

Voltage Comparator

DESCRIPTION

The **RH1011** is a general purpose comparator with significantly better input characteristics than the LM111. Although pin compatible with the LM111, it offers four times lower bias current, six times lower offset voltage and five times higher voltage gain.

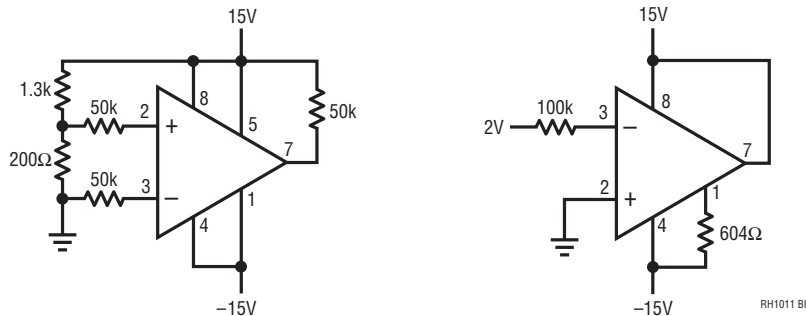
The wafer lots are processed to Analog Devices' in-house Class S flow to yield circuits usable in stringent military applications.

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ABSOLUTE MAXIMUM RATINGS

Supply Voltage (Pin 8 to Pin 4)	36V
Output to Negative Supply (Pin 7 to Pin 4)	35V
Ground to Negative Supply (Pin 1 to Pin 4)	30V
Differential Input Voltage	$\pm 35V$
Voltage at STROBE Pin (Pin 6 to Pin 8)	5V
Input Voltage (Note 1)	Equal to Supplies
Output Short-Circuit Duration	10 sec
Operating Temperature Range	
(Note 2)	$-55^{\circ}C$ to $125^{\circ}C$
Storage Temperature Range	$-65^{\circ}C$ to $150^{\circ}C$
Lead Temperature (Soldering, 10 sec)	$300^{\circ}C$

BURN-IN CIRCUIT



PACKAGE INFORMATION

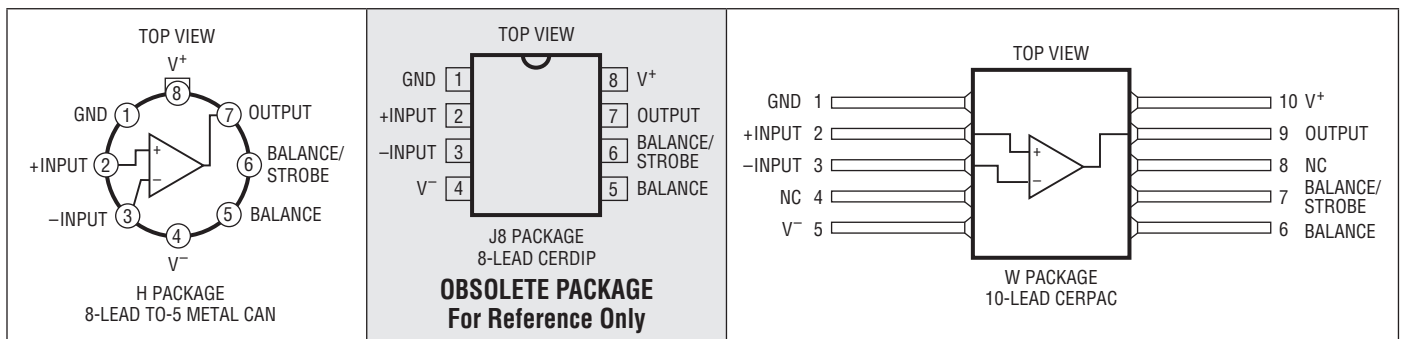


TABLE 1: ELECTRICAL CHARACTERISTICS (Preirradiation) (Note 10)

SYMBOL	PARAMETER	CONDITIONS	NOTES	$T_A = 25^\circ\text{C}$			$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$			UNITS
				MIN	TYP	MAX	MIN	TYP	MAX	
V_{OS}	Input Offset Voltage	$R_S \leq 50\text{k}\Omega$	3		1.5	1			3.0	mV
			4		2.0	1			3.0	mV
I_{OS}	Input Offset Current		3,4		4	1			20	nA
I_B	Input Bias Current		3		50	1			80	nA
			4		65	1			80	nA
$\frac{\Delta V_{OS}}{\Delta T}$	Input Offset Voltage Drift	$T_{MIN} \leq T \leq T_{MAX}$	5,9						25	$\mu\text{V}/^\circ\text{C}$
A_{VOL}	Large Signal Voltage Gain	$V_S = \pm 15\text{V}$, $R_L = 1\text{k}\Omega$, $-10\text{V} \leq V_{OUT} \leq 14.5\text{V}$		200		4				V/mV
		$V_S = 5\text{V}$, $R_L = 500\Omega$, $0.5\text{V} \leq V_{OUT} \leq 4.5\text{V}$		50		4				V/mV
CMRR	Common Mode Rejection Ratio			90		1				dB
	Input Voltage Range	$V_S = \pm 15\text{V}$	8,9	-14.5	13		-14.5		13	V
		$V_S = \text{Single } 5\text{V}$	8,9	0.5	3.0		0.5		3.0	V
t_d	Response Time		6,9		250					ns
V_{OL}	Output Saturation Voltage	$V_{IN} = -5\text{mV}$, $I_{SINK} = 8\text{mA}$ $I_{SINK} = 50\text{mA}$	11		0.4	1			0.5	V
					1.5	1			1.5	V
	Output Leakage Current	$V_{IN} = 5\text{mV}$, $V_{GND} = -15\text{V}$, $V_{OUT} = 20\text{V}$			10	1			500	nA
	Positive Supply Current		11		4.0	1				mA
	Negative Supply Current		11		2.5	1				mA
	Strobe Current	Minimum to Ensure Output Transistor is Turned Off	7,9,11	500						μA
	Input Capacitance			6						pF

TABLE 2: ELECTRICAL CHARACTERISTICS (Postirradiation) (Note 10, Note 12)

SYMBOL	PARAMETER	CONDITIONS	NOTES	100KRAD (Si)		UNITS
				MIN	MAX	
V_{OS}	Input Offset Voltage				2.5	mV
I_{OS}	Input Offset Current				20	nA
I_B	Input Bias Current				200	nA
A_{VOL}	Large-Signal Voltage Gain	$R_L = 1k\Omega$, $-10V \leq V_{OUT} \leq 14.5V$		100		V/mV
CMRR	Common Mode Rejection Ratio			90		dB
	Input Voltage Range	$V_S = \pm 15V$ $V_S = \text{Single } 5V$	8,9	-14.5 0.5	13 3.0	V V
V_{OL}	Output Saturation Voltage	$V_{IN} = -5mV$, $I_{SINK} = 8mA$ $I_{SINK} = 50mA$	11		0.4 1.5	V V
	Output Leakage Current	$V_{IN} = 5mV$, $V_{GND} = -15V$ $V_{OUT} = 20V$			100	nA
	Positive Supply Current		11		4.0	mA
	Negative Supply Current		11		2.5	mA
	Strobe Current	Minimum to Ensure Output Transistor is Turned Off	7,9,11	500		μA
	Input Capacitance			6 (Typ)		pF

Note 1: Inputs may be clamped to supplies with diodes so that maximum input voltage actually exceeds supply voltage by one diode drop. See Input Protection discussion in the LT[®]1011 data sheet.

Note 2: $T_{JMAX} = 150^\circ C$.

Note 3: Output is sinking 1.5mA with $V_{OUT} = 0V$.

Note 4: These specifications apply for all supply voltages from a single 5V to $\pm 15V$, the entire input voltage range and for both high and low output states. The high state is $I_{SINK} = 100\mu A$, $V_{OUT} = (V^+ - 1V)$ and the low state is $I_{SINK} = 8mA$, $V_{OUT} = 0.8V$. Therefore, this specification defines a worst-case error band that includes effects due to common mode signals, voltage gain and output load.

Note 5: Drift is calculated by dividing the offset difference measured at minimum and maximum temperatures by the temperature difference.

Note 6: Response time is measured with a 100mV step and 5mV overdrive. The output load is a 500 Ω resistor tied to 5V. Time measurement is taken when the output crosses 1.4V.

Note 7: Do not short the STROBE pin to ground. It should be current driven at 3mA to 5mA for the shortest strobe time. Currents as low as 500 μA will strobe the RH1011 if speed is not important. External leakage on the STROBE pin in excess of 0.2 μA when the strobe is "off" can cause offset voltage shifts.

Note 8: See graph, Input Offset Voltage vs Common Mode Voltage on the LT1011 data sheet.

Note 9: Guaranteed by design, characterization or correlation to other tested parameters.

Note 10: $V_S = \pm 15V$, $V_{CM} = 0V$, $R_S = 0\Omega$, $T_A = 25^\circ C$, $V_{GND} = V^-$, output at Pin 7, unless otherwise noted.

Note 11: $V_{GND} = 0V$.

Note 12: Device is characterized at 10KRAD, 20KRAD, 50KRAD, 100KRAD, and 200KRAD; it is production tested at 100KRAD only.

TABLE 3: ELECTRICAL TEST REQUIREMENTS

MIL-PRF-38535 TEST REQUIREMENTS	SUBGROUP
Final Electrical Test Requirements	1*, 2, 3, 4
Group A Test Requirements	1, 2, 3, 4
Group C End Point Electrical Parameters	1, 2, 3
Group D End Point Electrical Parameters	1, 2, 3
Group E End Point Electrical Parameters	1

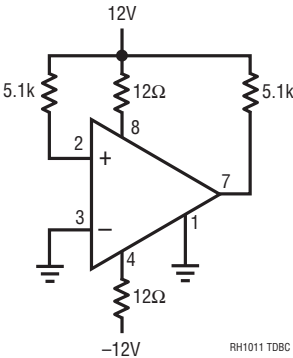
* PDA applies to subgroup 1. See PDA Test Notes.

PDA Test Notes

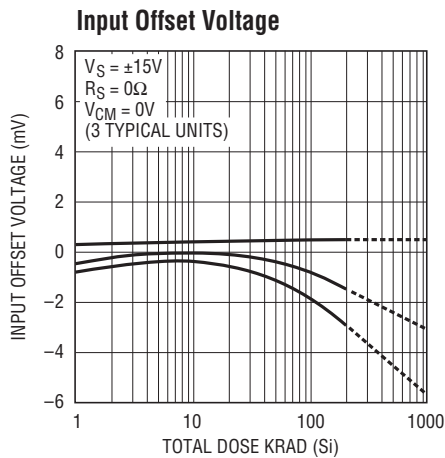
The PDA is specified as 5% based on failures from group A, subgroup 1, tests after cooldown as the final electrical test in accordance with method 5004 of MIL-STD-883 Class B. The verified failures (including Delta parameters) of group A, subgroup 1, after burn-in divided by the total number of devices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

Analog Devices reserves the right to test to tighter limits than those given.

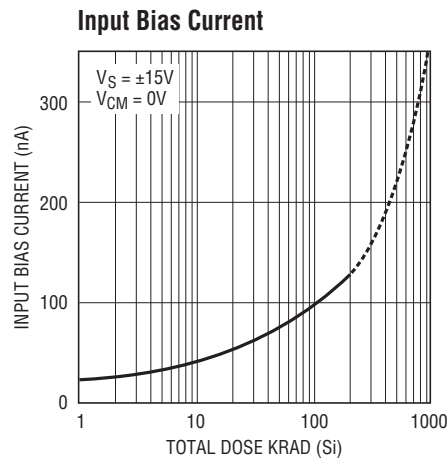
TOTAL DOSE BIAS CIRCUIT



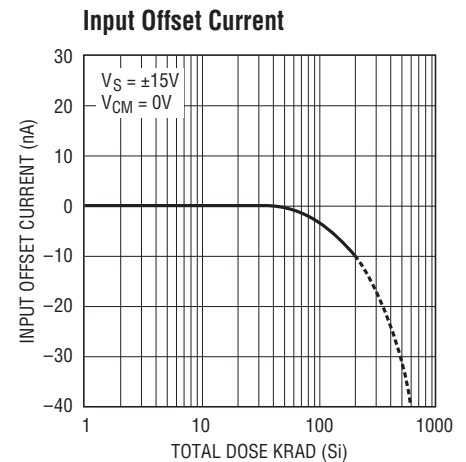
TYPICAL PERFORMANCE CHARACTERISTICS



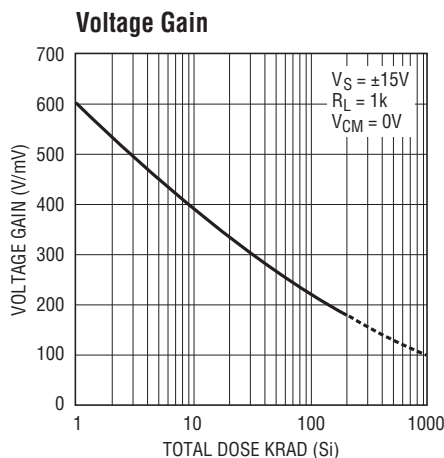
RH1011 G01



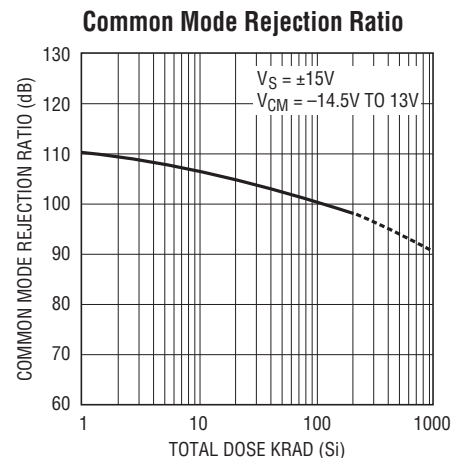
RH1011 G02



RH1011 G03



RH1011 G04



RH1011 G05

PIN FUNCTIONS

GND (PIN 1): Ground.

INPUT⁺ (PIN 2): Non-Inverting Input of Comparator

INPUT⁻ (PIN 3): Inverting Input of Comparator

V⁻ (PIN 4): Negative Supply Voltage

OUT (PIN 7): Open-Collector Output of Comparator

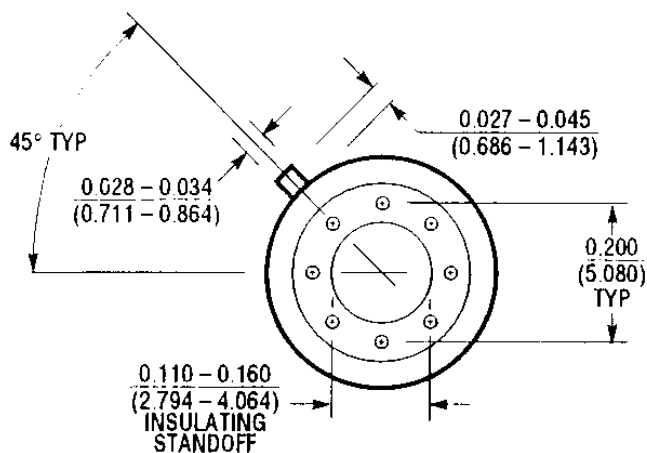
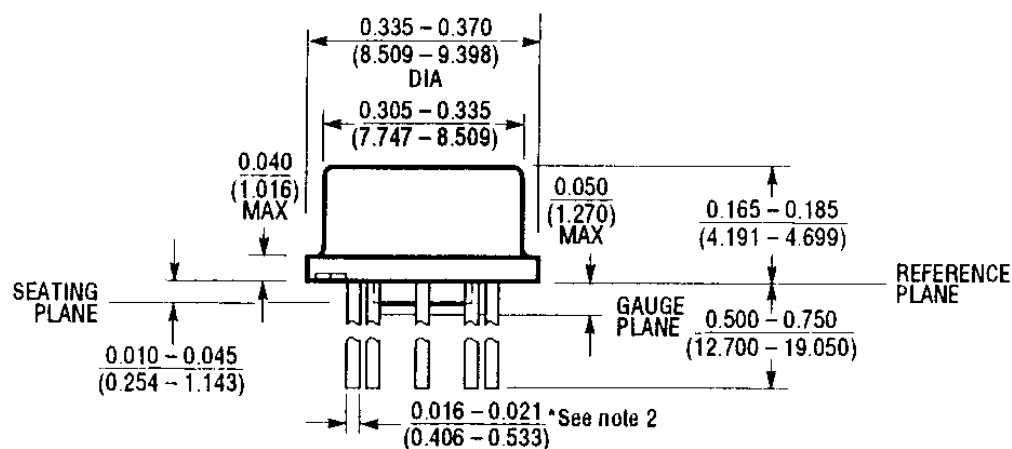
BALANCE (PIN 5): Balance Input. This input can be used to adjust the input voltage offset or to add hysteresis. If offset balancing or hysteresis is not used, the BALANCE pins should be connected together with a 0.1 μ F capacitor.

BALANCE/STROBE (PIN 6): Strobe Input Pin. Using this pin, the output transistor can be forced to an “off” state, giving a “hi” output at the collector (Pin 7). This input can be used to adjust the input voltage offset or used to add hysteresis. If offset balancing or hysteresis is not used, the BALANCE pins should be connected together with a 0.1 μ F capacitor.

V⁺ (PIN 8): Positive Supply Voltage

PACKAGE OUTLINE

DEVICE OPTION #1 (H) TO5 / 8 LEADS CASE OUTLINE



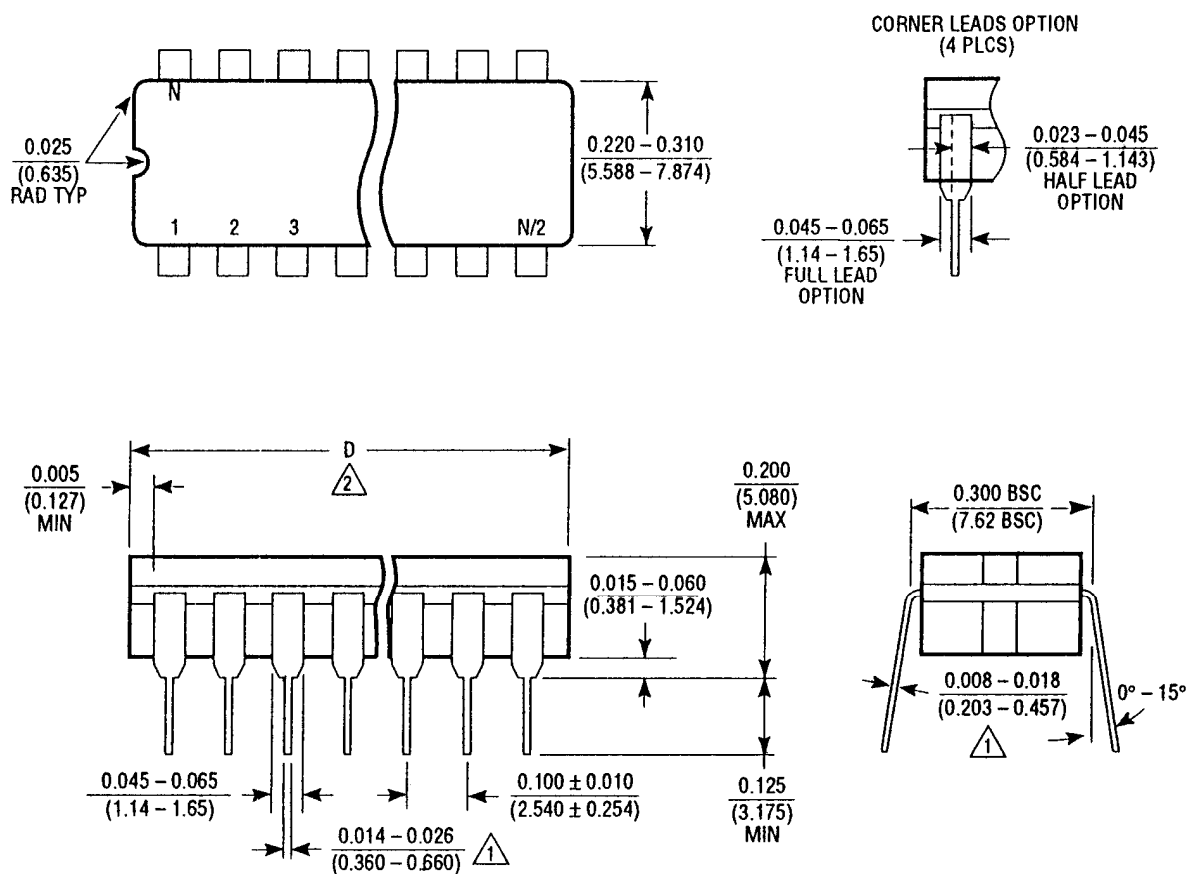
- NOTE: 1. LEAD DIAMETER IS UNCONTROLLED BETWEEN THE REFERENCE PLANE AND SEATING PLANE.
2. FOR SOLDER DIP LEAD FINISH, LEAD DIAMETER IS $0.016 - 0.024$ (0.406 - 0.610)

$$\theta_{ja} = +150^{\circ}\text{C/W}$$

$$\theta_{jc} = +40^{\circ}\text{C/W}$$

PACKAGE OUTLINE (CONTINUED)

DEVICE OPTION # 2 (J8) CERAMIC DIP / 8 LEADS CASE OUTLINE



NOTE:

1. LEAD DIMENSIONS APPLY TO SOLDER DIP OR TIN PLATE LEADS.
2. 8 LEAD D MAX = .405 (10.287)

$$\theta_{ja} = +110^\circ\text{C/W}$$

$$\theta_{jc} = +30^\circ\text{C/W}$$

REVISION HISTORY (Revision history begins at Rev E)

REV	DATE	DESCRIPTION	PAGE NUMBER
E	02/19	Obsoleting J8 package and updating document to ADI format.	All Pages
F	08/20	Adding Pin Functions.	5
G	07/24	Updated Table 2: Electrical Test Requirements	4
H	01/25	Renamed Table 1A to Table 2 and Table 2 to Table 3, updated Table 2, added Note 12 and package outline drawings	3, 4, 6, 7