

# QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 1206

## 1.8A, 4 MHz SYNCHRONOUS STEP-DOWN DC/DC CONVERTER

LTC3568

### DESCRIPTION

Demonstration circuit 1206 is a step-down converter, using the LTC3568 monolithic synchronous buck regulator. The DC1206 has an input voltage range of 2.25V to 5.5V, and is capable of delivering up to 1.8A of output current at a minimum input voltage of 2.25V. The output voltage of the DC1206 can be set as low as 0.8V, the reference voltage of the LTC3568. At low load currents, the DC1206 can operate in either noise sensitive applications, due to the capability of the LTC3568 to operate in pulse-skipping mode, or in high efficiency applications, because the LTC3568 can also operate in Burst-Mode®. During Burst-Mode® operation, the output ripple voltage is still low – less than 30 mV – due to the improvements made in the design of the LTC3568. Of course, in continuous mode, or large

load current applications, the DC1206 is a high efficiency circuit - over 95%. The DC1206 consumes less than 70 uA of quiescent current during sleep operation typically, and during shutdown, it consumes less than 1 uA. Because of the high switching frequency of the LTC3568, which is programmable up to 4 MHz, the DC1206 uses low profile surface mount components. These features, plus the LTC3568 coming in a small 10-Lead DFN package, make the DC1206 an ideal circuit for use in battery-powered, hand-held applications.

**Design files for this circuit are available. Call the LTC Factory.**

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Table 1. Performance Summary ( $T_A = 25^\circ\text{C}$ )

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		2.25V
Maximum Input Voltage		5.5V
Run/Shutdown		GND = Shutdown
		$V_{IN} = \text{Run}$
Output Voltage $V_{OUT}$	$V_{IN} = 2.25\text{V to } 5.5\text{V}, I_{OUT} = 0\text{A to } 1.8\text{A}$	$1.2\text{V} \pm 4\%$ (1.152V – 1.248V)
		$1.5\text{V} \pm 4\%$ (1.44V - 1.56V)
		$1.8\text{V} \pm 4\%$ (1.728V – 1.872V)
Typical Output Ripple $V_{OUT}$	$V_{IN} = 3.3\text{V}, V_{OUT} = 1.8\text{V}, I_{OUT} = 1.8\text{A}$ (20 MHz BW)	< 20mV <sub>p-p</sub>
Operation Modes	Burst Mode - $V_{IN} = 3.3\text{V}, V_{OUT} = 1.8\text{V}$	< 500 mA
	Pulse-Skip - $V_{IN} = 3.3\text{V}, V_{OUT} = 1.8\text{V}$	< 425 mA
Nominal Switching Frequency	$R_T = 324\text{k}$	1 MHz

### QUICK START PROCEDURE

Demonstration Circuit 1206 is easy to set up to evaluate the performance of the LTC3568. For proper measurement equipment configuration, set up the circuit according to the diagram in **Figure 1**. Before proceeding to test, insert shunts into the OFF position of header JP3, which connects the RUN pin to ground (GND), and thus, shuts down the circuit, the pulse-skip position of header JP1, and the 1.8V output voltage header – JP2.

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 measurement technique.

With the DC1206 set up according to the proper measurement and equipment set-up in **Figure 1**, apply 3.3V at Vin (Do not hot-plug Vin or increase Vin over the rated maximum supply voltage of 5.5V, or the part may be damaged.). Measure Vout; it should read 0V. Turn on the circuit by inserting the shunt in header JP3 into the ON position. The output voltage should be regulating. Measure Vout - it should measure 1.8V +/- 2% (1.764V to 1.836V).

Vary the input voltage from 2.25V to 5.5V and adjust the load current from 0 to 1.8A. Vout should read 1.8V +/- 4% (1.728V to 1.872V).

Adjust the output current to 1A. Measure the output ripple voltage; it will measure less than 20 mVAC.

Observe the voltage waveform at the switch node. Verify the switching frequency is between 850 kHz and 1.15 MHz ( $T = 1.176 \mu\text{s}$  and  $0.869 \mu\text{s}$ ), and that the switch node waveform is rectangular in shape.

Adjust the input voltage to 3.3V and the output current to any current less than 400 mA. Observe the pulse-skip mode of operation at the switch node. Also, measure the output ripple voltage; it should measure less than 20 mV. Change the JP1 shunt from pulse-skip mode to Burst Mode®. Observe the Burst Mode® operation at the switch node, and measure the output ripple voltage. It should measure less than 50 mV.

Insert the JP3 shunt into the OFF position and move the 1.8V Vout JP2 shunt into any of the two remaining output voltage option headers: 1.2V or 1.5V. Just as in the 1.8Vout test, the output voltage should read Vout +/- 2% tolerance under static line and load conditions, and +/- 1% tolerance under dynamic line and load conditions (+/- 2% total). Also, circuit operation in either Burst Mode® or pulse-skip mode will be the same.

When finished, turn off the circuit by inserting the shunt in header JP3 into the OFF position (connecting the RUN pin to ground).

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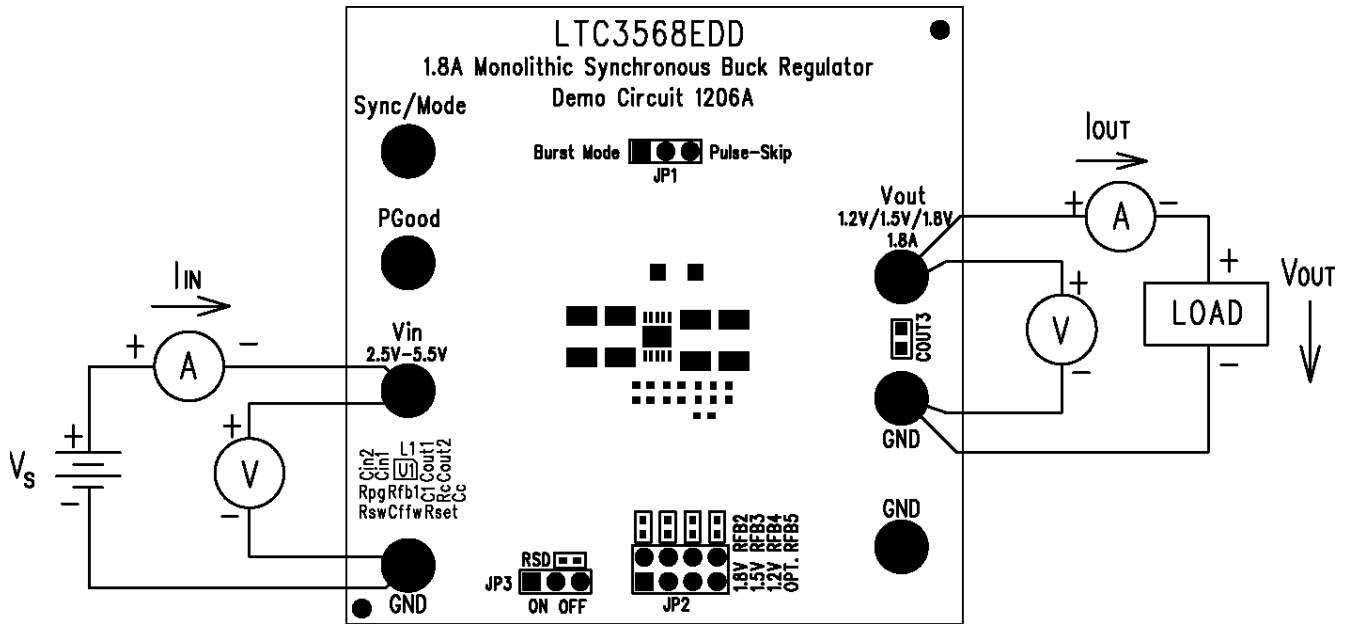


Figure 1. Proper Equipment Measurement Set-Up

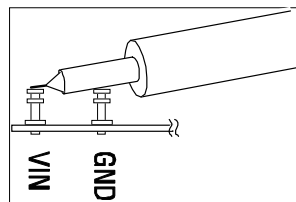
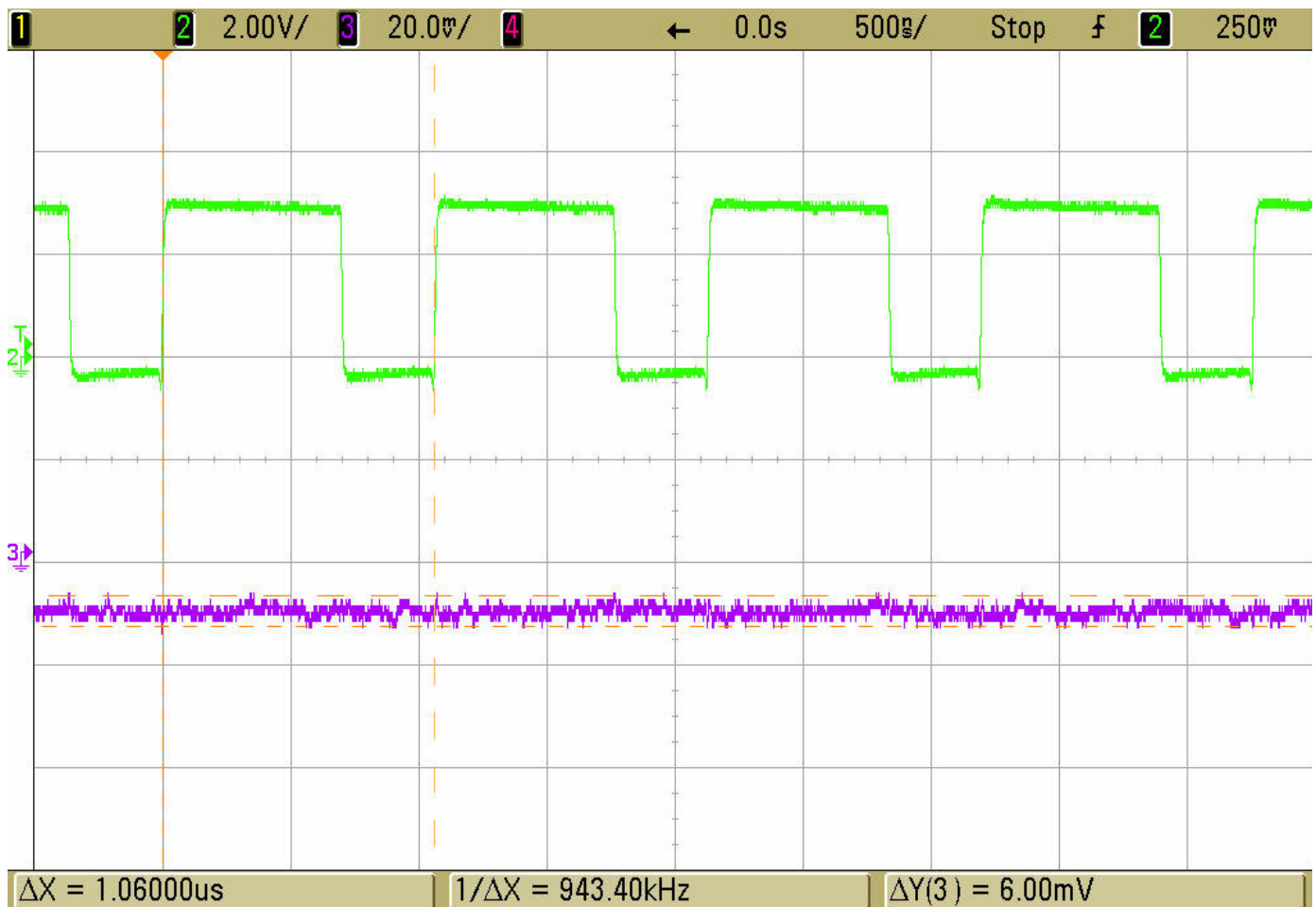


Figure 2. Measuring Input or Output Ripple

## Normal Switching Frequency & Output Ripple Voltage

### Waveforms



**Figure 3. Switch Waveform & Output Ripple Voltage**

$V_{IN} = 3.3V$ ,  $V_{OUT} = 1.8V$ ,  $I_{OUT} = 1.8A$

Trace 2: Switch Voltage (2 V/div)

Trace 3: Output Ripple Voltage (20 mV/div AC)

## Load Step Response Waveform

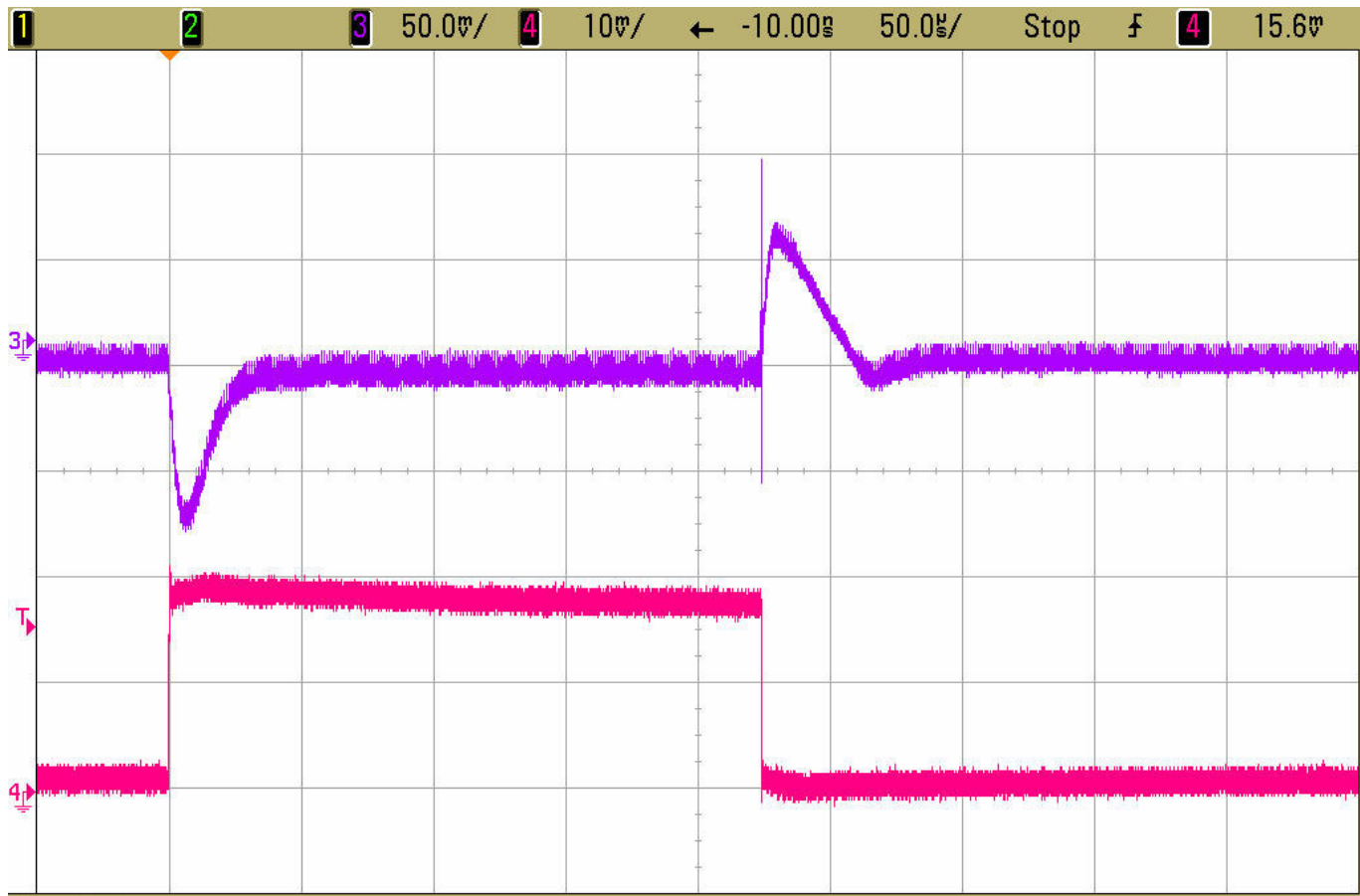


Figure 4. Load Step Response

$V_{IN} = 3.3V$ ,  $V_{OUT} = 1.8V$ , 1.62A Load Step (180mA  $\leftrightarrow$  1.8A)

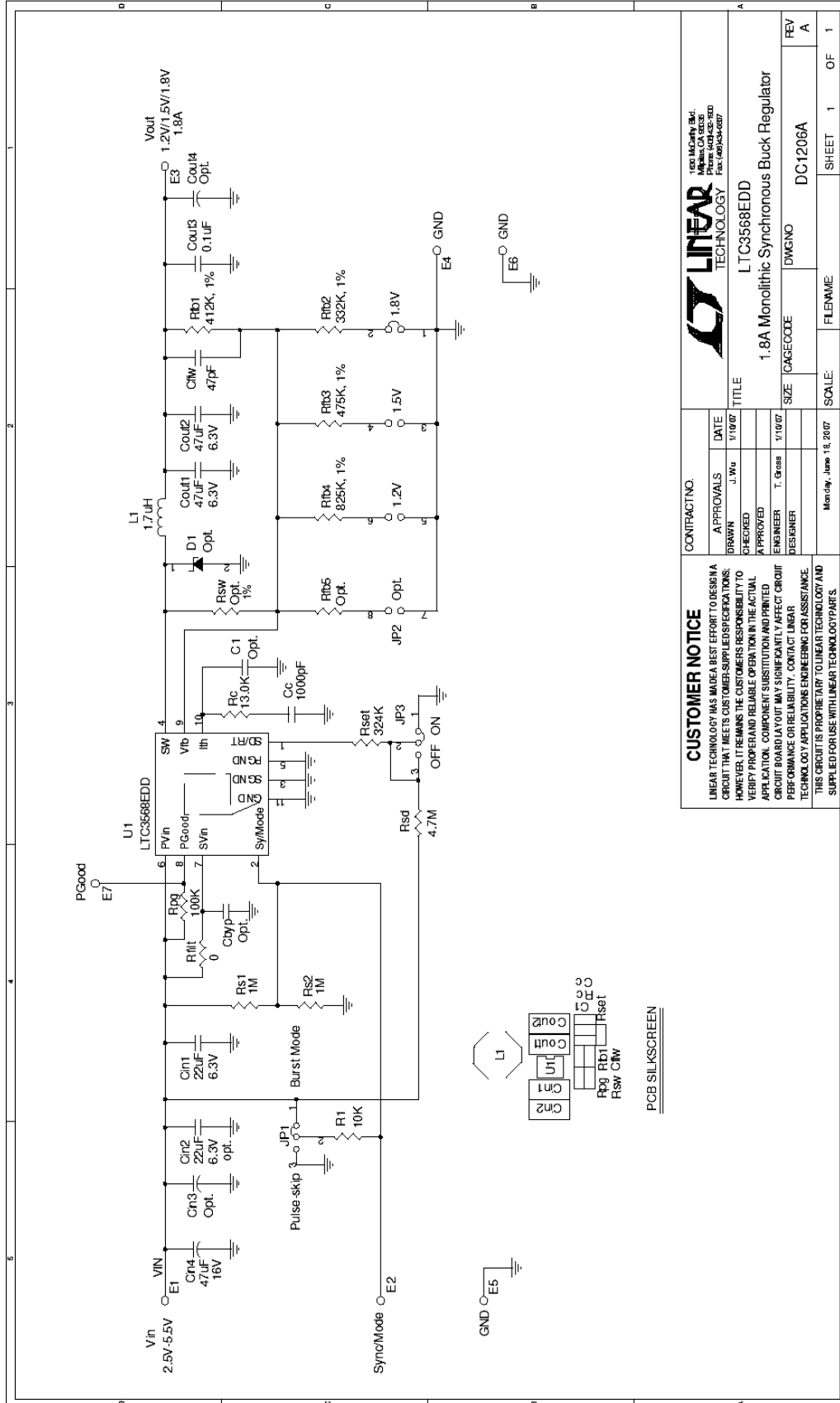
Pulse-Skip Mode  $F_{sw} = 1\text{ MHz}$

Trace 3: Output Voltage (50mV/div AC)

Trace 4: Output Current (1A/div)

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<b>CUSTOMER NOTICE</b> LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS. HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE. THIS CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.		<b>CONTRACTING NO.</b> DRAWN: J. Wu CHECKED: [ ] APPROVED: [ ] ENGINEER: T. Green DESIGNER: [ ]		<b>DATE</b> 1/10/07		<b>TITLE</b> LTC3568EDD 1.8A Monolithic Synchronous Buck Regulator	
<b>APPROVALS</b> [ ] [ ] [ ] [ ]		<b>SIZE</b> CAGE CODE		<b>SCALE</b> DWGNO		<b>REV</b> DC1206A	
<b>DATE</b> Monday, June 18, 2007		<b>SCALE</b> FLEMME		<b>SHEET</b> 1 OF 1		<b>REV</b> A	

