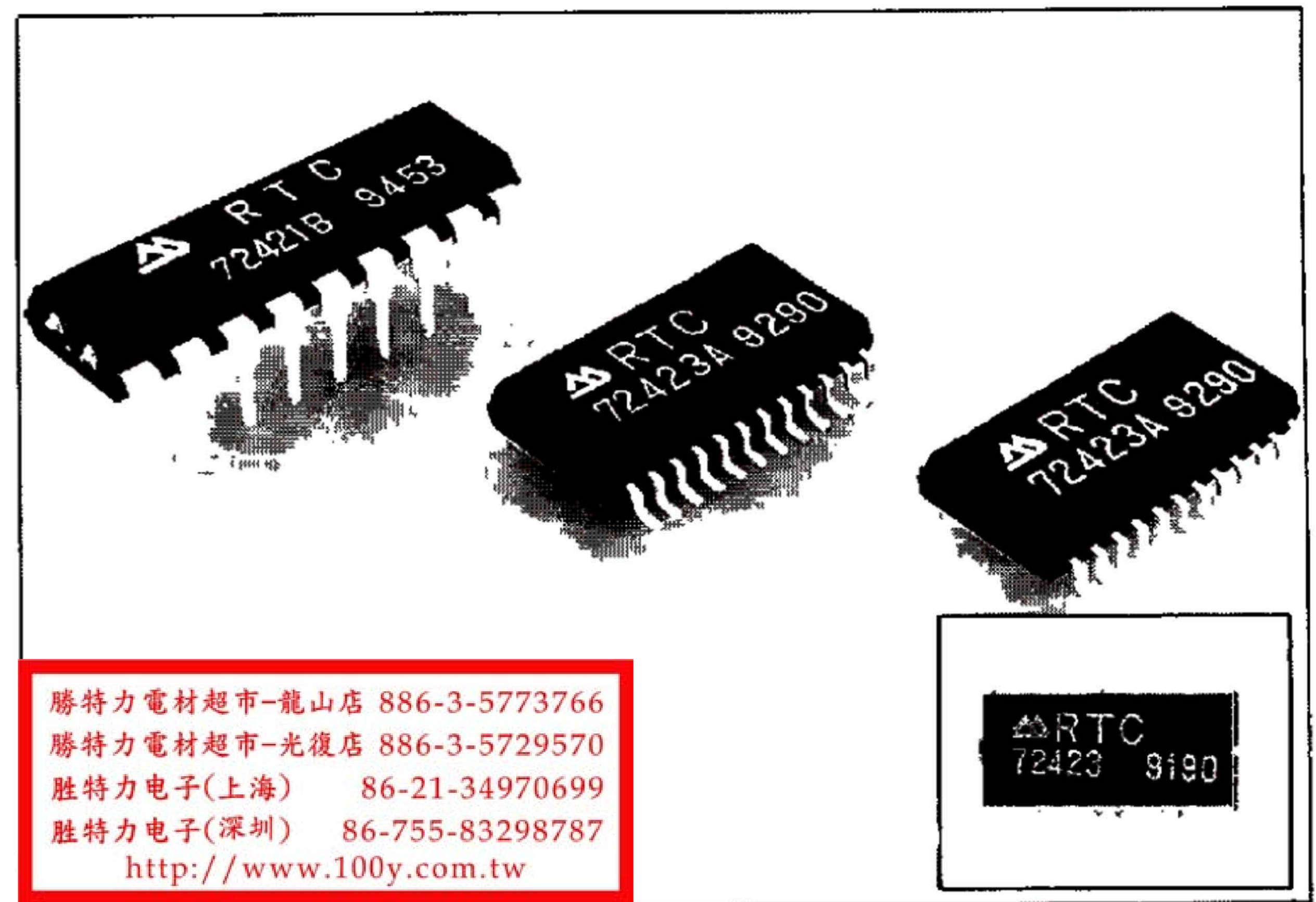


# 4-bit REAL TIME CLOCK MODULE RTC-72421/72423

- The built-in quartz crystal makes regulation unnecessary and allows for easy design
- Direct bus-compatibility (120 ns. access time)
- ALE INPUT terminal available for 8048, 8051, and 8085 series
- Incorporates built-in Time (hour, minute, second), and Date (year, month, week, day) counters
- 12H/24H clock switchover function and automatic leap year setting
- Interrupt masking
- 30 seconds error adjustment function
- READ, WRITE, HOLD, STOP, RESET, and CHIP SELECT INPUTS
- Low current consumption and features a backup function



## Specifications (characteristics)

### Absolute Maximum Rating

Item	Symbol	Condition	Specifications	Unit
Power source voltage	$V_{DD}$	$T_a = 25^\circ\text{C}$	-0.3 to 7.0	V
Input and output voltage	$V_{I/O}$	$T_a = 25^\circ\text{C}$	GND -0.3 to $V_{DD} + 0.3$	V
Storage temperature	$T_{STG}$	RTC-72421	-55 to +85	°C
		RTC-72423	-55 to +125	
Soldering condition	$T_{SOL}$	RTC-72421	Under 260°C within 10 sec (lead part) (package should be less than 150°C)	
		RTC-72423	Under 260°C within 10 sec × up to 2 times or under 230°C within 3 min	

### Operating Range

Item	Symbol	Condition	Specifications	Unit
Operating voltage	$V_{DD}$		4.5 to 5.5	V
Operating temperature	$T_{OPR}$	RTC-72421	-10 to 70	°C
		RTC-72423	-40 to 85	
Data holding voltage	$V_{DH}$		2.0 to 5.5	V
CSI data holding time	$t_{CDR}$	Refer to the data holding timing	2.0 MIN.	μs
Operation restoring time	$t_R$	Refer to the data holding timing	2.0 MIN.	μs

### Frequency characteristics and current consumption characteristics

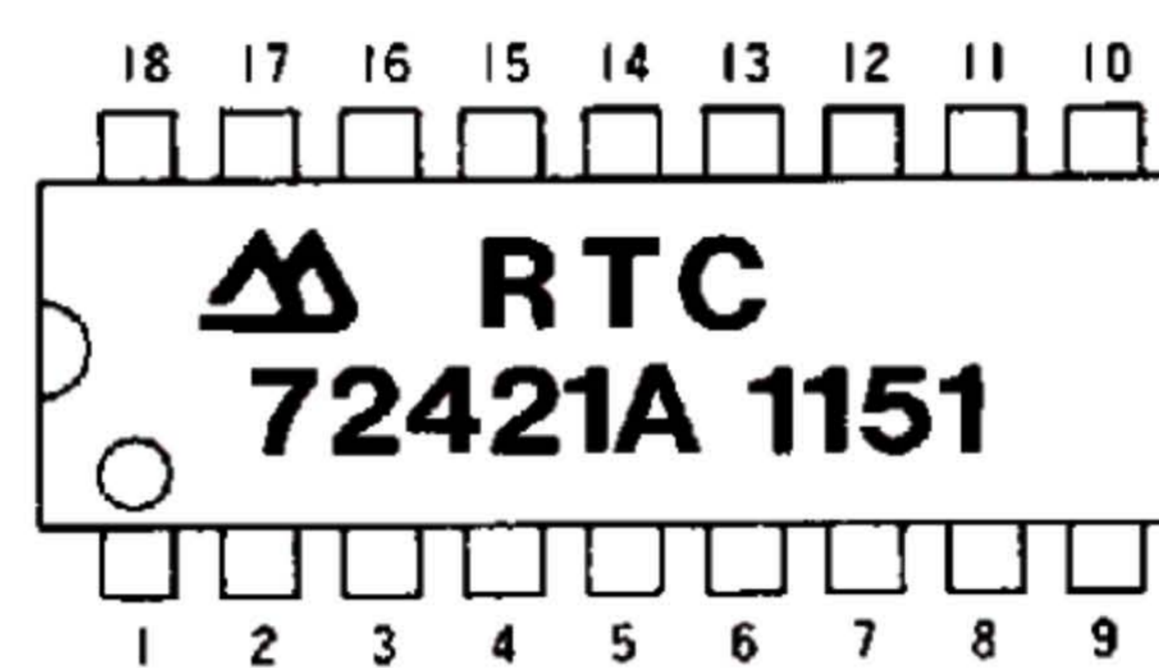
Item	Symbol	Condition	Specifications	Unit	
Frequency tolerance	$\Delta f/f_0$	$T_a = 25^\circ\text{C}$ $V_{DD} = 5\text{V}$	72421A	±10	ppm
			72421B	±50	
			72423A	±20	
			72423	±50	
Frequency temperature characteristics		-10 to +70°C (25°C reference temperature)	+10/-120		
Aging	$f_a$	$V_{DD} = 5\text{V}$ , $T_a = 25^\circ\text{C}$ , first year	±5 MAX.	ppm/Y	
Shock resistance	S. R.	Drop test of 3 times on a hard board from 75cm height or 3000G × 0.3ms × 1/2 sine wave × 3 directions	±10 MAX.	ppm	
Current consumption	$I_{DD1}$	$CS_1 = 0\text{V}$ $V_{DD} = 5\text{V}$	10 MAX.	μA	
	$I_{DD2}$	Exclude input/output current $V_{DD} = 2\text{V}$	5 MAX.		

### Electrical Characteristics

Item	Symbol	Condition	MIN	TYP	MAX	Unit	Applicable terminal
"H" input voltage (1)	$V_{IH1}$		2.2	-	-	V	All inputs other than $CS_1$
"L" input voltage (1)	$V_{IL1}$		-	-	0.8	V	All inputs other than $CS_1$
Input leak current (1)	$I_{LK1}$	$V_1 = V_{DD}/OV$	-	-	±1	μA	Input other than $D_0$ to $D_3$
Input leak current (2)	$I_{LK2}$		$D_0$ to $D_3$				
"L" output voltage (1)	$V_{OL1}$	$I_{OL} = 2.5\text{mA}$	-	-	0.4	V	$D_0$ to $D_3$
"H" output voltage	$V_{OH}$	$I_{OH} = -400\mu\text{A}$	2.4	-	-		
"L" output voltage (2)	$V_{OL2}$	$I_{OL} = 2.5\text{mA}$	-	-	0.4	V	STD.P
OFF leak current	$I_{OFFLK}$	$V_1 = V_{DD}/OV$	-	-	10		
Input capacity	$C_1$	Input frequency 1MHz	-	10	-	pF	Input other than $D_0$ to $D_3$
			-	20	-		
"H" input voltage (2)	$V_{IH2}$	$V_{DD} = 2$ to $5.5\text{V}$	$4/5V_{DD}$	-	-	V	$CS_1$
"L" input voltage (2)	$V_{IL2}$		-	-	$1/5V_{DD}$		

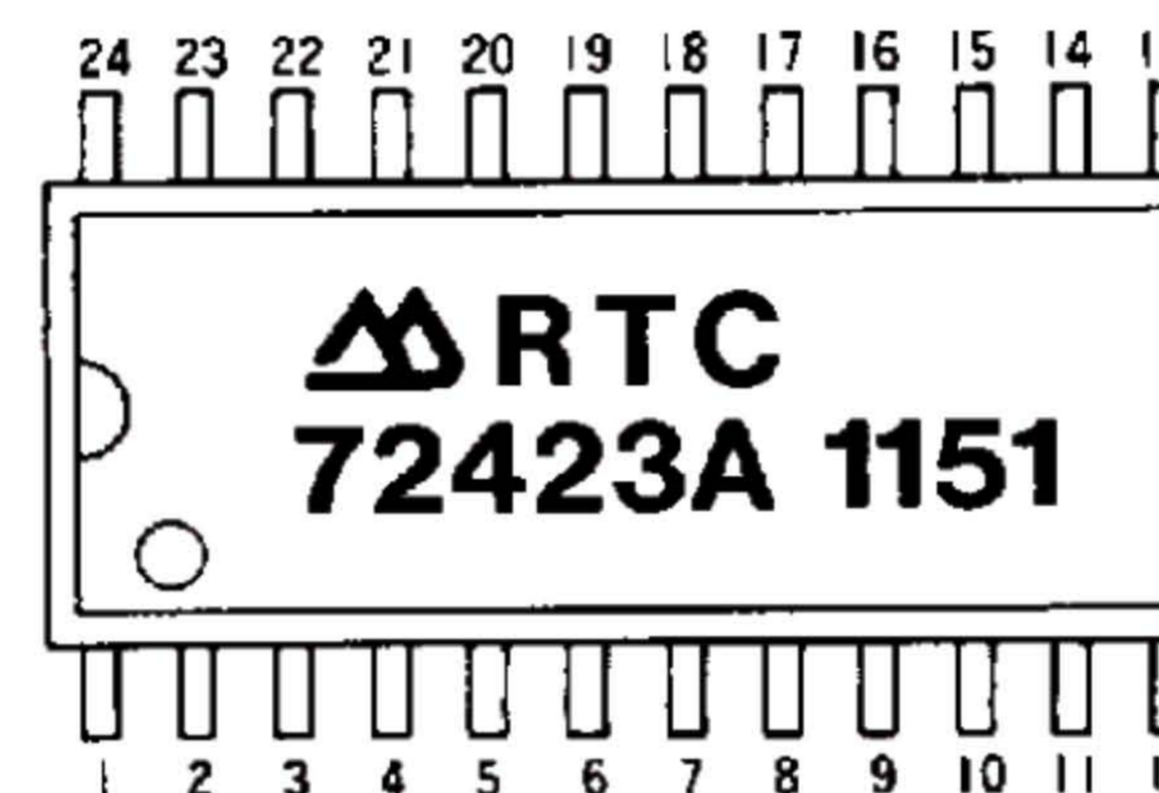
### Terminal Connection

#### RTC-72421



1 STD P	18 $V_{DD}$
2 $CS_0$	17 ( $V_{DD}$ )
3 ALE	16 ( $V_{DD}$ )
4 $A_0$	15 $CS_1$
5 $A_1$	14 $D_0$
6 $A_2$	13 $D_1$
7 $A_3$	12 $D_2$
8 $\overline{RD}$	11 $D_3$
9 GND	10 WR

#### RTC-72423



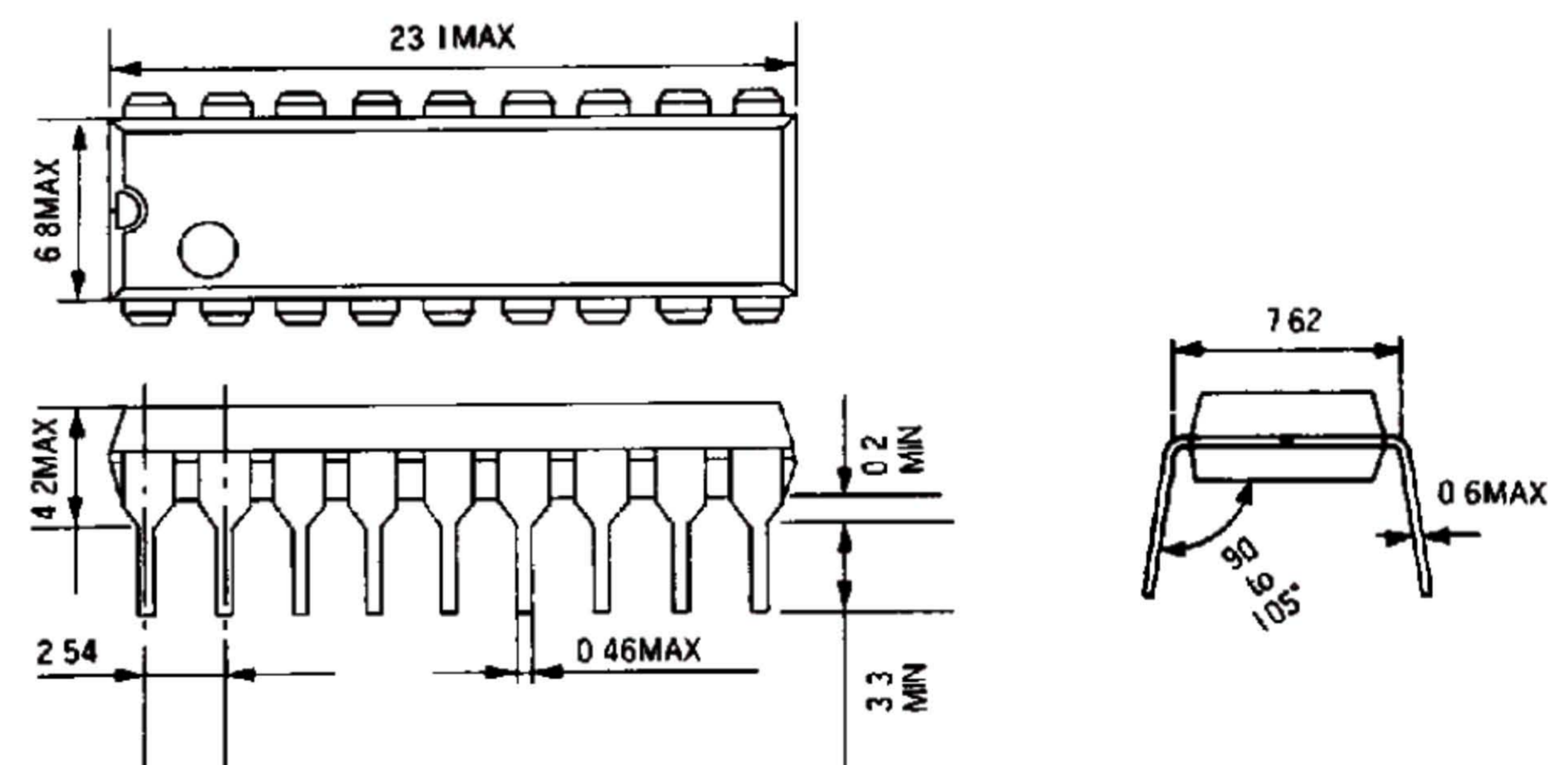
1 STD P	24 $V_{DD}$
2 $CS_0$	23 ( $V_{DD}$ )
3 NC	22 ( $V_{DD}$ )
4 ALE	21 NC
5 $A_0$	20 $CS_1$
6 $A_1$	19 $D_0$
7 $A_2$	18 NC
8 NC	17 NC
9 $A_3$	16 $D_1$
10 $A_2$	15 $D_2$
11 $\overline{RD}$	14 $D_3$
12 GND	13 WR

- ( $V_{DD}$ ) is to be same level of voltage as of  $V_{DD}$ . Do not connect it to any external terminals
- NC is not connected internally

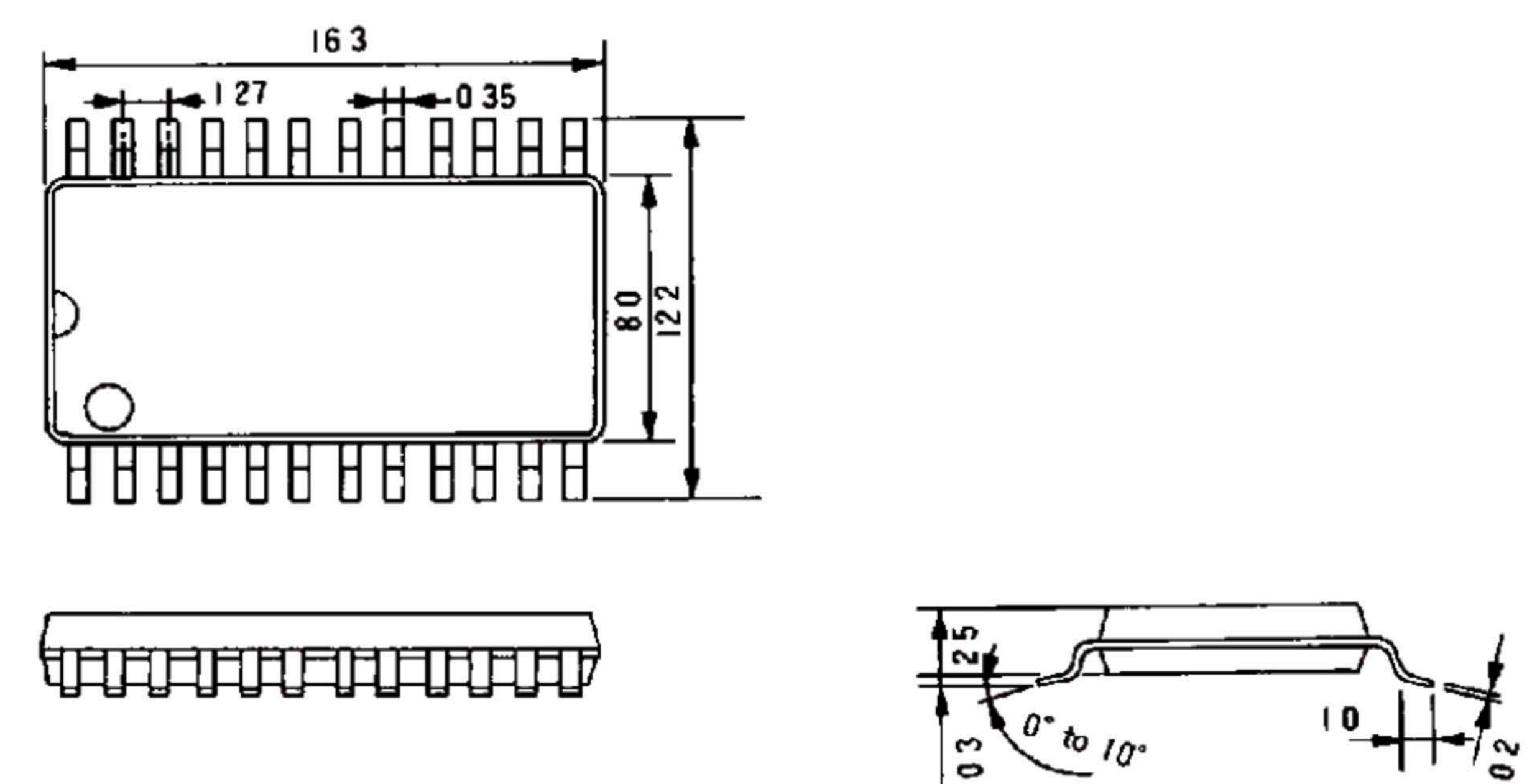
### External Dimensions

(Unit: mm)

#### RTC-72421



#### RTC-72423





## Function Table

Address	A <sub>3</sub>	A <sub>2</sub>	A <sub>1</sub>	A <sub>0</sub>	Register	Data				Count Value	Remarks
						D <sub>3</sub>	D <sub>2</sub>	D <sub>1</sub>	D <sub>0</sub>		
0	0	0	0	0	S <sub>1</sub>	s <sub>8</sub>	s <sub>4</sub>	s <sub>2</sub>	s <sub>1</sub>	0 to 9	1-second digit register
1	0	0	0	1	S <sub>10</sub>	*	s <sub>40</sub>	s <sub>20</sub>	s <sub>10</sub>	0 to 5	10-second digit register
2	0	0	1	0	M <sub>1</sub>	mi <sub>8</sub>	mi <sub>4</sub>	mi <sub>2</sub>	mi <sub>1</sub>	0 to 9	1-minute digit register
3	0	0	1	1	M <sub>10</sub>	*	mi <sub>40</sub>	mi <sub>20</sub>	mi <sub>10</sub>	0 to 5	10-minute digit register
4	0	1	0	0	H <sub>1</sub>	h <sub>8</sub>	h <sub>4</sub>	h <sub>2</sub>	h <sub>1</sub>	0 to 9	1-hour digit register
5	0	1	0	1	H <sub>10</sub>	*	PM/AM	h <sub>20</sub>	h <sub>10</sub>	0 to 2 or 0 to 1	PM/AM, 10-hour digit register
6	0	1	1	0	D <sub>1</sub>	d <sub>8</sub>	d <sub>4</sub>	d <sub>2</sub>	d <sub>1</sub>	0 to 9	1-day digit register
7	0	1	1	1	D <sub>10</sub>	*	*	d <sub>20</sub>	d <sub>10</sub>	0 to 3	10-day digit register
8	1	0	0	0	MO <sub>1</sub>	mo <sub>8</sub>	mo <sub>4</sub>	mo <sub>2</sub>	mo <sub>1</sub>	0 to 9	1-month digit register
9	1	0	0	1	MO <sub>10</sub>	*	*	*	mo <sub>10</sub>	0 to 1	10-month digit register
A	1	0	1	0	Y <sub>1</sub>	y <sub>8</sub>	y <sub>4</sub>	y <sub>2</sub>	y <sub>1</sub>	0 to 9	1-year digit register
B	1	0	1	1	Y <sub>10</sub>	y <sub>80</sub>	y <sub>40</sub>	y <sub>20</sub>	y <sub>10</sub>	0 to 9	10-year digit register
C	1	1	0	0	W	*	w <sub>4</sub>	w <sub>2</sub>	w <sub>1</sub>	0 to 6	Week register
D	1	1	0	1	Reg D	30sec ADJ	IRQ FLAG	BUSY	HOLD	—	Control Register D
E	1	1	1	0	Reg E	t <sub>1</sub>	t <sub>0</sub>	ITRPT /STND	MASK	—	Control Register E
F	1	1	1	1	Reg F	TEST	24/12	STOP	REST	—	Control Register F

\* 0="L" level, 1="H" level, REST=RESET ITRPT/STND=INTERRUPT/STANDARD

- 1) Bit \* does not exist
- 2) Please mask AM/PM bit with 10's of hours operations.
- 3) Busy is read only. IRQ can only be set low ("0")

Data Bit	PM/AM	ITRPT/STND	24/12
1	PM	ITRPT	24
0	AM	STND	12

- 5) TEST bit should be "0".

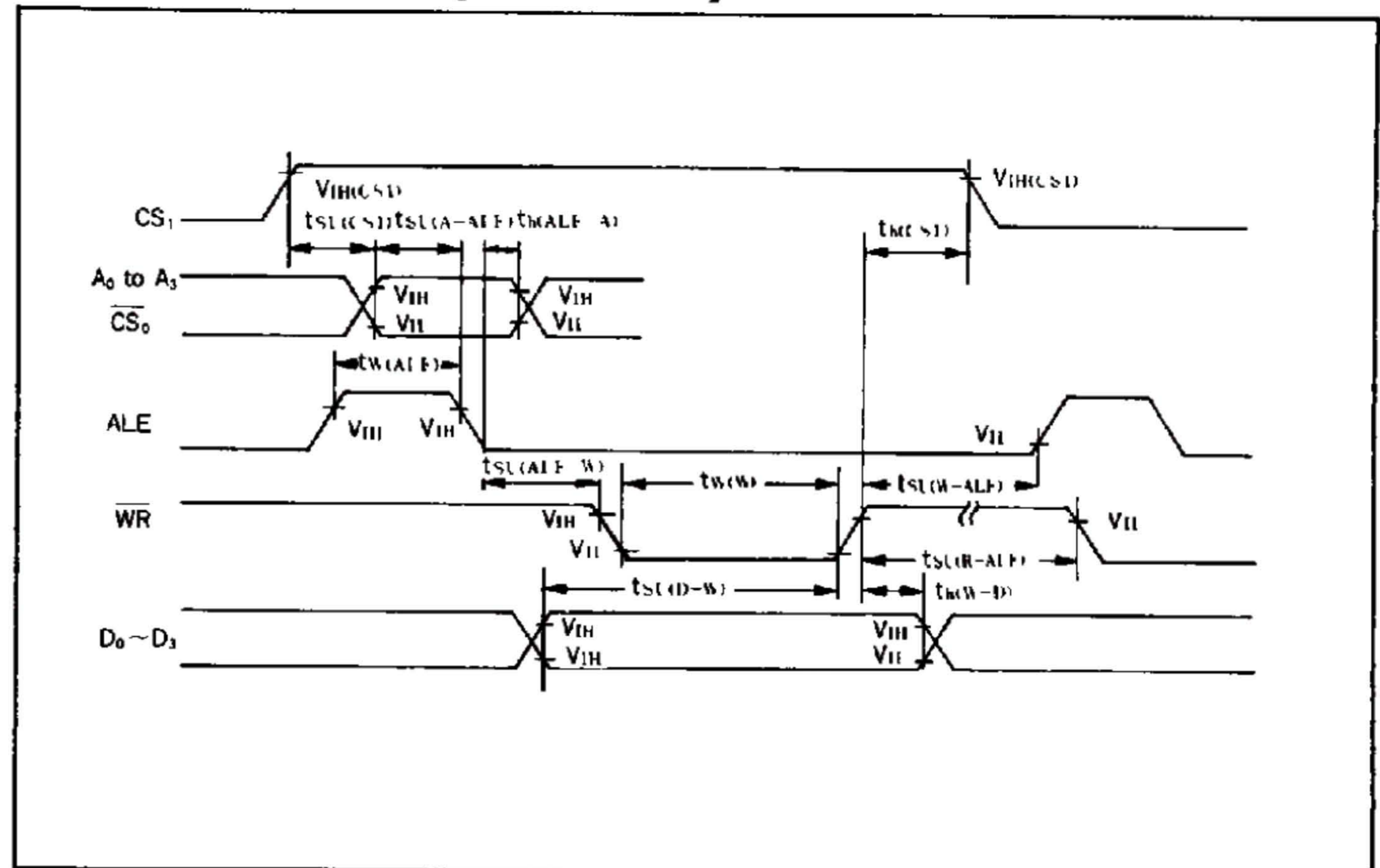
## Switching Characteristics (with ALE)

(Please connect ALE to V<sub>DD</sub> if the microprocessor does not have an ALE OUTPUT)

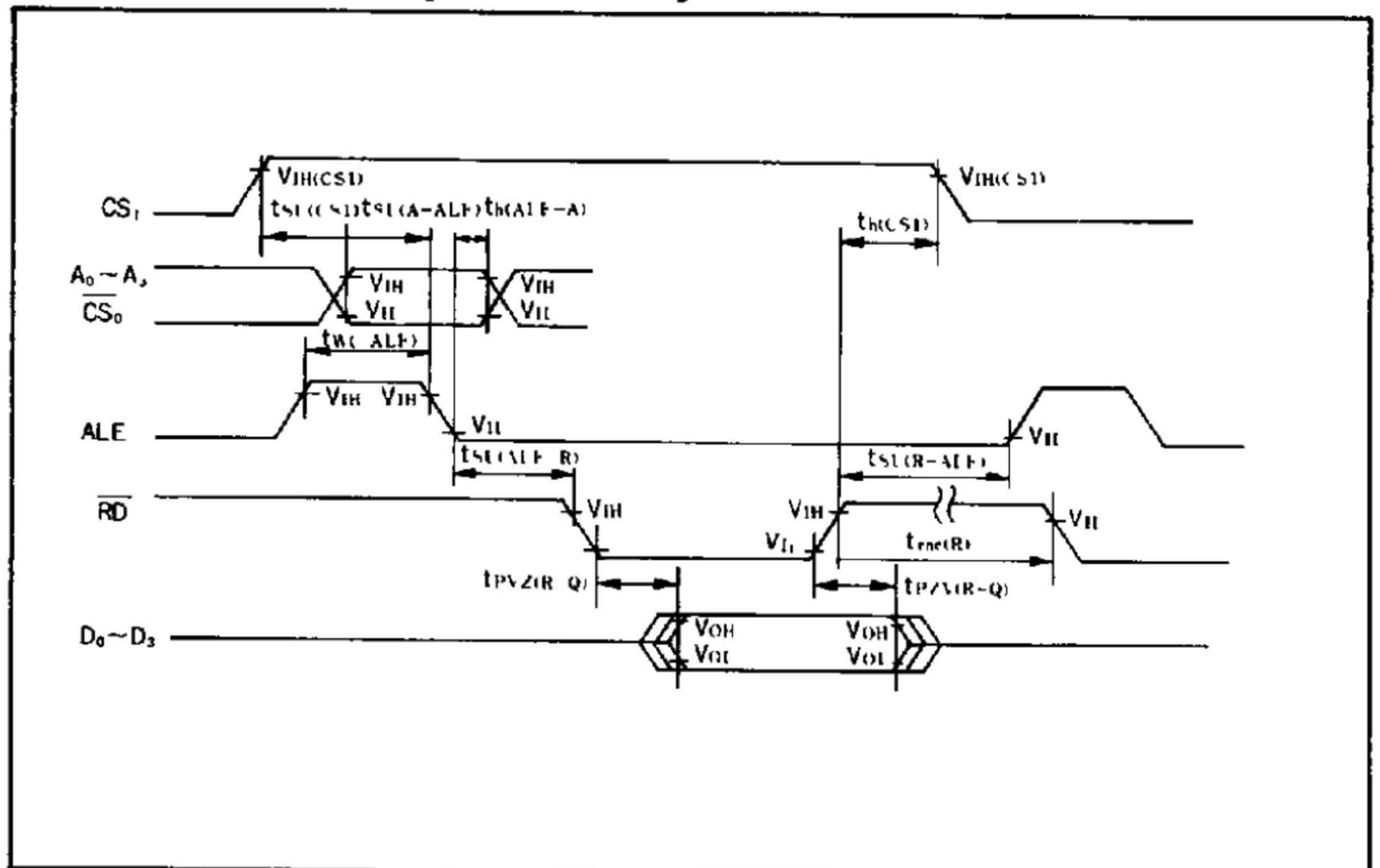
Item	Symbol	Condition	MIN	MAX	Unit
CS <sub>1</sub> Set up Time	t <sub>SU</sub> (CS <sub>1</sub> )		1000	—	ns
Address Set up Time Before ALE	t <sub>SU</sub> (A-ALE)		50	—	
Address HOLD Time After ALE	t <sub>H(ALE-V)</sub>		50	—	
ALE Pulse Width	t <sub>W</sub> (ALE)		80	—	
ALE Set up Time Before WRITE	t <sub>SU</sub> (ALE-W)		0	—	
ALE Set up Time Before READ	t <sub>SU</sub> (ALE-R)		0	—	
ALE Set up Time After WRITE	t <sub>SU(W-ALE)</sub>		50	—	
ALE Set up Time After READ	t <sub>SU(R-ALE)</sub>		50	—	
WRITE Pulse Width	t <sub>W</sub> (W)		120	—	
DATA delay Time After READ	t <sub>PVZ</sub> (R-Q)	CL=150pF	—	120	
DATA Hold Time After READ	t <sub>PVZ</sub> (R-Q)		0	70	
DATA Set up Time Before WRITE	t <sub>SU</sub> (D-W)		80	—	
DATA Hold Time After WRITE	t <sub>H(W-D)</sub>		10	—	
CS <sub>1</sub> Hold Time	t <sub>H(CS<sub>1</sub>)</sub>		1000	—	
READ/WRITE Recovery Time	t <sub>RE(CR-W)</sub>		200	—	

(V<sub>DD</sub>=5V ±0.5V)

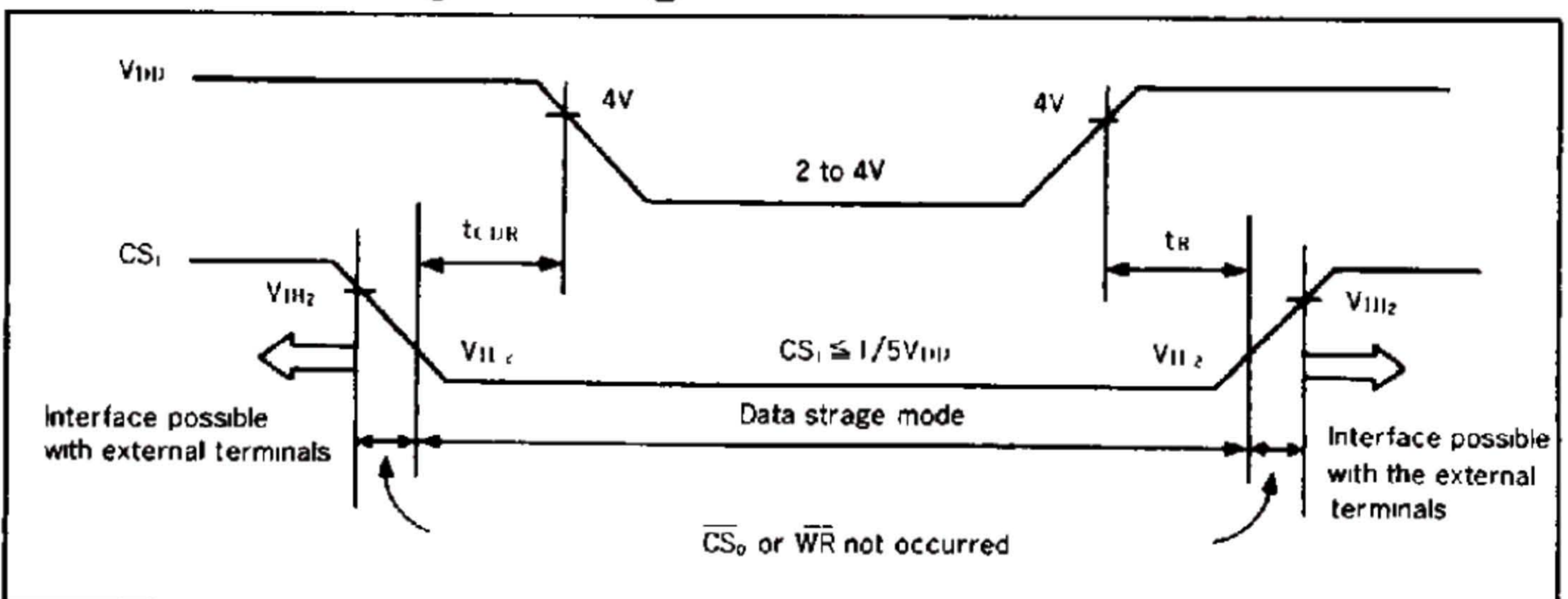
## WRITE mode (with ALE)



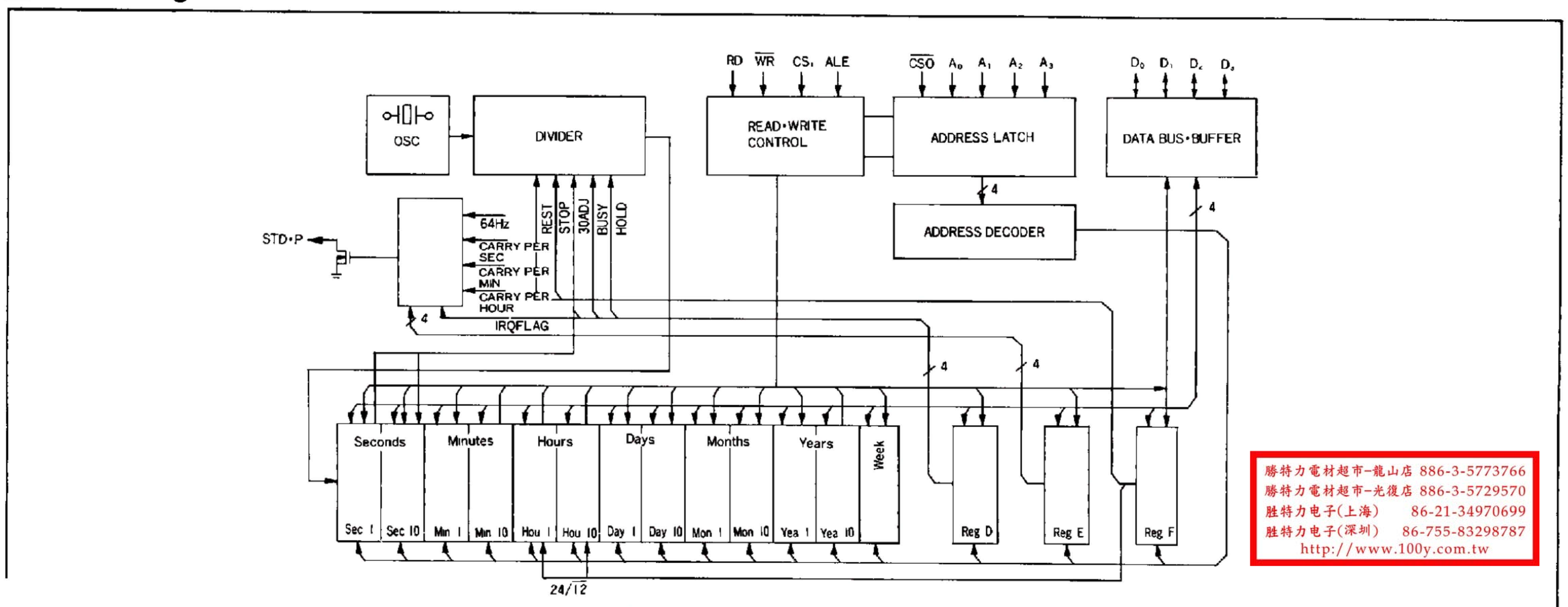
## READ mode (with ALE)



## Data Holding Timing



## Block Diagram



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