### 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/AD9054
2.0 Part Number. The complete part number(s) of this specification follow:

Part Number
AD9054-703J44

### 2.1 Case Outline.

Letter
J44
Descriptive designator
J

8-Bit, 200 MSPS ADC

## Case Outline (Lead Finish per MIL-PRF-38535) 44-Lead ceramic JLCC

### 3.0 Terminal Connections:

| Pin Number | Mnemonic | Pin Number | Mnemonic |
| :---: | :---: | :---: | :---: |
| 1 | AIN | 23 | GND |
| 2 | GND | 24 | VDD |
| 3 | VDD | 25 | $\mathrm{DB}_{0}$ |
| 4 | DEMUX | 26 | $\mathrm{DB}_{1}$ |
| 5 | DS | 27 | $\mathrm{DB}_{2}$ |
| 6 | DS | 28 | $\mathrm{DB}_{3}$ |
| 7 | ENCODE | 29 | $\mathrm{DB}_{4}$ |
| 8 | ENCODE | 30 | $\mathrm{DB}_{5}$ |
| 9 | VDD | 31 | $\mathrm{DB}_{6}$ |
| 10 | GND | 32 | $\mathrm{DB}_{7}$ |
| 11 | VDD | 33 | GND |
| 12 | GND | 34 | VDD |
| 13 | $\mathrm{DA}_{7}$ | 35 | GND |
| 14 | $\mathrm{DA}_{6}$ | 36 | VDD |
| 15 | $\mathrm{DA}_{5}$ | 37 | VDD |
| 16 | $\mathrm{DA}_{4}$ | 38 | GND |
| 17 | $\mathrm{DA}_{3}$ | 39 | VREF OUT |
| 18 | $\mathrm{DA}_{2}$ | 40 | VREF IN |
| 19 | $\mathrm{DA}_{1}$ | 41 | GND |
| 20 | $\mathrm{DA}_{0}$ | 42 | VDD |
| 21 | VDD | 43 | GND |
| 22 | GND | 44 | $\overline{\text { AIN }}$ |

Figure 1 - Terminal connections.

## AD9054A

4.0 Absolute Maximum Ratings. $\left(\mathrm{T}_{\mathrm{A}}=25^{\circ} \mathrm{C}\right.$, unless otherwise noted)

V
Analog Inputs............................................................................................... $\mathrm{V}_{\mathrm{DD}}$ to 0.0 V
Digital Inputs................................................................................................ $\mathrm{V}_{\mathrm{DD}}$ to 0.0 V
VREF IN, VREF OUT....................................................................................V ${ }_{\text {DD }}$ to 0.0 V
Digital Output Current...............................................................................................20mA
Operating Temperature............................................................................ $55^{\circ} \mathrm{C}$ to $+125^{\circ} \mathrm{C}$
Storage Temperature................................................................................ $65^{\circ} \mathrm{C}$ to $+150^{\circ} \mathrm{C}$
Maximum Junction Temperature............................................................................ $+150^{\circ} \mathrm{C}$
Maximum Case Temperature ................................................................................. $150^{\circ} \mathrm{C}$
NOTES
Absolute maximum ratings are limiting values to be applied individually, and beyond which the serviceability of the circuit may be impaired. Functional operability is not necessarily implied. Exposure to absolute maximum rating conditions for an extended period of time may affect device reliability.

### 4.1 Thermal Characteristics:

Thermal Resistance, 44-lead JLCC Package
Junction-to-Case $\left(\Theta_{J C}\right)=10^{\circ} \mathrm{C} / \mathrm{W}$ Max
Junction-to-Ambient $\left(\Theta_{J A}\right)=49^{\circ} \mathrm{C} / \mathrm{W}$ Max

### 4.2 Electrical Table:

| Table I |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Parameter <br> See notes at end of table | Symbol | Conditions 1/ | Subgroup | Limit Min | Limit <br> Max | Units |
| DC Accuracy |  |  |  |  |  |  |
| Differential Nonlinearity | DNL |  | $\begin{gathered} 1 \\ 2,3 \\ \hline \end{gathered}$ | $\begin{aligned} & -1 \\ & -1 \\ & \hline \end{aligned}$ | $\begin{array}{r} +1.5 \\ +2.0 \\ \hline \end{array}$ | LSB |
| Integral Nonlinearity | INL |  | $\begin{gathered} 1 \\ 2,3 \end{gathered}$ |  | $\begin{aligned} & \pm 1.5 \\ & \pm 2.0 \end{aligned}$ | LSB |
| No Missing Codes |  | Guaranteed |  |  |  |  |
| Gain Error | $\mathrm{A}_{\text {e }}$ | $\begin{aligned} & 2 / \\ & \underline{8 /} \end{aligned}$ | $\begin{gathered} 1 \\ 2,3 \end{gathered}$ |  | $\begin{array}{r}  \pm 7.0 \\ \pm 9.0 \\ \hline \end{array}$ | \%FS |
| Analog Input |  |  |  |  |  |  |
| Input Offset Voltage | $\mathrm{V}_{\text {OS }}$ |  | $\begin{gathered} 1 \\ 2,3 \end{gathered}$ |  | $\begin{aligned} & \pm 16 \\ & \pm 23 \\ & \hline \end{aligned}$ | mV |
| Input Resistance | $\mathrm{R}_{\text {in }}$ | 8/ | $\begin{gathered} 1 \\ 2,3 \end{gathered}$ | $\begin{aligned} & \hline 36 \\ & 23 \end{aligned}$ |  | k $\Omega$ |
| Input Bias Current | $\mathrm{I}_{\mathrm{b}}$ |  | $\begin{gathered} 1 \\ 2,3 \end{gathered}$ |  | $\begin{aligned} & \hline 50 \\ & 75 \\ & \hline \end{aligned}$ | $\mu \mathrm{A}$ |
| Reference Output |  |  |  |  |  |  |
| Output Voltage | $\mathrm{V}_{\text {ReF }}$ | 8/ | 1,2,3 | 2.4 | 2.6 | V |


| Table I (Continued) |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Parameter <br> See notes at end of table | Symbol | Conditions $\underline{1 /}$ | Subgroup | Limit <br> Min | $\begin{aligned} & \text { Limit } \\ & \text { Max } \\ & \hline \end{aligned}$ | Units |
| Switching Performance |  |  |  |  |  |  |
| Maximum Conversion Rate | $\mathrm{F}_{\text {S }}$ |  | 1,2,3 | 200 |  | MSPS |
| Output Valid Time | $\mathrm{t}_{\mathrm{v}}$ | 3/ , 9/ | 7 | 2.7 |  | ns |
| Output Propagation Delay | $t_{\text {PD }}$ | 3/, 9/ | 7 |  | 7.9 | ns |
| Digital Inputs |  |  |  |  |  |  |
| HIGH Level Current | $\mathrm{I}_{\mathrm{IH}}$ | 4/, 8/ | 1,2,3 |  | 625 | $\mu \mathrm{A}$ |
| LOW Level Current | $\mathrm{I}_{\text {IL }}$ | 4/, 8/ | 1,2,3 |  | 625 | $\mu \mathrm{A}$ |
| Digital Outputs |  |  |  |  |  |  |
| HIGH Output Voltage | $\mathrm{V}_{\mathrm{OH}}$ | 9/ | 1,2,3 | 2.4 |  | V |
| LOW Output Voltage | $\mathrm{V}_{\mathrm{OL}}$ | $\underline{\text { 9/ }}$ | 1,2,3 |  | 0.4 | V |
| Power Supply |  |  |  |  |  |  |
| $\mathrm{V}_{\text {DD }}$ Supply Current | $\mathrm{I}_{\mathrm{DD}}$ | 8/ | 1,2,3 |  | 156 | mA |
| Power Dissipation | $\mathrm{P}_{\mathrm{D}}$ | 5/ | 1 |  | 781 | mW |
| Power Dissipation Sensitivity | $\mathrm{P}_{\text {SS }}$ | 6/ | 1 |  | 15 | mV/V |
| Dynamic Performance |  |  |  |  |  |  |
| Signal-to-Noise Ratio (Without Harmonics) | SNR | $\begin{aligned} & \hline \mathrm{f}_{\mathrm{IN}}=49.7 \mathrm{MHZ} \\ & \mathrm{f}_{\mathrm{IN}}=70.1 \mathrm{MHZ} \end{aligned}$ | $\begin{aligned} & 9 \\ & 9 \end{aligned}$ | $\begin{aligned} & 42 \\ & 42 \end{aligned}$ |  | dB |
| Signal-to-Noise Ratio (With Harmonics) | SINAD | $\begin{aligned} & \hline \mathrm{f}_{\mathrm{IN}}=49.7 \mathrm{MHZ} \\ & \mathrm{f}_{\mathrm{IN}}=70.1 \mathrm{MHZ} \end{aligned}$ | $\begin{aligned} & \hline 9 \\ & 9 \\ & \hline \end{aligned}$ | $\begin{aligned} & \hline 40 \\ & 39 \\ & \hline \end{aligned}$ |  | dB |
| Effective Number of Bits | ENOB | $\begin{aligned} & \mathrm{f}_{\mathrm{IN}}=49.7 \mathrm{MHZ} \\ & \mathrm{f}_{\mathrm{IN}}=70.1 \mathrm{MHZ} \\ & \hline \end{aligned}$ | $\begin{aligned} & 9 \\ & 9 \end{aligned}$ | $\begin{array}{r} 6.35 \\ 6.18 \\ \hline \end{array}$ |  | Bits |
| $2^{\text {nd }}$ Harmonic Distortion | 2HD | $\begin{aligned} & \mathrm{f}_{\mathrm{IN}}=49.7 \mathrm{MHZ} \\ & \mathrm{f}_{\mathrm{IN}}=70.1 \mathrm{MHZ} \end{aligned}$ | $\begin{aligned} & \hline 9 \\ & 9 \\ & \hline \end{aligned}$ | $\begin{aligned} & 54 \\ & 49 \\ & \hline \end{aligned}$ |  | dBc |
| $3{ }^{\text {rd }}$ Harmonic Distortion | 3HD | $\begin{aligned} & \mathrm{f}_{\mathrm{IN}}=49.7 \mathrm{MHZ} \\ & \mathrm{f}_{\mathrm{IN}}=70.1 \mathrm{MHZ} \end{aligned}$ | $\begin{aligned} & 9 \\ & 9 \end{aligned}$ | $\begin{aligned} & 48 \\ & 43 \end{aligned}$ |  | dBc |

## TABLE I NOTES:

1/ $\quad \mathrm{V}_{\mathrm{DD}}=5 \mathrm{~V}$, external reference, $\mathrm{f}_{\mathrm{s}}=$ max unless otherwise noted.
2/ Gain error and gain temperature coefficient are based on the ADC only (with a fixed 2.5 V external reference)
3/ $\quad \mathrm{t}_{\mathrm{v}}$ and $\mathrm{t}_{\mathrm{PD}}$ are measured from the threshold crossing of the ENCODE input to valid TTL levels of the digital outputs. The output ac load during test is 5 pF .
4/ $\quad \mathrm{I}_{\mathrm{IH}}$ and $\mathrm{I}_{\mathrm{IL}}$ are valid for differential input voltages of less than 1.5 V . At higher differential voltages, the input current will increase to a maximum of 1.5 mA at $25^{\circ} \mathrm{C}$ and $2.0 \mathrm{~mA} @-55^{\circ} \mathrm{C}$ and $125^{\circ} \mathrm{C}$
5/ Power dissipation is measured under the following conditions: analog input is -1 dBFS at 19.7 MHz .
6/ A change in input offset voltage with respect to a change in $\mathrm{V}_{\mathrm{DD}}$.
7/ SNR/harmonics based on an analog input voltage of -1.0 dBFS referenced to a 1.024 V full-scale input range.
8/ $100 \%$ production tested at $25^{\circ} \mathrm{C}$; guaranteed by design and characterization testing for full mil temperature range.
9/ Go/No-Go parameter only, no read and record data available.

### 4.3 Electrical Test Requirements:

| Table II |  |
| :--- | :--- |
| Test Requirements |  |
| Subgroups (in accordance with <br> MIL-PRF-38535, Table III) |  |
| Interim Electrical Parameters | 1 |
| Final Electrical Parameters | $1,2,3,7,9 \quad \underline{1} / \underline{2} / \underline{3} /$ |
| Group A Test Requirements | $1,2,3,7,9 \quad \underline{/} /$ |
| Group C end-point electrical parameters | $1 \underline{2} /$ |
| Group D end-point electrical parameters | 1 |

1/ PDA applies to subgroup 1 only. Delta's excluded from PDA.
2/ See Table III for delta parameters. See Table I for test conditions.
3/ Table I parameters with Note $\underline{8}$ / are $100 \%$ production tested at $25^{\circ} \mathrm{C}$; guaranteed by design and characterization testing for full mil temperature range.
4.4 Table III - Life Test Endpoint and Delta Parameter (Product is tested in accordance with Table I with the following exceptions)

| Parameter | Symbol | Sub- <br> groups | Post Burn <br> in Limit | Burn In | Post Life <br> Test Limit | Life Test <br> $n n$ <br> Delta | Units |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 156 |  | 171.6 | $\pm 15.6$ | mA |
| Input Offset Voltage | $\mathrm{V}_{\mathrm{OS}}$ | 1 | $\pm 23$ | $\pm 7$ | $\pm 30$ | $\pm 7$ | mV |
| Gain Error | $\mathrm{A}_{\mathrm{e}}$ | 1 | $\pm 9$ | $\pm 2$ | $\pm 13$ | $\pm 4$ | $\% \mathrm{FS}$ |

### 5.0 MIL-STD-38535 QMLV exceptions:

5.1 Full WLA per MIL-STD-883 TM 5007 is not available for this product fabricated in a QMLQ wafer process facility. SEM Inspection only is available per MIL-STD-883, TM2018.

| Rev | Description of Change | Date |
| :---: | :--- | :---: |
| A | Initiate | $10 / 18 / 2004$ |
| B | Typical values for Dynamic Performance for subgroup 10 \& 11 deleted | $06 / 15 / 2005$ |
| C | Clarify SEM vs. WLA availability for QMLQ fab process | $11 / 12 / 2007$ |
| D | Update header/footer and add to 1.0 Scope description. | March 17, 2008 |
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