Application Report
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Using The TPS6235x Without The I²C Interface

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ABSTRACT

The TPS6235x series of DC/DC converters have an I²C-compatible interface that facilitates changing the output voltage for dynamic voltage-scaling applications. However, it is possible to use the TPS6235x series of converters, without the I²C interface, as a standalone DC/DC converter that can be dynamically switched between two fixed voltages. This technique does not work for the TPS62351.

1 Introduction

The TPS6235x is a 800-mA, 3-MHz synchronous step-down converter with an I²C-compatible interface typically used to power the core of digital signal processors (DSP) or microprocessors. Typically, the microprocessor communicates with the TPS6235x via an I²C interface to adjust the output voltage of the TPS6235x to a level sufficient to support the processors clock frequencies. Output voltage adjustments via the I²C interface allows for a wide range of possible output voltages to be selected to power the core. However, some applications only require one or two distinct output voltages. For example, one voltage for normal operation of the processor and a lower voltage for when the processor is in shutdown or in a low power mode. In these one- or two-voltage-level applications, the I²C interface is not required for operation or for the selection of the output voltage. This application report shows examples of how to use the TPS6235x without the I²C interface.

2 Output Voltage Selection

The TPS6235x has two internal 8-bit registers, VSEL0 and VSEL1, that are used to determine the output voltage of the converter. Only the lower 6 bits of each register is used to determine the output voltage; the upper two bits are control bits. For the purposes of this document, the registers are referenced as 6-bit registers because these are the only bits that set the output voltage. Figure 1 shows a functional diagram of how the TPS6235x output voltage is selected. The VSEL pin of the TPS6235x selects which 6-bit register will be used to set the output voltage. If the VSEL pin is a logic low, then the VSEL0 register is used to determine the output voltage. If the VSEL pin is a logic high, then the VSEL1 register is used. The output voltage of the TPS6235x is the decimal number stored in the selected register multiplied by 12.5 mV and added to the minimum output voltage possible. For example, from the Ordering Information Table in the TPS62350 data sheet (SLVS540), the minimum output voltage possible for the TPS62350 is 0.75 V. If the selected register contains the decimal number 37, then the output voltage is 0.75 + (0.0125 × 37) = 1.2125 V.

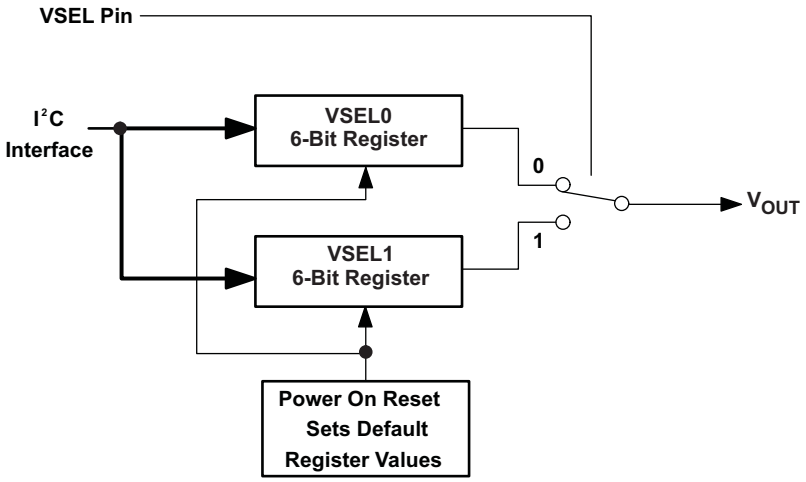

Figure 1. Functional Diagram

The I²C interface can be used to change the bits in either register in order to select different output voltages for each respective register. However, communications through the I²C register is not mandatory to produce an output voltage for the TPS62350/2/3/4. If the I²C interface is not used, then the output voltage is determined by the power on default values of the registers. At power up, the TPS6235x loads each of the 6-bit registers with factory-defined values. Therefore, after power up, two distinct output voltages can be selected based on the state of the VSEL pin. The VSEL pin can be toggled at anytime to change the output voltage to the corresponding value in the other register. Therefore, the TPS6235x can still be used for dynamic voltage scaling applications without the I²C interface. The unused I²C pins (SDA and SCL) must be connected to the Vin pin when not used and cannot be left floating.

The power-up default for the TPS62351 is to have the output voltage software disabled. Therefore, the system controller must use the I²C interface to software-enable the output in order to have a voltage present on the output. Therefore, the I²C interface is required for the TPS62351.

3 Application Examples

Figure 2 shows an example of a converter with an output voltage that can be selected to be either 1.05 V or 1.35 V depending on the logic state of the VSEL pin. The converter can provide up to 800 mA of output current at either output voltage. Typically, the VSEL pin of the converter would be driven by an output on a microprocessor to select the appropriate output voltage. For example, VSEL would be driven high to produce a 1.35-V core voltage when the processor is operating at full clock speed. When the processor enters a low power mode, the clock frequency can be reduced so that the core voltage can be reduced as well. The processor then drives VSEL low to set the core voltage to 1.05 V to save power.

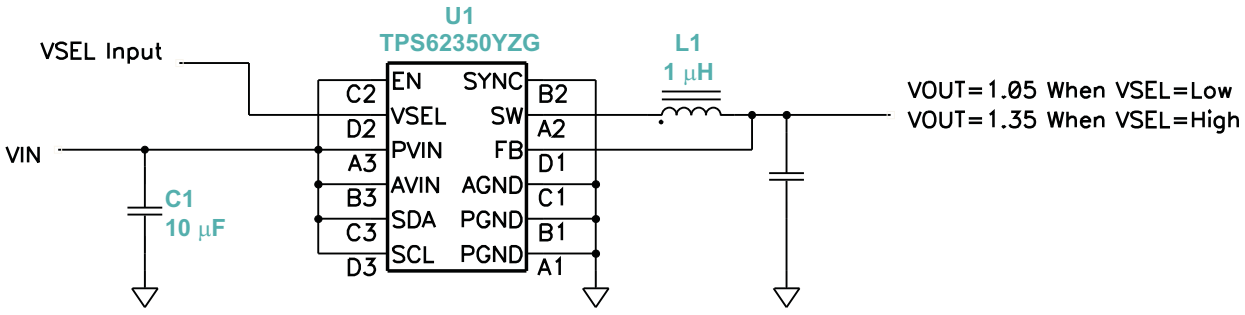

Figure 2. Pin-Selectable Output Voltage

Figure 3 shows a TPS62353 configured as a 1.2-V fixed output voltage converter. In this example, the VSEL pin is tied high so that VSEL1 register is always selected. The default output voltage based on the VSEL1 register is 1.2 V.

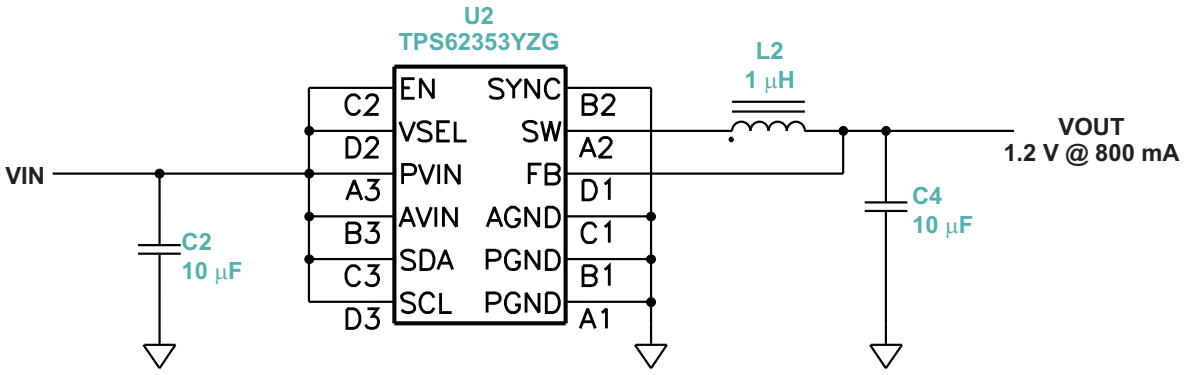

Figure 3. 1.2 V at 800-mA Fixed Output Voltage Converter

4 Conclusion

The TPS6235x family of step-down converters has an I^2C interface to control several operating parameters of the converter including the output voltage. The I^2C interface is not required if the default values of the registers provide the desired output voltage and operating modes. The unused pins of the I^2C interface are connected to the input voltage.

5 Reference

1. *TPS62350, 800-mA, 3-MHz Synchronous Step-Down Converter With I^2C Compatible Interface in Chip Scale Packaging* data sheet (SLVS540)

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