TL082
TL082A - TL082B

General purpose J-FET dual operational amplifiers

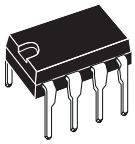
Features

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

Description

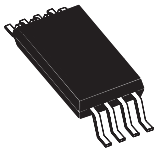
The TL082, TL082A and TL082B are high speed J–FET input dual operational amplifiers incorporating well matched, high voltage J–FET and bipolar transistors in a monolithic integrated circuit.

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



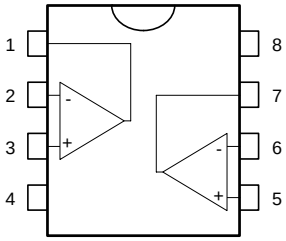
N
DIP8
(Plastic package)

D
SO8
(Plastic micropackage)



P
TSSOP8
(Thin shrink small outline package)

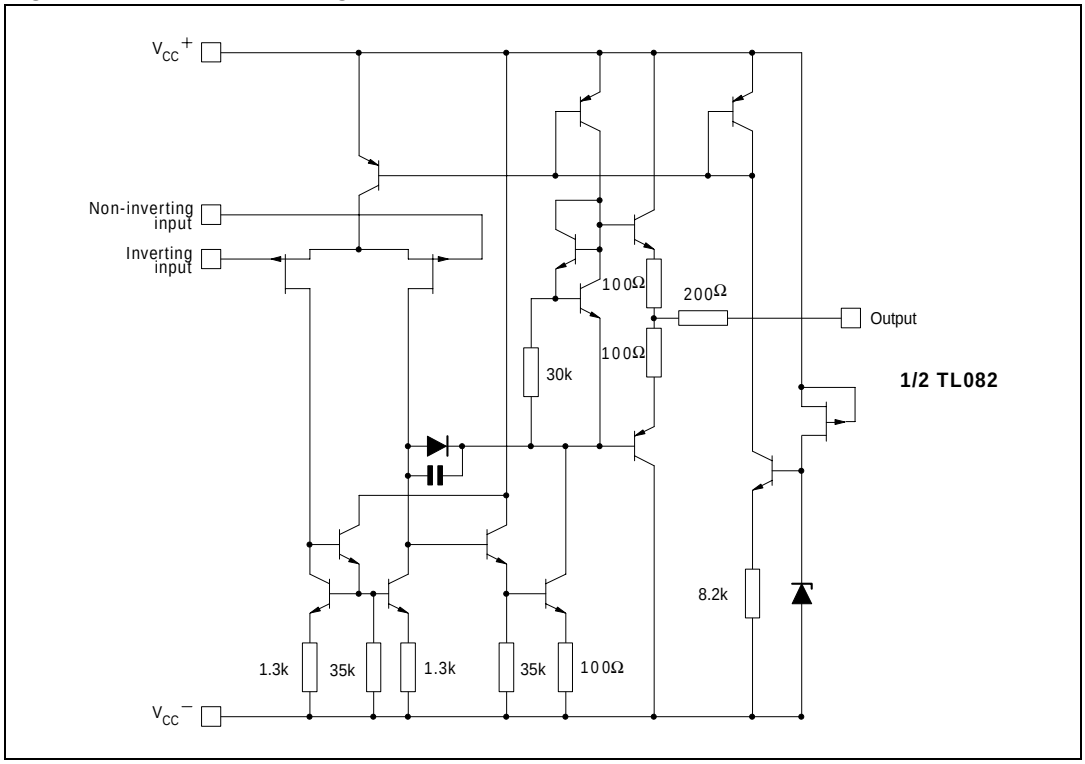
Pin connections (top view)



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	TL082M, AM, BM	TL082I, AI, BI	TL082C, AC, BC	Unit
V_{CC}	Supply voltage (1)	±18			V
V_i	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: 100pF discharged through a 1.5kΩ resistor between two pins of the device, done for all couples of pin combinations with other pins floating.
7. Machine model: a 200pF cap is charged to the specified voltage, then discharged directly between two pins of the device with no external series resistor (internal resistor < 5Ω), 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	TL082M, AM, BM	TL082I, AI, BI	TL082C, AC, BC	Unit
V_{CC}	Supply voltage	6 to 36			V
T_{oper}	Operating free-air temperature range	-55 to +125	-40 to +105	0 to +70	°C

3 Electrical characteristics

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

Symbol	Parameter	TL082I,M,AC,AI,AM,BC,BI,BM			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 RL = 2kΩ RL = 10kΩ $T_{min} \le T_{amb} \le T_{max}$ RL = 2kΩ RL = 10kΩ	10 12 10 12	12 13.5		10 12 10 12	12 13.5		V
SR	Slew rate (T_{amb} = +25°C) 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,M,AC,AI,AM,BC,BI,BM			TL082C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
t_r	Rise time (T_{amb} = +25°C) V_{in} = 20mV, R_L = 2kΩ, C_L = 100pF, unity gain		0.1			0.1		µs
K_{ov}	Overshoot (T_{amb} = +25°C) V_{in} = 20mV, R_L = 2kΩ, C_L = 100pF, unity gain		10			10		%
GBP	Gain bandwidth product (T_{amb} = +25°C) 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 (T_{amb} = +25°C), f=1kHz, R_L = 2kΩC_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

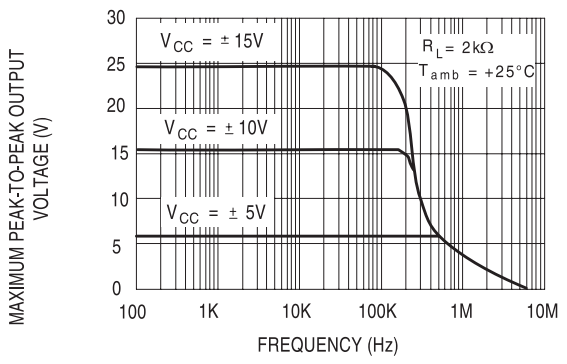


Figure 3. Maximum peak-to-peak output voltage versus frequency

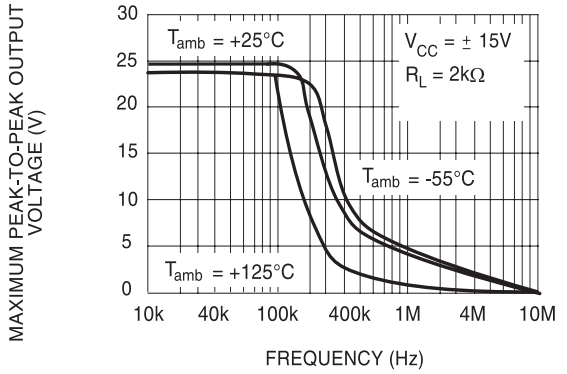


Figure 4. Maximum peak-to-peak output voltage versus load resistance

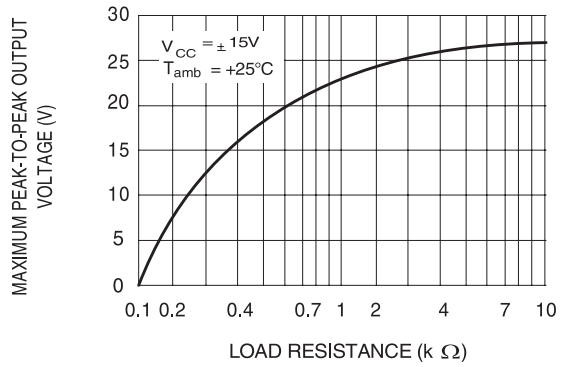


Figure 5. Maximum peak-to-peak output voltage versus frequency

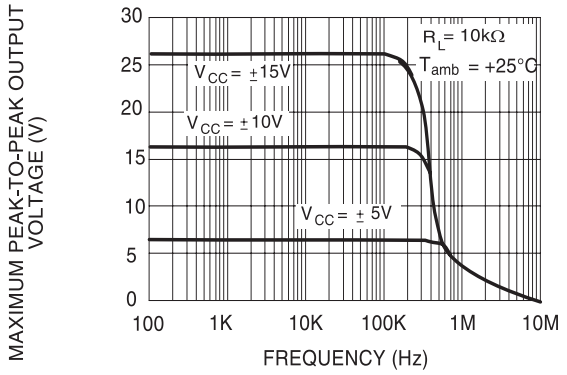


Figure 6. Maximum peak-to-peak output voltage versus free air temperature

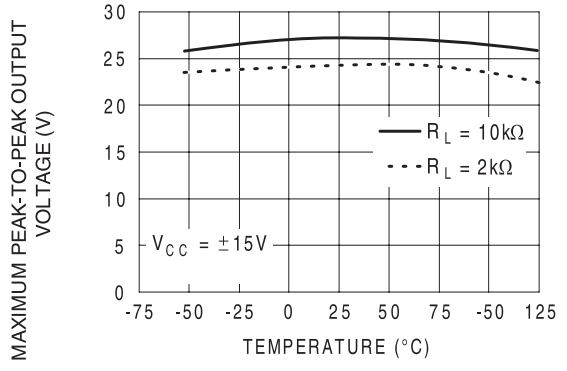


Figure 7. Maximum peak-to-peak output voltage versus supply voltage

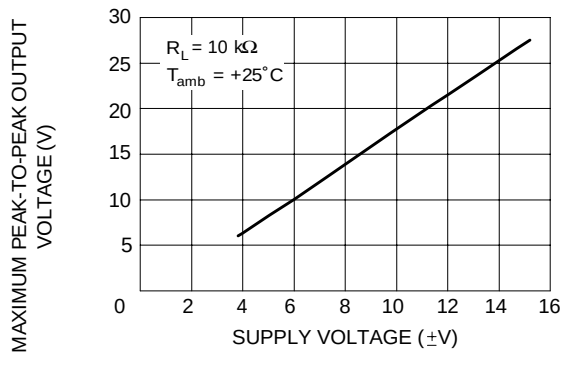


Figure 8. Input bias current versus free air temperature

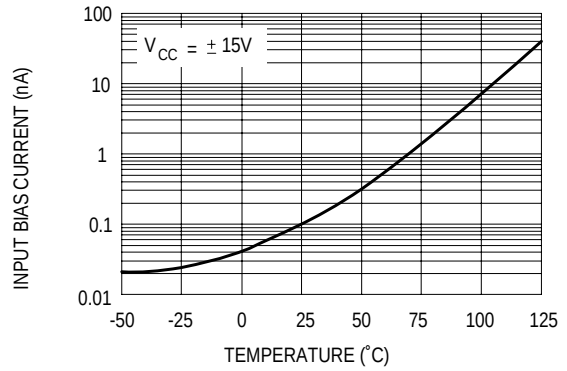


Figure 9. Large signal differential voltage amplification and phase shift versus frequency

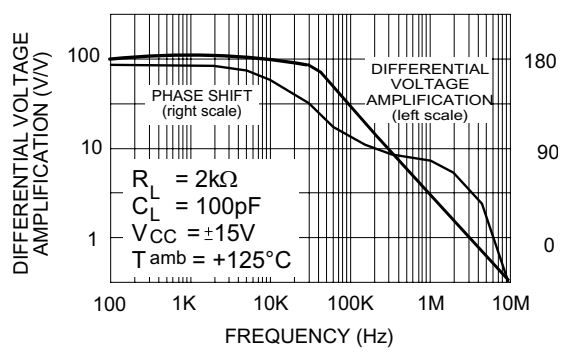


Figure 10. Supply current per amplifier versus free air temperature

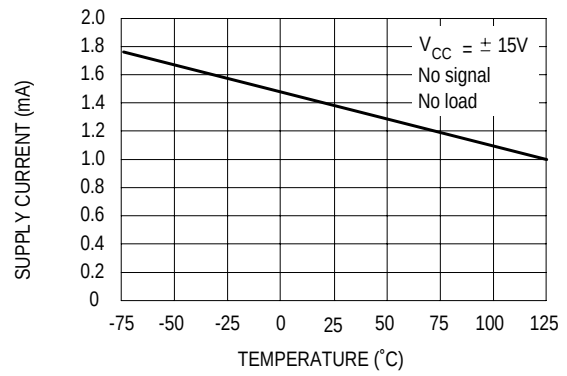


Figure 11. Large signal differential voltage amplification versus free air temp.

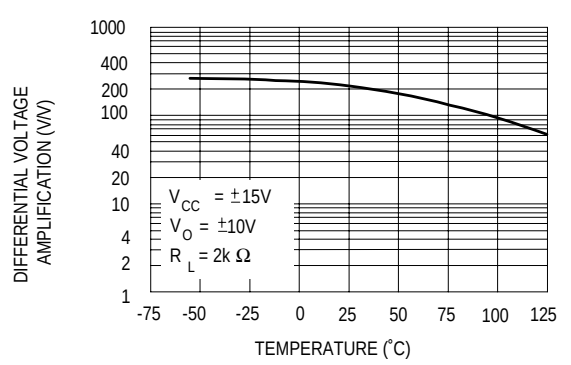


Figure 12. Total power dissipation versus free air temperature

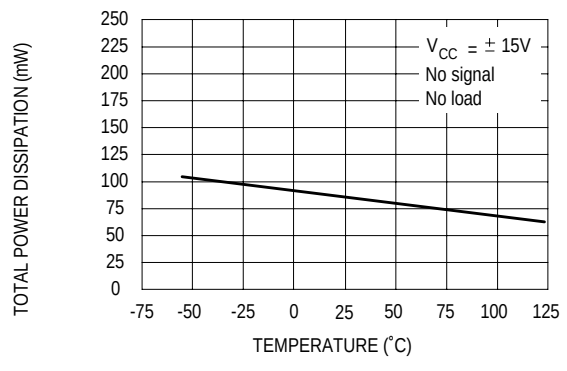


Figure 13. Supply current per amplifier versus supply voltage

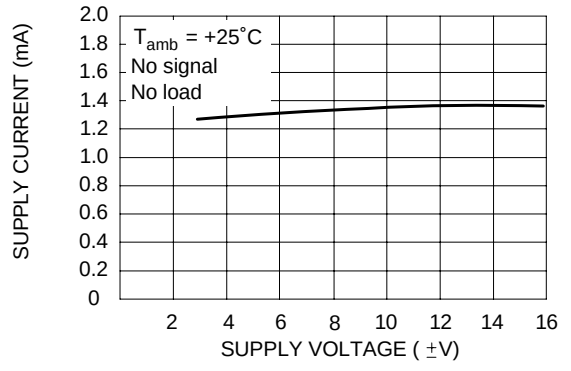


Figure 14. Common mode rejection ratio versus free air temperature

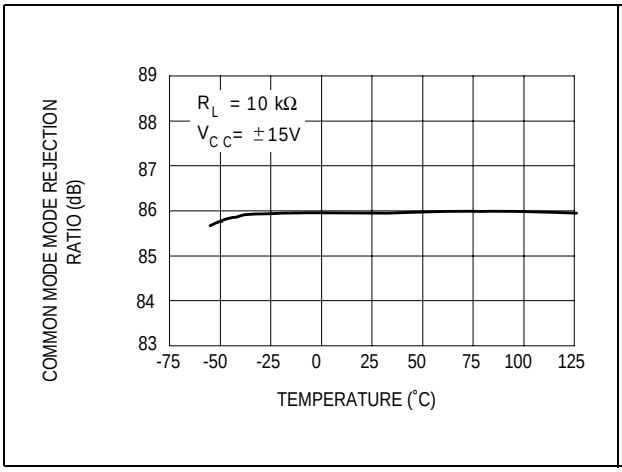


Figure 15. Output voltage versus elapsed time

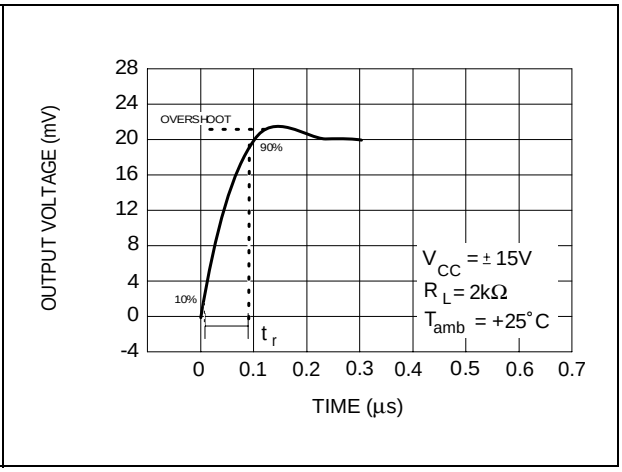


Figure 16. Voltage follower large signal pulse response

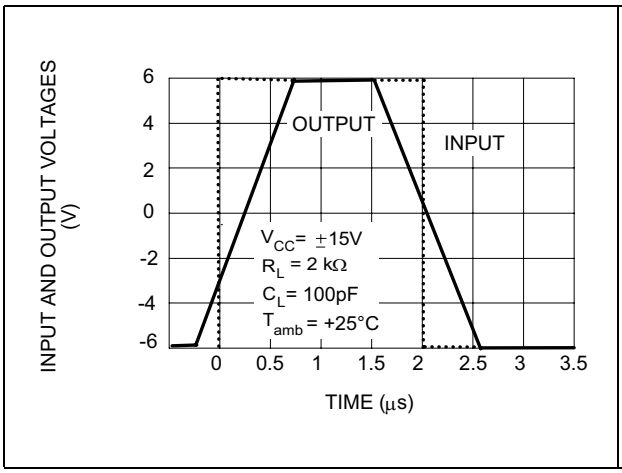


Figure 17. Equivalent input noise voltage versus frequency

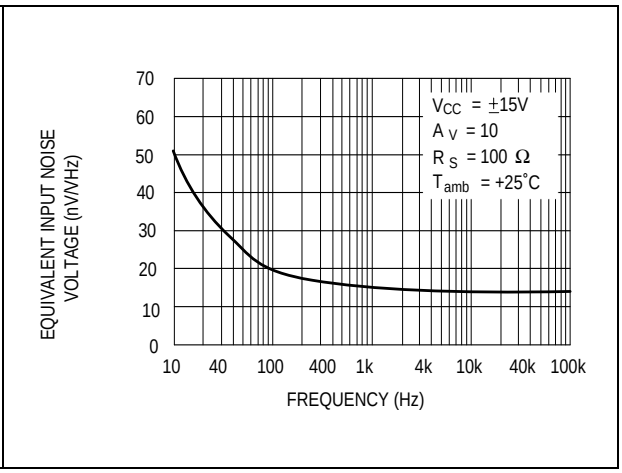
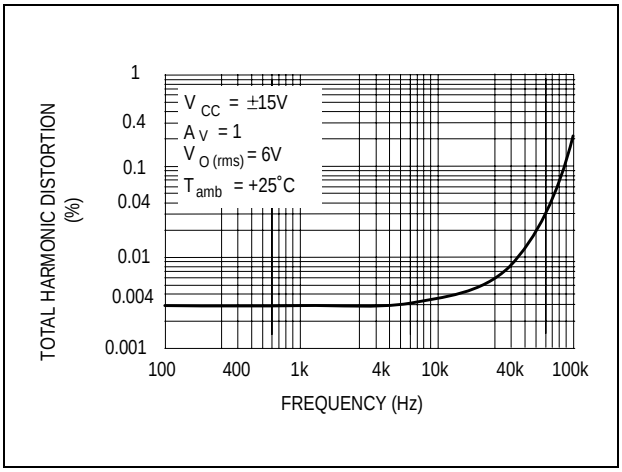


Figure 18. Total harmonic distortion versus frequency



4 Parameter measurement information

Figure 19. Voltage follower

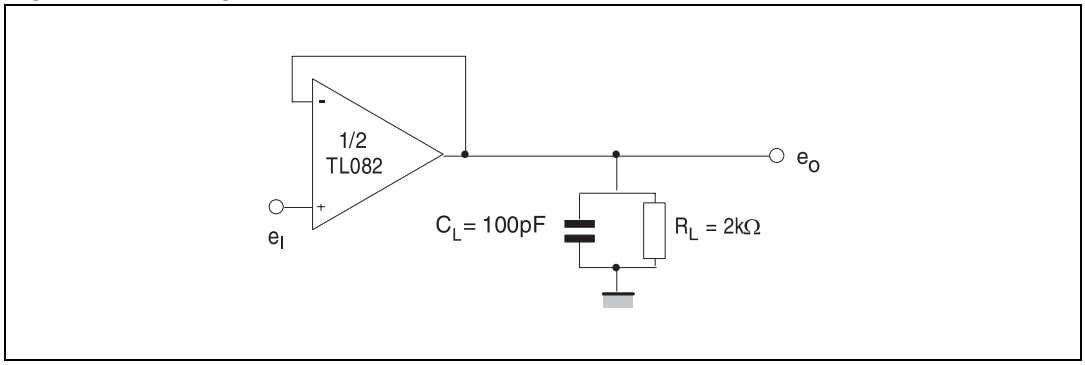
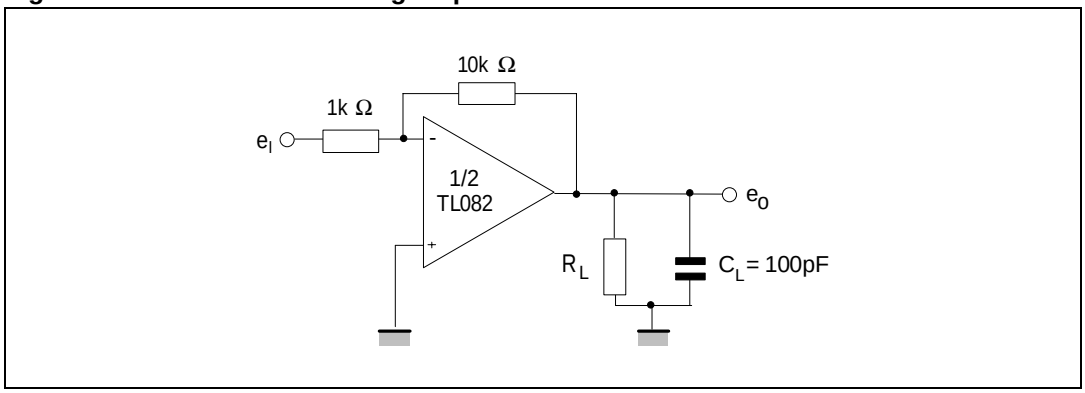
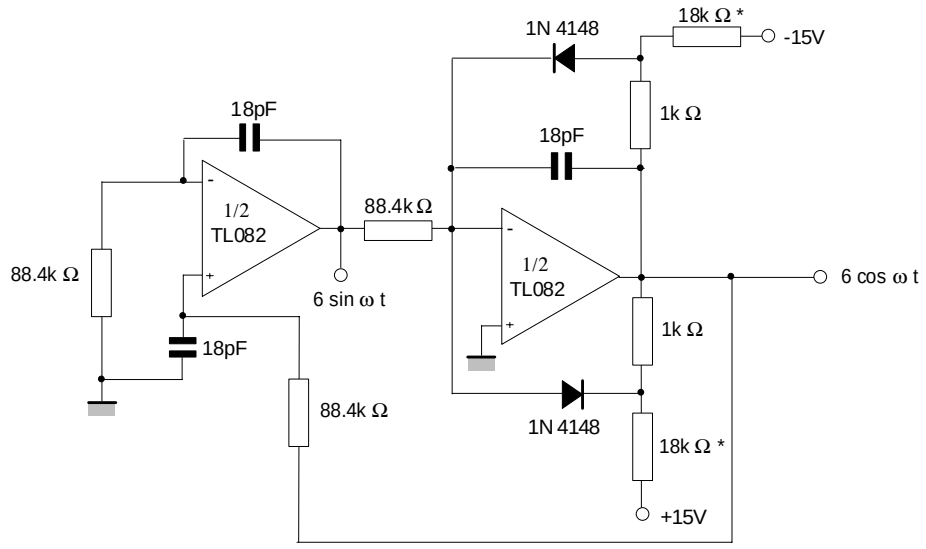


Figure 20. Gain-of-10 inverting amplifier



5 Typical applications

Figure 21. 100kHz quadruple oscillator



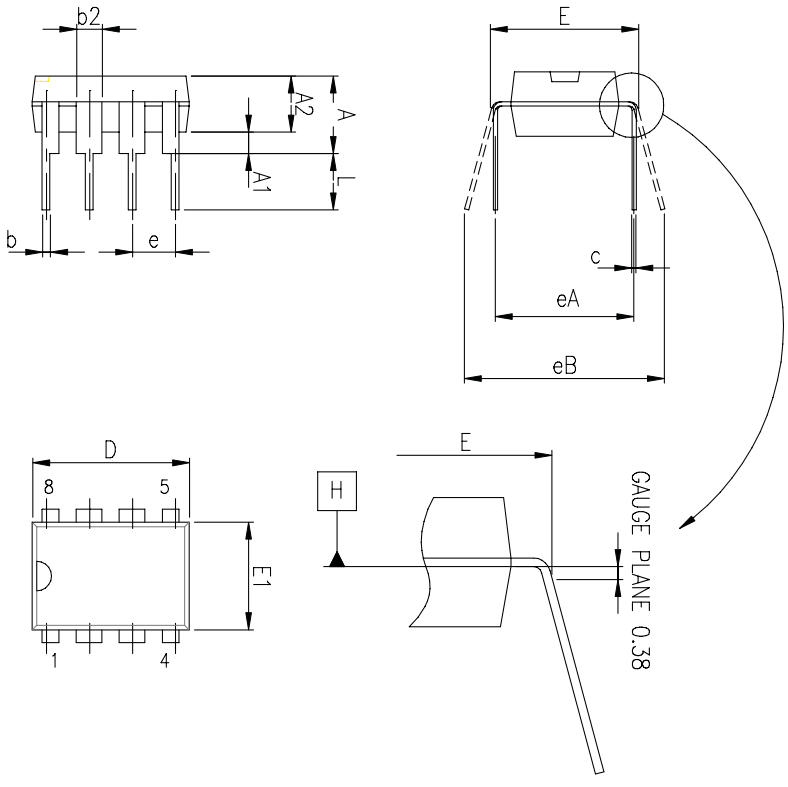
* These resistors values may be adjusted for a symmetrical output

6 Package information

In order to meet environmental requirements, STMicroelectronics offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an STMicroelectronics trademark. ECOPACK specifications are available at: www.st.com.

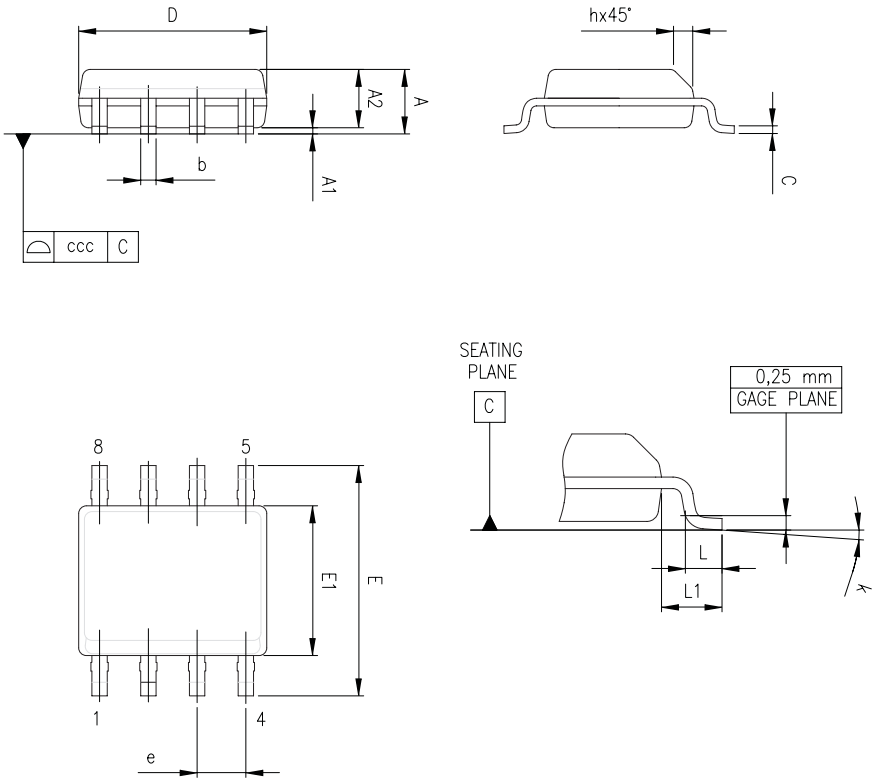
6.1 8-pin plastic DIP package mechanical data

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



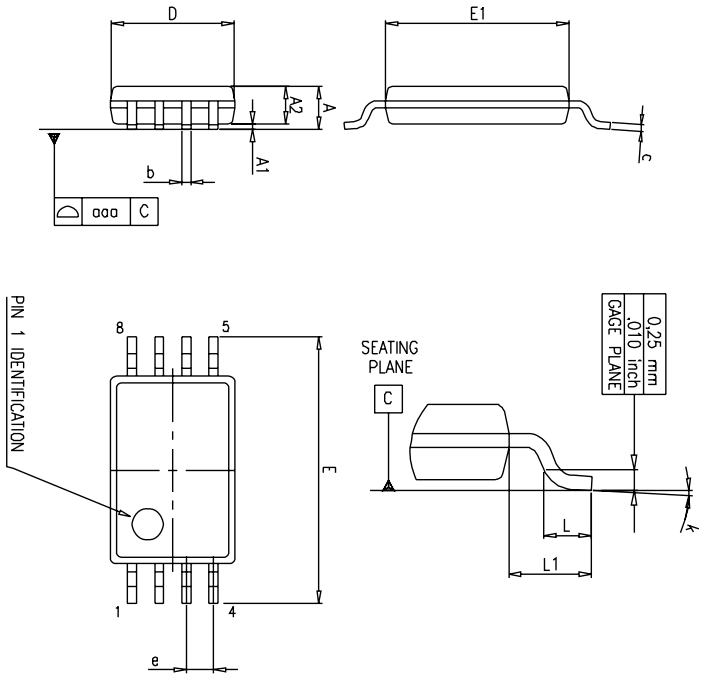
6.2 8-pin plastic micropackage (SO8) mechanical data

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



6.3 8-pin TSSOP (thin shrink small outline package) mechanical data

Ref.	Dimensions					
	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.2			0.047
A1	0.05		0.15	0.002		0.006
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19		0.30	0.007		0.012
c	0.09		0.20	0.004		0.008
D	2.90	3.00	3.10	0.114	0.118	0.122
E	6.20	6.40	6.60	0.244	0.252	0.260
E1	4.30	4.40	4.50	0.169	0.173	0.177
e		0.65			0.0256	
k	0°		8°	0°		8°
L	0.45	0.60	0.75	0.018	0.024	0.030
L1		1			0.039	
aaa		0.1			0.004	



7 Ordering information

Table 4. Order codes

Part number	Temperature range	Package	Packing	Marking
TL082MN	-55°C, + 125°C	DIP8	Tube	TL082MN
TL082MD/MDT		SO8	Tube or tape & reel	082M
TL082MPT		TSSOP8	Tape & reel	
TL082AMN		DIP8	Tube	TL082AMN
TL082AMD/AMDT		SO8	Tube or tape & reel	082AM
TL082AMPT		TSSOP8	Tape & reel	
TL082BMN		DIP8	Tube	TL082BMN
TL082BMD/BMDT		SO8	Tube or tape & reel	082BM
TL082BMPT		TSSOP8	Tape & reel	
TL082IN	-40°C, +105°C	DIP8	Tube	TL082IN
TL082ID/IDT		SO8	Tube or tape & reel	082I
TL082IPT		TSSOP8	Tape & reel	
TL082AIN		DIP8	Tube	TL082AIN
TL082AID/AIDT		SO8	Tube or tape & reel	082AI
TL082AIPT		TSSOP8	Tape & reel	
TL082BIN		DIP8	Tube	TL082BIN
TL082BID/BIDT		SO8	Tube or tape & reel	082BI
TL082BIPT		TSSOP8	Tape & reel	
TL082CN	0°C, +70°C	DIP8	Tube	TL082CN
TL082CD/CDT		SO8	Tube or tape & reel	082C
TL082CPT		TSSOP8	Tape & reel	
TL082ACN		DIP8	Tube	TL082ACN
TL082ACD/ACDT		SO8	Tube or tape & reel	082AC
TL082ACPT		TSSOP8	Tape & reel	
TL082BCN		DIP8	Tube	TL082BCN
TL082BCD/BCDT		SO8	Tube or tape & reel	082BC
TL082BCPT		TSSOP8	Tape & reel	
TL082IYDT(1)	-40°C, +105°C	SO8 (automotive grade level)	Tube or tape & reel	082IY
TL082AIYDT(1)				82AIY
TL082BIYDT(1)				82BIY

1. Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 & Q 002 or equivalent.

8 Revision history

Date	Revision	Changes
2-Apr-2001	1	Initial release.
2002-2003	2-7	Internal revisions.
30-Apr-2004	8	Format update.
6-Mar-2007	9	Added ESD information in *Table 1 on page 3*. Expanded order codes table and added automotive grade order codes. See *Table 4 on page 15*. Added *Table 2: Operating conditions on page 3*. Updated package information to make it compliant with the latest JEDEC standards.

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