



MULTI-INNO TECHNOLOGY CO., LTD.

www.multi-inno.com

LCD MODULE SPECIFICATION

Model : MI12864H-G-5

For Customer's Acceptance:

Customer	
Approved	
Comment	

Revision	1.0
Engineering	
Date	2012-12-12
Our Reference	



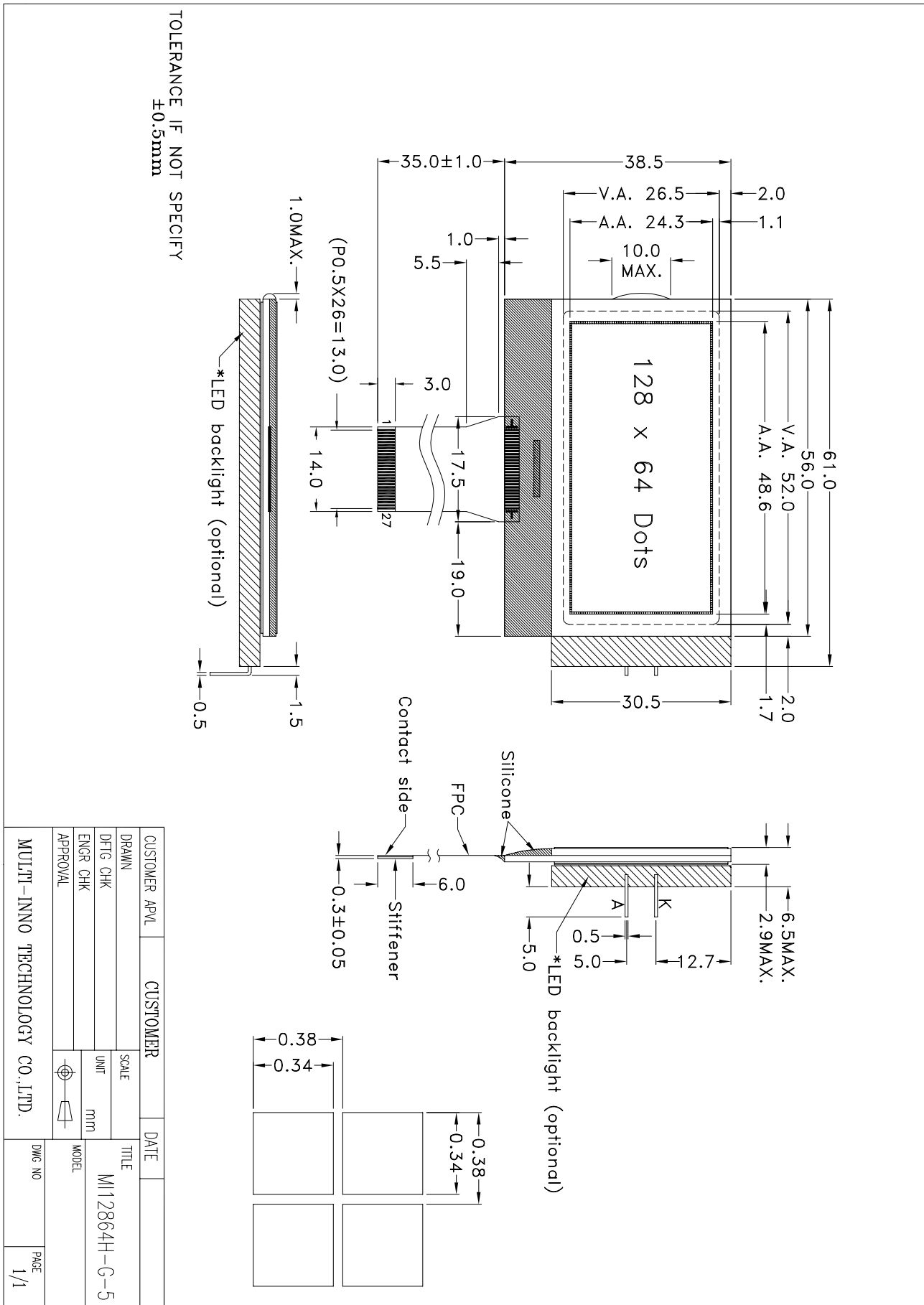
CONTENTS

- GENERAL INFORMATION
- EXTERNAL DIMENSIONS
- BLOCK DIAGRAM
- ABSOLUTE MAXIMUM RATINGS
- ELECTRICAL CHARACTERISTICS
- ELECTRO-OPTICAL CHARACTERISTICS
- INTERFACE DESCRIPTION
- REFERENCE APPLICATION CIRCUIT
- RELIABILITY TEST CONDITIONS
- INSPECTION CRITERION
- PRECAUTIONS FOR USING LCD MODULES
- PACKING SPECIFICATION
- PRIOR CONSULT MATTER

**■ GENERAL INFORMATION**

Item of general information	Contents	Unit
Display mode	STN Grey,graphic COG LCD module	/
Recommended Viewing Direction	6:00	O' Clock
Number of Dots	128×64	/
No backlight (L ×W×H)	56.00×38.50×2.90	mm ³
LED sided backlight (L× W×H)	61.00×38.50×6.50	mm ³
Viewing area (L ×W)	52.00×26.50	mm ²
Dot size (L×W)	0.34×0.34	mm ²
Dot pitch (L × W)	0.38×0.38	mm ²
Driver IC	ST7565R	/
Interface Type	Serial	/
Input voltage	3.0	V
Driving method	1/65 duty,1/9 bias	/

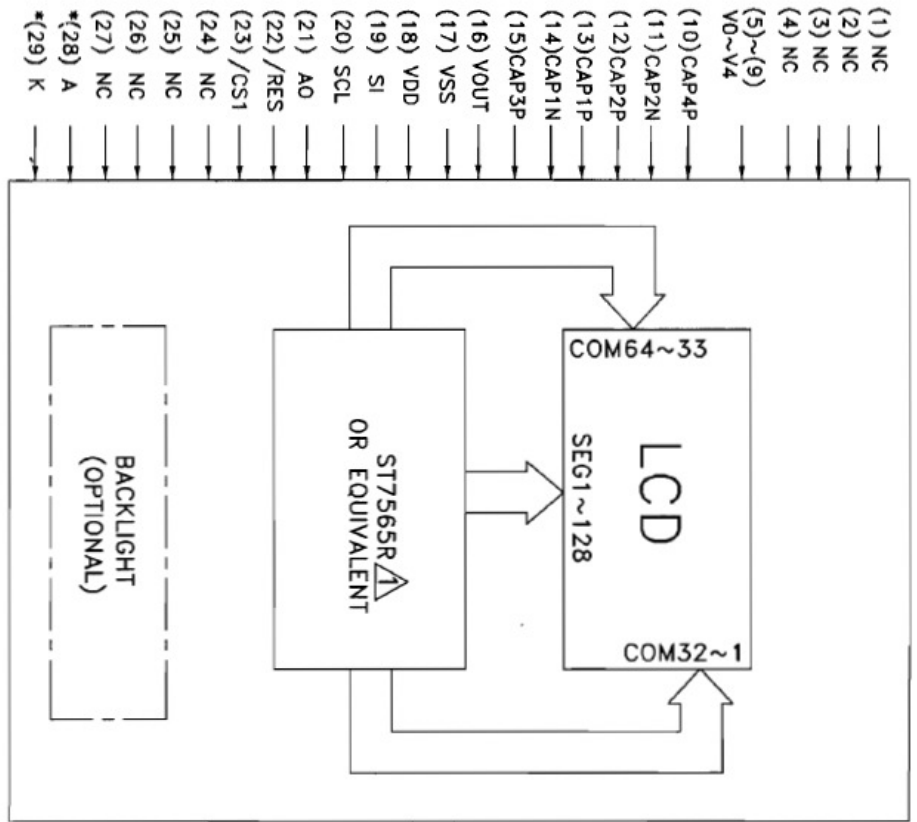
EXTERNAL DIMENSIONS



■ BLOCK DIAGRAM

TOLERANCE IF NOT SPECIFY
±0.5mm

*NOTE: Pin28,29 are used for backlight version



PIN NUMBER	SYMBOL	FUNCTION
1	NC	NO connection
2	NC	
3	NC	
4	NC	
5	V0	Supply voltage for LCD
6	V1	
7	V2	
8	V3	
9	V4	DC/DC voltage converter terminal
10	CAP4P	
11	CAP2N	
12	CAP2P	
13	CAP1P	Operating voltage for LCD
14	CAP1N	
15	CAP3P	
16	VOUT	Ground(0V)
17	VSS	
18	VDD	Supply voltage for logic
19	SI	Serial data input
20	SCL	Serial clock input
21	AO	Data control signal
22	/RES	Reset
23	/CS1	Chip select signal
24	NC	No connection
25	NC	
26	NC	
27	NC	
28	A	Voltage supply for backlight (+)
29	K	Voltage supply for backlight (-)

CUSTOMER APVL	CUSTOMER	DATE	TITLE	DWG NO	PAGE
DRAWN	SCALE		MI12864H-G-5		1/1
DFTG CHK	UNIT	mm			
ENGR CHK	MODEL				
APPROVAL					
MULTI-INNO TECHNOLOGY CO.,LTD.					



■ ABSOLUTE MAXIMUM RATINGS

Please make sure not to exceed the following maximum rating values under the worst application conditions.

Item	Symbol	Rating (for normal temperature)	Rating (for wide temperature)	Unit
Supply Voltage	VDD	0.3 to 4.0	0.3 to 4.0	V
Operating Temperature	T _{opr}	0 to 50	-20 to 70	°C
Storage Temperature	T _{stg}	-10 to 60	-30 to 80	°C

■ ELECTRICAL CHARACTERISTICS

Item	Symbol	MIN.	TYP.	MAX.	Unit	Item	Symbol	MIN.	TYP.	MAX.	Unit
Supply Voltage for logic	VDD	2.4	3.0	3.3	V	“H”Level Input Voltage	V _{IH}	0.8VDD	—	VDD	V
Supply Current for logic	I _{DD}	—	250	550	μA	“L”Level Input Voltage	V _{IL}	VSS	—	0.2VDD	V
Operating Voltage for LCD	V _{LCD}	8.55	9.0	9.45	V	—	—	—	—	—	—
EL Backlight Voltage (VEL)						Backlight Current					
EL (@ Frequency 400Hz)	—	—	—	—	—	—	—	—	—	—	—
Side-lited LED Backlight Forward Voltage (VF)						Side-lited LED Backlight Forward Current (IF)					
White	V _{BL}	—	5.0	—	V	White	I _{BL}	—	40	—	mA
Blue	V _{BL}	—	5.0	—	V	Blue	I _{BL}	—	40	—	mA
Yellow Green	V _{BL}	—	5.0	—	V	Yellow Green	I _{BL}	—	40	—	mA

Note : (*) Please refer to **REFERENCE CIRCUIT EXAMPLE** (5X Boosting Circuit).

■ ELECTRO-OPTICAL CHARACTERISTICS

MEASURING CONDITION: POWER SUPPLY = V_{OP} / 64 Hz
 TEMPERATURE = 22 ± 5 °C
 RELATIVE HUMIDITY = 60 ± 15 %

ITEM	SYMBOL	UNIT	TYP. STN
RESPONSE TIME	T _{on}	ms	220
	T _{off}	ms	280
CONTRAST RATIO	Cr	-	12
VIEWING ANGLE (Cr ≥ 2)	V _{3:00}	°	40
	V _{6:00}	°	70
	V _{9:00}	°	40
	V _{12:00}	°	50

THE ELECTRO-OPTICAL CHARACTERISTICS ARE MEASURED VALUE BUT NOT GUARANTEED ONES.

**■ INTERFACE DESCRIPTION**

Pin No.	Symbol	Function	Pin No.	Symbol	Function
1	NC	No connection	16	VLCD	Operating voltage for LCD
2	NC		17	VSS	Ground(0V)
3	NC		18	VDD	Supply voltage for logic
4	NC		19	SI	Serial data input
5	V0	Supply voltage for LCD	20	SCL	Serial clock input
6	V1		21	A0	Data control signal
7	V2		22	/RES	Reset
8	V3		23	/CS1	Chip select signal
9	V4		24	NC	No connection
10	CAP4P	25	NC		
11	CAP2N	26	NC		
12	CAP2P	DC/DC voltage converter terminal	27	NC	Supply voltage for backlight (+VE)
13	CAP1P		*28	A	
14	CAP1N		*29	K	Supply voltage for backlight (-VE)
15	CAP3P		—	—	—

Note * : Pin 28, 29 are used for backlight version only.

■ REFERENCE APPLICATION NOTES

1. INSTRUCTIONS

(Note) *: disabled data

Command	Command Code										Function		
	A0	/RD	/WR	D7	D6	D5	D4	D3	D2	D1		D0	
(1) Display ON/OFF	0	1	0	1	0	1	0	1	1	1	0	1	LCD display ON/OFF 0: OFF, 1: ON
(2) Display start line set	0	1	0	0	1	Display start address						0	Sets the display RAM display start line address
(3) Page address set	0	1	0	1	0	1	1	Page address				0	Sets the display RAM page address
(4) Column address set upper bit	0	1	0	0	0	0	1	Most significant column address				0	Sets the most significant 4 bits of the display RAM column address.
Column address set lower bit	0	1	0	0	0	0	0	Least significant column address				0	Sets the least significant 4 bits of the display RAM column address.
(5) Status read	0	0	1	Status				0	0	0	0	0	Reads the status data
(6) Display data write	1	1	0	Write data								0	Writes to the display RAM
(7) Display data read	1	0	1	Read data								0	Reads from the display RAM
(8) ADC select	0	1	0	1	0	1	0	0	0	0	0	0	Sets the display RAM address SEG output correspondence 0: normal, 1: reverse
(9) Display normal/reverse	0	1	0	1	0	1	0	0	1	1	0	1	Sets the LCD display normal/reverse 0: normal, 1: reverse
(10) Display all points ON/OFF	0	1	0	1	0	1	0	0	1	0	0	1	Display all points 0: normal display 1: all points ON
(11) LCD bias set	0	1	0	1	0	1	0	0	0	1	0	1	Sets the LCD drive voltage bias ratio 0: 1/9 bias, 1: 1/7 bias (ST7565P)
(12) Read/modify/write	0	1	0	1	1	1	0	0	0	0	0	0	Column address increment At write: +1 At read: 0
(13) End	0	1	0	1	1	1	0	1	1	1	0	0	Clear read/modify/write
(14) Reset	0	1	0	1	1	1	0	0	0	1	0	0	Internal reset
(15) Common output mode select	0	1	0	1	1	0	0	0	1	*	*	*	Select COM output scan direction 0: normal direction 1: reverse direction
(16) Power control set	0	1	0	0	0	1	0	1	Operating mode			0	Select internal power supply operating mode
(17) Vo voltage regulator internal resistor ratio set	0	1	0	0	0	1	0	0	Resistor ratio			0	Select internal resistor ratio(Rb/Ra) mode
(18) Electronic volume mode set	0	1	0	1	0	0	0	0	0	0	0	1	Set the Vo output voltage electronic volume register
Electronic volume register set				0	0	Electronic volume value							
(19) Static indicator ON/OFF	0	1	0	1	0	1	0	1	1	0	0	1	0: OFF, 1: ON
Static indicator register set				0	0	0	0	0	0	0	0	0	Mode
(20) Booster ratio set	0	1	0	1	1	1	1	1	0	0	0	0	select booster ratio 00: 2x,3x,4x 01: 5x 11: 6x
(21) Power saver													Display OFF and display all points ON compound command
(22) NOP	0	1	0	1	1	1	0	0	0	1	1	1	Command for non-operation
(23) Test	0	1	0	1	1	1	1	*	*	*	*	*	Command for IC test. Do not use this command

2. RECOMMENDED INITIAL SETTINGS

- Display Start Line Set : 40H
- ADC Select : A0H
- LCD Bias Set : A2H
- Common Output Mode Select : C8H
- Power Control Set: 2FH
- V0 Voltage Regulator Internal Resistor Ratio Set : 27H
- Electronic Volume Register Set : 2CH
- Booster Ratio Set : 01H

3. DISPLAY DATA RAM (DDRAM)

The display data RAM stores the dot data for the LCD. It has a 65 (8 page x 8 bit +1) x 132 bit structure. As is shown in below, the D7 to D0 display data from the MPU corresponds to the LCD display common direction; there are few constraints at the time of display data transfer when multiple ST7565P are used, thus and display structures can be created easily and with a high degree of freedom. Moreover, reading from and writing to the display RAM from the MPU side is performed through the I/O buffer, which is an independent operation from signal reading for the liquid crystal driver. Consequently, even if the display data RAM is accessed asynchronously during liquid crystal display, it will not cause adverse effects on the display (such as flickering).

D0	0	1	1	1		0
D1	1	0	0	0		0
D2	0	0	0	0		0
D3	0	1	1	1		0
D4	1	0	0	0		0
-						

Display data RAM

COM0						
COM1						
COM2						
COM3						
COM4						
-						

Liquid crystal display

4. PAGE ADDRESS CIRCUIT

Page address of the display data RAM is specified through the Page Address Set Command. The page address must be specified again when changing pages to perform access. Page address 8 (D3, D2, D1, D0 = 1, 0, 0, 0) is a special RAM for icons, and only display data D0 is used.

5. COLUMN ADDRESS

The display data RAM column address is specified by the Column Address Set command. The specified column address is incremented (+1) with each display data read/write command. This allows the MPU display data to be accessed continuously. Moreover, the incrementing of column addresses stops with 83H. Because the column address is independent of the page address, when moving, for example, from page 0 column 83H to page 1 column 00H, it is necessary to respect both the page address and the column address. Furthermore, the ADC command (segment driver direction select command) can be used to reverse the relationship between the display data RAM column address and the segment output. Because of this, the constraints on the IC layout when the LCD module is assembled can be minimized.

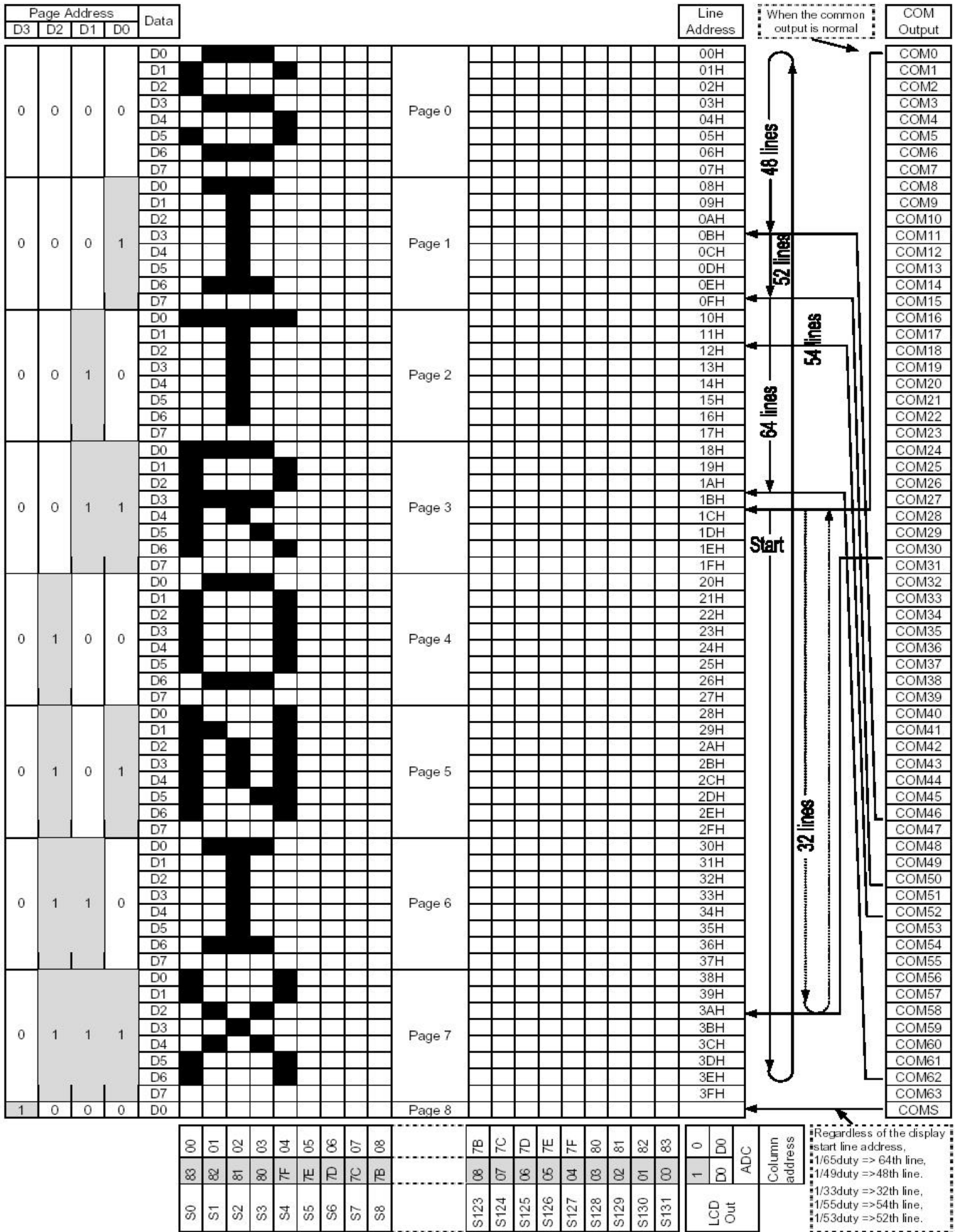
SEG Output ADC	SEG0	SEG 131
(D0) "0"	0 (H) → Column Address →	83 (H)
(D0) "1"	83 (H) ← Column Address ←	0 (H)

6. LINE ADDRESS CIRCUIT

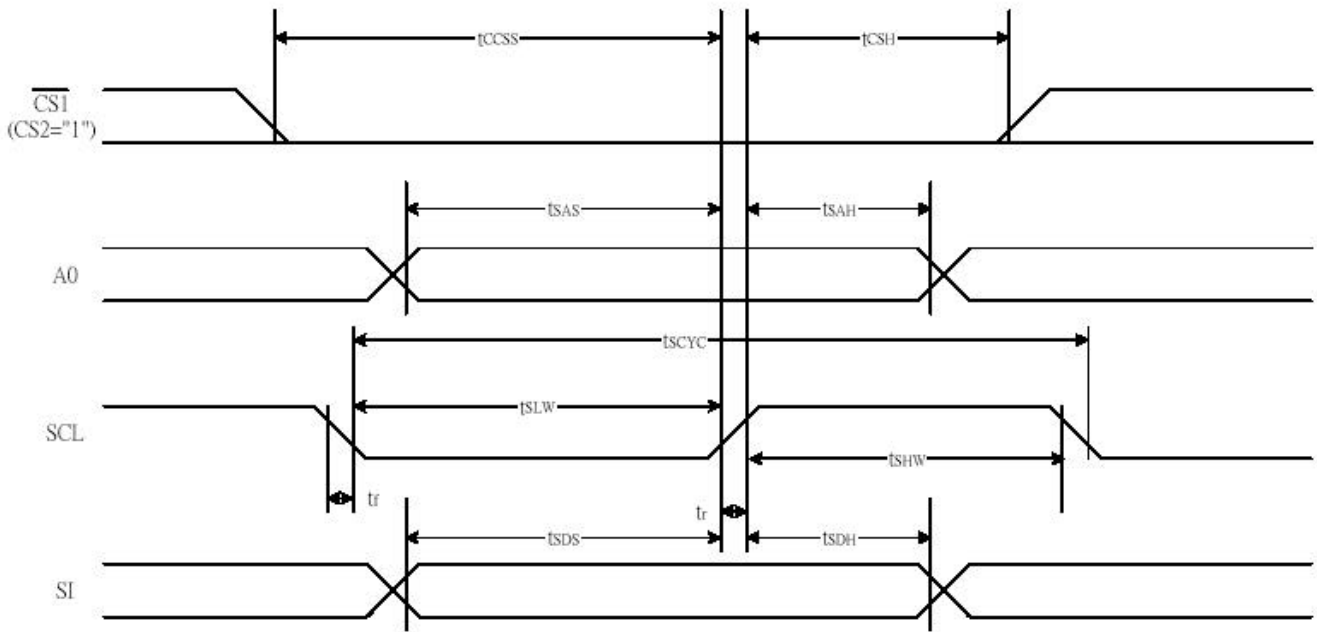
The line address circuit, specifies the line address relating to the COM output when the contents of the display data RAM are displayed. Using the display start line address set command, what is normally the top line of the display can be specified (this is the COM0 output when the common output mode is normal, and the COM63 output. for ST7565R , The display area is a 65 line area for the ST7565R. If the line addresses are changed dynamically using the display start line address set command, screen scrolling, page swapping, etc. can be performed.



7. PAGE ADDRESS AND LINE ADDRESS CIRCUIT

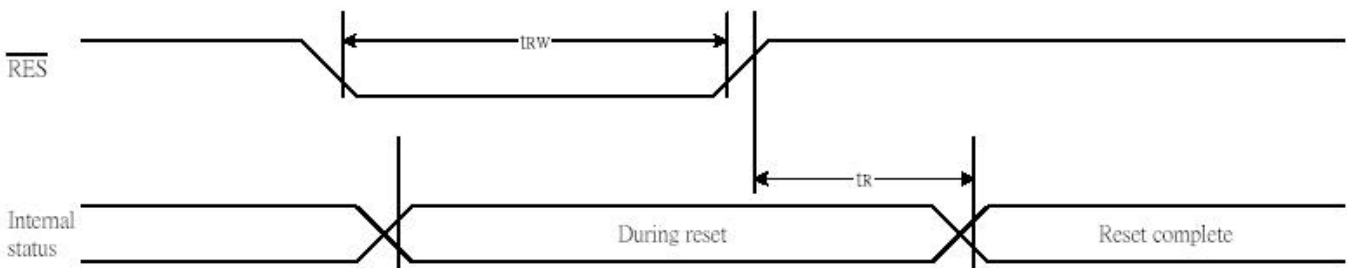


8. TIMING CHARACTERISTICS (FOR SERIAL INTERFACE)



Item	Signal	Symbol	Condition	Rating		Units
				Min.	Max.	
Serial Clock Period	SCL	T_{scyc}		100	—	ns
SCL "H" pulse width		T_{shw}		50	—	
SCL "L" pulse width		T_{slw}		50	—	
Address setup time	A0	T_{sas}		20	—	
Address hold time		T_{sah}		10	—	
Data setup time	SI	T_{sds}		20	—	
Data hold time		T_{sdh}		10	—	
CS-SCL time	CS	T_{css}		20	—	
CS-SCL time		T_{csh}		40	—	

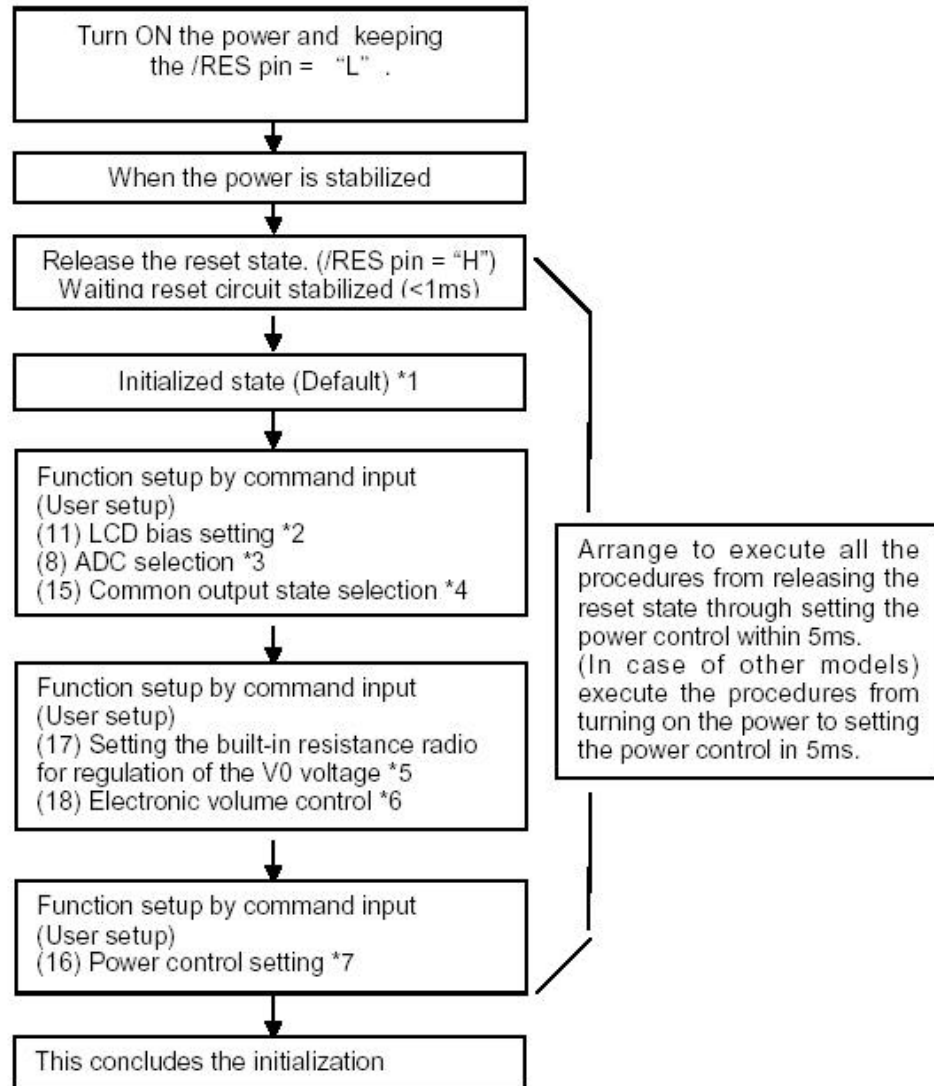
9. RESET TIMING



Item	Signal	Symbol	Condition	Rating			Units
				Min.	Typ.	Max.	
Reset time		t_r		—	—	1.0	us
Reset "L" pulse width	\overline{RES}	t_{RW}		1.0	—	—	us

10. INITIALIZATION METHOD

With built-in power supply circuit:



* The target time of 5ms will result to vary depending on the panel characteristics and the capacitance of the smoothing

capacitor. Therefore, we suggest you to conduct an operation check using the actual equipment.

Notes: Refer to respective sections or paragraphs listed below.

*1: Description of functions; Resetting circuit

*2: Command description; LCD bias setting

*3: Command description; ADC selection

*4: Command description; Common output state selection

*5: Description of functions; Power circuit & Command description; Setting the built-in resistance ratio for regulation of the V0 voltage

*6: Description of functions; Power circuit & Command description; Electronic volume control

*7: Description of functions; Power circuit & Command description; Power control setting

■ RELIABILITY TEST CONDITIONS

ITEM	TEST CONDITION FOR NORMAL TEMPERATURE	TEST CONDITION FOR WIDE TEMPERATURE	TIME
High temperature operating	50°C	70°C	240 hours
Low temperature operating	0°C	-20°C	240 hours
High temperature storage	60°C	80°C	240 hours
Low temperature storage	-10°C	-30°C	240 hours
Temperature-humidity storage	40°C 90% R.H.	60°C 90% R.H.	96 hours
Temperature cycling	-10°C to 60°C 30 Min Dwell	-30°C to 80°C 30 Min Dwell	5 cycle
Vibration Test at LCM Level	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	Freq 10-55 Hz Sweep rate: 10-55-10 at 1 min Sweep mode Linear Displacement: 2 mm p-p 1 Hour each for X, Y, Z	—

■ INSPECTION CRITERION

1. SAMPLING METHOD

SAMPLING PLAN: MIL-STD 105E

CLASS OF AQL: LEVEL II/ SINGLE SAMPLING
 MAJOR-0.65% MINOR – 1.5%

2. QUALITY STANDARD

DEFECT	CRITERIA	TYPE	FIGURE
SHORT CIRCUIT	-	MAJOR	-
MISSING SEGMENT	-	MAJOR	-
UNEVEN / POOR CONTRAST	-	MAJOR	-
CROSS TALK	-	MAJOR	-
PIN HOLE	$MAX(a,b) \leq 1/4 W$	MINOR	1
EXCESS SEGMENT	$MAX(c,d) \leq 1/4 T$	MINOR	1
BUBBLES	$d^* \geq 0.2$ QTY=0	MINOR	2
BLACKS SPOTS	$d \leq 0.3$ N.A.** $0.3 < d \leq 0.4$ QTY≤1 $0.4 < d$ QTY=0	MINOR	2
LINE SCRATCHES	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3
BLACK LINE	$x \geq 0.7$ $y \geq 0.05$ QTY=0	MINOR	3

*d = MAX (d₁,d₂)

** N. A . = NOT APPLICABLE

DEFECT TABLE : B

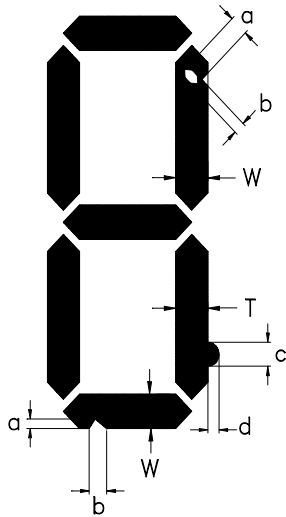
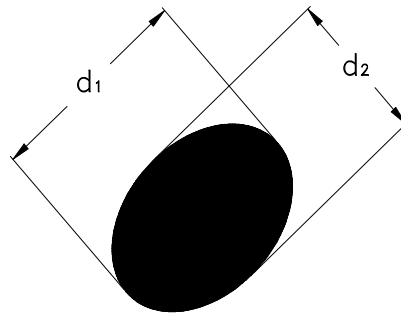
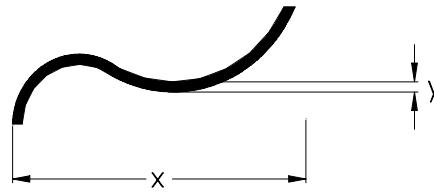


fig . 1



POLARIZER BUBBLES / SPOTS
fig . 2



LINE SCRATCHES / BLACK LINE
fig . 3

3. QUALITY STANDARD (CONT .)

DEFECT		CRITERIA	TYPE	FIGURE
CHIPS	CONTACT EDGE	$e \leq 1/2T$ $f \leq 1/3W$ $g \leq 3.5$	MINOR	4
	BOTTOM GLASS	$p \leq 1.0$ $q \leq 3.5$ $r \leq 1/2T$		4
	CORNER	$a \leq 1.5$ $b \leq W$		4
	TOP GLASS	$a \leq 3.0$ $b \leq 1/3T$ $c \leq 1/2W$		5
GLASS PROTRUSION		$a \leq 1/4 W$	MINOR	6
RAINBOW		-	MINOR	-

UNLESS STATE OTHERWISE , ALL UNIT ARE IN MILLIMETER .

DEFECT TABLE : B

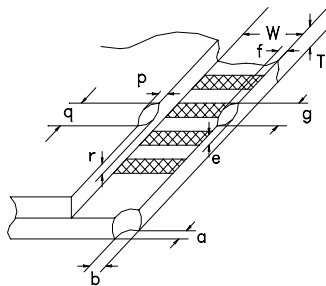


fig . 4

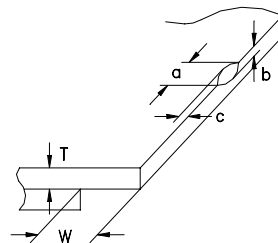


fig . 5

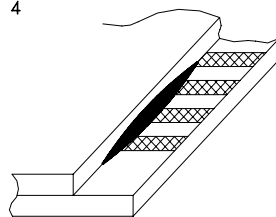


fig . 6



4. HANDLING PRECAUTIONS

(1) CAUTION OF LCD HANDLING & CLEANING

Use soft cloth with solvent (recommended below) to clean the display surface and wipe lightly.
- Isopropyl alcohol, ethyl alcohol, trichlorotrifluoroethane

Do not wipe the display surface with dry or hard materials that will damage the polarizer surface. Do not use the following solvent;
-water, ketone, aromatics

(2) CAUTION AGAINST STATIC CHARGE

The LCD modules use CMOS LSI drivers, so customers are recommend that any unused input terminal would be connected to V_{DD} or V_{SS} , do not input any signals before power is turned on, and ground your body, work/assembly areas, assembly equipment to protect against static electricity.

Remove the protective film slowly and, if possible, under ESD control device like ion blower and humidity of working room should be kept over 50%RH to reduce risk of static charge.

(3) PACKAGING

Avoid intense shock and falls from a height and do not operate or store them exposed direct to sunshine or high temperature/humidity.

(4) CAUTION FOR OPERATION

It is an indispensable condition to drive LCD's within the specified voltage limit since the higher voltage than the limit causes the shorter LCD life. The use of direct current drive should be avoided because an electrochemical reaction due to direct current causes LCD's undesirable deterioration.

Response time will be extremely delayed at low temperature, and LCD's show dark color at high temperature. However those phenomena do not mean malfunction or out of order with LCD's.

Some font will be abnormally displayed when the display area is pushed hard during operation. But it resumes normal condition after turning off once.

(5) SOLDERING (for Pin type)

It is recommended to complete dip soldering at 270 °C or hand soldering at 280 °C within 3 seconds. The soldering position is at least 3mm apart from the pin head. Wave or reflow soldering are not recommended. Metal pins should not be soldered for more than 3 times and each soldering should be done after cool down of metal pins.

(6) SAFETY

For crash damaged or unnecessary LCD's, it is recommended to wash off liquid crystal by either of solvents such as acetone and ethanol and should be burned up later.

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

5. WARRANTY

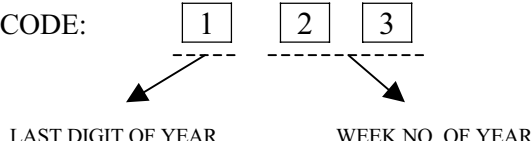
MULTI-INNO will replace or repair any of her LCD module in accordance with her LCD specification for a period of one year from date of shipment. The warranty liability of MULTI-INNO is limited to repair and/or replacement. MULTI-INNO will not be responsible for any subsequent or consequential event.

5. APPENDIX

LOT INDICATION OF LCD MODULE

CODING SYSTEM:

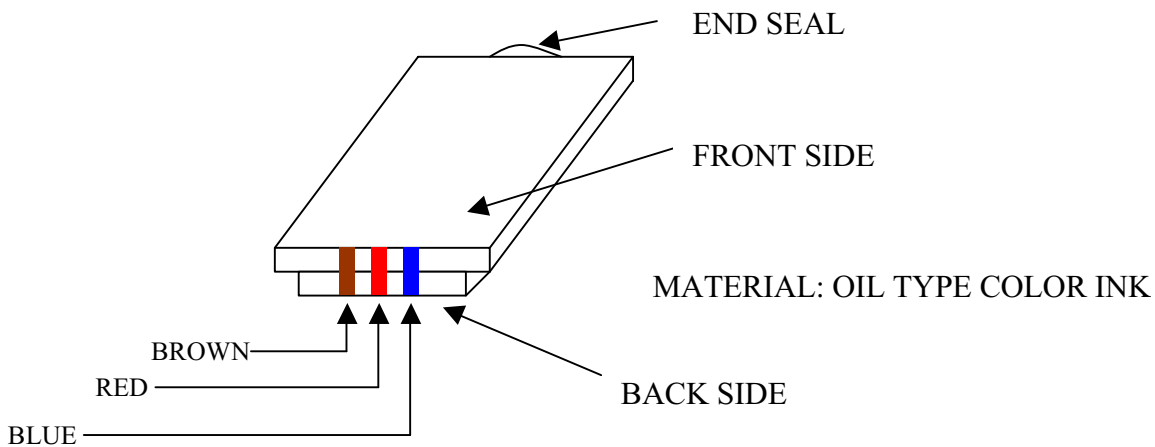
3-DIGIT COLOR CODE:



COLOR CODE:

	COLOR
0	BLACK
1	BROWN
2	RED
3	ORANGE
4	YELLOW
5	GREEN
6	BLUE
7	PURPLE
8	GREY
9	WHITE

LOCATION AS SHOWN BELOW:



e.g. WEEK 26 OF YEAR 2001