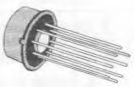
SGS-THOMSON MICROELECTRONICS

TL061
TL061A-TL061B

LOW POWER J–FET INPUT SINGLE OP–AMPs

- VERY LOW POWER CONSUMPTION
- WIDE COMMON-MODE AND DIFFERENTIAL VOLTAGE RANGES
- LOW INPUT BIAS AND OFFSET CURRENTS
- TYPICAL SUPPLY CURRENT : 200 µA
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J–FET INPUT STAGE
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE : 3.5 V/µs (typ)

N
DIP8
(Plastic package)



H
TO-99
(Metal can)

D
SO8
(Plastic micropackage)

GC
LCC20
(Tricecop LCC)

ORDER CODES

Part Number	Temperature Range	Package			
		N	D	H	GC
TL061M	– 55 °C to + 125 °C			•	•
TL061I	– 40 °C to + 105 °C	•	•		
TL061C	0 °C to + 70 °C	•	•		
TL061AC	0 °C to + 70 °C	•	•		
TL061BC	0 °C to + 70 °C	•	•		

Note : Hi-Rel Versions Available
Examples : TI061MH. TL061IN

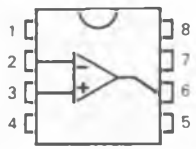
DESCRIPTION

The TL061, TL061A and TL061B are high speed J–FET input single operational amplifier family. Each of these J–FET input operational amplifiers incorporates 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.

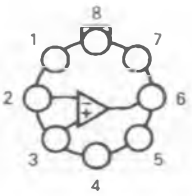
PIN CONNECTIONS (Top views)

DIP8
SO8



5 - Balance
6 - Output
7 - V_{CC}^{-}
8 - NC

TO-99



1 - Balance
2 - Inverting input
3 - Non-inverting input
4 - V_{CC}^{-}

LCC20

1 - NC
2 - Balance
3 - NC
4 - NC
5 - Inverting input
6 - NC
7 - Non-inverting input
8 - NC
9 - NC
10 - V_{CC}^{-}
11 - NC
12 - Balance
13 - NC
14 - NC
15 - Output
16 - NC
17 - V_{CC}^{+}
18 - NC
19 - NC
20 - NC

MAXIMUM RATINGS

Symbol	Parameter	TL061M	TL061I	TL061C	Unit
V_{CC}	Supply Voltage (note 1)	± 18	± 18	± 18	V
V_{ID}	Differential Input Voltage (note 2)	± 30	± 30	± 30	V
V_i	Input Voltage (note 3)	± 15	± 15	± 15	V
	Output Short-circuit Duration (note 4)	Indefinite	Indefinite	Indefinite	
P_{tot}	Power Dissipation (note 5)	680	680	680	mW
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	− 65 to + 150	− 65 to + 150	°C

* Devices bonded on a 6 cm x 0.15 cm glass epoxy substrate with 30 mm² of 35 µm thick copper.

Notes : 1. All voltage values, except differential voltages, 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}^-.

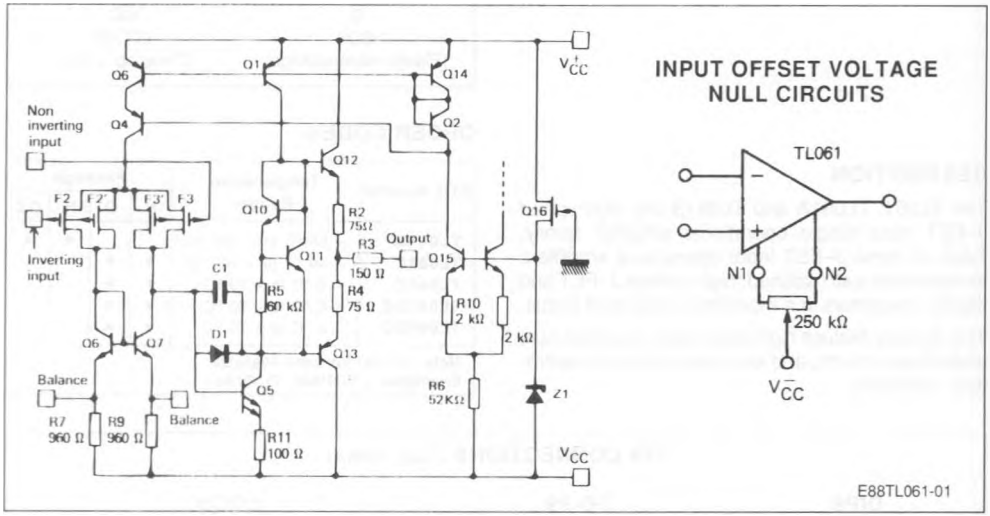
2. Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.

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 exceed.

5. For operation above + 25 °C free-air temperature, refer to dissipation derating table.

SCHEMATIC DIAGRAM



Case	Balance	Inverting Input	Non-Inverting Input	V_{CC}^-	V_{CC}^+	Output	N.C.
DIP8 SO8 TO-99	1, 5	2	3	4	7	6	8
LCC20	2, 12	5	7	10	17	15	*

* **LCC20** : Other pins are not connected.

ELECTRICAL CHARACTERISTICS

TL061M : – 55 °C ≤ T_{amb} ≤ + 125 °C
TL061I : – 40 °C ≤ T_{amb} ≤ + 105 °C
TL061C : 0 °C ≤ T_{amb} ≤ + 70 °C
V_{CC} = ± 15V.
All characteristics are specified under open-loop conditions unless otherwise specified.

Symbol	Parameter	TL061M			TL061I			TL061C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage T_{amb} = + 25 °C, R_S = 50 Ω $T_{min} \le T_{amb} \le T_{max}$, R_S = 50 Ω		3	6 9		3	6 9		3	15 20	mV
αV_{IO}	Temperature Coefficient of Input Offset Voltage (R_S = 50 Ω)		10			10			10		µV/°C
I_{IO}	Input Offset Current * T_{amb} = + 25 °C $T_{min} \le T_{amb} \le T_{max}$		5	100 20		5	100 10		5	200 5	pA nA
I_{IB}	Input Bias Current * T_{amb} = + 25 °C $T_{min} \le T_{amb} \le T_{max}$		30	200 50		30	200 20		30	400 10	pA nA
V_i	Input Common-mode Voltage Range (T_{amb} = + 25 °C)	± 11	± 12		± 11.5	± 12		± 10	± 11		V
V_{OPP}	Output Voltage Swing : R_L = 10 KΩ, T_{amb} = + 25 °C R_L ≥ 10 KΩ, $T_{min} \le T_{amb} \le T_{max}$	20 20	27		20 20	27		20 20	27		V
A_{VD}	Large Signal Voltage Gain T_{amb} = + 25 °C, R_l > 10 KΩ, V_O = ± 10 V $T_{min} \le T_{amb} \le T_{max}$, R_L > 10 KΩ, V_O = ± 10 V	4 4	6		4 4	6		3 3	6		V/mV
GW_R	Small Signal Bandwidth (T_{amb} = + 25 °C, R_L = 10 KΩ)		1			1			1		MHz
R_I	Input Resistance (T_{amb} = + 25 °C)		10^{12}			10^{12}			10^{12}		Ω
CMR	Common-mode Rejection Ratio (R_S > 10 KΩ, T_{amb} = + 25 °C)	80	86		80	86		70	76		dB
SVR	Supply Voltage Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$) R_S > 10 KΩ, T_{amb} = + 25 °C	80	95		80	95		70	95		dB
I_{CC}	Supply Current (T_{amb} = + 25 °C, no load, no signal)		200	250		200	250		200	250	µA
P_D	Total Power Consumption (each amplifier) T_{amb} = + 25 °C, No load, no signal		6	7.5		6	7.5		6	7.5	mW

* Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as is possible.

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	TL061M			TL061I, C			Unit.
		Min.	Typ.	Max.	Min.	Typ.	Max.	
S_{VO}	Slew Rate (e_i = 10 V, R_L = 10 KΩ, C_L = 100 pF, A_V = 1)	2	3.5			3.5		V/µs
t_r	Rise Time (e_i = 20 mV, R_L = 10 KΩ, C_L = 100 pF, A_V = 1) (see fig. 1)		0.2			0.2		µs
K_{OV}	Overshoot Factor (e_i = 20 mV, R_L = 10 KΩ, C_L = 100 pF, A_V = 1) (see fig. 1)		10			10		%
Vn	Equivalent Input Noise Voltage (R_S = 100 KΩ, f = 1 KHz)		42			42		nV/√Hz

ELECTRICAL CHARACTERISTICS

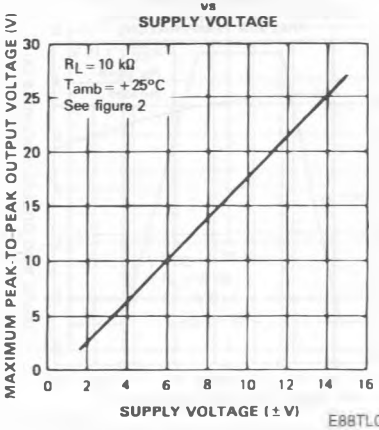
TL061C : $0\ °C \leq T_{amb} \leq +70\ °C$
$V_{CC} = \pm 15V$
All characteristics are specified under open-loop conditions unless otherwise specified.

Symbol	Parameter	TL061C			TL061AC			TL061BC			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage $T_{amb} = +25\ °C$, $R_S = 50\ \Omega$ $T_{min} \leq T_{amb} \leq T_{max}$, $R_S = 50\ \Omega$		3	15 20		3	6 7.5		2	3 5	mV
αV_{IO}	Temperature Coefficient of Input Offset Voltage ($R_S = 50\ \Omega$)		10			10			10		µV/°C
I_{IO}	Input Offset Current * $T_{amb} = +25\ °C$ $T_{min} \leq T_{amb} \leq T_{max}$		5	200 5		5	100 3		5	100 3	pA nA
I_{IB}	Input Bias Current * $T_{amb} = +25\ °C$ $T_{min} \leq T_{amb} \leq T_{max}$		30	400 10		30	200 7		30	200 7	pA nA
V_I	Input Common-mode Voltage Range	± 10	± 11		± 11.5	± 12		±11.5	± 12		V
V_{OPP}	Output Voltage Swing : $R_L = 10\ K\Omega$, $T_{amb} = +25\ °C$ $R_L \geq 10\ K\Omega$, $T_{min} \leq T_{amb} \leq T_{max}$	20 20	27		20 20	27		20 20	27		V
A_{VD}	Large Signal Voltage Gain $T_{amb} = +25\ °C$, $R_l \geq 10\ K\Omega$, $V_O = \pm 10\ V$ $T_{min} \leq T_{amb} \leq T_{max}$	3 3	6		4 4	6		4 4	6		V/mV
GW_R	Small Signal Bandwidth ($T_{amb} = +25\ °C$, $R_L = 10\ K\Omega$)		1			1			1		MHz
R_i	Input Resistance ($T_{amb} = +25\ °C$)		10^{12}			10^{12}			10^{12}		Ω
CMR	Common-mode Rejection Ratio ($R_S \geq 10\ K\Omega$; $T_{amb} = +25\ °C$)	70	76		80	86		80	86		dB
SVR	Supply Voltage Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$) $R_S \geq 10\ K\Omega$, $T_{amb} = +25\ °C$	70	95		80	95		80	95		dB
I_{CC}	Supply Current ($T_{amb} = +25\ °C$, no load, no signal)		200	250		200	250		200	250	µA
P_D	Total Power Consumption (each amplifier) $T_{amb} = +25\ °C$, no load, no signal		6	7.5		6	7.5		6	7.5	mW

* Input bias currents of a FET-input operational amplifier are normal junction reverse currents, which are temperature sensitive. Pulse techniques must be used that will maintain the junction temperature as close to the ambient temperature as is possible.

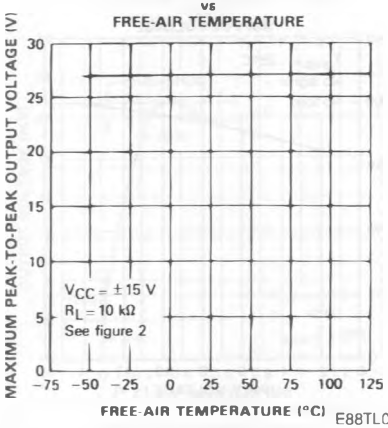
TYPICAL CHARACTERISTICS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE



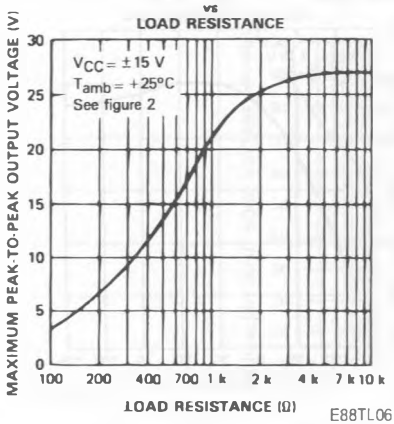
E88TL061-02

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE



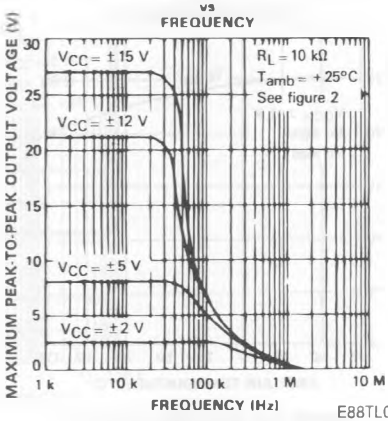
E88TL061-03

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE



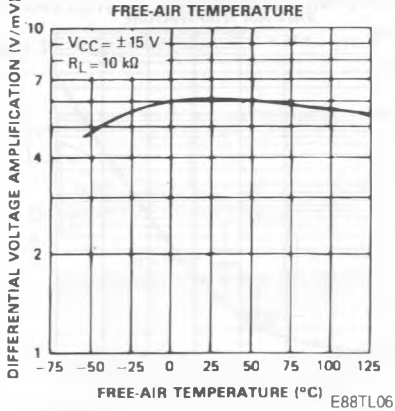
E88TL061-04

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE vs FREQUENCY



E88TL061-05

DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE



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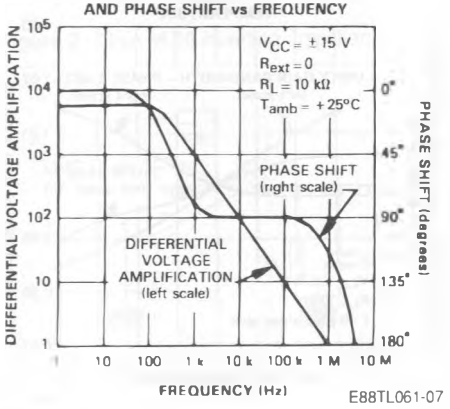
LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT vs FREQUENCY



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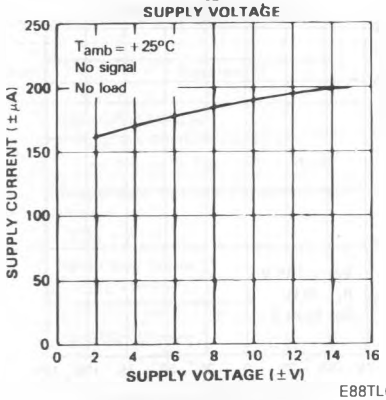
TYPICAL CHARACTERISTICS (continued)

SUPPLY CURRENT PER AMPLIFIER
vs
SUPPLY VOLTAGE



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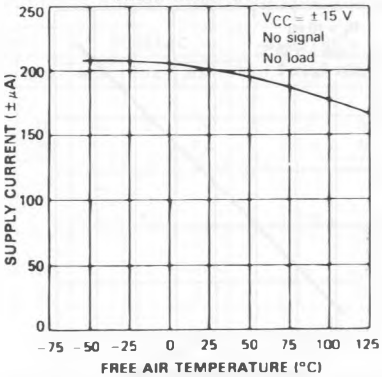
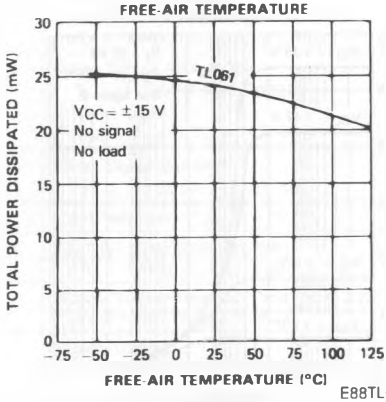
SUPPLY CURRENT PER AMPLIFIER
vs
FREE-AIR TEMPERATURE



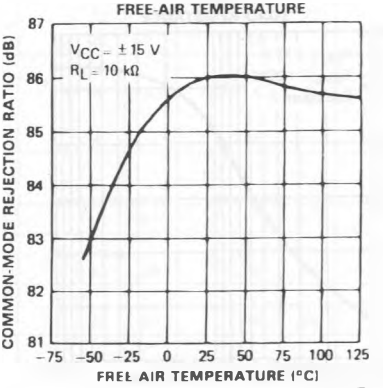
E88TL061-09

TOTAL POWER DISSIPATED
vs
FREE-AIR TEMPERATURE



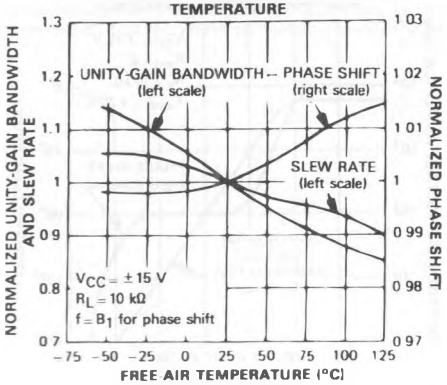
E88TL061-10

COMMON MODE REJECTION RATIO
vs
FREE-AIR TEMPERATURE



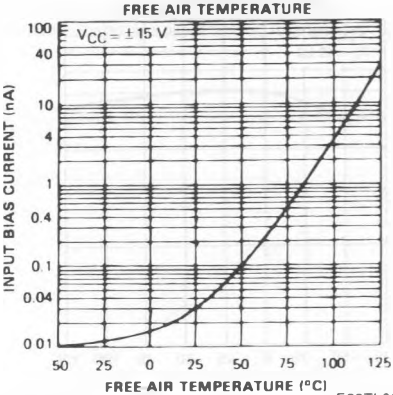
E88TL061-11

NORMALIZED UNITY-GAIN BANDWIDTH
SLEW RATE, AND PHASE SHIFT
vs
TEMPERATURE



E88TL061-12

INPUT BIAS CURRENT
vs
FREE AIR TEMPERATURE



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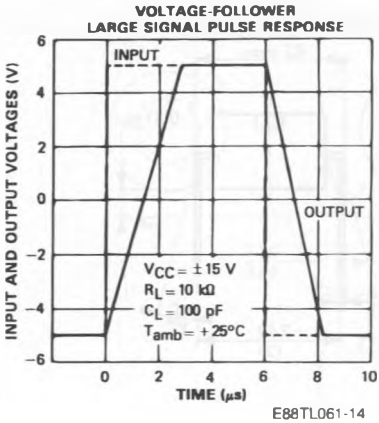
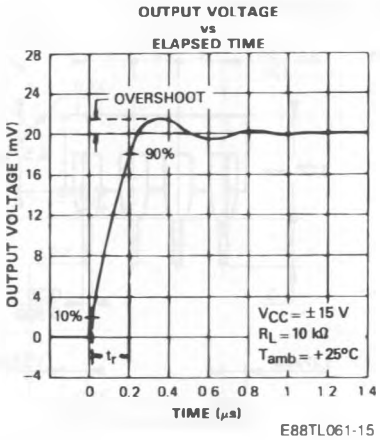
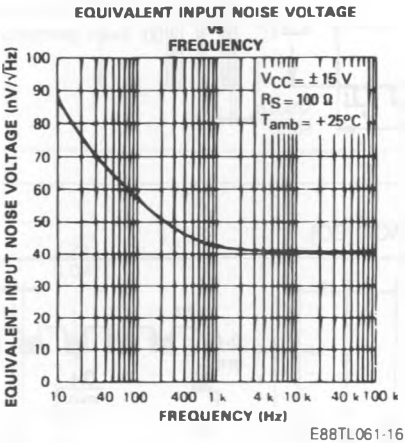
TYPICAL CHARACTERISTICS (continued)







PARAMETER MEASUREMENT INFORMATION

Figure 1 : Voltage follower.

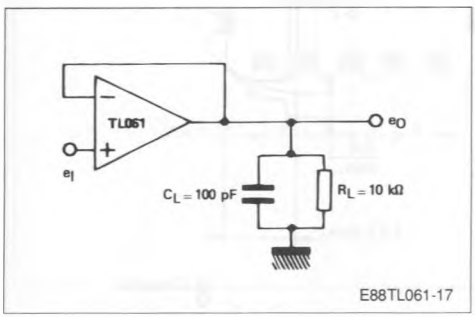
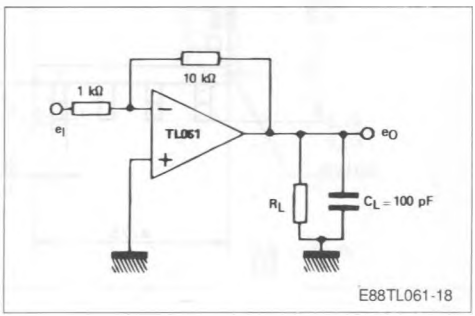
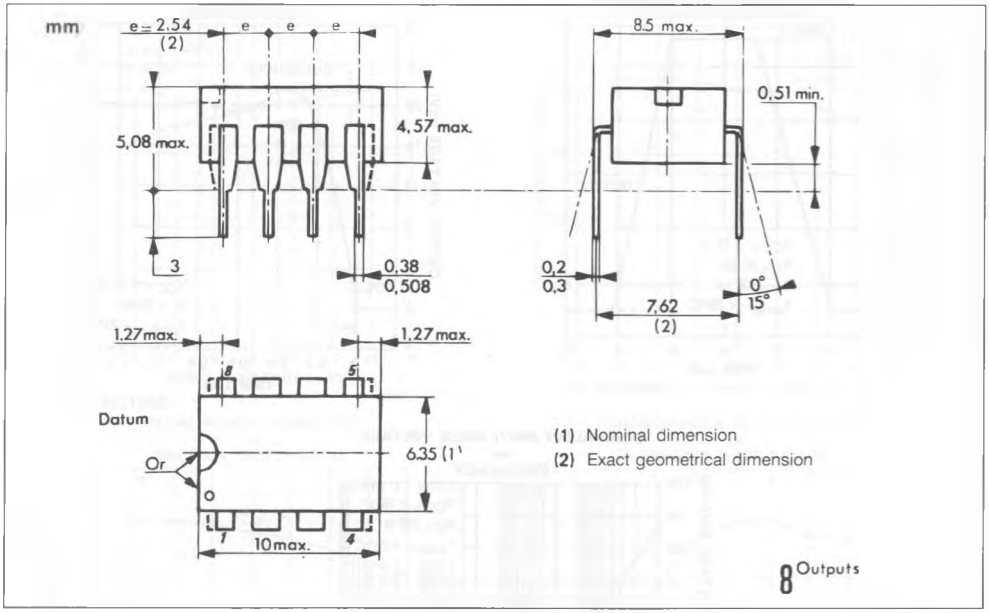


Figure 2 : Gain-of-10 inverting amplifier.

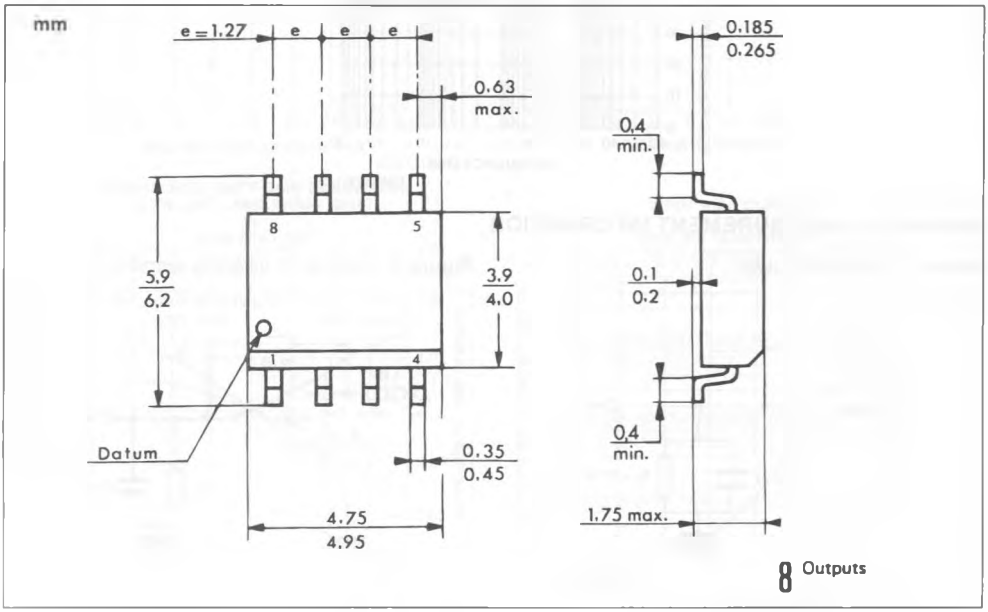


PACKAGE MECHANICAL DATA

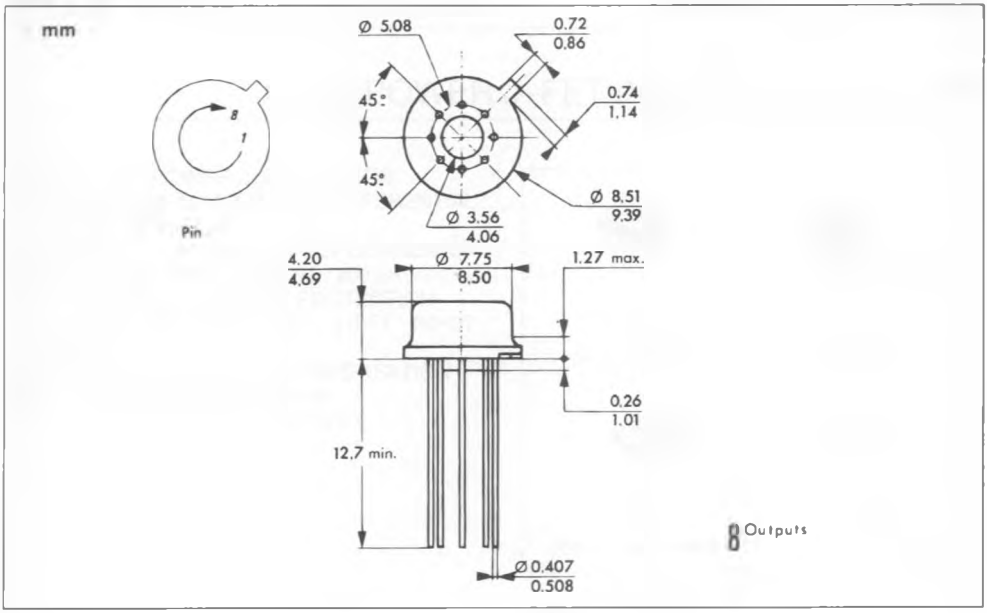
8 PINS – PLASTIC DIP



8 PINS – PLASTIC MICROPACKAGE (SO)



TO-99 – METAL CAN



20 PINS – TRICECOP (LCC)