LTC3104EDHD
2.8µA Quiescent Current, 15V, 300mA Synchronous Step-Down DC/DC Converter and 10mA Quiescent

DESCRIPTION

Demonstration Circuit 1754A features the LTC®3104, a high efficiency, monolithic synchronous step-down converter using a current mode architecture capable of supplying 300mA of output current. The IC operates with a fixed frequency oscillator at 1.2MHz.

The LTC3104 has two user selectable (JP3) operating modes: Burst Mode® operation and forced continuous operation (fixed frequency PWM). The IC has internal compensation and an accurate programmable RUN pin.

The LTC3104 also incorporates a programmable LDO which can be operated from V_{IN}, V_{OUT} or an independent supply. Jumper JP4 provides a convenient way to change the input supply to the LDO. The LDO can also be independently turned off or on through JP2.

The LTC3104 operates with a 2.5V to 15V input voltage range. The demo board has been designed with the main output set to 3.3V and the LDO output (VLDO) to 1.8V. Since the LTC3104 is a buck converter, as V_{IN} approaches V_{OUT}, the output will start dropping out of regulation. Consult the data sheet for information on the minimum V_{IN} to V_{OUT} differential for regulation. The regulation range is also a function of the load current. Typical demo board efficiency is shown in Figures 1 and 2.

The LTC3104 data sheet has detailed information about the operation, specification and applications of the part. The data sheet should be read in conjunction with this Quick Start Guide.

Design files for this circuit board are available. Call the LTC factory.

PERFORMANCE SUMMARY (T_A = 25°C)

PARAMETER	CONDITIONS	TYPICAL VALUE
Input Voltage Range	(See Note 1)	2.5V to 15V
V_{OUT}	(See Note 1)	3.3V
VLDO		1.8V
I_{OUT}		300mA
I_{OUT} LDO		10mA

Note 1. The demo board can operate with V_{IN} less than V_{OUT}, however V_{OUT} will drop out of regulation. The regulation range is a function of I_{OUT}. Please refer to the data sheet for more information.

QUICK START PROCEDURE

Using short twisted-pair leads for any power connections and with all loads and power supplies off, refer to Figure 3 for the proper measurement and equipment setup. The battery/power supply (PS1) should not be connected to the circuit until it is stated in the following procedure.

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 4), or by using an oscilloscope probe tip jack.

1. Jumper, PS1 and LOAD settings to start:

   PS1 = OFF

   JP1 (RUN) = OFF

   JP2 (RUNLDO) = OFF

   JP3 (MODE) = FIXED FREQUENCY

   JP4 (VLDO) = V_{OUT}

2. With power off, connect the power supply (PS1) as shown in Figure 3. If accurate current measurements are desired (for efficiency calculation for example), then connect an ammeter in series with the supply as shown. The ammeter is not required, however.

3. Connect a load to V_{OUT}, as shown in Figure 3. The load can be up to 300mA or 11Ω for V_{OUT} = 3.3V. Connect an ammeter if accurate current measurement or monitoring is desired.

4. Connect a load to VLDO, as shown in Figure 3. The load can be up to 10mA or 180Ω for VLDO = 1.8V. Again, connect an ammeter if accurate current measurement or monitoring is desired.

5. Turn on PS1 and slowly increase voltage until the voltage at V_{IN} is 5V. Move Jumper JP1 to ON.

6. Verify V_{OUT} is ~3.3V.

7. Move Jumper JP2 to ON.

8. Verify VLDO is ~1.8V

9. V_{IN} can now be varied between 4.1V and 15V. V_{OUT} should remain in regulation.

10. V_{IN} can also be varied down to 2.5V. For $V_{IN} \leq 4.1V$, V_{OUT} may drop out of regulation as previously described. VLDO should remain in regulation.

11. I_{OUT} can also be varied from 0mA to 300mA. I_{OUT} VLDO may also be varied from 0mA to 10mA.

12. For Burst Mode operation, move jumper JP2 to BURST. See the data sheet for more information.

NOTES:

(1) If V_{OUT} drops out of regulation, check to be sure the maximum load has not been exceeded, or that V_{IN} is not below the minimum value for regulation (see the data sheet).

(2) To measure no-load input current, remove R4.

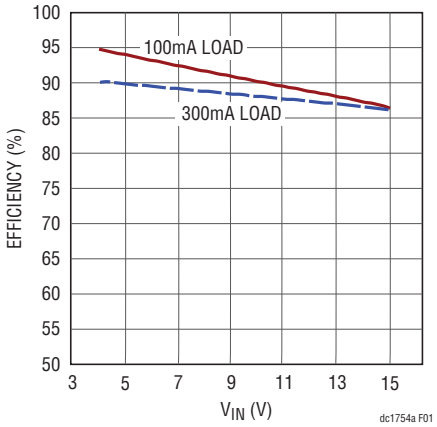

Figure 1. DC1754A Efficiency in PWM Mode

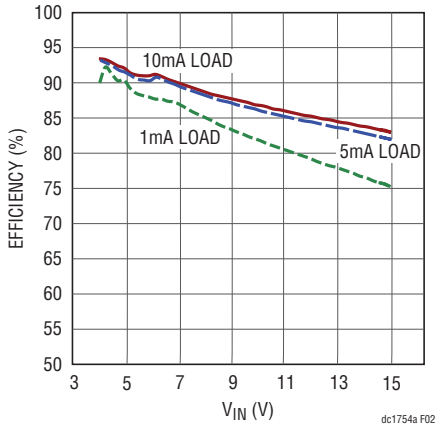

Figure 2. DC1754A Efficiency in Burst Mode Operation

QUICK START PROCEDURE

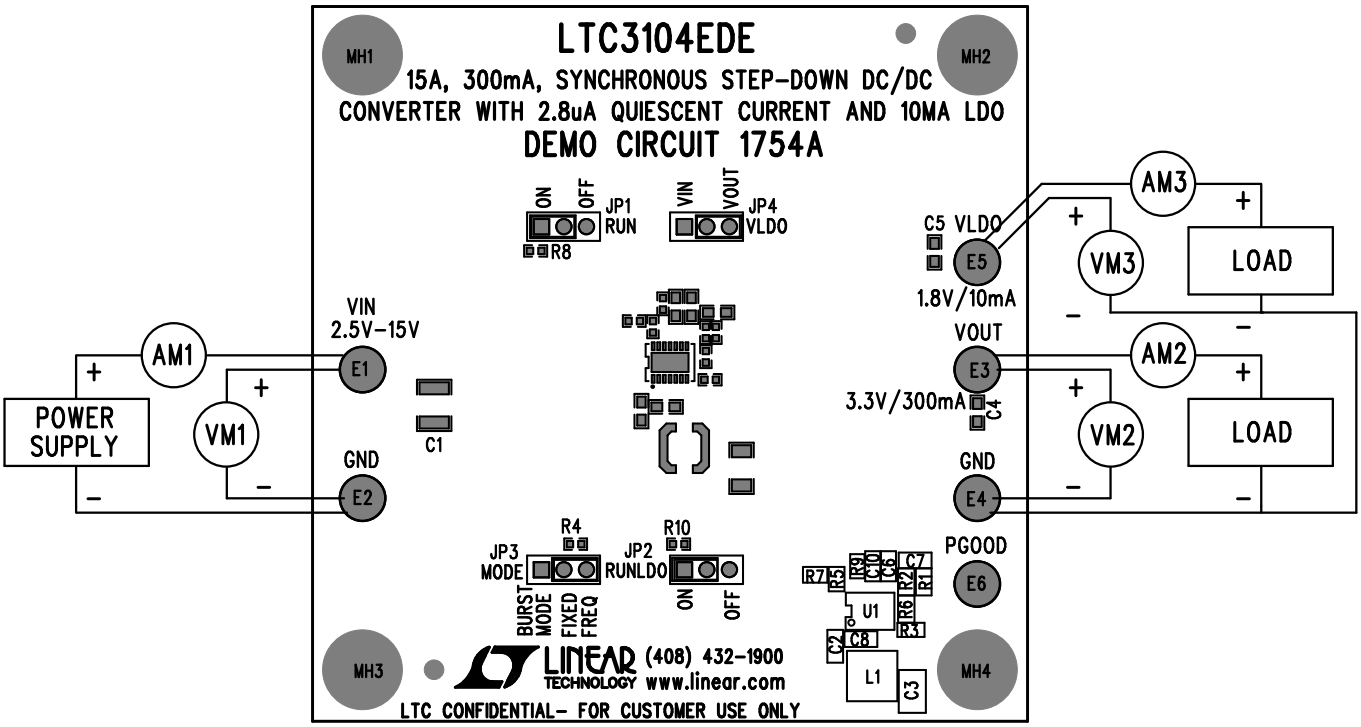

Figure 3. Proper Measurement Equipment Setup

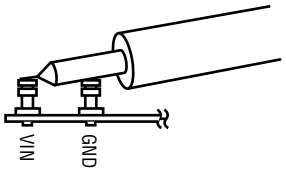

Figure 4. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP CER, 10µF, 25V, X5R, 1210	TDK, C3225X5R1E106M
2	3	C2, C4, C6	CAP CER, 1µF, 25V, X5R, 0603	TDK, C1608X5R1E105M
3	1	C3	CAP CER, 22µF, 10V, X5R, 20%, 1206	TDK, C3216X5R1A226M
4	1	C5	CAP CER, 4.7µF, 6.3V, X5R, 0603	TDK, C1608X5R0J475K
5	1	C7	CAP CER, 12pF, 50V, C0G 5%, 0603	TDK, C1608C0G1H120J
6	1	C8	CAP CER, 0.1µF, 50V, X7R, 0603	TDK, C1608X7R1H104M
7	1	L1	Inductor, 15µH	Coilcraft, LPS4018-153MLB
8	2	R1, R5	RES, 2MΩ, 1/10W, 1%, 0402, SMD	Panasonic, ERJ-2GEJ205X
9	1	R2	RES, 2.21kΩ, 1/10W, 1%, 0402, SMD	Panasonic, ERJ-2RKF2211X
10	5	R3, R4, R7, R8, R10	RES, 1MΩ, 1/10W, 1%, 0402, SMD	Panasonic, ERJ2RKF1004X
11	1	R6	RES, 442kΩ, 1/10W, 1%, 0402, SMD	Panasonic, ERJ-2RKF4423X
12	1	U1	LTC3104EDE, DFN14DE	Linear Technology Corporation, LTC3104EDHD
Additional Demo Board Circuit Components				
1	0	C9 (OPT)	OPT CAP TANT, 68µF, 20V, 10%, SMD, 7343	OPT
2	1	C10	OPT CAP CER, 1000pF, 50V, X7R, 20%, 0603	OPT
3	0	R9	OPT RES, 1/10W, 1%, 0402, SMD	OPT
Hardware—for Demo Board Only				
1	6	E1, E2, E3, E4, E5, E6	Testpoint, Turret 0.094"	Mill-Max, 2501-2-00-80-00-00-07-0
2	4	JP1, JP2, JP3, JP4	JMP, 0.079" Single Row Header, 3-Pin	Samtec, TMM-103-02-L-S
3	4	XJP1, XJP2, XJP3, XJP4	Shunt, 0.079" Center	Samtec, 2SN-BK-G
4	4	(Stand-Offs)	Stand-Off, Nylon, 0.375" Tall	Keystone, 8832 (Snap on)

SCHEMATIC DIAGRAM

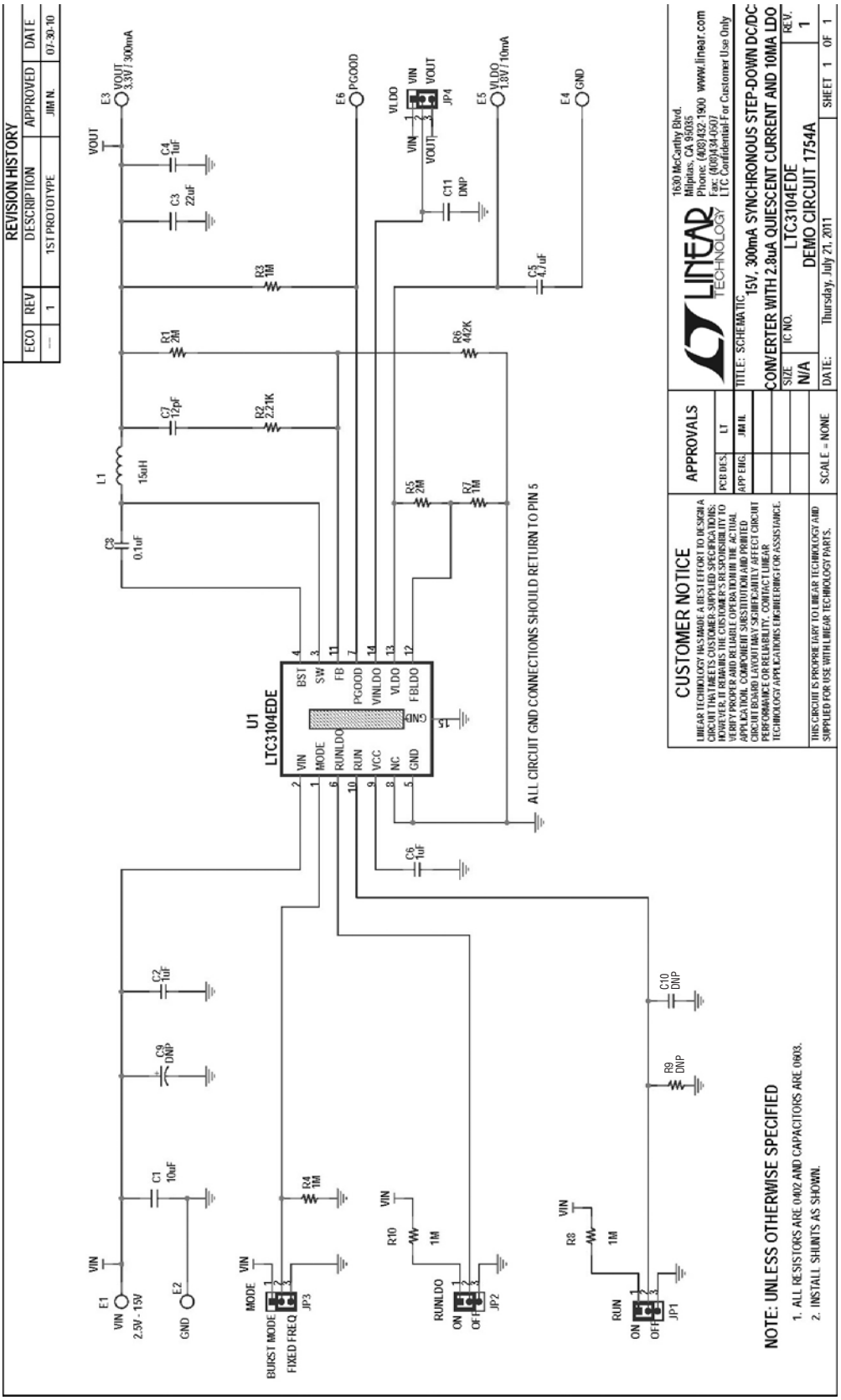

Figure 5. Circuit Schematic

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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.

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LT 1211 • PRINTED IN USA