National Semiconductor

MICROCIRCUIT DATA SHEET

MJLF156-X REV 0A0

Original Creation Date: 06/20/95
Last Update Date: 08/02/01
Last Major Revision Date: 06/20/95

JFET INPUT, WIDE BAND

General Description

This is the first monolithic JFET input operational amplifier to incorporate well matched, high voltage JFETs on the same chip with standard bipolar transistors (BI-FET(TM) Technology). This amplifier features low input bias and offset currents, low offset voltage and offset voltage drift, coupled with offset adjust which does not degrade drift or common-mode rejection. The device is also designed for high slew rate, wide bandwidth, extremely fast settling time, low voltage and current noise and a low 1/f noise corner.

Industry Part Number

LF156

NS Part Numbers

JL156BGA
JL156SGA

Prime Die

LF156

Controlling Document

38510/11402,AMEND.6 CIR.E REV A

Processing

MIL-STD-883, Method 5004

Quality Conformance Inspection

MIL-STD-883, Method 5005

Subgrp	Description	Temp (°C)
	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55
12	Settling time at	+25

Features

- Low input bias current	30 pA
- Low input Offset Current	3 pA
- High input impedance	10e12 Ohms
- Low input offset voltage	1 mV
- Low input offset voltage temp. drift	3 uV/ C
- Low input noise current	0.01 pA/sqrtHz
- High common-mode rejection ratio	100 dB
- Large dc voltage gain	106 dB
- Extremely fast settling time to 0.01%	1.5 uS
- Fast slew rate	12 V/uS
- Wide gain bandwidth	5 MHz
- Low input noise voltage	12 nV/sqrtHz

(Absolute Maximum Ratings)

(Note 1)

Supply Voltage	±22V
Input Voltage Range (Note 3)	±20V
Differential Input Voltage	±40V
Storage Temperature Range	-65 C ≤ Ta ≤ +150 C
Output Short Circuit Duration (Note 4)	Continuous
Lead Temperture (Soldering, 10 seconds)	300 C
Tjmax	175 C
Power Dissipation at Ta = 25 C (Note 2)	
(Still Air)	560mW
(400 LF/Min Air Flow)	1200mW
Thermal Resistance	
ThetaJA	
(Still Air)	160 C/W
(400 LF/Min Air Flow)	65 C/W
ThetaJC	23 C/W
ESD Tolerance (Note 5)	1200V

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics. The guaranteed specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

Note 2: The maximum power dissipation must be derated at elevated temperatures and is dictated by Tjmax (maximum junction temperature), ThetaJA (package junction to ambient thermal resistance), and TA (ambient temperature). The maximum allowable power dissipation at any temperature is Pdmax = (Tjmax - TA)/ThetaJA or the number given in the Absolute Maximum Ratings, whichever is lower.

Note 3: The absolute maximum negative input voltage is equal to the negative power supply voltage.

Note 4: Short circuit may be to ground or either supply. Rating applies to +125 C case temperature or +75 C ambient temperature.

Note 5: Human body model, 1.5K Ohms in series with 100pF

Recommended Operating Conditions

Supply voltage range	±5 to ±20 Vdc
Ambient temperature range	-55 C to +125 C

Electrical Characteristics

DC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vcc = ±20V, Vcm = 0

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Icc	Supply Current	+Vcc = 15V, -Vcc = -15V				7	mA	1
						6	mA	2
						11	mA	3
Vio	Input Offset Voltage	+Vcc = 5V, -Vcc = -35V, Vcm = 15V			-5	5	mV	1
					-7	7	mV	2, 3
		+Vcc = 35V, -Vcc = -5V, Vcm = -15V			-5	5	mV	1
					-7	7	mV	2, 3
					-5	5	mV	1
					-7	7	mV	2, 3
		+Vcc = 5V, -Vcc = -5V			-5	5	mV	1
					-7	7	mV	2, 3
-Iib	Input Bias Current	+Vcc = 5V, -Vcc = -35V, Vcm = 15V			-0.1	3.5	nA	1
					-10	60	nA	2
		+Vcc = 35V, -Vcc = -5V, Vcm = -15V			-0.1	0.1	nA	1
					-10	50	nA	2
					-0.1	0.1	nA	1
					-10	50	nA	2
		+Vcc = 5V, -Vcc = -25V, Vcm = 10V			-0.1	0.3	nA	1
					-10	50	nA	2
+Iib	Input Bias Current	+Vcc = 5V, -Vcc = -35V, Vcm = 15V			-0.1	3.5	nA	1
					-10	60	nA	2
		+Vcc = 35V, -Vcc = -5V, Vcm = -15V			-0.1	0.1	nA	1
					-10	50	nA	2
					-0.1	0.1	nA	1
					-10	50	nA	2
		+Vcc = 5V, -Vcc = -25V, Vcm = 10V			-0.1	0.3	nA	1
					-10	50	nA	2
Iio	Input Offset Current				-0.02	0.02	nA	1
					-20	+20	nA	2
+PSRR	Power Supply Rejection Ratio	+Vcc = 10V, -Vcc = -20V			85		dB	1, 2, 3

Electrical Characteristics

DC PARAMETERS(Continued)

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vcc = ±20V, Vcm = 0

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
-PSRR	Power Supply Rejection Ratio	+Vcc = 20V, -Vcc = -10V			85		dB	1, 2, 3
CMR	Input Voltage Common Mode Rejection	Vcm = -15V to 15V			85		dB	1, 2, 3
Vio ADJ(+)	Adjustment for Input Offset Voltage				8		mV	1, 2, 3
Vio ADJ(-)	Adjustment for Input Offset Voltage					-8	mV	1, 2, 3
Ios(+)	Output Short Circuit Current (For Positive Output)	+Vcc = 15V, -Vcc = -15V, t ≤ 25mS			-50		mA	1, 2, 3
Ios(-)	Output Short Circuit Current (For Negative Output)	+Vcc = 15V, -Vcc = -15V, t ≤ 25mS				50	mA	1, 2, 3
Delta Vio/Delta T	Temperature Coefficient of Input Offset Voltage	25 C ≤ TA ≤ +125 C	3		-30	30	uV/ C	2
		25 C ≤ TA ≤ -55 C	3		-30	30	uV/ C	3
-Avs	Open Loop Voltage Gain (Single Ended)	Vo = -15V, Rl = 2K Ohms	1		50		V/mV	4
			1		25		V/mV	5, 6
+Avs	Open Loop Voltage Gain (Single Ended)	Vo = +15V, Rl = 2K Ohms	1		50		V/mV	4
			1		25		V/mV	5, 6
Avs	Open Loop Voltage Gain (Single Ended)	Vcc = ±5V, Vo = ±2V, Rl = 2K Ohms	1		10		V/mV	4, 5, 6
-Vop	Output Voltage Swing	Vcm = 20V, Rl = 10K Ohms				-16	V	4, 5, 6
		Vcm = 20V, Rl = 2K Ohms				-15	V	4, 5, 6
+Vop	Output Voltage Swing	Vcm = -20V, Rl = 10K Ohms			16		V	4, 5, 6
		Vcm = -20V, Rl = 2K Ohms			15		V	4, 5, 6

Electrical Characteristics

AC PARAMETERS

(The following conditions apply to all the following parameters, unless otherwise specified.)
AC: Vcc ±15V, Vcm = 0

SYMBOL	PARAMETER	CONDITIONS	NOTES	PIN-NAME	MIN	MAX	UNIT	SUB-GROUPS
Sr-	Slew Rate Fall	Vin = 5V to -5V, Av = 1			7.5		V/uS	7
					5		V/uS	8A, 8B
Sr+	Slew Rate Rise	Vin = -5V to 5V, Av = 1			7.5		V/uS	7
					5		V/uS	8A, 8B
TR(tr)	Transient Response Rise Time	Rl = 2K Ohms, Cl = 100pF, Vin = 50mV, Av = 1	2			100	nS	7, 8A, 8B
TR(os)	Transient Response Overshoot	Rl = 2K Ohms, Cl = 100pF, Vin = 50mV, Av = 1	2			40	%	7, 8A, 8B
NI(BB)	Noise Broad Band	Bandwidth = 5KHz, Vcc = ±20V	2			10	uVrms	7
NI(PC)	Noise Popcorn	Bandwidth = 5KHz, Vcc = ±20V	2			40	uVpk	7
ts(+)	Settling Time	Av = -1	2			1500	nS	12
ts(-)	Settling Time	Av = -1	2			1500	nS	12

DC PARAMETERS: DRIFT VALUES

(The following conditions apply to all the following parameters, unless otherwise specified.)
DC: Vcc = ±20V, Vcm = 0. "Delta calculations performed on JAN S and QMLV devices at group B, subgroup 5 only".

Vio	Input Offset Voltage				-1	1	mV	1
-Iib	Input Bias Current				-0.05	0.05	nA	1
+Iib	Input Bias Current				-0.05	0.05	nA	1

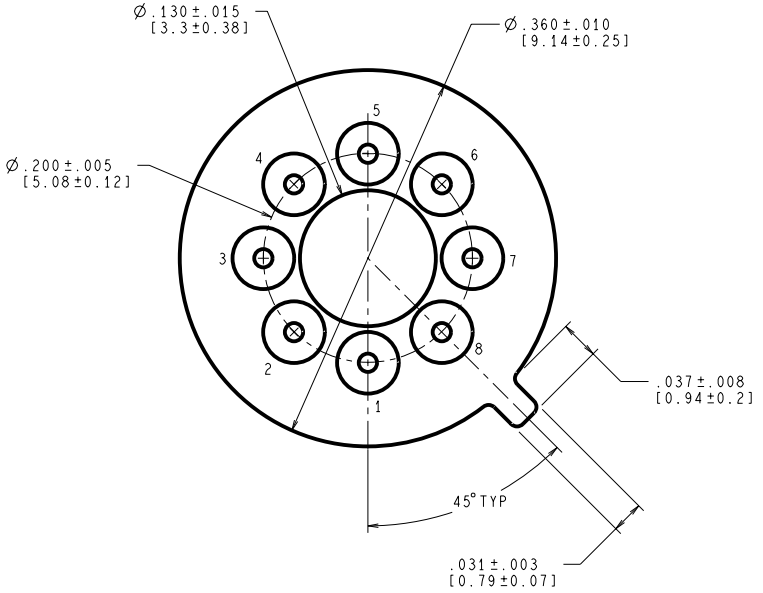
Note 1: Datalog Reading in K = V/mV.
Note 2: Bench test.
Note 3: Calculated parameter.

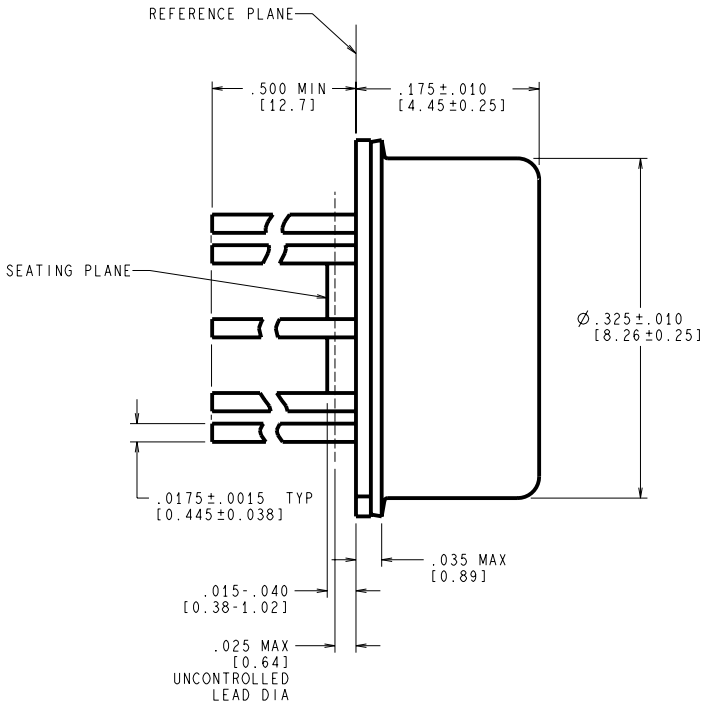
Graphics and Diagrams

GRAPHICS#	DESCRIPTION
05094HRB3	METAL CAN (H), TO-99, 8LD .200 DIA P.C. (B/I CKT)
H08CRF	METAL CAN (H), TO-99, 8LD, .200 DIA P.C. (P/P DWG)
P000175A	METAL CAN (H), TO-39, 8LD .200 DIA P.O. (PINOUT)

See attached graphics following this page.

REVISIONS				
LTR	DESCRIPTION	E.C.N.	DATE	BY/APP'D
F	REVISE & REDRAW PER CURRENT STANDARD; UPDATE MIL/AERO STAMP & TITLE.	11002	06/22/95	MS/





CONTROLLING DIMENSION IS INCH
VALUES IN [] ARE MILLIMETERS

MIL-I-38535
CONFIGURATION CONTROL

NOTES: UNLESS OTHERWISE SPECIFIED

1. LEADS TO BE LOCATED WITHIN .007 IN/ 0.18 mm OF THEIR TRUE POSITIONS RELATIVE TO A MAXIMUM WIDTH TAB.
2. STANDARD METAL CAN TYPE: SOLID BASE WITH CERAMIC STANDOFF.
3. APPLIES TO MIL-AERO AND LINEAR PRODUCTS.
4. REFERENCE JEDEC REGISTRATION TO-99, JEDEC PUBLICATION No.95.

APPROVALS	DATE
DRAWN: MARTA SUCHY	06/22/95
DFTG. CHK.	
ENGR. CHK.	

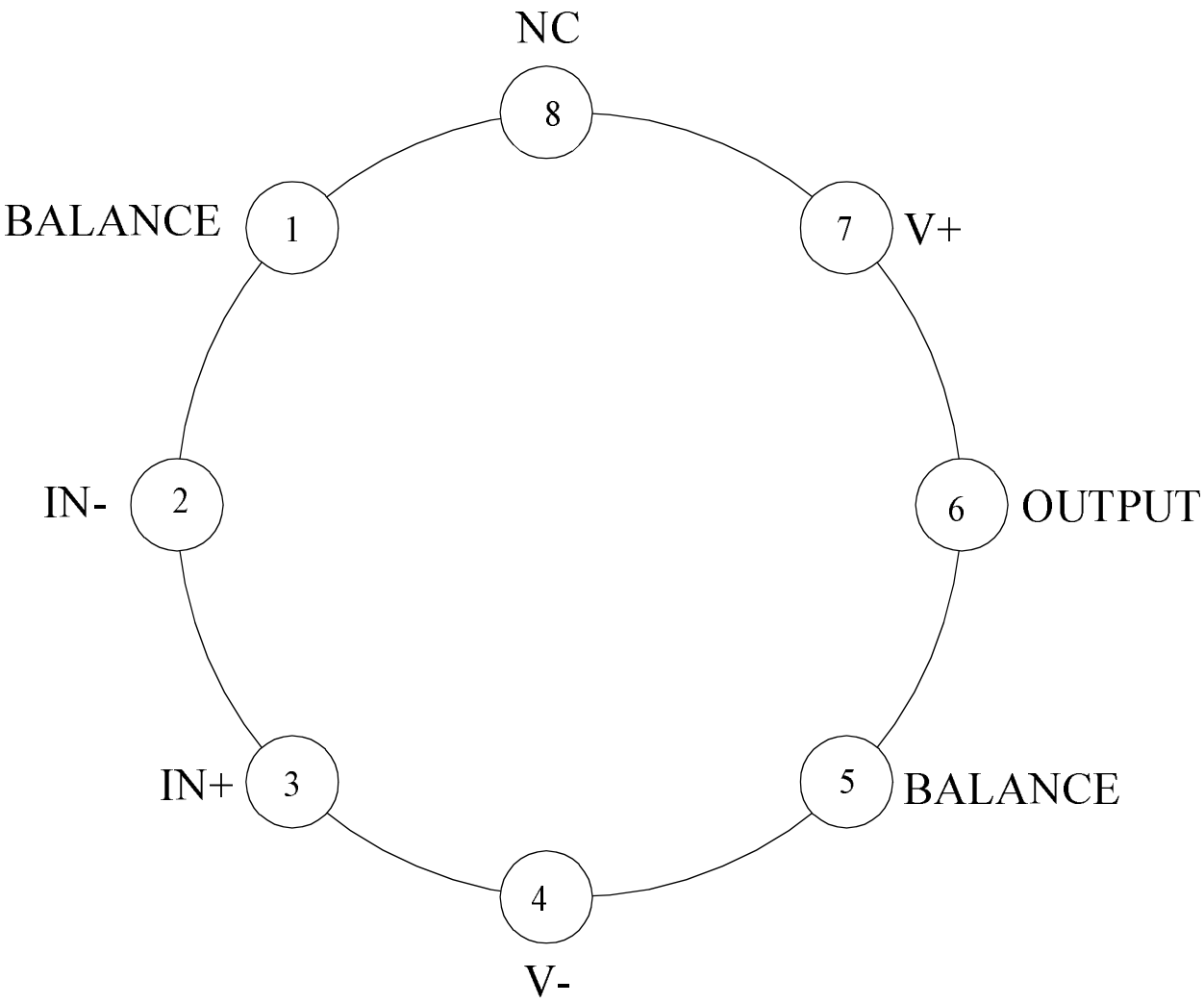
National Semiconductor
2900 Semiconductor dr, Santa Clara, CA 95052-8090

METAL CAN, TO-99, 8 LEAD, .200 DIA P.C.

PROJECTION — INCH [MM]

SCALE	SIZE	DRAWING NUMBER	REV
N/A	C	MKT-H08C	F

DO NOT SCALE DRAWING — SHEET 1 of 1



LF156AH, LF156H
8 - PIN METAL CAN
CONNECTION DIAGRAM
TOP VIEW
P000175A

National Semiconductor™
MIL/AEROSPACE OPERATIONS
2900 SEMICONDUCTOR DRIVE
SANTA CLARA, CA 95050

Revision History

Rev	ECN #	Rel Date	Originator	Changes
0CL	M0001717	08/02/01	Barbara Lopez	Changed: MJLF156-X Rev. 0BL to MJLF156-X Rev. 0CL. Added reference to Subgroup 12 on Main Table.
0A0	M0003813	08/02/01	Rose Malone	Update MDS: MJLF156-X, Rev. 0CL to Fully Released MDS MJLF156-X, Rev. 0A0