

# LT3999EMSE

## Low Noise Isolated Power Supply

### DESCRIPTION

The DC2049A demonstrates how a power supply regulates two output voltage by using the LT<sup>®</sup>3999 and low dropout (LDO) regulators.

The LT3999 is a monolithic push-pull DC/DC driver which features wide input range and small external passive components.

The LT3999 has duty circle control for  $\Delta V_{IN}$  compensation, which allows for a wide input voltage range and low LDO losses.

The DC2049A employs a push-pull topology that inherently provides a low-noise solution. The design is well suited to noise sensitive systems such as medical instruments, industrial sensing and control, data conversion and wide band communications. The post regulator LDOs reduce output noise further. For more details about the LDOs, please check the LT3065 and LT3090 data sheets.

The DC2049A produces an isolated  $12V_{OUT}$  and  $-12V_{OUT}$  at up to 200mA each from a 10V ~ 15.5V input voltage range. This board can be modified, by changing the transformer (and duty cycle), to produce other output voltages.

The DC2049A features a small transformer, small inductors and capacitors that work at a 1MHz switching frequency.

The LT3999 data sheet gives a complete description of the part, operation and applications information. The data sheet must be read in conjunction with this demo manual. The LT3999EMSE is assembled in a 10-lead plastic MSE package with a thermally enhanced ground pad. Proper board layout is essential for maximum thermal performance. See the data sheet section Layout Consideration Check List.

**Design files for this circuit board are available at <http://www.linear.com/demo/DC2049A>**

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

PARAMETERS	MIN	TYP	MAX	UNITS
Input Voltage Range	10.0		15.5	VDC
Output Voltage 1 (VOUT1)	11.64	12.0	12.3	VDC
Output Voltage 2 (VOUT2)	-12.36	-12.0	-11.64	VDC
Output Current 1	0		200	mA
Output Current 2	0		200	mA
Switching Frequency		1.0		MHz
Isolation		1000		VDC

## QUICK START PROCEDURE

DC2049A is easy to set up to evaluate the performance of the LT3999EMSE. Refer to Figure 1 for proper measurement equipment setup and follow the procedure below:

1. Connect Load 1 (positive) between the VOUT1 and GND terminals and another Load 2 (negative) between the VOUT2 and GND terminals.
2. With power off, connect the input power supply to the +VIN and -VIN terminals.
3. Turn the input power supply on and make sure the voltage is between 10V and 15.5V.
4. To measure the output noise, connect one end of a BNC connector J1. Connect the other end of the BNC cable to an oscilloscope with a 50Ω input impedance. Refer to Application Note 70 for more precise techniques for measuring the output noise.

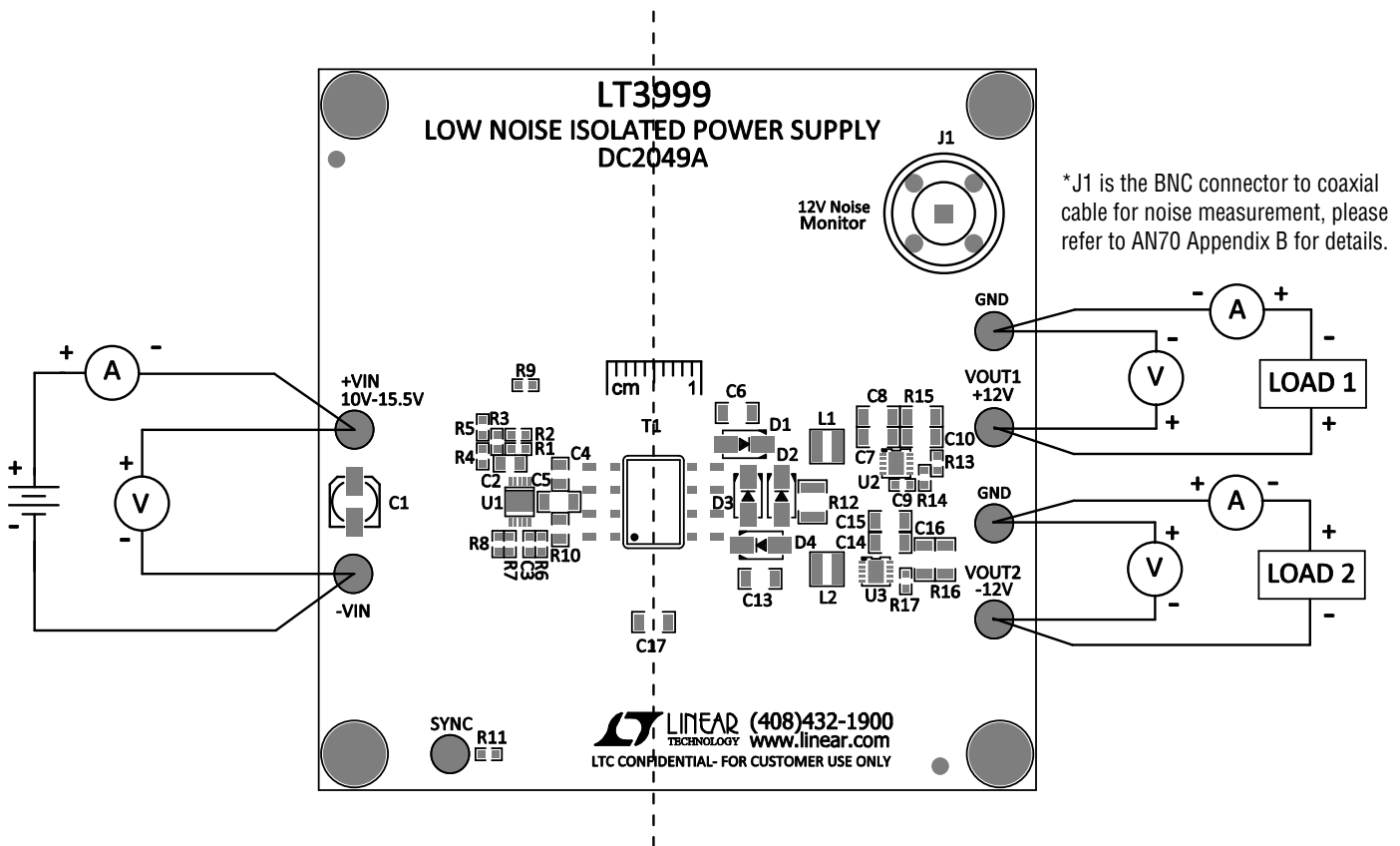


Figure 1. Test Procedure Setup Drawing for DC2049A

**QUICK START PROCEDURE**

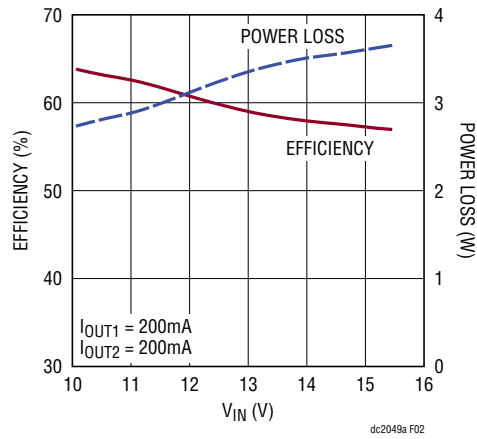


Figure 2. Efficiency and Power Loss vs Input Voltage with LT3999 and LDOs



Figure 3. Switch Node Voltage,  $V_{IN} = 10V$

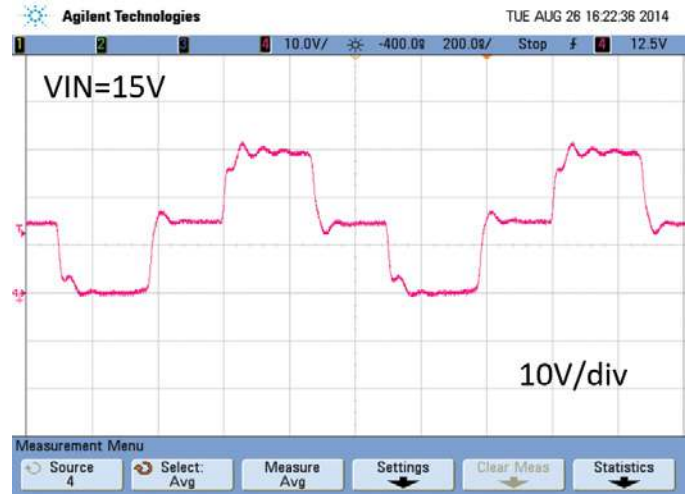


Figure 4. Switch Node Voltage,  $V_{IN} = 15V$

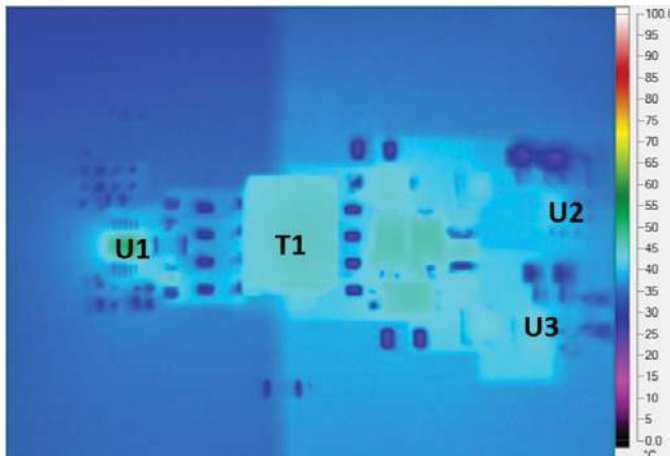


Figure 5. Thermal Image,  $V_{IN} = 10V$ ,  $I_{OUT1} = I_{OUT2} = 200mA$

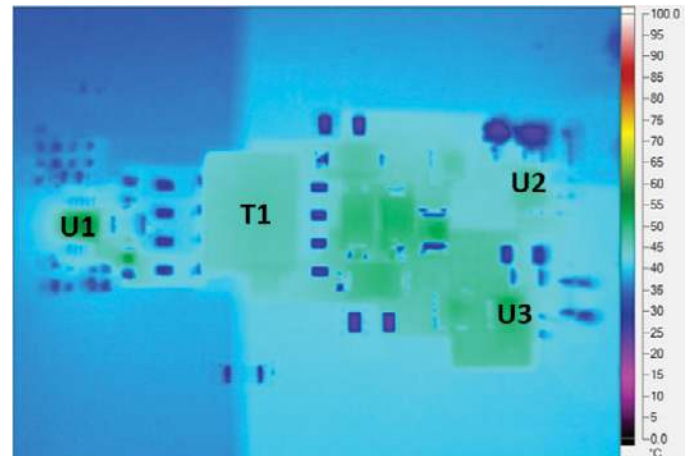


Figure 6. Thermal Image,  $V_{IN} = 15V$ ,  $I_{OUT1} = I_{OUT2} = 200mA$

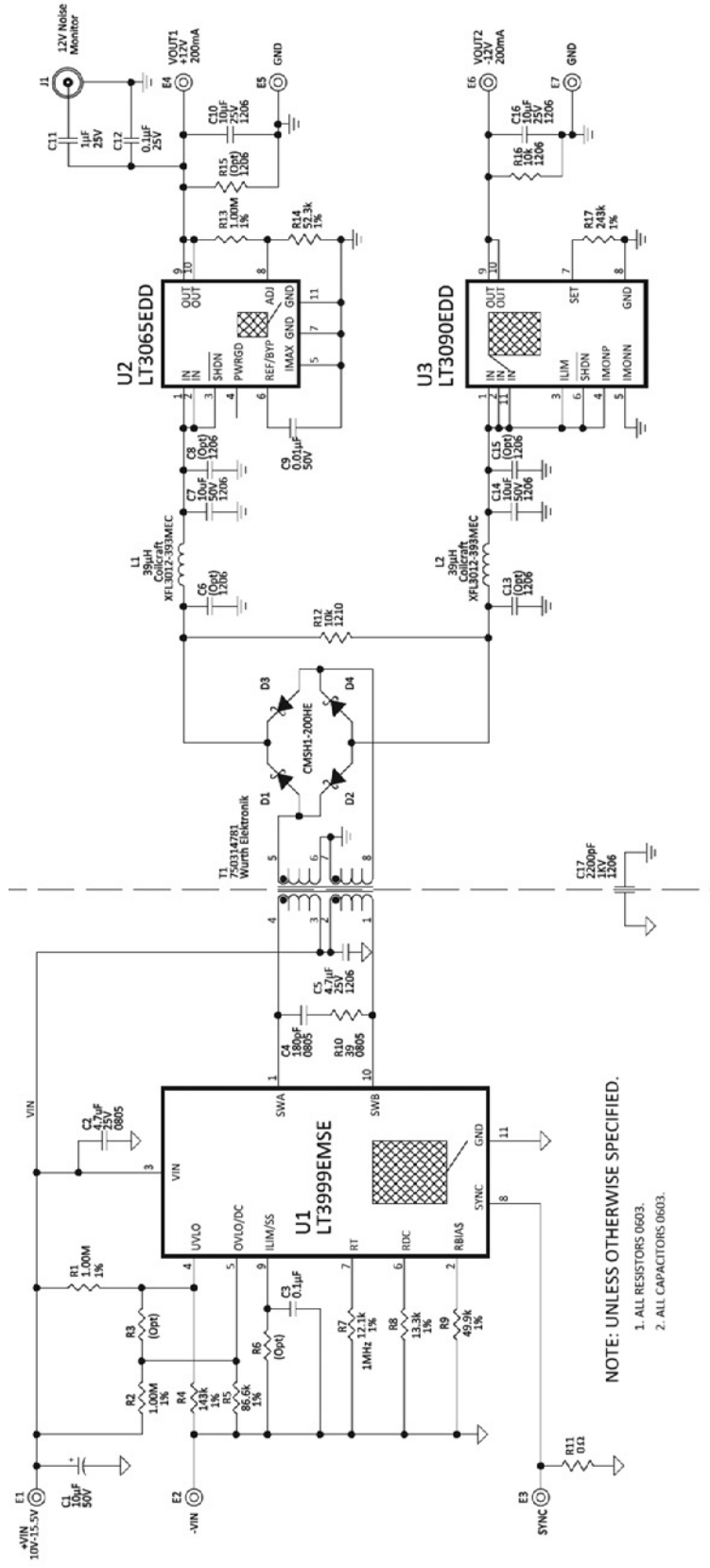
dc2049af

# DEMO MANUAL DC2049A

## PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
<b>Required Circuit Components</b>				
1	1	U1	I.C., Push-Pull DC/DC Driver	Linear Tech. Corp. LT3999EMSE#PBF
2	1	U2	I.C., Low Noise Linear Reg.	Linear Tech. Corp. LT3065EDD#PBF
3	1	U3	I.C., Negative Linear Reg.	Linear Tech. Corp. LT3090EDD#PBF
4	4	D1, D2, D3, D4	Schottky Diode 200V/1AMP	Central Semi. CMSH1-200HE
5	1	T1	Xfmr.	Würth Elektronik 750314781
6	2	L1, L2	Inductor, 39µH	Coilcraft XFL3012-393MEC
7	1	C1	Cap., Alum 10µF 50V 10%	Sun Elect., 50CE10BSS
8	1	C2	Cap., X5R 4.7µF 25V 20% 0805	Taiyo Yuden TMK212BJ475MG-T
9	2	C3	Cap., X7R 0.1µF 25V 10% 0603	AVX 06033C104KAT2A
10	1	C4	Cap., NPO 180pF 50V 10% 0805	AVX 08055A181KAT2A
11	1	C5	Cap., X7R 4.7µF 25V 20% 1206	TDK C3216X7R1E475M
12	2	C7, C14	Cap., X5R 10µF 50V 20% 1206	TDK C3216X5R1H106M
13	1	C9	Cap., X7R 0.01µF 50V 10% 0603	AVX 06035C103KAT2A
14	2	C10, C16	Cap., X7R 10µF 25V 20% 1206	TDK C3216X7R1E106MT
15	1	C17	Cap., X7R 2200pF 1KV 20% 1206	AVX 1206AC222MAT2A
16	3	R1, R2, R13	Res., Chip 1.00M 0.10W 1% 0603	Vishay CRCW06031M00FKEA
17	1	R4	Res., Chip 143k 0.10W 1% 0603	Vishay CRCW0603143KFKEA
18	1	R5	Res., Chip 86.6k 0.10W 1% 0603	Vishay CRCW060386K6FKEA
19	1	R7	Res., Chip 12.1k 0.10W 1% 0603	Vishay CRCW060312K1FKEA
20	1	R8	Res., Chip 13.3k 0.10W 1% 0603	Vishay CRCW060313K3FKEA
21	1	R9	Res., Chip 49.9k 0.10W 1% 0603	Vishay CRCW060349K9FKEA
22	1	R10	Res., Chip 39Ω 0.125W 5% 0805	Vishay CRCW080539R0JNEA
23	1	R12	Res., Chip 10k 0.50W 5% 1210	Vishay CRCW121010K0JNEA
24	1	R14	Res., Chip 52.3k 0.10W 1% 0603	Vishay CRCW060352K3FKEA
25	1	R16	Res., Chip 10k 0.25W 5% 1206	Vishay CRCW120610K0JNEA
26	1	R17	Res., Chip 243k 0.10W 1% 0603	Vishay CRCW0603243KFKEA
<b>Additional Demo Board Circuit Components</b>				
1	1	R11	Res/Jumper, Chip 0Ω 0.10W 0603	Vishay CRCW06030000Z0EA
2	2	C12	Cap., X7R 0.1µF 25V 10% 0603	AVX 06033C104KAT2A
3	1	C11	Cap., X5R 1µF 25V 20% 0603	AVX 06033D105MAT2A
4	0	C6, C8, C13, C15 (Opt)	Cap., 1206	
5	0	R3, R6 (Opt)	Res., 0603	
6	0	R15 (Opt)	Res., 1206	
<b>Hardware: For Demo Board Only</b>				
1	1	J1	BNC Connector	Connex 112404
2	7	E1, E2, E3, E4, E5, E6, E7	Turret, Testpoint	Mill Max 2501-2-00-80-00-00-07-0

**SCHEMATIC DIAGRAM**



**NOTE: UNLESS OTHERWISE SPECIFIED.**

- 1. ALL RESISTORS 0603.
- 2. ALL CAPACITORS 0603.

# DEMO MANUAL DC2049A

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**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.

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