3.6-V to 6.0-V Input, High-Efficiency DC/DC Converter Reference Design

PMP - DC/DC Low-Power Converters

ABSTRACT

This design was created to help those desiring to design-in a Stellaris® ARM® Cortex™-M3 MCU into a system using an input voltage in the range of 3.6V to 6.0V and is interested in using a high-efficiency DCDC Converter with integrated FETs for a small, simple design.

1 Features

- 3.6-V to 6.0-V input voltage range
- Fixed 3.3-V output eliminates need for external voltage-setting resistors
- Up to 98% efficiency
- 1-MHz PWM operation for small passive components
- Transitions to PFM mode for highest light-load efficiency
- The TPS62203 is capable of driving up to 300 mA
- Low quiescent current (15 µA)
- SOT23-5 package

2 Introduction

This reference design is for the Stellaris® ARM® Cortex™-M3 MCU devices and accounts for voltage and current, requirements given below. The Stellaris® devices only require a single 3.3V input, so no sequencing is required. The operating input voltage for this reference design is 3.6V to 6.0V. This design is optimized for high efficiency, small design/low part count and quick design time.

3 Requirements

The power requirements for each Stellaris® ARM® Cortex™-M3 MCU family are listed below.

For more information and other reference designs, please visit www.ti.com/processorpower.

Table 1. Stellaris® ARM® Cortex™-M3 MCU Family Power Requirements

DEVICE FAMILY	PIN NAME	VOLTAGE (V)	I_{MAX} (mA)	TOLERANCE	SEQUENCING ORDER	TIMING DELAY	COMMENTS
LM3S100 series LM3S300 series LM3S600 series LM3S800 series LM3S1000 series LM3S2000 series LM3S3000 series LM3S5000 series	VDD	3.3	170	±10%	—	—	Internal regulator supplies power to device core
LM3S6000 series LM3S8000 series	VDD	3.3	225	±10%	—	—	Internal regulator supplies power to device core
LM3S9000 series	VDD	3.3	150	±10%	—	—	Internal regulator supplies power to device core
LM3S2B93, LM3S2B2793, LM3S5B91, LM3S5791	VDD	3.3	100	±10%	—	—	Internal regulator supplies power to device core
Note: The "Imax" currents listed are worst case expected values.							

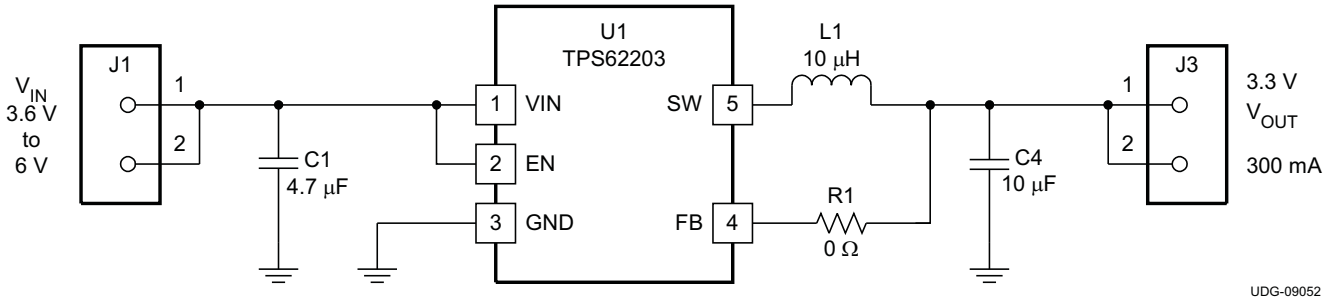

Figure 1. PMP4774 Reference Design Schematic

4 List of Materials

Table 2. PMP4774 List of Materials

REF DES	QTY	VALUE	DESCRIPTION	SIZE	PART NUMBER	MFR
C1	1	4.7 µF	Capacitor, Ceramic, 6.3 V, X5R, 20%	0805	GRM21BR60J475KA 11	muRata
C4	1	10 µF	Capacitor, Ceramic, 6.3 V, X5R, 20%	0805	C2012X5R0J106M	TDK
L1	1	10 µH	Inductor, SMT, 10 µH, 1 A, 128 mΩ	0.185x0.185	CDRH4D28-100	Sumida
U1	1	TPS62203	IC, Switching Buck Converter, 1.8 V, 300 mA	SOT23-5	TPS62203DBV	Texas Instruments
R1	1	0	Resistor, Chip, 0 Ω, 1/16-W, yy%	0603	Std	Std

5 Test Results

The input and output startup waveforsm are shown in Figure 2 through Figure 5. The 3.3-V output ripple voltage is shown in Figure 6. Figure 7 shows the 3.3-V transient response. The switching node waveform is shown in Figure 8.

5.1 Test Results

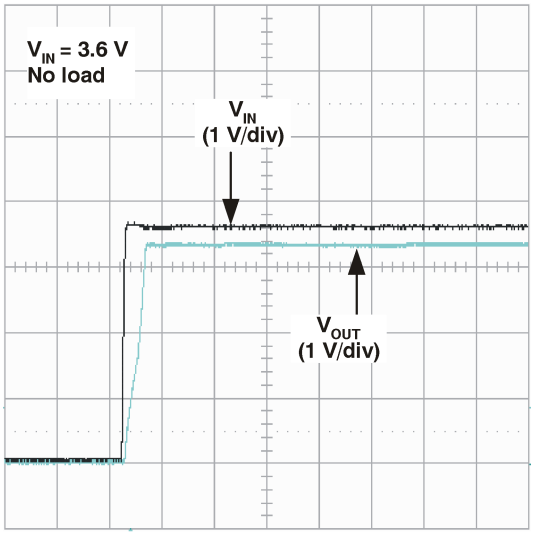

Figure 2. 3.3-V Startup Waveform

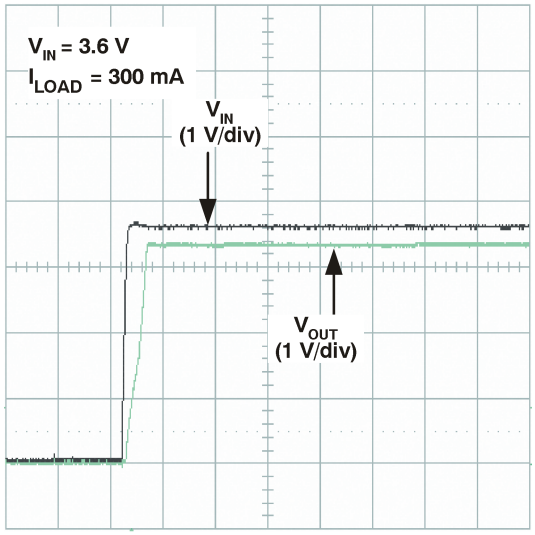

Figure 3. 3.3-V Startup Waveform

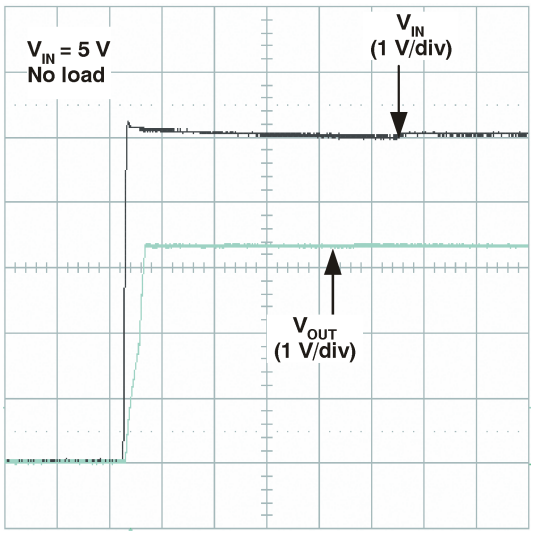

Figure 4. 5-V Startup Waveform

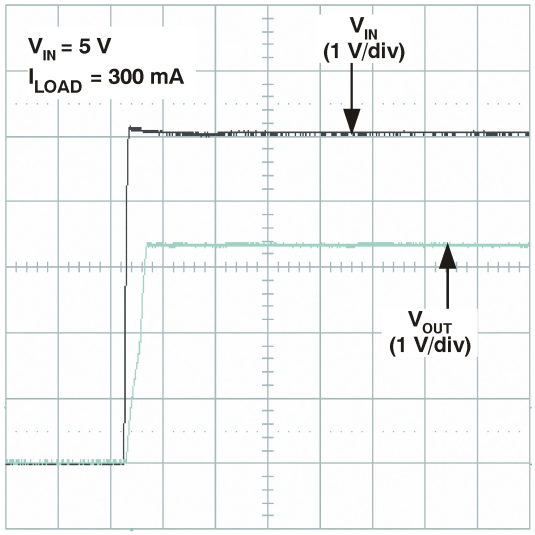

Figure 5. 5-V Startup Waveform

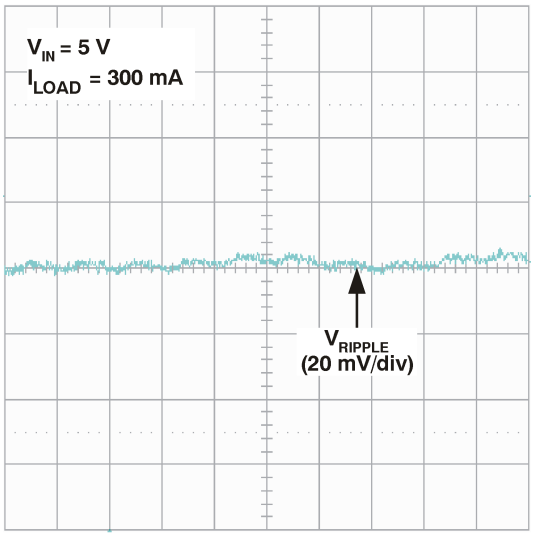

Figure 6. Output Ripple Voltage

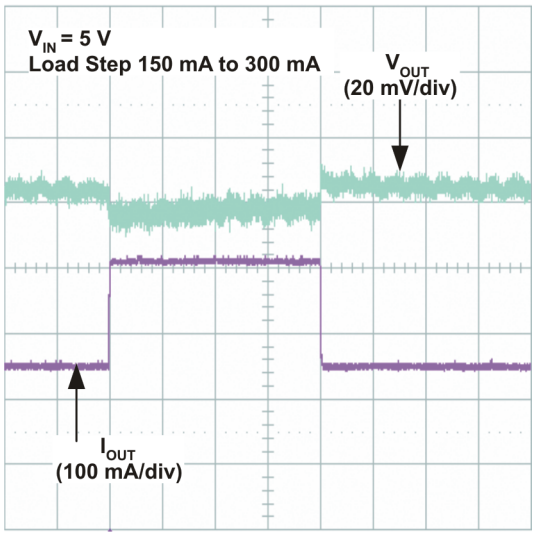

Figure 7. Load Transient 50% to 100% Load

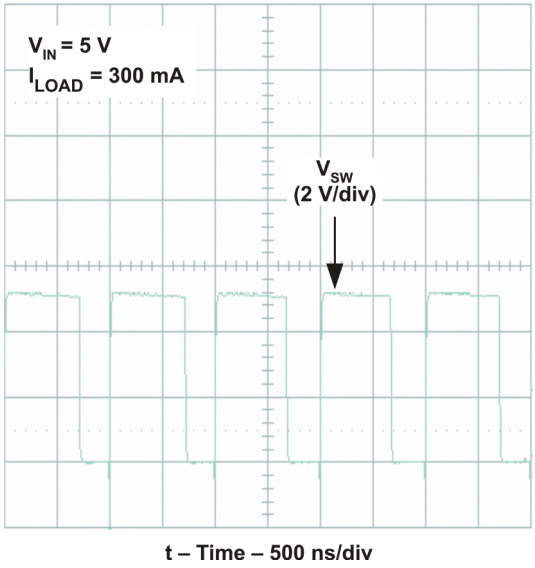

Figure 8. Switching Node Waveform

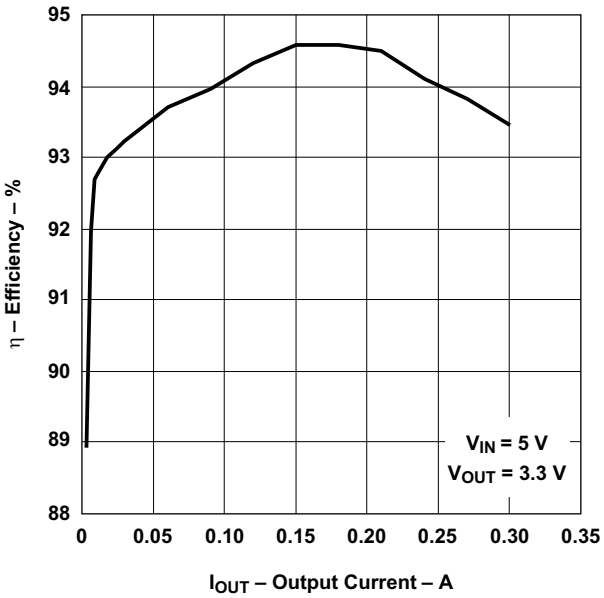

Figure 9. Efficiency vs Output Current

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