Application Report
SLVA362–October 2009

3.6-V to 6-V Input, 3.3-V Output, Tiny and High Efficiency DC/DC Converter

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 where the chief concern is minimizing solution size as well as maintaining high efficiency and long battery life. This particular design allows for an input voltage between 3.6V to 6V.

1 Features

- 3.6-V to 6-V input voltage range
- The TPS62300 is capable of driving up to 500 mA
- 3-MHz operation allows for small passive components
- High efficiency (over 92%)
- Low quiescent current (20 µA)
- Tiny 8-pin NanoStar™ (chip scale) and QFN-10 and 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 6V. This design is optimized for small solution size, low part count, and high efficiency.

NanoStar is a trademark of Texas Instruments.

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.							

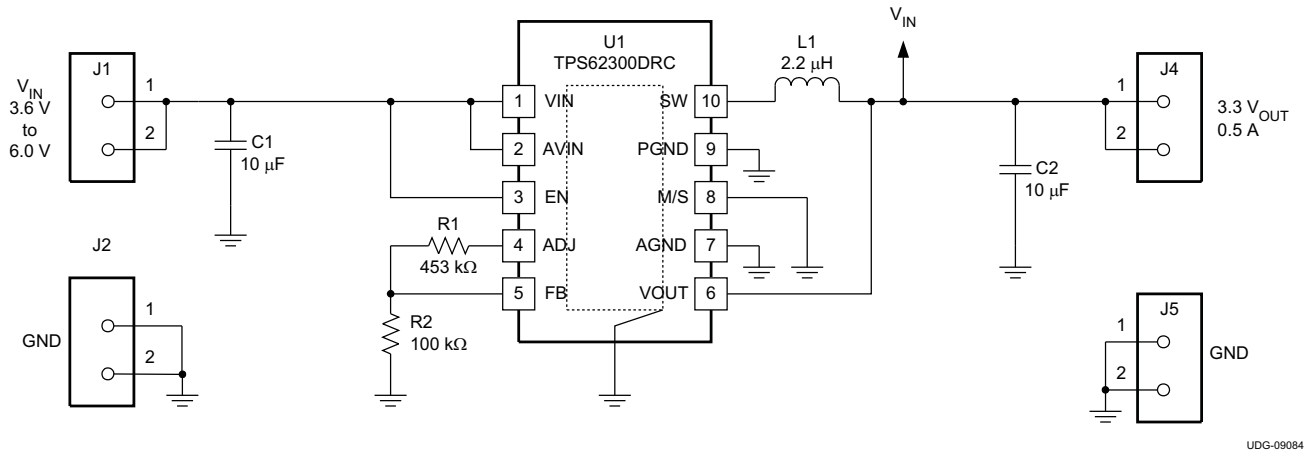

Figure 1. PMP4775 Reference Design Schematic

4 List of Materials

Table 2. PMP4775 List of Materials

REF DES	QTY	VALUE	DESCRIPTION	SIZE	PART NUMBER	MFR
C1, C2	2	10 µF	Capacitor, Ceramic, 6.3 V, X5R, 10%	0603	C1608X5R0J106KT	TDK
L1	1	2.2 µH	Inductor, SMT, 1.5A, 110 mΩ	0.102" x 0.110"	VLF3010AT-2R2M1R0	TDK
R1	1	453 kΩ	Resistor, Chip, 1/16W, 1%	0603	Std	Std
R2	1	100 kΩ	Resistor, Chip, 1/16-W, 1%	0603	Std	Std
U1	1		3-MHz synchronous step-down converter, 500-mA, Adj	QFN-10	TPS62300DRC	TI

5 Test Results

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

5.1 Test Results

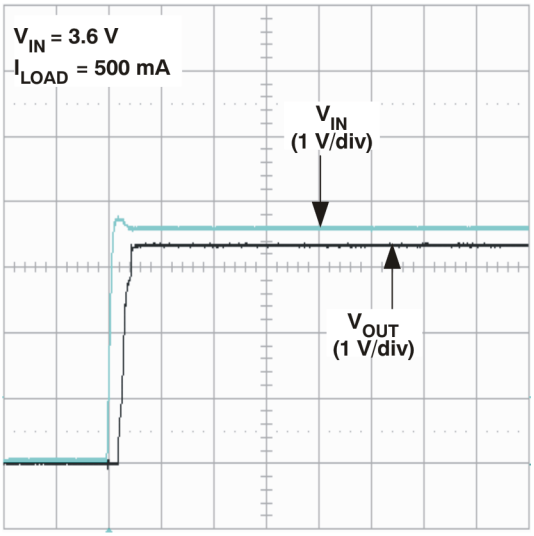

Figure 2. Startup

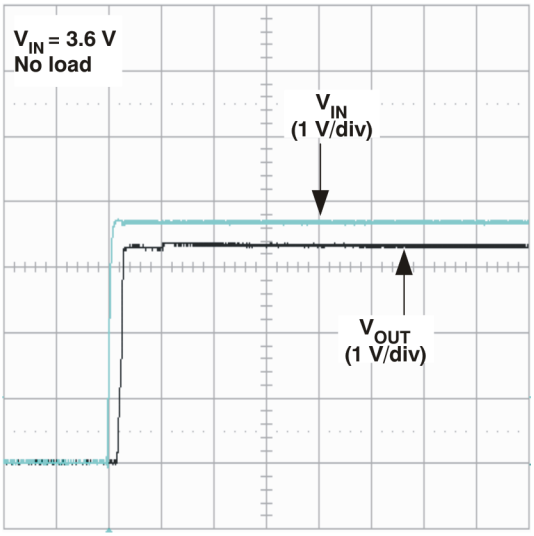

Figure 3. Startup

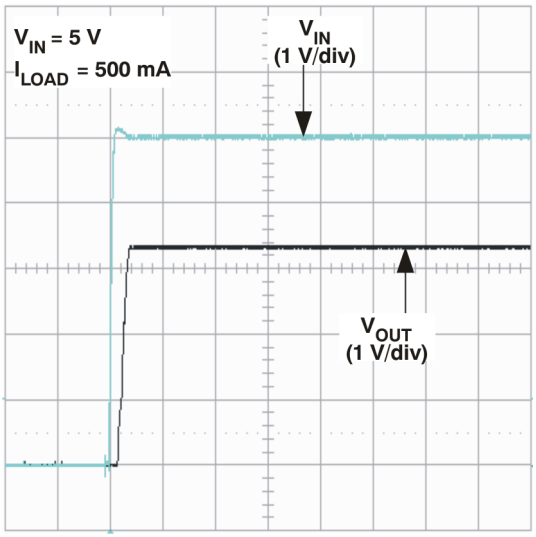

Figure 4. Startup

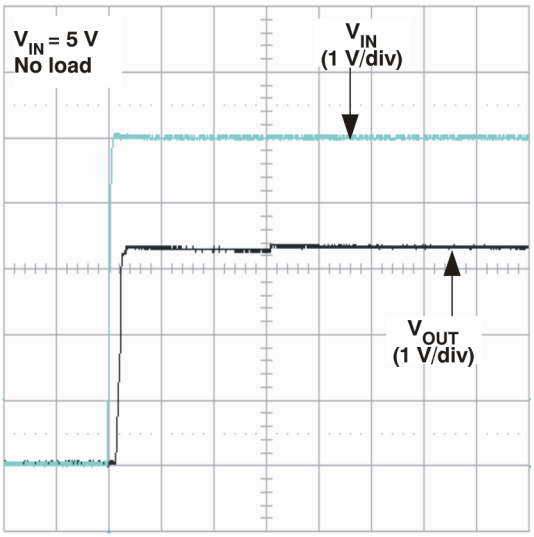

Figure 5. Startup

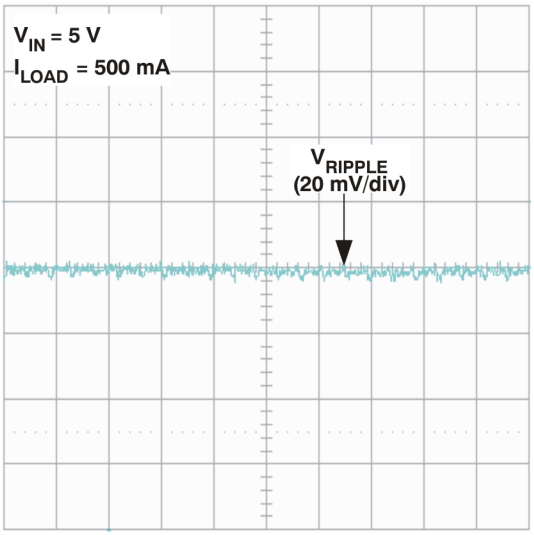

Figure 6. Output Ripple Voltage

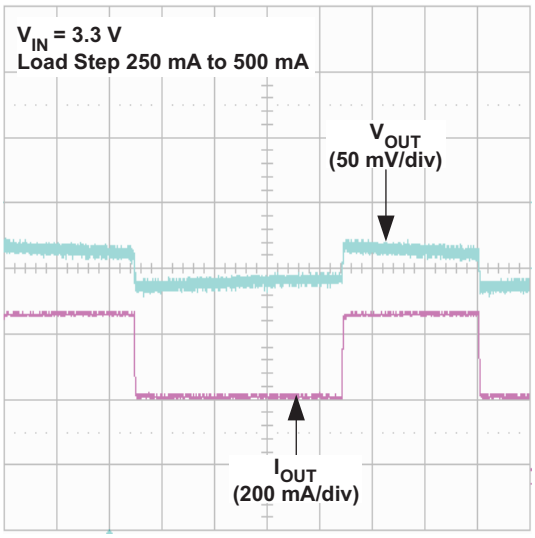

Figure 7. Load Transient

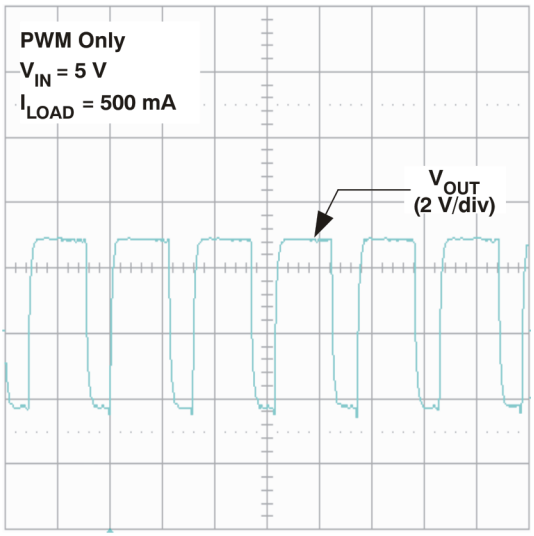

Figure 8. Switching Node Waveform

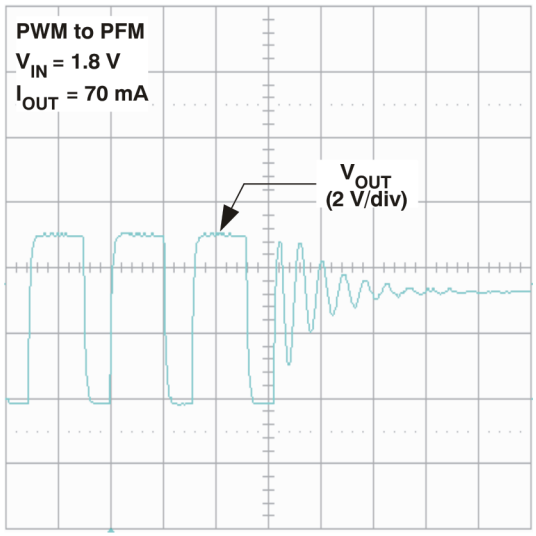

Figure 9. Switching Node Waveform

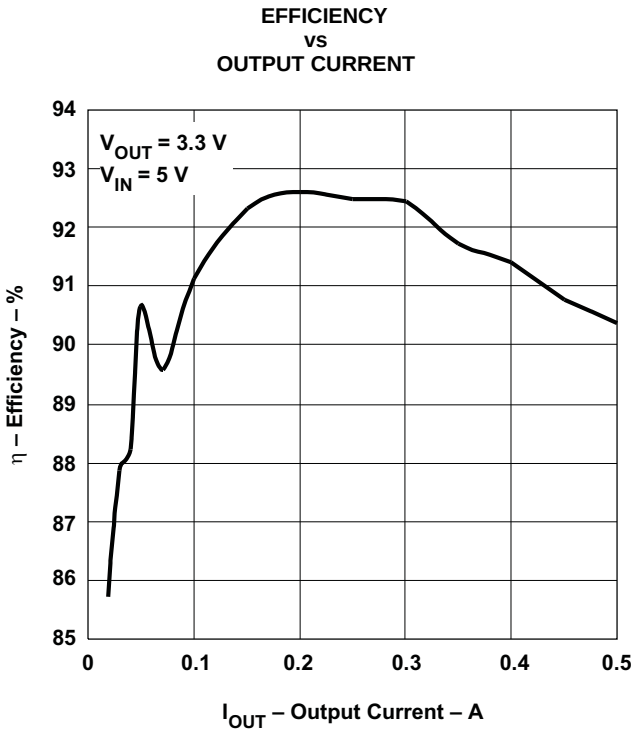

Figure . Figure 10.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products		**Applications**	
Amplifiers	amplifier.ti.com	Audio	www.ti.com/audio
Data Converters	dataconverter.ti.com	Automotive	www.ti.com/automotive
DLP® Products	www.dlp.com	Broadband	www.ti.com/broadband
DSP	dsp.ti.com	Digital Control	www.ti.com/digitalcontrol
Clocks and Timers	www.ti.com/clocks	Medical	www.ti.com/medical
Interface	interface.ti.com	Military	www.ti.com/military
Logic	logic.ti.com	Optical Networking	www.ti.com/opticalnetwork
Power Mgmt	power.ti.com	Security	www.ti.com/security
Microcontrollers	microcontroller.ti.com	Telephony	www.ti.com/telephony
RFID	www.ti-rfid.com	Video & Imaging	www.ti.com/video
RF/IF and ZigBee® Solutions	www.ti.com/lprf	Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265