To all our customers

Regarding the change of names mentioned in the document, such as Mitsubishi Electric and Mitsubishi XX, to Renesas Technology Corp.

The semiconductor operations of Hitachi and Mitsubishi Electric were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Mitsubishi Electric, Mitsubishi Electric Corporation, Mitsubishi Semiconductors, and other Mitsubishi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Note : Mitsubishi Electric will continue the business operations of high frequency & optical devices and power devices.

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

M66222SP/FP

128 × 8-BIT × 2 MAIL-BOX

DESCRIPTION

The M66222 is a mail box that incorporates two complete CMOS shared memory cells of 128 × 8-bit configuration using high-performance silicon gate CMOS process technology, and are equipped with two access ports of A and B.

Access ports A and B are equipped with independent addresses $\overline{CS}$, $\overline{WE}$ and $\overline{OE}$ control pins and I/O pins to allow independent and asynchronous read/write operations individually. This product exclusively performs a write operation from A port and a read operation from B port for one memory, and a read operation from A port and a write operation from B port for the other memory.

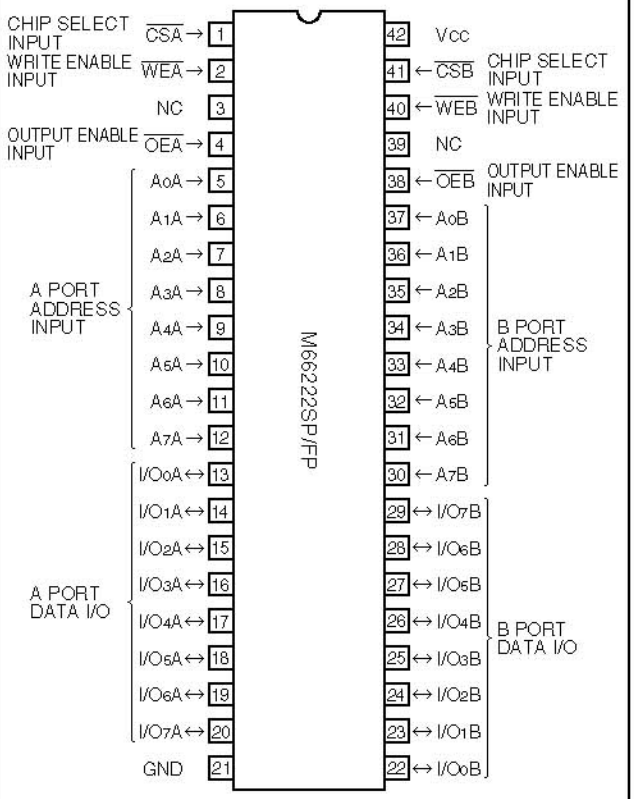
FEATURES

- Memory configuration of 128 × 8 bits × 2 memory areas
- High-speed access, address access time 40ns (typ.)
- Complete asynchronous accessibility from ports A and B
- Fixed read/write access ports for memory
- Completely static operation
- Low power dissipation CMOS design
- 5V single power supply
- TTL direct-coupled I/O
- 3-state output for I/O pins

APPLICATION

Inter-MCU data transfer memory, communication buffer memory

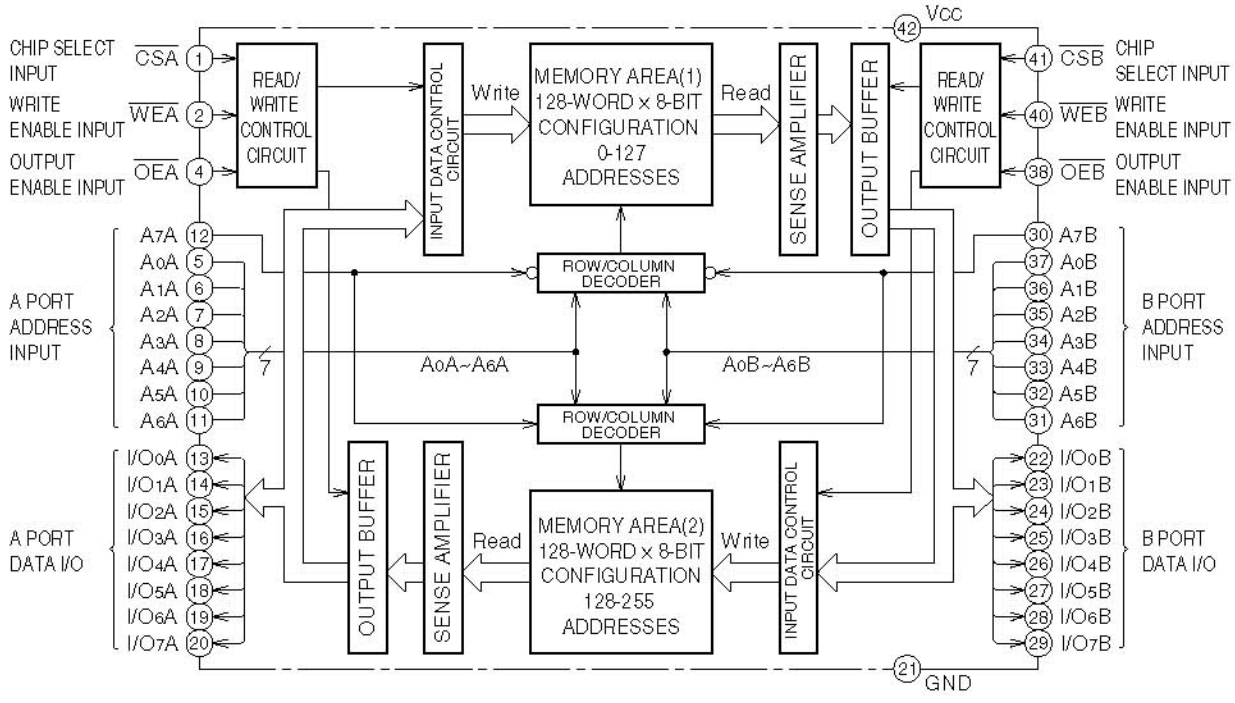
PIN CONFIGURATION (Top view)



Outline 42P4B
42P2R-A

NC: No Connection

BLOCK DIAGRAM



FUNCTION

The M66222 is a mail box most suitable for inter-MCU data communication interface. Provision of two pairs of addresses and data buses in its shared memory cell of 128 × 8-bit configuration allows independent and asynchronous read/write operations from/to two access ports of A and B individually.

Two memory areas of 128 × 8-bit configuration are incorporated in the chip. Memory area (1) is used only to perform a write operation from A port and a read operation from B port, and memory area (2) only to perform a read operation from A port and a write operation from B port.

In this case, address A_7A should be set to "L" when writing data from A port in memory area (1), and address A_7B should be set to "L" when reading data from B port in memory area (1). Also, address A_7B should be set to "H" when writing data from B port in memory area (2), and address A_7A should be set to "H" when reading data from A port in memory area (2).

Therefore, an attempt to set addresses A_7A and A_7B from each port in a mode other than the above setting invalidates any read/write operation from the corresponding port (See Table 1 and Fig 1).

As a basic write operation to memory, one of addresses A_0 to A_7 is specified. The $\overline{CS}$ signal is set to "L" to place one of I/O pins in the input mode. Also, the $\overline{WE}$ signal is set to "L". Data at the I/O pin is written into memory.

As a read operation, the $\overline{WE}$ signal is set to "H". Both $\overline{CS}$ signal and $\overline{OE}$ signal are set to "L" to place one of I/O pins in the output mode. One of addresses A_0 to A_7 is specified. Data at the specified address is thus output to the I/O pin.

When the $\overline{CS}$ signal is set to "H", the chip enters a non-select state which inhibits a read and write operation. At this time, the output is placed in the floating state (high impedance state), thus allowing OR tie with another chip. When the $\overline{OE}$ signal is set to "H", the output enters the floating state. In the I/O bus mode, setting the $\overline{OE}$ signal to "H" at a write time avoids contention of I/O bus data. When the $\overline{CS}$ signal is set to Vcc, the output enters the full stand-by state to minimize supply current (See Tables 2 and 3).

Table 1 Port Operations and Address A_7 Setting Conditions

Operation \ Access port	A port	B port
Write	A_7A = "L"	A_7B = "H"
Read	A_7A = "H"	A_7B = "L"

Note 1: No input data is written into any port having address A_7 set under any condition other than Table 1. Undefined data is read to an output pin during a read operation.

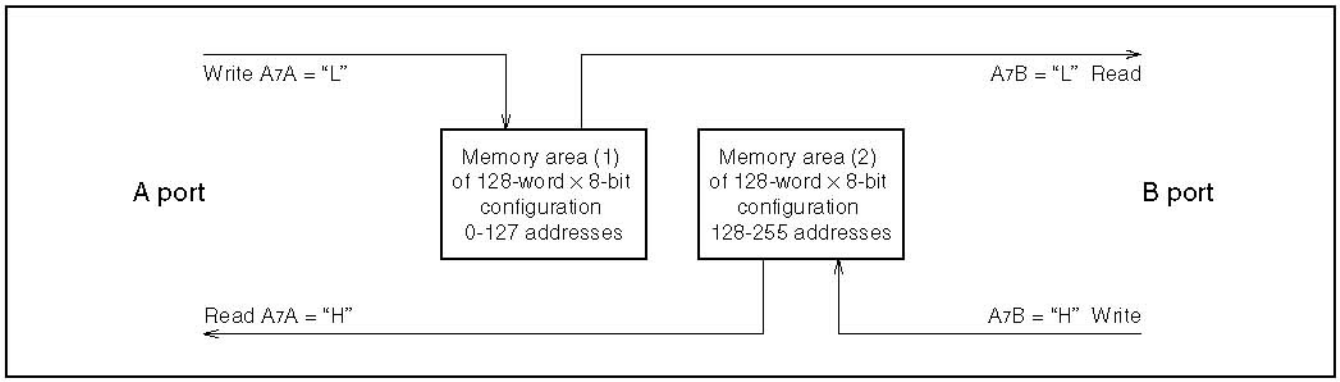


Fig 1 Access from Ports

Table 2 A Port Function Table

$\overline{CSA}$	$\overline{WEA}$	$\overline{OEA}$	A_7A	Mode	I/O pin	Icc
L	L	×	L	Write	DIN	Operation
			H	Invalid	DIN	Operation
L	H	L	L	Invalid	DOUT	Operation
			H	Read	DOUT	Operation
L	H	H	×	—	High impedance	Operation
H	×	×	×	Non-select	High impedance	Stand-by

Note 2: × indicates "L" or "H". (Irrelevant)
"H" = High level, "L" = Low level

Table 3 B Port Function Table

$\overline{CSB}$	$\overline{WEB}$	$\overline{OEB}$	A_7B	Mode	I/O pin	Icc
L	L	×	L	Invalid	DIN	Operation
			H	Write	DIN	Operation
L	H	L	L	Read	DOUT	Operation
			H	Invalid	DOUT	Operation
L	H	H	×	—	High impedance	Operation
H	×	×	×	Non-select	High impedance	Stand-by

FUNCTIONAL DESCRIPTION

The M66222 with independent and asynchronous accessibility from two ports has the following four basic operations depending on an address and mode set from both ports:

(1) A port ..... Write B port ..... Write
(2) A port ..... Write B port ..... Read
(3) A port ..... Read B port ..... Write
(4) A port ..... Read B port ..... Read

In this case, the same address is not selected when the same read/write instruction is being executed at both ports as given in (1) and (4). There is no concern about uncertainty of read/write data at an active address. If one port operates in the write mode and the other does in the read mode as given in (2) and (3), however, the same address may be selected. In this case, data of the port operating in the write mode is written. If the port in the read mode comes first, read data of the first-in port becomes uncertain until write data of the last-in port is determined (If the same address is selected, data of the port operating in the write mode is written into memory. Therefore, data of the port in the read mode may change from previously written data to newly written ones during the same cycle) (See Fig 2).

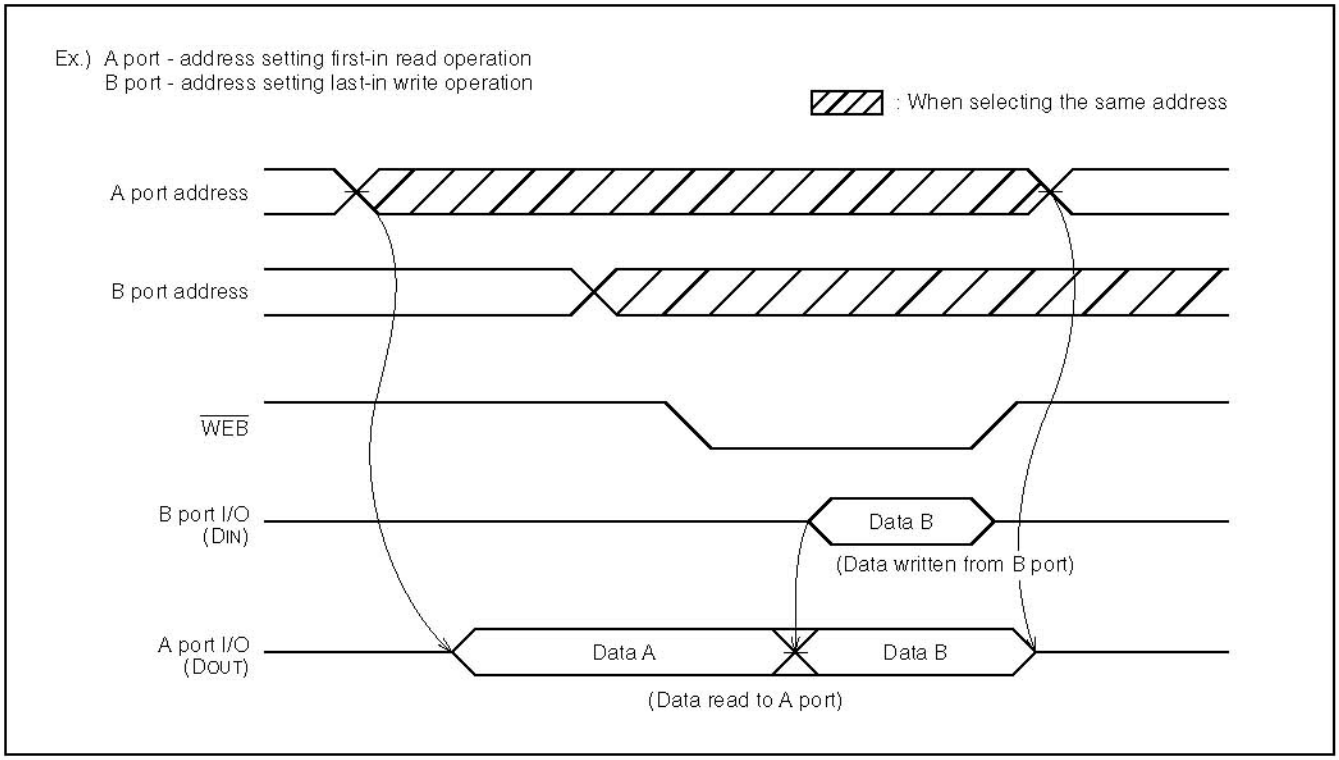


Fig 2 Example of Read Data Transition at Selection of Same Address

ABSOLUTE MAXIMUM RATINGS (Ta = 0 ~ 70°C, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage	When defining GND pin as a reference.	−0.3 ~ +7.0	V
V_I	Input voltage		−0.3 ~ V_{CC} + 0.3	V
V_O	Output voltage		0 ~ V_{CC}	V
P_d	Maximum power dissipation	Ta = 25°C	700	mW
T_{stg}	Storage temperature range		−65 ~ 150	°C

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
V_{CC}	Supply voltage	4.5	5.0	5.5	V
GND	Ground		0		V
V_I	Input voltage	0		V_{CC}	V
T_{opr}	Operating temperature range	0		70	°C

ELECTRICAL CHARACTERISTICS (Ta = 0 ~ 70°C, Vcc=5V±10%, unless otherwise noted)

Symbol	Parameter		Test conditions	Limits			Unit
				Min.	Typ.	Max.	
V_{IH}	"H" input voltage			2.2		V_{CC}+0.3	V
V_{IL}	"L" input voltage			−0.3		0.8	V
V_{OH}	"H" output voltage		I_{OH} = −2mA	2.4			V
V_{OL}	"L" output voltage		I_{OL} = 4mA			0.5	V
I_{IH}	"H" input current		V_I = V_{CC}			10.0	µA
I_{IL}	"L" input current		V_I = GND			−10.0	µA
I_{OZH}	Off state "H" output current		$\overline{CS}$ = V_{IH} or $\overline{OE}$ = V_{IH} V_O = V_{CC}			10.0	µA
I_{OZL}	Off state "L" output current		$\overline{CS}$ = V_{IH} or $\overline{OE}$ = V_{IH} V_O = GND			−10.0	µA
I_{CC}	Static current dissipation (active)		$\overline{CS}$ < 0.2V, Another input V_{IN} > V_{CC} − 0.2V or V_{IN} < 0.2V, Output pin open			60	mA
I_{SB1}	Stand-by current	Two-port stand-by	$\overline{CSA}$, $\overline{CSB}$ = V_{IH}			5	mA
I_{SB2}		One-port stand-by	$\overline{CSA}$ or $\overline{CSB}$ = V_{IH} I_{OUT} = 0mA (Active port output pin open)			60	mA
I_{SB3}		Two-port full stand-by	$\overline{CSA}$, $\overline{CSB}$ > V_{CC} − 0.2V Another input V_{IN} > V_{CC} − 0.2V or V_{IN} < 0.2V			0.1	mA
I_{SB4}		One-port full stand-by	$\overline{CSA}$ or $\overline{CSB}$ > V_{CC} − 0.2V Another input V_{IN} > V_{CC} − 0.2V or V_{IN} < 0.2V, I_{OUT} = 0mA (Active port output pin open)			30	mA
C_I	Input capacitance					10	pF
C_O	Output capacitance in off state					15	pF

Notes 3: The direction in which current flows into the IC is defined as positive (no sign).
4: The above typical values are standard values for V_{CC}=5V and Ta=25°C.

SWITCHING CHARACTERISTICS (Ta = 0 ~ 70°C, Vcc = 5V±10%, unless otherwise noted)

Read cycle

Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
tCR	Read cycle time	70			ns
ta(A)	Address access time			70	ns
ta(CS)	Chip select access time			70	ns
ta(OE)	Output enable access time			35	ns
tdis(CS)	Output disable time after $\overline{CS}$ (Note 5)			35	ns
tdis(OE)	Output disable time after $\overline{OE}$ (Note 5)			35	ns
ten(CS)	Output enable time after $\overline{CS}$ (Note 5)	5			ns
ten(OE)	Output enable time after $\overline{OE}$ (Note 5)	5			ns
tv(A)	Data effective time after Address	10			ns

TIMING REQUIREMENTS (Ta = 0 ~ 70°C, Vcc = 5V±10%, unless otherwise noted)

Write cycle

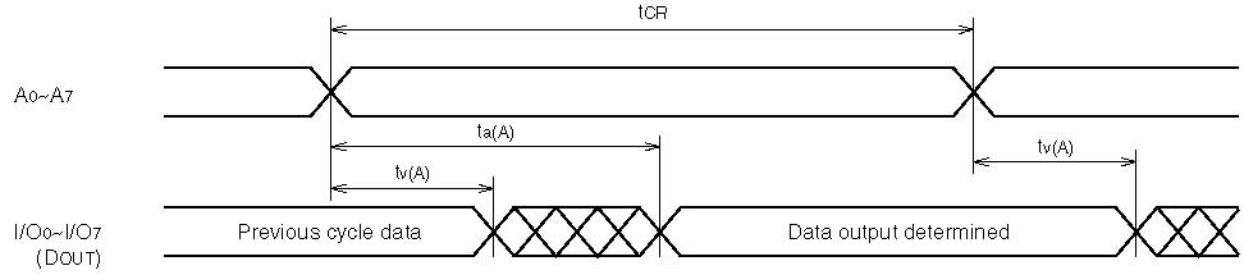
Symbol	Parameter	Limits			Unit
		Min.	Typ.	Max.	
tCW	Write cycle time	70			ns
tw(WE)	Write pulse width	45			ns
tsu(A)1	Address setup time (for $\overline{WE}$)	0			ns
tsu(A)2	Address setup time (for $\overline{CS}$)	0			ns
tsu(A-WEH)	Address setup time for rise of $\overline{WE}$	65			ns
tsu(CS)	Chip select setup time	65			ns
tsu(D)	Data setup time	40			ns
th(D)	Data hold time	0			ns
trec(WE)	Write recovery time	0			ns
tdis(WE)	Output disable time after $\overline{WE}$ (Note 5)			35	ns
tdis(OE)	Output disable time after $\overline{OE}$ (Note 5)			35	ns
ten(WE)	Output enable time after $\overline{WE}$ (Note 5)	0			ns
ten(OE)	Output enable time after $\overline{OE}$ (Note 5)	5			ns

Note 5: The time required for the output to change from a steady state to ±500mV under the load conditions shown in Figure 4.
This parameter is guaranteed but is not tested at shipment.

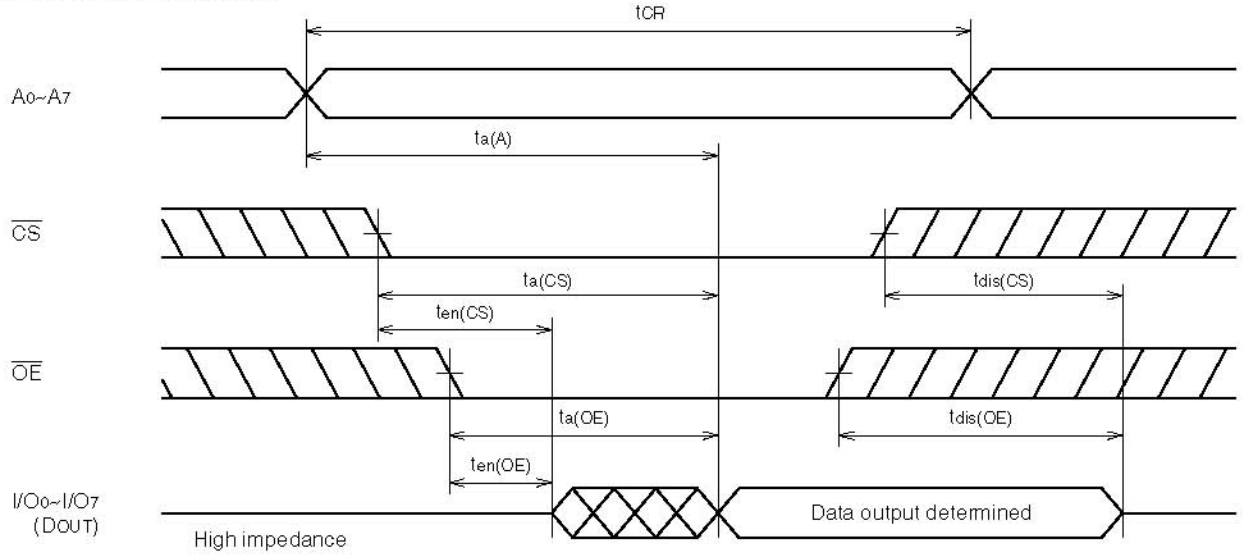
TIMING DIAGRAM

Read Cycle ($\overline{WE}$ = VIH)

Read cycle No. 1 (Address control) ($\overline{CS}$ = $\overline{OE}$ = VIL)

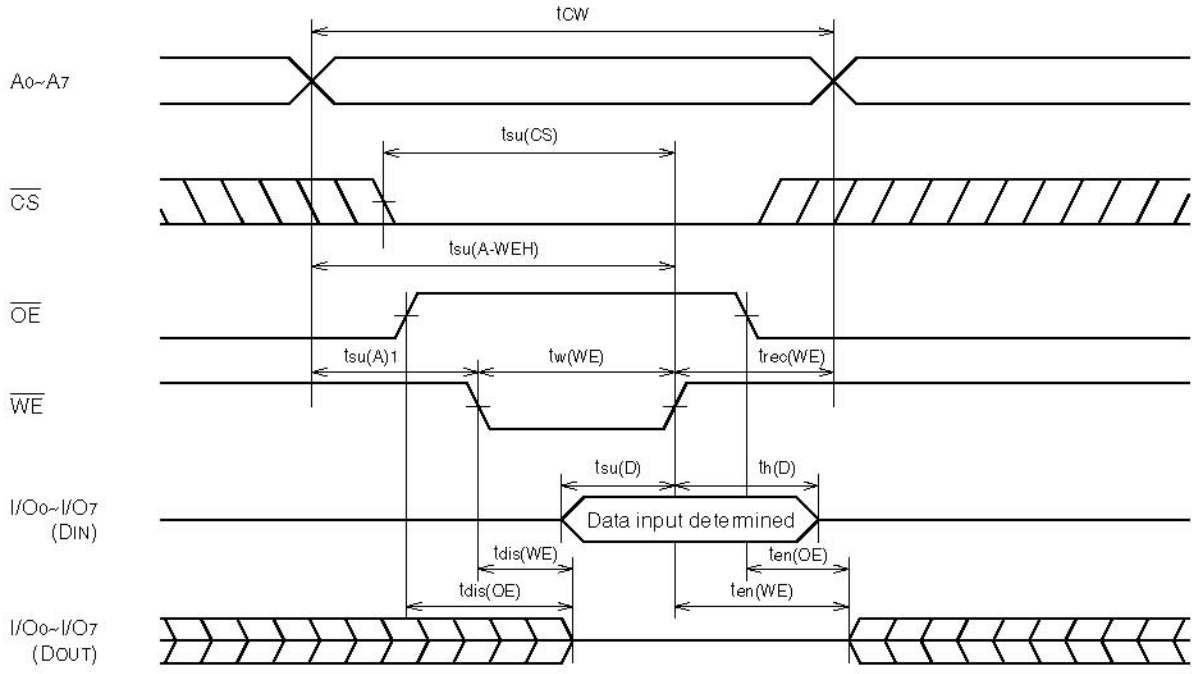


Read cycle No. 2 ($\overline{CS}$ control)

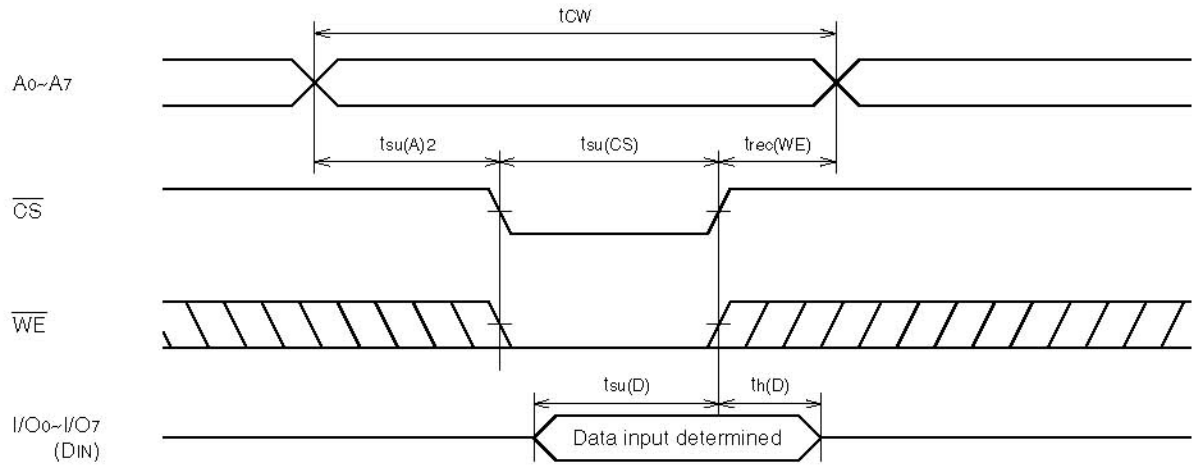


Write Cycle

Write cycle No.1 ($\overline{WE}$ control) See Notes 6, 7 and 8.



Write cycle No.2 ($\overline{CS}$ control) See Notes 7 and 8.



Notes 6: The $\overline{WE}$ of the port must be set to "H" when an address input changes.
7: A write operation is performed during the overlap period when both $\overline{CS}$ and $\overline{WE}$ are "L".
8: Do not apply any negative-phase signal from outside when an I/O pin is in output state.
9: The shaded part means a state in which a signal can be "H" or "L".

SWITCHING CHARACTERISTICS MEASUREMENT CIRCUIT

Input pulse level : V_{IH} = 3.0V, V_{IL} = 0V
Input pulse rise/fall time : tr/tf = 5ns
Input timing reference voltage : 1.5V
Output timing decision voltage : 1.5V
Output load : Figure 3 ~ 4 (The capacitance includes stray wiring capacitance and the probe input capacitance.)

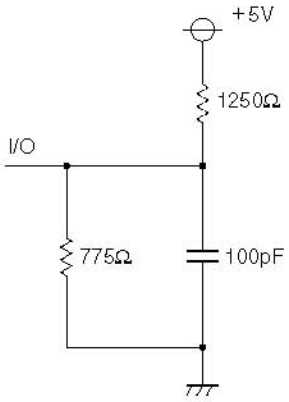


Fig 3. Output Load

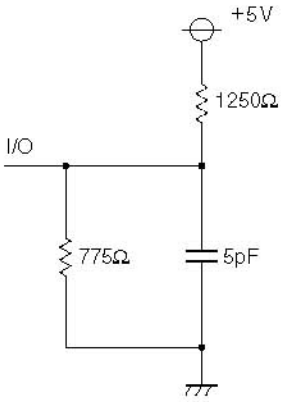


Fig 4. Output Load (to ten, tdis)