

Improved Industry Standard CMOS 12-Bit Multiplying DAC

FEATURES

- Improved Direct Replacement for AD7541A and AD7541
- 4-Quadrant Multiplication
- **12-Bit End-Point Linearity: $\pm 0.5\text{LSB}$ DNL and INL Over Temperature**
- All Grades Guaranteed Monotonic
- **Maximum Gain Error: $\pm 1\text{LSB}$**
- Single 5V to 15V Supply
- TTL and CMOS Logic Compatible
- Reduced Sensitivity to Op Amp Offset
- Low Power Consumption
- Virtually Latch-Up Proof
- Low Cost

APPLICATIONS

- Motion Control Systems
- Microprocessor-Controlled Calibration
- Automatic Test Equipment
- Programmable Gain Amplifiers
- Digitally Controlled Filters

DESCRIPTION

The LTC[®]7541A is a 12-bit resolution multiplying digital-to-analog converter (DAC).

Laser-trimmed thin-film resistors provide excellent absolute accuracy. Precision matched resistors and CMOS circuitry result in remarkable stability with temperature and supply variations.

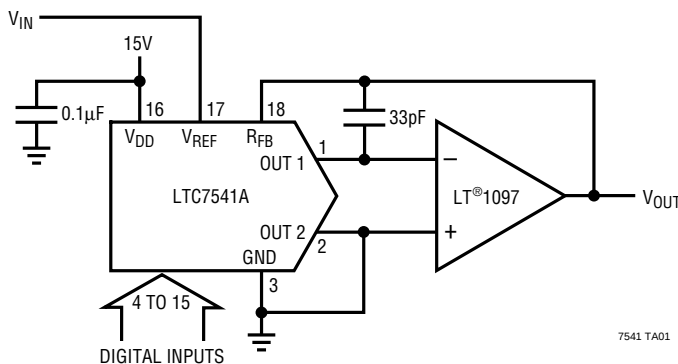
The LTC7541A is a superior pin compatible replacement for the industry standard AD7541A/AD7541. Improvements include better typical accuracy and stability and reduced sensitivity to output amplifier offset. The LTC7541A is also very resistant to latch-up.

In addition to 2-quadrant and 4-quadrant multiplying configurations, the LTC7541A performs well in digitally programmable gain and noninverting voltage output applications. Low cost, improved performance and versatility make the LTC7541A the best choice for many new designs and for upgrading existing systems. Parts are available in 18-pin PDIP and 18-pin SO Wide packages.

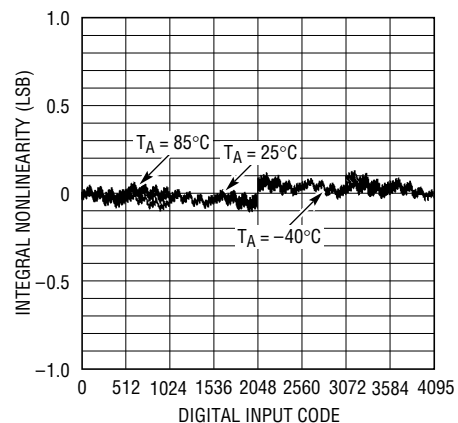
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TYPICAL APPLICATION

**2-Quadrant Multiplying DAC Has Less Than
0.5LSB (Typ) Total Unadjusted Error**



Integral Nonlinearity Over Temperature

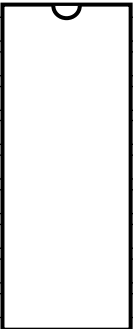


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ABSOLUTE MAXIMUM RATINGS

V_{DD} to GND	-0.5V to 17V
V_{REF} to GND	$\pm 25V$
R_{FB} to GND	$\pm 25V$
Digital Inputs to GND	-0.5V to ($V_{DD} + 0.5V$)
OUT 1, OUT 2 to GND	-0.5V to ($V_{DD} + 0.5V$)
Power Dissipation	450mW (Derate 6mW/°C Above 75°C)
Maximum Junction Temperature	-65°C to 125°C
Operating Temperature Range	
Commercial (J, K Versions)	0°C to 70°C
Industrial (B Version)	-40°C to 85°C
Storage Temperature Range	-65°C to 150°C
Lead Temperature (Soldering, 10 sec)	300°C

PACKAGE/ORDER INFORMATION

TOP VIEW		ORDER PART NUMBER	
OUT 1	1	18	R _{FB}
OUT 2	2	17	V _{REF}
GND	3	16	V _{DD}
BIT 1 (MSB)	4	15	BIT 12 (LSB)
BIT 2	5	14	BIT 11
BIT 3	6	13	BIT 10
BIT 4	7	12	BIT 9
BIT 5	8	11	BIT 8
BIT 6	9	10	BIT 7
			
N PACKAGE		SW PACKAGE	
18-LEAD PDIP		18-LEAD PLASTIC SO WIDE	
T _{JMAX} = 150°C, θ _{JA} = 100°C/W (N)			
T _{JMAX} = 150°C, θ _{JA} = 130°C/W (SW)			

Consult factory for Military grade parts.

ELECTRICAL CHARACTERISTICS

 $V_{DD} = 15V$, $V_{REF} = 10V$, OUT 1 = OUT 2 = GND = 0V, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise specified.

SYMBOL	PARAMETER	CONDITIONS		LTC7541AJ			LTC7541AK/LTC7541AB			UNITS		
				MIN	TYP	MAX	MIN	TYP	MAX			
Accuracy												
	Resolution		●	12			12			Bits		
INL	Integral Nonlinearity (Relative Accuracy)	(Note 1)	●	±1			±0.5			LSB		
DNL	Differential Nonlinearity	Guaranteed Monotonic, T _{MIN} to T _{MAX}	●	±1			±0.5			LSB		
GE	Gain Error	(Note 2) T _A = 25°C T _{MIN} to T _{MAX}	●	±6			±1			LSB		
			●	±8			±2			LSB		
	Gain Temperature Coefficient	(Note 3)	●	1		5	1		5	ppm/°C		
I _{LKG}	Output Leakage Current	(Note 4) T _A = 25°C T _{MIN} to T _{MAX}	●	±5			±5			nA		
			●	±10			±10			nA		
PSRR	Power Supply Rejection	V _{DD} = 15V ±5%	●	±0.002			±0.002			%/%		
Reference Input												
R _{REF}	V _{REF} Input Resistance		●	7		11	15	7		11	15	kΩ
	V _{REF} Input Resistance Temperature Coefficient			−100			−100			ppm/°C		

V_{DD} = 15V, V_{REF} = 10V, OUT 1 = OUT 2 = GND = 0V, T_A = T_{MIN} to T_{MAX}, unless otherwise specified.

Note 7: $V_{REF} = 0V$. All digital inputs 0V to V_{DD} or V_{DD} to 0V. Measured using LT1363 as output amplifier.

TYPICAL APPLICATIONS

Unipolar Operation (2-Quadrant Multiplication)

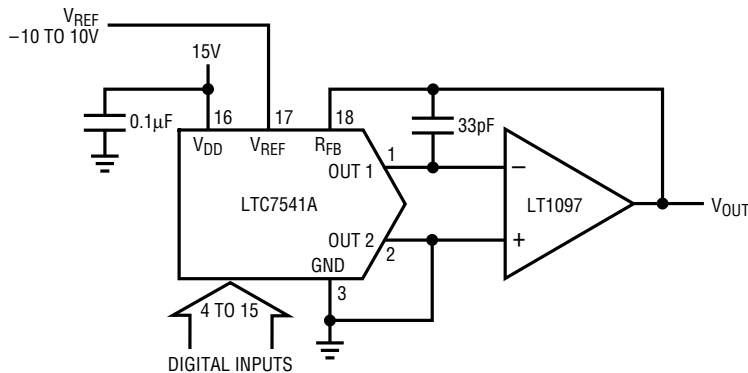


Table 1. Unipolar Binary Code Table

DIGITAL INPUT		ANALOG OUTPUT V _{OUT}
MSB	LSB	
1111	1111 1111	-V _{REF} (4095/4096)
1000	0000 0000	-V _{REF} (2048/4096) = -V _{REF} /2
0000	0000 0001	-V _{REF} (1/4096)
0000	0000 0000	0V

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Bipolar Operation (4-Quadrant Multiplication)

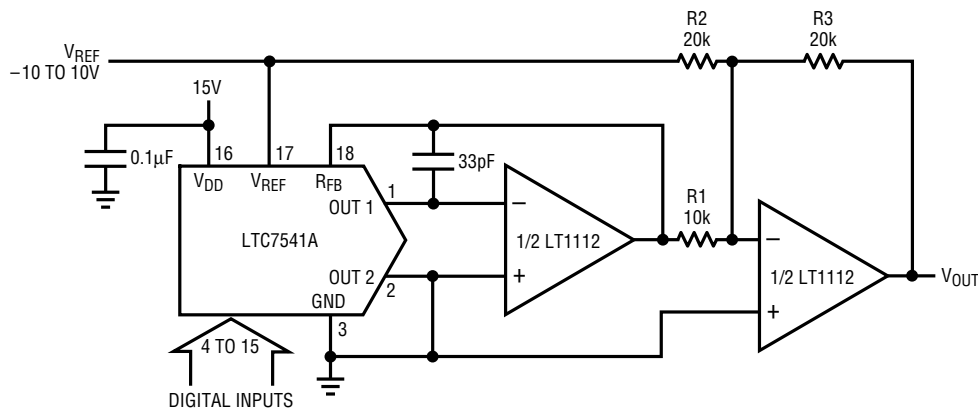


Table 2. Bipolar Offset Binary Code Table

DIGITAL INPUT		ANALOG OUTPUT V _{OUT}
MSB	LSB	
1111	1111 1111	V _{REF} (2047/2048)
1000	0000 0001	V _{REF} (1/2048)
1000	0000 0000	0V
0111	1111 1111	-V _{REF} (1/2048)
0000	0000 0000	-V _{REF}

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RELATED PARTS

PART NUMBER	DESCRIPTION	COMMENTS
LTC1257	Complete Serial I/O V _{OUT} 12-Bit DAC	5V to 15V Single Supply in 8-Pin SO and PDIP
LTC1451/LTC1452/LTC1453	Complete Serial I/O V _{OUT} 12-Bit DACs	3V/5V Single Supply in 8-Pin SO and PDIP
LTC7543/LTC8143	Serial I/O Multiplying 12-Bit DACs	Clear Pin, Serial Data Output (LTC8143)
LTC8043	Serial Multplying 12-Bit DAC	8-Pin SO and PDIP