

### 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. This brochure can be found at: <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/AD1671](http://www.analog.com/AD1671).

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

Part Number	Description
AD1671-703D	12-Bit A/D Converter
AD1671-703F	12-Bit A/D Converter
AD1671-713F	12-Bit A/D Converter with radiation test

### 2.1. Case Outline:

Letter	Descriptive	Designator Case Outline (Lead Finish per MIL-PRF-38535)
D	CDIP2-T28	28-Lead sidebraced DIP (.6")
F	CDFP3-F28	28-Lead bottom-braced flatpack

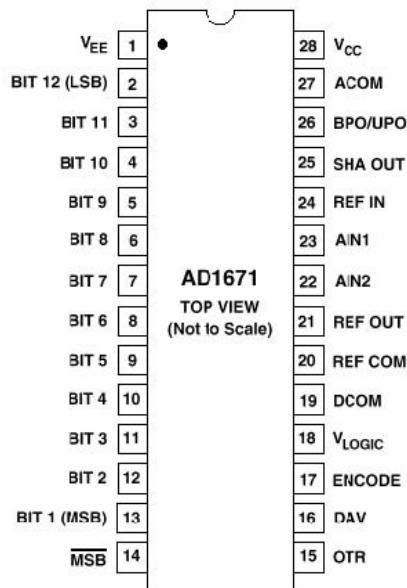


Figure 1 - Terminal connections.

**3.0 Absolute Maximum Ratings.** (T<sub>A</sub> = 25°C, unless otherwise noted)

V <sub>CC</sub> to ACOM.....	-0.5V to +6.5V
V <sub>EE</sub> to ACOM.....	-6.5V to +0.5V
V <sub>LOGIC</sub> to DCOM.....	-0.5V to +6.5V
ACOM to DCOM.....	-1.0V to +1.0V
V <sub>CC</sub> to V <sub>LOGIC</sub> .....	-6.5V to +6.5V
ENCODE to DCOM.....	-0.5V to V <sub>LOGIC</sub> +0.5V
REF IN, BPO/UPO to ACOM.....	-0.5V to V <sub>CC</sub> +0.5V
AIN to ACOM.....	-11V to +11V
Power Dissipation.....	1000mW
Operating Temperature Range.....	-55°C to +125°C
Storage Temperature Range.....	-65°C to +150°C
Lead Temperature (Soldering, 60 sec.).....	+300°C
Junction Temperature (T <sub>J</sub> ).....	+150°C

**3.1. Thermal Characteristics:**

- Thermal Resistance, SBDIP (D) Package
  - Junction-to-Case (Θ<sub>JC</sub>) = 28°C/W Max
  - Junction-to-Ambient (Θ<sub>JA</sub>) = 60°C/W Max
- Thermal Resistance, Bottom brazed (F) Package
  - Junction-to-Case (Θ<sub>JC</sub>) = 22°C/W Max
  - Junction-to-Ambient (Θ<sub>JA</sub>) = 60°C/W Max

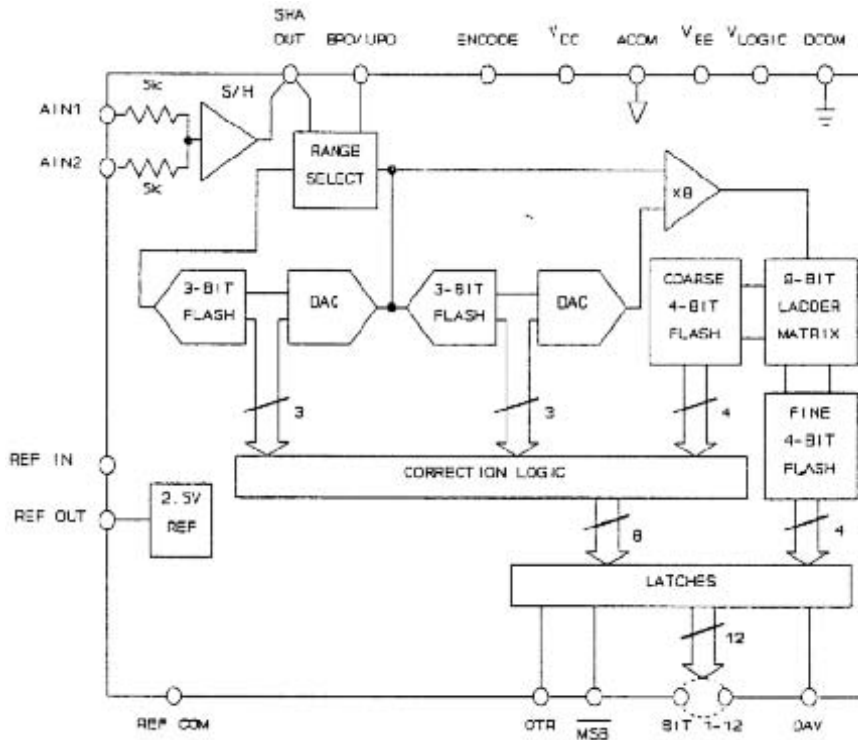


Figure 2. Functional block diagram

## 4.0 Electric Table:

Table I

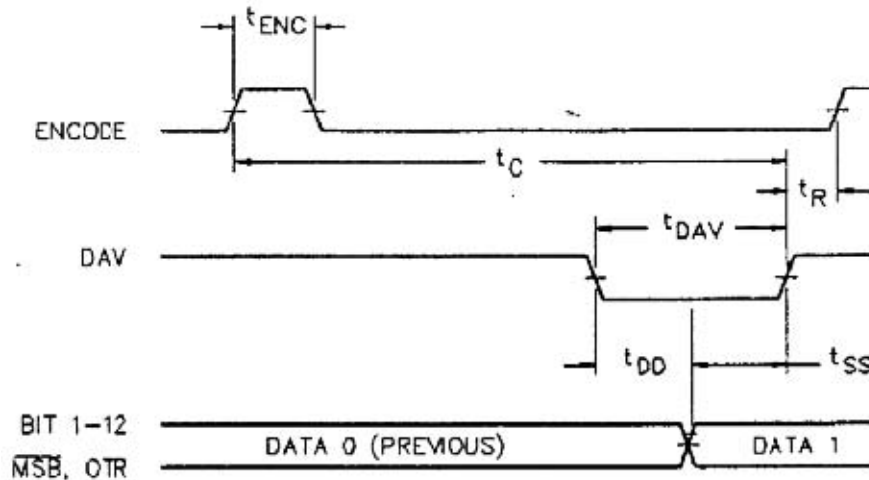
Parameter See notes at end of table	Symbol	Conditions Note 1/	Sub- group	Limit Min	Limit Max	Units	
Resolution	RES		1, 2, 3		12	Bits	
Integral nonLinearity	INL	All codes histogram	1	-2.5	2.5	LSB	
			2, 3	-3	3	LSB	
Differential nonLinearity	+DNL	All codes histogram	1, 2, 3	0	2	LSB	
	-DNL			-1	0	LSB	
Unipolar offset error	V <sub>OSE</sub>	2.5V, 5V span	1	-9	9	LSB	
Unipolar offset drift	TC <sub>VOS</sub>	2.5V, 5V span T <sub>A</sub> = -55°C, +125°C	2,3		20	±ppm/°C	
Gain Error	A <sub>E</sub>	Unipolar & bipolar	1		0.37	%FSR	
Gain drift	TC <sub>A</sub>	Unipolar & Bipolar T <sub>A</sub> = -55°C, +125°C	2,3		40	±ppm/°C	
Bipolar zero error	B <sub>POE</sub>	2.5V, 5V span	1	-10	10	LSB	
Bipolar zero drift	TC <sub>BPO</sub>	2.5V, 5V span T <sub>A</sub> = -55°C, +125°C	2,3		30	±ppm/°C	
Analog input ranges	V <sub>IN</sub>	Unipolar Mode	R <sub>in</sub> =10MΩ 3/	1,2,3		2.5	V
			R <sub>in</sub> =10KΩ 3/	1,2,3		5	
		Bipolar Mode	R <sub>in</sub> =10MΩ 3/	1,2,3		2.5	
			R <sub>in</sub> =10KΩ 3/	1,2,3		5	
Reference voltage 4/	V <sub>RO</sub>	Unipolar & Bipolar 2/	1	2.475	2.525	V	
Reference drift	TC <sub>VRO</sub>	Unipolar & Bipolar 2/ T <sub>A</sub> = -55°C, +125°C	2,3		30	±ppm/°C	
Reference Current	I <sub>REF</sub>	Unipolar Mode 2/	1		2.5	mA	
		Bipolar Mode 2/	1		1		
Power dissipation	P <sub>D</sub>	V <sub>S</sub> = ±5.25V, V <sub>LOGIC</sub> = +5.5V	1,2,3		750	mW	
Power Supply Current	I <sub>CC</sub>	Tested under static conditions	1,2,3		75	mA	
	I <sub>EE</sub>				-75		
	I <sub>LOGIC</sub>				5		
PSRR	V <sub>CC</sub>	Full-Scale Change measured	1,2,3	-4	4	LSB	
	V <sub>EE</sub>						
	V <sub>LOGIC</sub>						
Input Logic voltages	V <sub>IH</sub>	Encode Input	1,2,3	2.0		V	
	V <sub>IL</sub>				0.8		
Input Logic Current	I <sub>IH</sub>		1,2,3	-10	10	μA	
	I <sub>IL</sub>						
Output Logic Voltage	V <sub>OH</sub>	I <sub>OH</sub> = 500μA	1,2,3	2.4		V	
	V <sub>OL</sub>	I <sub>OL</sub> = 1.6mA					0.4
Output Logic Current	I <sub>OH</sub>		1,2,3		500	μA	
	I <sub>OL</sub>				-1.6	mA	
Signal to noise plus distortion	SINAD	f <sub>IN</sub> = 100KHz, f <sub>S</sub> = 1MHz, -0.5 dB input	4,5,6	68		dB	
Effective number of bits	ENOB		4	11		Bits	
Total harmonic distortion	THD		4,5,6		-73	dB	
Peak spurious of peak harmonic component	PS		4,5,6		-75		
Intermodulation distortion	Σ <sup>2nd</sup>		2 <sup>nd</sup> order products	4,5,6			-75
	Σ <sup>3rd</sup>	3 <sup>rd</sup> order products					
Conversion time	T <sub>CONV</sub>	See figure 3	9,10,11		800	ns	
Sample Rate	F <sub>S</sub>	2/	9,10,11		1.25	MSPS	

Table I (Continued)

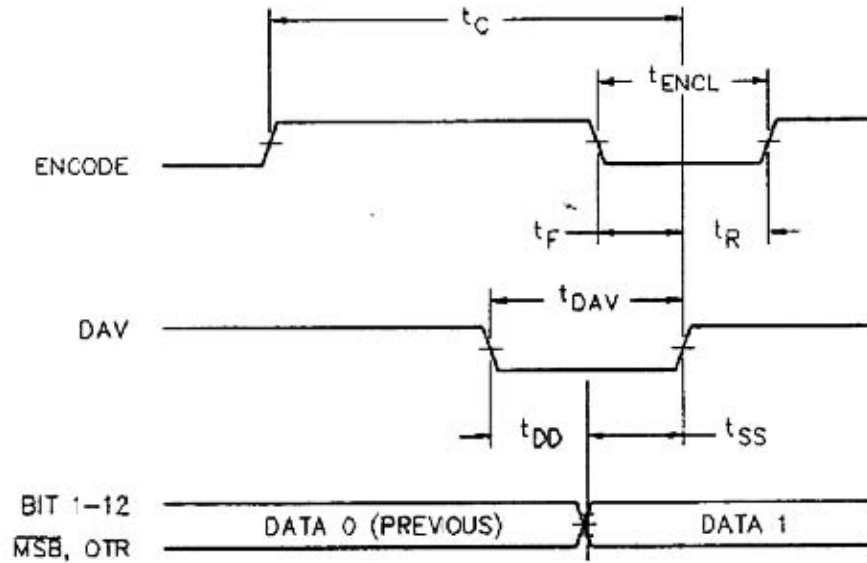
Parameter See notes at end of table	Symbol	Conditions Note 1/	Sub-group	Limit Min	Limit Max	Units
Encode width high (short encode)	$t_{ENC}$	See figure 3 2/	9,10,11	20	50	ns
Encode width Low (long encode)	$t_{ENCL}$	See figure 3 2/	9,10,11	20		
DAV pulse width	$t_{DAV}$	See figure 3	9,10,11	150	300	
Encode falling edge delay	$t_F$	See figure 3 2/	9	0		
Start new conversion delay	$t_R$	See figure 3 2/	9	0		
Data and QTR delay from DAV falling edge	$t_{DD}$	See figure 3 2/	9	20		
Data and OTR delay from DAV rising edge	$t_{SS}$	See figure 3 2/	9	20		

TABLE I NOTES:

1/	$V_{CC} = +5V, V_{EE} = -5V, V_{LOGIC} = +5V$ , unless otherwise specified.
2/	This parameter is guaranteed, but not necessarily tested.
3/	$R_{IN}$ values are typical values only.
4/	The AD1671 includes an onboard +2.5 V reference. The reference input pin (REF IN) can be connected to reference output pin (REF OUT) or a standard external +2.5 V reference can be selected to meet specific system requirements. Fast switching input dependent currents are modulated at the reference input. The reference input voltage can be held with the use of a capacitor. To prevent the AD1671's onboard reference from oscillating when not connected to REF IN, REF OUT must be connected to +5 V. It is possible to connect REF OUT to +5 V due to its output circuit implementation which shuts down the reference



Encode Pulse High  
Figure 3. Timing Diagrams



Encode Pulse Low  
Figure 3. 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, 4, 5, 6, 9, 10, 11 <u>1/</u> <u>2/</u>
Group A Test Requirements	1, 2, 3, 4, 5, 6, 9, 10, 11
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 only. Deltas excluded from PDA.  
2/ See table III for delta parameters.

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

<b>Table III</b>				
<b>TEST TITLE</b>	<b>BURN-IN ENDPOINT</b>	<b>LIFETEST ENDPOINT</b>	<b>DELTA</b>	<b>UNITS</b>
I <sub>CC</sub>	75	75	± 7.5	mA max
V <sub>OH</sub>	2.4	2.4	± 0.24	V min
V <sub>OL</sub>	0.4	0.4	± 0.1	V max

**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 B.
- 5.3** Steady state life test is per MIL-STD-883 Method 1005, test condition B.

Rev	Description of Change	Date
A	Initiate	Feb. 29, 2000
B	Add flatpack. Add radiation part number. Exclude Delta's from PDA. Delete reference to unused subgroups in table II. Update Table III.	Aug. 21, 2001
C	Update web address.	Feb. 14, 2002
D	Change Table I AC parameters from subgroups 1, 2, 3 to subgroups 9, 10, 11. (SINAD, THD, PS, $\Sigma 2^{\text{nd}}$ and $\Sigma 3^{\text{rd}}$ )	Jan. 9, 2003
E	Delete burn-in circuit	Aug. 5, 2003
F	Change TCVOS, TCA, TCBPO, TCVRO from subgroups 2, 3 to subgroup 8. Add subgroup 8 to Table II.	Jun. 14, 2004
G	Update header/footer and add to 1.0 Scope description.	Feb. 12, 2008
H	Add Junction Temperature (T <sub>j</sub> ).....+150°C	April 4, 2008
I	Change subgroup for ENOB to 9	Aug. 3, 2009
J	Match DNL limits and units to actual production test plus this now confirms testing does ensure no missing codes. Minor limit format change for tests with LSB. Update document formatting	Sep. 15, 2011
K	Removed obsolete part number	Nov. 7, 2011
L	Add application note to prevent oscillation	Jan. 18, 2015
M	Corrected Subgroup 8,9,10,11 to 2,3,4,5,6 ( TCVOS, TCA, TCBPO, TCVRO,SINAD, THD, PS, $\Sigma 2^{\text{nd}}$ and $\Sigma 3^{\text{rd}}$ ). Add Fs symbol for Sample Rate.	Oct. 06, 2017