April 1990
Edition 2.0

FUJITSU

DATA SHEET

MB3120
COMPANDOR IC

COMPANDOR IC

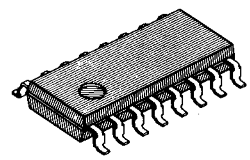
The Fujitsu MB3120 is a compandor IC to expand dynamic range at transmission/reception systems and to improve the tone quality by means of restricting noise.

Two function are loaded on one IC, the one is the compressor which has the 2/1 ratio of input/output ratio by logarithm, and the expandor which has the 1/2 ratio of input/output ratio by logarithm.

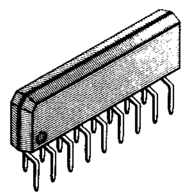
The MB3120 is encapsulated in a small package, this enables high density mounting.

The MB3120 is well suitable for a mobile radio system like as cellular radio, MCA and handy telephone set.

- Wide power supply voltage range (3.2V to 10.0V)
- Low power supply current
- On-chip both compressor and expandor
- Wide dynamic range
- Less external elements
- Inhibit function with compression/expantion ratio of one
- Equipped with mute function which cut off the output signal
- 16-pin Flat Package
  17-pin Zig-zag In-line Package

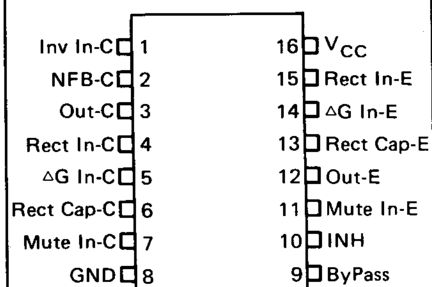


PLASTIC PACKAGE
FPT-16P-M04



PLASTIC PACKAGE
ZIP-17P-M01

PIN ASSIGNMENT
(TOP VIEW)



(FPT-16P–M02)

ZIP-17P-M01 Pin Assignment
Please See Page 12

ABSOLUTE MAXIMUM RATINGS (See NOTE)

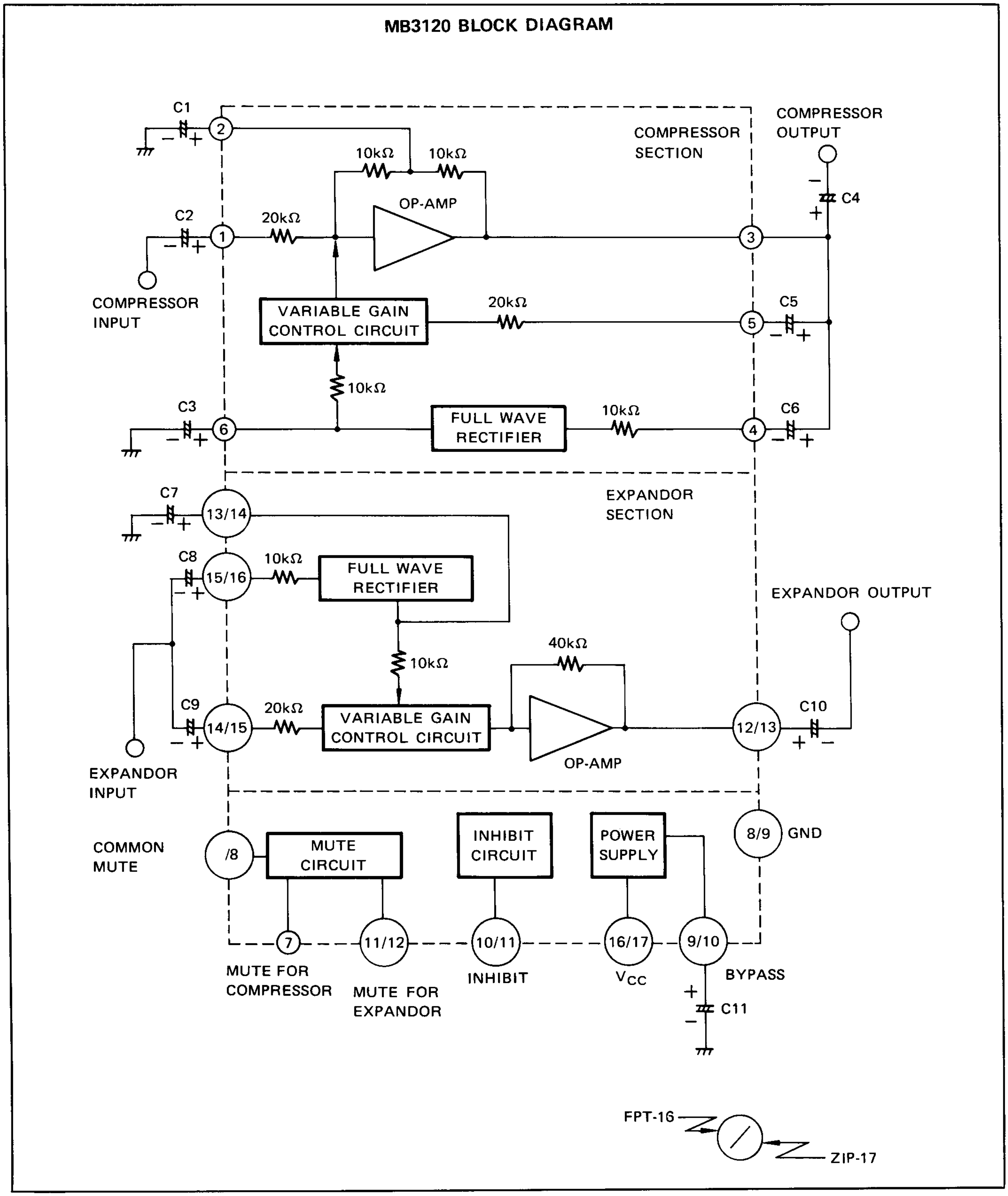
(T_A = 25°C)

Rating	Symbol	Value	Unit
Power Supply Voltage	V_{CC}	12	V
Mute Control Voltage	V_{MUTE}	5*	V
Inhibit Control Voltage	V_{INH}	5*	V
Power Dissipation	P_D	560	mW
Operating Temperature	T_A	-20 to +75	°C
Storage Temperature	T_{STG}	-55 to +125	°C

*: This value takes V_{CC} when V_{CC} is less than 5V.

NOTE: Permanent device damage may occur if ABSOLUTE MAXIMUM RATINGS are exceeded. Functional operation should be restricted to the conditions as detailed in the operational sections of this data sheet. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

This device contains circuitry to protect the inputs against damage due to high static voltages or electric fields. However, it is advised that normal precautions be taken to avoid application of any voltage higher than maximum rated voltages to this high impedance circuit.


MB3120 BLOCK DIAGRAM
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
COMPRESSOR SECTION
COMPRESSOR OUTPUT
COMPRESSOR INPUT
10kΩ
10kΩ
OP-AMP
20kΩ
VARIABLE GAIN CONTROL CIRCUIT
20kΩ
10kΩ
FULL WAVE RECTIFIER
10kΩ
EXPANDOR SECTION
EXPANDOR OUTPUT
EXPANDOR INPUT
10kΩ
FULL WAVE RECTIFIER
10kΩ
40kΩ
20kΩ
VARIABLE GAIN CONTROL CIRCUIT
OP-AMP
COMMON MUTE
MUTE CIRCUIT
INHIBIT CIRCUIT
POWER SUPPLY
GND
MUTE FOR COMPRESSOR
MUTE FOR EXPANDOR
INHIBIT
V_{CC}
BYPASS
FPT-16
ZIP-17

BLOCK DESCRIPTIONS

C_1 : C1 determines the low cut off frequency of compressor section.

$$fc = \frac{1}{2\pi R \cdot C_1}$$

R is on chip feed back resistor (10kΩ typ.)

C_2, C_8, C_9 : Input coupling condenser

C_3, C_7 : Smooth capacitor of full wave rectifier. Atack time and recovery time are determined by C_3 and C_7.
Time constant T_C can be calculated.
T_C (ms) ≒ 10 x C_3 (μF)

C_4, C_{10} : Output coupling condenser

C_5, C_6 : Coupling condenser for internal feed back of compressor section.

C_{11} : Ripple filter condenser

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Value			Unit
		Min	Typ	Max	
Power Supply Voltage	V_{CC}	3.2		10	V
Operating Temperature	T_A	-20		75	°C

ELECTRICAL CHARACTERISTICS

(V_{CC} = 8V, T_A = 25°C, f = 1kHz, R_L = 10kΩ)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Power Supply Current	I_{CC}			3.0	4.5	mA

Compressor

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Input Resistance	R_{INC}		14	20		kΩ
Input Reference Level	V_{OC0}	V_{IN} = -6dBm	-10.5	-9.0	-7.5	dBm
		V_{IN} = -6dBm, T_A = -20 to 75°C*2	-2.5	0	2.5	dB
Output Level*1	V_{OC1}	V_{IN} = -20dB	-10.5	-10.0	-9.5	dB
	V_{OC2}	V_{IN} = -40dB	-20.7	-20.0	-19.3	dB
	V_{OC3}	V_{IN} = -60dB	-31.5	-30.0	-29.0	dB
		V_{IN} = -60dB, T_A = -20 to 75°C*2	-4.0	0	3.0	dB
	V_{OC4}	V_{IN} = -80dB		-40.0		dB

ELECTRICAL CHARACTERISTICS (continued)

Parameter	Symbol	Condition	Value			Unit
			Min	Typ	Max	
Expandor						
Input Resistance	R_{INE}		4.7	6.7		kΩ
Input Reference Level	V_{OE0}	V_{IN} = -9dBm	-1.5	0	1.5	dBm
		V_{IN} = -9dBm, T_A = -20 to 75°C*2	-2.5	0	2.5	dB
Output Level*1	V_{OE1}	V_{IN} = -10dB	-20.5	-20.0	-19.5	dB
	V_{OE2}	V_{IN} = -20dB	-40.7	-40.0	-39.3	dB
	V_{OE3}	V_{IN} = -30dB	-61.0	-60.0	-58.5	dB
		V_{IN} = -30dB, T_A = -20 to 75°C*2	-3.0	0	4.5	dB
	V_{OE4}	V_{IN} = -40dB		-80.0		dB
Compandor						
Total Harmonic Distortion	THD	V_O = 0dBm		0.5	2.0	%
Output Noise Voltage	V_{ON}	BW = 100Hz to 5kHz			-80.0	dBm
Voltage Gain	A_V	V_{IN} = -6dBm	4.5	6.0	7.5	dB
Gain Deviation 1	ΔA_{V1}	V_{IN} = -6dBm, T_A = -20 to 75°C*2	-3.0	0	3.0	dB
Gain Deviation 2	ΔA_{V2}	f = 200Hz to 5kHz, V_O = 0dBm	-0.5	0	0.5	dB
Voltage Gain at Inhibit	A_{VINH}	V_{IN} = -6dBm, V_{ININH} = 0.4V	4.5	6.0	7.5	dB
Compressor Mute Attenuation*3	V_{OCMUTE}	V_{IN} = -6dBm, $V_{INCMUTE}$ = 2.7V		-50		dBm
Expandor Mute Attenuation*3	V_{OEMUTE}	V_{IN} = -9dBm, $V_{INEMUTE}$ = 2.7V		-70		dBm
High-level Control Voltage for Mute and Inhibit Pins*3	V_{IH}		2.7			V
Low-level Control Voltage for Mute and Inhibit Pins*3	V_{IL}				0.4	V

Notes:

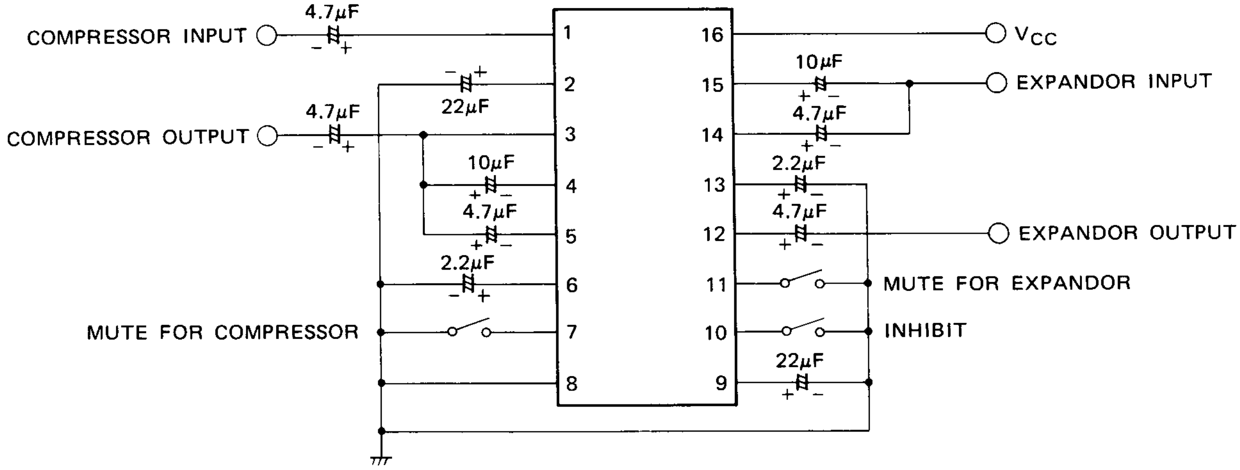
*1 Measured at input reference level of 0dB.

*2 Gain deviation with temperature when output level of 25°C is specified as 0dB.

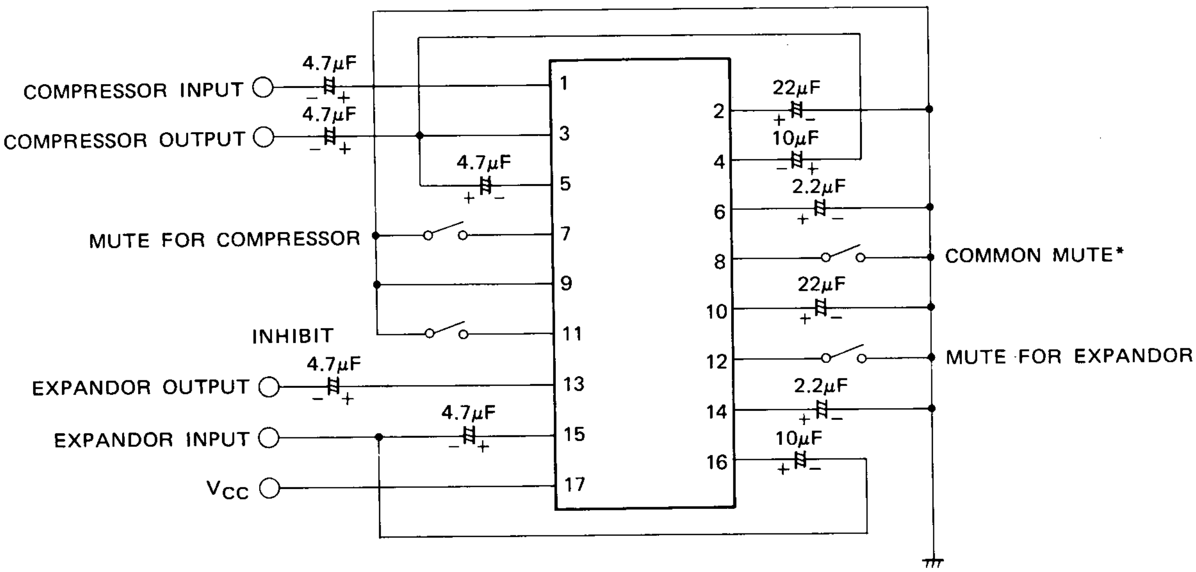
*3 As for Zip-17 pin, both compressor and expandor circuit enter mute function depending on 8 pin input.

TYPICAL CONNECTION EXAMPLE

FPT-16



ZIP-17



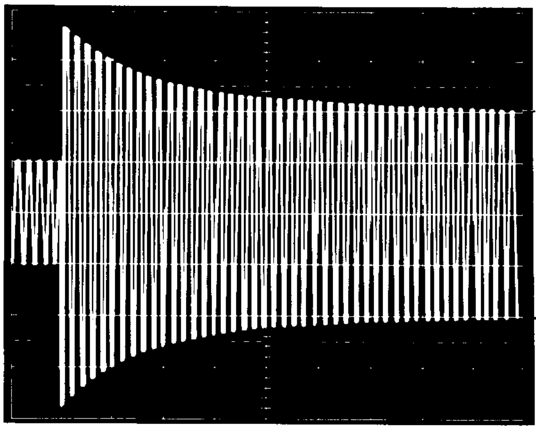
*: Both the mute of Compressor and Expandor can be controlled by this terminal.

OUTPUT TRANSITION RESPONSE CHARACTERISTICS

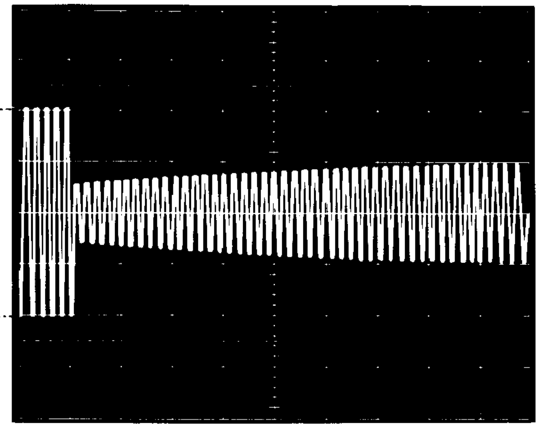
Condition: V_{CC} = 8V, f = 1kHz, R_L = 10kΩ, Mute OFF, INH OFF, Typ. connection

COMPRESSOR (Y: 0.2V/div, X: 5msec/div)

V_{IN} = −18dBm → −6dBm (V_O = −15dBm → −9dBm)

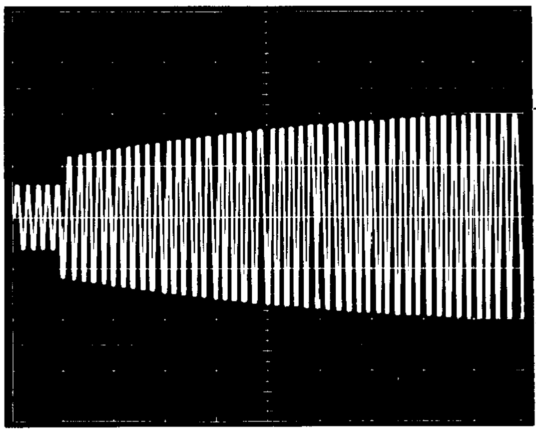


V_{IN} = −6dBm → −18dBm (V_O = −9dBm → −15dBm)

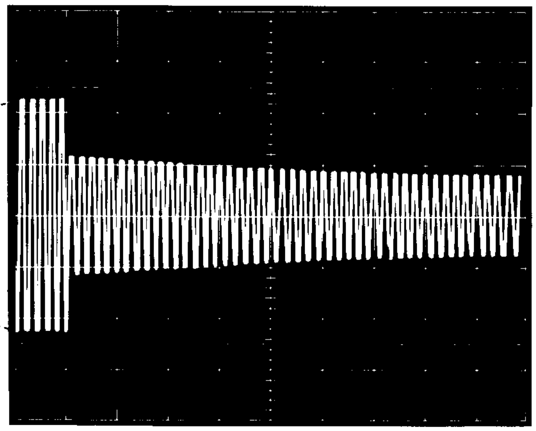


EXPANDOR (Y: 0.5V/div, X: 5msec/div)

V_{IN} = −15dBm → −9dBm (V_O = −12dBm → 0dBm)

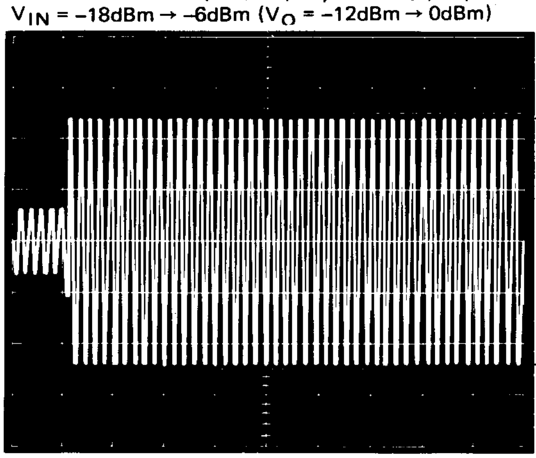


V_{IN} = −9dBm → −15dBm (V_O = 0dBm → −12dBm)

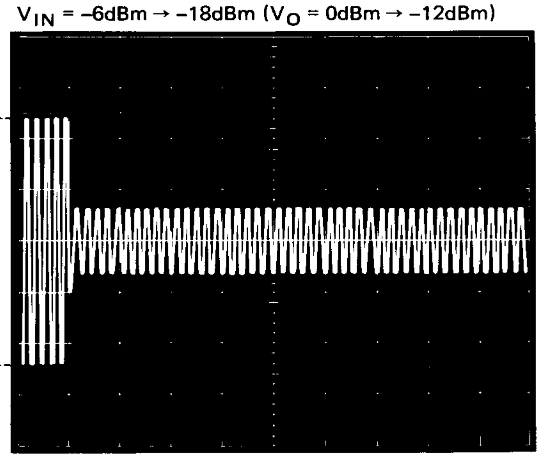


COMPANDOR (Y: 0.5V/div, X: 5msec/div)

V_{IN} = −18dBm → −6dBm (V_O = −12dBm → 0dBm)



V_{IN} = −6dBm → −18dBm (V_O = 0dBm → −12dBm)



TYPICAL CHARACTERISTICS CURVES

Fig. 1 – INPUT VOLTAGE vs. OUTPUT LEVEL

f = 1kHz
Mute OFF
INH OFF
Rg = 600Ω
R_L = 10kΩ
TYP. CONNECTION

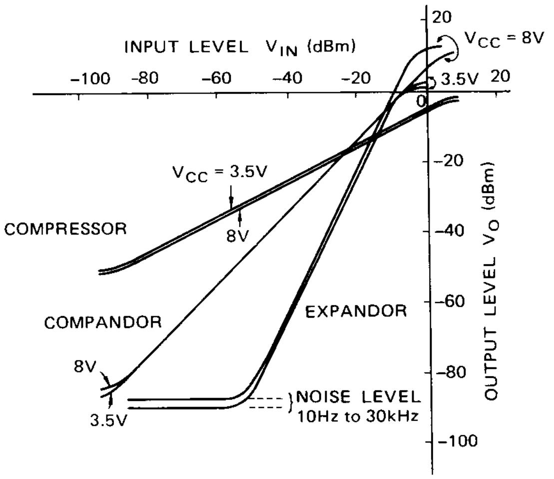


Fig. 2 – INPUT VOLTAGE vs. OUTPUT LEVEL (INHIBIT COND.)

f = 1kHz
Mute OFF
INH ON
Rg = 600Ω
R_L = 10kΩ
TYP. CONNECTION

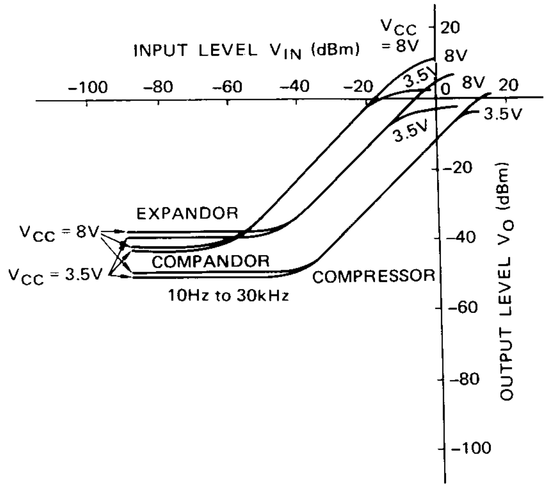


Fig. 3 – INPUT REFERENCE LEVEL vs. VOLTAGE SUPPLY

f = 1kHz
Mute OFF
INH OFF ----- R_L = 600Ω
Rg = 600Ω —— R_L = 10kΩ

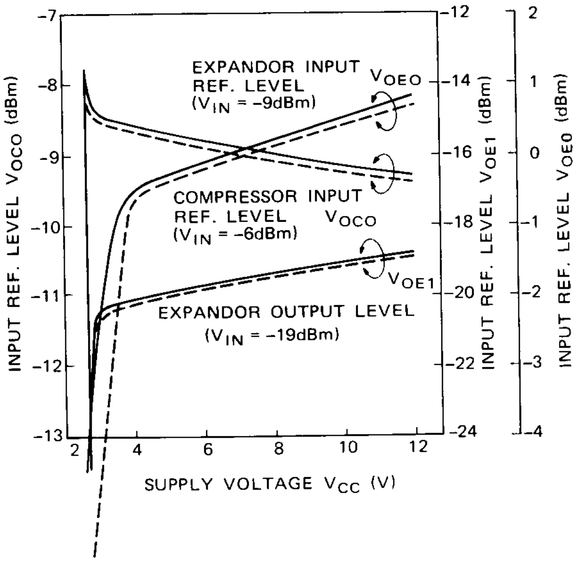
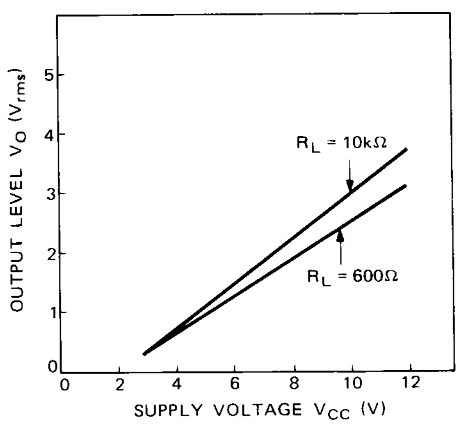


Fig. 4 – MAX. OUTPUT LEVEL vs. SUPPLY VOLTAGE (COMPANDOR)

LPF: 100kHz
THD = 1% INH OFF
Mute OFF Rg = 600Ω



TYPICAL CHARACTERISTICS CURVES (continued)

Fig. 5 – FREQUENCY vs. VOLTAGE GAIN (COMPANDOR)

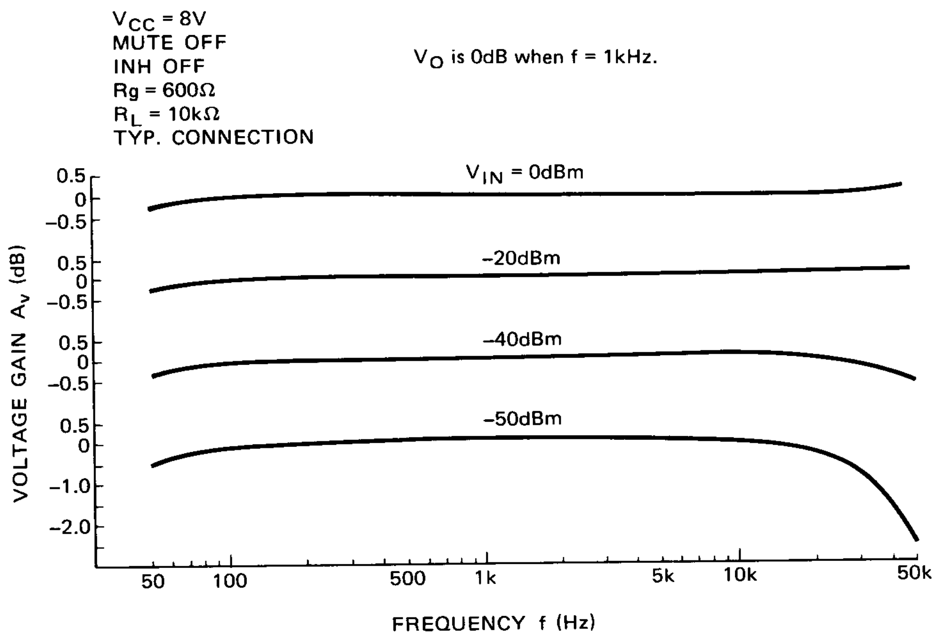


Fig. 6 – INPUT REFERENCE LEVEL vs. TEMPERATURE

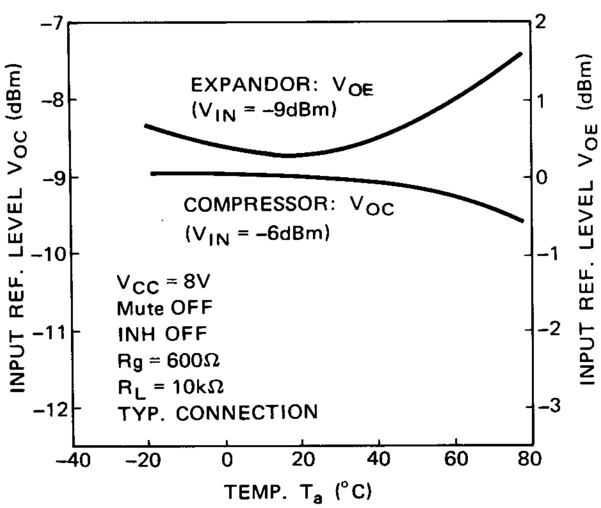
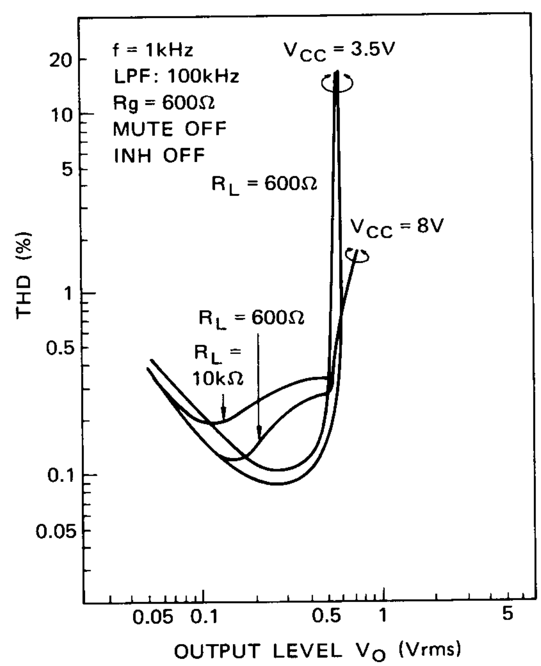


Fig. 7 – OUTPUT LEVEL vs. TOTAL HARMONIC DISTORTION (COMPRESSOR)



TYPICAL CHARACTERISTICS CURVES (continued)

Fig. 8 – OUTPUT LEVEL vs. TOTAL HARMONIC DISTORTION (EXPANDOR)

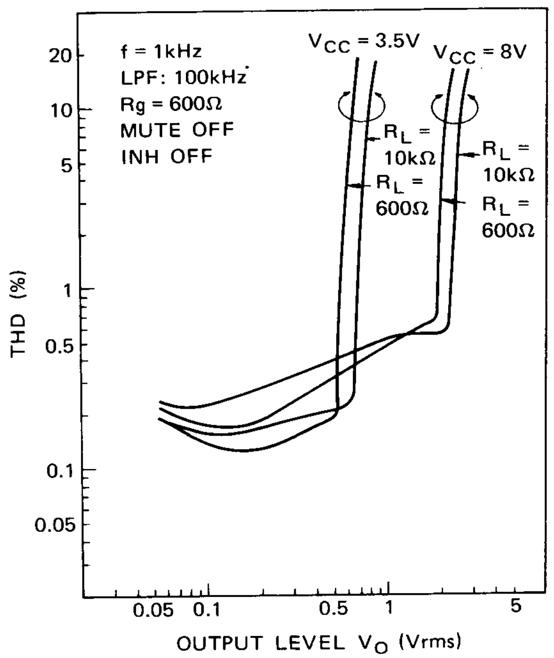


Fig. 9 – OUTPUT LEVEL vs. TOTAL HARMONIC DISTORTION (COMPANDOR)

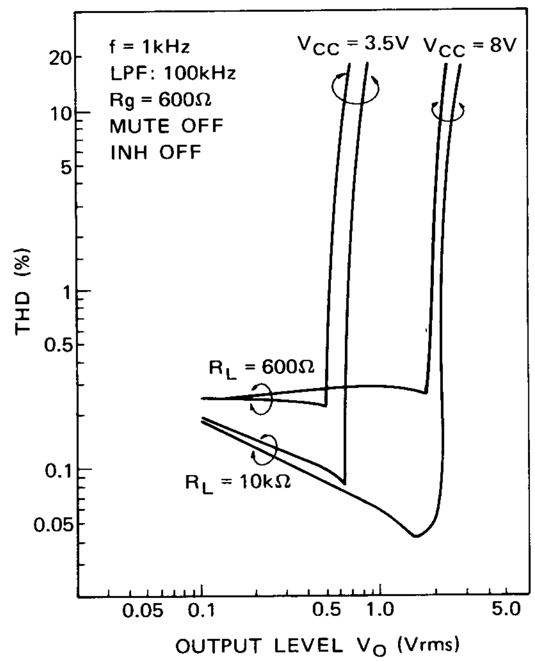


Fig. 10 – OUTPUT LEVEL vs. TOTAL HARMONIC DISTORTION (EXPANDOR INHIBIT COND.)

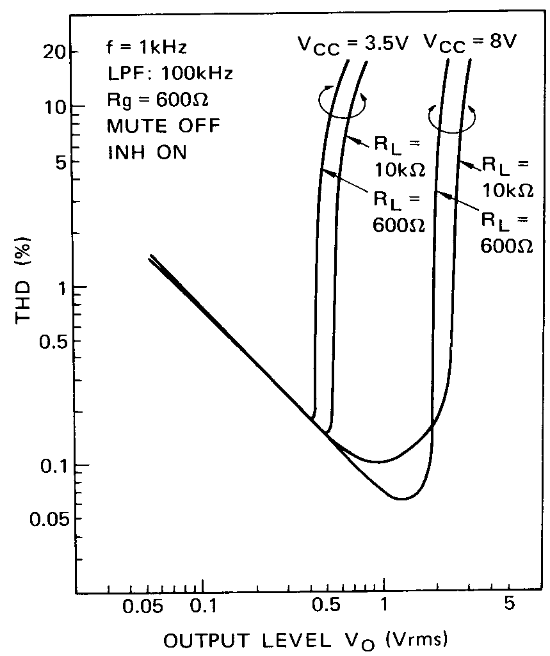
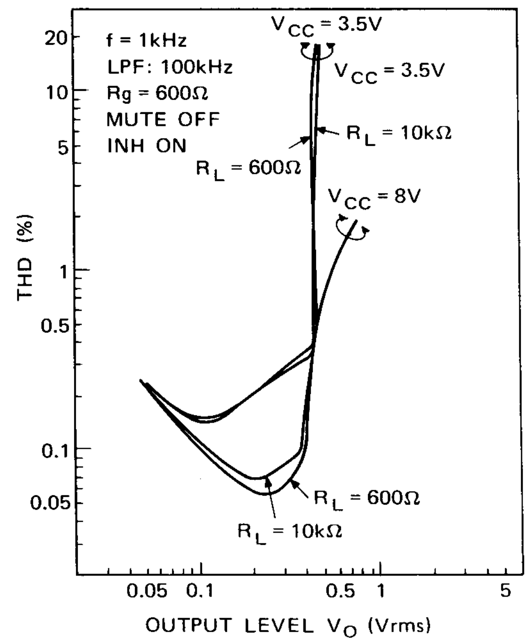


Fig. 11 – OUTPUT LEVEL vs. TOTAL HARMONIC DISTORTION (COMPRESSOR INHIBIT COND.)



TYPICAL CHARACTERISTICS CURVES (continued)

Fig. 12 – FREQUENCY vs. TOTAL HARMONIC DISTORTION (COMPANDOR)

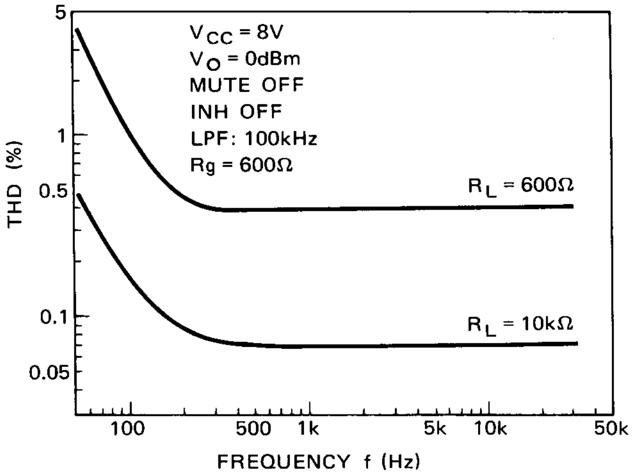


Fig. 13 – EXAPNDOR MUTE ATTENUATION

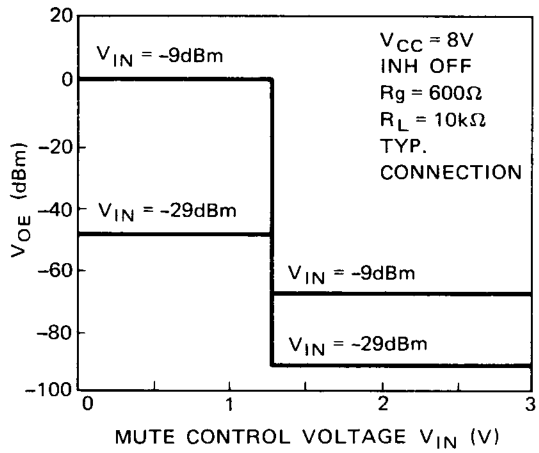
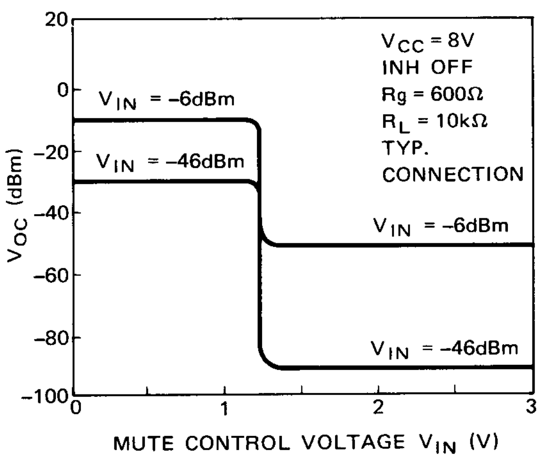
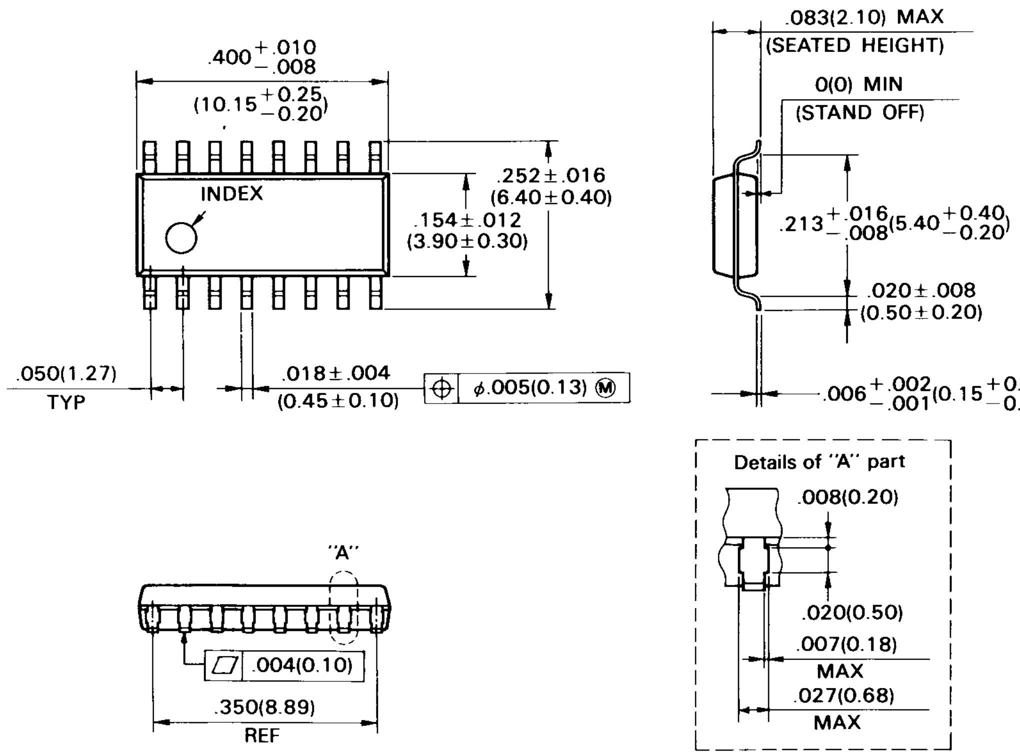


Fig. 14 – COMPRESSOR MUTE ATTENUATION



PACKAGE DIMENSIONS

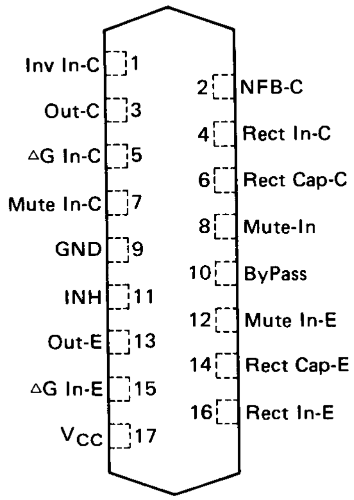
16-LEAD PLASTIC FLAT PACKAGE
(CASE No.: FPT-16P-M04)



Dimensions in
inches (millimeters)

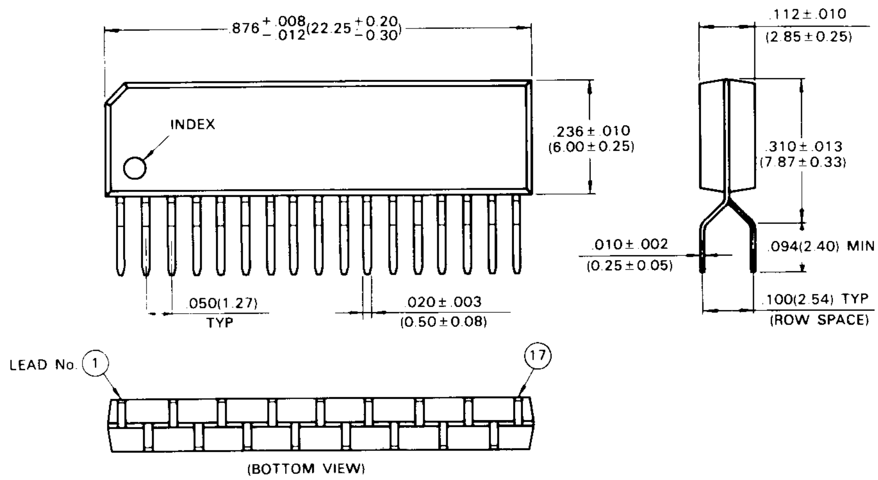
PACKAGE DIMENSIONS (Continued)

(TOP VIEW)



(ZIP-17P-M01)

17-LEAD PLASTIC ZIG-ZAG IN-LINE PACKAGE
(CASE No.: ZIP-17P-M01)



Dimensions in inches (millimeters)

FUJITSU LIMITED

For further information please contact:

Japan
FUJITSU LIMITED
Integrated Circuits and Semiconductor Marketing
Furukawa Sogo Bldg., 6–1, Marunouchi 2–chome
Chiyoda–ku, Tokyo 100, Japan
Tel: (03) 216–3211
Telex: 781–2224361
FAX: (03) 216–9771

North and South America
FUJITSU MICROELECTRONICS, INC.
Integrated Circuits Division
3545 North First Street
San Jose, CA 95134–1804 USA
Tel: 408–922–9000
Telex: 910–338–0190
FAX: 408–432–9044

Europe
FUJITSU MIKROELEKTRONIK GmbH
Arabella Centre 9. OG
Lyoner Strasse 44–48
D–6000 Frankfurt 71
F.R. Germany
Tel: (069) 66320
Telex: 411963
FAX: (069) 6632122

Asia
FUJITSU MICROELECTRONICS ASIA PTE LIMITED
#06–04 to #06–07
Plaza By The Park
No. 51 Bras Basah Road
Singapore 0719
Tel: 336–1600
Telex: 55573
FAX: 336–1609

PV0008–904A2