

High 50MHz Current Feedback Amplifier

The α RD2020 is a fast settling, wide bandwidth amplifier optimized for gains between -10 and +10. Built using the JSC "RD Alfa Microelectronic Department" monolithic Complementary Bipolar process, this amplifier uses current mode feedback to achieve more bandwidth at a given gain than a conventional voltage feedback operational amplifier. The α RD2020 will drive two double terminated 75Ω coax cables to video levels with low distortion. Since it is a closed loop device, the α RD2020 provides better gain accuracy and lower distortion than an open loop buffer. The device includes output short circuit protection, and input offset adjust capability. The bandwidth and slew rate of the α RD2020 are relatively independent of the closed loop gain taken. The 50MHz bandwidth at unity gain only reduces to 30MHz at a gain of 10. The α RD2020 may be used in most applications where a conventional op amp is used, with a big improvement in speed power product.

Features

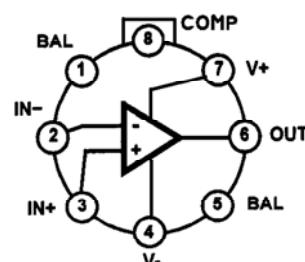
- Slew rate $500V/\mu s$
- $\pm 33mA$ output current
- Drives $\pm 2.4V$ into 75Ω
- Differential phase $< 0.1^\circ$
- Differential gain $< 0.1\%$
- V supply $\pm 5V$ to $\pm 18V$
- Output short circuit protected
- Uses current mode feedback
- 1% settling time of 50ns for 10V step
- Low cost
- 9mA supply current
- 8-pin mini-dip

Applications

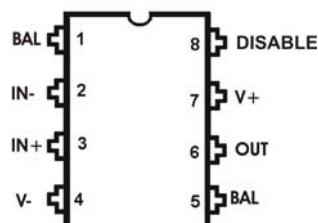
- Video gain block
- Residue amplifier
- Radar systems
- Current to voltage converter
- Coax cable driver with gain of 2

Pinout

8-lead metal can . Top View



8-Pin Metal-Ceramic DIP. Top View



Ordering information

Part	Mark.	Temp., °C	Package	Package drawing
α RD2020A/C5D	2020A	-40 to +85	8-lead metal can	SH-8
α RD2020A/A5D	2020A		8-Pin Metal-Ceramic DIP	RF-8

Notes:

1. This Pb-free hermetic packaged products employ 100% Au plate, which is RoHS.

Absolute Maximum Ratings($T_A = 25^\circ\text{C}$)

V_S	Supply Voltage	$\pm 18\text{V}$ or 36V
V_{IN}	Input Voltage	$\pm 18\text{V}$ or V_S
V_{IN}	Differential Input Voltages	$\pm 10\text{ V}$
I_{IN}	Input Current (Pins 2 or 3)	$\pm 10\text{mA}$
I_{INS}	Input Current (Pins 1, 5, or 8)	$\pm 5\text{mA}$
PD	Maximum Power Dissipation	(See Curves) 1.25W
I_{OP}	Peak Output Current	Short Circuit Protected

Notes:

2. While of the same time of above mentioned supply voltage and output current not more 1 h
3. Common mode Input Voltage is determined in accordance with fig.11

Operation ConditionTemperature range -40°C to $+85^\circ\text{C}$ **Thermal Information**

Thermal Resistance (typical)

 $\theta_{JA} = 170\text{ }^\circ\text{C/W}$ (note 4) $\theta_{JC} = 85\text{ }^\circ\text{C/W}$ (note 5)Maximum junction temperature $+150^\circ\text{C}$ Lead temperature (soldering 3 s) 350°C

Notes:

4. θ_{JA} is measured with component on an evaluation PC board in free air
5. For θ_{JC} "case temp" location is the center of metal can

Electrical Specifications $V_{SUPPLY} = \pm 15\text{ V}$

Parameter	Temp., $^\circ\text{C}$	$\alpha\text{RD2020A/C5D}, \alpha\text{RD2020A/A5D}$			Units
		Min	Typ	Max	
Offset Voltage (note 6)	25	-10	3.0	10	mV
	+85	-15		15	mV
	-40	-15		15	mV
Offset Voltage Drift	-40 to 25		30		$\mu\text{V}/^\circ\text{C}$
	25 to +85		30		$\mu\text{V}/^\circ\text{C}$
Common Mode Rejection Ratio(Note 7)	ALL	50	60		dB
Power Supply Rejection Ratio(Note 8)	25	65	75		dB
	+85	60			dB
	-40	60			dB
Non-inverting Input Current	25	-15	5	15	μA
	+85	-15	5	15	μA
	-40	-25		25	μA
Non-Inverting Input Resistance	25	1	5		$\text{M}\Omega$
	+85	1	5		$\text{M}\Omega$
	-40	1	5		$\text{M}\Omega$
Non-Inverting Input Current Power Supply Rejection(Note 8)	25		0.05	0.5	$\mu\text{A/V}$
	+85		0.05	0.5	$\mu\text{A/V}$
	-40			1	$\mu\text{A/V}$
-Input Current(note 6)	25	-40	10	40	μA
	+85	-40	10	40	μA
	-40	-50		50	μA
-Input Current Common Mode Rejection(Note 7)	25		0.5	2	$\mu\text{A/V}$
	+85		0.5	2	$\mu\text{A/V}$
	-40			4	$\mu\text{A/V}$

Parameter	Temp., °C	αRD2020A/C5D, αRD2020A/A5D			Units
		Min	Typ	Max	
-Input Current Power Supply Rejection (Note 8)	25		0.05	0.5	µA/V
	+85		0.05	0.5	µA/V
	-40			1	µA/V
Transimpedance (ΔVOUT/ Δ(-IIN)) RL = 400Ω, VOUT = ±10V	25	300	1000		V/mA
	+85	300	1000		V/mA
	-40	50			V/mA
Open Loop DC Voltage Gain RL = 400Ω, VOUT = ±10V	25	70	80		dB
	+85	70	80		dB
	-40	60			dB
Open Loop DC Voltage Gain RL = 100Ω, VOUT = ±2.5V	25	60	70		dB
	+85	60	70		dB
	-40	55			dB
Output Voltage Swing RL = 400Ω	25	±12	±13		V
	+85	±12	±13		V
	-40	±11			V
Output Current RL = 400Ω	25	±30	±32.5		mA
	+85	±30	±32.5		mA
	-40	±27.5			mA
Quiescent Supply Current	25		9	12	mA
	+85			15	mA
	-40			15	mA
Supply Current, Disabled, V8 = 0V	25		5.5	7.5	mA
	+85		5.5	7.5	mA
	-40		5.5	7.5	mA
Pin 8 Current, Pin 8 = 0V	25		1.1	1.5	mA
	+85		1.1	1.5	mA
	-40		1.1	1.5	mA
Min Pin 8 Current to Disable	25		120	250	µA
	+85		120	250	µA
	-40		120	250	µA
Max Pin 8 Current to Enable	25			30	µA
	+85			30	µA
	-40			30	µA

Notes:

6. The offset voltage and inverting input current

can be adjusted with an external 10kΩ pot between pins 1 and 5 with the wiper connected to VCC (Pin 7) to make the output offset voltage zero.

7. VCM = ±10V

8. ±4.5V ≤ VS ≤ ±18V.

AC Closed Loop Electrical Specifications VS = ±15V, TA = 25°C

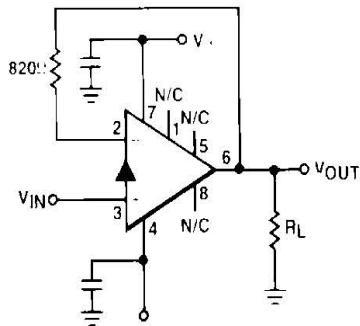
DESCRIPTION	αRD2020A/C5D, αRD2020A/A5D			Units
	Min	Typ	Max	
Closed Loop Gain of 1V/V (0dB), RF = 1kΩ				
Slew Rate, RI = 400Ω, VO = ±10V, test at VO = ±5V	300	500		V/μs
Full Power Bandwidth (Note 9)	4.77	7.95		MHz
Rise Time, RI = 100Ω, VOUT = 1V, 10% to 90%		6		ns
Fall Time, RI = 100Ω, VOUT = 1V, 10% to 90%		6		ns
Propagation Delay, RI = 100Ω, VOUT = 1V, 50% Points		8		ns
Closed Loop Gain of 1V/V (0dB), RF = 820Ω				
-3dB Small Signal Bandwidth, RI = 100Ω, VO = 100mV		50		MHz
1% Settling Time, RI = 400Ω, VO = 10V		50		ns
0.1% Settling Time, RI = 400Ω, VO = 10V		90		ns
Closed Loop Gain of 10V/V (20dB), RF = 1 kΩ, RG = 111Ω				
Slew Rate, RI = 400Ω, VO = ±10V, Test at VO = ±5V	300	500		V/μs
Full Power Bandwidth	4.77	7.95		MHz
Rise Time, RI = 100Ω, VOUT = 1V, 10% to 90%		25		ns
Fall Time, RI = 100Ω, VOUT = 1V, 10% to 90%		25		ns
Propagation Delay, RI = 100Ω, VOUT = 1V, 50% Points		12		ns
Closed Loop Gain of 10V/V (20dB), RF = 680Ω, RG = 76Ω				
-3dB Small Signal Bandwidth, RI = 100Ω, VO = 100mV		30		MHz
1% Settling Time, RI = 400Ω, VO = 10V		55		ns
0.1% Settling Time, RI = 400Ω, VO = 10V		280		ns

Notes:

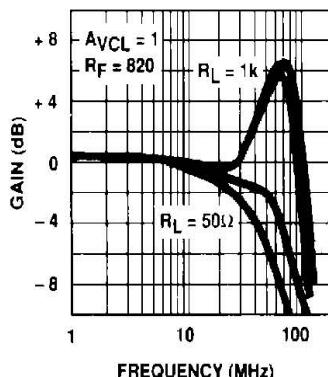
9. Full Power Bandwidth is guaranteed based on Slew Rate measurement. FPBW = SR/2πVpeak.

Typical Performance Curves Non-Inverting Gain of One

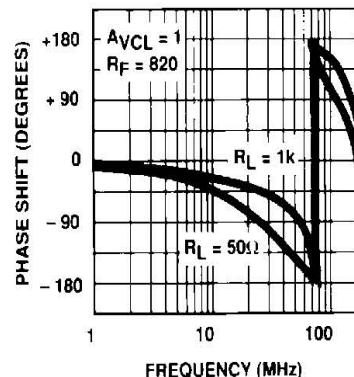
$A_{VCL} = +1$



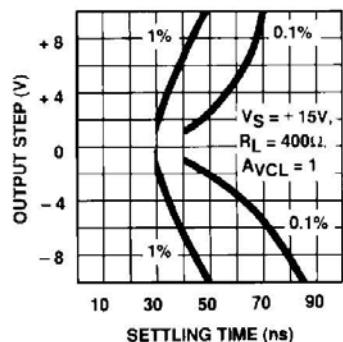
Gain vs Frequency



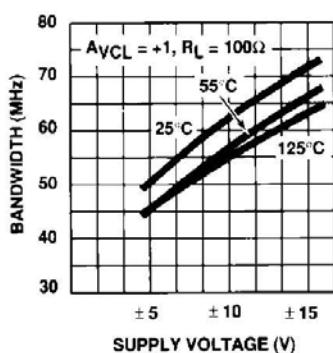
Phase Shift vs Frequency



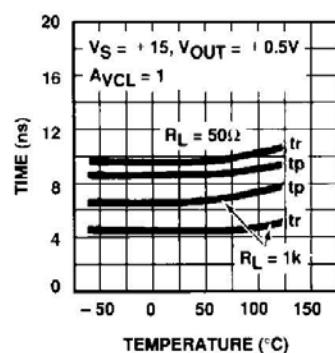
Settling Time vs Output Swing



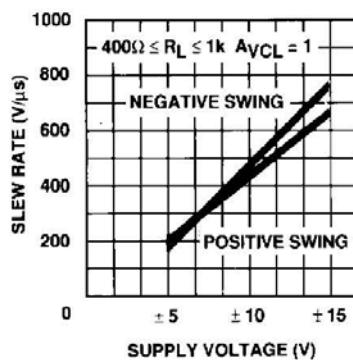
-3dB Bandwidth vs Supply Voltage



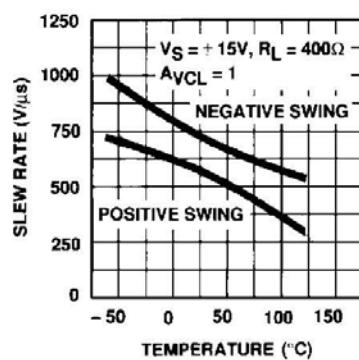
Rise Time and Prop Delay vs Temperature



Slew Rate vs Supply Voltage

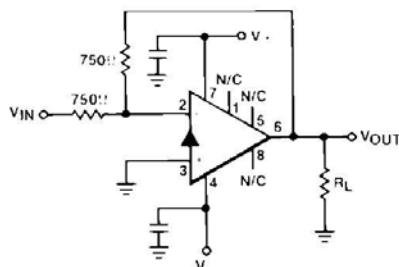


Slew Rate vs Temperature

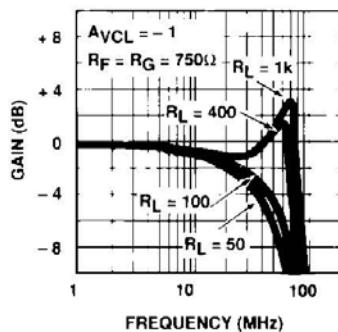


Typical Performance Curves Non-Inverting Gain of One (Continued)

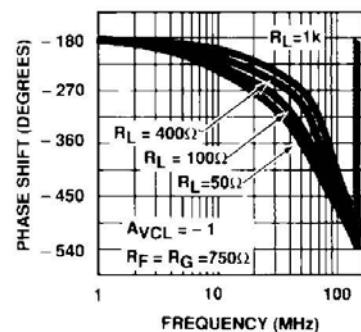
$A_{VCL} = -1$



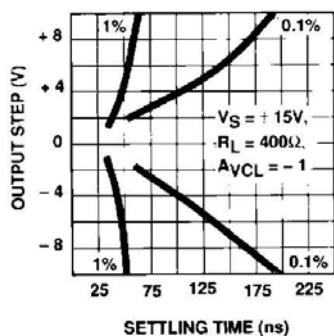
Gain vs Frequency



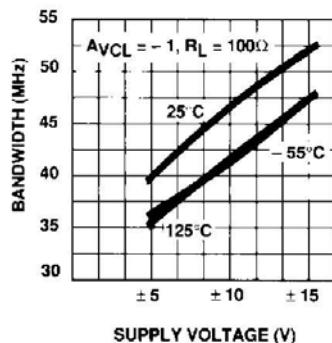
Phase Shift vs Frequency



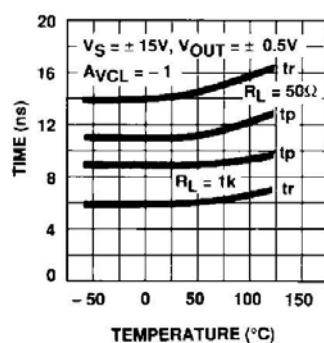
Settling Time vs Output Swing



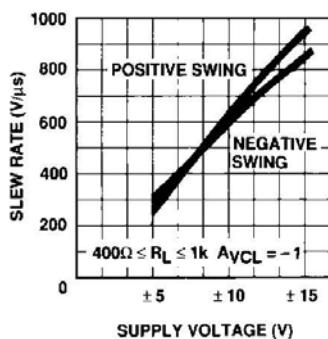
-3dB Bandwidth vs Supply Voltage



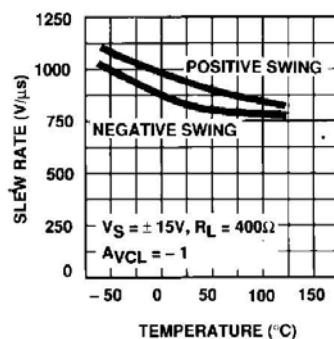
Rise Time and Prop Delay vs Temperature



Slew Rate vs Supply Voltage

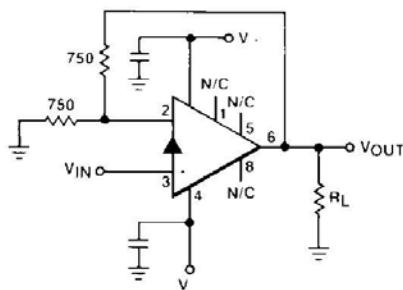


Slew Rate vs Temperature

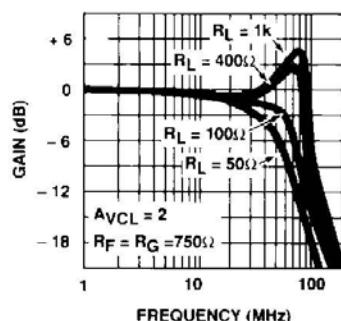


Typical Performance Curves Non-Inverting Gain of One (Continued)

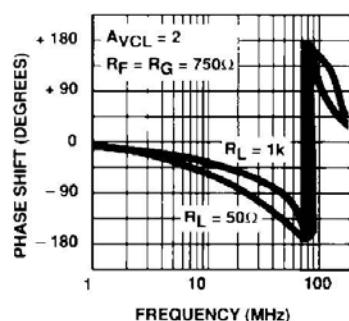
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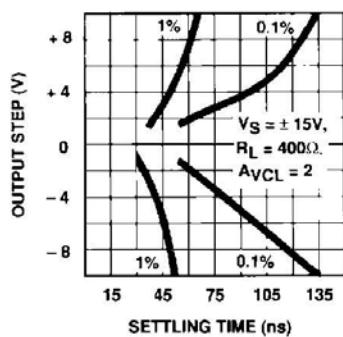
Gain vs Frequency



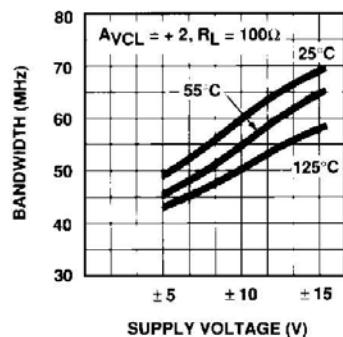
Phase Shift vs Frequency



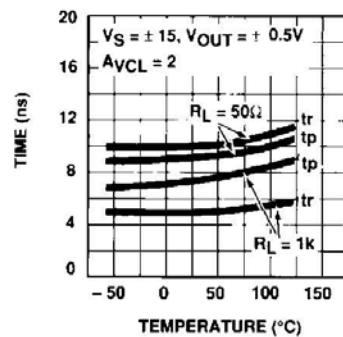
Settling Time vs Output Swing



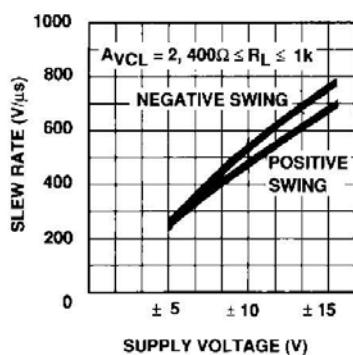
-3dB Bandwidth vs Supply Voltage



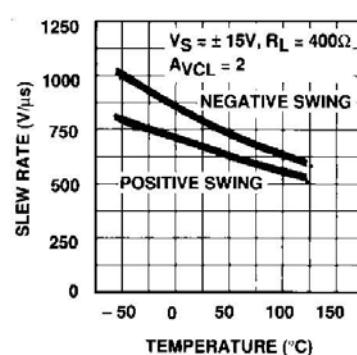
Rise Time and Prop Delay vs Temperature



Slew Rate vs Supply Voltage

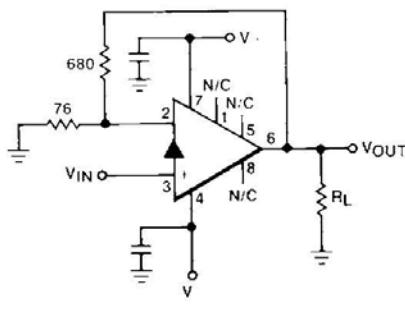


Slew Rate vs Temperature

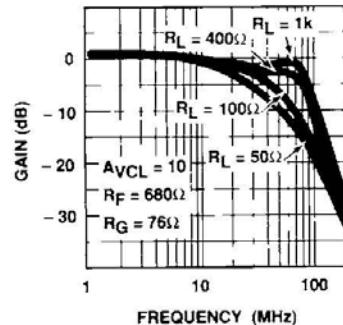


Typical Performance Curves Non-Inverting Gain of One (Continued)

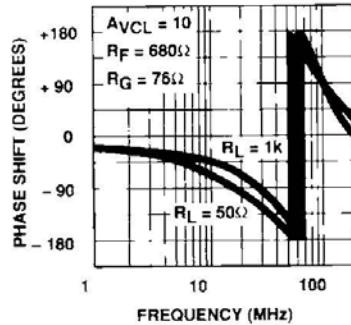
AVCL = -1



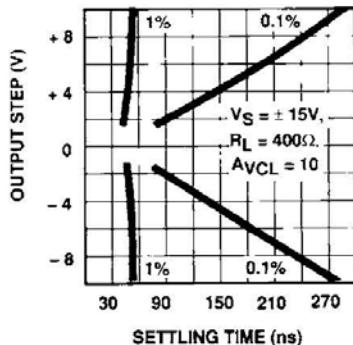
Gain vs Frequency



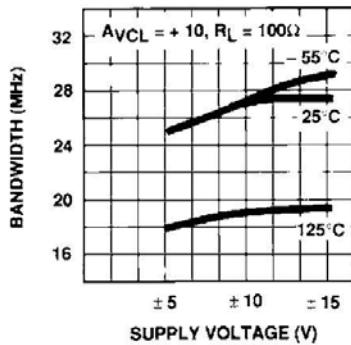
Phase Shift vs Frequency



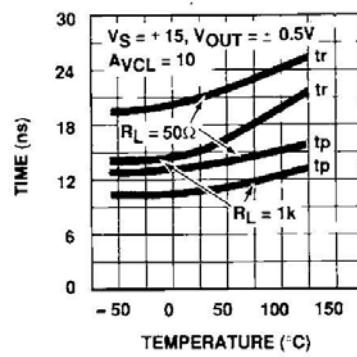
Settling Time vs Output Swing



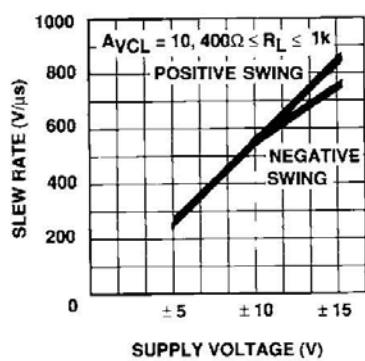
-3dB Bandwidth vs Supply Voltage



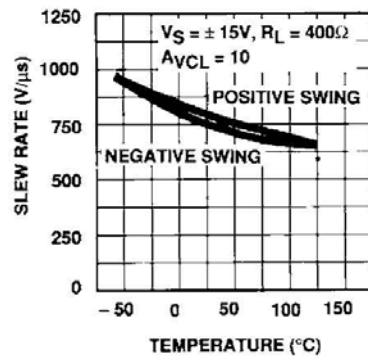
Rise Time and Prop Delay vs Temperature



Slew Rate vs Supply Voltage

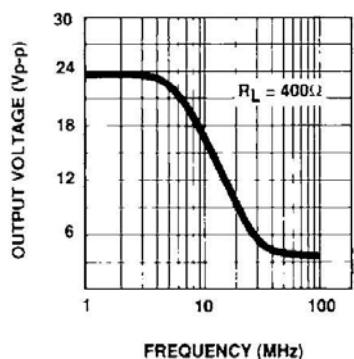


Slew Rate vs Temperature

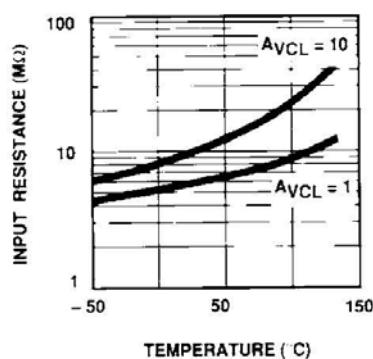


Typical Performance Curves Non-Inverting Gain of One

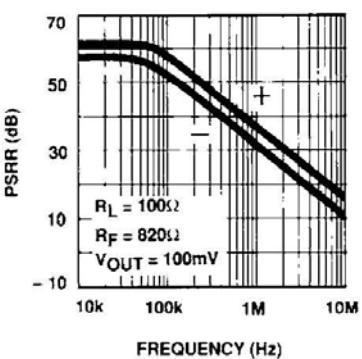
Maximum Undistorted Output Voltage vs Frequency



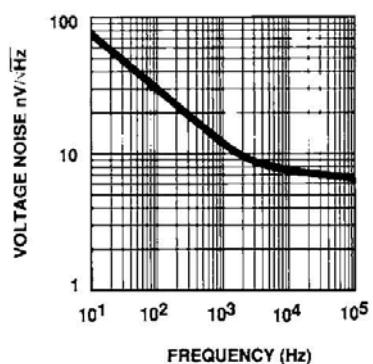
Input Resistance vs. Temperature



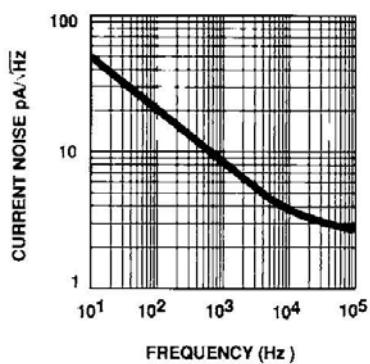
PSRR vs Frequency



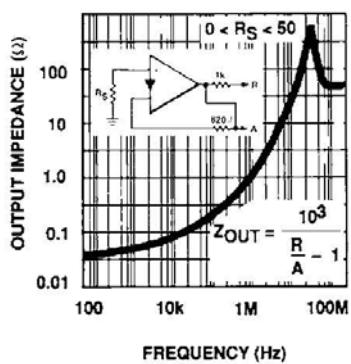
Voltage Noise vs Frequency



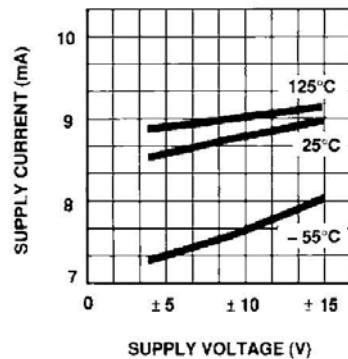
Current Noise vs Frequency



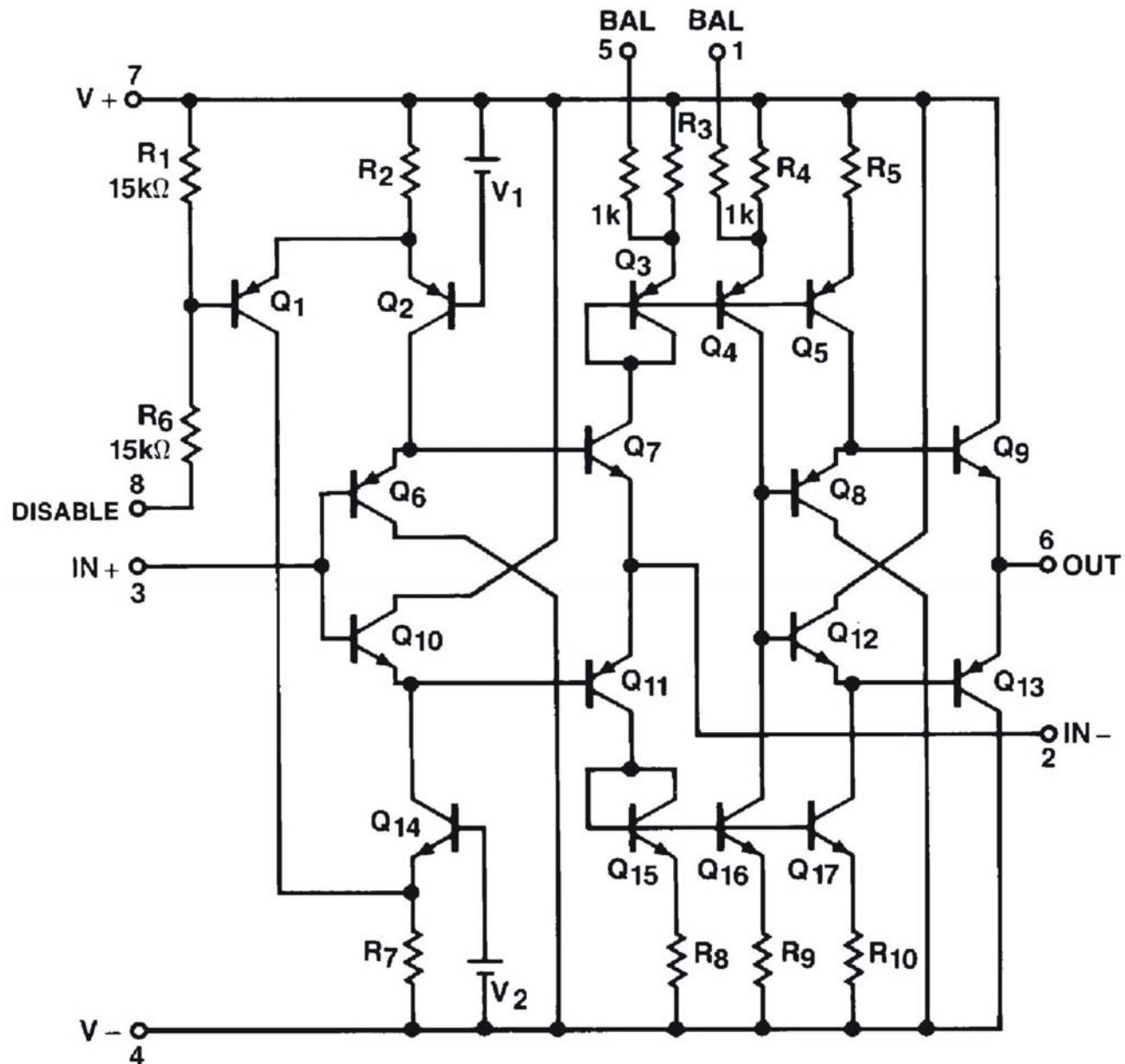
Output Impedance vs Frequency



Supply Current vs Supply Voltage



Equivalent Circuit



Die Characteristics

Die dimensions:

2.1 x 2.1 ± 0.1 mm,

83x83 ± 4 mils.

Wafer thickness 0.46 ± 0.02 mm,

18 ± 1 mils.

Metallization:

type: Al, 1% Si, thickness: 1.4 ± 0.1 μ m

Glassivation:

type: Phosphosilicate glass (PSG)

PSG thickness 1.2 ± 0.2 μ m.

Worst case current density:

8 · 10⁴ A/cm².

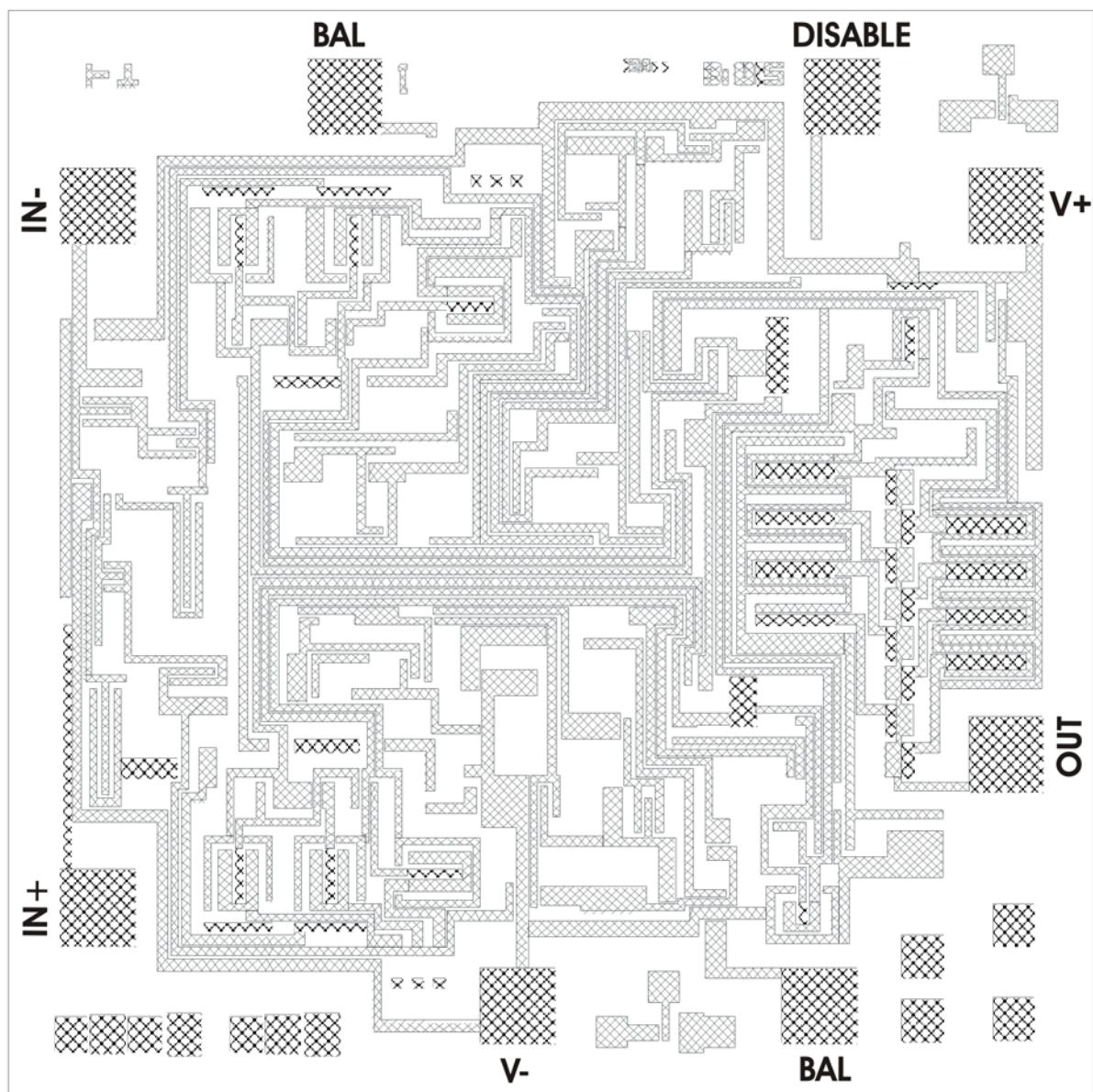
Substrate potential (Powered Up):

Unbiased.

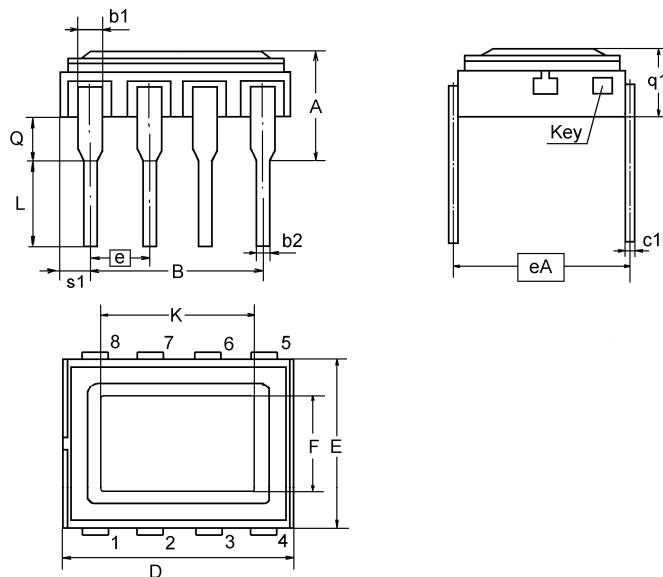
Process:

Complementary bipolar epitaxial.

Metallization Mask layout

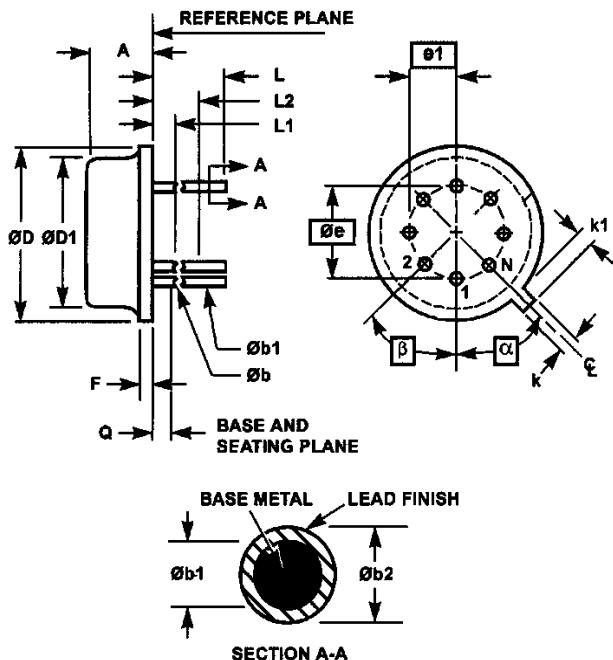


8-Pin Metal-Ceramic DIP



Symbol	Inches		Millimeters	
	Min.	Max.	Min.	Max.
A	-	0,20	-	5
b1	-	0,06	-	1,5
b2	0,016	0,027	0,41	0,69
c1	0,009	0,015	0,22	0,38
D	0,391	0,395	9,98	10,02
E	0,276	0,291	7,0	7,4
e	0,098		2,5	
eA	0,295		7,5	
F	0/177	0,193	4,5	4,9
K	0,283	0,299	7,2	7,6
L	0,128	0,147	3,26	3,74
Q	0,031	0,071	0,8	1,8
q1	0,094	0,122	2,4	3,1
s1	-	0,098	-	2,5

Metal Can Package



Notes:

10. (All leads) $\varnothing b$ applies between L1 and L2. $\varnothing b_1$ applies between L2 and 0.500 from the reference plane. Diameter is uncontrolled in L1 and beyond 0.500 from the reference plane.
11. Measured from maximum diameter of the product.
12. α is the basic spacing from the centerline of the tab to terminal 1 and β is the basic spacing of each lead or lead position ($N - 1$ places) from a, looking at the bottom of the package.
13. N is the maximum number of terminal positions.
14. Controlling dimension: millimeter.

SF-8

8-lead metal can package

Symbol	Millimeters		Inches		Note
	MIN	MAX	MIN	MAX	
A	6.00	6.22	0.236	0.244	-
$\varnothing b$	0.41	0.48	0.016	0.019	13
$\varnothing b_1$	0.41	0.53	0.016	0.021	13
$\varnothing b_2$	0.41	0.61	0.016	0.024	-
$\varnothing D$	9.09	9.19	0.335	0.375	-
$\varnothing D_1$	8.23	8.43	0.305	0.335	-
$\varnothing e$	0.200		5.08		-
e1	0.100		2.54		-
F	0.33	0.43	0.013	0.017	-
k	0.69	0.86	0.027	0.034	-
k1	0.69	1.14	0.027	0.045	14
L	13.0	14.0	0.512	0.552	13
L1	-	1.27	-	0.05	13
L2	6.35	6.85	0.250	0.270	13
Q	0.5	-	0.02	-	-
α	45°		45°		15
β	45°		45°		15
N	8		8		16

All RD ALFA Microelectronics semiconductor products are manufactured, assembled and tested under ISO9001 quality systems certification.

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