MIC2566

Single-Slot PC Card/CardBus Power Controller

Preliminary

General Description

The MIC2566 single-slot PC Card / CardBus power controller is a V_{CC} and V_{PP} power switch matrix that supports 3.3V and 5V PC Card (PCMCIA) slot power supply pins.

The MIC2566 can switch PC Card slot V_{CC} voltages between 0V (ground), 3.3V and 5.0V and V_{PP} voltages between 0V (ground), 3.3V, 5V, or high impedance at output currents of up to 1A for V_{CC} and 200mA for V_{PP}. The MIC2566 features well-controlled voltage rise and fall times. Each MIC2566 output voltage is switched by two digital inputs, typically controlled from a separate PC Card logic controller.

The MIC2566 is designed for efficient operation. In standby (sleep) mode the device draws very little quiescent current, typically only 0.3µA. The power controller includes thermal shutdown and protects itself and its PC Card ports with current limiting. Full cross-conduction lockout protects the system power supplies.

The MIC2566 is available in 14-pin SOP and TSSOP packages.

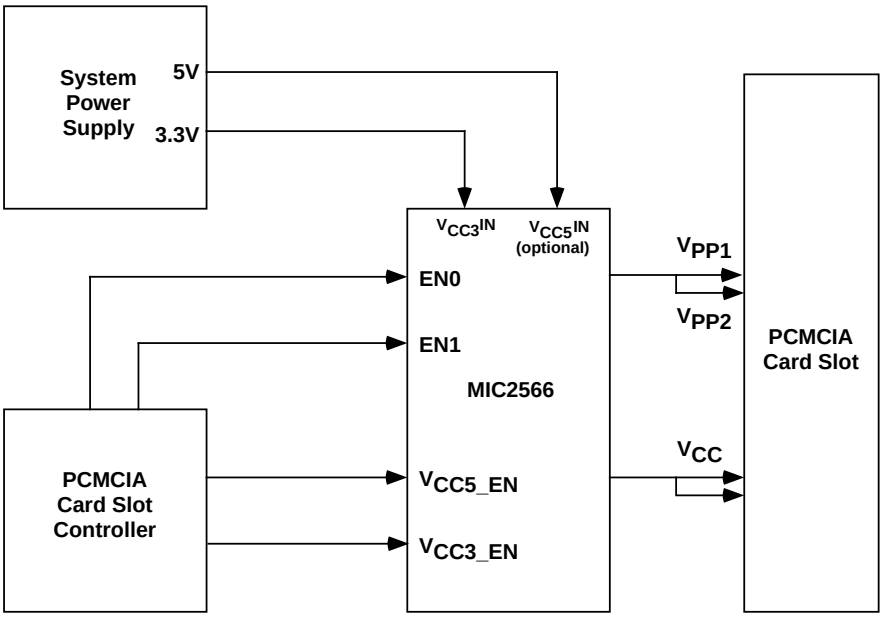
Features

- Complete single-slot power switch solution
- No external components required
- Output current limit and thermal shutdown
- Ultra-low power consumption
- Compatible with standard PC Card logic controllers
- Break-before-make switching (no transients)
- Digital V_{CC} and V_{PP} voltage selection
- > 1A V_{CC} output current per slot
- > 120mA V_{PP} output current per slot
- 14-pin SOP and TSSOP package
- Pb-free SO package
- UL recognized, file #179633

Applications

- Single-slot PC Card power supply 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
- Portable and desktop computer docking stations
- Power supply management
- Power analog switching

Typical Application

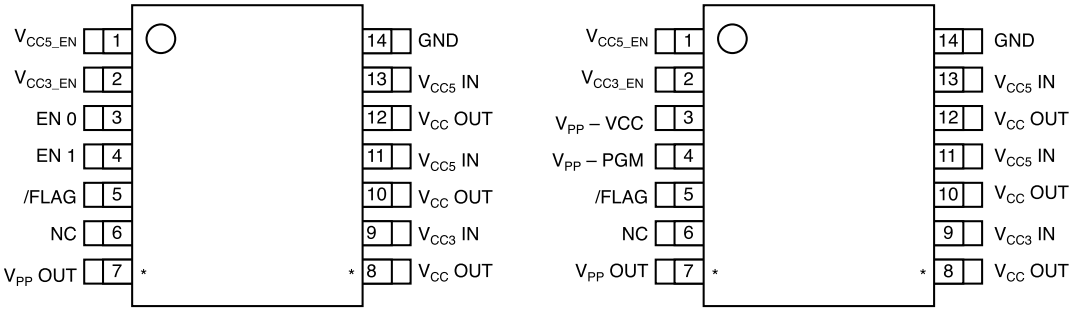


UL Recognized Component

Ordering Information

Part Number	Operating Temp. Range	Package	Pb-Free
MIC2566-0BM	–40°C to +85°C	14-pin SOP	
MIC2566-1BM	–40°C to +85°C	14-pin SOP	
MIC2566-0YM	–40°C to +85°C	14-pin SOP	X
MIC2566-1YM	–40°C to +85°C	14-pin SOP	X
MIC2566-0BTS	–40°C to +85°C	14-pin TSSOP	
MIC2566-1BTS	–40°C to +85°C	14-pin TSSOP	

Pin Configuration



MIC2566-0 **MIC2566-1**

* Denotes pinout differences. Duplicate pins must be connected together for prober operation.
Example: V_{CC5}IN pins 11 & 13 must be externally connected together.

Pin Description

Pin Number MIC2566-0	Pin Number MIC2566-1	Pin Name	Pin Function
1	1	V_{CC5} EN	V_{CC} 5V Enable (Input).
2	2	V_{CC3} EN	V_{CC} 3.3V Enable (Input).
3		EN0	Enable 0: Micrel standard logic-control signal. MIC2566-0 only.
	3	V_{PP}_V_{CC}	V_{PP}_V_{CC} Control: Cirrus Logic logic-controller compatible control signal. MIC2566-1 only.
4		EN1	Enable 1: Micrel standard logic-control signal. MIC2566-0 only.
	4	V_{PP}_PGM	Program: Cirrus Logic-compatible control signal. MIC2566-1 only.
5	5	/FLAG	Error Flag: This pin requires a pull-up resistor (10kΩ recommended) to V_{CC3}IN or V_{CC5}IN.
6	6	NC	Not internally connected.
7	7	V_{PP} OUT	V_{PP} Output: 0V (ground), 3.3V, 5V, or high-impedance output.
9	9	V_{CC3} IN	3.3V-Nominal Supply Input: Mandatory supply, switchable to V_{CC} and V_{PP} outputs. Also powers MIC2566 internal circuitry.
8, 10, 12	8, 10, 12	V_{CC} OUT	V_{CC} Output: 0V (ground), 3.3V, 5V, or high-impedance output. Pins 8, 10, and 12 must be externally connected.
11, 13	11, 13	V_{CC5} IN	5V-Nominal Supply Input: Optional supply, switchable to V_{CC} and V_{PP} outputs. Pins 11 and 13 must be externally connected.
14	14	GND	Ground.

Absolute Maximum Ratings (Note 1)

V_{CC3} IN ..... +6.0V
V_{CC5} IN ..... +6.0V
V_{EN0}, V_{EN1}, V_{CC5EN}, V_{CC3EN} ..... –0.3V to +6.0V
V_{FLAG} ..... +6.0V
V_{PP} OUT ..... >120mA, Internally Limited
V_{CC} OUT ..... >1A, Internally Limited
Power Dissipation at $T_A \le 25°C$ (P_D) ..... Internally Limited
Storage Temperature ..... –65°C to +150°C
Lead Temperature (5 sec.) ..... +260°C
ESD Rating, **Note 3**

Operating Ratings (Note 2)

V_{CC3} IN ..... +3.0V to +5.5V
V_{CC5} IN ..... 0V to +5.5V
V_{EN0}, V_{EN1}, V_{CC5EN}, V_{CC3EN} ..... 0V to +5.5V
V_{PP} OUT ..... 0 to 120mA
V_{CC} OUT ..... 0 to 1A
Clock Frequency ..... 0 to 2MHz
Ambient Temperature (T_A) ..... –40°C to +85°C
Junction Temperature (T_J) ..... +125°C
Package Thermal Resistance (θ_{JA})
SOP ..... 90°C/W
TSSOP ..... 83°C/W

Electrical Characteristics (Note 4)

Specified over operating ambient temperature range of –40°C to +85°C with V_{CC3} IN = 3.3V, V_{CC5} IN = 5.0V, unless otherwise specified.

Symbol	Parameter	Condition	Min	Typ	Max	Units
DIGITAL INPUTS (V_{EN0}, V_{EN1}, V_{CC3EN}, V_{CC5EN})						
V_{IH}	Logic 1 Input Voltage		$0.7xV_{CC3}IN$		5.5	V
V_{IL}	Logic 0 Input Voltage		–0.3		$0.3xV_{CC3}IN$	V
I_{IN}	Input Current	$0 V < V_{IN} < 5.5V$			±2	µA
V_{PP} OUTPUT						
$I_{PP\ OUT}$ Hi-Z	High Impedance Output Leakage Current	Shutdown Mode $0 \le V_{PP\ OUT} \le 5V$		1	10	µA
I_{PPSC}	Short Circuit Current Limit	$V_{PP\ OUT}$ = 0V	0.12	0.4		A
R_O	Switch Resistance	Select $V_{PP\ OUT}$ = 5V Select $V_{PP\ OUT}$ = 3.3V $I_{PP\ OUT}$ = –100mA (Sourcing)		1.4 1.5	**3** **4**	Ω Ω
R_O	Switch Resistance, Select $V_{PP\ OUT}$ = 0V	Select $V_{PP\ OUT}$ = clamped to ground $I_{PP\ OUT}$ = 50µA (Sinking)		1300	3900	Ω
V_{PP} SWITCHING TIME (See Figure 1)						
t_1 t_2	Output Turn-On Delay **Note 5**	$V_{PP\ OUT}$ = Hi-Z to 10% of 3.3V $V_{PP\ OUT}$ = Hi-Z to 10% of 5V		5 10	50 50	µs µs
t_3 t_4	Output Rise Time **Note 5**	$V_{PP\ OUT}$ = 10% to 90% of 3.3V $V_{PP\ OUT}$ = 10% to 90% of 5V	100 100	200 300	800 1000	µs µs
t_5 t_6	Output Turn-Off Delay Time **Note 5**	$V_{PP\ OUT}$ = 3.3V to Hi-Z $V_{PP\ OUT}$ = 5V to Hi-Z		**400** **400**	1000 1000	ns ns
t_7 t_8	Output Turn-Off Fall Time **Note 5**	$V_{PP\ OUT}$ = 90% to 10% of 3.3V $V_{PP\ OUT}$ = 90% to 10% of 5V		50 50	1000 1000	ns ns
V_{CC} OUTPUT						
I_{CCSC}	Short Circuit Current Limit	$V_{CC\ OUT}$ = 0V	1	1.5		A
R_O	Switch Resistance	Select $V_{CC\ OUT}$ = 3.3V $I_{CC\ OUT}$ = –1A (Sourcing) Select $V_{CC\ OUT}$ = 5V $I_{CC\ OUT}$ = –1A (Sourcing) Select $V_{CC\ OUT}$ = clamped to ground $I_{CC\ OUT}$ = 1mA (Sinking)		120 90 1800	**180** **135** **3900**	mΩ mΩ Ω

Electrical Characteristics (continued)

Symbol	Parameter	Condition	Min	Typ	Max	Units
V_{CC} SWITCHING TIME (See Figure 2)						
t_9 t_{10}	Output Turn On Delay Time **Note 6**	$V_{CC\ OUT}$ = 0V to 10% of 3.3V $V_{CC\ OUT}$ = 0V to 10% of 5.0V		200 350	1500 3000	µs
t_{11} t_{12}	Output Rise Time **Note 6** 	$V_{CC\ OUT}$ = 10% to 90% of 3.3V $V_{CC\ OUT}$ = 10% to 90% of 5V	200 200	700 1500	2500 6000	µs µs
t_{13} t_{14}	Output Turn-Off Delay **Notes 6, 7** 	$V_{CC\ OUT}$ = 3.3V $V_{CC\ OUT}$ = 5V		0.65 0.7	2 2	ms ms
t_{15} t_{16}	Output Fall Time **Note 6** 	$V_{CC\ OUT}$ = 90% to 10% of 3.3V $V_{CC\ OUT}$ = 90% to 10% of 5.0V	100 100	300 600	1000 2000	µs µs
POWER SUPPLY						
I_{CC5}	$V_{CC5\ IN}$ Supply Current (5V)	$V_{CC\ OUT}$ = 5V or 3.3V, $I_{CC\ OUT}$ = 0 $V_{CC\ OUT}$ = 0V (Sleep Mode)		8 0.2	50 10	µA µA
I_{CC3}	$V_{CC3\ IN}$ Supply Current (3.3V) **Note 8**	$V_{CC\ OUT}$ = 5V or 3.3V, $I_{CC\ OUT}$ = 0 $V_{CC\ OUT}$ = 0V (Sleep Mode)		40 0.1	100 10	µA µA
V_{CC5}	Operating Input Voltage (5V)	$V_{CC5\ IN}$ not required for operation		5.0	5.5	V
V_{CC3}	Operating Input Voltage (3.3V)	**Note 8**	3.0	3.3	5.5	V
THERMAL SHUTDOWN						
T_{SD}	Thermal Shutdown Temperature			130		°C
FLAG OUTPUT						
I_{FLAGLK}	Error FLAG Off Current	V_{FLAG} = 5V			**4**	µA
V_{OL}	FLAG Output Low Voltage	$V_{CCx\ IN} - V_{CC\ OUT} > 1V$ 1mA pull-up from FLAG to $V_{CCx\ IN}$			0.4	V

Note 1. Exceeding the absolute maximum rating may damage the device.

Note 2. The device is not guaranteed to function outside its operating rating.

Note 3. Devices are ESD sensitive. Handling precautions recommended. Human body model, 1.5k in series with 100pF.

Note 4. Specification for packaged product only.

Note 5. R_L = 100Ω connected to ground.

Note 6. R_L = 10Ω connected to ground.

Note 7. Delay from commanding Hi Z or 0V to beginning slope. Does not apply to current limit or overtemperature shutdown conditions.

Note 8. The MIC2566 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.

Timing Diagram

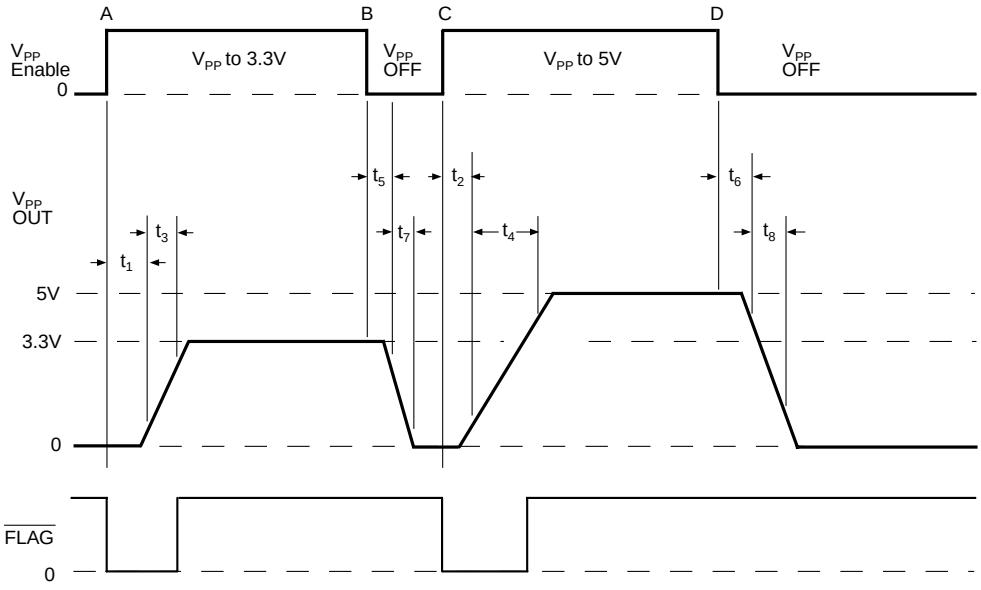


Figure 1. MIC2566 V_{PP} Timing Diagram

Note. V_{PP} Enable is shown generically. Refer to the logic tables on the next page for specific control logic input. At time A, V_{PP} = 3.3V. At B, V_{PP} is disabled. At C, V_{PP} is programmed to 5V. At D, V_{PP} is disabled. R_L = 100Ω for all measurements. Load capacitance is negligible.

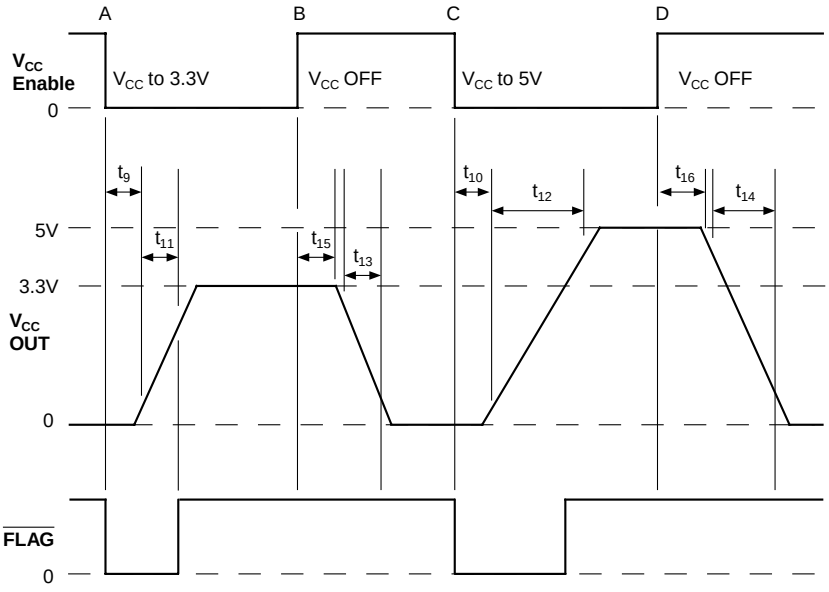


Figure 2. MIC2566 V_{CC} Timing Diagram

Note. V_{CC} Enable is shown generically. Refer to the logic tables on the next page 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 = 100Ω. FLAG pull-up resistor is 10kΩ to V_{CC3} IN.

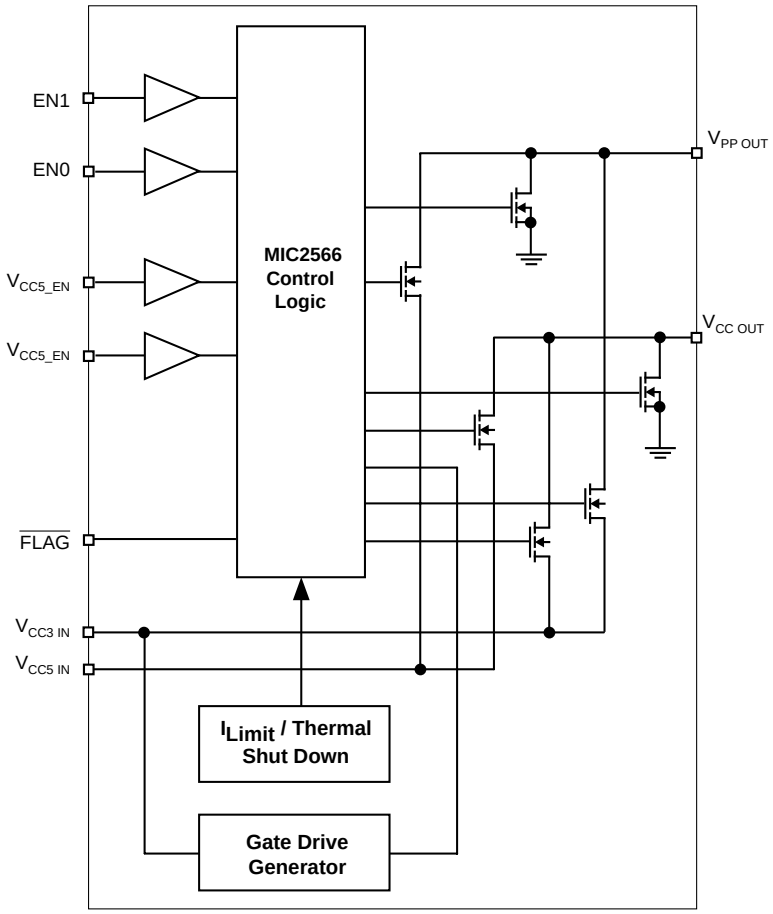
MIC2566-0 Control Logic Table

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	High Z
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	High Z
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

MIC2566-1 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	High Z
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	High Z
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

Functional Diagram



Applications Information

PC Card V_{CC} and V_{PP} control is easily accomplished using the MIC2566 PC Card/CardBus Slot V_{CC} and V_{PP} Power Controller IC. Four control bits 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), 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. An error flag alerts the user if the output voltage is too low because of overtemperature or overcurrent faults. 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 MIC2566 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 speed requirements.

Supply Bypassing

External capacitors are not required for operation. The MIC2566 is a switch and has no stability problems. For best results however, bypass V_{CC3} IN and V_{CC5} 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. Larger values of output capacitors are not necessary.

PC Card Slot Implementation

The MIC2566 is designed for PC Card applications, including the CardBus option, that do not require a 12V bias. One MIC2566 is required for each PC Card slot.

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 MIC2566, 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.

Figure 3 shows MIC2566 configuration for situations where only a single +5V V_{CC} is available.

Output Current and Protection

MIC2566 output switches are capable of passing the maximum current needed by any PC Card. 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 MIC2566, the system power supplies, the card socket pins, and the PC Card. A final protective feature is the error FLAG, which signals the PC Card slot logic controller when a fault condition exists, allowing the controller to notify the user that the card inserted has a problem. The open-drain FLAG monitors the voltage level on both $V_{CC\ OUT}$ and $V_{PP\ OUT}$ and activates (pulls low) when either output is 1V below its programmed level or an overtemperature fault exists.

This FLAG signals output voltage transitions as well as fault conditions. Refer to Figures 1 and 2 for details.

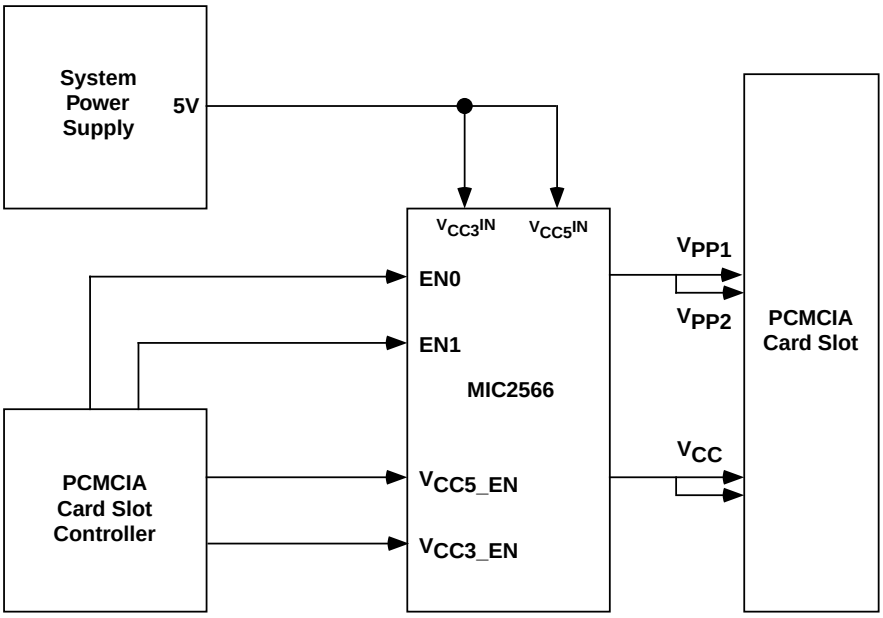
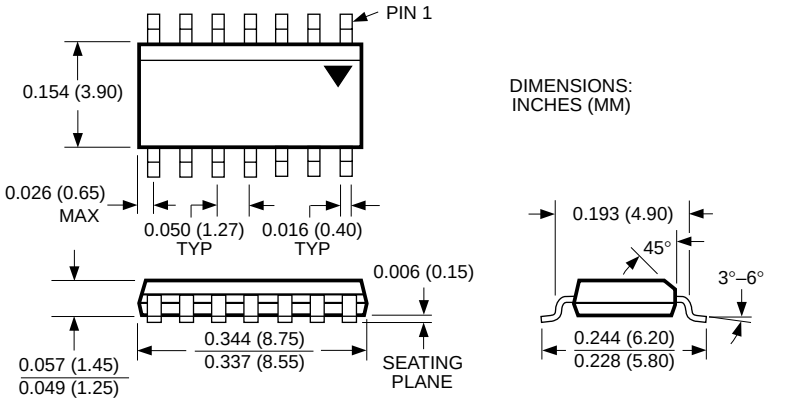


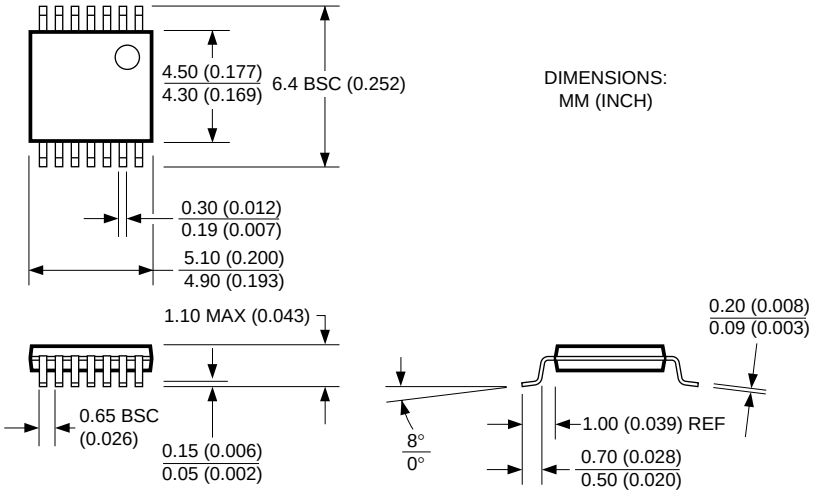
Figure 3. PC Card Slot Power Control Application Without an Available 3.3V V_{CC}

Note that $V_{CC3\ IN}$ and $V_{CC5\ IN}$ are driven together. The MIC2566 is powered by the $V_{CC3\ IN}$ line. In this configuration, $V_{CC\ OUT}$ will be 5V when either V_{CC3} or V_{CC5} is enabled from the logic table. Take advantage of the lower switch resistance of the V_{CC5} switch by using the V_{CC5_EN} control as your main V_{CC} switch.

Package Information



14-Pin SOP



14-Pin TSSOP

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