



# TL072 TL072A TL072B

## Low noise JFET dual operational amplifiers

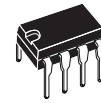
### Features

- 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 JFET input stage
- Low harmonic distortion: 0.01% (typical)
- 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 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.

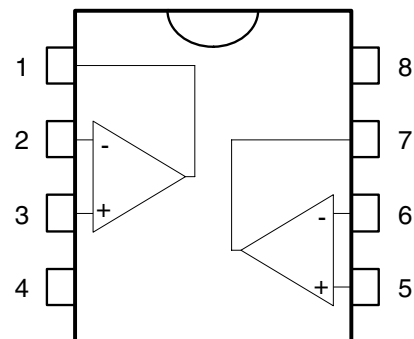


**N**  
**DIP8**  
**(Plastic package)**



**D**  
**SO-8**  
**(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 -  $V_{CC}^+$

## 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 <sup>(1)</sup>	±18		V
$V_{in}$	Input voltage <sup>(2)</sup>	±15		V
$V_{id}$	Differential input voltage <sup>(3)</sup>	±30		V
$R_{thja}$	Thermal resistance junction to ambient <sup>(4)</sup>			°C/W
	SO-8	125		
	DIP8	85		
$R_{thjc}$	Thermal resistance junction to case <sup>(4)</sup>			°C/W
	SO-8	40		
	DIP8	41		
	Output short-circuit duration <sup>(5)</sup>	Infinite		
$T_{stg}$	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>	1.5		kV

- 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  $V_{CC}^-$ .
- The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
- Differential voltages are the non-inverting input terminal with respect to the inverting input terminal.
- Short-circuits can cause excessive heating. Destructive dissipation can result from simultaneous short-circuits on all amplifiers.
- 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.
- 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.
- 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). This is done for all couples of pin combinations with other pins floating.
- 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 +105	0 to +70	°C

### 3 Electrical characteristics

Table 3. Electrical characteristics at  $V_{CC} = \pm 15V$ ,  $T_{amb} = +25^{\circ}C$  (unless otherwise specified)

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

**Table 3. Electrical characteristics at  $V_{CC} = \pm 15V$ ,  $T_{amb} = +25^{\circ}C$  (unless otherwise specified) (continued)**

Symbol	Parameter	TL072I,AC,AI BC,BI			TL072C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$\pm V_{opp}$	Output voltage swing $T_{amb} = +25^{\circ}C$ $R_L = 2k\Omega$ $R_L = 10k\Omega$	10 12	12 13.5		10 12	12 13.5		V
	$T_{min} \leq T_{amb} \leq T_{max}$ $R_L = 2k\Omega$ $R_L = 10k\Omega$	10 12			10 12			
SR	Slew rate $V_{in} = 10V$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain	8	16		8	16		V/ $\mu s$
$t_r$	Rise time $V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain		0.1			0.1		$\mu s$
$K_{ov}$	Overshoot $V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , unity gain		10			10		%
GBP	Gain bandwidth product $V_{in} = 10mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $F = 100kHz$	2.5	4		2.5	4		MHz
$R_i$	Input resistance		$10^{12}$			$10^{12}$		$\Omega$
THD	Total harmonic distortion $F = 1kHz$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $A_v = 20dB$ , $V_o = 2V_{pp}$		0.01			0.01		%
$e_n$	Equivalent input noise voltage $R_S = 100\Omega$ , $F = 1kHz$		15			15		$\frac{nV}{\sqrt{Hz}}$
$\phi_m$	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  $10^{\circ}C$  increase in the junction temperature.

## 6.2 SO-8 package information

Figure 22. SO-8 package mechanical drawing

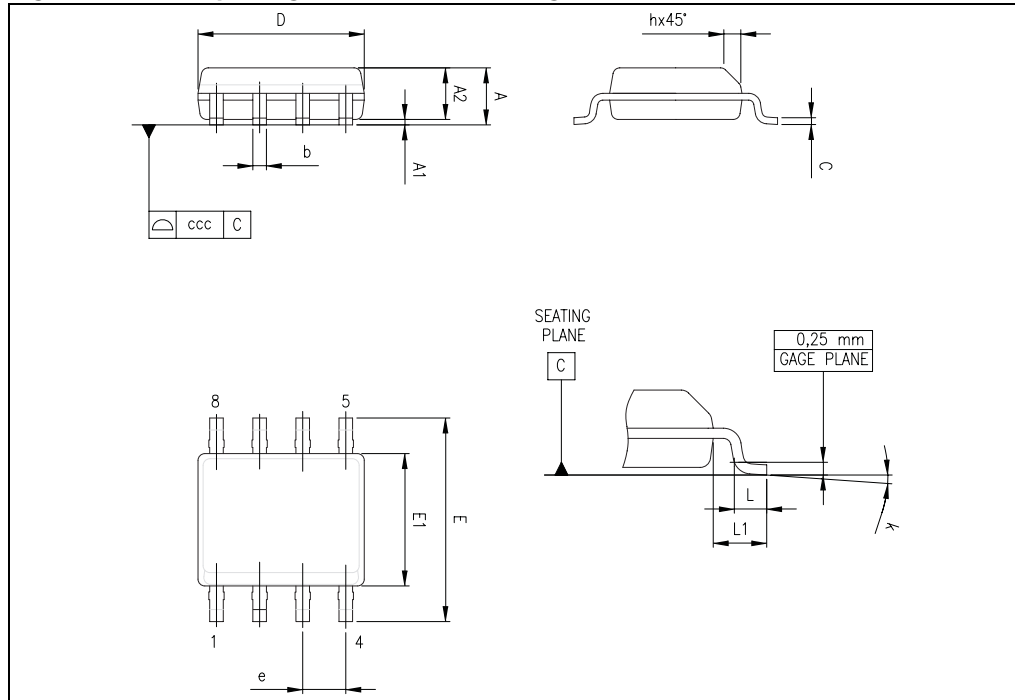


Table 5. SO-8 package mechanical data

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 6. Order codes**

Order code	Temperature range	Package	Packing	Marking
TL072IN	-40°C, +105°C	DIP8	Tube	TL072IN
TL072AIN				TL072AIN
TL072BIN				TL072BIN
TL072ID TL072IDT		SO-8	Tube or tape & reel	072I
TL072AID TL072AIDT				072AI
TL072BID TL072BIDT				072BI
TL072CN	0°C, +70°C	DIP8	Tube	TL072CN
TL072ACN				TL072ACN
TL072BCN				TL072BCN
TL072CD TL072CDT		SO-8	Tube or tape & reel	072C
TL072ACD TL072ACDT				072AC
TL072BCD TL072BCDT				072BC
TL072IYD/DT <sup>(1)</sup> TL072AIYD/DT <sup>(1)</sup> TL072BIYD/DT <sup>(1)</sup>	-40°C, +105°C	SO-8 (Automotive grade)	Tube or tape & reel	072IY 072AIY 072BIY

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