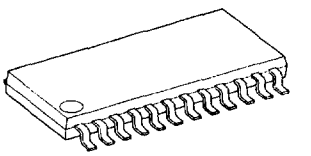
COMPANDER IC FOR CORDLESS TELEPHONE

FEATURES

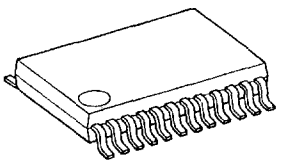
- Noise reduction IC, compressor and expander on a chip
- 2 buffer amp. for filter, MIC AMP, receiver amp. and PRE AMP are included
- Ceramic or dynamic type receiver is available
- Mute functions for each compressor and expander, and through mode SW
- Super small package with 0.65mm pitch (TA31103FN), possible to shrink much area of board
- V_{CC} = 3.0V
  I_{CCQ} = 6.0mA (Typ.)

TA31103F



SSOP24-P-300

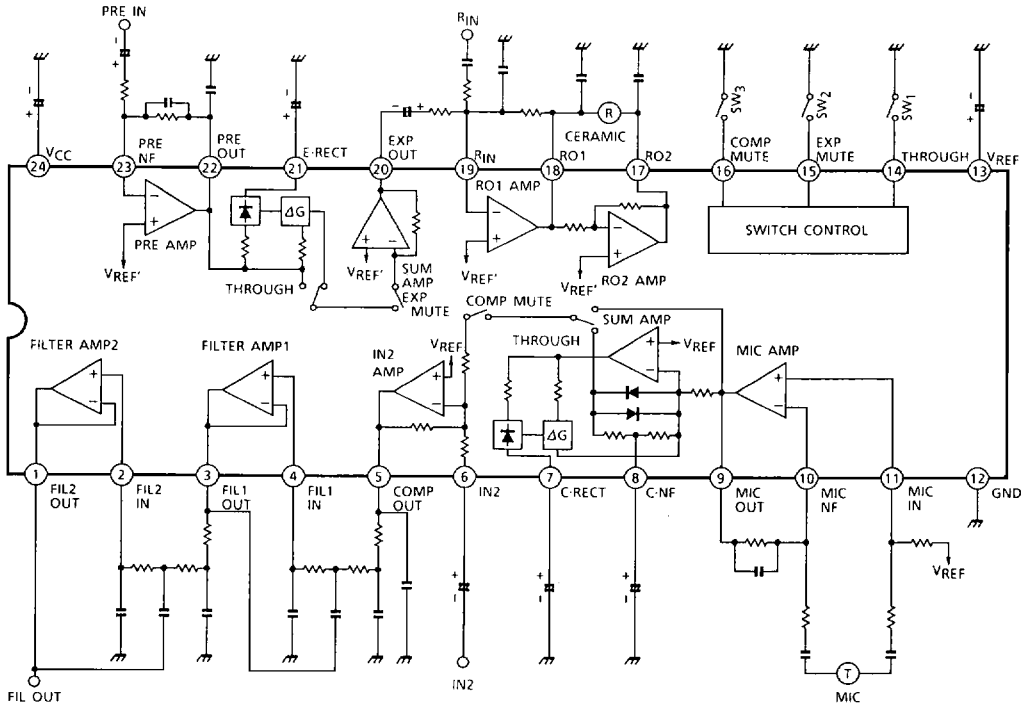
TA31103FN



SSOP24-P-300A

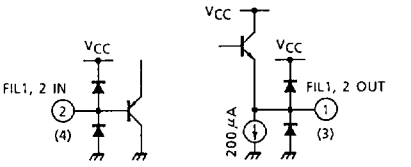
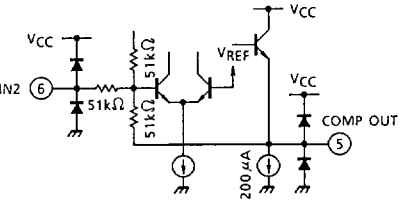
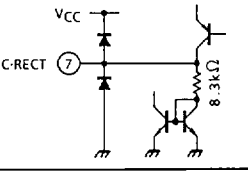
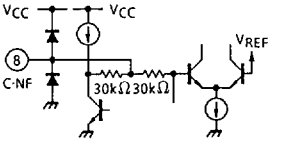
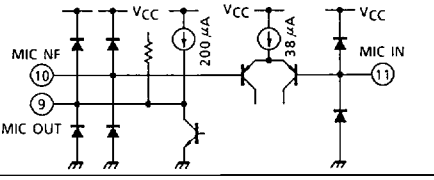
Weight SSOP24-P-300 : 0.32g (Typ.)
SSOP24-P-300A : 0.14g (Typ.)

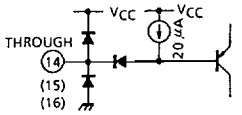
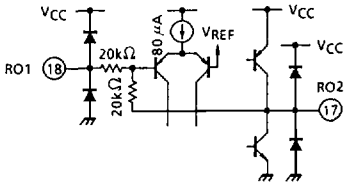
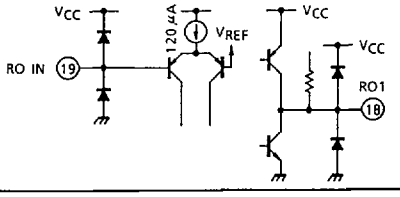
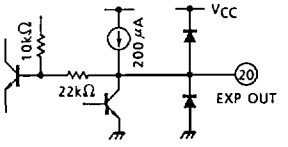
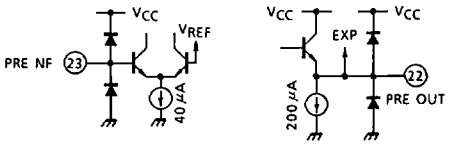
BLOCK DIAGRAM



8

PIN FUNCTION (The Values of resistor and capacitor are typical.)

PIN No.	PIN NAME	FUNCTION	EQUIVALENT CIRCUIT
1	FIL2 OUT	Output of FILTER AMP2.	
2	FIL2 IN	Input of FILTER AMP2.	
3	FIL1 OUT	The same circuit as FILTER AMP2.	
4	FIL1 IN		
5	COMP OUT	Output of IN2 AMP.	
6	IN2	Input of IN2 AMP and outputs to pin 5 with signal from SUM AMP.	
7	C·RECT	Connected capacitor for full-wave rectifier circuit.	
8	C·NF	Feedback circuit of T type is formed by external capacitor with SUM AMP.	
9	MIC OUT	Output of MIC AMP and connected directly to input of SUM AMP.	
10	MIC NF	Inverted input of MIC AMP.	
11	MIC IN	Non-inverted input of MIC AMP.	
12	GND	GND terminal.	—
13	V_{REF}	Reference terminal of compressor. Also reference for expander through internal buffer.	—

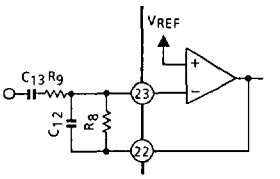
PIN No.	PIN NAME	FUNCTION	EQUIVALENT CIRCUIT
14	THROU-GH	Each terminal is the same circuit. These must not be added voltage under GND over V_{CC}.	
15	EXP MUTE		
16	COMP MUTE		
17	RO2	Used for BTL output type with RO1 terminal when a ceramic receiver is used.	
18	RO1	Receiving output for a dynamic receiver.	
19	RO IN	Inverted input of receiver amplifier.	
20	EXP OUT	Output of SUM AMP at expander. The signal from gain cell is gained by inverted amp.	
21	E-RECT	Terminal for rectifier of expander. Almost the same circuit as C-RECT terminal.	—
22	PRE OUT	Output of PRE AMP. Connected directly to expander.	
23	PRE IN	Inverted input of PRE AMP.	
24	V_{CC}	Power supply terminal.	—

PRE AMP

This part is a normal inverting amp. so the gain is adjustable by R_8, R_9

$$G_{PRE} = -R_8 / R_9$$

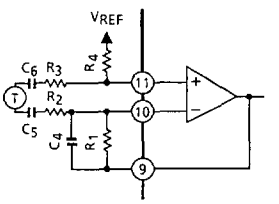
Control frequency characteristic by C_{12}.



MIC AMP

It is possible to use by some styles, differential input, non-inverting, inverting, because both plus and minus terminals appear.

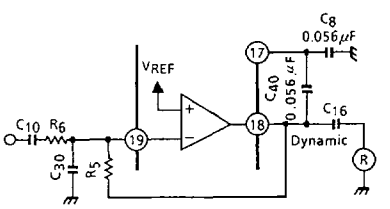
$R_1 = R_4$ is required for suppressing the offset of output.



Receiver amp.

Both ceramic and dynamic types of receiver are possible to drive.

In case of dynamic type, the method of use is as the right figure.



Switches

Logic is as follows.

IC FUNCTIONAL STATE		STATE OF EACH TERMINAL		
COMPRESSOR	EXPANDER	THROUGH TERMINAL	EXP-MUTE TERMINAL	COMP-MUTE TERMINAL
ON	ON	OPEN or V_{CC}	OPEN or V_{CC}	OPEN or V_{CC}
OUTPUT MUTE	—	—	—	GND
—	OUTPUT MUTE	—	GND	—
OFF (THROUGH)	OFF (THROUGH)	GND	OPEN or V_{CC}	OPEN or V_{CC}

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC		SYMBOL	RATING	UNIT
Supply Voltage		V_{CC}	10	V
Power Dissipation	31103FN	P_D	350	mW
	31103F		450	
Operating Temperature		T_{opr}	−20~70	°C
Storage Temperature		T_{stg}	−50~150	°C

ELECTRICAL CHARACTERISTICS (V_{CC} = 3V, f_{IN} = 1kHz, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	V_{CC}	1	—	2.7	3.0	8.0	V
Quiescent Current	I_{CCQ}	1	—	3.5	5.7	9.5	mA
Reference Voltage	V_{REF}	1	—	1.12	1.27	1.42	V

Compressor

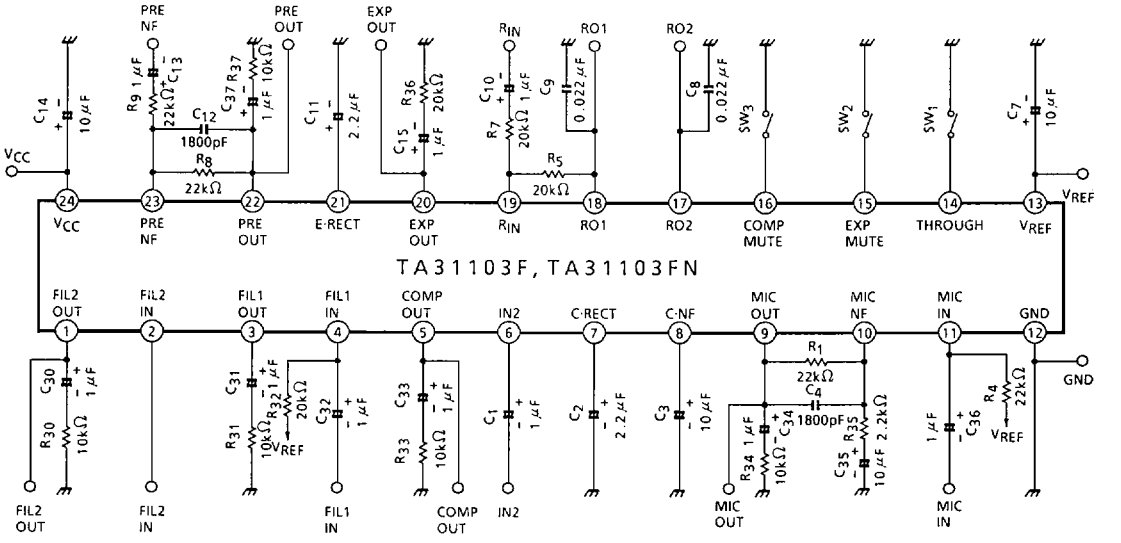
Input Reference Level	V_{REFC}	2	V_{OM} = −10dBV	−11.1	−10.4	−9.6	dBV
Total Harmonic Distortion	THD_C	3	V_{OM} = −10dBV	—	0.15	1.5	%
Output Noise Level	V_{NOC}	4	MIC IN : GND	—	—	−50	dBV
Output Deviation 1	V_{OC1}	2	V_{OM} = −30dBV	−0.8	−0.1	0.6	dB
Output Deviation 2	V_{OC2}	2	V_{OM} = −50dBV	−1.1	−0.3	0.5	dB
Limiting Level	V_{LIM}	5	V_{IM} = −20dBV	−7.1	−6.0	−4.7	dBV
Through Mode Gain	G_{TH}	2	V_{OM} = −15dBV Through mode	−1.6	−0.6	0.4	dB
Maximum Output Level	DR_C	3	THD = 3%	−9.8	−7.0	—	dBV
Mute Output Level	V_{ATTC}	6	V_{IM} = −20dBV	—	—	−70	dBV
IN2 AMP Gain	G_{IN2}	7	V_{IN2} = −10dBV	−1.2	0	1.2	dB
IN2 Input Impedance	R_{IN2}	—	—	—	51	—	kΩ
Crosstalk E→C	$CT_{E\rightarrow C}$	8	V_{IP} = 0dBV	—	—	−33	dBV

Expander

Input Reference Level	V_{REFE}	2	V_{OP} = −10dBV	−11.1	9.6	−8.1	dBV
Total Harmonic Distortion	THD_E	3	V_{OP} = −10dBV	—	0.4	2.0	%
Output Noise Level	V_{NOE}	4	PRE IN : GND	—	—	−90	dBV
Output Deviation 1	V_{OE1}	2	V_{OP} = −20dBV	−0.6	0.5	1.6	dB
Output Deviation 2	V_{OE2}	2	V_{OP} = −35dBV	−0.3	0.8	1.9	dB
Through Mode Gain	G_{TH}	2	V_{OP} = −15dBV Through mode	−1.2	0.3	1.5	dB
Maximum Output Level	DR_C	3	THD = 3%	−6.0	−0.6	—	dBV
Mute Output Level	V_{ATTE}	6	V_{IP} = 0dBV	—	—	−90	dBV
Crosstalk C→E	$CT_{C\rightarrow E}$	8	V_{IM} = −20dBV	—	—	−75	dBV

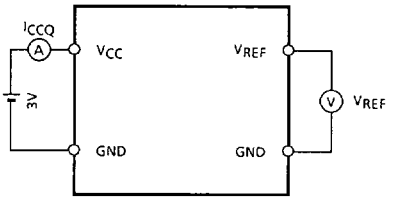
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Receiver amplifier (RO1-RO2 OUTPUT, 55nF LOAD)							
Reciver Amp. Gain	G_{R1}	9	V_{OP} = – 10dBV	4.9	6.3	7.7	dB
Maximum Output Level	DR_{R1}	10	THD = 3%	0	5	—	dBV
Total Harmonic Distortion 1	THD_{R1}	10	V_{OP} = – 10dBV	—	0.4	2.0	%
DC Offset 1	V_{OFF1}	13	—	– 25	0	25	mV
Receiver amplifier (RO1 OUTPUT, 150Ω LOAD)							
Receiver Amp. Gain	GR_2	11	V_{OP} = – 10dBV	– 2.1	– 0.4	1.3	dB
Maximum Output Level	DR_{R2}	12	THD = 3%	– 15	– 1	—	dBV
Total Harmonic Distortion 2	THD_{R2}	12	V_{OP} = – 10dBV	—	0.7	6.0	%
DC Offset 2	V_{OFF2}	13	—	– 25	0	25	mV
MIC AMP							
Maximum Output Level	DR_M	14	THD = 3%	– 7.0	– 1.5	—	dBV
DC Offset	V_{OFFM}	15	—	– 25	0	25	mV
PRE AMP							
Maximum Output Level	DR_P	14	THD = 3%	– 9.0	– 4.0	—	dBV
DC Offset	V_{OFFP}	15	—	– 25	0	25	mV
FILTER AMP1, 2							
Filter AMP Gain	G_F	—	—	—	0	—	dB
Maximum Output Level	DR_F	16	THD = 3%	– 5.5	– 3.0	—	dBV
Total Harmonic Distortion	THD_F	16	V_{IF} = – 10dBV	—	0.01	0.3	%
Input Bias Current	I_{BIAS}	17	—	—	0.1	2.0	μA
DC Offset	V_{OFFF}	17	—	– 31	– 3	25	mV
Sink Current	I_{SINK}	18	V_{OF} = 2.1V	100	200	—	μA
Switch							
Switch Input Voltage	V_{IL}	—	pin 14, 15, and 16	—	—	0.2	V

TEST CIRCUIT

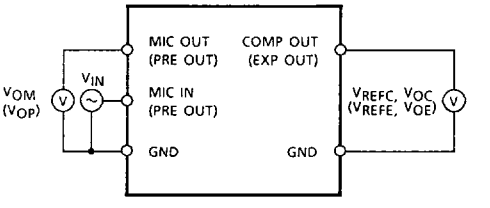


TEST CIRCUIT (V_{CC} = 3V, f_{IN} = 1kHz, unless otherwise specified, $SW_1 = SW_2 = SW_3$ = OPEN)

(1) I_{CCQ}, V_{REF}



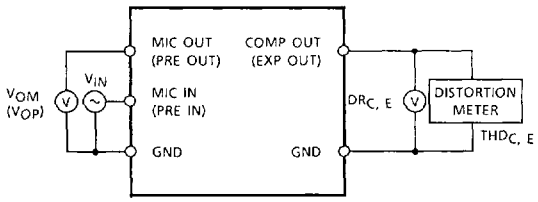
(2) V_{REFC}, E, G_{TH}, $V_{OC1, 2}$, $V_{OE1, 2}$



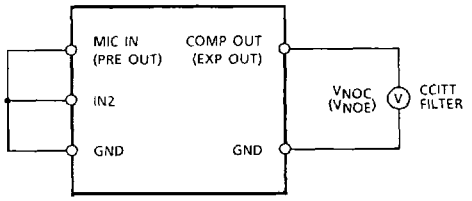
V_{REFC} ; V_{OM} = − 10dBV
$V_{OC1, 2}$ = V_{OC} − V_{REFC} − 0.5 (V_{OM} + 10) V_{OC1} ; V_{OM} = − 30dBV V_{OC2} ; V_{OM} = − 50dBV
V_{REFE} ; V_{OP} = − 10dBV
$V_{OE1, 2}$ = V_{CC} − V_{REFE} − 2 (V_{OP} + 10) V_{OE1} ; V_{OP} = − 20dBV V_{OE2} ; V_{OP} = − 35dBV

G_{TH} = V_{OC} − V_{OM}, V_{OE} − V_{OP}
(SW_1 = GND)

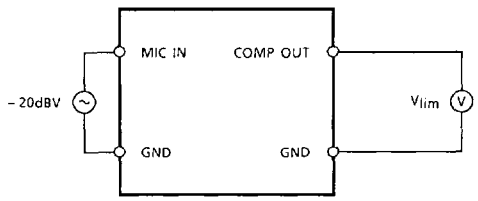
(3) $THD_{C,\,E}$, $DR_{C,\,E}$



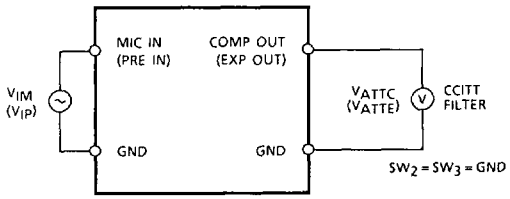
(4) V_{NOC}, V_{NOE}



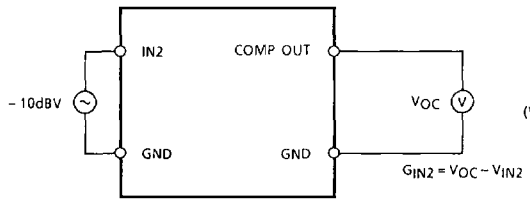
(5) V_{lim}



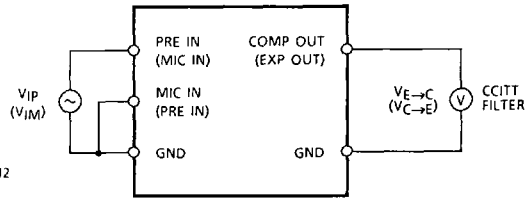
(6) V_{ATTC}, V_{ATTE}



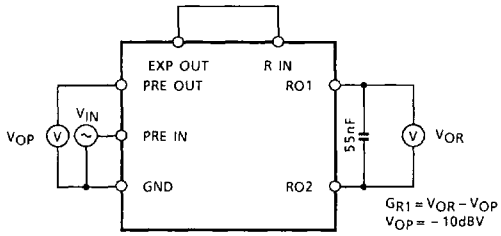
(7) G_{IN2}



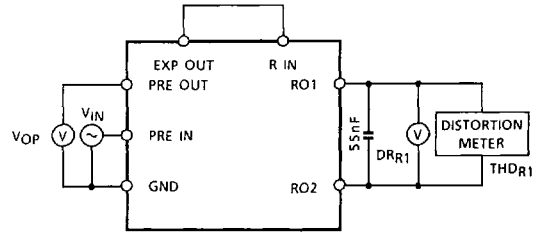
(8) $CT_{E\rightarrow C}$, $C\rightarrow E$



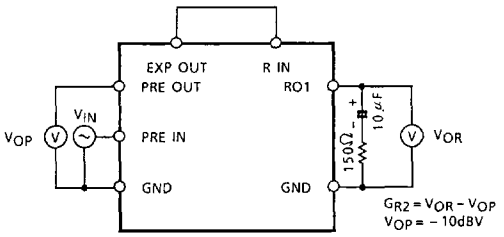
(9) G_{R1}



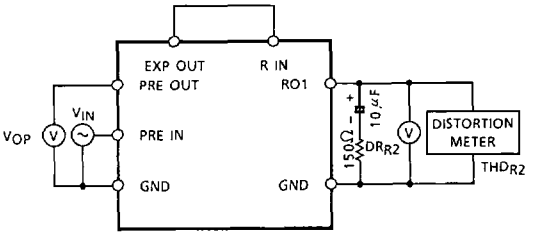
(10) DR_{R1}, THD_{R1}



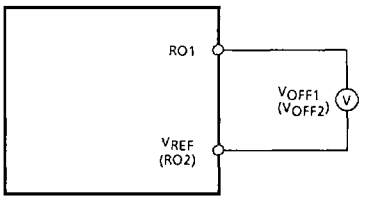
(11) G_{R2}



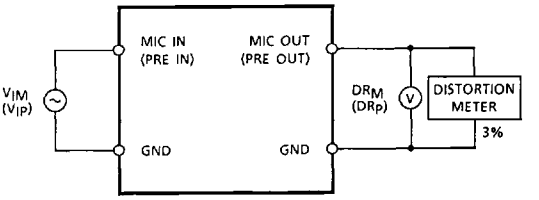
(12) DR_{R2}, THD_{R2}



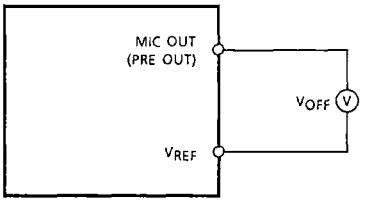
(13) $V_{OFF1, 2}$



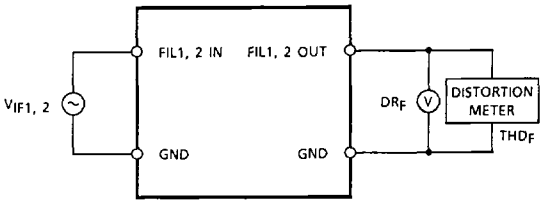
(14) DR_M, DR_P



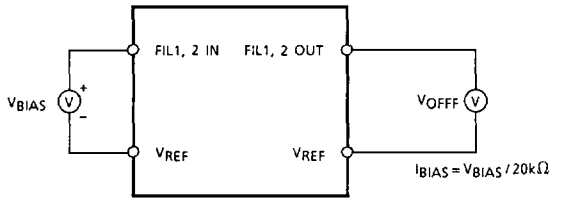
(15) $V_{OFFM, P}$



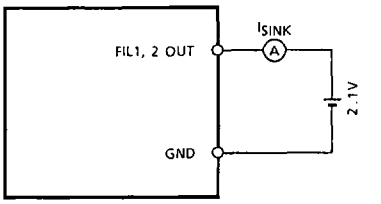
(16) DR_F, THD_F



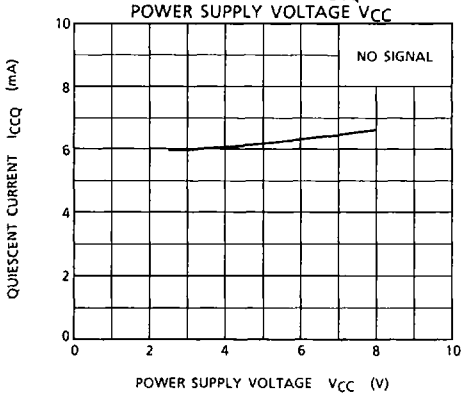
(17) I_{BIAS}, V_{OFF}



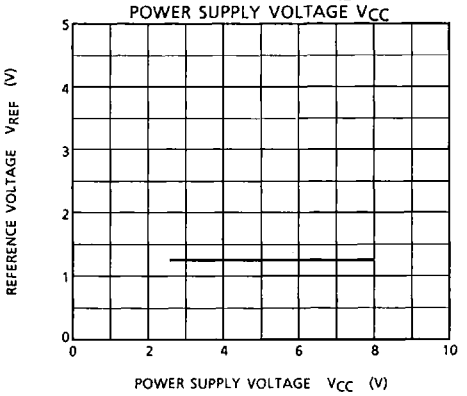
(18) I_{SINK}



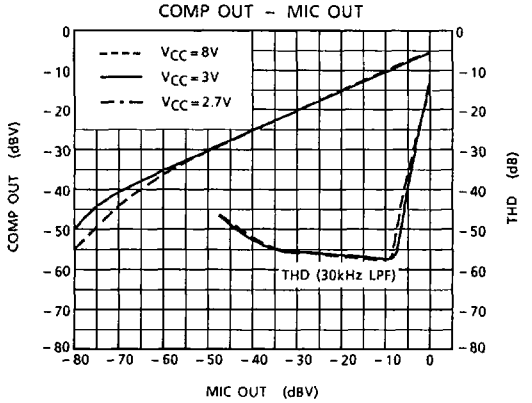
QUIESCENT CURRENT I_{CCQ} – POWER SUPPLY VOLTAGE V_{CC}



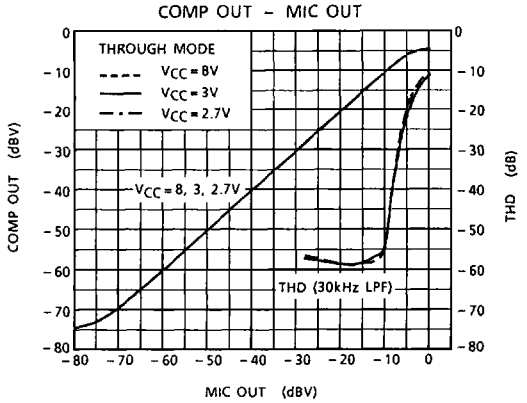
REFERENCE VOLTAGE V_{REF} – POWER SUPPLY VOLTAGE V_{CC}



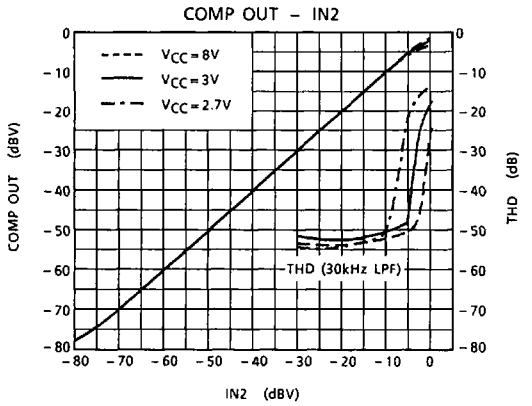
COMP OUT – MIC OUT



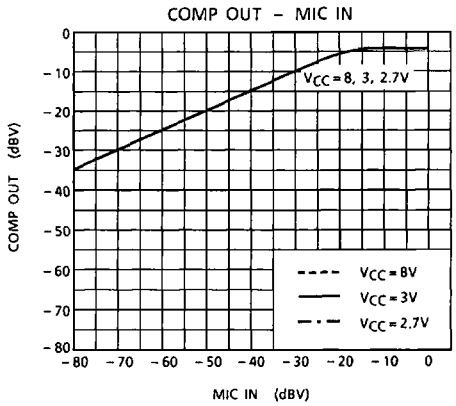
COMP OUT – MIC OUT



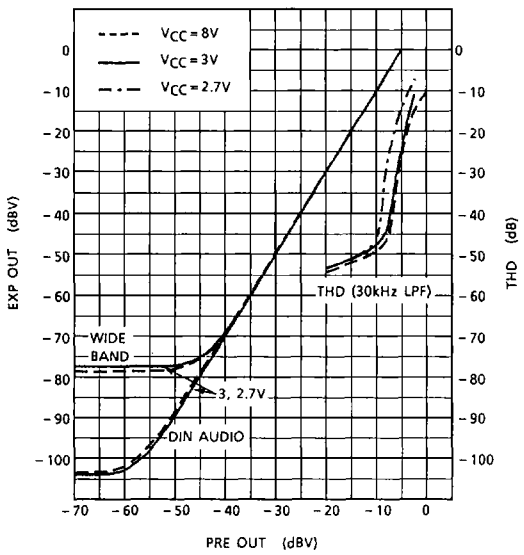
COMP OUT – IN2



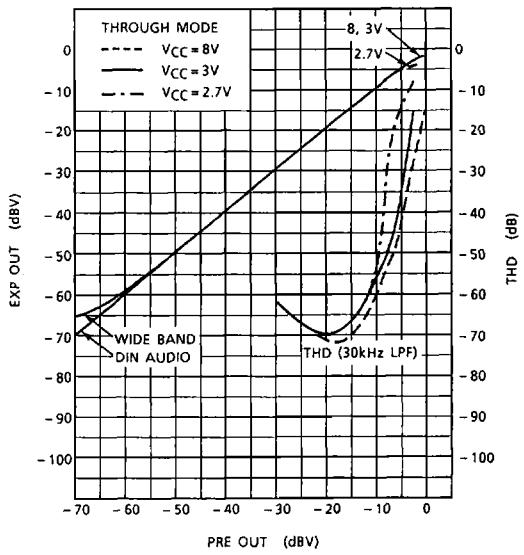
COMP OUT – MIC IN



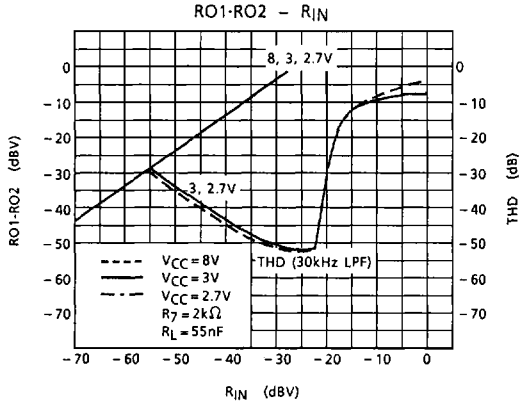
EXP OUT – PRE OUT



EXP OUT – PRE OUT



RO1-RO2 – R_{IN}



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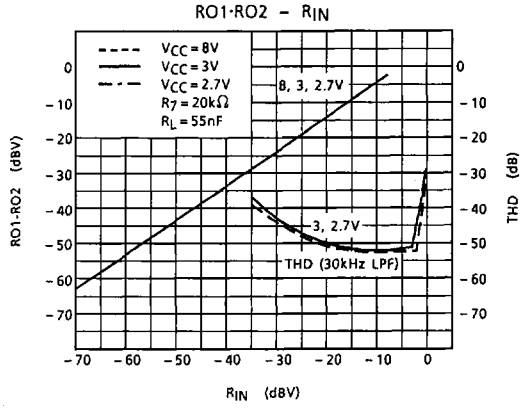

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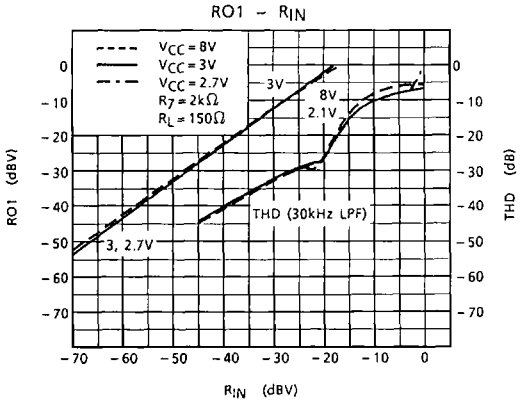
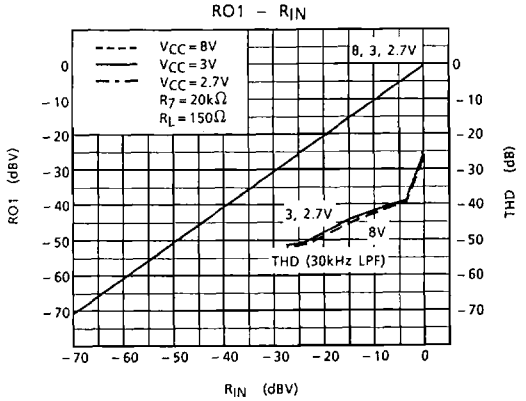
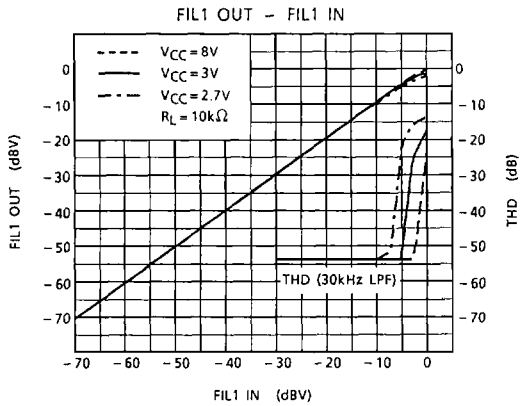
RO1 – R_{IN}



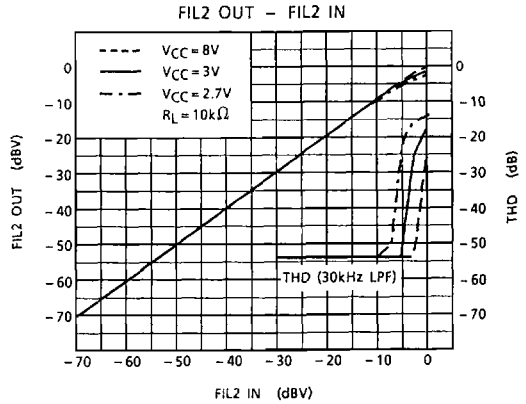
RO1 – R_{IN}



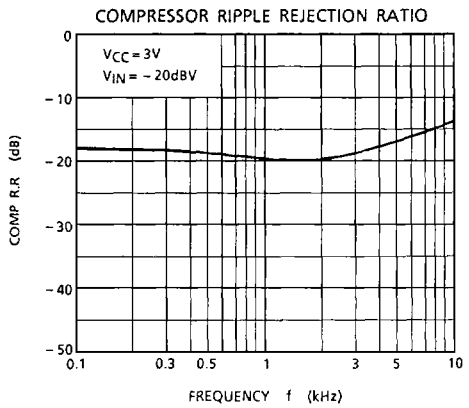
FIL1 OUT – FIL1 IN



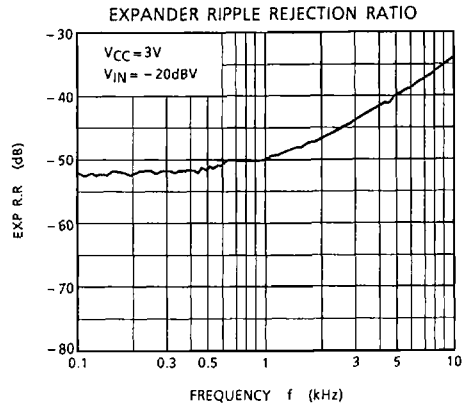
FIL2 OUT – FIL2 IN



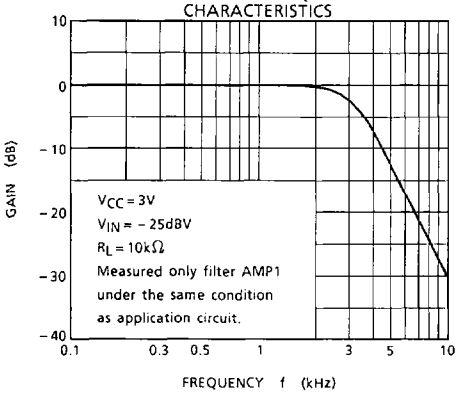
COMPRESSOR RIPPLE REJECTION RATIO



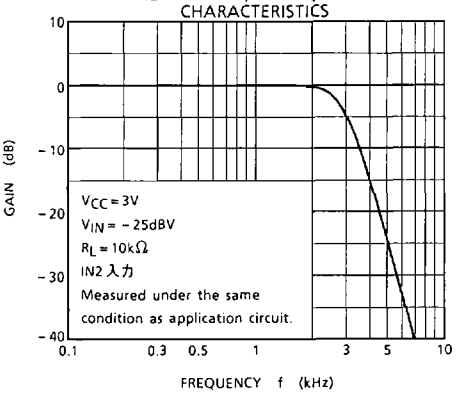
EXPANDER RIPPLE REJECTION RATIO



FILTER AMP1 FREQUENCY CHARACTERISTICS



FILTER AMP1, 2 FREQUENCY CHARACTERISTICS



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APPLICATION CIRCUIT