Application Note 11

Interfacing PC Card Power Controllers to Logic Controllers

General Description

This application note describes the interface connections between Micrel PCMCIA Power Controllers and industry standard logic controllers from Cirrus Logic, Data Book, Intel, and Vadem. Combining one or two Micrel PC Card Power Controller s and one of these controllers produces a complete PCMCIA-compatible PC Card slot. In most cases, no other components are necessary.

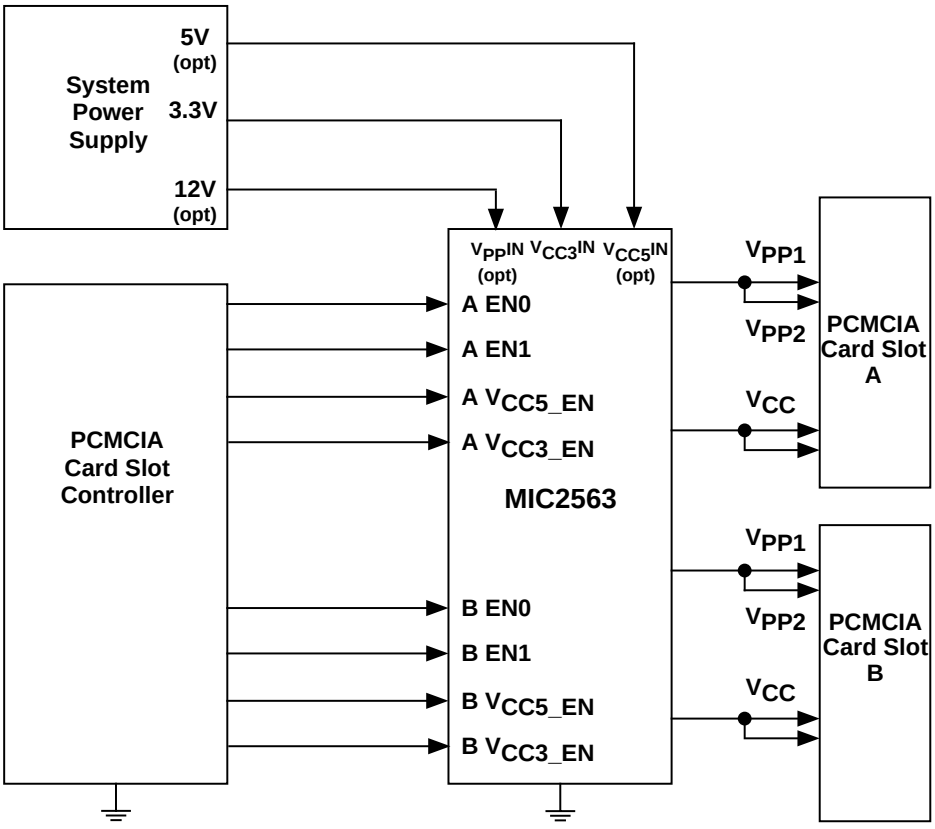
This note concentrates on the power control subsystem only. For full details on designing-with and operating the PC Card logic controllers, please refer to the respective manufacturer's literature. For detailed specifications and additional information on the MIC2560, MIC2561, MIC2562, and MIC2563 please see their datasheets earlier in this section.

Overview

The MIC2560 is a fully-protected PC Card Power Controller that meets all PCMCIA specifications. It provides full control of both V_{CC} and V_{PP} for one PC Card slot. It features industry-leading ON resistances and is available in different control logic configurations for "glueless" compatibility with the major industry-standard PC Card logic controllers.

The MIC2561 is also a fully protected card slot controller, similar to the MIC2560, but has higher ON resistances, enabling its use in price-sensitive applications. It is available in the same MIC2560 pinout as well as in a smaller package that is less than half the size of the MIC2560.

The MIC2562 is a new design, providing full functionality from a 3.3V supply. The new MIC2563 is a dual version of the MIC2562 in a SSOP package.



This note details the connections between the PCMCIA slot logic controller and Micrel PC Card Power Controllers.

Cirrus Logic Controllers

PC Card logic controllers from Cirrus Logic are compatible with Micrel's "–1" option of PC Card power controllers. Tables 1, 2, and 3 show pin connections between three popular Cirrus Logic controllers and the MIC2560-1 and MIC2561-1.

Figure 1 is a schematic of a typical two slot PC Card implementation using the CL-PD6720 and the MIC2560-1.

CL-PD6710		MIC2560-1BWM MIC2561-1BWM		MIC2561-1BM MIC2562-1BM
Pin Name	**Pin #**	**Pin Name**	**Pin #**	**Pin #**
VCC_5	6	V_{CC5_EN}	5	1
VCC_3	5	V_{CC3_EN}	6	2
VPP_VCC	3	V_{PP_VCC}	7	3
VPP_PGM	2	V_{PP_PGM}	8	4

Table 1. CL-PD6710 single slot controller and MIC2560-1/MIC2561-1 pin equivalencies.

CL-PD6720			MIC2560-1BWM MIC2561-1BWM		MIC2561-1BM MIC2562-1BM	MIC2563-1BSM	
Pin Name	**Pin #**		**Pin Name**	**Pin #**	**Pin #**	**Pin #**	
	Slot A	**Slot B**				**Slot A**	**Slot B**
VCC_5	5	207	V_{CC5_EN}	5	1	5	19
VCC_3	4	206	V_{CC3_EN}	6	2	6	20
VPP_VCC	2	205	V_{PP_VCC}	7	3	7	21
VPP_PGM	1	204	V_{PP_PGM}	8	4	8	22

Table 2. CL-PD6720 dual slot controller and MIC2560-1/MIC2561-1 pin equivalencies.

CL-PD6729			MIC2560-1BWM MIC2561-1BWM		MIC2561-1BM MIC2562-1BM	MIC2563-1BSM	
Pin Name	**Pin #**		**Pin Name**	**Pin #**	**Pin #**	**Pin #**	
	Slot A	**Slot B**				**Slot A**	**Slot B**
VCC_5	130	138	V_{CC5_EN}	5	1	5	19
VCC_3	129	136	V_{CC3_EN}	6	2	6	20
VPP_VCC	128	135	V_{PP_VCC}	7	3	7	21
VPP_PGM	127	134	V_{PP_PGM}	8	4	8	22

Table 3. CL-PD6729 dual slot controller and MIC2560-1/MIC2561-1 pin equivalencies.

Cirrus Logic CL-PD6720 Application Circuit

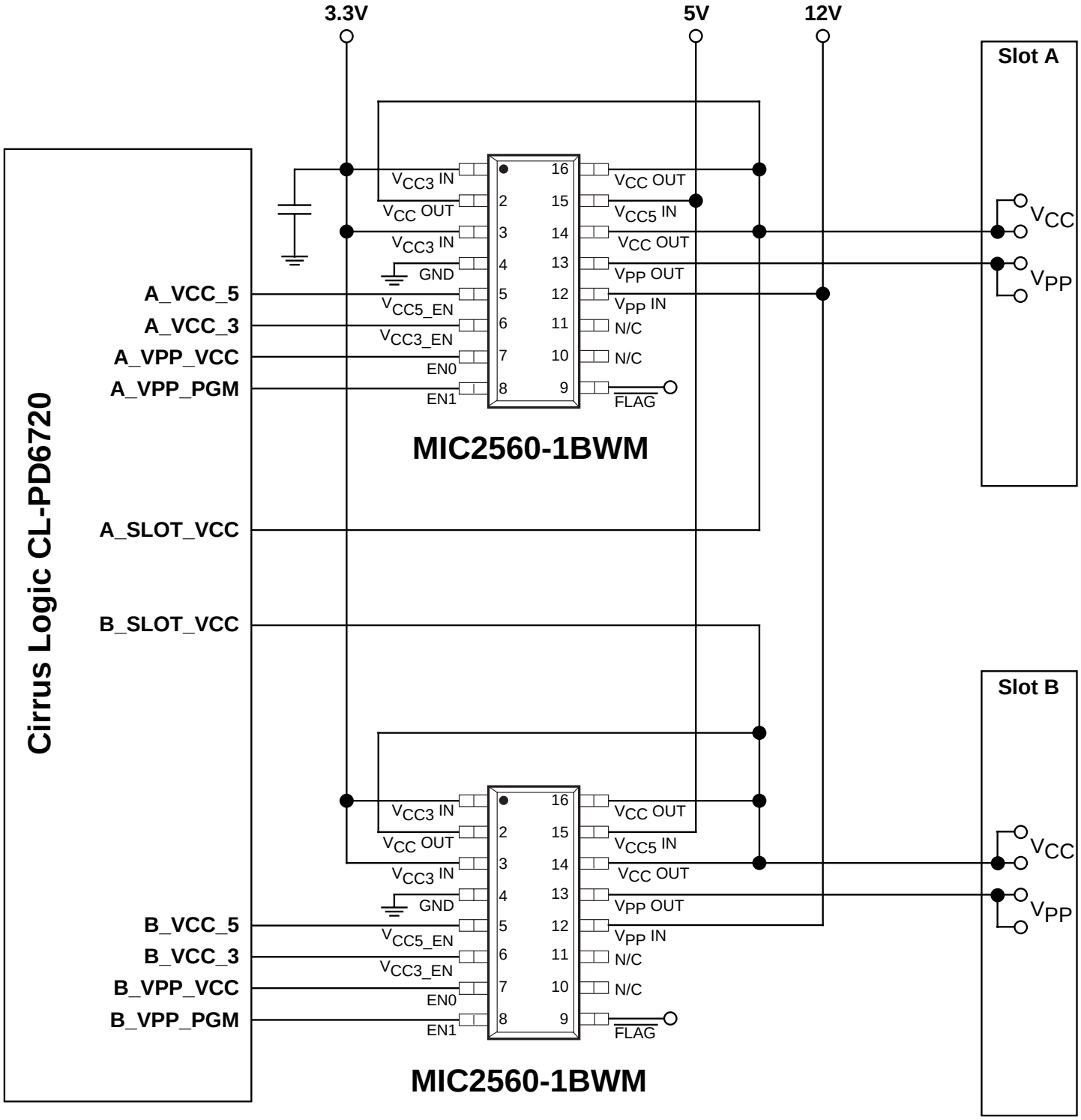


Figure 1. A typical two slot PC Card (PCMCIA) implementation using the Cirrus Logic CL-PD6720 and two MIC2560-1. The lower cost MIC2561-1BWM may be directly substituted for the MIC2560-1 in this circuit. The MIC2561-1BM will also work: refer to Table 2 for pin connection changes.

Data Book Controllers

Micrel's option "–2" PC Card power controllers are designed to interface with Data Book logic controllers. The Data Book devices have individually programmable power supply control pin polarity, which is determined at power-up. Resistors are used to force positive polarity for proper interfacing with the MIC2560-2. Refer to the control logic shown in Table 4 for details. When V_{CC} is deselected (OFF), a MIC2560-2 internal clamp actively pulls-down the output, insuring zero volts on the socket. This clamp has an ON resistance of approximately 1.2kΩ. The Databook DB86184 PCMCIA controller requires 100kΩ pull-down resistors from VCCSEL0, VCCSEL1, VPPSEL0, and VPPSEL1 to ground and 100kΩ pull-up resistors from VCCSEL2 and VCCSEL3 to +3.3V (or +5V). MIC2560-2 pin 8 should be connected to ground.

While not required, a 0.1µF capacitor from V_{CC3} IN to ground provides decoupling for the current sense amplifier.

Pin 5 V_{CCSEL1}	Pin 6 V_{CCSEL2}	Pin 7 V_{PPSEL}	Pins 2 & 14 $V_{CC\ OUT}$	Pin 13 $V_{PP\ OUT}$
0	1	0	Clamped to Ground	Clamped to Ground
1	1	0	3.3V	3.3V
0	0	0	3.3V	12V
1	0	0	3.3V	Clamped to Ground
0	1	1	Clamped to Ground	Clamped to Ground
1	1	1	5V	5V
0	0	1	5V	12V
1	0	1	5V	Clamped to Ground

Table 4. MIC2560-2 Logic

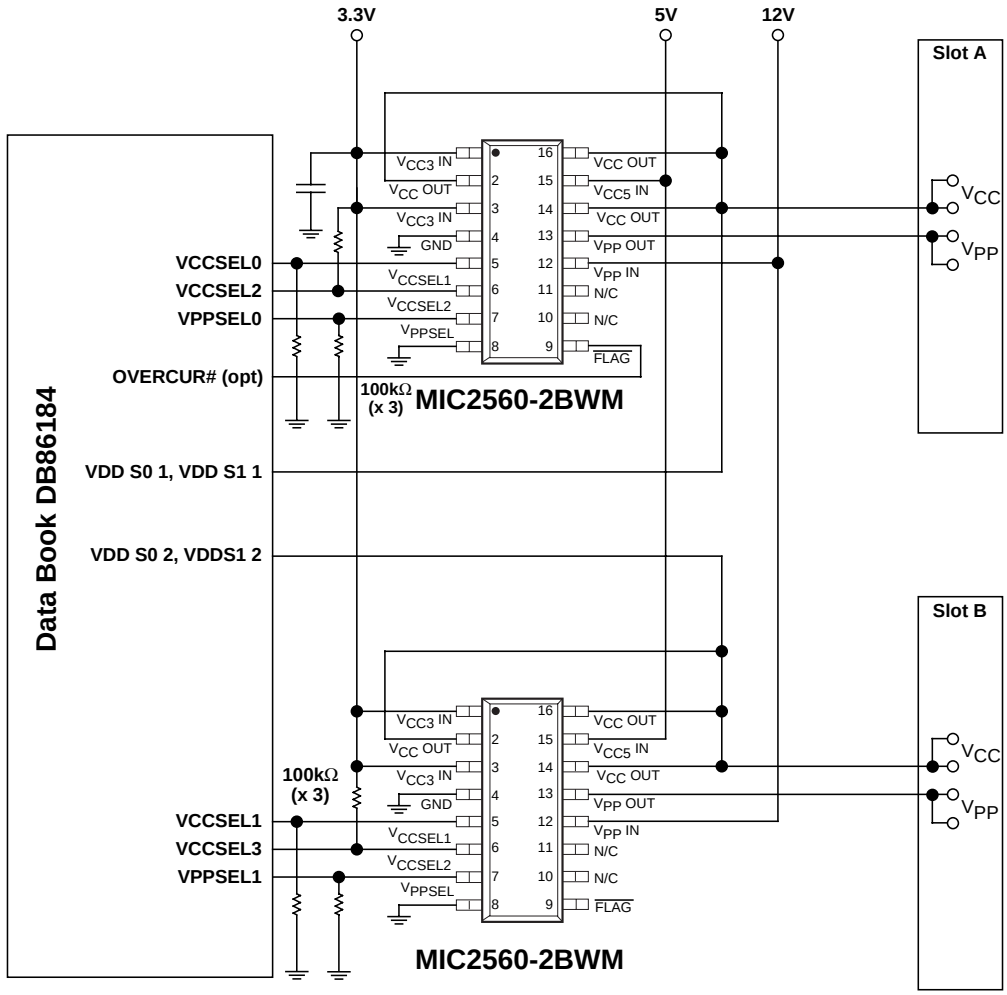


Figure 2. The Data Book DB86184 and two MIC2560-2BWM in a typical two slot application.

Intel Controllers

Intel PC Card logic controllers generally interface with the option "–0", MIC2560-0 and MIC2561-0. The older Intel 82365 supports two V_{PP} pins per slot, but only one V_{CC} level (5V). Use the MIC2558 PCMCIA Dual Card Slot V_{PP} Switching Matrix to control the additional V_{PP} for each socket. Since the MIC2558 has separate V_{CC} inputs, full independence between V_{PP2} of slot A and V_{PP2} of slot B is maintained. Since only 5V is available for V_{CC} OUT, connect all MIC2560/MIC2561 V_{CC} inputs together. These inputs, including both $V_{CC3\ IN}$ pins, are rated to 6V, so no damage will occur. Take advantage of the lower ON resistance of the 3.3V V_{CC} switch by using the V_{CC3_EN} control as the V_{CC} enable. Figure 3 shows this configuration.

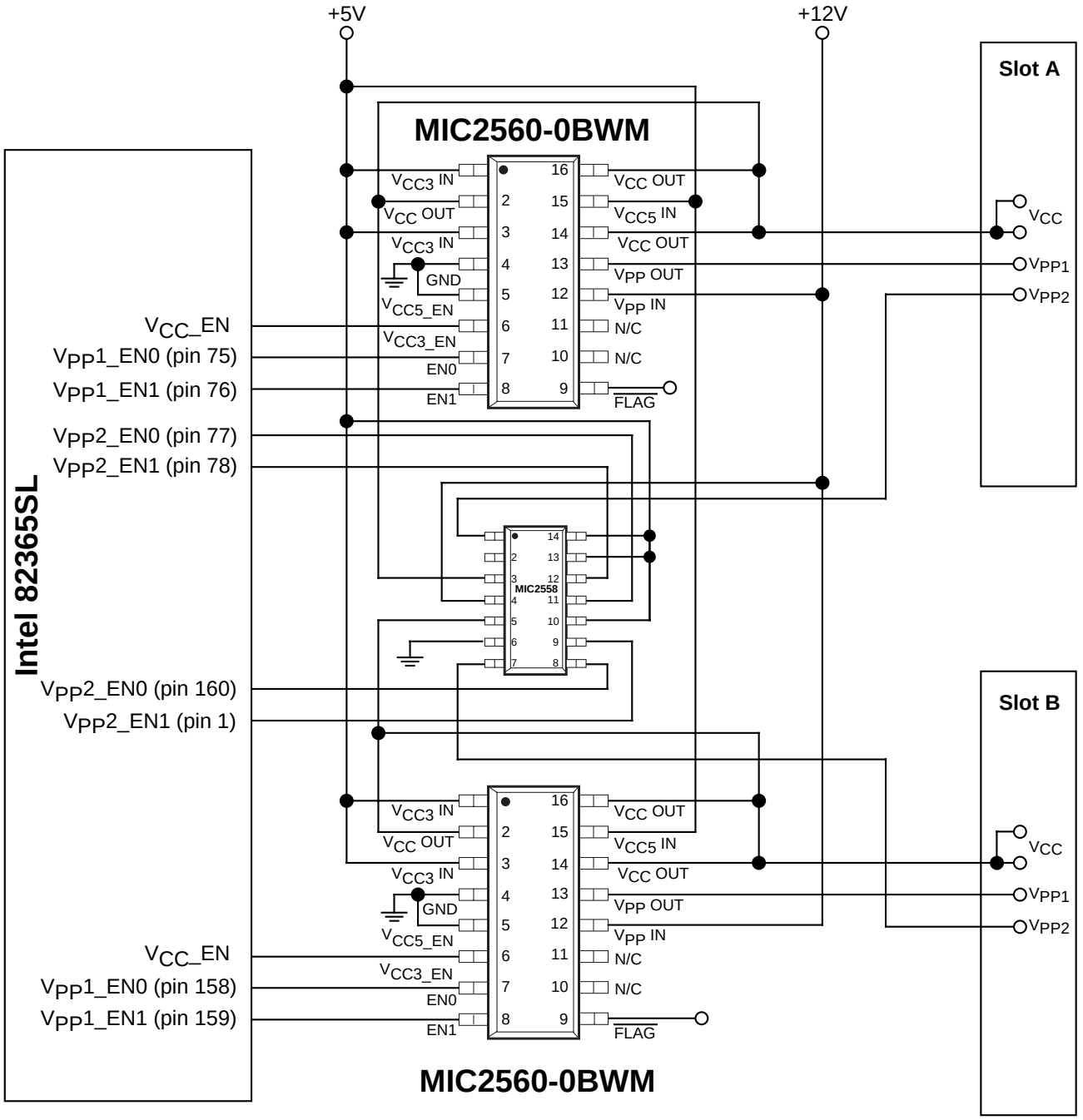


Figure 3. A two slot configuration using the Intel 82365 controller and the MIC2560-0. Note that this Intel controller does not support 3.3V supplies: for best results, connect the +5V supply to all V_{CC} pins (both V_{CC3} IN pins and the V_{CC5} IN pin.

Interfacing with the Intel PPEC PCI to PCMCIA logic controller

The Intel PPEC (PCI to PCMCIA Enhanced IDE Controller) is a dual slot, dual V_{CC} controller that does not provide latched data outputs for power control. Thus, an external latch is required. This latch is easily implemented using a 74273 or equivalent Octal D Flip-Flop. One octal latch supplies two slots (two MIC2560-0 or MIC2561-0). Figure 4 and Table 5 illustrate this system.

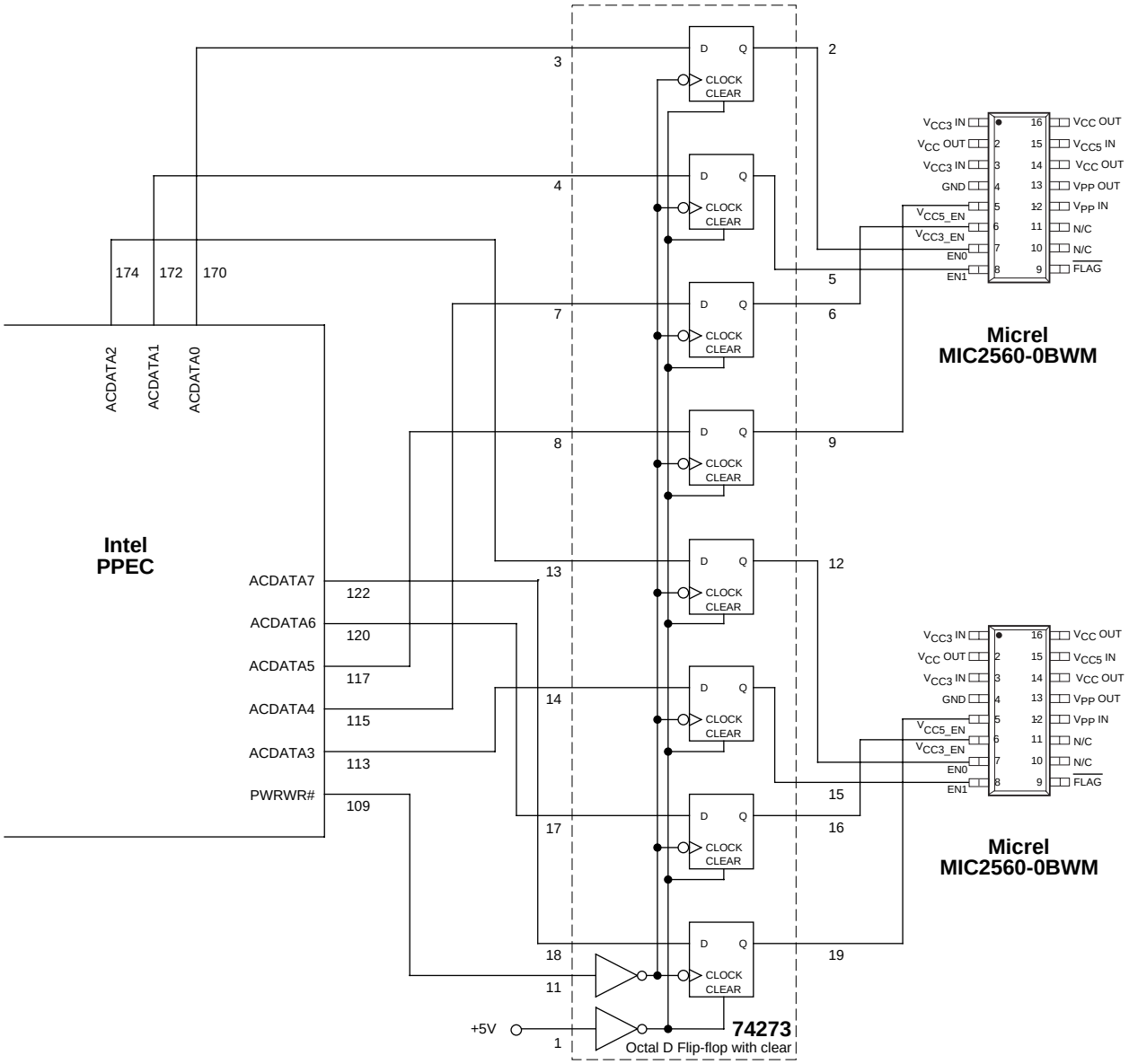


Figure 4. A dual slot system using the Intel PPEC controller and the MIC2560-0/MIC2561-0.

Intel PPEC			74273		MIC2560-0	
Power Signal	**Pin Name**	**Pin #**	**Pin # In**	**Pin # Out**	**Pin Name**	**Pin #**
A-EN0	ACDATA0	170	3	2	EN0	7
A-EN1	ACDATA1	172	4	5	EN1	8
A-VCC3V	ACDATA4	115	7	6	V_{CC3_EN}	6
A-VCC5V	ACDATA5	117	8	9	V_{CC5_EN}	5
B-EN0	ACDATA2	174	13	12	EN0	7
B-EN1	ACDATA3	113	14	15	EN1	8
B-VCC3V	ACDATA6	120	17	16	V_{CC3_EN}	6
B-VCC5V	ACDATA7	122	18	19	V_{CC5_EN}	5

Table 5. Power control signals for Figure 4.

Omega Micro Controllers

The MIC2560, MIC2561, MIC2562, and MIC2563 are compatible with Omega Micro logic controllers, including the 82C722GX ISA to PCMCIA (use the "–1" option, shown in Figure 5) and the 82C094 PCI to PCMCIA (use the "–0" option, shown in Figure 6) controllers. Both controllers support dual V_{CC} voltages to dual slots. The 82C094 offers a serial control output: the Omega Micro 82C28 converts this serial output into the latched parallel control required by Micrel MIC256x-0 Power Controllers.

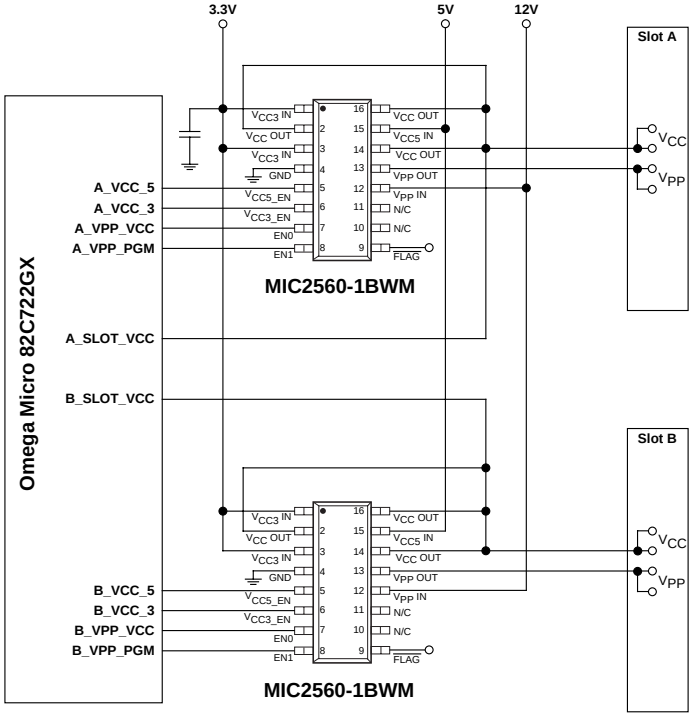


Figure 5. The Omega Micro 82C722GX and two MIC256x-1 (or one MIC2563-1) adapt the ISA bus to two PCMCIA sockets.

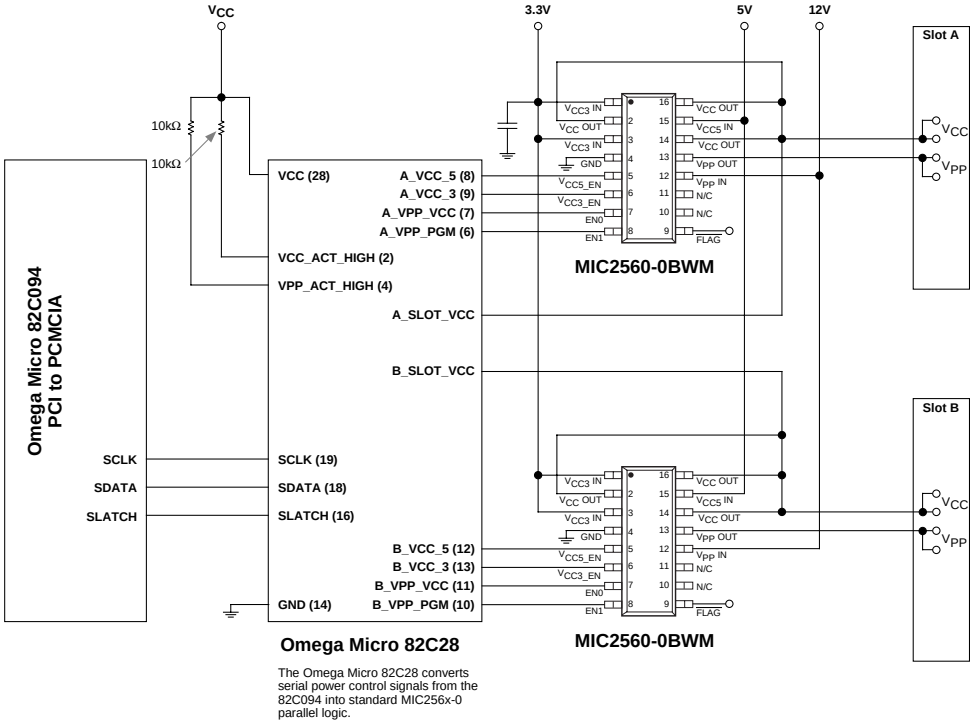


Figure 6. The Omega Micro 82C094 and two MIC256x-0 (or one MIC2563-0) adapt the PCI bus to PCMCIA. An Omega Micro 82C28 converts serial output from the 82C094 to the parallel control needed by the MIC256x-0.

Opti Controllers

The Opti 82C852 is logic compatible with Micrel "–1" option logic power controllers. Figure 7 shows a typical single-slot PC Card implementation using the Opti 82C852 and the MIC2560-1 power controller. The MIC2561-1 and MIC2562-1 are also directly compatible with the 82C852.

Figure 8 shows the Opti 82C824 dual-slot logic controller interfacing with the MIC2563A-1. Two MIC2560-1, MIC2561-1, or two MIC2562A-1 power controllers are also compatible with the 82C824.

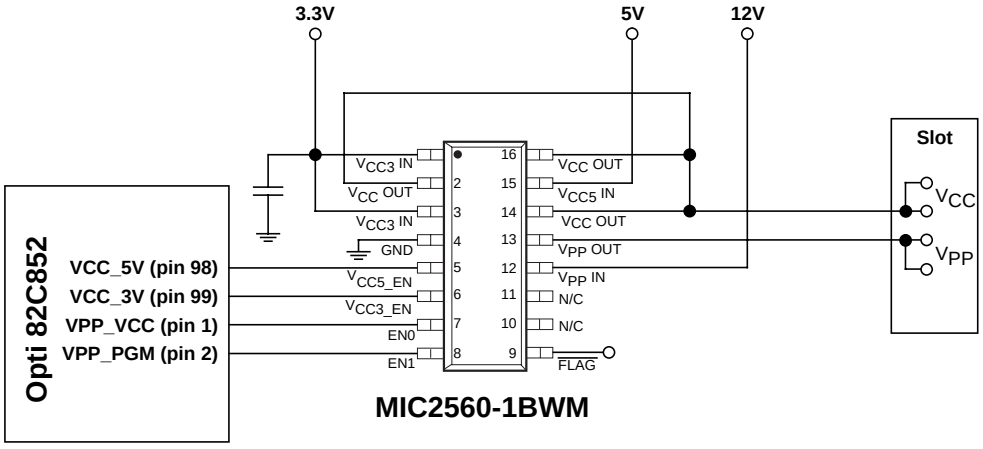


Figure 7. The Opti 82C852 is a single slot PC Card logic controller that directly interfaces with Micrel MIC2560-1, MIC2561-1, or MIC2562-1 power controllers.

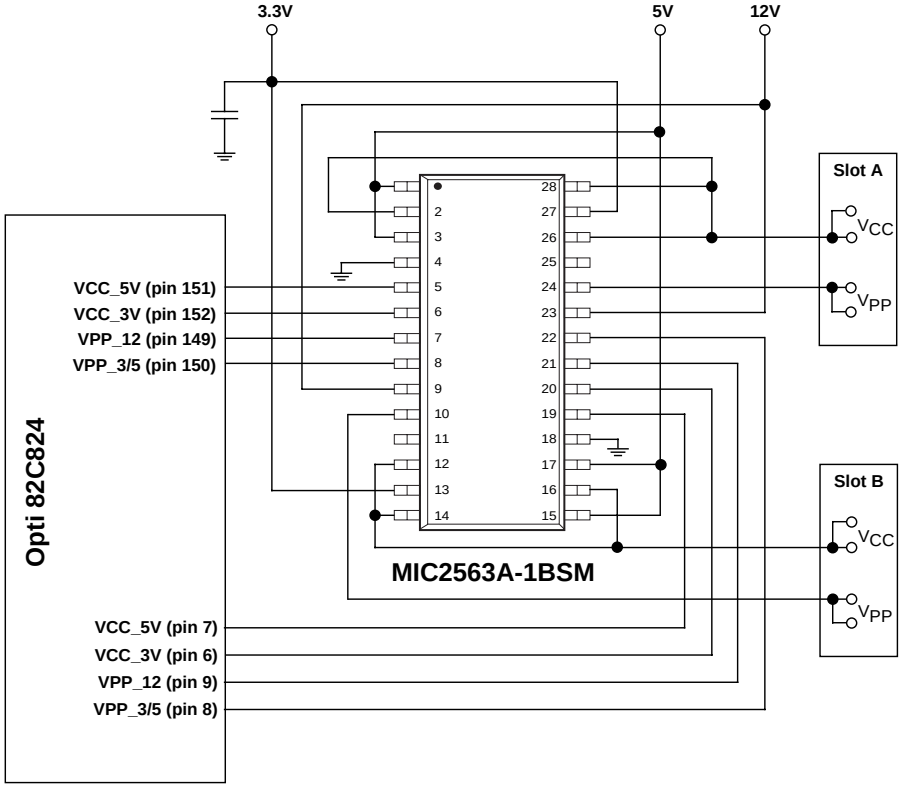


Figure 8. The Opti 82C824 dual slot CardBus controller/docking station that works with the MIC2563 forming a two-IC solution for two PC Card slots.

Vadem Controllers

The MIC2560-0, MIC2561-0, MIC2562-0, and MIC2563-0 are compatible with Vadem logic controllers, including the VG-365, VG-465, VG-468, and VG-469. The VG-365, VG-465, and VG-468 are straight forward implementations; the VG-469 with its flexible voltage control scheme requires a strapping option for voltage control. Refer to Vadem's design literature for full details. Table 6 shows the VG-469 V_{CC} strapping options for positive pin polarity.

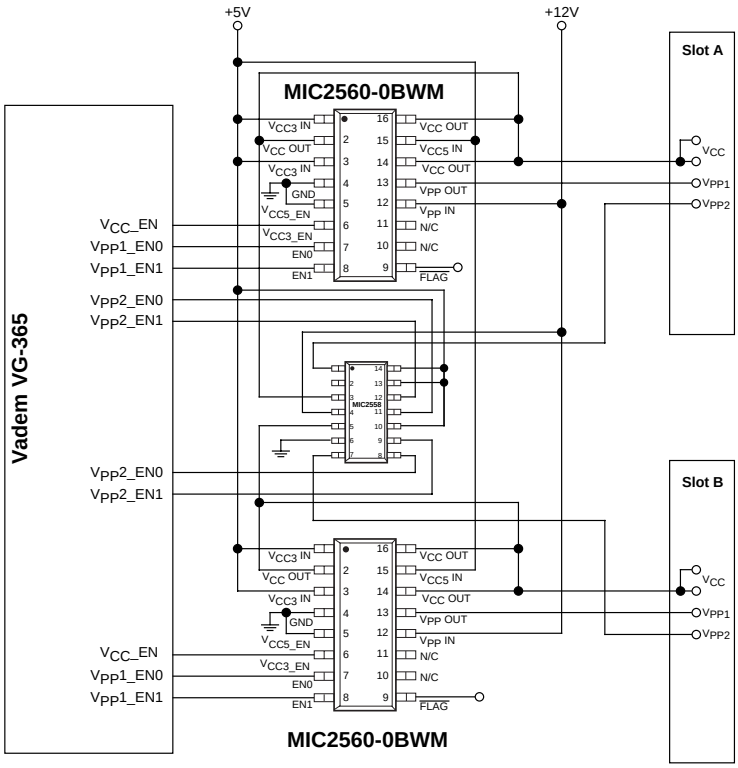


Figure 7. A dual slot PC Card system using the Vadem VG-365 and the MIC256x-0. One MIC2563-0 may replace the two MIC2560-0 shown in this schematic.

D1 Reg 2F/6F	D0 Reg 2F/6F	V_{CC_EN1}	V_{CC_EN0}	V_{CC} OUT
1	0	0	0	Hi-Z
1	1	0	1	3.3V
0	0	1	0	5V
0	1	1	1	3.3V

Table 6. Vadem VG-469 flexible voltage control strapping scheme for the MIC2560-0, MIC2561-0, MIC2562-0, or the MIC2563-0.

Serial-Interface Logic Controllers

With the advent of the CardBus option, logic controllers need more and more pins to handle the extra functions. Some of the eight pins previously reserved for power control are now employed for these new functions. Converting from a parallel control bus to a serial bus is one answer: this change frees up to six pins. However; the control logic inside the power controller must be significantly more complex to handle serial data protocols.

Existing parallel bus power controllers may be adapted for serial control operation. A typical circuit consists of two main blocks: a serial to-parallel converter and an eight-bit latch.

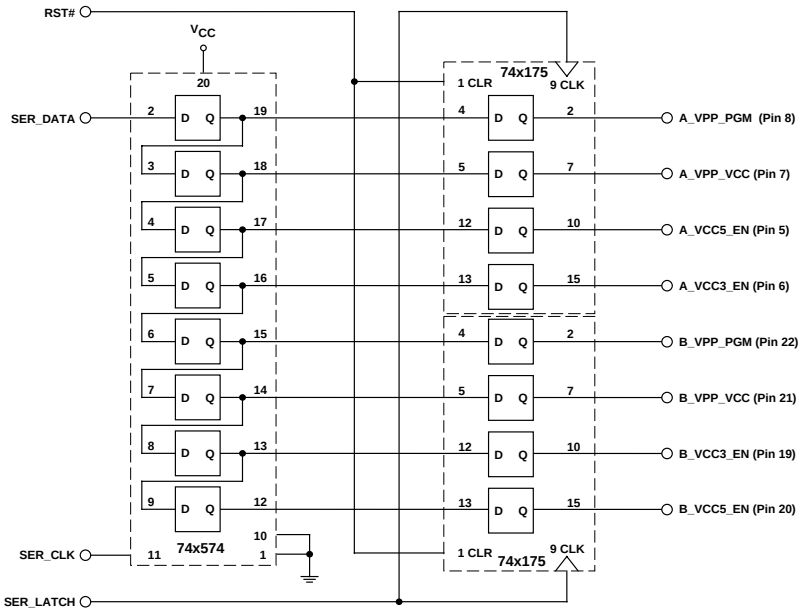


Figure 6. Interfacing the MIC2563A with a serial-output data controller. Pinouts shown are for the MIC2563A-1 and a three-wire serial controller.

Serial Control

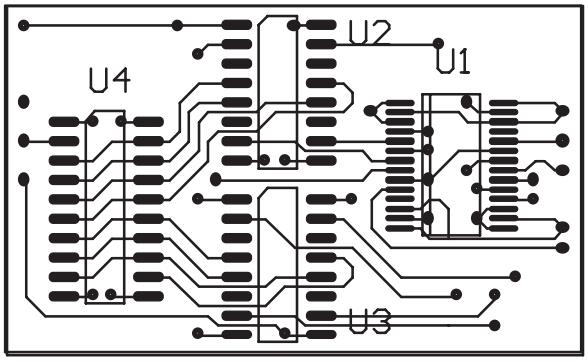
Figure 6 shows conversion from a three-wire serial interface, such as used by the Cirrus Logic CL-PD6730, to the standard eight-line parallel interface used by the MIC2563A-1. It is compatible with any of Micrel's "-1" controllers. This interface requires three common, low cost 7400-series logic ICs:

- 74x574 Octal D Flip-Flop
- 74x175 Quad Flip-Flop with Latches (two needed)

Either 3.3V or 5V logic devices may be used, depending upon the control voltage employed by the slot logic controller. Pin numbers in parenthesis refer to the MIC2563A-1BSM. Gerber™ files for this P.C. board layout are available to Micrel customers. Please contact Micrel directly.

Another serial-to-parallel solution for this application is the 74HC594, 8-bit shift register with output registers. This device contains the eight D flip-flops plus has latched outputs suitable for this purpose.

Serial Control Adapter P.C. Board Layout

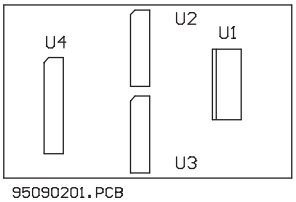


Component Key

U1 ..... MIC2563

U2, U3 ..... 74x175

U4 ..... 74x574



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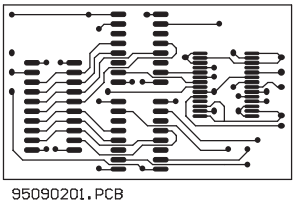

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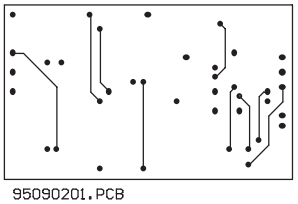

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