

PAMTDMGenRec -- Overview

PAM Modulation - Time Division Multiplexing



Dr. B Kanmani
Department Head,
Telecommunication Engineering

BMS College of Engineering (BMSCE),
Bangalore, India



OBJECTIVES:

At the end of performing this experiment, learners would be able to:

- Describe the concept of PAM - TDM
- Obtain the PAM -TDM from given input
- Understand the working of LF398 IC (sample-and-hold circuit)

EQUIPMENT:

- IC LF398
- Signal generator
- Resistors – 47 k Ω , 1.5 k Ω
- Capacitor – 0.1 μ F
- +/- 15V DC Power Supply
- Digital Storage Oscilloscope & probes
- Connecting wires & Bread Board

DESIGN:

(Recovery stage) for Low Pass Filter

$$f = 500\text{Hz}$$

$$R = ?$$

$$\text{let } C = 0.1\mu\text{F}$$

$$f = \frac{1}{2\pi RC}$$

$$R = 3.18\text{k}\Omega$$

THEORY:

- LF398 is a monolithic sample-and-hold circuit utilizing BI-FET technology for accurate fast acquisition of input signal.
- A sample and hold circuit is an analog device that samples (captures) the voltage of a continuously varying analog signal and holds (locks) its value at a constant level for a specified minimum

period of time (hold time). They are typically used in analog-to-digital converters to eliminate variations in input signal that can corrupt the conversion process.

- PAM is one basic type of analog pulse modulation. In PAM, the amplitude of regularly spaced rectangular pulses vary with the instantaneous sample values of an analog signal in a one to one fashion.
- TDM is a technique used for transmitting several analog message signals over a communication channel by dividing the time frame into slots, one slot for each message signal.

Reference reading:

B Kanmani, "Some applications of the combination: LM-741 and LF - 398", WASET CESSE 2009: International conference on Computer, Electrical and Systems science and Engineering, Rome, 28th-30th April, Italy, 2009. Volume 52, April 2009, ISSN: 2070-3724, pages 335-340.

Acknowledgement

Mr. Shreenivas B for converting laboratory experiment to Tektronix courseware format

PAMTDMGenRec -- Procedures

Step 1

Circuit setup:

Build the following circuit with given component values

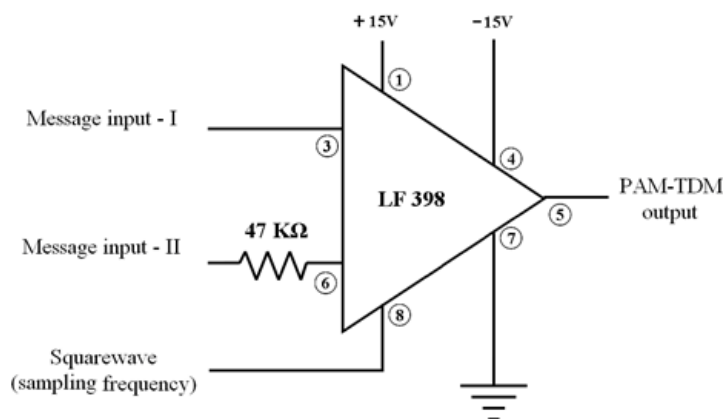


Figure 1: The circuit used to generate two channel PAM-TDM

Step 2

- Use a signal generator to generate analog inputs message - I (sine wave of 500 Hz for example), message-II (triangular wave of 1 KHz for example) and sampling (square wave signal). The analog input will be set to 1 kHz Sine wave (or triangular wave) and sampling signal will be 15-20 kHz Square-wave of 50% duty cycle.

- Turn on the supply of the circuit and enable signal generator that is feeding signal to the circuit.

Step 3

- Connect the DSO probe – CH1 at analog input (pin # 3 of LF398 IC), CH2 at analog input (pin # 6 of LF398 IC), CH3 at sampling signal input (pin # 8 of LF398 IC) and CH4 at output (pin # 5 of the LF398 IC).

- Perform Autoset on DSO and capture the output signal.

Step 4

- Configure PEAK-to-PEAK measurement on the input and output signal.
- Observe – input and output on DSO and record the signal

Step 5

Following figure shows the two message signals to be time division multiplexed

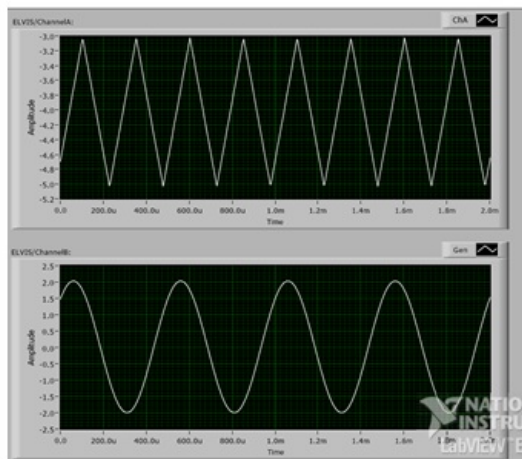


Figure 2: The two message signals to be time division multiplexed.

Step 6

Following figure shows the Carrier signals and the corresponding PAM-TDM waveform

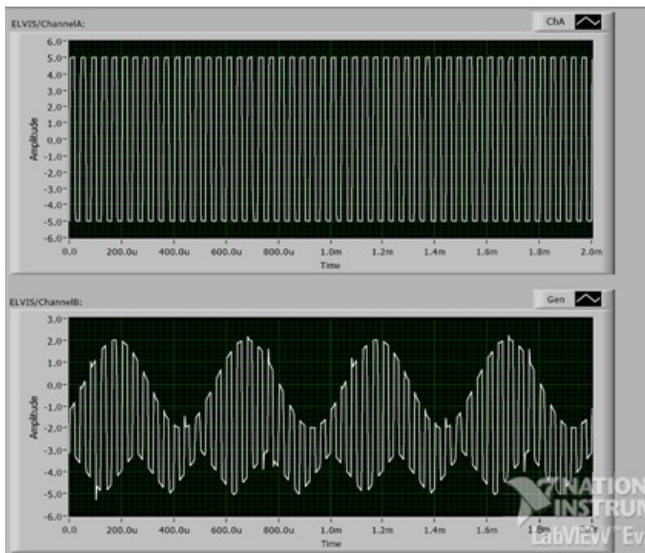


Figure 3: The carrier, and the corresponding PAM-TDM waveform

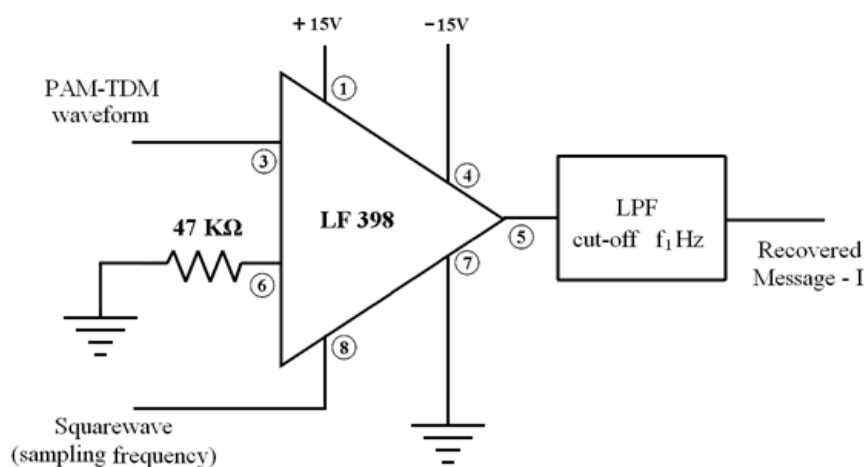
Step 7

Circuit setup to recover message - I :

- Build the following circuit with given component values
- The output of PAM-TDM circuit is given as an input to the recovery circuit as shown in following figure, sampling signal input (pin # 8 of LF398 IC) The same square wave used for generation of the PAM-TDM is cascaded with recovery circuit

Step 8

To recover Message signal-I:



Step 9

- Cut-off frequency of LPF: Highest frequency component in message signal - I

- Output of IC LF 398 is given to LPF as an input, to recover the message - I
- Record the measurement and Observe – input, output on DSO

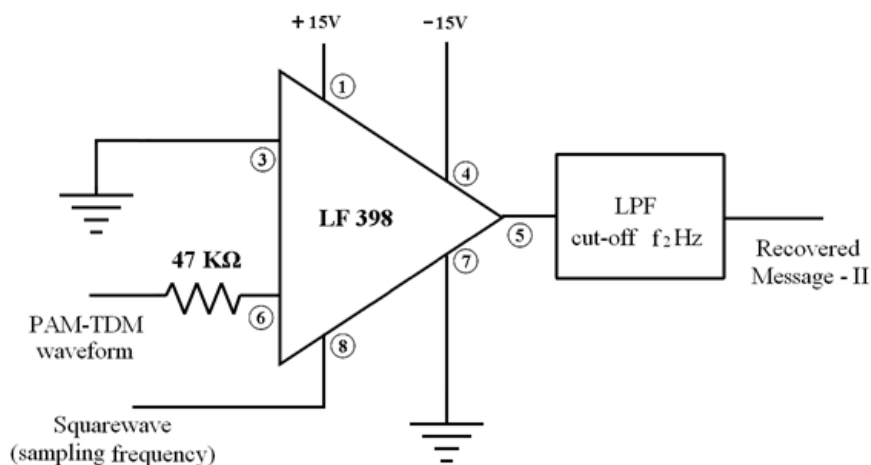
Step 10

Circuit setup to recover message - II :

- Build the following circuit with given component values
- The output of PAM-TDM circuit is given as an input to the recovery circuit as shown in following figure, sampling signal input (pin # 8 of LF398 IC) is the same square wave used for generation of the PAM-TDM is cascaded with recovery circuit

Step 11

To recover Message signal-II:



Step 12

- Cut-off frequency of LPF: Highest frequency component in message signal - II
- Output of IC LF 398 is given to LPF as an input, to recover the message - II
- Record the measurement and Observe – input, output on DSO

Step 13

Observation:

- 1) Simultaneously two signals are transmitted on the same channel
- 2) Multiplexing of two signals can be verified.

Open-ended Question / Can you answer this?

What will be the effect on output waveform if:

- 1) Order of the LPF is increased