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Keywords: DS1307,RTC,real-time clock

APPLICATION NOTE 3921

Using a DS1307 with a PIC Microcontroller

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Abstract: This application note is intended to demonstrate an application using the DS1307 real-time clock (RTC) with a Microchip PIC microcontroller. The software example includes basic operating routines. A schematic of the application circuit is included.

Discussion

This application note demonstrates how to use the [DS1307](#) real-time clock (RTC) with a Microchip PIC16F628 microcontroller.

The example code, written in assembly code, includes a routine for reading the time and date from the RTC and a routine to write time and date data to the RTC from user entries.

Operation

The program uses two general-purpose port pins on the microcontroller to communicate with the DS1307 using the I²C serial interface. The microcontroller's internal UART drives two port pins, which are connected to a DS232 line driver/receiver. User inputs and data outputs from the program are passed through the RS-232 interface from a terminal emulator program on a PC to the microcontroller. The RS-232 DTR input line controls the microcontroller's reset input.

The microcontroller in this example is a PIC16F628. For information on the microcontroller used in this application note, including available programming tools, visit the [Microchip web site](#).

The software is shown in **Figure 1**. A schematic of the circuit is shown in **Figure 2**.

```

#include <P18F2455.h>
#define FOSC 16000000
#define XTAL 16000000
/* The config gives us 1.5V and enables INTOSC
   so we don't need a crystal */
#define F_CPU 16000000

/* Define the baud rate for the hardware UART
   #define BAUD_RATE 9600          . On 15 rate the baud rate is 9600 with a 20 MHz crystal
   #define BAUD_RATE 19200       . On 15 rate the baud rate is 19200 with a 20 MHz crystal
   #define BAUD_RATE 38400       . On 15 rate the baud rate is 38400 with a 20 MHz crystal
   #define BAUD_RATE 76800       . On 15 rate the baud rate is 76800 with a 20 MHz crystal
   #define BAUD_RATE 153600      . On 15 rate the baud rate is 153600 with a 20 MHz crystal
   #define BAUD_RATE 307200      . On 15 rate the baud rate is 307200 with a 20 MHz crystal
   #define BAUD_RATE 614400      . On 15 rate the baud rate is 614400 with a 20 MHz crystal
   #define BAUD_RATE 1228800     . On 15 rate the baud rate is 1228800 with a 20 MHz crystal
   #define BAUD_RATE 2457600     . On 15 rate the baud rate is 2457600 with a 20 MHz crystal
   #define BAUD_RATE 4915200     . On 15 rate the baud rate is 4915200 with a 20 MHz crystal
   #define BAUD_RATE 9830400     . On 15 rate the baud rate is 9830400 with a 20 MHz crystal
   #define BAUD_RATE 19660800    . On 15 rate the baud rate is 19660800 with a 20 MHz crystal
   #define BAUD_RATE 39321600    . On 15 rate the baud rate is 39321600 with a 20 MHz crystal
   #define BAUD_RATE 78643200    . On 15 rate the baud rate is 78643200 with a 20 MHz crystal
   #define BAUD_RATE 157286400   . On 15 rate the baud rate is 157286400 with a 20 MHz crystal
   #define BAUD_RATE 314572800   . On 15 rate the baud rate is 314572800 with a 20 MHz crystal
   #define BAUD_RATE 629145600   . On 15 rate the baud rate is 629145600 with a 20 MHz crystal
   #define BAUD_RATE 1258291200  . On 15 rate the baud rate is 1258291200 with a 20 MHz crystal
   #define BAUD_RATE 2516582400  . On 15 rate the baud rate is 2516582400 with a 20 MHz crystal
   #define BAUD_RATE 5033164800  . On 15 rate the baud rate is 5033164800 with a 20 MHz crystal
   #define BAUD_RATE 10066329600 . On 15 rate the baud rate is 10066329600 with a 20 MHz crystal
   #define BAUD_RATE 20132659200 . On 15 rate the baud rate is 20132659200 with a 20 MHz crystal
   #define BAUD_RATE 40265318400 . On 15 rate the baud rate is 40265318400 with a 20 MHz crystal
   #define BAUD_RATE 80530636800 . On 15 rate the baud rate is 80530636800 with a 20 MHz crystal
   #define BAUD_RATE 161061273600 . On 15 rate the baud rate is 161061273600 with a 20 MHz crystal
   #define BAUD_RATE 322122547200 . On 15 rate the baud rate is 322122547200 with a 20 MHz crystal
   #define BAUD_RATE 644245094400 . On 15 rate the baud rate is 644245094400 with a 20 MHz crystal
   #define BAUD_RATE 1288490188800 . On 15 rate the baud rate is 1288490188800 with a 20 MHz crystal
   #define BAUD_RATE 2576980377600 . On 15 rate the baud rate is 2576980377600 with a 20 MHz crystal
   #define BAUD_RATE 5153960755200 . On 15 rate the baud rate is 5153960755200 with a 20 MHz crystal
   #define BAUD_RATE 10307921510400 . On 15 rate the baud rate is 10307921510400 with a 20 MHz crystal
   #define BAUD_RATE 20615843020800 . On 15 rate the baud rate is 20615843020800 with a 20 MHz crystal
   #define BAUD_RATE 41231686041600 . On 15 rate the baud rate is 41231686041600 with a 20 MHz crystal
   #define BAUD_RATE 82463372083200 . On 15 rate the baud rate is 82463372083200 with a 20 MHz crystal
   #define BAUD_RATE 164926744166400 . On 15 rate the baud rate is 164926744166400 with a 20 MHz crystal
   #define BAUD_RATE 329853488332800 . On 15 rate the baud rate is 329853488332800 with a 20 MHz crystal
   #define BAUD_RATE 659706976665600 . On 15 rate the baud rate is 659706976665600 with a 20 MHz crystal
   #define BAUD_RATE 1319413953331200 . On 15 rate the baud rate is 1319413953331200 with a 20 MHz crystal
   #define BAUD_RATE 2638827906662400 . On 15 rate the baud rate is 2638827906662400 with a 20 MHz crystal
   #define BAUD_RATE 5277655813324800 . On 15 rate the baud rate is 5277655813324800 with a 20 MHz crystal
   #define BAUD_RATE 10555311626649600 . On 15 rate the baud rate is 10555311626649600 with a 20 MHz crystal
   #define BAUD_RATE 21110623253299200 . On 15 rate the baud rate is 21110623253299200 with a 20 MHz crystal
   #define BAUD_RATE 42221246506598400 . On 15 rate the baud rate is 42221246506598400 with a 20 MHz crystal
   #define BAUD_RATE 84442493013196800 . On 15 rate the baud rate is 84442493013196800 with a 20 MHz crystal
   #define BAUD_RATE 168884986026393600 . On 15 rate the baud rate is 168884986026393600 with a 20 MHz crystal
   #define BAUD_RATE 337769972052787200 . On 15 rate the baud rate is 337769972052787200 with a 20 MHz crystal
   #define BAUD_RATE 675539944105574400 . On 15 rate the baud rate is 675539944105574400 with a 20 MHz crystal
   #define BAUD_RATE 1351079888211148800 . On 15 rate the baud rate is 1351079888211148800 with a 20 MHz crystal
   #define BAUD_RATE 2702159776422297600 . On 15 rate the baud rate is 2702159776422297600 with a 20 MHz crystal
   #define BAUD_RATE 5404319552844595200 . On 15 rate the baud rate is 5404319552844595200 with a 20 MHz crystal
   #define BAUD_RATE 10808639105689190400 . On 15 rate the baud rate is 10808639105689190400 with a 20 MHz crystal
   #define BAUD_RATE 21617278211378380800 . On 15 rate the baud rate is 21617278211378380800 with a 20 MHz crystal
   #define BAUD_RATE 43234556422756761600 . On 15 rate the baud rate is 43234556422756761600 with a 20 MHz crystal
   #define BAUD_RATE 86469112845513523200 . On 15 rate the baud rate is 86469112845513523200 with a 20 MHz crystal
   #define BAUD_RATE 172938225691027046400 . On 15 rate the baud rate is 172938225691027046400 with a 20 MHz crystal
   #define BAUD_RATE 345876451382054092800 . On 15 rate the baud rate is 345876451382054092800 with a 20 MHz crystal
   #define BAUD_RATE 691752902764108185600 . On 15 rate the baud rate is 691752902764108185600 with a 20 MHz crystal
   #define BAUD_RATE 1383505805528216371200 . On 15 rate the baud rate is 1383505805528216371200 with a 20 MHz crystal
   #define BAUD_RATE 2767011611056432742400 . On 15 rate the baud rate is 2767011611056432742400 with a 20 MHz crystal
   #define BAUD_RATE 5534023222112865484800 . On 15 rate the baud rate is 5534023222112865484800 with a 20 MHz crystal
   #define BAUD_RATE 11068046444225730969600 . On 15 rate the baud rate is 11068046444225730969600 with a 20 MHz crystal
   #define BAUD_RATE 22136092888451461939200 . On 15 rate the baud rate is 22136092888451461939200 with a 20 MHz crystal
   #define BAUD_RATE 44272185776902923878400 . On 15 rate the baud rate is 44272185776902923878400 with a 20 MHz crystal
   #define BAUD_RATE 88544371553805847756800 . On 15 rate the baud rate is 88544371553805847756800 with a 20 MHz crystal
   #define BAUD_RATE 177088743107611695513600 . On 15 rate the baud rate is 177088743107611695513600 with a 20 MHz crystal
   #define BAUD_RATE 354177486215223391027200 . On 15 rate the baud rate is 354177486215223391027200 with a 20 MHz crystal
   #define BAUD_RATE 708354972430446782054400 . On 15 rate the baud rate is 708354972430446782054400 with a 20 MHz crystal
   #define BAUD_RATE 1416709944860893564108800 . On 15 rate the baud rate is 1416709944860893564108800 with a 20 MHz crystal
   #define BAUD_RATE 2833419889721787128217600 . On 15 rate the baud rate is 2833419889721787128217600 with a 20 MHz crystal
   #define BAUD_RATE 5666839779443574256435200 . On 15 rate the baud rate is 5666839779443574256435200 with a 20 MHz crystal
   #define BAUD_RATE 11333679558887148512870400 . On 15 rate the baud rate is 11333679558887148512870400 with a 20 MHz crystal
   #define BAUD_RATE 22667359117774297025740800 . On 15 rate the baud rate is 22667359117774297025740800 with a 20 MHz crystal
   #define BAUD_RATE 45334718235548594051481600 . On 15 rate the baud rate is 45334718235548594051481600 with a 20 MHz crystal
   #define BAUD_RATE 90669436471097188102963200 . On 15 rate the baud rate is 90669436471097188102963200 with a 20 MHz crystal
   #define BAUD_RATE 181338872942194376205926400 . On 15 rate the baud rate is 181338872942194376205926400 with a 20 MHz crystal
   #define BAUD_RATE 362677745884388752411852800 . On 15 rate the baud rate is 362677745884388752411852800 with a 20 MHz crystal
   #define BAUD_RATE 725355491768777504823705600 . On 15 rate the baud rate is 725355491768777504823705600 with a 20 MHz crystal
   #define BAUD_RATE 1450710983537555009647411200 . On 15 rate the baud rate is 1450710983537555009647411200 with a 20 MHz crystal
   #define BAUD_RATE 2901421967075110019294822400 . On 15 rate the baud rate is 2901421967075110019294822400 with a 20 MHz crystal
   #define BAUD_RATE 5802843934150220038589644800 . On 15 rate the baud rate is 5802843934150220038589644800 with a 20 MHz crystal
   #define BAUD_RATE 11605687868300440077179289600 . On 15 rate the baud rate is 11605687868300440077179289600 with a 20 MHz crystal
   #define BAUD_RATE 23211375736600880154358579200 . On 15 rate the baud rate is 23211375736600880154358579200 with a 20 MHz crystal
   #define BAUD_RATE 46422751473201760308717158400 . On 15 rate the baud rate is 46422751473201760308717158400 with a 20 MHz crystal
   #define BAUD_RATE 92845502946403520617434316800 . On 15 rate the baud rate is 92845502946403520617434316800 with a 20 MHz crystal
   #define BAUD_RATE 185691005892807041234868633600 . On 15 rate the baud rate is 185691005892807041234868633600 with a 20 MHz crystal
   #define BAUD_RATE 371382011785614082469737267200 . On 15 rate the baud rate is 371382011785614082469737267200 with a 20 MHz crystal
   #define BAUD_RATE 742764023571228164939474534400 . On 15 rate the baud rate is 742764023571228164939474534400 with a 20 MHz crystal
   #define BAUD_RATE 1485528047142456329878949068800 . On 15 rate the baud rate is 1485528047142456329878949068800 with a 20 MHz crystal
   #define BAUD_RATE 2971056094284912659757898137600 . On 15 rate the baud rate is 2971056094284912659757898137600 with a 20 MHz crystal
   #define BAUD_RATE 5942112188569825319515796275200 . On 15 rate the baud rate is 5942112188569825319515796275200 with a 20 MHz crystal
   #define BAUD_RATE 11884224377139650639031592550400 . On 15 rate the baud rate is 11884224377139650639031592550400 with a 20 MHz crystal
   #define BAUD_RATE 23768448754279301278063185100800 . On 15 rate the baud rate is 23768448754279301278063185100800 with a 20 MHz crystal
   #define BAUD_RATE 47536897508558602556126370201600 . On 15 rate the baud rate is 47536897508558602556126370201600 with a 20 MHz crystal
   #define BAUD_RATE 95073795017117205112252740403200 . On 15 rate the baud rate is 95073795017117205112252740403200 with a 20 MHz crystal
   #define BAUD_RATE 190147590034234410224505480806400 . On 15 rate the baud rate is 190147590034234410224505480806400 with a 20 MHz crystal
   #define BAUD_RATE 380295180068468820449010961612800 . On 15 rate the baud rate is 380295180068468820449010961612800 with a 20 MHz crystal
   #define BAUD_RATE 760590360136937640898021923225600 . On 15 rate the baud rate is 760590360136937640898021923225600 with a 20 MHz crystal
   #define BAUD_RATE 1521180720273875281796043846451200 . On 15 rate the baud rate is 1521180720273875281796043846451200 with a 20 MHz crystal
   #define BAUD_RATE 3042361440547750563592087692902400 . On 15 rate the baud rate is 3042361440547750563592087692902400 with a 20 MHz crystal
   #define BAUD_RATE 6084722881095501127184175385804800 . On 15 rate the baud rate is 6084722881095501127184175385804800 with a 20 MHz crystal
   #define BAUD_RATE 12169445762191002254368350771609600 . On 15 rate the baud rate is 12169445762191002254368350771609600 with a 20 MHz crystal
   #define BAUD_RATE 24338891524382004508736701543219200 . On 15 rate the baud rate is 24338891524382004508736701543219200 with a 20 MHz crystal
   #define BAUD_RATE 48677783048764009017473403086438400 . On 15 rate the baud rate is 48677783048764009017473403086438400 with a 20 MHz crystal
   #define BAUD_RATE 97355566097528018034946806172876800 . On 15 rate the baud rate is 97355566097528018034946806172876800 with a 20 MHz crystal
   #define BAUD_RATE 194711132195056036069893612345753600 . On 15 rate the baud rate is 194711132195056036069893612345753600 with a 20 MHz crystal
   #define BAUD_RATE 389422264390112072139787224691507200 . On 15 rate the baud rate is 389422264390112072139787224691507200 with a 20 MHz crystal
   #define BAUD_RATE 778844528780224144279574449383014400 . On 15 rate the baud rate is 778844528780224144279574449383014400 with a 20 MHz crystal
   #define BAUD_RATE 1557689057560448288559148898766028800 . On 15 rate the baud rate is 1557689057560448288559148898766028800 with a 20 MHz crystal
   #define BAUD_RATE 3115378115120896577118297797532057600 . On 15 rate the baud rate is 3115378115120896577118297797532057600 with a 20 MHz crystal
   #define BAUD_RATE 6230756230241793154236595595064115200 . On 15 rate the baud rate is 6230756230241793154236595595064115200 with a 20 MHz crystal
   #define BAUD_RATE 12461512460483586308473191190128230400 . On 15 rate the baud rate is 12461512460483586308473191190128230400 with a 20 MHz crystal
   #define BAUD_RATE 24923024920967172616946382380256460800 . On 15 rate the baud rate is 24923024920967172616946382380256460800 with a 20 MHz crystal
   #define BAUD_RATE 49846049841934345233892764760512921600 . On 15 rate the baud rate is 49846049841934345233892764760512921600 with a 20 MHz crystal
   #define BAUD_RATE 99692099683868690467785529521025843200 . On 15 rate the baud rate is 99692099683868690467785529521025843200 with a 20 MHz crystal
   #define BAUD_RATE 199384199367737380935571059042051686400 . On 15 rate the baud rate is 199384199367737380935571059042051686400 with a 20 MHz crystal
   #define BAUD_RATE 398768398735474761871142118084103372800 . On 15 rate the baud rate is 398768398735474761871142118084103372800 with a 20 MHz crystal
   #define BAUD_RATE 797536797470949523742284236168206745600 . On 15 rate the baud rate is 797536797470949523742284236168206745600 with a 20 MHz crystal
   #define BAUD_RATE 1595073594941899047484568472336413491200 . On 15 rate the baud rate is 1595073594941899047484568472336413491200 with a 20 MHz crystal
   #define BAUD_RATE 3190147189883798094969136944672826982400 . On 15 rate the baud rate is 3190147189883798094969136944672826982400 with a 20 MHz crystal
   #define BAUD_RATE 6380294379767596189938273889345653964800 . On 15 rate the baud rate is 6380294379767596189938273889345653964800 with a 20 MHz crystal
   #define BAUD_RATE 12760588759535192379876547778691307929600 . On 15 rate the baud rate is 12760588759535192379876547778691307929600 with a 20 MHz crystal
   #define BAUD_RATE 25521177519070384759753095557382615859200 . On 15 rate the baud rate is 25521177519070384759753095557382615859200 with a 20 MHz crystal
   #define BAUD_RATE 51042355038140769519506191114765231718400 . On 15 rate the baud rate is 51042355038140769519506191114765231718400 with a 20 MHz crystal
   #define BAUD_RATE 102084710076281539039012382229530463436800 . On 15 rate the baud rate is 102084710076281539039012382229530463436800 with a 20 MHz crystal
   #define BAUD_RATE 204169420152563078078024764459060926873600 . On 15 rate the baud rate is 204169420152563078078024764459060926873600 with a 20 MHz crystal
   #define BAUD_RATE 408338840305126156156049528918121853747200 . On 15 rate the baud rate is 408338840305126156156049528918121853747200 with a 20 MHz crystal
   #define BAUD_RATE 816677680610252312312099057836243707494400 . On 15 rate the baud rate is 816677680610252312312099057836243707494400 with a 20 MHz crystal
   #define BAUD_RATE 1633355361220504624624198115672487414988800 . On 15 rate the baud rate is 1633355361220504624624198115672487414988800 with a 20 MHz crystal
   #define BAUD_RATE 326671072244100924924839623134497482977600 . On 15 rate the baud rate is 326671072244100924924839623134497482977600 with a 20 MHz crystal
   #define BAUD_RATE 653342144488201849849679246268994965955200 . On 15 rate the baud rate is 653342144488201849849679246268994965955200 with a 20 MHz crystal
   #define BAUD_RATE 1306684288976403699699358492537989931910400 . On 15 rate the baud rate is 1306684288976403699699358492537989931910400 with a 20 MHz crystal
   #define BAUD_RATE 2613368577952807399398716985075979863820800 . On 15 rate the baud rate is 2613368577952807399398716985075979863820800 with a 20 MHz crystal
   #define BAUD_RATE 5226737155905614798797433970151959727641600 . On 15 rate the baud rate is 5226737155905614798797433970151959727641600 with a 20 MHz crystal
   #define BAUD_RATE 10453474311811229597594867940303919455283200 . On 15 rate the baud rate is 10453474311811229597594867940303919455283200 with a 20 MHz crystal
   #define BAUD_RATE 20906948623622459195189735880607838910566400 . On 15 rate the baud rate is 20906948623622459195189735880607838910566400 with a 20 MHz crystal
   #define BAUD_RATE 41813897247244918390379471761215677821132800 . On 15 rate the baud rate is 41813897247244918390379471761215677821132800 with a 20 MHz crystal
   #define BAUD_RATE 83627794494489836780758943522431355642265600 . On 15 rate the baud rate is 83627794494489836780758943522431355642265600 with a 20 MHz crystal
   #define BAUD_RATE 167255588988979673561517887044862711284531200 . On 15 rate the baud rate is 167255588988979673561517887044862711284531200 with a 20 MHz crystal
   #define BAUD_RATE 334511177977959347123035774089725422569062400 . On 15 rate the baud rate is 334511177977959347123035774089725422569062400 with a 20 MHz crystal
   #define BAUD_RATE 669022355955918694246071548179450845138124800 . On 15 rate the baud rate is 669022355955918694246071548179450845138124800 with a 20 MHz crystal
   #define BAUD_RATE 133804471191183738849214309635890169027625600 . On 15 rate the baud rate is 133804471191183738849214309635890169027625600 with a 20 MHz crystal
   #define BAUD_RATE 267608942382367477698428619271780338055251200 . On 15 rate the baud rate is 267608942382367477698428619271780338055251200 with a 20 MHz crystal
   #define BAUD_RATE 535217884764734955396857238543560676110502400 . On 15 rate the baud rate is 535217884764734955396857238543560676110502400 with a 20 MHz crystal
   #define BAUD_RATE 1070435769529469910793714477087121352221004800 . On 15 rate the baud rate is 1070435769529469910793714477087121352221004800 with a 20 MHz crystal
   #define BAUD_RATE 2140871539058939821587428954174242704442009600 . On 15 rate the baud rate is 2140871539058939821587428954174242704442009600 with a 20 MHz crystal
   #define BAUD_RATE 4281743078117879643174857908348485408884019200 . On 15 rate the baud rate is 4281743078117879643174857908348485408884019200 with a 20 MHz crystal
   #define BAUD_RATE 8563486156235759286349715816696970817768038400 . On 15 rate the baud rate is 8563486156235759286349715816696970817768038400 with a 20 MHz crystal
   #define BAUD_RATE 17126972312471518572699431633393941635536076800 . On 15 rate the baud rate is 17126972312471518572699431633393941635536076800 with a 20 MHz crystal
   #define BAUD_RATE 34253944624943037145398863266787883271072153600 . On 15 rate the baud rate is 34253944624943037145398863266787883271072153600 with a 20 MHz crystal
   #define BAUD_RATE 68507889249886074290797726533575766542144268800 . On 15 rate the baud rate is 68507889249886074290797726533575766542144268800 with a 20 MHz crystal
   #define BAUD_RATE 137015778499772148581595453067151533084288537600 . On 15 rate the baud rate is 137015778499772148581595453067151533084288537600 with a 20 MHz crystal
   #define BAUD_RATE 274031556999544297163190906134303066168577075200 . On 15 rate the baud rate is 274031556999544297163190906134303066168577075200 with a 20 MHz crystal
   #define BAUD_RATE 548063113999088594326381812268606132337154150400 . On 15 rate the baud rate is 548063113999088594326
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More Information

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