

**1.0 SCOPE**

This specification documents the detail requirements for space qualified product manufactured on Analog Devices, Inc.'s QML certified line per MIL-PRF-38535 Level V except as modified herein. The manufacturing flow described in the STANDARD SPACE LEVEL PRODUCTS PROGRAM brochure is to be considered a part of this specification. <http://www.analog.com/aerospace>. This data sheet specifically details the space grade version of this product. A more detailed operational description and a complete data sheet for commercial product grades can be found at [www.analog.com/AD670](http://www.analog.com/AD670).

**2.0 Part Number.** The complete part number(s) of this specification follow:

<u>Part Number</u>	<u>Description</u>
AD670-703D	8-Bit low cost signal conditioning ADC

**2.1 Case Outline.**

<u>Letter</u>	<u>Descriptive designator</u>	<u>Case Outline (Lead Finish per MIL-PRF-38535)</u>
D	CDIP2-T20	20-Lead ceramic, metal sealed, side-brazed leads

**3.0 Absolute Maximum Ratings.** (TA = 25°C, unless otherwise noted)

V <sub>CC</sub> to ground	0V to +7.5V
Digital inputs (Pins 11-15)	-0.5V to V <sub>CC</sub> +0.5V
Digital outputs (Pins 1-9)	Momentary short to V <sub>CC</sub> or ground
Analog inputs (Pins 16-19)	±30V
Power dissipation	450mW
Storage temperature range	-65°C to +150°C
Lead temperature range (soldering)	+300°C
Operating temperature range	-55°C to +125°C
Junction Temperature (T <sub>J</sub> )	150°C

**3.1 Thermal Characteristics:**

Thermal Resistance, Sidebrazed (D) Package  
 Junction-to-Case (θ<sub>JC</sub>) = 25°C/W Max  
 Junction-to-Ambient (θ<sub>JA</sub>) = 85°C/W Max

Terminal	Function
1	DB0 LSB
2	DB1
3	DB2
4	DB3
5	DB4
6	DB5
7	DB6
8	DB7 MSB
9	Status output
10	Power ground
11	BPO/ UPO
12	Format (See note)
13	R/W
14	CS
15	CE
16	-VIN High
17	-VIN Low
18	+VIN High
19	+VIN Low
20	VCC

NOTE: Twos complement or *straightbinary* .

Figure 1 - Terminal connections.

$R/\overline{W}$	$\overline{CS}$	$\overline{CE}$	Operation	Output
X	X	X	Converting (see note 1)	Three-state
0	0	0	Write/convert (see note 2)	Three-state
1	0	0	Read (see note 2)	Data valid
X	X	1	None (see note 3)	Three-state
X	1	X	None (see note 3)	Three-state

NOTES:

1. Status output high.
2. Status output low
3. Status output don't care

Figure 2. Control signal truth table.

Mode	Range	Min	Max	Unit
Unipolar	Low	0	255	mV
Unipolar	High	0	2.55	V
Bipolar	Low	-128	+127	mV
Bipolar	High	-1.28	+1.27	V

Figure 3. Differential input signal range truth table.

$BPO/\overline{UPO}$	Format	Input range/output format
0	0	Unipolar/straight binary
1	0	Bipolar/offset binary
0	1	Unipolar/2's complement
1	1	Bipolar/2's complement

Figure 4. Input selection/output format truth table.

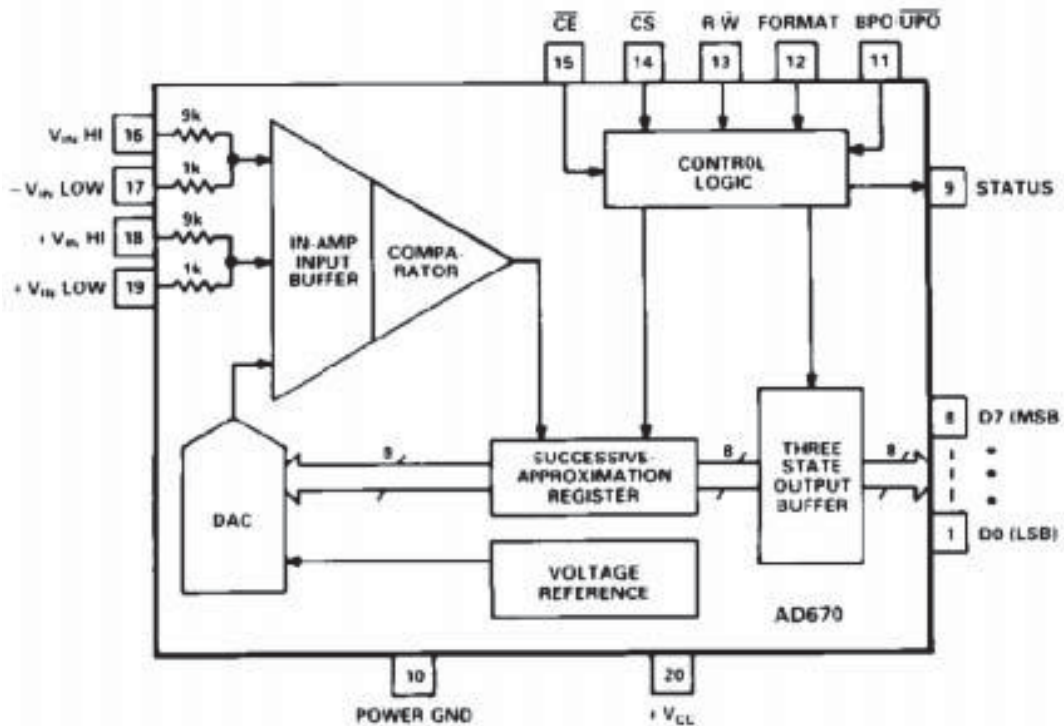


Figure 5. Block diagram.

# AD670

## 4.0 Electrical Table:

Table I						
Parameter See notes at end of table	Symbol	Conditions $V_{CC} = +5V$	Sub-group	Limit Min	Limit Max	Units
Relative accuracy <u>1/</u>	RA		1		$\pm 1/2$	LSB
			2, 3		$\pm 1$	
Differential nonlinearity <u>2/ 3/</u>	DNL		1, 2, 3	8		Bits
Gain Error <u>1/</u>	A <sub>E</sub>		1		$\pm 1.5$	LSB
			2, 3		$\pm 2.5$	
Unipolar offset error	O <sub>E</sub>	0V to +2.55V input range FS	1		$\pm 1$	
			2,3		$\pm 2$	
Bipolar Zero Error	BPZE	-1.28V to +1.27V FS	1		$\pm 1$	
			2, 3		$\pm 2$	
Input resistance <u>3/</u>	R <sub>IN</sub>	2.55V input range	1	8	12	K $\Omega$
Input bias current <u>3/</u>	I <sub>B</sub>	255 mV input range	1, 2, 3		$\pm 750$	nA
Input offset current <u>3/</u>	I <sub>OS</sub>	255 mV input range	1, 2, 3		$\pm 200$	
Absolute input signal range <u>3/ 4/ 5/</u>	V <sub>ABS</sub>	Low range	1	-0.34	V <sub>CC</sub> -3.3V	V
			2, 3	-1.15	V <sub>CC</sub> - 3.5V	
		High range	1	-3.4	V <sub>CC</sub>	
			2, 3	-1.5	V <sub>CC</sub>	
Power supply rejection ratio	PSRR	2.55V FS, V <sub>CC</sub> = +4.75V to +5.5V	1, 2, 3		$\pm 0.015$	%FS/%
Power supply current	I <sub>CC</sub>	V <sub>CC</sub> = 5.5V (DBO-DB7, R/W - high); (STATUS, CE, CS, FORMAT, BPO, UPO - LOW)	1, 2, 3		45	mA
Digital input high voltage <u>3/</u>	V <sub>IH</sub>		1, 2, 3	2.0		V
Digital input low voltage <u>3/</u>	V <sub>IL</sub>		1		0.8	
			2, 3		0.7	
Digital input high current <u>3/</u>	I <sub>IH</sub>	V <sub>IH</sub> = 5V	1, 2, 3		100	$\mu$ A
Digital input low current <u>3/</u>	I <sub>IL</sub>	V <sub>IL</sub> = 0V	1, 2, 3		-100	
Digital output low voltage	V <sub>OL</sub>	I <sub>OL</sub> = 1.6mA, V <sub>CC</sub> = 5.5V	1, 2, 3		0.4	V
Digital output high voltage	V <sub>OH</sub>	I <sub>OH</sub> = 0.5mA, V <sub>CC</sub> = 4.5V	1, 2, 3	2.4		
Digital output low current	I <sub>OL</sub>	V <sub>OL</sub> = 0.4V, V <sub>CC</sub> = 5.5V	1, 2, 3	-1.6		mA
Digital output high current	I <sub>OH</sub>	V <sub>OH</sub> = 2.4V, V <sub>CC</sub> = 4.5V	1, 2, 3	0.5		
Common mode rejection ratio <u>3/ 7/</u>	CMRR	V <sub>CM</sub> = -0.34V to (V <sub>CC</sub> - 3.6V)	1		$\pm 1$	LSB
		V <sub>CM</sub> = -0.15V to (V <sub>CC</sub> - 3.8V)	2, 3		$\pm 2$	
Three-state leakage current <u>3/</u>	I <sub>OZ</sub>	V <sub>applied</sub> = 0V & 5V	1, 2, 3		$\pm 40$	$\mu$ A
Functional tests <u>8/</u>			7, 8			
Bus access time <u>3/</u>	t <sub>TD</sub>	See fig. 5, R <sub>L</sub> = 3K $\Omega$ , C <sub>L</sub> = 90pF	9	250	nS	
Output float delay <u>3/</u>	t <sub>DT</sub>	See fig. 5, R <sub>L</sub> = 3K $\Omega$			150	
Write/start pulse width <u>3/</u>	t <sub>W</sub>	See fig. 6, R <sub>L</sub> = 3K $\Omega$ , C <sub>L</sub> = 90pF		300		
Input data setup time	t <sub>DS</sub>	<u>6/</u>			200	
Input data hold time	t <sub>DH</sub>				10	
R/W setup before control	t <sub>RWC</sub>				0	
Delay to convert start	t <sub>DC</sub>					700
Delay from STATUS OUTPUT to data read	t <sub>SD</sub>					250
Data hold time	t <sub>DH</sub>				25	
Conversion time <u>3/</u>	T <sub>C</sub>	V <sub>CC</sub> = +5V	9		10	$\mu$ S
		<u>6/</u>	10,11		13	

TABLE I NOTES:

- 1/ Tested on both 2.55V full scale and -1.28V to 1.27V full scale.
- 2/ Minimum resolution for which there are no missing codes.
- 3/ Parameter is tested at  $V_{CC} = +5V$ , but is guaranteed from  $V_{CC} = 4.5V$  to  $V_{CC} = 5.5V$
- 4/ The absolute input signal range defines the limits of input signal value from either the (+) or (-) input to ground (as a function of  $V_{CC}$ ) over which the device will produce distinct output codes.
- 5/ The differential input signal range defines the input signal span over which distinct output codes are produced. As this range is exceeded, the device ceases to change output state (see fig. 4).
- 6/ Guaranteed, if not tested, to the specified limits.
- 7/ 255 mV range. CMRR tested with 0V and full scale applied to analog inputs output change measured from 0 to VCM maximum and 0 to VCM minimum and will not exceed specified limits.
- 8/ Subgroups 7 and 8 shall include verification of the truth table. (Fig. 3 and Fig. 4)

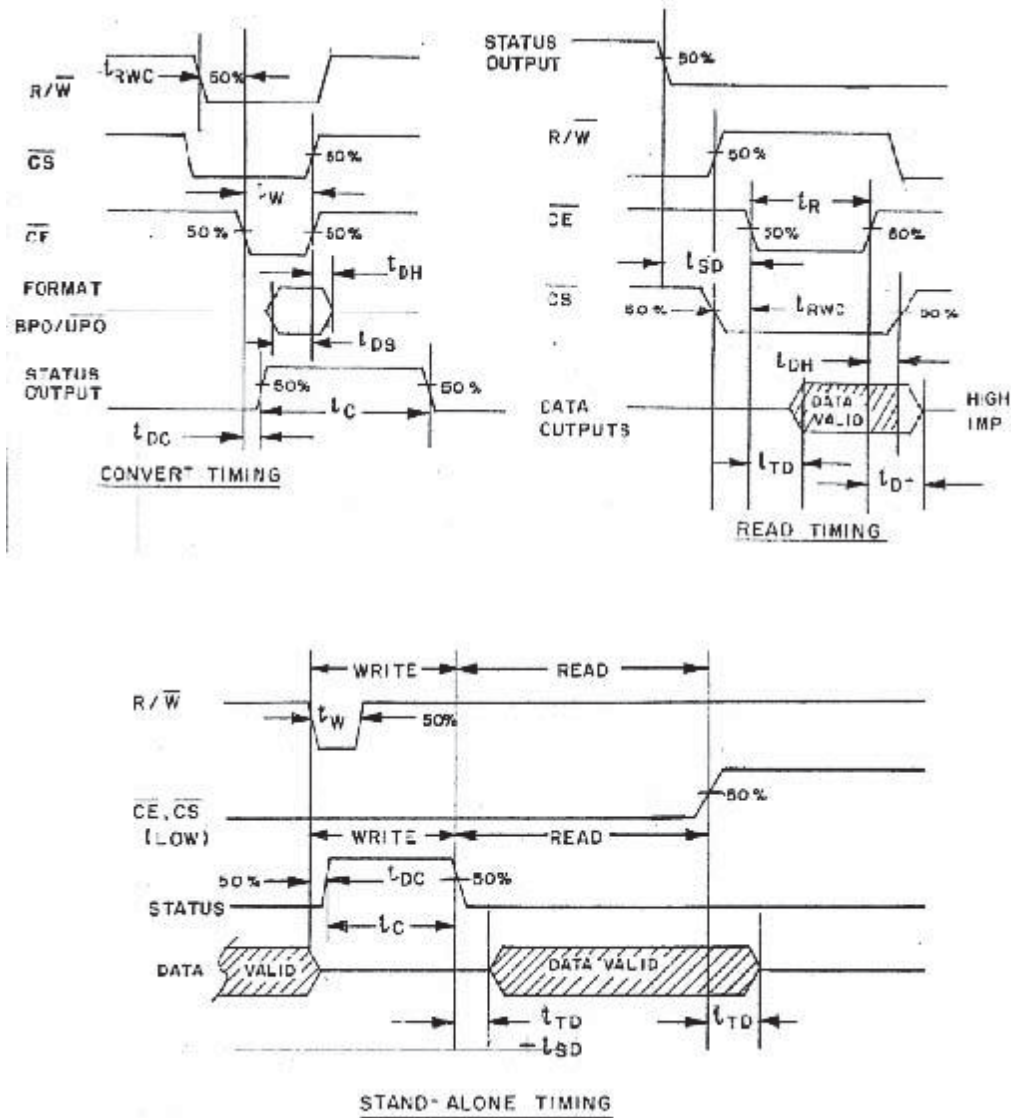


Figure 6. Timing diagram.

## 4.1 Electrical Test Requirements:

Table II	
Test Requirements	Subgroups (in accordance with MIL-PRF-38535, Table III)
Interim Electrical Parameters	1
Final Electrical Parameters	1, 2, 3, 7, 8, 9 <u>1/</u> <u>2/</u>
Group A Test Requirements	1, 2, 3, 7, 8, 9
Group C end-point electrical parameters	1 <u>2/</u>
Group D end-point electrical parameters	1
Group E end-point electrical parameters	1

- 1/ PDA applies to Subgroup 1. Delta's excluded from PDA.  
2/ See Table III for delta parameters. See table I for conditions.

## 4.2 Table III. Lifetest / Burn-in delta limits.

Table III				
TEST TITLE	BURN-IN ENDPOINT	LIFETEST ENDPOINT	DELTA LIMIT	UNITS
A <sub>E</sub>	±1.5	±1.5	±1.5	LSB
V <sub>OS</sub>	±1	±1	±1	LSB
B <sub>PZE</sub>	±1	±1	±1	LSB

## 5.0 Life Test/Burn-In Circuit:

- 5.1 HTRB is not applicable for this drawing.  
 5.2 Burn-in is per MIL-STD-883 Method 1015 test condition D.  
 5.3 Steady state life test is per MIL-STD-883 Method 1005.

Rev	Description of Change	Date
A	Initiate	8/9/2000
B	Various corrections made to Table I to make compatible with 883. SMD has errors. Correct BI to dynamic. Update Table III.	9/18/2001
C	Update web address, BI condition is D	1/25/2002
D	Change BP2E to BPZE on table III (typo) Change Table I BOE to BPZE	11/27/2002
E	Update web address. Delete burn-in circuit	6/20/2003
F	Update header/footer & add to 1.0 Scope description.	2/25/2008
G	Add Junction Temperature (TJ).....150°C to 3.0 Absolute Max. Ratings	3/28/2008
H	Remove obsolete part numbers and update ASD to ADI standard	11/21/2011