

Low noise J-FET dual operational amplifiers

Features

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

Description

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

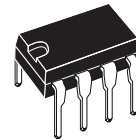
The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.

Order codes

Part number	Temperature range	Package	
		N	D
TL072M/AM/BM	-55°C, +125°C	x	x
TL072I/AI/BI	-40°C, +105°C	x	x
TL072C/AC/BC	0°C, +70°C	x	x
Example : TL072CN			

N = Dual in line package (DIP)

D = Small outline package (SO) - also available in tape & reel (DT)

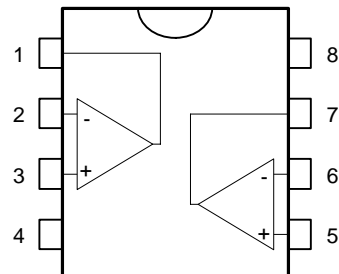


N
DIP8
(Plastic package)



D
SO8
(Plastic micropackage)

Pin connections
(top view)

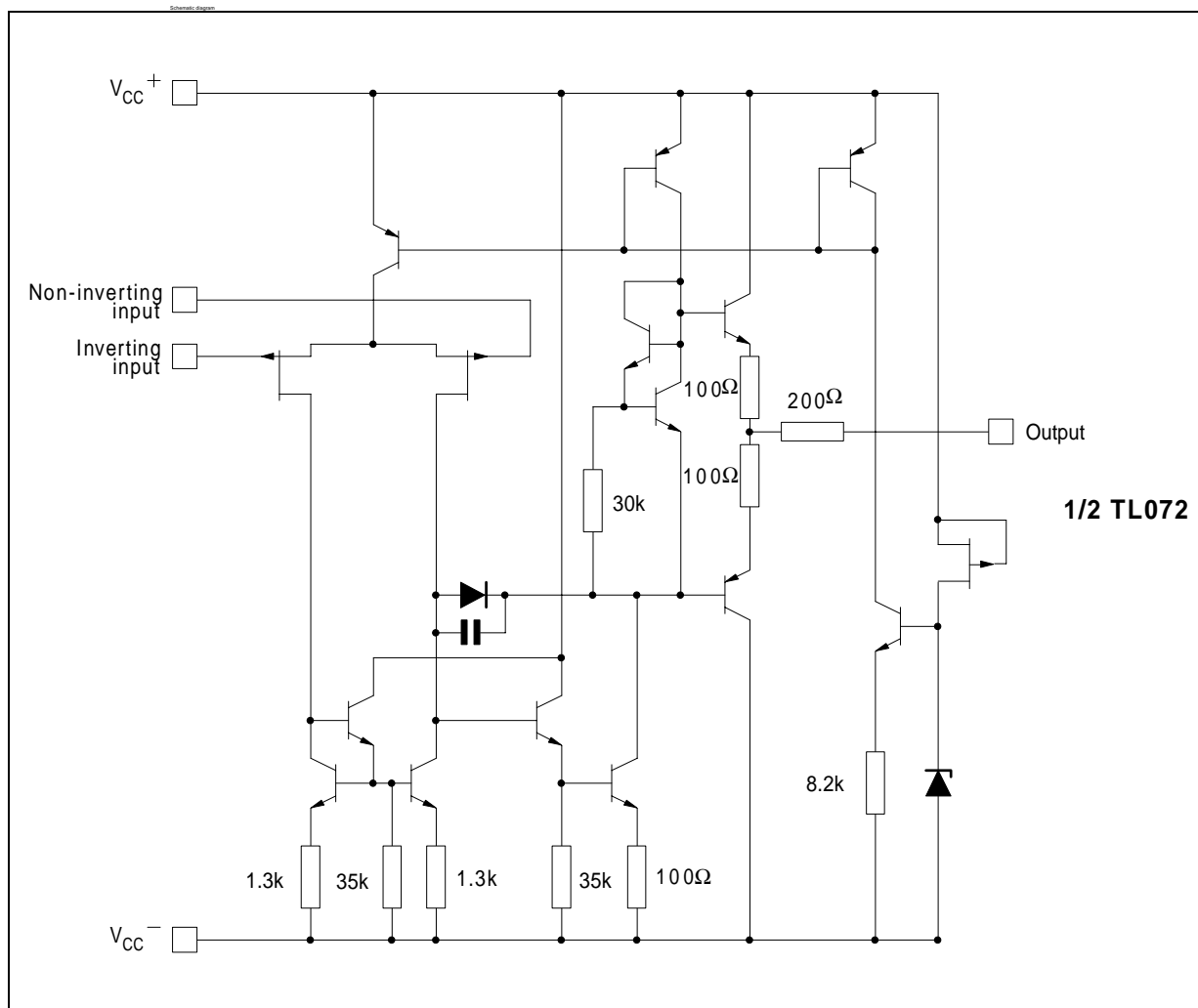


- 1 - Output 1
- 2 - Inverting input 1
- 3 - Non-inverting input 1
- 4 - V_{CC^-}
- 5 - Non-inverting input 2
- 6 - Inverting input 2
- 7 - Output 2
- 8 - V_{CC^+}

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1 Schematic diagram



2 Absolute maximum ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	TL072M, AM, BM	TL072I, AI, BI	TL072C, 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
	Output short-circuit duration ⁽⁴⁾	Infinite			
T_{oper}	Operating free-air temperature range	-55 to +125	-40 to +105	0 to +70	°C
T_{stg}	Storage temperature range	-65 to +150			°C

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. 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.

3 Electrical characteristics

Table 2. Electrical characteristics at $V_{CC} = \pm 15V$, $T_{amb} = +25^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	TL072I,M,AC,AI,AM ,BC,BI,BM			TL072C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{io}	Input offset voltage ($R_S = 50\Omega$) $T_{amb} = +25^{\circ}C$ TL072 TL072A TL072B		3 3 1	10 6 3		3 10		mV
	$T_{min} \leq T_{amb} \leq T_{max}$ TL072 TL072A TL072B			13 7 5		13		
DV_{io}	Input offset voltage drift		10			10		$\mu V/^{\circ}C$
I_{io}	Input offset current ⁽¹⁾ $T_{amb} = +25^{\circ}C$		5	100		5	100	pA
	$T_{min} \leq T_{amb} \leq T_{max}$			4		10		nA
I_{ib}	Input bias current ⁽¹⁾ $T_{amb} = +25^{\circ}C$		20	200		20	200	pA
	$T_{min} \leq T_{amb} \leq T_{max}$			20		20		nA
A_{vd}	Large signal voltage gain ($R_L = 2k\Omega$, $V_O = \pm 10V$) $T_{amb} = +25^{\circ}C$	50	200		25	200		V/mV
	$T_{min} \leq T_{amb} \leq T_{max}$	25			15			
SVR	Supply voltage rejection ratio ($R_S = 50\Omega$) $T_{amb} = +25^{\circ}C$	80	86		70	86		dB
	$T_{min} \leq T_{amb} \leq T_{max}$	80			70			
I_{CC}	Supply current, no load $T_{amb} = +25^{\circ}C$		1.4	2.5		1.4	2.5	mA
	$T_{min} \leq T_{amb} \leq T_{max}$			2.5		2.5		
V_{icm}	Input common mode voltage range	± 11	+15 -12		± 11	+15 -12		V
CMR	Common mode rejection ratio ($R_S = 50\Omega$) $T_{amb} = +25^{\circ}C$	80	86		70	86		dB
	$T_{min} \leq T_{amb} \leq T_{max}$	80			70			
I_{os}	Output short-circuit current $T_{amb} = +25^{\circ}C$	10	40	60	10	40	60	mA
	$T_{min} \leq T_{amb} \leq T_{max}$	10		60	10		60	

Table 2. Electrical characteristics at $V_{CC} = \pm 15V$, $T_{amb} = +25^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	TL072I,M,AC,AI,AM,BC,BI,BM			TL072C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$\pm V_{opp}$	Output voltage swing $T_{amb} = +25^{\circ}C$ $R_L = 2k\Omega$	10	12		10	12		V
	$R_L = 10k\Omega$	12	13.5		12	13.5		
	$T_{min} \leq T_{amb} \leq T_{max}$ $R_L = 2k\Omega$ $R_L = 10k\Omega$	10 12			10 12			
SR	Slew rate ($T_{amb} = +25^{\circ}C$) $V_{in} = 10V$, $R_L = 2k\Omega$, $C_L = 100pF$, unity gain	8	16		8	16		V/ μs
t_r	Rise time ($T_{amb} = +25^{\circ}C$) $V_{in} = 20mV$, $R_L = 2k\Omega$, $C_L = 100pF$, unity gain		0.1			0.1		μs
K_{ov}	Overshoot ($T_{amb} = +25^{\circ}C$) $V_{in} = 20mV$, $R_L = 2k\Omega$, $C_L = 100pF$, unity gain		10			10		%
GBP	Gain Bandwidth Product ($T_{amb} = +25^{\circ}C$) $V_{in} = 10mV$, $R_L = 2k\Omega$, $C_L = 100pF$, $f = 100kHz$	2.5	4		2.5	4		MHz
R_i	Input resistance		10^{12}			10^{12}		Ω
THD	Total harmonic distortion ($T_{amb} = +25^{\circ}C$) $f = 1kHz$, $R_L = 2k\Omega$, $C_L = 100pF$, $A_v = 20dB$, $V_o = 2V_{pp}$		0.01			0.01		%
e_n	Equivalent input noise voltage $R_S = 100\Omega$, $f = 1KHz$		15			15		$\frac{nV}{\sqrt{Hz}}$
ϕ_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 1. Maximum peak-to-peak output voltage versus frequency

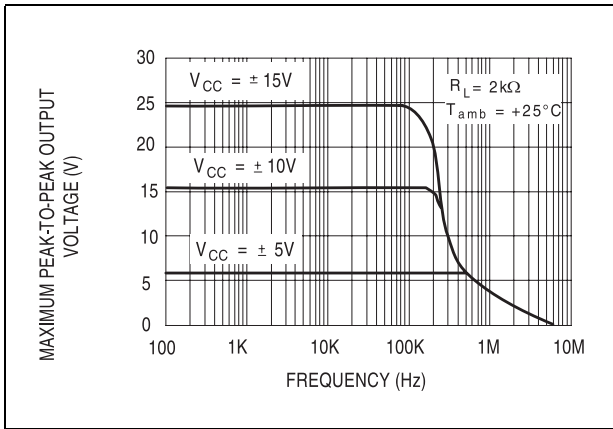


Figure 2. Maximum peak-to-peak output voltage versus frequency

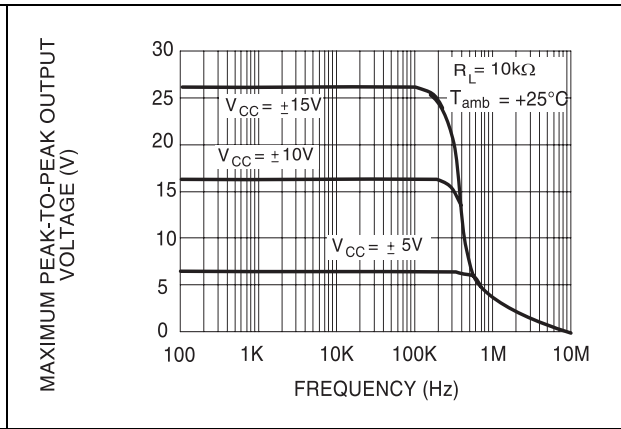


Figure 3. Maximum peak-to-peak output voltage versus frequency

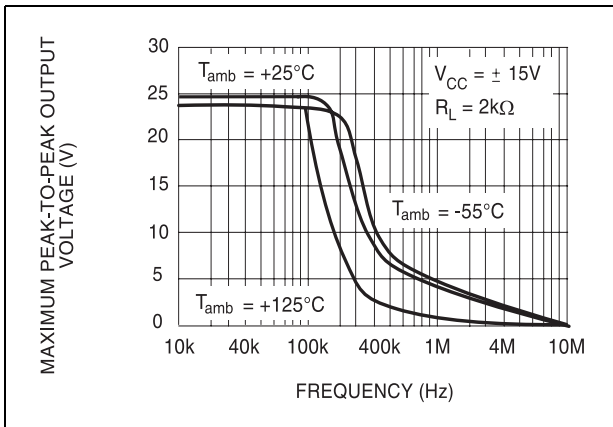


Figure 4. Maximum peak-to-peak output voltage versus free air temperature

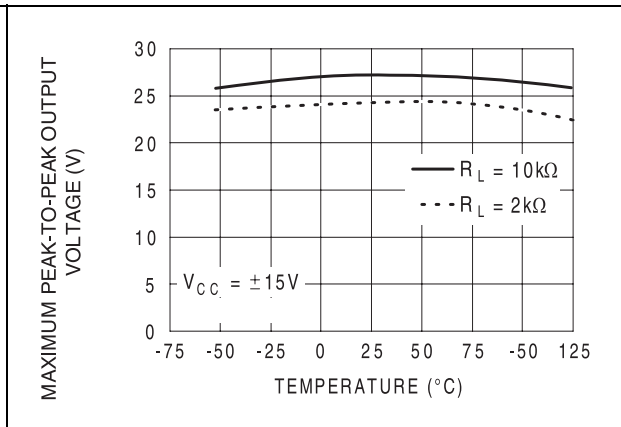


Figure 5. Maximum peak-to-peak output voltage versus load resistance

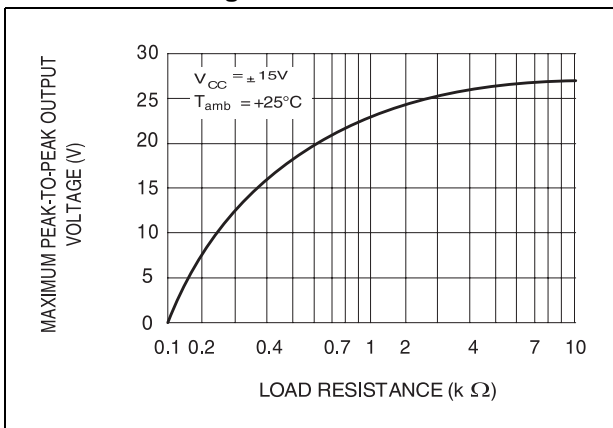


Figure 6. Maximum peak-to-peak output voltage versus supply voltage

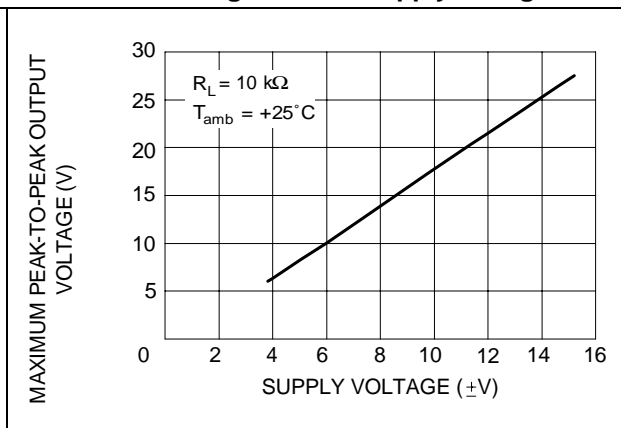


Figure 7. Input bias current versus free air temperature

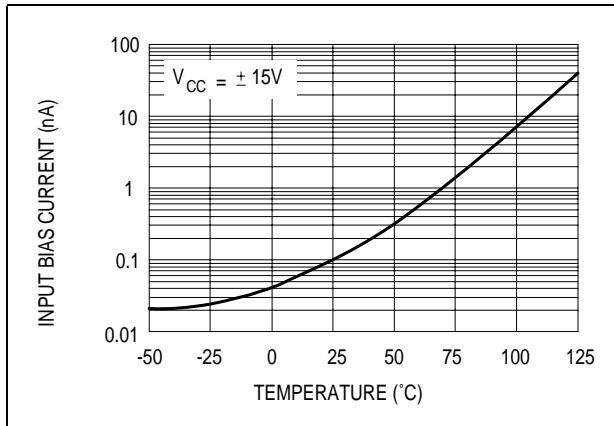


Figure 8. Large signal differential voltage amplification versus free air temp

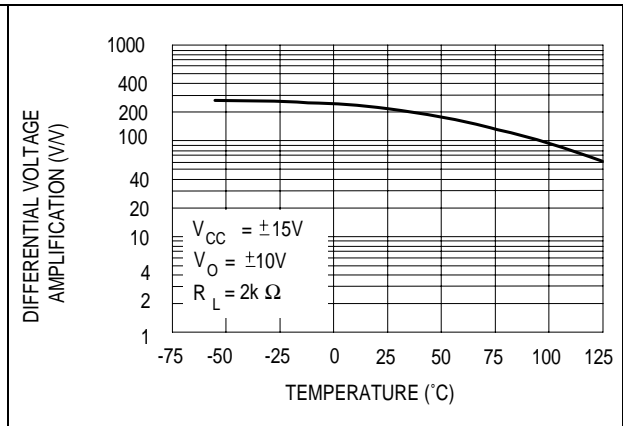


Figure 9. Large signal differential voltage amplification and phase shift versus frequency

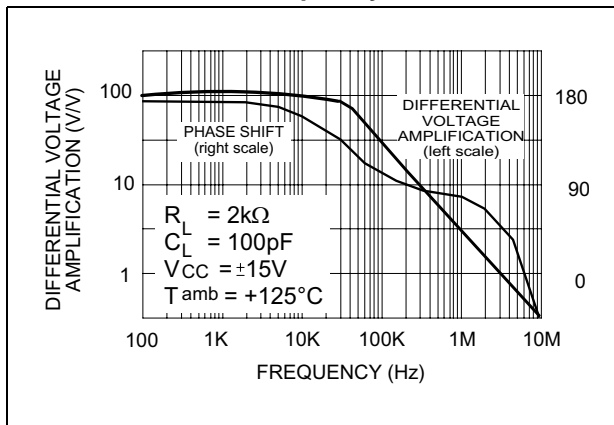


Figure 10. Total power dissipation versus free air temperature

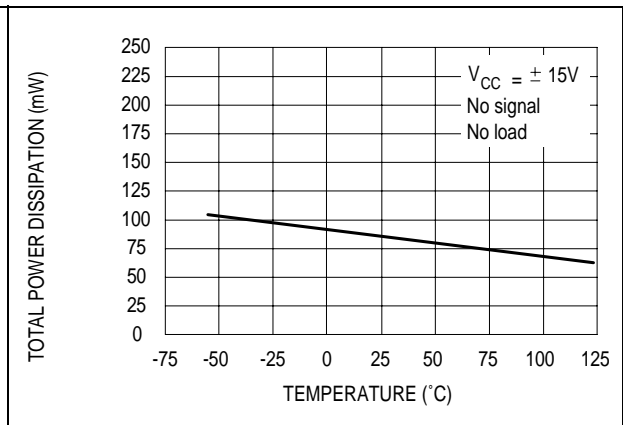


Figure 11. Supply current per amplifier versus free air temperature

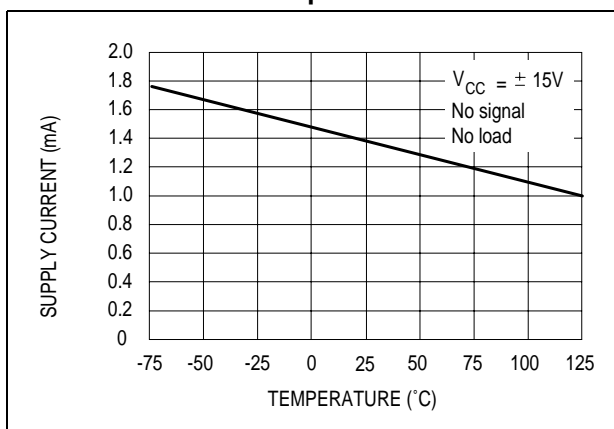


Figure 12. Common mode rejection ratio versus free air temperature

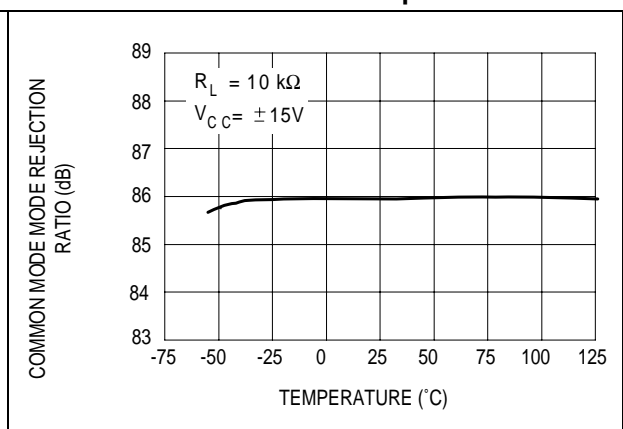


Figure 13. Voltage follower large signal pulse response

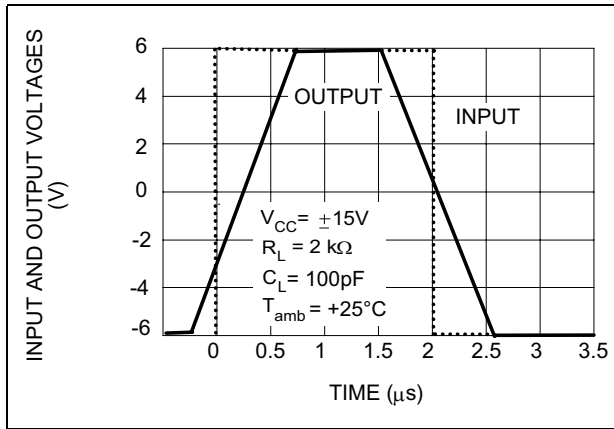


Figure 14. Output voltage versus elapsed time response

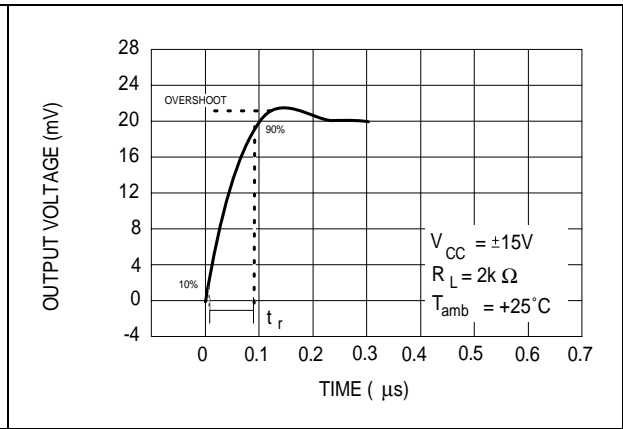


Figure 15. Equivalent input noise voltage versus frequency

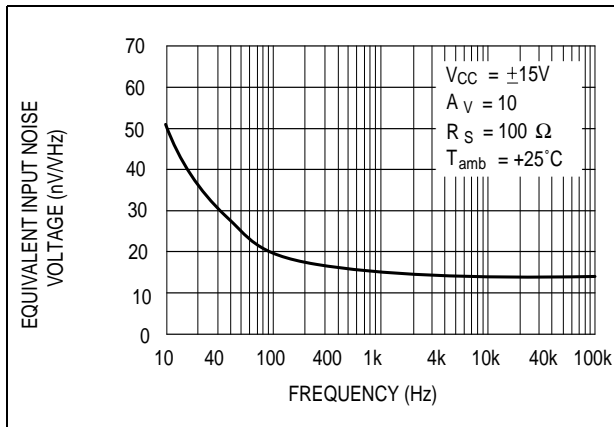
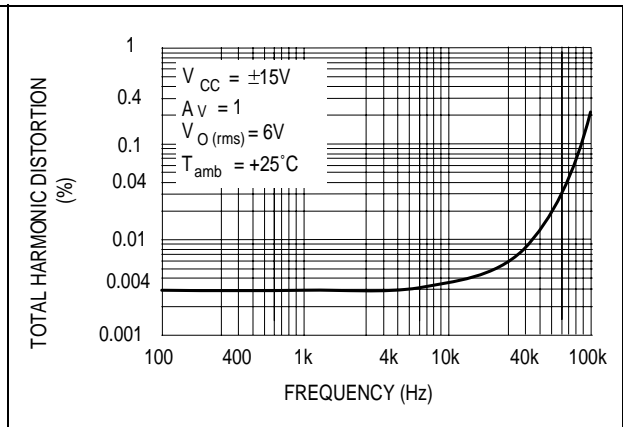


Figure 16. Total harmonic distortion versus frequency



4 Parameter measurement information

Figure 17. Voltage follower

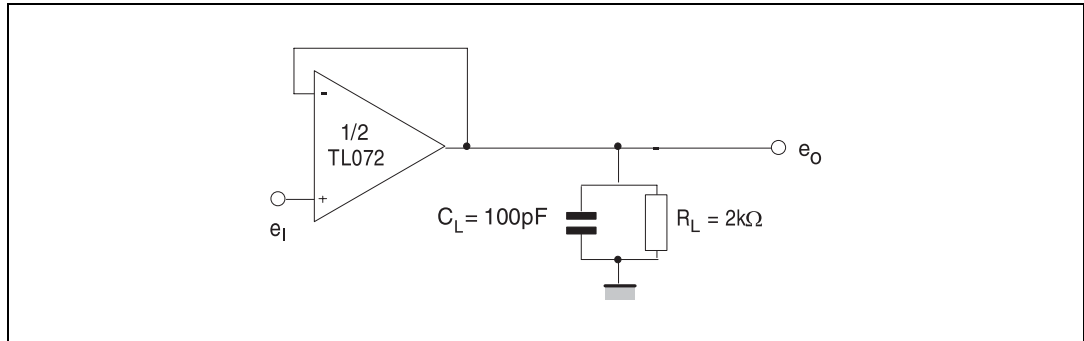
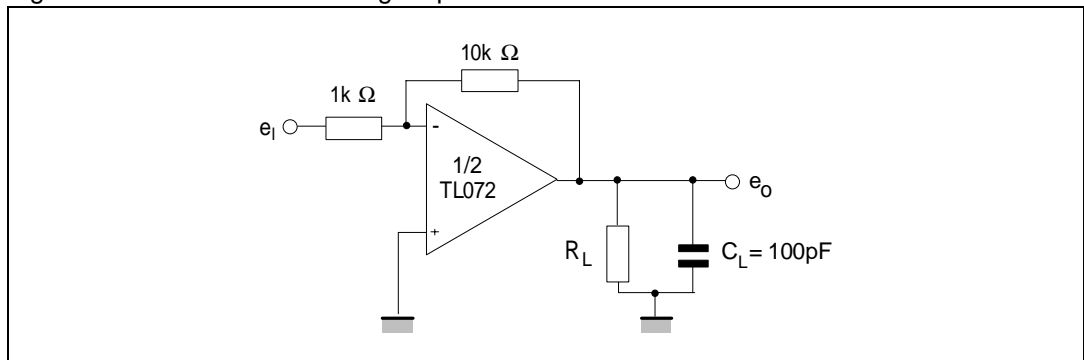
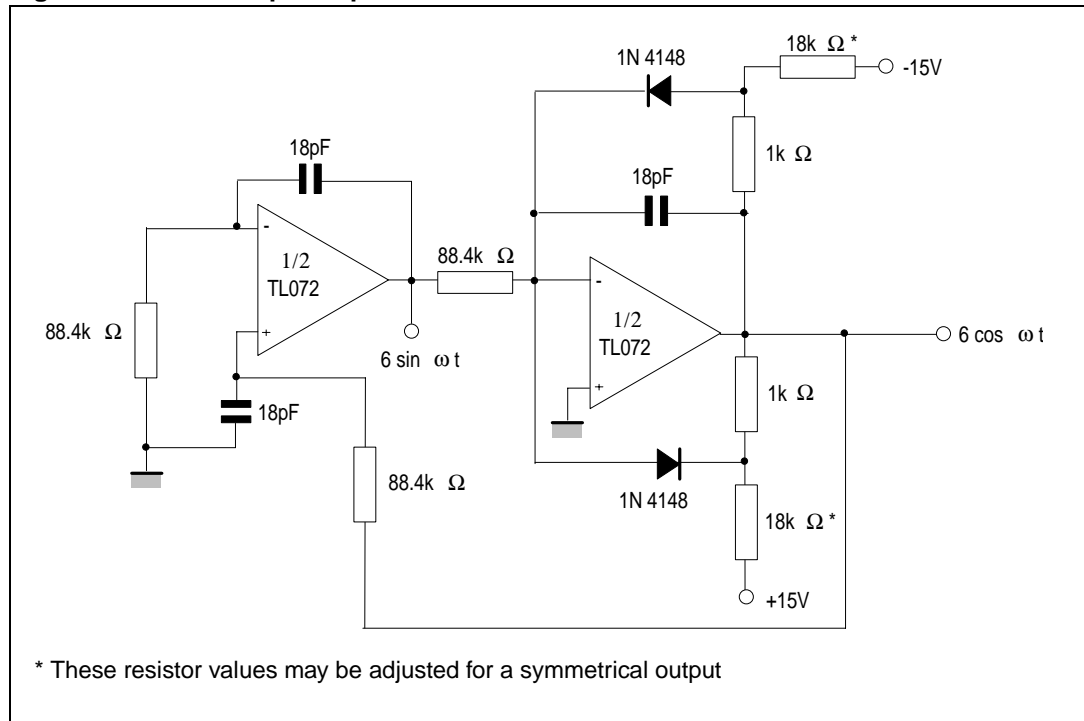


Figure 18. Gain-of-10 inverting amplifier



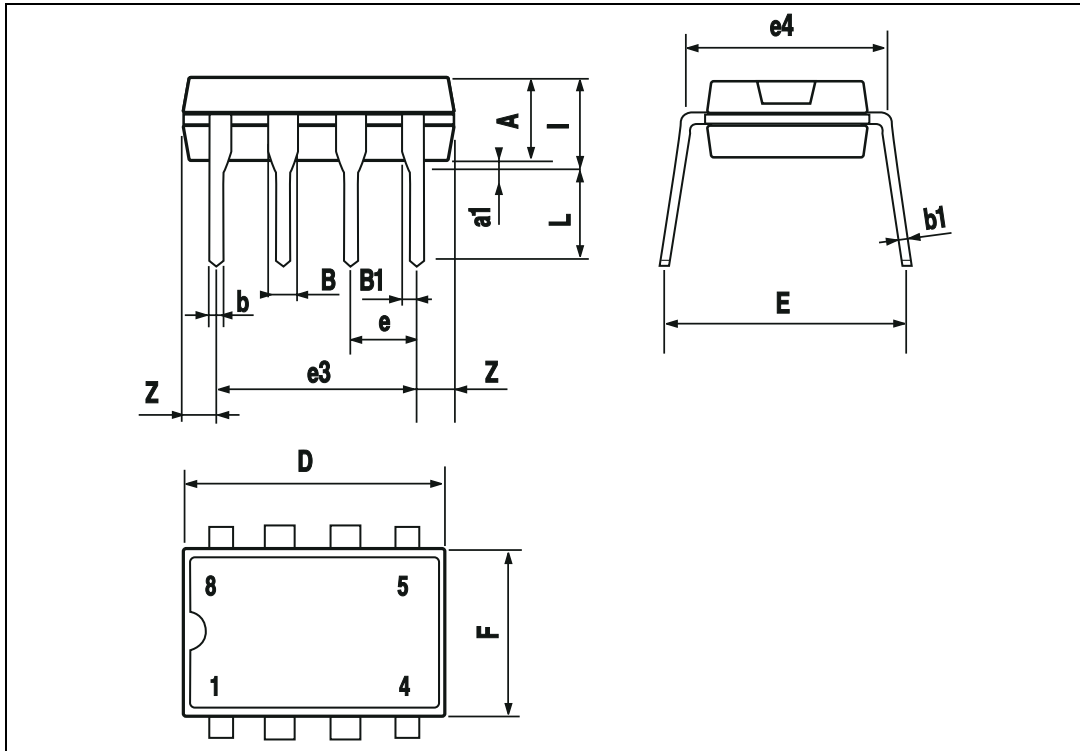
5 Typical applications

Figure 19. 100kHz quadruple oscillator



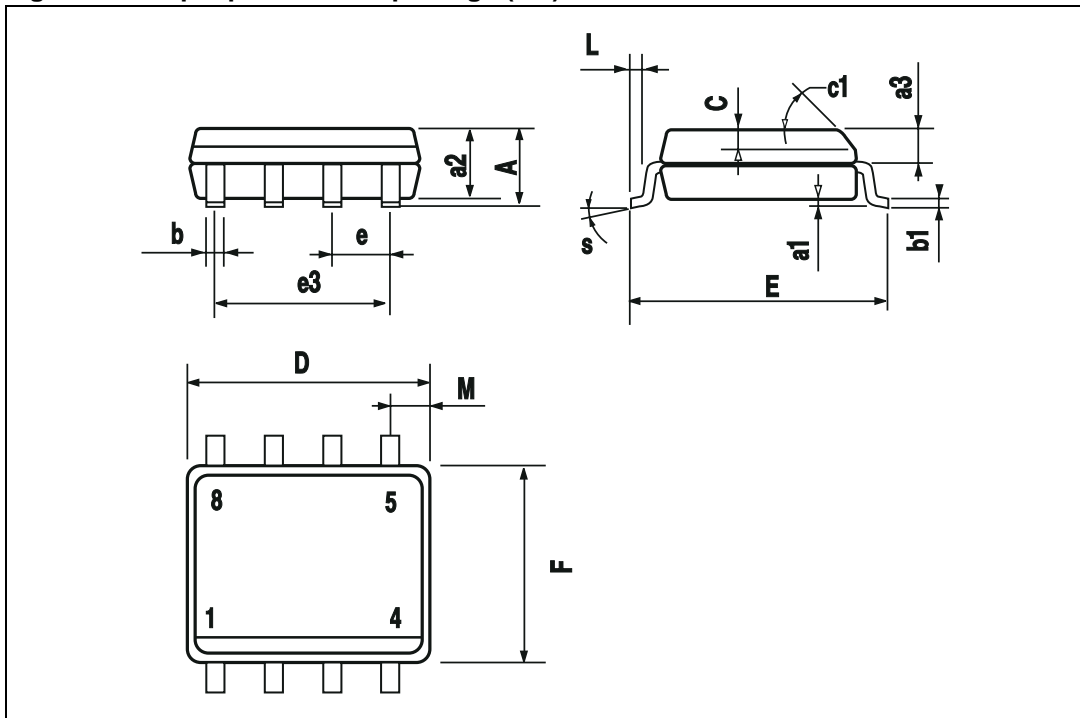
6 Package mechanical data

Figure 20. 8-pin plastic DIP



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

Figure 21. 8-pin plastic micropackage (SO)



Dim.	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F	3.8		4.0	0.150		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

7 Revision history

Date	Revision	Changes
28-Mar-2001	1	Initial release.
2-Apr-2004	2	Correction to pin connection diagram on cover page. Unpublished.
4-Dec-2006	3	Modified graphics in package mechanical data.

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