DESCRIPTION

Demonstration circuit 475 is a step-down converter featuring the LTC1909-8 synchronous current mode switching controller. The output voltage is selected from one of two 5-bit VID codes programmed into internal registers via a 2-wire SMBus interface. MOSFET Rdson is used for current sensing.

The Demo board is optimized for output voltage in the range of 1.3 to 2.2V. Consult LTC applications Engineering for optimum component selection for higher output voltages up to 3.5V. Although the rated current is 10A, the board can easily provide up to 15A at output voltage up to 2.5V.

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

Table 1. Performance Summary

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		7.5V
Maximum Input Voltage		21V
V_{OUT}	V_{IN} = 7.5-21V, Iout=0-10A	See table 2
Typical Output Ripple V_{OUT}	V_{IN} 15V, Vout=2V, Iout=10A	$35mV_{P-P}$
Nominal Switching Frequency	Vout=1.2V-2.2V	300kHz
	Vout=3.5V	400kHz

QUICK START PROCEDURE

Demonstration circuit 475 is easy to set up to evaluate the performance of the LTC1909-8. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

NOTE: 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 technique.

SETUP

1. The SMBus interface can be provided by DC410A, an RS232 to SMBus adapter provided as part of the Demo Kit. This Demo board can be connected to the COM1 or COM2 port on an IBM PC or compatible. A software driver is provided on CDROM. Please refer to the DC410 manual for installation and operation of this software.
2. Refer to Figure 1 for the required equipment and the proper way to connect the test equipment. JP2 should be in the OFF position initially.

3. Turn on power in the following sequence. PC, 12V to SMBus adapter, Vin to DC475A, EXT VCC (=5V) to DC475A. *When powering down, turn off EXT VCC first.*

4. Start the SMBus Demo software. Select COM1 or COM2 as appropriate.
5. Set VRON to logic low or short to GND (as precaution). (Open=High)

6. Set SEL to logic Low. (Open=Low)
7. Use LTC1909-8 setup protocol to set the VID registers.

   Example: To set Register 0 for 1.30V (VID=78H) and register 1 for 2.00V(VID=08H) send the following command using word write.

   E2 20 0878 (HEX).

   Note: E2 is entered in the DEVICE ADDRESS field, 20 in the DEVICE COMMAND field and 0878 in the DEVICE DATA field. The DATA field is in High Byte, Low Byte Order but the bytes are transmitted in the Low Byte, High Byte order.

   Verify the VID settings by sending a READ COMMAND

   E2 40 (HEX). (This step is optional)

   Check the returned data. It should read 0C7C. (This step is optional)
8. Send the ON command twice to clear the DCON bit. (E2 00 XXXX). X=don't care.
9. Verify the DCON is cleared using read-back protocol (E2 40 XXXX).
10. Data returned should be 0878 (HEX).
11. Now Pull the VRON input high (or float).
12. The LTC 1909-8 will soft start and the output voltage will be per the register selected by SEL. SEL "LOW" will select register 0(1.30Vout) and SEL "HIGH" will select register 1(2.00Vout).
13. You can toggle between the two output settings using SEL.
14. If there is no output, temporarily disconnect the load to make sure that the load is not set too high and repeat if necessary.
15. To send another VID setting you must first turn off the output by sending an OFF command twice using write word: E2 60 XXXX (HEX).
16. The Hex codes for all the VID codes are listed in Table 2.
17. Once the proper output voltages are established, adjust the loads within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters
18. Figure 3 shows efficiency data for 1.30V and 2.00V output.

Dynamic Load Step Test:

A dynamic load test circuit is provided on board for user convenience. A MOSFET Q6 in series with resistors R18, R19 is connected across the output voltage. The MOSFET gate is driven with a pulse waveform with adjustable rise and fall times and a pulse width of about 100usec. The resulting pulse load current can be viewed by connecting a BNC cable to J1. The dynamic load circuit derives +/- 12V from Vin. Jumper JP2 when in the ON position turns on the +/- 12V converters and enables the Dynamic Load.

1. After the output voltage reaches steady state, apply a DC load current that is equal to the minimum load level.
2. Set R16 to maximum clockwise position (zero step load).
3. Enable the Dynamic Load Circuit by moving JP2 to the ON position.
4. Adjust R16, R15, R21 to change the amplitude, slope up and slope down while viewing the current step from the BNC current monitor jack. The controls interact so adjust them gradually. Each 50mV reading on the scope represents 10A. The DC load current applied in step one at the output is not included in the scope waveform.

5. Verify the transient response on a second scope channel by measuring the output waveform across the output ceramic capacitor COUT5.

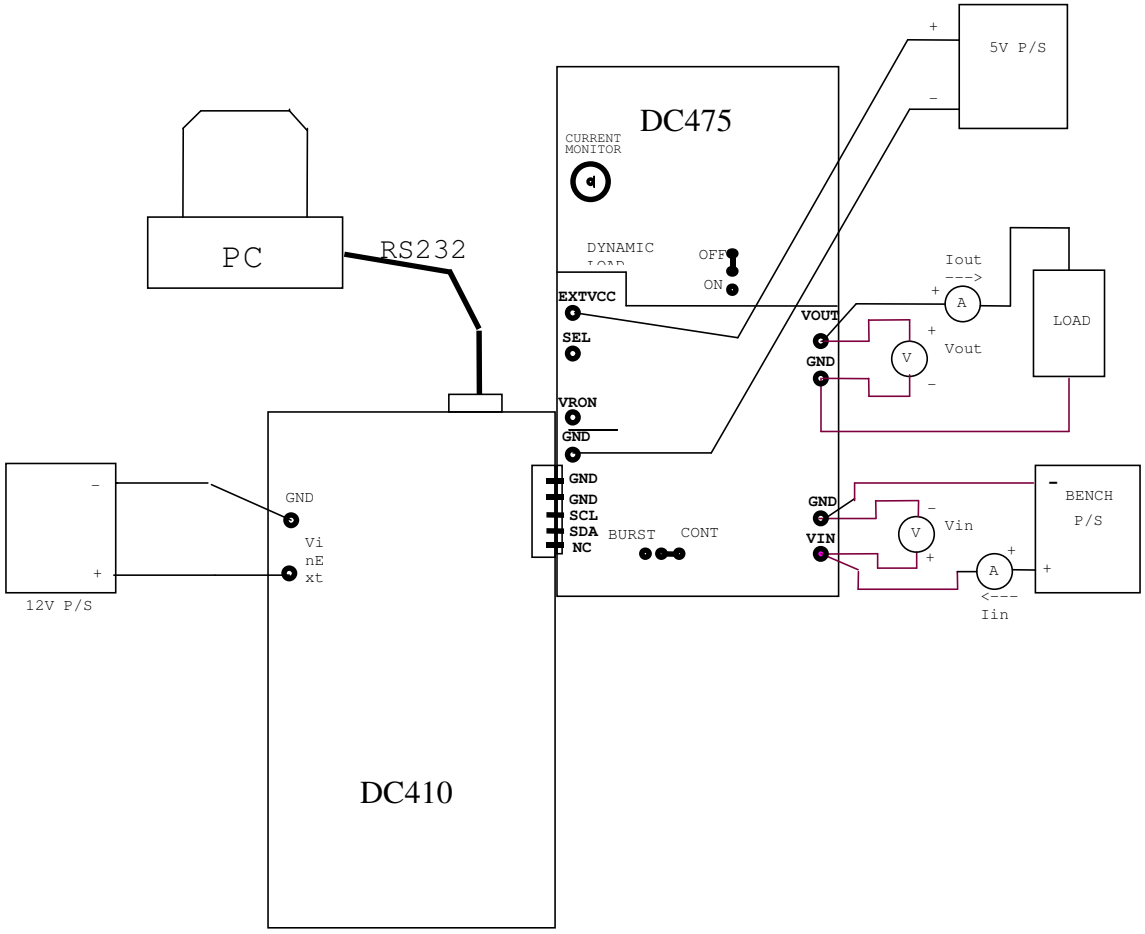

Figure 1. Proper Measurement Equipment Setup

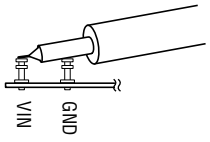

Figure 2. Scope Probe Placement for Measuring Input or Output Ripple

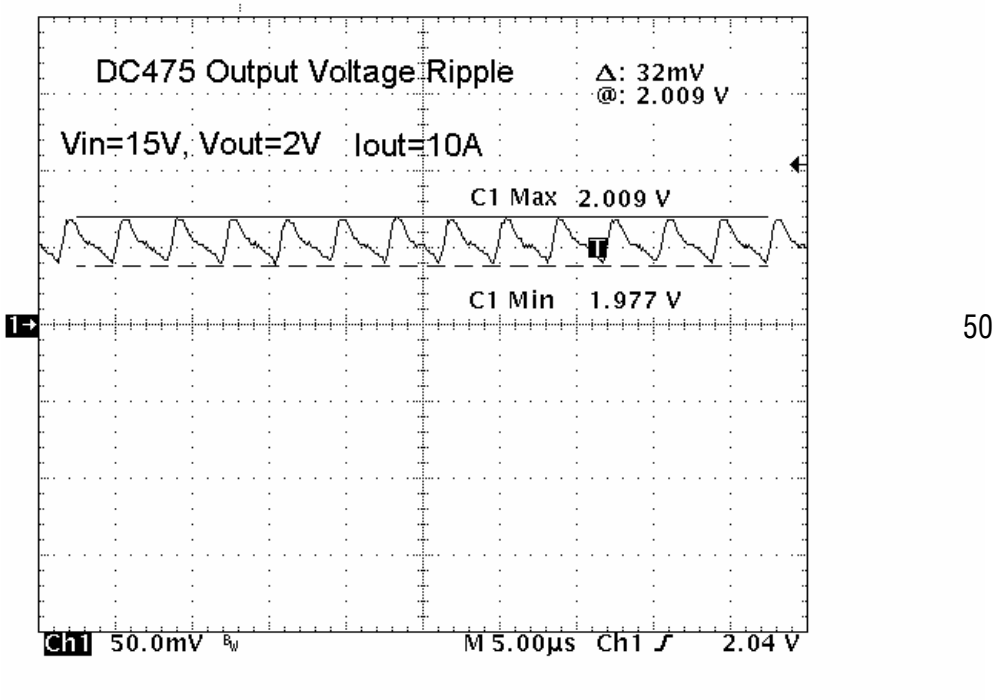

Figure 4. Output voltage ripple

Table 2. VID Hex Codes

OUTPUT VOLTAGE	HEX CODE
2.05	00
2.00	08
1.95	10
1.90	18
1.85	20
1.80	28
1.75	30
1.70	38
1.65	40
1.60	48
1.55	50
1.50	58
1.45	60
1.40	68
1.35	70
1.30	78
3.50	80
3.40	88
3.30	90
3.20	98
3.10	A0
3.00	A8
2.90	B0
2.80	B8
2.70	C0
2.60	C8
2.50	D0
2.40	D8
2.30	E0
2.20	E8
2.10	F0
2.00	F8

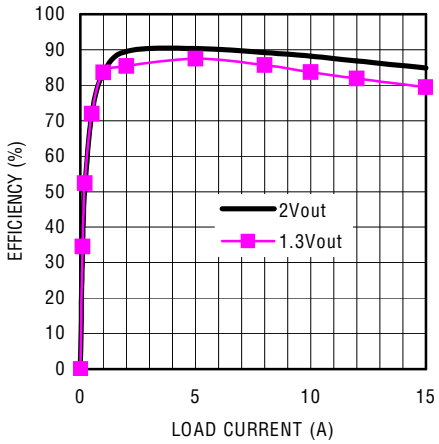

Figure 3. Efficiency @1.3Vout and 2Vout at 15Vin

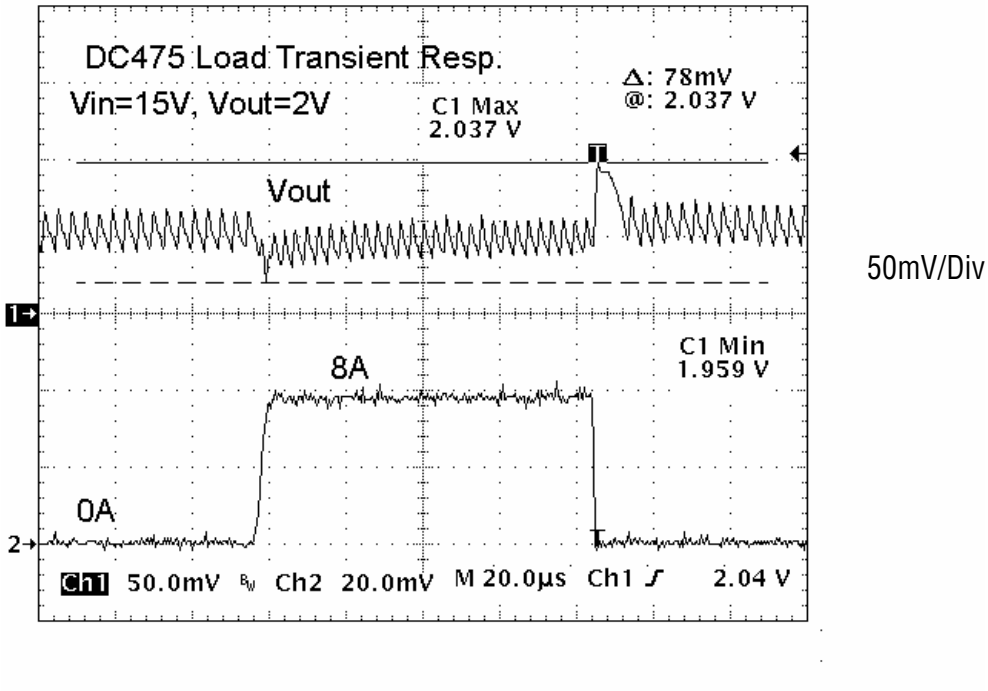

Figure 5. Load Transient response