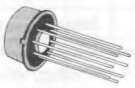
SGS-THOMSON MICROELECTRONICS

TL062
TL062A-TL062B

LOW POWER J–FET INPUT DUAL 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)

DESCRIPTION

The TL062, TL062A and TL062B are high speed J–FET input dual 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 rate, low input bias and offset currents, and low offset voltage temperature coefficient.

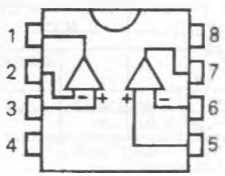
ORDER CODES

Part Number	Temperature Range	Package			
		N	H	D	GC
TL062M	– 55 °C to + 125 °C		•		•
TL062I	– 40 °C to + 105 °C	•		•	
TL062C	0 °C to + 70 °C	•		•	
TL062AC	0 °C to + 70 °C	•		•	
TL062BC	0 °C to + 70 °C	•		•	

Note : Hi-Rel versions available
Examples : TL062 MH, TL062 CN

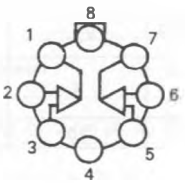
PIN CONNECTIONS (Top views)

DIP8
SO8



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

TO-99



5 - Non-inverting input 2
6 - Inverting input 2
7 - Output 2
8 - V_{CC}^+

LCC20

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

MAXIMUM RATINGS

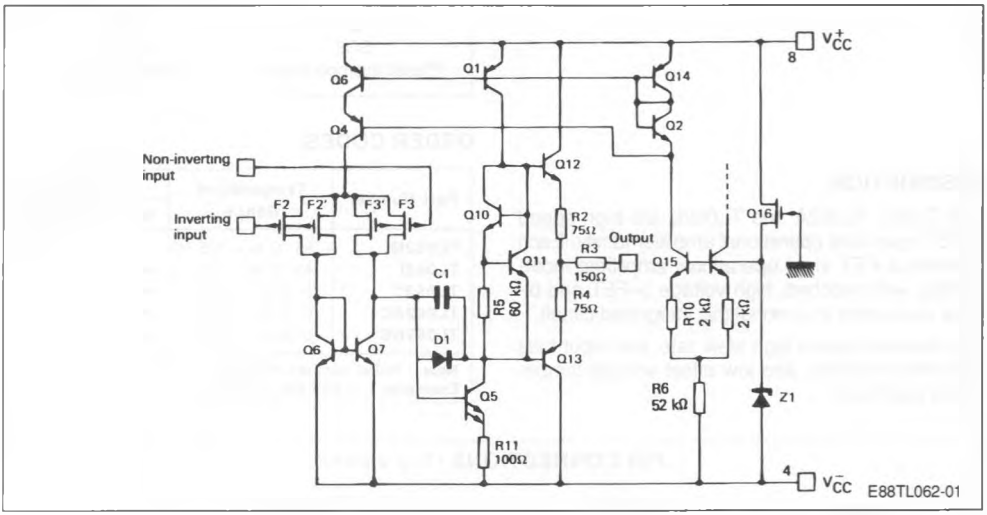
Symbol	Parameter	TL064M	TL064I	TL064C	Unit
V_{CC}	Supply Voltage (note 1)	± 18	± 18	± 18	V
P_{tot}	Power Dissipation (note 5)	680	680	680	mW
V_{ID}	Differential Input Voltage (note 2)	± 30	± 30	± 30	V
V_I	Input Voltage (note 3)	± 15	± 15	± 15	V
	Ouput Short-circuit Duration (note 4)	Indefinite	Indefinite	Indefinite	
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 mm^2 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 1/2 TL062



Case	Outputs	Inverting Inputs	Non-inverting Inputs	V_{cc}^-	V_{cc}^+	N.C.
DIP8 SO8 TO-99	1, 7	2, 6	3, 5	4	8	
LCC20	2, 17	5, 15	7, 12	10	20	*

* LCC20 : Other pins are not connected

ELECTRICAL CHARACTERISTICS

TL062M : $-55\ ^{\circ}C \leq T_{amb} \leq +125\ ^{\circ}C$
TL062I : $-40\ ^{\circ}C \leq T_{amb} \leq +105\ ^{\circ}C$
TL062C : $0\ ^{\circ}C \leq T_{amb} \leq +70\ ^{\circ}C$
$V_{CC} = \pm 15V$.
All characteristics are specified under open-loop conditions unless otherwise specified.

Symbol	Parameter	TL062M			TL062I			TL062C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage ($R_S = 50\ \Omega$) $T_{amb} = +25\ ^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		3	6 15		3	6 9		3	15 20	mV
αV_{IO}	Temperature Coefficient of Input Offset Voltage $R_S = 50\ \Omega$		10			10			10		µV/°C
I_{IO}	Input Offset Current * $T_{amb} = +25\ ^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		5	100 20		5	100 10		5	200 5	pA nA
I_{IB}	Input Bias Current * $T_{amb} = +25\ ^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$		30	200 50		30	200 20		30	400 10	pA nA
V_I	Input Common-mode Voltage Range $T_{amb} = +25\ ^{\circ}C$	±11	±12		±11.5	±12		±10	±11		V
V_{OPP}	Output Voltage Swing $T_{amb} = +25\ ^{\circ}C$, $R_L = 10\ K\Omega$ $T_{min} \leq T_{amb} \leq T_{max}$, $R_L \geq 10\ K\Omega$	20 20	27		20 20	27		20 20	27		V
A_{VD}	Large Signal Voltage Gain ($R_L \geq 10\ K\Omega$, $V_O = \pm 10\ V$) $T_{amb} = +25\ ^{\circ}C$ $T_{min} \leq T_{amb} \leq T_{max}$	4 4	6		4 4	6		3 3	6		V/mV
GW_R	Small Signal Bandwidth ($T_{amb} = +25\ ^{\circ}C$, $R_L = 10\ K\Omega$)		1			1			1		MHz
R_I	Input Resistance ($T_{amb} = +25\ ^{\circ}C$)		10^{12}			10^{12}			10^{12}		Ω
CMR	Common-mode Rejection Ratio $R_S \leq 10\ K\Omega$, $T_{amb} = +25\ ^{\circ}C$	80	86		80	86		70	76		dB
SVR	Supply Voltage Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$) $R_S \leq 10\ K\Omega$, $T_{amb} = +25\ ^{\circ}C$	80	95		80	95		70	95		dB
I_{CC}	Supply Current (Per Amplifier) $T_{amb} = +25\ ^{\circ}C$, No Load, No Signal		200	250		200	250		200	250	µA
V_{O1}/V_{O2}	Channel Separation ($A_{VD} = 100$, $T_{amb} = +25\ ^{\circ}C$)		120			120			120		mW
P_D	Total Power Consumption (Each Amplifier) No Load, No Signal $T_{amb} = +25\ ^{\circ}C$		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 closes to the ambient temeprature as is possible.

ELECTRICAL CHARACTERISTICS

$V_{CC} = \pm 15V$, $T_{amb} = +25\ ^{\circ}C$.

Symbol	Parameter	TL062M			TL062I, C			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	
S_{VO}	Slew Rate ($e_I = 10\ V$, $R_L = 10\ K\Omega$, $C_L = 100\ pF$, $A_V = 1$)	2	3.5			3.5		V/µs
t_r	Rise Time ($e_I = 20\ mV$, $R_L = 10\ K\Omega$, $C_L = 100\ pF$, $A_V = 1$) (See Fig. 1)		0.2			0.2		µs
K_{OV}	Overshoot Factor ($e_I = 20\ mV$, $R_L = 10\ K\Omega$, $C_L = 100\ pF$, $A_V = 1\ V$) (See Fig. 1)		10			10		%
Vn	Equivalent Input Noise Voltage ($R_S = 100\ K\Omega$, f = 1 KHz)		42			42		$nV/\sqrt{Hz}$

ELECTRICAL CHARACTERISTICS

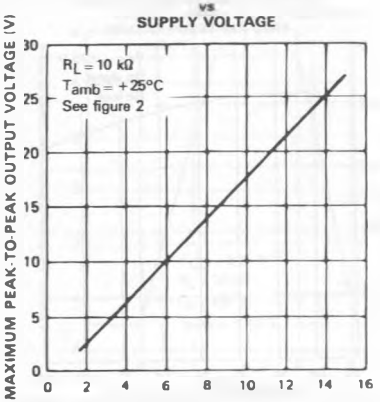
TL062C : 0 °C ≤ Tamb≤ + 70 °C
V_{CC} = ± 15V
All characteristics are specified under open-loop conditions unless otherwise specified.

Symbol	Parameter	TL062C			TL062AC			TL062BC			Unit
		Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{IO}	Input Offset Voltage (R_S = 50 Ω) T_{amb} = + 25 °C $T_{min} \le T_{amb} \le T_{max}$		3	15 20		3	6 7.5		2	3 5	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	200 5		5	100 3		5	100 3	pA nA
I_{IB}	Input Bias Current * T_{amb} = + 25 °C $T_{min} \le T_{amb} \le T_{max}$		30	400 10		30	200 7		30	200 7	pA nA
V_I	Input Common-mode Voltage Range T_{amb} = + 25 °C	±10	±11		±11.5	±12		±11.5	±12		V
V_{OPP}	Output Voltage Swing 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 ($R_L \ge$ 10 KΩ, V_O = ± 10 V) T_{amb} = + 25 °C $T_{min} \le T_{amb} \le T_{max}$	3 3	6		4 4	6		4 4	6		V/mV
GW_R	Small Signal Bandwidth (T_{amb} = + 25 °C, R_L = 10 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 $R_S \le$ 10 KΩ, T_{amb} = + 25 °C	70	76		80	86		80	86		dB
SVR	Supply Voltage Rejection Ratio ($\Delta V_{CC}/\Delta V_{IO}$) $R_S \le$ 10 KΩ, T_{amb} = + 25 °C	70	95		80	95		80	95		dB
I_{CC}	Supply Current (Per Amplifier) T_{amb} = + 25 °C, No Load, No Signal		200	250		200	250		200	250	µA
V_{O1}/V_{O2}	Channel Separation (A_{VD} = 100, T_{amb} = + 25 °C)		120			120			120		dB
P_D	Total Power Consumption (Each Amplifier) No Load , No Signal T_{amb} = + 25 °C		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.

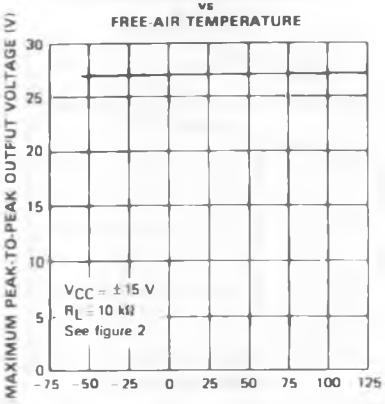
TYPICAL CHARACTERISTICS

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs SUPPLY VOLTAGE



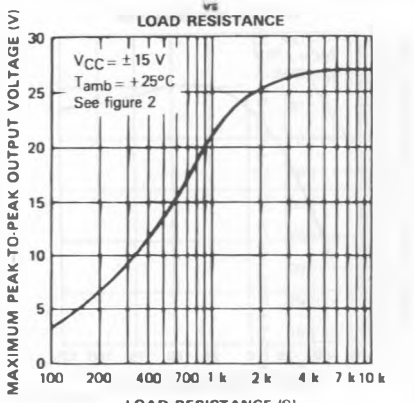
E88TL062-02

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE vs FREE-AIR TEMPERATURE



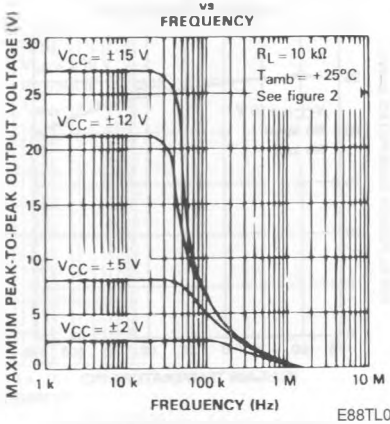
E88TL062-03

MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE vs LOAD RESISTANCE



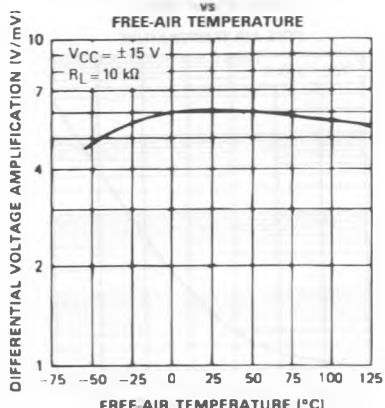
E88TL062-04

MAXIMUM PEAK TO PEAK OUTPUT VOLTAGE vs FREQUENCY



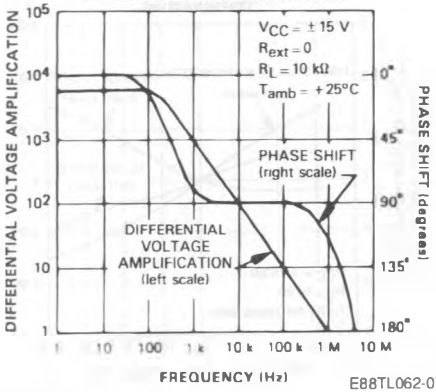
E88TL062-05

DIFFERENTIAL VOLTAGE AMPLIFICATION vs FREE-AIR TEMPERATURE



E88TL062-06

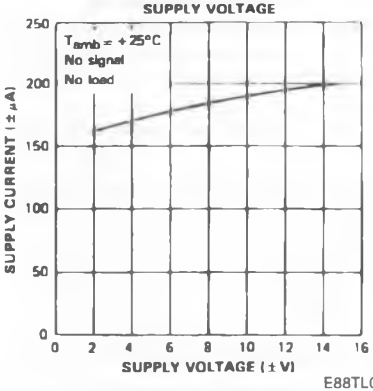
LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT vs FREQUENCY



E88TL062-07

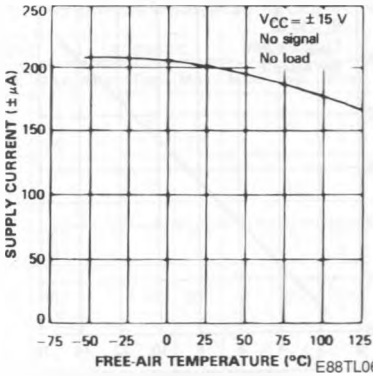
TYPICAL CHARACTERISTICS (continued)

SUPPLY CURRENT PER AMPLIFIER vs SUPPLY VOLTAGE



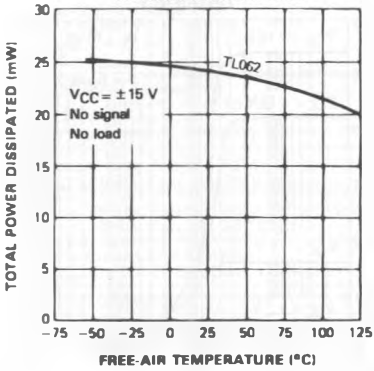
E88TL062-08

SUPPLY CURRENT PER AMPLIFIER vs FREE-AIR TEMPERATURE



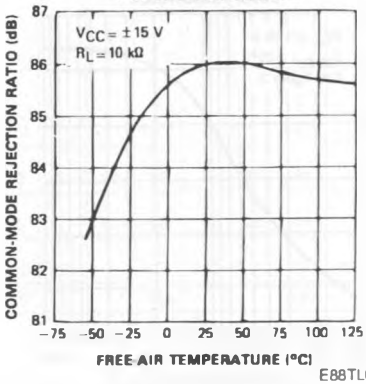
E88TL062-09

TOTAL POWER DISSIPATED vs FREE-AIR TEMPERATURE



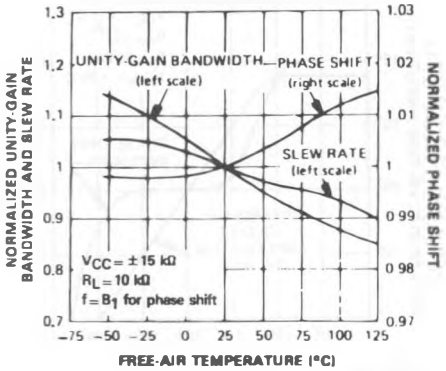
E88TL062-10

COMMON-MODE REJECTION RATIO vs FREE-AIR TEMPERATURE



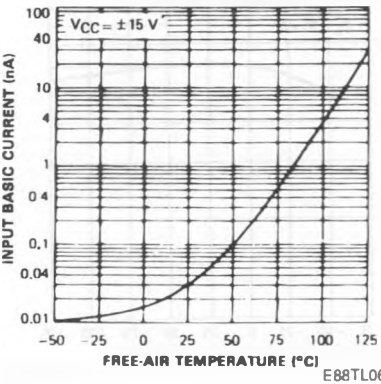
E88TL062-11

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



E88TL062-12

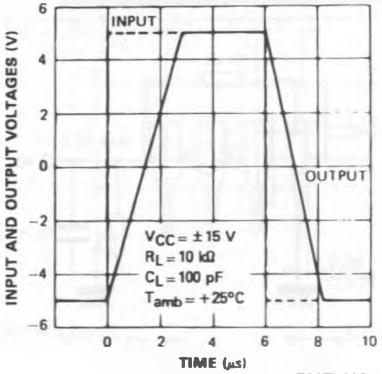
INPUT BIAS CURRENT vs FREE-AIR TEMPERATURE



E88TL062-13

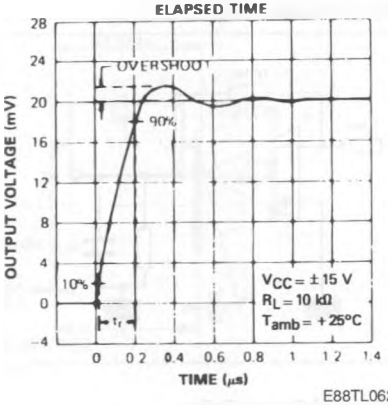
TYPICAL CHARACTERISTICS (continued)

VOLTAGE-FOLLOWER
LARGE SIGNAL PULSE RESPONSE



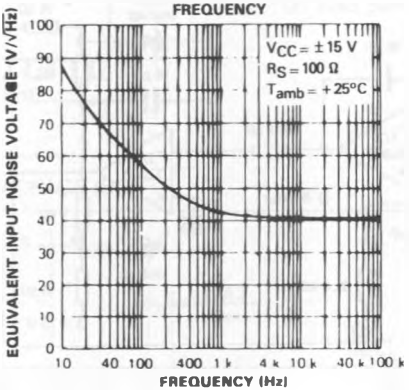
E88TL062-14

OUTPUT VOLTAGE
vs
ELAPSED TIME



E88TL062-15

EQUIVALENT INPUT NOISE VOLTAGE
vs
FREQUENCY



E88TL062-16

PARAMETER MEASUREMENT INFORMATION
TEST CIRCUITS

Figure 1 : Voltage follower.

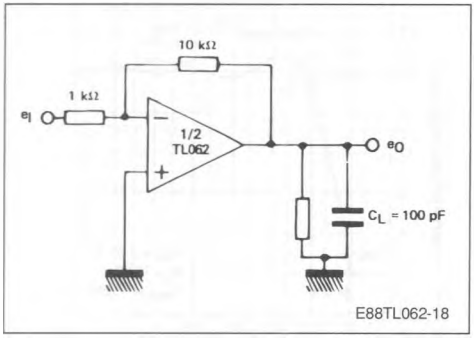
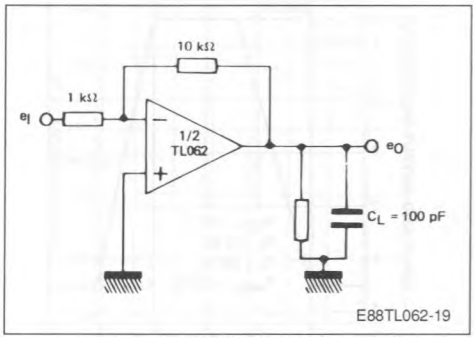
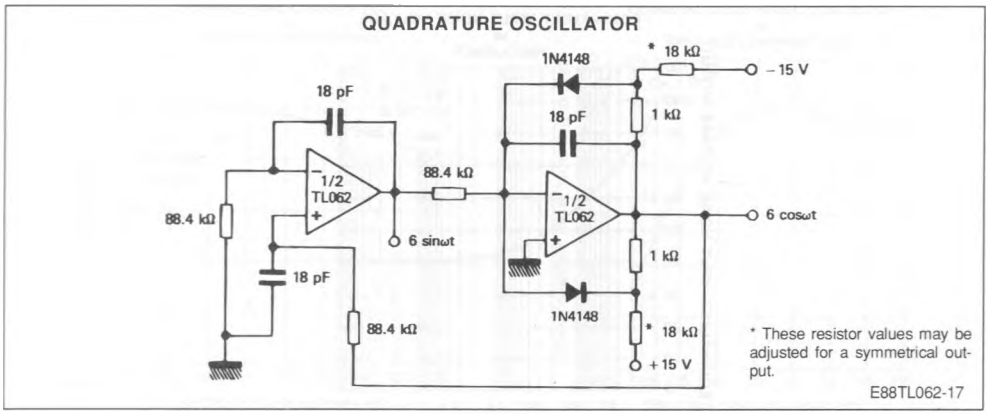


Figure 2 : Gain-of-10 inverting amplifier.

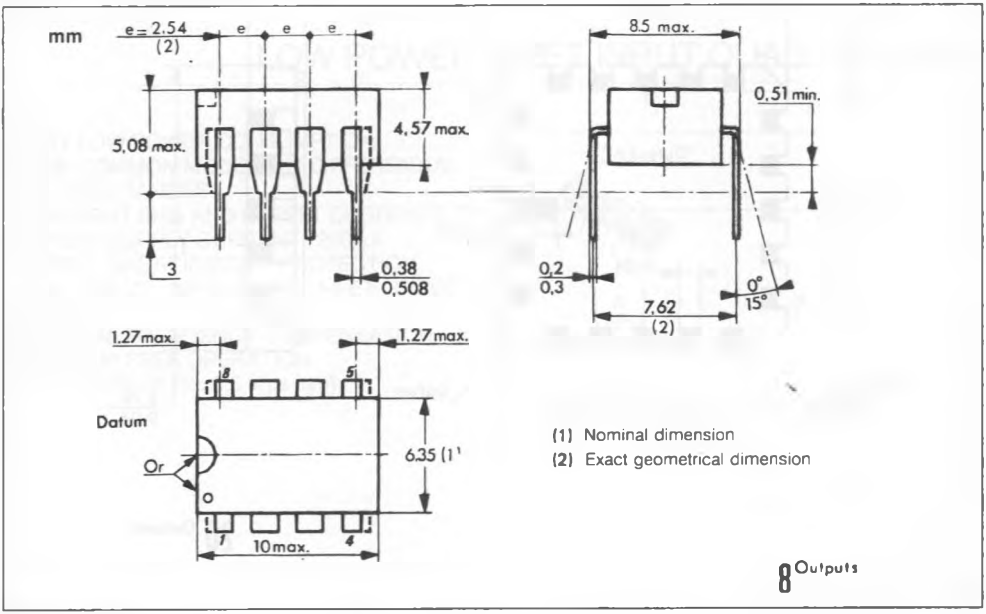


TYPICAL APPLICATION

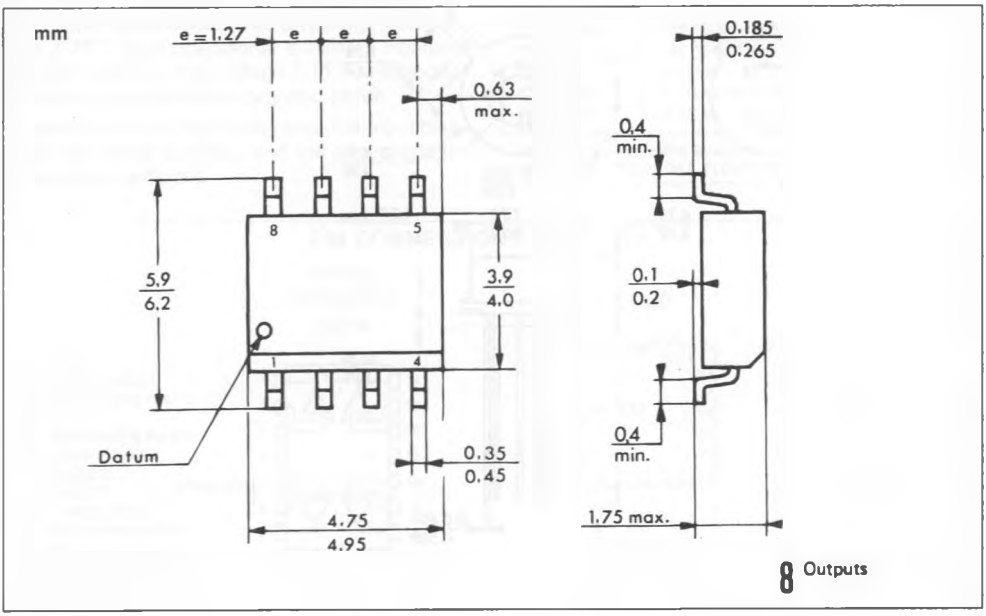


PACKAGE MECHANICAL DATA

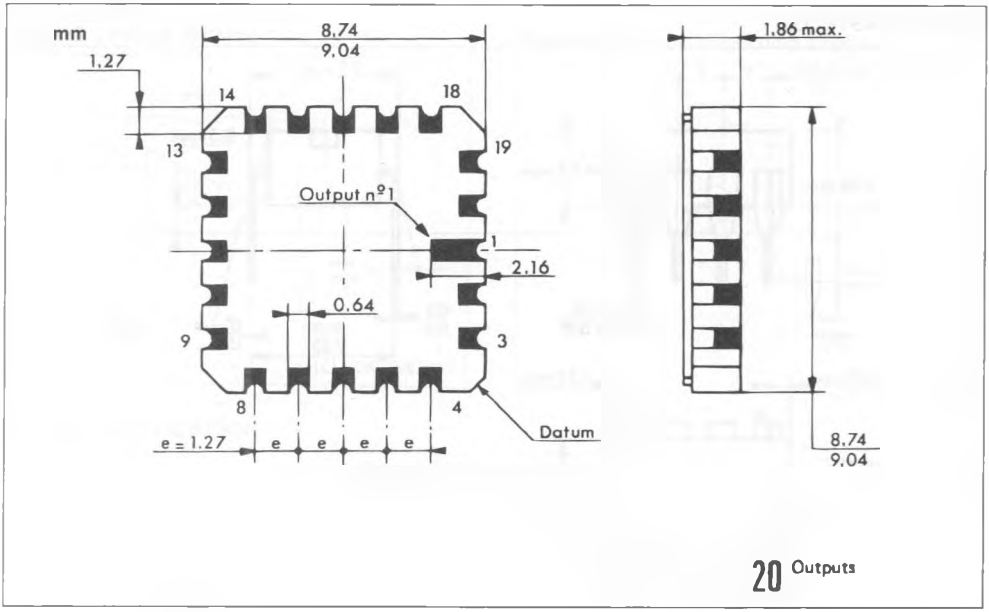
8 PINS– PLASTIC DIP



8 PINS – PLASTIC MICROPACKAGE (SO)



20 PINS – TRICECOP (LCC)



TO-99 – METAL CAN