LINEAR TECHNOLOGY

DESIGN NOTES

Tracking and Sequencing Made Simple with Tiny Point-of-Load Circuit – Design Note 389

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Introduction

Multiple-voltage electronics systems often require complex supply voltage tracking or sequencing, which if not met, can result in system faults or even permanent failures in the field. The design difficulties in meeting these requirements are often compounded in distributed-power architectures where point-of-load (POL) DC/DC converters or linear regulators are scattered across PC board space, sometimes on different board planes. The problem is that power supply circuitry is often the last circuitry to be designed into the board, and it must be shoehorned into whatever little board real estate is left. Often, a simple, drop-in, flexible solution is needed to meet these requirements.

The LTC®2927 provides a simple and versatile solution in a tiny footprint for both tracking and sequencing without the drawbacks of series MOSFETs. Furthermore, power supply stability and transient response remain unaffected because the LTC2927 offsets the output voltage of the regulator without altering the power supply control loop dynamics.

Basic Operation

Each POL converter that must be tracked or sequenced can have a single LTC2927 placed at point-of-load as shown in Figure 1. By selecting a few resistors and a capacitor, a supply is configured to ramp up and ramp down with a variety of voltage profiles. The choice of resistors can cause a slave supply to track the master signal exactly or with a different ramp rate, voltage offset, time delay, or combination of these.

Figure 2 shows a 4-supply tracking and sequencing profile that highlights the flexibility of the LTC2927. A master signal is generated by tying a capacitor from the RAMP pin to ground or by supplying another ramping signal to be tracked. This ramping signal can be a master signal generated by another LTC2927 or another tracking controller such as the LTC2923. Likewise, another supply voltage can be used as the master signal. If an external ramping signal is used, it can be connected directly to the RAMP pin or to the resistive divider connected to the TRACK pin.

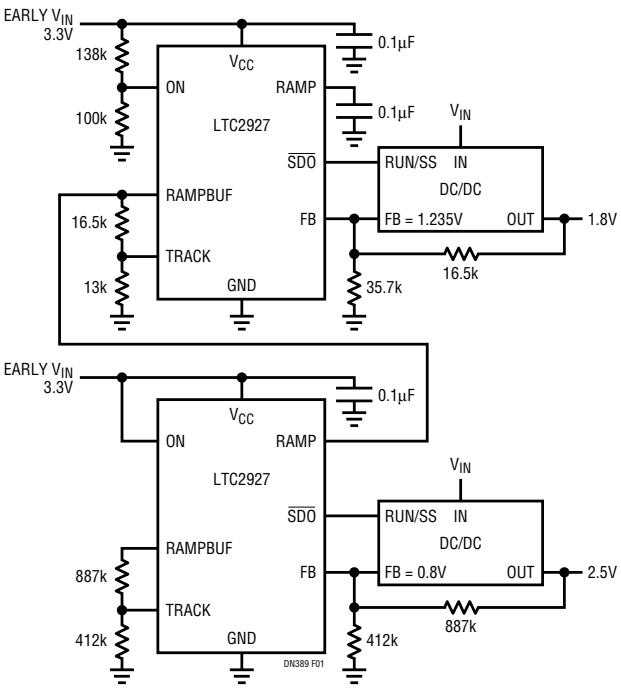

Figure 1. Dual Supply Tracking Application

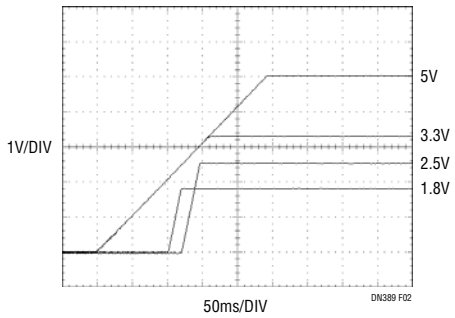

Figure 2. Output Profile of a 4-Supply System Showing Tracking, Sequencing and Ramp Rate Control

For applications that require master control of the shutdown or RUN/SS pins of the slave supplies, the LTC2927 provides an SDO output. SDO pulls low when the ON pin is below 1.23V and the RAMP pin is below 200mV.

Negative Supply Tracking

The LTC2927 can also be used to track negative voltage regulators. Figure 3 shows a tracking example using an LT3462 inverting DC/DC converter to produce a –5V supply. This converter has a ground-based reference, which allows current to be pulled from a node where R_{FA} has been divided. To properly pull current from the LT3462 FB network, a current mirror must be placed between the LTC2927 and the converter. Figure 4 shows the tracking profile of Figure 3 with a ramp rate of 100V/s. V_{MASTER} is positive, but the inverse is shown for clarity. The –5V slave does not pull all the way up to 0V at V_{MASTER} = 0V because the ground referenced current mirror cannot pull its output all the way to ground. If the converter has an FB reference voltage greater than 0V or if a negative supply is available for the current mirror, the offset can be removed. Figure 5 shows the resulting waveform.

Conclusion

The LTC2927 simplifies power supply tracking and sequencing by offering superior performance in a tiny point-of-load footprint. Only a few resistors are needed to configure simple or complex supply behaviors. Series MOSFETs are eliminated along with their parasitic voltage drops and power consumption. The LTC2927 offers all of these features in tiny 8-lead ThinSOT™ and 8-lead (3mm × 2mm) DFN package.

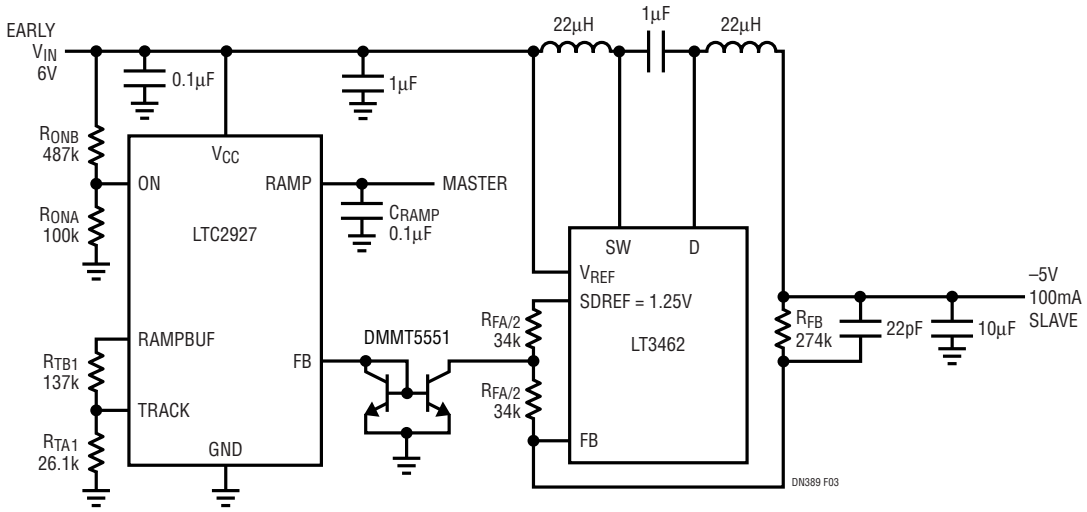

Figure 3. Supply Tracking of a GND Referenced Negative Regulator

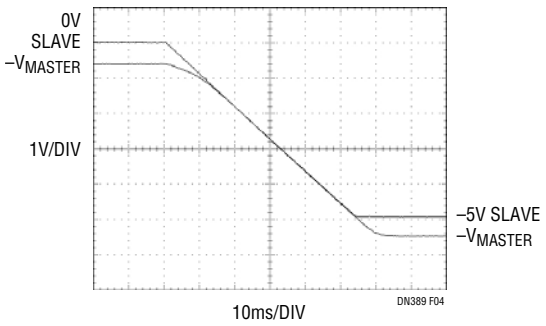

Figure 4. Tracking Profile of the Negative Regulator Application in Figure 3

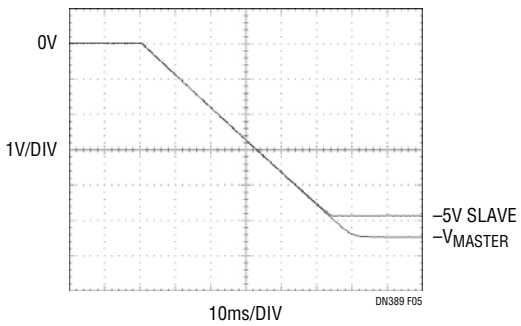

Figure 5. Tracking Profile of the Negative Regulator Application Without the Current Mirror Pull-Down Limitation

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