

### LM111-LM211-LM311

### Voltage comparator with strobe

#### **Features**

Maximum input current: 150nAMaximum offset current: 20nA

Differential input voltage range: ±30VPower consumption:135mW at ±15V

■ Supply voltage: +5V to ±15V

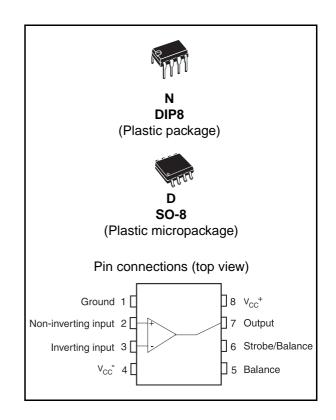
■ Output current: 50mA

### **Description**

The LM111, LM211, LM311 are voltage comparators that have low input currents.

They are also designed to operate over a wide range of supply voltages: from standard ±15V operational amplifier supplies down to the single +5V supply used for IC logic.

Their output is compatible with RTL-DTL and TTL as well as MOS circuits and can switch voltages up to +50V at output currents as high as 50mA.



#### **Order codes**

Part number	Temperature range	Package	Packing	Marking
LM211N	-40℃, +105℃	DIP8	Tube	LM211N
LM211D/DT	-40 C, +103 C	SO-8	Tube or tape & reel	211
LM311N	0℃, +70℃	DIP8	Tube	LM311
LM311D/DT	00, +700	SO-8	Tube or Tape & reel	311

Contents LM111-LM211-LM311

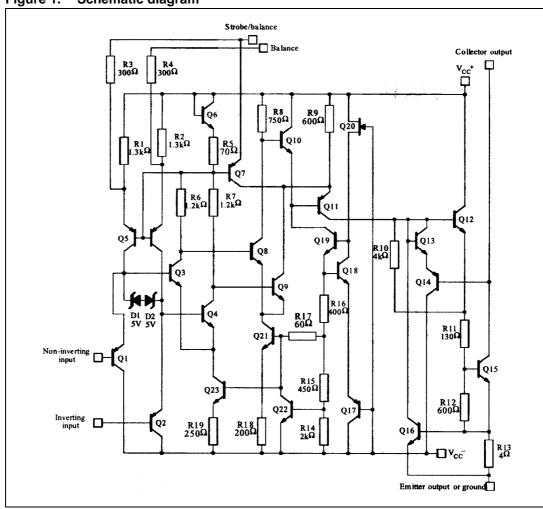
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LM111-LM211-LM311 Schematic diagram

## 1 Schematic diagram

Figure 1. Schematic diagram



### 2 Absolute maximum ratings & operating conditions

Table 1. Absolute maximum ratings (AMR)

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	Supply voltage	36	V
V <sub>id</sub>	Differential input voltage	±30	V
V <sub>i</sub>	Input voltage (1)	±15	V
V <sub>(1-4)</sub>	Ground to negative supply voltage	30	V
V <sub>(7-4)</sub>	Output to negative supply voltage LM111-LM211 LM311	50 40	V
	Output short-circuit duration	10	S
	Voltage at strobe pin	V <sub>CC</sub> <sup>+</sup> -5	V
P <sub>d</sub>	Power dissipation <sup>(2)</sup> DIP8 SO-8	1250 710	mW
Tj	Junction temperature	+150	C
T <sub>stg</sub>	Storage temperature range	-65 to +150	C

<sup>1.</sup> This rating applies for ±15V supplies. The positive input voltage limit is 30V above the negative. The negative input voltage is equal to the negative supply voltage or 30V below the positive supply, whichever is less

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply voltage	5 to ±15	V
T <sub>oper</sub>	Operating free-air temperature range LM111 LM211 LM311	-55 to +125 -40 to +105 0 to +70	С

<sup>2.</sup>  $P_d$  is calculated with  $T_{amb}$  = +25°C,  $T_j$  = +150°C and  $R_{thja}$  = 100°C/W for the DIP8 package, and  $R_{thja}$  = 175°C/W for the SO-8 package.

### 3 Electrical characteristics

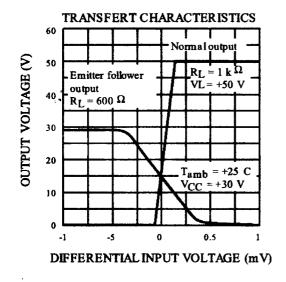
Table 3.  $V_{CC}^+ = \pm 15V$ ,  $T_{amb} = +25$ °C (unless otherwise specified)

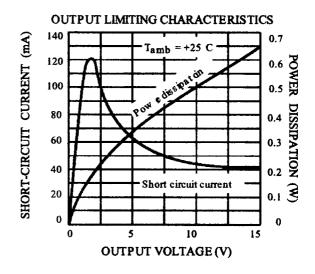
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Symbol	Parameter	Conditions	Min.	Тур.	Max.	Min.	Тур.	Max.	Unit	
V <sub>io</sub>	Input offset voltage (1)	$\begin{aligned} R_{S} &\leq 50 k \Omega \\ T_{amb} &= +25 °C \\ T_{min} &\leq T_{amb} \leq T_{max} \end{aligned}$		0.7	3 4		2	7.5 10	mV	
l <sub>io</sub>	Input offset current (1)	$T_{amb} = +25 \text{°C}$ $T_{min} \le T_{amb} \le T_{max}$		4	10 20		6	50 70	nA	
l <sub>ib</sub>	Input bias current (1)	$T_{amb}$ = +25°C $T_{min} \le T_{amb} \le T_{max}$		60	100 150		100	250 300	nA	
A <sub>vd</sub>	Large signal voltage gain		40	200		40	200		V/mV	
I <sub>CC</sub> <sup>+</sup>	Supply currents	Positive Negative		5.1 4.1	6 5		5.1 4.1	7.5 5	mA	
V <sub>icm</sub>	Input common mode voltage range	$T_{min} \le T_{amb} \le T_{max}$	-14.5	+13.8 -14.7	+13	-14.5	+13.8 -14.7	+13	V	
		$T_{amb}$ = +25°C, $I_O$ = 50mA, $V_i \le$ -5mV $T_{amb}$ = +25°C, $I_O$ = 50mA, $V_i \le$ -10mV		0.75	1.5		0.75	1.5		
V <sub>OL</sub> Low level output voltage	$T_{min} \le T_{amb} \le T_{max}$ $V_{CC}^+ \ge +4.5V, V_{CC}^- = 0$ $I_O = 8mA, V_i \le -6m$		0.23	0.4				V		
		$T_{min} \le T_{amb} \le T_{max}$ $V_{CC}^{+} \ge +4.5V, V_{CC}^{-} = 0$ $I_{O} = 8mA, V_{i} \le -10mV$					0.23	0.4		
		$T_{amb} = +25$ °C Vi $\geq$ +5mV, V <sub>O</sub> = +35V		0.2	10				nA	
I <sub>ОН</sub>	High level output current	$T_{amb} = +25$ °C Vi $\ge +10$ mV, V <sub>O</sub> = +35V					0.2	50	nA	
		$T_{min} \le T_{amb} \le T_{max}$ Vi $\ge +5$ mV, V <sub>O</sub> = +35V		0.1	0.5				μΑ	
I <sub>strobe</sub>	Strobe current			3			3		mA	
t <sub>re</sub>	Response time (2)			200			200		ns	

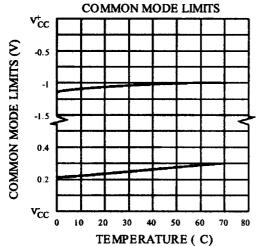
<sup>1.</sup> The offset voltage, offset current and bias current specifications apply for any supply voltage from a single +5V supply up to ±15V supplies. The offset voltages and offset currents given are the maximum values required to drive the output down to +1V or up to +14V with a 1mA load current. Thus, these parameters define an error band and take into account the worst-case of voltage gain and input impedance.

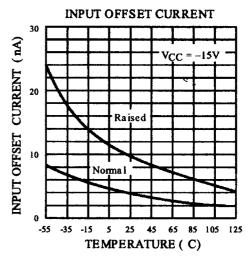
<sup>2.</sup> The response time specified is for a 100mV input step with 5mV overdrive.

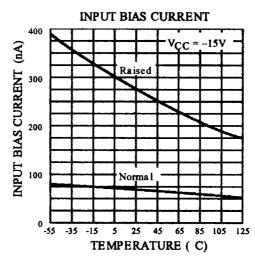
Electrical characteristics LM111-LM211-LM311

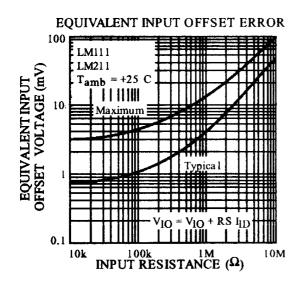


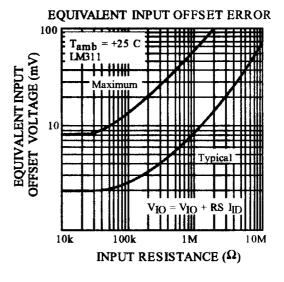


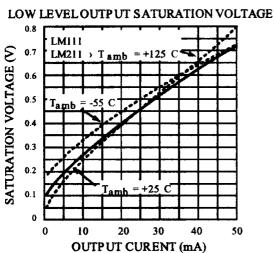


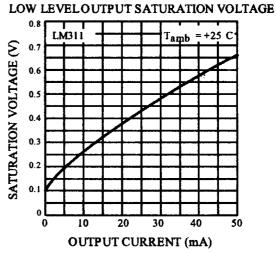


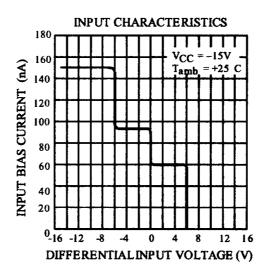




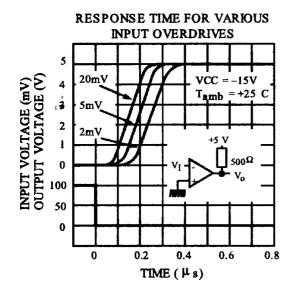


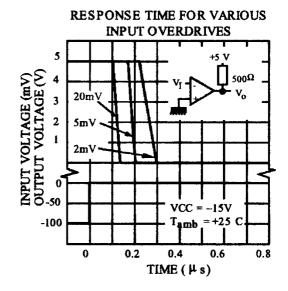


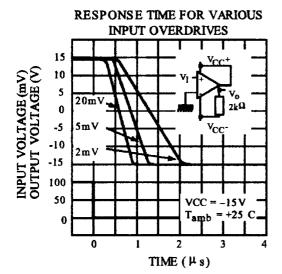


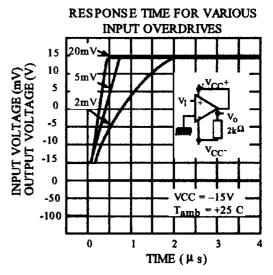


Electrical characteristics LM111-LM211-LM311





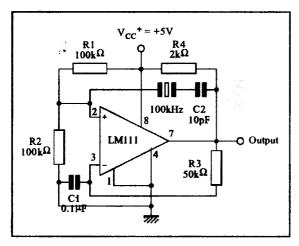




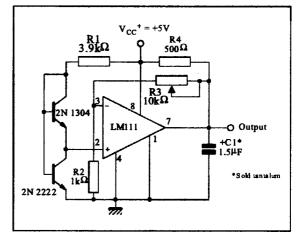
### 4 Typical application schematics

#### **TYPICAL APPLICATIONS**

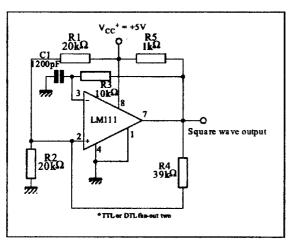
**CRYSTAL OSCILLATOR** 



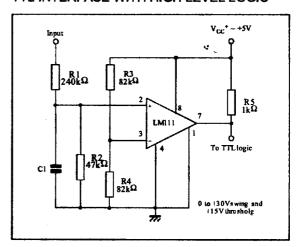
LOW VOLTAGE ADJUSTABLE REFERENCE SUPPLY



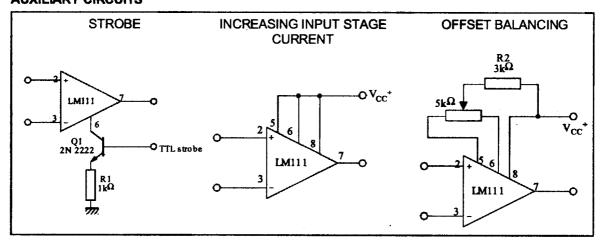
100KHz FREE RUNNING MULTIVIBRATOR



TTL INTERFACE WITH HIGH LEVEL LOGIC



### **AUXILIARY CIRCUITS**



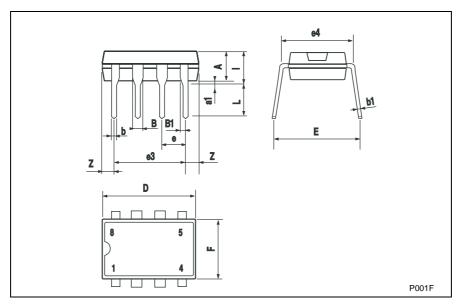
### 5 Package mechanical data

In order to meet environmental requirements, STMicroelectronics offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an STMicroelectronics trademark. ECOPACK specifications are available at: <a href="https://www.st.com">www.st.com</a>.

## 5.1 DIP8 package

#### Plastic DIP-8 MECHANICAL DATA

DIM.	mm.			inch			
DIW.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.	
Α		3.3			0.130		
a1	0.7			0.028			
В	1.39		1.65	0.055		0.065	
B1	0.91		1.04	0.036		0.041	
b		0.5			0.020		
b1	0.38		0.5	0.015		0.020	
D			9.8			0.386	
E		8.8			0.346		
е		2.54			0.100		
e3		7.62			0.300		
e4		7.62			0.300		
F			7.1			0.280	
I			4.8			0.189	
L		3.3			0.130		
Z	0.44		1.6	0.017		0.063	

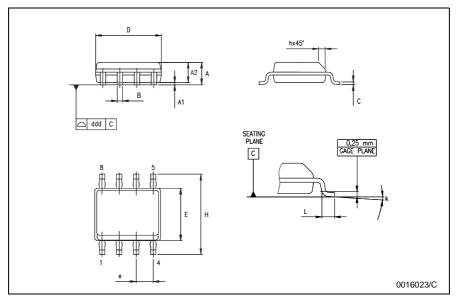


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## 5.2 SO-8 package

#### **SO-8 MECHANICAL DATA**

DIM	mm.			inch			
DIM.	MIN.	TYP	MAX.	MIN.	TYP.	MAX.	
А	1.35		1.75	0.053		0.069	
A1	0.10		0.25	0.04		0.010	
A2	1.10		1.65	0.043		0.065	
В	0.33		0.51	0.013		0.020	
С	0.19		0.25	0.007		0.010	
D	4.80		5.00	0.189		0.197	
Е	3.80		4.00	0.150		0.157	
е		1.27			0.050		
Н	5.80		6.20	0.228		0.244	
h	0.25		0.50	0.010		0.020	
L	0.40		1.27	0.016		0.050	
k		8° (max.)					
ddd			0.1			0.04	



LM111-LM211-LM311 Revision history

# 6 Revision history

Date	Revision	Changes
1-Jun-02	1	Initial release.
2-Jan-06	2	Table 3. on page 5 updated. Formatting changes throughout.
1-Mar-06	3	Pin connections updated on page 1.
26-Sep-06	4	Corrected description under title on cover page.

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