

# 10-Bit 125MSPS Sampling Digital-to-Analog Converter

## nDA10125-13

### FEATURES

- ? 1.2V power supply
- ? SFDR > 60dB for ( $f_{in} = 5\text{MHz}$ )
- ? Low power (55mW @ 1.2V)
- ? Update rate: 125MSPS
- ? Differential output (2 – 15mA)
- ? Internal voltage reference
- ? Edge-triggered input latches
- ? Power Down mode

### APPLICATIONS

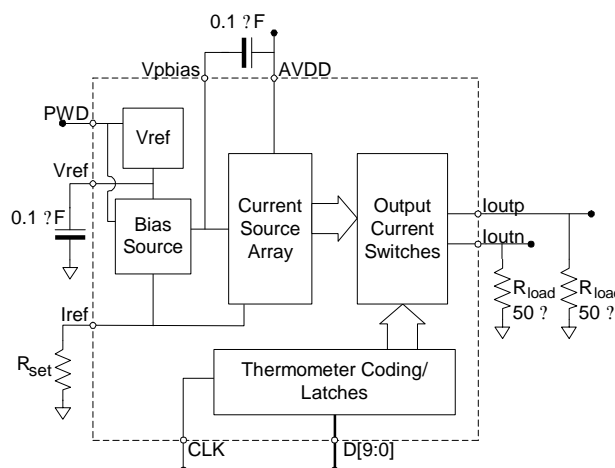
- ? Wireless LAN
- ? Basestations
- ? Digital radio link
- ? Set top boxes
- ? Instrumentation
- ? Digital video systems

### GENERAL DESCRIPTION

The nDA10125-13 is a compact, high-speed, low power 10-bit digital-to-analog converter, implemented in a 0.13 $\mu\text{m}$  pure digital CMOS process. The power consumption is only 55mW from a 1.2V supply operating at 125MHz update rate. The nDA10125-13 offer good AC and DC performance at update rates up to 125MHz.

The DAC has differential current outputs with a nominal full-scale output current of 15mA. The full-scale output range is adjustable between 2mA and 15mA using the external  $R_{set}$  resistor. It operates from a single 1.2V power supply, and despite this low supply voltage the output compliance voltage range is as large as 0.5V.

Functional block diagram



### QUICK REFERENCE DATA

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{DD}$	Supply Voltage		1.0	1.2	1.4	V
$I_{DD}$	Supply Current	125 MSPS			46	mA
$P_D$	Power Dissipation	125 MSPS, 1.2V			55	mW
DNL	Differential nonlinearity				$\pm 0.5$	LSB
INL	Integral nonlinearity				$\pm 1$	LSB
$f_{clk,max}$	Maximum update rate		125			MHz
SFDR	Spurious free dynamic range	125 MSPS, $f_{OUT}=5\text{MHz}$	60			dB
N	Resolution				10	bit



## ELECTRICAL SPECIFICATIONS

**DC SPECIFICATIONS** ( $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 1.2\text{V}$ , Update Rate = 125MHz, Full scale range = 15mA)

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
	DC Accuracy				
DNL	Differential Nonlinearity			±0.5	LSB
INL	Integral Nonlinearity			±1.0	LSB
	Monotonicity	guaranteed			
	Analog Output				
I <sub>FSR</sub>	Full-scale Output Current (differential)	2		15	mA
V <sub>FSR</sub>	Output compliance range (differential)	0		±0.50	V
R <sub>OUT</sub>	Output resistance		TBD		k?
C <sub>OUT</sub>	Output capacitance		TBD		pF
ε <sub>offset</sub>	Offset error	-0.03		0.03	% FSR
ε <sub>gain</sub>	Gain error	-10		10	% FSR
	Reference Voltage				
V <sub>ref</sub>	Reference Voltage		TBD		V
	Reference Voltage Drift			100	ppm/°C
	Power Supply				
V <sub>DD</sub>	Positive supply voltage	1.0	1.2	1.4	V
I <sub>DD</sub>	Supply current			46	mA
V <sub>SS</sub>	Negative supply voltage		GND		
P <sub>D</sub>	Power dissipation(@1.2V)			55	mW
T	Ambient operating temperature	-40		+85	°C

**AC SPECIFICATIONS** ( $T_A = 25^\circ\text{C}$ ,  $V_{DD} = 1.2\text{V}$ , Update Rate = 125MHz, Full scale range = 15mA)

Symbol	Parameter (condition)	Min.	Typ.	Max.	Units
<b>Dynamic Performance</b>					
$f_{max}$	Maximum output update rate	125			MSPS
$t_{ST}$	Output Settling time		35		ns
$t_{PD}$	Output Propagation Delay		TBD		ns
$E_{glitch}$	Glitch impulse energy		TBD		pV-s
$t_{rise}$	Output Rise time		2.5		ns
$t_{fall}$	Output Fall time		2.5		ns
onoise	Output noise ( $I_{FSR}=20\text{mA}$ )		50		pA/Hz $^{1/2}$
onoise	Output noise ( $I_{FSR}=2\text{mA}$ )		30		pA/Hz $^{1/2}$
<b>AC Linearity</b>					
SFDR	Spurious Free Dynamic Range				
	$f_{OUT} = 5\text{ MHz}$	60			dB
	$f_{OUT} = 20\text{ MHz}$	55			dB



## ABSOLUTE MAXIMUM RATINGS

### Supply voltages

$AV_{DD}$ ..... - 0.2V to +2.2V

$DV_{DD1}$  ..... - 0.2V to  $V_{DD} + 0.2V$

$OV_{DD}$ ..... - 0.2V to  $V_{DD} + 0.2V$

### Temperatures

Operating Temperature....-40 to +85°C

Storage Temperature..... - 65 to +125°C

### Input voltages

Digital In..... - 0.2V to  $V_{DD} + 0.2V$

CLOCK..... - 0.2V to  $V_{DD} + 0.2V$

*Note: Stress above one or more of the limiting values may cause permanent damage to the device.*

## TIMING DIAGRAM

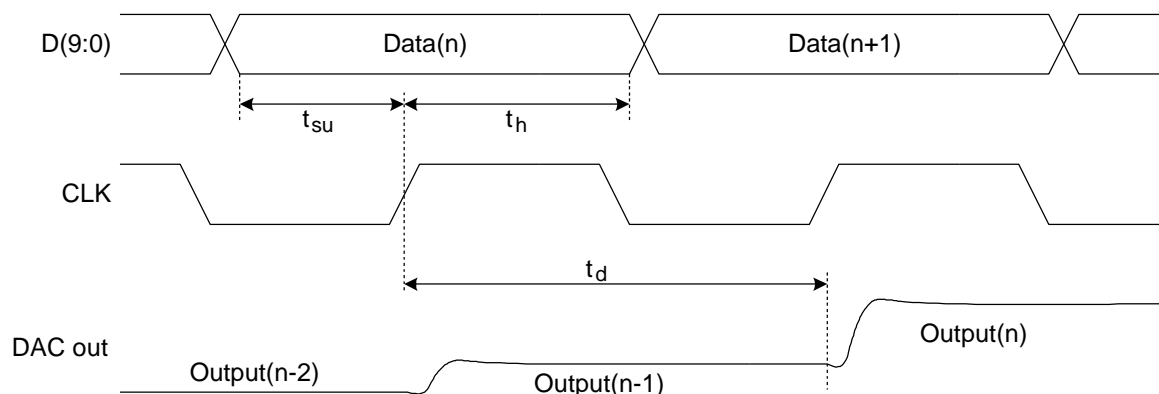


Figure 1: Timing Diagram

## DEFINITIONS

Data sheet status	
Objective product specification	This datasheet contains target specifications for product development.
Preliminary product specification	This datasheet contains preliminary data; supplementary data may be published from Nordic VLSI ASA later.
Product specification	This datasheet contains final product specifications.
Limiting values	
Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Specifications sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

Table 3. Definitions



## **LIFE SUPPORT APPLICATIONS**

These products are not designed for use in life support appliances, devices, or systems where malfunction of these products can reasonably be expected to result in personal injury. Nordic VLSI ASA customers using or selling these products for use in such applications do so at their own risk and agree fully indemnify Nordic VLSI ASA for any damages resulting from such improper use or sale.



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World Wide Web/Internet: Visit our site at <http://www.nvlsi.no>.

### ORDERING INFORMATION

Type number	Description	Price	Available
nDA10125-13-IC	nDA10125-13 sample in SSOP28 package (limited availability)	USD 50	August 15 <sup>th</sup> , 2002
nDA10125-13-EVB	nDA10125-13 evaluation board including characterisation report and user guide	USD 300	August 15 <sup>th</sup> , 2002

Table 4. Ordering information

Objective Product Specification. Revision Date: August 28<sup>th</sup>, 2001

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