

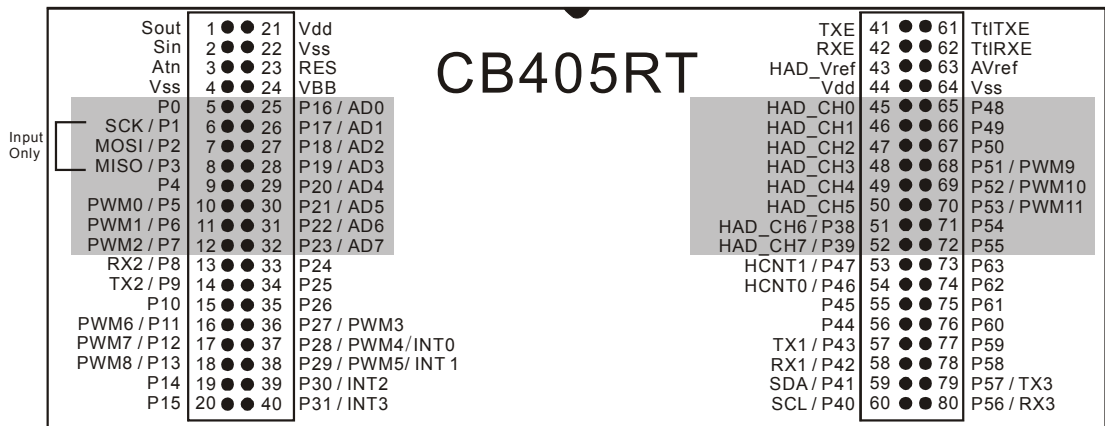
CB405RT

- CB405 core module
- equipped with a built-in accurate RTC (DS3231)
- equipped with a built-in 16-bit A/D converter (8 channels)

CB405RT is a product, which adds an RTC and a 16-bit ADC to the original CB405. The external dimensions and pinout are the same as CB405 except that ports P32 to P37 cannot be used, as input pins dedicated to the 16-bit ADC are placed there.

This product has a built-in realtime clock DS3231, which automatically compensates for clock error due to temperature changes. Accordingly, it sports improved accuracy over the existing RTC.

When a super-condensator is connected to the VBB pin, even when power supply is interrupted the data memory is preserved. Since the super-condensator is charged automatically when there is power supply and it supplies current during interruption of power supply, there is no need to replace batteries.



The following describes all the pins except for the I/O ports.

Name	Pin No.	I/O	Description
SOUT	1	OUT	SERIAL OUTPUT for DOWNLOAD
SIN	2	IN	SERIAL OUTPUT for DOWNLOAD
ATN	3	IN	SERIAL OUTPUT for DOWNLOAD
VSS	4, 22, 64	POWER IN	GROUND
VDD	21, 44	POWER IN	Supplies 4.5V to 5.5V
HAD_Vref	43	IN	Supplies reference voltage to the 16-bit ADC 전압공급
AVREF	63	IN	Supplies reference voltage to the 10-bit ADC 전압공급
VBB	24	POWER IN	Battery connection pin for battery backup
RES	23	IN	RESET pin
TTLTXE	61	OUT	RS232 to TTL232 conversion circuit, TX connection terminal

TTLRXE	62	IN	RS232 to TTL232 conversion circuit, RX connection terminal
TXE	41	OUT	RS232 output terminal, connects with external RS232 port
RXE	42	IN	RS232 input terminal, connects with external RS232 port

The following describes the I/O ports, listed by their port blocks.

Block	Name	Pin No.	I/O	Special Function	Description
0	P0	5	I/O	SPI's SS	
	P1	6	Input	SPI's SCK	Input only pin
	P2	7	Input	SPI's MOSI	Input only pin
	P3	8	Input	SPI's MISO	Input only pin
	P4	9	I/O		
	P5	10	I/O	PWM CHANNEL 0	
	P6	11	I/O	PWM CHANNEL 1	
	P7	12	I/O	PWM CHANNEL 2	

1	P8	13	I/O	TTL232 RX2	
	P9	14	I/O	TTL232 TX2	
	P10	15	I/O		
	P11	16	I/O	PWM CHANNEL 6	
	P12	17	I/O	PWM CHANNEL 7	
	P13	18	I/O	PWM CHANNEL 8	
	P14	19	I/O		
	P15	20	I/O		

2	P16	25	I/O	AD CHANNEL 0	
	P17	26	I/O	AD CHANNEL 1	
	P18	27	I/O	AD CHANNEL 2	
	P19	28	I/O	AD CHANNEL 3	
	P20	29	I/O	AD CHANNEL 4	
	P21	30	I/O	AD CHANNEL 5	
	P22	31	I/O	AD CHANNEL 6	
	P23	32	I/O	AD CHANNEL 7	

3	P24	33	I/O		
	P25	34	I/O		
	P26	35	I/O		
	P27	36	I/O	PWM3	
	P28	37	I/O	PWM4 / INT0	
	P29	38	I/O	PWM5 / INT1	
	P30	39	I/O	INT2	
	P31	40	I/O	INT3	

This part has been changed.

Block	Name	Pin No.	I/O	Special Function	Description
Belongs to no block	HADCH0	45	INPUT	16bit AD CHANNEL 0	
	HADCH1	46	INPUT	16bit AD CHANNEL 1	
	HADCH2	47	INPUT	16bit AD CHANNEL 2	
	HADCH3	48	INPUT	16bit AD CHANNEL 3	
	HADCH4	49	INPUT	16bit AD CHANNEL 4	
	HADCH5	50	INPUT	16bit AD CHANNEL 5	
	HADCH6 / P38	51	I/O	16bit AD CHANNEL 6	P38 usable
	HADCH7 / P39	52	I/O	16bit AD CHANNEL 7	P39 usable

Note: Since ports P32 to P37 are internally connected to the RTC and the 16-bit ADC, if a program uses these ports, the RTC and ADC chip will not function properly. Also, if ports P38 and P39 are used for output, HADCH6 and HADCH7 cannot be used, respectively.

5	P40	60	I/O	SCL	CUNET clock
	P41	59	I/O	SDA	CUNET data
	P42	58	I/O	RX1	TTLRX channel 1
	P43	57	I/O	TX1	TTLTX channel 1
	P44	56	I/O		
	P45	55	I/O		
	P46	54	I/O	HCNT0	High-speed counter channel 0
	P47	53	I/O	HCNT1	High-speed counter channel 1

6	P48	65	I/O		
	P49	66	I/O		
	P50	67	I/O		
	P51	68	I/O	PWM CANNEL 9	
	P52	69	I/O	PWM CANNEL 10	
	P53	70	I/O	PWM CANNEL 11	
	P54	71	I/O		
	P55	72	I/O		

7	P56	80	I/O	RX3	TTLRX channel 3
	P57	79	I/O	TX3	TTLTX channel 3
	P58	78	I/O		
	P59	77	I/O		
	P60	76	I/O		
	P61	75	I/O		
	P62	74	I/O		
	P63	73	I/O		

CB405RT-related Commands

CB405RT-related commands can be used on in CUBLOC STUDIO V2.6.B or in later versions.

First, the RTC-related commands

RTCread()

Variable = RTCread(address)

Variable : variable to store the result (Byte type)

Address : RTC's address

If you see the address table of RTC chip (DS3231) below, you will notice that the time data are stored from addresses 0 through 6. The rest of the addresses are related to the alarm and RTC chipsetting; thus, we recommend those interested to refer to the DS3231 databook.

RTCread command literally reads data from the RTC chip.

ADDRESS	BIT 7 MSB	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0 LSB	FUNCTION	RANGE
00h	0	10 Seconds			Seconds			Seconds	Seconds	00-59
01h	0	10 Minutes			Minutes			Minutes	Minutes	00-59
02h	0	12/24	AM/PM 10 Hour	10 Hour	Hour			Hours	Hours	1-12 + AM/PM 00-23
03h	0	0	0	0	Day			Day	Day	1-7
04h	0	0	10 Date		Date			Date	Date	01-31
05h	Century	0	0	10 Month	Month			Month/ Century	Month/ Century	01-12 + Century
06h	10 Year			Year			Year	Year	Year	00-99
07h	A1M1	10 Seconds			Seconds			Alarm 1 Seconds	Alarm 1 Seconds	00-59
08h	A1M2	10 Minutes			Minutes			Alarm 1 Minutes	Alarm 1 Minutes	00-59
09h	A1M3	12/24	AM/PM 10 Hour	10 Hour	Hour			Alarm 1 Hours	Alarm 1 Hours	1-12 + AM/PM 00-23
0Ah	A1M4	DY/DT	10 Date		Day			Alarm 1 Day	Alarm 1 Day	1-7
					Date			Alarm 1 Date	Alarm 1 Date	1-31
0Bh	A2M2	10 Minutes			Minutes			Alarm 2 Minutes	Alarm 2 Minutes	00-59
0Ch	A2M3	12/24	AM/PM 10 Hour	10 Hour	Hour			Alarm 2 Hours	Alarm 2 Hours	1-12 + AM/PM 00-23
0Dh	A2M4	DY/DT	10 Date		Day			Alarm 2 Day	Alarm 2 Day	1-7
					Date			Alarm 2 Date	Alarm 2 Date	1-31
0Eh	EOSC	BBSQW	CONV	RS2	RS1	INTCN	A2IE	A1IE	Control	—
0Fh	OSF	0	0	0	EN32kHz	BSY	A2F	A1F	Control/Status	—
10h	SIGN	DATA	DATA	DATA	DATA	DATA	DATA	DATA	Aging Offset	—
11h	SIGN	DATA	DATA	DATA	DATA	DATA	DATA	DATA	MSB of Temp	—
12h	DATA	DATA	0	0	0	0	0	0	LSB of Temp	—

Caution:

To use CB405RT, in the beginning of the program, one must replace

Const Device = CB405

with

#Include "CB405RT".

```

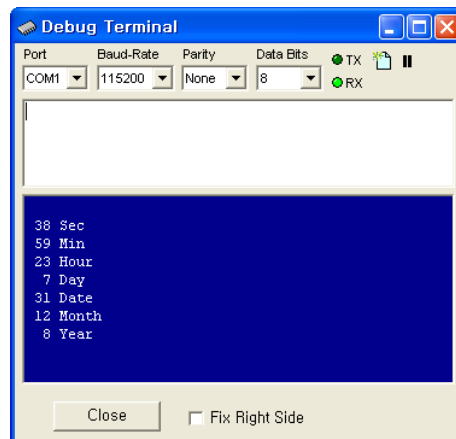
#include "CB405RT"      ←Use "#include" instead of the "Const Device" statement.
Dim i As Integer

Wait 100
RTCwrite 0,&h20      ' Sec
RTCwrite 1,&h59      ' Min
RTCwrite 2,&h23      ' Hour 24h
RTCwrite 3,&h7       ' day 1-7, 1=Sun, 2=Mon, 3=Tue, 4=Wed, 5=Thu, 6=FRI, 7=SAT
RTCwrite 4,&h31      ' Date
RTCwrite 5,&h12      ' Month
RTCwrite 6,&h08      ' Year

Do
  i = RTCCread(0)
  Debug Goxy,1,1,Hex2 i, " Sec"
  i = RTCCread(1)
  Debug Goxy,1,2,Hex2 i, " Min"
  i = RTCCread(2) And &h3f
  Debug Goxy,1,3,Hex2 i, " Hour"
  i = RTCCread(3)
  Debug Goxy,1,4,Hex2 i, " Day"
  i = RTCCread(4)
  Debug Goxy,1,5,Hex2 i, " Date"
  i = RTCCread(5)
  Debug Goxy,1,6,Hex2 i, " Month"
  i = RTCCread(6)
  Debug Goxy,1,7,Hex2 i, " Year"
  Wait 500
Loop

```

When the above example program is run, one will see a debug window as follows:



RTCwrite

RTCwrite address, data

```
address : RTC chip's address  
data : the variable or constant to store
```

This command write a new data value at the specified address of the RTC chip.

TIPS

In other RTC chips, the main reason the clock becomes inaccurate is due to the temperature changes. The RTC chips, which work properly at room temperature, begin to tick abnormally in lower or higher temperatures, as their crystal begins to oscillate slower or faster.

DS3231 is an RTC chip that avoids such shortcoming. It has a thermister (i.e., a temperature sensor) inside along with a 32 KHz crystal. The oscillation frequency is adapted based on the temperature sensed by the thermister. As a result, the clock errors due to temperature changes are reduced to render more accurate time.

But beware that even the DS3231 does not guarantee 100% accuracy. Thus, some form of minimal maintenance to check and correct the time is necessary.

Hadin()

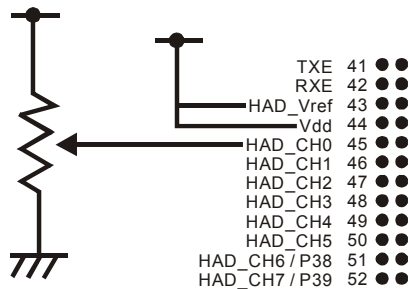
Variable = Hadin(channel)

Variable : Variabel to store the result (Integer or Long type)
 Channel : AD's channel

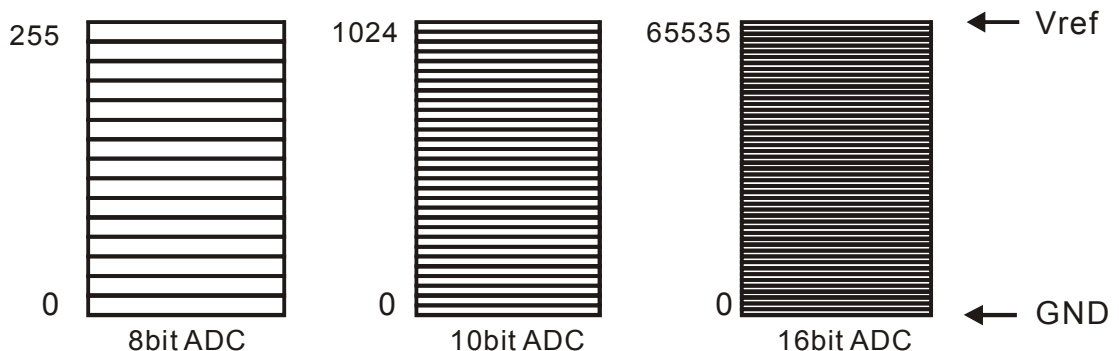
This function stores the result of 16-bit A/D conversion at the specified variable.

```
#include "CB405RT"
Do
  Debug Goxy,1,1,Dec5 Hadin(0)
  Wait 500
Loop
```

For the above example program to work, as shown in the figure below a 5 V voltage should be connected to the HAD_Vref and a volume resistance should be connected to the HAD_CH0. Note that voltage ranging only from 1 V to 5 V can be connected to HAD_Vref. Naturally, voltage ranging only from 0 V to HAD_Vref can be applied to HAD_CH0 to HAD_CH7.



The 16-bit ADC gives a result ranging from 0 V to Vref expressed as one of the 65536 equally divided intervals. It is capable of much more accurate measurement compared to a 10-bit ADC.



Hadin2()

Variable = Hadin2(channel combination)

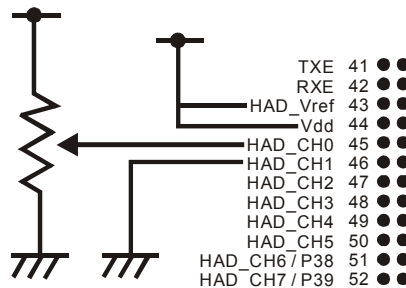
Variable : Variable to store the result (Integer or Long type)

Channel combination: AD's channel combination code

This command is for a differential A/D input. 2 channels are paired up, where + input and - input are applied to A/D convert the difference of the 2 voltages.

Channel combination code	+ Input	- Input
0	CH0	CH1
1	CH2	CH3
2	CH4	CH5
3	CH6	CH7
4	CH1	CH0
5	CH3	CH2
6	CH5	CH4
7	CH7	CH6

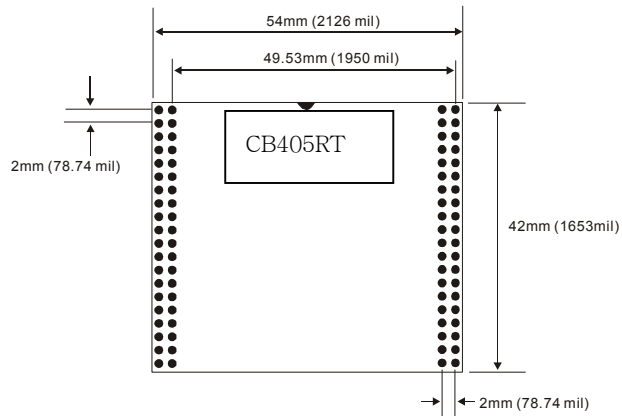
```
#include "CB405RT"  
Do  
  Debug Goxy,1,1,Dec5 Hadin2(0)  
  Wait 500  
Loop
```



TIPS

For a more accurate measurement, one should start with consideration of a better power source. Linear power source (e.g., using 7805, etc.) is better for A/D input than switching power source circuit (e.g., using LM2576). Also, when the A/D input pins are extended and exposed outside the board, a protection circuit (where additional chips such as insulation circuit, etc. are involved) should be added to protect the core module from external noise. For your circuit design, keep in mind that, especially when a voltage over 5 V would be applied to the A/D input port, a lethal damage could happen to the core module.

CB405RT's External Dimensions



All measurements are the same with CB405's.

<THE END>