Specification document of LM50C, LM50-Q1

Component manufacturer	Texas Instruments
Model number	LM50C, LM50-Q1
Datasheets	LM50 and LM50-Q1 SOT-23 Single-Supply Centigrade Temperature Sensor datasheet (Rev. G)
Specification Ver	01.00.00 Nov 1,2022 New release
Documentation provided	Rui Long Lab Inc. https://rui-long-lab.com/

1. Component datasheet

Temperature accuracy	±3.0° C	Accuracy T_A = 25° C
	±4.0° C	Accuracy T_A = T_{MAX}(125° C)
	±4.0° C	Accuracy T_A = T_{MIN}(-40° C)
Temperature range	-40 to +125° C	
Range of power supply voltage (Vdd)	4.5 to 10.0[V]	
Output voltage (Vout)	Linear 10 [mV/° C] Typ. (-40 to +125° C)	
	0 [° C] 500 [mV]	
Calculation	Vout = 0.5V + (0.01 V/° C × Ta)	
	Ta = (Vout – 0.5V) / (0.01 V/° C)	
Vdd vs Vout	Non-link	

Applications

IoT etc

- Computers
- Disk Drives
- Battery Management
- FAX Machines
- Printers
- Portable Medical Instruments
- HVAC
- Power Supply Modules

Automotive

2. Component Software IF specification

The software interface specifications based on the LM50C, LM50-Q1 component specifications are as follows.
The voltage value-to-physical value conversion equation is a linear conversion equation as shown in the equation below.

ADC value to voltage value conversion formula

$$vi = (ai \times iADC\_vdd) / 2^{iADC\_bit} \quad [V]$$

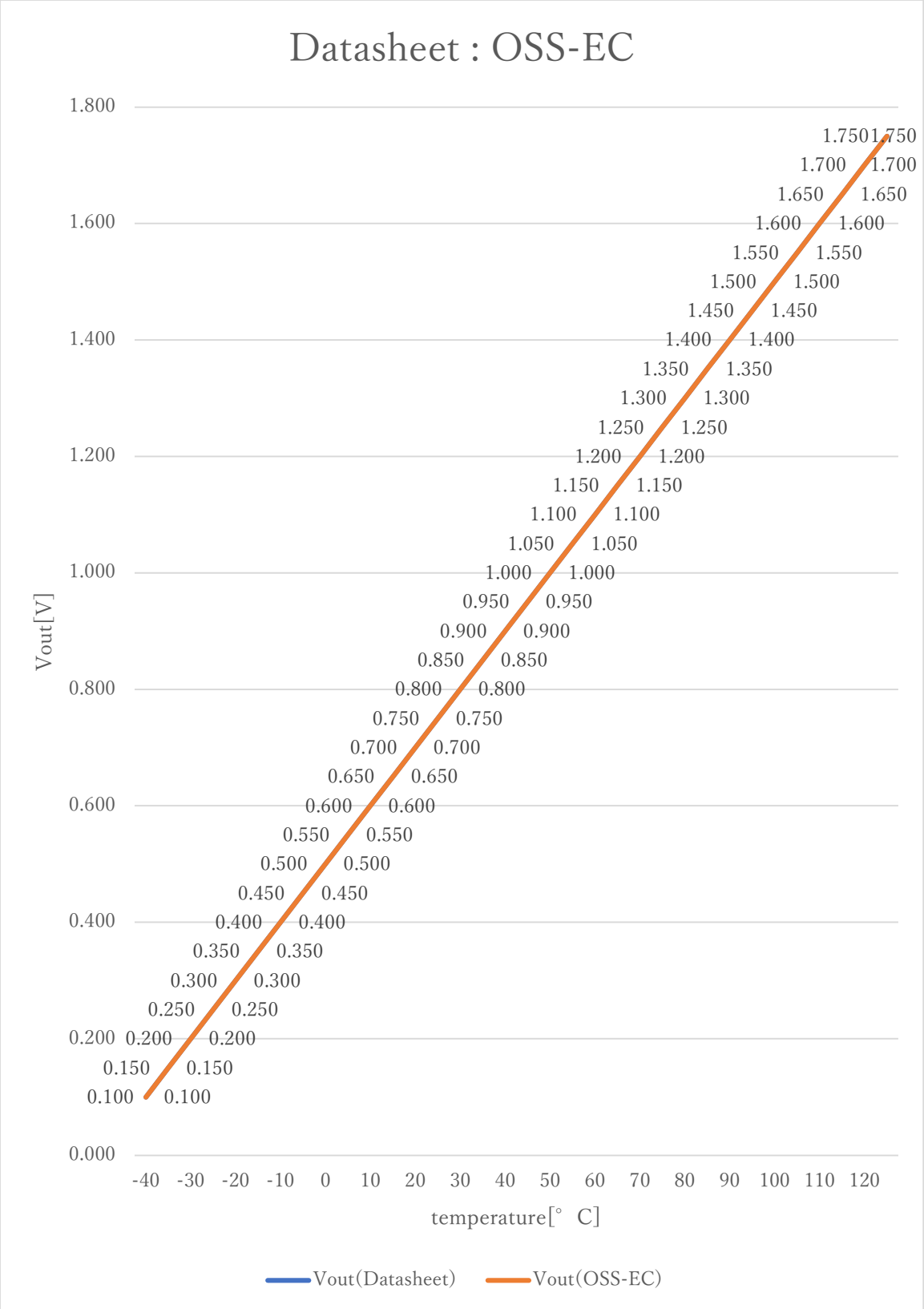
Voltage value to physical value conversion formula

$$y = (vi - iLM50C\_xoff) / iLM50C\_gain + iLM50C\_yoff \quad [℃]$$

$$iLM50C\_min \leqq y \leqq iLM50C\_max$$

ai	A/D conversion value
vi	Sensor output voltage value [V]
iADC_vdd	Sensor supply voltage value [V]
iADC_bit	A/D conversion bit length
y	Temperature value [℃]

```
#define iLM50C_xoff             0.5F            // X offset [V]
#define iLM50C_yoff             0.0F            // Y offset [℃]
#define iLM50C_gain             0.01F           // Gain [V/℃]
#define iLM50C_max              125.0F          // Temperature Max [℃]
#define iLM50C_min              -40.0F          // Temperature Min [℃]
```



Vout(Datasheet) = 10 mV/° C × T ° C + 500 mV

3. File Structure and Definitions

LM50C.h

```
#include "user_define.h"

// Components number
#define iLM50C              131U                    // Texas Instruments LM50C, LM50-Q1

// LM50C, LM50-Q1 System Parts definitions
#define iLM50C_xoff         0.5F                    // X offset [V]
#define iLM50C_yoff         0.0F                    // Y offset [℃]
#define iLM50C_gain         0.01F                   // Gain [V/℃]
#define iLM50C_max          125.0F                  // Temperature Max [℃]
#define iLM50C_min          -40.0F                  // Temperature Min [℃]

extern const tbl_adc_t tbl_LM50C;
```

LM50C.cpp

```
#include        "LM50C.h"
#if     iLM50C_ma == iSMA                               // Simple moving average filter
static float32 LM50C_sma_buf[iLM50C_SMA_num];
static const sma_f32_t LM50C_Phy_SMA =
{
        iInitial ,                                      // Initial state
        iLM50C_SMA_num ,                                // Simple moving average number & buf size
        0U ,                                            // buffer position
        0.0F ,                                          // sum
        &LM50C_sma_buf[0]                               // buffer
};
#elif   iLM50C_ma == iEMA                               // Exponential moving average filter
static const ema_f32_t LM50C_Phy_EMA =
{
        iInitial ,                                      // Initial state
        0.0F ,                                          // Xn-1
        iLM50C_EMA_K                                    // Exponential smoothing factor
};
#elif   iLM50C_ma == iWMA                               // Weighted moving average filter
static float32 LM50C_wma_buf[iLM50C_WMA_num];
static const wma_f32_t LM50C_Phy_WMA =
{
        iInitial ,                                      // Initial state
        iLM50C_WMA_num ,                        // Weighted moving average number & buf size
        0U ,                                            // buffer poition
        iLM50C_WMA_num * (iLM50C_WMA_num + 1)/2 ,       // kn sum
        &LM50C_wma_buf[0]                               // Xn buffer
};
#else                                                   // Non-moving average filter
#endif

#define iDummy_adr      0xffffffff                      // Dummy address
```

```
const tbl_adc_t tbl_LM50C =
{
        iLM50C                  ,
        iLM50C_pin              ,
        iLM50C_xoff             ,
        iLM50C_yoff             ,
        iLM50C_gain             ,
        iLM50C_max              ,
        iLM50C_min              ,
        iLM50C_ma               ,

#if     iLM50C_ma == iSMA                       // Simple moving average filter
        &LM50C_Phy_SMA          ,
        (ema_f32_t*)iDummy_adr ,
        (wma_f32_t*)iDummy_adr
#elif   iLM50C_ma == iEMA                       // Exponential moving average filter
        (sma_f32_t*)iDummy_adr ,
        &LM50C_Phy_EMA          ,
        (wma_f32_t*)iDummy_adr
#elif   iLM50C_ma == iWMA                       // Weighted moving average filter
        (sma_f32_t*)iDummy_adr ,
        (ema_f32_t*)iDummy_adr ,
        &LM50C_Phy_WMA
#else                                           // Non-moving average filter
        (sma_f32_t*)iDummy_adr ,
        (ema_f32_t*)iDummy_adr ,
        (wma_f32_t*)iDummy_adr
#endif

};
```