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Applications of Embedded - Microcontroller,

Details	
Product Status	Obsolete
Module/Board Type	MPU Core
Core Processor	Rabbit 2000
Co-Processor	-
Speed	22.1MHz
Flash Size	512KB
RAM Size	512KB
Connector Type	2 IDC Headers 2x13
Size / Dimension	1.6" x 2.3" (41mm x 58mm)
Operating Temperature	-40°C ~ 70°C
Purchase URL	https://www.e-xfl.com/product-detail/digi-international/101-0955

RabbitCore RCM2200 User's Manual

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1. INTRODUCTION

The RCM2200 RabbitCore module is designed to be the heart of embedded control systems. The RCM2200 features an integrated Ethernet port and provides for LAN and Internet-enabled systems to be built as easily as serial-communication systems.

Throughout this manual, the term RCM2200 refers to the complete series of RCM2200 RabbitCore modules unless other production models are referred to specifically.

The RCM2200 has a Rabbit 2000 microprocessor operating at 22.1 MHz, static RAM, flash memory, two clocks (main oscillator and timekeeping), and the circuitry necessary for reset and management of battery backup of the Rabbit 2000's internal real-time clock and the static RAM. Two 26-pin headers bring out the Rabbit 2000 I/O bus lines, address lines, data lines, parallel ports, and serial ports.

The RCM2200 receives its +5 V power from the user board on which it is mounted. The RabbitCore RCM2200 can interface with all kinds of CMOS-compatible digital devices through the user board.

1.1 RCM2200 Features

- Small size: 1.60" × 2.30" × 0.86"
  (41 mm × 58 mm × 22 mm)
- Microprocessor: Rabbit 2000 running at 22.1 MHz
- 26 parallel I/O lines: 16 configurable for input or output, 7 fixed inputs, 3 fixed outputs
- 8 data lines (D0–D7)
- 4 address lines (A0–A3)
- Memory I/0 read, write
- External reset input
- Five 8-bit timers (cascadable in pairs) and two 10-bit timers
- 256K–512K flash memory, 128K–512K SRAM
- Real-time clock
- Watchdog supervisor

1.3 Development and Evaluation Tools

A complete Development Kit, including a Prototyping Board and Dynamic C development software, is available for the RCM2200. The Development Kit puts together the essentials you need to design an embedded microprocessor-based system rapidly and efficiently.

1.3.1 Development Software

The RCM2200 module uses the Dynamic C development environment for rapid creation and debugging of runtime applications. Dynamic C provides a complete development environment with integrated editor, compiler and source-level debugger. It interfaces directly with the target system, eliminating the need for complex and unreliable in-circuit emulators.

> **NOTE:** The RCM2200 module requires Dynamic C v7.04 or later for development. A compatible version is included on the Development Kit CD-ROM.

1.4 Development Kit Contents

The RCM2200 Development Kit contains the following items:

- RCM2200 module with 10Base-T Ethernet port, 256K flash memory, and 128K SRAM.
- RCM2200/RCM2300 Prototyping Board.
- Wall transformer power supply, 12 V DC, 1 A. (Included only with Development Kits sold for the North American market. Overseas users will have to substitute a power supply compatible with local mains power.)
- 10-pin header to DB9 programming cable with integrated level-matching circuitry.
- ***Dynamic C*** CD-ROM, with complete product documentation on disk.
- ***Getting Started*** instructions.
- ***Rabbit 2000 Processor Easy Reference*** poster.
- Registration card.

2.1.3 Connect Power

When all other connections have been made, you can connect power to the RCM2200 Prototyping Board.

First, prepare the AC adapter for the country where it will be used by selecting the plug. The RCM2200 Development Kit presently includes Canada/Japan/U.S., Australia/N.Z., U.K., and European style plugs. Snap in the top of the plug assembly into the slot at the top of the AC adapter as shown in Figure 3, then press down on the spring-loaded clip below the plug assembly to allow the plug assembly to click into place.

Connect the AC adapter to 3-pin header J5 on the Prototyping Board as shown in Figure 3 below. The connector may be attached either way as long as it is not offset to one side.

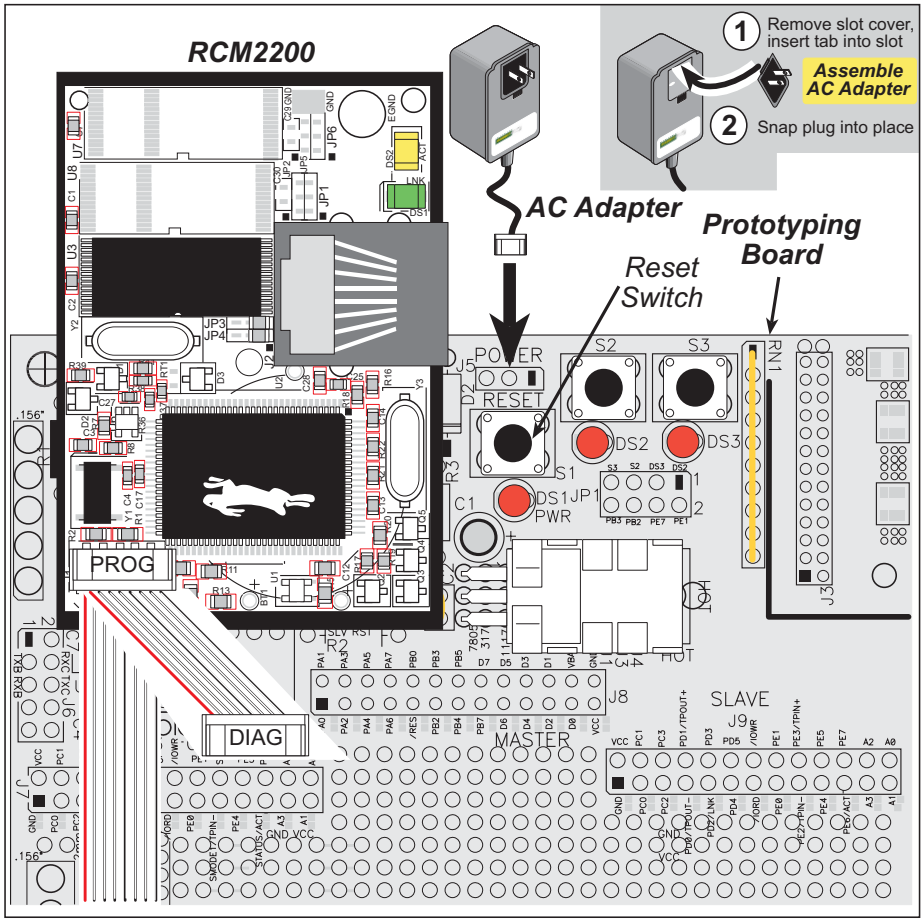


Figure 3. Power Supply Connections

Plug in the AC adapter. The power LED on the Prototyping Board should light up. The RCM2200 and the Prototyping Board are now ready to be used.

NOTE: A **RESET** button is provided on the Prototyping Board to allow hardware reset without disconnecting power.

4.4 Memory

4.4.1 SRAM

The RCM2200 is designed to accept 32K to 512K of SRAM packaged in an SOIC case.

4.4.2 Flash EPROM

The RCM2200 is also designed to accept 128K to 512K of flash EPROM packaged in a TSOP case.

> **NOTE:** Rabbit recommends that any customer applications should not be constrained by the sector size of the flash EPROM since it may be necessary to change the sector size in the future.

Writing to arbitrary flash memory addresses at run time is also discouraged. Instead, define a "user block" area to store persistent data. The functions **`writeUserBlock`** and **`readUserBlock`** are provided for this.

A Flash Memory Bank Select jumper configuration option based on 0 Ω surface-mounted resistors exists at JP2, JP3, and JP5 (corresponding to the flash memory chips at U8 [second flash on RCM2250], U3 [RCM2200], and U7 [no flash installed on existing RCM2200 versions]). This option, used in conjunction with some configuration macros, allows Dynamic C to compile two different co-resident programs for the upper and lower halves of the 256K flash in such a way that both programs start at logical address 0000. This is useful for applications that require a resident download manager and a separate downloaded program. See Technical Note 218, ***Implementing a Serial Download Manager for a 256K Flash***, for details.

> **NOTE:** Only the Normal Mode, which corresponds to using the full code space, is supported at the present time.

4.4.3 Dynamic C BIOS Source Files

The Dynamic C BIOS source files handle different standard RAM and flash EPROM sizes automatically.

5.2 I/O

The RCM2200 was designed to interface with other systems, and so there are no drivers written specifically for the I/O. The general Dynamic C read and write functions allow you to customize the parallel I/O to meet your specific needs. For example, use

```
WrPortI(PEDDR, &PEDDRShadow, 0x00);
```

to set all the port E bits as inputs, or use

```
WrPortI(PEDDR, &PEDDRShadow, 0xFF);
```

to set all the Port E bits as outputs.

The sample programs in the Dynamic C **SAMPLES\RCM2200** directory provide further examples.

5.2.1 PCLK Output

The PCLK output is controlled by bits 7 and 6 of the Global Output Register (GOCR) on the Rabbit 2000 microprocessor, and so can be enabled or disabled in software. Starting with Dynamic C v 7.02, the PCLK output is disabled by default at compile time to minimize radiated emissions; the PCLK output is enabled in earlier versions of Dynamic C.

Use the following code to set the PCLK output as needed.

PCLK output driven with peripheral clock:

```
WrPortI(GOCR, &GOCRShadow, (GOCRShadow&~0xc0));
```

PCLK output driven with peripheral clock ÷ 2:

```
WrPortI(GOCR, &GOCRShadow, ((GOCRShadow&~0xc0)| 0x40));
```

PCLK output off (low):

```
WrPortI(GOCR, &GOCRShadow, ((GOCRShadow&~0xc0)| 0x80));
```

PCLK output on (high):

```
WrPortI(GOCR, &GOCRShadow, (GOCRShadow | 0xc0));
```

5.2.2 External Interrupts

The Rabbit 2000 microprocessor has four external interrupt inputs on Parallel Port E, which is accessed through pins PE0, PE1, PE4, and PE5 on header J4. These pins may be used either as I/O ports or as external interrupt inputs.

Earlier versions of the Rabbit 2000 microprocessor labeled ***IQ1T*** or ***IQ2T*** would occasionally lose an interrupt request when one of the interrupt inputs was used as a pulse counter. See Technical Note 301, ***Rabbit 2000 Microprocessor Interrupt Problem***, for further information on how to work around this problem if you purchased your RCM2200 before July, 2002, and the Rabbit 2000 microprocessor is labeled ***IQ1T*** or ***IQ2T***.

NOTE: Interrupts on RCM2000 series RabbitCore modules sold after July, 2002, work correctly and do not need this workaround.

The following options require more care in address selection and testing actions, as conflicts with other users, servers and systems can occur:

- **LAN —** Connect the RCM2200's Ethernet port to an existing LAN, preferably one to which the development PC is already connected. You will need to obtain IP addressing information from your network administrator.
- **WAN —** The RCM2200 is capable of direct connection to the Internet and other Wide Area Networks, but exceptional care should be used with IP address settings and all network-related programming and development. We recommend that development and debugging be done on a local network before connecting a RabbitCore system to the Internet.

  TIP: Checking and debugging the initial setup on a micro-LAN is recommended before connecting the system to a LAN or WAN.

The PC running Dynamic C through the serial port on the RCM2200 does not need to be the PC with the Ethernet card.

3. Apply Power

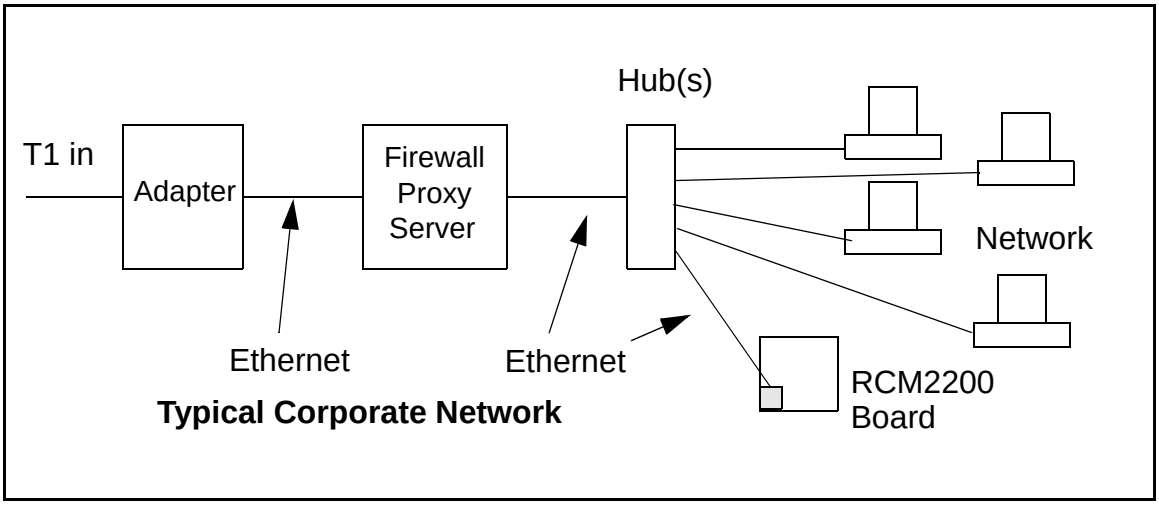
   Plug in the AC adapter. The RCM2200 is now ready to be used.

The following IP addresses are set aside for local networks and are not allowed on the Internet: 10.0.0.0 to 10.255.255.255, 172.16.0.0 to 172.31.255.255, and 192.168.0.0 to 192.168.255.255.

The RCM2200 board uses a 10Base-T type of Ethernet connection, which is the most common scheme. The RJ-45 connectors are similar to U.S. style telephone connectors, except they are larger and have 8 contacts.

An alternative to the direct connection using a crossover cable is a direct connection using a hub. The hub relays packets received on any port to all of the ports on the hub. Hubs are low in cost and are readily available. The RCM2200 board uses 10 Mbps Ethernet, so the hub or Ethernet adapter must be either a 10 Mbps unit or a 10/100 unit that adapts to either 10 or 100 Mbps.

In a corporate setting where the Internet is brought in via a high-speed line, there are typically machines between the outside Internet and the internal network. These machines include a combination of proxy servers and firewalls that filter and multiplex Internet traffic. In the configuration below, the RCM2200 board could be given a fixed address so any of the computers on the local network would be able to contact it. It may be possible to configure the firewall or proxy server to allow hosts on the Internet to directly contact the controller, but it would probably be easier to place the controller directly on the external network outside of the firewall. This avoids some of the configuration complications by sacrificing some security.



Typical Corporate Network

If your system administrator can give you an Ethernet cable along with its IP address, the netmask and the gateway address, then you may be able to run the sample programs without having to setup a direct connection between your computer and the RCM2200 board. You will also need the IP address of the nameserver, the name or IP address of your mail server, and your domain name for some of the sample programs.

6.6 Placing Your Device on the Internet

In many corporate settings, users are isolated from the Internet by a firewall and/or a proxy server. These devices attempt to secure the company from unauthorized network traffic, and usually work by disallowing traffic that did not originate from inside the network. If you want users on the Internet to communicate with your RCM2200, you have several options. You can either place the RCM2200 directly on the Internet with a real Internet address or place it behind the firewall. If you place the RCM2200 behind the firewall, you need to configure the firewall to translate and forward packets from the Internet to the RCM2200.

6.11 Where Do I Go From Here?

NOTE: If you purchased your RCM2200 through a distributor or through a Rabbit partner, contact the distributor or partner first for technical support.

If there are any problems at this point:

- Use the Dynamic C **Help** menu to get further assistance with Dynamic C.
- Check the Rabbit Technical Bulletin Board and forums at www.rabbit.com/support/bb/ and at www.rabbit.com/forums/.
- Use the Technical Support e-mail form at www.rabbit.com/support/.

If the sample programs ran fine, you are now ready to go on.

Additional sample programs are described in the ***Dynamic C TCP/IP User's Manual***.

Please refer to the ***Dynamic C TCP/IP User's Manual*** to develop your own applications. ***An Introduction to TCP/IP*** provides background information on TCP/IP, and is available on the CD and on our Web site.

APPENDIX A. RABBITCORE RCM2200 SPECIFICATIONS

Appendix A provides the specifications for the RCM2200, and describes the conformal coating.

A.4 I/O Buffer Sourcing and Sinking Limit

Unless otherwise specified, the Rabbit I/O buffers are capable of sourcing and sinking 8 mA of current per pin at full AC switching speed. Full AC switching assumes a 25.8 MHz CPU clock and capacitive loading on address and data lines of less than 100 pF per pin. Address pin A0 and data pin D0 are rated at 16 mA each. Pins A1–A12 and D1–D7 are each rated at 8 mA. The absolute maximum operating voltage on all I/O is V_{DD} + 0.5 V or 5.5 V.

Table A-5 shows the AC and DC output drive limits of the parallel I/O buffers when the Rabbit 2000 is used in the RCM2200.

Table A-5. I/O Buffer Sourcing and Sinking Capability

Pin Name	Output Drive Sourcing*/Sinking† Limits (mA)	
Output Port Name	Full AC Switching SRC/SNK	Maximum‡ DC Output Drive SRC/SNK
PA [7:0]	8/8	12/12
PB [7:6]	8/8	12/12
PC [6, 2, 0]	8/8	12/12
PD [5:4]	8/8	12/12
PD [3:0]**	16/16	25/25
PE [7, 5, 4, 1, 0]	8/8	12/12

* The maximum DC sourcing current for I/O buffers between V_{DD} pins is 112 mA.

† The maximum DC sinking current for I/O buffers between V_{SS} pins is 150 mA.

‡ The maximum DC output drive on I/O buffers must be adjusted to take into consideration the current demands made my AC switching outputs, capacitive loading on switching outputs, and switching voltage.

The current drawn by all switching and nonswitching I/O must not exceed the limits specified in the first two footnotes.

** The combined sourcing from Port D [7:0] may need to be adjusted so as not to exceed the 112 mA sourcing limit requirement specified in Note 1.

A.5 Jumper Configurations

Figure A-5 shows the header locations used to configure the various RCM2200 options via jumpers.

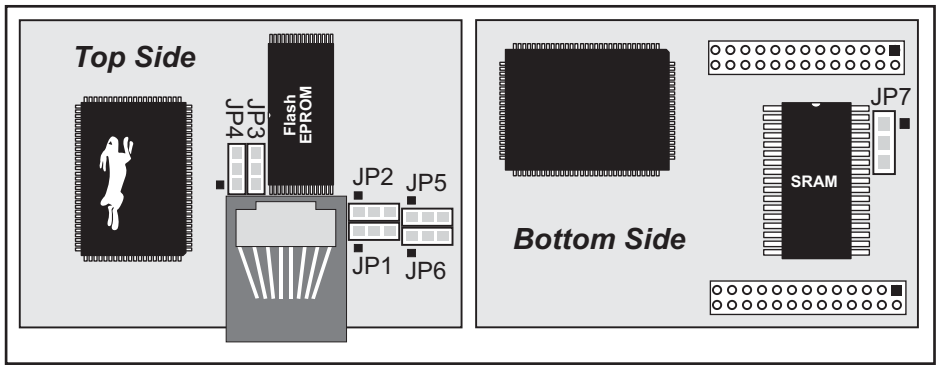


Figure A-5. Location of RCM2200 Configurable Positions

Table A-6 lists the configuration options.

Table A-6. RCM2200 Jumper Configurations

Header	Description	Pins Connected		Factory Default
JP1	Flash Memory Size (U8—RCM2250 only)	1–2	128K/256K	×
		2–3	512K	
JP2	Flash Memory Bank Select (U8—RCM2250 only)	1–2	Normal Mode	×
		2–3	Bank Mode	
JP3	Flash Memory Bank Select (U3)	1–2	Normal Mode	×
		2–3	Bank Mode	
JP4	Flash Memory Size (U3)	1–2	128K/256K	×
		2–3	512K	
JP5	Flash Memory Bank Select (U7—not installed)	1–2	Normal Mode	—
		2–3	Bank Mode	
JP6	Flash Memory Size (U7—not installed)	1–2	128K/256K	—
		2–3	512K	
JP7	SRAM Size	1–2	128K	RCM2200 RCM2210
		2–3	512K	RCM2250

NOTE: The jumper connections are made using 0 Ω surface-mounted resistors.

A.6 Conformal Coating

The areas around the 32 kHz real-time clock crystal oscillator has had the Dow Corning silicone-based 1-2620 conformal coating applied. The conformally coated area is shown in Figure A-6. The conformal coating protects these high-impedance circuits from the effects of moisture and contaminants over time.

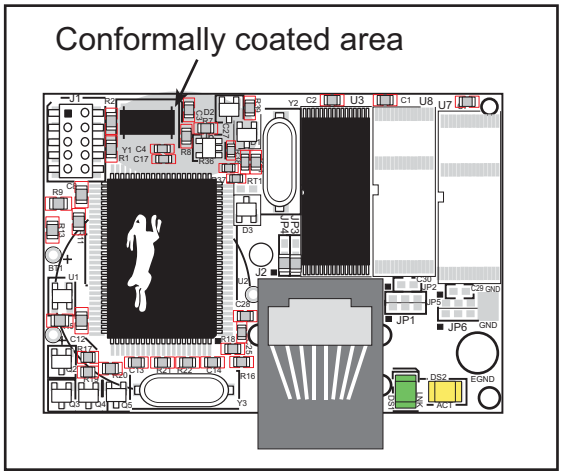


Figure A-6. RCM2200 Areas Receiving Conformal Coating

Any components in the conformally coated area may be replaced using standard soldering procedures for surface-mounted components. A new conformal coating should then be applied to offer continuing protection against the effects of moisture and contaminants.

NOTE: For more information on conformal coatings, refer to Technical Note TN303, ***Conformal Coatings***.

B.4.1 Adding Other Components

There is room on the Prototyping Board for a user-supplied RS-232 transceiver chip at location U2 and a 10-pin header for serial interfacing to external devices at location J6. A Maxim MAX232 transceiver is recommended. When adding the MAX232 transceiver at position U2, you must also add 100 nF charge storage capacitors at positions C3–C7 as shown in Figure B-7.

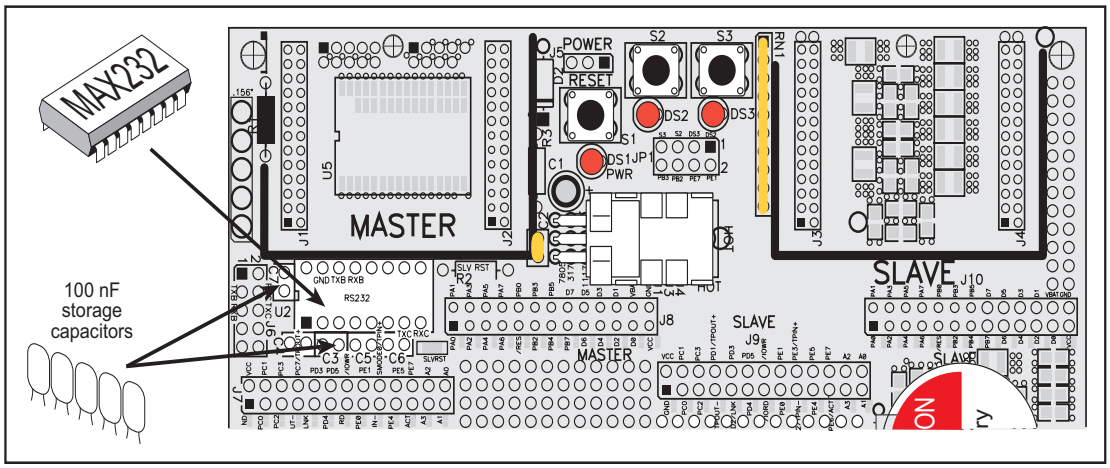


Figure B-7. Location for User-Supplied RS-232 Transceiver and Charge Storage Capacitors on Back Side of Prototyping Board

NOTE: The board that is supplied with the DeviceMate Development Kit already has the RS-232 chip and the storage capacitors installed, and is called the DeviceMate Demonstration Board.

There are two sets of pads that can be used for surface mount prototyping SOIC devices. The silk screen layout separates the rows into six 16-pin devices (three on each side). However, there are pads between the silk screen layouts giving the user two 52-pin (2×26) SOIC layouts with 50 mil pin spacing. There are six sets of pads that can be used for 3- to 6-pin SOT23 packages. There are also 60 sets of pads that can be used for SMT resistors and capacitors in an 0805 SMT package. Each component has every one of its pin pads connected to a hole in which a 30 AWG wire can be soldered (standard wire wrap wire can be soldered in for point-to-point wiring on the Prototyping Board). Because the traces are very thin, carefully determine which set of holes is connected to which surface-mount pad.

There is also a space above the space for the RS-232 transceiver that can accommodate a large surface-mounted SOIC component.

The drain on the battery by the RCM2200 is typically 16 µA when no other power is supplied. If a 950 mA·h battery is used, the battery can last more than 6 years:

$$\frac{950\ \text{mA}\cdot\text{h}}{16\ \mu\text{A}} = 6.8\ \text{years}.$$

The actual life in your application will depend on the current drawn by components not on the RCM2200 and the storage capacity of the battery. Note that the shelf life of a lithium ion battery is ultimately 10 years. The RCM2200 does not drain the battery while it is powered up normally.

The battery-backup circuit serves three purposes:

- It reduces the battery voltage to the SRAM and to the real-time clock, thereby limiting the current consumed by the real-time clock and lengthening the battery life.
- It ensures that current can flow only ***out*** of the battery to prevent charging the battery.
- A voltage, VOSC, is supplied to U6, which keeps the 32.768 kHz oscillator working when the voltage begins to drop.

VRAM and Vcc are nearly equal (<100 mV, typically 10 mV) when power is supplied to the RCM2200.

Figure C-2 shows the RCM2200 battery-backup circuit.

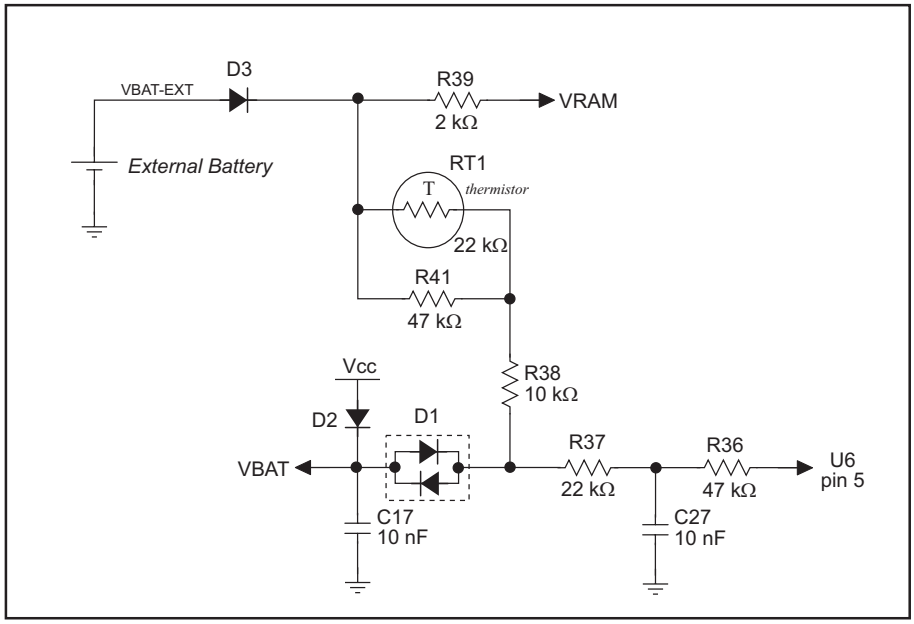


Figure C-2. RCM2200 Battery-Backup Circuit

C.1.2 Reset Generator

The RCM2200 uses a reset generator, U1, to reset the Rabbit 2000 microprocessor when the voltage drops below the voltage necessary for reliable operation. The reset occurs between 4.50 V and 4.75 V, typically 4.63 V. The RCM2200 has a reset output, pin 9 on header J5.

APPENDIX D. SAMPLE CIRCUITS

This appendix details several basic sample circuits that can be used with the RCM2200 modules.

- RS-232/RS-485 Serial Communication
- Keypad and LCD Connections
- External Memory
- D/A Converter

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