

Am111/211/311

Precision Voltage Comparator

Distinctive Characteristics

- The Am111/211/311 are functionally, electrically, and pin-for-pin equivalent to the National LM 111/211/311
- Output Drive – 50V and 50mA
- Input Bias Current – 150nA max.
- Input Offset Voltage – 4mV max.
- Differential Input Voltage Range – $\pm 30V$

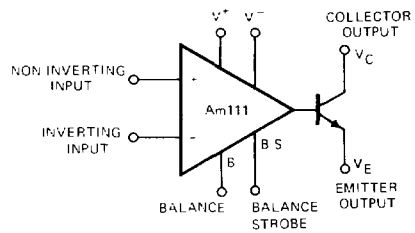
- 100% reliability assurance testing in compliance with MIL-STD-883
- Electrically tested and optically inspected die for assemblers of hybrid products
- Mixing privileges for obtaining price discounts. Refer to price list.
- Available in Metal Can, Hermetic Dual-In-Line or hermetic Flat Packages

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FUNCTIONAL DESCRIPTION

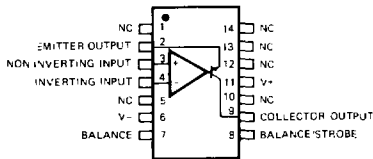
The Am111/211/311 are voltage comparators featuring low input currents, high differential and common mode voltage ranges, wide supply voltage range, and outputs compatible with all bipolar and MOS circuitry. The inputs and outputs can be isolated from system ground, and the output can drive loads referred to ground or either supply. Strobing and offset balancing are available and the outputs can be wire ORed.

FUNCTIONAL DIAGRAM



LIC-081

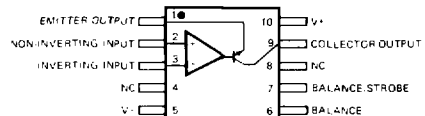
CONNECTION DIAGRAM Top View Dual-In-Line Am111/211/311



Pin 6 is connected to bottom of package.

LIC-082

CONNECTION DIAGRAM Top View Flat Package Am111/211/311



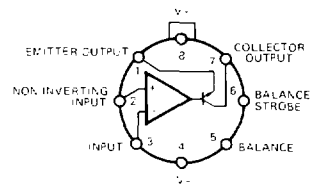
Pin 5 is connected to bottom of package.

LIC-083

ORDERING INFORMATION

Part Number	Package Type	Temperature Range	Order Number
Am311	TO-99	0°C to +70°C	LM311H
	Hermetic DIP	0°C to +70°C	LM311D
	Mini-DIP	0°C to +70°C	LM311N
	Dice	0°C to +70°C	LD311
Am211	TO-99	-25°C to +85°C	LM211H
	Hermetic DIP	-25°C to +85°C	LM211D
Am111	TO-99	-55°C to +125°C	LM111H
	Hermetic DIP	-55°C to +125°C	LM111D
	Flat Pak	-55°C to +125°C	LM111F
	Dice	-55°C to +125°C	LD111

CONNECTION DIAGRAM Top View Metal Can Am111/211/311



Pin 4 is connected to case.

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Am111/211/311

MAXIMUM RATINGS

Voltage from V^+ to V^-	36V
Voltage from Collector Output to V^-	
Am111/211	50V
Am311	40V
Voltage from Emitter Output to V^-	30V
Voltage between Inputs	$\pm 30V$
Voltage from Inputs to V^-	+30V, -0V
Voltage from Inputs to V^+	-30V
Power Dissipation (Note 1)	500mW
Output Short Circuit Duration	10 sec
Operating Temperature Range	
Am111	-55°C to $+125^\circ\text{C}$
Am211	-25°C to $+85^\circ\text{C}$
Am311	0°C to $+70^\circ\text{C}$
Storage Temperature Range	-65°C to $+150^\circ\text{C}$
Lead Temperature (soldering, 10 sec)	300°C

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise specified) (Note 2)

Parameters (see definitions)	Test Conditions	Am311			Am111 Am211			Units
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Input Offset Voltage (Note 3)			2.0	7.5		0.7	3.0	mV
Input Offset Current (Note 3)			6.0	50.0		4.0	10.0	nA
Input Bias Current (Note 3)			100	250		60	100	nA
Response Time (Note 4)	$R_L = 500\ \Omega$ to $+5\ \text{V}$, $V_E = 0$		200			200		ns
Supply Current								
Positive (Note 5)			3.9	7.5		3.9	6.0	mA
Negative (Note 5)			2.6	5.0		2.6	4.5	mA
Voltage Gain			200			200		V/mV
Saturation Voltage	$V_{IN} \leq -5\ \text{mV}$, $I_C = 50\ \text{mA}$					0.75	1.5	Volts
	$V_{IN} \leq -10\ \text{mV}$, $I_C = 50\ \text{mA}$		0.75	1.5				Volts
Output Leakage Current	$V_{IN} \geq +5\ \text{mV}$, V_C to $V_E = 50\ \text{V}$					0.2	10.0	nA
	$V_{IN} \geq +10\ \text{mV}$, V_C to $V_E = 40\ \text{V}$		0.2	50.0				nA
The Following Specifications Apply Over The Operating Temperature Ranges								
Input Offset Voltage (Note 3)				10.0			4.0	mV
Input Offset Current (Note 3)				70.0			20.0	nA
Input Bias Current (Note 3)				300			150	nA
Saturation Voltage	$V_{IN} \leq -6\ \text{mV}$, $I_C = 8\ \text{mA}$					0.23	0.40	Volts
	$V_{IN} \leq -10\ \text{mV}$, $I_C = 8\ \text{mA}$		0.23	0.40				Volts
Output Leakage Current	$V_{IN} \geq +6\ \text{mV}$, V_C to $V_E = 50\ \text{V}$					0.1	0.5	μA
Input Voltage Range			± 13	± 14		± 13	± 14	Volts
Supply Current								
Positive (Note 5)	$T_A = 125^\circ\text{C}$					2.7	4.5	mA
Negative (Note 5)						1.8	3.5	mA

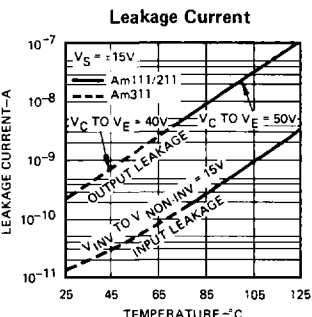
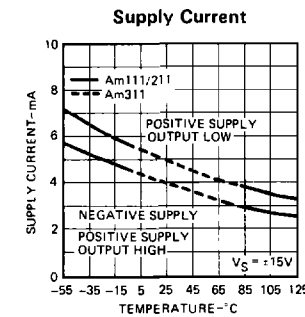
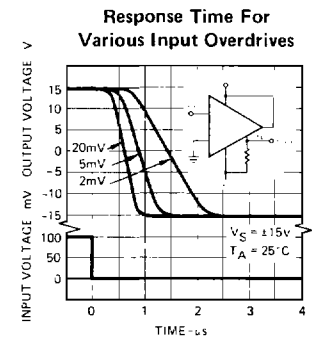
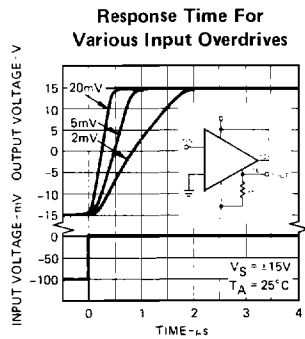
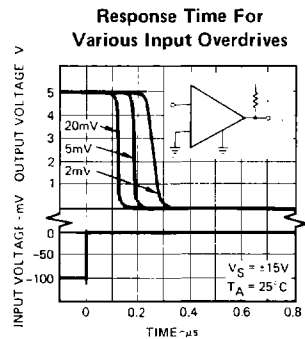
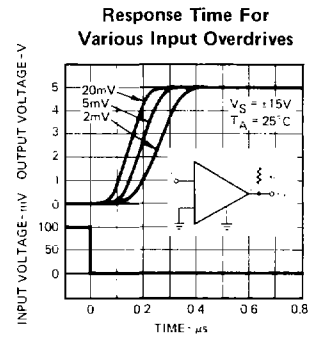
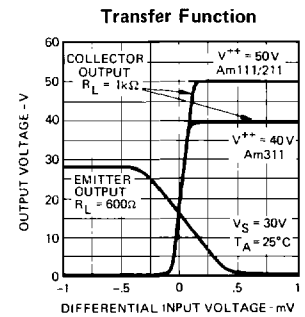
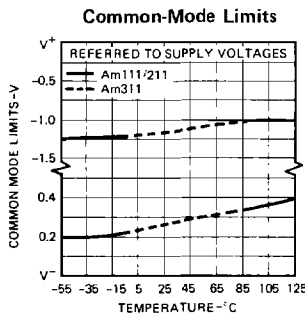
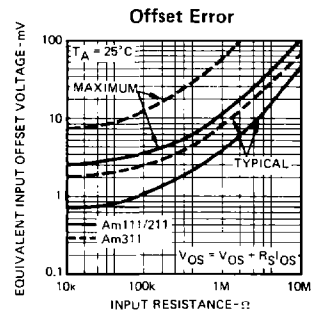
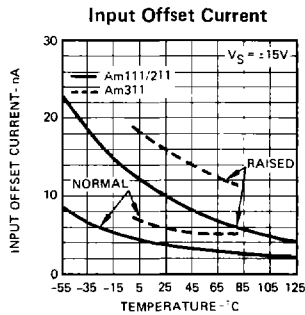
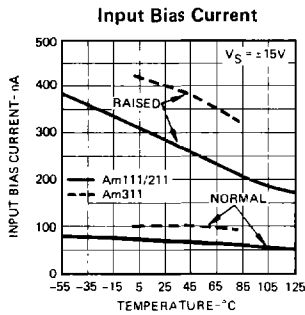
Notes: 1. For the Am111/211/311, derate Metal Can package at $6.8\text{mW}/^\circ\text{C}$ for operation at ambient temperatures above 75°C , the Dual In-Line at $9\text{mW}/^\circ\text{C}$ for operation at ambient temperatures above 95°C , and the Flat Packages at $5.4\text{mW}/^\circ\text{C}$ for operation at ambient temperatures above 57°C .

2. Unless otherwise specified, these specifications apply for $V^+ = +15\text{V}$, $V^- = -15\text{V}$, $V_E = -15\text{V}$, and R_L at collector output = $7.5\text{k}\Omega$ to $+15\text{V}$.

3. The offset voltage, offset current and bias current given are the maximum values required to drive the collector output to within 1V of the supplies with a $7.5\text{k}\Omega$ load. These parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

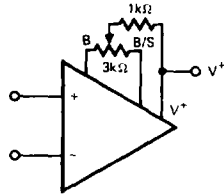
4. The response time specified (see definitions) is for a 100mV input step with 5mV overdrive.

PERFORMANCE CURVES



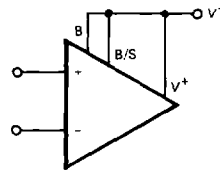
APPLICATIONS

Offset Balancing



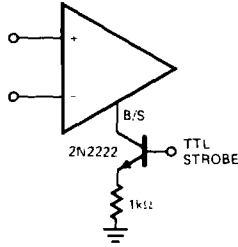
LIC-086

Increasing Input Stage Current*



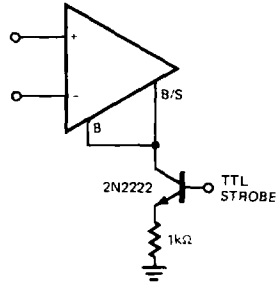
LIC-087

Strobing



LIC-088

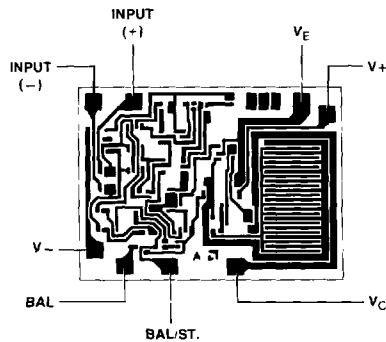
Strobing OFF both Input and Output Stages**



LIC-089

*Increases input bias current and common mode slew rate by a factor of 3.
 **Typical input current = 50pA with inputs strobed OFF.

Metallization and Pad Layout



48 x 65 Mils