LTC3769
60V_{IN}, Low I_Q Synchronous Boost Controller

DESCRIPTION

Demonstration circuit DC2173A is a DC/DC synchronous boost converter featuring the LTC®3769 constant frequency current mode synchronous boost controller. The DC2173A generates a 48V output voltage and provides 1.5A to 6A of output current.

The 150kHz constant switching frequency operation results in a small and efficient circuit.

This board operates over a wide 6V to 60V input voltage range, has a 28µA quiescent current during standby mode, and has a low power onboard bias supply along with adjustable current limit. The user can select Burst Mode® operation, pulse skipping, or continuous conduction mode at light loads via an onbourd jumper. This converter provides high output voltage accuracy (typically ±3%) over the entire load and temperature range.

The DC2173A supports the following methods for biasing the LTC3769 onboard controller as follows:

1. Directly from the input voltage
2. With the onboard low power bias supply
3. From the output voltage after start-up
4. Connecting to an external voltage source

The onboard low power bias supply, based on LTC3630 high efficiency, 65V 500mA synchronous step-down converter provides a stable 10V bias voltage, which increases the overall efficiency at high input voltages.

The DC2173A has a small circuit footprint and is a high performance, 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	MIN	TYP	MAX	UNITS
Minimum Input Supply Voltage	IOUT = 0A to 1.5A		6		V
Maximum Input Supply Voltage	IOUT = 0A to 6.0A		60		V
Output Voltage Range	VIN = 6V to 36V, IOUT = 0A to 6.0A		48 ±3%		V
Typical Switching Frequency			150		kHz
Typical Output Ripple (VOUT, 48V)	I_{LOAD} = 3A		200		mV
Efficiency Typical (VOUT, 48V, V_{IN} 12V)			96		%

QUICK START PROCEDURE

Demonstration circuit 2173A is easy to set up to evaluate the performance of the LTC3769 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 VIN or VOUT 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.
2. Place jumper AUX (JP4) in ON position.
3. Place jumper OVP (JP3) in OFF position.
4. With power off, connect the input power supply to VIN and GND.

Turn the input power source on and slowly increase the input voltage. Be careful not to exceed 60V.

NOTE: Make sure that the input voltage V_{IN} does not exceed 60V. If higher operating voltage is required, power components with higher voltage ratings should be used.

4. Check for the proper output voltage of 48V. 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 voltages are established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

To synchronize DC2173A with external clock insert jumper MODE (JP1) in BURST position and apply clock signals to terminal CLKIN (E12).

DC2173A Bias Circuits

The demo board DC2173A shipped to be biased from the internal low power bias supply based on LTC3630. It's accomplished by populating R42, which connect output of auxiliary power supply to VBIAS. If input or output voltages are desired as a bias source, then resistors R31 or R32 should be installed, instead of R42. Another possibility is to use external power source, by connecting it to terminal EXTVCC (E13). Please refer to LTC3769 data sheet for details. On board low power converter can be disabled by placing jumper AUX (JP4) in OFF position.

Converter Efficiency

DC2173A exceeds 96% efficiency at 12V input voltage generating 48V at 3A, see Figure 3. DC2173A delivers 3A of output current at 12V input; however output current changes in a range from 1.5A to 6A depending on input voltage. Figure 4 demonstrates maximum output current, as function of input voltage, assuming 48V output voltage.

All measurements were conducted at room temperature, natural convection cooling with no air flow.

QUICK START PROCEDURE

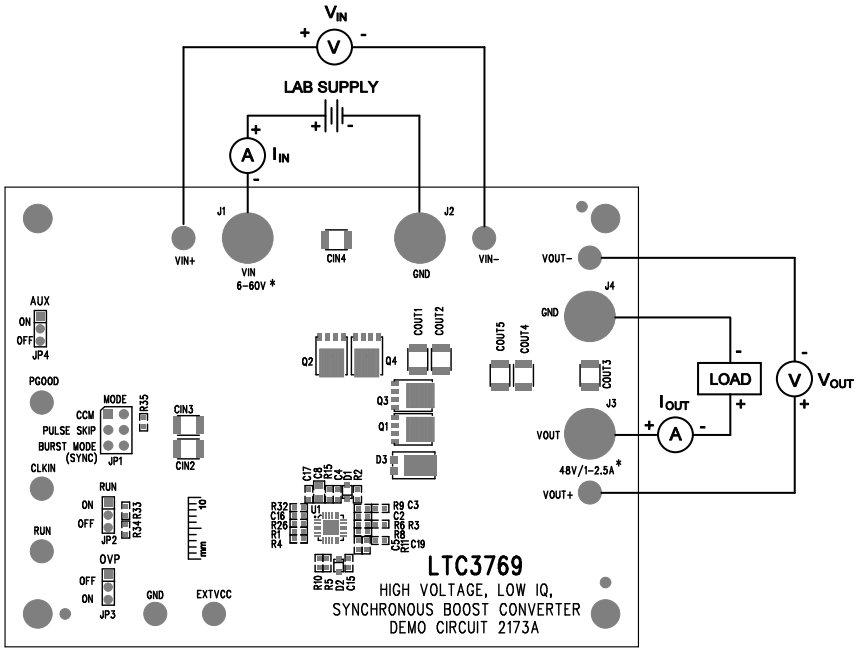


Figure 1. Proper Measurement Equipment Setup

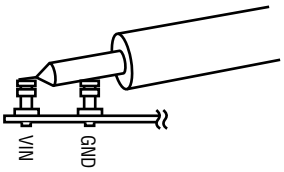


Figure 2. Measuring Input or Output Ripple

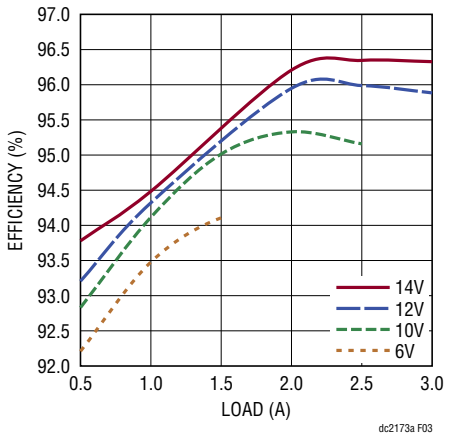


Figure 3. DC2173A, Efficiency vs Load for Different Input Voltages

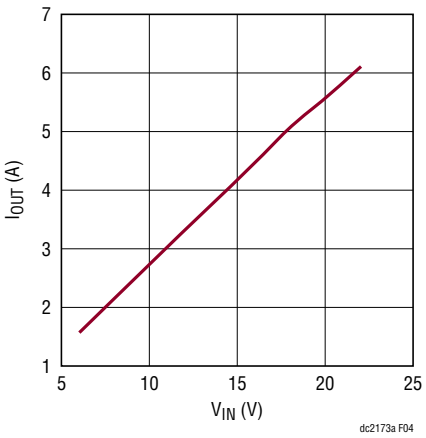


Figure 4. Maximum Output Current vs Input Voltage

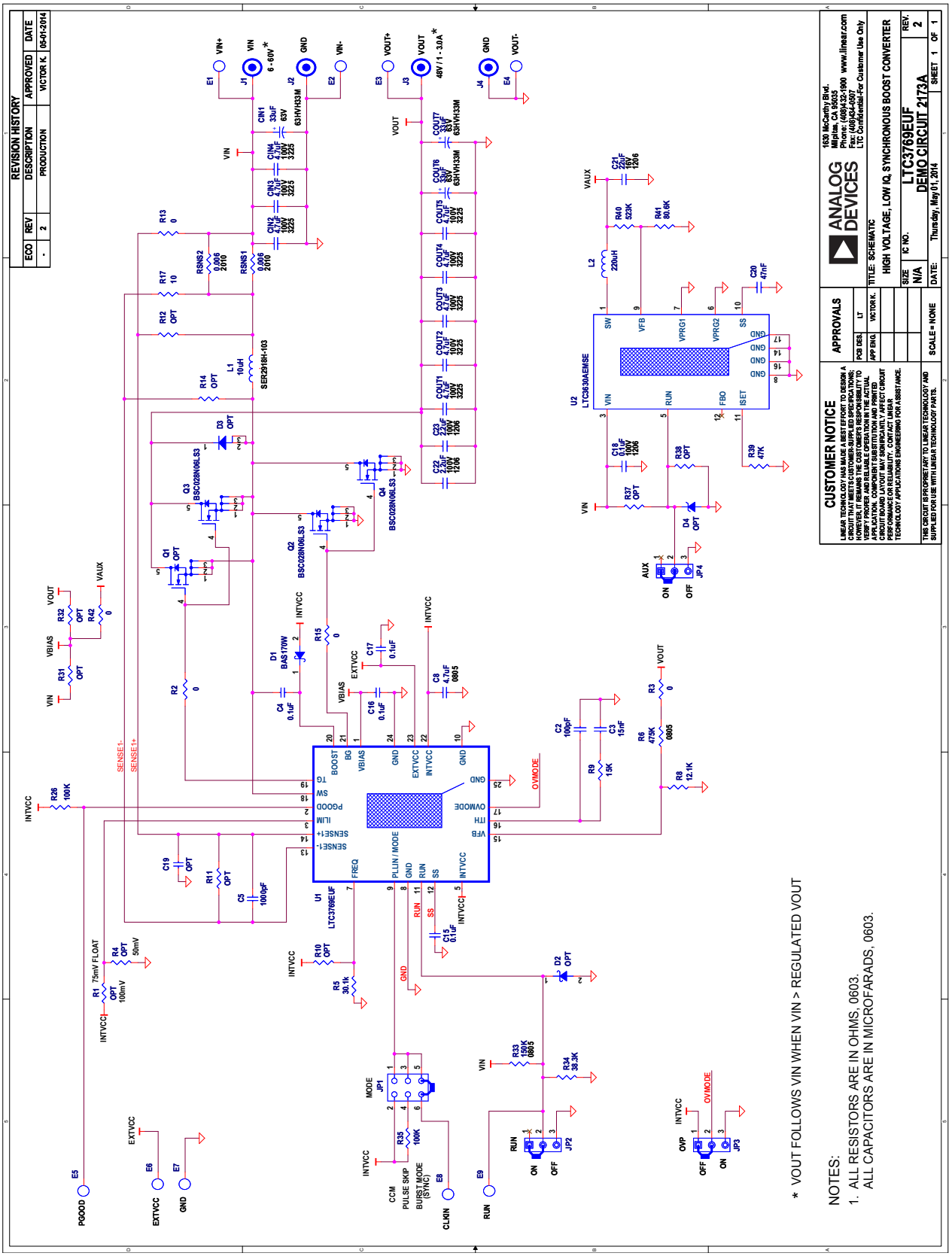
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	3	CIN1, COUT6, COUT7	CAP., 33µF, 63V, EP-CAP	SUN ELECTRONICS, 63HVH33M
2	8	CIN2-CIN4, COUT1-COUT5	CAP., X7S, 4.7µF 100V, 20%, 1210	TDK, C3225X7S2A475M
3	1	C2	CAP., NPO, 100pF, 25V, 10%, 0603	AVX, 06033A101KAT2A
4	1	C3	CAP., X7R, 15nF, 25V, 10%, 0603	AVX, 06033C153KAT2A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
5	4	C4, C15, C16, C17	CAP., X5R, 0.1µF, 25V, 10%, 0603	AVX, 06033D104KAT2A
6	1	C5	CAP., NPO, 1000pF, 25V, 10%, 0603	AVX, 06033A102KAT2A
7	1	C8	CAP., X5R, 4.7µF, 25V, 10%, 0805	AVX, 08053D475KAT2A
8	1	C18	CAP., X7R, 0.1µF, 100V, 10%, 1206	AVX, 12061C104KAT2A
9	1	C20	CAP., X7R, 47nF, 25V, 10%, 0603	AVX, 06033C473KAT2A
10	1	C21	CAP., X5R, 22µF, 16V, 10%, 1206	AVX, 1206YD226KAT2A
11	2	C22, C23	CAP., X7R, 2.2µF, 100V, 10%, 1206	MURATA, GRM31CR72A225KA73
12	1	D1	DIODE, SCHOTTKY 70V 0.07A SOD323-2	INFINEON, BAS 170W E6327
13	1	L1	IND, 10µH	COILCRAFT, SER2918H-103KL
14	1	L2	INDUCTOR, POWER 220µH 0.51A SMD	WURTH ELEC., 744775222
15	3	Q1, Q2, Q3	MOSFET, N-CH 60V 100A TDSON-8	INFINEON, BSC028N06LS3 G
16	2	RSNS1, RSNS2	RES., 0.006Ω 1/2W 1% 2010 SMD	VISHAY, WSL20106L000FEA
17	5	R2, R3, R13, R15, R42	RES., CHIP, 0Ω, 1%, 0603	VISHAY, CRCW06030000Z0EA
18	1	R5	RES., CHIP, 30.1k, 1%, 0603	VISHAY, CRCW060330K1FKEA
19	1	R6	RES., CHIP, 475k, 1%, 0603	VISHAY, CRCW0603475KFKEA
20	1	R8	RES., CHIP, 12.1k, 1%, 0603	VISHAY, CRCW060312K1FKEA
21	1	R9	RES., CHIP, 15k, 1%, 0603	VISHAY, CRCW060315K0FKEA
22	1	R17	RES., CHIP, 10Ω, 1%, 0603	VISHAY, CRCW060310R0FKEA
23	2	R26, R35	RES., CHIP, 100k, 1%, 0603	VISHAY, CRCW0603100KFKEA
24	1	R33	RES., CHIP, 150k, 1%, 0805	VISHAY, CRCW0805150KFKEA
25	1	R34	RES., CHIP, 38.3k, 1%, 0603	VISHAY, CRCW060338K3FKEA
26	1	R39	RES., CHIP, 47k, 1%, 0603	VISHAY, CRCW060347K0FKEA
27	1	R40	RES., CHIP, 523k, 1%, 0603	VISHAY, CRCW0603523KFKEA
28	1	R41	RES., CHIP, 80.6k, 1%, 0603	VISHAY, CRCW060380K6FKEA
29	1	U1	I.C. LTC3769IUFD, QFN24UF-4X4	ANALOG DEVICES, LTC3769IUFD#PBF
30	1	U2	I.C. LTC3630AEMSE, MSE-16L	ANALOG DEVICES, LTC3630AEMSE#PBF
Additional Demo Board Circuit Components				
1	1	C19		OPT
2	3	D2, D3, D4		OPT
3	1	Q4		OPT
4	10	R1, R4, R10, R11, R12, R14, R31, R32, R37, R38		OPT
Hardware: For Demo Board Only				
1	9	E1-E9	TURRET, TESTPOINT, 091"	MILL-MAX, 2501-2-00-80-00-00-07-0
2	1	JP1	HEADER, 2X3 6POS 0.100" DUAL GOLD	SAMTEC, TSW-103-07-L-D
3	3	JP2, JP3, JP4	HEADER, 2mm SINGLE STR 3POS	SULLINS, NRPN031PAEN-RC
4	4	J1, J2, J3, J4	BANANA JACK NON-INSULATED 0.218"	KEYSTONE, 575-4
5	1	XJP1	SHUNT, 2POS0 0.100" (2.54mm) CTRS	SAMTEC, SNT-100-BK-G
6	3	XJP2, XJP3, XJP4	SHUNT, 2mm CTRS	SAMTEC, 2SN-BK-G
7	4	MTGS	HEX STANDOFF 6-32 NYLON 3/4"	KEYSTONE, 1903D
8	4	MTGS	MACHINE SCREW, PAN PHILLIPS 6-32	B & F, PMSSS 632 0038 PH

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.

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