LTC3622EMSE
17V, Dual 1A Synchronous Step-Down Regulator with Ultralow Quiescent Current

DESCRIPTION

Demonstration circuit 2004A is a synchronous step-down regulator using the power-saving LTC®3622EMSE monolithic buck regulator in a 16-lead MSE package. The DC2004A operates from an input voltage range of 2.7V to 17V and provides dual 1A outputs with adjustable output voltage range from 1.2V to 5V. The LTC3622 IC quiescent current can be as low as 5µA in Burst Mode® operation with both channels enabled and less than 0.1µA in shut-down mode. The switching frequency is fixed to 1MHz or 2.25MHz with a ±50% synchronization range to an external clock. A user-selectable mode input is provided to allow the user to trade off ripple noise for light load efficiency.

Burst Mode operation provides the highest efficiency at light loads, while pulse-skipping mode provides the lowest ripple noise.

It is recommended to read the data sheet LTC3622 with this demo manual prior to working on or making any changes to DC2004A.

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

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

PARAMETER	CONDITIONS	VALUE
Default IC		LTC3622EMSE
Default Switching Frequency		1MHz
Default Operation Mode		Burst Mode Operation
Input Voltage Range		2.7V to 17V
Onboard User Selectable Output Voltages	V_{IN} = 2.7V to 17V, I_{OUT1} = I_{OUT2} = 0A to 1A ($V_{OUT} \leq V_{IN}$)	V_{OUT1}: 1.2V, 1.8V, 2.5V V_{OUT2}: 3.3V, 5.0V
Default Output Voltage		V_{OUT1} = 2.5V V_{OUT2} = 3.3V
Per Channel Maximum Continuous Output Current	V_{IN} = 2.7V to 17V	I_{OUT1} = I_{OUT2} = 1A
Efficiency, V_{OUT1}	V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT1} = 1A	85.7% (See Figure 3)
Efficiency, V_{OUT2}	V_{IN} = 12V, V_{OUT2} = 3.3V, I_{OUT2} = 1A	87.9% (See Figure 4)
Output Voltage Ripple, V_{OUT1}	V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT1} = 1A	<4.7mV_{P-P} (See Figure 5)
Output Voltage Ripple, V_{OUT2}	V_{IN} = 12V, V_{OUT2} = 3.3V, I_{OUT2} = 1A	<5.3mV_{P-P} (See Figure 6)
Load Transient Response, V_{OUT1}	V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT1} = 100mA to 1A	See Figure 7
Load Transient Response, V_{OUT2}	V_{IN} = 12V, V_{OUT2} = 3.3V, I_{OUT2} = 100mA to 1A	See Figure 8
Thermal Image	V_{IN} = 12V, V_{OUT1} = 2.5V, V_{OUT2} = 3.3V, I_{OUT1} = I_{OUT2} = 1A, T_A = 25°C	See Figure 9

QUICK START PROCEDURE

Demonstration circuit 2004A is easy to set up to evaluate the performance of the LTC3622. Please refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Place jumpers in the following positions:

Table 1. Jumper Selection

JP1	JP2	JP3	JP4	JP5
RUN1	RUN2	MODE/SYNC	PHASE	ILIM
ON	ON	BURST	180°	1A

2. Place VO1 SELECT jumper in 2.5V position (JP8) and VO2 SELECT jumper in 3.3V position (JP10).
3. With power off, connect the input power supply at VIN1 and GND.
4. Connect the Loads between VOUT1 and GND, VOUT2 and GND. Preset the loads to 0A.
5. Connect the DMMs to the input and output to monitor the input voltage and output voltages.
6. Turn on the power supply at the input. The RUN1 and RUN2 pin jumpers should be at ON position. Measure and make sure the input supply voltage is 12V. The output voltage VOUT1 should be 2.5V ±1%, and VOUT2 should be 3.3V ±1%.
7. Once the input and output voltages are properly established adjust the loads within the operating range (0A to 1A max) and observe the output voltage regulations, output ripple voltages, switch node waveforms and other parameters. Refer to Figure 2 for proper input/output voltage ripple measurement.
8. To select other output voltages, use the onboard user selectable output voltage jumpers. Shutting down LTC3622 by placing RUN1 and RUN2 pin jumpers to the OFF position or turn off the input power supply. Refer to the following tables (Table 2 and Table 3) for the output voltage selections and repeat steps 3 to 6.

Table 2. VOUT1 Jumper Selection

JP6	JP7	JP8	JP9
1.2V	1.8V	2.5V	*USER SELECT

Table 3. VOUT2 Jumper Selection

JP10	JP11	JP12
3.3V	5V	*USER SELECT

*Note: If JP9 or JP12 is selected, R5 or R15 needs to be calculated and inserted to obtain the desired output voltage.

Note 1: To measure the input/output voltage ripple properly, 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.

Note 2: DC2004A can also be used to evaluate LTC3622EMSE-2 (2.25MHz) by simply changing U1 to LTC3622EMSE-2, L1 to 1.0µH (Coilcraft XFL4020-102ME) and L2 to 2.2µH (Coilcraft XFL4020-222ME).

QUICK START PROCEDURE

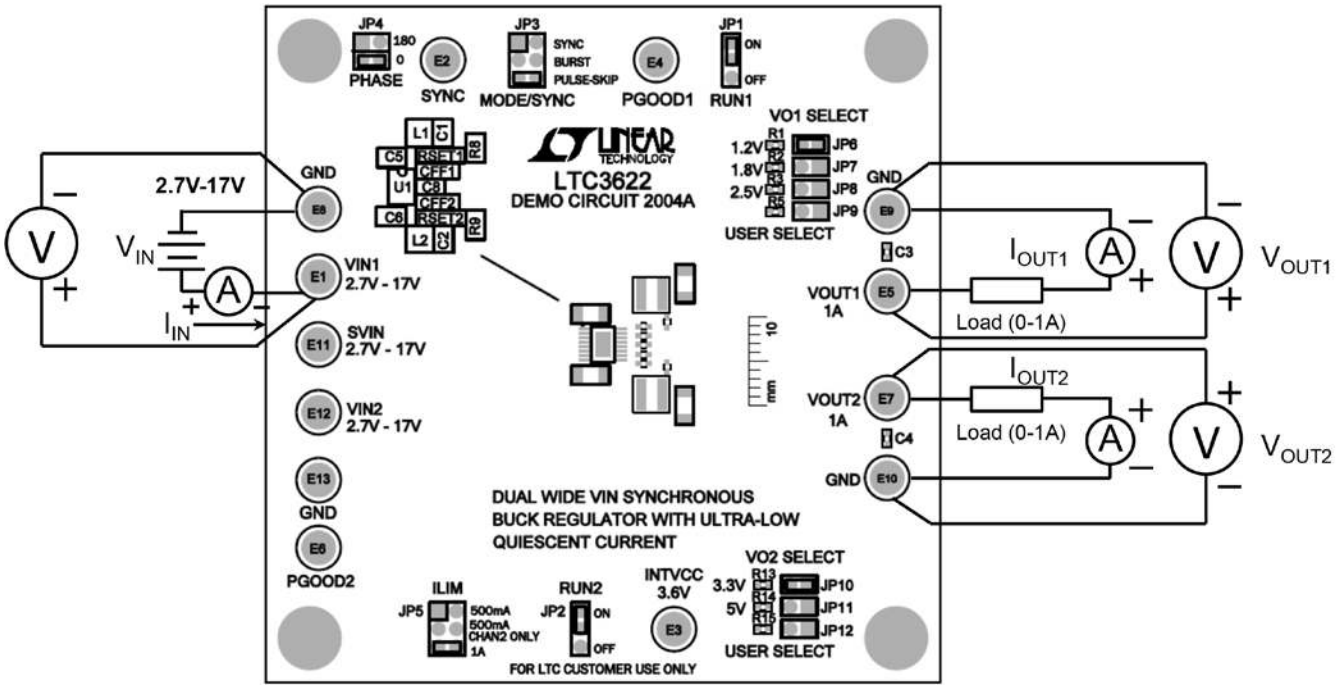


Figure 1. Proper Equipment Measurement Setup

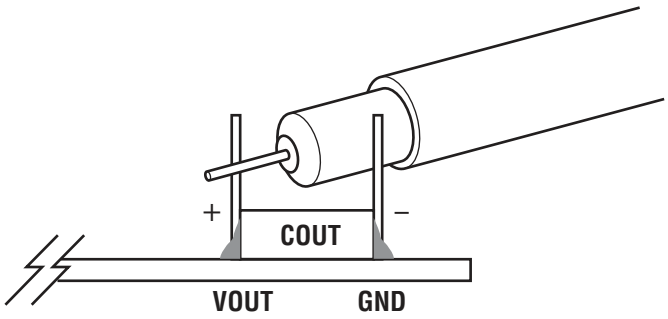


Figure 2. Scope Probe Placements for Measuring Input or Output Ripple

QUICK START PROCEDURE

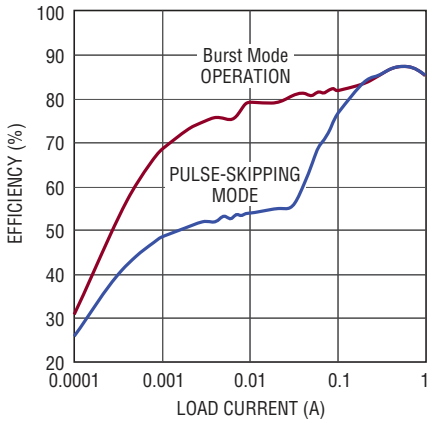


Figure 3. VOUT1 Measured Efficiency at V_{IN} = 12V, V_{OUT1} = 2.5V, L1 = 3.3µH, f_{SW} = 1MHz (with VOUT2 OFF)

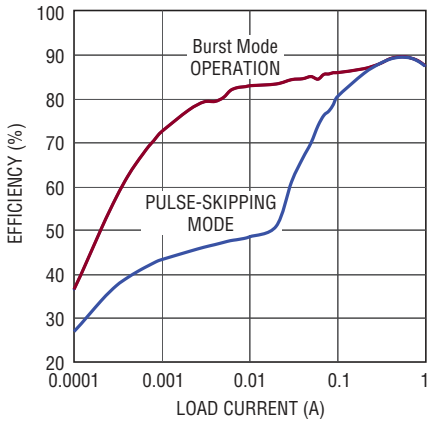


Figure 4. VOUT2 Measured Efficiency at V_{IN} = 12V, V_{OUT2} = 3.3V, L1 = 4.7µH, f_{SW} = 1MHz (with VOUT1 OFF)

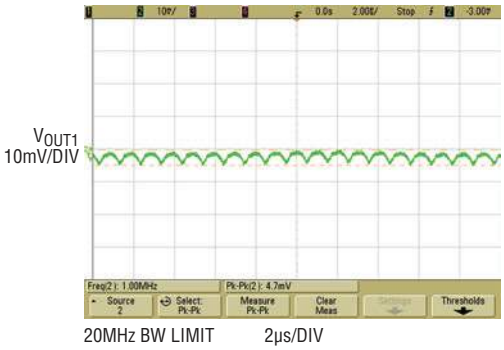


Figure 5. VOUT1 Measured Output Voltage Ripple at V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT1} = 1A, f_{SW} = 1MHz

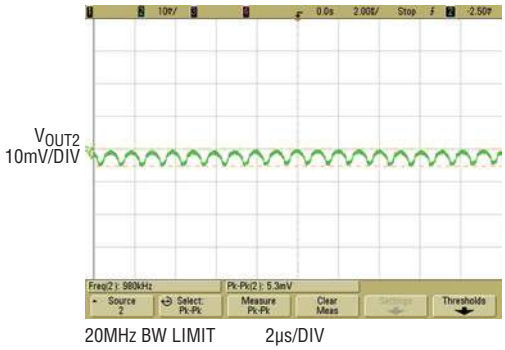


Figure 6. VOUT2 Measured Output Voltage Ripple at V_{IN} = 12V, V_{OUT2} = 3.3V, I_{OUT2} = 1A, f_{SW} = 1MHz

QUICK START PROCEDURE

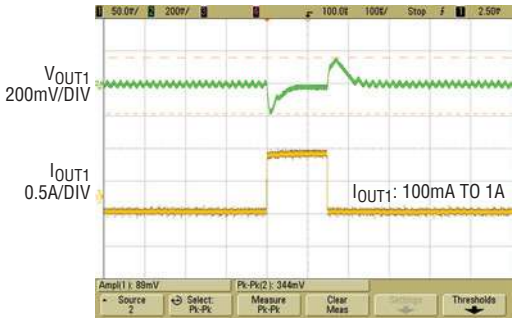


Figure 7. Load Transient Response at V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT1} = 100mA to 1A, f_{SW} = 1MHz, Burst Mode Operation

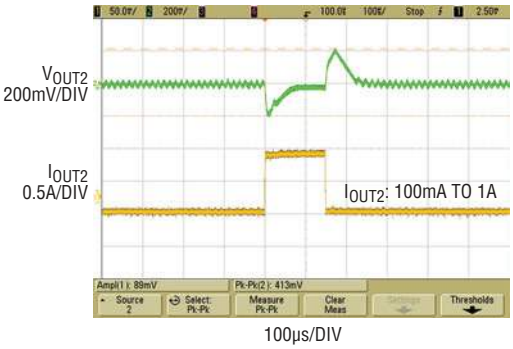


Figure 8. Load Transient Response at V_{IN} = 12V, V_{OUT2} = 3.3V, I_{OUT2} = 100mA to 1A, f_{SW} = 1MHz, Burst Mode Operation

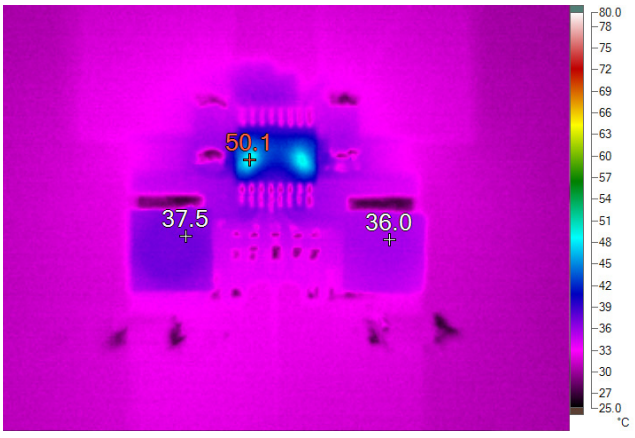
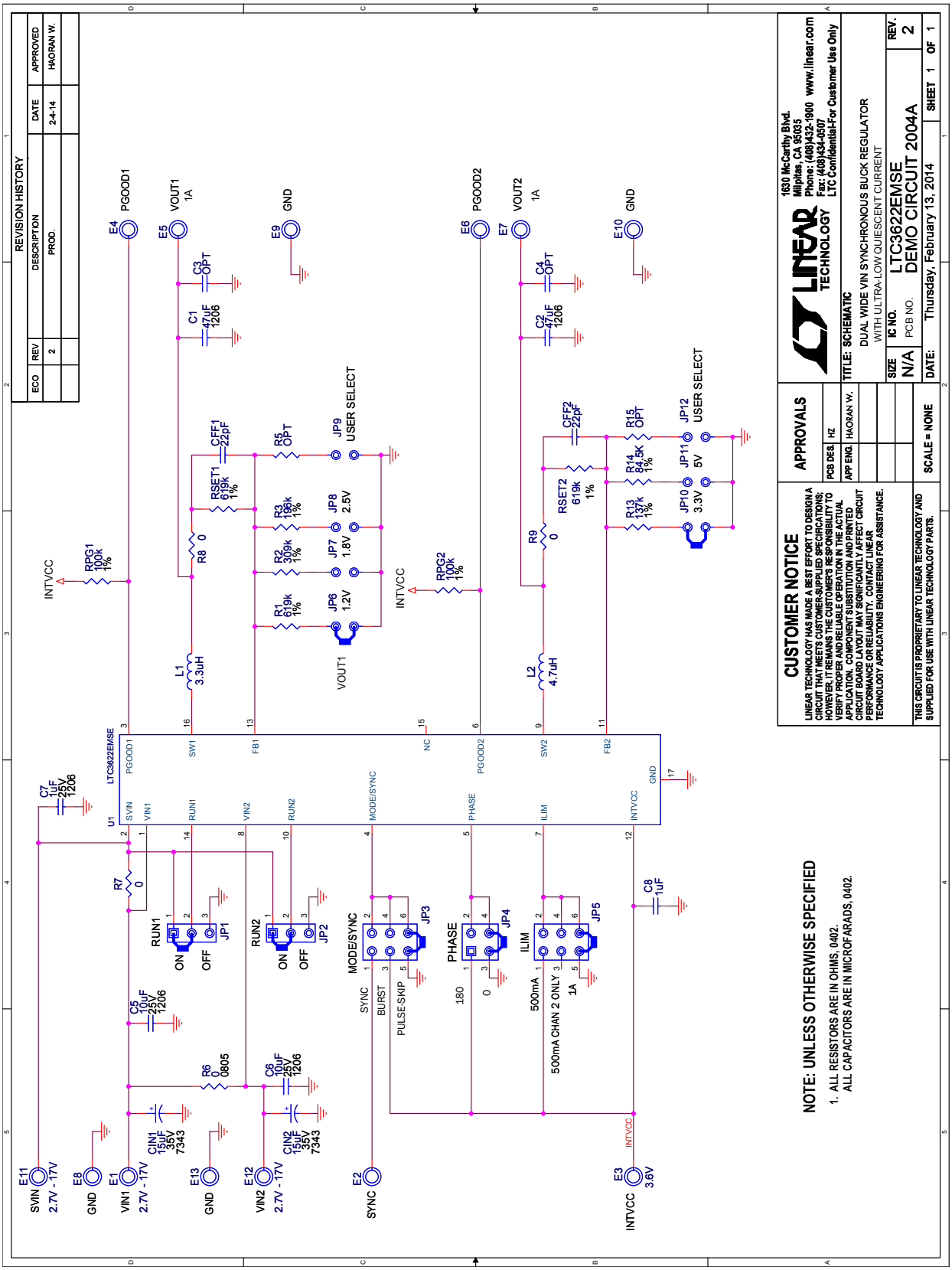


Figure 9. Thermal Performance at V_{IN} = 12V, V_{OUT1} = 2.5V, I_{OUT1} = 1A, V_{OUT2} = 3.3V, I_{OUT2} = 1A, f_{SW} = 1MHz, No Airflow, T_A = 25°C

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	CFF1, CFF2	CAP, 0402 22pF 5% 50V NPO	AVX 04025A220JAT2A
2	2	CIN1, CIN2	CAP, 7343 22µF 20% 35V TANT	AVX TPSY226M035R0200
3	2	C1, C2	CAP, 1206 47µF 20% 16V X5R	TDK C3216X5R1C476M160AB
4	2	C5, C6	CAP, 1206 10µF 20% 25V X5R	TDK C3216X5R1E106M
5	1	C7	CAP, 1206 1.0µF 20% 10V X5R	TDK C3216X5R1A105M
6	1	C8	CAP, 0402 1.0µF 20% 10V X5R	TDK C1005X5R1A105M
7	1	L1	IND, 3.3µH 20%	COILCRAFT XFL4020-332MEC
8	1	L2	IND, 4.7µH 20%	COILCRAFT XFL4020-472MEC
9	2	RPG1, RPG2	RES, 0402 100k 1% 1/16W	VISHAY CRCW0402100KFKED
10	3	RSET1, R1, RSET2	RES, 0402 619k 1% 1/16W	VISHAY CRCW0402619KFKED
11	1	R2	RES, 0402 309k 1% 1/16W	VISHAY CRCW0402309KFKED
12	1	R3	RES, 0402 196k 1% 1/16W	VISHAY CRCW0402196KFKED
13	1	R13	RES, 0402 137k 1% 1/16W	VISHAY CRCW0402137KFKED
14	1	R6	RES, 0805 0Ω JUMPER	VISHAY CRCW08050000Z0EA
15	1	R7	RES, 0603 0Ω JUMPER	VISHAY CRCW06030000Z0EA
16	2	R8, R9	RES, 0402 0Ω 1%	VISHAY, CRCW04020000Z0ED
17	1	R14	RES, 0402 84.5k 1% 1/16W	VISHAY CRCW040284K5FKED
18	1	U1	IC, DUAL SYNCHRONOUS STEP-DOWN CONVERTER	LINEAR TECH LTC3622EMSE
Additional Demo Board Circuit Components				
1	0	C3, C4	CAP, 0402 OPTION	OPTION
2	0	R5, R15	RES, 0402 OPTION	OPTION
Hardware				
1	13	E1, E2, E3, E4, E5, E6, E7, E8,	TURRET	MILL-MAX 2501-2-00-80-00-00-07-0
		E9, E10, E11, E12, E13		
2	2	JP1, JP2	HEADER, 3PIN, 2mm	SULLINS NRPN031PAEN-RC
3	2	JP3, JP5	HEADER, 3PIN, DBL ROW 2mm	SULLINS NRPN032PAEN-RC
4	1	JP4	HEADER, 2mm DBL ROW (2X2) 4PIN	SULLINS, NRPN022PAEN-RC
5	7	JP6, JP7, JP8, JP9, JP10, JP11, JP12	HEADER, 2PIN, 2mm	SULLINS NRPN021PAEN-RC
6	7	XJP1, XJP2, XJP3, XJP4, XJP5, XJP6, XJP10	SHUNT, 2mm	SAMTEC 2SN-BK-G
7	4	MH1, MH2, MH3, MH4	STANDOFF, SNAP ON	KEYSTONE_8831

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