LT3975
42V, 2.5A, 2.7µA Micropower Buck Regulator

DESCRIPTION

Demonstration circuit 1736A is a monolithic step-down DC/DC switching regulator featuring the LT®3975. The demo circuit is designed for 3.3V, 2.5A output from a 4.3V to 42V input. The wide input range of the LT3975 allows a variety of input sources, such as automotive batteries and industrial supplies. The switching frequency can be programmed either via oscillator resistor or external clock up to 2MHz. When the circuit is synchronized to an external clock connected to the SYNC terminal, the R_T resistor (R5) should be chosen to set the LT3975 internal switching frequency at least 20% below the lowest synchronization input frequency. Low ripple Burst Mode® operation increases the efficiency at the light load while keeping the output ripple below 15mV.

The circuit consumes only 2.7µA of quiescent current. The LT3975 internal boost diode and loop compensation reduce the components count and solution size. The current mode control scheme creates fast transient response and good loop stability. The LT3975 is in shutdown when the EN pin is low and active when the pin is high. The threshold of the EN pin is accurate at 1.02V with 60mV of hysteresis. Users can populate R7 and R8 to provide a programmable undervoltage lockout. During a short-circuit fault, the LT3975 has current limit foldback to limit the power dissipation.

The LT3975 data sheet gives a complete description of the part, operation and application information. The data sheet must be read in conjunction with this demo manual for demo circuit 1736A. The LT3975 is assembled in a 16-lead plastic MSOP package with an exposed pad for low thermal resistance. Proper board layout is essential for both proper operation and maximum thermal performance. See the data sheet section PCB Layout and High Temperature Considerations.

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

PERFORMANCE SUMMARY T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		4.3V
Maximum Input Voltage		42V
Output Voltage, V_{OUT}	V_{IN} = 4.3V ~ 42V	3.3V ± 3%
Switching Frequency	R_T = 78.7k	600kHz ±20%
Maximum Output Current, I_{OUT}	V_{IN} = 4.3V ~ 42V	2.5A
Typical Efficiency	V_{IN} = 12V, I_{OUT} = 2.5A	82.1%
Typical Output Voltage Ripple	V_{IN} = 12V, I_{OUT} = 2.5A, 25MHz BW	20mV

QUICK START PROCEDURE

Demonstration circuit 1736A is easy to set up to evaluate the performance of the LT3975. Refer to Figure 2 for proper measurement equipment setup and follow the procedure below:

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 V_{IN} or V_{OUT} and GND terminals. See Figure 3 for the proper scope technique.

1. Place JP1 on the ON position.
2. Place JP2 on the RT FREQ position.
3. With power off, connect the input power supply to V_{IN} and GND.
4. With power off, connect load from V_{OUT} to GND.
5. Turn on the power at the input.

NOTE. Make sure that the input voltages do not exceed 42V.

6. Check for the proper output voltage (3.3V).

NOTE. If there is no output, temporarily disconnect the load to make sure that the load is not set too high or is shorted.

7. Once the proper output voltages are established, adjust the load within the operating ranges and observe the output voltage regulation, ripple voltage, efficiency and other parameters.
8. An external clock can be added to the SYNC terminal when SYNC function is used (JP2 on the SYNC position). Please make sure that the SYNC frequency is at least 20% higher than the set switching frequency. See the data sheet section Synchronization.

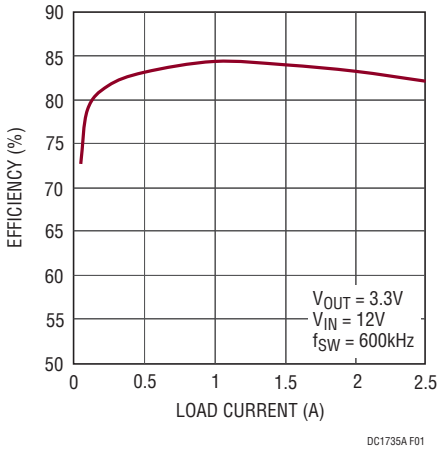


Figure 1. Efficiency vs Load Current

QUICK START PROCEDURE

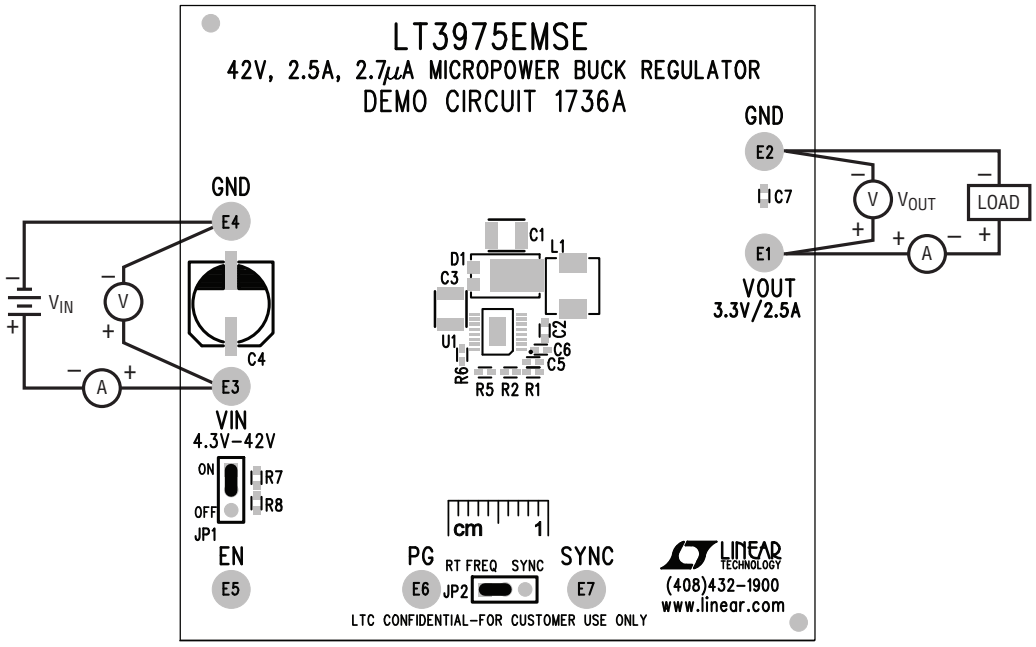


Figure 2. Proper Measurement Equipment Setup

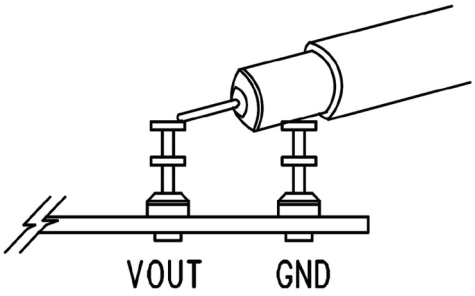
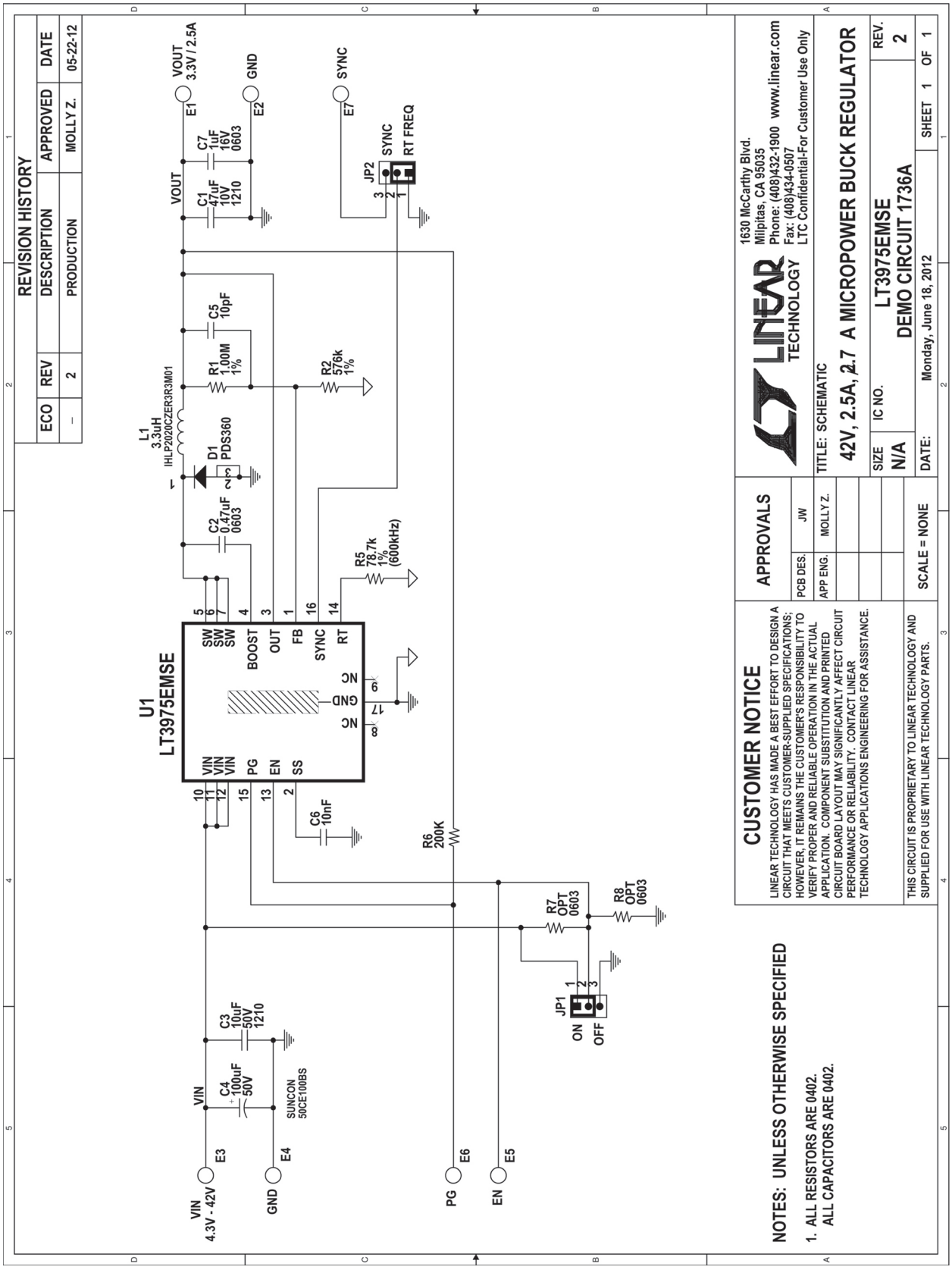


Figure 3. Measuring Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	Cap., X5R, 47µF 10V 20% 1210	TDK, C3225X5R1A476M
2	1	C2	Cap., X5R, 0.47µF 25V 10% 0603	TDK, C1608X5R1E474K
3	1	C3	Cap., X5R, 10µF 50V 10%, 1210	TDK, C3225X5R1H106K
4	1	C5	Cap., C0G, 10pF 50V 10%, 0402	TDK, C1005C0G1H100D
5	1	C6	Cap., X7R, 10nF 25V 10%, 0402	TDK, C1005X7R1E103K
6	1	D1	Diode, Scholtky, PowerDi5	DIODE INC, PDS360-13
7	1	L1	IND, 3.3µH	VISHAY, IHLP2020CZER3R3M01
8	1	R1	Res., Chip, 1.00M 1/16W 1% 0402	VISHAY, CRCW04021M00FKED
9	1	R2	Res., Chip, 576k 1/16W 1% 0402	VISHAY, CRCW0402576KFKED
10	1	R5	Res., Chip, 78.7k 1/16W 1% 0402	VISHAY, CRCW040278K7FKED
11	1	R6	Res., Chip, 200k 1/16W 1% 0402	VISHAY, CRCW0402200KFKED
12	1	U1	I.C., MSE16	LINEAR TECH., LT3975EMSE
Additional Circuits				
13	1	C4	Cap., Elect.,100µF 50V 10%	SUN ELECT, 50CE100BS
14	1	C7	Cap., X5R, 1µF 16V 20% 0603	AVX, 0603YD105MAT
15	0	R7, R8	Res., 0402	OPT
Hardware—For Demo Board Only				
16	7	E1, E2, E3, E4, E5, E6, E7	Turret, 0.094"	MILL-MAX, 2501-2-00-80-00-00-07-0
17	2	JP1, JP2	JMP, 1X3-079	SAMTEC, TMM-103-02-L-S
18	2	Shunt	Shunt, 2mm Ctrs.	SAMTEC, 2SN-BK-G

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 0712 • PRINTED IN USA

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Analog Devices Inc.:

DC1736A