# DESCRIPTION

Demonstration Circuit 974 is a 100kHz – 500kHz programmable frequency, high voltage, current-mode DC/DC step-down converter featuring the LT3844. The operating frequency can be synchronized up to 600kHz.

The board operates from a Vin range of 15V – 60V and outputs 12Vout @ 4.2A (50W). A soft-start feature controls the output voltage slew rate at start-up, reducing current surges and voltage overshoots. The Burst Mode of operation that improves the efficiency at light loads can be enabled with a jumper.

An Optional Boost Bias circuit is provided on the bottom side of the board for back-driving the LT3844 internal regulator from the output voltage. Customers might want to use this optional circuit with modified applications that have relatively high input voltages and low (~ 5V) output voltages.  In such applications, the optional circuit can increase the overall efficiency by reducing the power lost in the LT3844. The demonstration board has also been layed out with the option for a second switching MOSFET to facilitate higher output currents. The circuit design can be modified for a Boost converter configuration.

This board is suitable for a wide range of Industrial control and automotive applications.

Note: It's best to Ground the SYNC pin if the SYNC function is not being used.

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

Table 1.  **Performance Summary (T$_A$ = 25°C)**

| PARAMETER | CONDITION | VALUE |
|---|---|---|
| Vin Input Voltage Range | | 15V → 60Vin |
| | | |
| Efficiency | 48Vin, 0.1Aout | 76.5% |
| | 48Vin, 1.0Aout | 79.5% |
| | 48Vin, 4.2Aout | 87.5% |
| Switching Frequency | | 100kHz – 600kHz.. |
| Output Voltage | 0 – 4.2Aout | 12V |
| Vout_ripple_pp | | ~ 75mV |

## QUICK START PROCEDURE

DC974 is easy to set up to evaluate the performance of the LT3844. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Apply a 0 – 4.2A Load across the Vout/Gnd turrets.

2. Connect Voltmeters and Ammeters as shown in Figure 1.

3. Connect a 0 - 60V Power Supply (or better) across the Vin/Gnd turrets. Typically it's best to set the Current Limit of this Power Supply to its maximum setting. The power supply must be capable of providing the required start-up power. If using a bench power supply, a 60V/15A rated (or better) supply is recommended. Set Vin to 15V – 60Vin for start-up. Make sure the SHDN/RUN jumper is in the RUN position.
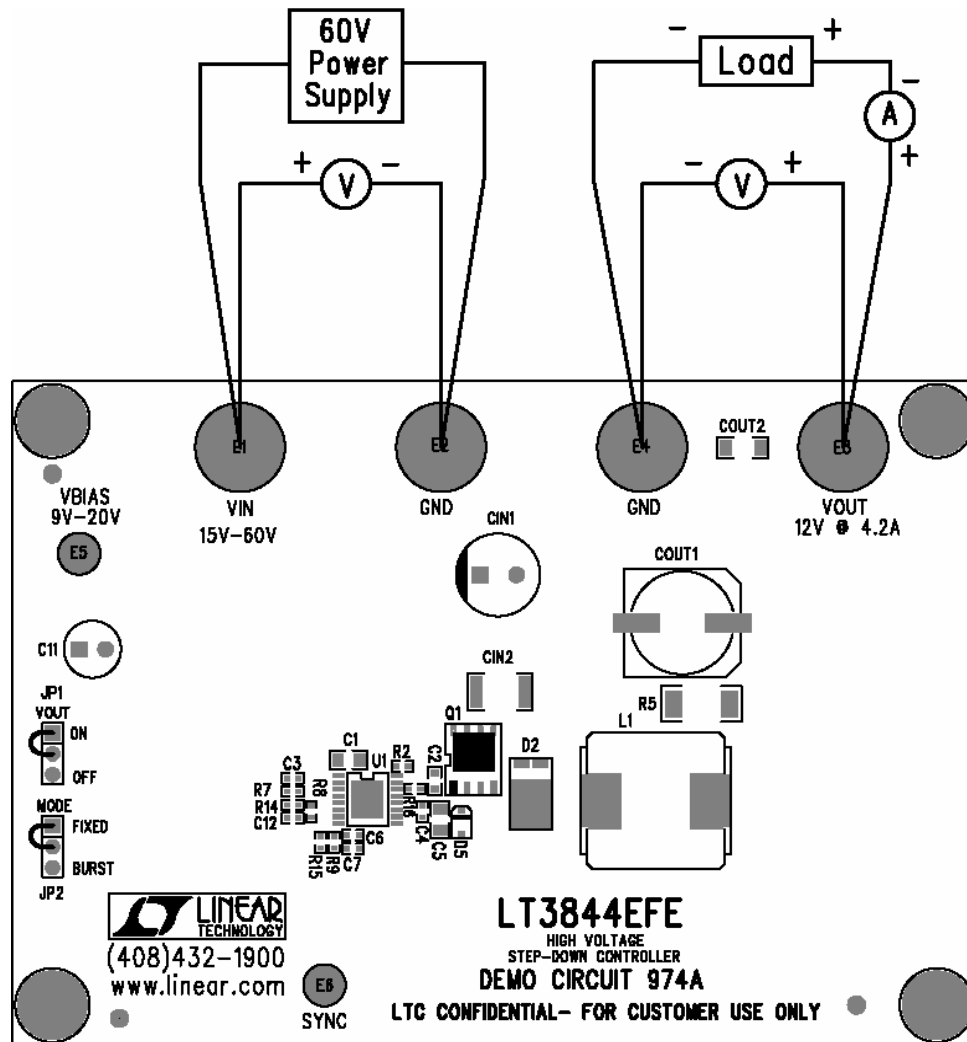
**Figure1. Proper Measurement Equipment Setup**

**NOTES: 1. If the SYNC function is not being used tie the Sync pin to ground.**

OPTIONAL BOOST BIAS CIRCUIT
(DO NOT INSTALL)
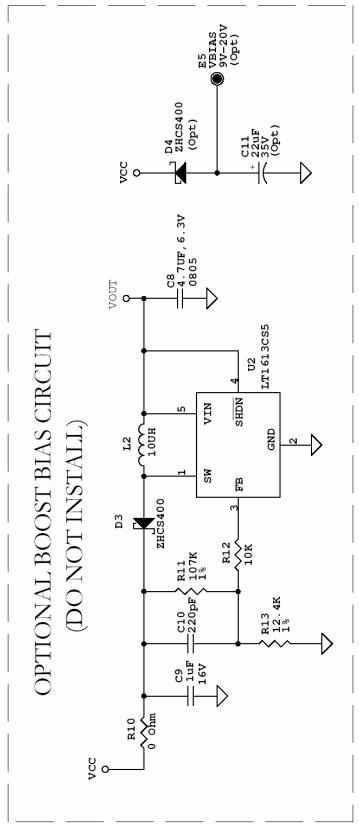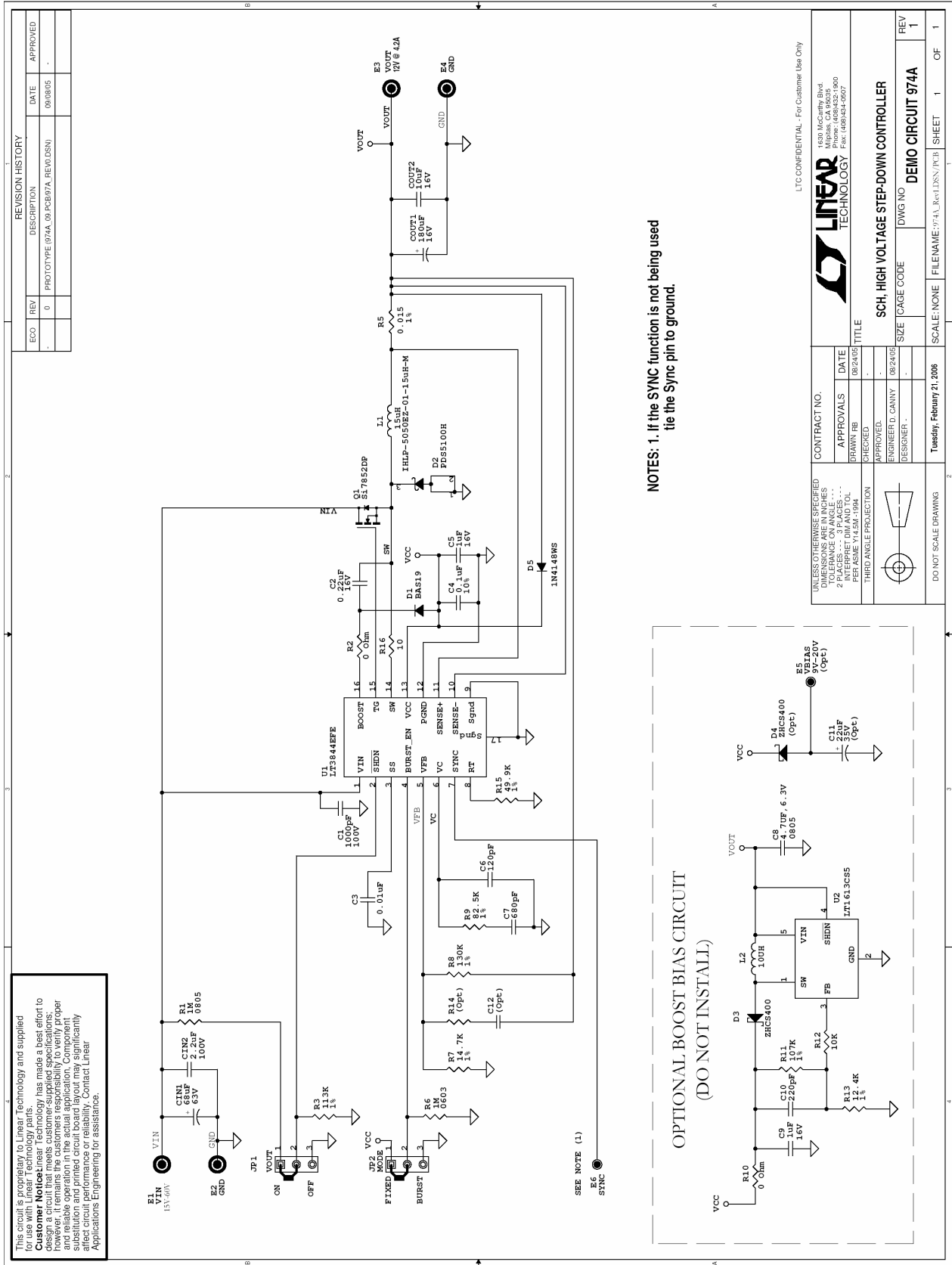
This circuit is proprietary to Linear Technology and supplied for use with Linear Technology parts.
**Customer Notice**: Linear Technology has made a best effort to design a circuit that meets customer-supplied specifications; however, it remains the customers responsibility to verify proper and reliable operation in the actual application. Component substitution and printed circuit board layout may significantly affect circuit performance or reliability. Contact Linear Applications Engineering for assistance.

| REVISION HISTORY | | | | |
|---|---|---|---|---|
| ECO | REV | DESCRIPTION | DATE | APPROVED |
| - | 0 | PROTOTYPE (974A_09.PCB97A_REV0.DSN) | 09/08/05 | - |

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1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408)432-1900  Fax: (408)434-0507

TITLE
SCH, HIGH VOLTAGE STEP-DOWN CONTROLLER

DEMO CIRCUIT 974A

| CONTRACT NO. | | |
|---|---|---|
| APPROVALS | DATE | |
| DRAWN RB | 08/24/05 | |
| CHECKED | - | |
| ENGINEER D. CANNY | 08/24/05 | |
| DESIGNER - | - | |

Tuesday, February 21, 2006

DWG NO
974A_Rev1.DSN/PCB

SIZE CAGE CODE
SCALE: NONE  FILENAME: 974A_Rev1.DSN/PCB  SHEET 1 OF 1

REV 1

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCE ON ANGLE - - -
2 PLACES - - - 3 PLACES - - -
INTERPRET DIM AND TOL PER ASME Y14.5M -1994
THIRD ANGLE PROJECTION

DO NOT SCALE DRAWING

| | | | REQUIRED CIRCUIT COMPONENTS: | |
|---|---|---|---|---|
| **Item** | **Qty** | **Reference** | **Part Description** | **Manufacturer / Part #** |
| | | | | |
| | | | | |
| 1 | 1 | CIN1 | Cap., Alum 68uF 63V 20% | SANYO 63ME68AX+TS |
| 2 | 1 | CIN2 | Cap., X7R 2.2uF 100V 20% | TDK C4532X7R2A225M |
| 3 | 1 | COUT1 | Cap., OSCON Alum 180uF 16V 20% | SANYO 16SVP180MX |
| 4 | 1 | COUT2 | Cap., X5R 10uF 16V 20% | TDK C3216X5R1C106M |
| 5 | 1 | C1 | Cap., NPO 1000pF 100V 10% | AVX 08051A102KAT1A |
| 6 | 1 | C2 | Cap., X7R 0.22uF 16V 10% | TDK C1608X7R1C224K |
| 7 | 1 | C3 | Cap., X7R 0.01uF 16V 10% | AVX 0402YC103KAT2A |
| 8 | 1 | C4 | Cap., X5R 0.1uF 16V 10% | AVX 0402YD104KAT2A |
| 9 | 1 | C5 | Cap., X7R 1uF 16V 10% | TDK C2012X7R1C105K |
| 10 | 1 | C6 | Cap., X7R 120pF 25V 10% | AVX 04023C121KAT2A |
| 11 | 1 | C7 | Cap., X7R 680pF 25V 10% | AVX 04023C681KAT2A |
| 12 | 1 | D1 | Diode,  Speed Switching | Diodes Inc. BAS19 |
| 13 | 1 | D2 | Schottky Diode  5A | Diodes Inc. PDS5100H |
| 14 | 1 | D5 | Diode,  75V/200mW | Diodes Inc. 1N4148WS |
| 15 | 1 | L1 | Inductor,  15uH | Vishay Dale IHLP5050EZPJ150M01/ Vishay Dale IHLP5050EZRZ150M01 |
| 16 | 1 | Q1 | Mosfet N-Chan.,  PowerPAK SO8 | Vishay Siliconix Si7852DP |
| 17 | 1 | R1 | Res., Chip 1M 0.1W 5% | AAC CR10-105M |
| 18 | 1 | R2 | Res/Jumper, Chip 0 Ohm 0.06W 1 AMP | AAC CJ05-000M |
| 19 | 1 | R3 | Res., Chip 113K 0.06W 1% | VISHAY CRCW04021133FRT6 |
| 20 | 1 | R5 | Res., LRC 0.015 0.5W 1% | IRC LRF2010-01-R015-F |
| 21 | 1 | R6 | Res., Chip 1M 0.1W 5% | AAC CR16-105JM |
| 22 | 1 | R7 | Res., Chip 14.7K 0.06W 1% | AAC, CR05-1472FM |
| 23 | 1 | R8 | Res., Chip 130K 1/16W 1% | AAC CR05-1303FM |
| 24 | 1 | R9 | Res., Chip 82.5K 0.06W 1% | AAC CR05-8252FM |
| 25 | 1 | R15 | Res., Chip 49.9K 0.06W 1% | AAC CR05-4992FM |
| 26 | 1 | R16 | Res., Chip 10.0 .06W 5% | AAC CR05-100JM |
| 27 | 1 | U1 | I.C.,  Volt. Reg. | Linear Tech. Corp. LT3844EFE |
| | | | | |
| | | | | |
| | | | | |
| | | | ADDITIONAL DEMO BOARD CIRCUIT COMPONENTS: | |
| | | | | |
| | | | | |
| 1 | 0 | C8 | Cap., X5R C-4.7UF,6.3V-0805 6.3V 20% | Taiyo Yuden JMK212BJ475MG-T |
| 2 | 0 | C9 | Cap., X5R 1uF 16V 10% | Taiyo Yuden EMK212BJ105KG |
| 3 | 0 | C10 | Cap., NPO 220pF 25V 10% | AVX 04023A221KAT2A |
| 4 | 0 | C11 | Cap., Alum 22uF 35V 10% | SANYO 35MV22UAX |
| 5 | 0 | C12 | Cap., 0402 TBD | |
| 6 | 0 | D3,D4 | Schottky Diode,  40V | ZETEX ZHCS400 |
| 7 | 0 | E5 | Testpoint,  Turret | Mill Max 2501-2 |
| 8 | 0 | L2 | Inductor,  L-10UH | muRata LQH3C100M24 |
| 9 | 0 | R10 | Res/Jumper, Chip 0 Ohm 0.06W 1 AMP | AAC CJ05-000M |
| 10 | 0 | R11 | Res., Chip 107K 0.06W 1% | AAC CR05-1073FM |
| 11 | 0 | R12 | Res., Chip 10K 0.06W 5% | AAC CR05-103JM |

| Item | Qty | Reference | Part Description | Manufacturer / Part # |
|---|---|---|---|---|
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| 12 | 0 | R13 | Res., Chip 12.4K 1/16W 1% | AAC CR05-1242FM |
| 13 | 0 | R14 | Res., 0402 TBD |  |
| 14 | 0 | U2 | I.C., Volt. Reg. | Linear Tech. Corp. LT1613CS5 |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  | **HARDWARE-FOR DEMO BOARD ONLY:** |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| 1 | 4 | E1,E2,E3,E4 | Conn. Banana Jack | keystone 575-4 |
| 2 | 1 | E6 | Testpoint, Turret | Mill Max 2501-2 |
| 3 | 2 | JP1,JP2 | Headers, 3 Pins 2mm Ctrs. | CommConn Con Inc. 2802S-03G2 |
| 4 | 2 | XJP2,XJP1 | Shunt, 2mm Ctrs. | CommConn Con Inc. CCIJ2MM-138G |
| 5 | 4 | X1,X2,X3,X4 | STAND-OFF 4-40 x1/2" | MICRO PLASTICS 14HTSP003 |
| 6 | 4 |  | HWD, SCREW #4-40x1/4" | ANY |
| 7 | 1 |  | FAB, PRINTED CIRCUIT BOARD | DEMO CIRCUIT #974A |
| 8 | 2 |  | STENCIL | STENCIL 974A |

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