

# LM111/211/311

## Precision Voltage Comparator

### Distinctive Characteristics

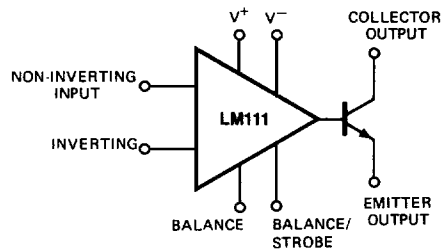
- The AMD LM111/211/311 are functionally, electrically, and pin-for-pin equivalent to the National LM 111/211/311

- Output Drive – 50V and 50mA
- Input Bias Current – 150nA max.
- Input Offset Voltage – 4mV max.
- Differential Input Voltage Range –  $\pm 30V$

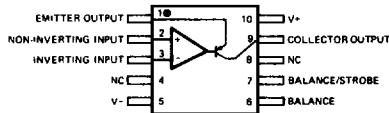
### FUNCTIONAL DESCRIPTION

The LM111/211/311 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



### CONNECTION DIAGRAM – Top View Ceramic Flat Package F-10-1



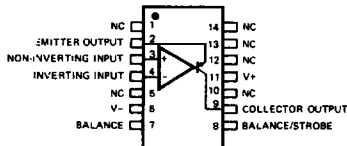
Pin 5 is connected to bottom of package.

LIC-083

LIC-081

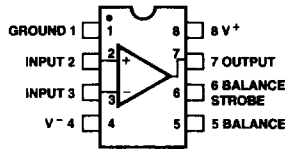
### CONNECTION DIAGRAMS – Top Views

#### Hermetic DIP D-14-1

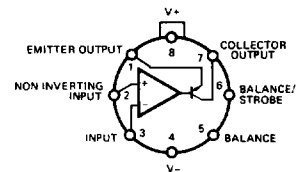


Pin 6 is connected to bottom of package.

#### Mini-DIP P-8-1



#### Metal Can H-8-1



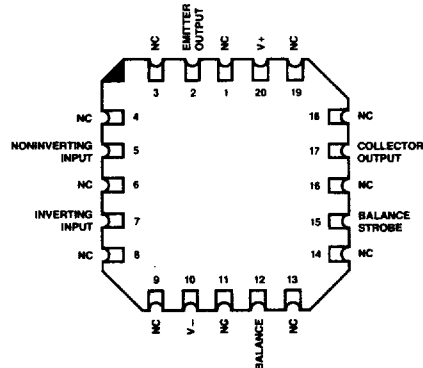
Pin 4 is connected to case. LIC-084

### ORDERING INFORMATION\*

Part Number	Package Type	Temperature Range	Order Number
LM311	TO-99	0 to +70°C	LM311H
	Hermetic DIP	0 to +70°C	LM311D
	Mini-DIP	0 to +70°C	LM311N
	Dice	0 to +70°C	LD311
	Leadless	0 to +70°C	LM311L
LM211	TO-99	-25 to +85°C	LM211H
	Hermetic DIP	-25 to +85°C	LM211D
	Leadless	-25 to +85°C	LM211L
	Ceramic Flat Package	-25 to +85°C	LM211F
LM111	TO-99	-55 to +125°C	LM111H
	Hermetic DIP	-55 to +125°C	LM111D
	Flat Pak	-55 to +125°C	LM111F
	Dice	-55 to +125°C	LD111
	Leadless	-55 to +125°C	LM111L
	Ceramic Flat Package	-55 to +125°C	LM111F

\*Also available with burn-in processing. To order add suffix B to part number.

### CONNECTION DIAGRAM – Top View Leadless Chip-Pak L-20-1



**LM111/211/311  
MAXIMUM RATINGS**

Voltage from $V^+$ to $V^-$	36V
Voltage from Collector Output to $V^-$	
LM111/211	50V
LM311	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	
LM111	-55°C to +125°C
LM211	-25°C to +85°C
LM311	0°C to +70°C
Storage Temperature Range	-65°C to +150°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	LM311			LM111 LM211			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 V, $V_E = 0$		200			200		ns
Supply Current								
Positive			3.9	7.5		3.9	6.0	mA
Negative			2.6	5.0		2.6	5.0	mA
Voltage Gain			200			200		V/mV
Saturation Voltage	$V_{IN} < -5\ \text{mV}$ , $I_C = 50\ \text{mA}$					0.75	1.5	Volts
	$V_{IN} < -10\ \text{mV}$ , $I_C = 50\ \text{mA}$		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
<b>The Following Specifications Apply Over The Operating Temperature Ranges</b>								
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	$V_{IN} < -6\ \text{mV}$ , $I_C = 8\ \text{mA}$					0.23	0.40	Volts
	$V_{IN} < -10\ \text{mV}$ , $I_C = 8\ \text{mA}$		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	$\mu\text{A}$
Input Voltage Range		$\pm 13$	$\pm 14$		$\pm 13$	$\pm 14$		Volts
Supply Current								
Positive (Note 5)	$T_A = 125^\circ\text{C}$					5.1	6.0	mA
Negative (Note 5)						4.1	5.0	mA

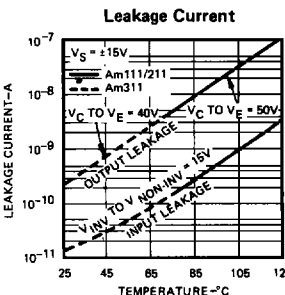
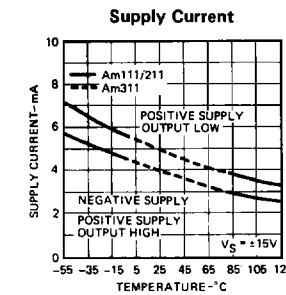
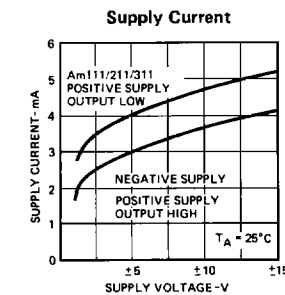
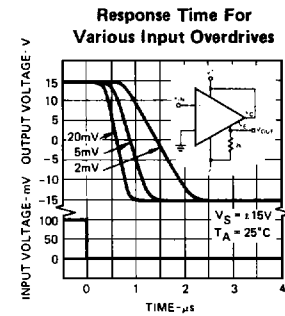
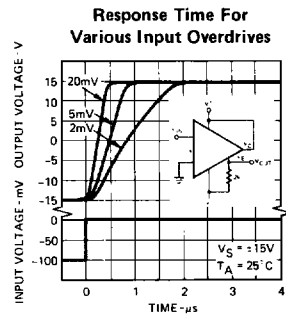
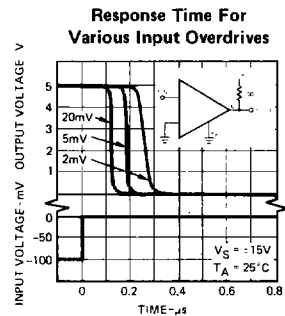
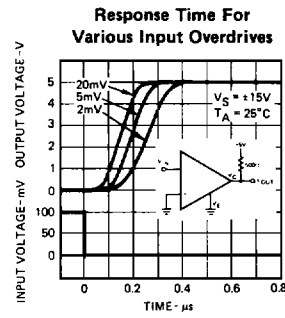
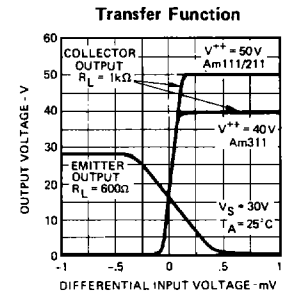
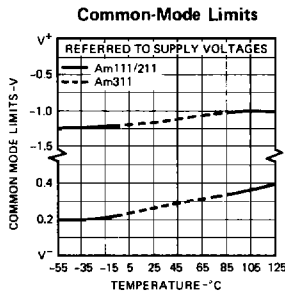
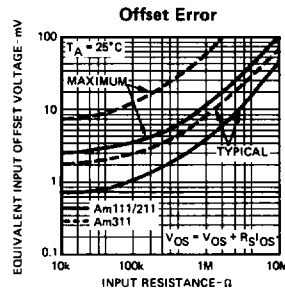
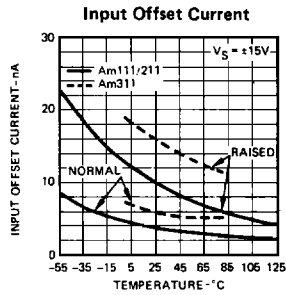
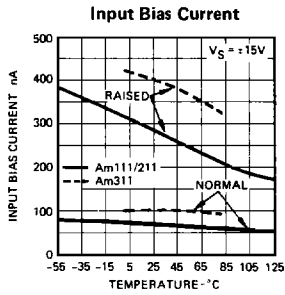
Notes: 1. For the LM111/211/311, derate Metal Can package at 6.8mW/°C for operation at ambient temperatures above 75°C, the Dual In-Line at 9mW/°C for operation at ambient temperatures above 95°C, the Flat Packages at 5.4mW/°C for operation at ambient temperatures above 57°C, and the Mini-DIP at 6.6mW/°C above 36°.

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

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 7.5k $\Omega$  load. These parameters define an error band and take into account the worst case effects of voltage gain and input impedance.

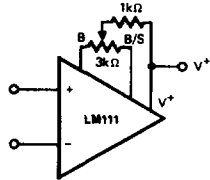
4. The response time specified (see definitions) is for a 100mV input step with 5mV overdrive.

PERFORMANCE CURVES



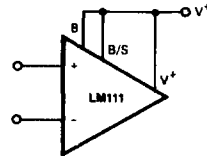
APPLICATIONS

Offset Balancing



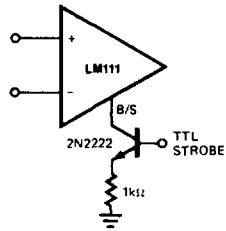
LIC-086

Increasing Input Stage Current\*



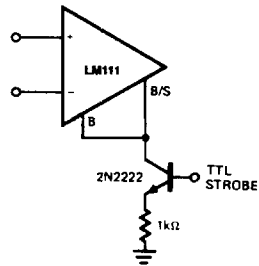
LIC-087

Strobing



LIC-088

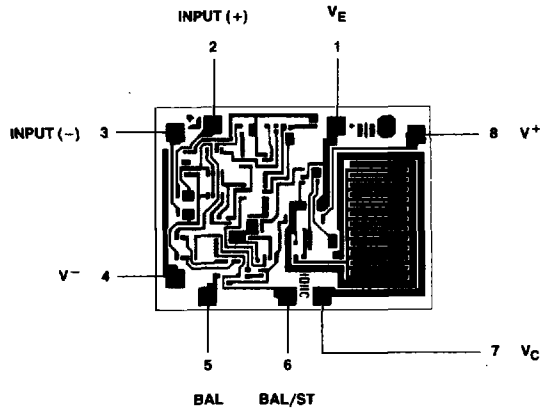
Strobing OFF both Input and Output Stages\*\*



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



DIE SIZE: 0.048" X 0.065"