

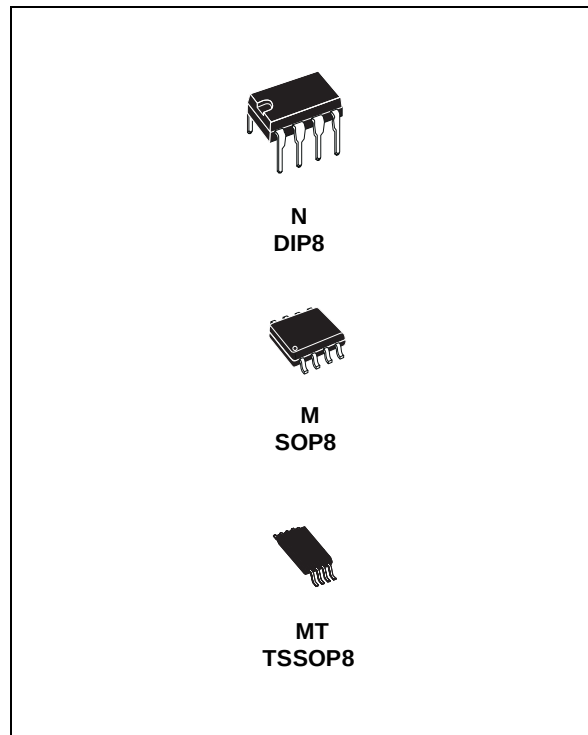
LOW POWER DUAL VOLTAGE COMPARATORS

- 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 (1mW/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

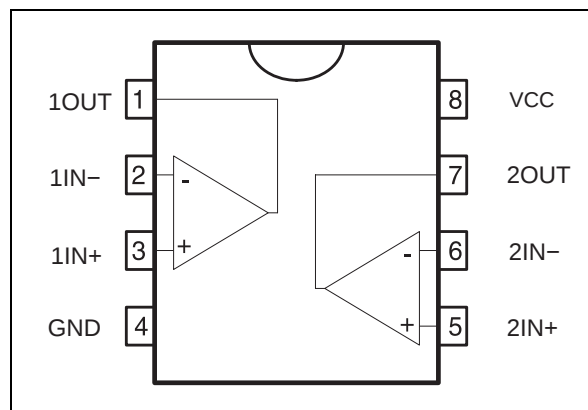
DESCRIPTION

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 that the input common-mode voltage range includes ground even though operated from a single power supply voltage.

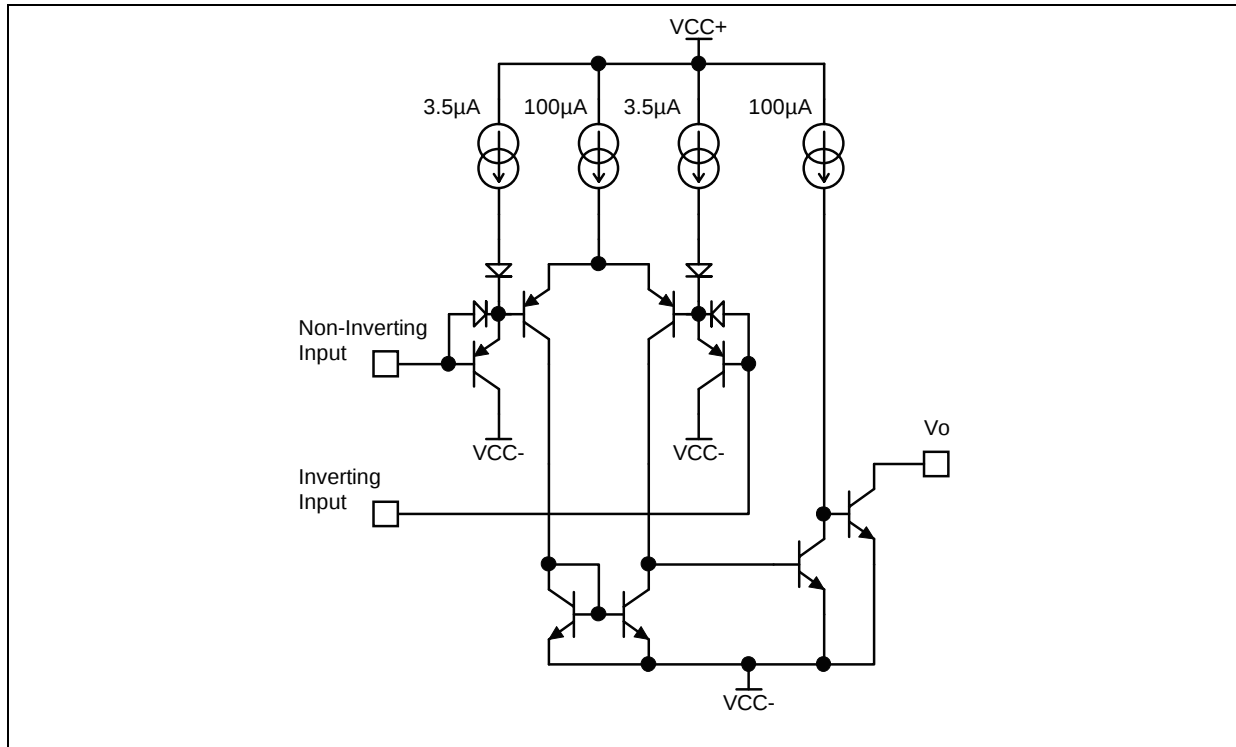


PIN CONNECTIONS (top view)



ORDERING INFORMATION

DEVICE	Package Type	MARKING	Packing	Packing Qty
LM2903N	DIP8L	LM2903	TUBE	2000/box
LM2903M/TR	SOP8L	LM2903	REEL	2500/reel
LM2903MT/TR	TSSOP8L	LM2903	REEL	2500/reel

SCHEMATIC DIAGRAM (1/2 LM2903)

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}	Supply Voltage	± 18 to 36	V
V_{ID}	Differential Input Voltage	± 36	V
V_I	Input Voltage	-0.3 to +36	V
	Output Short-circuit to Ground ¹⁾	Infinite	
P_d	Power Dissipation ²⁾ DIP8 SO8 TSSOP8	1250 710 625	mW
$T_{Junction}$	Junction Temperature	+150	°C
T_{stg}	Storage Temperature Range	-65 to +150	°C

- 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}^+ .
- P_d is calculated with $T_{amb} = +25^\circ\text{C}$, $T_j = +150^\circ\text{C}$ and $R_{thja} = 100^\circ\text{C/W}$ for DIP8 package
 $= 175^\circ\text{C/W}$ for SO8 package
 $= 200^\circ\text{C/W}$ for TSSOP8 package

OPERATING CONDITIONS

Symbol	Parameter	Value	Unit
V_{icm}	Common Mode Input Voltage Range	0 to $V_{CC}^+ - 1.5$	V
T_{oper}	Operating Free-Air Temperature range	-40 to +125	°C

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

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{IO}	Input Offset Voltage ¹⁾ $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$.		1	7 15	mV
I_{IO}	Input Offset Current $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$.		5	50 150	nA
I_{IB}	Input Bias Current ²⁾ $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$.		25	250 400	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 ($V_{CC} = 30V$) ³⁾ $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$.	0 0		$V_{CC}^+ - 1.5$ $V_{CC}^+ - 2$	V
V_{ID}	Differential Input Voltage ⁴⁾			V_{CC}^+	V
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 ($V_{CC} = V_O = 30V, V_{id} = 1V$) $T_{amb} = +25^\circ C$ $T_{min} \leq T_{amb} \leq T_{max}$		0.1	1	nA μA
I_{SINK}	Output Sink Current ($V_{id} = -1V, V_O = 1.5V$)	6	16		mA
t_{RE}	Small Signal Response Time ⁵⁾ ($R_L = 5.1k\Omega$ to V_{CC}^+)		1.3		μs
t_{REL}	Large Signal Response Time ⁶⁾ 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 μs

1. At output switch point, $V_O \approx 1.4V$, $R_S = 0\Omega$ with V_{CC}^+ from 5V to 30V, and over the full input common-mode range (0V to $V_{CC}^+ - 1.5V$).

2. 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 of input lines

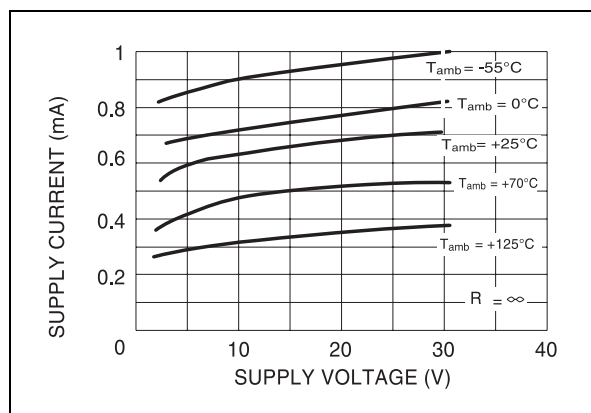
3. The input common-mode voltage of either input signal voltage should not be allowed to go negative by more than 0.3V. The upper end of the common-mode voltage range is $V_{CC}^+ - 1.5V$, but either or both inputs can go to +30V without damage.

4. 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)

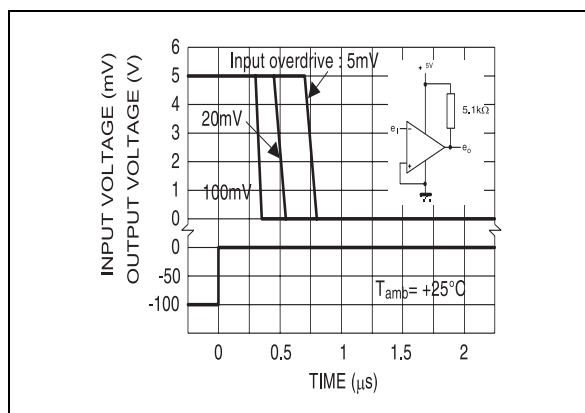
5. The response time specified is for a 100mV input step with 5mV overdrive.

6. Maximum values are guaranteed by design & evaluation.

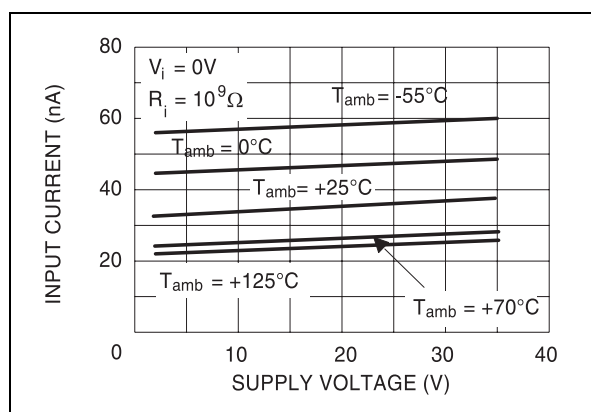
SUPPLY CURRENT versus SUPPLY VOLTAGE



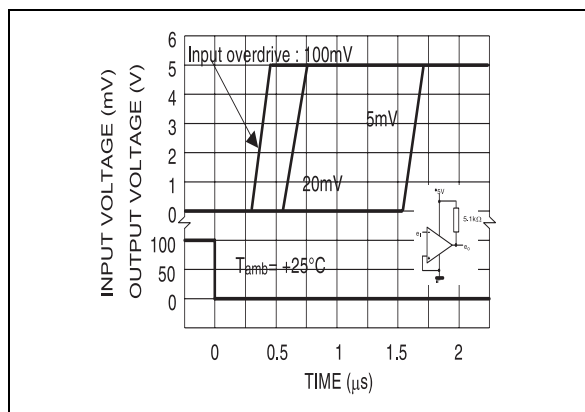
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - NEGATIVE TRANSITION



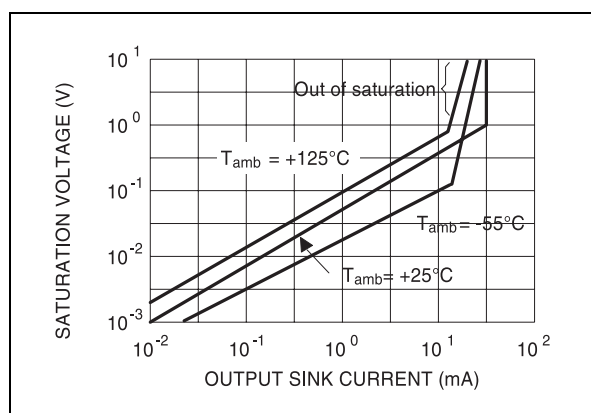
INPUT CURRENT versus SUPPLY VOLTAGE



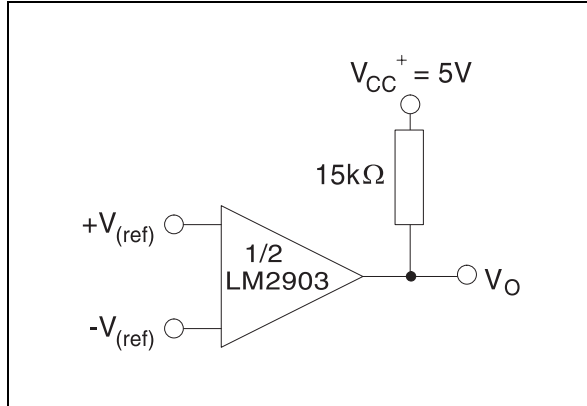
RESPONSE TIME FOR VARIOUS INPUT OVERDRIVES - POSITIVE TRANSITION



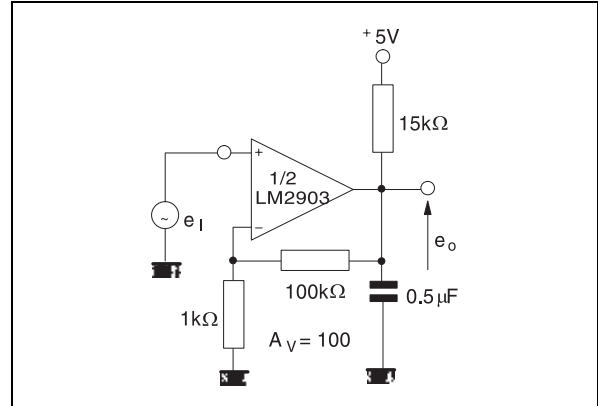
OUTPUT SATURATION VOLTAGE versus OUTPUT CURRENT



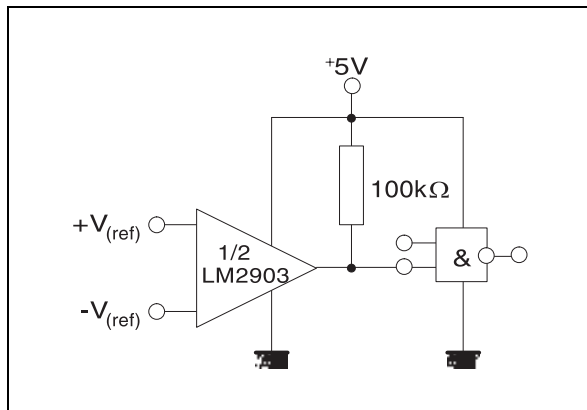
TYPICAL APPLICATIONS
BASIC COMPARATOR



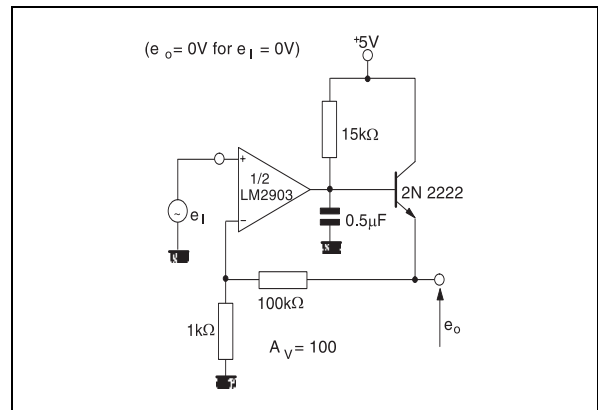
LOW FREQUENCY OP AMP



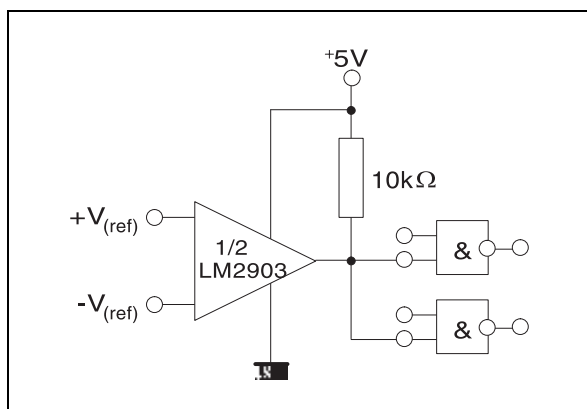
DRIVING CMOS



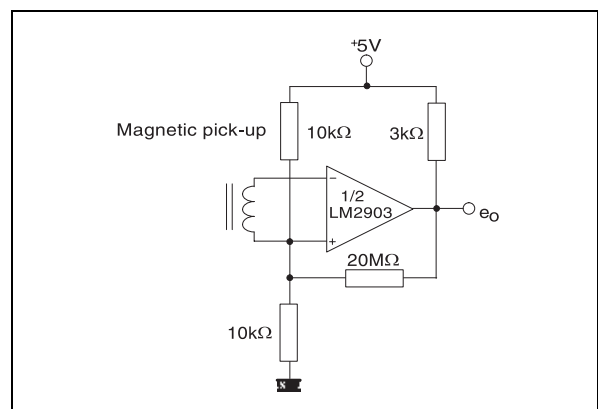
LOW FREQUENCY OP AMP



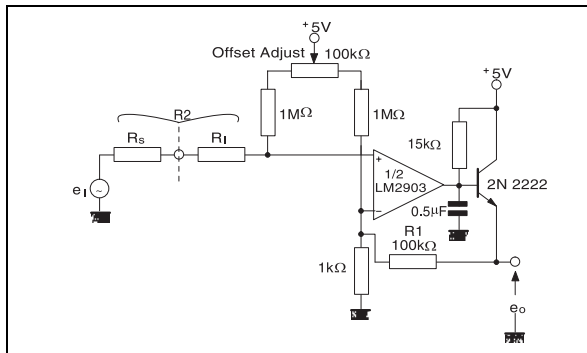
DRIVING TTL



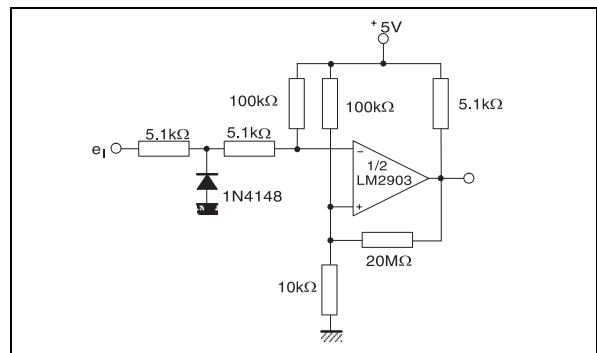
TRANSDUCER AMPLIFIER



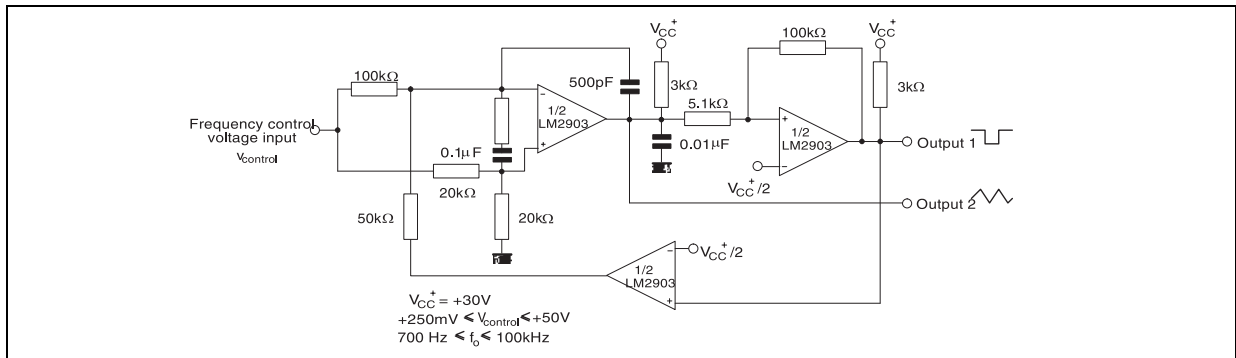
LOW FREQUENCY OP AMP WITH OFFSET ADJUST



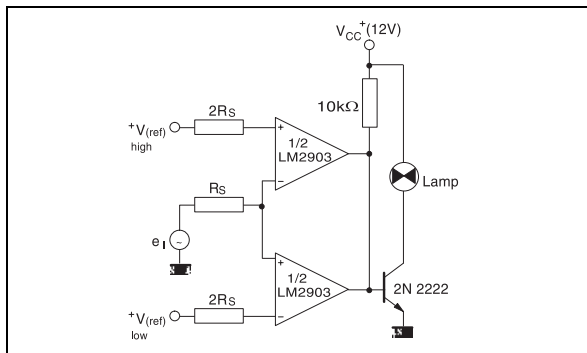
ZERO CROSSING DETECTOR (single power supply)



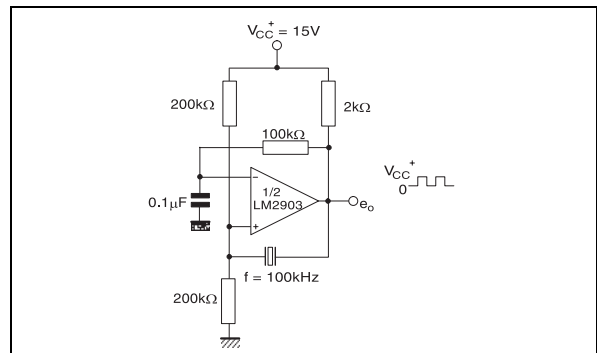
TWO-DECADE HIGH-FREQUENCY VCO



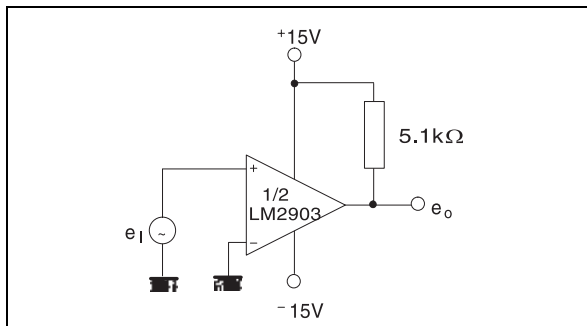
LIMIT COMPARATOR



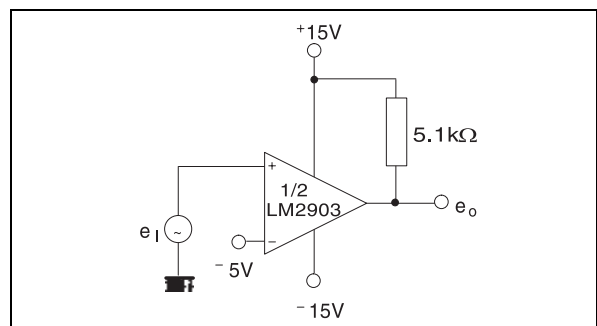
CRYSTAL CONTROLLED OSCILLATOR



SPLIT-SUPPLY APPLICATIONS ZERO CROSSING DETECTOR

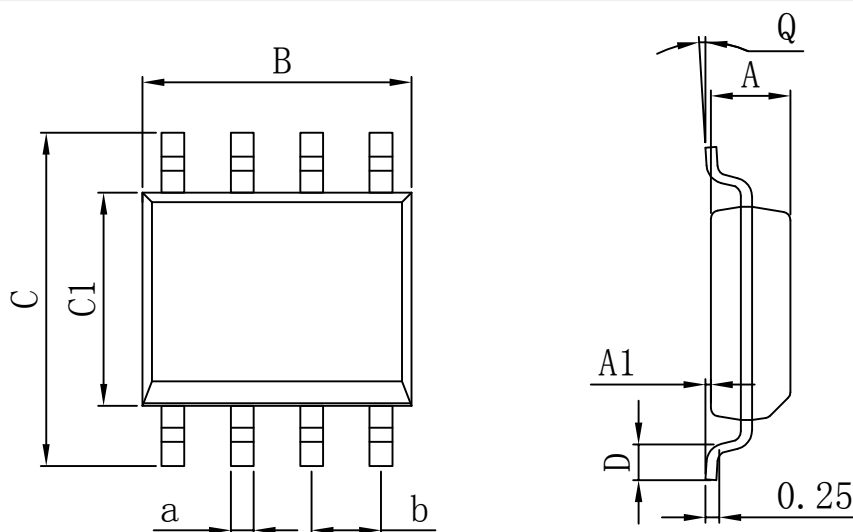


COMPARATOR WITH A NEGATIVE REFERENCE



PACKAGE

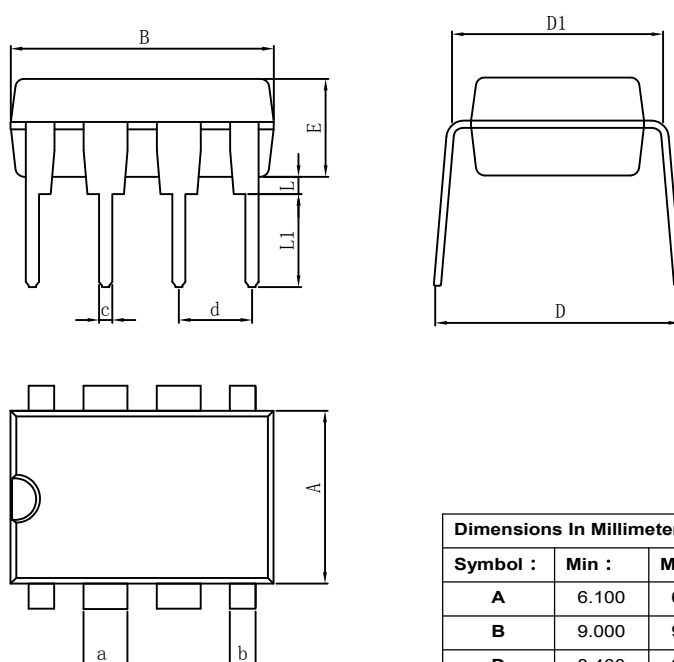
SOP8



Dimensions In Millimeters

Symbol :	Min :	Max :	Symbol :	Min :	Max :
A	4.520	4.620	D	0.400	0.950
A1	0.100	0.250	Q	0°	8°
B	4.800	5.100	a	0.420 TYP	
C	5.800	6.250	b	1.270 TYP	
C1	3.800	4.000			

DIP8

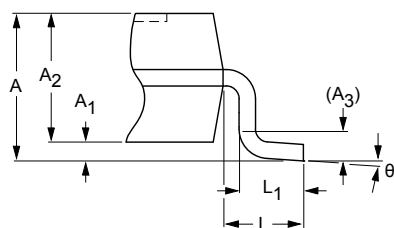
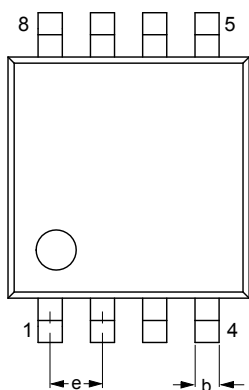
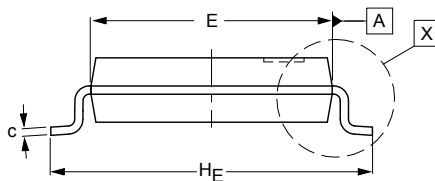
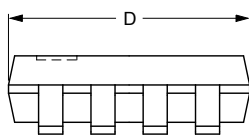


Dimensions In Millimeters

Symbol :	Min :	Max :	Symbol :	Min :	Max :
A	6.100	6.680	L1	3.000	3.600
B	9.000	9.500	a	1.524 TYP	
D	8.400	9.000	b	0.889 TYP	
D1	7.420	7.820	c	0.457 TYP	
E	3.100	3.550	d	2.540 TYP	
L	0.500	0.700			

PACKAGE

TSSOP8



Dimensions In Millimeters

Symbol :	Min :	Max :	Symbol :	Min :	Max :
A	0.750	1.100	L1	0.330	0.470
A1	0	0.150	θ	0°	8°
A2	0.750	0.950	b	0.130 TYP	
D	2.900	3.100	C	0.150 TYP	
E	2.900	3.100	e	0.650 TYP	
L	0.400	0.600			

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