LTM8049
Dual SEPIC or Inverting µModule DC/DC Converter

DESCRIPTION

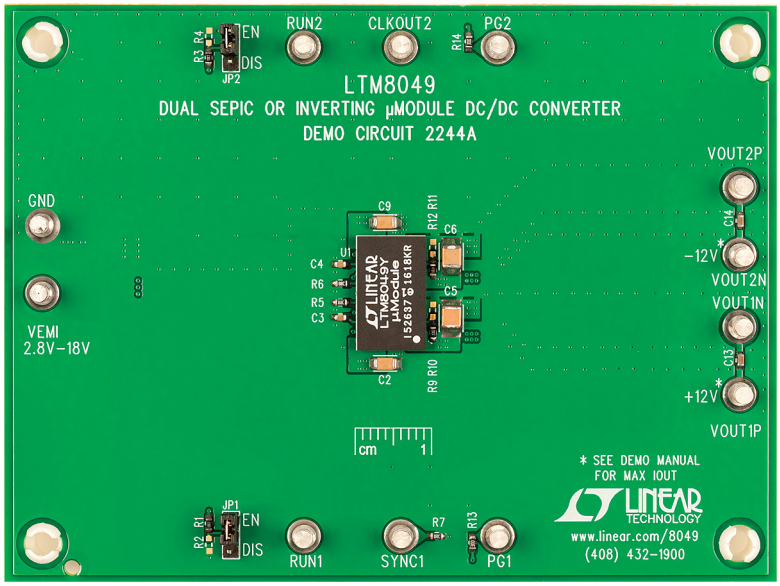
Demonstration circuit 2244A features the LTM®8049, a dual SEPIC or inverting µModule® regulator. The demo circuit is configured as two stand-alone DC/DC converters with +12.0V and –12V output voltages from an input voltage up to 20V. The switching frequencies of both channels are set at 1MHz on DC2244A. 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

BOARD PHOTO



PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		2.8		18	V
F_{SW}	Switching Frequency	V_{IN} = 12V, I_{OUT1} = 1A		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} = 12V	1			A
V_{OUT1} (AC)	Output Ripple of Channel 1 (Across C5)	V_{IN} = 12V, I_{OUT1} = 0.7A		60		mV
η_1	Efficiency of Channel 1	V_{IN} = 12V, I_{OUT1} = 0.7A		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} = 12V	1			A
V_{OUT2} (AC)	Output Ripple of Channel 2 (Across C6)	V_{IN} = 12V, I_{OUT2} = 0.7A		20		mV
η_2	Efficiency of Channel 2	V_{IN} = 12V, I_{OUT2} = 1A		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 (VOUT1P = 12V). Check for the proper output voltage between VOUT2P and VOUT2N (VOUT2N = –12V).

   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.

QUICK START PROCEDURE

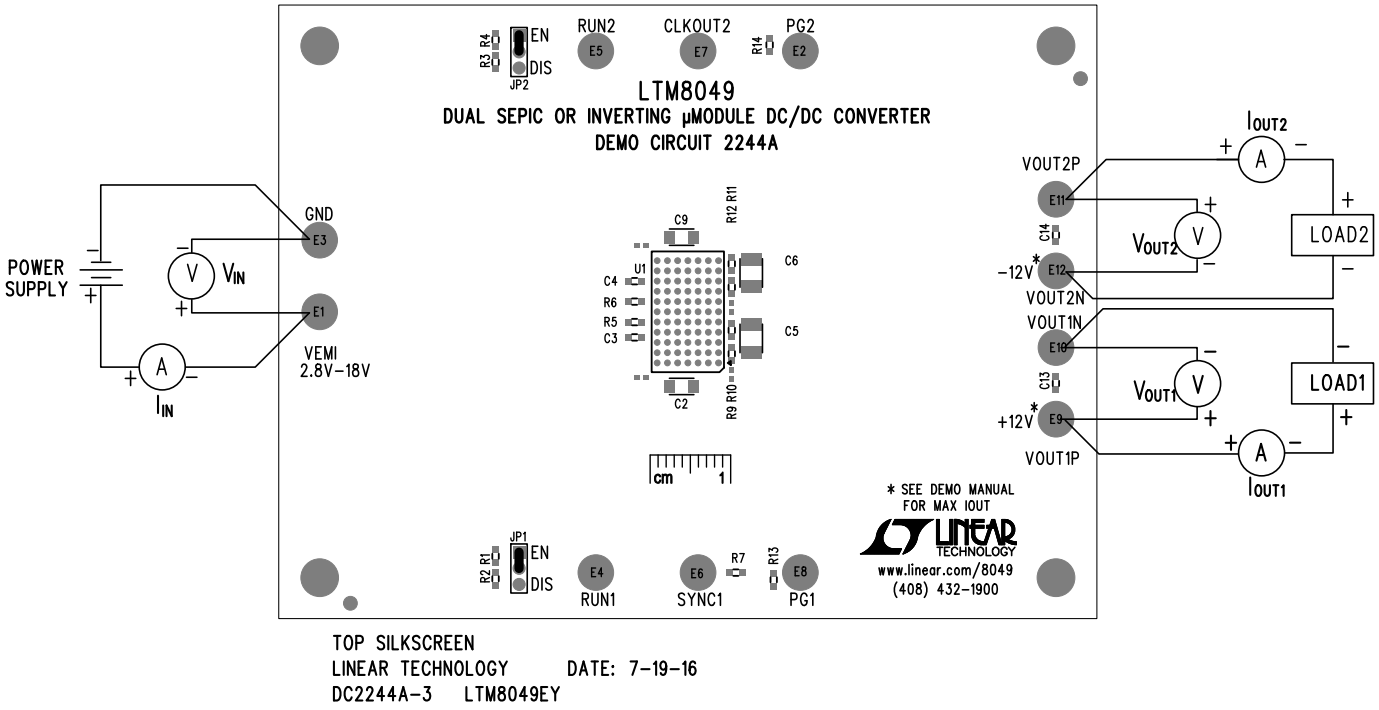


Figure 1. DC2244A Proper Equipment Setup

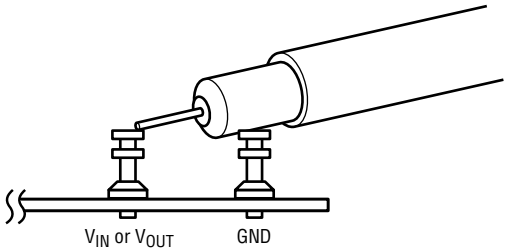


Figure 2. Measuring Input or Output Ripple

QUICK START PROCEDURE

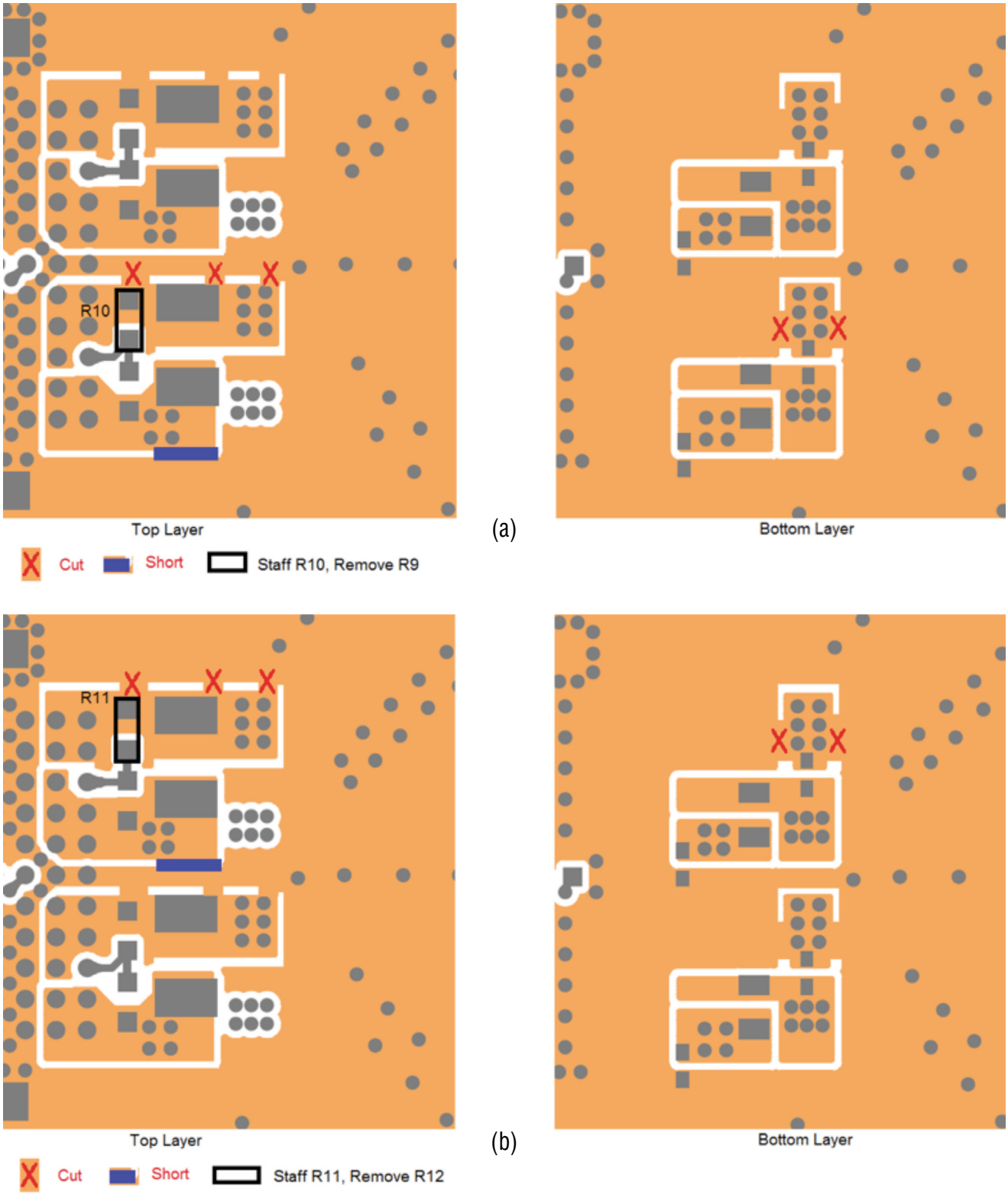
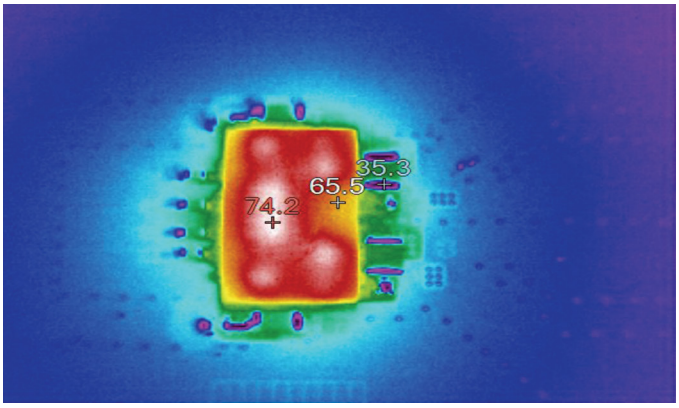
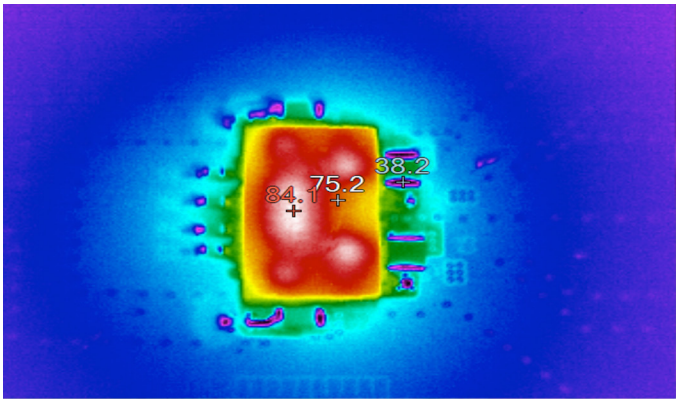


Figure 3. Change the Boards to (a) Two Negative Outputs, (b) Two Positive Outputs

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°C)

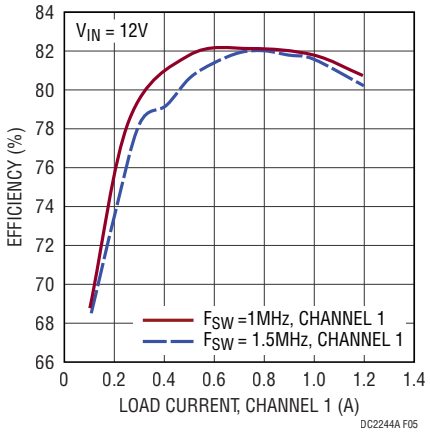
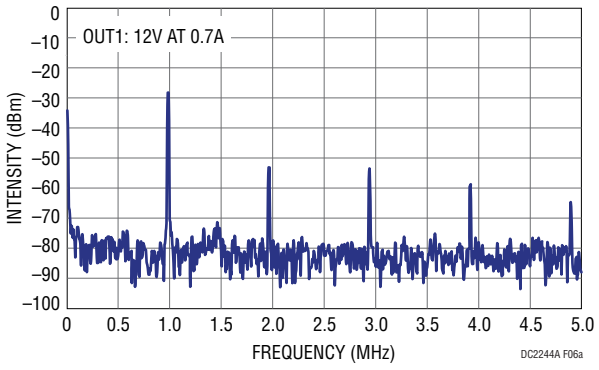
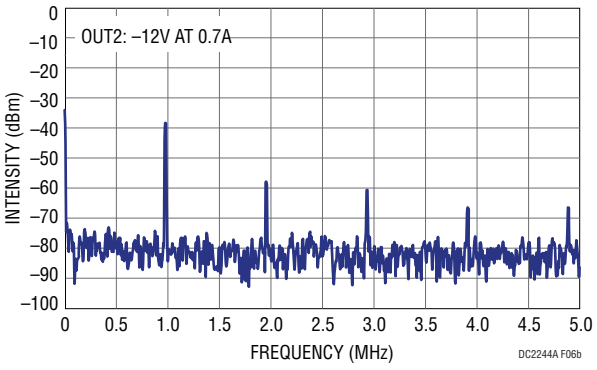


Figure 5. DC2244A Efficiency vs Load Current (T_A = 25°C)



(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

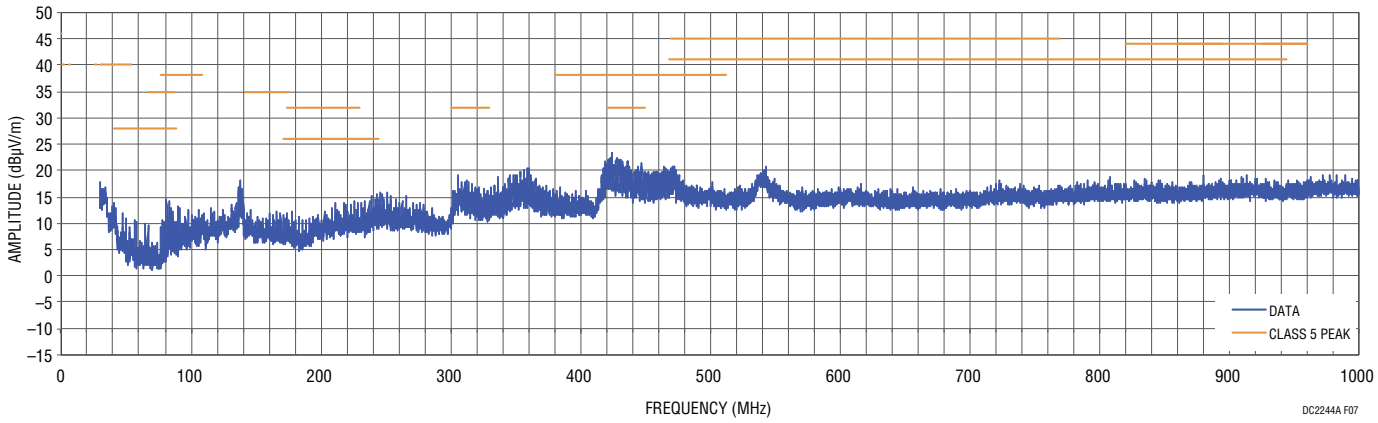
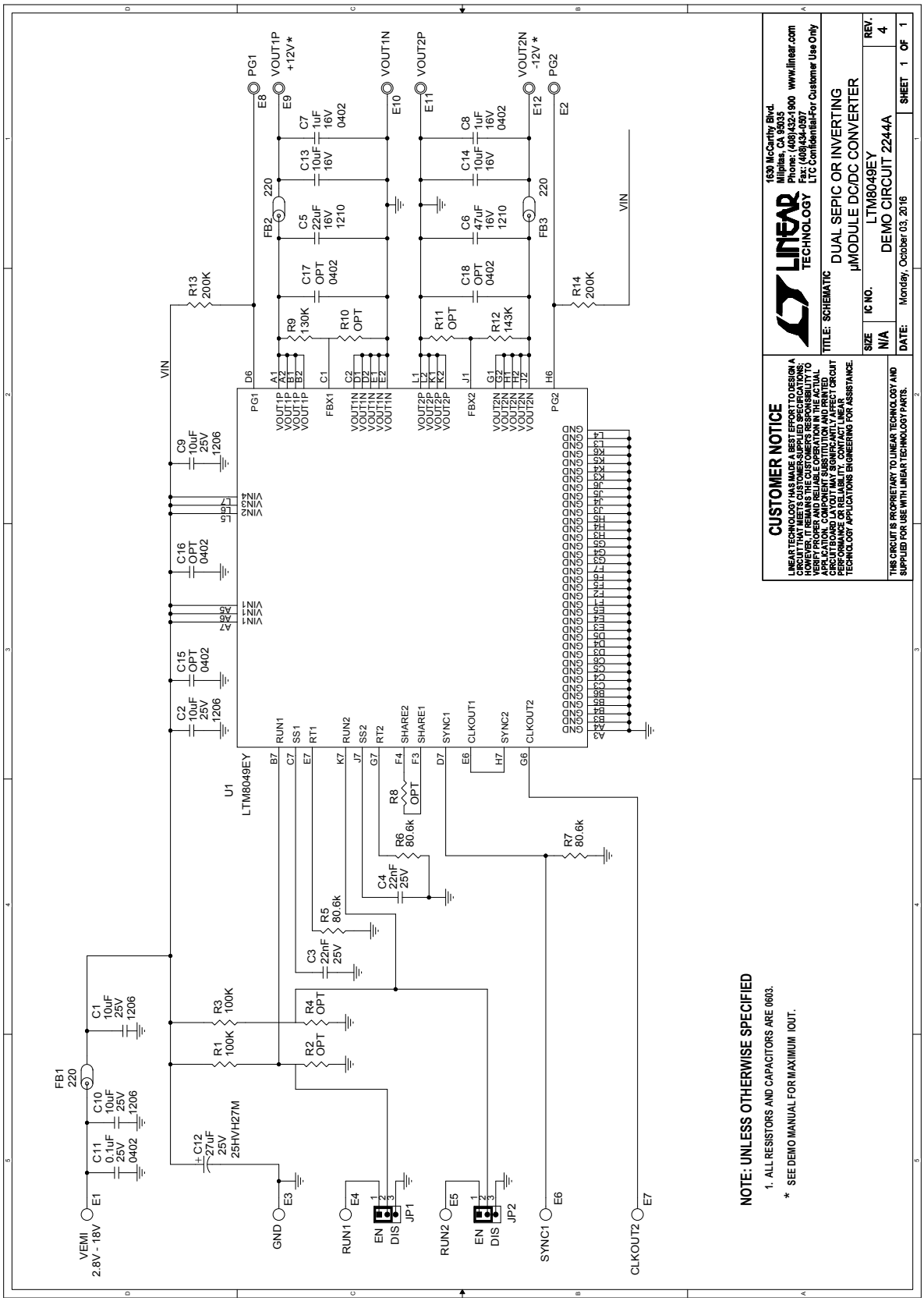


Figure 7. Radiated EMI CISPR25- Class 5 Peak Limit (Vertical Polarization) with 0.7A Load Current. (V_{IN} = 14V)

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)

SCHEMATIC DIAGRAM



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