

LTC7138

High Efficiency, High V_{IN} , Step-Down Regulator

DESCRIPTION

Demonstration circuit 2172A is a high input voltage, 400mA step-down regulator featuring the LTC7138. The output of the regulator can be programmed for either 5V, 3.3V or 1.8V with on-board jumpers or is adjustable from 800mV to V_{IN} using an optional feedback divider. The input voltage range is from 4V to 140V. The LTC7138's Burst Mode[®] operation, low quiescent current and internal top FET switch provide high efficiency over a wide range of loads.

Other features include:

- Optional components to adjust the current limit, make it proportional to V_{IN} or improve the efficiency and reduce the output voltage ripple.

- FBO turret to tie two or more LTC7138 regulators together if the application requires more load current.
- Optional UVLO and OVLO divider.
- External/internal soft-start.

For more details, refer to the LTC7138 data sheet. The LTC7138 data sheet gives a complete description of the IC operation and application information. The data sheet must be read in conjunction with this quick start guide.

Design files for this circuit board are available at
<http://www.linear.com/demo/DC2172A>

LT, LTC, LTM, Burst Mode, 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

Specifications are at $T_A = 25^\circ\text{C}$

PARAMETER	CONDITIONS	VALUE
Input Voltage Range		4V to 140V
5.0V Output Voltage	$V_{IN} = 12\text{V}$, $I_{OUT} = 0\text{mA}$ to 400mA	5.0V $\pm 2\%$
3.3V Output Voltage	$V_{IN} = 12\text{V}$, $I_{OUT} = 0\text{mA}$ to 400mA	3.3V $\pm 2\%$
1.8V Output Voltage	$V_{IN} = 12\text{V}$, $I_{OUT} = 0\text{mA}$ to 400mA	1.8V $\pm 2\%$
Maximum Output Current, I_{OUT}	$V_{IN} = 4\text{V}$ to 140V, $V_{OUT} = 5.0, 3.3\text{V}, 1.8\text{V}$ or ADJ ($V_{OUT} \leq V_{IN}$)	400mA
Typical Efficiency	$V_{IN} = 12\text{V}$, $V_{OUT} = 5\text{V}$, $I_{OUT} = 400\text{mA}$	82.3%
Typical Output Ripple	$V_{IN} = 12\text{V}$, $V_{OUT} = 5\text{V}$, $I_{OUT} = 400\text{mA}$	87mV _{p-p}

QUICK START PROCEDURE

Demonstration circuit 2172A is easy to set up to evaluate the performance of the LTC7138. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

- 1) With power off, connect the input supply, load and meters as shown in Figure 1. Preset the load to 0A and V_{IN} supply to 0V.
- 2) Place the RUN pin jumper (JP3) in the ON position.
- 3) Set the output to 5V by placing the JP1 jumper in the B position and the JP2 jumper in the A position.
- 4) Turn-on the V_{IN} supply and increase to 12V. The 5V output should be $5V \pm 2\%$ per the Performance Summary table.
- 5) Next, apply 400mA load to the output and re-measure V_{OUT} .
- 6) Once the DC regulation is confirmed, observe the output voltage ripple, load step response, efficiency and other parameters for the 5V, 3.3V and 1.8V output settings.

Note 1. CAUTION: The maximum input voltage of the DC2172A is 140V. Voltages of 140V or lower are high enough to cause electric shock. Use great care when testing this demo board.

Note 2. For a 5V output, the input voltage should be 6V or more.

Note 3. When measuring the output or input voltage ripple, do not use the long ground lead on the oscilloscope probe. See Figure 2 for the proper scope probe technique. Short, stiff leads need to be soldered to the (+) and (–) terminals of an output capacitor. The probe's ground ring needs to touch the (–) lead and the probe tip needs to touch the (+) lead.

QUICK START PROCEDURE

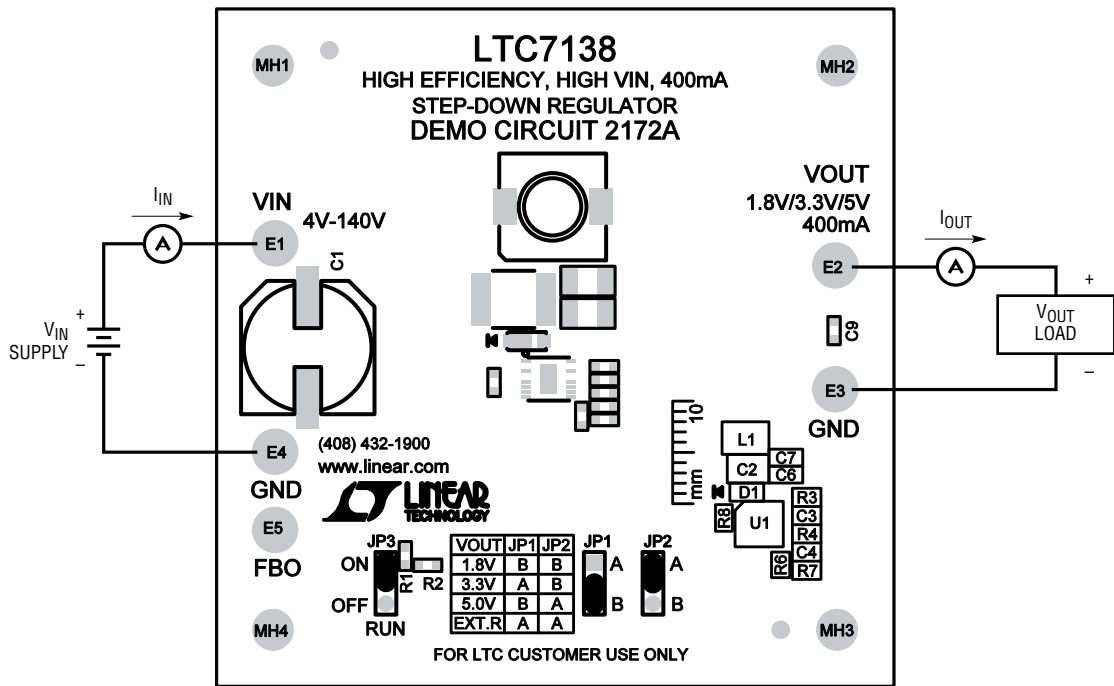


Figure 1. Proper Measurement Equipment Setup

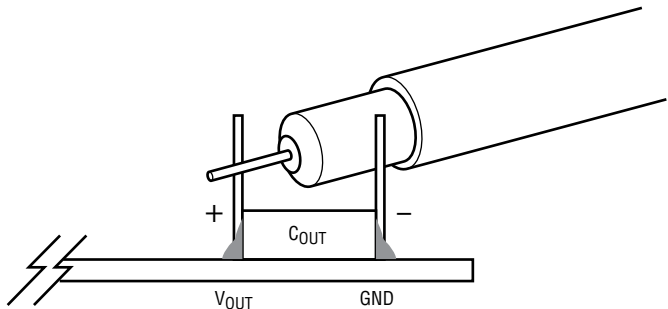


Figure 2. Measuring Output Voltage Ripple

QUICK START PROCEDURE

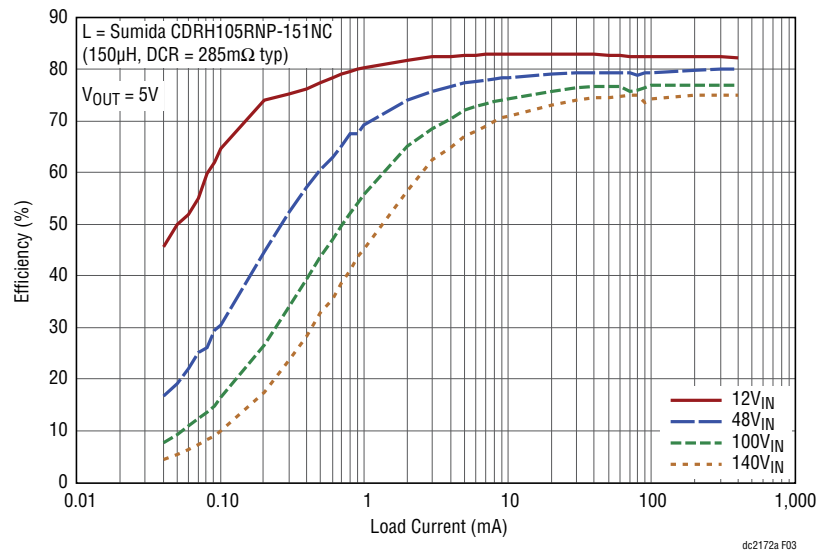


Figure 3. Efficiency at 5V_{OUT}

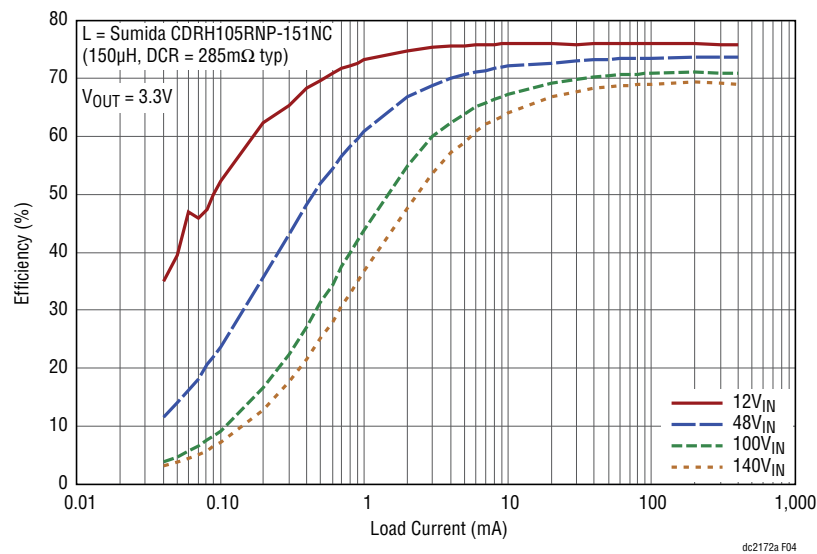


Figure 4. Efficiency at 3.3V_{OUT}

QUICK START PROCEDURE

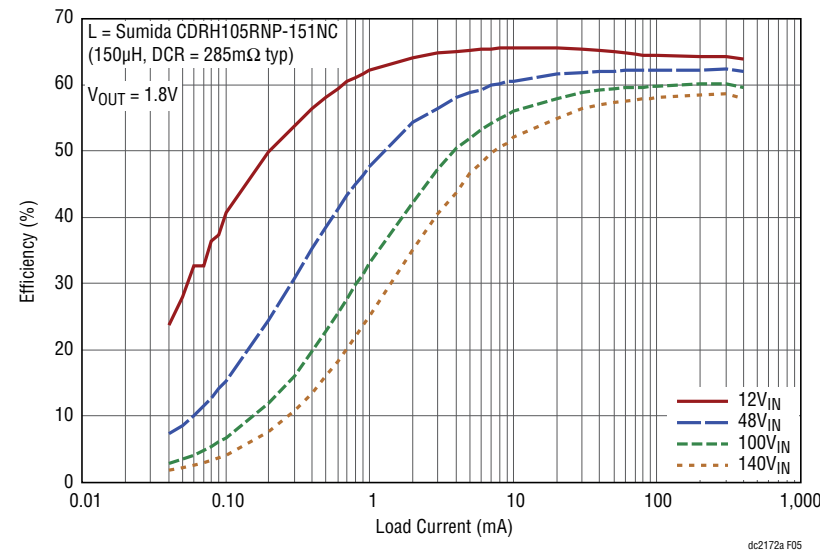


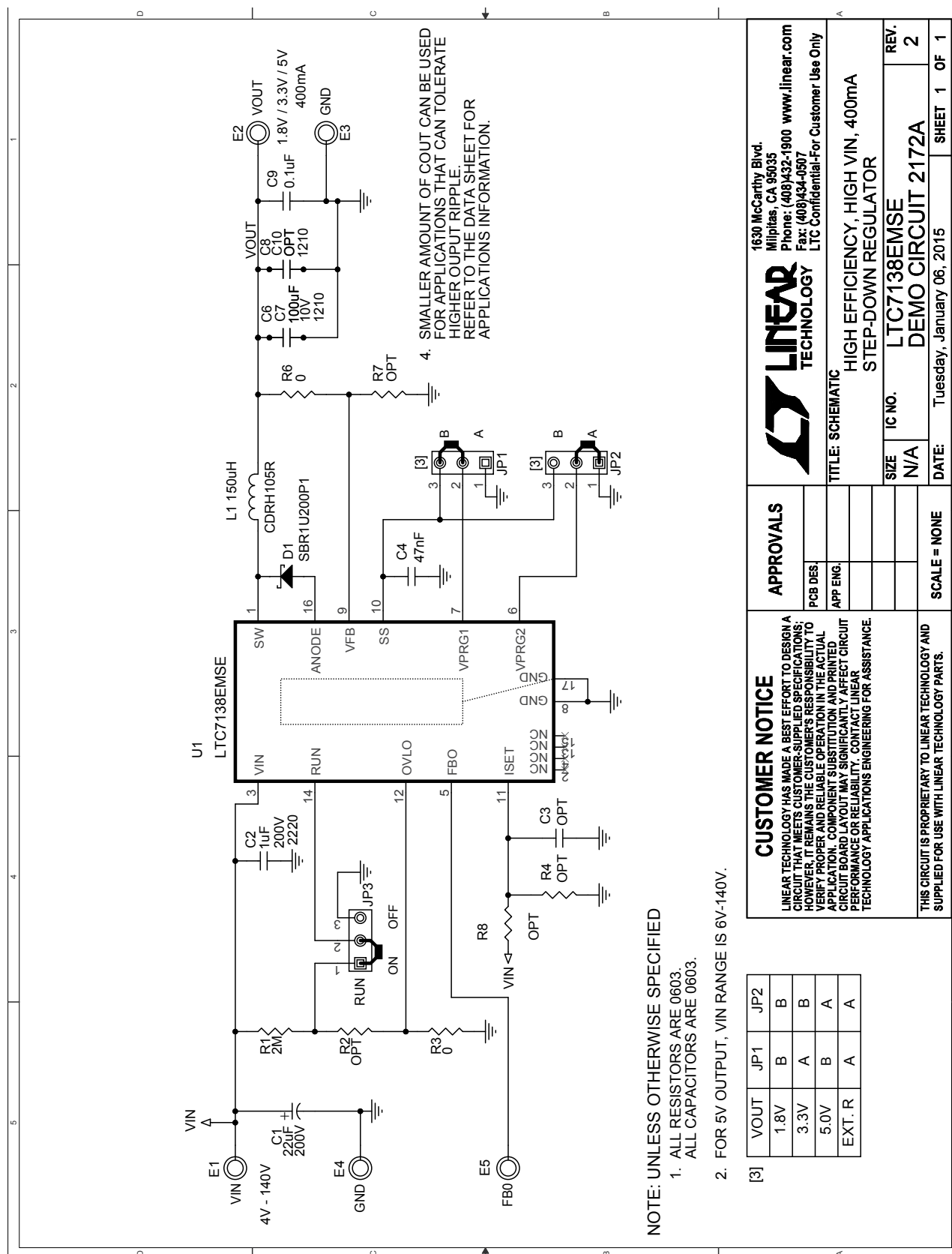
Figure 5. Efficiency at 1.8V_{OUT}

DEMO MANUAL DC2172A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	CAP 22 μ F, 200V, ELEC	NIPPON CHEMI-CON, EMVE201ARA220MKG5S
2	1	C2	CAP 1 μ F, 2220, 10%, 200V, X7R	KEMET C2220X105K2RACTU
3	1	C4	CAP 47nF, 0603, 10%, 25V, X7R	AVX 06033C473KAT2A
4	2	C6, C7	CAP 100 μ F, 1210, 20%, 10V, X7R	TAIYO YUDEN LMK325ABJ107MMH-T
5	1	C9	CAP 0.1 μ F, 0603, 10%, 25V, X7R	AVX 06033C104KAT2A
6	1	D1	DIODE SBR1U200P1	DIODES, SBR1U200P1-7
7	1	L1	INDUCTOR 150 μ H	SUMIDA CDRH105RNP-151NC
8	1	R1	RES 2M, 0603 Ω , 5%, 1/10W	VISHAY CRCW06032M00JNEA
9	1	U1	IC LTC7138EMSE	LINEAR TECH LTC7138EMSE#PBF
Additional Demo Board Circuit Components				
1	0	C3	CAP 0603 OPTION	OPTION
2	0	C8, C10	CAP 1210 OPTION	OPTION
3	0	R2, R4, R7, R8	RES 0603 OPTION	OPTION
4	2	R3, R6	RES 0 Ω 0603 JUMPER	VISHAY CRCW06030000Z0ED
Hardware				
1	5	E1, E2, E3, E4, E5	TURRET	MILL-MAX 2501-2-00-80-00-00-07-0
2	3	JP1, JP2, JP3	HEADER 2mm PIN	SULLINS, NRPN031PAEN-RC
3	4	MH1, MH2, MH3, MH4	STANDOFF SNAP ON	KEYSTONE_8831
4	3	JP1, JP2, JP3	SHUNT 2mm	SAMTEC 2SN-BK-G

SCHEMATIC DIAGRAM



NOTE: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTORS ARE 0603.
ALL CAPACITORS ARE 0603.
2. FOR 5V OUTPUT, VIN RANGE

VOUT	JP1	JP2
1.8V	B	B
3.3V	A	B
5.0V	B	A
EXT. R	A	A

CUSTOMER NOTICE

LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS CUSTOMER-SUPPLIED SPECIFICATIONS; HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. COMPONENT SUBSTITUTION AND PRINTED CIRCUIT BOARD LAYOUT MAY SIGNIFICANTLY AFFECT CIRCUIT PERFORMANCE OR RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

APPROVALS

[illegible]

LINEAR
TECHNOLOGY

Free one hour seminar for a limited number of seats

TITLE: SCHEMATIC

DATE:	Tuesday, January 06, 2015	SHEET 1	OF 1
SIZE	N/A	IC NO.	LTC7138EMSE DEMO CIRCUIT 2172A
REV.	2		

DEMO MANUAL DC2172A

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

dc2172af