



LTC7149

60V, Low IQ High Voltage, Negative Output Monolithic Synchronous Regulator

DESCRIPTION

Demonstration circuit 2354A is a high input voltage, high efficiency synchronous monolithic step-down converter with negative output featuring the LTC7149. The DC2354A has wide input voltage range from 3.5V up to 55V. The output voltage of the DC2354A can be set as to -3.3V or -5V and "User Select" option of DC2354A allows output voltage to be in a rage from 0V to -60V. However voltage difference between user-selected negative output voltage $(-V_{OLIT})$ and maximum input voltage (V_{IN}) , should not exceed 60V. $|-V_{OUT}| + V_{IN} < 60V$. DC2354A is capable of delivering up to 4A of output current, nevertheless at lower input voltage load current should be reduced in accordance to enclosed derating curves. DC2354A supports three operation modes: Fixed-frequency modulation, Burst Mode[™] operation and user can synchronize it with external clock also. Fixed-frequency mode of operation maximizes the output current, reduces output voltage ripple, and yields a low noise switching spectrum. Burst Mode operation employs a variable frequency switching algorithm that minimizes the no-load input quiescent current and improves efficiency at light loads.

The DC2354A consumes less than 15μA of quiescent current during shutdown and it consumes less than 600μA at no-load conditions in Burst Mode of operation. The DC2354A has a standard operating frequency of 500kHz, but can be adjusted in a range between 300kHz and as high as 3MHz. LTC7149, which is used in DC2354A, integrates top and bottom N-Channel MOSFETs, significantly reducing overall circuit footprint. DC2354A was designed to support multiple footprints of input/output capacitors and inductors to accommodate variety of applications. The data sheet of LTC7149 gives a complete description functionality of this regulator; also contains operation and application information and must be read in conjunction with this manual for Demonstration circuit 2354A.

Design files for this circuit board are available at http://www.linear.com/demo/DC2354A

T, LT, LTC, LTM, Linear Technology, the Linear logo and Burst Mode 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°C

| PARAMETER | CONDITIONS/NOTES | VALUE |
|--|--|------------------------|
| Minimum Input Voltage | | 3.5V |
| Maximum Input Voltage | | 55V |
| Output Voltage V _{OUT} Regulation | $V_{IN} = 3.5V - 60V$ | -5V ± 2% or -3.3V ± 2% |
| Maximum Continuous Output Current | V _{OUT} - | 4A |
| Preset Operating Frequency | R10 = 200kΩ | 500kHz |
| External Clock Sync. Frequency Range | | 300kHz – 3MHz |
| Efficiency | $V_{IN} = 12V$, $V_{OUT}^- = -5V$, $I_{OUT} = 1A$ $V_{IN} = 12V$, $V_{OUT}^- = -3.3V$, $I_{OUT} = 1A$ | 90% 90% |
| Typical Output Ripple V _{OUT} | $V_{IN} = 12V, V_{OUT}^- = -5V, I_{OUT} = 1A (20MHz BW)$ | <15mV _{P-P} |
| Quiescent Current at Shutdown | $V_{IN} = 3.5V - 55V$ | <14μΑ |
| Input Current at No-Load | V _{IN} = 3.5V – 55V, Burst Mode Operation | <600μΑ |



Demonstration circuit 2354A is easy to set up to evaluate the performance of the LTC7149. For proper measurement equipment configuration, set up the circuit according to the diagram in Figure 1. Before proceeding to test, insert shunt into JP2 (RUN) into OFF position, which connects the RUN pin to ground (GND), and thus, shutdown the output. Set jumper JP1 (MODE) into FCC (Forced Counties Conduction Mode) position. Set jumper JP3 (V_{OUT}^-) into -5.0V position.

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 V_{IN} or V_{OUT}^- and GND terminals. See Figure 2 for proper scope probe technique.

- 1. With the DC2354A set up according to the proper measurement and equipment in Figure 1, apply 16V at V_{IN} . Measure V_{OUT}^- ; it should read 0V. If desired, one can measure the shutdown supply current at this point. The supply current will be approximately 14 μ A, or less, in shutdown.
- 2. Turn on V_{OUT} of the circuit by inserting the shunt in header JP2 (RUN) into the ON position. The output voltage should be regulating. Measure V_{OUT} and it should measure –5.0V ±2%. Vary the current load, which should not exceed 4A. Vary the input voltage from 3.5V to 55V, the V_{OUT}, it should measure –5.0V ±2%. Maximum load current is function of input voltage and should be changed accordance to derating graphs on Figure 3.

- Set JP2 (RUN) into OFF and then jumper JP3 (V_{OUT}⁻) into -3.3V position.
- 4. Turn on V_{OUT2} of the circuit by inserting the shunt in header JP2 (RUN) into the ON position. The output voltage should be regulating. Measure V_{OUT} , it should measure -3.3V $\pm 2\%$ (do not apply more than the maximum voltage of 55V to the board or the part may be damaged). Vary the current load, which should not exceed 4A. Vary the input voltage from 3.5V to 55V, the V_{OUT} , it should measure -3.3V $\pm 2\%$.
- 5. Set output current to zero and move jumper JP1 (MODE) into BURST position and measure V_{OUT}^- , which should be $-3.3V \pm 2\%$.
- Set output current to zero and move jumper JP1 (MODE) into BURST position and measure V_{OUT}-, which should be -5V ±2%...

DC2354A supports synchronization to external clock referenced to input GND; use EXT_SYNC terminal for synchronization. PG00D signal also referenced to input GND, to activate PG00D functionality connect external voltage source to terminals VL0GIC and GND. DC2354A supports also EXTV $_{CC}$ function, however, EXTV $_{CC}$ is referenced to V_{OUT}^{-} . Remove R5 and install optional R33 10Ω resistor if external EXTV $_{CC}$ voltage source is used.

Note: Do not apply more than the maximum voltage of 55V to the board or the part may be damaged.

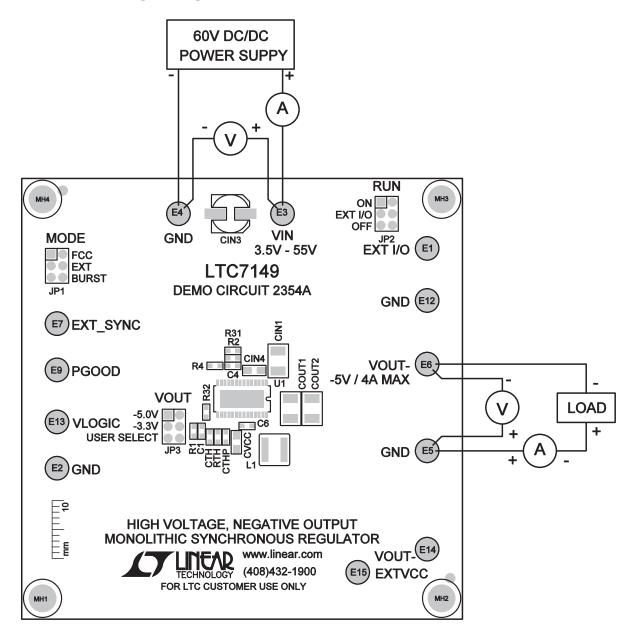


Figure 1. Proper Measurement Equipment Setup



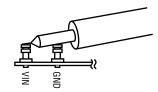


Figure 2. Measuring Input or Output Ripple

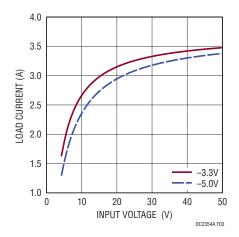


Figure 3. Output Current vs. Input Voltage Derating Charts

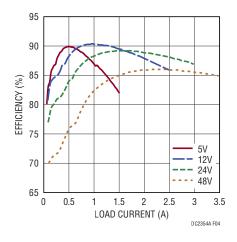


Figure 4. Efficiency vs. Load Current for Different Input Voltages

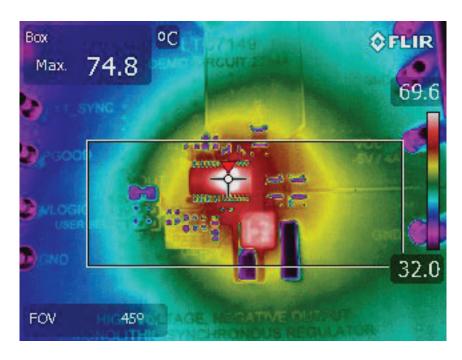
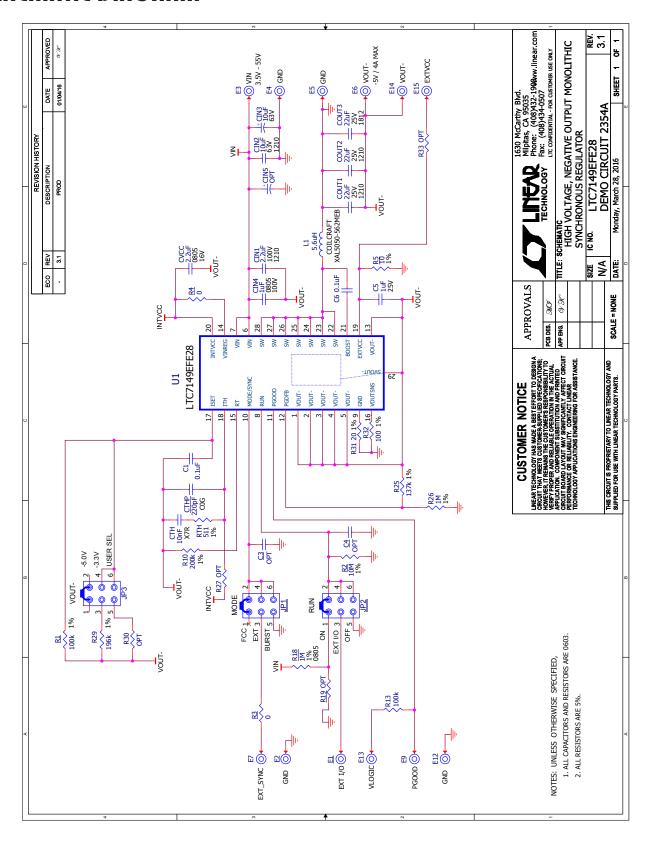


Figure 5. Thermal Map, V_{IN} 48V, V_{OUT}^- is -5V at 3.5A, No Air Flow

PARTS LIST

| QTY | REFERENCE | PART DESCRIPTION | MANUFACTURER/PART NUMBER |
|---------|--|---------------------------------|----------------------------------|
| Require | ed Circuit Components | | |
| 1 | CIN1 | CAP, 1210 2.2µF 10% 100V X7R | TDK C3225C7R1H225K |
| 1 | CIN2 | CAP, 1210 10µF 10% 63V X7R | MURATA GRM32ER71J106KA12K |
| 1 | CIN3 | CAP, 10uF 20% 63V ELEC | PANASONIC EEH-ZA1J100P |
| 1 | CIN4 | CAP, 0805 1µF 10% 100V X7S | TDK C2012X7S2A105K125AB |
| 2 | COUT1, COUT2 | CAP, 1210 22µF 10% 25V X7R | MURATA GRM32ER71E226KE15L |
| 1 | COUT3 | CAP, X7R, 22µF, 25V, 1812 | TDK, C4532X7R1E226M250KC |
| 1 | СТН | CAP, 0603 10nF 10% 50V X7R | AVX 06035A221KAT |
| 1 | CTHP | CAP, 0603, 220pF, 10%, 50V, NPO | AVX 06031A101KAT2A |
| 1 | CVCC | CAP, 0805 2.2µF 10% 16V X7R | AVX 0805YC225KAT2A |
| 2 | C1, C6 | CAP, 0603 0.1µF 10% 50V X7R | TDK C1608X7R1H104K080AA |
| 1 | C5 | CAP, 0603 1µF 20% 25V X7R | TDK C1608X7R1E105M080AB |
| 1 | L1 | IND, 5.6μH | COILCRAFT XAL5050-562MEB |
| 1 | RTH | RES, 0603 511Ω 1% 1/10W | VISHAY CRCW0603511RFKEA |
| 2 | R1, R13 | RES, 0603 100kΩ 1% 1/10W | VISHAY CRCW0603100KFKEA |
| 1 | R2 | RES, 0603 10MΩ 1% 1/10W | VISHAY CRCW060310M0FKEA |
| 1 | R5 | RES, 0603 10Ω 1% 0.1W | VISHAY CRCW060310RFKEA |
| 2 | R3, R4 | RES, 0603 0Ω JUMPER | VISHAY CRCW06030000Z0EA |
| 1 | R10 | RES, 0603 200kΩ 1% 1/10W | VISHAY CRCW0603200KFKEA |
| 1 | R18 | RES, 0805 1MΩ 1% 1/8W | VISHAY CRCW08051M00FKEA |
| 1 | R25 | RES, 0603 137kΩ 1% 0.063W | VISHAY CRCW0603137KFKEA |
| 1 | R26 | RES, 0603 1MΩ 1% 1/10W | VISHAY CRCW06031M00FKEA |
| 1 | R29 | RES, 0603 196kΩ 1% 1/10W | VISHAY CRCW0603196KFKEA |
| 1 | R31 | RES, 0603 20Ω 1% 0.1W | VISHAY CRCW060320R0FKEA |
| 1 | R32 | RES, 0603 100Ω 1% 0.1W | VISHAY CRCW0603100RFKEA |
| 1 | U1 | IC, NEGATIVE OUTPUT REGULATOR | LINEAR TECH. LTC7149EFE28#PBF |
| Additio | nal Demo Board Circuit Components | | |
| | R19, R27, R30, R33 | RES, 0603 OPTION | OPTION |
| | C3, C4 | CAP, 0603 OPTION | OPTION |
| | CIN5 | CAP, OPTION | OPTION |
| Hardwa | re | | |
| 12 | E1, E2, E3, E4, E5, E6, E7, E9, E12, E13, E14, E15 | TURRET | MILL MAX 2501-2-00-80-00-00-07-0 |
| 3 | JP1, JP2, JP3 | HEADER, 3-PIN, DBL ROW 2mm | SULLINS, NRPN032PAEN |
| 4 | MH1, MH2, MH3, MH4 | STANDOFF, SNAP ON | KEYSTONE 8833 |
| 3 | XJP1, XJP2, XJP3 | SHUNT | SAMTEC 2SN-BK-G |

SCHEMATIC DIAGRAM





DEMO MANUAL DC2354A

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



ПОСТАВКА ЭЛЕКТРОННЫХ КОМПОНЕНТОВ

Общество с ограниченной ответственностью «МосЧип» ИНН 7719860671 / КПП 771901001 Адрес: 105318, г.Москва, ул.Щербаковская д.3, офис 1107

Данный компонент на территории Российской Федерации Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

http://moschip.ru/get-element

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

Офис по работе с юридическими лицами:

105318, г. Москва, ул. Щербаковская д. 3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:

moschip.ru moschip.ru_6 moschip.ru 4 moschip.ru 9