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// **
// ** MLAW2LIN.v - MU-LAW TO LINEAR 2'S COMPLEMENT CODE TRANSLATOR
// **
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// *****
// ** Revision      : 1.0
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// **
// ** 11/01/2001: Initial design
// **
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// **
// *****

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```
`timescale 1ns/10ps
```

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module MLAW2LIN      ( DataI, DataO );

    input  [07:00]    DataI;          // data input - Mu-law
    output [12:00]    DataO;          // data output - linear 2's complement

// *****
// **  DECLARATIONS
// ** -----
// **  1.01: Mu-Law Input Inversion
// ** -----
// **  1.02: Mu-Law to Linear Table
// ** -----

    wire [07:00]    DataI_N;          // bit-wise inverted input
    wire [12:00]    DataO;            // linear data output - 2's complement

    reg  [13:00]    BiasedData;       // linear data - biased
    wire [12:00]    LinearData;       // linear data - unsigned

// *****
// **  FORMAT CONVERSION
// ** -----
// **  1.01: Mu-Law Input Inversion
// ** -----

    assign DataI_N = ~DataI;

// -----
// **  1.02: Mu-Law to Linear Table
// ** -----

always @(DataI_N) begin
    casex(DataI_N)
        8'b0111xxxx : BiasedData = {2'b11,DataI_N[03:00],8'b10000000}; // + full scale
        8'b0110xxxx : BiasedData = {3'b101,DataI_N[03:00],7'b1000000};
        8'b0101xxxx : BiasedData = {4'b1001,DataI_N[03:00],6'b100000};
        8'b0100xxxx : BiasedData = {5'b10001,DataI_N[03:00],5'b10000};
        8'b0011xxxx : BiasedData = {6'b100001,DataI_N[03:00],4'b1000};
        8'b0010xxxx : BiasedData = {7'b1000001,DataI_N[03:00],3'b100};
    end

```

```

8'b0001xxxx : BiasedData = {8'b10000001,DataI_N[03:00],2'b10};
8'b0000xxxx : BiasedData = {9'b100000001,DataI_N[03:00],1'b1}; // + zero

8'b1000xxxx : BiasedData = {9'b000000001,DataI_N[03:00],1'b1}; // - zero
8'b1001xxxx : BiasedData = {8'b00000001,DataI_N[03:00],2'b10};
8'b1010xxxx : BiasedData = {7'b0000001,DataI_N[03:00],3'b100};
8'b1011xxxx : BiasedData = {6'b000001,DataI_N[03:00],4'b1000};
8'b1100xxxx : BiasedData = {5'b00001,DataI_N[03:00],5'b10000};
8'b1101xxxx : BiasedData = {4'b0001,DataI_N[03:00],6'b100000};
8'b1110xxxx : BiasedData = {3'b001,DataI_N[03:00],7'b1000000};
8'b1111xxxx : BiasedData = {2'b01,DataI_N[03:00],8'b10000000}; // - full scale
endcase
end

// -----
//      1.03:  Linear Output Unbias
// -----

assign LinearData = (BiasedData - 33) >> 1;

// -----
//      1.04:  Linear 2's Complement
// -----

assign Data0 = LinearData[12] ? {1'b0,LinearData[11:00]} : {1'b1,(~LinearData[11:00] + 1)};
endmodule

```