TL082

General purpose JFET dual operational amplifiers

Features

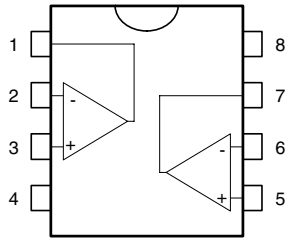
- Wide common-mode (up to V_{CC}^{+}) and differential voltage range
- Low input bias and offset current
- Output short-circuit protection
- High input impedance JFET input stage
- Internal frequency compensation
- Latch up free operation
- High slew rate: 16 V/µs (typical)

Description

The TL082,IS high speed JFET input dual operational amplifiers
incorporating well matched, high voltage JFET and bipolar transistors in a monolithic integrated circuit.

The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.

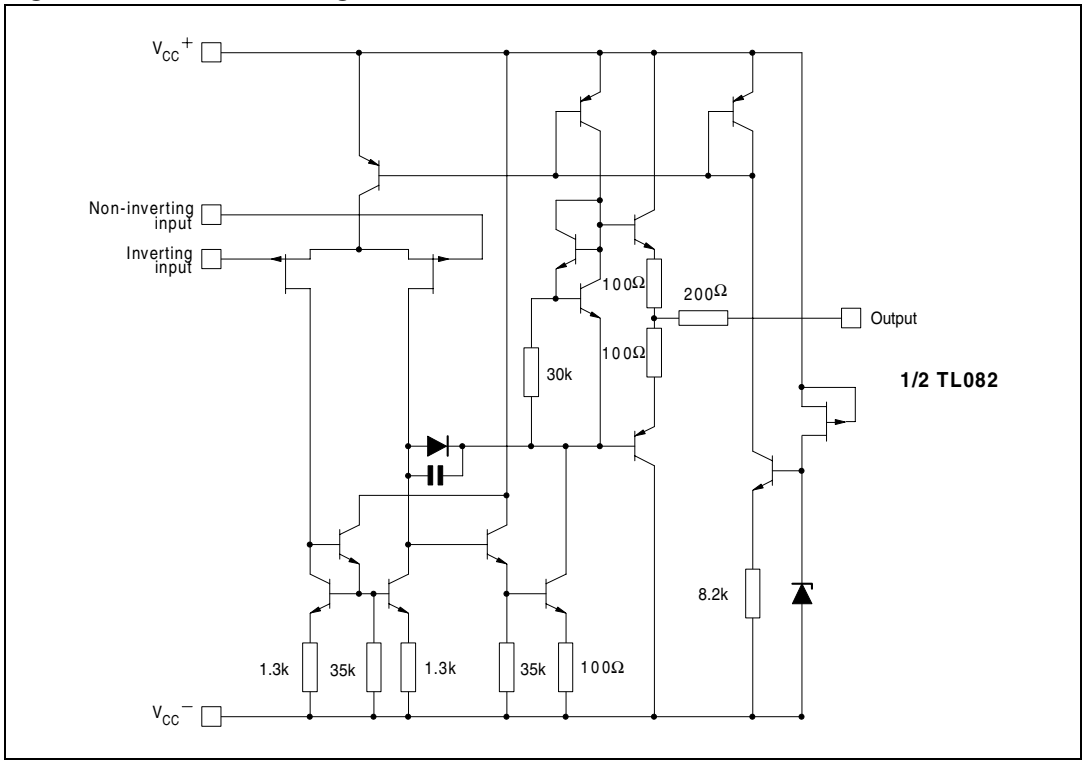
Pin connections (top view)



1 - Output 1
2 - Inverting input 1
3 - Non-inverting input 1
4 - V_{CC}^{-}
5 - Non-inverting input 2
6 - Inverting input 2
7 - Output 2
8 - V_{CC}^{+}

1 Schematic diagram

Figure 1. Schematic diagram



2 Absolute maximum ratings and operating conditions

Table 1. Absolute maximum ratings

Symbol	Parameter	TL082I, AI, BI	TL082C, AC, BC	Unit
V_{CC}	Supply voltage (1)	±18		V
V_{in}	Input voltage (2)	±15		V
V_{id}	Differential input voltage (3)	±30		V
P_{tot}	Power dissipation	680		mW
R_{thja}	Thermal resistance junction to ambient(4) SO-8 DIP8 TSSOP8	 125 85 120		°C/W
R_{thjc}	Thermal resistance junction to case SO-8 DIP8 TSSOP8	 40 41 37		°C/W
	Output short-circuit duration (5)	Infinite		
T_{stg}	Storage temperature range	-65 to +150		°C
ESD	HBM: human body model(6)	1		kV
	MM: machine model(7)	200		V
	CDM: charged device model(8)	1500		V

1. All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between V_{CC}^+ and V_{CC}^-.
2. The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
3. Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
4. Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuit on all amplifiers.
5. The output may be shorted to ground or to either supply. Temperature and/or supply voltages must be limited to ensure that the dissipation rating is not exceeded
6. Human body model: 100 pF discharged through a 1.5 kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
7. Machine model: a 200 pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5 Ω), done for all couples of pin combinations with other pins floating.
8. Charged device model: all pins plus package are charged together to the specified voltage and then discharged directly to the ground.

Table 2. Operating conditions

Symbol	Parameter	TL082I, AI, BI	TL082C, AC, BC	Unit
V_{CC}	Supply voltage	6 to 36		V
T_{oper}	Operating free-air temperature range	-40 to +105	0 to +70	°C

3 Electrical characteristics

Table 3. V_{CC} = ±15V, T_{amb} = +25°C (unless otherwise specified)

Symbol	Parameter	TL082			TL082C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input offset voltage (R_s = 50Ω) T_{amb} = +25°C TL082 TL082A TL082B $T_{min} \le T_{amb} \le T_{max}$ TL082 TL082A TL082B		 3 3 1	 10 6 3 13 7 5		 3	 10 13	mV
DV_{io}	Input offset voltage drift		10			10		µV/°C
I_{io}	Input offset current (1) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		5	 100 4		5	 100 10	 pA nA
I_{ib}	Input bias current T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		20	 200 20		20	 400 20	 pA nA
A_{vd}	Large signal voltage gain (R_L = 2kΩ, V_o = ±10V) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$	 50 25	 200		 25 15	 200		V/mV
SVR	Supply voltage rejection ratio (R_S = 50Ω) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$	 80 80	 86		 70 70	 86		dB
I_{CC}	Supply current, no load T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$		1.4	 2.5 2.5		1.4	 2.5 2.5	mA
V_{icm}	Input common mode voltage range	±11	+15 -12		±11	+15 -12		V
CMR	Common mode rejection ratio (R_S = 50Ω) T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$	 80 80	 86		 70 70	 86		dB
I_{os}	Output short-circuit current T_{amb} = +25°C $T_{min} \le T_{amb} \le T_{max}$	 10 10	 40	 60 60	 10 10	 40	 60 60	mA
$\pm V_{opp}$	Output voltage swing T_{amb} = +25°C R_L = 2kΩ R_L = 10kΩ $T_{min} \le T_{amb} \le T_{max}$ R_L = 2kΩ R_L = 10kΩ	 10 12 10 12	 12 13.5		 10 12 10 12	 12 13.5		V
SR	Slew rate V_{in} = 10V, R_L = 2kΩ, C_L = 100pF, unity gain	8	16		8	16		V/µs

Table 3. V_{CC} = ±15V, T_{amb} = +25°C (unless otherwise specified) (continued)

Symbol	Parameter	TL082I,AC,AI,BC, BI			TL082C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
t_r	Rise time V_{in} = 20mV, R_L = 2kΩ, C_L = 100pF, unity gain		0.1			0.1		µs
K_{ov}	Overshoot V_{in} = 20mV, R_L = 2kΩ, C_L = 100pF, unity gain		10			10		%
GBP	Gain bandwidth product V_{in} = 10mV, R_L = 2kΩ, C_L = 100pF, F= 100kHz	2.5	4		2.5	4		MHz
R_i	Input resistance		10^{12}			10^{12}		Ω
THD	Total harmonic distortion F=1kHz, R_L = 2kΩ,C_L=100pF, A_v=20dB, V_o=2V_{pp}		0.01			0.01		%
e_n	Equivalent input noise voltage R_S = 100Ω, F = 1kHz		15			15		$\frac{nV}{\sqrt{Hz}}$
∅m	Phase margin		45			45		degrees
V_{o1}/V_{o2}	Channel separation A_v = 100		120			120		dB

1. The input bias currents are junction leakage currents which approximately double for every 10° C increase in the junction temperature.

Figure 2. Maximum peak-to-peak output voltage versus frequency

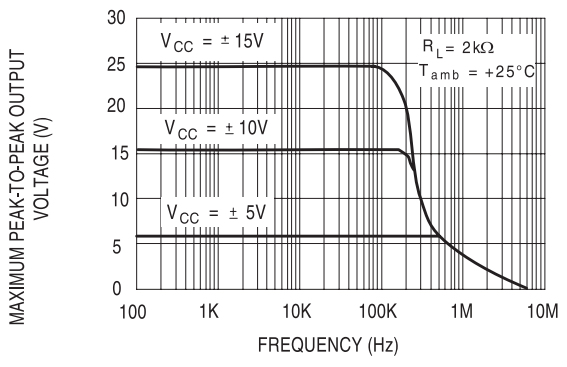


Figure 3. Maximum peak-to-peak output voltage versus frequency

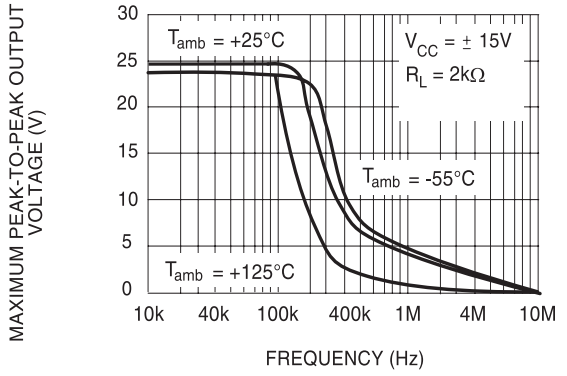


Figure 4. Maximum peak-to-peak output voltage versus load resistance

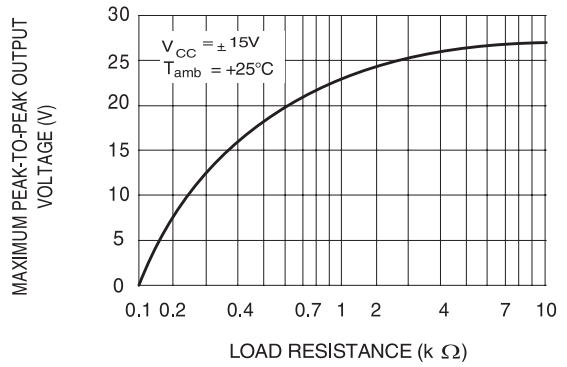


Figure 5. Maximum peak-to-peak output voltage versus frequency

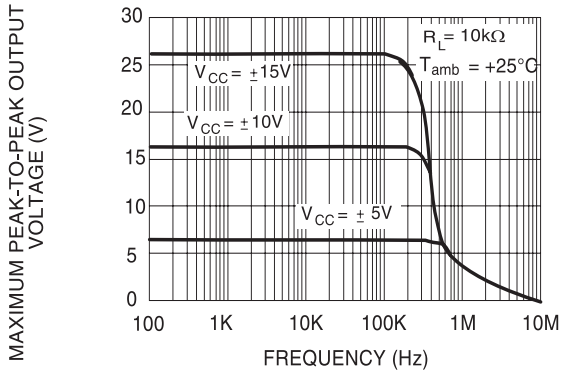


Figure 6. Maximum peak-to-peak output voltage versus free air temperature

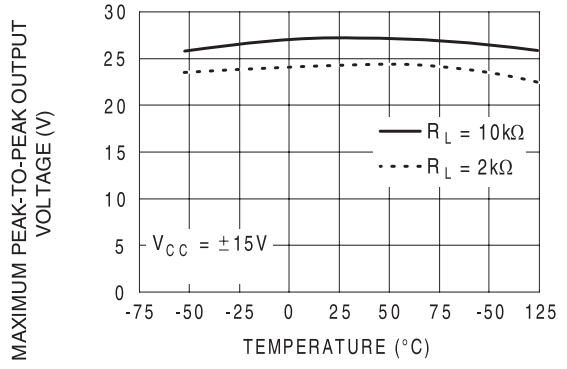


Figure 7. Maximum peak-to-peak output voltage versus supply voltage

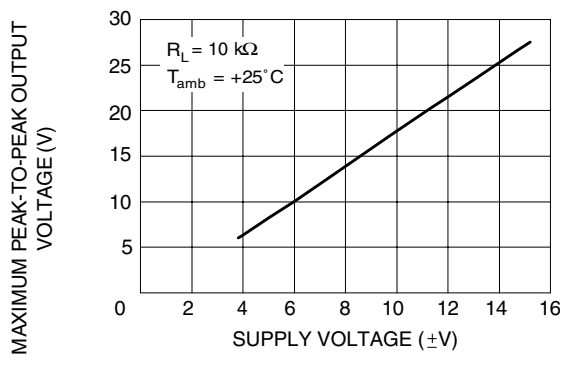


Figure 8. Input bias current versus free air temperature

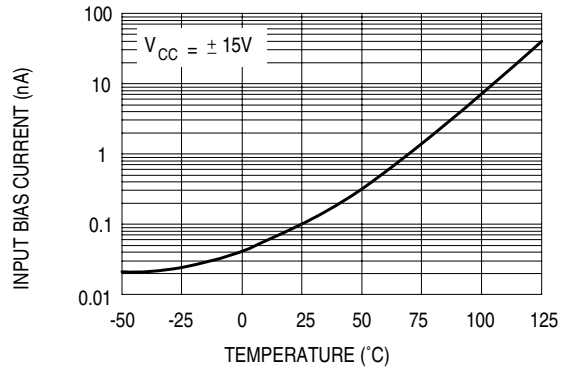


Figure 9. Large signal differential voltage amplification and phase shift versus frequency

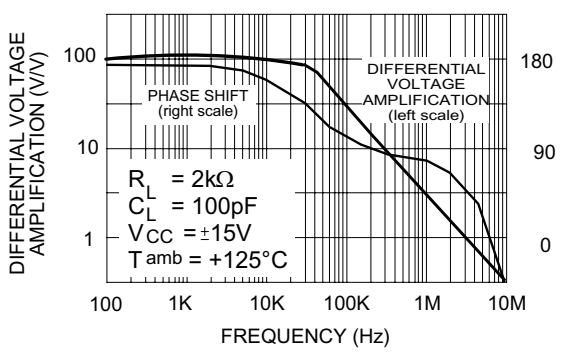


Figure 10. Supply current per amplifier versus free air temperature

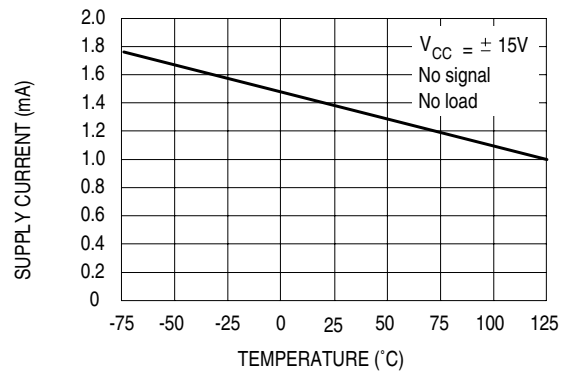


Figure 11. Large signal differential voltage amplification versus free air temp.

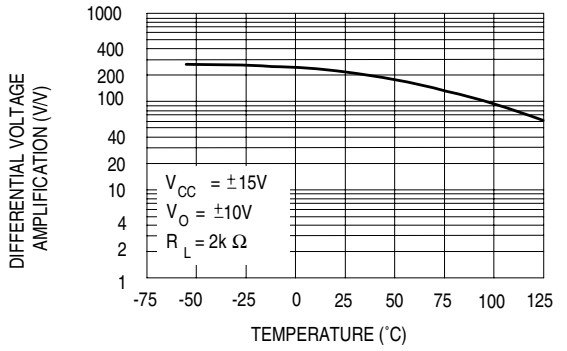


Figure 12. Total power dissipation versus free air temperature

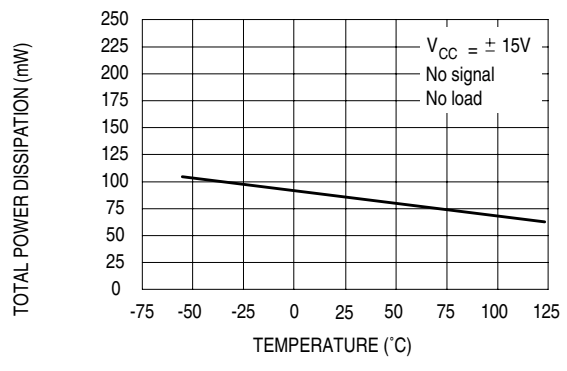


Figure 13. Supply current per amplifier versus supply voltage

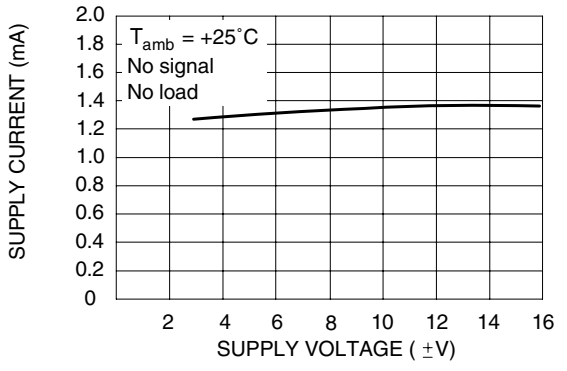


Figure 14. Common mode rejection ratio versus free air temperature

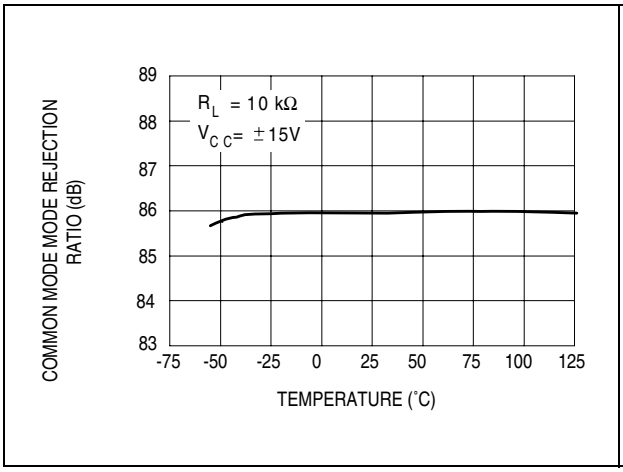


Figure 15. Output voltage versus elapsed time

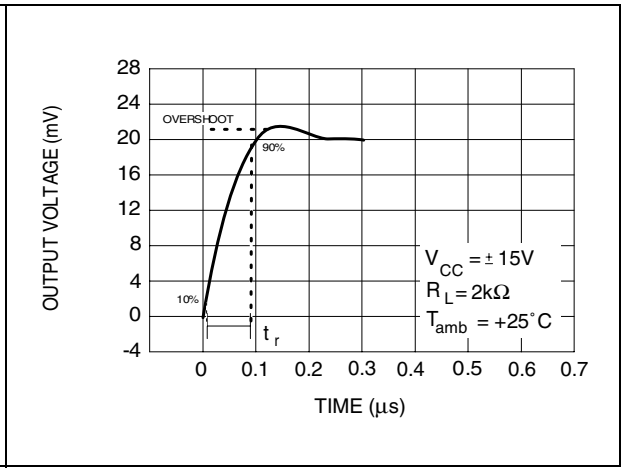


Figure 16. Voltage follower large signal pulse response

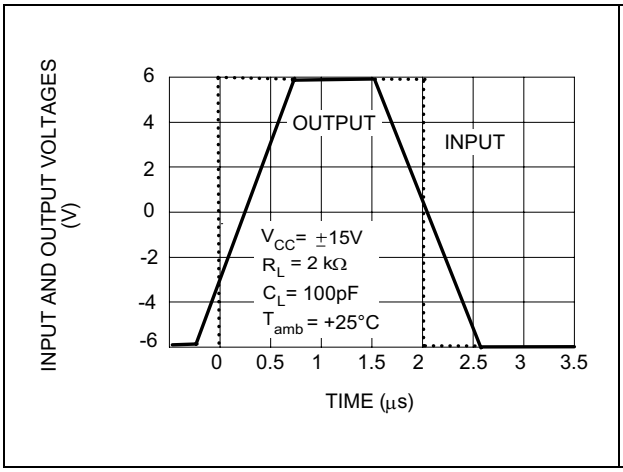


Figure 17. Equivalent input noise voltage versus frequency

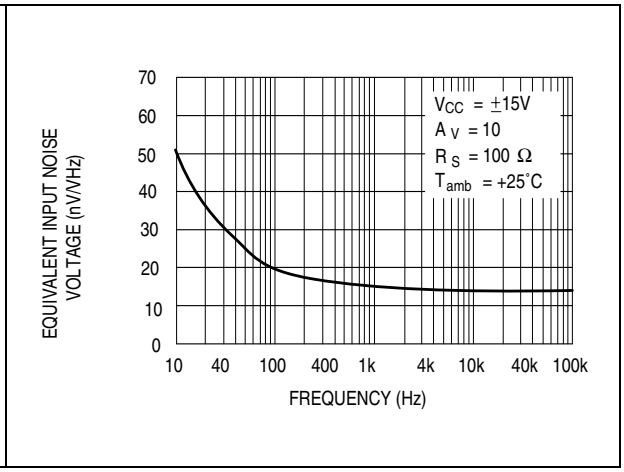
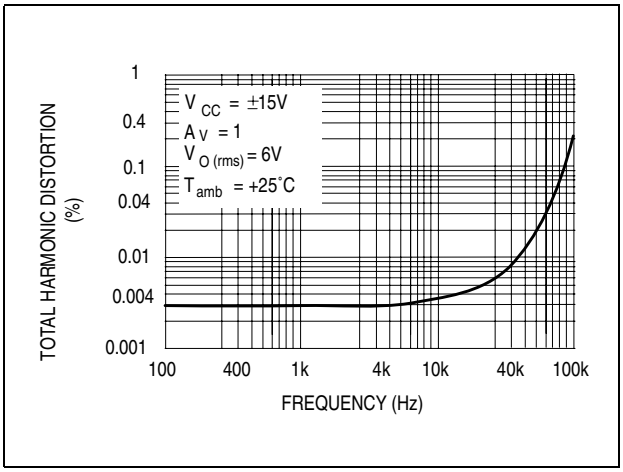


Figure 18. Total harmonic distortion versus frequency



4 Parameter measurement information

Figure 19. Voltage follower

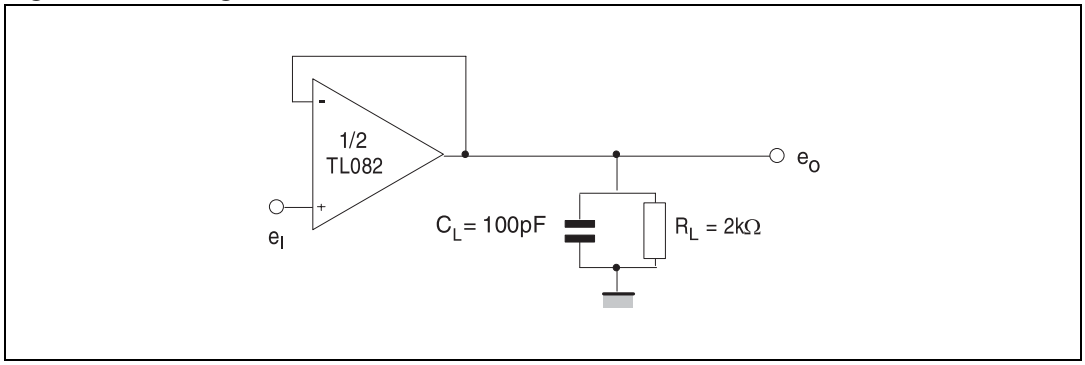
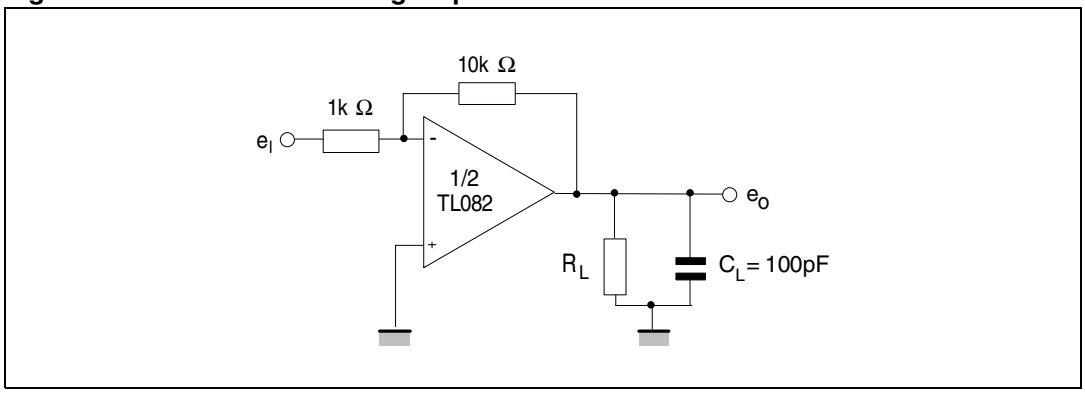
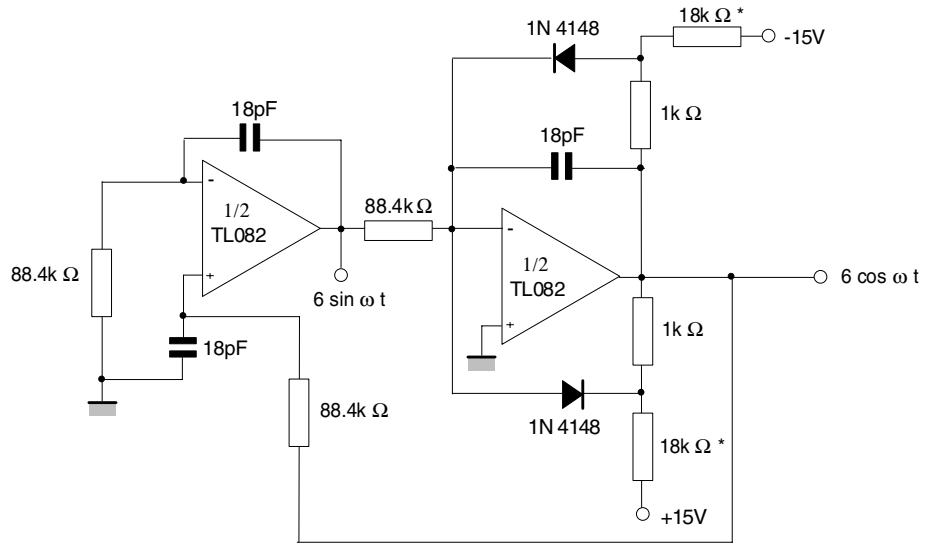


Figure 20. Gain-of-10 inverting amplifier



5 Typical applications

Figure 21. 100 kHz quadruple oscillator



* These resistor values may be adjusted for a symmetrical output

6.1 DIP8 package information

Figure 22. DIP8 package mechanical drawing

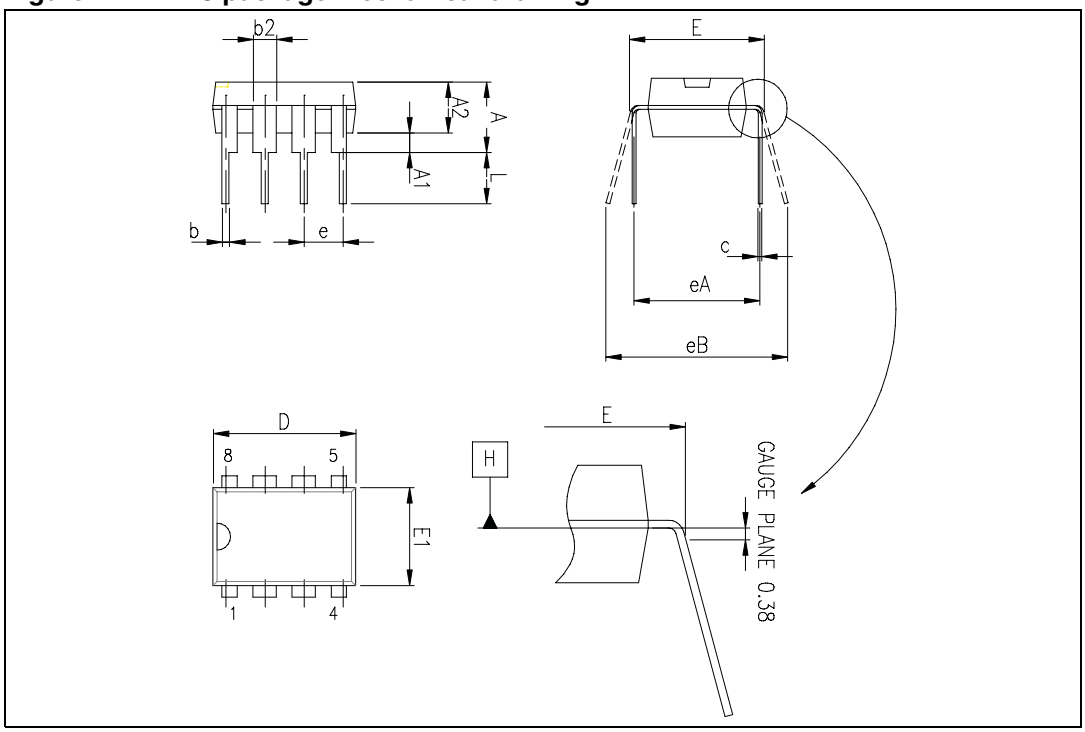


Table 4. DIP8 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			5.33			0.210
A1	0.38			0.015		
A2	2.92	3.30	4.95	0.115	0.130	0.195
b	0.36	0.46	0.56	0.014	0.018	0.022
b2	1.14	1.52	1.78	0.045	0.060	0.070
c	0.20	0.25	0.36	0.008	0.010	0.014
D	9.02	9.27	10.16	0.355	0.365	0.400
E	7.62	7.87	8.26	0.300	0.310	0.325
E1	6.10	6.35	7.11	0.240	0.250	0.280
e		2.54			0.100	
eA		7.62			0.300	
eB			10.92			0.430
L	2.92	3.30	3.81	0.115	0.130	0.150

6.2 SO-8 package information

Figure 23. SO-8 package mechanical drawing

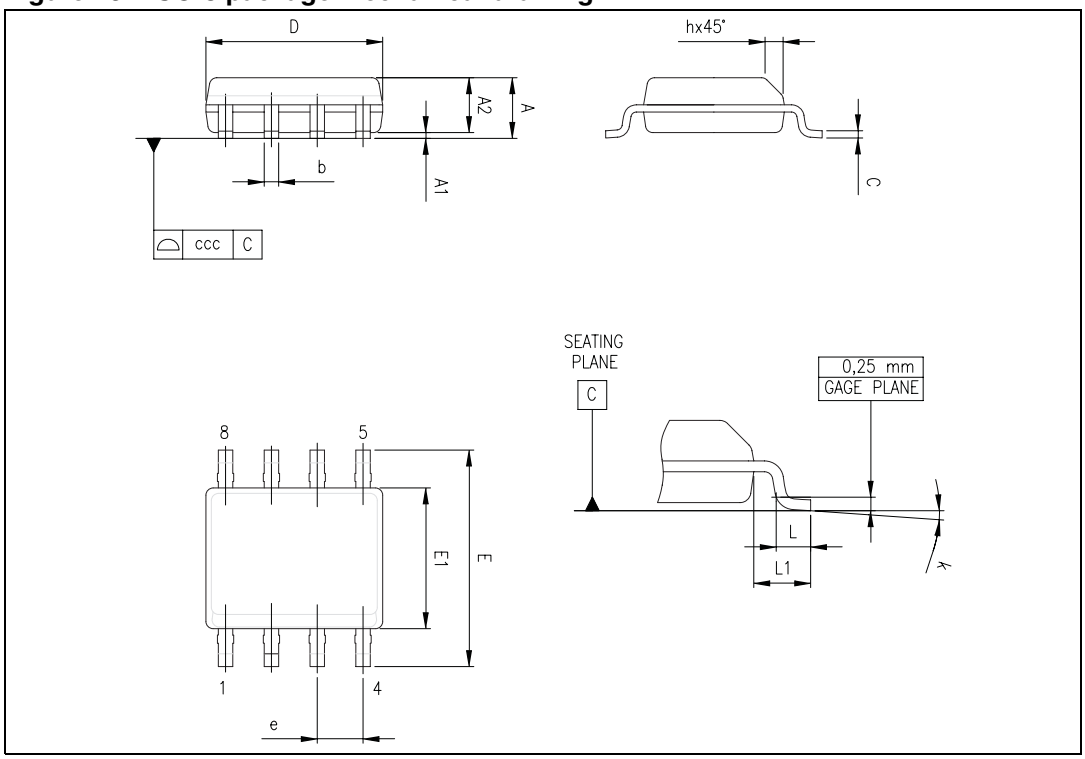


Table 5. SO-8 package mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
A1	0.10		0.25	0.004		0.010
A2	1.25			0.049		
b	0.28		0.48	0.011		0.019
c	0.17		0.23	0.007		0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	5.80	6.00	6.20	0.228	0.236	0.244
E1	3.80	3.90	4.00	0.150	0.154	0.157
e		1.27			0.050	
h	0.25		0.50	0.010		0.020
L	0.40		1.27	0.016		0.050
k	1°		8°	1°		8°
ccc			0.10			0.004