Quad 3mA, 100MHz, 750V/µs Operational Amplifier

DESCRIPTION

The RH1814 is a quad, low power, high speed, very high slew rate operational amplifier with excellent DC performance, reduced supply current, lower input offset voltage, lower input bias current and higher DC gain than other devices with comparable bandwidth. The circuit topology is a voltage feedback amplifier with the slewing characteristics of a current feedback amplifier.

The output drives a 100Ω load to ±3.35V with ±5V supplies. On a single 5V supply, the output swings from 1.1V to 3.7V with a 100Ω load connected to 2.5V. The amplifiers are stable with a 1000pF capacitive load making them useful in buffer and cable driver applications.

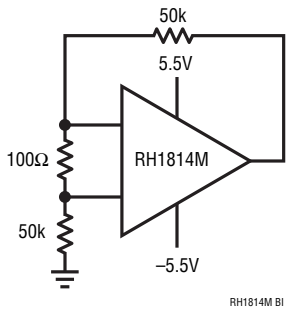
The RH1814 is manufactured on Linear Technology's advanced low voltage complementary bipolar process.

ABSOLUTE MAXIMUM RATINGS

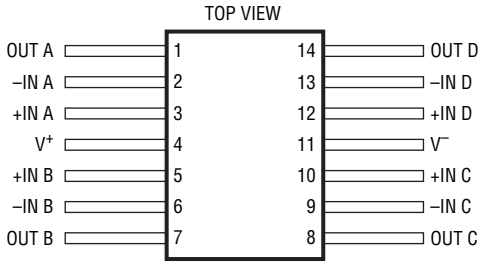
(Note 1)

Supply Voltage 12.6V
Differential Input Voltage (Note 2) ..... ±6V
Input Voltage ..... $\pm V_S$
Output Short-Circuit Duration (Note 3) ..... Indefinite
Operating Temperature Range ..... –55°C to 125°C
Storage Temperature Range ..... –65°C to 150°C
Lead Temperature (Soldering, 10 sec)..... 300°C

BURN-IN CIRCUIT



PACKAGE INFORMATION



W PACKAGE
14-LEAD FLATPAK GLASS SEALED

TABLE 1: ELECTRICAL CHARACTERISTICS (Pre-Irradiation)

V_S = ±5V, V_{CM} = 0V, unless otherwise noted. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	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	(Note 4)			1.5	1			4	2, 3	mV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Tempco of Offset Voltage	(Note 5)							30		µV/°C
I_{OS}	Input Offset Current				400	1			1000	2, 3	nA
I_B	Input Bias Current				±4	1			±10	2, 3	µA
e_n	Input Noise Voltage Density	f_O = 10kHz		8							nV/√Hz
i_n	Input Noise Current Density	f_O = 10kHz		1							pA/√Hz
R_{IN}	Input Resistance	V_{CM} = ±3.5V	3								MΩ
A_{VOL}	Large-Signal Voltage Gain	V_O = ±3V, R_L ≥ 500Ω V_O = ±3V, R_L ≥ 100Ω	1.5 1			4 4	0.7 0.5			5, 6	V/mV V/mV
	Input Voltage Range	Guaranteed by CMRR	±3.5				±3.5				V
CMRR	Common Mode Rejection Ratio	V_{CM} = ±3.5V	75			1	70				dB
PSRR	Power Supply Rejection Ratio	V_S = ±2V to ±5.5V	78			1	72			2, 3	dB
	Channel Separation	V_O = ±3V, R_L = 100Ω	82			1	78				dB
V_{OUT}	Output Voltage Swing	R_L = 500Ω, 30mV Overdrive R_L = 100Ω, 30mV Overdrive	±3.8 ±3.35			4 4	±3.4 ±3			5, 6 5, 6	V V
I_{OUT}	Maximum Output Current	V_{OUT} = ±3V, 30mV Overdrive	±40				±20				mA
I_{SC}	Output Short-Circuit Current	V_{OUT} = 0V, 1V Overdrive (Note 3)	±75				±40				mA
I_S	Supply Current	per Amplifier			3.6	1			6.5	2, 3	mA

TABLE 2: ELECTRICAL CHARACTERISTICS (Post-Irradiation)

V_S = ±5V, V_{CM} = 0V, T_A = 25°C, unless otherwise noted. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	10KRAD(Si) MIN	10KRAD(Si) MAX	20KRAD(Si) MIN	20KRAD(Si) MAX	50KRAD(Si) MIN	50KRAD(Si) MAX	100KRAD(Si) MIN	100KRAD(Si) MAX	200KRAD(Si) MIN	200KRAD(Si) MAX	UNITS
V_{OS}	Input Offset Voltage	(Note 4)		2		2		4		4		4	mV
I_{OS}	Input Offset Current			500		500		750		1000		1500	nA
I_B	Input Bias Current			±5		±5		±7.5		±10		±15	µA
	Input Voltage Range	Guaranteed by CMRR	±3.5		±3.5		±3.5		±3.5		±3.5		V
CMRR	Common Mode Rejection Ratio	V_{CM} = ±3.5V	73		73		62		62		62		dB
PSRR	Power Supply Rejection Ratio	V_S = ±2V to ±5.5V	77		75		65		65		65		dB
A_{VOL}	Large-Signal Voltage Gain	V_O = ±3V, R_L = 500Ω V_O = ±3V, R_L = 100Ω	1.4 0.9		1.3 0.8		1.0 0.6		0.8 0.5		0.6 0.4		V/mV V/mV
V_{OUT}	Maximum Output Voltage Swing	R_L = 500Ω, 30mV Overdrive R_L = 100Ω, 30mV Overdrive	±3.8 ±3.35		±3.8 ±3.30		±3.7 ±3.25		±3.6 ±3.15		±3.5 ±3.05		V V
I_S	Supply Current	per Amplifier		3.6		3.6		3.6		3.6		3.6	mA

TABLE 1: ELECTRICAL CHARACTERISTICS (Pre-Irradiation)

V_S = 5V, 0V, V_{CM} = 2.5V, unless otherwise noted. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	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	(Note 4)			2	1			5	2, 3	mV
$\frac{\Delta V_{OS}}{\Delta Temp}$	Average Tempco of Offset Voltage	(Note 5)							30		µV/°C
I_{OS}	Input Offset Current				400	1			1000	2, 3	nA
I_B	Input Bias Current				±4	1			±10	2, 3	µA
e_n	Input Noise Voltage Density	f_O = 10kHz		8							nV/√Hz
i_n	Input Noise Current Density	f_O = 10kHz		1							pA/√Hz
R_{IN}	Input Resistance	V_{CM} = 1.5V to 3.5V	3								MΩ
A_{VOL}	Large-Signal Voltage Gain	V_O = 1.5V to 3.5V, R_L ≥ 500Ω V_O = 1.5V to 3.5V, R_L ≥ 100Ω	1 0.7			4 4	0.5 0.3			5, 6	V/mV V/mV
	Input Voltage Range (Positive)	Guaranteed by CMRR	3.5				3.5				V
	Input Voltage Range (Negative)	Guaranteed by CMRR			1.5				1.5		V
CMRR	Common Mode Rejection Ratio	V_{CM} = 1.5V to 3.5V	73			1	68				dB
PSRR	Power Supply Rejection Ratio	V_S = ±2V to ±5.5V	78			1	72			2, 3	dB
	Channel Separation	V_{OUT} = 1.5V to 3.5V, R_L = 100Ω	81			1	77				dB
V_{OUT}	Output Voltage Swing (Positive)	R_L = 500Ω, 30mV Overdrive R_L = 100Ω, 30mV Overdrive	3.9 3.7			4 4	3.5 3.3			5, 6 5, 6	V V
	Output Voltage Swing (Negative)	R_L = 500Ω, 30mV Overdrive R_L = 100Ω, 30mV Overdrive			1.1 1.3				1.3 1.5	 5, 6	V V
I_{OUT}	Maximum Output Current	V_{OUT} = 1.5V to 3.5V, 30mV Overdrive	±25				±15				mA
I_{SC}	Output Short-Circuit Current	V_{OUT} = 2.5V, 1V Overdrive (Note 3)	±55				±30				mA
I_S	Supply Current	per Amplifier			4	1			7.5	2, 3	mA

TABLE 2: ELECTRICAL CHARACTERISTICS (Post-Irradiation)

V_S = 5V, 0V, V_{CM} = 2.5V, T_A = 25°C, unless otherwise noted. Device is characterized at the TID levels below. Device is production tested at 100kRad(si).

SYMBOL	PARAMETER	CONDITIONS	10KRAD(Si) MIN	10KRAD(Si) MAX	20KRAD(Si) MIN	20KRAD(Si) MAX	50KRAD(Si) MIN	50KRAD(Si) MAX	100KRAD(Si) MIN	100KRAD(Si) MAX	200KRAD(Si) MIN	200KRAD(Si) MAX	UNITS
V_{OS}	Input Offset Voltage	(Note 4)		2.5		2.5		4.5		4.5		4.5	mV
I_{OS}	Input Offset Current			500		500		750		1000		1500	nA
I_B	Input Bias Current			±5		±5		±7.5		±10		±15	µA
	Input Voltage Range Negative Positive	Guaranteed by CMRR	 3.5	 1.5 	 3.5	 1.5 	 3.5	 1.5 	 3.5	 1.5 	 3.5	 1.5 	 V V
CMRR	Common Mode Rejection Ratio	V_{CM} = 1.5V to 3.5V	71		71		60		60		60		dB
PSRR	Power Supply Rejection Ratio	V_S = ±2V to ±5.5V	77		75		65		65		65		dB
A_{VOL}	Large-Signal Voltage Gain	V_O = 1.5V to 3.5V, R_L = 500Ω V_O = 1.5V to 3.5V, R_L = 100Ω	0.9 0.6		0.8 0.55		0.6 0.45		0.5 0.40		0.4 0.35		V/mV V/mV
V_{OUT}	Maximum Output Voltage Swing (Positive)	R_L = 500Ω, 30mV Overdrive R_L = 100Ω, 30mV Overdrive	3.9 3.7		3.9 3.65		3.8 3.55		3.7 3.45		3.6 3.40		V V
	Maximum Output Voltage Swing (Negative)	R_L = 500Ω, 30mV Overdrive R_L = 100Ω, 30mV Overdrive		1.1 1.3		1.1 1.35		1.15 1.4		1.2 1.45		1.3 1.5	V V
I_S	Supply Current	per Amplifier		4		4		4		4		4	mA

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: Differential inputs of ±6V are appropriate for transient operation only, such as during slewing. Large sustained differential inputs can cause excessive power dissipation and may damage the part.

Note 3: A heat sink may be required to keep the junction temperature below absolute maximum when the output is shorted indefinitely.

Note 4: Input offset voltage is pulse tested and is exclusive of warm-up drift.

Note 5: This parameter is not 100% tested.

TABLE 2: ELECTRICAL TEST REQUIREMENTS

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

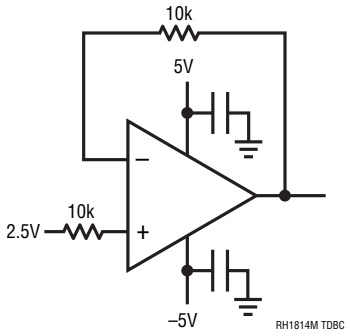
* PDA applies to subgroup 1. See PDA Test Notes.

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. 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.

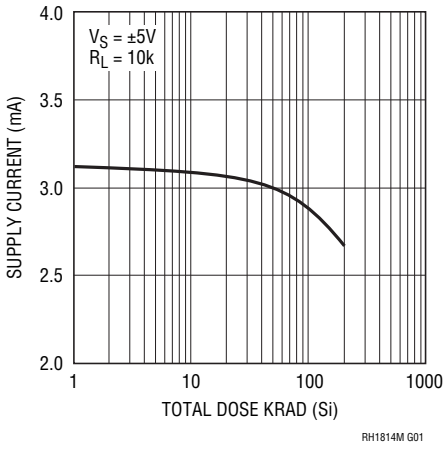
Linear Technology Corporation reserves the right to test to tighter limits than those given.

TOTAL DOSE BIAS CIRCUIT

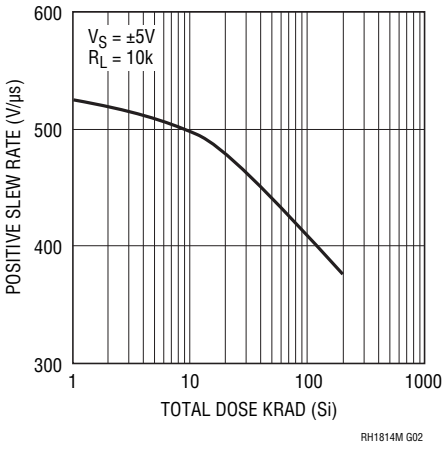


TYPICAL PERFORMANCE CHARACTERISTICS

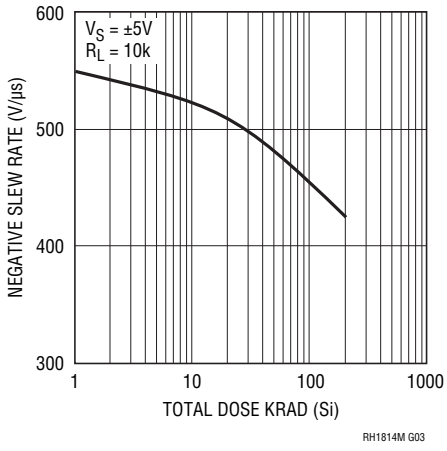
Supply Current (Per Amplifier)



Positive Slew Rate

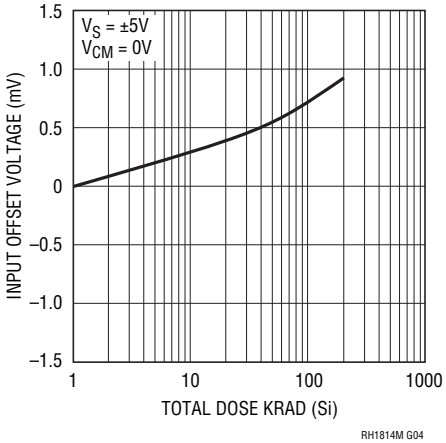


Negative Slew Rate

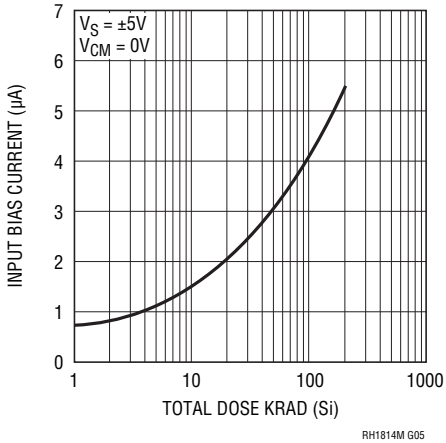


TYPICAL PERFORMANCE CHARACTERISTICS

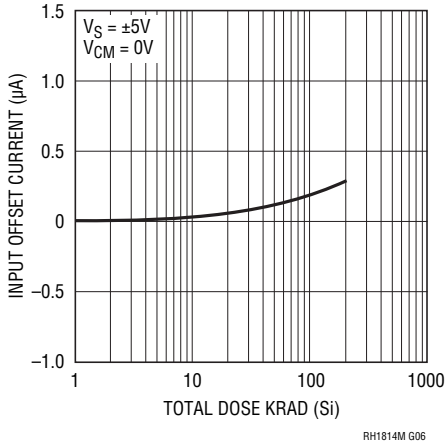
Input Offset Voltage



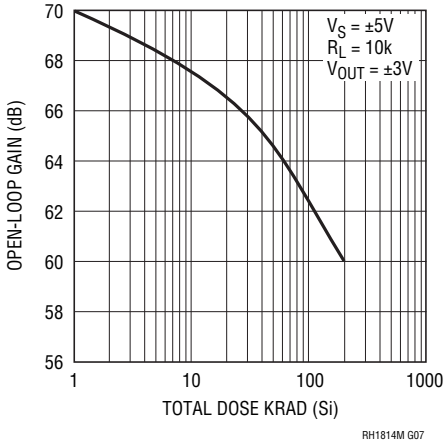
Input Bias Current



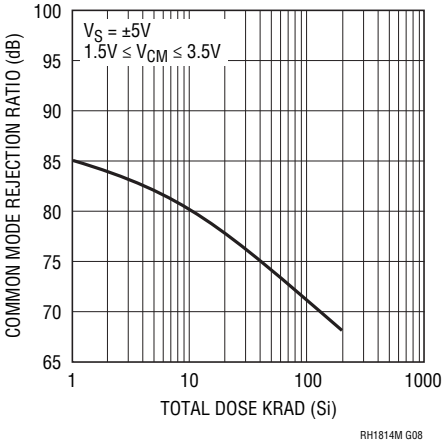
Input Offset Current



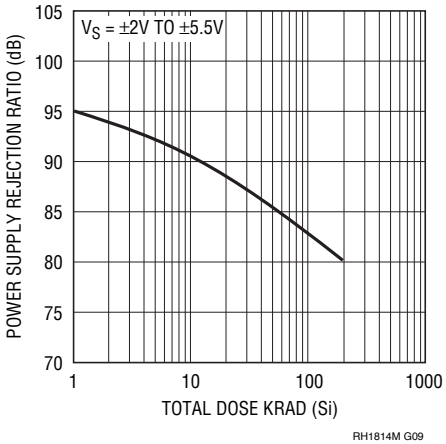
Open-Loop Gain



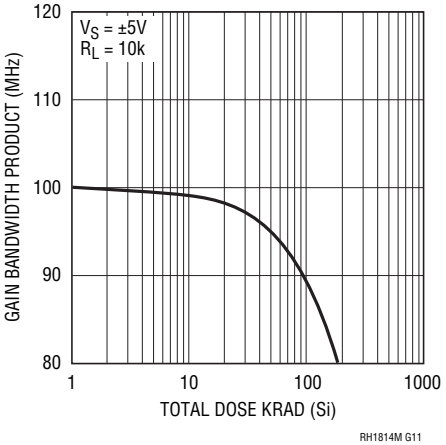
Common Mode Rejection Ratio



Power Supply Rejection Ratio



Gain-Bandwidth Product



REVISION HISTORY

REV	DATE	DESCRIPTION	PAGE NUMBER
A	02/10	Changes to Electrical Characteristics	3, 4, 5
B	12/10	Revised section headers	3, 4, 5
C	07/23	Updated art title in the Electrical Characteristics section and updated the document to ADI format	1–8