



# RabbitCore RCM2300

C-Programmable Module

## User's Manual

019-0099 • 010601-A

# **RabbitCore RCM2300 User's Manual**

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# 1. INTRODUCTION

The RabbitCore RCM2300 is a very small advanced core module that incorporates the powerful Rabbit 2000™ microprocessor, flash memory, static RAM, and digital I/O ports, all on a PCB that is just 1.15" × 1.60" (29.2 mm × 40.6 mm).

The RCM2300 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 RCM2300 receives its +5 V power from the user board on which it is mounted. The RabbitCore RCM2300 can interface with all kinds of CMOS-compatible digital devices through the user board.

## 1.1 RabbitCore RCM2300 Features

- Small size: 1.15" × 1.60" × 0.48"  
(29 mm × 41 mm × 12 mm)
- Microprocessor: Rabbit 2000 running at 22.1 MHz
- 29 parallel I/O lines: 17 configurable for input or output, 8 fixed inputs, 4 fixed outputs
- 11 additional I/O are available via less convenient 0.30" diameter through-hole connection points
- 8 data lines (D0–D7)
- 4 address lines (A0–A3)
- Memory I/O read, write
- External reset input
- Five 8-bit timers (cascadable in pairs) and one 10-bit timer with two match registers
- 256K flash memory, 128K SRAM
- Real-time clock
- Watchdog supervisor
- Provision for customer-supplied backup battery via header connections

- Four CMOS-compatible serial ports. All the serial ports can be configured asynchronously, and two serial ports can be configured synchronously if so desired. The maximum asynchronous baud rate is 691,200 bps (Dynamic C drivers are capable of handling up to the sustained rate of 345,600 bps), and the maximum synchronous baud rate is 5.5296 Mbps (user-written drivers can sustain a rate of 2.7648 Mbps). One synchronous port clock line is available only on the programming header.
- The programming port is also routed to the 26-pin headers, which allows the user board the ability to reprogram the RCM2300.

Appendix A, “RabbitCore RCM2300 Specifications,” provides detailed specifications for the RCM2300.

## 1.2 Advantages of the RabbitCore RCM2300

- Fast time to market using a fully engineered, “ready to run” microprocessor core.
- Competitive pricing when compared with the alternative of purchasing and assembling individual components.
- Easy C-language program development and debugging, including rapid production loading of programs.
- Generous memory size allows large programs with tens of thousands of lines of code, and substantial data storage.
- Very small size.

## 1.3 Development and Evaluation Tools

A complete Development Kit, which includes a Prototyping Board and Dynamic C development software, is available for the RCM2300. The Development Kit puts together the essentials you need to design an embedded microprocessor-based system rapidly and efficiently.

See the *RabbitCore RCM2300 Getting Started Manual* for complete information on the Development Kit.

## 1.4 How to Use This Manual

This user’s manual is intended to give users detailed information on the RCM2300 module. It does not contain detailed information on the Dynamic C development environment. Most users will want more detailed information on some or all of these topics in order to put the RCM2300 module to effective use.

### 1.4.1 Additional Product Information

Introductory information about the RCM2300 and its associated Development Kit and Prototyping Board will be found in the printed *RabbitCore RCM2300 Getting Started Manual*, which is also provided on the accompanying CD-ROM in both HTML and Adobe PDF format.

We recommend that any users unfamiliar with Z-World products, or those who will be using the prototyping board for initial evaluation and development, begin with at least a read-through of the *Getting Started* manual.

### 1.4.2 Additional Reference Information

In addition to the product-specific information contained in the *RabbitCore RCM2300 Getting Started Manual* and the *RabbitCore RCM2300 User's Manual* (this manual), two higher level reference manuals are provided in HTML and PDF form on the accompanying CD-ROM. Advanced users will find these references valuable in developing systems based on the RCM2300 modules:

- *Dynamic C Premier User's Manual*
- *Rabbit 2000 Microprocessor User's Manual*

### 1.4.3 Using Online Documentation

We provide the bulk of our user and reference documentation in two electronic formats, HTML and Adobe PDF. We do this for several reasons.

We believe that providing all users with our complete library of product and reference manuals is a useful convenience. However, printed manuals are expensive to print, stock, and ship. Rather than include and charge for manuals that every user may not want, or provide only product-specific manuals, we choose to provide our complete documentation and reference library in electronic form with every Development Kit and with our Dynamic C development environment.

**NOTE:** The most current version of Adobe Acrobat Reader can always be downloaded from Adobe's Web site at <http://www.adobe.com>. We recommend that you use version 4.0 or later.

Providing this documentation in electronic form saves an enormous amount of paper by not printing copies of manuals that users don't need. It reduces the number of outdated manuals we have to discard from stock as well, and it makes providing a complete library of manuals an almost cost-free option. For one-time or infrequent reference, electronic documents are more convenient than printed ones.

#### 1.4.3.1 Finding Online Documents

The online documentation is installed along with Dynamic C, and an icon for the documentation menu is placed on the workstation's desktop. Double-click this icon to reach the menu. If the icon is missing, use your browser to find and load **default.htm** in the **docs** folder, found in the Dynamic C installation folder.

The latest versions of all documents are always available for free, unregistered download from our Web sites as well.

#### 1.4.3.2 Printing Electronic Manuals

We recognize that many users prefer printed manuals for some uses. Users can easily print all or parts of those manuals provided in electronic form. The following guidelines may be helpful:

- Print from the Adobe PDF versions of the files, not the HTML versions.
- Print only the sections you will need to refer to more than once.
- Print manuals overnight, when appropriate, to keep from tying up shared resources during the work day.
- If your printer supports duplex printing, print pages double-sided to save paper and increase convenience.
- If you do not have a suitable printer or do not want to print the manual yourself, most retail copy shops (e.g., Kinkos, AlphaGraphics, CopyMax) will print the manual from the PDF file and bind it for a reasonable charge—about what we would have to charge for a printed and bound manual.

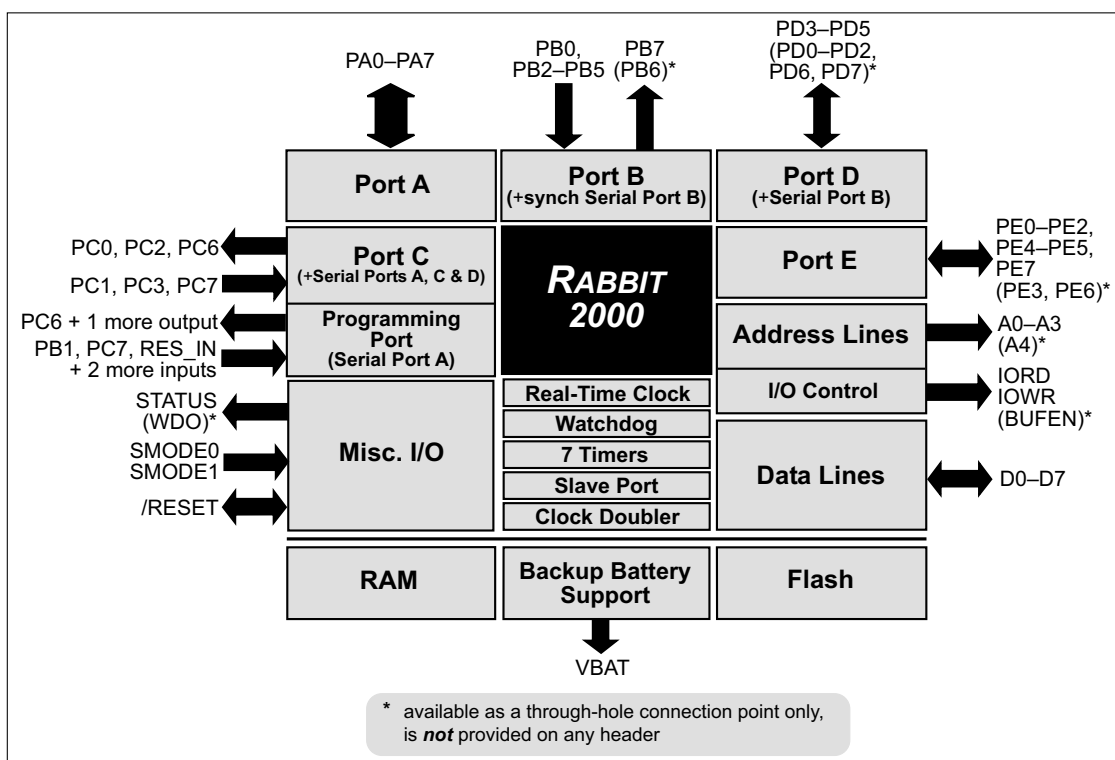


## 2. HARDWARE REFERENCE

Chapter 2 describes the hardware components and principal hardware subsystems of the RCM2300. Appendix A, “Rabbit-Core RCM2300 Specifications,” provides complete physical and electrical specifications.

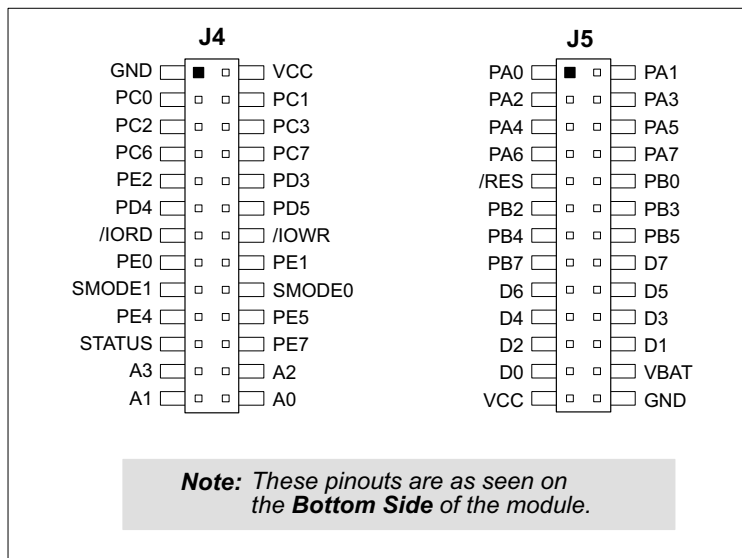
### 2.1 RCM2300 Digital Inputs and Outputs

Figure 1 shows the subsystems designed into the RCM2300.



**Figure 1. Rabbit Subsystems**

The RCM2300 modules have two 26-pin headers to which cables can be connected, or which can be plugged into matching sockets on a production device. The pinouts for these connectors are shown in Figure 2 below.

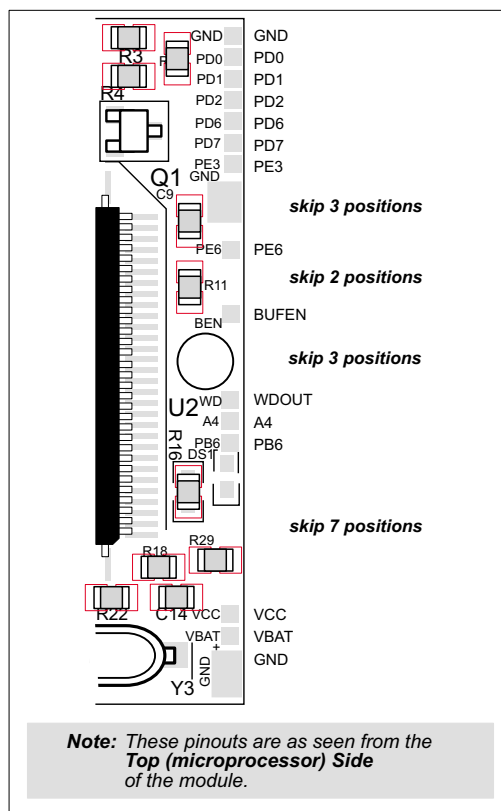


**Figure 2. RCM2300 I/O Pinout**

Fifteen additional connection points are available along one edge of the RCM2300 board. These connection points are 0.030" diameter holes spaced 0.05" apart, and are shown in Figure 3.

The remaining discussion is focused on the I/O points available on headers J4 and J5 because it is anticipated that most users will not use the through-hole connection points because of their reduced convenience.

Table 1 lists the pinout configurations on headers J4 and J5. The ports on the Rabbit 2000 microprocessor used in the RCM2300 are configurable, and so the factory defaults can be reconfigured. Table 1 lists the factory defaults and the alternate configurations.



**Figure 3. Additional RCM2300 Connection Points**

**Table 1. RabbitCore RCM2300 Pinout Configurations**

Pin	Pin Name	Default Use	Alternate Use	Notes
Header J4	1	GND		
	2	VCC		
	3	PC0	Output	TXD
	4	PC1	Input	RXD
	5	PC2	Output	TXC
	6	PC3	Input	RXC
	7	PC6	Output	TXA
	8	PC7	Input	RXA
	9	PE2	Bidirectional I/O	I/O control
	10	PD3	Bitwise or parallel programmable I/O	
	11	PD4		ATXB output
	12	PD5		ARXB input
	13	/IORD	Input (I/O read strobe)	
	14	/IOWR	Output (I/O write strobe)	
	15	PE0	Bitwise or parallel programmable I/O	I0 control or INT0A input
	16	PE1		I1 control or INT1A input
	17	SMODE1	Startup mode bit input	Can only be used as general inputs <i>after</i> the startup mode op-code has been read following boot-up
	18	SMODE0	Startup mode bit input	
	19	PE4	Bitwise or parallel programmable I/O	I4 control or INT0B input
	20	PE5		I5 control or INT1B input
	21	STATUS	Low on first op-code fetch of instruction	Output
	22	PE7	Bitwise or parallel programmable I/O	I7 control or slave port chip select /SCS
	23–26	A[3:0]		Rabbit 2000 address bus

**Table 1. RabbitCore RCM2300 Pinout Configurations (continued)**

Pin	Pin Name	Default Use	Alternate Use	Notes
Header J5	1–8	PA[0:7]	Bytewise programmable parallel I/O	Slave port data bus SD0–SD7
	9	/RESET	Reset output	Reset input
	10	PB0	Input	Serial port clock CLKB input or output
	11	PB2	Input	Slave port write /SWR
	12	PB3	Input	Slave port read /SRD
	13	PB4	Input	SA0
	14	PB5	Input	
	15	PB7	Output	Slave port attention line /SLAVEATTN
	16–23	D[7:0]	Input/Output	Rabbit 2000 data bus
	24	VBAT	3 V battery input	
	25	VCC		
	26	GND		

## 2.1.1 Dedicated Inputs

PB0 is a general CMOS input when the Rabbit 2000 is either not using Serial Port B or is using Serial Port B in an asynchronous mode. Four other general CMOS input-only pins are located on PB2–PB5. These pins can also be used for the slave port in master/slave communication between two processors. PB2 and PB3 are slave write and slave read strobes, while PB4 and PB5 serve as slave address lines SA0 and SA1, and are used to access the slave registers. PC1, PC3, and PC7 are general CMOS inputs only. These pins can instead be selectively enabled to serve as the serial data inputs for Serial Ports D, C, and A.

SMODE0 and SMODE1 are read at start-up, and set the mode whereby instructions are fetched. Thereafter the user may use and read these pins as inputs by reading the Slave Port Control Register.

**NOTE:** Exercise care so that the SMODE0 and SMODE1 pins revert to the correct startup code when a reset occurs.

### 2.1.2 Dedicated Outputs

One of the general CMOS output-only pins is located on PB7. PB7 can also be used with the slave port as the /SLAVEATTN output. This configuration signifies that the slave is requesting attention from the master. PC0, PC2, and PC6 are also output-only pins; alternatively, they can serve as the serial data outputs for Serial Ports D, C, and A.

The STATUS pin goes low by default after the first op-code fetch of an instruction cycle. The STATUS pin may be programmed as a separate output by changing the Rabbit 2000's Global Output Control Register.

### 2.1.3 Memory I/O Interface

Four of the Rabbit 2000 address lines (A0–A3) and all the data lines (D0–D7) are available. I/O write (/IOWR) and I/O read (/IORD) are also available for interfacing to external devices.

### 2.1.4 Other Inputs and Outputs

As shown in Table 1, pins PA0–PA7 can be used to allow the Rabbit 2000 to be a slave to another processor. The slave port also uses PB2–PB5, PB7, and PE7.

PE0, PE1, PE4, and PE5 can be used for up to two external interrupts. PB0 can be used to access the clock on Serial Port B of the Rabbit microprocessor. PD4 can be programmed to be a serial output for Serial Port B. PD5 can be used as a serial input by Serial Port B.

## 2.2 Serial Communication

The RCM2300 board does not have an RS-232 or an RS-485 transceiver directly on the board. However, an RS-232 or RS-485 interface may be incorporated on the board the RCM2300 is mounted on. For example, the Prototyping Board supports a standard RS-232 transceiver chip.

### 2.2.1 Serial Ports

There are four serial ports designated as Serial Ports A, B, C, and D. All four serial ports can sustain their operation in an asynchronous mode up to the baud rate of the system clock divided by 64. The maximum burst rate for an asynchronous byte can be as high as the system clock divided by 32. An asynchronous port can handle 7 or 8 data bits. A 9th bit address scheme, where an additional bit is sent to mark the first byte of a message, is also supported.

Serial Ports A and B can also be operated in the clocked serial mode. In this mode, a clock line synchronously clocks the data in or out. Either of the two communicating devices can supply the clock. When the Rabbit 2000 provides the clock, the sustained baud rate can be up to the system clock frequency divided by 8, or 2.76 Mbps for a 22.1 MHz clock speed. The maximum burst rate for a byte can be as high as the system clock divided by 4.

Serial Port A's clock pin is available only on the programming port, and so is likely to be inconvenient to interface with.

## 2.2.2 Programming Port

Serial Port A has special features that allow it to cold-boot the system after reset. Serial Port A is also the port that is used for software development under Dynamic C.

The RCM2300 has a 10-pin program header labeled J1. The Rabbit 2000 startup-mode pins (SMODE0, SMODE1) are presented to the programming port so that an externally connected device can force the RCM2300 to start up in an external bootstrap mode. The ***Rabbit 2000 Microprocessor User's Manual*** provides more information about the bootstrap mode.

The programming port is used to start the RCM2300 in a mode where it will download a program from the port and then execute the program. The programming port transmits information to and from a PC while a program is being debugged in-circuit.

The RCM2300 can be reset from the programming port via the /RES\_IN line.

The Rabbit 2000 status pin is also presented to the programming port. The status pin is an output that can be used to send a general digital signal.

The clock line for Serial Port A is presented to the programming port, which makes synchronous serial communication possible.

All the programming port pins, except the Serial Port A clock line, are duplicated on the 26-pin headers.

### 2.2.2.1 Alternate Uses of the Programming Port

The programming port may also be used as an application port with the **DIAG** connector on the programming cable.

All three clocked Serial Port A signals are available for use as

- a synchronous serial port
- an asynchronous serial port, with the clock line usable as a general CMOS input
- two general CMOS inputs and one general CMOS output.

Two startup mode pins, SMODE0 and SMODE1, are available as general CMOS inputs after they are read during the initial boot-up. The logic state of these two pins is very important in determining the startup procedure after a reset.

/RES\_IN is an external input used to reset the Rabbit 2000 microprocessor.

The status pin may also be used as a general CMOS output.

See Appendix C, "Programming Cable," for more information.

## 2.3 Other Hardware

### 2.3.1 Clock Doubler

The RCM2300 takes advantage of the Rabbit 2000 microprocessor's internal clock doubler. A built-in clock doubler allows half-frequency crystals to be used to reduce radiated emissions. The 22.1 MHz frequency is generated using an 11.0592 MHz crystal. The clock doubler is disabled automatically in the BIOS for crystals with a frequency above 12.9 MHz.

The clock doubler may be disabled if 22.1 MHz clock speeds are not required. Disabling the Rabbit 2000 microprocessor's internal clock doubler will reduce power consumption and further reduce radiated emissions. The clock doubler is disabled with a simple change to the BIOS as described below.

1. Open the BIOS source code file, **RABBITBIOS.C** in the **BIOS** directory.
2. Change the line

```
#define CLOCK_DOUBLED 1 // set to 1 to double the clock if XTAL<=12.9MHz,  
to read as follows.
```

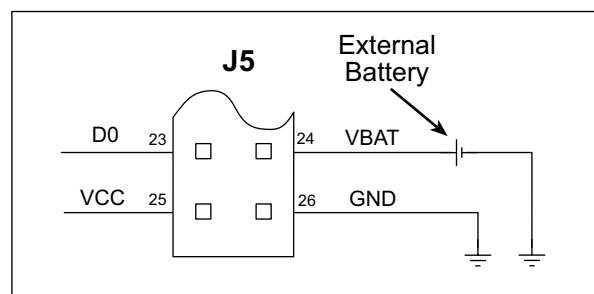
```
#define CLOCK_DOUBLED 0 // set to 1 to double the clock if XTAL<=12.9MHz,
```

3. Save the change using **File > Save**.

### 2.3.2 Backup Battery Circuit

The RCM2300 does not have a battery, but there is provision for a customer-supplied battery to back up SRAM and keep the internal Rabbit 2000 real-time clock running.

Header J5, shown in Figure 4, allows access to the external battery. This header makes it possible to connect an external 3 V lithium battery. This allows the internal Rabbit 2000 real-time clock to run and allows the SRAM to retain data when the RCM2300 is powered down.



**Figure 4. External Battery Connections at Header J5**

A lithium battery with a nominal voltage of 3 V and a minimum capacity of 950 mA·h is recommended. A lithium battery is needed because of its nearly constant nominal voltage over most of its life.

The drain on the battery by the RCM2300 is typically 16  $\mu$ A when no other power is supplied. If a 950 mA·h battery is used, the battery can last more than 6 years:

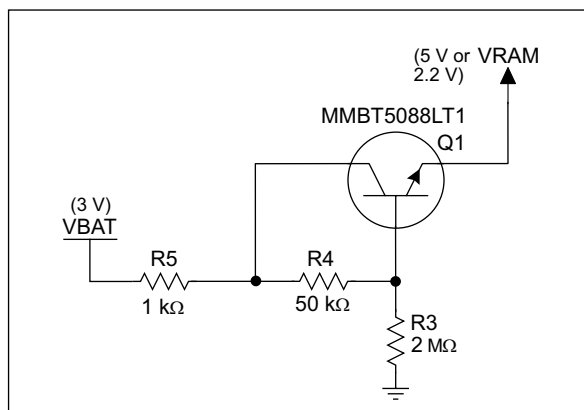
$$\frac{950 \text{ mA}\cdot\text{h}}{16 \text{ }\mu\text{A}} = 6.8 \text{ years.}$$

The actual life in your application will depend on the current drawn by components not on the RCM2300 and the storage capacity of the battery. Note that the shelf life of a lithium battery is ultimately 10 years.

The battery-backup circuit serves two purposes:

- It reduces the battery voltage to the real-time clock, thereby reducing 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.

Figure 5 shows the RCM2300 battery backup circuit.



**Figure 5. RabbitCore RCM2300  
Battery Backup Circuit**

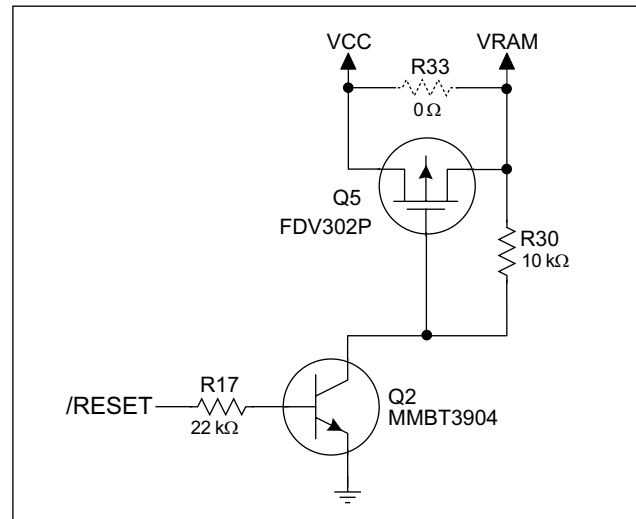
It is important not to charge a lithium battery with any appreciable current. Resistor R5, shown in Figure 5, prevents any catastrophic failure of Q1 by limiting current to the customer-supplied battery. VRAM and Vcc are nearly equal (difference <100 mV, typically 10 mV) when power is supplied to the RCM2300.

Resistors R3 and R4 make up a voltage divider that biases the base of Q1 to about  $0.9 \times$  VBAT.  $V_{BE}$  on Q1 is about 0.55 V. Therefore, VRAM is about  $0.9 \times$  VBAT - 0.55 V, or about 2.15 V for a 3 V battery.



### 2.3.2.1 Power to VRAM Switch

The VRAM switch, shown in Figure 6, allows a customer-supplied external battery to provide power when the external power goes off. The switch provides an isolation between Vcc and the battery when Vcc goes low. This prevents the Vcc line from draining the battery.



**Figure 6. VRAM Switch**

Transistor Q5 is needed to ensure a very small voltage drop between Vcc and VRAM (difference <100 mV, typically 10 mV) so that the processor lines powered by Vcc will not have a significantly different voltage than VRAM.

When the RCM2300 is not resetting (pin 2 on U1 is high), the /RESET line will be high. This turns on Q2, causing its collector to go low. This turns on Q5, allowing VRAM to nearly equal Vcc.

When the RCM2300 is resetting, the /RESET line will go low. This turns off Q2 and Q5, providing an isolation between Vcc and VRAM.

The battery backup circuit keeps VRAM from dropping below 2 V.

### 2.3.2.2 Reset Generator

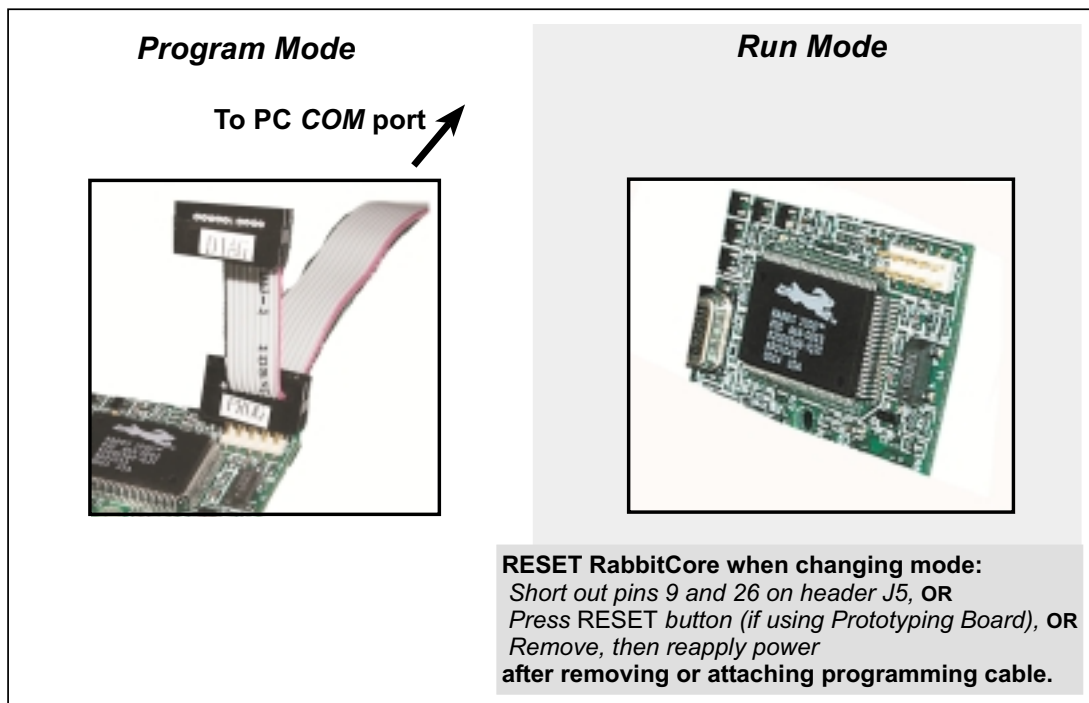
The RCM2300 uses a reset generator, U1, to reset the Rabbit 2000 microprocessor when the voltage drops below the voltage necessary for reliable operation. The reset occurs between 4.50 V and 4.75 V, typically 4.63 V.

The RCM2300 has a reset output, pin 9 on header J5. The reset output may be overdriven with at least 5 mA, essentially turning pin 9 on header J5 into a reset input, which may be used to reset the RCM2300.

## 2.4 Programming Cable

The RCM2300 is automatically in program mode when the **PROG** connector on the programming cable is attached, and is automatically in run mode when no programming cable is attached.

The **DIAG** connector of the programming cable may be used on header J1 of the RCM2300 with the board operating in the run mode. This allows the programming port to be used as an application port. See Appendix C, “Programming Cable,” for more information.



**Figure 7. Switching Between Program Mode and Run Mode**

### 2.4.1 Changing from Program Mode to Run Mode

1. Disconnect the programming cable from header J1 of the RCM2300.
2. Reset the RCM2300. You may do this as explained in Figure 7.

The RCM2300 is now ready to operate in the run mode.

### 2.4.2 Changing from Run Mode to Program Mode

1. Attach the programming cable to header J1 on the RCM2300.
2. Reset the RCM2300 series. You may do this as explained in Figure 7.

The RCM2300 is now ready to operate in the program mode.

## 3. SOFTWARE REFERENCE

Dynamic C Premier is an integrated development system for writing embedded software. It runs on an IBM-compatible PC and is designed for use with Z-World controllers and other controllers based on the Rabbit microprocessor. Chapter 3 provides the libraries, function calls, and sample programs related to the RCM2300.

### 3.1 More About Dynamic C

Dynamic C has been in use worldwide since 1989. It is specially designed for programming embedded systems, and features quick compile and interactive debugging in the real environment. A complete reference guide to Dynamic C is contained in the *Dynamic C Premier User's Manual*.

Dynamic C for Rabbit 2000<sup>™</sup> processors uses the standard Rabbit programming interface. This is a 10-pin connector that connects to the Rabbit 2000 serial port A. It is possible to reset and cold-boot a Rabbit processor via the programming port. No software needs to be present in the target system. More details are available in the *Rabbit 2000 Microprocessor User's Manual*.

Dynamic C cold-boots the target system and compiles the BIOS. The BIOS is a basic program of a few thousand bytes in length that provides the debugging and communication facilities that Dynamic C needs. Once the BIOS has been compiled, the user can compile his own program and test it. If the user program stops running, a new cold boot and BIOS compile can be done at any time.

Dynamic C does not use **include** files, rather it has libraries that are used for the same purpose, that is, to supply functions and function prototypes to programs before they are compiled.

Dynamic C supports assembly language, either as separate functions or as fragments embedded in C programs. Interrupt routines may be written in Dynamic C or in assembly language.

### 3.1.1 Operating System Framework

Dynamic C does not include an operating system in the usual sense of a complex software system that is resident in memory. The user has complete control of what is loaded as a part of his program, other than those routines that support loading and debugging (which are inactive at embedded run time). However, certain routines are very basic and normally should always be present and active.

- Periodic interrupt routine. This interrupt routine is driven by the Rabbit periodic interrupt facility, and when enabled creates an interrupt every 16 ticks of the 32.768 kHz oscillator, or every 488  $\mu$ s. This routine drives three long global variables that keep track of the time: **SEC\_TIMER**, **MS\_TIMER**, and **TICK\_TIMER** that respectively count seconds, milliseconds, and 488  $\mu$ s ticks. These variables are needed by some functions that measure time. The **SEC\_TIMER** is set to seconds elapsed since 1 Jan 1980, and thus also keeps track of the time and date. The periodic interrupt routine must be disabled when the microprocessor enters sleepy mode and the processor clock is operating at 32.768 kHz. The interrupt routine cannot complete at this slow speed before the next tick of the periodic interrupt. In this situation, the hardware real-time clock can be read directly to provide the time.

The periodic interrupt function also hits the hardware watchdog timer. Software or “virtual” watchdog timers are available in Dynamic C. See the *Dynamic C Premier User’s Manual* for more information.

### 3.1.2 Using Dynamic C

You have a choice of doing your software development in the flash memory or in the static RAM. There are 256K bytes of flash memory and 128K bytes of SRAM. The advantage of working in RAM is to save wear on the flash, which is limited to about 100,000 writes.

**NOTE:** Note that an application can be developed in RAM, but cannot run standalone from RAM after the programming cable is disconnected. All applications can only run from flash memory.

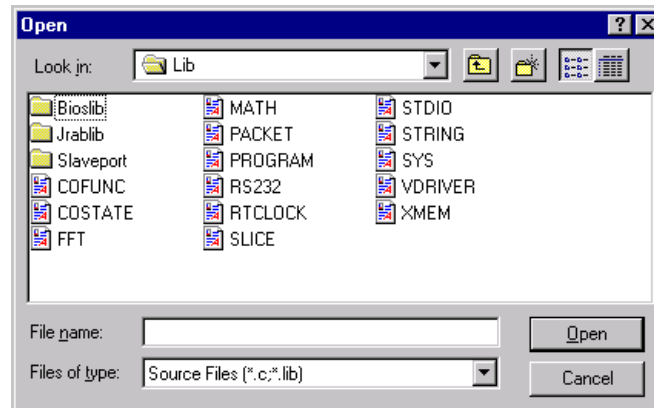
**NOTE:** Do not depend on the flash memory sector size or type. Due to the volatility of the flash memory market, the RCM2300 and Dynamic C were designed to accommodate flash devices with various sector sizes.

The disadvantage of using flash memory when debugging a program is that interrupts must be disabled for approximately 5 ms to 20 ms whenever a break point is set in the program. This can crash fast interrupt routines that are running while you stop at a break point or single-step the program.

Flash memory or RAM is selected with the Dynamic C **Options > Compiler** menu.

## 3.2 Dynamic C Libraries

With Dynamic C running, click **File > Open**, and select **Lib**. The following list of Dynamic C libraries will be displayed.



There is no unique library that is specific to the RCM2300. The functions in the above libraries are described in the *Dynamic C Premier User's Manual*.

### 3.2.1 I/O

The RCM2300 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/RCM2300** directory provide further examples.

These functions are provided for convenience, not speed. User code should be written in assembly language when speed is important.

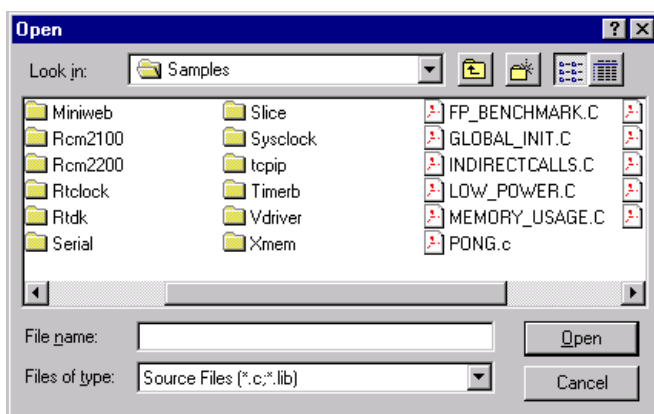
### 3.2.2 Serial Communication Drivers

The Prototyping Board has room for an RS-232 chip. Dynamic C has two libraries to support serial communication: **RS232.LIB** provides a set of circular-buffer-based functions, and **PACKET.LIB** provides packet-based support. Packets can be delimited by time gap, 9th bit detection, or special-character detection.

Both the packet-based and the circular-buffer-based routines are available in blocking and nonblocking (cofunction) flavors. See the *Dynamic C Premier User's Manual* and Technical Note 213, *Rabbit 2000 Serial Port Software*, for more details on serial communication.

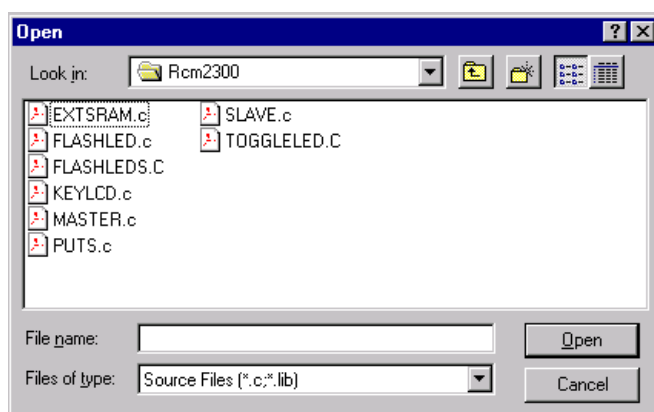
### 3.3 Sample Programs

Sample programs are provided in the Dynamic C **samples** folder, which is shown below.



The various folders contain specific sample programs that illustrate the use of the corresponding Dynamic C libraries. For example, the sample program **PONG.C** demonstrates the output to the Dynamic C **STDIO** window.

The sample programs in the Dynamic C **SAMPLES/RCM2300** directory demonstrate the basic operation of the RCM2300.



Follow the instructions included with the sample program to connect the RCM2300 and the other hardware identified in the instructions.

To run a sample program, open it with the **File** menu (if it is not still open), compile it using the **Compile** menu, and then run it by selecting **Run** in the **Run** menu. The RCM2300 must be in Program Mode (see Section 2.4, “Programming Cable”) and must be connected to a PC using the programming cable.

More complete information on Dynamic C is provided in the *Dynamic C Premier User’s Manual*.

## 3.4 Upgrading Dynamic C

Dynamic C patches that focus on bug fixes are available from time to time. Check the Web sites

- [www.zworld.com/support/supportcenter.html](http://www.zworld.com/support/supportcenter.html)

or

- [www.rabbitsemiconductor.com/support.html](http://www.rabbitsemiconductor.com/support.html)

for the latest patches, workarounds, and bug fixes.

The default installation of a patch or bug fix is to install the file in a directory (folder) different from that of the original Dynamic C installation. Z-World recommends using a different directory so that you can verify the operation of the patch without overwriting the existing Dynamic C installation. If you have made any changes to the BIOS or to libraries, or if you have programs in the old directory (folder), make these same changes to the BIOS or libraries in the new directory containing the patch. Do **not** simply copy over an entire file since you may overwrite a bug fix; of course, you may copy over any programs you have written. Once you are sure the new patch works entirely to your satisfaction, you may retire the existing installation, but keep it available to handle legacy applications.

### 3.4.1 Upgrades

A special edition of Dynamic C, Dynamic C SE, is included on the CD that comes with the RCM2300 Development Kit, and has been customized with all the libraries and features needed to develop and run an application on the RabbitCore RCM2300.

More advanced users who may need upgrades and additional capabilities for other Z-World products in the future are encouraged to consider the standard edition of Dynamic C Premier, which Z-World plans to fully support with upgrades now and into the future.





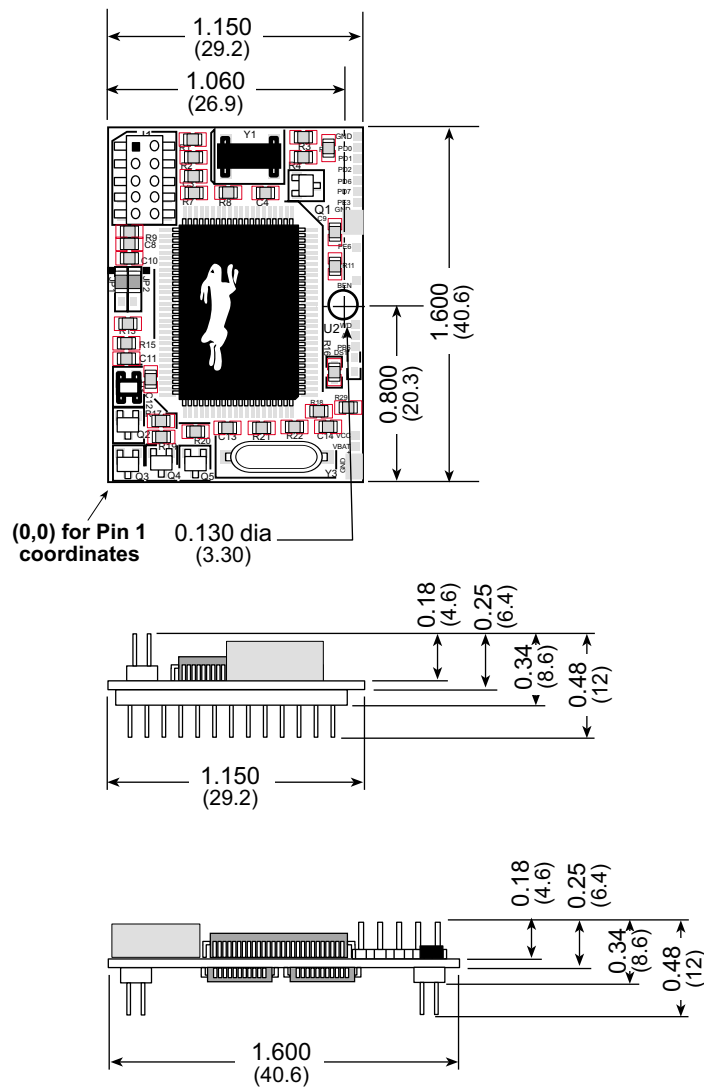


## **APPENDIX A. RABBITCORE RCM2300 SPECIFICATIONS**

Appendix A provides the specifications for the RCM2300, and describes the conformal coating.

## A.1 Electrical and Mechanical Characteristics

Figure A-1 shows the mechanical dimensions for the RCM2300.



**Figure A-1. RabbitCore RCM2300 Dimensions**

Table A-1 provides the pin 1 locations for the RCM2300 headers viewed from the top side (as in Figure A-1).

**Table A-1. RabbitCore RCM2300 Header Pin 1 Locations**

Header	Description	Pin 1 (x,y) Coordinates (Inches)
J4	RabbitCore RCM2300 user board interface	(0.100, 1.445)
J5	RabbitCore RCM2300 user board interface	(0.100, 0.195)
J1	Programming header (top side)	(0.125, 1.515)
Top <b>GND</b>	Through-Hole Connection Points	(1.110, 1.560)

Table A-2 lists the electrical, mechanical, and environmental specifications for the RCM2300.

**Table A-2. RabbitCore RCM2300 Specifications**

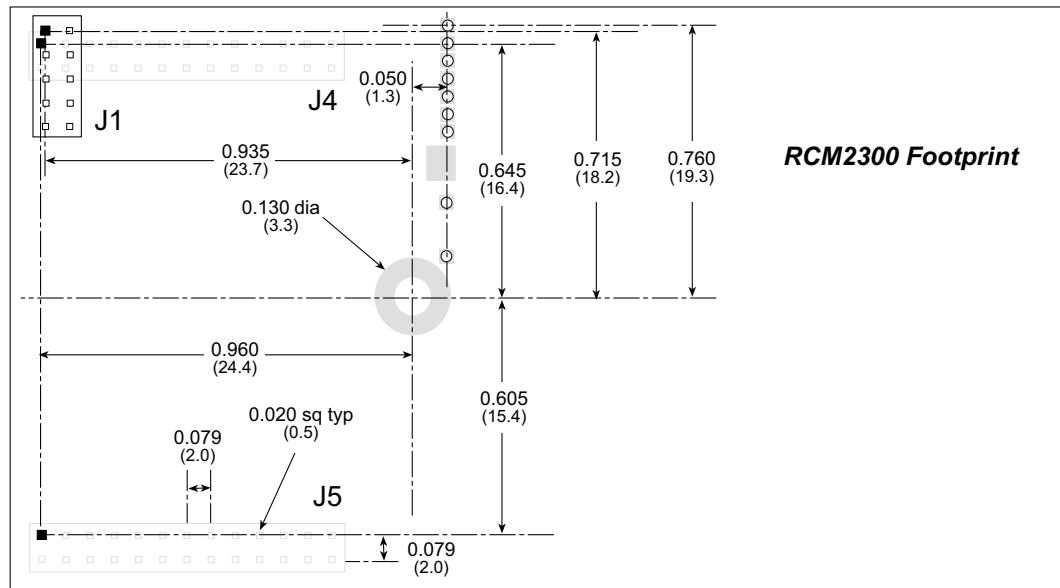
Parameter	Specification
Board Size	1.15" × 1.60" × 0.48" (29 mm × 41 mm × 12 mm)
Operating Temperature	–40°C to +70°C
Humidity	5% to 95%, noncondensing
Input Voltage	4.75 V to 5.25 V DC
Current	108 mA at 22.1 MHz, 5 V DC; 10 mA additional with programming cable attached
General-Purpose I/O*	29 parallel I/O lines grouped in five 8-bit ports (shared with serial ports): 17 configurable I/O, 8 fixed inputs, 4 fixed outputs
Memory, I/O Interface	4 address lines, 8 data lines, I/O read/write
Additional Digital Inputs	Startup mode (2), reset in
Additional Digital Outputs	Status, reset out
Microprocessor	Rabbit 2000™
Clock	22.1 MHz
SRAM	128K × 8, surface mount
Flash Memory	One 256K × 8, surface mount
Timers	Five 8-bit timers cascadable in pairs, one 10-bit timer with 2 match registers that each have an interrupt
Serial Ports	Four CMOS-compatible ports; two ports are configurable as clocked ports.
Serial Rate	Maximum sustained synchronous rate of 2.76 Mbps or asynchronous rate of 345,600 bps
Slave Interface	A slave port allows the RCM2300 to be used as an intelligent peripheral device slaved to a master processor, which may either be another Rabbit 2000 or any other type of processor
Program/Debug	One clock line is available only on the programming header. The programming port is available both on the programming header (J1) and on J4, one of the headers that interfaces with the user board
Watchdog/Supervisor	Yes
Time/Date Clock	Yes
Socket Strip (for connection to headers J4 and J5)	2x13, 2 mm pitch
Backup Battery	Provision for user-supplied backup battery (2.85 V to 3.15 V) via connections on header J5

\* 11 additional I/O are available via less convenient 0.30" diameter through-hole connection points

### A.1.1 Headers

The RCM2300 uses headers at J4 and J5 for physical connection to other boards. J4 and J5 are  $2 \times 13$  SMT headers with a 2 mm pin spacing. J1, the programming port, is a  $2 \times 5$  header with a 2 mm pin spacing.

Figure A-2 shows the footprint of another board that the RCM2300 would be plugged into. These values are relative to the header connectors.



**Figure A-2. User Board Footprint for RabbitCore RCM2300**

### A.1.2 Physical Mounting

An insulating 9/32" or 1/4" (7 mm) standoff with a 4-40 screw is recommended to attach the RCM2300 to a user board at the hole position shown in Figure A-2.

## A.2 Bus Loading

You must pay careful attention to bus loading when designing an interface to the RCM2300. This section provides bus loading information for external devices.

Table A-3 lists the capacitance for the various Rabbit 2000 I/O ports with SRAM and flash memory connected.

**Table A-3. Capacitance of Rabbit 2000 I/O Ports with External Memory**

I/O Ports	Input Capacitance (pF)	Output Capacitance (pF)
Parallel Ports A to E	12	14
Data Lines D0–D7	30	32
Address Lines A0–A12	—	32

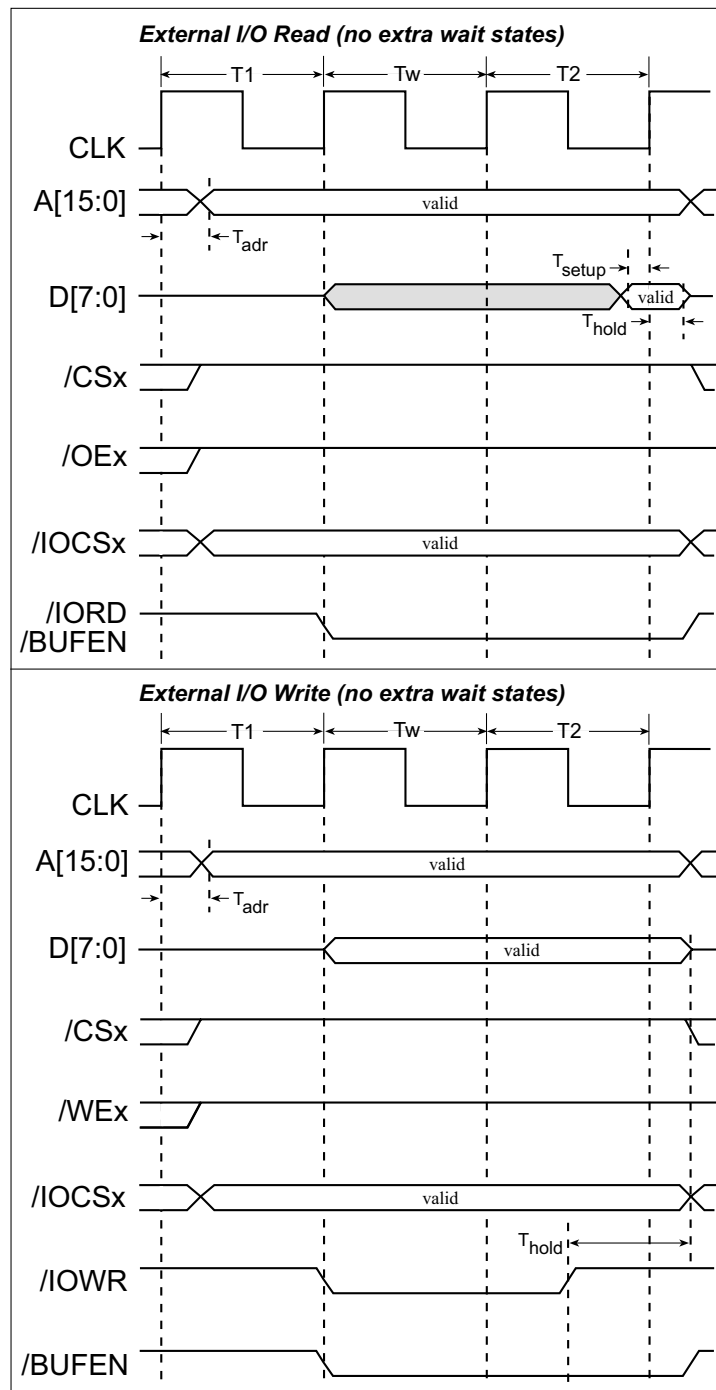
Table A-4 lists the external capacitive bus loading for the various Rabbit 2000 output ports. Be sure to add the loads for the devices you are using in your system and verify that they do not exceed the values in Table A-4.

**Table A-4. External Capacitive Bus Loading -40°C to +85°C**

Output Port	Clock Speed (MHz)	Maximum External Capacitive Loading (pF)
A[4:1] D[7:1]	22.1	50
A[4:1] D[7:1]	22.1	100 for 55 ns flash
A0 D0	22.1	100
PD[3:0]	22.1	100
PA[7:0] PB[7,6] PC[6,2,0] PD[7:0] PE[7:0]	22.1	90
All data, address, and I/O lines with clock doubler disabled	11.06	100

The values from the table above are derived using 55 ns (flash memory) and 70 ns (SRAM) memory access times. External capacitive loading can be improved by 10 pF for commercial temperature ranges, but do not exceed 100 pF. See the AC timing specifications in the *Rabbit 2000 Users Manual* for more information.

Figure A-3 shows a typical timing diagram for the Rabbit 2000 microprocessor external memory read and write cycles.



**Figure A-3. Memory Read and Write Cycles**

$T_{adr}$  is the time required for the address output to reach 0.8 V. This time depends on the bus loading.  $T_{setup}$  is the data setup time relative to the clock.  $T_{setup}$  is specified from 30%/70% of the  $V_{DD}$  voltage level.

Table A-5 lists the parameters shown in these figures and provides minimum or measured values.

**Table A-5. Memory and External I/O Read/Write Parameters**

Parameter		Description	Value	
Read Parameters	T <sub>adr</sub>	Time from CPU clock rising edge to address valid	Max.	7 ns @ 20 pF, 5 V (10 ns @ 3.3 V) 14 ns @ 70 pF, 5 V (19 ns @ 3.3 V)
	T <sub>setup</sub>	Data read setup time	Min.	2 ns @ 5 V (3 ns @ 3.3 V)
	T <sub>hold</sub>	Data read hold time	Min.	0 ns
Write Parameters	T <sub>adr</sub>	Time from CPU clock rising edge to address valid	Max.	7 ns @ 20 pF, 5 V (10 ns @ 3.3 V) 14 ns @ 70 pF, 5 V (19 ns @ 3.3 V)
	T <sub>hold</sub>	Data write hold time from /WEx or /IOWR	Min.	½ CPU clock cycle

### A.3 Rabbit 2000 DC Characteristics

Table A-6 outlines the DC characteristics for the Rabbit 2000 at 5.0 V over the recommended operating temperature range from T<sub>a</sub> = –40°C to +85°C, V<sub>DD</sub> = 4.5 V to 5.5 V.

**Table A-6. 5.0 Volt DC Characteristics**

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
I <sub>IH</sub>	Input Leakage High	V <sub>IN</sub> = V <sub>DD</sub> , V <sub>DD</sub> = 5.5 V			10	μA
I <sub>IL</sub>	Input Leakage Low (no pull-up)	V <sub>IN</sub> = V <sub>SS</sub> , V <sub>DD</sub> = 5.5 V	-10			μA
I <sub>OZ</sub>	Output Leakage (no pull-up)	V <sub>IN</sub> = V <sub>DD</sub> or V <sub>SS</sub> , V <sub>DD</sub> = 5.5 V	-10		10	μA
V <sub>IL</sub>	CMOS Input Low Voltage				0.3 x V <sub>DD</sub>	V
V <sub>IH</sub>	CMOS Input High Voltage		0.7 x V <sub>DD</sub>			V
V <sub>T</sub>	CMOS Switching Threshold	V <sub>DD</sub> = 5.0 V, 25°C		2.4		V
V <sub>OL</sub>	CMOS Output Low Voltage	I <sub>OL</sub> = See Table A-7 (sinking) V <sub>DD</sub> = 4.5 V		0.2	0.4	V
V <sub>OH</sub>	CMOS Output High Voltage	I <sub>OH</sub> = See Table A-7 (sourcing) V <sub>DD</sub> = 4.5 V	0.7 x V <sub>DD</sub>	4.2		V



## 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 22.1 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–A4 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-7 shows the AC and DC output drive limits of the parallel I/O buffers when the Rabbit 2000 is used in the RCM2300.

**Table A-7. I/O Buffer Sourcing and Sinking Capability**

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

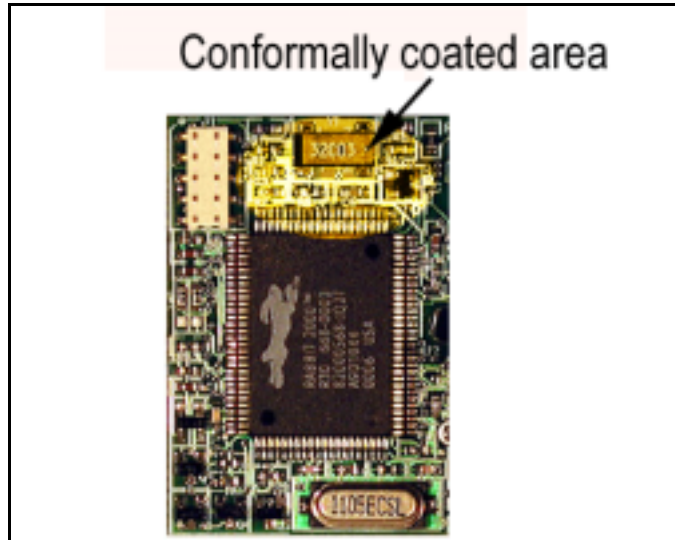
‡ The maximum DC output drive on I/O buffers must be adjusted to take into consideration the current demands made by AC switching outputs, capacitive loading on switching outputs, and switching voltage.

***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 the first footnote.

## A.5 Conformal Coating

The area around the crystal oscillator has had the Dow Corning silicone-based 1-2620 conformal coating applied. The conformally coated area is shown in Figure A-4. The conformal coating protects these high-impedance circuits from the effects of moisture and contaminants over time.



**Figure A-4. RCM2300 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 Rabbit Semiconductor Technical Note 303, *Conformal Coatings*.

## APPENDIX B. POWER SUPPLY

Appendix B provides information on the current requirements of the RCM2300, and some background on the chip select circuit used in power management.

### B.1 Power Supplies

The RCM2300 requires a regulated  $5\text{ V} \pm 0.25\text{ V}$  DC power source. The RabbitCore design presumes that the voltage regulator is on the user board, and that the power is made available to the RabbitCore board through headers J4 and J5.

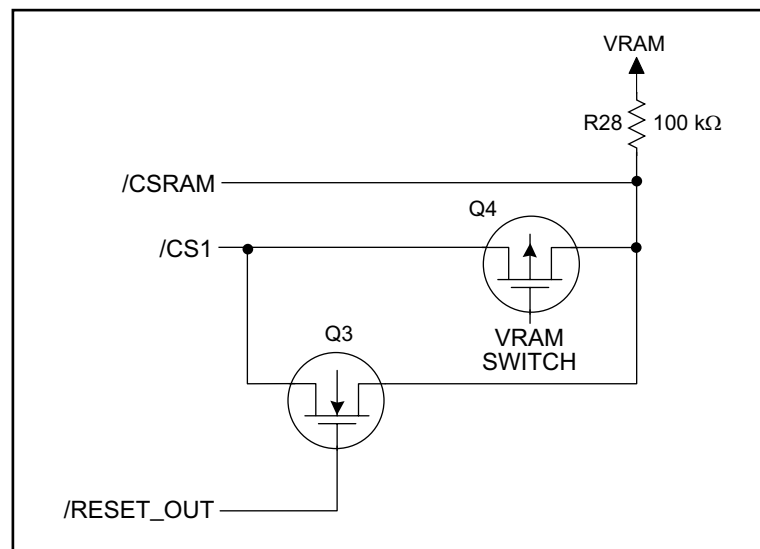
An RCM2300 with no loading at the outputs operating at 22.1 MHz typically draws 108 mA. The RCM2300 will consume an additional 10 mA when the programming cable is used to connect J1 to a PC.

### B.2 Battery-Backup Circuits

As explained in Section 2.3.2, the RCM2300 has provision for battery backup, which kicks in to keep VRAM from dropping below 2 V.

The current drain on the battery in a battery-backed circuit must be kept to a minimum. When the RCM2300 is not powered, the battery keeps the SRAM memory contents and the real-time clock (RTC) going. The SRAM has a powerdown mode that greatly reduces power consumption. This powerdown mode is activated by raising the chip select (CS) signal line. Normally the SRAM requires  $V_{cc}$  to operate. However, only 2 V is required for data retention in powerdown mode. Thus, when power is removed from the circuit, the battery voltage needs to be provided to both the SRAM power pin and to the CS signal line. The CS control switch accomplishes this task for the CS signal line.

Figure B-1 shows a schematic of the chip select control switch.



**Figure B-1. Chip Select Control Switch**

In a powered-up condition, the CS control switch must allow the processor's chip select signal /CS1 to control the SRAM's CS signal /CSRAM. So, with power applied, /CSRAM must be the same signal as /CS1, and with power removed, /CSRAM must be held high (but only needs to be as high as the battery voltage). Q3 and Q4 are MOSFET transistors with opposing polarity. They are both turned on when power is applied to the circuit. They allow the CS signal to pass from the processor to the SRAM so that the processor can periodically access the SRAM. When power is removed from the circuit, the transistors will turn off and isolate /CSRAM from the processor. The isolated /CSRAM line has a 100 kΩ pullup resistor to VRAM (R28). This pullup resistor keeps /CSRAM at the VRAM voltage level (which under no power condition is the backup battery's regulated voltage at a little more than 2 V).

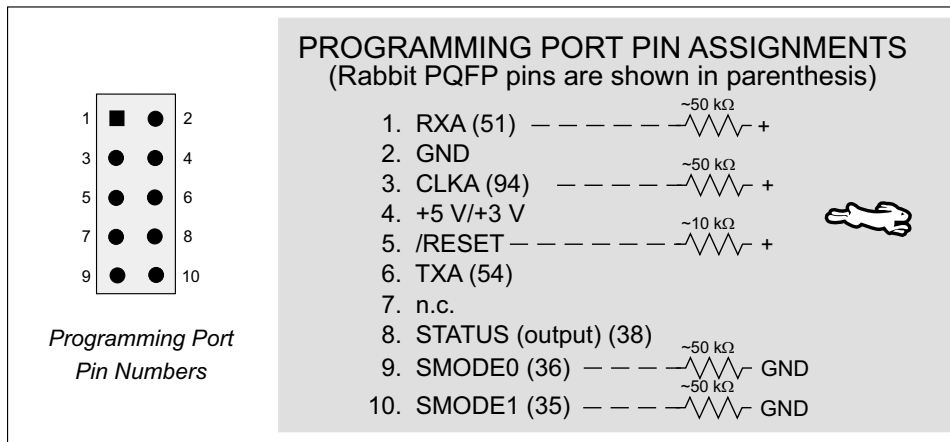
Transistors Q3 and Q4 are of opposite polarity so that a rail-to-rail voltages can be passed. When the /CS1 voltage is low, Q3 will conduct. When the /CS1 voltage is high, Q4 will conduct. It takes time for the transistors to turn on, creating a propagation delay. This delay is typically very small, about 10 ns to 15 ns.



## APPENDIX C. PROGRAMMING CABLE

Appendix C provides additional theoretical information for the Rabbit 2000™ microprocessor when using the **DIAG** and **PROG** connectors on the programming cable. The **PROG** connector is used only when the programming cable is attached to the programming connector (header J1) while a new application is being developed. Otherwise, the **DIAG** connector on the programming cable allows the programming cable to be used as an RS-232 to CMOS level converter for serial communication, which is appropriate for monitoring or debugging a RabbitCore system while it is running.

The programming port, which is shown in Figure C-1, can serve as a convenient communications port for field setup or other occasional communication need (for example, as a diagnostic port). There are several ways that the port can be automatically integrated into software. If the port is simply to perform a setup function, that is, write setup information to flash memory, then the controller can be reset through the programming port, and a cold boot is performed to start execution of a special program dedicated to this functionality.



**Figure C-1. Programming Port Pin Assignments**

When the **PROG** connector is used, the **/RESET** line can be asserted by manipulating the serial port **DTR** line and the **STATUS** line can be read as **DSR** on the serial port. The target can be restarted by pulsing reset and then, after a short delay, sending a special character string at 2400 bps. To simply restart the BIOS, the string 80h, 24h, 80h can be sent. When the BIOS is started, it can tell whether the programming cable is connected because the **SMODE1** and **SMODE0** pins are sensed as being high. This will cause the Rabbit 2000 to enter the bootstrap mode.

Alternatively, the **DIAG** connector can be used on the programming port. The **/RESET** line and the **SMODE1** and **SMODE0** pins are not connected when this connector is used, and are pulled low by resistors on the target board. The programming port is then enabled as a diagnostic port by polling the port periodically to see if communication needs to begin or to enable the port and wait for interrupts. The pull-up resistors on **RXA** and **CLKA** prevent spurious data reception that might take place if the pins floated.

If the clocked serial mode is used, the serial port can be driven by using two toggling lines that can be driven and one line that can be sensed. This allows a conversation with a device that does not have an asynchronous serial port but that has two output signal lines and one input signal line.

Once you establish that the programming port will never again be needed for programming, it is possible to use the programming port I/O for additional I/O lines. Table C-1 lists the pins available for this alternate configuration.

**Table C-1. RabbitCore RCM2300 Programming Port Pinout Configurations**

	Pin	Pin Name	Default Use	Alternate Use	Notes
Header J1	1	RXA	Serial Port A	PC6—Input	
	2	GND			
	3	CLKA		PB1—Bitwise or parallel programmable input	
	4	VCC			
	5	RESET	Reset (input only)		Connected to reset generator U1
	6	TXA	Serial Port A	PC7—Output	
	8	STATUS		Output	
	9	SMODE0		Input	Must be low when RCM2300 boots up
	10	SMODE1		Input	Must be low when RCM2300 boots up

Table C-2 lists the locations of these programming port I/O on headers J4 and J5.

**Table C-2. Locations of Programming Port I/O on RCM2300 Headers J4 and J5**

Programming Port Pin Name	Pin		Pin	
RXA	Header J4	7	Header J5	not connected
GND		1		26
CLKA		not connected		not connected
VCC		2		25
RESET		not connected		9*
TXA		8		not connected
STATUS		21		not connected
SMODE0		18		not connected
SMODE1		17		not connected

\* This is not the same reset that is on the programming port. Refer to the schematic (090-0119) for more information.







## APPENDIX D. SAMPLE CIRCUITS

This appendix details several basic sample circuits that can be used with the RCM2300.

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

## D.1 RS-232/RS-485 Serial Communication

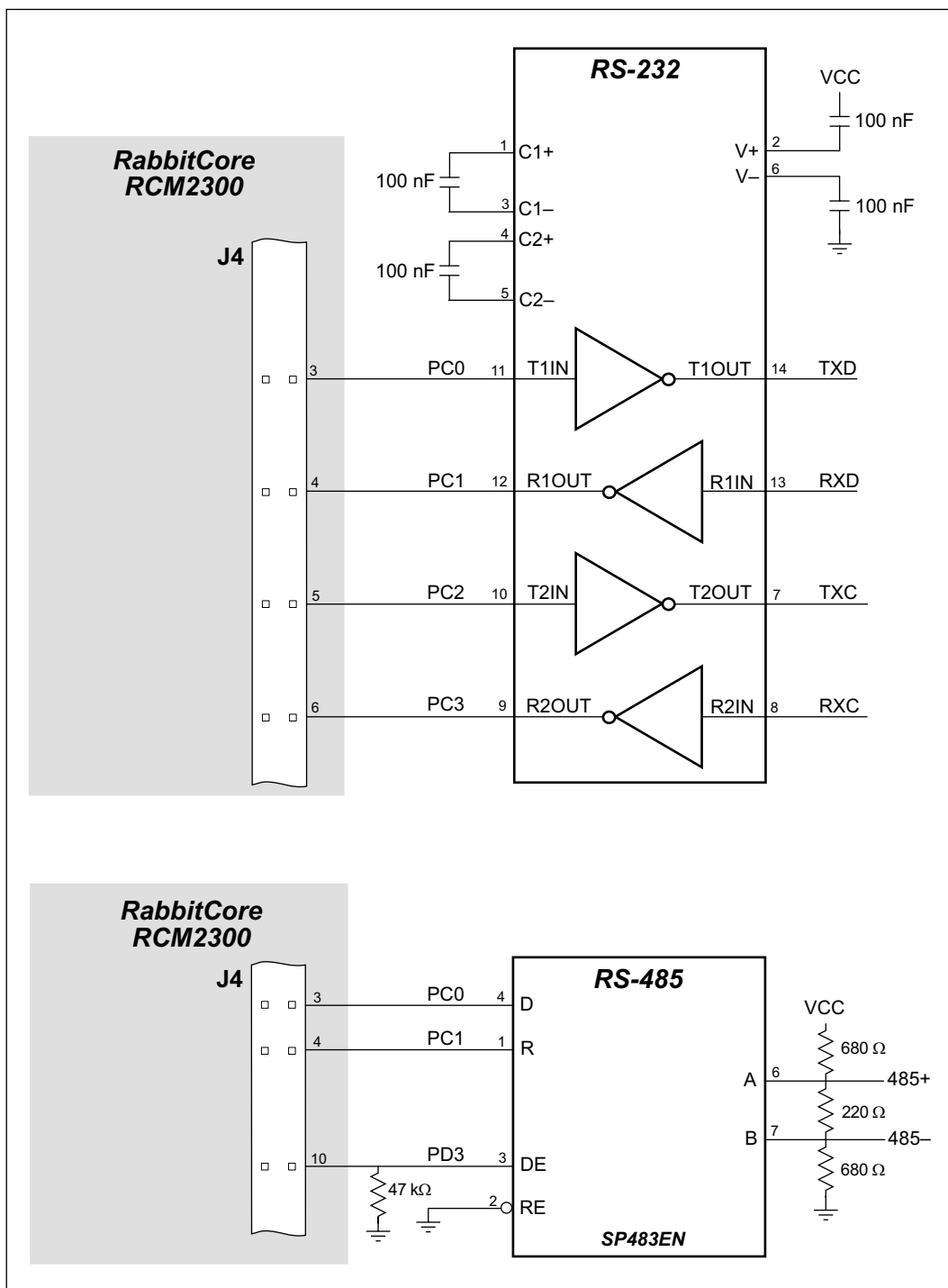
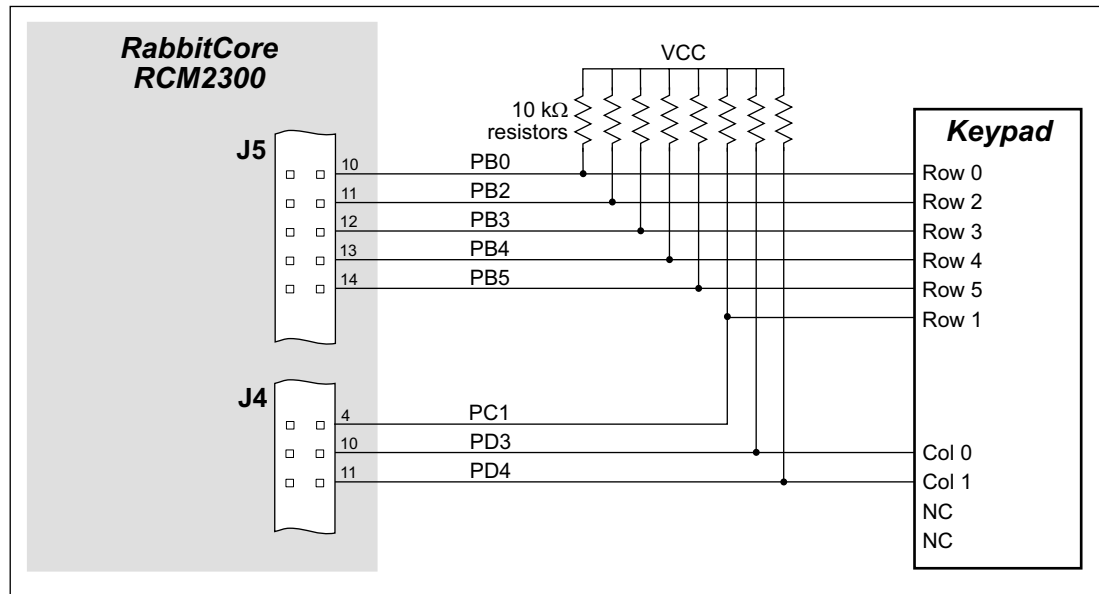


Figure D-1. Sample RS-232 and RS-485 Circuits

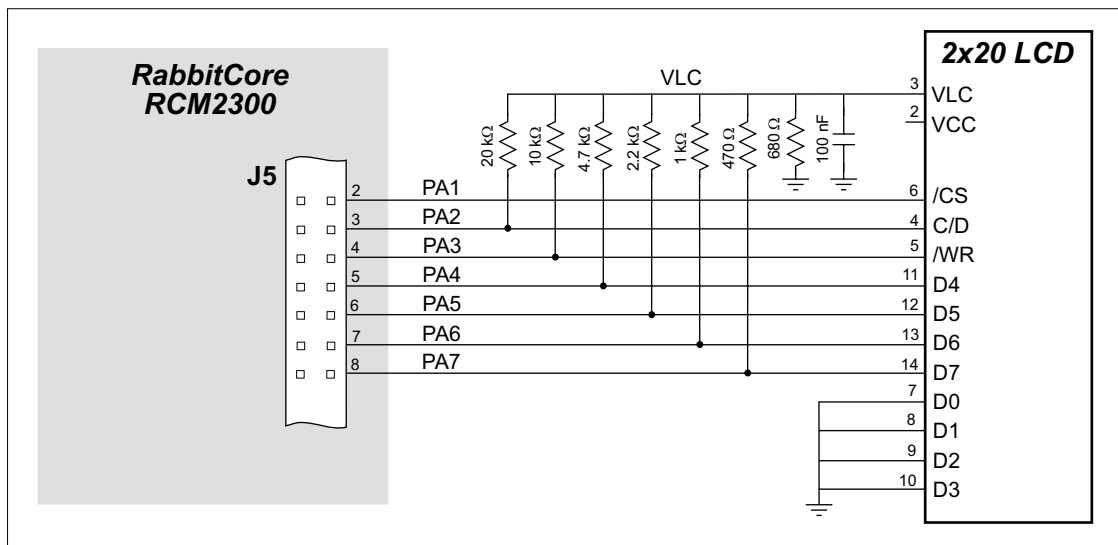
Sample Program: `PUTS.C` in `SAMPLES/RCM2300`.

## D.2 Keypad and LCD Connections



**Figure D-2. Sample Keypad Connections**

Sample Program: **KEYLCD.C** in **SAMPLES/RCM2300**.

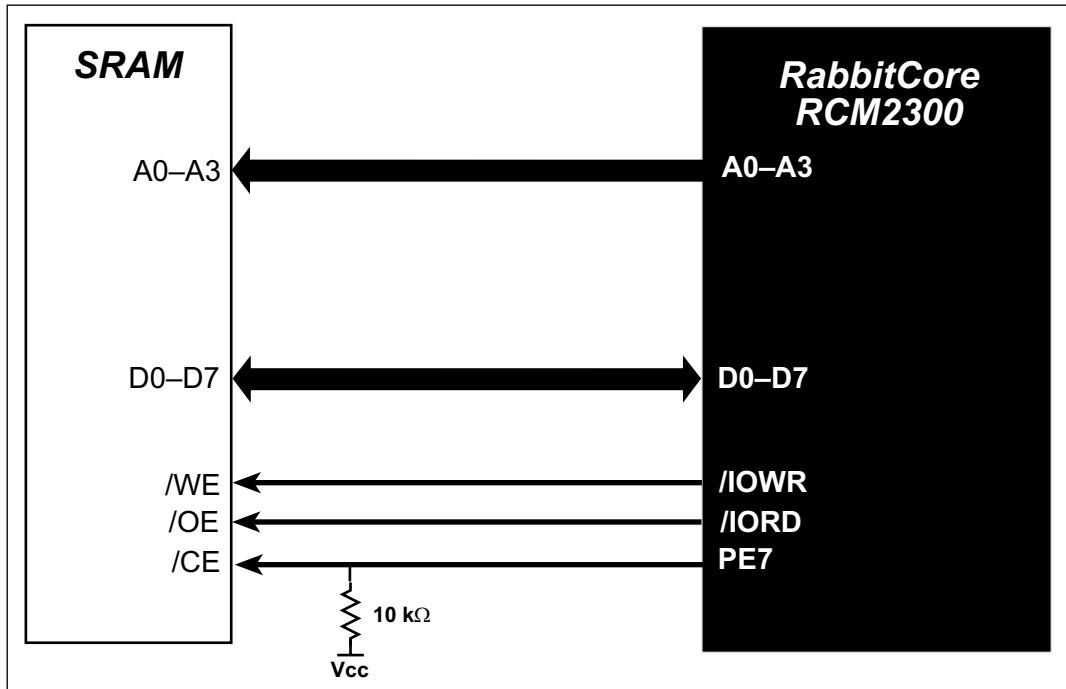


**Figure D-3. Sample LCD Connections**

Sample Program: **KEYLCD.C** in **SAMPLES/RCM2300**. (When Parallel Port A is not being used for quick communication, its resting, quiescent value is used to set the LCD contrast level.)

### D.3 External Memory

The sample circuit can be used to access 16 bytes on an external 64K memory device. Larger SRAMs can be written to using this scheme by using other available Rabbit 2000 ports (parallel ports A to E) as address lines.

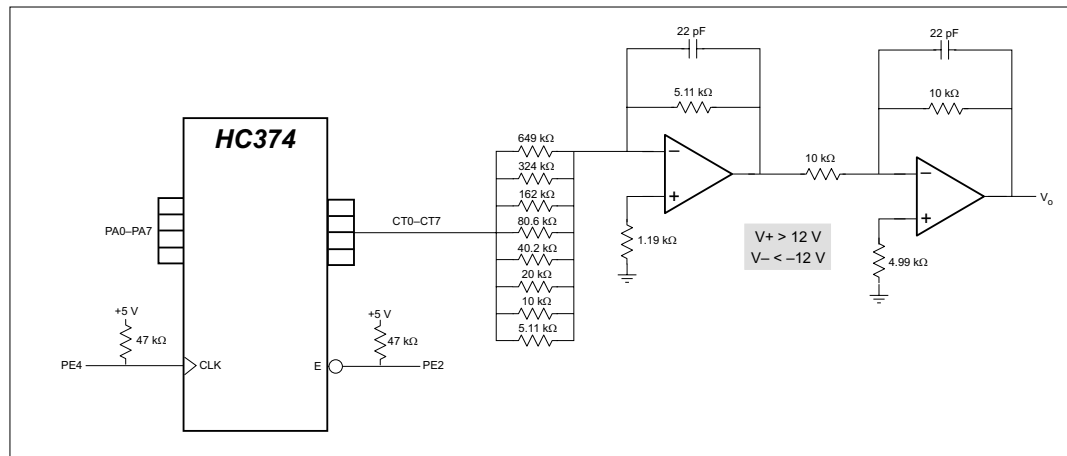


**Figure D-4. Sample External Memory Connections**

Sample Program: **EXTSRAM.C** in **SAMPLES/RCM2300**.

## D.4 D/A Converter

The output will initially be 0 V to -10.05 V after the first inverting op-amp, and 0 V to +10.05 V after the second inverting op-amp. All lows produce 0 V out, FF produces 10 V out. The output can be scaled by changing the feedback resistors on the op-amps. For example, changing 5.11 k $\Omega$  to 2.5 k $\Omega$  will produce an output from 0 V to -5 V. Op-amps with a very low input offset voltage are recommended.



**Figure D-5. Sample D/A Converter Connections**



## APPENDIX E. EXTERNAL INTERRUPTS

Appendix E provides information about using the RabbitCore RCM2300 external interrupts.

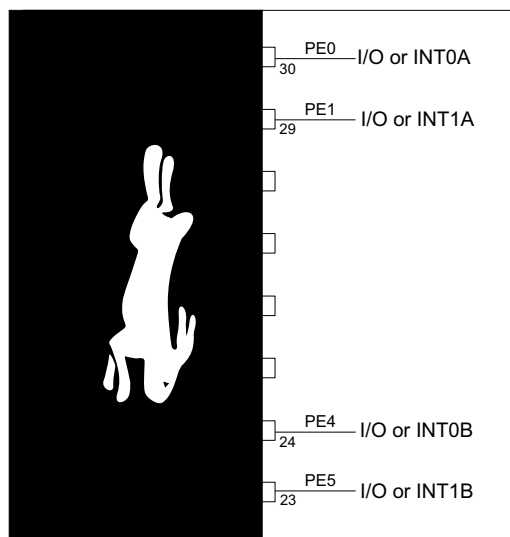
The Rabbit 2000 microprocessor has four external interrupt inputs on Parallel Port E, which is accessed through pins PE0, PE1, PE4, and PE5 on header J4.

Table E-1 lists the general-purpose Parallel Port E I/O pins that can be used for external interrupts.

**Table E-1. Rabbit 2000 Parallel Port E Interrupts**

Pin	Default Use	Alternate Use
PE0	General-Purpose I/O	INT0A input
PE1		INT1A input
PE4		INT0B input
PE5		INT1B input

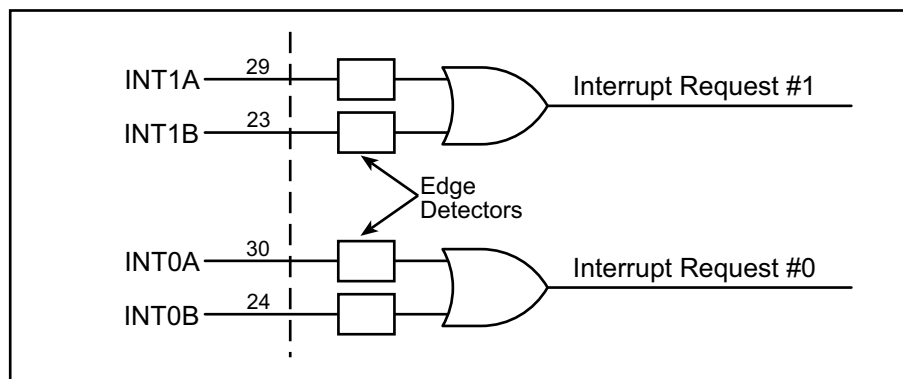
Figure E-1 illustrates these pins.



**Figure E-1. Rabbit 2000 Interrupt Pins**

## E.1 Use of External Interrupts

Figure E-2 shows a block diagram of how the Rabbit 2000 external interrupt logic is used in general.



**Figure E-2. Rabbit 2000 External Interrupt Logic**

Interrupts on the Rabbit 2000 can take place at three priority levels from low to high priority, and are numbered 1, 2 and 3. Each on-chip device, including the two external interrupts, can be assigned a priority at which interrupts will take place. For interrupts that have been assigned the same programmed priority, there is an implicit priority with external interrupt #1 having the highest priority, external interrupt #0 the second highest, and the remaining on-chip devices having lower priorities in the order specified in Section 7.8, “Rabbit Interrupt Structure,” in the *Rabbit 2000 User’s Manual*.

The two independent interrupts are generated by inputs to the four pins shown in Figure E-2. Each pin is connected to an edge detector that can be configured under program control to detect rising edges, falling edges, or both. These same pins, a part of parallel port E, support alternate functionality as reflected in Table E-1.

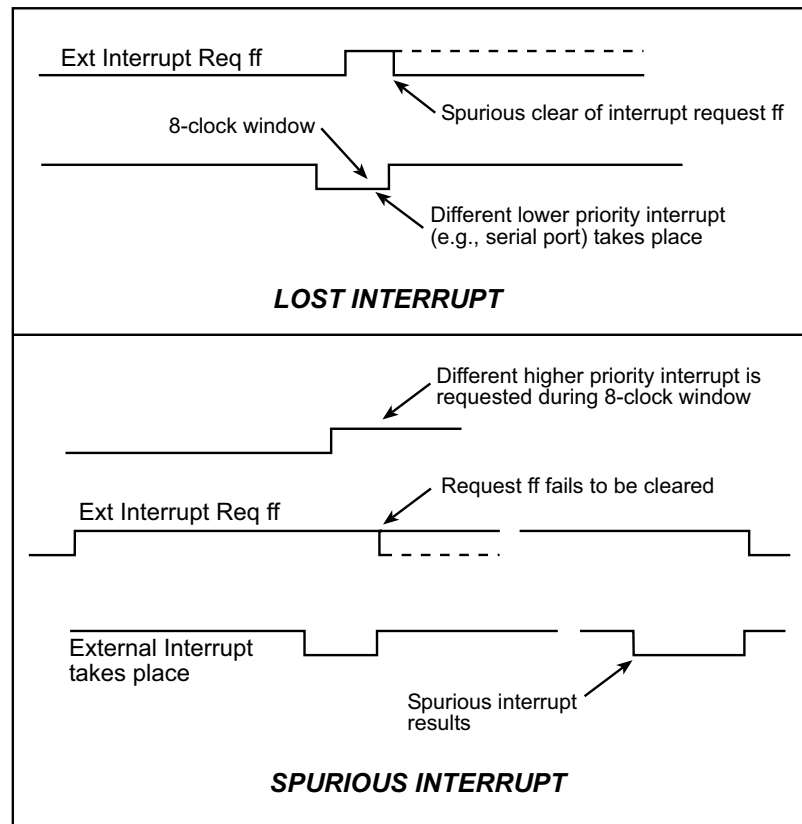
When the edge detector detects the rising or falling edge that it is programmed to detect, it sets a flip-flop that drives the output of the edge detector. The flip-flop should be cleared automatically when the interrupt takes place.

Instead, the flip-flop may be cleared spuriously because a different, *lower priority*, interrupt occurs nearly simultaneously (during an 8-clock window) with the occurrence of the edge that sets the flip-flop. This results in a lost interrupt.

Or the flip-flop might not be cleared when the interrupt takes place if a different, *higher priority*, interrupt is being requested nearly simultaneously (during an 8-clock window) with the occurrence of the external interrupt. This results in a spurious interrupt after the first interrupt because the interrupt request was not cleared.



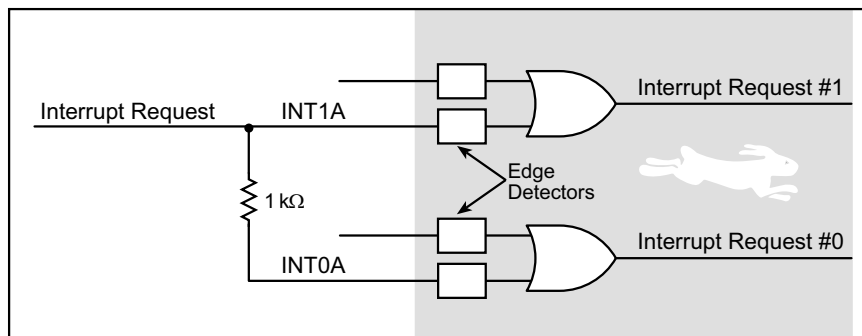
In either case, precautions need to be taken if an interrupt request transitions during a short time period 8 clocks long. These sequences are shown schematically in Figure E-3.



**Figure E-3. Interrupt Sequences with Lost or Spurious Interrupts**

## E.2 Single-Interrupt Request

Tie the inputs for external interrupt #1 and #0 together by adding a 1 k $\Omega$  resistor between the two lines. Under this configuration, shown in Figure E-4, both interrupt #1 and #0 will be requested when an edge is detected. The #1 interrupt will take place first since it is of a higher priority.



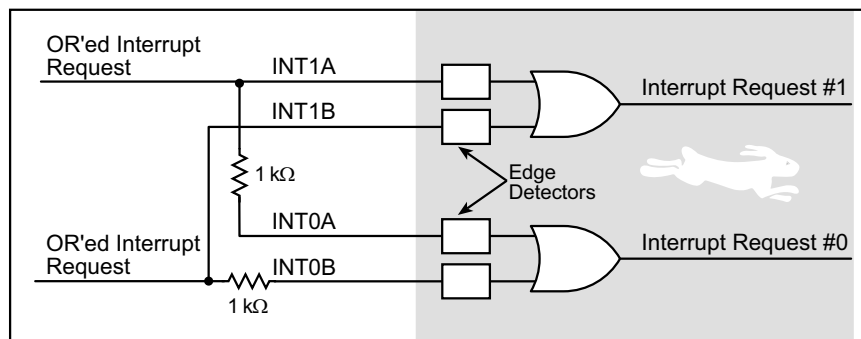
**Figure E-4. RabbitCore RCM2300 Configuration for Single-Interrupt Request**

The interrupt service routine for interrupt #1 should ignore the interrupt. The actual service routine will be the service routine for interrupt #0. If an interrupt is lost, it will always be #1 and never #0. The 1 k $\Omega$  resistor delays the edge slightly so that interrupt #1 is guaranteed to be latched earlier or simultaneously with interrupt #0. It is important that the programmed priority of interrupt #1 be higher than or equal to the programmed priority of interrupt #0. Normally they should be equal.

Spurious interrupts, which occur because of a failure to clear the request latch, are a possibility only if there are other interrupts of higher priority than external interrupt #1 and #0. These can only be the result of programming one of the on-chip peripheral interrupts to have a higher interrupt priority. This could be the case, for example, if the external interrupts are programmed to have priority 1, and one of the serial port interrupts is programmed to have priority 2. Spurious interrupts can always be eliminated by programming both external interrupts to have a priority equal to the highest priority used for another device. The priority can be reduced on entry to the service routine to avoid blocking the true high-priority interrupts. External interrupt #1 cannot cause interrupt #0 to have a spurious interrupt or vice versa. In some cases, spurious interrupts may not disturb function, but the fix is so simple that it is not usually worth the trouble to analyze this possibility.

### E.3 OR'ed Interrupt Request

Tie the inputs for external interrupt #1 and #0 together by adding a 1 k $\Omega$  resistor. This configuration is shown in Figure E-5.



**Figure E-5. RabbitCore RCM2300 Configuration for OR'ed Interrupt Request**

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# SCHEMATICS

The following schematics are included for reference.

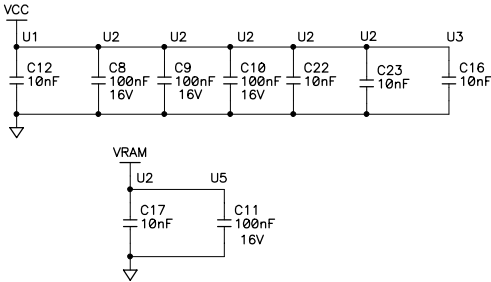
090-0119	RabbitCore RCM2300
090-0122	RCM2200/RCM2300 Prototyping Board
090-0128	Programming Cable

REVISION HISTORY			REVISION APPROVAL			
REV	ECO	DESCRIPTION OF CHANGE	PROJECT ENGINEER	APPROVAL DATE	DOCUMENT CONTROL	APPROVAL DATE
A	E11400	INITIAL RELEASE				

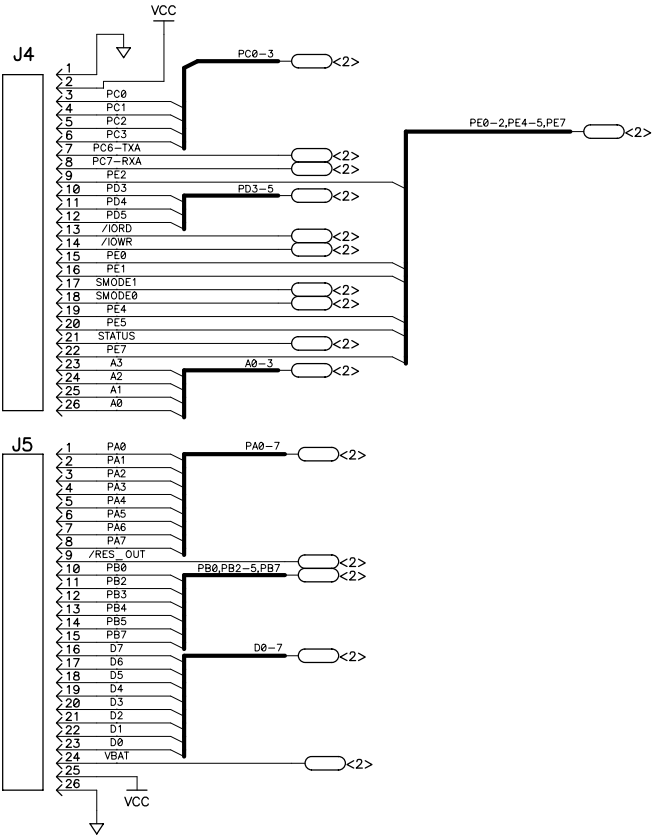
TABLE A

REF DES	DEVICE	DEVICE VOLTAGE INFORMATION				DEVICE: FILTER CAP REF DES(s)
		GND	VCC	VRAM	NO CONNECTS	
U1	ETC811L					C12
U2	RABBIT 2000	2,27,39 52,77,89	3,28,53, 78,92	42		C8,C10,C9,22,23 C17 – PIN42 (VRAM)
U3	FLASH	24	8			C16
U5	SRAM 128K X 8	24		8		C11

Decoupling Capacitors




- NOTES: UNLESS OTHERWISE SPECIFIED;
- ALL RESISTOR VALUES ARE IN OHMS, 1/16W, 5%.
  - ALL CAPACITORS ARE 50VDC OR HIGHER.
  - THE ORIGIN SOURCE OF A VOLTAGE IS REPRESENTED BY (VCC), AND ALL REFERENCES TO THAT VOLTAGE ARE REPRESENTED BY (VCC).
  - R27, R33, & J3 NOT NORMALLY STUFFED.
  - COMPONENT VALUES SHOWN WITH AN ASTERISK (\*) FOLLOWING THE VALUE, MAY HAVE DIFFERENT VALUES, OR MAY NOT BE STUFFED DEPENDING ON MODEL. SEE STUFFING CHART FOR CLARIFICATION.
  - JP1 AND JP2 ARE JUMPERED POSITION 1 TO POSITION 2 BY FACTORY DEFAULT.

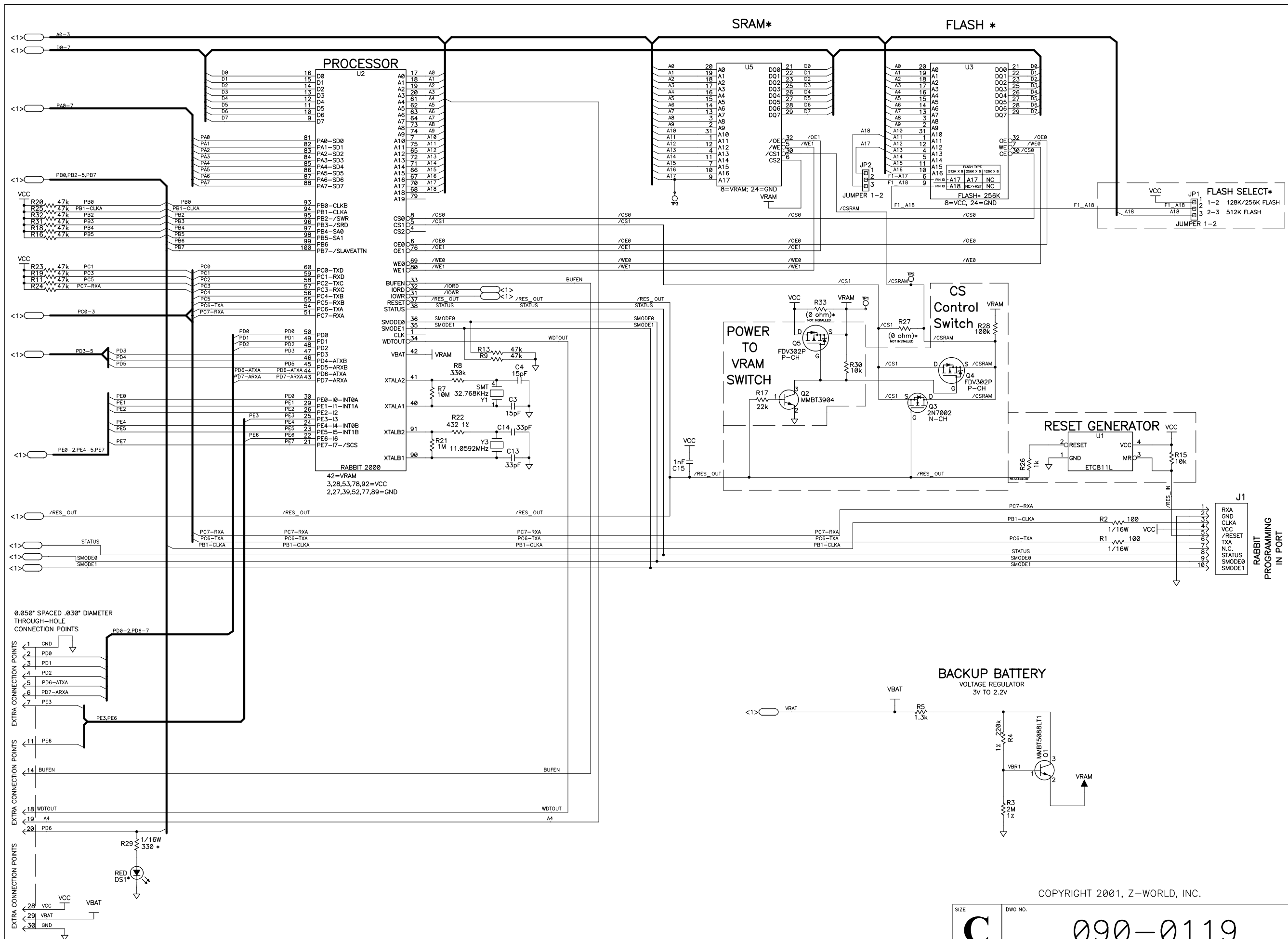


STUFFING TABLE

	CIRCUIT	PART	RCM2210
POWER TO VRAM SWITCH	WITH BATTERY BACKUP CIRCUITRY	R33	NOT INSTALLED
CS CONTROL SWITCH	WITH BATTERY BACKUP CIRCUITRY	R27	NOT INSTALLED
FLASH	MAIN	U3	256K FLASH
	FLASH SELECT	JP1	ZERO ohm ACROSS PINS 1-2
	FLASH TYPE	JP2	ZERO ohm ACROSS PINS 1-2
LED	RED LED CIRCUIT	R29	NOT INSTALLED
		DS1	NOT INSTALLED

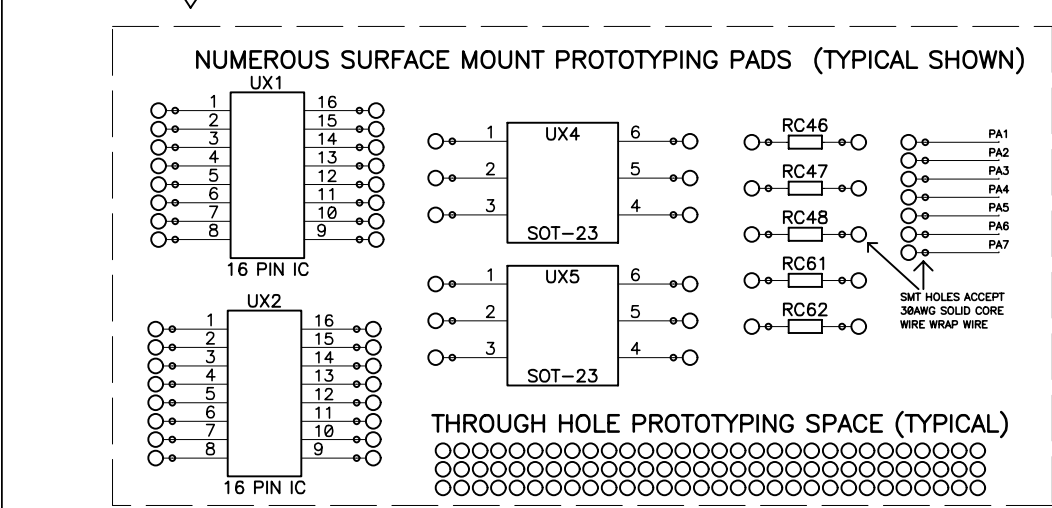
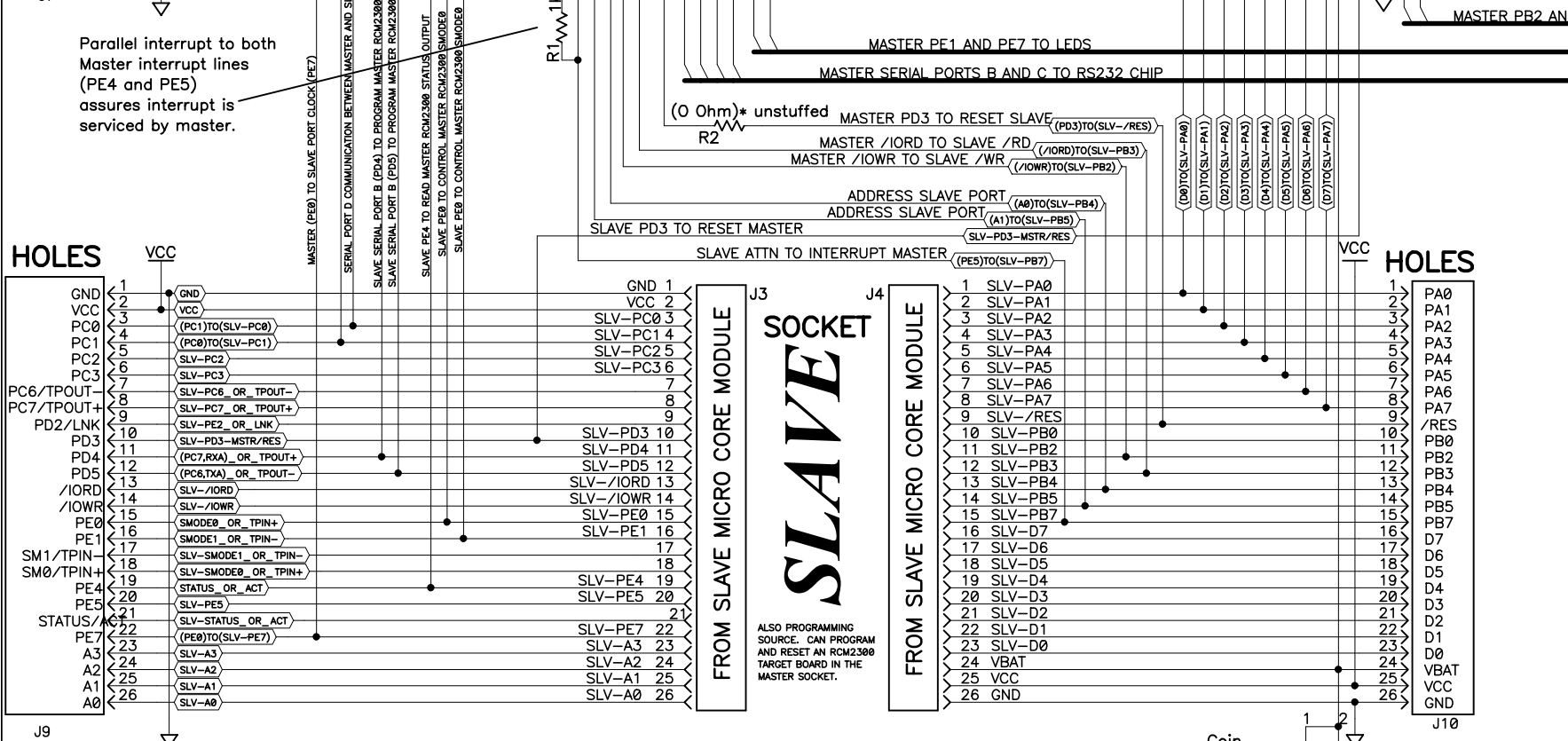
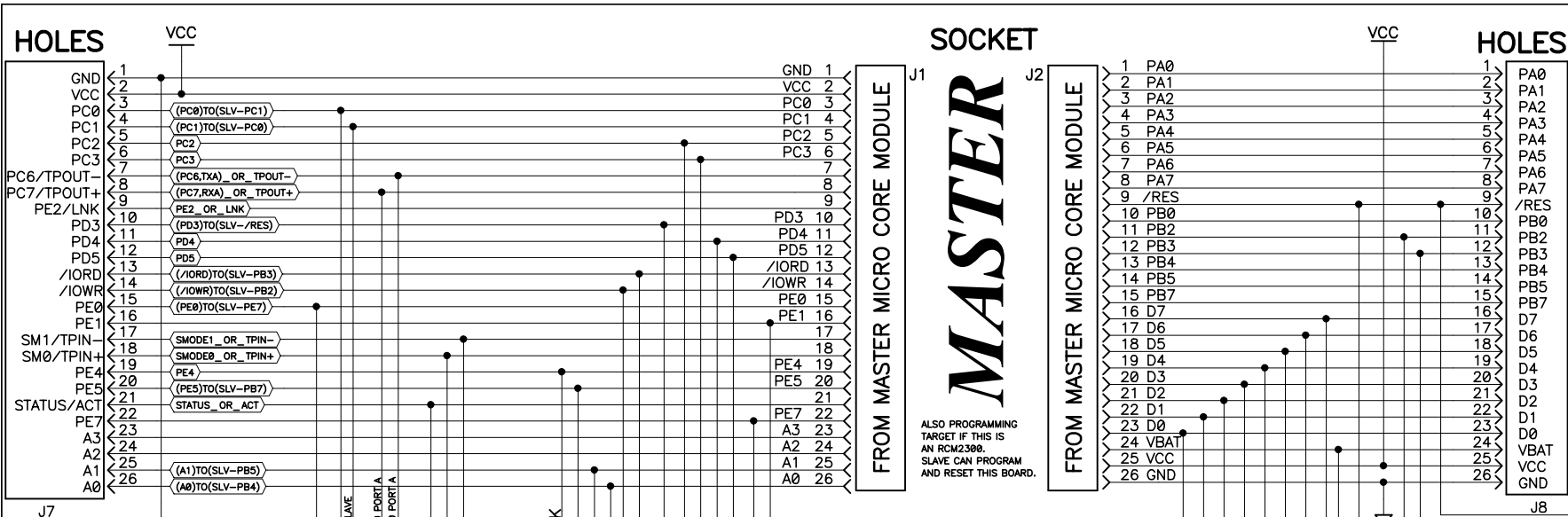
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		RJH	3/22/01							
		REVISED BY:								
		RJH	5/11/01							
		APPROVALS: INITIAL RELEASE		SIZE <b>C</b>		DWG NO.  090-0119				
		PROJECT ENGINEER:								
		ENGINEERING MANAGER:								
		SIGNATURES	DATE	SCALE	NONE	RELEASE DATE	SHEET	1	OF	2

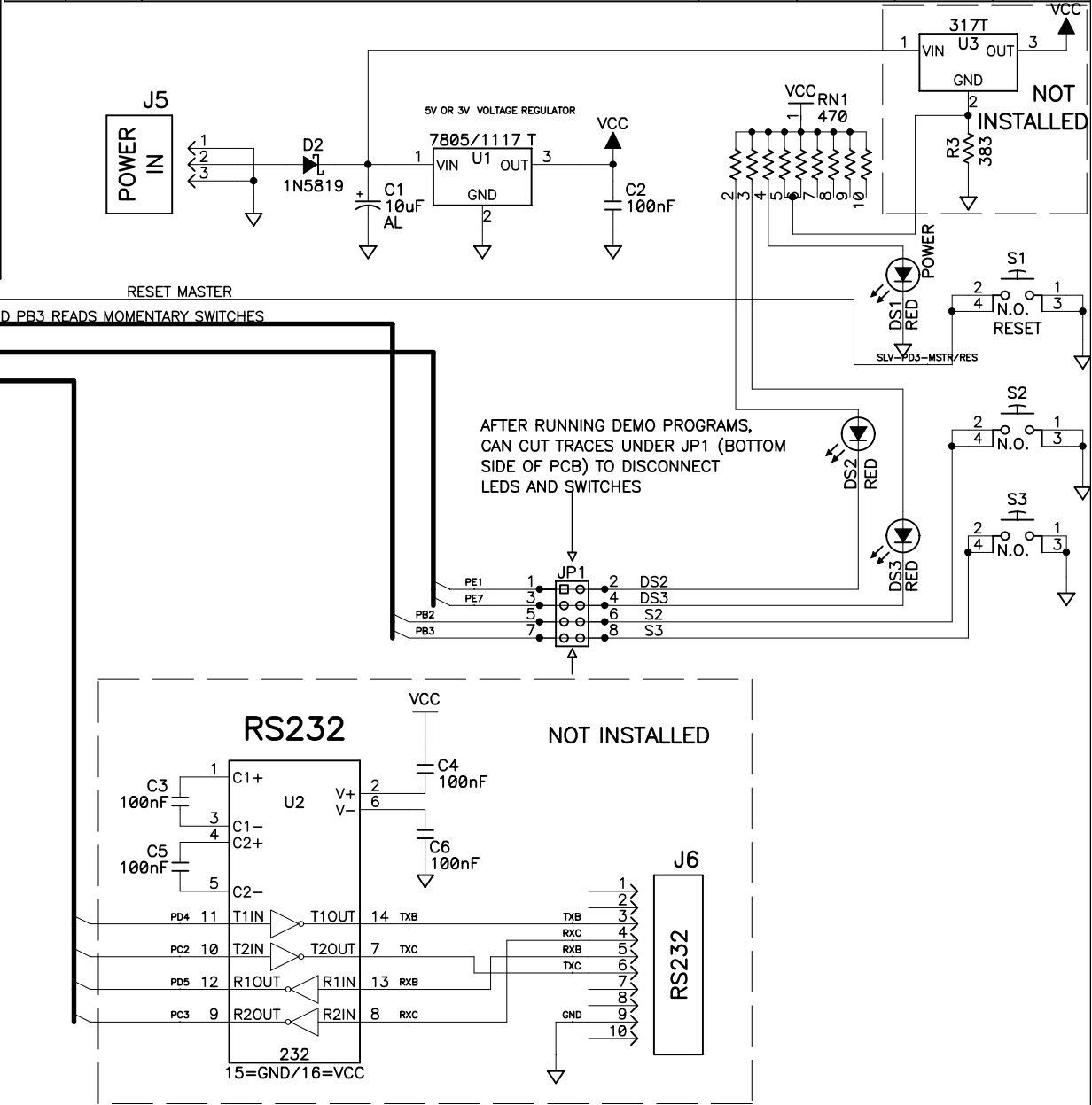


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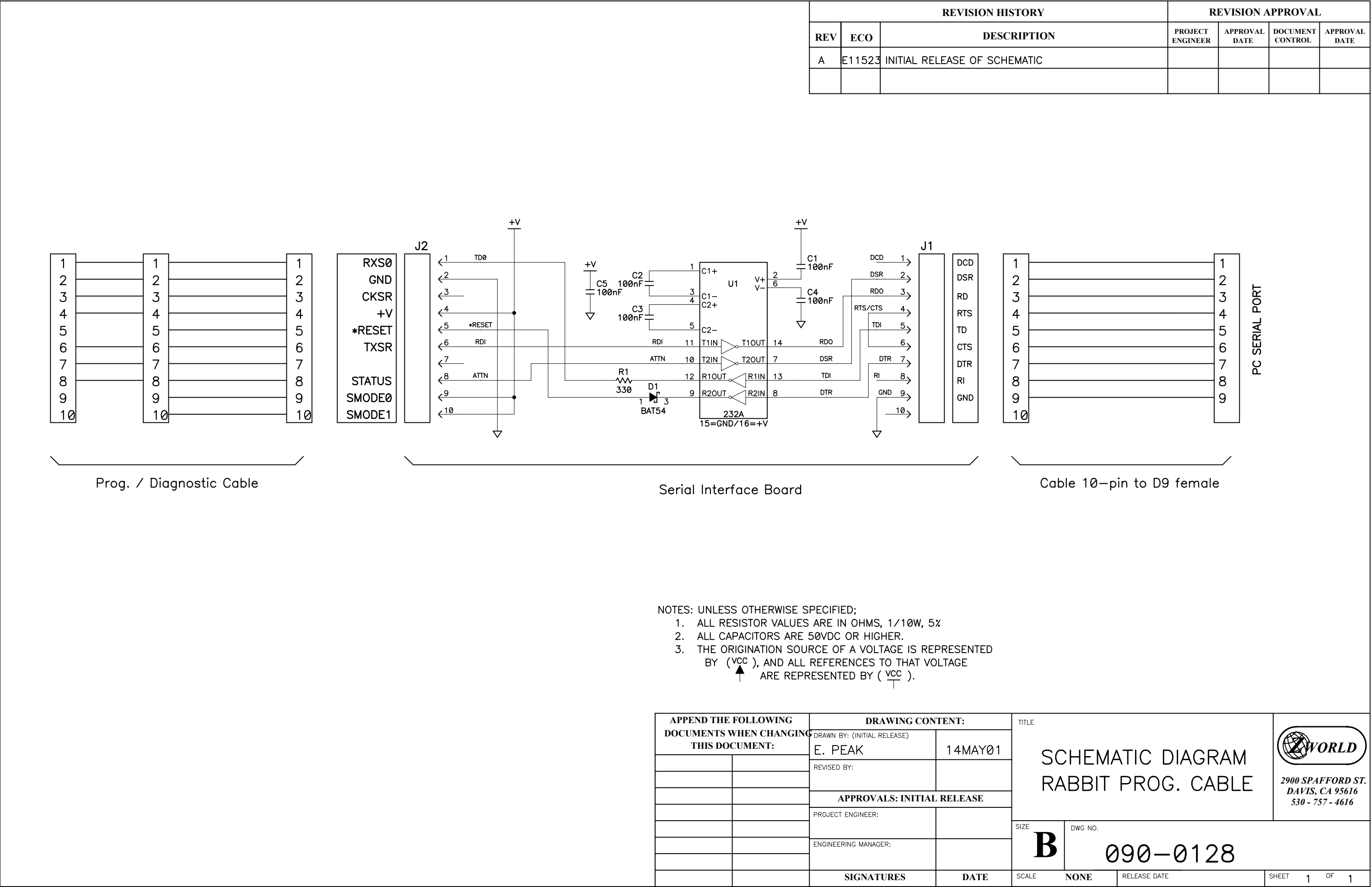


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REV	ECO	DESCRIPTION	PROJECT ENGINEER	APPROVAL DATE	DOCUMENT CONTROL	APPROVAL DATE
A	E11401	INITIAL RELEASE A/W @ REV-A	RJH	4/9/01	KIS	4/9/01
B	E11520	ADD RCM2300 CONNECTIONS				



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APPROVALS: INITIAL RELEASE		PROJECT ENGINEER:		2900 SPAFFORD ST. DAVIS, CA 95616 530 - 757 - 4616	
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10

Cable 10-pin to D9 female

PC SERIAL PORT

1

2

3

4

5

6

7

8

9

10

DCD

DSR

RD

RTS

TD

CTS

DTR

RI

GND

NOTES: UNLESS OTHERWISE SPECIFIED;  
1. ALL RESISTOR VALUES ARE IN OHMS, 1/10W, 5%  
2. ALL CAPACITORS ARE 50VDC OR HIGHER.  
3. THE ORIGATION SOURCE OF A VOLTAGE IS REPRESENTED BY (VCC ), AND ALL REFERENCES TO THAT VOLTAGE ARE REPRESENTED BY ( VCC ).

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		ENGINEERING MANAGER:		SIZE B	DWG NO. 090-0128
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