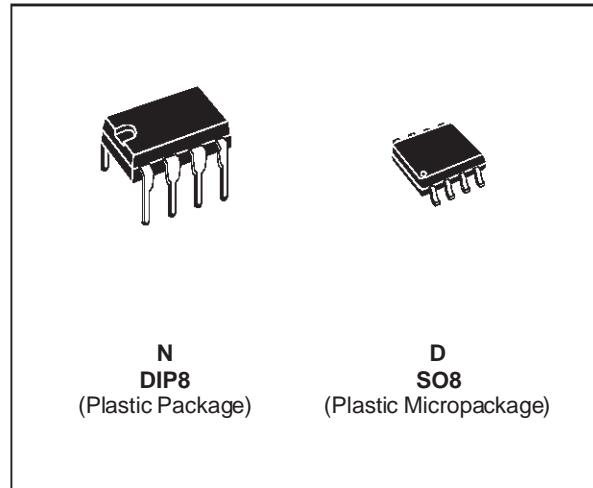




# TL071 TL071A - TL071B

## LOW NOISE J-FET SINGLE OPERATIONAL AMPLIFIERS

- 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

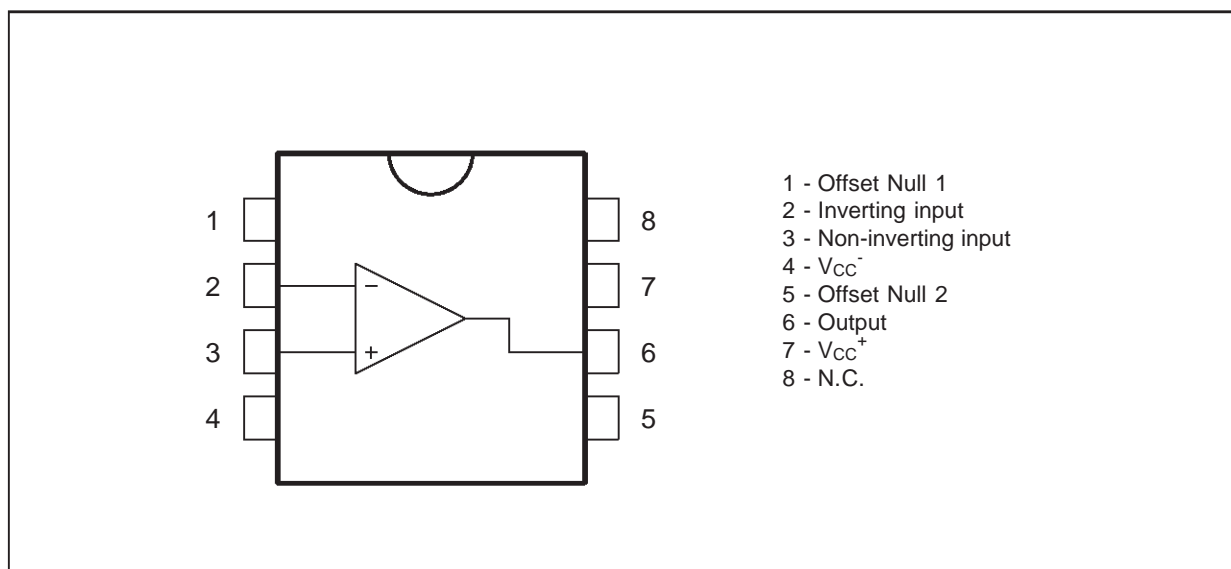
The TL071, TL071A and TL071B are high speed J-FET input single operational amplifiers incorporating well matched, high voltage J-FET and bipolar transistors in a monolithic integrated circuit.

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

### ORDER CODES

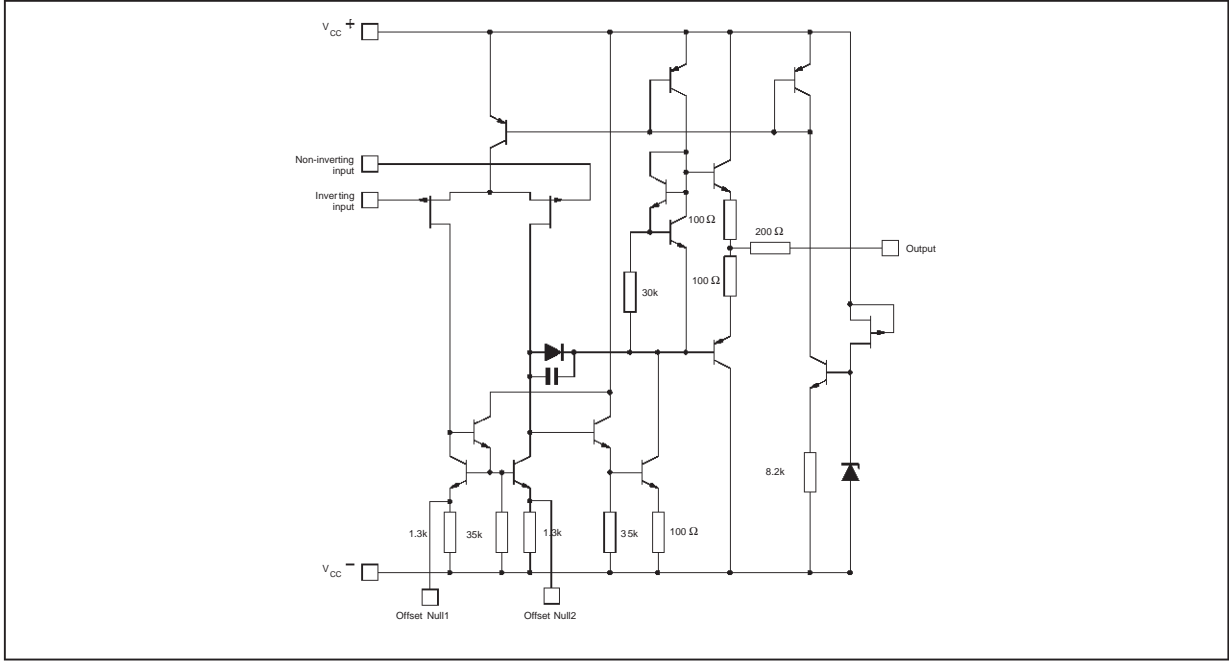
Part Number	Temperature Range	Package	
		N	D
TL071M/AM/BM	-55°C, +125°C	•	•
TL071I/AI/BI	-40°C, +105°C	•	•
TL071C/AC/BC	0°C, +70°C	•	•
Example : TL071CN			

### PIN CONNECTIONS (top view)

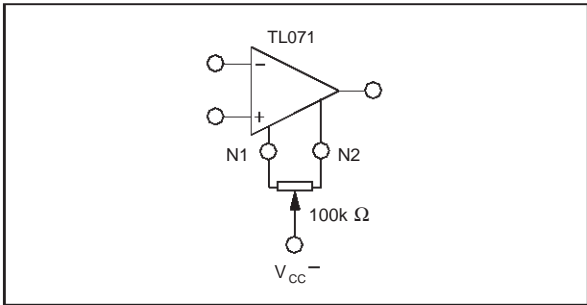


# TL071 - TL071A - TL071B

## SCHEMATIC DIAGRAM



## INPUT OFFSET VOLTAGE NULL CIRCUITS



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC}$	Supply Voltage - (note 1)	$\pm 18$	V
$V_i$	Input Voltage - (note 3)	$\pm 15$	V
$V_{id}$	Differential Input Voltage - (note 2)	$\pm 30$	V
$P_{tot}$	Power Dissipation	680	mW
	Output Short-circuit Duration - (note 4)	Infinite	
$T_{oper}$	Operating Free Air Temperature Range	TL071C,AC,BC TL071I,AI,BI TL071M,AM,BM 0 to 70 -40 to 105 -55 to 125	$^{\circ}\text{C}$
$T_{stg}$	Storage Temperature Range	-65 to 150	$^{\circ}\text{C}$

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

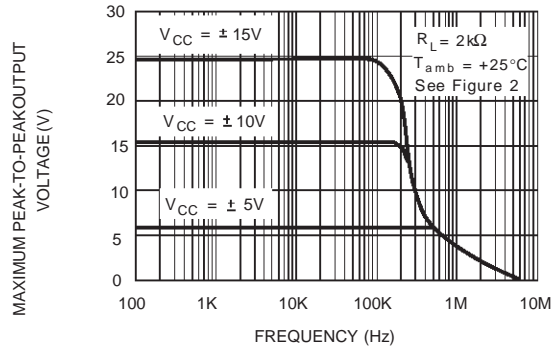
# ELECTRICAL CHARACTERISTICS

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

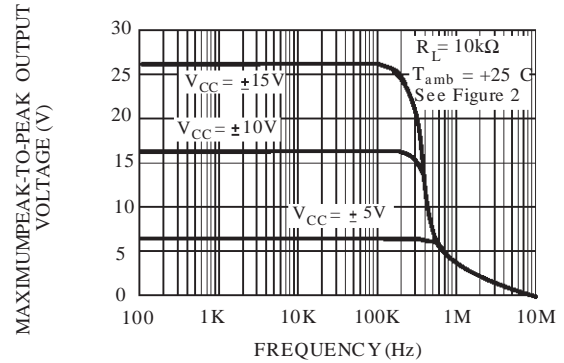
Symbol	Parameter	TL071I,M,AC,AI, AM,BC,BI,BM			TL071C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
$V_{io}$	Input Offset Voltage ( $R_S = 50\Omega$ ) $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ TL071 TL071A TL071B TL071 TL071A TL071B		3 3 1	10 6 3 13 7 5		3	10 13	mV
$DV_{io}$	Input Offset Voltage Drift		10			10		$\mu V/^{\circ}C$
$I_{io}$	Input Offset Current * $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		5	100 4		5	100 10	pA nA
$I_{ib}$	Input Bias Current * $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$		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	$\pm 11$	+15 -12		$\pm 11$	+15 -12		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
$\pm V_{OPP}$	Output Voltage Swing $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ $R_L = 2k\Omega$ $R_L = 10k\Omega$ $R_L = 2k\Omega$ $R_L = 10k\Omega$	10 12 10 12	12 13.5		10 12 10 12	12 13.5		V
SR	Slew Rate ( $V_{in} = 10V$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , unity gain)	8	16		8	16		V/ $\mu s$
$t_r$	Rise Time ( $V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , unity gain)		0.1			0.1		$\mu s$
$K_{OV}$	Overshoot ( $V_{in} = 20mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , unity gain)		10			10		%
GBP	Gain Bandwidth Product ( $f = 100kHz$ , $T_{amb} = 25^{\circ}C$ , $V_{in} = 10mV$ , $R_L = 2k\Omega$ , $C_L = 100pF$ )	2.5	4		2.5	4		MHz
$R_i$	Input Resistance		$10^{12}$			$10^{12}$		$\Omega$
THD	Total Harmonic Distortion ( $f = 1kHz$ , $A_V = 20dB$ , $R_L = 2k\Omega$ , $C_L = 100pF$ , $T_{amb} = 25^{\circ}C$ , $V_O = 2V_{PP}$ )		0.01			0.01		%
$e_n$	Equivalent Input Noise Voltage ( $f = 1kHz$ , $R_S = 100\Omega$ )		15			15		$\frac{nV}{\sqrt{Hz}}$
$\phi_m$	Phase Margin		45			45		Degrees

\* The input bias currents are junction leakage currents which approximately double for every  $10^{\circ}C$  increase in the junction temperature.

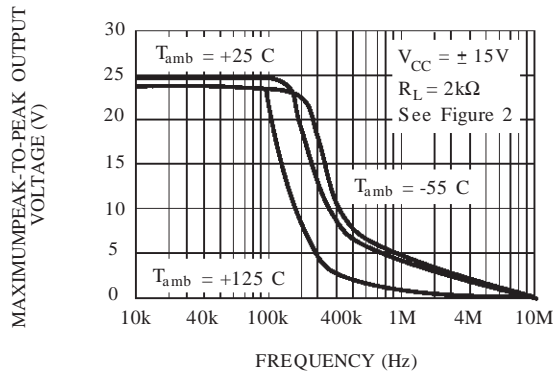
MAXIMUM PEAK-TO-PEAK OUTPUT  
VOLTAGE VERSUS FREQUENCY



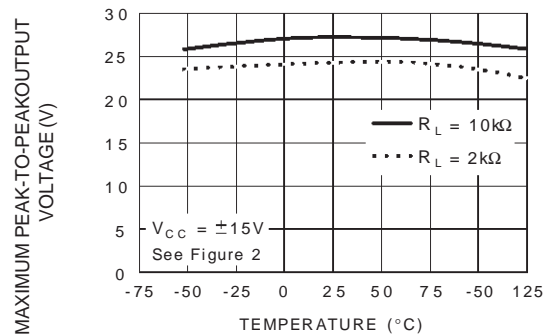
MAXIMUM PEAK-TO-PEAK OUTPUT  
VOLTAGE VERSUS FREQUENCY



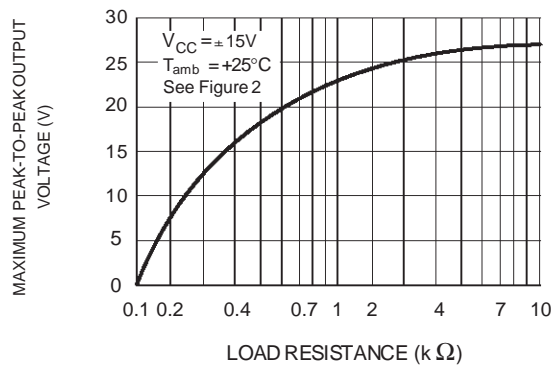
MAXIMUM PEAK-TO-PEAK OUTPUT  
VOLTAGE VERSUS FREQUENCY



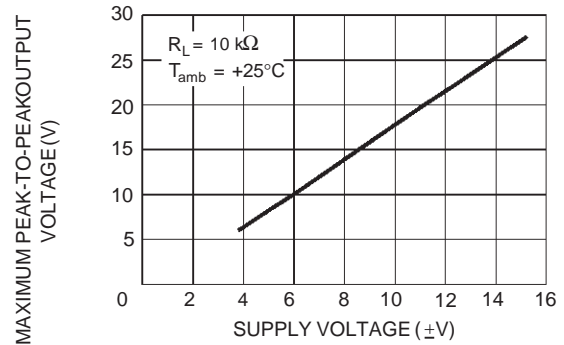
MAXIMUM PEAK-TO-PEAK OUTPUT  
VOLTAGE VERSUS FREE AIR TEMP.



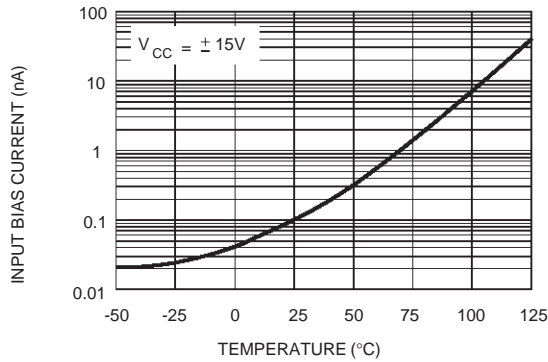
MAXIMUM PEAK-TO-PEAK OUTPUT  
VOLTAGE VERSUS LOAD RESISTANCE



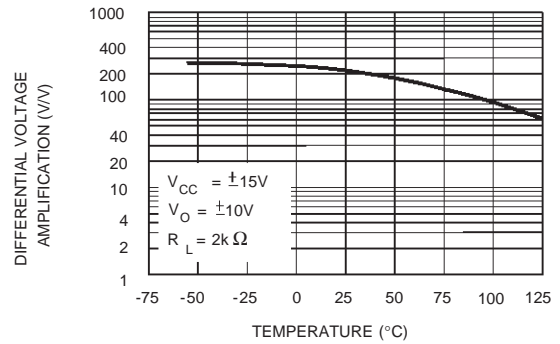
MAXIMUM PEAK-TO-PEAK OUTPUT  
VOLTAGE VERSUS SUPPLY VOLTAGE



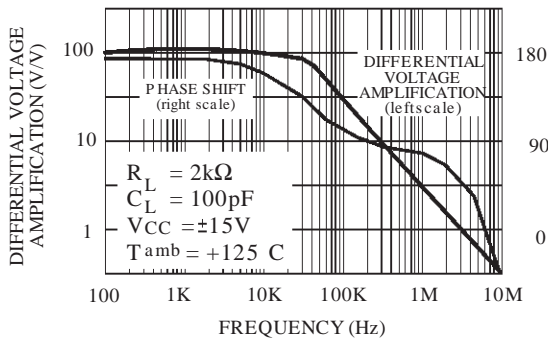
**INPUT BIAS CURRENT VERSUS  
FREE AIR TEMPERATURE**



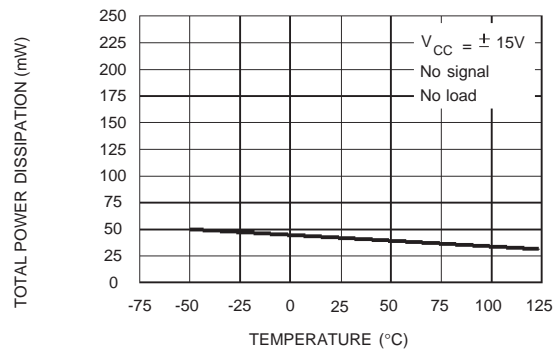
**LARGE SIGNAL DIFFERENTIAL  
VOLTAGE AMPLIFICATION VERSUS  
FREE AIR TEMPERATURE**



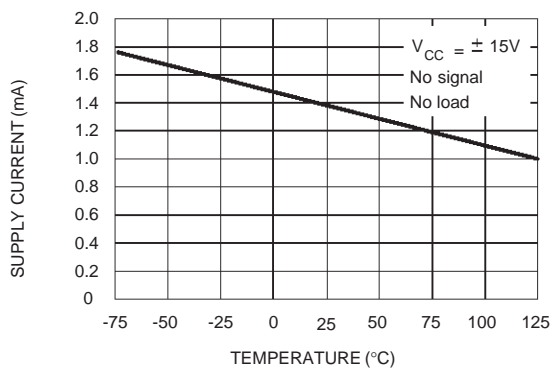
**LARGE SIGNAL DIFFERENTIAL  
VOLTAGE AMPLIFICATION AND PHASE  
SHIFT VERSUS FREQUENCY**



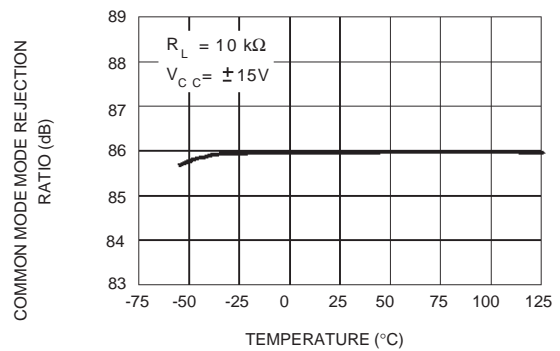
**TOTAL POWER DISSIPATION VERSUS  
FREE AIR TEMPERATURE**



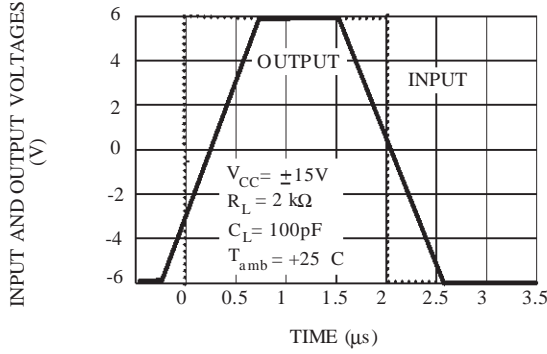
**SUPPLY CURRENT PER AMPLIFIER  
VERSUS FREE AIR TEMPERATURE**



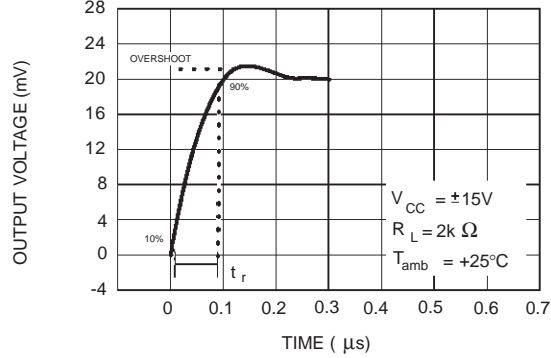
**COMMON MODE REJECTION RATIO  
VERSUS FREE AIR TEMPERATURE**



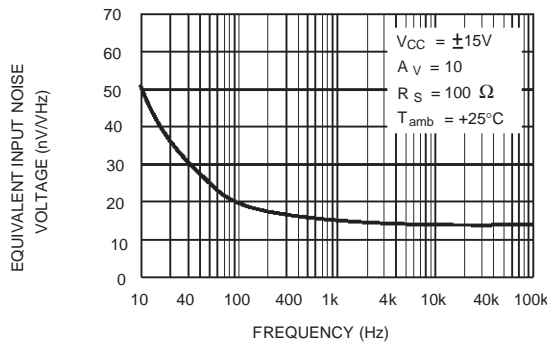
VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



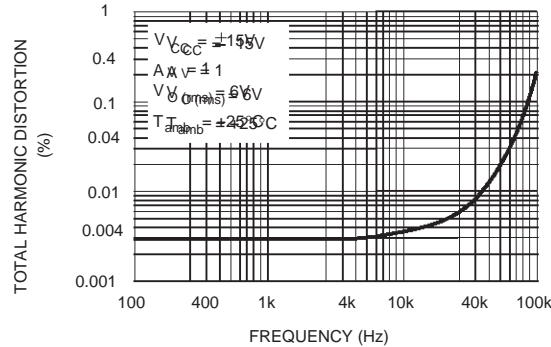
OUTPUT VOLTAGE VERSUS ELAPSED TIME



EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY



TOTAL HARMONIC DISTORTION VERSUS FREQUENCY



## PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower

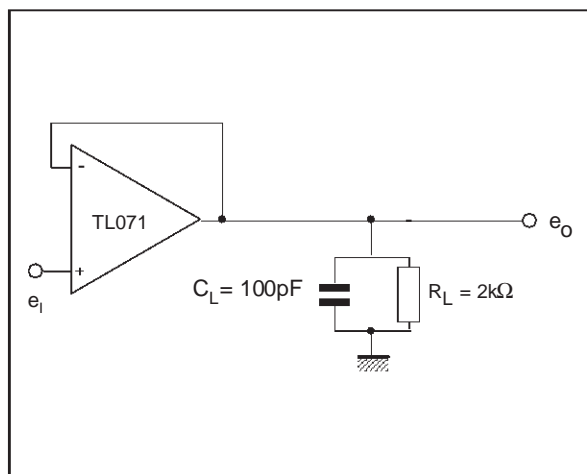
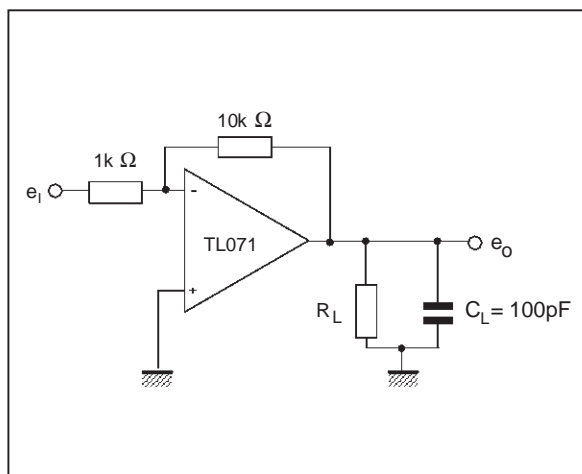
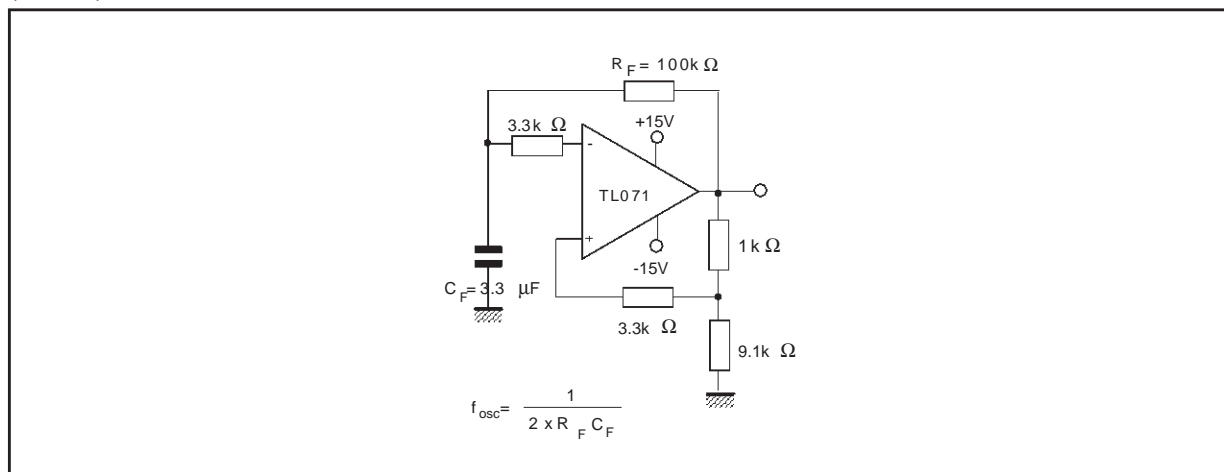


Figure 2 : Gain-of-10 Inverting Amplifier

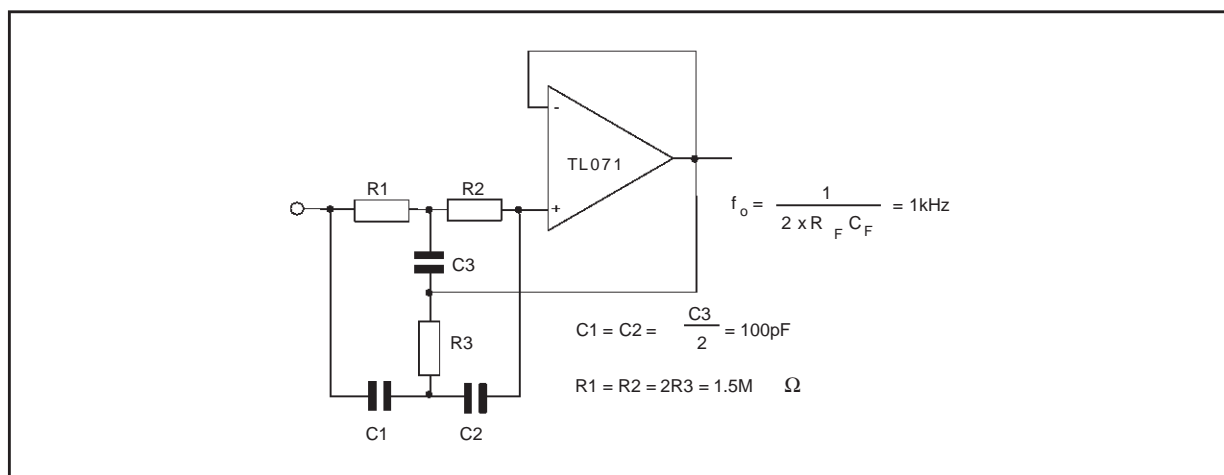


## TYPICAL APPLICATIONS

### (0.5Hz) SQUARE WAVE OSCILLATOR

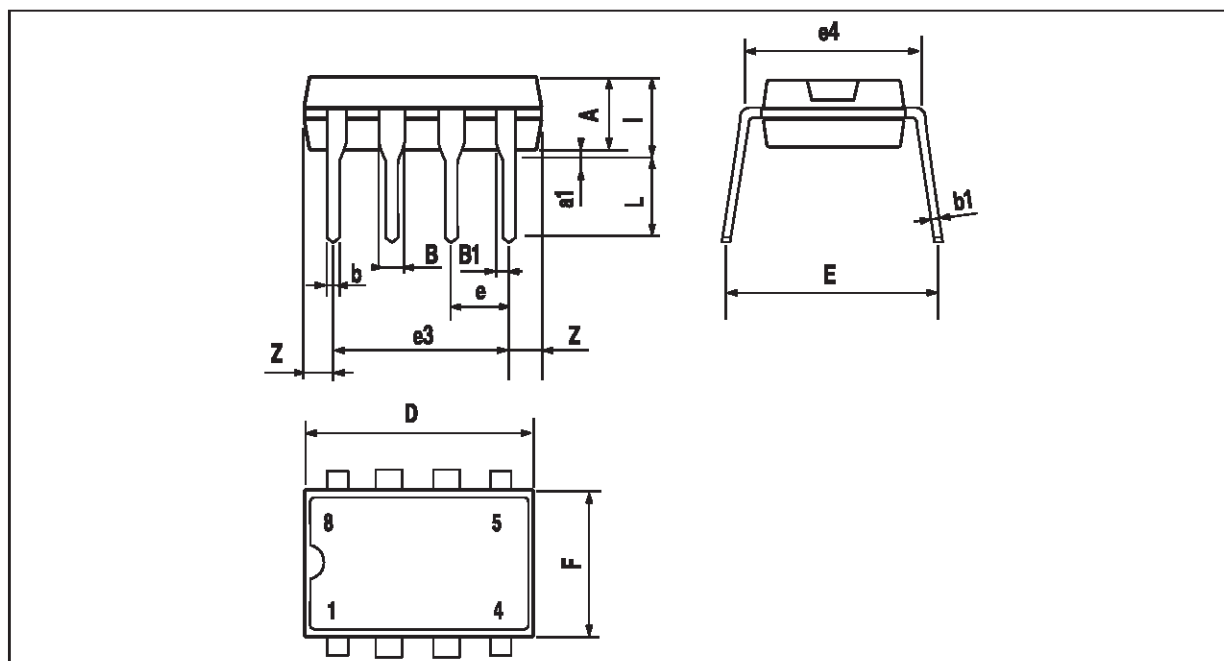


### HIGH Q NOTCH FILTER



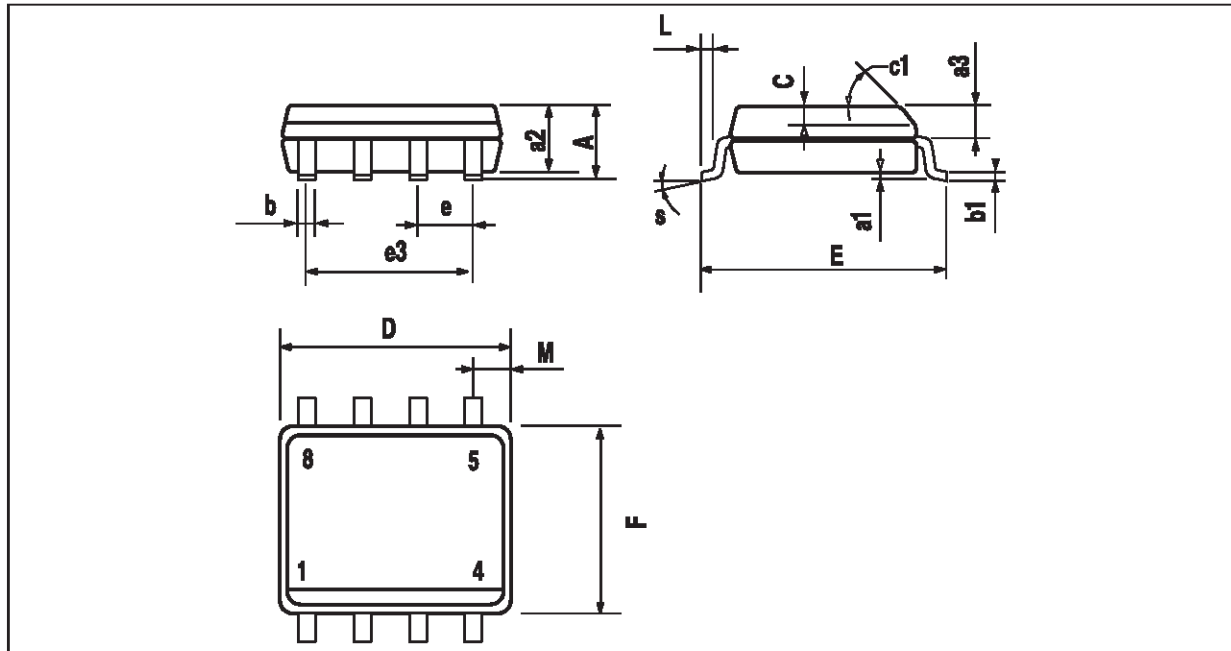
# **PACKAGE MECHANICAL DATA**

8 PINS - PLASTIC DIP



Dimensions	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



**PACKAGE MECHANICAL DATA****8 PINS - PLASTIC MICROPACKAGE (SO)**

Dimensions	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.)					

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