12-Bit, Current Output, Complete High Speed D/A Converter

AD565

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://www.analog.com/aerospace 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/AD565

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

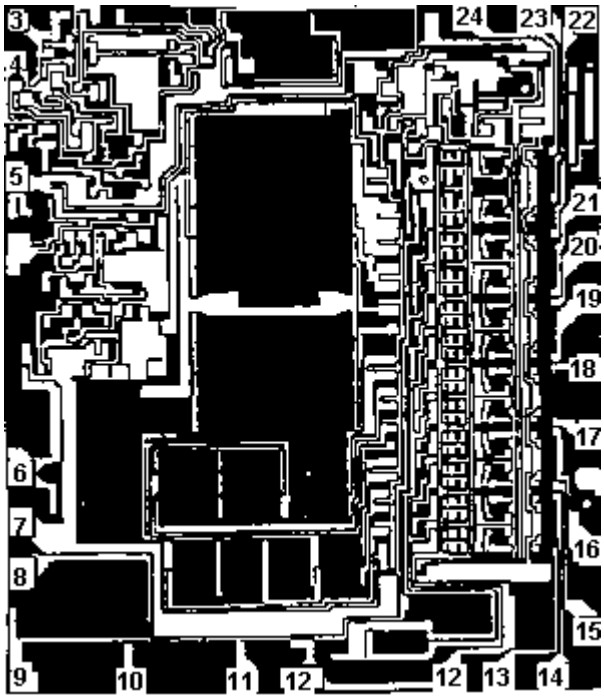
Part Number	Description
AD565-000C	12-Bit, Current Output, Complete High Speed D/A Converter

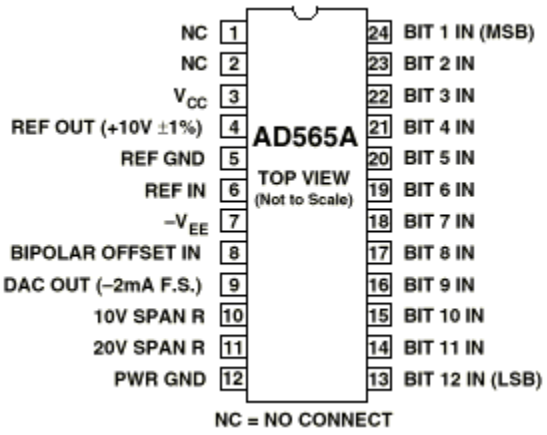
3.0 Die Information

3.1 Die Dimensions

Die Size	Die Thickness mil	Bond Pad Metalization
119 mil x 146 mil	19 mil ± 2 mil	Al/Cu

3.2 Die Picture





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3.3 Absolute Maximum Ratings. 1/

V_{CC} to power ground……0 to +18V dc
V_{EE} to power ground……0 to -18V dc
Voltage on DAC output (pin 9)……-3V dc to +12V dc
Digital inputs (pins 13 to 24) to power ground……-1.0V dc to +7.0V dc
Ref in to ref 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
Ref out……Indefinite short to power ground
momentary short to V_{CC}
Power dissipation……1000 mW
Storage temperature range……-65°C to +150°C
Operating temperature range……-55°C to +125°C
Junction temperature (T_J)……+150°C

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.

3.4 Recommended operating conditions.

Positive supply voltage (V_{CC})……+15V
Negative supply voltage (V_{EE})……-15V
Operating ambient temperature range……-55°C to +125°C

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 Package – Sidebrazed DIP
(b) Qual Sample Size and Qual Acceptance Criteria – 10/0
(c) Pre-screen electrical test over temperature performed post-assembly prior to die qualification.

5.0 Dice Electrical Characteristics

Table I					
Parameter	**Symbol**	**Conditions Note 1**	**Limit Min**	**Limit Max**	**Units**
Relative Accuracy	RA	All bits w/ positive errors on All bits w/ negative errors on		±0.5	LSB
Differential Nonlinearity	DNL	Major transition		±0.75	LSB
Gain Error	A_E	R_{REF} = 50• fixed		±0.25	% of FS
Offset Error	V_{OS}			±0.05	% of FS
Bipolar Zero Error Note 2	B_{PZE}	R_{BO} = 50• fixed		±0.15	% of FS
Reference Output Voltage	V_{REF}	Note 3	9.90	10.10	V
Output Current	I_{OUT}	Unipolar (all bits on)	-1.6	-2.4	mA
		Bipolar (all bits on)	-0.8	-1.2	
Power Supply Rejection Ratio	PSRR	V_S = +11.4V to +16.5V dc		±10.0	PPM of FRS/%
		V_S = -11.4V to -16.5V dc		±25.0	
Power Supply Current Note 4, 5	I_{CC}			+5.0	mA
	I_{EE}			-18.0	
Power Dissipation	P_D			345.0	mW
Digital Input High Voltage	V_{IH}		2.0	5.5	V
Digital Input Low Voltage	V_{IL}			0.8	V
Digital Input High Current	I_{IH}	V_{IH} = 5.5V		300.0	µA
Digital Input Low Current	I_{IL}	V_{IL} = 0V		100.0	µA

Table I Notes:

1. V_{CC} = +15V, V_{EE} = -15V, V_{IH} = 2.0V, V_{IL} = 0.8V, T_A = 25°C.
2. MSB on, all other bits off.
3. The reference output is loaded with 0.5mA reference input current, 1.0mA bipolar offset current, and 1.5mA additional current.
4. Guaranteed for +11.4 ≤ V_{CC} ≤ +16.5V.
5. Guaranteed for -11.4 ≤ V_{EE} ≤ -16.5V.

5.1 Electrical Characteristics for Qual Samples

Table II

Parameter	Symbol	Conditions Note 1	Sub-groups	Limit Min	Limit Max	Units
Relative Accuracy	RA	All bits w/ positive errors on All bits w/ negative errors on	1		±0.5	LSB
			2, 3		±0.75	
Differential Nonlinearity	DNL	Major transition	1		±0.75	LSB
			2, 3		±1.0	
Gain Error	A_E	R_{REF} = 50• fixed	1		±0.25	% of FS
Gain Error Temperature Coefficient	TCA_E		2, 3		±30.0	ppm of FS/°C
Offset Error	V_{OS}		1		±0.05	% of FS
Offset Error Temperature Coefficient	TCV_{OS}		2, 3		±2.0	ppm of FS/°C
Bipolar Zero Error Note 2	B_{PZE}	R_{BO} = 50• fixed	1		±0.15	% of FS
Bipolar Zero Error Temperature Coefficient Note 2	TCB_{PZE}		2, 3		±10.0	ppm of FS/°C
Reference Output Voltage Note 3	V_{REF}		1, 2, 3	9.90	10.10	V
Reference Output Current Note 4	I_{REF}		1	1.5		mA
Output Current	I_{OUT}	Unipolar (all bits on)	1	-1.6	-2.4	mA
		Bipolar (all bits on)		-0.8	-1.2	
Power Supply Rejection Ratio	PSRR	V_S = +11.4V to +16.5V dc	1		±10.0	PPM of FRS/%
		V_S = -11.4V to -16.5V dc			±25.0	
Power Supply Current Note 4, 5	I_{CC}		1		+5.0	mA
	I_{EE}				-18.0	
Power Dissipation	P_D		1		345.0	mW
Digital Input High Voltage	V_{IH}		1	2.0	5.5	V
Digital Input Low Voltage	V_{IL}		1		0.8	V
Digital Input High Current	I_{IH}	V_{IH} = 5.5V	1		300.0	µA
Digital Input Low Current	I_{IL}	V_{IL} = 0V	1		100.0	µA

Table II Notes:

1. V_{CC} = +15V, V_{EE} = -15V, V_{IH} = 2.0V, V_{IL} = 0.8V.
2. MSB on, all other bits off.
3. In subgroup 1, the reference output is loaded with 0.5mA reference input current, 1.0mA bipolar offset current, and 1.5mA additional current. In subgroup 2 and 3, only the 0.5mA reference input current is applied. The reference must be buffered to supply external loads at elevated temperatures.
4. Guaranteed for +11.4 ≤ V_{CC} ≤ +16.5V.
5. Guaranteed for -11.4 ≤ V_{EE} ≤ -16.5V.

6.0 Delta Parameter Table

Table III

Parameter	Symbol	Sub-groups	Post Burn In Limit		Post Life Test Limit		Life Test Delta	Units
			Min	Max	Min	Max		
Gain Error	A_E	1		±0.25		±0.30	±0.05	% of FS
Bipolar Zero Error	B_{PZE}	1		±0.15		±0.225	±0.075	% of FS

7.0 Life Test/Burn-In Information

7.1 HTRB is not applicable for this drawing.

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

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

Rev	Description of Change	Date
A	Initiate	June 26, 2001
B	Update web address. Fix footer	Jan. 25, 2002
C	Update web address.	Aug. 5, 2003
D	Update header/footer & add to 1.0 Scope description.	Feb. 26, 2008
E	Add Absolute Maximum Ratings table in section 3.3	April 2, 2008
F	Updated Section 4.0c note to indicated pre-screen temp testing being performed.	June 6, 2009
G	Updated Fonts and Sizes to ADI standard, enlarged die picture pad numbering	22-Sept-2011

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