

LTM8049

Dual SEPIC or Inverting μModule DC/DC Converter

DESCRIPTION

Demonstration circuit 2244A features the **LTM®8049**, a dual SEPIC or inverting μModule® regulator. The demo circuit is configured as two stand-alone DC/DC converters with +12.0V and -12V output voltages from an input voltage up to 20V. The switching frequencies of both channels are set at 1MHz on DC2244A. The frequency foldbacks when the output is 15% below the target regulation point during a fault or output overload, thus protects the power switch from damage.

Both channels can be configured as either SEPIC or inverting by simply grounding the appropriate output rail, component change, and/or PCB board cut. The maximum output current of each channel varies with the input voltage,

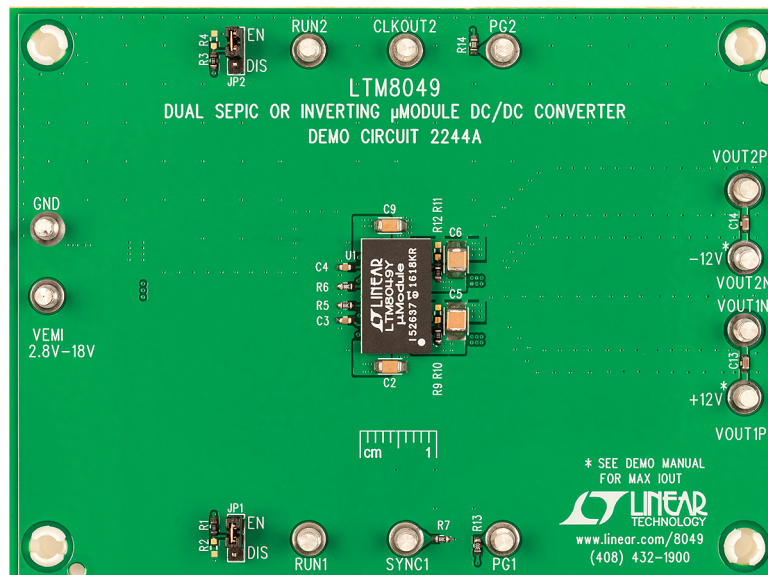
and is 1A at 12V_{IN}. The two channels can be paralleled for higher output current with SHARE1, SHARE2 pins tied together. See the Quick Start Procedure for more information on the modification of the board, and paralleling of two outputs.

The LTM8049 data sheet gives complete description of the device, operation and application information. The data sheet must be read in conjunction with this demo manual prior to working on or modifying demo circuit 2244A.

Design files for this circuit board are available at <http://www.linear.com/demo/DC2244A>

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

BOARD PHOTO



DEMO MANUAL DC2244A

PERFORMANCE SUMMARY

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

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		2.8		18	V
F_{SW}	Switching Frequency	$V_{IN} = 12\text{V}$, $I_{OUT1} = 1\text{A}$		1		MHz
V_{OUT1}	Output Voltage of Channel 1, SEPIC		11.75	12	12.25	V
I_{OUT1}	Maximum Output Current of Channel 1	$V_{IN} = 12\text{V}$	1			A
$V_{OUT1}(\text{AC})$	Output Ripple of Channel 1 (Across C5)	$V_{IN} = 12\text{V}$, $I_{OUT1} = 0.7\text{A}$		60		mV
η_1	Efficiency of Channel 1	$V_{IN} = 12\text{V}$, $I_{OUT1} = 0.7\text{A}$		82		%
V_{OUT2}	Output Voltage of Channel 2, INVERTING		-11.75	-12	-12.25	V
I_{OUT2}	Maximum Output Current of Channel 2	$V_{IN} = 12\text{V}$	1			A
$V_{OUT2}(\text{AC})$	Output Ripple of Channel 2 (Across C6)	$V_{IN} = 12\text{V}$, $I_{OUT2} = 0.7\text{A}$		20		mV
η_2	Efficiency of Channel 2	$V_{IN} = 12\text{V}$, $I_{OUT2} = 1\text{A}$		81.0		%

QUICK START PROCEDURE

Demo circuit 2244A is an easy way to evaluate the performance of the LTM8049. Refer to Figure 1 for proper measurement equipment setup, and follow the procedure below:

1. Place JP1 and JP2 in EN position.
2. With power off, connect the input power supply to VEMI and GND. Connect the load to VOUT1P and VOUT1N, VOUT2P and VOUT2N.
3. Set voltage of the DC power supply at 12V. Turn on the power at the input.

Note. Make sure that the input voltage does not exceed 20V.

4. Check for the proper output voltage between VOUT1P and VOUT1N ($V_{OUT1P} = 12\text{V}$). Check for the proper output voltage between VOUT2P and VOUT2N ($V_{OUT2N} = -12\text{V}$).

Note. If there is no output, or output voltage value is out of the spec, temporarily disconnect the load to make sure that the load is not set too high.

Note. The circuit features frequency foldback to protect the power switches during a fault or output current overload. During startup, the frequency foldback also limits the current the circuit delivers to the load. Refer to LTM8049 data sheet for more information on maximum output current and startup current.

5. Once the proper output voltage at each channel is established, adjust the load within the operating range and

measure the output voltage regulation, ripple voltage, efficiency and other parameters.

Note. When measuring the input or output voltage ripple, care must be taken to avoid a long ground lead on the oscilloscope probe. Measure the input or output voltage ripple by touching the probe tip directly across the VEMI and GND terminals, VOUT1P and VOUT1N terminals, or VOUT2P and VOUT2N terminals. See Figure 2 for proper scope probe technique.

6. An external clock can be added to the SYNC1 terminal when SYNC function is used. The clock from CLKOUT2 can be used to sync the other boards, and its duty ratio varies with the internal temperature of the module.
7. The board is set for positive output at channel 1, and negative output at channel 2. The outputs can be set to other voltages by changing the feedback resistors (R9 or R10). To modify the board for two negative outputs, cut the copper along C5 and short the other terminal of C5 to ground. Remove resistor R9 and staff the resistor R10 with proper values. Refer to Figure 3a. To modify the board for two positive outputs, cut the copper along C6 and short the other terminal of C6 to ground. Remove resistor R12 and staff the resistor R11 with proper values. Refer to Figure 3b.
8. Two outputs of same voltage can be paralleled to increase the output current capability. Make sure a 0Ω resistor is added to R8. To ensure better current sharing, grounds of the two output caps C5 and C6 must be connected with short wires.

dc2244afa

QUICK START PROCEDURE

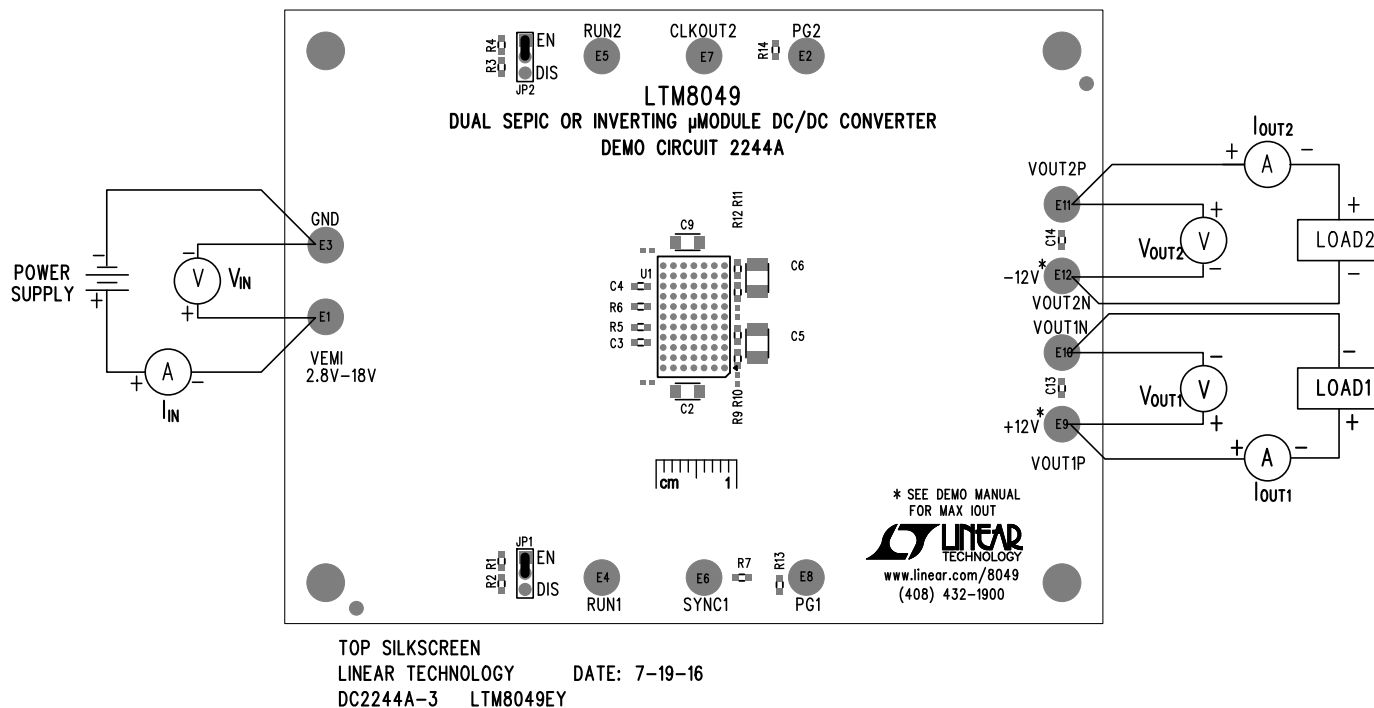


Figure 1. DC2244A Proper Equipment Setup

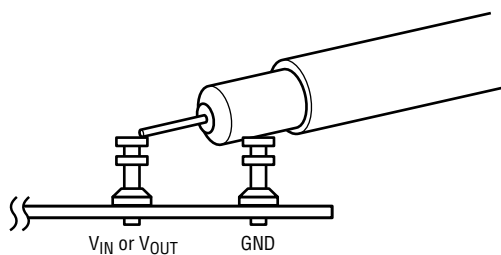


Figure 2. Measuring Input or Output Ripple

QUICK START PROCEDURE

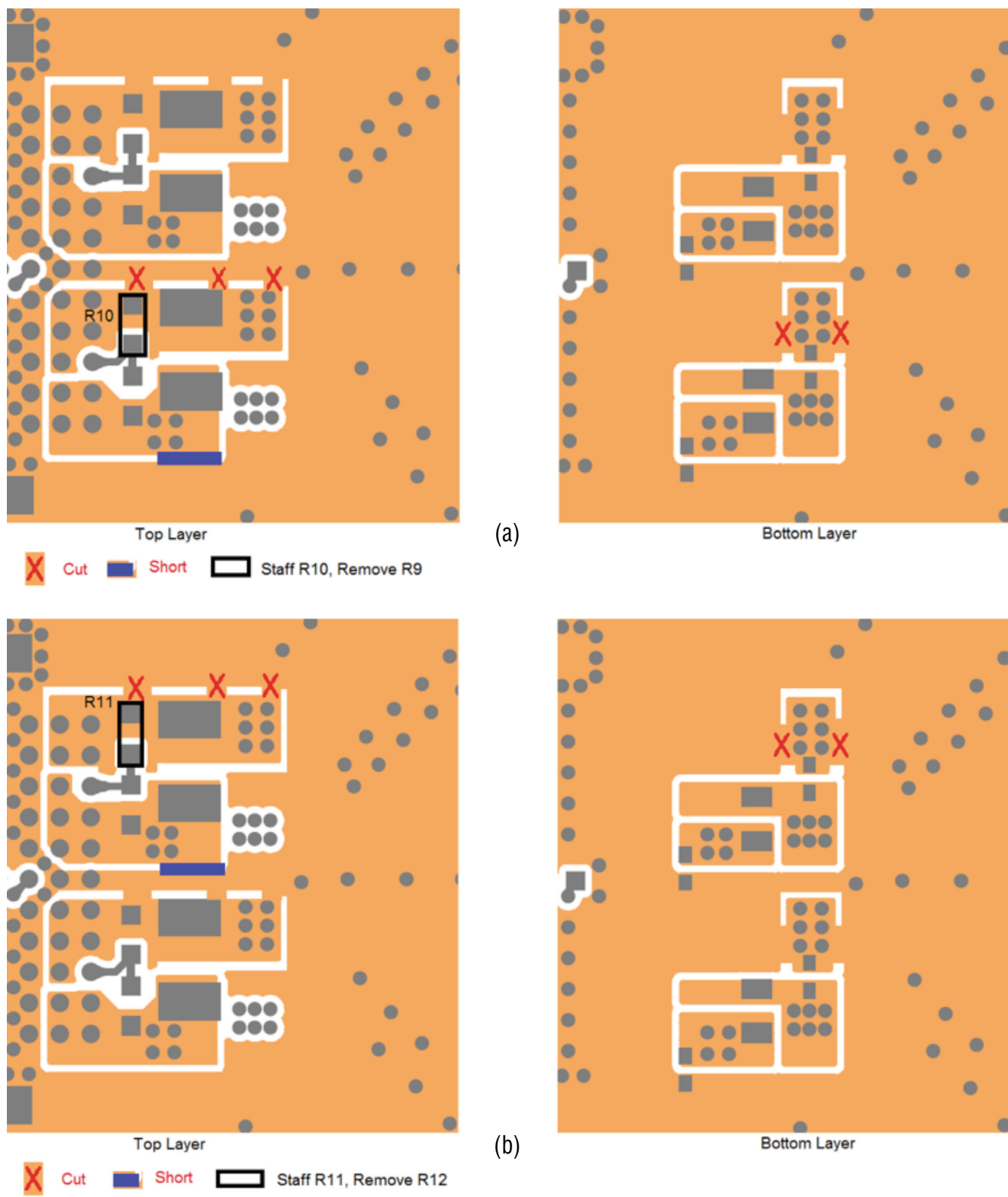
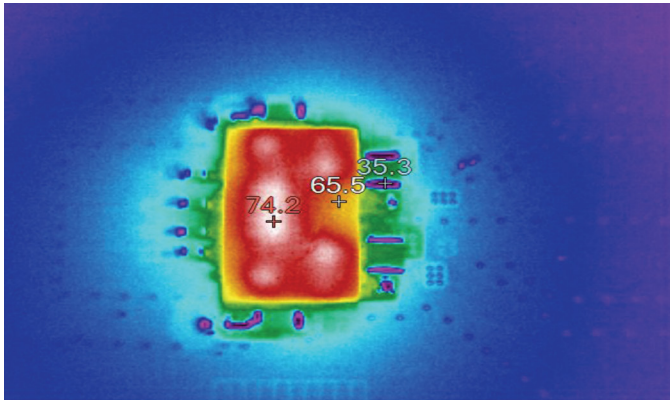
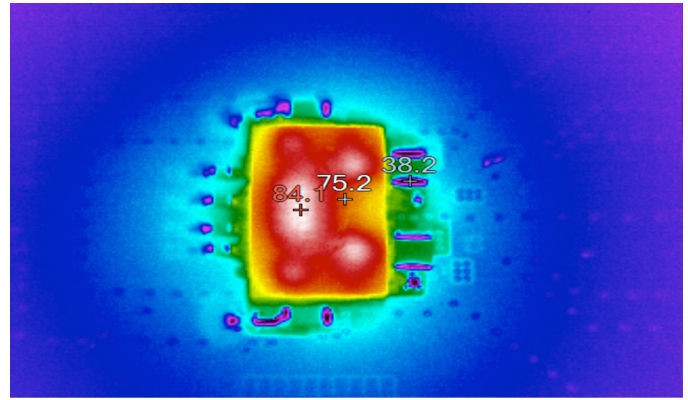


Figure 3. Change the Boards to (a) Two Negative Outputs, (b) Two Positive Outputs

QUICK START PROCEDURE



(a) $V_{IN} = 12V$



(b) $V_{IN} = 20V$

Figure 4. DC2244A Thermal Performance ($12V_{IN}$, $I_{OUT1} = I_{OUT2} = 0.7A$, $T_A = 25^\circ C$)

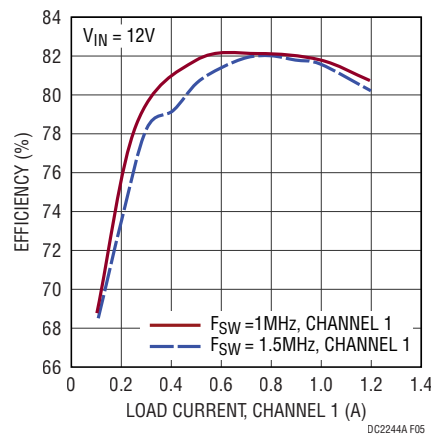
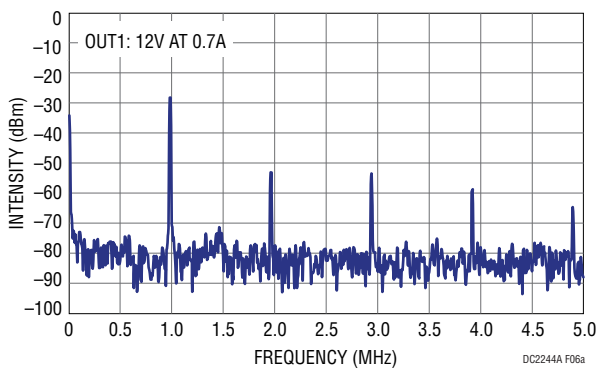
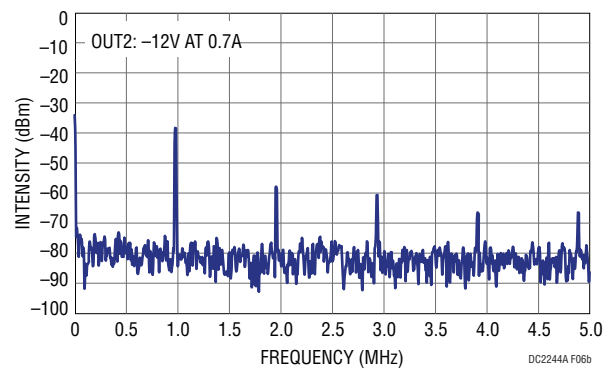


Figure 5. DC2244A Efficiency vs Load Current ($T_A = 25^\circ C$)



(a) V_{OUT1} Noise Spectrum, $I_{OUT1} = 0.7A$



(b) V_{OUT2} Noise Spectrum, $I_{OUT2} = 0.7A$

Figure 6. Output Noise Spectrum with 0.7A Load Current ($V_{IN} = 12V$, Short Output Ferrite Beads)

QUICK START PROCEDURE

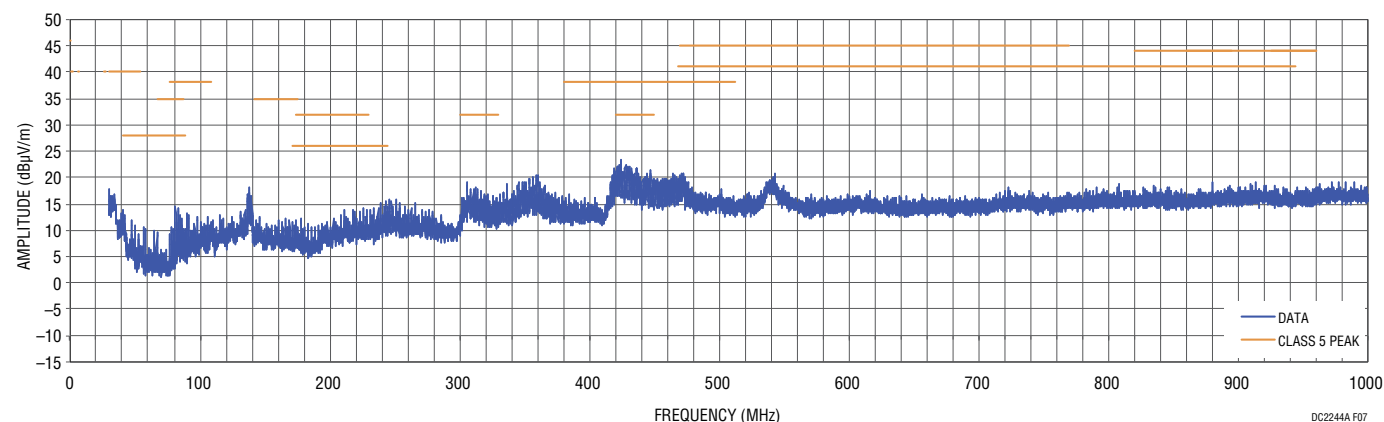


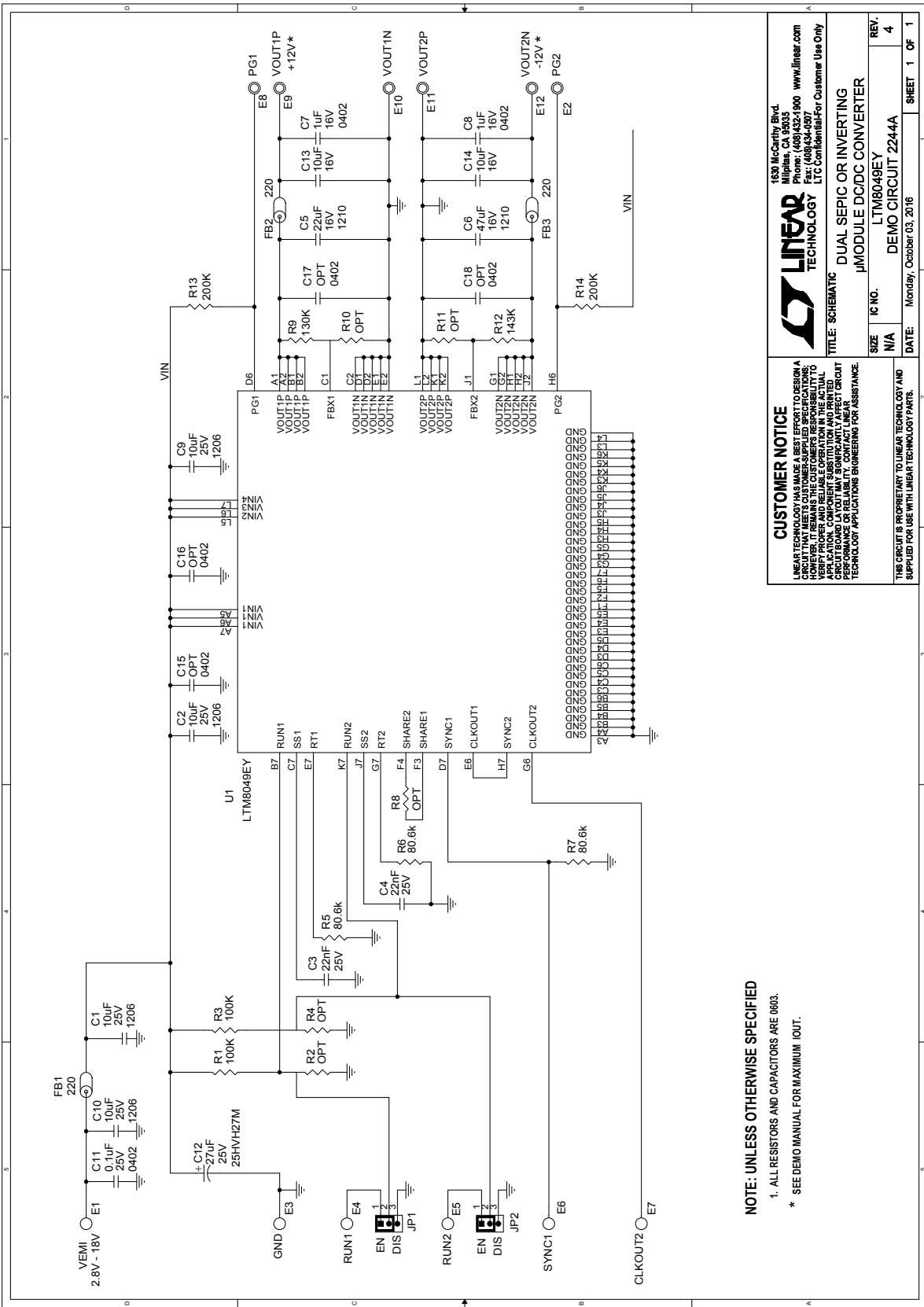
Figure 7. Radiated EMI CISPR25- Class 5 Peak Limit (Vertical Polarization) with 0.7A Load Current. ($V_{IN} = 14V$)

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	4	C1, C2, C9, C10	CAP, X7R, 10μF, 25V, 10%, 1206	MURATA, GRM31CR71E106KA12L
2	2	C3, C4	CAP, X7R, 22nF, 25V, 10%, 0603	MURATA, GRM188R71E223KA01D
3	1	C5	CAP, X7R, 22μF, 16V, 10%, 1210	MURATA, GRM32ER71C226KE18L
4	1	C6	CAP, X5R, 47μF, 16V, 10%, 1210	MURATA, GRM32ER61C476KE15K
5	2	C13, C14	CAP, X5R, 10μF, 16V, 10%, 0603	MURATA, GRM188R61C106KAALD
6	2	C7, C8	CAP, X5R, 1μF, 16V, 10%, 0402	MURATA, GRM155R61C105KE01D
7	1	C11	CAP, X7R, 0.1μF, 25V, 10%, 0402	MURATA, GRM155R71E104KE14D
8	1	C12	CAP, ALUM, 27μF, 25V	SUN ELECT., 25HVH27M
9	2	R1, R3	RES., CHIP, 100k, 1/10W, 1%, 0603	VISHAY, CRCW0603100KFKEA
10	3	R5, R6, R7	RES., CHIP, 80.6k, 1/10W, 1%, 0603	VISHAY, CRCW060380K6FKEA
11	1	R9	RES., CHIP, 130k, 1/10W, 1%, 0603	VISHAY, CRCW0603130KFKEA
12	1	R12	RES., CHIP, 143k, 1/10W, 1%, 0603	VISHAY, CRCW0603143KFKEA
13	2	R13, R14	RES, CHIP, 200k, 1/10W, 1%, 0603	VISHAY, CRCW0603200KFKEA
14	3	FB1, FB2, FB3	Ferrite Bead, 220Ω MPZ2012	TDK Corp. MPZ2012S221AT000
15	1	U1	IC., LTM8049EY BGA	LINEAR TECH., LTM8049EY#PBF
Additional Demo Board Circuit Components				
1	2	C15, C16 (OPT)	CAP, X5R, 1μF, 25V, 10%, 0402	MURATA, GRM155R61E105KA12D
2	2	C17, C18 (OPT)	CAP, X5R, 0.47μF, 16V, 10%, 0402	TDK Corporation, C1005X5R1C474K050BC
3	0	R2, R4, R8, R10, R11 (OPT)	RES., OPT, 0603	
Hardware for Demo Board Only				
1	12	E1-E12	TESTPOINT, TURRET, .094" pbf	MILL-MAX, 2501-2-00-80-00-00-07-0
2	2	JP1, JP2	3 PIN 0.079 SINGLE ROW HEADER	SULLIN, NRPN031PAEN-RC
3	2	XJP1, XJP2	SHUNT, .079" CENTER	WURTH, 608 002 134 21
4	4	(STAND-OFF)	STAND-OFF, NYLON 0.25"	KEYSTONE, 8831 (SNAP ON)

dc2244afa

SCHEMATIC DIAGRAM



CUSTOMER NOTICE

LINEAR TECHNOLOGY HAS MADE A BEST EFFORT TO DESIGN A CIRCUIT THAT MEETS THE SPECIFICATIONS OF THE LTM8049EY. HOWEVER, IT REMAINS THE CUSTOMER'S RESPONSIBILITY TO VERIFY PROPER AND RELIABLE OPERATION IN THE ACTUAL APPLICATION. LINEAR TECHNOLOGY DOES NOT WARRANT THE PERFORMANCE OF RELIABILITY. CONTACT LINEAR TECHNOLOGY APPLICATIONS ENGINEERING FOR ASSISTANCE.

LINEAR TECHNOLOGY

1630 McCarthy Blvd.
Milpitas, CA 95035
Phone: (408) 432-1900 www.linear.com
Fax: (408) 432-1997
LTC Confidential-For Customer Use Only

TITLE: SCHEMATIC

IC NO. LTM8049EY

REV. 4

SIZE N/A

DATE Monday, October 03, 2016

DEMO CIRCUIT 2244A

SHEET 1 OF 1

DEMO MANUAL DC2244A

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

dc2244afa