



LC74776, 74776M

On-Screen Display Controller IC

Preliminary

Overview

The LC74776/M is an on-screen display controller CMOS IC that displays characters and patterns on the TV screen under microprocessor control. This IC includes a built-in PDC/VPS/UDT interface circuit.

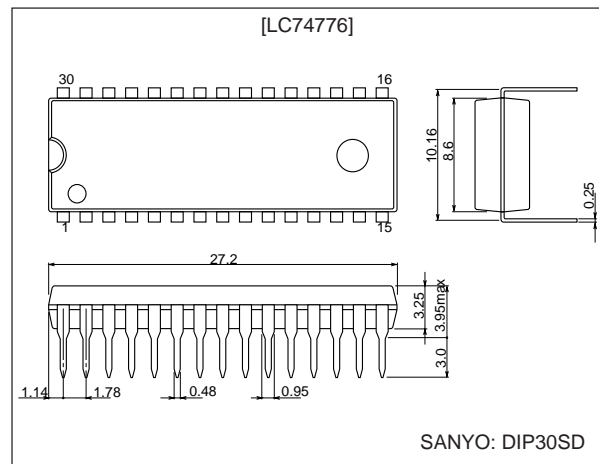
Functions

- Display format: 24 characters by 12 rows (Up to 288 characters)
- Character format: 12 (horizontal) × 18 (vertical) dots
- Character sizes: Three sizes each in the horizontal and vertical directions
- Characters in font: 256 (Of the 256 characters, one is a space character (FE hexadecimal) and one is a transparent space character (FF hexadecimal))
- Initial display positions: 64 horizontal positions and 64 vertical positions
- Blinking: Specifiable in character units
- Blinking types: Two periods supported:
1.0 second and 0.5 second
- Blanking: Over the whole font (12 × 18 dots)
- Background color: 8 colors (internal synchronization mode): $4f_{SC}$ and $2f_{SC}$
Blue background only: NTSC
- Line background color: Three lines can be set up.
8 line background colors (in internal synchronization mode): $4f_{SC}$ and $2f_{SC}$
- External control input: 8-bit serial input format
- On-chip sync separator circuit
- Video outputs: PAL and NTSC format composite video outputs
- On-chip PDC/VPS/UDT interface circuit supporting I²C
- Package: DIP30SD
MFP30S

Package Dimensions

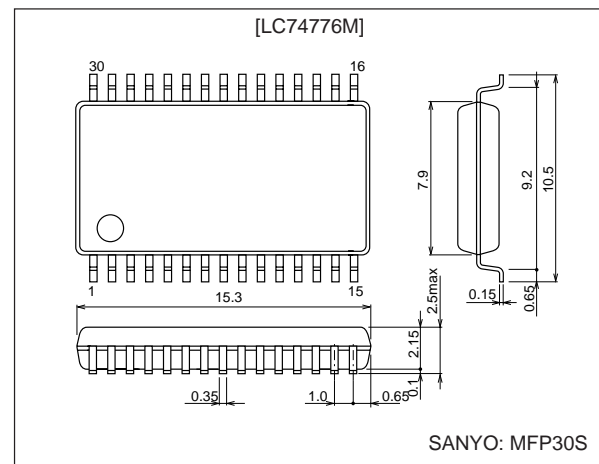
unit: mm

3196-DIP30SD



unit: mm

3216A-MFP30S



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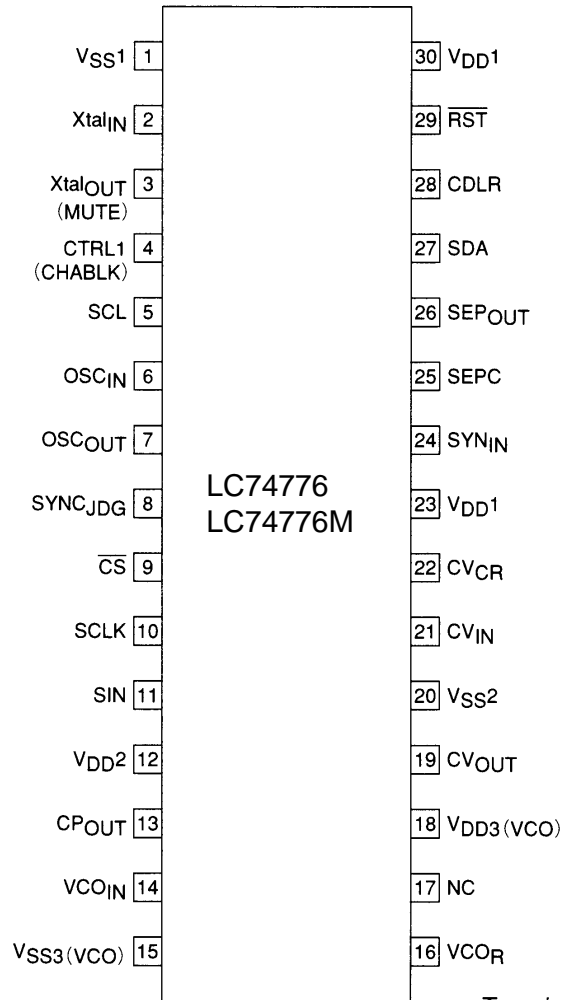
SANYO Electric Co.,Ltd. Semiconductor Business Headquarters

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

20399RM(OT) No. 6018-1/35

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Pin Assignment



Top view

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Pin Functions

Pin no.	Pin	Function	Notes
1	V _{SS1}	Ground	Ground connection (digital system ground)
2	Xtal _{IN}	Crystal oscillator (MUTE input)	These pins are used either to connect the crystal and capacitors used to form an external crystal oscillator circuit to generate the internal synchronizing signals, or to input an external clock signal (2fsc or 4fsc). As a mask option, the Xtal _{OUT} pin can be set to function as the MUTE input pin. When this pin is set low, the video output is held at the pedestal level. (A pull-up resistor is built in and the input has hysteresis characteristics.)
3	Xtal _{OUT} (MUTE)		
4	CTRL1 (CHABLK)	Crystal oscillator input switching (CHABLK)	Switches the mode between external clock input and crystal oscillator operation. A low level selects crystal oscillator operation and a high level selects external clock input. As a mask option, the CTRL1 input pin can be set to function as the CHABLK (character . frame) output. This is a 3-value output.
5	SCL	I ² C clock input	Clock input for the PDC/VPS data output. I ² C bus.
6	OSC _{IN}	LC oscillator connections	Connection for the external coil and capacitor for the oscillator used to generate the character output dot clock
7	OSC _{OUT}		
8	SYNC _{JDC}	External synchronizing signal judgment output	Outputs the state of the external synchronizing signal presence/absence judgment. Outputs a high level when synchronizing signals are present. Outputs either the crystal oscillator clock if \overline{CS} and \overline{RST} are low, or the VCO clock if \overline{CS} and \overline{RST} are high. (This signal is not output after a command reset.)
9	\overline{CS}	Enable input	Enable input for the OSD serial data input. Serial data input is enabled when this pin is low. A pull-up resistor is built in and the input has hysteresis characteristics.
10	SCLK	Clock input	Serial data input enable pin. A pull-up resistor is built in and the input has hysteresis characteristics.
11	SIN	Data input	Serial data input. A pull-up resistor is built in and the input has hysteresis characteristics.
12	V _{DD2}	Power supply	Composite video signal level adjustment power supply (analog system power supply)
13	CP _{OUT}	Charge pump output	Charge pump output. Connect a low-pass filter to this pin.
14	VCO _{IN}	Oscillator control voltage input	VCO oscillator control voltage input. (For data slicing)
15	V _{SS3}	Ground	Ground (VCO ground)
16	VCO _R	Oscillator range adjustment	VCO oscillator range adjustment resistor connection
17	NC		This pin must either be connected to ground or left open
18	V _{DD3}	Power supply (+5 V)	Power supply (+5 V: VCO power supply)
19	CV _{OUT}	Video signal output	Composite video signal output
20	V _{SS2}	Ground	Ground (analog system ground)
21	CV _{IN}	Video signal input	Composite video signal input
22	CV _{CR}	Video signal input	SECAM chrominance signal input
23	V _{DD1}	Power supply (+5 V)	Power supply (+5 V: digital system power supply)
24	SYN _{IN}	Sync separator circuit input	Video signal input to the internal sync separator circuit
25	SEPC	Slice level output	Slice level verification pin
26	SEP _{OUT}	Composite synchronizing signal output	Internal sync separator circuit composite synchronizing signal output. The signal actually output can be switched by MOD0 and SEL0. The DAV signal is output in the initial state.
27	SDA	I ² C bus data I/O	PDC/VPS data I/O. The I ² C bus write address is [0111 1100]. The I ² C bus read address is [0111 1101].
28	CDLR	Background color phase adjustment	Background color phase adjustment resistor connection
29	\overline{RST}	Reset input	System reset input. A pull-up resistor is built in and the input has hysteresis characteristics.
30	V _{DD1}	Power supply (+5 V)	Power supply (+5 V: digital system power supply)

Note: *Both V_{DD1} pins must be connected to power.

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Absolute Maximum Ratings

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V _{DDmax}	V _{DD1} , V _{DD2} , and V _{DD3}	V _{SS} – 0.3 to V _{SS} + 6.5	V
Maximum input voltage	V _{INmax}	All input pins	V _{SS} – 0.3 to V _{DD1} + 0.3	V
Maximum output voltage	V _{OUTmax}	SDA, SYNC _{JDG} , and SEP _{OUT}	V _{SS} – 0.3 to V _{DD1} + 0.3	V
Allowable power dissipation	P _{d max}	T _a = 25°C	350	mW
Operating temperature	T _{opr}		–30 to +70	°C
Storage temperature	T _{stg}		–40 to +125	°C

Allowable Operating Ranges

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Supply voltage	V _{DD1}	V _{DD1} , V _{DD3}	4.5	5.0	5.5	V
	V _{DD2}	V _{DD2}	4.5	5.0	6.5	V
Input high-level voltage	V _{IH1}	\overline{CS} , SIN, SCLK, SDA, SCL,	0.8V _{DD1}		5.5	V
	V _{IH2}	\overline{RST} , MUTE	0.8V _{DD1}		V _{DD1} + 0.3	V
	V _{IH3}	CTRL1	0.7V _{DD1}		V _{DD1} + 0.3	V
Input low-level voltage	V _{IL1}	\overline{RST} , \overline{CS} , SIN, SCLK, SDA, SCL, MUTE	V _{SS} – 0.3		0.2V _{DD1}	V
	V _{IL2}	CTRL1	V _{SS} – 0.3		0.3V _{DD1}	V
Pull-up resistance	R _{PU}	\overline{RST} , \overline{CS} , SIN, SCLK, MUTE Applies to pins set up by options.	25	50	90	kΩ
Composite video signal input voltage	V _{IN1}	CV _{IN} ; CV _{CR} : V _{DD1} = 5V		2.0		V _{p-p}
	V _{IN2}	SYN _{IN} : V _{DD1} = 5V	1.5	2.0	2.5	V _{p-p}
Input voltage	V _{IN3}	Xtal _{IN} (when used for external clock input) f _{IN} = 2fsc or 4fsc: V _{DD1} = 5V	0.10		5.0	V _{p-p}
Oscillator frequencies	f _{OSC1}	Xtal _{IN} and Xtal _{OUT} oscillator pins (2fsc: PAL)		8.867		MHz
	f _{OSC2}	Xtal _{IN} and Xtal _{OUT} oscillator pins (4fsc: PAL)		17.734		MHz
	f _{OSC3}	OSC _{IN} and OSC _{OUT} oscillator pins (LC oscillator)	5		10	MHz

Note: Applications must be especially cautious about noise when using the Xtal_{IN} input pin in clock input mode.

Electrical Characteristics at T_a = –30 to +70°C, V_{DD1} = 5 V unless otherwise specified

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Input off leakage current	I _{leak1}	CV _{IN} ; CV _{CR}			1	μA
Output off leakage current	I _{leak2}	CV _{OUT} ; SDA			1	μA
Output high-level voltage	V _{OH1}	SEP _{OUT} , CP _{OUT} , SYNC _{JDG} V _{DD1} = 4.5V, I _{OH} = –1.0 mA	3.5			V
Output low-level voltage	V _{OL1}	SEP _{OUT} , CP _{OUT} , SYNC _{JDG} V _{DD1} = 4.5 V, I _{OL} = 1.0 mA			1.0	V
	V _{OL2}	SDA: V _{DD1} = 5.0V, I _{OL} = 3.0 mA			0.4	V
Three-value output voltage	V _O	CHABLK: V _{DD1} = 5.0 V	H	3.3	5.0	V
			M	1.8	2.3	V
			L	0	0.8	V
Input current	I _{IH}	\overline{RST} , \overline{CS} , SIN, SCLK, SDA, SCL, CTRL1, MUTE, VCOIN: V _{IN} = V _{DD1}			1	μA
	I _{IL}	CTRL1, SDA, SCL, VCOIN V _{IN} = V _{SS1}	–1			μA
Operating mode current drain	I _{DD1}	V _{DD1} and V _{DD3} : With all outputs open Xtal: 17.734 MHz, LC: 8 MHz			40	mA
	I _{DD2}	V _{DD2} : V _{DD2} = 5 V			20	mA
SYNC level	V _{SN}	CV _{OUT} : V _{DD1} = 5.0 V, V _{DD2} = 5.0 V	(1)	0.80		V
			(2)	1.00		V
			(3)	1.40		V
Pedestal level	V _{PD}	CV _{OUT} : V _{DD1} = 5.0 V, V _{DD2} = 5.0 V	(1)	1.37		V
			(2)	1.57		V
			(3)	1.97		V

Continued on next page.

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Continued from preceding page.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Color burst low level	V _{CBL}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		1.07	V
			(2)		1.27	V
			(3)		1.67	V
Color burst high level	V _{CBH}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		1.67	V
			(2)		1.87	V
			(3)		2.27	V
Background color (other than blue) low level	V _{RSL0}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		1.23	V
			(2)		1.43	V
			(3)		1.83	V
Background color (other than blue) high level	V _{RSH0}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		2.37	V
			(2)		2.57	V
			(3)		2.97	V
Blue background color 1 low level	V _{RSL1}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		1.16	V
			(2)		1.36	V
			(3)		1.76	V
Blue background color 2 low level	V _{RSL2}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		1.52	V
			(2)		1.72	V
			(3)		2.12	V
Blue background color 1 and 2 high level	V _{RSH}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		2.01	V
			(2)		2.21	V
			(3)		2.61	V
Frame level 0	V _{BK0}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		1.50	V
			(2)		1.70	V
			(3)		2.10	V
Frame level 1	V _{BK1}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		2.08	V
			(2)		2.28	V
			(3)		2.68	V
Character level	V _{CHA}	CV _{OUT} : V _{DD1} = 5.0V, V _{DD2} = 5.0V	(1)		2.65	V
			(2)		2.85	V
			(3)		3.25	V

Notes: (1): When the sync level = 0.8 V

(2): When the sync level = 1.0 V

(3): When the sync level = 1.4 V

The blue background color (1 or 2) is set as an option.

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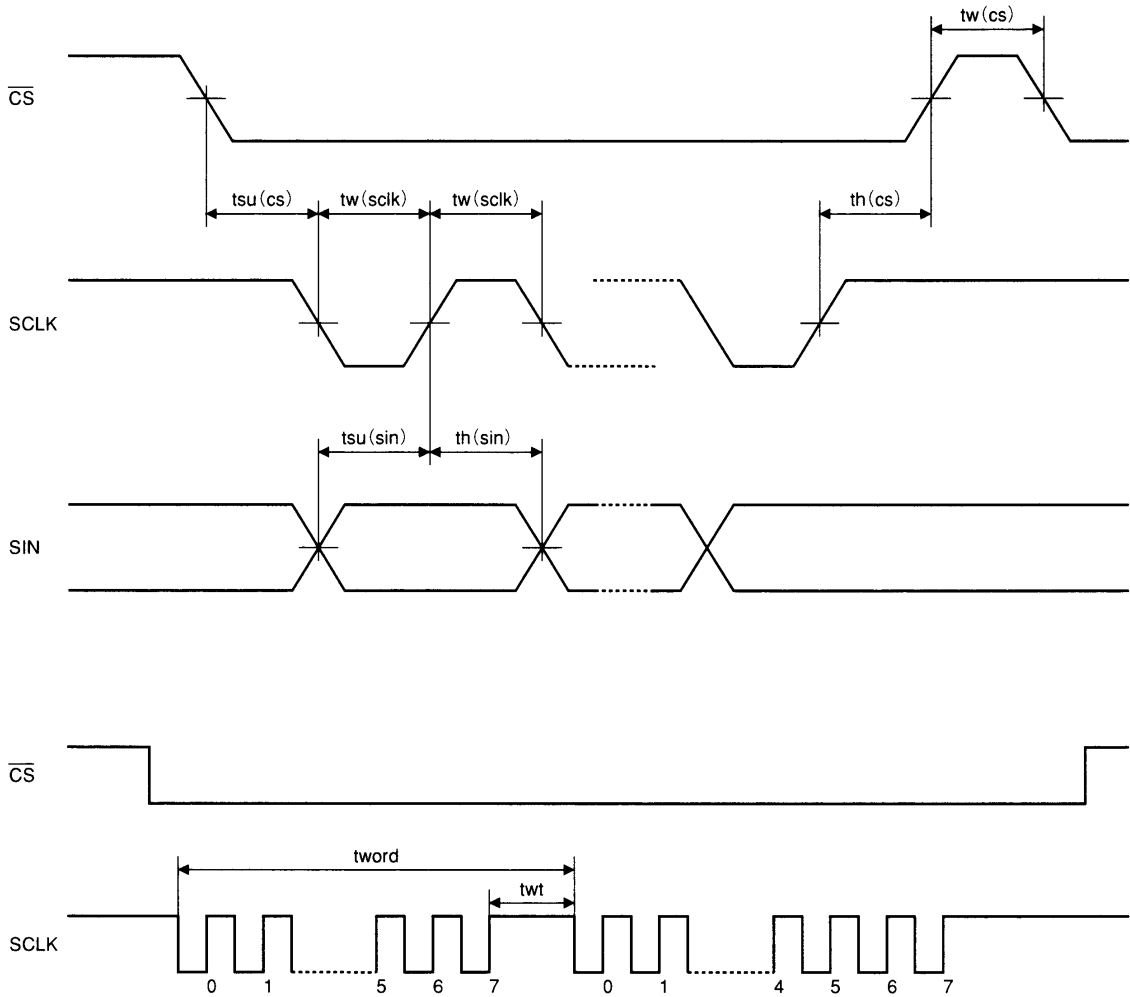
Timing Characteristics at $T_a = -30$ to $+70^\circ\text{C}$, $V_{DD1} = 5 \pm 0.5$ V

- OSD Write (See figure 1.)

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Minimum input pulse width	t_W (SCLK)	SCLK	200			ns
	t_W (CS)	$\overline{\text{CS}}$ (The period when $\overline{\text{CS}}$ is high)	1			μs
Data setup time	t_{SU} (CS)	$\overline{\text{CS}}$	200			ns
	t_{SU} (SIN)	SIN	200			ns
Data hold time	t_h (CS)	$\overline{\text{CS}}$	2			μs
	t_h (SIN)	SIN	200			ns
One word write time	t_{word}	The 8-bit data write time	4.2			μs
	t_{wt}	The RAM data write time	1			μs

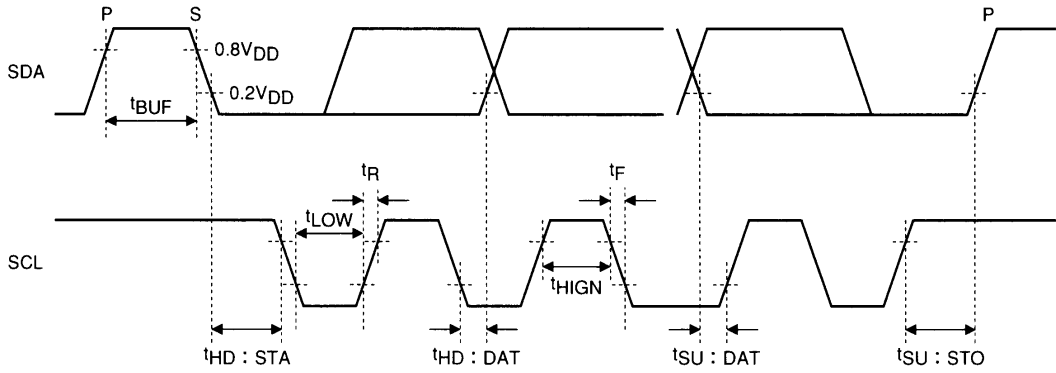
- PDC/VPS Write and Read (I²C timing)

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
SCL frequency	f_{SCL}				100	kHz
Bus release time	t_{BUF}		4.7			μs
Start/hold	t_{HD} : STA		4.0			μs
SCL low-level period	t_{LOW}		4.7			μs
SCL high-level period	t_{HIGH}		4.0			μs
Data hold	t_{HD} : DAT		0			μs
Data setup	t_{SU} : DAT		250			ns
Rise time	t_R				1000	ns
Fall time	t_F				300	ns
Stop/setup	t_{SU} : S _{TO}		4.0			μs



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Figure 1 OSD Serial Data Input Timing

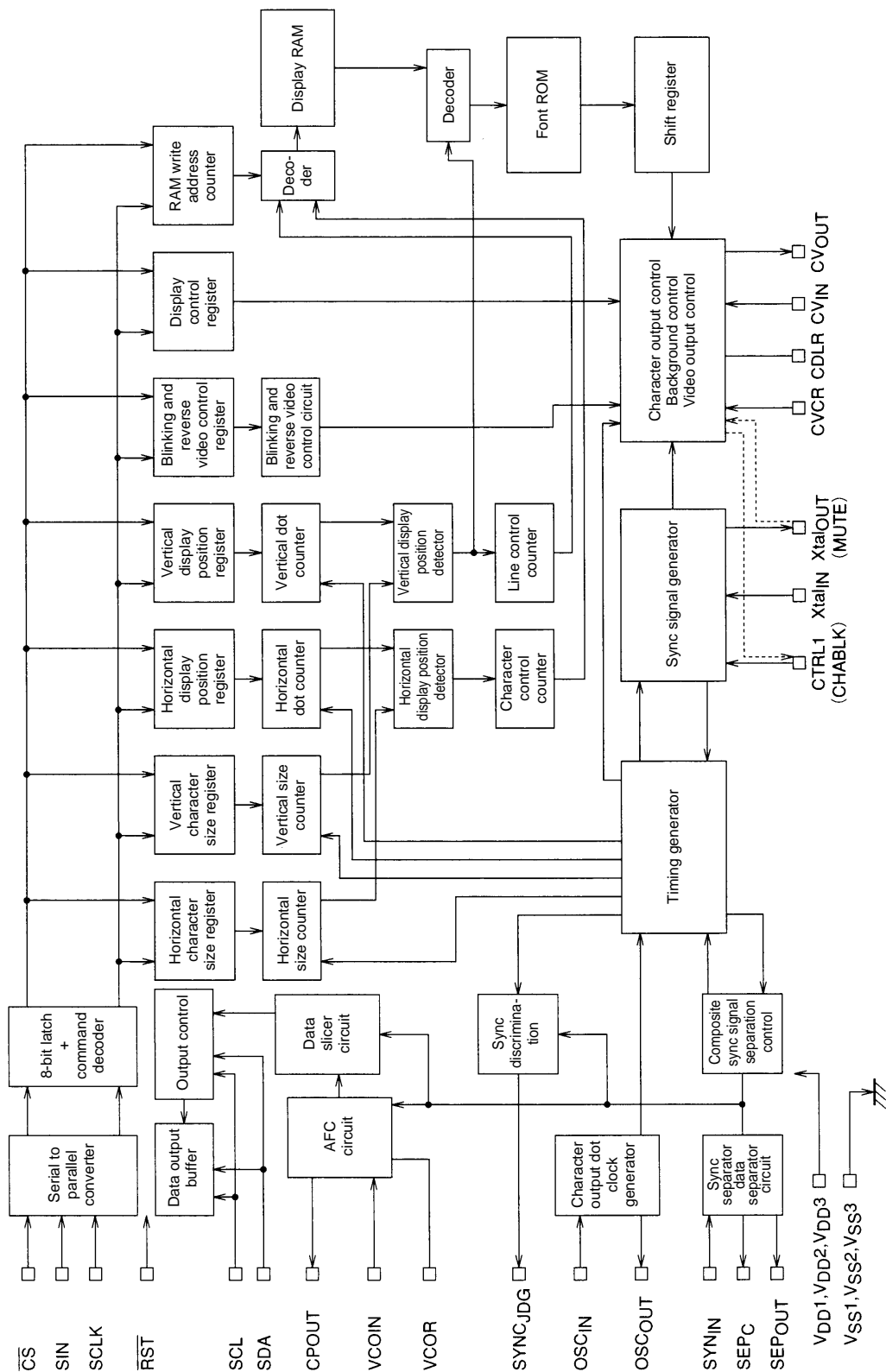


S: Start condition
P: Stop condition

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Figure 2 PDC/VPS Serial Timing (I²C bus)

System Block Diagram



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Display Control Commands

Display control commands have an 8-bit format and are transferred using the serial input function. Commands consist of a command identification code in the first byte and command data in the following bytes. The following commands are supported.

COMMAND0: Display memory (VRAM) write address setup command

COMMAND1: Display character data write command

COMMAND2: Vertical display start position and vertical character size setup command

COMMAND3: Horizontal display start position and horizontal character size setup command

COMMAND4: Display control setup command

COMMAND5: Display control setup command

COMMAND6: Synchronizing signal detection setup command

COMMAND7 to COMMAND12 and COMMAND18: Display control setup commands

COMMAND13 to COMMAND17: VPS/PDC control commands. These commands can only be written with the I²C bus (the SCL and SDA pins).

Display Control Command Table

Command	First byte								Second byte							
	Command identification code				Data				Data							
	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
COMMAND0 (Write address setup)	1	0	0	0	V3	V2	V1	V0	0	0	0	H4	H3	H2	H1	H0
COMMAND1 (Character write)	1	0	0	1	0	0	0	0	at	c6	c5	c4	c3	c2	c1	c0
COMMAND2 (Vertical character size and vertical display start position)	1	0	1	0	VS	VS	VS	VS	0	FS	VP	VP	VP	VP	VP	VP
COMMAND3 (Horizontal character size and horizontal display start position)	1	0	1	1	HS	HS	HS	HS	0	LC	HP	HP	HP	HP	HP	HP
COMMAND4 (Display control)	1	1	0	0	TST	RAM	OSC	SYS	0	BLK	BLK	BLK	BK	BK	RV	DSP
COMMAND5 (Display control)	1	1	0	1	NP	NP	NON	INT	0	RSH	HLF	BCL	CB	PH	PH	PH
COMMAND6 (Synchronizing signal detection)	1	1	1	0	SEL	MOD	DIS	MUT	0	RN	RN	RN	SN	SN	SN	SN
COMMAND7 (Display control)	1	1	1	1	0	0	0	0	0	CIN	CIN	VNP	VSP	MSK	MSK	EGL
COMMAND8 (Display control)	1	1	1	1	0	0	0	1	0	LNA	LNA	LNA	LNA	LPA	LPA	LPA
COMMAND9 (Display control)	1	1	1	1	0	0	1	0	0	LNB	LNB	LNB	LNB	LPB	LPB	LPB
COMMAND10 (Display control)	1	1	1	1	0	0	1	1	0	LNC	LNC	LNC	LNC	LPC	LPC	LPC
COMMAND11 (Display control)	1	1	1	1	0	1	0	0	0	0	VSP	VSP	LNC	MOD	LNB	MOD
COMMAND12 (Display control)	1	1	1	1	0	1	0	1	0	0	OTD	OTD	HLF	SEL	OTH	IND
COMMAND18 (Display control)	1	1	1	1	1	0	1	1	0	0	RNE	SJN	SJN	SJN	SJC	SJC
COMMAND13 (VPS/PDC control)	1	1	1	1	0	1	0	1	0	CPA	CPA	CPA	VPM	VPM	VPM	VPM
COMMAND14 (VPS/PDC control)	1	1	1	1	0	1	1	0	0	VMW	VMW	HBS	HBS	BMS	EMS	DCE
COMMAND15 (VPS/PDC control)	1	1	1	1	0	1	1	1	0	0	ECV	ECV	ECV	ECV	ECV	ECV
COMMAND16 (VPS/PDC control)	1	1	1	1	1	0	0	0	0	ECP	ECP	ECP	ECP	ECP	ECP	ECP
COMMAND17 (VPS/PDC control)	1	1	1	1	1	0	0	1	0	0	ECP	ECP	ECP	ECP	ECP	ECP

Once written, a first byte command identification code is stored until the next first byte is written. However, when the display character data write command (COMMAND1) is written, the LC74776/M locks into the display character data write mode, and another first byte cannot be written.

When the $\overline{\text{CS}}$ pin is set high, the LC74776/M is set to the COMMAND0 (display memory write address setup mode) state.

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COMMAND0 (Display memory write address setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 0 identification code. Display memory write address setup.	
6	–	0		
5	–	0		
4	–	0		
3	V3	0	Display memory line address (0 to B hexadecimal)	
		1		
2	V2	0		
		1		
1	V1	0		
		1		
0	V0	0		
		1		

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	–	0		
5	–	0		
4	H4	0	Display memory column address (0 to 17 hexadecimal)	
		1		
3	H3	0		
		1		
2	H2	0		
		1		
1	H1	0		
		1		
0	H0	0		
		1		

Note: All registers are set to 0 when the LC74776/M is reset by the $\overline{\text{RST}}$ pin.

COMMAND1 (Display character data write setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 1 identification code. Display character data write mode setup.	When this command is input, the LC74776/M locks in the display character data write mode until the $\overline{\text{CS}}$ pin goes high.
6	–	0		
5	–	0		
4	–	1		
3	–	0		
2	–	0		
1	–	0		
0	–	0		

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• Second byte

DA 0 to 7	Register	Contents		Notes	
		State	Function		
7	at	0	Character attribute off		
		1	Character attribute on		
6	c6	0	Character code (00 to FF hexadecimal)		
		1			
5	c5	0			
		1			
4	c4	0			
		1			
3	c3	0			
		1			
2	c2	0			(FE _{HEX} : Space character)
		1			(FF _{HEX} : Transparent space character)
1	c1	0			
		1			
0	c0	0			
		1			

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

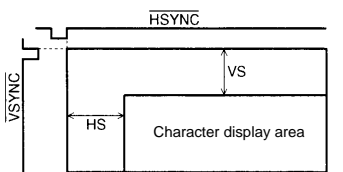
COMMAND2: Vertical display start position and vertical character size setup command

• First byte

DA 0 to 7	Register	Contents		Notes									
		State	Function										
7	–	1	Command 2 identification code. Vertical display start position and the vertical character size setup.										
6	–	0											
5	–	1											
4	–	0											
3	VS21	0	<table border="1" style="display: inline-table;"> <tr> <td style="text-align: center;">VS20 \ VS21</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1H/dot</td> <td style="text-align: center;">2H/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3H/dot</td> <td style="text-align: center;">1H/dot</td> </tr> </table>	VS20 \ VS21	0	1	0	1H/dot	2H/dot	1	3H/dot	1H/dot	Second line vertical character size
		VS20 \ VS21		0	1								
0	1H/dot	2H/dot											
1	3H/dot	1H/dot											
1													
2	VS20	0	<table border="1" style="display: inline-table;"> <tr> <td style="text-align: center;">VS10 \ VS11</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1H/dot</td> <td style="text-align: center;">2H/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3H/dot</td> <td style="text-align: center;">1H/dot</td> </tr> </table>	VS10 \ VS11	0	1	0	1H/dot	2H/dot	1	3H/dot	1H/dot	First line vertical character size
		VS10 \ VS11		0	1								
0	1H/dot	2H/dot											
1	3H/dot	1H/dot											
1													
1	VS11	0	<table border="1" style="display: inline-table;"> <tr> <td style="text-align: center;">VS10 \ VS11</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1H/dot</td> <td style="text-align: center;">2H/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3H/dot</td> <td style="text-align: center;">1H/dot</td> </tr> </table>	VS10 \ VS11	0	1	0	1H/dot	2H/dot	1	3H/dot	1H/dot	
		VS10 \ VS11		0	1								
0	1H/dot	2H/dot											
1	3H/dot	1H/dot											
1													
0	VS10	0	<table border="1" style="display: inline-table;"> <tr> <td style="text-align: center;">VS10 \ VS11</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1H/dot</td> <td style="text-align: center;">2H/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3H/dot</td> <td style="text-align: center;">1H/dot</td> </tr> </table>	VS10 \ VS11	0	1	0	1H/dot	2H/dot	1	3H/dot	1H/dot	
		VS10 \ VS11		0	1								
0	1H/dot	2H/dot											
1	3H/dot	1H/dot											
1													

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	FS	0	Crystal oscillator frequency: 2fsc	
		1	Crystal oscillator frequency: 4fsc	
5	VP5 (MSB)	0	If VS is the vertical display start position then: $VS = \alpha + H \times \left(2 \sum_{n=0}^5 2^n VP_n \right)$ H: The horizontal synchronization pulse period $\alpha = 20H$ (525H systems) $\alpha = 25H$ (625H systems)	The vertical display start position is set by the 6 bits VP0 to VP5. The weight of bit 1 is 2H.
		1		
4	VP4	0		
		1		
3	VP3	0		
		1		
2	VP2	0		
		1		
1	VP1	0		
		1		
0	VP0 (LSB)	0		
		1		



Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND3 (Horizontal display start position and horizontal size setup command)

• First byte

DA 0 to 7	Register	Contents			Notes									
		State	Function											
7	–	1	Command 3 identification code. Horizontal display start position and the horizontal character size setup.											
6	–	0												
5	–	1												
4	–	1												
3	HS21	0	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">VS20 VS21</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1Tc/dot</td> <td style="text-align: center;">2Tc/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3Tc/dot</td> <td style="text-align: center;">1Tc/dot</td> </tr> </table>		VS20 VS21	0	1	0	1Tc/dot	2Tc/dot	1	3Tc/dot	1Tc/dot	Second line horizontal character size
		VS20 VS21			0	1								
0	1Tc/dot	2Tc/dot												
1	3Tc/dot	1Tc/dot												
1														
2	HS20	0	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">VS10 VS11</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1Tc/dot</td> <td style="text-align: center;">2Tc/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3Tc/dot</td> <td style="text-align: center;">1Tc/dot</td> </tr> </table>		VS10 VS11	0	1	0	1Tc/dot	2Tc/dot	1	3Tc/dot	1Tc/dot	First line horizontal character size
		VS10 VS11			0	1								
0	1Tc/dot	2Tc/dot												
1	3Tc/dot	1Tc/dot												
1														
1	HS11	0	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">VS10 VS11</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1Tc/dot</td> <td style="text-align: center;">2Tc/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3Tc/dot</td> <td style="text-align: center;">1Tc/dot</td> </tr> </table>		VS10 VS11	0	1	0	1Tc/dot	2Tc/dot	1	3Tc/dot	1Tc/dot	First line horizontal character size
		VS10 VS11			0	1								
0	1Tc/dot	2Tc/dot												
1	3Tc/dot	1Tc/dot												
1														
0	HS10	0	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">VS10 VS11</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">1Tc/dot</td> <td style="text-align: center;">2Tc/dot</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">3Tc/dot</td> <td style="text-align: center;">1Tc/dot</td> </tr> </table>		VS10 VS11	0	1	0	1Tc/dot	2Tc/dot	1	3Tc/dot	1Tc/dot	First line horizontal character size
		VS10 VS11			0	1								
0	1Tc/dot	2Tc/dot												
1	3Tc/dot	1Tc/dot												
1														

• Second byte

DA 0 to 7	Register	Contents			Notes
		State	Function		
7	–	0	Second byte identification bit		
6	LC	0	Use the LC oscillator as the dot clock		Selects the dot clock used for character display in the horizontal direction.
		1	Use the crystal oscillator as the dot clock		
5	HP5 (MSB)	0	If HS is the horizontal start position then: $HS = T_c \times \left(2 \sum_{n=0}^5 2^n HP_n \right)$ Tc: Period of the oscillator connected to OSCIN/OSCOU in operating mode.		The horizontal display start position is set by the 6 bits HP0 to HP5. The weight of bit 1 is 2Tc.
		1			
4	HP4	0			
		1			
3	HP3	0			
		1			
2	HP2	0			
		1			
1	HP1	0			
		1			
0	HP0 (LSB)	0			
		1			

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND4 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 4 identification code. Display character data write setup.	
6	–	1		
5	–	0		
4	–	0		
3	TSTMOD	0	Normal operating mode	This bit must be set to 0
		1	Test mode	
2	RAMERS	0	Erase display RAM.(The RAM data is set to FF hexadecimal.)	Erasing RAM takes about 500 μs. (This operation must be executed in the DSPOFF state.)
		1		
1	OSCSPT	0	Do not stop the crystal and LC oscillators	Valid in external synchronization mode when character display is off
		1	Stop the crystal and LC oscillators	
0	SYSRST	0	Reset all registers and turn display off	The registers are reset when the \overline{CS} pin is low, and the reset state is cleared when \overline{CS} is set high.
		1		

• Second byte

DA 0 to 7	Register	Contents			Notes										
		State	Function												
7	–	0	Second byte identification bit												
6	BLK2	0	Character display area		Specifies the size for complete fill in										
		1	Video display area												
5	BLK1	0	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">BLK0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> </tr> <tr> <td style="text-align: center;">BLK1</td> <td style="text-align: center;">Blanking off</td> <td style="text-align: center;">Character size</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Frame size</td> <td style="text-align: center;">Complete fill in size</td> </tr> </table>		BLK0	0	1	BLK1	Blanking off	Character size	1	Frame size	Complete fill in size	Changes the blanking size	
		BLK0			0	1									
BLK1	Blanking off	Character size													
1	Frame size	Complete fill in size													
1															
4	BLK0	0	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">0</td> <td style="text-align: center;">Blanking off</td> <td style="text-align: center;">Character size</td> </tr> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">Frame size</td> <td style="text-align: center;">Complete fill in size</td> </tr> </table>		0	Blanking off	Character size	1	Frame size	Complete fill in size					
		0			Blanking off	Character size									
1	Frame size	Complete fill in size													
1															
3	BK1	0	Blinking period: About 0.5 s		Switches the blinking period										
		1	Blinking period: About 1.0 s												
2	BK0	0	Blinking off		Blinking in character reverse video mode switches the display between normal character display and reverse video display										
		1	Blinking on												
1	RV	0	Reverse video off												
		1	Reverse video on												
0	DSPON	0	Character display off												
		1	Character display on												

Note: All registers are set to 0 when the LC74776/M is reset by the \overline{RST} pin.

LC74776, 74776M

COMMAND5 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 5 identification code. Display control setup.	
6	–	1		
5	–	0		
4	–	1		
3	NP1	0	NTSC	Switches between NTSC and PAL
		1	PAL	
2	NP0	0	525 lines	Modified by the external input signal V
		1	625 lines	
1	NON	0	Interlaced	Switches between interlaced and noninterlaced video
		1	Noninterlaced	
0	INT	0	External synchronization	Switches between external and internal synchronization
		1	Internal synchronization	

• Second byte

DA 0 to 7	Register	Contents				Notes	
		State	Function				
7	–	0	Second byte identification bit				
6	RSHLV2	0	Background color level 1. (Level that is different from blue.)			Switches the background color signal level	
		1	Background color level 2. (Level that is identical to the blue level.)				
5	HLFINT	0	Normal mode				
		1	Partial internal synchronization mode				
4	BCL	0	Background color on			Only valid in internal synchronization mode	
		1	No background color. (Only the background level is set.)				
3	CB	0	Color burst signal output			Only valid when BCL is high	
		1	Color burst signal output stopped				
2	PH2	0	PH2	PH1	PH0 (phase)	Background color	Background color specification
		1	0	0	0	Cyan	
1	PH1	0	0	0	1	Yellow	
		1	0	1	0	Red	
0	PH0	0	0	1	1	Blue	
		1	1	0	0	Cyan - blue	
0	PH0	0	1	0	1	Green	
		1	1	1	0	Orange	
		1	1	1	1	Magenta	

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND6 (Synchronizing signal detection setup command)

• First byte

DA 0 to 7	Register	Contents			Notes	
		State	Function			
7	–	1	Command 6 identification code. Synchronizing signal control setup.			
6	–	1				
5	–	1				
4	–	0				
3	SEL0	0	SEL0	MOD0	SEPOUT	Switches the SEP _{OUT} (pin 19) output
		1	0	0	DAV	
2	MOD0	0	0	1	Sliced data width	
		1	1	0	CSYNC	
		1	1	1	ST pulse signal	
		0	12 lines			
1	DISLIN	0			Switches the number of lines displayed	
		1	10 lines			
0	MUT	0	Normal output		CV _{OUT} switching	
		1	CV _{IN} is cut and CV _{OUT} is held at the pedestal level			

• Second byte

DA 0 to 7	Register	Contents				Notes		
		State	Function					
7	–	0	Second byte identification bit					
6	RN2	0	Number of times HSYNC detected			External synchronizing signal detection control. Signal absent → signal present transition detection. Sets the sampling period in which SYNC can be detected continuously in the horizontal synchronizing signal period (1H). Values in parentheses apply when RNE0 (COM18) is 1.		
		1					0	0
5	RN1	0	0	0	1		4 (64)	
		1	0	1	0		8 (128)	
4	RN0	0	1	0	0		16 (256)	
		1						
3	SN3	0	Number of times HSYNC detected			External synchronizing signal detection control. Signal present → signal absent transition detection. Sets the sampling period in which SYNC cannot be detected continuously in the horizontal synchronizing signal period (1H).		
		1					0	0
2	SN2	0	0	0	0		1	32
		1	0	0	1		0	64
1	SN1	0	0	1	0		0	128
		1	1	0	0		0	256
0	SN0	0	1	0	0		0	
		1						

Note: All registers are set to 0 when the LC74776/M is reset by the $\overline{\text{RST}}$ pin.

LC74776, 74776M

COMMAND7 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 0 identification code	
2	–	0		
1	–	0		
0	–	0		

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7		0	Second byte identification bit	
6	CINSEL	0	Blank area (The logical OR of the character and frame signals)	CV _{CR} on signal switching
		1	Video signal display area	
5	CINCTL	0	CV _{CR} : off	CV _{CR} on/off switching
		1	CV _{CR} : on	
4	VNPSEL	0	V falling edge detection	Switches the V acquisition polarity in external mode when internal V separation is used.
		1	V rising edge detection	
3	VSPSEL	0	VSEP: about 8.9 μs (NTSC)	Switches the internal V separation period
		1	VSEP: about 17.8 μs (NTSC)	
2	MSKERS	0	Mask valid	Clears the HSYNC and VSYNK masks
		1	Mask invalid	
1	MSKSEL	0	3H (NTSC)	Switches the VSYNC mask
		1	20H (NTSC)	
0	EGL	0	Frame level 0 only (VBK0)	Switches the frame level. (Only valid when BLK0 is 0 and BLK1 is 1.)
		1	Two-stage frame level (VBK0 and VBK1)	

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND8 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 1 identification code	
2	–	0		
1	–	0		
0	–	1		

• Second byte

DA 0 to 7	Register	Contents		Notes																																																
		State	Function																																																	
7	–	0	Second byte identification bit																																																	
6	LNA3	0	<table border="1"> <thead> <tr> <th>LNA3</th> <th>LNA2</th> <th>LNA1</th> <th>LNA0</th> <th>Specified line</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>Do not change the line background</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>Line 1</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>Line 2</td> </tr> </tbody> </table>	LNA3	LNA2	LNA1	LNA0	Specified line	0	0	0	0	Do not change the line background	0	0	0	1	Line 1	0	0	1	0	Line 2	Specifies the line whose background is to be changed. (When the background color is specified for the same line with LNA*, LNB*, and LNC*, the command specified last becomes valid. The previously specified registers (LN* and LP*) are all cleared to 0.)																												
		LNA3	LNA2	LNA1	LNA0	Specified line																																														
0	0	0	0	Do not change the line background																																																
0	0	0	1	Line 1																																																
0	0	1	0	Line 2																																																
1	<table border="1"> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>Line 3</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>Line 4</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>Line 5</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>Line 6</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>Line 7</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>Line 8</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>Line 9</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>Line 10</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>Line 11</td> </tr> <tr> <td>1</td> <td>1</td> <td>–</td> <td>–</td> <td>Line 12</td> </tr> </tbody> </table>	0	0	1	1	Line 3	0	1	0	0	Line 4	0	1	0	1	Line 5	0	1	1	0	Line 6	0	1		1	1	Line 7	1	0	0	0	Line 8	1	0	0	1	Line 9	1	0	1	0	Line 10	1	0	1	1	Line 11	1	1	–	–	Line 12
0	0	1	1	Line 3																																																
0	1	0	0	Line 4																																																
0	1	0	1	Line 5																																																
0	1	1	0	Line 6																																																
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1	0	0	0	Line 8																																																
1	0	0	1	Line 9																																																
1	0	1	0	Line 10																																																
1	0	1	1	Line 11																																																
1	1	–	–	Line 12																																																
5	LNA2	0																																																		
		1																																																		
4	LNA1	0																																																		
		1																																																		
3	LNA0	0																																																		
		1																																																		
2	LPA2	0	<table border="1"> <thead> <tr> <th>LPA2</th> <th>LPA1</th> <th>LPA0</th> <th>Line background color (phase)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Cyan</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Yellow</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Red</td> </tr> </tbody> </table>	LPA2	LPA1	LPA0	Line background color (phase)	0	0	0	Cyan	0	0	1	Yellow	0	1	0	Red	Specifies the background color																																
		LPA2	LPA1	LPA0	Line background color (phase)																																															
0	0	0	Cyan																																																	
0	0	1	Yellow																																																	
0	1	0	Red																																																	
1	<table border="1"> <tbody> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Cyan - blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Green</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Orange</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Magenta</td> </tr> </tbody> </table>	0	1	1	Blue	1	0	0	Cyan - blue	1	0	1	Green	1	1	0	Orange	1	1		1	Magenta																														
0	1	1	Blue																																																	
1	0	0	Cyan - blue																																																	
1	0	1	Green																																																	
1	1	0	Orange																																																	
1	1	1	Magenta																																																	
1	LPA1	0																																																		
		1																																																		
0	LPA0	0																																																		
		1																																																		

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND9 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 2 identification code	
2	–	0		
1	–	1		
0	–	0		

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	LNB3	0	LNB3 LNB2 LNB1 LNB0 Specified line	Specifies the line whose background is to be changed. (When the background color is specified for the same line with LNA*, LNB*, and LNC*, the command specified last becomes valid. The previously specified registers (LN* and LP*) are all cleared to 0.)
			0 0 0 0 Do not change the line background	
		1	0 0 0 1 Line 1	
5	LNB2	0	0 0 1 0 Line 2	
			0 0 1 1 Line 3	
		1	0 1 0 0 Line 4	
4	LNB1	0	0 1 0 1 Line 5	
			0 1 1 0 Line 6	
		1	0 1 1 1 Line 7	
3	LNB0	0	1 0 0 0 Line 8	
			1 0 0 1 Line 9	
		1	1 0 1 0 Line 10	
2	LPB2	0	LPC2 LPC1 LPC0 Line background color (phase)	Specifies the background color
			0 0 0 Cyan	
		1	0 0 1 Yellow	
1	LPB1	0	0 1 0 Red	
			0 1 1 Blue	
		1	1 0 0 Cyan - blue	
0	LPB0	0	1 0 1 Green	
			1 1 0 Orange	
		1	1 1 1 Magenta	

Note: All registers are set to 0 when the LC74776/M is reset by the $\overline{\text{RST}}$ pin.

LC74776, 74776M

COMMAND10 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 3 identification code	
2	–	0		
1	–	1		
0	–	1		

• Second byte

DA 0 to 7	Register	Contents		Notes																				
		State	Function																					
7	–	0	Second byte identification bit																					
6	LNC3	0	<table border="1"> <thead> <tr> <th>LNB3</th> <th>LNB2</th> <th>LNB1</th> <th>LNB0</th> <th>Specified line</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>Do not change the line background</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>Line 1</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>Line 2</td> </tr> </tbody> </table>	LNB3	LNB2	LNB1	LNB0	Specified line	0	0	0	0	Do not change the line background	0	0	0	1	Line 1	0	0	1	0	Line 2	Specifies the line whose background is to be changed. (When the background color is specified for the same line with LNA*, LNB*, and LNC*, the command specified last becomes valid. The previously specified registers (LN* and LP*) are all cleared to 0.)
		LNB3	LNB2	LNB1	LNB0	Specified line																		
0	0	0	0	Do not change the line background																				
0	0	0	1	Line 1																				
0	0	1	0	Line 2																				
1	<table border="1"> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>Line 3</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>Line 4</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>Line 5</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>Line 6</td> </tr> </tbody> </table>	0	0	1	1	Line 3	0	1	0	0	Line 4	0	1	0	1	Line 5	0	1	1	0	Line 6			
0	0	1	1	Line 3																				
0	1	0	0	Line 4																				
0	1	0	1	Line 5																				
0	1	1	0	Line 6																				
5	LNC2	0	<table border="1"> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>Line 7</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>Line 8</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>Line 9</td> </tr> </tbody> </table>	0	0	1	1	Line 7	1	0	0	0	Line 8	1	0	0	1	Line 9						
		0	0	1	1	Line 7																		
1	0	0	0	Line 8																				
1	0	0	1	Line 9																				
1	<table border="1"> <tbody> <tr> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>Line 10</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>Line 11</td> </tr> <tr> <td>1</td> <td>1</td> <td>–</td> <td>–</td> <td>Line 12</td> </tr> </tbody> </table>	1	0	1	0	Line 10	1	0	1	1	Line 11	1	1	–	–	Line 12								
1	0	1	0	Line 10																				
1	0	1	1	Line 11																				
1	1	–	–	Line 12																				
4	LNC1	0	<table border="1"> <thead> <tr> <th>LPB2</th> <th>LPB1</th> <th>LPB0</th> <th>Line background color (phase)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Cyan</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Yellow</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Red</td> </tr> </tbody> </table>	LPB2	LPB1	LPB0	Line background color (phase)	0	0	0	Cyan	0	0	1	Yellow	0	1	0	Red	Specifies the background color				
		LPB2	LPB1	LPB0	Line background color (phase)																			
0	0	0	Cyan																					
0	0	1	Yellow																					
0	1	0	Red																					
1	<table border="1"> <tbody> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Cyan - blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Green</td> </tr> </tbody> </table>	0	1	1	Blue	1	0	0	Cyan - blue	1	0	1	Green											
0	1	1	Blue																					
1	0	0	Cyan - blue																					
1	0	1	Green																					
3	LNC0	0	<table border="1"> <tbody> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Orange</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Magenta</td> </tr> </tbody> </table>	1	1	0	Orange	1	1	1	Magenta													
		1	1	0	Orange																			
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1	<table border="1"> <tbody> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Magenta</td> </tr> </tbody> </table>	1	1	1	Magenta																			
1	1	1	Magenta																					
2	LPC2	0	<table border="1"> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>Cyan</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>Yellow</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>Red</td> </tr> </tbody> </table>	0	0	0	Cyan	0	0	1	Yellow	0	1	0	Red	Specifies the background color								
		0	0	0	Cyan																			
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1	<table border="1"> <tbody> <tr> <td>0</td> <td>1</td> <td>1</td> <td>Blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Cyan - blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Green</td> </tr> </tbody> </table>	0	1	1	Blue	1	0	0	Cyan - blue	1	0	1	Green											
0	1	1	Blue																					
1	0	0	Cyan - blue																					
1	0	1	Green																					
1	LPC1	0	<table border="1"> <tbody> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Orange</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Magenta</td> </tr> </tbody> </table>	1	1	0	Orange	1	1	1	Magenta	Specifies the background color												
		1	1	0	Orange																			
1	1	1	Magenta																					
1	<table border="1"> <tbody> <tr> <td>1</td> <td>0</td> <td>0</td> <td>Cyan - blue</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Green</td> </tr> </tbody> </table>	1	0	0	Cyan - blue	1	0	1	Green															
1	0	0	Cyan - blue																					
1	0	1	Green																					
0	LPC0	0	<table border="1"> <tbody> <tr> <td>1</td> <td>1</td> <td>0</td> <td>Orange</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Magenta</td> </tr> </tbody> </table>	1	1	0	Orange	1	1	1	Magenta		Specifies the background color											
		1	1	0	Orange																			
1	1	1	Magenta																					
1	<table border="1"> <tbody> <tr> <td>1</td> <td>1</td> <td>1</td> <td>Magenta</td> </tr> </tbody> </table>	1	1	1	Magenta																			
1	1	1	Magenta																					

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND11 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 4 identification code	
2	–	1		
1	–	0		
0	–	0		

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	–	0		
5	VSPDCK	0	LC oscillator: operating	LC oscillator control
		1	LC oscillator: stopped	
4	VSPSLC	0	VCO: operating	VCO control
		1	VCO: stopped	
3	LNCSEL	0	Normal line background color operation	Switches the RV mode background color for RV specified characters in LNC* specified lines
		1	RV characters have the background color specified by PH* and the RV character background color is white	
2	MOD3	0	The LNCSEL = 1 setting specifications	Valid when LNCSEL is high
		1	RV characters have the background color specified by PH* and characters are white	
1	LNBSEL	0	Normal line background color operation	Switches the RV mode background color for RV specified characters in LNB* specified lines
		1	RV characters have the background color specified by PH* and the RV character background color is white	
0	MOD2	0	The LNBSEL = 1 setting specifications	Valid when LNBSEL is high
		1	RV characters have the background color specified by PH* and characters are white	

Note: All registers are set to 0 when the LC74776/M is reset by the \overline{RST} pin.

LC74776, 74776M

COMMAND12 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 5 identification code	
2	–	1		
1	–	0		
0	–	1		

• Second byte

DA 0 to 7	Register	Contents			Notes	
		State	Function			
7	–	0	Second byte identification bit			
6	–	0				
5	OTDCS1	0	OTDS1	OTDS0	Dot clock	External synchronization mode dot clock setting
		1	0	0	LC oscillator	
4	OTDCS0	0	0	1	Crystal oscillator	
		1	1	0	VCO	
3	HLFTON	0	SEL2	HLFTON	Output	SYNC _{JDG} pin (pin 8) output switching. The halftone output line specification depends on background color specification (the logical OR of the 3-line specification).
		1	0	0	SYNC _{JDG}	
2	SEL2	0	0	1	Halftone	
		1	1	0	LOCK	
1	OTHS	0	CSYNCB (sync separator)		External synchronization mode H input switching	
		1	HDB (slicer AFC)			
0	IND3	0	LC oscillator		Internal synchronization mode dot clock setup	
		1	Crystal oscillator			

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND18 (Display control setup command)

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	1	Extended command B identification code	
2	–	0		
1	–	1		
0	–	1		

• Second byte

DA 0 to 7	Register	Contents				Notes	
		State	Function				
7	–	0	Second byte identification bit				
6	–	0					
5	RNE0	0	Sync discrimination signal absent → present: normal value			Changes the discrimination value for the sync discrimination signal absent → present transition	
		1	Sync discrimination signal absent → present: value shown in parentheses				
4	SJNS3	0	SJNS3	SJNS2	SJNS1	Number of times	Setting for the noise rejection circuit used for sync discrimination signal absent → present transition. The sync signal absent state is recognized when the number of high-level signals shown in the table is input during a 1H period.
		1	0	0	1	4	
3	SJNS2	0	0	1	0	8	
		1	0	1	1	16	
2	SJNS1	0	1	0	1	64	
		1	1	1	0	128	
1	SJCS1	0	SJCS1	SJCS0	PAL	NTSC	
		1	0	0	677 ns (1/3)	558 ns (1/2)	
0	SJCS0	0	0	1	903 ns (1/4)	838 ns (1/3)	
		1	1	0	450 ns (1/2)	1117 ns (1/4)	

Note: All registers are set to 0 when the LC74776/M is reset by the \overline{RST} pin.

LC74776, 74776M

COMMAND13 (VPS/PDC control setup command) I²C bus only

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 5 identification code	
2	–	1		
1	–	0		
0	–	1		

• Second byte

DA 0 to 7	Register	Contents		Notes																									
		State	Function																										
7	–	0	Second byte identification bit																										
6	CPA2	0	<table border="1" style="font-size: small;"> <thead> <tr> <th>CPA2</th> <th>CPA1</th> <th>CPA0</th> <th>Clock</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>No. 1</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>No. 2</td> </tr> </tbody> </table>	CPA2	CPA1	CPA0	Clock	0	0	0	No. 1	0	0	1	No. 2	Data acquisition clock selection. Shifts in multiples of 8 clock units with respect to the data.													
		CPA2	CPA1	CPA0	Clock																								
0	0	0	No. 1																										
0	0	1	No. 2																										
1	<table border="1" style="font-size: small;"> <tbody> <tr> <td>0</td> <td>1</td> <td>0</td> <td>No. 3</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>No. 4</td> </tr> </tbody> </table>	0	1	0	No. 3	0	1	1	No. 4																				
0	1	0	No. 3																										
0	1	1	No. 4																										
5	CPA1	0	<table border="1" style="font-size: small;"> <tbody> <tr> <td>1</td> <td>0</td> <td>0</td> <td>No. 5</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>No. 6</td> </tr> </tbody> </table>	1	0	0	No. 5	1	0	1	No. 6																		
		1	0	0	No. 5																								
1	0	1	No. 6																										
1	<table border="1" style="font-size: small;"> <tbody> <tr> <td>1</td> <td>1</td> <td>0</td> <td>No. 7</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>No. 8</td> </tr> </tbody> </table>	1	1	0	No. 7	1	1	1	No. 8																				
1	1	0	No. 7																										
1	1	1	No. 8																										
4	CPA0	0																											
		1																											
3	VPM3	0	<table border="1" style="font-size: small;"> <thead> <tr> <th>M3</th> <th>M2</th> <th>M1</th> <th>M0</th> <th>Operating mode</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td>0</td> <td>VPS</td> </tr> <tr> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>8/30/2 (PDC)</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>0</td> <td>Automatic PDC/VPS discrimination 1</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> <td>8/30/1 (UDT)</td> </tr> </tbody> </table>	M3	M2	M1	M0	Operating mode	0	0	0	0	VPS	0	0	0	1	8/30/2 (PDC)	0	0	1	0	Automatic PDC/VPS discrimination 1	0	0	1	1	8/30/1 (UDT)	Slicer mode selection
		M3	M2	M1	M0	Operating mode																							
0	0	0	0	VPS																									
0	0	0	1	8/30/2 (PDC)																									
0	0	1	0	Automatic PDC/VPS discrimination 1																									
0	0	1	1	8/30/1 (UDT)																									
1	<table border="1" style="font-size: small;"> <tbody> <tr> <td>0</td> <td>1</td> <td>0</td> <td>0</td> <td>Header time 1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td>1</td> <td>Header time 2</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>0</td> <td>Header time 3</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>Header time 4</td> </tr> </tbody> </table>	0	1	0	0	Header time 1	0	1	0	1	Header time 2	0	1	1	0	Header time 3	0	1	1	1	Header time 4								
0	1	0	0	Header time 1																									
0	1	0	1	Header time 2																									
0	1	1	0	Header time 3																									
0	1	1	1	Header time 4																									
2	VPM2	0	<table border="1" style="font-size: small;"> <tbody> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> <td>Status display 1</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>1</td> <td>Status display 2</td> </tr> </tbody> </table>	1	0	0	0	Status display 1	1	0	0	1	Status display 2																
		1	0	0	0	Status display 1																							
1	0	0	1	Status display 2																									
1	<table border="1" style="font-size: small;"> <tbody> <tr> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>Status display 3</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>Status display 4</td> </tr> </tbody> </table>	1	0	1	0	Status display 3	1	0	1	1	Status display 4																		
1	0	1	0	Status display 3																									
1	0	1	1	Status display 4																									
1	VPM1	0	<table border="1" style="font-size: small;"> <tbody> <tr> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>PAL Pulse</td> </tr> </tbody> </table>	1	1	0	0	PAL Pulse																					
		1	1	0	0	PAL Pulse																							
1	<table border="1" style="font-size: small;"> <tbody> <tr> <td>1</td> <td>1</td> <td>0</td> <td>1</td> <td>Automatic PDC/VPS discrimination 2</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>0</td> <td>Automatic PDC/VPS discrimination 3</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td>1</td> <td>Automatic PDC/VPS discrimination 4</td> </tr> </tbody> </table>	1	1	0	1	Automatic PDC/VPS discrimination 2	1	1	1	0	Automatic PDC/VPS discrimination 3	1	1	1	1	Automatic PDC/VPS discrimination 4													
1	1	0	1	Automatic PDC/VPS discrimination 2																									
1	1	1	0	Automatic PDC/VPS discrimination 3																									
1	1	1	1	Automatic PDC/VPS discrimination 4																									
0	VPM0	0																											
		1																											

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND14 (VPS/PDC control setup command) I²C bus only

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 6 identification code	
2	–	1		
1	–	1		
0	–	0		

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	VMWSE2	0	V mask period start - From the retrace period	CPOUT pin (pin 13) V mask period switching 2
		1	V mask period start - From 10H before the retrace period	
5	VMWSEL	0	The V mask period is the retrace period	CPOUT pin (pin 13) V mask period switching
		1	The V mask period is 9H	
4	HBS2	0	Clock running discrimination 1 (2 times)	Clock running discrimination count setting
		1	Clock running discrimination 2 (4 times)	
3	HBS1	0	Framing code discrimination 1	Framing code discrimination selection
		1	Framing code discrimination 2 (Single bad bits are ignored)	
2	BMS	0	Error check valid (Error checking can be turned on or off on a per-byte basis.)	When set to 0, if there are no errors in bytes for which error checking is turned on, those bytes are written to P-S. When set to 1, all bytes are written to P-S regardless of the error status.
		1	Error check invalid (Applications can select whether data for which an error is detected is held or writing on a per-byte basis.)	
1	EMS	0	Data hold	Specifies handling of bytes for which error checking is set to off but in which an error occurred when error checking is turned on
		1	Data write (When the error bit is 0 in VPS mode.)	
0	DCE	0	Error checking enabled for unused data bytes. VPS: bytes 3, 4, and 6 to 10, PDC: bytes 7 to 12, header 1: bytes 14 to 37, header 2: bytes 14 to 29, header 3: bytes 14 to 21, status 1 (3): bytes 7 to 25, status 2 (4): bytes 7 to 35	Error checking setting for unused data bytes. Biphasic (VPS), Hamming (PDC), and odd parity (header)
		1	Error checking disabled for unused data bytes. VPS: bytes 3, 4, and 6 to 10, PDC: bytes 7 to 12, header 1: bytes 14 to 37, header 2: bytes 14 to 29, header 3: bytes 14 to 21, status 1 (3): bytes 7 to 25, status 2 (4): bytes 7 to 35	

Note: All registers are set to 0 when the LC74776/M is reset by the $\overline{\text{RST}}$ pin.

LC74776, 74776M

COMMAND15 (VPS/PDC control setup command) I²C bus only

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	0	Extended command 7 identification code	
2	–	1		
1	–	1		
0	–	1		

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	–	0		
5	ECV15	0	Byte 15 biphas error check on (Data hold)	Specification when the VPS data BMS bit is 0. The item in parentheses is the specification when the VPS data BMS bit is 1.
		1	Byte 15 biphas error check off (Data write)	
4	ECV14	0	Byte 14 biphas error check on (Data hold)	
		1	Byte 14 biphas error check off (Data write)	
3	ECV13	0	Byte 13 biphas error check on (Data hold)	
		1	Byte 13 biphas error check off (Data write)	
2	ECV12	0	Byte 12 biphas error check on (Data hold)	
		1	Byte 12 biphas error check off (Data write)	
1	ECV11	0	Byte 11 biphas error check on (Data hold)	
		1	Byte 11 biphas error check off (Data write)	
0	ECV5	0	Byte 5 biphas error check on (Data hold)	
		1	Byte 5 biphas error check off (Data write)	

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

LC74776, 74776M

COMMAND16 (VPS/PDC control setup command) I²C bus only

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code. Display control setup.	
6	–	1		
5	–	1		
4	–	1		
3	–	1	Extended command 8 identification code	
2	–	0		
1	–	0		
0	–	0		

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	ECP19	0	Byte 19 Hamming error check on (Data hold) {Bytes 44, 28, 36, 20, 32, 42, 32, and 42}	Specification when the PDC data BMS bit is 0. The item in parentheses is the specification when the BMS bit is 1. The item in curly braces lists the odd parity check on/off bytes for header modes 1, 2, 3, and 4 and status mode 1, 2, 3, and 4.
		1	Byte 19 Hamming error check off (Data write) {Bytes 44, 28, 36, 20, 32, 42, 32, and 42}	
5	ECP18	0	Byte 18 Hamming error check on (Data hold) {Bytes 43, 27, 35, 19, 31, 41, 31, and 41}	
		1	Byte 18 Hamming error check off (Data write) {Bytes 43, 27, 35, 19, 31, 41, 31, and 41}	
4	ECP17	0	Byte 17 Hamming error check on (Data hold) {Bytes 42, 26, 34, 18, 30, 40, 30, and 40}	
		1	Byte 17 Hamming error check off (Data write) {Bytes 42, 26, 34, 18, 30, 40, 30, and 40}	
3	ECP16	0	Byte 16 Hamming error check on (Data hold) {Bytes 41, 25, 33, 17, 29, 39, 29, and 39}	
		1	Byte 16 Hamming error check off (Data write) {Bytes 41, 25, 33, 17, 29, 39, 29, and 39}	
2	ECP15	0	Byte 15 Hamming error check on (Data hold) {Bytes 40, 24, 32, 16, 28, 38, 28, and 38}	
		1	Byte 15 Hamming error check off (Data write) {Bytes 40, 24, 32, 16, 28, 38, 28, and 38}	
1	ECP14	0	Byte 14 Hamming error check on (Data hold) {Bytes 39, 23, 31, 15, 27, 37, 27, and 37}	
		1	Byte 14 Hamming error check off (Data write) {Bytes 39, 23, 31, 15, 27, 37, 27, and 37}	
0	ECP13	0	Byte 13 Hamming error check on (Data hold) {Bytes 38, 22, 30, 14, 26, 36, 26, and 36}	
		1	Byte 13 Hamming error check off (Data write) {Bytes 38, 22, 30, 14, 26, 36, 26, and 36}	

Note: All registers are set to 0 when the LC74776/M is reset by the $\overline{\text{RST}}$ pin.

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COMMAND17 (VPS/PDC control setup command) I²C bus only

• First byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	1	Command 7 identification code.	
6	–	1		
5	–	1		
4	–	1		
3	–	1	Display control setup.	
2	–	0		
1	–	0		
0	–	1		
			Extended command 9 identification code	

• Second byte

DA 0 to 7	Register	Contents		Notes
		State	Function	
7	–	0	Second byte identification bit	
6	–	0		
5	ECP25	0	Byte 25 Hamming error check on (Data hold)	Specification when the PDC data BMS bit is 0. The item in parentheses is the specification when the BMS bit is 1. The item in curly braces lists the odd parity check on/off bytes for header modes 1, 2, 3, and 4 and status mode 1, 2, 3, and 4.
		1	Byte 25 Hamming error check off (Data write)	
4	ECP24	0	Byte 24 Hamming error check on (Data hold)	
		1	Byte 24 Hamming error check off (Data write)	
3	ECP23	0	Byte 23 Hamming error check on (Data hold)	
		1	Byte 23 Hamming error check off (Data write)	
2	ECP22	0	Byte 22 Hamming error check on (Data hold) {Bytes , , , , 35, 45, 35, and 45}	
		1	Byte 22 Hamming error check off (Data write) {Bytes , , , , 35, 45, 35, and 45}	
1	ECP21	0	Byte 21 Hamming error check on (Data hold) {Bytes , , , , 34, 44, 34, and 44}	
		1	Byte 21 Hamming error check off (Data write) {Bytes , , , , 34, 44, 34, and 44}	
0	ECP20	0	Byte 20 Hamming error check on (Data hold) {Bytes 45, 29, 37, 21, 33, 43, 33, and 43}	
		1	Byte 20 Hamming error check off (Data write) {Bytes 45, 29, 37, 21, 33, 43, 33, and 43}	

Note: All registers are set to 0 when the LC74776/M is reset by the RST pin.

PDC/VPS Output Data Format

Data is output in order starting with bit 7 of byte 1.

Output data		PDC 8/30 mode				VPS mode		Header time mode 1 (3)		Header time mode 2 (4)		
		Format 1		Format 2								
Byte 1	Bit 7	byte 15	bit 0	byte 16	bit 0	byte 11	bit 0	byte 38	bit 0	byte 22	bit 0	
	6		1		1		1	(30)	1	(14)	1	
	5		2		2		2		2		2	
	4		3		3		3		3		3	
	3		4	byte17	bit 0	4		4		4		4
	2		5		1		5		5		5	
	1		6		2		6		6		6	
	0		7		3		7		7		7	
Byte 2	Bit 7	byte 16	bit 0	byte 18	bit 0	byte 12	bit 0	byte 39	bit 0	byte 23	bit 0	
	6		1		1		1	(31)	1	(15)	1	
	5		2		2		2		2		2	
	4		3		3		3		3		3	
	3		4	byte19	bit 0	4		4		4		4
	2		5		1		5		5		5	
	1		6		2		6		6		6	
	0		7		3		7		7		7	
Byte 3	Bit 7	byte 17	bit 0	byte 20	bit 0	byte 13	bit 0	byte 40	bit 0	byte 24	bit 0	
	6		1		1		1	(32)	1	(16)	1	
	5		2		2		2		2		2	
	4		3		3		3		3		3	
	3		4	byte 21	bit 0	4		4		4		4
	2		5		1		5		5		5	
	1		6		2		6		6		6	
	0		7		3		7		7		7	
Byte 4	Bit 7	byte 18	bit 0	byte 22	bit 0	byte 14	bit 0	byte 41	bit 0	byte 25	bit 0	
	6		1		1		1	(33)	1	(17)	1	
	5		2		2		2		2		2	
	4		3		3		3		3		3	
	3		4	byte 23	bit 0	4		4		4		4
	2		5		1		5		5		5	
	1		6		2		6		6		6	
	0		7		3		7		7		7	
Byte 5	Bit 7	byte 19	bit 0	byte 14	bit 0	byte 5	bit 0	byte 42	bit 0	byte 26	bit 0	
	6		1		1		1	(34)	1	(18)	1	
	5		2		2		2		2		2	
	4		3		3		3		3		3	
	3		4	byte 15	bit 0	4		4		4		4
	2		5		1		5		5		5	
	1		6		2		6		6		6	
	0		7		3		7		7		7	
Byte 6	Bit 7	byte 20	bit 0	byte 24	bit 0	byte 15	bit 0	byte 43	bit 0	byte 27	bit 0	
	6		1		1		1	(35)	1	(19)	1	
	5		2		2		2		2		2	
	4		3		3		3		3		3	
	3		4	byte 25	bit 0	4		4		4		4
	2		5		1		5		5		5	
	1		6		2		6		6		6	
	0		7		3		7		7		7	

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Output data		PDC 8/30 mode				VPS mode		Header time mode 1 (3)		Header time mode 2 (4)	
		Format 1		Format 2							
Byte 7	Bit 7	byte 21	bit 0	byte 13	bit 0	1		byte 44	bit 0	byte 28	bit 0
	6		1		1	1		(36)	1	(20)	1
	5		2		2	1			2		2
	4		3		3	1			3		3
	3		4	1	4	1			4		4
	2		5	1	5	1			5		5
	1		6	1	6	1			6		6
	0		7	1	7	0			7		7
Byte 8	Bit 7	byte 13	bit 0	Error information 1	byte 16	Error information	byte 11	byte 45	bit 0	byte 29	bit 0
	6		1		17		12	(37)	1	(21)	1
	5		2		18		13		2		2
	4		3		19		14		3		3
	3		4		20		5		4		4
	2		5		21		15		5		5
	1		6		22	0			6		6
	0		7		23	0			7		7
Byte 9	Bit 7	byte 14	bit 0	Error information 2	14			Error information	byte 38 (30)	Error information	byte 22 (14)
	6		1		15				39 (31)		23 (15)
	5		2		24				40 (32)		24 (16)
	4		3		25				41 (33)		25 (17)
	3		4		13				42 (34)		26 (18)
	2		5	0					43 (35)		27 (19)
	1		6	0					44 (36)		28 (20)
	0		7	0					45 (37)		29 (21)
Byte 10	Bit 7	byte 22	bit 0								
	6		1								
	5		2								
	4		3								
	3		4								
	2		5								
	1		6								
	0		7								
Byte 11	Bit 7	byte 23	bit 0								
	6		1								
	5		2								
	4		3								
	3		4								
	2		5								
	1		6								
	0		7								
Byte 12	Bit 7	byte 24	bit 0								
	6		1								
	5		2								
	4		3								
	3		4								
	2		5								
	1		6								
	0		7								
Byte 13	Bit 7	byte 25	bit 0								
	6		1								
	5		2								
	4		3								
	3		4								
	2		5								
	1		6								
	0		7								

Note: A value of 1 is output for section with no output data setting.

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Data is output in order starting with bit 7 of byte 1.

Status display 1 and 2: 8/30/2 - Status display 1 and 2: 8/30/1

Output data		Status display mode 1 (3)		Status display mode 2 (4)		PAL Puls
Byte 1	Bit 7	byte 26	bit 0	byte 36	bit 0	bit 0
	6	(26)	1	(36)	1	1
	5		2		2	2
	4		3		3	3
	3		4		4	4
	2		5		5	5
	1		6		6	6
	0		7		7	7
Byte 2	Bit 7	byte 27	bit 0	byte 37	bit 0	bit 8
	6	(27)	1	(37)	1	9
	5		2		2	10
	4		3		3	11
	3		4		4	12
	2		5		5	13
	1		6		6	0
	0		7		7	0
Byte 3	Bit 7	byte 28	bit 0	byte 38	bit 0	
	6	(28)	1	(38)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	
Byte 4	Bit 7	byte 29	bit 0	byte 39	bit 0	
	6	(29)	1	(39)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	
Byte 5	Bit 7	byte 30	bit 0	byte 39	bit 0	
	6	(30)	1	(40)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	
Byte 6	Bit 7	byte 31	bit 0	byte 41	bit 0	
	6	(31)	1	(41)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	
Byte 7	Bit 7	byte 32	bit 0	byte 42	bit 0	
	6	(32)	1	(42)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	

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Continued from preceding page.

Output data		Status display mode 1 (3)		Status display mode 2 (4)		PAL Puls
Byte 8	Bit 7	byte 33	bit 0	byte 43	bit 0	
	6	(33)	1	(43)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	
Byte 9	Bit 7	byte 34	bit 0	byte 44	bit 0	
	6	(34)	1	(44)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	
Byte 10	Bit 7	byte 35	bit 0	byte 45	bit 0	
	6	(35)	1	(45)	1	
	5		2		2	
	4		3		3	
	3		4		4	
	2		5		5	
	1		6		6	
	0		7		7	
Byte 11	Bit 7	Error	byte 26 (26)	Error	byte 36 (36)	
	6	information 1	27 (27)	information 1	37 (37)	
	5		28 (28)		38 (38)	
	4		29 (29)		39 (39)	
	3		30 (30)		40 (40)	
	2		31 (31)		41 (41)	
	1		32 (32)		42 (42)	
	0		33 (33)		43 (43)	
Byte 12	Bit 7	Error	byte 34 (34)	Error	byte 44 (44)	
	6	information 2	35 (35)	information 1	45 (45)	
	5		0		0	
	4		0		0	
	3		0		0	
	2		0		0	
	1		0		0	
	0		0		0	
Byte 13	Bit 7					
	6					
	5					
	4					
	3					
	2					
	1					
	0					

Note: A value of 1 is output for section with no output data setting.

Display Screen Structure

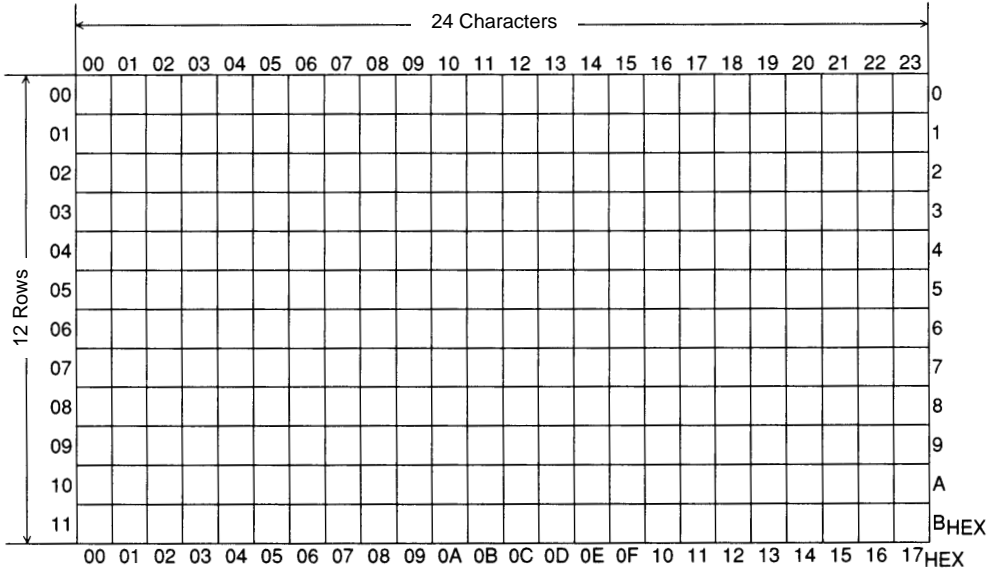
The display consists of 12 lines of 24 characters.

Up to 288 characters can be displayed.

The number of characters that can be displayed is reduced from the 288 maximum when enlarged characters are displayed.

Display memory addresses are specified as row (0 to 11 decimal) and column (0 to 23 decimal) addresses.

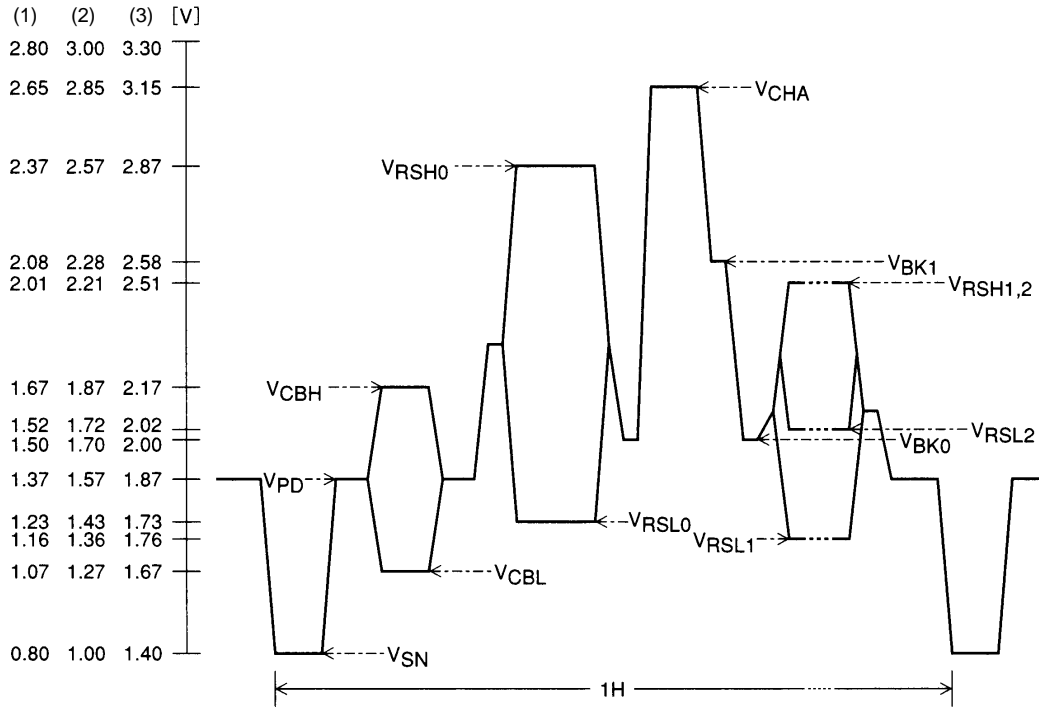
Display Screen Structure (display memory addresses)



A10741

Composite Video Signal Output Levels (internally generated levels)

CV_{OUT} output level waveform (V_{DD2} = 5.00 V)

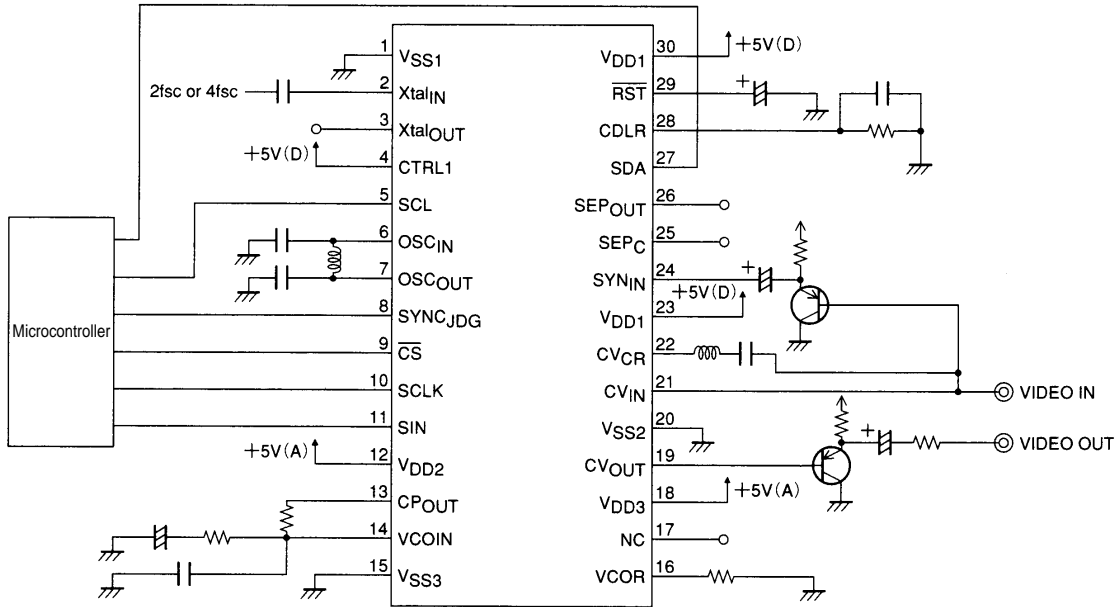


A10742

Output level	Output voltage (1) [V]	Output voltage (2) [V]	Output voltage (3) [V]
V _{CHA} : Character	2.65	2.85	3.25
V _{RS0} : Background colors other than blue: high	2.37	2.57	2.97
V _{RS1,2} : Blue background colors 1 and 2: high	2.01	2.21	2.61
V _{CBH} : Color burst high	1.67	1.87	2.27
V _{RS0} : Background colors other than blue: low	1.23	1.43	1.83
V _{RS1} : Blue background color 1: low	1.16	1.36	1.76
V _{RS2} : Blue background color 2: low	1.52	1.72	2.12
V _{BK1} : Frame 1	2.08	2.28	2.68
V _{BK0} : Frame 2	1.50	1.70	2.10
V _{PD} : Pedestal	1.37	1.57	1.97
V _{CBL} : Color burst low	1.07	1.27	1.67
V _{SN} : Sync	0.80	1.00	1.40

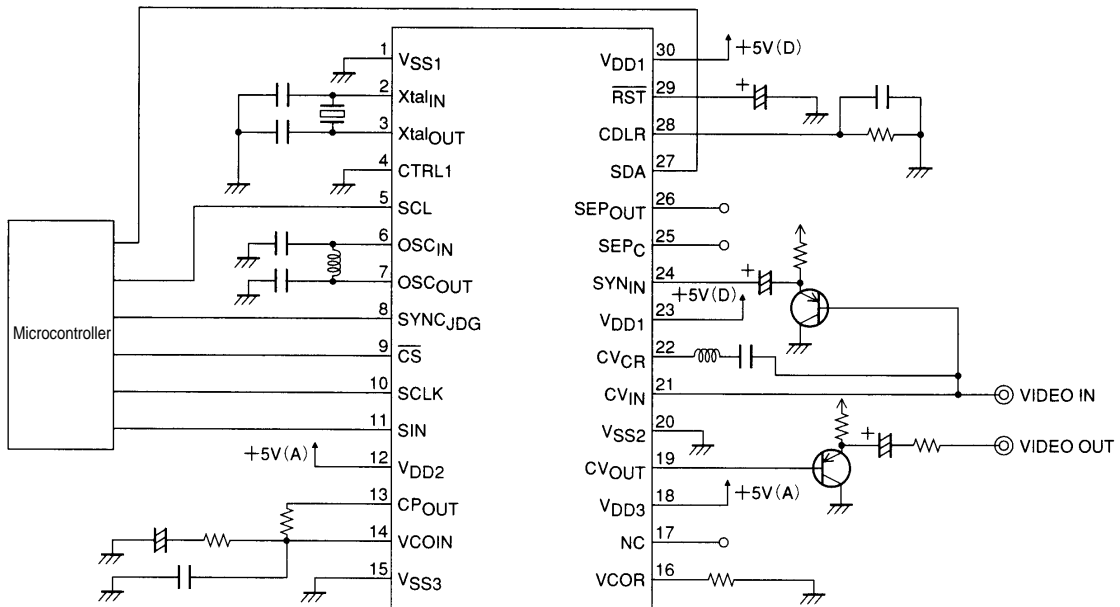
Application Circuit Examples (When used connected to a single-chip Y/C circuit)

- External system clock input



A10743

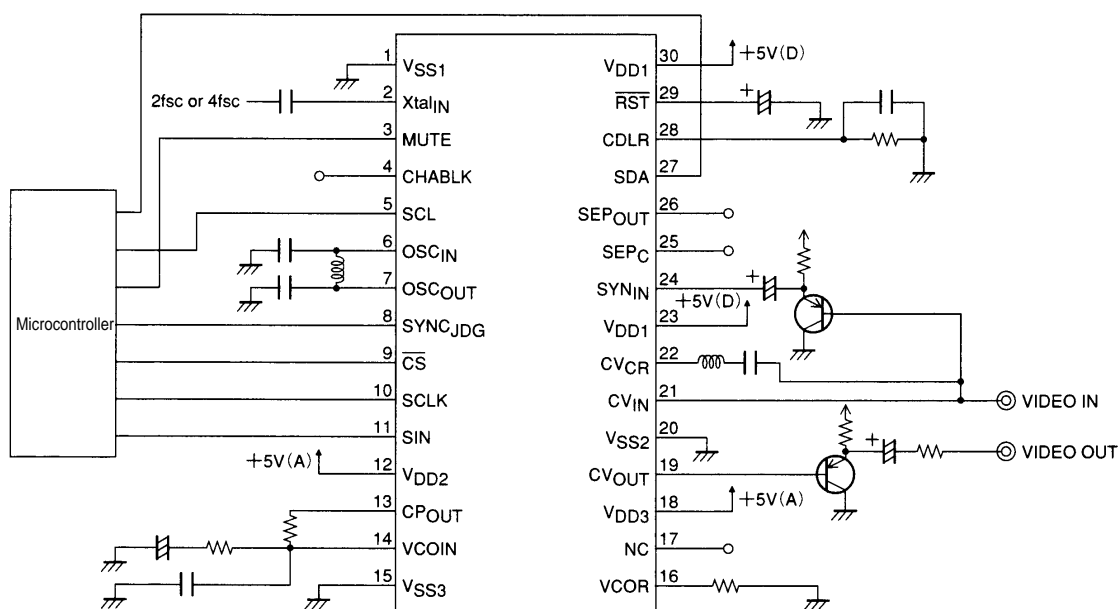
- Crystal oscillator



A10744

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- External system clock input (with pins 3 and 4 modified in the mask options)



A10745

The electrolytic capacitor connected to SYN_{IN} must be connected with the correct polarity when a sync tip level of 1.4 VDC (CV_{IN} input signal: sync tip = 1.4 V) is selected in the options for video signals generated with internal synchronization.

When V_{DD1} is 5.0 V, the SYN_{IN} input video signal pedestal level will be clamped to about 2.5 V.

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