

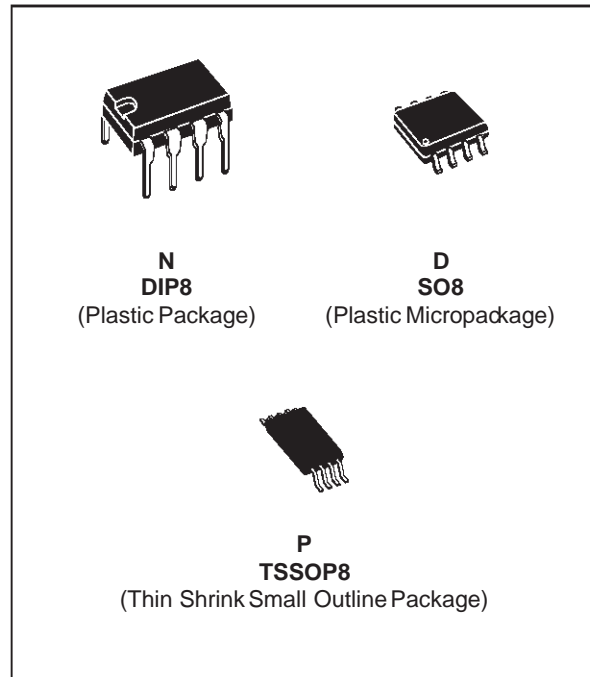
## LOW POWER DUAL VOLTAGE COMPARATORS

- WIDE SINGLE SUPPLY VOLTAGE RANGE OR DUAL SUPPLIES +2V TO +36V OR  $\pm 1V$  TO  $\pm 18V$
- VERY LOW SUPPLY CURRENT (0.4mA) INDEPENDENT OF SUPPLY VOLTAGE (1 mW/comparator at +5V)
- LOW INPUT BIAS CURRENT : 25nA TYP
- LOW INPUT OFFSET CURRENT :  $\pm 5nA$  TYP
- INPUT COMMON-MODE VOLTAGE RANGE INCLUDES GROUND
- LOW OUTPUT SATURATION VOLTAGE : 250mV TYP. ( $I_o = 4mA$ )
- DIFFERENTIAL INPUT VOLTAGE RANGE EQUAL TO THE SUPPLY VOLTAGE
- TTL, DTL, ECL, MOS, CMOS COMPATIBLE OUTPUTS

### DESCRIPTION

This device consists of two independent low power voltage comparators designed specifically to operate from a single supply over a wide range of voltages. Operation from split power supplies is also possible.

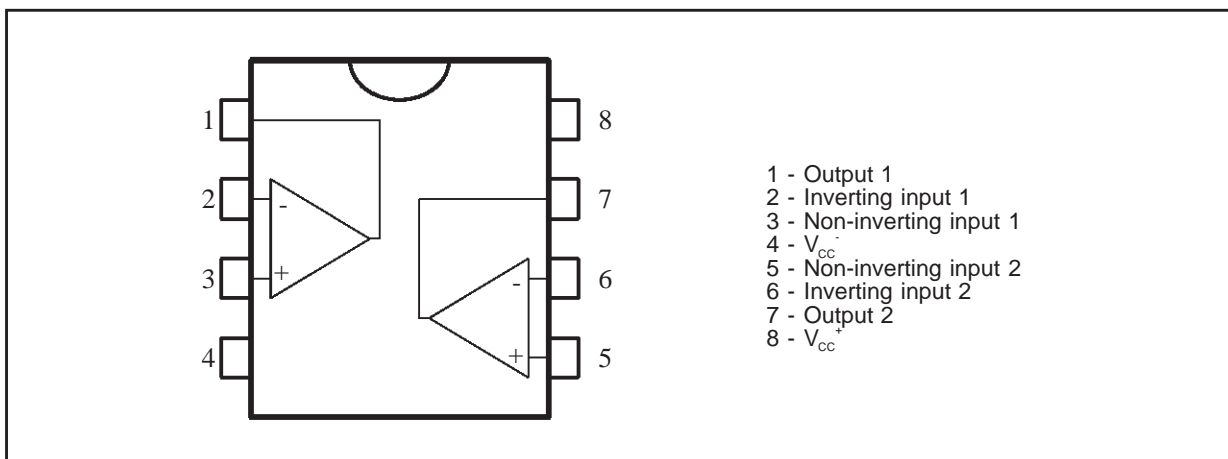
These comparators also have a unique characteristic in the fact that the input common-mode voltage range includes ground even though operated from a single power supply voltage.



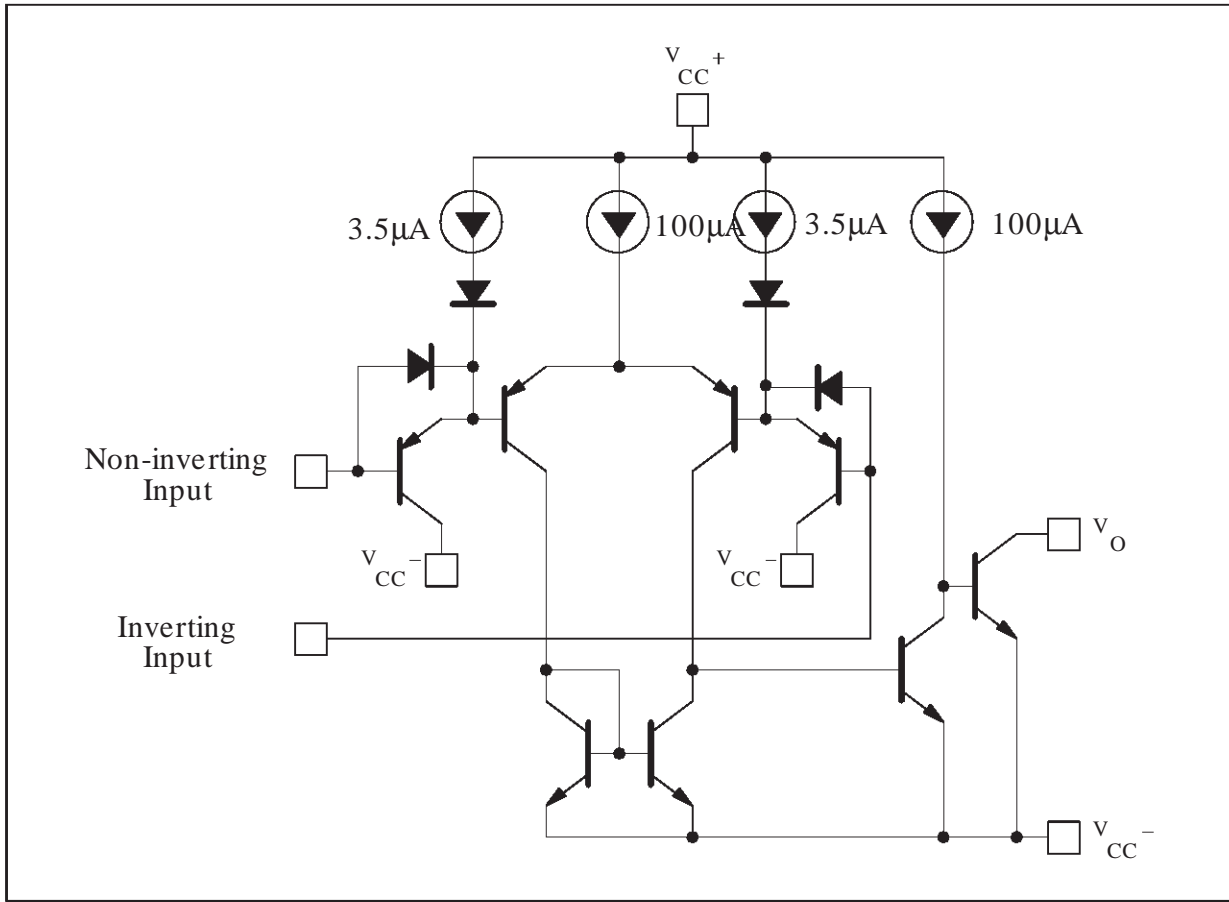
### ORDER CODES

Part Number	Temperature Range	Package		
		N	D	P
LM2903	-40, +125°C	•	•	•
<b>Example : LM2903N</b>				

### PIN CONNECTIONS (top view)



SCHMATIC DIAGRAM (1/2 LM2903)



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage	$\pm 18$ or 36	V
$V_{id}$	Differential Input Voltage	!36	V
$V_i$	Input Voltage	-0.3 to +36	V
	Output Short-circuit to Ground – (note 1)	Infinite	
$P_{tot}$	Power Dissipation	830	mW
$T_{oper}$	Operating Free-air Temperature Range	-40 to +125	$^{\circ}C$
$T_{stg}$	Storage Temperature Range	-65 to +150	$^{\circ}C$

Notes : 1. Short-circuit from the output to  $V_{CC}^+$  can cause excessive heating and eventual destruction. The maximum output current is approximately 20mA, independent of the magnitude of  $V_{CC}^+$ .

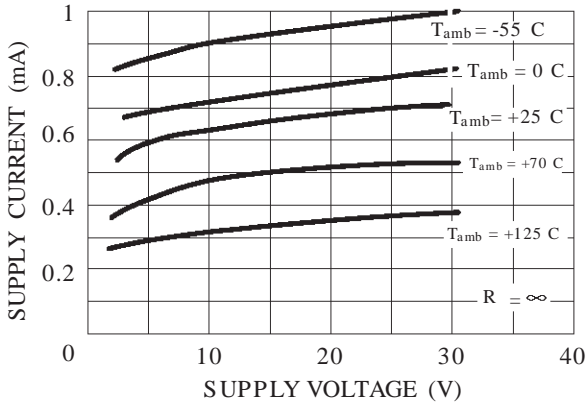
## ELECTRICAL CHARACTERISTICS

 $V_{CC}^+ = +5V$ ,  $V_{CC}^- = 0V$ ,  $T_{amb} = 25^\circ C$  (unless otherwise specified)

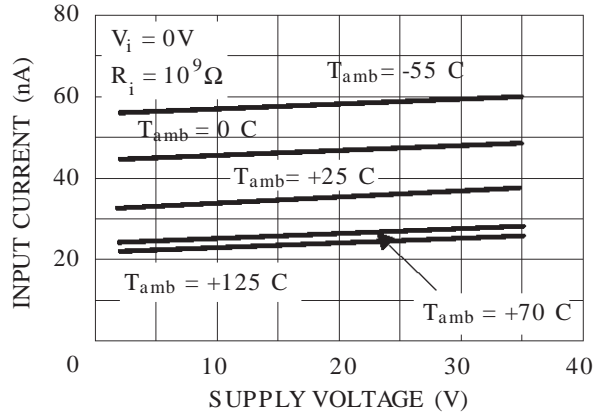
Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{io}$	Input Offset Voltage – (note 2) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		1	7 15	mV
$I_{ib}$	Input Bias Current – (note 3) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		25	250 400	nA
$I_{io}$	Input Offset Current $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		5	50 150	nA
$A_{vd}$	Large Signal Voltage Gain $V_{CC} = 15V$ , $R_L = 15k\Omega$ , $V_o = 1$ to $11V$	25	200		V/mV
$I_{CC}$	Supply Current (all comparators) $V_{CC} = 5V$ , no load $V_{CC} = 30V$ , no load		0.4 1	1 2.5	mA
$V_{icm}$	Input Common Mode Voltage Range ( $V_{CC} = 30V$ ) - (note 4) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$	0 0		$V_{CC}^+ - 1.5$ $V_{CC}^+ - 2$	V
$V_{id}$	Differential Input Voltage - (note 6)			$V_{CC}^+$	V
$I_{sink}$	Output Sink Current ( $V_{id} = -1V$ , $V_o = 1.5V$ )	6	16		mA
$V_{OL}$	Low Level Output Voltage ( $V_{id} = -1V$ , $I_{sink} = 4mA$ ) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		250	400 700	mV
$I_{OH}$	High Level Output Current ( $V_{id} = 1V$ , $V_{CC} = V_o = 30V$ ) $T_{amb} = 25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		0.1	1	nA $\mu A$
$t_{re}$	Small Signal Response Time ( $R_L = 5.1k\Omega$ to $V_{CC}^+$ ) - (note 5)		1.3		$\mu s$
$t_{rel}$	Large Signal Response Time - (note 7) TTL Input ( $V_{ref} = +1.4V$ , $R_L = 5.1k\Omega$ to $V_{CC}^+$ ) Output Signal at 50% of final value Output Signal at 95% of final value			500 1	ns $\mu s$

- Notes :
- At output switch point,  $V_o \neq 1.4V$ ,  $R_s = 0\Omega$  with  $V_{CC}^+$  from 5V to 30V and over the full input common-mode range (0V to  $V_{CC}^+ - 1.5V$ ).
  - The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output, so no loading charge exists on the reference or input lines.
  - The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is  $V_{CC}^+ - 1.5V$ , but either or both inputs can go to +30V without damage.
  - The response time specified is for a 100mV input step with 5mV overdrive.
  - Positive excursions of input voltage may exceed the power supply level.  
As long as the other voltage remains within the common-mode range the comparator will provide a proper output state. The low input voltage state must not be less than  $-0.3V$  (or  $0.3V$  below the negative power supply, if used).
  - Maximum values are guaranteed by design.

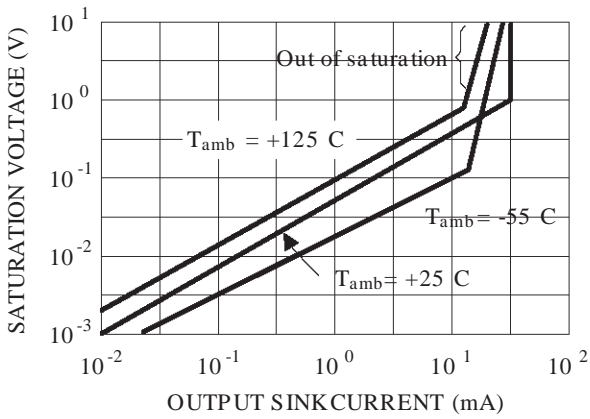
SUPPLY CURRENT versus SUPPLY VOLTAGE



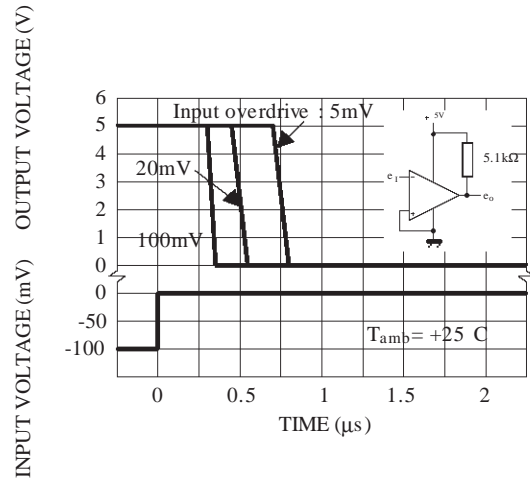
INPUT CURRENT versus SUPPLY VOLTAGE



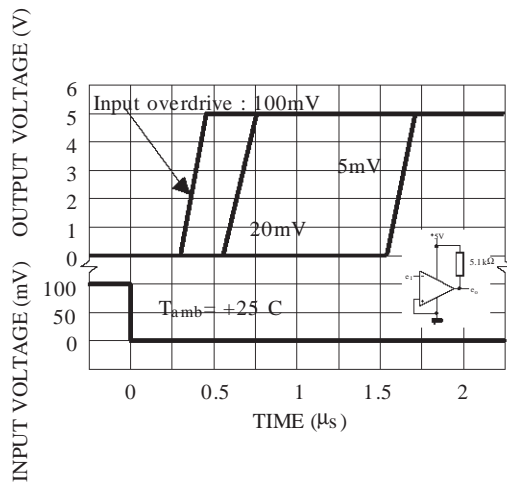
OUTPUT SATURATION VOLTAGE versus OUTPUT CURRENT



RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - NEGATIVE TRANSITION

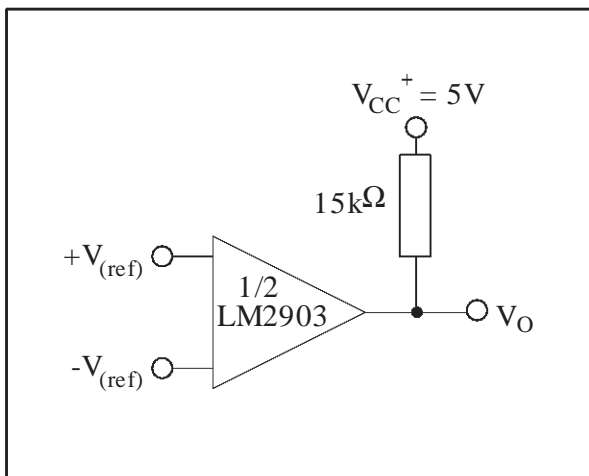


RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION

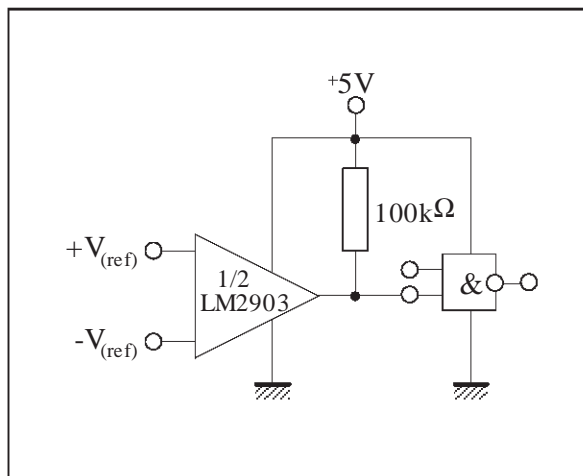


TYPICAL APPLICATIONS

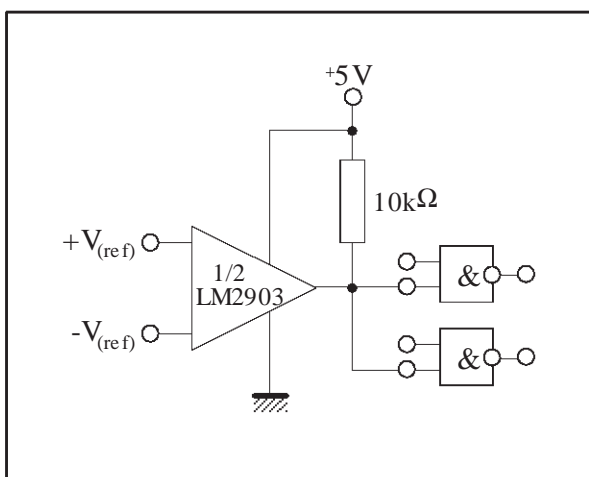
BASIC COMPARATOR



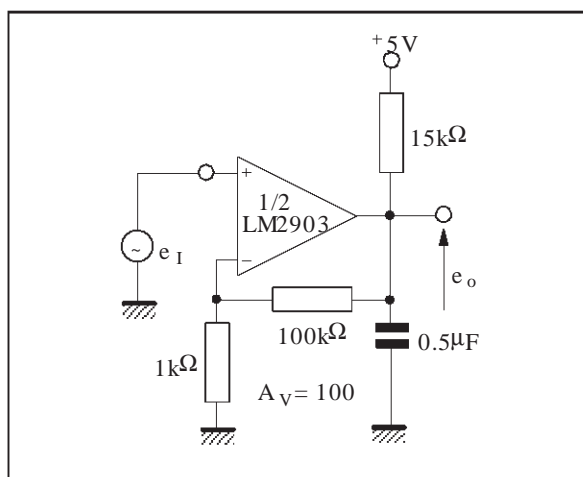
DRIVING CMOS



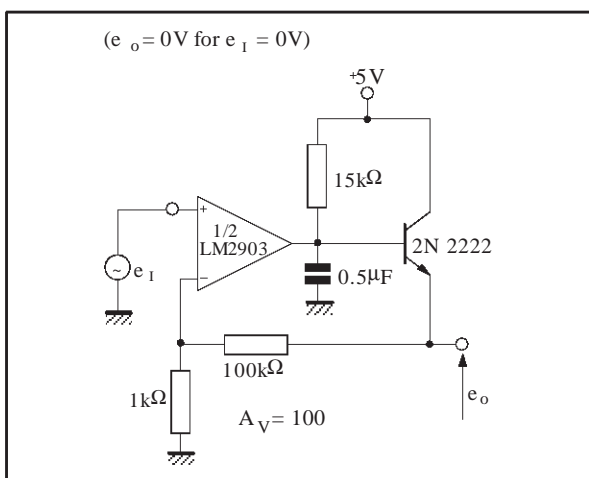
DRIVING TTL



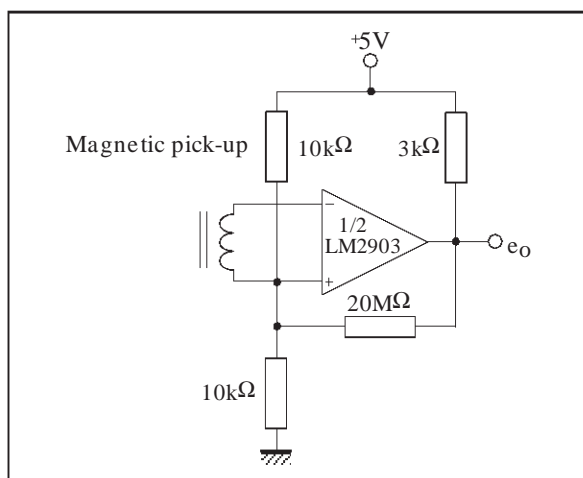
LOW FREQUENCY OP AMP



LOW FREQUENCY OP AMP

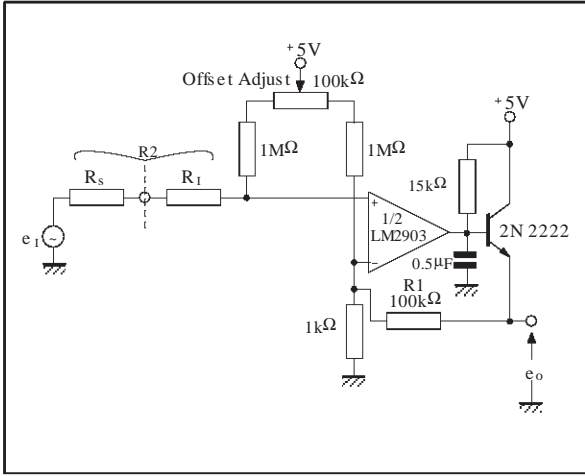


TRANSDUCER AMPLIFIER

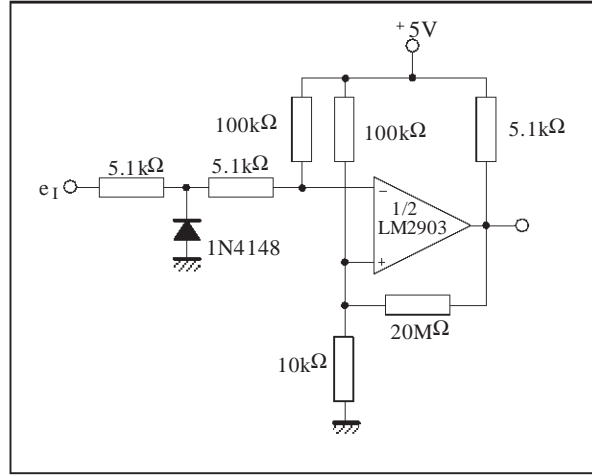


# LM2903

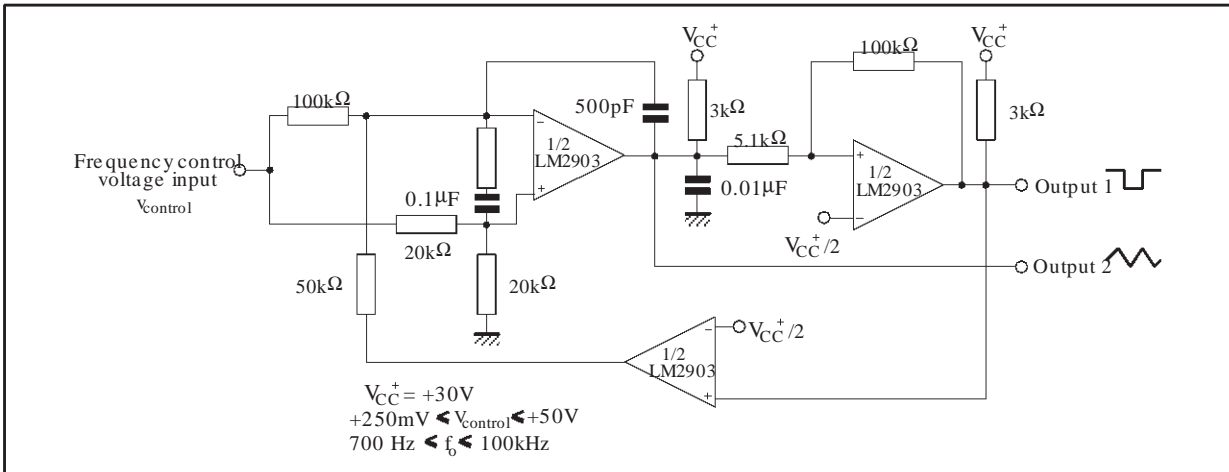
LOW FREQUENCY OP AMP WITH OFFSET ADJUST



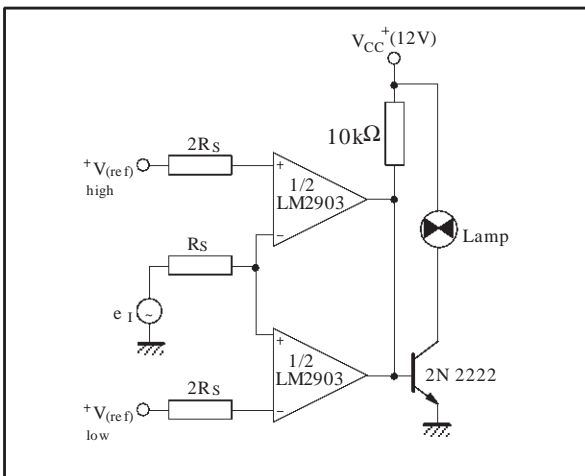
ZERO CROSSING DETECTOR (SINGLE POWER SUPPLY)



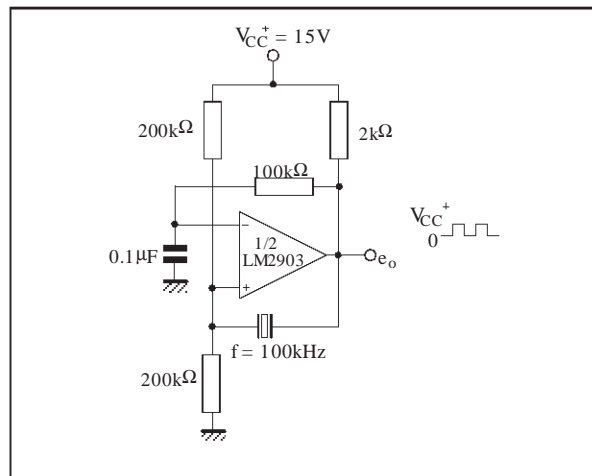
TWO DECADES HIGH FREQUENCY VCO

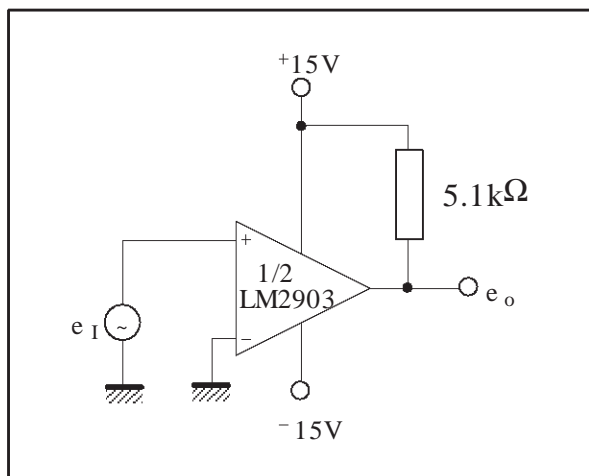
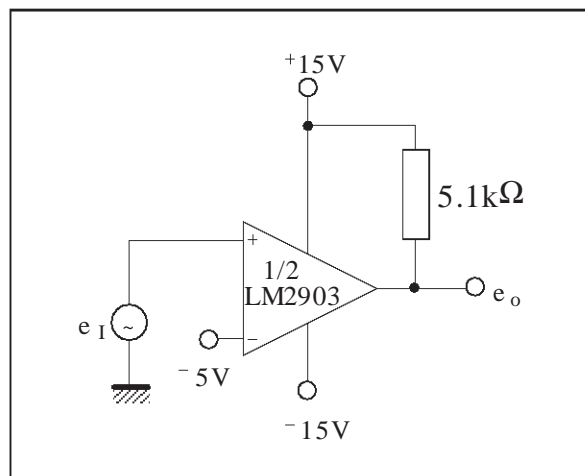


LIMIT COMPARATOR



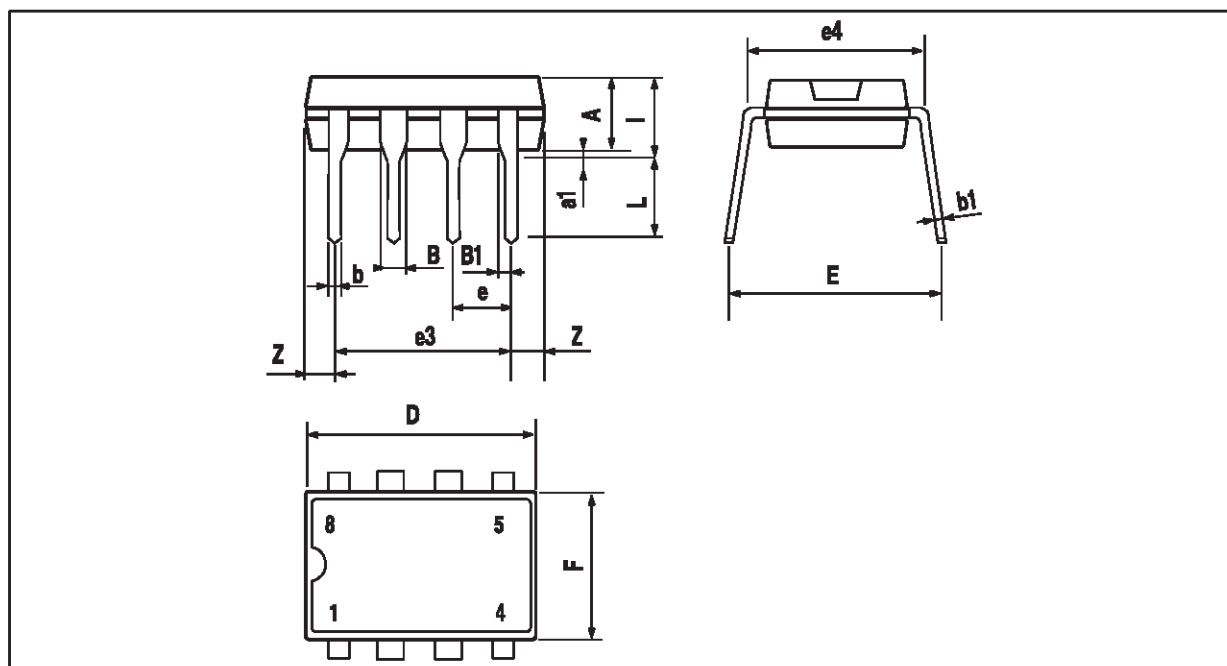
CRYSTAL CONTROLLED OSCILLATOR



**SPLIT-SUPPLY APPLICATIONS**  
**ZERO CROSSING DETECTOR****COMPARATOR WITH A NEGATIVE REFERENCE**

# LM2903

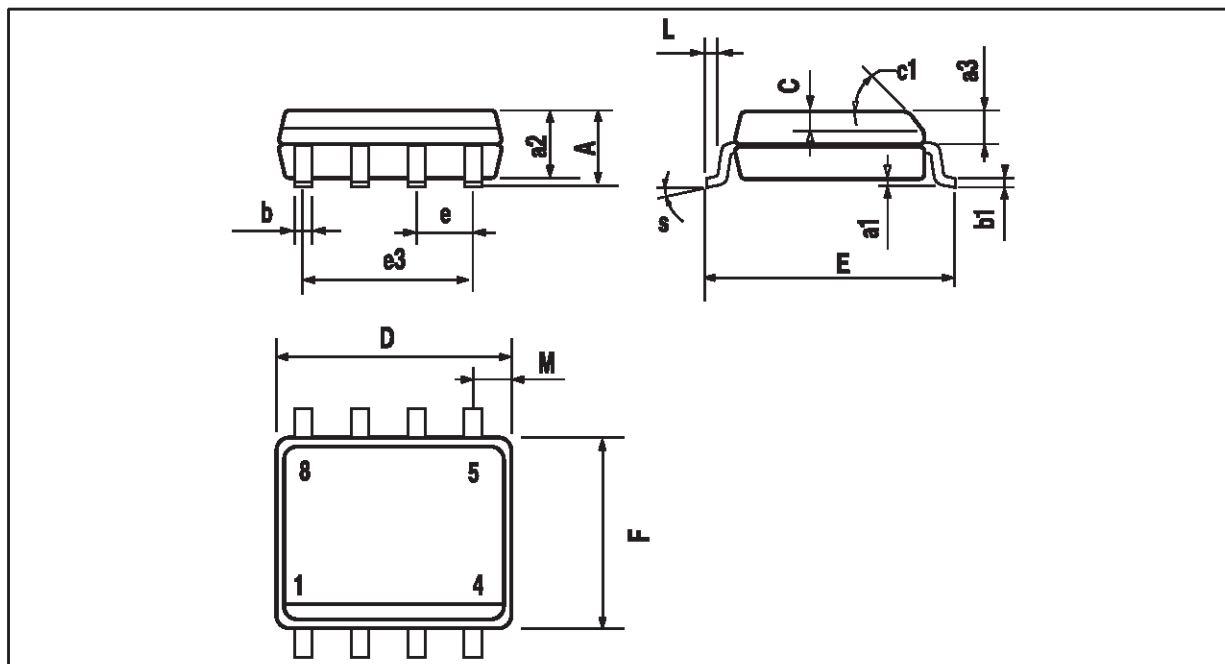
## PACKAGE MECHANICAL DATA 8 PINS -PLASTIC DIP



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

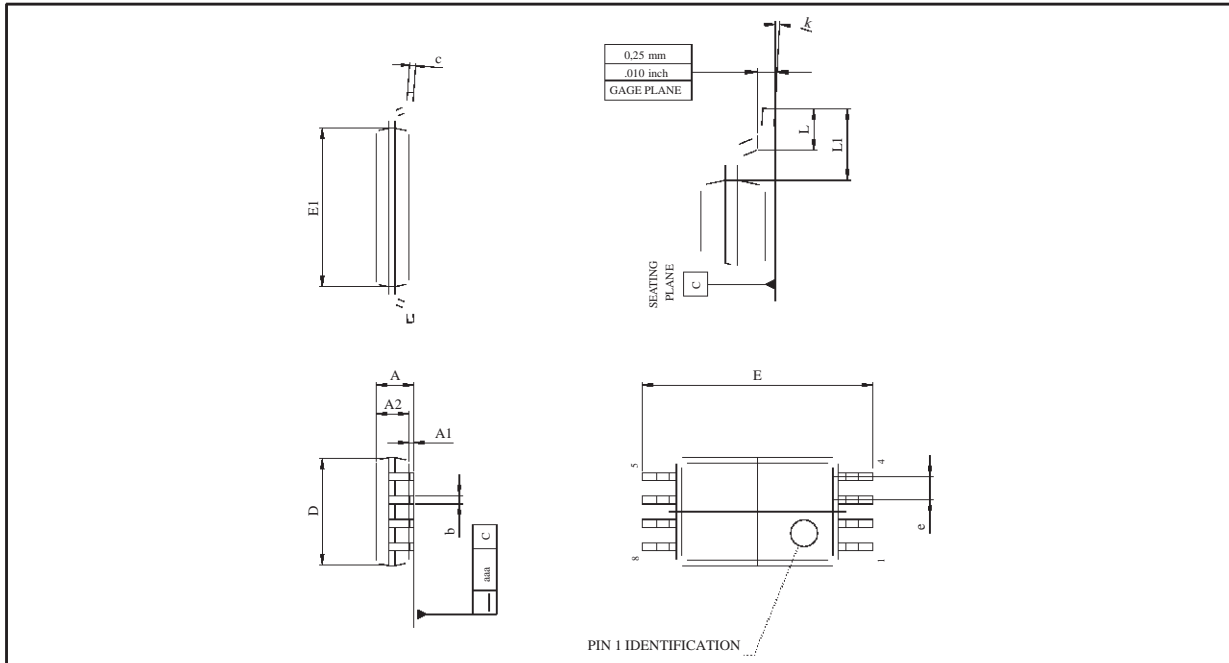


**PACKAGE MECHANICAL DATA**  
8 PINS -PLASTIC MICROPACKAGE (SO)



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.)					

**PACKAGE MECHANICAL DATA**  
**8 PINS -THIN SHRINK SMALL OUTLINE PACKAGE**



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.20			0.05
A1	0.05		0.15	0.01		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.15
c	0.09		0.20	0.003		0.012
D	2.90	3.00	3.10	0.114	0.118	0.122
E		6.40			0.252	
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.025	
k	0°		8°	0°		8°
l	0.50	0.60	0.75	0.09	0.0236	0.030

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