

LTM4647

30A DC/DC Step-Down μModule Regulator

DESCRIPTION

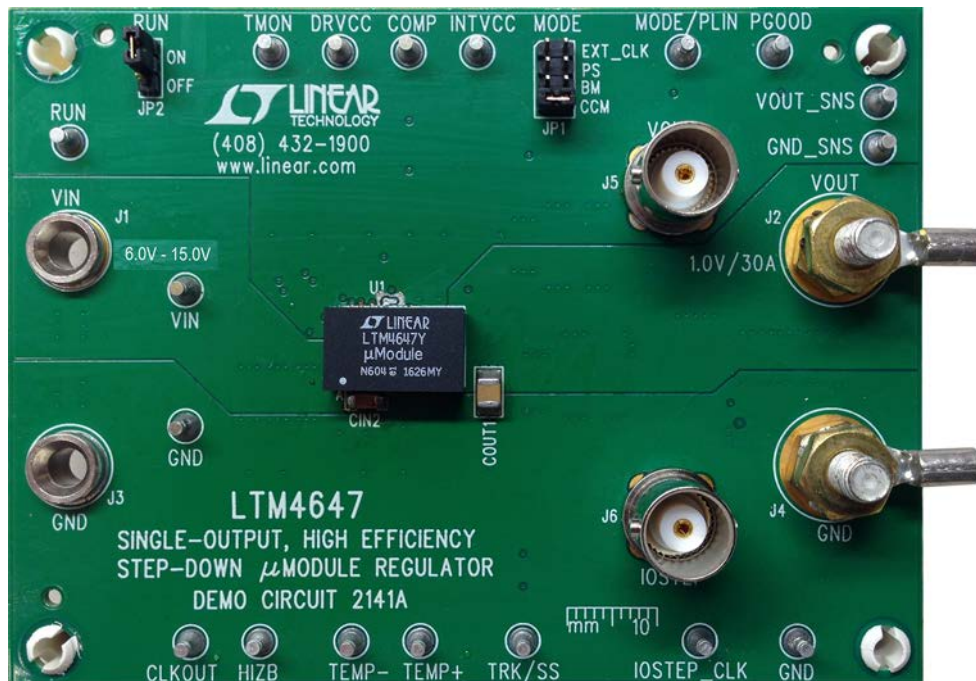
Demonstration circuit 2141A features the [LTM®4647EY](#), a 30A high efficiency, switch mode step-down power μModule regulator. The input voltage range is from 6V to 15V. To use DC2141A for input voltage range from 4.7V to 6V, connect INTVCC to SVIN (change R22 from OPT to 0Ω), DRVCC to VIN (change R21 from 0Ω to OPT, R28 from OPT to 0Ω). The output voltage range is 0.6V to 1.8V. Derating is necessary for certain VIN, VOUT, frequency and thermal conditions. The DC2141A offers the TRK/SS pin allowing the user to program output tracking or soft-start period. The board operates in continuous conduction mode in heavy load conditions. For high efficiency at low load currents, the MODE_PLLIN jumper selects pulse-skipping mode for noise sensitive applications or Burst Mode® operation in

less noise sensitive applications. The MODE_PLLIN pin also allows the LTM4647 to synchronize to an external clock signal (between 400kHz and 800kHz). DC2141A has the option of choosing both internal and external compensation circuit for LTM4647. Tying the PHASMD pin to different voltage generates certain phase difference between MODE_PLLIN and CLKOUT. The LTM4647 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC2141A.

Design files for this circuit board are available at <http://www.linear.com/demo/DC2141A>

LT, 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.

BOARD PHOTO



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

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
Input Voltage Range		6		15	V
Output Voltages	$R_{FB} = 90.9\text{k}\Omega$		$1.0 \pm 1.0\%$		V
Maximum Continuous Output Current	Derating Is Necessary for Certain Operating Conditions. See Data Sheet for Details		30		ADC
Operating Frequency	$R_{FREQ} = 47.5\text{k}\Omega$		600		kHz
Efficiency	$V_{IN} = 12\text{V}$, $V_{OUT} = 1.0\text{V}$, $I_{OUT} = 30\text{A}$		86.2 Figure 2		%
Load Transient	$V_{IN} = 12\text{V}$, $V_{OUT} = 1.0\text{V}$, $I_{STEP} = 5\text{A}$ to 20A		153 Figure 3		mV

QUICK START PROCEDURE

Demonstration circuit 2141A is an easy way to evaluate the performance of the LTM4647EY. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

- Place jumpers in the following positions for a typical application:

MODE	RUN
CCM	ON

- 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 12V.
- Turn on the power supply at the input. The output voltage should be $1.0\text{V} \pm 1.0\%$ (0.99V to 1.01V).

- Vary the input voltage from 6V to 15V and adjust the load current from 0A to 30A. Observe the output voltage regulation, ripple voltage, efficiency, and other parameters.
- (Optional) For optional load transient test, apply an adjustable pulse signal between IOSTEP_CLK and GND test points. The pulse amplitude sets the load step current amplitude. Keep the pulse width short (<1ms) and pulse duty cycle low (<5%) to limit the thermal stress on the load transient circuit.
- (Optional) LTM4647 can be synchronized to an external clock signal. Place the JP1 jumper on EXT_CLK and apply a clock signal (0V to 5V, square wave) on the MODE_PLLIN test point.

QUICK START PROCEDURE

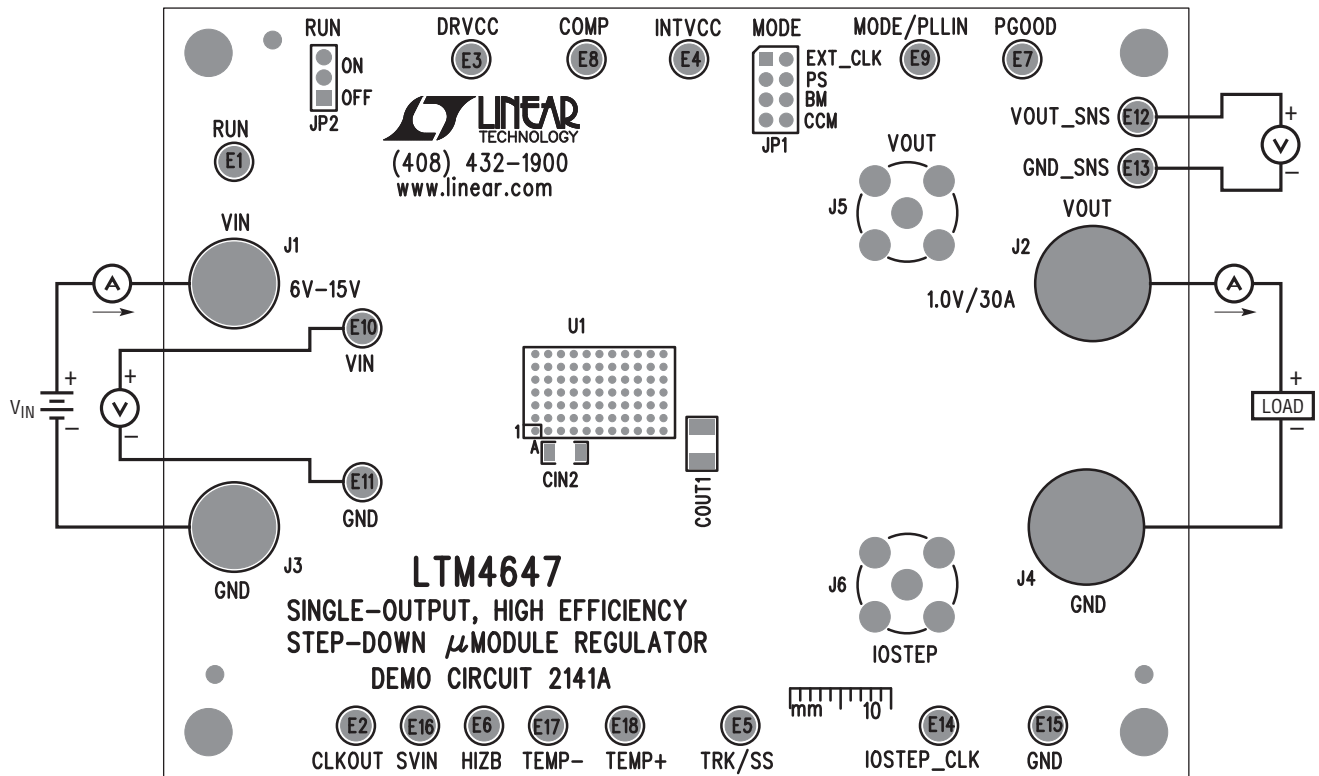


Figure 1. Measurement Set-Up of DC2141A

QUICK START PROCEDURE

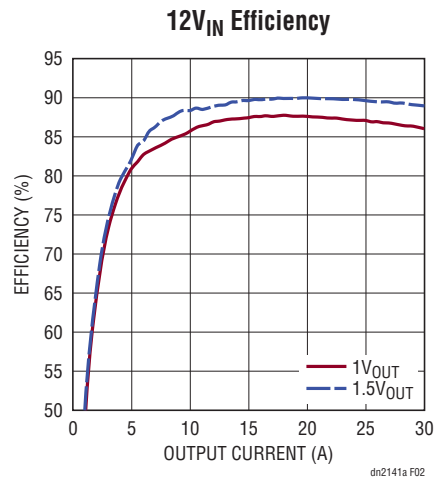


Figure 2. Measured Efficiency at $V_{IN} = 12.0V$, $f_{SW} = 600kHz$, CCM

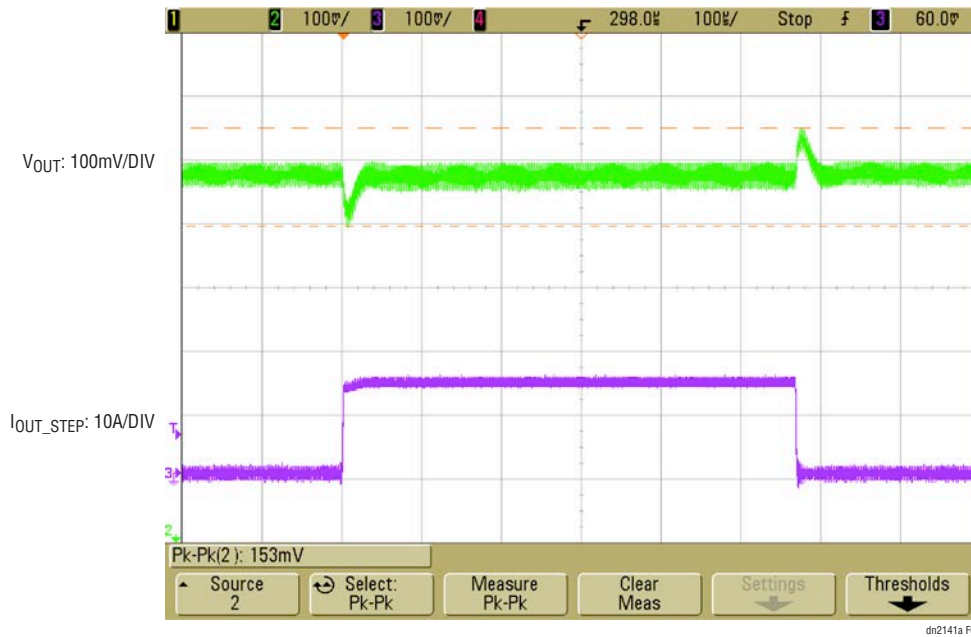


Figure 3. Measured Load Transient, $V_{IN} = 12V$, $V_{OUT1} = 1.0V$, $I_{STEP} = 5A$ to $20A$

QUICK START PROCEDURE

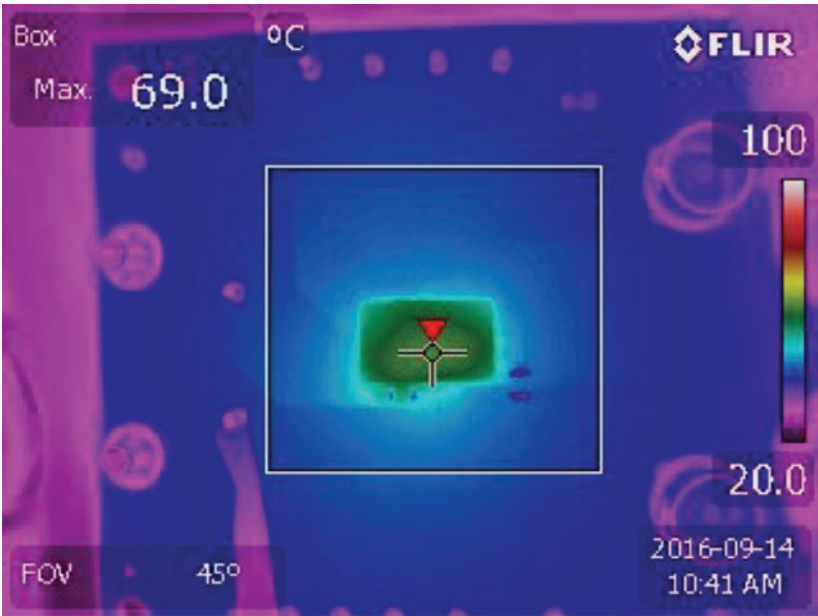


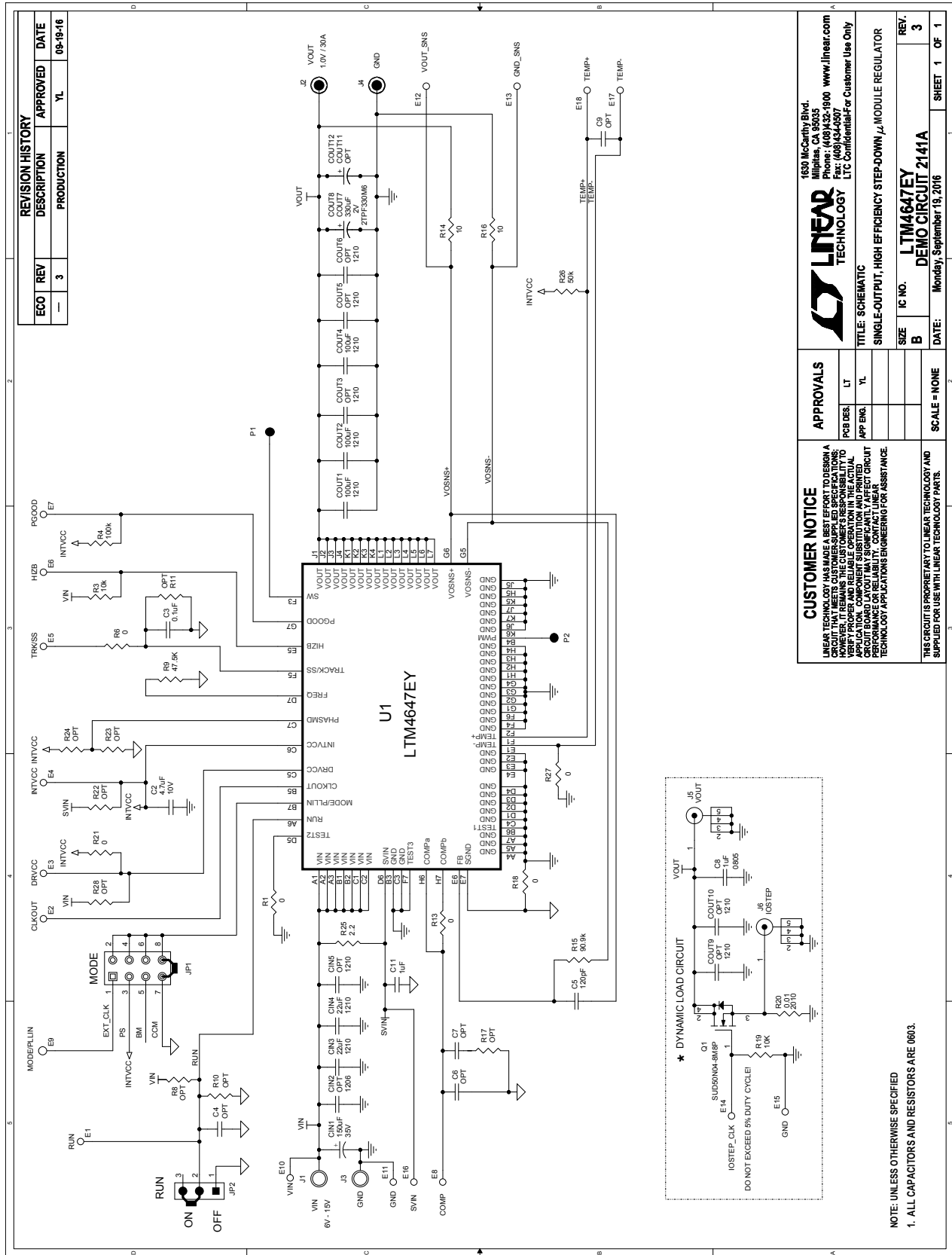
Figure 4. Thermal Image of LTM4647, $V_{IN} = 12V$, $V_{OUT} = 1.0V$, $I_{LOAD} = 30A$, $T_A = 23.0^{\circ}C$, No Forced Air Flow

DEMO MANUAL DC2141A

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	1	CIN1	CAP, ALUM., 150µF, 35V, 20%, HVH	SUN ELECTRONIC INDUSTRIES CORP, 35HVH150MT
2	3	CIN3, CIN4	CAP, 22µF, X5R, 25V, 20%, 1210	MURATA, GRM32ER61E226ME15L
3	3	COUT1, COUT2, COUT4	CAP, 100µF, X5R, 6.3V, 20%, 1210	MURATA, GRM32ER60J107ME20L
4	2	COUT7, COUT8	CAP, POSCAP, 330µF, 2V, D2E	PANASONIC, 2TPF330M6
5	1	C2	CAP, 4.7µF, X5R, 10V, 10%, 0603	AVX, 0603ZD475KAT2A
6	1	C3	CAP, 0.1µF, X7R, 16V, 10%, 0603	AVX, 0603YC104KAT2A
7	1	C5	CAP, 120pF, X7R, 50V, 10%, 0603	YAGEO, CC0603KRX7R9BB121
8	1	C8	CAP, 1µF, X7R, 50V, 10%, 0805	MURATA, GRM21BR71H105KA12L
9	1	C11	CAP, 1µF, X7R, 50V, 10%, 0603	TAIYO YUDEN, UMK107AB7105KA-T
10	1	Q1	XSTR., MOSFET, N-CH, 40V, TO-252	VISHAY, SUD50N04-8M8P-4GE3
11	2	R3, R19	RES., 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
12	1	R4	RES., 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
13	1	R9	RES., 47.5k, 1/10W, 1%, 0603	VISHAY, CRCW060347K5FKEA
14	2	R14, R16	RES., 10Ω, 1/10W, 5%, 0603	VISHAY, CRCW060310R0JNEA
15	1	R15	RES., 90.9k, 1/10W, 1%, 0603	VISHAY, CRCW060390K9FKEA
16	1	R20	RES., SENSE, 0.01Ω, 1/2W, 1%, 2010	VISHAY, WSL2010R0100FEA
17	1	R25	RES., 2.2Ω, 1/10W, 5%, 0603	VISHAY, CRCW06032R2JNEA
18	1	R26	RES., 50k, 1/10W, 1%, 0603	VISHAY, CRCW060350K0FKEA
19	1	U1	IC, LTM4647EY#PBF BGA77-15X9-5.01	LINEAR TECH., LTM4647EY#PBF
Additional Demo Board Circuit Components				
1	0	CIN2	CAP, OPTION, 1206	MURATA, GRM31CR6YA106KA12L
2	0	CIN5, COUT3, COUT5, COUT6, COUT9, COUT10	CAP, OPTION, 1210	OPT
3	0	COUT11, COUT12	CAP, OPTION, D3L	OPT
4	0	C4, C6, C7, C9	CAP, OPTION, 0603	OPT
5	6	R1, R6, R13, R18, R21, R27	RES., 0Ω, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
6	0	R8, R10, R11, R17, R22, R23, R24, R28	RES., OPTION, 0603	OPT
Hardware: For Demo Board Only				
1	18	E1-E18	TESTPOINT, TURRET, 0.062"	MILL-MAX, 2308-2-00-80-00-00-07-0
2	1	JP1	CONN., HEADER, 2X4, 2mm	SULLINS, NRPN042PAEN-RC
3	1	JP2	CONN., HEADER, 1X3, 2mm	SULLINS, NRPN031PAEN-RC
4	2	J1, J3	CONN., BANANA JACK	KEYSTONE, 575-4
5	2	J2, J4	STUD, TESTPIN	PEM, KFH-032-10
6	4	J2, J4 (X2)	NUT, BRASS 10-32	ANY, #10-32M/S BR PL
7	2	J2, J4	RING, LUG #10	KEYSTONE, 8205
8	2	J2, J4	WASHER, TIN PLATED BRASS	ANY, #10 EXT BZ TN
9	2	J5, J6	CONN, BNC, 5PINS	CONNEX, 112404
10	2	XJP1, XJP2	SHUNT, 2MM	SAMTEC, 2SN-BK-G
11	4	MTGS. AT 4 CORNERS	STAND-OFF, NYLON, SNAP-ON, 0.50" TALL	KEYSTONE, 8833 (SNAP ON)

SCHEMATIC DIAGRAM



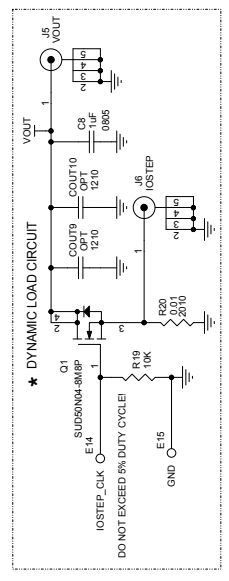
1630 McCarthy Blvd.
 Needham Heights, MA 02459-1090 www.linear.com
 Phone: (617) 452-5000 Fax: (617) 452-5007

LINEAR TECHNOLOGY
 LTM4647EY
 LTM4647EY Demo Circuit

1630 McCarthy Blvd.
 Needham Heights, MA 02459-1090 www.linear.com
 Phone: (617) 452-5000 Fax: (617) 452-5007

1630 McCarthy Blvd.
 Needham Heights, MA 02459-1090 www.linear.com
 Phone: (617) 452-5000 Fax: (617) 452-5007

1630 McCarthy Blvd.
 Needham Heights, MA 02459-1090 www.linear.com
 Phone: (617) 452-5000 Fax: (617) 452-5007



NOTE: UNLESS OTHERWISE SPECIFIED
 1. ALL CAPACITORS AND RESISTORS ARE 0603.

DEMO MANUAL DC2141A

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