Ordering number: EN *5585

CMOS LSI

LC86P4564

One-time PROM built-in 8-bit Single Chip Microcontroller

Preliminary

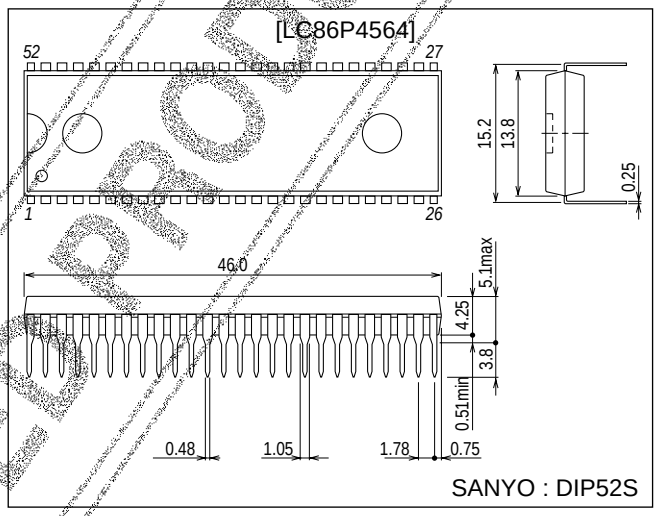
Overview

The LC86P4564 is a CMOS 8-bit single chip microcontroller with One-time PROM for the LC864500 series.
This microcontroller has the function and the pin assignment identical to those of the LC864500 series mask ROM version, and has the built-in 64K-byte PROM.

Package Dimensions

unit : mm

3128-DIP52S



Features

(1) Options switchable by PROM data
The option functions of the LC864500 series can be specified by the PROM data.
The functions of the trial pieces can be evaluated using mass production board.

(2) Internal PROM capacity : 65512 bytes (For program)
8192 × 12 bits (For character)

(3) Internal RAM capacity : 256 bytes
The LC86P4564 contains a 65512-byte PROM and a 256-byte RAM. Each size is the maximum capacity of the LC86P4564 mask-ROM series.

Mask ROM version	PROM capacity	RAM capacity
LC864532	32768 bytes	256 bytes
LC864528	28672 bytes	256 bytes
LC864524	24576 bytes	256 bytes
LC864520	20480 bytes	256 bytes
LC864516	16384 bytes	256 bytes
LC864512	12288 bytes	256 bytes
LC864508	8192 bytes	256 bytes

(4) Operating supply voltage : 4.5 V to 5.5 V
(5) Instruction cycle time : 1.0 µs to 366 µs
(6) Operating temperature : –30°C to +70°C
(7) The pin and the package compatible with the LC864500 series mask ROM version
(8) Applicable mask ROM version : LC864532/LC864528/LC864524/LC864520/LC864516/LC864512/LC864508
(9) Factory shipment : DIP52S

SANYO Electric Co.,Ltd. Semiconductor Bussiness Headquarters
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

Usage Notes

When using, take note of the followings.

(1) Differences between the LC86P4564 and the LC864500 series

Item	LC86P4564	LC864532/28/24/20/16/12/08
Operation after reset releasing	The option must be set internally within 3 ms after a high-level signal is applied to the reset terminal. In this period options are switched gradually, and after that, the program is executed from 00H of the program counter.	The program is executed from 00H of the program counter as soon as a high-level signal is applied to the reset terminal.
Operating supply voltage range (V_{DD})	4.5 V to 5.5 V	2.5 V to 6.0 V
Current drain under normal operation	Refer to 'electrical characteristics' on the semiconductor news.	

Port format of the LC86P4564 during the reset is identical to that of the LC864532/28/24/20/16/12/08.
The LC86P4564 uses 256-byte spaces addressed 0FF00H to 0FFFH in the program memory to set options. In this way, all options of the LC864500 series cannot be executed.
Some of the LC864500 series options, which the LC86P4564 can support are as shown in the table below.

• LC86P4564 options

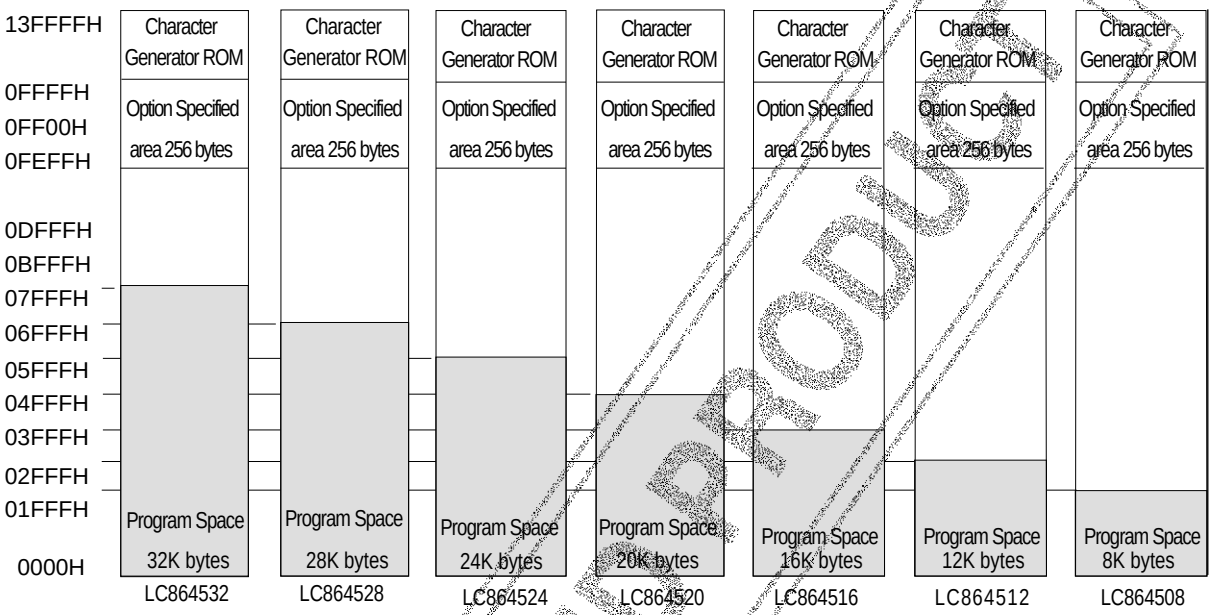
Option types	Pins, circuits	Contents of the option
Input/output specifications of input/output ports	Port 0	1. N-channel open-drain output 2. CMOS output *1
		1. Pull-up MOS transistor provided 2. Pull-up MOS transistor not provided *2
	Port 1 *1	1. Input : Programmable pull-up MOS transistor Output : N-channel open drain 2. Input : Programmable pull-up MOS transistor Output : CMOS
Pull-up MOS transistor of input port.	Port 7 *1	1. Pull-up MOS transistor not provided. 2. Pull-up MOS transistor provided.

*1) Specified in bit units
*2) When the "CMOS output" is selected as an output format, the pull-up MOS transistor will be provided, and when the "n-channel open-drain output" is selected, the pull-up MOS transistor will not be provided.

(2) Option setting program
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 LC86P4564 and LC864500 series use 256 bytes addressed on 0FF00H to 0FFFFH in the program memory as the option specified data area. The program memory capacity of the series is 65280 bytes addressed on 0000H to 0FEFFH. Note that the capacity of the LC86P4564 user-available PROM is 32768 bytes addressed on 0000H to 7FFFH, because the maximum ROM capacity of the LC864500 series ROM version is 32 K byte.



How to Use

(1) Create a programming data for LC86P4564
Programming data for PROM of the LC86P4564 is required.
Debugged evaluation file (EVA file) must be converted to an INTEL-HEX formatted file (HEX file) with file converter program EVA2HEX.EXE. The HEX file is used as the programming data for the LC86P4564.

(2) How to program for the PROM
The LC86P4564 can be programmed by the general purpose EPROM programmer with an attachment : W86EP4564D.

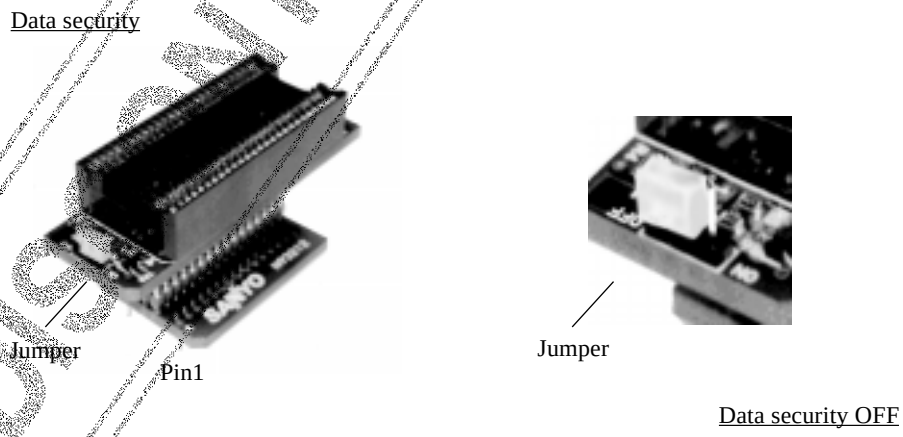
• Recommended EPROM programmers are as shown in the table below.

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

• The "27010 (Vp-p = 12.5 V) Intel high speed programming" mode requires to be used for writing. The storage area addressed "0 to 13FFFH" requires to be selected for address setting and the jumper (DASEC) must be set to 'OFF' at programming.

(3) How to use the data security function
"Data security" is the function to prevent the EPROM data from being read out.
The following is the process in order to execute the data security.
1. Set the jumper of attachment 'ON'.
2. Program again. The EPROM programmer will display an error. The error indication means normal activity of the data security. It does not mean a trouble of the EPROM programmer or the LSI.

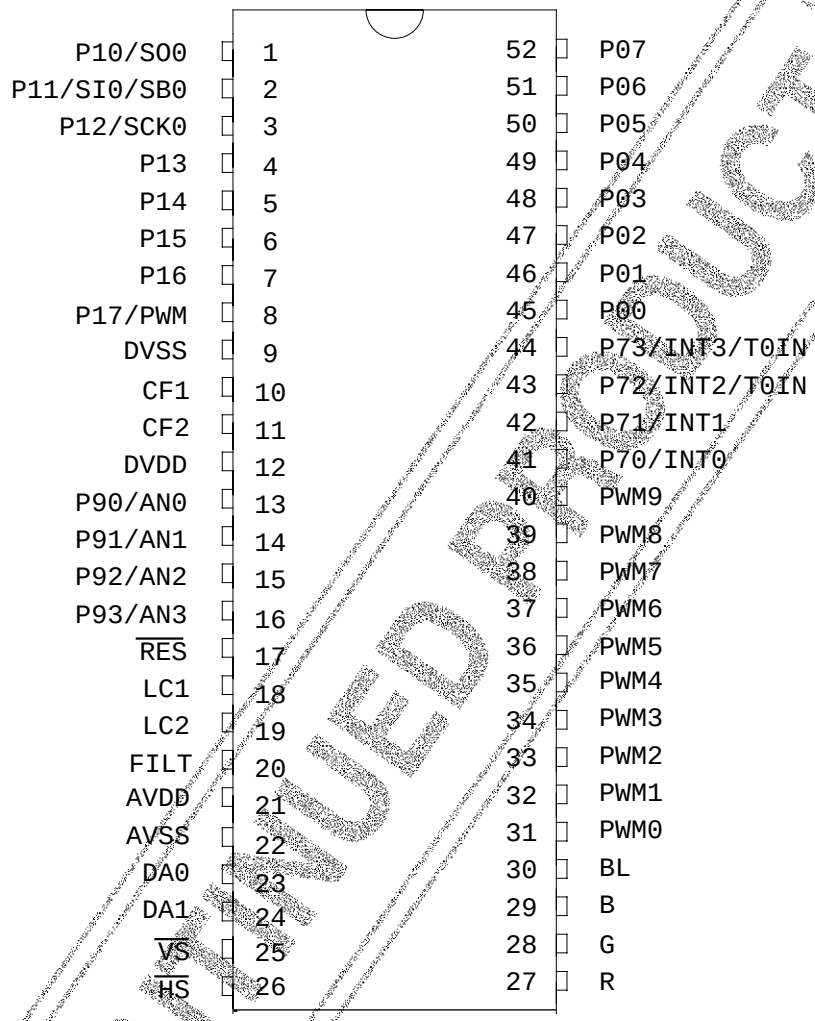
Notes
• Data security is not executed when the data of all address have 'FF' at sequence 2 above.
• Data security cannot be executed by programming the sequential operation "BLANK=>PROGRAM=>VERIFY" at sequence 2 above.
• Set the jumper 'OFF' after executing the data security.



W86EP4564D

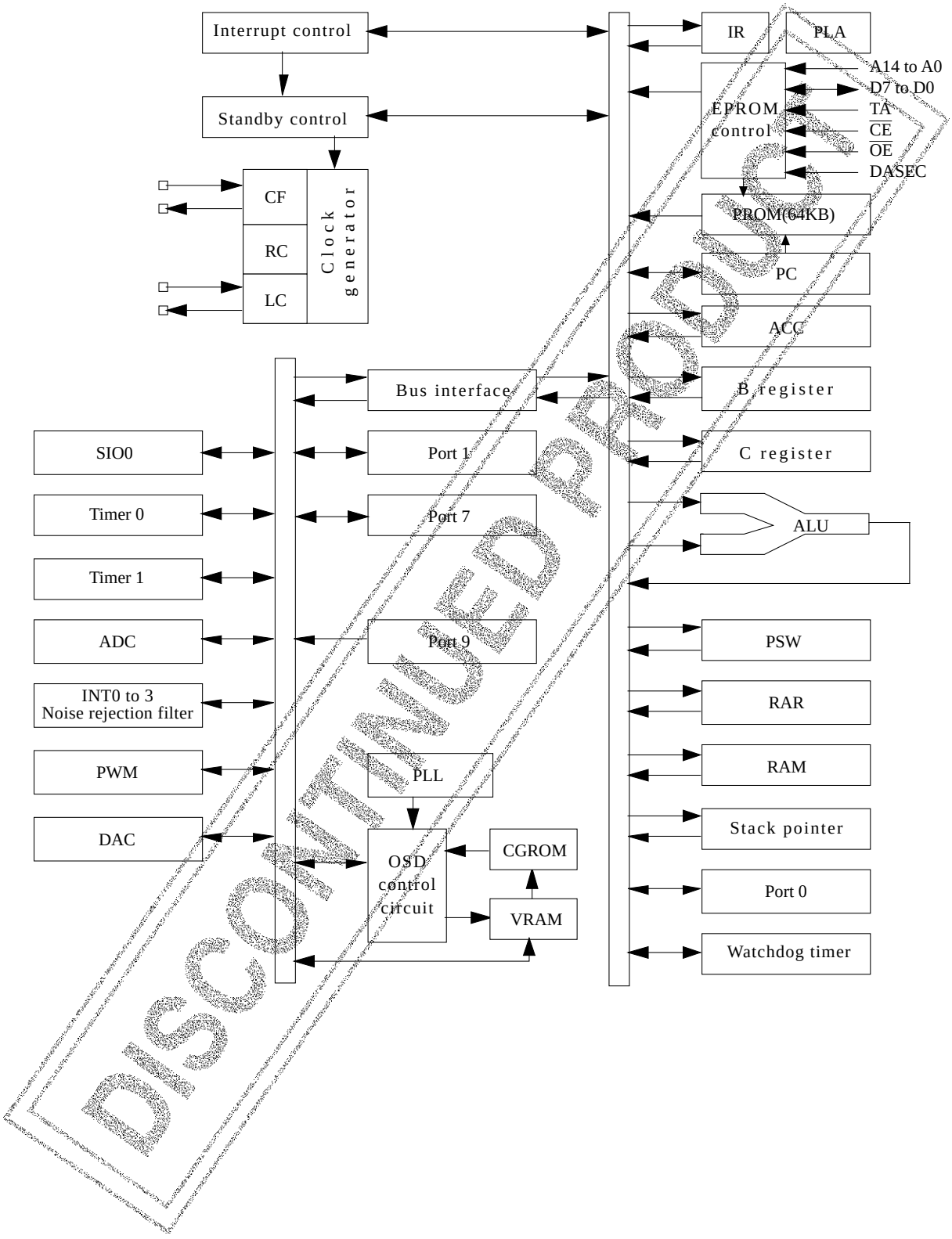
Pin Assignment

DIP52S



Top view

System Block Diagram



Pin Description

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 for ceramic oscillator		
CF2	11	O	Output for ceramic oscillator		
DVDD	12	—	Positive power supply for digital circuit		
$\overline{RES}$	17	I	Reset		
LC1	18	I	LC oscillation circuit input		
LC2	19	O	LC oscillation circuit output		
FILT	20	O	Filter for PLL		
AVDD	21	—	Positive power supply for analog circuit		
AVSS	22	—	Negative power supply for analog circuit		
DA0	23	I/O	DA0 output/General purpose I/O port		
DA1	24	I/O	DA1 output/General purpose I/O port		
$\overline{VS}$	25	I	Vertical synchronization signal input		
$\overline{HS}$	26	I	Horizontal synchronization signal input		
R	27	O	Red (R) output of RGB image output		A4 (*1)
G	28	O	Green (G) output of RGB image output		A5 (*1)
B	29	O	Blue (B) output of RGB image output		A6 (*1)
BL	30	O	Fast blanking control signal TV image signal or OSD image signal selecting		A7 (*1)
PWM0 to PWM9	31 to 40	O	PWM0 to PWM9 output 15V withstand		PWM 0 to PWM 8 : A8 to A16 (*1) PWM 9 : fixed to "L"
Port0 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 Output Format CMOS/Nch-OD	
Port1 P10 to P17	1 to 8	I/O	8-bit Input/output port Input/output can be specified in bit units. Other functions P10: SIO0 data output P11: SIO0 data input /bus input/output P12: SIO0 clock input/output P17: Timer 1 (PWM) output	Output Format CMOS/Nch-OD	D0 to D7 (*2)

<table>
<tr><th>Terminal</th><th>No.</th><th>I/O</th><th>Function description</th><th>Option</th><th>PROM mode</th></tr>
<tr><td>Port7
P70
P71 to P73</td><td>
41
42 to 44</td><td>
I/O
I</td><td>4-bit input port
Other function
P70 INT0 input/HOLD release input/ n-ch 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
Interrupt receiver format vector address
<table>
<tr><th></th><th>Rise</th><th>Fall</th><th>Rise/Fall</th><th>H level</th><th>L level</th><th>Vector</th></tr>
<tr><td>INT0</td><td>enable</td><td>enable</td><td>disable</td><td>enable</td><td>enable</td><td>03H</td></tr>
<tr><td>INT1</td><td>enable</td><td>enable</td><td>disable</td><td>enable</td><td>enable</td><td>0BH</td></tr>
<tr><td>INT2</td><td>enable</td><td>enable</td><td>enable</td><td>disable</td><td>disable</td><td>13H</td></tr>
<tr><td>INT3</td><td>enable</td><td>enable</td><td>enable</td><td>disable</td><td>disable</td><td>1BH</td></tr>
</table></td><td>Pull-up resistor provided/ not provided (in bit units)</td><td>P70 : VPP (*3)
P71 : DASEC (*4)
P72 : $\overline{OE}$ (*5)
P73 : $\overline{CE}$ (*6)</td></tr>
<tr><td>Port9
P90 to P93</td><td>
13 to 16</td><td>
I</td><td>4-bit input port
Other function
A/D converter input port (4 lines)</td><td></td><td>A0 to A3 (*1)</td></tr>
</table>

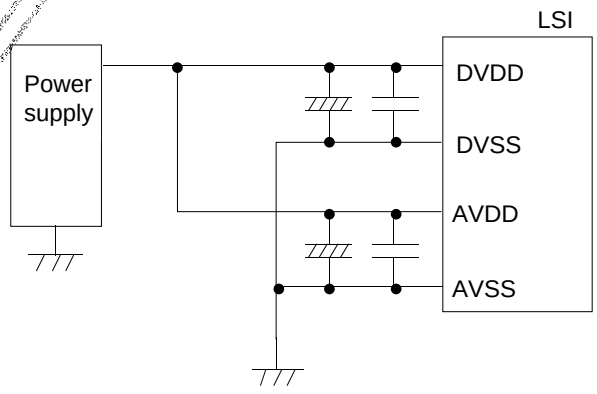
*1 An → Address input
*2 Data I/O
*3 Power for programming
*4 Memory select input/output for data security
*5 Output enable input
*6 Chip enable input

○ All of port options except the pull-up resistor option of Port 0 can be specified in bit units.
○ When the “CMOS output” is selected for port 0 as an output format, the pull-up resistor will be provided, and when the “n-channel open-drain output” is selected, the pull-up resistor will not be provided.
○ Whichever the “CMOS” or the “n-channel open-drain” output format is selected, the programmable pull-up resistor will be provided.

• Port states during reset

Terminal	I/O	Pull-up resistor status 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, V_{SS} = 0 V

Parameter		Symbol	Pins	Conditions	V_{DD}[V]	Ratings min	typ	max	Unit
Supply voltage		V_{DD} max	DVDD, AVDD	DVDD = AVDD		–0.3		+7.0	V
Input voltage		V_I (1)	• P71, 72, 73 • Port 9 • $\overline{RES}$, $\overline{HS}$, $\overline{VS}$			–0.3		V_{DD}+0.3	
Output voltage		V_O (1)	R, G, B, BL, FILT			–0.3		V_{DD}+0.3	
		V_O (2)	PWM0 to PWM9			–0.3		+15	
Input/output voltage		V_{IO} (1)	Ports 0, 1, P70 DA0, 1			–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 DA0, 1	• CMOS output • At each pin		–4			
		I_{OPH} (3)	R, G, B, BL	• CMOS output • At each pin		–5			
	Total output current	ΣI_{OAH} (1)	Port 1	The total of all pins		–10			
		ΣI_{OAH} (2)	Port 0	The total of all pins		–10			
		ΣI_{OAH} (3)	R, G, B, BL	The total of all pins		–15			
Low-level output current	Peak output current	I_{OPL} (1)	Ports 0, 1 DA0, 1	At each pin				20	
		I_{OPL} (2)	P70	At each pin				30	
		I_{OPL} (3)	• R, G, B, BL • PWM0 to PWM9	At each pin				5	
	Total output current	ΣI_{OAL} (1)	Port 0	The total of all pins				40	
		ΣI_{OAL} (2)	Port 1, P70	The total of all pins				40	
		ΣI_{OAL} (3)	R, G, B, BL	The total of all pins				15	
		ΣI_{OAL} (4)	PWM0 to PWM9	The total of all pins				30	
Allowable power dissipation		Pd max	DIP52S	Ta = –30 to +70°C				430	mW
Operating temperature range		Topr				–30		+70	°C
Storage temperature range		Tstg				–55		+150	

The same level voltage must be applied to both DVSS and AVSS. V_{SS} = DVSS = AVSS
The same level voltage must be applied to both DVDD and AVDD. V_{DD} = DVDD = AVDD

2. Allowable Operating Range at Ta = –30°C to +70°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	0.98 µs ≤ tCYC tCYC ≤ 1.02 µs		4.5		5.5	V
Hold voltage	V_{HD}	DVDD, AVDD	RAMs and the registers held at HOLD mode.		2.0		5.5	
High-level input 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 DA0, 1 port input		4.5 to 5.5	0.7 V_{DD}		V_{DD}	
Low-level input 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 DA0, 1 Port input		4.5 to 5.5	V_{SS}		0.3V_{DD}	
Operation cycle time	tCYC(1)		OSD function	4.5 to 5.5	0.98	1	1.02	µs
	tCYC(2)		No OSD function	4.5 to 5.5	0.98		30	

Parameter	Symbol	Pin	Conditions		Ratings			Unit
				V_{DD} [V]	min	typ	max	
Oscillation frequency range (Note 1)	FmCF	CF1, CF2	12 MHz (ceramic resonator oscillation) Refer to Figure 1	4.5 to 5.5	11.76	12	12.24	MHz
	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	2.0	
Oscillation stable time period (Note 2)	tmsCF	CF1, CF2	12 MHz (ceramic resonator oscillation) Refer to Figure 3	4.5 to 5.5		0.02	0.2	ms

(Note 1) Refer to Table 1 and Table 2 for the oscillation constant.
(Note 2) The oscillation stable time is a period necessary for the oscillation to be stable after the power first applied, the HOLD mode released and the main-clock oscillation stop instruction released.
Refer to the Figure 3 for details.

3. Electrical Characteristics at Ta = –30°C to +70°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	V_{DD} [V]	Ratings min	Ratings typ	Ratings max	Unit
Input high-level current	I_{IH}(1)	• Port 1 DA0, 1 • Port 0 without pull-up MOS transistor	• Output disable • Pull-up MOS transistor OFF • V_{IN} = V_{DD} (including the off-leakage current of the output transistor)	4.5 to 5.5			1	µA
	I_{IH}(2)	• Port 7 without pull-up MOS transistor • Port 9 • $\overline{RES}$ • $\overline{HS}$, $\overline{VS}$	V_{IN} = V_{DD}	4.5 to 5.5			1	
Input low-level current	I_{IL}(1)	• Port 1 DA0, 1 • Port 0 without pull-up MOS transistor	• Output disable • Pull-up MOS transistor OFF • V_{IN} = V_{SS} (including the off-leakage current of the output transistor)	4.5 to 5.5	–1			
	I_{IL}(2)	• Port 7 without pull-up MOS transistor • Port 9	V_{IN} = V_{SS}	4.5 to 5.5	–1			
	I_{IL}(3)	• $\overline{RES}$ • $\overline{HS}$, $\overline{VS}$	V_{IN} = V_{SS}	4.5 to 5.5	–1			
Output high-level voltage	V_{OH}(1)	CMOS output of ports 0, 1 DA0, 1	I_{OH} = –1.0 mA	4.5 to 5.5	V_{DD}–1			V
	V_{OH}(2)	R, G, B, BL	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 DA0, 1	• I_{OL} = 1.6 mA • The total current of the ports 0, 1 is not over 40 mA.	4.5 to 5.5			0.4	
	V_{OL}(3)	• R, G, B, BL • PWM0 to PWM9	• I_{OL} = 3.0 mA • The current of any 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	Rpu	• Ports 0, 1 • Port 7	V_{OH} = 0.9 V_{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}	• Ports 0, 1 • Port 7 • $\overline{RES}$ • $\overline{HS}$, $\overline{VS}$	Output disable	4.5 to 5.5		0.1V_{DD}		V

Parameter	Symbol	Pins	Conditions	Ratings				Unit
			V_{DD} [V]	min	typ	max	
Pin capacitance	CP	All pins	• f = 1 MHz • Unmeasured input pins are set to V_{SS} level. • Ta = 25°C	4.5 to 5.5		10		pF

4. Serial Input/Output Characteristics at Ta = –30°C to +70°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)			4.5 to 5.5	1			
		High-level pulse width	tCKH(1)			4.5 to 5.5	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)			4.5 to 5.5		1/2tCKCY		
		High-level pulse width	tCKH(2)			4.5 to 5.5		1/2tCKCY		
Serial input	Data set-up time		tICK	SI0	• Synchronized with the rising edge of SCK0. • 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 (1kΩ) when open-drain output. • Synchronized with the falling edge of SCK0. • 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 = –30°C to +70°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	Ratings				Unit
				V_{DD} [v]	min	typ	max	
High/low level pulse width	tPIH(1) tPIL(1)	• INT0, INT1 • INT2/T0IN	• Interrupt factor flag settable. • Timer and counter 0 pulse-countable.	4.5 to 5.5	1			tCYC
	tPIH(2) tPIL(2)	INT3/T0IN (The noise rejection filter time constant is 1/1)	• Interrupt factor flag settable. • Timer and counter 0 pulse-countable.	4.5 to 5.5	2			
	tPIH(3) tPIL(3)	INT3/T0IN (The noise rejection filter time constant is 1/16)	• Interrupt factor flag settable. • Timer and counter 0 pulse-countable.	4.5 to 5.5	32			
	tPIL(4)	$\overline{RES}$	Reset acceptable	4.5 to 5.5	200			µs
	tPIH(5) tPIL(5)	$\overline{HS}$, $\overline{VS}$	Display position can be controlled Each active edge of $\overline{HS}$, $\overline{VS}$ must be set apart more than 1tCYC. Refer to Figure 7	4.5 to 5.5	10			tCYC
Rise/fall time	tTHL tTLH	$\overline{HS}$	Refer to Figure 7	4.5 to 5.5			500	ns
Horizontal pull-in range	FH	$\overline{HS}$	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 = –30°C to +70°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	Ratings				Unit
				V_{DD} [V]	min	typ	max	
Resolution	N			4.5 to 5.5		4		bit
Absolute precision	ET	(Note 3)		4.5 to 5.5		±1/4	±1/2	LSB
Conversion time	tCAD	After the Vref selected till the conversion completed.	1 bit conversion time = 2tCYC	4.5 to 5.5			1.96	µs
Reference current	I_{REF}		(Regulate the ladder resistor)	4.5 to 55		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 (±1/2LSB).

7. D/A Converter Characteristics at Ta = –30°C to +70°C, V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	Ratings			Unit
			V_{DD} [V]	min	typ	max	
Resolution	NDA			4.5 to 5.5		7		bit
Absolute precision	ETDA		7 bits mode (Note 4)	4.5 to 5.5		±2.0		LSB
Settling time	tSDA		(Note 5)	4.5 to 5.5		1.0		µs
Analog input voltage range	V_{AOUT}	DA0 to DA1		4.5 to 5.5	V_{SS}		V_{DD}	V
Output resistor	RODA		(Note 6)	4.5 to 5.5		8		kΩ

Note 4 : The ±1/2-LSB quantization error is not included. (No load.)
Note 5 : Settling time refers to the time from when the D/A conversion instruction is executed to when the analog voltage output corresponding to the digital voltage on the specific port is generated.
Note 6 : D/A data = 80H

8. Current Drain Characteristics at Ta = –30°C to +20°C , V_{SS} = 0 V

Parameter	Symbol	Pins	Conditions	Ratings				Unit
				V_{DD} [V]	min	typ	max	
Current drain during basic operation (Note 7)	I_{DDOP}(1)	DVDD, AVDD	• FmCF = 12 MHz when ceramic oscillation • FmLC = 14.11MHz when LC oscillation • System clock : 12 MHz • Internal RC when oscillation stops	4.5 to 5.5		21	32	mA
Current drain in HALT mode (Note 7)	I_{DDHALT}(1)	DVDD, AVDD	• HALT mode • FmCF = 12 MHz when ceramic oscillation • FmLC = 0 Hz (when oscillation stops) • System clock : 12 MHz • Internal RC when oscillation stops.	4.5 to 5.5		5	10	mA
	I_{DDHALT}(2)	DVDD, AVDD	• HALT mode • FmCF = 0 MHz (when oscillation stops) • FmLC = 0 Hz (when oscillation stops) • System clock : Internal RC	4.5 to 5.5		400	800	µA
Current drain in HOLD mode (Note 7)	I_{DDHOLD}(1)	DVDD, AVDD	• HOLD mode • All oscillation stops.	4.5 to 5.5		0.05	20	µA
	I_{DDHOLD}(2)							

Note 7 : The current into the output transistors and the pull-up MOS transistors are ignored.

Oscillation type	Manufacturer	Oscillator	C1	C2
12 MHz ceramic resonator oscillation	Murata	CSA12.0MTZ	33 pF	33 pF
		CST12.0MTW	on chip	
	Kyocera	KBR-12.0M	47 pF	47 pF

* Both C1 and C2 must use an K rank (±10%) and an SL characteristics.

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

Oscillation type	L	C3	C4
14.11 MHz LC oscillation	4.7 μH	33 pF	45 pF (Trimmer)
	4.7 μH ±10% (Variable)	33 pH	33 pH

* 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 possible 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 $1/2V_{DD}$±10% by the LC oscillation constant 'L' or 'C' to lock the PLL circuit.

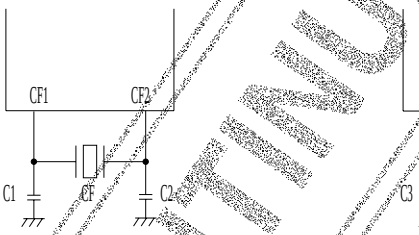


Figure 1 Ceramic Oscillation

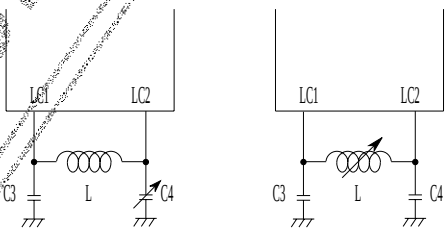


Figure 2 LC Oscillation

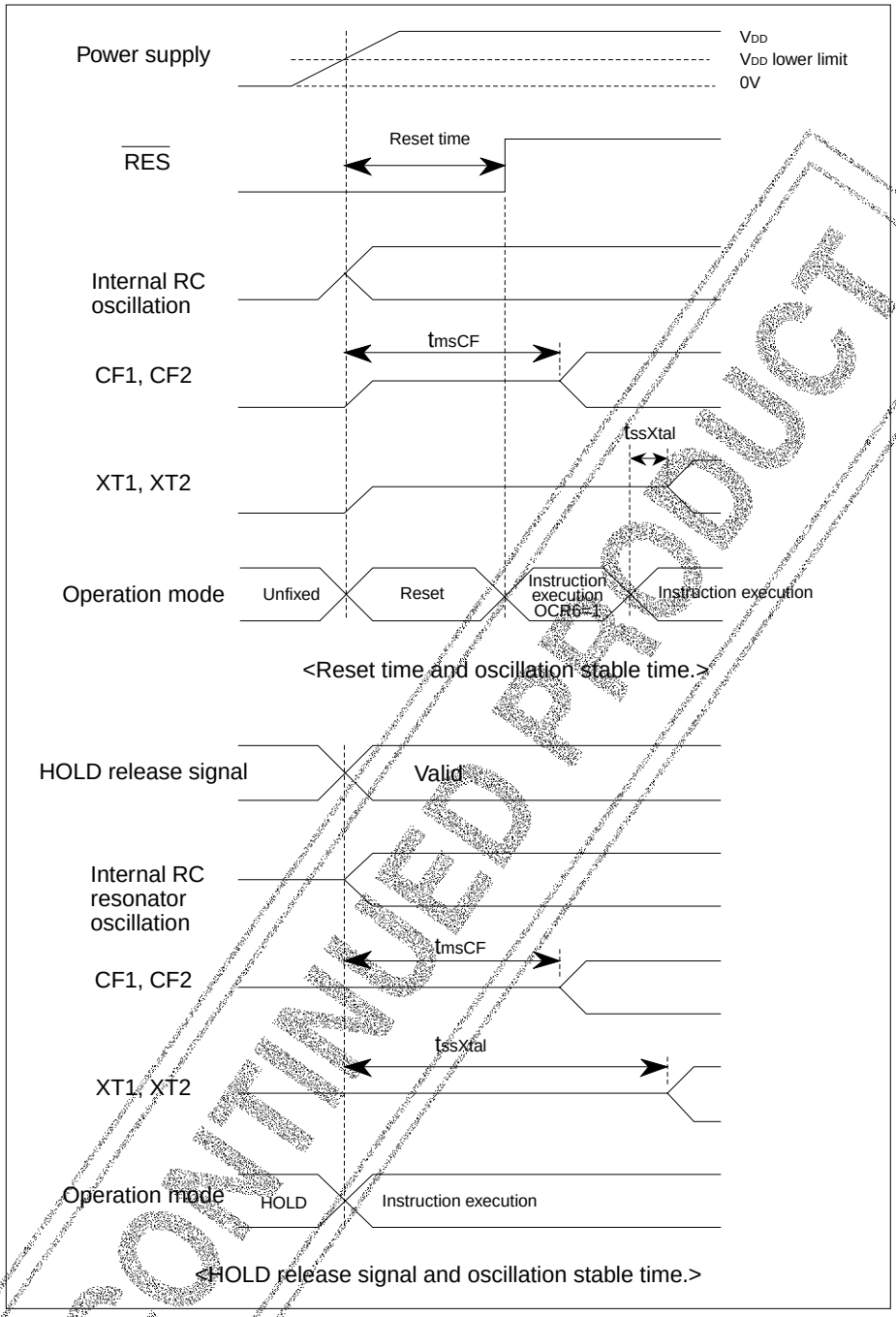
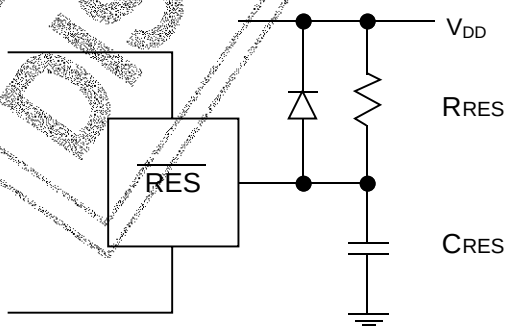


Figure 3 Oscillation Stable Time



(Note) Set the values of C_{RES}, R_{RES} so that the reset time is 200 μs or longer.

Figure 4 Reset Circuit

< AC timing point >

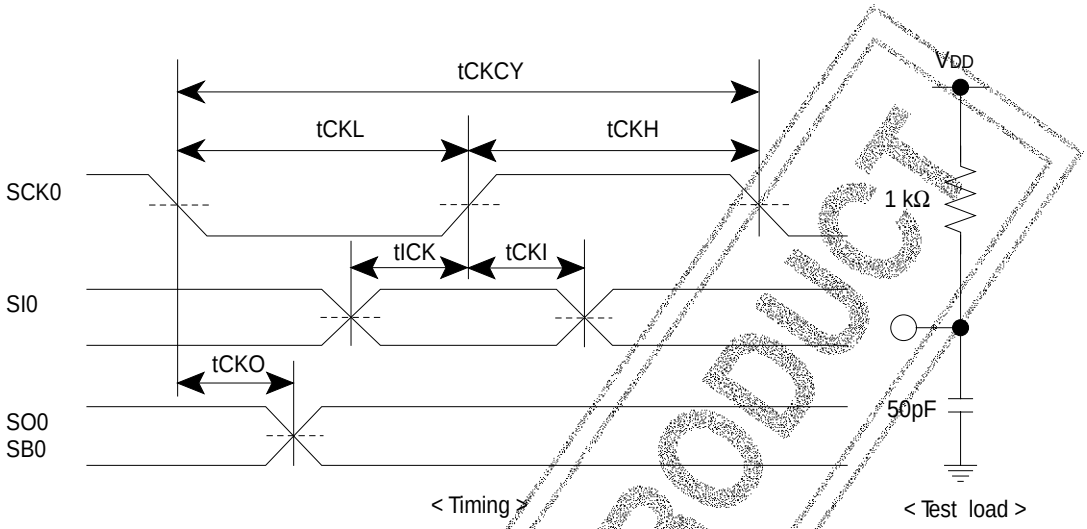


Figure 5 Serial Input/output Test Condition

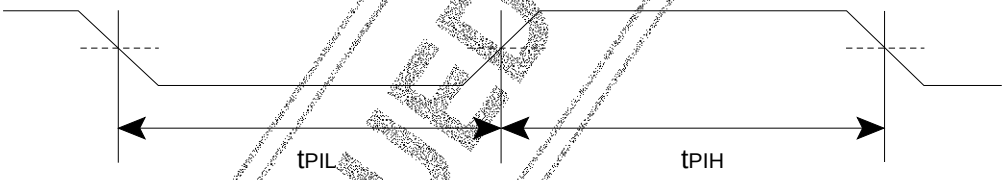
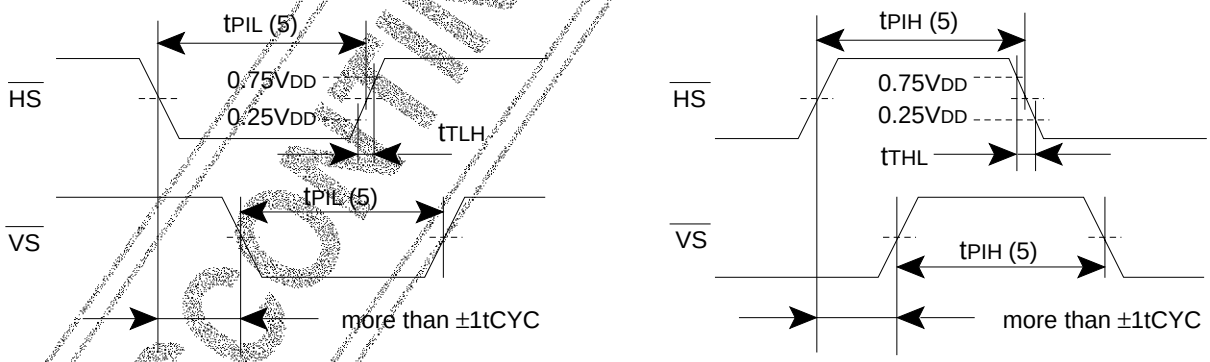


Figure 6 Pulse Input Timing Condition - 1



(a) In case of active low (b) In case of active high

Figure 7 Pulse Input Timing Condition - 2

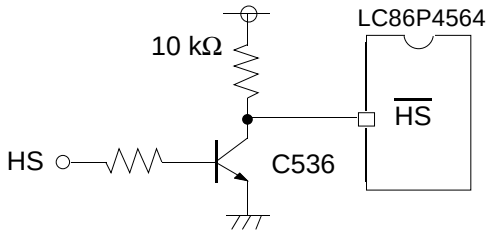


Figure 8 Recommended Interface Circuit

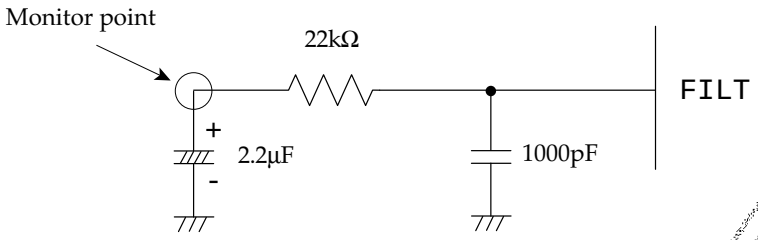


Figure 10 FILT Recommended Circuit

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

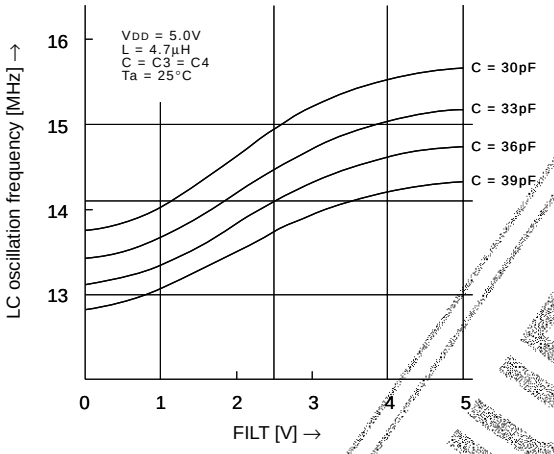


Figure 11 FILT-LC Oscillation Frequency(1)

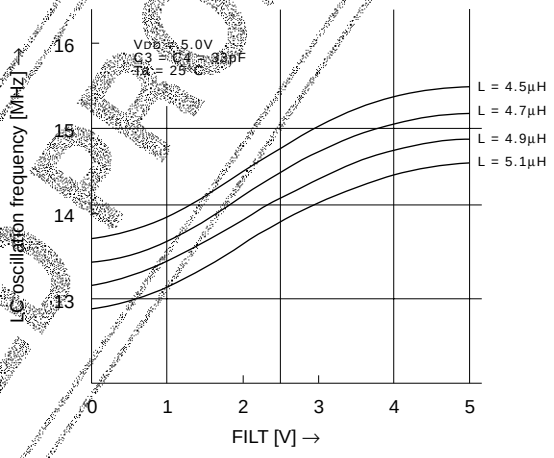


Figure 12 FILT-LC Oscillation Frequency(2)