LTC3618EUF
Dual ±3A Synchronous Buck Regulator for DDR Termination

DESCRIPTION

Demonstration circuit 1726 is a dual high efficiency monolithic step-down (buck) DC/DC switching regulator designed for double-data-rate (DDR) memory termination in computer systems. The VDDQ output is capable of sourcing and sinking up to 3A with output voltages of 1.5V, 1.8V, 2.5V plus an optional voltage, selected using jumpers. The VTT output can also source and sink up to 3A with an output voltage equal to half of the VDDQ voltage, half of the input voltage or half of an externally applied voltage, selected using a jumper. An additional low current output (VTTR) equal to the VTT voltage capable of sourcing and sinking up to 10mA is included. Input voltage range is from 2.25V to 5.5V with overvoltage protection for transients exceeding 6.5V. Switching frequency is set to 1MHz although it can be programmed up to 4MHz and can be synchronized to an external clock for noise sensitive applications.

Jumpers are included for selecting either internal or external compensation and jumpers for low quiescent current shutdown for each regulator. Other jumpers allow selecting internal or external soft-start, selecting the switching phase between the two regulators and selecting external frequency synchronizing, and forced continuous or pulse skipping modes of operation for the VDDQ regulator only.

Terminals are provided for connecting an input supply, output loads and voltmeters. Other terminals include external sync input, external reference input, external tracking input, and separate power good outputs that pull low at start-up and when the VDDQ or VTT output is outside a voltage window.

The LTC®3618 used on this board is housed in a 24-pin 4mm × 4mm thermally enhanced QFN package. The LTC3618 is also available in a 24-pin TSSOP package.

The LTC3618 data sheet gives a complete description of the part, operation and application information and should be read in conjunction with this quick start guide.

Design files for this circuit board are available at http://www.linear.com/demo

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETERS	CONDITION	TYPICAL VALUE
Input Voltage Range (VIN)		2.25V to 5.5V
VDDQ Output Voltages (1.5V, 1.8V, 2.5V)	VIN = 3.3V	±2.5%
VTTR Output Voltage	VIN = 3.3V	VDDQIN • 0.5 ±2%
VTT Output Voltage	VIN = 3.3V	VTTR ±6mV
Load Regulation (Each Regulator)	VIN = 3.3V, 0 to 3A Load	5mV
Maximum Output Current (Each Regulator)	VIN = 3.3V	±3A
Switching Frequency		1MHz ±20%
Output Voltage Ripple	VIN = 3.3V, 0 to 3A Load	$10mV_{P-P}$
Efficiency	VIN = 3.3V, VDDQ = 1.8V, 2A Load	88%
Efficiency	VIN = 3.3V, VTT = 900mV, 2A Load	80.5%

QUICK START PROCEDURE

Demonstration circuit 1726 allows the user to quickly evaluate the performance of the LTC3618. Refer to Figure 2 for proper measurement equipment setup and follow the procedure below

1. Place jumpers in the following positions.

JP1	VOUT 1 Select	1.5V
JP5	Track/SS	INT SS
JP6	PHASE	180°
JP8	MODE	FCM
JP9	COMP 1	INT
JP10	COMP 2	INT
JP11	RUN 1	ON
JP12	RUN 2	ON
JP13	VDDQIN	VDDQ

2. With the input power supply turned down and switched off, connect the supply and digital voltmeters as shown in Figure 2.
3. Switch on the input supply and adjust for approximately 3.3V on VIN.
4. Verify that the VDDQ output voltage is within the limits shown in the table on page 1 for each of the three output voltages as selected by JP1, JP2 and JP2. Note: moving the jumper to JP3 sets VDDQ to the internal reference voltage of 600mV. Other output voltages can be programmed by selecting a suitable resistor for R9.
5. To verify VDDQ output voltage tracking. Move JP5 to the TRACK position (upper) and remove all VOUT1 SELECT jumpers. Apply an external reference voltage between 100mV and 600mV to TRACK1 terminal. Verify that the VDDQ output is within ±11mV of the external reference voltage.
6. Move JP5 to the INT SS position (lower) and place a jumper on JP2 (1.8V). Verify that the VTTR output voltage is equal to VDDQ • 0.5 ±2%. Additional VDDQ voltages can be selected using JP1 or JP3.
7. Verify that the VTT output voltage is equal to the VTTR voltage ±6mV. The error voltage can be read differentially by placing the meter leads between the VTTR and VTT terminals
8. To evaluate sourcing current from VDDQ or VTT outputs, connect a suitable 10W load in series with an ammeter between each output terminal and ground. Resistor. See Figure 2 for resistor connections and resistor value equation. Verify that the output voltages still meet the specifications shown in the Performance Summary section.
9. To evaluate sinking current into the VTT output, connect a suitable 10W load resistor in series with an ammeter between the VTT output and the VIN terminals. Verify that the output voltages meet the specifications in the Performance Summary section.

The many jumpers on this board allow the user to evaluate the various features of the LTC3618. Jumpers are used to select VDDQ output voltages, switch phasing, soft-start, tracking, on/off, operating mode and compensation. Refer to the data sheet for information on these functions.

Extra pads are located on the top and bottom of the board for adding additional input and output capacitors if desired.

NOTE. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the VIN or VOUT and GND terminals. See Figure 1 for proper scope probe technique.

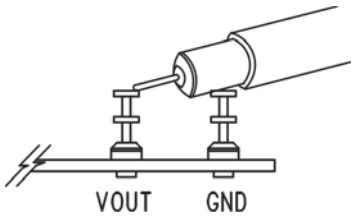


Figure 1.

QUICK START PROCEDURE

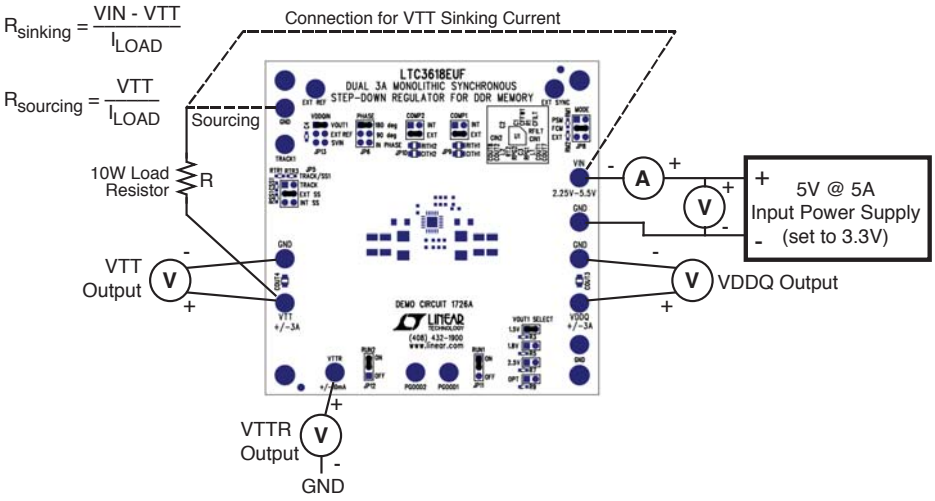


Figure 2. Proper Measurement Equipment Setup

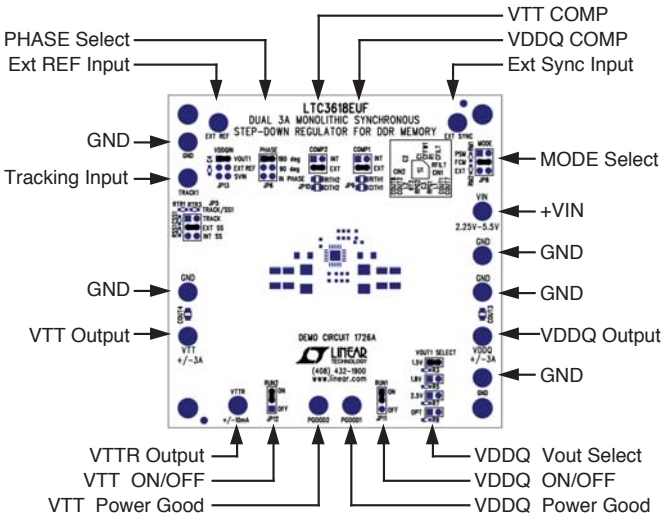


Figure 3. Jumper and Terminal Descriptions

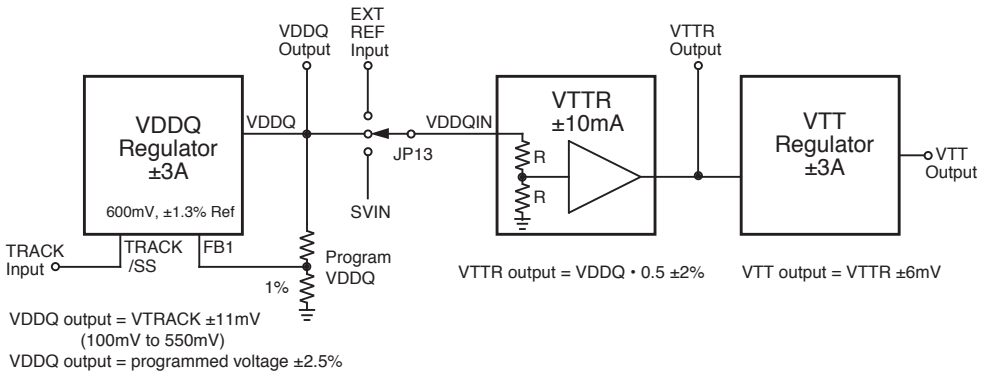
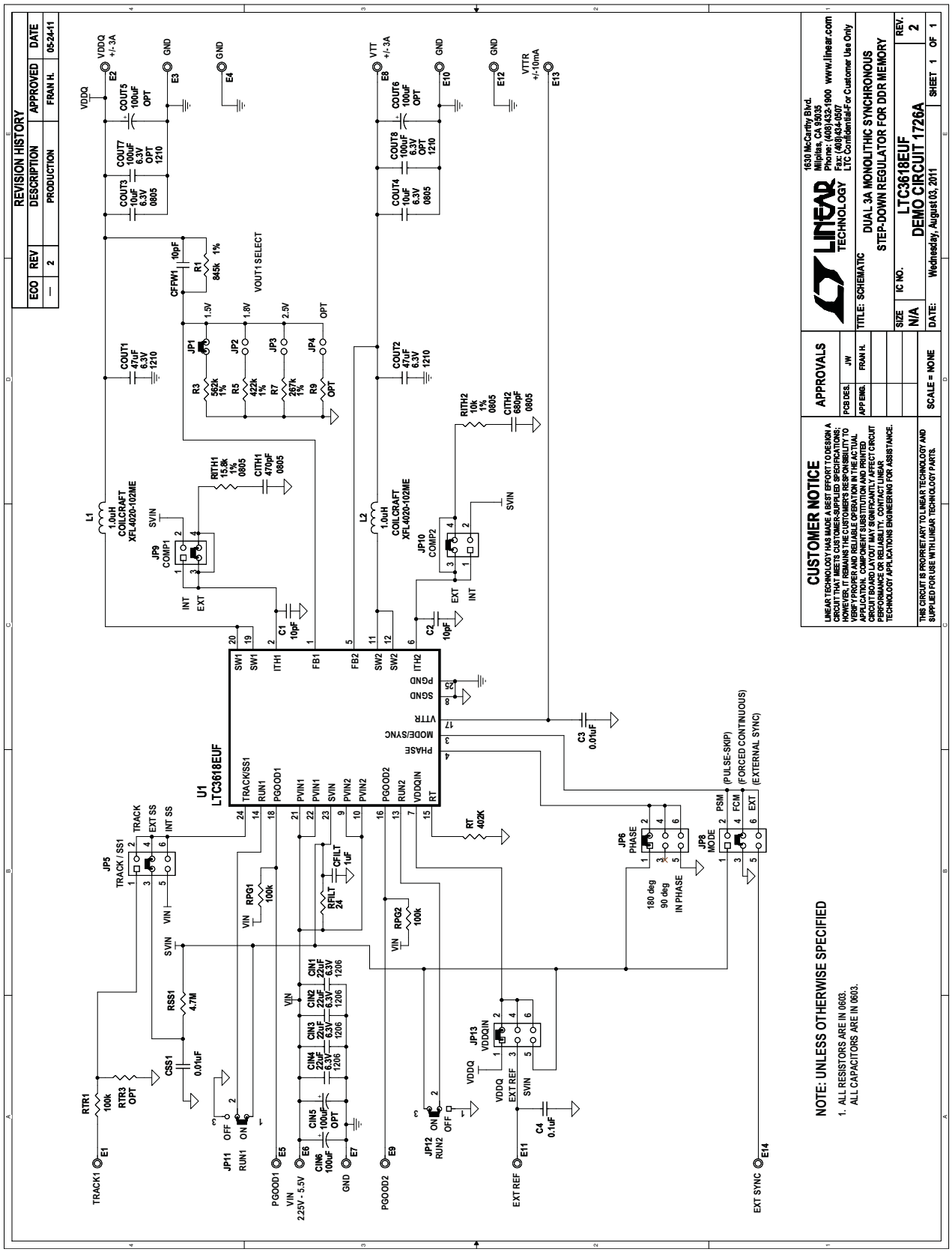


Figure 4. Simplified Block Diagram of Demo Board Showing Output Voltages and Tolerances

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C3	CAP., X7R, 0.01µF, 50V, 20% 0603	AVX, 06035C103MAT2A
2	4	CIN1, CIN2, CIN3, CIN4	CAP., X7R, 22µF, 6.3V, 20% 1206	AVX, 12066C226MAT2A
3	2	COUT1, COUT2	CAP., X5R, 47µF, 6.3V, 20% 1210	AVX, 12106D476MAT2A
4	2	L1, L2	INDUCTOR, 1µH	COILCRAFT, XFL4020-102MEB
5	1	RT	RES., CHIP, 402k, 1/16W, 5% 0603	VISHAY, CRCW0603402KFKEA
6	1	R1	RES., CHIP, 845k, 1/16W, 1% 0603	VISHAY, CRCW0603845KFKEA
7	1	R3	RES., CHIP, 562k, 1/16W, 1% 0603	VISHAY, CRCW0603562KFKEA
8	1	U1	IC., LTC3618EUF UF-24	LINEAR TECH., LTC3618EUF#PBF
Additional Demo Board Circuit Components				
1	3	C1, C2, CFFW1	CAP., C0G, 10pF, 25V, 20% 0603	AVX, 06033A100MAT2A
2	1	C4	CAP., X7R, 0.1µF, 50V, 20% 0603	AVX, 06035C104MAT2A
3	1	CIN6	CAP., TANT., 100µF 10V, 20% 7343	AVX, TPSW107M010Y0150
4	0	COUT5, COUT6, CIN5 (OPT)	CAP., 7343	
5	1	CITH1	CAP., NPO, 470pF, 25V, 20% 0805	AVX, 08053A471MAT2A
6	1	CITH2	CAP., NPO, 680pF, 25V, 20% 0805	AVX, 08053A681MAT2A
7	2	COUT3, COUT4	CAP., X7R, 10µF, 6.3V, 20% 0805	AVX, 08056C106MAT2A
8	0	COUT7, COUT8 (OPT)	CAP., 1210	
9	1	CSS1	CAP., X7R, 0.01µF, 50V, 20% 0603	AVX, 06035C103MAT2A
10	1	CFILT	CAP., X7R, 1µF, 10V, 20% 0603	AVX, 0603ZD105MAT2A
11	1	RFILT	RES., CHIP, 24Ω, 1/16W, 5% 0603	VISHAY, CRCW060324R0JNEA
12	1	RITH1	RES., CHIP, 15.4k, 1/16W, 1% 0805	VISHAY, CRCW080515K4FKEA
13	1	RITH2	RES., CHIP, 10k, 1/16W, 1% 0805	VISHAY, CRCW080510K0FKEA
14	1	RTR1	RES., CHIP, 100k, 1/16W, 1% 0603	VISHAY, CRCW0603100KFKEA
15	2	RPG1, RPG2	RES., CHIP, 100k, 1/16W, 5% 0603	VISHAY, CRCW0603100KJNEA
16	1	RSS1	RES., CHIP, 4.7M, 1/16W, 5% 0603	VISHAY, CRCW06034M70JNEA
17	0	RTR3, R9, RM1, RM2 (OPT)	RES., 0603	
18	1	R5	RES., CHIP, 422k, 1/16W, 1% 0603	VISHAY, CRCW0603422KFKEA
19	1	R7	RES., CHIP, 267k, 1/16W, 1% 0603	VISHAY, CRCW0603267KFKEA
Hardware/Components (For Demo Board Only)				
1	2	JP11, JP12	HEADER, 3 PIN 0.079 SINGLE ROW	SAMTEC, TMM-103-02-L-S
2	4	JP5, JP6, JP8, JP13	HEADER, 2x3 PIN 0.079 DOUBLE ROW	SAMTEC, TMM-103-02-L-D
3	2	JP9, JP10	HEADER, 2x2 PIN 0.079 DOUBLE ROW	SAMTEC, TMM-102-02-L-D
4	4	JP1-JP4	HEADER, 2 PIN 0.079 SINGLE ROW	SAMTEC, TMM-102-02-L-S
5	9	XJP1, XJP5, XJP6, XJP8-XJP13	SHUNT, .079" CENTER	SAMTEC, 2SN-BK-G
6	14	E1-E14	TESTPOINT, TURRET, 0.094" pbf	MILL-MAX, 2501-2-00-80-00-00-07-0
7	4	MH1-MH4	STANDOFF, NYLON, 0.25, 1/4"	KEYSTONE, 8831 (SNAP ON)

SCHEMATIC DIAGRAM



DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

Please read the DEMO BOARD manual prior to handling the product. Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged**.

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

LT 0811 • PRINTED IN USA