

# LTC2656

## 16-Bit, Octal Rail-to-Rail DAC with 10ppm/°C Max Reference

### DESCRIPTION

Demonstration circuit 1397B features the **LTC®2656** Octal 16-bit DAC with  $\pm 4$ LSB INL error. This device establishes a new board-density benchmark for 16-bit DACs and advances performance standards for output drive, cross-talk and load regulation in single supply, voltage-output multiple DACs.

The DC1397B has many features for evaluating the performance of the LTC2656. An external 1.25V precision reference is provided.

Another feature of this board is the onboard LTC2428 20-bit delta-sigma ADC for monitoring the DAC output voltage. The 16ppm total error of this device is adequate for taking meaningful measurements of various LTC2656 parameters.

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

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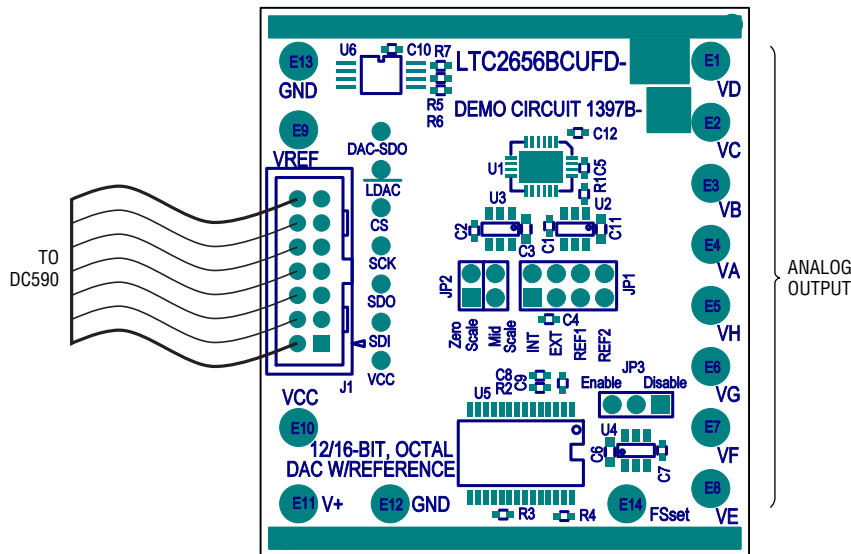


Figure 1. DC1397B Connection Diagram

### PERFORMANCE SUMMARY

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

| PARAMETER                 | CONDITION                                       | VALUE               |
|---------------------------|-------------------------------------------------|---------------------|
| Resolution                |                                                 | 16 Bits             |
| Monotonicity              | $V_{CC} = 5V$                                   | 16 Bits             |
| Differential Nonlinearity | $V_{CC} = 5V$                                   | $\pm 1$ LSB Maximum |
| Integral Nonlinearity     | $V_{CC} = 5V$                                   | $\pm 4$ LSB Maximum |
| Load Regulation           | $V_{CC} = 5V$ , Mid-Scale, $I_{OUT} = \pm 15mA$ | 2LSB/mA Maximum     |
| DC Crosstalk              | Due to Load Current Change on Any Other Channel | 3.5 $\mu V$ /mA     |

| DEMO BOARD TYPE | LTC2656 VARIATION | FULL SCALE |
|-----------------|-------------------|------------|
| DC1397B-A       | LTC2656BCUFD-L16  | 2.5V       |
| DC1397B-B       | LTC2656BCUFD-H16  | 4.096V     |

dc13297bf

QUICK START PROCEDURE

Connect DC1397B to a DC590 USB serial controller using the supplied 14-conductor ribbon cable. Connect DC590 to a host PC with a standard USB A/B cable. Run the evaluation software supplied with DC590 or download it from [www.linear.com/software](http://www.linear.com/software). The correct control panel will be loaded automatically. Click the COLLECT button

to begin outputting codes to the DACs and reading back the resulting output voltage for each DAC.

Complete software documentation is available from the Help menu item, as features may be added periodically.



Figure 2. Demo Board Software

## HARDWARE SETUP

### Jumpers

JP1 –  $V_{REF}$  Select. Either a 1.25V/2.048V internal or 1.25V onboard reference can be selected. To apply an external reference through the  $V_{REF}$  turret, set jumper to EXT.

JP2 – Power-Up Mode. The LTC2656 can be set to either power up at Mid-Scale or Zero-Scale.

JP3 – ADC Disable. Set to ON for normal operation, with the onboard ADC enabled. For very sensitive noise measurements, the ADC may be disabled. The software will then display a positive full-scale reading.

### Analog Connections

DAC Outputs – The eight DAC outputs from the LTC2656 are brought out to turrets labeled DAC A through DAC H. These may be connected to external instruments or other circuitry. DAC outputs are not in alphabetical order on the circuit board.

$V_{REF}$  – The  $V_{REF}$  turret is connected directly to the REFIN/OUT pin of the LTC2656.

When one of the onboard references is being used, the reference voltage may be monitored at this point. An external reference may also be applied to this turret after setting JP1 to EXT.

### Grounding and Power Connections

Power ( $V_{CC}$ ) – Normally DC1397B is powered by the DC590 controller.  $V_{CC}$  can be supplied to this turret, however the power supply on DC590 must be disabled! Refer to DC590 Quick Start Guide for more details on this mode of operation.

Grounding – Signal ground is connected to the exposed ground planes at the top and bottom edges of the board, and to the two turrets labeled “Gnd.” Use signal ground as the reference point for measurements and connections to external circuits.

# DEMO MANUAL DC1397B

## PARTS LIST

| ITEM                   | QTY | REFERENCE           | PART DESCRIPTION                 | MANUFACTURER/PART NUMBER          |
|------------------------|-----|---------------------|----------------------------------|-----------------------------------|
| 1                      | 0   | C1 (Opt.)           | CAP., 0402                       |                                   |
| 2                      | 5   | C2, C5, C7, C9, C10 | CAP., X7R, 0.1µF, 16V, 10% 0402  | TAIYO YUDEN, EMK105BJ104KV        |
| 3                      | 2   | C3, C6              | CAP., X7R, 1.0µF, 10V, 10% 0603  | TAIYO YUDEN, LMK107BJ105KA        |
| 4                      | 1   | C4                  | RES., CHIP, 0, 0402              | VISHAY, CRCW04020000Z0ED          |
| 5                      | 1   | C8                  | CAP., C0G, 100pF, 25V, 5% 0402   | AVX, 04023A101JAT2A               |
| 6                      | 0   | C11 (Opt.)          | CAP., 0603                       |                                   |
| 7                      | 14  | E1-E14              | TESTPOINT, TURRET, 0.061" PBF    | MILL-MAX, 2308-2-00-80-00-00-07-0 |
| 8                      | 1   | JP1                 | 2X4, 0.079 DOUBLE ROW HEADER     | SAMTEC, TMM104-02-L-D             |
| 9                      | 1   | JP2                 | 2X2, 0.079 DOUBLE ROW HEADER     | SAMTEC, TMM102-02-L-D             |
| 10                     | 1   | JP3                 | 3 PIN 0.079 SINGLE ROW HEADER    | SAMTEC, TMM103-02-L-S             |
| 11                     | 3   | SHUNT               | SHUNT, 0.079" CENTER             | SAMTEC, 2SN-BK-G                  |
| 12                     | 1   | J1                  | CONNECTOR, DUAL 2X7 0.079CC      | MOLEX, 87831-1420                 |
| 13                     | 4   | R1, R2, R3, R4      | RES., CHIP, 7.5k, 1/16W, 5% 0402 | VISHAY, CRCW04027K50JNED          |
| 14                     | 3   | R5, R6, R7          | RES., CHIP, 5.1k, 1/16W, 5% 0402 | VISHAY, CRCW04025K10JNED          |
| 15                     | 0   | U2 (Opt.)           | I.C., LT1790 SOT23-6             |                                   |
| 16                     | 1   | U3                  | I.C., LT1790ACS6-1.25 SOT23-6    | LINEAR., LT1790ACS6-1.25#PBF      |
| 17                     | 1   | U4                  | I.C., LT1790ACS6-5 SOT23-6       | LINEAR., LT1790ACS6-5#PbF         |
| 18                     | 1   | U5                  | I.C., LTC2428CG SSOP-28G         | LINEAR., LTC2428CG#PBF            |
| 19                     | 1   | U6                  | I.C., Serial EEPROM TSSOP8       | MICROCHIP, 24LC025-I/ST           |
| <b>Assembly Type-A</b> |     |                     |                                  |                                   |
| 20                     | 1   | U1                  | I.C., LTC2656BCUFD-L16, UFD-20   | LINEAR TECH                       |
| <b>Assembly Type-B</b> |     |                     |                                  |                                   |
| 20                     | 1   | U1                  | I.C., LTC2656BCUFD-H16, UFD-20   | LINEAR TECH                       |

## REVISION HISTORY

| REV | DATE  | DESCRIPTION           | PAGE NUMBER |
|-----|-------|-----------------------|-------------|
| B   | 10/13 | Add REFCOMP Capacitor | Throughout  |



# DEMO MANUAL DC1397B

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