



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:

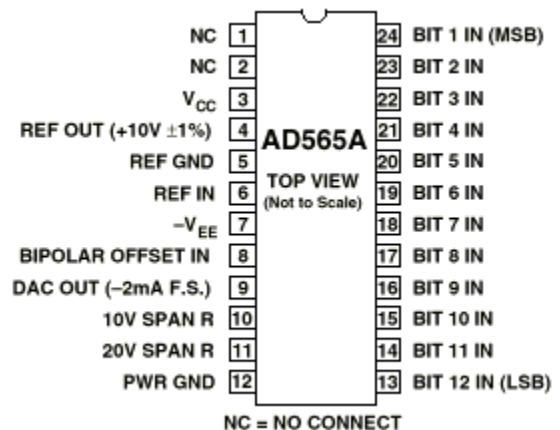
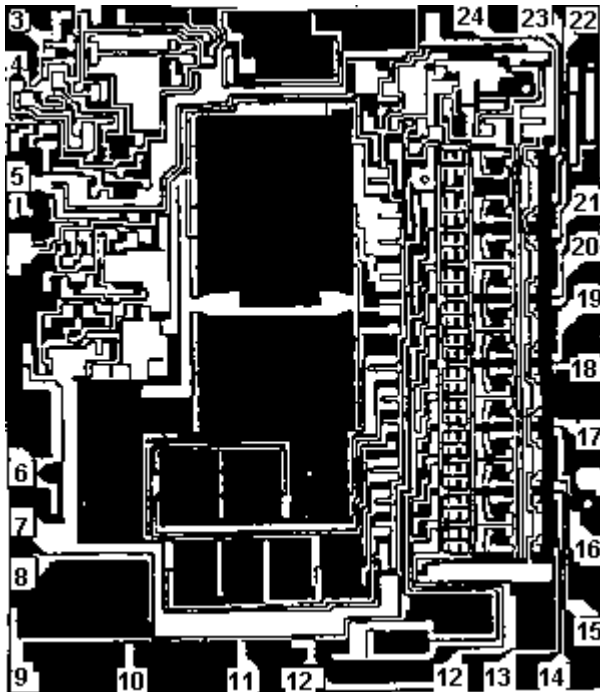
| Part Number | Description |
|-------------|---|
| AD565-000C | 12-Bit, Current Output, Complete High Speed D/A Converter |

3.0 Die Information

3.1 Die Dimensions

| Die Size | Die Thickness mil | Bond Pad Metalization |
|-------------------|--------------------|-----------------------|
| 119 mil x 146 mil | 19 mil \pm 2 mil | Al/Cu |

3.2 Die Picture



ASD0012329

Rev. G

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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..... | ± 12 V dc |
| Bipolar offset to reference ground..... | ± 12 V dc |
| 10V span R to reference ground..... | ± 12 V dc |
| 20V span R to reference ground..... | ± 24 V 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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