钍地半导体
Tudi Semiconductor

Product Specification

TUDI-LM2901

Low-power quad voltage comparator

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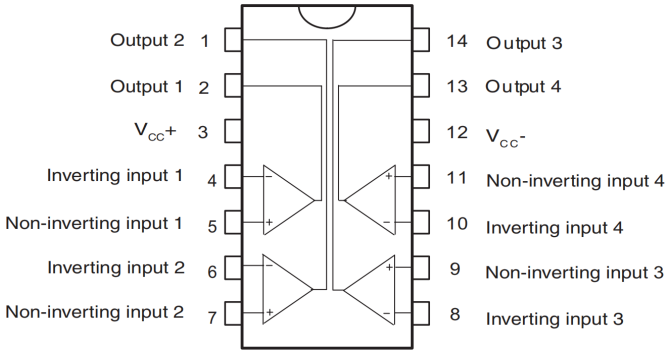
用芯智造·卓越品质

semiconductor device manufacturer

- Design
- research and development
- production
- and sales

Features

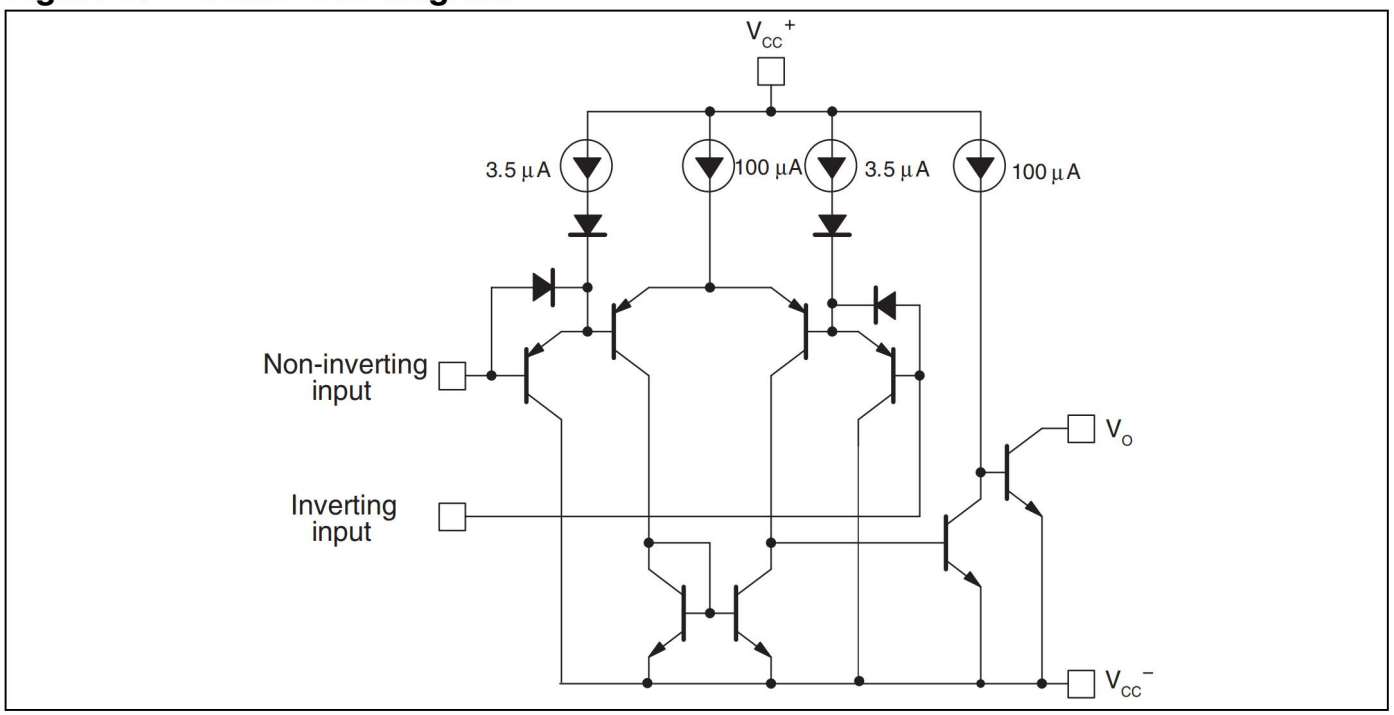
- Wide single supply voltage range or dual supplies for all devices: +2 V to +36 V or ±1 V to ±18 V
- Very low supply current (1.1 mA) independent of supply voltage (1.4 mW/comparator at +5 V)
- Low input bias current: 25 nA typ.
- Low input offset current: ±5 nA typ.
- Input common-mode voltage range includes negative rail
- Low output saturation voltage: 250 mV typ. (IO = 4 mA)
- Differential input voltage range equal to the supply voltage
- TTL, DTL, ECL, MOS, CMOS compatible outputs



Description

This device consists of four independent precision voltage comparators, which are 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 the negative rail even though operated from a single power supply voltage.

Figure 1. Schematic diagram



2 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Supply voltage	±18 to 36	V
V_{id}	Differential input voltage	±36	V
V_{in}	Input voltage	-0.3 to +36	V
	Output short-circuit to ground (1)		
R_{thja}	Thermal resistance junction to ambient(2) DIP14 SO-14 TSSOP14 QFN16 3x3	 80 105 100 45	°C/W
R_{thjc}	Thermal resistance junction to case(2) DIP14 SO-14 TSSOP14 QFN16 3x3	 33 31 32 14	
T_j	Maximum junction temperature	+150	°C
T_{stg}	Storage temperature range	-65 to +150	°C
ESD	HBM: human body model(3)	500	V
	MM: machine model(4)	100	V
	CDM: charged device model(5)	1500	V

1. Short-circuits from the output to V_{CC}^+ can cause excessive heating and eventual destruction. The maximum output current is approximately 20 mA, independent of the magnitude of V_{CC}^+.
2. Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits on all amplifiers. All values are typical.
3. Human body model: a 100 pF capacitor is charged to the specified voltage, then discharged through a 1.5 kΩ 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_{CC}	Supply voltage	2 to 32 ±1 to ±16	V
V_{icm}	Common mode input voltage range $T_{min} \le T_{amb} \le T_{max}$	0 to (V_{CC}^+ -1.5) 0 to (V_{CC}^+ -2)	V
T_{oper}	Operating free-air temperature range	-40 to +125	°C

3 Electrical characteristics

Table 3. Electrical characteristics at V_{CC}^+ = 5 V, V_{CC}^- = GND, T_{amb} = 25° C (unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit
V_{io}	Input offset voltage (1) $T_{min} \le T_{amb} \le T_{max}$		1	7 15	mV
I_{io}	Input offset current $T_{min} \le T_{amb} \le T_{max}$		5	50 150	nA
I_{ib}	Input bias current (I_I^+ or I_I^-) (2) $T_{min} \le T_{amb} \le T_{max}$		25	250 400	nA
A_{vd}	Large signal voltage gain (V_{CC} = 15 V, R_L = 15 kΩ, V_o = 1 to 11 V)	25	200		V/mV
I_{CC}	Supply current (all comparators) V_{CC} = +5 V, no load V_{CC} = +30 V, no load		 1.1 1.3	 2 2.5	mA
V_{id}	Differential input voltage(3)			V_{CC}^+	V
V_{OL}	Low level output voltage V_{id} = -1V, I_{sink} = 4 mA $T_{min} \le T_{amb} \le T_{max}$		250	400 700	mV
I_{OH}	High level output current (V_{CC} = V_o = 30 V, V_{id} = 1 V) $T_{min} \le T_{amb} \le T_{max}$		0.1	 1	nA µA
I_{sink}	Output sink current (V_{id} = -1 V, V_o = 1.5 V)	6	16		mA
t_{res}	Small signal response time(4) (R_L = 5.1 kΩ connected to V_{CC}^+)		1.3		µs
t_{rel}	Large signal response time(5) TTL input (V_{ref} = +1.4 V, R_L = 5.1 kΩ 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 V, R_S = 0 with V_{CC}^+ from 5 V to 30 V, and over the full input common-mode range (0 V to V_{CC}^+ –1.5 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 there is no loading charge on the reference of input lines.
3. The response time specified is for a 100 mV input step with 5 mV overdrive.
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 –0.3 V (or 0.3 V below the negative power supply, if used).
5. Maximum values are guaranteed by design.

4 Typical application schematics

Figure 2. Basic comparator

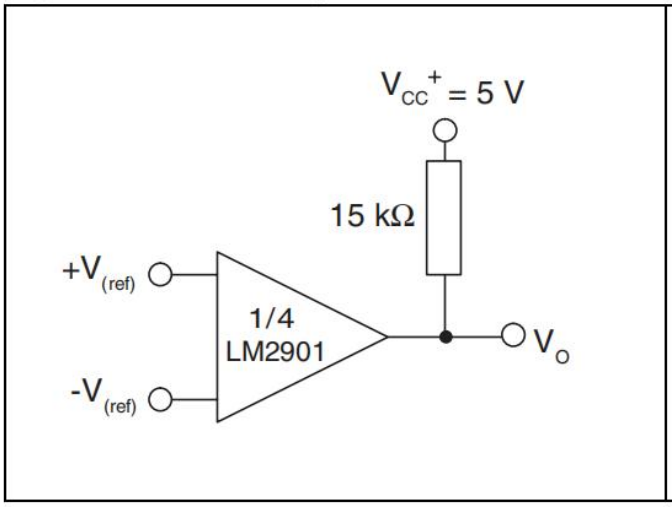


Figure 3. Driving CMOS

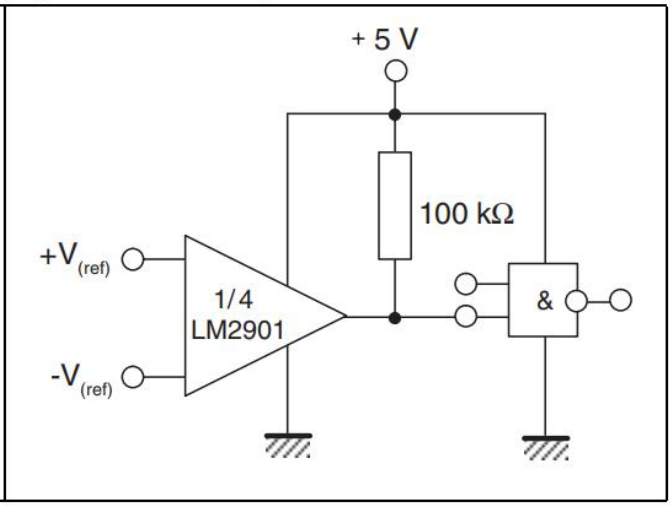


Figure 4. Driving TTL

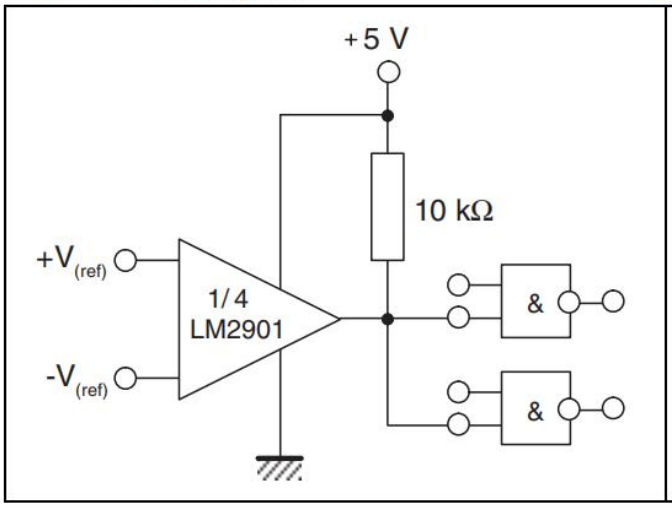


Figure 5. Low frequency op-amp

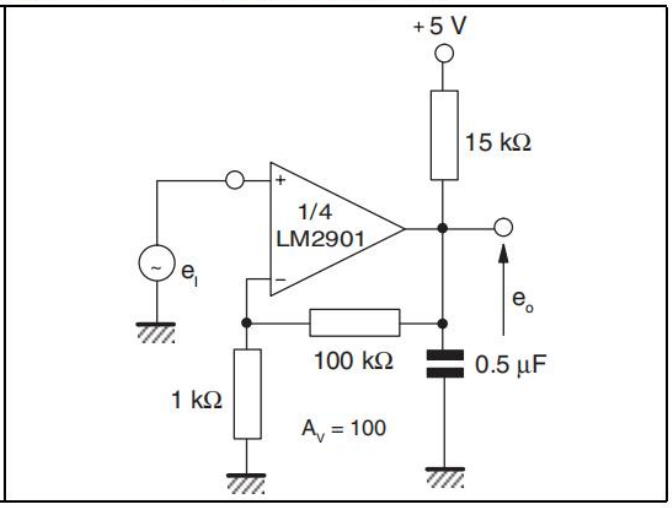


Figure 6. Low frequency op-amp with boost

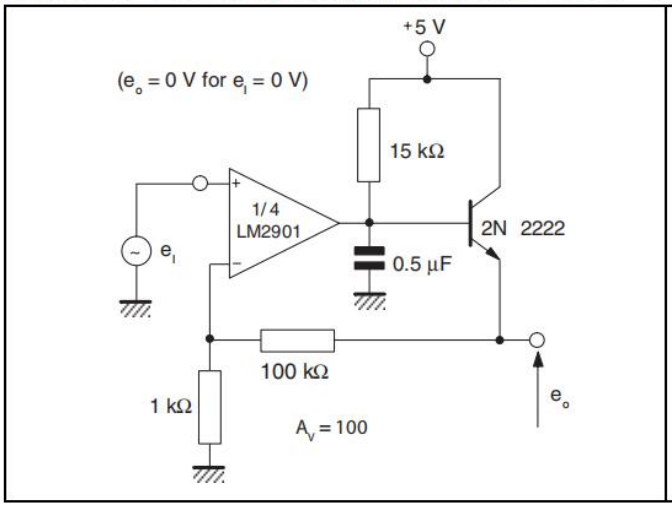


Figure 7. Transducer amplifier

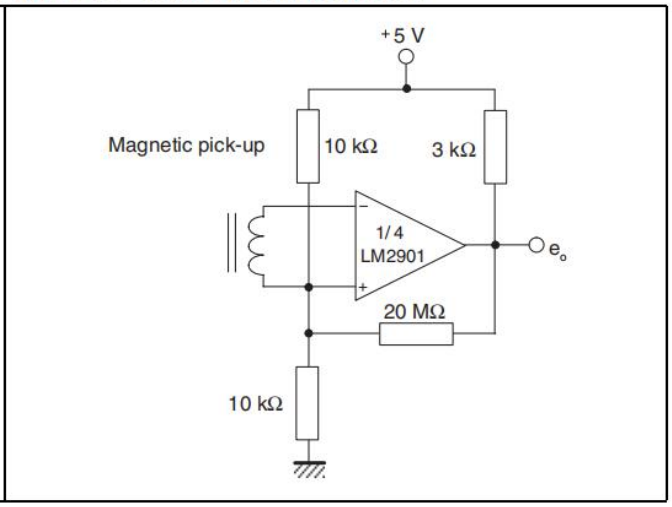


Figure 8. Low frequency op-amp with offset adjust

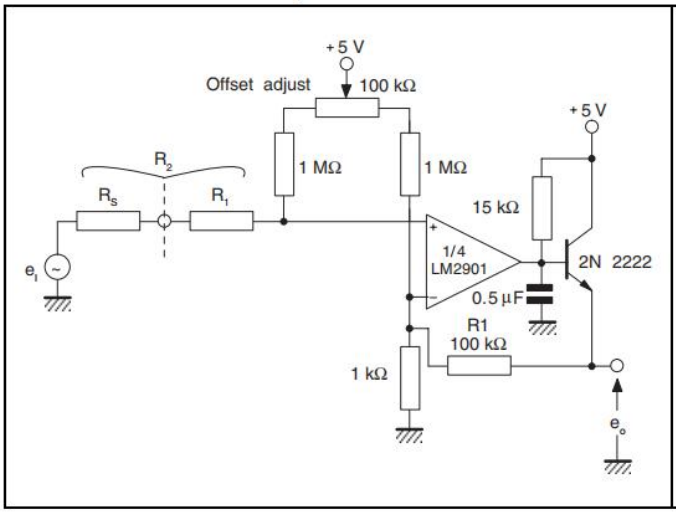


Figure 9. Zero crossing detector (single power supply)

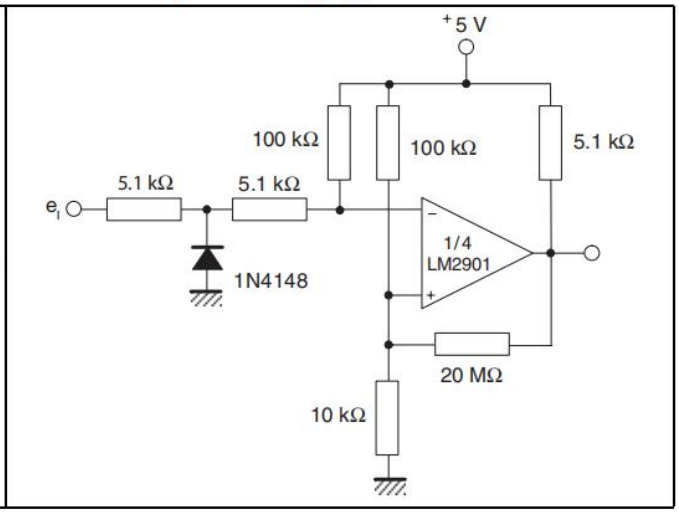


Figure 10. Limit comparator

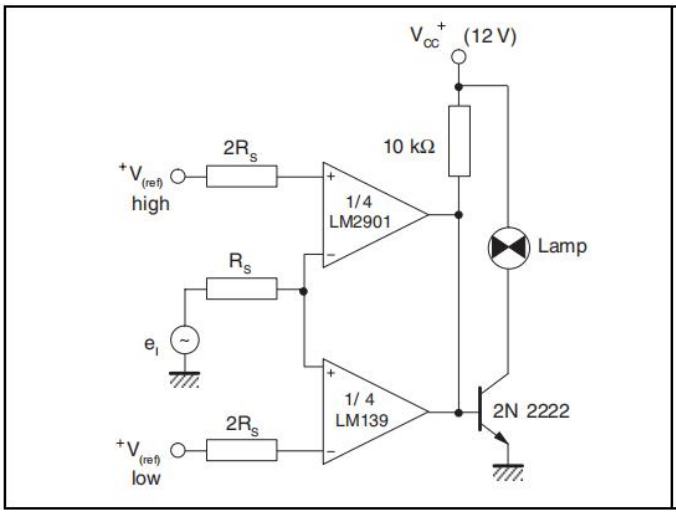


Figure 11. Split-supply applications - zero crossing detector

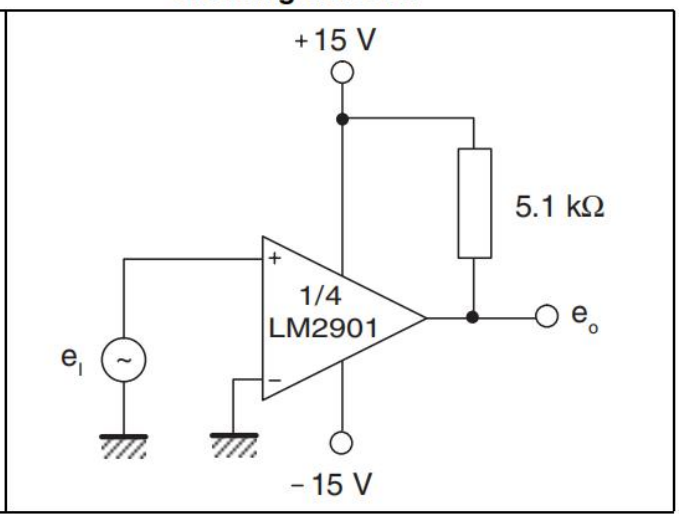


Figure 12. Crystal controlled oscillator

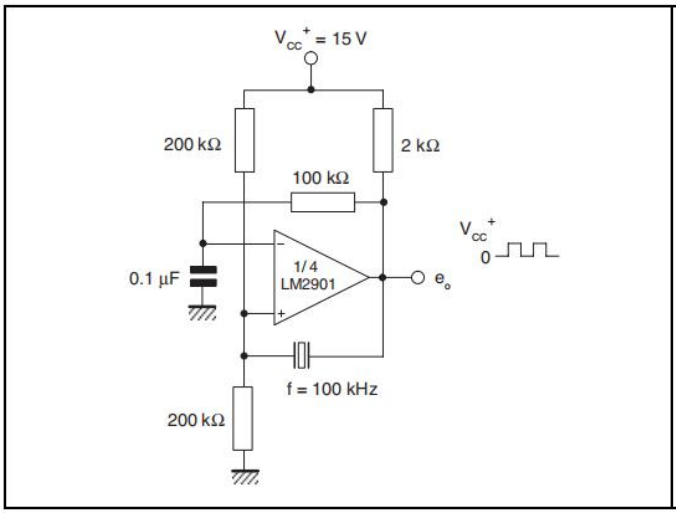


Figure 13. Comparator with a negative reference

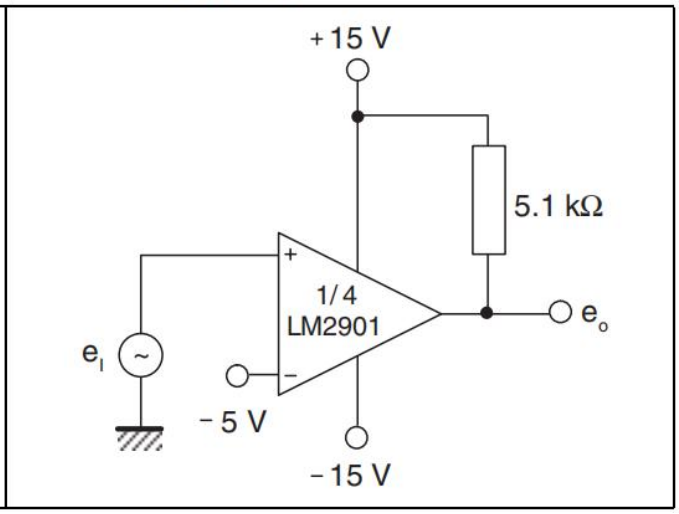


Figure 14. Time delay generator

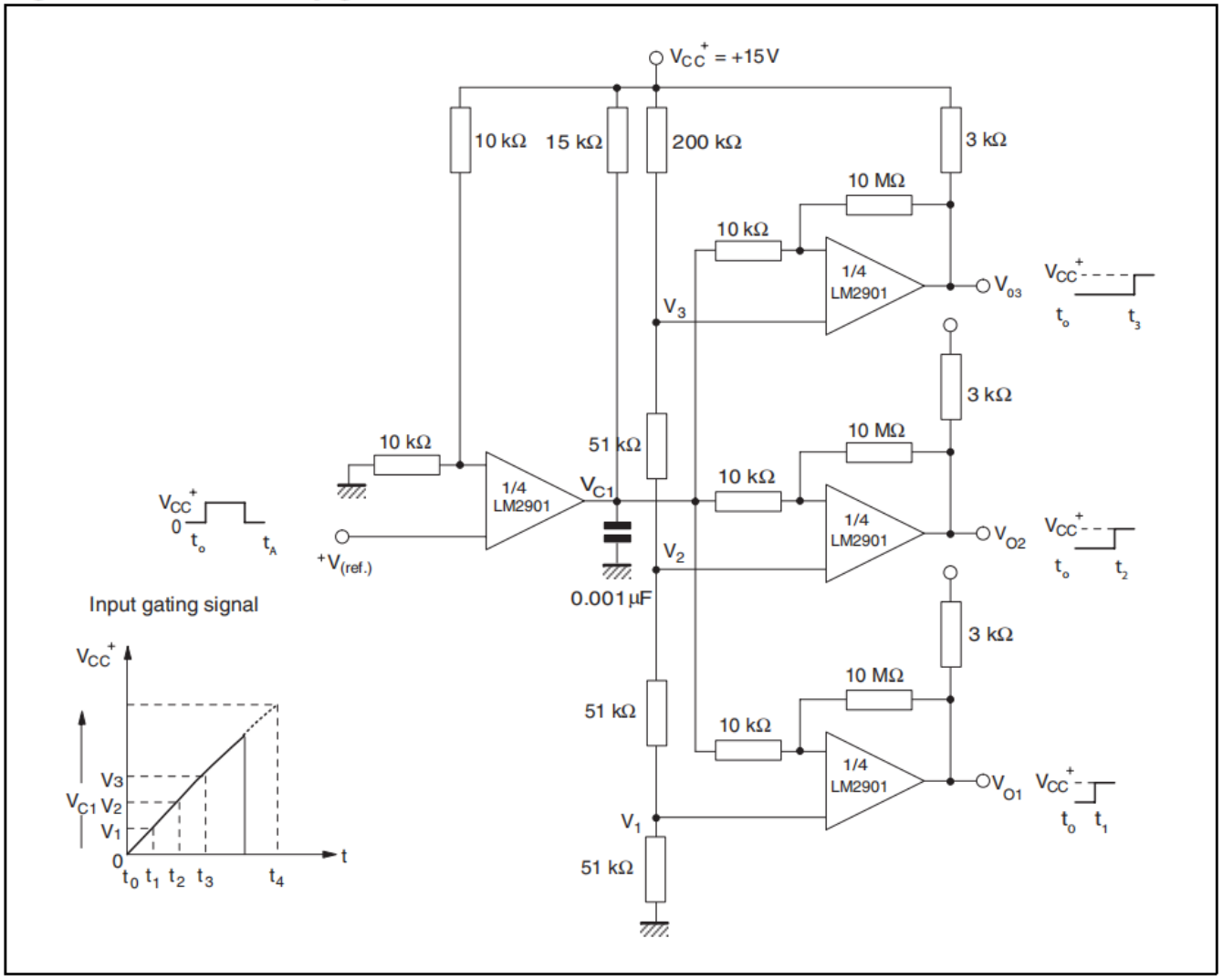
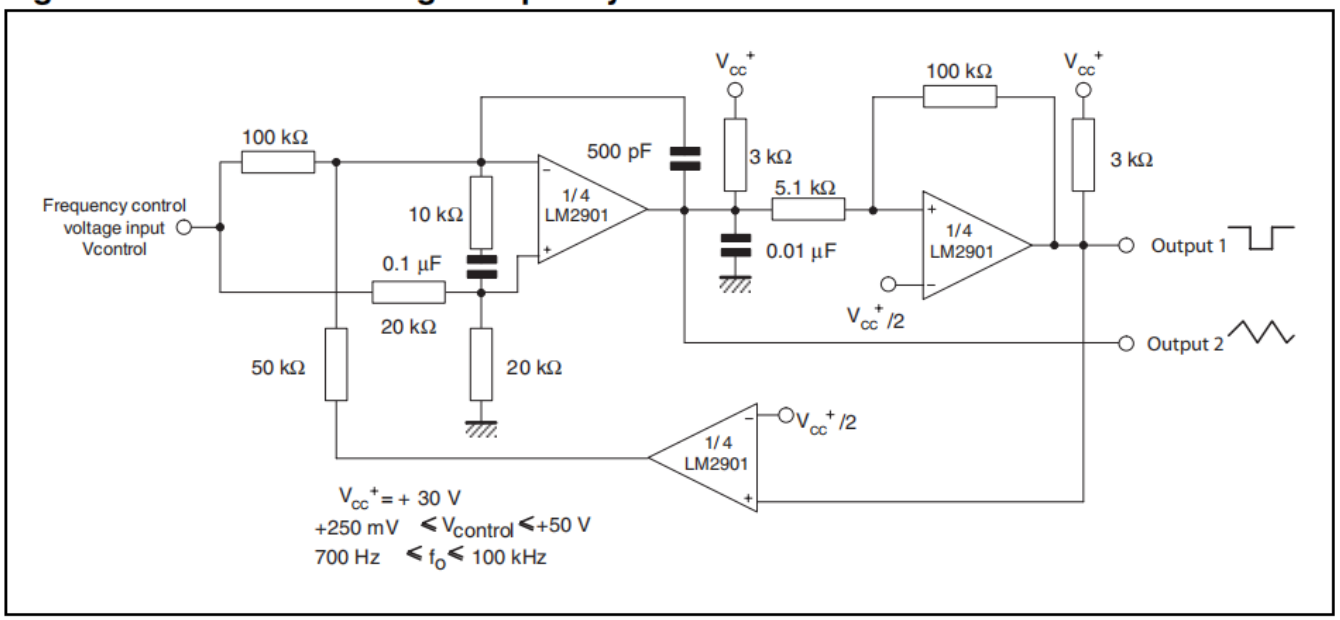


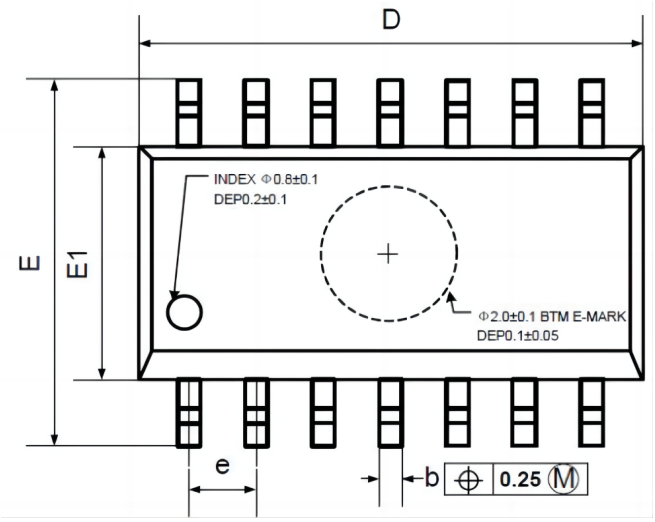
Figure 15. Two-decade high-frequency VCO

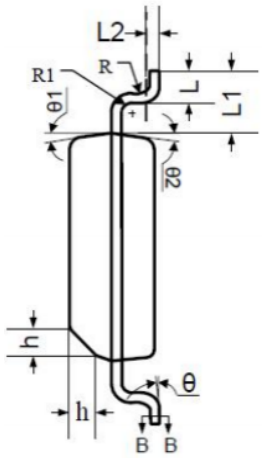


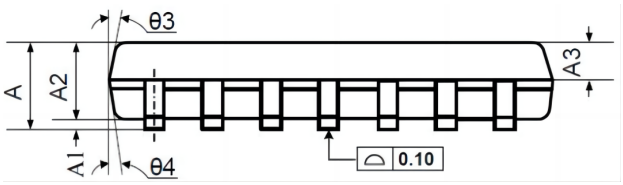
ORDERING INFORMATION

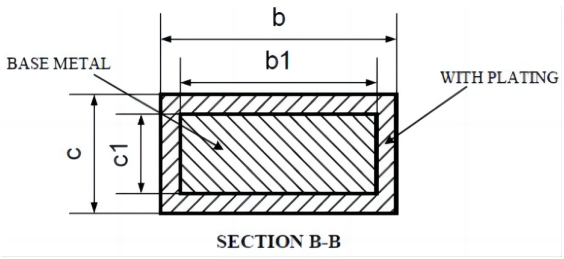
Order Number	Package	Package Quantity	MarkingOn The park
LM2901N-TUDI	DIP14	Tube,25,A box of 1000	LM2901N
LM2901DT-TUDI	SOP14	Tape,Reel,2500	2901
LM2901PT-TUDI	TSSOP14	Tape,Reel,2500	2901
LM2901YDT-TUDI	SOP14	Tape,Reel,2500	2901Y
LM2901YPT-TUDI	TSSOP14	Tape,Reel,2500	2901Y

Package SOP14



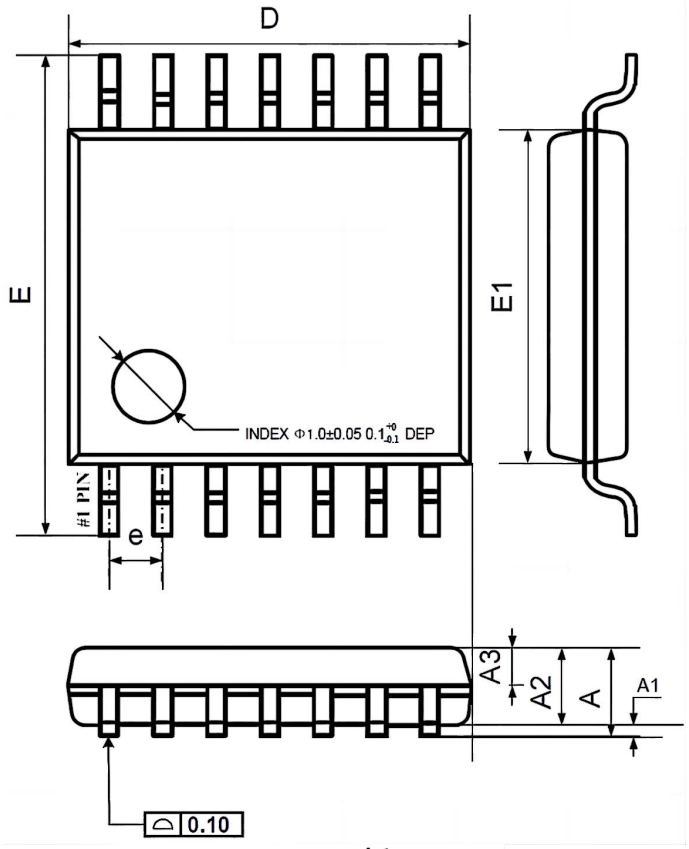


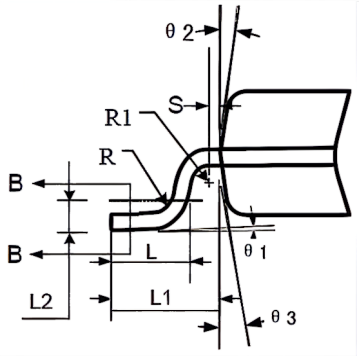


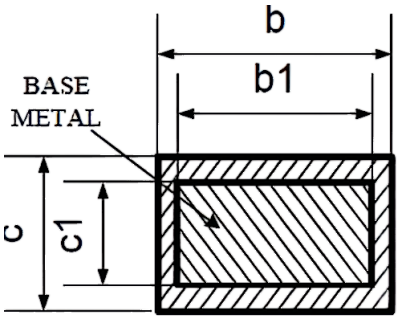


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	1.35	1.60	1.75
A1	0.10	0.15	0.25
A2	1.25	1.45	1.65
A3	0.55	0.65	0.75
b	0.36		0.49
b1	0.35	0.40	0.45
C	0.16		0.25
c1	0.15	0.20	0.25
D	8.53	8.63	8.73
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27 BSC		
L	0.45	0.60	0.80
L1	1.04 REF		
L2	0.25 BSC		
R	0.07		
R1	0.07		
h	0.30	0.40	0.50
θ	0°		8°
θ1	6°	8°	10°
θ2	6°	8°	10°
θ3	5°	7°	9°
θ4	5°	7°	9°

Package TSSOP14

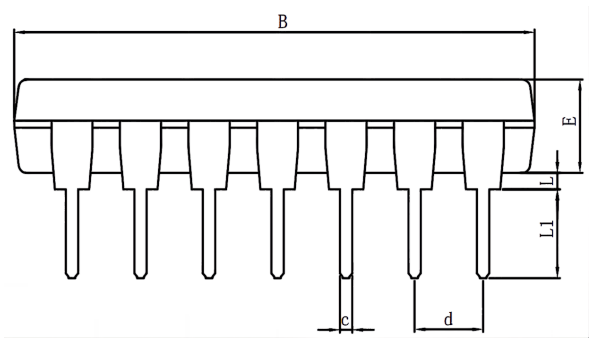


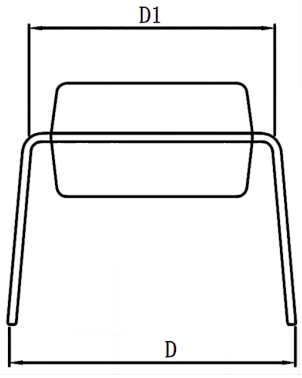


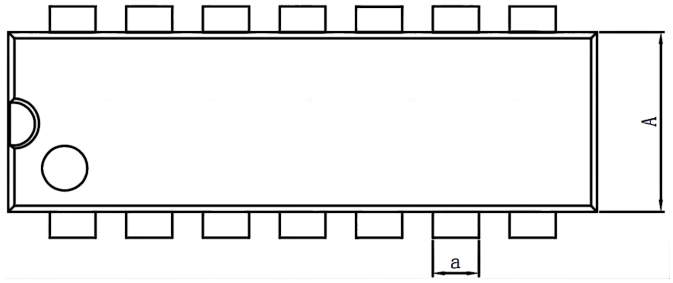


Symbol	Dimensions In Millimeters		
	MIN	NOM	MAX
A	—	—	1.20
A1	0.05	—	0.15
A2	0.90	1.00	1.05
A3	0.34	0.44	0.54
b	0.20	—	0.28
b1	0.20	0.22	0.24
C	0.10	—	0.19
c1	0.10	0.13	0.15
D	4.86	4.96	5.06
E	6.20	6.40	6.60
E1	4.30	4.40	4.50
e	0.65 BSC		
L	0.45	0.60	0.75
L1	1.00 REF		
L2	0.25 BSC		
R	0.09	—	—
R1	0.09	—	—
S	0.20	—	—
θ1	0°	—	8°
θ2	10°	12°	14°
θ3	10°	12°	14°

Package DIP14







DIM.	MIN	TYP	MAX	DIM.	MIN	TYP	MAX
A	6.100	6.300	6.680	a	1.504	1.524	1.544
B	18.940	19.200	19.560	C	0.437	0.457	0.477
D	8.200	8.700	9.200	d	2.530	2.540	2.550
D1	7.42	7.62	7.82	L	0.500	—	0.800
E	3.100	3.300	3.550	L1	3.000	3.200	3.600

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