TN00030

LPC54018 Temperature logging on LCD using emWin graphics library

1.0 — 26 January 2018 **Technical note**

Document information

Info	Content
Keywords	LPC540xx, LCD, Temperature sensor, ADC, emWin graphics library
Abstract	This technical note describes the example that logs temperature on LPC54018 LPCXpresso board LCD using the graphics library features of emWin.

Revision history

Rev	Date	Description
1.0	20180126	Initial version.

Contact information

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1. Introduction

The LPC540xx is a family of ARM Cortex-M4 based microcontrollers used in embedded applications. This technical note references the LPCXpresso development board for LPC540xx MCUs. For details of the board, see:

https://www.nxp.com/demoboard/om40003

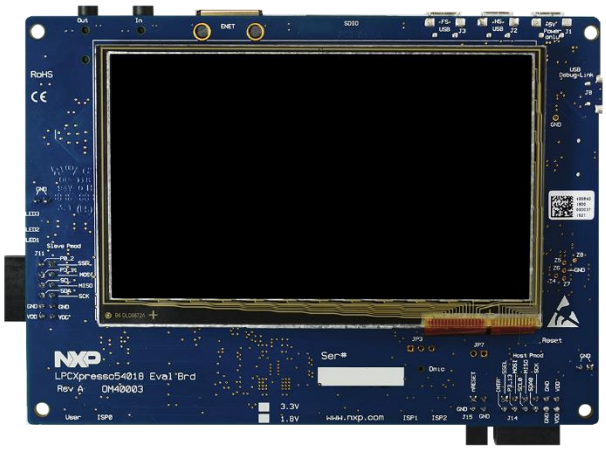

Fig 1. LPC54018 LPCXpresso development board

This technical note describes how to log temperature using the on-chip temperature sensor and the graphics library of emWin.

2. Description

This example uses the LPC54018 12-bit ADC and temperature sensor to measure temperature. The formula to convert the ADC conversion output value to temperature is given. Temperature is calculated in the Celsius scale. The temperature readings are displayed on the LPC54018 LPCXpresso board LCD display as a graph using the graphics library of emWin. The temperature data is also printed to a PC terminal via the UART.

Every ADC conversion result value corresponds to a voltage level and the temperature value is calculated from this voltage level.

$$ADC\ Voltage\ (\ in\ V\ ) = \frac{ADC\ conversion\ result\ (\ in\ decimal)\ \times Vsupply}{4096}$$

where *Vsupply* is the supply voltage (in Volts) to VREFP pin of LPC54018.

On the LPC54018 LPCXpresso board, the VREFP pin is connected to VDD pin by default. Therefore, in this example Vsupply = 3.3 V.

The formula to convert the temperature that is displayed on the LCD screen is:

$$Temperature\ (℃) = \frac{(ADC\ Voltage \times 1000) - VLLS0}{LLS\ Slope}$$

where VLLS0 is Linear Least Square (LLS) intercept at 0 ℃.

From the LPC540xx datasheet, LLS at 0 ℃ is 584 mV and LLS Slope = -2.04 mV/℃.

These values are used in this example.

This is a Plain Load example, where the application image is programmed into external SPI flash device on the LPC54018 LPCXpresso Board. On reset, the image is copied to SRAMX and executed from SRAMX. See LPC540xx User Manual for more details.

Note: See the “Getting Started with MCUXpresso SDK for LPC540xx.pdf” document in “docs” folder of SDK package. This document explains how to configure the IDEs for various debug configurations (SRAMX, Plain Load, and XIP).

The example is available in three tool chains:

- IAR embedded Workbench
- Keil MDK
- MCUXpresso

The Keil and IAR examples are found in:

lpc54018_emwin_temp_sensor_keil_iar\boards\lpcxpresso54018\emwin_examples\emwin_temp_sensor

The MCUXpresso example can be found in the zip file:

lpc54018_emwin_temp_sensor_mcux.zip

Note: The MCUXpresso version used in this Tech Note is 10.1.1. In this version, to program a plain load image into Quad SPI device, a binary file must be created from the axf file and using the LinkServer GUI Flash Programmer, the binary file is programmed into the Quad SPI device at location 0x1000 0000. This procedure will change in the next release of MCUXpresso IDE.

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