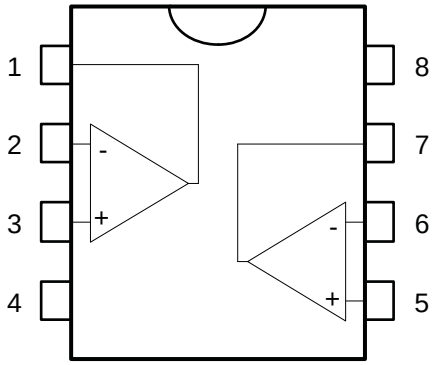
TL072, TL072A, TL072B

Low noise JFET dual operational amplifiers

Datasheet - production data

D
SO8

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}^+

Features

- Wide common-mode (up to V_{CC}^+) and differential voltage range
- Low input bias and offset current
- Low noise e_n = 15 nV/√Hz (typ)
- Output short-circuit protection
- High input impedance JFET input stage
- Low harmonic distortion: 0.01 % (typical)
- Internal frequency compensation
- Latch-up free operation
- High slew rate: 16 V/µs (typ)

Related products

- See TL071 for single op amp version
- See TL074 for quad op amp version

Description

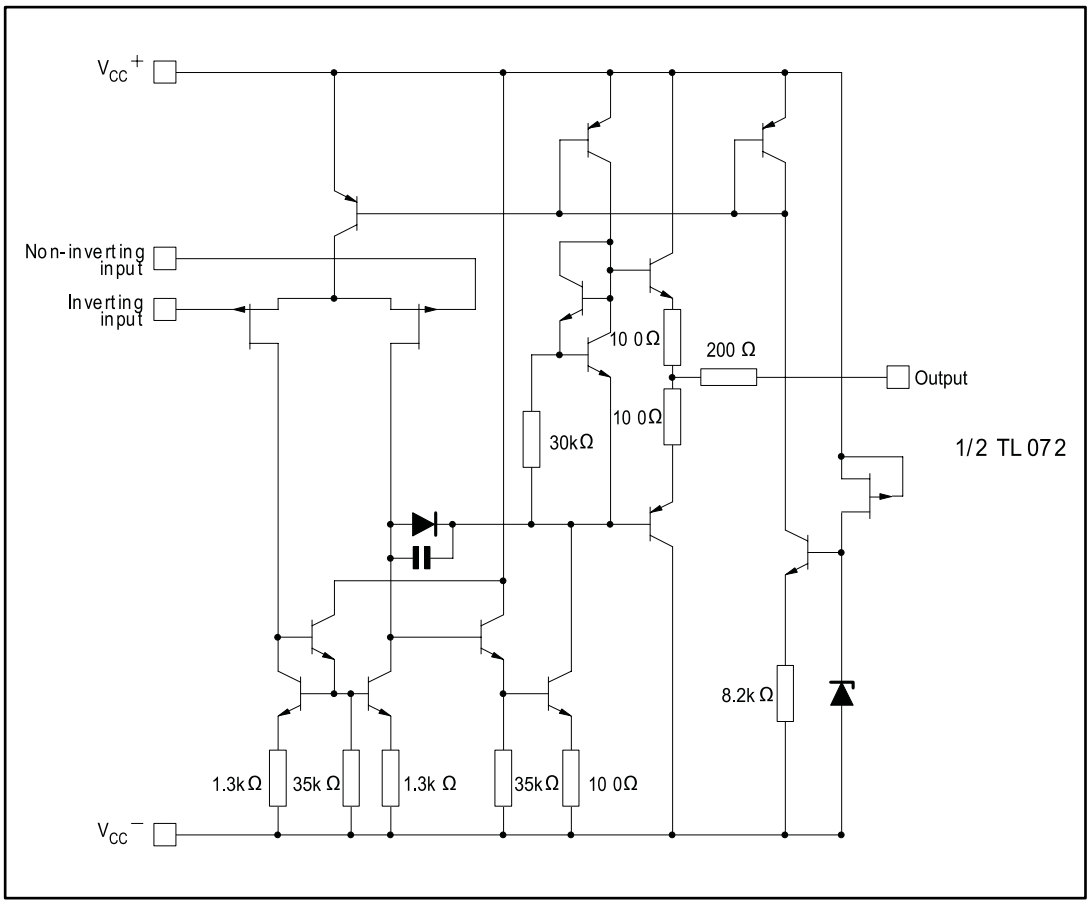
The TL072, TL072A, and TL072B are high speed JFET input dual operational amplifiers incorporating well-matched, high-voltage JFET and bipolar transistors in a monolithic integrated circuit.

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

Contents

1 Schematic diagram

Figure 1: Schematic diagram



2 Absolute maximum ratings and operating conditions

Table 1: Absolute maximum ratings

Symbol	Parameter	TL072I, AI, BI	TL072C, AC, BC	Unit
V_{CC}	Supply voltage (1)	±18		V
V_{in}	Input voltage (2)	±15		
V_{id}	Differential input voltage (3)	±30		
R_{thja}	Thermal resistance junction to ambient, SO8 (4)	125		°C/W
R_{thjc}	Thermal resistance junction to case, SO8 (4)	40		
	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)	1.5		kV

Notes:

(1)All voltage values, except the 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 voltages with respect to the inverting input terminal.

(4)Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits 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. This is 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 W). This is 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	TL072I, AI, BI	TL072C, AC, BC	Unit
V_{CC}	Supply voltage	6 to 36		V
T_{oper}	Operating free-air temperature range	-40 to +125	0 to +70	°C

3 Electrical characteristics

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

Symbol	Parameter		TL072I, AC, AI, BC, BI			TL072C			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input offset voltage (R_s = 50 Ω) T_{amb} = +25 °C	TL072		3	10		3	10	mV
		TL072A		3	6				
		TL072B		1	3				
	Input offset voltage (R_s = 50 Ω) $T_{min} \le T_{amb} \le T_{max}$	TL072			13			13	
		TL072A			7				
		TL072B			5				
$\Delta V_{io}/\Delta T$	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, $T_{min} \le T_{amb} \le T_{max}$				4			10	nA
I_{ib}	Input bias current, T_{amb} = +25 °C (1)			20	200		20	200	pA
	Input bias current, $T_{min} \le T_{amb} \le T_{max}$ (1)				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), $T_{min} \le T_{amb} \le T_{max}$		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), $T_{min} \le T_{amb} \le T_{max}$		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, $T_{min} \le T_{amb} \le T_{max}$				2.5			2.5	
V_{icm}	Input common mode voltage range		±11	-12 to +15		±11	-12 to +15		V
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), $T_{min} \le T_{amb} \le T_{max}$		80			70			
I_{os}	Output short-circuit current, T_{amb} = +25 °C		10	40	60	10	40	60	mA
	Output short-circuit current, $T_{min} \le T_{amb} \le T_{max}$		10		60	10		60	
$\pm V_{opp}$	Output voltage swing, T_{amb} = +25 °C	R_L = 2 kΩ	10	12		10	12		V
		R_L = 10 kΩ	12	13.5		12	13.5		
	Output voltage swing, $T_{min} \le T_{amb} \le T_{max}$	R_L = 2 kΩ	10			10			
		R_L = 10 kΩ	12			12			

Symbol	Parameter	TL072I, AC, AI, BC, BI			TL072C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
SR	Slew rate, V_{in} = 10 V, R_L = 2 kΩ, C_L = 100 pF, unity gain	8	16		8	16		V/µs
t_r	Rise time, V_{in} = 20 mV, R_L = 2 kΩ, C_L = 100 pF, unity gain		0.1			0.1		µs
K_{ov}	Overshoot, V_{in} = 20 mV, R_L = 2 kΩ, C_L = 100 pF, unity gain		10			10		%
GBP	Gain bandwidth product, V_{in} = 10 mV, R_L = 2 kΩ, C_L = 100 pF, F= 100 kHz	2.5	4		2.5	4		MHz
R_i	Input resistance		10^{12}			10^{12}		Ω
THD	Total harmonic distortion, F= 1 kHz, R_L = 2 kΩ, C_L = 100 pF, A_v = 20 dB, V_o = 2 V_{pp}		0.01			0.01		%
e_n	Equivalent input noise voltage, R_S = 100 Ω, F= 1 kHz		15			15		$\frac{nV}{\sqrt{Hz}}$
Øm	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.

Figure 2: Maximum peak-to-peak output voltage versus frequency (RL = 2 kΩ)

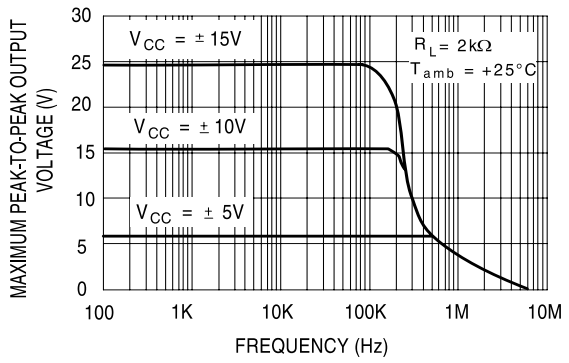


Figure 3: Maximum peak-to-peak output voltage versus frequency (RL = 10 kΩ)

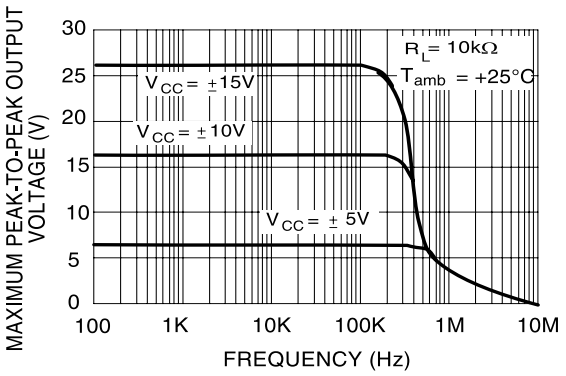


Figure 4: Maximum peak-to-peak output voltage versus frequency

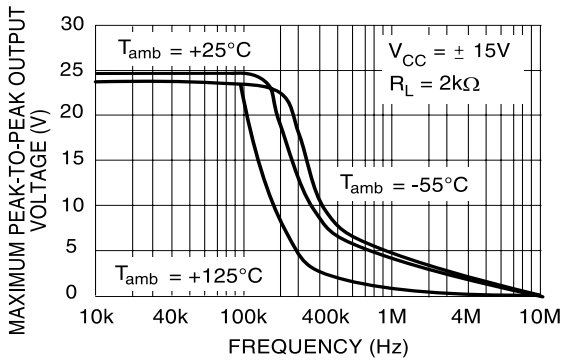


Figure 5: Maximum peak-to-peak output voltage versus free air temperature

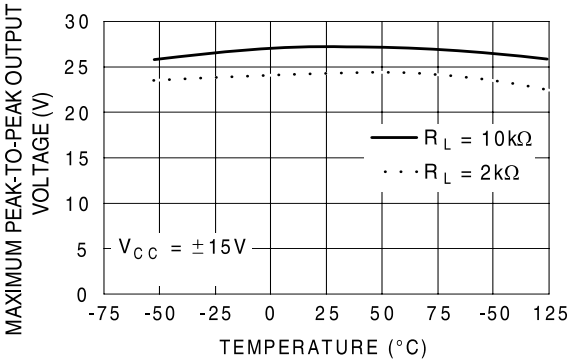


Figure 6: Maximum peak-to-peak output voltage versus load resistance

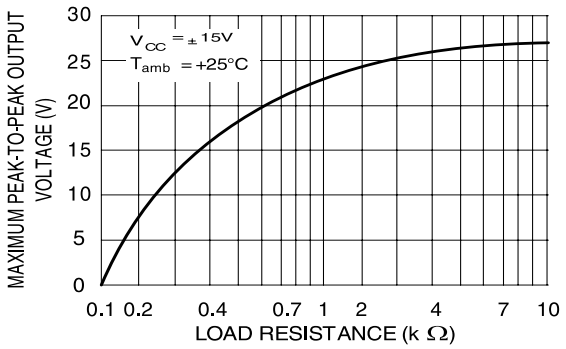


Figure 7: Maximum peak-to-peak output voltage versus supply voltage

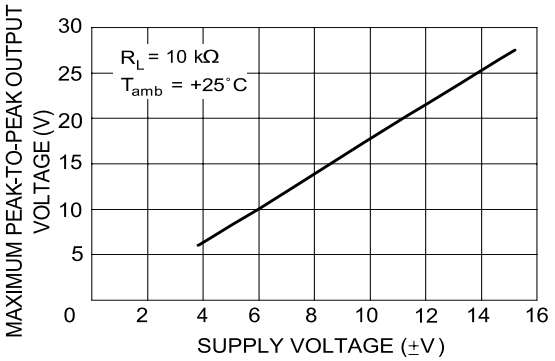


Figure 8: Input bias current versus free air temperature

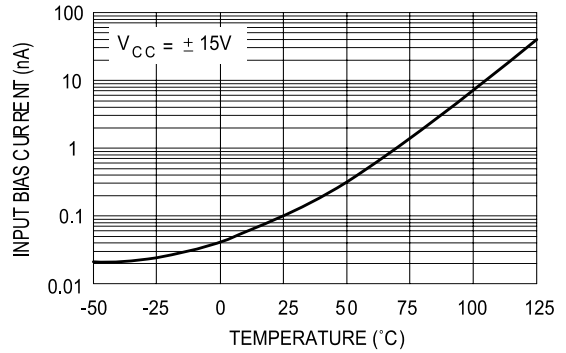


Figure 9: Large signal differential voltage amplification versus free air temperature

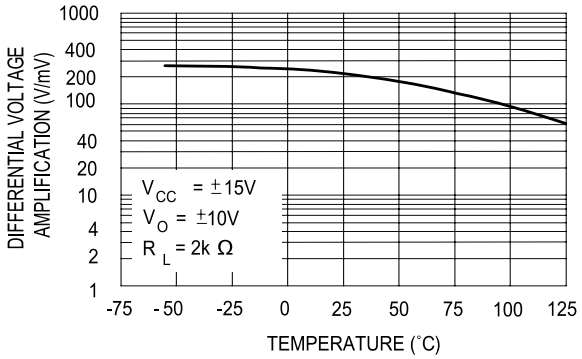


Figure 10: Large signal differential voltage amplification and phase shift versus frequency

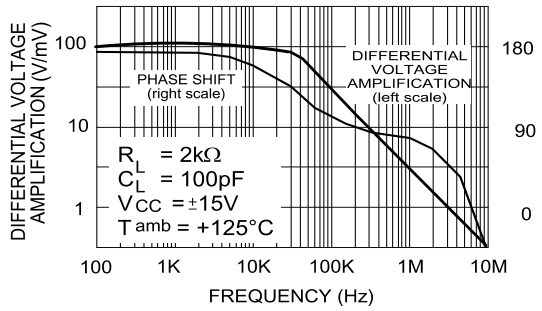


Figure 11: Total power dissipation versus free air temperature

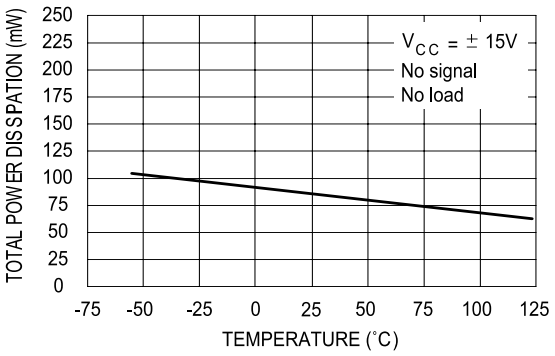


Figure 12: Supply current per amplifier versus free air temperature

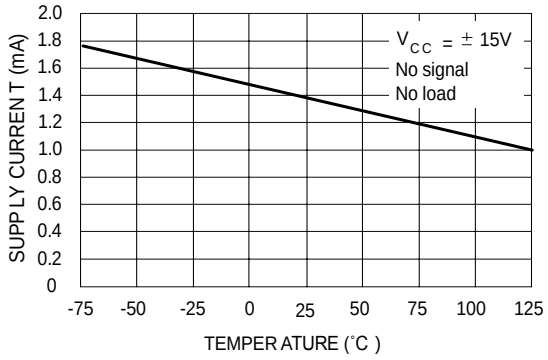


Figure 13: Common mode rejection ratio versus free air temperature

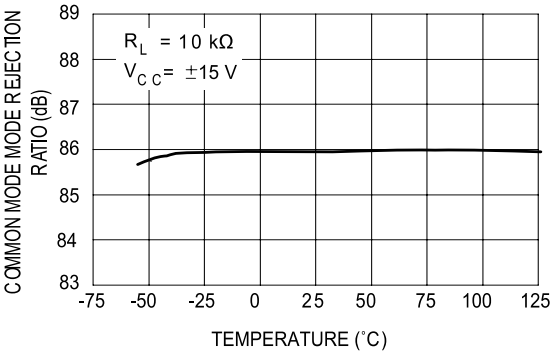


Figure 14: Voltage follower large signal pulse response

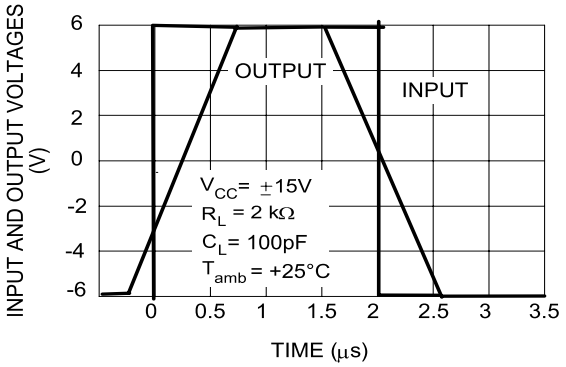


Figure 15: Output voltage versus elapsed time

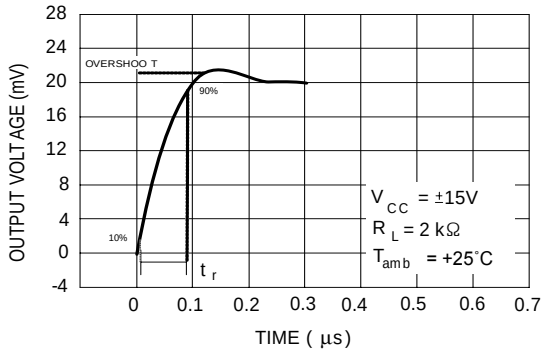


Figure 16: Equivalent input noise voltage versus frequency

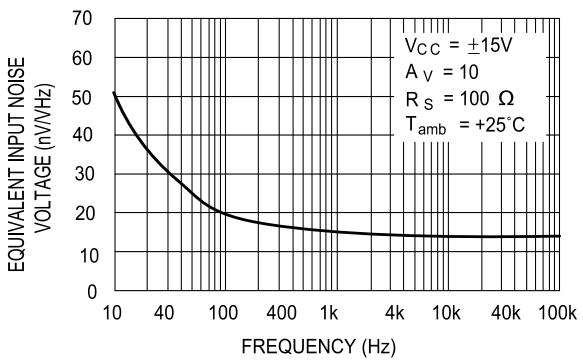
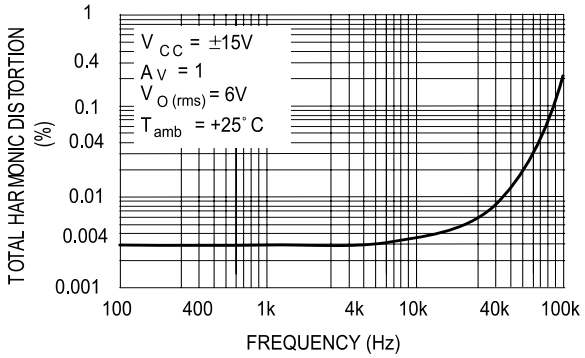


Figure 17: Total harmonic distortion versus frequency



4 Parameter measurement information

Figure 18: Voltage follower

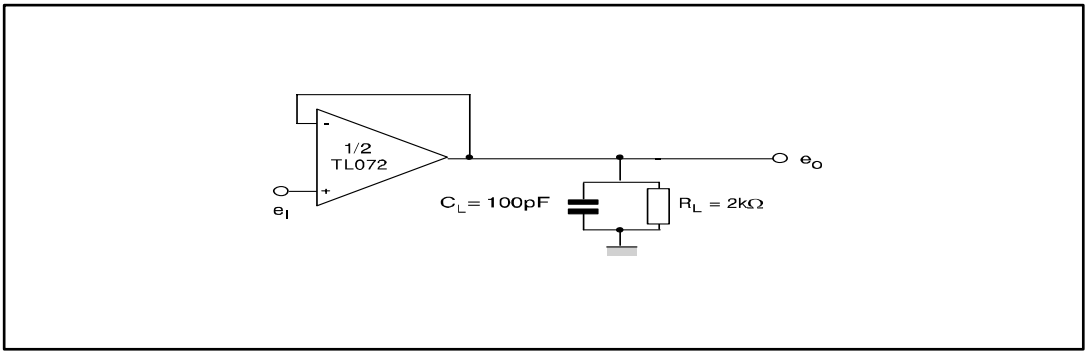
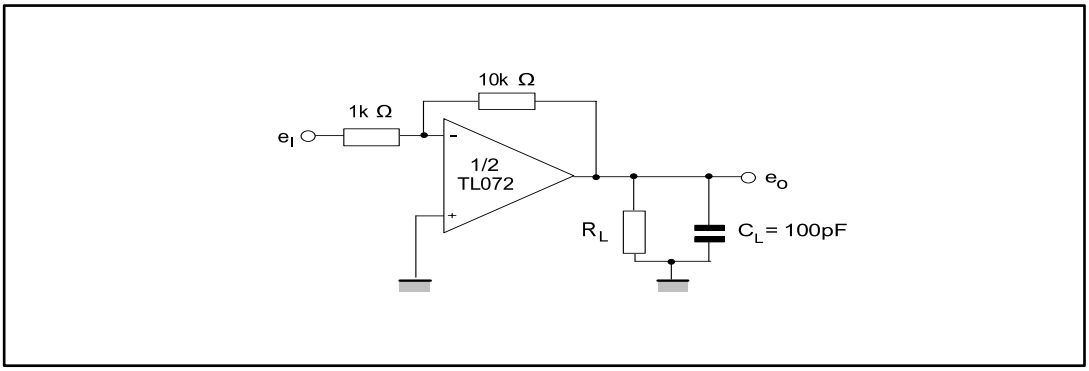
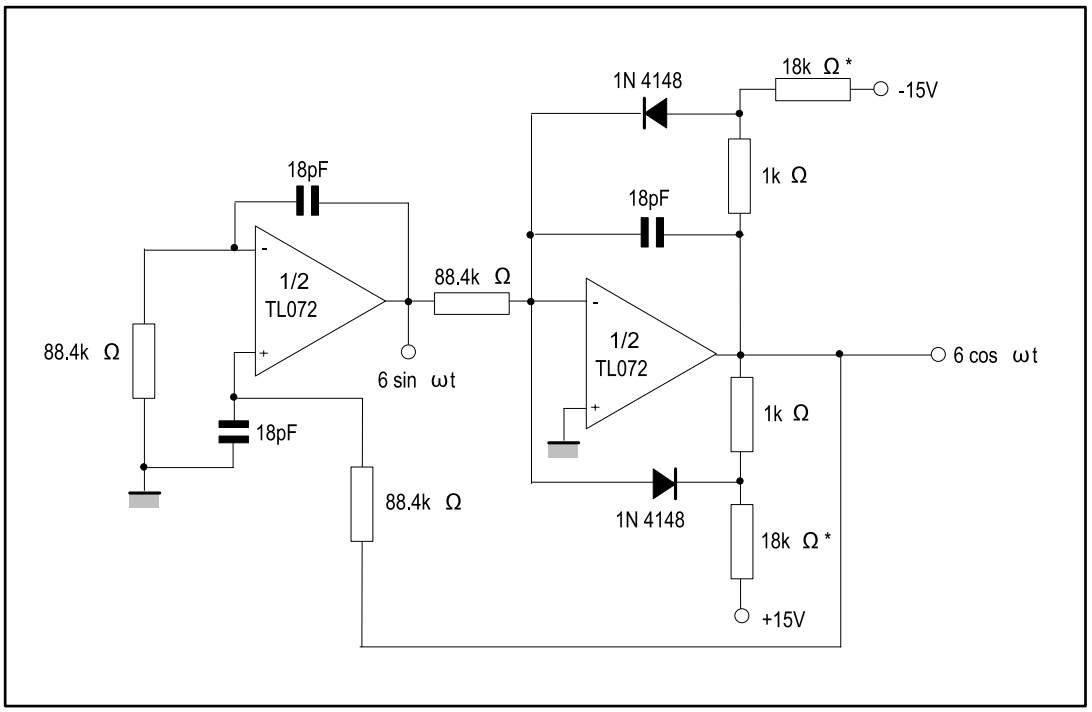


Figure 19: Gain-of-10 inverting amplifier



5 Typical application

Figure 20: 100 kHz quadruple oscillator



1. The resistor values of *Figure 20* may be adjusted for a symmetrical output

6 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.

6.1 SO8 package information

Figure 21: SO8 package mechanical drawing

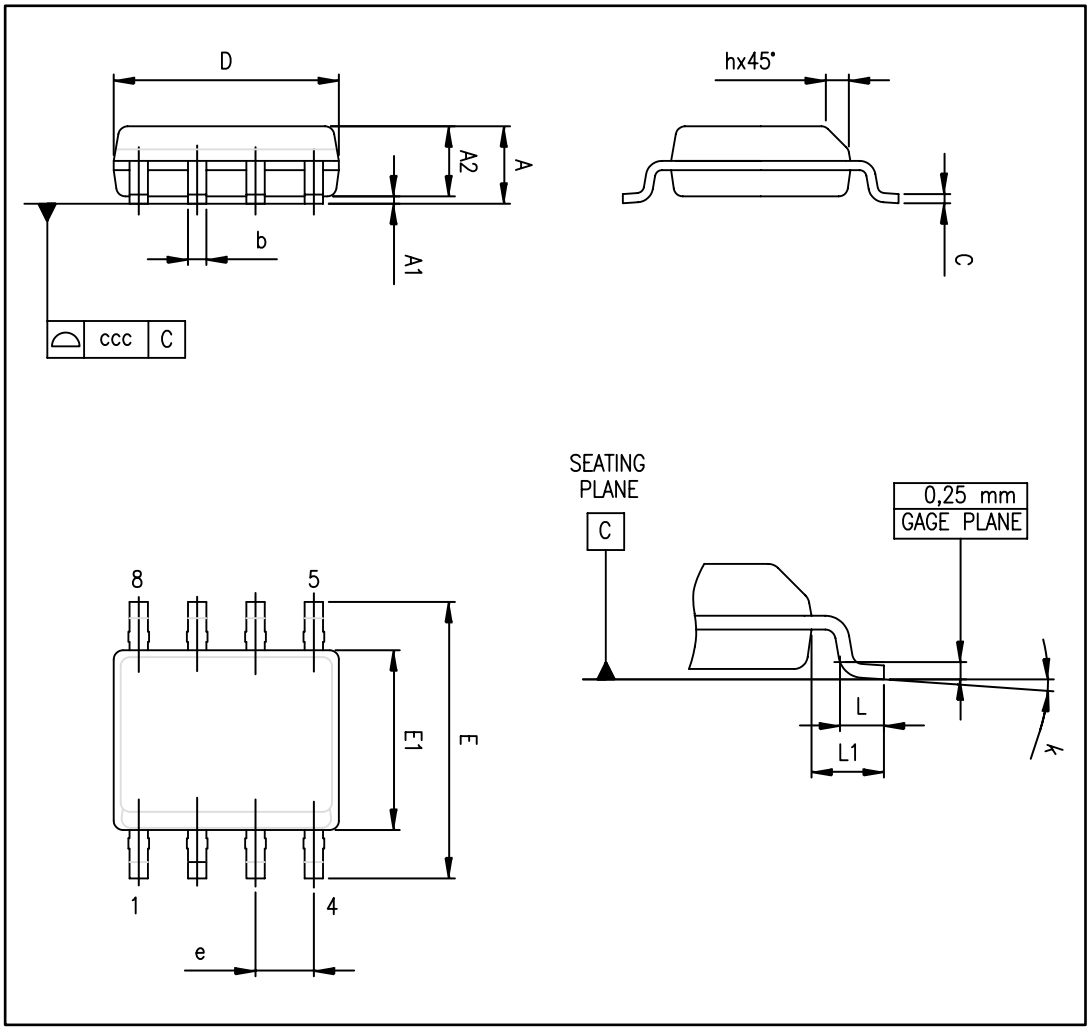


Table 4: SO8 package mechanical data

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

7 Ordering information

Table 5: Order codes

Order code	Temperature range	Package	Packing	Marking
TL072IDT	-40 °C, +125 °C	SO8	Tape and reel	072I
TL072AIDT				072AI
TL072BIDT				072BI
TL072CDT	0 °C, +70 °C			072C
TL072ACDT				072AC
TL072BCDT				072BC
TL072IYDT (1)	-40 °C, +125 °C	SO8 (automotive grade)		072IY
TL072AIYDT (1)				072AIY
TL072BIYDT (1)				072BIY

Notes:

(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

Table 6: Document revision history

Date	Revision	Changes
28-Mar-2001	1	Initial release.
02-Apr-2004	2	Correction to pin connection diagram on cover page. Unpublished.
04-Dec-2006	3	Modified graphics in package mechanical data.
06-Mar-2007	4	Expanded order codes table and added automotive grade order codes. See *Table 5: "Order codes"*. Added thermal resistance and ESD tolerance in *Table 1: "Absolute maximum ratings"*. Added *Table 2: "Operating conditions"*. Updated package mechanical data to make it compliant with the latest JEDEC standards.
13-Mar-2008	5	ESD HBM value modified in AMR table. Re-ordered order codes table. Removed TL072BIY and TL072AIY order codes from order code table. Corrected footnote for automotive grade order codes in order codes table.
15-Jul-2008	6	Removed information concerning military temperature range (TL072Mx, TL072AMx, TL072BMx). Added order codes for automotive grade products in *Table 5: "Order codes"*.
04-Jul-2012	7	Removed part numbers TL072IYD, TL072AIYD, TL072BIYD. Updated *Table 5: "Order codes"*.
19-Jun-2014	8	Removed DIP8 package Added *Related products* *Table 2: "Operating conditions"*: temperature range for “I” versions changed from “-40 °C, +105 °C” to “-40 °C, +125 °C”. *Table 3: Electrical characteristics at VCC = ±15 V, Tamb = +25 °C (unless otherwise specified)*: replaced DV_{io} with $\Delta V_{io}/\Delta T$. *Table 5: "Order codes"*: temperature range for “I” version order codes changed from “-40 °C, +105 °C” to “-40 °C, +125 °C”; removed tube packing and related order codes. Updated disclaimer

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