

THOMSON SEMICONDUCTORS

TL064
TL064A
TL064B

LOW POWER J-FET INPUT QUAD OP-AMPS

The TL064, TL064A and TL064B are high speed quad J-FET input 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 current and offset currents, and low offset voltage temperature coefficient.

- Very Low power consumption
- Wide common-mode and differential voltage ranges
- Low input bias and offset currents
- Typical supply current : 200 μ A
- Output short-circuit protection
- High input impedance J-FET input stage
- Internal frequency compensation
- Latch up free operation
- High slew rate : 3.5 V/ μ s (typ).

ORDERING INFORMATION

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

PART NUMBER	TEMPERATURE RANGE	PACKAGE			
		DP	DG	FP	GC
TL064M	- 55°C to + 125°C		●		●
TL064I	- 25°C to + 85°C	●			
TL064C	0°C to + 70°C	●		●	
TL064AC	0°C to + 70°C	●			
TL064BC	0°C to + 70°C	●			

Examples : TL064MDG, TL064IDP

LOW POWER J-FET INPUT QUAD OP-AMPS

CASES
CB-2 CB-705



DP SUFFIX
PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE

CB-511

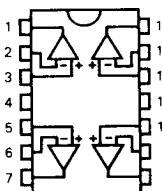


FP SUFFIX
PLASTIC MICROPACKAGE

PIN ASSIGNMENTS

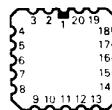
(Top views)

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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THOMSON
COMPONENTS

MAXIMUM RATINGS

Rating	Symbol	TL061M	TL061I	TL061C	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 (Note 5)	P_{tot}	680	680	680	mW
Operating free-air temperature range	T_{oper}	-55 to +125	-25 to +85	0 to +70	°C
Storage temperature range	T_{stg}	-65 to +150	-65 to +150	-65 to +150	°C

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

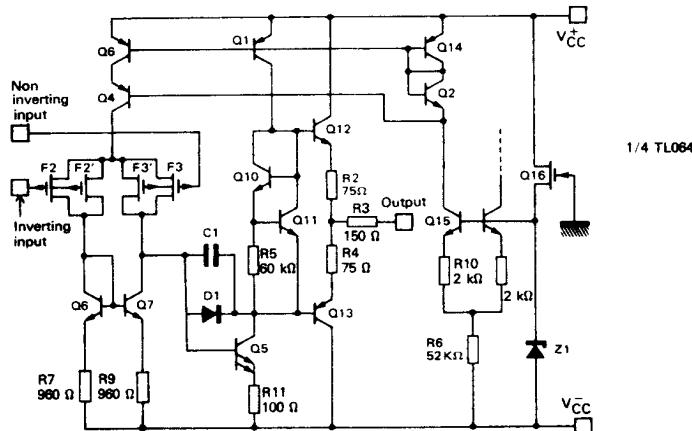
Note 1 : All voltage values, except differential voltages, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between V_{CC}^+ and V_{CC}^- .

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.

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

SCHEMATIC DIAGRAM

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

* CB-705 : Other pins are not connected

ELECTRICAL CHARACTERISTICSTL064M : $-55^{\circ}\text{C} \leq T_{\text{amb}} \leq +125^{\circ}\text{C}$ TL064I : $-25^{\circ}\text{C} \leq T_{\text{amb}} \leq +85^{\circ}\text{C}$ TL064C : $0^{\circ}\text{C} \leq T_{\text{amb}} \leq +70^{\circ}\text{C}$ $V_{\text{CC}} = \pm 15 \text{ V}$

All characteristics are specified under open-loop conditions unless otherwise specified.

Characteristic	Symbol	TL064M			TL064I			TL064C			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	15	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	100	—	5	100	—	5	200	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	400	pA nA
Input common-mode voltage range ($T_{\text{amb}} = +25^{\circ}\text{C}$)	V_I	± 11	± 12	—	± 11.5	± 12	—	± 10	± 11	—	V
Output voltage swing $R_L = 10 \text{ k}\Omega$; $T_{\text{amb}} = +25^{\circ}\text{C}$ $R_L \geq 10 \text{ k}\Omega$; $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	V_{OPP}	20 20	27 —	—	20 20	27 —	—	20 20	27 —	—	V
Large signal voltage gain ($R_L \geq 10 \text{ k}\Omega$, $V_O = \pm 10 \text{ V}$) $T_{\text{amb}} = +25^{\circ}\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	A_{VD}	4 4	6 —	—	4 4	6 —	—	3 3	6 —	—	V/mV
Small signal bandwidth ($T_{\text{amb}} = +25^{\circ}\text{C}$, $R_L = 10 \text{ k}\Omega$)	G_{WR}	—	1	—	—	1	—	—	1	—	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 ($\Delta V_{\text{CC}}/\Delta V_{\text{IO}}$) $R_S \leq 10 \text{ k}\Omega$; $T_{\text{amb}} = +25^{\circ}\text{C}$	SVR	80	95	—	80	95	—	70	95	—	dB
Supply current (per amplifier) $T_{\text{amb}} = +25^{\circ}\text{C}$, no load, no signal	I_{CC}	—	200	250	—	200	250	—	200	250	μA
Channel separation ($A_{\text{VD}} = 100$, $T_{\text{amb}} = +25^{\circ}\text{C}$)	$V_{\text{O1}}/V_{\text{O2}}$	—	120	—	—	120	—	—	120	—	dB
Total power consumption (each amplifier) $T_{\text{amb}} = +25^{\circ}\text{C}$, no load, no signal	P_D	—	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 $V_{\text{CC}} = \pm 15 \text{ V}$, $T_{\text{amb}} = +25^{\circ}\text{C}$

Characteristic	Symbol	TL064M			TL064I.C			Unit
		Min	Typ	Max	Min	Typ	Max	
Slew rate ($e_I = 10 \text{ V}$; $R_L = 10 \text{ k}\Omega$; $C_L = 100 \text{ pF}$; $A_V = 1$)	S_{VO}	2	3.5	—	—	3.5	—	$\text{V}/\mu\text{s}$
Rise time ($e_I = 20 \text{ mV}$; $R_L = 10 \text{ k}\Omega$; $C_L = 100 \text{ pF}$; $A_V = 1$) (See Fig. 1)	t_r	—	0.2	—	—	0.2	—	μs
Overshoot factor ($e_I = 20 \text{ mV}$; $R_L = 10 \text{ k}\Omega$; $C_L = 100 \text{ pF}$; $A_V = 1$) (See Fig. 1)	K_{OV}	—	10	—	—	10	—	%
Equivalent input noise voltage ($R_S = 100 \Omega$; $f = 1 \text{ kHz}$)	V_n	—	42	—	—	42	—	$\text{nV}/\sqrt{\text{Hz}}$

ELECTRICAL CHARACTERISTICS

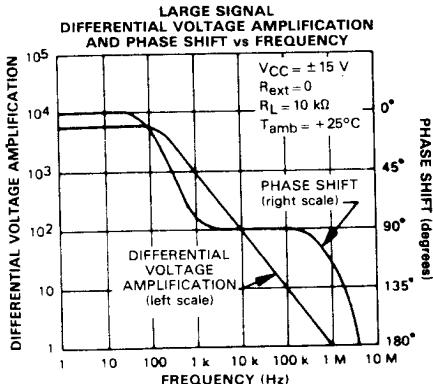
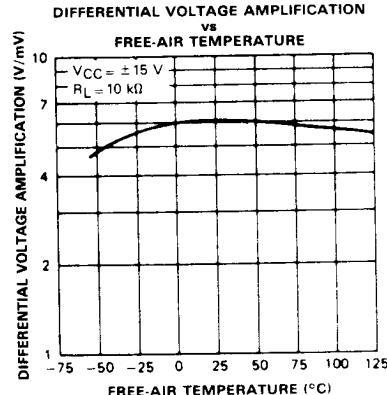
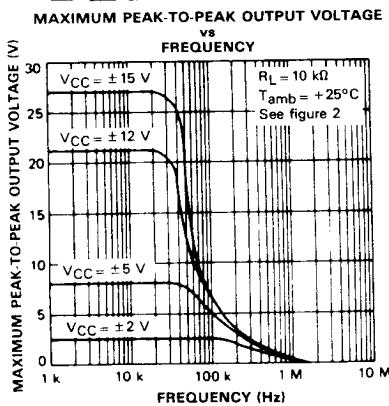
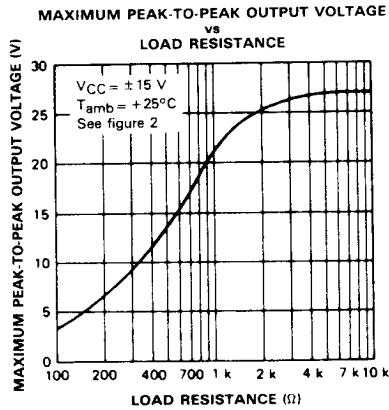
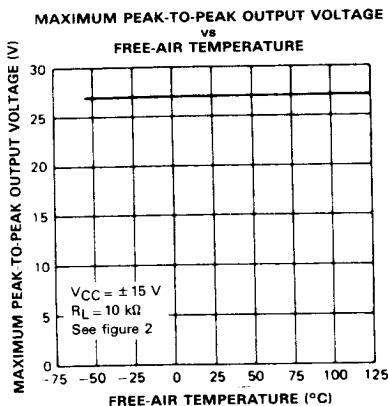
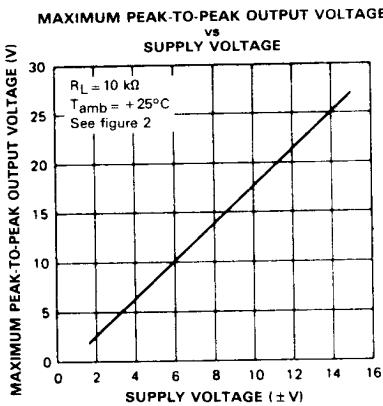
TL064C : $0^\circ\text{C} \leq T_{\text{amb}} \leq +70^\circ\text{C}$ $V_{\text{CC}} = \pm 15 \text{ V}$

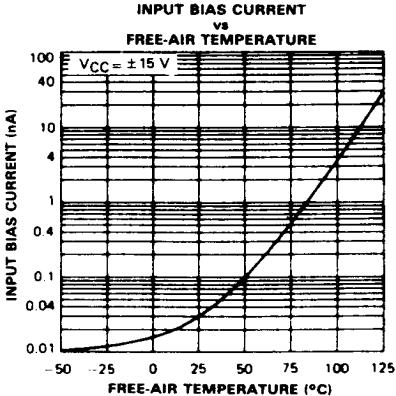
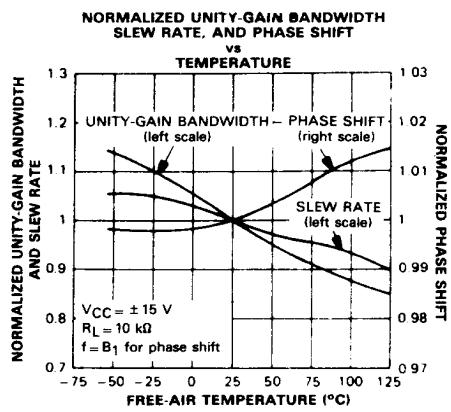
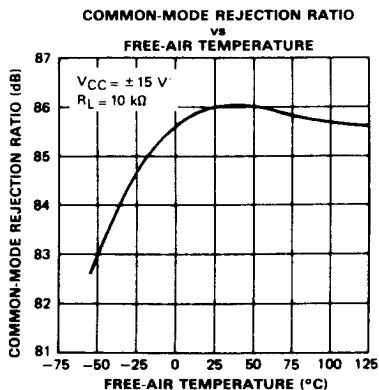
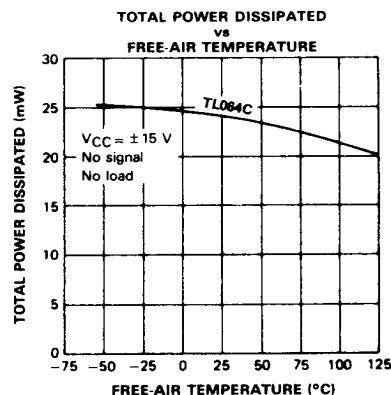
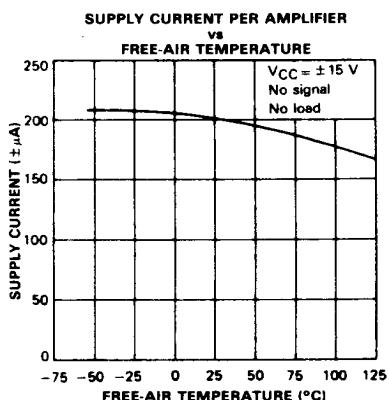
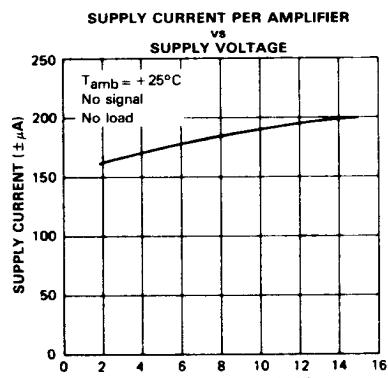
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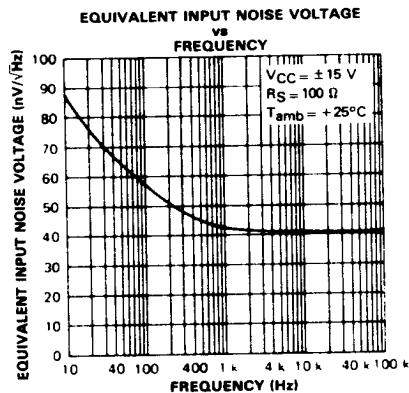
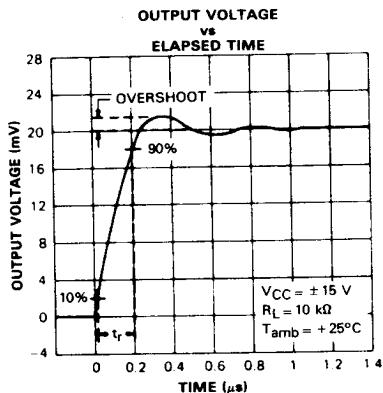
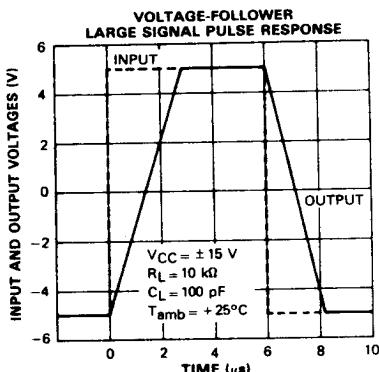
Characteristic	Symbol	TL064C			TL064AC			TL064BC			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Input offset voltage ($R_S = 50 \Omega$) $T_{\text{amb}} = +25^\circ\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	V_{IO}	—	3	15	—	3	6	—	2	3	mV
Temperature coefficient of input offset voltage ($R_S = 50 \Omega$)	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	200	—	5	100	—	5	100	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	400	—	30	200	—	30	200	pA
Input common-mode voltage range ($T_{\text{amb}} = +25^\circ\text{C}$)	V_I	± 10	± 11	—	± 11.5	± 12	—	± 11.5	± 12	—	V
Output voltage swing $R_L = 10 \text{ k}\Omega$, $T_{\text{amb}} = +25^\circ\text{C}$ $R_L \geq 10 \text{ k}\Omega$, $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	V_{OPP}	20	27	—	20	27	—	20	27	—	V
Large signal voltage gain ($R_L \geq 10 \text{ k}\Omega$, $V_O = \pm 10 \text{ V}$) $T_{\text{amb}} = +25^\circ\text{C}$ $T_{\text{min}} \leq T_{\text{amb}} \leq T_{\text{max}}$	A_{VD}	3	6	—	4	6	—	4	6	—	V/mV
Small signal bandwidth ($T_{\text{amb}} = +25^\circ\text{C}$, $R_L = 10 \text{ k}\Omega$)	G_{WR}	—	1	—	—	1	—	—	1	—	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	95	—	80	95	—	80	95	—	dB
Supply current (per amplifier) $T_{\text{amb}} = +25^\circ\text{C}$, no load, no signal	I_{CC}	—	200	250	—	200	250	—	200	250	μA
Channel separation ($A_{\text{VD}} = 100$, $T_{\text{amb}} = +25^\circ\text{C}$)	$V_{\text{O1}}/V_{\text{O2}}$	—	120	—	—	120	—	—	120	—	dB
Total power consumption (each amplifier) $T_{\text{amb}} = +25^\circ\text{C}$, no load, no signal	P_D	—	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







**PARAMETER, MEASUREMENT
INFORMATION**

Fig. 1 : VOLTAGE FOLLOWER

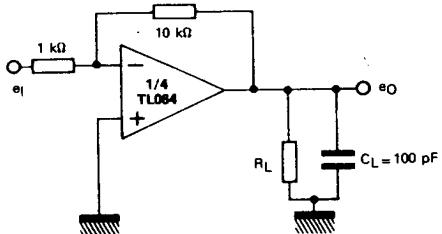
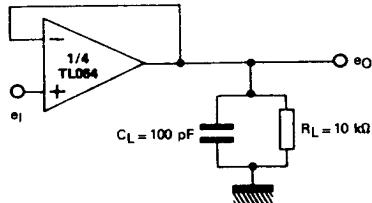
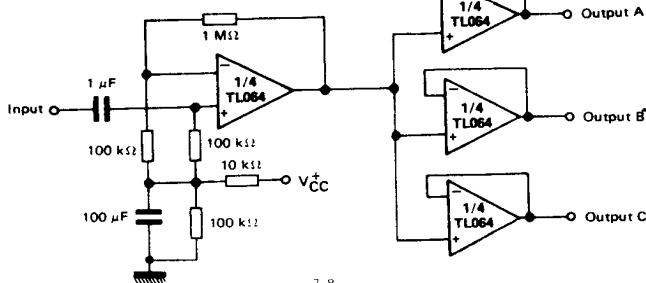


Fig. 2 : GAIN-OF-10 INVERTING AMPLIFIER



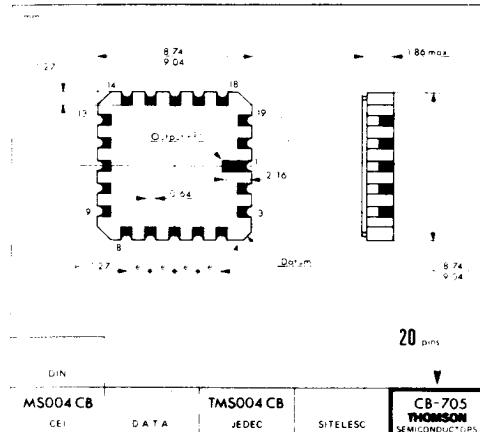
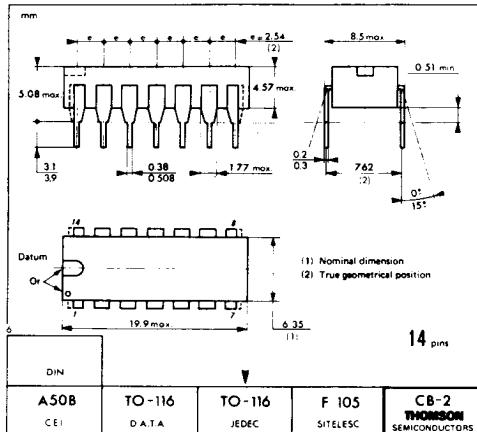
TYPICAL APPLICATION
AUDIO DISTRIBUTION AMPLIFIER



7.8

THOMSON SEMICONDUCTORS

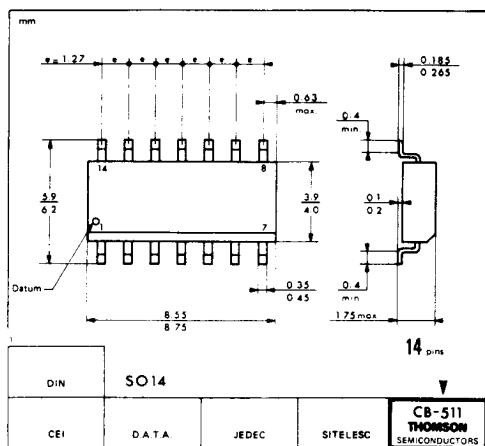
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CB-2
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PLASTIC PACKAGE
DG SUFFIX
CERDIP PACKAGE



CB-705
GC SUFFIX
TRICEOP (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.