

## 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  $3.5\text{nV}/\sqrt{\text{Hz}}$  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.

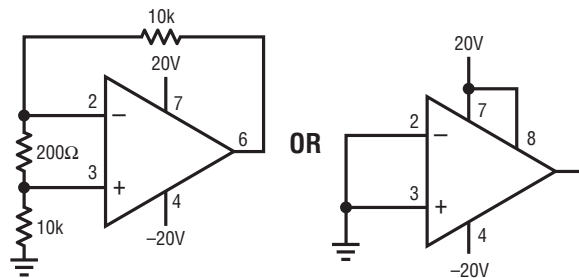
For complete electrical specifications and performance curves see the OP-27/OP-37 data sheet.

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage .....	$\pm 22\text{V}$
Internal Power Dissipation .....	500mW
Input Voltage.....	Equal to Supply Voltage
Output Short-Circuit Duration .....	Indefinite
Differential Input Current (Note 8) .....	$\pm 25\text{mA}$
Operating Temperature Range.....	$-55^\circ\text{C}$ to $125^\circ\text{C}$
Junction Temperature Range .....	$-55^\circ\text{C}$ to $150^\circ\text{C}$
Storage Temperature Range.....	$-65^\circ\text{C}$ to $150^\circ\text{C}$
Lead Temperature (Soldering, 10 sec) .....	$300^\circ\text{C}$

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## BURN-IN CIRCUIT



## PACKAGE INFORMATION

<p>TOP VIEW V<sub>OS</sub> TRIM</p> <p>V<sub>OS</sub> TRIM 1 -IN 2 +IN 3 V<sup>-</sup> (CASE) 4 H PACKAGE 8-LEAD TO-5 METAL CAN</p>	<p>TOP VIEW</p> <p>V<sub>OS</sub> TRIM 1 -IN 2 +IN 3 V<sup>-</sup> 4 J8 PACKAGE 8-LEAD CERDIP</p>	<p>TOP VIEW</p> <p>NC 1 V<sub>OS</sub> TRIM 2 -IN 3 +IN 4 V<sup>-</sup> 5 W PACKAGE 10-LEAD CERPAC</p>
ORDER PART NUMBER	ORDER PART NUMBER	ORDER PART NUMBER
RH27EH RH27CH	RH27CJ8	RH27AEW (Note 11) RH27EW RH27CW

**TABLE 1: ELECTRICAL CHARACTERISTICS**

(Preirradiation) (Note 9)

SYMBOL	PARAMETER	CONDITIONS	NOTES	$T_A = 25^\circ\text{C}$			SUB-GROUP	$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$			SUB-GROUP	UNITS	
				MIN	TYP	MAX		MIN	TYP	MAX			
$V_{OS}$	Input Offset Voltage	RH27AE	11			35	4			60	2, 3	$\mu\text{V}$	
		RH27E	1			55	4			100	2, 3	$\mu\text{V}$	
		RH27C	1			100	4			300	2, 3	$\mu\text{V}$	
$\frac{\Delta V_{OS}}{\Delta \text{Temp}}$	Average Offset Drift	RH27E	4, 7							1		$\mu\text{V}/^\circ\text{C}$	
		RH27C	4, 7							1.8		$\mu\text{V}/^\circ\text{C}$	
$\frac{\Delta V_{OS}}{\Delta \text{Time}}$	Long-Term Input Offset Voltage Stability	RH27E	2, 4			1						$\mu\text{V}/\text{Month}$	
		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				$\pm 40$	1			$\pm 60$	2, 3	nA	
		RH27C				$\pm 80$	1			$\pm 150$	2, 3	nA	
$e_n$	Input Noise Voltage	0.1Hz to 10Hz (RH27E)	4, 5			0.18						$\mu\text{V}_{P-P}$	
		0.1Hz to 10Hz (RH27C)	4, 5			0.25						$\mu\text{V}_{P-P}$	
	Input Noise Voltage Density	$f_0 = 10\text{Hz}$ (RH27E)	3			5.5						$\text{nV}/\sqrt{\text{Hz}}$	
		$f_0 = 30\text{Hz}$ (RH27E)	4			4.5						$\text{nV}/\sqrt{\text{Hz}}$	
		$f_0 = 1000\text{Hz}$ (RH27E)	4			3.8						$\text{nV}/\sqrt{\text{Hz}}$	
		$f_0 = 10\text{Hz}$ (RH27C)	3			8						$\text{nV}/\sqrt{\text{Hz}}$	
		$f_0 = 30\text{Hz}$ (RH27C)	4			5.6						$\text{nV}/\sqrt{\text{Hz}}$	
		$f_0 = 1000\text{Hz}$ (RH27C)	4			4.5							$\text{nV}/\sqrt{\text{Hz}}$
$i_n$	Input Noise Current Density	$f_0 = 1000\text{Hz}$	4, 6			0.6						$\text{pA}/\sqrt{\text{Hz}}$	
	Input Resistance Common Mode	RH27E				3						G $\Omega$	
		RH27C				2						G $\Omega$	
	Input Voltage Range	RH27E	4			$\pm 11$				$\pm 10.3$		V	
		RH27C	4			$\pm 11$				$\pm 10.2$		V	
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 11\text{V}$ (RH27E)			114		1					dB	
		$V_{CM} = \pm 10\text{V}$ (RH27E)							108		2, 3	dB	
		$V_{CM} = \pm 11\text{V}$ (RH27C)			100			1				2, 3	dB
		$V_{CM} = \pm 10\text{V}$ (RH27C)								94		2, 3	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 4\text{V}$ to $\pm 18\text{V}$ (RH27E)			100		1					dB	
		$V_S = \pm 4.5\text{V}$ to $\pm 18\text{V}$ (RH27E)							96		2, 3	dB	
		$V_S = \pm 4\text{V}$ to $\pm 18\text{V}$ (RH27C)			94			1				2, 3	dB
		$V_S = \pm 4.5\text{V}$ to $\pm 18\text{V}$ (RH27C)								86		2, 3	dB
$A_{VOL}$	Large-Signal Voltage Gain	$R_L \geq 2\text{k}\Omega$ , $V_O = \pm 10\text{V}$ (RH27E)	4		1000		4		600		5, 6	V/mV	
		$R_L \geq 600\Omega$ , $V_O = \pm 1\text{V}$ (RH27E)		250				V/mV					
		$R_L \geq 2\text{k}\Omega$ , $V_O = \pm 10\text{V}$ (RH27C)	4		700		4		300		5, 6	V/mV	
		$R_L \geq 600\Omega$ , $V_O = \pm 1\text{V}$ (RH27C)		200				V/mV					
$V_{OUT}$	Maximum Output Voltage Swing	$R_L \geq 2\text{k}\Omega$ (RH27E)			$\pm 12$		4		$\pm 11.5$		5, 6	V	
		$R_L \geq 600\Omega$ (RH27E)			$\pm 10$					V			
		$R_L \geq 2\text{k}\Omega$ (RH27C)			$\pm 11.5$		4		$\pm 10.5$		5, 6	V	
		$R_L \geq 600\Omega$ (RH27C)			$\pm 10$					V			
SR	Slew Rate	$R_L \geq 2\text{k}\Omega$			1.7		7				V/ $\mu\text{s}$		
GBW	Gain-Bandwidth Product	$f_0 = 100\text{kHz}$	4		5						MHz		
$Z_O$	Open-Loop Output Resistance	$V_O = 0$ , $I_O = 0$			70						$\Omega$		
$P_D$	Power Dissipation	RH27E				140	1					mW	
		RH27C				170	1					mW	

rh27fd

**TABLE 1A: ELECTRICAL CHARACTERISTICS**

(Postirradiation) (Note 10)

SYMBOL	PARAMETER	CONDITIONS	NOTES	10KRAD(Si)		20KRAD(Si)		50KRAD(Si)		100KRAD(Si)		200KRAD(Si)		UNITS
				MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
V <sub>OS</sub>	Input Offset Voltage	RH27E	1	55	80	100	150	200	μV					
		RH27C	1	100	130	180	280	400	μV					
I <sub>OS</sub>	Input Offset Current	RH27E		35	40	50	60	90	nA					
		RH27C		75	75	90	120	180	nA					
I <sub>B</sub>	Input Bias Current	RH27E		±40	±50	±80	±100	±200	nA					
		RH27C		±80	±80	±125	±200	±400	nA					
	Input Resistance Common Mode	RH27E		3 (Typ)	3 (Typ)	3 (Typ)	3 (Typ)	3 (Typ)	GΩ					
		RH27C		2 (Typ)	2 (Typ)	2 (Typ)	2 (Typ)	2 (Typ)	GΩ					
	Input Voltage Range		4	±11	±11	±11	±11	±11	V					
CMRR	Common Mode Rejection Ratio	V <sub>CM</sub> = ±11V (RH27E)		114	114	110	105	100	dB					
		V <sub>CM</sub> = ±11V (RH27C)		100	100	97	94	90	dB					
PSRR	Power Supply Rejection Ratio	V <sub>S</sub> = ±4V to ±18V (RH27E)		100	100	98	96	94	dB					
		V <sub>S</sub> = ±4V to ±18V (RH27C)		94	94	92	90	86	dB					
A <sub>VOL</sub>	Large-Signal Voltage Gain	R <sub>L</sub> ≥ 2kΩ, V <sub>O</sub> = ±10V (RH27E)		1000	1000	1000	900	800	V/mV					
V <sub>OUT</sub>	Maximum Output Voltage Swing	R <sub>L</sub> ≥ 2kΩ (RH27E)		±12	±12	±12	±12	±12	V					
		R <sub>L</sub> ≥ 600Ω (RH27E)		±10	±10	±10	±10	±10	V					
		R <sub>L</sub> ≥ 2kΩ (RH27C)		±11.5	±11.5	±11.5	±11.5	±11.5	V					
		R <sub>L</sub> ≥ 600Ω (RH27C)		±10	±10	±10	±10	±10	V					
Z <sub>O</sub>	Open-Loop Output Resistance	V <sub>O</sub> = 0, I <sub>O</sub> = 0		70 (Typ)	70 (Typ)	70 (Typ)	70 (Typ)	70 (Typ)	Ω					
P <sub>D</sub>	Power Dissipation	RH27E		140	140	140	140	140	mW					
		RH27C		170	170	170	170	170	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<sub>OS</sub> 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 unnullled or when nullled with a pot having a range 8kΩ to 20kΩ.

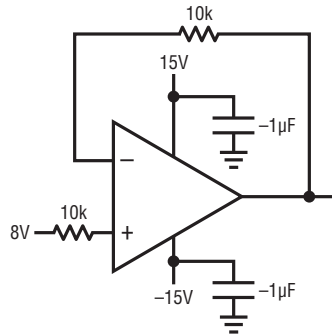
**Note 8:** The RH27's inputs are protected by back-to-back diodes. Current limiting resistors are not used in order to achieve low noise. If differential input voltage exceeds ±0.7V, the input current should be limited to 25mA.

**Note 9:** V<sub>S</sub> = ±15V, V<sub>CM</sub> = 0V unless otherwise noted.

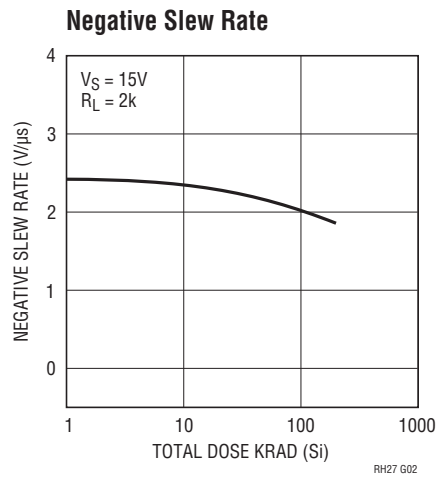
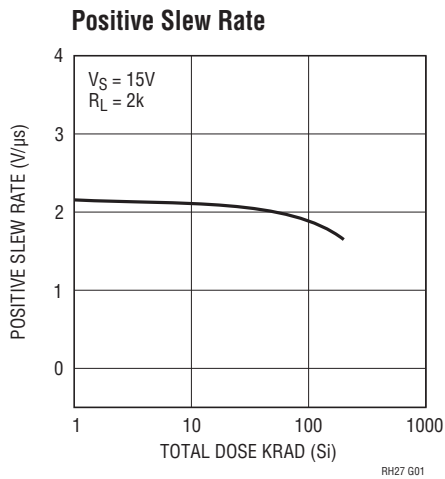
**Note 10:** T<sub>A</sub> = 25°C, V<sub>S</sub> = ±15V, V<sub>CM</sub> = 0V, unless otherwise noted.

**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<sub>OS</sub> specification shown on Table 1.

## TOTAL DOSE BIAS CIRCUIT

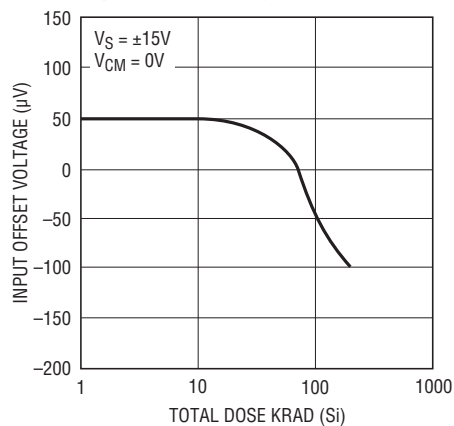


## TYPICAL PERFORMANCE CHARACTERISTICS

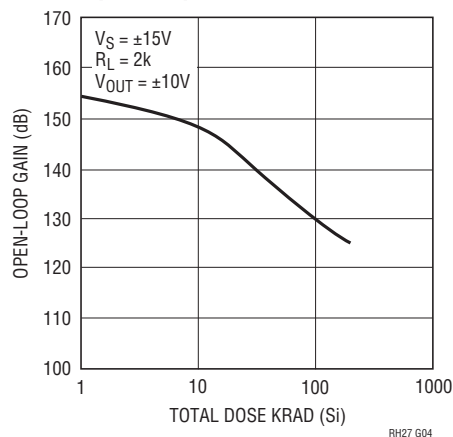


## TYPICAL PERFORMANCE CHARACTERISTICS

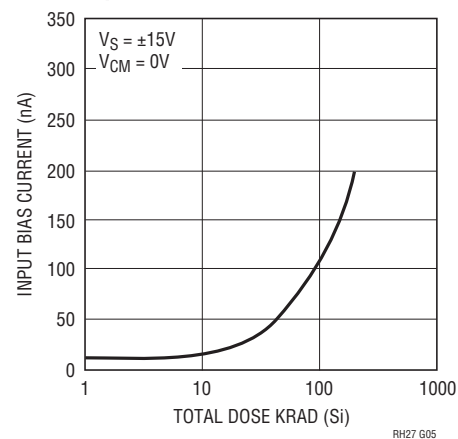
### Input Offset Voltage



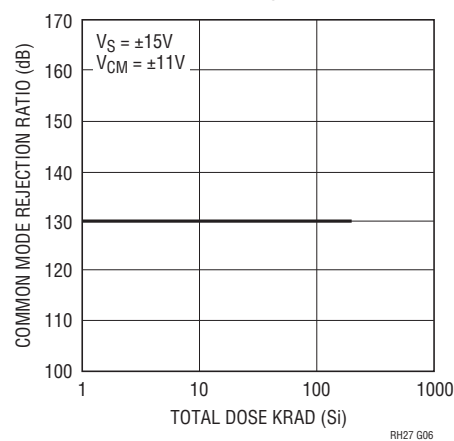
### Open-Loop Gain



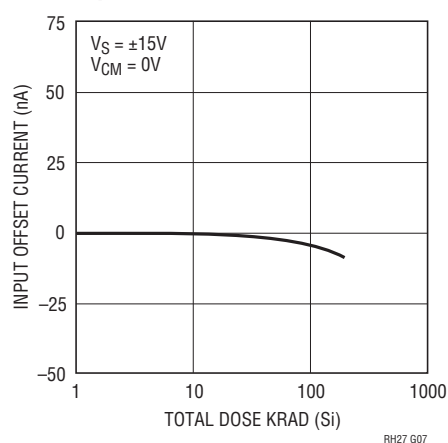
### Input Bias Current



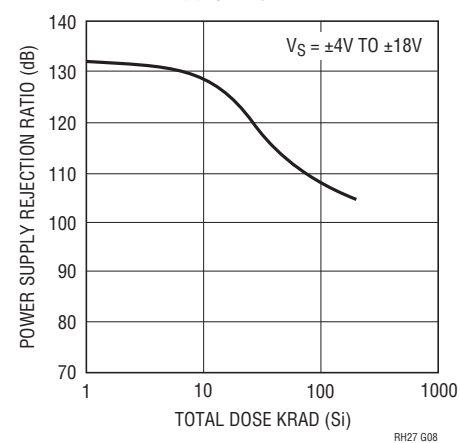
### Common Mode Rejection Ratio



### Input Offset Current



### Power Supply Rejection Ratio



**TABLE 2: ELECTRICAL TEST REQUIREMENTS**

<b>MIL-STD-883 TEST REQUIREMENTS</b>	<b>SUBGROUP</b>
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.