INTRODUCTION

This migration document describes how to replace the ST M41T11 RTCC with the MCP7940N RTCC.

Note: The MCP7940N has been designed to perform to the parameters of its data sheet. It has been tested to an electrical specification designed to determine its conformance with these parameters. Due to process differences in manufacturing this device, this device may have different performance characteristics than its earlier version. These differences may cause the device to perform differently in your application than the earlier version.

Note: The user should verify that the device oscillator starts and performs as expected. Adjusting the loading capacitor values and/or the Oscillator mode may be required.

The MCP7940N is an I²C™ RTCC device similar to M41T11. The MCP7940N and M41T11 are available in the standard 8-lead SOIC package.

Table 1 shows considerations that must be taken into account when migrating from M41T11 to the MCP7940N.

<table>
<thead>
<tr>
<th>No.</th>
<th>Required changes</th>
<th>HW</th>
<th>SW</th>
<th>Section Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>External load capacitors required</td>
<td>✓</td>
<td></td>
<td>Crystal Circuit</td>
</tr>
<tr>
<td>2</td>
<td>MCP7940N recommends additional components for the battery backup circuit</td>
<td>✓</td>
<td></td>
<td>Battery Backup</td>
</tr>
<tr>
<td>3</td>
<td>The MCP7940N battery backup function is enabled by setting the VBATEN bit</td>
<td></td>
<td>✓</td>
<td>Battery Backup</td>
</tr>
<tr>
<td>4</td>
<td>MCP7940N can work on 100 kHz and 400 kHz I²C™ frequency versus 100 kHz for M41T11</td>
<td>✓</td>
<td>✓</td>
<td>Configuring The I²C Bus</td>
</tr>
<tr>
<td>5</td>
<td>MCP7940N and M41T11 have different I²C control bytes</td>
<td></td>
<td>✓</td>
<td>Device Addressing</td>
</tr>
<tr>
<td>6</td>
<td>The MCP7940N MFP pin (FT/OUT on M41T11) has more functions: square-wave, alarms and firmware-controlled output</td>
<td></td>
<td>✓</td>
<td>FT/OUT vs. MFP Functionality</td>
</tr>
<tr>
<td>7</td>
<td>MCP7940N has a dedicated register for the clock calibration. The calibration range and resolution is different for these two devices</td>
<td></td>
<td>✓</td>
<td>Clock Calibration</td>
</tr>
<tr>
<td>8</td>
<td>The MCP7940N oscillator is enabled by a control bit with inverse polarity</td>
<td></td>
<td>✓</td>
<td>Starting the Oscillator</td>
</tr>
<tr>
<td>9</td>
<td>MCP7940N has an automatic leap year indicator. M41T11 does not have leap year indicator, but it has a century bit</td>
<td></td>
<td>✓</td>
<td>Accessing the RTCC and SRAM Registers</td>
</tr>
<tr>
<td>10</td>
<td>Additional control and status bits in the Date and Time registers. SRAM address range changes</td>
<td></td>
<td>✓</td>
<td>Accessing the RTCC and SRAM Registers</td>
</tr>
</tbody>
</table>
M41T11 and MCP7940N are electrically compatible. Although there are some differences between the two devices (shown in Table 3), these do not influence the migration process.

### TABLE 2: MCP7940N ADDITIONAL FEATURES

<table>
<thead>
<tr>
<th>No.</th>
<th>Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64 bytes of battery-backed SRAM; M41T11 has only 56 bytes of battery-backed SRAM.</td>
</tr>
<tr>
<td>2</td>
<td>Two programmable alarms.</td>
</tr>
<tr>
<td>3</td>
<td>More package options: 8-lead SOIC, TSSOP, MSOP and 2x3 TDFN.</td>
</tr>
<tr>
<td>4</td>
<td>100 kHz and 400 kHz I²C™ compatible.</td>
</tr>
<tr>
<td>5</td>
<td>Power-Up/Down Time-Stamp registers.</td>
</tr>
<tr>
<td>6</td>
<td>MCP7940N is available in Extended Temperature Range (-40°C to +125°C)</td>
</tr>
<tr>
<td>7</td>
<td>Leap year indication bit.</td>
</tr>
</tbody>
</table>

### TABLE 3: ELECTRICAL DIFFERENCES BETWEEN MCP7940 AND M41T11

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Symbol</th>
<th>MCP7940N Differences</th>
<th>M41T11 Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply Voltage</td>
<td>VCC</td>
<td>Industrial (I): 1.8V-5.5V</td>
<td>SO8: 2V-5.5V</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SOH28: 3.3V-5.5V</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Active supply current</td>
<td>ICC</td>
<td>Read: Max. 300 µA (400 kHz)</td>
<td>Max. 300 µA (100 kHz)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Write: Max. 400 µA (400 kHz)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>VBAT Battery Voltage</td>
<td>VBAT</td>
<td>1.3-5.5V (Typ. 3V)</td>
<td>2.5-3.5V (Typ. 3V)</td>
</tr>
<tr>
<td>4</td>
<td>VBAT Change Over</td>
<td>VTRIP</td>
<td>Typ. 1.5V</td>
<td>VBAT-0.5V</td>
</tr>
<tr>
<td></td>
<td>(VSO on M41T11)</td>
<td></td>
<td>(VSO on M41T11)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>VBAT Current (Vbat = 3.0V)</td>
<td>IBAT</td>
<td>Typ. 700 nA</td>
<td>Typ. 800 nA</td>
</tr>
<tr>
<td>6</td>
<td>Crystal Selection</td>
<td>—</td>
<td>6-9pF (external capacitors required)</td>
<td>12.5pF (includes internal capacitors)</td>
</tr>
</tbody>
</table>
ST M41T11 to MCP7940N Migration

SCHEMATIC RECOMMENDATIONS

The differences between the schematics of MCP7940N and M41T11 are the load capacitors (CX1 and CX2), the battery backup circuit and the pull-up resistors for the I2C bus.

The recommended connections for the MCP7940N and M41T11 devices are shown in Figure 1 and Figure 2.

FIGURE 1: RECOMMENDED CONNECTIONS FOR M41T11 DEVICES

FIGURE 2: RECOMMENDED CONNECTIONS FOR MCP7940N DEVICES
CRYSTAL CIRCUIT

M41T11 is designed to use 32.768 kHz crystals with 12.5pF load capacitance. The CX1 and CX2 capacitors are internal.

Figure 3 shows the MCP7940N schematic for the oscillator circuit (this device does not have internal load capacitors, which must be included on the PCB). It has been designed to operate with a standard 32.768 kHz tuning fork crystal with a load capacitance of between 6-9pF.

Microchip recommends several crystals for which MCP7940N works reliably. For more information, please consult the following documents:

- AN1365, “Recommended Usage of Microchip Serial RTCC Devices” (DS01365)
- MCP7940N Data Sheet (DS25010)

FIGURE 3: OSCILLATOR DIAGRAM

![Oscillator Diagram](image)

BATTERY BACKUP

MCP7940N and M41T11 devices both have an automatic switchover from VCC to VBAT, backup supply, to maintain the RTCC and SRAM during a VCC power fail.

The M41T11 battery backup feature is always enabled in hardware. On the MCP7940N, the battery backup feature is controlled by the VBATEN bit (bit 3) in the Day register (0x03). The VBATEN bit should be set to ‘1’ to match the functionality of the M41T11. This bit is cleared by default on the MCP7940N.

Note: If the battery backup function is not enabled, the SRAM content will be lost and RTCC will be reset when VCC drops to VTRIP. If the device is operating in Battery Backup mode and the VBAT drops to the minimum voltage (see Table 3, VBAT parameter), the entire SRAM and RTCC data will no longer be preserved during power loss.

The MCP7940N and M41T11 are fully accessible through the serial interface while VCC is higher than VTRIP/VSO. After VCC drops to VTRIP/VSO, the devices will be powered by VBAT, only to maintain the RTCC and SRAM data contents (Table 4).

<table>
<thead>
<tr>
<th>Device</th>
<th>Supply Condition</th>
<th>Serial Access</th>
<th>Powered By</th>
</tr>
</thead>
<tbody>
<tr>
<td>M41T11</td>
<td>VCC &gt; VSO</td>
<td>Yes</td>
<td>VCC</td>
</tr>
<tr>
<td></td>
<td>VCC &lt; VSO</td>
<td>No</td>
<td>VBAT</td>
</tr>
<tr>
<td>MCP7940N</td>
<td>VCC &gt; VTRIP</td>
<td>Yes</td>
<td>VCC</td>
</tr>
<tr>
<td></td>
<td>VCC &lt; VTRIP</td>
<td>No</td>
<td>VBAT</td>
</tr>
</tbody>
</table>

Note: The VTRIP parameter on MCP7940N is typically 1.5V. On M41T11, the VTRIP parameter is named VSO and is typically VBAT - 0.5V (VBAT = 3V typically).

When using any supply, it is recommended to include a 1K series resistor, R4 and a 100pF capacitor, C2, between the supply and the VBAT pin (as seen in Figure 4). This is required to remove the spikes that can occur when switching from VCC to VBAT.

Additionally, a series diode, D1, is recommended when using a battery to eliminate any current flowing into the cell during a catastrophic failure. For more information, see AN1365, “Recommended Usage of Microchip Serial RTCC Devices” (DS01365).
CONFIGURING THE I2C BUS

The MCP7940N is I2C 100 kHz and 400 kHz compatible (the M41T11 operates in the Standard mode – 100 kHz only). The SDA and SCL pins are open-drain terminals, therefore, they require pull-up resistors to VCC (typically 10 kΩ for 100 kHz and 2 kΩ for 400 kHz).

If the 400 kHz frequency is used, the master device must be configured to communicate at this increased speed.

DEVICE ADDRESSING

M41T11 and MCP7940N devices are I2C standard compatible, only the control bytes are different (as shown in Figure 5).

FIGURE 5: ADDRESS SEQUENCE BIT ASSIGNMENTS

The MCP740N control byte for accessing the SRAM and RTCC registers is set to '1101111x' (0xDF for a read, 0xDE for a write). The RTCC registers and the SRAM share the same address space.

The control byte for M41T11 is different, '1101000x' (0xD0 for a write, 0xD1 for a read operation).

FT/OUT vs. MFP FUNCTIONALITY

The FT/OUT pin from the M41T11 is called MFP on the MCP7940N. FT/OUT and MFP pins can be used to output a square-wave signal with a programmable frequency or toggled via the control bit, OUT. Alternatively, MFP can be asserted when the alarm is triggered.

On power-up, the FT/OUT and MFP pins have the same default state polarity.

TABLE 5: FT/OUT AND MFP DEFAULT STATE POLARITY

<table>
<thead>
<tr>
<th>Device</th>
<th>Pin No.</th>
<th>Pin Name</th>
<th>Power-Up State</th>
</tr>
</thead>
<tbody>
<tr>
<td>M41T11</td>
<td>7</td>
<td>FT/OUT</td>
<td>High</td>
</tr>
<tr>
<td>MCP7940N</td>
<td>7</td>
<td>MFP</td>
<td>High</td>
</tr>
</tbody>
</table>

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The MFP pin functionality is controlled by the Control register, similar to FT/OUT on the M41T11.

### TABLE 6: M41T11 AND MCP7940N CONTROL REGISTER

<table>
<thead>
<tr>
<th>Device</th>
<th>Address</th>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
<th>Calibration</th>
</tr>
</thead>
<tbody>
<tr>
<td>M41T11</td>
<td>07h</td>
<td>OUT</td>
<td>FT</td>
<td>S</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCP7940N</td>
<td>07h</td>
<td>OUT</td>
<td>SQWE</td>
<td>ALM1</td>
<td>ALM0</td>
<td>EXTOSC</td>
<td>RS2</td>
<td>RS1</td>
<td>RS0</td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** Set the ALM1, ALM0, RS2, RS1, RS0, and EXTOSC to ‘0’ to match with the M41T11 functionality.

2: SQWE and FT bits have the same function, to generate a square-wave signal. By default, on power-up, the FT and SQWE bits are set to ‘0’.

3: EXTOSC allows an external 32.768 kHz signal to drive the RTCC.

4: ALM1:ALM0 determines which alarms are active.

5: S is the Calibration sign bit (see Section “Clock Calibration”).

When FT/OUT and MFP are not used to generate a square-wave signal, the default state is controlled by the OUT bit (see Table 6). If OUT = 1, then FT/OUT = 1 and MFP = 1; if OUT = 0 then, FT/OUT = 0 and MFP = 0.

The SQWE and RS2:RS0 bits control the MFP when it is used to generate a square-wave signal (see Table 7); FT/OUT is controlled by the FT bit.

### TABLE 7: CONFIGURE FT/OUT AND MFP TO GENERATE A SQUARE-WAVE SIGNAL

<table>
<thead>
<tr>
<th>Device</th>
<th>Pin</th>
<th>Control Bits</th>
<th>Square-Wave Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>M41T11</td>
<td>FT/OUT</td>
<td>FT = 1</td>
<td>512 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FT = 0</td>
<td>Disabled</td>
</tr>
<tr>
<td>MCP7940N</td>
<td>MFP</td>
<td>SQWE = 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>RS2 RS1:RS0</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>01</td>
<td>4 kHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10</td>
<td>8 kHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>11</td>
<td>32 kHz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>X</td>
<td>64 Hz</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SQWE = 0</td>
<td>Disabled</td>
</tr>
</tbody>
</table>

**Note:** Calibration Mode — See device data sheet.
ST M41T11 to MCP7940N Migration

CLOCK CALIBRATION

M41T11 and MCP7940N allow calibration of the crystal by adding to or subtracting from the oscillator divider circuit.

On M41T11, the last five bits from the Control register represent the calibration value byte. The sign bit (bit 5 in the Control register) indicates a positive (add cycles, \( S = 1 \)) or a negative (subtract cycles, \( S = 0 \)) calibration.

MCP7940N has a dedicated Calibration register (address 08h). The first bit is the sign bit, and the last seven bits represent the calibration byte (each bit gives the ability to add or subtract two clock cycles). If sign bit = 1, cycles are added to the oscillator divider circuit and if sign bit = 0 the cycles are subtracted.

The calibration effect can be seen by generating a square-wave signal on MFP pin.

TABLE 8: CALIBRATION PROCESS ON M41T11 AND MCP7940N

<table>
<thead>
<tr>
<th>Device</th>
<th>Register Address</th>
<th>Sign Bit</th>
<th>Calibration Value</th>
<th>Calibration Effect</th>
<th>Clock/Bit</th>
<th>Calibration Range</th>
<th>PPM Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>M41T11</td>
<td>Control Register</td>
<td>Bit 5 (S)</td>
<td>Bit4:Bit0</td>
<td>One second of each minute from 2 minutes*Calibration Byte in the 64 minutes cycle</td>
<td>S = 0, -256 clocks</td>
<td>- 64 ppm to +128 ppm</td>
<td>+4 ppm, -2 ppm</td>
</tr>
<tr>
<td>MCP7940N</td>
<td>Calibration</td>
<td>Bit 7</td>
<td>Bit6:Bit0</td>
<td>RS2 = 0 Every minute (only one cycle in sixty will be affected)</td>
<td>±2 clocks</td>
<td>-127 ppm to +127 ppm</td>
<td>±1 ppm</td>
</tr>
</tbody>
</table>

Note: For more information, please refer to the MCP7940N and M41T11 data sheets.

When migrating from M41T11 to MCP7940N, the following equation can be used to write initialize the Calibration register:

**EQUATION 1:**

\[
\text{MCP7940N\_Calib\_Reg} = (\text{M41T11\_Calib\_Value}) \times 2 \times (2 \times \text{M41T11\_Calib\_Sign}) + (\text{M41T11\_Calib\_Sign} << 2);
\]

Note: \( M41T11\_\text{Calib\_Value} = (M41T11\_\text{Ctrl\_Reg} \& 0x1F); \)

\( M41T11\_\text{Calib\_Sign} = (M41T11\_\text{Ctrl\_Reg} \& 0x20); \)

STARTING THE OSCILLATOR

The oscillator in the both RTCC's is enabled by a control bit but the polarity varies between the devices. The enable is bit 7 in the Seconds register (0x00). On power-up, the MCP7940N oscillator is stopped.

<table>
<thead>
<tr>
<th>Device</th>
<th>Bit Name</th>
<th>State</th>
<th>Reset State</th>
</tr>
</thead>
<tbody>
<tr>
<td>M41T11</td>
<td>ST (Stop Oscillator)</td>
<td>disable oscillator</td>
<td>0</td>
</tr>
<tr>
<td>MCP7940N</td>
<td>ST (Start Oscillator)</td>
<td>enable oscillator</td>
<td>0</td>
</tr>
</tbody>
</table>

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ACCESSING THE RTCC AND SRAM
REGISTERS

On M41T11, the 56 bytes of RAM are located in
address locations from 08h to 3Fh. These memory
locations are used on MCP7940N by the calibration
alarms and time-stamp registers.

On MCP7940N, the 64 bytes of RAM are located in
address locations 20h to 5Fh.

Differences between the M41T11 and MCP7940N
memory maps are shown in Figure 6.

FIGURE 6:  M41T11 AND MCP7940N MEMORY MAP

<table>
<thead>
<tr>
<th>M41T11 Memory Map</th>
<th>MCP7940N Memory Map</th>
</tr>
</thead>
<tbody>
<tr>
<td>0x00</td>
<td>0x00</td>
</tr>
<tr>
<td>0x06</td>
<td>0x06</td>
</tr>
<tr>
<td>0x07</td>
<td>0x07</td>
</tr>
<tr>
<td>0x07</td>
<td>0x07</td>
</tr>
<tr>
<td>0x08</td>
<td>0x08</td>
</tr>
<tr>
<td>0x3F</td>
<td>0x08</td>
</tr>
<tr>
<td>0x40</td>
<td>0x09</td>
</tr>
<tr>
<td>0xFF</td>
<td>0x0A</td>
</tr>
<tr>
<td></td>
<td>0x08</td>
</tr>
<tr>
<td></td>
<td>0x09</td>
</tr>
<tr>
<td></td>
<td>0x0A</td>
</tr>
<tr>
<td></td>
<td>0x10</td>
</tr>
<tr>
<td></td>
<td>0x11</td>
</tr>
<tr>
<td></td>
<td>0x17</td>
</tr>
<tr>
<td></td>
<td>0x18</td>
</tr>
<tr>
<td></td>
<td>0x1F</td>
</tr>
<tr>
<td></td>
<td>0x20</td>
</tr>
<tr>
<td></td>
<td>0x5F</td>
</tr>
<tr>
<td></td>
<td>0x60</td>
</tr>
</tbody>
</table>

The Date and Time registers are mapped on
MCP7940N the same as M41T11 (from 00h to 06h
address) with several differences that will be described
below. The MINUTES, DATE and YEAR registers are
mapped the same as the M41T11.

The DAY register on MCP7940N contains the BCD day
and additional bits for configuration and status. The
VBATEN bit (bit 3) is used to enable/disable the battery
backup. The VBAT bit (bit 4) is set by hardware when
the Vcc falls and cleared by firmware. The OSCON bit
(bit 5) is set and cleared by hardware, indicating if the
oscillator is running or not. This is a read-only bit.

The MONTH register has an additional bit, LP (bit 5),
which indicates if the current year is a leap one. This is
a read-only bit. M41T11 has a Century bit, but does not
have a leap year indicator. MCP7940N and M41T11
have automatic leap year correction.
Care should be taken when the Date and Time registers are read or written. A number of the unimplemented "don't care" bits on DS1307, which read as '0', are used on MCP7940N as control and status bits (they are highlighted in Table 9).

### TABLE 9: DATE AND TIME REGISTER MAP FOR MCP7940N

<table>
<thead>
<tr>
<th>Address</th>
<th>Bit 7</th>
<th>Bit 6</th>
<th>Bit 5</th>
<th>Bit 4</th>
<th>Bit 3</th>
<th>Bit 2</th>
<th>Bit 1</th>
<th>Bit 0</th>
<th>Function</th>
<th>Range</th>
<th>Reset State</th>
</tr>
</thead>
<tbody>
<tr>
<td>00h</td>
<td>ST</td>
<td>10 Seconds</td>
<td>Seconds</td>
<td>Seconds</td>
<td>00-59</td>
<td>00h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01h</td>
<td></td>
<td>10 Minutes</td>
<td>Minutes</td>
<td>Minutes</td>
<td>00-59</td>
<td>00h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02h</td>
<td>X(2)</td>
<td>12/24(1)</td>
<td>10 Hour AM/PM</td>
<td>10 Hour</td>
<td>Hour</td>
<td>Hours</td>
<td>1-12 + AM/PM 00 - 23</td>
<td>00h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03h</td>
<td>X</td>
<td>X</td>
<td>OSCON(3, 7)</td>
<td>VBAT(4, 7)</td>
<td>VBATEN(5, 7)</td>
<td>Day</td>
<td>Day</td>
<td>1-7</td>
<td>01h</td>
<td></td>
<td></td>
</tr>
<tr>
<td>04h</td>
<td>X</td>
<td>X</td>
<td>10 Date</td>
<td>Date</td>
<td>01-31</td>
<td>01h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05h</td>
<td>X</td>
<td>X</td>
<td>LP(6, 7)</td>
<td>10 Month</td>
<td>Month</td>
<td>01-12</td>
<td>01h</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06h</td>
<td></td>
<td>10 Year</td>
<td>Year</td>
<td>00-99</td>
<td>01h</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note 1:** 12/24 bit determines hour format (set to ‘0’ enables 24-hour format, set to ‘1’ enables 12-hour format). This bit is the CB (century bit) on M41T11.

2: This bit is the CEB (century enable bit) on M41T11.

3: OSCON bit indicates if the oscillator is running or not.

4: VBAT bit is set by hardware when VCC falls.

5: VBATEN bit is used to enable/disable the battery backup.

6: LP bit indicates if the current year is a leap one.

7: The OSCON, VBAT, VBATEN and LP bits are "don’t care" bits on M41T11. The OSCON, VBAT and LP bits are read-only on the MCP7940N.

8: X = Don't Care.

**Note:** Shaded areas are not implemented on M41T11.

### EXAMPLE 1: READ DATE AND TIME FROM MCP7940N

- Seconds = (((Seconds_Register & 0x70) >> 4) * 10) + (Seconds_register & 0x0F);
- Minutes = (((Minutes_Register & 0x70) >> 4) * 10) + (Minutes_Register & 0x0F);
- Hours = (((Hours_Register & 0x30) >> 4) * 10) + (Hours_Register & 0x0F);
- Date = (((Date_Register & 0x30) >> 4) * 10) + (Date_Register & 0x0F);
- Day = Day_Register & 0x07;
- Month = (((Month_Register & 0x10) >> 4) * 10) + (Month_Register & 0x0F);
- Year = (((Year_Register & 0xF0) >> 4) * 10) + (Year_Register & 0x0F);

### EXAMPLE 2: WRITE DATE AND TIME TO MCP7940N

- Seconds_Register |= ((Seconds / 10) << 4) | (Seconds % 10);
- Minutes_Register = ((Minutes / 10) << 4) | (Minutes % 10);
- Hours_Register = ((Hours / 10) << 4) | (Hours % 10);
- Date_Register = ((Date / 10) << 4) | (Date % 10);
- Day_Register |= Day;
- Month_Register = ((Month/10) << 4) | (Month % 10);
- Year_Register = ((Year /10) << 4) | (Year%10);

MCP7940N does not have a Century bit indicator, but a software routine can be used to assert a flag when the century was changed. Therefore, a flag can be toggled when the time is 00:00:00, 01/01/2x01.
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ISBN: 9781620771518

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