μPC610
10-BIT POLARIZED D/A CONVERTER

Description

The μPC610 is a high performance precision monolithic digital-to-analog converter which converts 10-bit binary coded digital signals to an analog DC output voltage. All of the necessary circuit blocks are incorporated on board the converter to make designing simple. With the built-in voltage reference and reference input, multiplier operation is also possible.

Features

- ☐ Full Scale Temperature: 100 ppm/°C max
- ☐ Linearity error: 0.2% (1/2 LSB of 8th bit) max
- ☐ Settling Time: 1.5 μs typ
- ☐ Built-in band-gap reference voltage source
- ☐ Multiplying type
- ☐ Sign-Magnitude binary code
- ☐ Low noise
- ☐ Low power dissipation

Ordering Information

Part Number	Package	Operating Temperature Range
μPC610D	Ceramic DIP	−20°C to +80°C

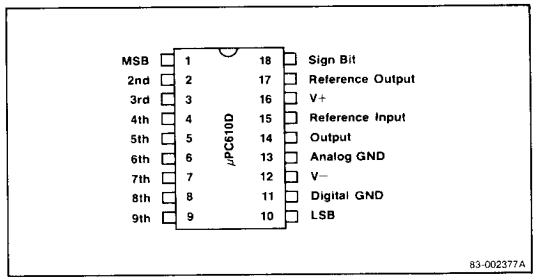
Absolute Maximum Ratings

$T_A = 25°C$

Voltage Between V+ and V−	±18 V
Power Dissipation	500 mW
Analog Ground to Digital Ground	±0.5 V
Logic Input Voltage	−5 to +15 V
Reference Input Voltage	0 to +7 V
Reference Voltage Source Output Current	1.0 mA
Output Short Circuit Duration	Indefinite
Operating Temperature Range	−20 to +80°C
Storage Temperature Range	−55 to +150°C

Comment: Stress above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Pin Configuration



Pin Identification

Pin	Name	Function
1	MSB	Data Bit 1
2	2nd	Data Bit 2
3	3rd	Data Bit 3
4	4th	Data Bit 4
5	5th	Data Bit 5
6	6th	Data Bit 6
7	7th	Data Bit 7
8	8th	Data Bit 8
9	9th	Data Bit 9
10	LSB	Data Bit 10
11	Digital Ground	
12	V− Supply	Power Supply Negative
13	Analog Ground	
14	V_{OUT} − Output	Voltage Output
15	Reference Input	
16	V+ Supply	Power Supply Positive
17	Reference Output	
18	Sign Bit	Sign + or −

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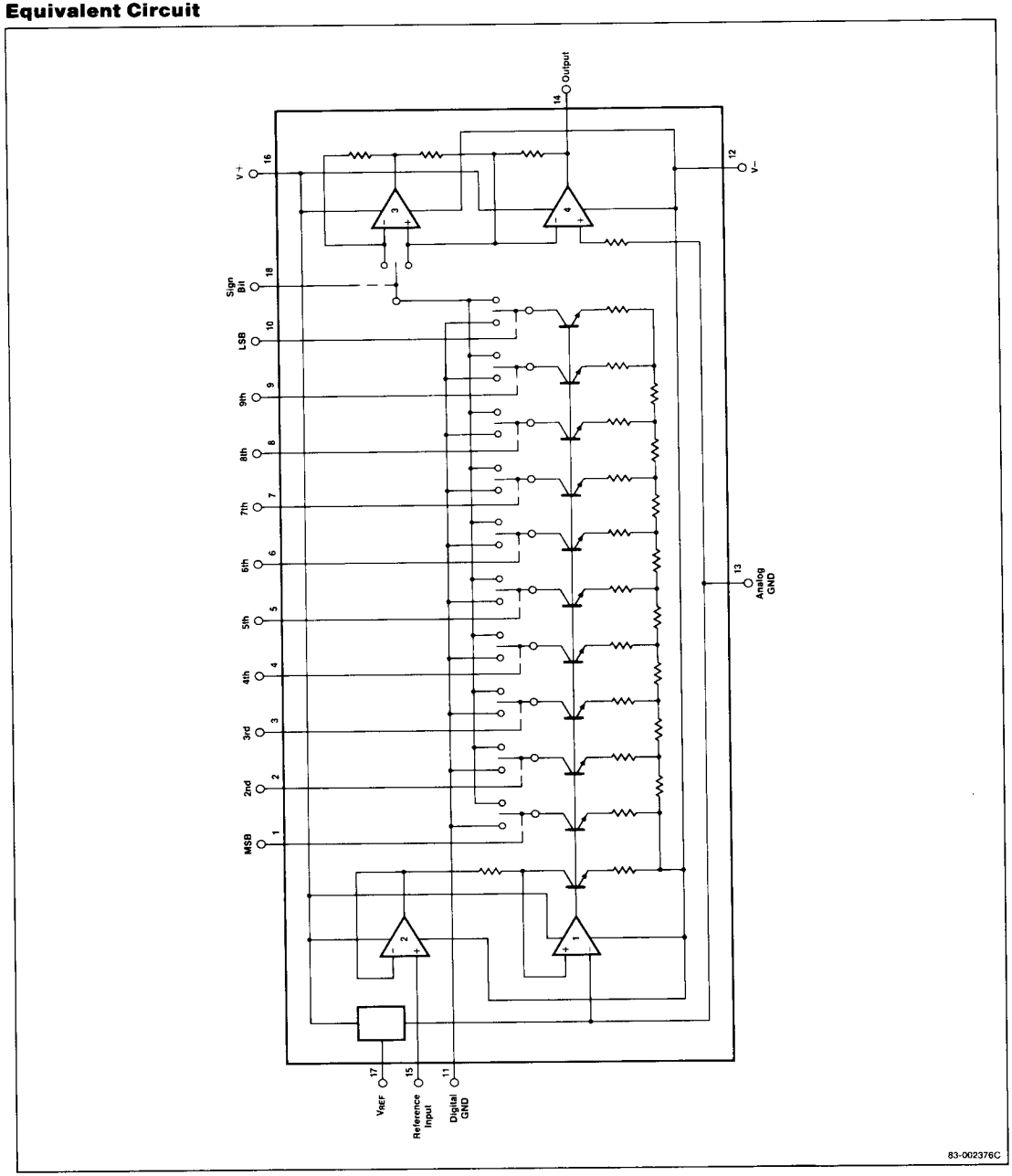
Equivalent Circuit



Electrical Characteristics

$T_A = +25°C$, $V\pm = +15$ V

Parameter	Symbol	Limits Min.	Typ.	Max.	Unit	Test Conditions
Resolution (Note 1)				11	Bit	Bipolar Operation
				10	Bit	Unipolar Operation
Linearity Error (Note 1)	NL		0.1	0.2	%FSR	$T_A = -20 \sim +80°C$
Settling Time	T_S		1.5	6.0	μs	Final Value ±20 mV
Full Scale Temperature Coefficient (Note 2)			50	100	ppm/°C	Using internal reference voltage source
			30	60	ppm/°C	Using external reference voltage source
Reference Input Bias Current	I_{IS}		100	500	nA	
Reference Input Slew Rate	SR		1.5		V/μs	
Reference Voltage	V_{REF}	2.2	2.4	2.6	V	$R_L \geq 20$ kΩ
Zero Scale Offset Voltage			±5	±10	mV	Signbit "ON", other bits "OFF"
Zero Scale Offset Symmetry			±1	±5	mV	
Full Scale Output Offset			±10	±80	mV	
Supply Voltage Rejection Ratio	SVRR		0.015	0.15	%FSR/V	$\pm 12\ V \leq V\pm \leq \pm 18\ V$
Power Dissipation	P_D			300	mW	
Logic Input Terminal Current	I_{IN}			10	μA	$V_{IN} = -5\ V \sim +15\ V$
High Level Input Voltage (Note 3)	V_{IH}	2.0			V	
Low Level Input Voltage (Note 3)	V_{IL}			0.8	V	
Full Scale Output Voltage (Note 4)	V_O	10.0		11.0	V	All bits "ON", $R_L \geq 2$ kΩ
		−11.0		−10.0	V	Signbit "OFF", other bits "ON", $R_L \geq 2$ kΩ

Notes: 1. Though the IC possesses a resolution of 10 or 11 bits, the linearity error is equivalent to 9 bits. In applications where perfect monotonicity is expected, employ the IC as an 8-bit D/A converter.
2. The average value of the differential coefficient at $T_A = -20°C$ to $+80°C$.
3. The digital input is active "High" binary code.
4. The value when the internal reference voltage is directly applied to the reference input terminals.

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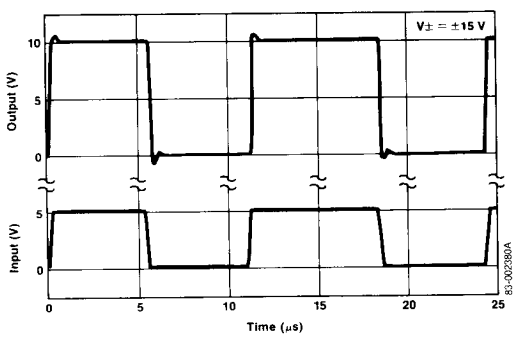
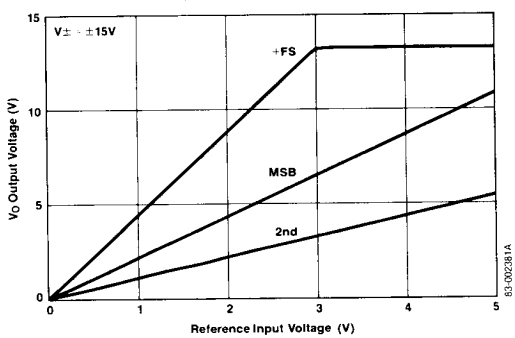
Typical Characteristics

($T_A = 25°C$)

Digital Input Response Characteristics

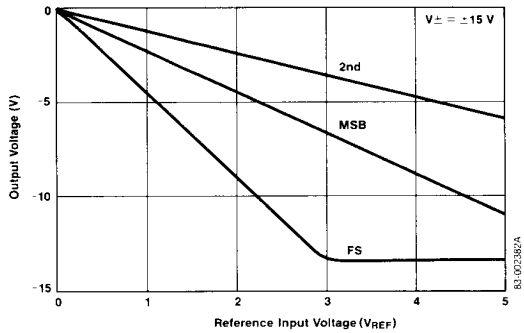


$V_{REF} - V_O+$ Characteristic

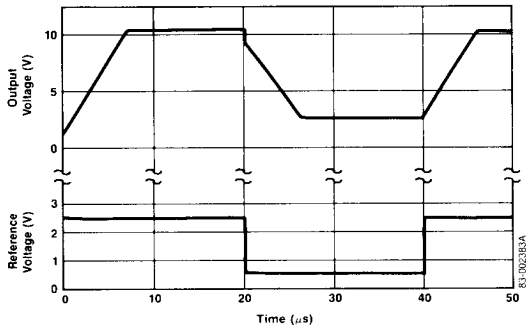


Typical Characteristics (Cont.)
($T_A = 25°C$)

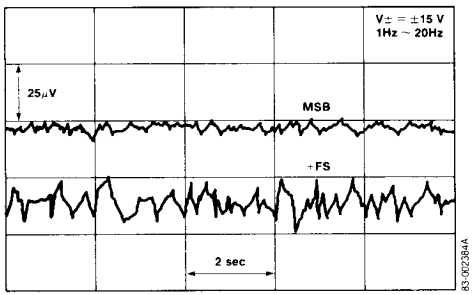
$V_{REF} - V_O$ Characteristic



Reference Input Response Characteristic

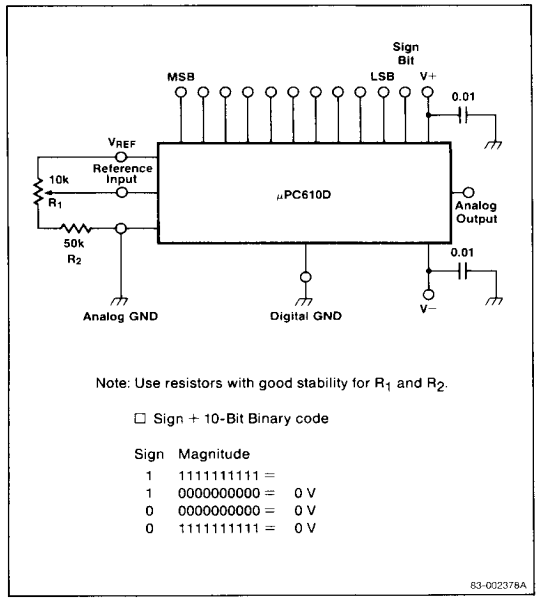


Output Noise Voltage

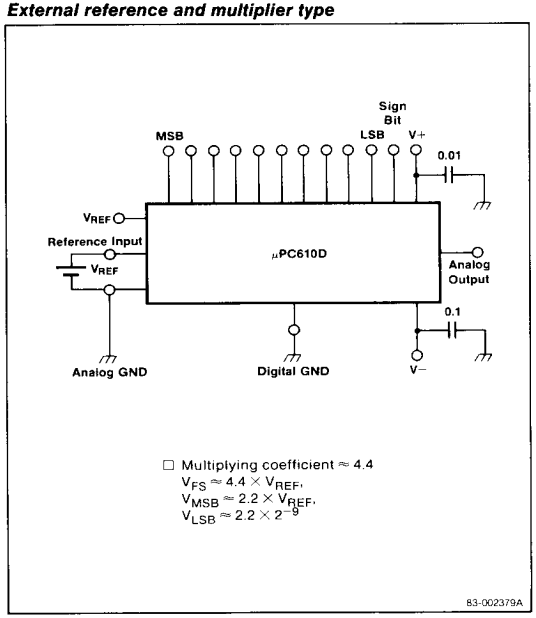


Typical Applications

Using internal reference voltage source



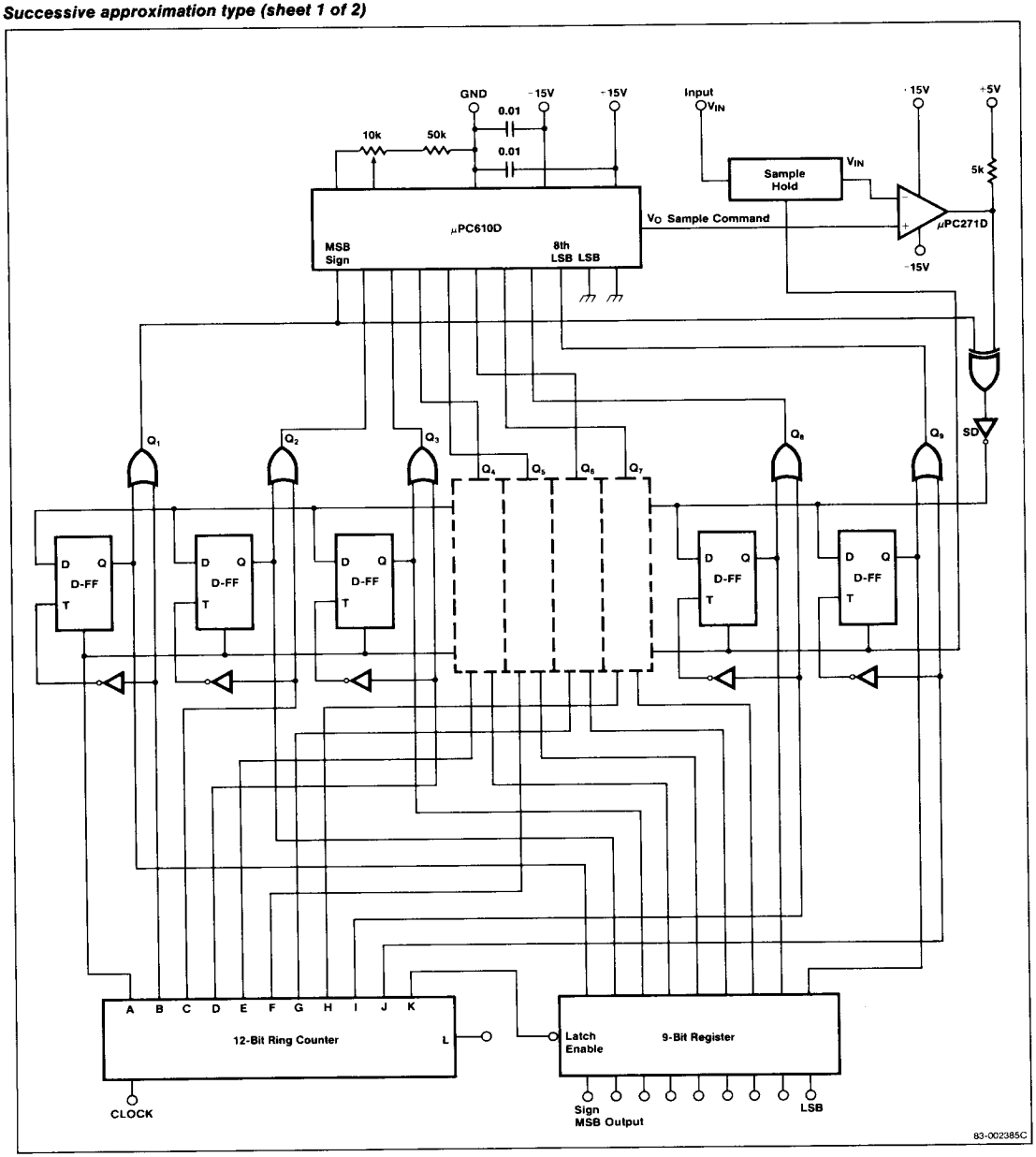
External reference and multiplier type



Application Circuits

8-Bit + sign A/D converter

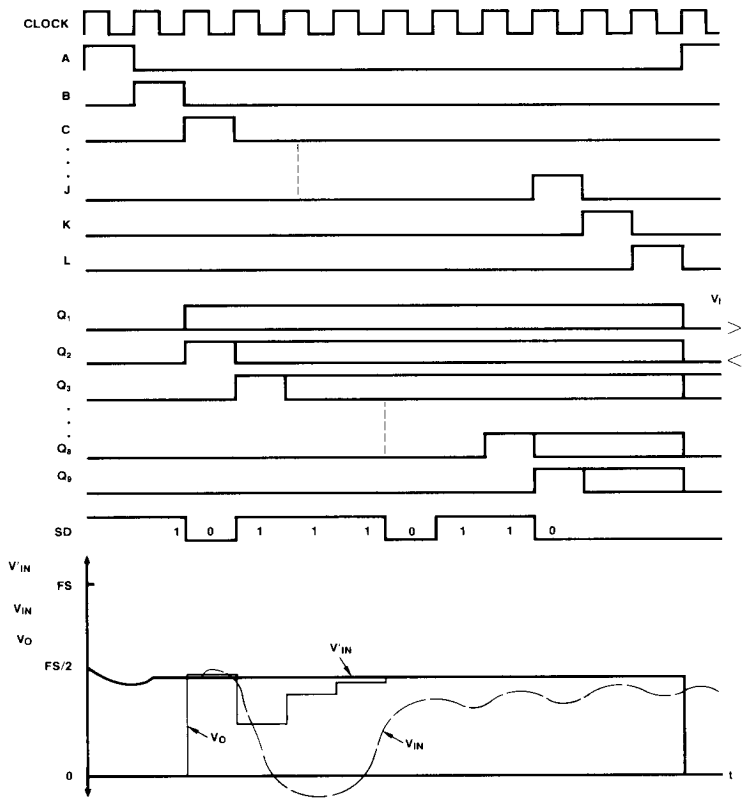
Successive approximation type (sheet 1 of 2)



Application Circuits (Cont.)

8-bit + sign A/D converter

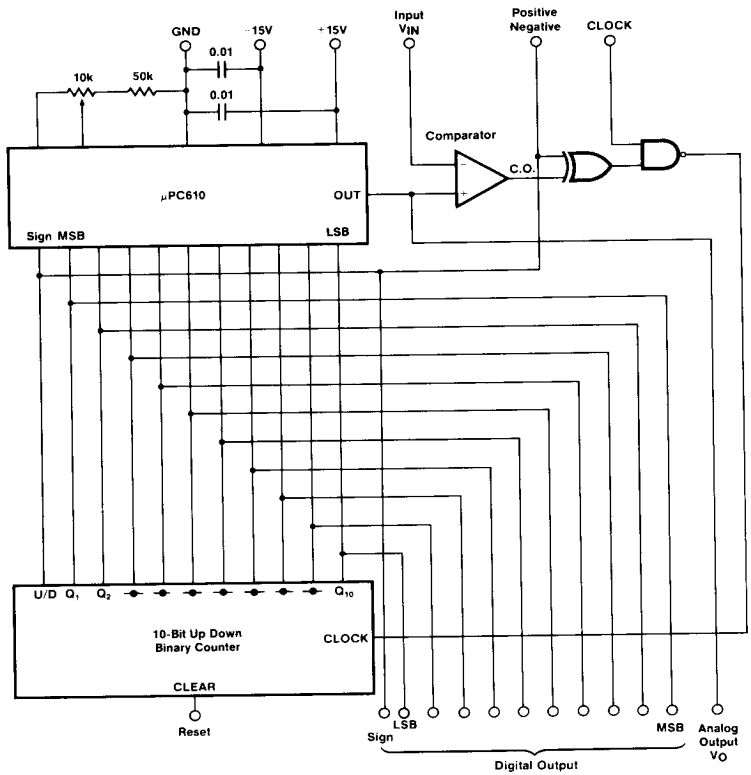
Successive approximation type (sheet 2 of 2)



Note: D, V_{IN}, V'_{IN} and V_O show in case when an input equivalent to an output of "101110110".

Application Circuits (Cont.)

Peak detector (positive/negative)



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Precautions for Usage

1. To absorb surges and prevent oscillation, bypass the power supply terminals with a capacitor of 0.01 μF.
2. To utilize the characteristics of the μPC610D in full, employ components of good stability for the full-scale adjustment resistor and the trimmer.
3. Since the settling time may increase or oscillation may occur in the case of capacitive loads, the μPC610D should be used with load capacitance of 100 pF or less.
4. The output amplifier will saturate at: $|V_{REF}| \geq 3$ V in the case of multiplier type operation. In this case the response time and power supply current will increase.
5. Since the reference potential inside the μPC610D is connected to the analog GND, common mode noise in regard to analog GND will present a direct error. Since analog GND and digital GND have independent circuits within the IC, these should be connected together outside the IC (if required).