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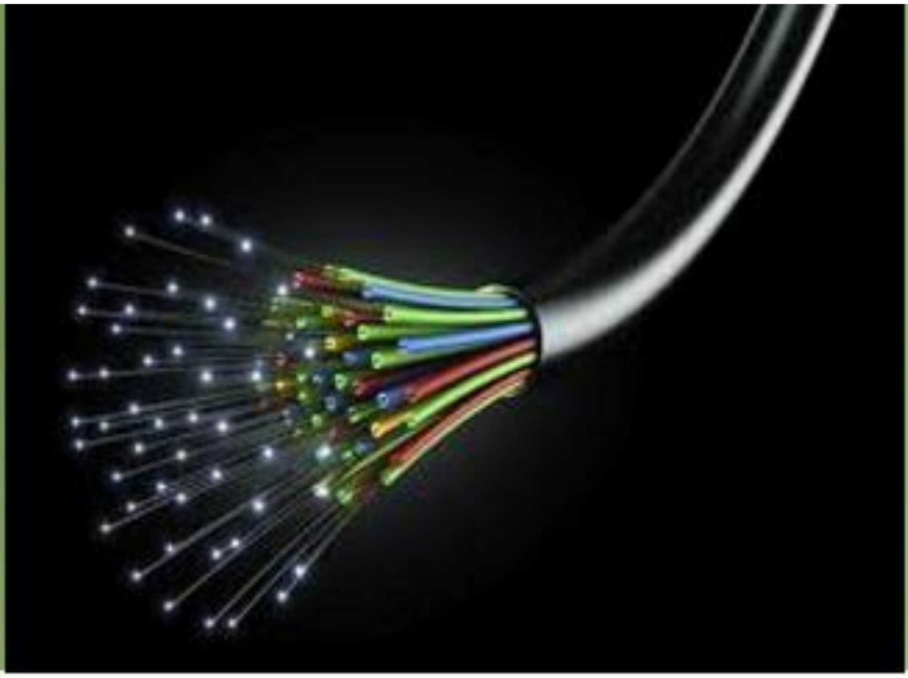
USER MANUAL

FIBER OPTIC ANALOG TRANSMITTER AND RECEIVER MODULE



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1. INTRODUCTION

Now we are in the twenty first century, the era of 'Information technology' there is no doubt that information technology has had an exponential growth through the modern telecommunication systems. Particularly, optical fiber communication plays a vital role in the development of high quality and high-speed telecommunication systems. Today, optical fibers are not only used in telecommunication links but also used in the Internet and local area networks (LAN) to achieve high signaling rates.

The Fiber Optics Analog communication Module consists of Fiber Optics Analog Transmitter Module PS-FO-AT and Fiber optics Analog Receiver Module PS-FO-AR. It uses to study the Fiber Optics Analog Transmission and Reception through plastic fiber cable.

In Transmitter Module, Onboard Function Generator at Variable frequency and Variable Amplitude, Supporting External Sine signal at certain range, Voice communication and LED Driver circuit. In Receiver Module, Photo diode Driver section, Amplifier, Buffer and Power Amplifier circuit. All connecterization are through BNC Connecters, RS232 connecters, uninsulated sockets and Patch chords.

2. PREFACE

2.1 Transmitter

The heart of the transmitter is a light source. The major function of a light source is to convert an information signal from its electrical form into light. Today's fiber-optic communications systems use, as a light source, either light-emitting diodes (LEDs) or laser diodes (LDS). Both are miniature semiconductor devices that effectively convert electrical signals into light. They need power-supply connections and modulation circuitry. All these components are usually fabricated in one integrated package.

2.2 Optical fiber

The transmission medium in fiber-optic communications systems is an optical fiber. The optical fiber is the transparent flexible filament that guides light from a transmitter to a receiver. An optical information signal entered at the transmitter end of a fiber - optic communications system is delivered to the receiver end by the optical fiber.

2.3 Receiver

The key component of an optical receiver is its photo detector. The major function of a photo detector is to convert an optical information signal back into an electrical signal (Photocurrent). The photo detector in today's fiber - optic communications systems is a semiconductor photodiode (PD). This miniature device is usually fabricated together with its electrical circuitry to from an integrated package that provides power-supply connections and signal amplification.

2.4 Advantage of Optical Fiber Systems:

- Greater information capacity: Optical fiber communications systems have a greater information capacity than metallic cables due to the inherently larger bandwidths available with optical frequencies. Optical fibers are available with bandwidth up to10 GHz. Metallic cables exhibit capacitance between and inductance along their conductors causing them to act like low-pass filters, which limit their transmission frequencies, bandwidths, and information-carrying capacity. Modern optical fiber communication systems are capable of transmitting several gigabits per second over hundreds of miles allowing literally millions of individual voice and data channels to be combined and propagated over one optical fiber cable.

- Immunity to crosstalk: Optical cables are immune to crosstalk between adjacent cables due to magnetic induction. Glass or plastic fibers are nonconductors of electricity and, therefore, do not have magnetic fields associated with them. In metallic cables, the primary cause of crosstalk is magnetic induction between conductors located physically close to each other.

- Immunity to static interference: Optical cables are immune to static noise caused by electromagnetic interference (EMI) from lighting, electric motors, fluorescent lights, and other electrical noise sources. This immunity is also attributed to the fact that optical fibers are nonconductors of electricity and external electrical noise does not affect energy at light frequencies. Fiber cables do not radiate RF energy either and, therefore, cannot interfere with other communications systems. This characteristic makes optical fiber systems ideally suited for military applications where the effects of nuclear weapons (electromagnetic pulse interference-EMP) have a devastating effect on conventional electronic communications systems.

- Environmental immunity: Optical cables are more resistant to environmental extremes than metallic cables. Optical cables also operate over wider temperature variations and fiber cables are less affected by corrosive liquids and gases.

- Safety: Optical cables are safer and easier and to install and maintain than metallic cables. Because glass and plastic fibers are nonconductors, there are no electrical currents or voltages associated with them. Optical fibers can be used around volatile liquids and gases without worrying about their causing explosions or fires. Optical fibers are smaller and much more lightweight than metallic cables. Consequently, users are easier to work with and much better suited to airborne applications. Fiber cables also require less storage space and are cheaper to transport.

- Security: Optical fibers are more secure than metallic cables. It is virtually impossible to tap into a fiber cable without the user's knowledge, and optical cables cannot be detected with metal detectors unless they are reinforced with steel for strength. These are also qualities that make optical fibers attractive to military applications.

- Longer lasting: Although it has not yet been proven, it is projected that fiber systems will last longer than metallic facilities. This assumption is based on the higher tolerances that fiber cables have to changes in environmental conditions and their immunity to corrosives.

- Economics: The cost of optical fiber cables is approximately the same as metallic cables. Fiber cables have less loss, however, and therefore require fewer repeaters. Fewer repeaters equate to lower installation and overall system costs, and improve reliability.

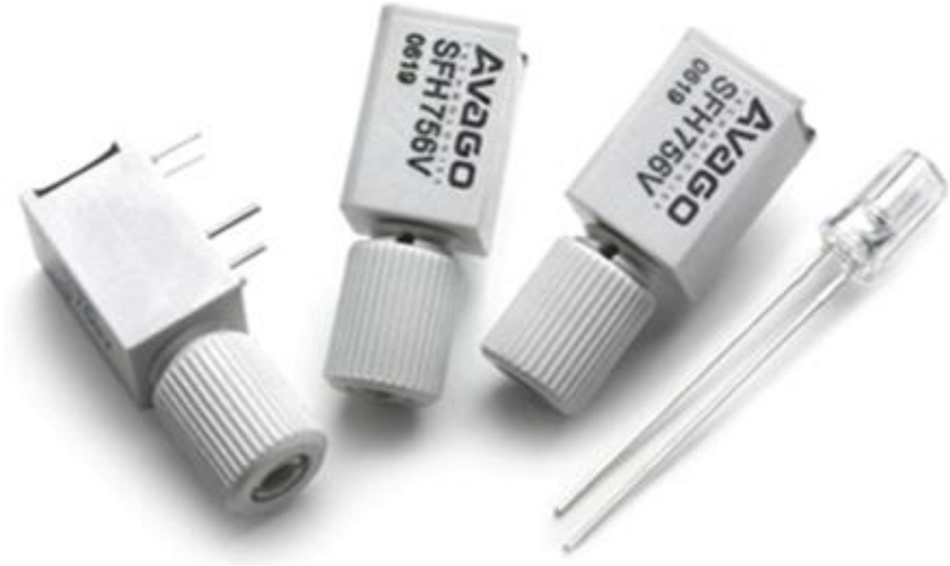
Components used in the optic fiber communication systems

Fiber Optic Analog communication

The fiber optic analog link consists of a transmitter which converts an electrical signal to a light signal, an optical fiber to guide the light and a receiver which detects the light signal and converts it to an electrical signal. Light sources are either light emitting diodes (LED's) or laser diodes and detectors are phototransistors or Photodiodes.

2.5 Transmitter

Transmitting LED SFH 756V



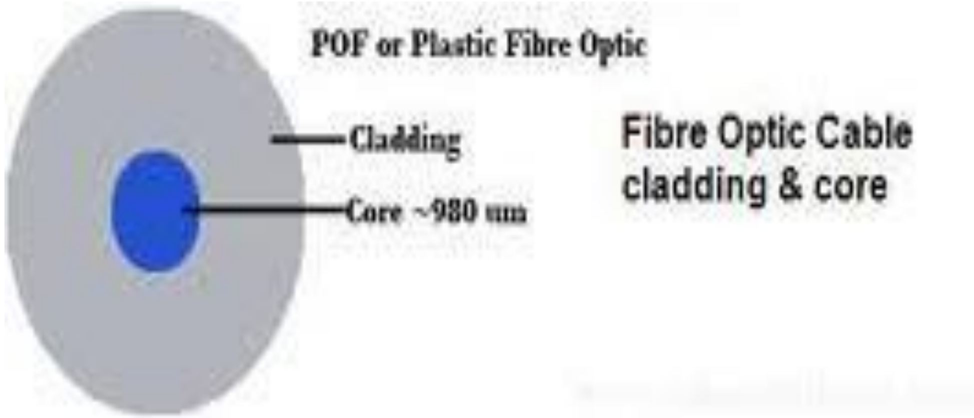
The heart of the transmitter is a light source. The major function of a light source is to convert an information signal from its electrical form into light. Today's fiber-optic communications systems use, as a light source, either light-emitting diodes (LEDs) or laser diodes (LDS). Both are miniature semiconductor devices that effectively convert electrical signals into light. They need power-supply connections and modulation circuitry. All these components are usually fabricated in one integrated package. Transistor based driver circuit need for this type LEDs.

2.6 Optical fiber

The transmission medium in fiber-optic communications systems is an optical fiber. The optical fiber is the transparent flexible filament that guides light from a transmitter to a receiver. An optical information signal entered at the transmitter end of a fiber - optic communications system is delivered to the receiver end by the optical fiber.

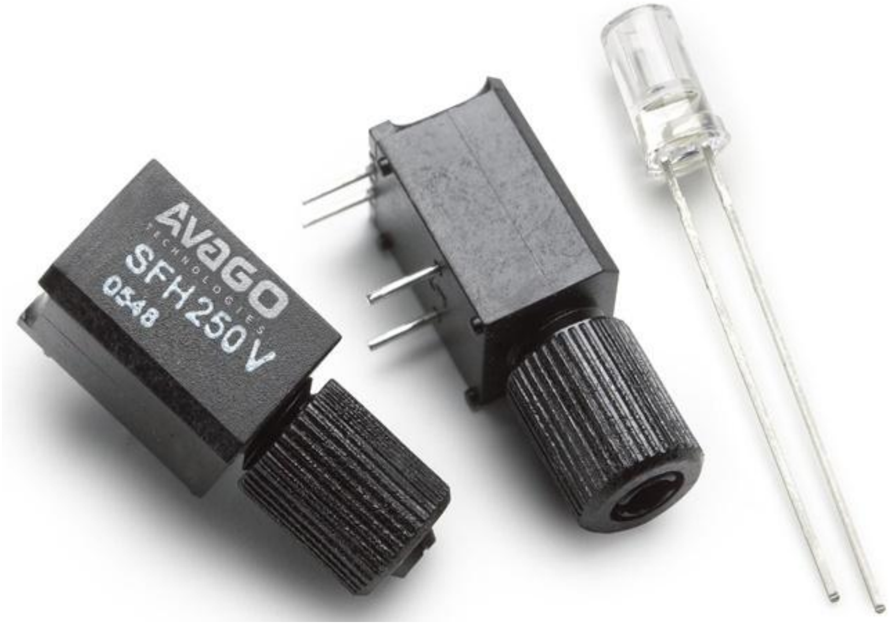
Model Diagram for Plastic Fiber cable

Fiber cable Properties



Receiver

Receiving Photo Diode SFH 250V



The key component of an optical receiver is its photo detector. The major function of a photo detector is to convert an optical information signal back into an electrical signal (Photocurrent). The photo detector in today's fiber - optic communications systems is a semiconductor photodiode (PD). This miniature device is usually fabricated together with its electrical circuitry to from an integrated package that provides power-supply connections and signal amplification.

3. TECHNICAL SPECIFICATION

3.1 TRANSMITTER

Transmitter LED Type	: DC coupled
Source Wavelength	: 660nm
Input signal type	: Analog Signal
Maximum I/P voltage	: 1.5Vpp
Supply Voltage	: +15V DC
Function Generator	: Sine Signal at Variable Freq and Amp
Speed	: 2 Mbps
LED Interface	: Self locking Cap
LED Driver	: On board Transistor Driver
Mic Pre Amplifier	: Transistor Based
Supply current	: 100 mA (Maximum)
Interface connectors	: 2mm socket

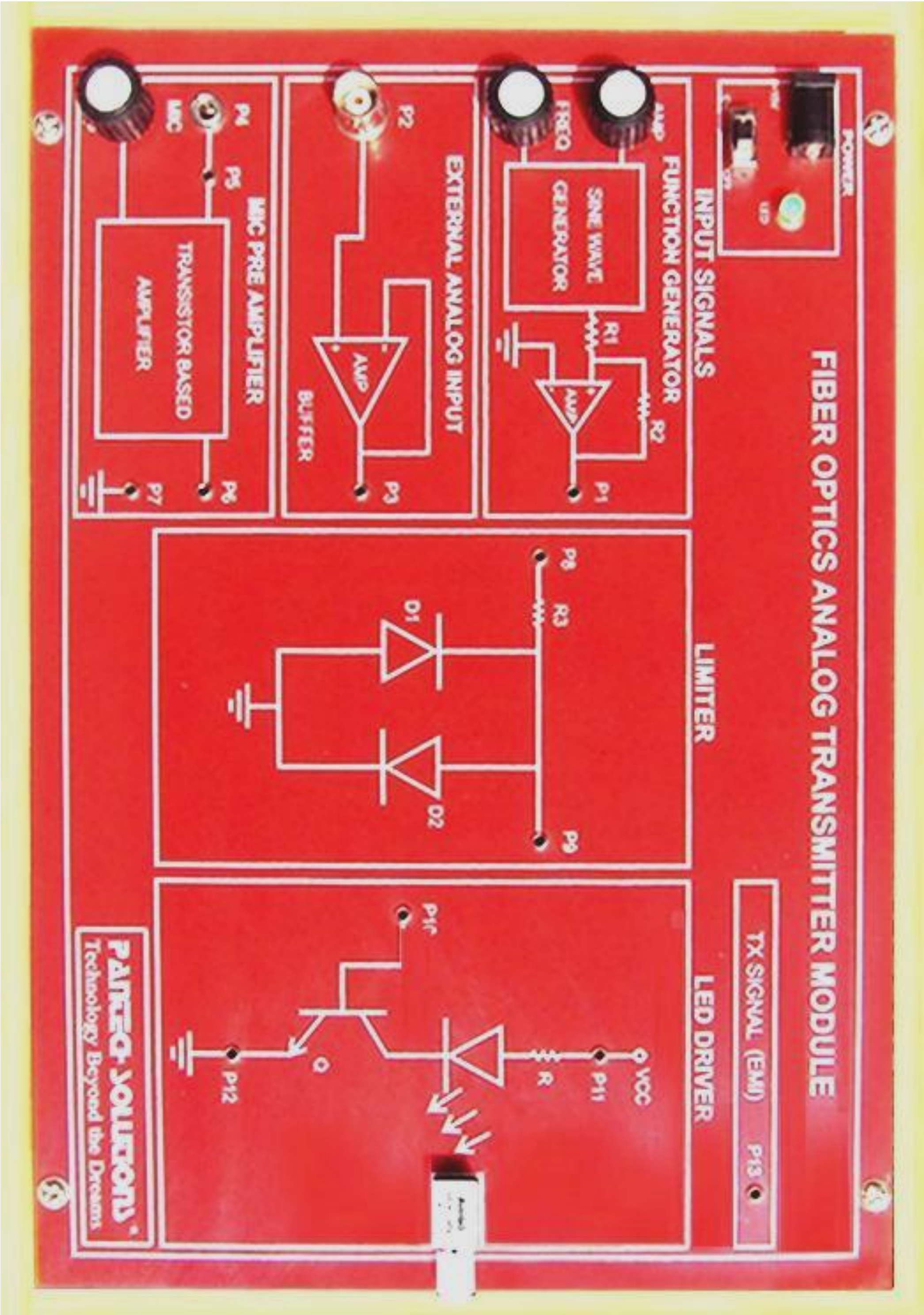
RECEIVER

Receiver type	: DC coupled
Diode Wavelength	: 660nm - 850nm
Receiving Range	: Up to 100MHz
Photo Diode Interface	: Self Locking Cap
Photo Diode Driver	: Internal Diode Driver
Power Amplifier	: IC Max232 Based Amplifier
Optical cable	: Plastic fiber multimode (1000 Micron core)
Core Refractive Index	: 1.492
Cladding Refractive Index	: 1.406
Numerical Aperture	: 0.5
Interface connector	: 2mm socket

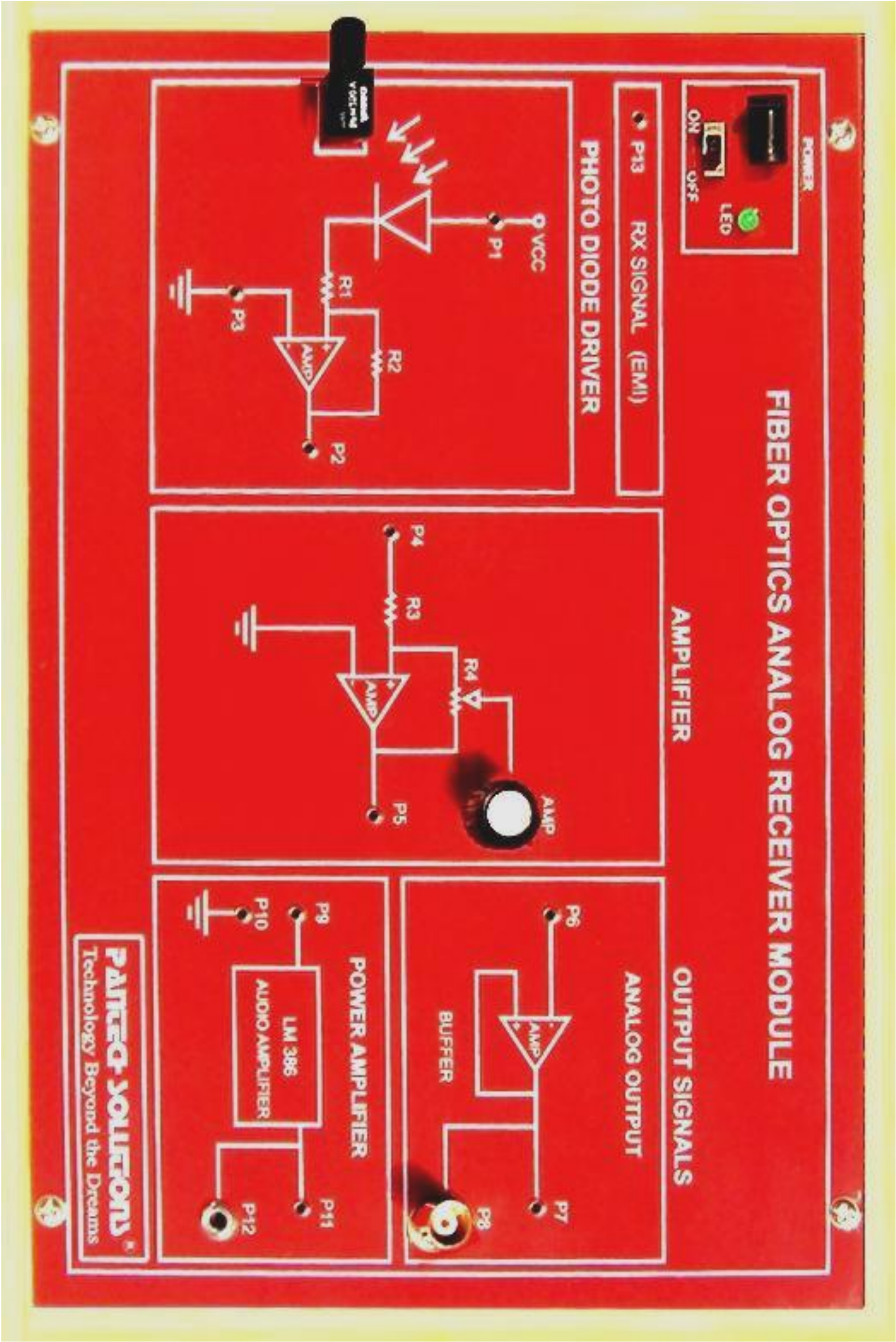
4. FEATURES

- On-board Sine wave generator at variable Amplitude and frequency.
- Input over voltage protection using ICs.
- Transmitter driver supports low and medium frequency input signal.
- Supporting External Sine signal at variable range (10 Hz to 500 KHz).
- Number of test point to study the fiber Analog optic link.
- Wide receiving range.
- Wider bandwidth link at 660nm to 850 nm.
- Voice communication over plastic fiber optic cable.
- On Board Driver at the transmitter and receiver.

4.1 FRONT PANAL DIAGRAM FOR TRANSMITTER



4.2 FRONT PANAL DIAGRAM FOR RECEIVER



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5. EXPERIMENTAL SECTION

5.1 LIST OF EXPERIMENTS

1. **Experiment 1:**

   To Study the Fiber Optics Analog Link using Internal Function Generator

2. **Experiment 2:**

   To Study the Fiber Optics Analog Link using External Function Generator

3. **Experiment 3:**

   To Study the Voice Communication using Fiber Optic Media

4. **Experiment 4:**

   To Study the Numerical Aperture Measurement

5. **Experiment 5**:

   To Study the Coupling Loss of Analog Communication

6. **Experiment 6:**

   To Study the Bending Loss of Analog Communication

7. **Experiment 7:**

   To Study the Cable Loss of Analog Communication

APPARATUS REQUIERED OF EXPERIMENTS

1. Fiber Optics Analog Transmitter Module	: 1 No
2. Fiber Optics Analog Receiver Module	: 1 No
3. CRO	: 1 No
4. Function Generator (optional)	: 1 No
5. Patch chord	: 6 No's
6. Fiber Cable (1 meter)	: 1 No
7. Fiber Cable (3 meter)	: 1 No
8. Adapter 15V DC	: 2 No's
9. Speaker	: 1 No
10. Mic	: 1 No
11. Numerical Aperture Setup	: 1 No
12. Coupling Setup	: 1 No

EXPERIMENT – 1: Study the Fiber Optics Analog Link using Internal Function Generator

Aim

To transmit and receive the Sine signal through plastic fiber cable by using internal function generator.

Apparatus Required

1.	Fiber Optics Analog Transmitter Module	- 01
2.	Fiber Optics Analog Receiver Module	- 01
3.	Plastic Fiber cable 1 meter	- 01
4.	CRO	- 01
5.	Adapter +15V/ DC	- 02
6.	Patch Chords	- 04

Procedure

1. Connect +15V adapter to both transmitter and receiver module
2. Switch (sw1) ON the transmitter Module and CRO
3. Connect the CRO Probe, positive to P1 and negative to P7 Ground.

4. Now check the sine wave output on CRO and vary the Frequency and Amplitude pot meter min to max range.
5. And set the sine wave output 1 Vpp/ 1 KHz.
6. Connect P1 and P8 using patch chord.
7. Connect the CRO positive to P9 test point and check the limiter output.
8. Connect P9 and P10 test point using patch chord.
9. Connect the 1 m Plastic fiber cable between transmitter module LED to receiver module Photo Diode.
10. Switch (sw1) ON the receiver Module.
11. Connect the CRO probe positive to receiver module P2 test point and negative to P3 test point. Now we get received sine signal.
12. Connect P2 and P4 using patch chord.
13. Now get an amplified output on P5 test point.
14. Connect P5 and P6 using patch chord.
15. Check the analog output on test point P7.

Result

Thus, the transmit and receive the Sine signal through plastic fiber cable using internal function generator was done.

EXPERIMENT - 2: Study the Fiber Optics Analog Link using External Function Generator

Aim

To Study the Band width Measurement of Fiber Optic Analog Link.

Apparatus Required

1. Fiber Optics Analog Transmitter Module - 01
2. Fiber Optics Analog Receiver Module - 01
3. Plastic Fiber cable 1 meter - 01
4. CRO - 01
5. Function Generator (1MHz) - 01
6. Adapter +15V/ DC - 02
7. Patch Chords - 06

System Band width

If the fiber optical analog link system Bandwidth means, the analog link system supporting range. It will be defined the system supporting minimum and maximum frequency range. The well communication systems have higher Bandwidth range and that system ready to transmit and receive higher range of signal in broad bandwidth.

Procedure

1. Connect +15V adapter to both transmitter and receiver module
2. Switch (sw1) ON the transmitter Module, CRO and function generator.
3. Connect the BNC to BNC cable between function generator and Ext Analog input P2 connecter.
4. Now check the P3 test point and get sine wave output on CRO.
5. Set the sine wave output 1 Vpp (V_{in}).
6. Connect P3 and P8 using patch chord.
7. Connect P9 and P10 using patch chord.
8. Connect the 1 m Plastic fiber cable between transmitter module LED to receiver module Photo Diode.
9. Switch (sw1) ON the receiver Module.
10. Connect P2 and P4 using patch chord.
11. Connect P5 and P6 using patch chord.
12. Check the analog output (V_o) on test point P7.

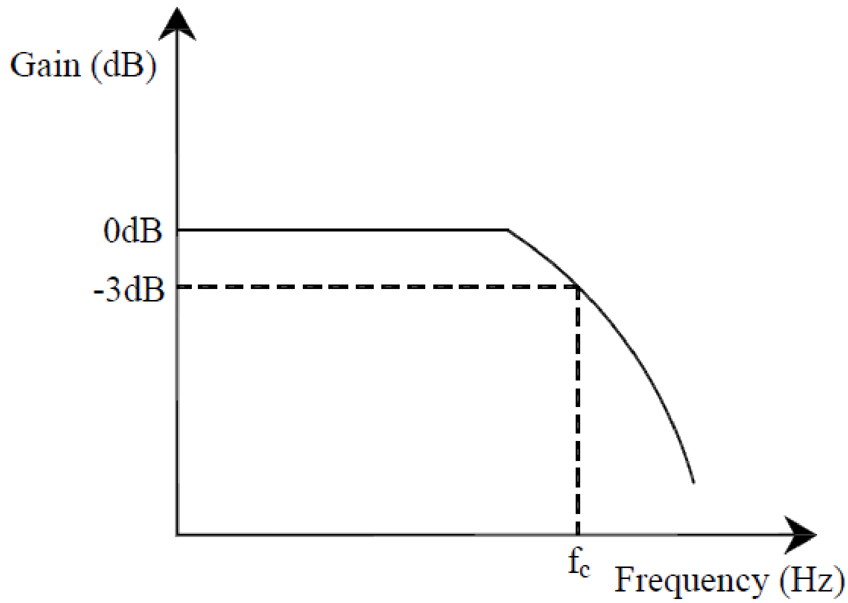
13. Vary the function generator frequency range 50 Hz to 500 KHz and note down the analog output Amplitude.
14. Tabulate the readings in bellow tabular Colum.
15. Plate the gain vs frequency graph.
16. And find the optical analog system bandwidth.

Tabular Colum

Input voltage (V_{in}) =

Sl No	Frequency (Hz)	Output Voltage (V_o)	Gain -20 log(Vo/Vin)dB

Model Graph



Result

Thus the fiber optic analog Link system bandwidth was calculated.

EXPERIMENT - 3: Study the Voice Communication using Fiber Optic Media

Aim

To Study the Voice communication using Fiber Optic Analog Link

Apparatus Required

1.	Fiber Optics Analog Transmitter Module	- 01
2.	Fiber Optics Analog Receiver Module	- 01
3.	Plastic Fiber cable 1 meter	- 01
4.	Adapter +15V/ DC	- 02
5.	Patch Chords	- 06
6.	Mic	- 01
7.	Speaker	- 01

Fiber Optic Voice Communication

The human voice consists of sound made by a human being using the vocal folds for talking, singing, laughing, crying, screaming, etc. Its frequency ranges from about 50Hz to 12KHz.In that voice signal converting electrical signal using microphone transducer. And this electrical signal used in electronic circuits in voice communication. After doing all process the electrical signal converting voice signal again using speakers.

Procedure

1. Connect +15V adapter to both transmitter and receiver module.
2. Switch (sw1) ON the transmitter Module.
3. Connect the Mic on P4 connecter.
4. Connect the CRO Probe, positive to P6 and negative to P7 Ground.
5. Now check the mic pre amplifier output on CRO and vary the Amplitude pot meter min to max range.
6. Connect P6 and P8 using patch chord.
7. Connect P9 and P10 using patch chord.
8. Connect the 1 m Plastic fiber cable between transmitter module LED to receiver module Photo Diode.
9. Switch (sw1) ON the receiver Module.
10. Connect P2 and P4, P5 and P9 in receiver module using patch chord.
11. Connect the speaker on P12 connecter in receiver module.

12. Check the Audio power amplifier output on test point P11.
13. Now we get the transmitted voice signal at speaker.

Result

Thus the Voice communication using Fiber Optic Analog Link was done.

EXPERIMENT - 4: Study the Numerical Aperture Measurement

Aim

To Study the Numerical Aperture of optical plastic fiber cable.

Apparatus Required

1. Fiber Optics Analog Transmitter Module - 01
2. Plastic Fiber cable 1 meter - 01
3. Adapter +15V/ DC - 01

4. Numerical Aperture Setup - 01
5. Patch Chords - 03

Numerical Aperture

In fiber optics, the numerical aperture (NA) of an optical system is a dimensionless number that characterizes the range of angles over which the system can accept or emit light. By incorporating index of refraction in its definition, NA has the property that it is constant for a beam as it goes from one material to another provided there is no optical power at the interface. The exact definition of the term varies slightly between different areas of optics. Numerical aperture is commonly used in microscopy to describe the acceptance cone of an objective (and hence its light-gathering ability and resolution), and in fiber optics, in which it describes the cone of light accepted into the fiber or exiting it.

Procedure

1. Connect +15V adapter to fiber optics analog transmitter module.
2. Switch (sw1) ON Module
3. Connect P1 and P8 test point, P9 and P10 test point using patch chord.

4. Connect the fiber cable one end to Transmitter module another end to Numerical Aperture setup (Fig1).

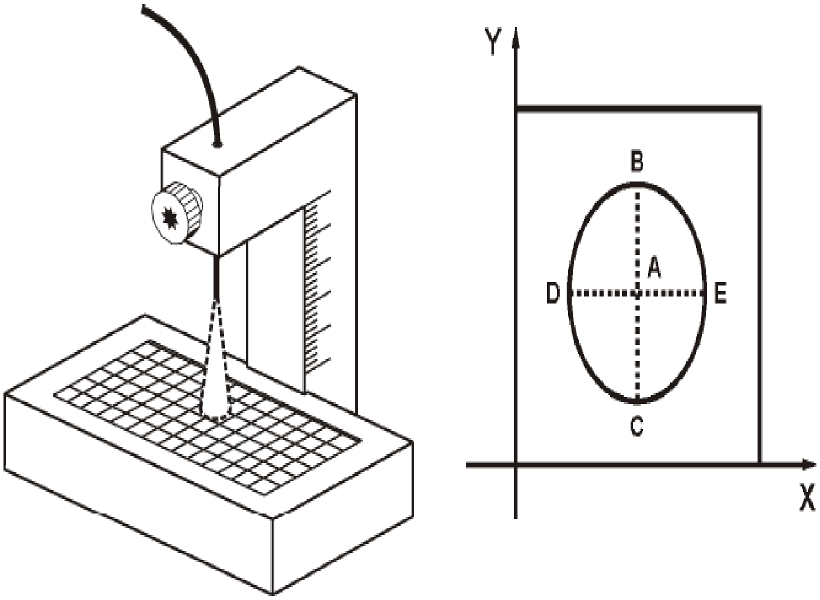


Fig.1

5. Numerical Aperture is,

$$NA = \frac{R}{\sqrt{R^2 + D^2}}$$

Where,

R = radius of circle

D = distance of cable

6. Note down the readings radius(R) in different distance(D) and calculate NA,
7. Find out the Average NA in the following table.

8. For the typical plastic fiber cable NA = 0.5 to 0.6

Tabular Colum

Distance (D)in mm	Radius (R) in mm	Numerical Aperture (NA)

Result

Thus the Numerical Aperture of plastic fiber cable was calculated.

EXPERIMENT - 5: Study the Coupling Loss of fiber optic analog Communication

Aim

To Study the Coupling Loss Measurement in Fiber Optic System

Apparatus Required

1. Fiber Optics Analog Transmitter Module - 01
2. Fiber Optics Analog Receiver Module - 01
3. Plastic Fiber cable 1 meter - 01
4. Plastic Fiber cable 3 meter - 01
5. CRO - 01
6. Adapter +15V/ DC - 02
7. Patch Chords - 06
8. Coupling Setup - 01

Coupling Loss

In fiber optic system face some losses in communication, which losses accrued from material, cable length, cable bend, couple the more no of fiber optic cable, splicing the fiber cable etc., in coupling loss, fiber coupler will act as a loss in that fiber optic system. Fiber coupler used for couple two fiber cable. During this coupling process some light signal was loss in that fiber optic system, which is known as coupling loss.

Procedure

1. Connect +15V adapter to both transmitter and receiver module
2. Switch (sw1) ON the transmitter Module, CRO and receiver module (sw1).
3. Set the sine wave output (V_{in}) 1 Vpp/ 2 KHz at P1.
4. Connect P1 and P8, P9 and P10 using patch chord.
5. Connect the 1 m Plastic fiber cable between transmitter module LED to receiver module Photo Diode.
6. Connect P2 and P4, P5 and P6 using patch chord in receiver module.
7. Vary the Amplifier pot meter and set output 3 Vpp.
8. Note down the analog output on test point P7.
9. Now we get the output voltage (V_{O1}).
10. Replace the Plastic fiber cable 1m into 3m.
11. Now note down the analog output on test point P7 and will get output voltage (V_{O2}).
12. Calculate the Propagation loss 'α_{3m}' for 3m fiber in dB/m,

    $\alpha_{3m} = -10 \log (V_{O2}/V_{in})$

13. Calculate the Propagation loss 'α_{1m}' for 1m fiber in dB/m,

    $\alpha_{1m} = \alpha_{3m}/ (L_2 - L_1)$

    L_1 - length of 1 meter fiber cable

L_2 - length of 3 meter fiber cable

ie, $\alpha_{1m} = \alpha_{3m} / (3 - 1)$

14. Connect one end of 3m fiber cable into transmitter module, connect one end of 1m fiber cable into receiver module, and insert free ends of 1m and 3m fiber cable into coupling setup as close as possible (see Figure 1).

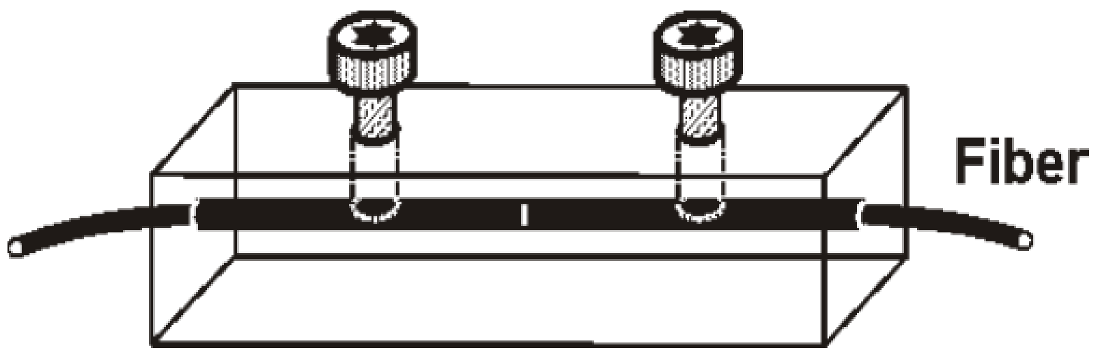


Figure 1 Coupling Setup

15. Now note down the analog output on test point P7 and will get output voltage (V_{O3}).

16. Calculate the Coupling loss 'α_c' in dB/m,

$$\alpha_c = -10 \log (V_{O3}/V_{in}) - (\text{total cable loss})$$

$$\text{Total cable loss} = \alpha_{1m} (L_2 + L_1)$$

$$\alpha_{1m} (3 + 1)$$

$$\text{Coupling loss } \alpha_c = -10 \log (V_{O3}/V_{in}) - (\alpha_{1m} (3 + 1))$$

Result

Thus the Coupling Loss of Fiber Optic System was calculated.

EXPERIMENT - 6: Study the Bending Loss of fiber optic analog Communication

Aim

To Study the Bending Loss Measurement in Fiber Optic System

Apparatus Required

1. Fiber Optics Analog Transmitter Module - 01
2. Fiber Optics Analog Receiver Module - 01
3. Plastic Fiber cable 1 meter - 01
4. CRO - 01
5. Adapter +15V/ DC - 02
6. Patch Chords - 06

Bending Loss

In fiber optic system face some losses in communication, which losses accrued from material, cable length, cable bend, couple the more no of fiber optic cable, splicing the fiber cable etc., in bending loss, cable bend will act as a loss in that fiber optic system. In fiber optic system light signal passes through fiber cable from one end to another end. If bends the fiber cable, the light signal was strike in there both ways. So now only bending loss accrued in the fiber optic system.

Procedure

1. Connect +15V adapter to both transmitter and receiver module

2. Switch (sw1) ON the transmitter Module, CRO and receiver module (sw1).
3. Set the sine wave output (V_{in}) 1 Vpp/ 1 KHz at P1.
4. Connect P1 and P8, P9 and P10 using patch chord.
5. Connect the 1 m Plastic fiber cable between transmitter module LED to receiver module Photo Diode.
6. Connect P2 and P4, P5 and P6 using patch chord.
7. Keep Amplifier pot meter in maximum position.
8. Note down the analog output (V_o) on test point P7.
9. Now bend the fiber cable like fig 1, measure the bending diameter and output voltage (V_o), change the bending diameter and tabulate the readings.

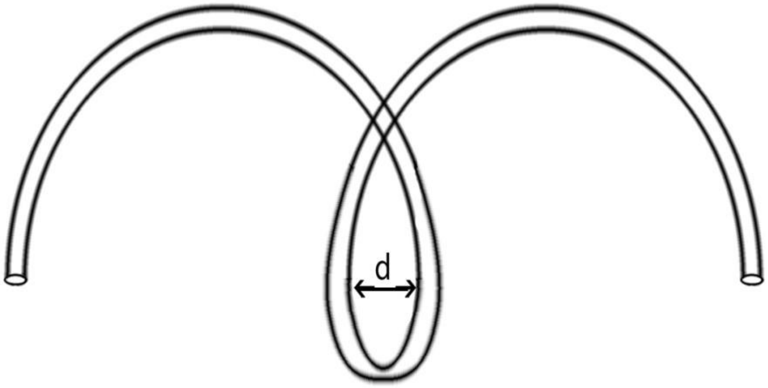


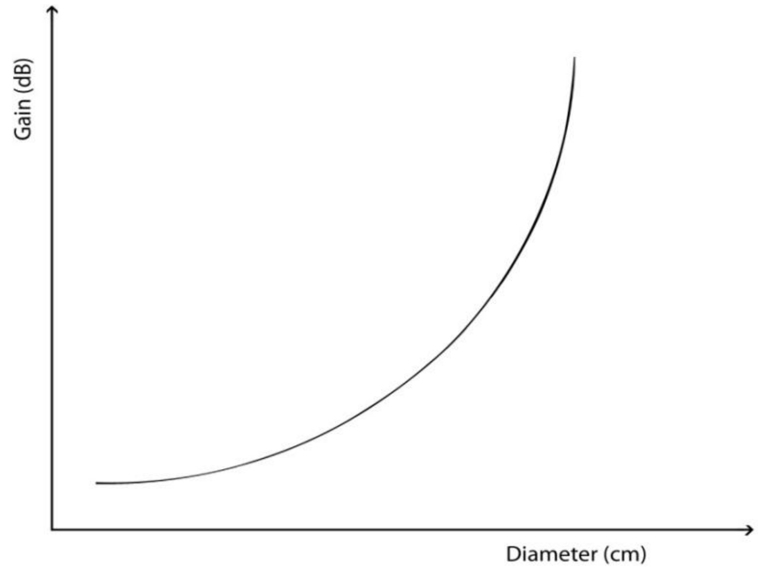
Fig 1, bending measurement

Tabular Colum

Input Voltage V_{in} =

Sl No	Bending Diameter (d)	Output Voltage (V_o)	Gain = $-10\log(V_o / V_{in})$ (dB)

Model Graph



Result

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Thus the Bending Loss of Fiber Optic System was calculated.

EXPERIMENT -7: Study the Attenuation Loss of fiber optic analog Communication

Aim

To Study the Propagation Loss Measurement in Fiber Optic System

Apparatus Required

1. Fiber Optics Analog Transmitter Module - 01
2. Fiber Optics Analog Receiver Module - 01
3. Plastic Fiber cable 1 meter - 01
4. Plastic Fiber cable 3 meter - 01
5. CRO - 01
6. Adapter +15V/ DC - 02
7. Patch Chords - 06

Propagation Loss

In fiber optic system face some losses in communication, which losses accrued from material, cable length, couple the more no of fiber optic cable, splicing the fiber cable etc., in propagation loss, cable length act as a loss in fiber optic system. In this loss identify from using long distance fiber optic cable in communication and it will be attenuate the signal gain and strength.

Procedure

1. Connect +15V adapter to both transmitter and receiver module
2. Switch (sw1) ON the transmitter Module, CRO and receiver module (sw1).
3. Set the sine wave output 1 Vpp/ 1 KHz at P1.
4. Connect P1 and P8, P9 and P10 using patch chord.
5. Connect the 1 m Plastic fiber cable between transmitter module LED to receiver module Photo Diode.
6. Connect P2 and P4, P5 and P6 using patch chord.
7. Keep Amplifier pot meter in maximum position.

8. Note down the analog output on test point P7.
9. Now we get the output voltage (V_1).
10. Replace the Plastic fiber cable 1m into 3m.
11. Now note down the analog output on test point P7 and will get output voltage (V_3).
12. Calculate the Propagation loss ‘α’ for 3m fiber in dB/m,

$$\alpha = -10 \log_{10} (V_3/V_1)$$

Result

Thus the Propagation Loss of Fiber Optic System was calculated.

6. TECHNICAL DATA SHEETS

1. XR 2206

6.1 FEATURES

- Low-Sine Wave Distortion, 0.5%, Typical
- Excellent Temperature Stability, 20ppm/°C, Typ.

- Wide Sweep Range, 2000:1, Typical
- Low-Supply Sensitivity, 0.01%V, Typ.
- Linear Amplitude Modulation
- TTL Compatible FSK Controls
- Wide Supply Range, 10V to 26V
- Adjustable Duty Cycle, 1% TO 99%

6.2 GENERAL DESCRIPTION

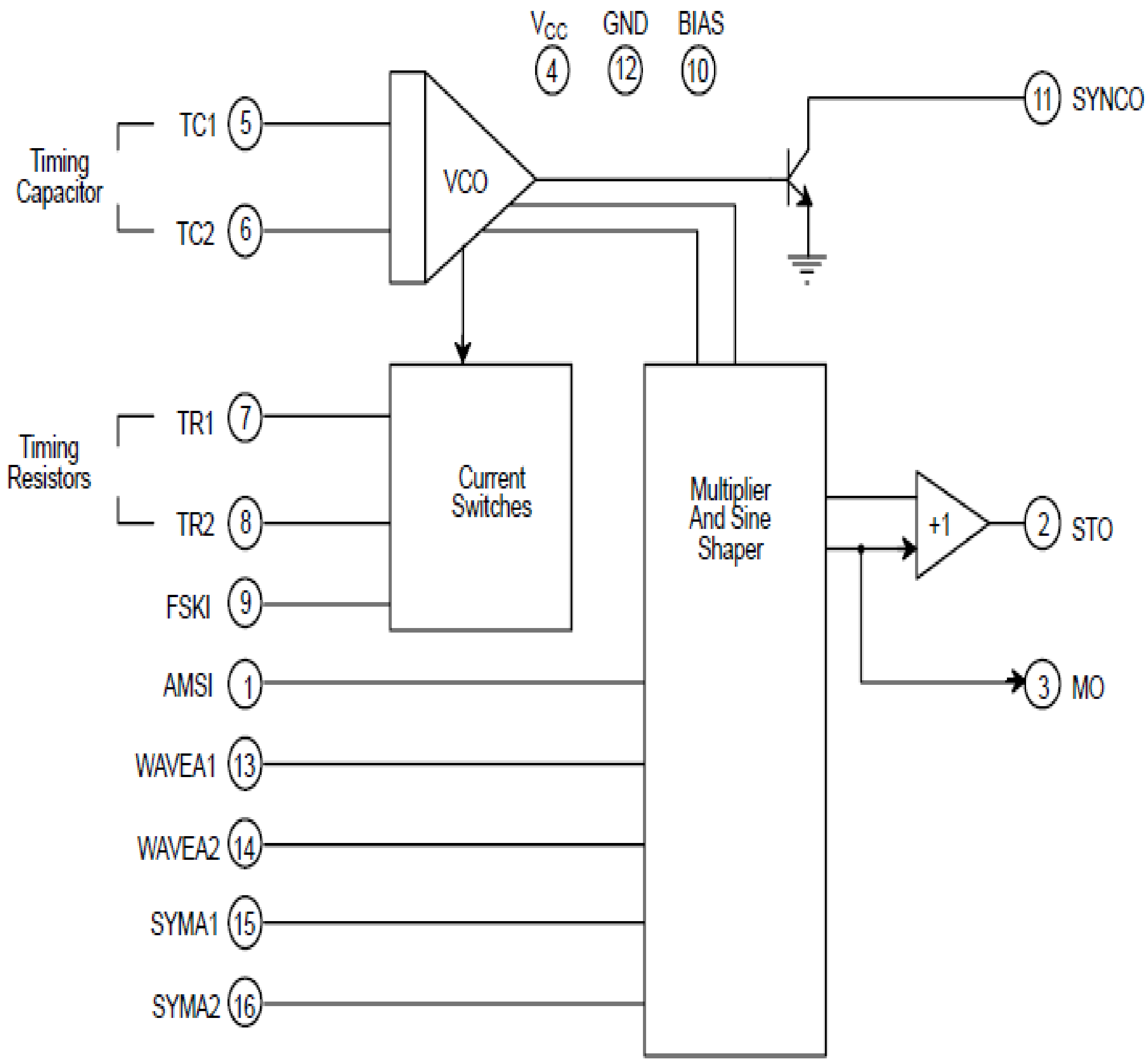
The XR-2206 is a monolithic function generator integrated circuit capable of producing high quality sine, square, triangle, ramp, and pulse waveforms of high-stability and accuracy. The output waveforms can be both amplitude and frequency modulated by an external voltage. Frequency of operation can be selected externally over a range of 0.01Hz to more than 1MHz.

The circuit is ideally suited for communications, instrumentation, and function generator applications requiring sinusoidal tone, AM, FM, or FSK generation. It has a typical drift specification of 20ppm/°C. The oscillator frequency can be linearly swept over a 2000:1 frequency range with an external control voltage, while maintaining low distortion.

6.3 Pin Description

Pin #	Symbol	Type	Description
1	AMSI	I	**Amplitude Modulating Signal Input.**
2	STO	O	**Sine or Triangle Wave Output.**
3	MO	O	**Multiplier Output.**
4	V_{CC}		**Positive Power Supply.**
5	TC1	I	**Timing Capacitor Input.**
6	TC2	I	**Timing Capacitor Input.**
7	TR1	O	**Timing Resistor 1 Output.**
8	TR2	O	**Timing Resistor 2 Output.**
9	FSKI	I	**Frequency Shift Keying Input.**
10	BIAS	O	**Internal Voltage Reference.**
11	SYNCO	O	**Sync Output.** This output is a open collector and needs a pull up resistor to V_{CC}.
12	GND		**Ground pin.**
13	WAVEA1	I	**Wave Form Adjust Input 1.**
14	WAVEA2	I	**Wave Form Adjust Input 2.**
15	SYMA1	I	**Wave Symetry Adjust 1.**
16	SYMA2	I	**Wave Symetry Adjust 2.**

6.4 Block Diagram of XR 2206



6.5 Frequency of Operation

The frequency of oscillation, fo, is determined by the external timing capacitor, C, across Pin 5 and 6, and by the timing resistor, R, connected to either Pin 7 or 8. The frequency is given as:

fo= 1/RC Hz

And can be adjusted by varying either R or C. The recommended values of R, for a given frequency range, as shown in Figure 5. Temperature stability is optimum for 4k_ < R < 200k_. Recommended values of C are from 1000pF to 100MF.

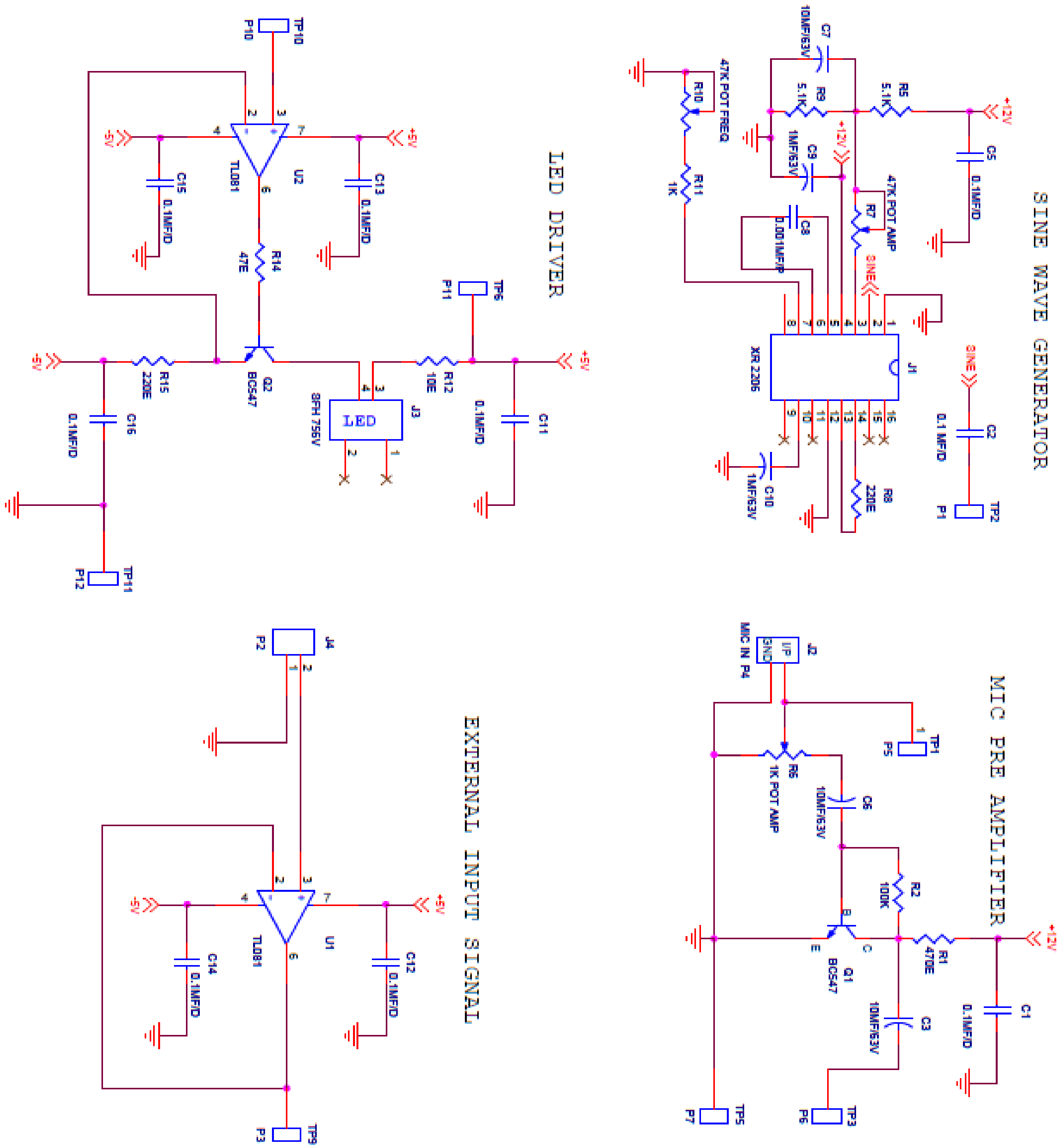
6.6 System Description

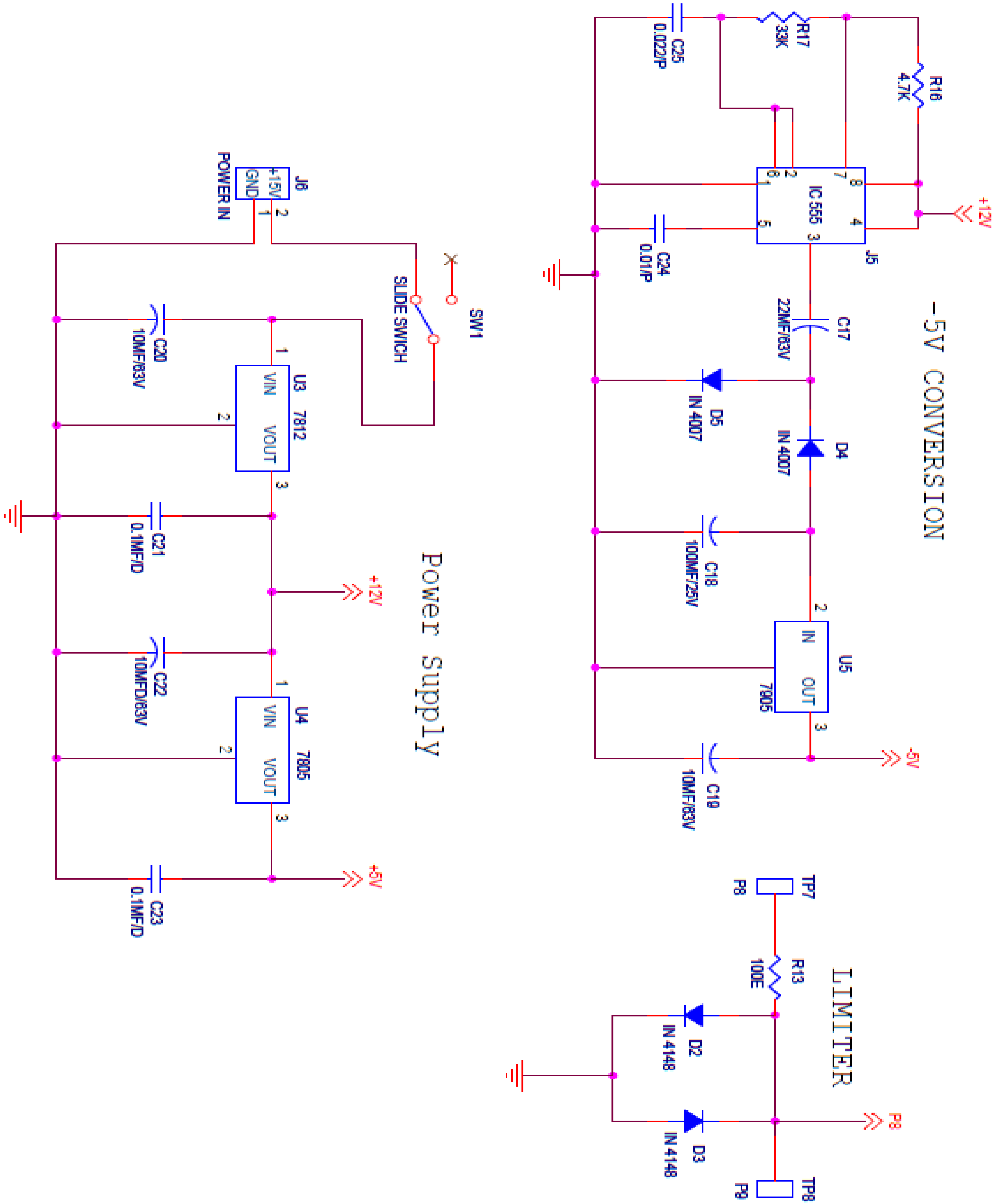
The XR-2206 is comprised of four functional blocks; a voltage-controlled oscillator (VCO), an analog multiplier and sine-shaper; a unity gain buffer amplifier; and a set of current switches. The VCO produces an output frequency proportional to an input current, which is set by a resistor from the timing terminals to ground. With two timing pins, two discrete output frequencies can be independently produced for FSK generation applications by using the FSK input control pin. This input controls the current switches which select one of the timing resistor currents, and routes it to the VCO.

6.7 APPLICATIONS

- Waveform Generation
- Sweep Generation
- AM/FM Generation
- V/F Conversion
- FSK Generation   Phase-Locked Loops (VCO)

7. CIRCUIT DIAGRAM





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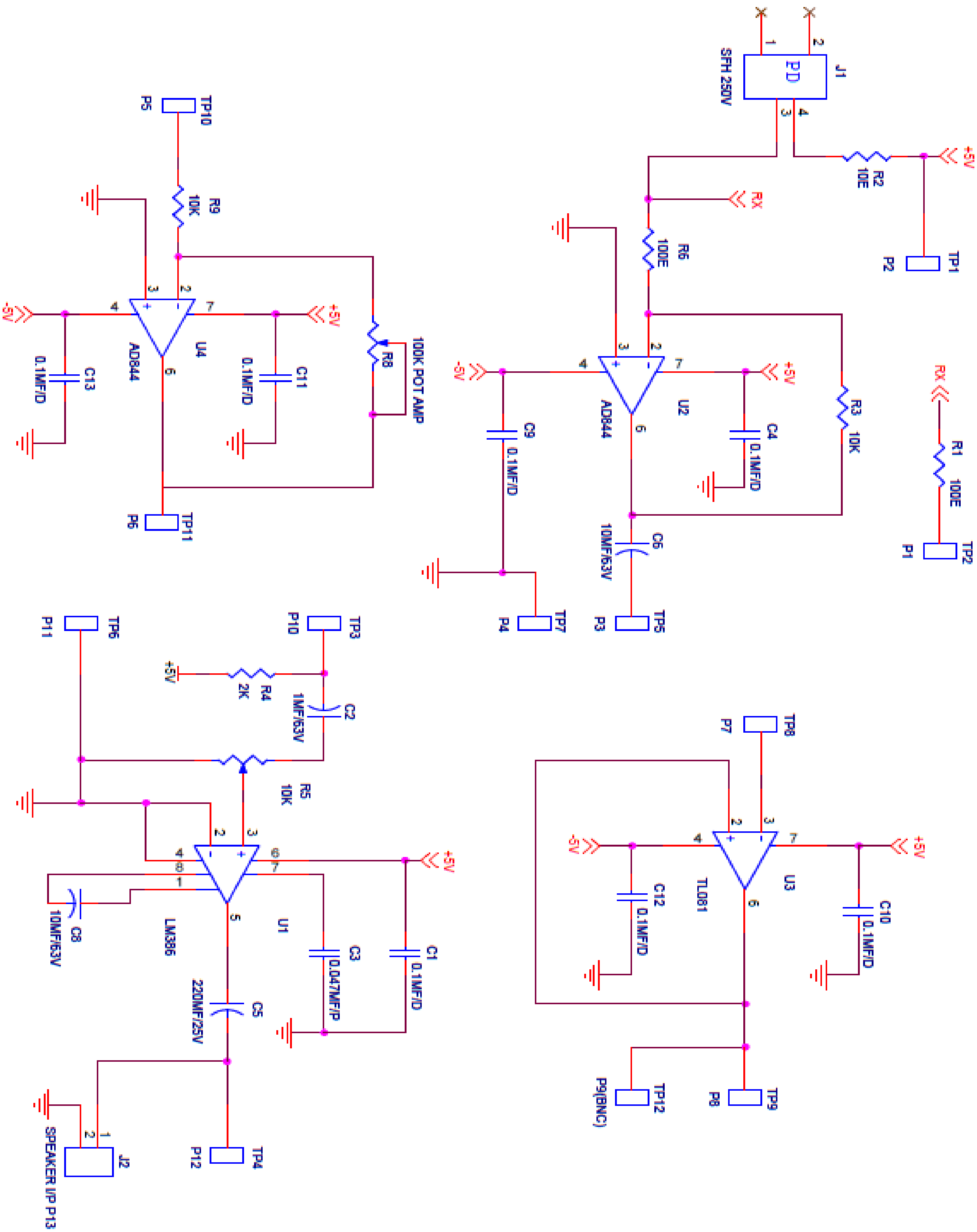

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