To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

MOS INTEGRATED CIRCUIT

μPD4992

8-Bit Parallel I/O Calendar Clock

The μPD4992 is a CMOS integrated circuit which outputs 8-bit parallel time and calendar data in a system in which a microprocessor is employed. The μPD4992 operates at 32.768 kHz and provides year, month, day of month, day of week, hour, minute, and second data to a system. The μPD4992 internally contains a voltage regulator so that low power consumption operation and high accuracy are realized even if the supply voltage varies. The μPD4992 uses the 8-bit bus to facilitate interfacing with a microprocessor.

FEATURES:

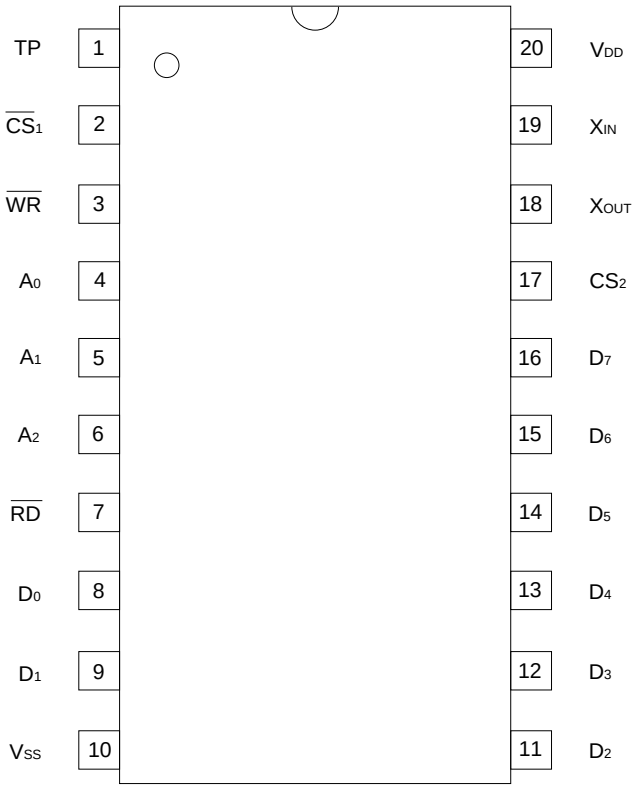
- Internal counter for time (hour, minute, second), and calendar (leap year, year, month, day of month, day of week)
- Super low power consumption (I_{DD} = 2 μA MAX. at V_{DD} = 2.4 V)
- Automatic determination of leap year, manual setting possible
- 12 hour/24 hour mode selectable
- 8-bit parallel input/output in BCD data format
- 12 kinds of interval timer output (can be used as watchdog timer)
- Internal voltage detection circuit for automatic determination of battery run-down
- High accuracy

ORDERING INFORMATION:

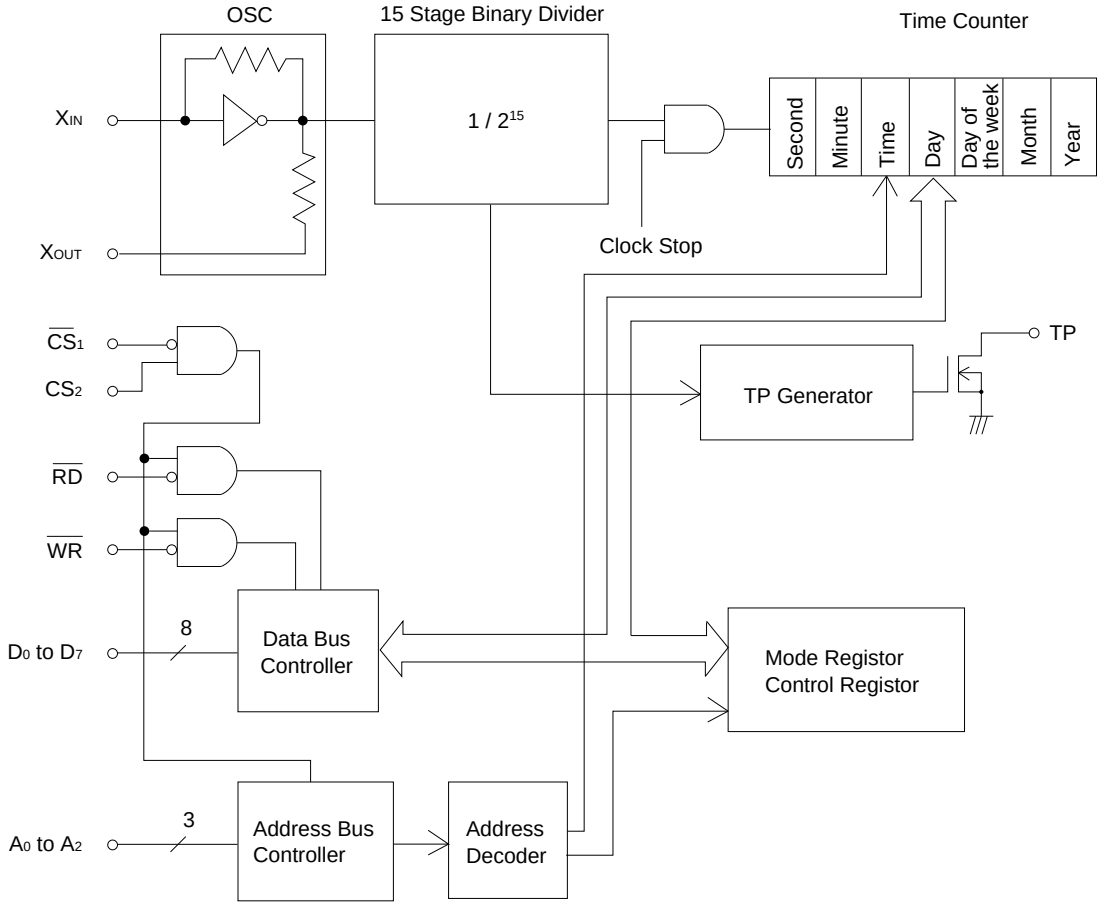
Order Code	Package
μPD4992CX	20-pin plastic DIP (300 mil)
μPD4992GS	20-pin plastic SOP (300 mil)
μPD4992GS-T1, T2	20-pin plastic SOP (300 mil) Provided on adhesive tape
μPD4992GS-E2	20-pin plastic SOP (300 mil) Provided on embossed carrier tape

Document No. ID-3084 (1st edition)
(O.D. No. ID-8222)
Date Published March 1997 P
Printed in Japan

PIN CONFIGURATION



BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS (V_{SS} = 0 V)

Item	Symbol	Ratings	Unit
Supply voltage	V_{DD}	–0.3 to 7.0	V
Input voltage range	V_{IN}	–0.3 to V_{DD} + 0.3	V
Output pin withstand voltage	V_{OUT}	7.0	V
Low level output current (N ch Open Drain)	I_{OUT}	30	mA
Operating temperature range	T_{opt}	–40 to +85	°C
Storage temperature range	T_{stg}	–65 to +125	°C

ELECTRICAL CHARACTERISTICS

(V_{SS} = 0 V, f = 32.768 kHz, C_G = C_D = 20 pF, C_i = 20k ohms, T_a = –40 to +85 °C)

Item	Symbol	Condition	MIN.	TYP.*	MAX.	Unit
Operating voltage range	V_{DD}		2.4		5.5	V
High level input voltage	V_{IH}		0.7 V_{DD}		V_{DD}	V
Low level input voltage	V_{IL}		V_{SS}		0.3 V_{DD}	V
Supply current	I_{DD}	V_{DD} = 5.5 V, V_{IN} = V_{SS}		2	6	μA
Supply current	I_{DD}	V_{DD} = 2.4 V, V_{IN} = V_{SS}		0.6	2	μA
Input leakage current	I_{LI}	V_{DD} = 5.5 V, V_{IN} = V_{DD} or V_{SS}		$\pm 1 \times 10^{-5}$	±1.0	μA
High level output voltage	V_{OH}	I_{OH} = –1.0 mA	2.4	4.3		V
Low level output voltage	V_{OL1}	I_{OL} = 2.0 mA		0.1	0.4	V
Low level output voltage	V_{OL2}	I_{OL} = 1.0 mA (N ch Open Drain)			0.4	V
High level leakage current	I_{LOH}	TP_{out} = V_{DD} (N ch Open Drain)		4×10^{-5}	1.0	μA

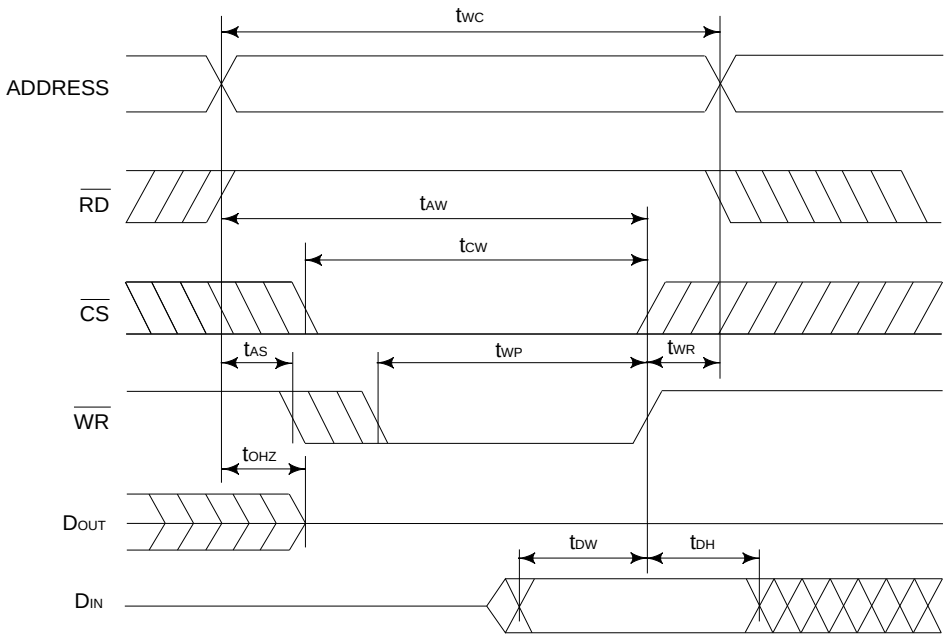
*: Ta = +25 °C

SWITCHING CHARACTERISTICS

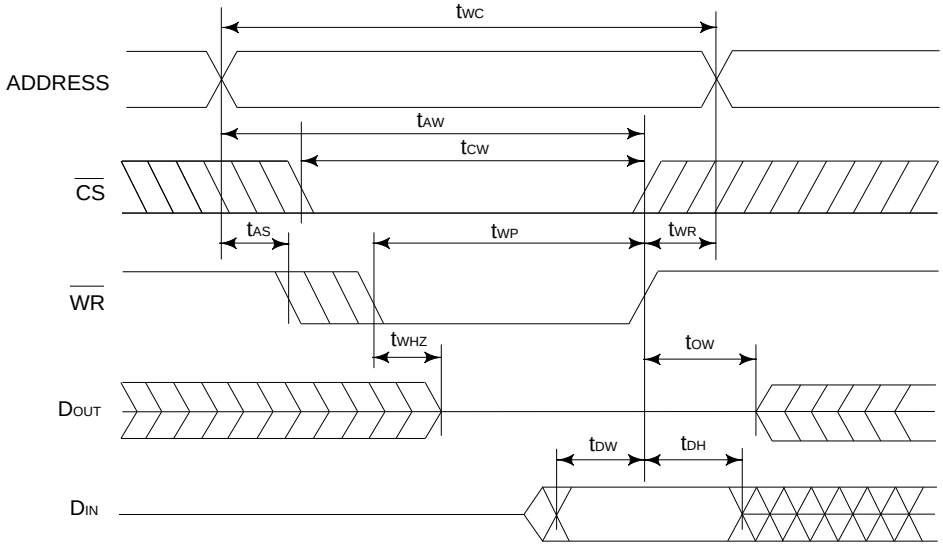
WRITE CYCLE (unless otherwise specified V_{DD} = 5 V ± 10 %, T_a = –40 to +85 °C)

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Cycle time	t_{WC}		150			ns
$\overline{CS}$-$\overline{WR}$ reset time	t_{CW}		120			
Address - $\overline{WR}$ reset time	t_{AW}		120			
Address - $\overline{WR}$ set up time	t_{AS}		0			
Write pulse width	t_{WP}		90			
Address hold time	t_{WR}		20			
Input data set up time	t_{DW}		50			
Input data hold time	t_{DH}		0			
$\overline{WR}$ - output floating time	t_{WHZ}				50	

WRITE CYCLE TIMING WAVEFORMS 1



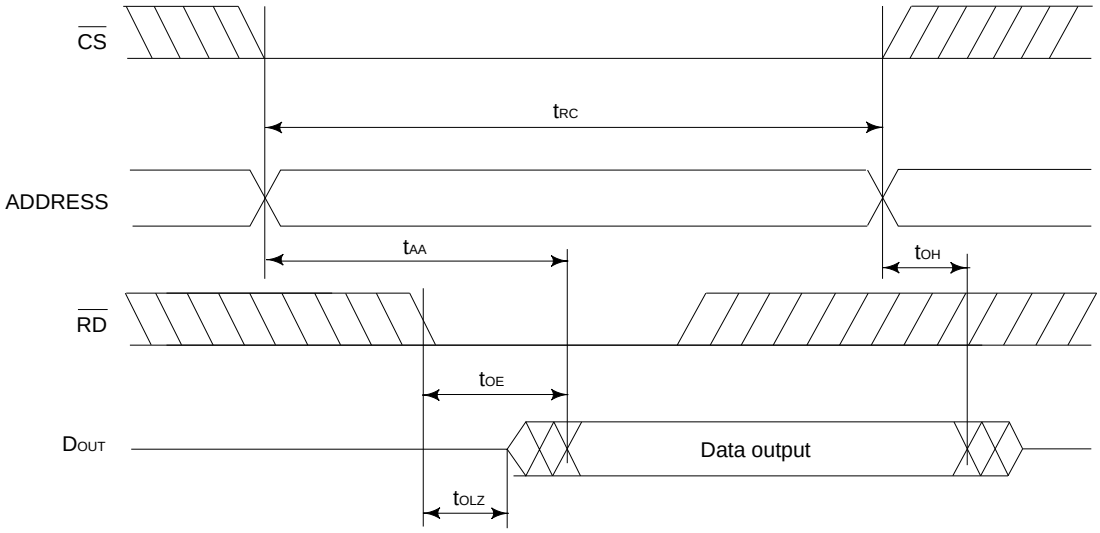
WRITE CYCLE TIMING WAVEFORMS 2 ($\overline{RD}$ = V_{IL})



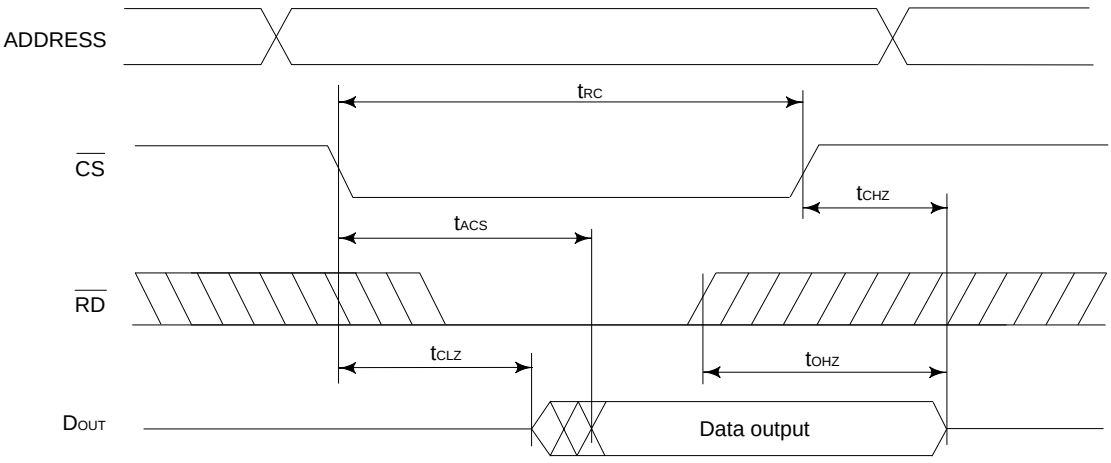
READ CYCLE (unless otherwise specified V_{DD} = 5 V ± 10 %, T_a = –40 to +85 °C)

Item	Symbol	Condition	MIN.	TYP.	MAX.	Unit
Cycle time	t_{RC}		150			ns
Address access time	t_{AA}				150	
$\overline{CS}$ - access time	t_{ACS}				150	
$\overline{RD}$ - output delay time	t_{OE}				75	
$\overline{RD}$ - output delay time	t_{OLZ}		5			
$\overline{RD}$ - output delay time	t_{OHZ}				50	
Output hold time	t_{OH}		15			
$\overline{CS}$ - output set time	t_{CLZ}		10			
$\overline{CS}$ - output floating time	t_{CHZ}		5			

READ CYCLE TIMING WAVEFORMS 1



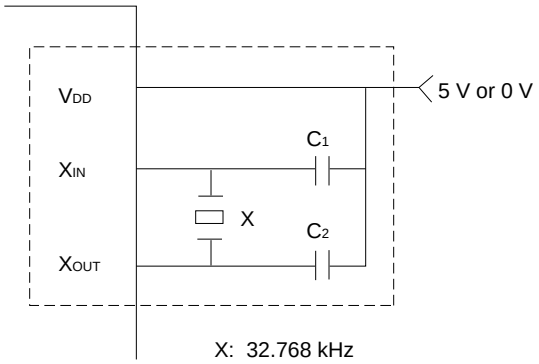
READ CYCLE TIMING WAVEFORMS 2



PIN FUNCTION

Pin symbol	Pin name	Pin number	Function
$\overline{CS_1}$	Chip select input	2	Internal register can be accessed when $\overline{CS_1}$ = L and CS_2 = H
CS_2	Chip select input	17	
$\overline{WR}$	Write signal input	3	Writes the contents of data bus to the register selected by address input at the rising edge
$\overline{RD}$	Read signal input	7	Outputs the contents of the register selected by address input to the data bus at the rising edge
D_0 to D_7	Data input/output	8, 9, 11 to 16	Data input/output bus
A_0 to A_2	Address input	4 to 6	Address input to select internal register
TP	Timing pulse output	1	Interval signal and timing pulse output (N ch open drain output)
X_{IN}	Crystal resonator connection pin	19	Crystal resonator and capacitor are connected to these pins.
X_{OUT}	Crystal resonator connection pin	18	
V_{DD}	Power supply pin	20	2.4 V to 5.5 V
V_{SS}	GND	10	Connect to GND

External components (crystal resonator, capacitors) must be located as close as the IC, and separated as far as from high speed clock wiring.



X: 32.768 kHz
C_1, C_2: 10 to 30 pF

REGISTER – ADDRESS CORRESPONDENCE TABLE

ADDRESS		Register contents							
HEX	BIN	b7	b6	b5	b4	b3	b2	b1	b0
0H	000B	10s second digit				1s second digit			
1H	001B	10s minute digit				1s minute digit			
2H	010B	12/$\overline{24}$H	$\overline{AM}$/PM	10s hour digit		1s hour digit			
3H	011B	Leap year control		Leap year counter		Day of week digit			
4H	100B	10s day digit				1s day of month digit			
5H	101B	10s month digit				1s month digit			
6H	110B	10s year digit				1s year digit			
7H	111B	Mode register				Control register			

$\overline{AM}$/PM flag (R/W) : In 12 hour mode, 0 indicates AM, and 1 indicates PM.
Always 0 in 24 hour mode.

12/$\overline{24}$H flag (R/W) : 0 indicates 24 hour mode, and 1 indicates 12 hour mode.

LEAP YEAR CONTROL REGISTER (R/W)

b7	b6	Mode	
0	0	Leap year effective	Writing to leap year counter disabled
0	1	Leap year effective	Writing to leap year counter enabled
1	0	Leap year invalid	Writing to leap year counter disabled
1	1	Leap year invalid	Writing to leap year counter enabled

- When the leap year control register is “0X” and the leap year counter is “00” → Leap year (Feb. has 29 days).
- To disable leap year mode, write “10” to the leap year control register (Feb. 28 is followed by Mar. 1).

MODE REGISTER (R/W)

HEX	BIN	Mode
0H	0000B	Outputs TP2048 Hz
1H	0001B	Outputs TP1024 Hz
2H	0010B	Outputs TP256 Hz
3H	0011B	Outputs TP64 Hz
4H	0100B	Outputs INT1/2048s
5H	0101B	Outputs INT1/1024s
6H	0110B	Outputs INT1/256s
7H	0111B	Outputs INT1/64s
8H	1000B	Outputs INT1s
9H	1001B	Outputs INT10s
AH	1010B	Outputs INT60s
BH	1011B	Outputs BUSY signal
CH	1100B	Test mode 1
DH	1101B	Test mode 2
EH	1110B	Test mode 3
FH	1111B	Test mode 4

CONTROL REGISTER

Access mode	b3	b2	b1	b0
When writing	0	CLK adjust	Reset	CLK stop
		0: NOP	0: NOP	0: CLK start
		1: CLK adjust	1: Reset	1: CLK stop
	1	TP enable*1	INT reset	INT stop
		0: TP = ENABLE	0: NOP	0: INT start
		1: TP = DISABLE	1: Reset	1: INT stop
When reading	* (Don't care)	TP flag	OSC flag*2	BUSY flag*3
		0: TP = Z	0: No oscillation	0: OFF
		1: TP = L	1: Oscillation	1: ON

***1** : When TP enable is 1 (TP = DISABLE), the TP pin becomes high impedance (actually a high level because a pull up resistor is connected to the TP pin).
But TP flag is not DISABLE in this case.

***2** : If the OSC flag becomes 0 by oscillation stop, the OSC flag remains to be 0 when oscillation is resumed. To set OSC flag to 1 again, execute CLK reset (if the OSC flag still remains to be 0, oscillation has not been started again).
Upon initial power application of the μPD4992, 0 is set to the OSC flag.

***3** : The BUSY flag is "1" when the time counter of the μPD4992 is operating (when read is disabled).

Table 1 Time Counter Data

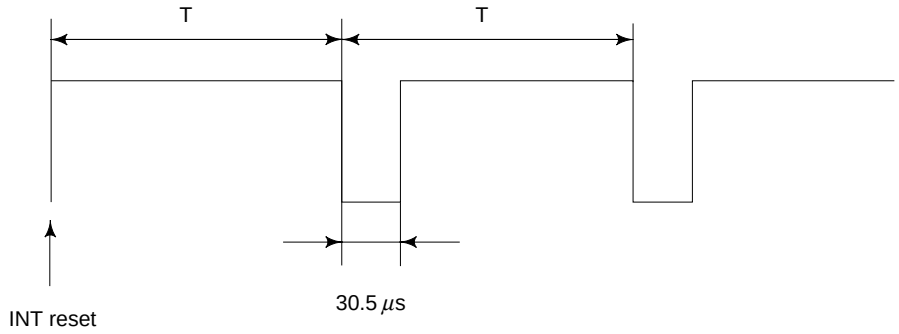
TIME COUNTER	DATA	TIME COUNTER	DATA
1s second digit	0-9	1s day of month digit	0-9
10s seocnd digit	0-5	10s day of month digit	0-3
1s minute digit	0-9	1s month digit	0-9
10s minute digit	0-5	10s month digit	0-1
1s hour digit	0-9	1s year digit	0-9
10s hour digit	0-5	10s year digit	0-9
Day of week digit	0-6		

Table 2 Hour Counter Data

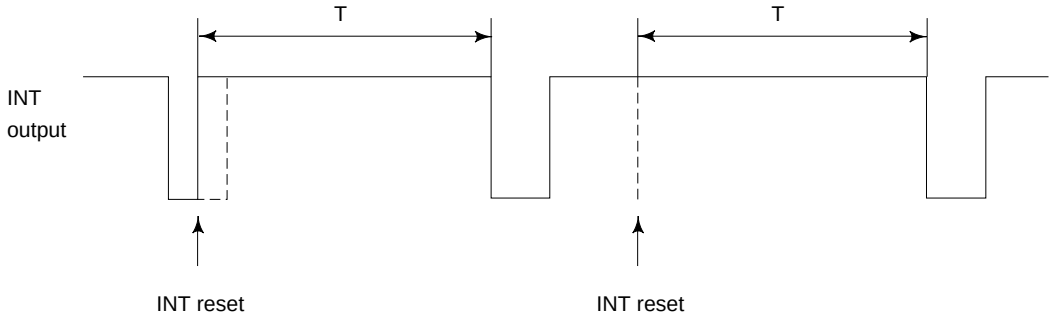
Hour	24 hour mode	12 hour mode	Hour	24 hour mode	12 hour mode
AM 1 o'clock	01H	81H	PM 1 o'clock	13H	C1H
AM 2 o'clock	02H	82H	PM 2 o'clock	14H	C2H
AM 3 o'clock	03H	83H	PM 3 o'clock	15H	C3H
AM 4 o'clock	04H	84H	PM 4 o'clock	16H	C4H
AM 5 o'clock	05H	85H	PM 5 o'clock	17H	C5H
AM 6 o'clock	06H	86H	PM 6 o'clock	18H	C6H
AM 7 o'clock	07H	87H	PM 7 o'clock	19H	C7H
AM 8 o'clock	08H	88H	PM 8 o'clock	20H	C8H
AM 9 o'clock	09H	89H	PM 9 o'clock	21H	C9H
AM 10 o'clock	10H	90H	PM 10 o'clock	22H	D0H
AM 11 o'clock	11H	91H	PM 11 o'clock	23H	D1H
PM 12 o'clock	12H	D2H	AM 12 o'clock	00H	92H

TYPICAL INT CONTROL EXAMPLES (mode register: INT output mode)

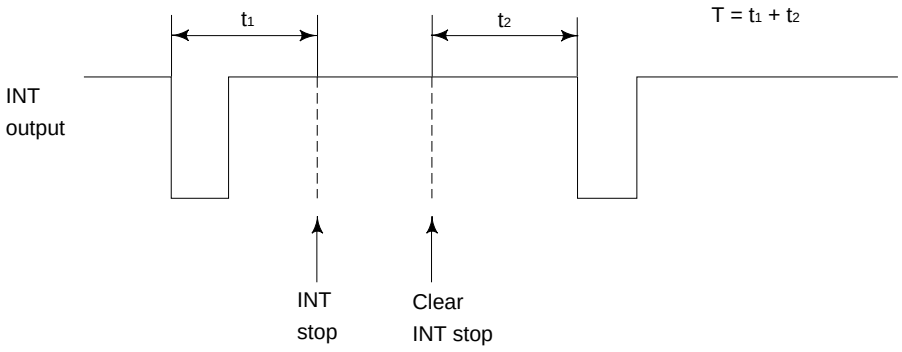
(1) Use of INT reset (example 1)



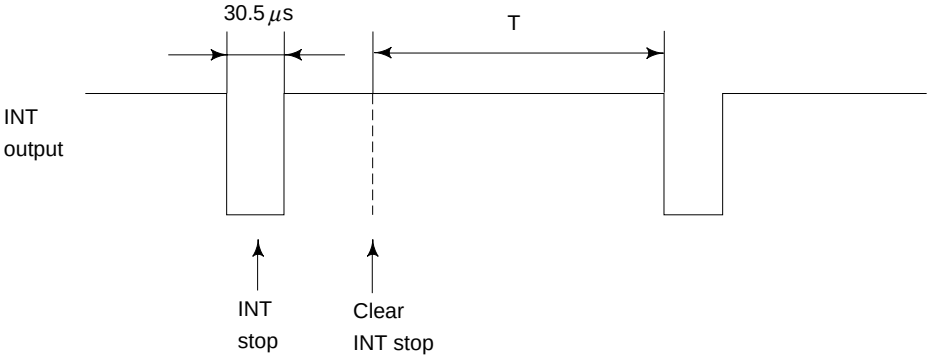
(2) Use of INT reset (example 2)



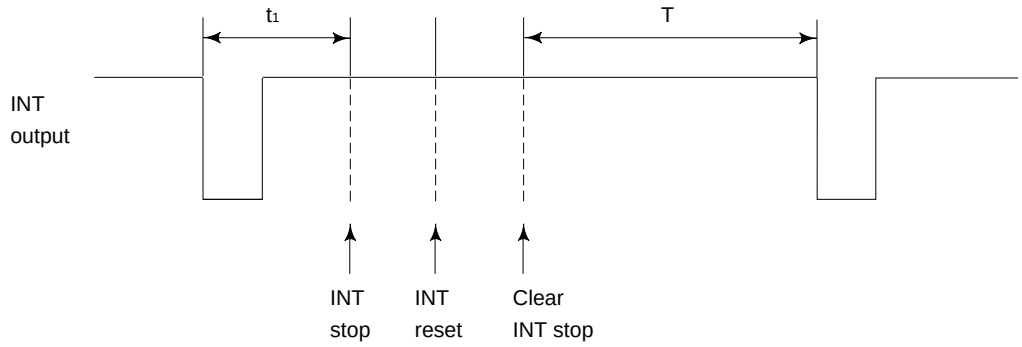
(3) Use of INT stop (example 1)



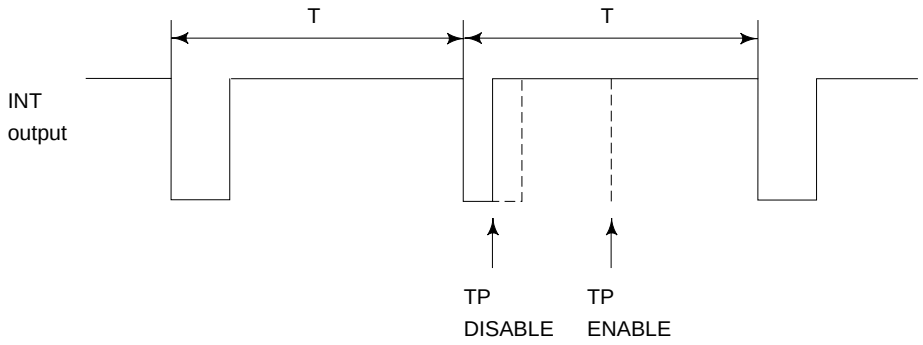
(4) Use of INT stop (example 2)



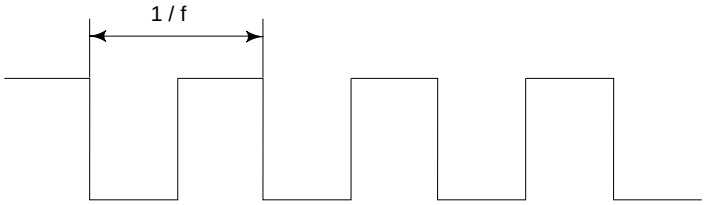
(5) Use of INT reset, INT stop



(6) Use of TP enable

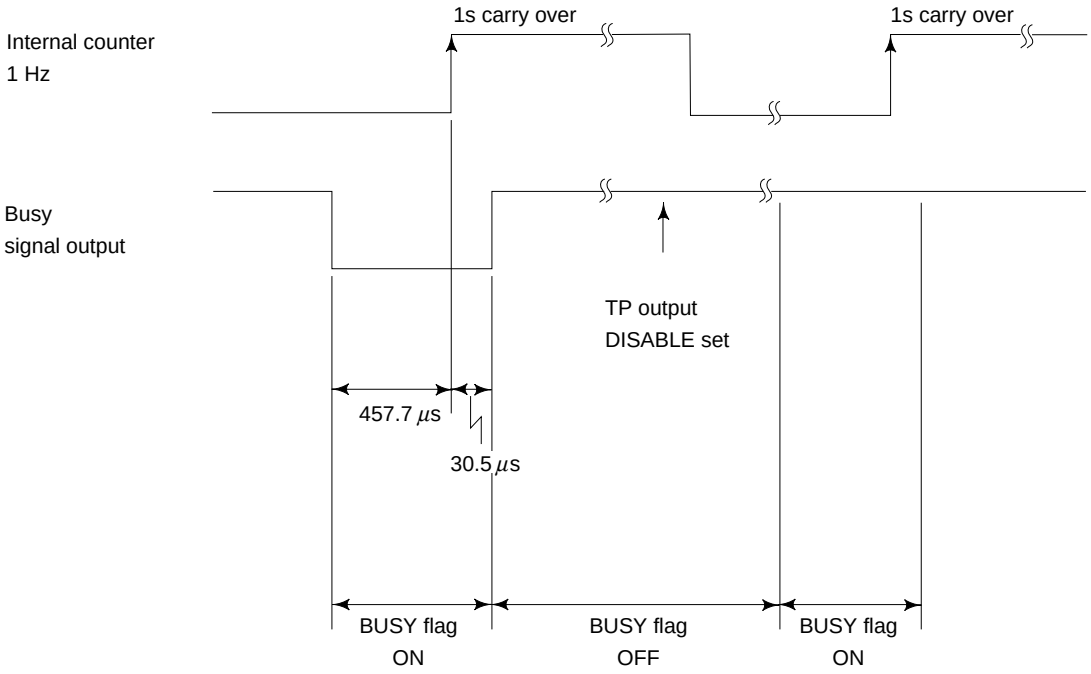


TP OUTPUT (mode register: TP output mode)



50 % duty continuous output

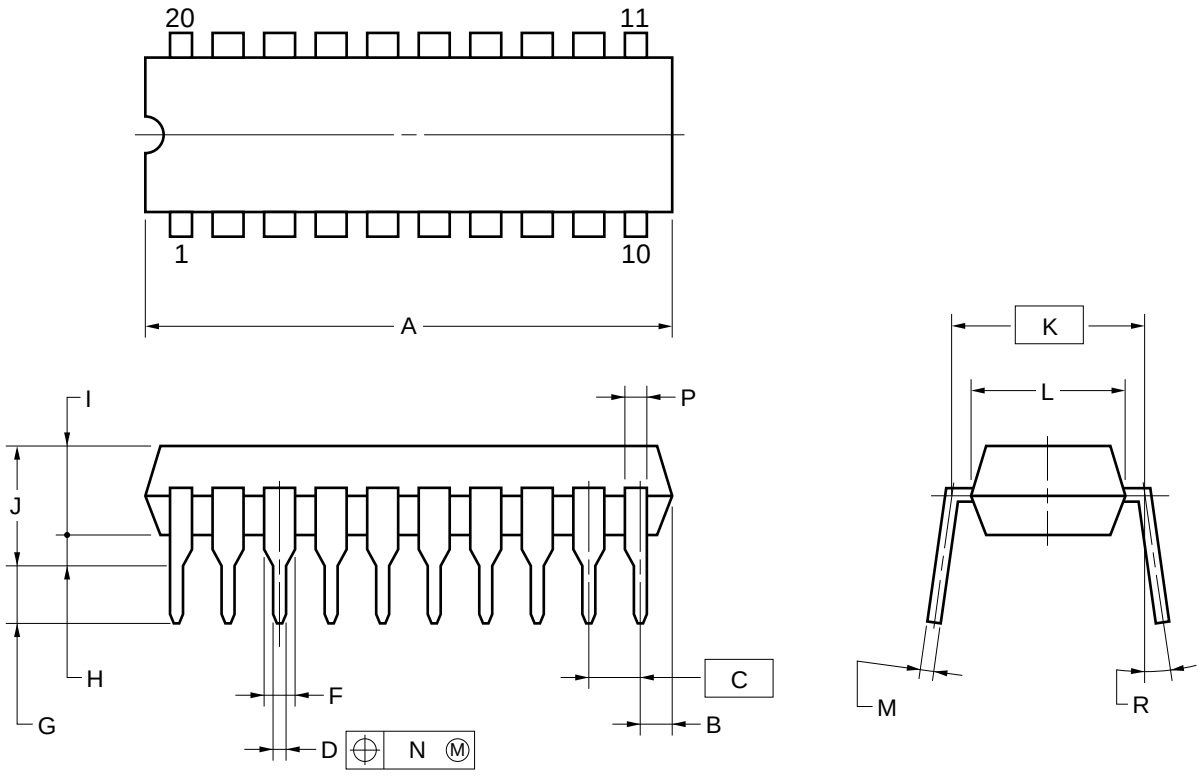
BUSY SIGNAL



The time and calendar data read out when BUSY signal is being output may not be correct. This is because, the internal time counter is operating. Therefore, accessing must be disabled during this period or the data must be read out twice and checked by the software. (Reading data during BUSY period has not effect on the contents of the internal counter.)

OUTLINE DRAWING

20PIN PLASTIC DIP (300 mil)



NOTES

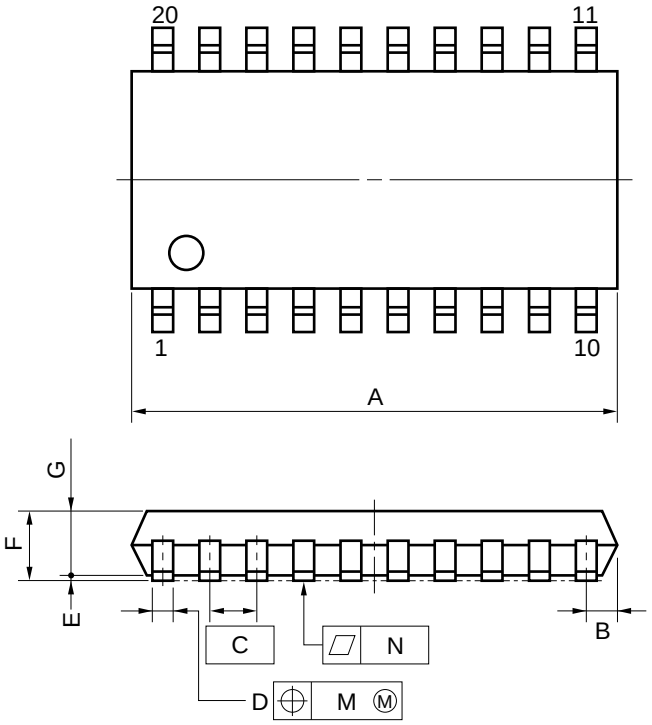
1) Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

2) Item "K" to center of leads when formed parallel.

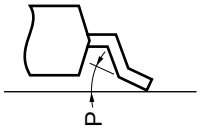
ITEM	MILLIMETERS	INCHES
A	25.40 MAX.	1.000 MAX.
B	1.27 MAX.	0.050 MAX.
C	2.54 (T.P.)	0.100 (T.P.)
D	0.50 ± 0.10	$0.020^{+0.004}_{-0.005}$
F	1.1 MIN.	0.043 MIN.
G	3.5±0.3	0.138±0.012
H	0.51 MIN.	0.020 MIN.
I	4.31 MAX.	0.170 MAX.
J	5.08 MAX.	0.200 MAX.
K	7.62 (T.P.)	0.300 (T.P.)
L	6.4	0.252
M	$0.25^{+0.10}_{-0.05}$	$0.010^{+0.004}_{-0.003}$
N	0.25	0.01
P	0.9 MIN.	0.035 MIN.
R	0~15°	0~15°

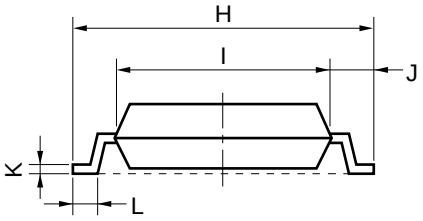
P20C-100-300A,C-1

20 PIN PLASTIC SOP (300 mil)



detail of lead end





NOTE

Each lead centerline is located within 0.12 mm (0.005 inch) of its true position (T.P.) at maximum material condition.

ITEM	MILLIMETERS	INCHES
A	13.00 MAX.	0.512 MAX.
B	0.78 MAX.	0.031 MAX.
C	1.27 (T.P.)	0.050 (T.P.)
D	$0.40^{+0.10}_{-0.05}$	$0.016^{+0.004}_{-0.003}$
E	0.1±0.1	0.004±0.004
F	1.8 MAX.	0.071 MAX.
G	1.55	0.061
H	7.7±0.3	0.303±0.012
I	5.6	0.220
J	1.1	0.043
K	$0.20^{+0.10}_{-0.05}$	$0.008^{+0.004}_{-0.002}$
L	0.6±0.2	$0.024^{+0.008}_{-0.009}$
M	0.12	0.005
N	0.10	0.004
P	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$	$3^{\circ}{}^{+7^{\circ}}_{-3^{\circ}}$

P20GM-50-300B, C-4

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.

Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

TYPES OF SURFACE MOUNT DEVICE

μPD4992GS

Soldering process	Soldering condition	Symbol
Infrared ray reflow	Peak package's surface temperature: 235 °C or below, Reflow time: 30 seconds or below (210 °C or higher), Number of reflow process: 2, Exposure limit*: None	IR35-00-2
VPS	Peak package's surface temperature: 215 °C or below, Reflow time: 40 seconds or below (200 °C or higher), Number of reflow process: 2, Exposure limit*: None	VP15-00-2
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below, Number of flow process: 1, Exposure limit*: None	WS60-00-1
Partial heating method	Terminal temperature: 300 °C or below, Flow time: 10 seconds or below, Exposure limit*: None	

*: Exposure limit before soldering after dry-pack package is opened.
Storage conditions: 25 °C and relative humidity at 65 % or less.

Note: Do not apply more than a single process at once, except for "Partial heating method".

TYPE OF THROUGH HOLE MOUNT DEVICE

μPD4992CX

Soldering process	Soldering conditions
Wave soldering	Solder temperature: 260 °C or below, Flow time: 10 seconds or below.

[MEMO]