Precision, High Speed, JFET Input Operational Amplifier

DESCRIPTION

The RH1056A JFET input operational amplifiers combine precision specifications with high speed performance.

For the first time, 16V/µs slew rate and 6.5MHz gain-bandwidth product are simultaneously achieved with offset voltage of typically 50µV, 1.2µV/°C drift, bias currents of 40pA at 70°C.

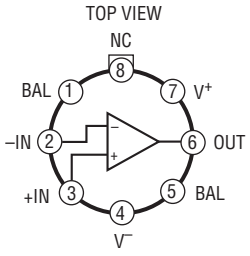
The wafer lots are processed to LTC's in-house Class S flow to yield circuits usable in stringent military applications.

ABSOLUTE MAXIMUM RATINGS

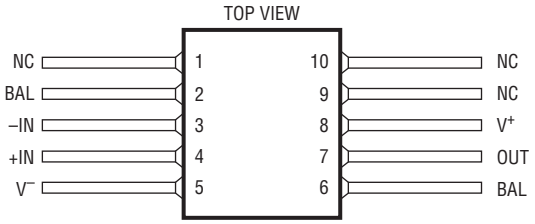
(Note 1)

Supply Voltage ..... ±20V
Differential Input Voltage ..... ±40V
Input Voltage ..... ±20V
Output Short-Circuit Duration ..... Indefinite
Operating Temperature Range ..... –55°C to 125°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

PACKAGE INFORMATION



H PACKAGE
8-LEAD TO-5 METAL CAN



W PACKAGE
10-LEAD CERPAC

BURN-IN CIRCUIT

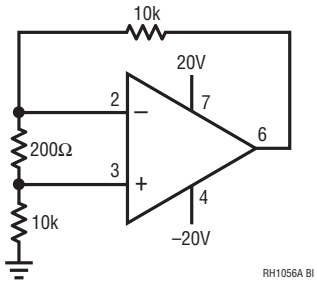


TABLE 1: ELECTRICAL CHARACTERISTICS (Preirradiation) (Note 3)

SYMBOL	PARAMETER	CONDITIONS	NOTES	T_A = 25°C MIN	TYP	MAX	SUB-GROUP	–55°C ≤ T_A ≤ 125°C MIN	TYP	MAX	SUB-GROUP	UNITS
V_{OS}	Input Offset Voltage	RH1056AMW RH1056AMH	2			300 300	4 4			900 1100	2, 3 2, 3	µV µV
I_{OS}	Input Offset Current	Fully Warmed Up T_A = 125°C	4 4			10	1			 1.5	 2	pA nA
I_B	Input Bias Current	Fully Warmed Up T_A = 125°C	4			50	1			 3.0	 2	pA nA
R_{IN}	Input Resistance				10^{12}							Ω
A_{VOL}	Large-Signal Voltage Gain	V_S = ±15V, V_O = ±10V, R_L = 2k V_S = ±15V, V_O = ±10V, R_L = 1k		150 130			4 4	40			5,6	V/mV V/mV
V_O	Output Voltage Swing	V_S = ±15V, R_L = 2k		±12			4	±12			5,6	V
V_{CM}	Input Common Mode Voltage Range	V_S = ±15V		±11			1	±11			2,3	V
CMRR	Common Mode Rejection Ratio	V_{CM} = ±11V V_{CM} = ±10.5V		86			1	 85			 2,3	dB dB
PSRR	Power Supply Rejection Ratio	V_S = ±10V to ±18V V_S = ±10V to ±17V		90			1	 88			 2,3	dB dB
I_S	Supply Current	V_S = ±15V				6.5	1					mA
SR	Slew Rate	AV = 1, V_S = ±15V		10			7					V/µs
GBW	Gain-Bandwidth Product	V_S = ±15V			6.5							MHz
e_n	Input Noise Voltage Density	V_S = ±15V, f = 10Hz V_S = ±15V, f = 1kHz			28 14							fA/√Hz fA/√Hz
i_n	Input Noise Current Density	V_S = ±15V, f = 10Hz V_S = ±15V, f = 1kHz			1.8 1.8							fA/√Hz fA/√Hz
C_{IN}	Input Capacitance				4				4			pF

TABLE 1A: ELECTRICAL CHARACTERISTICS

(Postirradiation) (Note 5)

SYMBOL	PARAMETER	CONDITIONS	NOTES	10KRAD (Si) MIN	MAX	20KRAD (Si) MIN	MAX	50KRAD (Si) MIN	MAX	100KRAD (Si) MIN	MAX	200KRAD (Si) MIN	MAX	UNITS
V_{OS}	Input Offset Voltage		2		300		300		370		570		870	µV
I_{OS}	Input Offset Current		4		±10		±50		±150		±250		±350	pA
I_B	Input Bias Current		4		±50		±250		±500		±1000		±2000	pA
A_{VOL}	Large-Signal Voltage Gain	V_O = ±10V, R_L ≥ 2k V_O = ±10V, R_L ≥ 1k		150 130		150 130		150 130		100 87		75 65		V/mV V/mV
V_O	Output Voltage Swing	R_L ≥ 2k		±12		±12		±12		±12		±12		V
V_{CM}	Input Common Mode Voltage Range	V_S = ±15V		±11		±11		±11		±11		±11		V
CMRR	Common Mode Rejection Ratio	V_{CM} = ±11V		86		86		86		86		86		dB
PSRR	Power Supply Rejection Ratio	V_S = ±10V to ±18V		90		90		90		90		90		dB
I_S	Supply Current				7		7		7		7		7	mA
SR	Slew Rate	A_V = 1, V_S = ±15V		10		10		9		9		9		V/µs
C_{IN}	Input Capacitance			3(Typ)		3(Typ)		3(Typ)		3(Typ)		3(Typ)		pF

TABLE 1A: ELECTRICAL CHARACTERISTICS

Note 1: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. Exposure to any Absolute Maximum Rating condition for extended periods may affect device reliability and lifetime.

Note 2: Unless otherwise specified, the absolute maximum negative input voltage is equal to the negative power supply voltage. Offset voltage is measured under two different conditions: (a) approximately 0.5 seconds after application of power, (b) at T_A = 25°C only, with the chip heated to approximately 45°C to account for chip temperature rise when the device is fully warmed up.

Note 3: Unless otherwise stated, V_S = ±15V; and V_{OS}, I_B and I_{OS} are measured at V_{CM} = 0V.

Note 4: The input bias currents are junction leakage currents which approximately double for every 10°C increase in the junction temperature, T_J. Due to limited production test time, the input bias currents measured are correlated to junction temperature. In normal operation the junction temperature rises above the ambient temperature as a result of internal power dissipation, P_D. $T_J = T_A + (\theta_{JA} \bullet P_D)$ where θ_{JA} is the thermal resistance from junction to ambient.

Note 5: Unless otherwise stated, V_S = ±15V, V_{CM} = 0V and T_A = 25°C.

TABLE 2: ELECTRICAL TEST REQUIREMENTS

MIL-STD-883 TEST REQUIREMENTS	SUBGROUP
Final Electrical Test Requirements (Method 5004)	1*,2,3,4,5,6, 7
Group A Test Requirements (Method 5005)	1,2,3,4,5,6, 7
Group B and D for Class S, and Class C and D for Class B** End Point Electrical Parameters (Method 5005)	1

*PDA applies to subgroup 1. See PDA Test Notes.
**For D3, D4, B5 and B6 V_{OS} Limit as follows

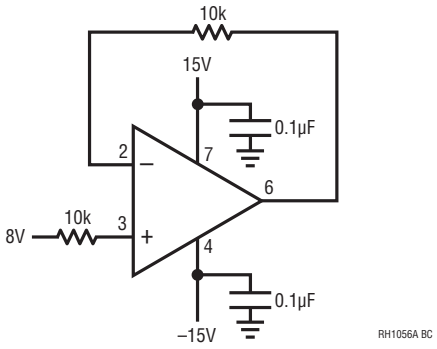
W Package	H Package
500µV	700µV

PDA Test Notes

The PDA is specified as 5% based on failures from group A, subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883. The verified failures of group A, subgroup 1, after burn-in divided by the total number of devices submitted for burn-in in that lot shall be used to determine the percent for the lot.

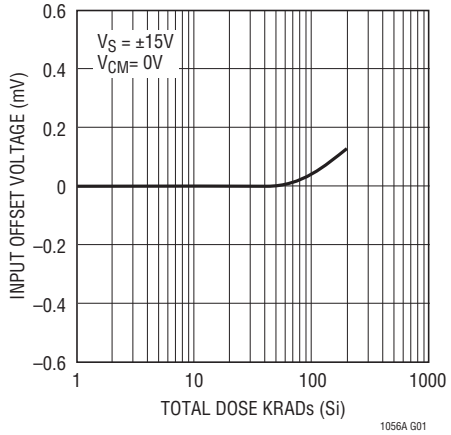
Linear Technology Corporation reserves the right to test to tighter limits than those given.

TOTAL DOSE BIAS CIRCUIT

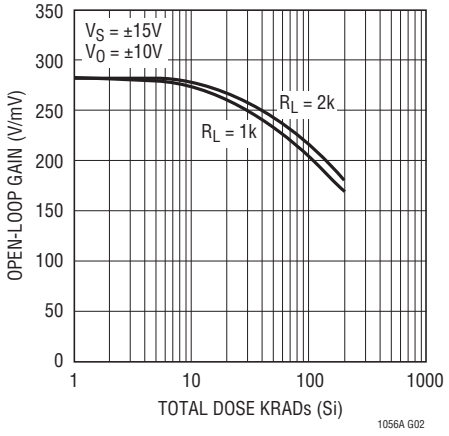


TYPICAL PERFORMANCE CHARACTERISTICS

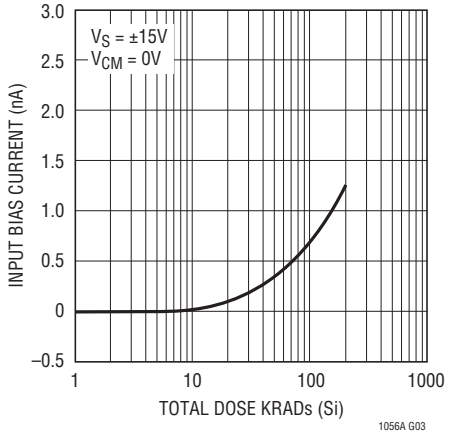
Input Offset Voltage



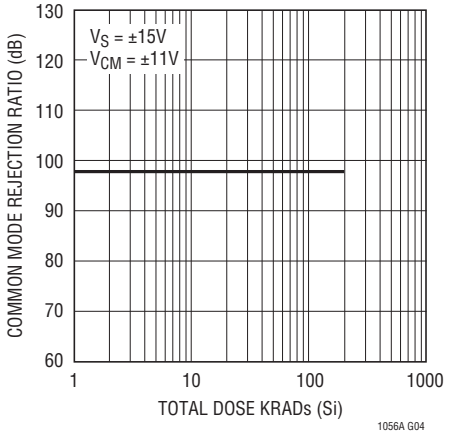
Open-Loop Gain



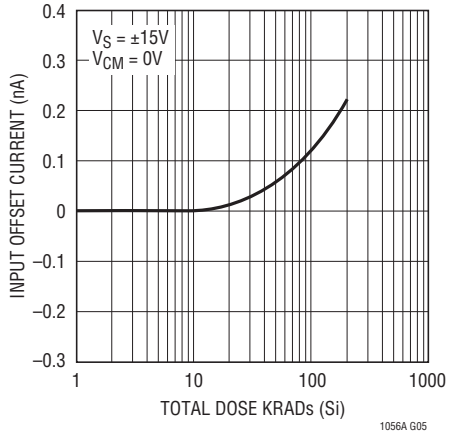
Input Bias Current



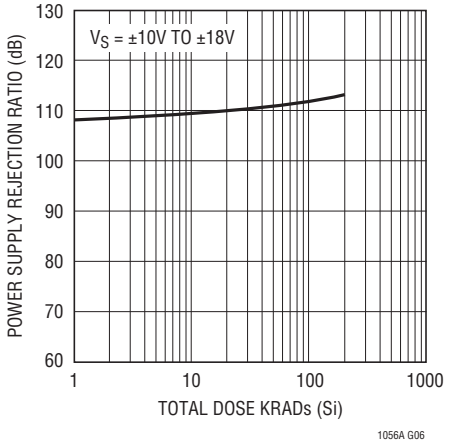
Common Mode Rejection Ratio



Input Offset Current



Power Supply Rejection Ratio



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Linear Technology Corporation
1630 McCarthy Blvd., Milpitas, CA 95035-7417
(408) 432-1900 • FAX: (408) 434-0507 • www.linear.com

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