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Triple-Supply Power-Good Indication with the ADM108x

by Stephen Carroll

INTRODUCTION

The ADM108x Simple Sequencer™ products can be used to implement basic triple-supply power-good indicators. The ADM1085/ADM1086/ADM1087/ADM1088 are low cost voltage detector circuits with capacitor adjustable output delays and output level shifting. The input stage consists of a comparator and a 0.6 V on-chip reference, and can tolerate voltages as high as 22 V. Active high or active low and push-pull or open-drain output stages are available.

To implement a triple-supply power-good indicator, a resistive voltage divider network is used to sum currents contributed by each of the three supplies and bias the comparator input. The output switches high or low depending on whether the three supplies are in tolerance or not. The power-good output is a digital signal that is high when all three supplies are in tolerance, i.e., above their trip point levels, and low if any of the three are below their trip point.

VOLTAGE DIVIDER TOPOLOGY

The voltage divider network consists of four resistors in a star configuration. A resistor is connected between each supply and the comparator input, and another resistor is connected between the comparator input and ground. Current from each supply is summed at the comparator input. It then flows to ground through a resistance chosen to have a voltage equal to the on-chip voltage reference across it when the comparator is required to switch. Since the required current flowing through this resistor at the switching point is fixed, it follows that the trip point of any of the three supplies is dependent on the voltage of the other two supplies. Therefore, the supply trip points are only as accurate as the designer's knowledge of the magnitude of the other supplies when the comparator switches. To minimize error introduced by resistor value tolerance, E192 resistors (0.5% tolerance) are recommended.

As will be discussed, if the sequence in which the supplies come up and the voltage levels at which they settle is known, then a reasonably accurate power-good trip point can be realized. Otherwise, the suggested circuits offer a rudimentary multisupply presence indication.

SIMULTANEOUS POWER-UP

If the three supplies being monitored power up and reach their trip points (set at the same percentage tolerance) at the same time, then a power-good signal can be asserted at the exact moment when the supplies are in tolerance. The circuit diagram in Figure 1 is an implementation of such a triple-supply power-good indicator where the trip points are set at 7% below the nominal supply level. Resistor values are chosen such that the comparator input is equal to the ADM1085's on-chip voltage reference of 0.6 V when the supplies are at the trip points of 3.06 V for the 3.3 V supply, 4.65 V for the 5 V supply, and 11.16 V for the 12 V supply. The ADM1085's CEXT pin is left floating so that power good is asserted as soon as the comparator switches.

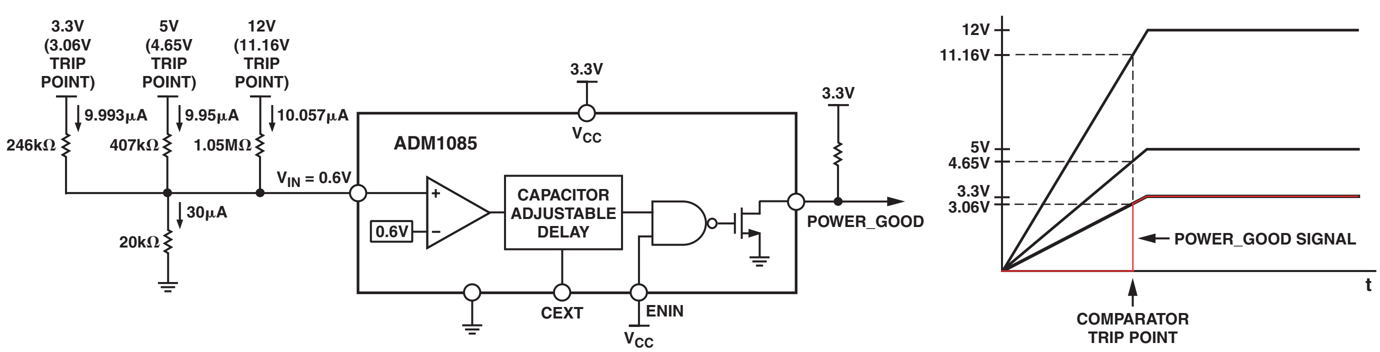

Figure 1. Triple-Supply Monitoring when Supplies Reach Trip Points Simultaneously

STAGGERED POWER-UP

Considering how the same circuit behaves when the three supplies do not come up simultaneously but in a staggered fashion, it's evident that the trip point on the final supply to come up will depend on the voltage levels at which the other two supplies have settled. Figure 2 illustrates what happens when the 12 V supply is the last to come up. It is assumed that by the time the 12 V supply has come up, the other two supplies have powered up and settled at their nominal voltage levels. As a result, they are injecting more current than if they had remained at their trip point levels. Since the current required to give a voltage of 0.6 V across the 20 kΩ resistor is a constant, it follows that the 12 V supply needs to contribute less current in order for the comparator to switch, since both other supplies are contributing more current. With the 12 V supply sourcing just 8.215 μA instead of 10.057 μA for the simultaneous power-up case, the trip point occurs at 9.23 V rather than 11.16 V. By using the capacitor adjustable delay feature of the ADM1085, the premature switching of the comparator can be compensated for by selecting a suitable time delay so the power-good signal is asserted when all three supplies have powered up.

KNOWN POWER-UP SEQUENCE

Resistors can be selected to provide a reasonably accurate power-good trip point if the sequence in which the supplies come up and the values at which they settle is known beforehand. Figure 3 shows that by adjusting the 12 V supply resistor to 1.29 MΩ , an ADM1086 will assert the power-good signal when the 3.3 V and 5 V supplies have settled at their nominal values, and the 12 V supply reaches 11.197 V, roughly 7% below the nominal supply value.

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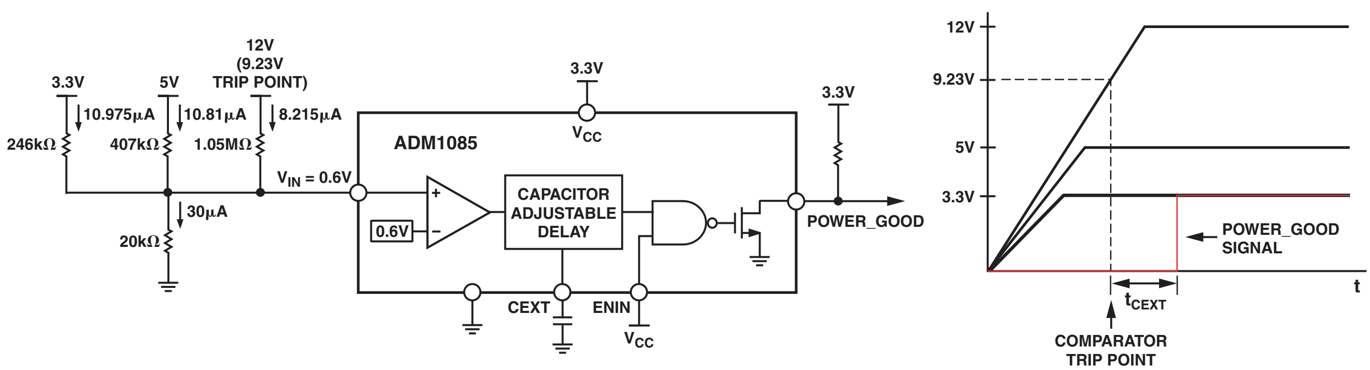

Figure 2. Delayed Power-Good Signal when Power-Up Sequence Is Unknown

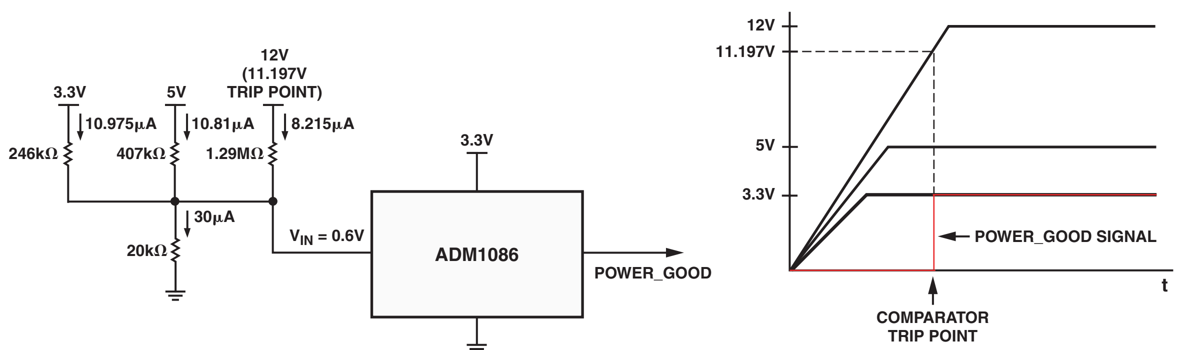

Figure 3. Resistor Values Chosen for Desired Trip Point when Power-Up Sequence Is Known