LTC3124
Dual Phase Synchronous Step-Up DC/DC Converter

DESCRIPTION

Demonstration circuit 1859A is a dual phase single output DC/DC boost converter featuring the LTC®3124. The DC1859A operates over 1.8V to 5.5V input and generates 12V at up to 1.5A from a 5V input. The maximum output current for a 1.8V input is 750mA. Also, the LTC3124 has a 2% precise voltage reference, which can generate an output voltage with 2.2% tolerance if 0.1% voltage divider resistors are used. The 1MHz switching frequency operation results in small and efficient circuit. The converter operates with only one phase in Burst Mode® operation and achieves over 90% efficiency with a 100mA load. The demonstration circuit can be easily modified to generate different output voltages.

The DC1859 has small circuit footprint. It is a high performance and cost effective solution for generating output voltages up to 15V from inputs as low as 1.8V.

Design files for this circuit board are available at http://www.linear.com/demo/DC1859A

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITION	MIN	TYP	MAX	UNITS
Minimum Input Voltage	I_{OUT} = 0A to 0.75A		1.8		V
Maximum Input Voltage	I_{OUT} = 0A to 1.5A		5.5		V
V_{OUT}	V_{IN} = 1.8V to 5.5V, I_{OUT} = 0A		12		V ±4%
Output Voltage Ripple	V_{IN} = 5V, I_{OUT} = 1.5A		100		mV_{P-P}
Nominal Switching Frequency			1		MHz

QUICK START PROCEDURE

Demonstration circuit 1859 is easy to set up to evaluate the performance of the LTC3124. For proper measurement equipment setup refer to Figure 1 and follow the procedure below:

NOTE: When measuring the input or output voltage ripple, care must be taken to minimize the length of oscilloscope probe ground lead. Measure the input or output voltage ripple by connecting the probe tip directly across the VIN or VOUT and GND terminals as shown in Figure 2.

1. With power off, connect the input power supply to V_{IN} and GND.
2. Keep the load set to 0A or disconnected.
3. Turn the input power source on and slowly increase the input voltage. Be careful not to exceed 5.5V.

   NOTE: Make sure that the input voltage V_{IN} does not exceed 5.5V.
4. Set the input voltage to 5V and check for the proper output voltage of 12V. 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 and observe the output voltage regulation, ripple voltage, efficiency and other parameters.

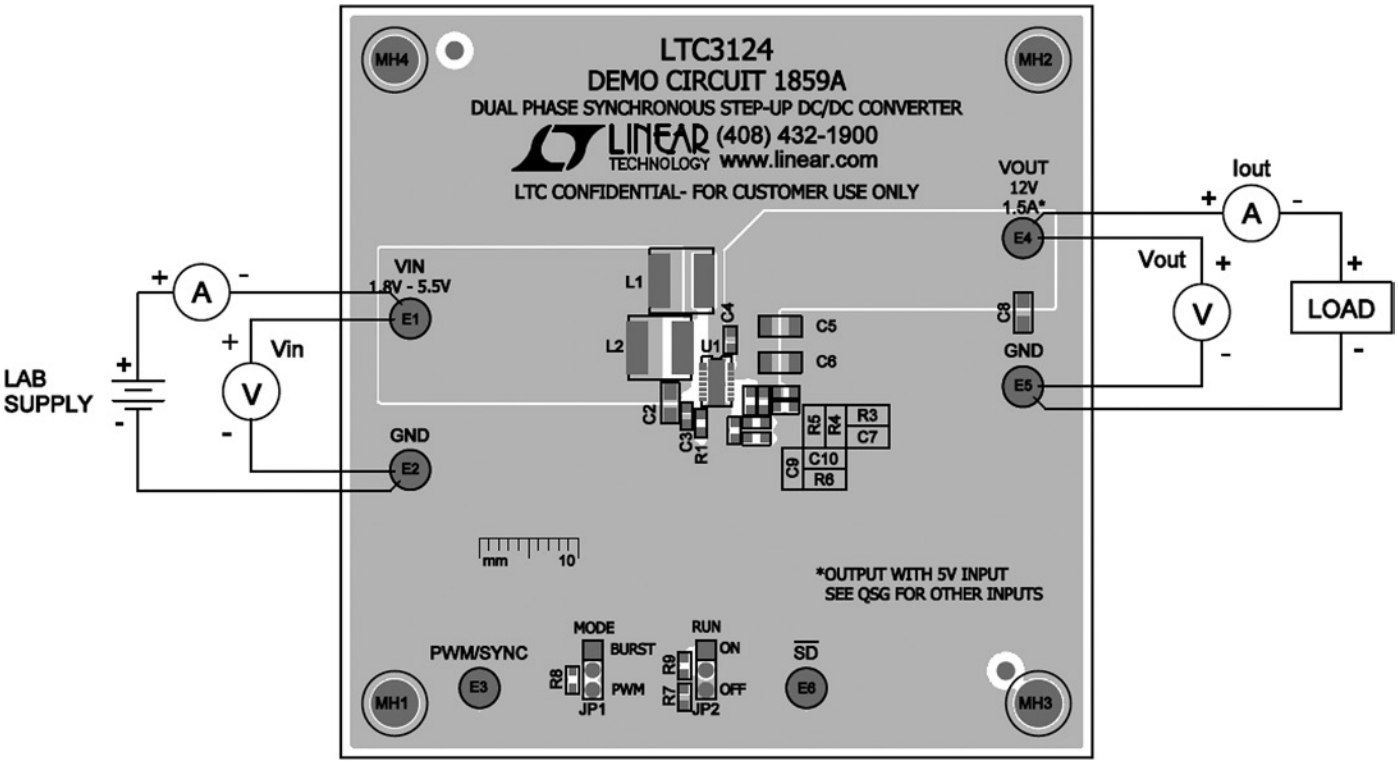


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

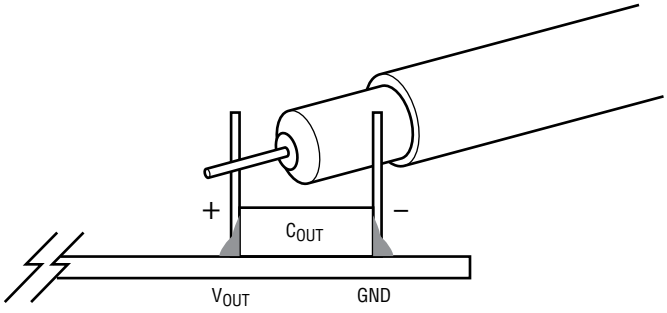


Figure 2. Measuring Input or Output Ripple

Changing the Output Voltage

To change the output voltage from the programmed 12V, change the voltage divider resistors connected to LTC3124 FB pin (see the schematic on page 5).

Converter Output Current

The DC1859 output current capability depends on the input voltage. Typical performance of DC1859A is shown in Figure 3. As can be seen from Figure 3, the maximum output current is 800mA with 2.6V input and 2A with 5V input. The efficiency is high at light loads thanks to phase shedding in BURST mode. By disabling one phase the related switching losses are reduced and the efficiency is maximized.

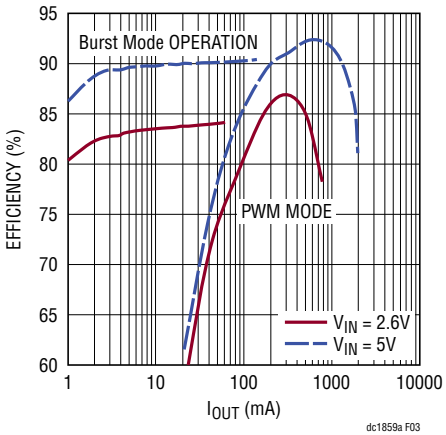


Figure 3. The Efficiency Is Maximized for Light Loads by Shedding One Phase in Burst Mode Operation. The Efficiency Is Over 90% at Higher Loads and It Reaches 92% at 800mA Load

Output Load Step Response

The load step response of DC1859A is dependent on the amount and type of output caps used. If higher load steps need to be handled more output capacitance can be added in order to keep the voltage transients at the desired level. The load step transients are shown in Figure 4. Other types of low ESR and high value capacitors can be used if space is available to reduce load transients to desired level.

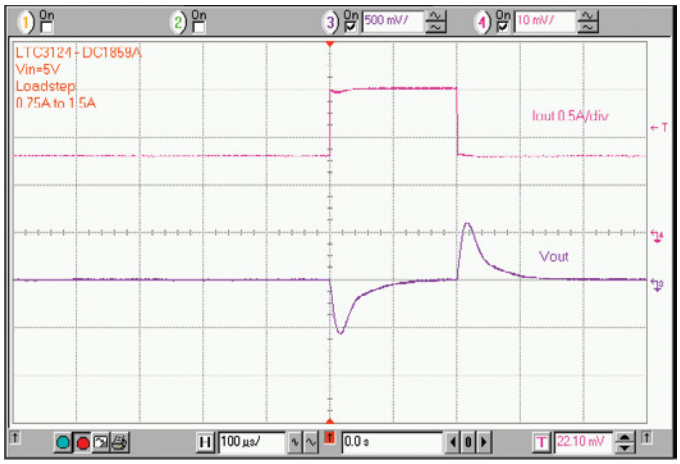


Figure 4. The LTC3124 Has Excellent Load Step Response with Small Output Capacitors Thanks to High Switching Frequency and Fast Feedback Loop Compensation

Start-Up and Soft-Start Function

The DC1859 features internal 10ms soft-start circuit that prevents input current surge at start-up. The soft-start circuit also prevents output voltage overshoot when output voltage ramp reaches regulation.

QUICK START PROCEDURE

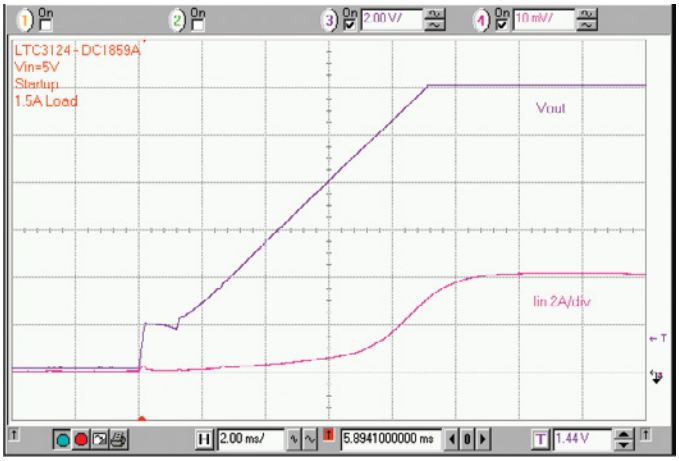


Figure 5. The DC1859 Ramps the Output Slowly at Start-Up without Generating an Input Current Surge

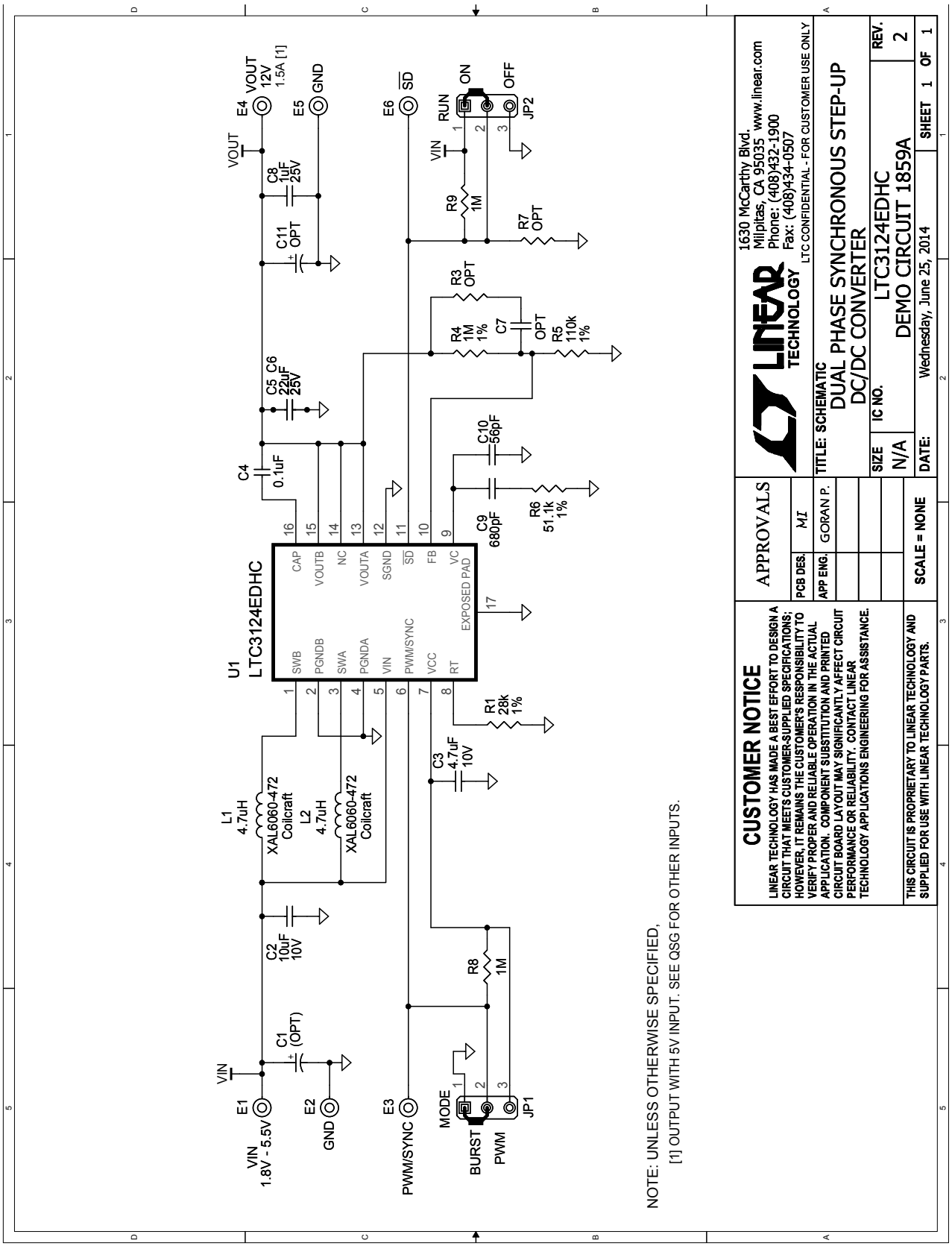
Output Short Circuit Protection

The LTC3124 features safe short-circuit and thermal protection. The part can operate continuously with output shorted while maintaining a maximum set current limit. The peak switch current is reduced during overload to about 2A and is restored to 3.5A once the output exceeds 1.5V.

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
2	1	C2	CAP, 0805 10µF 10% 10V X5R	MURATA GRM21BR61A106KE19L
3	1	C3	CAP, 0603 4.7µF 10% 10V X5R	AVX 0603ZD475KAT2A
4	1	C4	CAP, 0603 0.1µF 10% 25V X7R	AVX 06033C104KAT2A
5	2	C5, C6	CAP, 1206 22µF 20% 25V X5R	MURATA GRM31CR61E226ME15L
7	1	C8	CAP, 0805 1µF 20% 16V X5R	AVX 0805YD105MAT2A
8	1	C9	CAP, 0603 680pF 10% 25V X7R	AVX 06033C681KAT2A
9	1	C10	CAP, 0603 56pF 5% 50V C0G	AVX 06035A560JAT2A
12	2	L1, L2	IND, 4.7µH	COILCRAFT XAL6060-472MEC
14	1	R1	RES, 0603 28k 1% 1/10W	VISHAY CRCW060328K0FKEA
16	1	R4	RES, 0603 1M 1% 1/10W	VISHAY CRCW06031M00FKEA
17	1	R5	RES. 0603 110k 1% 1/10W	VISHAY CRCW0603110KFKEA
18	1	R6	RES, 0603 51.1k 1% 1/10W	VISHAY CRCW060351K1FKEA
19	2	R8, R9	RES, 0603 1M 5% 1/10W	VISHAY CRCW06031M00JNEA
20	1	U1	IC, DC/DC CONVERTER	LINEAR TECH. LTC3124EDHC#PBF
Additional Demo Board Circuit Components				
1	0	C1, C11	CAP. 7343 OPTION	OPTION
6	0	C7	CAP, 0603 OPTION	OPTION
15	0	R3, R7	RES, 0603 OPTION	OPTION
Hardware: For Demo Board Only				
10	6	E1, E2, E3, E4, E5, E6	TURRET	MILL MAX 2501-2-00-80-00-00-07-0
11	2	JP1, JP2	HEADER, 3 PIN SINGLE ROW	SULLINS, NRPN031PAEN-RC
13	4	MH1, MH2, MH3, MH4	STANDOFF, SNAP ON	KEYSTONE_8831
21	2	JP1, JP2	SHUNT	SAMTEC 2SN-BK-G

SCHEMATIC DIAGRAM



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