LT3641: Dual Monolithic Buck Regulator with Power-On Reset and Watchdog Timer

DESCRIPTION

Demonstration circuit 1727A is a dual monolithic buck regulator with power-on reset and watchdog timer featuring the LT3641. The board operates from inputs up to 42V and withstands transients up to 55V. The outputs are 5V, 1A and 1.8V, 0.8A. At light loads, both regulators operate in low ripple Burst Mode® to maintain high efficiency and low output ripple. Users can populate R13 on the EN/UVLO pin and R14 on EN2 to provide a programmable under voltage lockout for both outputs respectively. Both channels have cycle-by-cycle current limit, providing protection against shorted outputs.

The power-on reset and watchdog timer periods are independently adjustable using external capacitors. Tight accuracy specifications and glitch immunity ensure reliable operation of the circuit. Watchdog can be enabled or disabled by JP1.

The circuit can be synchronized to an external clock connected to the SYNC terminal. If the SYNC function is used, the R_T resistor (R9) should be chosen to set the LT3641 internal switching frequency at least 20% below the lowest synchronization input frequency.

The LT3641 data sheet gives complete descriptions of the part, operation and application information. The data sheet must be read in conjunction with this quick start guide for working on or modifying the demo circuit 1727A.

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

PERFORMANCE SUMMARY (T_A = 25°C)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range	V_{OUT1} = 5V, I_{OUT1} = 1A V_{OUT2} = 1.8V, I_{OUT2} = 0.8A	7		42	V
V_{OUT1}	Output Voltage 1	V_{IN} = 12V, I_{OUT1} = 0.8A	4.92	5.07	5.22	V
V_{OUT2}	Output Voltage 2	V_{IN} = 12V, I_{OUT2} = 1A	1.746	1.8	1.854	V
I_{OUT1}	Output Current 1		0		1	A
I_{OUT2}	Output Current 2		0		0.8	A
I_Q	No Load Quiescent Current	V_{IN} = 12V, V_{OUT1} = 5V, V_{OUT2} = 1.8V, No Load		0.37		mA
f_{SW}	Switching Frequency		1.75	2	2.35	MHz
t_{WDU}	Watchdog Upper Boundary Period	C7 = 1500pF		55.5		ms
t_{WDL}	Watchdog Lower Boundary Period	C7 = 1500pF		3.5		ms
t_{RST}	Programmed Reset Period	C8 = 1500pF		55.5		ms

QUICK START PROCEDURE

Demonstration circuit 1727A is easy to set up to evaluate the performance of the LT3641. Refer to Figure 2 for proper measurement equipment setup and follow the procedure below:

1. Place Jumper JP1 in the following position:

   OFF: Watchdog Disabled

   ON: Watchdog Enabled

2. With power off, connect the input power supply to V_{IN} and GND.

3. With power off, connect loads from V_{OUT1} to GND and V_{OUT2} to GND.

4. Turn on the power at the input.

   Note: Make sure that the input voltage does not exceed 42V.

5. Check for the proper output voltages:

   V_{OUT1} = 5V, V_{OUT2} = 1.8V

   Note: If there is no output, temporarily disconnect the load to make sure that the load is not set too high or is shorted.

6. 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.

7. To test the watchdog timer, place jumper JP1 in the ON position. Connect a clock input to the WDI terminal. Observe the output at the $\overline{WDO}$ terminal while the clock parameters are adjusted.

8. To test Power-On Reset, observe output at the RESET terminals: $\overline{RST1}$ and $\overline{RST2}$.

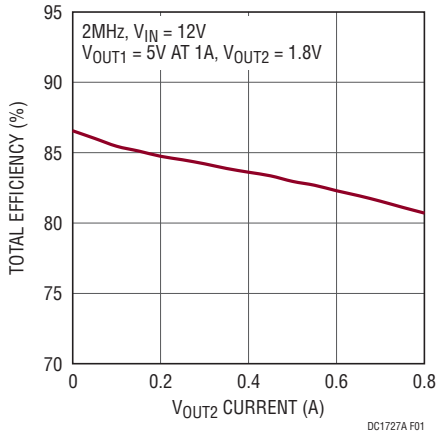


Figure 1. Total Efficiency vs V_{OUT2} Current

QUICK START PROCEDURE

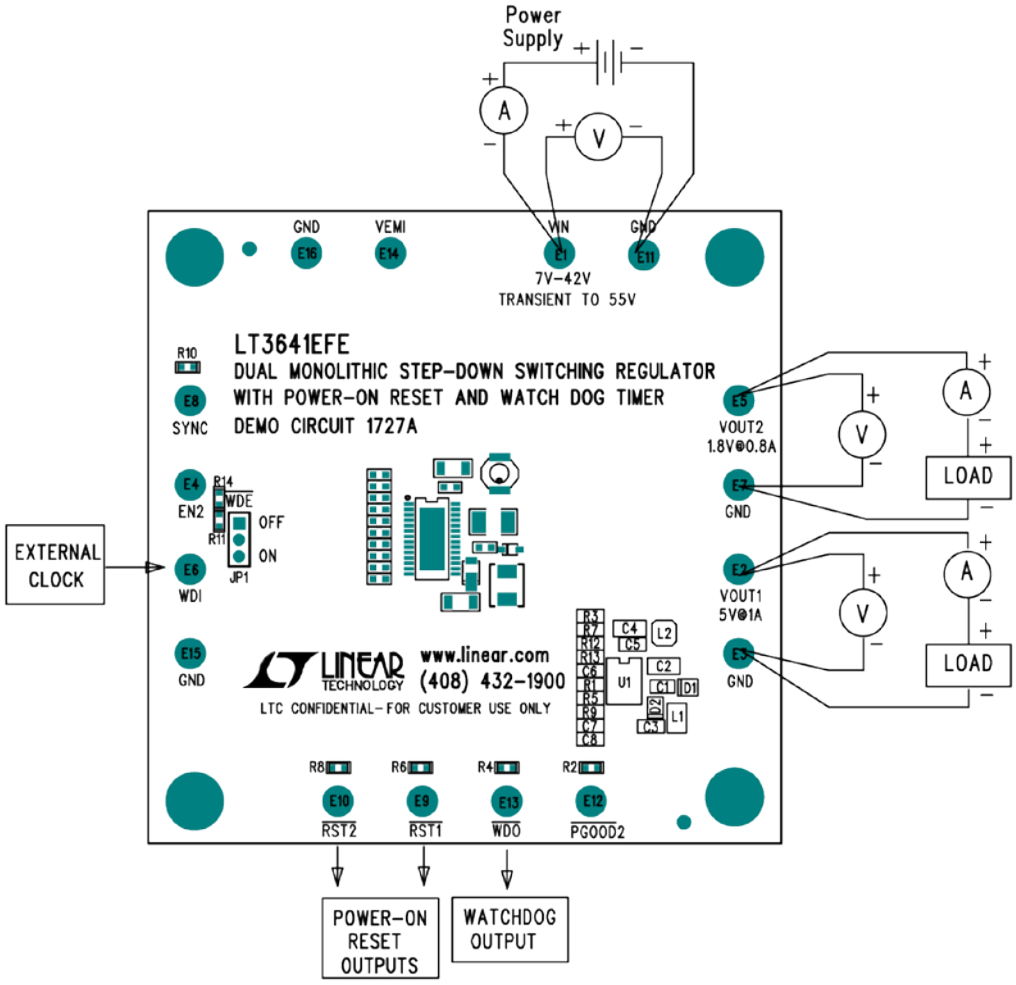


Figure 2. DC1727A Proper Measurement Equipment Setup

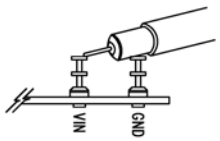
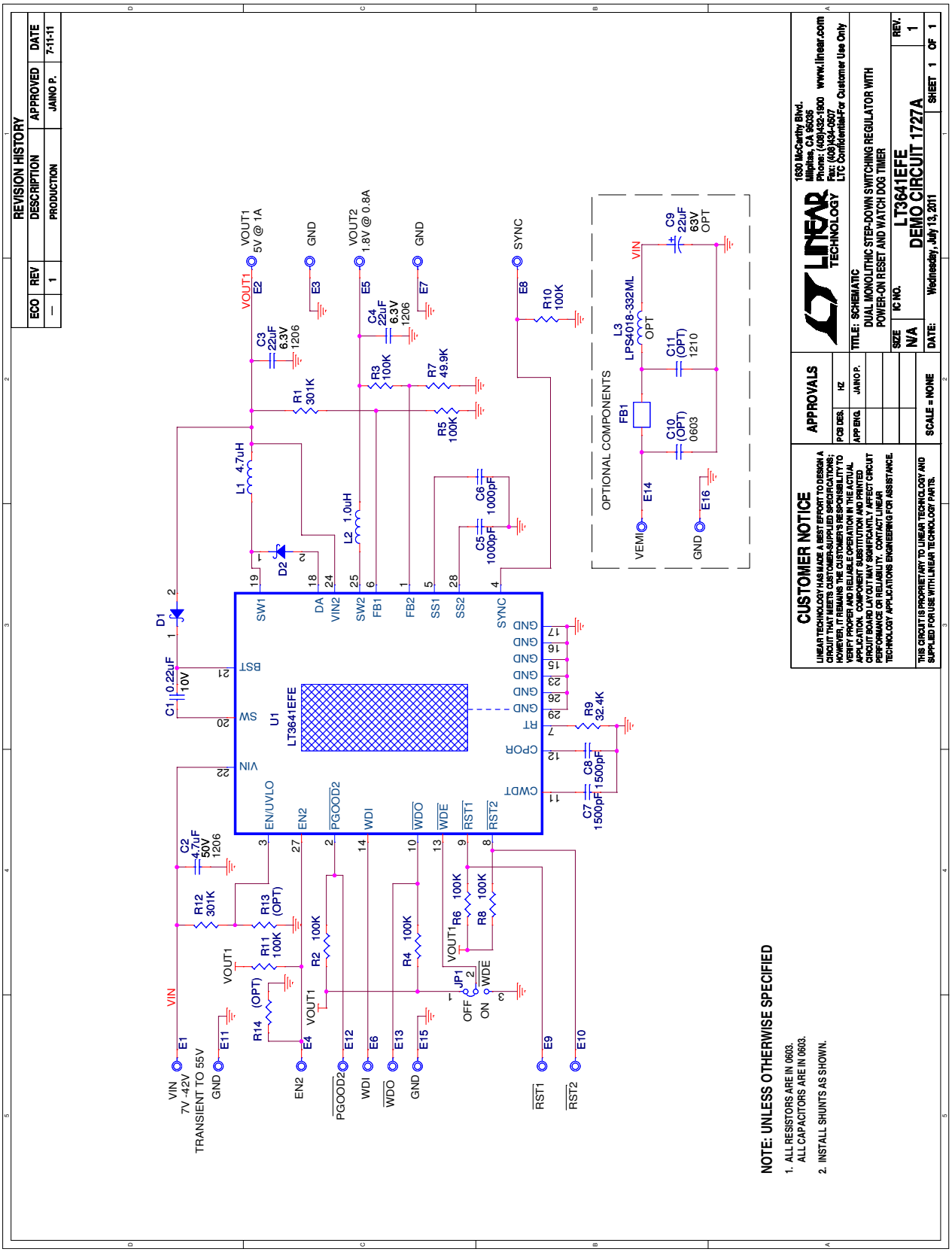


Figure 3. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	C1	Capacitor, X7R, 0.22µF, 10V, 10%, 0603	Murata, GRM188R71A224KA01D
2	1	C2	Capacitor, X7R, 4.7µF, 50V, 10%, 1206	Murata, GRM31CR71H475KA12L
3	2	C3, C4	Capacitor, X7R, 22µF, 6.3V, 20%, 1206	AVX, 12066C226MAT2A
4	2	C5, C6	Capacitor, X7R, 1000pF, 25V, 10%, 0603	AVX, 06033C102KAT2A
5	2	C7, C8	Capacitor, COG, 1500pF, 25V, 5%, 0603	Murata, GRM1885C1E152JA
6	1	D1	Diode, Schottky, Diode, SOD323	Central Semiconductor., CMDD6263
7	1	D2	Diode, Schottky, PowerDI123	DIODES/ZETEX, DFLS260-7
8	1	L1	Inductor, 4.7µH	Cooper Bussmann, MPI4040R3-4R7-R
9	1	L2	Inductor, 1.0µH	Cooper Bussmann, SD3812-1R0-R
10	2	R1, R12	Resistor, Chip, 301k, 1%, 0603	Vishay, CRCW0603301KFKED
11	3	R3, R5, R11	Resistor, Chip, 100k, 1%, 0603	Panasonic, ERJ3EKF1003V
12	1	R7	Resistor, Chip, 49.9k, 1%, 0603	Vishay, CRCW060349K9FKEA
13	1	R9	Resistor, Chip, 32.4k, 1%, 0603	Vishay, CRCW060332K4FKED
14	1	U1	IC, LT3641EFE#PBF, TSSOP (4.4mm)	Linear Technology, LT3641EFE#PBF
Additional Demo Board Circuit Components				
1	1	C9	Capacitor, Aluminum SMT, 22µF, 63V	Suncom, 63CE22BS
2	0	C10 (Optional)	Capacitor, 0603	
3	0	C11 (Optional)	Capacitor, 1210	
4	0	FB1 (Optional)	Ferrite Bead, Chip, 1206	
5	0	L3 (Optional)	Inductor, SMT Power Inductor	
6	5	R2, R4, R6, R8, R10	Resistor, Chip, 100k, 1%, 0603	Vishay, CRCW0603100KFKEA
7	0	R13, R14 (Optional)	Resistor, 0603	
Hardware: For Demo Board Only				
1	16	E1-E16	Testpoint, Turret, .095"	Mill-Max, 2501-2-00-80-00-00-07-0
2	1	JP1	2mm Single Row Header, 3-Pin	Samtec, TMM-103-02-L-S
3	1	JP1	Shunt, 2mm	Samtec, 2SN-BK-G
4	4	MTGS	Stand-Off, Nylon 0.5" Tall	Würth, 702935000 (Snap On)

SCHEMATIC DIAGRAM



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

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

LT 0711 • PRINTED IN USA