Precision Operational Amplifier

DESCRIPTION

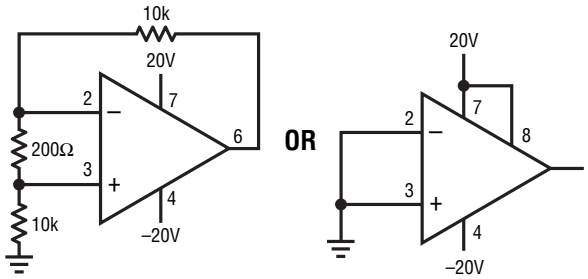
The RH27 combines very low noise with excellent precision and high speed specifications. The low 1/f noise corner frequency of 2.7Hz combined with 3.5nV$\sqrt{Hz}$ 10Hz noise and low offset voltage make the RH27 an excellent choice for low frequency military instrumentation applications. The wafer lots are processed to LTC's in-house Class S flow to yield circuits usable in stringent military applications.

For complete electrical specifications and performance curves see the OP-27/OP-37 data sheet.

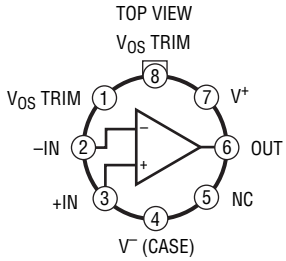
ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... ±22V
Internal Power Dissipation 500mW
Input Voltage..... Equal to Supply Voltage
Output Short-Circuit Duration ..... Indefinite
Differential Input Current (Note 8) ..... ±25mA
Operating Temperature Range..... –55°C to 125°C
Junction Temperature Range ..... –55°C to 150°C
Storage Temperature Range..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec) ..... 300°C

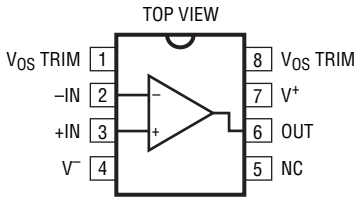
BURN-IN CIRCUIT



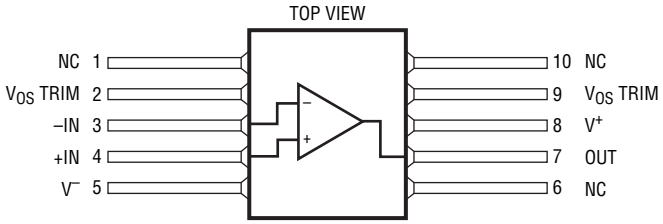
PACKAGE INFORMATION



H PACKAGE
8-LEAD TO-5 METAL CAN



J8 PACKAGE
8-LEAD CERDIP



W PACKAGE
10-LEAD CERPAC

ORDER PART NUMBER	ORDER PART NUMBER	ORDER PART NUMBER
RH27EH RH27CH	RH27CJ8	RH27AEW (Note 11) RH27EW RH27CW

TABLE 1: ELECTRICAL CHARACTERISTICS (Preirradiation) (Note 9)

Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

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	RH27AE	11			35	4			60	2, 3	µV
		RH27E	1			55	4			100	2, 3	µV
		RH27C	1			100	4			300	2, 3	µV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Offset Drift	RH27E	4, 7							1		µV/°C
		RH27C	4, 7							1.8		µV/°C
$\frac{\Delta V_{OS}}{\Delta Time}$	Long-Term Input Offset Voltage Stability	RH27E	2, 4			1						µV/ Month
		RH27C	2, 4			2						
I_{OS}	Input Offset Current	RH27E				35	1			50	2, 3	nA
		RH27C				75	1			135	2, 3	nA
I_B	Input Bias Current	RH27E				±40	1			±60	2, 3	nA
		RH27C				±80	1			±150	2, 3	nA
e_n	Input Noise Voltage	0.1Hz to 10Hz (RH27E)	4, 5			0.18						$µV_{P-P}$
		0.1Hz to 10Hz (RH27C)	4, 5			0.25						$µV_{P-P}$
	Input Noise Voltage Density	f_O = 10Hz (RH27E)	3			5.5						$nV/\sqrt{Hz}$
		f_O = 30Hz (RH27E)	4			4.5						$nV/\sqrt{Hz}$
		f_O = 1000Hz (RH27E)	4			3.8						$nV/\sqrt{Hz}$
		f_O = 10Hz (RH27C)	3			8						$nV/\sqrt{Hz}$
		f_O = 30Hz (RH27C)	4			5.6						$nV/\sqrt{Hz}$
		f_O = 1000Hz (RH27C)	4			4.5						$nV/\sqrt{Hz}$
i_n	Input Noise Current Density	f_O = 1000Hz	4, 6			0.6						$pA/\sqrt{Hz}$
	Input Resistance Common Mode	RH27E			3							GΩ
		RH27C			2							GΩ
	Input Voltage Range	RH27E	4	±11				±10.3				V
		RH27C	4	±11				±10.2				V
CMRR	Common Mode Rejection Ratio	V_{CM} = ±11V (RH27E)		114			1					dB
		V_{CM} = ±10V (RH27E)						108			2, 3	dB
		V_{CM} = ±11V (RH27C)		100			1					dB
		V_{CM} = ±10V (RH27C)						94			2, 3	dB
PSRR	Power Supply Rejection Ratio	V_S = ±4V to ±18V (RH27E)		100			1					dB
		V_S = ±4.5V to ±18V (RH27E)						96			2, 3	dB
		V_S = ±4V to ±18V (RH27C)		94			1					dB
		V_S = ±4.5V to ±18V (RH27C)						86			2, 3	dB
A_{VOL}	Large-Signal Voltage Gain	R_L ≥ 2kΩ, V_O = ±10V (RH27E)		1000			4	600			5, 6	V/mV
		R_L ≥ 600Ω, V_O = ±1V (RH27E) V_S = ±4V	4	250								V/mV
		R_L ≥ 2kΩ, V_O = ±10V (RH27C)		700			4	300			5, 6	V/mV
		R_L ≥ 600Ω, V_O = ±1V (RH27C) V_S = ±4V	4	200								V/mV
V_{OUT}	Maximum Output Voltage Swing	R_L ≥ 2kΩ (RH27E)		±12			4	±11.5			5, 6	V
		R_L ≥ 600Ω (RH27E)		±10			4					V
		R_L ≥ 2kΩ (RH27C)		±11.5			4	±10.5			5, 6	V
		R_L ≥ 600Ω (RH27C)		±10			4					V
SR	Slew Rate	R_L ≥ 2kΩ		1.7			7					V/µs
GBW	Gain-Bandwidth Product	f_O = 100kHz	4	5								MHz
Z_O	Open-Loop Output Resistance	V_O = 0, I_O = 0			70							Ω
P_D	Power Dissipation	RH27E				140	1					mW
		RH27C				170	1					mW

Rev. E

TABLE 1A: ELECTRICAL CHARACTERISTICS (Postirradiation) (Note 10)

Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

				10KRAD(Si)		20KRAD(Si)		50KRAD(Si)		100KRAD(Si)		200KRAD(Si)		
SYMBOL	**PARAMETER**	**CONDITIONS**	**NOTES**	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**MIN**	**MAX**	**UNITS**
V_{OS}	Input Offset Voltage	RH27E RH27C	1 1		55 100		80 130		100 180		150 280		200 400	µV µV
I_{OS}	Input Offset Current	RH27E RH27C			35 75		40 75		50 90		60 120		90 180	nA nA
I_B	Input Bias Current	RH27E RH27C			±40 ±80		±50 ±80		±80 ±125		±100 ±200		±200 ±400	nA nA
	Input Resistance Common Mode	RH27E RH27C		3 (Typ) 2 (Typ)		3 (Typ) 2 (Typ)		3 (Typ) 2 (Typ)		3 (Typ) 2 (Typ)		3 (Typ) 2 (Typ)		GΩ GΩ
	Input Voltage Range		4	±11		±11		±11		±11		±11		V
CMRR	Common Mode Rejection Ratio	V_{CM} = ±11V (RH27E) V_{CM} = ±11V (RH27C)		114 100		114 100		110 97		105 94		100 90		dB dB
PSRR	Power Supply Rejection Ratio	V_S = ±4V to ±18V (RH27E) V_S = ±4V to ±18V (RH27C)		100 94		100 94		98 92		96 90		94 86		dB dB
A_{VOL}	Large-Signal Voltage Gain	$R_L \geq 2k\Omega$, V_O = ±10V (RH27E) $R_L \geq 2k\Omega$, V_O = ±10V (RH27C)		1000 700		1000 700		1000 700		900 700		800 400		V/mV V/mV
V_{OUT}	Maximum Output Voltage Swing	$R_L \geq 2k\Omega$ (RH27E) $R_L \geq 600\Omega$ (RH27E) $R_L \geq 2k\Omega$ (RH27C) $R_L \geq 600\Omega$ (RH27C)		±12 ±10 ±11.5 ±10		±12 ±10 ±11.5 ±10		±12 ±10 ±11.5 ±10		±12 ±10 ±11.5 ±10		±12 ±10 ±11.5 ±10		V V V V
Z_O	Open-Loop Output Resistance	V_O = 0, I_O = 0		70 (Typ)		70 (Typ)		70 (Typ)		70 (Typ)		70 (Typ)		Ω
P_D	Power Dissipation	RH27E RH27C			140 170		140 170		140 170		140 170		140 170	mW mW

Note 1: Input offset voltage measurements are performed by automatic test equipment approximately 0.5 seconds after application of power.

Note 2: Long-term input offset voltage stability refers to the averaged trend line of offset voltage vs time over extended periods after the first 30 days of operation. Excluding the initial hour of operation, changes in V_{OS} during the first 30 days are typically 2.5µV. Refer to the typical performance curve.

Note 3: Sample tested to an LTPD of 15 on every lot. Contact factory for 100% testing of 10Hz voltage density noise.

Note 4: Parameter is guaranteed by design, characterization, or correlation to other tested parameters.

Note 5: See test circuit and frequency response curve for 0.1Hz to 10Hz tester on OP-27/OP-37 data sheet.

Note 6: See test circuit for current noise measurement on OP-27/OP-37 data sheet.

Note 7: The average input offset drift performance is within the specifications unnulled or when nulled with a pot having a range 8kΩ to 20kΩ.

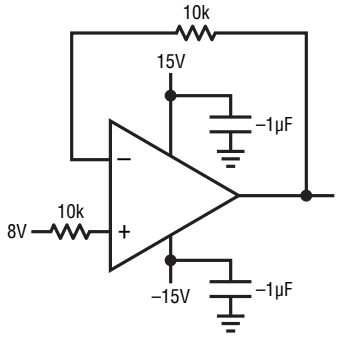
Note 8: The RH27's inputs are protected by back-to-back diodes. Current limiting resistors are not used in order to achieve low noise. If differential input voltage exceeds ±0.7V, the input current should be limited to 25mA.

Note 9: V_S = ±15V, V_{CM} = 0V unless otherwise noted.

Note 10: T_A = 25°C, V_S = ±15V, V_{CM} = 0V, unless otherwise noted.

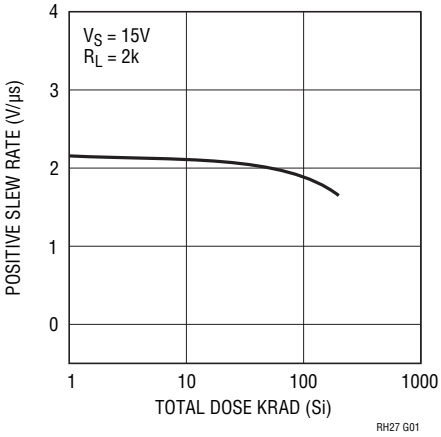
Note 11: RH27AEW is marked and processed as RH27EW. Orders will be delivered through box stock screening at 25°C, –55°C to 125°C to the V_{OS} specification shown on Table 1.

TOTAL DOSE BIAS CIRCUIT

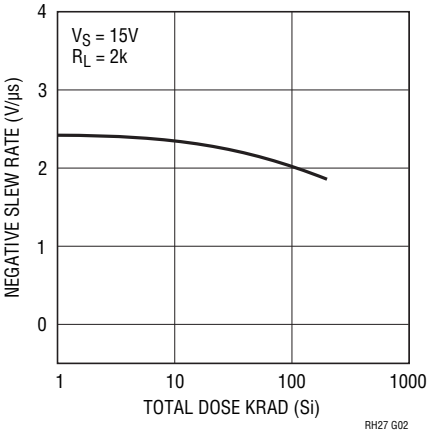


TYPICAL PERFORMANCE CHARACTERISTICS

Positive Slew Rate

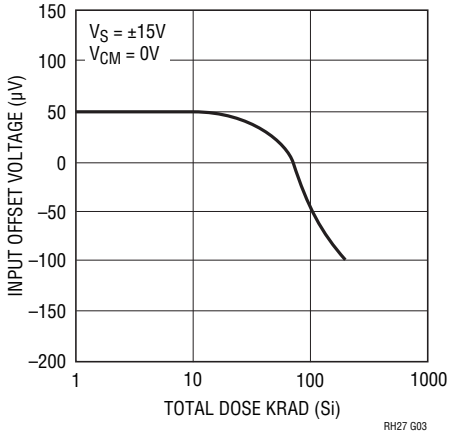


Negative Slew Rate

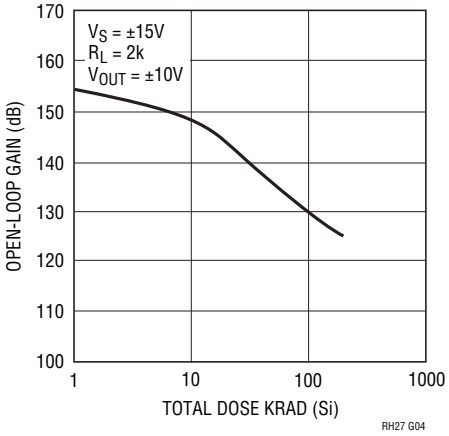


TYPICAL PERFORMANCE CHARACTERISTICS

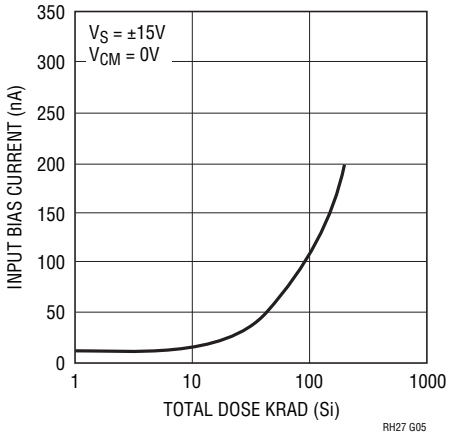
Input Offset Voltage



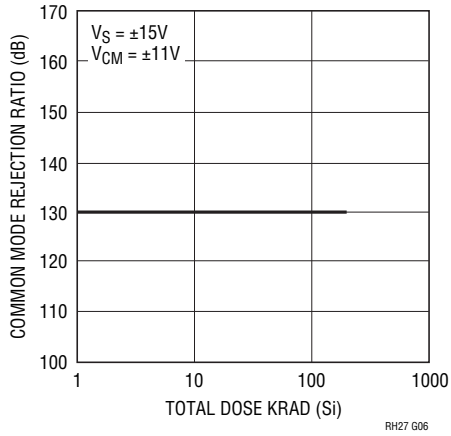
Open-Loop Gain



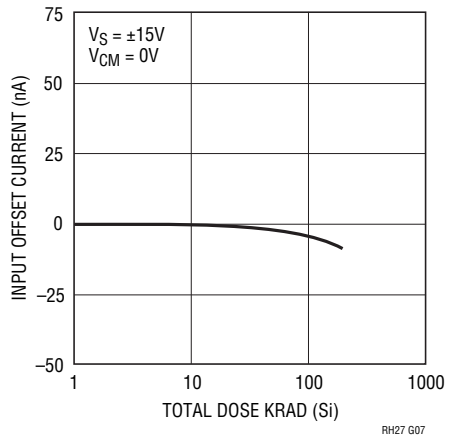
Input Bias Current



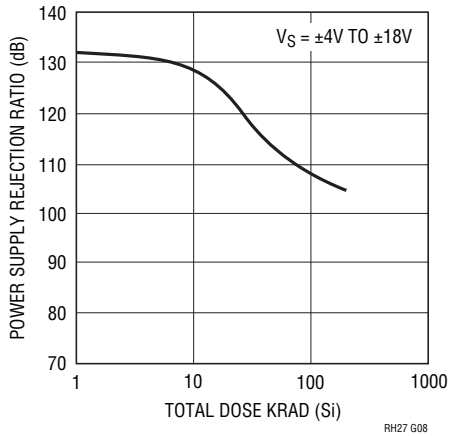
Common Mode Rejection Ratio



Input Offset Current



Power Supply Rejection Ratio



REVISION HISTORY

REV	DATE	DESCRIPTION	PAGE NUMBER
E	07/23	Updated art title in the Electrical Characteristics section and updated the document to ADI format	1–6

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 Group C and D for Class B End Point Electrical Parameters (Method 5005)	1

*PDA applies to subgroup 1. See PDA Test Notes.

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 Class B. 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.