LTM4636-1
40A DC/DC µModule Regulator with Overvoltage/Overtemperature Protection

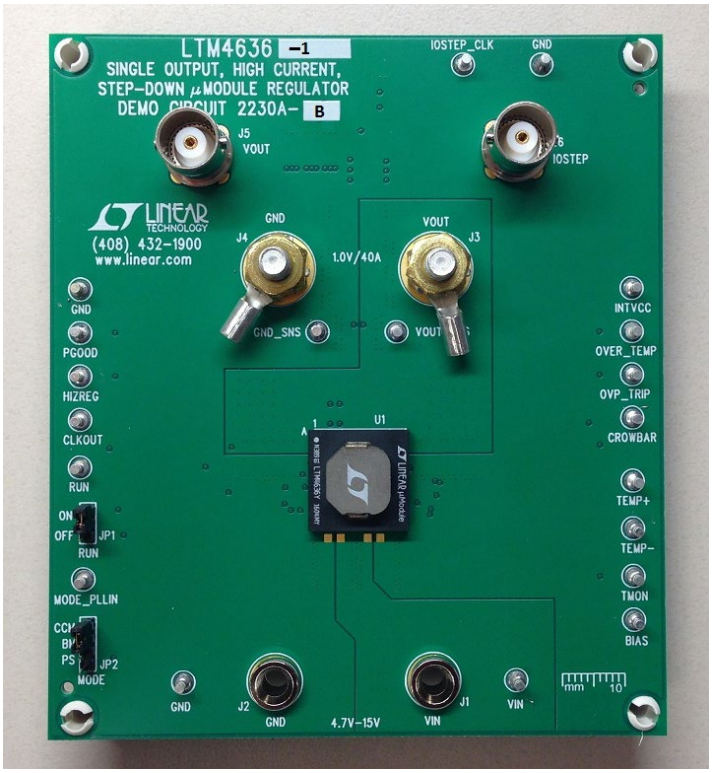
DESCRIPTION

Demonstration circuit 2230A-B features the LTM®4636-1EY, a 40A high efficiency, switch mode step-down power µModule® regulator with overtemperature and input/output overvoltage protection. The input voltage range is from 4.7V to 15V. For input voltage range from 4.7V to 5.5V, short PV_{CC} pin to V_{IN} pin with R8 = R21 = 0Ω and remove R17. The output voltage range is 0.6V to 3.3V. Derating is necessary for certain V_{IN}, V_{OUT}, frequency and thermal conditions. 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 LTM4636 to synchronize to an external clock signal. DC2230A-B has the option of choosing both internal and external compensation circuit for LTM4636-1. Tying the PHASMD pin to different voltage generates certain phase difference between MODE_PLLIN and CLKOUT. The LTM4636-1 data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit DC2230A-B.

Design files for this circuit board are available at http://www.linear.com/demo/DC2230A-B

, LT, LTC, LTM, Linear Technology, the Linear logo, Burst Mode and µModule are registered trademarks of Linear Technology Corporation. All other trademarks are the property of their respective owners.

BOARD PHOTO



PERFORMANCE SUMMARY

PARAMETER	CONDITIONS/NOTES	VALUE
Input Voltage Range		4.7V to 15V
Output Voltages		1.0V ± 1.3%
Maximum Continuous Output Current	Derating is Necessary for Certain Operating Conditions. See Data Sheet for Details.	40ADC
Operating Frequency		350kHz
Efficiency	V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 40A, Q2 Not Included	87.7% (see Figure 2)
Load Transient	V_{IN} = 12V, V_{OUT} = 1.0V, I_{STEP} = 0A to 10A	81mV (see Figure 3)
Overtemperature Trip Point	$R_{OTP} = R_{56}$ = 66.5kΩ	130°C
Overvoltage Trip Point	$R_{OVP} = R_{10}$ = 86.6kΩ	1.18V

QUICK START PROCEDURE

Demonstration circuit 2230A-B is an easy way to evaluate the performance of the LTM4636-1EY. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below.

1. Place jumpers in the following positions for a typical application:

MODE	RUN
CCM	ON

2. 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.
3. Turn on the power supply at the input. The output voltage should be 1.0V ± 1.3% (0.987V to 1.013V).
4. Vary the input voltage from 6V to 15V and adjust the load current from 0A – 40A. Observe the output voltage regulation, ripple voltage, efficiency, and other parameters.
5. (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.
6. (Optional) LTM4636 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

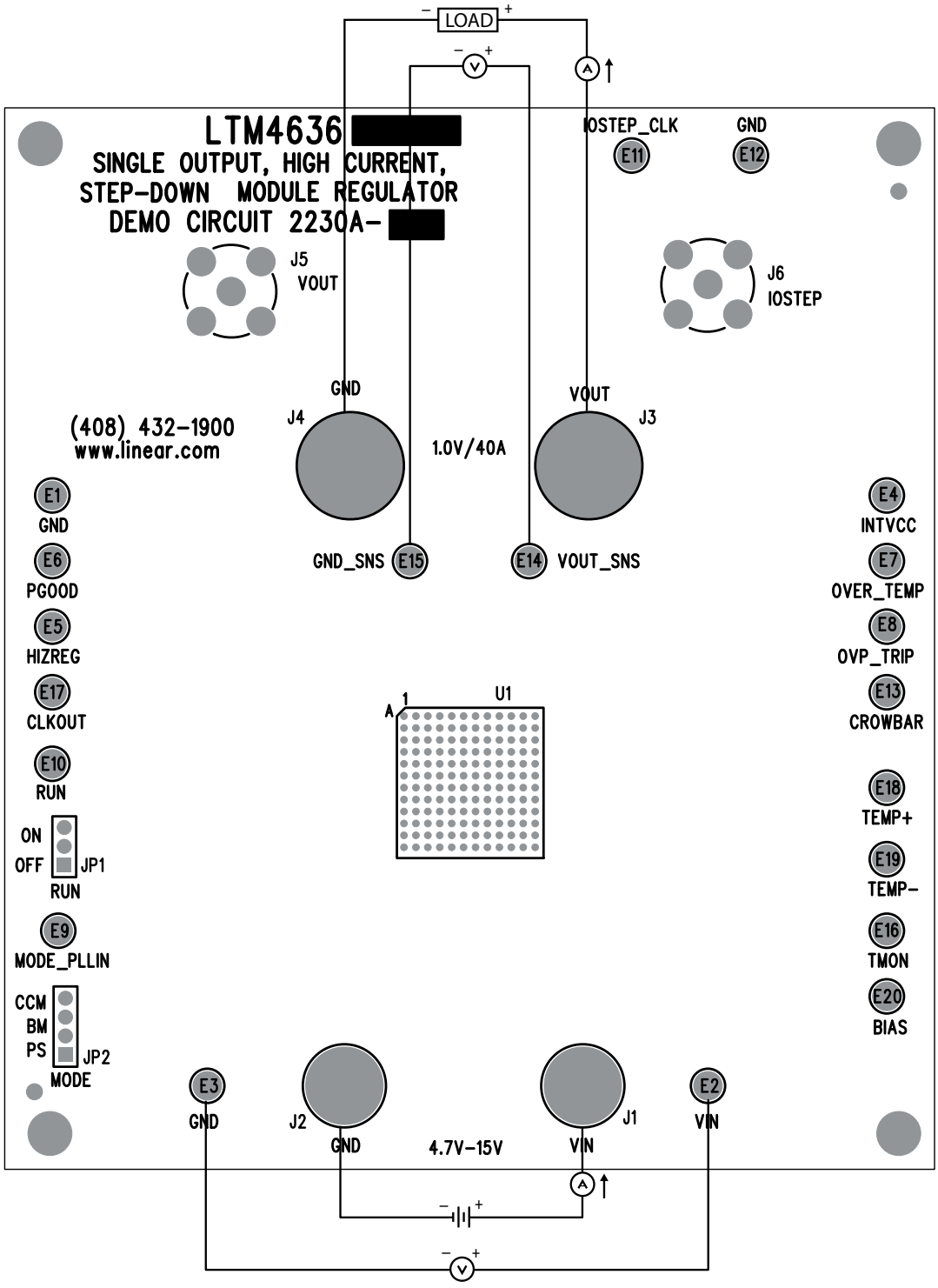


Figure 1. Proper Measurement Equipment Setup

QUICK START PROCEDURE

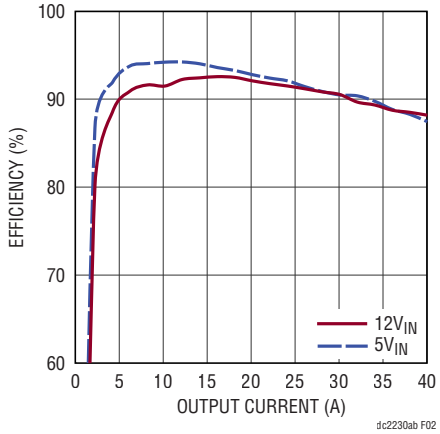


Figure 2. Measured Efficiency at V_{IN} = 5V/12V, V_{OUT} = 1V, f_{SW} = 350kHz, CCM, Q2 Not Included

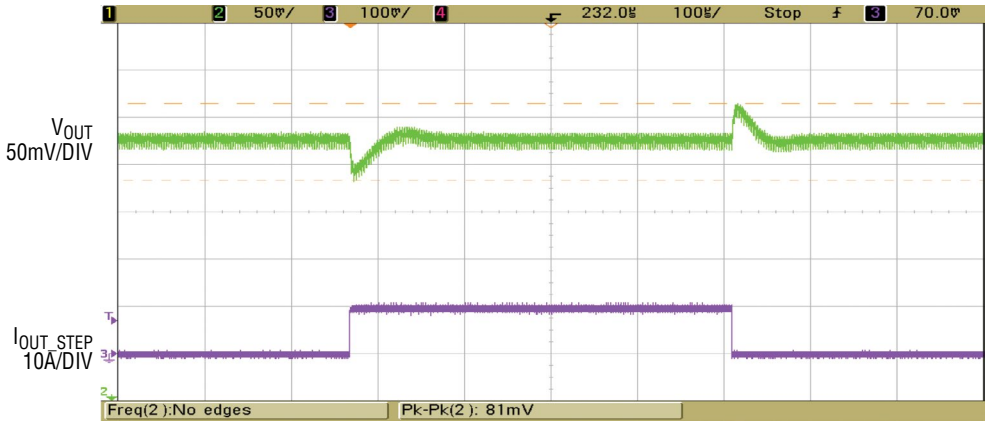


Figure 3. Measured Load Transient, V_{IN} = 12V, V_{OUT} = 1.0V, I_{STEP} = 0A to 10A

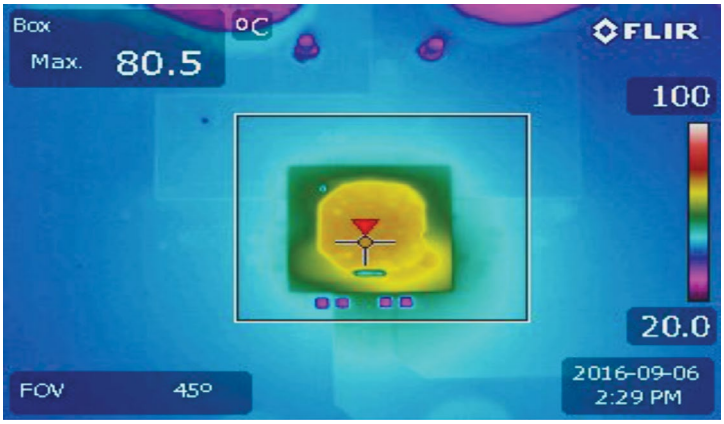


Figure 4. Thermal Image, V_{IN} = 12V, V_{OUT} = 1.0V, I_{LOAD} = 40A, Ambient Temperature = 23.0°C, No Forced Airflow

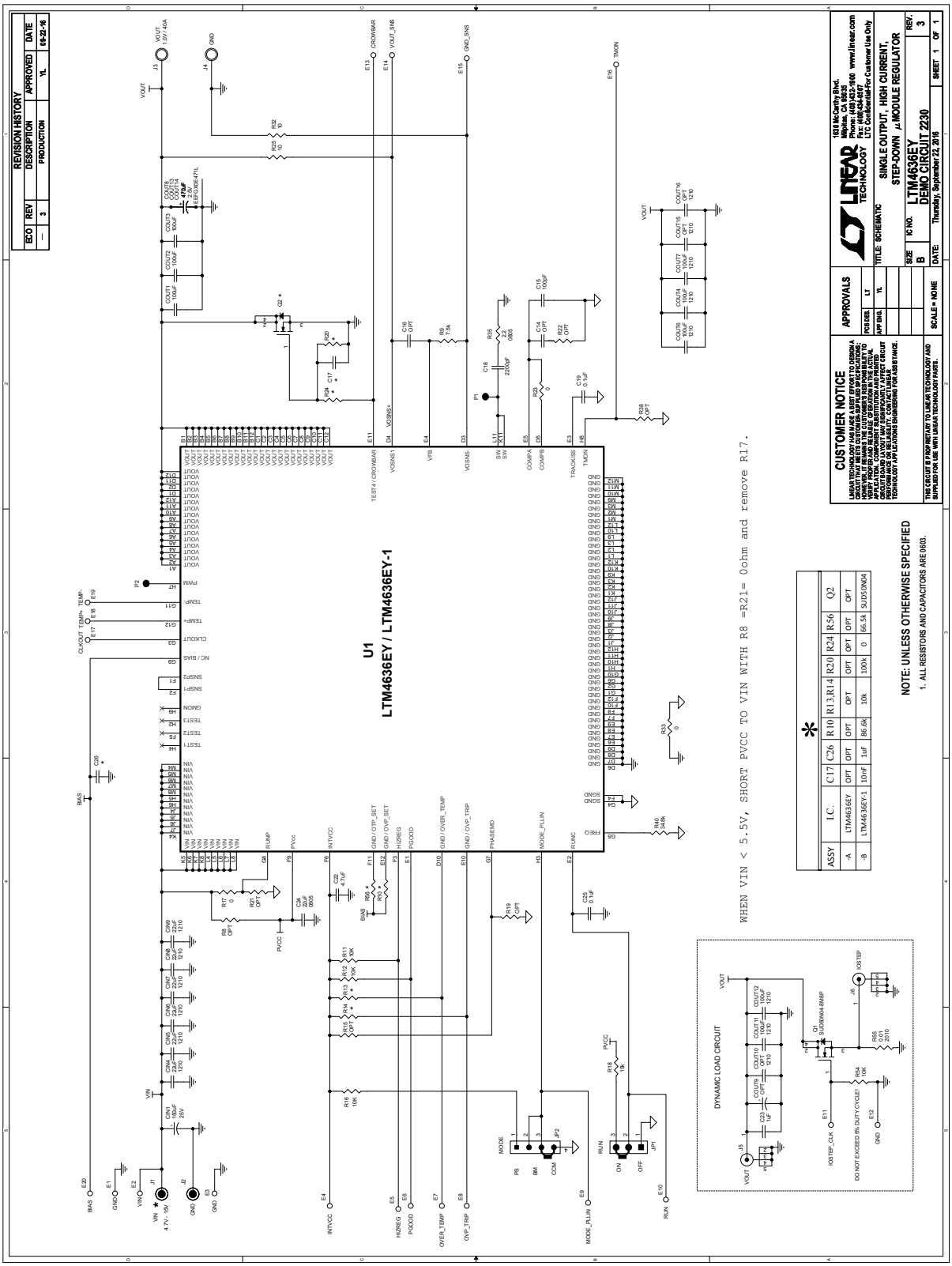
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART #
Required Circuit Components				
1	1	CIN1	CAP, ALUM ELECT, 150µF, 25V, CE SERIES	SUN ELECT, 25CE150AX
2	6	CIN4, CIN5, CIN6, CIN7, CIN8, CIN9	CAP, 22µF, X5R, 16V, 20%,1210	MURATA, GRM32ER61C226ME20
3	8	COUT1, COUT2, COUT3, COUT4, COUT6, COUT7, COUT11, COUT12	CAP, 100µF, X5R, 6.3V, 20%,1210	MURATA, GRM32ER60J107ME20L
4	3	COUT8, COUT13, COUT14	CAP, POSCAP, 470µF, 2.5V, 20%, D3L	PANASONIC, 2R5TPE470M9
5	1	C15	CAP, 100pF, NP0, 50V, 5%, 0603	MURATA, GRM1885C1H101JA01D
6	1	C17	CAP, 0.01µF, X7R, 25V, 10%, 0603	AVX, 06033C103KAT2A
7	1	C18	CAP, 2200pF, X7R, 25V, 10%, 0603	MURATA, GRM188R71E222KA01D
8	2	C19, C25	CAP, 0.1µF, X5R, 16V, 10%, 0603	MURATA, GRM188R61C104KA01D
9	1	C22	CAP, 4.7µF, X5R, 10V, 10%, 0603	TDK, C1608X5R1A475K080AC
10	1	C23	CAP, 1µF, X5R, 25V, 10%, 0603	MURATA, GRM188R61E105KA12D
11	1	C24	CAP, 22µF, X5R, 6.3V, 20%, 0805	KEMET, C0805C226M9PACTU
12	1	C26	CAP, 1µF, X5R, 25V, 10%, 0603	MURATA, GRM188R61E105KA12D
13	1	Q1	XSTR, MOSFET, N-CH, 40V, 50A, TO-252	VISHAY, SUD50N04-8M8P-4GE3
14	1	R9	RES, 7.5k, 0.5%, 0603	VISHAY, CRCW06037K5FKEA
15	1	R10	RES, 86.6k, 1/10W, 1%, 0603	VISHAY, CRCW060386K6FKEA
16	4	R11, R12, R16, R54	RES, 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
17	2	R13, R14	RES, 10k, 1/10W, 1%, 0603	VISHAY, CRCW060310K0FKEA
18	1	R18	RES, 15k, 1/10W, 1%, 0603	VISHAY, CRCW060315K0FKEA
19	1	R20	RES, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100K0FKEA
20	2	R25, R32	RES, 10Ω, 1/10W, 1%, 0603	VISHAY, CRCW060310R0FKEA
21	1	R35	RES, 2.2, 1/8W, 5%, 0805	VISHAY, CRCW08052R20JNEA
22	1	R40	RES, 34.8k, 1/10W, 1%, 0603	VISHAY, CRCW060334K8FKEA
23	1	R55	RES, SENSE, 0.01Ω, 1/2W, 1%, 2010	VISHAY, WSL2010R0100FEA
24	1	R56	RES, 66.5k, 1/10W, 1%, 0603	VISHAY, CRCW060366K5FKEA
25	1	U1	LTM4636-1EY#PBF, 16X16X5.01 BGA	LINEAR TECHNOLOGY, LTM4636-1EY#PBF
Additional Demo Board Circuit Components				
1	0	COUT9 (OPT)	CAP, OPTION, D3L	OPT
2	0	COUT10, COUT15, COUT16 (OPT)	CAP, OPTION, 1210	OPT
3	0	C14, C16 (OPT)	CAP, OPTION, 0603	OPT
4	0	R8, R15, R19, R21, R22, R38 (OPT)	RES, OPTION, 0603	OPT
5	4	R17, R23, R24, R33	RES, 0Ω, 1/10W, 0603	VISHAY, CRCW06030000Z0EA
6	0	Q2	XSTR, OPT, TO-252	OPT

PARTS LIST

Hardware				
1	20	E1 TO E20	TEST POINT, TURRET, 0.064" MTG. HOLE	MILL-MAX, 2308-2-00-80-00-00-07-0
2	1	JP1	CONN, HEADER, 1 × 3, 2mm	SULLINS, NRPN031PAEN-RC
3	1	JP2	CONN, HEADER, 1 × 4, 2mm	SULLINS, NRPN041PAEN-RC
4	2	J1, J2	CONN, JACK, BANANA, NON-INSULATED, 0.218"	KEYSTONE, 575-4
5	2	J3, J4	STUD, TEST PIN	PEM, KFH-032-10
6	4	J3, J4 × 2	NUT, BRASS 10-32	ANY, #10-32M/S BR PL
7	2	J3, J4	RING, LUG #10	KEYSTONE, 8205
8	2	J3, 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	(STAND-OFF)	STANDOFF, NYLON, SNAP-ON, 0.500"	KEYSTONE, 8833 (SNAP ON)

SCHEMATIC DIAGRAM



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.

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

© LINEAR TECHNOLOGY CORPORATION 2017