Multimedia ICs

On-screen display for camcorders
BU2848FS/BU2870FS/BU2873FS

The BU2848FS, BU2870FS and BU2873FS series ICs are fabricated using a CMOS process, and are designed for displaying character data on camcorder and television screens. The ICs are controlled by serial data from a microcontroller, and display patterns and data such as the date on the camcorder viewfinder. The characters are displayed in a 12×18 bit matrix, so Chinese characters can also be displayed. The display format is 12 lines×24 characters. There is no space between characters, so two or more characters can be joined to form icons.
The ICs are available in small SSOP packages and are suitable for high-density mounting in camcorders.

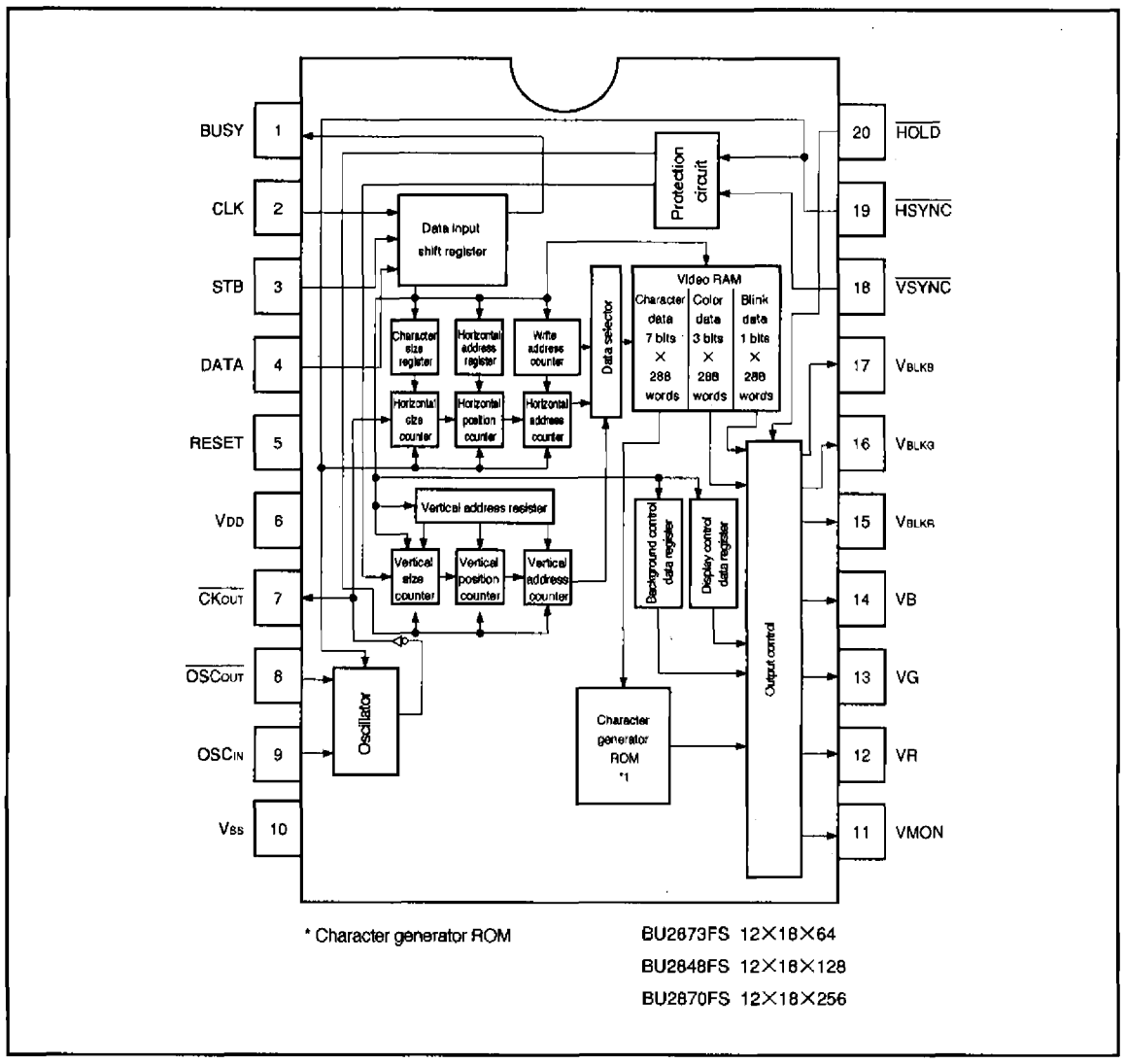
●Series

Part No.	No. of Characters
BU2873FS	64
BU2848FS	128
BU2870FS	256

●Applications
Camcorders and televisions

●Features
1)12 line×24 character display.
2)64, 128, or 256 character types depending on the model.
3)Three-system monochrome output.
4)Character size can be selected as 1H/dot or 2H/dot.
5)Background can be selected on a per screen basis: none, border, knockout or solid.
6)12×18 dot matrix, with no space between characters.
7)Character blinking ratio can be selected as 1:1, 3:1, or 1: 3.
8)8-bit serial microcontroller interface.
9)5V power supply.
10)CMOS for low power consumption.

●Block diagram



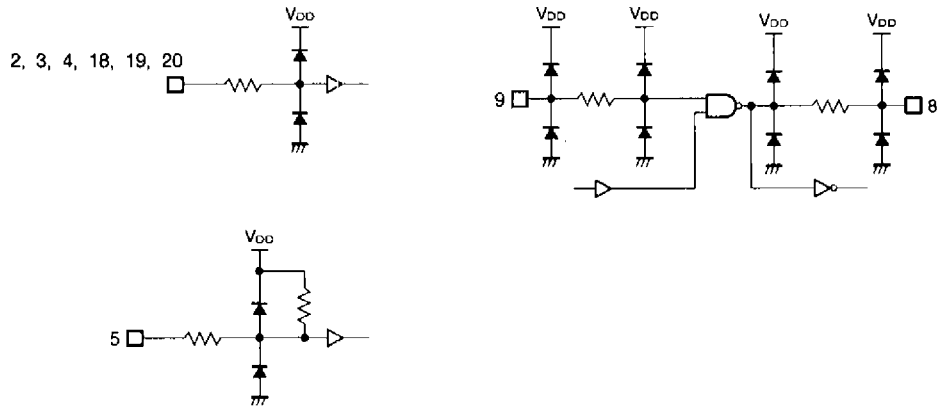
* Character generator ROM

BU2873FS 12×18×64
BU2848FS 12×18×128
BU2870FS 12×18×256

●Pin descriptions

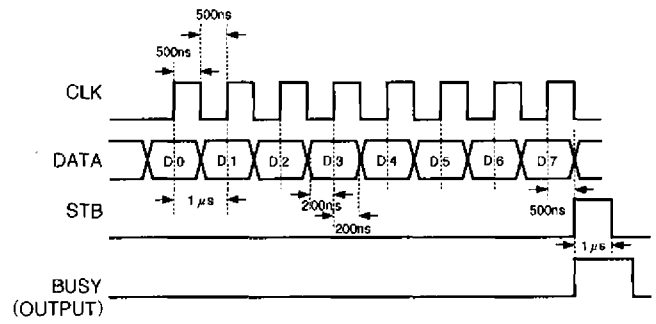
Pin No.	Input/output	Symbol	Function
1	Output	BUSY	Informs the microcontroller when strobe input is possible after serial data input. Strobe input can be input when this is low.
2	Input	CLK	Clock input for reading in data. Data on the DATA pin is read in on the rising edge of the clock.
3	Input	STB	Input pin for the strobe signal after serial-data input. The eight bits of data are read in on the rising edge of the pulse applied to the STB pin. When the bit-data is character data, the data address is incremented on the falling edge of the pulse.
4	Input	DATA	Control data input pin. Data on this pin is read synchronously with the rising edge of the clock signal.
5	Input	$\overline{\text{RESET}}$	Resets all internal registers. Clears the internal RAM in the case of the BU2870FS. (Pullup resister connected)
6	—	V_{DD}	Power supply (+5V)
7	Output	$\overline{\text{CKOUT}}$	OSC OUT inverting output. Use to check the oscillator frequency.
8 9	Input Output	$\overline{\text{OSC}}_{OUT}$ OSC_{IN}	For connection to oscillator capacitor and coil.
10	—	V_{SS}	Connect to system GND.
11	Output	VMON	High level is output when one of the VR, VG, or VB character signal outputs is high.
12 13 14	Output	VR VG VB	Character data output pin. Three-system output can be selected on a character basis. Active high output.
15 16 17	Output	V_{BLKR} V_{BLKG} V_{BLKB}	Blanking signal output for cutting the video signal. Active high output.
18	Input	$\overline{\text{VSYNC}}$	Vertical sync input. Active low input.
19	Input	$\overline{\text{HSYNC}}$	Horizontal sync input. Active low input.
20	Input	$\overline{\text{HOLD}}$	Low level input stops the oscillator. At this time, V_R, V_G, V_B, and V_{BLK} outputs all go low. (This input is normally high.)

●Input/output circuits



●Serial data timing

The control commands are in 8-bit serial input format. After the eight bits of command data have been input, a STB pulse is input to execute the command.
The data is read into a shift register on the rising edge of the CLK signal, and copied to the other registers on the rising edge of the STB signal. In the case of formatted data, the BUSY signal falls after the internal state has stabilized completely. When the data is written to VRAM, the BUSY signal falls when the data write operation is complete.



●Absolute maximum ratings (Ta=25℃)

Parameter	Symbol	Limits	Unit
Power supply voltage	V_{DD}	−0.3~7.0	V
Power dissipation	P_D	750*	mW
Operating temperature	Tstg	−50~150	℃
Storage temperature	Topr	−20~75	℃
Pin voltages	—	−30~V_{DD}0.3	V

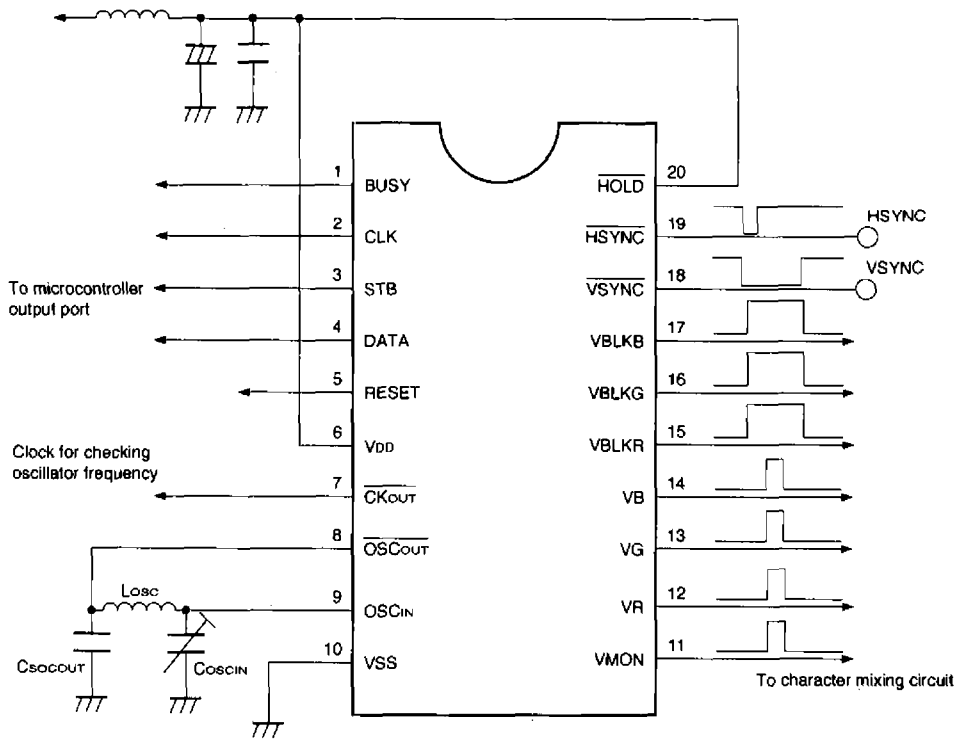
* Reduced by 6.0mW for each increase in Ta of 1°C over 25°C.

●Electrical characteristics (Unless otherwise specified: Ta=25℃ and V_{DD}=5V)

Parameter	Symbol	Min.	Typ.	Max.	Unit	Conditions
Operating voltage	V_{DD}	—	5	—	V	
"L" input voltage	V_{IL2}	0	—	0.3V_{DD}	V	For CMOS input
"H" input voltage	V_{IH2}	0.7V_{DD}	—	V_{DD}	V	For CMOS input
"L" output voltage	V_{OL1}	—	—	0.4	V	For OSC
"H" output voltage	V_{OH1}	4.6	—	—	V	For OSC
"L" output voltage	V_{OL2}	0	—	0.4	V	I_{OL}≦2mA
"H" output voltage	V_{OH2}	4.6	—	—	V	I_{OH}≦1mA
Input leakage current	I_{LI}	—	—	1	μA	
Output leakage current	I_{LO}	—	—	10	μA	
Input pullup resistance	R_R	—	28	70	kΩ	Pullup input
Operating current	I_{DD}	—	—	10	mA	

◎Not designed for radiation resistance.

●Application example



●Command format

The control command format is 8-bit serial data.
After the eight bits of data for the command have been input, a STB pulse is input to execute the command.

Content	F	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
Display character data	0	0	C_6	C_5	C_4	C_3	C_2	C_1	C_0
Character unit, blink data	0	1	0	0	0	Blink	R	G	B
Character display line address	0	1	0	0	1	AR_3	AR_2	AR_1	AR_0
Character display column address	0	1	0	1	AC_4	AC_3	AC_2	AC_1	AC_0
Background specification	0	1	1	0	BS_4	BS_3	RB	GB	BB
Blinking, dot oscillation control and display ON/OFF	0	1	1	1	0	D_0	B_{L2}	B_{L1}	OSC
Character code, bank switch *1	0	1	1	1	1	0	1	0	A
Frame control	0	1	1	1	1	0	0	E_{g1}	0
Format specification	×	1	1	1	1	1	1	F	FR
Display position vertical address	1	0	1	0	V_4	V_3	V_2	V_1	V_0
Display position horizontal address	1	1	1	0	H_4	H_3	H_2	H_1	H_0
Character size specification	1	1	0	M	S_4	AR_3	AR_2	AR_1	AR_0
Test mode setting	1	1	1	1	0	T_3	T_2	T_1	T_0

*1 Only used for the BU2870FS.

・Format set

F	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
×	1	1	1	1	1	1	F	FR

→ Software reset

→ F register data set 1 or 0

Software reset (BU2848FS and BU2873FS)
Reset when a "1" is input. The software reset data is not latched. After this command is executed, the following registers are reset.

・Character size register
・test mode set register
・format specification F→0

Data in the other registers is preserved. In the case of the BU2870FS, zeros are written to the RAM.

·Character display column address

F	D7	D6	D5	D4	D3	D2	D1	D0
0	1	0	1	AC4	AC3	AC2	AC1	AC0

Specifies the digit address when writing display data.
Do not specify an address outside the range 0H to 17H.
AC4 to AC0
MSB LSB

·Background specification

F	D7	D6	D5	D4	D3	D2	D1	D0
0	1	1	0	BS4	BS3	R	G	B

Background specification

BS4	BS3	Background
0	0	No background
1	0	Blank background
1	1	Solid background

·Frame

F	D7	D6	D5	D4	D3	D2	D1	D0
0	1	1	1	1	0	0	Eg1	X

Frame control
0: no border
1: border

●Command format

·Blinking, dot oscillation control, and display ON/OFF

F	D7	D6	D5	D4	D3	D2	D1	D0
0	1	1	1	0	D0	BL2	BL1	OSC

Oscillation control
0: oscillation OFF
1: oscillation ON

Blinking control

BL2	BL1	Function
0	0	Blinking OFF
0	1	ON(1): OFF(3)
1	0	ON(3): OFF(1)
1	1	ON(1): OFF(1)

Display ON/OFF control
0: display OFF
1: display ON

·Color and blinking data for each character

F	D7	D6	D5	D4	D3	D2	D1	D0
0	1	0	0	0	Blink	R	G	B

Blinking
0: character blinking OFF
1: character blinking ON

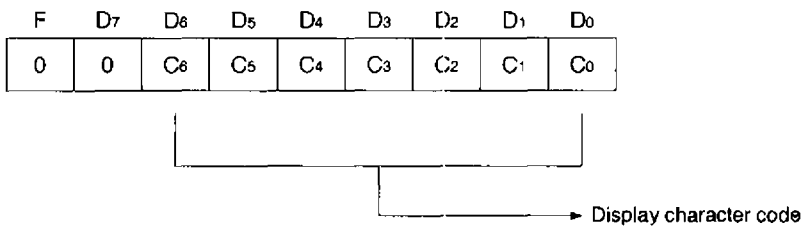
·Character code bank switching

F	D7	D6	D5	D4	D3	D2	D1	D0
0	1	1	1	1	0	1	0	A

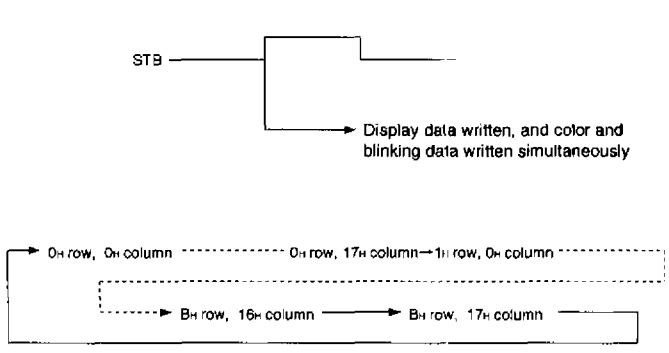
Character code bank
0 or 1

With the BU2870FS, use 0 and 1 to select between the two banks of 128 characters. This command does not apply to the BU2848FS and BU2873FS.

·Writing display data



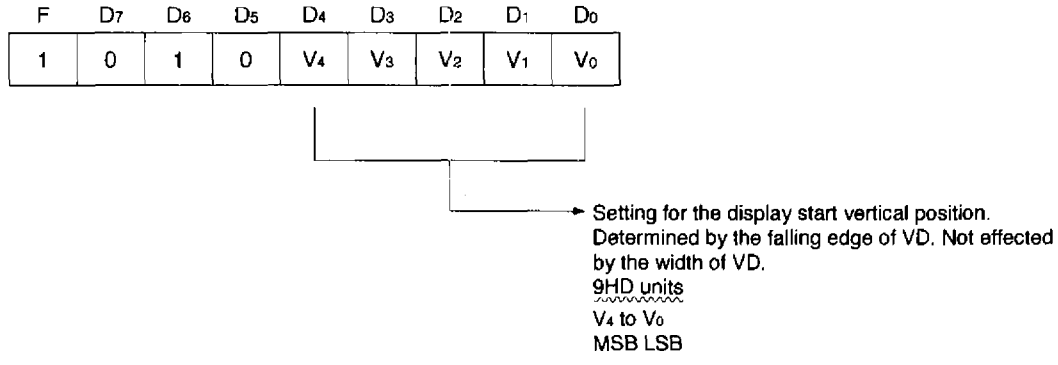
The address counter is incremented after the display data writing is complete.



* 1)The address counter is incremented after the RAM data is written. It is not effected by the STB pulse width.
* 2)The BUSY flag is high while the data is being written, but all other commands can be processed simultaneously.

It is possible to change the display position horizontal address and display position vertical address as described below.

·Display position vertical address



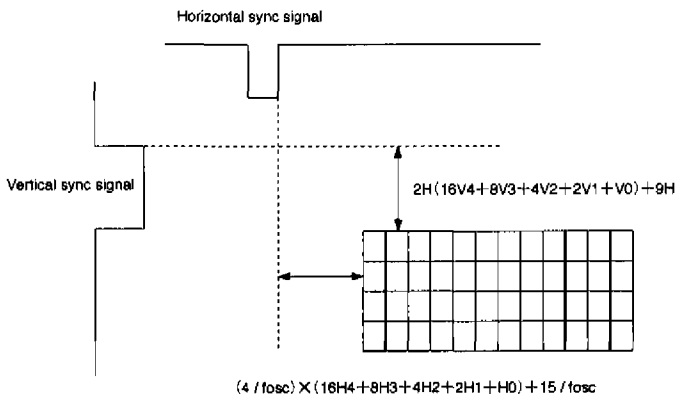
●Command format

·Display position horizontal address

F	D7	D6	D5	D4	D3	D2	D1	D0
1	1	1	0	H4	H3	H2	H1	H0

→ Setting for the display start horizontal position.
Sets the time from the falling edge of HD.
12 dot units
H4 to H0
MSB LSB

·The character display address specified by the display position vertical address and display position horizontal address commands is determined as shown in the diagram below.



*When specifying a double-square character, do not specify (H0, H1, H2, H3, H4)=(0, 0, 0, 0, 0).

Character display

The number of characters that can be displayed is 288 (12 lines×24 characters).

AC0~AC4		00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17
AR3 ~AR0	00																								
	01																								
	02																								
	03																								
	04																								
	05																								
	06																								
	07																								
	08																								
	09																								
	0A																								
	0B																								

Display RAM address for TV screen

·Character size specification

F	D7	D6	D5	D4	D3	D2	D1	D0
1	1	0	0	S4	AR3	AR2	AR1	AR0

Row number specifying size (hex data)
AR3 to AR0
MSB LSB

0: standard
1: double

●EPROM address and character data

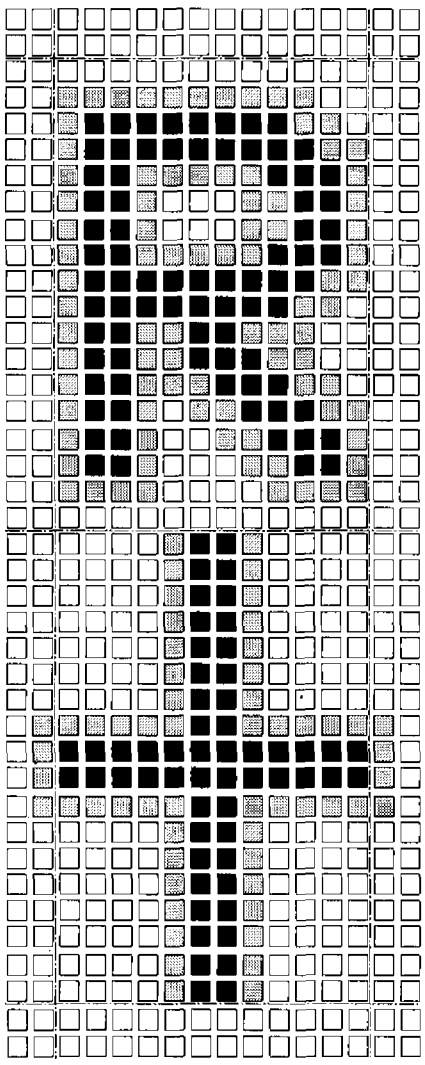
【ROM1】

EPROM Address	Character data (BIN) A0	A1	A2	A3	A4	A5	A6	A7	Character data (HEX)
0 0 0 0	0	0	0	0	0	0	0	0	0 0
0 0 0 1	0	0	0	0	0	0	0	0	0 0
0 0 0 2	0	0	0	0	0	1	1	0	6 0
0 0 0 3	0	0	0	0	1	1	1	1	F 0
0 0 0 4	0	0	0	1	1	1	1	1	F 8
0 0 0 5	0	0	1	1	1	0	0	0	8 0
0 0 0 6	0	1	1	1	0	0	0	0	0 E
0 0 0 7	0	1	1	0	0	0	0	0	0 6
0 0 0 8	0	1	1	0	0	0	0	0	0 6
0 0 0 9	0	1	1	0	0	0	0	0	0 6
0 0 0 A	0	1	1	1	1	1	1	1	F E
0 0 0 B	0	1	1	1	1	1	1	1	F E
0 0 0 C	0	1	1	0	0	0	0	0	0 6
0 0 0 D	0	1	1	0	0	0	0	0	0 6
0 0 0 E	0	1	1	0	0	0	0	0	0 6
0 0 0 F	0	1	1	0	0	0	0	0	0 6
0 0 1 0	0	0	0	0	0	0	0	0	0 0
0 0 1 1	0	0	0	0	0	0	0	0	0 0
0 0 1 2	0	0	0	0	0	0	0	0	0 0
.				.					
.				.					
.				.					
0 0 1 F	0	0	0	0	0	0	0	0	0 0

【ROM2】

Character data (BIN) A0	A1	A2	A3	A4	A5	A6	A7	Character data (HEX)
0	0	0	0	0	0	0	0	0 0
0	0	0	0	0	0	0	0	0 0
0	0	0	0	0	0	0	0	0 0
0	0	0	0	0	0	0	0	0 0
0	0	0	0	1	0	0	0	0 1
0	0	0	0	1	1	0	0	0 3
0	0	0	0	1	1	1	0	0 7
0	0	0	0	0	1	1	0	0 6
0	0	0	0	0	1	1	0	0 6
0	0	0	0	1	1	1	0	0 7
0	0	0	0	1	1	1	0	0 7
0	0	0	0	0	1	1	0	0 6
0	0	0	0	0	1	1	0	0 6
0	0	0	0	0	1	1	0	0 6
0	0	0	0	0	1	1	0	0 6
0	0	0	0	0	0	0	0	0 0
0	0	0	0	0	0	0	0	0 0
0	0	0	0	0	0	0	0	0 0
.				.				
.				.				
.				.				
0	0	0	0	0	0	0	0	0 0

●Frame data

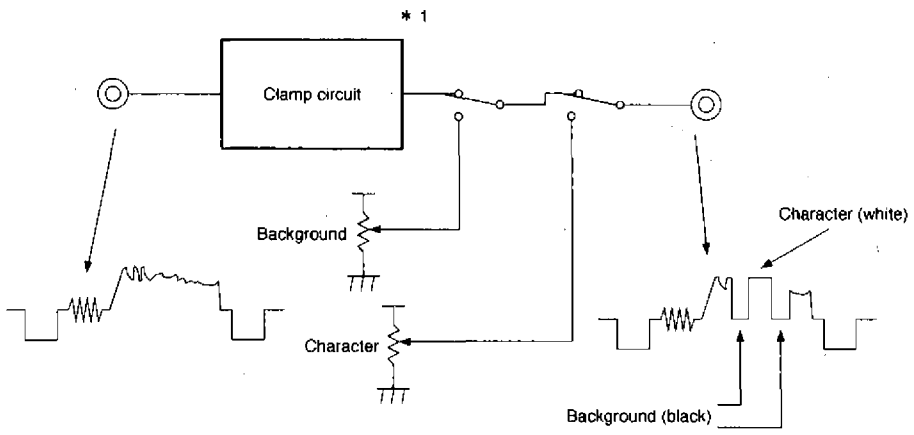


White
Character data
Border
Character size

The conditions for display of border data are no character data above the cell, and character data in one of the cells above, below, left, right, or diagonally removed from the cell. However, border data is not displayed above character data in the first row, below character data in the 18th row, or when there is character data in the first column. When there is character data in the 12th column, border data is displayed on the right, but when the next character is in the off state, the border is not displayed.
In the case of the 24th character, the border data for character data in the 12th column is not displayed. Character blinking is set individually for each character. When there is a border to the left or right in another character's area, blinking does not occur.

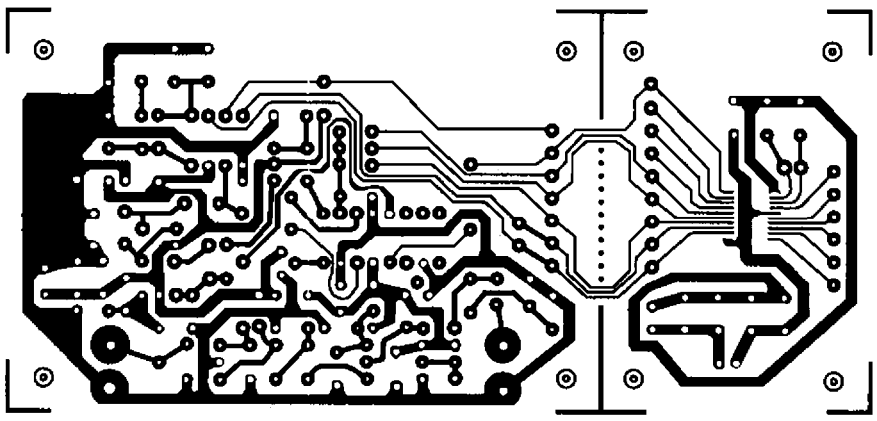
●Character superimposition (black and white)

To superimpose characters on a VCR, either a composite or color difference (component) signal is used. In the case of a composite signal, sync and color signals are included, so caution is required to ensure that the timing does not overlap.

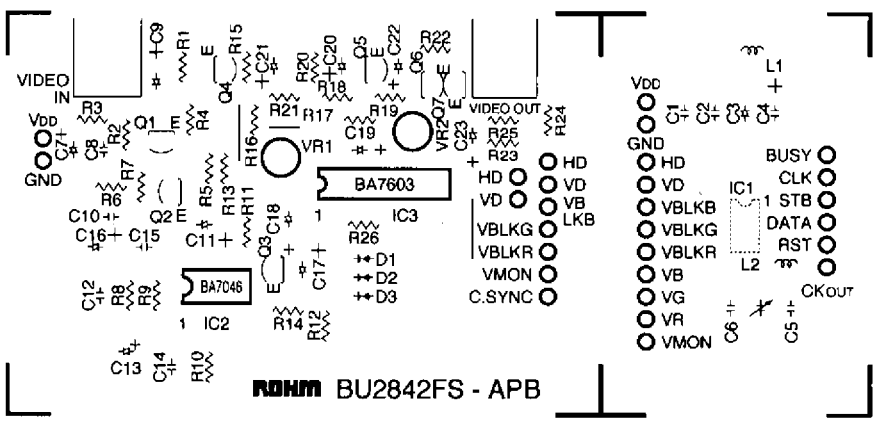


* 1) Composite signals have their level fixed at 1 V_{P-P}, and the DC level is fixed. However, in many cases, the signal used has had its frequency components removed by a capacitor. To superimpose white, gray, and black levels the DC level of the signal to be superimposed must be fixed with reference to the pedestal-level voltage. This is done using a clamp circuit.

●PCB for application example circuit (solder side)

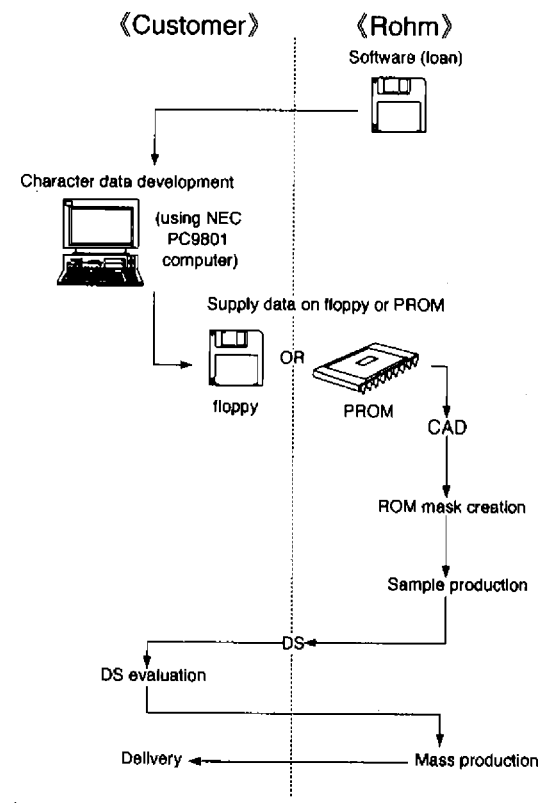


●PCB for application example circuit (component side)

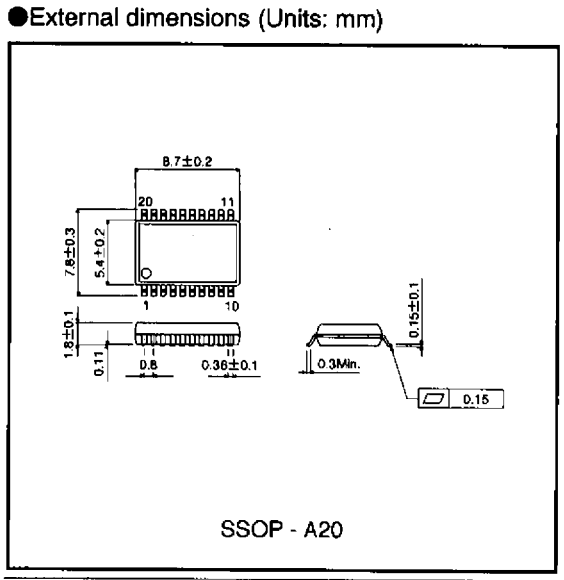


●Development flowchart

★Character data development flowchart



●External dimensions (Units: mm)



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.