T-51-09-16

BURR-BROWN®

DAC703L

LCC Monolithic 16-Bit DIGITAL-TO-ANALOG CONVERTER

FEATURES

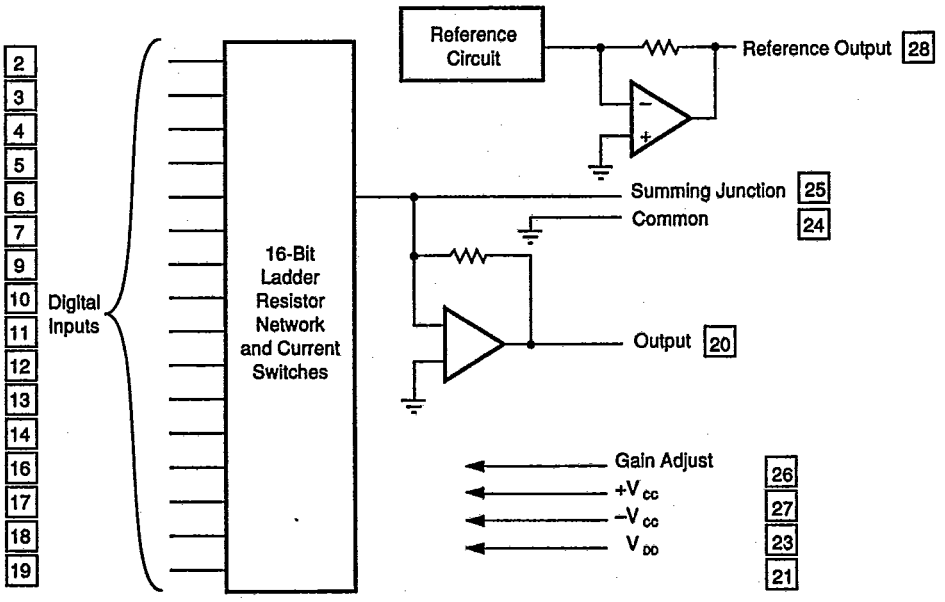
- MONOLITHIC CONSTRUCTION
- HIGH ACCURACY:
  Linearity Error ±0.0015% of FSR max
  Differential Linearity Error ±0.003% of FSR max
- MONOTONIC (at 15 bits) OVER FULL SPECIFICATION TEMPERATURE RANGE
- LOW COST
- HERMETIC SURFACE MOUNT PACKAGE

DESCRIPTION

This is another industry first from Burr-Brown—a complete 16-bit digital-to-analog converter that includes a precision buried-zener voltage reference and a low-noise, fast-settling output operational amplifier all on one small monolithic chip. A combination of current-switch design techniques accomplishes not only 15-bit monotonicity over the entire specified temperature range but also a maximum end-point linearity error of ±0.0015% of full-scale range. Total full-scale gain drift is limited to ±10ppm/°C maximum (LL and CL grades).

Digital inputs are complementary binary coded and are TTL-, LSTTL-, 54/74C- and 54/74HC-compatible over the entire temperature range.

The DAC703L is packaged in a hermetic 28-pin Leadless Chip Carrier.



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SPECIFICATIONS

ELECTRICAL

At T_A = +25°C and rated power supplies unless otherwise noted.

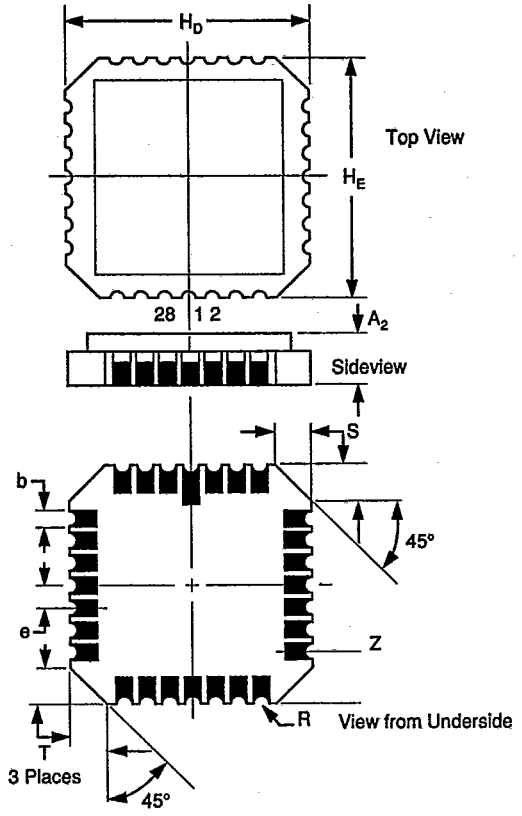
PARAMETER	DAC703KL MIN	DAC703KL TYP	DAC703KL MAX	DAC703BL, SL MIN	DAC703BL, SL TYP	DAC703BL, SL MAX	DAC703LL, CL MIN	DAC703LL, CL TYP	DAC703LL, CL MAX	UNITS
DIGITAL INPUT										
Resolution			16			*			*	Bits
Digital Inputs[1]										
V_{IH}	+2.4		$+V_{CC}$	*		*	*		*	V
V_{IL}	–1.0		+0.8	*		*	*		*	V
I_{IH}, V_I = +2.7V			+40			*			*	µA
I_{IH}, V_I = +0.4V		–0.35	–0.5		*	*		*	*	mA
ACCURACY										
Linearity Error [3]		±0.0015	±0.003		*	*		±0.00075	±0.0015	% of FSR[2]
Differential Linearity Error [3]		±0.003	±0.006		*	*		±0.0015	±0.003	% of FSR
Differential Linearity Error at Bipolar Zero[3]		±0.003	±0.006		±0.0015	±0.003		*	*	% of FSR
Gain Error [4]		±0.07	±0.15		±0.05	±0.10		*	*	%
Zero Error[4], [5]		±0.05	±0.10		*	*		*	*	% of FSR
Monotonicity Over Spec. Temperature Range	14			*			15			Bits
DRIFT (Over Specification Temperature Range)										
Total Error Over Temperature Range[6]		±0.08	±0.15		±0.05	±0.10		*	*	% of FSR
Total Full Scale Drift		±10	±25		±7	±15		*	*	ppm of FSR/°C
Gain Drift (All Models)		±10	±25		±7	±15		±5	±10	ppm/°C
Zero Drift		±5	±12		±4	±10		±2.5	±5	ppm of FSR/°C
Differential Linearity Over Temp[3]			+0.009 –0.006			*			+0.006 –0.003	% of FSR
Linearity Error Over Temp[3]			±0.006			*			±0.003	% of FSR
SETTLING TIME (to ±0.003% of FSR)[7]										
Full Scale Step, 2kΩ Load		4	8		*	*		*	*	µs
1LSB Step at Worst-Case Code[8]		2.5			*			*		µs
Slew Rate		10			*			*		V/µs
OUTPUT										
Output Voltage		±10			*			*		V
Output Current	±5			*			*			mA
Output Impedance		0.15			*			*		Ω
Short Circuit to Common Duration		Indefinite			*			*		
REFERENCE VOLTAGE										
Voltage	+6.0	+6.3	+6.6	+6.24	+6.3	+6.36	*	*	*	V
Source Current Available for External Loads	+1.5	+2.5		*	*		*	*		mA
Temperature Coefficient		±10	±25		*	±15		*	*	ppm/°C
Short Circuit to Common Duration		Indefinite			*			*		
POWER SUPPLY REQUIREMENTS										
Voltage: $+V_{CC}$	13.5	15	16.5	*	*	*	*	*	*	V
$-V_{CC}$	13.5	15	16.5	*	*	*	*	*	*	V
V_{DD}	+4.5	+5	+16.5	*	*	*	*	*	*	V
Current (No Load): $+V_{CC}$		+16	+30		*	*		*	*	mA
$-V_{CC}$		–18	–30		*	*		*	*	mA
V_{DD}		+4	+8		*	*		*	*	mA
Power Dissipation: (V_{DD} = +5.0V)[9]		530	940		*	780		*	*	mW
Power Supply Rejection: $+V_{CC}$					*	±0.003		*	*	% of FSR/%V_{CC}
$-V_{CC}$					*	±0.003		*	*	% of FSR/%V_{CC}
V_{DD}					*	*		*	*	% of FSR/%V_{DD}
TEMPERATURE RANGE										
Specification:										
B, C Grades				–25		+85	*		*	°C
S Grades				–55		+125				°C
K, L Grades	0		+70				0		+70	°C
Storage	–60		+150	*		*	*		*	°C

*Specification same as model to the left.

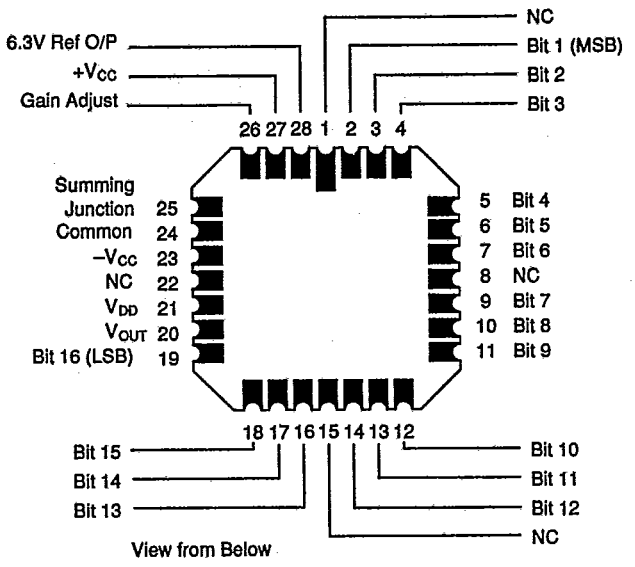
NOTES: (1) Digital inputs are TTL, LSTTL, 54/74C, 54/74HC, and 54/74HTC compatible over the operating voltage range of V_{DD} = +5V to +15V and over the specified temperature range. The input switching threshold remains at the TTL threshold of 1.4V over the supply range of V_{DD} = +5V to +15V. As logic "0" and logic "1" input very over 0V to +0.8V and +2.4V to +10V respectively, the change in the D/A converter output voltage will not exceed ±0.0015% of FSR for the LL and CL grades, ±0.003% of FSR for the BL grade and ±0.006% of FSR for the KL grade. (2) FSR means full scale range and is 20V for the ±10V range. (3) ±0.0015% of full-scale range is equivalent to 1LSB in 15-bit resolution. ±0.003% of full-scale range is equivalent to 1LSB in 14-bit resolution. ±0.006% of full-scale range is equivalent to 1LSB in 13-bit resolution. (4) Adjustable to zero with external trim potentiometer. Adjusting the gain potentiometer rotates the transfer function around the zero point. (5) Error at input code $7FFF_H$. (6) With gain and zero errors adjusted to zero at +25°C. (7) Maximum represents the 3σ limit. Not 100% tested for this parameter. (8) At the major carry, $7FFF_H$ to 8000_H and 8000_H to $7FFF_H$. (9) Power dissipation is an additional 40mW when V_{DD} is operated at +15V.

MECHANICAL

Ceramic LCC-28 Package

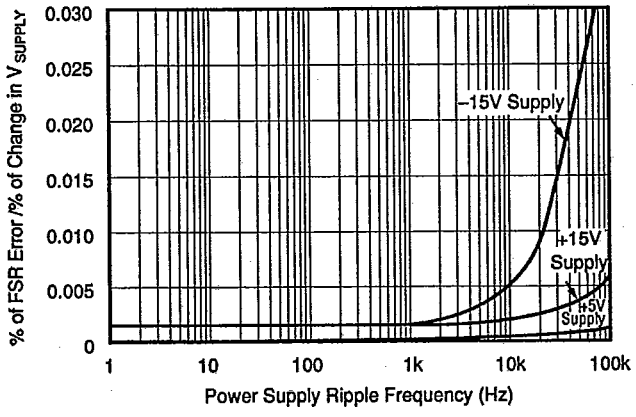


	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
H_D	.442	.458	11.23	11.63
H_E	.442	.458	11.23	11.63
A_Z	.064	.100	1.63	2.54
b	.022	.028	0.56	0.71
e	.050 BASIC		1.27 BASIC	
R	.008R TYP		0.20R TYP	
T	.040 TYP		1.016 TYP	
Z	.075 TYP		1.91 TYP	



TYPICAL PERFORMANCE CURVE

T_A = 25°C, $\pm V_{CC}$ = 15VDC, V_{DD} = 5VDC unless otherwise stated. For applications information refer to PDS-494.



Digital Input Codes	Complementary Offset Binary (COB)	Complementary Two's Complement (CTC)*
0000_H	+Full Scale	–1LSB
$7FFF_H$	Bipolar Zero	–Full Scale
8000_H	–1LSB	+Full Scale
$FFFF_H$	–Full Scale	Bipolar Zero

*Invert the MSB of the COB code with an external inverter to obtain the CTC Code.

TABLE I. Digital Input Codes.

ABSOLUTE MAXIMUM RATINGS

$+V_{CC}$ to Common	0V, +18V
$-V_{CC}$ to Common	0V, –18V
V_{DD} to Common	0V, +18V
Digital Data Inputs to Common	–1V, +18V
Reference Out to Common	Indefinite Short to Common
External Voltage Applied to D/A Output	–5V to +5V
V_{OUT}	Indefinite Short to Common
Power Dissipation	1000mW
Storage Temperature	–60°C to +150°C

*Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. Exposure to absolute maximum conditions for extended periods may affect device reliability.

ORDERING INFORMATION

DAC703 X L

Basic Model Number

Performance Grade Code
B, C: –25°C to +85°C
K, L: 0°C to +70°C
S: –55°C to +125°C

Package Code
L: 28-Pin Leadless Chip Carrier

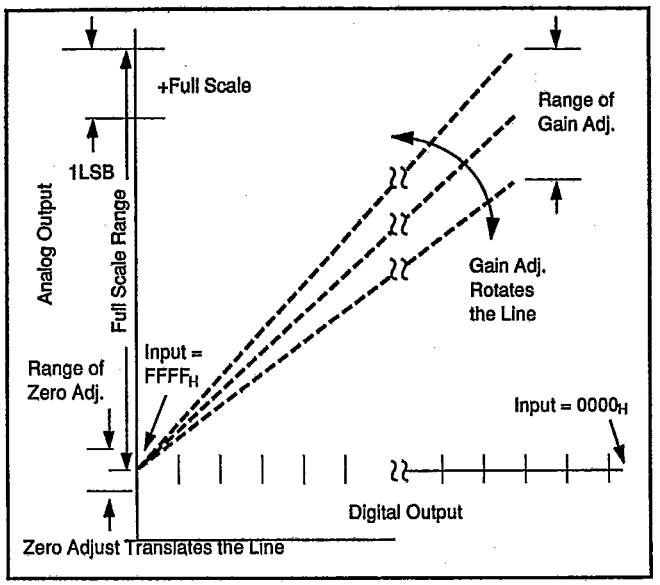


FIGURE 1. Relationship of Zero and Gain Adjustments for Unipolar D/A Converter DAC703.

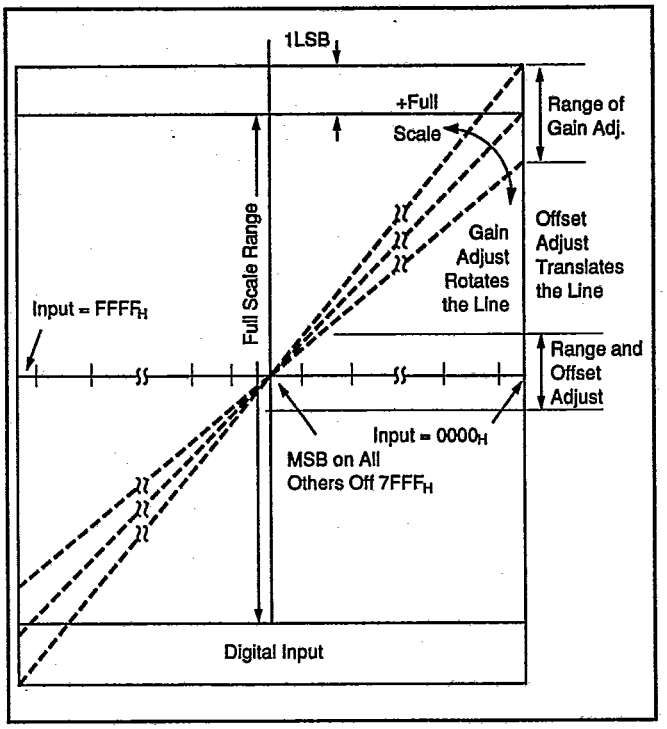


FIGURE 2. Relationship of Zero and Gain Adjustments for Bipolar D/A Converter DAC703.

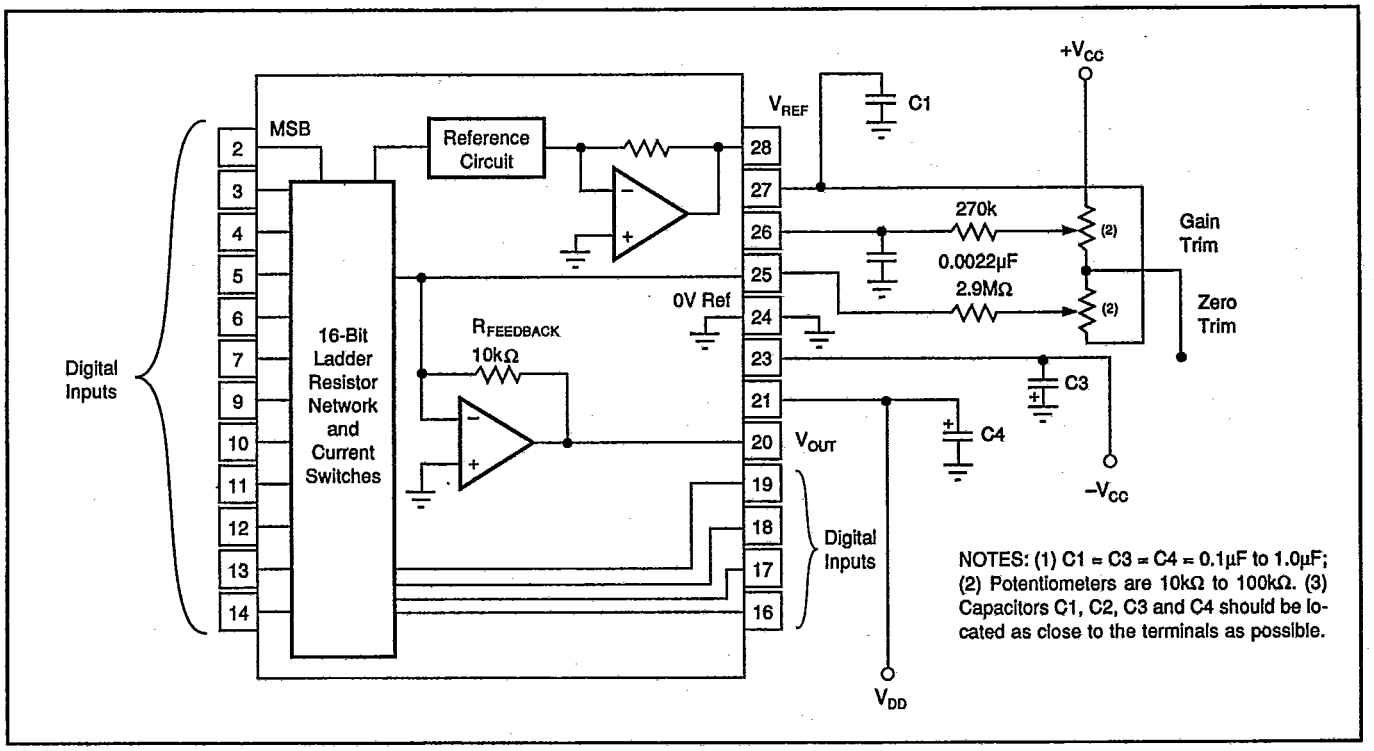


FIGURE 3. Pin Connection Diagram Showing Optional Gain and Zero Error Trim.