LTC3630EMSE High Efficiency 65V 500mA Synchronous Step-Down Converter

DESCRIPTION

Demonstration circuit 1489A is a 65V input, 500mA output DC/DC power supply featuring the LTC3630. The IC operates in a high efficiency Burst Mode® operation and includes internal high and low side switches. The board will accept an input voltage between 4V and 65V, and provide jumper selected output voltages of 1.8V, 3.3V, 5V and an option for additional voltages. The IC includes internal soft-start and a provision for increasing soft-start time.

Included on the board is an ON/OFF jumper that can also be configured as a precision undervoltage lockout. Additional PC pads are included for programming current limit to optimize efficiency and for reducing output voltage ripple and reducing component size. A terminal (FBO) is included to allow multiple boards to be paralleled for increase output current.

Output voltage between 800mV and V_{IN} can be programmed using optional resistors, although higher voltage output capacitors will be required.

The LTC3630 data sheet gives a complete description of the IC operation and application information. The data sheet must be read in conjunction with this quick start guide.

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

PERFORMANCE SUMMARY (T_A = 25°C)

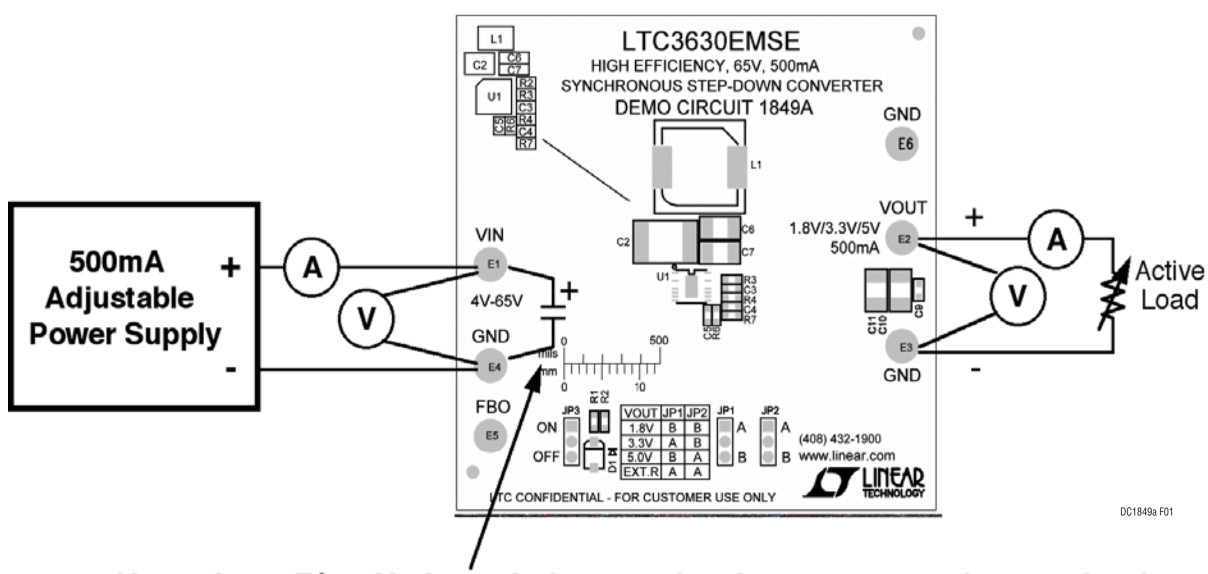
Table 1. Circuit Specifications

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4V to 65V
1.8V Output	V_{IN} = 20V, V_{OUT} Load = 100mA	1.8V ±2%
3.3V Output	V_{IN} = 20V, V_{OUT} Load = 100mA	3.3V ±2%
5V Output	V_{IN} = 20V, V_{OUT} Load = 100mA	5V ±2%
Maximum Output Current	V_{IN} = 20V, V_{OUT} = 5V	500mA
Typical Output Voltage Ripple	V_{IN} = 20V, V_{OUT} = 5V	$75mV_{P-P}$

QUICK START PROCEDURE

This demonstration circuit 1849A can be evaluated using the setup shown in Figure 1.

1. Connect voltmeters to V_{IN} and V_{OUT}, select 5V setting using jumper JP1 (lower position) and JP2 (upper position), select ON position for JP3.
2. With input power supply set for 0V, connect the supply to V_{IN} and GND terminals using short (less than 10 inches) leads, preferably twisted leads. Connect a suitable load resistor or active load to V_{OUT} and GND terminals
3. Slowly increase the input power supply to 10V. Observe output voltage and verify that it meets the specifications in Table 1 over full load range.
4. Move jumpers JP1 and JP2 to the other two fixed voltage settings and verify that each output voltage meets the values as shown in Table 1, with and without a load.
5. Increase the input power supply to 60V and verify output voltages. **CAUTION: 60V can result in an electric shock if care is not taken. Also, connecting the circuit to a power supply that has more than 40V present at it's output can produce a high voltage transient that may exceed the absolute maximum input voltage. These transients are caused by the inductance of the input leads and the ceramic input capacitor. When bench testing this circuit, a 10µF/100V electrolytic capacitor is recommended at the input terminals. See Figure 2.**
6. Peak-to-peak output voltage ripple can vary depending on input and output voltage settings due to the Burst Mode operation. To reduce output ripple, additional pads are included on the board for adding more output capacitance. When using an oscilloscope to measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the probe. Measure the input or output voltage ripple by touching the probe directly across the V_{IN} or V_{OUT} and GND terminals. See Figure 3 for proper scope probe technique.



Note: A 10µF/100V electrolytic capacitor is necessary when evaluating circuit with input voltages greater than 40V, using long input wires and hot plugging circuit into a powered input supply. See Figure 2.

Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

Circuit Options

Detailed information is contained in the data sheet.

Optional Output Voltage: Additional output voltages can be programmed by selecting proper resistors for the R6 and R7 feedback network. C5 is a feedforward capacitor to optimize transient response and increase stability. JP1 and JP2 must be in the lower position if R6 and R7 are used. The 10V rated output capacitors must be replaced with suitable voltage ratings.

ISET Components: C3, R3 and R4 are used to provide a number of features and circuit enhancements such as, output current limit, input current limit, optimizing output ripple voltage reduction and efficiency improvement. R4 sets maximum output current, see Figure 2 in LTC3630 data sheet, leave open for maximum load current. R3 and R4 can be used to set input current limit. C3 is used to reduce output voltage ripple and optimize efficiency. See data sheet for details.

RUN Pin Components: The converter is enabled when the RUN pin voltage exceeds 1.21V and is disabled when dropping below 1.1V. Pulling the RUN pin below 700mV forces a low quiescent current shutdown 5µA. Moving JP3 to the ON position allows an internal current to pull the RUN pin up to approximately 5V. R1 and R2 are used to program input undervoltage lockout. Select suitable resistors to divide the input voltage down to the precision threshold voltage levels that enable and disable the converter. Note that the maximum voltage on the RUN pin is 6V, therefore a nominal 5V Zener diode (D1) is required to limit the RUN pin voltage when high input voltages are used.

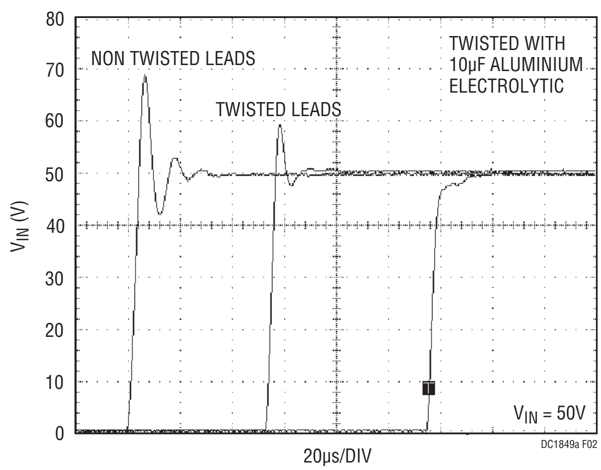


Figure 2. Hot Plugging Input Voltage Transient Using 12" Leads.

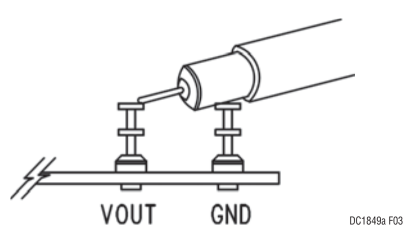
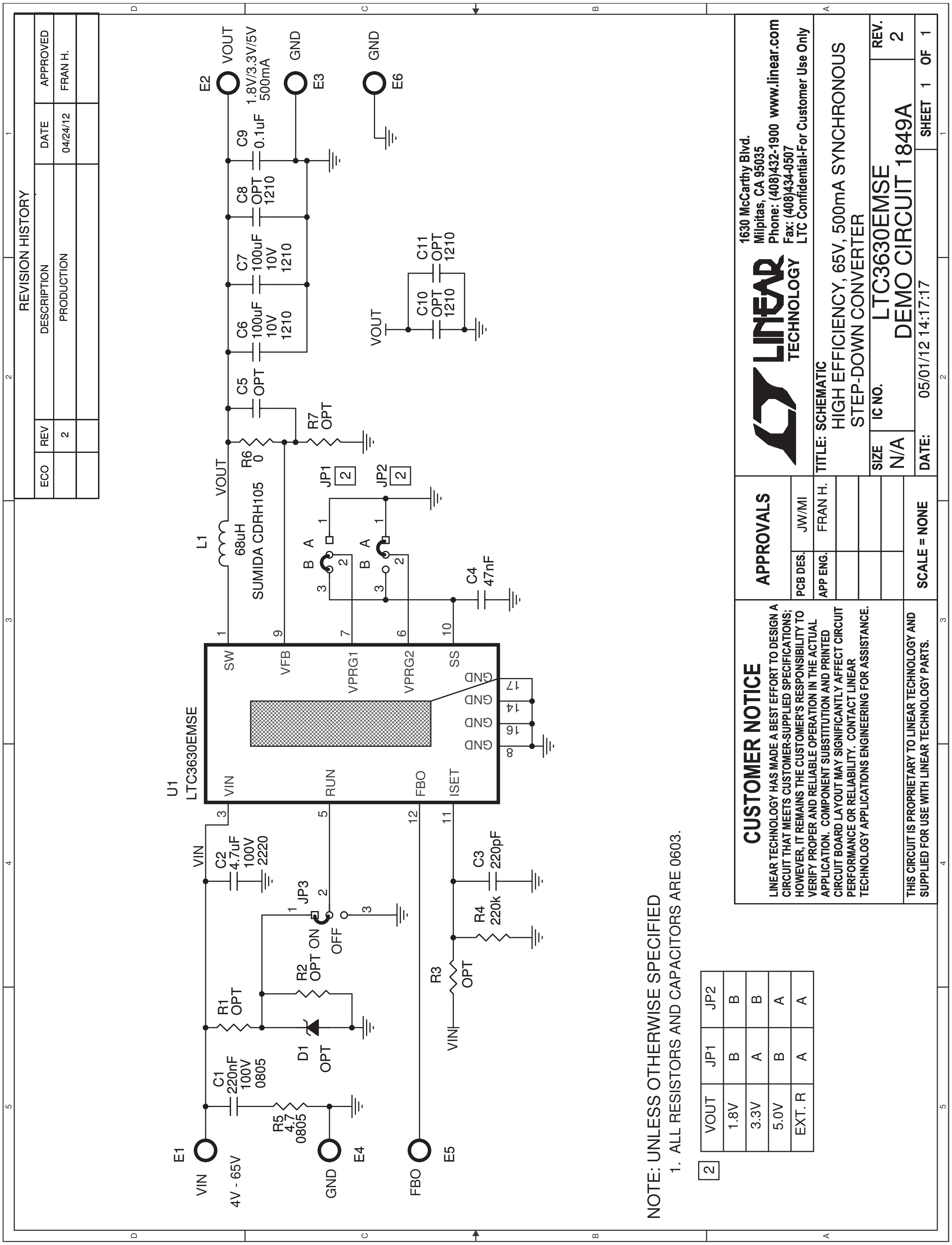


Figure 3. Measuring Input or Output Voltage Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components:				
1	1	C1	CAP, 0805 220nF 10% 100V X7R	MURATA GRM21AR72A224KAC5L
2	1	C2	CAP, 2220 4.7µF 20% 100V X7R	TDK C5750X7R2A475M
3	1	C3	CAP, 0603 220pF 10% 50V X7R	AVX 06035C221KAT2A
4	1	C4	CAP, 0603 47nF 10% 25V X7R	AVX 06033C473KAT
5	2	C6, C7	CAP, 1210 100µF 20% 10V X5R	TAIYO YUDEN LMK325ABJ107MM-T
6	1	C9	CAP, 0603 0.1µF 10% 25V X7R	AVX 06033C104KAT2A
7	1	L1	IND, 68µH	SUMIDA CDRH105RNP-680N
8	1	R4	RES, 0603 220k 5% 1/10W	VISHAY CRCW0603220KJNEA
9	1	R5	RES, 0805 4.7Ω 5% 1/8W	VISHAY CRCW08054R70JNEA
10	1	R6	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
11	1	U1	IC, SYNCHRONOUS STEP-DOWN CONVERTER	LINEAR TECHNOLOGY LTC3630EMSE
Additional Demo Board Circuit Components:				
1	0	C5	CAP, 0603 OPTION	OPTION
2	0	C8, C10, C11	CAP, 1210 OPTION	OPTION
3	0	D1	DIODE, OPTION	OPTION
4	0	R1, R2, R3, R7	RES, 0603 OPTION	OPTION
Hardware:				
1	6	E1, E2, E3, E4, E5, E6	TURRET	MILL MAX 2501-2-00-80-00-00-07-0
2	3	JP1, JP2, JP3	HEADER, 3PIN, 2mm	SAMTEC TMM-103-02-L-S
3	3	JP1, JP2, JP3	SHUNT, 2mm	SAMTEC 2SN-BK-G

SCHEMATIC DIAGRAM



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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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