

LTM4605

20V, 5A High Efficiency Buck-Boost μ Module Regulator

DESCRIPTION

Demonstration circuit DC1198B-A features the [LTM[®]4605EV](#), the high efficiency, high density switch mode buck-boost μ Module[®] regulator. The LTM4605EV can regulate its output voltage from an input voltage above, below, or equal to the output. The input voltage range of DC1198B-A is from 4.5V to 20V with a preset output voltage of 12V. The rated load current is 5A, although derating is necessary for certain V_{IN} , V_{OUT} , and thermal conditions. The switching frequency may be synchronized to an external clock from 200kHz to 400kHz. This PLL

can be used not only to reduce undesirable frequency harmonics but also to parallel LTM4605 to provide high output current. The LTM4605 data sheet must be read in conjunction with this demo manual prior to working on or modifying DC1198B-A.

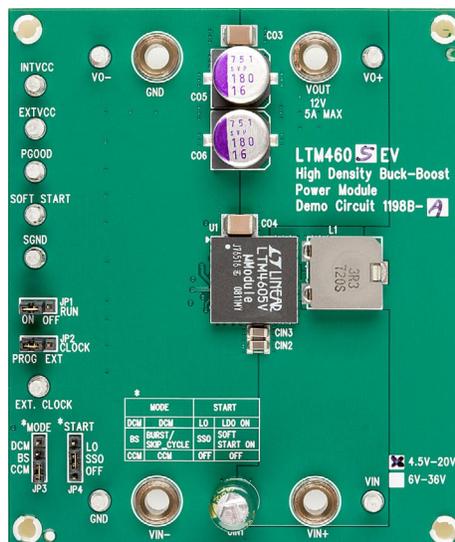
Design files for this circuit board are available at <http://www.linear.com/demo>

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PERFORMANCE SUMMARY ($T_A = 25^\circ\text{C}$)

| PARAMETER | CONDITIONS | VALUE |
|-----------------------------------|---|--|
| Input Voltage Range V_{IN} | | 4.5V to 20V |
| Output Voltage V_{OUT} | $V_{IN} = 12\text{V}$, $I_{OUT} = 5\text{A}$. | $12\text{V} \pm 2\%$ |
| Maximum Continuous Output Current | Derating Is Necessary for Certain V_{IN} , V_{OUT} , and Thermal Conditions | $5A_{DC}$ at $5V_{IN}$ $12A_{DC}$ at $V_{IN} > V_{OUT}$ |
| Default Operating Frequency | | 300kHz |
| Efficiency | $V_{IN} = 12\text{V}$, $V_{OUT} = 12\text{V}$, $I_{OUT} = 5\text{A}$ | 97.6%, See Figure 3 for More Information |
| Load Transient | $V_{IN} = 5\text{V}$, $V_{OUT} = 12\text{V}$ | See Figure 4 for Details |

BOARD PHOTO



dc1198bafa

DEMO MANUAL DC1198B-A

QUICK START PROCEDURE

Demonstration circuit DC1198B-A is an easy way to evaluate the performance of the LTM4605EV. Please refer to Figure 1 for proper measurement equipment set-up and follow the procedure below:

1. Place jumpers in the following positions for a typical $12V_{OUT}$ application:

| | | | |
|-----|-------|------|-------|
| RUN | CLOCK | MODE | START |
| ON | PROG | CCM | SSO |

2. With power off, connect the input power supply, load and meters as shown in Figure 1. Preset the load to 0A and V_{IN} supply to be less than 20V.
3. Turn on the power at the input. The output voltage should be $12V \pm 2\%$.

4. Once the proper output voltage is established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters. Cooling fan and lower current sensing resistor are necessary for $V_{IN} < 5V$ and $I_{OUT} = 5A$.
5. To measure input and output ripple, please refer to Figure 2 for proper setup.
6. The voltage of pin PLLFLTR determines the switching frequency. Modify R6 and R7 to adjust the switching frequency. Turn off the power supply before attempting to remove and replace R6 and R7. Do not allow voltage at pin PLLFLTR exceed 2.4V.
7. The Inductor, RS1 and RS2 should be modified to accommodate certain input and output condition. Please refer to the LTM4605 data sheet for recommended component values.

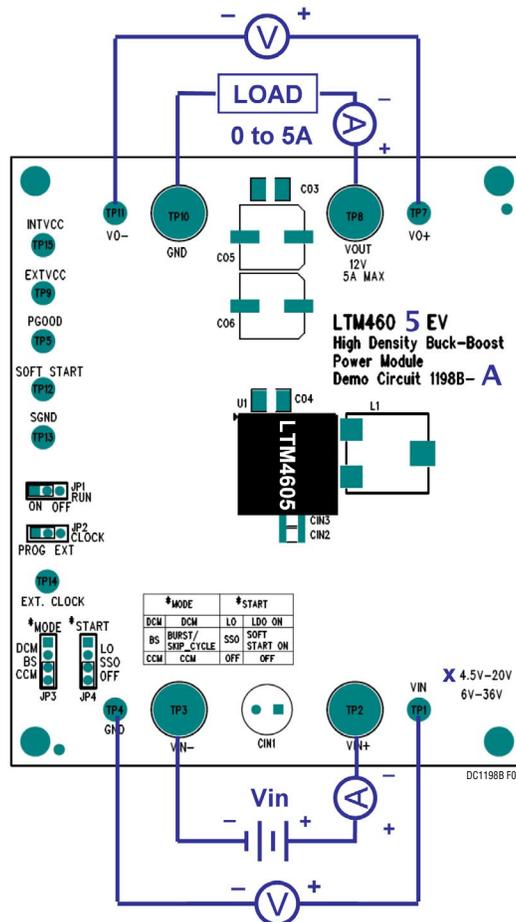
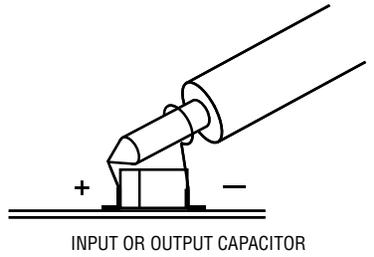


Figure 1. Test Setup of DC1198B-A

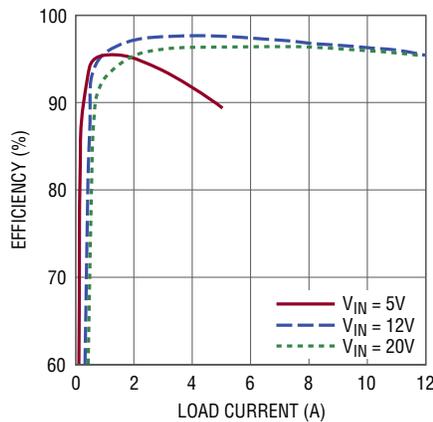
dc1198bafa

QUICK START PROCEDURE



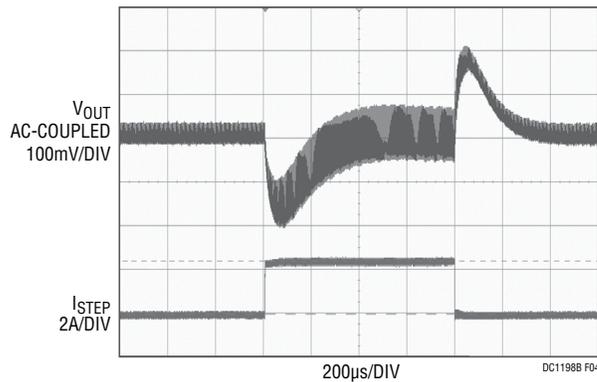
DC1198B F02

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



DC1198B F03

Figure 3. Measured Supply Efficiency with Different V_{IN} . ($V_{OUT} = 12V$)



DC1198B F04

$V_{IN} = 5V$, $V_{OUT} = 12V$
 CONTINUOUS CURRENT MODE (CCM)
 1.25A TO 3.75A LOAD STEP
 $C_{OUT} = 2 \times 22\mu F$ CERAMIC (1812, X7R), $2 \times 180\mu F$ OSCON (16V)
 PEAK-TO-PEAK OUTPUT VOLTAGE DEVIATION = 413mV

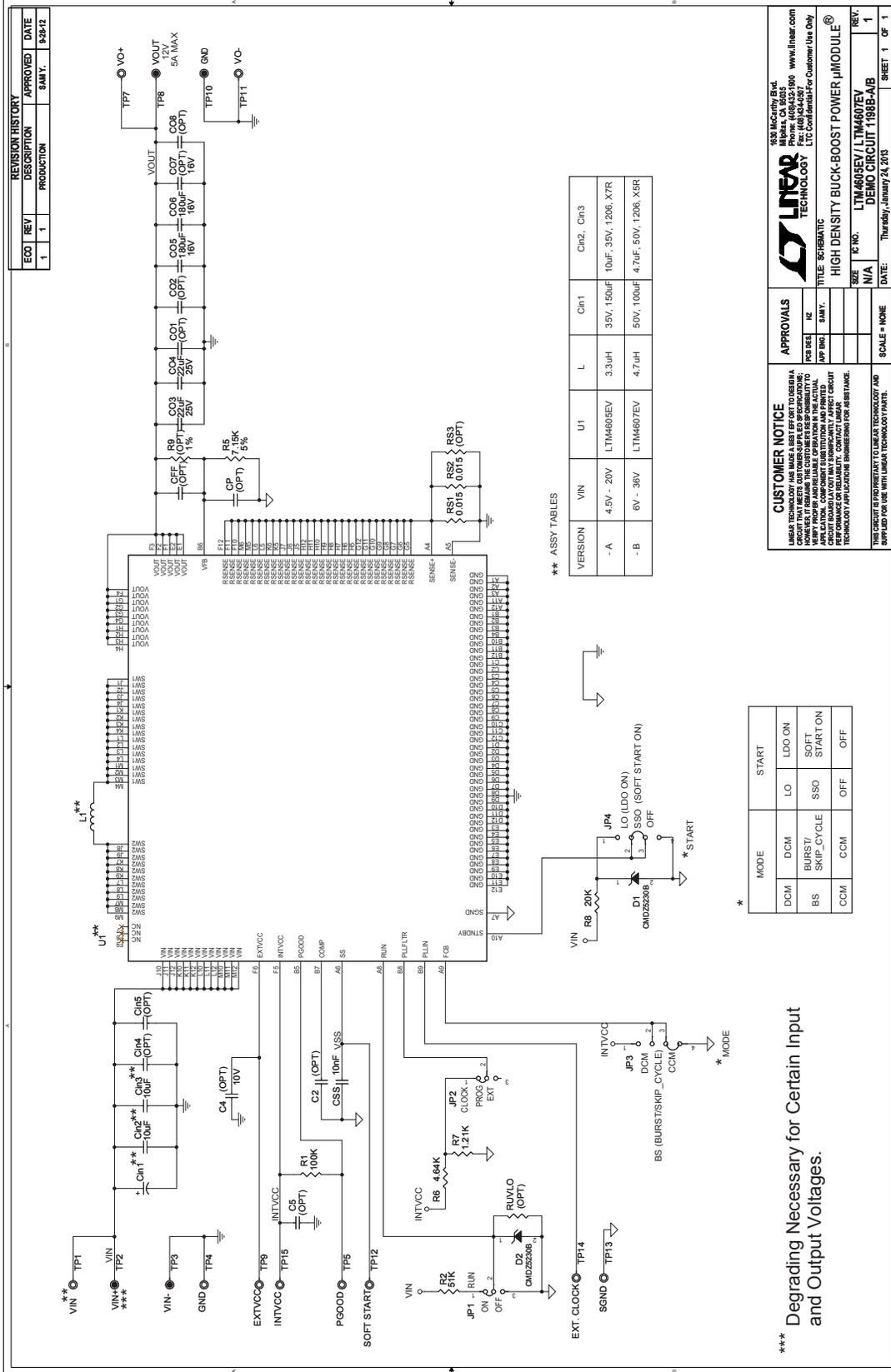
Figure 4. Measured Load Transient Response (2.5A Step, 25% to 75%)

DEMO MANUAL DC1198B-A

PARTS LIST

| ITEM | QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|--|-----|---------------------------------------|-----------------------------------|--|
| Required Circuit Components | | | | |
| 1 | 1 | CIN1 | CAP, ALUM, 150µF, 20%, 35V | SANYO, 35ME150WXV+TS (NOW SUNCON 35ME150WXV) |
| 2 | 2 | CIN2, CIN3 | CAP, X7R, 10µF, 20%, 35V, 1206 | TAIYO YUDEN, GMK316BJ106ML-T |
| 3 | 1 | CSS | CAP, X7R, 0.01µF, 25V, 10%, 0603 | AVX 06033C103KAT4A |
| 4 | 2 | CO3, CO4 | CAP, X7R, 22µF, 16V, 20%, 1812 | TDK C4532X7R1C226M |
| 5 | 2 | CO5, CO6 | CAP, OS-CON, 180µF, 16V | SANYO 16SVP180MX |
| 6 | 1 | L1 | IND IRON POWER SMT FIXED, 3.3µH | TOKO FD1254-3R3M=P3 |
| 7 | 1 | R5 | RES, CHIP, 7.15k, 1/16W, 1%, 0603 | VISHAY CRCW06037K15FKEA |
| 8 | 1 | R6 | RES, CHIP, 4.64k, 1/16W, 1%, 0603 | VISHAY CRCW06034K64FKEA |
| 9 | 1 | R7 | RES, CHIP, 1.21k, 1/16W, 1%, 0603 | VISHAY CRCW06031K21FKEA |
| 10 | 2 | RS1, RS2 | RES, CHIP, 0.015 1/2W, 1%, 1206 | VISHAY WSL1206R0150FEA |
| 11 | 1 | U1 | I.C., LTM4605EV#PBF | LINEAR TECHNOLOGY CORPORATION LTM4605EV#PBF |
| Additional Demo Board Circuit Components | | | | |
| 1 | 0 | CIN4, CIN5 (OPT) | CAP, 1206 | |
| 2 | 0 | C2, C4, C5, CP, CFF (OPT) | CAP, 0603 | |
| 3 | 0 | CO1, CO2 (OPT) | CAP, SVP, 100µF, D3L | |
| 4 | 0 | CO7 (OPT) | CAP, 1206, 16V | |
| 5 | 0 | CO8 (OPT) | POSCAP, D3L | |
| 6 | 2 | D1, D2 | ZENER DIODE, 4.7V | CENTRAL SEMICONDUCTOR CMDZ5230B-7-F |
| 7 | 1 | R1 | RES, CHIP, 100k, 1/16W, 5%, 0603 | VISHAY CRCW0603100KJNEA |
| 8 | 1 | R2 | RES, CHIP, 51k, 1/16W, 5%, 0603 | VISHAY CRCW060351K0JNEA |
| 9 | 1 | R8 | RES, CHIP, 20k, 1/16W, 1%, 0603 | VISHAY CRCW060320K0FKEA |
| 10 | 1 | RS3 (OPT) | RES, 1206 | |
| 11 | 1 | R9, RUVLO (OPT) | RES, 0603 | |
| Hardware/Components (For Demo Board Only) | | | | |
| 1 | 2 | JP1, JP2 | 2mm SINGLE ROW HEADER, 3 PIN | SAMTEC TMM-103-02-L-S |
| 2 | 2 | JP3, JP4 | 2mm SINGLE ROW HEADER, 4 PIN | SAMTEC TMM-104-02-L-S |
| 3 | 4 | JP1, JP2, JP3, JP4 | SHUNT | SAMTEC 2SN-BK-G |
| 4 | 10 | TP1, TP4, TP5, TP7, TP9, TP11 TO TP15 | TESTPOINT, TURRET, 0.095" | MILL-MAX 2501-2-00-80-00-00-07-0 |
| 5 | 4 | TP2, TP3, TP8, TP10 | BANANA JACK | KEYSTONE 575-4 |
| 6 | 4 | STAND OFF | STAND OFF, NYLON 0.50" TALL | KEYSTONE 8833 (SNAP ON) |

SCHEMATIC DIAGRAM



DEMO MANUAL DC1198B-A

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