M5246P,FP

SINGLE POWER SOURCE PREAMPLIFIER WITH SWITCHING CIRCUITS

DESCRIPTION

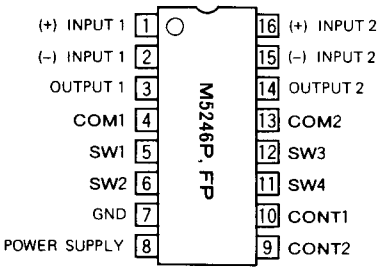
M5246 is a semiconductor integrated circuit designed as a single power source preamplifier containing analog switching circuits. Two channels of preamplifiers and analog switches are contained in the 16-pin DIP or mini-flat standard package. Each of them can be used separately or can be combined.

The switch control can be operated using CONT pins in four modes.

The (+) input can be operated from the GND level and can be used for the single preamplifier or the switching function plus preamplifier.

Since this device uses the single power supply, it is best suitable for portable audio equipments such as cassette tape recorders with radio, mini-component audio sets, tape recorders, etc.

PIN CONFIGURATION (TOP VIEW)



Outline 16P4(M5246P)
16P2S(M5246FP)

FEATURES

- Low noise . . . . . V_{NI} = 0.8μVrms (typ.) @R_S = 2.2kΩ
- High open loop voltage gain . . . . . G_{VO} = 80dB (typ.) @f = 400Hz
- Low distortion . . . . . THD = 0.025% (typ.) @f = 1kHz, V_O = 0.3Vrms
- Can be used as the switching function plus preamplifier or as a preamplifier.
- The switch section can use 4 modes.
- The input level can be operated from the GND level so that no coupling capacitor is required.
- Can use the single power supply for operation.
- Contains the output-rise speed-up circuit when power is applied.

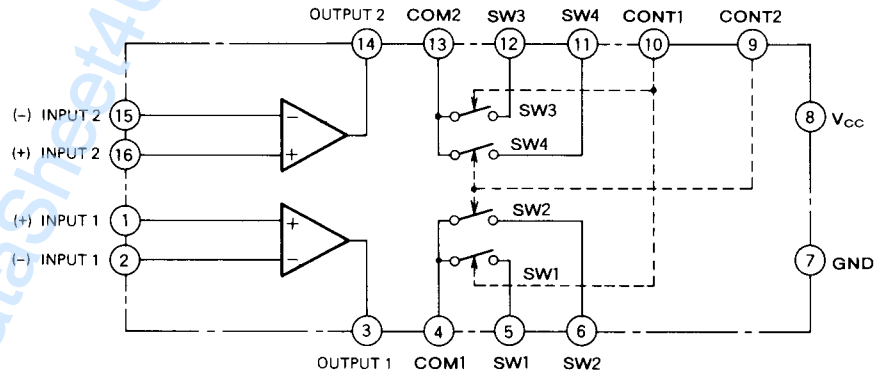
RECOMMENDED OPERATING CONDITIONS

Supply voltage range . . . . . 4 ~ 16V
Rated supply voltage 9V

APPLICATION

Cassette tape recorders with radio, tape recorders, preamplifiers for audio sets

BLOCK DIAGRAM



SINGLE POWER SOURCE PREAMPLIFIER WITH SWITCHING CIRCUITS

ABSOLUTE MAXIMUM RATINGS (Ta = 25℃, unless otherwise noted)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Supply voltage		20	V
V_{CONT}	Control voltage		−0.3 ~ 20	V
P_d	Power dissipation		700 (DIP)	mV
			550 (FP)	
K_θ	Thermal derating	Ta ≧ 25℃	7 (DIP)	mW/℃
			5.5 (FP)	
T_{opr}	Operating temperature		−20 ~ +75	℃
T_{stg}	Storage temperature		−55 ~ +125	℃

ELECTRICAL CHARACTERISTICS (Ta = 25℃, V_{CC} = 9V)

Symbol	Parameter	Test conditions		Limits			Unit
		f (Hz)		Min	Typ	Max	
I_{CC}	Circuit current	—	R_S = 2.2kΩ, R_R = 390kΩ, CONT = GND		3.9	8.0	mA
$+I_B$	Positive input bias current	—	R_S = 10kΩ		0.5	5	μA
$-I_B$	Negative input bias current	—	Rg = 390kΩ		50	500	nA
G_{VO}	Open loop voltage gain	400	V_O = −10dB	65	80		dB
THD	Total harmonic distortion	1k	V_O = 300mVrms, BW : 400Hz ~ 30kHz		0.025	1	%
V_{OM}	Maximum output voltage	1k	THD = 1%	0.5	0.7		Vrms
V_{NI}	Input-referred noise voltage	—	R_S = 2.2kΩ, 30kHz		0.8	2.5	μVrms
CC	Channel separation	1k	V_O = 0dBm, 30kHz	55	75		dB
R_{on}	ON resistance	1k	V_O = 10mVrms		20	50	Ω
CT	Cross talk	1k	V_O = 0dBm, 30kHz	55	75		dB
S_{on}	Switch ON voltage	—	I_O = 5mA, COM = GND, V_{OL} ≦ 400mV	2.0		20	V
S_{off}	Switch OFF voltage	—	I_{leak} ≦ 10μA, COM = GND	−0.3		0.6	V
V_{OL}	Low output voltage	—	I_O = 5mA		100	400	mV
I_{leak}	Leak current	—	V_O = 20V, C_{ONT} = GND		2	10	μA
I_{sink}	Sink current	—	V_O = 1V, C_{ONT} = OPEN	5	25		mA

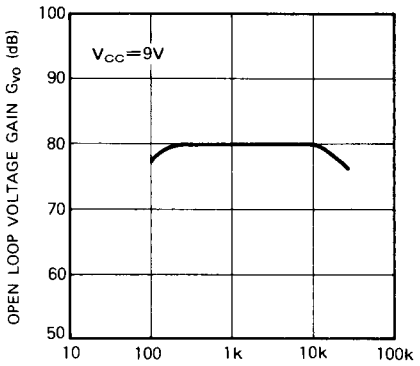
SWITCH ACTION (COM = GND)

CONTROL (CONT) VOLTAGE

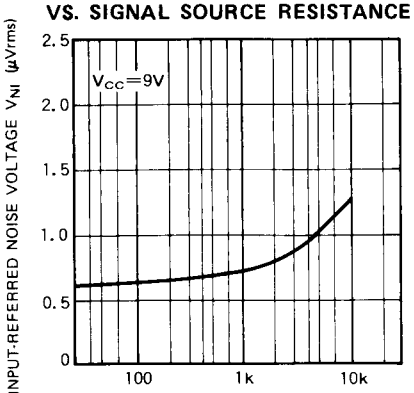
SINGLE POWER SOURCE PREAMPLIFIER WITH SWITCHING CIRCUITS

TYPICAL CHARACTERISTICS

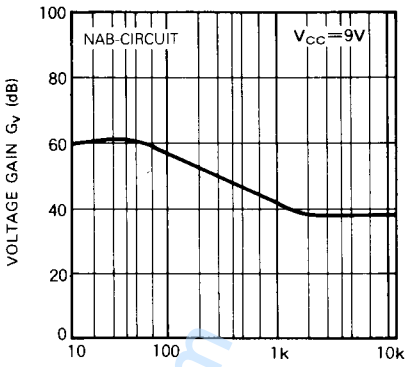
OPEN LOOP VOLTAGE GAIN VS. FREQUENCY RESPONSE



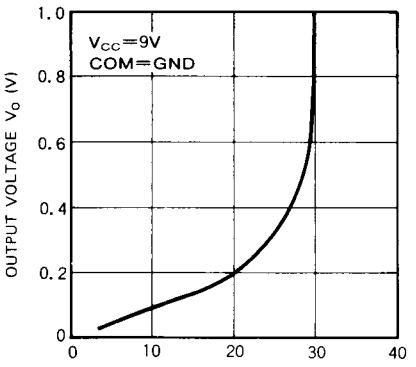
INPUT-REFERRED NOISE VOLTAGE VS. SIGNAL SOURCE RESISTANCE



VOLTAGE GAIN VS. FREQUENCY RESPONSE

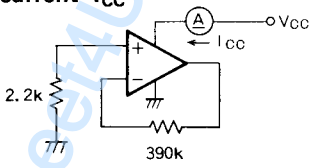


SW OUTPUT VOLTAGE VS. SW OUTPUT CURRENT

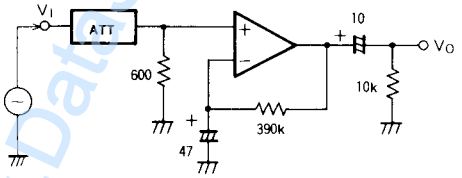


TEST CIRCUIT

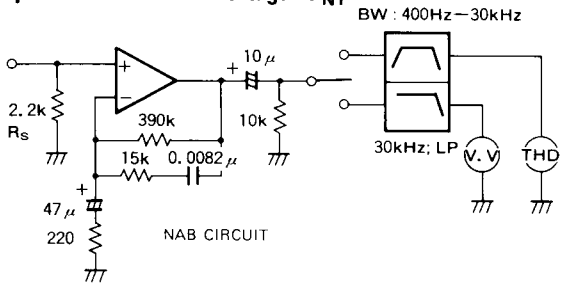
Circuit current I_{CC}



Open loop voltage gain G_{VO}



Total Harmonic distortion THD, Maximum output voltage V_{OM}, Input-referred noise voltage V_{NI}



Unit Resistance: Ω
Capacitance: F

SINGLE POWER SOURCE PREAMPLIFIER WITH SWITCHING CIRCUITS

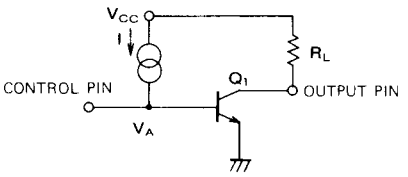
DESCRIPTION OF THE SWITCHING CIRCUIT OPERATIONS AND ITS USAGE

When constant current I is sent to the NPN transistor shown below, Q_1 becomes the bias status, V_A potential becomes the V_{BE} of Q_1, and the potential of the output pin becomes the $V_{CE(sat)}$ of Q_1.

At the point if the control pin is grounded, V_{BE} of Q_1 becomes off state and all the current flow to the GND. The output potential becomes V_{CC}.

In case of this circuit, the switching operation can be initiated by turning ON/OFF the V_{BE} of Q_1.

1. BASIC CIRCUIT



In case that COM = GND and the R_L in inserted between SW OUT-V_{CC}:

If constant current is supplied, D_2, D_3, and Q_1 become ON, the potential of V_A becomes $2V_F + V_{BE}$, and all the current I becomes the drive current for Q_1.

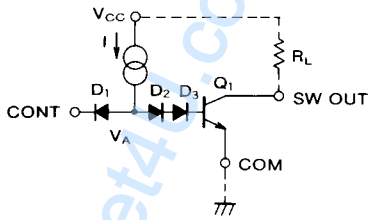
The SW OUT potential becomes the $V_{CE(sat)}$ of Q_1.

At this point if the CONT pin is grounded, V_A becomes the V_F of D_1 and D_2, D_3, and Q_1 can not be set to ON so that I will flow through D_1 to the GND.

By controlling the potential of V_A, M5246 switches Q_1.

Note: Each inserted diode is used for pressure compensation centering at the point V_A.

2. ACTUAL CIRCUIT

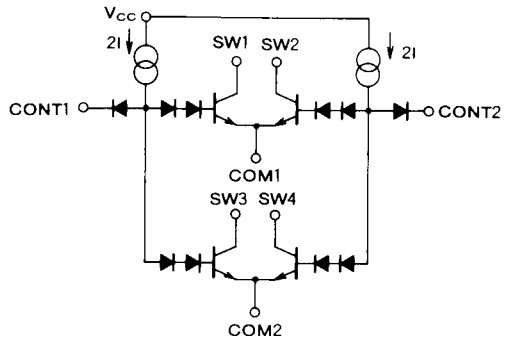


1. COM pin arbitrary sets the DC potential. (The above potential V_A is not determined if it is not DS biased.)
2. Because of the above, Q_1 ON/OFF will be set arbitrary. (The standard values for electrical characteristics is limited only to COM = GND.)
3. It is desirable that the switch control to be OPEN/GND as a standard.
4. AC input is available for both the COM and SW OUT sides.
5. Two circuits of emitters are shared (COM) so that it is best suitable for the selection, branch, and synthesis of 2-input/output.
6. Since SW1, 3/SW2, and 4 are common to the CONT, they cannot operate separately.

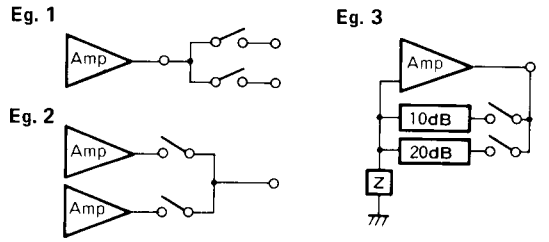
CONT1	OPEN	OPEN	GND	GND
CONT2	OPEN	GND	OPEN	GND
SW1	L	L	H	H
SW2	L	H	L	H
SW3	L	L	H	H
SW4	L	H	L	H

* When a R_L is inserted between each SW output pin and V_{CC} and each COM pin is grounded.

3. USAGE



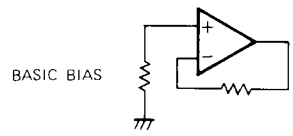
4. SAMPLE USAGES



NOTE ON THE USAGE:

1. DC bias voltage must be applied to the Amp. section.
2. Note that the reverse insertion of elements or supplying the source voltage under pin shifted status may degrade the performance or destroy the IC.

   Moreover, the SW section can be used separately as a driver of LEDs.



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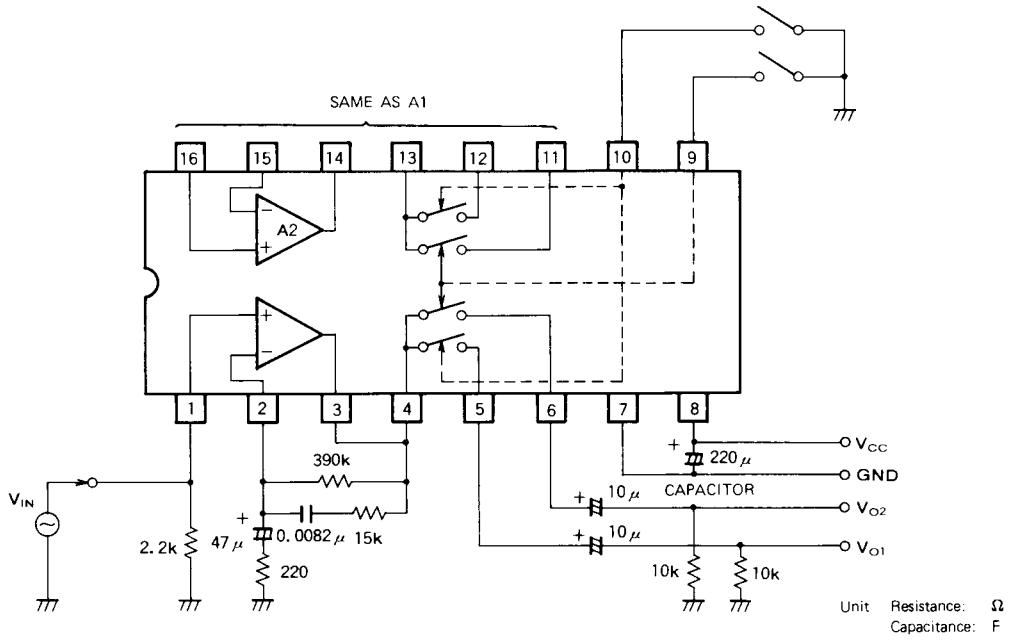
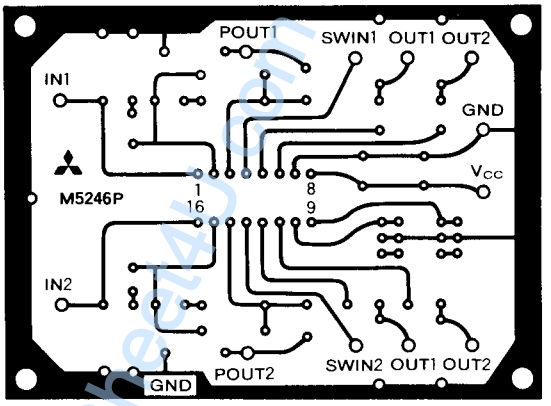
APPLICATION EXAMPLES



PCB FOR CIRCUIT TESTING (Typical application example)

PCB DIAGRAM (COPPER FOIL SIDE)



(PARTS INSERTION SIDE)