Datasheet

Multifunction LCD Segment Driver

BU97941FV MAX 104 segments (SEG26×COM4)

●Features

- Integrated RAM for display data (DDRAM): 26 x 4 bit (Max 104 Segments)
- LCD drive output: 4 Common output, 26 Segment output
- Integrated 4ch LED driver circuit
- Support standby mode
- Integrated Power-on-Reset circuit (POR)
- Integrated Oscillator circuit
- No external component
- Low power consumption design
- Independent power supply for LCD driving

●Key Specifications

- Supply Voltage Range: +1.8V to +3.6V
- LCD drive power supply Range: +2.7V to +5.5V
- Operating Temperature Range: -40°C to +85°C
- Max Segments: 104 Segments
- Display Duty: Static, 1/3, 1/4 selectable
- Bias: Static, 1/3
- Interface: 3wire serial interface

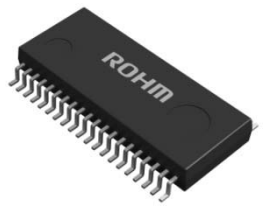
●Applications

- Telephone
- FAX
- Portable equipment (POS, ECR, PDA etc.)
- DSC
- DVC
- Car audio
- Home electrical appliance
- Meter equipment

etc.

●Package

W (Typ.) x D (Typ.) x H (Max.)



SSOP-B40
13.60mm x 7.80mm x 2.00mm

●Typical Application Circuit

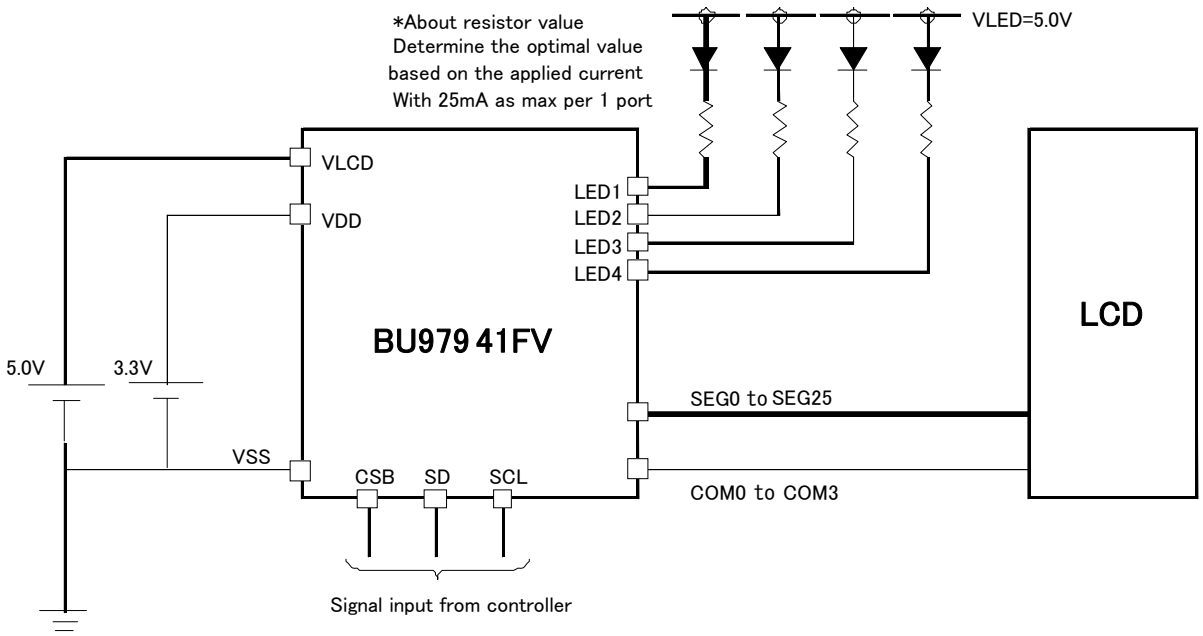


Figure 1. Typical application circuit

○Product structure：Silicon monolithic integrated circuit ○This product is not designed protection against radioactive rays.

●Block Diagram / Pin Configuration / Pin Description

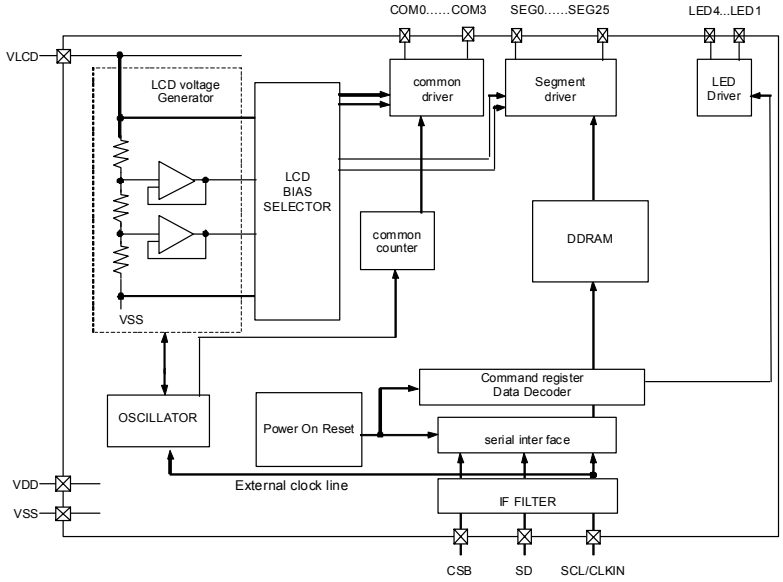


Figure 2. Block Diagram

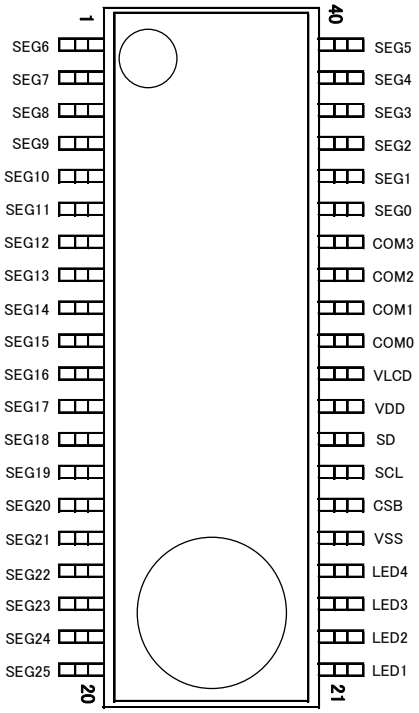


Figure 3. Pin Configuration (TOP VIEW)

Table 1 Pin Description

Pin Name	Pin No.	I/O	Setting when not in use	Function
CSB	26	I	VDD	Chip select: "L" active
SCL	27	I	VSS	Serial data transfer clock
SD	28	I	VSS	Input serial data
VDD	29	-	-	Power supply for LOGIC
VSS	25	-	-	External clock input terminal (for display/PWM using selectable) Support Hi-Z input mode at internal clock mode
VLCD	30	-	-	GND
COM0 to 3	31 to 34	O	OPEN	Power supply for LCD
SEG0 to 25	1 to 20 35 to 40	O	OPEN	COMMON output for LCD
LED1 to 4	21 to 24	O	OPEN	LED driver output

●**Absolute Maximum Ratings (VSS=0V)**

Item	Symbol	Ratings	Unit	Remarks
Power supply Voltage1	VDD	-0.3 to +4.5	V	Power supply
Power supply Voltage2	VLCD	-0.5 to +7.0	V	Voltage for Liquid crystal Drive
Power supply Voltage2	VLED	-0.5 to +7.0	V	Voltage for LED driving port terminal
Allowable loss	Pd	0.8*1	W	
Input Voltage Range	VIN	-0.5 to VDD+0.5	V	
Operating Temperature Range	Topr	-40 to +85	℃	
Storage Temperature Range	Tstg	-55 to +125	℃	
Output Current	Iout1	5	mA	SEG Output
	Iout2	5	mA	COM Output
	Iout3	50	mA	LED Output (per 1 port)

*Decreases 8mW per 1℃ when using at 1 Ta=25℃ or higher. （During ROHM standard board mounting）
（Board size：74.2mm×74.2mm×1.6mm Material：FR4 Glass-epoxy board Copper foil： Land pattern only）

●**Recommended Operating Ratings(Ta=-40°C to +85°C,VSS=0V)**

Item	Symbol	MIN	TYP	MAX	Unit	Remarks
Power supply Voltage1	VDD	1.8	-	3.6	V	Power supply
Power supply Voltage2	VLCD	2.7	-	5.5	V	Voltage for Liquid crystal Drive
Output Current	Iout1	-	-	25	mA	LED Output (per LED1 port)
	Iout2	-	-	100	mA	LED Output (LED port current total sum)

●**Electrical Characteristics**

DC Characteristics (Ta=-40°C to +85°C、VDD=1.8V to 3.6V、VLCD=2.7V to 5.5V、VSS=0V)

Item	Symbol	Limit Value			Unit	Condition
		MIN	TYP	MAX		
“H” level input voltage	VIH	0.8VDD	-	VDD	V	SD, SCL, CSB
“L” level input voltage	VIL	VSS	-	0.2VDD	V	SD, SCL, CSB
Hysteresis width	VH	-	0.2	-	V	SCL, VDD=3.3V、Ta=25°C
“H” level input current	IIH1	-	-	5	uA	SD,SCL, CSB, VI=3.6V
LED off leak	OFF LEAK	5	0	5	uA	LED VI=5.5V
“H” level output voltage (*2)	VOH1	VLCD -0.4	-	-	V	Iload=-50uA, VLCD=5.0V SEG0 to SEG25
	VOH2	VLCD -0.4	-	-	V	Iload=-50uA, VLCD=5.0V、COM0 to COM3
“L” level output voltage (*2)	VOL1	-	-	0.4	V	Iload= 50uA, VLCD=5.0V、SEG0 to SEG25
	VOL2	-	-	0.4	V	Iload= 50uA, VLCD=5.0V、COM0 to COM3
	VOL4	-	0.11	0.5	V	Iload=20mA、VLCD=5.0V、LED1 to 4
output voltage (*2)	VOUT1	2.73	3.33	3.93	V	Iload=+/-50uA, VLCD=5.0V, SEG0 to 25, COM0 to 3
	VOUT2	1.07	1.67	2.27	V	Iload=+/-50uA, VLCD=5.0V, SEG0 to 25, COM0 to 3
Supply current (*1)	IstVDD	-	3	10	uA	Input pin ALL ’L’, Display off, Oscillation off
	IstVLCD	-	0.5	5	uA	Input pin ALL ’L’, Display off, Oscillation off
	IVDD1	-	8	15	uA	VDD=3.3V、Ta=25°C、1/3bias、fFR=64Hz、Output open
	IVLCD1	-	10	15	uA	VLCD=5.0V、Ta=25°C、1/3bias、fFR=64Hz、Output open

＊1 During Power save mode 1、Frame inversion.

＊2 Iload：When setting the load of 1 pin only.

●**Electrical Characteristics – continued**

Oscillation Frequency Characteristics (Ta=-40°C to +85°C、VDD=1.8V to 3.6V、VLCD=2.7V to 5.5V、VSS=0V)

Item	Symbol	Limit Value			Unit	Condition
		MIN	TYP	MAX		
Frame Frequency 1	fFR1	76.5	85	93.5	Hz	VDD=3.3V、Ta=25°C、fFR=85Hz setting
Frame Frequency 2	fFR2	68	85	97.0	Hz	VDD=2.5V to 3.6V fFR=85Hz setting
Frame Frequency 3	fFR3	59.7	-	68	Hz	VDD=1.8V to 2.5V fFR=85Hz setting

MPU Interface Characteristics (Ta=-40°C to +85°C、VDD=1.8V to 3.6V、VLCD=2.7V to 5.5V、VSS=0V)

Item	Symbol	Limit Value			Unit	Condition
		MIN	TYP	MAX		
Input Rise Time	tr	-	-	50	ns	
Input Fall Time	tf	-	-	50	ns	
SCL Cycle	tSCYC	250	-	-	ns	
“H” SCL pulse width	tSHW	50	-	-	ns	
“L” SCL pulse width	tSLW	50	-	-	ns	
SD Setup Time	tSDS	50	-	-	ns	
SD Hold Time	tSDH	50	-	-	ns	
CSB Setup Time	tCSS	50	-	-	ns	
CSB Hold Time	tCSH	50	-	-	ns	
“H” CSB pulse width	tCHW	50	-	-	ns	

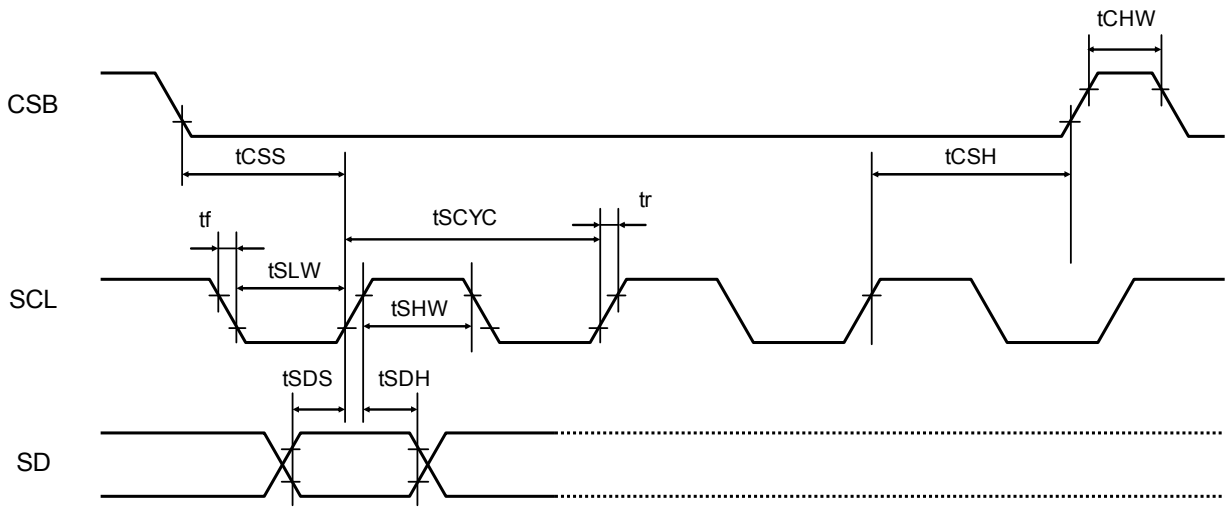


Figure 4. Serial Interface Timing

●I/O equivalent circuit

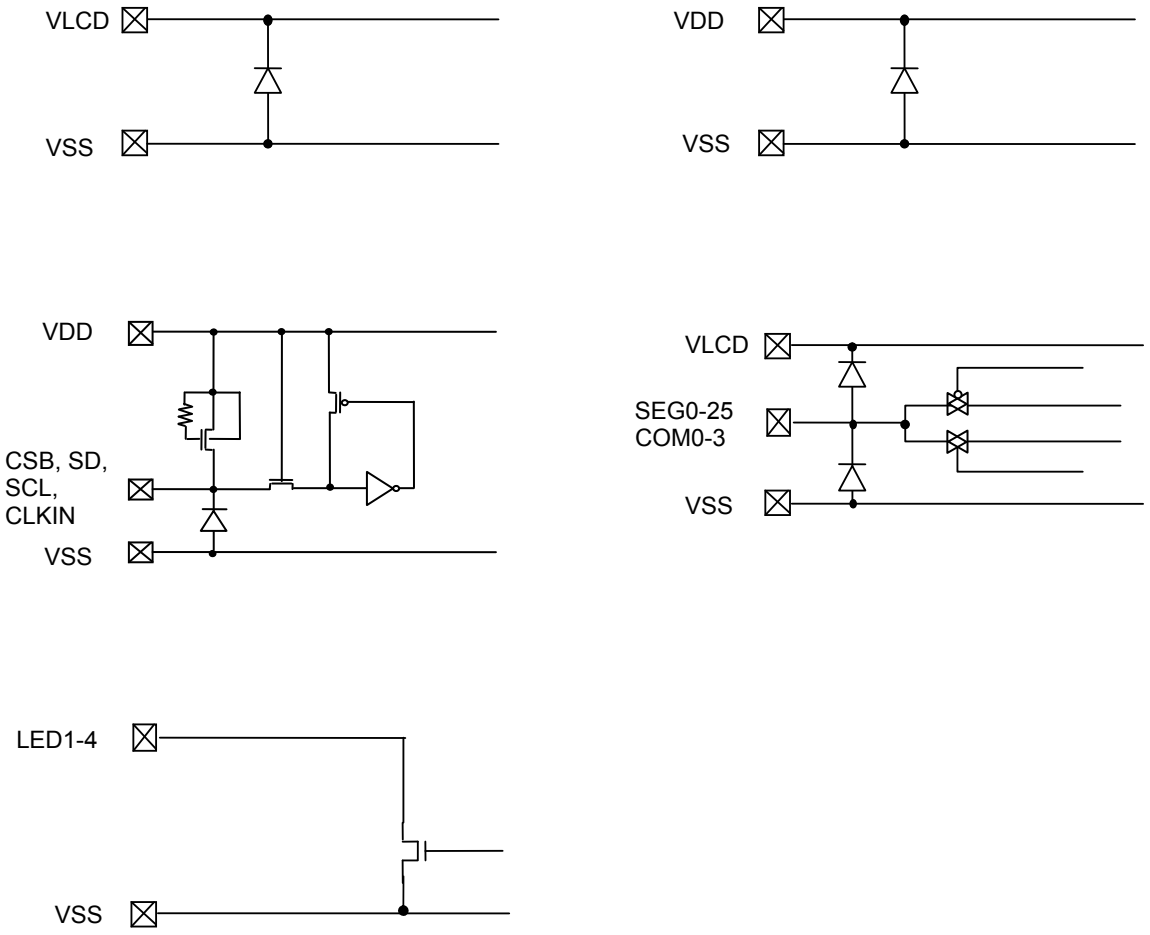


Figure 5. I/O equivalent circuit

●Example of recommended circuit

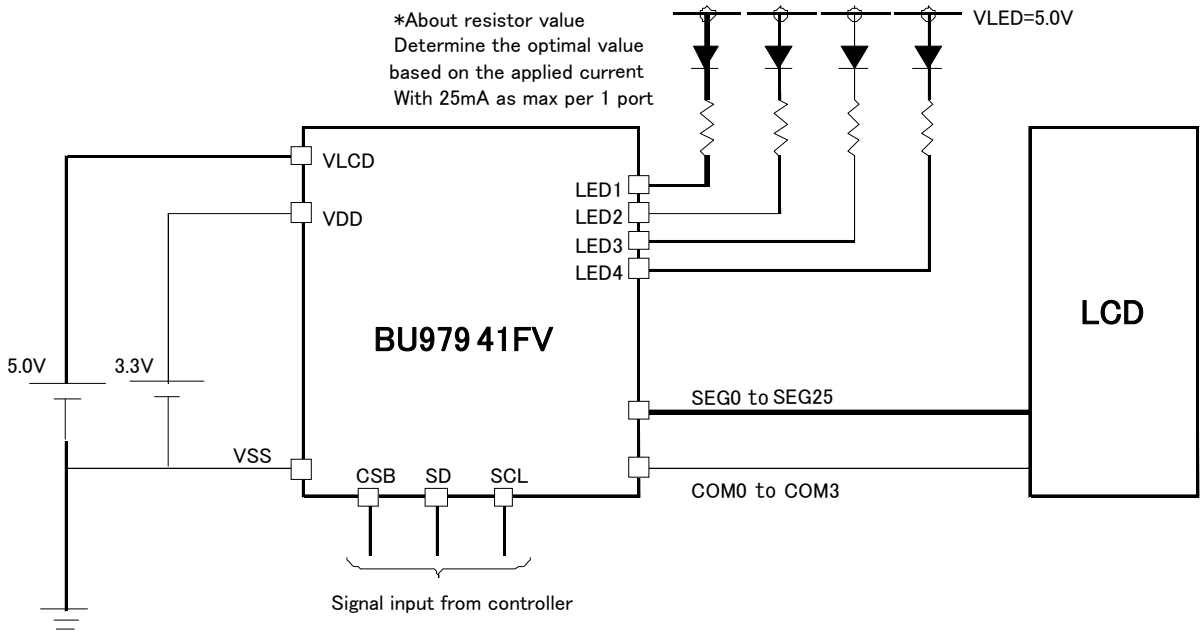


Figure 6. Recommended circuit example

●Function Description

○Command・Data Transfer Method

○3-SPI（3-wire Serial Interface）

This device is controlled by 3-wire signal: CSB, SCL, SD.
SD, SCL input are enabled with CSB = “L”. Also, interface counter is initialized with CSB = “H”, and the next command or data can be inputted. Each command starts with Command or data judgment bit (D/C) as MSB data, and continuously in order of D6 to D0 are followed after CSB=”L. Internal data is latched at the rising edge of SCL, it will be converted to 8bits parallel data at the falling edge of 8th CLK.

If CSB is set to “H” when the data is less than 8bit, command and data being transferred will be cancelled.
When inputting again, please set CSB to “L”. Then, be sure to input command for 1byte.

Also, when it becomes input state of DDRAM data through RAMWR command, command cannot be inputted.
When inputting again, please start up CSB.
If CSB is set to ”H”, the data input state is cancelled and by setting ”CSB” to ”L” again, command will be received.

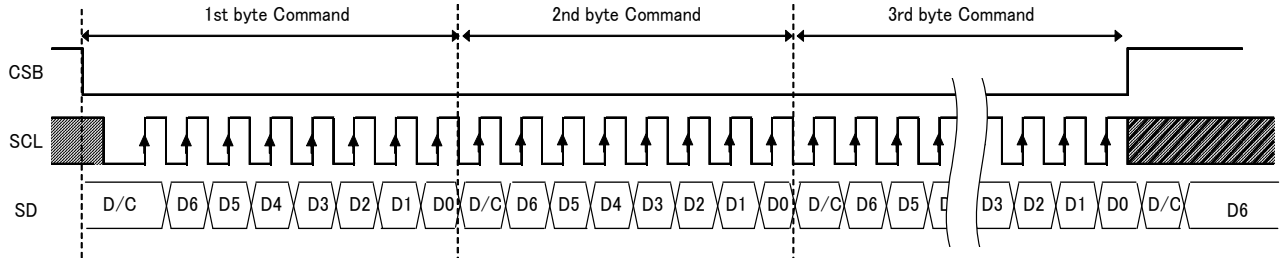
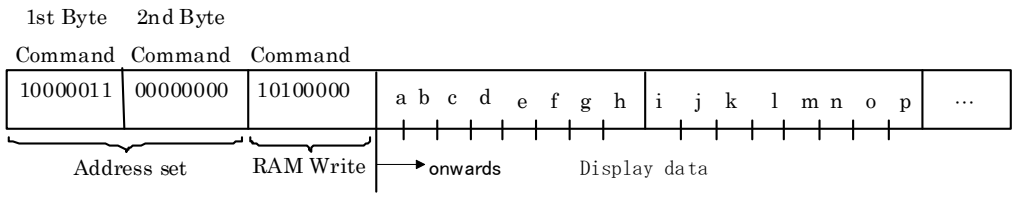


Figure 7. 3-SPI Data Transfer Format

○ Write and Transfer Method of Display Data

This device has display data ram of 26×4＝104bit.
The handling of display data with write and the handling of DDRAM data and Address and display are as follows:



Binary 8bit data is written to DDRAM. The address where the write begins is set with the Address set command, and address is automatically incremented per 4bit data.
Next, by transferring data, data can be written continuously to DDRAM.
(When continuously writing data to DDRAM, after writing to the final address 19h（SEG25）, address will return to 00h (SEG0) through auto increment.)

DDRAM address

BIT	00	01	02	03	04	05	06	07	・・・	17h	18h	19h	
0	a	e	i	m									COM0
1	b	f	j	n									COM1
2	c	g	k	o									COM2
3	d	h	l	p									COM3
	SEG 0	SEG 1	SEG 2	SEG 3	SEG 4	SEG 5	SEG 6	SEG 7		SEG 23	SEG 24	SEG 25	

Writing to RAM is done per 4bit. When CSB is set to 'H' when less than 4bit, the writing of RAM is cancelled. （Transfer of command is done per 8bit.）

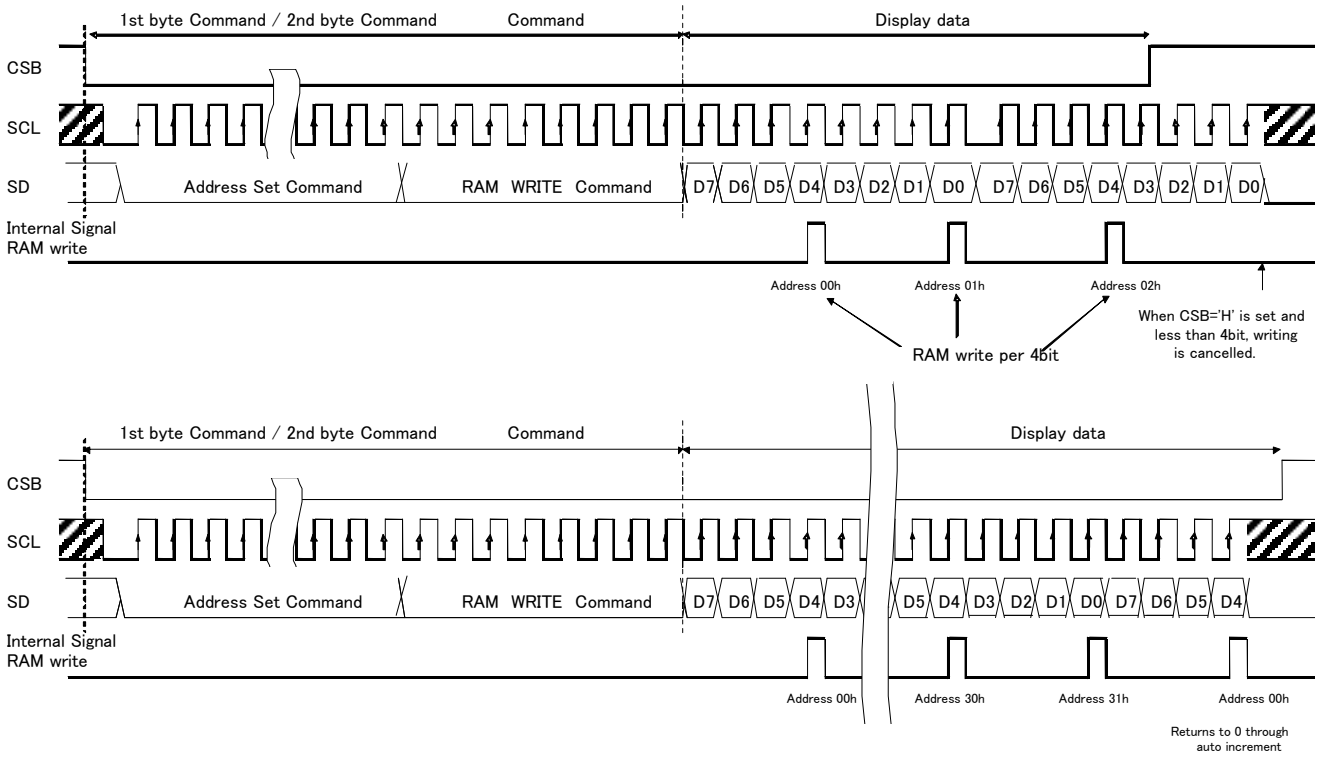


Figure 8. Display Data Transfer Method

○LCD Driver Bias / Duty Circuit

Voltage is generated for LCD drive.
Buffer amplifier is integrated low power consumption is possible.
＊Line, frame inversion can be set via MODESET command.
＊1/4, 1/3, static duty can be set via DISCTL command.
For each liquid crystal drive waveform, see ”Liquid crystal Drive Waveform”.

○Reset Initial State

The Reset Initial State after executing Software Reset is as follows:
・ Display is turned OFF.
・ Each command register enters Reset state.
・ DDRAM address is initialized.
(DDRAM data is not initialized. Therefore, it is recommended to write initial values to all DDRAM before Display on.）

●Command / Function Table

Function Description Table

NO	Command	Function
1	Mode Set (MODESET)	Liquid crystal Drive setting
2	Display control (DISCTL)	LCD setting1
3	Address set (ADSET)	LCD setting2
4	LED control (LEDCTL)	LED board ON/OFF setting
5	RAM WRITE (RAMWR)	RAM Write Start setting
6	All Pixel ON (APON)	All display ON
7	All Pixel OFF (APOFF)	All display OFF
8	All Pixel On/Off mode off (NORON)	Normal display APON/APOFF setting release）
9	Software Reset (SWRST)	Software reset

●Command Description

D/C (MSB) is bit for command or data judgment.
For details, see 3-wire Serial Interface Command, Data Transfer Method.

○Mode Set Command (MODESET)

	MSB							LSB		
	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	0	0	0	0	1	81h	-
2nd byte Command	0	0	0	0	P3	P2	P1	P0	-	00h

Display setting

Setting	P3	Reset state
Display OFF	0	○
Display ON	1	

Display OFF : Oscillation circuit operation OFF, Liquid crystal power supply circuit operation OFF with frame cycle. Display OFF state (Output : VSS level)
Display ON : Oscillation circuit operation ON, Liquid crystal power supply circuit ON. Read operation from DDRAM starts. Display ON state with frame cycle.

∗ LED board is not affected by the ON/OFF state of Display.
The output state of LED port is determined by the setting of the LEDCTL command.

Liquid crystal Drive Waveform Setting

Setting	P2	Reset state
Frame inversion	0	○
Line inversion	1	

Power save mode (Low current consumption mode) setting

Setting	P1	P0	Reset state
Power save mode1	0	0	○
Power save mode2	0	1	
Normal mode	1	0	
High power mode	1	1	

∗ Use high power mode at VLCD＞3V or higher.

(Reference Current Consumption Data)

Setting	Current Consumption
Power save mode 1	×1.0
Power save mode 2	×1.7
Normal mode	×2.7
High power mode	×5.0

∗ The current consumption data above is reference data and changes according to panel load.

○Display control command (DISCTL)

	MSB							LSB		
	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	0	0	0	1	0	82h	-
2nd byte Command	0	0	0	0	P3	P2	P1	P0	-	02h

Duty setting

Setting	P3	P2	Reset state
1/4duty (1/3bias)	0	0	○
1/3duty (1/3bias)	0	1	
Static (1/1bias)	1	*	

(*: Don't care)

When 1/3duty, the display / blink data for COM3 are invalid.
(COM3: same waveform with COM1)
When 1/1duty (Static), the display / blink data for COM1 to 3 are invalid.
(COM1 to 3: same waveform with COM0)

Be careful in sending display data.
For sample output waveform of SEG/COM with duty setting, see "Liquid crystal Drive Waveform".

Frame Frequency Setting

Setting (When 1/4,1/3,1/1duty)	P1	P0	Reset state
(128Hz, 130Hz, 128Hz)	0	0	
(85Hz, 86hz, 64Hz)	0	1	○
(64Hz, 65Hz, 48Hz)	1	0	
(51Hz, 52Hz, 32Hz)	1	1	

The relationship with frame frequency (FR), internal osc frequency and dividing number is below:

DISCTL (P1,P0)	Divide			FR [Hz]		
	1/4duty	1/3duty	1/1duty	1/4duty	1/3duty	1/1duty
(0,0)	160	156	160	128	131.3	128
(0,1)	240	237	320	85.3	86.4	64
(1,0)	320	315	428	64	65	47.9
(1,1)	400	393	640	51.2	52.1	32

When calculating the OSC frequency from the measurement value of frame frequency, use the following equation:

" OSC frequency = Frame Frequency (Measurement value) × Dividing number"

Dividing number : Using the values of Frame Frequency setting (P1,P0) and duty setting(P3,P2), determine the values from the table above.

Ex) (P1,P0) = (0,1) 、(P3,P2) = (0,1) ⇒ Dividing number= 237

＊1 : The value of FR in the table above is the Frame Frequency calcuated as OSC Frequency = 20.48KHz (typ).

○Address set command (ADSET)

MSB LSB

MSB	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	0	0	0	1	1	83h	-
2nd byte Command	0	0	0	P4	P3	P2	P1	P0	-	00h

Sets the address that starts the writing to RAM for normal display.
Address can be set from 00h to 1Bh.
Setting is prohibited for addresses not written above.
Address during Reset is 00h.
When writing to RAM, a separate RAM WRITE setting is needed.

○LED control command (LEDCTL)

MSB LSB

MSB	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	0	0	1	0	1	85h	-
2nd byte Command	0	0	0	0	P3	P2	P1	P0	-	00h

Sets the drive of the LED port. Setting during Reset is 00h.
The relationship between each parameter and the Drive board is as follows:

	LED1 P0	LED2 P1	LED3 P2	LED4 P3
LED ON	1	1	1	1
LED OFF	0	0	0	0

＊ Please input CSB="H" after LEDCTL command is issued.
To avoid influence of noise and reset interface.

○RAM WRITE command (RAMWR)

MSB LSB

	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	1	0	0	0	0	0	A0h	-
2nd byte Command	Display data									Random
	・・・・									
n byte Command	Display data									Random

The input data after command setting is the data input for display.
Be sure to send this command after setting the ADSET command.
The display data is transferred per 4bit. (For details, see “Write and Transfer Method of Display Data.”)

○All Pixel ON command (APON)

MSB LSB

	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	1	0	0	0	1	91h	-

Regardless of the contents of DDRAM, the SEG output will enter all light up mode. (Pin that selects SEG output)

○All Pixel OFF command (APOFF)

	MSB							LSB		
	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	1	0	0	0	0	90h	-

Regardless of the contents of DDRAM, the SEG output will enter all light up mode. (Pin that selects SEG output)

○All Pixel ON/OFF mode off (NORON)

	MSB							LSB		
	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	1	0	0	1	1	93h	-

APON / OFF mode is cancelled and switches to normal display mode. (Pin that selects SEG output)
After reset, NORON is set and becomes normal display state.

○Software Reset command (SWRST)

	MSB							LSB		
	D/C	D6	D5	D4	D3	D2	D1	D0	Hex	Reset
1st byte Command	1	0	0	1	0	0	1	0	92h	-

Resets software. This IC is in reset state.

●Liquid crystal Drive Waveform

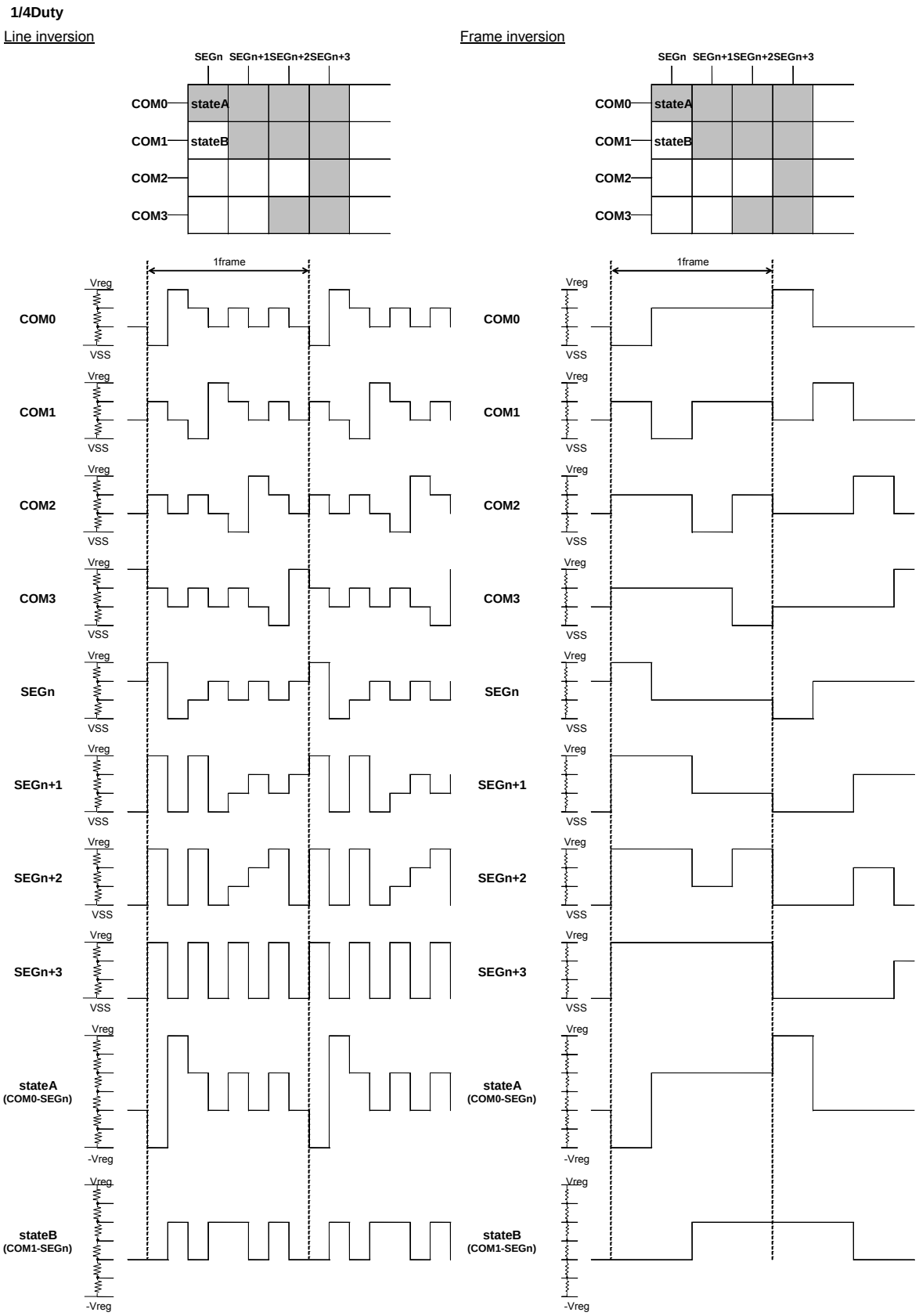


Figure 9. LCD Drive Waveform during Line inversion

Figure 10.LCD Drive Waveform during Frame inversion

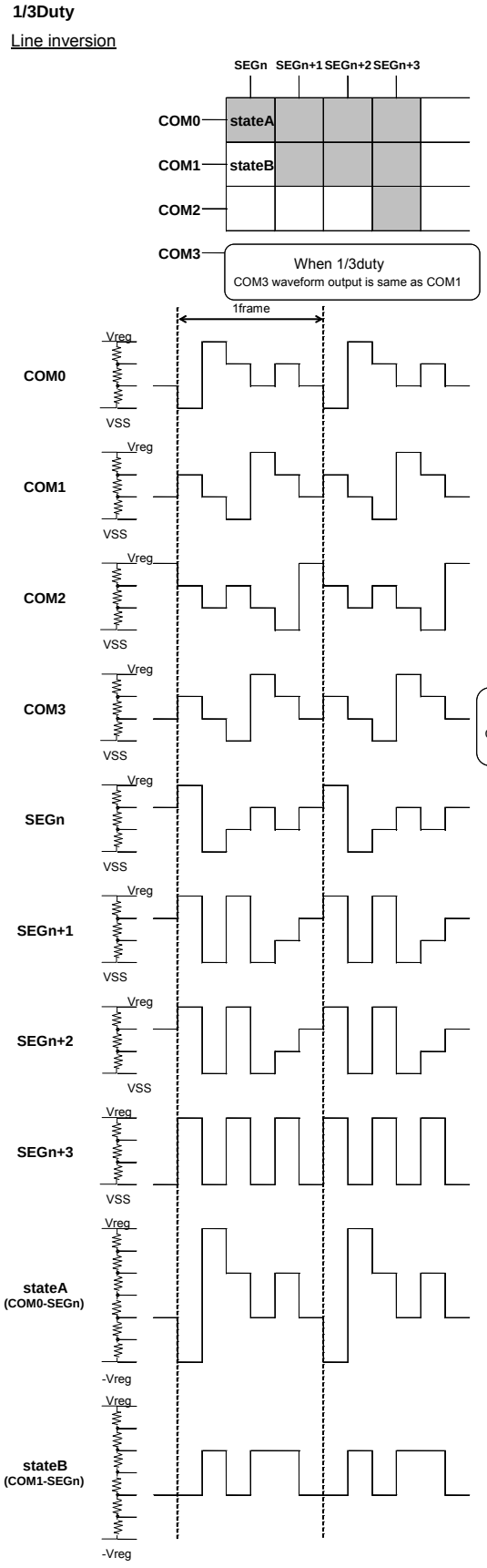


Figure 11. LCD Drive Waveform during Line inversion

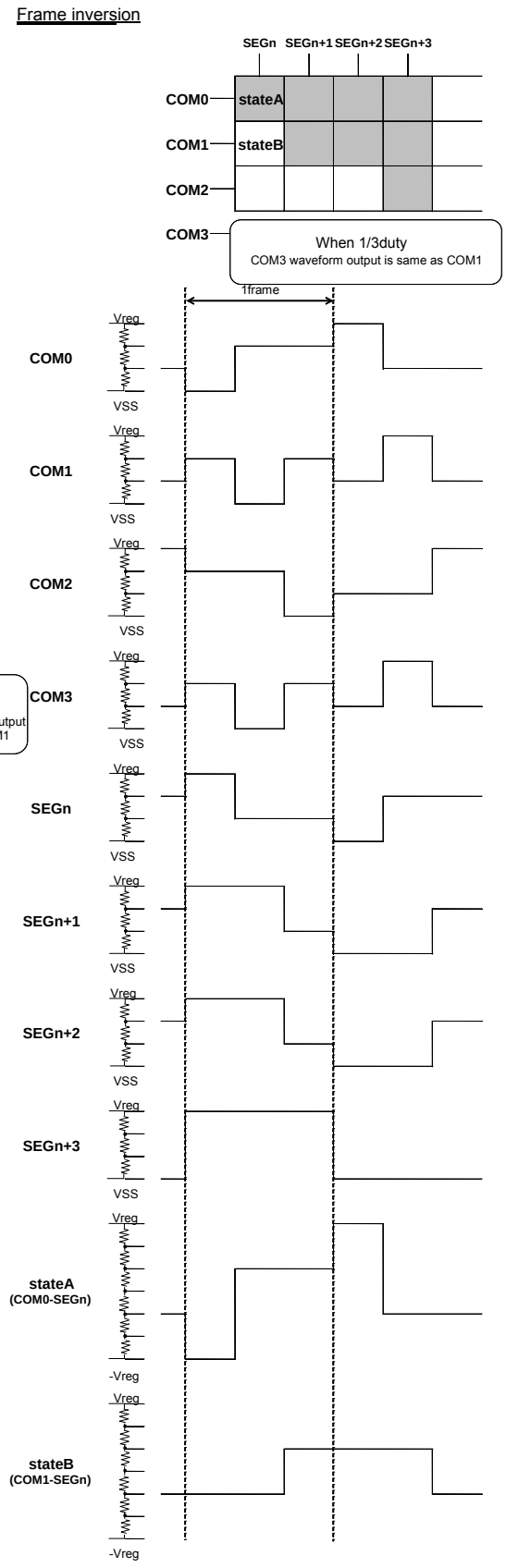


Figure 12. LCD Drive Waveform during Frame inversion

1/1Duty (Static)

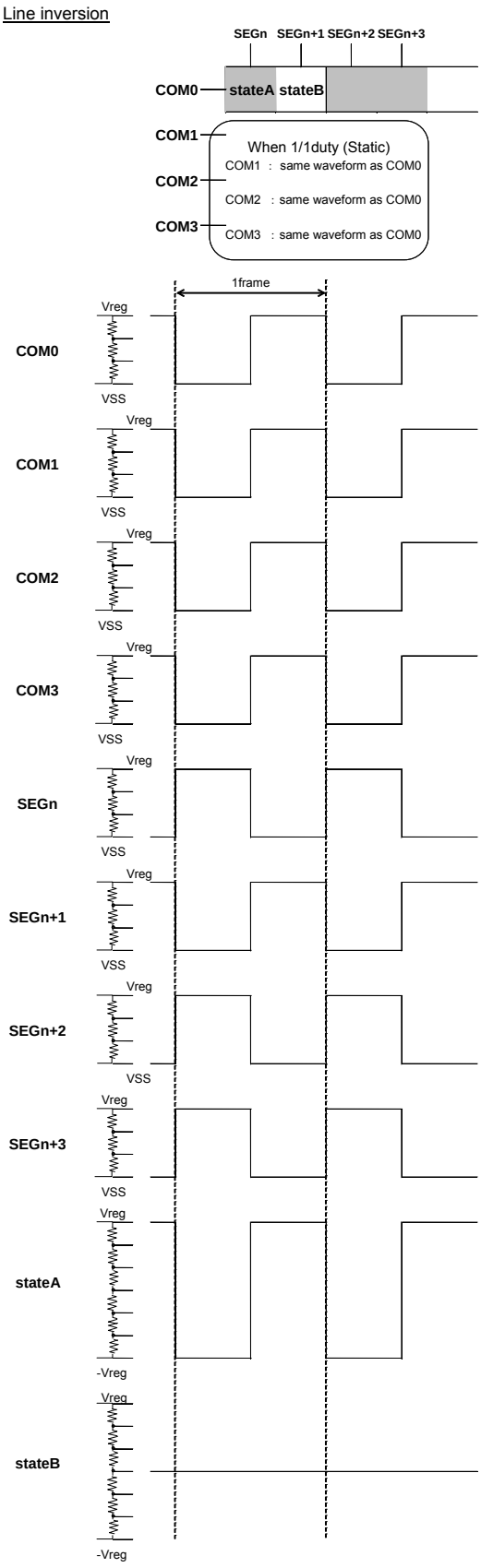


Figure 13.LCD Drive Waveform during Line inversion

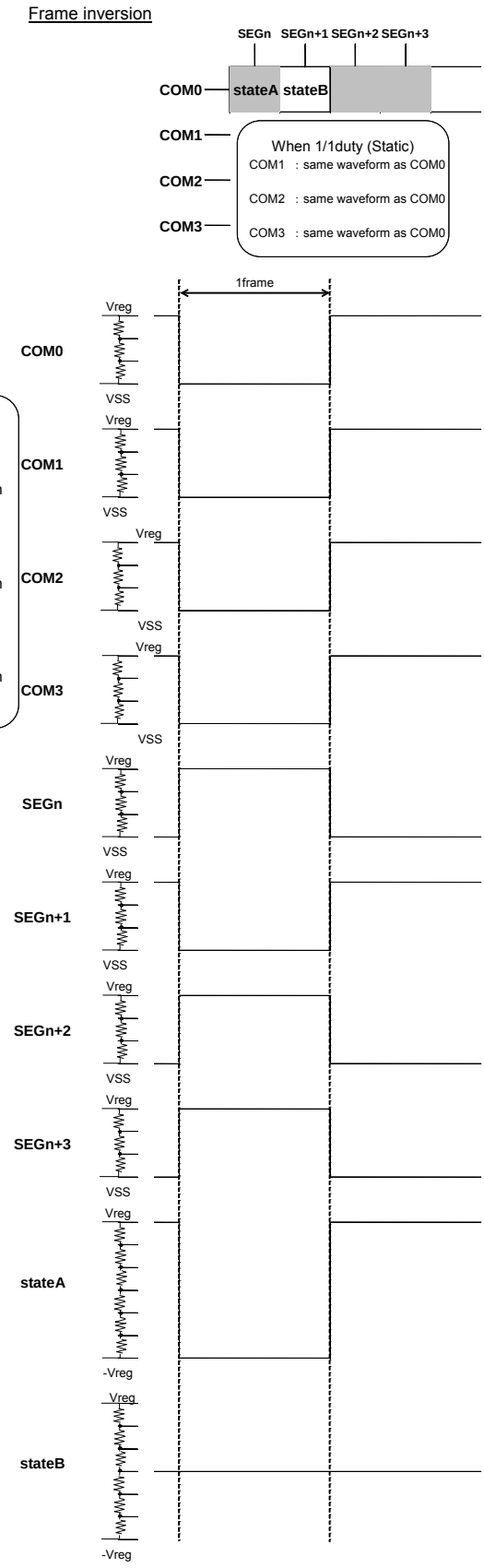


Figure 14. LCD Drive Waveform during Frame inversion

●**Initialization Sequence**

Execute the following sequence after power supply and start display after the IC has initialized.

Power supply
↓
CSB ‘H’ …Initialize I/F
↓
CSB ‘L’ …Start I/F Data Transfer
↓
Execute Software Reset from SWRST command
↓
MODESET (Display off)
↓
Various command setting
↓
RAM WRITE
↓
MODESET (Display on)
↓
Start display

∗ After inserting power supply, each register value, DDRAM address and DDRAM data until Initialization sequence are random.

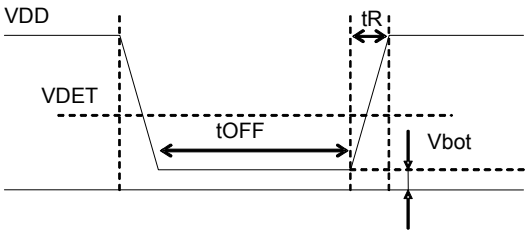
●Caution during Power supply ON/OFF

○POR circuit

During power supply rise, because the IC internal circuit and reset pass through an area of unstable low voltage and VDD starts up, there is a risk that the inside of the IC is not completely reset and wrong operation might occur. In order to prevent this, P.O.R circuit and Software Reset functions are incorporated. In order to ensure that operation, do as follows during power supply rise:

1. Set power up conditions to meet the recommended tR, tOFF and Vbot specs below in order to ensure POR operation.
（POR circuit uses VDET type）

(＊The voltage detection of POR differs depending on the used environment etc.
In order to make POR operate for sure, it recommended to make it Vbot = 0.5V or lower.)



Recommended conditions of tR, tOFF, Vbot

tR	tOFF	Vbot	VDET
10ms or lower	1ms or higher	0.5V or lower	TYP 1.2V

* VDET is integrated POR detection level

Figure 15. Rise Waveform

2. When the conditions are not met, do the following countermeasures after power supply ON:

(1) Set CSB to 'H'.
(2) Turn ON the CSB and execute SWRST command.

In order for the SWRST command to take effect for sure, it is recommended to start up CSB after 1ms after the VDD level has reached 90%.

※Since the state is irregular until SWRST command input after power supply ON, countermeasure through Software Reset is not the perfect substitute for P.O.R function so it is important to be careful.

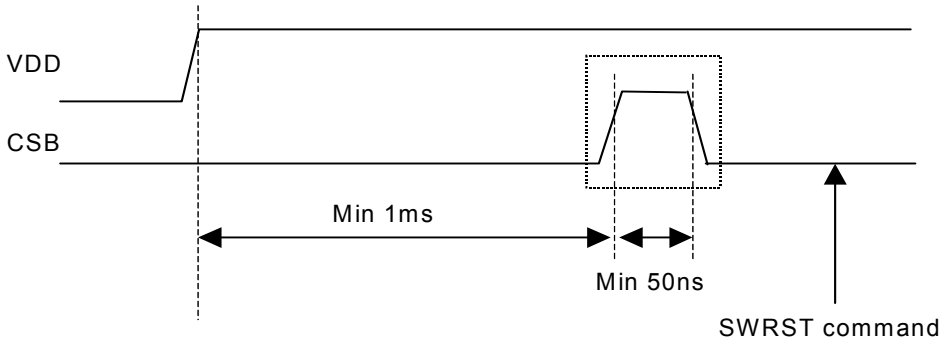


Figure 16. SWRST command sequence

●Attention about using LEDCTL(85h) command

Please input CSB="H" after LEDCTL command is issued. To avoid influence of noise and reset interface.

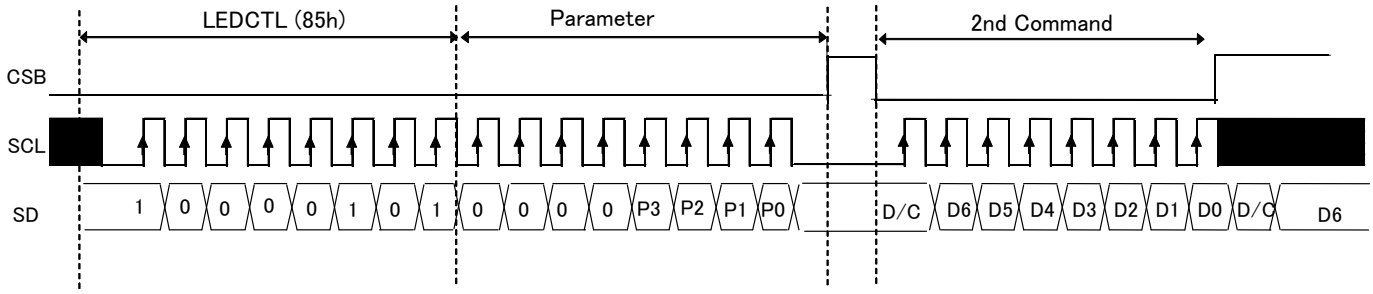


Figure 17. Recommended sequence when using LEDCTL (85h) command

●Attention about input port pull down

Satisfy the following sequence if input terminals are pulled down by external resisters (In case MPU output Hi-Z).

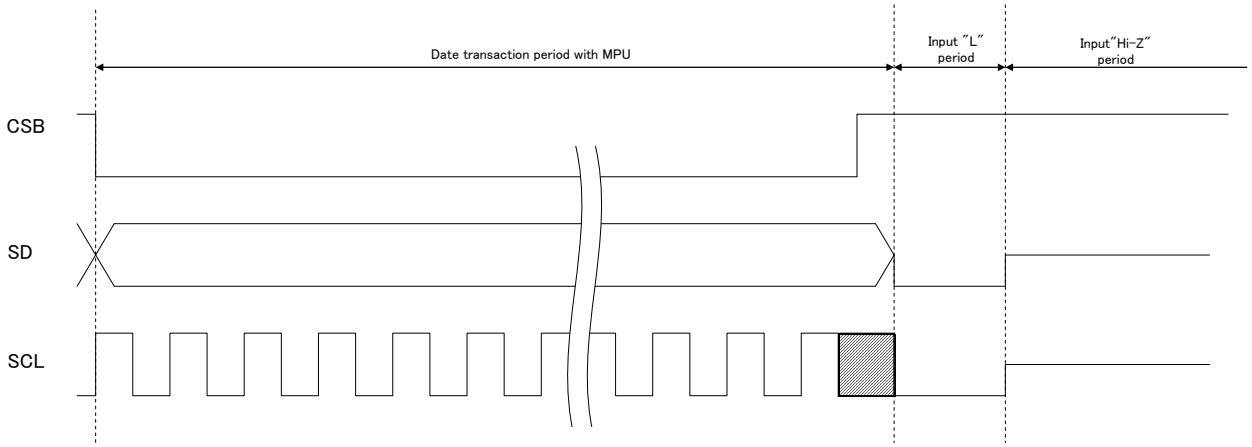


Figure 18. Recommended sequence when input ports are pulled down

BU97941FV adopts a 5V tolerant I/O for the digital input. This circuit includes a bus-hold function to keep the level of HIGH. A pull down resistor of below 10KΩshall be connected to the input terminals to transit from HIGH to LOW because the bus-hold transistor turns on during the input's HIGH level. (Refer to the Figure 5. I/O Equivalent Circuit)
A higher resistor than approximate 10KΩcauses input terminals being steady by intermediate potential between HIGH and LOW level so unexpected current is consumed by the system.
The potential depends on the pull down resistance and bus-hold transistor's resistance.
As the bus-hold transistor turns off upon the input level cleared to LOW a higher resistor can be used as a pull down resistor if a MPU set SD and SCL lines to LOW before it releases the lines.

The LOW period preceding MPU's bus release shall be at least 50ns as same as a minimum CLK width (tSLW).

●Operational Notes

(1) Absolute Maximum Ratings
An excess in the absolute maximum ratings, such as supply voltage, temperature range of operating conditions, etc., can break down devices, thus making impossible to identify breaking mode such as a short circuit or an open circuit. If any special mode exceeding the absolute maximum ratings is assumed, consideration should be given to take physical safety measures including the use of fuses, etc.

(2) Operating conditions
These conditions represent a range within which characteristics can be provided approximately as expected. The electrical characteristics are guaranteed under the conditions of each parameter.

(3) Reverse connection of power supply connector
The reverse connection of power supply connector can break down ICs. Take protective measures against the breakdown due to the reverse connection, such as mounting an external diode between the power supply and the IC's power supply terminal.

(4) Power supply line
Design PCB pattern to provide low impedance for the wiring between the power supply and the GND lines. In this regard, or the digital block power supply and the analog block power supply, even though these power supplies has the same level of potential, separate the power supply pattern for the digital block from that for the analog block, thus suppressing the diffraction of digital noises to the analog block power supply resulting from impedance common to the wiring patterns. For the GND line, give consideration to design the patterns in a similar manner.
Furthermore, for all power supply terminals to ICs, mount a capacitor between the power supply and the GND terminal. At the same time, in order to use an electrolytic capacitor, thoroughly check to be sure the characteristics of the capacitor to be used present no problem including the occurrence of capacity dropout at a low temperature, thus determining the constant.

(5) GND voltage
Make setting of the potential of the GND terminal so that it will be maintained at the minimum in any operating state. Furthermore, check to be sure no terminals are at a potential lower than the GND voltage including an actual electric transient.

(6) Short circuit between terminals and erroneous mounting
In order to mount ICs on a set PCB, pay thorough attention to the direction and offset of the ICs. Erroneous mounting can break down the ICs. Furthermore, if a short circuit occurs due to foreign matters entering between terminals or between the terminal and the power supply or the GND terminal, the ICs can break down.

(7) Operation in strong electromagnetic field
Be noted that using ICs in the strong electromagnetic field can malfunction them.

(8) Inspection with set PCB
On the inspection with the set PCB, if a capacitor is connected to a low-impedance IC terminal, the IC can suffer stress. Therefore, be sure to discharge from the set PCB by each process. Furthermore, in order to mount or dismount the set PCB to/from the jig for the inspection process, be sure to turn OFF the power supply and then mount the set PCB to the jig. After the completion of the inspection, be sure to turn OFF the power supply and then dismount it from the jig. In addition, for protection against static electricity, establish a ground for the assembly process and pay thorough attention to the transportation and the storage of the set PCB.

(9) Input terminals
In terms of the construction of IC, parasitic elements are inevitably formed in relation to potential. The operation of the parasitic element can cause interference with circuit operation, thus resulting in a malfunction and then breakdown of the input terminal. Therefore, pay thorough attention not to handle the input terminals, such as to apply to the input terminals a voltage lower than the GND respectively, so that any parasitic element will operate. Furthermore, do not apply a voltage to the input terminals when no power supply voltage is applied to the IC. In addition, even if the power supply voltage is applied, apply to the input terminals a voltage lower than the power supply voltage or within the guaranteed value of electrical characteristics.

(10) Ground wiring pattern
If small-signal GND and large-current GND are provided, It will be recommended to separate the large-current GND pattern from the small-signal GND pattern and establish a single ground at the reference point of the set PCB so that resistance to the wiring pattern and voltage fluctuations due to a large current will cause no fluctuations in voltages of the small-signal GND. Pay attention not to cause fluctuations in the GND wiring pattern of external parts as well.

●**Operational Notes - continued**

(11) External capacitor
In order to use a ceramic capacitor as the external capacitor, determine the constant with consideration given to a degradation in the nominal capacitance due to DC bias and changes in the capacitance due to temperature, etc.

(12) No Connecting input terminals
In terms of extremely high impedance of CMOS gate, to open the input terminals causes unstable state. And unstable state brings the inside gate voltage of p-channel or n-channel transistor into active. As a result, battery current may increase. And unstable state can also causes unexpected operation of IC. So unless otherwise specified, input terminals not being used should be connected to the power supply or GND line.

(13) Rush current
When power is first supplied to the CMOS IC, it is possible that the internal logic may be unstable and rush current may flow instantaneously. Therefore, give special condition to power coupling capacitance, power wiring, width of GND wiring, and routing of connections.

Status of this document
The Japanese version of this document is formal specification. A customer may use this translation version only for a reference to help reading the formal version.
If there are any differences in translation version of this document formal version takes priority.

●Ordering Information

B U 9 7 9 4 1 F V	-	E 2

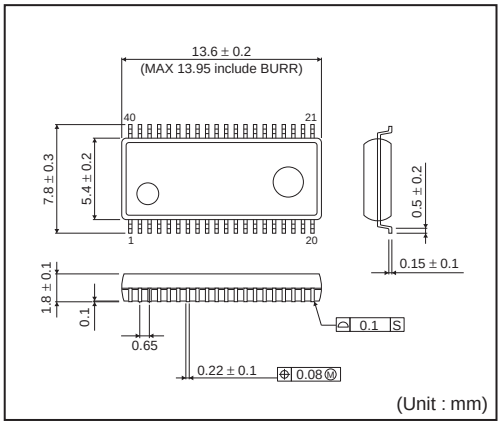
Part Number

Package
FV : SSOP-B40

Packaging and forming specification
E2: Embossed tape and reel
(SSOP-B40)

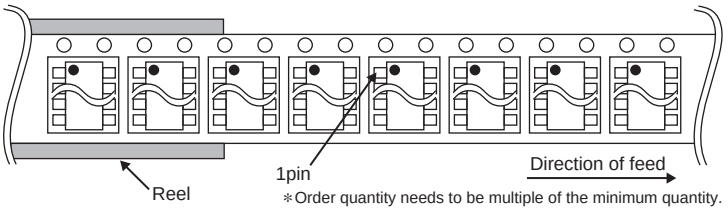
●Physical Dimension Tape and Reel Information

SSOP-B40



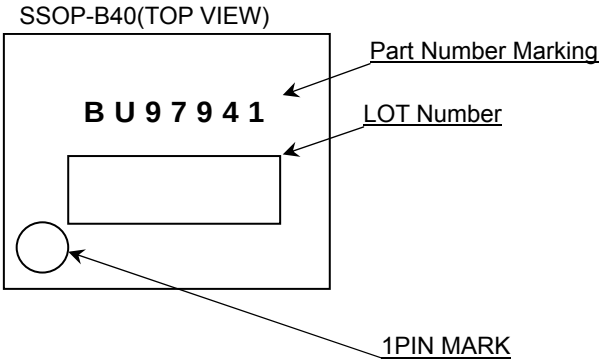
<Tape and Reel information>

Tape	Embossed carrier tape
Quantity	2000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)



∗Order quantity needs to be multiple of the minimum quantity.

●Marking Diagram



●**Revision History**

Date	Revision	Changes
1.Jun.2012	001	New Release

Notice

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   [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
   [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
   [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
   [f] Sealing or coating our Products with resin or other coating materials
   [g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
   [h] Use of the Products in places subject to dew condensation

4) The Products are not subject to radiation-proof design.

5) Please verify and confirm characteristics of the final or mounted products in using the Products.

6) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8) Confirm that operation temperature is within the specified range described in the product specification.

9) ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

●Precaution for Mounting / Circuit board design

1) When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2) In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

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1) If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2) You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

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This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

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   [a] the Products are exposed to sea winds or corrosive gases, including Cl2, H2S, NH3, SO2, and NO2
   [b] the temperature or humidity exceeds those recommended by ROHM
   [c] the Products are exposed to direct sunshine or condensation
   [d] the Products are exposed to high Electrostatic

2) Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3) Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4) Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

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