

BU2801S

On-Screen Display IC For VTR (NTSC formats)

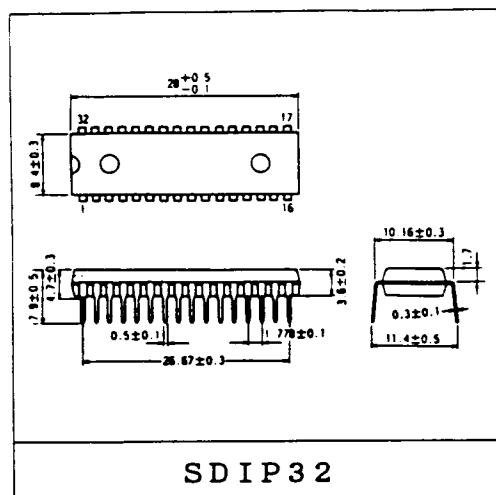
●Description

BU2801S is an On-Screen Display IC.
The BU2801S displays characters and figures on a TV screen connected with TV-related sets like VTR and CATV.

BU2801S is 1 chip IC having all the function required for OSD such as character ROM, display RAM, SYNC SEP, AFC and APC. The BU2801S is operated only by control signals from micro controller and composite video signal.

The number of character dots is 12×18 .
Up to 128 characters are stored in the built-in ROM. 8 colors are available for displaying characters or outline background.
It is possible to have optional characters only by changing ROM mask.

●Dimentions (Unit:mm)



●Features

- NTSC formats
- Characters set by micro controller are superimposed with composite video signal which is input through VIDEOIN. (7 colors are settable for each character).
- Built-in SYNC SEP circuit. It separates SYNC signal from the composite video signal which has been input through VIDEOIN.
- Built-in APC circuit. It phases locks the color burst from input composite video signal and 3.58MHz frequency which comes from internal oscillator.
- Built-in AFC circuit which composes f_H of composite video signal from VIDEOIN and internal timing generator (f_H =Horizontal synchronizing frequency).
- Settable 4×4 character size and 64 H/V display starting position.
- Available to set from 8 kinds of display image which can be displayed in 8 different colors and also blinked.
- Ready-to-use personal computer software is available to allow custom character generation.

●Application: VCR, CATV

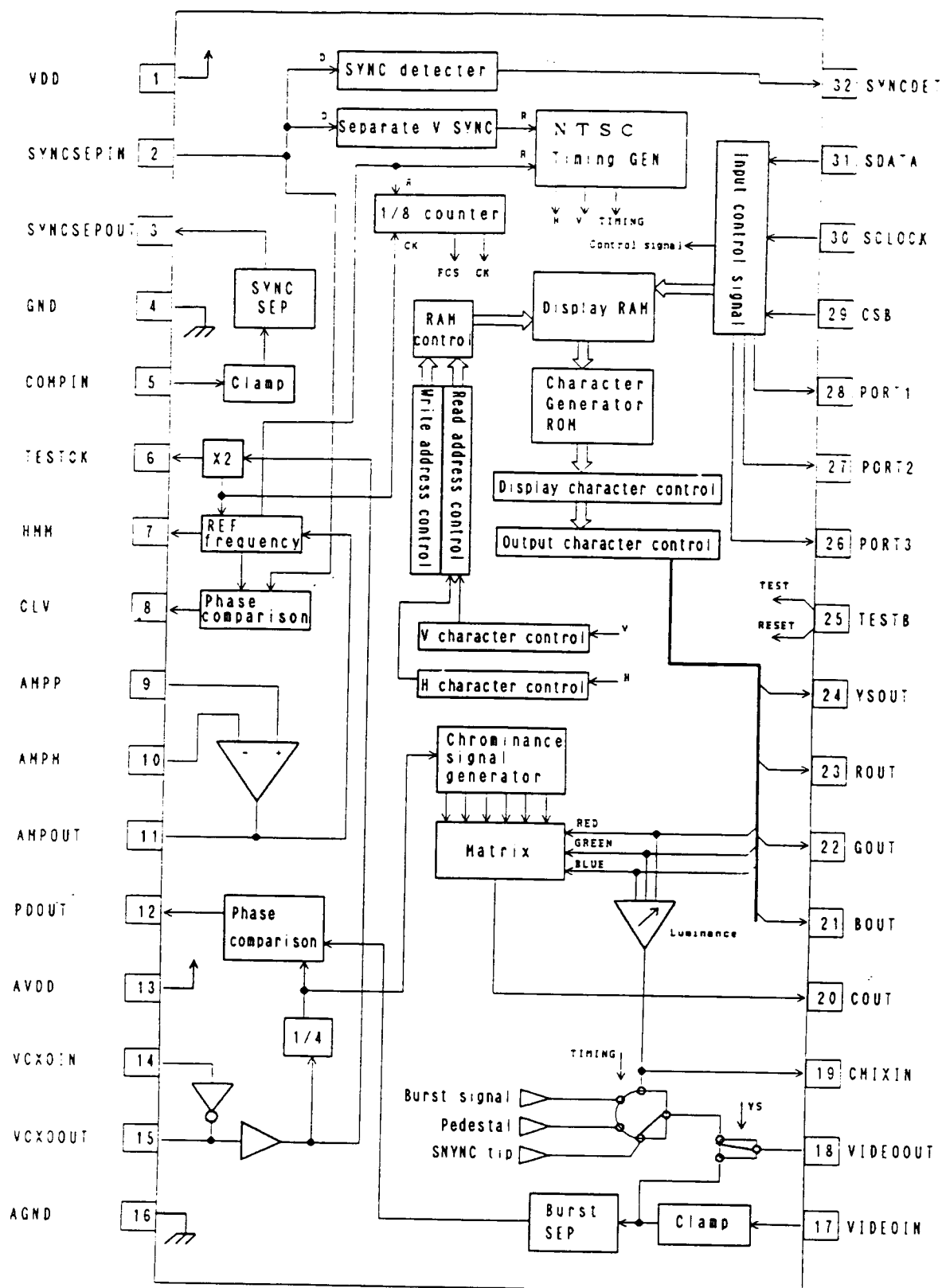
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- Specifications subject to change without notice for the purpose of improvement.

- Current specifications in effect as of Jun. 24, 1991

●Block Diagram/Pin Assignment



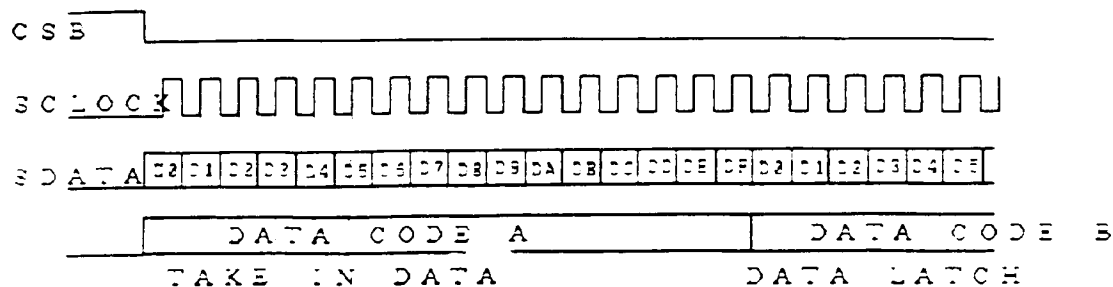
●Recommended Operating Conditions

Parameter	Symbol	Range	Units
Operating voltage	Vcc	+4.5 to +5.5	V

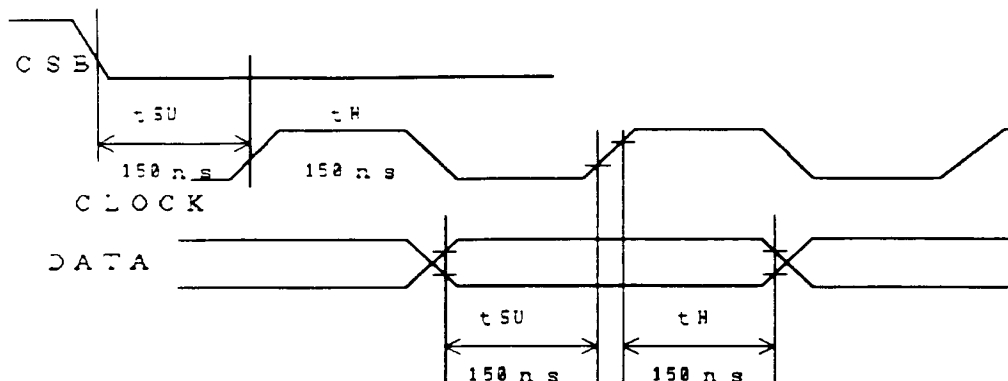
●Terminal Function

Pin No	Terminal code	Function	I/O cell
1	VDD		
2	SYNCSEPIN	Input composite SYNC signal	AIO
3	SYNCSEPOUT	Output SYNC signal separated internally(Output CMOS)	LOUT
4	GND		
5	COMPIN	Input composite video signal	AIO
6	TESTCK	Terminal to connect capacitor for multiplication(X2)	AIO
7	HMM	Terminal to connect CR for AFC mono-multi	MMP
8	CLV	AFC control voltage	CLV
9	AMPP	Input AFC comparator (+)	AIO
10	AMPM	Input AFC comparator (-)	AIO
11	AMPOUT	Output AFC comparator	LOUT
12	PDOUT	Output APC control voltage	PDP
13	AVDD		
14	VCXOIN	Terminal for connecting crystal (14.31818MHz)	VCXO
15	VCXOOUT		
16	AGND		
17	VIDEOIN	Input composite video signal	AIO
18	VIDEOOUT	Output composite video signal with Superimposing	AIO
19	CMIXIN	Input chrominance signal for mixing with luminance signal. (output luminance signal)	AIO
20	COUT	Output chrominance signal	AIO
21	BOUT	RGB signals output (CMOS output)	LOUT
22	GOUT	Each RGB signal output has no relation to the status of YSOUT.	LOUT
23	ROUT		LOUT
24	YSOUT		LOUT
		Superimposing timing output YSOUT depends on character data. However, YSOUT is low when composite video signal is passing through.	
25	TESTB	Terminal of power on reset and test H: Operation M: Test L: Reset	TIN
26	PORT3	Output control signal	LOUT
27	PORT2		LOUT
28	PORT1		LOUT
29	CSB	Serial data · Chip select input	HYS
30	SCLOCK	Serial data · Clock input	HYS
31	SDATA	Serial data · Data input	HYS
32	SYNCDDET	Output SYNC detector L: exist H: not exist	LOUT

●Serial Data Timing



SDATA is received at the start of SCLOCK. Data is input each 16 CLOCK pulses.



※ F c k (M A X) = 2 . 5 M H z

●Composition of the TV Screen

On the TV screen, display position and RAM address are as follows.
(Address 00H starts from upper left side)

00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13	14	15	16	17
18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F	40	41	42	43	44	45	46	47
48	49	4A	4B	4C	4D	4E	4F	50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F	70	71	72	73	74	75	76	77
78	79	7A	7B	7C	7D	7E	7F	80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F	A0	A1	A2	A3	A4	A5	A6	A7
A8	A9	AA	AB	AC	AD	AE	AF	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB	BC	BD	BE	BF
C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF	D0	D1	D2	D3	D4	D5	D6	D7
D8	D9	DA	DB	DC	DD	DE	DF	E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	EA	EB	EC	ED	EE	EF

●Composition of Memory

Configuration of RAM for display and register for controlling display are composed of 16 bits. Address is available from 0 to 243. RAM address for display character data is from 0 to 239. Register for controlling display is from address 240 to 243. There are 2 kinds of data receiving modes, addressing mode and data mode.

Bit 13 switches-between each mode. When setting bit 13 for "0", data mode is applied. When setting bit 13 for "1", addressing mode is applied and address can be set at 8 bits (0-7 bit) from the bottom.

After setting an address, the first data is written in it, and after that, the address is increased for every additional data.

Construction of data

Bit	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	A/D	DC	DB	DA	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0

Addressing mode

Bit	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	0	0	0	0	0	A7	A6	A5	A4	A3	A2	A1	A0

Data mode

Bit/ Add.	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	SPC	B	G	R	BLNK	0	CD6	CD5	CD4	CD3	CD2	CD1	CD0
		Super ON/OFF	Character colors				Blink		Character codes					
239	0	SPC	B	G	R	BLNK	0	CD6	CD5	CD4	CD3	CD2	CD1	CD0
240	0	*	*	*	HS21	HS20	HS11	HS10	HCP5	HCP4	HCP3	HCP2	HCP1	HCP0
241	0	*	*	*	VS21	VS20	VS11	VS10	VCP5	VCP4	VCP3	VCP2	VCP1	VCP0
242	0	*	*	*	*	HB	HG	HR	SB	SG	SR	BB	BG	BR
243	0	POR3	POR2	POR1	HC1	HCO	BRB	BI	BCN1	BCN0	BFC	DP2	DP1	DPO

Note1: Whichever the mode is, please set bit 14 and 15 for "0". Note2: Mark* means undefined.

●Address 0~239

	Register	Function
DC	SPC	Switch-over the character to be superimposed or output at RGB out. 1: Superimpose 2: RGB OUT
DB	B	Display character color Blue
DA	G	Display character color Green
D9	R	Display character color Red
D8	BLNK	ON/OFF switch of reverse display. 1: ON 0: OFF
D7	Undefined	
D6	CD6	Character code (MSB)
D5	CD5	"
D4	CD4	"
D3	CD3	"
D2	CD2	"
D1	CD1	"
D0	CD0	" (LSB)

Note: When all registers "R", "G" and "B" are "0", character isn't displayed in no relation with BLINK, SPC nor character code.

●Address 240

	Register	Status	Function
DC		0	
DB		0	
DA		0	
D9	HS21	0	Set horizontal character size. (from line to 10) 1TC is about 140ns
		1	
D8	HS20	0	
		1	
D7	HS11	0	Set horizontal character size. (the first line) 1TC is about 140ns
		1	
D6	HS10	0	
		1	
D5	HCP5	0	Starting position of horizontal character. Set starting position of display horizontal character. $\text{Starting display position} = T_c \times \sum_{n=0}^5 2^n \text{HCP}_n$ T_c is about 140ns
		1	
D4	HCP4	0	
		1	
D3	HCP3	0	
		1	
D2	HCP2	0	
		1	
D1	HCP1	0	
		1	
D0	HCP0	0	
		1	

●Address 241

	Register	Status	Function
DC		0	
DB		0	
DA		0	
D9	VS21	0	Set vertical character size.(line 2 to 10) "H" means horizontal synchronizing time.
		1	
D8	VS20	0	
		1	
D7	VS11	0	Set vertical character size. (the first line) "H" means horizontal synchronizing time.
		1	
D6	VS10	0	
		1	
D5	VCP5	0	Starting position of vertical character. Set starting position of display vertical character. $\text{Starting display position} = H \times \sum_{n=0}^5 2^n \text{VCP}_n$ "H" means horizontal synchronizing time.
		1	
D4	VCP4	0	
		1	
D3	VCP3	0	
		1	
D2	VCP2	0	
		1	
D1	VCP1	0	
		1	
D0	VCP0	0	
		1	

●Address 242

	Register	Status	Function	
DC		0		
DB		0		
DA		0		
D9		0		
D8	HB	0	Setting outline color	Blue
		1		
D7	HG	0	Setting outline color	Green
		1		
D6	HR	0	Setting outline color	Red
		1		
D5	SB	0	Character size color	Bule
		1		
D4	SG	0	Character size color	Green
		1		
D3	SR	0	Character size color	Red
		1		
D2	BB	0	Background color	Blue
		1		
D1	BG	0	Background color	Green
		1		
D0	BR	0	Background color	Red
		1		

●Address 243

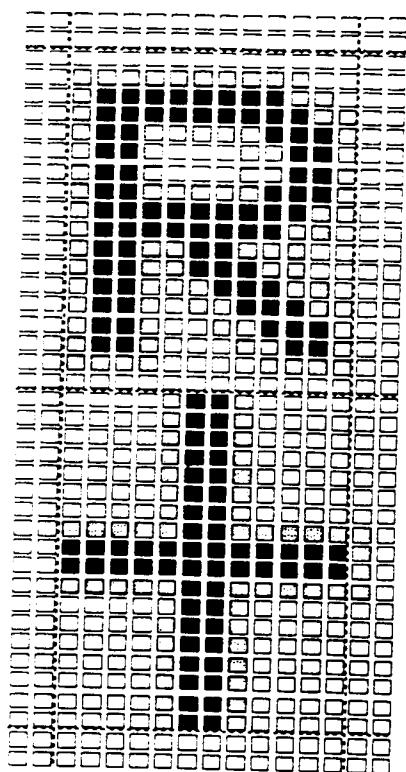
	Register	Status	Function																																							
DC	PORT3	0	26PIN" L" output " H"																																							
		1																																								
DB	PORT2	0	27PIN" L" output " H"																																							
		1																																								
DA	PORT1	0	28PIN" L" output " H"																																							
		1																																								
D9	HC1	0	Control display of outline and character size HCO=0 HC1=0 ;Normal character HCO=1 HC1=0 ;Outline																																							
		1																																								
D8	HCO	0	HCO=0 HC1=1 ;Character size HCO=1 HC1=1 ;Character size and outline																																							
		1																																								
D7	BRB	0	Control display mode to be reversed or non-display of characters which have been set blinking. "1": Normal "0": reversed																																							
		1																																								
D6	BI	0	When blinking is off, set display mode of characters which have been set blinking. "1": Normal "0": reversed or non-display																																							
		1																																								
D5	BCN1	0	Duty control of blinking/reverse display	<table><tr><td colspan="2"></td><td colspan="2">BCN0</td></tr><tr><td colspan="2">0</td><td colspan="2">1</td></tr><tr><td rowspan="2">BCN1</td><td>0</td><td>Blinking OFF</td><td>duty25%</td></tr><tr><td>1</td><td>Duty50%</td><td>duty75%</td></tr></table>				BCN0		0		1		BCN1	0	Blinking OFF	duty25%	1	Duty50%	duty75%																						
						BCN0																																				
0		1																																								
BCN1	0	Blinking OFF	duty25%																																							
	1	Duty50%	duty75%																																							
		1																																								
D4	BCN0	0																																								
		1																																								
D3	BFC	0	Setting of blinking frequency. "1": 64 frequency dividing of vertical synchronizing time. "0": 32 frequency dividing.																																							
		1																																								
D2	DP2		<table><tr><td>DP0</td><td>DP1</td><td>DP2</td><td>OUTPUT MODE</td></tr><tr><td>1</td><td>0</td><td>0</td><td>Superimposing</td></tr><tr><td>1</td><td>0</td><td>1</td><td>Superimposing</td></tr><tr><td>1</td><td>1</td><td>0</td><td>Superimposing</td></tr><tr><td>1</td><td>1</td><td>1</td><td>Superimposing</td></tr><tr><td>0</td><td>0</td><td>0</td><td>Input picture signal</td></tr><tr><td>0</td><td>0</td><td>1</td><td>Superimposing</td></tr><tr><td>0</td><td>1</td><td>0</td><td>Mono-color character (Interlace)</td></tr><tr><td>0</td><td>1</td><td>1</td><td>Mono-color character (Non-interlace)</td></tr></table>				DP0	DP1	DP2	OUTPUT MODE	1	0	0	Superimposing	1	0	1	Superimposing	1	1	0	Superimposing	1	1	1	Superimposing	0	0	0	Input picture signal	0	0	1	Superimposing	0	1	0	Mono-color character (Interlace)	0	1	1	Mono-color character (Non-interlace)
DP0	DP1	DP2	OUTPUT MODE																																							
1	0	0	Superimposing																																							
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D1	DP1																																									
D0	DP0																																									

The diagram illustrates the internal circuitry of a color television receiver, focusing on the colorburst separator and color control section. The circuit is organized into several functional blocks:

- Left Section (Signal Processing):**
 - Oscillator:** A 14.31818MHz crystal oscillator is connected to pins 14 and 15.
 - Phase-Locked Loop (PLL):** Consists of a phase comparator (pins 8, 12), a voltage-controlled oscillator (VCO) (pins 6, 7), and a divider (pins 10, 11).
 - Sync Separator:** Receives the sync signal (pin 1) and outputs a sync signal (pin 2) and a sync signal (pin 3).
 - Clamp:** A clamp circuit (pin 4) is used for signal processing.
 - 1/8 Counter:** A counter (pin 5) that provides timing signals.
- Right Section (Control and Timing):**
 - NTSC Timing GEN:** Generates NTSC timing signals (pins 30, 31, 32).
 - Display RAM:** A random access memory (pin 28) for storing display data.
 - Character Generator ROM:** A read-only memory (pin 27) for character data.
 - Display character control:** Controls the display character (pin 26).
 - Output character control:** Controls the output character (pin 25).
 - Matrix:** A matrix generator (pin 21) that outputs red, green, and blue signals.
 - Luminance:** A luminance section (pin 20) that processes the color signals.
 - Burst signal:** A burst signal (pin 19) that is used for color control.
 - Pedestal:** A pedestal signal (pin 18) that is used for color control.
 - SHYNC tip:** A sync tip signal (pin 17) that is used for color control.
- Control Signals:**
 - SDATA:** Serial data (pin 31).
 - SCLOCK:** Serial clock (pin 30).
 - CSB:** Chip select (pin 29).
 - TEST/RESET:** Test and reset signals (pin 25).
- Power Supply:**
 - VDD=5V:** The main power supply (pin 1).
 - VSS=0V:** The ground reference (pin 16).

A legend at the bottom left indicates that a capacitor symbol represents a ceramic capacitor. The diagram also shows various passive components like resistors and capacitors, and a 9V battery connected to the 360 pin.

●Outline Data



□ Blank
■ Character data
□ Outline data
..... Character size

Outline characters are generated in dots which have no character data but character data exists in adjoining the dot.

Outline can't be generated;

- above the character data which is on the first rank.
- under the character data which is on the 18th rank.
- left to the character data which is on the first file.

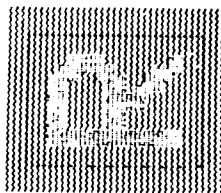
When character is on the 12th file, outline data occurs on the right side of the character. However, it does not appear on the screen if the next character data is off.

A character is defined as "off" when;

1. character color setting is $R=G=B=0$.
2. character setting is $SPC=0$.
3. blinking is set and blinkin is on.

● Display Image (non-reversed display)

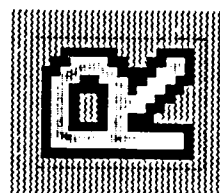
Normal display (HCO=HC1=0)



Character size (12x18dot)

- Decided by R, G, B. of each character.
- Picture, or mono-color background
- Decided by BR, BG, BB

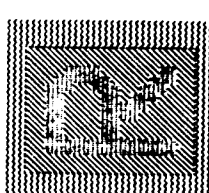
Outline display (HCO=1, HC1=0)



Character size (12x18dot)

- Decided by R, G, B. of each color.
- Outline color is decided by BR, HG, HB
- Picture, or mono-color background
- Decided by BR, BG, BB

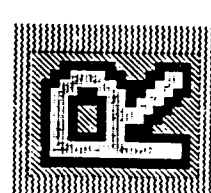
Character size display (HCO=0, HC1=1)



Character size (12x18dot)

- Decided by R, G, B. of each color
- Decided by character size Color SR, SC, SB
- Picture, or mono-color background
- Decided by BR, BG, BB

Character size and outline display (HCO=HC1=1)

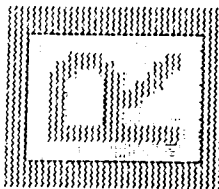


Character size (12x18dot)

- Decided by R, G, B. of each character
- Outline color is decided by BR, HG, HB
- Decided by character size color SR, SC, SB
- Picture, or mono-color background
- Decided by BR, BG, BB

● Display Image (reversed display)

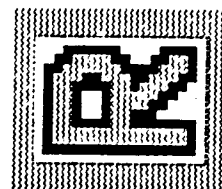
Normal display (HCO=HC1=0)



Character size (12x18dot)

- Decided by R, G, B. of each character
- Picture, or mono-color background
- Decided by BR, BG, BB

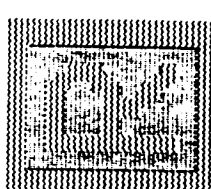
Outline display (HCO=1, HC1=0)



Character size (12x18dot)

- Decided by R, G, B. of each color
- Outline color is decided by BR, HG, HB
- Picture, or mono-color background
- Decided by BR, BG, BB

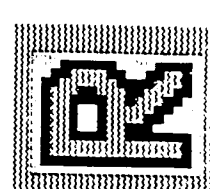
Character size display (HCO=0, HC1=1)



Character size (12x18dot)

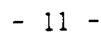
- Decided by R, G, B. of each character
- Decided by character size color SR, SC, SB
- Picture, or mono-color background
- Decided by BR, BG, BB

Character size and outline display (HCO=HC1=1)



Character size (12x18dot)

- Decided by R, G, B. of each character
- Outline color is decided by BR, HG, HB
- Decided by character size color SR, SC, SB
- Picture, or mono-color background
- Decided by BR, BG, BB



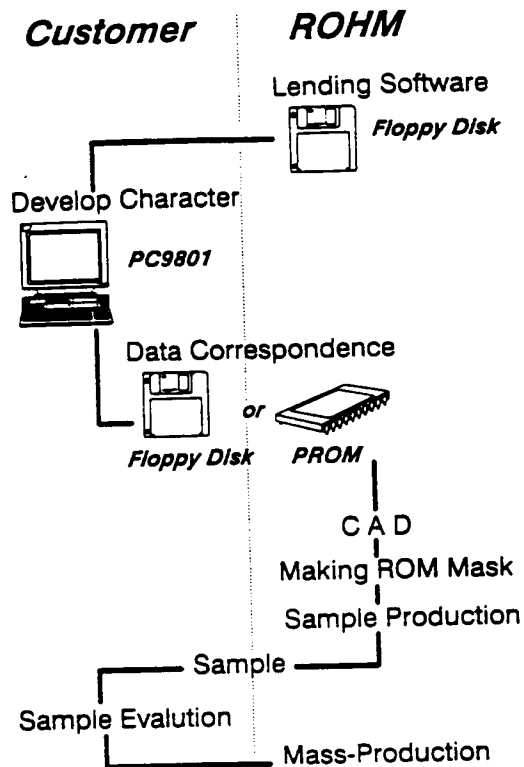
● Change of Character

BU2801 can set 128 built-in characters optionally according to the customers' request.
 ROHM prepared supporting tools for customers' character development of BU2801S.
 Please contact our sales man with regard to the loan of development supporting tools.

Development tool
 Software for making characters in personal computer PC9801 can be supplied on floppy disk.

Evaluation board
 The evaluation board makes it possible to write developed character on PROM and check it on TV screen.

Flow chart for developing character



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