OKI

MSM60851 Demo Board
User's Guide

Evaluation Board for MSM60851 USB Protocol Engine LSI

First Edition, February 1998

Oki Electric Industry Co., Ltd.

Notes

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Contents

1 Read Me First

This Chapter lists the procedures to be followed when the MSM60851 demo board is first unpacked. Read it thoroughly before applying power to the board.

1.1   Using this Product Safely and Properly

This User's Guide uses various labels and icons that serve as your guides to operating this product safely and properly so as to prevent death, personal injury, and property damage. The following table lists these labels and their definitions.

Labels

⚠ **Warning**	This label indicates precautions that, if ignored or otherwise not completely followed, could lead to death or serious personal injury.
⚠ **Caution**	This label indicates precautions that, if ignored or otherwise not completely followed, could lead to personal injury or property damage.

Icons

A triangular icon draws your attention to the presence of a hazard. The illustration inside the triangular frame indicates the nature of the hazard—in this example, an electrical shock hazard.

A circular icon with a solid background illustrates an action to be performed. The illustration inside this circle indicates this action—in this example, unplugging the power cord.

A circular icon with a crossbar indicates a prohibition. The illustration inside this circle indicates the prohibited action—in this example, disassembly.

1.2   Important Safety Notes

Please read this page before using the product.

⚠ **Warning**

●**Use only the specified voltage.**

Using the wrong voltage risks fire and electrical shock.

●**At the first signs of smoke, an unusual smell, or other problems, disconnect the power plug and unplug all external power cords.**

Continued use risks fire and electrical shock.

●**Do not use the product in an environment exposing it to moisture or high humidity.**

Such exposure risks fire and electrical shock.

●**Do not pile objects on top of the product.**

Such pressure risks fire and electrical shock.

●**At the first signs of breakdown, immediately stop using the product, disconnect the power plug, and unplug all external power cords.**

Continued use risks fire and electrical shock.

Please read this page before using the product.

⚠️**Caution**

●**Do not use this product on an unstable or inclined base as it can fall or overturn, producing injury.**	🚫
●**Do not use this product in an environment exposing it to excessive vibration, strong magnetic fields, or corrosive gases.** Such factors can loosen or even disconnect cable connectors, producing a breakdown.	🚫
●**Do not use this product in an environment exposing it to temperatures outside the specified range, direct sunlight, or excessive dust.** Such factors risk fire and breakdown.	🚫
●**Use only the cables and other accessories provided.** Using non-compatible parts risks fire and breakdown.	🚫
●**Always observe the specified order for turning equipment on and off.** Using the incorrect order risks fire and breakdown.	❗
●**Do not use the cables and other accessories provided with other systems.** Such improper usage risks fire.	🚫

1.3   Notations

This User's Guide uses the following labels for material that complements the main text.

■ **Caution** ■   This notation introduces material requiring special attention.

■ **Reference** ■   This notation gives cross-references for related material elsewhere in this User's Guide.

■ **Example** ■   This notation introduces an example illustrating the discussion.

(See Note n.)   This notation introduces a reference to a numbered note providing supplementary information later in the same Section.

■ **Note n** ■   This notation introduces a numbered note providing supplementary information.

1.4   For Further Information

Thank you for choosing the MSM60851 demo board.

Please direct any questions or comments that you may have to your Oki distributor or the nearest Oki Electric Sales Office.

1.5   Packing List

When you first unpack your MSM60851 demo board, check that the package contains all the components shown in Figure 1.1.

Although every effort has been made to minimize damage and eliminate mistakes, please report any damage or missing parts to your Oki distributor or the nearest Oki Electric Sales Office.

Shipping Documents

Packing List

Test Result

Accessories

Power Supply Cable

Manual

MSM60851 Demo Board
User's Guide

**MSM60851
Demo Board**

*User's
Guide*

Hardware

MSM60851 Demo Board
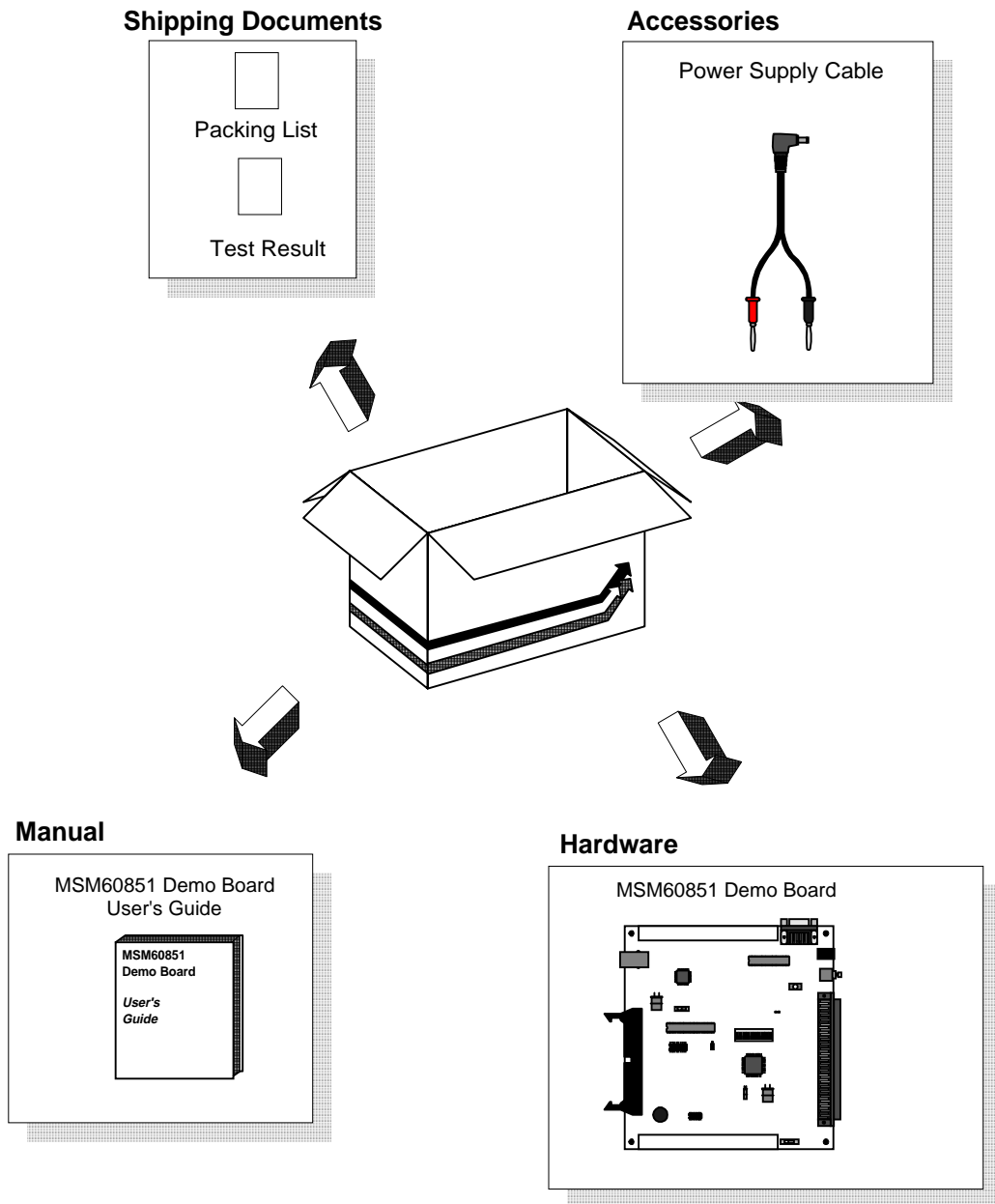
Figure 1-1   MSM60851 Demo Board Shipping Contents

Shipping documents

Packing list

Test result
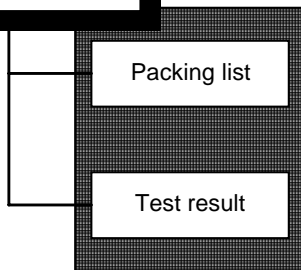
This document lists the contents of the MSM60851 demo board package. Check the package contents against this list.

This document reports the results of tests conducted on the MSM60851 demo board prior to shipping.

Hardware

MSM60851 Demo Board

This board is the key component of the kit.

Manual

MSM60851 Demo Board User's Guide
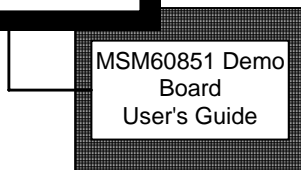
This document, the manual that you are now reading, describes the MSM60851 demo board in full.

Accessories
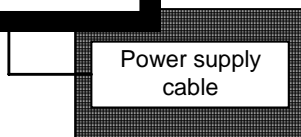
Power supply cable

This cable provides one way to supply power to the MSM60851's microcontroller interface. (The input voltage specifications are the same as for the MSM60851's VCC5 pin.)

2   Overview

This Chapter provides an overview of the MSM60851 demo board, its components, and its functions.

2.1   What is it?

The MSM60851 demo board, for developers debugging and evaluating USB Version 1.0 control programs, is a circuit board containing an Oki MSM60851 USB device controller LSI.

This LSI contains a USB transceiver, send and receive FIFOs, and other circuits. Connecting the MSM60851 demo board to a microcontroller, in-circuit emulator, or the Oki ARM7TDMI™ emulation kit motherboard, permits the debugging of USB control programs.

The board also has a socket for mounting a member of the Oki MSM66573 family as the microcontroller for the USB control system.

The following documents contain material related to the contents of this Manual.

• Oki ARM7TDMI Motherboard User's Guide

• MSM60851 Data Sheet

• MSM66573 Family User's Guide

■ **Reference** ■

The Oki ARM7TDMI motherboard is a kit for developers debugging embedded system applications for the ARM7TDMI core. For details, set the Oki ARM7TDMI Motherboard User's Guide.

MSM60851 specifications appear in the MSM60851 Data Sheet.

2.2   Main Components

This Section shows the layout of the MSM60851 demo board and describes the main
components.
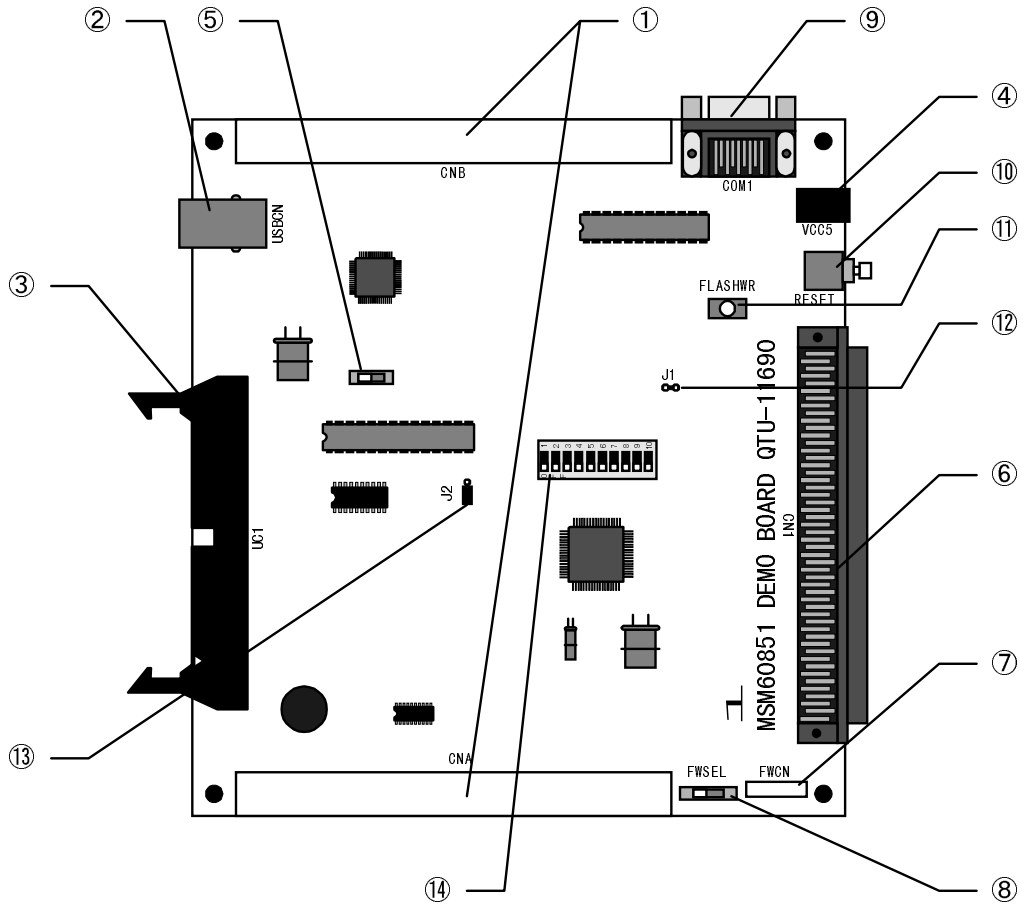
Figure 2-1   MSM60851 Demo Board Layout

① ARM interface connectors (CNA, CNB):

These are for connecting the MSM60851 demo board to the Oki ARM7TDMI™ emulation kit motherboard. Do not connect anything to them when using this board to evaluate USB operation with another controller present—either an external microcontroller attached to the UC1 connector described below or a member of the MSM66573 family mounted on the board.

② USB connector (USBCN): This is a right angle receptacle of Type B as defined in the USB standard.

③ Microcontroller interface connector (UC1):

This is for connecting the MSM60851 demo board to an external microcontroller. Do not connect anything to it when using this board to evaluate USB operation with another controller present—either an Oki ARM7TDMI™ emulation kit motherboard attached to the CNA and CNB connectors described above or a member of the MSM66573 family mounted on the board.

④ DC jack (VCC5): This supplies the microcontroller interface power supply (+3.0 V to +5.0 V) for the MSM60851 USB protocol engine LSI built into this evaluation board—if that power supply is not already supplied via the UC1 connector described above.

⑤ Microcontroller selector switch (MCUSEL):

This specifies whether the device controlling the MSM60851 USB protocol engine LSI built into this evaluation board is a member of the MSM66573

family or some other device. Set this switch to the appropriate setting before powering up the board.

⑥ MSM66573 user interface connector (CN1):

This provides access to the I/O pins on the MSM66573 family microcontroller if one is mounted on the board.

⑦ Flash writer connector (FWCN):

This is for connecting the flash writer for rewriting the contents of the MSM66573 family microcontroller's program memory if one is mounted on the board and contains flash ROM.

⑧ Flash writer select switch (FWSEL):

This switches the MSM66573 family microcontroller, if present, between normal and serial modes for rewriting the contents of its program memory with an external flash writer. The setting is ignored if MSM66573 family microcontroller does not contain flash ROM.

⑨ RS-232C connector (COM1):

This provides access to serial port 0 (UART) on the MSM66573 family microcontroller, if present, for such purposes as rewriting the contents of the flash ROM in user mode from the development host.

⑩ System reset switch (RESET):

This produces a system reset for the MSM66573 family microcontroller, if present. It does not affect the operation of the other controller possibilities.

⑪ Flash writer interrupt switch (FLASHWR):

This sends an external interrupt 0 to the MSM66573 family microcontroller, if present, for such purposes as rewriting the contents of the flash ROM in user mode in versions containing flash ROM.

⑫ Jumper pin pair 1 (J1):   This connects the signal from the flash writer interrupt push-button switch (FLASHWR) to MSM66573 pin 20, the Port 6.0 pin whose secondary function is external interrupt 0 input. If the user application system uses external interrupt 0, leave this pair open.

⑬ Interrupt selector jumper pin pair 2 (J2):

This selects the destination on the Oki ARM7TDMI™ emulation kit motherboard for the interrupt request signal (INTR/) from MSM60851 USB protocol engine LSI pin 12: the EXT external interrupt input (nEXT_INT) or the FIQ interrupt input (nFIQ_INT). The setting is invalid if there is no application program running on the Oki ARM7TDMI™ emulation kit motherboard.

⑭ DIP switches (ADSW):   These are for individually providing fixed input levels for the MSM66573 family microcontroller's dedicated input port pins (P12.7/A17 to P12.0/A10) and analog-to-digital converter reference voltage pins (VREF and AGND) when the user application system is not connected or does not use the pins. Their ON positions connect the VREF pin to the VCC5 level and the others pins to 0 V (GND). The settings have no effect on the other controller possibilities.

2.3   Hardware Specifications

The MSM60851 demo board has the following specifications.

USB protocol engine LSI: MSM60851 (USB Ver. 1.0 specifications)

User interfaces: One microcontroller interface connector,
                                              supporting buses with separate or multiplexed
                                              address and data lines
                                              One ARM7TDMI interface for connecting an Oki
                                              ARM7TDMI™ emulation kit motherboard

USB interface: One Type B USB connector

Other: Built-in MSM66573 family control circuits

3　Microcontroller Interface

This Chapter describes the microcontroller interface block, the peripheral circuits connecting the MSM60851 demo board to an external microcontroller.

The other two controller possibilities, a member of the MSM66573 family mounted on the board and an Oki ARM7TDMI™ emulation kit motherboard, are described in Chapters 4 "MSM66573 Interface" and 5 "ARM Interface," respectively.

3.1   Microcontroller Interface Connector (UC1)

The MSM60851 demo board has a single interface connector for connecting it to an external microcontroller for debugging application programs. This connector is called the microcontroller interface connector.
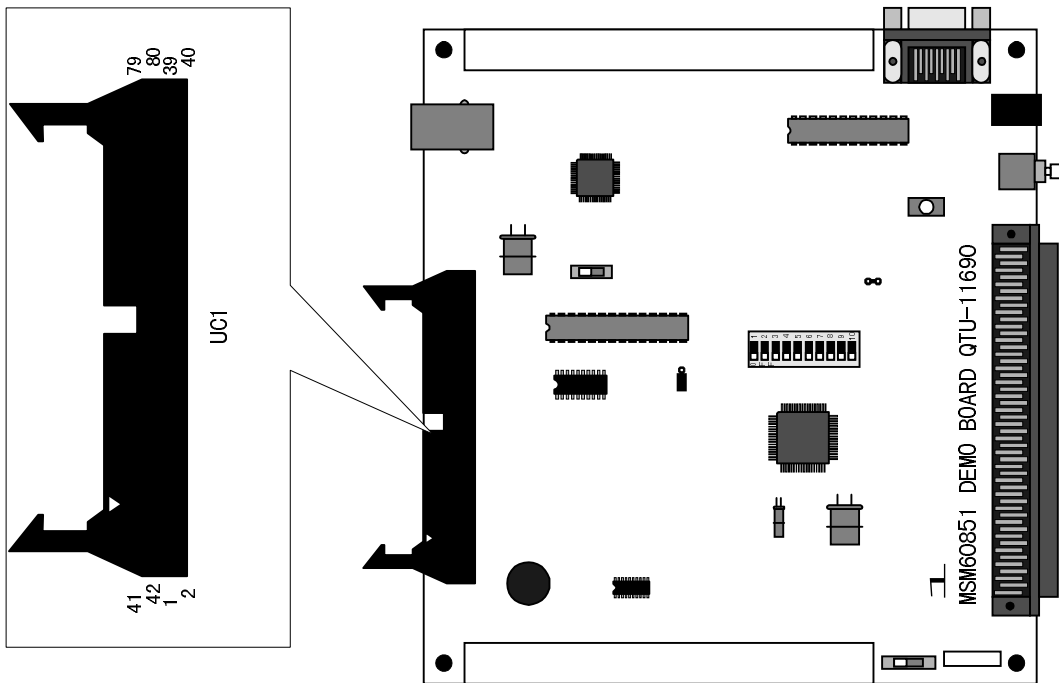
Figure 3-1   Microcontroller Interface Connector (UC1)

Connecting it to the microcontroller's external device access bus with an 80-pin flat cable permits debugging of the application program controlling the MSM60851 USB protocol engine LSI.

This interface uses the following connectors.

- **Cable Compression Connector**

    Manufacturer: Hirose Denki

    Model Number: HIF6-80D-1.27R

- **Pin Header (connector on board)**

    Manufacturer: Hirose Denki

    Model Number: HIF6-80PA-1.27DS (right angle)
                         HIF6-80PA-1.27DSA (straight)

The pin assignments and signal descriptions for this connector appear below.
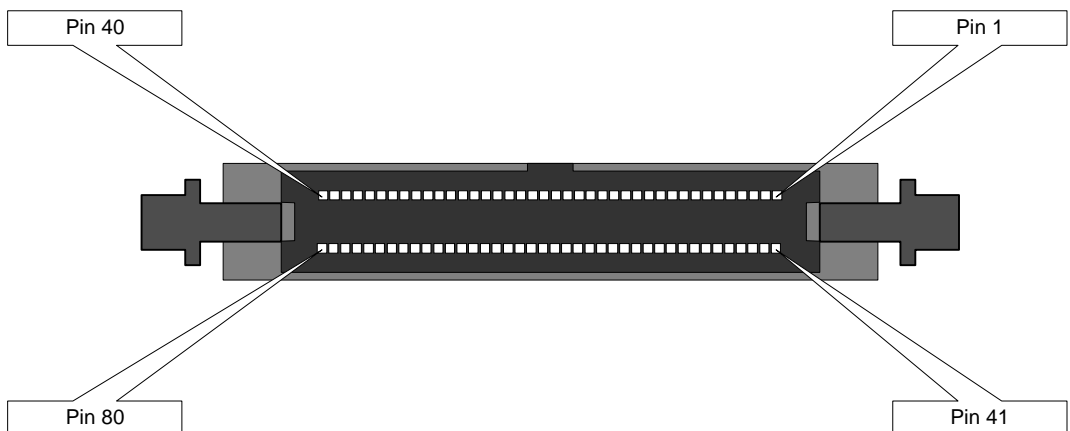
Figure 3-2   Microcontroller Interface Connector (UC1) Pin Layout

Pin Assignments for Microcontroller Interface Connector (UC1)					
Pin No.	**Signal Name**	**I/O**	**Pin No.**	**Signal Name**	**I/O**
1	VCC5	I	41	VCC5	I
2	VCC5	I	42	VCC5	I
3	ABUS0	I	43	ABUS2	I
4	ABUS1	I	44	ABUS3	I
5	ABUS4	I	45	ABUS6	I
6	ABUS5	I	46	ABUS7	I
7	GND	I	47	GND	I
8	GND	I	48	GND	I
9	A/DBUS0	I/O	49	A/DBUS2	I/O
10	A/DBUS1	I/O	50	A/DBUS3	I/O
11	A/DBUS4	I/O	51	A/DBUS6	I/O
12	A/DBUS5	I/O	52	A/DBUS7	I/O
13	DBUS8	I/O	53	DBUS10	I/O
14	DBUS9	I/O	54	DBUS11	I/O
15	DBUS12	I/O	55	DBUS14	I/O
16	DBUS13	I/O	56	DBUS15	I/O
17	GND	I	57	GND	I
18	GND	I	58	GND	I
19	RD/	I	59	WR/	I
20	GND	I	60	GND	I
21	GND	I	61	GND	I
22	ALE	I	62	N.C.	-
23	GND	I	63	GND	I
24	GND	I	64	GND	I
25	CS/	I	65	DREQ/	O
26	GND	I	66	GND	I
27	GND	I	67	GND	I
28	INT_REQ/	O	68	DACK	I
29	GND	I	69	GND	I
30	GND	I	70	GND	I
31	RESET/	I	71	ADSEL	I
32	N.C.	-	72	N.C.	-
33	N.C.	-	73	N.C.	-
34	GND	I	74	GND	I
35	N.C.	-	75	GND	I
36	N.C.	-	76	N.C.	-
37	N.C.	-	77	GND	I
38	N.C.	-	78	GND	I
39	N.C.	-	79	N.C.	-
40	N.C.	-	80	N.C.	-

VCC5:	Reference voltage for the interface between the MSM60851 demo board and the external microcontroller. Connect these to the microcontroller's operating voltage. Note, however, that the permissible range is the same as that for the MSM60851's VCC5 pin.
ABUS[7:0]:	Address bus for the interface between the MSM60851 demo board and an external microcontroller with separate address and data lines. If the external microcontroller multiplexes the two, leave these open.
A/DBUS[7:0]:	Address/data bus for the interface between the MSM60851 demo board and the external microcontroller. If the external microcontroller has separate address and data lines, connect these to the data bus. If it multiplexes the two, connect these to the address bus.
DBUS[15:8]:	Data bus for the interface between the MSM60851 demo board and an external microcontroller with a 16-bit DMA controller. Otherwise, leave these open.
RD/:	Negative-logic read signal from the external microcontroller.
WR/:	Negative-logic write signal from the external microcontroller.
ALE:	Positive-logic address latch enable signal from an external microcontroller with multiplexed address and data lines. If the external microcontroller has separate address and data lines, leave this open.

CS/:   Negative-logic chip select signal from the external microcontroller.

DREQ/:   Negative-logic DMA request signal to the external microcontroller with a DMA controller. Otherwise, leave this open.

INT_REQ/:   Negative-logic interrupt request signal to the external microcontroller. The MSM60851 USB protocol engine LSI asserts this line, for example, when it receives a valid packet. For details, refer to the MSM60851 Data Sheet.

DACK: DMA acknowledge signal from an external microcontroller with a DMA controller. Otherwise, leave this open.

RESET/:   Negative-logic system reset signal to the MSM60851. The power on sequence must assert this line for at least 100 ms.

ADSEL: Address/data bus selector pin. "H" level input specifies multiplexing of the address and lower eight bits of the data over the A/DBUS[7:0] lines; "L" level, use of the separate address bus, ABUS[7:0].

■ **Note 1** ■

VCC5 power can also come from the included power supply cable. For details, see Section 6.3 "Power Supply Cable Connections." For the permissible voltage range, refer to the MSM60851 Data Sheet.

■ **Reference** ■

For detailed interface timing, refer to the MSM60851 Data Sheet.

3.2 Microcontroller Interface Configuration

This Section describes circuit configurations for the interface between the MSM60851 demo board and the external microcontroller.

3.2.1 Bus Interfaces
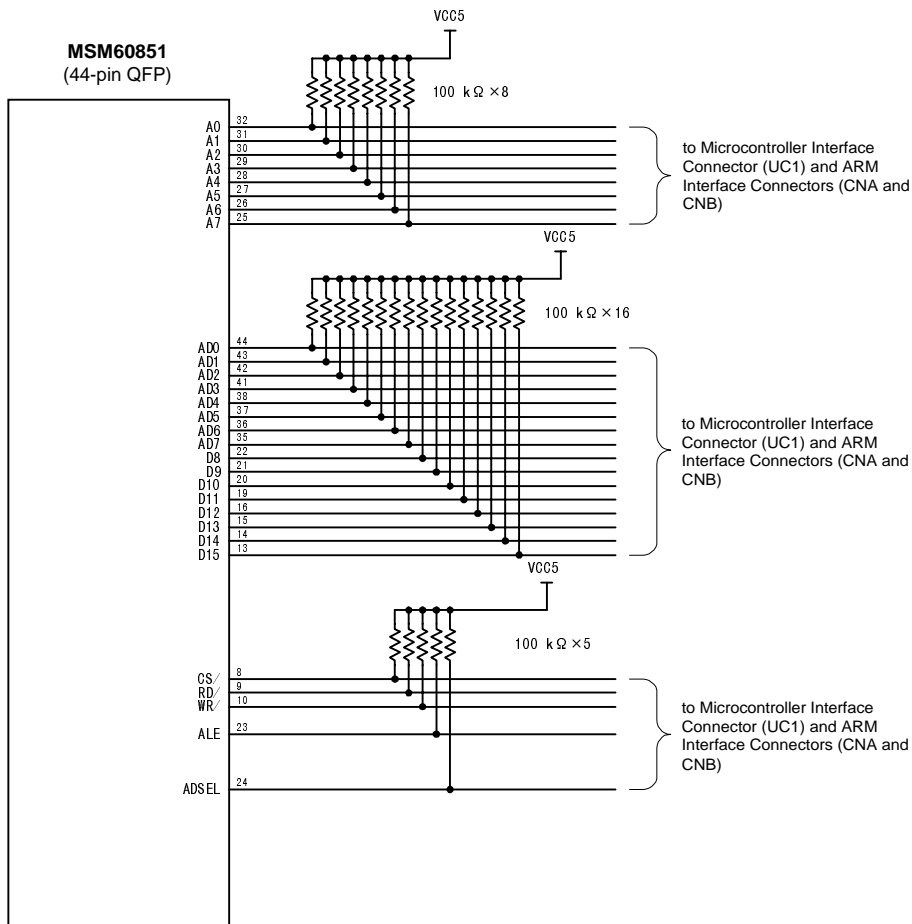
Figure 3-3 Microcontroller Interface Circuits (Buses)

Figure 3.3 shows the MSM60851 demo board's interface circuits connecting to the microcontroller's external device access address and data buses.

As the Figure shows, the board provides built-in 100-kΩ pull-up resistors for all address, data, and control signal lines.

3.2.2   Other Interfaces
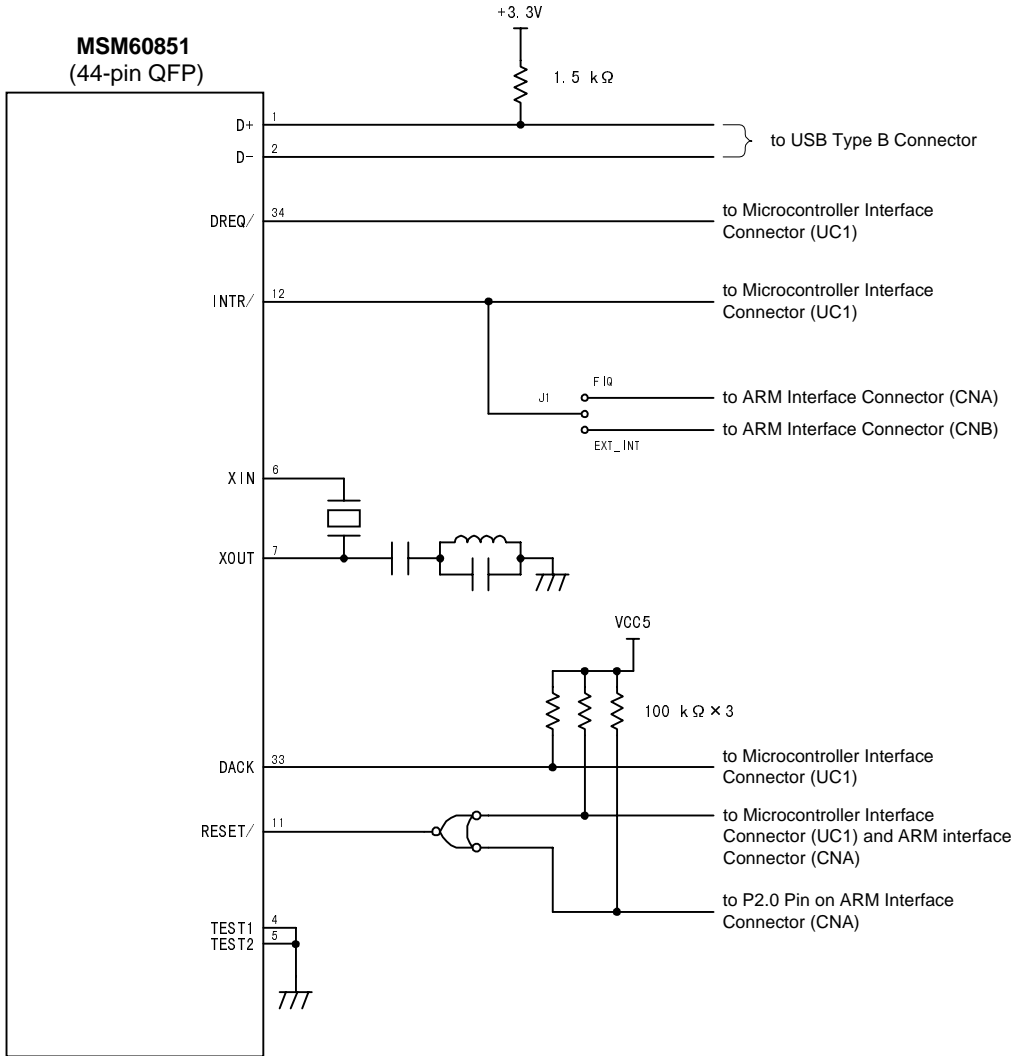
Figure 3-4   Microcontroller Interface Circuits (Others)

Figure 3.4 shows the MSM60851 demo board's other interface circuits connecting to the external microcontroller.

As the Figure shows, the board provides built-in 100-kΩ pull-up resistors for the RESET/ and DACK signal lines.

4　MSM66573 Interface

This Chapter describes the circuit configuration, address space, etc. when the controller is a member of the MSM66573 family mounted on the board.

The third controller possibility, an Oki ARM7TDMI™ emulation kit motherboard, is described in Chapter 5 "ARM Interface."

4.1 System Configuration

Figure 4.1 shows the connections that the MSM60851 demo board makes between the MSM60851 and a member of the MSM66573 family mounted on the board.
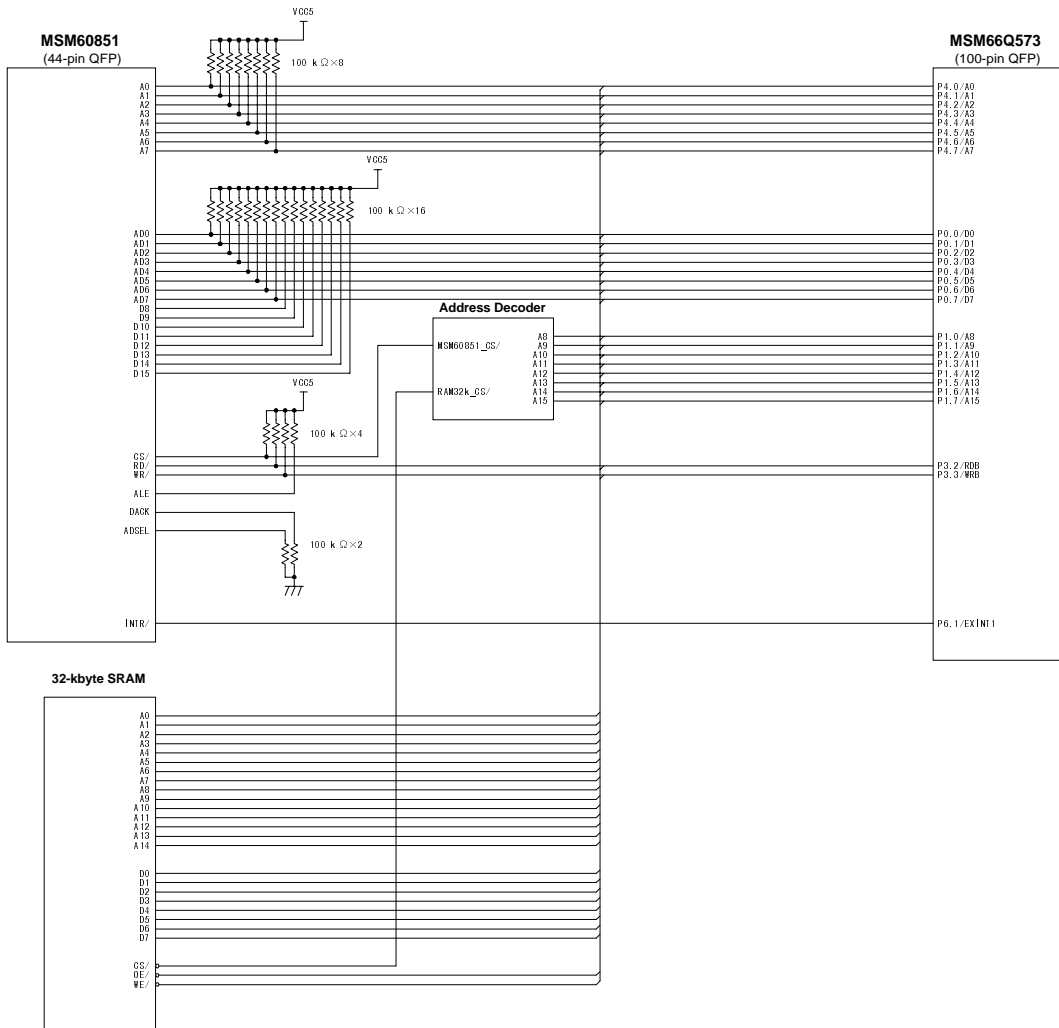
Figure 4-1   MSM60851-MSM66573 Connections

These connections assign the MSM60851 and 32 kilobytes of RAM to the MSM66573 external memory space.

Figure 4.2 shows the resulting data memory address mapping for a member of the MSM66573 family.

	0x0000
SFR Region	
0x01FF	0x0200
Internal RAM Region (4 Kbyte)	
	Internal Addresses
0x11FF	0x1200
MSM60851 Access Region	
0x12FF	0x1300
External Device Access Region	
0x7FFF	0x8000
	External Addresses
External RAM Region (32 Kbyte)	
0xFFFF	
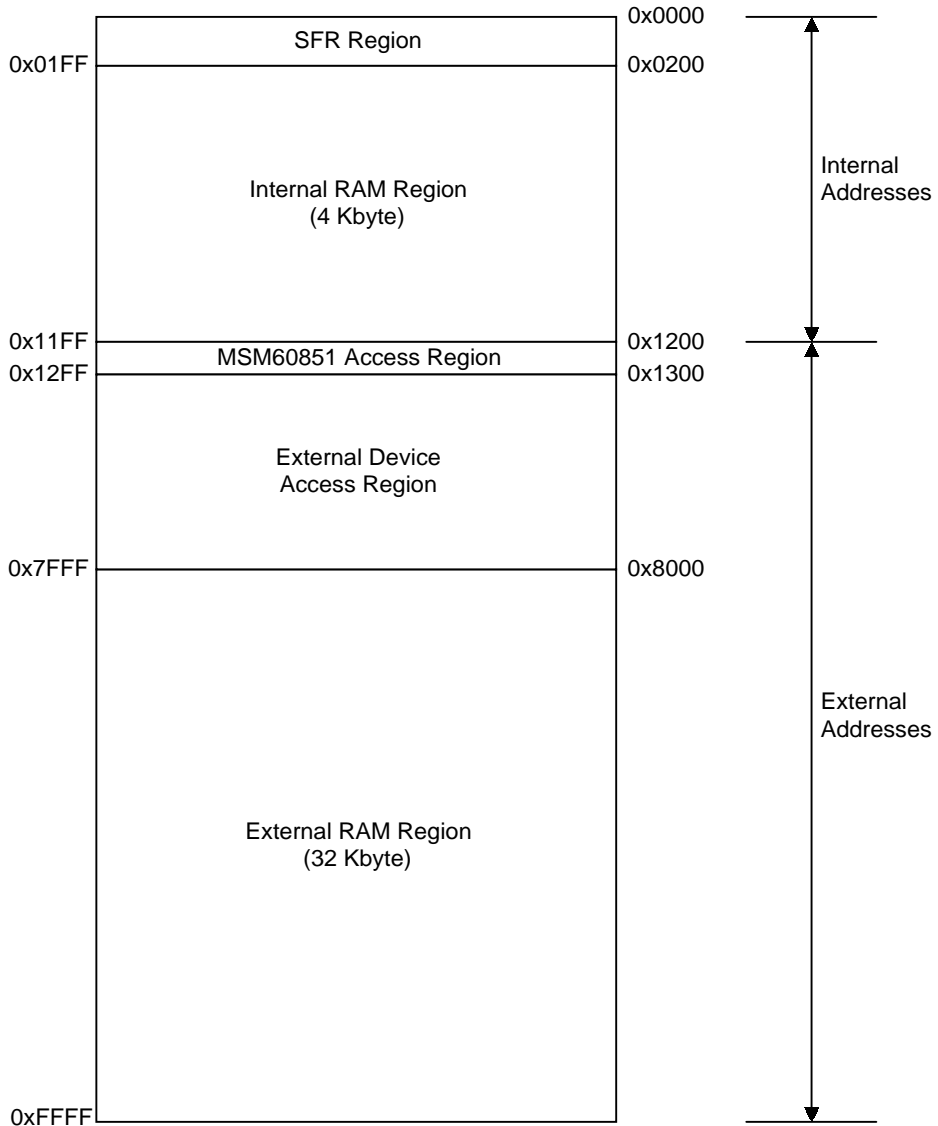
Figure 4-2   Address Mapping for MSM66573 Family

The regions in Figure 4.2 have the following functions.

SFR region: Special Function Registers for the member of the MSM66573 family. For details, refer to the MSM66573 User's Manual.

Internal RAM region: Onboard data memory for the member of the MSM66573 family. For details, refer to the MSM66573 User's Manual.

MSM60851 access region: MSM60851 internal registers (See Section 4.4.4 "MSM60851 Internal Register Map") mapped to the MSM66573 external memory address space for access over the separate external address bus using MSM66573 I/O port secondary functions. For details, refer to the MSM66573 User's Manual. (See Note 1.)

External device access region:

Addresses unused by this board and thus available for accessing other devices in the user application system. They too are mapped to the MSM66573 external memory address space for access over the separate external address bus using MSM66573 I/O port secondary functions. For details, refer to the MSM66573 User's Manual. (See Note 1.)

External RAM region: This board's 32 kilobytes of data RAM, mapped to the MSM66573 external memory address space for access over the separate external address bus using MSM66573 I/O port secondary functions. For details, refer to the MSM66573 User's Manual. (See Note 1.)

■ **Note 1** ■

Accessing these devices requires configuring the corresponding I/O pins (Ports 0, 1, 3, and 4) to their secondary functions using the procedures in the MSM66573 Family User's Manual.

The designer must also remember that the address decoder on this board assumes that the application program uses the small model, with a maximum address space of 64 kilobytes.

■ **Caution** ■

This device is only available when the MSM66573 operating voltage (also the voltage supplied to the MSM60851 VCC5 pin) is +5.0 V.

4.2   User Application System Interface Connector (CN1)

The MSM60851 demo board has a single interface connector (CN1) for connecting the MSM66573 microcontroller mounted on it to the user application system.
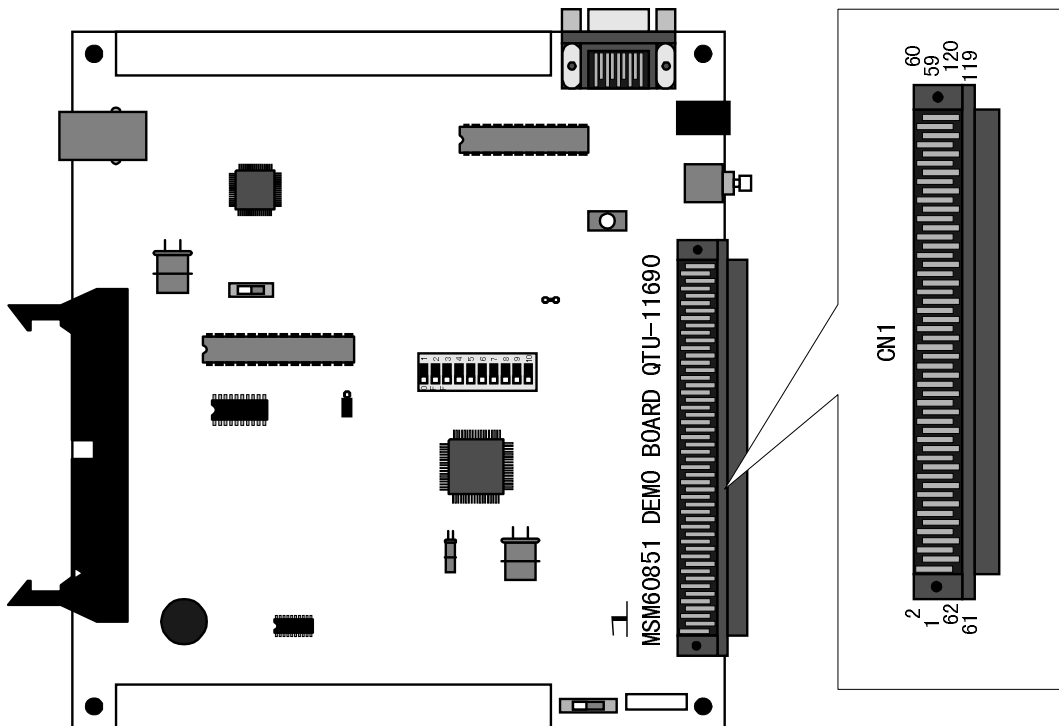
Figure 4-3   User Application System Interface Connector (CN1)

This connector provides access to all MSM66573 pins except EA/ (pin 34), XT0 (pin 36), XT1/ (pin 37), OSC0 (pin 39), and OSC1 (pin 40). (The EA/ pin is connected to the flash writer select switch (FWSEL); the others, to the internal oscillator circuit.)

With the addition of an optional adapter, this connector allows the MSM66573 microcontroller mounted on this board to control external devices in the user application system. Two such adapters are available: a flat cable version with a 120-pin shielded cable and a flexible cable version accepting a TQPACK socket that is pin-compatible with the MSM66573 family's 100-pin QFP socket. For further particulars on the adapters, see Chapter 7 "Appendices."

The following Table lists the pin assignments for the CN1 connector.

User Application System Interface Connector (CN1) Pin Assignments							
Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	P10.4	31	P5.7	61	P4.1	91	P7.0
2	P10.5	32	RES/	62	P4.2	92	P7.1
3	P10.7	33	NMI	63	P4.3	93	GND
4	P8.0	34	N.C.	64	P4.4	94	P7.2
5	P8.1	35	VCC5	65	P4.5	95	P7.4
6	P8.2	36	N.C.	66	P4.6	96	P7.5
7	P8.3	37	N.C.	67	P4.7	97	P10.0
8	P8.4	38	GND	68	P1.0	98	P10.1
9	P8.6	39	N.C.	69	P1.1	99	P10.2
10	P8.7	40	N.C.	70	P1.2	100	P10.3
11	P7.6	41	VCC5	71	P1.3	101	GND
12	P7.7	42	P11.0	72	P1.4	102	GND
13	VCC5	43	P11.1	73	P1.5	103	GND
14	GND	44	P11.2	74	P1.6	104	GND
15	P9.7	45	P11.3	75	P1.7	105	GND
16	P9.0	46	P11.6	76	P2.0	106	GND
17	P9.1	47	P11.7	77	P2.1	107	GND
18	P9.2	48	P3.1	78	P2.2	108	GND
19	P9.3	49	P3.2	79	P2.3	109	GND
20	P6.0	50	P3.3	80	VCC5	110	GND
21	P6.1	51	P0.0	81	VREF	111	GND
22	P6.2	52	P0.1	82	P12.0	112	GND
23	P6.3	53	P0.2	83	P12.1	113	GND
24	P6.4	54	P0.3	84	P12.2	114	GND
25	P6.5	55	P0.4	85	P12.3	115	GND
26	P6.6	56	P0.5	86	P12.4	116	GND
27	P6.7	57	P0.6	87	P12.5	117	GND
28	P5.4	58	P0.7	88	P12.6	118	GND
29	P5.5	59	GND	89	P12.7	119	GND
30	P5.6	60	P4.0	90	AGND	120	GND

N.C.: Not Connected

Note that the MSM60851 demo board uses some of these pins, making them unavailable to the user application system or available only by setting switches or jumpers. For details, see Section 4.3 "MSM66573 Peripheral Circuits" below.

4.3   MSM66573 Peripheral Circuits

The MSM60851 demo board includes hardware accessible only to a member of the MSM66573 family mounted on the board. This Section describes this hardware.

4.3.1   RS-232C Interface (COM1)

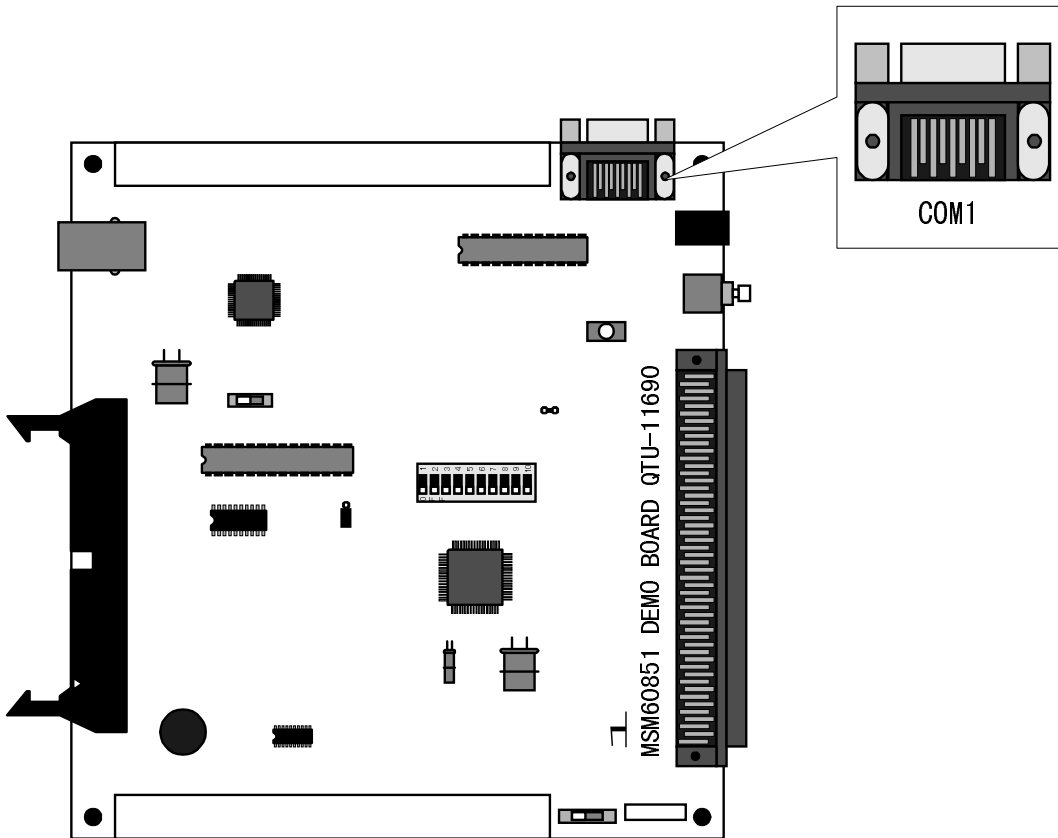This interface provides access to MSM66573 family serial port 0, secondary functions for Port 7 bits 0 and 1.

Figure 4-4   RS-232C Interface (COM1)

One use for this interface is rewriting the contents of the flash ROM in an MSM66Q573 or other version with it present in user mode from the development host. (See Note 2.)

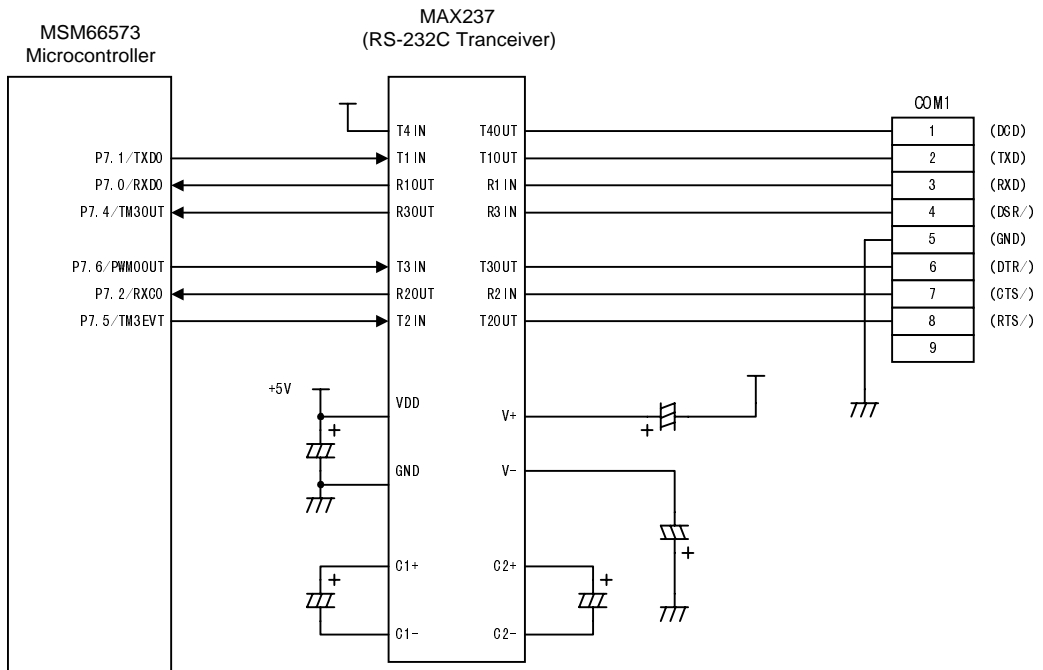Figure 4.5 shows the connections for this block.

Figure 4-5   RS-232C Interface (COM1) Peripheral Circuits

The signal lines have the following functions.

TXD: Asynchronous serial I/O transmit signal, secondary function for the MSM66573 Port 7.1 pin. Using it requires setting the baud rate and configuring the pin for its secondary function.

RXD: Asynchronous serial I/O receive signal, secondary function for the MSM66573 Port 7.0 pin. Using it requires setting the baud rate and configuring the pin for its secondary function.

DSR/:   Asynchronous serial I/O control signal, secondary function for the MSM66573 Port 7.4 pin. Using it requires configuring the pin for input and providing software control.

DTR/:   Asynchronous serial I/O control signal, secondary function for the MSM66573 Port 7.6 pin. Using it requires configuring the pin for output and providing software control.

CTS/:   Asynchronous serial I/O control signal, secondary function for the MSM66573 Port 7.2 pin. Using it requires configuring the pin for input and providing software control.

RTS/:   Asynchronous serial I/O control signal, secondary function for the MSM66573 Port 7.5 pin. Using it requires configuring the pin for output and providing software control.
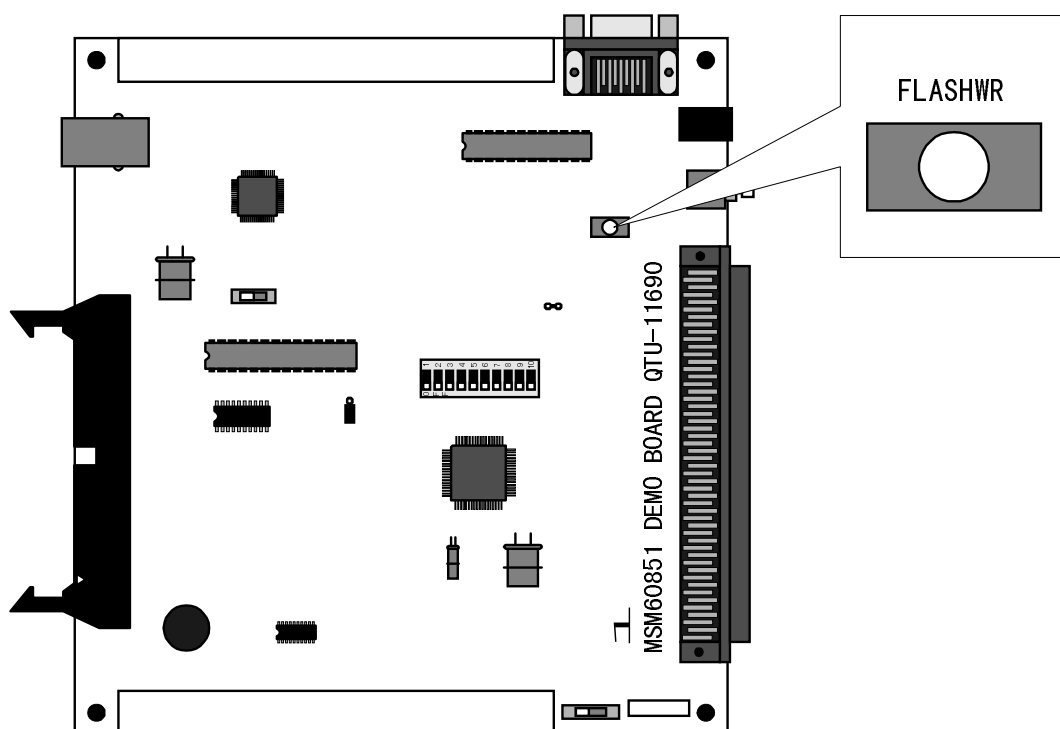
■ **Note 2** ■

This device is only available when the MSM66573 operating voltage (also the voltage supplied to the MSM60851 VCC5 pin) is +5.0 V.

Do not use the pins in this block in the user application system.

4.3.2   Flash Writer Interrupt Switch (FLASHWR)

Pressing this switch sends an external interrupt 0 signal, secondary function for the MSM66573 Port 6.0 pin.

Figure 4-6   Flash Writer Interrupt Switch (FLASHWR)

This is used in conjunction with the RS-232C interface described above for rewriting the contents of the flash ROM in an MSM66Q573 or other version with it present in user mode from the development host.

Figure 4.7 shows the connections for this block.
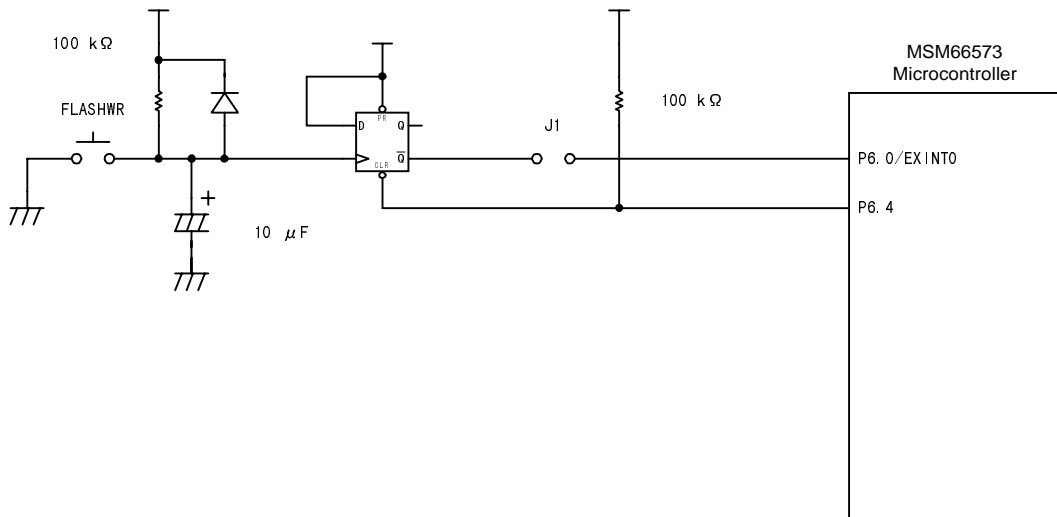
Figure 4-7   Flash Writer Interrupt Switch (FLASHWR) Peripheral Circuits

As Figure 4.7 shows, the external interrupt 0 signal uses negative logic.

Note that the signal remains at "L" level after the switch is pressed, and the interrupt service routine must reset it with an asynchronous clear signal to the switch input sense circuit from the Port 6.4 pin.

If this switch is not used, leaving the jumper pin pair J1 open makes the Port 6.0 pin available to the user application system.

4.3.3   Flash Writer Select Switch (FWSEL)

This switch switches an MSM66Q573 or other version with flash ROM present to serial mode for rewriting the contents of its program memory with an Oki FW66500S Series flash writer.
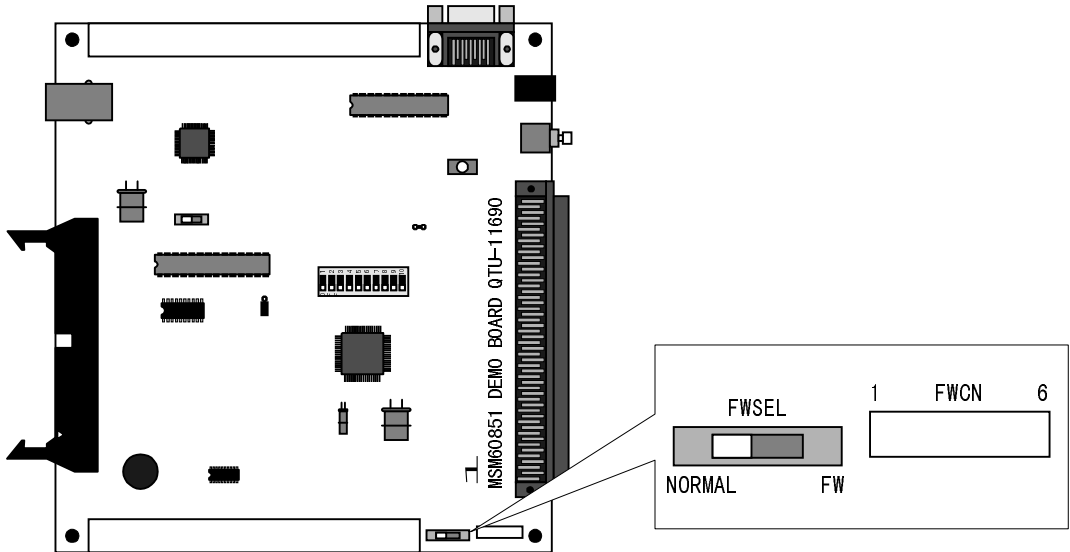
Figure 4-8   Flash Writer Select Switch (FWSEL)

Figure 4.9 shows the connections for this block.
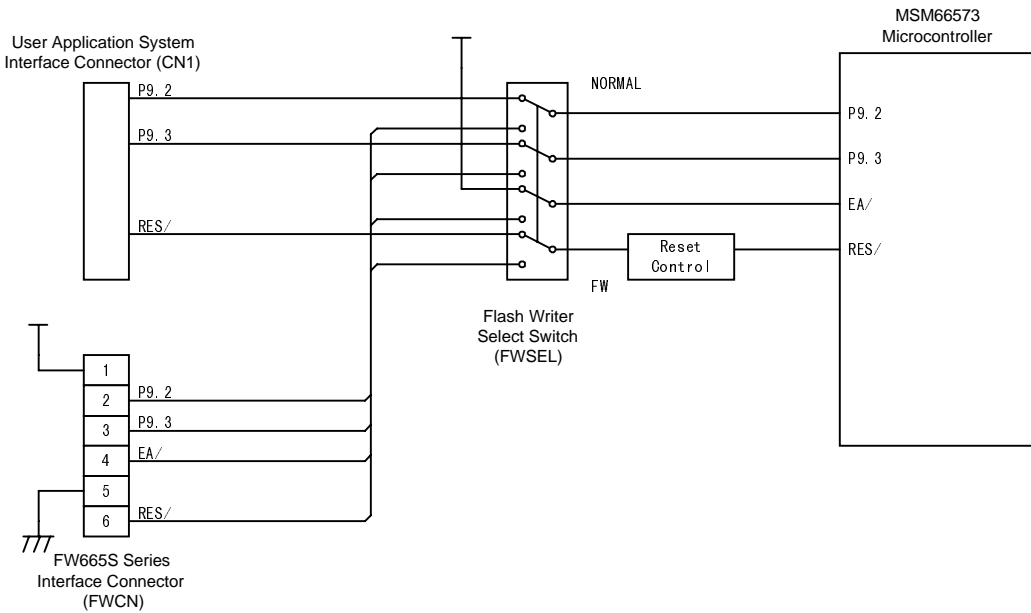
Figure 4-9   Flash Writer Select Switch (FWSEL) Peripheral Circuits

As Figure 4.9 shows, setting this switch to its NORMAL position disconnects the flash writer, makes the Port 9.2, Port 9.3, and RES/ pins available to the user application system via the MSM66573 user interface connector (CN1), and internally connects the EA/ pin to "H" level.

To use a flash writer, set this switch to its FW position and then make the connections.

4.3.4   System Reset Switch (RESET)

This push-button switch generates a system reset signal for the MSM66573 microcontroller mounted on the MSM60851 demo board.
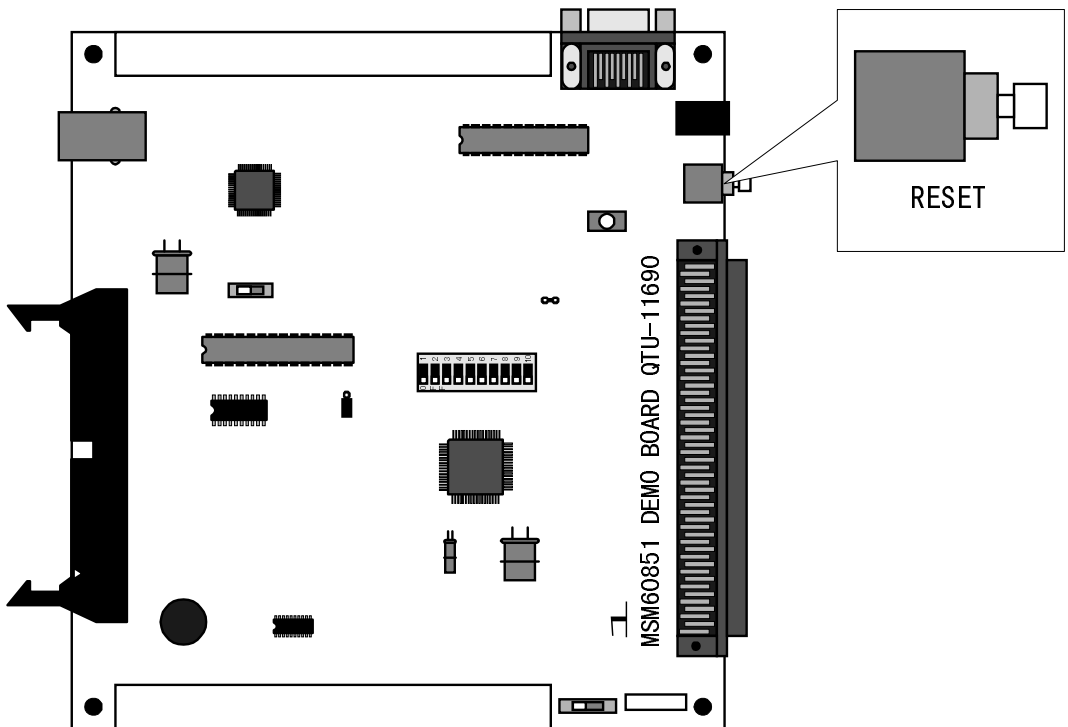
Figure 4-10   System Reset Switch (RESET)

Figure 4.11 shows the connections for this block.
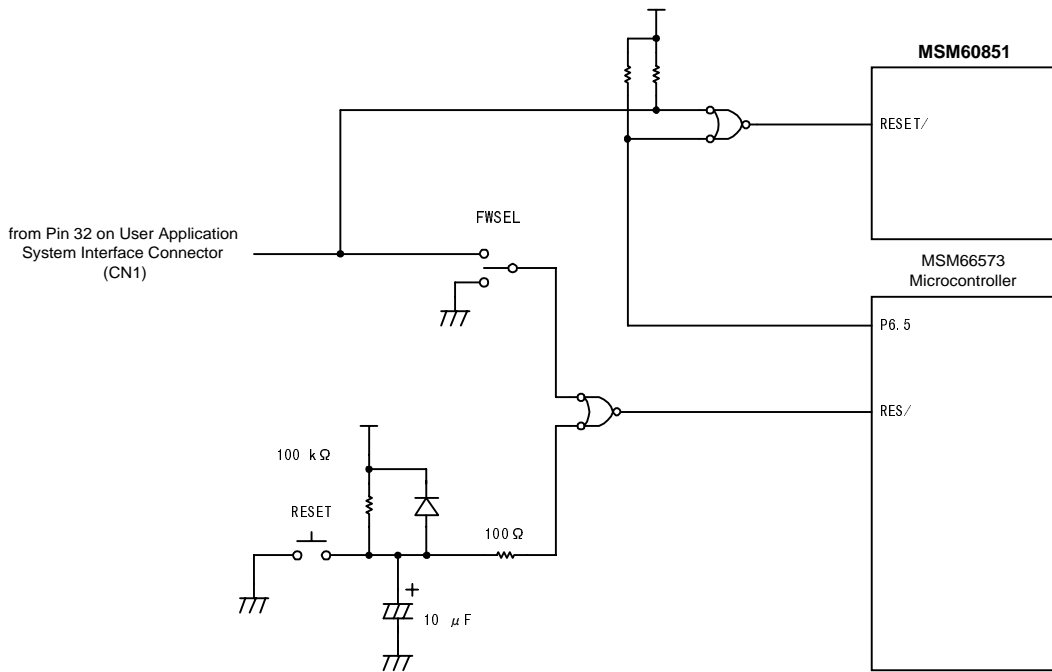
Figure 4-11   System Reset Switch (RESET) Peripheral Circuits

As Figure 4.11 shows, the MSM66573 system reset input ORs signals from two sources: the RESET switch and, with the normal flash writer select switch setting, from pin 32 on the user application system interface connector (CN1). (During flash writer operation, the connection is to ground.)

The latter source also feeds, via an OR gate, into the MSM60851 RESET/ pin. MSM60851 reset signals are available as Port 6.5 inputs.

4.3.5   DIP Switches (ADSW)

The switches individually provide fixed input levels for the MSM66573 family microcontroller's dedicated input port pins (P12.7/A17 to P12.0/A10) and analog-to-digital converter reference voltage pins (VREF and AGND) when the user application system is not connected or does not use the pins.
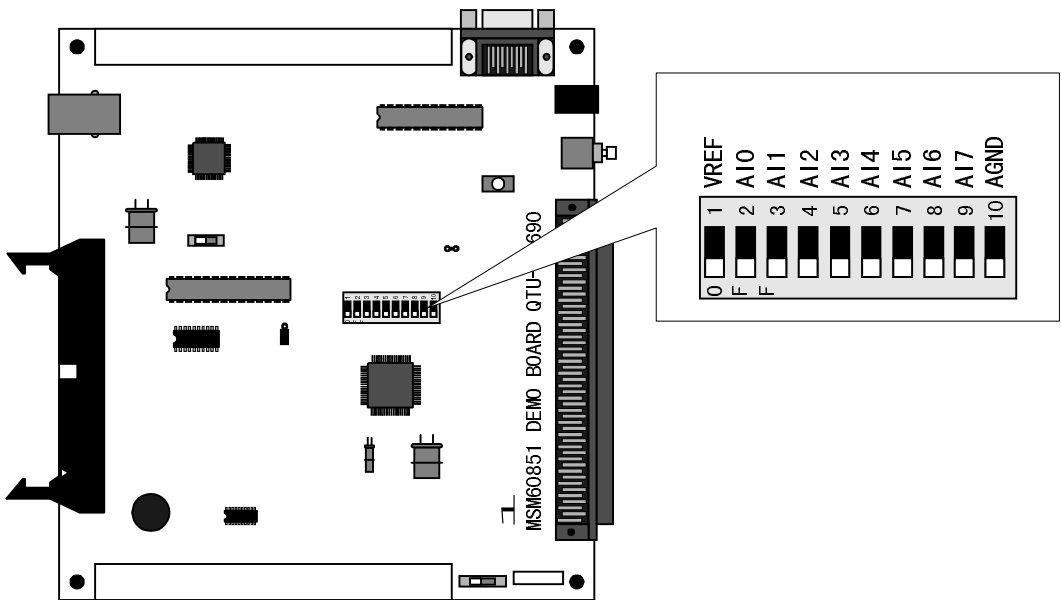
Figure 4-12   DIP Switches (ADSW)

Figure 4.13 shows the connections for this block.
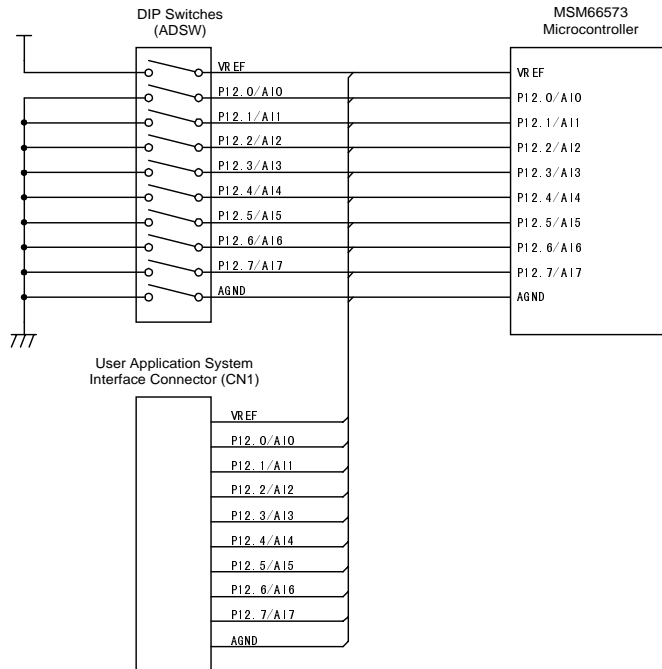
Figure 4-13   DIP Switches (ADSW) Peripheral Circuits

As Figure 4.13 shows, these switches offer settings at the bit level. Their ON positions connect the VREF pin to the VCC5 level and the others pins to 0 V (GND).

■ **Note 3** ■

Note that the ON position also connects the same level to the corresponding pin on the user application system interface connector (CN1), so be sure to leave that pin open.

4.4   Notes on MSM66573 Interfaces

This Section describes points to keep in mind when designing MSM60851 application programs for a member of the MSM66573 family.

4.4.1   MSM66573 Operating Voltage

A MSM66573 microcontroller mounted on the MSM60851 demo board supports an operating voltage (VCC5) range from +3.0 to +5.0 V. The following onboard support devices, however, only operate at +5.0 V.

- **RS-232C interface**

- **External RAM (32 kilobytes)**

If the user application system operates at a lower voltage, remove these two devices from their sockets before turning on the power.
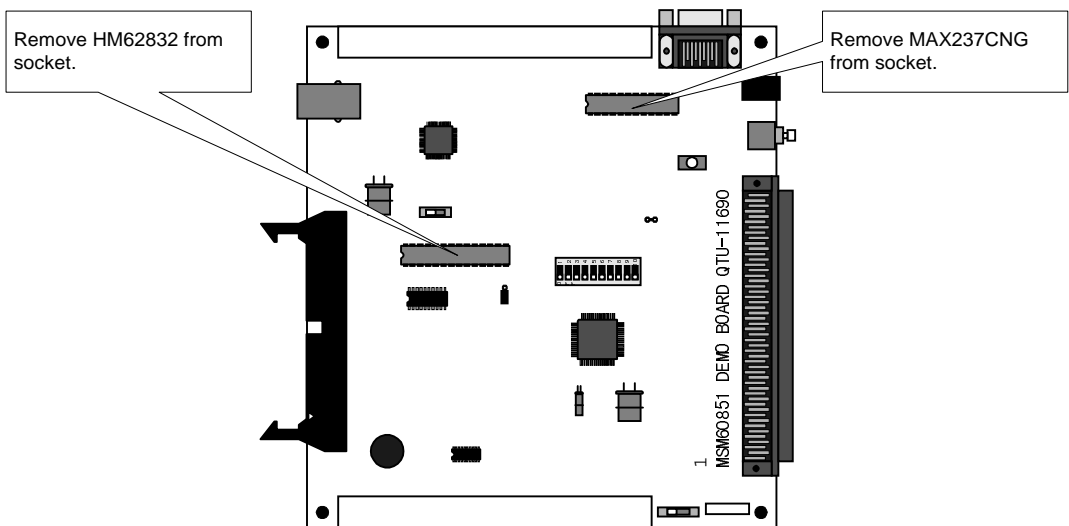
Figure 4-14   Removing Support Devices

■ Note ■

Make sure that the system power is off before removing these devices.

4.4.2   MSM60851 Reset Signals

Figure 4.15 shows the circuit configuration for the MSM60851 RESET/ pin.
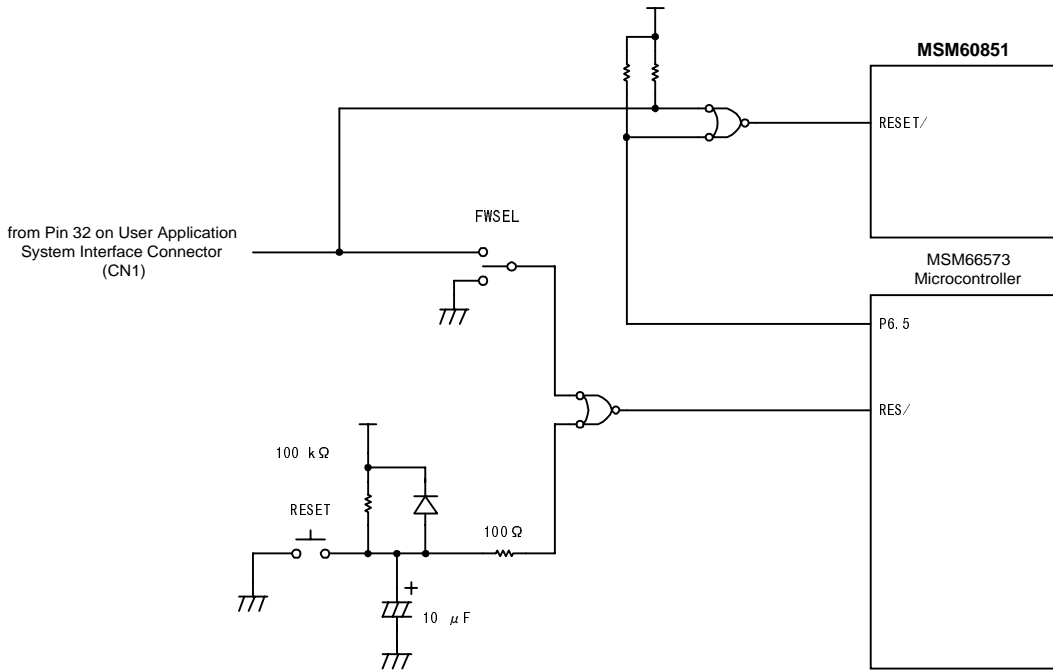
Figure 4-15   Reset Pin (RESET/) Peripheral Circuits

If there is no user application system present, the only available source for reset signals is the Port 6.5 pin on the MSM66573 microcontroller.

For further details on the MSM60851 RESET/ pin, refer to the MSM60851 Data Sheet.

4.4.3   Accessing External Data Memory

To access the MSM60851 and 32-kilobyte external RAM on the MSM60851 demo board, the application program must reconfigure the following port pins.

■ Example ■

- Write 0xff to the Port 1 and Port 4 mode registers (P1IO and P410) to configure all pins for output.

- Write 0x0 (the default setting) to the Port 0 mode register (P0IO) to configure all pins for input.

- Write 0xc to the Port 3 mode register (P3IO) to configure the P3.2 (read strobe) and P3.3 (write strobe) pins for output.

- Write 0xff to the port secondary function registers P0SF, P1SF, and P4SF and 0x0c to P3SF to configure the above pins for their secondary functions.

The above settings configure the MSM66573 for accessing the MSM60851, the 32-kilobyte RAM, and other devices in its external data memory space.

For further details, refer to the MSM66573 Family User's Manual.

4.4.4   MSM60851 Internal Register Map

The following Table lists the addresses for accessing MSM60851 internal registers from the MSM66573 microcontroller.

MSM60851 Internal Registers for MSM66573 Microcontroller		
Access		**Register Name**
Read	Write	
0x12c0	0x1240	Device Address Register
0x12c1	0x1241	Device State Register
0x12c2	-	Packet Error Register
0x12c3	-	Receive FIFO Register
0x12c4	-	Send FIFO Register
0x12c8	0x1248	Endpoint Packet Ready Register
0x12c9	-	Endpoint 0 Receive Byte Count Register
0x12ca	-	Endpoint 1 Receive Byte Count Register
0x12cb	-	Endpoint 2 Receive Byte Count Register
-	0x124e	Flash Send FIFO
-	0x124f	Software Reset
0x12d0	-	bmRequestType Setup Register
0x12d1	-	bRequest Setup register
0x12d2	-	wValue LSB Setup Register
0x12d3	-	wValue MSB Setup Register
0x12d4	-	wIndex LSB Setup Register
0x12d5	-	wIndex MSB Setup Register
0x12d6	-	wLength LSB Setup Register
0x12d7	-	wLength MSB Setup Register
0x12da	0x125a	Polarity Selection Register
0x12db	0x125b	Interrupt Enable Register
0x12dc	-	Interrupt Status Register
0x12dd	0x125d	DMA Control Register
0x12de	0x125e	DMA Interval Register
0x12e0	-	Endpoint 0 Receive Control Register
0x12e1	-	Endpoint 0 Receive General-Purpose Register
0x12e2	0x1262	Endpoint 0 Receive Payload Register
0x12e4	0x1264	Endpoint 1 Control Register
0x12e5	0x1265	Endpoint 1 General-Purpose Register
0x12e6	0x1266	Endpoint 1 Payload Register
0x12f0	-	Endpoint 0 Send Control Register
0x12f1	-	Endpoint 0 Send General-Purpose Register
0x12f2	0x1272	Endpoint 0 Send Payload Register
0x12f3	0x1273	Endpoint 0 General-Purpose Register
0x12f4	0x1274	Endpoint 2 Control Register
0x12f5	0x1275	Endpoint 2 General-Purpose Register
0x12f6	0x1276	Endpoint 2 Payload Register
0x1240	-	Endpoint 0 Receive FIFO
0x1241	-	Endpoint 1 Receive FIFO
0x1242	-	Endpoint 2 Receive FIFO
-	0x12c0	Endpoint 0 Send FIFO
-	0x12c1	Endpoint 1 Send FIFO
-	0x12c2	Endpoint 2 Send FIFO

4.4.5   MSM66573 Operating Frequencies

The operating frequencies for the MSM66573 microcontroller mounted on the MSM60851 demo board are 27.6480 MHz (OSC) and 32.768 kHz (XT).

5　ARM Interface

This Chapter describes the address spaces, system configuration, etc. for a demo system running an application program on an Oki ARM7TDMI™ emulation kit motherboard connected to the MSM60851 demo board.

5.1   System Configuration

Figure 5.1 shows the system connections between the MSM60851 on the MSM60851
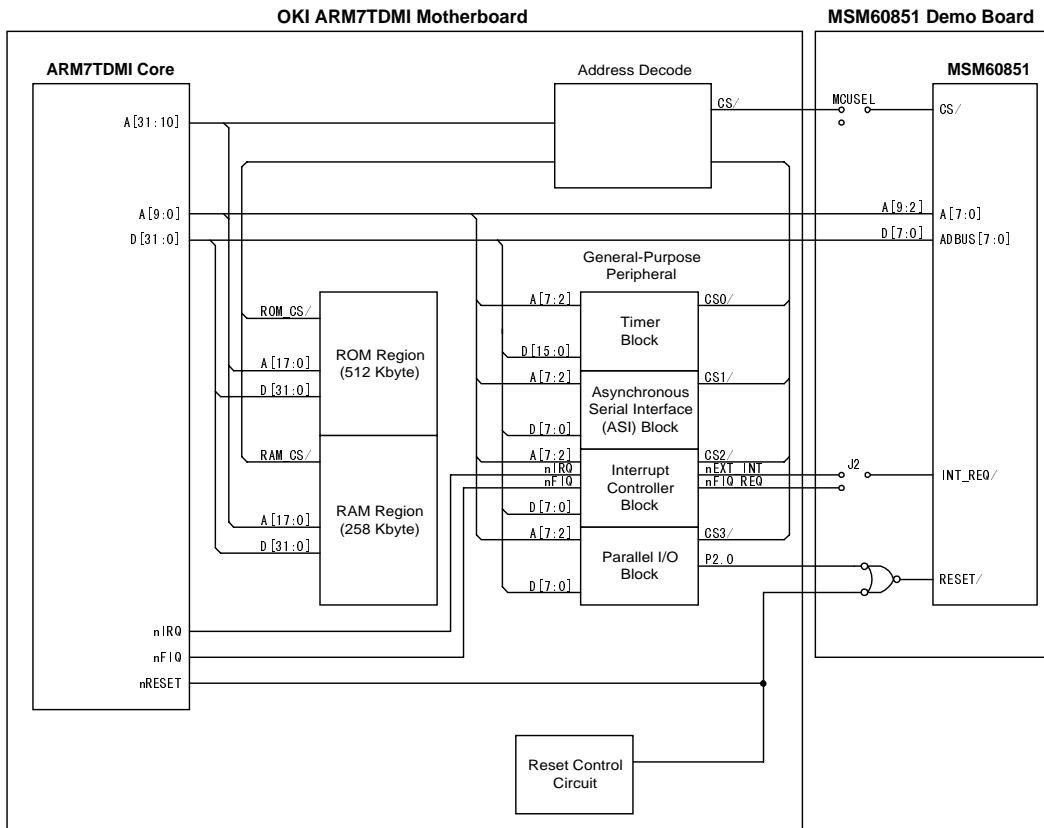demo board and the Oki ARM7TDMI™ emulation kit motherboard.

Figure 5-1   MSM60851-Oki ARM7TDMI Motherboard Peripheral Circuits

Figure 5.2 shows how connecting the MSM60851 changes the address map for the
ARM7TDMI core.
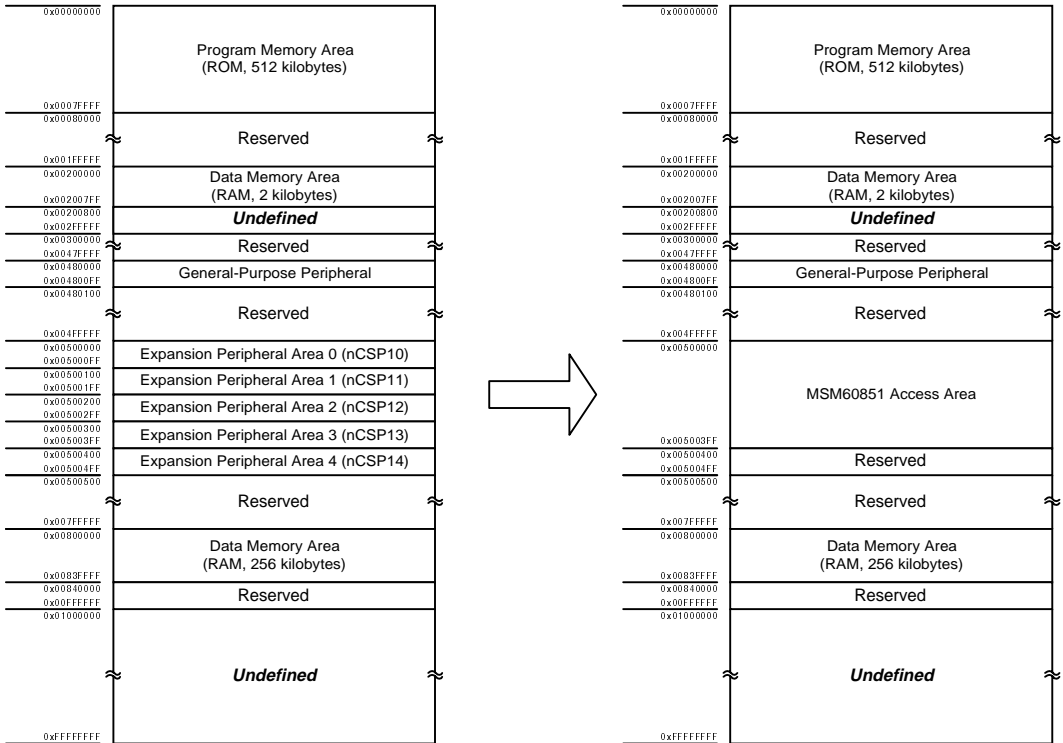
Figure 5-2   ARM7TDMI Core Address Map

As the left side of Figure 5.2 shows, the Oki ARM7TDMI™ emulation kit motherboard provides five expansion peripheral areas. As the right side shows, the MSM60851 demo board uses four of these to provide an interface between the ARM7TDMI core and the MSM60851. (See Note 1.)

For further details on the individual areas, refer to the Oki ARM7TDMI Motherboard User's Guide.

■ **Note 1** ■

Connecting the MSM60851 automatically disables the insertion of wait cycles for expansion peripherals in expansion peripheral areas 1 to 4.

5.2 Oki ARM7TDMI Motherboard Peripheral Circuits

The MSM60851 demo board includes hardware usable only with the Oki ARM7TDMI™ emulation kit motherboard connected to the board. This Section describes this hardware.

5.2.1 Interrupt Selector Jumper Pin Pair 2 (J2)

This jumper setting selects the destination on the Oki ARM7TDMI™ emulation kit motherboard for the interrupt request signal (INTR/) from MSM60851 pin 12: the EXT external interrupt input (nEXT_INT) or the FIQ interrupt input (nFIQ_INT). Select the interrupt mapping best matching the needs of the application program and the user application system.
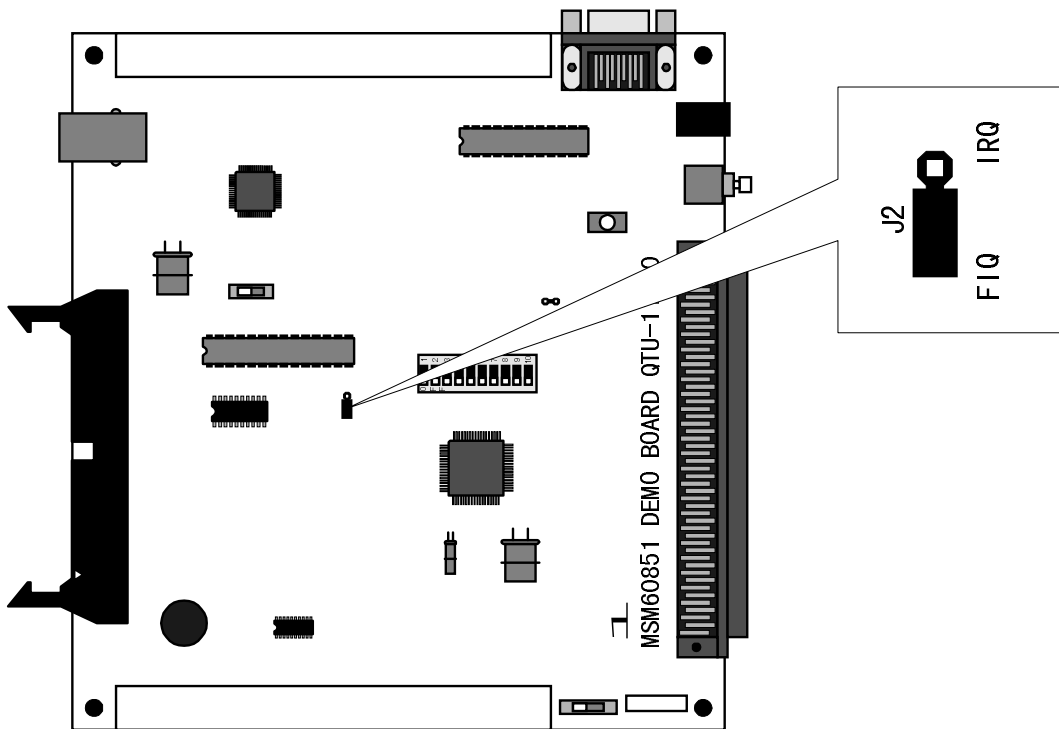

Figure 5-3   Interrupt Selector Jumper Pin Pair 2 (J2)

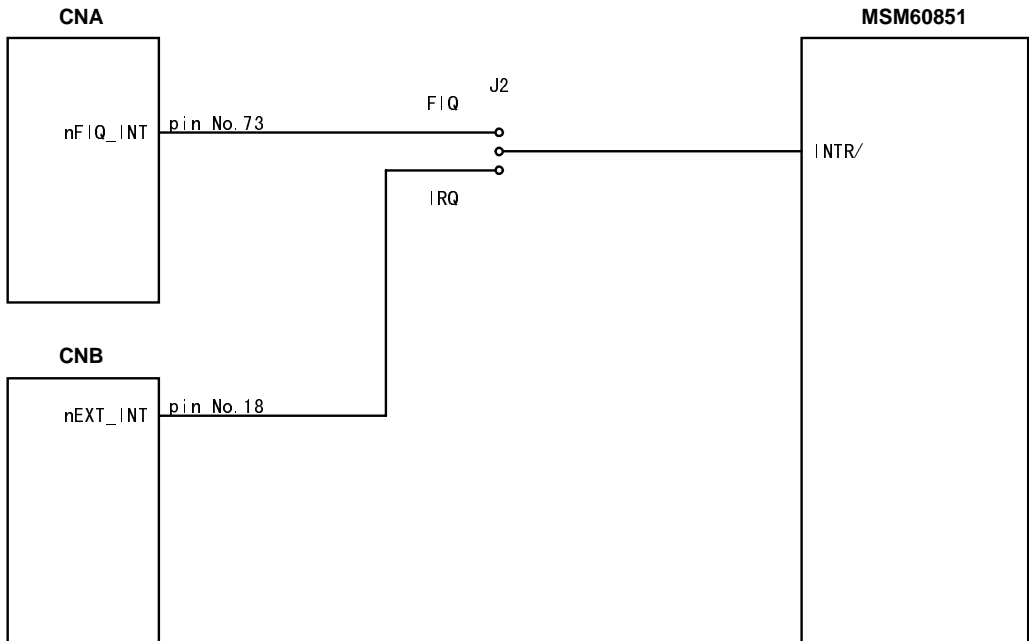Figure 5.4 shows the connections for this block.

Figure 5-4   Interrupt Selector Jumper Pin Pair 2 (J2) Peripheral Circuits

5.3 Notes on ARM Interface

This Section describes points to keep in mind when designing MSM60851 application programs for the Oki ARM7TDMI™ emulation kit motherboard.

5.3.1 MSM60851 Reset Signals

Figure 5.5 shows the circuit configuration for the MSM60851 RESET/ pin with the Oki ARM7TDMI™ emulation kit motherboard connected.

OKI ARM7TDMI Motherboard   **MSM60851 Demo Board**
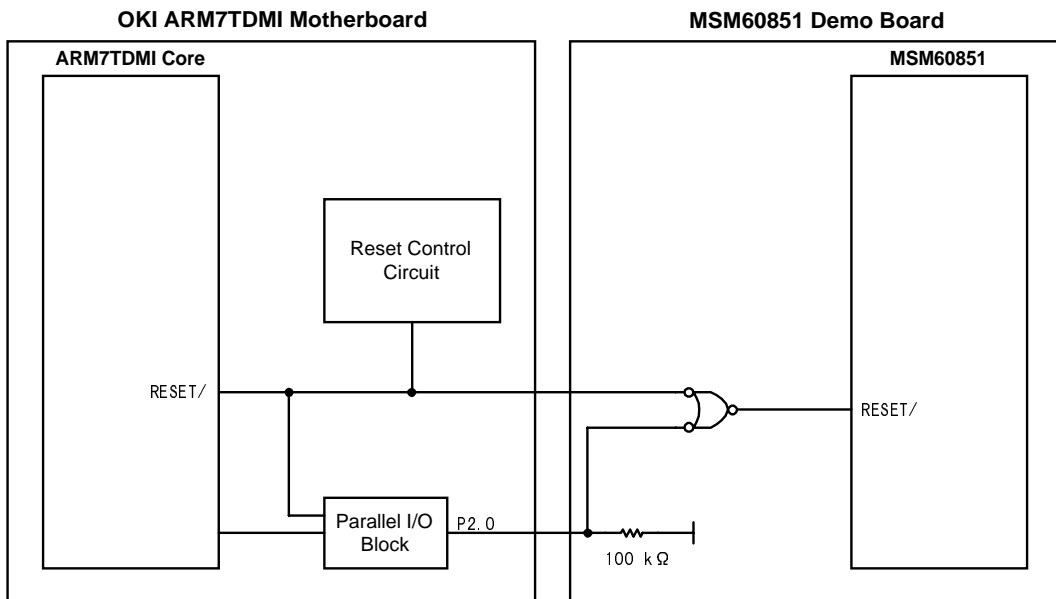
Figure 5-5   Reset Pin (RESET/) Peripheral Circuits

As Figure 5.5 shows, the MSM60851 reset input ORs signals from two sources: ARM7TDMI core reset signals and Port 2.0 output from the parallel I/O block among the general-purpose peripherals on the Oki ARM7TDMI™ emulation kit motherboard. To use the latter, the application program must configure Port 2.0 appropriately.

For further details on the MSM60851 RESET/ pin, refer to the MSM60851 Data Sheet.

5.3.2   MSM60851 Internal Register Map

The following Table lists the addresses for accessing MSM60851 internal registers from the Oki ARM7TDMI™ emulation kit motherboard.

MSM60851 Internal Registers for Oki ARM7TDMI Motherboard		
Access		**Register Name**
Read	Write	
0x500300	0x500100	Device Address Register
0x500304	0x500104	Device State Register
0x500308	-	Packet Error Register
0x50030c	-	Receive FIFO Register
0x500310	-	Send FIFO Register
0x500320	0x500120	Endpoint Packet Ready Register
0x500324	-	Endpoint 0 Receive Byte Count Register
0x500328	-	Endpoint 1 Receive Byte Count Register
0x50032c	-	Endpoint 2 Receive Byte Count Register
-	0x500138	Flash Send FIFO
-	0x50013c	Software Reset
0x500340	-	bmRequestType Setup Register
0x500344	-	bRequest Setup Register
0x500348	-	wValue LSB Setup Register
0x50034c	-	wValue MSB Setup Register
0x500350	-	wIndex LSB Setup Register
0x500354	-	wIndex MSB Setup Register
0x500358	-	wLength LSB Setup Register
0x50035c	-	wLength MSB Setup Register
0x500368	0x500168	Polarity Selection Register
0x50036c	0x50016c	Interrupt Enable Register
0x500370	-	Interrupt Status Register
0x500374	0x500174	DMA Control Register
0x500378	0x500178	DMA Interval Register
0x500380	-	Endpoint 0 Receive Control Register
0x500384	-	Endpoint 0 Receive General-Purpose Register
0x500388	0x500188	Endpoint 0 Receive Payload Register
0x500390	0x500190	Endpoint 1 Control Register
0x500394	0x500194	Endpoint 1 General-Purpose Register
0x500398	0x500198	Endpoint 1 Payload Register
0x5003c0	-	Endpoint 0 Send Control Register
0x5003c4	-	Endpoint 0 Send General-Purpose Register
0x5003c8	0x5001c8	Endpoint 0 Send Payload Register
0x5003cc	0x5001cc	Endpoint 0 General-Purpose Register
0x5003d0	0x5001d0	Endpoint 2 Control Register
0x5003d4	0x5001d4	Endpoint 2 General-Purpose Register
0x5003d8	0x5001d8	Endpoint 2 Payload Register
0x500100	-	Endpoint 0 Receive FIFO
0x500104	-	Endpoint 1 Receive FIFO
0x500108	-	Endpoint 2 Receive FIFO
-	0x500300	Endpoint 0 Send FIFO
-	0x500304	Endpoint 1 Send FIFO
-	0x500308	Endpoint 2 Send FIFO

6   Powering Up

This Chapter covers procedures for powering up the MSM60851 demo board and starting the application program for use in debugging.

6.1   Operating Specifications

Only use the MSM60851 demo board in an environment satisfying the following operating conditions.

| MSM60851 Demo Board Operating Conditions	
Item	**Specifications**
Microcontroller interface power supply input voltage (VCC5)	+3.0 to +5.0V ±5%
Maximum current drain	300 mA
Ambient temperature	5 to 35°C
Ambient humidity	40 to 60%

The following are the external dimensions and weight of the product.

MSM60851 Demo Board Dimensions and Weight	
Item	**Specifications**
External dimensions	160×150×35 mm
Weight	approximately 0.2 kg

6.2   Microcontroller Selector Switch (MCUSEL)

This switch configures the MSM60851 demo board to match the controlling microcontroller.
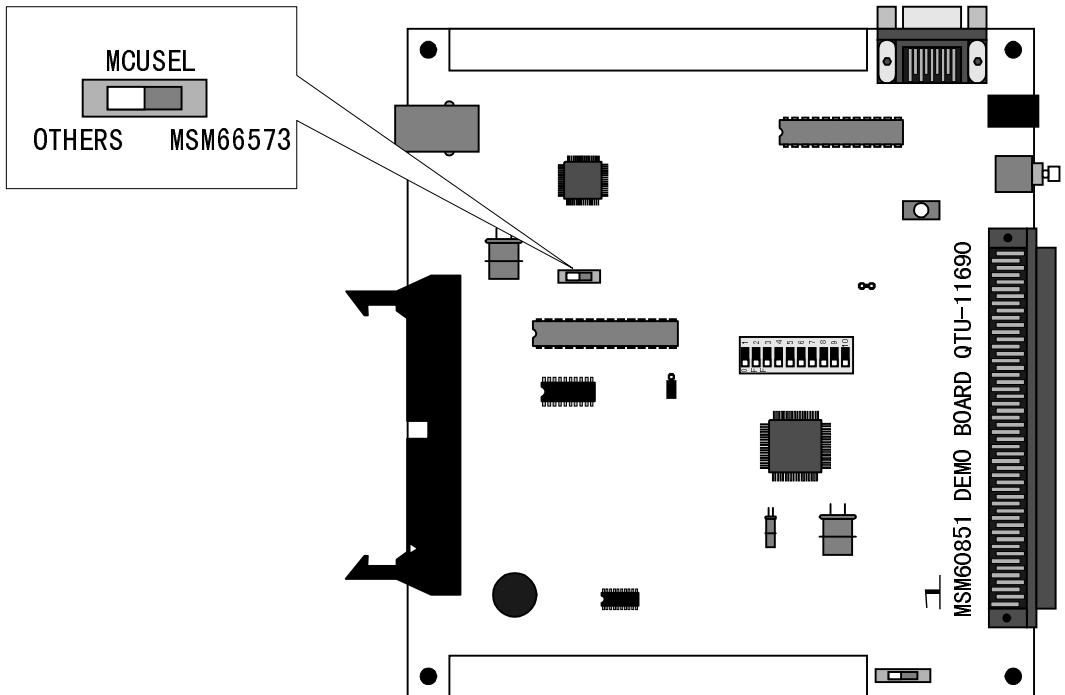

Figure 6-1   Microcontroller Selector Switch (MCUSEL)

This switch specifies whether the device controlling the MSM60851 USB protocol engine LSI built into this evaluation board is a member of the MSM66573 family or some other device. Set this switch to the appropriate setting before powering up the board.

6.3   Power Supply Cable Connections

The MSM60851 demo board ships with the microcontroller interface power supply cable shown in Figure 6.2.
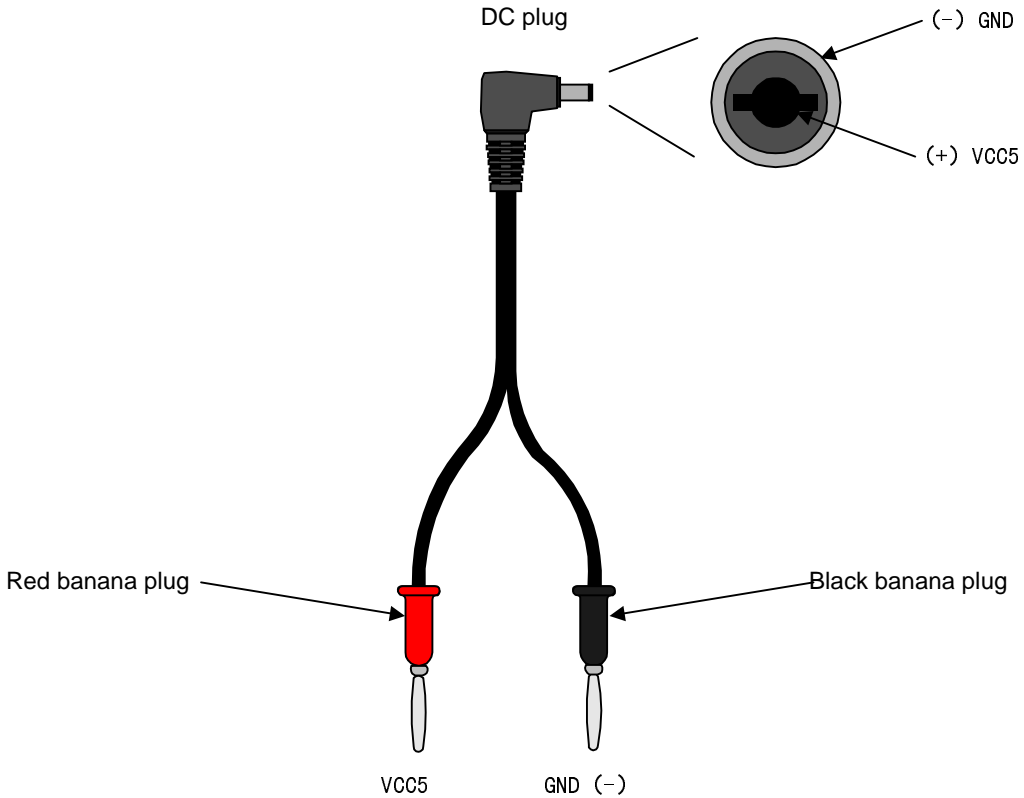
Figure 6-2   MSM60851 Demo Board Power Supply Cable

This cable provides one way to supply power to the MSM60851's microcontroller interface. (The input voltage specifications are the same as for the MSM60851's VCC5 pin.) A built-in DC-DC converter then derives the MSM60851's internal +3.3-V power supply from this one.

Figure 6.3 shows the structure of the power supply block.
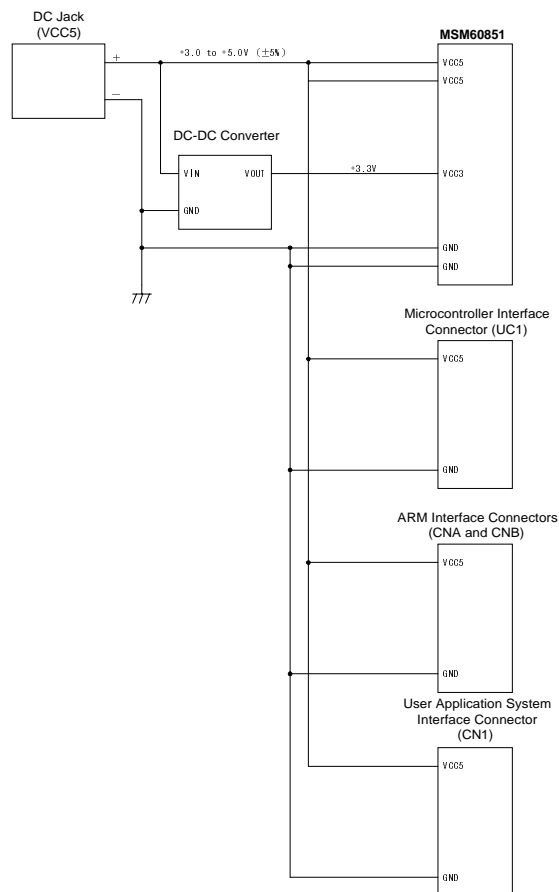
Figure 6-3   MSM60851 Demo Board Power Supply Peripheral Circuits

As Figure 6.3 shows, the VCC5 pins on all connectors are interconnected, so use only one power supply for all components. In particular, note that the Oki ARM7TDMI™ emulation kit motherboard has its own power supply, rendering this power supply cable unnecessary.

The following is the procedure for powering the MSM60851 demo board via the included power supply cable.

① **Connect the cable to the board's DC jack.**

Locate the DC connector (VCC5) in the upper right corner of the MSM60851 demo board as shown in the Figure.
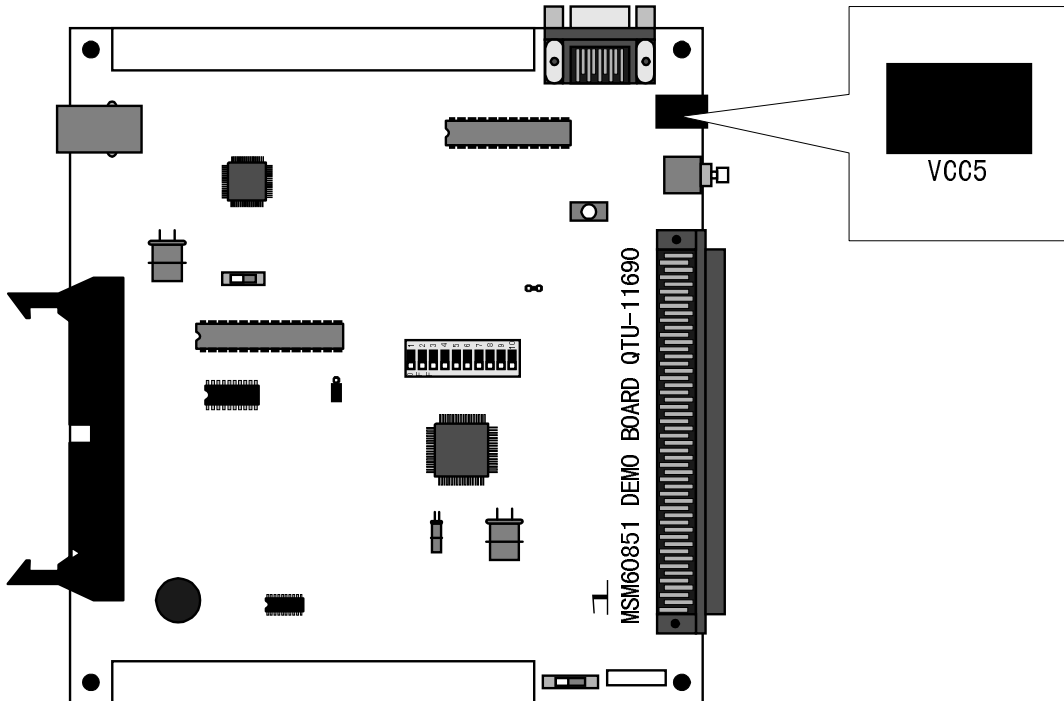
Figure 6-4   MSM60851 Demo Board DC Jack

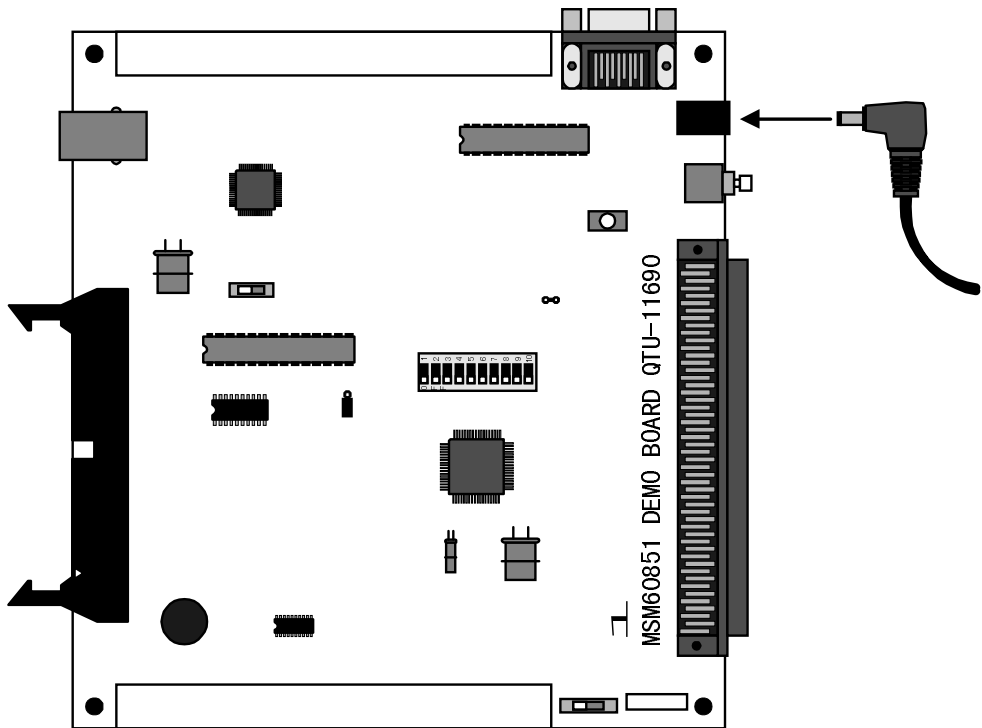Fit the plug end of the power supply cable into the DC jack.

Figure 6-5   Power Supply Cable Connections (DC Jack)

② **Connect the banana plugs to a stabilized DC power supply.**

Stabilized DC Power Supply
(+3.0 to +5.0V, ±5%, 500mA)

Red Banana Plug
(VCC5)

Black Banana Plug
(GND)

to DC Jack (VCC5)
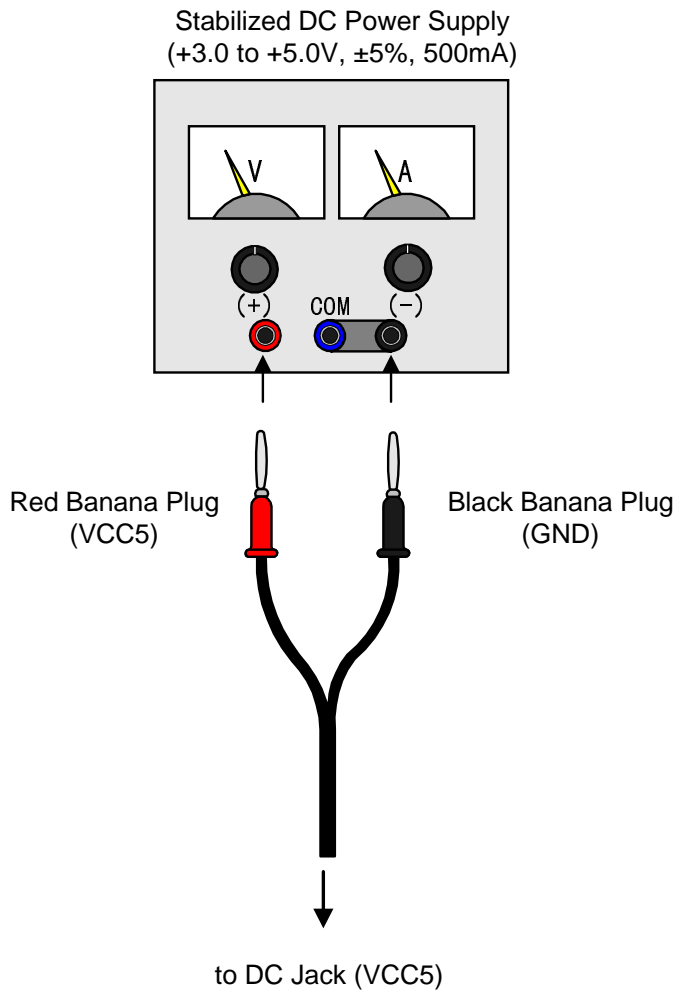
Figure 6-6   Power Supply Cable Connections (Power Supply)

This completes the power supply connections.

■ Note ■

Make sure that the banana plugs go into the correct outlets. Reversing the polarity leads to breakdown or fire and risks electrical shock.

6.4 System Connections and Powering Up

This Section covers procedures for configuring and hooking up the MSM60851 demo board for debugging an application program in the three major system configurations.

6.4.1 Using External Microcontroller

The following is the procedure for configuring and hooking up the MSM60851 demo board used with an external microcontroller.

① **Configure the board.**

The only switch on the MSM60851 demo board that requires setting is the microcontroller selector switch (MCUSEL)—to its OTHERS position.

② **Hook up the system.**

Figure 6.7 shows the cable connections for this configuration.
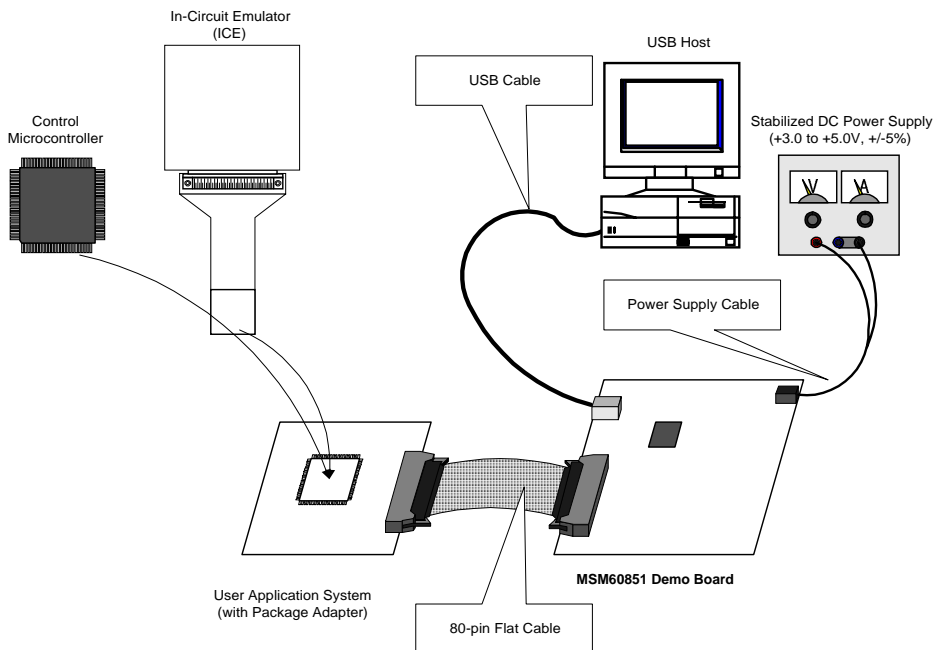
Figure 6-7 System Configuration with External Microcontroller

The Figure shows how to connect the in-circuit emulator for the microcontroller and the MSM60851 demo board to create a development support system for debugging USB control programs.

This configuration can also serve as a demo system for USB control programs.

Although the Figure shows the board's power supply as coming from the included power supply cable, an alternate configuration would be to supply it from the user application system via the 80-pin flat cable.

6.4.2   Using MSM66573 Microcontroller

The following is the procedure for configuring and hooking up the MSM60851 demo board with a member of the MSM66573 family mounted on it.

① **Configure the board.**

Set at least the following switches on the MSM60851 demo board.

- Set the microcontroller selector switch (MCUSEL) to its MSM66573 position.

- Set the flash writer select switch (FWSEL) to its NORMAL position.

Note that the user application system and other factors may dictate setting other switches and jumpers as well. For details, see Section 4.3 "MSM66573 Peripheral Circuits."

② **Hook up the system.**

Figure 6.8 shows the cable connections for this configuration.
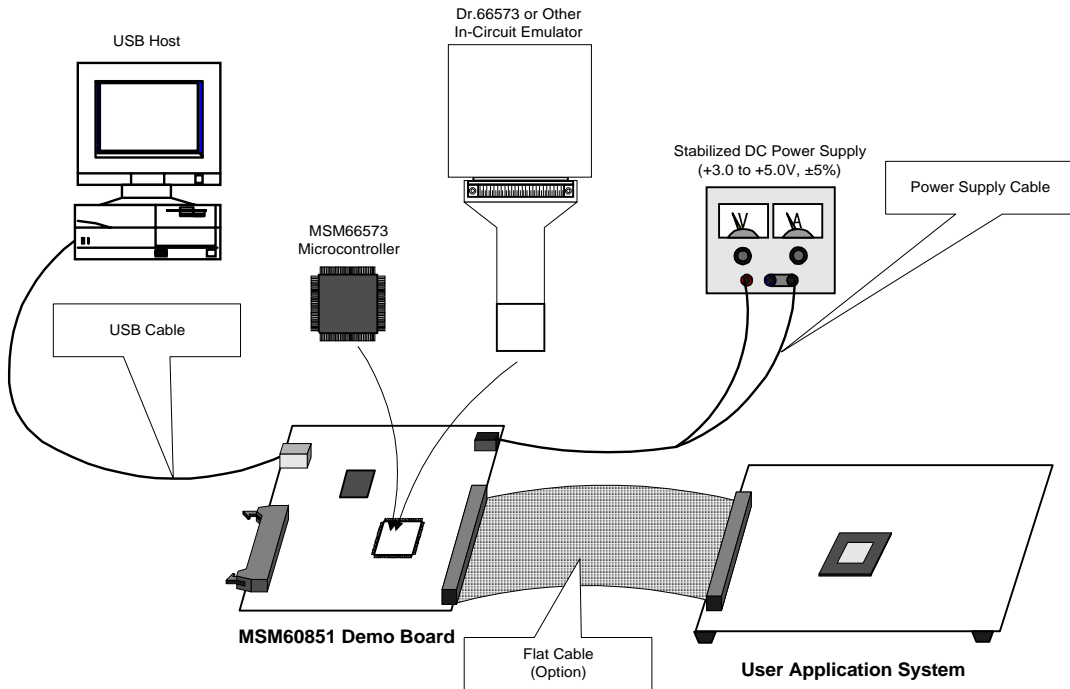
Figure 6-8   System Configuration with MSM66573 Microcontroller

Figure 6.8 shows a demo system for USB control programs using the MSM60851 demo board with a member of the Oki MSM66573 family of single-chip 16-bit microcontrollers.

Adding a Dr. 66573 or other in-circuit emulator available for the MSM66573 family, creates a development support system for debugging USB control programs.

Although the Figure shows the board's power supply as coming from the included power supply cable, an alternate configuration would be to supply it from the user application system via an adapter available as an extra-cost option.

6.4.3   Using Oki ARM7TDMI Motherboard

The following is the procedure for configuring and hooking up the MSM60851 demo board together with the Oki ARM7TDMI™ emulation kit motherboard.

① **Configure the board.**

- Set the microcontroller selector switch (MCUSEL) to its OTHERS position.

- Set the interrupt selector jumper pin pair 2 (J2) to the desired position.

Note that the user application system and other factors may dictate setting other switches and jumpers as well. For details, see Section 5.2 "Oki ARM7TDMI Motherboard Peripheral Circuits."

② **Hook up the system.**

Figure 6.9 shows the cable connections for this configuration.
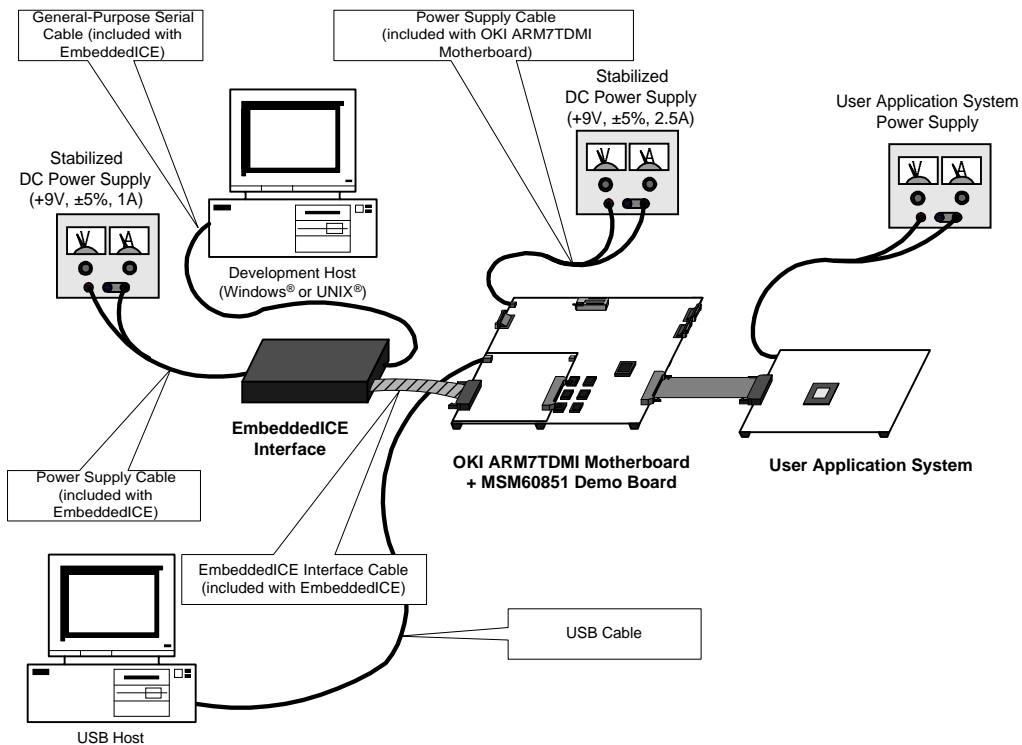
Figure 6-9   System Configuration with Oki ARM7TDMI Motherboard

Figure 6.9 shows an embedded system built around the ARM7TDMI core by connecting the MSM60851 demo board to an Oki ARM7TDMI™ emulation kit motherboard.

There is no power cable to the MSM60851 demo board because it gets its power from the Oki ARM7TDMI™ emulation kit motherboard.

■ **Reference** ■

For detailed system connections, refer to the Oki ARM7TDMI Motherboard User's Guide.
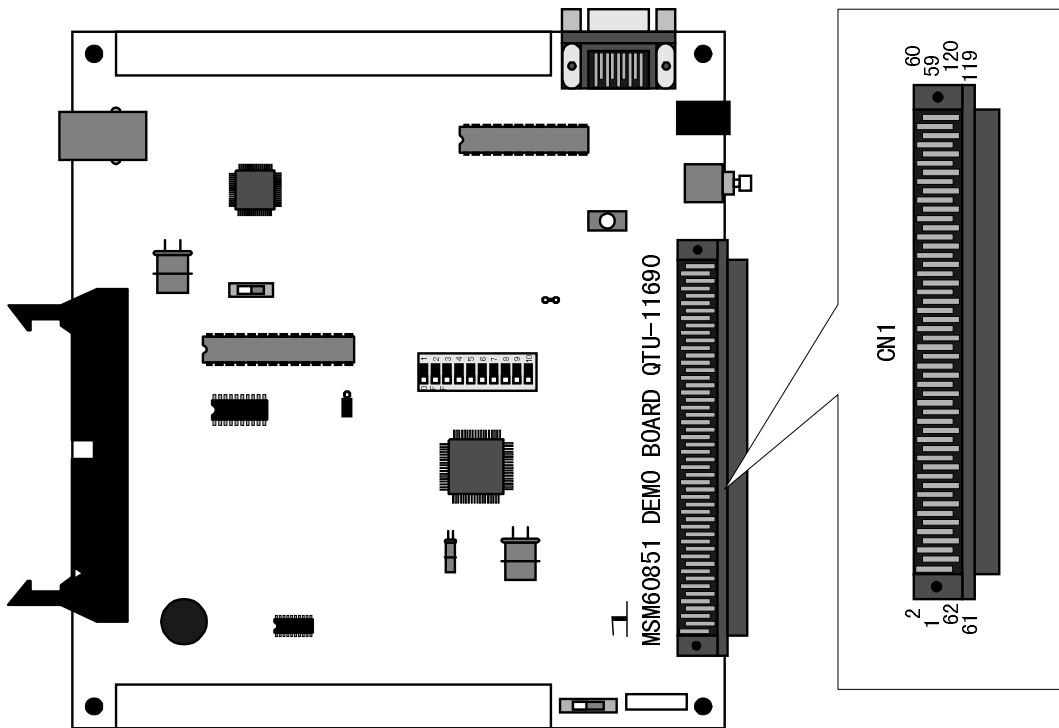
7   Appendices

7.1   MSM66573 User Interface Cable

The MSM60851 demo board has a single interface connector (CN1) for connecting the MSM66573 microcontroller mounted on it to the user application system.

Figure 7-1   User Application System Interface Connector (CN1)

With the addition of an optional adapter, this connector allows the MSM66573 microcontroller mounted on this board to control external devices in the user application system. Two such adapters are available: a flat cable version with a 120-pin shielded cable and a flexible cable version accepting a TQPACK socket that is pin-compatible with the MSM66573 family's 100-pin QFP socket.

This Section describes these adapters.

7.1.1   Flat Cable Adapter

Figure 7.2 show the flat cable adapter.

MSM60851 Demo Board

User Application System
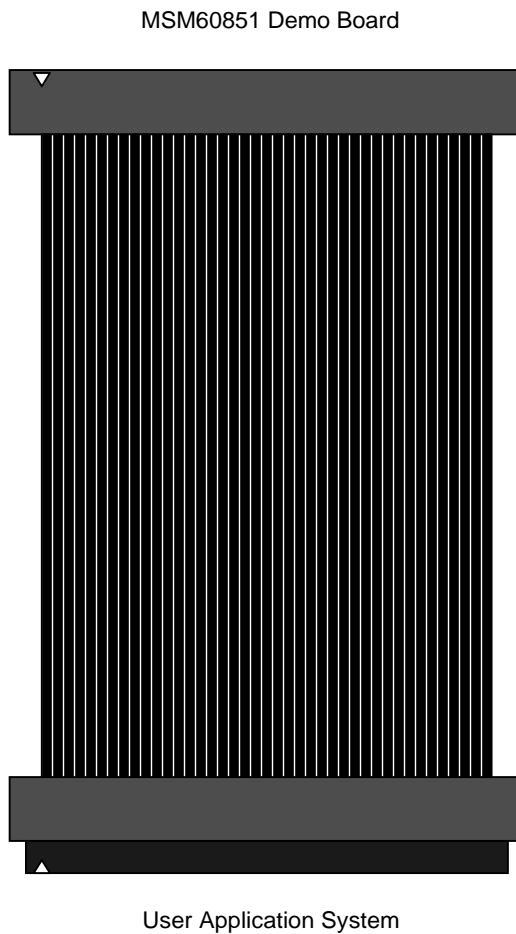
Figure 7-2   Flat Cable Adapter

The following Table lists the pin assignments for this cable.

| Flat Cable Adapter (120-Pin Shielded Cable) Pin Assignments							
Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name
1	P10.4	31	P5.7	61	P4.1	91	P7.0
2	P10.5	32	RES/	62	P4.2	92	P7.1
3	P10.7	33	NMI	63	P4.3	93	GND
4	P8.0	34	N.C.	64	P4.4	94	P7.2
5	P8.1	35	VCC5	65	P4.5	95	P7.4
6	P8.2	36	N.C.	66	P4.6	96	P7.5
7	P8.3	37	N.C.	67	P4.7	97	P10.0
8	P8.4	38	GND	68	P1.0	98	P10.1
9	P8.6	39	N.C.	69	P1.1	99	P10.2
10	P8.7	40	N.C.	70	P1.2	100	P10.3
11	P7.6	41	VCC5	71	P1.3	101	GND
12	P7.7	42	P11.0	72	P1.4	102	GND
13	VCC5	43	P11.1	73	P1.5	103	GND
14	GND	44	P11.2	74	P1.6	104	GND
15	P9.7	45	P11.3	75	P1.7	105	GND
16	P9.0	46	P11.6	76	P2.0	106	GND
17	P9.1	47	P11.7	77	P2.1	107	GND
18	P9.2	48	P3.1	78	P2.2	108	GND
19	P9.3	49	P3.2	79	P2.3	109	GND
20	P6.0	50	P3.3	80	VCC5	110	GND
21	P6.1	51	P0.0	81	VREF	111	GND
22	P6.2	52	P0.1	82	P12.0	112	GND
23	P6.3	53	P0.2	83	P12.1	113	GND
24	P6.4	54	P0.3	84	P12.2	114	GND
25	P6.5	55	P0.4	85	P12.3	115	GND
26	P6.6	56	P0.5	86	P12.4	116	GND
27	P6.7	57	P0.6	87	P12.5	117	GND
28	P5.4	58	P0.7	88	P12.6	118	GND
29	P5.5	59	GND	89	P12.7	119	GND
30	P5.6	60	P4.0	90	AGND	120	GND

N.C.: Not Connected

Note that the MSM60851 demo board uses some of these pins, making them unavailable to the user application system or available only by setting switches or jumpers. For details, see Section 4.3 "MSM66573 Peripheral Circuits."

The following are the specifications for the connector to be provided on the user application system.

> **Manufacturer: Hirose Denki**
>
> **Model Number: FX2-120P-1.27DS(L) (right angle)**

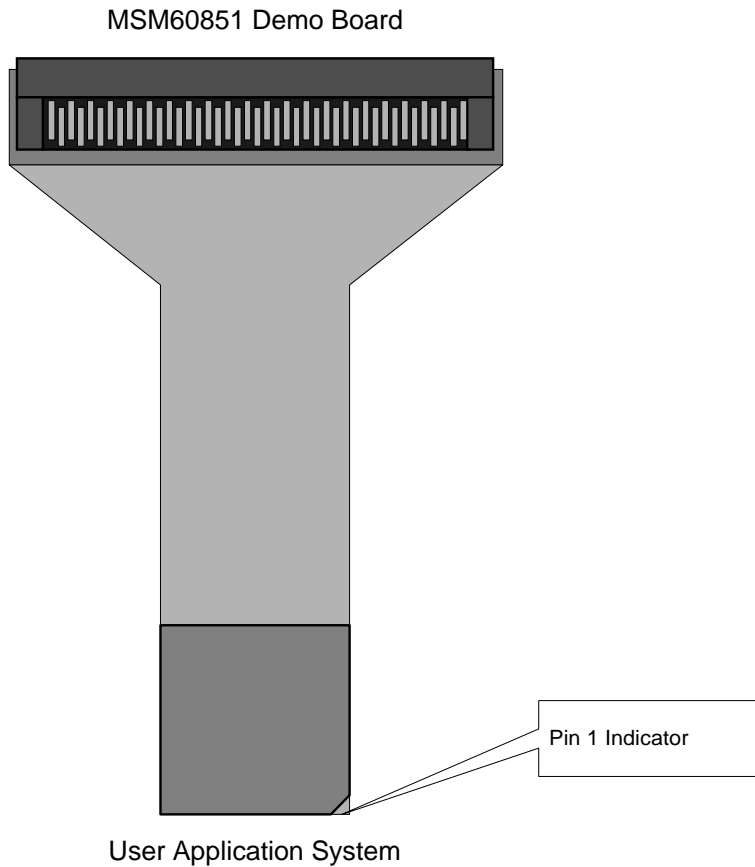Figure 7.3 shows the pin assignments for the above connector on the circuit board.
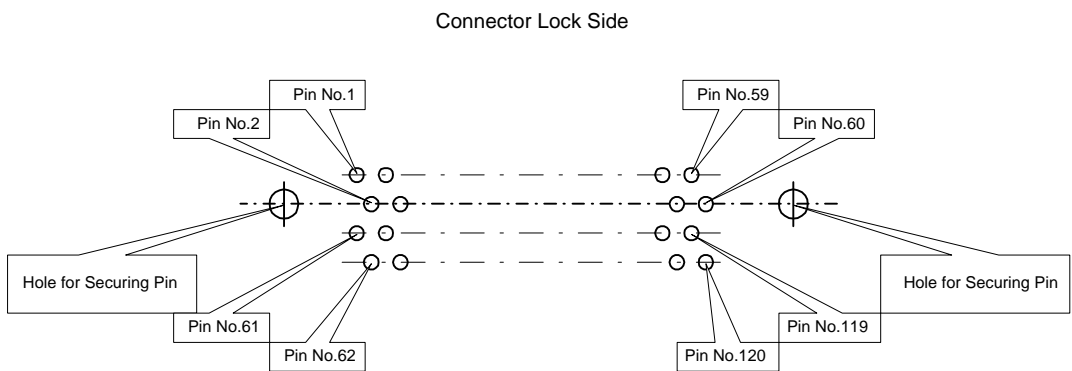
Figure 7-3   User Application System Connector Pin Assignments

Note that the Figure shows the view from the side with the parts.
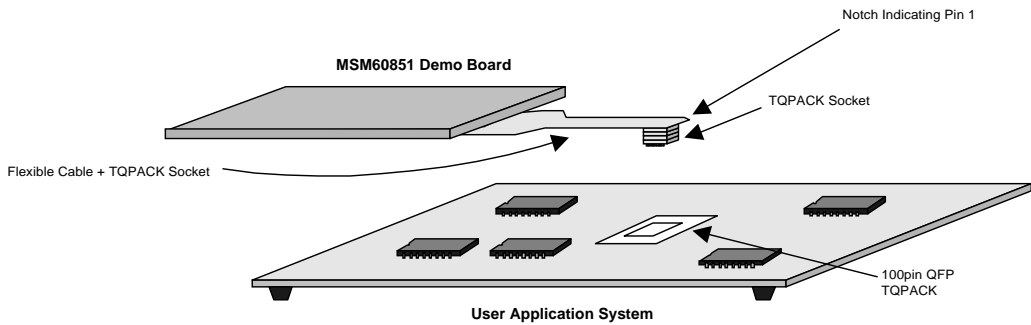
7.1.2   Flexible Cable Adapter

Figure 7.4 show the flexible cable adapter.

MSM60851 Demo Board

Pin 1 Indicator

User Application System

Figure 7-4   Flexible Cable Adapter

This cable connects to a TQPACK on the user application system to provide access to the MSM66573 microcontroller pins.

Figure 7.5 shows the structure of one possible system using this adapter.

MSM60851 Demo Board

RS-232C

TXD0/RXD0

Oscillator
Circuit

MSM66573
Microcontroller

External Memory Bus
(Ports 0, 1, 3, and 4)

USB
Interface

MSM60851

External RAM
(32 kilobytes)

CN1

I/O Pins

Flexible Cable Adapter

MSM60851 Demo Board

Notch Indicating Pin 1

TQPACK Socket

Flexible Cable + TQPACK Socket

100pin QFP
TQPACK

User Application System
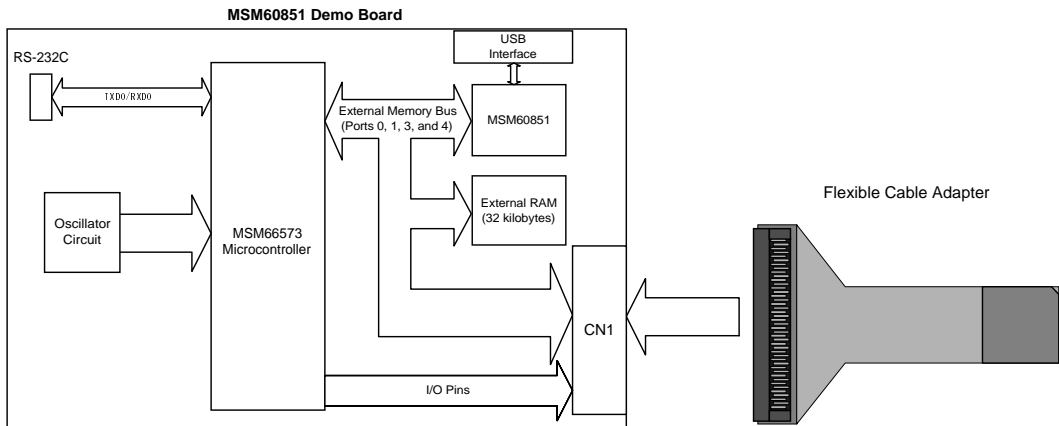
Figure 7-5   Sample System using Flexible Cable Adapter

As Figure 7.5 shows, the user application system must provide a pad matching the MSM66573 package and pin assignments. For details on the MSM66573 package and pin assignments, see the MSM66573 Family User's Manual.