N *National*
Semiconductor

MILITARY DATA SHEET

MNDAC0854CM-X REV 0B0

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QUAD 8-BIT VOLTAGE-OUTPUT SERIAL D/A CONVERTER WITH READBACK

General Description

The DAC0854 is a complete quad 8-bit voltage-output digital-to-analog converter that can operate on a single 5V supply. It includes on-chip output amplifiers, internal voltage reference, and a serial microprocessor interface. By combining in one package the reference, amplifiers and convesion circuitry for four D/A converters, the DAC0854 minimizes wiring and parts count and is hence ideally suited for applications where cost and board space are of prime concern.

The DAC0854 also has a data readback function, which can be used by the microprocessor to verify that the desired input word has been properly latched into the DAC0854's data registers. The data readback function simplifies the design and reduces the cost of systems which need to verify data integrity.

The logic comprises a MICROWIRE[TM]-compatible serial interface and control circuitry. The interface allows the user to write to any one of the input registers or to all four at once. The latching registers are double-buffered, consisting of 4 seperate input registers and 4 DAC registers. Double buffering allows all 4 DAC outputs to be updated simultaneously.

The four reference inputs allow the user to configure the system to have a separate output voltage range for each DAC. The output voltage of each DAC can range between 0.3V and 2.8V and is a function of Vbias, Vref, and the input word.

Industry Part Number

DAC0854CM

NS Part Numbers

DAC0854CMJ-QML

Prime Die

DAC0854C

Controlling Document

5962-9551201QRA

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp ($^{\circ}$C)
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55

Features

- Single +5V supply operation
- MICROWIRE serial interface allows easy interface to COPS(TM) and HPC(TM) families of
  microcontrollers
- Data readback capability
- Output data can be formatted to read back MSB or LSB first
- Versatile logic allows selective or global update of the DACs
- Power fail flag
- Output amplifiers can drive 2K Ohm load
- Synchronous/asynchronous update of the DAC outputs

Applications

- Automatic test equipment
- Industrial process controls
- Automotive controls and diagnostics
- Instrumentation

(Absolute Maximum Ratings)
(Note 1, 2)

Supply Voltage (AVcc, DVcc)

7V

Supply Voltage Difference (AVcc-DVcc)

5.5V

Voltage at Any Pin
 (Note 3)

Gnd - 0.3V to AVcc/ DVcc +0.3V

Input Current at Any Pin
 (Note 3)

5mA

Package Input Current
 (Note 4)

20mA

Power Dissipation
 (Note 5)

105mW

ESD Susceptibility
 (Note 6)

1250V

Soldering Information
   (Soldering, 10 seconds)   300 C
Maximum Junction Temperature

150 C

Storage Temperature

-65 C to +150 C

Thermal Resistance
   ThetaJA
     (Still Air)   TBD
     (500LF/Min Air flow)   TBD

   ThetaJC   TBD

Note 1:   Absolute Maximum Ratings indicate limits beyond which damage to the device may occur.
          Operating Ratings indicate conditions for which the device is functional. These
          ratings do not guarantee specific performance limits, however. For guaranteed
          specifications and test conditions, see the Converter Electrical Characteristics. The
          guaranteed specifications apply only for the test conditions listed. Some performance
          characteristics may degrade when the device is not operated under the listed test
          conditions.
Note 2:   All voltages are measured with respect to ground, unless otherwise specified.
Note 3:   When the input voltage (Vin) at any pin exceeds the power supply rails (Vin<Gnd or
          Vin>V+) the absolute value of current at that pin should be limited to 5mA or less.
Note 4:   The sum of the currents at all pins that are driven beyond the power supply voltages
          should not exceed 20mA.
Note 5:   The maximum power dissipation must be derated at elevated temperatures and is
          dictated by Tjmax (maximum junction temperature), ThetaJA (package junction to
          ambient thermal resistance), and TA (ambient temperature). The maximum allowable
          power dissipation at any temperature is Pdmax = (Tjmax-TA)/ThetaJA or the number
          given in the Absolute Maximum Ratings, whichever is lower.
Note 6:   Human body model, 100pF discharged through a 1.5k Ohms resistor.

Recommended Operating Conditions
(Note 1, 2)

Supply Voltage

4.5V to 5.5V

Temperature Range

Tmin < TA < Tmax
-55 C < TA < 125 C

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         occure. Operating Ratings indicate conditions for which the device is functional.
         These ratings do not guarantee specific performance limits, however. For guaranteed
         specifications and test conditions, see the Converter Electrical Characteristics. The
         guaranteed specifications apply only for the test conditions listed. Some performance
         characteristics may degrade when the device is not operated under the listed test
         conditions.
Note 2: All voltages are measured with respect to ground, unless otherwise specified.

Electrical Characteristics

DC PARAMETERS: STATIC CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vref = 2.65V, AVcc=DVcc=5V, VBias = 1.4V, Rl = 2K Ohms, fCLK = 10MHz, Rl = Load resistors on the analog
      outputs Vout1, Vout2, Vout3 Vout4.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
n	Resolution	fCLK = 10 MHz				8	bits	1, 2, 3
	Monotonicity		1			8	bits	1, 2, 3
	Integral Linearity Error		2		-1.0	1.0	LSB	1, 2, 3
	Differential Linearity Error				-1.0	1.0	LSB	1, 2, 3
	Fullscale Error		3		-35	35	mV	1, 2, 3
	Zero Error		4		-35	35	mV	1, 2, 3
	Power Supply Sensitivity		5			-34	dB	1, 2, 3

DC PARAMETERS: DIGITAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vref = 2.65V, AVcc=DVcc=5V, VBias = 1.4V, Rl = 2K Ohms, fCLK = 10MHz, Rl = Load resistors on the analog
      outputs Vout1, Vout2, Vout3, Vout4.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Vin(1)	Logical "1" Input Voltage	AVcc = DVcc = 5.5V			2.0		V	1, 2, 3
Vin(0)	Logical "0" Input Voltage	AVcc = Dvcc = 4.5V				.8	V	1, 2, 3
Iil	Digital Input Leakage Current					5.0	uA	1, 2, 3
Vout(1)	Logical "1" Output Voltage	Isource = 0.8mA			2.4		V	1, 2, 3
Vout(0)	Logical "0" Output Voltage	Isink = 3.2mA				.4	V	1, 2, 3
Vint	Interrupt Pin Output Voltage	10K Ohms Pullup				.4	V	1, 2, 3
Is	Supply Current	Outputs Unloaded				19.0	mA	1, 2, 3

DC PARAMETERS: REFERENCE INPUT CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vref = 2.65V, AVcc=DVcc=5V, VBias = 1.4V, Rl = 2K Ohms, fCLK = 10MHz, Rl = Load resistors on the analog
      outputs Vout1, Vout2, Vout3, Vout4.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Rref	Input Resistance				4	10	KOhms	1, 2, 3

Electrical Characteristics

DC PARAMETERS: BANDGAP REFERENCE CHARACTERISTICS(CL = 220uF)

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vref = 2.65V, AVcc=DVcc=5V, VBias = 1.4V, Rl = 2K Ohms, fCLK = 10MHz, Cl = 220uF, Rl = Load resistors
     on the analog outputs Vout1, Vout2, Vout3, Vout4.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
VrefOUT	Output Voltage		6		2.597	2.703	V	1, 2, 3
	Line Regulation	4.5V < Vcc < 5.5V, IL = 4mA				5	mV	1, 2, 3
Delta Vref/Delta Il	Load Regulation	0 < Il < 4mA				15	mV	1, 2, 3

DC PARAMETERS: DYNAMIC CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vref = 2.65V, AVcc=DVcc=5V, VBias = 1.4V, Rl = 2K Ohms, fCLK = 10MHz, Rl = Load resistors on the analog
     outputs Vout1, Vout2, Vout3, Vout4.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
ts+	Positive Voltage Output Settling Time	CL = 200pF	7			2.1	uS	4, 5, 6
ts−	Negative Voltage Output Settling Time	CL = 200pF	7			2.7	uS	4, 5, 6

Electrical Characteristics

AC PARAMETERS: ELECTRICAL CHARACTERISTICS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: AVcc=DVcc=5V, Vref = 2.65V, VBias = 1.4V, Rl = 2K Ohms, fCLK = 10MHz, Rl = Load resistors on the analog
     outputs Vout1, Vout2, Vout3, Vout4.

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
tDS	Data Setup Time				10		nS	9, 10, 11
tDH	Data Hold Time				0		nS	9, 10, 11
tCS	Control Setup Time				15		nS	9, 10, 11
tCH	Control Hold Time				0		nS	9, 10, 11
tMIN	Clock Frequency					10	MHz	9, 10, 11
tH	Minimum Clock High Time				20		nS	9, 10, 11
tL	Minimum Clock Low Time				40		nS	9, 10, 11
tCZ1	Output Hi-Z to Valid 1					37	nS	9, 10, 11
tCZ0	Output Hi-Z to Valid 0					42	nS	9, 10, 11
t1H	$\overline{CS}$ to Output Hi-Z	10K Ohms with 60pF				130	nS	9, 10, 11
t0H	$\overline{CS}$ to Output Hi-Z	10K Ohms with 60pF				117	nS	9, 10, 11

Graphics and Diagrams

GRAPHICS#	DESCRIPTION
6269HRA1	CERDIP (J), 20 LEAD (B/I CKT)
J20ARM	CERDIP (J), 20 LEAD (P/P DWG)

See attached graphics following this page.