

## General Description

The MIC2557 switches the four voltages required by PCMCIA (Personal Computer Memory Card International Association) card  $V_{PP}$  Pins. The MIC2557 provides selectable 0V, 3.3V, 5.0V, or 12.0V ( $\pm 5\%$ ) from the system power supply to  $V_{PP1}$  or  $V_{PP2}$ . Output voltage is selected by two digital inputs. Output current ranges up to 120mA. Four control states,  $V_{PP}$ ,  $V_{CC}$ , high impedance, and active logic low are available. An auxiliary control input determines whether the high impedance (open) state or low logic state is asserted.

In either quiescent mode or full operation, the device draws very little current, typically less than 1 $\mu$ A.

The MIC2557 is available in an 8-pin SOIC and an 8-pin plastic DIP.

## Applications

- PCMCIA  $V_{PP}$  Pin Voltage Switch
- Power Supply Management
- Power Analog Switch

## Features

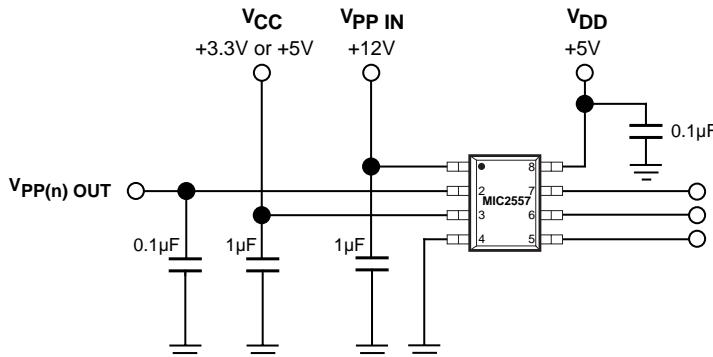
- Complete PCMCIA  $V_{PP}$  Switch Matrix in a Single IC
- No External Components Required
- Digital Selection of 0V,  $V_{CC}$ ,  $V_{PP}$ , or High Impedance Output
- No  $V_{PP\ OUT}$  Overshoot or Switching Transients
- Break-Before-Make Switching
- Low Power Consumption
- 120mA  $V_{PP}$  (12V) Output Current
- Optional Active Source Clamp for Zero Volt Condition
- 3.3V or 5V Supply Operation
- 8-Pin SOIC Package

## Ordering Information

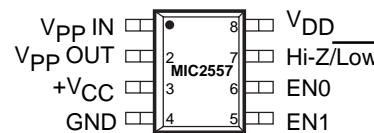
Part Number	Temperature Range	Package
MIC2557BM	-40°C to +85°C	8-pin SOIC
MIC2557BM T&R	-40°C to +85°C	8-SOIC Tape & Reel*

\* 2,500 Parts per reel.

## Typical Application



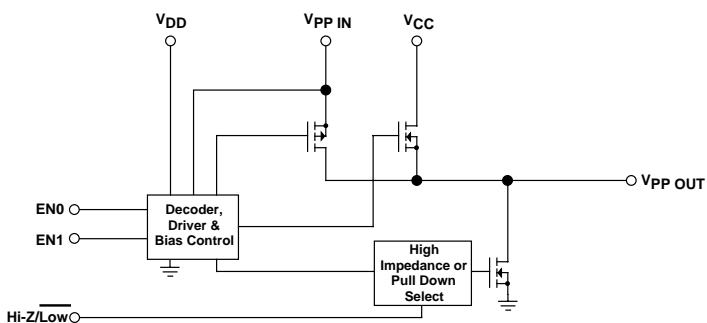
## Pin Configuration



Hi-Z/ Low Control  
EN0  
EN1

EN1	EN0	Hi-Z/ Low	V <sub>PP OUT</sub>
0	0	0	0V, (Sink current)
0	0	1	Hi-Z (No Connect)
0	1	x	V <sub>CC</sub> (3.3V or 5.0V)
1	0	x	V <sub>PP</sub>
1	1	x	Hi-Z (No Connect)

## Simplified Block Diagram

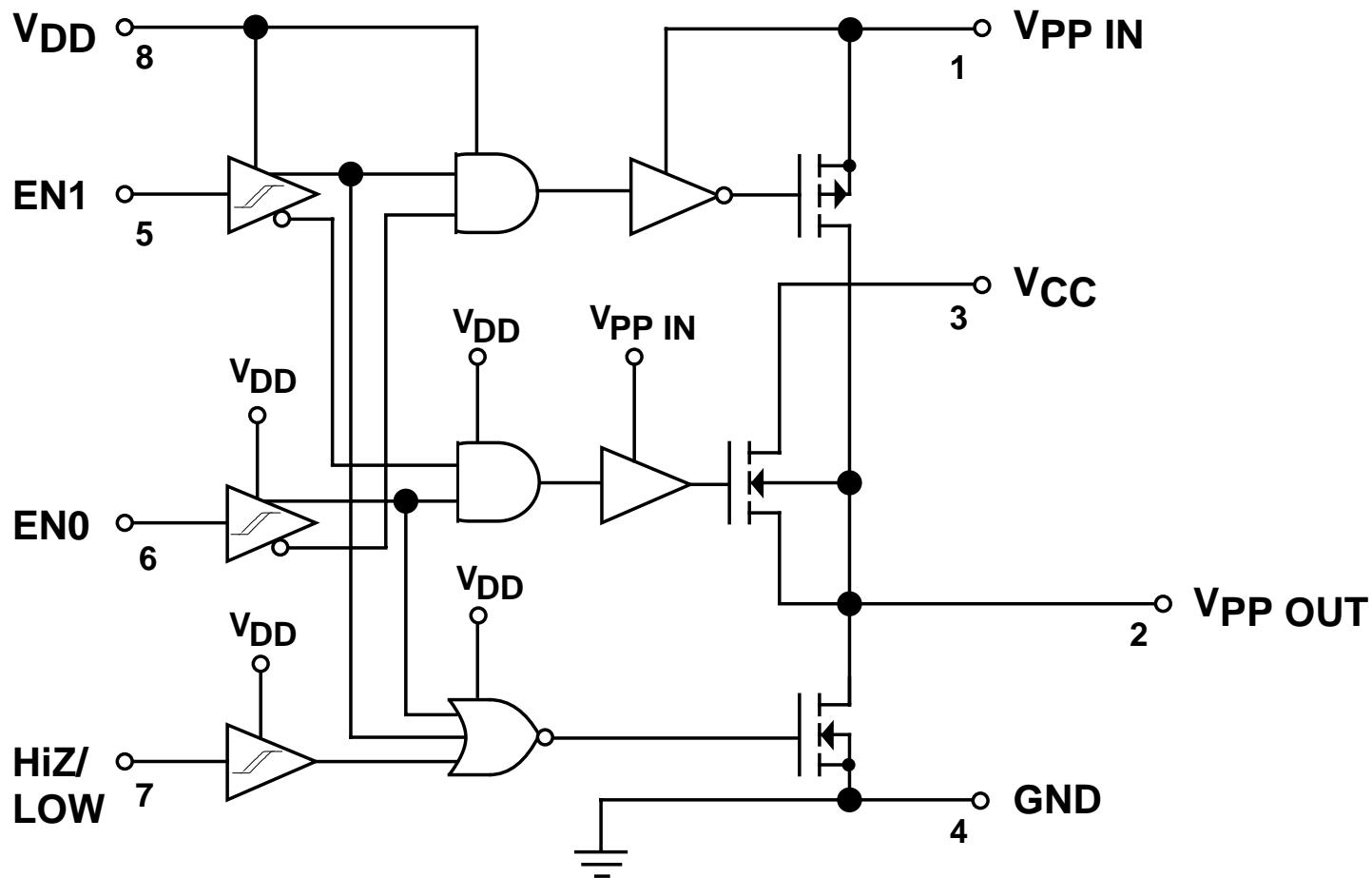


For a dual PCMCIA Card Socket  $V_{PP}$  Switching Matrix, see the MIC2558.

For a  $V_{PP}$  and  $V_{CC}$  Switching Matrix, see the MIC2560.

**Absolute Maximum Ratings** (Notes 1 and 2)

Power Dissipation, $T_{AMBIENT} \leq 25^\circ\text{C}$	800 mW
SOIC	4 mW/ $^\circ\text{C}$
Derating Factors (To Ambient)	
SOIC	4 mW/ $^\circ\text{C}$
Storage Temperature	-65 $^\circ\text{C}$ to +150 $^\circ\text{C}$
Operating Temperature (Die)	125 $^\circ\text{C}$
Operating Temperature (Ambient)	-40 $^\circ\text{C}$ to +85 $^\circ\text{C}$
Lead Temperature (5 sec)	260 $^\circ\text{C}$
Supply Voltage, $V_{PP\text{ IN}}$	15V
$V_{CC}$	7.5V
$V_{DD}$	7.5V
Logic Input Voltages	-0.3V to $V_{DD}$
Output Current	
$V_{PP\text{ OUT}} = 12\text{V}$	600mA
$V_{PP\text{ OUT}} = V_{CC}$	250mA

**Logic Block Diagram**

**Electrical Characteristics:** (Over operating temperature range with  $V_{DD} = V_{CC} = 5V$ ,  $V_{PP\ IN} = 12\ V$  unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>INPUT</b>						
$V_{IH}$	Logic 1 Input Voltage	$V_{DD} = 3.3V\ or\ 5.0V$	2.2			V
$V_{IL}$	Logic 0 Input Voltage	$V_{DD} = 3.3V\ or\ 5.0V$			0.8	V
$V_{IN}$ (Max)	Input Voltage Range		-5		$V_{DD}$	V
$I_{IN}$	Input Current	$0\ V < V_{IN} < V_{DD}$			$\pm 1$	$\mu A$
<b>OUTPUT</b>						
$V_{OL}$	Clamp Low Output Voltage	$EN0 = EN1 = HiZ = 0, I_{SINK} = 1.6mA$			0.4	V
$I_{OUT},\ Hi-Z$	High Impedance Output Leakage Current	$EN0 = EN1 = 0, HiZ = 1$ $0 \leq V_{PP\ OUT} \leq 12V$		1	10	$\mu A$
$R_{oc}$	Clamp Low Output Resistance	Resistance to Ground. $I_{SINK} = 2mA$ $EN0 = EN1 = 0, HiZ = 0$		130	250	$\Omega$
$R_o$	Switch Resistance, $V_{PP\ OUT} = V_{CC}$	$I_{PP\ OUT} = -10\ mA$ (Sourcing)		2.5	5	$\Omega$
$R_o$	Switch Resistance, $V_{PP\ OUT} = V_{PP\ IN}$	$I_{PP\ OUT} = -100\ mA$ (Sourcing)		0.5	1	$\Omega$
<b>SWITCHING TIME</b> (See Figure 1)						
$t_1$	Delay + Rise Time	$V_{PP\ OUT} = 0V\ to\ 5V$ (Notes 3, 5)		15	50	$\mu s$
$t_2$	Delay + Rise Time	$V_{PP\ OUT} = 5V\ to\ 12V$ (Notes 3, 5)		12	50	$\mu s$
$t_3$	Delay + Fall Time	$V_{PP\ OUT} = 12V\ to\ 5V$ (Notes 3, 5)		25	75	$\mu s$
$t_4$	Delay + Fall Time	$V_{PP\ OUT} = 5V\ to\ 0V$ (Notes 3, 5)		45	100	$\mu s$
$t_5$	Output Turn-On Delay	$V_{PP\ OUT} = Hi-Z\ to\ 5V$ (Notes 4, 5)		10	50	$\mu s$
$t_6$	Output Turn-Off Delay	$V_{PP\ OUT} = 5V\ to\ Hi-Z$ (Notes 4, 5)		75	200	ns
<b>POWER SUPPLY</b>						
$I_{DD}$	$V_{DD}$ Supply Current			-	1	$\mu A$
$I_{CC}$	$V_{CC}$ Supply Current	$I_{PP\ OUT} = 0$		-	1	$\mu A$
$I_{PP}$	$I_{PP}$ Supply Current	$V_{PP\ OUT} = 0\ V$ or $V_{PP} \cdot I_{PP\ OUT} = 0$ . $V_{PP\ OUT} = V_{CC}$		-	10	$\mu A$
				10	40	$\mu A$

## Electrical Characteristics, (continued)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>POWER SUPPLY, continued</b>						
$V_{CC}$	Operating Input Voltage				6	V
$V_{DD}$	Operating Input Voltage		2.8		6	V
$V_{PP\ IN}$	Operating Input Voltage		8.0		14.5	V

**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:** With  $R_L = 2.9\text{k}\Omega$  and  $C_{OUT} = 0.1\mu\text{F}$  on  $V_{PP\ OUT}$ .

**NOTE 4:**  $R_L = 2.9\text{k}\Omega$ .  $R_L$  is connected to  $V_{CC}$  during  $t_5$ , and is connected to ground during  $t_6$ .

**NOTE 5:** Rise and fall times are measured to 90% of the difference between initial and final values.

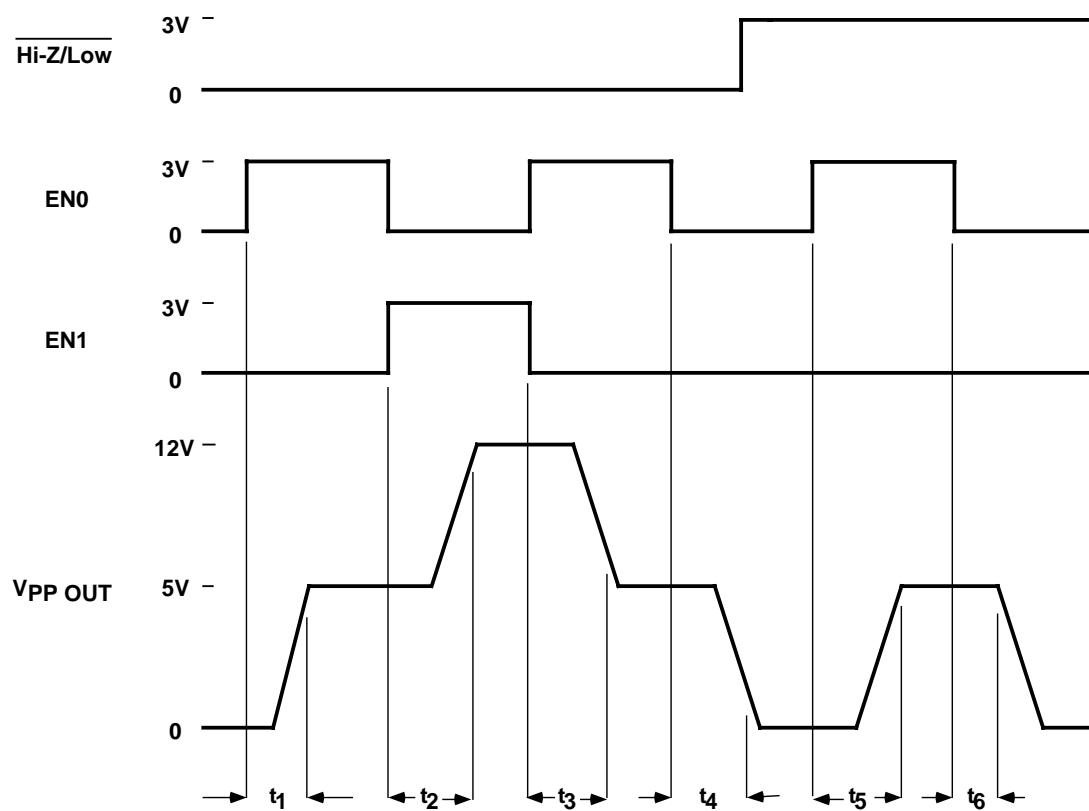


Figure 1. Timing Diagram

## Applications Information

PCMCIA  $V_{PP}$  control is easily accomplished using the MIC2557 voltage selector/switch IC. Two control bits determine output voltage and standby/operate mode condition. Output voltages of 0V (defined as less than 0.4V),  $V_{CC}$  (3.3V or 5V),  $V_{PP}$ , or a high impedance state, are available. When either the high impedance or low voltage conditions are selected, the device switches into "sleep" mode, and draws only nanoamperes of leakage current.

The MIC2557 is a low-resistance power MOSFET switching matrix that operates from the computer system main power supply. Device power is obtained from  $V_{DD}$ , which may be either 3.3V or 5V, and FET drive is obtained from  $V_{PP\ IN}$  (usually +12V). Internal break-before-make switches determine the output voltage and device mode.

### Supply Bypassing

For best results, bypass  $V_{CC}$  and  $V_{PP\ IN}$  at their inputs with 1 $\mu$ F capacitors.  $V_{PP\ OUT}$  should have a 0.01 $\mu$ F to 0.1 $\mu$ F capacitor for noise reduction and electrostatic discharge (ESD) damage prevention. Larger values of output capacitor will create large current spikes during transitions, requiring larger bypass capacitors on the  $V_{CC}$  and  $V_{PP\ IN}$  pins.

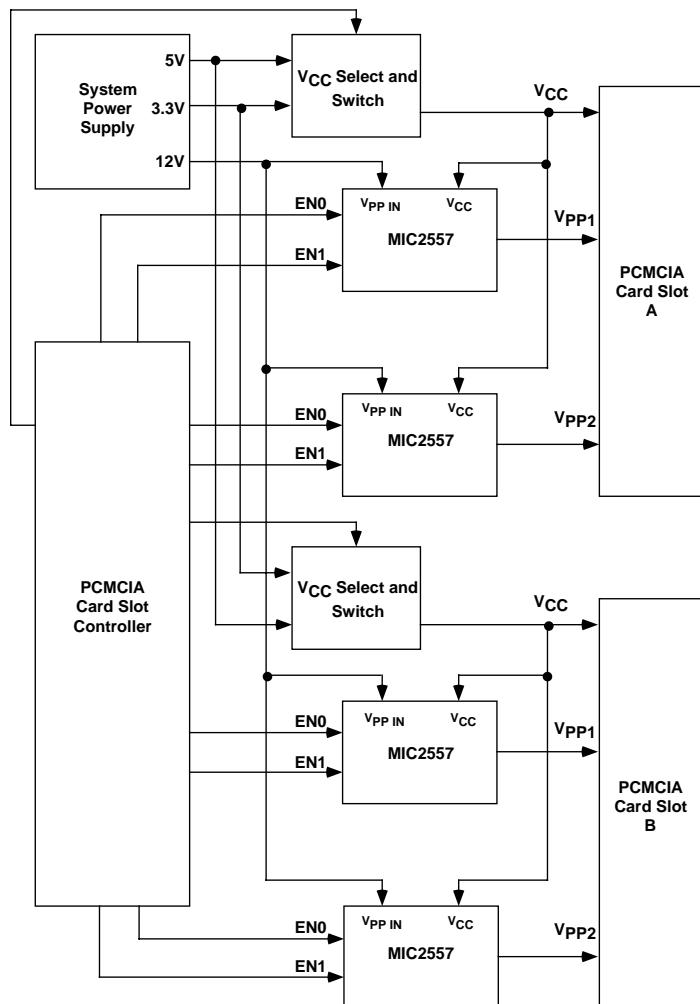


Figure 2. MIC2557 Typical two slot PCMCIA application with dual  $V_{CC}$  (5.0V or 3.3V).

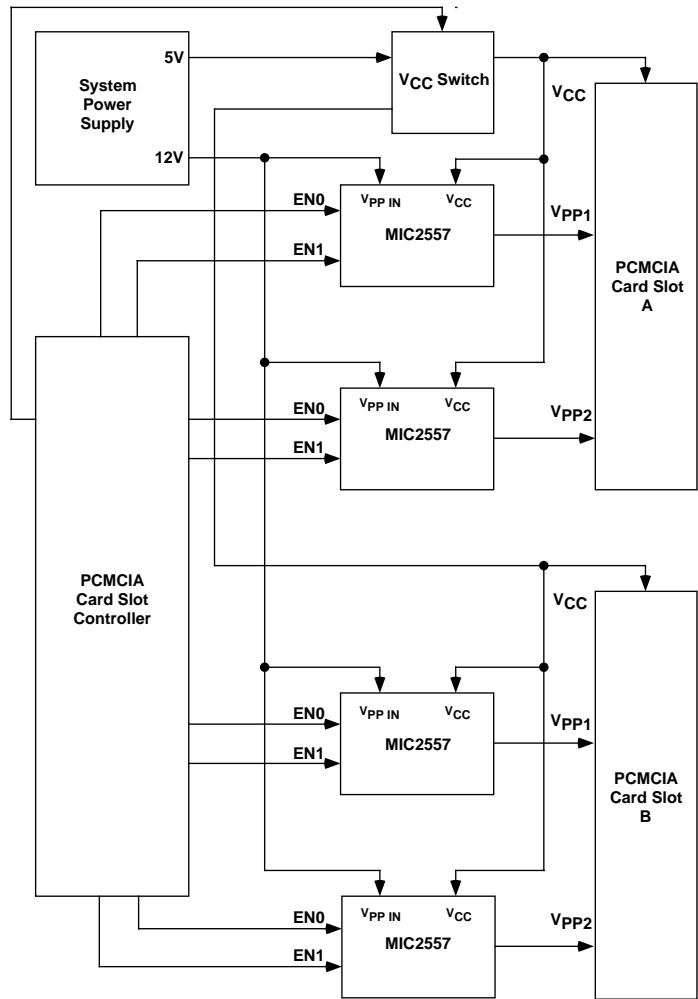


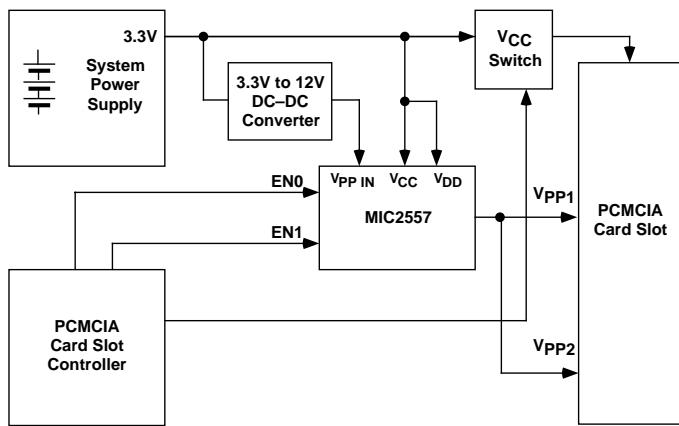
Figure 3. MIC2557 Typical two slot PCMCIA application with single 5.0V  $V_{CC}$ .

### PCMCIA Implementation

The Personal Computer Memory Card International Association (PCMCIA) specification requires two  $V_{PP}$  supply pins per PCMCIA slot.  $V_{PP}$  is primarily used for programming Flash (EEPROM) memory cards. The two  $V_{PP}$  supply pins may be programmed to different voltages. Fully implementing PCMCIA specifications requires two MIC2557, and a controller. Figure 2 shows this full configuration, supporting both 5.0V and 3.3V  $V_{CC}$  operation. Figure 3 is a simplified design with fixed  $V_{CC} = 5V$ . Palmtop computers, where size and battery life are tantamount, can sometimes use a compromise implementation, with  $V_{PP1}$  tied to  $V_{PP2}$  (see Figure 4).

When a memory card is initially inserted, it should receive  $V_{CC}$ , usually  $5.0V \pm 5\%$ . 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 5.0V or 3.3V  $V_{CC}$ . If the card uses 3.3V  $V_{CC}$ , the controller commands this change, which is reflected on the  $V_{CC}$  pins of both the PCMCIA slot and the MIC2557.

During Flash memory programming, the PCMCIA controller outputs a (1,0) to the MIC2557, which connects  $V_{PP\ IN}$  to



**Figure 4. MIC2557 Palmtop application. Note that the  $V_{PP1}$  and  $V_{PP2}$  pins are combined. Although this does not fully satisfy PCMCIA specifications, it simplifies the circuitry and is acceptable in certain applications.**

$V_{PP\ OUT}$ . The low ON resistance of the MIC2557 switch requires only a small bypass capacitor on  $V_{PP\ OUT}$ , with the main filtering action performed by a large filter capacitor on  $V_{PP\ IN}$ . The  $V_{PP\ OUT}$  transition from  $V_{CC}$  to 12.0V typically takes 25 $\mu$ s. After programming is completed, the controller outputs a (0,1) to the MIC2557, which then reduces  $V_{PP\ OUT}$  to the  $V_{CC}$  level. Break-before-make switching action reduces switching transients and lowers maximum current spikes through the switch from the output capacitor.

If no card is inserted, or the system is in sleep mode, the controller outputs either a (0,0) or a (1,1) to the MIC2557. Either input places the switch into its shutdown mode, where only a small leakage current flows.

The HiZ/Low input controls the optional logic low output clamp. With HiZ/Low in the high state and  $EN0 = EN1 = 0$ ,  $V_{PP\ OUT}$  enters a high impedance (open) state. With HiZ/Low in the low state and  $EN0 = EN1 = 0$ ,  $V_{PP\ OUT}$  is clamped to ground, providing a logic low signal. The clamp does not require DC bias current for operation.

MOSFET drive and bias voltage is derived from  $V_{PP\ IN}$ . Internal device control logic is powered from  $V_{DD}$ , which should be connected to the same supply voltage as the PCMCIA controller (normally either 3.3V or 5V).

#### Output Current

MIC2557 output switches are capable of far more current than usually needed in PCMCIA applications. PCMCIA  $V_{PP}$  output current is limited primarily by switch resistance voltage drop ( $I \times R$ ) and the requirement that  $V_{PP\ OUT}$  cannot drop more than 5% below nominal.  $V_{PP\ OUT}$  will survive output short circuits to ground if  $V_{PP\ IN}$  and  $V_{CC}$  are current limited by the regulator that supplies these voltages.

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