

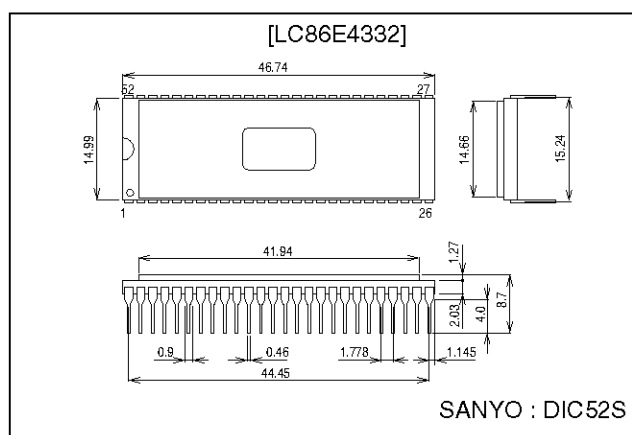
**LC86E4332****8-bit Single Chip Microcontroller****Preliminary****Overview**

The LC86E4332 is a CMOS 8-bit single chip microcontroller with UVEPROM for the LC864300 series.

This microcontroller has the function and the pin description of the LC864300 series mask ROM version, and the 32K-byte EPROM. The program data is rewritable. It is suitable for developing programs.

Package Dimensions

unit : mm

3225-DIC52S**Features**

- (1) Option switching by EPROM data
The option function of the LC864300 series can be specified by the EPROM data.
The functions of the trial pieces can be evaluated using the mass production board.
- (2) Internal EPROM capacity : 32768 bytes (For program)
: 16384 × 12 bits (For character)
- (3) Internal RAM capacity : 384 bytes

Mask ROM version	PROM capacity	RAM capacity
LC864332	32512 bytes	384 bytes
LC864328	28672 bytes	384 bytes
LC864324	24576 bytes	384 bytes
LC864320	20480 bytes	384 bytes
LC864316	16384 bytes	384 bytes
LC864312	12288 bytes	384 bytes

- (4) Operating supply voltage : 4.5 V to 5.5 V
- (5) Instruction cycle time : 0.99 μs to 40 μs
- (6) Operating temperature : +10°C to +40°C
- (7) The pin and the package compatible with the LC864300 series mask ROM version.
- (8) Applicable mask ROM version : LC864332/LC864328/LC864324/LC864320/LC864316/LC864312
- (9) Factory shipment : DIC52S

SANYO Electric Co.,Ltd. Semiconductor Bussiness Headquarters

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

Notice for Use

When using, take notice of the followings.

(1) Differences between the LC86E4332 and the LC864300 series

Items	LC86E4332	LC864332/28/24/20/16/12
Operation after reset releasing	The option is specified by degrees until 3 ms after going to a 'H' level to the reset terminal. The program is executed from 00H of the program counter.	The program is executed from 00H of the program counter immediately after going to a 'H' level to the reset terminal.
Operating supply voltage range (V _{DD})	4.5 V to 5.5 V	4.5 V to 5.5 V
Operating temperature range (Topr)	+10 to +40°C	−30 to +70°C
Power dissipation	Refer to 'electrical characteristics' on the semiconductor news.	

Port configurations of LC86E4332 and LC864332/28/24/20/16/12 are identical during the reset operation.

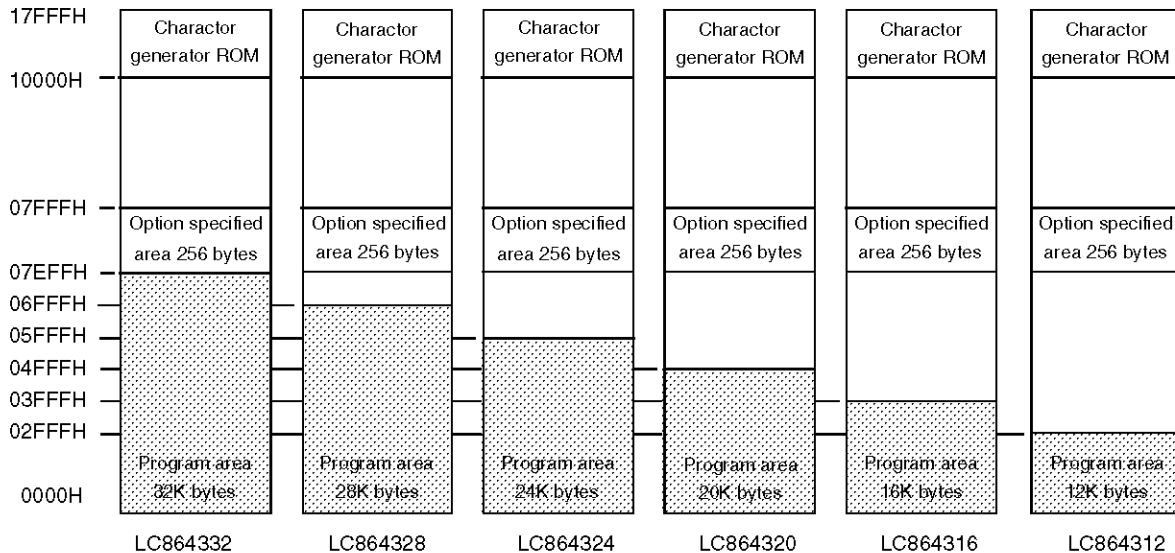
The LC86E4332 uses the program memory area of 256 bytes from 7F00H to 7FFFH to select the options. All LC86E4332 series' options can be specified with this configuration.

(2) Option

The option data is written with the option specifying program "SU86K.EXE". The option data is linked to the program area by the linkage loader "L86K.EXE".

(3) ROM space

The LC86E4332 and LC864300 series use the program memory area of 256 bytes from 7F00H to 7FFFH to select the options. The program memory capacity of this series is, at most, 32512 bytes addressed on 0000H to 7EFFFH.



How to Use

(1) Create a programming data for LC86E4332

Programming data for EPROM of the LC86E4332 is required.

Debugged evaluation file (EVA file) must be converted to an INTEL-HEX formatted file (HEX file) with the file converter program EVA2HEX.EXE. The HEX file is used as the programming data for the LC86E4332.

(2) How to program for the EPROM

The LC86E4332 can be programmed by the EPROM programmer with attachment W86EP4164D.

- Recommended EPROM programmer

Manufacturer	EPROM programmer
Advantest	R4945, R4944, R4943
Andou	AF-9704
AVAL	PKW-1100, PKW-3000
Minato electronics	MODEL1890A

- "27010 (Vpp = 12.5 V) Intel high speed programming" mode should be adopted.
- A jumper (DASEC) must be set to 'OFF' at programming.
- There are two ways to program the data of the hexa-decimal file described above into the EPROM of the LC86E4332.
 - How to program the program and the character data individually.

First, the hexa-decimal data of 00h to 07FFFh is programmed into the address 00h to 07FFFh of the EPROM.
Next, write the hexa-decimal data for character addressed 10000h to 17FFFh into the address of 10000h to 17FFFh.
 - How to program the program and the character data simultaneously.

First, copy the program data addressed from 00h to 07FFFh into the addresses 8000h to 0FFFFh with an EPROM programmer.
Next, write the data of 00h to 17FFFh into the EPROM of the LC86E4332.

An error will occur when the hexa-decimal data generated by the EVA2HEX program is programmed to the EPROM of the LC86E4332 directly.

(3) How to use the data security function

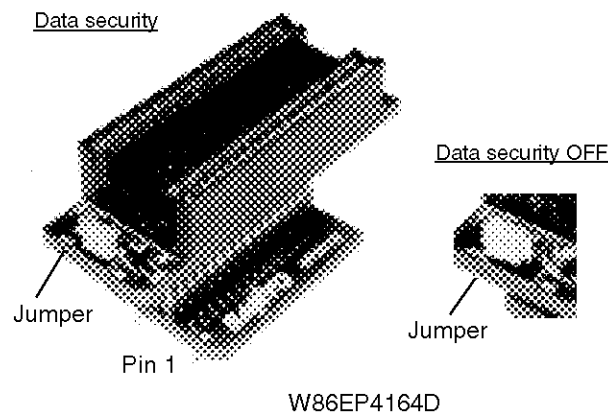
"Data security" is the function to disable the EPROM data from being read out.

The following is the process in order to execute data security function.

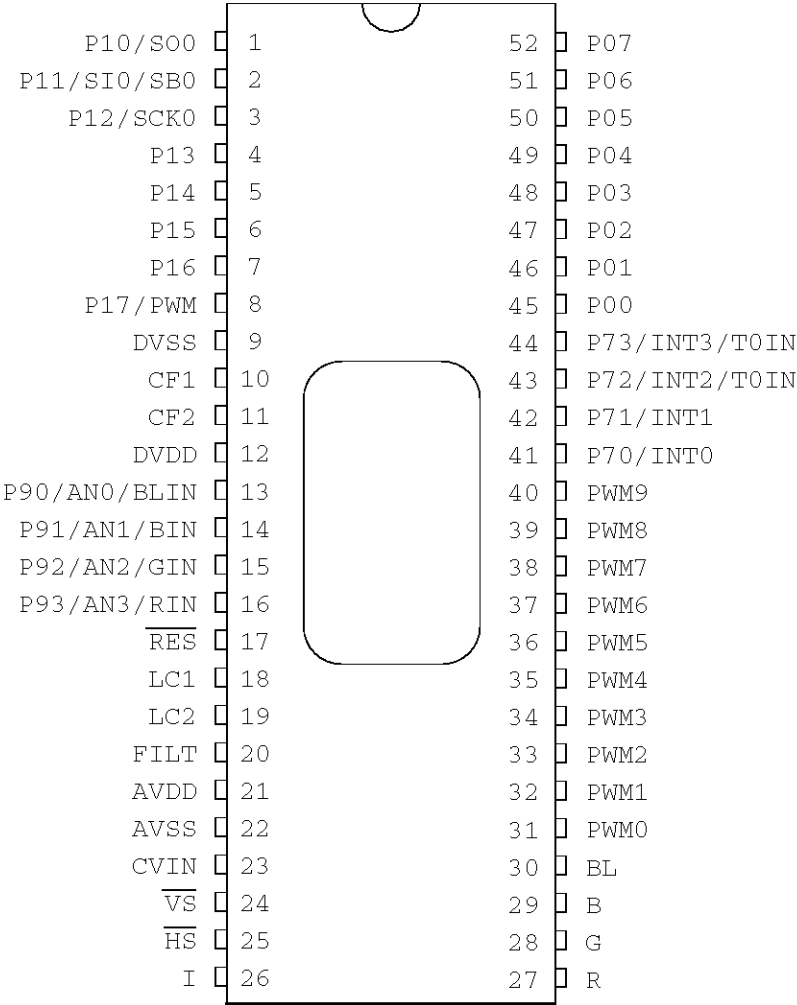
- Set the jumper of attachment 'ON'.
- Program again. The EPROM programmer will display an error. The error means that the data security functions normally. It is not a trouble of the EPROM programmer or the LSI.

Notes

- Data security is not executed when the data of all address have 'FF' at sequence 2 above.
- Data security cannot be executed by programming the sequential operation "BLANK=>PROGRAM=>VERIFY" at procedure 2 above.
- Set the jumper to 'OFF' after executing the data security.

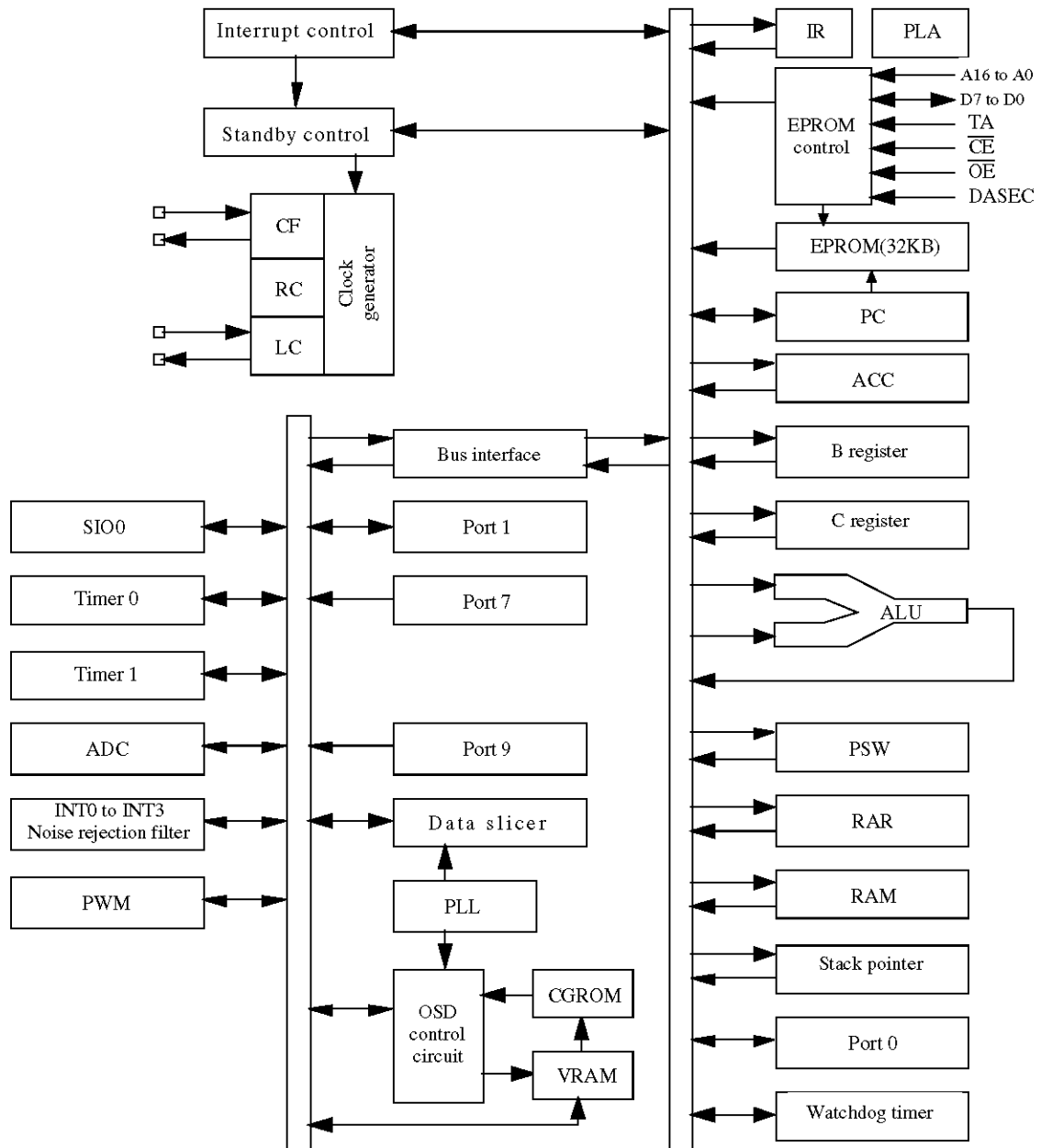


Pin Assignment



Top view

System Block Diagram



Pin Description

- Port option can be specified by bit units.
- At port 0, 'Pull-up resistor provided' when specifying CMOS output.
'Pull-up resistor not provided' when specifying N-ch open drain output.
- At port 1, 'Programmable pull-up resistor provided' when specifying either CMOS or N-ch open drain output.

Pin Description Table

Pin name	Pin No.	I/O	Function description	Option	PROM mode			
DVSS	9	—	Negative power supply for digital circuit					
CF1	10	I	Input terminal for ceramic resonator					
CF2	11	O	Output terminal for ceramic resonator					
DVDD	12	—	Positive power supply for digital circuit					
RES	17	I	Reset terminal					
LC1	18	I	LC oscillation circuit input terminal					
LC2	19	O	LC oscillation circuit output terminal					
FILT	20	O	Filter terminal for PLL					
AVDD	21	—	Positive power supply for analog circuit					
AVSS	22	—	Negative power supply for analog circuit					
CVIN	23	I	Video signal input terminal					
$\overline{\text{VS}}$	24	I	Vertical synchronization signal input terminal					
$\overline{\text{HS}}$	25	I	Horizontal synchronization signal input terminal					
I	26	O	Image intensity output					
R	27	O	Red (R) output terminal of RGB image output		A4 (*1)			
G	28	O	Green (G) output terminal of RGB image output		A5 (*1)			
B	29	O	Blue (B) output terminal of RGB image output		A6 (*1)			
BL	30	O	Fast blanking control signal Switch TV image signal and caption/OSD image signal		A7 (*1)			
PWM0 to PWM9	31 to 40	O	PWM0 to 9 output terminal 15 V withstand		PWM0 to 8 : A8 to A16 (*1) PWM9 : "L" fixed			
Port 0 P00 to P07	45 to 52	I/O	8-bit Input/output port Input/output can be specified in nibble units HOLD release input Interrupt input	Pull-up resistor Provided/not provided (in bit units) Output Format CMOS/Nch-OD (in bit units)				
Port 1 P10 to P17	1 to 8	I/O	8-bit Input/output port Input/output can be specified in bit units. Other function	Output Format CMOS/Nch-OD (in bit units)	D0 to D7 (*2)			
<table><tr><td>P10</td><td>SIO0 data output</td></tr><tr><td>P11</td><td>SIO0 data input /bus input/output</td></tr><tr><td>P12</td><td>SIO0 clock input/output</td></tr><tr><td>P17</td><td>Timer 1 (PWM) output</td></tr></table>			P10			SIO0 data output	P11	SIO0 data input /bus input/output
P10	SIO0 data output							
P11	SIO0 data input /bus input/output							
P12	SIO0 clock input/output							
P17	Timer 1 (PWM) output							

LC86E4332

Pin name	Pin No.	I/O	Function Description				Option	PROM mode								
Port 7	41 42 to 44	I/O I	4-bit input port Other function				Pull-up resistor provided/ not provided (in bit units)	P70 : VPP (*3) P71 : DASEC (*4) P72 : OE (*5) P73 : CE (*6)								
P70			<table><tr><td>P70</td><td>INT0 input/HOLD release input/ Nch-transistor output for watchdog timer</td></tr><tr><td>P71</td><td>INT1 input/HOLD release input</td></tr><tr><td>P72</td><td>INT2 input/timer 0 event input</td></tr><tr><td>P73</td><td>INT3 input (noise rejection filter attached input/timer 0 event input</td></tr></table>						P70	INT0 input/HOLD release input/ Nch-transistor output for watchdog timer	P71	INT1 input/HOLD release input	P72	INT2 input/timer 0 event input	P73	INT3 input (noise rejection filter attached input/timer 0 event input
P70									INT0 input/HOLD release input/ Nch-transistor output for watchdog timer							
P71									INT1 input/HOLD release input							
P72									INT2 input/timer 0 event input							
P73									INT3 input (noise rejection filter attached input/timer 0 event input							
P71 to P73																
Interrupt receiver format vector address																
	Rise	Fall	Rise/Fall	H level	L level	Vector										
INT0	enable	enable	disable	enable	enable	03H										
INT1	enable	enable	disable	enable	enable	0BH										
INT2	enable	enable	enable	disable	disable	13H										
INT3	enable	enable	enable	disable	disable	1BH										
Port 9	13 to 16	I	4-bit input port				External RGB input	A0 to A3 (*3)								
P90 to P93			Other functions AD converter input port (4 lines)													

*1 An → Address input

*2 Data I/O

*3 Power for programming

*4 Memory select input/output for data security

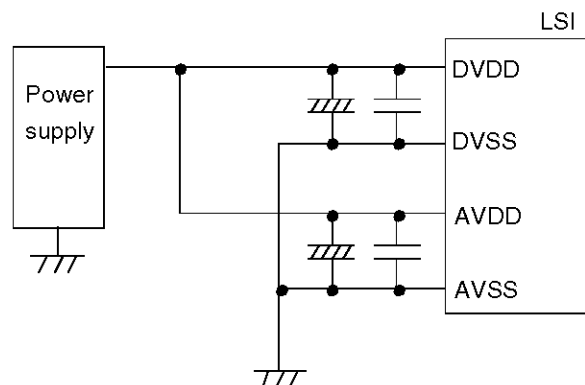
*5 Output Enable input

*6 Chip Enable input

- Port status in reset

Terminal	I/O	Pull-up resistor state at selecting pull-up option
Port 0	Input	Pull-up resistor OFF, ON after reset release
Port 1	Input	Programmable pull-up resistor OFF
Port 7	Input	Fixed pull-up resistor provided

* AVDD and AVSS are the power supply terminals for the analog operation block. DVDD and DVSS are the power supply terminals for the digital operation block. Connect as shown in the following figure to reduce the mutual noise influence.



Specifications

1. Absolute Maximum Ratings at Ta = 25°C, VSS = 0 V

Parameter		Symbol	Pins	Conditions	V _{DD} [V]	Ratings			Unit
						min	typ	max	
Supply voltage		V _{DD} max	DVDD, AVDD	DVDD=AVDD		−0.3		+7.0	V
Input voltage		V _I (1)	• P71, 72, 73 • Port 9 • $\overline{\text{RES}}$, HS, $\overline{\text{VS}}$, CVIN			−0.3		V _{DD} +0.3	
Output voltage		V _O (1)	R, G, B, BL, I, FILT			−0.3		V _{DD} +0.3	
		V _O (2)	PWM0 to PWM9			−0.3		+15	
Input/output voltage		V _{IO}	Ports 0, 1, P70			−0.3		V _{DD} +0.3	
High-level output current	Peak output current	I _{OPH} (1)	Ports 0, 1	• Pull-up MOS transistor output • At each pin		−2			mA
		I _{OPH} (2)	Ports 0, 1	• CMOS output • At each pin		−4			
		I _{OPH} (3)	R, G, B, BL, I	• CMOS output • At each pin		−5			
	Total output current	ΣI _{OA} H(1)	Port 1	The total of all pins		−10			
		ΣI _{OA} H(2)	Port 0	The total of all pins		−10			
		ΣI _{OA} H(3)	R, G, B, BL, I	The total of all pins		−15			
Low-level output current	Peak output current	I _{OPL} (1)	Ports 0, 1	At each pin				20	
		I _{OPL} (2)	P70	At each pin				30	
		I _{OPL} (3)	• R, G, B, BL, I • PWM0 to PWM9	At each pin				5	
	Total output current	ΣI _{OA} L(1)	Port 0	The total of all pins				40	
		ΣI _{OA} L(2)	Port 1, P70	The total of all pins				40	
		ΣI _{OA} L(3)	R, G, B, BL, I	The total of all pins				15	
		ΣI _{OA} L(4)	PWM0 to PWM9	The total of all pins				30	
Maximum power dissipation		P _d max	DIC52S	T _a = +10 to +40°C				430	mW
Operating temperature range		T _{opr}				+10		+40	°C
Storage temperature range		T _{stg}				−55		+125	

*DVSS and AVSS must be supplied the same voltage, VSS.
DVDD and AVDD must be supplied the same voltage, VDD.

VSS = DVSS = AVSS
VDD = DVDD = AVDD

2. Recommended Operating Range at Ta = +10°C to +40°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	Ratings				Unit
				V _{DD} [V]	min	typ	max	
Operating supply voltage range	V _{DD}	DVDD, AVDD	0.97 μs ≤ tCYC tCYC ≤ 1.02 μs		4.5		5.5	V
Hold voltage	V _{HD}	DVDD, AVDD	RAMs and the registers hold data at HOLD mode.		2.0		5.5	
Input high-level voltage	V _{IH} (1)	Port 0 (Schmitt)	Output disable	4.5 to 5.5	0.6V _{DD}		V _{DD}	
	V _{IH} (2)	• Port 1 (Schmitt) • P72, 73 • HS, VS	Output disable	4.5 to 5.5	0.75V _{DD}		V _{DD}	
	V _{IH} (3)	• P70 port input / interrupt • P71 • RES (Schmitt)	Output N-channel transistor OFF	4.5 to 5.5	0.75V _{DD}		V _{DD}	
	V _{IH} (4)	• P70 Watchdog timer input	Output N-channel transistor OFF	4.5 to 5.5	V _{DD} −0.5		V _{DD}	
	V _{IH} (5)	Port 9 port input		4.5 to 5.5	0.7V _{DD}		V _{DD}	
Input low-level voltage	V _{IL} (1)	Port 0 (Schmitt)	Output disable	4.5 to 5.5	V _{SS}		0.2V _{DD}	
	V _{IL} (2)	• Port 1 (Schmitt) • P72, 73 • HS, VS • Port 9	Output disable	4.5 to 5.5	V _{SS}		0.25V _{DD}	
	V _{IL} (3)	• P70 port input / interrupt • P71 • RES (Schmitt)	N-channel transistor OFF	4.5 to 5.5	V _{SS}		0.25V _{DD}	
	V _{IL} (4)	• P70 Watchdog timer input	N-channel transistor OFF	4.5 to 5.5	V _{SS}		0.6V _{DD}	
	V _{IL} (5)	Port 9 port input		4.5 to 5.5	V _{SS}		0.3V _{DD}	
CVIN input amplitude	V _{CVIN}	CVIN		5.0	1Vp-p −3dB	1Vp-p	1Vp-p +3dB	Vp-p
Operation cycle time	tCYC(1)		OSD function	4.5 to 5.5	0.97	1	1.02	μs
	tCYC(2)		Except OSD function	4.5 to 5.5	0.97		40	

* Vp-p : Peak-to-peak voltage

LC86E4332

Parameter	Symbol	Pins	Conditions	V _{DD} [V]	Ratings			Unit
					min	typ	max	
Oscillation frequency range (Note 1)	FmCF(1)	CF1, CF2	12 MHz (ceramic resonator oscillation) Refer to Figure 1.	4.5 to 5.5	11.76	12	12.24	MHz
	FmCF(2)		12.08 MHz (ceramic resonator oscillation) Refer to Figure 1.		11.84	12.08	12.32	
	FmLC	LC1, LC2	14.11 MHz (LC oscillation) Refer to Figure 2.	4.5 to 5.5		14.11		
	FmRC		RC oscillation	4.5 to 5.5	0.4	0.8	3.0	
Oscillation stable time period (Note 2)	tmsCF(1)	CF1, CF2	12 MHz (ceramic resonator oscillation) Refer to Figure 3.	4.5 to 5.5		0.02	0.2	ms
	tmsCF(2)		12.08 MHz (ceramic resonator oscillation) Refer to Figure 3.			0.02	0.2	

(Note 1) Refer to Table 1 and Table 2 for oscillation constant.

(Note 2) The oscillation stable time period refers to the time it takes to oscillate stably after the following conditions.

1. Applying the first supply voltage.
 2. Release of the HOLD mode.
 3. Release of the stopping of the main-clock oscillation.
- Refer to Figure 3 for details.

3. Electrical Characteristics at Ta = +10°C to +40°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	V _{DD} [V]	Ratings			Unit
					min	typ	max	
Input high-level current	I _{IH} (1)	<ul style="list-style-type: none"> Port 1 Port 0 without pull-up MOS transistor 	<ul style="list-style-type: none"> Output disable Pull-up MOS transistor OFF V_{IN} = V_{DD} (including the off-leak current of the output transistor)	4.5 to 5.5			1	μA
	I _{IH} (2)	<ul style="list-style-type: none"> Port 7 without pull-up MOS transistor Port 9 $\overline{\text{RES}}$ $\overline{\text{HS}}, \overline{\text{VS}}$ 	V _{IN} = V _{DD}	4.5 to 5.5			1	
Input low-level current	I _{IL} (1)	<ul style="list-style-type: none"> Port 1 Port 0 without pull-up MOS transistor 	<ul style="list-style-type: none"> Output disable Pull-up MOS transistor OFF V_{IN} = V_{SS} (including the off-leak current of the output transistor)	4.5 to 5.5	−1			
	I _{IL} (2)	<ul style="list-style-type: none"> Port 7 without pull-up MOS transistor Port 9 	V _{IN} = V _{SS}	4.5 to 5.5	−1			
	I _{IL} (3)	<ul style="list-style-type: none"> $\overline{\text{RES}}$ $\overline{\text{HS}}, \overline{\text{VS}}$ 	V _{IN} = V _{SS}	4.5 to 5.5	−1			
Output high-level voltage	V _{OH} (1)	CMOS output of ports 0, 1	I _{OH} = −1.0 mA	4.5 to 5.5	V _{DD} −1			V
	V _{OH} (2)	R, G, B, BL, I	I _{OH} = −0.1 mA	4.5 to 5.5	V _{DD} −0.5			
Output low-level voltage	V _{OL} (1)	Ports 0, 1	I _{OL} = 10 mA	4.5 to 5.5			1.5	
	V _{OL} (2)	Ports 0, 1	<ul style="list-style-type: none"> I_{OL} = 1.6 mA The total current of the ports 0, 1 is 40 mA or less. 	4.5 to 5.5			0.4	
	V _{OL} (3)	<ul style="list-style-type: none"> R, G, B, BL, I 	<ul style="list-style-type: none"> I_{OL} = 3.0 mA PWM0 to PWM9 The current of any unmeasured pin is 3 mA or less. 	4.5 to 5.5			0.4	
	V _{OL} (4)	P70	I _{OL} = 1 mA	4.5 to 5.5			0.4	
Pull-up MOS transistor resistance	R _{pu}	<ul style="list-style-type: none"> Ports 0, 1 Port 7 	V _{OH} = 0.9V _{DD}	4.5 to 5.5	13	38	80	kΩ
Output off-leakage current	I _{OFF}	PWM0 to PWM9	V _{OUT} = 13.5 V	4.5 to 5.5			5	μA
Hysteresis voltage	V _{HIS}	<ul style="list-style-type: none"> Ports 0, 1 Port 7 $\overline{\text{RES}}$ $\overline{\text{HS}}, \overline{\text{VS}}$ 	Output disable	4.5 to 5.5		0.1V _{DD}		V

LC86E4332

Parameter	Symbol	Pins	Conditions	Ratings				Unit
				V _{DD} [V]	min	typ	max	
Input clamp voltage	V _{CLMP}	CVIN		5.0	2.3	2.5	2.7	V
Pin capacitance	CP	All pins	<ul style="list-style-type: none">• f = 1 MHz• Unmeasured terminals for the input are set to V_{SS} level.• Ta = 25°C	4.5 to 5.5		10		pF

4. Serial Input/Output Characteristics at Ta = +10°C to +40°C, V_{SS} = 0 V

Parameter			Symbol	Pins	Conditions		Ratings			Unit
						V _{DD} [V]	min	typ	max	
Serial clock	Input clock	Cycle	tCKCY(1)	• SCK0 • SCLK0	Refer to Figure 5.	4.5 to 5.5	2			tCYC
		Low-level pulse width	tCKL(1)				1			
		High-level pulse width	tCKH(1)				1			
	Output clock	Cycle	tCKCY(2)	• SCK0 • SCLK0	• Use a pull-up resistor (1 kΩ) when open drain output • Refer to Figure 5.	4.5 to 5.5	2			
		Low-level pulse width	tCKL(2)					1/2tCKCY		
		High-level pulse width	tCKH(2)					1/2tCKCY		
Serial input	Data set-up time	tICK	• SI0	• Data set-up to SCK0 rising • Data hold from SCK0 rising • Refer to Figure 5.	4.5 to 5.5	0.1			μs	
	Data hold time	tCKI			4.5 to 5.5	0.1				
Serial output	Output delay time (External serial clock)	tCKO(1)	• SO0	• Use a pull-up resistor (1 kΩ) when open drain output • Data set-up to SCK0 falling • Data hold from SCK0 falling • Refer to Figure 5.	4.5 to 5.5			7/12tCYC +0.2	μs	
	Output delay time (Internal serial clock)	tCKO(2)			4.5 to 5.5			1/3tCYC +0.2		

5. Pulse Input Conditions at Ta = +10°C to +40°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	V _{DD} [V]	Ratings			Unit
					min	typ	max	
High/low level pulse width	tPIH(1) tPIL(1)	• INT0, INT1 • INT2/T0IN	• Interrupt acceptable • Timer0-countable	4.5 to 5.5	1			tCYC
	tPIH(2) tPIL(2)	INT3/T0IN (The noise rejection clock is set to 1/1)	• Interrupt acceptable • Timer0-countable	4.5 to 5.5	2			
	tPIH(3) tPIL(3)	INT3/T0IN (The noise rejection clock is set to 1/16)	• Interrupt acceptable • Timer0-countable	4.5 to 5.5	32			
	tPIL(4)	$\overline{\text{RES}}$	Reset acceptable	4.5 to 5.5	200			μs
	tPIH(5) tPIL(5)	$\overline{\text{HS}}$, $\overline{\text{VS}}$	Display position controllable Each active edge of $\overline{\text{HS}}$, $\overline{\text{VS}}$ must be more than 1tCYC. Refer to Figure 7.	4.5 to 5.5	10			tCYC
Rising/falling time	tTHL tTLH	$\overline{\text{HS}}$	Refer to Figure 7.	4.5 to 5.5			500	ns
Horizontal pull-in range	FH	$\overline{\text{HS}}$	The monitor point in Figure 10 is 1/2 V _{DD} .	4.5 to 5.5	15.23	15.73	16.23	kHz

6. A/D Converter Characteristics at Ta = +10°C to +40°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	V _{DD} [V]	Ratings			Unit
					min	typ	max	
Resolution	N			4.5 to 5.5		5		bit
Absolute precision	ET		(Note 3)	4.5 to 5.5		±1/4	±3/4	LSB
Conversion time	tCAD	From Vref selection to when the result is output	1 bit conversion time = 2tCYC	4.5 to 5.5		2		μs
Reference current	I _{REF}		(Regulate the ladder resistor)	4.5 to 5.5		1.0	2.0	mA
Analog input voltage range	V _{AIN}	AN0 to AN3		4.5 to 5.5	V _{SS}		V _{DD}	V
Analog port input current	I _{AINH}		V _{AIN} = V _{DD}	4.5 to 5.5			1	μA
	I _{AINL}		V _{AIN} = V _{SS}	4.5 to 5.5	-1			

(Note 3) Absolute precision excepts quantizing error (±1/2 LSB).

7. Current Drain Characteristics at Ta = +10°C to +40°C , V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	V _{DD} [V]	Ratings			Unit
					min	typ	max	
Current drain during basic operation (Note 4)	I _{DDOP} (1)	DVDD, AVDD	<ul style="list-style-type: none"> FmCF = 12 MHz or FmCF = 12.08 MHz when ceramic resonator oscillation FmLC = 14.11 MHz when LC oscillation System clock : CF oscillation Internal RC oscillation stops 	4.5 to 5.5		25	38	mA
Current drain in HALT mode (Note 4)	I _{DDHALT} (1)	DVDD, AVDD	<ul style="list-style-type: none"> HALT mode FmCF = 12 MHz or FmCF = 12.08 MHz when ceramic resonator oscillation FmLC = 0 Hz (when oscillation stops) System clock : CF oscillation Internal RC oscillation stops. 	4.5 to 5.5		5	10	mA
	I _{DDHALT} (2)	DVDD, AVDD	<ul style="list-style-type: none"> HALT mode FmCF = 0 MHz (when oscillation stops) FmLC = 0 Hz (when oscillation stops) System clock : Internal RC 	4.5 to 5.5		600	1200	μA
Current drain in HOLD mode (Note 4)	I _{DDHOLD}	DVDD, AVDD	<ul style="list-style-type: none"> HOLD mode All oscillation stops. 	4.5 to 5.5		0.05	20	μA

(Note 4) The currents to the output transistors and the pull-up MOS transistors are ignored.

Oscillation types	Manufacturer	Oscillator	C1	C2
12 MHz ceramic resonator oscillation	Murata	CSA12.0MTZ	33 pF	33 pF
		CST12.0MTW	on chip	
	Kyocera	KBR-12.0M	33 pF	33 pF
12.08 MHz ceramic resonator oscillation	Murata	CSA12.0MTZ021	33 pF	33 pF
		CST12.0MTW021	on chip	
	Kyocera	KBR-12.08M	33 pF	33 pF

* Both C1 and C2 must use K rank ($\pm 10\%$) and SL characteristics.

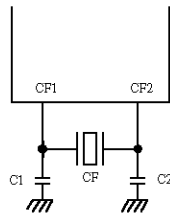
Table 1. Ceramic Resonator Oscillation Guaranteed Constant (main-clock)

Oscillation types	L	C3	C4
14.11 MHz LC oscillation	4.7 μ H	33 pF	45 pF (Trimmer)
	4.7 μ H $\pm 10\%$ (Variable)	33 pF	33 pF

* See Figures 11 and 12.

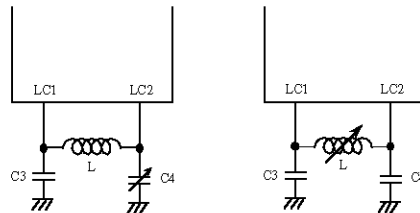
Table 2. LC oscillation Guaranteed Constant (OSD clock)

- (Notes)
- Since the circuit pattern affects the oscillation frequency, place the oscillation-related parts as close to the oscillation pins as possible with the shortest pattern length.
 - If you use other oscillators herein, we provide no guarantee for the characteristics.
 - Adjust the voltage of monitor point in Figure 10 to $1/2 V_{DD} \pm 10\%$ by the LC oscillation constant 'L' or 'C' to lock the PLL circuit.



Main clock

Figure 1 Ceramic Resonator Oscillation



OSD clock

Figure 2 LC Resonator Oscillation

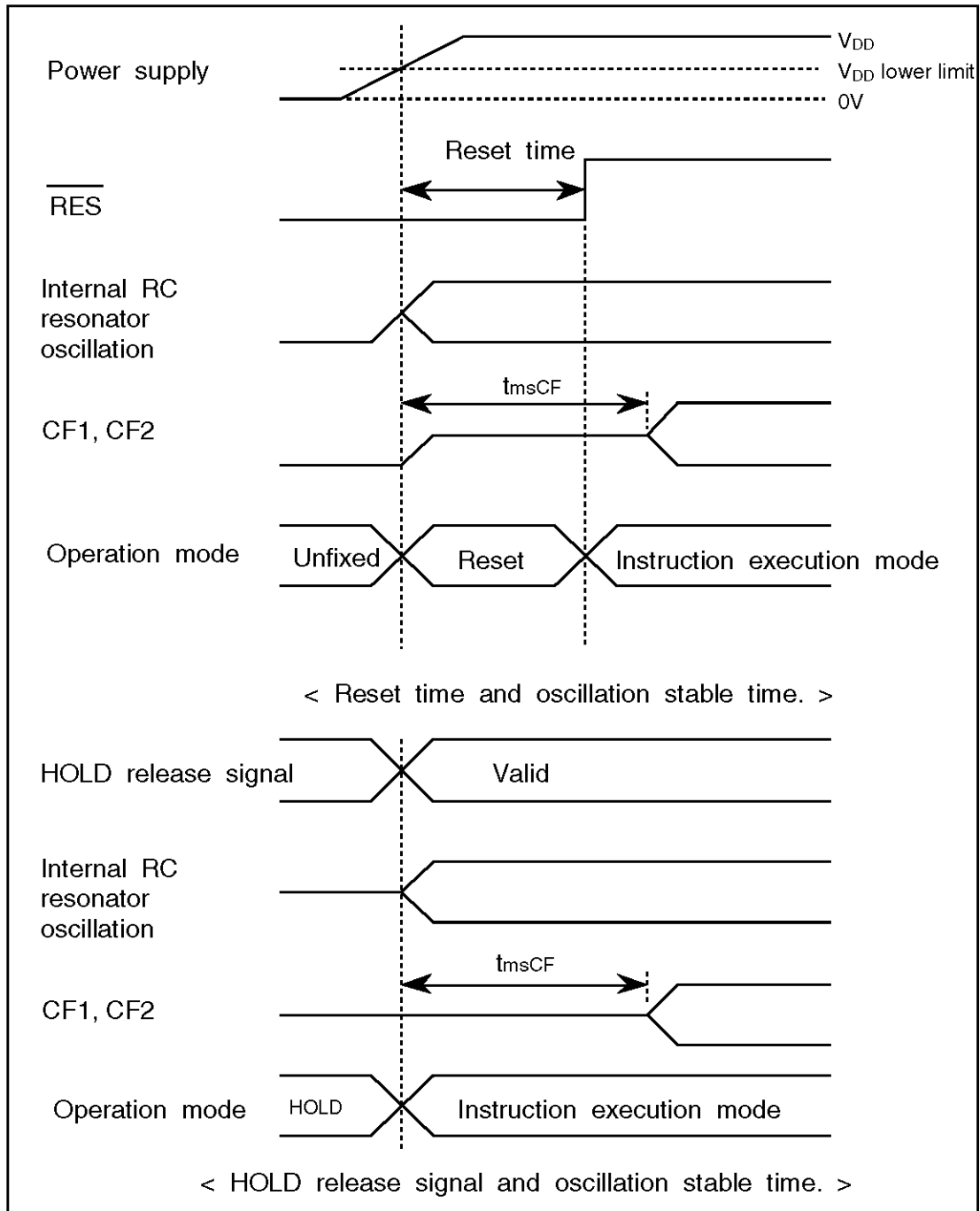


Figure 3 Oscillation Stable Time

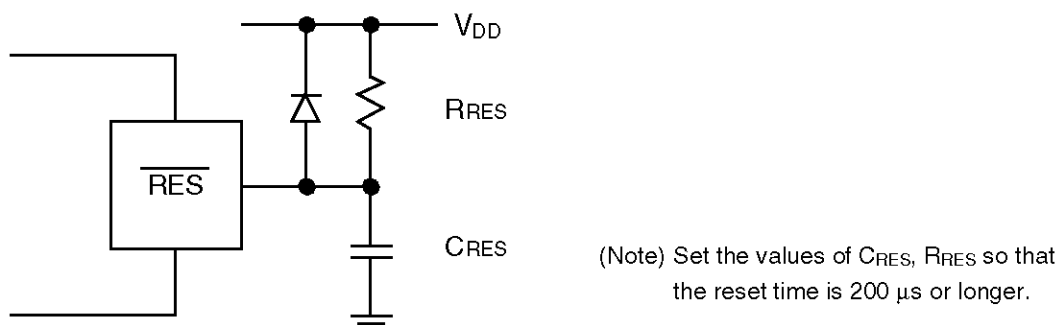


Figure 4 Reset Circuit

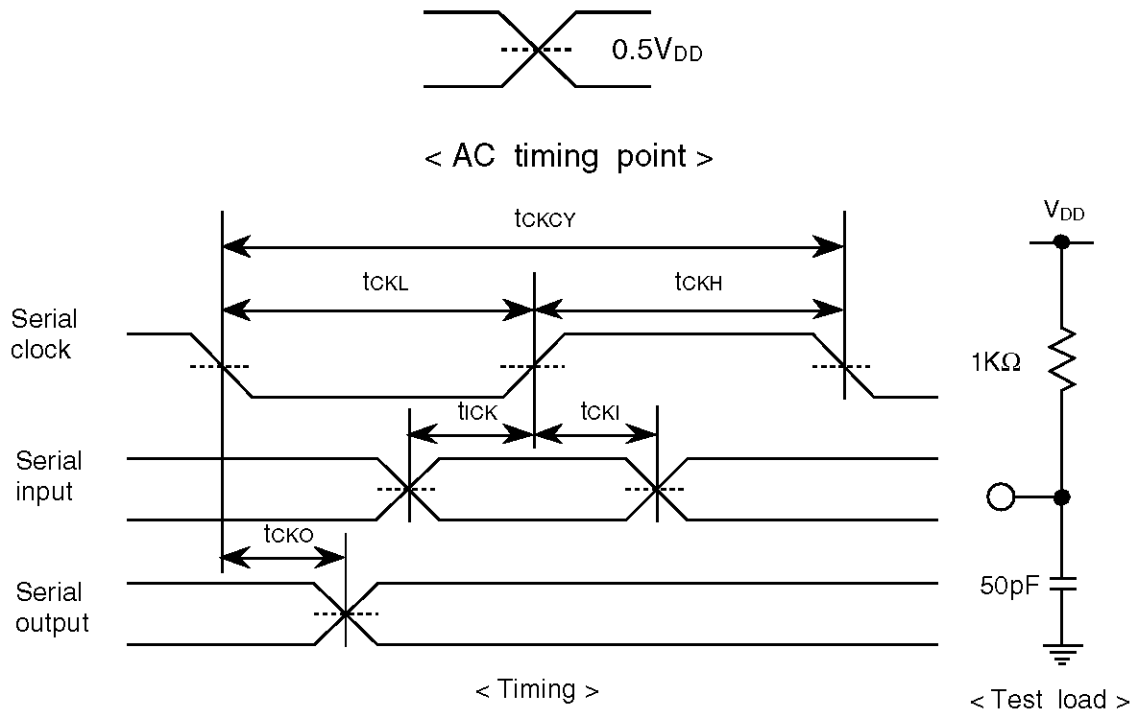


Figure 5 Serial Input/output Test Condition

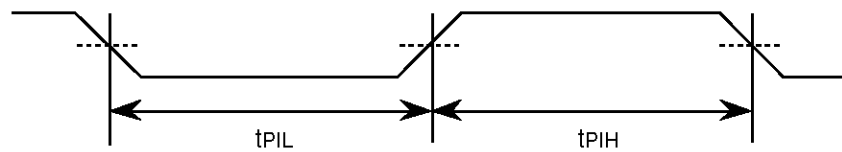


Figure 6 Pulse Input Timing Condition - 1

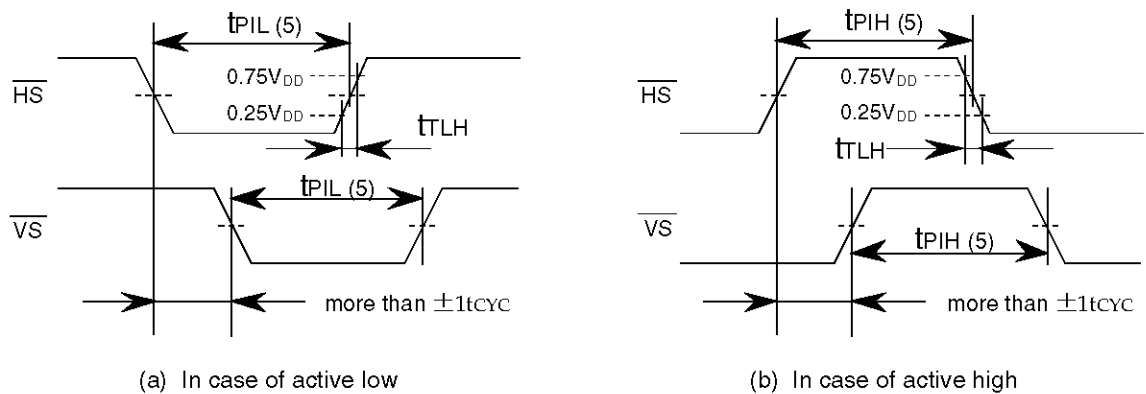


Figure 7 Pulse Input Timing Condition - 2

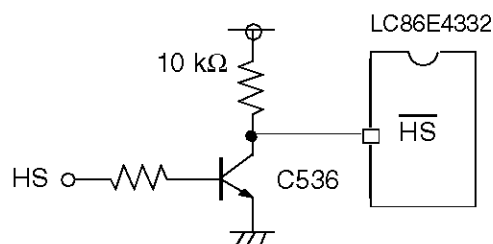


Figure 8 Recommended Interface Circuit

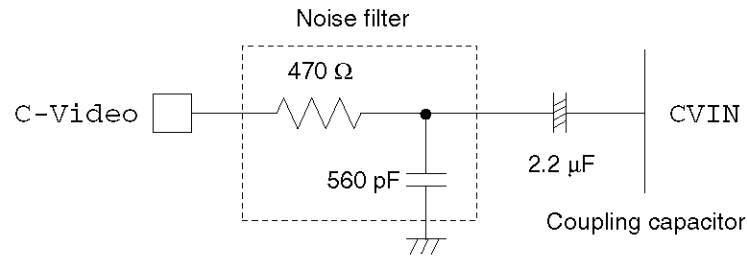


Figure 9 CVIN Recommended Circuit

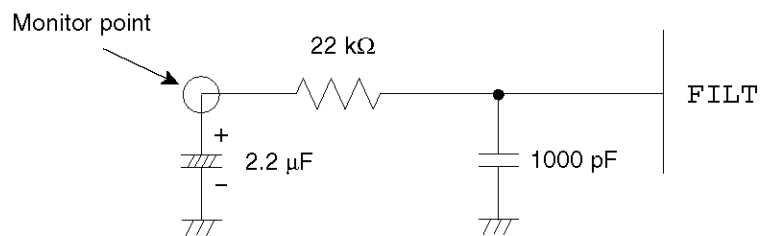


Figure 10 FILT Recommended Circuit

(Note) • Place the parts connected FILT terminal as close to the FILT as possible with the shortest pattern length on the board.

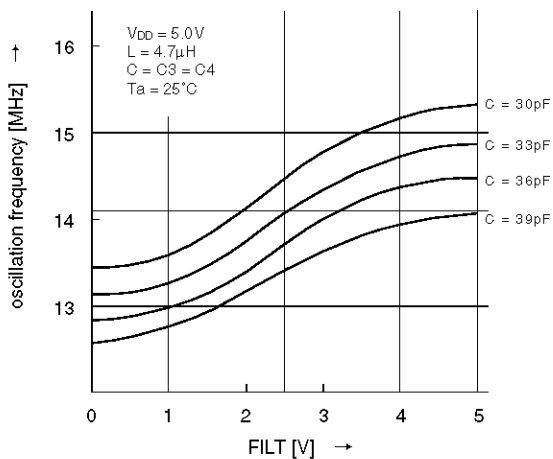


Figure 11 FILT-LC Oscillation Frequency(1)

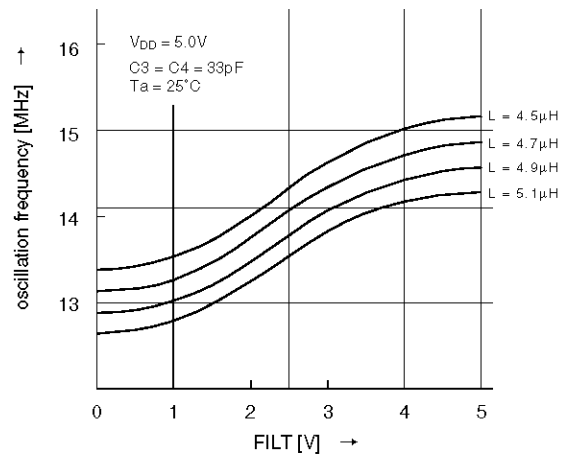


Figure 12 FILT-LC Oscillation Frequency(2)

- No products described or contained herein are intended for use in surgical implants, life-support systems, aerospace equipment, nuclear power control systems, vehicles, disaster/crime-prevention equipment and the like, the failure of which may directly or indirectly cause injury, death or property loss.
- Anyone purchasing any products described or contained herein for an above-mentioned use shall:
 - ① Accept full responsibility and indemnify and defend SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors and all their officers and employees, jointly and severally, against any and all claims and litigation and all damages, cost and expenses associated with such use
 - ② Not impose any responsibility for any fault or negligence which may be cited in any such claim or litigation on SANYO ELECTRIC CO., LTD., its affiliates, subsidiaries and distributors or any of their officers and employees jointly or severally.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.

This catalog provides information as of March, 1998. Specifications and information herein are subject to change without notice.