LTC7804
Low I_Q Synchronous Boost Controller

DESCRIPTION

Demonstration circuit DC2846A is a DC/DC synchronous boost converter featuring the LTC®7804 (MSE package), a spread spectrum or constant frequency current mode synchronous boost controller. The DC2846A generates a 24V output voltage and provides up to 6A of output current.

The 500kHz constant switching frequency operation results in a small and efficient circuit.

The main features of this board include:

- Wide input voltage range: from 6V to 24V
- Relatively high output power, up to 150W
- Extremely low quiescent current, it's 15µA at sleep mode and as low as 1µA at shutdown
- Onboard low power bias supply
- Ability to select spread spectrum or fixed frequency
- Pulse-skipping mode, forced continuous operation or low ripple Burst Mode® operation at light loads
- Synchronization with external clock
- If $V_{IN} > V_{OUT}$, the DC2846A eliminates the usual boost topology losses by keeping the top MOSFET on continuously.

The converter provides high output voltage accuracy (typically ±2%) over a wide load range with no minimum load requirement.

The DC2846A supports two ways of biasing step-up controllers: directly from the input voltage or output rail. The third possibility is connecting voltage source to $EXTV_{CC}$ terminal.

The DC2846A extremely wide switching frequency range from 100kHz to 3MHz. It can be synchronized to the external clock anywhere inside this range. The spread spectrum operation is used for reducing the peak radiated and conducted noise to simplify compliance with electromagnetic interference (EMI) standards

The DC2846A has small circuit footprint. It is a high performance and cost-effective solution for telecom, automotive and Power over Ethernet applications.

Design files for this circuit board are available.

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE	UNITS
Minimum Input Supply Voltage		6	V
Maximum Input Supply Voltage		24	V
Output Voltage Range	V_{IN} = 6V to 20V	24±2%	V
Typical Switching Frequency		500	kHz
Typical Output Ripple (V_{OUT}, 48V)	I_{LOAD} = 3A	200	mV
Efficiency Typical (V_{OUT}, 48V, V_{IN} 12V)		95	%

QUICK START PROCEDURE

Demonstration circuit 2846 is easy to set up to evaluate the performance of the LTC7804 controllers. Refer to Figure 1 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 2 for proper scope probe technique.

1. Place jumper RUN (J2) in ON position, place jumper MODE (JP1) in PULSE SKIP position, place jumper FREQSET (JP4) into FIX FREQ position.
2. Place jumper VBIAS (JP3) in VIN position.
3. With power off, connect the input power supply to V_{IN} and GND.

Turn the input power source on and slowly increase the input voltage to 12V. Be careful not to exceed 24V.

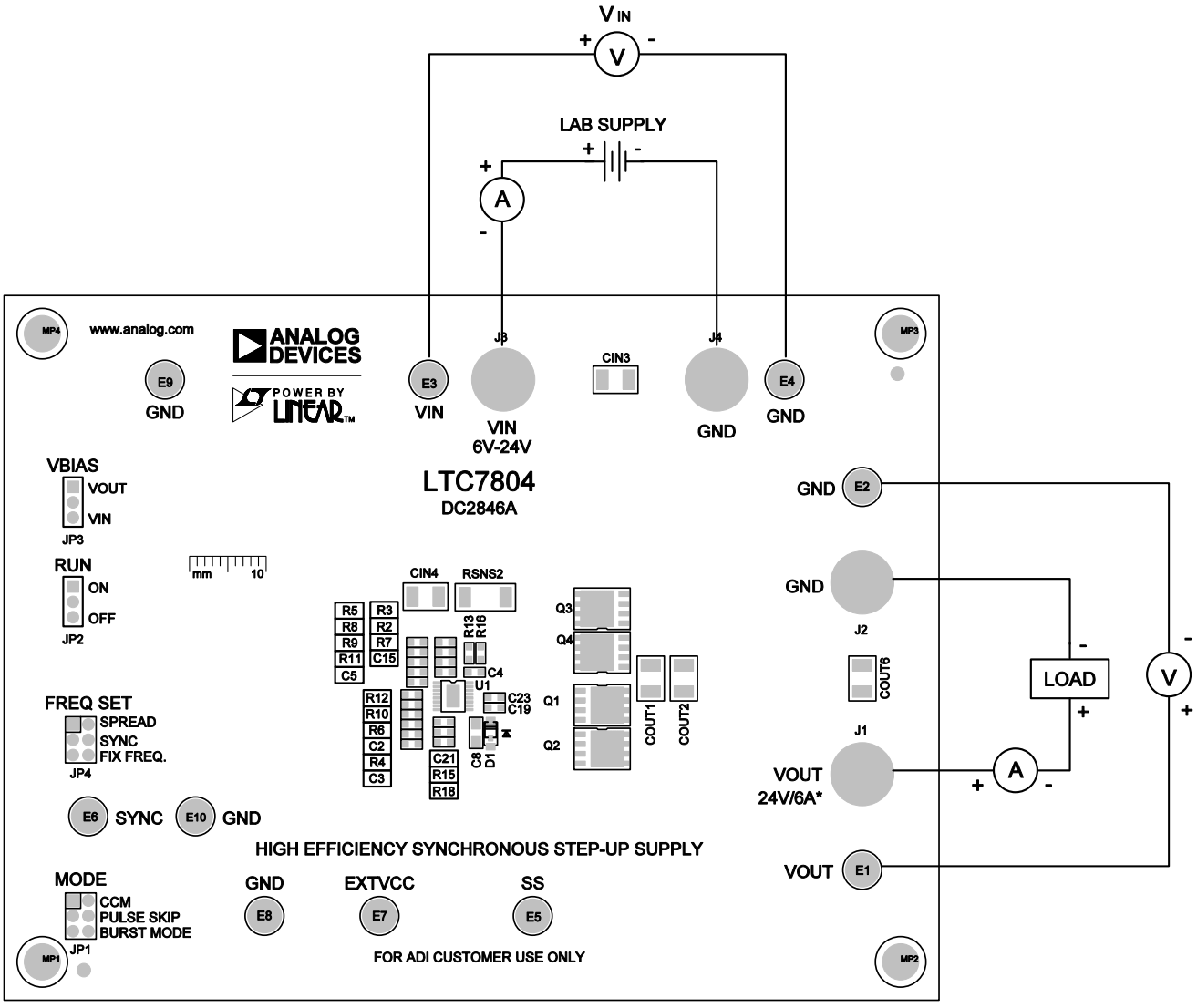


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

NOTE: Make sure that the input voltage V_{IN} does not exceed 20V. If higher operating voltage is required, power components with higher voltage ratings should be used.

4. Check for the proper output voltage of 24V. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.
5. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

To synchronize DC2846A with external clock insert jumper FREQSET (JP4) in SYNC position and apply clock signals to terminal SYNC (E6).

CONVERTER EFFICIENCY

DC2846SA yields 96% efficiency at 16V input voltage generating 24V at 6A, see Figure 3. DC2846A able to deliver 6A output current down to 9V of input; however, output current should be reduced at lower voltage per Figure 4. All efficiency measurements were conducted at room temperature, natural convection cooling with no air flow.

DC2846A SPRED SPECTRUM

The demo board DC2846AA shipped with fixed frequency operation. To employ the spread spectrum operation, insert the jumper PLLIN/SPREAD (JP4) in into SPREAD position. In this setting the switching frequency will change in ±15% range relatively to the preset value.

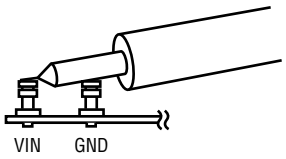


Figure 2. Measuring Input or Output Ripple

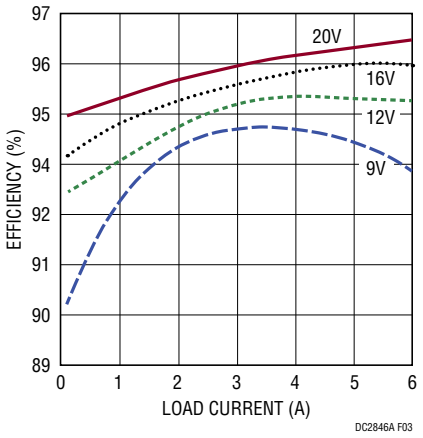


Figure 3. Efficiency vs Load for Different Input Voltage

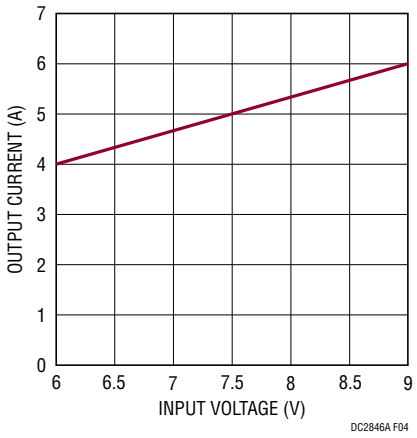
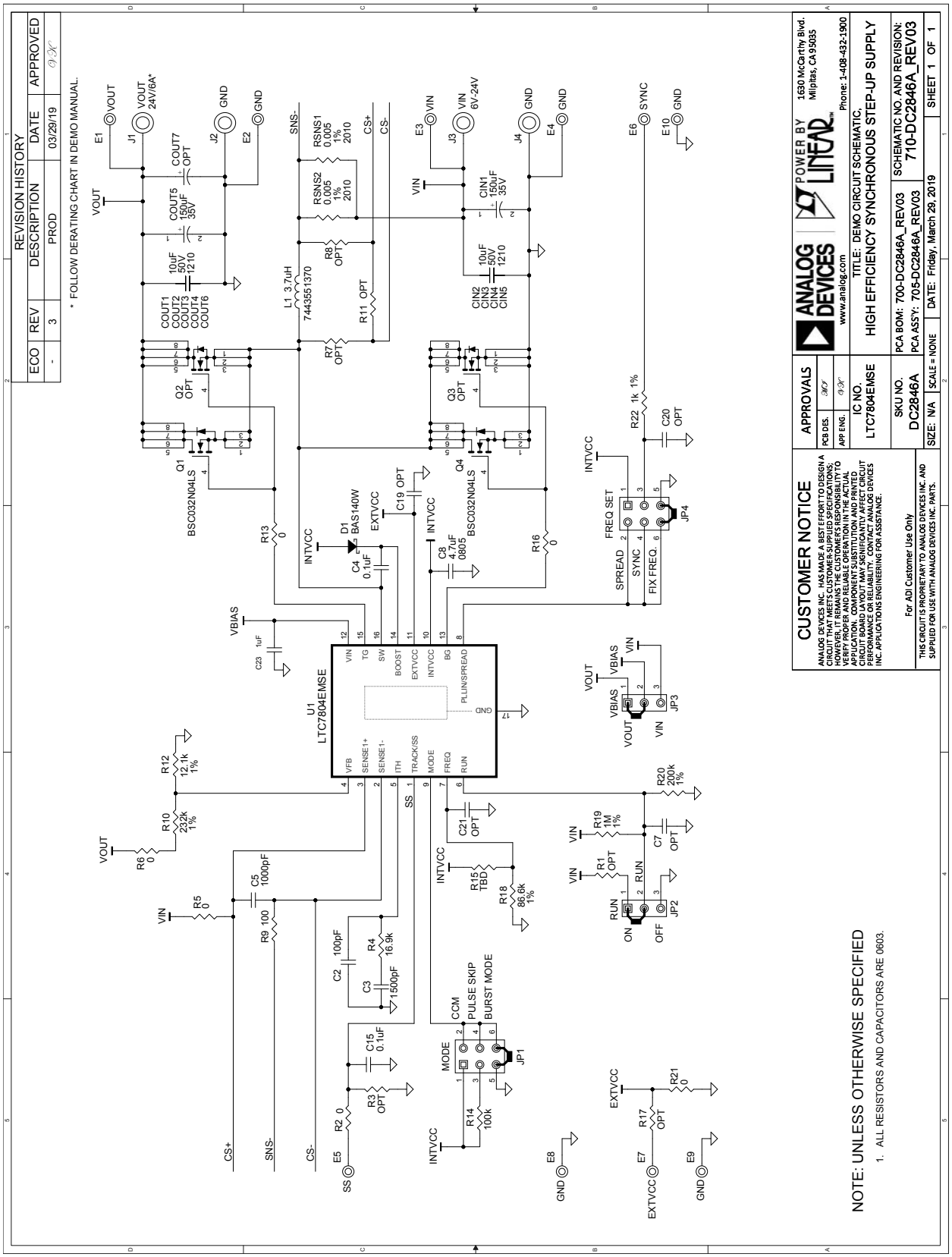


Figure 4. Maximum Output Current vs Input Voltage

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C2	CAP, 100pF, C0G, 25V, 10%, 0603	AVX, 06033A101KAT2A
2	1	C3	CAP, 1500pF, X7R, 25V, 10%, 0603	AVX, 06033C152KAT2A
3	2	C4, C15	CAP, 0.1µF, X5R, 25V, 10%, 0603	AVX, 06033D104KAT2A
4	1	C5	CAP, 1000pF, C0G, 25V, 10%, 0603	AVX, 06033A102KAT2A
5	1	C8	CAP, 4.7µF, X5R, 25V, 10%, 0805	MURATA, GRM219R61E475KA73D
6	2	C19, C23	CAP, 1µF, X5R, 50V, 10%, 0603	AVX, 06035D105KAT2A
7	2	CIN1, COUT5	CAP, 150µF, ALUM ELECT, 35V, 20%, SMD	SUN ELECT, 35HVH150M
8	9	CIN2, CIN3, CIN4, CIN5, COUT1, COUT2, COUT3, COUT4, COUT6	CAP, 10µF, X5R, 50V, 10%, 1210	TDK, C3225X5R1H106K250AB
9	1	D1	DIODE, SCHOTTKY, 60V, 1A, SOD-123F	DIODES, B160S1F-7
10	1	L1	IND, 2.8µH, WE-HCI, FLAT WIRE, SMD	WURTH, 7443551280
11	2	Q1,Q4	XSTR, MOSFET, N-CH, 40V, 98A, TDSON-8	INFINEON, BSC032N04LS
12	5	R2, R5, R6, R13, R16	RES, AEC-Q200, 0Ω, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
13	1	R4	RES, AEC-Q200, 16.9kΩ, 1%, 1/10W, 0603	NIC, NRC06F1692TRF
14	1	R9	RES, 100Ω, 1%, 1/10W, 0603	YAGEO, RC0603FR-07100RL
15	1	R10	RES, AEC-Q200, 232kΩ, 1%, 1/10W, 0603	VISHAY, CRCW0603232KFKEA
16	1	R12	RES, AEC-Q200, 12.1kΩ, 1%, 1/10W, 0603	VISHAY, CRCW0603100KFKEA
17	1	R14	RES, AEC-Q200, 100kΩ, 1%, 1/10W,0603	VISHAY, CRCW0603100KFKEA
18	1	R18	RES, AEC-Q200, 76.8kΩ, 1%, 1/10W, 0603	PANASONIC, ERJ3EKF7682V
19	1	R19	RES, AEC-Q200, 1MΩ, 1%, 1/10W, 0603	VISHAY, CRCW06031M00FKEA
20	1	R20	RES, 200kΩ, 1%, 1/10W, 0603	VISHAY, CRCW0603200KFKEA
21	1	R22	RES, AEC-Q200, 1kΩ, 1%, 1/10W, 0603	VISHAY, CRCW06031K00FKEA
22	2	RSNS1, RSNS2	RES, SENSE, AEC-Q200, 0.005Ω, 1%, 1/2W, 2010	VISHAY, WSL20105L000FEA
23	1	U1	IC, LOW I_Q SYNC BOOST CONTROLLER, SSOP-16	ANALOG DEV INC, LTC7804EMSE#PBF
Additional Demo Board Circuit Components				
1		C7, C20, C21, C22	CAP, OPTION, 0603	OPT
2		COUT7	CAP, OPTION, ALUM ELECT, SMD	OPT
3		Q2, Q3	XSTR, OPTION, MOSFET N-CH, PG-TDSON-8	OPT
4		R1, R3, R7, R8, R11, R15, R17	RES, OPTION, 0603	OPT
Hardware: For Demo Board Only				
1	10	E1, E2, E3, E4, E5, E6, E7, E8, E9, E10	TEST POINT, TURRET, 0.094", MTG HOLE	MILL-MAX, 2501-2-00-80-00-00-07-0
2	4	J1, J2, J3, J4	CONN, BANANA JACK, FEMALE, THT, NON-INSULATED, SWAGE	KEYSTONE, 575-4
3	2	JP1, JP4	CONN, HDR, MALE, 2 × 3, 2mm, VERT, STR, THT	WURTH, 62000621121
4	2	JP2, JP3	CONN, HDR, MALE, 1 × 3, 2mm, STR, THT	WURTH, 62000311121

SCHEMATIC DIAGRAM



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.