

## LTM4605 20V, 5A High Efficiency Buck-Boost $\mu$ Module Regulator

### DESCRIPTION

Demonstration circuit DC1198A-A features the LTM<sup>®</sup>4605EV, the high efficiency, high density switch mode buck-boost  $\mu$ Module<sup>®</sup> regulator. The LTM4605EV can regulate its output voltage from an input voltage above, below, or equal to the output. The input voltage range of DC1198A-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 DC1198A-A.

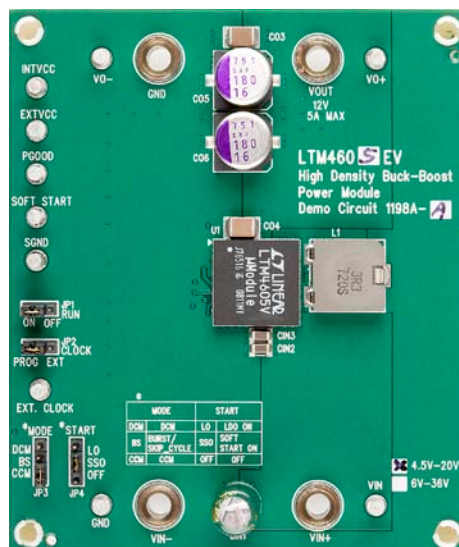
**Design files for this circuit board are available at <http://www.linear.com/demo>**

LT, LT, LTC, LTM,  $\mu$ Module, Linear Technology and the Linear logo are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

### PERFORMANCE SUMMARY (T<sub>A</sub> = 25°C)

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

### BOARD PHOTO



dc1198aaf

# DEMO MANUAL DC1198A-A

## QUICK START PROCEDURE

Demonstration circuit DC1198A-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<sub>OUT</sub> 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<sub>IN</sub> supply to be less than 20V.
3. Turn on the power at the input. The output voltage should be 12V ± 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<sub>IN</sub> < 5V and I<sub>OUT</sub> = 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.

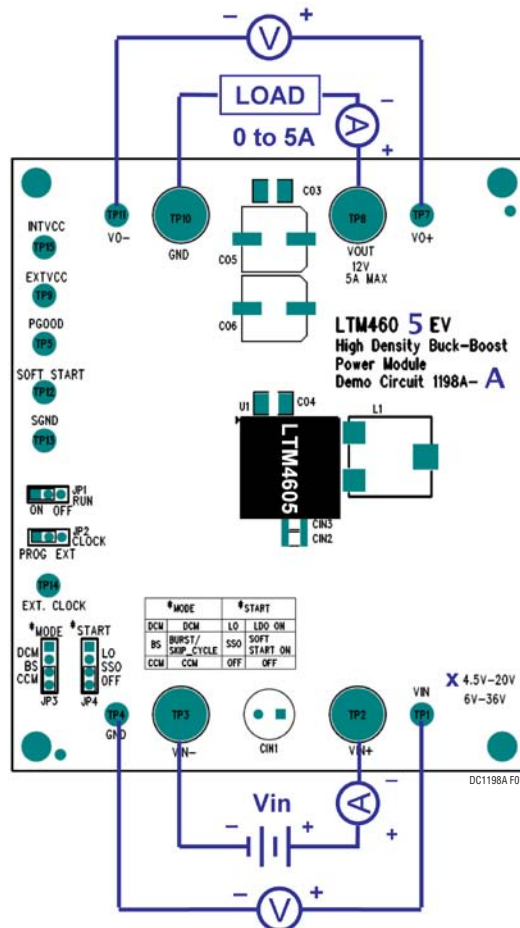
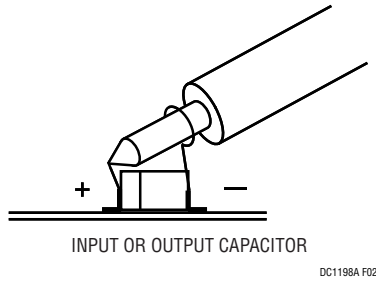


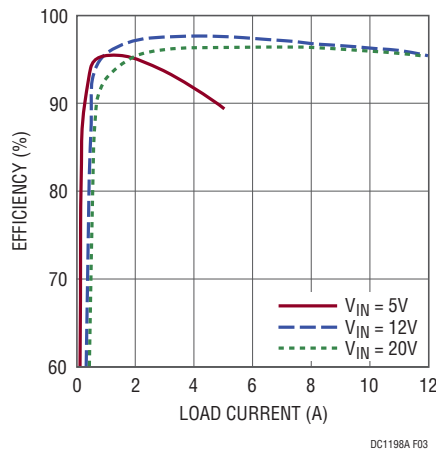
Figure 1. Test Setup of DC1198A-A

dc1198aaf

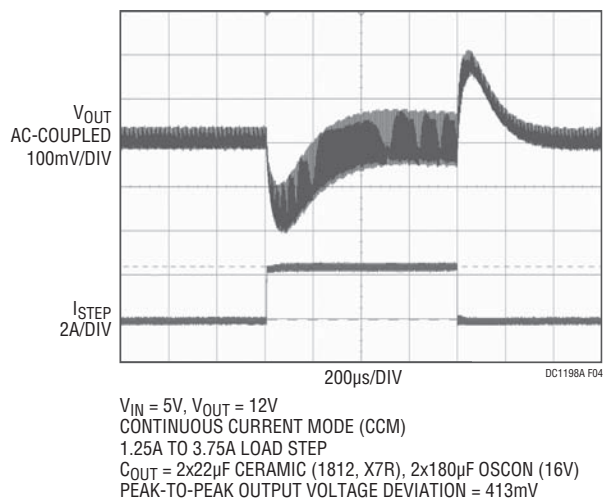
**QUICK START PROCEDURE**



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



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



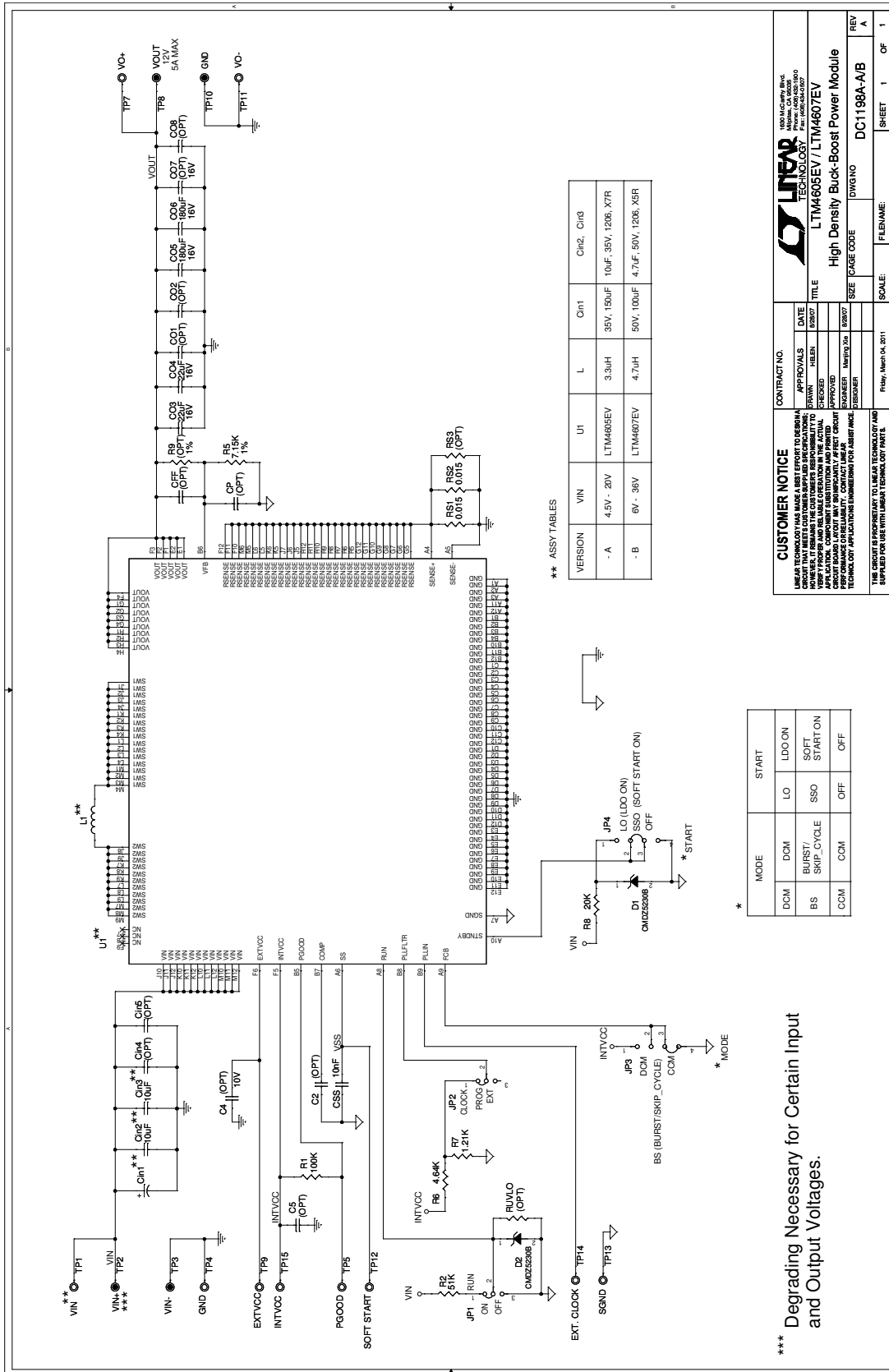
**Figure 4. Measured Load Transient Response (2.5A Step, 25% to 75%)**

# DEMO MANUAL DC1198A-A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
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	IRC LRC-LRF1206-01-R015-F
11	1	U1	I.C., LTM4605EV#PBF	LINEAR TECHNOLOGY CORPORATION LTM4605EV#PBF
<b>Additional Demo Board Circuit Components</b>				
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	
<b>Hardware/Components (For Demo Board Only)</b>				
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**



**\*\* ASSY TABLES**

VERSION	VIN	Ui	U1	Ch1	Ch2	Ch3
-A	4.5V - 20V	LTM4607EV	3.3uH	10uF, 150uF	35V, 1206, X7R	
-B	6V - 39V	LTM4607EV	4.7uH	50V, 100uF	4.7uF, 50V, 1206, X5R	

**\* MODE**

MODE	START
DCM	LDO ON
BURST/SKIP_CYCLE	SOFT START ON
CCM	OFF

\*\*\* Degrading Necessary for Certain Input and Output Voltages.

**CUSTOMER NOTICE**  
 LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN AND MANUFACTURE THIS PRODUCT TO MEET THE SPECIFICATIONS AND REQUIREMENTS OF THE CUSTOMER'S ORDER. LINEAR TECHNOLOGY DOES NOT WARRANT THE PERFORMANCE OF THIS PRODUCT IN ANY PARTICULAR APPLICATION. THE CUSTOMER IS RESPONSIBLE FOR VERIFYING THE PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. LINEAR TECHNOLOGY ACCEPTS NO LIABILITY FOR ANY DAMAGE TO PROPERTY OR PERSONS ARISING FROM THE USE OF THIS PRODUCT. THE CUSTOMER SHALL INDEMNIFY AND HOLD LINEAR TECHNOLOGY HARMLESS FROM ALL SUCH DAMAGES.

**CONTRACT NO.** \_\_\_\_\_  
**APPROVALS**  
 DRAWN: \_\_\_\_\_ DATE: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_  
 APPROVED: \_\_\_\_\_  
 ENGINEER: \_\_\_\_\_  
 DESIGNER: \_\_\_\_\_

**FILE NAME:** \_\_\_\_\_  
**SCALE:** \_\_\_\_\_  
**SHEET:** 1 OF 1

**LINEAR TECHNOLOGY**  
 1000 Massachusetts Blvd  
 Lincoln, MA 01916  
 Phone: (417) 254-3200  
 Fax: (417) 254-3201  
**MODEL NO.** LTM4607EV/LTM4607EV  
**TITLE** High Density Buck-Boost Power Module  
**SIZE** CAGE CODE \_\_\_\_\_  
**DWG NO.** DC1198A-A/B  
**REV** A

THE CIRCUIT IS PROPRIETARY TO LINEAR TECHNOLOGY AND IS SUPPLIED FOR USE WITH LINEAR TECHNOLOGY PARTS.



Information furnished by Linear Technology Corporation is believed to be accurate and reliable. However, no responsibility is assumed for its use. Linear Technology Corporation makes no representation that the interconnection of its circuits as described herein will not infringe on existing patent rights.

# DEMO MANUAL DC1198A-A

---

## DEMONSTRATION BOARD IMPORTANT NOTICE

Linear Technology Corporation (LTC) provides the enclosed product(s) under the following **AS IS** conditions:

This demonstration board (DEMO BOARD) kit being sold or provided by Linear Technology is intended for use for **ENGINEERING DEVELOPMENT OR EVALUATION PURPOSES ONLY** and is not provided by LTC for commercial use. As such, the DEMO BOARD herein may not be complete in terms of required design-, marketing-, and/or manufacturing-related protective considerations, including but not limited to product safety measures typically found in finished commercial goods. As a prototype, this product does not fall within the scope of the European Union directive on electromagnetic compatibility and therefore may or may not meet the technical requirements of the directive, or other regulations.

If this evaluation kit does not meet the specifications recited in the DEMO BOARD manual the kit may be returned within 30 days from the date of delivery for a full refund. **THE FOREGOING WARRANTY IS THE EXCLUSIVE WARRANTY MADE BY THE SELLER TO BUYER AND IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED, OR STATUTORY, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE. EXCEPT TO THE EXTENT OF THIS INDEMNITY, NEITHER PARTY SHALL BE LIABLE TO THE OTHER FOR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES.**

The user assumes all responsibility and liability for proper and safe handling of the goods. Further, the user releases LTC from all claims arising from the handling or use of the goods. Due to the open construction of the product, it is the user's responsibility to take any and all appropriate precautions with regard to electrostatic discharge. Also be aware that the products herein may not be regulatory compliant or agency certified (FCC, UL, CE, etc.).

No License is granted under any patent right or other intellectual property whatsoever. **LTC assumes no liability for applications assistance, customer product design, software performance, or infringement of patents or any other intellectual property rights of any kind.**

LTC currently services a variety of customers for products around the world, and therefore this transaction **is not exclusive**.

**Please read the DEMO BOARD manual prior to handling the product.** Persons handling this product must have electronics training and observe good laboratory practice standards. **Common sense is encouraged.**

This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

Mailing Address:

Linear Technology  
1630 McCarthy Blvd.  
Milpitas, CA 95035

Copyright © 2004, Linear Technology Corporation