

# LT3992A

## Monolithic Dual Tracking 3A Step-Down Switching Regulator

### DESCRIPTION

The demo circuit 1537A is a dual current mode PWM step-down DC/DC converter featuring LT<sup>®</sup>3992. The demo circuit is designed for 5V and 3.3V outputs from a 7V to 60V input. The current capability of each channel is up to 3A when running individually and 2A when both are sourcing the same current without special heat sinking. Individual soft-start, current limit, comparator, input voltage for each output as well as frequency division and synchronous and clock output functions simplify the complex design of dual-output power converters.

Both converters are synchronized to either a common external clock input or a resistor programmable 250kHz to 2MHz internal oscillator. At all frequencies, a 180° phase shift between channels is maintained, reducing voltage ripple. Programmable frequency allows optimization between efficiency and external component size. Each output can be independently disabled using its own SHDN pin and be placed in a low quiescent current shutdown mode.

The LT3992 data sheet gives complete description of the device, operation and application information. The data

sheet must be read in conjunction with this quick start guide for demo circuit 1537A.

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

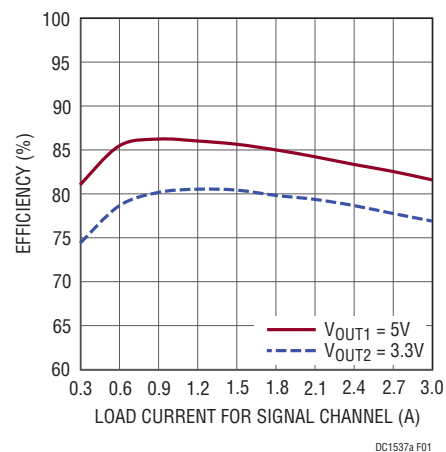


**Figure 1. Single Channel Efficiency at  $V_{IN} = 24V$ ,  $f = 300kHz$**

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### PERFORMANCE SUMMARY

Specifications are at  $T_A = 25^\circ C$ .

| PARAMETER                         | CONDITIONS                    | VALUE                                                                                                         |
|-----------------------------------|-------------------------------|---------------------------------------------------------------------------------------------------------------|
| Minimum Input Voltage             |                               | 7V                                                                                                            |
| Maximum Input Voltage             |                               | 60V (For Transient. Continuous Operation if D3 and D4 Are Replaced with Higher Voltage Rated Schottky Diodes) |
| Output Voltage $V_{OUT1}$         | $V_{IN} = 7 \sim 60V$         | $5.0V \pm 3\%$                                                                                                |
| Output Voltage $V_{OUT2}$         | $V_{IN} = 7 \sim 60V$         | $3.3V \pm 3\%$                                                                                                |
| Switching Frequency               |                               | $300kHz \pm 10\%$                                                                                             |
| Maximum Output Current $I_{OUT1}$ | $V_{IN} = 7 \sim 60V$         | 3A Individually, 2A Both Running                                                                              |
| Maximum Output Current $I_{OUT2}$ | $V_{IN} = 7 \sim 60V$         | 3A Individually, 2A Both Running                                                                              |
| Voltage Ripple $V_{OUT1}$         | $V_{IN} = 12V, I_{OUT1} = 3A$ | $<20mV$                                                                                                       |
| Voltage Ripple $V_{OUT2}$         | $V_{IN} = 12V, I_{OUT2} = 3A$ | $<20mV$                                                                                                       |

## DESCRIPTION

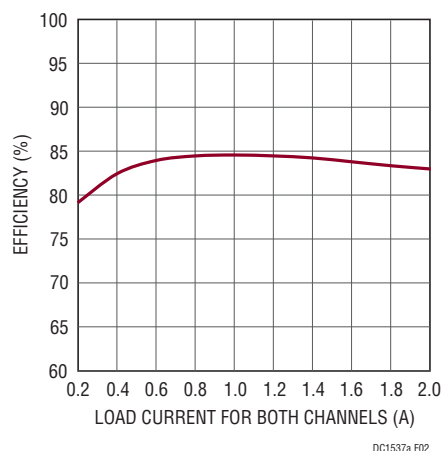


**Figure 2. Dual Channel Efficiency at  $V_{IN} = 24V$ ,  $f = 300kHz$**

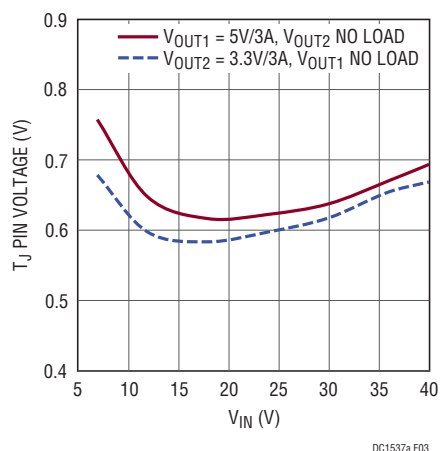


**Figure 3. DC1537A T<sub>J</sub> Pin Voltage When Channels Running Individually at 3A Load ( $T_A = 25^\circ C$ )**

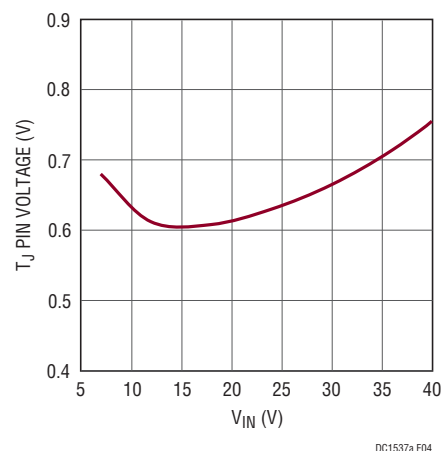


**Figure 4. DC1537A T<sub>J</sub> Pin Voltage When Both Channels Sourcing 2A Current at Meantime ( $T_A = 25^\circ C$ )**

## QUICK START PROCEDURE

Demo circuit 1537A is easy to set up to evaluate the performance of the LT3992. Refer to Figure 5 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 6 for proper scope probe technique.

1. Place JP1 on the SINGLE position.
2. With power off, connect the input power supply to VIN1 and GND. (Connect another input power supply to VIN2 and GND if DUAL is selected.)
3. Turn on the power at the input.

**NOTE.** Make sure that the input voltage does not exceed 60V (Due to part selection on D3 and D4, 60V is for transient purpose. Continuous operation can be available after D3 and D4 are replaced with higher voltage rated schottky diodes).

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.

### ADDITIONAL NOTES

If an EMI filter is desirable on VIN1, it can be feasibly installed on the back of the board in the optional circuit area. However, a trace cut is required for the insertion of the optional circuit. See Figure 7 for the cut line.

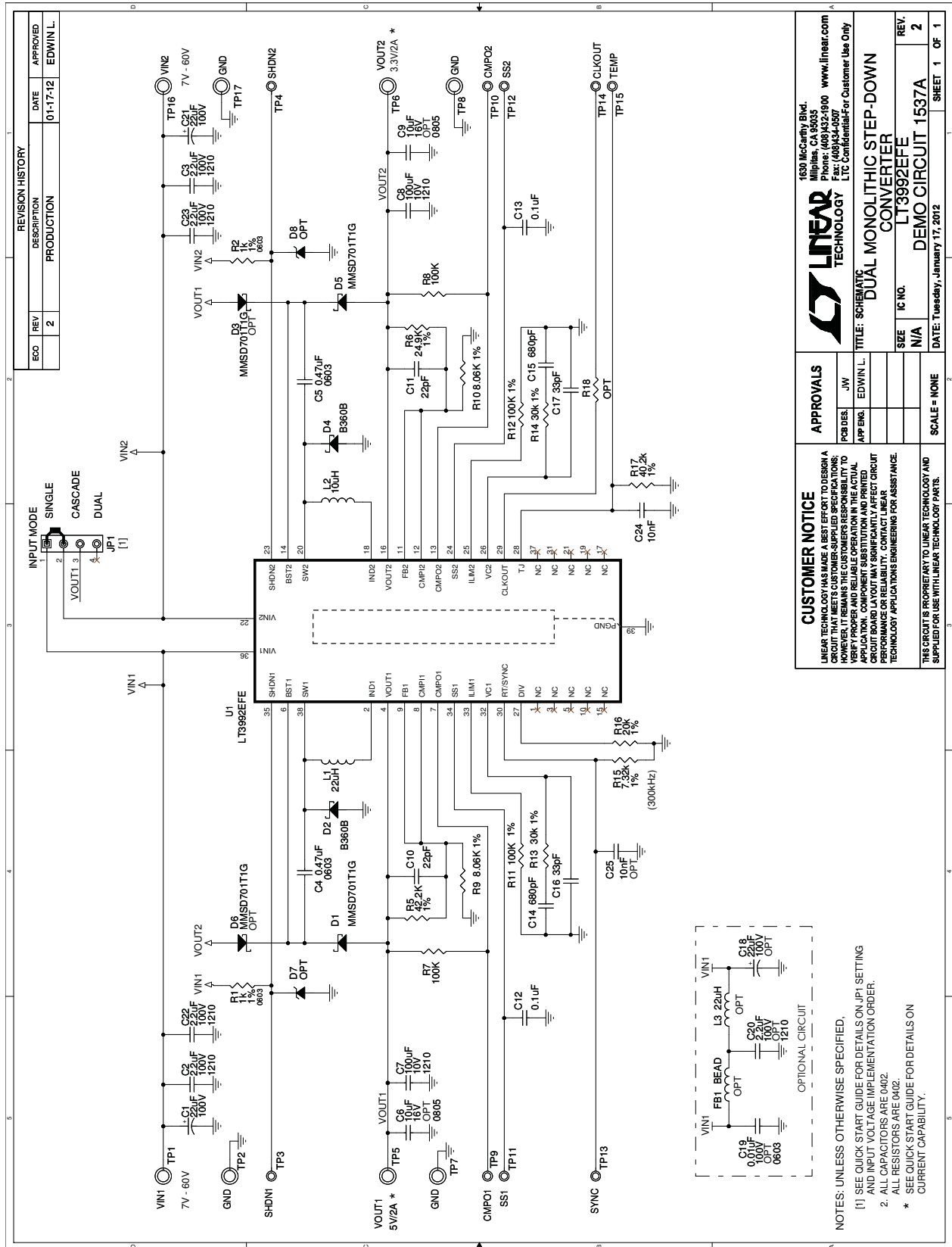


# DEMO MANUAL DC1537A

## PARTS LIST

| ITEM                                             | QTY | REFERENCE                        | PART DESCRIPTION                           | MANUFACTURER/PART NUMBER           |
|--------------------------------------------------|-----|----------------------------------|--------------------------------------------|------------------------------------|
| <b>Required Circuit Components</b>               |     |                                  |                                            |                                    |
| 1                                                | 4   | C2, C3, C22, C23                 | CAP, 1210 2.2 $\mu$ F 10% 100V X7R         | AVX 12101C225KAT2A                 |
| 2                                                | 2   | C4, C5                           | CAP, 0603 0.47 $\mu$ F 10% 25V X7R         | MURATA GRM188R71E474KA12D          |
| 3                                                | 2   | C7, C8                           | CAP, 1210 100 $\mu$ F 20% 10V X5R          | TAIYO YUDEN LMK325ABJ107MM-T       |
| 4                                                | 2   | C10, C11                         | CAP, 0402 22pF 10% 25V NPO                 | AVX 04023A220KAT2A                 |
| 5                                                | 2   | C12, C13                         | CAP, 0402 0.1 $\mu$ F 10% 16V X7R          | TDK C1005X7R1C104K                 |
| 6                                                | 2   | C14, C15                         | CAP, 0402 680pF 10% 25V X7R                | AVX 04023C681KAT2A                 |
| 7                                                | 2   | C16, C17                         | CAP, 0402 33pF 10% 25V NPO                 | AVX 04023A330KAT                   |
| 8                                                | 1   | C24                              | CAP, 0402 10nF 10% 16V X7R                 | MURATA GRM155R71C103KA01D          |
| 9                                                | 2   | D1, D5                           | DIODE, SCHOTTKY BARRIER SOD123             | ON SEMICONDUCTOR MMSD701T1G        |
| 10                                               | 2   | D2, D4                           | DIODE, SCHOTTKY RECTIFIER SMB              | DIODES INC. B360B                  |
| 11                                               | 1   | L1                               | IND, 22 $\mu$ H                            | NIC NPIM104B220MTRF                |
| 12                                               | 1   | L2                               | IND, 10 $\mu$ H                            | NIC NPIM104B100MTRF                |
| 13                                               | 2   | R1, R2                           | RES, 0603 1k $\Omega$ 1% 1/16W             | NIC NRC06F1001TRF                  |
| 14                                               | 1   | R5                               | RES, 0402 42.2k $\Omega$ 1% 1/16W          | VISHAY CRCW040242K2FKED            |
| 15                                               | 1   | R6                               | RES, 0402 24.9k $\Omega$ 1% 1/16W          | VISHAY CRCW040224K9FKED            |
| 16                                               | 2   | R7, R8                           | RES, 0402 100k $\Omega$ 5% 1/16W           | VISHAY CRCW0402100KJNED            |
| 17                                               | 2   | R9, R10                          | RES, 0402 8.06k $\Omega$ 1% 1/16W          | VISHAY CRCW04028K06FKED            |
| 18                                               | 2   | R11, R12                         | RES, 0402 100k $\Omega$ 1% 1/16W           | VISHAY CRCW0402100KFKED            |
| 19                                               | 2   | R13, R14                         | RES, 0402 30k $\Omega$ 1% 1/16W            | NIC NRC04F3002TRF                  |
| 20                                               | 1   | R15                              | RES, 0402 7.32k $\Omega$ 1% 1/16W          | VISHAY CRCW04027K32FKED            |
| 21                                               | 1   | R16                              | RES, 0402 20k $\Omega$ 1% 1/16W            | VISHAY CRCW040220K0FKED            |
| 22                                               | 1   | R17                              | RES, 0402 40.2k $\Omega$ 1% 1/16W          | VISHAY CRCW040240K2FKED            |
| 23                                               | 1   | U1                               | IC, STEP-DOWN REGULATOR                    | LINEAR TECHNOLOGY LT3992EFE        |
| <b>Additional Demo Board Circuit Components</b>  |     |                                  |                                            |                                    |
| 1                                                | 2   | C1, C21                          | CAP, 22 $\mu$ F 20% 100V OSCON             | SUNCON 100CE22BS                   |
| 2                                                | 0   | C6, C9                           | CAP, 0805 10 $\mu$ F 10% 16V X5R OPTION    | MURATA GRM21BR61C106KE15L OPTION   |
| 3                                                | 0   | C18                              | CAP, 22 $\mu$ F 20% 100V OSCON OPTION      | SANYO 100CE22BS OPTION             |
| 4                                                | 0   | C19                              | CAP, 0603 0.01 $\mu$ F 10% 100V X7R OPTION | AVX 06031C103KAT OPTION            |
| 5                                                | 0   | C20                              | CAP, 1210 2.2 $\mu$ F 10% 100V X7R OPTION  | AVX 12101C225KAT2A OPTION          |
| 6                                                | 0   | C25                              | CAP, 0402 10nF 10% 16V X7R OPTION          | MURATA GRM155R71C103KA01D OPTION   |
| 7                                                | 0   | D3, D6                           | DIODE, SCHOTTKY BARRIER SOD123 OPTION      | ON SEMICONDUCTOR MMSD701T1G OPTION |
| 8                                                | 0   | D7, D8                           | DIODE, OPT                                 | OPTION                             |
| 9                                                | 0   | R18                              | RES, 0603 0 $\Omega$ JUMPER OPTION         | VISHAY CRCW06030000Z0EA OPTION     |
| 10                                               | 0   | FB1                              | FERRITE BEAD OPTION                        | TAIYO YUDEN FBMJ3216HS800 OPTION   |
| 11                                               | 0   | L3                               | IND, 22 $\mu$ H OPTION                     | VISHAY IHLP4040DZ-01 OPTION        |
| <b>Hardware/Components (For Demo Board Only)</b> |     |                                  |                                            |                                    |
| 1                                                | 1   | JP1                              | HEADER, 4-PIN                              | SAMTEC TMM-104-02-L-S              |
| 2                                                | 8   | TP1, TP2, TP5 TO TP8, TP16, TP17 | TURRET                                     | MILL-MAX 2501-2-00-80-00-00-07-0   |
| 3                                                | 9   | TP3, TP4, TP9 TO TP15            | TURRET                                     | MILL-MAX 2308-2-00-80-00-00-07-0   |
| 4                                                | 1   | JP1                              | SHUNT, 2mm                                 | SAMTEC 2SN-BK-G                    |

## SCHEMATIC DIAGRAM



# DEMO MANUAL DC1537A

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This notice contains important safety information about temperatures and voltages. For further safety concerns, please contact a LTC application engineer.

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