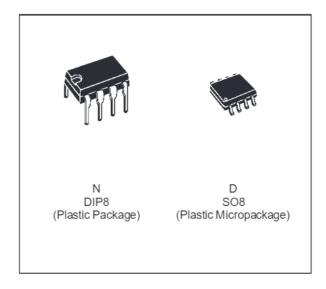


## TL072 TL072A - TL072B

## LOW NOISE J-FET DUAL OPERATIONAL AMPLIFIERS

- WIDE COMMON-MODE (UP TO Vcc<sup>+</sup>) 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: 16V/cs (typ)



### **DESCRIPTION**

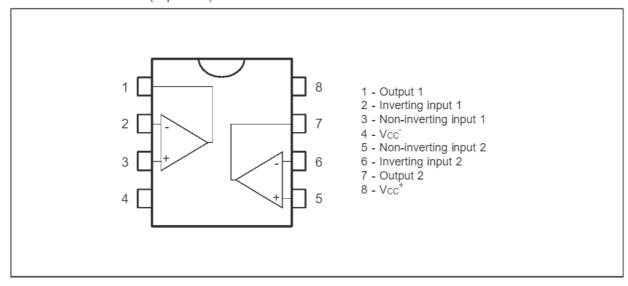
The TL072, TL072A and TL072B are high speed J–FET input dual operational amplifiers incorporating well matched, high voltage J–FET and bipolar transistors in a monolithic integrated circuit.

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

## **ORDER CODES**

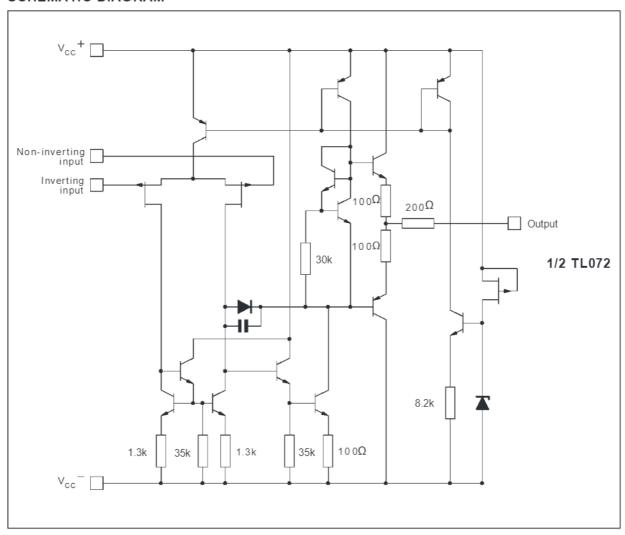
Part Number	Temperature	Package				
rait Number	Range	N	D			
TL072M/AM/BM	–55°C, +125°C	•	•			
TL072I/AI/BI	–40°C, +105°C					
TL072C/AC/BC	0°C, +70°C					
Example : TL072CN						

## PIN CONNECTIONS (top view)



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### SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit	
Vcc	Supply Voltage - (note 1)	±18	V	
Vi	Input Voltage - (note 3)		±15	V
Vid	Differential Input Voltage - (note 2)		±30	V
Ptot	Power Dissipation		680	mW
	Output Short-circuit Duration - (note 4)		Infinite	
T <sub>oper</sub>	Г , , , , , , , , , , , , , , , , , , ,	L072C,AC,BC L072I,AI,BI L072M,AM,BM	0 to 70 -40 to 105 -55 to 125	°C
T <sub>stg</sub>	Storage Temperature Range		-65 to 150	°C

Notes:

- 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>.
   Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.
   The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
   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.

## ELECTRICAL CHARACTERISTICS

 $V_{CC}$  = ±15V,  $T_{amb}$  = 25 $^{\circ}$ C (unless otherwise specified)

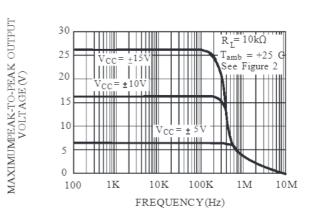
Symbol	Parameter	TL072I,M,AC,AI, AM,BC,BI,BM			TL072C			Unit
-		Min.	Тур.	Max.	Min.	Тур.	Max.	
Vio	$\begin{array}{c} \text{Input Offset Voltage } (R_S = 50\Omega) \\ T_{amb} = 25^{\circ}\text{C} \\ TL072 \\ TL072A \\ TL072B \\ T_{min.} \leq T_{amb} \leq T_{max.} \\ TL072 \\ TL072 \\ TL072A \\ TL072B \\ TL072B \end{array}$		3 3 1	10 6 3 13 7 5		3	10	mV
DVio	Input Offset Voltage Drift		10			10		∞V/°C
l <sub>io</sub>	Input Offset Current * $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$		5	100 4		5	100 10	pA nA
l <sub>ib</sub>	Input Bias Current * T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		20	200 20		20	200 20	pA nA
$A_{vd}$	Large Signal Voltage Gain (R <sub>L</sub> = $2k\Omega$ , V <sub>O</sub> = $\pm 10V$ ) $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$	50 25	200		25 15	200		V/mV
SVR	Supply Voltage Rejection Ratio (R <sub>S</sub> = $50\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$		86		70 70	86		dB
Icc	Supply Current, per Amp, no Load $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$		1.4	2.5 2.5		1.4	2.5 2.5	mA
V <sub>icm</sub>	Input Common Mode Voltage Range	±11	+15 -12		±11	+15 -12		V
CMR	Common Mode Rejection Ratio (Rs = $50\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$	80 80	86		70 70	86		dB
los	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
±V <sub>OPP</sub>	$ \begin{array}{ll} \text{Output Voltage Swing} \\ T_{amb} = 25^{\circ}\text{C} & \text{RL} = 2k\Omega \\ & \text{RL} = 10k\Omega \\ T_{min.} \leq T_{amb} \leq T_{max.} & \text{RL} = 2k\Omega \\ & \text{RL} = 10k\Omega \end{array} $	10 12 10 12	12 13.5		10 12 10 12	12 13.5		V
SR	Slew Rate ( $V_{in}$ = 10V, $R_L$ = 2k $\Omega$ , $C_L$ = 100pF, $T_{amb}$ = 25°C, unity gain)	8	16		8	16		V/∞s
t <sub>r</sub>	Rise Time ( $V_{in}$ = 20mV, $R_L$ = 2k $\Omega$ , $C_L$ = 100pF, $T_{amb}$ = 25°C, unity gain)		0.1			0.1		∞S
Kov	Overshoot ( $V_{in}$ = 20mV, $R_L$ = 2k $\Omega$ , $C_L$ = 100pF, $T_{amb}$ = 25°C, unity gain)		10			10		%
GBP	Gain Bandwidth Product (f = 100kHz, $T_{amb}$ = 25°C, $V_{in}$ = 10mV, $R_L$ = 2k $\Omega$ , $C_L$ = 100pF)	2.5	4		2.5	4		MHz
Ri	Input Resistance		10 <sup>12</sup>			10 <sup>12</sup>		Ω
THD	Total Harmonic Distortion (f = 1kHz, $A_V$ = 20dB, $R_L$ = 2k $\Omega$ , $C_L$ = 100pF, $T_{amb}$ = 25°C, $V_O$ = 2V <sub>PP</sub> )		0.01			0.01		%
en	Equivalent Input Noise Voltage $(f = 1kHz, R_s = 100\Omega)$		15			15		<u>nV</u> √Hiz
øm	Phase Margin		45			45		Degrees
V <sub>01</sub> /V <sub>02</sub>	Channel Separation (A <sub>v</sub> = 100)		120			120		dB

<sup>\*</sup> The input bias currents are junction leakage currents which approximately double for every 10°C increase in the junction temperature.

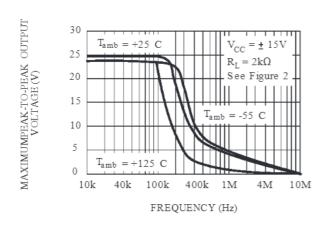
## MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY

#### 30 $V_{CC} = \pm 15V$ $R_L = 2k\Omega$ MAXIMUM PEAK-TO-PEAKOUTPUT 25 See Figure 2 20 VOLTAGE (V) 15 10 = ± 5V 5 1K 10K 100K 1M 10M 100 FREQUENCY (Hz)

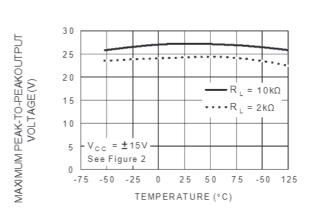
# MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



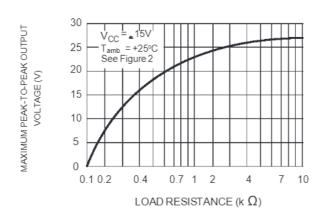
## MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



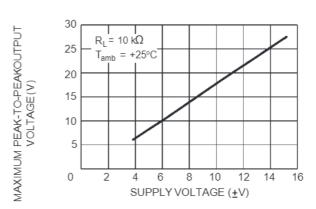
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREE AIR TEMP.



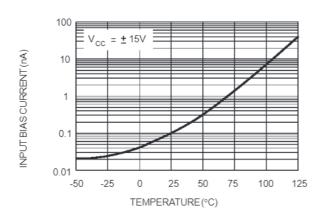
## MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



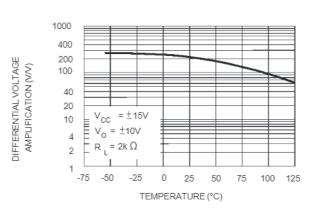
# MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE



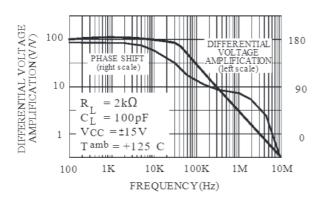
### INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE



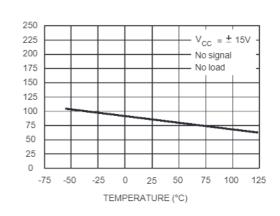
# LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE



# LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



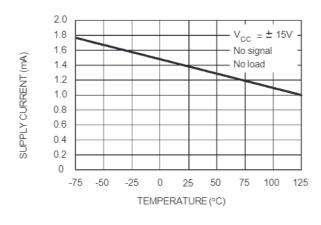
# TOTAL POWER DISSIPATION VERSUS FREE AIR TEMPERATURE



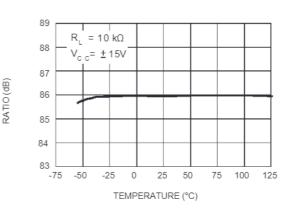
TOTAL POWER DISSIPATION (mW)

COMMON MODE MODE REJECTION

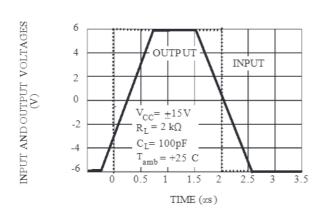
# SUPPLY CURRENT PER AMPLIFIER VERSUS FREE AIR TEMPERATURE



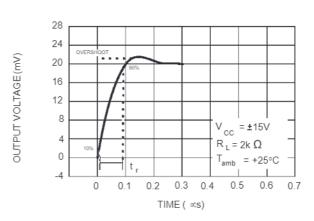
# COMMON MODE REJECTION RATIO VERSUS FREE AIR TEMPERATURE



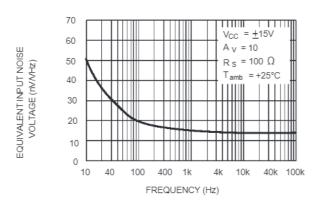
# VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



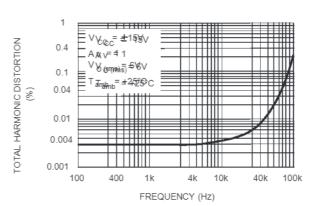
## OUTPUT VOLTAGE VERSUS ELAPSED TIME



# EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY



# TOTAL HARMONIC DISTORTION VERSUS FREQUENCY



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## PARAMETER MEASUREMENT INFORMATION

Figure 1: Voltage Follower

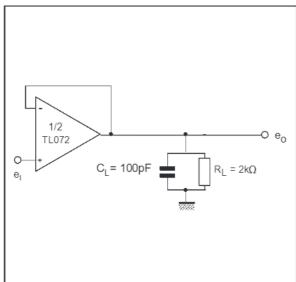
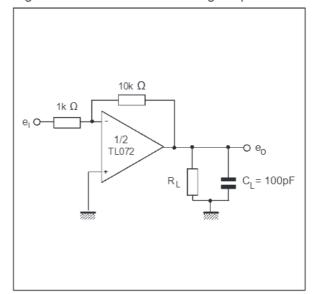
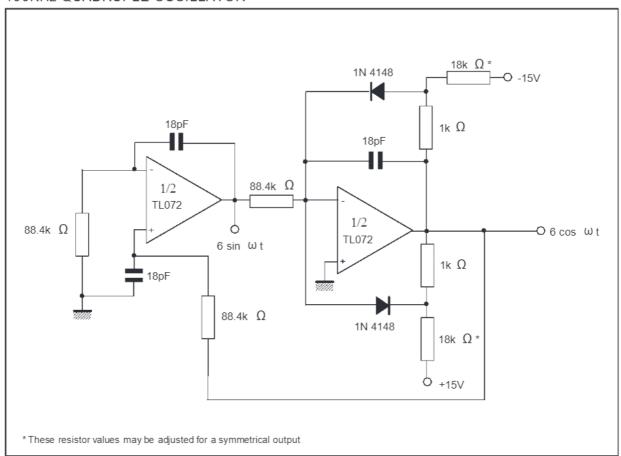


Figure 2: Gain-of-10 Inverting Amplifier

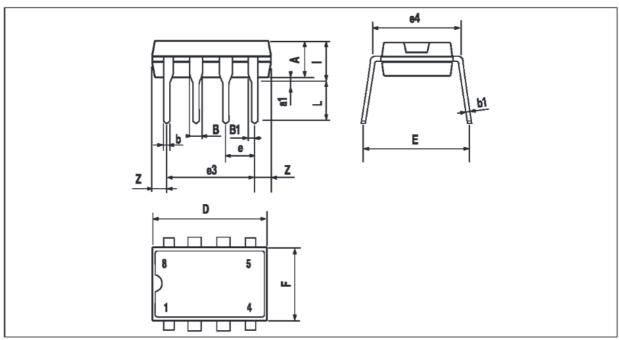


## TYPICAL APPLICATION

100KHz QUADRUPLE OSCILLATOR



# PACKAGE MECHANICAL DATA 8 PINS - PLASTIC DIP

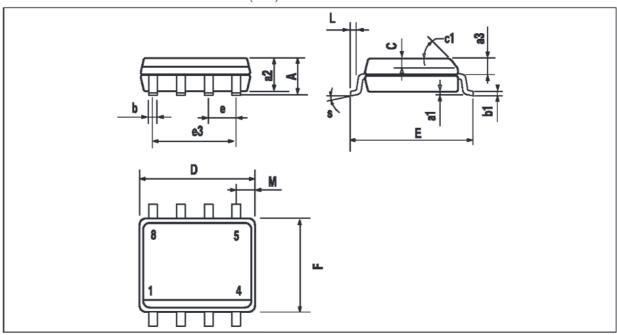


Dimensions	Millimeters			Inches			
	Min.	Тур.	Max.	Min.	Тур.	Max.	
А		3.32			0.131		
a1	0.51			0.020			
В	1.15		1.65	0.045		0.065	
b	0.356		0.55	0.014		0.022	
b1	0.204		0.304	0.008		0.012	
D			10.92			0.430	
E	7.95		9.75	0.313		0.384	
е		2.54			0.100		
e3		7.62			0.300		
e4		7.62			0.300		
F			6.6			0260	
i			5.08			0.200	
L	3.18		3.81	0.125		0.150	
Z			1.52			0.060	

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### PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



Dimensions	Millimeters			Inches			
Difficusions	Min.	Тур.	Max.	Min.	Тур.	Max.	
Α			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	
С	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	
е		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.)						

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