

Preliminary

Overview

The LC86E6032 microcomputer is CMOS 8-bit single chip microcomputer with UVEPROM for LC866000A series.

This microcomputer has the function and the pin discription of LC866000A series mask ROM version, and 32K-byte EPROM, the program data is rewritable.

It is suitable to develop the program.

Features

- (1) Option switching by EPROM data
 - The option function of LC866000A series can be specified by EPROM data.
 - LC86E6032 can be checked the functions of trial piece using mass production board.
- (2) Internal 32K-byte UVEPROM
 - 32K-byte UVEPROM (ultraviolet erasable and programmable ROM) is built in. This corresponds to LC866032B/28B/24B/20A/16A12A/08A.
- (3) The pin compatible with mask ROM version
- (4) Factory shipment
 - DIC-64S
 - QFC-64E (Under development)

Notice for use

LC86E6032 is provided for the program development and checking the function of LC866000A series.

At using, take notice of the followings.

(1) Reset

It is necessary to be sure to go into 'L' level and hold for 200 μ s to reset terminal after power supplied voltage has been over inferior limit of supply voltage.

The option is specified until 3ms after going into 'H' level to reset terminal by degrees.

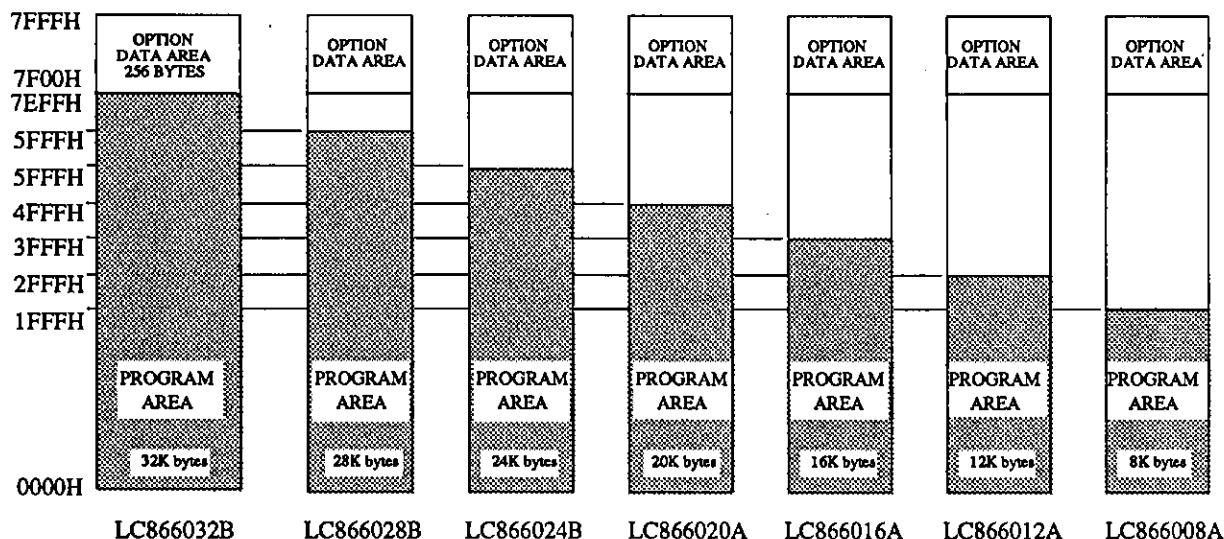
The program is executed from 00H of program counter. The output form of all ports are N-channel open drain while 'L' level to reset terminal.

(2) Option

LC86E6032 uses 256 bytes which is addressed on 7F00H~7FFFH in the program memory as option data area. This area does not affect the execution of program but the program memory capacity of LC866032A is 32512 bytes which is addressed on 0000H ~ 7EFFH.

The option data is created by option specified program "SU866000.EXE". The created option data is linked program area by linkage loader "L866000.EXE".

(3) ROM space



(4) Points of difference LC86E6032 and LC866000A series (mask ROM version)

Item	LC86E6032	LC866032B/28B/24B/20A/16A/12A/08A
Operating temperature range (Topg)	+10°C ~ +40°C	-30°C ~ 70°C
Output form of port at reset	Open drain output	Output form specified by option data
Output form of segment · S0/T0 ~ S6/T6 · S7/T7 ~ S15/T15 · S16 ~ S23 · S24 ~ S29	Pulldown resistor Not provided Provided (fixed) Provided (fixed) Not provided	Pulldown resistor : Provided / Not provided Specified by option Provided (fixed) Specified by option Specified by option
Operating supply voltage range (VDD)	4.5 ~ 6.0V	2.5 ~ 6.0V

Option

· A kind of option corresponding LC86E6032

A kind of option	Pins, Circuits	Contents of option
Input/output form of input/output ports	Port 0 (specified in a bit)	1. Input : No Pullup MOS Tr. Output : N-channel opendrain 2. Input : Pullup MOS Tr. Output : COMS
	Port 1 (specified in a bit)	1. Input : Programmable pullup MOS Tr. Output : N-channel opendrain 2. Input : Programmable pullup MOS Tr. Output : COMS
Pullup MOS Tr. of input port	Port 7 (specified in a bit)	1. No pullup MOS Tr. 2. Pullup MOS Tr.

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· A kind of option not corresponding LC86E6032

A kind of option	Pins, Circuits	Contents of option
Pulldown resistor of high voltage withstand output terminal	· S0/T0 ~ S6/T6 · S16 ~ S29 (specified in a bit)	1. Pulldown resistor 2. No pulldown resistor

How to use

(1) Specification of option

LC86E6032 must be programmed after specifying option data. The option is specified by "SU866000.EXE". The specified option file and the file created by our macro assembler "M866000.EXE" are linked by our linkage loader "L866000.EXE" which creates .HEX file, then the option code is put in the option specified area (7F00H~7FFFH) of its .HEX file.

(2) How to program for EPROM

LC86E6032 can be programmed by EPROM programmer with attachment ; W86EP6032D, W86EP6032Q
· Recommended EPROM programmer

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

· "27512 (Vpp=12.5V) Intel high speed programming" mode available. The address must be set "0H~7FFFH" and jumper (DASEC) must be set 'OFF' at programming.

(3) How to use the data security function

"Data security" is the function disable to read the data of EPROM.

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

1. Set 'ON' the jumper (DASEC) of attachment.
2. Program again. Then EPROM programmer displays error. The error is the reason of data security, not trouble of EPROM programmer or of LSI.

Notes

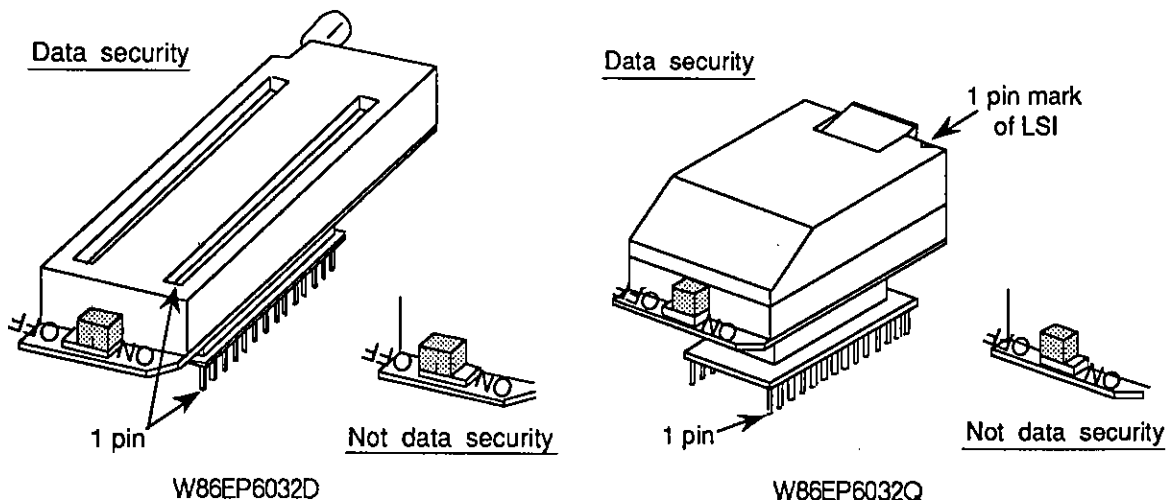
- Data security is not executed when the data of all address have 'FF' at sequence 2 above.
- The programming by sequential operation "BLANK→PROGRAM→VERIFY" cannot be executed data security at sequence 2 above.
- Set 'OFF' the jumper after execution of data security.

(4) How to eliminate

The programming data can be erased by using the EPROM eraser.

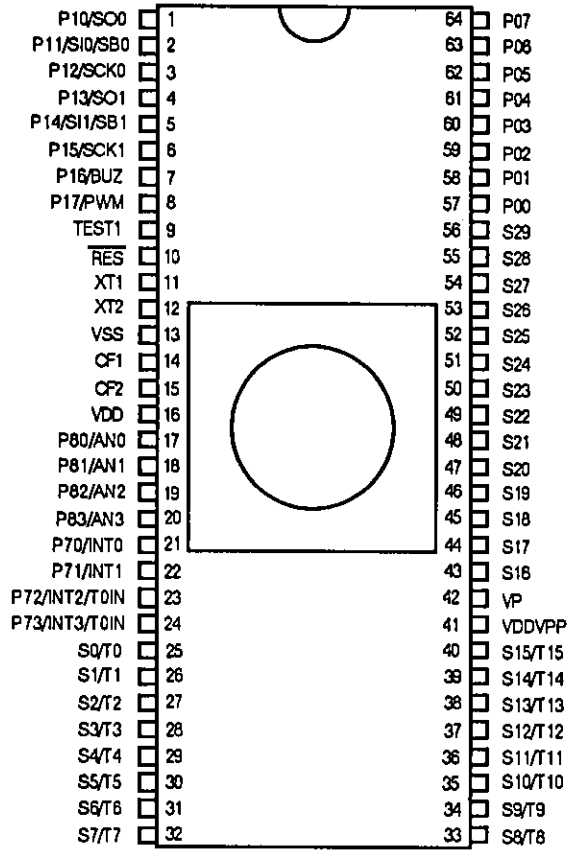
(5) Shielding

UVEPROM (ultraviolet erasable and programmable ROM) is in it. Put the seal on the window in use.

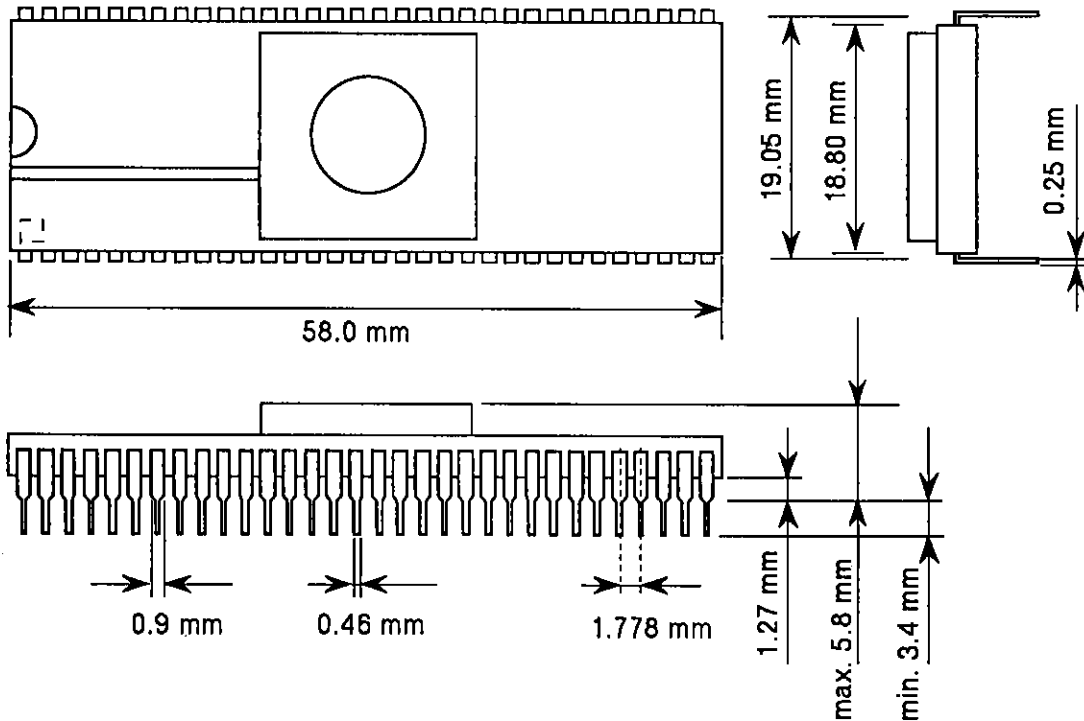


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Pin Assignment



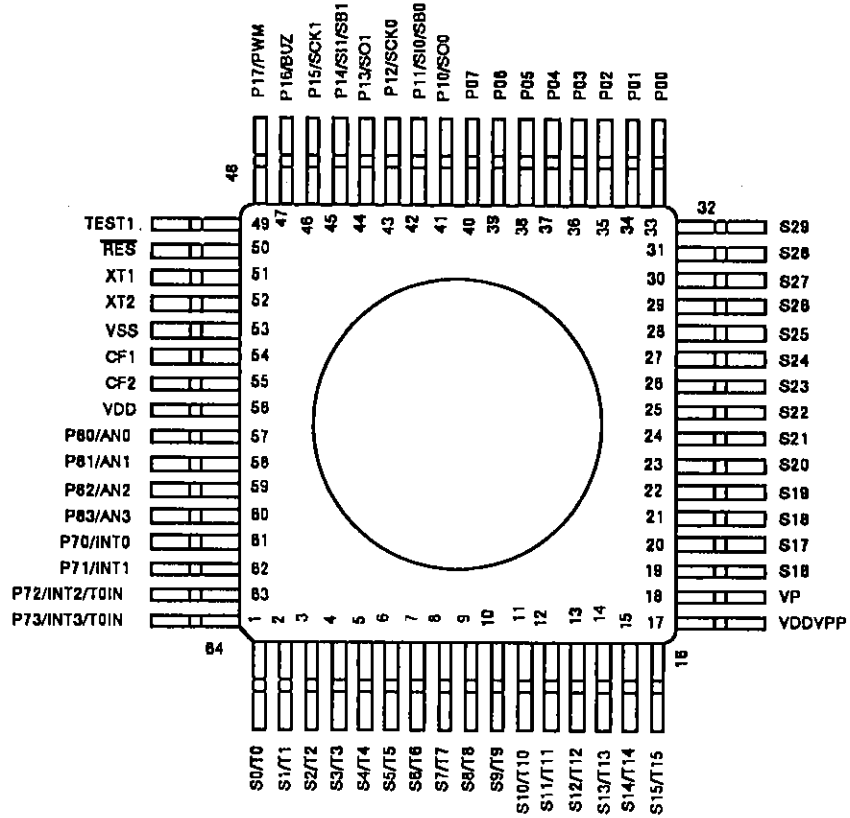
Package Dimensions 3126



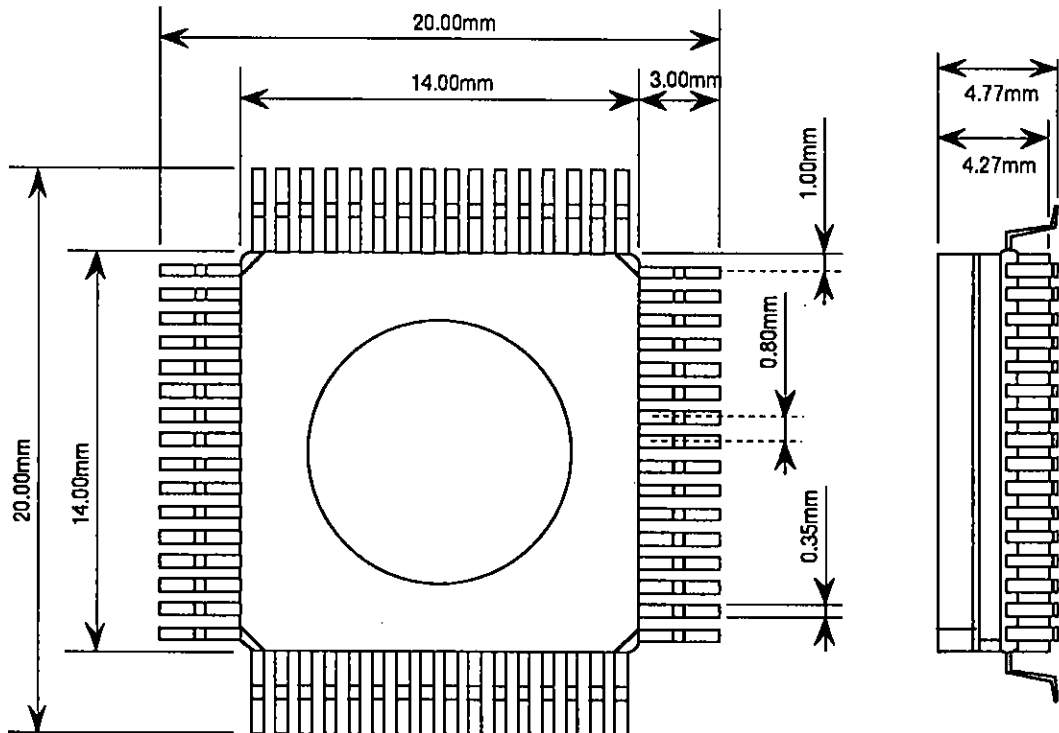
SANYO : DIC64S

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Pin Assignment

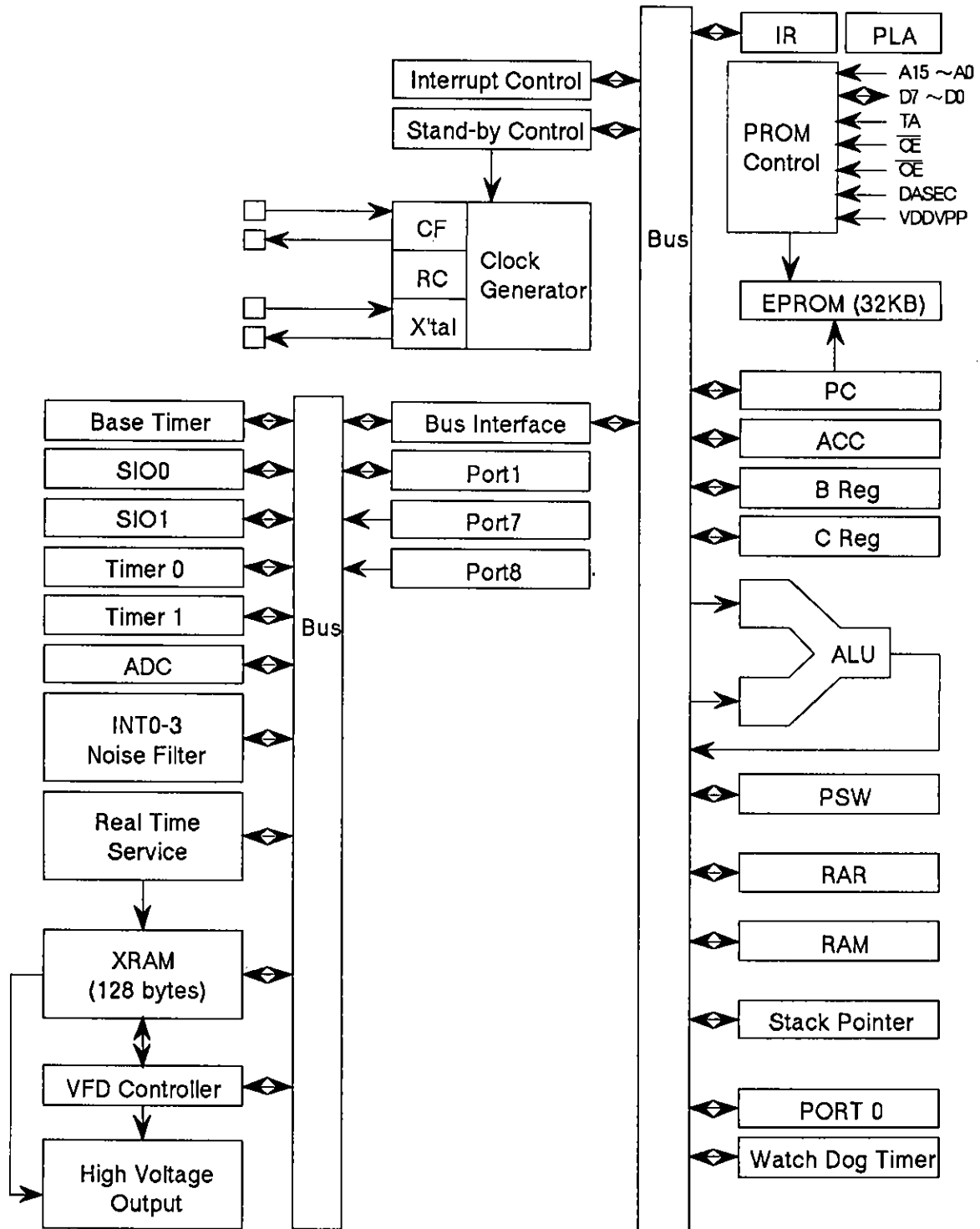


Package Dimensions 3152



SANYO : QIC64E

System Block Diagram



LC86E6032

Pin name	I/O	Function description	Option	Function at PROM mode
S24~S29	O	Output for VFD display controller segment output.		Address input · A13~A0
RES	I	Reset pin.		
TEST1	O	Test pin. Should be left unconnected.		
XT1	I	Input pin for 32.768kHz crystal oscillation. In case of non use, connect to VDD.		
XT2	O	Output pin for 32.768kHz crystal oscillation. In case of non use, should be left unconnected.		
CF1	I	Input pin for ceramic resonator oscillation.		
CF2	O	Output pin for ceramic resonator oscillation.		

*1 Memory select input for data security

*2 Output enable input

*3 Chip enable input

*4 TA → PROM control signal input

*5 A14 → address input

* All of port options can be specified in bit unit.

* A state of pins at reset.

Pin name	Input/output mode	A state of pullup resistor specified at pullup option
Ports 0,7	Input	Fixed pullup resistor exist
Port 1	Input	Programmable pullup resistor OFF

Pin name	A state of P-channel transistor
S0/T0~S15/T15	P-channel transistor OFF
S16~S29	P-channel transistor OFF

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1. Absolute maximum ratings / Ta = 25°C, VSS = 0 V

Parameter		Symbol	Pins	Conditions	Limits				
					VDD[v]	min.	typ.	max.	unit
Supply voltage		VDD MAX	VDD,VDDVPP	VDD=VDDVPP		-0.3	~	+7.0	V
Input voltage		VI(1)	·Ports 71,72,73 ·Port 8 ·RES			-0.3	~	VDD+0.3	
		VI(2)	VP			VDD-45	~	VDD+0.3	
Output voltage		VO	·S0/T0~S15/T15 ·S16~S29			VDD-45	~	VDD+0.3	
Input/output voltage		VIO	Ports 0,1,70			-0.3	~	VDD+0.3	
High Level output current	Peak output current	IOPH(1)	Ports 0,1	·CMOS output ·At each pins.		-4			mA
		IOPH(2)	S0/T0~S15/T15	At each pins.		-30			
		IOPH(3)	S16~S29	At each pins.		-15			
	Total output current	ΣIOAH(1)	Port 0	The total all pins.		-10			
		ΣIOAH(2)	Port 1	The total all pins.		-10			
		ΣIOAH(3)	·S0/T0~S15/T15 ·S16~S29	The total all pins.		-130			
Low Level output current	Peak output current	IOPL(1)	Ports 0,1	At each pins.				20	
		IOPL(2)	Port 70	At each pins.				15	
	Total output current	ΣIOAL(1)	Port 0	The total all pins.				-30	
		ΣIOAL(2)	Ports 1, 70	The total all pins.				40	
Power dissipation(max.)		Pdmax(1)	DIC64S	Ta=+10~+40°C				760	mW
		Pdmax(2)	QFC64E	Ta=+10~+40°C		Under development			
Operating temperature range		Topg				+10		+40	°C
Storage temperature range		Tstg				-65	~	150	

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2. Recommended operating range / Ta =+10°C to +40°C, VSS = 0 V

Parameter	Symbol	Pins	Conditions	Limits				unit.
				VDD[V]	min.	typ.	max.	
Operating supply voltage range	VDD(1)	VDD	$0.98 \mu s \leq T_{cyc}$ $T_{cyc} \leq 400 \mu s$		4.5		6.0	V
HOLD voltage	VHD	VDD	RAMs and Registers hold voltage at HOLD mode.		2.0		6.0	
Pulldown voltage	VP	VP		4.5~6.0	-35		VDD	
Input high voltage	VIH(1)	Port 0 (Schmitt)	Output disable	4.5~6.0	0.4VDD +0.9		VDD	
	VIH(2)	·Port 1 ·Ports 72,73 (Schmitt)	Output disable	4.5~6.0	0.75VDD		VDD	
	VIH(3)	·Port 70 port input/ interrupt. ·Port 71 ·RES (Schmitt)	Output N-channel Tr. OFF	4.5~6.0	0.75VDD		VDD	
	VIH(4)	Port 70 Watchdog timer input.	Output N-channel Tr. OFF	4.5~6.0	0.9VDD		VDD	
	VIH(5)	Port 8			4.5~6.0	0.75VDD		VDD
Input low voltage	VIL(1)	Port 0 (Schmitt)	Output disable	4.5~6.0	VSS		0.2VDD	
	VIL(2)	·Port 1 ·Ports 72,73 (Schmitt)	Output disable	4.5~6.0	VSS		0.25VDD	
	VIL(3)	·Port 70 Port input/ interrupt. ·Port 71 ·RES (Schmitt)	N-channel Tr. OFF	4.5~6.0	VSS		0.25VDD	
	VIL(4)	Port 70 Watchdog timer.	N-channel Tr. OFF	4.5~6.0	VSS		0.8VDD -1.0	
	VIL(5)	Port 8			4.5~6.0	VSS		0.25VDD
Operation cycle time	Tcyc			4.5~6.0	0.98		400	μs

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Parameter	Symbol	Pins	Conditions	Limits				
				VDD[v]	min.	typ.	max.	unit.
Oscillation frequency range (Note 1)	FmCF(1)	CF1,CF2	·12MHz(ceramic resonator oscillation). ·Refer to figure 1	4.5~6.0	11.76	12	12.24	MHz
	FmCF(2)	CF1,CF2	·3MHz(ceramic resonator oscillation). ·Refer to figure 1	4.5~6.0	2.94	3	3.06	
	FmRC		RC oscillation	4.5~6.0	0.4	0.8	2.0	
	FsXtal	XT1,XT2	·32.768kHz(crystal oscillation). ·Refer to figure 2	4.5~6.0		32.768		kHz
Oscillation stable time period (Note 1)	TmsCF(1)	CF1,CF2	·12MHz(ceramic resonator oscillation). ·Refer to figure 3	4.5~6.0		0.02	0.2	ms
	TmsCF(2)	CF1,CF2	·3MHz(ceramic resonator oscillation). ·Refer to figure 3	4.5~6.0		0.1	1	
	TssXtal	XT1,XT2	·32.768kHz(crystal oscillation). ·Refer to figure 3	4.5~6.0		1	1.5	s

(Note 1) The oscillation constant is shown on table 1 and table 2.

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3. Electrical characteristics / Ta=+10°C to +40°C , VSS = 0 V

Parameter	Symbol	Pins	Conditions	Limits				
				VDD[v]	min.	typ.	max.	unit.
Input high current	I _{IH} (1)	·Port 1 ·Port 0 without pullup MOS Tr.	·Output disable ·Pullup MOS Tr. OFF. VIN=VDD (including off-leak current of output Tr.)	4.5~6.0			1	μA
	I _{IH} (2)	·Port 7 without pullup MOS Tr. ·Port 8	VIN=VDD	4.5~6.0			1	
	I _{IH} (3)	·RES	VIN=VDD	4.5~6.0			1	
Input low current	I _{IL} (1)	·Port 1 ·Port 0 without pullup MOS Tr.	·Output disable ·Pullup MOS Tr. OFF. VIN=VSS (including off-leak current of output Tr.)	4.5~6.0	-1			
	I _{IL} (2)	·Port 7 without pullup MOS Tr. ·Port 8	VIN=VSS	4.5~6.0	-1			
	I _{IL} (3)	·RES	VIN=VSS	4.5~6.0	-1			
Output high voltage	VOH(1)	Ports 0, 1 of CMOS output	IOH=-1.0mA	4.5~6.0	VDD-1			V
	VOH(2)		IOH=-0.1mA	4.5~6.0	VDD-0.5			
	VOH(3)	S0/T0~S15/T15	IOH=-20mA	4.5~6.0	VDD-1.8			
	VOH(4)		·IOH=-1.0mA ·The current of any unmeasurement pin is not over 1 mA.	4.5~6.0	VDD-1			
	VOH(5)	S16~S29	IOH=-5mA	4.5~6.0	VDD-1.8			
	VOH(6)		·IOH=-1.0mA ·The current of any unmeasurement pin is not over 1 mA.	4.5~6.0	VDD-1			
Output low voltage	VOL(1)	Ports 0,1	IOL=10mA	4.5~6.0			1.5	
	VOL(2)		·IOL=1.6mA ·The total current of port 0,1 is not over 40mA.	4.5~6.0			0.4	
	VOL(3)	Port 70	IOL=1mA	4.5~6.0			0.4	
Pullup MOS Tr. resistor	Rpu	·Ports 0,1 ·Port 7	VOH=0.9 VDD	4.5~6.0	15	40	70	kΩ

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Parameter	Symbol	Pins	Conditions	Limits				
				VDD[v]	min.	typ.	max.	unit.
Output off-leakage current	IOFF(1)	·S0/T0~S6/T6 ·S24~S29 (Without pull down resistor.)	·Output P-channel Tr . OFF. ·VOUT=VSS	4.5~6.0	-1			μ A
	IOFF(2)		·Output P-channel Tr . OFF. ·VOUT=VDD-40v	4.5~6.0	-30			
Pulldown transistor resistor	Rpd	·S7/T7~S15/T15 ·S16~S23 (With pulldown resistor.)	·Output P-channel Tr . OFF. ·VOUT=3V ·Vp=-30V	5.0	60	100	200	k Ω
Hysteresis voltage	VHIS	·Ports 0,1 ·Port 7 ·RES	·Output disable	4.5~6.0		0.1VDD		V
Pin capacitance	CP	All pins.	·f=1MHz ·Unmeasurement terminals for input are set to VSS level. ·Ta=25°C	4.5~6.0		10		pF

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4. Serial input/output characteristics / Ta=+10°C to +40°C , VSS = 0 V

Parameter		Symbol	Pins	Conditions	Limits				unit.	
					VDD[v]	min.	typ.	max.		
Serial clock	Input clock	Cycle	TCKCY(1)	SCK0,SCK1	Refer to figure 5	4.5~6.0	2		Tcyc	
		Low level pulse width	TCKL(1)			4.5~6.0	1			
		High level pulse width	TCKH(1)			4.5~6.0	1			
	Output clock	Cycle	TCKCY(2)	SCK0,SCK1	· Use pullup resistor (1kΩ) when open drain output. · Refer to figure 5	4.5~6.0	2			
		Low level pulse width	TCKL(2)			4.5~6.0		1/2Tckey		
		High level pulse width	TCKH(2)			4.5~6.0		1/2Tckey		
Serial input	Data set up time	TICK	· SI0,SI1 · SB0,SB1	· Data set-up to SCK0,1 · Data hold from SCK0,1 · Refer to figure 5	4.5~6.0	0.1		μs		
	Data hold time	TCKI			4.5~6.0	0.1				
Serial output	Output delay time (Serial clock is external clock)	TCKO(1)	· SO0,SO1 · SB0,SB1	· Use pullup resistor (1kΩ) when open drain output. · Data hold from SCK0,1 · Refer to figure 5	4.5~6.0			7/12Tcyc +0.2		
	Output delay time (Serial clock is internal clock)	TCKO(2)			4.5~6.0			1/3Tcyc +0.2		

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5. Pulse input conditions / Ta=+10°C to +40°C , VSS = 0 V

Parameter	Symbol	Pins	Conditions	Limits				
				VDD[v]	min.	typ.	max.	unit.
High/low level pulse width	TPIH(1) TPIL(1)	·INT0,INT1 ·INT2/T0IN	·Interrupt acceptable ·Timer0-countable	4.5~6.0	1			Tcyc
	TPIH(2) TPIL(2)	·INT3/T0IN (The noise rejection clock select to 1/1.)	·Interrupt acceptable ·Timer0-countable	4.5~6.0	2			
	TPIH(3) TPIL(3)	·INT3/T0IN (The noise rejection clock select to 1/64.)	·Interrupt acceptable ·Timer0-countable	4.5~6.0	128			
	TPIL(4)	·RES	Reset acceptable	4.5~6.0	200			μs

6. A/D converter characteristics / Ta=+10°C to +40°C , VSS = 0 V

Parameter	Symbol	Pins	Conditions	Limits				
				VDD[v]	min.	typ.	max.	unit.
Resolution	N			4.5~6.0		8		bit
Absolute precision (Note 2)	ET			4.5~6.0			±1.5	LSB
Conversion time	TCAD		AD conversion time=16×Tcyc (ADCR2=0) (Note 3)	4.5~6.0	15.68 (Tcyc=0.98 μs)		65.28 (Tcyc=4.08 μs)	μs
			AD conversion time=32×Tcyc (ADCR2=1) (Note 3)		31.36 (Tcyc=0.98 μs)		130.56 (Tcyc=4.08 μs)	
Analog input voltage range	VAIN	AN0~AN3		4.5~6.0	VSS		VDD	V
Analog port input current	IAINH		VAIN=VDD	4.5~6.0			1	μA
	IAINL		VAIN=VSS	4.5~6.0	-1			

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

(Note 3) The conversion time means the time to set complete digital conversion value to register from execution of instruction to start conversion.

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7.Current dissipation characteristics / Ta=+10°C to +40°C , VSS = 0 V

Parameter	Symbol	Pins	Conditions	Limits				
				VDD[v]	min.	typ.	max.	unit.
Current dissipation during basic operation (Note 4)	IDDOP(1)	VDD	·FmCF=12MHz Ceramic resonator oscillation. ·FsXtal=32.768 kHz crystal oscillation. ·System clock : CF oscillation. ·Internal RC oscillation stops.	4.5~6.0		13	26	mA
	IDDOP(2)		·FmCF=3MHz Ceramic resonator oscillation. ·FsXtal=32.768 kHz crystal oscillation. ·System clock : CF oscillation . ·Internal RC oscillation stops.	4.5~6.0		6.5	14	
	IDDOP(3)		·FmCF=0Hz (when oscillation stops). ·FsXtal=32.768 kHz crystal oscillation. ·System clock : RC oscillation.	4.5~6.0		4	10	
	IDDOP(4)		·FmCF=0Hz (when oscillation stops). ·FsXtal=32.768 kHz crystal oscillation. ·System clock : Xtal oscillation. ·Internal RC oscillation stops.	4.5~6.0		3.5	9	

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Parameter	Symbol	Pins	Conditions	Limits				
				VDD[V]	min.	typ.	max.	unit.
Current dissipation HALT mode (Note 4)	IDDHALT(1)	VDD	·HALT mode ·FmCF=12MHz Ceramic resonator oscillation. ·FsXtal=32.768 kHz crystal oscillation. ·System clock : CF oscillation . ·Internal RC oscillation stops.	4.5~6.0		5	10	mA
	IDDHALT(2)		·HALT mode FmCF=3MHz Ceramic resonator oscillation. ·FsXtal=32.768 kHz crystal oscillation. ·System clock : CF oscillation . ·Internal RC oscillation stops.	4.5~6.0		1.8	4.6	
	IDDHALT(3)		·HALT mode FmCF=0Hz (when oscillation stops). ·FsXtal=32.768 kHz crystal oscillation. ·System clock : RC oscillation.	4.5~6.0		400	800	μA
	IDDHALT(4)		·HALT mode FmCF=0Hz (when oscillation stops). ·FsXtal=32.768 kHz crystal oscillation. ·System clock : Xtal oscillation. ·Internal RC oscillation stops.	4.5~6.0		20	60	
Current dissipation HOLD (Note 4)	IDDHOLD(1)	VDD	HOLD mode	4.5~6.0		0.05	30	
	IDDHOLD(2)			2.5~4.5		0.02	20	

(Note 4) The currents of output transistors and pull-up transistors are ignored.

Table 1. Ceramic resonator oscillation guaranteed constant (main-clock)

A kind of oscillation	Producer	Oscillator	C1	C2
12MHz ceramic resonator oscillation	Murata	CSA12.0MTZ	33pF	33pF
		CSA12.0MT	33pF	33pF
	Kyocera	KBR-12.0M	33pF	33pF
3MHz ceramic resonator oscillation	Murata	CSA3.00MG	33pF	33pF
		CST3.00MGW	on chip	
	Kyocera	KBR-3.0MS	47pF	47pF

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

Table 2. Crystal oscillation guaranteed constant (sub-clock)

A kind of oscillation	Producer	Oscillator	C3	C4
32.768kHz crystal oscillation	Dai Sinky	DT-38(1TA252E00)	18pF	18pF
	Kyocera	KF-38G-13P0200	18pF	18pF

* Both C3 and C4 must use J rank ($\pm 5\%$) and CH characteristics.

(Not in need of high precision, use K rank ($\pm 10\%$) and SL characteristics.)

- 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.

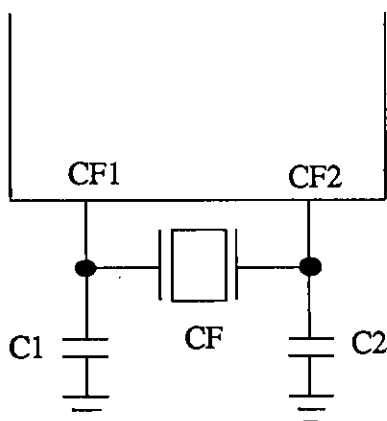


Figure 1 Main-clock circuit
Ceramic resonator oscillation

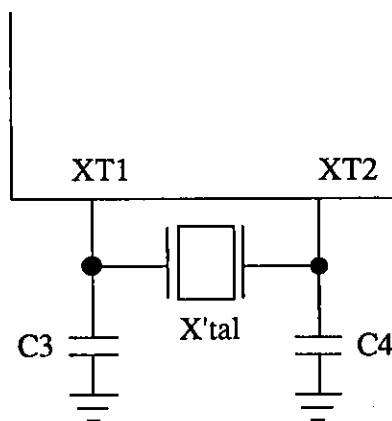


Figure 2 Sub-clock circuit
Crystal oscillation

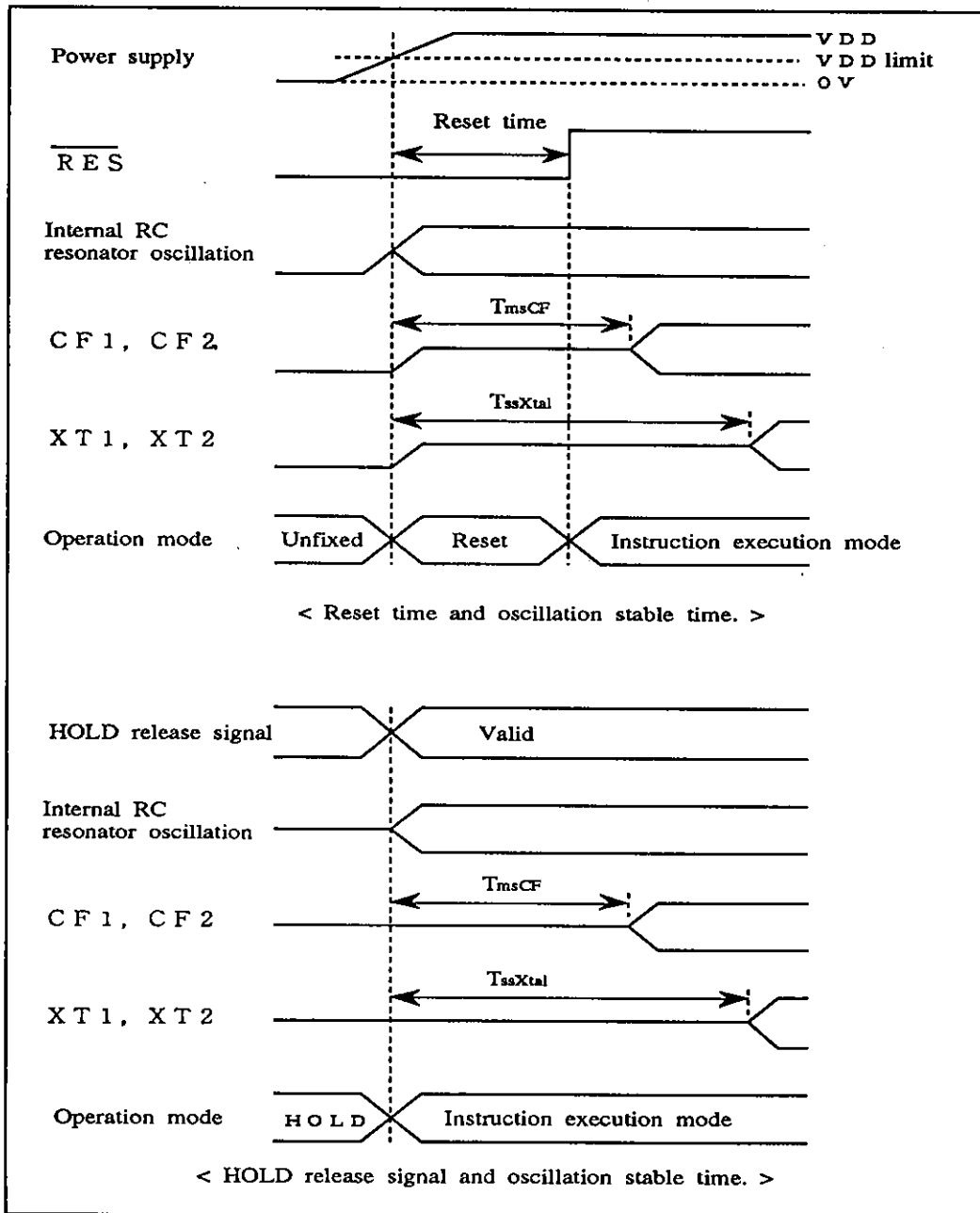
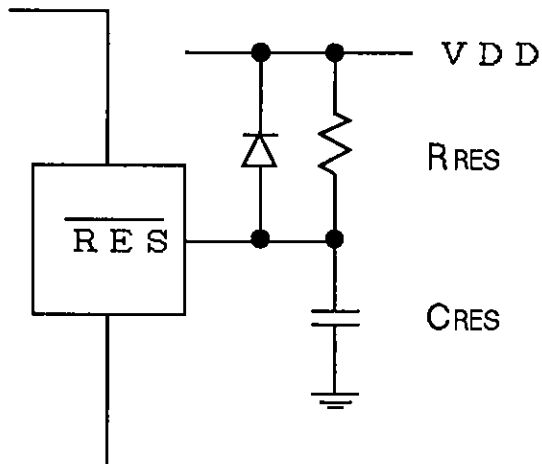
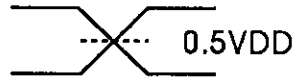


Figure. 3 Oscillation stable time



(Note) Fix the value of CRES, RRES that is sure to reset until $200\mu s$, after Power supply has been over inferior limit of supply voltage.

Figure. 4 Reset circuit



< AC timing point >

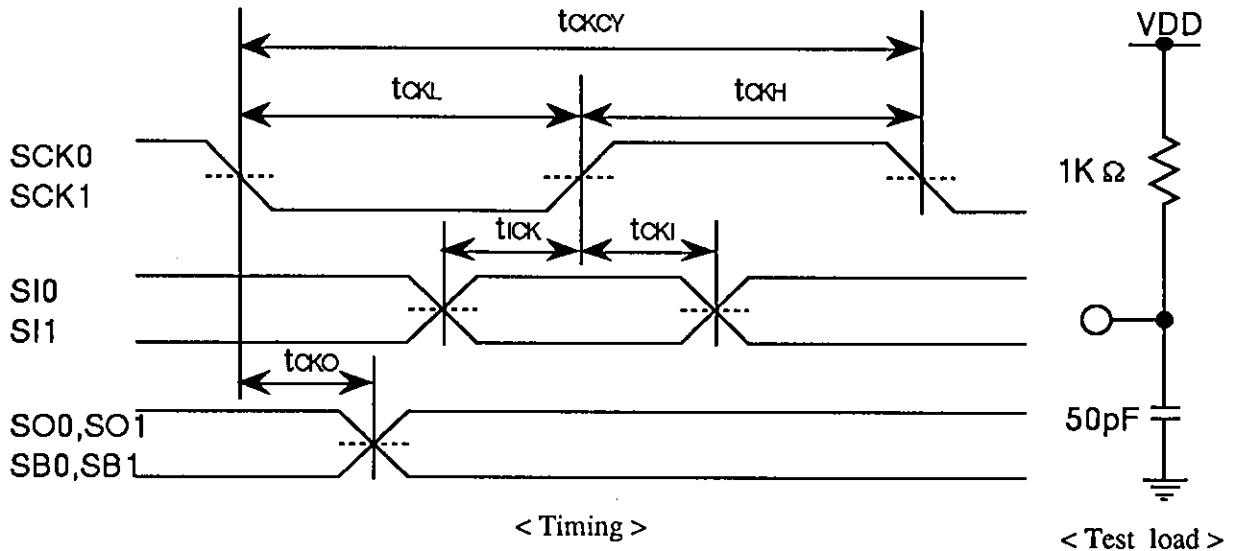


Figure. 5 Serial input/output test condition

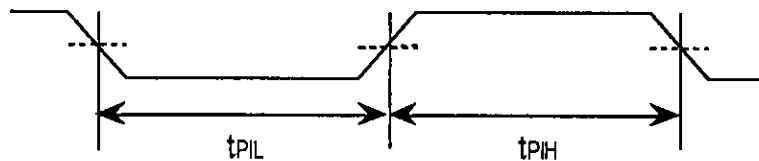


Figure. 6 Pulse input timing condition

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