LTC3614
4A, 4MHz, MONOLITHIC SYNCHRONOUS DC/DC STEP-DOWN CONVERTER

DESCRIPTION

Demo Circuit 1467 is a high efficiency, high frequency step-down converter, incorporating the LTC3614 monolithic synchronous regulator. The DC1467A has an input voltage range of 2.25V to 5.5V, and is capable of delivering up to 4A of output current. The output voltage of the DC1467A can be set as low as 0.6V, the reference voltage of the LTC3614. The operating frequency range of the DC1467A is either set to a fixed 2.25 MHz by connecting the frequency pin to SVin, set by an external resistor, or synchronized to an external clock, with a range up to 4 MHz. At low load currents, the DC1467A can operate in either noise sensitive applications, due to the capability of the LTC3614 to operate in pulse-skipping mode, or in high efficiency applications, because the LTC3614 also has Burst-Mode capability. The Burst Mode clamp can be set externally. Of course, in (forced) continuous mode, or large load current applications, the DC1467A is a very efficient circuit - over 90%. The DC1467A consumes less than 300 uA of quiescent current during sleep operation, and during shutdown, it consumes less than 1 uA. The DC1467A can track another voltage, due to the LTC3614 track function, for easy power supply sequencing. Extra features include frequency and current foldback, and an adjustable 0.3V-to-0.6V external reference. Because of the high switching frequency of the LTC3614, which is programmable up to 4 MHz, the DC1467A uses low profile surface mount components. All these features make the DC1467A perfectly suited for portable computer and distributed power applications.

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

As Shipped Performance Summary

PARAMETER	CONDITIONS	VALUE
Minimum Input Voltage		2.25V
Maximum Input Voltage		5.5V
Run/Shutdown		GND = Shutdown
		V_{IN} = Run
Output Voltage Regulation	V_{IN} = 2.25V to 5.5V, I_{OUT} = 0A to 4A	1.2V ±4% (1.152V – 1.248V)
	V_{IN} = 2.5V to 5.5V, I_{OUT} = 0A to 4A	1.8V ±4% (1.728V – 1.872V)
	V_{IN} = 3.3V to 5.5V, I_{OUT} = 0A to 4A	2.5V ±4% (2.4V – 2.6V)
	V_{IN} = 4.2V to 5.5V, I_{OUT} = 0A to 4A	3.3V ±4% (3.168V – 3.432V)
Typical Output Ripple Voltage	V_{IN} = 5V, V_{OUT} = 1.8V, I_{OUT} = 4A (20 MHz BW)	<20mV_{P-P}
Burst Mode	V_{IN} = 5V, V_{OUT} = 1.8V	<1.6A
Pulse-Skip Mode	V_{IN} = 5V, V_{OUT} = 1.8V	<1.5A
Nominal Switching Frequency	R_T = 165k	2 MHz ± 20%

Table 1. Jumper Description

JUMPER	FUNCTION	RANGE/SETTING (DEFAULT)
JP1	Output Voltage Setting.	1.2V
J1	Mode: Forced Continuous Mode (FC), Burst Mode (BM or BMEC), or Pulse-Skip Mode(SYNC)	(FC) – BMEC – BM - PSM
J2	Run	(ON) - OFF
J3	Tracking (TRACK), Internal Soft-Start (INT SS), or External Soft-Start (EXT SS)	(EXT SS) – INT SS - TRACK
J4	DDR Memory Termination	(OFF) - ON
J5	External or Internal ITH Compensation	(EXT) – INT
J6	Frequency Setting: Timing Resistor (RT), Internally Synchronized (2.25 MHz), or Externally Synchronized	(Rt) – INT SYNC – EXT SYNC
J7	External Burst Mode Clamp Voltage	(SET) – EXT

QUICK START PROCEDURE

Demonstration Circuit 1467 is easy to set up to evaluate the performance of the LTC3614. For proper measurement equipment configuration, set up the circuit according to the diagram in **Figure 1**. Before proceeding to test, insert shunts into the 1.2V position of the output voltage header JP1, into the FCM (Forced Continuous Mode) position of MODE header J1, into the OFF position of RUN header J2, into the EXT SS (external soft-start) position of Track/SS header J3, into the OFF position of DDR header J4, into the EXT (external) position of COMP header J5, into the Rt position of Rt/SYNC header J6, and into the SET position of VBMCV header J7.

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 DC1467 set up according to the proper measurement configuration and equipment in **Figure 1**, apply 6.3V 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 J2 into the ON position. The output voltage should be regulating. Measure Vout - it should measure 1.2V +/- 2% (1.176V to 1.224V).

Vary the input voltage from 2.25V to 5.5V and adjust the load current from 0 to 4A. Vout should regulate around 1.2V. Measure the output ripple voltage; it should measure less than 40 mVAC.

Observe the voltage waveform at the switch pins (the other side of the inductor from the output). Verify the switching frequency is between 1.6 MHz and 2.4 MHz (T = 625 ns and 416 ns), and that the switch node waveform is rectangular in shape.

Change the J1 shunt from forced continuous mode to Burst Mode or pulse-skip mode. Set the input voltage to 5V and the output current to any current less than 1A. Observe the discontinuous mode of operation at the switch node, and measure the output ripple voltage. It should measure less than 100 mV.

Insert the J2 shunt into the OFF position and move the shunt in the 1.2V output JP1 header into any of the two remaining output voltage option headers: 1.8V (JP2), 2.5V (JP3), or 3.3V (JP4). Just as in the 1.2V Vout 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, the circuit operation in discontinuous mode will be the same. When finished, turn off the circuit by inserting the shunt in header J2 into the OFF position.

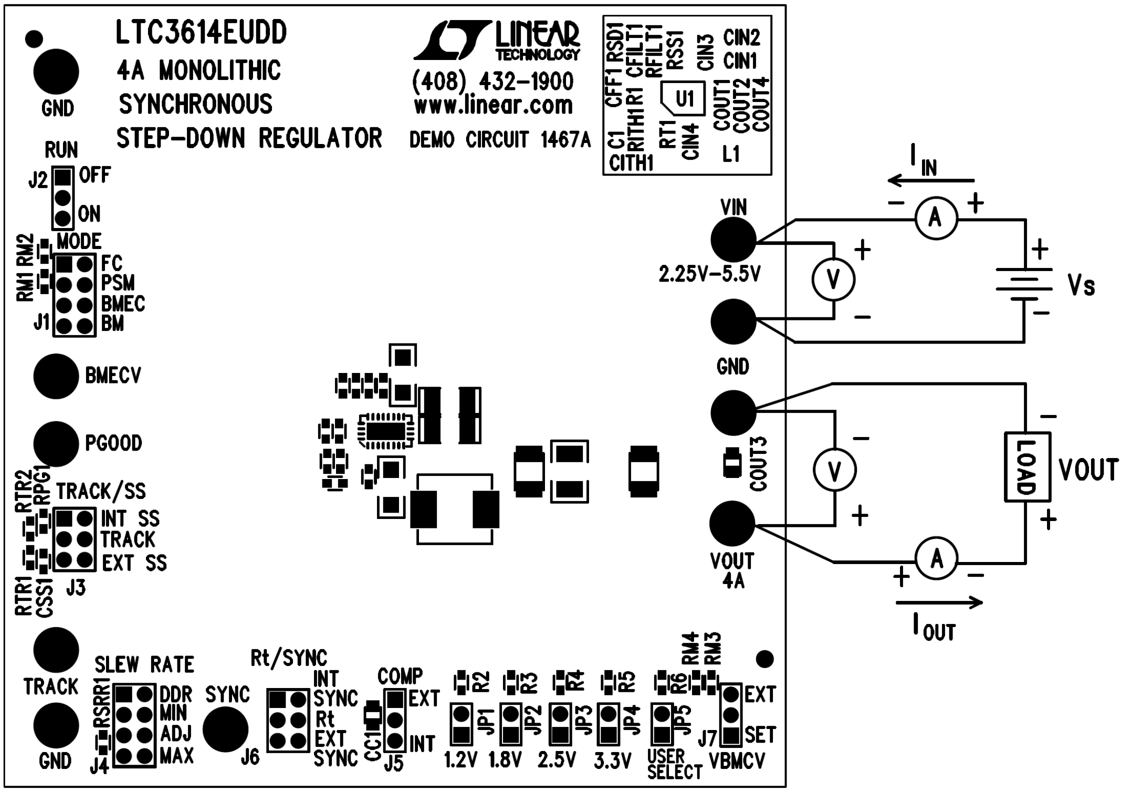


Figure 1. Proper Measurement Equipment Set-Up

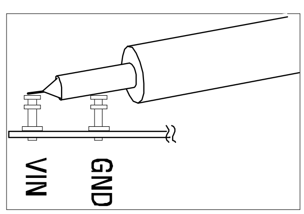


Figure 2. Measuring Input or Output Ripple

Normal Switching Frequency & Output Ripple Voltage Waveforms

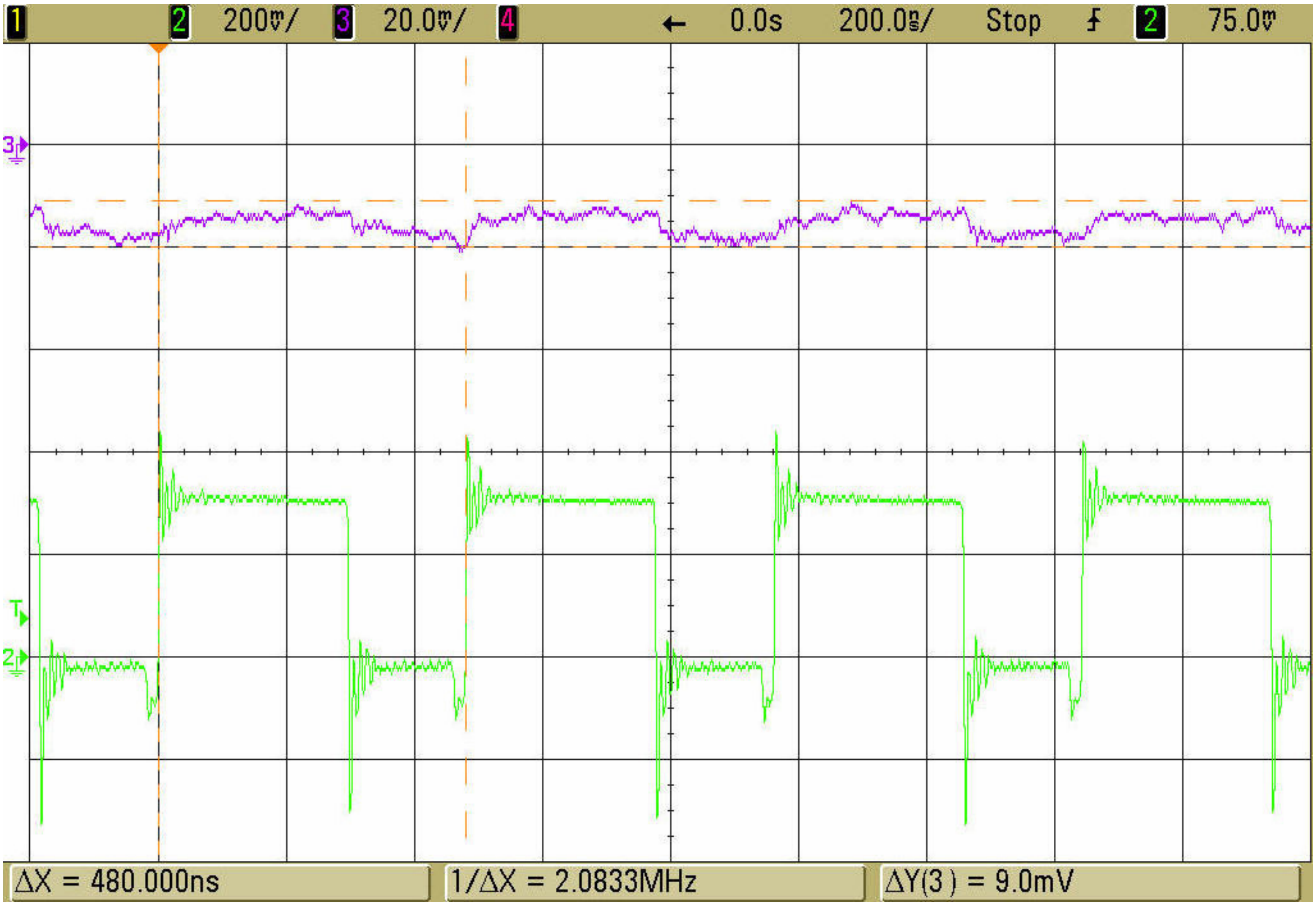


Figure 3. Switch Node & Output Ripple Voltage Waveforms
V_{IN} = 3.3V, V_{OUT} = 1.8V, I_{OUT} = 4A

F_{SW} = 2 MHz

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

Trace 2: Switch Voltage (2 V/div)

Load Step Response Waveform

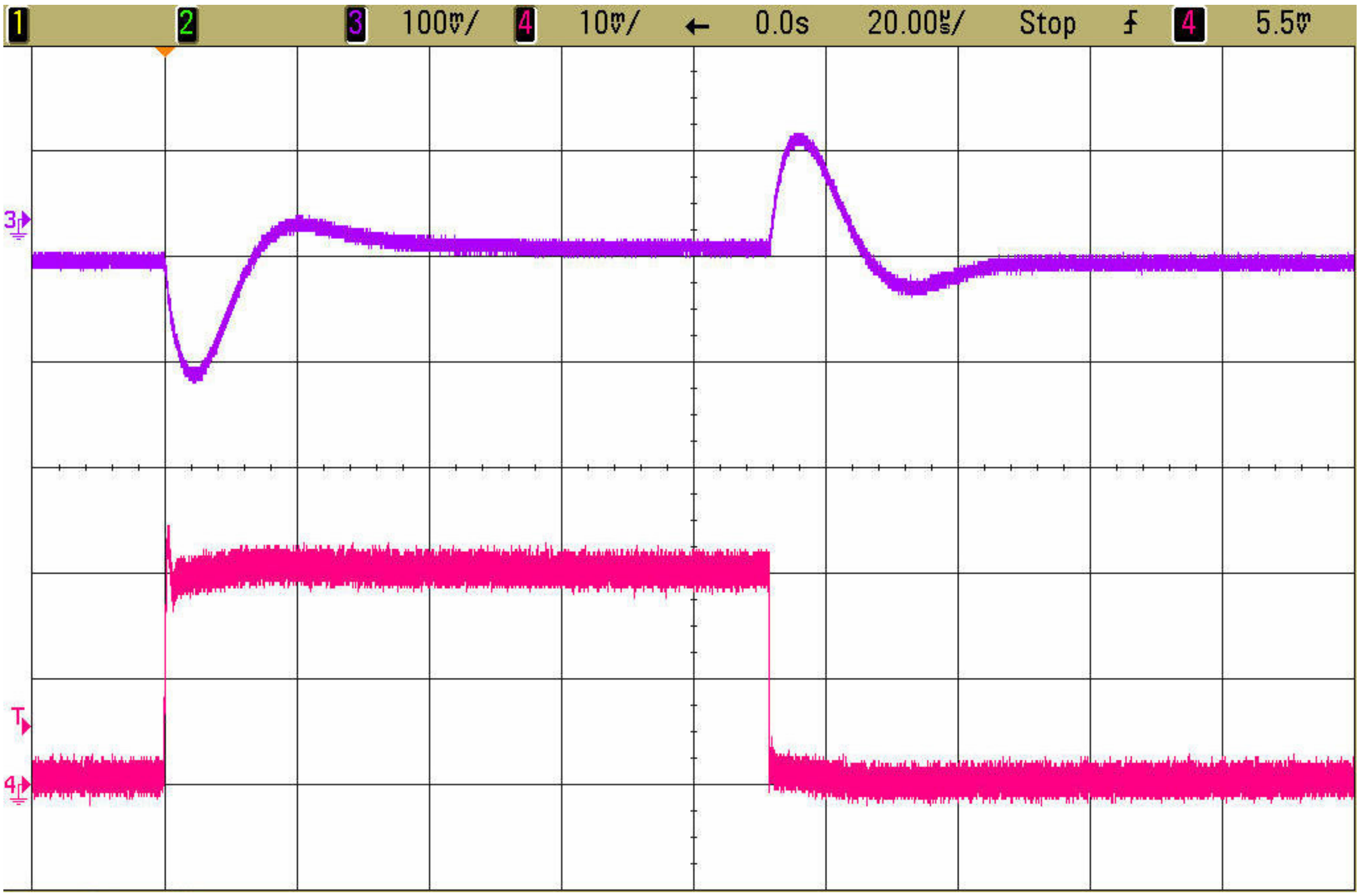


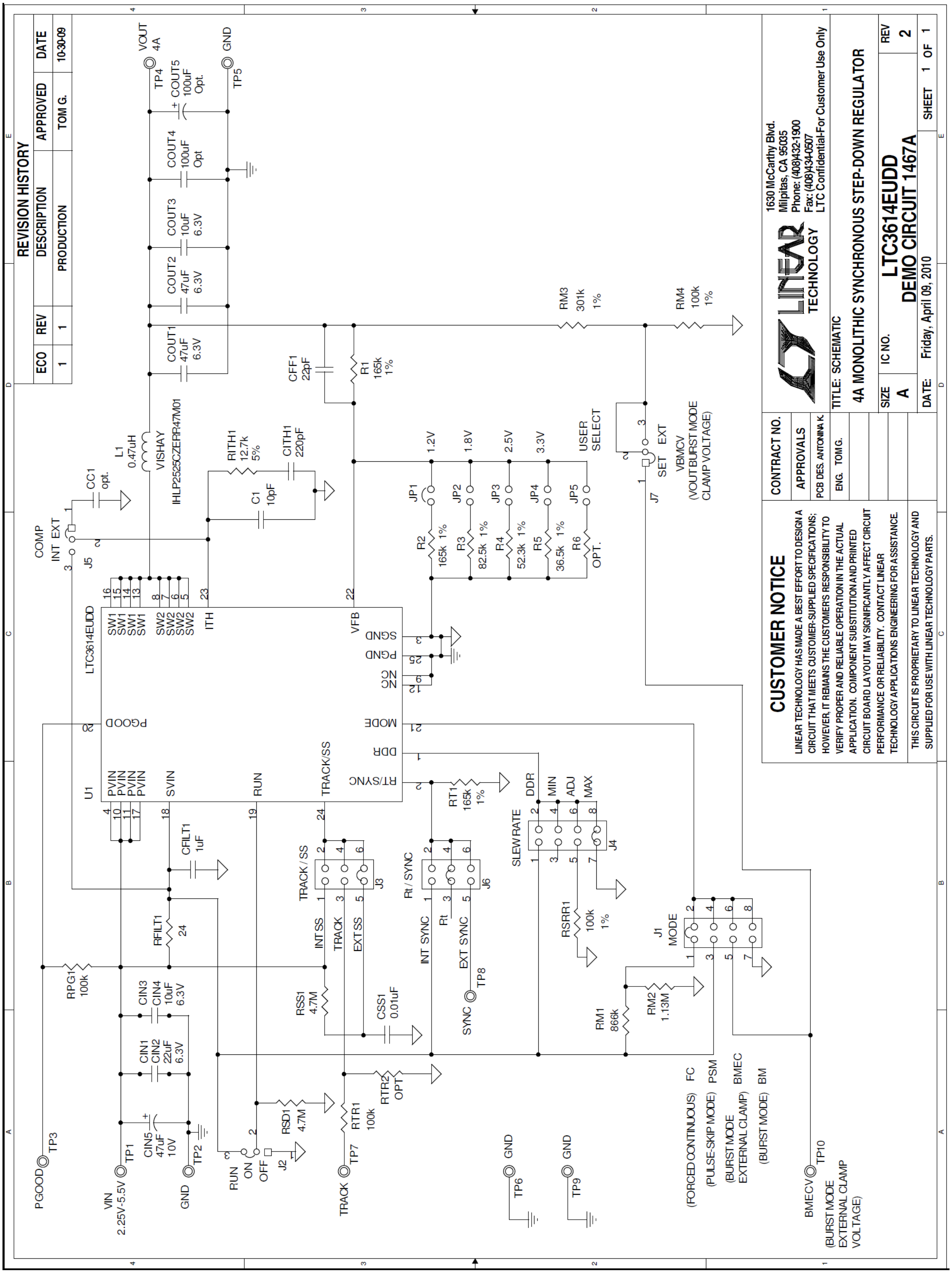
Figure 4. Load Step Response

V_{IN} = 3.3V, V_{OUT} = 1.8V, 4A Load Step (0.1A <-> 4A)

Forced Continuous Mode F_{SW} = 2 MHz

External Compensation: Rith = 12.7k, Cith = 220 pF

Trace 3: Output Voltage (100mV/div AC)
Trace 4: Output Current (2A/div)


REVISION HISTORY
ECO REV DESCRIPTION APPROVED DATE
1 1 PRODUCTION TOM G. 10-30-09
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Fax: (408)434-0507
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TITLE: SCHEMATIC
4A MONOLITHIC SYNCHRONOUS STEP-DOWN REGULATOR
SIZE A
IC NO. LTC3614EUDD
DEMO CIRCUIT 1467A
REV 2
DATE: Friday, April 09, 2010
SHEET 1 OF 1
U1 LTC3614EUDD
VOUT 4A
GND
VIN 2.25V-5.5V
PGOOD
BMECV (BURST MODE EXTERNAL CLAMP VOLTAGE)
L1 0.47uH VISHAY IHLP2525CZER R47M01
(FORCED CONTINUOUS) FC
(PULSE-SKIP MODE) PSM
(BURST MODE EXTERNAL CLAMP) BMEC
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