

DESCRIPTION

The RH1028 (gain of -1 stable)/RH1128 (gain of $+1$ stable) achieve a new standard of excellence in noise performance with $0.9\text{nV}/\sqrt{\text{Hz}}$ 1kHz noise, $1.0\text{nV}/\sqrt{\text{Hz}}$ 10Hz noise. This ultralow noise is combined with excellent high speed specifications (gain-bandwidth product is 75MHz for RH1028, 20MHz for RH1128), distortion-free output, and true precision parameters ($0.25\mu\text{V}/^\circ\text{C}$ drift, $20\mu\text{V}$ offset voltage, 25 million voltage gain). Although the RH1028/RH1128 input stage operates at nearly 1mA of collector current to achieve low voltage noise, input bias current is only 50nA.

The RH1028/RH1128's voltage noise is less than the noise of a 50Ω resistor. Therefore, even in very low source impedance transducer or audio amplifier applications, the RH1028/RH1128's contribution to total system noise will be negligible.

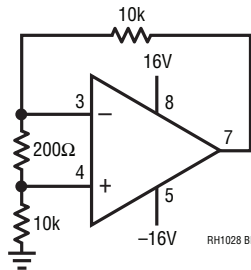
ABSOLUTE MAXIMUM RATINGS

(Note 1)

Supply Voltage (-55°C to 125°C)	$\pm 16\text{V}$
Differential Input Current (Note 9)	$\pm 25\text{mA}$
Input Voltage	Equal to Supply Voltage
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

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BURN-IN CIRCUIT



PACKAGE INFORMATION

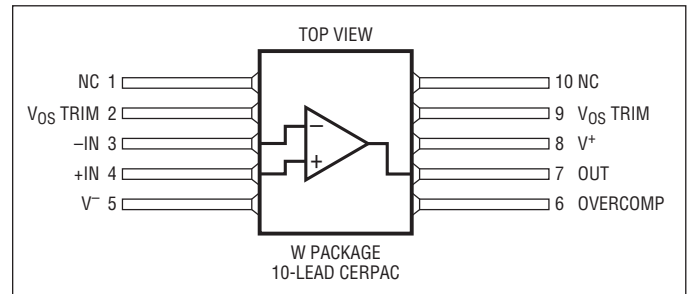


TABLE 1: ELECTRICAL CHARACTERISTICS

(Preirradiation) $V_S = \pm 15\text{V}$, $V_{CM} = 0\text{V}$, unless otherwise noted.

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		2		20	80	1		45	180	2, 3	μV
$\frac{\Delta V_{OS}}{\Delta \text{Time}}$	Long-Term Input Offset Voltage Stability		3		0.3							$\mu\text{V}/M_0$
$\frac{\Delta V_{OS}}{\Delta \text{Temp}}$	Average Input Offset Voltage Drift		8					0.25	1.0			$\mu\text{V}/^\circ\text{C}$
I_{OS}	Input Offset Current	$V_{CM} = 0\text{V}$			18	150	1		30	200	2, 3	nA
I_B	Input Bias Current	$V_{CM} = 0\text{V}$			± 50	± 400	1		± 100	± 600	2, 3	nA
e_n	Input Noise Voltage Density	$f_0 = 10\text{Hz}$ $f_0 = 1000\text{Hz}$, 100% Tested	5		1.0	2.5						$\text{nV}/\sqrt{\text{Hz}}$ $\text{nV}/\sqrt{\text{Hz}}$
I_n	Input Noise Current Density	$f_0 = 10\text{Hz}$ $f_0 = 1000\text{Hz}$, 100% Tested	4, 6		4.7	24						$\text{pA}/\sqrt{\text{Hz}}$ $\text{pA}/\sqrt{\text{Hz}}$

rh10281128fb

RH1028M/RH1128M

TABLE 1: ELECTRICAL CHARACTERISTICS

(Preirradiation) $V_S = \pm 15V$, $V_{CM} = 0V$, unless otherwise noted.

SYMBOL	PARAMETER	CONDITIONS	NOTES	$T_A = 25^\circ C$			SUB-GROUP	$-55^\circ C \leq T_A \leq 125^\circ C$			SUB-GROUP	UNITS
				MIN	TYP	MAX		MIN	TYP	MAX		
	Input Resistance Common Mode Differential Mode				300 20							M Ω k Ω
	Input Capacitance				5							pF
	Input Voltage Range			± 11.0	± 12.2			± 10.3	± 11.7			V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 11V$ $V_{CM} = \pm 10.3V$		110	126		1	100	120		2, 3	dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 4V$ to $\pm 16V$ $V_S = \pm 4.5V$ to $\pm 16V$		110	132		1	104	130		2, 3	dB
A_{VOL}	Large-Scale Voltage Gain	$R_L \geq 2k$, $V_O = \pm 10V$ $R_L \geq 1k$, $V_O = \pm 10V$ $R_L \geq 600\Omega$, $V_O = \pm 10V$		5.0 3.5 2.0	25 20 15		4	2.0 1.5	14 10		5, 6	V/ μV V/ μV V/ μV
V_{OUT}	Maximum Output Voltage Swing	$R_L \geq 2k$ $R_L \geq 600\Omega$		± 12.0 ± 10.5	± 13.0 ± 12.2		4	± 10.3	± 11.6		5, 6	V V
SR	Slew Rate	$A_{VCL} = -1$ (RH1028) $A_{VCL} = -1$ (RH1128)		11.0 4.5	15 6		4					V/ μs V/ μs
GWB	Gain Bandwidth Product	$f_0 = 20kHz$ (RH1028) $f_0 = 200kHz$ (RH1128)	7 7	50 11	75 20							MHz MHz
Z_O	Open-Loop Output Impedance	$V_O = 0$, $I_O = 0$			80							Ω
I_S	Supply Current			7.6	10.5		1	9	13		2, 3	mA

TABLE 1A: ELECTRICAL CHARACTERISTICS

(Postirradiation) $V_S = \pm 15V$, $V_{CM} = 0V$, $T_A = 25^\circ C$, unless otherwise noted.

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_{OS}	Input Offset Voltage		2	100		120		140		160		180		μV
I_{OS}	Input Offset Current			200		200		200		300		500		nA
I_B	Input Bias Current			± 600		± 600		± 600		± 900		± 1500		nA
SR	Slew Rate	$A_{VCL} = -1$ (RH1028) $A_{VCL} = -1$ (RH1128)		7.5 3.0		7.5 3.0		7.5 3.0		7.5 3.0		7.5 3.0		V/ μs V/ μs
	Input Voltage Range			± 11		± 11		± 11		± 11		± 11		V
CMRR	Common Mode Rejection Ratio	$V_{CM} = \pm 11V$		106		106		106		106		106		dB
PSRR	Power Supply Rejection Ratio	$V_S = \pm 4V$ to $\pm 16V$		104		104		104		104		104		dB
A_{VOL}	Large-Signal Voltage Gain	$R_L \geq 2k$, $V_O = \pm 10V$		2		2		2		2		2		V/ μV
V_{OUT}	Maximum Output Voltage Swing	$R_L \geq 2k$ $R_L \geq 600\Omega$		± 11.5 ± 10		± 11.5 ± 10		± 11.5 ± 10		± 11.5 ± 10		± 11.5 ± 10		V V

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: Input offset voltage measurements are performed by automatic test equipment approximately 0.5 seconds after application of power. In addition, at $T_A = 25^\circ C$, offset voltage is measured with the chip heated to approximately $55^\circ C$ to account for the chip temperature rise when the device is fully warmed up.

Note 3: Long-term input offset voltage stability refers to the average 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 $2.5\mu V$.

Note 4: This parameter is tested on a sample basis only.

Note 5: 10Hz noise voltage density is sample tested on every lot. Devices 100% tested at 10Hz are available on request.

Note 6: Current noise is defined and measured with balanced source resistors. The resultant voltage noise (after subtracting the resistor noise

TABLE 1A: ELECTRICAL CHARACTERISTICS

on an RMS basis) is divided by the sum of the two source resistors to obtain current noise. Maximum 10Hz current noise can be inferred from 100% testing at 1kHz.

Note 7: Gain-bandwidth product is not tested. It is guaranteed by design and by inference from the slew rate measurement.

Note 8: This parameter is not 100% tested.

Note 9: The 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 $\pm 1.8V$, the input current should be limited to 25mA.

TABLE 2: ELECTRICAL TEST REQUIREMENTS

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

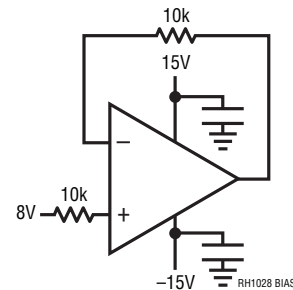
*PDA Applies to subgroup 1. See PDA Test Notes.

PDA Test Notes

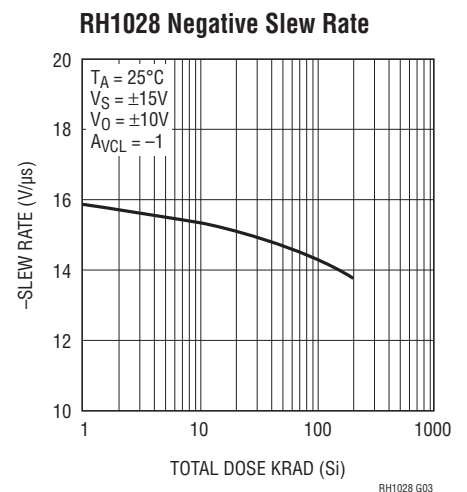
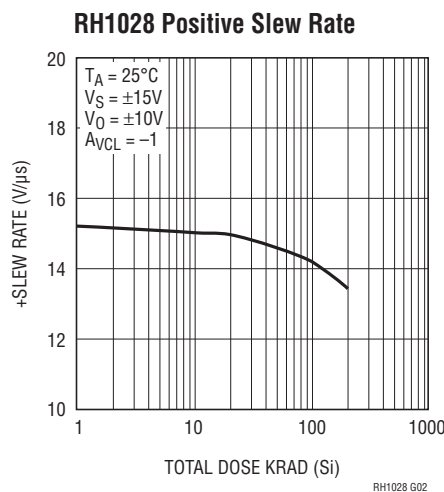
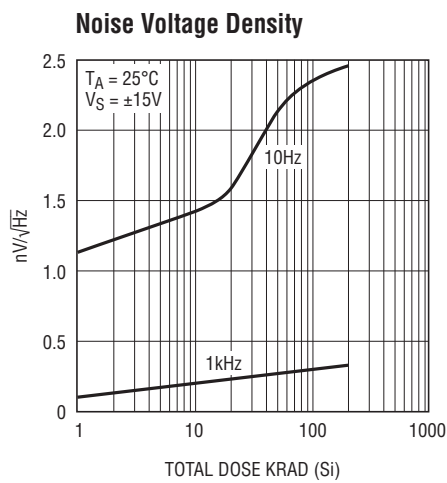
The PDA is specified as 5% based on failures from group A, subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883 Class B. The verified failures (including Delta parameters) of group A, subgroup 1, after burn-in divided by the total number of devices 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

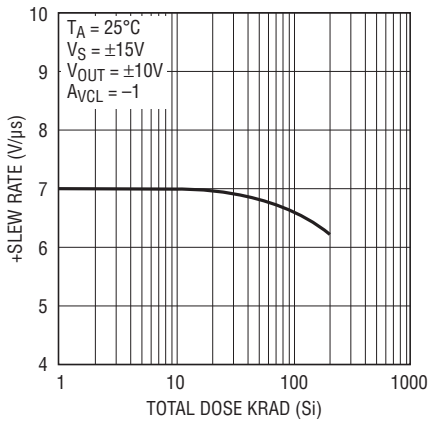


TYPICAL PERFORMANCE CHARACTERISTICS



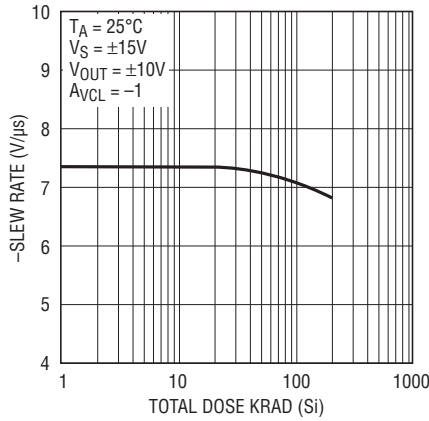
TYPICAL PERFORMANCE CHARACTERISTICS

RH1128 Positive Slew Rate



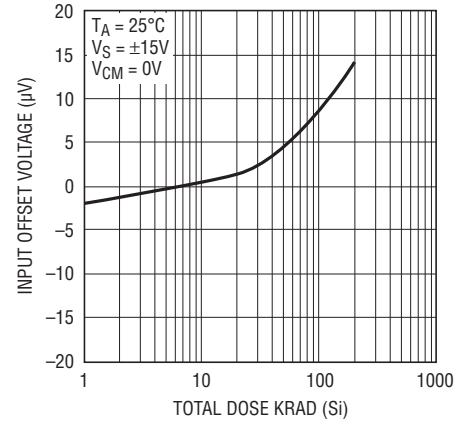
RH1028 G04

RH1128 Negative Slew Rate



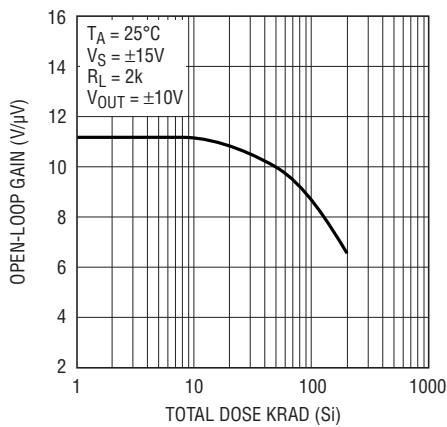
RH1028 G05

Input Offset Voltage



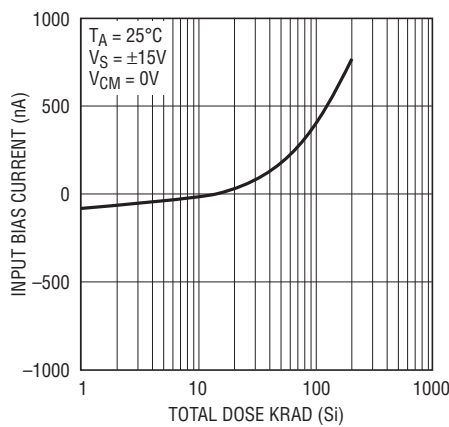
RH1028 G06

Open-Loop Gain



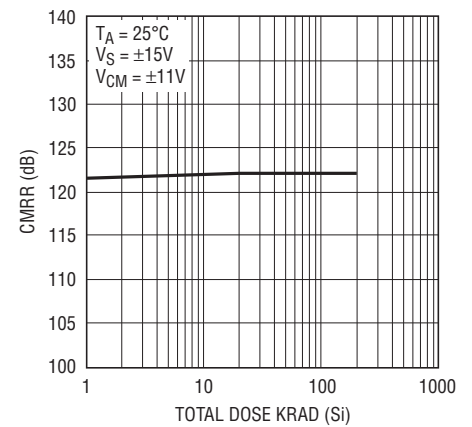
RH1028 G07

Input Bias Current



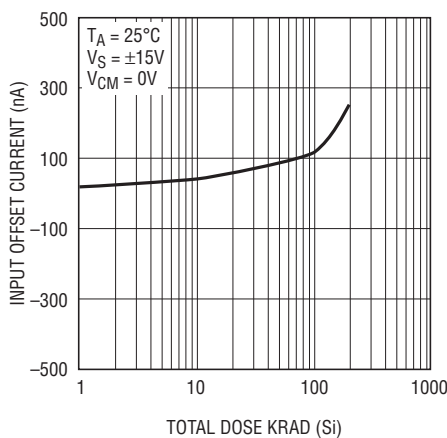
RH1028 G08

Common Mode Rejection Ratio



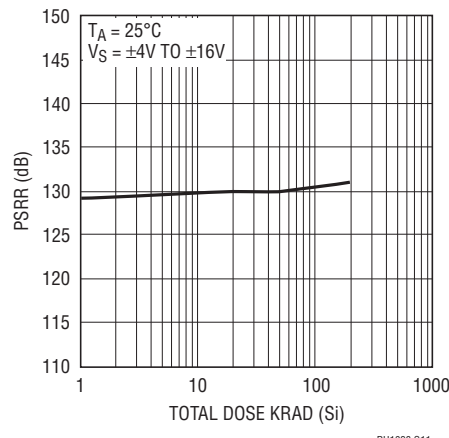
RH1028 G09

Input Offset Current



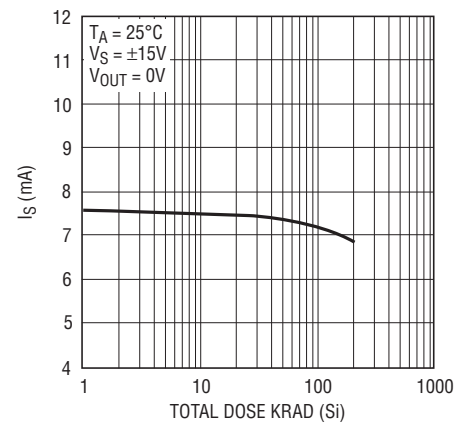
RH1028 G10

Power Supply Rejection Ratio



RH1028 G11

Supply Current



RH1028 G12