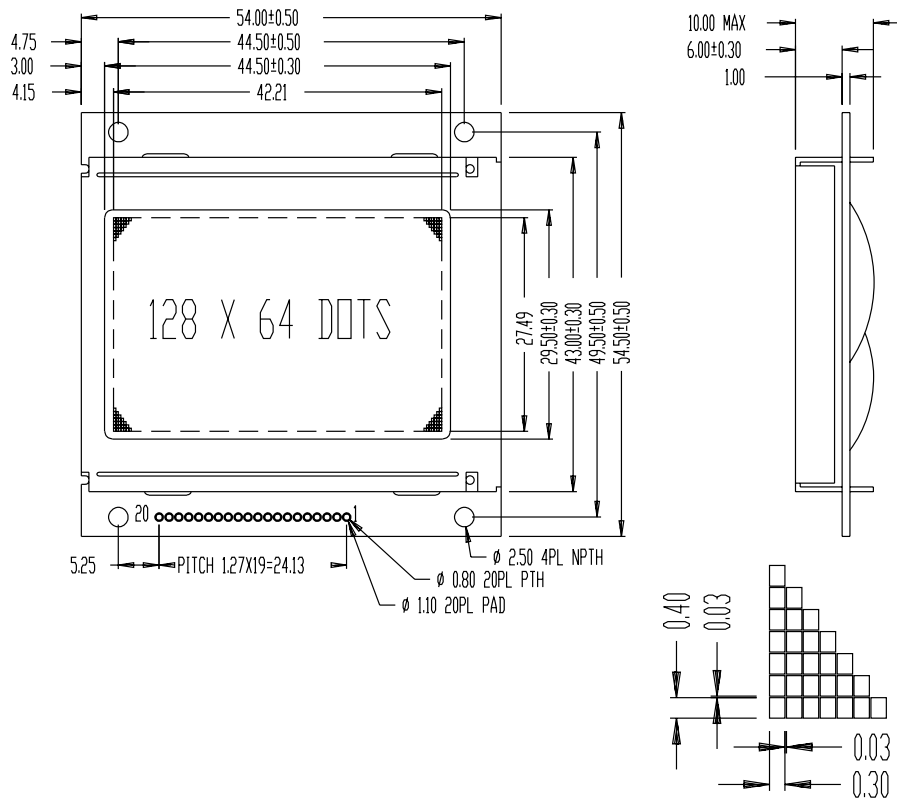
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
CS1	CS2	GND	VCC	VO	D/I	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	SLA	SLK



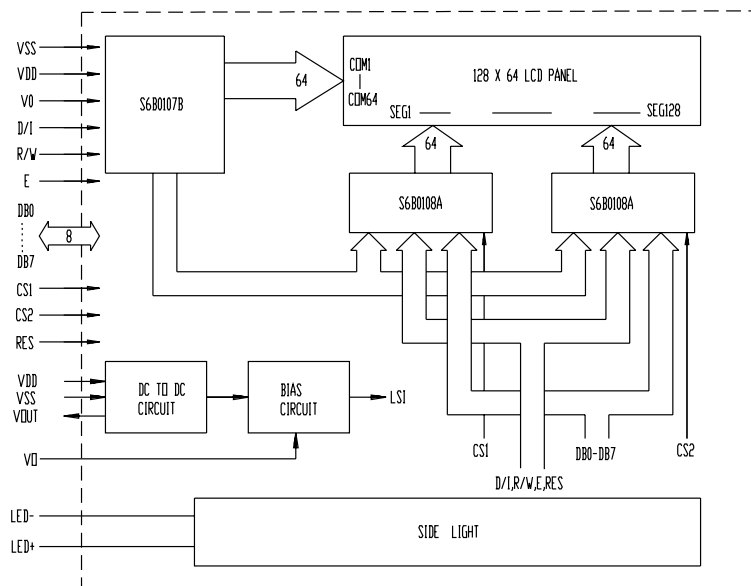
MG12864-6

• EXTERNAL DIMENSIONS :



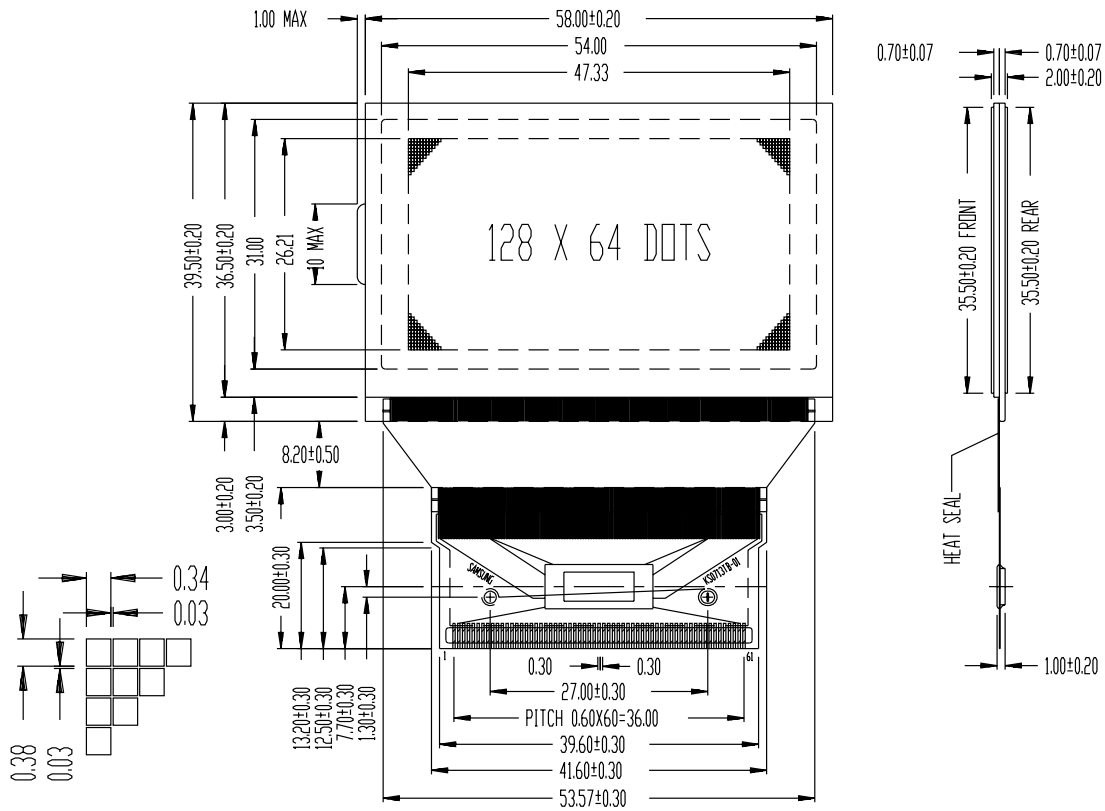
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	VO	D/I	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	RSTB	VOUT	LED-	LED+



MG12864-8

• EXTERNAL DIMENSIONS :

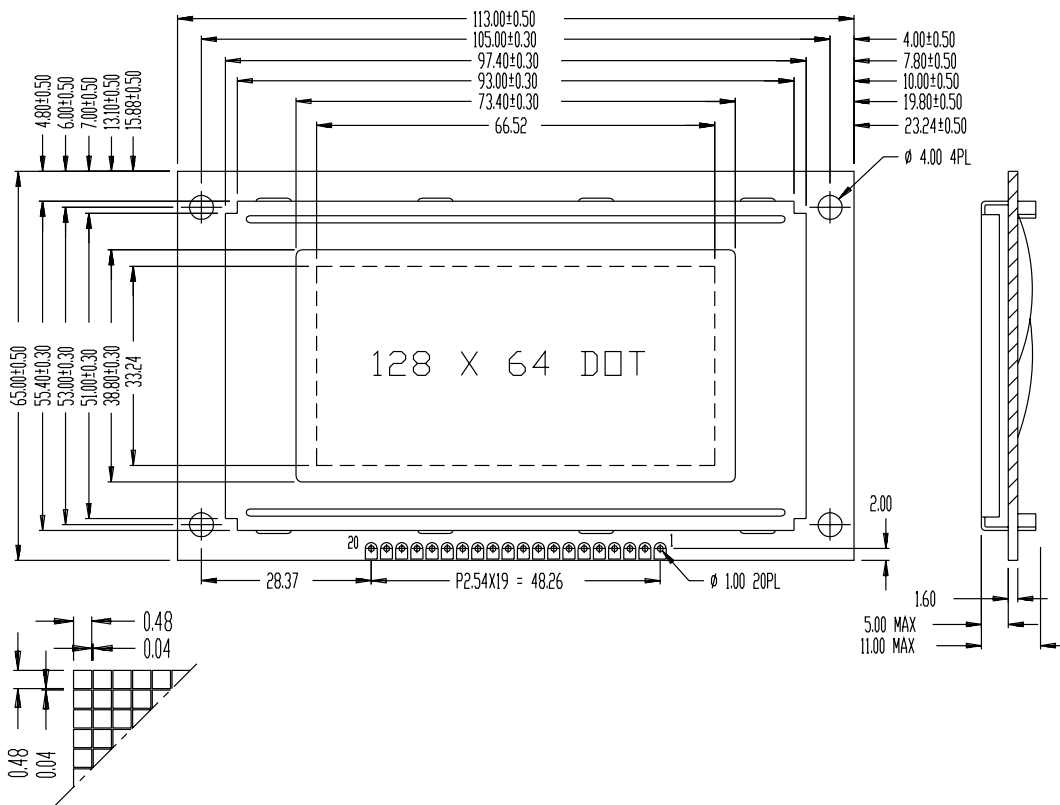


• BLOCK DIAGRAM :

PIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
SIGNAL	DUMMY	FRS	M	CL	DISP	VSS	CS1B	CS2	VDD	RESETB	RS	VSS	RW_WR	E_RD	VDD	DB0	DB1	DB2	DB3	DB4	DB5
PIN	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
SIGNAL	DB6 SCLK	DB7 SID	VSS	TESTL1	TESTL2	VDD	DUTY0	DUTY1	VSS	MS	CLS	VDD	MI	PS	VSS	VDD	VDUT	C3+	C3-	C1+	C1-
PIN	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61		
SIGNAL	C2+	C2-	VSS	VR	V0	V1	V2	V3	V4	VSS	BSTS	DCDC5B	VDD	HPM	INTRS	VSS	TEMPS	VDD	DUMMY		

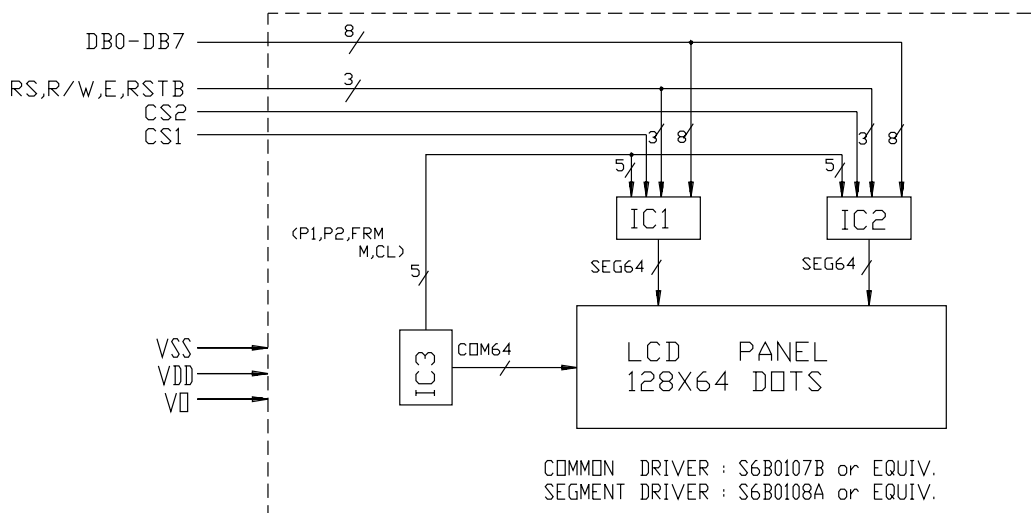
MG12864-10

• EXTERNAL DIMENSIONS :



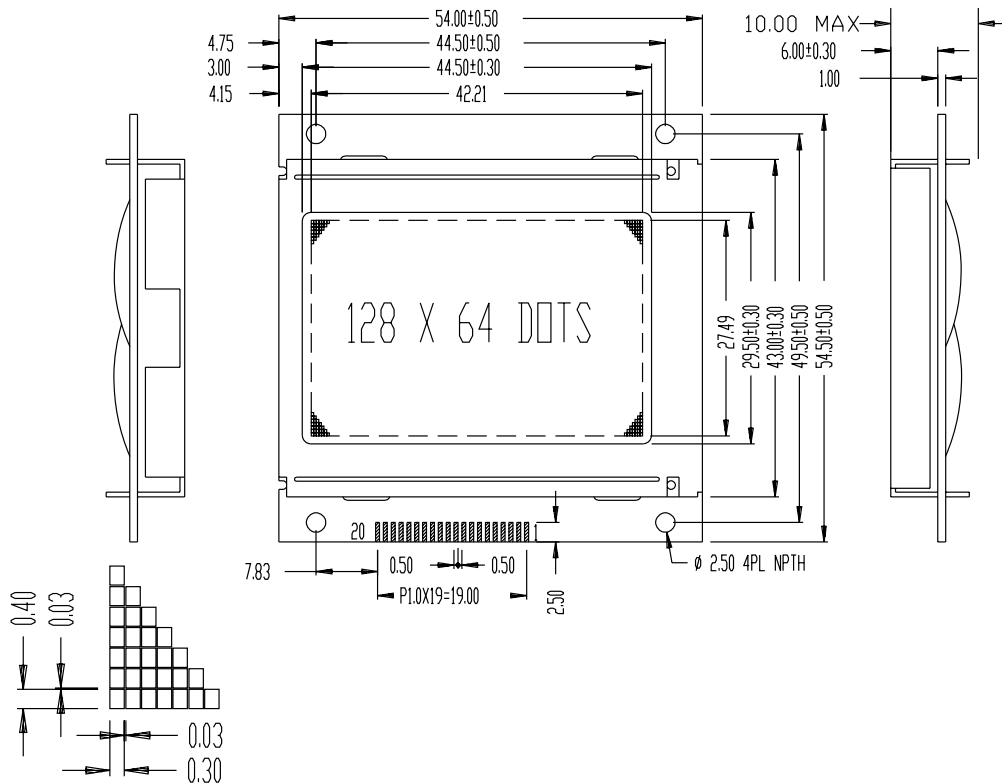
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	RSTB	NC	NC	NC



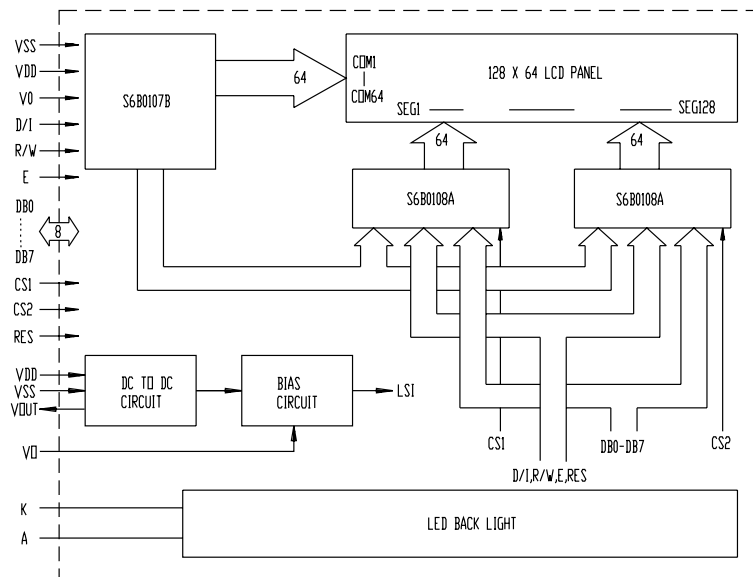
MG12864-12

• EXTERNAL DIMENSIONS :



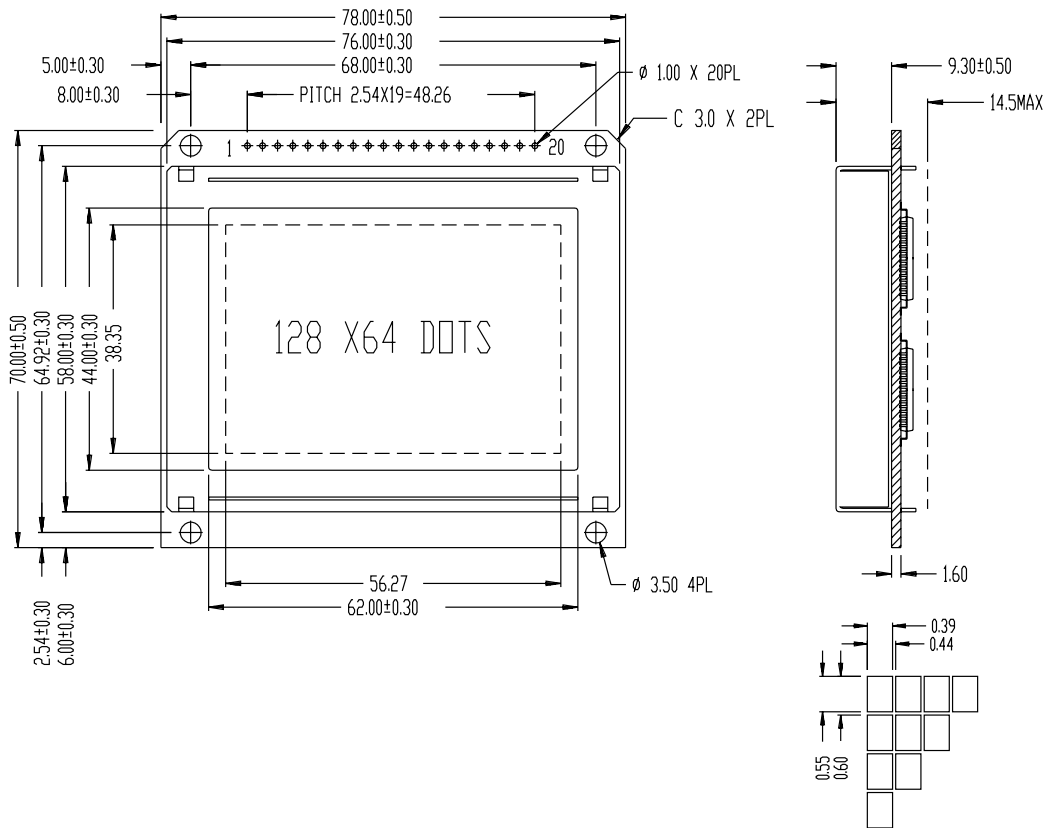
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	V0	D/I	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	RSTB	VOUT	A	K



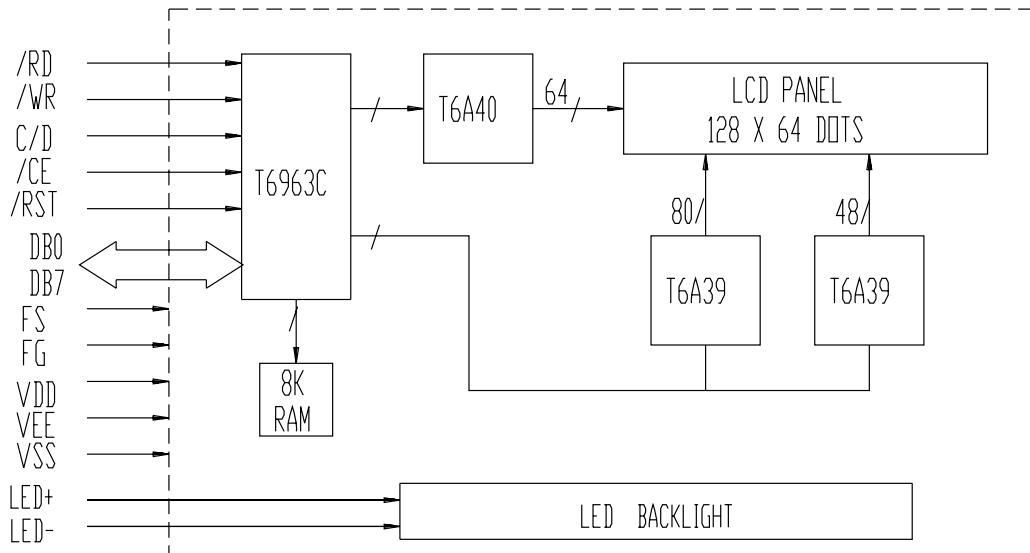
MG12864-15

• EXTERNAL DIMENSIONS :



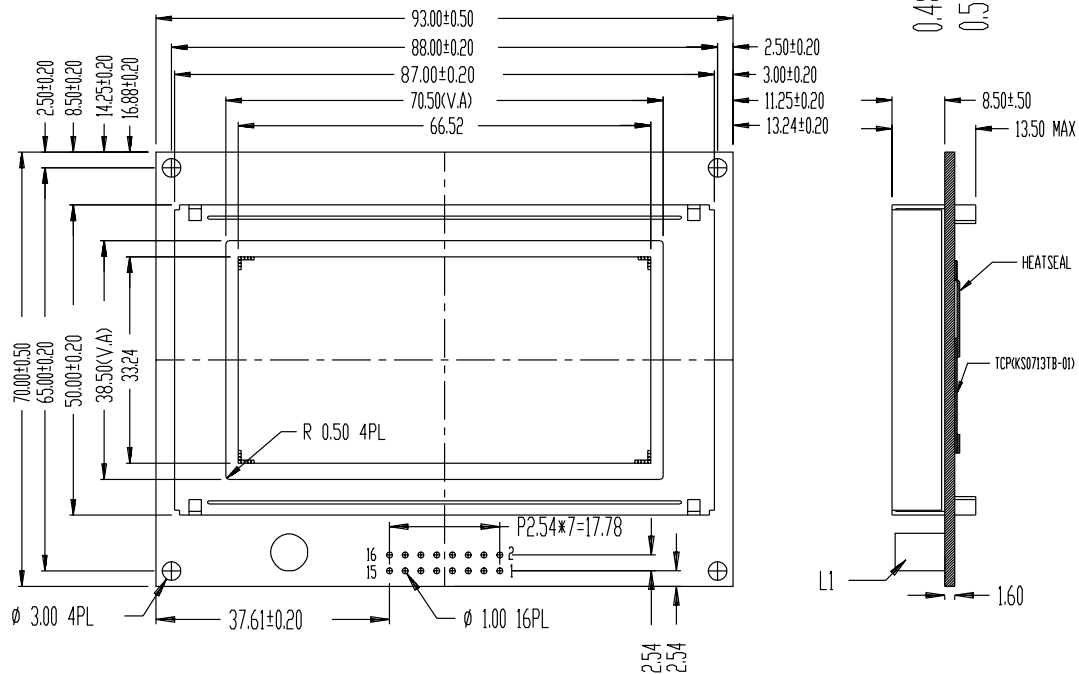
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
FG	VSS	VDD	VEE	/WR	/RD	/CE	C/D	/RST	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	FS	LED-	LED+



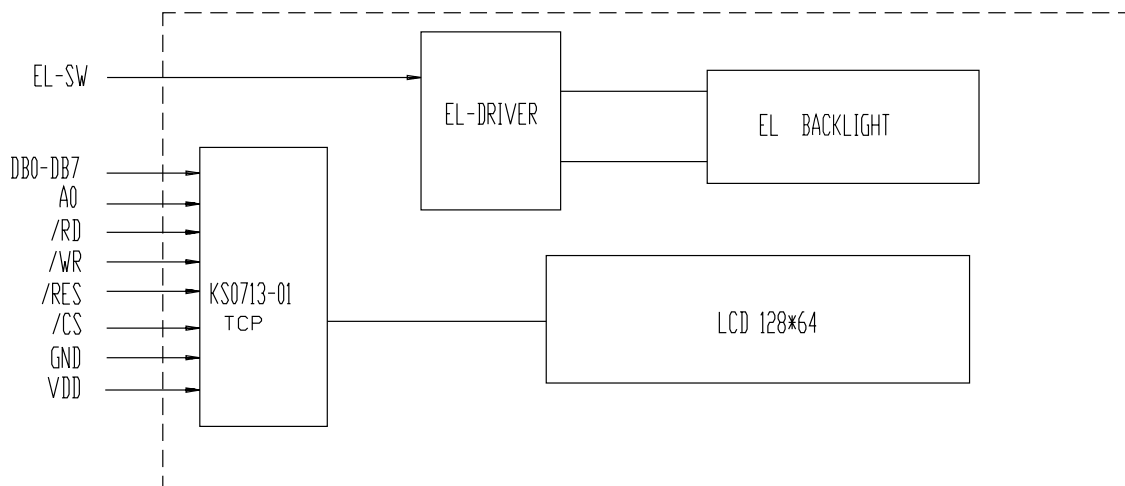
MG12864-23

• EXTERNAL DIMENSIONS :



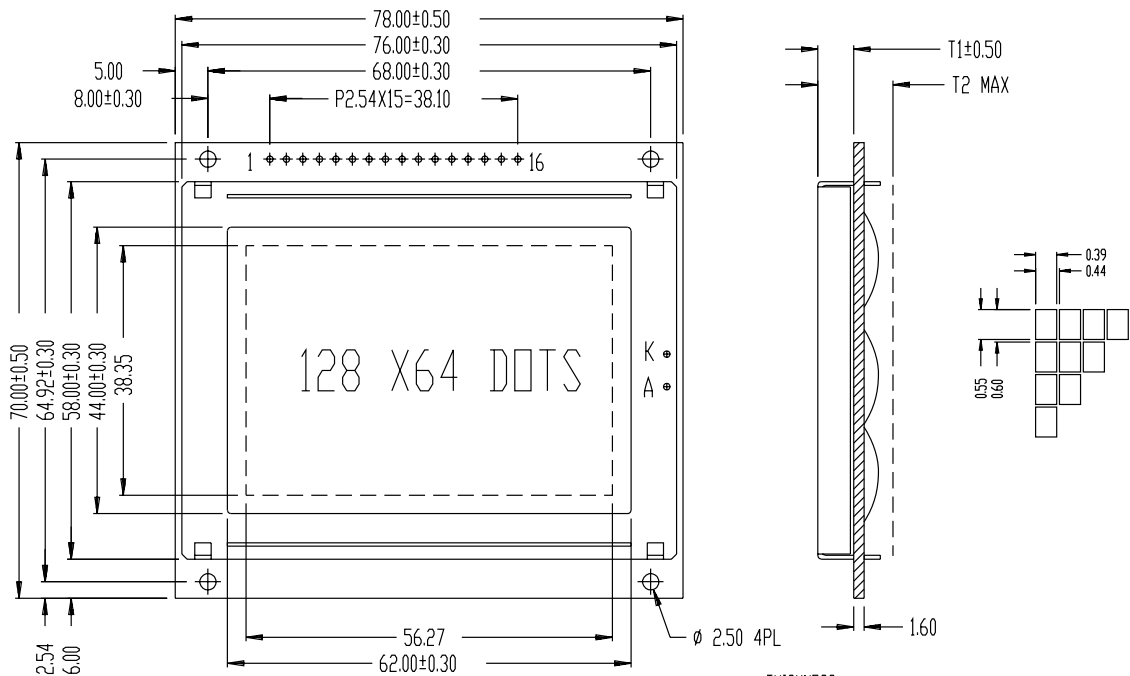
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
A0	/RD	/WR	/RES	/CS	GND	EL_SW	VDD	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7



MG12864-24

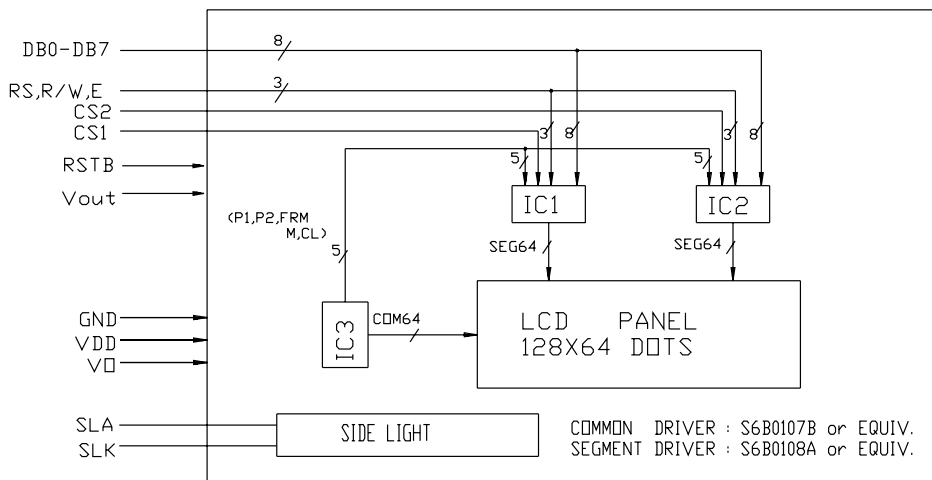
• **EXTERNAL DIMENSIONS :**



Version	T1	T2
EL&ND Backlight	5.50	10.00
LED Side Light	7.80	13.00
LED Back Light	9.30	14.50

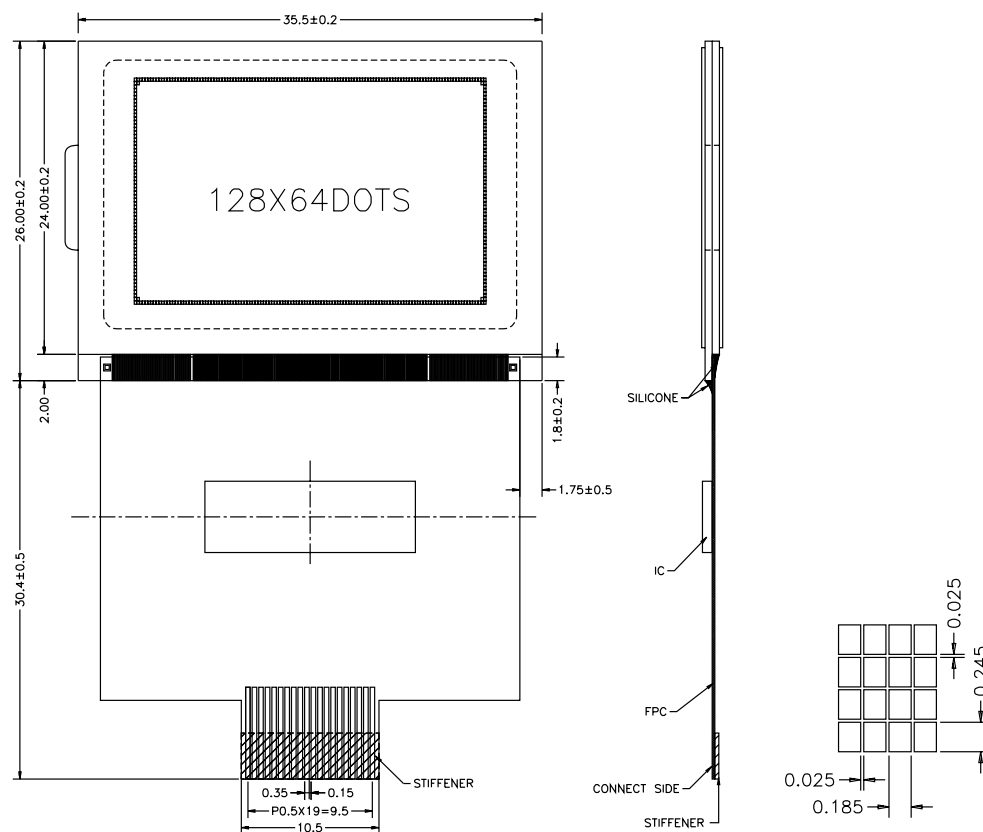
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
CS1	CS2	GND	VDD	V _{DD}	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	RSTB	Vout	SLA	SLK



MG12864-26

• EXTERNAL DIMENSIONS :



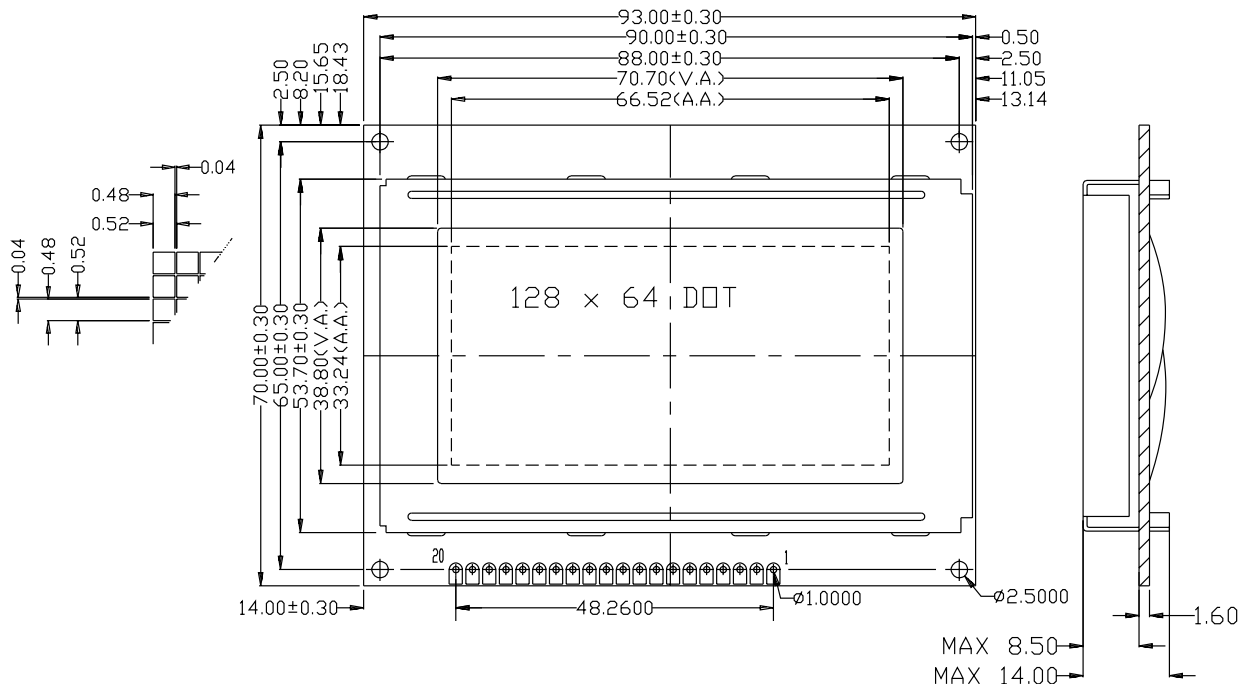
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
NC	VSS	VDD	VSS	D7	D6	D5	D4	D3	D2	D1	D0	RDB	WRB	VDD	RS	CSB	RESB	VSS	NC

IC:LH155KF1

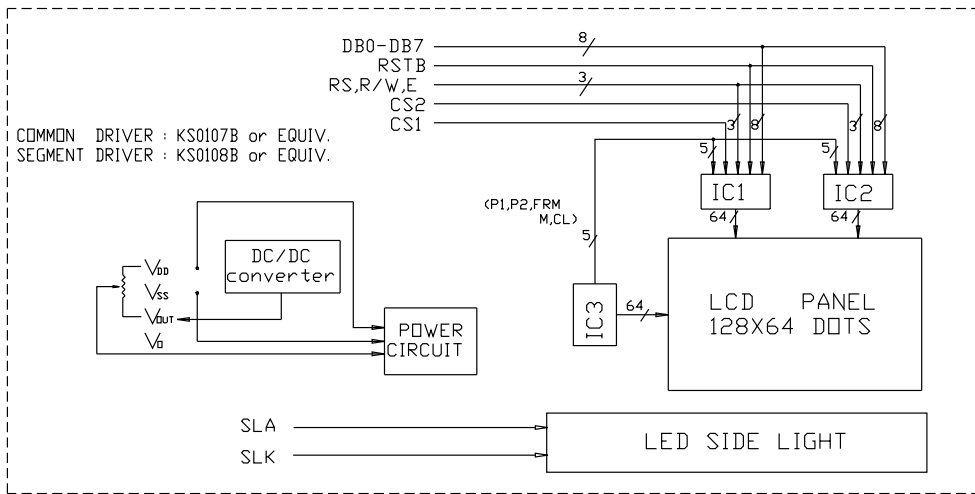
MG12864-27

• **EXTERNAL DIMENSIONS :**



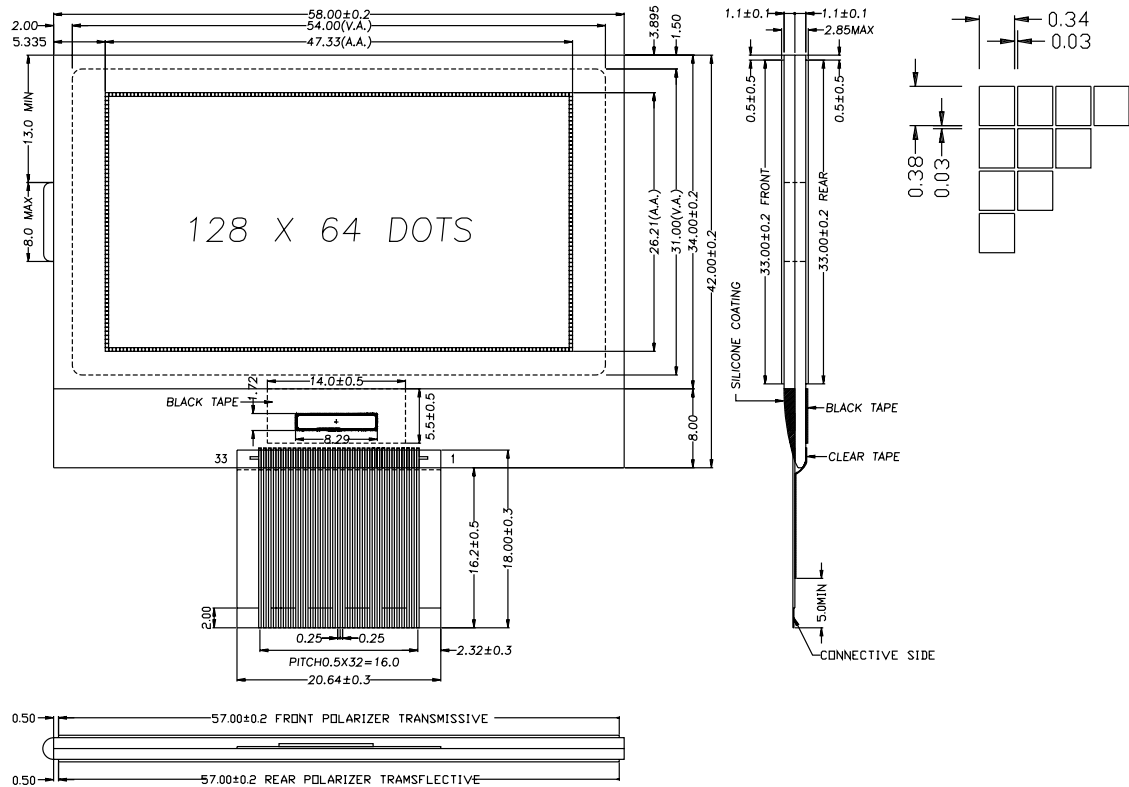
• **BLOCK DIAGRAM :**

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	VO	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	RSTB	VOUT	SLA	SLK



MG12864-29

• EXTERNAL DIMENSIONS :



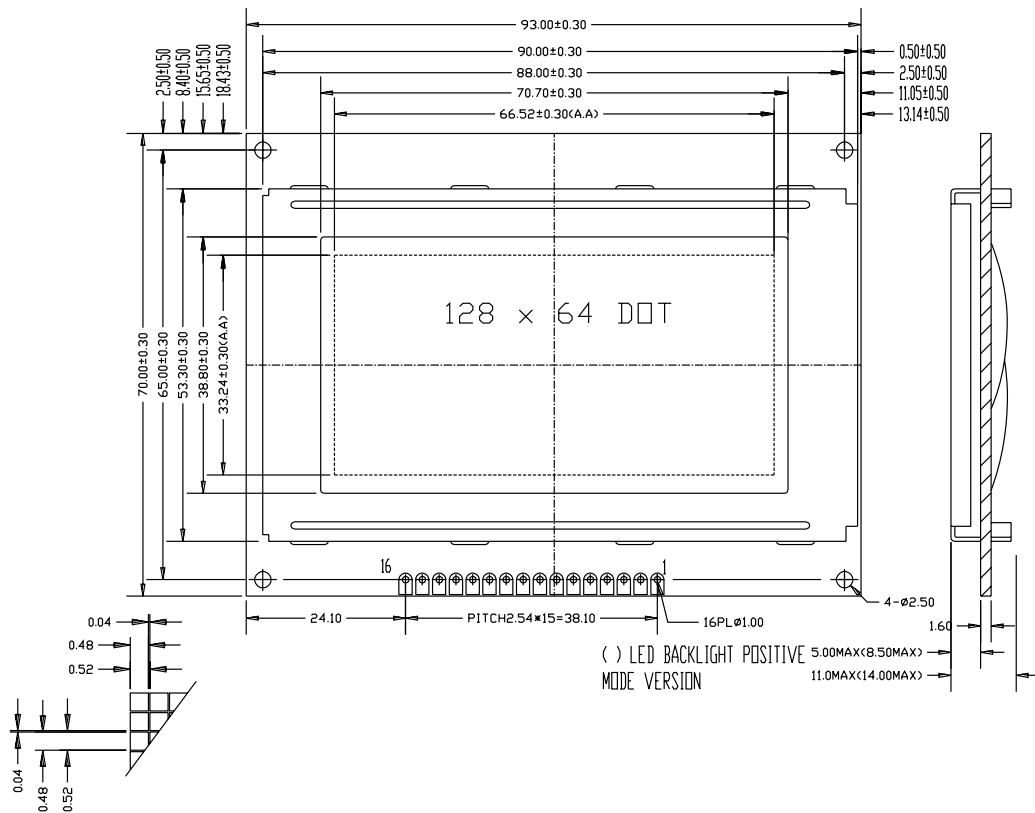
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
NC	NC	CS1	RES	AOP	WR	RD	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	VDD	VSS
18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	
VOUT	C3-	C1+	C1-	C2-	C2+	V1	V2	V3	V4	V5	VR	C86	P/S	IRS	NC	

IC:SPLC501C(COG)

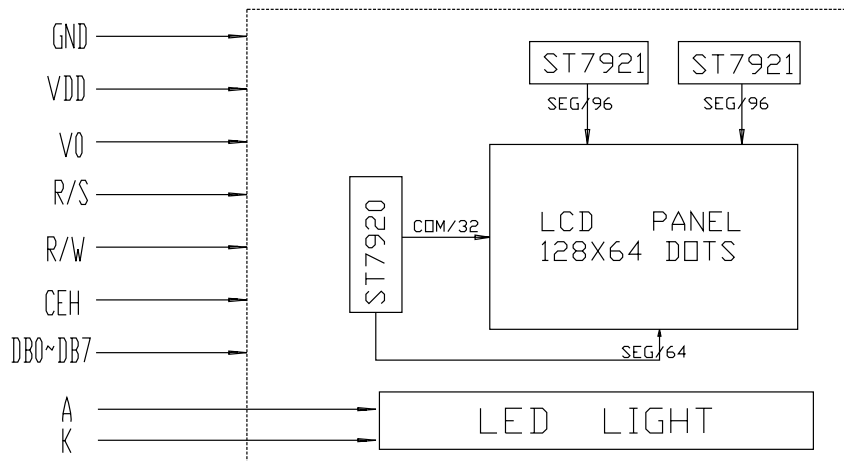
MG12864-32

• EXTERNAL DIMENSIONS :



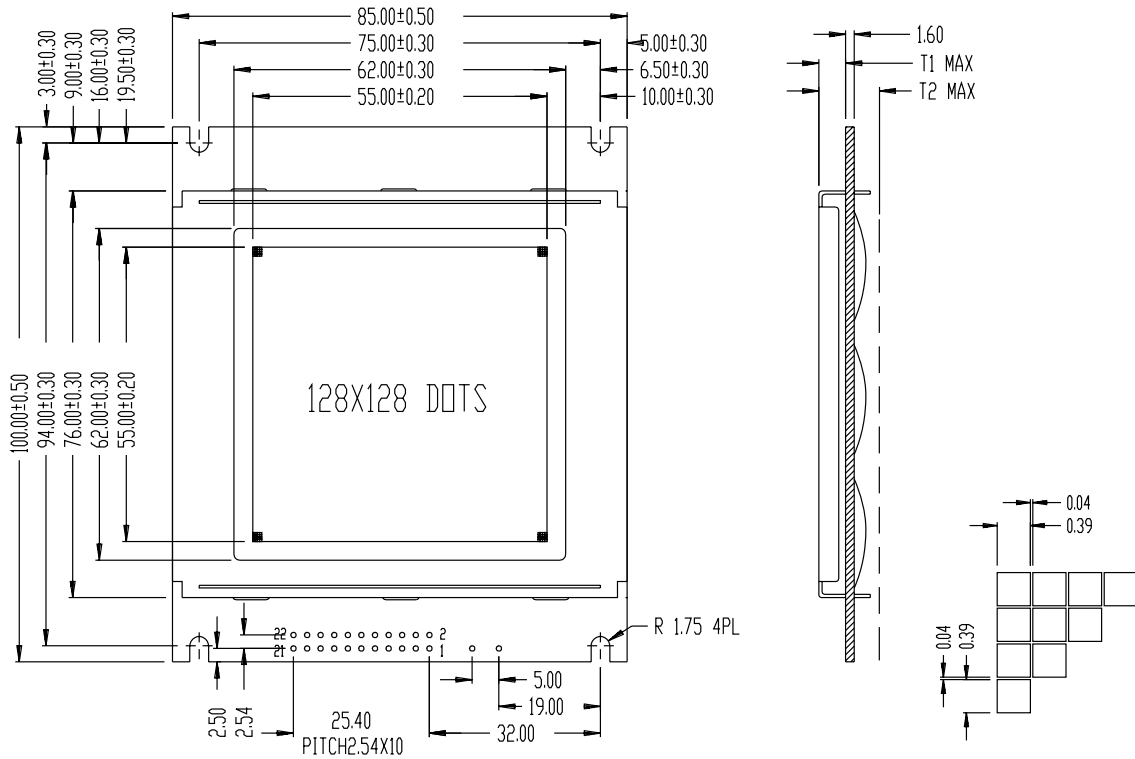
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GND	VDD	V0	R/S	R/W	CEH	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	A	K



MG128128-1

• EXTERNAL DIMENSIONS :

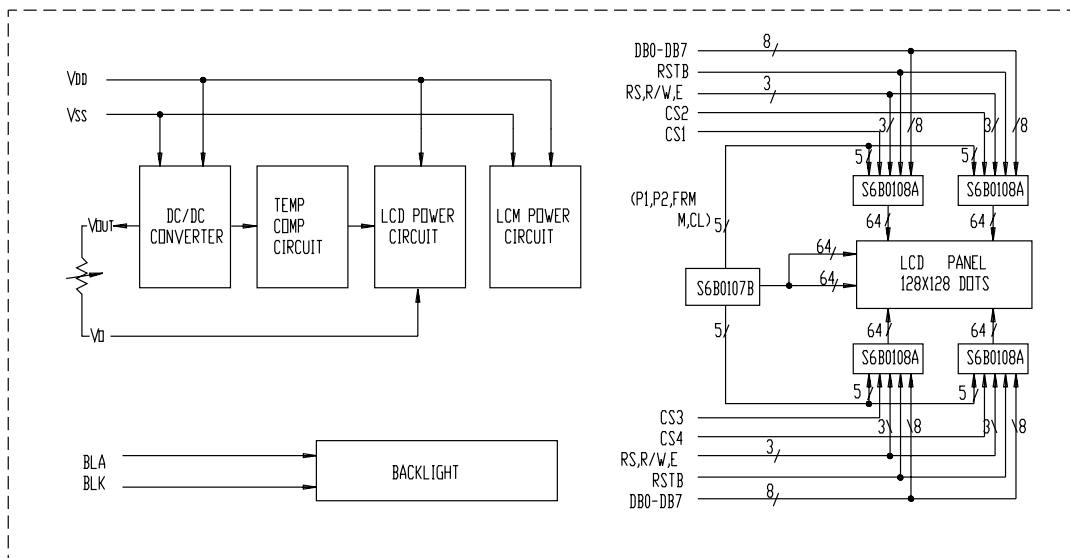


• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
VSS	VDD	VO	RS	R/W	E	RSTB	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	CS3	CS4	VOUT	BLA	BLK

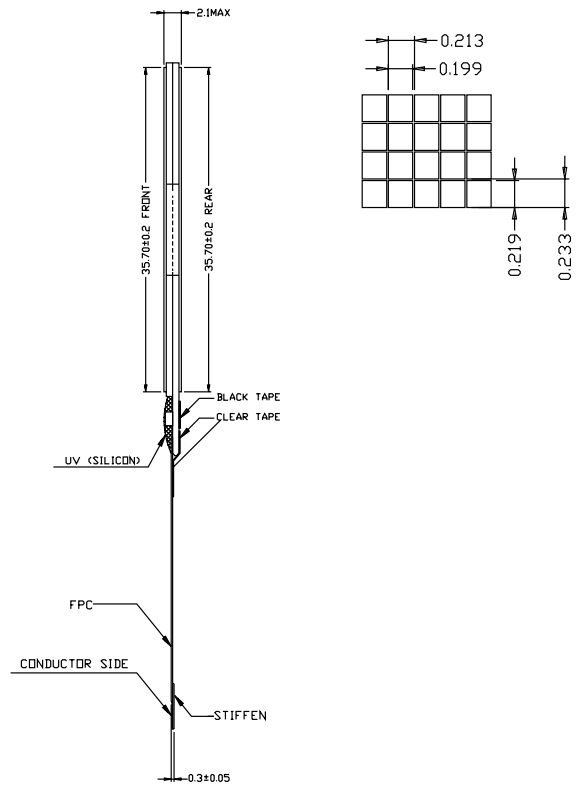
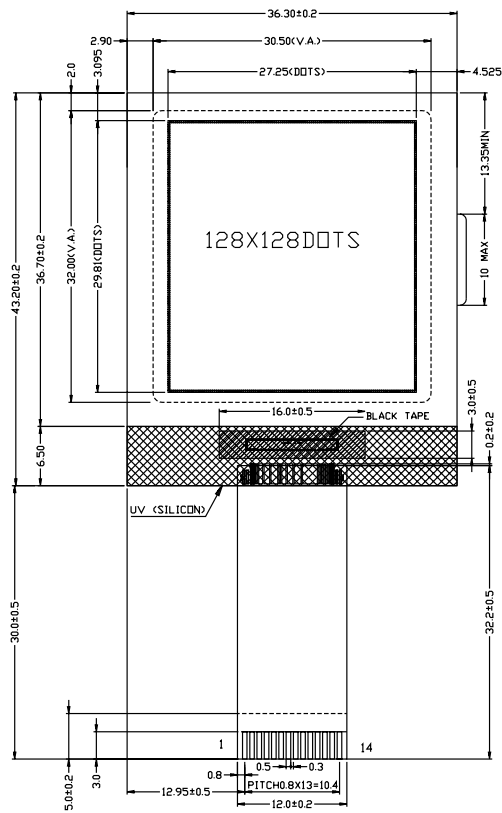
THICKNESS

Version	T1	T2
EL&NO Backlight	5.00	10.00
LED Side Light	7.20	12.50



MG128128-5

• EXTERNAL DIMENSIONS :



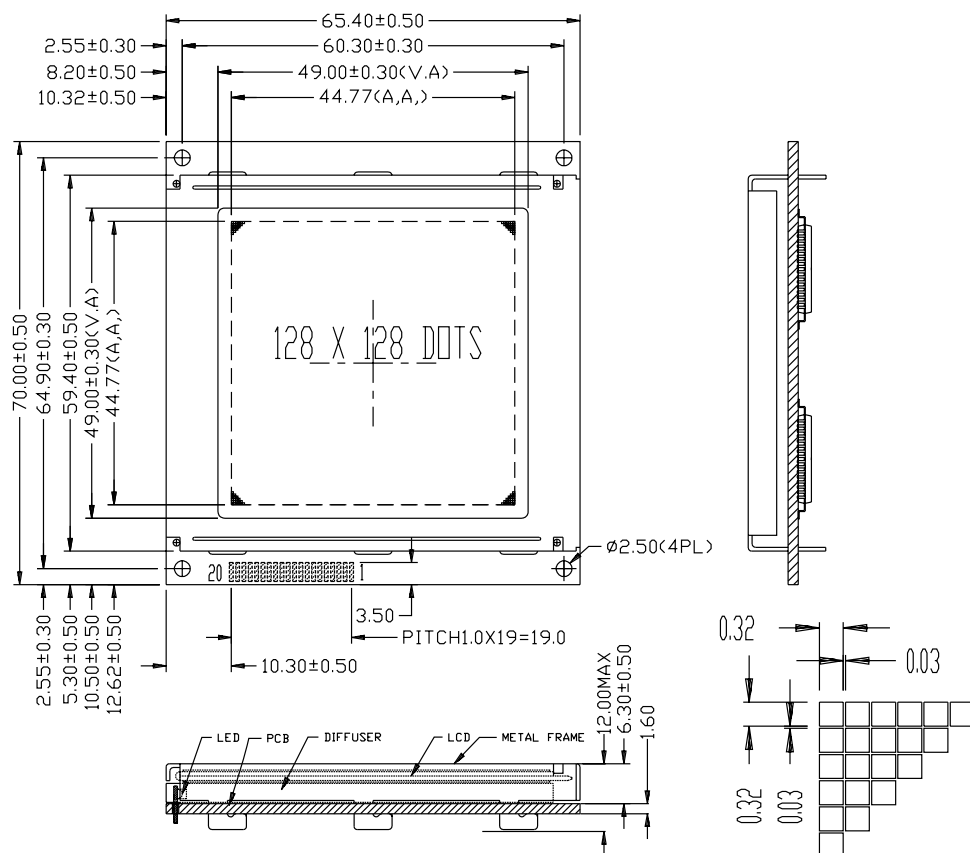
• BLOCK DIAGRAM :

PIN NO	SYMBOL
1	VREF
2	VLCD
3	VB0+
4	VB1+
5	PS0
6	VB1-
7	VB0-
8	VDD
9	VSS
10	CD
11	CSD
12	RESET
13	SDA
14	SCK

1.DRIVER IC :UC1607(CDG)

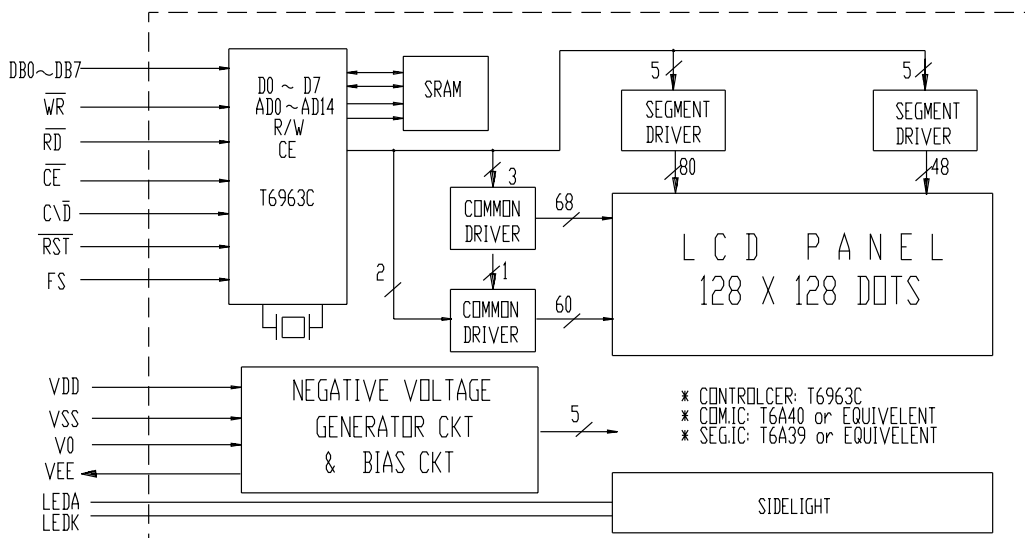
MG128128-14

• EXTERNAL DIMENSIONS :



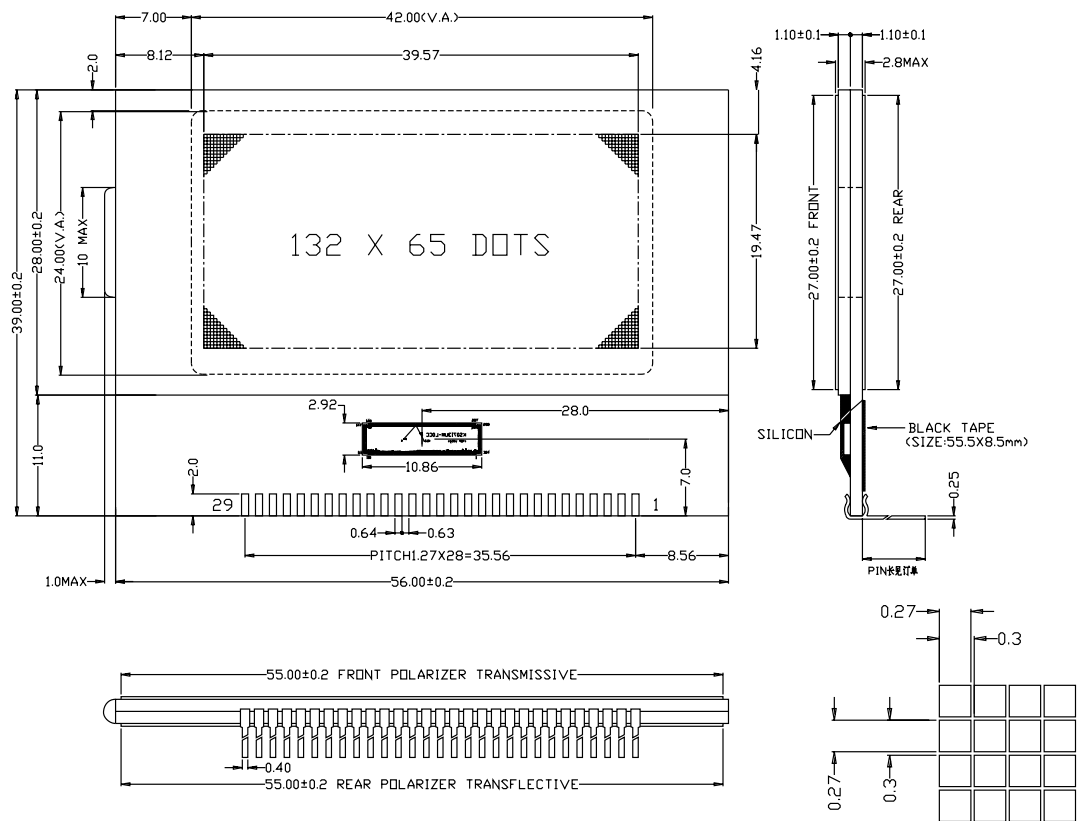
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VSS	VDD	V0	WR	RD	CE	CD	RESET	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	FS	VEE	LEDK	LEDA



MG13265-3

• EXTERNAL DIMENSIONS :



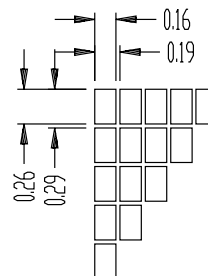
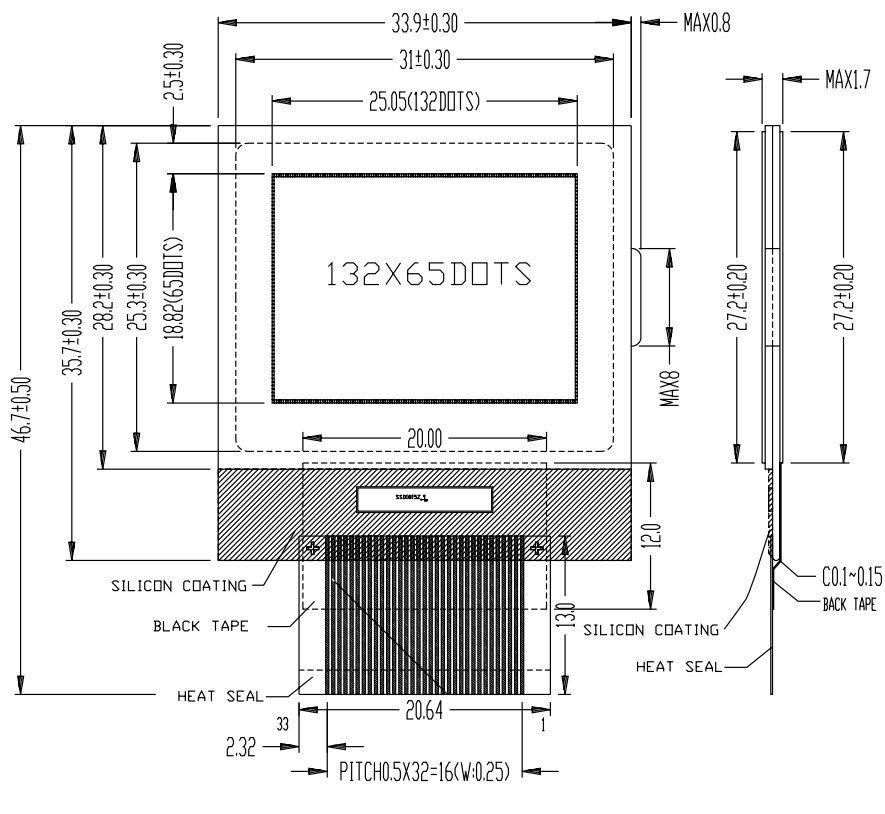
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
CS1B	REST	RS	RW-WR	E_RD	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	MI	VSS	VDD	VOUT	C3+	C3-	C1+	C1-	C2+	C2-	V0	V1	V2	V3	V4	VSS1

IC DRIVER: S6B1713A01-B0CZ(COG)

MG13265-4

• EXTERNAL DIMENSIONS :



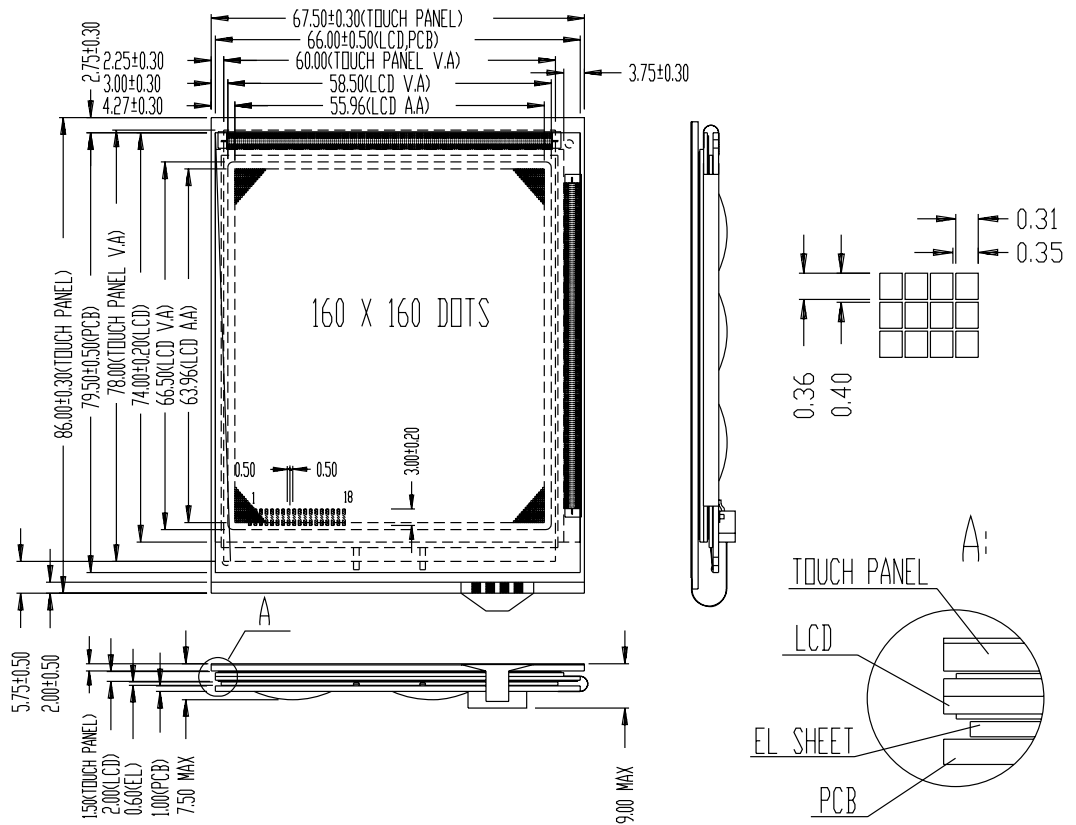
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
NC	CS1	RES	D/C	R/W	E/RD	DO	D1	D2	D3	D4	D5	D6	D7	VDD	VSS	VEE	C3N	C1P	C1N	C2N	C2P	VL2	VL3	VL4	VL5	VL6	VFF	C68/80	P/S	HPM	IRS	NC

IC:SSD1815BZ(COG)

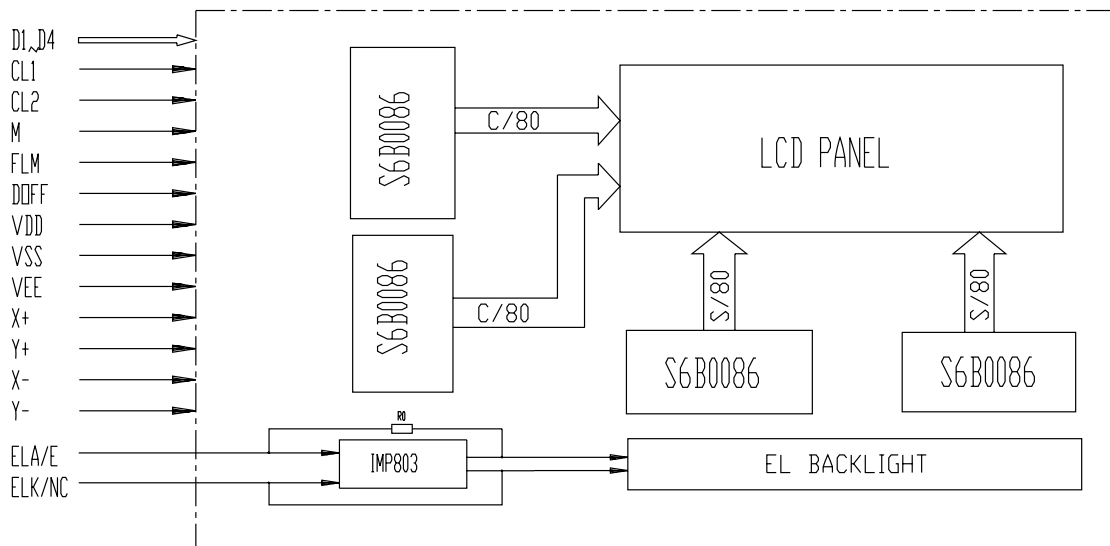
MG160160-2

• EXTERNAL DIMENSIONS :

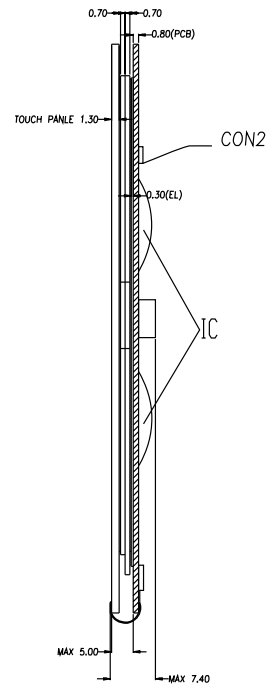


• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
D1	D2	D3	D4	CL1	CL2	M	FLM	DOFF	VDD	VSS	VEE	X+	Y+	X-	Y-	ELA/E	ELK/NC



• EXTERNAL DIMENSIONS :



CON2

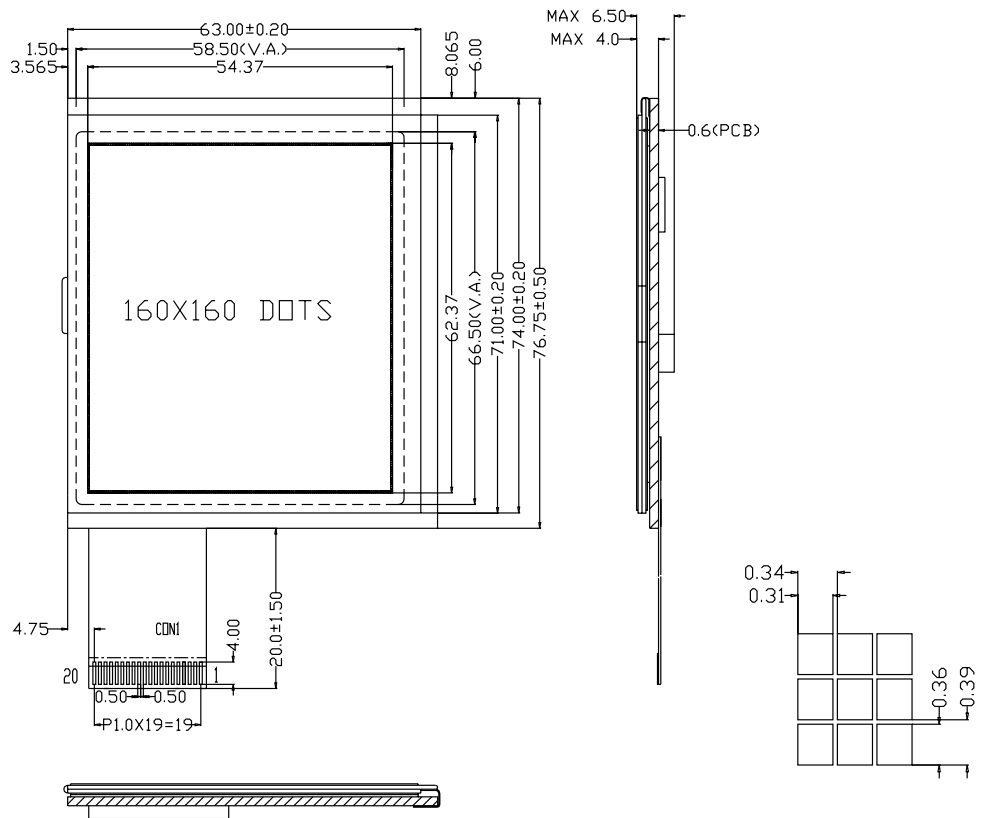
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GND	X2	Y2	X1	Y1	NC	VDD	NC	BUT1	BUT2	BUT3	BUT4	NC	VEE	NC	EL/SW	NC	VDD
19	20	21	22	23	24	25	26	27	28	29	30						
D3	D2	D1	D0	CL2	GND	DOFF	CL1	M	FLM	NC	VDD1						

1	2	3	4
x2	y2	x1	y1



MG160160-5

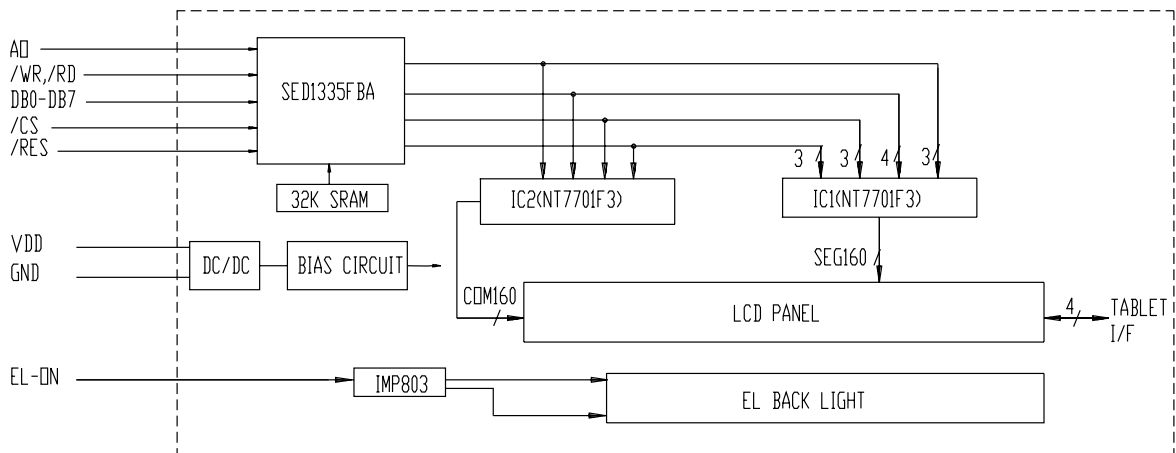
• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

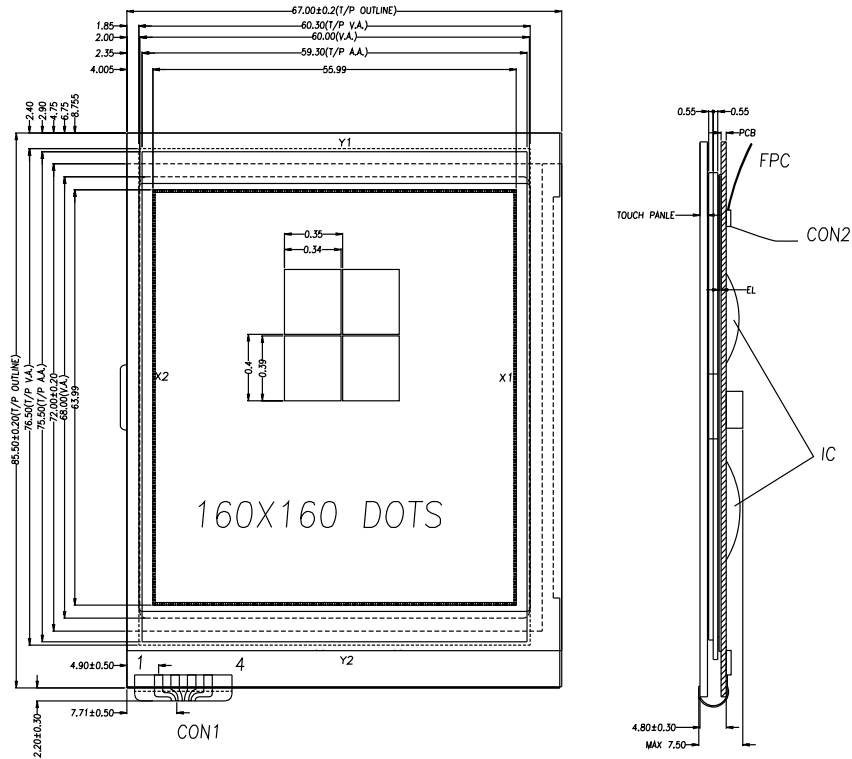
CON1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
VDD	NC	/WR	/RD	/CS	AD	/RES	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	GND	NC	NC	EL_ON	NC



MG160160-6

• EXTERNAL DIMENSIONS :



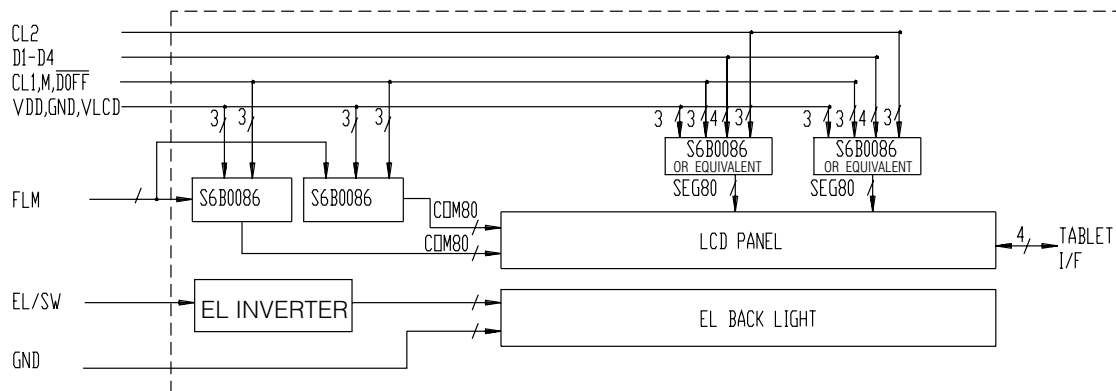
• BLOCK DIAGRAM :

CON1

1	2	3	4
X2	Y2	X1	Y1

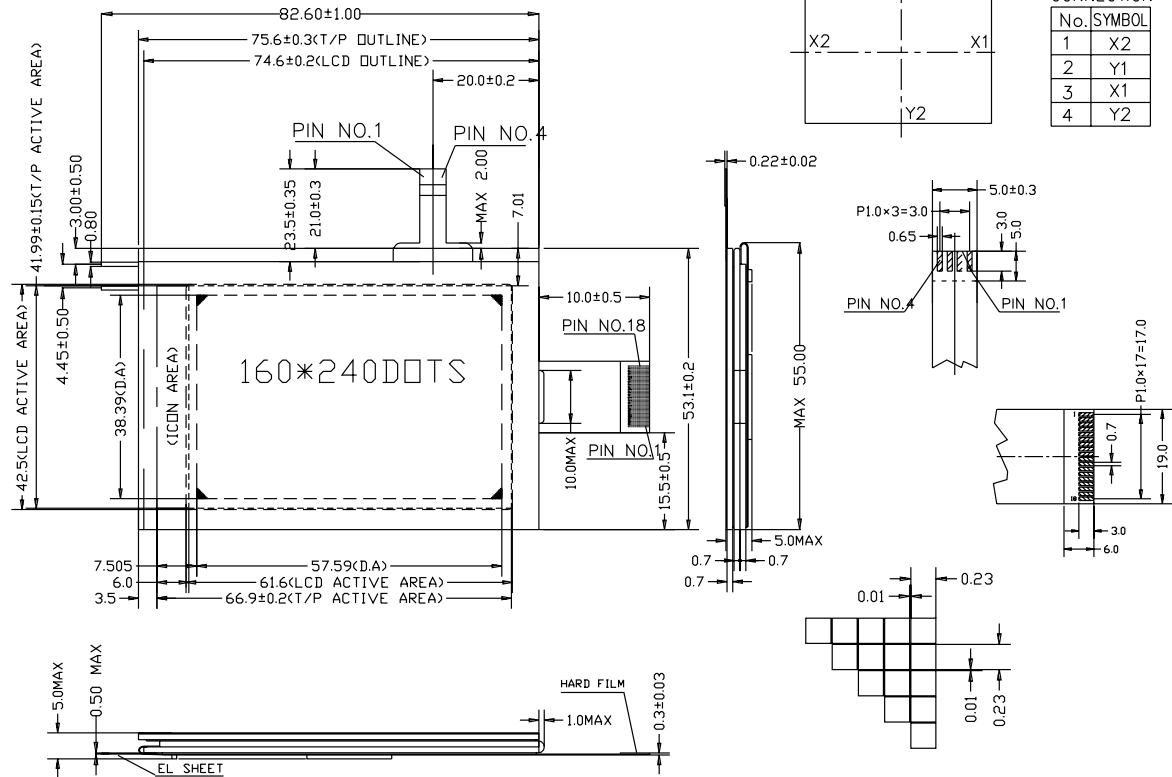
CON2

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GND	X2	Y2	X1	Y1	NC	VDD	LCDDN	NC	NC	NC	NC	VREF	VLCD	FB	EL/SW	NC	VDD
19	20	21	22	23	24	25	26	27	28	29	30						
D4	D3	D2	D1	CL2	GND	DOFF	CL1	M	FLM	NC	VDD						



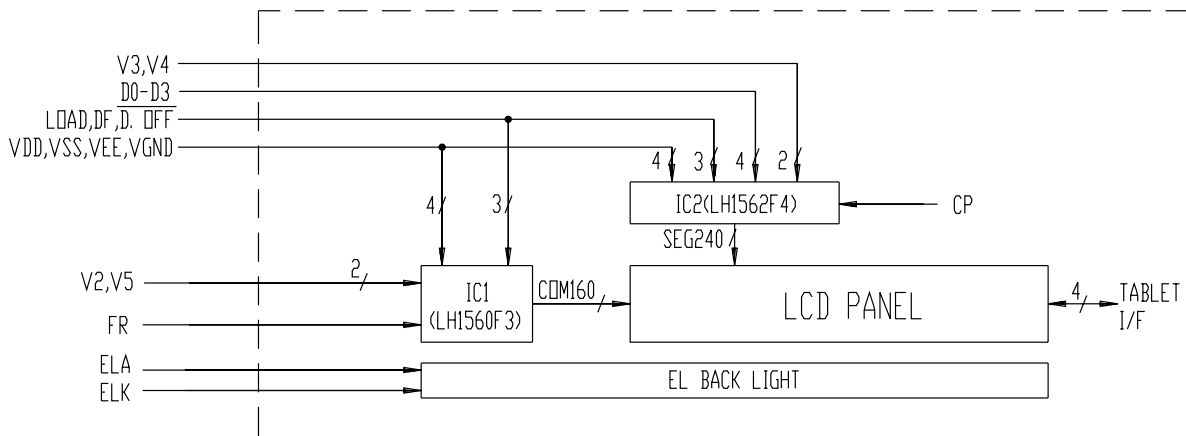
MG160240-1

• EXTERNAL DIMENSIONS :



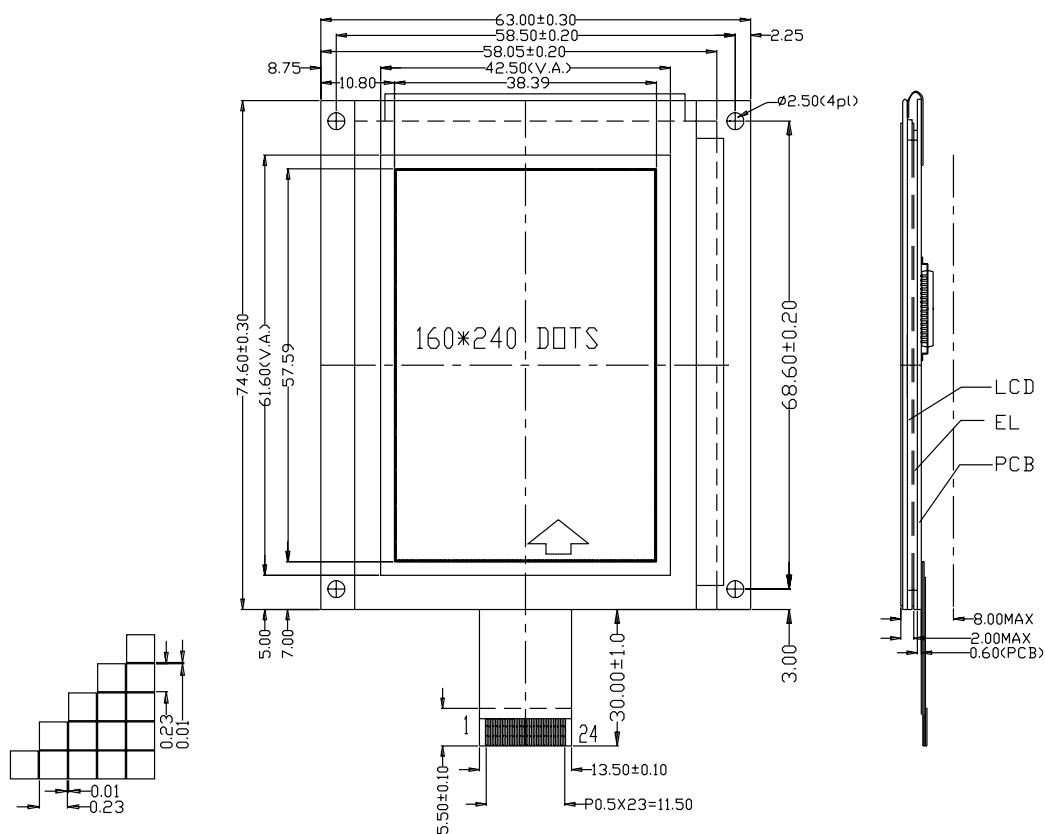
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
V ₅	V ₂	V _{EE}	V _{DD}	FR	V _{GND}	LOAD	V _{SS}	DF	D.OFF	CP	V ₄	V ₃	D ₃	D ₂	D ₁	D ₀	NC



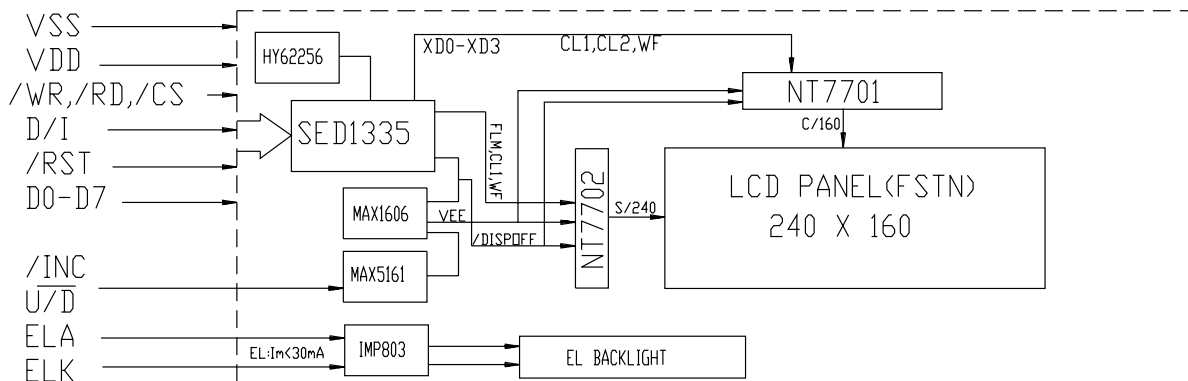
MG160240-2

• EXTERNAL DIMENSIONS :



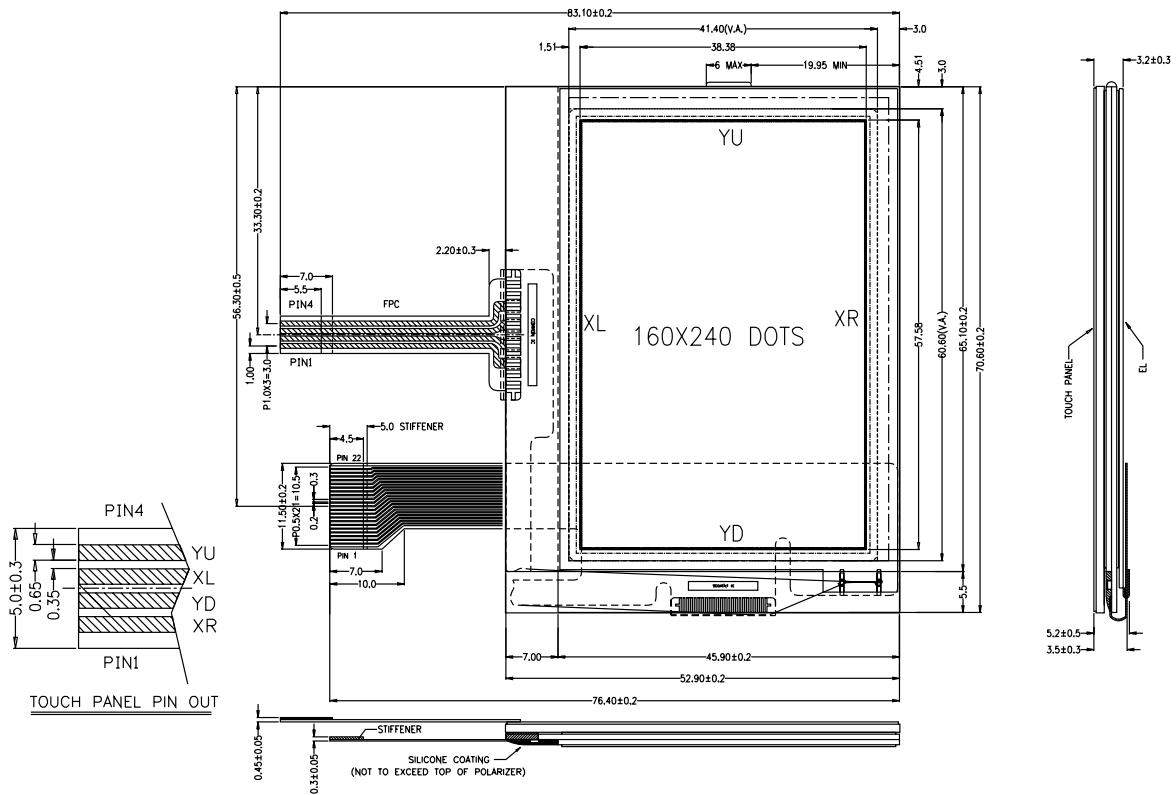
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
VSS	VDD	/WR	/RD	/CS	D/I	/RST	D0	D1	D2	D3	D4	D5	D6	D7	/INC	U/D	NC	ELA	ELK	NC	NC	NC	NC



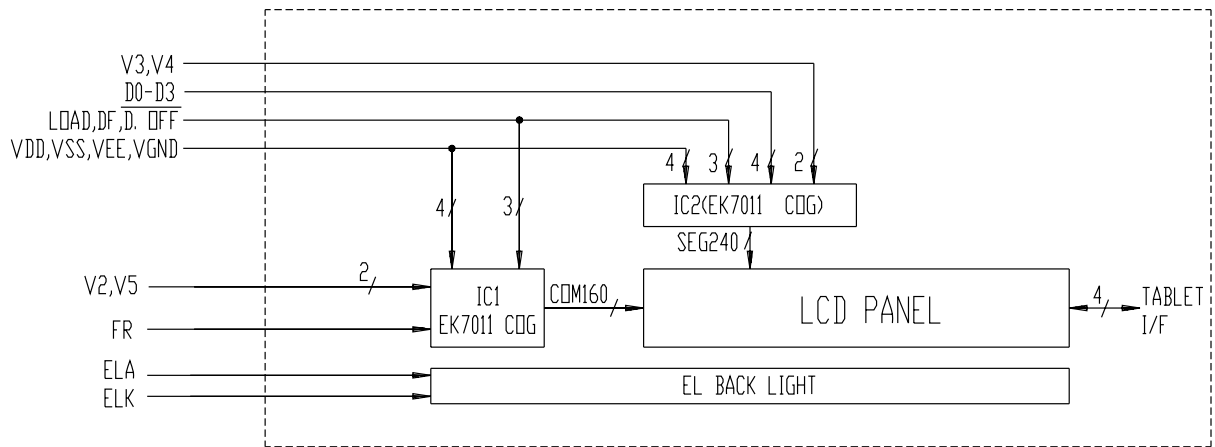
MG160240-6

• EXTERNAL DIMENSIONS :



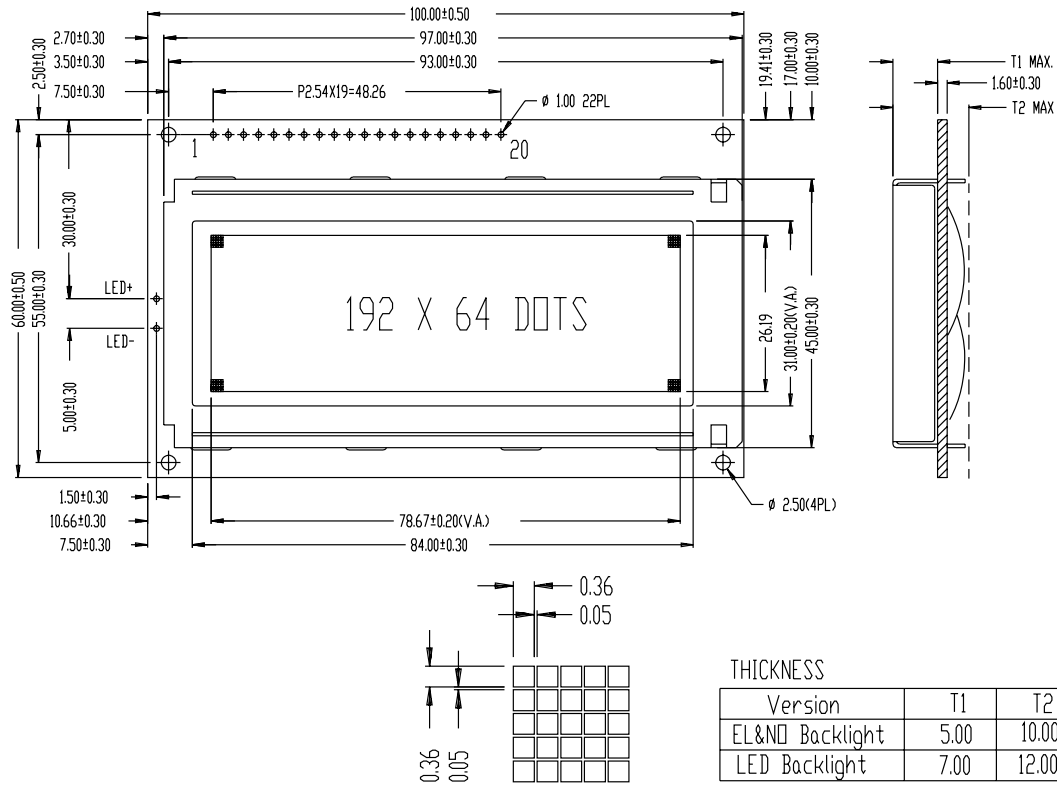
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
V _S	V ₂	V _{EE}	V _{DD}	FR	V _{GND}	LOAD	V _{SS}	DF	D.OFF	CP	V ₄	V ₃	D ₃	D ₂	D ₁	D ₀	V _{GND}	V _{SS}	EL-	V _{SS}	EL+



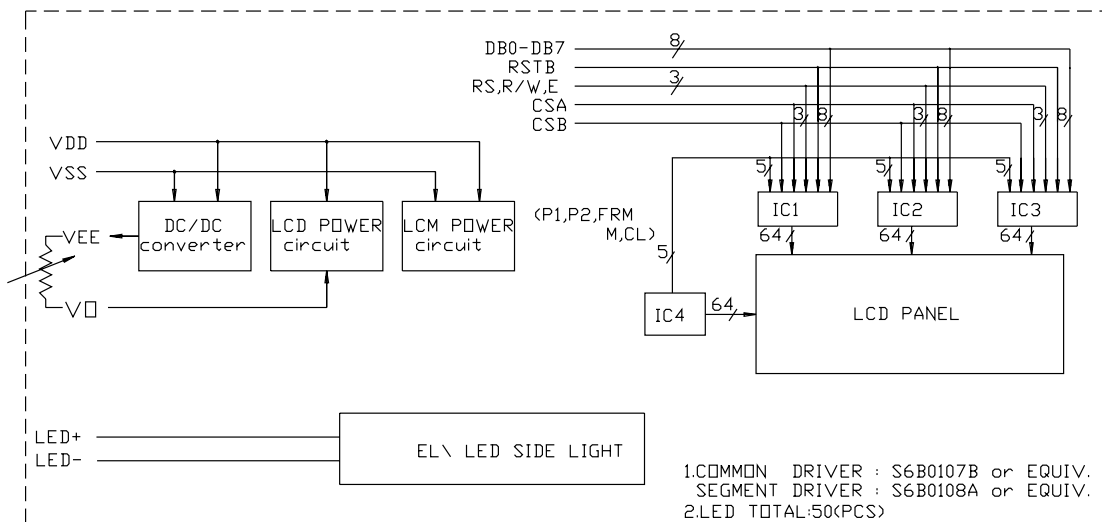
MG19264-1

• EXTERNAL DIMENSIONS :



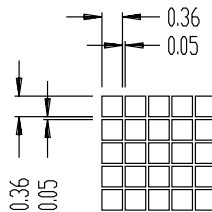
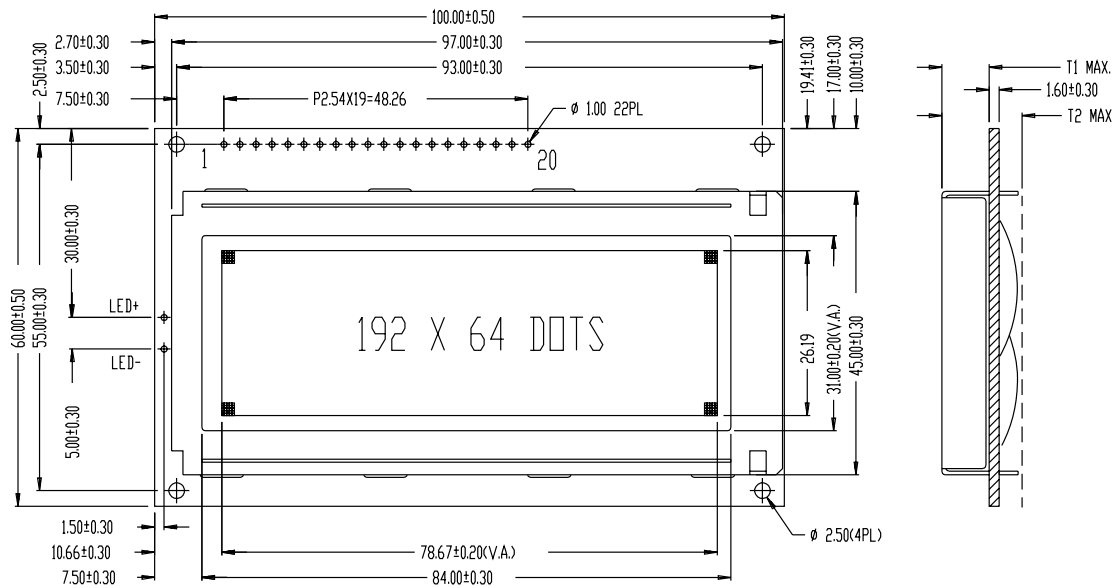
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	E	R/W	RS	VO	VDD	VSS	CSB	CSA	VOUT	RSTB	LED+	LED-



MG19264-2

• EXTERNAL DIMENSIONS :

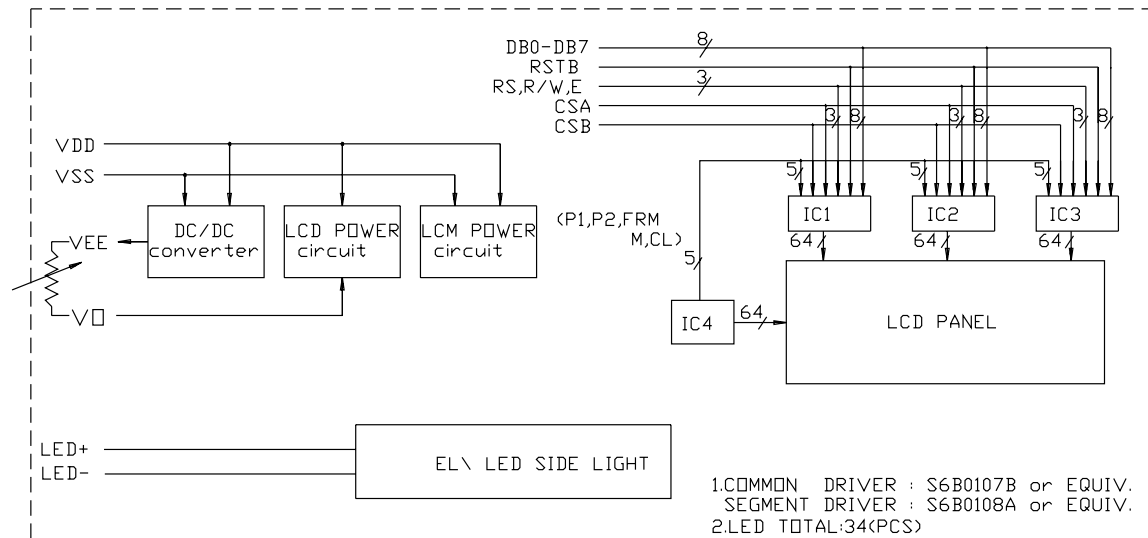


THICKNESS

Version	T1	T2
EL&NO Backlight	5.00	10.00
LED Backlight	7.00	12.00

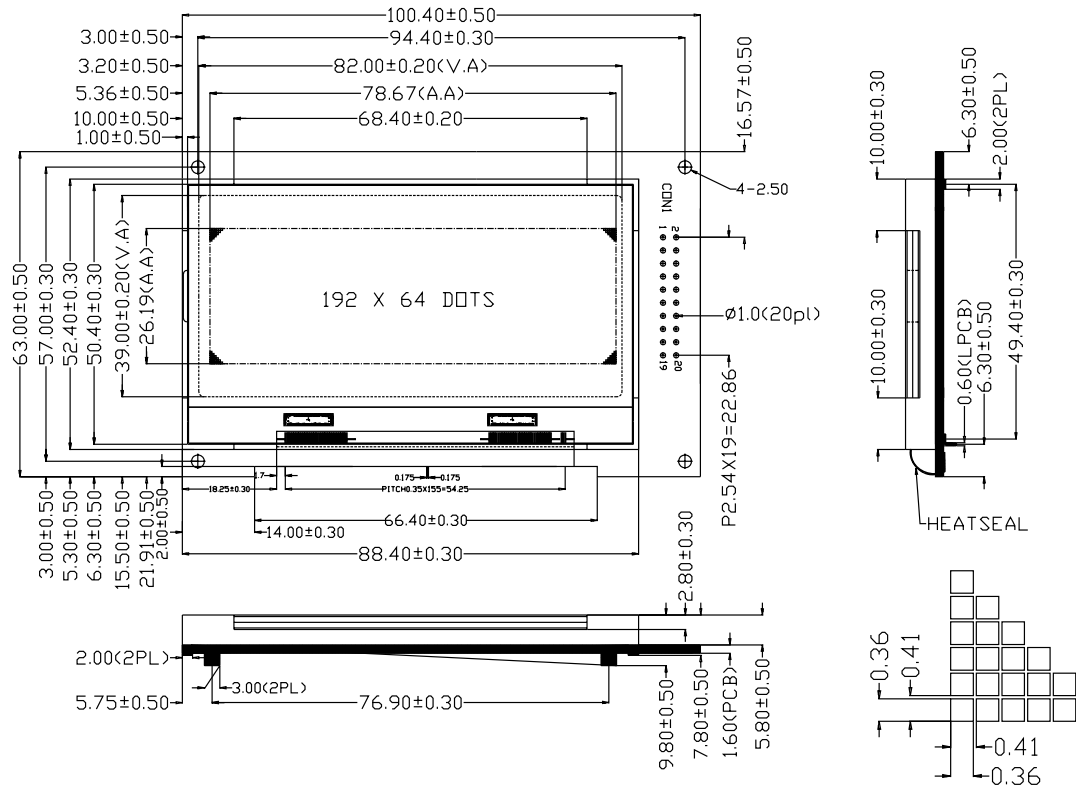
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	E	R/W	RS	VO	VDD	VSS	CSB	CSA	VDOUT	RSTB	LED+	LED-



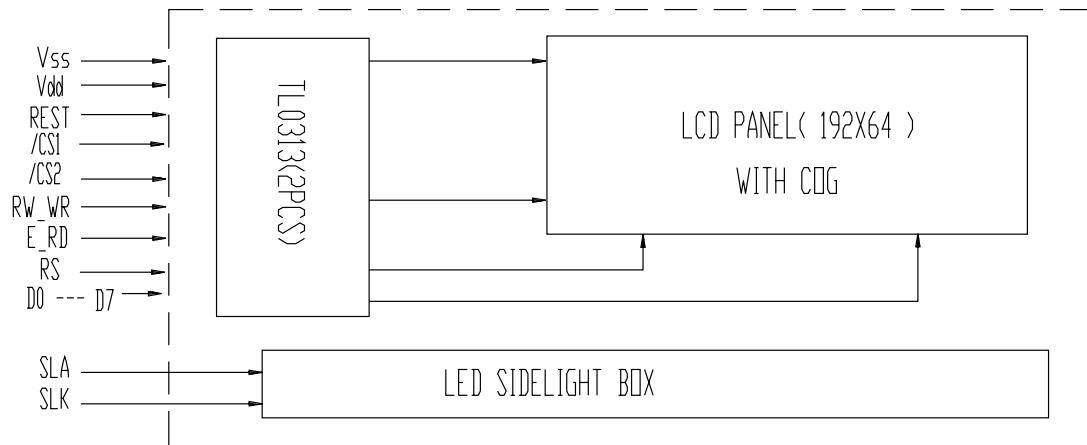
MG19264-6

• EXTERNAL DIMENSIONS :



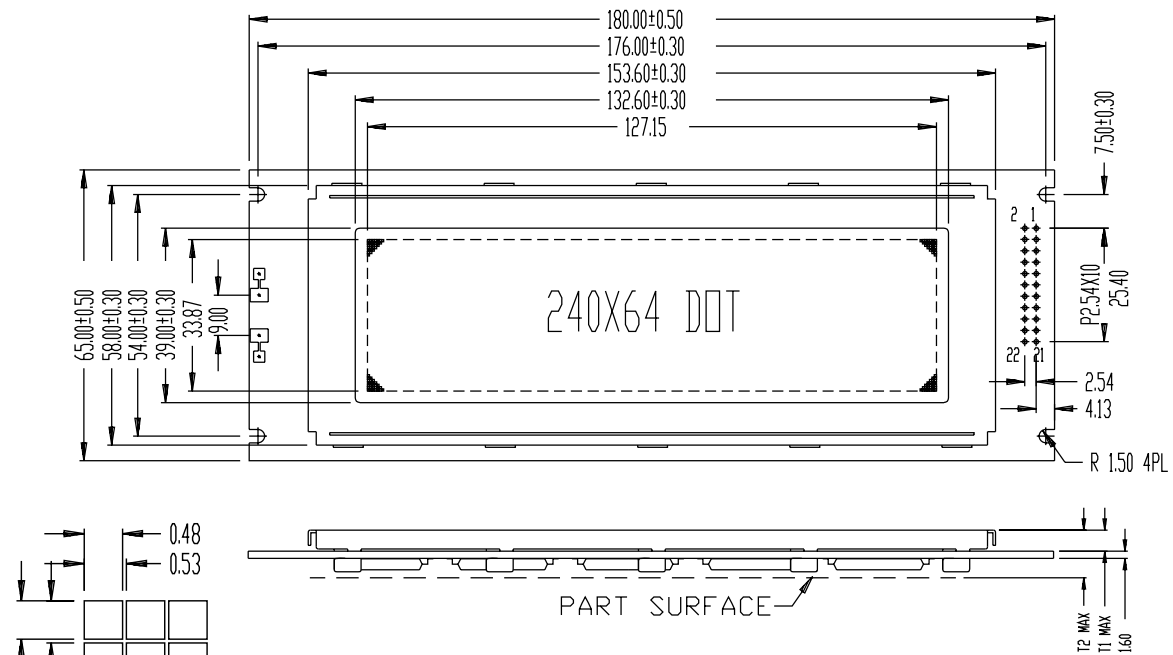
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0	E_RD	RW_WR	RS	NC	Vdd	Vss	CS1	CS2	NC	REST	SLA	SLK



MG24064-2

• EXTERNAL DIMENSIONS :

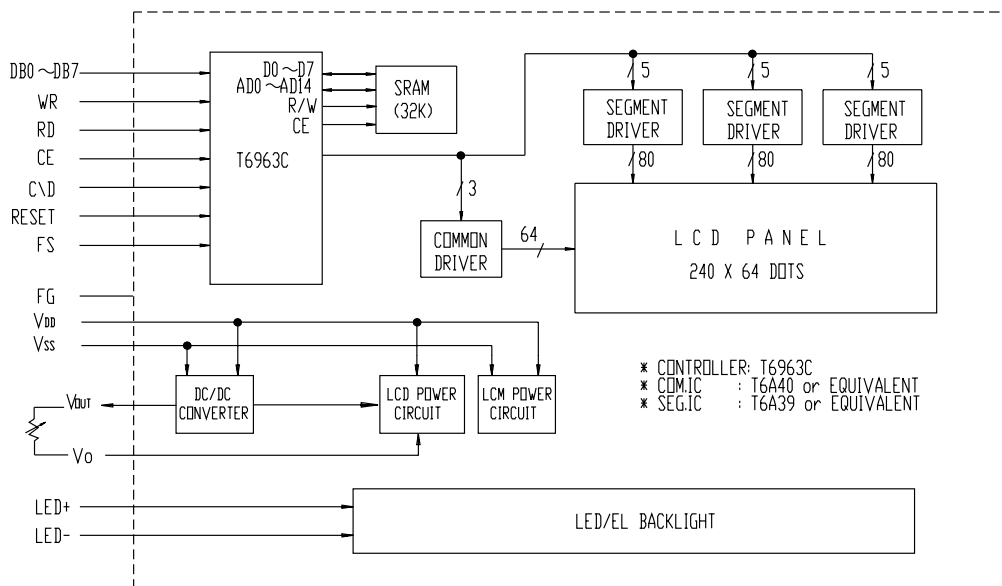


THICKNESS

Version	T1	T2
EL&ND Backlight	5.00	10.00
LED Side Light	7.50	12.50

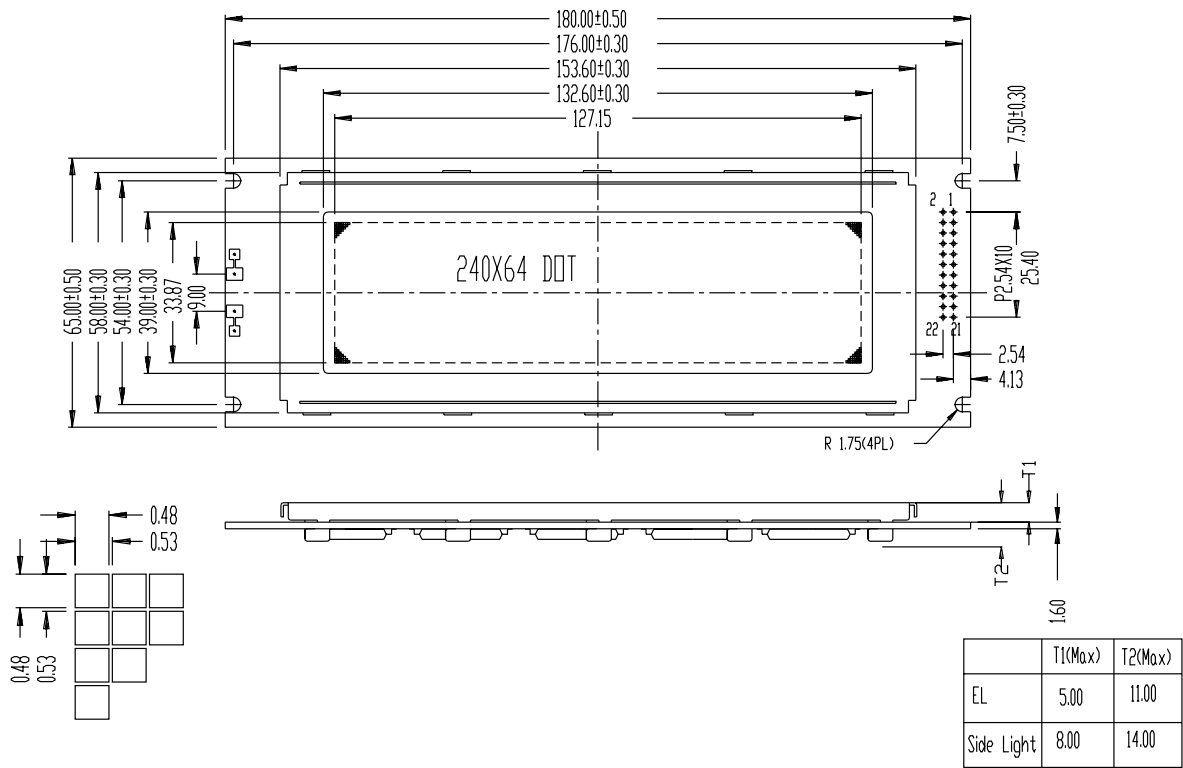
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
FG	Vss	VDD	Vo	WR	RD	CE	C/D	NC	RESET	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	FS	Vout	LED+	LED-



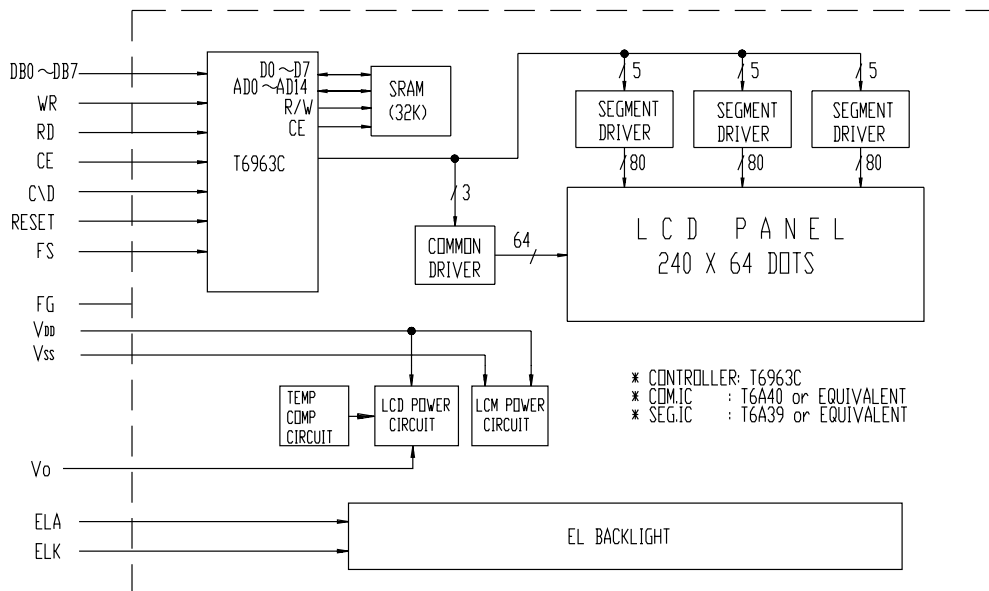
MG24064-6

• EXTERNAL DIMENSIONS :



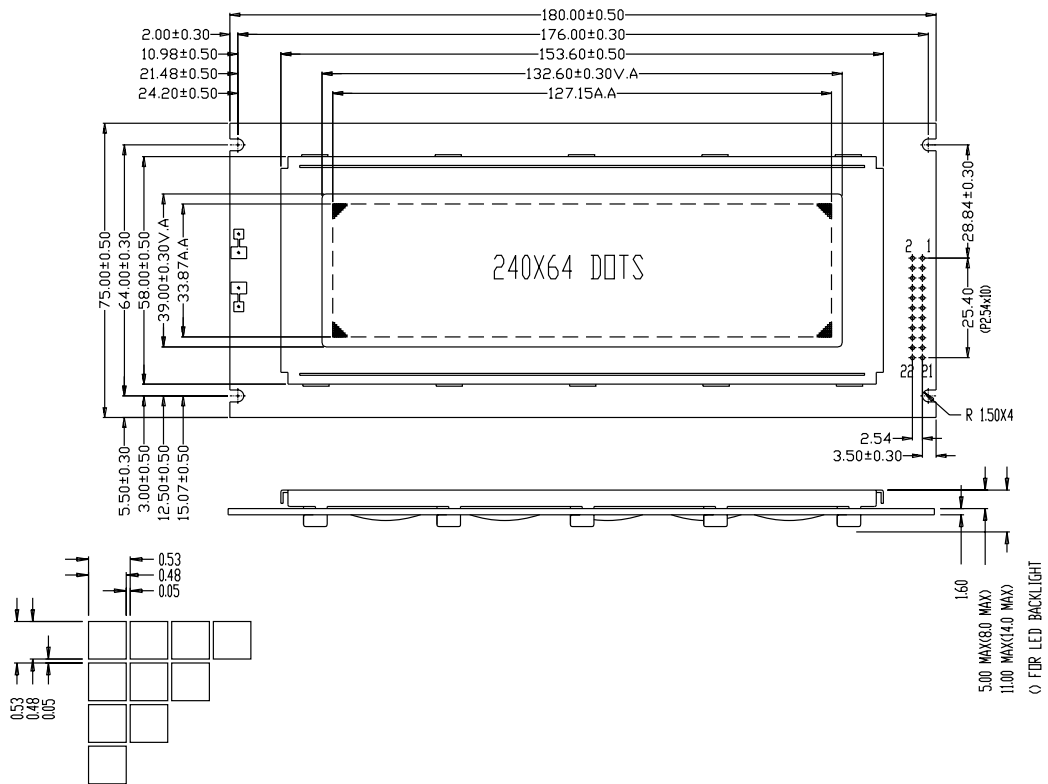
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
FG	V _{SS}	V _{DD}	V _O	WR	RD	CE	C/D	NC	RESET	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	FS	NC	ELA	ELK



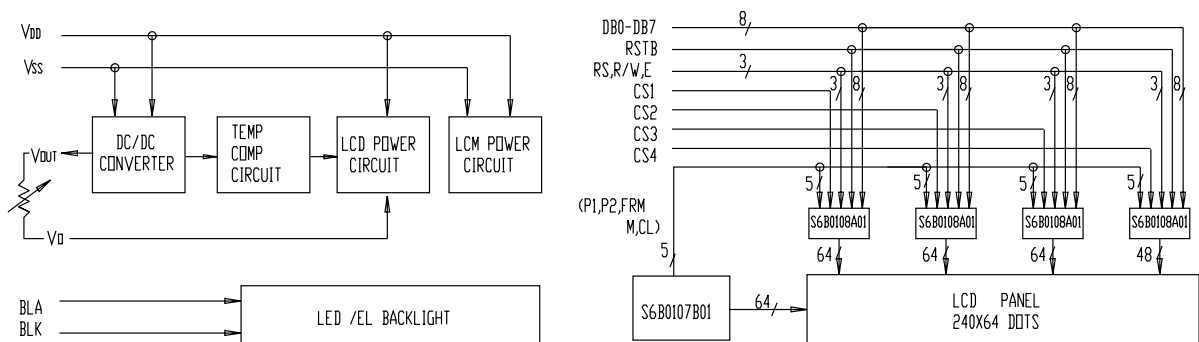
MG24064-13

• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
VSS	VDD	VO	RS	R/W	E	RSTB	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	CS1	CS2	CS3	CS4	VOUT	BLA	BLK



NOTES: 1. Operating Temperature -20° C TO 70° C
Storage Temperature -30° C TO 80° C
2. Polarizer Type : R ☐ F ☒ T ☐

• **EXTERNAL DIMENSIONS :**

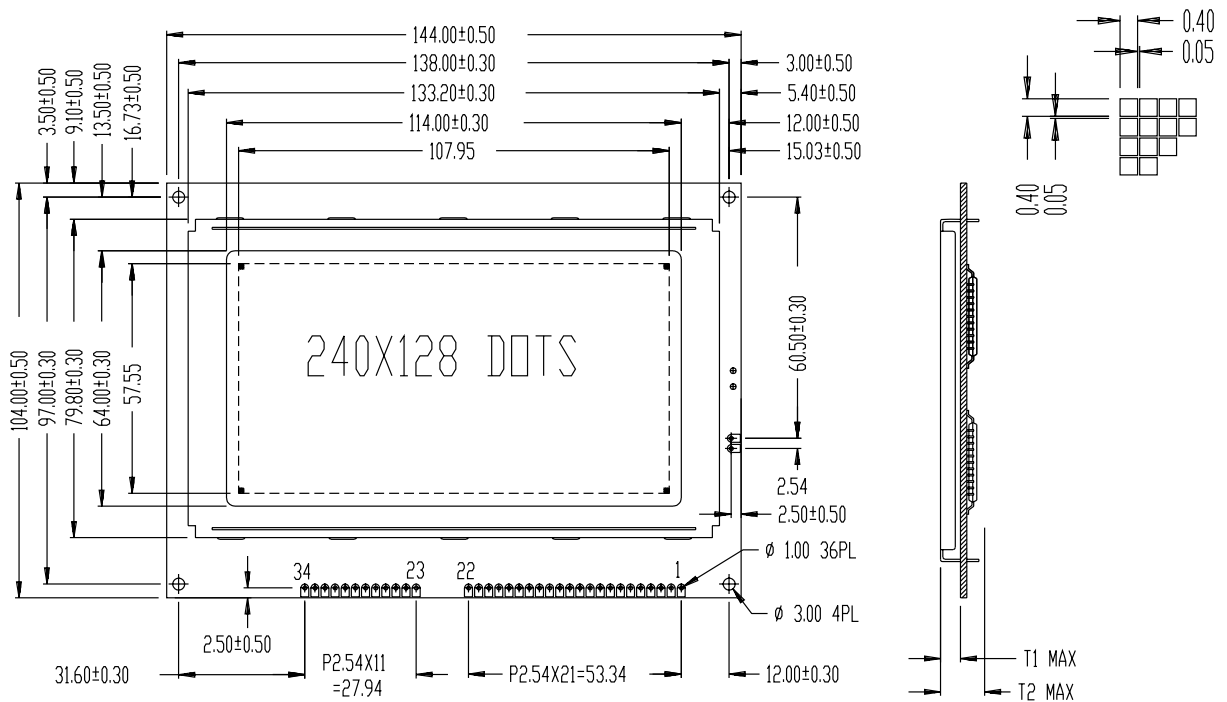


1	2	3	4
VFL1	NC	NC	VFL2



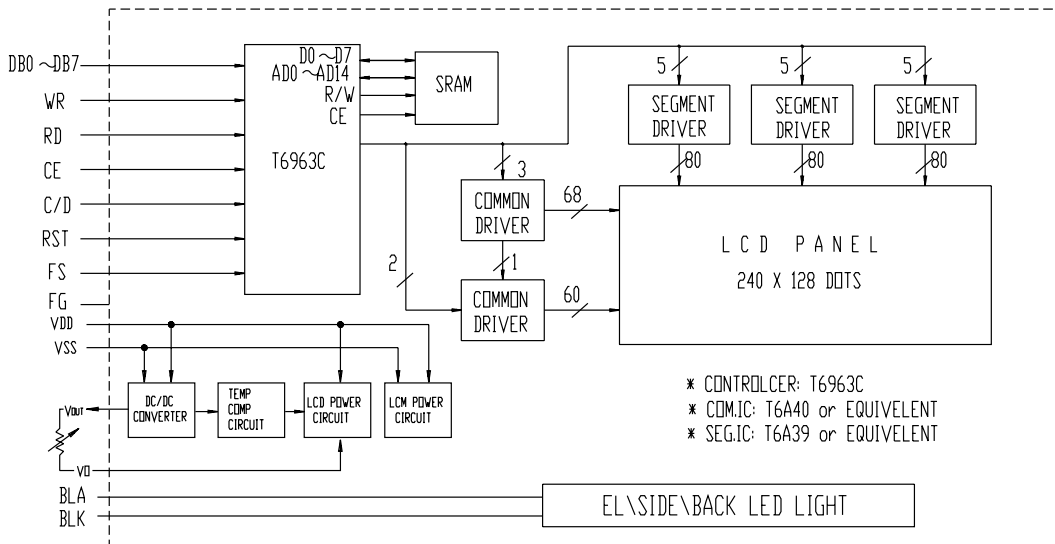
MG240128-3

• EXTERNAL DIMENSIONS :



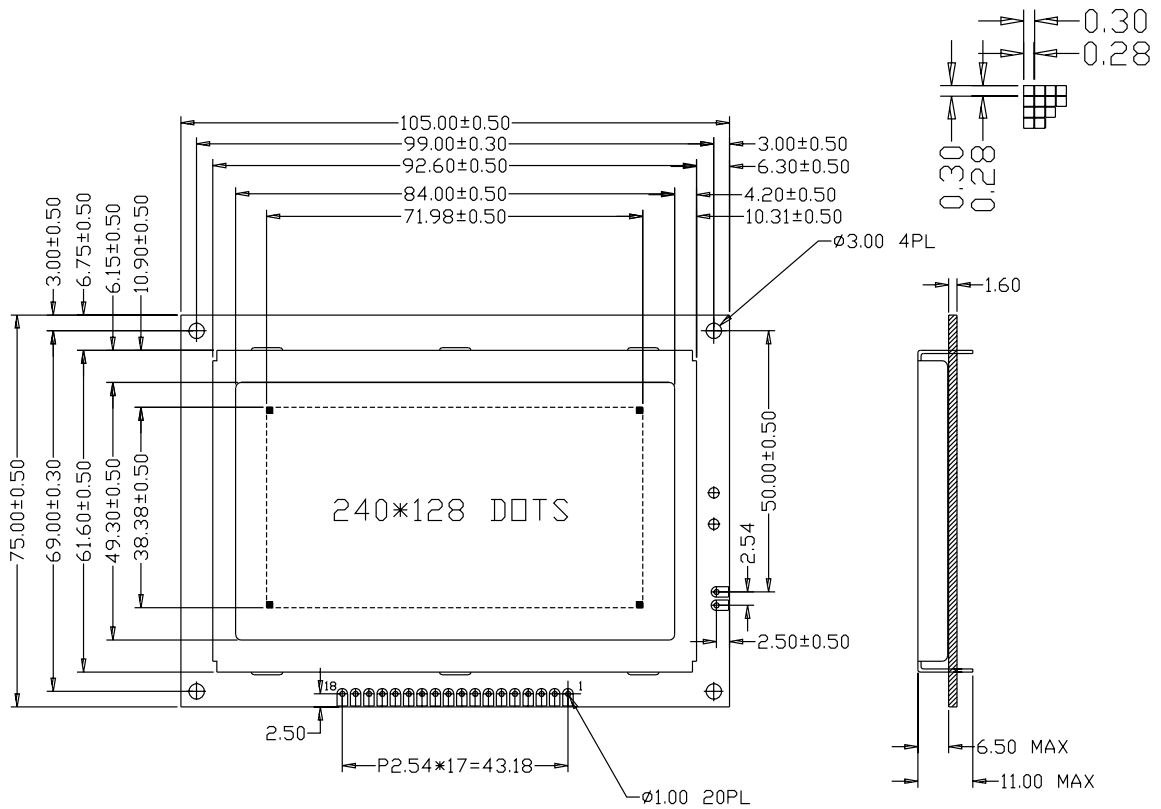
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
FG	VSS	VDD	VO	WR	RD	CE	C/D	NC	RST	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	FS	VDUT	BLA	BLK	ED	C/DATA	FR	LP	HSCP	NC	VDD	VSS	VO	VDUT	BLA	BLK



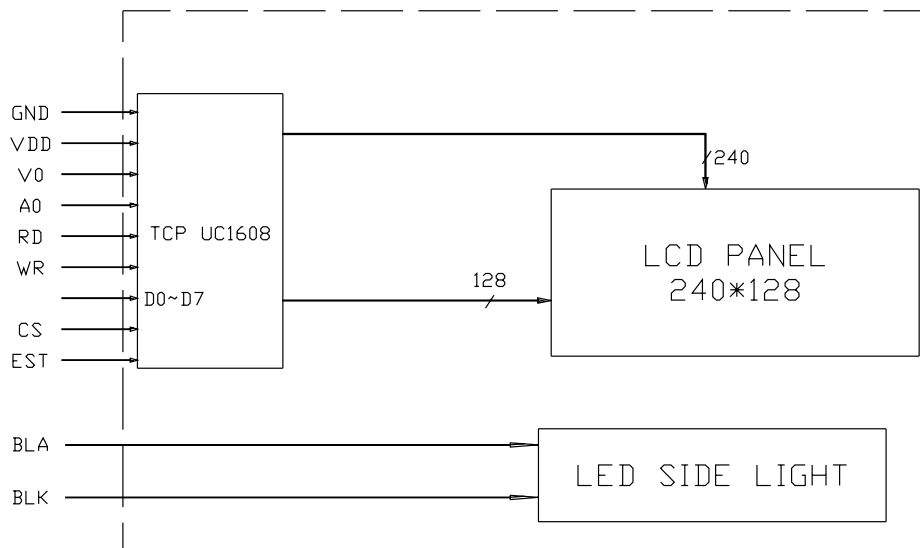
MG240128-5

• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
GND	VDD	V0	A0	RD	WR	D0	D1	D2	D3	D4	D5	D6	D7	CS	RST	BLA	BLK



• **EXTERNAL DIMENSIONS :**

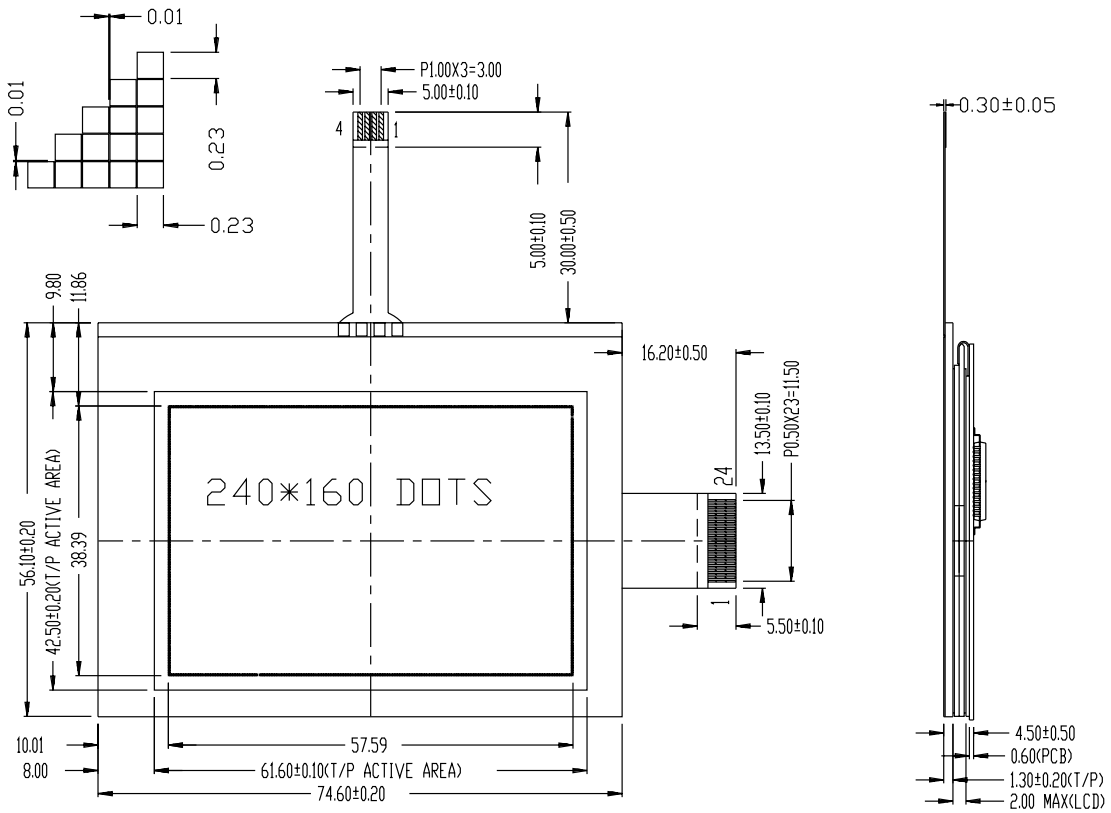


Block diagram of the T6963C LCD controller system:

- Inputs to T6963C:** DB0~DB7, WR, RD, HSC, PED, FR, CD, DATA, CE, C/D, RST, FS, FG, VDD, VSS, VOUT, VD.
- Outputs from T6963C:**
 - DO~D7, AD0~AD14, R/W, CE to SRAM.
 - Signal to COMMON DRIVERX2.
 - Signal to SEGMENT DRIVERX3.
- COMMON DRIVERX2:** Connected to LCD PANEL via C128.
- SEGMENT DRIVERX3:** Connected to LCD PANEL via S240.
- LCD PANEL:** 240 X 128 DOTS.
- POWER CIRCUIT:** Connected to VDD, VSS, VOUT, and VD. Outputs 6V to LSI.
- LED BACKLIGHT:** Connected to SLA and SLK.
- Component Specifications:**
 - * CONTROL IC: T6963C
 - * COM. IC: S6B0086X01-COCX
 - * SEG. IC: S6B0086X01-COCX

MG240160-1

• EXTERNAL DIMENSIONS :



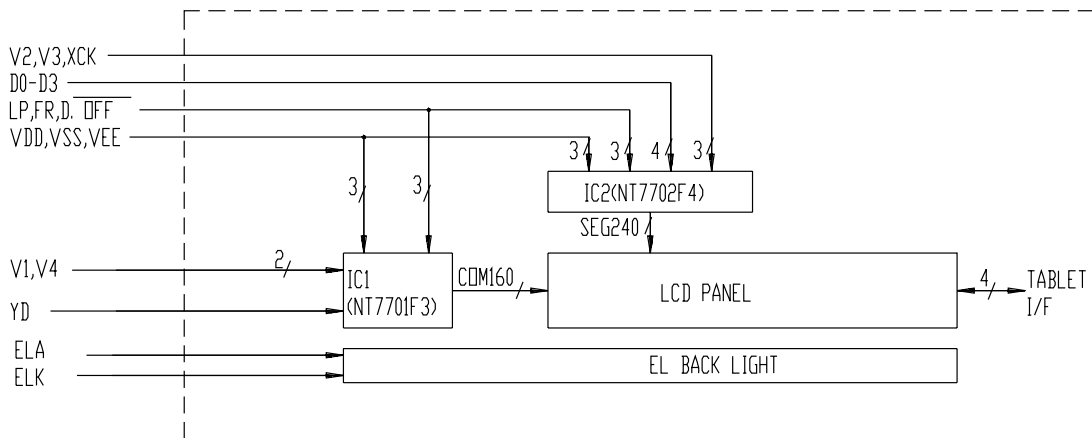
• BLOCK DIAGRAM :

CON1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
NC	NC	GND	NC	VDD	NC	VEE	NC	LP	XCK	YD	FR	D.OFF	DB0	DB1	DB2	DB3	NC	X2	Y1	X1	Y2	ELA	ELK

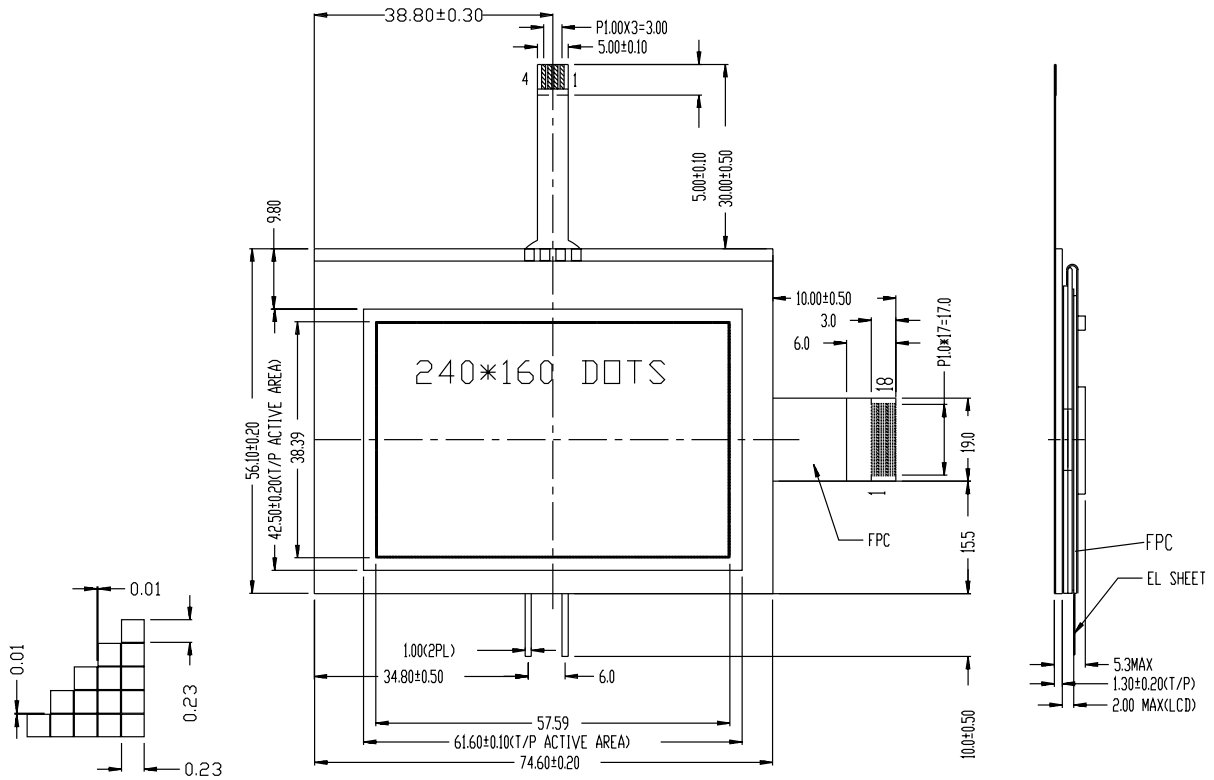
CON2

1	2	3	4
X2	Y1	X1	Y2



MG240160-2

• EXTERNAL DIMENSIONS :



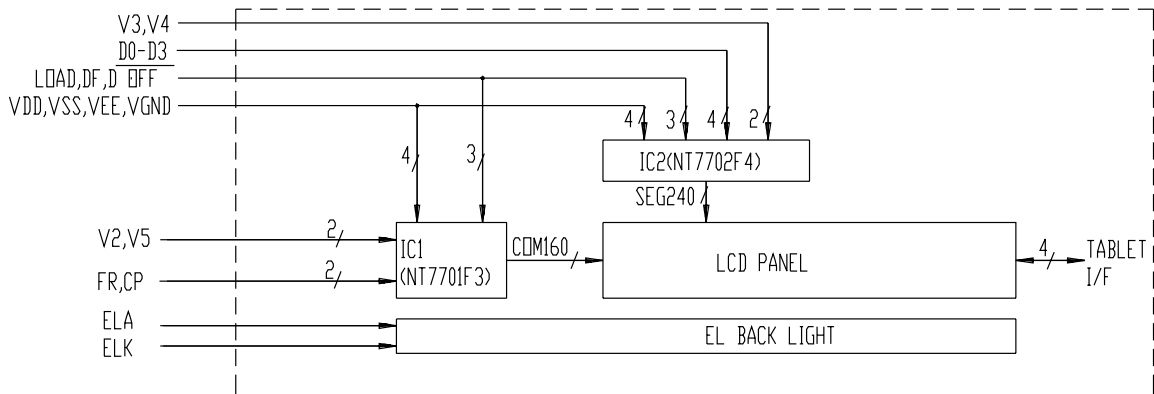
• BLOCK DIAGRAM :

CON1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
V _S	V _L	V _{EE}	V _{DD}	FR	V _{GND}	LOAD	V _{SS}	DF	D ₀ D _{FF}	CP	V ₄	V ₃	D ₃	D ₂	D ₁	D ₀	NC

CON2

1	2	3	4
X ₂	Y ₁	X ₁	Y ₂

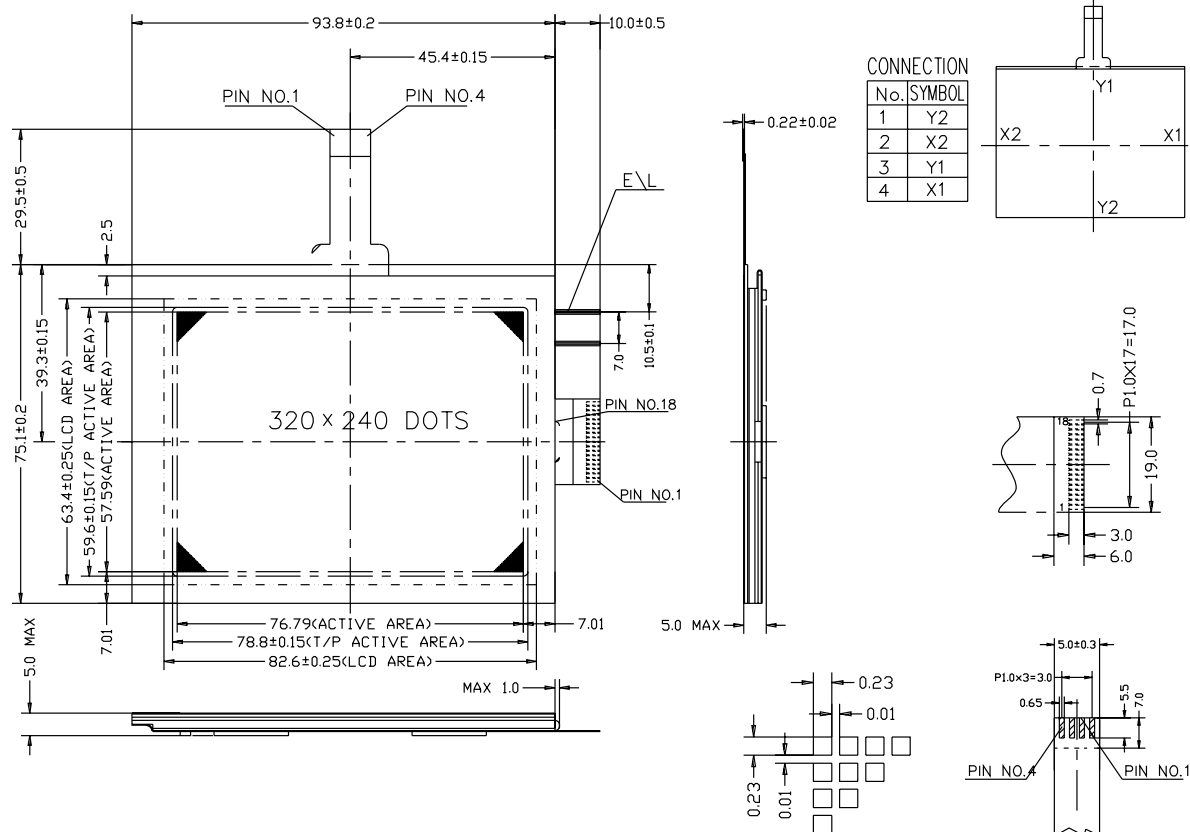


• **EXTERNAL DIMENSIONS :**



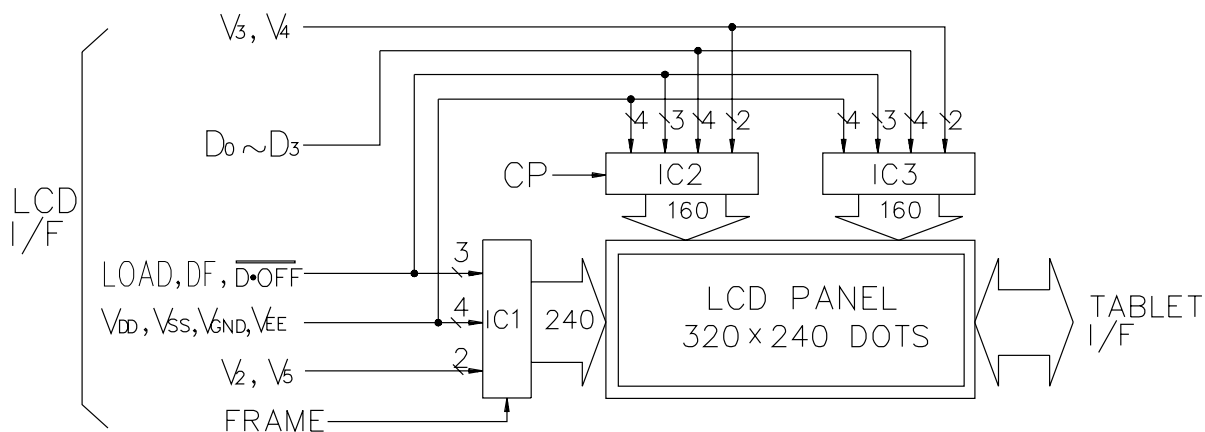
MG320240-10

• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
V _b	V ₂	V _{EE}	V _{DD}	FRAME	V _{GND}	LOAD	V _{SS}	DF	D-OFF	CP	V ₄	V ₃	D ₃	D ₂	D ₁	D ₀	NC



• **EXTERNAL DIMENSIONS :**

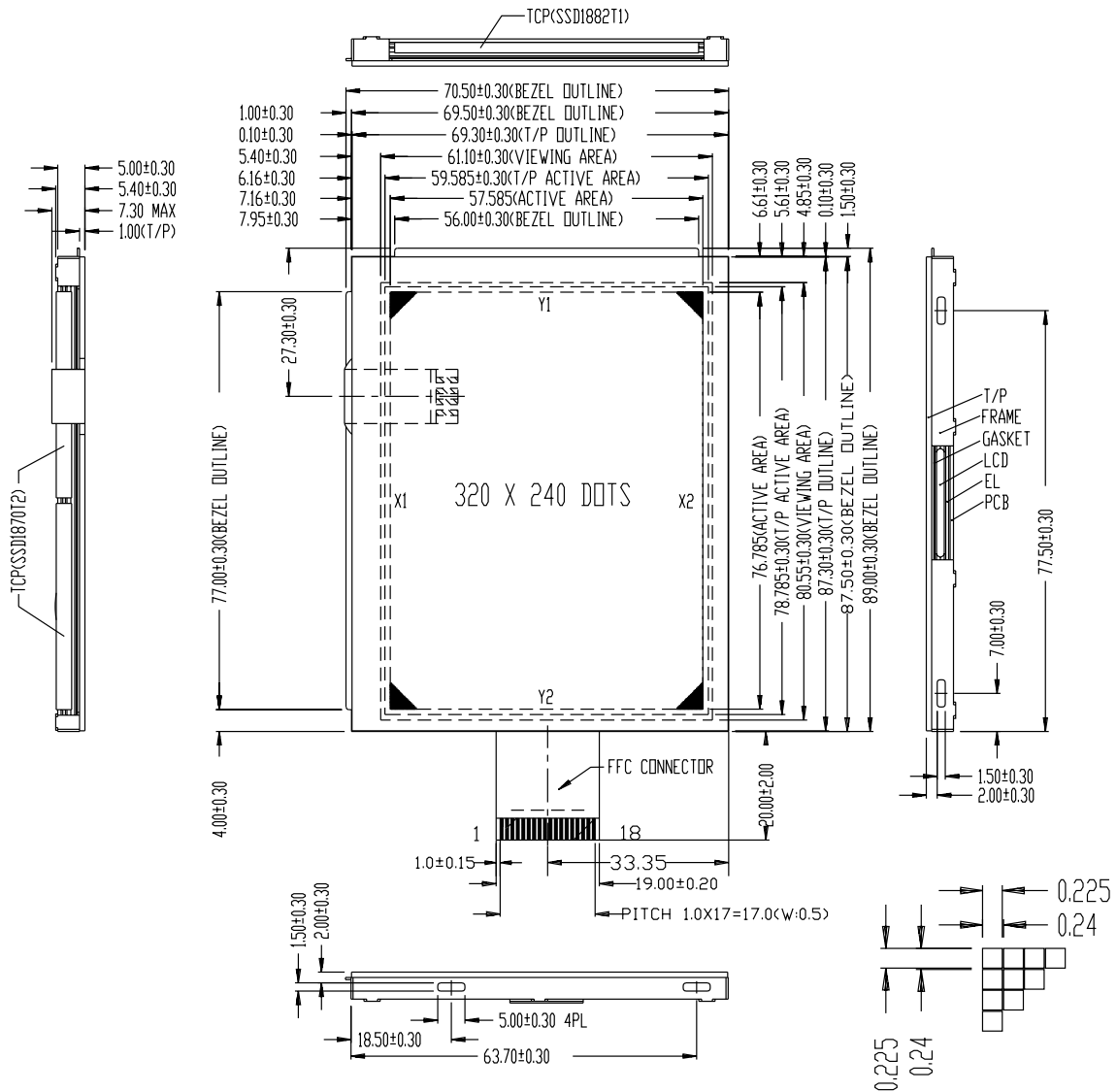


1	2	3	4	5
VFL1	NC	NC	NC	VFL2



MG320240-13

• EXTERNAL DIMENSIONS :



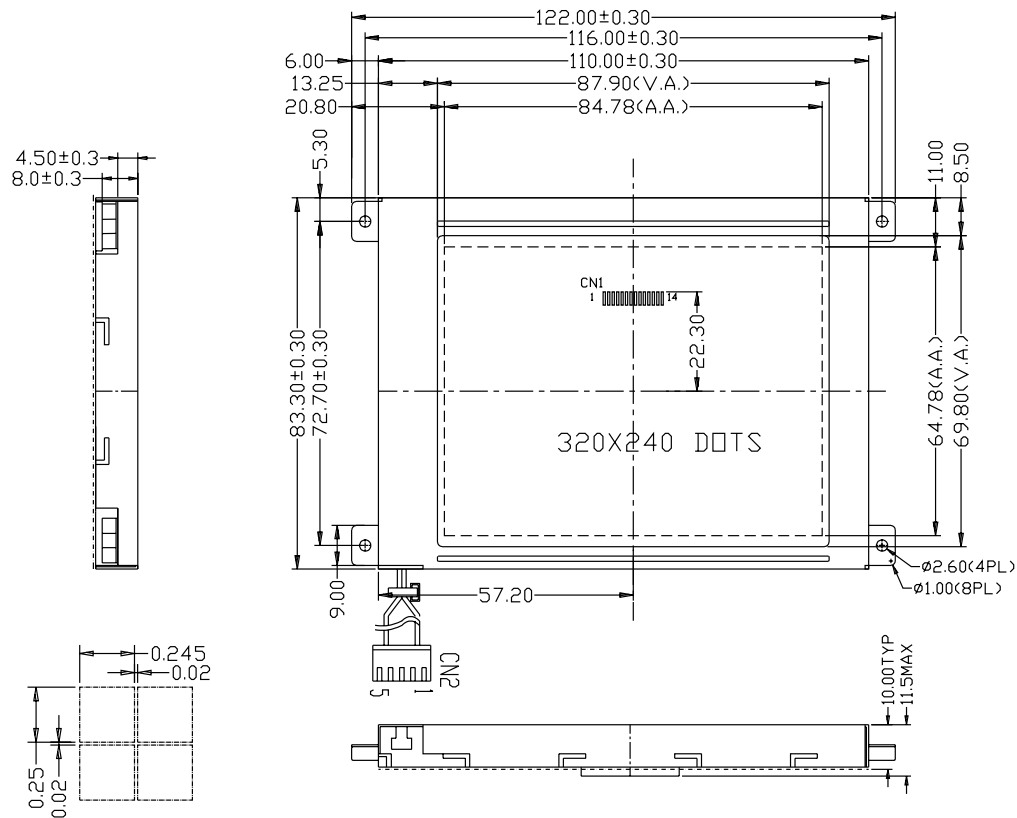
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
YD	LP	XSCL	D0	D1	D2	D3	D0FF	V3	VSS	TPX2	TPY1	TPX1	TPY2	NC	VELA	NC	VELB

NOTES: 1. SEG:SSD1870T
COM:SSD1882T
2. EL BACKLIGHT

MG320240-14

• EXTERNAL DIMENSIONS :



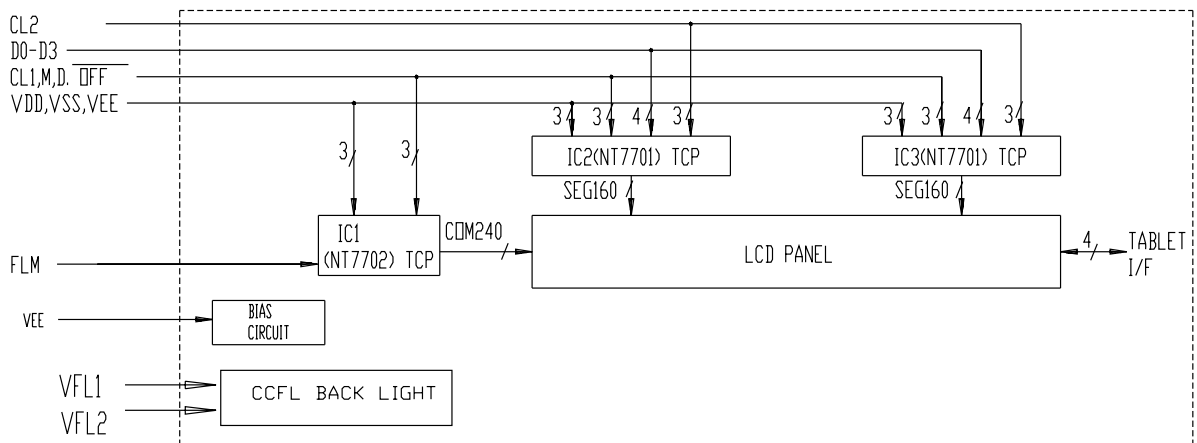
• BLOCK DIAGRAM :

CN1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
VEE	VDD	FLM	VSS	CL1	VSS	M	D, OFF	CL2	D3	D2	D1	D0	NC

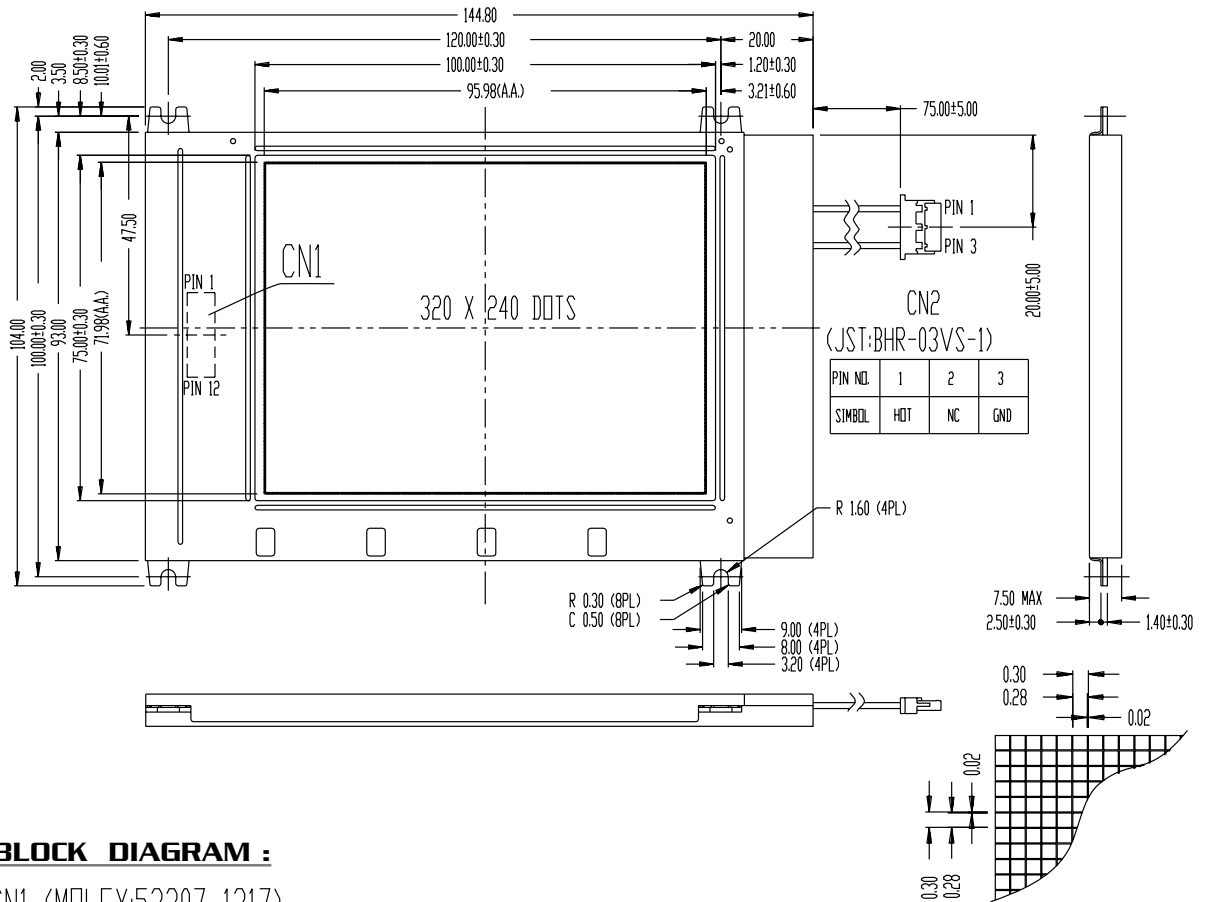
CN2

1	2	3	4	5
VFL1	NC	NC	NC	VFL2



MG320240-19

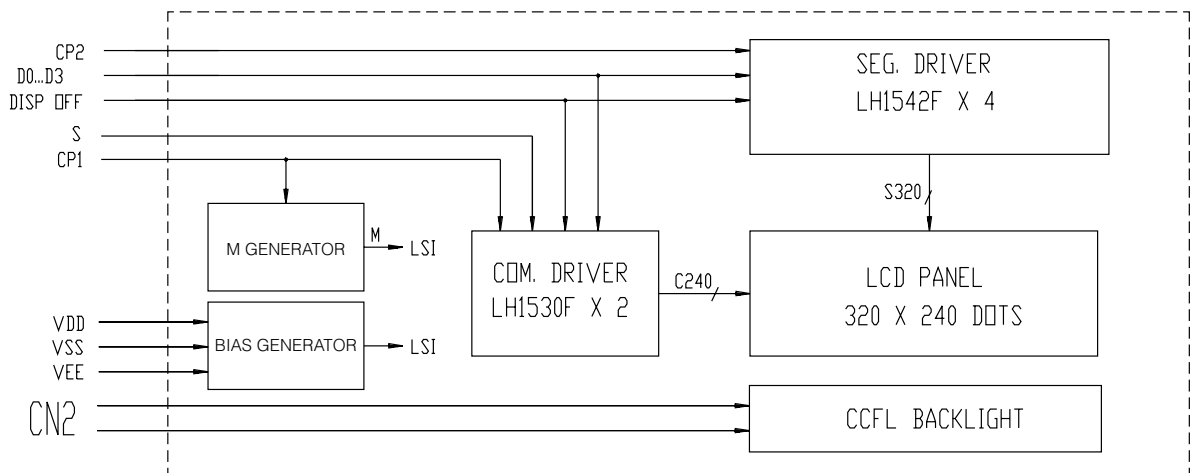
• EXTERNAL DIMENSIONS :



• BLOCK DIAGRAM :

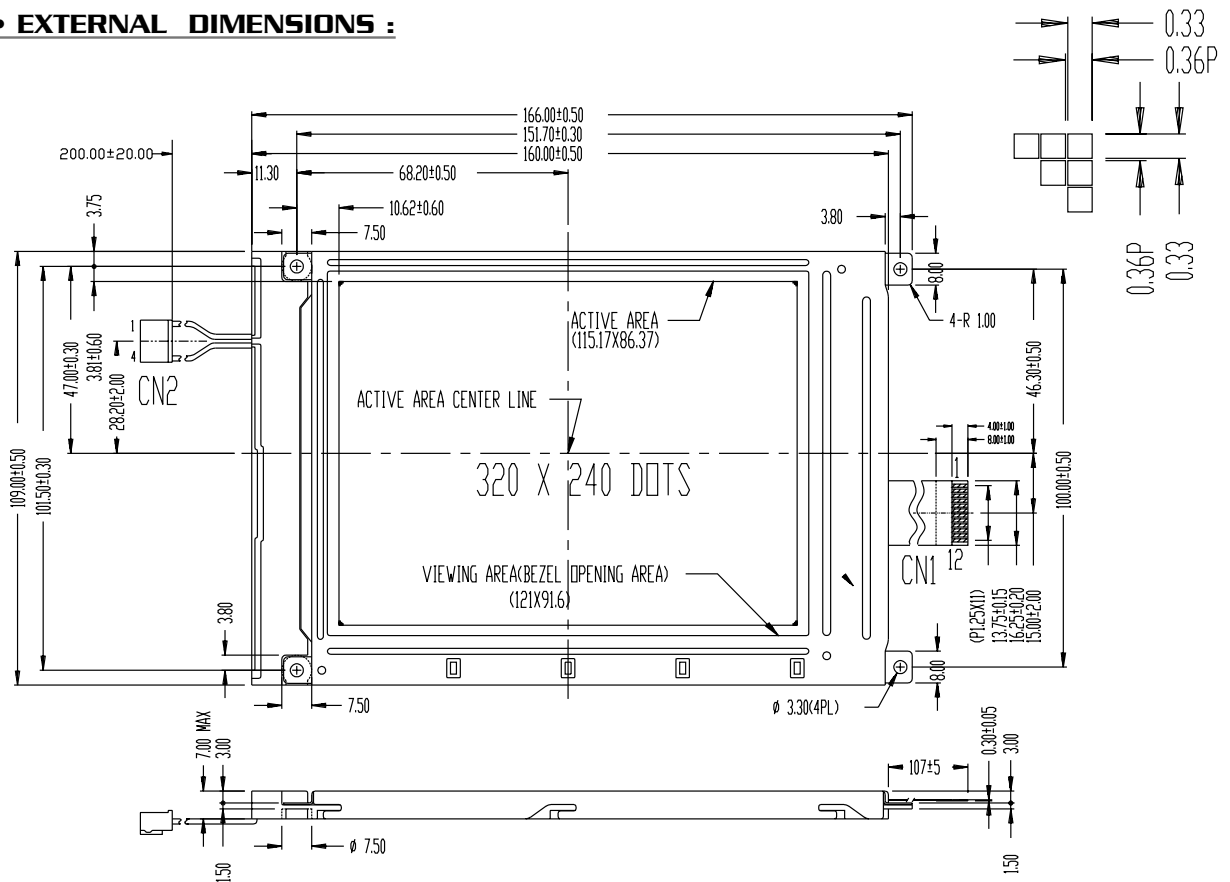
CN1 (MOLEX:52207-1217)

PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12
SIMBOL	S	CP1	CP2	NC	DISP OFF	D0	D1	D2	D3	VDD	VSS	VEE



MG320240-20

• EXTERNAL DIMENSIONS :



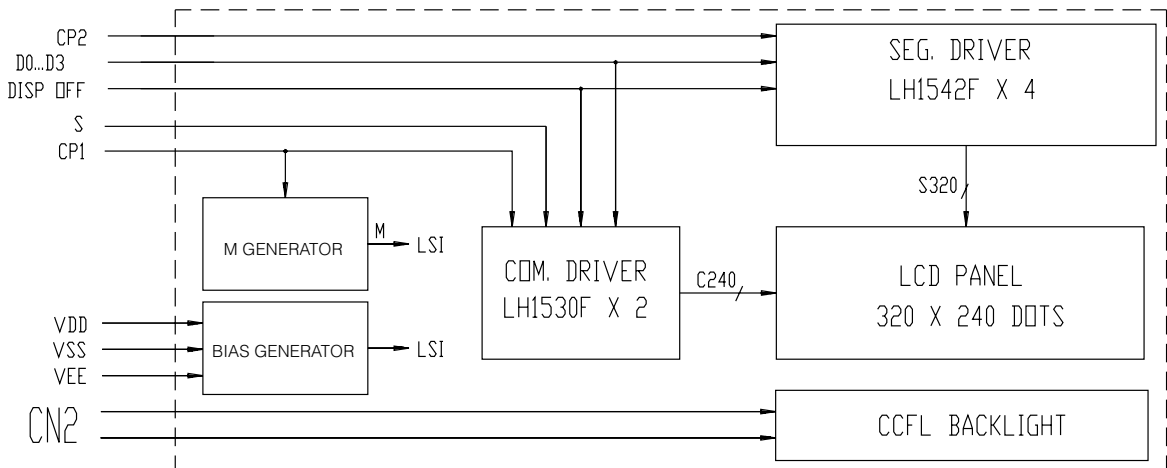
• BLOCK DIAGRAM :

CN2

PIN NO.	1	2/3	4
SIMBOL	HOT	NC	GND

CN1

PIN NO.	1	2	3	4	5	6	7	8	9	10	11	12
SIMBOL	S	CP1	CP2	NC	DISP OFF	D0	D1	D2	D3	VDD	VSS	VEE

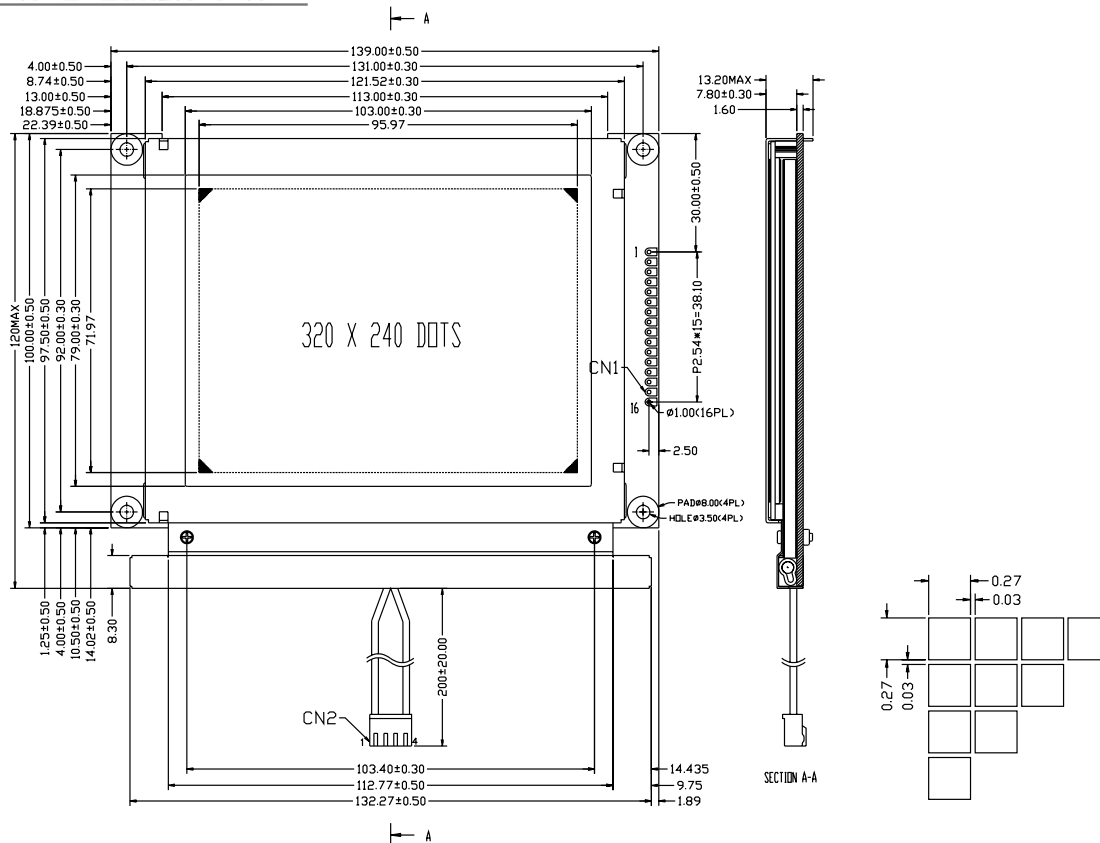


• **EXTERNAL DIMENSIONS :**

[illegible]

MG320240-27

• EXTERNAL DIMENSIONS :



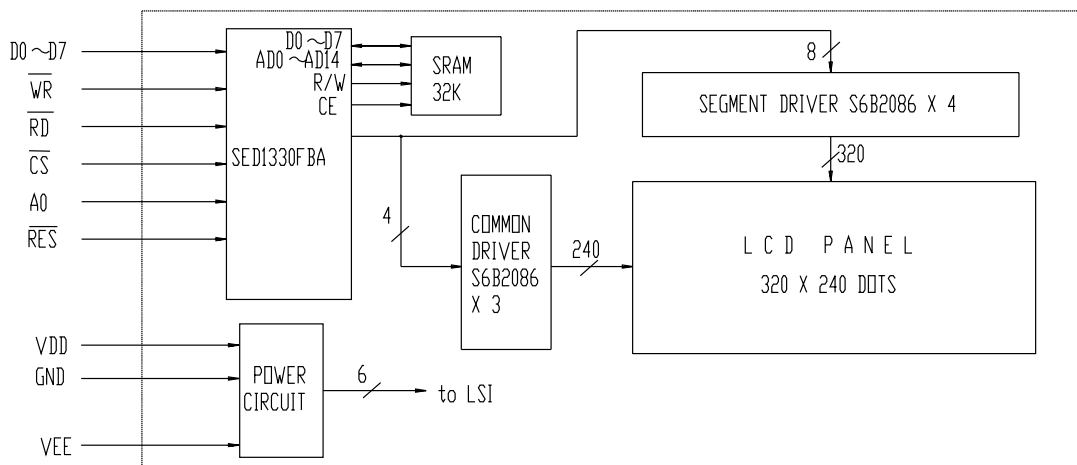
• BLOCK DIAGRAM :

CN1

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
GND	VDD	VEE	WR	RD	CS	AD	RES	D0	D1	D2	D3	D4	D5	D6	D7

CN2

1	2	3	4
VFL1	NC	NC	VFL2



• **EXTERNAL DIMENSIONS :**

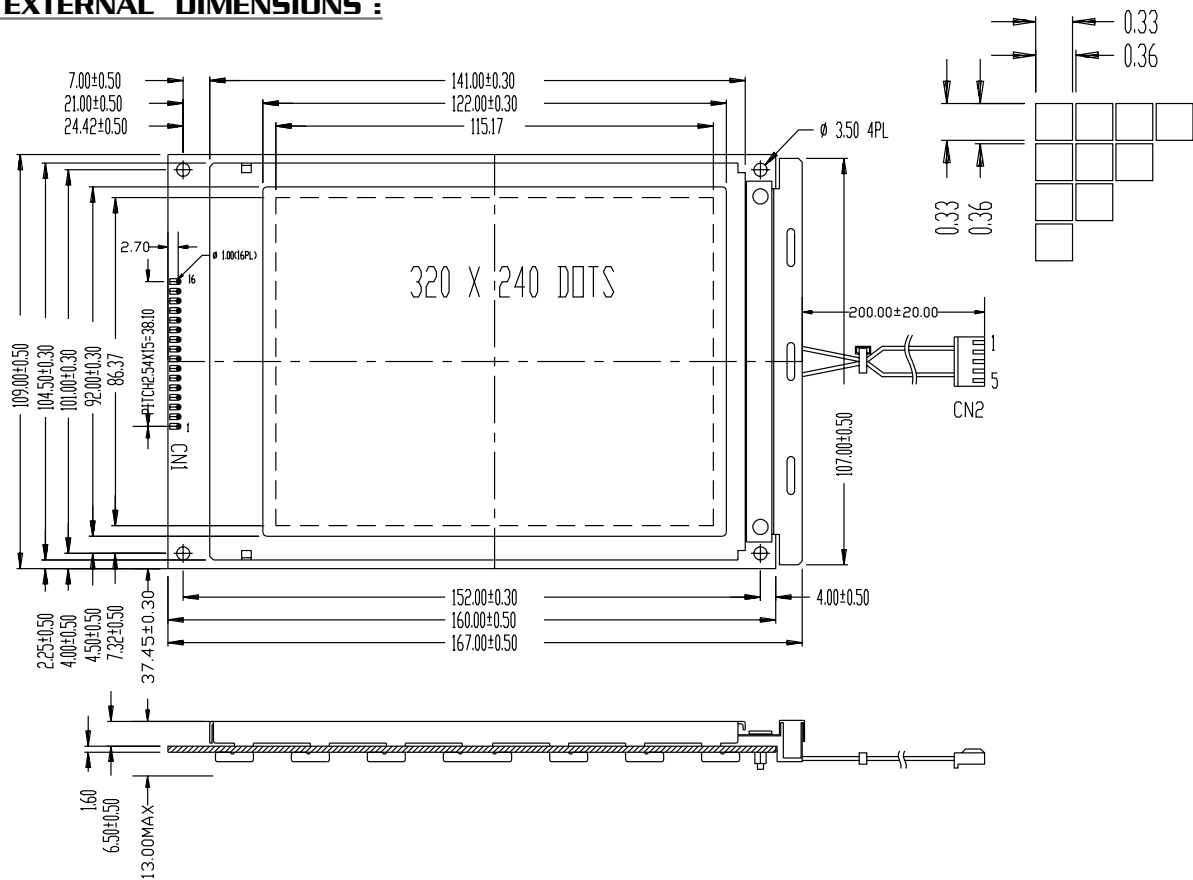


The block diagram illustrates the internal connections of the LCD module. On the left, a vertical dashed line represents the module's interface pins. The connections are as follows:

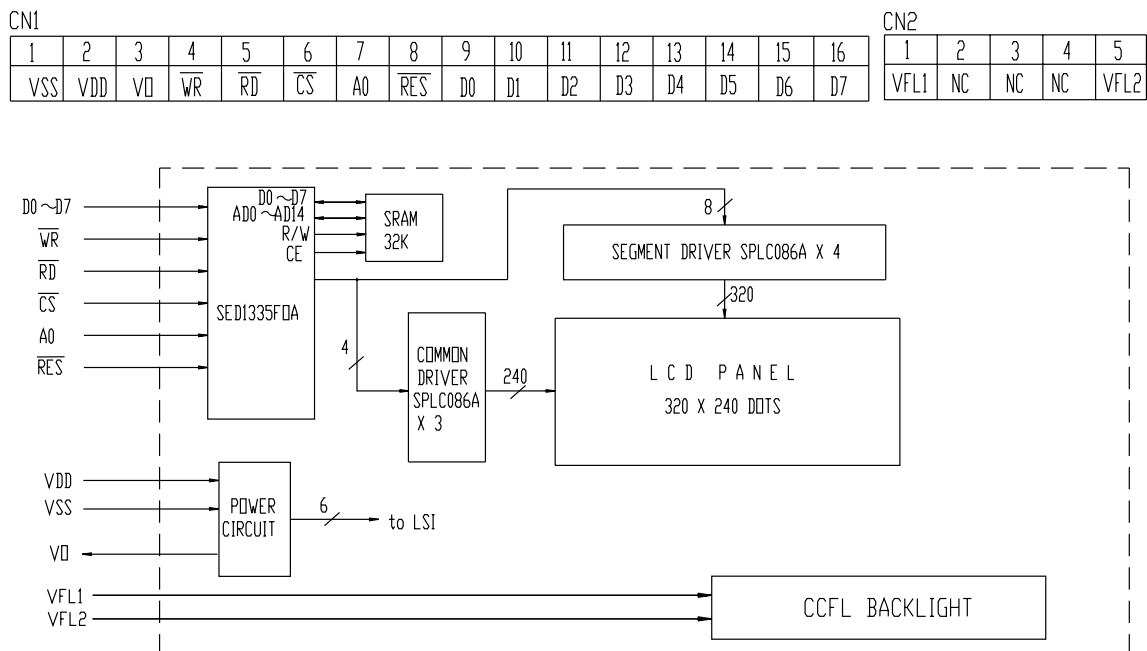
- CL2**: Connected to the top of the IC1:IST3032TB0 and IC2:IST3031TA0.
- D0-D3**: Connected to the top of the IC1:IST3032TB0 and IC2:IST3031TA0.
- CL1, VM, M**: Connected to the top of the IC1:IST3032TB0 and IC2:IST3031TA0.
- VCC**: Connected to the top of the IC1:IST3032TB0 and IC2:IST3031TA0.
- VSS**: Connected to the bottom of the IC1:IST3032TB0 and IC2:IST3031TA0.
- FLM, DISP, VLCD**: Connected to the left side of the IC1:IST3032TB0.
- IC1:IST3032TB0**: A controller chip that receives signals from the interface pins and outputs **COM240** to the LCD PANEL.
- IC2:IST3031TA0**: A driver chip that receives signals from the interface pins and outputs **SEG320** to the LCD PANEL.
- LCD PANEL**: Receives **COM240** from IC1 and **SEG320** from IC2.
- EL A** and **EL K**: Connected to the EL BACK LIGHT (WHITE OR BLUE) component at the bottom.

MG320240-211

• EXTERNAL DIMENSIONS :

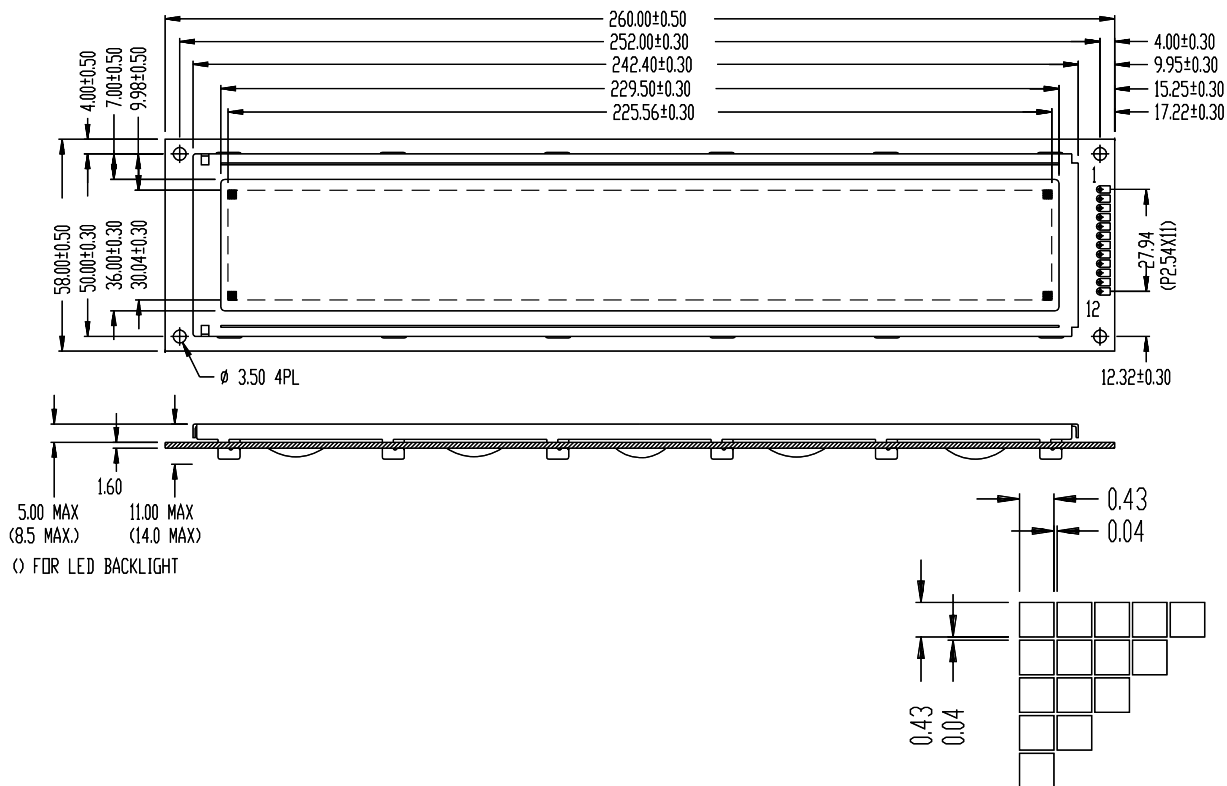


• BLOCK DIAGRAM :



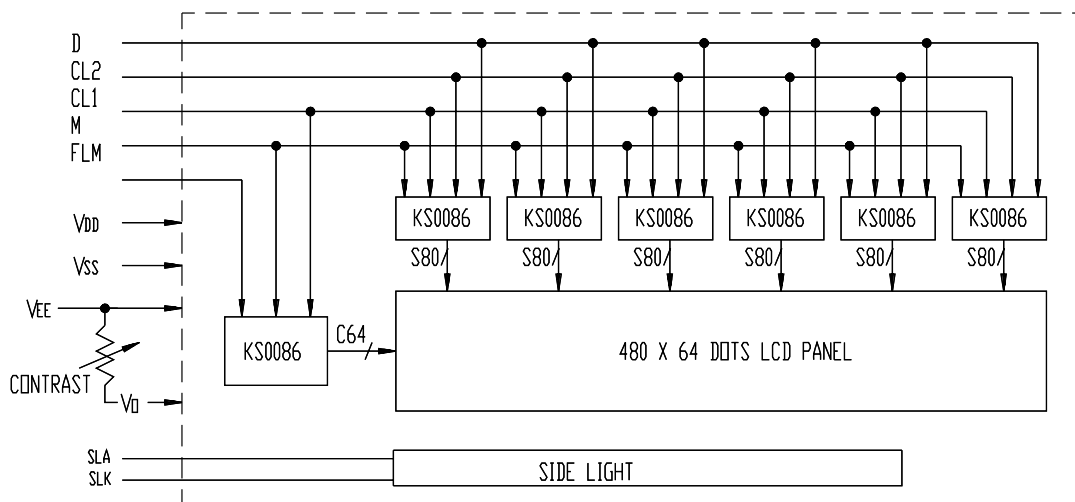
MG48064-1

• EXTERNAL DIMENSIONS :



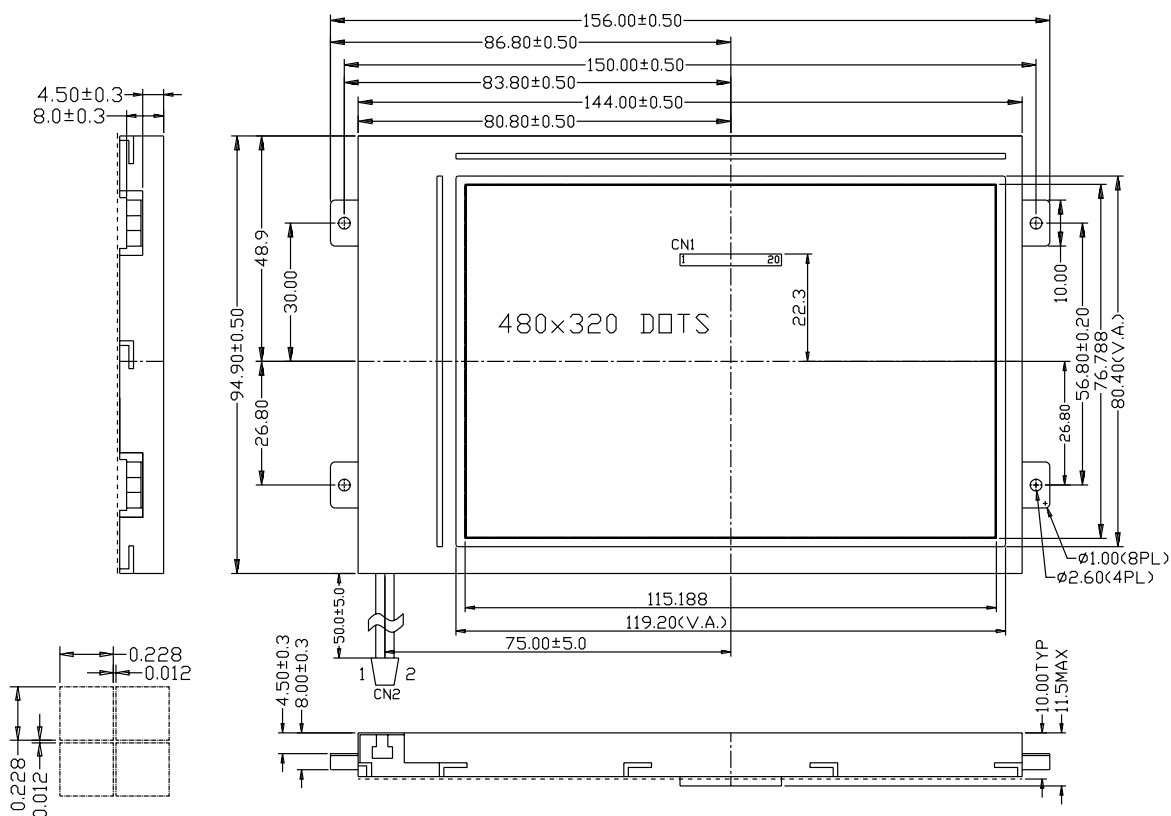
• BLOCK DIAGRAM :

1	2	3	4	5	6	7	8	9	10	11	12
D	FLM	M	CL1	CL2	NC	VDD	VSS	VEE	VO	SLA	SLK



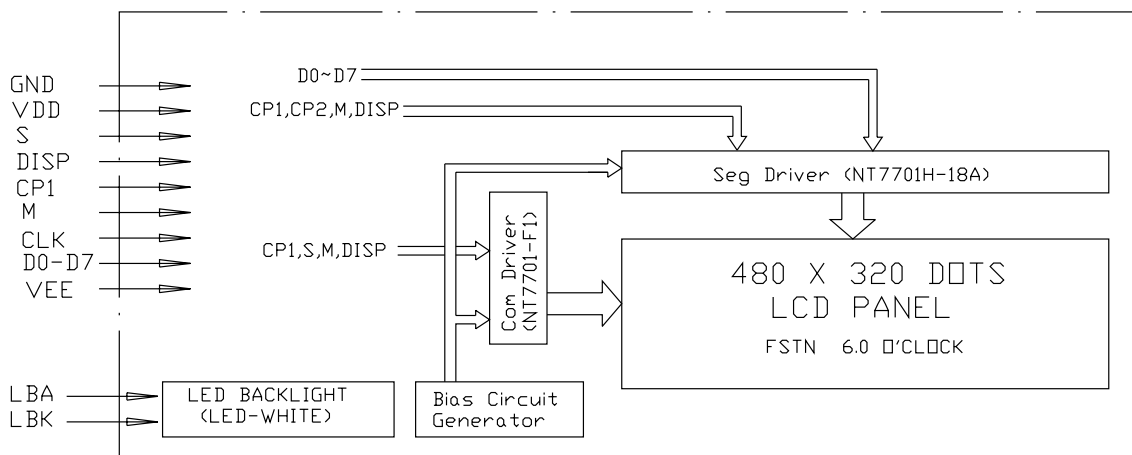
MG480320-1

• EXTERNAL DIMENSIONS :



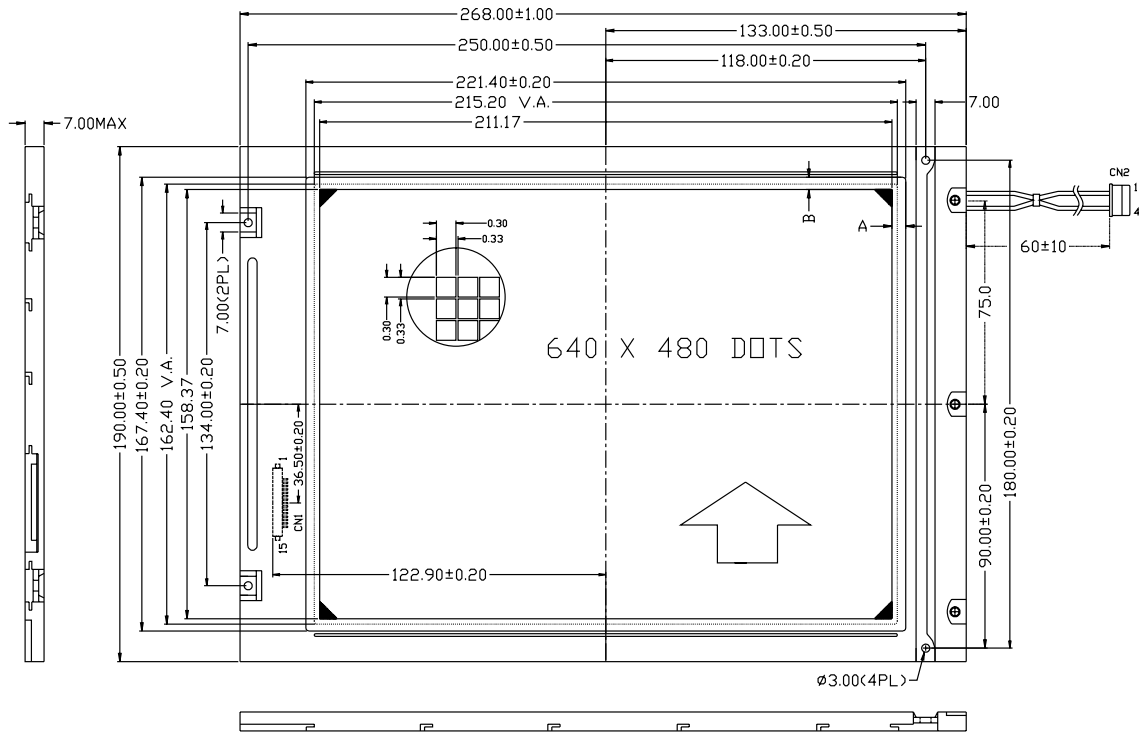
• BLOCK DIAGRAM :

CN1																				CN2	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	1	2
GND	GND	VDD	S	M	CP1	DISP	CLK	D0	D1	D2	D3	D4	D5	D6	D7	VEE	VDD	GND	GND	LBA	LBK



MG640480-2

• EXTERNAL DIMENSIONS :

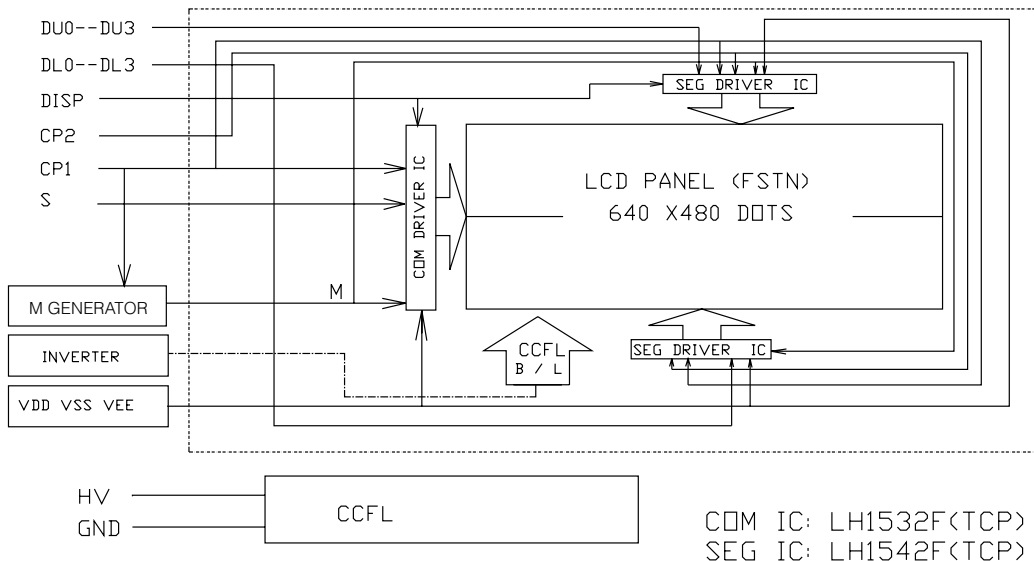


- 1) TOL X-direction A:4.50±0.8
2) TOL y-direction B:3.50±0.8

• BLOCK DIAGRAM :

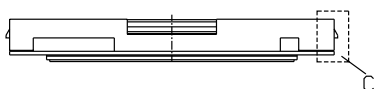
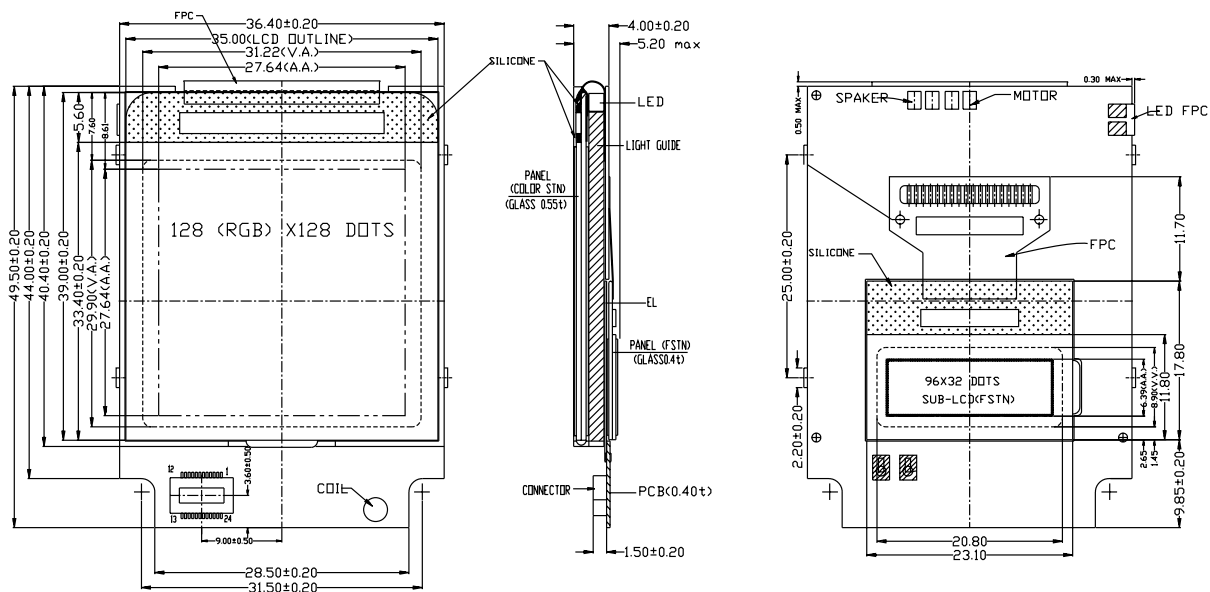
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
S	CP1	CP2	DISP	VDD	VSS	VEE	DU0	DU1	DU2	DU3	DL0	DL1	DL2	DL3

1	2	3	4
GND	NC	NC	HV

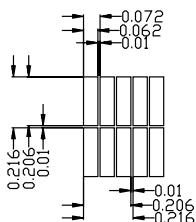


MG128128-6

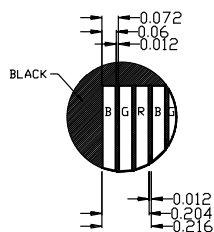
• EXTERNAL DIMENSIONS :



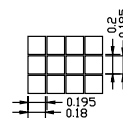
DETAIL C
(S=2/1)



ITO DETAIL



COLOR FILTER DETAIL

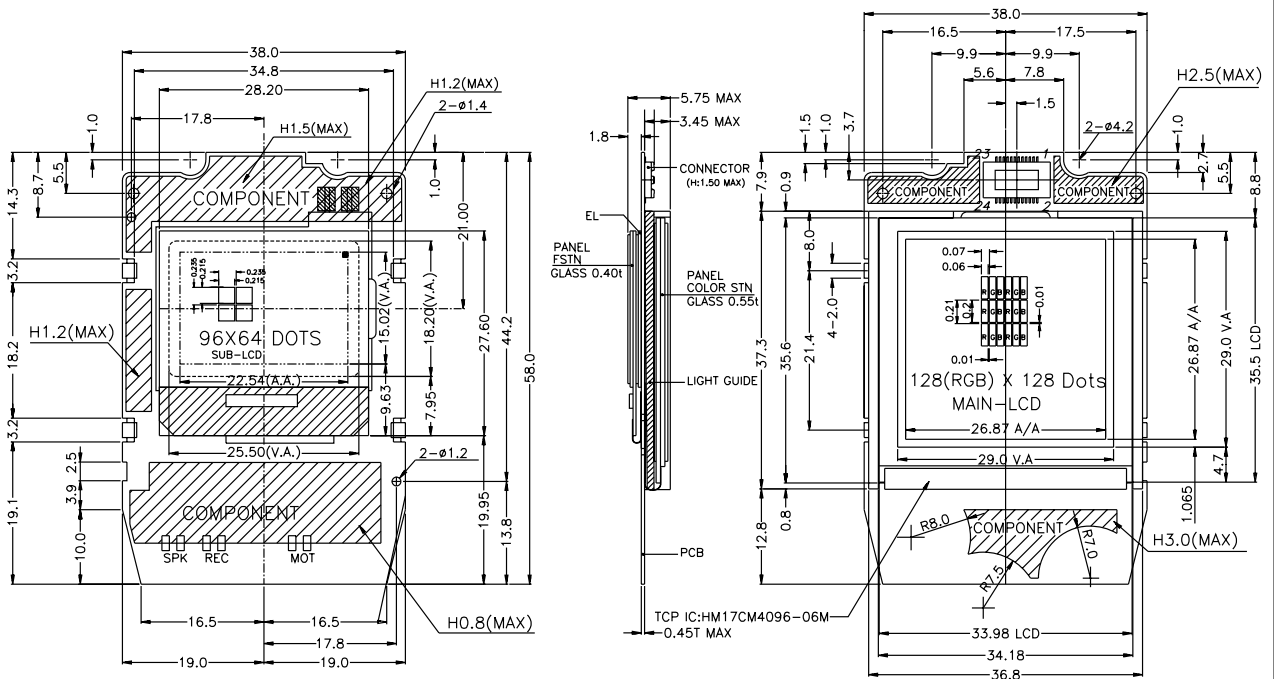


SUB-LCD DOT

NO.	SYMBOL
1	VBAT
2	GND
3	DB7
4	DB6
5	DB5
6	DB4
7	DB3
8	DB2
9	DB1
10	DB0
11	MLCD_CS
12	SLCD_CS
13	RSTB
14	RS
15	WR
16	RD
17	LED_VCC
18	GND
19	EL_EN
20	SPK+
21	SPK-
22	BACKUP_BAT
23	ON_OFF
24	MOTOR

MG128128-7

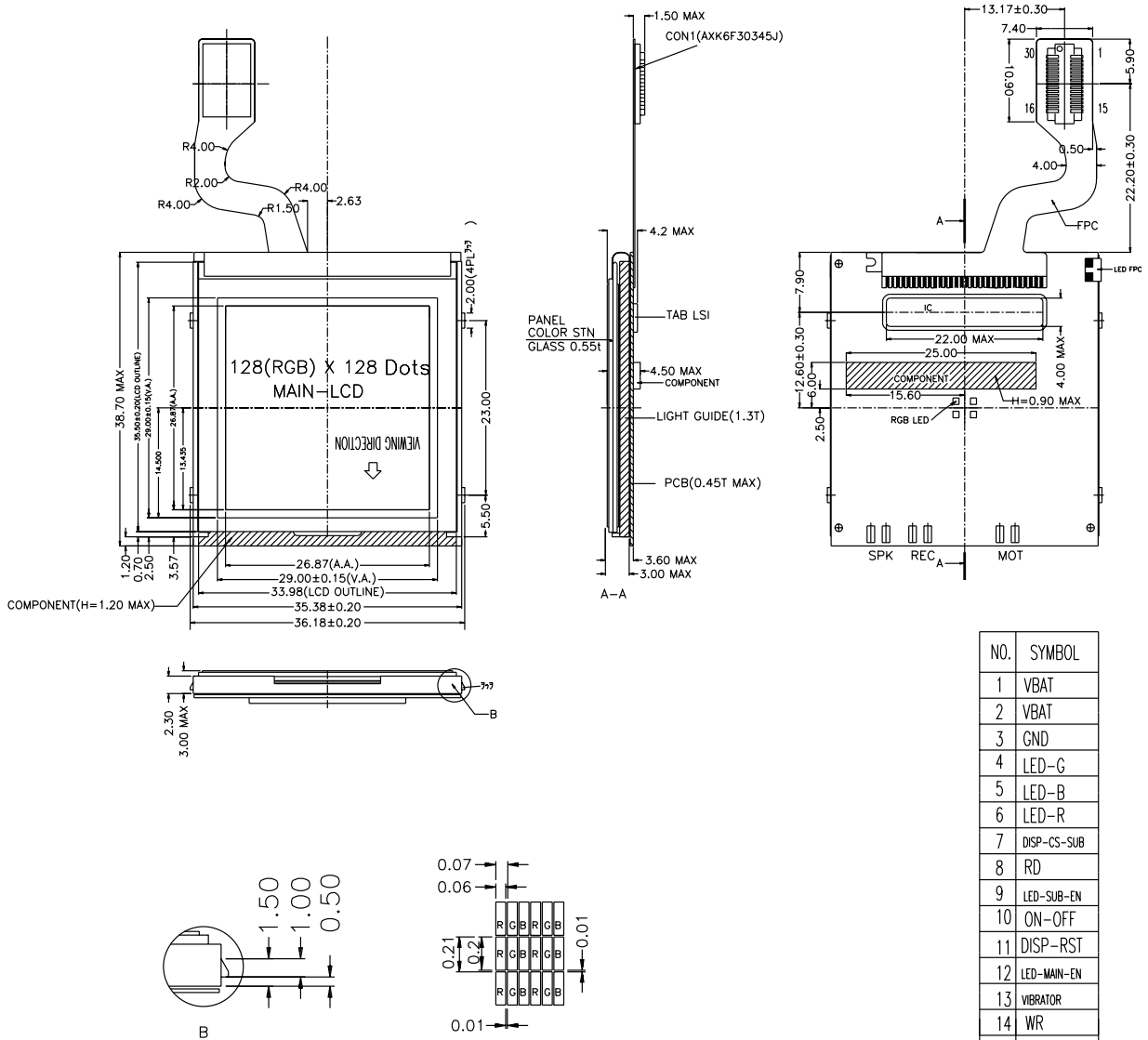
• EXTERNAL DIMENSIONS :



No	Symbol
1	VBAT
2	WR
3	CS_MAIN
4	RS
5	RESET
6	CS_SUB
7	VDD
8	D7
9	D6
10	D5
11	D4
12	D3
13	D2
14	D1
15	D0
16	GND
17	SPK+
18	SPK-
19	LED_EN
20	REC+
21	REC-
22	EL_EN
23	MOT+
24	MOT-

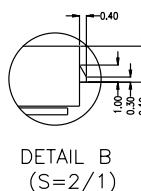
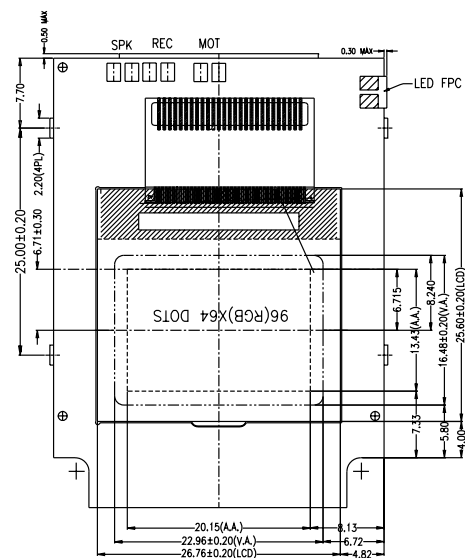
MG128128-9

• EXTERNAL DIMENSIONS :

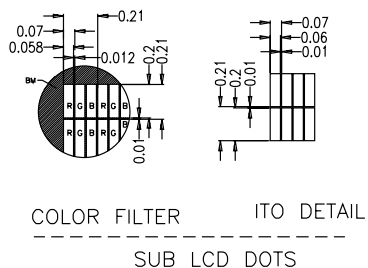


NO.	SYMBOL
1	VBAT
2	VBAT
3	GND
4	LED-G
5	LED-B
6	LED-R
7	DISP-CS-SUB
8	RD
9	LED-SUB-EN
10	ON-OFF
11	DISP-RST
12	LED-MAIN-EN
13	VIBRATOR
14	WR
15	DISP-CS-MAIN
16	DB0
17	DB1
18	DB2
19	DB3
20	DB4
21	DB5
22	DB6
23	DB7
24	RS
25	ADR7
26	GND
27	REC+
28	REC-
29	SP+
30	SP-

• **EXTERNAL DIMENSIONS :**



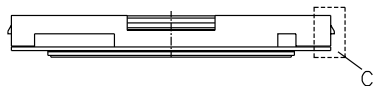
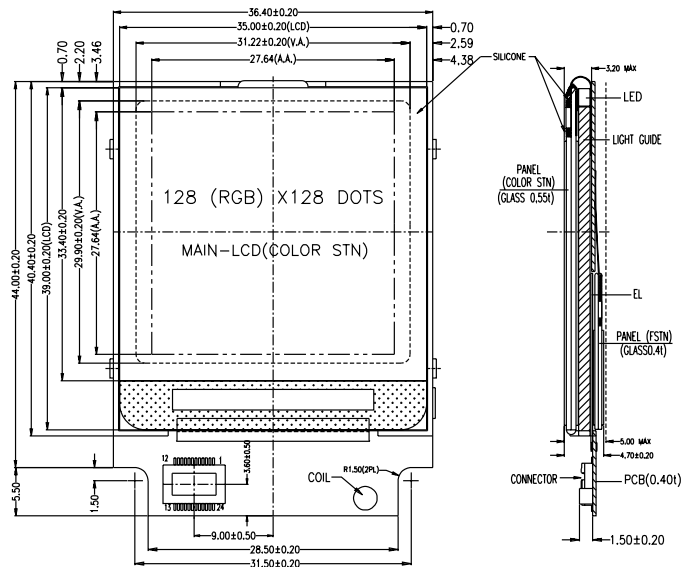
DETAIL B
(S=2/1)



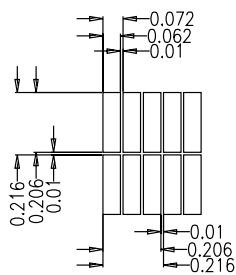
NO.	SYMBOL
1	VBAT
2	VBAT
3	GND
4	LED-G
5	LED-B
6	LED-R
7	DISP-CS-SUB
8	RD
9	LED-SUB-EN
10	ON-OFF
11	DISP-RST
12	LED-MAIN-EN
13	VIBRATOR
14	WR
15	DISP-CS-MAIN
16	DB0
17	DB1
18	DB2
19	DB3
20	DB4
21	DB5
22	DB6
23	DB7
24	RS
25	ADR7
26	GND
27	REC+
28	REC-
29	SP+
30	SP-

MG128128-11

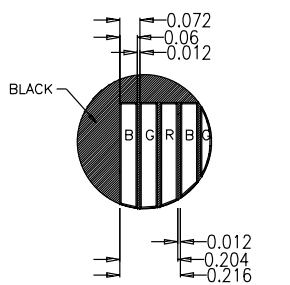
• EXTERNAL DIMENSIONS :



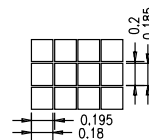
DETAIL C
(S=2/1)



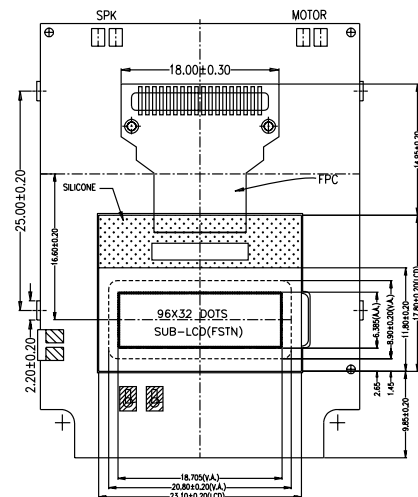
ITO DETAIL



COLOR FILTER DETAIL



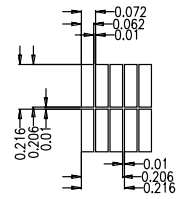
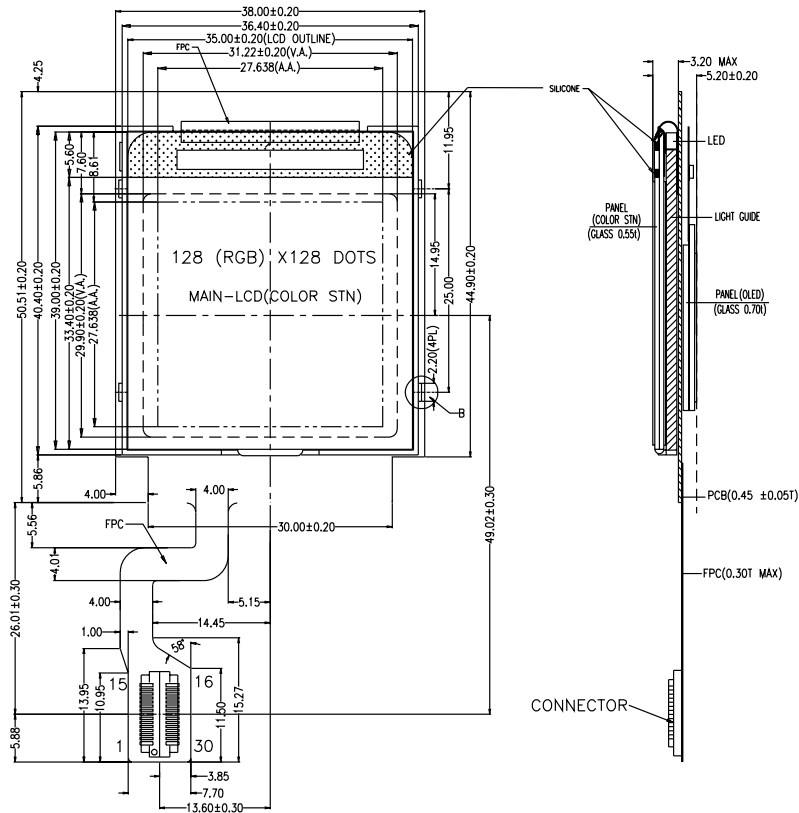
SUB-LCD DOT



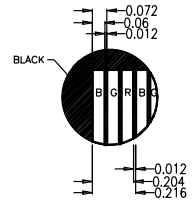
NO.	SYMBOL
1	VBAT
2	GND
3	DB7
4	DB6
5	DB5
6	DB4
7	DB3
8	DB2
9	DB1
10	DB0
11	MLCD_CS
12	SLCD_CS
13	RSTB
14	RS
15	WR
16	RD
17	LED_VCC
18	GND
19	EL_EN
20	SPK+
21	SPK-
22	BACKUP_BAT
23	ON_OFF
24	MOTOR

MG128128-12

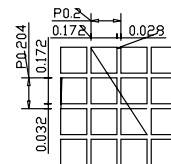
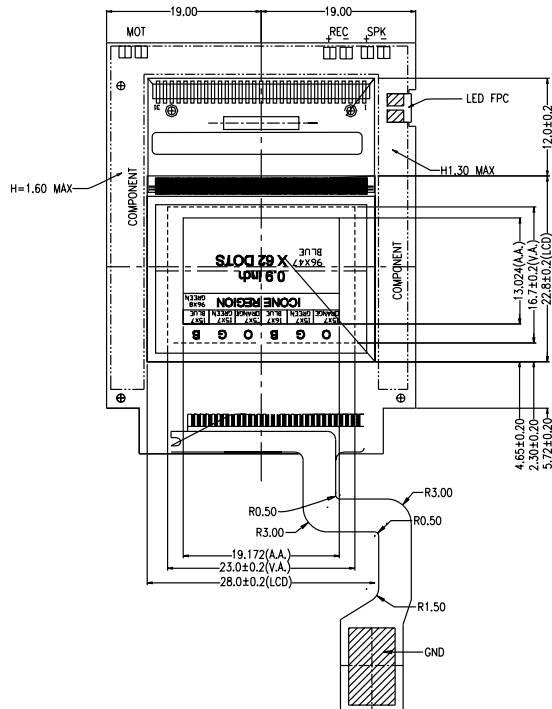
• EXTERNAL DIMENSIONS :



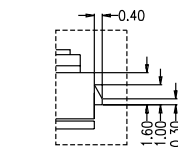
ITO DETAIL



COLOR FILTER DETAIL



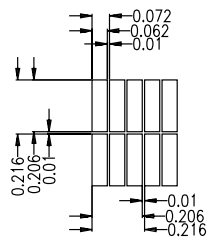
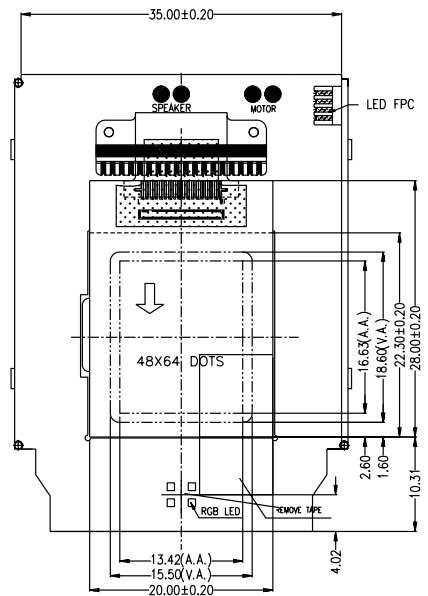
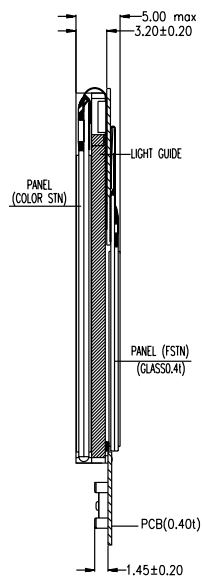
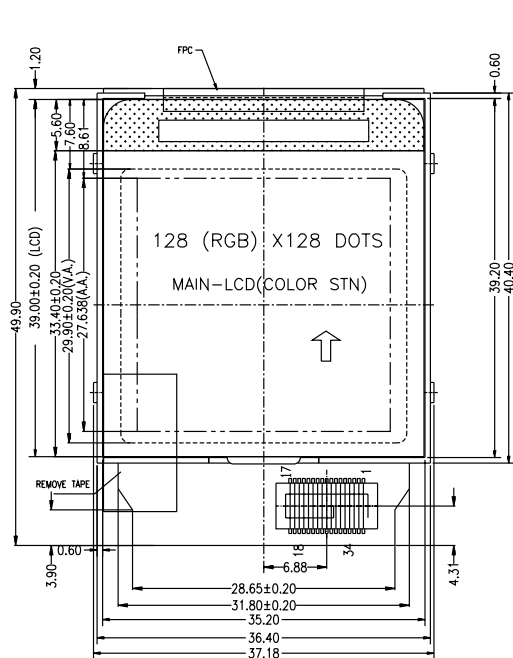
SUB-LCD DOT



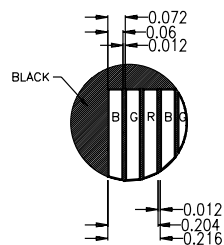
DETAIL B
(S=2/1)

NO.	SYMBOL
1	VBAT
2	VBAT
3	GND
4	NC
5	NC
6	NC
7	/CS-SUB
8	/RD
9	MAINLED-ON/OFF
10	LDO-ON/OFF
11	RESET
12	LED-ALL/HALF
13	VIBRTOR
14	/WR
15	/CS-MAIN
16	DB0
17	DB1
18	DB2
19	DB3
20	DB4
21	DB5
22	DB6
23	DB7
24	RS
25	OLED-VEE(ON/OFF)
26	GND
27	REC+
28	REC-
29	SPK+
30	SPK-

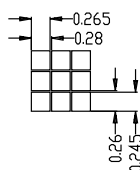
• **EXTERNAL DIMENSIONS :**



ITO DETAIL



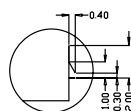
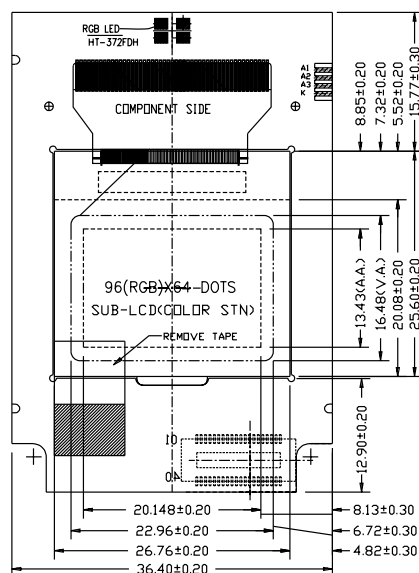
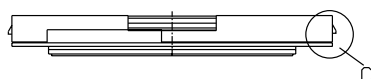
COLOR FILTER DETAIL



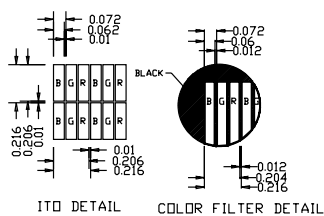
SUB-LCD DOT

NO.	SYMBOL	NO.	SYMBOL
1	SUB-DISP-EN	18	LED_B
2	DISP-AO	19	LED_G
3	DISP-SCK	20	LED_R
4	DISP-DI	21	POLY-VIB
5	GND	22	REC_P
6	MAIN-DISP-CS	23	SPK_P
7	NC	24	REC_N
8	AOD01	25	SPK_N
9	DB0	26	NC
10	DB1	27	+5V
11	DB2	28	GND
12	DB3	29	RESET
13	DB4	30	MAIN_BL
14	DB5	31	NC
15	DB6	32	WR
16	DB7	33	VBAT
17	GND	34	VBAT

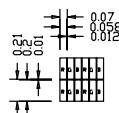
• **EXTERNAL DIMENSIONS :**



DETAIL C
SCALE 2:1



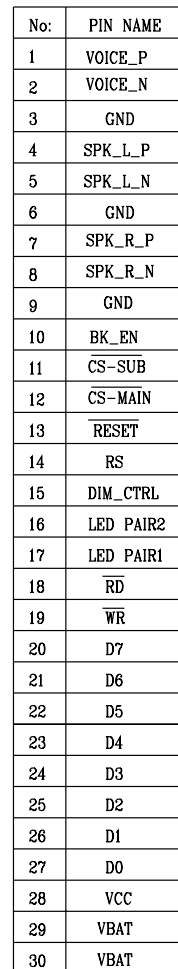
MAIN-LCD(COLOR STN)



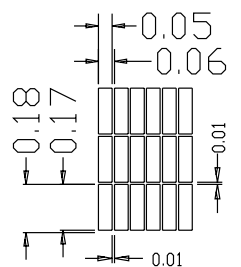
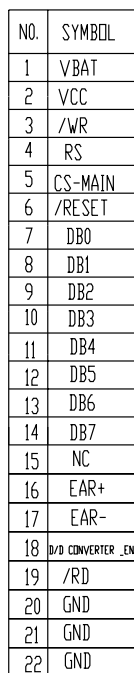
SUB-LCD(COLOR STN)

89

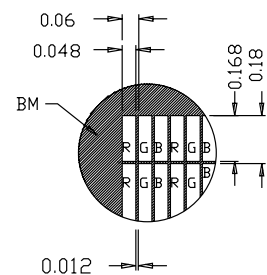
• **EXTERNAL DIMENSIONS :**



• **EXTERNAL DIMENSIONS :**



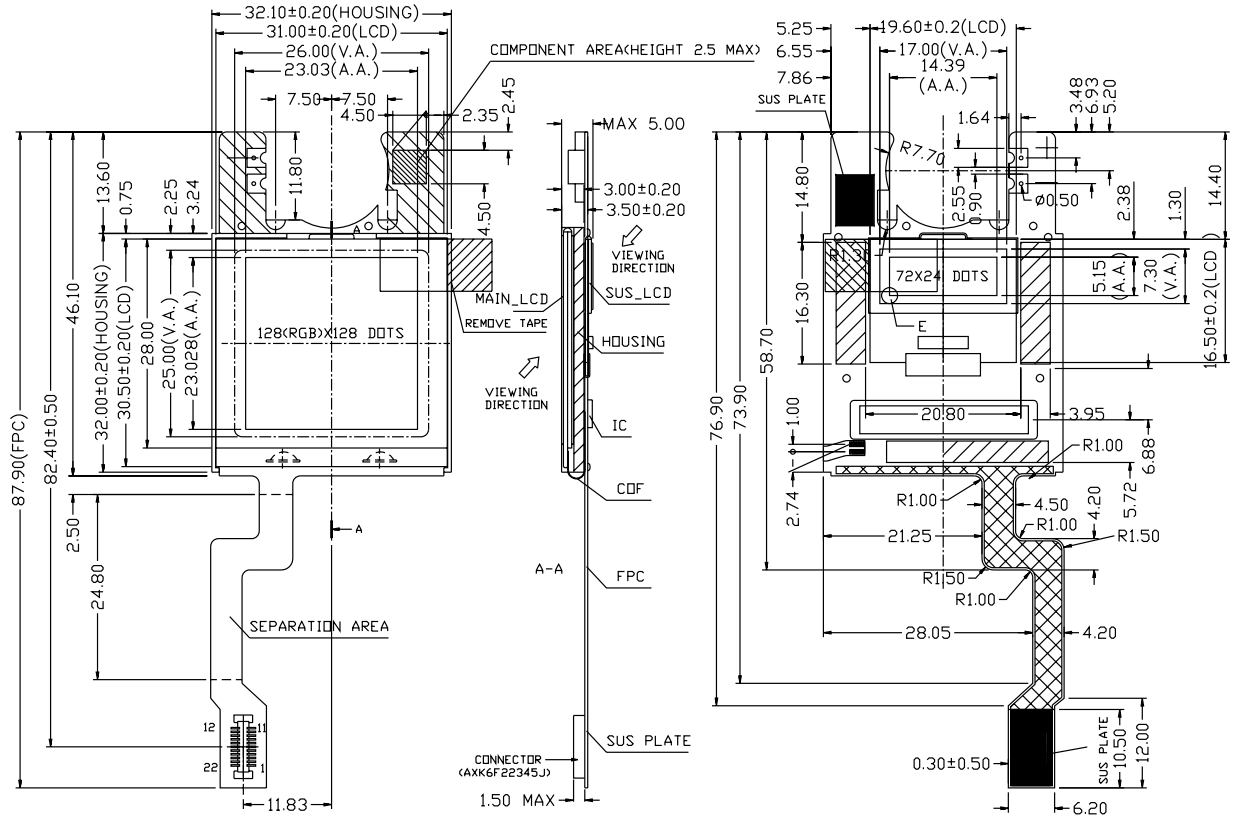
ITO DETAIL



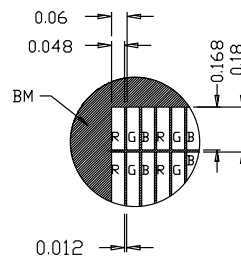
COLOR FILTER

MG128128-18

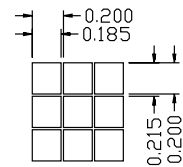
• EXTERNAL DIMENSIONS :



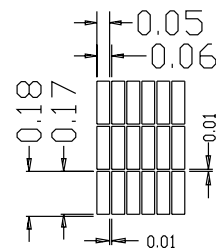
NO.	SYMBOL
1	VBAT
2	VCC
3	/WR
4	RS
5	CS-MAIN
6	/RESET
7	DB0
8	DB1
9	DB2
10	DB3
11	DB4
12	DB5
13	DB6
14	DB7
15	CS-SUB
16	EAR+
17	EAR-
18	EN-LED
19	/RD
20	GND
21	GND
22	GND



COLOR FILTER



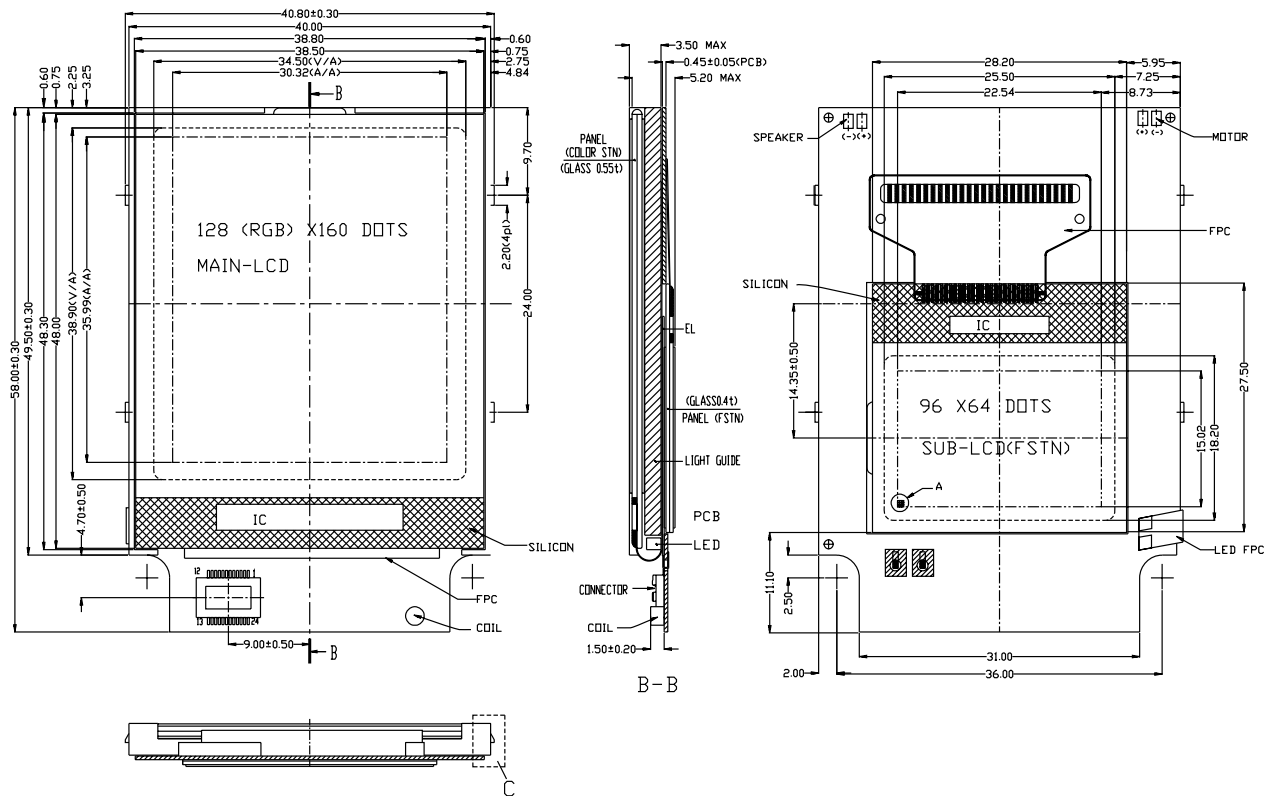
E DETAIL



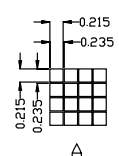
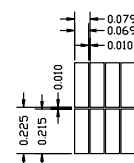
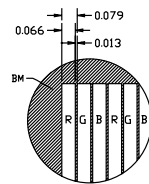
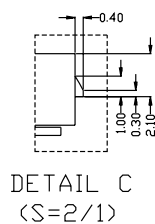
ITO DETAIL

MG128160-3

• EXTERNAL DIMENSIONS :

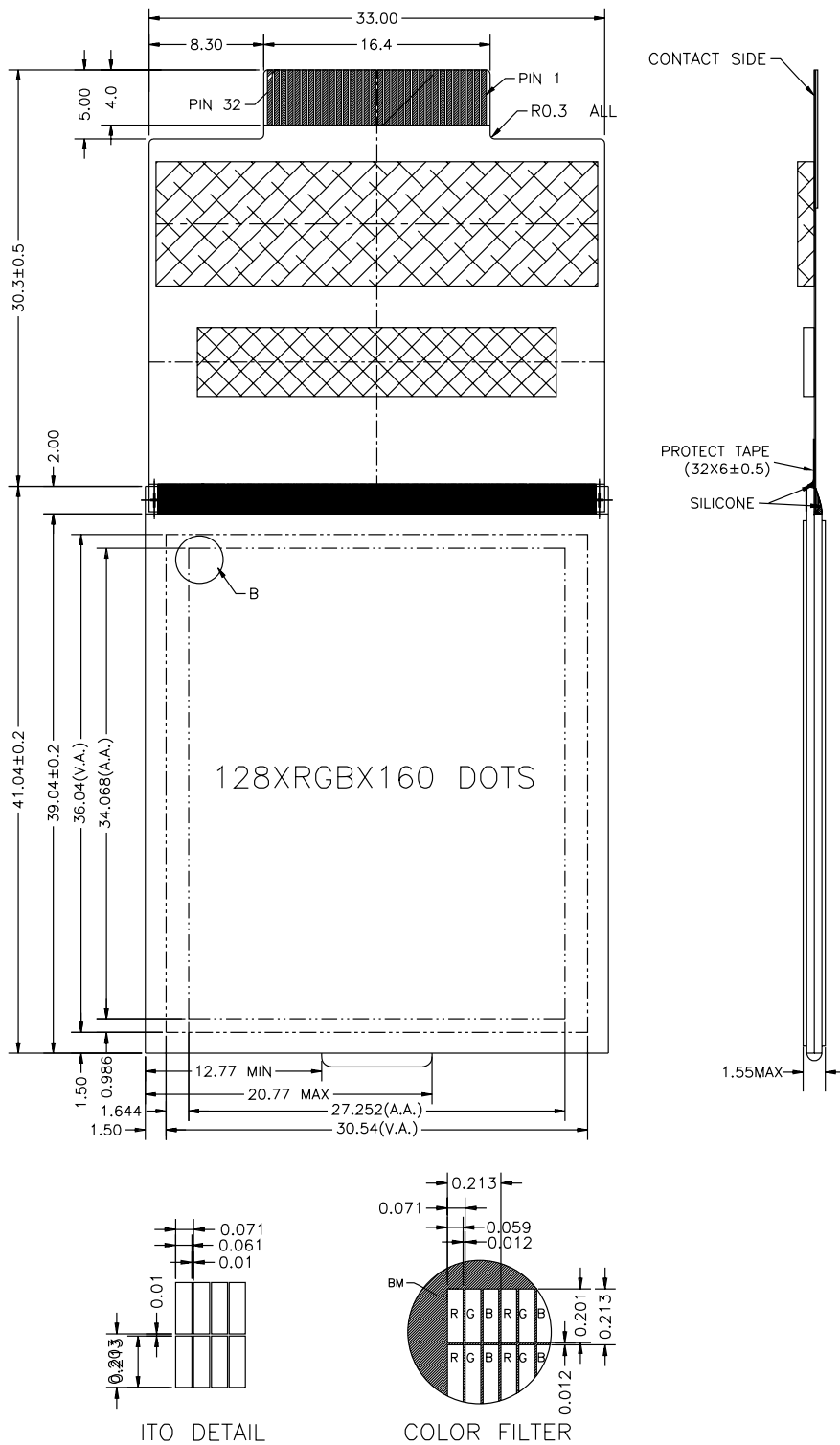


NO.	SYMBOL	NO.	SYMBOL
1	VBAT	2	GND
3	DB7	4	DB6
5	DB5	6	DB4
7	DB3	8	DB2
9	DB1	10	DB0
11	MLCD_CS	12	SLCD_CS
13	RSTB	14	RS
15	RW	16	E
17	LED_VCC	18	GND
19	EL_EN	20	SPK+
21	SPK-	22	BACKUP_BAT
23	ON_OFF	24	MOTOR

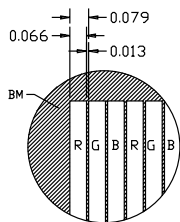


MG128160-4

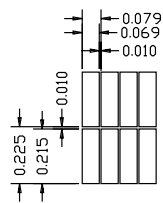
• EXTERNAL DIMENSIONS :



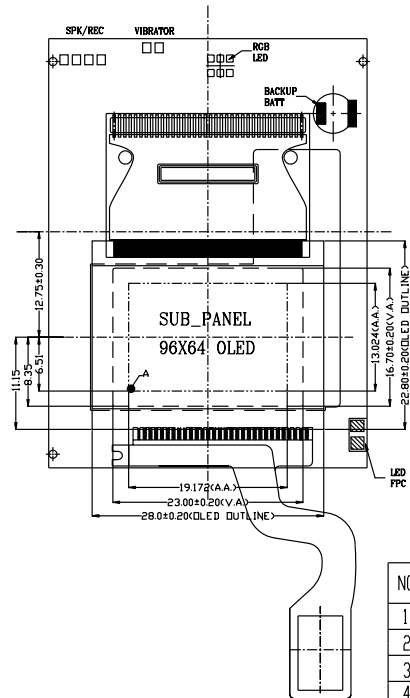
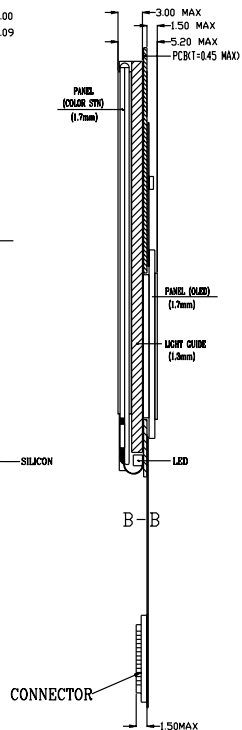
• **EXTERNAL DIMENSIONS :**



COLOR FILTER

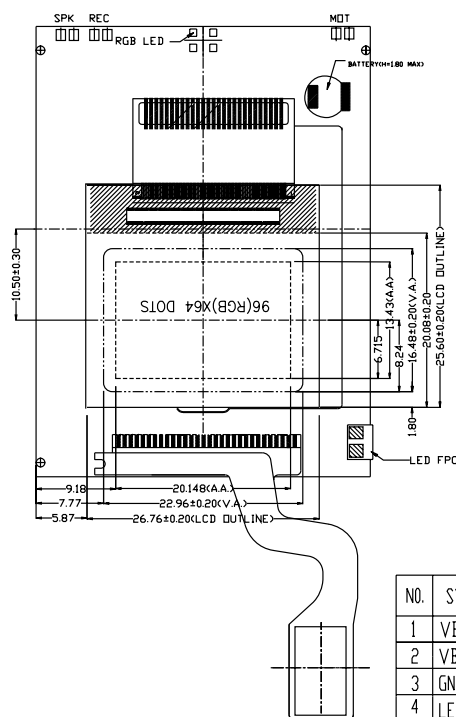
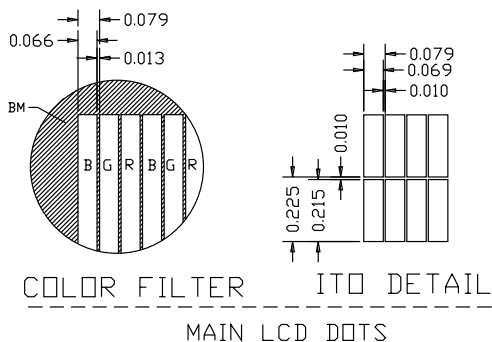


ITO DETAIL



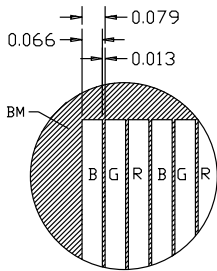
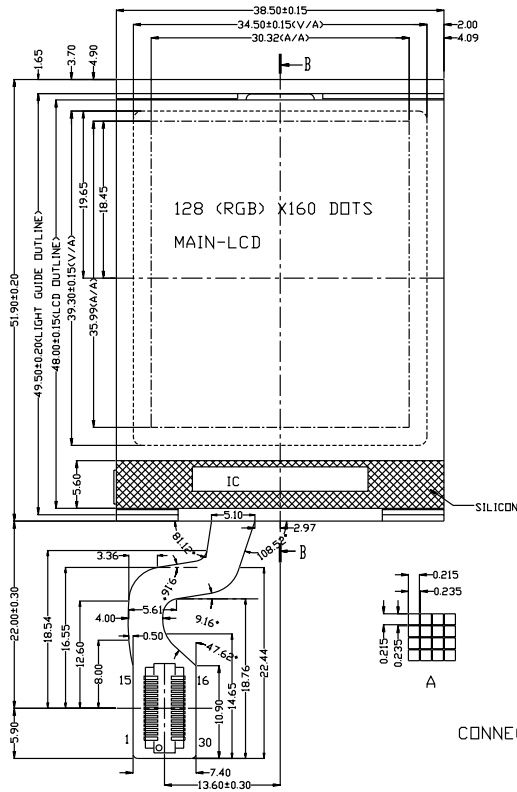
NO.	SYMBOL
1	VBAT
2	VBAT
3	GND
4	LED-G
5	LED-B
6	LED-R
7	DISP-CS-SUB
8	RD
9	LED-SUB-EN
10	ON-OFF
11	DISP-RST
12	LED-MAIN-EN
13	VIBRATOR
14	WR
15	DISP-CS-MAIN
16	DB0
17	DB1
18	DB2
19	DB3
20	DB4
21	DB5
22	DB6
23	DB7
24	RS
25	ADR7
26	GND
27	REC+
28	REC-
29	SP+
30	SP-

• **EXTERNAL DIMENSIONS :**

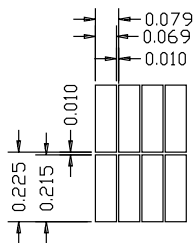
96

MG128160-8

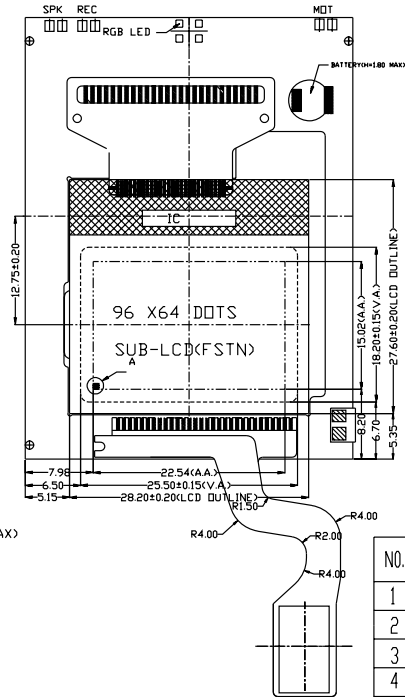
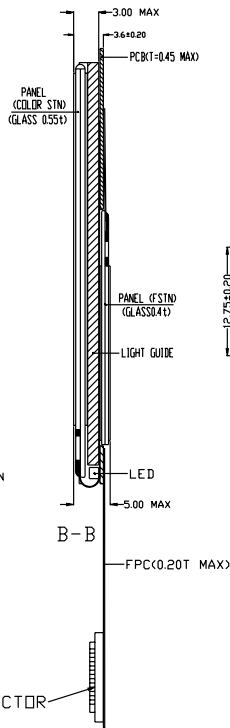
• EXTERNAL DIMENSIONS :



COLOR FILTER

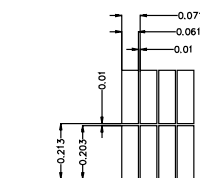


ITO DETAIL

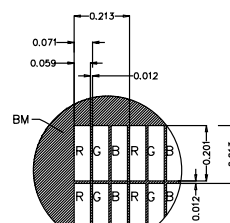


NO.	SYMBOL
1	VBAT
2	VBAT
3	GND
4	LED-G
5	LED-B
6	LED-R
7	DISP-CS-SUB
8	RD
9	LED-SUB-EN
10	ON-OFF
11	DISP-RST
12	LED-MAIN-EN
13	VIBRATOR
14	WR
15	DISP-CS-MAIN
16	DB0
17	DB1
18	DB2
19	DB3
20	DB4
21	DB5
22	DB6
23	DB7
24	RS
25	ADR7
26	GND
27	REC+
28	REC-
29	SP+
30	SP-

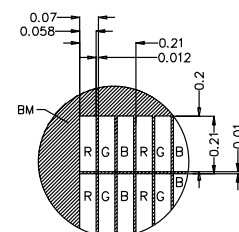
• **EXTERNAL DIMENSIONS :**



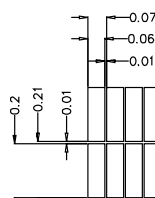
ITO DETAIL



COLOR FILTER
MAIN LCD DOTS



COLOR FILTER



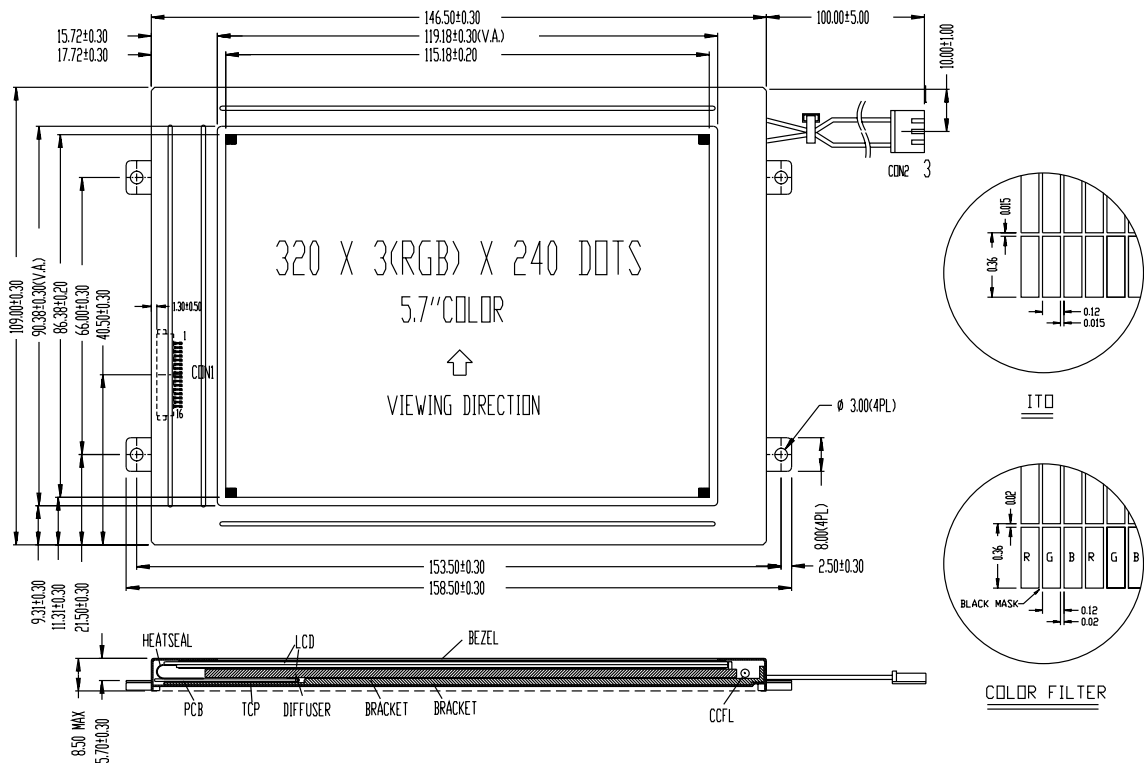
ITO DETAIL

SUB LCD DOTS

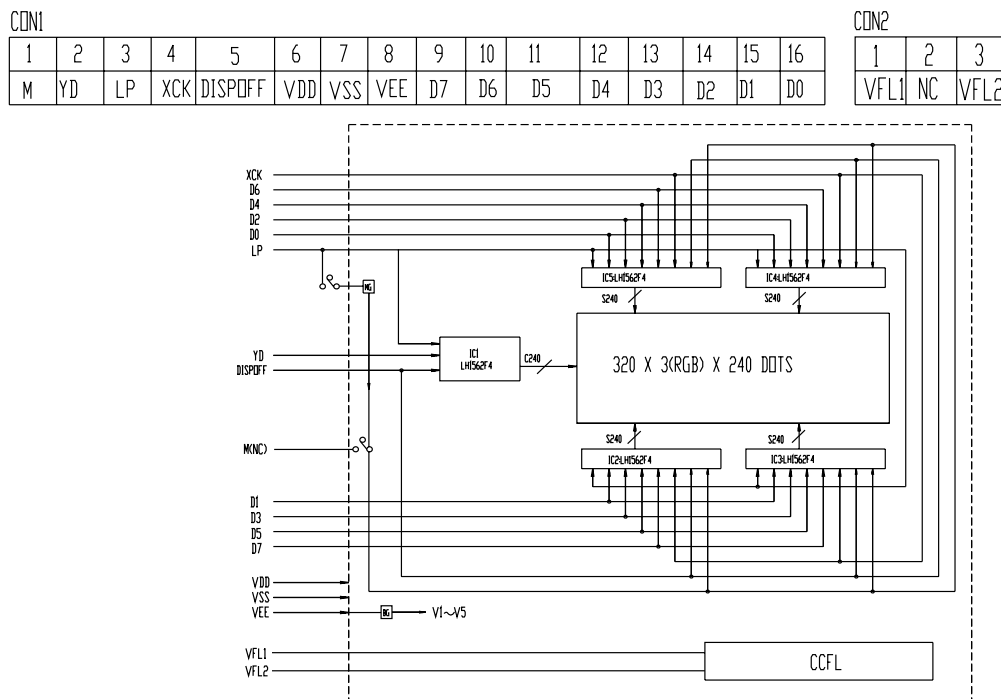
FPC total five layer, three layer routing and two layer copper.

MG320240-15

• EXTERNAL DIMENSIONS :

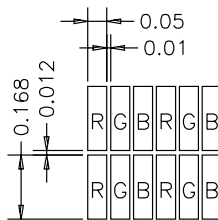
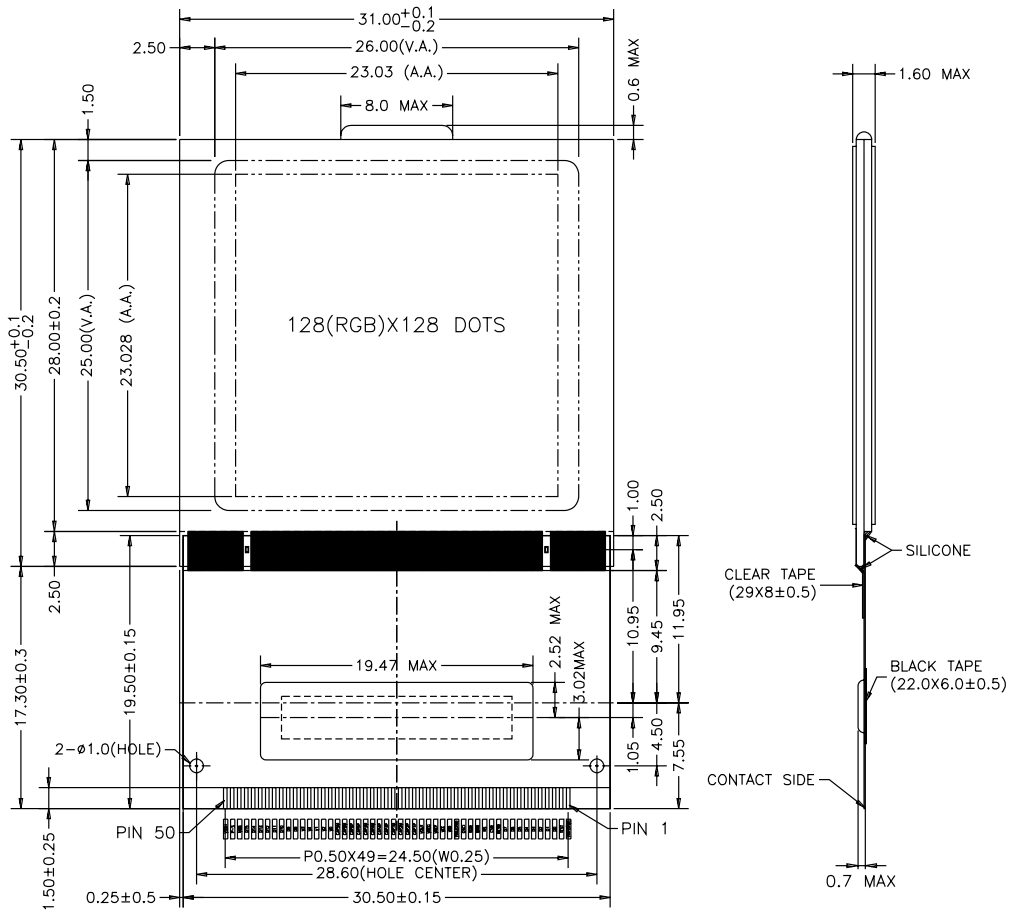


• BLOCK DIAGRAM :

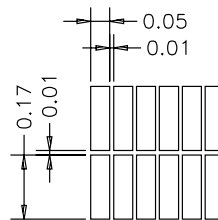


TSE1588

• EXTERNAL DIMENSIONS :



COLOR FILTER DETAIL

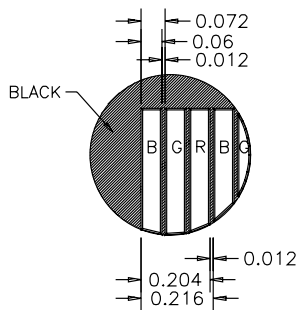
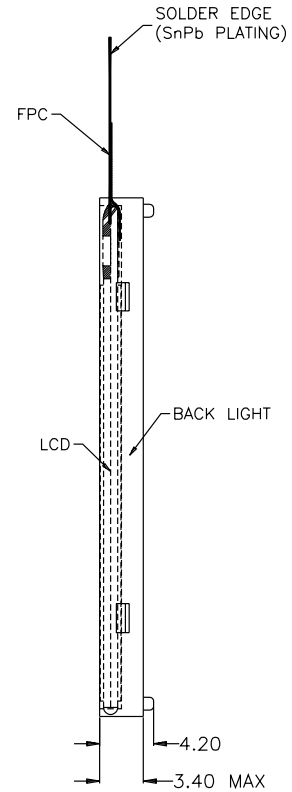
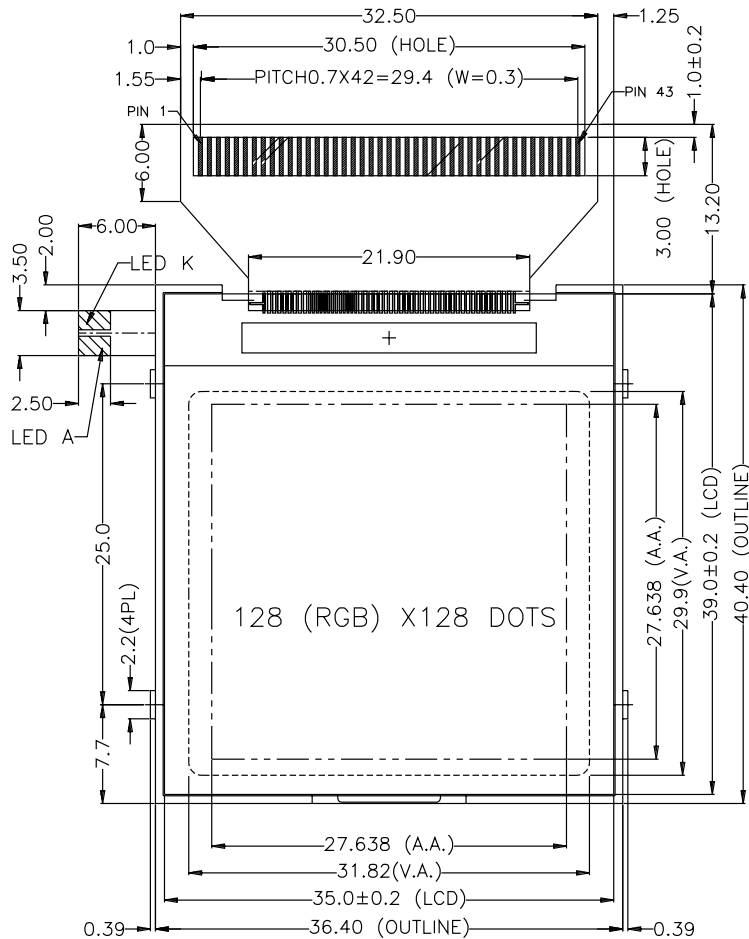


ITO DETAIL

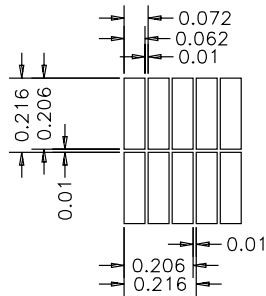
PIN	NAME	PIN	NAME
1	VSSH(GND)	26	CAP1M
2	TEST	27	CAP3P
3	D0	28	CAP4P
4	D1	29	CAP4M
5	D2	30	CAP3M
6	D3	31	CAP5P
7	D4	32	CAP6P
8	D5	33	CAP6M
9	D6	34	CAP5M
10	D7	35	V0
11	RESB	36	V2
12	CSB	37	V1
13	RS	38	V4
14	WRB	39	V3
15	RDB	40	D8
16	OSCI	41	D9
17	VSSL(GND)	42	D10
18	VDD	43	D11
19	VEE	44	D12
20	VREF	45	D13
21	VREG	46	D14
22	VOUT	47	D15
23	CAP1P	48	M86
24	CAP2P	49	P-S
25	CAP2M	50	VSSH

TSE6258

• EXTERNAL DIMENSIONS :



COLOR FILTER DETAIL

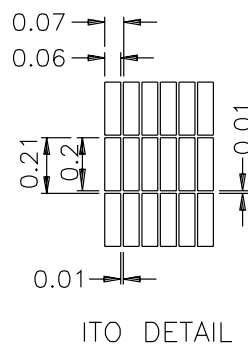
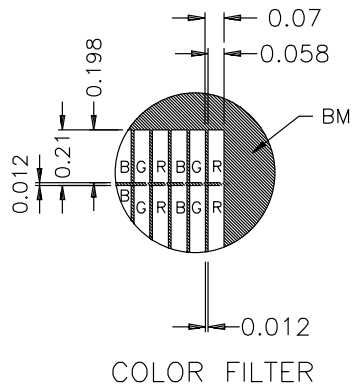
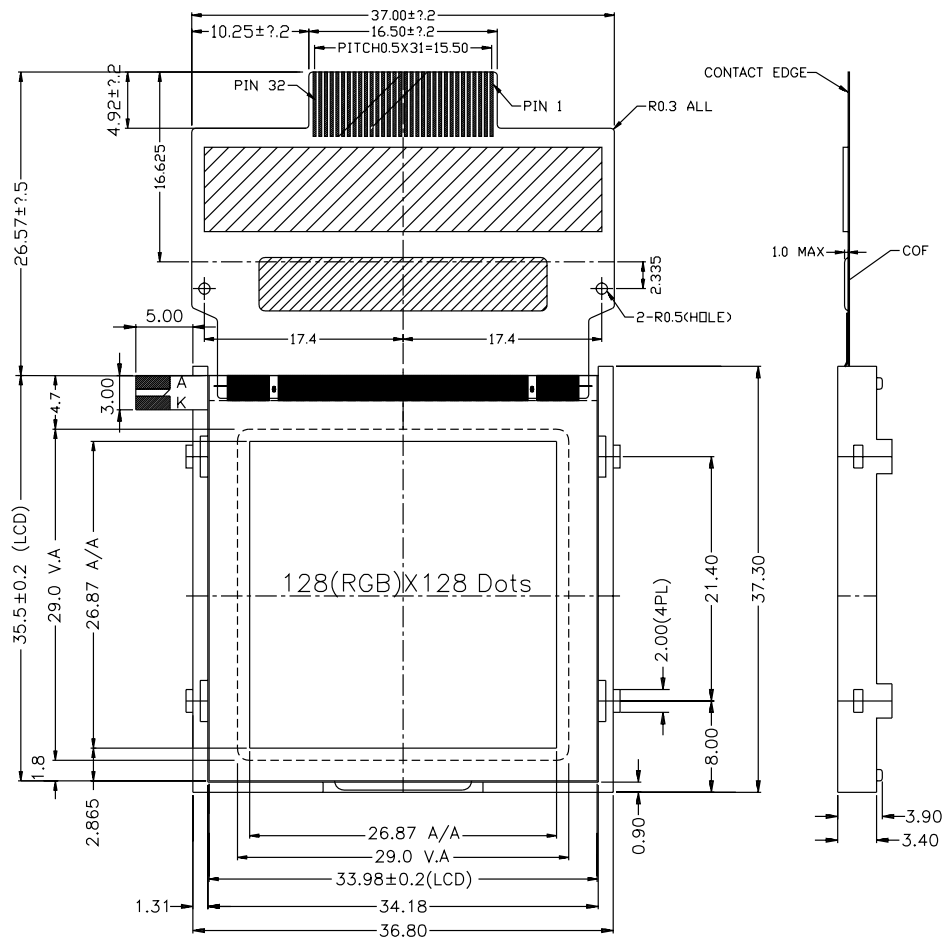


ITO DETAIL

1	RES	23	votp_gate
2	TE	24	C1+
3	VSS1	25	C1-
4	VSS2	26	C2+
5	CS/SCE	27	C2-
6	VDD1	28	C3+
7	VDD3	29	C3-
8	VDD2	30	C4+
9	D7	31	C4-
10	D3	32	VLCDOUT1
11	D6	33	VLCDIN1
12	D2	34	C5+
13	D5	35	C5-
14	D1	36	VLCDOUT2
15	D4	37	VLCDSENSE
16	DO/SDIN	38	VLCDIN2
17	SDOUT	39	V2L
18	DC/SCLK	40	V1L
19	WR	41	VC
20	RD	42	V1H
21	PS0	43	V2H
22	votp_drain		

TSE1540

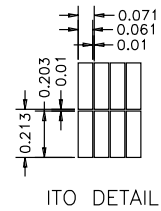
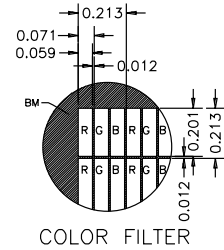
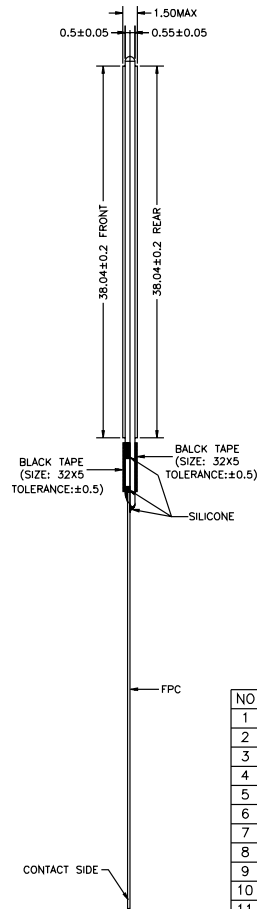
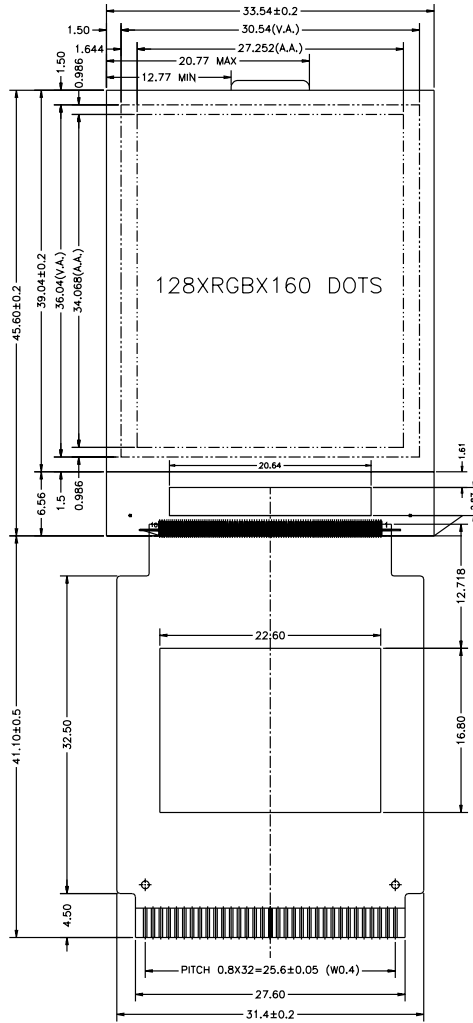
• EXTERNAL DIMENSIONS :



PIN	NAME
1	ATEST
2	VCI
3	VDDIO
4	VDD
5	VSS
6	BTEST
7	BUSY
8	D15
9	D14
10	D13
11	D12
12	D11
13	D10
14	D9
15	D8
16	D7
17	D6
18	D5
19	D4
20	D3
21	D2
22	D1
23	D0
24	E
25	RW
26	PS0
27	PS1
28	PS2
29	CS
30	RS
31	RES
32	VOUT

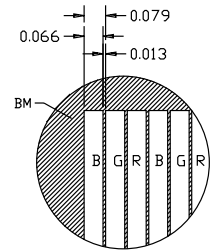
TSF6298

• EXTERNAL DIMENSIONS :

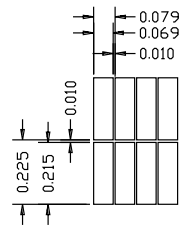


NO	SYMBOL	NO	SYMBOL	NO	SYMBOL
1	Dummy1	35	VSS	69	V1T
2	Dummy2	36	VSS	70	VMOUT
3	Dummy3	37	VSS	71	VMOUT
4	VOIN	38	VSS	72	VMOUT
5	VOIN	39	REG_ENB	73	DC2OUT
6	PS	40	INTRS	74	DC2OUT
7	VDD3	41	OSC4	75	C21P
8	MPU1	42	OSC3	76	C21P
9	VSS	43	OSC2	77	C21M
10	MPU0	44	OSC1	78	C21M
11	CS1B	45	VDD	79	C22P
12	VDD3	46	REG_OUT	80	C22P
13	RESETB	47	VDD3	81	C22M
14	RS	48	VDD3	82	C22M
15	WRD	49	VDD3	83	C23P
16	RDB	50	VDD3	84	C23P
17	VDD3	51	VIN1	85	C23M
18	DB0	52	VIN1	86	C23M
19	DB1	53	VIN1A	87	C24P
20	DB2	54	VIN1A	88	C24P
21	DB3	55	VIN2	89	C24M
22	DB4	56	VIN2	90	C24M
23	DB5	57	VOUT45	91	VRN
24	DB6	58	VOUT45	92	VRN
25	DB7	59	C11P	93	NC1
26	DB8	60	C11P	94	VRP
27	DB9	61	C11M	95	VRP
28	DB10	62	C11M	96	C31P
29	DB11	63	C12P	97	C31P
30	DB12	64	C12P	98	C31M
31	DB13	65	C12M	99	C31M
32	DB14	66	C12M	100	VSS
33	DB15	67	V1OUT	101	VOIN
34	VSS	68	V1OUT	102	Dummy4
				103	Dummy5
				104	Dummy6

• **EXTERNAL DIMENSIONS :**



COLOR FILTER

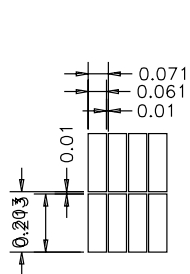
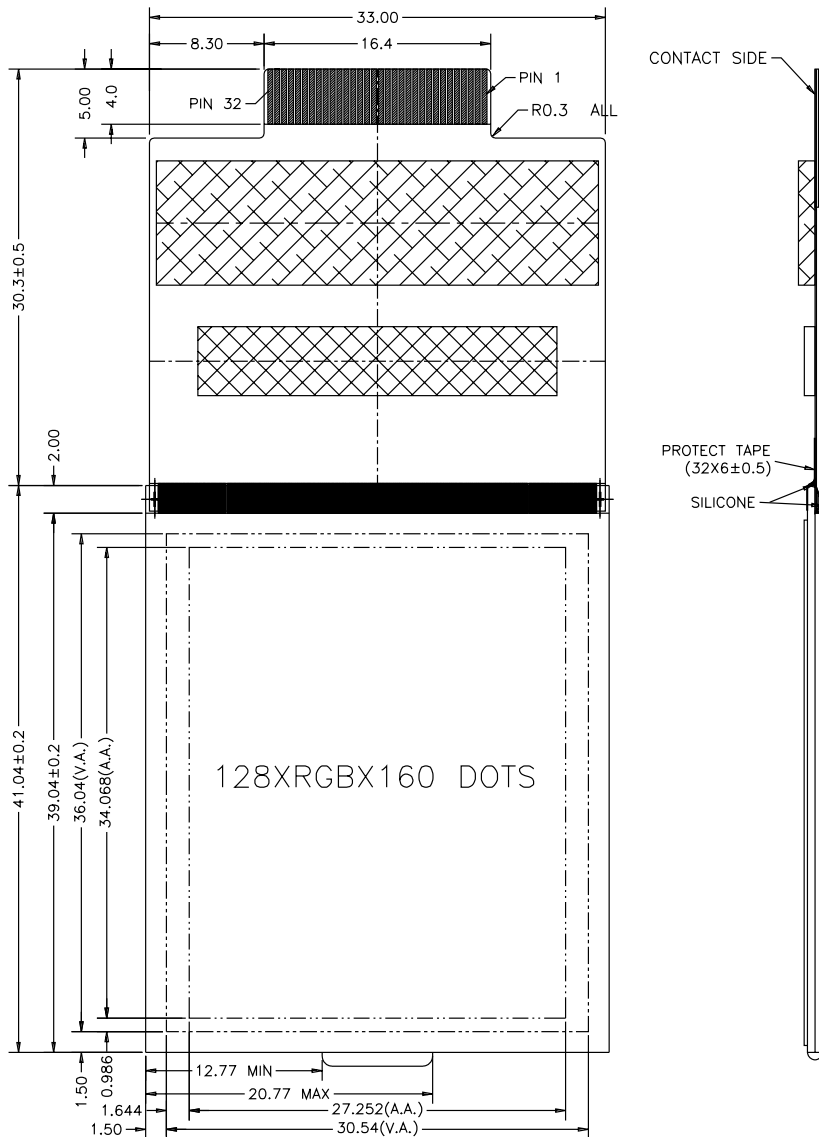


ITO DETAIL

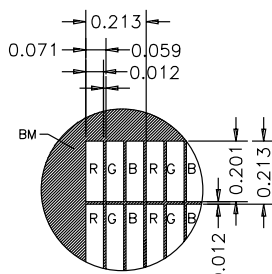
PIN	SYMBOL	PIN	SYMBOL
1	GND	14	DB4
2	VDD	15	DB3
3	DB15	16	DB2
4	DB14	17	DB1
5	DB13	18	DB0
6	DB12	19	RD
7	DB11	20	WR
8	DB10	21	RS
9	DB9	22	RST
10	DB8	23	CSI
11	DB7	24	MPU0
12	DB6	25	MPU1
13	DB5	26	PS

TSF1536

• EXTERNAL DIMENSIONS :



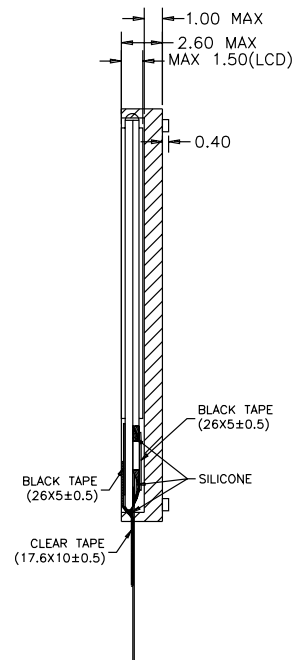
ITO DETAIL



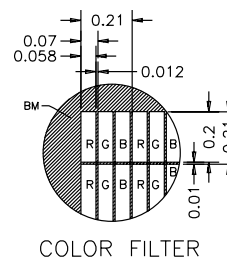
COLOR FILTER

1	ATESTX
2	VCI
3	VDDIO
4	VDD
5	VSS
6	BTESTX
7	BUSY
8	D15
9	D14
10	D13
11	D12
12	D11
13	D10
14	D9
15	D8
16	D7
17	D6
18	D5
19	D4
20	D3
21	D2
22	D1
23	D0
24	EX
25	RWX
26	PS0X
27	PS1X
28	PS2X
29	CSBX
30	RSX
31	RSTBX
32	VOUT

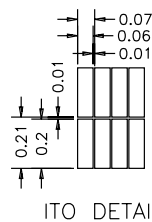
• **EXTERNAL DIMENSIONS :**


$$A - A$$

PIN 1	LED 1+
PIN 2	LED 2+
PIN 3	LED -



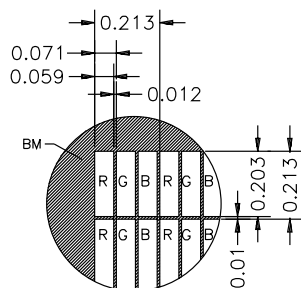
COLOR FILTER



ITO DETAIL

PIN	SYMBOL
1	VDD
2	VSS
3	$\overline{CS}$
4	RES
5	D/C
6	R/W(WR)
7	E ($\overline{RD}$)
8	D0
9	D1
10	D2
11	D3
12	D4
13	D5
14	D6 (SCK)
15	D7 (SDA)
16	$\overline{CS}$
17	VDD
18	VSS
19	VL2
20	VL3
21	VL4
22	VL5
23	VOUT
24	LED+
25	LED-

• EXTERNAL DIMENSIONS :

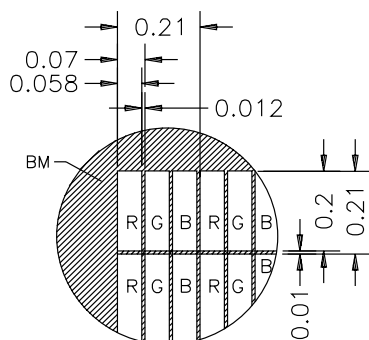
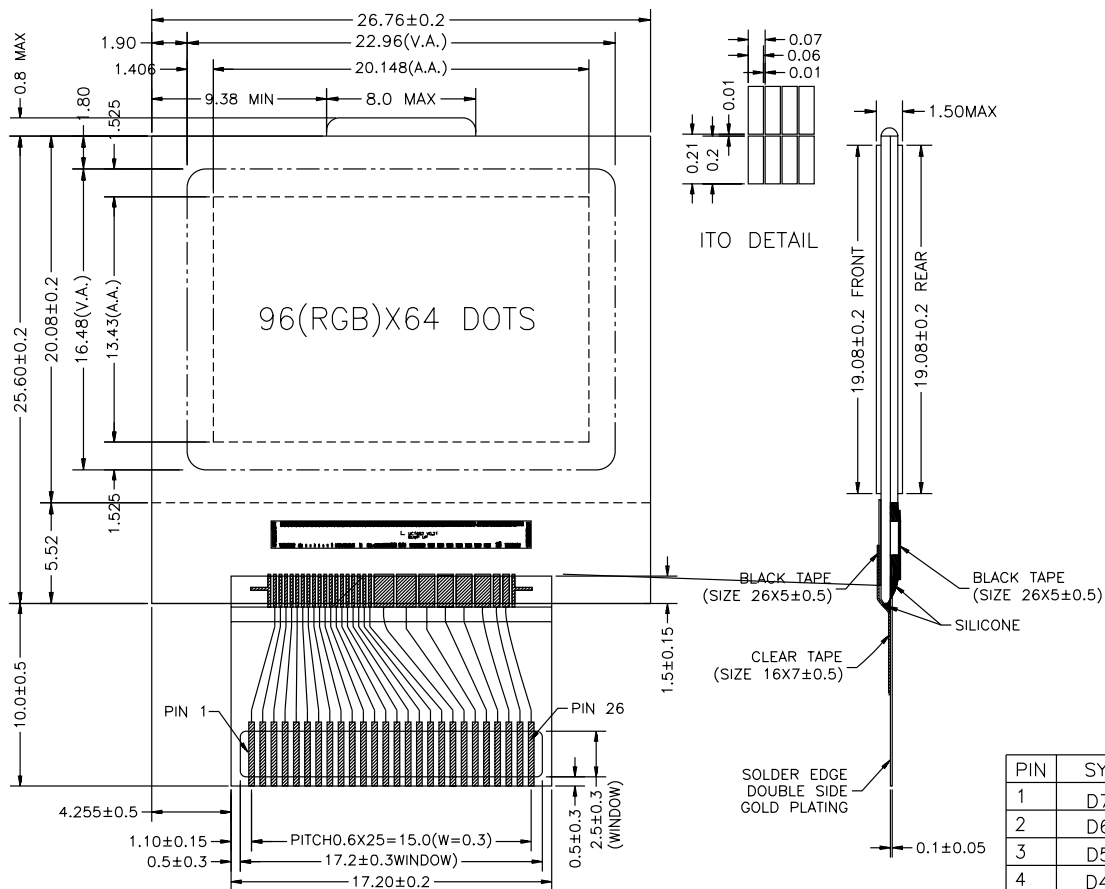


ITO DETAIL

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TSD6288

• EXTERNAL DIMENSIONS :

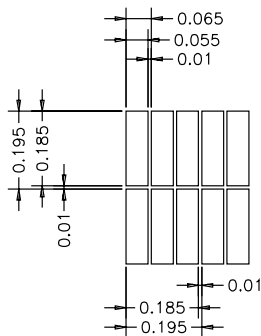
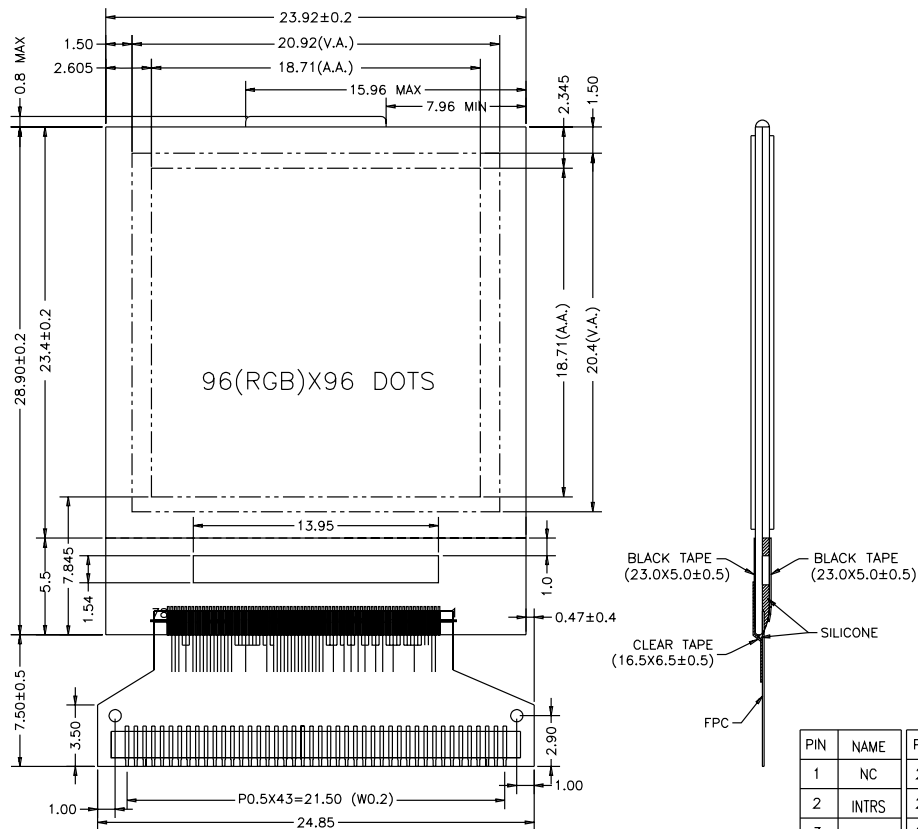


COLOR FILTER

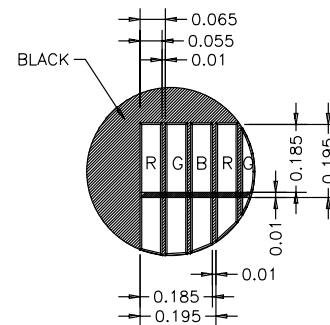
PIN	SYMBOL
1	D7
2	D6
3	D5
4	D4
5	D3
6	D2
7	D1
8	D0
9	VBIAS
10	RST ₋
11	CS0
12	CD
13	WR0
14	WR1
15	BM0
16	BM1
17	TST4
18	ID
19	VSS
20	VDD
21	VB0+
22	VB1+
23	VB1-
24	VB0-
25	VLCDIN
26	VLCDOUT

TSE6312

• EXTERNAL DIMENSIONS :



ITO DETAIL

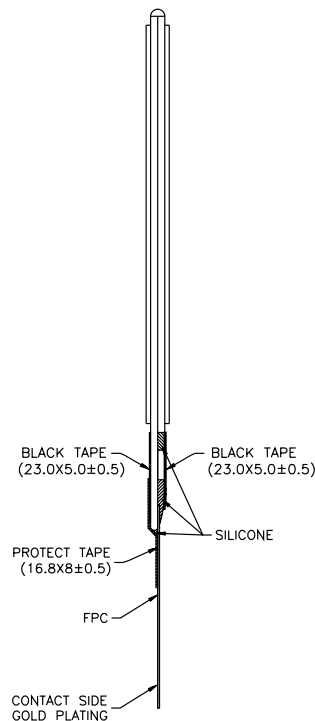
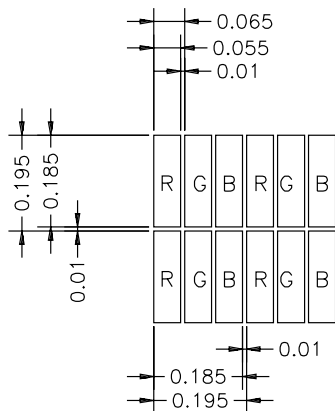
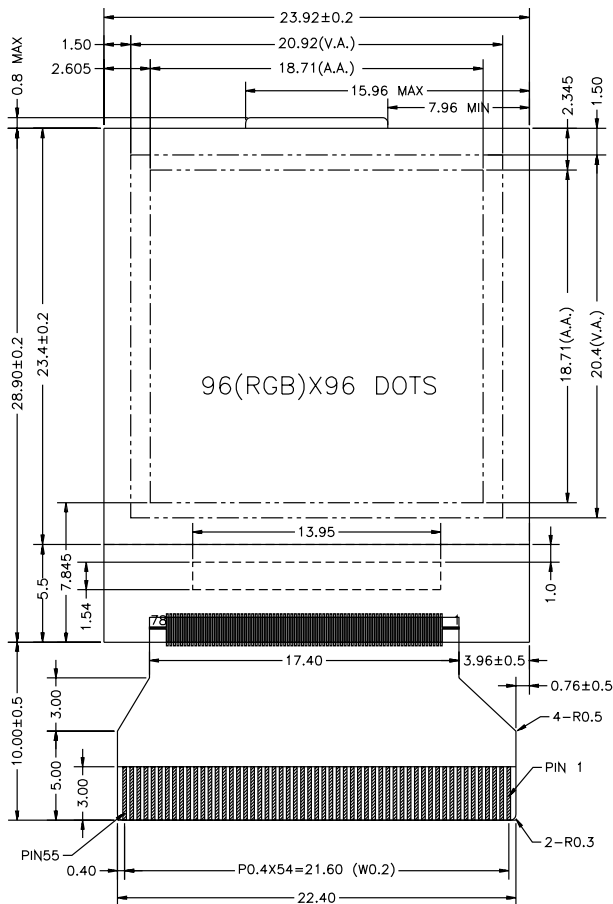


COLOR FILTER DETAIL

PIN	NAME	PIN	NAME	PIN	NAME
1	NC	27	VIN45	53	DB14
2	INTRS	28	VIN1B	54	DB13
3	VREF-I	29	VIN1A	55	DB12
4	VREF-T	30	VSS2	56	DB11
5	VREF-O	31	VSS2	57	DB10
6	VCC	32	VSS1	58	DB9
7	VCC	33	VSS1	59	DB8
8	VCC	34	C31N	60	DB7
9	VRP-FB	35	C31P	61	DB6
10	VRP	36	C24N	62	DB5
11	VRP	37	C24P	63	DB4
12	VEE	38	C23N	64	DB3
13	VEE	39	C23P	65	DB2
14	VEE	40	C22N	66	DB1
15	VRN-FB	41	C22P	67	DB0
16	VRN	42	C21N	68	E_RDB
17	V0-I	43	C21P	69	RW_WRB
18	VM-I2	44	C12N	70	DI
19	VM-FB	45	C12P	71	CS1B
20	VM-O	46	C11N	72	MPU2
21	V1-I	47	C11P	73	MPU1
22	V1-FB	48	DVSS!	74	SP
23	V1-O	49	DVSS!	75	RSTB
24	VIN2	50	DVDD!	76	OSC2
25	VOUT45	51	DVDD!	77	OSC1
26	VIN45P	52	DB15	78	NC

TSE6328

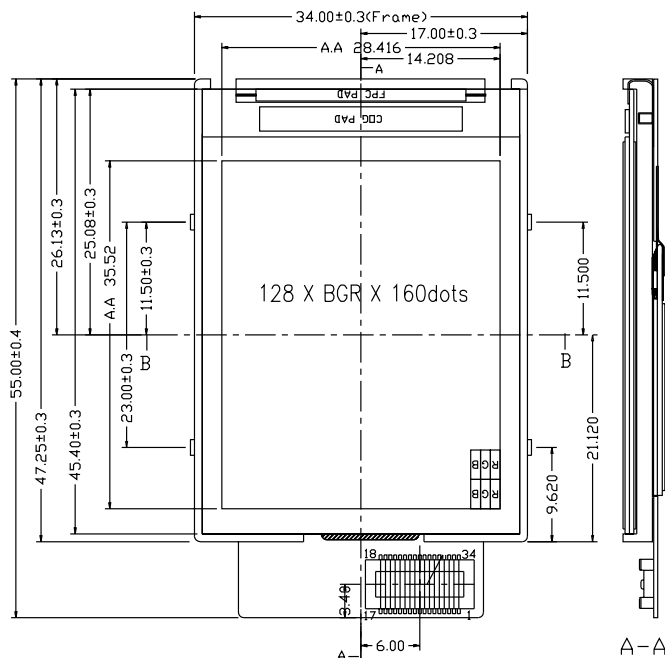
• EXTERNAL DIMENSIONS :



PIN	NAME	PIN	NAME
1	INTRS	28	DVSS
2	VREF-I	29	DVDD
3	VREF-T	30	DB15
4	VREF-O	31	DB14
5	VCC	32	DB13
6	VEE	33	DB12
7	V0-I	34	DB11
8	VM	35	DB10
9	V1	36	DB9
10	VIN2	37	DB8
11	V45	38	DB7
12	VIN1	39	DB6
13	VSS	40	DB5
14	C31N	41	DB4
15	C31P	42	DB3
16	C24N	43	DB2
17	C24P	44	DB1
18	C23N	45	DB0
19	C23P	46	E_RDB
20	C22N	47	RW_WRB
21	C22P	48	DI
22	C21N	49	CS1B
23	C21P	50	MPU2
24	C12N	51	MPU1
25	C12P	52	SP
26	C11N	53	RSTB
27	C11P	54	OSC2
		55	OSC1

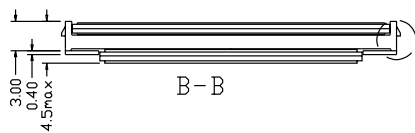
MG128160-16

• EXTERNAL DIMENSIONS :

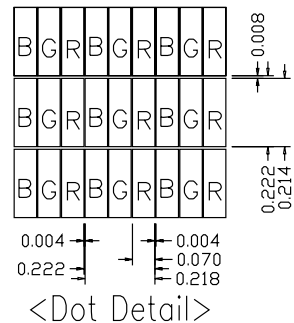
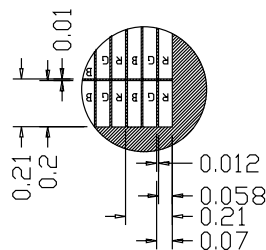
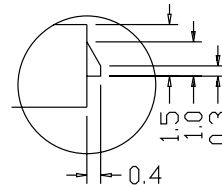
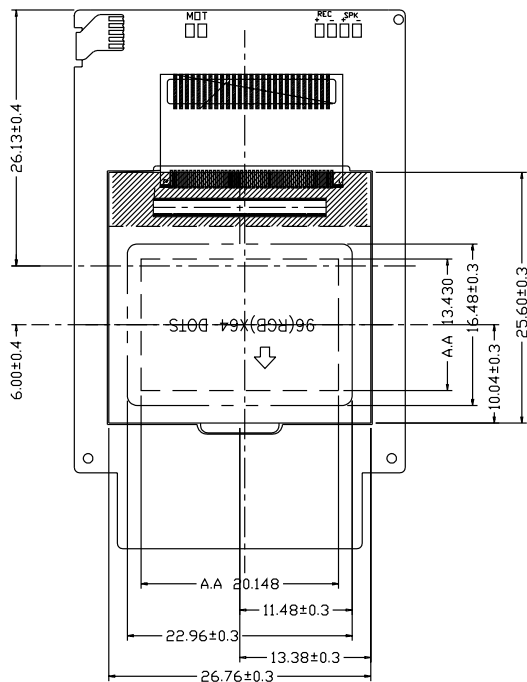


CONNECTOR
WAXR5F34345J

A-A



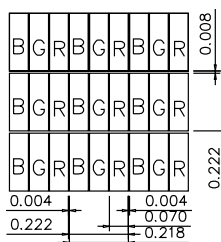
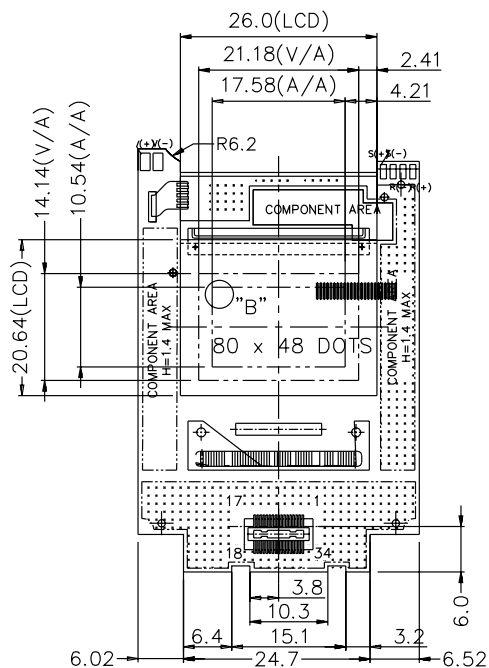
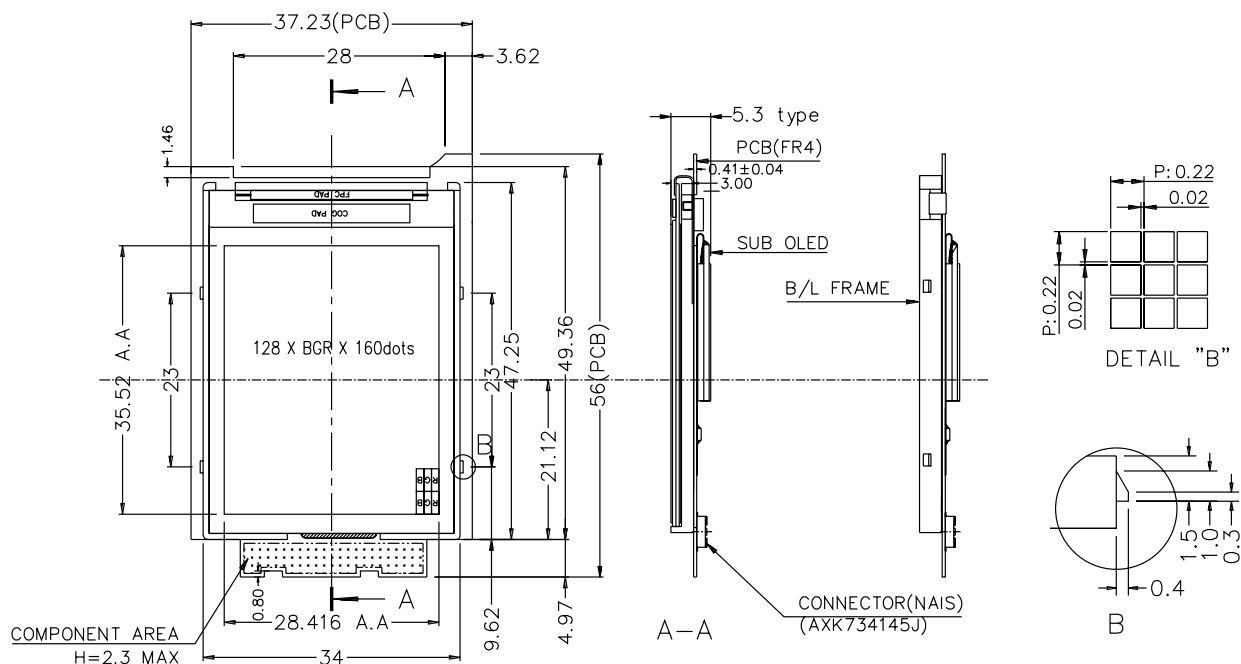
B-B



No.	PIN NAME
1	REC+
2	REC-
3	SPC+
4	SPK-
5	LED_EN
6	GND
7	GND
8	VCC
9	VCC
10	GND
11	XRD
12	XWR
13	D0
14	D1
15	D2
16	D3
17	D4
18	D5
19	D6
20	D7
21	D8
22	D9
23	D10
24	D11
25	D12
26	D13
27	D14
28	D15
29	XCS_Main
30	XRS
31	RES
32	XCS_Sub
33	GND
34	VIBATOR

MG128160-17

• EXTERNAL DIMENSIONS :

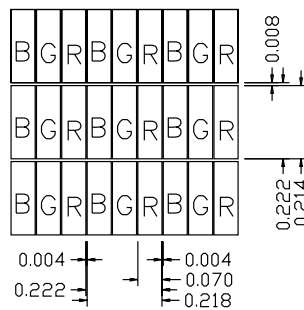
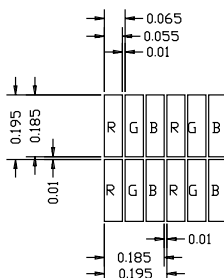
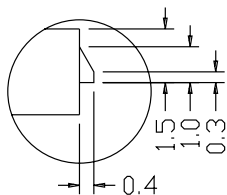
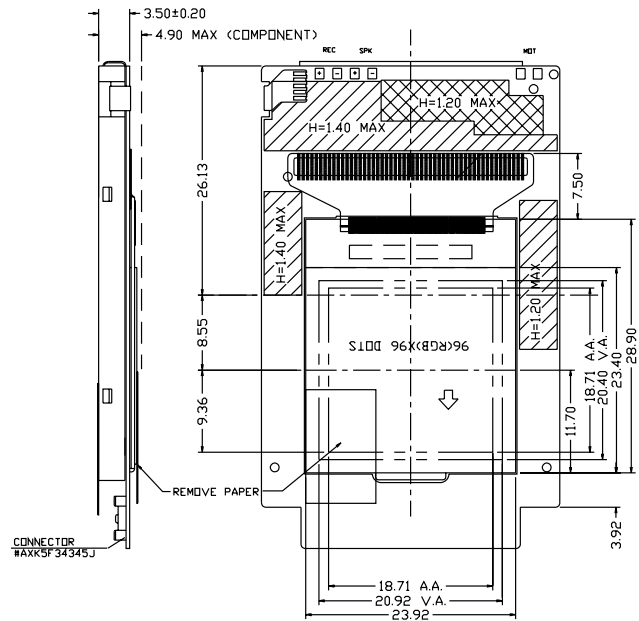
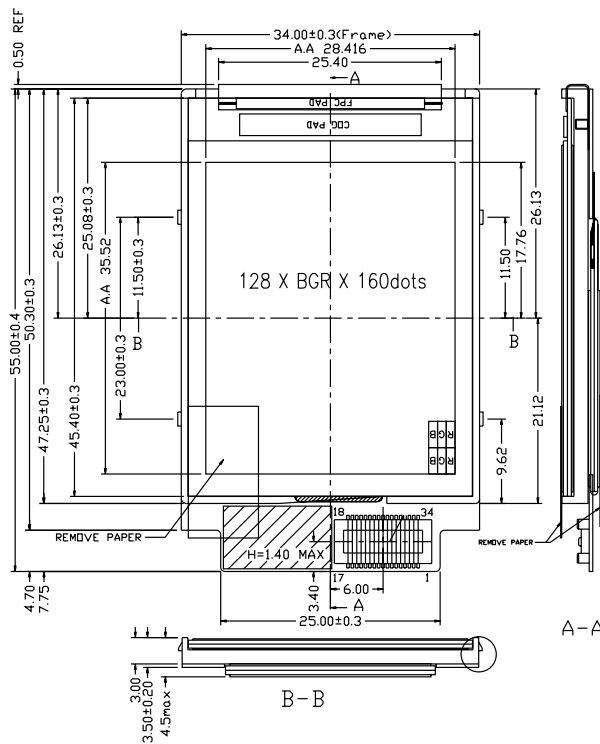


<Dot Detail>

NO.	SYMBOL	NO.	SYMBOL
1	Sub_CS	18	SPK-
2	Main_CS	19	GND
3	OLED_EN	20	V_MOT
4	LWR	21	LED_EN
5	A	22	VBATT
6	D7	23	VBATT
7	D6	24	D15
8	D5	25	D14
9	D4	26	D13
10	D3	27	D12
11	D2	28	D11
12	D1	29	D10
13	D0	30	D9
14	VDD	31	D8
15	/RESET	32	REC+
16	GND	33	REC-
17	SPK+	34	GND

MG128160-20

• EXTERNAL DIMENSIONS :

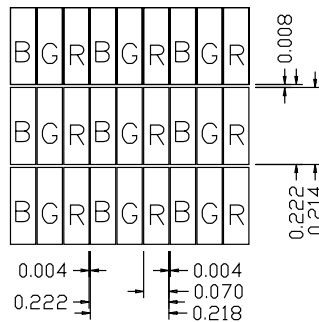
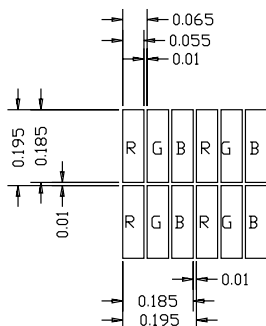
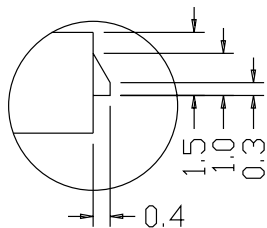
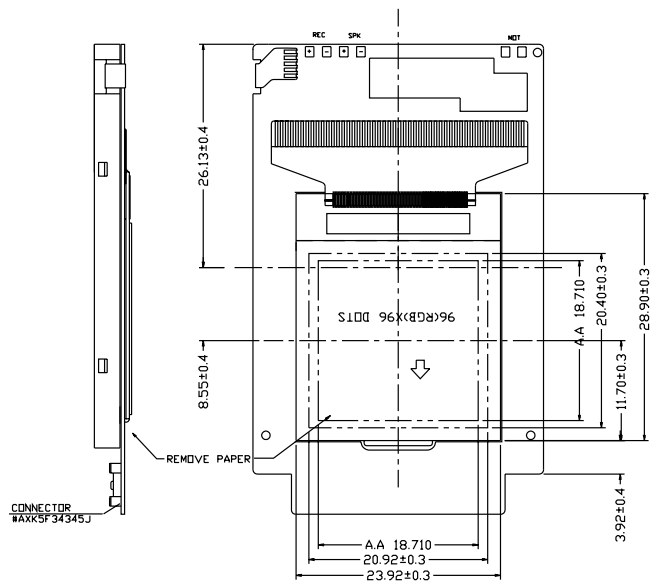
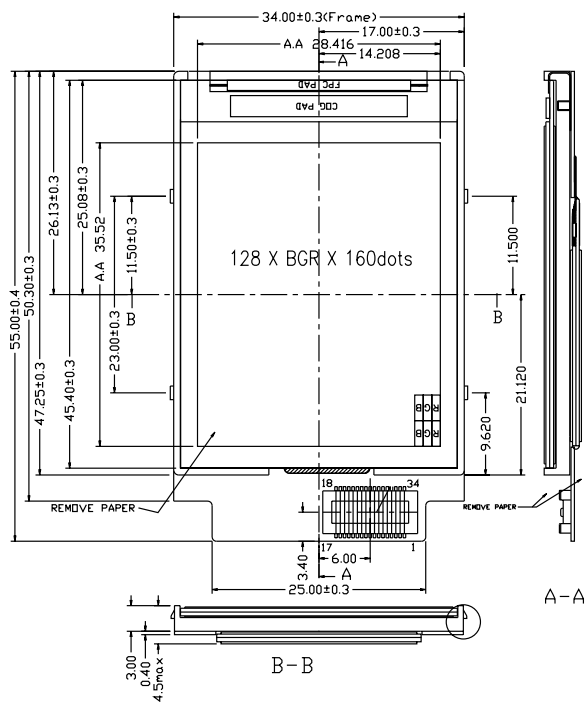


<Dot Detail>

No.	PIN NAME
1	REC+
2	REC-
3	SPC+
4	SPK-
5	LED_EN
6	GND
7	GND
8	LCDVDD
9	VBAT
10	GND
11	XRD
12	XWR
13	D0
14	D1
15	D2
16	D3
17	D4
18	D5
19	D6
20	D7
21	D8
22	D9
23	D10
24	D11
25	D12
26	D13
27	D14
28	D15
29	XCS_Main
30	XRS
31	RES
32	XCS_Sub
33	GND
34	VIBATOR

MG128160-21

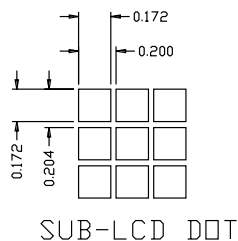
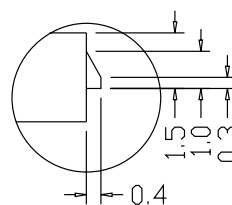
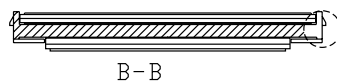
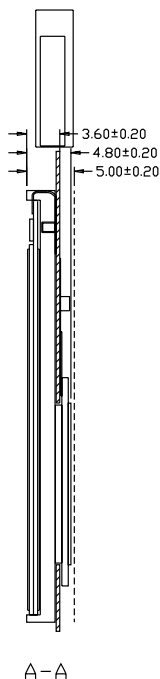
• EXTERNAL DIMENSIONS :



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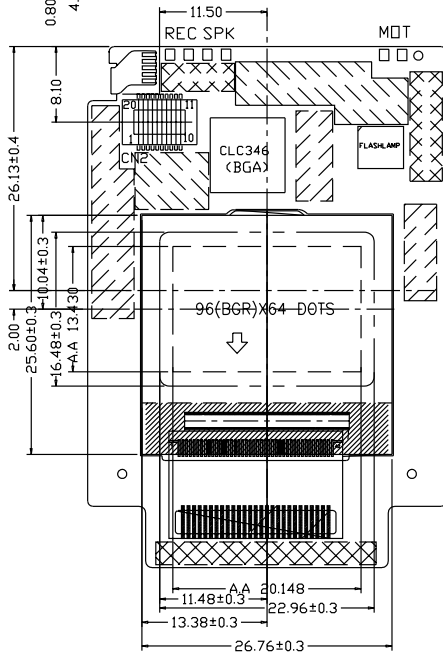
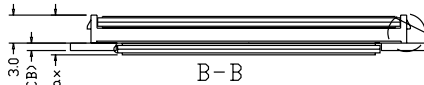
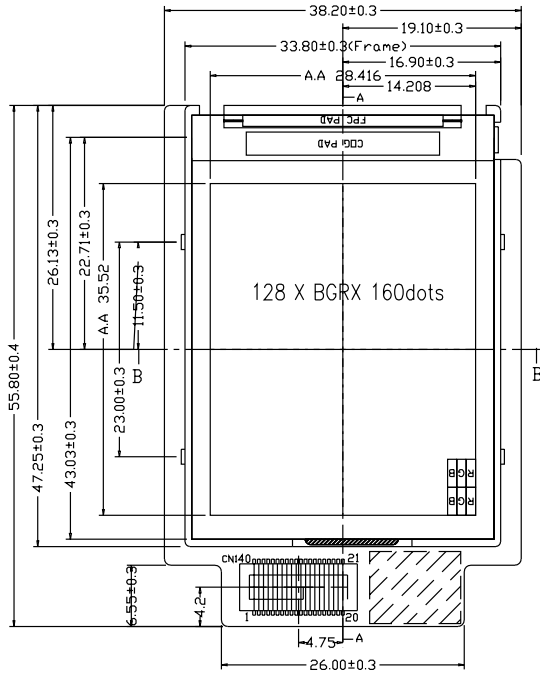
No.	PIN NAME
1	REC+
2	REC-
3	SPC+
4	SPK-
5	LED_EN
6	GND
7	GND
8	LCDVDD
9	VBAT
10	GND
11	XRD
12	XWR
13	D0
14	D1
15	D2
16	D3
17	D4
18	D5
19	D6
20	D7
21	D8
22	D9
23	D10
24	D11
25	D12
26	D13
27	D14
28	D15
29	XCS_Main
30	XRS
31	RES
32	XCS_Sub
33	GND
34	VIBATOR

• **EXTERNAL DIMENSIONS :**

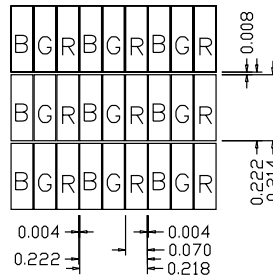
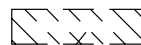
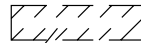
115

MG128160-27

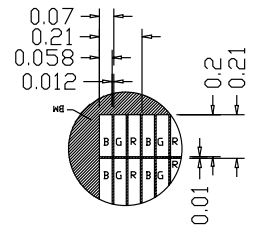
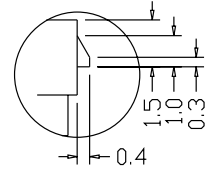
• EXTERNAL DIMENSIONS :



A-A



<Dot Detail>



CN1

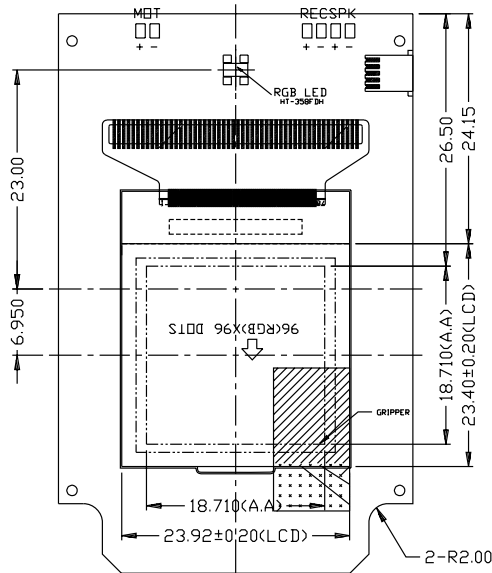
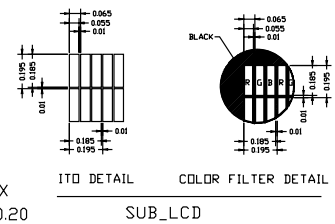
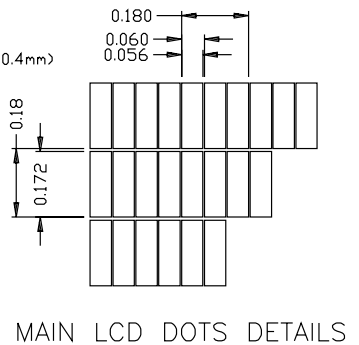
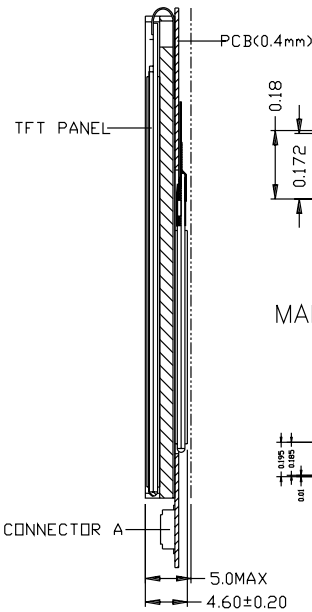
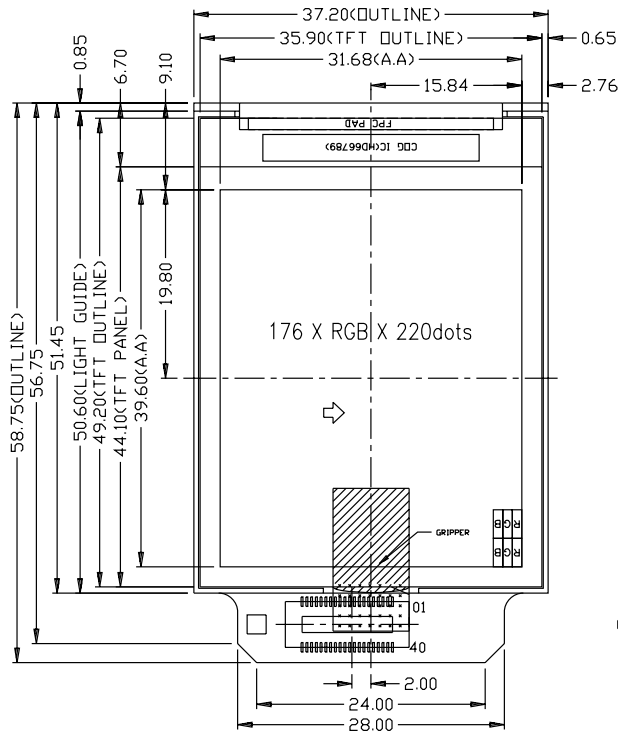
No.	PIN NAME
1	VDD
2	VDD
3	CLK13M
4	GND
5	DB00
6	DB01
7	DB02
8	DB03
9	DB04
10	DB05
11	DB06
12	DB07
13	DB08
14	DB09
15	DB10
16	DB11
17	DB12
18	DB13
19	DB14
20	DB15
21	VBAT
22	/LCDRESET
23	/CAMRESET
24	CAMERA_HOLD
25	/CAMERA_INTR
26	/CS_MAIN
27	/CS_SUB
28	/RD
29	/WR
30	ADD01
31	ADD02
32	MOTOR
33	BL_MAIN
34	NC
35	GND
36	RECEIVER+
37	RECEIVER-
38	SPEAKER+
39	SPEAKER-
40	GND

CN2

PIN NO.	NAME
1	GND
2	HREF
3	VSYNC
4	PWDN
5	PCLK
6	VDD
7	DOVDD
8	SIDD
9	XCLK
10	SIOC
11	Y0
12	Y1
13	Y2
14	Y3
15	GND
16	Y4
17	Y5
18	Y6
19	Y7
20	RESET

MG176220-1

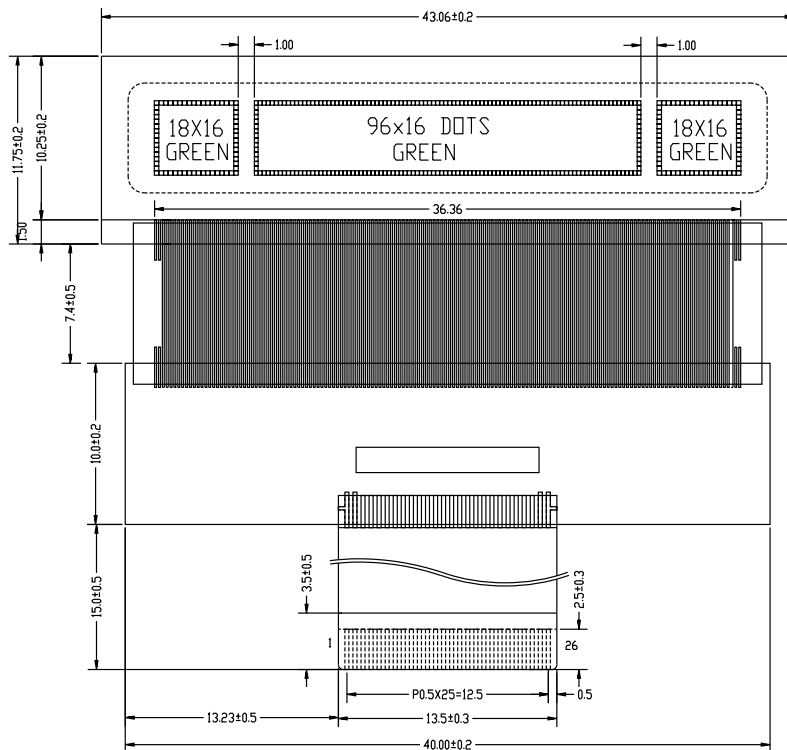
• EXTERNAL DIMENSIONS :



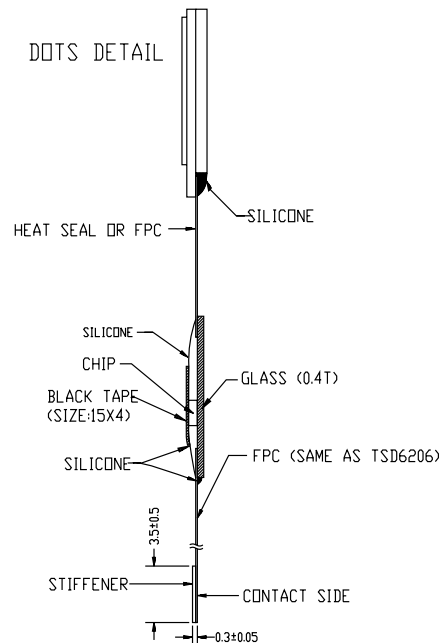
NO.	SYMBOL	NO.	SYMBOL
01	GND	21	GND
02	DB0	22	REC-
03	DB2	23	REC+
04	DB4	24	SPK-
05	DB6	25	SPK+
06	DB8	26	VIBRTOR
07	DB10	27	LED_EN
08	DB12	28	VBAT
09	DB14	29	VBAT
10	GND	30	GND
11	WR	31	DB15
12	RD	32	DB13
13	RS	33	DB11
14	MAIN_CS	34	DB9
15	SUB_CS	35	DB7
16	RESET	36	DB5
17	GND	37	DB3
18	LED_R	38	DB1
19	LED_G	39	VCC
20	LED_B	40	VCC

TS13216-1

• EXTERNAL DIMENSIONS :



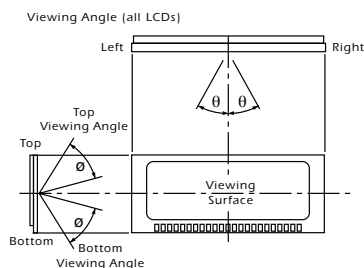
DOTS DETAIL



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
NC	VEE	IREF	VREF	VSS	VDD	D7	D6	D5	D4	D3	D2	D1	D0	E	R/W	D/C	/RES	/CS	VEE	NC	NC	NC	NC	NC	NC

MONOCHROME OPTICAL CHARACTERISTICS

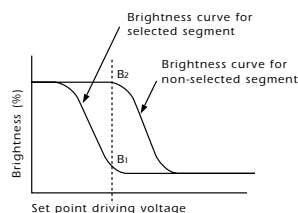
Note 1. Definition of Viewing Angle



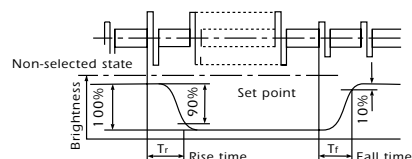
Note : Select either top or bottom viewing angle.

Note 2. Definition of Contrast Ratio "K"

$$K = \frac{\text{Brightness of non-selected segment (B}_2\text{)}}{\text{Brightness of selected segment (B}_1\text{)}}$$



Note 3. Definition of Optical Response Time



For TN Display Modules

Item	Symbol	Test Condition	Standard Value			Unit	Notes to see
			Min.	Typ.	Max.		
Viewing Angle	θ	$K = 1.4$	30	—	—	degree	1, 2
	ϕ		—	—	30	degree	1, 2
Contrast Ratio	K	$\phi = 20. \theta = 0.$	2.5	4	—	—	1, 2
Response Time (rise)	Tr	$\phi = 0. \theta = 0.$	—	150	250	ms	3
Response Time (fall)	Tf	$\phi = 0. \theta = 0.$	—	150	250	ms	3

For STN Display Modules

Item	Symbol	Test Condition	Standard Value			Unit	Notes to see
			Min.	Typ.	Max.		
Viewing Angle	θ	$K = 2.0$	50	—	—	degree	1, 2
	ϕ		—	—	.40	degree	1, 2
Contrast Ratio	K	$\phi = 0. \theta = 0.$	4	7	—	—	1, 2
Response Time (rise)	Tr	$\phi = 0. \theta = 0.$	—	150	250	ms	3
Response Time (fall)	Tf	$\phi = 0. \theta = 0.$	—	150	250	ms	3

For FSTN Display Modules

Item	Symbol	Test Condition	Standard Value			Unit	Notes to see
			Min.	Typ.	Max.		
Viewing Angle	θ	$K = 2.5$	50	—	—	degree	1, 2
	ϕ		—	—	.40	degree	1, 2
Contrast Ratio	K	$\phi = 0. \theta = 0.$	7	10	—	—	1, 2
Response Time (rise)	Tr	$\phi = 0. \theta = 0.$	—	150	250	ms	3
Response Time (fall)	Tf	$\phi = 0. \theta = 0.$	—	150	250	ms	3

MONOCHROME OPTICAL CHARACTERISTICS

STN LCD

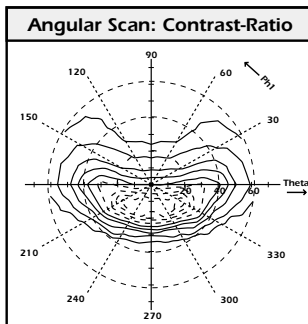
■ Principles

The following features are available STN mode:

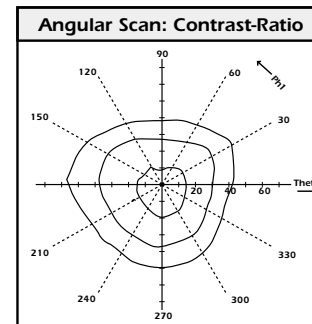
- High contrast, wide viewing angle.
- Assurance of vertical viewing angle of display.

This technology has come to be widely used in the last several years, because it permits the use of the existing process and makes it possible to obtain a high picture quality at low cost.

Equi-Contrast Distribution Curve TN vs STN



TN



STN

FSTN LCD

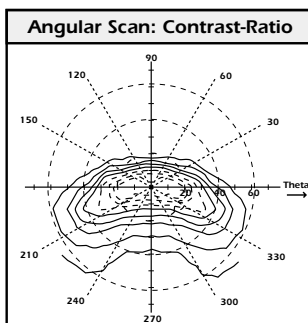
■ Features

- Clear and legible black and white display.
- High contrast and wide viewing angle at a high multiplex drive.
- Up to VGA resolution.
- Small temperature dependency of background color.
- Contrast of B/W display is approximately three times higher than STN.

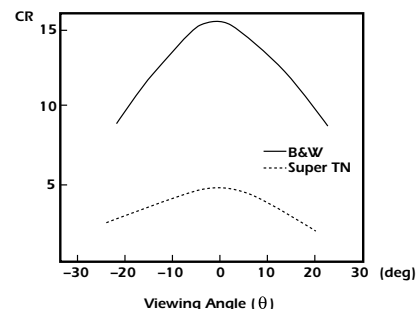
■ Principles

This technology is achieved by adding an optical retardation film to LC cell. The same driving method as STN is used.

Equi-Contrast Distribution Curve



Contrast vs. Viewing Angle



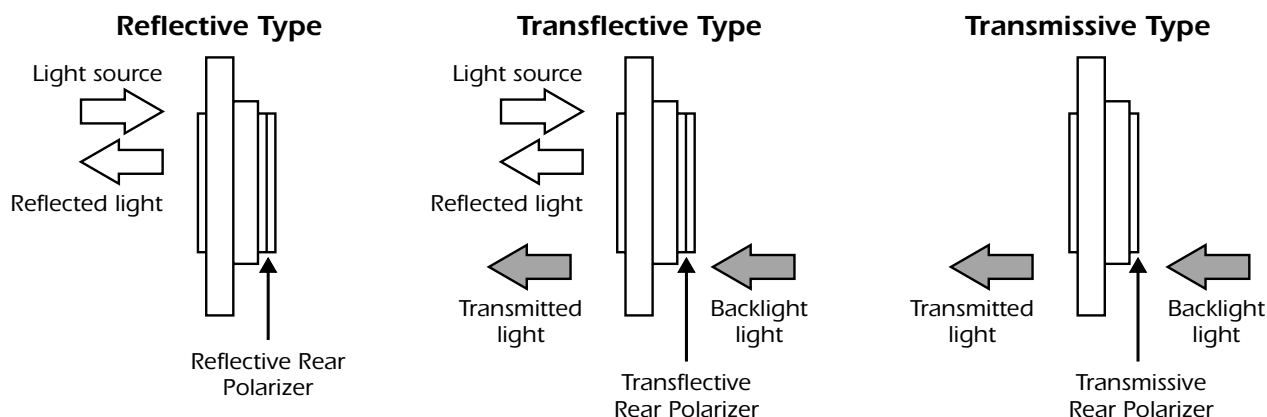
TECHNICAL ISSUES

LCD PANEL

■ Features

- Low driving voltage, low power dissipation ($0.2 \sim 2.A/cm^2@5V_{DC}$).
- Compact and thin structure.
- Custom artwork designs.
- Sunlight readable.

■ Viewing Modes



Positive Type



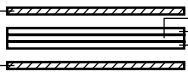
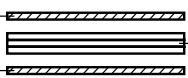
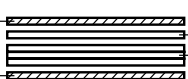
Positive type display requires no backlighting.

Negative Type



Negative type display requires backlighting.

■ LCD Modes

LCD MODE	COLOR MODE	DOT COLOR	BACKGROUND COLOR	STRUCTURE
TN	—	Black	Gray	Polarizer —  — LC — Glass — Polarizer Twist angle 90.
STN	Yellow	Dark Blue	Yellow-Green	Polarizer —  — STN Cell — Polarizer Twist angle 180. to 240.
	Gray	Medium Blue	Blue-Gray	
	Blue	White	Dark Blue	
FSTN	—	Black	White	Polarizer —  — Compensation Film — STN Cell — Polarizer

LCD MOUNTING METHODS

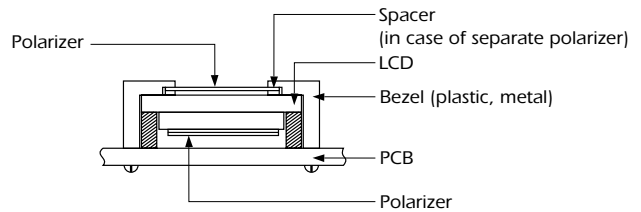
The following interfaces are available for connecting the LCD to the drive circuit :

Rubber Connector

- **Structure :**
Alternate Lamination of Conductive Rubber and Insulating Rubber.
- **Connecting Method :**
Mechanical Compression.
- **Pitch (mm) :**
Min 0.5

LCD MOUNTING METHOD

Rubber Connector



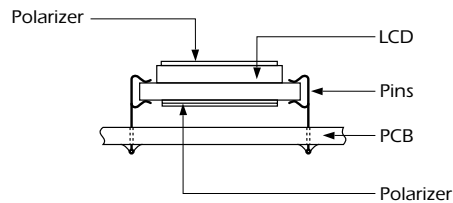
- Easy to assemble.
- Long Life.
- Wide Range of Applications.

Pin Connector

- **Structure :**
Metal Pins Fit onto the Panel Pad.
- **Connecting Method :**
Soldering.
- **Pitch (mm) :**
1.27, 1.5, 1.8, 1.905, 2.0, 2.54

LCD MOUNTING METHOD

Pin Connector



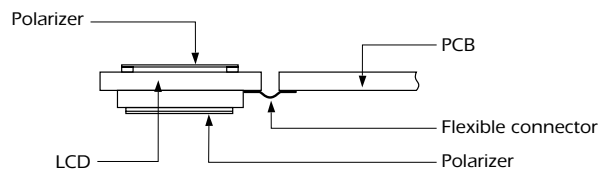
- Stable.
- Suitable for small production runs.

Flexible Connector

- **Structure :**
Electroconductive thin film.
- **Connecting Method :**
Heat and Pressure Fitting, Soldering or Mechanical Compression.
- **Pitch (mm) :**
Heat Seal : Min 0.2, Soldering : Min 0.7

LCD MOUNTING METHOD (example)

Flexible Connector



- Low Profile.
- Bending Flexibility

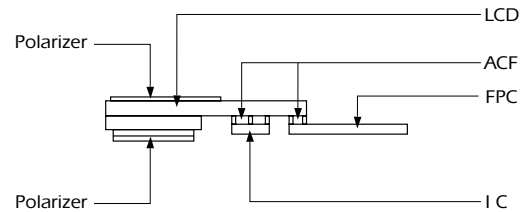
PRODUCTION PROCESSES

COG Structure

Chip On Glass

Connecting Method :

Heat and pressure fitting (ACF),
Heatseal, Fpc, Rubber, Socket or Pin.



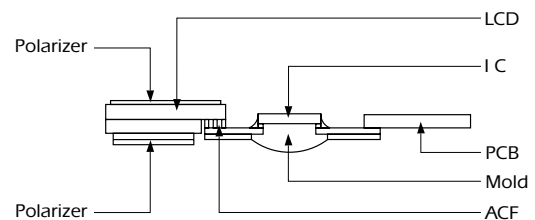
- Enables high resolution display.
- Saves mounting space.
- Can achieve a Low Profile Structure.

TAB Structure

Tape Automated Bonding / Tape Carrier Package (with driver)

Connecting Method :

Heat and pressure fitting (ACF) or Soldering.



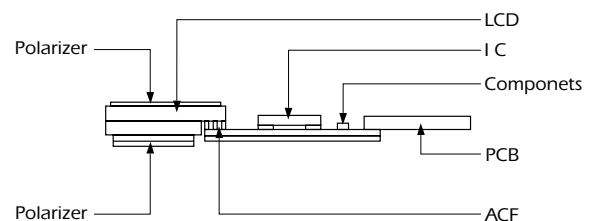
- Enables high resolution display.
- Can achieve a Low Profile Structure.

COF Structure

Chip-On-Film

Connecting Method :

Heat and pressure fitting (ACF),
Soldering, Mechanical Compression,
Plug in with Adjoining Socket or Heat
and Pressure Fitting (ACF).



- Desired design for LCD with FPC.
- Enables high resolution display.
- Saves mounting space.
- Can achieve a Low Profile Structure.
- Fine bending flexibility.

BACKLIGHTS FOR LCD MODULES

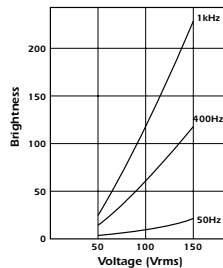
EL

■ Features

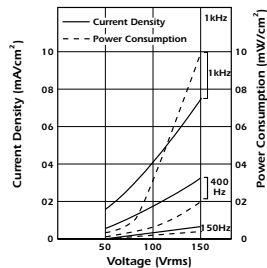
- Max 1.3mm thickness (Max 1.5mm for lead portion).
- Wide driving condition of 60 – 1,000Hz and 150V AC Max. with inverter; step-up voltage from 1.5V battery is available.
- Emitted colors are blue-green and white.
- Life : 3K ~ 8K Hours.

■ Electrical Characteristics

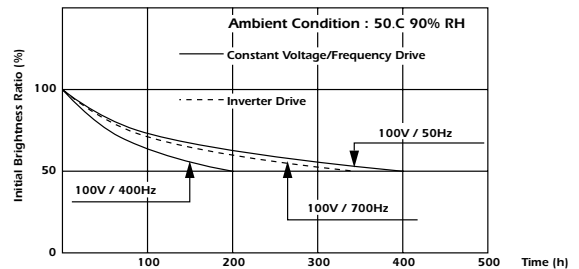
▪ Voltage vs. Brightness



▪ Voltage vs. Current Density



■ Life Characteristics



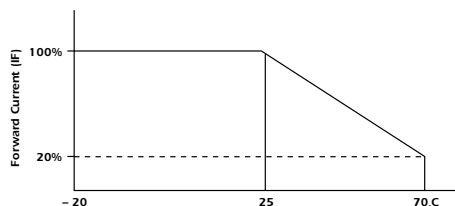
LED

■ Features

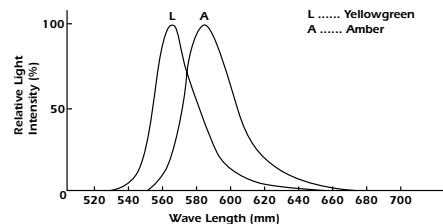
- Low voltage driving (DC) is available without inverter.
- Life: 100,000 hours (average).
- No noise.
- Various colors.

■ Electrical Characteristics (Reference Data)

▪ Forward Current Derating Curve



▪ Wave Length vs. Relative Light Intensity



Note : The above spec. are only for reference

BACKLIGHTS FOR LCD MODULES

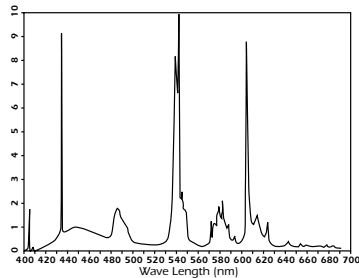
Cold Cathode Fluorescent Lamp

■ Features

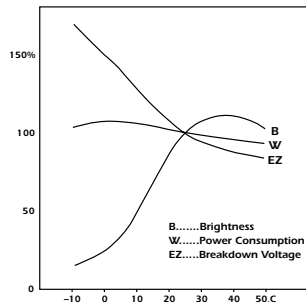
- Hight brightness of 3,000-4,000cd/m²
- OE lamp and AE lamp show good results in color enhancement
- Life: 20,000 hours
- Low heat generation when operating at rated lamp current of 5-20mA

■ Electrical Characteristics (Reference Data)

▪ Spectrum



▪ Temperature Characteristics Curve



■ CCFL Backlight

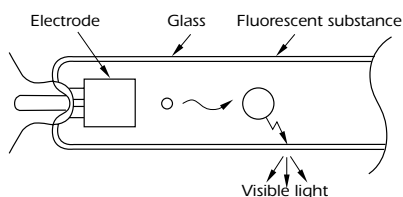
CCFL backlight provides two to three times the luminance of an EL backlight.

▪ Outline

	Characteristics	Direct Lighting	Edge Lighting	Remarks
1	Luminescent Color	White	White	
2	Luminance	Approx 100 nt typ.	Approx 60 nt typ.	
3	Thickness (Unit base)	24.2mm max.	14mm max.	
4	Operating Voltage	1,500 Vrms AC max.	1,500 Vrms AC max.	
5	Power Consumption	Approx 3 to 6 W (including inverter) Approx 3.4W (CCFL only) CCFL : 2 pcs.	Approx 3 to 6 W (including inverter) Approx 3.4W (CCFL only) CCFL : 2 pcs.	To lower the power consumption, improve the efficiency of inverter design.
6	Life	20,000 hours (IL = 5mA)	10,000 hours (IL = 5mA)	Continuous operation The definition of life differs by each MFR's spec.

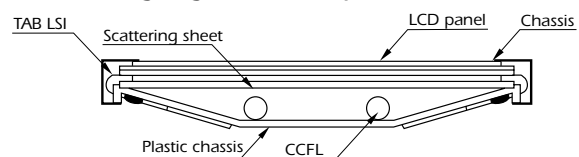
Note : The above spec. is for reference only.

▪ Sectional View

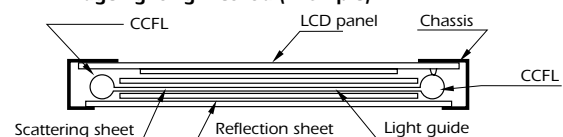


▪ Sectional View of The LCD Unit

Direct lighting method (Example)



Edge lighting method (Example)



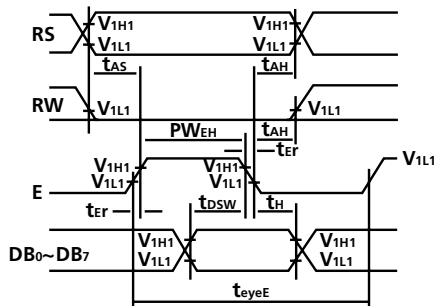
BASIC INSTRUCTIONS FOR CHARACTER LCD MODULES

INTERFACE PIN CONNECTIONS

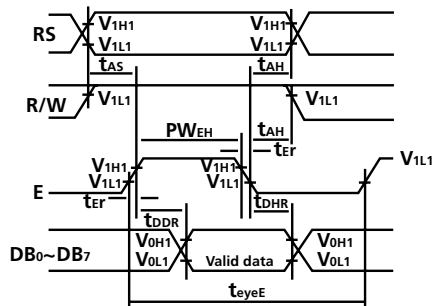
Pin No.	Symbol	Level	Pin Description	Functions	
1	V _{SS}	—	Ground	0V	
2	V _{DD}	—	Supply voltage for logic and LCD(+)	5V . 5.	
3	V _O	—	Supply voltage for LCD	Decision by user system	
4	RS	H/L	Register selection	H : Data L : Instruction code	
5	R/W	H/L	Read / Write	H : Read L : Write	
1	E	H, H→L	Enable signal	—	
1	DB0	H/L	Data bit 0	8 bits 4 bits	
1	DB1	H/L	Data bit 1		
1	DB2	H/L	Data bit 2		
1	DB3	H/L	Data bit 3		
1	DB4	H/L	Data bit 4		
1	DB5	H/L	Data bit 5		
1	DB6	H/L	Data bit 6		
1	DB7	H/L	Data bit 7		
1	LED +	LED Backlight			
1	LED –				

Interface Timing

Write Operation



Read Operation

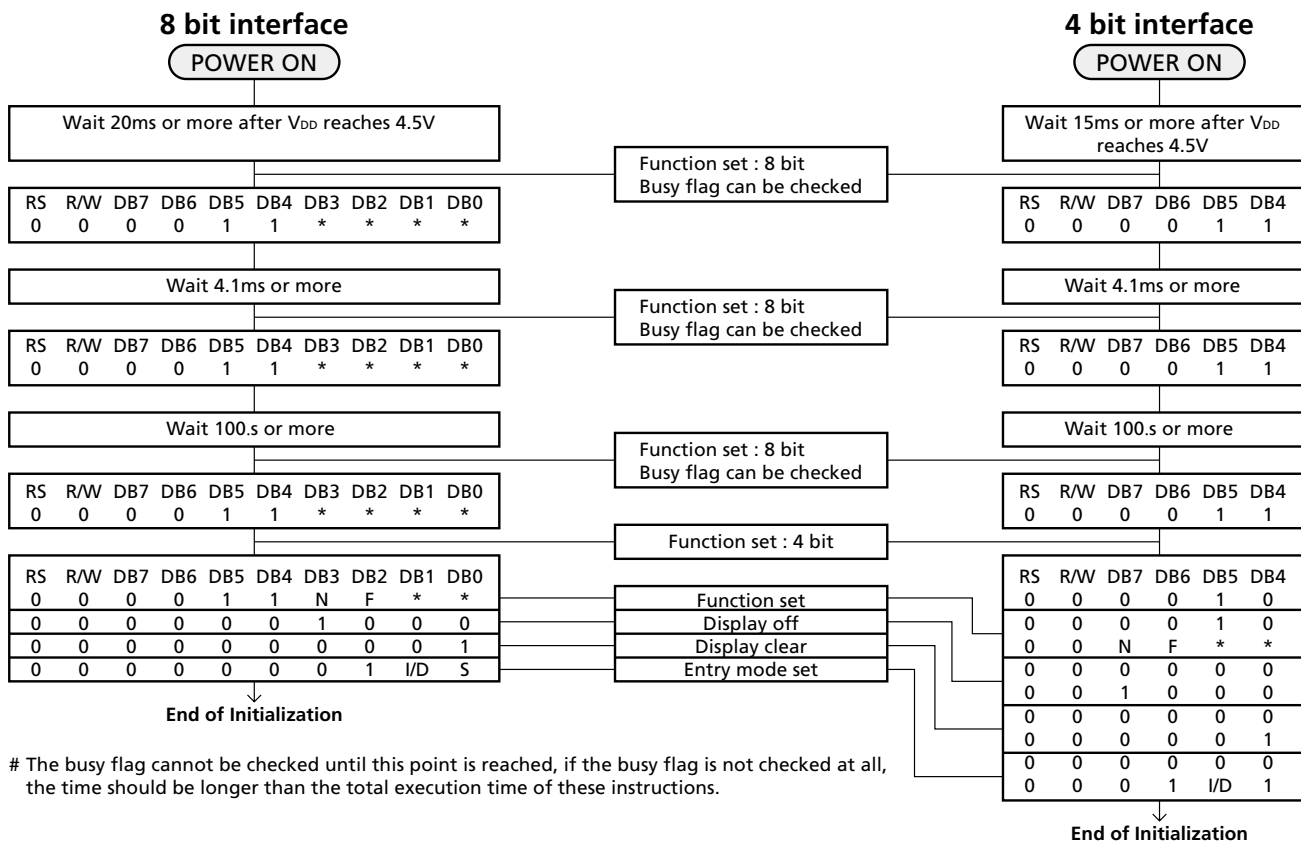


Item	Symbol	Measuring conditions	Standard Value		Unit
			Min	Max	
Enable cycle time	t_{eyeE}	As shown above	800	—	ns
Enable pulse width "High" Level	PW_{EH}		450	—	ns
Enable rise time	t_{Er}		—	25	ns
Enable decay time	t_{Ed}		—	25	ns
Address set-up time RS./R/W-E	t_{AS}		140	—	ns
Address hold time	t_{AH}		10	*	ns
Data set-up time	t_{DSW}		195	320	ns
Data hold time	t_H		10	—	ns

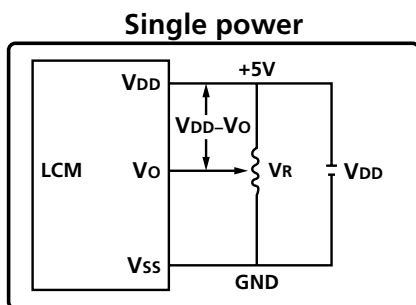
Item	Symbol	Measuring conditions	Standard Value		Unit
			Min	Max	
Enable cycle time	t_{eyeE}	As shown above	800	—	ns
Enable pulse width "High" Level	PW_{EH}		450	—	ns
Enable rise time	t_{Er}		—	25	ns
Enable decay time	t_{Ed}		—	25	ns
Address set-up time RS./R/W-E	t_{AS}		140	—	ns
Address hold time	t_{AH}		10	—	ns
Data set-up time	t_{DDR}		—	320	ns
Data hold time	t_{DHR}		20	—	ns

BASIC INSTRUCTIONS FOR CHARACTER LCD MODULES

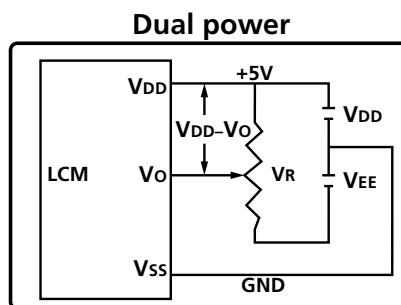
Initialization Procedure



Module Interface to Power Supply

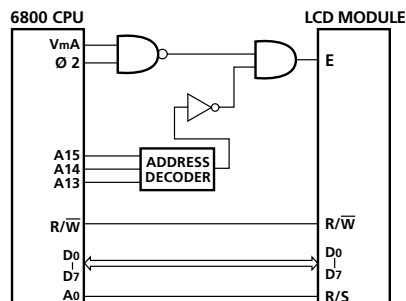
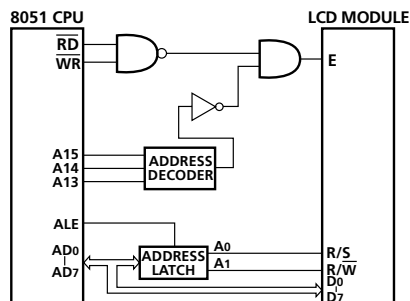


V_{DD} ~ V_O : Operating Voltage for LCD
V_R : 10k ~ 20k



V_{DD} ~ V_O : Operating Voltage for LCD
V_R : 10k ~ 20k

Module Interface to MPU



BASIC INSTRUCTIONS FOR CHARACTER LCD MODULES

INSTRUCTION SET

Instructions	Code										Description	Execution time (fosc = 250KHz)	Execution time (fosc = 160KHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0			
Clear display	0	0	0	0	0	0	0	0	0	1	Cursor is resumed to home Position (address 0) after entire display clear	82.s . 1.64ms	120.s . 4...4
Cursor at home	0	0	0	0	0	0	0	0	1	*	Cursor is resumed to home Position (address 0). Shifted display is also returned to the original position. Contents of DDRAM are not changed	40.s . 1.6ms	120.s . 4.8ms
Entry mode set	0	0	0	0	0	0	0	1	1/D	S	Cursor advance direction and display shift are set. These operations are performed during data write and read modes	40.s	120.s
Display ON/OFF control	0	0	0	0	0	0	1	D	C	B	Entire display ON/OFF (D), cursor ON/OFF (C) and character blink (B) at cursor position are set.	40.s	120.s
Cursor / display shift	0	0	0	0	0	1	S/C	R/L	*	*	Cursor and display are shifted without changing the contents of DDRAM	40.s	120.s
Function set	0	0	0	0	1	DL	N	F	*	*	Interface data length (DL), number of display lines (N) and character font (F) are set.	40.s	120.s
CGRAM address set	0	0	0	1	Acc						CGRAM address is set. Transmitted and received after this are the data of CGRAM.	40.s	120.s
DDRAM address set	0	0	1	ADD						DDRAM address is set. Transmitted and received after this are the data of DDRAM.	40.s	120.s	
Busy flag	0	0	BF	AC						Busy flag (BF) showing internal operation and contents of address counter are read.	1.s	1.s	
CGRAM/DDRAM data write	1	0	Write Data						Data are written in DDRAM or CGRAM		40.s	120.s	
CGRAM/DDRAM data read	1	1	Read Data						Data are read out of DDRAM or CGRAM		40.s	120.s	
	I/D = 1 : Increment (+1) I/D = 0 : Decrement (-1) S = 1 : With display shift S/C = 1 : With display shift S/C = 0 : Cursor movement R/L = 1 : Shift to the right R/L = 0 : Shift to the left DL = 1 : 8 bits DL = 0 : 4 bits N = 1 : 2 lines N = 0 : 1 line F = 1.5 x 10 dots F = 0.5 x 7 dots BF = 1 : Internal operation is being performed BF = 0 : Instruction acceptable										DDRAM : Display data RAM CGRAM : Character Generator RAM ACC : Address of CGRAM ADD : Address of DDRAM These correspond to cursor address. AC : Address counter used for both DDRAM and CGRAM.	Execution time changes with change in internal oscillation frequency (fosc). (Ex.) When fosc = 270KHz. $40.s \times \frac{250}{270} = 37.s$	

BASIC INSTRUCTIONS FOR CHARACTER LCD MODULES

CHARACTER MODULE FONT TABLE (Standard Font)

Character modules with built in controllers and Character Generator (CG) ROM & RAM will display 96 ASCII and special characters in a dot matrix format. Then first 16 locations are occupied by the character generator RAM. These locations can be loaded with the user designed symbols and displayed along with the characters stored in the CG ROM.

■ Character Font Table

UPPER 4 BITS LOWER 4 BITS		0000	0010	0011	0100	0101	0110	0111	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)		0	@	P	`	P		-	9	=	α	p	
0001	(2)	!	1	A	Q	a	q	•	7	¢	£	ä	q	
0010	(3)	"	2	B	R	b	r	「	イ	ウ	×	ß	θ	
0011	(4)	#	3	C	S	c	s	」	ウ	〒	€	ε	ω	
0100	(5)	\$	4	D	T	d	t	、	I	ト	¥	μ	Ω	
0101	(6)	%	5	E	U	e	u	•	オ	ナ	1	σ	Ü	
0110	(7)	&	6	F	V	f	v	ヲ	カ	ニ	ヨ	ρ	Σ	
0111	(8)	'	7	G	W	g	w	7	キ	ズ	ラ	g	π	
1000	(1)	(	8	H	X	h	x	イ	ク	ホ	リ	ル	Σ	
1001	(2)	)	9	I	Y	i	y	ウ	ケ	ノ	ル	リ	γ	
1010	(3)	*	:	J	Z	j	z	エ	コ	ハ	レ	j	¥	
1011	(4)	+	;	K	[	k	{	オ	サ	ヒ	ロ	*	¥	
1100	(5)	,	<	L	¥	l		ハ	シ	フ	ワ	Φ	¥	
1101	(6)	-	=	M	]	m	}	ユ	ズ	ヘ	ン	ト	÷	
1110	(7)	•	>	N	^	n	→	ヨ	セ	ホ	ッ	ñ		
1111	(8)	/	?	O	_	o	←	ッ	リ	マ	°	ö		

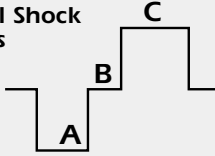
BASIC INSTRUCTIONS FOR CHARACTER LCD MODULES

CHARACTER MODULE FONT TABLE (European Font)

■ Character Font Table

UPPER 4 BITS LOWER 4 BITS		0000	0010	0011	0100	0101	0110	0111	1000	1001	1010	1011	1100	1101	1110	1111
0000	CG RAM (1)		0	@	P	`	F	O	E	æ	§	ø	'	α	ρ	
0001	(2)	!	1	A	Q	a	q	Ù	É	í	±	L	ˆ	¼	q	
0010	(3)	"	2	B	R	b	r	Ú	Ê	î	ü	ð	°	½	θ	
0011	(4)	#	3	C	S	c	s	Û	Ë	ï	†	ß	`	¾	ω	
0100	(5)	\$	4	D	T	d	t	Ü	ë	ì	‡	Ç	´	⅔	Ω	
0101	(6)	%	5	E	U	e	u	Ý	è	í	¶	Ø	˜	¾	ƒ	
0110	(7)	&	6	F	V	f	v	Ö	ó	ñ	ƒ	È	÷	ρ	Σ	
0111	(8)	'	7	G	W	g	w	Ô	ë	ñ	£	£	×	g	ˆ	
1000	(1)	(	8	H	X	h	x	ò	À	Ñ	ƒ	ƒ	×	†	†	
1001	(2)	)	9	I	Y	i	y	ó	Ä	ƒ	ƒ	ƒ	ƒ	‡	‡	
1010	(3)	*	:	J	Z	j	z	ô	à	ƒ	ƒ	ƒ	ƒ	j	ƒ	
1011	(4)	+	;	K	[	k	(	à	à	ƒ	ƒ	ƒ	ƒ	ƒ	ƒ	
1100	(5)	,	<	L	¥	l	l	ò	à	ƒ	ƒ	ƒ	ƒ	ƒ	ƒ	
1101	(6)	-	=	M	J	m	>	ó	à	ƒ	ƒ	ƒ	ƒ	ƒ	ƒ	
1110	(7)	.	>	N	^	n	÷	ö	à	ƒ	ƒ	ƒ	ƒ	ƒ	ƒ	
1111	(8)	/	?	O	_	o	÷	ö	à	ƒ	ƒ	ƒ	ƒ	ƒ	ƒ	

MONOCHROME RELIABILITY CRITERIA

		TN Type		STN Type		
		Normal Temperature	Wide Temperature	Normal Temperature	Wide Temperature	
VIEWING ANGLE	Horizontal Ø	. 30.	. 30.	. 30.	. 30.	
	Vertical θ (min)	10. to 30.	10. to 30.	−10. to 40.	−10. to 40.	
Operating Temperature		−10.C to 70.C	−25.C to 80.C	0.C to 50.C	★ −20.C to 70.C	
Storage Temperature		−20 .C to 80.C	−35 .C to 90.C	−20 .C to 70.C	★ −30 .C to 80.C	
High Temperature (Power Off)		240 Hours . 70.C	240 Hours . 90.C	240 Hours . 65.C	240 Hours . 75.C	
Low Temperature (Power Off)		240 Hours . −20.C	240 Hours . −35.C	240 Hours . −15 .C	240 Hours . −25.C	
High Temperature (Power On)		240 Hours . 70.C	240 Hours . 80.C	240 Hours . 60.C	240 Hours . 70.C	
Low Temperature (Power On)		240 Hours . −10.C	240 Hours . −25.C	240 Hours . −10.C	240 Hours . −20.C	
High Temperature & High Humidity		55.C/90%RH 240 Hours	75.C/90%RH 240 Hours	45.C/90%RH 240 Hours	65.C/90%RH 240 Hours	
Thermal Shock 5 Cycles		A	60 Min . −20.C	60 Min . −35.C	60 Min . −20.C	60 Min . −30.C
		B	5 Min . 25.C	5 Min . 25.C	5 Min . 25.C	25 Min . 25.C
		C	60 Min . 70.C	60 Min . 90.C	60 Min . 70.C	60 Min . 80.C
Expected Life		50,000 Hours	50,000 Hours	50,000 Hours	50,000 Hours	

★ Wide temp. version may not be available for some products. Please consult our sales engineer or representative.

MONOCHROME ABSOLUTE MAXIMUM RATINGS

For Character Display Modules

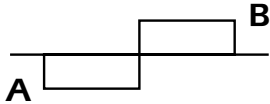
Item	Symbol	Test Condition	Standard Value		Unit
			Min.	Max.	
Supply Voltage for Logic	V _{DD} -V _{SS}	Ta .KN.C	0	7.0	V
Supply Voltage for LCD	V _{DD} -V _{EE}		0	6.5	V
Input Voltage	V _I		V _{SS}	V _{DD}	V
Operating Temperature	T _{opr}	-	0	50	.C
Storage Temperature	T _{stg}	-	-10	60	.C

For Graphic Display Modules

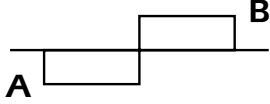
Item	Symbol	Test Condition	Standard Value		Unit
			Min.	Max.	
Supply Voltage for Logic	V _{DD} -V _{SS}	Refer to individual spec.			V
Supply Voltage for LCD	V _{DD} -V _{EE}				V
Input Voltage	V _I				V
Operating Temperature	T _{opr}				.C
Storage Temperature	T _{stg}				.C

COLOR RELIABILITY TEST DATA

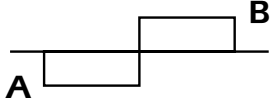
Color STN (CSTN) :

Item	Condition
Operation life time	100000 Hours
High temperature (storage)	80.C x 480 Hours
Low temperature (storage)	-30.C x 480 Hours
High temperature high humidity (storage)	60.C x 90% RH x 480 Hours
Cold-Hot rotation impact One cycle 	A : -30.C x 30 minutes B : 80.C x 30 minutes Total : 20 cycles

OLED :

Item	Condition
Operation life time	8000 Hours
High temperature (storage)	70.C x 240 Hours
Low temperature (storage)	-30.C x 240 Hours
High temperature high humidity (storage)	50.C x 90% RH x 120 Hours
Cold-Hot rotation impact One cycle 	A : -20.C x 30 minutes B : 55.C x 30 minutes Total : 10 cycles

TFT :

Item	Condition
Operation life time	100000 Hours
High temperature (storage)	80.C x 480 Hours
Low temperature (storage)	-30.C x 480 Hours
High temperature high humidity (storage)	60.C x 90% RH x 480 Hours
Cold-Hot rotation impact One cycle 	A : -30.C x 30 minutes B : 80.C x 30 minutes Total : 20 cycles

PROPER USE OF LCD MODULES

■ Liquid Crystal Display Modules

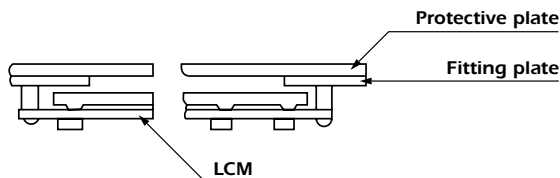
LCD is composed of glass and polarizer. Pay attention to the following items when handling.

- (1) Please keep the temperature within specified range for use and storage. Polarization degradation, bubble generation or polarizer peel-off may occur with high temperature and high humidity.
- (2) Do not touch, push or rub the exposed polarizers with anything harder than an HB pencil lead (glass, tweezers, etc.).
- (3) N - hexane is recommended for cleaning the adhesives used to attach front/rear polarizers and reflectors made of organic substances which will be damaged by such chemicals as acetone, toluene, ethanol and isopropylalcohol.
- (4) When the display surface becomes dusty, wipe gently with absorbent cotton or other soft material like chamois soaked in petroleum benzine. Do not scrub hard to avoid damaging the display surface.
- (5) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause deformation or color fading.
- (6) Avoid contacting oil and fats.
- (7) Condensation on the surface and contact terminals due to cold will damage, stain or dirty the polarizers. After products are tested at low temperatures they must be warmed up in a container before coming to contact with room temperature air.
- (8) Do not put or attach anything on the display area to avoid leaving marks on it.
- (9) Do not touch the display with bare hands. This will stain the display area and degrade insulation between terminals. (Some cosmetics are detrimental to the polarizers).
- (10) As glass is fragile, it tends to become chipped during handling especially on the edges. Please avoid dropping or jarring.

■ Installing LCD Modules

The hole in the printed circuit board is used to fix LCM as shown in the picture below. Attend to the following items when installing the LCM.

- (1) Cover the surface with a transparent protective plate to protect the polarizer and LC cell.



- (2) When assembling the LCM into other equipment, the spacer to the bit between the LCM and the fitting plate should have enough height to avoid causing stress to the module surface. Refer to the individual specifications for measurements. The measurement tolerance should be .0.1mm

■ Precaution for Handling LCD Modules

Since LCM has been assembled and adjusted with a high degree of precision, avoid applying excessive shocks to the module or making any alterations or modifications to it.

- (1) Do not alter, modify or change the shape of the tab on the metal frame.
- (2) Do not make extra holes on the printed circuit board, modify its shape or change the positions of components to be attached.
- (3) Do not damage or modify the pattern wiring on the printed circuit board.
- (4) Absolutely do not modify the zebra rubber strip (conductive rubber) or touch it with another object.
- (5) Except for soldering the interface, do not make any alterations or modifications with a soldering iron.
- (6) Do not drop, bend or twist LCM.

■ Electro-Static Discharge Control

Since this module uses a CMOS LSI, the same careful attention should be paid to electrostatic discharge as for an ordinary CMOS IC.

- (1) Make certain that you are grounded when handling LCM.
- (2) Before removing LCM from its packing case or incorporating it into a set, be sure that the module and your body have the same electric potential.
- (3) When soldering the terminal of LCM, make certain that the AC power source for the soldering iron does not leak.
- (4) When using an electric screwdriver to attach LCM, the screwdriver should be of ground potential to minimize as much as possible any transmission of electromagnetic waves produced sparks coming from the commutator of the motor.
- (5) As far as possible make the electric potential of your work clothes and that of the work bench the ground potential.
- (6) To reduce the generation of static electricity be careful that the air in the working environment is not too dry. (A relative humidity of 50%–60% is recommended.)

■ Precaution for Soldering to the LCM

- (1) Observe the following when soldering lead wire, connector cable, etc., to the LCM.
 - Soldering iron temperature : 280.C.10.C
 - Soldering time : 3-4 sec.
 - Solder ; eutectic solder

If soldering flux is used, be sure to remove any remaining flux after finishing to soldering operation. (This does not apply in the case of a non-halogen type of flux.) It is recommended that you protect the LCD surface with a cover during soldering to prevent any damage due to flux spatters.

- (2) When soldering the electroluminescent panel and PC board, the panel and board should not be detached more than three times. This maximum number is determined by the temperature and time conditions mentioned above, though there may be some variance depending on the temperature of the soldering iron.
- (3) When removing the electroluminescent panel from the PC board, be sure that the solder has completely melted, the soldered pad on the PC board could be damaged.

LIQUID CRYSTAL DISPLAY HANDLING PROCEDURES

■ Liquid Crystal Display (LCD)

An LCD is made up of glass, organic sealant, organic fluid and polymer based polarizers. The following precautions should be taken when handling:

- (1) Keep the temperature within range for use and storage. Excessive temperature and humidity could cause polarization degradation, polarizer peel-off or bubble generation. When storage for a long period over 40.C is required, the relative humidity should be kept below 60%.
- (2) Do not contact the exposed polarizers with anything harder than an HB pencil lead. To clean dust off the display surface, wipe gently with cotton, chamois or other soft material soaked in petroleum benzine. Never scrub hard.
- (3) Wipe off saliva or water drops immediately. Contact with water over a long period of time may cause polarizer deformation or color fading, while an active LCD with water condensation on its surface will cause corrosion of ITO electrodes.
- (4) PETROLEUM BENZINE is recommended to remove adhesives used to attach front/rear polarizer and reflectors, while chemicals like acetone, toluene, ethanol and isopropyl alcohol will cause damage to the polarizer. Avoid oil and fats. Avoid lacquer and epoxies which might contain solvents and hardeners to cause electrode erosion. Some solvents will also soften the epoxy covering the DIL pins and thereby weaken the adhesion of the epoxy on glass. This will cause the exposed electrodes to erode electro-chemically when operating in high humidity and condensing environment.
- (5) Glass can be easily chipped or cracked from rough handling, especially at corners and edges.
- (6) Do not drive LCD with DC voltage.
- (7) When soldering DIL pins, avoid excessive heat and keep soldering temperature between 260.C to 300.C for no more than 5 seconds.

■ Operation

- (1) The viewing angle can be adjusted by varying the LCD driving voltage.
- (2) Driving voltage should be kept within specified range; excess voltage shortens display life.
- (3) Response time increases with decrease in temperature.
- (4) Display may turn black or dark blue at temperatures above its operational range, however, this is not destructive and the display will return to normal once the temperature falls back to range.
- (5) Mechanical disturbance during operation (such as pressing on the viewing area) may cause the segments to appear "fractured". They will recover once the display is turned off.
- (6) Condensation at terminals will cause malfunction and possible electro-chemical reaction. Relative humidity of the environment should therefore be kept below 60%.

■ Storage

- (1) Store LCDs and modules in dark places and do not expose to sunlight or fluorescent light. Keep the temperature between 0.C and 35.C and the relative humidity low.
- (2) Modules should be kept in antistatic packaging. If properly sealed, there is no need for desiccant.

■ Safety

If any fluid leaks out of a damaged glass cell, wash off with soap and water any human part that comes into contact with the fluid. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all times.

■ Limited Warranty

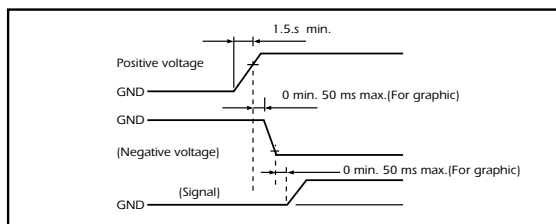
Unless otherwise agreed between TRULY and customer, TRULY will repair any of its LCDs functionally defective when inspected in accordance with TRULY LCD acceptance standards (copies available upon request) for a period of one year from date of shipments. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date shall be based on freight documents. The warranty liability of TRULY is limited to repair and/or replacement on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

■ Returning LCD under Warranty

No warranty can be granted if the precautions stated above have been disregarded. Broken glass, scratches on polarizers, mechanical damage as well as defects that are caused by accelerated environmental tests are excluded from warranty.

■ Precautions for Operation

- (1) Viewing angle varies with the change of liquid crystal driving voltage(V_0).
Adjust V_0 to show the best contrast.
- (2) Driving an LCD in the voltage above the limit shortens its life.
- (3) Response time is greatly delayed at temperatures below the operating temperature range. The display area becomes dark color at temperatures above this range. However, this does not mean the LCD will be out of order, it will recover when it returns to the specified temperature range.
- (4) If the display area is pushed hard during operation, the display will become abnormal. However, it will return to normal if it is turned off and then back on.
- (5) Condensation on terminals can cause an electrochemical reaction disrupting the terminal circuit. Therefore, it must be used in the relative condition of 40.C, 50% RH.
- (6) when turning on power, input each signal after the positive / negative voltage becomes stable.



■ Storage

When storing LCDs as spares for some years, the following precautions are necessary.

- (1) Store them in a sealed polyethylene bag. If Properly sealed, there's no need for dessicant.
- (2) Store them in a dark place, do not expose to sunlight or fluorescent light. Keep the temperature between 0.C and 35.C.
- (3) The polarizer surface should not come in contact with any other object. (We advise you to store them in the container in which they were shipped).
- (4) Environmental conditions :
 - Do not leave them for more than : 168 hrs. at 60.C.
 - Should not be left for more than 48 hrs. at -20.C.

■ Safety

- (1) It is recommended to crush damaged or unnecessary LCDs into pieces and wash them off with solvents such as acetone and ethanol, which should later be burned.
- (2) If any liquid leaks out of a damaged glass cell and comes in contact with the hands, wash off thoroughly with soap and water.

■ Limited Warranty

Unless otherwise agreed between TRULY and customer, TRULY will replace or repair any of its LCD and modules which are found to be functionally defective when inspected in accordance with TRULY LCD acceptance standards (copies available upon request), for a period of one year from date of shipments. Cosmetic/visual defects must be returned to TRULY within 90 days of shipment. Confirmation of such date be based on freight documents. The warranty liability of TRULY is limited to repair and/or replacement on the terms set forth above. TRULY will not be responsible for any subsequent or consequential events.

■ Return LCM under Warranty

No warranty can be granted if the precautions stated above have been disregarded. A typical examples of violations are:

- broken LCD glass;
- PCB eyelet's damaged or modified;
- PCB conductors damaged;
- circuit modified in any way, including addition of components;
- PCB tampered with by grinding, engraving or painting varnish;
- soldering to or modifying the bezel in any manner.

Module repairs will be invoiced to the customer upon mutual agreement. Modules must be returned in antistatic packaging together with sufficient description of the failures or defects. Any connectors or cables installed by the customer must be removed completely without damaging the PCB eyelet's, conductors and terminals.

TN LCD PANEL NUMBERING SYSTEM

T T D 1000 U P R D P W -P -C1 -G -H - -
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 TRULY SEMICONDUCTORS LTD.

2 LCD TYPE

T - TN-LCD H - HTN-LCD

3 APPLICATION

T - Timer P - Pager C - Calculator K - Keyboard
D - Audio M - Module G - Games R - Others

4 PRODUCT NUMBER

5 VIEWING ANGLE

U - Upper 12 o' clock R - Right 3 o' clock Z - Others
D - Lower 6 o' clock L - Left 9 o' clock

6 LCD DISPLAY MODE

P - Positive N - Negative

7 REAR POLARIZER MODE

R - Reflective T - Transmissive F - Transflective

8 POLARIZER METHOD

N - Two side non-adhesive R - Rear side adhesive
D - Two side adhesive F - Front side adhesive

9 CONNECTOR

P - Pin Connector H - Heat sealed C - Normal F - FPC

10 TEMPERATURE

W - Wide Temperature N - Normal

11 POLISHED AND CHAMFER AND SPECIAL PIN

P - Side polished SP-P1 - Chamfer and special pin
P1 - Chamfer P-P1 - Side polished and chamfer
SP - Special pin Blank - No polished no chamfer and no special pin

12 INK SCREENING

C1 - Outside ink screen on glass C5 - Print mark on glass side
C2 - Outside ink screen on polarizer C6 - Print mark on polarizer
C3 - Black mask or ink screen between two glass CR - Overlap chrome on the glass
C4 - Mixed ink screen

13 SPECIAL REMARKS

G - COG type with IC
T - TAB type with TCP
BLANK - Having no special remark

14 SPECIAL REMARKS

H - With heat seal
F - With FPC
EL - With EL
LED - With LED
BLANK - With no append remark

15-16 INTERNAL FACTORY DESIGNATORS

STN LCD PANEL NUMBERING SYSTEM

T S D 0001 D Y R D C W -P -C1 -G -H -
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1 TRULY SEMICONDUCTORS LTD.

2 PRODUCT TYPE

S - STN F - FMLCD

3 DUTY

B - .1/16 D - .1/64 F - .1/240
 C - .1/32 E - .1/128 G - >1/240

4 SUCCESSIVE NUMBER

5 VIEWING ANGLE

U - Upper 12 o' clock R - Right 3 o' clock Z - Others
 D - Lower 6 o' clock L - Left 9 o' clock

6 LCD DISPLAY MODE

Y - Yellow Green G - Grey (STN positive) F - FSTN and ECB positive
 B - Blue (STN negative) C - Color W - FSTN and ECB negative

7 REAR POLARIZER MODE

R - Reflective T - Transmissive F - Transflective

8 POLARIZER METHOD

N - Non-adhesive R - Rear side adhesive
 D - Two side adhesive F - Front side adhesive

9 CONNECTOR

P - Pin Connector H - Heat sealed C - Common T - TAB connector F - FPC

10 TEMPERATURE

W - Wide Temperature N - Normal

11 POLISHED AND CHANFER AND SPECIAL PIN

P - Side polished SP-P1 - Chamfer and special pin
 P1 - Chamfer P-P1 - Side polished and chanfer
 SP - Special pin Blank - No polished no chamfer and no special pin

12 INK SCREENING

C1 - Outside ink screen on glass C5 - Print mark on glass side
 C2 - Outside ink screen on polarizer C6 - Print mark on polarizer
 C3 - Black mask or ink screen between two glass CR - Overlap chrome on the glass
 C4 - Mixed ink screen

13 SPECIAL REMARKS

G - COG type with IC
 T - TAB type with TCP
 BLANK - Having no special remark

14 SPECIAL REMARKS

H - With heat sea
 F - With FPC
 EL - With EL
 LED - With LED
 BLANK - With no append remark

15 INTERNAL FACTORY DESIGNATOR

CHECK LIST FOR CUSTOM DESIGN LCD PANELS

ACCOUNT	APPLICATION
Company Name: _____ Contact Person: _____ Tel: _____ Fax: _____ E-mail: _____	

DISPLAY SPECIFICATION			Outside Dimensions: (L1) : _____ mm (W1) : _____ mm (t) : _____ mm	Terminal Width: _____ mm					
			Viewing Area: (L2) : _____ mm (W2) : _____ mm	End Seal: (W3) : _____ mm (H) : _____ mm					
LCD CONFIGURATION	☐ Bottom 	☐ Top 	☐ Left 	☐ Right 	☐ Two Sides 	☐ Two Sides 	☐ Two Sides 	☐ Three Sides 	
LCD PANEL SPECIFICATION	Display Type ☐ TN ☐ NTN ☐ STN (☐ Yellow-Green ☐ Gray ☐ Blue ☐ Green ☐ Yellow) ☐ FSTN ☐ STN ☐ Others								
	View Direction ☐ 6:00 ☐ 12:00 ☐ 3:00 ☐ 9:00 ☐ Others								
	Polarizer Type ☐ Reflective ☐ Transflective ☐ Transmissive								
	LCD mode ☐ Positive ☐ Negative								
	Visual Specification ☐ Normal ☐ Anti-Glare								
	Operating Method Operating Voltage: _____ Volts, Frame Frequency: _____ Hz _____ Duty _____ Bias								
TEMPERATURE RANGE	Operating Temperature: _____ .C ~ _____ .C Storage Temperature: _____ .C ~ _____ .C		CONNECTOR TYPE	☐ Heat Seal ☐ Rubber Connector ☐ With _____ Pins Length: _____ mm					
CONTROLLER IC	(Manufacturer & Part No. if specified)								
DESIRED SCHEDULE	Item	Finalize Specification	Start Design	W/S	E/S	P/P	M/P	Monthly Q'ty	Total Q'ty
	Date								
	Quantity								
NOTES	Other information: ☐ With ☐ Without File (We can accept an AUTOCAD File) Please send via E-mail.								

LEAD TIME LCD MODULES

- 1) Counter drawing: 7~14 days after price confirmed.
- 2) Samples: 45~60 days after counter drawing approved.
- 3) Mass production: 45~60 days after sample approved.

CUSTOM DESIGN LCD MODULE NUMBERING SYSTEM

CM T – C C 001 D P L Y – N – TP
 1 2 3 4 5 6 7 8 9 10 11

1 CUSTOM DESIGNED MODULE

2 LCD TYPE

T – TN LCD H – HTN LCD S – STN LCD F – FSTN C – Color STN

3 IC PACKING

P – Packing type G – Chip on glass N – Without IC C – Chip on board T – TCP

4 LCD MODE

C – Characters G – Graphic Z – Other

5 PRODUCT NUMBER

6 VIEWING ANGLE

U – Upper 12 o' clock R – Right 3 o' clock Z – Others
 D – Lower 6 o' clock L – Left 9 o' clock

7 COLOR MODE

HTN / TN : P – Positive STN : G – Grey FSTN (F) : P – Positive CSTN : F – Negative / Transflective
 N – Negative Y – Yellow green N – Negative type T – Negative / Transmissive
 B – Blue

8 BACKLIGHT MODE

Without backlight : R – Reflective Blacklight : L – LED (Transflective)
 F – Transflective C – CCFL (Transmissive)
 T – Transmissive E – EL (Transflective)
 S – Side lit LED

9 BACKLIGHT COLOR

B – Blue A – Amber Y – Yellow green R – Red W – White N – Without backlight

10 TEMPERATURE

N – Normal temperature W – Wide temperature S – Super wide temperature Z – Others

11 SPECIAL REMARKS

TP – With touch panel

CHECK LIST FOR CUSTOM DESIGN LCD MODULES

ACCOUNT	APPLICATION
Company Name: _____ Contact Person: _____ Tel: _____ Fax: _____ E-mail: _____	

DISPLAY SPECIFICATION	Display Type	Display Configuration							
	Character	Character Font: ____ x ____ dots ☐ with ☐ without Cursor Character x Lines: ____ Character x ____ Lines	Character Size: (W) ____ x (H) ____ mm Character Pitch: (W) ____ x (H) ____ mm						
	Graphic	(W) ____ dots x (H) ____ dots	Dot Size: (W) ____ x (H) ____ mm Dot Pitch: (W) ____ x (H) ____ mm						
LCD PANEL SPECIFICATION	Display Type	☐ TN ☐ NTN ☐ STN (☐ Yellow-Green ☐ Gray ☐ Blue ☐ Green ☐ Yellow) ☐ FSTN ☐ STN ☐ Others							
	View Direction	☐ 6:00 ☐ 12:00 ☐ 3:00 ☐ 9:00 ☐ Others							
	Polarizer Type	☐ Reflective ☐ Transflective ☐ Transmissive							
	LCD mode	☐ Positive ☐ Negative							
	Visual Specification	☐ Normal ☐ Anti-Glare							
	Operating Method	Operating Voltage: ____ Volts, Frame Frequency: ____ Hz ____ Duty ____ Bias							
MECHANICAL SPECIFICATION	☐ COG ☐ COF ☐ TAB ☐ COB ☐ Other ☐ With Touch Panel Outside Dimension: (W) ____ x (H) ____ x (T) ____ mm Viewing Area: (W) ____ x (H) ____ mm								
DRAWING CONDITIONS	Power Supply Voltage (V _{DD}) ____ V	CONTRAST ADJUST	☐ VR ☐ Thermo-Resistor ☐ Others						
	Power Supply For LCD (V _{EE}) ____ V								
BEZEL	☐ Steel ☐ Resin ☐ Other Plating: ☐ Zinc ☐ Varnish ☐ Nickel ☐ Others _____ Color: _____	CONNECTOR TYPE	LCD/PCB: ☐ Heat Seal ☐ Rubber Connector ☐ With Pin ☐ FPC ☐ Other _____ External: ☐ None ☐ Pin Header ☐ Flat Cable ☐ Other _____						
BACKLIGHT	☐ LED ☐ EL ☐ CCFL ☐ Other _____ ☐ With ☐ Without Inverter	TEMPERATURE RANGE	Operating Temperature: ____ .C ~ ____ .C Storage Temperature: ____ .C ~ ____ .C						
CONTROLLER IC	(Manufacturer & Part No. if specified)								
DESIRED SCHEDULE	Item	Finalize Specification	Start Design	W/S	E/S	P/P	M/P	Monthly Q'ty	Total Q'ty
	Date								
	Quantity								
NOTES									

LEAD TIME LCD MODULES

- 1) Counter drawing: 7~14 days after price confirmed.
- 2) Samples: 45~60 days after counter drawing approved.
- 3) Mass production: 45~60 days after sample approved.



IATF CERT. No. : 0011847
(ISO/TS16949)



CERT. No. : H002005
(ISO14001)



CERT. No. : 946535
(ISO9001) (TL9000)

TRULY®

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