

THOMSON SEMICONDUCTORS

TL074
TL074A
TL074B

LOW NOISE J-FET INPUT QUAD OP-AMPS

The TL074, TL074A and TL074B are high speed J-FET input quad 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.

- Low power consumption
- Wide common-mode and differential voltage range
- Low input bias and offset current
- Low noise $V_n = 18 \text{ nV}/\sqrt{\text{Hz}}(\text{typ})$
- 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 : 13 V/ μs (typ)

ORDERING INFORMATION

Hi-Rel versions available - Consult our LINEAR data book.

PART NUMBER	TEMPERATURE RANGE	PACKAGE			
		DP	DG	FP	GC
TL074M	-55°C to +125°C				●
TL074I	-25°C to + 85°C	●			
TL074C	0°C to + 70°C	●		●	
TL074AC	0°C to + 70°C	●			
TL074BC	0°C to + 70°C	●			

Examples : TL074MDG, TL074IDP

LOW NOISE J-FET INPUT QUAD OP-AMPS

CASES
CB-2 CB-705



DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE

GC SUFFIX
TRICECOP (LCC)

CB-511

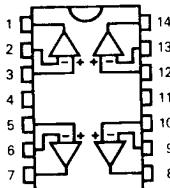


FP SUFFIX
PLASTIC MICROPACKAGE

PIN ASSIGNMENTS

(Top views)

CB-2
CB-511



- | | |
|---------------------------|----------------------------|
| 1 - Output 1 | 8 - Output 3 |
| 2 - Inverting input 1 | 9 - Inverting input 3 |
| 3 - Non-inverting input 1 | 10 - Non-inverting input 3 |
| 4 - V_{CC} | 11 - V_{CC} |
| 5 - Non-inverting input 2 | 12 - Non-inverting input 4 |
| 6 - Inverting input 2 | 13 - Inverting input 4 |
| 7 - Output 2 | 14 - Output 4 |

CB-705



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

THOMSON SEMICONDUCTORS

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MAXIMUM RATINGS

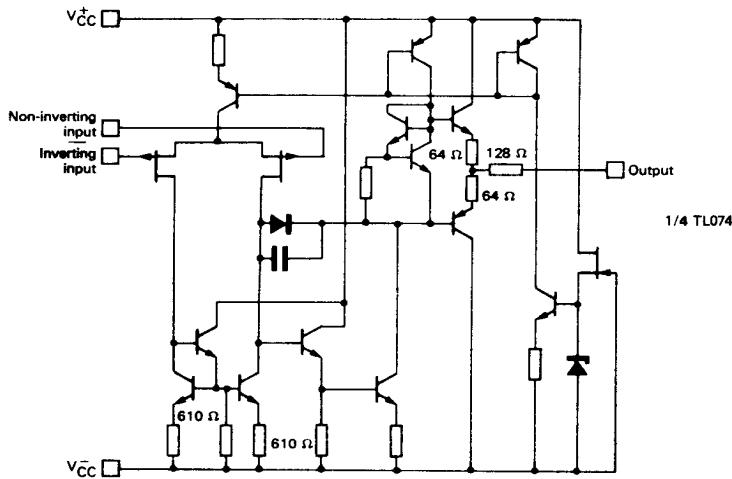
Rating	Symbol	TL074M	TL074I	TL074C	Unit
Supply voltage (Note 1)	V_{CC}	± 18	± 18	± 18	V
Differential input voltage (Note 2)	V_{ID}	± 30	± 30	± 30	V
Input voltage (Note 3)	V_I	± 15	± 15	± 15	V
Output short-circuit duration (Note 4)	—	Indefinite	Indefinite	Indefinite	—
Power dissipation	P_{tot}	680	680	680	mW
Operating free-air temperature range	T_{oper}	-55 to +125	-25 to +85	0 to +70	°C

Note 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}^- .

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

Note 3 : The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.

Note 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.

SCHEMATIC DIAGRAM

CASE	Outputs	Inverting inputs	Non-inverting inputs	V_{CC}^-	V_{CC}^+	N.C.
CB-2, CB-511	1, 7, 8, 14	2, 6, 9, 13	3, 5, 10, 12	11	4	—
CB-705	2, 10, 12, 20	3, 9, 13, 19	4, 8, 14, 18	16	6	*

* CB-705 : Other pins are not connected

ELECTRICAL CHARACTERISTICSTL074M : $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +125^{\circ}\text{C}$ TL074I : $-25^{\circ}\text{C} \leq T_{\text{amb}} \leq +85^{\circ}\text{C}$ TL074C : $0^{\circ}\text{C} \leq T_{\text{amb}} \leq +70^{\circ}\text{C}$ V_{CC} = ± 15 V

Test conditions : all characteristics are specified under open-loop conditions unless otherwise specified.

Characteristic	Symbol	TL074M			TL074I			TL074C			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input offset voltage ($R_S = 50 \Omega$) $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	V _{IO}	—	3	6	—	3	6	—	3	10	mV
Temperature coefficient of input offset voltage ($R_S = 50 \Omega$)	αV_{IO}	—	10	—	—	10	—	—	10	—	$\mu\text{V}/^{\circ}\text{C}$
Input offset current* $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	I _{IO}	—	5	50	—	5	50	—	5	50	pA/nA
Input bias current* $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	I _{IB}	—	30	200	—	30	200	—	30	200	pA/nA
Input common-mode voltage range ($T_{\text{amb}} = +25^{\circ}\text{C}$)	V _I	± 11	± 12	—	± 11	± 12	—	± 10	± 11	—	V
Output voltage swing $T_{\text{amb}} = +25^{\circ}\text{C}$, $R_L = 10 \text{ k}\Omega$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$, $R_L \geq 10 \text{ k}\Omega$ $R_L \geq 2 \text{ k}\Omega$	V _{OPP}	24 24 20	27 — 24	— 25 —	24 24 20	27 — 24	— — 20	24 — 24	27 — —	—	V
Large signal voltage gain ($R_L \geq 2 \text{ k}\Omega$, $V_O = \pm 10 \text{ V}$) $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	A _{VD}	35 20	200	—	50	200	—	25	200	—	V/mV
Small signal bandwidth ($T_{\text{amb}} = +25^{\circ}\text{C}$)	G _{WR}	—	3	—	—	3	—	—	3	—	MHz
Input resistance ($T_{\text{amb}} = +25^{\circ}\text{C}$)	R _I	—	10^{12}	—	—	10^{12}	—	—	10^{12}	—	Ω
Common-mode rejection ratio ($R_S \leq 10 \text{ k}\Omega$; $T_{\text{amb}} = +25^{\circ}\text{C}$)	CMR	80	86	—	80	86	—	70	76	—	dB
Supply voltage rejection ratio ($\Delta V_{CC}/\Delta V_{IO}$) $R_S \leq 10 \text{ k}\Omega$; $T_{\text{amb}} = +25^{\circ}\text{C}$	SVR	80	86	—	80	86	—	70	76	—	dB
Supply current (per amplifier) $T_{\text{amb}} = +25^{\circ}\text{C}$	I _{CC}	—	1.4	2.5	—	1.4	2.5	—	1.4	2.5	mA
Channel separation ($A_{VD} = 100$, $T_{\text{amb}} = +25^{\circ}\text{C}$)	V _{O1} /V _{O2}	—	120	—	—	120	—	—	120	—	dB

* 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 CHARACTERISTICSV_{CC} = ± 15 V, $T_{\text{amb}} = +25^{\circ}\text{C}$

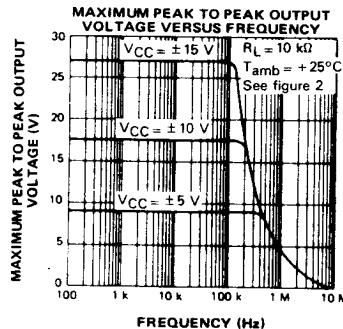
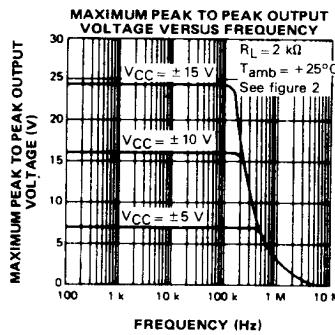
Characteristic	Symbol	TL074M			TL074I,C			Unit
		Min	Typ	Max	Min	Typ	Max	
Slew rate ($e_I = 10 \text{ V}$; $R_L = 2 \text{ k}\Omega$; $C_L = 100 \text{ pF}$; $A_V = 1$)	S _{VO}	10	13	—	—	13	—	V/ μ s
Rise time ($e_I = 20 \text{ mV}$; $R_L = 2 \text{ k}\Omega$; $C_L = 100 \text{ pF}$; $A_V = 1$)	t _r	—	0.1	—	—	0.1	—	μ s
Overshoot factor ($e_I = 20 \text{ mV}$; $R_L = 2 \text{ k}\Omega$; $C_L = 100 \text{ pF}$; $A_V = 1$)	K _{OV}	—	10	—	—	10	—	%
Equivalent input noise voltage $f = 1 \text{ kHz}$, $R_S = 100 \Omega$ $f = 10 \text{ Hz to } 10 \text{ kHz}$	V _n	—	18	—	—	18	—	$\text{nV}/\sqrt{\text{Hz}}$ μV
Equivalent input noise current ($R_S = 100 \Omega$, $f = 1 \text{ kHz}$)	I _n	—	0.01	—	—	0.01	—	pA/ $\sqrt{\text{Hz}}$
Total harmonic distortion ($V_O(\text{rms}) = 10 \text{ V}$, $R_S = 1 \text{ k}\Omega$, $R_L \geq 2 \text{ k}\Omega$, $f = 1 \text{ kHz}$)	THD	—	0.01	—	—	0.01	—	%

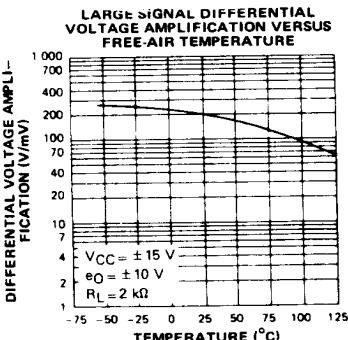
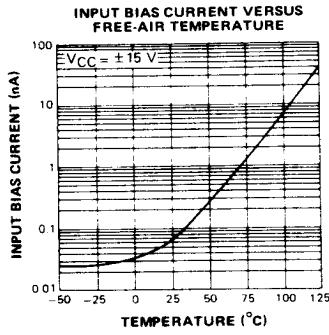
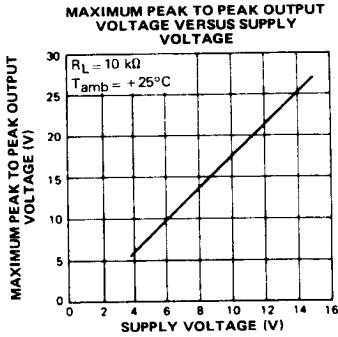
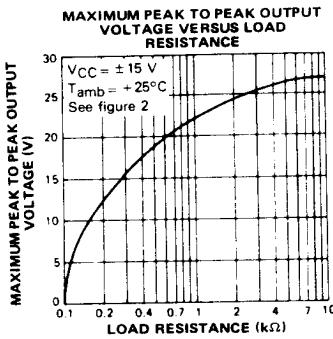
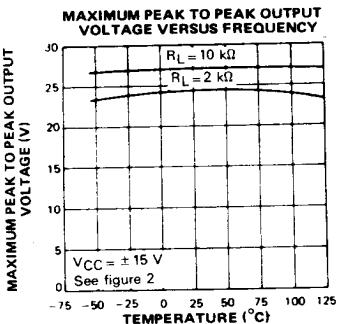
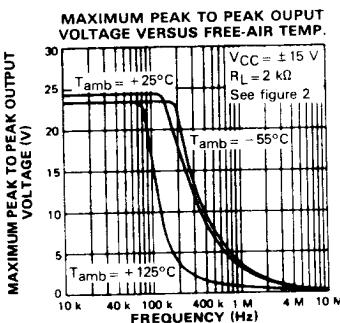
ELECTRICAL CHARACTERISTICSTL074C : $0^\circ\text{C} \leq T_{\text{amb}} \leq +70^\circ\text{C}$ $V_{\text{CC}} = \pm 15\text{ V}$

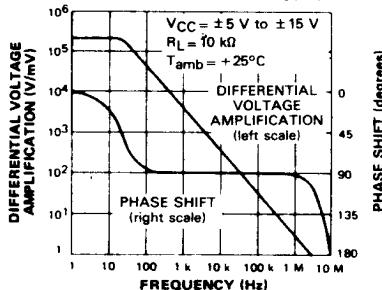
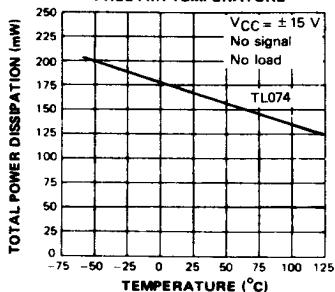
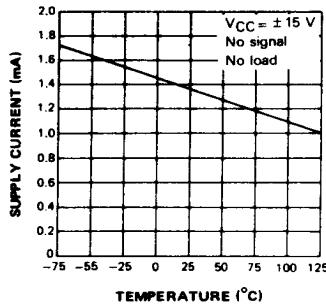
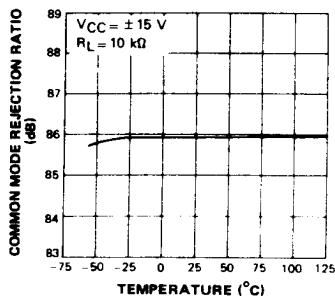
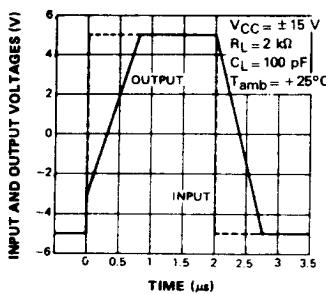
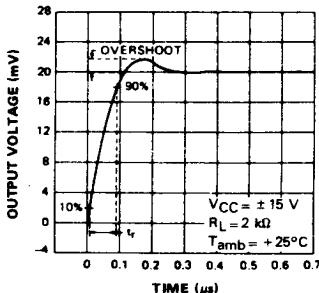
Test conditions : all characteristics are specified under open-loop conditions unless otherwise specified.

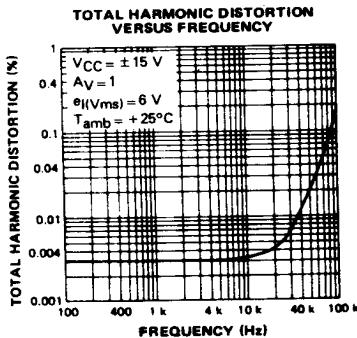
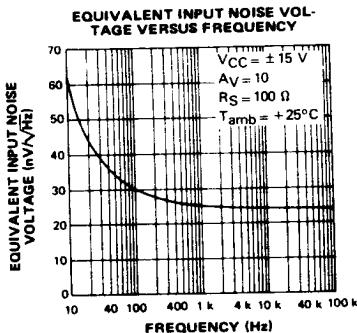
Characteristic	Symbol	TL074C			TL074AC			TL074BC			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input offset voltage ($R_S = 50\text{ }\Omega$) $T_{\text{amb}} = +25^\circ\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	V_{IO}	—	3	10	—	3	6	—	2	3	mV
Temperature coefficient of input offset voltage ($R_S = 50\text{ }\Omega$)	αV_{IO}	—	10	—	—	10	—	—	10	—	$\mu\text{V}/^\circ\text{C}$
Input offset current* $T_{\text{amb}} = +25^\circ\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	I_{IO}	—	5	50	—	5	50	—	5	50	pA
Input bias current* $T_{\text{amb}} = +25^\circ\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	I_{IB}	—	30	200	—	30	200	—	30	200	nA
Input common-mode voltage range ($T_{\text{amb}} = +25^\circ\text{C}$)	V_i	± 10	± 11	—	± 11	± 12	—	± 11	± 12	—	V
Output voltage swing $T_{\text{amb}} = +25^\circ\text{C}, R_L = 10\text{ k}\Omega$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}, R \geq 10\text{ k}\Omega$ $R_L \geq 2\text{ k}\Omega$	V_{OPP}	24	27	—	24	27	—	24	27	—	V
Large signal voltage gain ($R_L \geq 2\text{ k}\Omega, V_O = \pm 10\text{ V}$) $T_{\text{amb}} = +25^\circ\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	A_{VD}	25	200	—	50	200	—	25	200	—	V/mV
Small signal bandwidth ($T_{\text{amb}} = +25^\circ\text{C}$)	G_{WR}	—	3	—	—	3	—	—	3	—	MHz
Input resistance ($T_{\text{amb}} = +25^\circ\text{C}$)	R_I	—	10^{12}	—	—	10^{12}	—	—	10^{12}	—	Ω
Common-mode rejection ratio ($R_S \leq 10\text{ k}\Omega; T_{\text{amb}} = +25^\circ\text{C}$)	CMR	70	76	—	80	86	—	80	86	—	dB
Supply voltage rejection ratio ($\Delta V_{\text{CC}}/\Delta V_{\text{IO}}$) $R_S \leq 10\text{ k}\Omega; T_{\text{amb}} = +25^\circ\text{C}$	SVR	70	76	—	80	86	—	80	86	—	dB
Supply current (per amplifier) $T_{\text{amb}} = +25^\circ\text{C}$	I_{CC}	—	1.4	2.5	—	1.4	2.5	—	1.4	2.5	mA
Channel separation ($A_{\text{VD}} = 100, T_{\text{amb}} = +25^\circ\text{C}$)	$V_{\text{O1}}/V_{\text{O2}}$	—	120	—	—	120	—	—	120	—	dB

* 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.





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 TIME




PARAMETER MEASUREMENT INFORMATION

Fig. 1 : VOLTAGE FOLLOWER

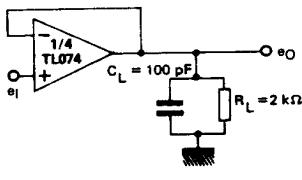
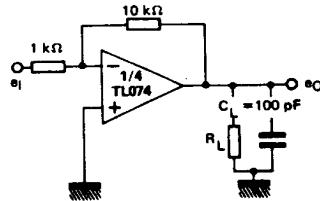
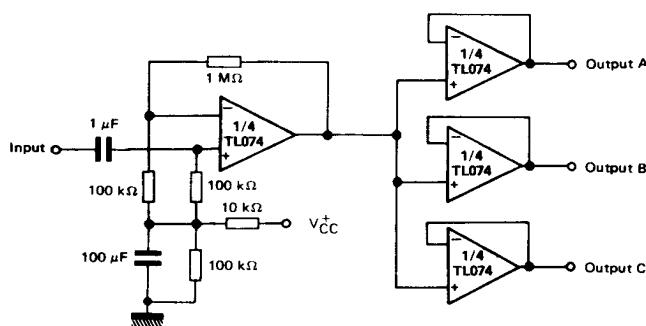


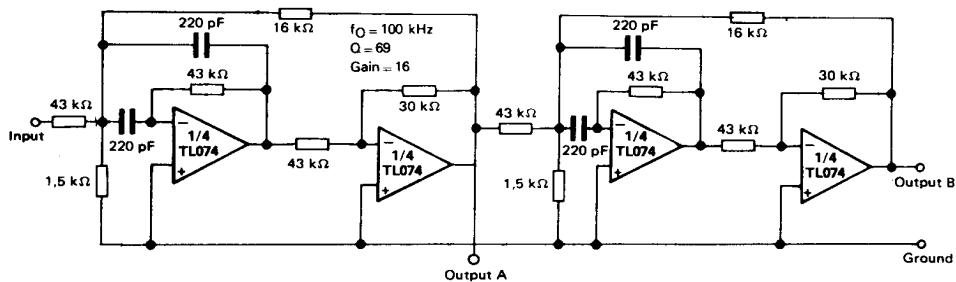
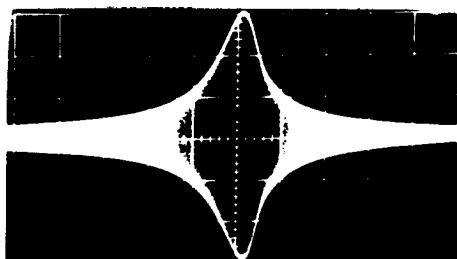
Fig. 2 : GAIN-OF-10 INVERTING AMPLIFIER



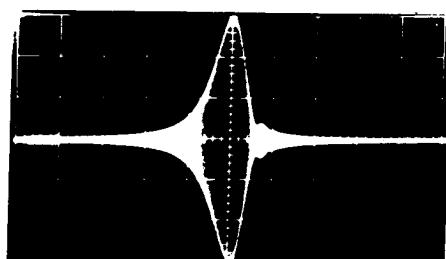
TYPICAL APPLICATIONS
AUDIO DISTRIBUTION AMPLIFIER

 $f_0 = 100 \text{ kHz}$ 

POSITIVE FEEDBACK BANDPASS-FILTER

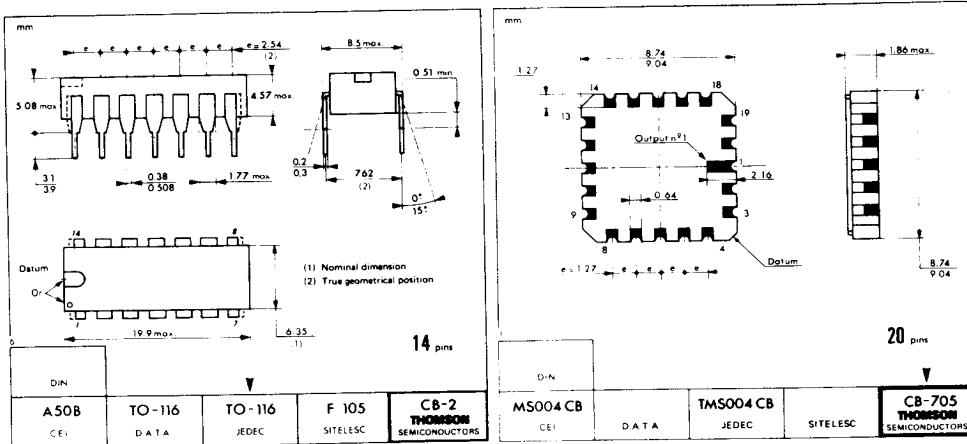
**OUTPUT A**

2 kHz/div

SECOND ORDER BANDPASS FILTER $f_0 = 100 \text{ kHz} ; Q = 69 ; \text{Gain} = 16$ **OUTPUT B**

2 kHz/div

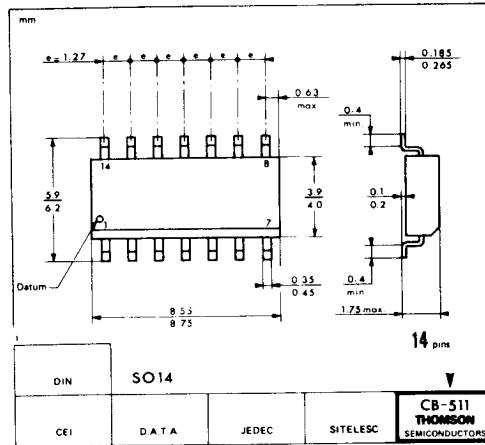
CASCADED BANDPASS FILTER $f_0 = 100 \text{ kHz} ; Q = 30 ; \text{Gain} = 4$



CB-2
DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE



CB-705
GC SUFFIX
TRICECOP (LCC)



CB-511
FP SUFFIX
PLASTIC MICROPACKAGE

These specifications are subject to change without notice.
Please inquire with our sales offices about the availability of the different packages.