



钜地半导体
Tudi Semiconductor

Product Specification

TUDI-LM2903

Low-power dual voltage comparator

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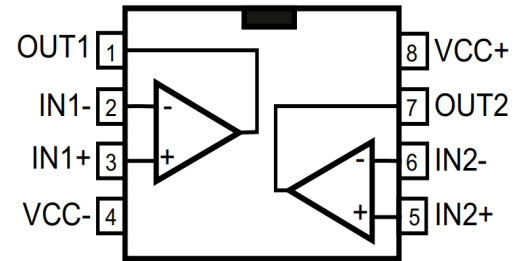
**semiconductor device
manufacturer**

- Design
- research and development
- production
- and sales



Features

- Wide single supply voltage range or dual supplies +2 V to +36 V or ± 1 V to ± 18 V
- Very low supply current (0.4 mA) independent of supply voltage (1 mW/comparator at +5 V)
- Low input bias current: 25 nA typ.
- Low input offset current: ± 5 nA typ.
- Input common-mode voltage range includes negative rail
- Low output saturation voltage: 250 mV typ. ($I_O = 4$ mA)
- Differential input voltage range equal to the supply voltage
- TTL, DTL, ECL, MOS, CMOS compatible outputs
- Automotive qualification



DIP8 / SO8 / TSSOP8 / MiniSO8

Related products

- See LM2903W for similar device with higher ESD performances
- See LM2903H for similar device with operating temperature up to 150 °C

Description

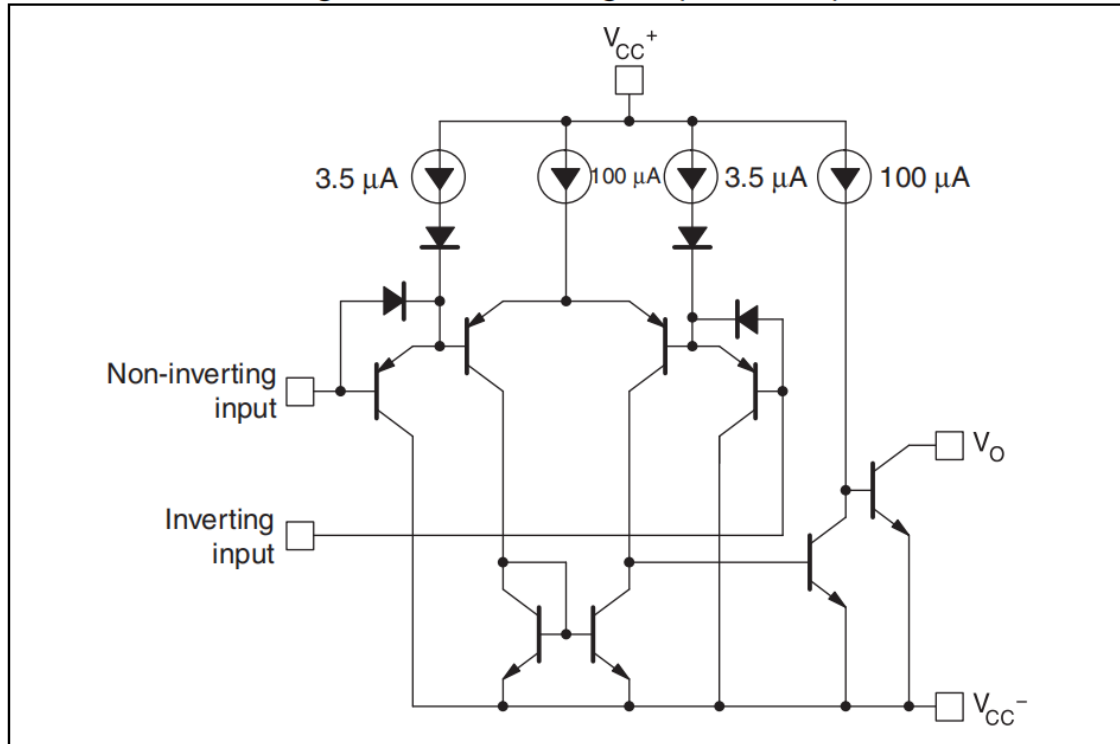
This device consists of two independent low-power voltage comparators designed specifically to operate from a single supply over a wide range of voltages. Operation from split power supplies is also possible.

In addition, the device has a unique characteristic in that the input common-mode voltage range includes the negative rail even though operated from a single power supply voltage.



Schematic diagram

Figure 1. Schematic diagram (1/2 LM2903)





Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	± 18 or 36	V
V_{id}	Differential input voltage	± 36	
V_{in}	Input voltage	-0.3 to +36	
	Output short-circuit to ground ⁽¹⁾	Infinite	
R_{thja}	Thermal resistance junction to ambient ⁽²⁾		$^{\circ}\text{C/W}$
	DIP8	85	
	SO8	125	
	TSSOP8	120	
	MiniSO8	190	
	DFN8 2x2 mm	57	
R_{thjc}	Thermal resistance junction to case ⁽²⁾		$^{\circ}\text{C/W}$
	DIP8	41	
	SO8	40	
	TSSOP8	37	
	MiniSO8	39	
	DFN8 2x2 mm	57	
T_j	Maximum junction temperature	+150	$^{\circ}\text{C}$
T_{stg}	Storage temperature range	-65 to +150	
ESD	Human body model (HBM) ⁽³⁾	800	V
	Machine model (MM) ⁽⁴⁾	200	
	CDM: charged device model (all packages except MiniSO8) ⁽⁵⁾	1.5	kV
	CDM: charged device model (MiniSO8)	1.3	

1. Short-circuits from the output to V_{CC}^{+} can cause excessive heating and possible destruction. The maximum output current is approximately 20 mA, independent of the magnitude of V_{CC}^{+} .
2. Short-circuits can cause excessive heating and destructive dissipation. Values are typical.
3. Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 k Ω resistor between two pins of the device. This is done for all couples of connected pin combinations while the other pins are floating.
4. Machine model: a 200 pF capacitor is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω). This is done for all couples of connected pin combinations while the other pins are floating.
5. Charged device model: all pins and the package are charged together to the specified voltage and then discharged directly to the ground through only one pin. This is done for all pins.

Table 2. Operating conditions

Symbol	Parameter	Value	Unit
V_{icm}	Common mode input voltage range $T_{min} \leq T_{amb} \leq T_{max}$	0 to $V_{CC}^{+} - 1.5$ 0 to $V_{CC}^{+} - 2$	V
T_{oper}	Operating free-air temperature range	-40 to +125	$^{\circ}\text{C}$



Electrical characteristics

Table 3. $V_{CC}^+ = 5\text{ V}$, $V_{CC}^- = \text{GND}$, $T_{\text{amb}} = 25^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage ⁽¹⁾ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		1	7 15	mV
I_{io}	Input offset current $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		5	50 150	nA
I_{ib}	Input bias current ⁽²⁾ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		25	250 400	
A_{vd}	Large signal voltage gain $V_{CC} = 15\text{ V}$, $R_L = 15\text{ k}\Omega$, $V_o = 1\text{ to }11\text{ V}$	25	200		V/mV
I_{CC}	Supply current (all comparators) $V_{CC} = 5\text{ V}$, no load $V_{CC} = 30\text{ V}$, no load		0.4 1	1 2.5	mA
V_{id}	Differential input voltage ⁽³⁾			V_{CC}^+	V
V_{OL}	Low level output voltage ($V_{id} = -1\text{ V}$, $I_{\text{sink}} = 4\text{ mA}$) $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		250	400 700	mV
I_{OH}	High level output current ($V_{CC} = V_o = 30\text{ V}$, $V_{id} = 1\text{ V}$) $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$		0.1	1	nA μA
I_{sink}	Output sink current ($V_{id} = -1\text{ V}$, $V_o = 1.5\text{ V}$)	6	16		mA
t_{res}	Small signal response time ⁽⁴⁾ ($R_L = 5.1\text{ k}\Omega$ to V_{CC}^+)		1.3		μs
t_{rel}	Large signal response time ⁽⁵⁾ TTL input ($V_{\text{ref}} = +1.4\text{ V}$, $R_L = 5.1\text{ k}\Omega$ 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, $V_o \approx 1.4\text{ V}$, $R_S = 0\text{ }\Omega$ with V_{CC}^+ from 5 V to 30 V , and over the full input common-mode range (0 V to $V_{CC}^+ - 1.5\text{ V}$).
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. 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 provides a proper output state. The low input voltage state must not be less than -0.3 V (or 0.3 V below the negative power supply, if used).
4. The response time specified is for a 100 mV input step with 5 mV overdrive.
5. Maximum values are guaranteed by design and evaluation.



Typical application schematics

Figure 1. Basic comparator

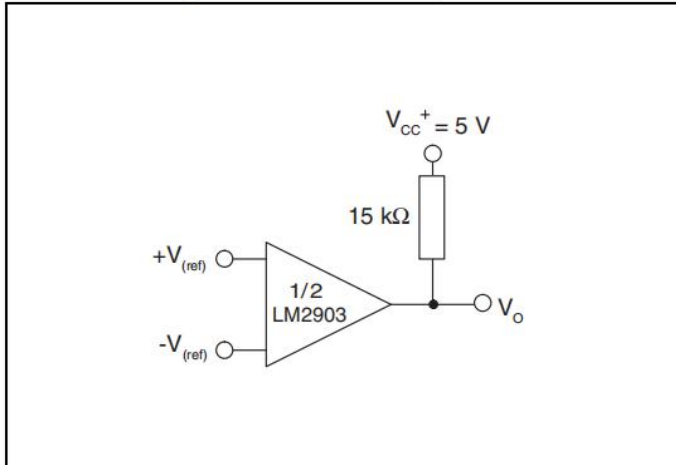


Figure 2. Driving CMOS

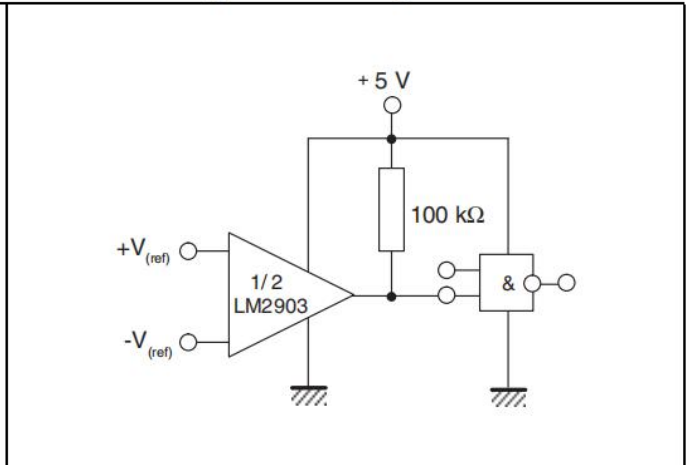


Figure 3. Driving TTL

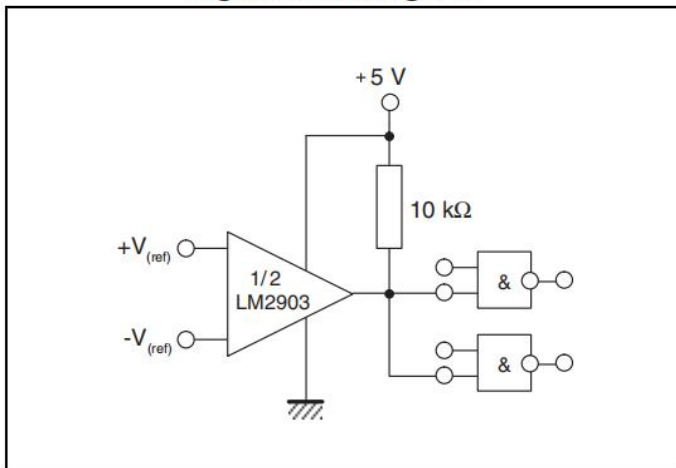


Figure 4. Low frequency op-amp

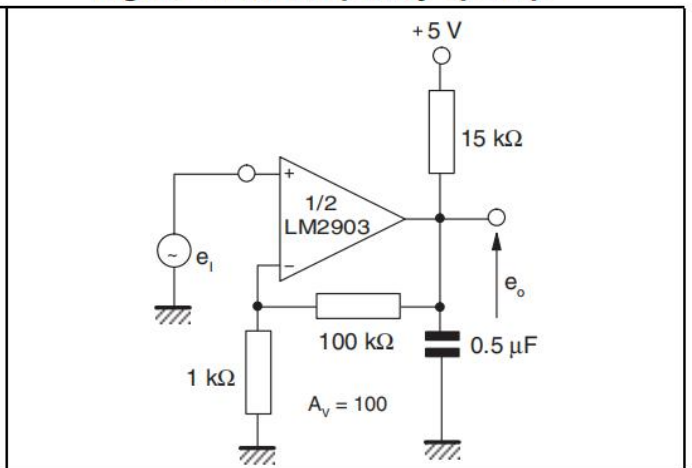


Figure 5. Low frequency op-amp with boost

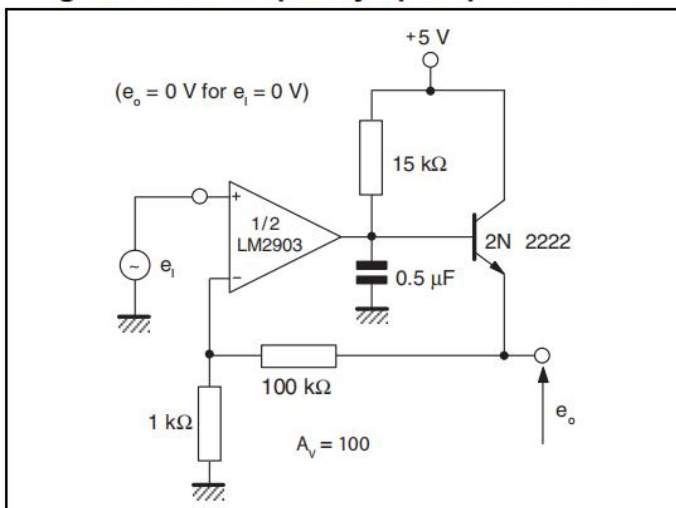


Figure 6. Transducer amplifier

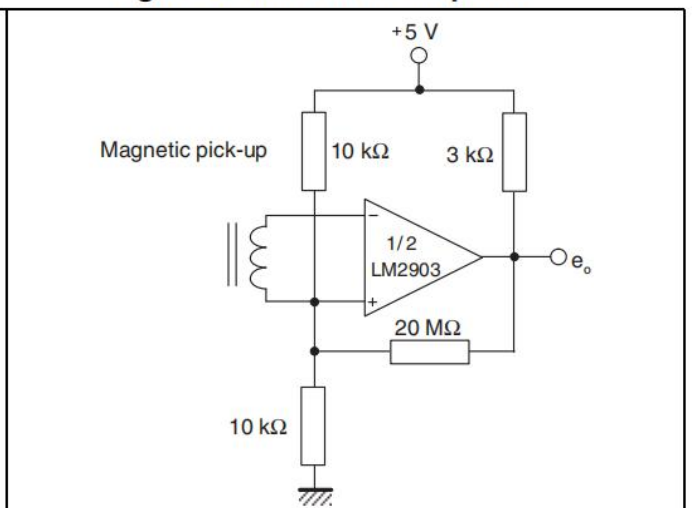




Figure 7. Low frequency op- amp with offset adjust

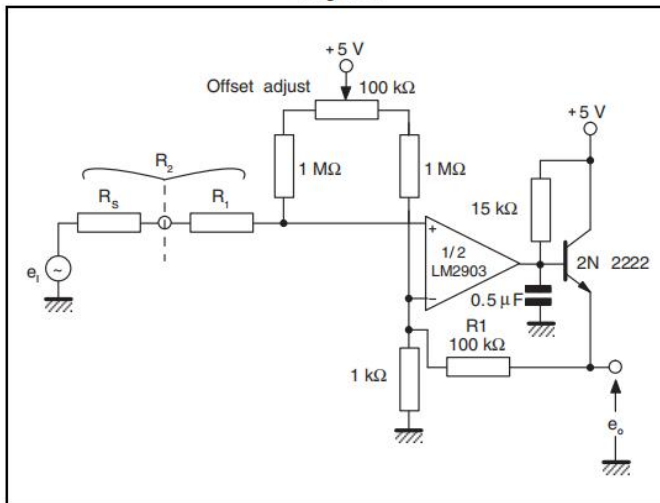


Figure 8. Zero crossing detector (single power supply)

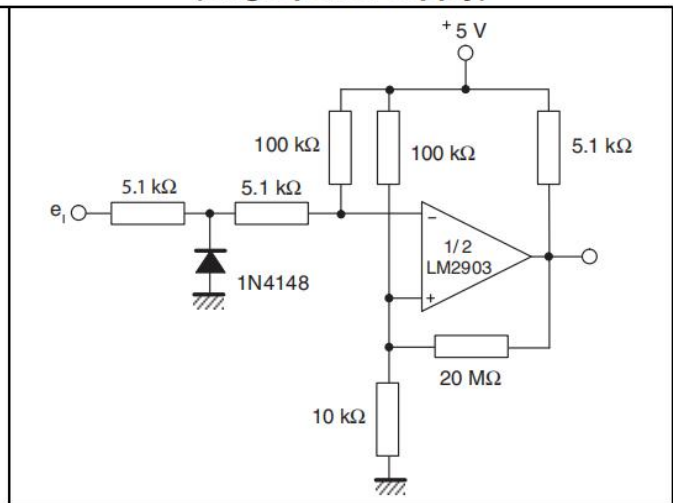


Figure 9. Limit comparator

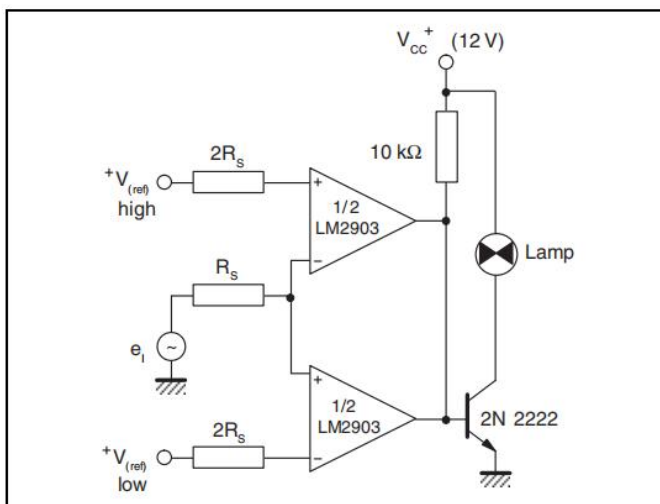


Figure 10. Split-supply applications - zero crossing detector

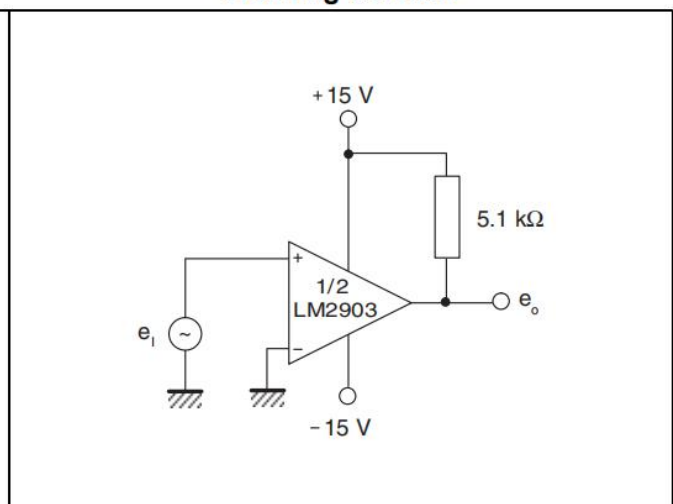


Figure 11. Crystal controlled oscillator

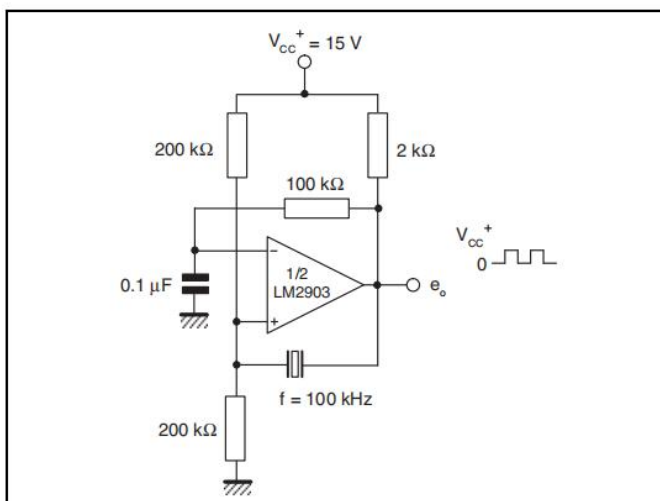


Figure 12. Comparator with a negative reference

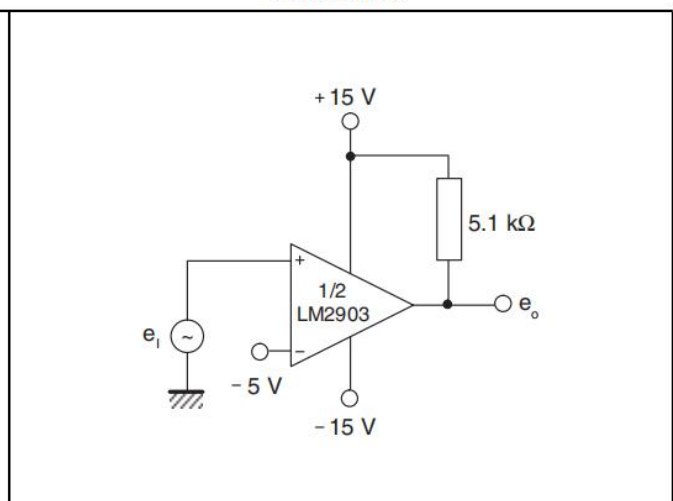




Figure 13. Time delay generator

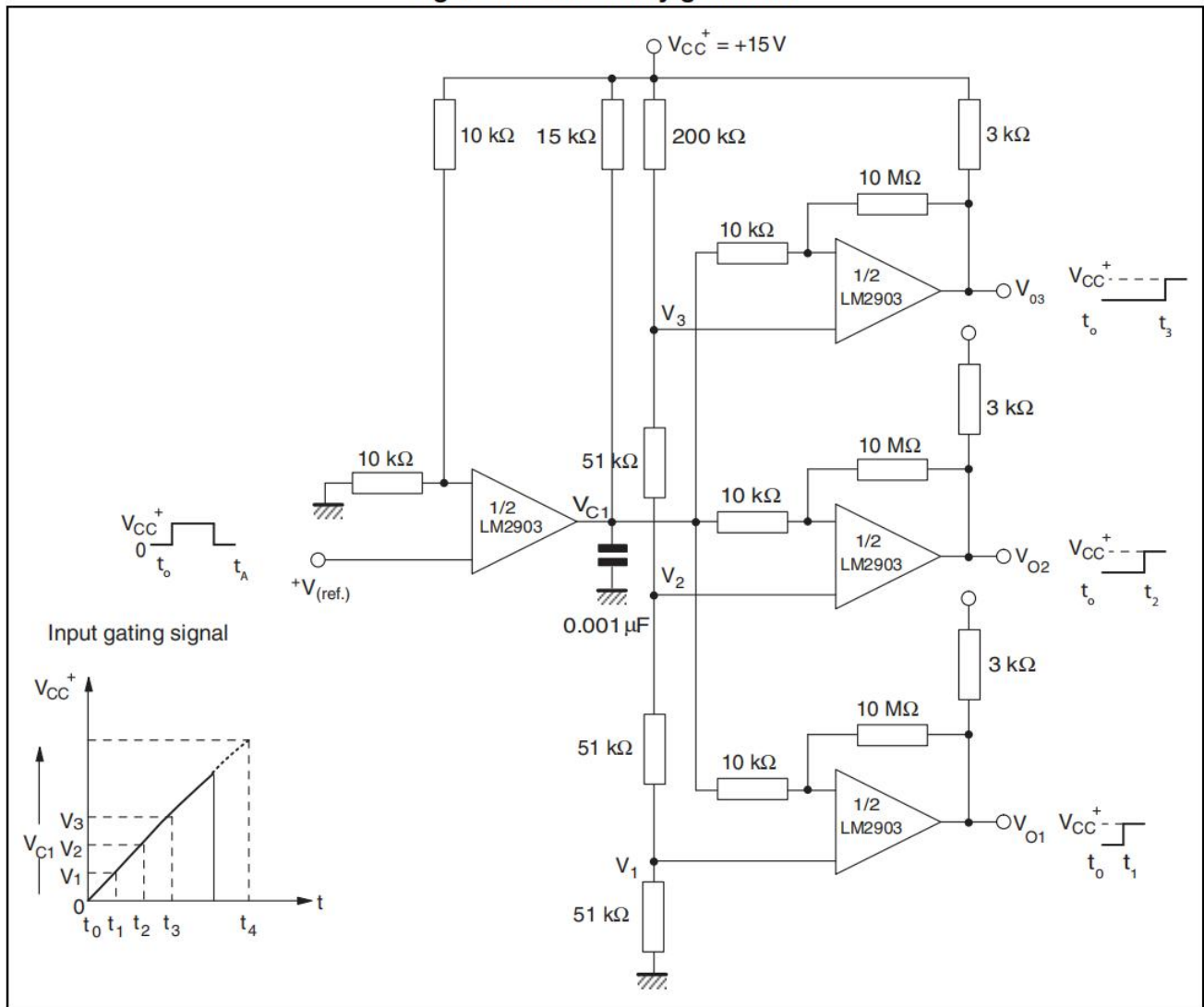
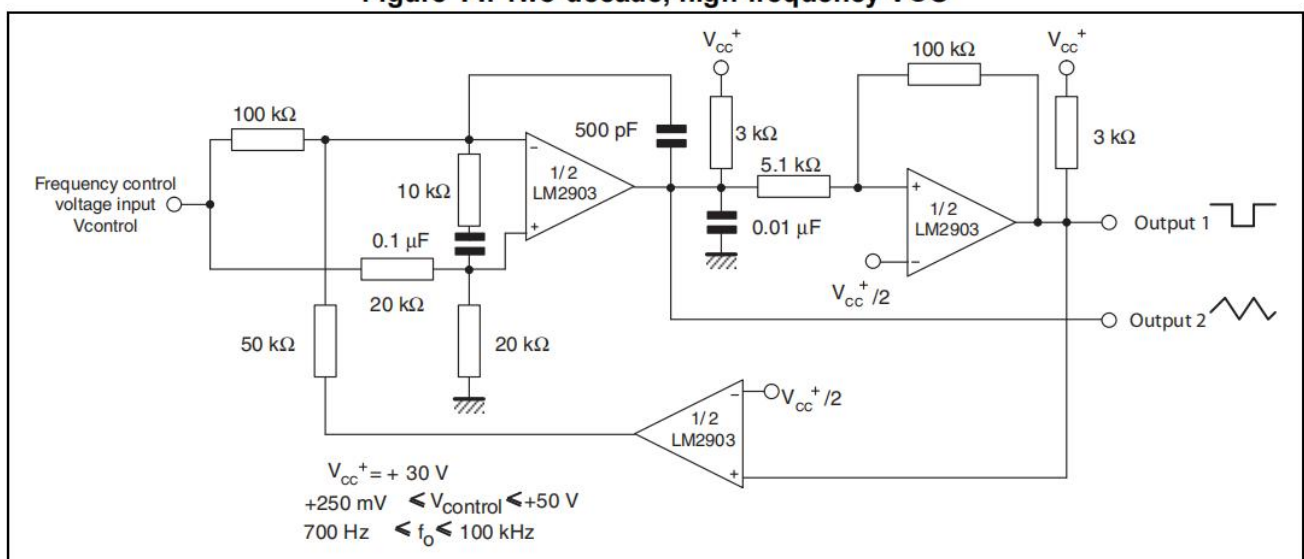


Figure 14. Two-decade, high-frequency VCO



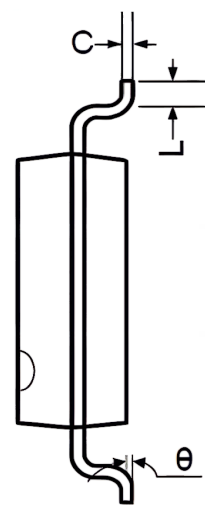
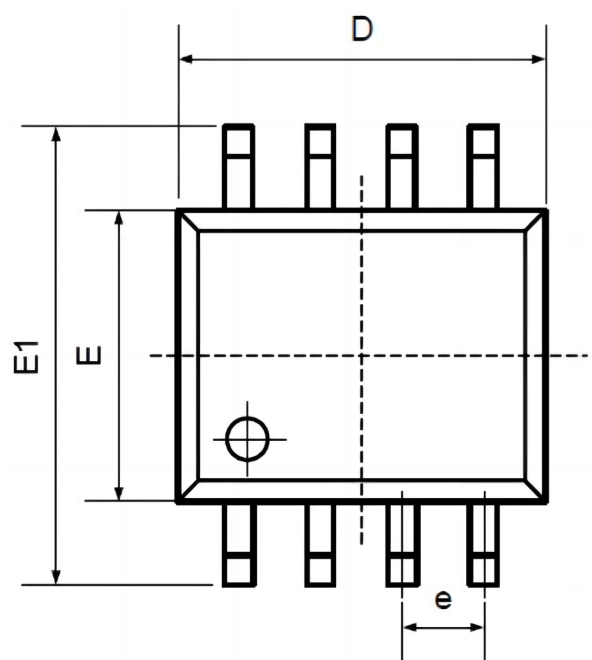


ORDERING INFORMATION

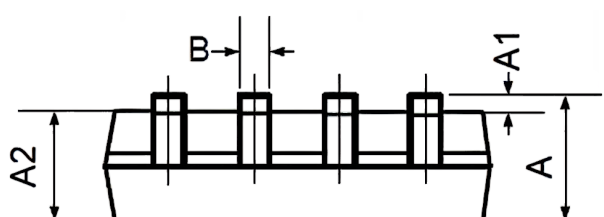
Order Number	Package	Package Quantity	Marking On The park
LM2903N-TUDI	DIP8	Tube,50,A box of 2000	LM2903N
LM2903DT-TUDI	SOP8	Tape,Reel,2500	2903
LM2903YDT-TUDI	SOP8	Tape,Reel,2500	2903Y
LM2903PT-TUDI	TSSOP8	Tape,Reel,2500	2903
LM2903YPT-TUDI	TSSOP8	Tape,Reel,2500	2903Y
LM2903YST-TUDI	MSOP8	Tape,Reel,2500	K419



Package SOP8

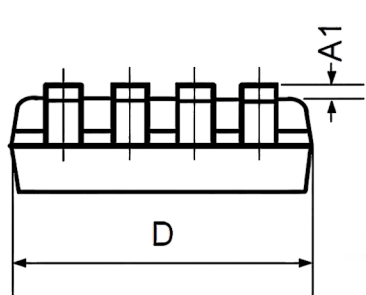
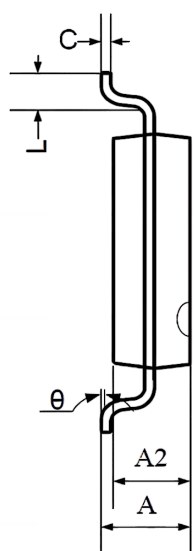
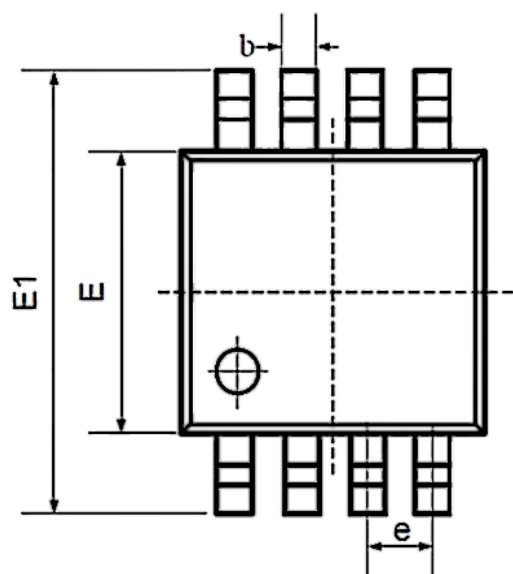


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
B	0.330	0.510	0.013	0.020
C	0.190	0.250	0.007	0.010
D	4.780	5.000	0.188	0.197
E	3.800	4.000	0.150	0.157
E1	5.800	6.300	0.228	0.248
e	1.270TYP		0.050TYP	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°





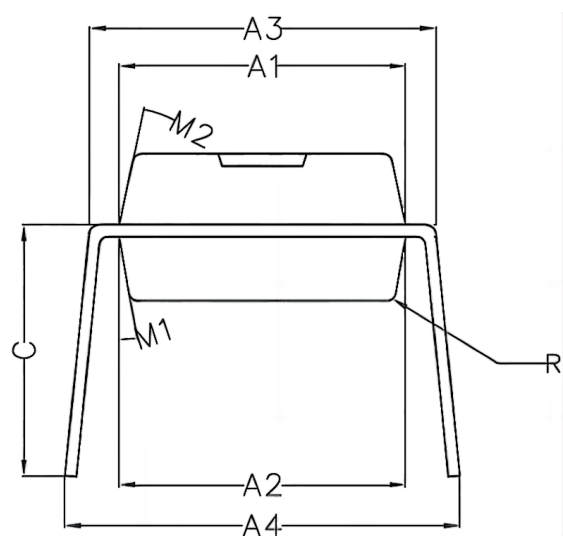
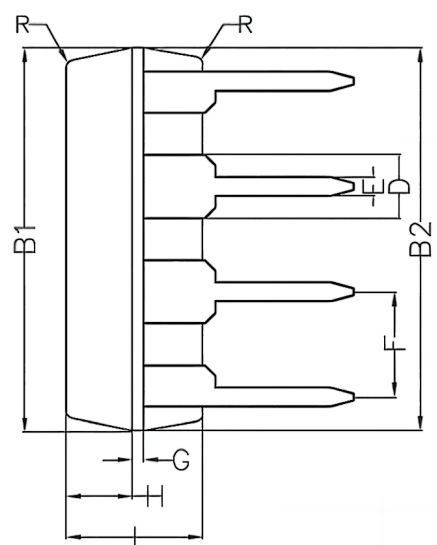
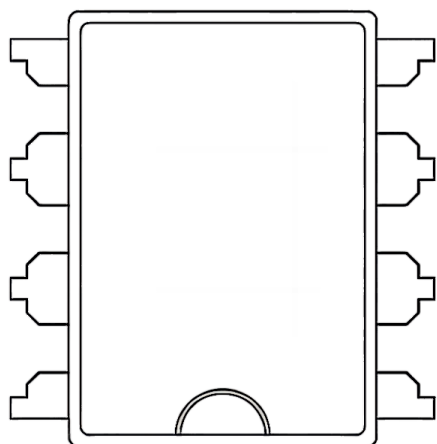
Package MSOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.800	1.200	0.031	0.047
A1	0.000	0.200	0.000	0.008
A2	0.760	0.970	0.030	0.038
b	0.30 TYP		0.012 TYP	
C	0.15 TYP		0.006 TYP	
D	2.900	3.100	0.114	0.122
e	0.65 TYP		0.026 TYP	
E	2.900	3.100	0.114	0.122
E1	4.700	5.100	0.185	0.201
L	0.410	0.650	0.016	0.026
θ	0°	6°	0°	6°

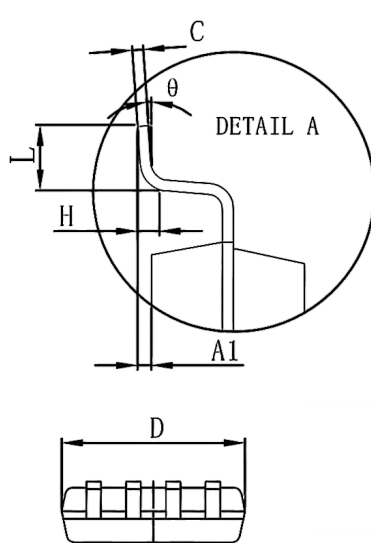
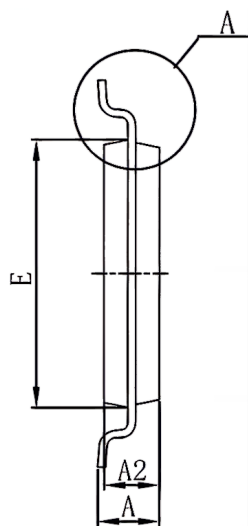
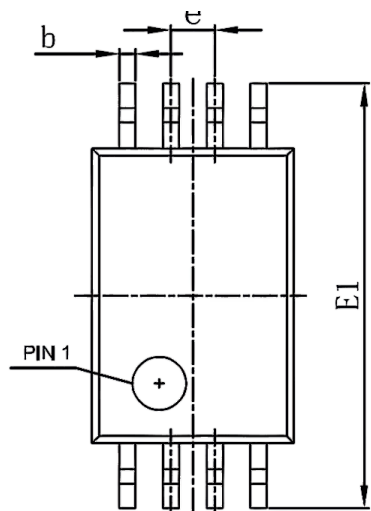


Package DIP8



Symbol	Min	Non	Max
A1	6.28	6.33	6.38
A2	6.33	6.38	6.43
A3	7.52	7.62	7.72
A4	7.80	8.40	9.00
B1	9.15	9.20	9.25
B2	9.20	9.25	9.30
C		5.57	
D		1.52	
E	0.43	0.45	0.47
F		2.54	
G		0.25	
H	1.54	1.59	1.64
I	3.22	3.27	3.32
R		0.20	
M1	9°	10°	11°
M2	11°	12°	13°

Package TSSOP8



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
D	2.900	3.100	0.114	0.122
E	4.300	4.500	0.169	0.177
b	0.190	0.300	0.007	0.012
C	0.090	0.200	0.004	0.008
E1	6.250	6.550	0.246	0.258
A		1.200		0.047
A2	0.800	1.000	0.031	0.039
A1	0.050	0.150	0.002	0.006
e	0.65(BSC)		0.026(BSC)	
L	0.500	0.700	0.020	0.028
H	0.25(TYP)		0.01(TYP)	
θ	1°		1°	



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