

# IEEE754 floating-point Translate

Here we provide an example by C, C# and VB to translate between float and byte format.

## ◆ C

```

/*****
**   Main Function   main()
*****/
int main (void)
{
    //Example: float=22.11 to byte array = 0x41 0xB0 0xE1 0x48
    unsigned char data[4];
    unsigned char *datap;
    float fdata;
    float *fdatap;

    //===Solution 1: Get float=====//
    printf("\n####   Get float from byte array by mapping method   ####\n");
    fdata = 0; //reset fdata
    data[0] = 0x48; data[1] = 0xE1; data[2] = 0xB0; data[3] = 0x41; //init data array
    fdata = *(float *)data;
    printf("float value = %f\n", fdata);
    //===Solution 2: Get float=====//
    printf("\n####   Get float from byte array by function call   ####\n");
    fdata = 0; //reset fdata
    data[0] = 0x48; data[1] = 0xE1; data[2] = 0xB0; data[3] = 0x41; //init data array
    if (GetFloatFromByte(&fdata, data[3], data[2], data[1], data[0])==0)
        printf("float value = %f\n", fdata);
    else
        printf("GetFloatFromByte by function failed !!\n");
    //===Solution 1: Get byte=====//
    printf("\n####   Get byte array from float by mapping method   ####\n");
    fdata = 22.11; //init fdata
    data[0] = 0; data[1] = 0; data[2] = 0; data[3] = 0; //reset data array
    fdatap = &fdata;
    datap = (unsigned char *)fdatap;
    printf("byte array = %2X%2X%2X%2X\n",datap[3],datap[2],datap[1],datap[0]);
    //===Solution 2: Get byte=====//
    printf("\n####   Get byte array from float by function call   ####\n");
    fdata = 22.11; //init fdata
    data[0] = 0; data[1] = 0; data[2] = 0; data[3] = 0; //reset data array
    if (GetByteFromFloat(fdata, &data[3], &data[2], &data[1], &data[0])==0)
        printf("byte array = %2X%2X%2X%2X\n",data[3],data[2],data[1],data[0]);
    else
        printf("GetByteFromFloat by function failed !!\n");
    //=====//

    return 0;
}

int GetFloatFromByte(float *fdata, unsigned char data0, unsigned char data1, unsigned char data2, unsigned char data3)
{
    //Get IEEE 754 Floating point format from data0, data1, data2, data3
    //fdata : float data

```

```
//data0, data1, data2, data3 : 8-bit Hexadecimal data
//return code ==> 0: OK, -1: Not Available
```

```
int i, s=1;
unsigned char e=0;
unsigned long m=0;
double value, result;
```

```
if (data0 & 0x80)
    s=-1;
e=(data0 & 0x7F)<<1;
e = e | ((data1 & 0x80)?1:0);
m=(data1 & 0x7F)<<16;
m = m | (data2<<8);
m = m | data3;
```

```
if ((e == 0) && (m == 0))
```

```
{
    fdata = 0;
    return 0;
}
```

```
else if ((data0 == 0x7F) && (data1 >= 0x80))//7F800001~7FFFFFFF
```

```
{
    if ((data1 != 0x80) && (data3 != 0x00))
        return -1;
}
```

```
else if ((data0 == 0xFF) && (data1 >= 0x80))//FF800001~FFFFFFFF
```

```
{
    if ((data1 != 0x80) && (data3 != 0x00))
        return -1;
}
```

```
result=1;
```

```
for (i=-23;i<0;i++)
```

```
{
    value = (m & 0x00000001)?pow(2,i):0;
    result+=value;
    m=m>>1;
}
```

```
result*=s;
```

```
result*=pow(2, e-127);
```

```
*fdata=result;
```

```
return 0;
```

```
}
```

```
int GetByteFromFloat(float fdata, unsigned char *data0, unsigned char *data1, unsigned char *data2, unsigned char *data3)
```

```
{
```

```
//Get data0, data1, data2, data3 from IEEE 754 Floating point format
```

```
//fdata : float data
```

```
//data0, data1, data2, data3 : 8-bit Hexadecimal data
```

```
//return code ==> 0: OK, -1: Not Available
```

```
int i;
```

```
unsigned char s = 0, e = 0;
```

```
unsigned char find = 0, bit_value = 0;
```

```
unsigned long m = 0;
```

```
double value, temp;
```

```

if (fdata < 0)
{
    s = 1;
    fdata *= -1;
}

i = -127;
while ((fdata / pow(2, i)) > 1)
{
    i++;
    if (i > 128)
        return -1;
}
if (i <= -127)
    return -1;

e = (unsigned char)(i - 1 + 127);
value = fdata / pow(2, (i - 1));
value -= 1;

for (i = -1; i > -24; i--)
{
    bit_value = 0;
    if (find == 0)
    {
        temp = pow(2, i);
        if (value == temp)
        {
            find = 1;
            bit_value = 1;
        }
        else if (value > temp)
        {
            value -= temp;
            bit_value = 1;
        }
        else
            bit_value = 0;
    }
    m |= bit_value;
    if (i > -23)
        m = m << 1;
}

//process data
*data0 = (unsigned char)((s << 7) + (e >> 1));
*data1 = (unsigned char)(((e & 0x01) << 7) + ((m & 0xFF0000) >> 16));
*data2 = (unsigned char)((m & 0xFF00) >> 8);
*data3 = (unsigned char)(m & 0xFF);

return 0;
}

```

## ◆ C#

```

public int GetFloatFromByte(ref double fdata, Byte data0, Byte data1, Byte data2, Byte data3)
{
    //Get IEEE 754 Floating point format from data0, data1, data2, data3
    //fdata : float data
    //data0, data1, data2, data3 : 32-bit Hexadecimal data

```

```

        //return code ==> 0: OK, -1: Not Available

        byte[] arr = new byte[4];
        arr[0] = data3;
        arr[1] = data2;
        arr[2] = data1;
        arr[3] = data0;
        fdata = BitConverter.ToSingle(arr, 0);

        return 0;
    }

    public int GetByteFromFloat(double fdata, ref Byte data0, ref Byte data1, ref Byte data2, ref Byte data3)
    {
        //Get data0, data1, data2, data3 from IEEE 754 Floating point format
        //fdata : float data
        //data0, data1, data2, data3 : 32-bit Hexadecimal data
        //return code ==> 0: OK, -1: Not Available

        byte[] arr = new byte[4];
        float value = (float)fdata;
        arr = BitConverter.GetBytes(value);
        data0 = arr[3];
        data1 = arr[2];
        data2 = arr[1];
        data3 = arr[0];

        return 0;
    }
}

```

## ◆ VB

```

Private Function GetFloatFromByte(ByRef fdata As Double, ByVal data0 As Byte, ByVal data1 As Byte, ByVal data2
As Byte, ByVal data3 As Byte) As Integer

```

```

    'Get IEEE 754 Floating point format from data0, data1, data2, data3
    'fdata : float data
    'data0, data1, data2, data3 : 32-bit Hexadecimal data
    'return code ==> 0: OK, -1: Not Available

```

```

    Dim arr(3) As Byte
    arr(0) = data3
    arr(1) = data2
    arr(2) = data1
    arr(3) = data0
    fdata = BitConverter.ToSingle(arr, 0)

```

```

    Return 0

```

```

End Function

```

```

Private Function GetByteFromFloat(ByVal fdata As Double, ByRef data0 As Byte, ByRef data1 As Byte, ByRef data2
As Byte, ByRef data3 As Byte) As Integer

```

```

    'Get data0, data1, data2, data3 from IEEE 754 Floating point format
    'fdata : float data
    'data0, data1, data2, data3 : 32-bit Hexadecimal data
    'return code ==> 0: OK, -1: Not Available

```

```

    Dim arr(3) As Byte
    Dim value As Single

```

```
value = fdata
arr = BitConverter.GetBytes(value)
data0 = arr(3)
data1 = arr(2)
data2 = arr(1)
data3 = arr(0)
```

```
Return 0
```

```
End Function
```