Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of "Quality Parts,Customers Priority,Honest Operation,and Considerate Service",our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!

Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832
Email & Skype: info@chipsmall.com Web: www.chipsmall.com
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China

LT3964
36V Synchronous Dual LED Driver with I^{2}C

DESCRIPTION

The DC2424A is a 36V synchronous dual LED driver with I^{2}C featuring the LT®3964. It drives two separate LEDs (or channels of LEDs) at 1A when V$_{IN}$ is between 5V and 36V. DC2424A runs at 2MHz switching frequency. Its two channels can drive separate LED strings which can have different currents, voltages, or dimming ratios. It can be controlled with I^{2}C communications or it can be run in non-I^{2}C mode with proper ADDR pin settings. It is protected against both open and short LED conditions and reports the faults. In I^{2}C mode, faults can be enabled or disabled. Up to 9 different DC2424As can be placed on the same I^{2}C bus with unique addresses. A graphical user interface (GUI) is available through Qui-kEval™ when connected to a DC2026C Linduino® One demo circuit.

The LT3964 has an input voltage range from 4V to 36V. It has two independent 1.6A, 40V bucks with internal, synchronous 40V switches for high efficiency and small size. It has adjustable switching frequency between 200kHz and 2MHz. It can be synchronized to an external source or programmed with a clock output (CLKOUT) from the serial interface. The PWMTG high side PWM MOSFET drivers assist with short-circuit protection and versatility. Although the demo circuit is optimized for just one LED per channel, it can be altered to be buck regulators with as high as 33V of LEDs if V$_{IN}$ is high enough and circuit components are changed appropriately.

In non-I^{2}C mode, each channel can separately be PWM- and analog-dimmed by placing a PWM signal or CTRL voltage on the provided turrets. In I^{2}C mode, each channel can be dimmed to up to 8192:1 and analog dimmed to a high ratio using serial communications.

Small ceramic input and output capacitors are used to save space and cost. The open LED overvoltage protection uses the IC's constant voltage regulation loop to regulate the output to approximately 4.2V if the LED string is opened. There is a protection diode from each LED+ to GND to prevent negative ringing during a short-circuit condition.

Undervoltage lockout can be adjusted on the circuit with a few simple resistor choices. The output voltage (overvoltage protection) can be adjusted by changing the feedback resistors for higher string voltages. Other components may need to be changed to accommodate higher voltages also.

The LT3964 data sheet gives a complete description of the device, operation and applications information. The data sheet must be read in conjunction with this demo manual for DC2424A. The LT3964EUHE is assembled in a 36-lead plastic 5mm × 6mm QFN package with a thermally enhanced ground pad. Proper board layout is essential for maximum thermal performance. See the data sheet Layout Considerations section.

Design files for this circuit board are available at http://www.linear.com/demo/DC2424A

PERFORMANCE SUMMARY Specifications are at $T_A = 25°C$

PARAMETER	CONDITION		MIN	TYP	MAX
Input Voltage PV_{IN} Range	Operating		5V		36V
Switching Frequency	R8 = 27.4k			2.0MHz	
I_{LED1}, I_{LED2}	R12 = R16 = 0.1Ω			1.0A	
Open LED Voltage V_{OUT} (V COUT)	R10 = R14 = 1M	R11 = R15 = 383k		4.2V	
Efficiency (100% PWM DC)	12.0V PV_{IN}, 2MHz, I_{LED1} = I_{LED2} = 1.0A, 1 LED			81%	
V_{LED} Range	R10 = R14 = 1M	R11 = R15=383k	2.5V		3.6V
I^2C PWM Dimming Frequency	R8 = 27.4k			244Hz	
PV_{IN} Undervoltage Lockout (Falling)	R1 = 332k	R2 = 102k		5.0V	
PV_{IN} Turn-On Voltage (Rising)	R1 = 332k	R2 = 102k		6.0V	

QUICK START PROCEDURE

How to Operate in Non-I^2C Mode

The DC2424A is easy to set up to evaluate the performance of the LT3964 in non-I^2C mode. Follow the procedure below:

1. With power off, connect a single LED between LED1+ and LED1– terminals and the same for LED2+ and LED2–. Connect the EN/UVLO terminal to GND to keep the circuit shut down. With power off, connect the input power supply to the V_{IN} and GND terminals. Make sure that the input voltage will not exceed 36V.

2. For non-I^2C mode operation, set both JP1 and JP2 (ADDR1 and ADDR2) to 0. The 00 address pins setting is for non-I^2C mode, but all other settings are for I^2C serial communications mode.

3. Turn the input power supply on and make sure the voltage is between 8V and 36V to start operation.

4. Release the EN/UVLO-to-GND connection.

5. Observe the LED string running at the programmed LED current.

6. To change the brightness with analog dimming in non-I^2C mode, simply attach a voltage source the CTRL1 and/or CTRL2 terminals and set the voltage between 0V and 1.5V. See data sheet for details.

7. To change brightness with external PWM dimming in non-I^2C mode, simply attach a rectangular waveform with varying duty cycle to the PWM1 and/or PWM2 terminals.

How to Operate with Graphical User Interface (GUI) – I^2C Serial Communications Mode

1. With power off, connect a single LED between LED1+ and LED1– terminals and the same for LED2+ and LED2–. Connect the EN/UVLO terminal to GND to keep the circuit shut down. With power off, connect the input power supply to the V_{IN} and GND terminals. Make sure that the input voltage will not exceed 36V.

2. For I^2C serial communications operation, set JP1 (ADDR1) to 0 and JP2 (ADDR2) to 1. The 01 address setting works seamlessly with the DC2424A GUI in QuikEval. In general, serial communications can be used with the LT3964 as long as ADDR1 and ADDR2 settings are anything other than 00. There are three states to each ADDRX pin, 0, 1, or float. There are 9 unique I^2C address settings.

3. Connect a ribbon cable between the J1 serial communications connection and a Linduino One (DC2026C) demo circuit.

4. Connect a USB cable between a PC and the DC2026C.

5. Turn on 12V power to the PV_{IN} and GND pins of the DC2424A.

dc2424af

QUICK START PROCEDURE

6. Launch QuikEval (find installation instructions on the www.linear.com website) and the LT3964 DC2424A GUI launches.

7. Use the DC2424A GUI in QuikEval to test the performance of the LT3964 demo circuit.

NOTE: A DC2424A LT3964 GUI user guide is posted on the landing page for the LT3964 and DC2424A. It contains the GUI pages, commands, and other details. Please contact Linear support for help with the GUI and User Guide.
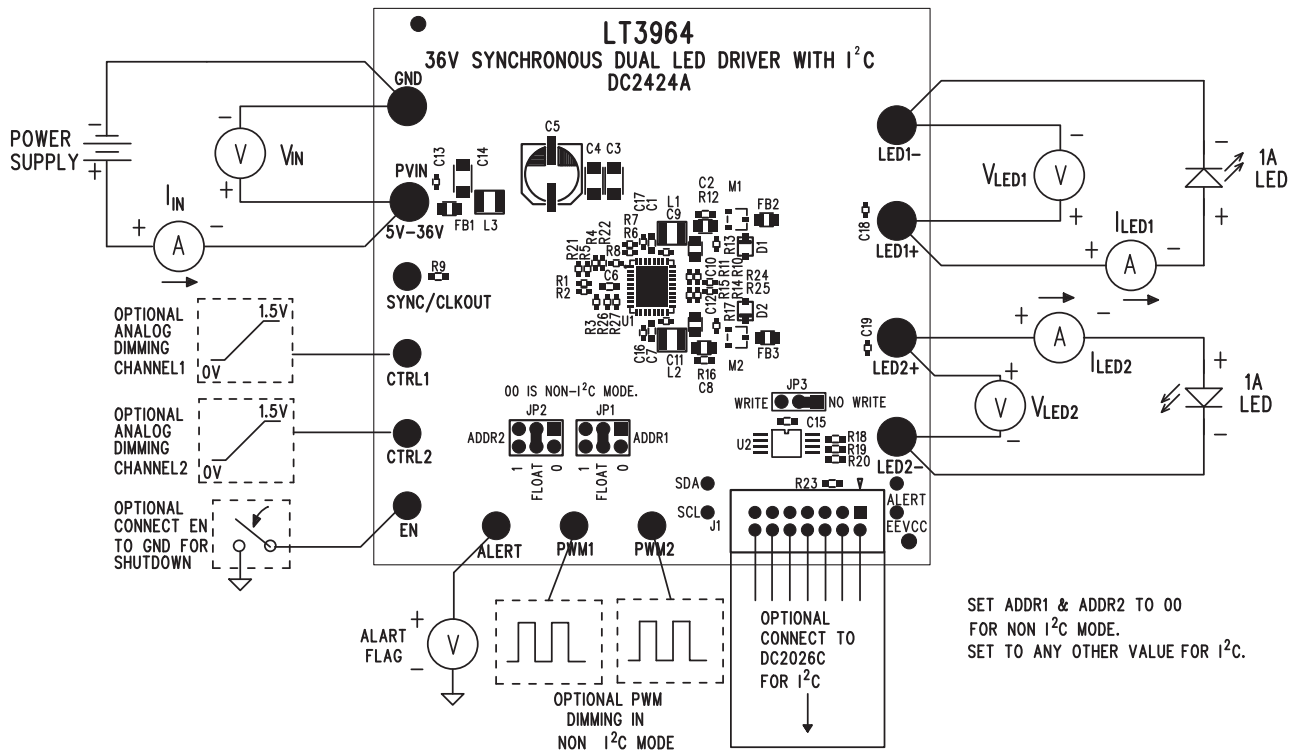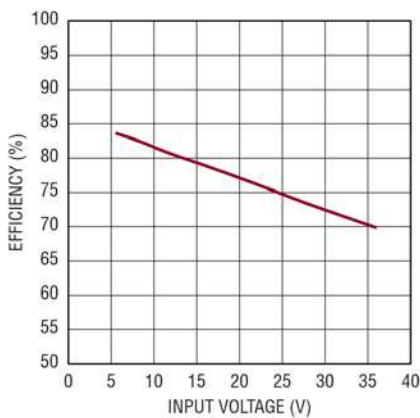

Figure 1. Test Procedure Setup Drawing for DC2424A

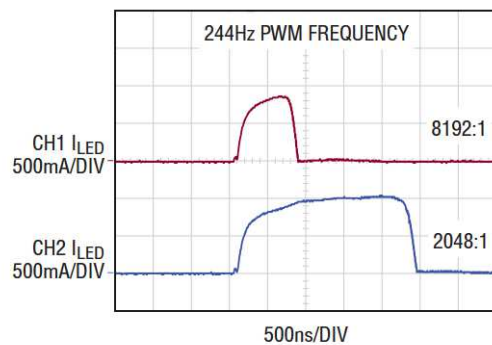**Figure 2. DC2424A Efficiency vs Input Voltage with 2MHz and Single 1A LED on Each Channel**

Figure 3. DC2424A PWM Dimming Using I²C Settings for 8192:1 and 2048:1 Dimming Ratios
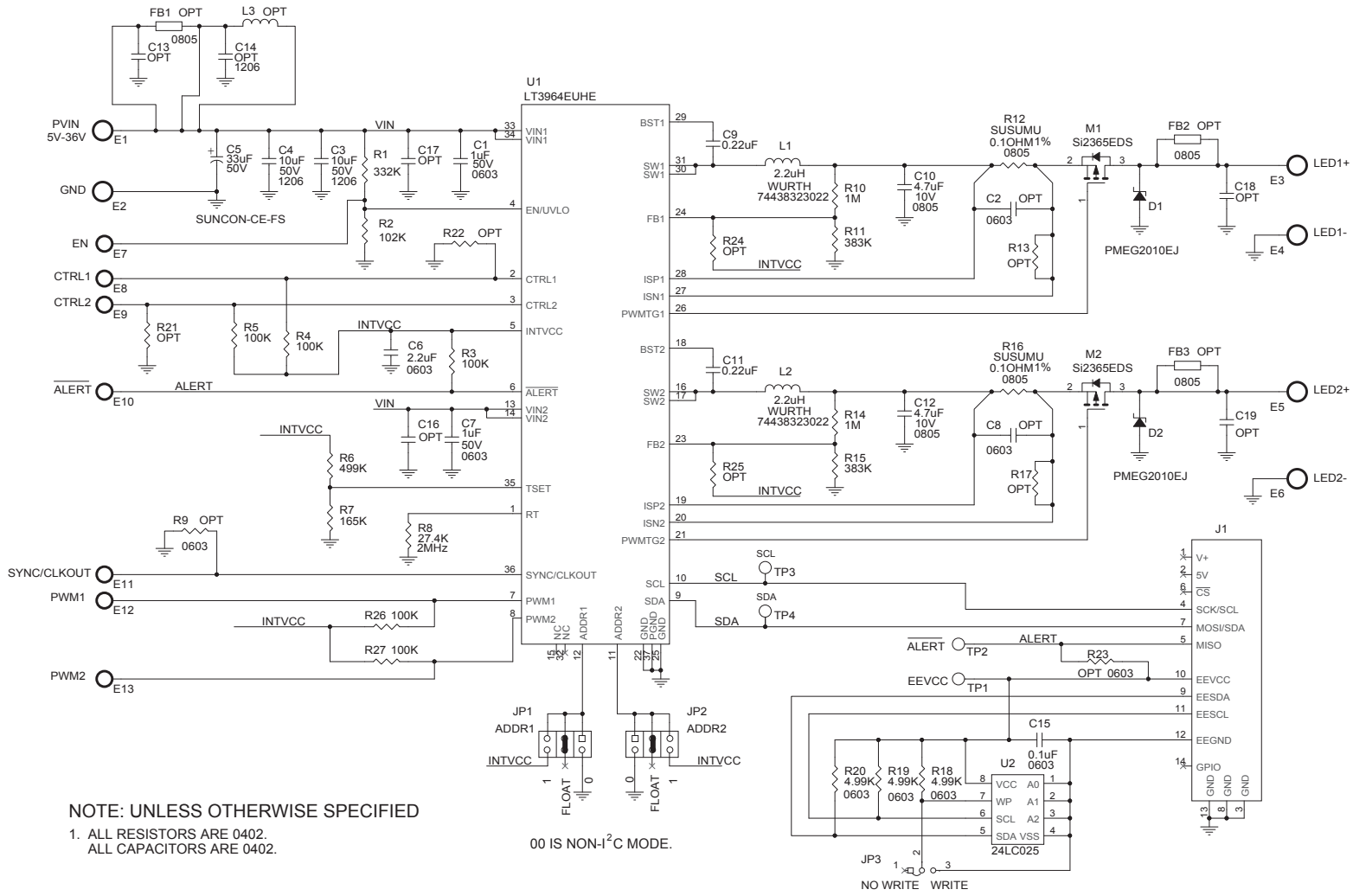
PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C7	CAP, 1µF, X5R, 50V, 10%, 0603	MURATA, GRM188R61H105KAALD
2	2	C10, C12	CAP, 4.7µF, X7R,10V,10%, 0805	MURATA, GRM21BR71A475KA73L
4	2	C3, C4	CAP, 10µF, X5R, 50V, 10%, 1206	MURATA, GRM31CR61H106KA12L
6	1	C6	CAP, 2.2µF, X5R, 25V, 10%, 0603	MURATA, GRM188R61E225ME84D
7	2	C9, C11	CAP, 0.22µF, X5R, 25V, 10%, 0402	MURATA, GRM155R61E224KE01D
19	2	L1, L2	INDUCTOR, 2.2µH	WURTH ELEKTRONIK, 74438323022
21	2	M1, M2	MOSFET P-CH, 20V, 5.9A, SOT-23	VISHAY, Si2365EDS-T1-GE3
22	1	R1	RES., 332k, 1/16W, 1%, 0402	VISHAY, CRCW0402332KFKED
24	1	R2	RES., 102k, 1/16W, 1%, 0402	VISHAY, CRCW0402102KFKED
25	1	R3	RES., 100k, 1/16W, 1%, 0402	VISHAY, CRCW0402100KFKED
23	1	R6	RES., 499k, 1/16W, 1%, 0402	VISHAY, CRCW0402499KFKED
26	1	R7	RES., 165K, 1/16W, 1%, 0402	VISHAY, CRCW0402165KFKED
27	1	R8	RES., 27.4k, 1/16W, 1%, 0402	VISHAY, CRCW040227K4FKED
28	2	R11, R15	RES., 383k, 1/16W, 1%, 0402	VISHAY, CRCW0402383KFKED
30	2	R10, R14	RES., 1M, 1/16W, 1%, 0402	VISHAY, CRCW04021M00FKED
31	2	R12, R16	RES., 0.1Ω, 1/2W, 1%, 0805	SUSUMU, KRL1220E-M-R100-F-T5
34	1	U1	I.C. LED DRIVER QFN-5 × 6	LINEAR, LT3964EUHE#PBF
Optional Electrical Components				
3	0	C2, C8 (OPT)	CAP, 0603	OPTION
5	1	C5	CAP, ALUM., 33µF, 50V, 6.3 × 7.7	SUNCON, 50CE33FS
8	0	C13, C16, C18, C19 (OPT)	CAP, 0402	OPTION
9	0	C14 (OPT)	CAP, 1206	OPTION
10	1	C15	CAP, 0.1µF, X7R, 16V,10%, 0603	MURATA, GRM188R71C104KA01D
11	2	D1, D2	DIODE SCHOTTKY, 20V, 1A, SOD323F	NXP, PMEG2010EJ, 115
14	0	FB1, FB2, FB3 (OPT)	FERRITE BEAD, CHIP, 0805	
20	0	L3 (OPT)	INDUCTOR, 2.2µH	WURTH ELEKTRONIK, 74438323022
25	4	R4, R5, R26, R27	RES., 100k, 1/16W, 1%, 0402	VISHAY, CRCW0402100KFKED
29	0	R9, R23 (OPT)	RES, OPT, 0603	
32	0	R13, R17, R21, R22, R24, R25	RES, 0402	OPTION
33	3	R18, R19, R20	RES., 4.99k, 1/10W, 1%, 0603	VISHAY, CRCW06034K99FKEA
35	1	U2	I.C., EEPROM 2-KBIT 400kHz 8-TSSOP	MICROCHIP, 24LC025-I/ST
Hardware				
1	6	E1-E6	TESTPOINT, TURRET, 0.094" PBF	MILL-MAX, 2501-2-00-80-00-00-07-0
2	7	E7-E13	TESTPOINT, TURRET, 0.061" PBF	MILL-MAX, 2308-2-00-80-00-00-07-0
3	2	JP1, JP2	HEADER, 2 × 3 PIN, 0.079 DOUBLE ROW	WURTH ELEKTRONIK, 62000621121
4	1	JP3	HEADOR, 3 × 1 PIN, 0.079", SINGLE ROW	WURTH ELEKTRONIK, 62000311121
5	3	XJP1, XJP2, XJP3	SHUNT, 0.079" CENTER	WURTH ELEKTRONIK, 60800213421
6	1	J1	HEADER, 2 × 7 DUAL ROW	MOLEX, 87831-1420

FB1 OPT   L3 OPT
C13 OPT   0805
C14 OPT
1206

U1
LT3964EUHE

PVIN 5V-36V E1

C5 33uF 50V SUNCON-CE-FS
C4 10uF 50V 1206
C3 10uF 50V 1206
R1 332K
C17 OPT
C1 1uF 50V 0603

GND E2

VIN
33 VIN1
34 VIN1

4 EN/UVLO
R2 102K
R22 OPT

EN E7
CTRL1 E8   2 CTRL1
CTRL2 E9   3 CTRL2

R21 OPT
R5 100K
R4 100K
INTVCC
C6 2.2uF 0603
R3 100K
5 INTVCC

ALERT E10   ALERT   6 ALERT

VIN
13 VIN2
14 VIN2
C16 OPT
C7 1uF 50V 0603

INTVCC
R6 499K
35 TSET

R9 OPT 0603
R7 165K
R8 27.4K 2MHz
1 RT

SYNC/CLKOUT E11   36 SYNC/CLKOUT
PWM1 E12   7 PWM1
PWM2   8 PWM2
INTVCC
R26 100K
R27 100K

PWM2 E13

BST1 29
C9 0.22uF
L1 2.2uH WURTH 74438323022
SW1 31
SW1 30
R10 1M
C10 4.7uF 10V 0805
R12 SUSUMU 0.1OHM1% 0805
C2 OPT 0603
M1 Si2365EDS
2 3
1
D1 PMEG2010EJ
FB2 OPT 0805
LED1+ E3
C18 OPT
LED1- E4

FB1 24
R24 OPT
INTVCC
R11 383K
R13 OPT

ISP1 28
ISN1 27
PWMTG1 26

BST2 18
C11 0.22uF
L2 2.2uH WURTH 74438323022
SW2 16
SW2 17
R14 1M
C12 4.7uF 10V 0805
R16 SUSUMU 0.1OHM1% 0805
C8 OPT 0603
M2 Si2365EDS
2 3
1
D2 PMEG2010EJ
FB3 OPT 0805
LED2+ E5
C19 OPT
LED2- E6

FB2 23
R25 OPT
INTVCC
R15 383K
R17 OPT

ISP2 19
ISN2 20
PWMTG2 21

SCL TP3
SCL 10 SCL
SDA TP4
SDA 9 SDA

NC 15
NC 33
ADDR1 12
ADDR2 11
GND 22
PGND 37
GND 25

JP1
ADDR1
INTVCC
1
FLOAT   0

JP2
ADDR2
0
FLOAT   1
INTVCC

J1
1 V+
2 5V
6 CS
4 SCK/SCL
7 MOSI/SDA
5 MISO
10 EEVCC
9 EESDA
11 EESCL
12 EEGND
14 GPIO
13 8 3 GND GND GND

ALERT TP2   ALERT
R23 OPT 0603
EEVCC TP1

C15 0.1uF 0603
R20 4.99K 0603
R19 4.99K 0603
R18 4.99K 0603

U2
8 VCC A0 1
7 WP A1 2
6 SCL A2 3
5 SDA VSS 4
24LC025

JP3
1 2
NO WRITE   WRITE

NOTE: UNLESS OTHERWISE SPECIFIED
1. ALL RESISTORS ARE 0402.
   ALL CAPACITORS ARE 0402.

00 IS NON-I2C MODE.

LINEAR TECHNOLOGY
1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408)432-1900 www.linear.com
Fax: (408)434-0507
LTC Confidential-For Customer Use Only

TITLE: SCHEMATIC
36V SYNCHRONOUS DUAL LED DRIVER WITH I2C

SIZE N/A
IC NO. LT3964EUHE
DC2424A
REV. 3
DATE: Thursday, July 13, 2017
SHEET 1 OF 1

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

dc2424af