3 Amp Point of Load Power Supplies

Several of today's electronic products are turning to the significant advantages of using point of load power supplies. The main reasons for this are the cost and efficiency advantages that these implementations can bring to the design.

One such implementation is the intermediate semi-regulated bus that is converted from –48V or other larger input voltages. The intermediate bus converter is a much lower cost power design than its fully regulated counterparts, which is especially true if you buy power modules.

These converters operate at the perfect duty cycle and have smaller input voltage ranges. Lower input voltages allow the design to use lower rds-on MOSFETs and have lower switching losses. These advantages provide significant increases in efficiency. The lower input ranges also provide an easier design for the transformer. Therefore the output voltage is proportional to the turn ratio of the input voltage. A 10V variation in input voltage may translate into a 3V output voltage variation. Also, the output voltage may very well move a few volts with changes in load.

Since intermediate bus converters are semi-regulated, they can be distributed around a backplane and PC board without the concern for regulation changes with IR drops and parasitic inductances. The small accurate point of load power supplies can be placed very close to the loads and powered from the intermediate bus converter. If you bus the low voltages around the PC board, there is a concern for IR drop and parasitic inductances that effect the load regulation and transient response of the regulator.

It costs a lot to add more layers to the PC board and use bulk capacitors to reduce this problem. Thus, the point of load regulator can be an efficient and cost-effective solution.

The point of load regulator will be required to operate over a varying input voltage range due to the intermediate semi-regulated bus; a current mode regulator is a good choice for the application. The current mode regulator is easier to compensate with varying input voltages and is also more immune to line variations. It generally has very good short circuit protection, which is important when bussing around a large power bus regulator. In addition, a synchronous step down converter is desired for high efficiency and reduced thermal issues.

Specific Point of Load Applications

The MP1570 device is a 340KHz constant frequency, current mode step down converter. The input range of this converter is 4.75V to 24V, and it can produce output voltages down to 1.235V. The maximum duty cycle of this converter is 90%.

The device has two onboard 100mΩ N-Channel MOSFETs for synchronous step-down operation in order to provide high efficiency. The MP1570 device comes in a SO8 exposed pad package for very small board layouts and has very good short circuit control, thermal fault protection and a programmable soft-start. The device has a good over voltage protection scheme that will shut off the regulator at 20% above the output regulation point. Also, the device has a fast bandwidth control loop for using small ceramic output capacitors. The datasheet has specific design equations for the designing of the converter.

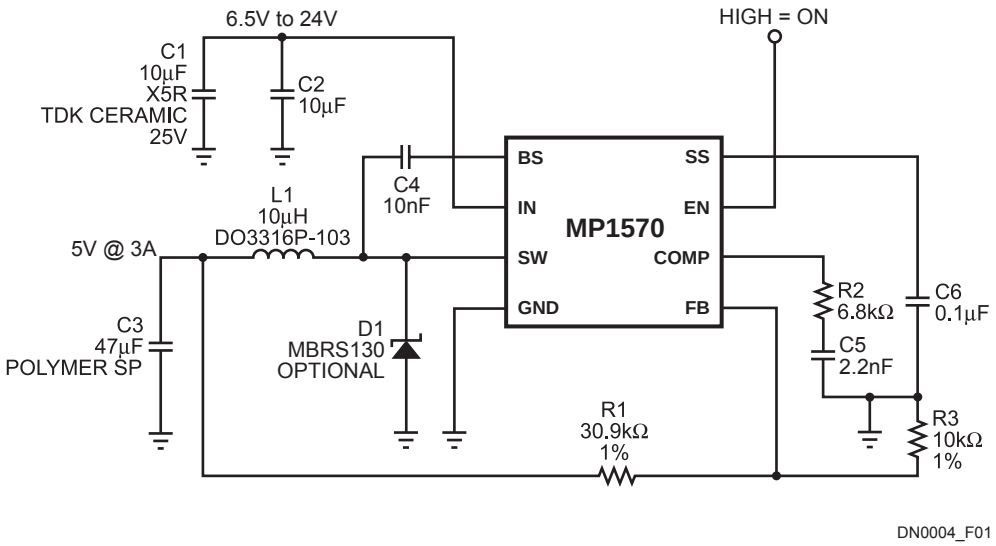
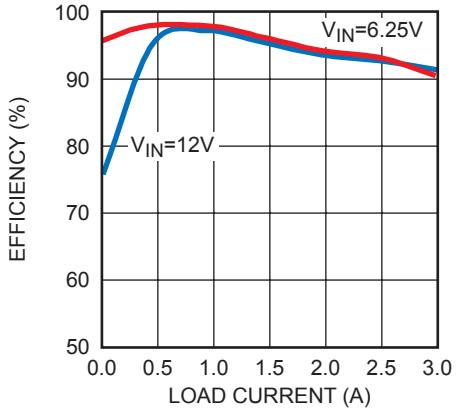
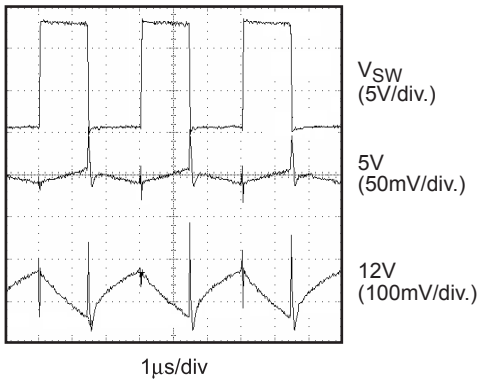


Figure 1—12V to 5V @ 3A

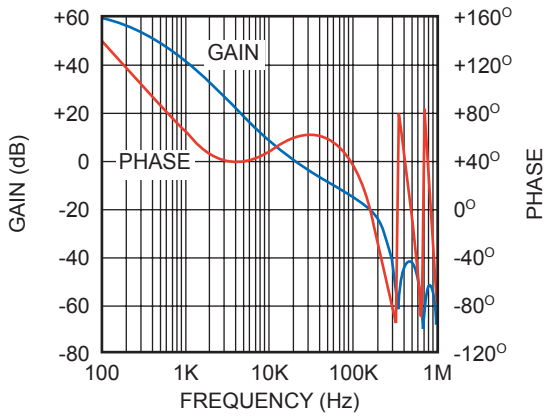
5V Efficiency Curve



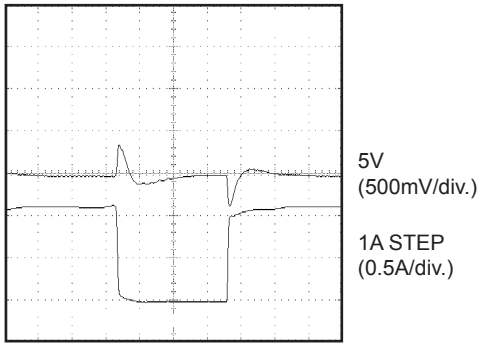
5V Ripple Noise



5V Bode Plot



5V Load Step



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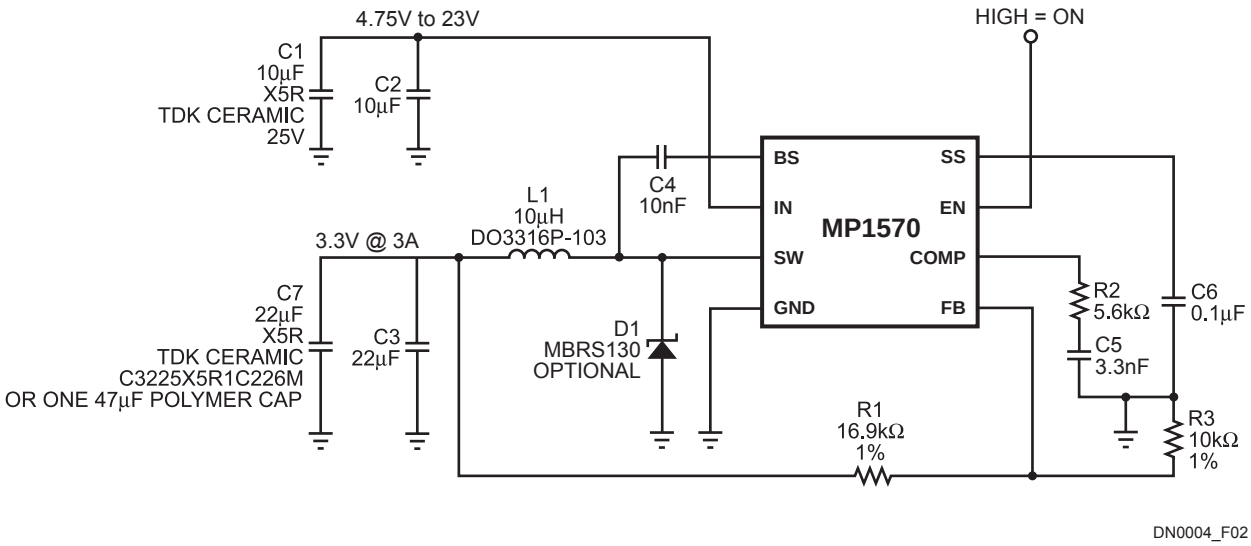
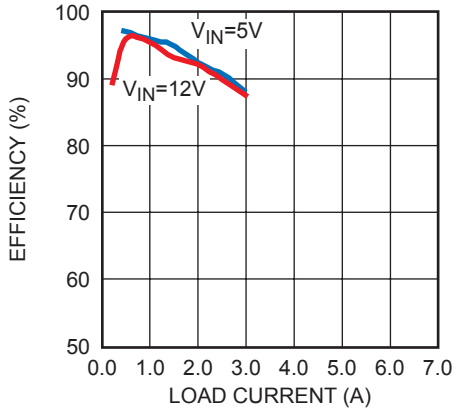
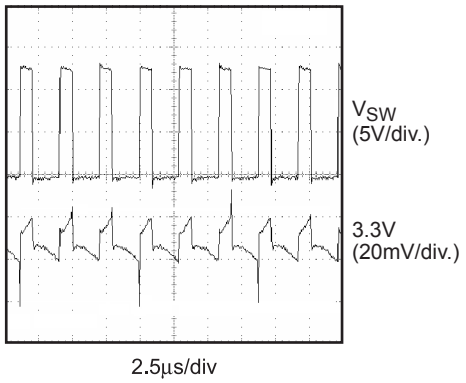


Figure 2—12V to 3.3V @ 3A

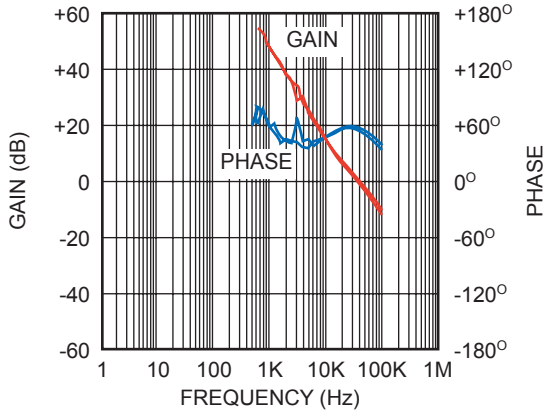
3.3V Efficiency Curve



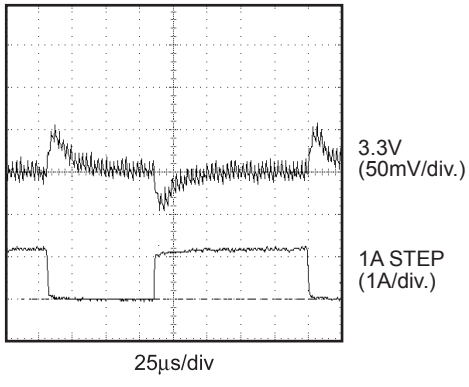
3.3V Ripple Noise



3.3V Bode Plot



3.3V Load Step



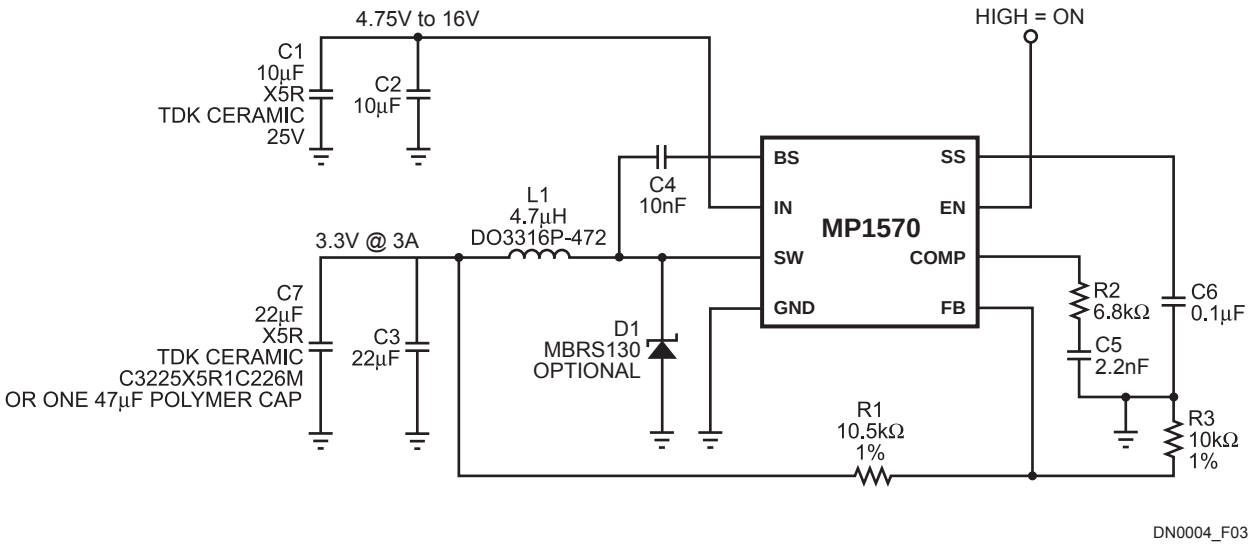
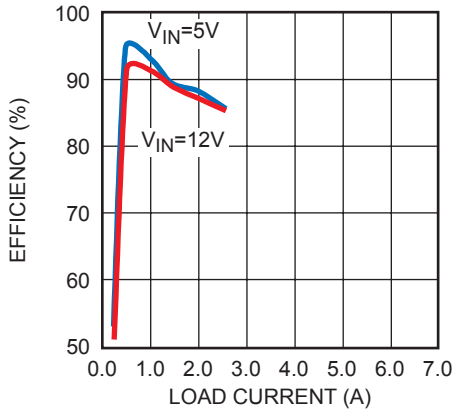
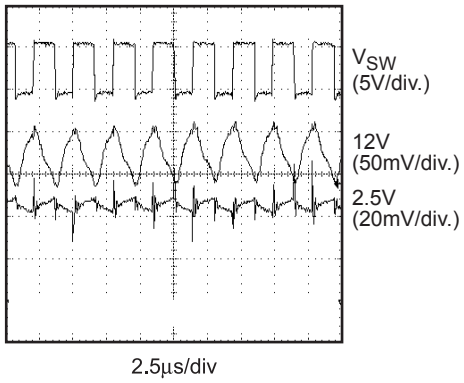


Figure 3—12V to 2.5V @ 3A
(Can operate up to 23V, but watch minimum on time.)

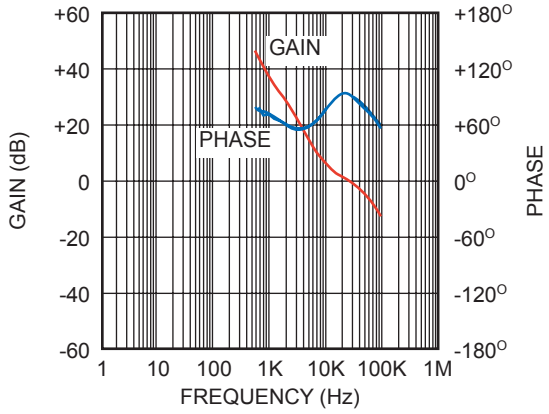
2.5V Efficiency Curve



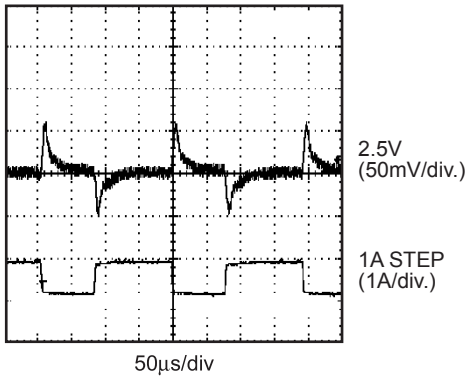
2.5V Ripple Noise



2.5V Bode Plot



2.5V Load Step



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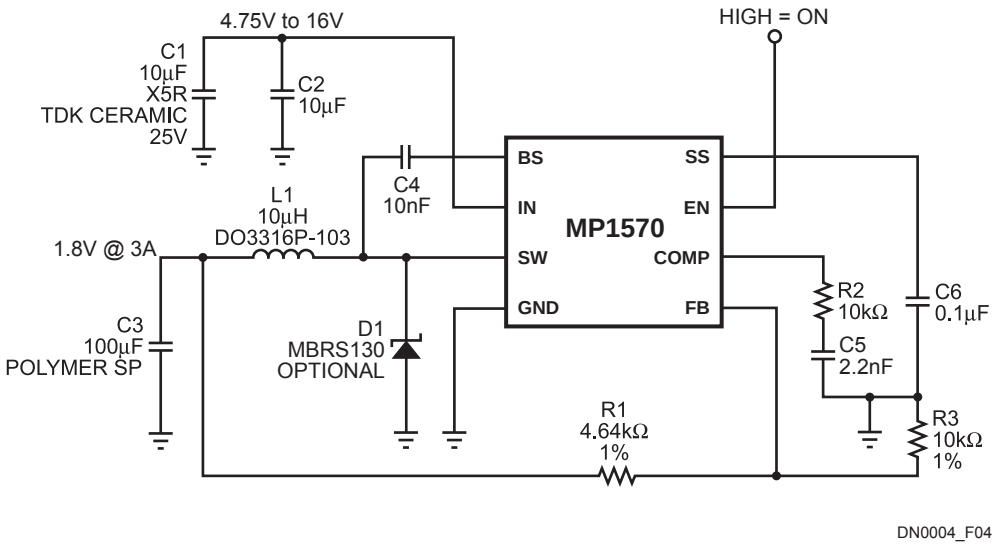
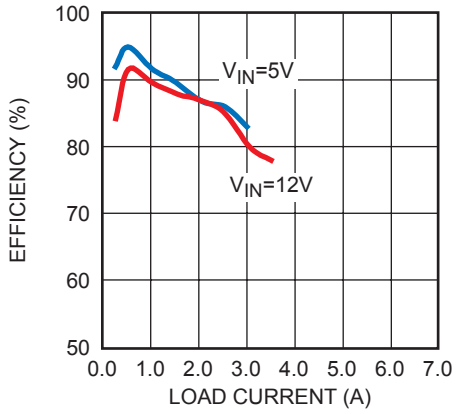
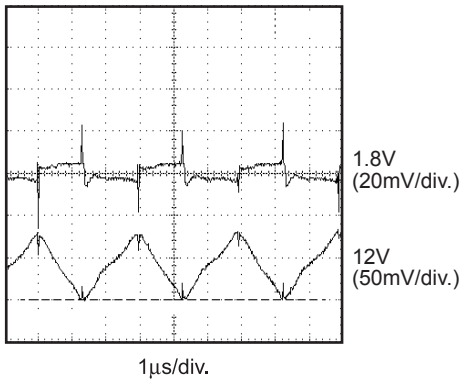


Figure 4—12V to 1.8V @ 3A
(Can operate up to 23V, but watch minimum on time.)

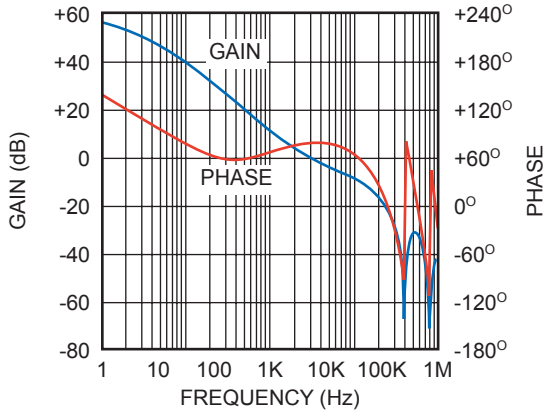
1.8V Efficiency Curve



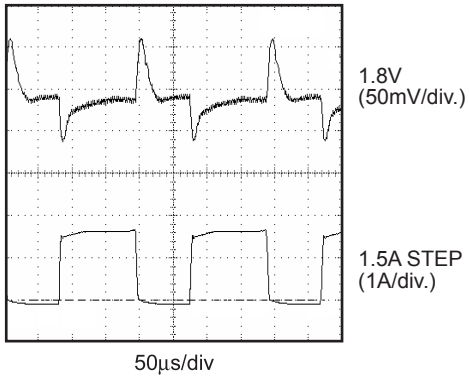
1.8V Ripple Noise



1.8V Bode Plot



1.8V Load Step



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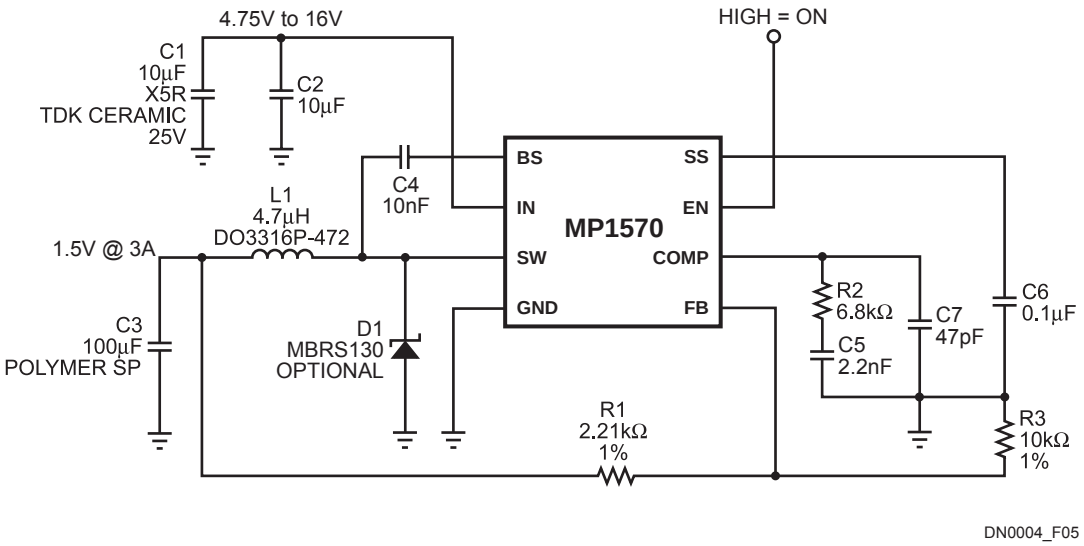

Figure 5—3.3V to 1.5V @ 1.0A