



PD6722 — Implementing DMA Functionality

Application Note

May 2001



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1.0 Introduction

The PD6722 is a single-chip PCMCIA interface controller capable of controlling two PCMCIA or compact Flash sockets, respectively. The PD6722 is designed for use in embedded applications and notebook systems where reduced form factor and low power consumption are critical design objectives.

Current typical application examples include:

- Routers
- Access network servers
- PBXs
- Vending machines
- Portable handheld systems
- Data acquisition systems
- Settop boxes
- Integrated access devices
- DSLAMs
- Terminal servers
- Point of Sale terminals
- Navigation systems
- Measurement equipment

With the PD6722, a complete dual-socket PCMCIA solution with power-control circuitry can occupy less than 2 square inches (13 square centimeters) of board space.

The PD6722 controller is completely compatible with the standards of PCMCIA (Personal Card Memory International Association) Release 2.0 Standard as well as JEIDA (Japan Electronic Industry Development Association) Version 4.1 Standard. The PD67XX controllers also offer special power-saving features such as Automatic Low-power Dynamic Mode and Suspend Mode. The PD6722 controller is a true mixed-voltage device that can operate at +5 volts, +3.3 volts, or a combination of these at various interfaces. The controller has full internal buffering and require no additional circuitry to interface to the ISA (or ISA-like) Bus or to PCMCIA sockets.

2.0 Implementing DMA Functionality

This document describes the hardware modifications required to implement DMA on the PCMCIA bus while using the PD6722. External logic and the associated connections are shown. PAL[®] equations are also described. Any one of the DMA channels applicable to an ISA-based system can be supported, and there is the flexibility to allow software to select the specific DMA channel.

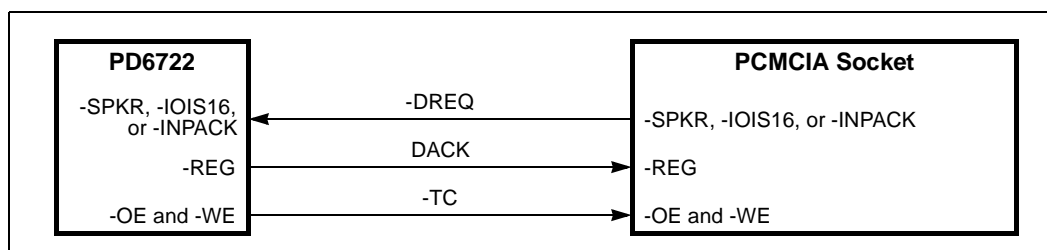
2.1 DMA with the PD6722

DMA function is enabled when bit 6 of the **Misc Control 2** register is set to a '1' and bits 7:6 of the **Extension Control 1** (formerly named **DMA Control**) register (extension index 03h) are set to select the -DREQ input. See Chapter 11 of the *PD6710/PD672X Data Sheet* for more information about DMA.

The PD6722 connects to a PCMCIA socket on the PCMCIA side and to the ISA bus on the system side.

On the PCMCIA side, any one of three pins (-SPKR, -IOIS16, or -INPACK) can be used for the DMA request (-DREQ) input, the -REG pin is used as the DMA acknowledge (DACK) output, and the -OE and -WE pins are used as the terminal count (-TC) output. [Figure 1](#) shows how the PD6722 uses these standard pin connections to support DMA to the PCMCIA socket.

Figure 1. Use of Standard Pin Connections for DMA to PCMCIA Socket



On the ISA bus side, the IRQ10 pin becomes the DREQ output, the IRQ9 pin becomes the -DACK input, and the -VPP_VALID pin becomes the TC input. Exactly how these connections are made depends on the flexibility desired for selecting the DMA channel and whether IRQ9, IRQ10, and -VPP_VALID must be available for their original functions when the PD6722 is not in DMA mode.

2.2 Basic DMA Solution

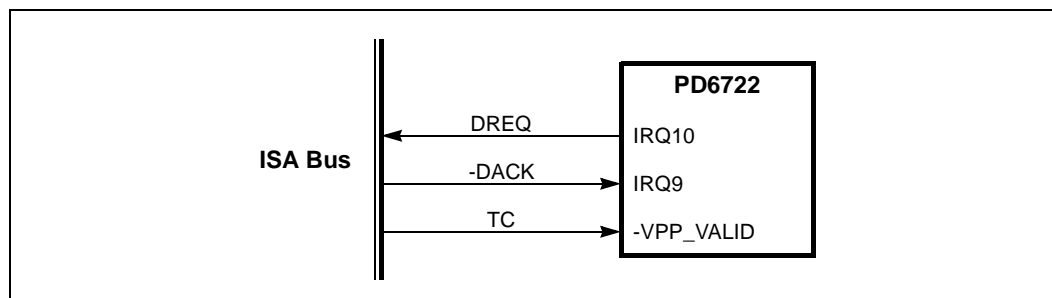
The ISA system architecture provides 8-bit DMA support on channels 0, 1, 2, and 3. Sixteen-bit DMA support is available on channels 5, 6, and 7. When choosing which DMA channel to support, the system designer must consider the specific requirements of the PCMCIA card(s) most likely to be used in the target system. In the most basic implementation, the system designer can connect the PD6722 in a way to support only one of the DMA channels.

Floppy disk drives generally use DMA channel 2. For example, DMA channel 2 can be used to specifically support a PCMCIA-card-based external floppy drive of a subnotebook computer that does not have a built-in floppy drive. Note that if a computer has an internal floppy drive and is to be set up to use a PCMCIA-card-based external floppy drive, channel 2 to the internal floppy drive must be freed (by disabling the internal floppy drive) for use by the external floppy drive.

ISA sound cards generally use DMA channel 1 for 8-bit and channel 5 for 16-bit operation. Sound Blaster™, for example, uses channel 1. Channel 1 is recommended to ensure the widest range of software support.

In these implementations, IRQ9, IRQ10, and -VPP_VALID are not available for use in their non-DMA function. Although there may be some older token ring cards that use only IRQ10 in their Interrupt Service Routine, the trend in the PCMCIA industry is for ‘plug and play’ solutions. This means that most of the PCMCIA cards are highly configurable and do not have rigid requirements for IRQ10 or IRQ9. This allows a hard-wired basic solution for DMA, as shown in Figure 2.

Figure 2. Basic DMA Connection to ISA Bus



Only one DMA channel is supported with this solution, and IRQ9, IRQ10, and -VPP_VALID are not available for their original functions but will work as -DACK, DREQ, and TC instead. Still, this is a simple solution requiring no external logic, and it should be adequate for many implementations.

Note: When using the PD6722, only one socket can support DMA at a time.

2.3 Support for More DMA Channels

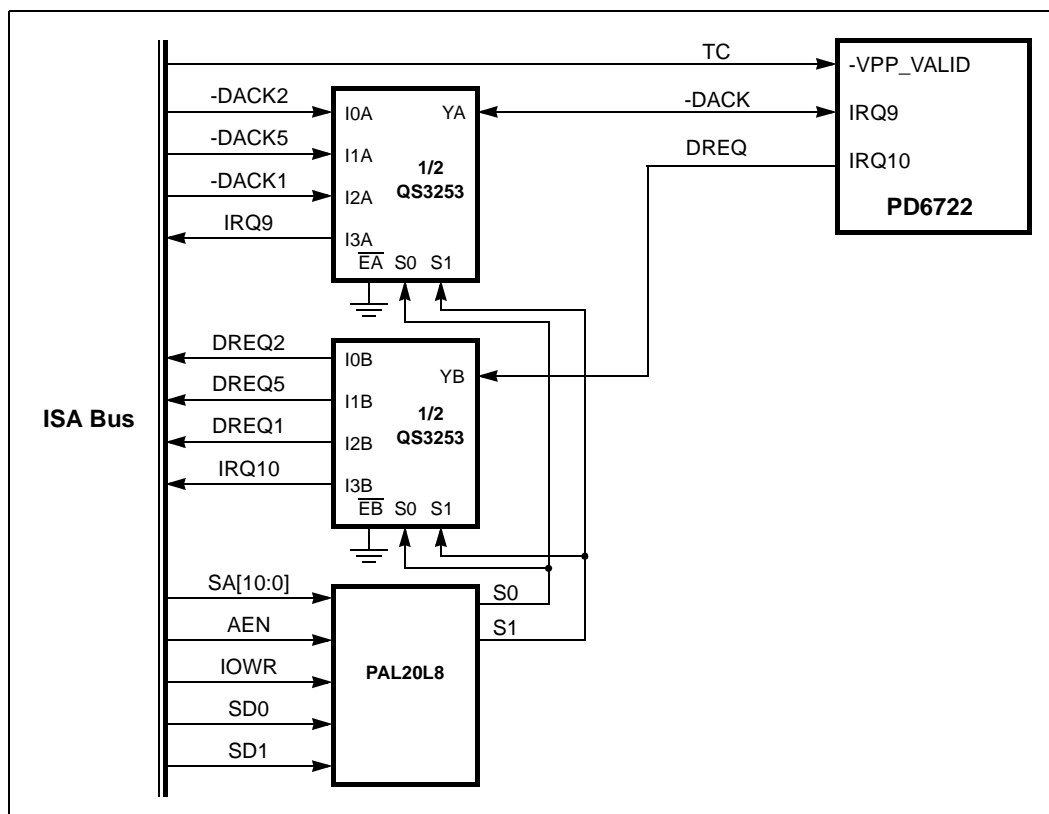
Figure 3 shows an example of software-selected support for DMA channels 1, 2, and 5. This solution allows software to turn on or off the DMA function. It also allows IRQ9, IRQ10, and -VPP_VALID to be used for their original functions when the PD6722 is not in DMA mode.

The PAL20L8 in Figure 3 is used to decode a particular address that is determined by the system designer. If a PAL device is used, be sure that only I/O pins are used for the S0, S1, and DMA_PORT signals to ensure feedback internal to the PAL device. Software has to write a non-zero value to the selected port address by using bits D0 and D1 of the ISA data bus. When a non-zero value is written, DMA channel 1, 2, or 7 will be routed to the ISA bus by the QS3253 device. When software does not use DMA function, it can write a zero to this address, and IRQ10 and IRQ9 will be routed to the ISA bus.

Figure 4 shows an example of support for all DMA channels in the ISA environment.

The address decode function may be less complicated in some situations, and a smaller PAL may be adequate.

Figure 3. Three-Channel DMA Connection to ISA Bus



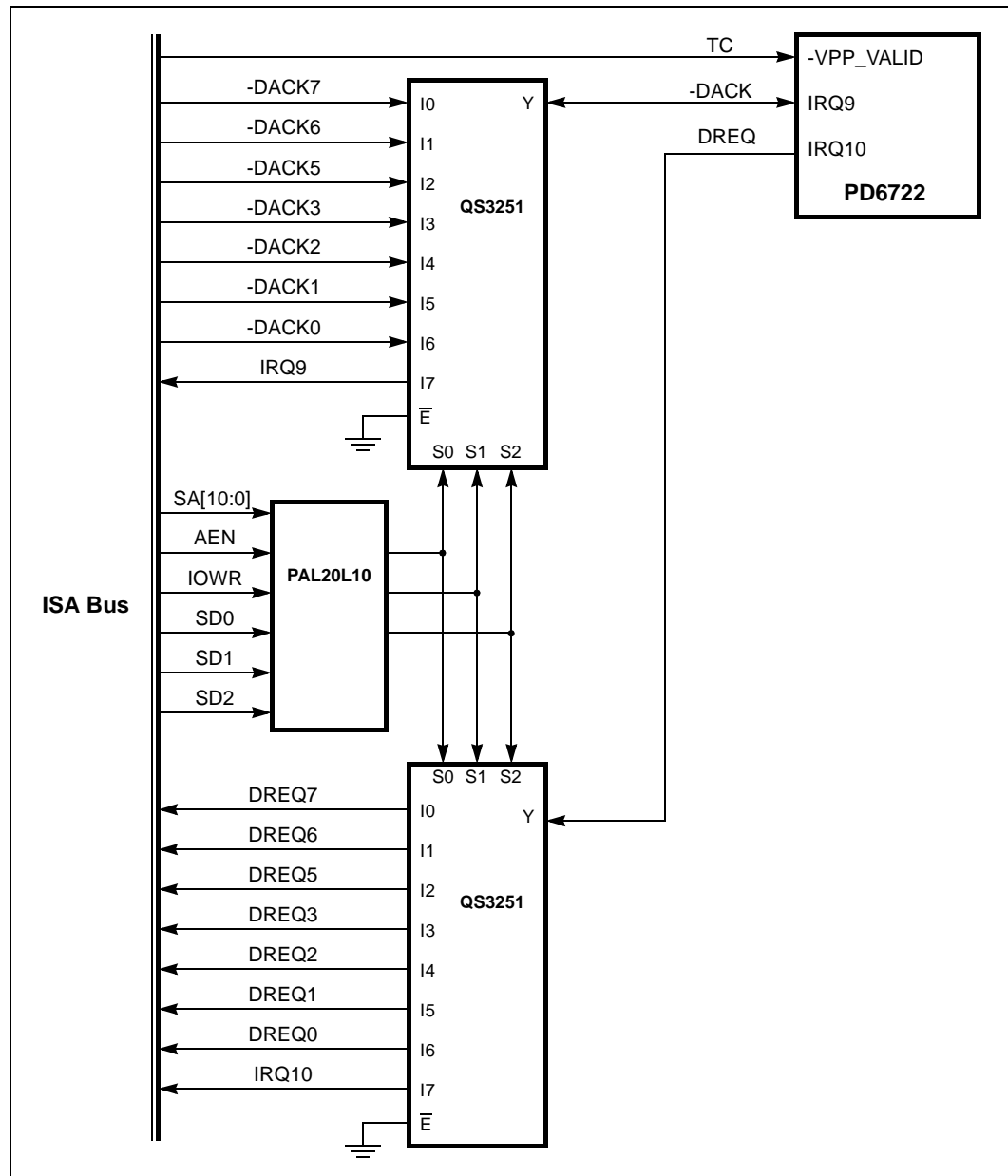
2.3.1 Why the QS3253 is Recommended

The IRQ signals on the PD6722 device can be at any of three levels: high, low, or high-impedance. The DREQ and -DACK signals can be either high or low. This requires high-speed switches that can assume any of the three levels (depending on the level of the input) and then present the corresponding level at the output. Also, these switches allow the DMA channel signals to be shared by other ISA devices.

2.3.2 Logic Equations for the PAL20L8

The attached CUPL™ file shows the PAL equations for the G20V8 device that was used during verification of the implementation shown in Figure 3. DMA_PORT is located at address 400h. Any appropriate PAL device or other logic circuit can be used, depending on the requirements. OrCAD® schematics are also attached for the three-channel implementation in Figure 3.

Figure 4. Multi-Channel DMA Connection to ISA Bus

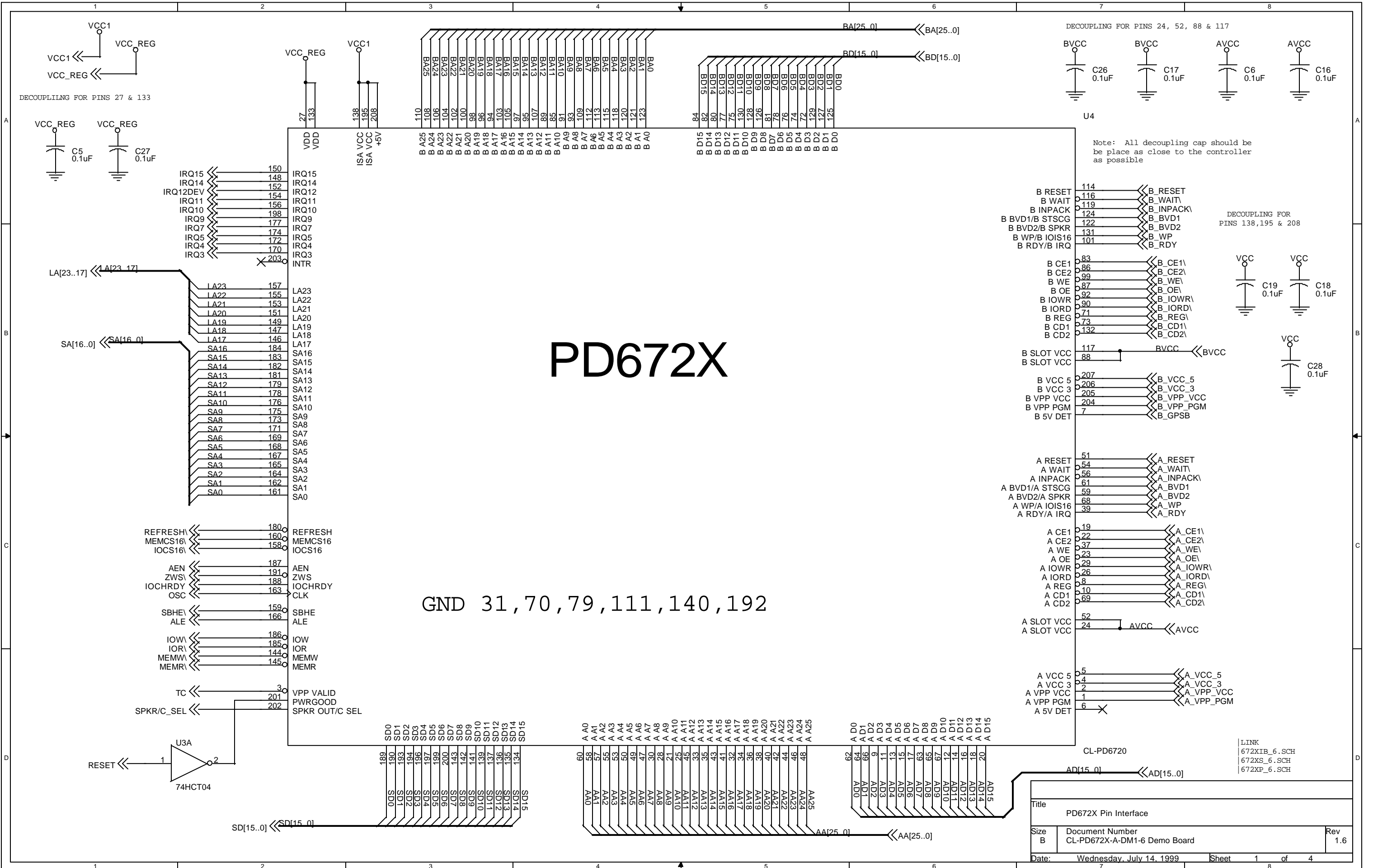


2.4 Conclusion

The PD6722 can directly connect to a specific DMA channel with no external logic. With external logic, the PD6722 can allow software to select one of the DMA channels. The system designer has the flexibility to directly connect one DMA channel, or, by using external logic, allow software to select one of the DMA channels, as required by the PCMCIA card(s) to be supported.

PD672X

GND 31, 70, 79, 111, 140, 192

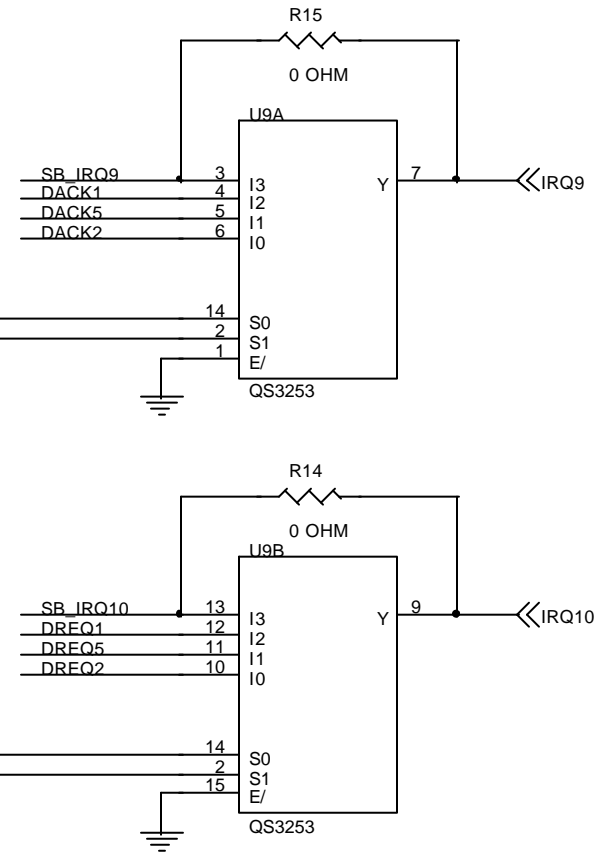
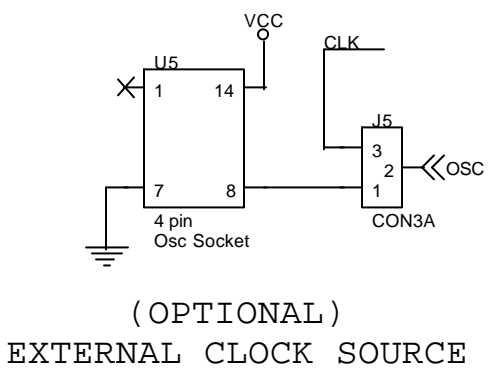
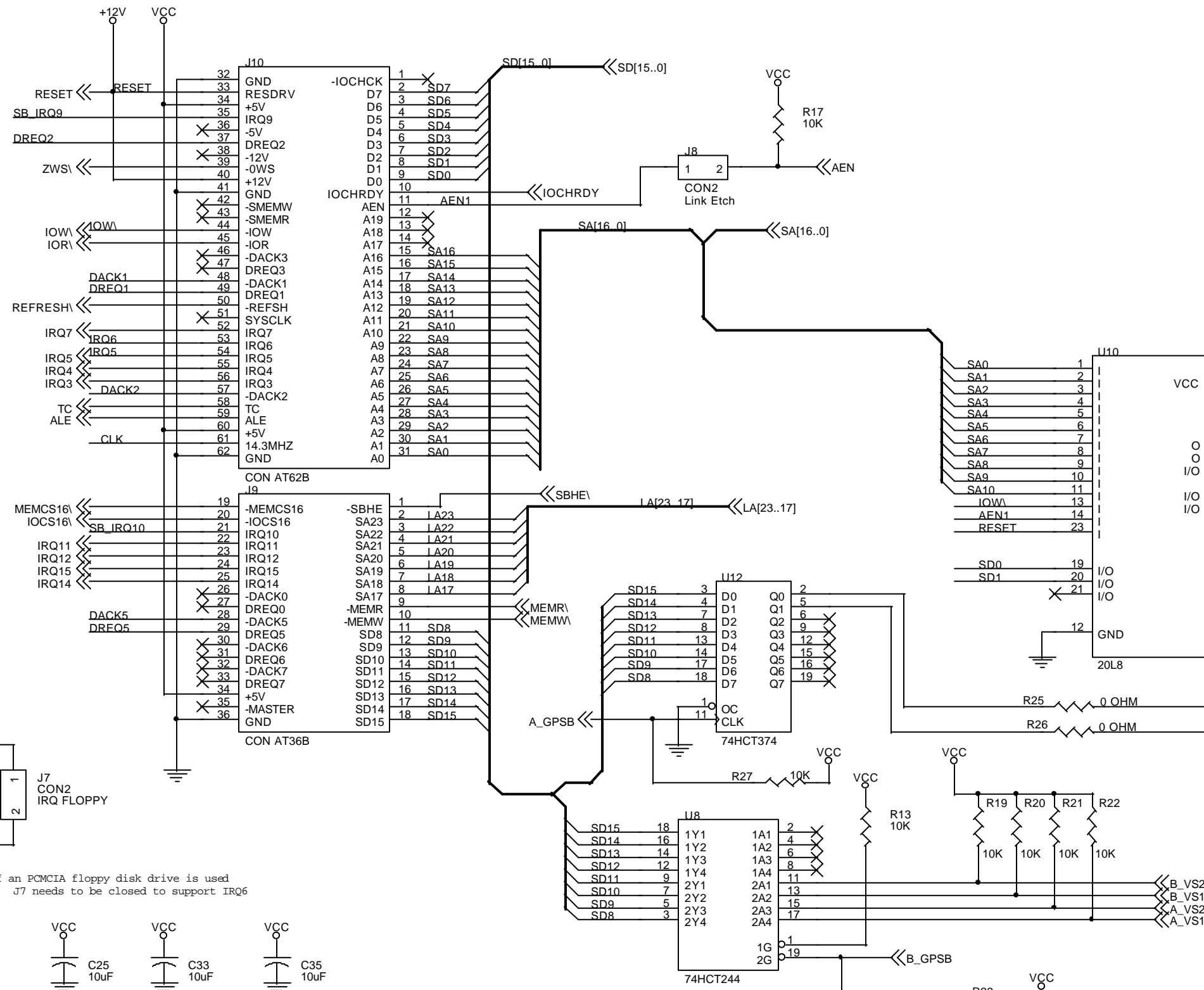


Note: All decoupling cap should be placed as close to the controller as possible

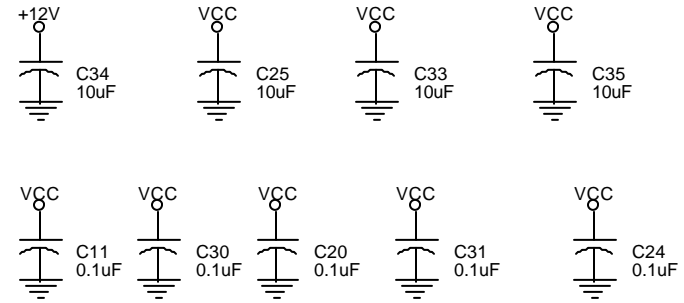
DECOUPLING FOR PINS 138, 195 & 208

LINK
672XIB_6.SCH
672XS_6.SCH
672XP_6.SCH

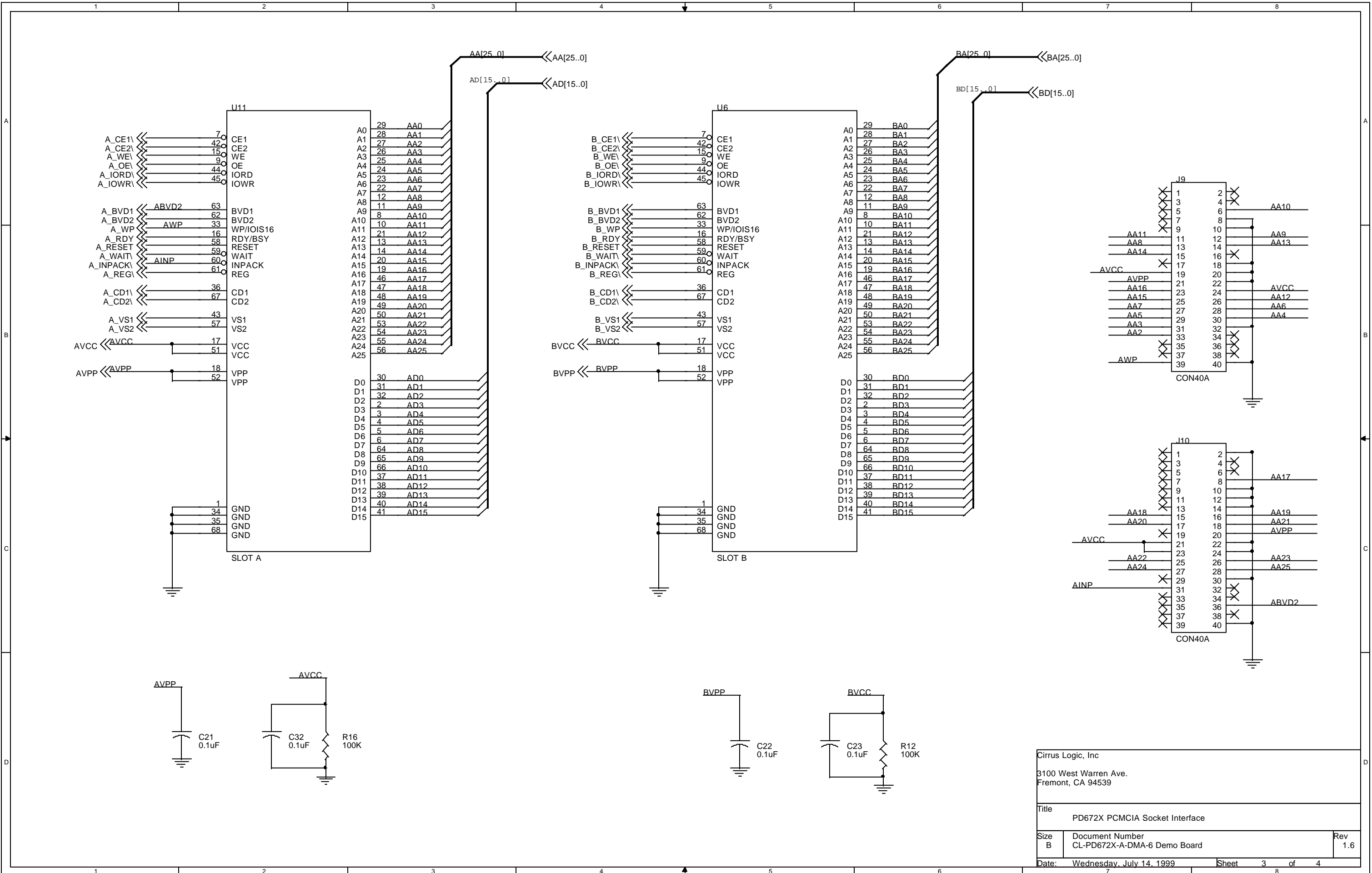
| | | | | | |
|-------|------------------------------|--|----------------------|---|------|
| Title | | | PD672X Pin Interface | | |
| Size | Document Number | | | | Rev |
| B | CL-PD672X-A-DM1-6 Demo Board | | | | 1.6 |
| Date: | Wednesday, July 14, 1999 | | Sheet | 1 | of 4 |



Note: If an PCMCIA floppy disk drive is used
J7 needs to be closed to support IRQ6



| | | |
|--|---|--------------|
| Cirrus Logic, Inc. | | |
| 3100 West Warren Ave. Fremont, CA 94539 | | |
| Title ISA BUS INTERFACE | | |
| Size B | Document Number CL-PD672X-A-DM1-6 DEMO BOARD | Rev 1.6 |
| Date: | Wednesday, July 14, 1999 | Sheet 2 of 4 |

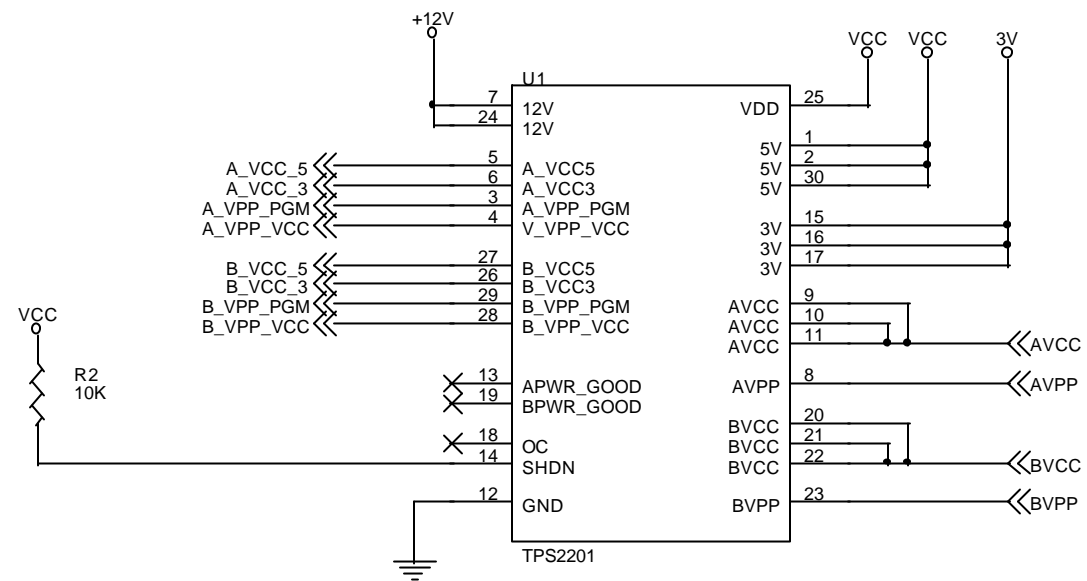


Cirrus Logic, Inc
 3100 West Warren Ave.
 Fremont, CA 94539

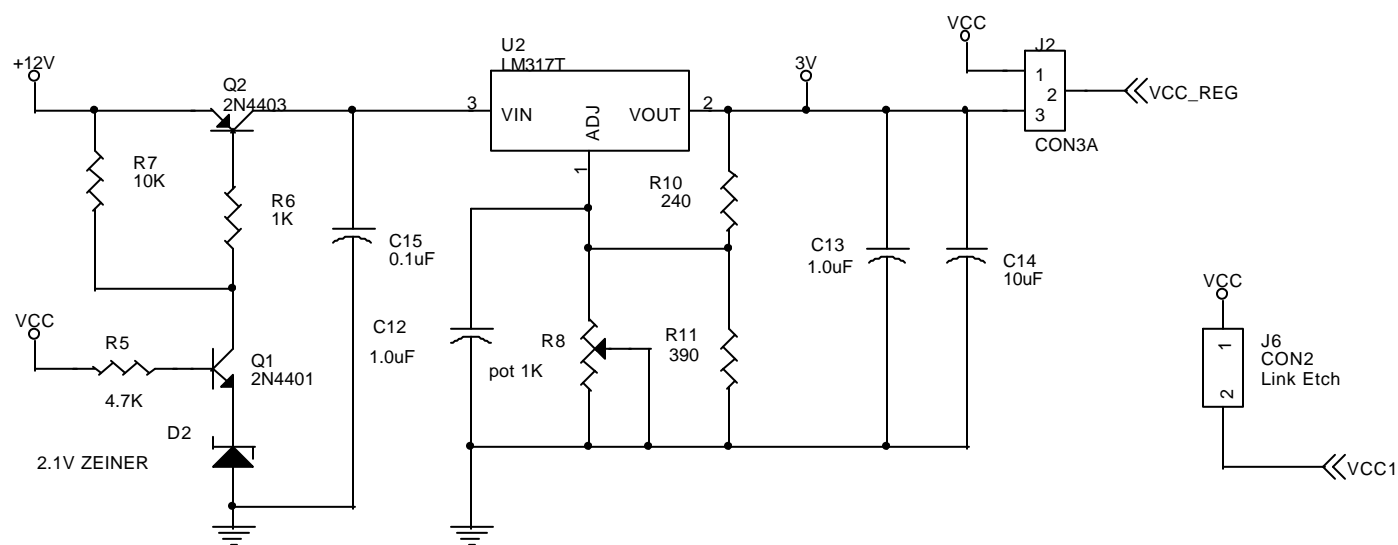
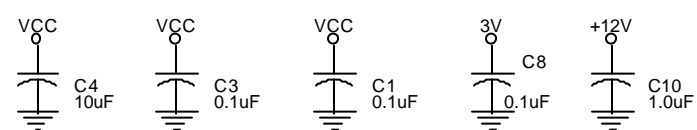
Title
 PD672X PCMCIA Socket Interface

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| Size B | Document Number CL-PD672X-A-DMA-6 Demo Board | Rev 1.6 |
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Date: Wednesday, July 14, 1999 Sheet 3 of 4

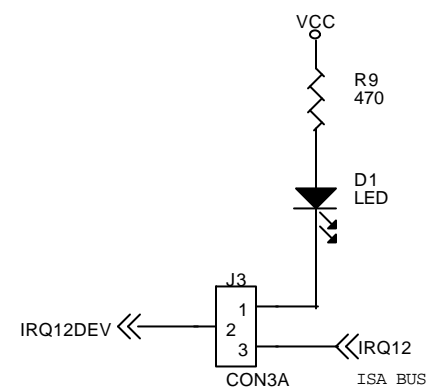


PCMCIA SOCKET POWER CONTROL VCC & VPP

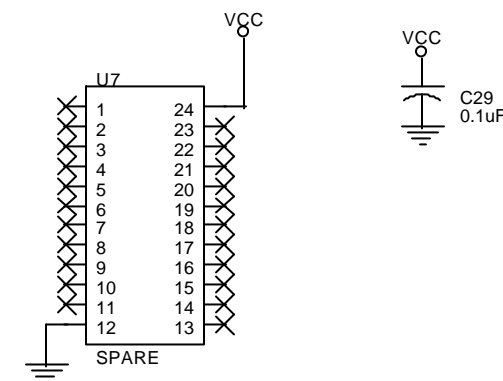


NOTE: INSTALL EITHER R1 OR R501
DO NOT INSTALL BOTH RESISTORS

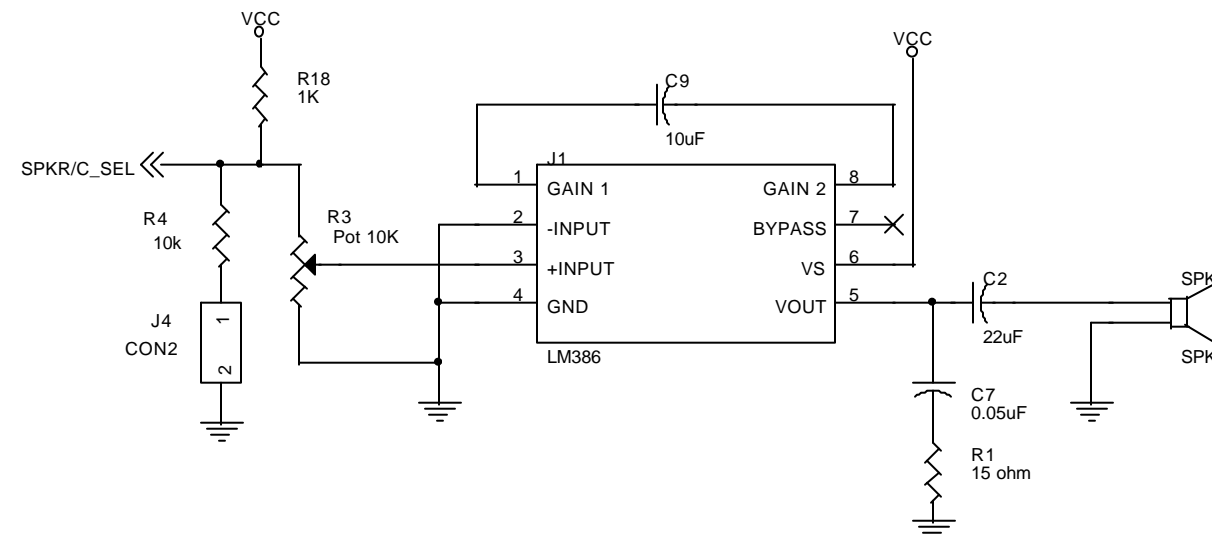
3.3V Volt Regulator



(OPTIONAL)
LED CIRCUIT
ATA MODE ONLY



SPARE 20 PIN



(OPTIONAL)
SPEAKER CIRCUIT

| | | |
|------------------------------|---|--------------|
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| Fremont, CA 94539 | | |
| Title POWER CONTROL LOGIC | | |
| Size B | Document Number CL-PD672X-A-DM1-6 DEMO BOARD | Rev 1.6 |
| Date: | Wednesday, July 14, 1999 | Sheet 4 of 4 |

