LT3504
Quad 40V/1A Step-Down Switching Regulator with 100% Duty Cycle Operation

DESCRIPTION

The demo circuit 1207A is a quad current mode PWM step-down DC/DC converter featuring the LT®3504. The demo circuit is designed for 5V, 3.3V, 2.5V and 1.8V outputs from a 5.4V to 40V input. The current capability of each channel is up to 1A. Individual soft-start and current limit for each output as well as synchronous function simplify the complex design of quad-output power converters.

Each converter is synchronized to either a common external clock input or a resistor programmable 250kHz to 2.2MHz internal oscillator. Programmable frequency allows optimization between efficiency and external component size. Each output can be independently disabled using its own RUN/SS pin.

The LT3504 data sheet gives a complete description of the device, operation and application information. The data sheet must be read in conjunction with this quick start guide for the demo circuit 1207A.

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

PERFORMANCE SUMMARY

Specifications are at T_A = 25°C

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
V_{IN}	Input Supply Range		5.4		40	V
V_{OUT1}	Output Voltage 1		4.75	5	5.15	V
V_{OUT2}	Output Voltage 2		3.135	3.3	3.40	V
V_{OUT3}	Output Voltage 3		2.375	2.5	2.575	V
V_{OUT4}	Output Voltage 4		1.71	1.8	1.854	V
Frequency	Switching Frequency		0.9	1	1.1	MHz
I_{OUT1}	V_{OUT1} Maximum Output Current	V_{IN} = 5.4 ~ 40V	1			A
I_{OUT2}	V_{OUT2} Maximum Output Current	V_{IN} = 5.4 ~ 40V	1			A
I_{OUT3}	V_{OUT3} Maximum Output Current	V_{IN} = 5.4 ~ 40V	1			A
I_{OUT4}	V_{OUT4} Maximum Output Current	V_{IN} = 5.4 ~ 40V	1			A
$V_{OUT1(AC)}$	V_{OUT1} Output Ripple	V_{IN} = 5.4 ~ 40V, I_{OUT1} = 1A, BW = 20MHz			20	mV
$V_{OUT2(AC)}$	V_{OUT2} Output Ripple	V_{IN} = 5.4 ~ 40V, I_{OUT2} = 1A, BW = 20MHz			20	mV
$V_{OUT3(AC)}$	V_{OUT3} Output Ripple	V_{IN} = 5.4 ~ 40V, I_{OUT3} = 1A, BW = 20MHz			20	mV
$V_{OUT4(AC)}$	V_{OUT4} Output Ripple	V_{IN} = 5.4 ~ 40V, I_{OUT4} = 1A, BW = 20MHz			20	mV

DESCRIPTION

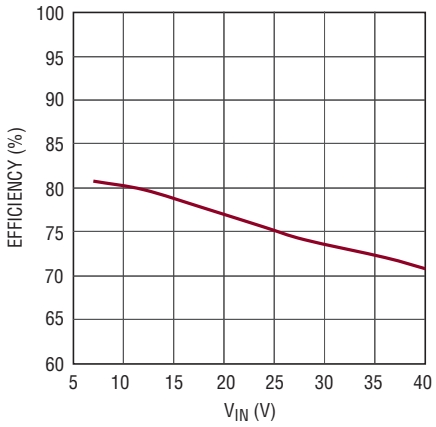


Figure 1. System Efficiency at f = 1MHz with All Channels Sourcing 1A Current

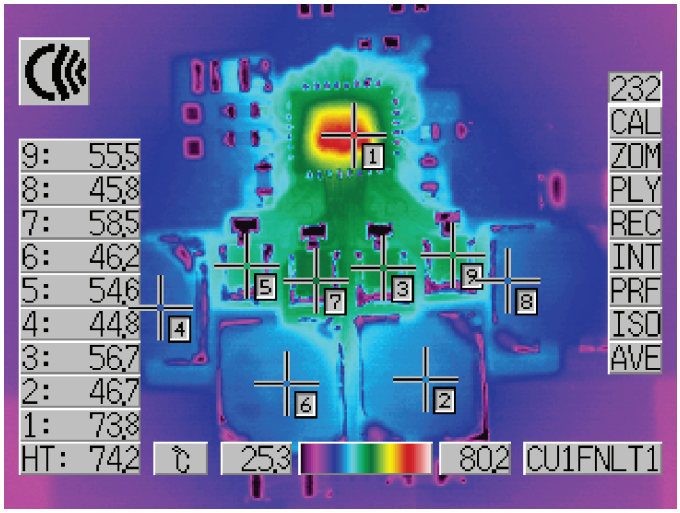


Figure 2. Thermal Image at V_{IN} = 12V, f = 1MHz with All Channels Sourcing 1A Current

QUICK START PROCEDURE

The demo circuit 1207A is easy to set up to evaluate the performance of the LT3504. Refer to Figure 3 for proper measurement equipment setup and follow the procedure below:

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 VIN or VOUT and GND terminals. See Figure 4 for proper scope probe technique.

1. Place JP1-JP5 on ON position.
2. With power off, connect the input power supply to VIN and GND.
3. Turn on the power at the input.

NOTE: Make sure that the input voltage does not exceed 40V.

4. Check for the proper output voltages.

NOTE. If there is no output, temporarily disconnect the load to make sure that the load is not set too high.

5. Once the proper output voltages are established, adjust the load within the operating range and observe the output voltage regulation, ripple voltage, efficiency and other parameters

QUICK START PROCEDURE

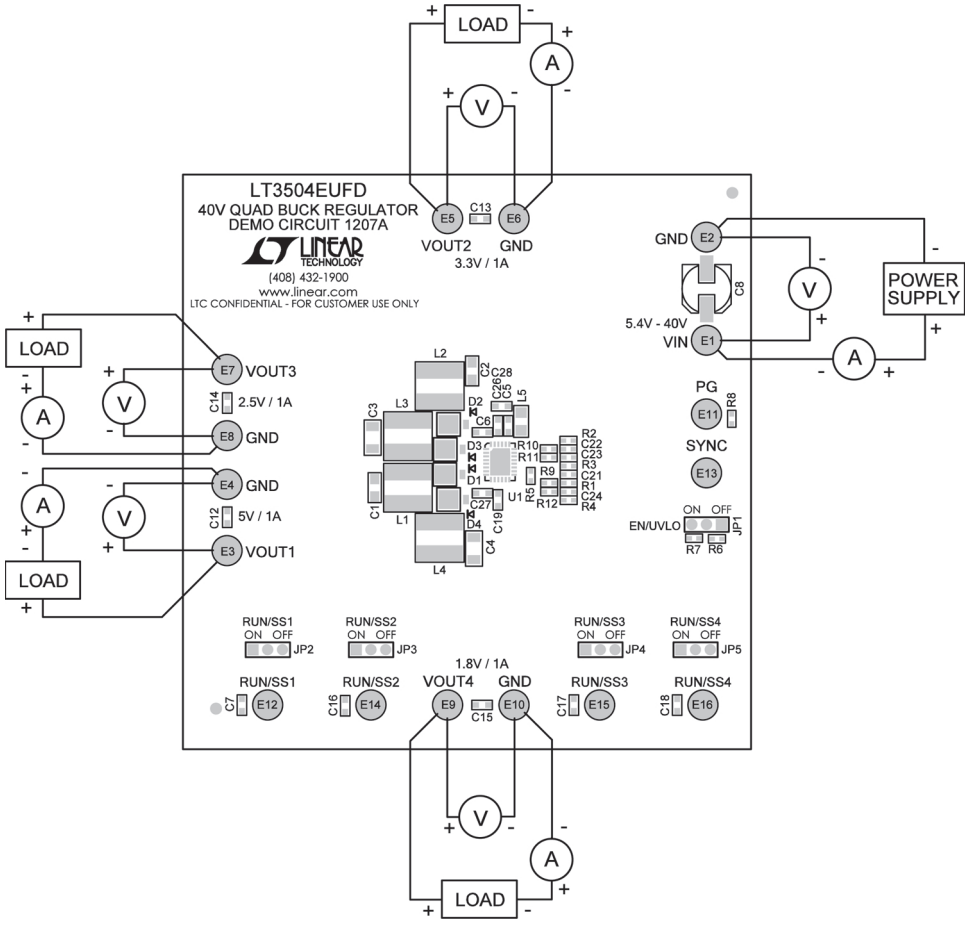


Figure 3. DC1207A Proper Equipment Setup

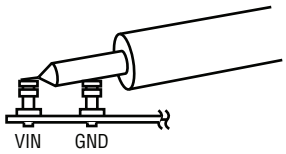
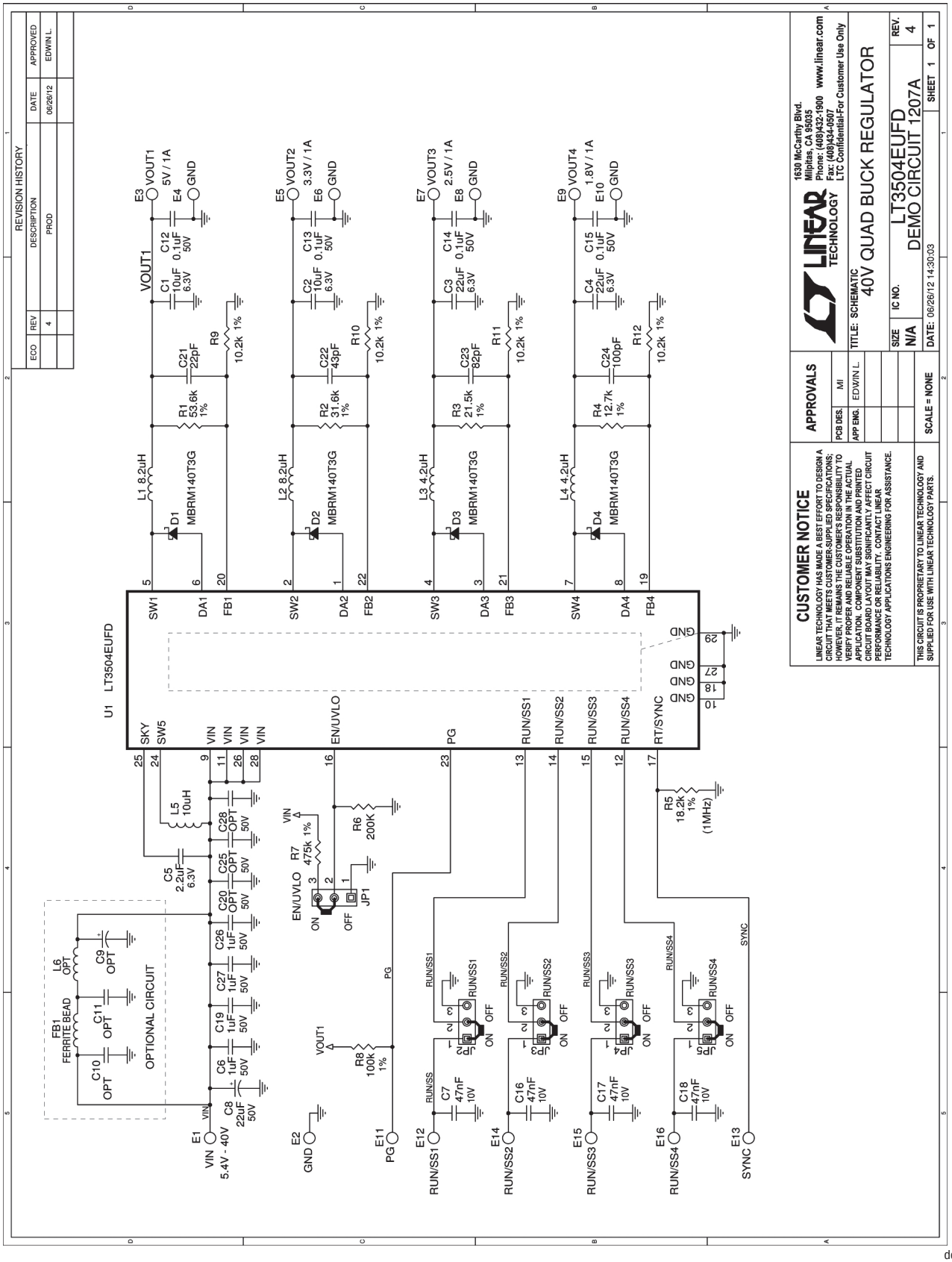


Figure 4. Measuring Input or Output Ripple

PARTS LIST

ITEM	QTY	REFERENCE	PART DESCRIPTION	MANUFACTURER/PART NUMBER
Required Circuit Components				
1	2	C1, C2	CAP, 0805 10µF 10% 6.3V X5R	AVX 08056D106KAT2A
2	2	C3, C4	CAP, 1206 22µF 10% 6.3V X5R	AVX 12066D226KAT2A
3	1	C5	CAP, 0603 2.2µF 10% 6.3V X5R	TAIYO YUDEN JMK107BJ225KAT
4	4	C6, C19, C26, C27	CAP, 0603 1µF 10% 50V X5R	TDK C1608X5R1H105K
5	4	C7, C16, C17, C18	CAP, 0603 47nF 10% 10V X7R	AVX 0603ZC473KAT2A
6	1	C21	CAP, 0402 22pF 5% 16V NPO	AVX 0402YA220JAT2A
7	1	C22	CAP, 0402 43pF 5% 25V NPO	AVX 04023A430JAT
8	1	C23	CAP, 0402 82pF 5% 50V NPO	AVX 04025A820JAT
9	1	C24	CAP, 0402 100pF 10% 16V X7R	AVX 0402YC101KAT
10	4	D1-D4	DIODE, SCHOTTKY BARRIER RECTIFIER	ON SEMI MBRM140T3G
11	2	L1, L2	IND, 8.2µH	SUMIDA CDRH5D28-8R2
12	2	L3, L4	IND, 4.2µH	SUMIDA CDRH5D28-4R2
13	1	L5	IND, 10µH	TAIYO YUDEN CBC2016100M
14	1	R1	RES, 0402 53.6k 1% 1/16W	VISHAY CRCW040253K6FKED
15	1	R2	RES, 0402 31.6k 1% 1/16W	VISHAY CRCW040231K6FKED
16	1	R3	RES, 0402 21.5k 1% 1/16W	VISHAY CRCW040221K5FKEA
17	1	R4	RES, 0402 12.7k 1% 1/16W	VISHAY CRCW040212K7FKED
18	1	R5	RES, 0402 18.2k 1% 1/16W	VISHAY CRCW040218K2FKED
19	1	R6	RES, 0402 200k 5% 1/16W	VISHAY CRCW0402200KJNED
20	1	R7	RES, 0402 475k 1% 1/16W	VISHAY CRCW0402475KFKED
21	1	R8	RES, 0402 100k 1% 1/16W	NIC NRC06F1003TRF
22	4	R9-R12	RES, 0402 10.2k 1% 1/16W	VISHAY CRCW040210K2FKED
23	1	U1	IC, 40V QUAD BUCK REGULATOR	LINEAR TECH. LT3504EUFD
Additional Demo Board Circuit Components				
1	1	C8	CAP, 22µF 20% 50V ALUM	SANYO 50CE22BS
2	0	C9	CAP, OPTION	OPTION
3	0	C10	CAP, 0603 OPTION	OPTION
4	0	C11	CAP, 1206 OPTION	OPTION
5	4	C12-C15	CAP, 0603 0.1µF 10% 50V X7R	MURATA GRM188R71H104KA93D
6	0	FB1	FERRITE BEAD OPTION	OPTION
7	0	L6	IND, OPTION	OPTION
Hardware—For Demo Board Only				
1	16	E1-E16	TURRET	MILL MAX 2501-2-00-80-00-00-07-0
2	5	JP1-JP5	HEADER, 3-PIN, 2mm	SAMTEC TMM-103-02-L-S
3	5	JP1-JP5	SHUNT, 2mm	SAMTEC 2SN-BK-G

SCHEMATIC DIAGRAM



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Mailing Address:

Linear Technology
1630 McCarthy Blvd.
Milpitas, CA 95035

Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

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