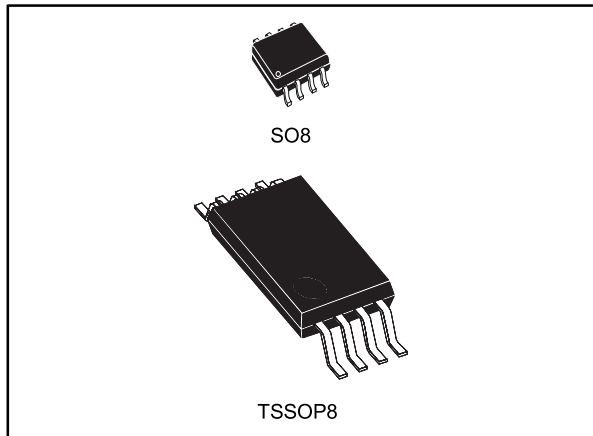


**General purpose JFET dual operation amplifiers**

Datasheet - production data

**Description**

The TL082, TL082A and TL082B are 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.

**Features**

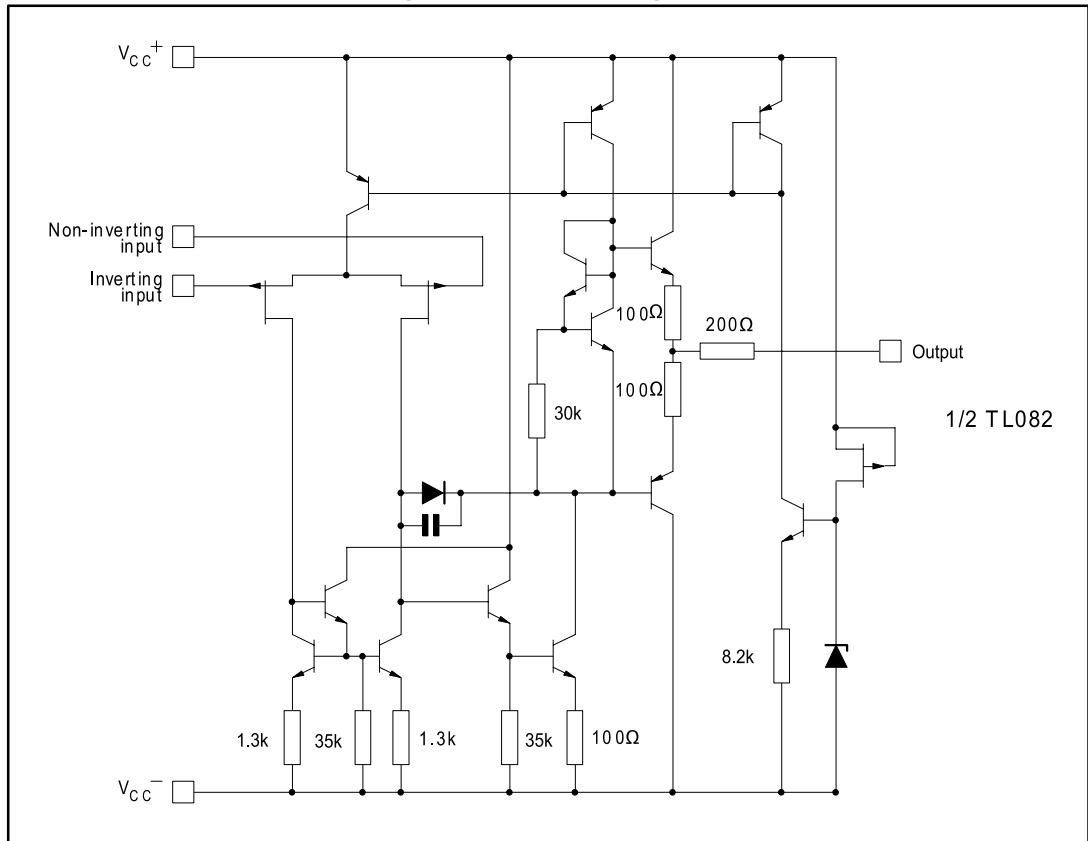
- Wide common-mode (up to  $V_{CC+}$ ) and differential voltage range
- Low input bias and offset current
- Output short-circuit protection
- High input impedance JFET input stage
- Internal frequency compensation
- Latch up free operation
- High slew rate: 16 V/ $\mu$ s (typical)

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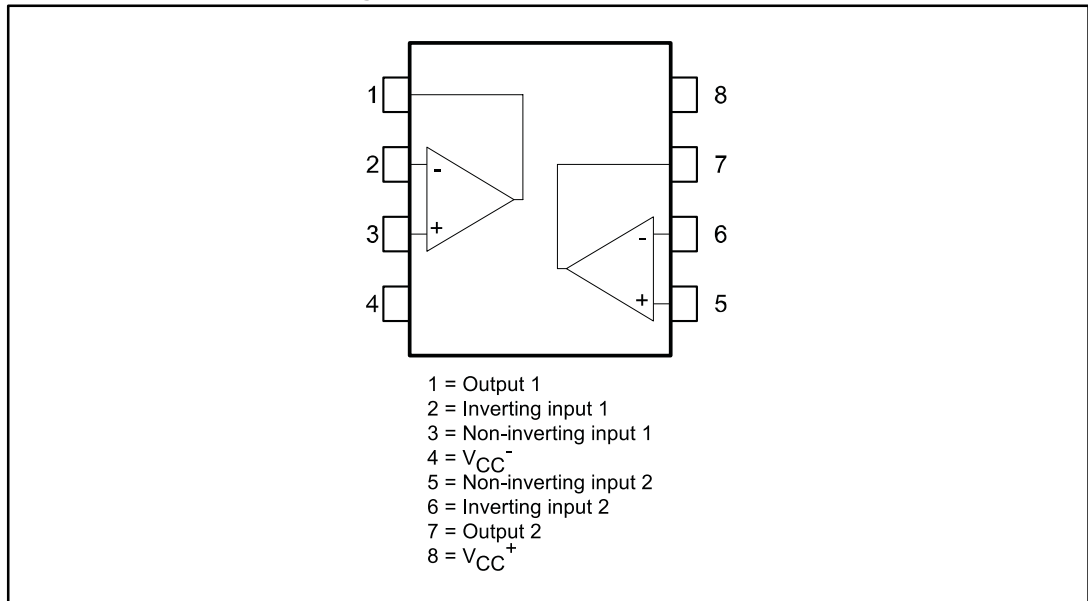
# 1 Schematic diagram

Figure 1: Schematic diagram



## 2 Pin connections

Figure 2: Pin connections (top view)



### 3 Absolute maximum ratings and operating conditions

Table 1: Absolute maximum ratings

Symbol	Parameter	TL082I, AI, BI	TL082C, AC, BC	Unit
V <sub>CC</sub>	Supply voltage <sup>(1)</sup>	±18		V
V <sub>in</sub>	Input voltage <sup>(2)</sup>	±15		
V <sub>id</sub>	Differential input voltage <sup>(3)</sup>	±30		
P <sub>tot</sub>	Power dissipation	680		mW
R <sub>thja</sub>	Thermal resistance junction-to-ambient <sup>(4)</sup>	SO8	125	°C/W
		TSSOP8	120	
R <sub>thjc</sub>	Thermal resistance junction-to-case	SO8	40	
		TSSOP8	37	
	Output short-circuit duration <sup>(5)</sup>	Infinite		
T <sub>stg</sub>	Storage temperature range	-65 to 150		°C
ESD	HBM: human body model <sup>(6)</sup>	1		kV
	MM: machine model <sup>(7)</sup>	200		V
	CDM: charged device model <sup>(8)</sup>	1500		

**Notes:**

<sup>(1)</sup>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<sub>CC</sub><sup>+</sup> and V<sub>CC</sub><sup>-</sup>.

<sup>(2)</sup>The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.

<sup>(3)</sup>Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.

<sup>(4)</sup>Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuit on all amplifiers.

<sup>(5)</sup>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.

<sup>(6)</sup>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.

<sup>(7)</sup>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.

<sup>(8)</sup>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 <sub>CC</sub>	Supply voltage	6 to 36		V
T <sub>oper</sub>	Operating free-air temperature range	-40 to 105	0 to 70	°C

## 4 Electrical characteristics

Table 3: VCC = ±15V, Tamb = +25°C (unless otherwise specified)

Symbol	Parameter	TL082I, AC, AI, BC, BI			TL082C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>io</sub>	Input offset voltage, R <sub>s</sub> = 50 Ω, T <sub>amb</sub> = 25 °C, TL082		3	10		3	10	mV
	Input offset voltage, R <sub>s</sub> = 50 Ω, T <sub>amb</sub> = 25 °C, TL082A		3	6				
	Input offset voltage, R <sub>s</sub> = 50 Ω, T <sub>amb</sub> = 25 °C, TL082B		1	3				
	Input offset voltage, R <sub>s</sub> = 50 Ω, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub> , TL082			13			13	
	Input offset voltage, R <sub>s</sub> = 50 Ω, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub> , TL082A			7				
	Input offset voltage, R <sub>s</sub> = 50 Ω, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub> , TL082B			5				
DV <sub>io</sub>	Input offset voltage drift		10			10		μV/°C
I <sub>io</sub>	Input offset current, T <sub>amb</sub> = 25 °C <sup>(1)</sup>		5	100		5	100	pA
	Input offset current, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub> <sup>(1)</sup>			4			10	nA
I <sub>ib</sub>	Input bias current, T <sub>amb</sub> = 25 °C		20	200		20	400	pA
	Input bias current, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>			20			20	nA
A <sub>vd</sub>	Large signal voltage gain, R <sub>L</sub> = 2 kΩ, V <sub>o</sub> = ±10 V, T <sub>amb</sub> = 25 °C	50	200		25	200		V/mV
	Large signal voltage gain, R <sub>L</sub> = 2 kΩ, V <sub>o</sub> = ±10 V, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>	25			15			
SVR	Supply voltage rejection ratio, R <sub>S</sub> = 50 Ω, T <sub>amb</sub> = 25 °C	80	86		70	86		dB
	Supply voltage rejection ratio, R <sub>S</sub> = 50 Ω, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>	80			70			
I <sub>cc</sub>	Supply current, no load, T <sub>amb</sub> = 25 °C		1.4	2.5		1.4	2.5	mA
	Supply current, no load, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>			2.5			2.5	
V <sub>icm</sub>	Input common mode voltage range	±11	15		±11	15		V
			-12			-12		
CMR	Common mode rejection ratio, R <sub>S</sub> = 50 Ω, T <sub>amb</sub> = 25 °C	80	86		70	86		dB
	Common mode rejection ratio, R <sub>S</sub> = 50 Ω, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>	80			70			
I <sub>os</sub>	Output short-circuit current, T <sub>amb</sub> = 25 °C	10	40	60	10	40	60	mA
	Output short-circuit current, T <sub>min</sub> ≤ T <sub>amb</sub> ≤ T <sub>max</sub>	10		60	10		60	

Symbol	Parameter	TL082I, AC, AI, BC, BI			TL082C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$\pm V_{opp}$	Output voltage swing, $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $R_L = 2\text{ k}\Omega$	10	12		10	12		V
	Output voltage swing, $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $R_L = 10\text{ k}\Omega$	12	13.5		12	13.5		
	Output voltage swing, $T_{min} \leq T_{amb} \leq T_{max}$ , $R_L = 2\text{ k}\Omega$	10			10			
	Output voltage swing, $T_{min} \leq T_{amb} \leq T_{max}$ , $R_L = 10\text{ k}\Omega$	12			12			
SR	Slew rate, $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{in} = 10\text{ V}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , unity gain	8	16		8	16		V/ $\mu\text{s}$
$t_r$	Rise time, $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{in} = 20\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , unity gain		0.1			0.1		$\mu\text{s}$
$K_{ov}$	Overshoot, $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{in} = 20\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , unity gain		10			10		%
GBP	Gain bandwidth product, $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{in} = 10\text{ mV}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $F = 100\text{ kHz}$	2.5	4		2.5	4		MHz
$R_i$	Input resistance		$10^{12}$			$10^{12}$		$\Omega$
THD	Total harmonic distortion, $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $F = 1\text{ kHz}$ , $R_L = 2\text{ k}\Omega$ , $C_L = 100\text{ pF}$ , $A_v = 20\text{ dB}$ , $V_o = 2\text{ V}_{pp}$		0.01			0.01		%
$e_n$	Equivalent input noise voltage, $R_s = 100\text{ }\Omega$ , $F = 1\text{ kHz}$		15			15		nV/ $\sqrt{\text{Hz}}$
$\phi_m$	Phase margin		45			45		degrees
$V_{o1}/V_{o2}$	Channel separation, $A_v = 100$		120			120		dB

**Notes:**

(1)The input bias currents are junction leakage currents which approximately double for every  $10^{\circ}\text{ C}$  increase in the junction temperature.

## 5 Electrical characteristic curves

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

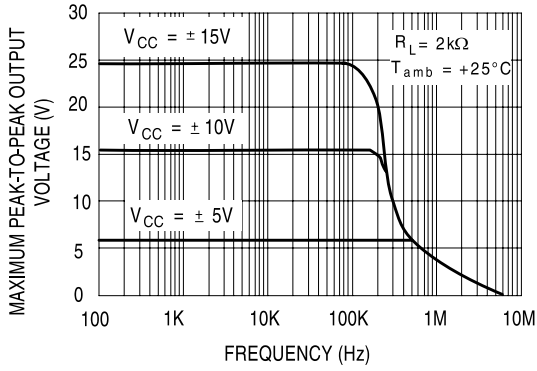


Figure 4: Maximum peak-to-peak output voltage versus frequency

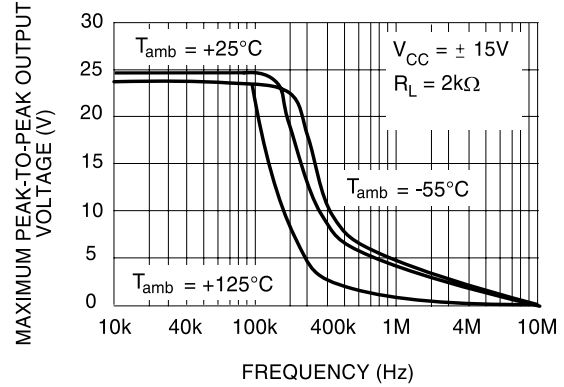


Figure 5: Maximum peak-to-peak output voltage versus load resistance

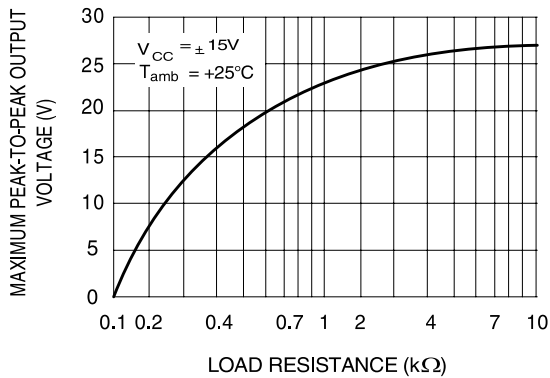


Figure 6: Maximum peak-to-peak output voltage versus frequency

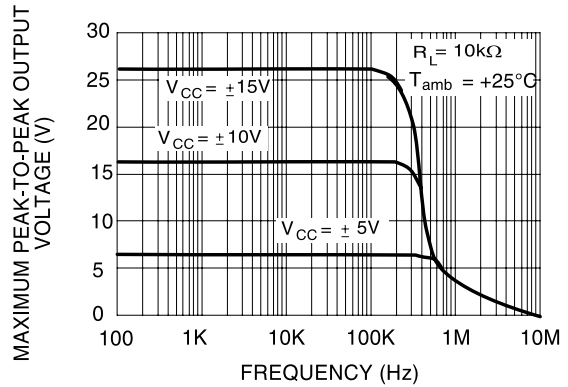


Figure 7: Maximum peak-to-peak output voltage versus free air temperature

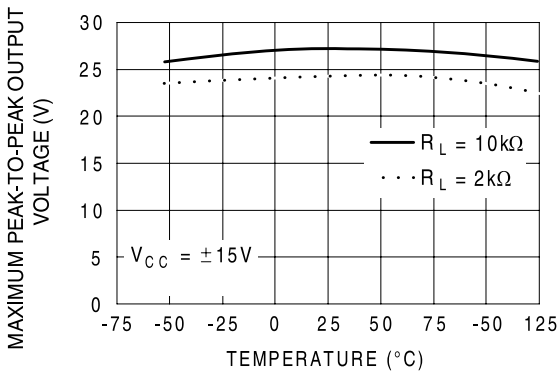


Figure 8: Maximum peak-to-peak output voltage versus supply voltage

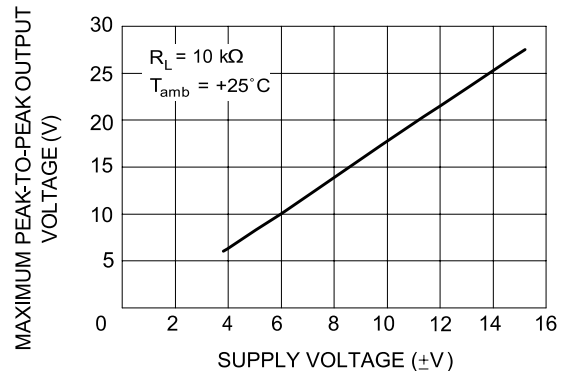




Figure 9: Input bias current versus free air temperature

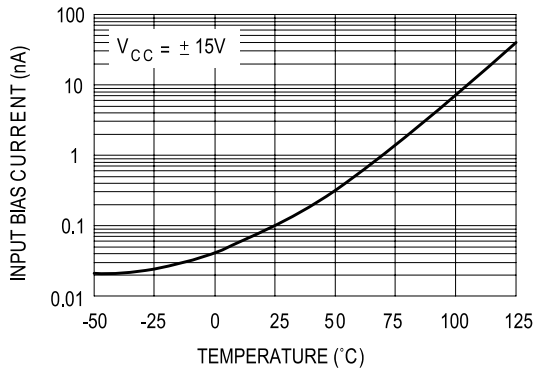


Figure 10: Large signal differential voltage amplification and phase shift versus frequency

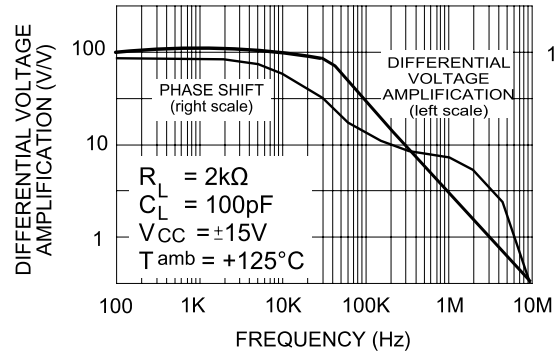


Figure 11: Supply current per amplifier versus free air temperature

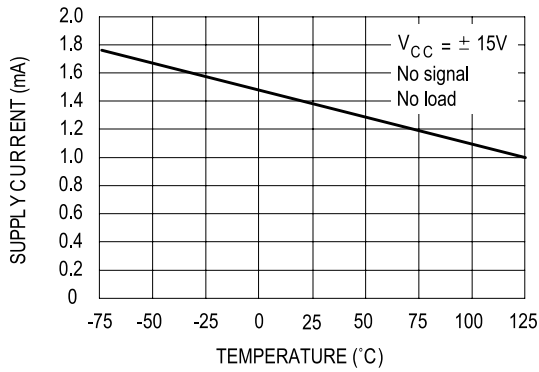


Figure 12: Large signal differential voltage amplification versus free air temperature

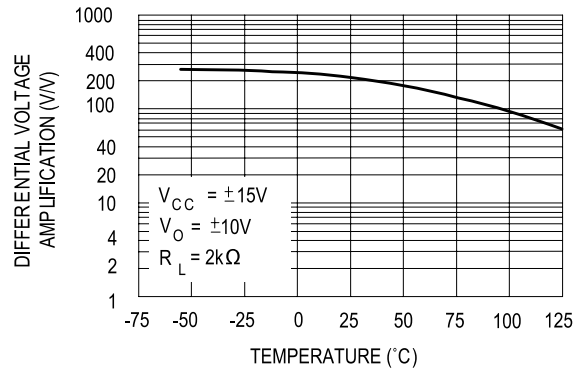


Figure 13: Total power dissipation versus free air temperature

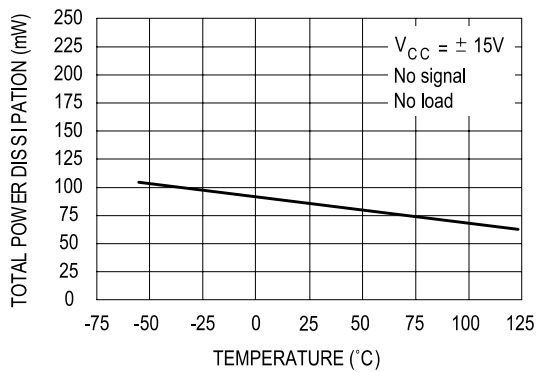


Figure 14: Supply current per amplifier versus supply voltage

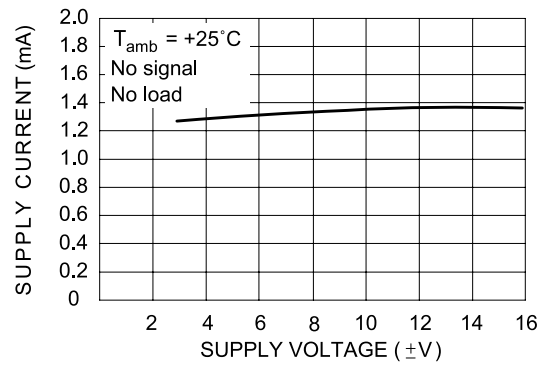


Figure 15: Common-mode rejection ratio versus free air temperature

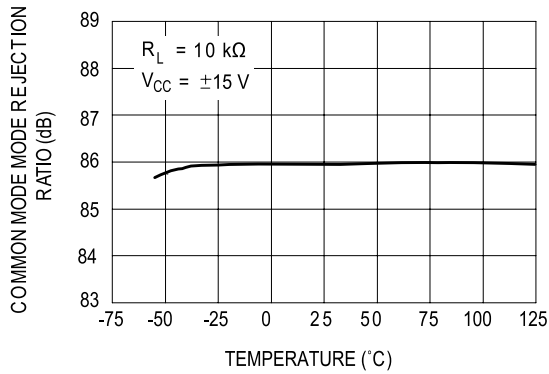


Figure 16: Output voltage versus elapsed time

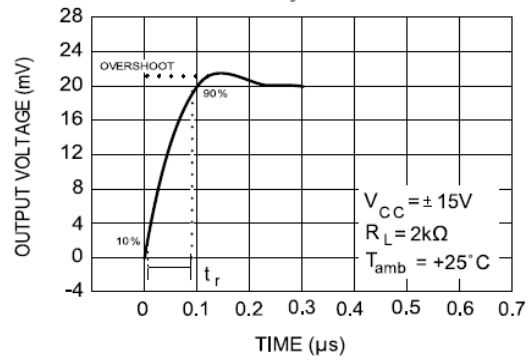


Figure 17: Voltage follower large signal pulse response

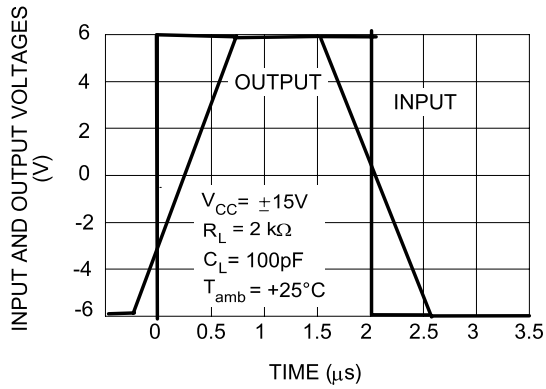


Figure 18: Equivalent input noise voltage versus frequency

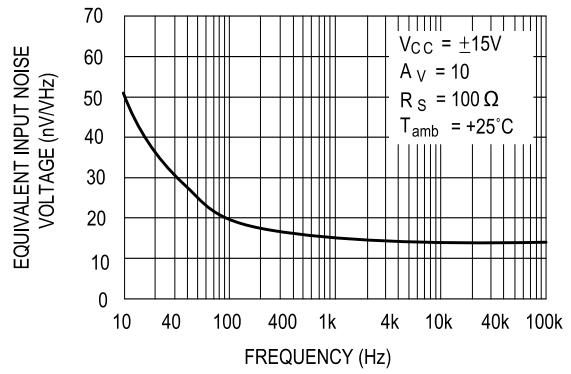
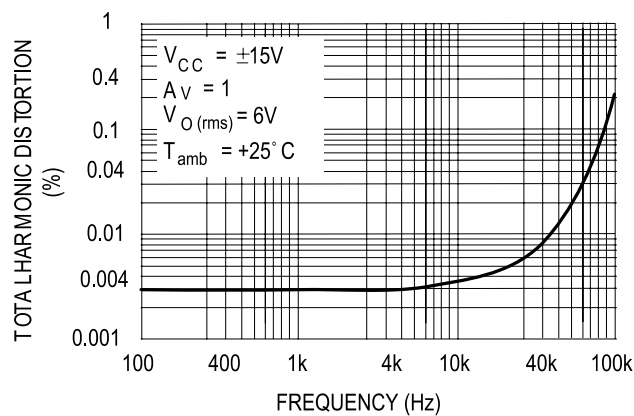


Figure 19: Total harmonic distortion versus frequency



## 6 Parameter measurement information

Figure 20: Voltage follower

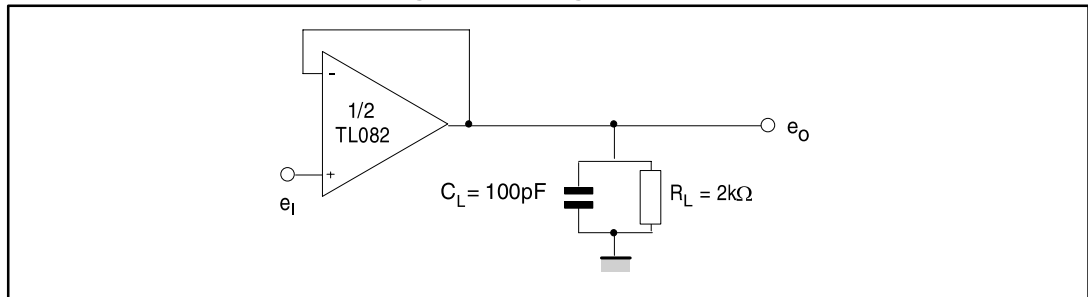
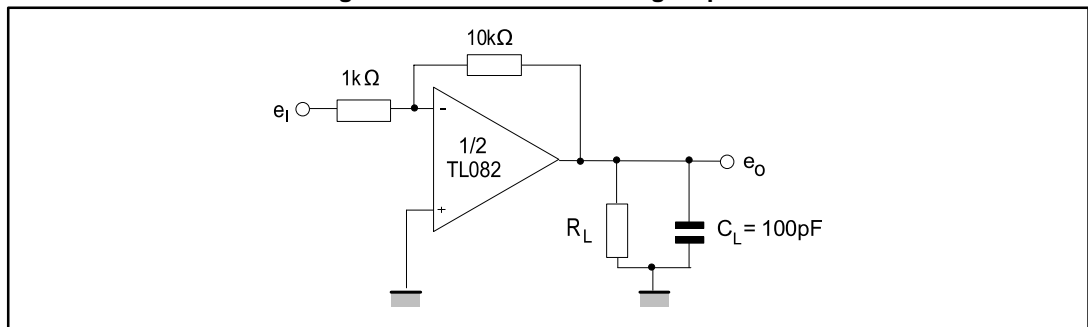
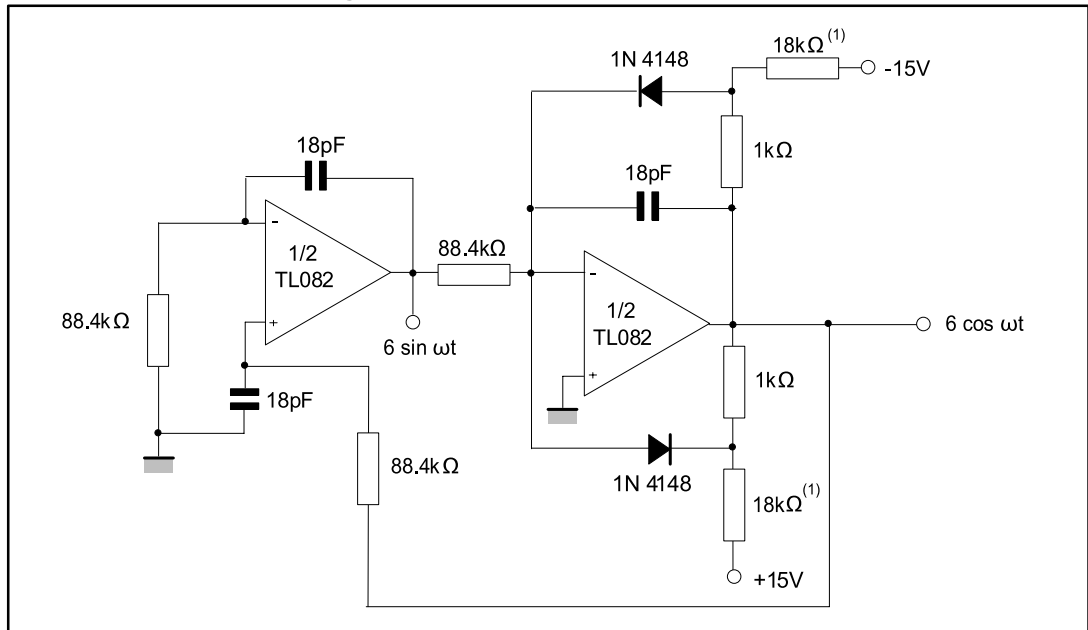


Figure 21: Gain-of-10 inverting amplifier



## 7 Typical applications

Figure 22: 100 kHz quadruple oscillator



1. These resistor values may be adjusted for a symmetrical output

## 8 Package information

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

### 8.1 SO8 package information

Figure 23: SO8 package outline

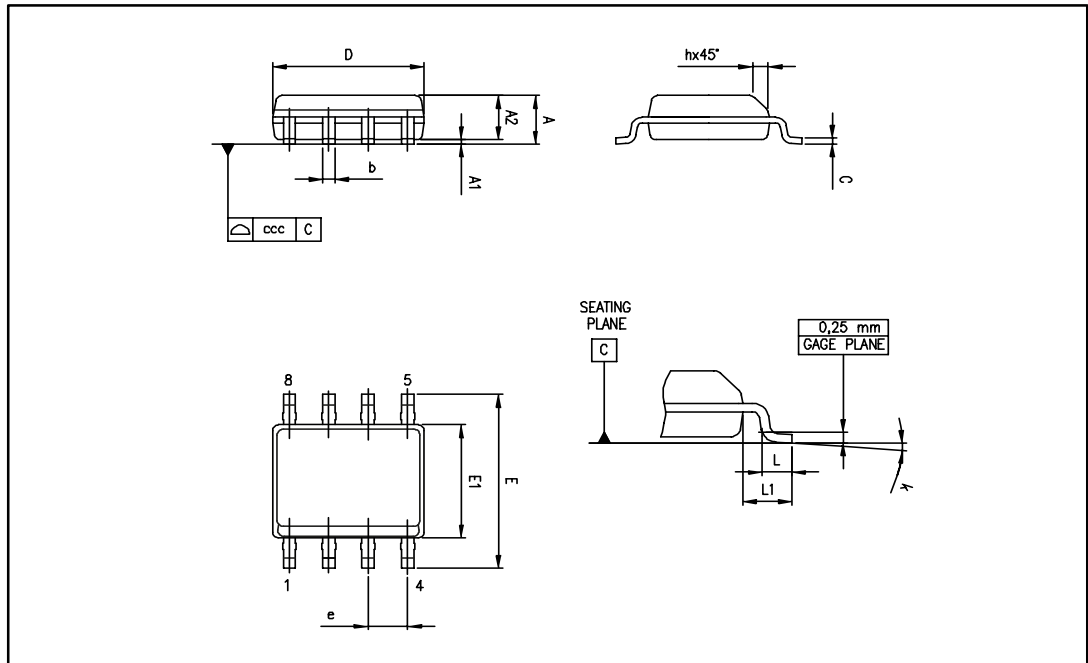


Table 4: SO8 mechanical data

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
L1		1.04			0.040	
k	1°		8°	1°		8°
ccc			0.10			0.004

## 8.2 TSSOP8 package information

Figure 24: TSSOP8 package outline

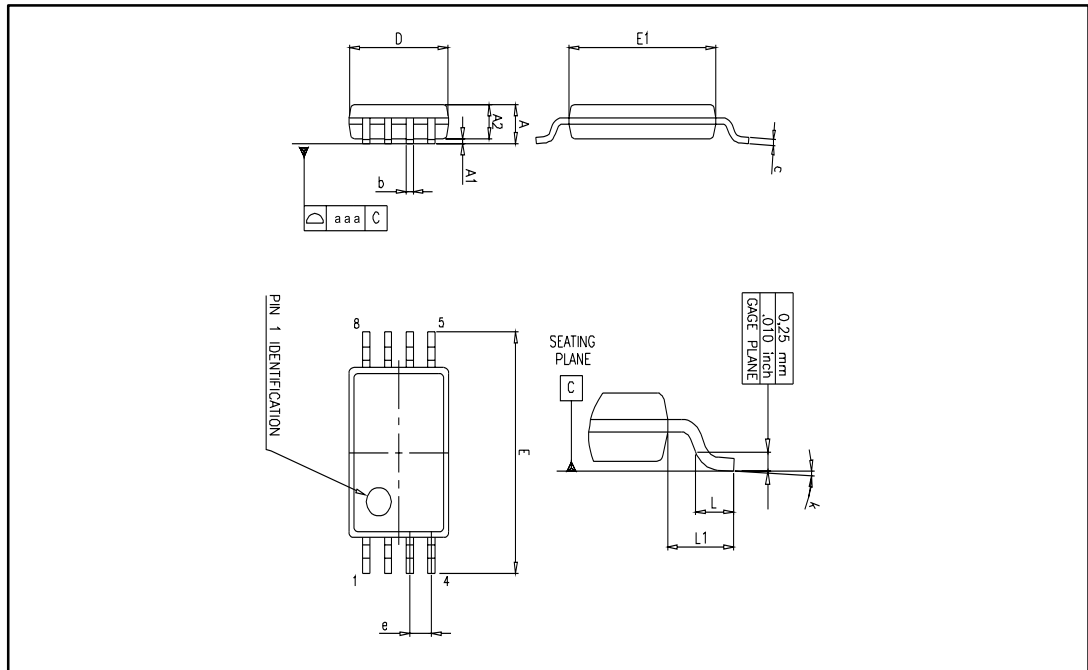


Table 5: TSSOP8 mechanical data

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	

## 9 Ordering information

Table 6: Order codes

Order code	Temperature range	Package	Packing	Marking
TL082ID	-40 °C to 105 °C	SO8	Tube or tape and reel	082I
TL082IDT		TSSOP8	Tape and reel	
TL082IPT				
TL082CD	0 °C to 70 °C	SO8	Tube or tape and reel	082C
TL082CDT		TSSOP8	Tape and reel	
TL082CPT				
TL082ACDT		SO8		082AC
TL082BCDT				082BC
TL082IYDT <sup>(1)</sup>	-40 °C to 105 °C	SO8 (automotive grade)	Tube or tape and reel	082IY
TL082AIYDT <sup>(1)</sup>				82AIY
TL082BIYDT <sup>(1)</sup>				82BIY

**Notes:**

<sup>(1)</sup>Qualified and characterized according to AEC Q100 and Q003 or equivalent, advanced screening according to AEC Q001 and Q 002 or equivalent.



## 10 Revision history

**Table 7: Document revision history**

Date	Revision	Changes
02-Apr-2001	1	Initial release.
2002-2003	2-7	Internal revisions.
30-Apr-2004	8	Format update.
06-Mar-2007	9	Added ESD information in Table 1 on page 4. Expanded order codes table and added automotive grade order codes. See Table 7 on page 16. Added Table 2: Operating conditions on page 4. Updated package information to make it compliant with the latest JEDEC standards.
12-Jun-2008	10	Removed information concerning military temperature range (TL082M*, TL082AM*, TL082BM*).
10-Jun-2016	11	Removed DIP8 package and all obsolete order codes Updated document layout <i>Table 4</i> : added L1 dimension <i>Figure 24</i> : removed silhouette and added package outline

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### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

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