=== DATA SHEET ===

FUJITSU

MB87079A/87080A
AUDIO FILTER LSI

AUDIO FILTER LSI

The Fujitsu MB87079A/MB87080A, fabricated in CMOS technology, are audio filter LSI for radio equipment. The MB87079A/MB87080A are well suited for cordless telephone, cellular telephone and portable telephone applications.

- Applications
  Cordless telephone
  Celluar radio
  Portable telephone

- Single power supply voltage: + 5V

- Stand–by mode function

- I/O's are TTL compatible

- On–chip oscillator circuit

- Uses standard crystal
  (3 579545MHz)

- Output pins for external compressor, expander are provided

- Limiter circuit suppresses a instaneous frequency deviation in FM modulation

- Mute control of transmit, reception circuits is achieved, individually

- On–chip 1/2 VDD generator circuit (Transmit, Reception)

- 28–pin plastic flat package

PLASTIC PACKAGE
FPT–28P–M01

	Transmit Splatter Filter Cut off Frequency	Standards
MB87079A	$f_C = 3.0kHz$	AMPS/TACS
MB87080A	$f_C = 3.3$ kHz	AMPS/TACS/EIA

ABSOLUTE MAXIMUM RATINGS (see NOTE)

Rating	Symbol	Pin Name	Value			Unit
			Min	Typ	Max	
Power Supply Voltage	V_{DD}	V_{DD}	GND–0.3	–	7	V
Input Voltage	V_{IN}	All Input Pins	GND–0.3	–	$V_{DD} + 0.3$	V
Output Voltage	V_{OUT}	All Output Pins	GND–0.3	–	$V_{DD} + 0.3$	V
Output Current	I_{OUT}	All Output Pins	–10	–	10	mA
Storage Temperature	T_{STG}	–	–40	–	135	°C

NOTE: Permanent device damage may occur if the above **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.

PIN ASSIGNMENT

R_{REF}	1	28	T_{REF}
$RV_{DD/2}$	2	27	$TV_{DD/2}$
DEM	3	26	MOD
AF_{OUT}	4	25	AF_{IN}
EX_{IN}	5	24	EMP_{OUT}
EX_{OUT}	6	23	$COMP_{IN}$
TONE	7 TOP VIEW	22	$COMP_{OUT}$
AGR	8	21	AGT
RAM	9	20	LIM_{OUT}
TAM	10	19	LIM_{IN}
$\overline{PD}$	11	18	AMP_{OUT}
V_{DD}	12	17	AMP_{IN}
DG	13	16	BYPS
OSC_{IN}	14	15	OSC_{OUT}

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MB87079A/MB87080A BLOCK DIAGRAM
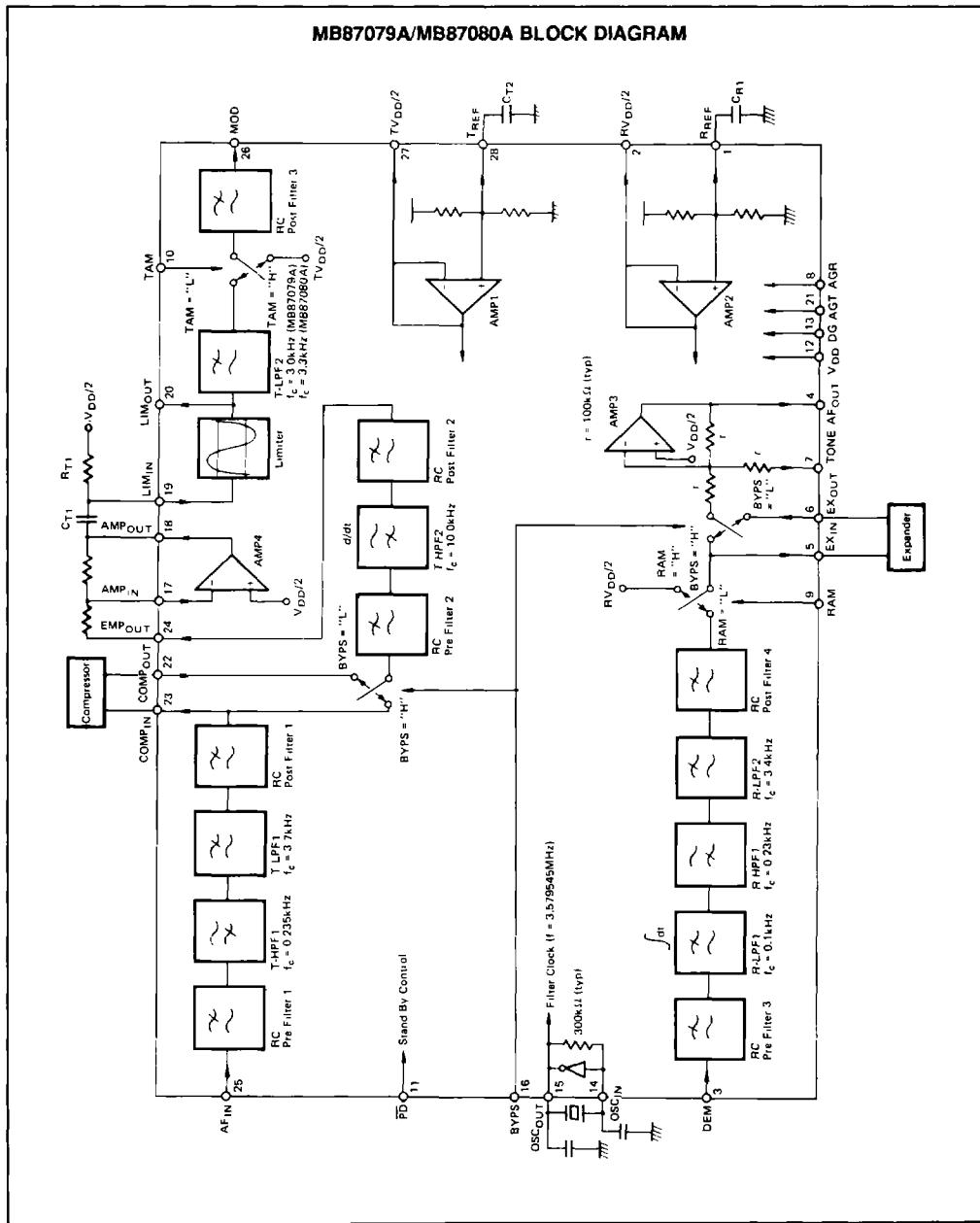
PIN DESCRIPTIONS

Pin No.	Pin Name	I/O	Descriptions
1	R_{REF}	O	Reference output pin to output reference voltage for reception section.
2	$RV_{DD}/2$	O	Reference voltage output pin for reception section. Reception circuit operates referenced to this output level.
3	DEM	I	Input pin for reception section.
4	AF_{OUT}	O	Output pin for reception section.
5	EX_{IN}	O	Output pin for an external expander.
6	EX_{OUT}	I	Input pin from an external expander
7	TONE	I	External tone input pin. This input signal is added to reception signal
8	AGR	–	Ground pin for reception analog circuit.
9	RAM	I	Mute control signal input pin for reception section. When high, reception filter is muted. When low, it is not muted.
10	TAM	I	Mute control signal input pin for transmit section. When high, transmit filter is muted. When low, it is not muted.
11	$\overline{PD}$	I	Standby control input pin. When low, the MB87079A/87080A go to stand–by mode. The oscillator circuit stops operation as well. When high, normal operating mode is selected.
12	V_{DD}	–	Supply voltage input (5V ± 10%)
13	DG	–	Ground pin for digital circuit.
14	OSC_{IN}	I	Clock input pin for internal SCF (Switched capacitor filter). An external crystal (3 579545MHz) is connected between OSC_{IN} pin and OSC_{OUT} pin, or external clock is input to OSC_{IN} pin. In this case, OSC_{OUT} pin should be left open.
15	OSC_{OUT}	O	Output pin for oscillator circuit. When an external oscillator is used, this pin shold be left open.
16	BYPS	I	Bypass control signal input for external compressor and expander. When high, external compressor and expander are bypassed When low, they are not bypassed.
17	AMP_{IN}	I	Negative input pin for AMP4.
18	AMP_{OUT}	O	Output pin for AMP4.
19	LIM_{IN}	I	Limiter input pin. When a capacitor is inserted before LIM_{IN} pin, DC level is cut. After cutting DC level is input to this pin.
20	LIM_{OUT}	O	Output pin for transmit limiter Clipped wave by LIMH and LIML levels is output.

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PIN DISCRIPTIONS (Continued)

| Pin No.	Pin Name	I/O	Descriptions
21	AGT	–	Ground pin for transmit analog circuit.
22	COMP$_{OUT}$	I	Input pin from an external compressor.
23	COMP$_{IN}$	O	Output pin for an external compressor.
24	EMP$_{OUT}$	O	Output pin for Pre Emphasis.
25	AF$_{IN}$	I	Input pin for transmit section.
26	MOD	O	Output pin for transmit section.
27	TV$_{DD}$/2	O	Reference voltage output pin for transmit section. Transmit circuit operates referenced to this output level.
28	T$_{REF}$	O	Reference output pin to output reference voltage for transmit section.

FUNCTIONAL DESCRIPTIONS

1. STAND–BY MODE

Mode			$\overline{PD}$	L	H
Block Name	Transmit Section		Pre Filter 1	X	O
			T–HPF 1	X	O
			T–LPF 1	X	O
			Post Filter 1	X	O
			Pre Filter 2	X	O
			T–HPF 2	X	O
			Post Filter 2	X	O
			Limiter	X	O
			T–LPF 2	X	O
			Post Filter 3	X	O
			AMP 4	X	O
			AMP 1	O	O
	Reception Section		Pre Filter 3	X	O
			R–LPF 1	X	O
			R–HPF 1	X	O
			R–LPF 2	X	O
			Post Filter 4	X	O
			AMP 2	O	O
			AMP 3	X	O
	–		OSC	X	O

Note: O = Normal operating mode
     X = Stand–by mode

2. LIMITER CIRCUIT

89.4Ω (Typ.)

10.6Ω (Typ.)

$V_{DD}/2$

10.6Ω (Typ.)

89.4Ω (Typ.)

Decoder

S1

S2

S3

S1

S2

S3

SW

LIM $_{IN}$

LIM $_{OUT}$

LIM$_{IN}$ Input Level (Typ)	SW	LIM$_{OUT}$ Output Level (Typ)
$(V_{DD}/2) - 0.265 > VLIM_{IN}$	S1	$(V_{DD}/2) - 0.265$ [V]
$(V_{DD}/2) - 0.265 \leq VLIM_{IN} \leq (V_{DD}/2) + 0.265$	S2	$VLIM_{IN}$ [V]
$(V_{DD}/2) + 0.265 < VLIM_{IN}$	S3	$(V_{DD}/2) + 0.265$ [V]

*$V_{DD} = 5.0V$

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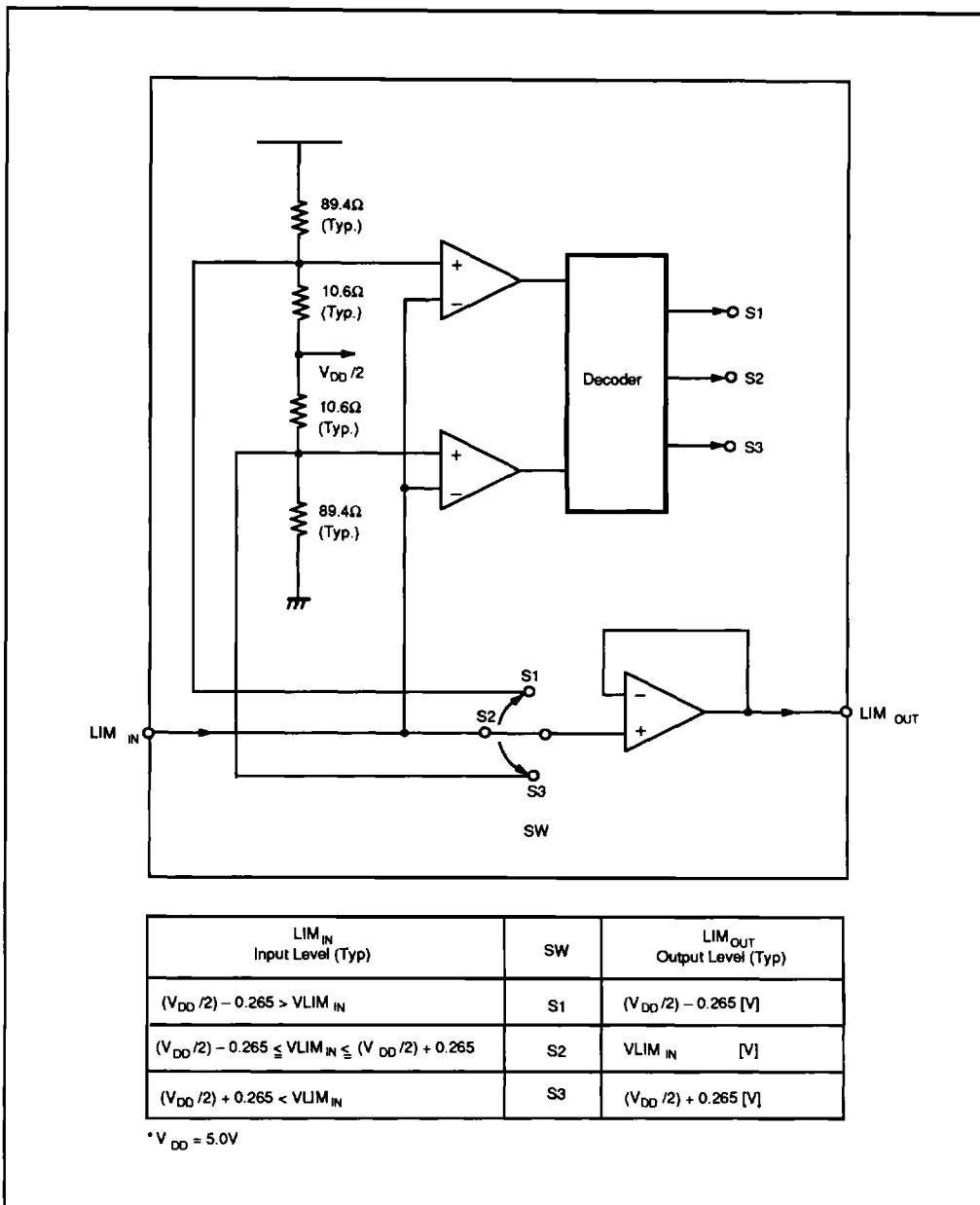
3. FILTER CALUCULATION VALUE

Filter Name	f_C (Hz)	Gain (dB)	Function
T–HPF 1	0.235k	0.0	3rd order butterworth
T–LPF 1	3.7k	0.0	4rd order butterworth
T–HPF 2	10.0k	0.0 at 1kHz	1st order butterworth
T–LPF 2	3.0k(MB87079A) 3.3k (MB87080A)	9.0	6th order butterworth
R–LPF 1	0.1k	0.0 at 1kHz	1st order butterworth
R–HPF 1	0.23k	0.0	5th order butterworth
R–LPF 2	3 4k	0 0	5th order butterworth
Pre Filter 1 ~ 3	20.0k	0 0	2nd order butterworth
Post Filter 1 ~ 4	20.0k	0 0	2nd order butterworth

RECOMMENDED OPERATING CONDITIONS

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Parameter	Symbol	Pin Name	Value			Unit
			Min	Typ	Max	
Power Supply Voltage	V_{DD}	V_{DD}	4.5	5.0	5.5	V
Input Voltage	V_{IN}	All Input Pins	0.0	–	V_{DD}	V
Analog Output Load Resistance 1	R_{L1}	$COMP_{IN}$, MOD, EX_{IN} , AF_{OUT} , $TV_{DD}/2$, $RV_{DD}/2$, AMP_{OUT} , EMP_{OUT} , LIM_{OUT}	10	–	–	kΩ
Analog Output Load Capacitance 1	C_{L1}	T_{REF} R_{REF}	–	1.0	–	μF
Analog Output Load Capacitance 2	C_{L2}	$TV_{DD}/2, RV_{DD}/2$	–	–	100.0	pF
Operating Temperature	T_A	–	0	–	70	°C

Note: The MB87079A/87080A contain analog circuit and digital circuit on a single chip. When the MB87079A/87080A are mounted on the PCB, normal characteristics may not achieved due to nise problem We recommended to use bypass condenser and strong ground.

ELECTRICAL CHARACTERISTICS

### 1. DC CHARACTERISTICS

V_{DD}= 5.0V ±10%, T_A = 0 ~ 70° C

Parameter	Symbol	Pin Name	Condition	Value			Unit
				Min	Typ	Max	
Power Supply Current 1	I_{DD1}	V_{DD}	$\overline{PD}$ = "H"	–	6	10	mA
Power Supply Current 2	I_{DD2}	V_{DD}	$\overline{PD}$ = "L"	–	0.7	1.5	mA
Digital Input Low Voltage	V_{IL}	TAM, RAM $\overline{PD}$, BYPS	–	0.0	–	0.8	V
		OSC $_{IN}$	External Clock Input	0.0	–	0.3	V
Digital Input High Voltage	V_{IH}	TAM, RAM $\overline{PD}$, BYPS	–	2.2	–	V_{DD}	V
		OSC $_{IN}$	External Clock Input	3.0	–	V_{DD}	V
Digital Input Low Current	I_{IL}	TAM, RAM $\overline{PD}$, BYPS	V_{IN} = GND	–10	–	10	μA
Digital Input High Current	I_{IH}	TAM, RAM $\overline{PD}$, BYPS	V_{IN} = V_{DD}	–10	–	10	μA
Analog Input Voltage Range	V_{IA}	COMP$_{OUT}$, DEM LIM $_{IN}$, EX$_{OUT}$ AF $_{IN}$, TONE AMP$_{IN}$	–	1/4 V_{DD}	–	3/4 V_{DD}	V
Analog Input Resistance	R_{AIN1}	COMP$_{OUT}$, DEM LIM $_{IN}$, EX$_{OUT}$ AF$_{IN}$, AMP$_{IN}$	Input Pins to V_{DD}/2	100	–	–	kΩ
Analog Output Load Resistance 1	R_{LA1}	COMP$_{IN}$, MOD, AF $_{OUT}$, EX $_{IN}$ AMP$_{OUT}$, LIM$_{OUT}$ EMP $_{OUT}$	Output Pins to V_{DD}/2	10	–	–	kΩ
Analog Output Load Capacitance 1	C_{LA1}	TV$_{DD}$/2 RV$_{DD}$/2	–	–	–	100	pF
Analog Output Load Capacitance 2	C_{LA2}	T$_{REF}$ R$_{REF}$	–	–	1.0	–	μF
Analog Output Voltage Range	V_{OA}	COMP$_{IN}$, MOD, EX $_{IN}$, EMP$_{OUT}$ AF $_{OUT}$, AMP $_{OUT}$ LIM$_{OUT}$	–	1/4 V_{DD}	–	3/4 V_{DD}	V
Limiter High Voltage	V_{DLH}	LIM $_{IN}$ – LIM $_{OUT}$	Input Lervel LIM$_{IN}$ = 3/4 V_{DD}	TV$_{DD}$/2 +0.050 x V_{DD}	TV$_{DD}$/2 +0.053 x V_{DD}	TV$_{DD}$/2 +0.056 x V_{DD}	V
Limiter Low Voltage	V_{DLL}	LIM $_{IN}$ – LIM $_{OUT}$	Input Lervel LIM$_{IN}$ = 1/4 V_{DD}	TV$_{DD}$/2 –0.056 x V_{DD}	TV$_{DD}$/2 –0.053 x V_{DD}	TV$_{DD}$/2 –0.050 x V_{DD}	V

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2. AC CHARACTERISTICS

V_{DD} = 5.0V ±10%, 0dBV = 1Vrms, T_A = 0 ~ 70°C

Parameter	Symbol	Pin Name	Condition	Value			Unit
				Min·	Typ	Max	
Clock High Pulse Width	t_{WHCK}	OSC_{IN}	External clock input	0.1	–	–	μs
Clock Low Pulse Width	t_{WLCK}	OSC_{IN}	External clock input	0.1	–	–	μs
Rise Time	t_r	OSC_{IN}	External clock input	0	–	20	ns
Fall Time	t_f	OSC_{IN}	External clock input	0	–	20	ns

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TRANSMISSION CHARACTERISTICS

V_{DD} = 5.0V ±10%, 0dBV = 1Vrms, T_A = 0 ~ 70°C

Parameter	Symbol	Pin Name	Condition	Value			Unit
				Min	Typ	Max	
Transmission Gain	TG_{AIN}	AF_{IN}–MOD	Input: –27dBV, 1kHz $\overline{PD}$ = "H", TAM = "L" BYPS = "H"	7.0	9.0	11.0	dB
Transmission Mute Attenuation	TMUTE	AF_{IN}–MOD	Input: –27dBV, 1kHz $\overline{PD}$ = "H", TAM = "H" BYPS = "H"	45	–	–	dB
Transmission S/N Ratio	T–S/N	AF_{IN}–MOD	Input: –27dBV, 1kHz $\overline{PD}$ = "H", TAM = "L" BYPS = "H" Band width: 50Hz~20kHz	40	50	–	dB
Transmission Distortion	T–S/D	AF_{IN}–MOD	Input: –27dBV, 1kHz $\overline{PD}$ = "H", TAM = "L" BYPS = "H" Band width: 50Hz~20kHz	–	–50	–40	dB
Reception Gain	RG_{AIN}	DEM–AF_{OUT}	Input: –26dBV, 1kHz $\overline{PD}$ = "H", RAM = "L" BYPS = "H" TONE = V_{DD}/2(R)	–1.0	0.0	1.0	dB
Reception Mute Attenuation	RMUTE	DEM–AF_{OUT}	Input: –18dBV, 1kHz $\overline{PD}$ = "H", RAM = "H" BYPS = "H" TONE = V_{DD}/2(R)	45	–	–	dB
Reception S/N Ratio	R–S/N	DEM–AF_{OUT}	Input: –18dBV, 1kHz $\overline{PD}$ = "H", RAM = "L" BYPS = "H" TONE = V_{DD}/2(R) Band width: 50Hz~20kHz	45	60	–	dB
Retention Distortion	R–S/D	DEM–AF_{OUT}	Input: –18dBV, 1kHz $\overline{PD}$ = "H", RAM = "L" BYPS = "H" TONE = V_{DD}/2(R) Band width: 50Hz~20kHz	–	–60	–40	dB

V_{DD} = 5.0V ±10%, 0dBV = 1Vrms, T_A = 0 ~ 70°C

Parameter	Symbol	Pin Name	Condition	Characteristics
Transmission Frequency Characteristics	T_{FA}	AF_{IN}–MOD	Input: –27dBV, $\overline{PD}$ = "H", TAM = "L" BYPS = "H" Ref. 1kHz	See Fig. 1 (MB87079A) See Fig. 2 (MB87080A)
Reception Frequency Characteristics	R_{FA}	DEM–AF_{OUT}	Input: –26dBV, $\overline{PD}$ = "H", RAM = "L" BYPS = "H" TONE = V_{DD}/2(R) Ref. 1kHz	See Fig. 3 (MB87079A/80A)

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# TRANSMISSION CHARACTERISTICS

Fig. 1 – MB87079A TRANSMT FREQUENCY CHARACTERISTICS

Fig. 2 – MB87080A TRANSMIT FREQUENCY CHARACTERISTICS

Fig. 3 – MB87079A/MB87080A RECEPTION FREQUENCY CHARACTERISTICS
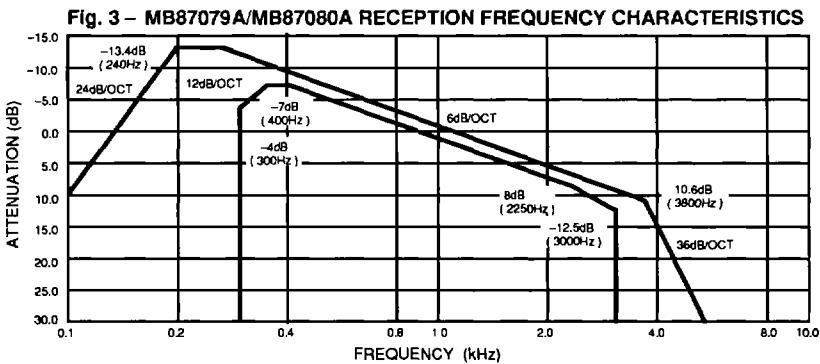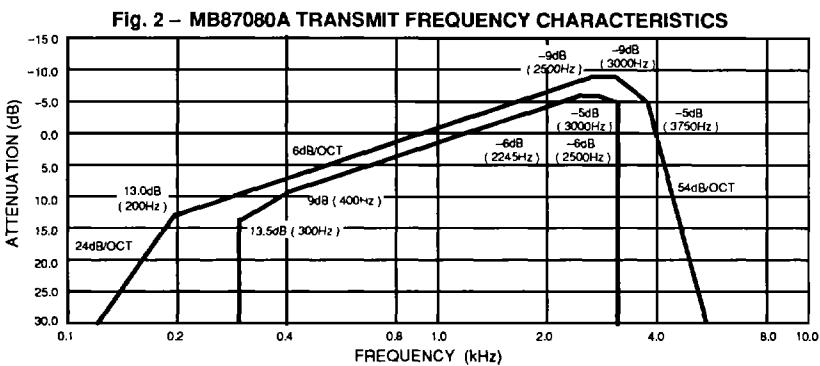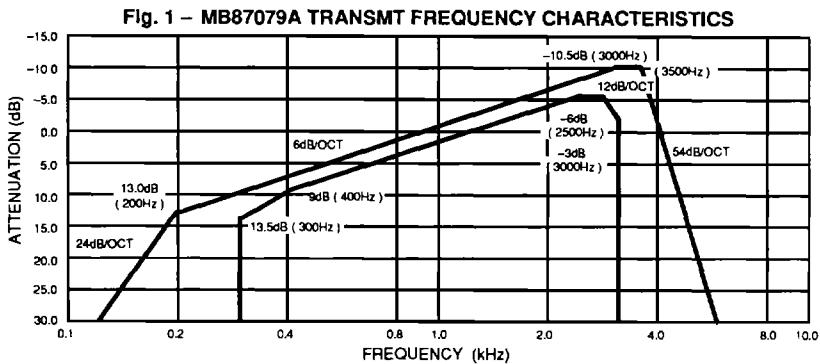
Fig. 4 – MB87079A/87080A APPLICATION EXAMPLE
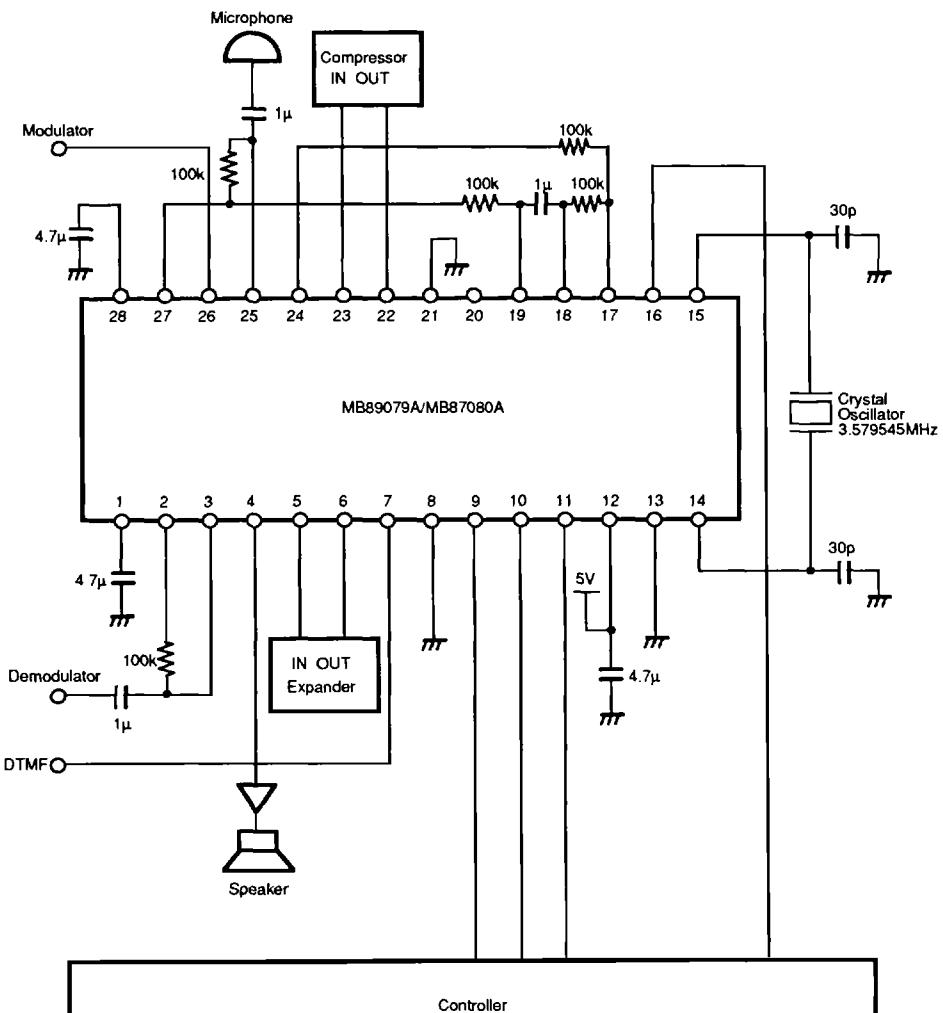
PACKAGE DIMENSIONS

28–LEAD PLASTIC FLAT PACKAGE
(Case No.: FPT–28P–M01)

699 + 010 / 008 (17 75 + 0 25 / - 0 20)

402 ± 016
(10 20 ± 0 40)

299 ± 012
(7 60 ± 0 30)

INDEX

050(1 271)
TYP

018 ± 004
(0 45 ± 0 10)

⊕ φ 005(0 13) Ⓜ

A

004(0 10)

650(16 51) REF

110(2 80) MAX
(SEATED HEIGHT)

002(0 05) MIN
(STAND OFF)

362 ± 012
(9 20 ± 0 30)

020 ± 008
(0 50 ± 0 20)

006 + 002 / 001 (0 15 + 0 05 / - 0 02)

Details of 'A' part

008(0 20)

024(0 60)

007(0 18)
MAX
027(0 68)
MAX
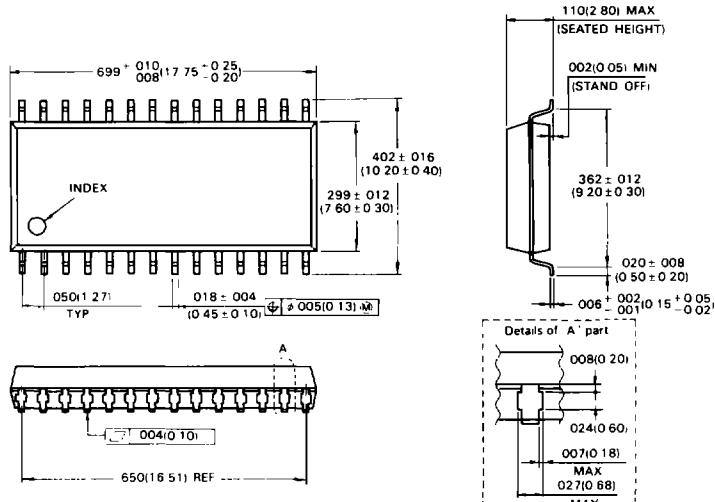
Dimensions in
inches (millimeters)

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