

# Distinguishing between the Different Devices in the HT47 MCU Series

D/N : HA0045E

## Introduction

The HT47 series of MCUs are 8-bit high performance RISC architecture MCU devices. Most instructions execute within 1 instruction cycle apart from a few exceptions which take 2 instruction cycles to complete. With their LCD interface and R to F function, the devices are extremely suitable for LCD applications such as electronic computers, timers, game products, electronic scales, toys, thermometers, hygrometers, clinical thermometers and other LCD hand products.

All devices are available in both C type and R type, with the C denoting a mask level version of the MCU and the R denoting an OTP (one time programmable) version of the MCU.

The table below summaries the different features of the HT47 series MCUs :

Part No.	HT47R20A-1	HT47C20-1	HT47C20L
ROM	2kx16 ROM	2kx16 ROM	2kx16 ROM
RAM	64x8 RAM	64x8 RAM	64x8 RAM
Timer/Clock	16 bit with PFD RTC	16 bit with PFD RTC	16 bit with PFD RTC
I/O ports	8I/O + 4I	8I/O + 4I	8I/O + 4I
Internal Interrupt	3	3	3
External Interrupt	1	1	1
Stack Level	4	4	4
Maximum System Frequency	8MHz	8MHz	32.768kHz
WDT	yes	yes	yes
LCD Driver	20x2, 20x3, 19x4	20x2, 20x3, 19x4	20x2, 20x3, 19x4
AD Switch	2 channel RC type ADC	2 channel RC type ADC	2 channel RC type ADC
BZ Output	yes	yes	yes
IR Carrier Wave Output	38kHz or 40kHz Carrier	38kHz or 40kHz Carrier	none

It can be concluded from the above that the three main differences among the HT47 MCU series devices are in the clock types, the counter and the IR carrier applications. Also it should be noted that the LCD drivers are slightly different.

More detailed description:

- WDT (WatchDog Timer function)

Owing to the three different WDT clock sources, namely the 12kHz WDTCLK, the 32kHz RTC and the system clock/4, when choosing the system clock as the WDT clock source, it should be noted that different HT47 MCU devices will provide different WDT overflow time.

WDT Overflow Time

Clock Source	WDT Overflow Cycle
12kHz (WDTCLK)	2.73066s
32kHz (RTC)	1.00000s
System Frequency/4	0.27306s

Note: System Frequency is 480kHz

If the MCU is the HT47C20L device, the system clock can only be 32768Hz which will give a 1 second of overflow time.

- Time Base

The time base function within the HT47 series MCU offers a periodical time-out cycle to

produce a regular internal interrupt. The time base clock source can be chosen by configuration options as the WDT clock, the RTC clock or the system clock/4. However in the HT47C20L only the instruction clock can be used and in the HT47R20A-1 it is the same clock source as the WDT whose time-out range can be set by options as clock "source/2<sup>12</sup>" ~ "clock source/2<sup>15</sup>". If a time-out occurs, the corresponding flag TBF will be set. If the interrupts are enabled, an interrupt service routine will be executed starting from the address 08H.

Time Base Overflow Cycle Table

Time Base Overflow Cycle	Clock Source		
	12kHz (WDTCLK)	32.768kHz (RTC)	System Frequency/4
Clock source/2 <sup>12</sup>	341.33 ms	125 ms	34.133 ms
Clock source/2 <sup>13</sup>	682.66 ms	250 ms	68.266 ms
Clock source/2 <sup>14</sup>	1365.33 ms	500 ms	136.533 ms
Clock source/2 <sup>15</sup>	2730.66 ms	1000 ms	273.066 ms

Note: System clock is 480kHz.

for the HT47C20L the clock source can only be 32.768kHz.

for the HT47R20A-1 the clock source can choose between 12kHz, T1 and 32.768kHz.

- RTC

The RTC clock can be sourced from either the WDT, RTC or system clock/4 via configuration options, whose overflow time can be setup using program instructions to give a range of between "clock source/2<sup>8</sup>" ~ "clock source/2<sup>15</sup>".

RTC Interrupt Cycle Table

RTC Divider				Clock Source		
RT2	RT1	RT0		12kHz (WDTCLK)	32.768kHz (RTC)	System Frequency/4
0	0	0	28	21.33 ms	7.8125 ms	2.133 ms
0	0	1	29	42.66 ms	15.625 ms	4.266 ms
0	1	0	210	85.33 ms	31.250 ms	8.533 ms
0	1	1	211	170.66 ms	62.500 ms	17.066 ms
1	0	0	212	341.33 ms	125.000 ms	34.133 ms
1	0	1	213	682.66 ms	250.000 ms	68.266 ms
1	1	0	214	1365.33 ms	500.000 ms	136.533 ms
1	1	1	215	2730.66 ms	1000.000 ms	273.066 ms

Note: System clock is 480kHz.

for the HT47C20L the clock source can only be 32.768kHz.

for the HT47R20A-1 the clock source can choose between 12kHz, T1 and 32.768kHz.

- IR carrier wave

The HT47C20-1 and HT47R20A-1 can provide a 38kHz (455kHz system clock) or 40kHz (480kHz system clock) infrared carrier wave, a function that is not provided in the HT47C20L.

For relevant details please consult the relative pdf files.