INTEGRATED CIRCUITS, SILICON MONOLITHIC,

LOW POWER, QUAD, BIPOLAR OPERATIONAL AMPLIFIERS,

αRD124A

Detail Specification RDm 504

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This specification is for the sample purposes only and is subject to change.

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1. General

1.1 Scope

This specification details the rating, physical and electrical characteristics, test and inspections data for a silicon monolithic, Low Power, Quad, Bipolar Operational Amplifier, based on Types LM124A This document defines screening and conformance inspection requirements and follows the general guidelines of ESCC 9000 for space-level products.
Available with Radiation Specification:
High Dose Rate: Maximum total dose available RHA designator R 100krads (dose rate = 50-300 rads(Si)/s)
ELDRS Free : Maximum total dose available RHA designator R 100krads (dose rate = 10 mrads(Si)/s)

2. Applicable documents

The following documents form part of this specification and shall be read in conjunction with it:

a) ESCC 20100, Requirements for the Qualification of Standard Electronic Components for Space Application
b) ESCC 9000, Integrated Circuits, Monolithic, Hermetically Sealed
c) ESCC 20400, Internal Visual Inspection
d) ESCC 20500, External Visual Inspection
e) ESCC 20600, Preservation, Packaging and Dispatch of ESCC Components
f) ESCC 21700, General Requirements for the Marking of ESCC Components
g) MIL-STD-883, Microcircuit, Test Method Standard

3. Terms, definitions, abbreviations, symbols and units

For the purpose of this specification, the terms, definitions, abbreviations, symbols and units specified in ESCC Basic Specification No. 21300 shall apply. In addition, the following abbreviations are used:

Vcc = Supply Voltage of the device under test.
PSRR = Power Supply Rejection Ratio.
OS = Overshoot.
Tr = Rise time.
Rsu = Supply Resistance.
Icc = Supply Current.
Ios(t) = Output Shot Circuit Duration.

4. Requirements

4.1 General

All devices supplied to this specification shall be in accordance with the ESCC 9000 flow requirements, except as specified or modified herein. Single wafer lot and single date code are required.

4.2 Workmanship

Workmanship shall be in accordance with ESCC 9000 requirements

4.3 Phisical and Mechanical Characteristics

4.3.1 Outline Dimension

The dimension of the integrated circuits specified herein shall be checked. They shall conform to those shown in **Figure 1. Physical dimensions.**

4.3.2 Material and finishes

The materials and finishes shall be as specified herein. Where a definite material is not specified, a material which will enable the microcircuits specified herein to meet the performance requirements of this specification shall be used. Acceptance or approval of any constituent material does not guarantee acceptance of the finished product.
Pure tin material shall be not used for any internal or external package surface or as a lead finish. Pure tin finish is fully prohibited. Pure tin definition is a percentage of tin superior to 97%.

4.3.3 Case

The case (FP14) shall be hermetically sealed and have ceramic body. The lids shall be welded.

4.3.4 Lead

To be defined

4.3.5 Device construction

Device construction shall be as follows :

4.3.6 Marking

Components shall be marked as per MIL-PRF-19500 requirements and as much as space permits in the following order of precedence

a) Manufacturer Part Number

b) Serial number on strap. The serial number shall be permanently marked on the part for traceability to read and record data.

c) Lot date code

d) Polarity symbol

If device size precludes above marking requirements on the individual part, all of the marking shall be placed on the individual package for each part except that polarity marking, Serial Number, and Lot Date Code, as a minimum, must be placed on the individual devices.

4.3.7 PIN assignment

A symbol mark (dot mark) shall be used to identify pin #1 as per Figure 2.

4.3.8 Functional diagram

As per Figure 3.

Figure 1. Physical dimensions

Case: FP14

Figure 2. PIN assignment

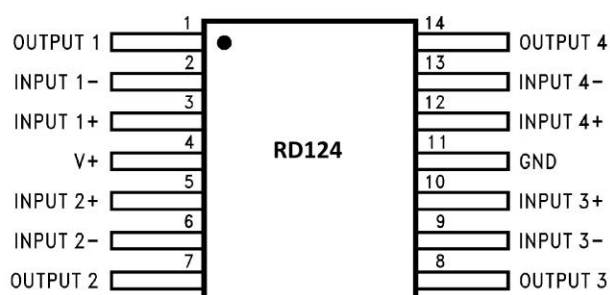
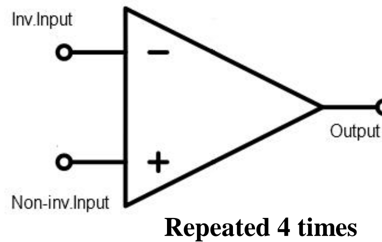


Figure 3. Functional diagram



Repeated 4 times

4.4 Electrostatic Discharge Sensitivity

The devices are susceptible to be damaged by electrostatic discharge. Therefore, suitable precautions shall be employed for protection during all phases of manufacture, testing, packaging, shipment and any handling.

4.5 Electrical Characteristics

4.5.1 Maximum ratings

The maximum ratings, which shall not be exceeded at any time during use or storage, applicable to the integrated circuits specified herein, are as scheduled in Table 1.

Table 1 Maximum ratings

No	Characteristics	Symbol	Maximum ratings	Unit	Remarks
1	Supply Voltage	V_{CC}	32 or ±16	V	-
2	Differential Input Voltage	V_{ID}	32	V	-
3	Input Voltage		−0.3 to +32	V	(1)
4	Input Current ($V_{IN} < -0.3V$)	I_{IN}	50	mA	(2)
5	Power Dissipation	P_D	700	mW	-
6	Output Short-Circuit Duration (One Amplifier)	Ios(t)	Indefinite		(3)
7	Operating Temperature Range	Top	−55 to +125	°C	-
8	Maximum Junction Temperature	Tj	+150	°C	-
9	Storage Temperature Range	Tstg	−65 to +150	°C	-
10	Lead Temperature (Soldering, 10 seconds)	Tsol	+260	°C	-
11	ESD Tolerance		250	V	(4)

Notes

(1) For supply voltages less than +32V, the absolute maximum input voltage is equal to supply voltage.

(2) This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is also lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the op amps to go to the V+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than -0.3VDC (at 25°C).

(3) Short circuits from the output to Vcc can cause excessive heating and eventual destruction. The maximum output current is approximately 20 mA, independent of the magnitude of +Vcc. At +Vcc> +15V, continuous short circuits can exceed the power dissipation ratings and cause eventual destruction.
(4) Human body model, 1.5 kΩ in series with 100 pF.

4.5.2 Electrical measurement at room temperature

The parameters to be measured in respect of electrical characteristics are scheduled in Table 2(a) (DC parameters) and in Table 2(b) (AC parameters). Unless otherwise specified, the measurements shall be performed at Tamb = +22 ±3 °C.

4.5.3 Electrical Measurements at High and Low Temperatures

The parameters to be measured at high and low temperatures are scheduled in Tables 3(a) (DC parameters at T_{amb}= + 125°C) and 3(b) (AC parameters at T_{amb}= + 125°C) and 4(a) (DC parameters at T_{amb}=-55°C) and 4(b) (AC parameters at T_{amb}=-55°C).

4.5.4 POST RADIATION LIMITS (+25°C) are scheduled in Table 5

Table 2(a) - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE DC PARAMETERS (1) (2)

(The following conditions apply to all the following parameters, unless otherwise specified.) **All voltages referenced to device ground.**

Parameter	Symbol	Test Fg.	Test Method MIL-STD 883	Conditions	Min Value	Max Value	Units
Input Offset Voltage	Vio		4001	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-2	2	mV
				V_{CC+} = 2V, V_{CC-} = -28V, V_{CM} = -13V	-2	2	mV
				V_{CC+} = 5V, V_{CC-} = Gnd, V_{CM} = +1.4V	-2	2	mV
				V_{CC+} = 2.5V, V_{CC-} = -2.5, V_{CM} = -1.1V	-2	2	mV
Input Offset Current	Iio		4001	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-10	10	nA
				V_{CC+} = 2V, V_{CC-} = -28V, V_{CM} = -13V	-10	10	nA
				V_{CC+} = 5V, V_{CC-} = Gnd, V_{CM} = +1.4V	-10	10	nA
				V_{CC+} = 2.5V, V_{CC-} = -2.5, V_{CM} = -1.1V	-10	10	nA
Input Bias Current	$\pm I_{IB}$		4001	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-50	+0.1	nA
				V_{CC+} = 2V, V_{CC-} = -28V, V_{CM} = -13V	-50	+0.1	nA
				V_{CC+} = 5V, V_{CC-} = Gnd, V_{CM} = +1.4V	-50	+0.1	nA
				V_{CC+} = 2.5V, V_{CC-} = -2.5, V_{CM} = -1.1V	-50	+0.1	nA
Power Supply Rejection Ratio	+PSRR		4003	V_{CC-} = Gnd, V_{CM} = +1.4V, 5V ≤ V_{CC} ≤ 30V	-100	100	uV/V
Common Mode (3) Rejection Ratio	CMRR		4003	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = 28,5V	76		dB
Short Circiut Output Current	I_{OS+}		3011	V_{CC+} = 30V, V_{CC-} = Gnd, V_O = 25V	-70		mA
Power Supply Current	I_{CC}		4005	V_{CC+} = 30V, V_{CC-} = Gnd		3	mA
Low Level Output Voltage	V_{OL}		3007	V_{CC+} = 30V, V_{CC-} = Gnd, R_L = 10K Ω		35	mV

Characteristics	Symbol	Test Fig.	Test method	Test Conditions	Min	Max	Unit
				Vcc+ = 30V, Vcc- = Gnd, IOI = 5mA		1.5	V
				Vcc+ = 4.5V, Vcc- = Gnd, IOI = 2uA		0.4	V
High Level Output Voltage	VOH		3006	Vcc+ = 30V, Vcc- = Gnd, IOH = -10mA	27		V
				Vcc+ = 4.5V, Vcc- = Gnd, IOH = -10mA	2.4		V
Open Loop Voltage Gain (Plus)	+AVS		4004	Vcc+ = 30V, Vcc- = Gnd, 1V ≤ Vo ≤ 26V, RL = 10K Ω	50		V/mV
				Vcc+ = 30V, Vcc- = Gnd, 5V ≤ Vo ≤ 20V, RL = 2K Ω	50		V/mV
Open Loop Voltage Gain	AVS		4004	Vcc+ = 5V, Vcc- = Gnd, 1V ≤ Vo ≤ 2.5V, RL = 10K Ω	10		V/mV
				Vcc+ = 5V, Vcc- = Gnd, 1V ≤ Vo ≤ 2.5V, RL = 2K Ω	10		V/mV
Output Voltage Swing (Plus)	Vout(+)		4004	Vcc+ = 30V, Vcc- = Gnd, Vo = +30V, RL = 10K Ω	27		V
				Vcc+ = 30V, Vcc- = Gnd, Vo = +30V, RL = 2K Ω	26		V

Notes:

(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD-883, Method 1019
(2) Low dose rate testing should be perform on a wafer-by-wafer basis, per test method 1019 condition D of MIL-STD-883, with no enhanced low dose rate sensitivity (ELDRS) effect.
(3) The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V (at 25°C). The upper end of the common-mode voltage range is V+ −1.5V (at 25°C), but either or both inputs can go to +32V without damage independent of the magnitude of V+.

Table 2(b) - ELECTRICAL MEASUREMENTS AT ROOM TEMPERATURE AC PARAMETERS (1) (2)

(The following conditions apply to all the following parameters, unless otherwise specified.) **All voltages referenced to device ground.**

Characteristics	Symbol	Test Fig.	Test method	Test Conditions	Min	Max	Unit
Rise Time	Tr		4002	Vcc+ = 30V, Vcc- = Gnd		1	uS
Overshoot	OS		4002	Vcc+ = 30V, Vcc- = Gnd		50	%
Slew Rate (Plus)	SR(+)		4002	Vcc+ = 30V, Vcc- = Gnd	0.1		V/uS
Slew Rate (Minus)	SR(-)		4002	Vcc+ = 30V, Vcc- = Gnd	0.1		V/uS
Noise Broadband	NIBB			+VCC = 15V, -VCC = -15V, BW = 10Hz to 5KHz		15	uVrm s
Noise Popcorn	NIPC			+VCC = 15V, -VCC = -15V, RS = 20K Ω, BW = 10Hz to 5KHz		50	uVpK
Channel Separation (3)	Cs			+VCC = 30V, -VCC = Gnd, RL = 2K Ω	80		dB
				RL = 2K Ω, VIN = 1V and 16V, A to B	80		dB
				RL = 2K Ω, VIN = 1V and 16V, A to C	80		dB
				RL = 2K Ω, VIN = 1V and 16V, A to D	80		dB
				RL = 2K Ω, VIN = 1V and 16V, B to A	80		dB
				RL = 2K Ω, VIN = 1V and 16V, B to C	80		dB
				RL = 2K Ω, VIN = 1V and 16V, B to D	80		dB
				RL = 2K Ω, VIN = 1V and 16V, C to A	80		dB
				RL = 2K Ω, VIN = 1V and 16V, C to B	80		dB
				RL = 2K Ω, VIN = 1V and 16V, C to D	80		dB
				RL = 2K Ω, VIN = 1V and 16V, D to A	80		dB
				RL = 2K Ω, VIN = 1V and 16V, D to B	80		dB
				RL = 2K Ω, VIN = 1V and 16V, D to C	80		dB

Notes:

(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD-883, Method 1019
(2) Low dose rate testing should be perform on a wafer-by-wafer basis, per test method 1019 condition D of MIL-STD-883, with no enhanced low dose rate sensitivity (ELDRS) effect.
(3) Due to proximity of external components, insure that coupling is not originating via stray capacitance between these external parts. This typically can be detected as this type of capacitance increases at higher frequencies.

Table 3(a) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE, +125 (+0 -3) oC
DC PARAMETERS (1) (2)

Parameter	Symbol	Test Fg.	Test Method MIL-STD 883	Conditions	Min Value	Max Value	Units
Input Offset Voltage	Vio		4001	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-4	4	mV
				V_{CC+} = 2V, V_{CC-} = -28V, V_{CM} = -13V	-4	4	mV
				V_{CC+} = 5V, V_{CC-} = Gnd, V_{CM} = +1.4V	-4	4	mV
				V_{CC+} = 2.5V, V_{CC-} = -2.5, V_{CM} = -1.1V	-4	4	mV
Input Offset Current	Iio		4001	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-10	10	nA
				V_{CC+} = 2V, V_{CC-} = -28V, V_{CM} = -13V	-10	10	nA
				V_{CC+} = 5V, V_{CC-} = Gnd, V_{CM} = +1.4V	-10	10	nA
				V_{CC+} = 2.5V, V_{CC-} = -2.5, V_{CM} = -1.1V	-10	10	nA
Input Bias Current	$\pm I_{IB}$		4001	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-50	+0.1	nA
				V_{CC+} = 2V, V_{CC-} = -28V, V_{CM} = -13V	-50	+0.1	nA
				V_{CC+} = 5V, V_{CC-} = Gnd, V_{CM} = +1.4V	-50	+0.1	nA
				V_{CC+} = 2.5V, V_{CC-} = -2.5, V_{CM} = -1.1V	-50	+0.1	nA
Power Supply Rejection Ratio	+PSRR		4003	V_{CC-} = Gnd, V_{CM} = +1.4V, 5V $\leq V_{CC} \leq$ 30V	-100	100	uV/V
Common Mode Rejection Ratio	CMRR		4003	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = 28V	76		dB
Short Circiut Output Current	I_{OS+}		3011	V_{CC+} = 30V, V_{CC-} = Gnd, V_O = 25V	-70		mA
Power Supply Current	I_{CC}		4005	V_{CC+} = 30V, V_{CC-} = Gnd		3	mA
Low Level Output Voltage	V_{OL}		3007	V_{CC+} = 30V, V_{CC-} = Gnd, R_L = 10K Ω		35	mV
				V_{CC+} = 30V, V_{CC-} = Gnd, I_{OI} = 5mA		1.5	V
				V_{CC+} = 4.5V, V_{CC-} = Gnd, I_{OI} = 2uA		0.4	V
High Level Output Voltage	V_{OH}		3006	V_{CC+} = 30V, V_{CC-} = Gnd, I_{OH} = -10mA	27		V
				V_{CC+} = 4.5V, V_{CC-} = Gnd, I_{OH} = -10mA	2.4		V
Open Loop Voltage Gain (Plus)	$+A_{VS}$		4004	V_{CC+} = 30V, V_{CC-} = Gnd, 1V $\leq V_O \leq$ 26V, R_L = 10K Ω	25		V/mV
				V_{CC+} = 30V, V_{CC-} = Gnd, 5V $\leq V_O \leq$ 20V, R_L = 2K Ω	25		V/mV
Open Loop Voltage Gain	A_{VS}		4004	V_{CC+} = 5V, V_{CC-} = Gnd, 1V $\leq V_O \leq$ 2.5V, R_L = 10K Ω	10		V/mV
				V_{CC+} = 5V, V_{CC-} = Gnd, 1V $\leq V_O \leq$ 2.5V, R_L = 2K Ω	10		V/mV
Output Voltage Swing (Plus)	Vout(+)		4004	V_{CC+} = 30V, V_{CC-} = Gnd, V_O = +30V, R_L = 10K Ω	27		V
				V_{CC+} = 30V, V_{CC-} = Gnd, V_O = +30V, R_L = 2K Ω	26		V
Input Offset Voltage Temperature Sensitivity (3)	$\Delta V_{IO}/\Delta T$			+25°C $\leq T_A \leq$ +125°C, $+V_{CC}$ = 5V, $-V_{CC}$ = 0V, V_{CM} = +1.4V	-30	30	uV/ °C
Input Offset Current Temperature Sensitivity (3)	$\Delta I_{IO}/\Delta T$			+25°C $\leq T_A \leq$ +125°C, $+V_{CC}$ = 5V, $-V_{CC}$ = 0V, V_{CM} = +1.4V	-400	400	pA/° C

Notes:

(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD-883, Method 1019
(2) Low dose rate testing should be perform on a wafer-by-wafer basis, per test method 1019 condition D of MIL-STD-883, with no

enhanced low dose rate sensitivity (ELDRS) effect.
(3) Calculated parameters

TABLE 3(b) - ELECTRICAL MEASUREMENTS AT HIGH TEMPERATURE, +125 (+0 -3) oC AC PARAMETERS (1) (2)

Parameter	Symbol	Test Fg.	Test MethodMIL-STD 883	Conditions	Min Value	Max Value	Units
Rise Time (3)	Tr		4002	Vcc+ = 30V, Vcc- = Gnd		1	uS
Overshoot (3)	OS		4002	Vcc+ = 30V, Vcc- = Gnd		50	%
Slew Rate (Plus) (3)	SR(+)		4002	Vcc+ = 30V, Vcc- = Gnd	0.1		V/uS
Slew Rate (Minus) (3)	SR(-)		4002	Vcc+ = 30V, Vcc- = Gnd	0.1		V/uS

Notes:
(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD-883, Method 1019
(2) Low dose rate testing should be perform on a wafer-by-wafer basis, per test method 1019 condition D of MIL-STD-883, with no enhanced low dose rate sensitivity (ELDRS) effect.
(3) Ensured, not tested

TABLE 4(a) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE, -55(+ 5-0) °C DC PARAMETERS (1) (2)

Parameter	Symbol	Test Fg.	Test Method MIL-STD 883	Conditions	Min Value	Max Value	Units
Input Offset Voltage	Vio		4001	Vcc+ = 30V, Vcc- = Gnd, VCM = +15V	-4	4	mV
				Vcc+ = 2V, Vcc- = -28V, VCM = -13V	-4	4	mV
				Vcc+ = 5V, Vcc- = Gnd, VCM = +1.4V	-4	4	mV
				Vcc+ = 2.5V, Vcc- = -2.5, VCM = -1.1V	-4	4	mV
Input Offset Current	Iio		4001	Vcc+ = 30V, Vcc- = Gnd, VCM = +15V	-30	30	nA
				Vcc+ = 2V, Vcc- = -28V, VCM = -13V	-30	30	nA
				Vcc+ = 5V, Vcc- = Gnd, VCM = +1.4V	-30	30	nA
				Vcc+ = 2.5V, Vcc- = -2.5, VCM = -1.1V	-30	30	nA
Input Bias Current	±IIB		4001	Vcc+ = 30V, Vcc- = Gnd, VCM = +15V	-100	+0.1	nA
				Vcc+ = 2V, Vcc- = -28V, VCM = -13V	-100	+0.1	nA
				Vcc+ = 5V, Vcc- = Gnd, VCM = +1.4V	-100	+0.1	nA
				Vcc+ = 2.5V, Vcc- = -2.5, VCM = -1.1V	-100	+0.1	nA
Power Supply Rejection Ratio	+PSRR		4003	Vcc- = Gnd, VCM = +1.4V, 5V ≤ Vcc ≤ 30V	-100	100	uV/V
Common Mode (3) Rejection Ratio	CMRR		4003	Vcc+ = 30V, Vcc- = Gnd, VCM = 28V	76		dB
Short Circiut Output Current	IOS+		3011	Vcc+ = 30V, Vcc- = Gnd, VO = 25V	-70		mA
Power Supply Current	ICC		4005	Vcc+ = 30V, Vcc- = Gnd		4	mA
Low Level Output Voltage	VOL		3007	Vcc+ = 30V, Vcc- = Gnd, RL = 10K Ω		35	mV
				Vcc+ = 30V, Vcc- = Gnd, IOI = 5mA		1.5	V
				Vcc+ = 4.5V, Vcc- = Gnd, IOI = 2uA		0.4	V
High Level Output Voltage	VOH		3006	Vcc+ = 30V, Vcc- = Gnd, IOH = -10mA	27		V
				Vcc+ = 4.5V, Vcc- = Gnd, IOH = -10mA	2.4		V
Open Loop Voltage Gain (Plus)	+AVS		4004	Vcc+ = 30V, Vcc- = Gnd, 1V ≤ VO ≤ 26V, RL = 10K Ω	25		V/mV
				Vcc+ = 30V, Vcc- = Gnd, 5V ≤ VO ≤ 20V, RL = 2K Ω	25		V/mV

Open Loop Voltage Gain	Avs		4004	Vcc+ = 5V, Vcc- = Gnd, 1V ≤ Vo ≤ 2.5V, RL = 10K Ω	10		V/mV
				Vcc+ = 5V, Vcc- = Gnd, 1V ≤ Vo ≤ 2.5V, RL = 2K Ω	10		V/mV
Output Voltage Swing (Plus)	Vout(+)		4004	Vcc+ = 30V, Vcc- = Gnd, Vo = +30V, RL = 10K Ω	27		V
				Vcc+ = 30V, Vcc- = Gnd, Vo = +30V, RL = 2K Ω	26		V
Input Offset Voltage Temperature Sensitivity (3)	ΔVIO/ ΔT			-55°C ≤ TA ≤ +25°C, +Vcc = 5V, -Vcc = 0V, VCM = +1.4V	-30	30	uV/ °C
Input Offset Current Temperature Sensitivity (3)	ΔIIO/ ΔT			-55°C ≤ TA ≤ +25°C, +Vcc = 5V, -Vcc = 0V, VCM = +1.4V	-700	700	pA/° C

Notes:

(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD-883, Method 1019

(2) Low dose rate testing should be perform on a wafer-by-wafer basis, per test method 1019 condition D of MIL-STD-883, with no enhanced low dose rate sensitivity (ELDRS) effect.

(3) Calculated parameters

TABLE 4(b) - ELECTRICAL MEASUREMENTS AT LOW TEMPERATURE, -55 (+5 -0) °C AC PARAMETERS (1) (2)

Parameter	Symbol	Test Fg.	Test MethodMIL-STD 883	Conditions	Min Value	Max Value	Units
Rise Time (3)	Tr		4002	Vcc+ = 30V, Vcc- = Gnd		1	uS
Overshoot (3)	OS		4002	Vcc+ = 30V, Vcc- = Gnd		50	%
Slew Rate (Plus) (3)	SR(+)		4002	Vcc+ = 30V, Vcc- = Gnd	0.1		V/uS
Slew Rate (Minus) (3)	SR(-)		4002	Vcc+ = 30V, Vcc- = Gnd	0.1		V/uS

Notes:

(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD-883, Method 1019

(2) Low dose rate testing should be perform on a wafer-by-wafer basis, per test method 1019 condition D of MIL-STD-883, with no enhanced low dose rate sensitivity (ELDRS) effect.

(3) Ensured, not tested

Table 5 POST RADIATION LIMITS +25°C: (1) (2)

(The following conditions apply to all the following parameters, unless otherwise specified.) **All voltages referenced to device ground.**

Characteristics	Symbol	Test method	Test Fig.	Test Conditions	Min	Max	Unit
Input Offset Voltage	Vio			Vcc+ = 30V, Vcc- = Gnd, VCM = +15V	-2.5	2.5	mV
				Vcc+ = 2V, Vcc- = -28V, VCM = -13V	-2.5	2.5	mV
				Vcc+ = 5V, Vcc- = Gnd, VCM = +1.4V	-2.5	2.5	mV
				Vcc+ = 2.5V, Vcc- = -2.5, VCM = -1.1V	-2.5	2.5	mV
Input Offset Current	Iio			Vcc+ = 30V, Vcc- = Gnd, VCM = +15V	-15	15	nA
				Vcc+ = 2V, Vcc- = -28V, VCM = -13V	-15	15	nA
				Vcc+ = 5V, Vcc- = Gnd, VCM = +1.4V	-15	15	nA

				Vcc+ = 2.5V, Vcc- = -2.5, VCM = -1.1V	-15	15	nA
Input Bias Current	±IIB			Vcc+ = 30V, Vcc- = Gnd, VCM = +15V	-75	+0.1	nA
				Vcc+ = 2V, Vcc- = -28V, VCM = -13V	-75	+0.1	nA
				Vcc+ = 5V, Vcc- = Gnd, VCM = +1.4V	-75	+0.1	nA
				Vcc+ = 2.5V, Vcc- = -2.5, VCM = -1.1V	-75	+0.1	nA
Open Loop Voltage Gain (Plus)	+AVS			Vcc+ = 30V, Vcc- = Gnd, 1V ≤ Vo ≤ 26V, RL = 10K Ω	40		V/mV
				Vcc+ = 30V, Vcc- = Gnd, 5V ≤ Vo ≤ 20V, RL = 2K Ω	40		V/mV

Notes:
(1) Pre and post irradiation limits are identical to those listed under AC and DC electrical characteristics except as listed in the Post Radiation Limits Table. These parts may be dose rate sensitive in a space environment and demonstrate enhanced low dose rate effect. Radiation end point limits for the noted parameters are ensured only for the conditions as specified in MIL-STD-883, Method 1019
(2) Low dose rate testing should be perform on a wafer-by-wafer basis, per test method 1019 condition D of MIL-STD-883, with no enhanced low dose rate sensitivity (ELDRS) effect.

4.6 WAFER LOT ACCEPTANCE

Wafer Lot Acceptance shall be performed in accordance with MIL-STD-883, test method 5007, if specified on the Purchase Order.

4.7 SPECIAL IN PROCESS CONTROLS

Unless otherwise specified herein, all lots of components used for lot validation testing and for delivery shall be subjected to tests and inspections in accordance with table x of this specification.

Any component which do not meet these requirements shall be removed from the lot and no future time be resubmitted to the requirements of this specification.

Table 6 : Special In Process Controls

Component Lot Manufacturing

Examination or test	MIL-STD-883 Test Method	Test Condition	Sample plan
Internal Visual Inspection	ESCC 20400		100 %
Bond strength (1)	2011	Condition C	3 devices
Die Shear	2019		3 devices
Encapsulation			
Dimension Check	ESCC 20500		3 devices

To Screening tests

(1) DESTRUCTIVE BOND PULL TEST

4.8 BURN-IN TEST

4.8.1 Parameter Drift Value

The parameter drift values applicable to burn-in are specified in Table 7 of this specification. Unless otherwise stated the measurements shall be performed at T_{amb} = (+22±3)°C. The drift values (Δ) applicable to each parameter shall not be exceeded.

Table 7 – PARAMETER DRIFT VALUES FOR BURN-IN TEST AND UPON COMPLETION OF ENDURANCE TESTING

N°	Electrical Parameters	Symbol	Test Conditions	Delta (Δ) Limits		Unit
				Min	Max	
1	Input Offset Voltage	V_{IO}	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-0.5	+0.5	mV
2	Input Bias Current (positive)	$\pm I_{IB}$	V_{CC+} = 30V, V_{CC-} = Gnd, V_{CM} = +15V	-10	0.1	nA

4.8.2 Conditions for Power Burn-In

The requirements for Burn-In are specified in table 8 of this specification. The components shall be subjected to a total power burn-in period of 240 hours.

Table 8 – CONDITIONS FOR POWER BURN IN AND ENDURANCE TEST

N°	Characteristics	Symbol	Condition	Unit
1	Ambient Temperature	T_{amb}	+125	°C
2	Positive supply voltage	V_{CC+}	+30V	V
3	Negative supply voltage	V_{CC-}	Gnd	V
4	Duration	t	240	hours

4.8.3 Electrical Circuit for Power Burn-In

Circuit for use to perform the Power Burn-In tests is shown in Figure 4 of this specification.

FIGURE 4 - POWER BURN-IN AND ENDURANCE TEST ELECTRICAL CIRCUIT

5 QUALITY ASSURANCE PROVISIONS

5.1 GENERAL

The inspection, general procedures for acceptance, and inspection conditions and methods of testing shall be in accordance with this specification, seller quotation, and buyer purchase order.

5.2 QUALITY CONTROL PRACTICES

The manufacturer shall establish and maintain a quality control inspection system in accordance with ESCC 9000, chapter 7, requirements. The manufacturer shall notify the procuring activity of any changes to its drawings and process specifications that affect form, fit, function, or reliability of this part

5.3 TEST EQUIPMENT AND INSPECTION FACILITIES

Test and measuring equipment and inspection facilities of sufficient accuracy, quality, and quantity to permit performance of the required inspection shall be established and maintained by the supplier.

5.4 INSPECTION

The manufacturer is responsible for the performance of all inspection requirements as specified herein and shall provide a certificate of compliance and summary of parts fallout with each item furnished in accordance with this document.

5.4.1 Precap CSI Inspection

Precap CSI inspection shall be performed after manufacturer's precap inspection, if specified on the Purchase Order.

5.4.2 Quality Conformance Inspection : QCI (Final Acceptance Inspection)

Final CSI inspection shall be specified on the Purchase Order, if required.

5.5 SCREENING REQUIREMENTS

Each device shall be screened in accordance with ESCC 9000 requirements and as specified in table 9.

Table 9 – SCREENING REQUIREMENTS

Item	Screen	MIL-STD-883 Test Method	Detail and Conditions T_{amb} = 25°C unless otherwise specified
1	Precap – Internal Visual		ESCC Basic Specification No. 20400
2	Serialization		
3	High Temperature Stabilization Bake	1008	Duration 24 hours at maximum storage temperature rating
4	Temperature cycling	1010	Condition C ; -65°C to 150°C, 10 cycles, 10 minutes min at each extreme
5	Particle Impact Noise Detection (PIND)	2020	Condition A
6	Initial electrical measurements – Ambient temperature		As per table 2(a), 2(b)
7	Power Burn-In	1015	Condition B ; t = 240 hours ; Tamb = 125°C.
8	Final electrical measurements - Ambient temperature		Repeat Initial measurements as per table 2(a), 2(b). Measurements shall be made within 96 hours of bias removal - Read and record required
9	Check for lot failure - PDA calculation		PDA_{max} = 5 %
10	Final electrical measurements High and Low temperature		As per tables 3a and 4a
11	Hermetic seal Fine and Gross leak	1014	Test condition A (fine leak) Test condition C (gross leak)
12	External Visual Inspection and dimension check		ESCC Basic Specification No. 20500

5.5.1 Percent Defective Allowable (PDA)

PDA over Burn-In is 5%. PDA calculation shall include room temperature electrical measurements and drift calculations .If the percent defective exceeds 5% the lot shall be rejected. Lots that exceed 5% but not 10% PDA may be resubmitted for Burn-In and test. Lots resubmitted to Burn-In shall be rejected if the percent of defects during the second Burn-In test exceeds 3%. In the event the number of failures exceeds the allowed PDA, the manufacturer shall notify the customer within

5 working days and the lot shall be considered as non-conformant and placed in quarantine waiting for the Customer decision.

5.6 QUALITY CONFORMANCE INSPECTION : QCI (FINAL ACCEPTANCE INSPECTION)

5.6.1 Environmental / Mechanical Subgroup

Environmental / Mechanical subgroup tests have to be done in accordance with ESCC 9000 chart F4 and table 10 here-in. No reject shall be allowed.

This test is optional and has to be defined / written in the purchase order.

Table 10 : Environmental / Mechanical Subgroup Tests

Examination or test	MIL-STD-883 Test Method	Test Condition	Sample plan
Mechanical Subgroup			
Mechanical shock	2002	Condition B	15 devices
Vibration	2007	Condition A	15 devices
Constant acceleration	2001	Condition E	15 devices
Hermetic seal Fine and Gross leak	1014	Test condition A (fine leak) Test condition C (gross leak)	15 devices
Intermediate and end-point electrical measurements		As per table 2(a)	15 devices
External visual inspection	ESCC Basic Specification No. 20500		15 devices
Environmental Subgroup			
Thermal shock	1011	Condition C	15 devices
Moisture resistance	1004		15 devices
Hermetic seal Fine and Gross leak	1014	Test condition A (fine leak) Test condition C (gross leak)	15 devices
Intermediate and end-point electrical measurements		As per table 2(a)	15 devices
External visual inspection	ESCC Basic Specification No. 20500		15 devices

5.6.2 Endurance Capability Subgroup

Endurance subgroup tests have to be done in accordance with ESCC 9000 chart F4 and table 11 here-in. No reject shall be allowed.

Endurance subgroup test is required for the first procurement and must be done again if :

- integrated circuit dice are from a different diffusion lot
- last endurance subgroup exceeds two years of last received Date Code

Table 11 : Endurance Capability Subgroup Tests

Examination or test	MIL-STD-883 Test Method	Test Condition	Sample plan
Operating life 2000 hours	1005	As per table 8	15 devices

Intermediate and end-point electrical measurements		As per table 2(a)	15 devices
Hermetic seal Fine and Gross leak	1014	Test condition A (fine leak) Test condition C (gross leak)	15 devices
External visual inspection	ESCC Basic Specification No. 20500		15 devices

5.6.3 Assembly Capability Subgroup

Assembly capability subgroup tests shall be conducted in accordance with ESCC 9000 chart F4 and table 12 here-in. No reject shall be allowed.

This test is not optional and shall be ordered in every purchase order.

Table 12 : Assembly Capability Subgroup Tests

Examination or test	MIL-STD-883 Test Method	Test Condition	Sample plan
Permanence of marking	ESCC Basic Specification N° 24800		5 devices
Terminal strength	2004	Condition B2, 3 leads (excluding corner leads) or 10 % of the leads (whichever is greater) shall be randomly selected on each component.	5 devices
Internal visual inspection	ESCC Basic Specification N° 20400		5 devices
Bond strength	2011	Condition C	5 devices
Die shear	2019		5 devices

6 Documentation

The manufacturer shall submit the following documentation with each shipment :

- Certificate of Conformance (See chapter 7)
- Serial number Log Sheet
- Summary report (attribute data) of screening process and results (variable data).
- Burn-In Electrical test data and Delta calculations
- Copy of screening and conformance travelers.

7 Certificate of conformance

The certificate of conformance consists of and includes as a minimum :

- RD Alfa Part Number
- Rd Alfa sales order
- Date code
- Assembly Lot
- Diffusion Lot
- Dice identification (mask reference)
- ESD HBM Class
- Assembly & Screening manufacturing location
- Detail specification with the applicable revisions
- Shipped quantity
- Serial Numbers

8 Preparation for delivery

8.1 PACKING AND PACKAGING

The device shall be packaged to prevent mechanical damage in accordance with ESCC 20600. The packing is TBD.

8.1.1 Protection Against Electrostatic Discharge

Each device shall be packaged in a static dissipative static shielded waffle pack to prevent ESD damage according to ESD HBM class in Certificate of Conformance.

8.1.2 Package Identification

The Waffle Pack label shall contain, as a minimum, the following:

- Part number
- Date code
- Purchase order number
- ESD Label.