

LT3975

42V, 2.5A, 2.7 μ A 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 2.7 μ A 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>

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PERFORMANCE SUMMARY $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		4.3V
Maximum Input Voltage		42V
Output Voltage, V_{OUT}	$V_{IN} = 4.3V \sim 42V$	$3.3V \pm 3\%$
Switching Frequency	$R_T = 78.7k$	$600kHz \pm 20\%$
Maximum Output Current, I_{OUT}	$V_{IN} = 4.3V \sim 42V$	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.

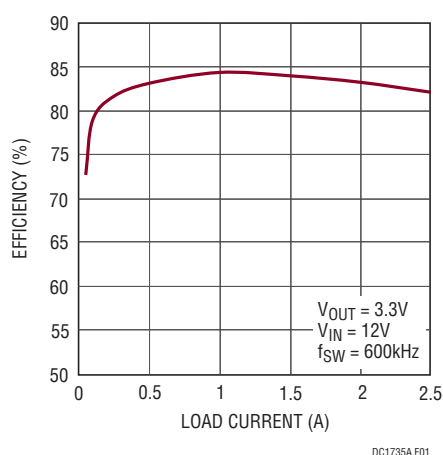


Figure 1. Efficiency vs Load Current

QUICK START PROCEDURE

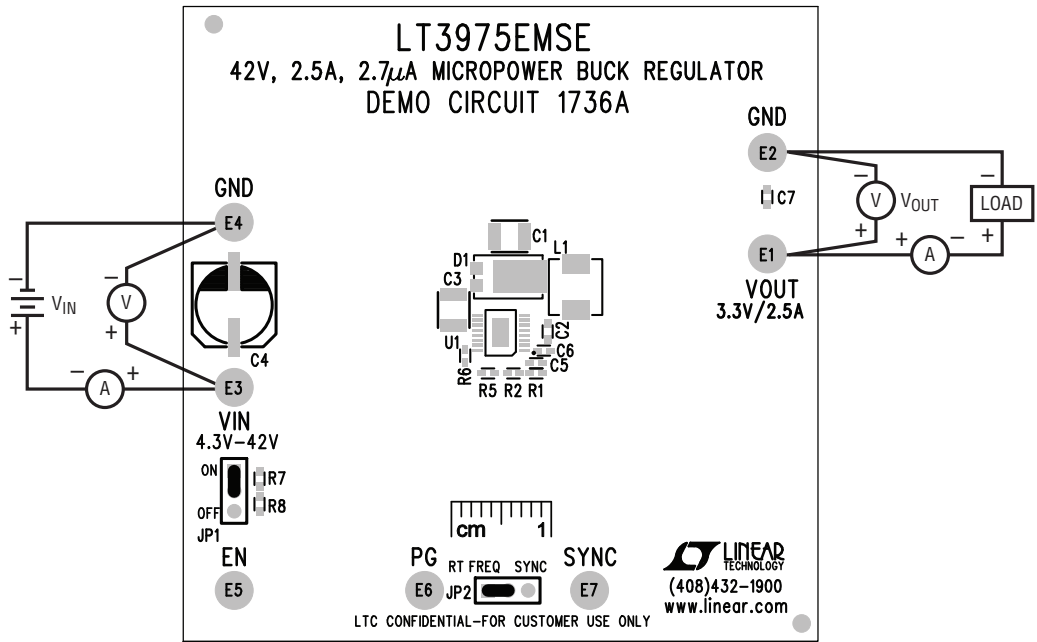


Figure 2. Proper Measurement Equipment Setup

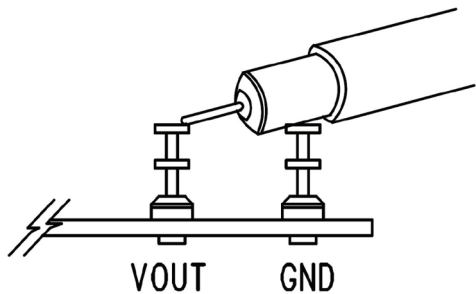


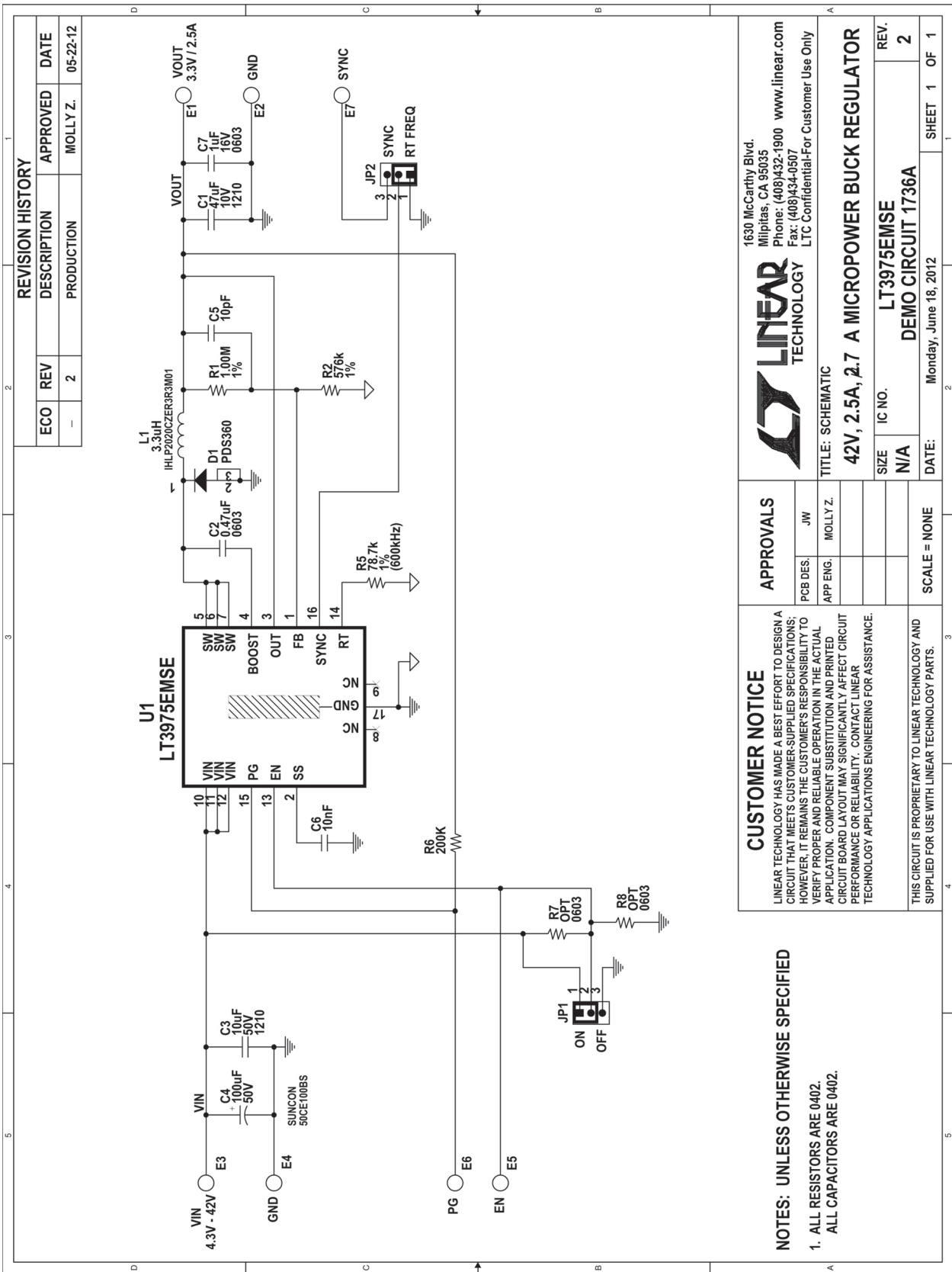
Figure 3. Measuring Output Ripple

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PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	Cap., X5R, 47 μ F 10V 20% 1210	TDK, C3225X5R1A476M
2	1	C2	Cap., X5R, 0.47 μ F 25V 10% 0603	TDK, C1608X5R1E474K
3	1	C3	Cap., X5R, 10 μ F 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, 3.3 μ H	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, CRCW0402787KFKED
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., 100 μ F 50V 10%	SUN ELECT, 50CE100BS
14	1	C7	Cap., X5R, 1 μ F 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



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