Microprocessor-Compatible 12-Bit D/A Converter

AD667

1.0 SCOPE

This specification documents the detailed requirements for Analog Devices space qualified die including die qualification as described for Class K in MIL-PRF-38534, Appendix C, Table C-II except as modified herein.

The manufacturing flow described in the STANDARD DIE PRODUCTS PROGRAM brochure at http://mil-aero.analog.com/en/space/segment/ma.html is to be considered a part of this specification.

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/AD667

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

Part Number	Description
AD667-000C	Microprocessor-Compatible 12- Bit D/A Converter

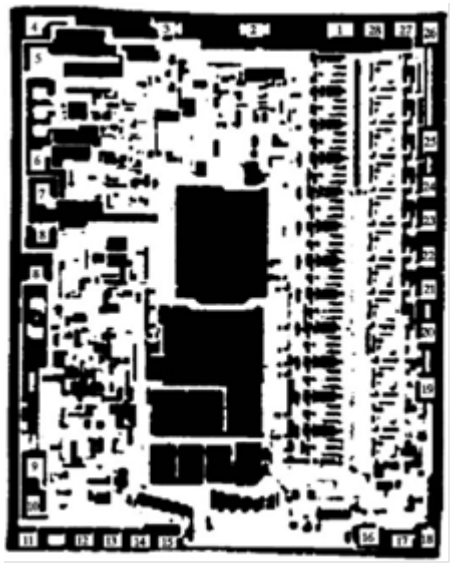
3.0 Die Information

3.1 Die Dimensions

Die Size	Die Thickness	Bond Pad Metalization
142 mil x 184 mil	19 mil ± 2 mil	Al/Cu

One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106, U.S.A.
Tel: 781.329.4700 www.analog.com
Fax: 781.326.8703

3.2 Die Picture



PACKAGE PIN	FUNCTION
1	20V SPAN
2	10V SPAN
3	SUM JCT
4	BIP OFF
5	AGND
6	VREF OUT
7	VREF IN
8	+VCC
9	VOUT
10	-VEE
11	CS
12	A3
13	A2
14	A1
15	A0
16	POWER GROUND
17	DB0 LSB
18	DB1
19	DB2
20	DB3
21	DB4
22	DB5
23	DB6
24	DB7
25	DB8
26	DB9
27	DB10
28	DB11 MSB

Figure 1 - Terminal connections.

3.3 Absolute Maximum Ratings 1/

V_{CC} to power ground range .....0V dc to +18V dc
V_{EE} to power ground range .....0V dc to -18V dc
Digital inputs (pins 11-15, 17-28) to power ground range…±0.3V dc
Reference in to reference ground.....±12V dc
Bipolar offset to reference ground .....±12V dc
10V span R to reference ground .....±12V dc
20V span R to reference ground .....±24V dc
Reference out, V_{OUT} (pins 6 and 9) .....continuous short to power ground, momentary short to V_{CC}
Storage Temperature Range ..... -65°C to +150°C
Junction Temperature (T_J)……+150°C
Ambient Operating Temperature Range…..... -55°C to +125°C

Absolute Maximum Ratings Notes:
1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.

4.0 Die Qualification

In accordance with class-K version of MIL-PRF-38534, Appendix C, Table C-II, except as modified herein.
(a) Qual Sample Size and Qual Acceptance Criteria – 10/0
(b) Qual Sample Package – DIP
(c) Pre-screen electrical test over temperature performed post-assembly prior to die qualification.

Table I - Dice Electrical Characteristics

Parameter	Symbol	Conditions 1/	Limit Min	Limit Max	Units
Resolution	RES		12		Bits
Relative Accuracy	RA	All bits with positive errors on & All bits with negative error on.		±0.5	LSB
Differential Nonlinearity	DNL	Major carry errors		±0.75	LSB
Gain Error 2/	A_E	All bits on; All bits high		.20	%FSR
Unipolar Offset Error	V_{OS}	All bits off; All bits low		±2	LSB
Bipolar Zero Error	B_{PZE}	MSB on, all other bits off		±0.1	%FSR
Reference Output Voltage 3/	V_{REF}	Bipolar mode, V_S = ±11.4V, 0.1 mA external load	9.9	10.1	V
Power Supply Rejection Ratio	PSRR	All bits on; +11.4V≤ VCC ≤ +16.5V		10	ppm of FSR/%
		All bits on; -11.4V≥ VEE ≥ -16.5V		10	
Power Supply Current		V_S = ±16.5 V, All bits on			mA
	I_{CC}			12	
	I_{EE}			25	
Digital Input High Voltage	V_{IH}		2		V
Digital Input Low Voltage	V_{IL}			0.8	V
Digital Input High Current	I_{IH}	V_{IH} =5.5 V		10	µA
Digital Input Low Current	I_{IL}	V_{IL} =0V		5	µA

Table I Notes:

1/ V_{CC} = +15V, V_{EE} = -15V, 50Ω resistor pin 6 to pin 7 A_O, A_1, A_2, A_3, CS = Logic "0", V_{IH} = 2V, V_{IL} =0.8V, Unipolar configuration unless otherwise specifed. Unipolar configuration – Pins 1 and 2 to Pin 9, Pin 4 to Pin 5. Bipolar configuration – Pin 1 to Pin 9, 50Ω resistor Pin 4 to Pin 6.

2/ Adjustable to 0.

3/ In subgroup 1, the reference output is loaded with 0.5mA nominal reference current, 1.0 mA bipolar offset current and 0.1 mA additional current.

Table II - Electrical Characteristics for Qual Samples

Parameter	Symbol	Conditions 1/	Sub-groups	Limit Min	Limit Max	Units
Resolution	RES			12		Bits
Relative Accuracy	RA	All bits with positive errors on & All bits with negative error on.	1		±0.5	LSB
			2, 3		±0.75	
Differential Nonlinearity	DNL	Major carry errors	1		±0.75	LSB
			2, 3		±1	
Gain Error 2/	A_E	All bits on; All bits high	1		0.2	%FSR
Gain Temperature Coefficient	TCA_E		2, 3		30	ppm/°C
Unipolar Offset Error	V_{OS}	All bits off; All bits low	1		±2	LSB
Unipolar Offset Temperature Coefficient	TCV_{OS}		2, 3		±3	ppm/°C
Bipolar Zero Error 2/	B_{PZE}	MSB on, all other bits off	1		±0.14	%FSR
B_{PZE} Temperature Coefficient	TCB_{PZE}		2, 3		±12	ppm/°C
Reference Output Voltage 3/	V_{REF}	Bipolar mode, V_S = ±11.4V, 0.1 mA external load	1, 2, 3	9.9	10.1	V
Power Supply Rejection Ratio	PSRR	All bits on; +11.4V≤ VCC ≤ +16.5V	1		10	ppm of FSR/%
		All bits on; -11.4V≥ V_{EE} ≥ -16.5V	1		10	
Power Supply Current	I_{CC}	V_S = ±16.5 V, All bits on	1		12	mA
	I_{EE}		1		25	
Digital Input High Voltage	V_{IH}		1, 2, 3	2		V
Digital Input High Voltage	V_{IL}		1		0.8	V
			2, 3		0.7	
Digital Input High Voltage	I_{IH}	V_{IH} =5.5 V	1		10	µA
Digital Input High Voltage	I_{IL}	V_{IL} =0V	1		5	

Table II Notes:

1/ V_{CC} = +15V, V_{EE} = -15V, 50Ω resistor pin 6 to pin 7 A_O, A_1, A_2, A_3, CS = Logic "0", V_{IH} = 2.0V, V_{IL} =0.8V,
Unipolar configuration unless otherwise specified. Unipolar configuration -Pins 1 and 2 to Pin 9, Pin 4 to Pin 5.
Bipolar configuration – Pin 1 to Pin 9, 50Ω resistor Pin 4 to Pin 6.

2/ Adjustable to 0.

3/ In subgroup 1, the reference output is loaded with 0.5mA nominal reference current, 1.0 mA bipolar offset current and 0.1 mA additional current. In subgroups 2 and 3, only the 0.5 mA reference input current is applied. The reference must be buffered to supply external loads at elevated temperatures.

Table III - Delta Parameter Table

Parameter	Symbol	Sub-groups	Post Burn In Limit		Post Life Test Limit		Life Test Delta	Units
			Min	Max	Min	Max		
Input Offset Voltage	V_{OS}	1		±3		±4	±1	LSB
Bipolar Zero Error	B_{PZE}	1		±0.19		±0.24	±0.05	%FS
Power Supply Current	I_{CC}	1		13.2		14.4	1.2	mA
Power Supply Current	I_{EE}	1		27.5		30	2.5	mA

5.0 Life Test/Burn-In Information

5.1 HTRB is not applicable for this drawing.

5.2 Burn-in is per MIL-STD-883 Method 1015 test condition B or C.

5.3 Steady state life test is per MIL-STD-883 Method 1005.

Rev	Description of Change	Date
A	Initiate	9-Apr-02
B	Update 1.0 Scope description.	1 Aug. 2007
C	Update header/footer & add to 1.0 Scope description	Mar. 3, 2008
D	Add Junction Temperature (T_J) .....+150°C to 3.3 Absolute Max. Ratings	April 2, 2008
E	Updated Section 4.0c note to indicate pre-screen temp testing being performed	5-JUN-2009
F	Update Fonts and sizes to ADI standard	22-Sept-2011
G	Correct pin assignment in section 3.2	08-MAR-2013