Simple Power Good Circuit Using the TPS61175 FREQ Pin as Reference

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ABSTRACT

The TPS61175 FREQ pin can provide a 1.229V reference for use in other circuits, including a power good circuit.

Some systems require a power good signal when a specific power rail reaches regulation. In cost sensitive, low precision applications, where an external supervisory IC, like the TPS38xx family, is not practical, the power supply designer can create a simple supervisory circuit using a low-cost comparator and reference. While the TPS61175 does not specifically provide an external reference, its FREQ pin, which requires a resistor to ground in order to set the switching frequency, tracks the internal reference voltage, 1.229V, through the internal current mirror that is powered by the reference voltage. Mismatches in the current mirror increase the FREQ pin voltage tolerance to approximately 1.229V ±5%. Figure 1 shows the FREQ pin used as a reference for the power good (PG) circuit created by the TL331 comparator, R4, R5, R2 and C4.

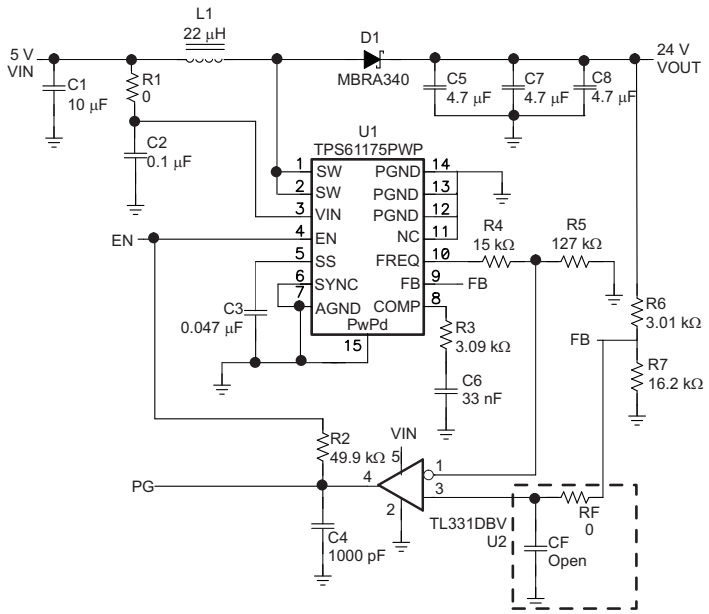

Figure 1. TPS61175 With PG Circuit Using the TL331

The TL331 wide input range and open collector output makes it an excellent choice because the IC itself can be powered by the same input supply as the TPS61175 while the open drain collector is pulled up to a separate logic-level rail. In this application, the FREQ pin resistors, R4 and R5, are sized to meet two criteria. First, their sum must give the desired switching frequency (f_{SW}) per Figure 13 or Table 1 in the data sheet (SLVS892). Second, they are sized so that the comparator output goes high impedance when the TPS61175 output, and therefore, the FB pin, reaches 90% of its regulated voltage, per Equation 1:

$$\frac{R5}{R4 + R5} = 0.90 \quad (1)$$

As long as the additional load current into the comparator is significantly (e.g., << 1/10) less than the current sunk by the frequency setting resistors, the switching frequency will not significantly deviate from the expected value. The TL331 has maximum I_{BIAS} current of 250nA, which is more than 1/30 of the 1.229V/(15k + 127k) = 8.6µA needed through R4 and R5 for the designed switching frequency. Note that the TL331 output is pulled high to EN instead of VIN through resistor R2 not only to keep the PG signal within logic levels of the system, but also because the FREQ pin voltage goes to zero when EN is low. Capacitor C4, was sized with R2 to provide a 50 µs delay so that the PG pull-up voltage is not present before the FREQ pin voltage can rise to 1.229V. RF and CF can be used to create an optional low pass filter to reduce the likelihood false power good failures during a load transient. Figure 2 shows the output voltage and PG signal from a modified TPS61175EVM-326.

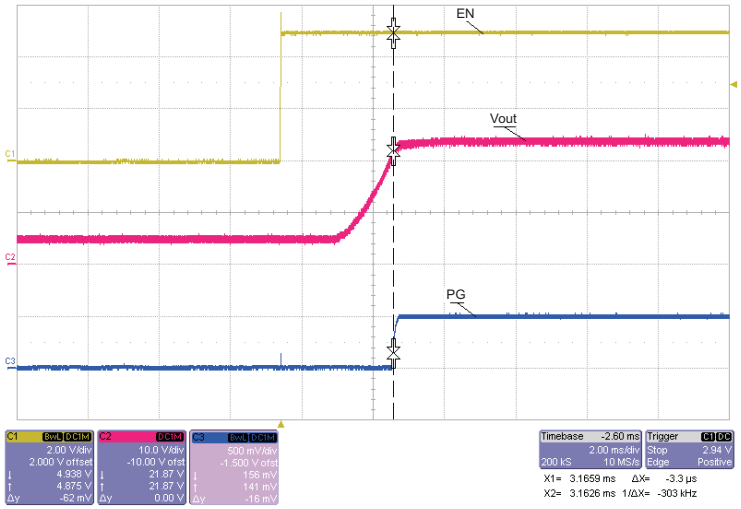

Figure 2.

In this application, there was no noticeable difference in switching frequency with and without the PG circuit installed.

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