

DESCRIPTION

Demonstration circuit 579 features the LTC2600 Octal 16-bit DAC. This device establishes a new board-density benchmark for 16 bit DACs and advances performance standards for output drive, crosstalk and load regulation in single supply, voltage-output multiple DACs.

DC579 has many features for evaluating the performance of the LTC2600. Onboard 5 volt and 4.096 volt precision references are provided, and the LTC2600

may be powered by the 5 volt reference for evaluating rail-to-rail operation.

Another feature of this board is the onboard LTC2428 20-bit ADC for monitoring DAC output voltage. The 16ppm total error of this device is adequate for taking meaningful measurements of various LTC2600 parameters.

Design files for this circuit board are available. Call the LTC factory.

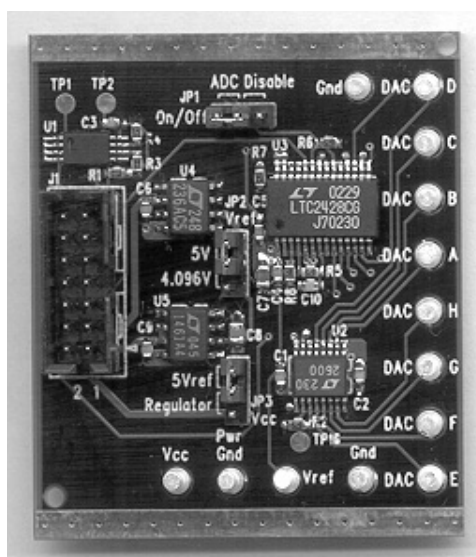


Table 1. LTC2600 Performance Summary

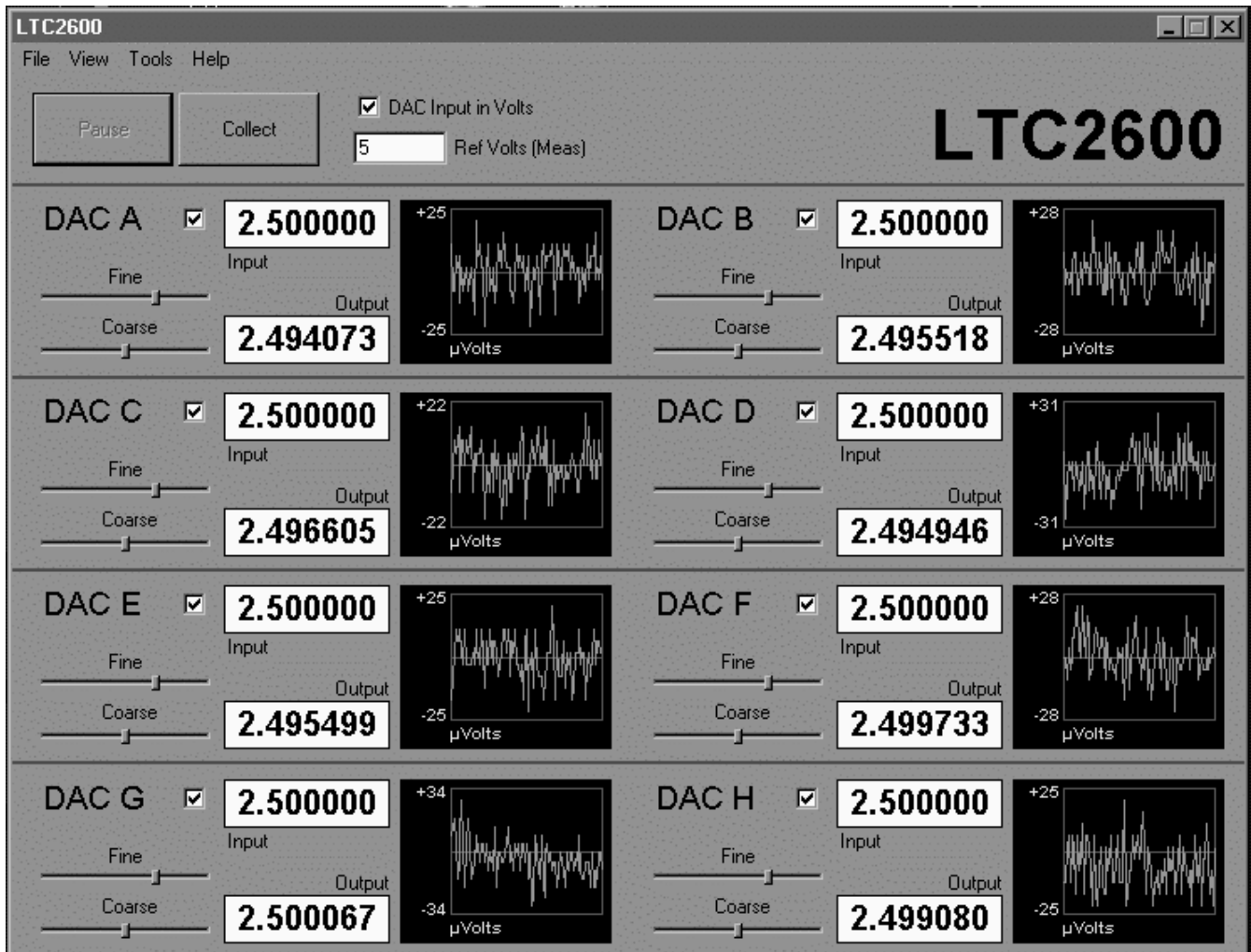
PARAMETER	CONDITION	VALUE
Resolution		16 BITS
Monotonicity	Vcc = 5V, Vref = 4.096V	16 BITS
Differential Nonlinearity	Vcc = 5V, Vref = 4.096V	+/-1 LSB
Integral Nonlinearity	Vcc = 5V, Vref = 4.096V	+/-12 LSB Typical
Load Regulation	Vcc = Vref = 5V, Midscale Iout = +/- 15 mA	2 LSB/mA Max
DC Crosstalk	Due to load current change on any other channel	3.5 μ V/mA

QUICK START PROCEDURE

Connect DC579 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. 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.



HARDWARE SET-UP

JUMPERS

JP1 – 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.

JP2 – Vref Select. Either a 5 volt or 4.096 volt reference can be selected. To apply an external reference through the Vref Turret, remove this jumper.

JP3 – Vcc select. Vcc is taken either from the onboard 5 volt reference or the 5 volt regulated supply from the controller board. Selecting the 5 volt reference for VCC and Vref allows characterization of rail to rail operation of the LTC2600.

ANALOG CONNECTIONS

DAC outputs – The eight DAC outputs from the LTC2600 are brought out to turrets labeled DAC A through DAC H. These may be connected to external instruments or other circuitry.

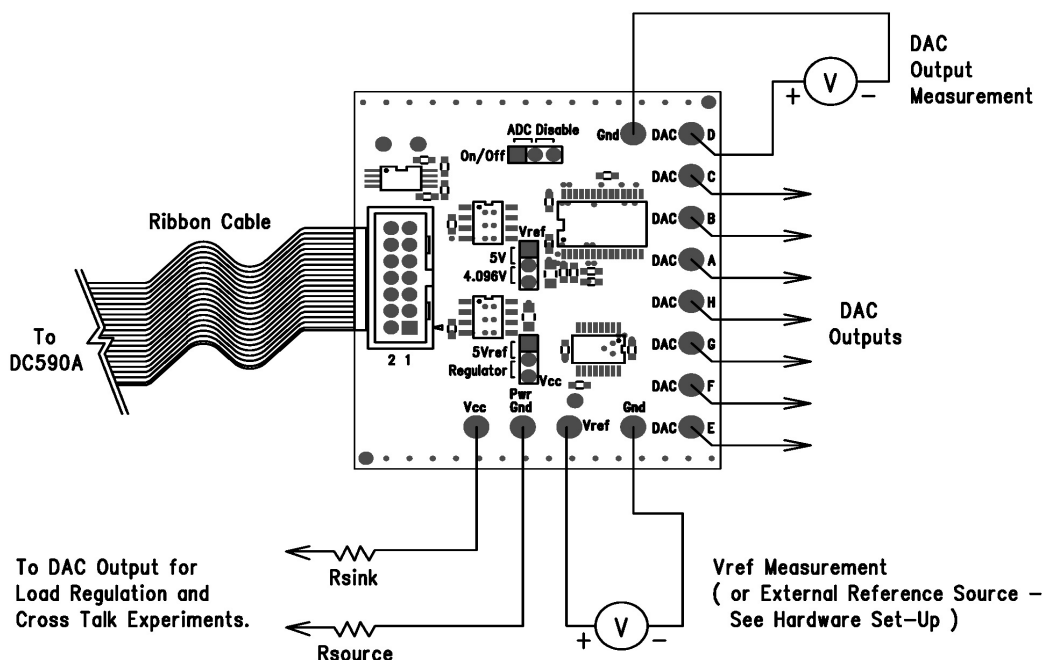
NOTE: DAC outputs are not in alphabetical order on the circuit board.

Vref – The Vref turret is connected directly to the reference terminals of the LTC2600 and LTC2428 ADC. 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 removing JP2.

GROUNDING AND POWER CONNECTIONS

Power (Vcc) – Normally DC579 is powered by the DC590 controller. Vcc 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 – Separate power and signal grounds are provided. Any large currents drawn from the DAC outputs should be returned to power ground. Also, if an external power supply is connected, power ground should be used. 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.



EXPERIMENTS

The following experiments are intended to demonstrate some of the outstanding features of the LTC2600. All can be performed using the onboard LTC2428 to monitor the DAC output voltage. The indicated output voltage will typically agree with an HP3458A voltmeter to 5 digits. If a DAC will be sinking or sourcing a significant current, then the output voltage should be measured as close to the DAC as possible.

Most of the data sheet specifications use a 4.096 volt reference, so this is the preferred reference to use for these experiments. Using the 5 volt reference has the limitation that V_{CC} may be slightly lower than V_{ref} , which may affect the full scale error. Selecting the 5 volt reference as the source for V_{CC} overcomes this, however the total current that the LTC2600 can source will be limited to approximately 5mA.

NOTE: Using an external power supply is highly recommended for these experiments, especially those that draw significant current. Refer to the DC590 Quick Start Guide for details.

RESOLUTION

The onboard LTC2428 ADC has an input resolution of $6\mu\text{V}$. This will easily resolve a 1 LSB ($76\mu\text{V}$ for $V_{ref}=5\text{V}$, $62.5\mu\text{V}$ for $V_{ref}=4.096\text{V}$) change in the LTC2600 output. Set one of the DAC channels to a voltage close to Midscale. Select the FINE slider on the control panel with the mouse and use the right and left arrow keys to step the output by single LSBs. The change should be clearly visible in the output graph. (It may be necessary to wait for the graph to clear if a large step has just occurred. This can be sped up by disabling all other DAC channels in the software by un-checking them.)

INTEGRAL NONLINEARITY

A rough measurement of INL can be taken using the onboard ADC. Measure one of the LTC2600 outputs at code 256 and 65,535 and calculate the slope and intercept using a spreadsheet. Next, take several

readings at intermediate points. The readings should not deviate from the calculated line by more than 64 LSBs, and they will typically be within 12 LSBs.

LOAD REGULATION / DC OUTPUT IMPEDANCE

Select “Regulator” for V_{CC} source. Set one of the outputs to Midscale (code 32768.) source or sink 15 mA from one of the DAC outputs by pulling it to power ground or V_{CC} with an appropriate value resistor. The voltage change should be less than 2.25mV, corresponding to an output impedance of 0.15Ω . Output impedance is typically less than 0.030Ω . (measure DAC voltage at the output pin if using a voltmeter.)

ZERO SCALE ERROR

Set one of the DACs to code 0. The measured output should be less than 9mV and will typically be less than 1mV.

OFFSET ERROR

Set one of the DACs to code 256. The output voltage should be within 1mV of the correct value, or $V_{ref} \times 256/65535$.

GAIN ERROR

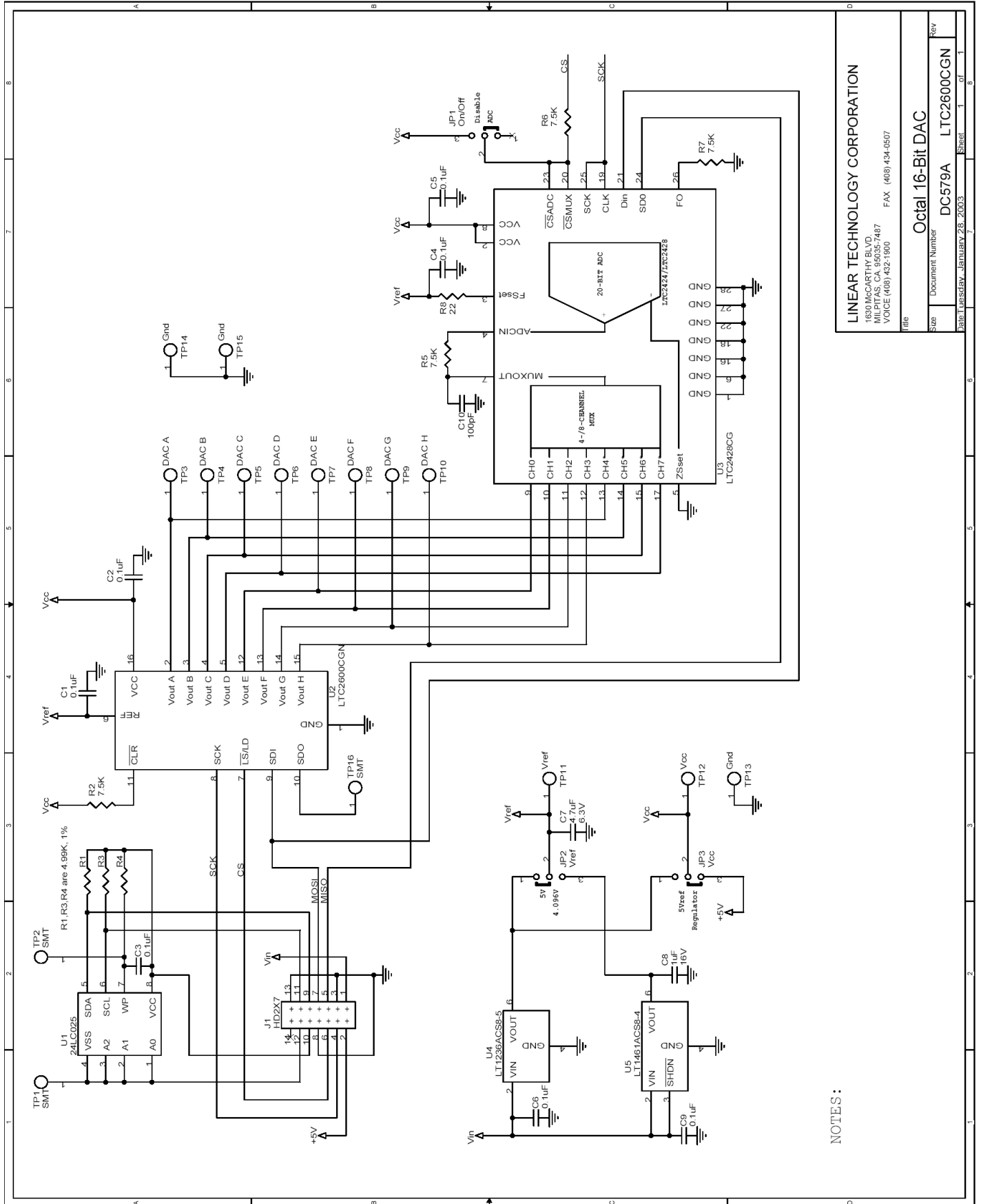
Set one of the DACs to code 65,535. The output voltage should be within 0.7% of V_{ref} , and will typically be within 0.2%.

DC CROSSTALK

Set all DACs to Midscale. Connect a 250 ohm resistor from one output to V_{CC} or Power Ground (to sink or source 10mA, respectively, when the 5V reference is being used.) A given output should not change by more than $3.5\mu\text{V}$ per milliamp of output current in all other DACs combined.

QUICK START GUIDE FOR DEMONSTRATION CIRCUIT 579

OCTAL 16-BIT DAC



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File	Octal 16-Bit DAC
Document Number	DC-579A
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Sheet	1 of 1

NOTES:

Item	Qty	Reference	Part Description	Manufacture / Part #
1	1	C10	CAP., CHIP NPO 100pF 50V	AVX, 06035A101JAT 0603
2	7	C1-C6,C9	CAP., CHIP X7R 0.1uF 16V	AVX, 0603YC104MAT1A 0603
3	1	C8	CAP., CHIP X5R 1uF 16V	TAIYO YUDEN, EMK212BJ105MG 0805
4	1	C7	CAP., CHIP X5R 4.7uF 6.3V	TAIYO YUDEN, JMK212BJ475MG 0805
5	13	TP3-TP15	TURRET, TESTPOINT .064"	MILL-MAX, 2308-2
6	0	TP1,TP2,TP16	OPT.	
7	3	JP1-JP3	HEADER, 3PIN 1 ROW .079CC	COMM-CON 2802S-03-G1
8	3	FOR (JP1-JP3)	SHUNT, .079" CENTER	COMM-CON CCIJ2MM-138G
9	1	J1	CONNECTOR, DUAL 2X7 .079CC	MOLEX, 87331-1420
10	1	R8	RES., CHIP 22 OHM 5%	AAC, CR16-220JM 0603
11	3	R1,R3,R4	RES., CHIP 4.99K 1%	AAC, CR16-4991FM 0603
12	4	R2,R5,R6,R7	RES., CHIP 7.5K 5%	AAC, CR16-752JM 0603
13	1	U2	I.C., Octal 16-BIT DAC	LINEAR TECH., LTC2600CGN SSOP-16
14	1	U3	I.C., 4-/8-Channel 20-BIT ADCs	LINEAR TECH., LTC2428CG SSOP-28
15	1	U5	I.C., Micropower Precision Low Dropout	LINEAR TECH., LT1461ACS8-4 SO8
16	1	U4	I.C., Precision Reference	LINEAR TECH., LT1236ACS8-5 SO8
17	1	U1	I.C., Serial EEPROM	MICROCHIP, 24LC025 TSSOP-8
18	0	(DO NOT SEND PARTS TO ASSY).	CABLE ASSY., 8" STRIP	RIBBON CABLE CA-2440
19	1		PRINTED CIRCUIT BOARDS	DEMO CIRCUIT #579A
20	1		STENCIL	STENCIL 579A