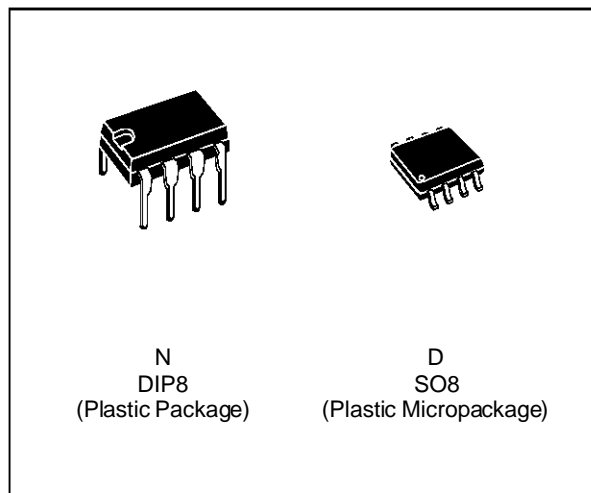


## LOW NOISE SINGLE J-FET OPERATIONAL AMPLIFIERS

- LOW POWER CONSUMPTION
- WIDE COMMON-MODE (UP TO  $V_{CC}^+$ ) AND DIFFERENTIAL VOLTAGE RANGE
- LOW INPUT BIAS AND OFFSET CURRENT
- LOW NOISE  $e_n = 15nV/\sqrt{Hz}$  (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 :  $16V/\mu s$  (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.

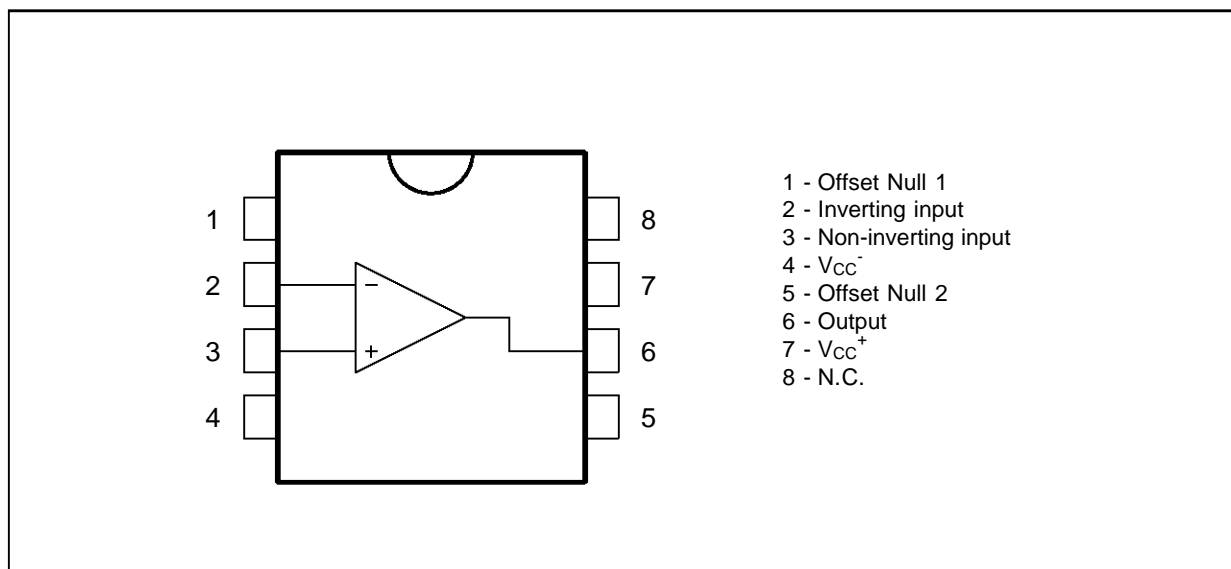
The devices feature high slew rates, low input bias and offset currents, and low offset voltage temperature coefficient.

### 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			

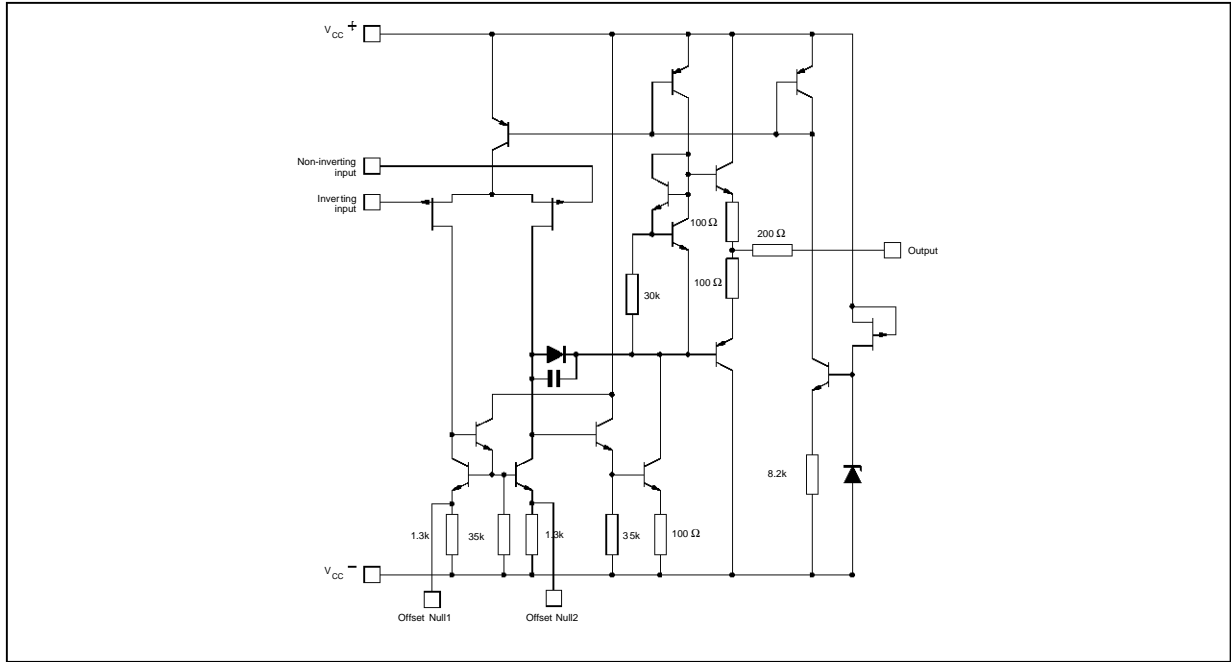
071-01.TEL

### PIN CONNECTIONS (top view)



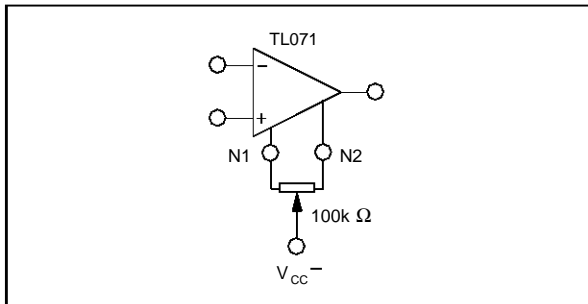
# TL071 - TL071A - TL071B

## SCHEMATIC DIAGRAM



071-Q2.EPS

## INPUT OFFSET VOLTAGE NULL CIRCUITS



071-Q4.EPS

## 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	$^{\circ}\text{C}$

071-Q2.TEL

- 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**

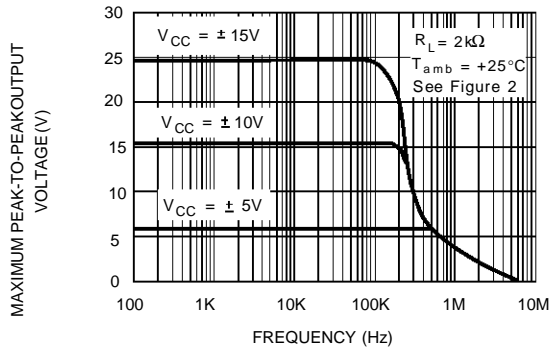
V<sub>CC</sub> = ±15V, T<sub>amb</sub> = 25°C (unless otherwise specified)

Symbol	Parameter	TL0711,M,AC,AI, AM,BC,BI,BM			TL071C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
V <sub>io</sub>	Input Offset Voltage (R <sub>S</sub> = 50Ω) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub> TL071BC,BI,BM TL071BC,BI,BM		3 1	6 3 7 5		3	10 13	mV
DV <sub>io</sub>	Input Offset Voltage Drift		10			10		μV/°C
I <sub>io</sub>	Input Offset Current * T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		5	100 4		5	100 10	pA nA
I <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 <sub>vd</sub>	Large Signal Voltage Gain (R <sub>L</sub> = 2kΩ, V <sub>O</sub> = ±10V) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	50 25	200		25 15	200		V/mV
SVR	Supply Voltage Rejection Ratio (R <sub>S</sub> = 50Ω) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	80 80	86		70 70	86		dB
I <sub>CC</sub>	Supply Current, no Load T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>		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 (R <sub>S</sub> = 50Ω) T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	80 80	86		70 70	86		dB
I <sub>os</sub>	Output Short-circuit Current T <sub>amb</sub> = 25°C T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub>	10 10	40	60 60	10 10	40	60 60	mA
±V <sub>OPP</sub>	Output Voltage Swing T <sub>amb</sub> = 25°C R <sub>L</sub> = 2kΩ R <sub>L</sub> = 10kΩ T <sub>min.</sub> ≤ T <sub>amb</sub> ≤ T <sub>max.</sub> R <sub>L</sub> = 2kΩ R <sub>L</sub> = 10kΩ	10 12 10 12	12 13.5		10 12 10 12	12 13.5		V
SR	Slew Rate (V <sub>in</sub> = 10V, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, unity gain)	8	16		8	16		V/μs
t <sub>r</sub>	Rise Time (V <sub>in</sub> = 20mV, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, unity gain)		0.1			0.1		μs
K <sub>OV</sub>	Overshoot (V <sub>in</sub> = 20mV, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, unity gain)		10			10		%
GBP	Gain Bandwidth Product (f = 100kHz, T <sub>amb</sub> = 25°C, V <sub>in</sub> = 10mV, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF)	2.5	4		2.5	4		MHz
R <sub>i</sub>	Input Resistance		10 <sup>12</sup>			10 <sup>12</sup>		Ω
THD	Total Harmonic Distortion (f = 1kHz, A <sub>V</sub> = 20dB, R <sub>L</sub> = 2kΩ, C <sub>L</sub> = 100pF, T <sub>amb</sub> = 25°C, V <sub>O</sub> = 2V <sub>PP</sub> )		0.01			0.01		%
e <sub>n</sub>	Equivalent Input Noise Voltage (f = 1kHz, R <sub>S</sub> = 100Ω)		15			15		$\frac{nV}{\sqrt{Hz}}$
∅ <sub>m</sub>	Phase Margin		45			45		Degrees

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

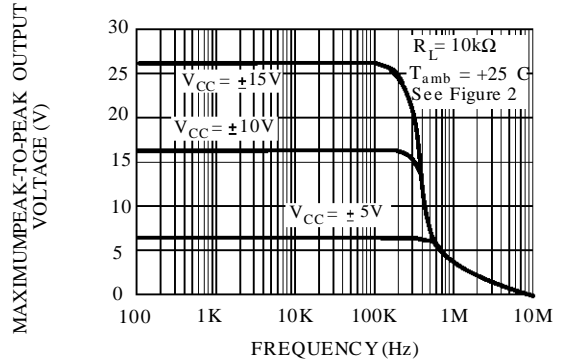
071-02 TEL

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



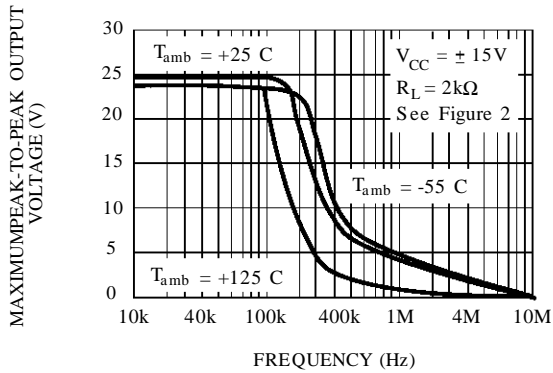
071-05.EPS

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



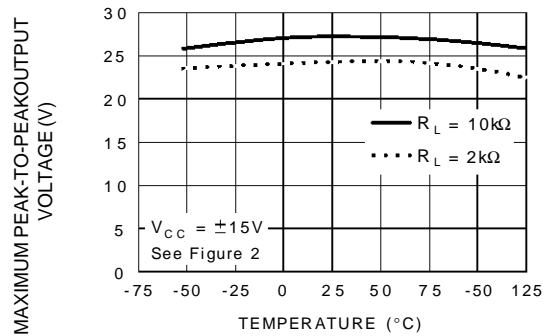
071-06.EPS

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



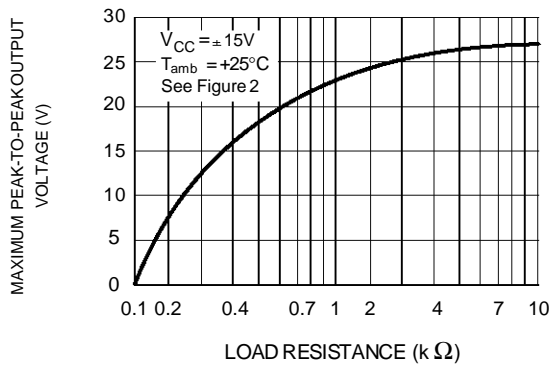
071-07.EPS

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



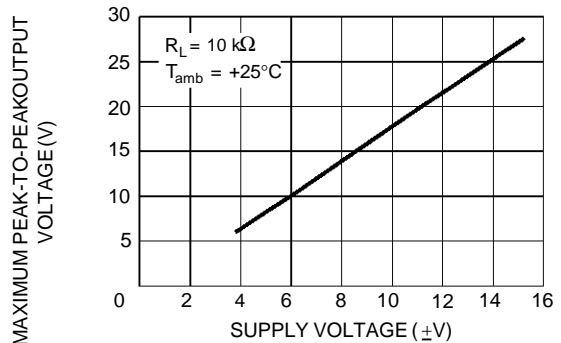
071-08.EPS

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



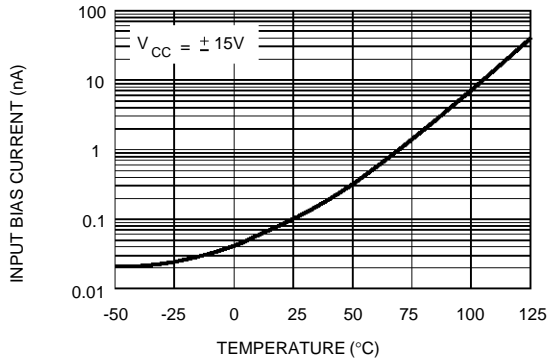
071-09.EPS

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



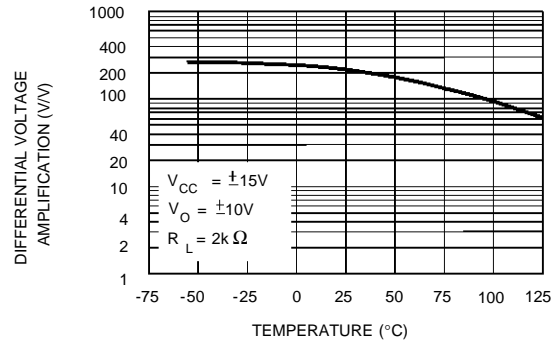
071-10.EPS

**INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE**



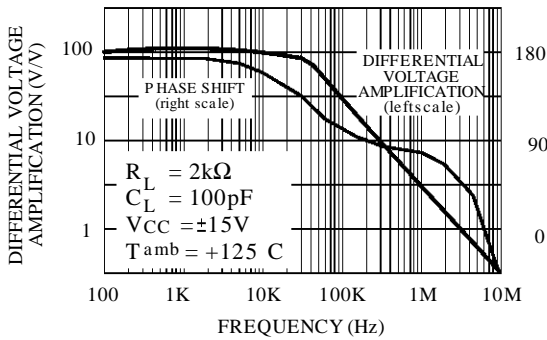
071-11.EPS

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



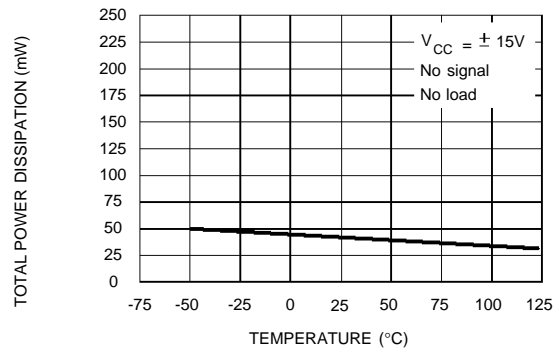
071-12.EPS

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



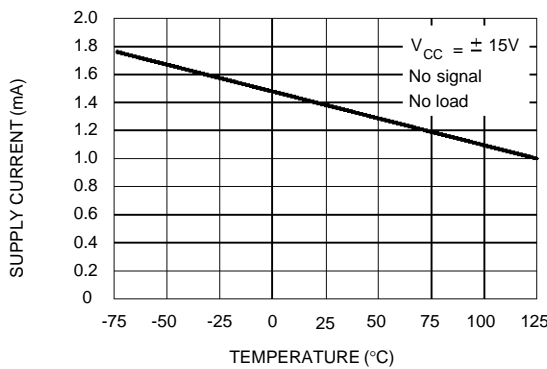
071-13.EPS

**TOTAL POWER DISSIPATION VERSUS FREE AIR TEMPERATURE**



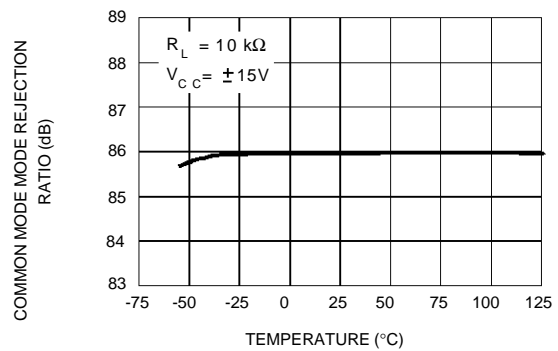
071-14.EPS

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



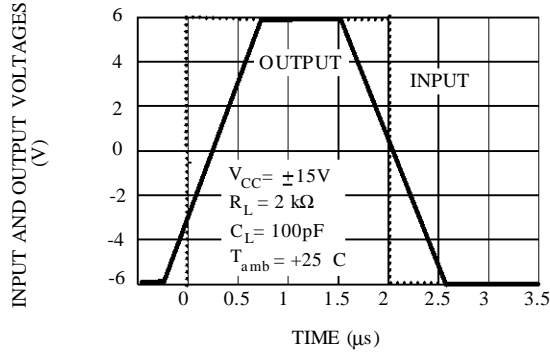
071-15.EPS

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



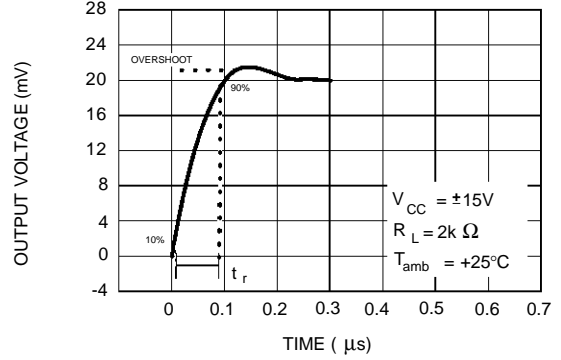
071-16.EPS

VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE



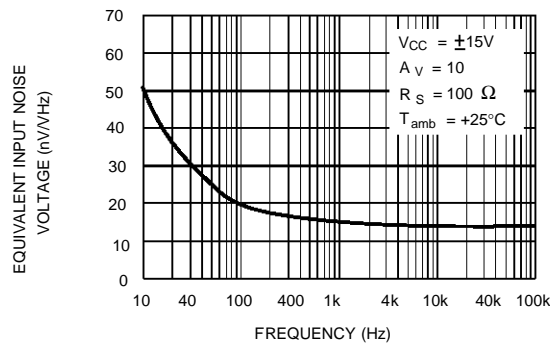
071-17.EPS

OUTPUT VOLTAGE VERSUS ELAPSED TIME



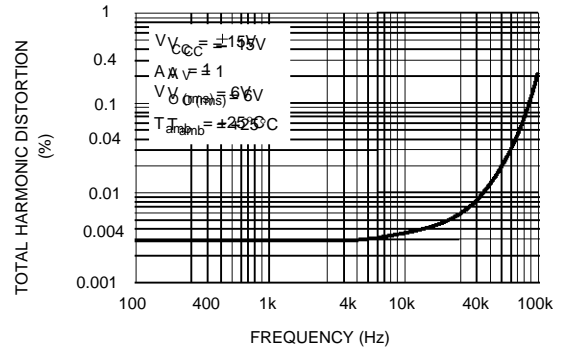
071-18.EPS

EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY



071-18.EPS

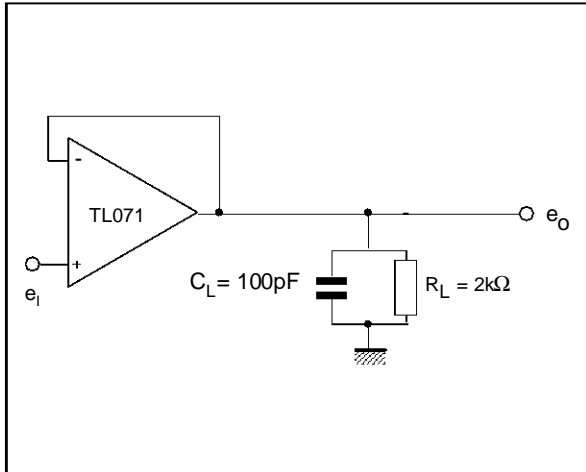
TOTAL HARMONIC DISTORTION VERSUS FREQUENCY



071-20.EPS

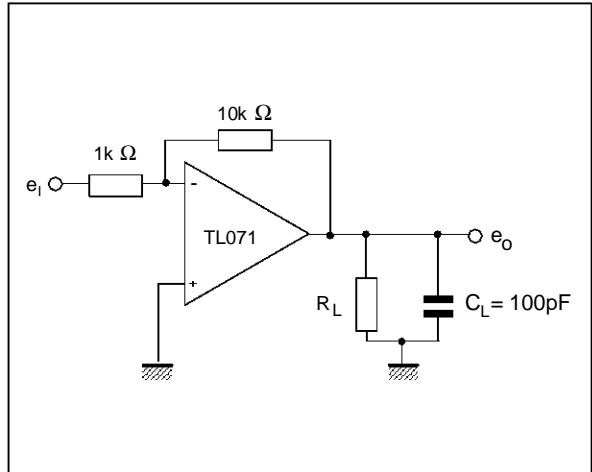
PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage Follower



071-21.EPS

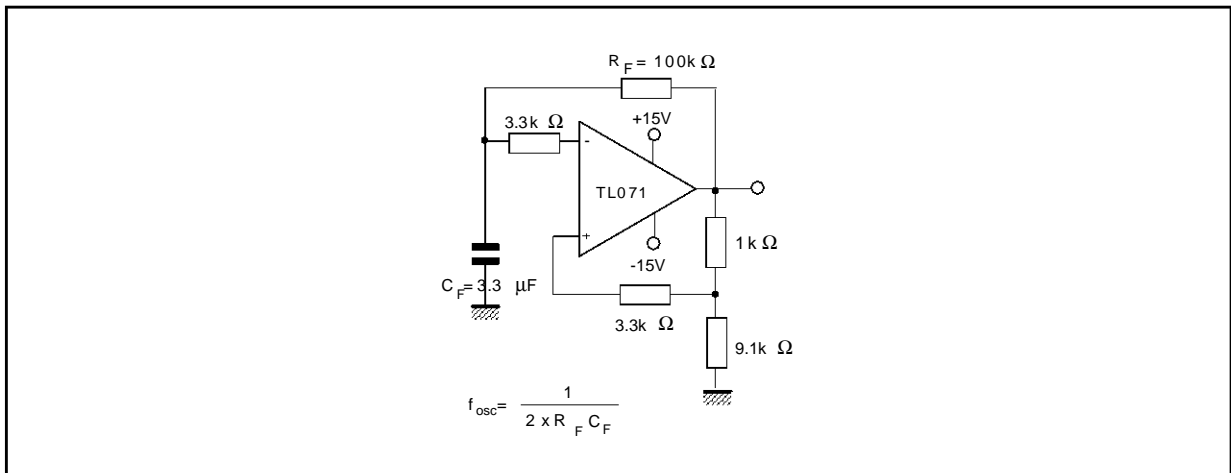
Figure 2 : Gain-of-10 Inverting Amplifier



071-22.EPS

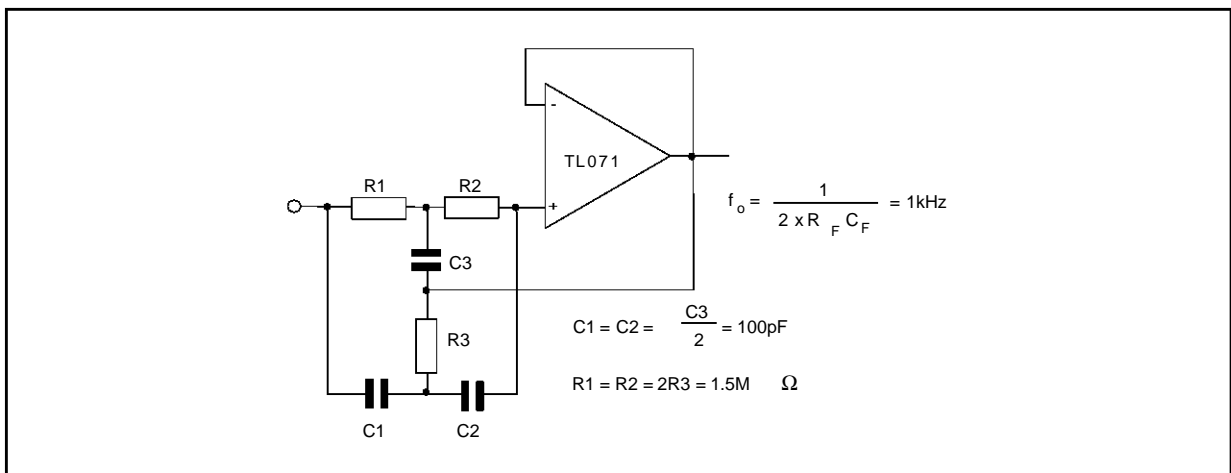
TYPICAL APPLICATIONS

(0.5Hz) SQUARE WAVE OSCILLATOR



071-23.EPS

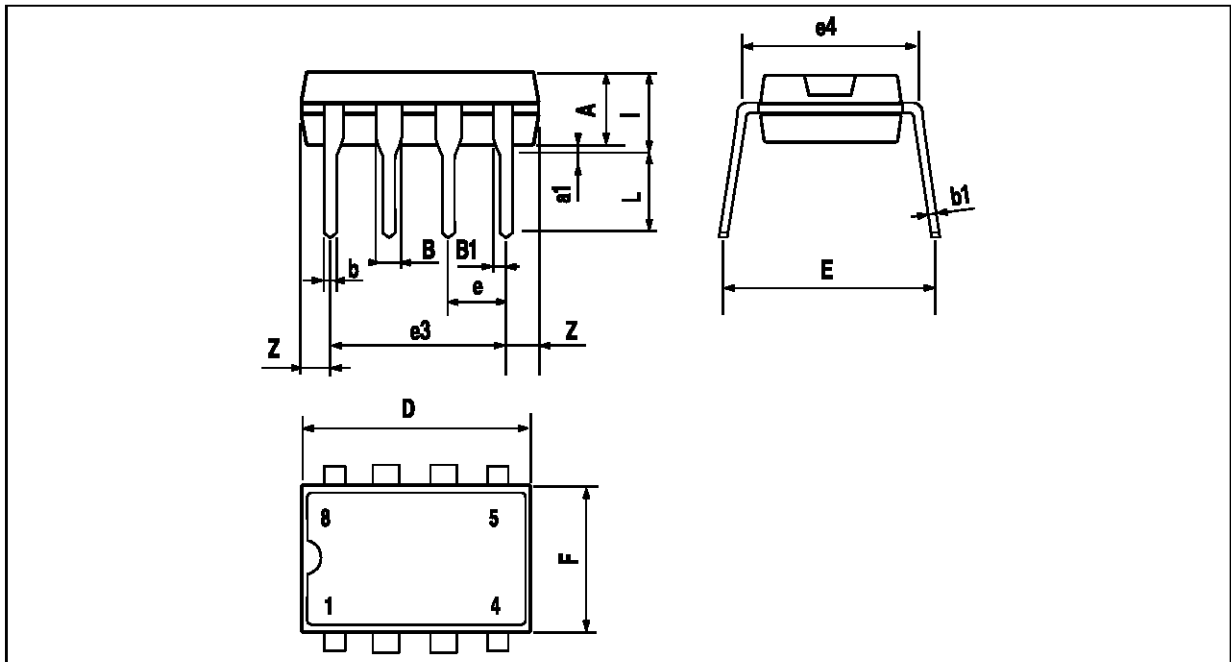
HIGH Q NOTCH FILTER



071-24.EPS

**TL071 - TL071A - TL071B**

**PACKAGE MECHANICAL DATA**  
8 PINS - PLASTIC DIP



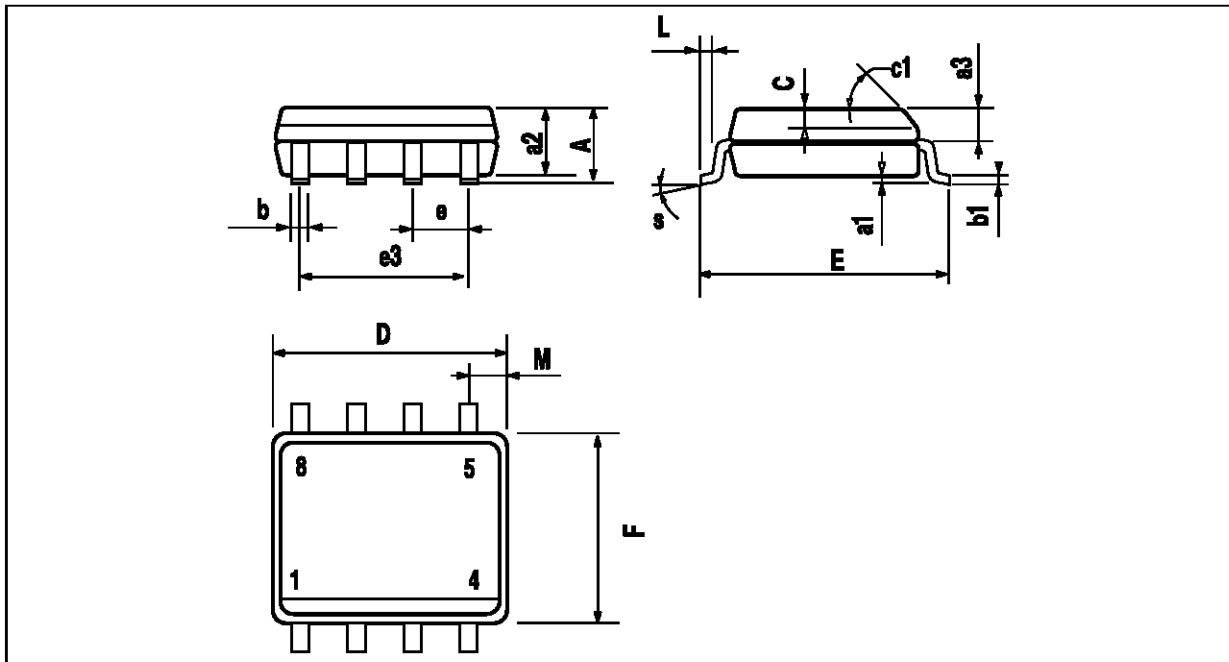
PM-DIP&EFS

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

DIP&TEL



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



PM-SO8-EPS

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.)					

0  
7  
1

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