DESCRIPTION

Demonstration circuit 1326A consists of three voltage regulators; a synchronous boost, a synchronous buck and a linear LDO. The high efficiency DC/DC converters feature 700mA switches for the boost, 250mA for the buck and a 100mA rating for the LDO regulator.

With a light load, the boost converter can startup with an input voltage as low as 700mV and once started, the input can go as low as 500mV while maintaining a regulated output. Buck converter requires 1.8V minimum input.

Separate input terminals are provided for each switch mode converter, and a jumper for paralleling the two converter inputs or powering the buck from the output of the boost. The LDO regulator is always powered from the boost output.

Jumpers are included for separately shutting down the boost regulator or shutting down or sequencing the buck and LDO regulators. Jumpers are also provided for selecting a total of nine output voltages and selecting BURST or PWM operation. The 16-pin 3X3 mm QFN thermally enhanced package combined with the high switching frequency provides a very tiny multi output solution. The LTC3100 boost converter also features output disconnect and the input voltage can be greater or less than the output voltage. Power Good terminals for the boost and buck converters are also included.

This demonstration circuit allows the user to quickly evaluate the LTC3100 performance. Jumpers make selecting different output voltages simple while terminals on the board allow easy hookup to input supplies and output loads.

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

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Table 1. Typical Specifications (25°C)

	Conditions	Limits
Boost Converter Input Voltage Range V_{IN}		0.68V to 5.5V
Boost Converter, 1.8V V_{OUT}	V_{IN} = 1.2V, I_{OUT} = 100mA	1.8V ± 3%
Boost Converter, 3.3V V_{OUT}	V_{IN} = 1.2V, I_{OUT} = 100mA	3.3V ± 3%
Boost Converter, 5V V_{OUT}	V_{IN} = 1.2V, I_{OUT} = 100mA	5.0V ± 3%
Boost Output Voltage Ripple (burst mode)	V_{IN} = 1.5V, V_{OUT} = 3.3V, I_{OUT} = 10mA	25mV p-p
Boost Output Voltage Ripple (PWM)	V_{IN} = 1.5V, V_{OUT} = 5V, I_{OUT} = 100mA	10mV p-p
Buck Converter, 1.2V V_{OUT}	V_{IN} = 2V, I_{OUT} = 100mA	1.2V ± 3%
Buck Converter, 1.5V V_{OUT}	V_{IN} = 2V, I_{OUT} = 100mA	1.5V ± 3%
Buck Converter, 1.8V V_{OUT}	V_{IN} = 2V, I_{OUT} = 100mA	1.8V ± 3%
Buck Output Voltage Ripple (burst mode)	V_{IN} = 2V, V_{OUT} = 1.5V, I_{OUT} = 10mA	10mV p-p
Buck Output Voltage Ripple (PWM)	V_{IN} = 2V, V_{OUT} = 1.5V, I_{OUT} = 100mA	5mV p-p
LDO Regulator, 1.5V V_{OUT}	V_{IN} = 3.3V from V_{OUT} Boost, I_{OUT} = 50mA	1.5V ± 3%
LDO Regulator, 2.85V V_{OUT}	V_{IN} = 3.3V from V_{OUT} Boost, I_{OUT} = 50mA	2.85V ± 3%
LDO Regulator, 3V V_{OUT}	V_{IN} = 3.3V from V_{OUT} Boost, I_{OUT} = 50mA	3.0V ± 3%

Board Number	LTC Part Number	Part Marking
1326A	LTC3100EUD	LDJR

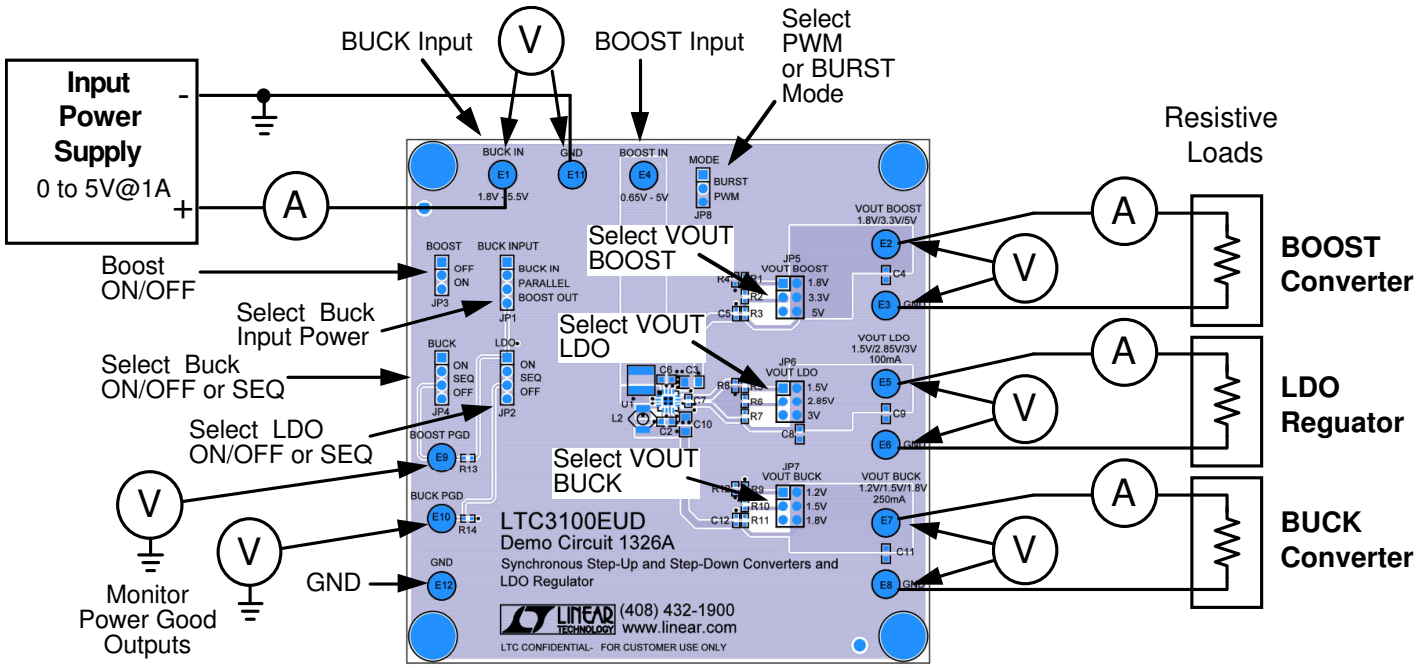


Figure 1. Demonstration Circuit Test Setup

QUICK START PROCEDURE

The LTC3100 circuit can be evaluated using the setup shown in Figure 1. Simply placing jumpers in various locations, attaching output loads and measuring voltages can verify most of the features. It is recommended that the LTC3100 data sheet be nearby for a more complete explanation of the various features and specifications.

Place the BUCK INPUT jumper (JP1) in the “PARALLEL” position. Using jumpers JP5, JP6 and JP7, select the desired output voltages (with no jumpers installed, the output voltage is set for the highest voltage). Note; set the boost output voltage to 3.3V to provide sufficient input voltage for the LDO regulator. Enable each regulator by placing jumpers JP2, JP3 and JP4 in the ON position. Select the desired mode Using JP8 (PWM or BURST).

Connect voltmeters and ammeters as shown in the Figure 1 test setup. Connect a power supply to the BUCK IN and GND terminals and suitable load resistors on the three output and GND terminals. Avoid excessive wire lengths between the input power supply and the demonstration board. Wire lengths greater than 18 inches may require additional capacitance near the input terminals.

With a light load (1k resistor) at each output, begin increasing the input power supply voltage. At approximately 700mV, the boost output will rise to the selected regulated voltage. When the boost output voltage exceeds the input voltage by at least 240mV, the boost converter powers itself from the output instead of the input. This feature allows the input voltage to drop as low as 500mV (at light loads) and still maintain a regulated output voltage. A data sheet curve shows the minimum resistive load vs. Vin that will allow the boost converter to start. Undervoltage lockout for the buck converter keeps it off for voltages below 1.6V (typ).

Increase the input voltage to approximately 2V and increase each load current. The maximum load current for the boost converter depends on the input and output voltage settings while the maximum load for the buck and LDO regulators are 250mA and 100mA respectively. A data sheet curve shows the maximum boost converter output current for different input and output voltages.

Using voltmeters, verify each regulator output voltage for each of the output voltage options. Output ripple voltage and startup waveforms can be observed using an oscilloscope. In Burst mode with light load current, the output ripple voltage is higher than in non-burst mode. Observe proper scope probe placement shown in Figure 3. Typical Electrical Specifications are shown in table 1.

With JP3 in the burst position, under light load, each converter can operate in a low quiescent current burst mode, independent of the other converter. As the load current increases, the converter transitions into fixed frequency (PWM) mode. In the PWM position, the converters are operating in the low output ripple, constant frequency mode.

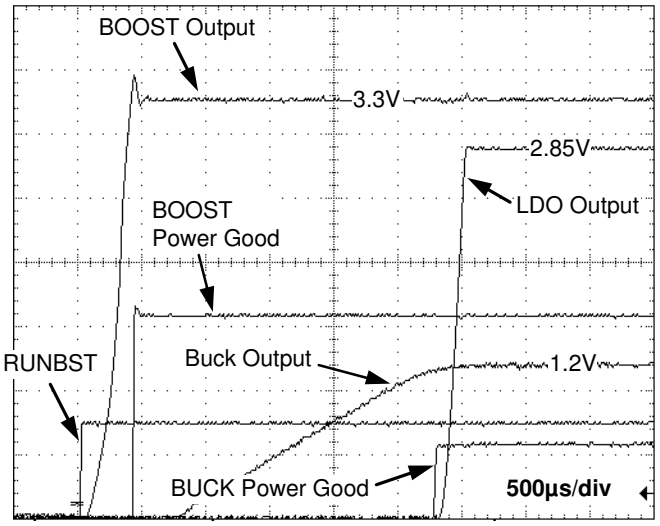


Figure 2. Sequenced Voltages at Start-up

Moving jumpers JP2, JP3 or JP4 to the OFF position can individually shut down the respective regulator. Since the LDO regulator receives power from the boost converter, shutting down the boost converter will also cause the LDO output to drop

Jumpers JP2 and JP4 also can also be set to provide output voltage sequencing. Depending on the jumper settings, one of the regulators will remain shut down until the other regulator has reached regulation.

The PWRGOOD open drain output terminals are high when the output voltage is in regulation and pull low if the output voltage is approximately 10% low, for any reason. Figure 2 shows various waveforms with the Buck output sequenced to the boost output and the LDO output sequenced to the Buck output. Placing JP2 and JP4 in the SEQ position connects the power good output of the boost converter to the run input of the Buck converter, and the power good output of the buck converter to the run input of the LDO regulator. Sequencing provides an orderly startup of one or more of the output voltages.

The DC/DC converters have separate input pins and can be powered from different voltage sources. JP1 allows the Buck converter to be powered from BUCK IN pin, BOOST IN pin (parallel) or powered from the boost convert-

ers output. The boost converter input voltage can exceed the output voltage and still maintain regulation, although the load current is less and efficiency is lower.

With input voltage applied to the boost converter, shutting it down completely opens the input-to-output current path, unlike other boost converters that do not have an output disconnect feature.

When evaluating the circuit at low input voltages, it is important to monitor the input voltage directly at the input terminals of the circuit board. At very low input voltages, voltage drops in the power supply wire and Ammeter will result in the input voltage at the input terminals dropping below the minimum voltage required for operation.

Additional pc board pads are provided on the backside for optional input bypass capacitors (C1 and C13). These maybe necessary when using long wires between the power supply and circuit board, or for adding tantalum capacitors to minimize input voltage transients that may occur when the input is hot-switched. Also, pads on the board backside are provided for adding small Schottky diodes (D1 and D2), which can increase converters efficiency. When verifying output ripple, it is important to use the scope probe connection as shown in figure 3.

See LTC3527 Data Sheet for additional information

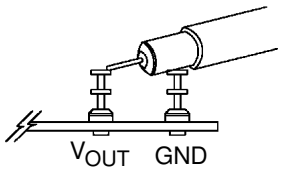
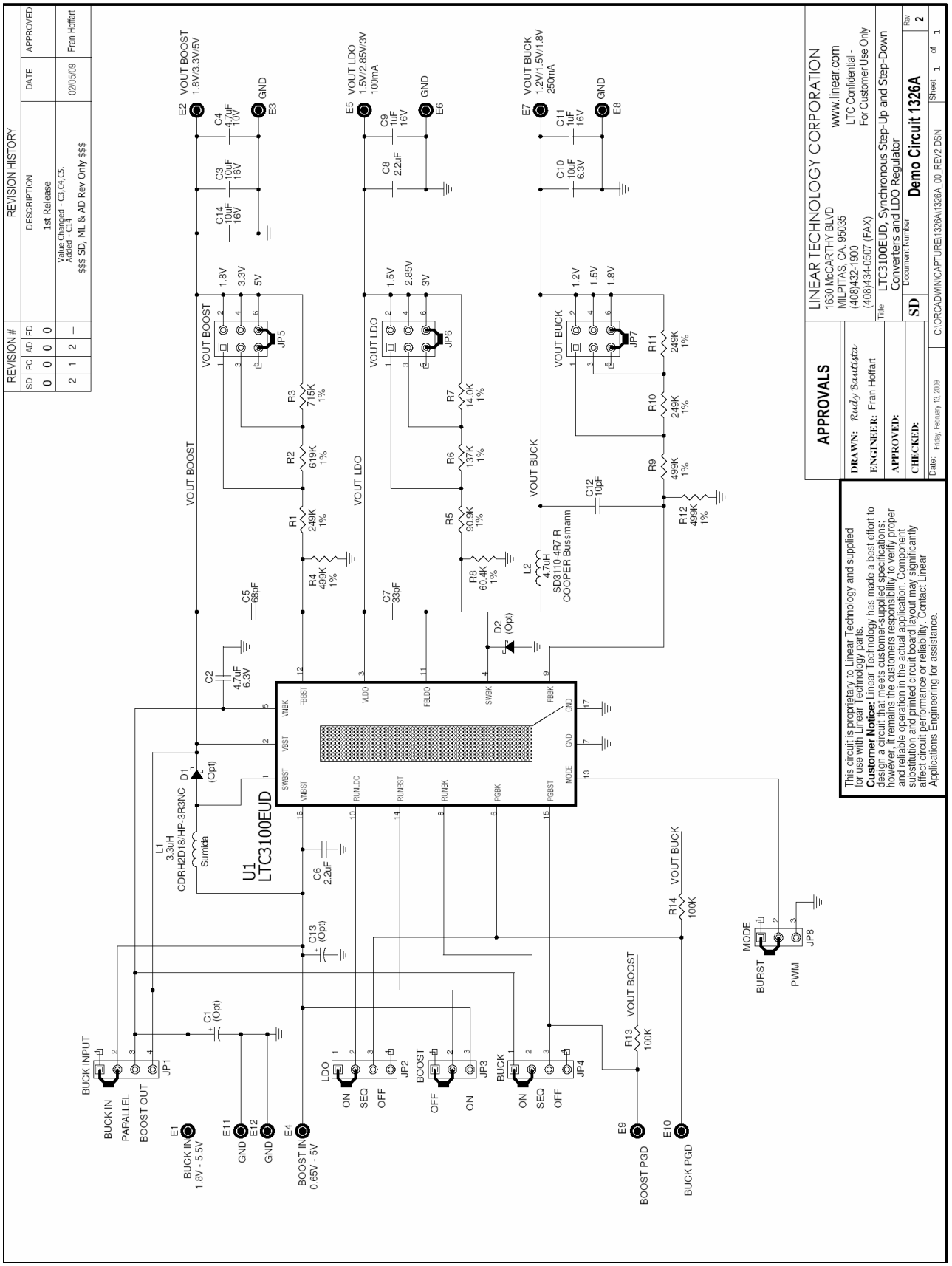


Figure 3. Scope Probe Placement for Measuring Output Ripple Voltage


REVISION HISTORY
REVISION #
SD PC AD FD
0 0 0 0
2 1 2 —
DESCRIPTION
1st Release
Value Changed - C3,C4,C5.
Added - C14
$$$ SD, ML & AD Rev Only $$$
DATE
02/05/09
APPROVED
Fran Hoffart
U1
LTC3100EUD
L1
3.3uH
CDRH2D18/HP-3R3NC
Sumida
L2
4.7uH
SD3110-4R7-R
COOPER Bussmann
VOUT BOOST
1.8V/3.3V/5V
VOUT LDO
1.5V/2.85V/3V
100mA
VOUT BUCK
1.2V/1.5V/1.8V
250mA
GND
BUCK INPUT
BUCK IN
PARALLEL
BOOST OUT
BUCK IN
1.8V - 5.5V
BOOST IN
0.65V - 5V
BOOST PGD
BUCK PGD
LDO
BOOST
BUCK
ON
SEQ
OFF
MODE
BURST
PWM
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Title
LTC3100EUD, Synchronous Step-Up and Step-Down
Converters and LDO Regulator
Document Number
SD
Demo Circuit 1326A
Rev
2
Date: Friday, February 13, 2009
C:\ORCADWINCAPTURE\1326A\1326A_00_REV2.DSN
Sheet 1 of 1
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