

# IEEE-754 Decimal-32 Floating-Point Converter

## Introduction

This document provides a simple guide for the IEEE-754 Decimal-32 floating-point converter. This application is designed to convert decimal and base-10 inputs into IEEE-754 Decimal-32 format, handling special cases such as NaN or infinity, and rounding options. The output includes the binary representation with spaces between sections, its hexadecimal equivalent, and an option to output in the text file.

## Overview of IEEE-754 Decimal-32 Format

The IEEE-754 Decimal-32 format is a 32-bit representation used for floating-point numbers. It consists of three main components:

- Sign bit (1 bit): Indicates whether the number is positive or negative.
- Combination field (5 bits): Composed of the two most significant bits of the exponent representation and 1 or 3 bits of the most significant digit of the significand.
- Exponent continuation field (6 bits): Composed of the remaining 6 digits of the exponent representation.
- Coefficient continuation field (20 bits): Composed of the remaining 6 digits of the significand, which are represented as densely-packed BCD.

## Input Specifications

1. Decimal and Base-10 Input: User input must be in this format ( $127.0 \times 10^5$ ) in order for it to be accepted, otherwise it will assume it as NaN.
2. NaN: Users can input either 'NaN', or any other input that does not follow the decimal and base-10 format.
3. Infinity (positive & negative): Any value higher than  $9999999 \times 10^{90}$  or  $-9999999 \times 10^{90}$ .
4. Zero: Any value ranging from  $0 \times 10^{-96}$  to  $0 \times 10^{95}$ .

## Rounding Options

The application provides multiple rounding methods:

- Round to nearest

- Round towards zero
- Round up (towards  $+\infty$ )
- Round down (towards  $-\infty$ )

## Output Specifications

The converter outputs the following formats:

1. Binary Output
2. Hexadecimal Output
3. Text File Output containing the Binary and Hexadecimal Output

## Test Cases

1. Normal positive input

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

**Binary Output:** 0 01111 111001 00101000111001010110

**Hexadecimal Output:** 07E151CA6

2. Normal negative input

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

Convert

**Binary Output:** 1 11010 010001 11111001011000110010

**Hexadecimal Output:** 1241F2C62

Download Output

### 3. NaN

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

Convert

**Binary Output:** 0 11111 000000 00000000000000000000

**Hexadecimal Output:** 7C000000

Download Output

### 4. Positive infinity

# Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method: 

Round to 0

Convert

**Binary Output:** 0 11110 000000 00000000000000000000

**Hexadecimal Output:** 060000000

Download Output

## 5. Negative infinity

## Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

**Binary Output:** 1 11110 000000 00000000000000000000

**Hexadecimal Output:** 160000000

## 6. Zero

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

Convert

**Binary Output:** 0 01000 100000 00000000000000000000

**Hexadecimal Output:** 008000000

Download Output

7. Normal with rounding to 0

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

Convert

**Binary Output:** 0 01001 110101 01001101001010000000

**Hexadecimal Output:** 01D19A500

Download Output

8. Normal with rounding to + infinity

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

Convert

**Binary Output:** 0 01001 110101 01001101001010000000

**Hexadecimal Output:** 01D19A500

Download Output

9. Normal with rounding to - infinity

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

Convert

**Binary Output:** 0 01001 110101 01001101001010000000

**Hexadecimal Output:** 01D19A500

Download Output

10. Normal with rounding to nearest, ties away from 0

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

**Binary Output:** 0 01001 110101 01001101001010000000

**Hexadecimal Output:** 01D19A500

11. Normal with rounding to nearest, ties to even

### Decimal-32 Floating Point Converter

Enter Decimal Number:

Rounding Method:

**Binary Output:** 0 01001 110101 01001101001010000000

**Hexadecimal Output:** 01D19A500