DEMO CIRCUIT 1184A
QUICK START GUIDE

LTC3860EUH
DUAL OUTPUT
SYNCHRONOUS BUCK CONVERTER

DESCRIPTION

Demonstration circuit DC1184A is a dual output voltage mode synchronous buck converter featuring the LTC3860EUH. This board provides two outputs of 1.2V/25A and 1.8V/25A from an input voltage of 10V to 14V at a switching frequency of 500kHz. The power stage consists of the Renesas R2J20602NP which is a tri-state PWM compatible 8mm x 8mm DrMOS and a 0.47uH 13.2mm x 12.8mm iron powder type inductor from Wurth. An on-board 5V LT1616 buck regulator provides the 5V bias for the LTC3860 and the DrMOS.

The demo board uses a high density, two sided drop-in layout. The power components, excluding the bulk output and input capacitors, fit within a 1.5" x 1.25" area on the top layer. The control circuit resides in a 0.75" x 0.75" area on the bottom layer. The package style for the LTC3860EUH is a 32-lead 5mm x 5mm QFN.

The main features of the board are listed below:

- Differential amplifier for remote sensing V_{OUT1} which is setup for 1.2V.
- Optional components for single output dual phase operation.
- CLKIN pin for synchronization to an external clock which can be used in conjunction with optional PHSMD resistors and CLKOUT pin for up to 12-phase operation.
- TRACK/SS pins for external coincident rail tracking.
- RUN pins and PGOOD pins for each phase.
- For each phase, optional footprints for an LTC4449 gate driver and two top FETs and two bottom FETs.

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

Table 1. **Performance Summary (T_A = 25°C)**

PARAMETER	CONDITION	VALUE
Minimum Input Voltage		10V
Maximum Input Voltage		14V
Output Voltage V_{OUT1}	I_{OUT1} = 0A TO 25A, V_{IN} = 10V to 14V	1.2V ± 1.75%
Output Voltage V_{OUT2}	I_{OUT2} = 0A TO 25A, V_{IN} = 10V to 14V	1.8V ± 1.75%
Nominal Switching Frequency		500kHz
Efficiency	V_{OUT1} = 1.2V, I_{OUT1} = 25A, V_{IN} = 12V	87.8% typical
See Figure 2	V_{OUT2} = 1.8V, I_{OUT2} = 25A, V_{IN} = 12V	91.0% typical

QUICK START PROCEDURE

Demonstration circuit 1184A is easy to set up to evaluate the performance of the LTC3860EUH. Refer to Figure 1 for the proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions:

JP1	**RUN1**	**ON**
JP2	**RUN2**	**ON**
JP3	**INT 5V**	**ON**
JP4	**+5V SELECT**	**INT**

2. With power off, connect the input power supply to VIN and GND. Turn on the power at the input and increase the input voltage to 10V or higher.
3. Check for the proper output voltages:
   Vout1 = 1.179V to 1.221V
   Vout2 = 1.769V to 1.832V
4. 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.

Note 1. Do not apply load between the VOS1+ and VOS1- pins or between the VO2+ and VO2- pins. These pins are only intended to sense the output voltage across COUT4 and COUT10 respectively. Heavy load currents applied across these pins may damage the converter.

Note 2. Use J9 and J10 to monitor the output voltage ripple. J9 will measure the ripple across COUT2 and J10 will measure the ripple across COUT8. Connect J9 and J10 to the oscilloscope with a short coaxial cable. To avoid excessive noise pickup, keep the length of the cable to a minimum.

SINGLE OUTPUT / DUAL PHASE OPERATION

A single output / dual phase converter may be preferred for high output current applications. The benefits of single output / dual phase operation is lower ripple current through the input and output capacitors, improved load step response and simplified thermal design. To implement single output / dual phase operation, make the following modifications:

1. Select phase 1 to be the master and phase 2 the slave since the differential amplifier already senses V_{OUT1}.
2. Stuff R16 with 0 Ohms to disable the error amp for phase 2.
3. Stuff 0 Ohms at R49 to tie COMP1 to COMP2 and remove the redundant compensation components.
4. Stuff R20 with 0 Ohms.
5. Remove 0 Ohm resistor at R25 to release IAVG from ground.
6. Stuff C16 with 100pF to filter the IAVG signal.
7. Stuff R60 with 0 Ohms to tie the two RUN pins together.
8. Stuff R57 with 0 Ohms to tie the two TRK/SS pins together.
9. Tie VOUT1 to VOUT2 by tying together the exposed copper pads on the VOUT shapes with pieces of heavy copper foil.

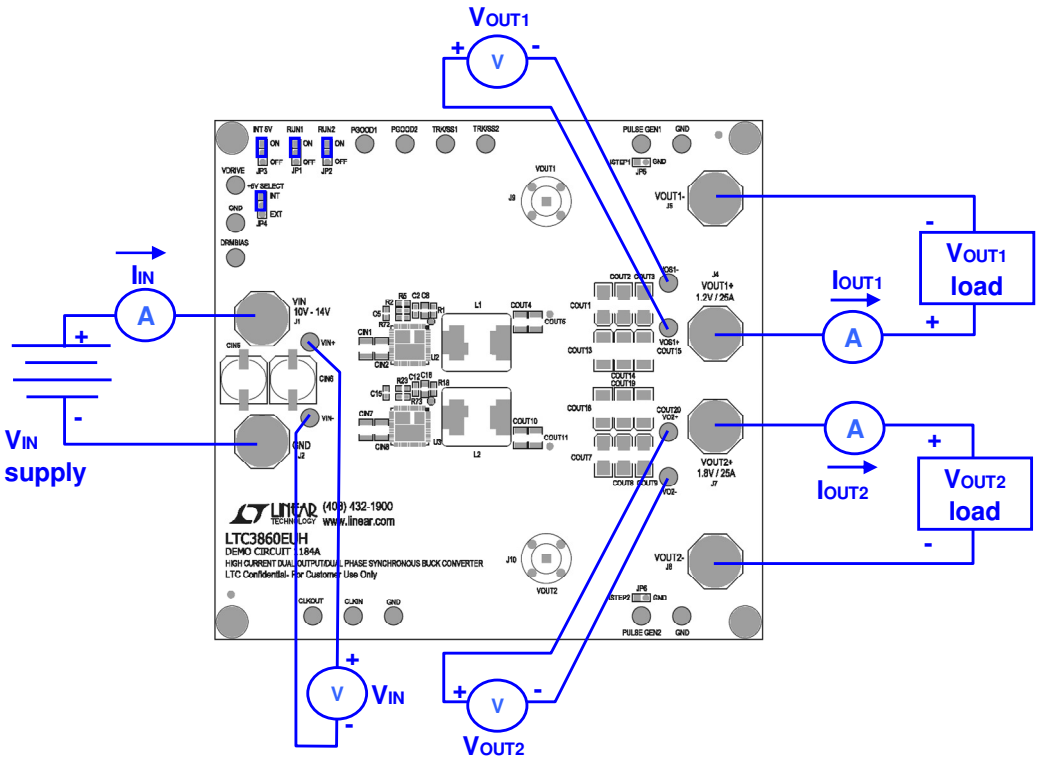


Figure 1. Proper Measurement Equipment Setup

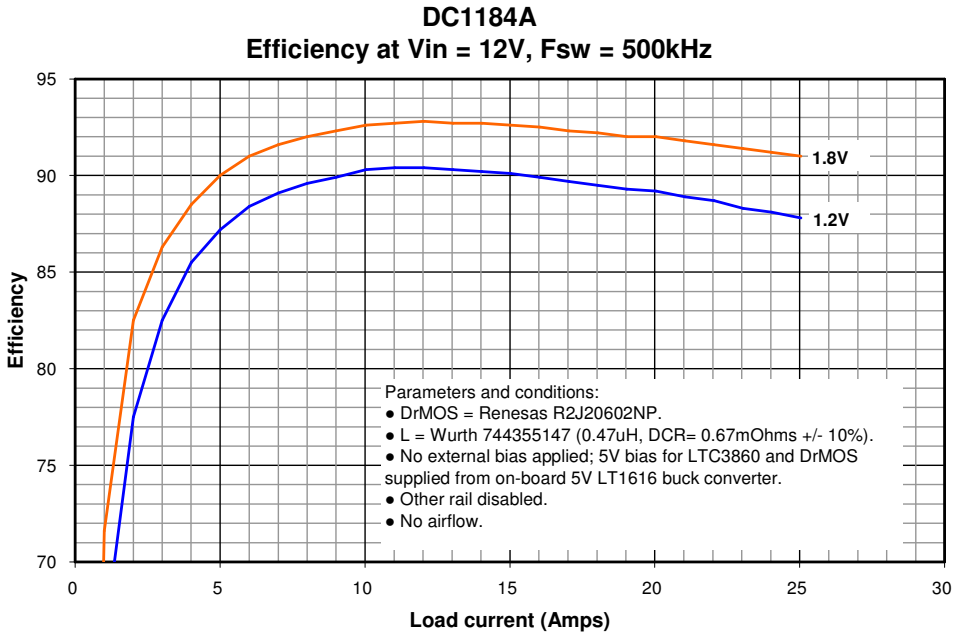
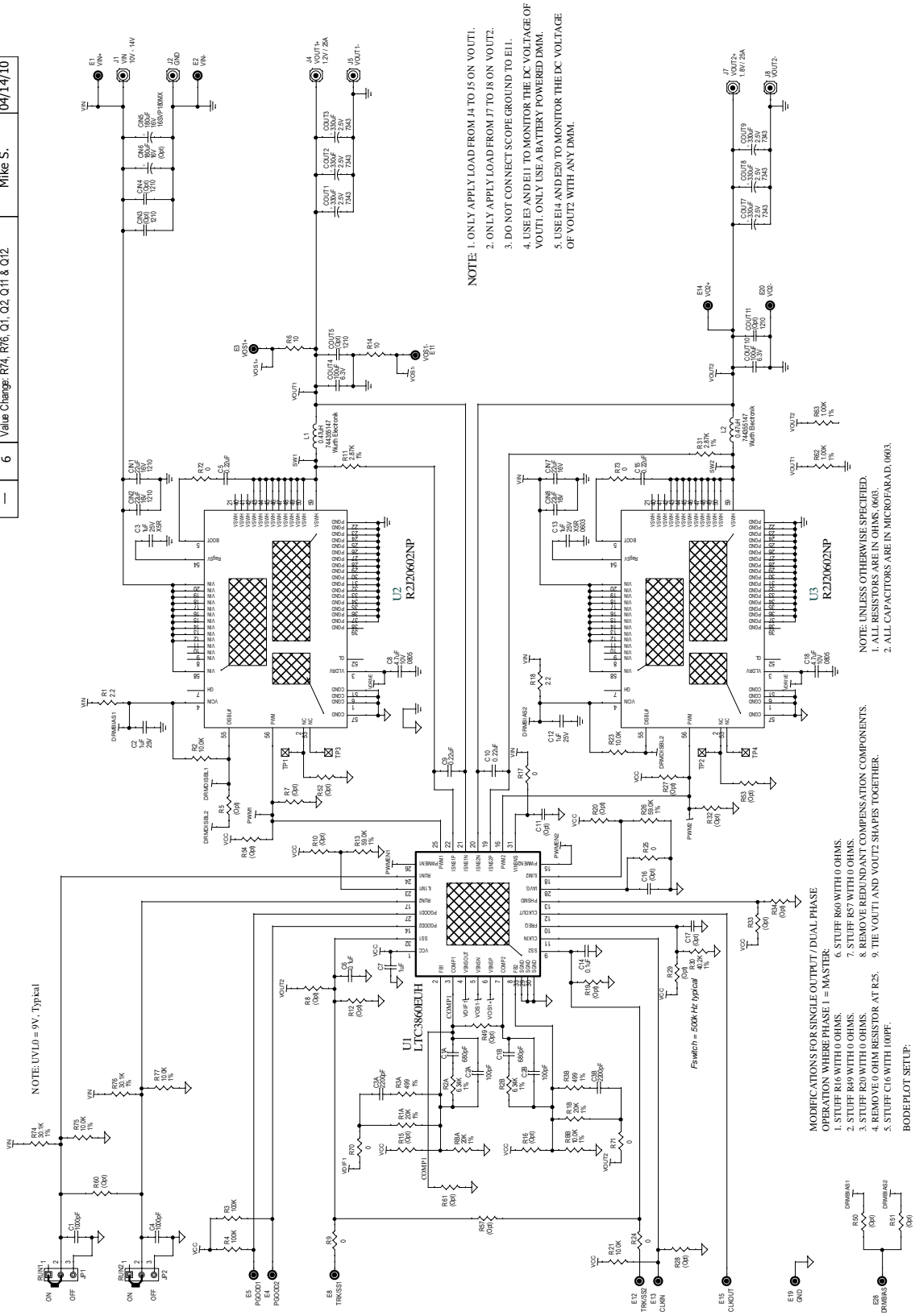
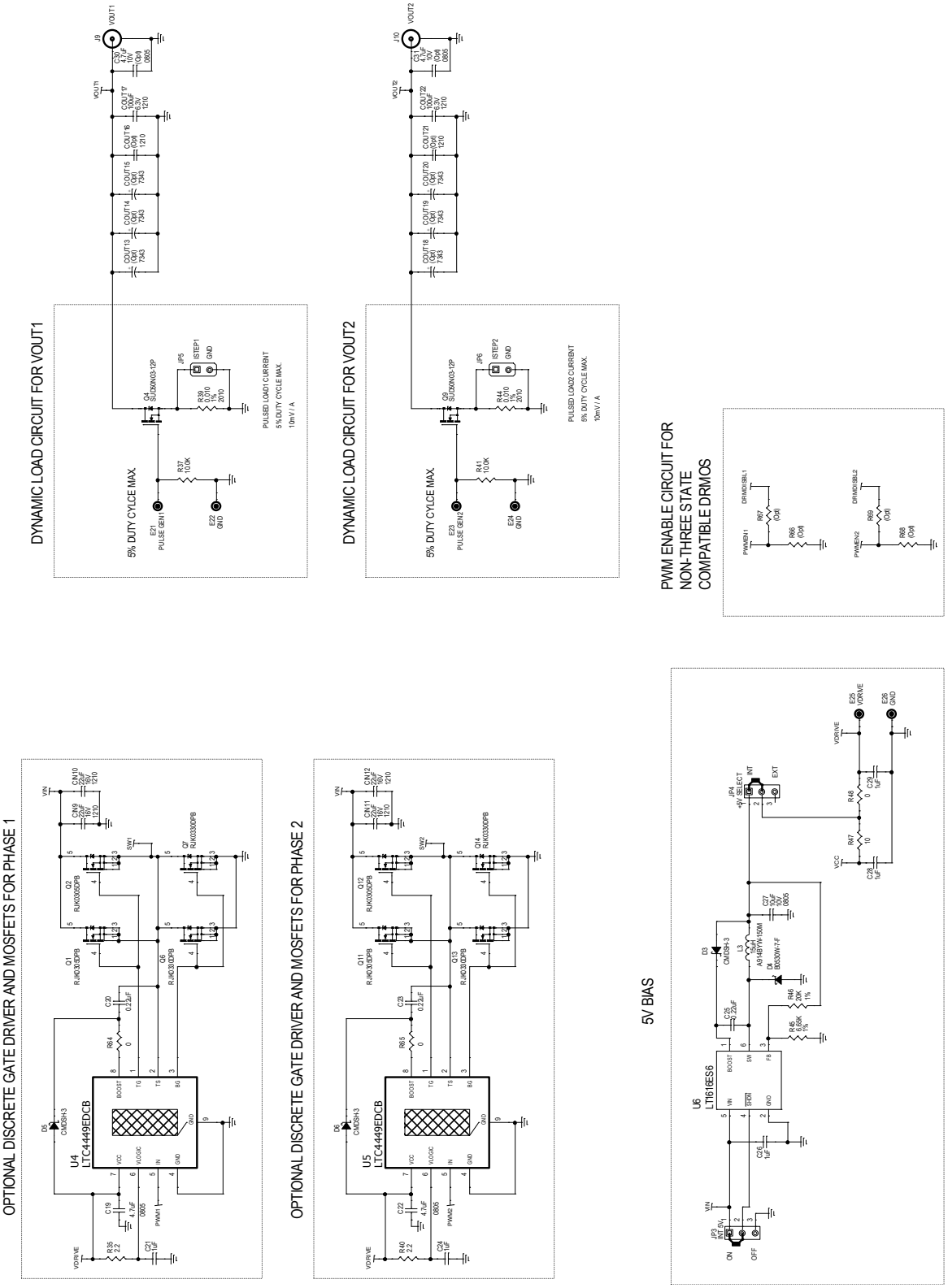


Figure 2. Typical Efficiency Curves

REVISION HISTORY

ECO	REV	DESCRIPTION	APPROVED	DATE
-	4	PRODUCTION	Mike Shriver	06/22/09
—	5	Value Change: R2A, R2B, R30, R26, R13, COUT17, COUT22, C30 & C31. (FSwitch 400kHz to 500kHz)	Mike S.	01/11/10
—	6	Value Change: R74, R76, Q1, Q2, Q11 & Q12	Mike S.	04/14/10




DYNAMIC LOAD CIRCUIT FOR VOUT1
DYNAMIC LOAD CIRCUIT FOR VOUT2
PWM ENABLE CIRCUIT FOR NON-THREE STATE COMPATIBLE DRMOS
OPTIONAL DISCRETE GATE DRIVER AND MOSFETS FOR PHASE 1
OPTIONAL DISCRETE GATE DRIVER AND MOSFETS FOR PHASE 2
5V BIAS
VOUT1
VOUT2
5% DUTY CYCLE MAX.
PULSE GEN1
PULSE GEN2
PULSED LOAD1 CURRENT
PULSED LOAD2 CURRENT
10mV / A
U4
LTC4449EDCB
U5
LTC4449EDCB
U6
LT1616ES6
VDRIVE
VCC
VIN
5V
ON
OFF
PWMEN1
PWMEN2
DRMOSBL1
DRMOSBL2