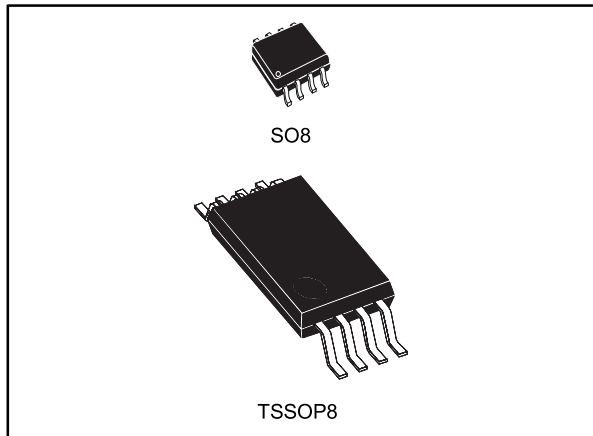


General purpose JFET dual operation amplifiers

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

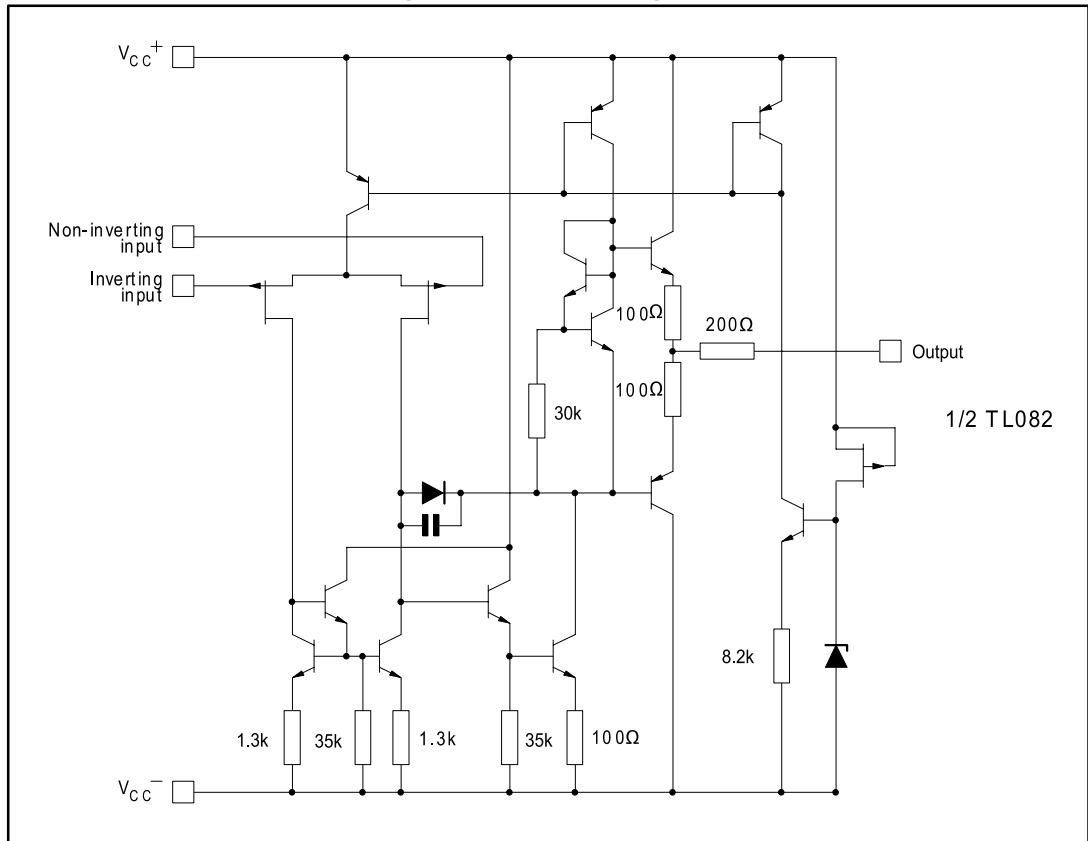
- Wide common-mode (up to V_{CC+}) and differential voltage range
- Low input bias and offset current
- Output short-circuit protection
- High input impedance JFET input stage
- Internal frequency compensation
- Latch up free operation
- High slew rate: 16 V/ μ s (typical)

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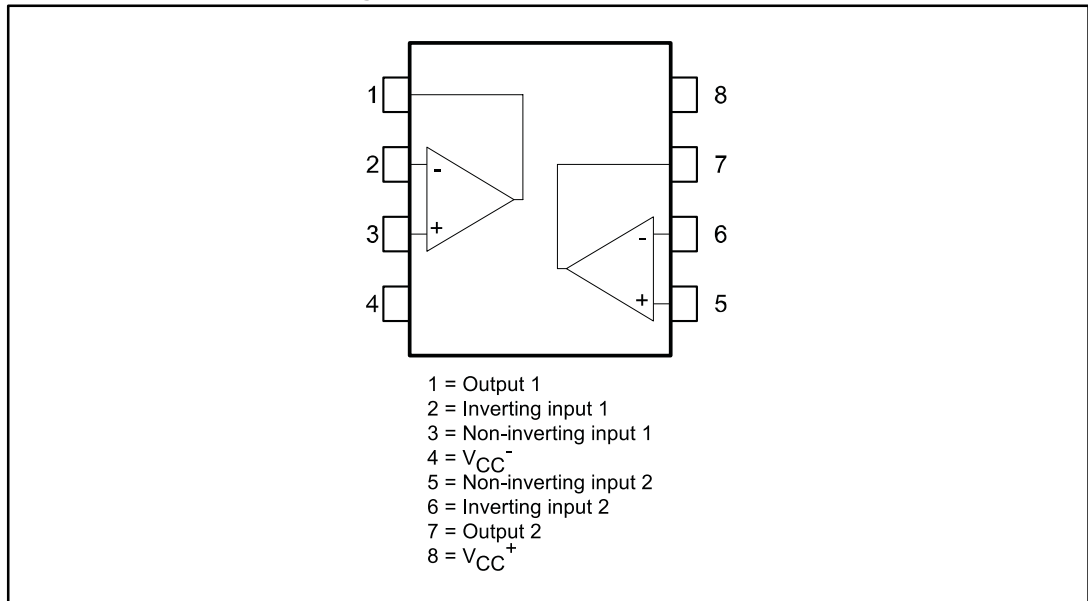
1 Schematic diagram

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 _{CC}	Supply voltage ⁽¹⁾	±18		V
V _{in}	Input voltage ⁽²⁾	±15		
V _{id}	Differential input voltage ⁽³⁾	±30		
P _{tot}	Power dissipation	680		mW
R _{thja}	Thermal resistance junction-to-ambient ⁽⁴⁾	SO8	125	°C/W
		TSSOP8	120	
R _{thjc}	Thermal resistance junction-to-case	SO8	40	
		TSSOP8	37	
	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		

Notes:

⁽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

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 _{io}	Input offset voltage, R _s = 50 Ω, T _{amb} = 25 °C, TL082		3	10		3	10	mV
	Input offset voltage, R _s = 50 Ω, T _{amb} = 25 °C, TL082A		3	6				
	Input offset voltage, R _s = 50 Ω, T _{amb} = 25 °C, TL082B		1	3				
	Input offset voltage, R _s = 50 Ω, T _{min} ≤ T _{amb} ≤ T _{max} , TL082			13			13	
	Input offset voltage, R _s = 50 Ω, T _{min} ≤ T _{amb} ≤ T _{max} , TL082A			7				
	Input offset voltage, R _s = 50 Ω, T _{min} ≤ T _{amb} ≤ T _{max} , TL082B			5				
DV _{io}	Input offset voltage drift		10			10		μV/°C
I _{io}	Input offset current, T _{amb} = 25 °C ⁽¹⁾		5	100		5	100	pA
	Input offset current, T _{min} ≤ T _{amb} ≤ T _{max} ⁽¹⁾			4			10	nA
I _{ib}	Input bias current, T _{amb} = 25 °C		20	200		20	400	pA
	Input bias current, T _{min} ≤ T _{amb} ≤ T _{max}			20			20	nA
A _{vd}	Large signal voltage gain, R _L = 2 kΩ, V _o = ±10 V, T _{amb} = 25 °C	50	200		25	200		V/mV
	Large signal voltage gain, R _L = 2 kΩ, V _o = ±10 V, T _{min} ≤ T _{amb} ≤ T _{max}	25			15			
SVR	Supply voltage rejection ratio, R _S = 50 Ω, T _{amb} = 25 °C	80	86		70	86		dB
	Supply voltage rejection ratio, R _S = 50 Ω, T _{min} ≤ T _{amb} ≤ T _{max}	80			70			
I _{cc}	Supply current, no load, T _{amb} = 25 °C		1.4	2.5		1.4	2.5	mA
	Supply current, no load, T _{min} ≤ T _{amb} ≤ T _{max}			2.5			2.5	
V _{icm}	Input common mode voltage range	±11	15		±11	15		V
			-12			-12		
CMR	Common mode rejection ratio, R _S = 50 Ω, T _{amb} = 25 °C	80	86		70	86		dB
	Common mode rejection ratio, R _S = 50 Ω, T _{min} ≤ T _{amb} ≤ T _{max}	80			70			
I _{os}	Output short-circuit current, T _{amb} = 25 °C	10	40	60	10	40	60	mA
	Output short-circuit current, T _{min} ≤ T _{amb} ≤ T _{max}	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/ μs
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		μs
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}		Ω
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/ $\sqrt{\text{Hz}}$
ϕ_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°C increase in the junction temperature.

5 Electrical characteristic curves

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

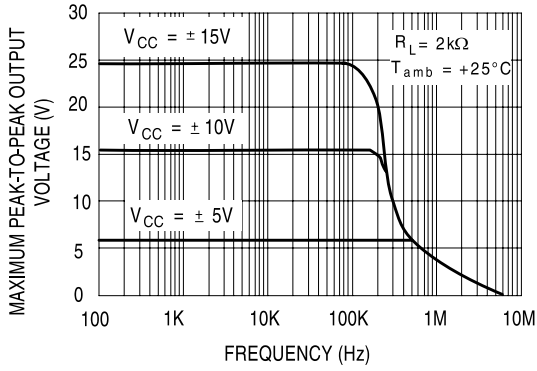


Figure 4: Maximum peak-to-peak output voltage versus frequency

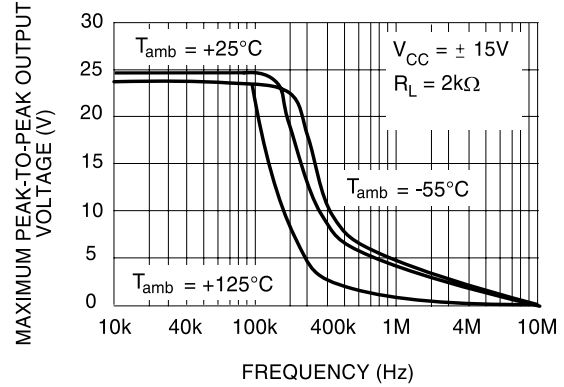


Figure 5: Maximum peak-to-peak output voltage versus load resistance

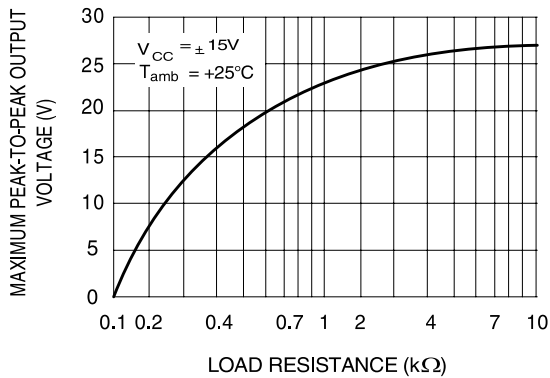


Figure 6: Maximum peak-to-peak output voltage versus frequency

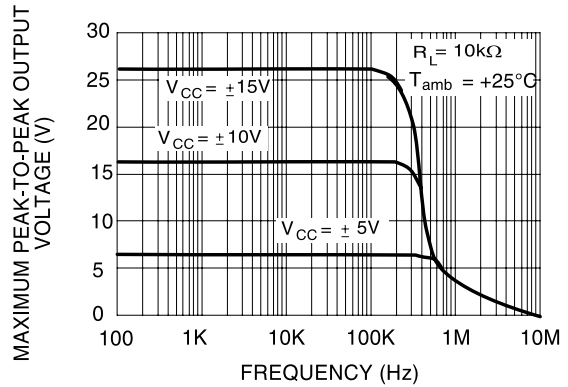


Figure 7: Maximum peak-to-peak output voltage versus free air temperature

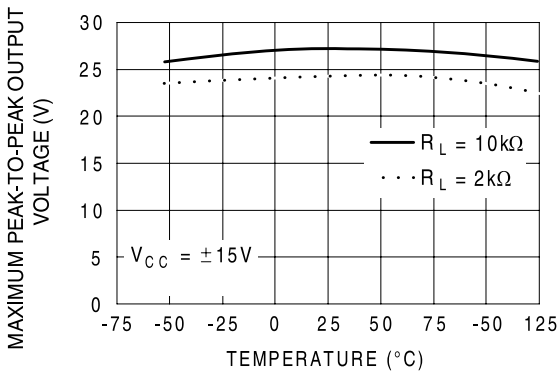


Figure 8: Maximum peak-to-peak output voltage versus supply voltage

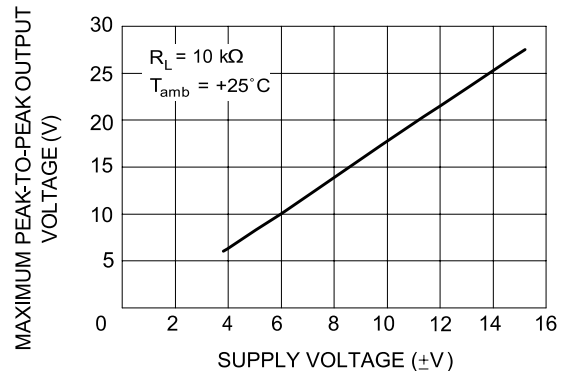


Figure 9: Input bias current versus free air temperature

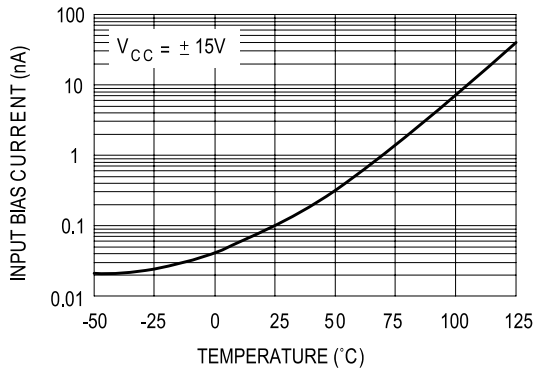


Figure 10: Large signal differential voltage amplification and phase shift versus frequency

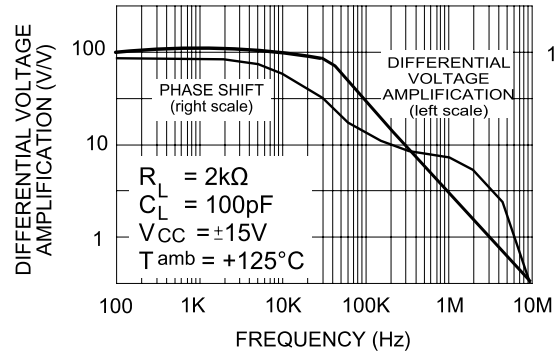


Figure 11: Supply current per amplifier versus free air temperature

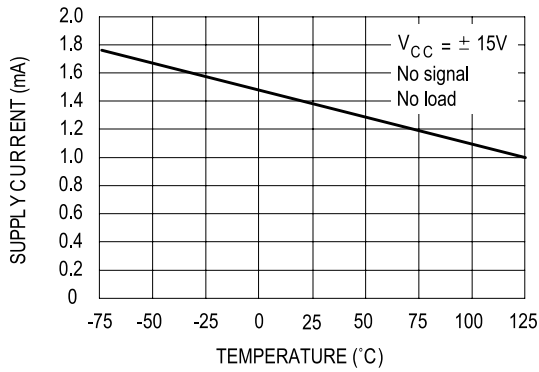


Figure 12: Large signal differential voltage amplification versus free air temperature

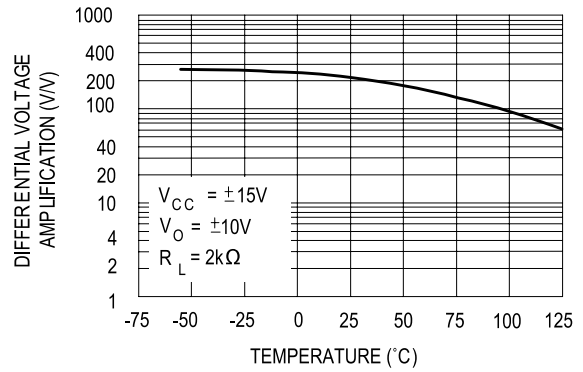


Figure 13: Total power dissipation versus free air temperature

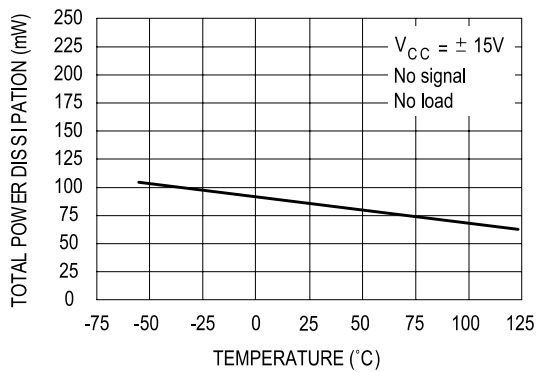


Figure 14: Supply current per amplifier versus supply voltage

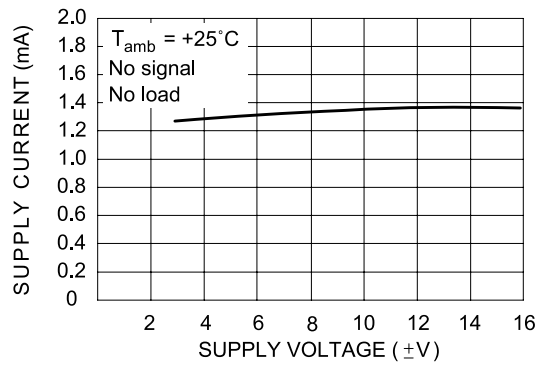


Figure 15: Common-mode rejection ratio versus free air temperature

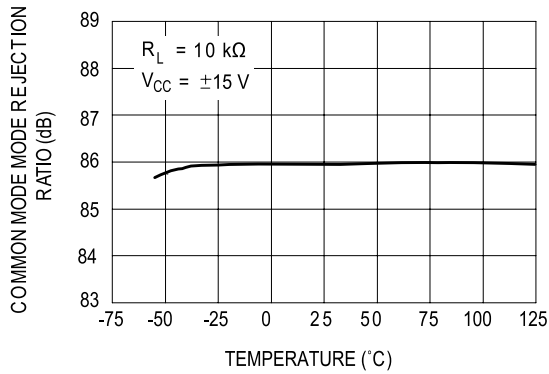


Figure 16: Output voltage versus elapsed time

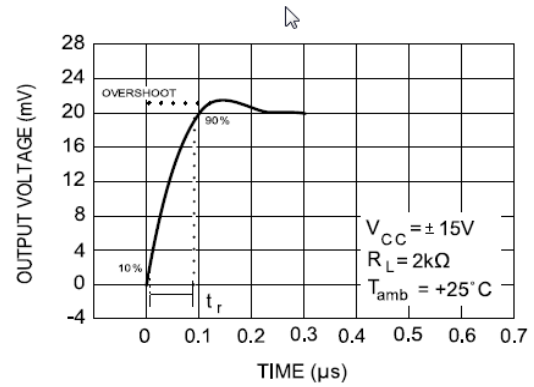


Figure 17: Voltage follower large signal pulse response

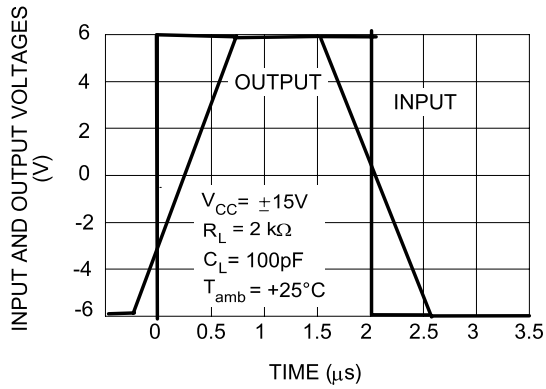


Figure 18: Equivalent input noise voltage versus frequency

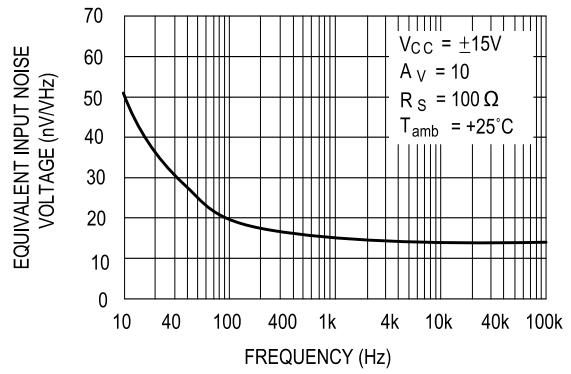
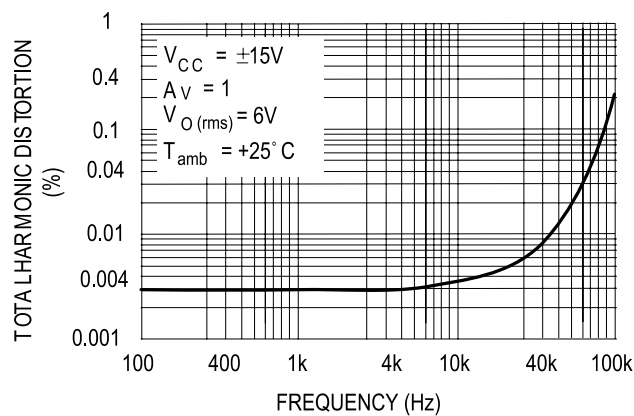


Figure 19: Total harmonic distortion versus frequency



6 Parameter measurement information

Figure 20: Voltage follower

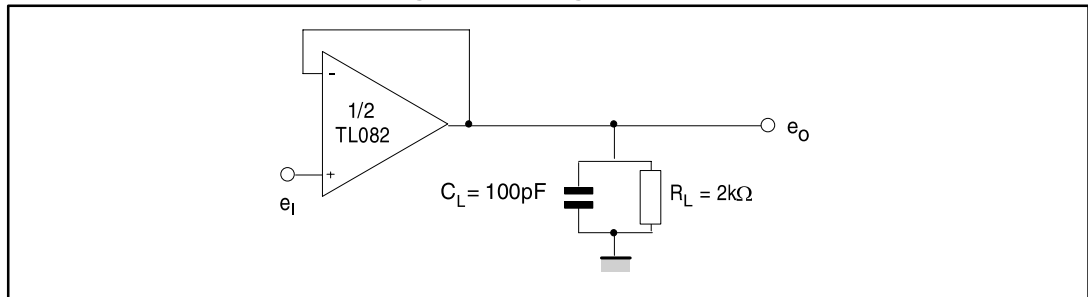
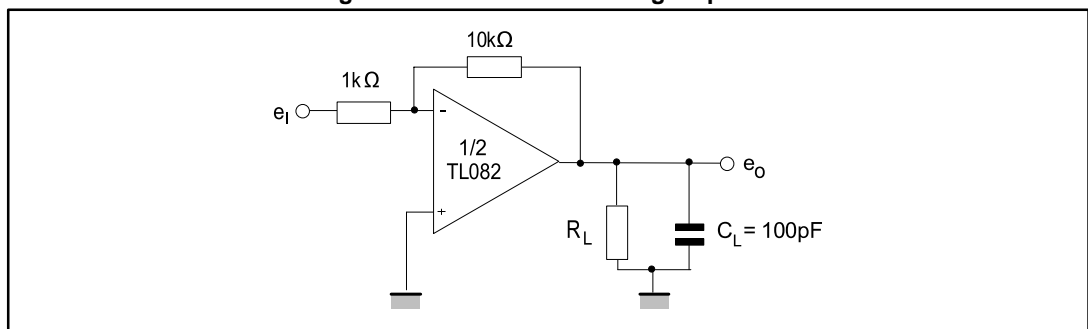
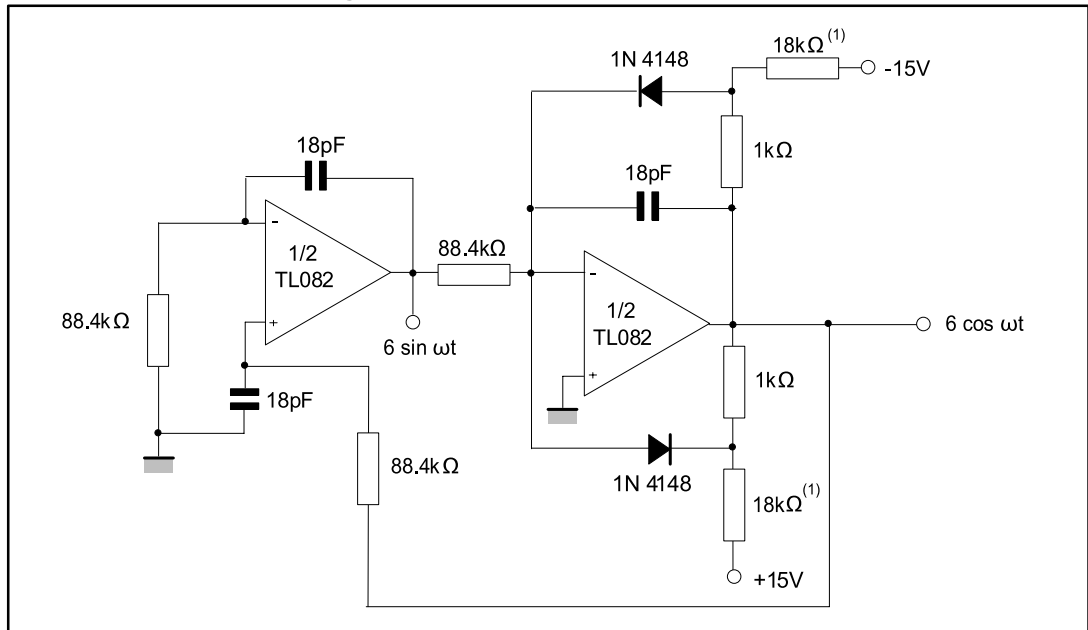


Figure 21: Gain-of-10 inverting amplifier



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. ECOPACK® is an ST trademark.

8.1 SO8 package information

Figure 23: SO8 package outline

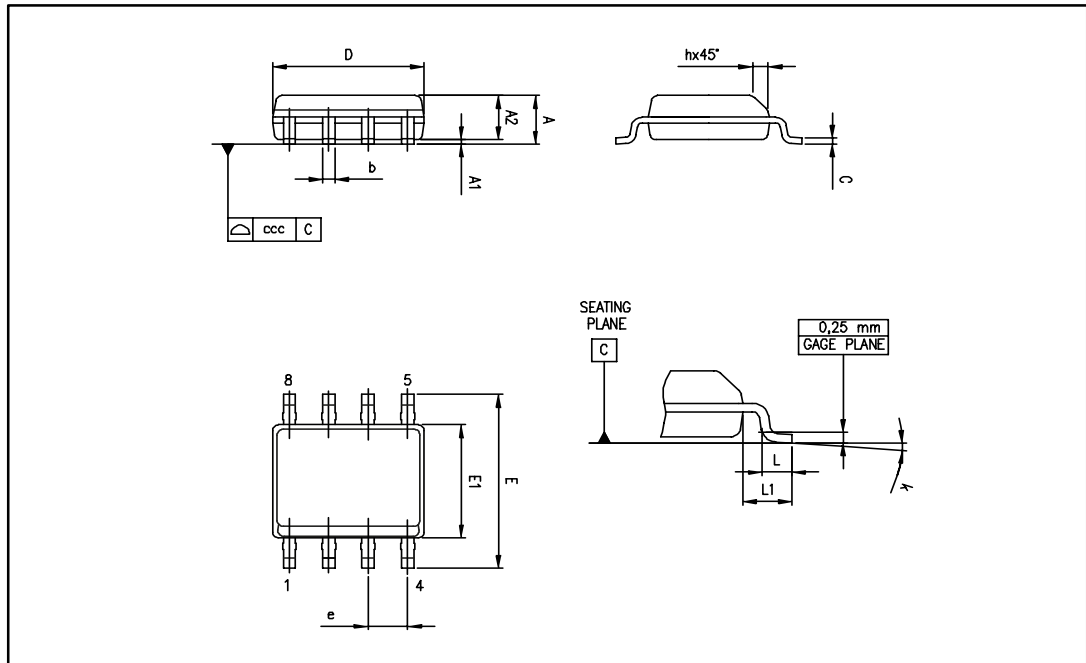


Table 4: SO8 mechanical data

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

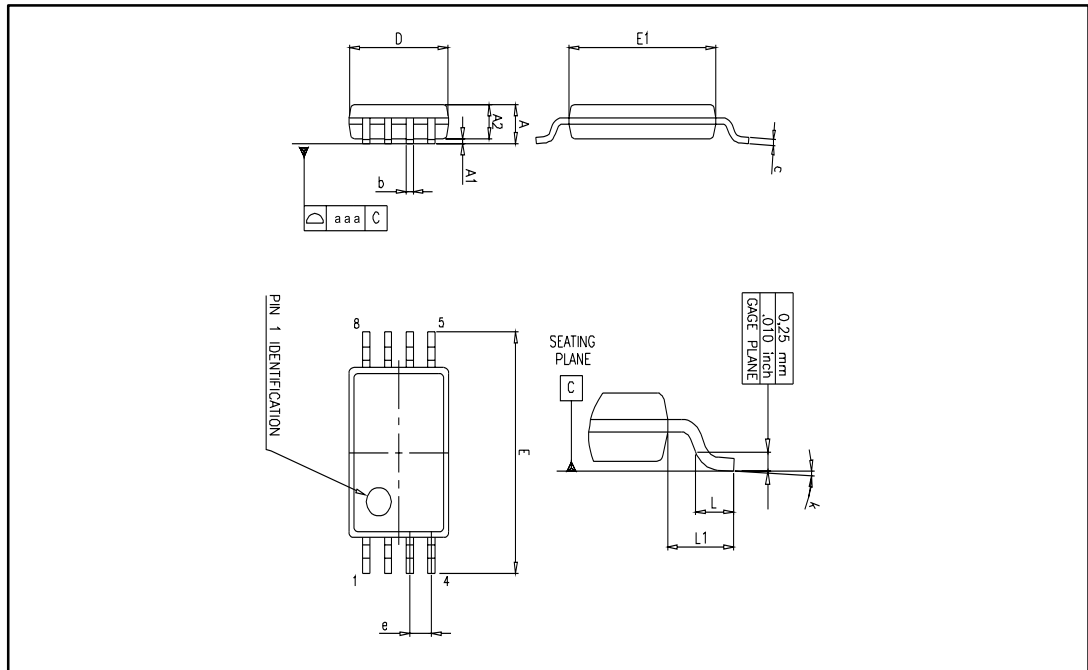


Table 5: TSSOP8 mechanical data

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 ⁽¹⁾	-40 °C to 105 °C	SO8 (automotive grade)	Tube or tape and reel	082IY
TL082AIYDT ⁽¹⁾				82AIY
TL082BIYDT ⁽¹⁾				82BIY

Notes:

⁽¹⁾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

Skype отдела продаж:

moschip.ru

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