

Introduction

Some applications require a multiplexer that can deliver two or more supply voltages at 1A or greater. An example is the V_{CC} multiplexer for the PCMCIA interface. A low cost multiplexer for high current loads can be made using the Micrel MIC5014 and a few discrete power MOSFETs. A simple 3.3V and 5V switch is shown in Figure 1. Since low cost discrete MOSFETs are available with ON resistances of a few milliohms, these multiplexers can manage currents exceeding several tens of amperes.

The MIC5014

Making this solution possible is the MIC5014 MOSFET driver. This driver is designed to provide gate enhancement above the positive rail for an N-channel FET. N-channel FETs have the advantages of lower cost and lower $R_{DS(ON)}$ than similar P-channel FETs. The MIC5014 consumes a maximum of 1 μ A in the OFF state and typically 100 μ A in the ON state while powered from a 5V supply. The MIC5014 does not require its supply to be the input logic supply since the control input threshold is approximately 1.2V and is independent of supply voltage. Likewise, the MIC5014 does not require its supply to be the MOSFET drain supply voltage because the voltage supplied to the gate is regulated and will not exceed 16V above the source voltage and is also independent of the supply voltage. The MIC5014 is available in an 8-pin SOIC package which helps minimize the size of the complete switch matrix.

The Switch Matrices

Figure 1 shows the basic switching matrix configurations. Q1 through Q3 can be any low impedance N-channel power FETs. Table 1 shows the expected V_{OUT} for several FETs with different $R_{DS(ON)}$ values.

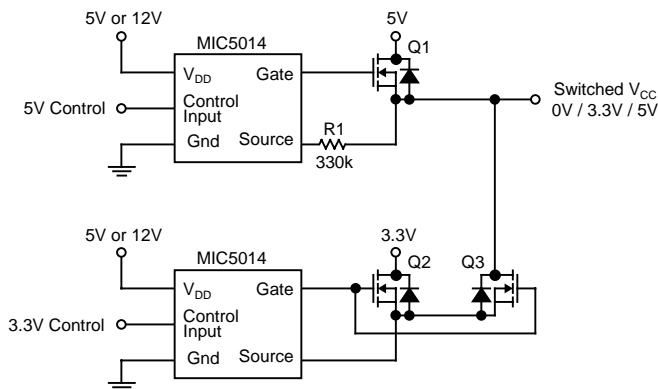


Figure 1. Switch Matrix for 0V, 3.3V, and 5V

Each FET has its body internally connected to its source, resulting in an intrinsic diode between the body and the drain known as a "body diode." Figure 1 shows that the body diode does not present a problem for the Q1 switch, because it is always reverse biased. If Q3 were not in the circuit and the source of Q2 connected directly to the output, then Q2's body diode would be reverse biased when both Q1 and Q2 are OFF and the output voltage is zero. However, Q2's body diode would be forward biased when Q1 is ON and the 5V supply would be shorted to the 3.3V supply through Q1 and the forward biased body diode of Q2. Similarly, if Q2 were not in the circuit and the source of Q3 connected to 3.3V, then Q3's body diode would be reverse biased when Q1 is ON but forward biased when both Q1 and Q3 are OFF and the load would be held one diode drop below 3.3V. With two MOSFETs connected back to back, both body diodes will be reverse biased when all switches are OFF as long as the output voltage remains positive with respect to ground. Although Q3 conducts current in the reverse direction when it is ON, the body diode will not conduct because it is shorted by Q3's ON resistance.

FET Part Number	$R_{DS(ON)}$	V_{OUT} at 1A	
		5.0V Input	3.3V Input
IRFZ20	100m Ω	4.9V	3.1V
IRFZ30	50m Ω	4.95V	3.20V
SMP06N06-14	14m Ω	4.99V	3.27V

Table 1. Power FETs and Expected Output Voltages at 1A

Low Current PCMCIA V_{PP} Switching Matrices

If V_{PP} programming currents are switched, the new MIC2557/2558 devices provide all level shifting, timing, and high current switches for this function in one package. The MIC2557 serves as a single channel and is available in an 8-pin SOIC package (see Figure 2). The MIC2558 is a dual channel device, and is available in a 14-pin SOIC package (see Figure 3). See the MIC2557 or MIC2558 data sheets for full details.

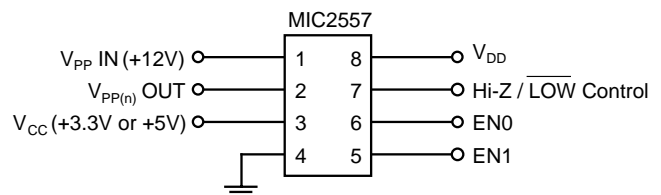


Figure 2. Typical MIC2557 Application

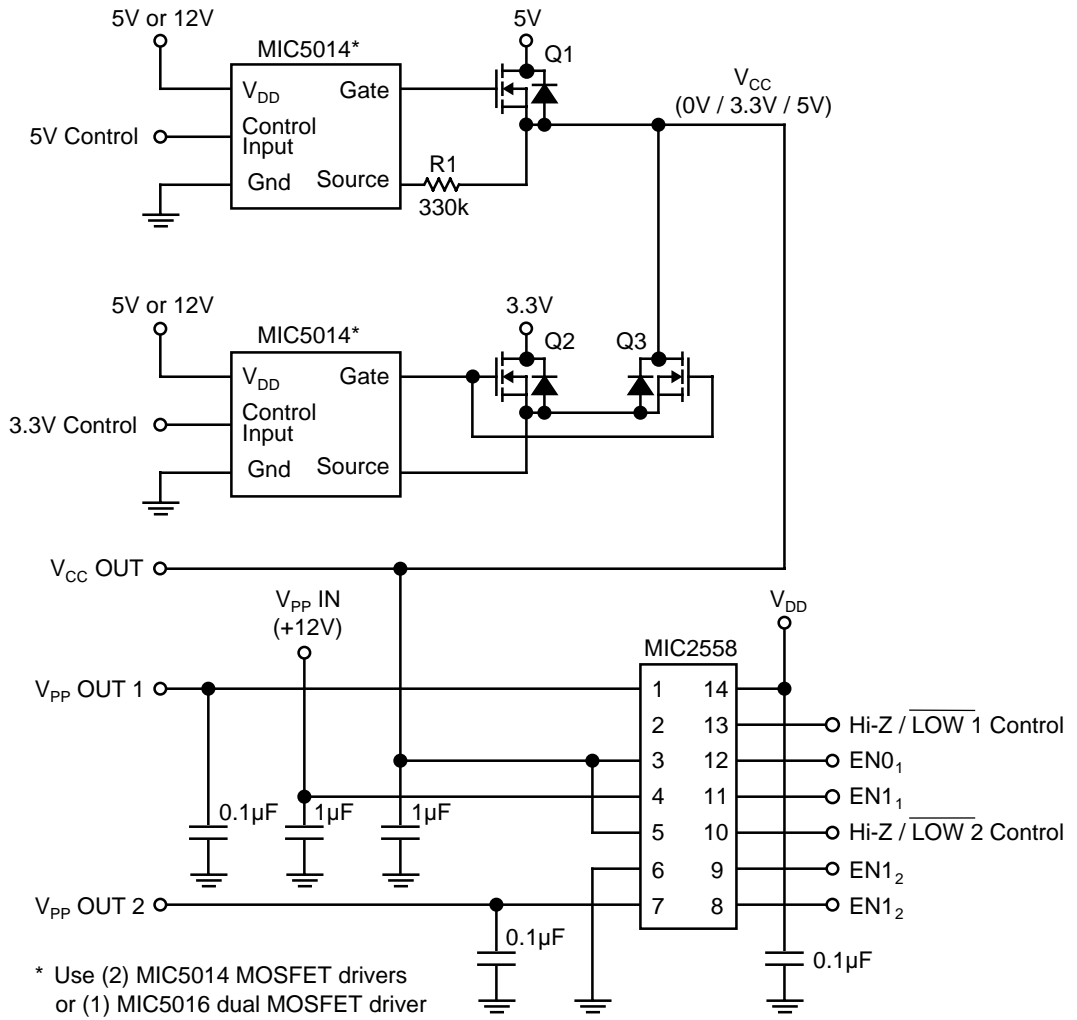


Figure 3. Full PCMCIA V_{PP} and V_{CC} Circuit using MIC5014 (or MIC5016) and MIC2558