

Panel interface for telephones

BU8317KV

The BU8317KV is a large-scale integrated circuit which enables a serial input/output interface between the key input required for panel boards used in PHS systems, portable telephones, and telephone answering machines and LED and LCD control functions. It reduces the number of wiring harnesses needed between the main board in the telephone and the panel board, and takes some of the processing load off the main CPU.

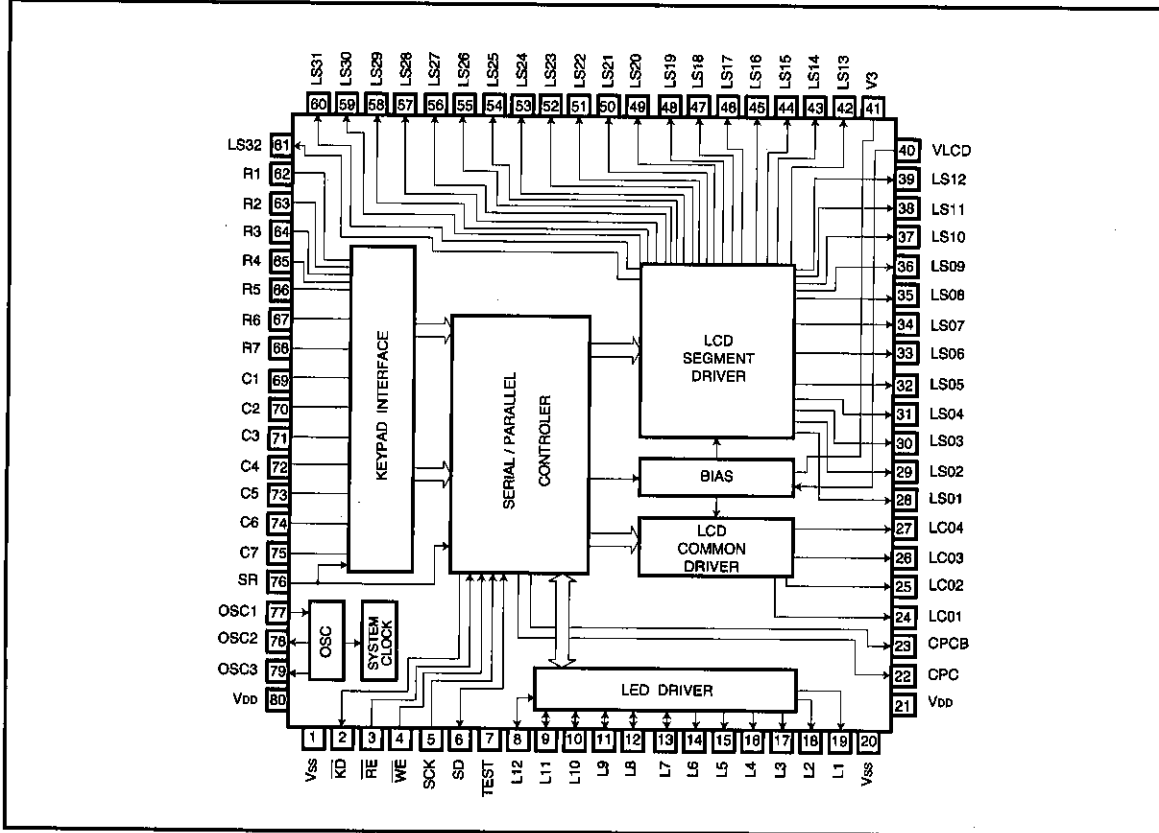
●Applications

PHS systems, portable telephones, telephone answering machines

●Features

- 1) 7 × 7 keypad matrix interface.
- 2) 12-bit LED driver. (6 bits can also function as input pins)
- 3) 4-column 32-segment LCD driver. (internal bias-generating resistor)
- 4) Standby mode.
- 5) VQFP80 package.

●Block diagram



● Absolute maximum ratings (Unless otherwise noted : Ta=25°C)

| Parameter | Symbol | Limits | Unit | Conditions |
|-----------------------|-------------------|---|------|--------------------------------------|
| Power supply voltage | V _{DD} | 7.0 | V | Including power supply for LCD drive |
| Power dissipation | P _d | 400 | mW | |
| Operating temperature | T _{opr} | -25~+60 | °C | |
| Storage temperature | T _{stg} | -55~+125 | °C | |
| Input voltage | V _{IN} | V _{SS} -0.3~V _{DD} +0.3 | V | RE, WE, SCK, SD pins |
| Output voltage 1 | V _{OUT1} | V _{SS} -0.3~V _{DD} +0.3 | V | SD, L7~L12 pins |
| Output voltage 2 | V _{OUT2} | V _{SS} -0.3~7.0 | V | L1~L6, \overline{KD} pins |
| Output current 1 | I _{OUT1} | 20 | mA | L1~L6 pins |
| Output current 2 | I _{OUT2} | 15 | mA | L7~L12 pins |

● Recommended operating conditions (Ta=25°C)

| Parameter | Symbol | Range | Unit | Conditions |
|---------------------------|------------------|-----------------|-------------------------------------|---|
| Power supply voltage | V _{DD} | 1.8~5.5 | V | * |
| Oscillation frequency | f _{osc} | 800 | Hz | R _i =1MΩ, R _x =270kΩ C _x =2.2nF |
| Input voltage | H | V _{IH} | 0.8V _{DD} ~V _{DD} | RE, WE, SCK, SD, L7~L12 pins |
| | L | V _{IL} | 0~0.2V _{DD} | |
| Key connection resistance | R _{KC} | 0~5 | kΩ | |

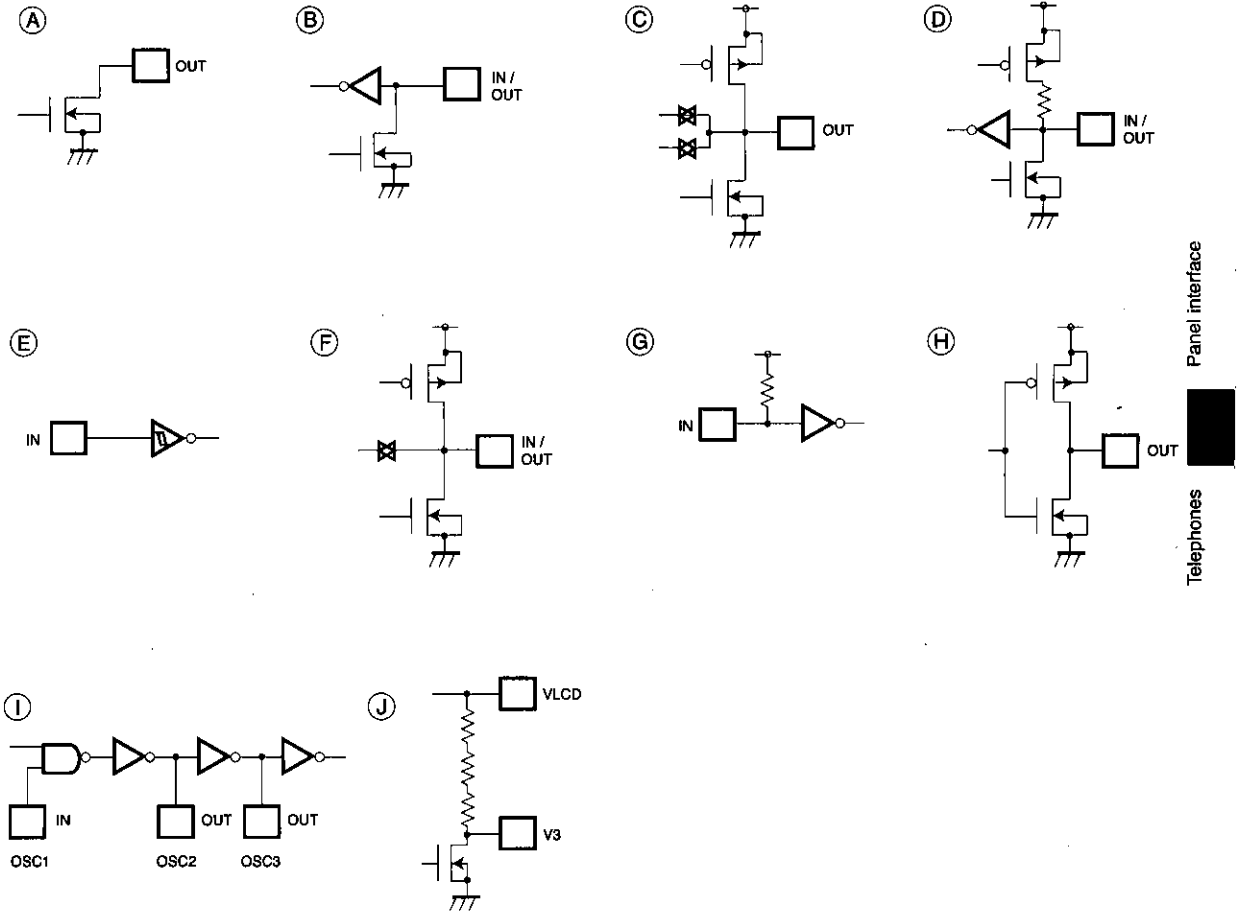
* The power supply voltage range listed is for the BU8317KV operated as a stand-alone unit, and operations originating in characteristics of attachments such as LEDs and LCDs are not guaranteed at these values.

● Pin descriptions

| Pin No. | Pin Name | Function | Model |
|----------------|-----------------|--|-------|
| 19~14 | L1~L6 | These are the output pins for LED drive. They output a LOW state and cause the LED to light when "1" is applied to the LED register, and they output a Z (high impedance) state when "0" is written, and cause the LED to go off. | (A) |
| 13~8 | L7~L12 | These are the LED control output and parallel input pins. They output a LOW state when "1" is applied to the LED register, and they output a Z (high impedance) state when "0" is written. When used as parallel input pins, "0" should be written to the pertinent LED register. The pin state is read as serial data. | (B) |
| 24~27 | LC01~LC04 | These are the LCD drive common output pins. They are connected to the common pins on the LCD panel, and when a standby mode, all LEDs valid, or all LEDs invalid command is executed, they output a LOW state and cause the LCD to go out. | (C) |
| 28~39 42~61 | LS01~LS32 | These are the LCD drive segment output pins. They are connected to the segment pins on the LCD panel, and when a standby mode, all LEDs valid, or all LEDs invalid command is executed, they output a LOW state and cause the LCD to go out. | (C) |
| 62~68 69~75 | R1~R7 C1~C7 | These are the keypad input and output pins. They can be used to configure a keypad of up to 7 × 7 using single-contact key switches. | (D) |
| 2 | \overline{KD} | This is the output pin for the key press state. When a key is pressed, an on debounce state is valid, and a LOW state is output. After the key has been released, an off debounce state is valid, and these are Z (high impedance). | (A) |

| Pin No. | Pin name | Function | Model | | | | | | | | | | | | | | | |
|-----------------|-----------------|---|-----------------|-----------------|----------------|---|---|------------------|---|---|------------|---|---|-----------|---|---|--------------|---|
| 3 | \overline{RE} | This is the read enable input pin and serves as the Schmitt trigger input. The read mode (serial output of key data) is accessed when this is LOW. Key data is set to the output serial register at the falling edge. | Ⓔ | | | | | | | | | | | | | | | |
| 4 | \overline{WE} | This is the write enable input pin and serves as the Schmitt trigger input. The write mode (serial input of data) is accessed when this key is LOW. Serial data is taken up internally at the rising edge. | | | | | | | | | | | | | | | | |
| | | <table border="1"> <thead> <tr> <th>\overline{RE}</th> <th>\overline{WE}</th> <th>Operation mode</th> </tr> </thead> <tbody> <tr> <td>H</td> <td>H</td> <td>Normal operation</td> </tr> <tr> <td>H</td> <td>L</td> <td>Write mode</td> </tr> <tr> <td>L</td> <td>H</td> <td>Read mode</td> </tr> <tr> <td>L</td> <td>L</td> <td>Standby mode</td> </tr> </tbody> </table> | \overline{RE} | \overline{WE} | Operation mode | H | H | Normal operation | H | L | Write mode | L | H | Read mode | L | L | Standby mode | Ⓔ |
| \overline{RE} | \overline{WE} | Operation mode | | | | | | | | | | | | | | | | |
| H | H | Normal operation | | | | | | | | | | | | | | | | |
| H | L | Write mode | | | | | | | | | | | | | | | | |
| L | H | Read mode | | | | | | | | | | | | | | | | |
| L | L | Standby mode | | | | | | | | | | | | | | | | |
| 5 | SCK | This is the shift clock input pin for serial data, and serves as the Schmitt trigger input. When \overline{RE} is LOW, data is read from the SD pin one bit at a time, at the rising edge of a Schmitt trigger input. When \overline{WE} is LOW, data is written to the SD one bit at a time, at the falling edge of the Schmitt trigger input. | Ⓔ | | | | | | | | | | | | | | | |
| 6 | SD | This is the serial data input pin. Data is input and output in the pertinent data format. Data is output when $\overline{RE} = \text{LOW}$ and $\overline{WE} = \text{HIGH}$. In any state other than data output state, this pin is Z (high impedance). | Ⓕ | | | | | | | | | | | | | | | |
| 76 | SR | This is the standby mode cancel input pin. Input is possible when \overline{RE} is LOW and \overline{WE} is LOW, and the standby mode is cancelled when this pin is LOW. Because this pin is pulled up to a resistance, this can be used to configure a standby mode cancel key for V_{SS} by connecting it to a single-contact key switch. | Ⓖ | | | | | | | | | | | | | | | |
| 77~79 | OSC1~OSC3 | These are the I/O pins for the internal oscillator. The recommended values are as follows: $R_i = 1\text{M}\Omega$, $R_x = 270\text{k}\Omega$, $C_x = 2.2\text{nF}$ | Ⓖ | | | | | | | | | | | | | | | |
| 22, 23 | CPC, CPCB | These are the output pins for the booster circuit drive. A VLCD booster power supply can be configured using an external diode and capacitor. | Ⓕ | | | | | | | | | | | | | | | |
| 21, 80 | V_{DD} | This is the V_{DD} pin. | | | | | | | | | | | | | | | | |
| 1, 20 | V_{SS} | This is the V_{SS} pin. | | | | | | | | | | | | | | | | |
| 40 | VLCD | This is the power supply pin for the LCD. Voltages higher than V_{DD} and lower than the absolute maximum rating can be applied to this pin. | Ⓖ | | | | | | | | | | | | | | | |
| 41 | V3 | This is the LCD bias correction pin. When selected, a LOW level reference voltage is output. | Ⓖ | | | | | | | | | | | | | | | |
| 7 | TEST | This is the test input pin and should not be connected to anything. | Ⓖ | | | | | | | | | | | | | | | |

● Input/output circuits



For the corresponding pins, please see "Model" under "Pin descriptions".

●Electrical characteristics (Unless otherwise noted : Ta=25°C, V_{DD}=2.7 to 5.5V)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions | Measurement Circuit | | |
|-----------------------|---------------------------|------------------|---|------|---|-----------------------------|--|--|-------|
| Circuit current 1 | I _{DD1} | — | — | 2 | μA | When oscillation is stopped | Fig.3 | | |
| Circuit current 2 | I _{DD2} | — | 30 | 50 | μA | V _{DD} =3.0V | Fig.3 | | |
| Circuit current 3 | I _{DD3} | — | 180 | 300 | μA | V _{DD} =5.0V | Fig.3 | | |
| Input voltage | H | I _{IH} | — | 1 | μA | RE, WE, SCK, SDpins | Fig.3 | | |
| | L | I _{IL} | — | 1 | μA | | Fig.3 | | |
| Output voltage | H | V _{OH} | 0.9V _{DD} | — | V _{DD} | SDpin no load | Fig.3 | | |
| | L1 | V _{OL1} | 0 | — | 0.1V _{DD} | SD, KDpin no load | Fig.3 | | |
| | L2 | V _{OL2} | 0 | — | 0.5 | V | L1~L6 pin V _{DD} =5V, I _{OL} =15mA | Fig.3 | |
| | L3 | V _{OL3} | 0 | — | 0.5 | V | L7~L12 pin V _{DD} =5V, I _{OL} =10mA | Fig.3 | |
| | H+ | V _{H+} | 0.95V _{DD} | — | V _{DD} | V | HIGH when selected | LC01~LC04 LS01~LS32 with no load | Fig.3 |
| | L+ | V _{L+} | $\frac{2}{3}V_{DD}$ -0.05V _{DD} | — | $\frac{2}{3}V_{DD}$ +0.05V _{DD} | V | HIGH when not selected | | Fig.3 |
| | L- | V _{L-} | $\frac{1}{3}V_{DD}$ -0.05V _{DD} | — | $\frac{1}{3}V_{DD}$ +0.05V _{DD} | V | LOW when not selected | | Fig.3 |
| | H- | V _{H-} | 0.05V _{DD} | — | 0 | V | LOW when selected | | Fig.3 |
| Input | Setup time S | t _{SUS} | 100 | — | — | nS | Fig.4 | | |
| | Setup time I | t _{SUI} | 100 | — | — | nS | Fig.4 | | |
| | Hold time I | t _{HI} | 100 | — | — | nS | Fig.4 | | |
| Output | Setup time K | t _{SUK} | 100 | — | — | nS | Fig.4 | | |
| | Setup time R | t _{SUR} | 100 | — | — | nS | Fig.4 | | |
| | SD output delay time | t _{DO} | 100 | — | — | nS | Fig.4 | | |
| Common | Serial clock cycle period | t _{CYC} | 500 | — | — | nS | DUTY=50% | Fig.4 | |
| Key on debounce time | | t _{OBV} | — | 30 | — | mS | Fig.4 | | |
| Key off debounce time | | t _{OFF} | — | 50 | — | mS | Fig.4 | | |

○Not designed for radiation resistance.

● Timing charts

Serial data input timing

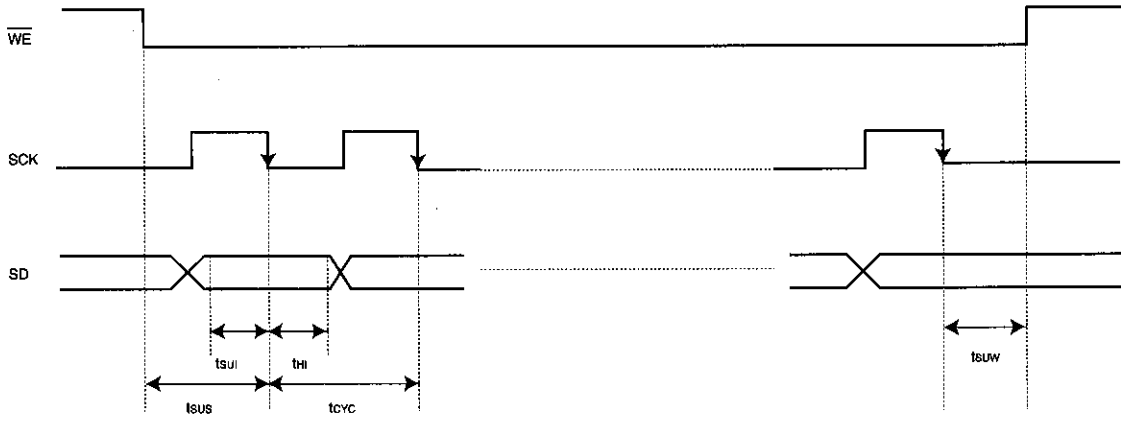


Fig. 1

Serial data output timing

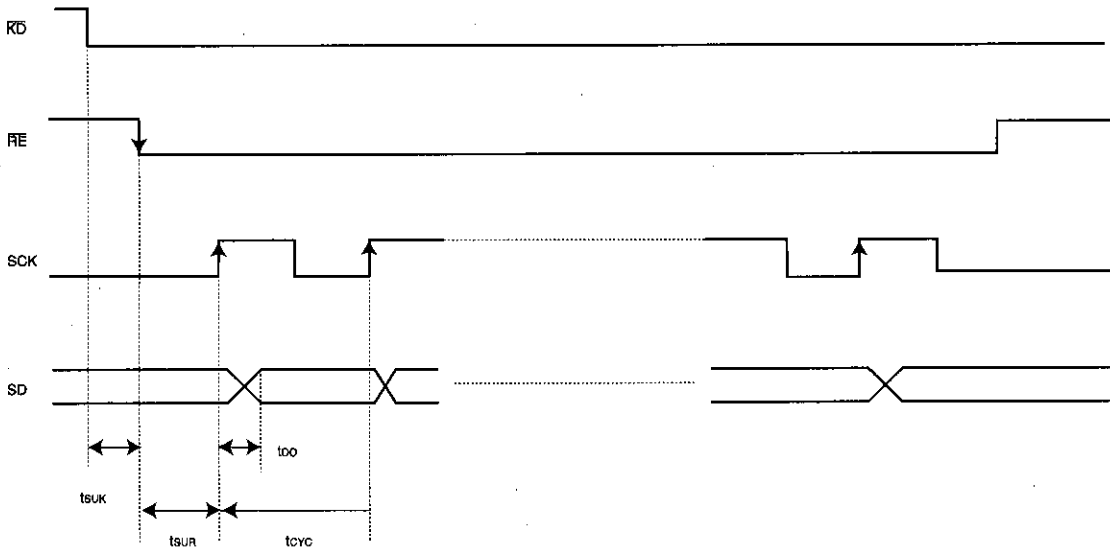


Fig. 2

Panel interface

Telephones

● Measurement circuits

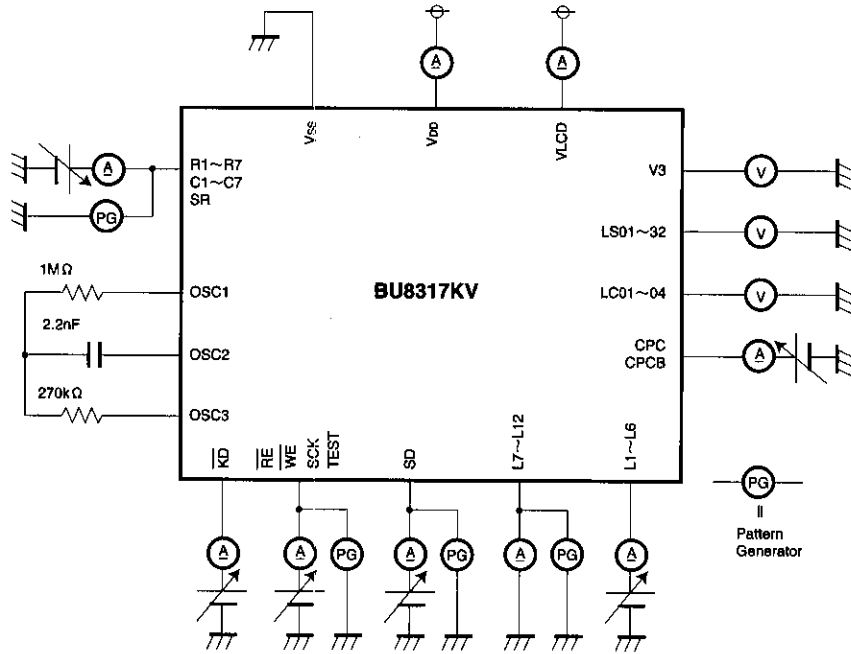


Fig. 3 Measurement circuit for DC items

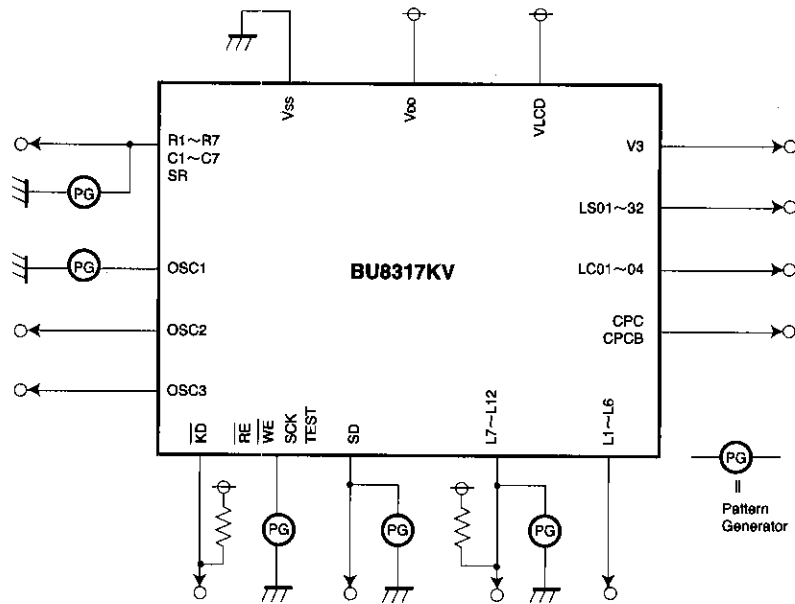
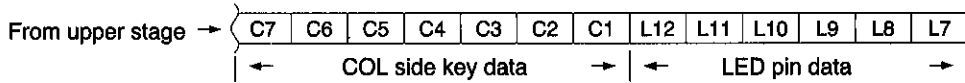
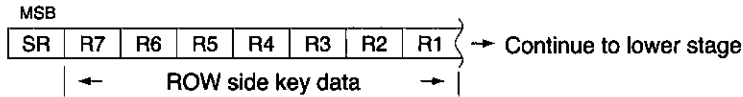


Fig. 4 Measurement circuit for AC items

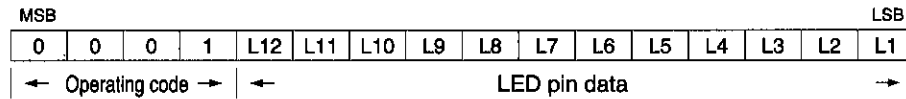
●Data formats (Serial data is input and output with the MSB coming first.)

1. Reading data



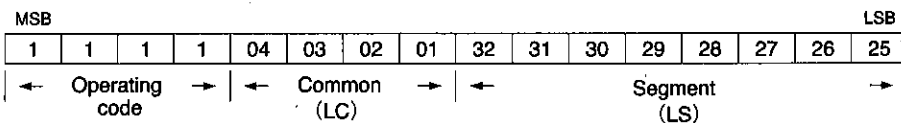
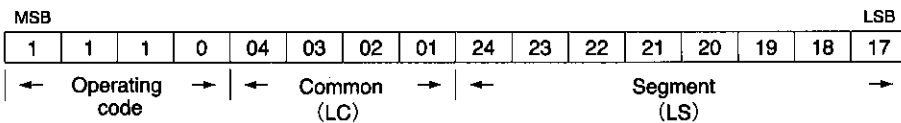
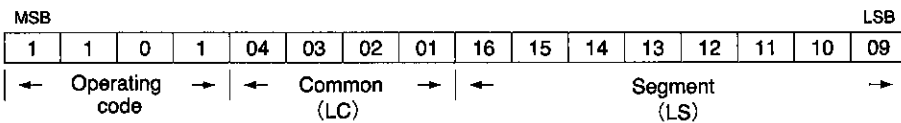
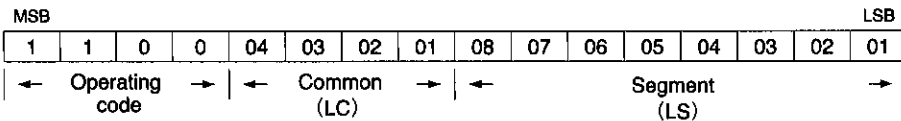
- SR : Outputs SR pin status. Pressing a key (low level) outputs "1" and releasing the key (high level) outputs "0".
A "0" is output is the key is not pressed on low level.
- R1~R7, C1~C7 : Outputs key data. Pressing a key outputs "1" and not pressing the key outputs "0", when on low level.
- L7~L12 : Outputs parallel input data. Output "1" when the pin is on high level and "0" when it is on low level.

2. LED resistor writing command



- L1~L12 : Used for LED control. LED lights up with "1" and is unlit with "0".

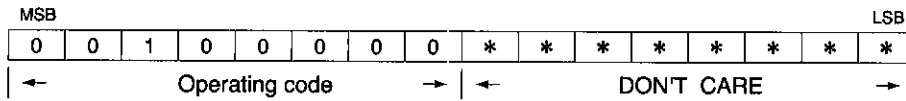
3. LCD register writing command



- LC01~LC04 : Selects LCD common. "1" means select and "0" means do not select.
Segment control is active on the selected common, only.
Multiple commons can be selected simultaneously.
- LS01~LS32 : Used for LCD segment control. Lights up with "1" and is unlit with "0".

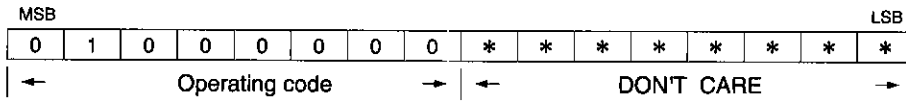
Panel interface
Telephones

4. All LEDs, LCDs activate command



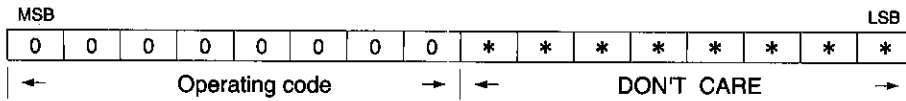
Used to clear non-active status of all LEDs and LCDs.

5. All LEDs, LCDs non-active command



Temporarily turns off all LEDs and LCDs, while holding the LED and LCD register settings as they are.
 LCD output changes to low level and the bias current channel is cut.

6. Register reset command



Resets all LED and LCD registers to "0".
 Clears stand-by mode.
 Non-active status of all LEDs and LCDs changes to active status.

● Recommended method for inputting/outputting data

1. Control command serial input

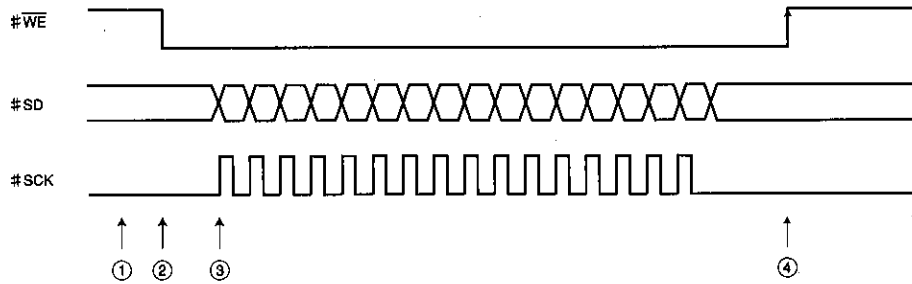


Fig. 5

| State | CPU Operation (#) |
|-------|---|
| ① | At standby, $\overline{WE} = \text{HIGH}$, $\text{SCK} = \text{LOW}$ |
| ② | \overline{WE} set to LOW (write mode) |
| ③ | Serial data is input sequentially to SD at falling edge of SCK |
| ④ | After all 16-bit data has been input, \overline{WE} rising edge is supplied, and data is taken in internally. |

2. Key data serial output

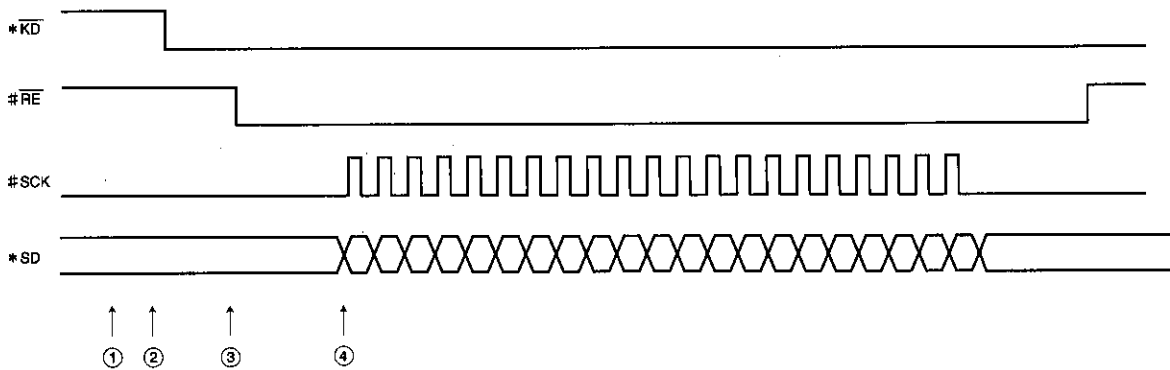


Fig. 6

| State | CPU Operation (#) | BU8317KV Series Operation (*) |
|-------|---|--|
| ① | At standby, $\overline{RE} = \text{HIGH}$, $\text{SCK} = \text{LOW}$ | |
| ② | | \overline{KD} goes LOW when key is pressed. |
| ③ | \overline{RE} set to LOW (read mode) | (Key data setting) |
| ④ | Supplied sequentially at rising edge of SCK | Serial data is output from SD in sequential order. |

Panel interface

Telephones

● Standby mode

(1) Setting the standby mode

- The standby mode is set by setting \overline{RE} to L and \overline{WE} to L.
- Oscillation stops and the line current falls to an extremely low level.
- The contents of the LED and LCD registers are reset (all data cleared to 0), and all LEDs and LCDs are turned off.
- The LCD output goes LOW, and the bias current channel is cut off.
- The only effective key input is the SR key; no input is accepted from the keypad.

(2) Cancelling the standby mode

- The standby mode is cancelled by executing the register reset command.
- Setting SR to LOW in any state other than $\overline{RE} = \text{LOW}$ and $\overline{WE} = \text{LOW}$ immediately cancels the standby mode.
- Setting SR to LOW when $\overline{RE} = \text{LOW}$ and $\overline{WE} = \text{LOW}$ initiates oscillation but does not cancel the standby mode. Setting SR to HIGH stops oscillation once again. (If "on debounce" is valid for the SR key and KD has output a LOW level, oscillation continues until an "off debounce" becomes valid.)

Standby mode setting example

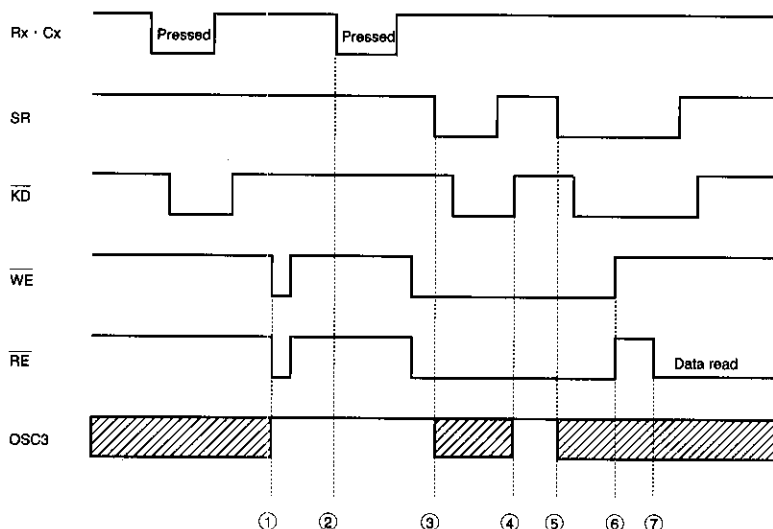


Fig. 7

- ① At $\overline{RE} = \text{LOW}$, $\overline{WE} = \text{LOW}$, the standby mode is set, and oscillation stops.
- ② In standby mode, no input is accepted.
- ③ Setting the SR pin to LOW initiates oscillation even in the standby mode.
(SR = LOW takes priority over $\overline{RE} = \text{LOW}$, $\overline{WE} = \text{LOW}$.)
- ④ When the SR pin is open (HIGH), $\overline{RE} = \text{LOW}$ and $\overline{WE} = \text{LOW}$, so oscillation stops and the standby mode continues to be effective.
- ⑤ Setting the SR pin LOW initiates oscillation even in the standby mode.
- ⑥ When $\overline{RE} = \text{LOW}$, $\overline{WE} = \text{LOW}$ is no longer true, the standby mode is cancelled, and oscillation continues even if the SR pin is open (HIGH).
- ⑦ Data is set in the output serial register at the falling edge of \overline{RE} and when SR = LOW, and can be read.

● Oscillation frequencies

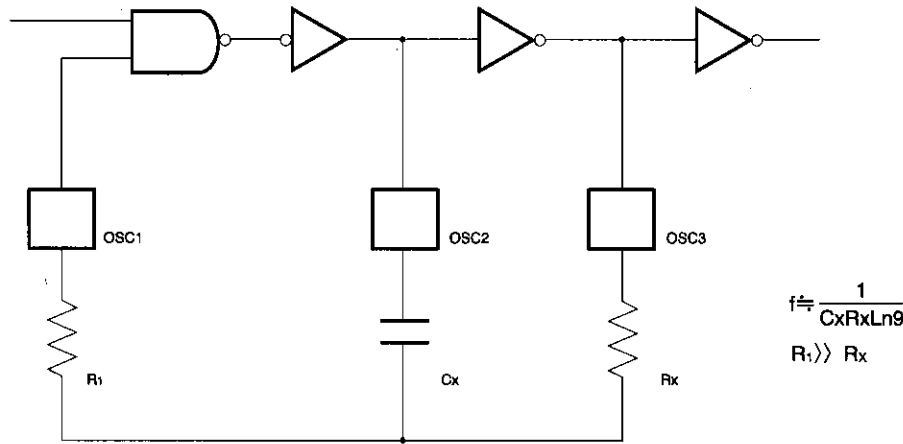


Fig. 8

● LCD drive wave forms

This is a time-shared drive system in which 1/3 bias and 1/4 duty alternate between two frames.

The figure at the right shows the drive wave forms for the following conditions :

- LC01-LSxx : Lighted
- LC02-LSxx : Not lighted
- LC03-LSxx : Lighted
- LC04-LSxx : Not lighted

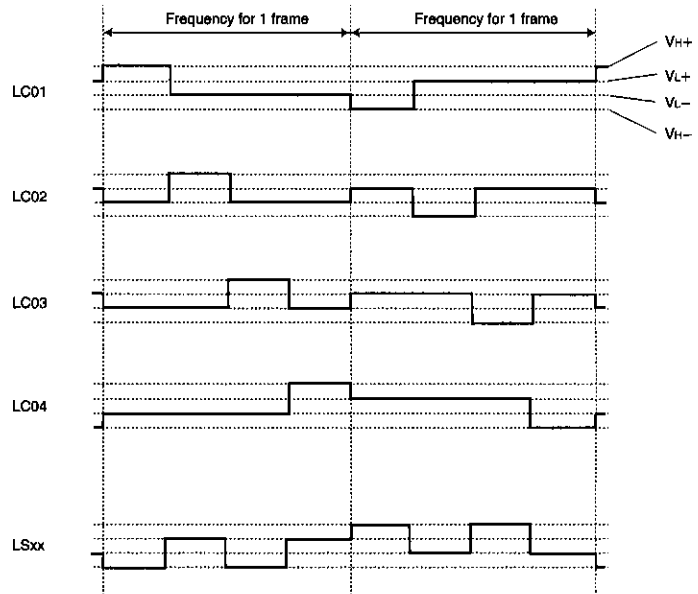


Fig. 9

Panel interface
 Telephones

●Configuring a booster circuit

This shows an example of booster circuit configuration for a VLCD pin, using the CPC and CPCB pins.

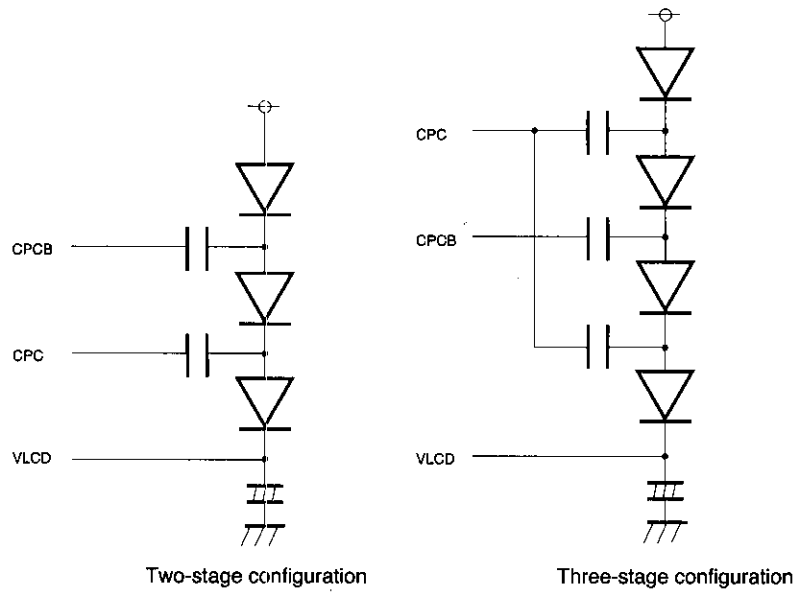


Fig. 10

●Configuring an LCD bias correction circuit

This shows an example of correction circuit configuration for the LCD output voltage, using the V3 pin.

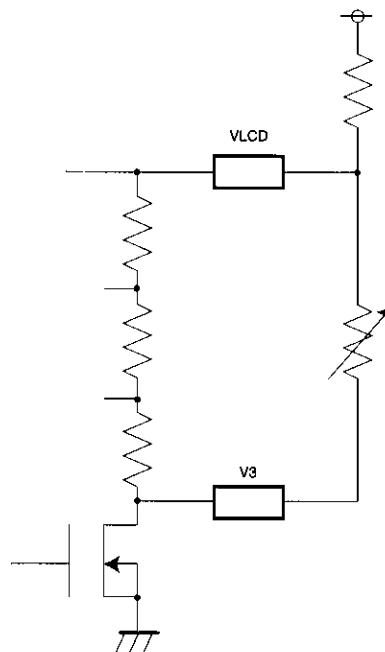


Fig. 11

●Precautions when turning on the power supply

The power supply should be turned on when $\overline{RE} = \text{LOW}$ and $\overline{WE} = \text{LOW}$, and the registers should then be reset using the register reset command.

●Precautions concerning data input and output

(1) Serial output of key data when several keys are pressed at the same time is as shown at the right.

The key data when (A) and (D) are pressed at the same time is the same as the key data when (B) and (C) are pressed at the same time.

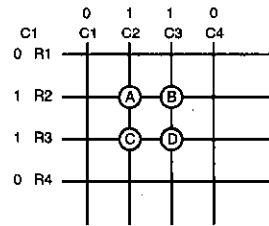
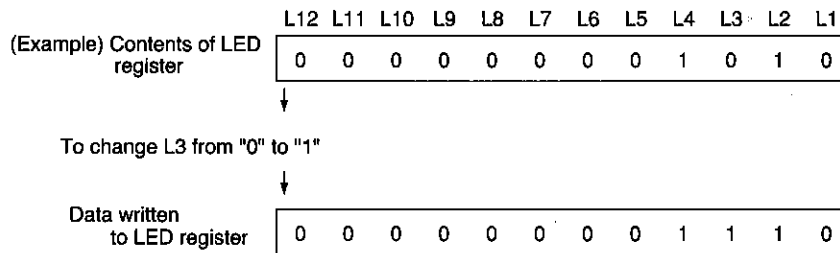


Fig. 12

(2) If the LED and LCD registers are rewritten, all of the bits should be written, and not just the pertinent bits.



●Electrical characteristic curves

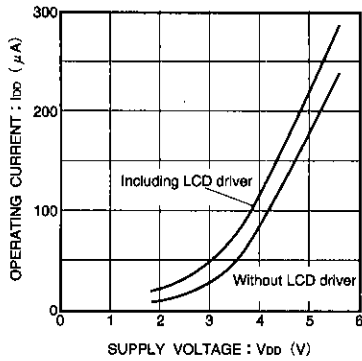
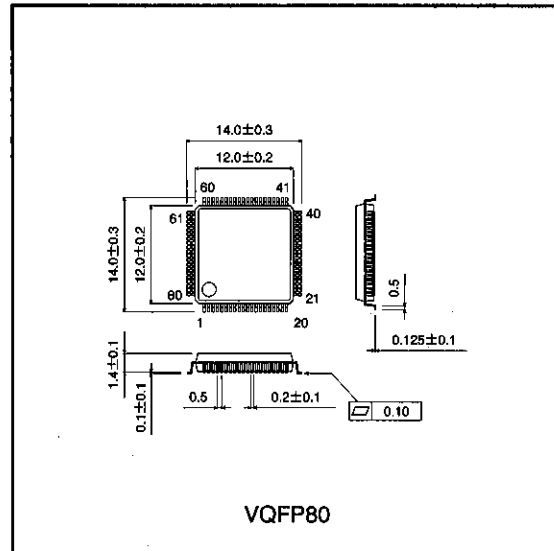


Fig. 13 Operating current vs. supply voltage characteristic

●External dimensions (Units: mm)



Panel interface
Telephones

Notes

- The contents described in this catalogue are correct as of March 1997.
- No unauthorized transmission or reproduction of this book, either in whole or in part, is permitted.
- The contents of this book are subject to change without notice. Always verify before use that the contents are the latest specifications. If, by any chance, a defect should arise in the equipment as a result of use without verification of the specifications, ROHM CO., LTD., can bear no responsibility whatsoever.
- Application circuit diagrams and circuit constants contained in this data book are shown as examples of standard use and operation. When designing for mass production, please pay careful attention to peripheral conditions.
- Any and all data, including, but not limited to application circuit diagrams, information, and various data, described in this catalogue are intended only as illustrations of such devices and not as the specifications for such devices. ROHM CO., LTD., disclaims any warranty that any use of such device shall be free from infringement of any third party's intellectual property rights or other proprietary rights, and further, assumes absolutely no liability in the event of any such infringement, or arising from or connected with or related to the use of such devices.
- Upon the sale of any such devices; other than for the buyer's right to use such devices itself, resell or otherwise dispose of the same; no express or implied right or license to practice or commercially exploit any intellectual property rights or other proprietary rights owned or controlled by ROHM CO., LTD., is granted to any such buyer.
- The products in this manual are manufactured with silicon as the main material.
- The products in this manual are not of radiation resistant design.

The products listed in this catalogue are designed to be used with ordinary electronic equipment or devices (such as audio-visual equipment, office-automation equipment, communications devices, electrical appliances, and electronic toys). Should you intend to use these products with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers, or other safety devices) please be sure to consult with our sales representatives in advance.

- **Notes when exporting**

- It is essential to obtain export permission when exporting any of the above products when it falls under the category of strategic material (or labor) as determined by foreign exchange or foreign trade control laws.
- Please be sure to consult with our sales representatives to ascertain whether any product is classified as a strategic material.