



## VOLTAGE COMPARATORS

- MAXIMUM INPUT CURRENT : 150nA
- MAXIMUM OFFSET CURRENT : 20nA
- DIFFERENTIAL INPUT VOLTAGE RANGE :  $\pm 30V$
- POWER CONSUMPTION : 135mW AT  $\pm 15V$
- SUPPLY VOLTAGE : +5V TO  $\pm 15V$
- 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  $\pm 15V$  operational amplifier supplies down to the single +5V supply used for IC logic.

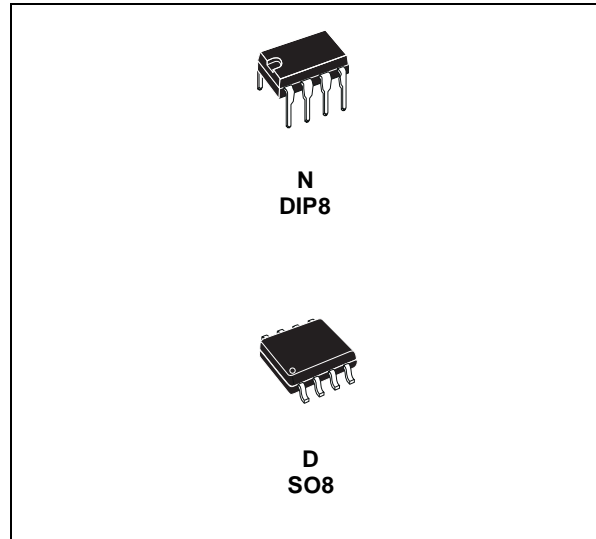
Their output is compatible with RTL-DTL and TTL as well as MOS circuits and can switch voltages up to +50V at outputs currents as high as 50mA.

### ORDER CODE

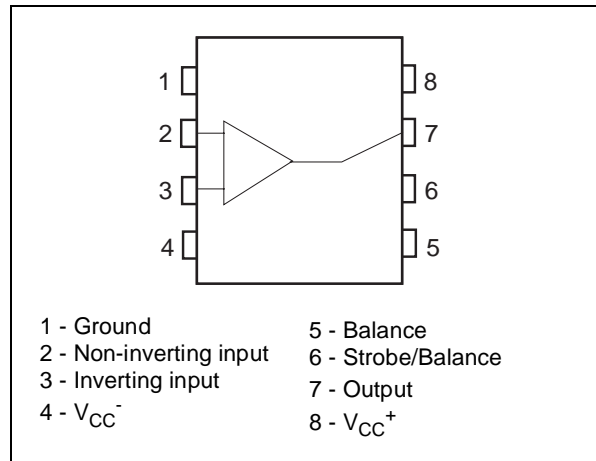
Part Number	Temperature Range	Package	
		N	D
LM111	-55°C, +125°C	•	•
LM211	-40°C, +105°C	•	•
LM311	0°C, +70°C	•	•
<b>Example : LM311D</b>			

N = Dual in Line Package (DIP)

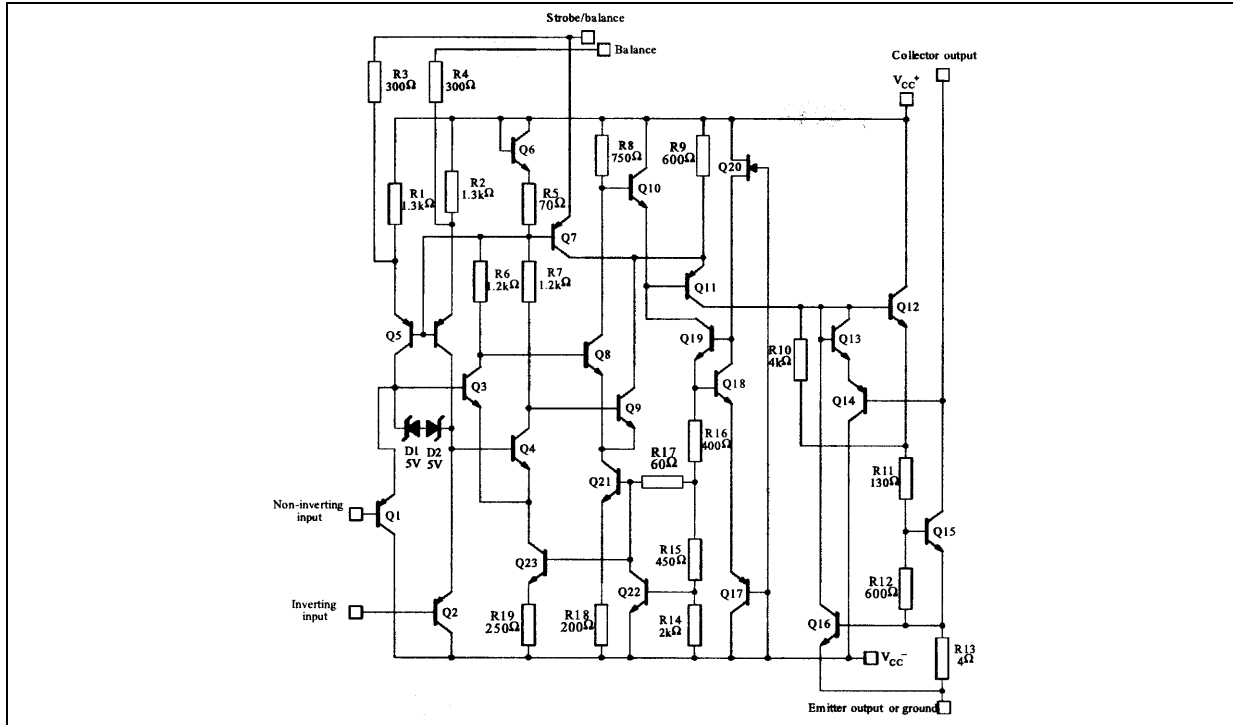
D = Small Outline Package (SO) - also available in Tape & Reel (DT)



### PIN CONNECTIONS (top view)



**SCHEMATIC DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	36	V
$V_{id}$	Differential Input Voltage	$\pm 30$	V
$V_i$	Input Voltage <sup>1)</sup>	$\pm 15$	V
$V_{(1-4)}$	Ground to Negative Supply Voltage	30	V
$V_{(7-4)}$	Output to Negative Supply Voltage	LM111-LM211 LM311	V
	Output Short-Circuit Duration	10	s
	Voltage at strobe pin	$V_{CC} + -5$	V
$P_d$	Power Dissipation <sup>2)</sup>	DIP8 SO8	mW
$T_j$	Junction Temperature	+150	°C
$T_{stg}$	Storage Temperature Range	-65 to +150	°C

1. This rating applies for  $\pm 15V$  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.

2.  $P_d$  is calculated with  $T_{amb} = +25^\circ C$ ,  $T_j = +150^\circ C$  and  $R_{thja} = 100^\circ C/W$  for DIP8 package  
 $R_{thja} = 175^\circ C/W$  for SO8 package

**OPERATING CONDITIONS**

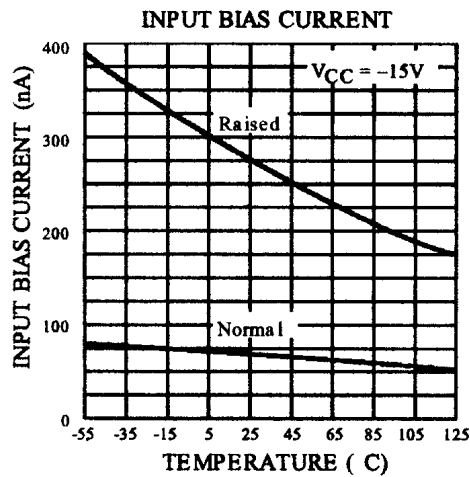
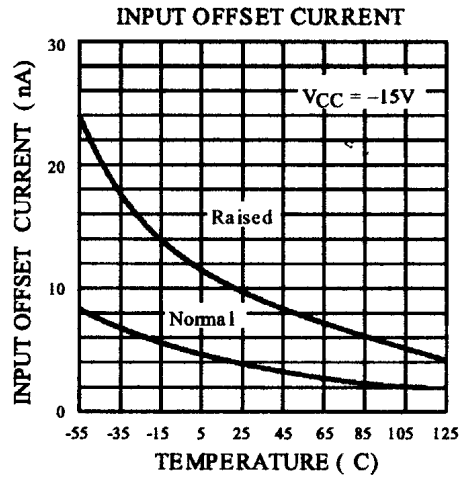
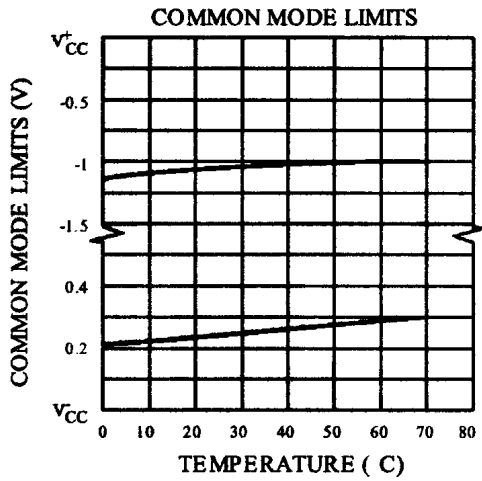
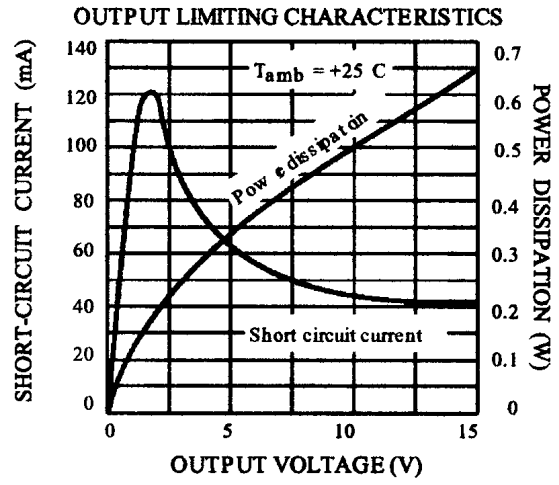
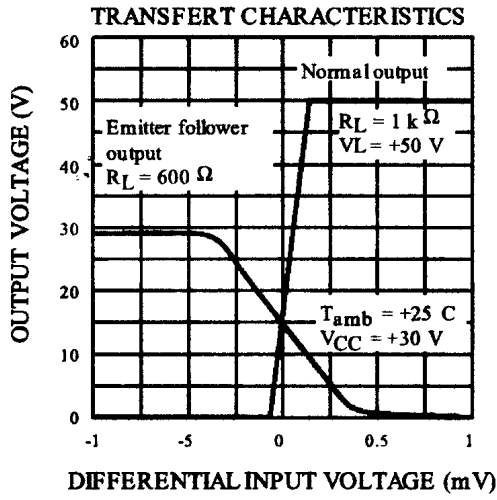
Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	5 to $\pm 15$	V
$T_{oper}$	Operating Free-Air Temperature range	LM111 LM211 LM311	°C
		-55 to +125 -40 to +105 0 to +70	

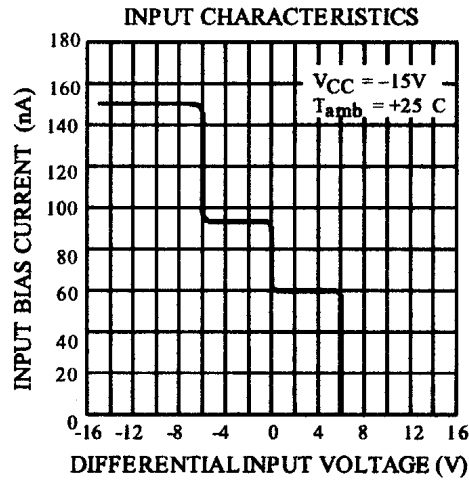
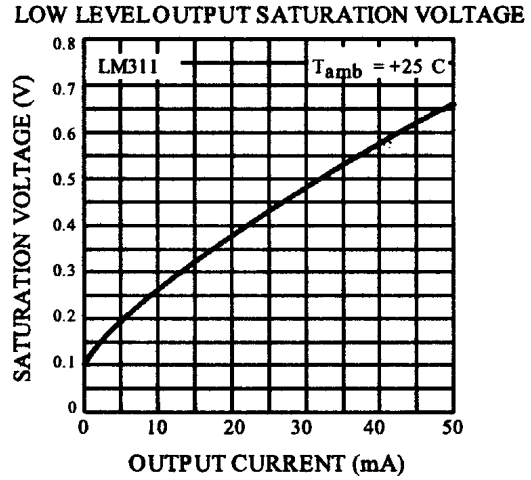
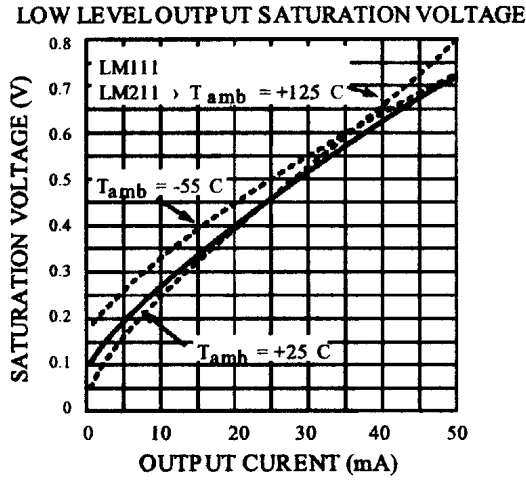
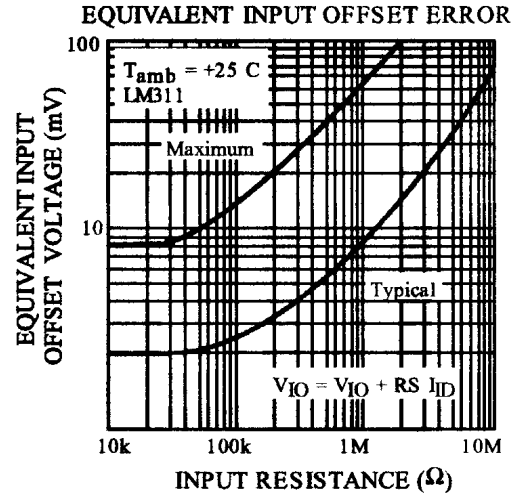
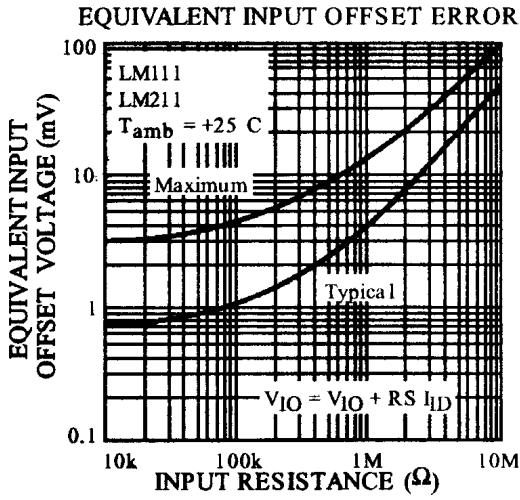
**ELECTRICAL CHARACTERISTICS**

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

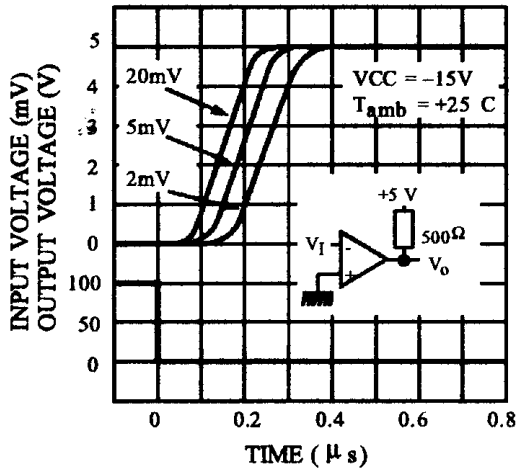
Symbol	Parameter	LM111 - LM211			LM311			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_{io}$	Input Offset Voltage ( $R_S \leq 50k\Omega$ )- note <sup>1)</sup> $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		0.7	3 4		2	7.5 10	mV
$I_{io}$	Input Offset Current -(see note 1) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		4	10 20		6	50 70	nA
$I_{ib}$	Input Bias Current - (see note 1 ) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		60	100 150		100	250 300	nA
$A_{vd}$	Large Signal Voltage Gain	40	200		40	200		V/mV
$I_{CC}^+$ $I_{CC}^-$	Supply Currents Positive Negative		5.1 4.1	6 5		5.1 4.1	7.5 5	mA
$V_{icm}$	Input Common Mode Voltage Range $T_{min} \leq T_{amb} \leq T_{max}$	-14.5	+13.8 -14.7	+13	-14.5	+13.8 -14.7	+13	V
$V_{OL}$	Low Level Output Voltage $T_{amb} = +25^\circ C$ , $I_O = 50mA$ $T_{min} \leq T_{amb} \leq T_{max}$ $V_{CC}^+ \geq +4.5V$ , $V_{CC}^- = 0$ $I_O = 8mA$		0.75 0.23	1.5 0.4		0.75 0.23	1.5 0.4	V
$I_{OH}$	High Level Output Current $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		0.2 0.1	10 0.5		0.2	50	nA nA $\mu A$
Istrobe	Strobe Current		3			3		mA
$t_{re}$	Response Time - note <sup>2)</sup>		200			200		ns

- The offset voltage, offset current and bias current specifications apply for any supply voltage from a single +5V supply up to  $\pm 15V$  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.
- The response time specified (see definitions) is for a 100mV input step with 5mV overdrive.

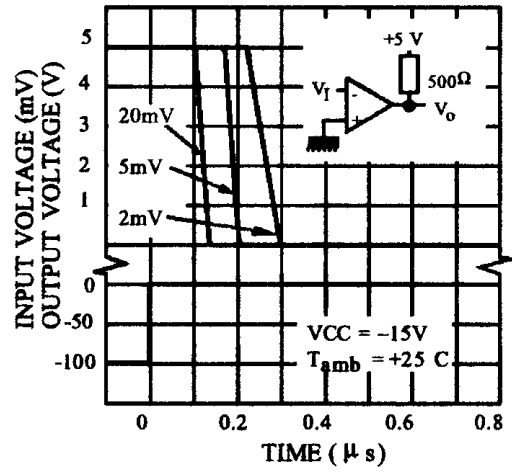




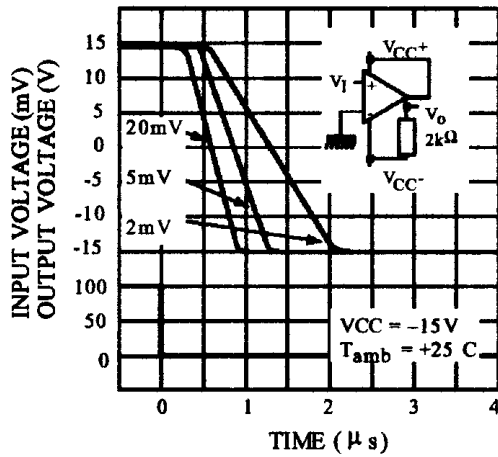
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



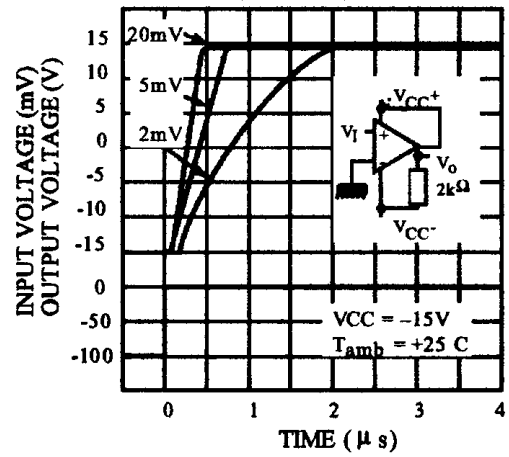
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

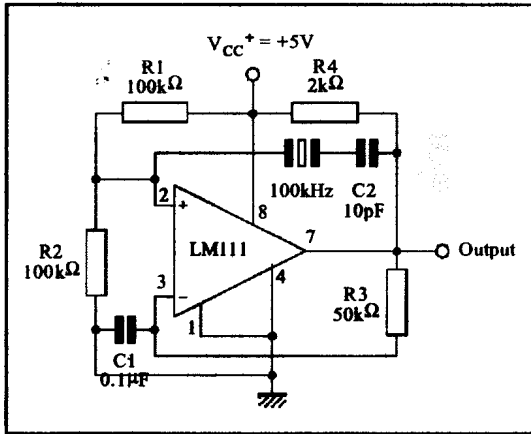


RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES

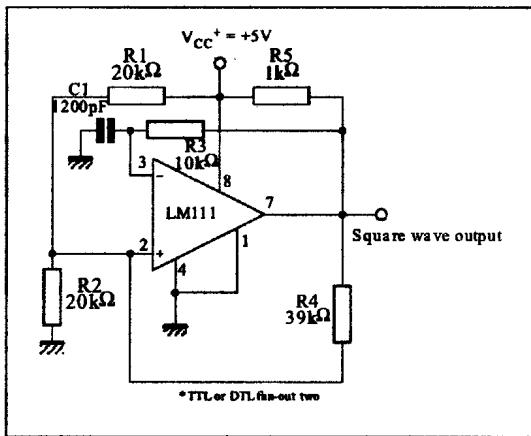


TYPICAL APPLICATIONS

CRYSTAL OSCILLATOR

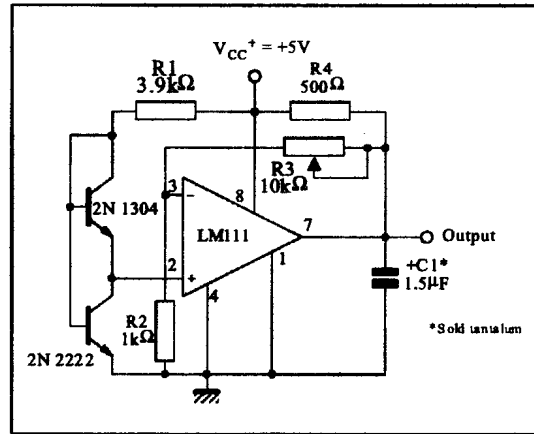


100kHz FREE RUNNING MULTIVIBRATOR



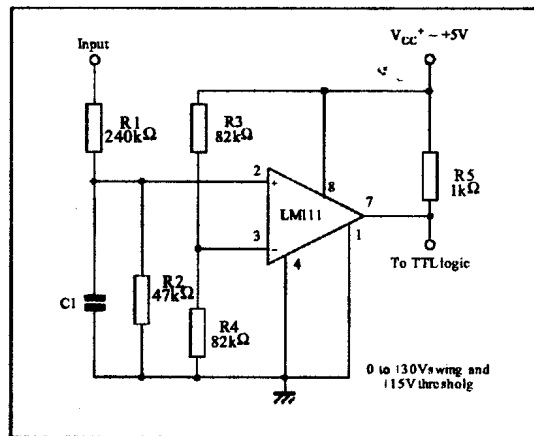
\* TTL or DTL fan-out two

LOW VOLTAGE ADJUSTABLE REFERENCE SUPPLY



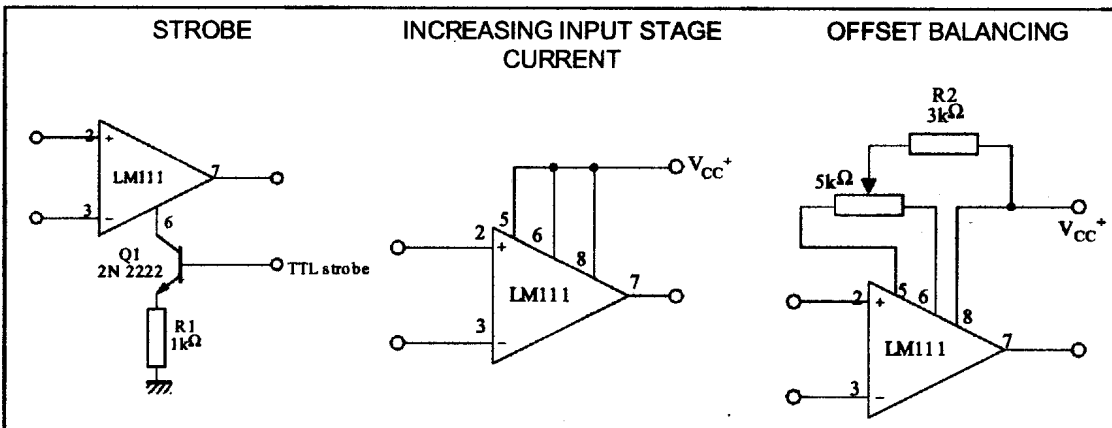
\* Sold separately

TTL INTERFACE WITH HIGH LEVEL LOGIC

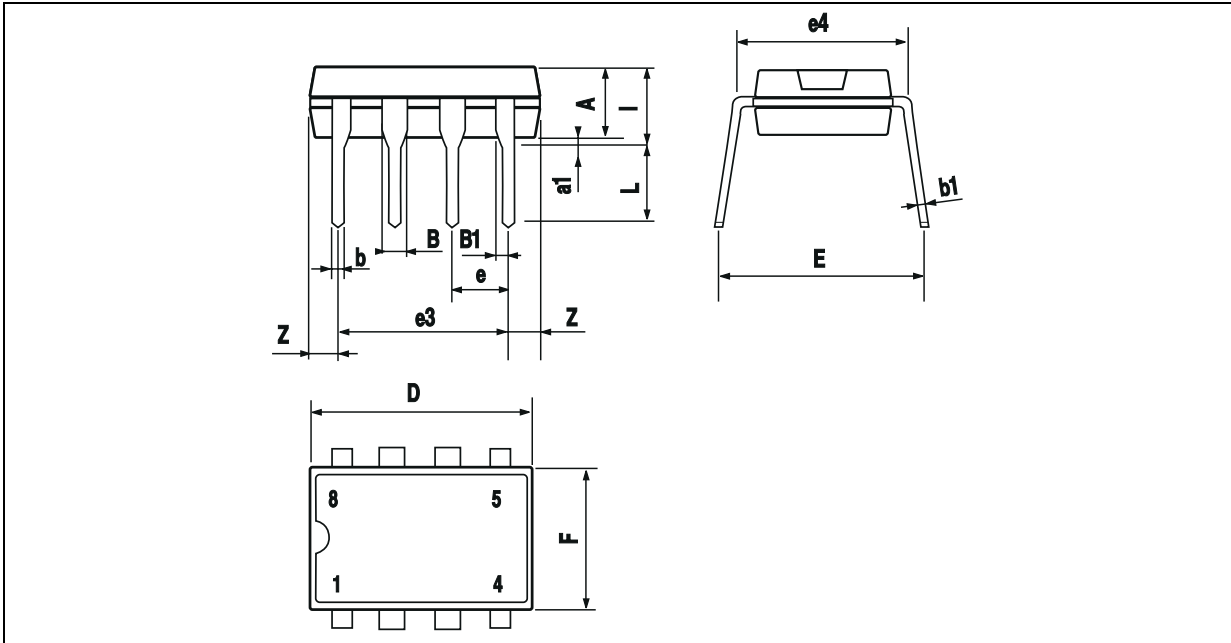


0 to 130Vswing and 115V threshold

AUXILIARY CIRCUITS



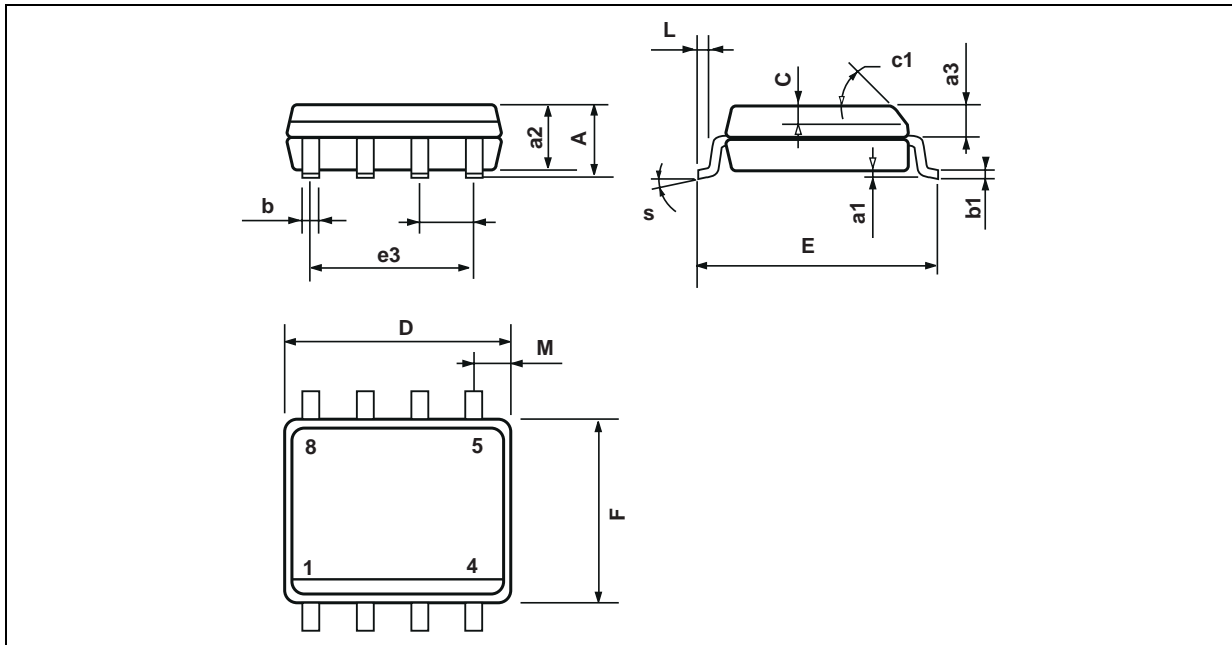
**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC DIP



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060



**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC MICROPACKAGE (SO)



Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

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