MIC2563A

Dual Slot PCMCIA/CardBus Power Controller

Preliminary Information

General Description

The MIC2563A Dual Slot PCMCIA (Personal Computer Memory Card International Association) and CardBus Power Controller handles all PC Card slot power supply pins, both V_{CC} and V_{PP}. The MIC2563A switches between the three V_{CC} voltages (0V, 3.3V and 5.0V) and the V_{PP} voltages (OFF, 0V, 3.3V, 5V, or 12.0V) required by PC Cards. The MIC2563A switches voltages from the system power supply to V_{CC} and V_{PP}. Output voltage is selected by two digital inputs each and output current ranges up to 1A for V_{CC} and 250mA for V_{PP}.

The MIC2563A provides power management capability controlled by the PC Card logic controller. Voltage rise and fall times are well controlled. Medium current V_{PP} and high current V_{CC} output switches are self-biasing: ***no +12V supply is required for 3.3V or 5V output.***

The MIC2563A is designed for efficient operation. In standby (sleep) mode the device draws very little quiescent current, typically 0.3µA. The device and PCMCIA port is protected by current limiting and overtemperature shutdown. Full cross-conduction lockout protects the system power supplies.

The MIC2563A is an improved version of the MIC2563, offering lower ON-resistances and a V_{CC} pulldown clamp in the OFF mode. It is available in a 28-pin SSOP.

Applications

- Dual Slot PC Card Power Supply Pin Voltage Switch
- CardBus Slot Power Supply Control
- Data Collection Systems
- Machine Control Data Input Systems
- Wireless Communications
- Bar Code Data Collection Systems
- Instrumentation Configuration/Datalogging
- Docking Stations (portable and desktop)
- Power Supply Management
- Power Analog Switching

Features

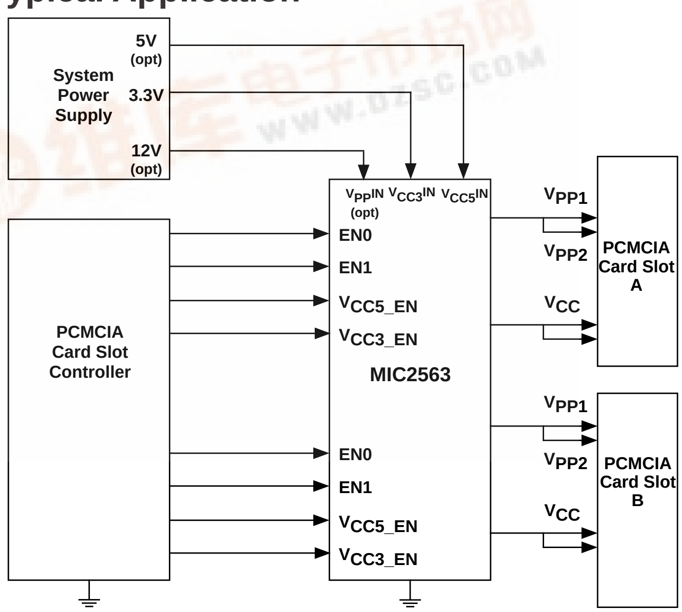
- Single Package Controls Two PC Card Slots
- High Efficiency, Low Resistance Switches Require No 12V Bias Supply
- No External Components Required
- Output Current Limit and Overtemperature Shutdown
- Ultra Low Power Consumption
- Complete Dual Slot PC Card/CardBus V_{CC} and V_{PP} Switch Matrix in a Single Package
- Logic Compatible with Industry Standard PC Card Logic Controllers
- No Voltage Shoot-Through or Switching Transients
- Break-Before-Make Switching
- Digital Selection of V_{CC} and V_{PP} Voltages
- Over 1A V_{CC} Output Current for Each Section
- Over 250mA V_{PP} Output Current for Each Section
- 28-Pin SSOP Package

Ordering Information

Part Number	Temperature Range	Package
MIC2563A-0BSM	–40°C to +85°C	28-pin SSOP
MIC2563A-1BSM	–40°C to +85°C	28-pin SSOP

Note: see the logic table inside for a description of the differences between the logic options

Typical Application

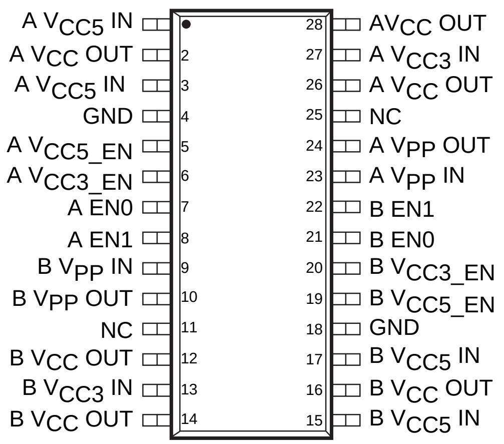


Absolute Maximum Ratings (Notes 1 and 2)

Power Dissipation, $T_{AMBIENT} \leq 25°C$ ...... *Internally Limited*
SSOP .... 800 mW
Derating Factors (To Ambient)
SSOP .... 4 mW/°C
Storage Temperature .... –65°C to +150°C
Operating Temperature (Die) .... 125°C
Lead Temperature (5 sec) .... 260°C

Supply Voltage, $V_{PP\ IN}$ 15V
V_{CC3} IN 7.5V
V_{CC5} IN 7.5V
Logic Input Voltages .... –0.3V to +10V
Output Current (each Output)
$V_{PP\ OUT}$ .... *>200mA, Internally Limited*
$V_{CC\ OUT}$ .... *>1A, Internally Limited*

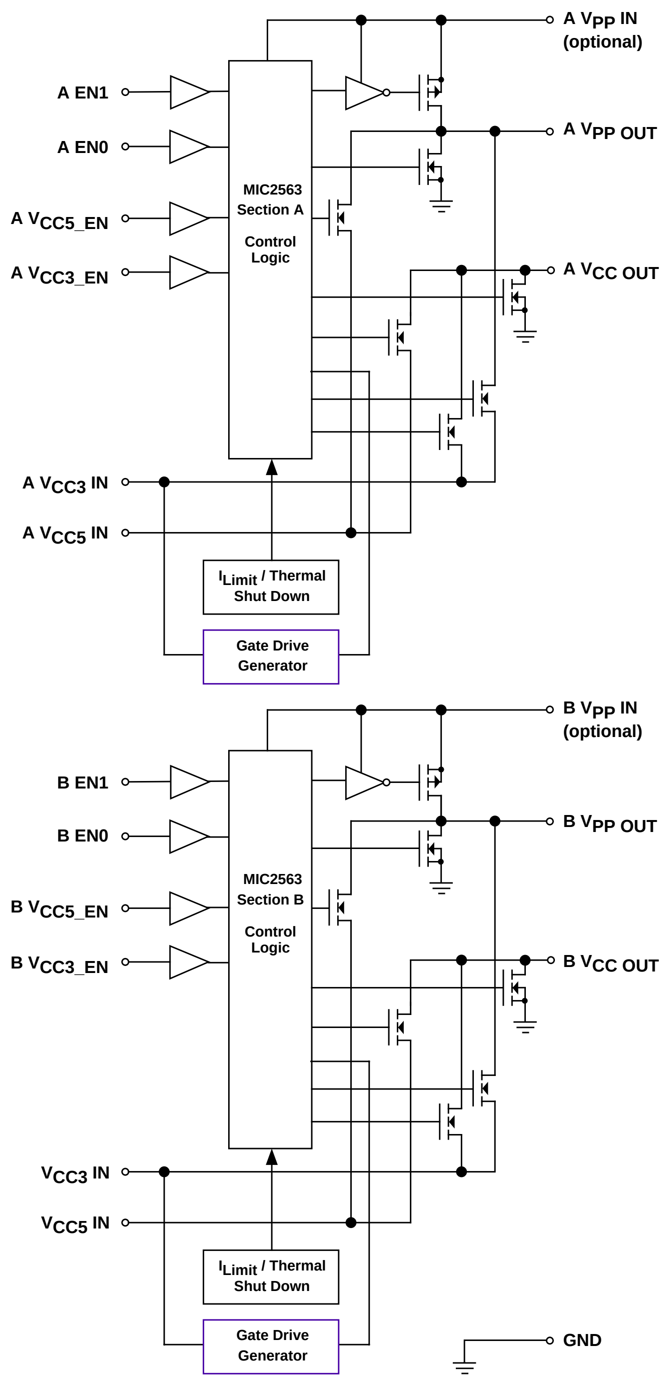
Pin Configuration



28 Pin SSOP Package

Connect all pins with the same name together for proper operation.

Logic Block Diagram



MIC2563A-1 Redefined Pin Assignment

Function	Pin Number	
	Slot A	Slot B
VPP_VCC	7	21
VPP_PGM	8	22

Some pin names for the MIC2563A-1 are different from the MIC2563A-0. This table shows the differences. All other pin names are identical to the MIC2563A-0 as shown in the **Pin Configuration**, above.

Electrical Characteristics: (Over operating temperature range with V_{CC3} IN = 3.3V, V_{CC5} IN = 5.0V, V_{PP} IN = 12V, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
DIGITAL INPUTS						
V_{IH}	Logic 1 Input Voltage		2.2		7.5	V
V_{IL}	Logic 0 Input Voltage		–0.3		0.8	V
I_{IN}	Input Current	0 V < V_{IN} < 5.5V			±1	µA
V_{PP} OUTPUT						
$I_{PP\ OUT}$ Hi-Z	High Impedance Output Leakage Current	Shutdown Mode $0 \le V_{PP\ OUT} \le 12V$		1	10	µA
I_{PPSC}	Short Circuit Current Limit	$V_{PP\ OUT}$ = 0	0.2	0.3		A
R_O	Switch Resistance	Select $V_{PP\ OUT}$ = 5V Select $V_{PP\ OUT}$ = 3.3V $I_{PP\ OUT}$ = –100mA (Sourcing)		1.8 3.3	2.5 5	Ω
R_O	Switch Resistance, Select $V_{PP\ OUT}$ = 12V	$V_{PP\ IN}$ = 12V $I_{PP\ OUT}$ = –100 mA (Sourcing)		0.6	1	Ω
R_O	Switch Resistance, Select $V_{PP\ OUT}$ = 0V	Select $V_{PP\ OUT}$ = clamped to ground $I_{PP\ OUT}$ = 50µA (Sinking)		2500	3900	Ω
V_{PP} SWITCHING TIME (See Figure 1)						
t_1 t_2 t_3	Output Turn-ON Delay (Note 3)	$V_{PP\ OUT}$ = Hi-Z to 10% of 3.3V $V_{PP\ OUT}$ = Hi-Z to 10% of 5V $V_{PP\ OUT}$ = Hi-Z to 10% of 12V		5 10 70	50 50 250	µs
t_4 t_5 t_6	Output Rise Time (Note 3)	$V_{PP\ OUT}$ = 10% to 90% of 3.3V $V_{PP\ OUT}$ = 10% to 90% of 5V $V_{PP\ OUT}$ = 10% to 90% of 12V	100 100 100	200 300 225	800 1000 800	µs
t_7 t_8 t_9 t_{10}	Output Transition Timing (Note 3)	$V_{PP\ OUT}$ = 3.3V to 90% of 12V $V_{PP\ OUT}$ = 5V to 90% of 12V $V_{PP\ OUT}$ = 12V to 90% of 3.3V $V_{PP\ OUT}$ = 12V to 90% of 5V	100 100 100 100	250 200 200 350	1000 800 800 1200	µs
t_{14} t_{15} t_{16}	Output Turn-Off Delay Time (Notes 3, 5)	$V_{PP\ OUT}$ = 3.3V to Hi-Z $V_{PP\ OUT}$ = 5V to Hi-Z $V_{PP\ OUT}$ = 12V to Hi-Z		200 200 200	1000 1000 1000	ns
t_{11} t_{12} t_{13}	Output Turn-OFF Fall Time (Note 3)	$V_{PP\ OUT}$ = 90% to 10% of 3.3V $V_{PP\ OUT}$ = 90% to 10% of 5V $V_{PP\ OUT}$ = 90% to 10% of 12V		50 50 300	1000 1000 2000	ns

Electrical Characteristics (continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{CC} OUTPUT						
I_{CCSC}	Short Circuit Current Limit	$V_{CC\ OUT}$ = 0	1	1.5		A
R_O	Switch Resistance	Select $V_{CC\ OUT}$ = 3.3V $I_{CC\ OUT}$ = –1A (Sourcing)		100	150	mΩ
		Select $V_{CC\ OUT}$ = 5V $I_{CC\ OUT}$ = –1A (Sourcing)		70	100	mΩ
		Select $V_{CC\ OUT}$ = clamped to ground $I_{CC\ OUT}$ = 0.1mA (Sinking)		500	3900	Ω
V_{CC} SWITCHING TIME (See Figure 2)						
t_1	Output Turn ON Delay Time	$V_{CC\ OUT}$ = 0V to 10% of 3.3V		300	1500	µs
t_2	(Note 4)	$V_{CC\ OUT}$ = 0V to 10% of 5.0V		750	3000	
t_3	Output Rise Time (Note 4)	$V_{CC\ OUT}$ = 10% to 90% of 3.3V	200	700	2500	µs
t_4		$V_{CC\ OUT}$ = 10% to 90% of 5V	200	1500	6000	
t_7	Output Turn-Off Delay (Notes 4, 5)	$V_{CC\ OUT}$ = 3.3V		2.4	8	ms
t_8		$V_{CC\ OUT}$ = 5V		2.8	8	
t_5	Output Fall Time (Note 4)	$V_{CC\ OUT}$ = 90% to 10% of 3.3V	100	240	1000	µs
t_6		$V_{CC\ OUT}$ = 90% to 10% of 5.0V	100	600	2000	
POWER SUPPLY						
I_{CC5}	$V_{CC5\ IN}$ Supply Current (5V)	$V_{CC\ OUT}$ = 5V or 3.3V, $I_{CC\ OUT}$ = 0		8	50	µA
		$V_{CC\ OUT}$ = 0V (Sleep Mode)		0.2	10	
I_{CC3}	$V_{CC3\ IN}$ Supply Current (3.3V)	$V_{CC\ OUT}$ = 5V or 3.3V, $I_{CC\ OUT}$ = 0		40	100	µA
	(Note 6)	$V_{CC\ OUT}$ = 0V (Sleep Mode)		0.1	10	
I_{PP} IN	$V_{PP\ IN}$ Supply Current (12V)	$V_{PP\ OUT}$ = 3.3V or 5V. $I_{PP\ OUT}$ = 0		0.3	4	µA
	(Note 7)	$V_{PP\ OUT}$ = Hi-Z, 0 or V_{PP}		0.3	4	
V_{CC5}	Operating Input Voltage (5V)	$V_{CC5\ IN}$ not required for operation	—	5.0	6	V
V_{CC3}	Operating Input Voltage (3.3V)	(Note 6)	3.0	3.3	6	V
$V_{PP\ IN}$	Operating Input Voltage (12V)	$V_{PP\ IN}$ not required for operation (Note 8)	—	12.0	14.5	V

Electrical Characteristics (continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
THERMAL SHUTDOWN						
T_{SD}	Thermal Shutdown Temperature			130		°C

NOTE 1: Functional operation above the absolute maximum stress ratings is not implied.

NOTE 2: Static-sensitive device. Store only in conductive containers. Handling personnel and equipment should be grounded to prevent damage from static discharge.

NOTE 3: R_L = 100Ω connected to ground.

NOTE 4: R_L = 10Ω connected to ground.

NOTE 5: Delay from commanding Hi Z or 0V to beginning slope. Does not apply to current limit or overtemperature shutdown conditions.

NOTE 6: The MIC2563A uses $V_{CC3\ IN}$ for operation. For single 5V supply systems, connect 5V to both $V_{CC3\ IN}$ and V_{CC5IN}. See Applications Information for further details.

NOTE 7: $V_{PP\ IN}$ is not required for operation.

NOTE 8: $V_{PP\ IN}$ must be either high impedance or greater than or approximately equal to the highest voltage V_{CC} in the system. For example, if both 3.3V and 5V are connected to the MIC2563A, $V_{PP\ IN}$ must be either 5V, 12V, or high impedance.

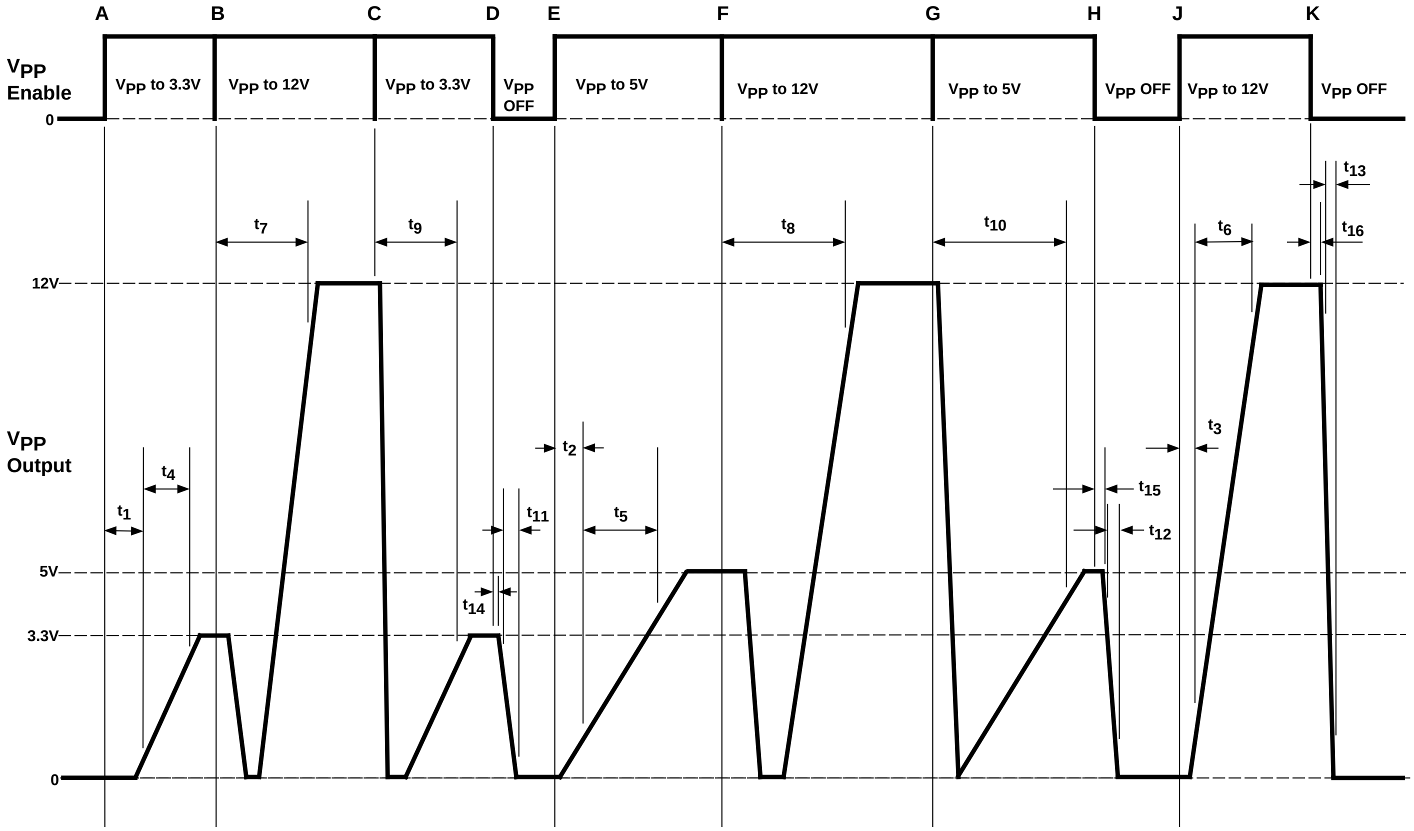


Figure 1. MIC2563A V_{PP} Timing Diagram. V_{PP} Enable is shown generically: refer to the timing tables (below). At time "A" V_{PP} = 3.3V is selected. At B, V_{PP} is set to 12V. At C, V_{PP} = 3.3V (from 12V). At D, V_{PP} is disabled. At E, V_{PP} is programmed to 5V. At F, V_{PP} is set to 12V. At G, V_{PP} is programmed to 5V. At H, V_{PP} is disabled. At J, V_{PP} is set to 12V. And at K, V_{PP} is again disabled. R_L = 100Ω for all measurements. Load capacitance is negligible.

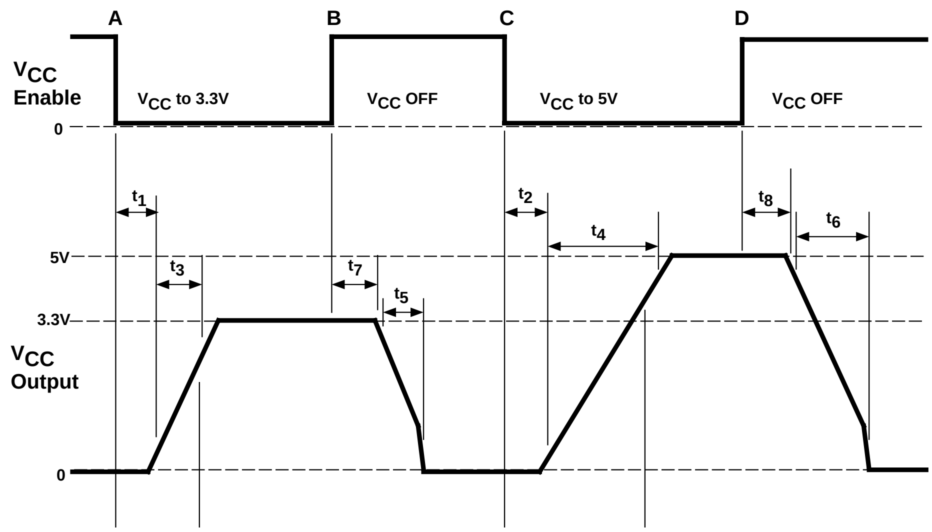


Figure 2. MIC2563A V_{CC} Timing Diagram. V_{CC} Enable is shown generically: refer to the timing tables (below) for specific control logic input. At time A, V_{CC} is programmed to 3.3V. At B, V_{CC} is disabled. At C, V_{CC} is programmed to 5V. And at D, V_{CC} is disabled. $R_L = 10\Omega$

MIC2563A-0 Control Logic Table

V_{CC5_EN}	V_{CC3_EN}	EN1	EN0	V_{CC} OUT	V_{PP} OUT
0	0	0	0	Clamped to Ground	High Z
0	0	0	1	Clamped to Ground	High Z
0	0	1	0	Clamped to Ground	High Z
0	0	1	1	Clamped to Ground	Clamped to Ground
0	1	0	0	3.3	High Z
0	1	0	1	3.3	3.3
0	1	1	0	3.3	12
0	1	1	1	3.3	Clamped to Ground
1	0	0	0	5	High Z
1	0	0	1	5	5
1	0	1	0	5	12
1	0	1	1	5	Clamped to Ground
1	1	0	0	3.3	High Z
1	1	0	1	3.3	3.3
1	1	1	0	3.3	5
1	1	1	1	3.3	Clamped to Ground

MIC2563A-1 Control Logic (compatible with Cirrus Logic CL-PD6710 & PD672x-series Controllers)

V_{CC5_EN}	V_{CC3_EN}	V_{PP_PGM}	V_{PP_VCC}	V_{CC} OUT	V_{PP} OUT
0	0	0	0	Clamped to Ground	Clamped to Ground
0	0	0	1	Clamped to Ground	High Z
0	0	1	0	Clamped to Ground	High Z
0	0	1	1	Clamped to Ground	High Z
0	1	0	0	5	Clamped to Ground
0	1	0	1	5	5
0	1	1	0	5	12
0	1	1	1	5	High Z
1	0	0	0	3.3	Clamped to Ground
1	0	0	1	3.3	3.3
1	0	1	0	3.3	12
1	0	1	1	3.3	High Z
1	1	0	0	Clamped to Ground	Clamped to Ground
1	1	0	1	Clamped to Ground	High Z
1	1	1	0	Clamped to Ground	High Z
1	1	1	1	Clamped to Ground	High Z

Applications Information

PC Card power control for two sockets is easily accomplished using the MIC2563A PC Card/CardBus Slot V_{CC} & V_{PP} Power Controller IC. Four control bits per socket determine $V_{CC\ OUT}$ and $V_{PP\ OUT}$ voltage and standby/operate mode condition. V_{CC} outputs of 3.3V and 5V at the maximum allowable PC Card current are supported. $V_{PP\ OUT}$ output voltages of V_{CC} (3.3V or 5V), V_{PP}, 0V, or a high impedance state are available. When the V_{CC} clamped to ground condition is selected, the device switches into "sleep" mode and draws only nanoamperes of leakage current. Full protection from hot switching is provided which prevents feedback from the $V_{CC\ OUT}$ (from 5V to 3.3V, for example) by locking out the low voltage switch until the initial switch's gate voltage drops below the desired lower V_{CC}.

The MIC2563A operates from the computer system main power supply. Device logic and internal MOSFET drive is generated internally by charge pump voltage multipliers powered from $V_{CC3\ IN}$. Switching speeds are carefully controlled to prevent damage to sensitive loads and meet all PC Card Specification timing requirements.

Supply Bypassing

External capacitors are not required for operation. The MIC2563A is a switch and has no stability problems. For best results however, bypass V_{CC3} IN, V_{CC5} IN, and V_{PP} IN inputs with 1µF capacitors to improve output ripple. As all internal device logic and comparison functions are powered from the V_{CC3} IN line, the power supply quality of this line is the most important, and a bypass capacitor may be necessary for some layouts. Both $V_{CC\ OUT}$ and $V_{PP\ OUT}$ pins may use 0.01µF to 0.1µF capacitors for noise reduction and electrostatic discharge (ESD) damage prevention.

PC Card Slot Implementation

The MIC2563A is designed for full compatibility with the Personal Computer Memory Card International Association's (PCMCIA) PC Card Specification, (March 1995), including the CardBus option.

When a memory card is initially inserted, it should receive V_{CC} — either 3.3V ± 0.3V or 5.0V ±5%. The initial voltage is determined by a combination of mechanical socket "keys" and voltage sense pins. The card sends a handshaking data stream to the controller, which then determines whether or not this card requires V_{PP} and if the card is designed for dual V_{CC}. If the card is compatible with and desires a different V_{CC} level, the controller commands this change by disabling V_{CC}, waiting at least 100ms, and then re-enabling the other V_{CC} voltage.

V_{CC} switches are turned ON and OFF slowly. If commanded to immediately switch from one V_{CC} to the other (without turning OFF and waiting 100ms first), enhancement of the second switch begins after the first is OFF, realizing break-before-make protection. V_{PP} switches are turned ON slowly and OFF quickly, which also prevents cross conduction.

If no card is inserted or the system is in sleep mode, the slot logic controller outputs a (V_{CC3} IN, V_{CC5} IN) = (0,0) to the MIC2563A, which shuts down V_{CC}. This also places the switch into a high impedance output shutdown (sleep) mode, where current consumption drops to nearly zero, with only tiny CMOS leakage currents flowing.

Internal device control logic and MOSFET drive and bias voltage is powered from V_{CC3} IN. The high voltage bias is generated by an internal charge pump quadrupler. Systems without 3.3V may connect V_{CC3} IN to 5V. Input logic threshold voltages are compatible with common PC Card logic controllers using either 3.3V or 5V supplies.

The PC Card Specification defines two V_{PP} supply pins per card slot. The two V_{PP} supply pins may be programmed to different voltages. V_{PP} is primarily used for programming FLASH memory cards. Implementing two independent V_{PP} voltages is easily accomplished with the MIC2563A and a MIC2557 PCMCIA V_{PP} Switching Matrix. Figure 3 shows this full configuration, supporting independent V_{PP} and both 5.0V and 3.3V V_{CC} operation. However, few logic controllers support multiple V_{PP}—most systems connect V_{PP1} to V_{PP2} and the MIC2557 is not required. This circuit is shown in Figure 4.

During Flash memory programming with standard (+12V) Flash memories, the PC Card slot logic controller outputs a (0 , 1) to the EN0, EN1 control pins of the MIC2563A, which connects V_{PP} IN (nominally +12V) to $V_{PP\ OUT}$. The low ON resistance of the MIC2563A switch allows using a small bypass capacitor on the $V_{PP\ OUT}$ pins, with the main filtering action performed by a large filter capacitor on V_{PP} IN (usually the main power supply filter capacitor is sufficient). Using a small-value capacitor such as 0.1µF on the output causes little or no timing delays. The $V_{PP\ OUT}$ transition from V_{CC} to 12.0V typically takes 250µs. After programming is completed, the controller outputs a (EN1, EN0) = (0,1) to the MIC2563A, which then reduces $V_{PP\ OUT}$ to the V_{CC} level. Break-before-make switching action and controlled rise times reduces switching transients and lowers maximum current spikes through the switch.

Figure 5 shows MIC2563A configuration for situations where only a single +5V V_{CC} is available.

Output Current and Protection

MIC2563A output switches are capable of passing the maximum current needed by any PC Card. The MIC2563A meets or exceeds all PCMCIA specifications. For system and card protection, output currents are internally limited. For full system protection, long term (millisecond or longer) output short circuits invoke overtemperature shutdown, protecting the MIC2563A, the system power supplies, the card socket pins, and the PC Card.

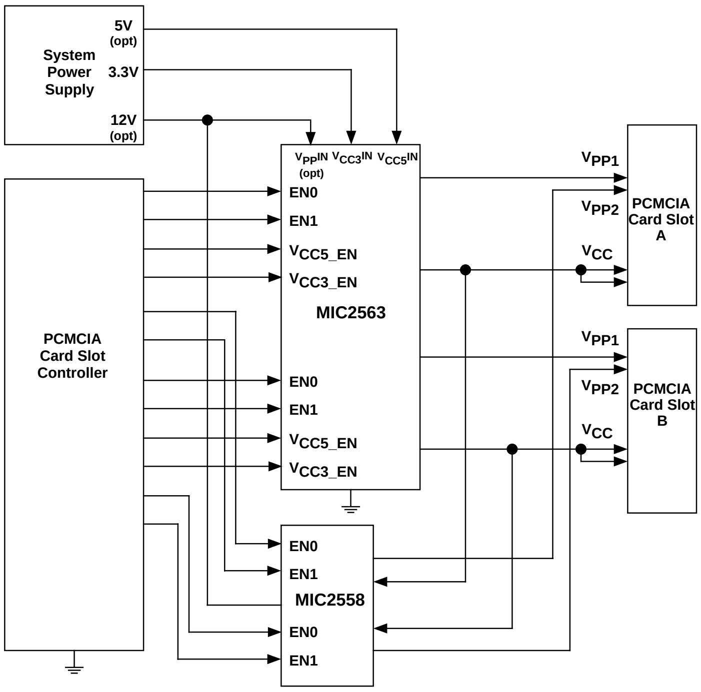


Figure 3. PC Card slot power control application with dual V_{CC} (5.0V or 3.3V) and separate V_{PP1} and V_{PP2}.

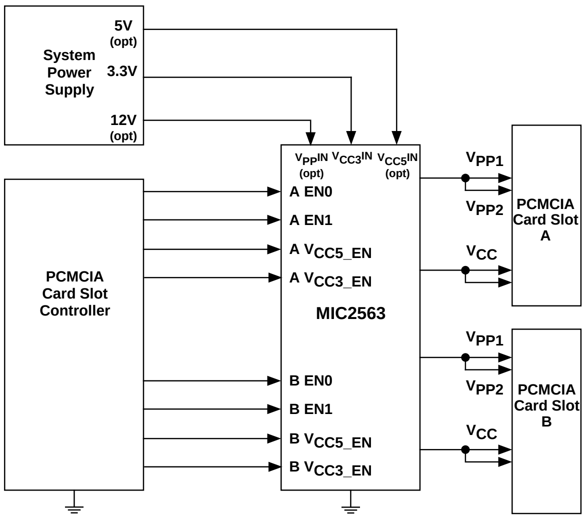


Figure 4. Typical PC Card slot power control application with dual V_{CC} (5.0V or 3.3V). Note that V_{PP1} and V_{PP2} are driven together.

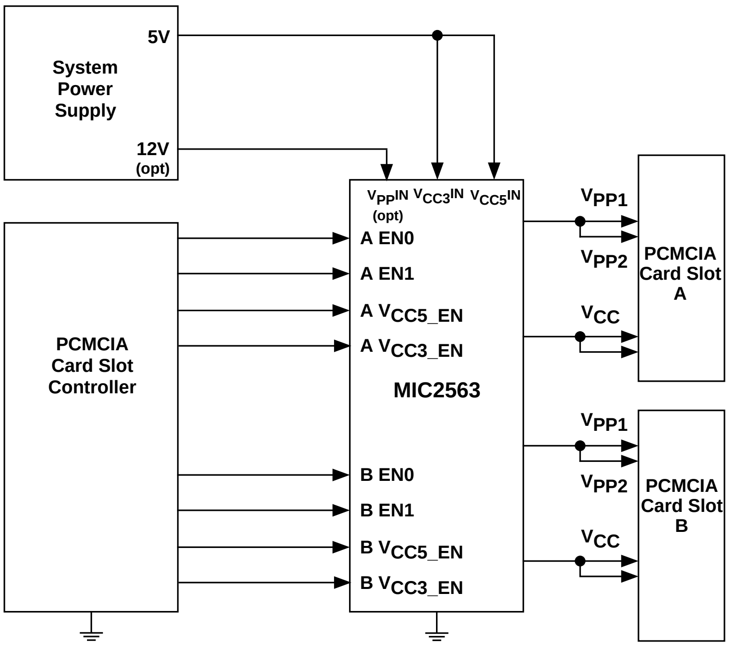


Figure 5. PC Card slot power control application without a 3.3V V_{CC} supply. Note that $V_{CC3\ IN}$ and $V_{CC5\ IN}$ lines are driven together. The MIC2563A is powered from the $V_{CC3\ IN}$ line. In this configuration, $V_{CC\ OUT}$ will be 5V when either V_{CC3} or V_{CC5} is enabled.

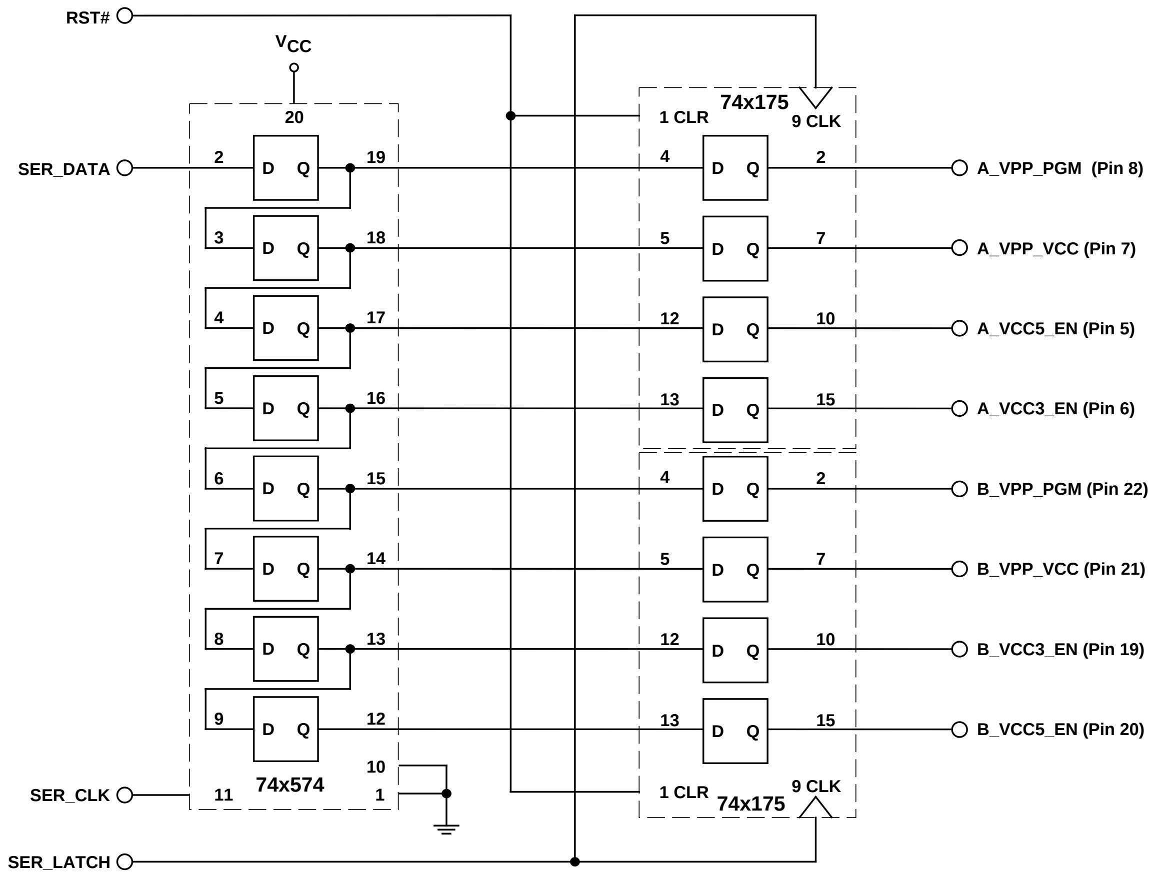


Figure 6. Interfacing the MIC2563A with a serial-output data controller. Pinouts shown are for the MIC2563A-1 and a three-wire serial controller.

Serial Control

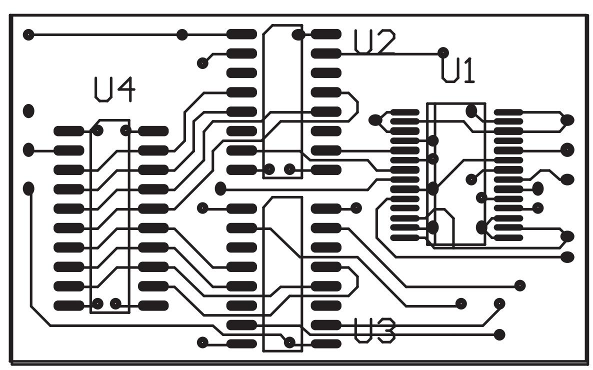
Figure 6 shows conversion from a three-wire serial interface, such as used by the Cirrus Logic CL-PD6730, to the standard eight-line parallel interface used by the MIC2563A-1. This interface requires three common, low cost 7400-series logic ICs:

- 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.

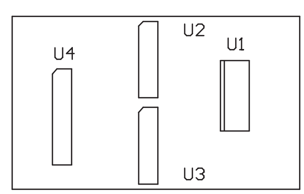
Another serial-to-parallel solution for this application is the 74HC594, 8-bit shift register with output registers. This device contains the eight D flip-flops plus has latched outputs suitable for this purpose.

Serial Control Adapter P.C. Board Layout



Component Key

U1 .... MIC2563
U2, U3 ...... 74x175
U4 .... 74x574



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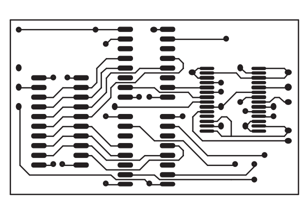
Top Overlay



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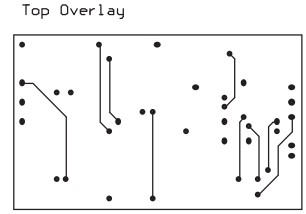

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