User's Guide

TMP4718EVM User's Guide

ABSTRACT

This user's guide describes the characteristics, operation, and use of the TMP4718 Evaluation Module (EVM). This document contains information on the set up and configuration of the software as well as a review of the hardware. Throughout this document, the terms evaluation board, evaluation module, and EVM are synonymous with the TMP4718EVM. A complete schematic diagram, printed-circuit board layouts, and bill of materials are included in this document.

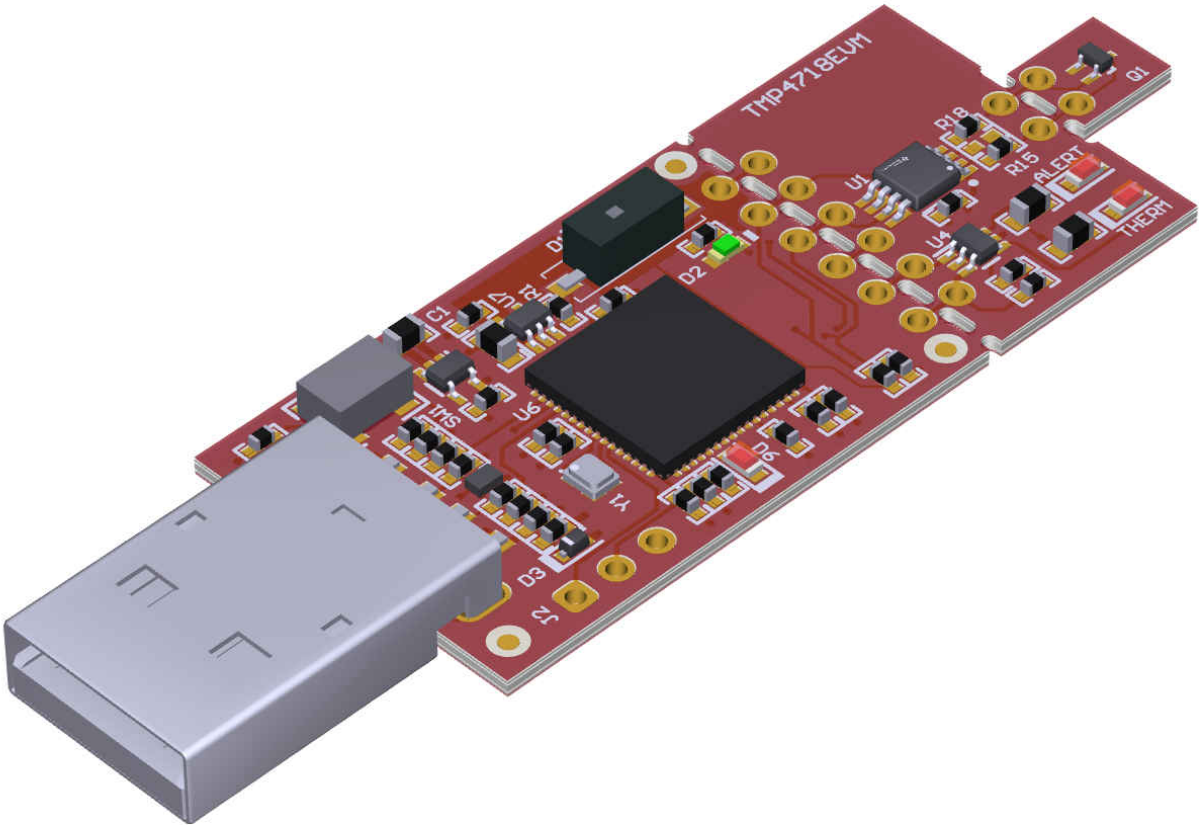

Figure 1-1. TMP4718EVM Hardware

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Trademarks

1 Introduction

The TMP4718 is a high-accuracy, low-power remote temperature sensor monitor with a built-in local temperature sensor. The remote temperature sensors are typically low-cost discrete NPN or PNP transistors, on-die transistors or diode structures that are an integral part of microprocessors, microcontrollers, and FPGAs. Temperature accuracy for the local and the remote temperature sensors is ±1°C. The two-wire serial interface accepts SMBus communication protocol. The module and GUI are designed to provide the user a quick setup to evaluate the system and register map. The EVM perforations allow the user to isolate and connect the temperature sensor, microcontroller, and remote BJT to external systems.

1.1 Features

This EVM has the following features:

- GUI for easy setup
- Perforated PCB for placement flexibility
- Online or offline software installation for parallelism
- NPN and PNP footprints for remote sensor evaluation

1.2 EVM Kit Contents

Table 1-1 details the contents of the EVM kit. Contact the nearest Texas Instruments Product Information Center if any components are missing. TI recommends that users check the TI website to verify that they have the latest versions of the related software.

Table 1-1. TMP4718EVM Kit Contents

ITEM	QUANTITY
TMP4718EVM	1

2 TMP4718EVM Hardware Overview and Setup

This section describes the setup and hardware features present on the TMP4718EVM.

CAUTION

Many of the components on the TMP4718EVM are susceptible to damage by electrostatic discharge (ESD). Customers are advised to observe proper ESD handling precautions when unpacking and handling the EVM, including the use of a grounded wrist strap at an approved ESD workstation.

2.1 Board Connectors and Components

Figure 2-1 shows the top side of the TMP4718EVM with callouts for the USB connector, breakout sections, the TMP4718 device, and the remote NPN transistor. Figure 2-2 shows the bottom side of the TMP4718EVM, which has a footprint available for the user to populate a PNP transistor. The USB connector is directly plugged into the computer for power and communication from the computer to the USB2ANY microcontroller. The engineer can use the perforated breakouts to break off certain sections of the EVM and connect these sections to external systems. Users can also solder headers to the vias to use as test points.

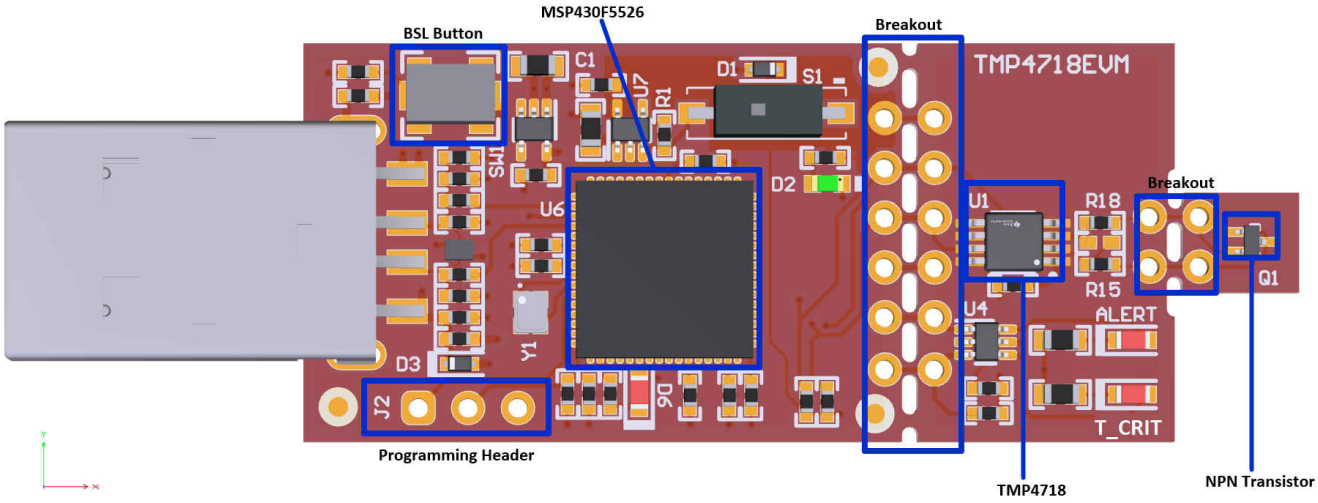

Figure 2-1. TMP4718EVM Board Top Side

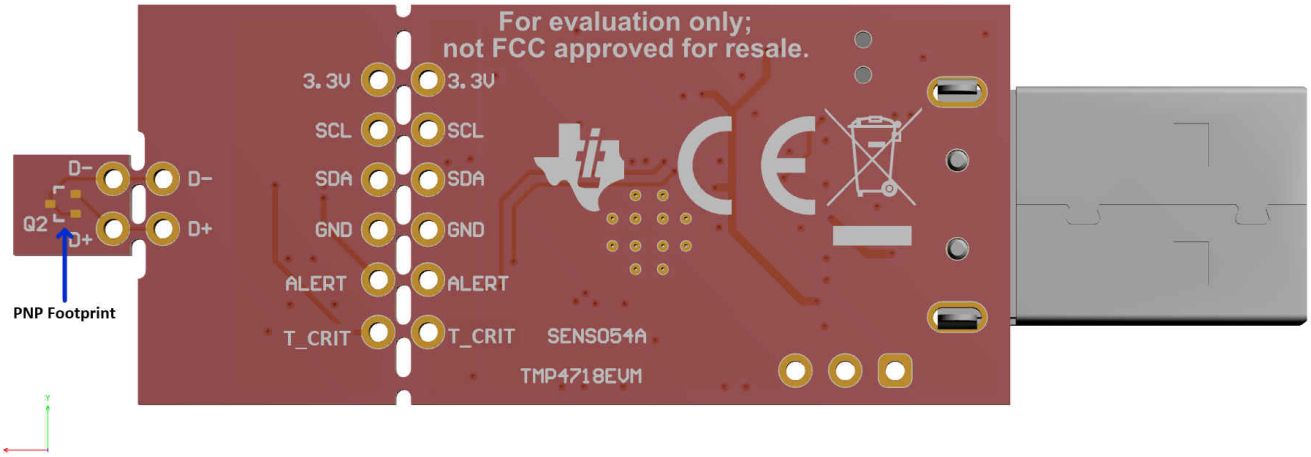

Figure 2-2. TMP4718EVM Board Bottom Side

2.1.1 Programming Header

The TMP4718EVM is pre-loaded with firmware that is necessary for correct operation. Header J2 allows for Spy-Bi-Wire access to the MSP430F5526, but TI does not recommend that users access this header or reprogram the device.

2.1.2 Pushbutton Switch

The Switch SW1 allows the device to enter USB BSL mode for firmware updates. To enter BSL mode, connect the EVM to a USB port while holding down Switch SW1.

2.1.3 Status LEDs

The TMP4718EVM includes several LEDs which indicate the status of the board at any time. The green LED D2 illuminates when power is supplied to the VDD net. The VDD net is connected directly to pin 1 of the TMP4718. The red LED D6 is a status LED for the MSP430F5526. Table 2-1 summarizes the functions of D6.

Table 2-1. D6 LED Statuses

D6 LED STATUS	MEANING
Off	USB2ANY controller is unpowered or still initializing
Blinking	USB2ANY controller is powered but not connected
On	USB2ANY controller is connected

The ALERT and T_CRIT LEDs illuminate when the corresponding ALERT and T_CRIT device pins are asserted. The default value of the Remote and Local T_CRIT limits are adjustable with the use of the ALERT and T_CRIT pullup resistance values. The TMP4718EVM has 10.5-kΩ pullup resistors on ALERT and T_CRIT, which sets 0x65 (101°C) as the default value of registers 0x19 and 0x20. Refer to the TMP4718 data sheet for more information on the adjustable T_CRIT limit.

2.1.4 Remote BJT

Q1 is a MMBT3904T NPN BJT, and these temperature limits are used as the remote temperature sensor on the EVM. A PNP footprint located on the back of the EVM (Q2) allows the user to evaluate both types of transistors. The MMBT3904T is on a perforated section of the board that can be broken off to connect different remote sensors.

2.2 EVM Operating Conditions

The TMP4718EVM power is supplied through the USB connector. The LDO converts the 5 V from the USB to 3.3 V used by the TMP4718 and the MSP430. The EVM may be directly inserted into a USB port on a PC or laptop, or may be connected to the latter using an appropriate USB cable. The controller and device sides of the EVM have different temperature limits as shown in Table 2-2. These temperature limits are set by the onboard MSP430 on the controller and the TMP4718 ICs on the breakout points.

Table 2-2. TMP4718EVM Temperature Limits

BOARD SECTION	CONDITIONS	TEMPERATURE RANGE
Controller Board	Recommended operating free-air temperature, T_A	–40°C to 125°C
	Absolute maximum junction temperature, T_J	95°C
TMP4718 Breakout	Recommended operating free-air temperature, T_A	–40°C to 125°C
	Absolute maximum junction temperature, T_J	–55°C to 150°C

3 TMP4718EVM Software Overview

This section discusses how to install and use the TMP4718EVM software.

3.1 Software Download

The PC GUI software for the TMP4718EVM operates on TI's GUI Composer framework. The PC GUI software is available as a live version that operates in a web browser and as a download for offline use. The software is compatible with Windows®, macOS®, and Linux® operating systems.

3.1.1 Live Software on dev.ti.com

The live software currently works on Google Chrome™, Firefox™, and Safari® browsers. Internet Explorer™ is not supported. Users can access the live version through one of the following actions:

- Navigate to the EVM tool page and click Evaluate
- Navigate to dev.ti.com/gallery and search for TMP4718EVM
  - Click the application icon within the gallery to launch the software
  - Click the prompt to install the TI Cloud Agent Bridge browser plug-in

3.1.2 Offline Software

Users can access the latest version of the offline software by navigating to the live version as noted above. Look for the download icon ( ) and download both the application and runtime software for the operating system.

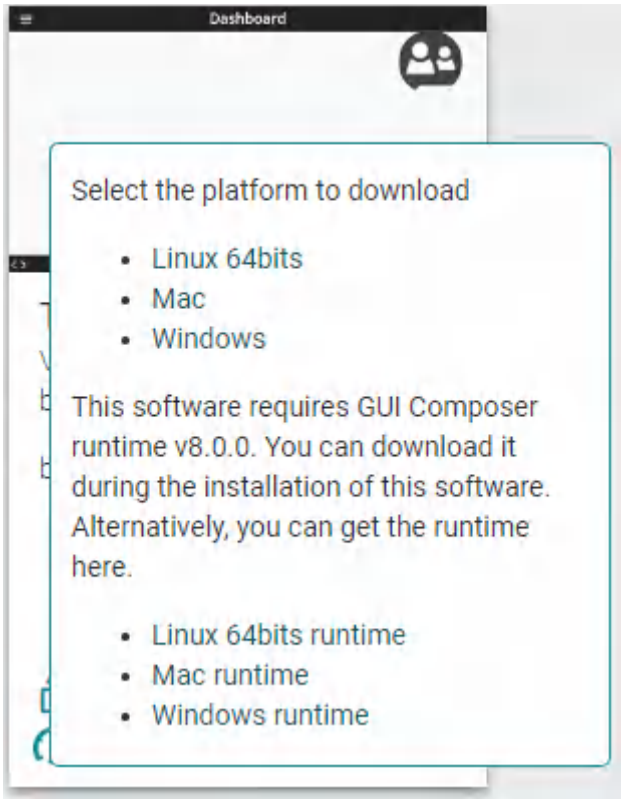

Figure 3-1. Download Pop-Up

3.2 Software Operation

3.2.1 Home Tab

The Home Tab is shown at software launch. The icons are shortcuts to the tabs that are shown on the left side of the screen.

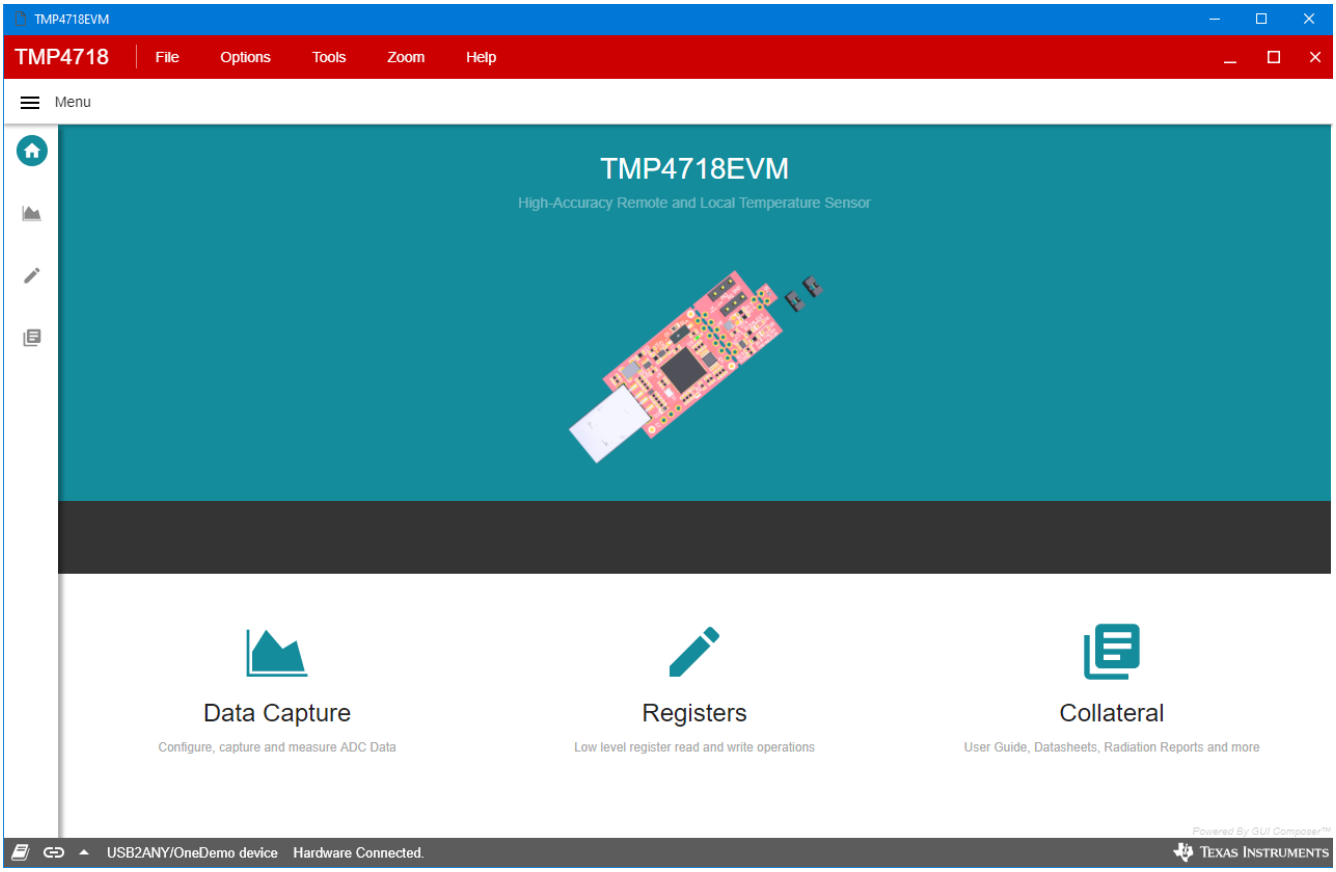

Figure 3-2. Home Tab

3.2.2 Data Capture Tab

The Data Capture tab reports the temperature from the TMP4718 device and the remote temperature sensor included on the EVM.

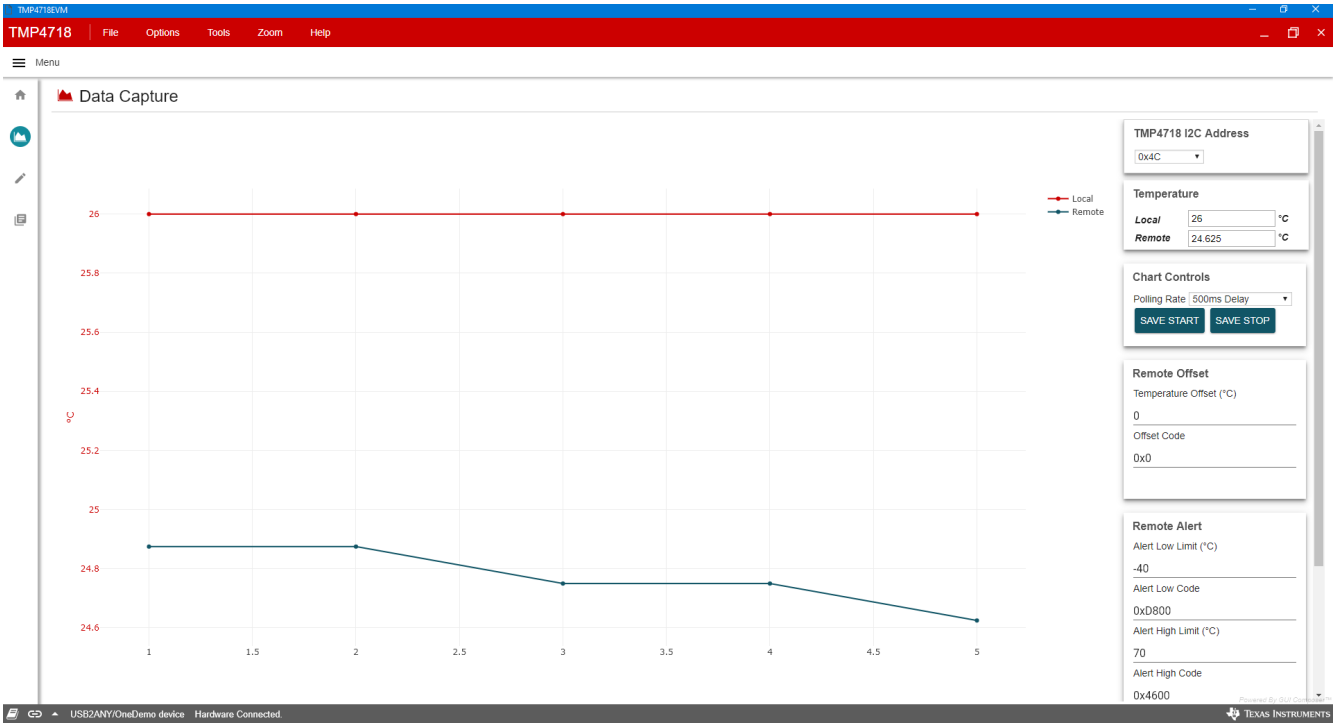

Figure 3-3. Data Capture Tab

The top right panel of the Data Capture tab allows the user to configure the device address. See Table 3-1 for the device orderables and respective addresses. The evaluation board is populated with TMP4718ADGKR, which has I^2C address 0x4C.

Table 3-1. TMP4718 Device Address Options

PART NUMBER	I^2C ADDRESS
TMP4718**A**DGKR	0x4C
TMP4718**B**DGKR	0x4D

The current Local and Remote temperature values are read out in °C. The user can also control the polling rate and filestream save from the Data Capture tab. Offset and alert controls allow the user to input a value for these registers in both C and hex. This feature allows for simple and quick control of the register map settings.

3.2.3 Registers Tab

The Registers tab interacts with the registers and bits within the TMP4718 device. The Auto Read drop-down box configures polling of register contents.

When Auto Read is Off, click *Read Register* to fetch the contents of the current register. Click *Read All Registers*to see the contents of all registers at once.

The *Write Register* button is greyed and disabled when the drop-down next to the button is set to Immediate. Immediate mode triggers a Write operation each time a register is modified.

When Deferred mode is selected, the *Write Register* button is enabled. Write operations will not start until the Write Register button is clicked. These settings give the user total control over I^2C Bus activity and allow the user to see individual transactions with an oscilloscope, logic analyzer, or bus-sniffing device.

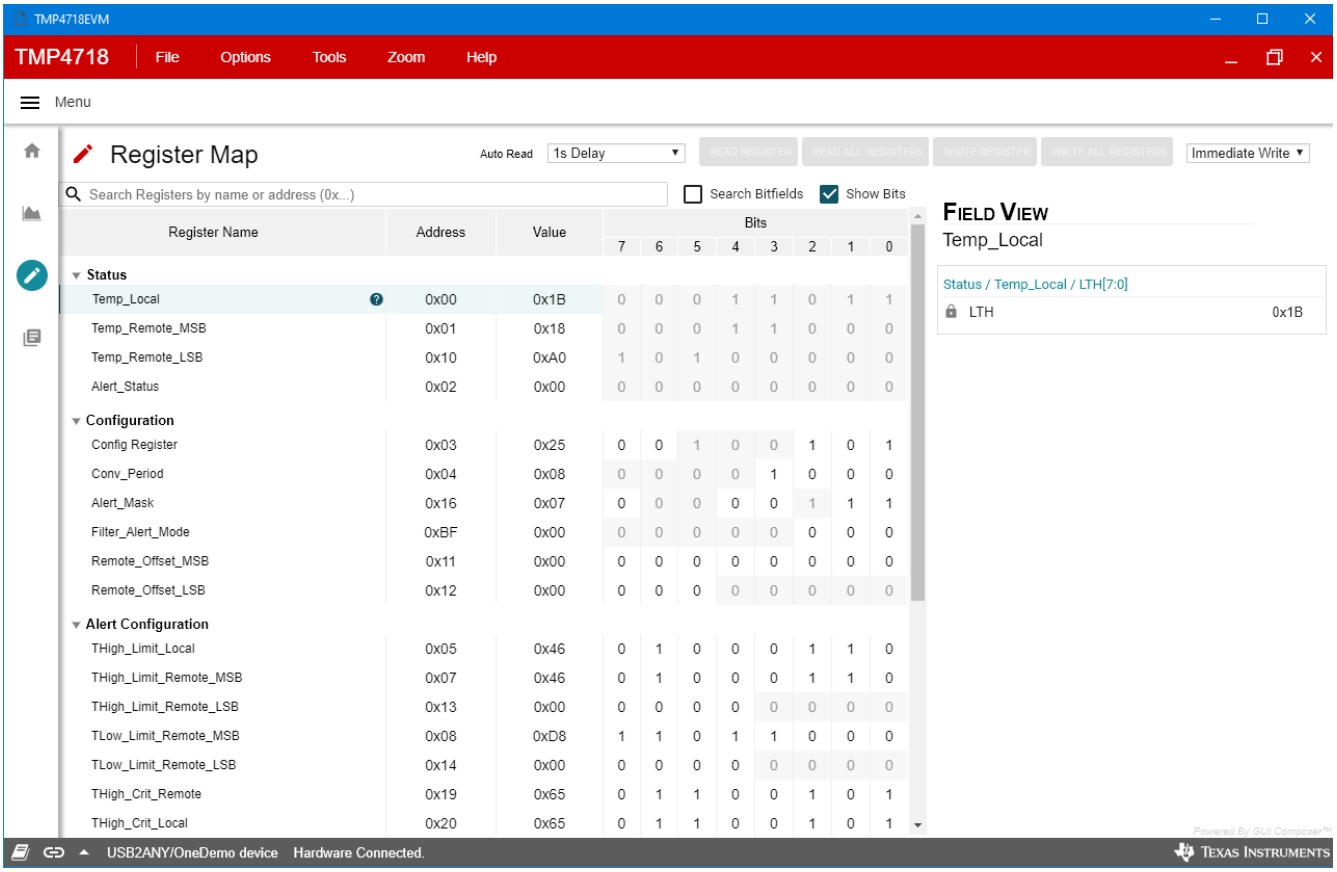

Figure 3-4. TMP4718 Register Map

3.2.4 Collateral Tab

The Collateral tab contains links to the EVM user's guide, the tool page on ti.com, as well as links to the product data sheet and other relevant literature.

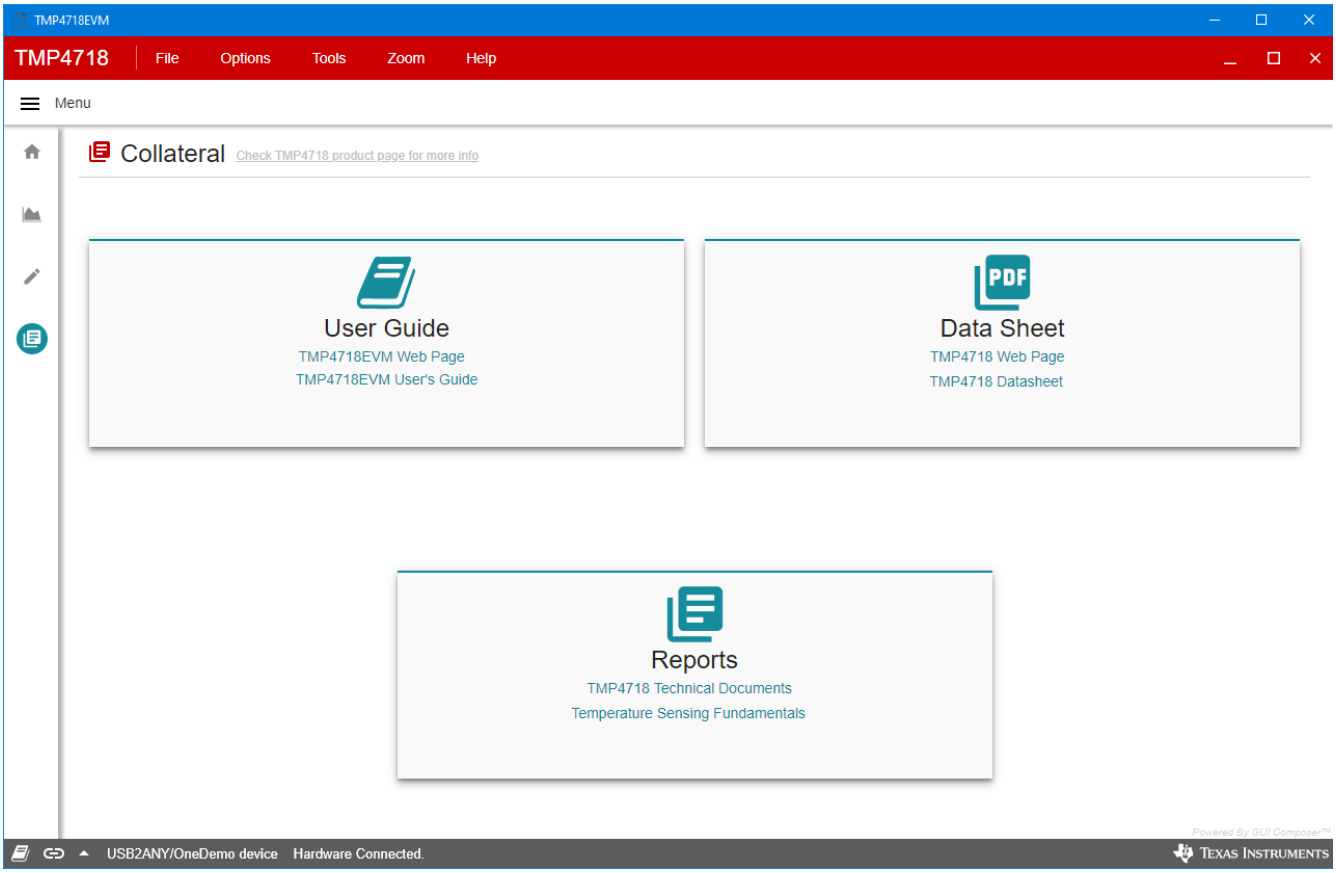

Figure 3-5. Collateral Tab

4 Schematic, Board Layout, and Bill of Materials

4.1 Schematic

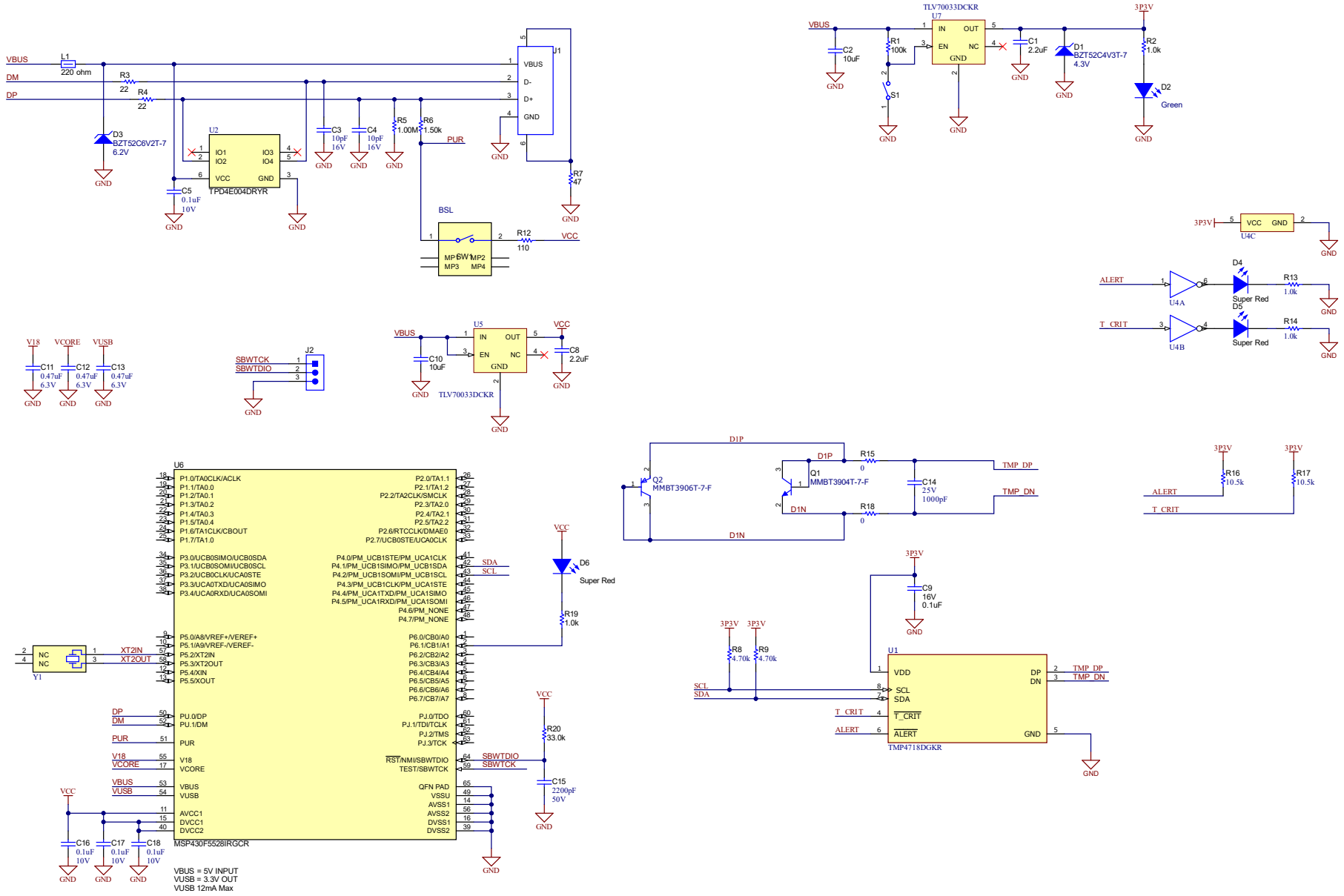

Figure 4-1. TMP4718EVM Schematic

4.2 Layout

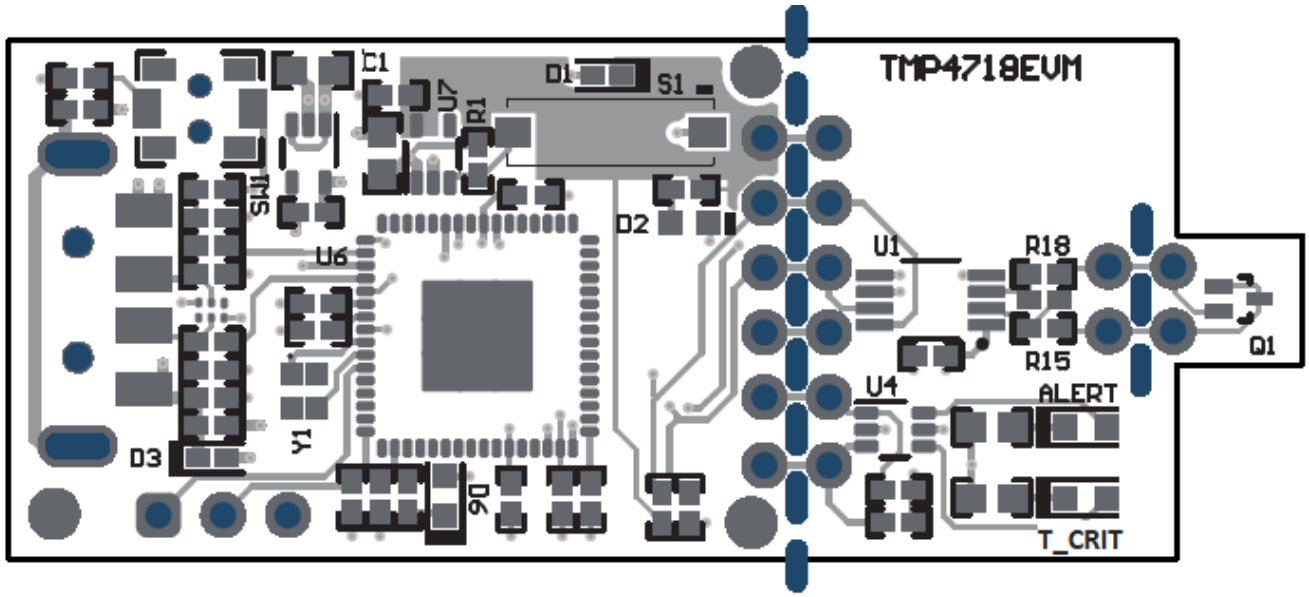

Figure 4-2. TMP4718EVM PCB Top View

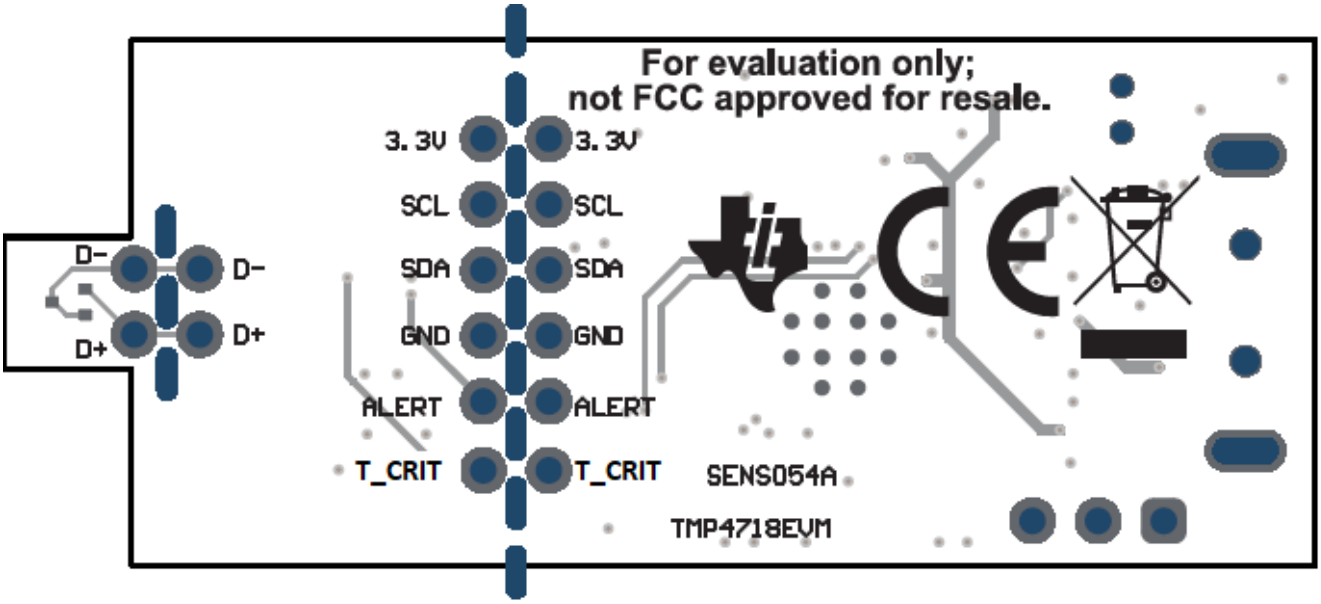

Figure 4-3. TMP4718EVM PCB Bottom View

4.3 Bill of Materials

Table 4-1. Bill of Materials (BOM)

DESIGNATOR	QUANTITY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
C1, C8	2	2.2 µF	CAP, CERM, 2.2 uF, 16 V, +/- 10%, X5R, 0402	402	GRM155R61C225KE11D	MuRata
C2, C10	2	10 µF	CAP, CERM, 10 uF, 10 V, +/- 20%, X5R, 0603	603	C1608X5R1A106M080AC	TDK
C3, C4	2	10 pF	CAP, CERM, 10 pF, 16 V,+/- 10%, C0G, 0402	402	C0402C100K4GACTU	Kemet
C5, C16, C17, C18	4	0.1 µF	CAP, CERM, 0.1 uF, 10 V,+/- 10%, X5R, 0402	402	LMK105BJ104KV-F	Taiyo Yuden
C9	1	0.1 µF	CAP, CERM, 0.1 uF, 16 V, +/- 10%, X7R, 0402	402	ATC530L104KT16T	AT Ceramics
C11, C12, C13	3	0.47 µF	CAP, CERM, 0.47 uF, 6.3 V, +/- 10%, X7R, 0402	402	JMK105B7474KVHF	Taiyo Yuden
C15	1	2200 pF	CAP, CERM, 2200 pF, 50 V, +/- 5%, X7R, 0402	402	CL05B222JB5NNNC	Samsung Electro-Mechanics
D1	1	4.3 V	Diode, Zener, 4.3 V, 300 mW, SOD-523	SOD-523	BZT52C4V3T-7	Diodes Inc.
D2	1	Green	LED, Green, SMD	LED, GREEN, 0603	SML-LX0603GW-TR	Lumex
D3	1	6.2 V	Diode, Zener, 6.2 V, 300 mW, SOD-523	SOD-523	BZT52C6V2T-7	Diodes Inc.
D4, D5, D6	3	Super Red	LED, Super Red, SMD	LED_0603	150060SS75000	Wurth Elektronik
J1	1		Connector, Plug, USB Type A, R/A, Top Mount SMT	USB Type A right angle	48037-1000	Molex
L1	1	220 Ω	Ferrite Bead, 220 ohm @ 100 MHz, 0.45 A, 0402	402	BLM15AG221SN1D	MuRata
Q1	1	40 V	Transistor, NPN, 40 V, 0.2 A, SOT-523	SOT-523	MMBT3904T-7-F	Diodes Inc.
R1	1	100 kΩ	RES, 100 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2GEJ104X	Panasonic
R2, R19	2	1.0 kΩ	RES, 1.0 k, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2GEJ102X	Panasonic
R3, R4	2	22 Ω	RES, 22, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2GEJ220X	Panasonic
R5	1	1.00 MΩ	RES, 1.00 M, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	RMCF0402FT1M00	Stackpole Electronics Inc

Table 4-1. Bill of Materials (BOM) (continued)

DESIGNATOR	QUANTITY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
R6	1	1.50 kΩ	RES, 1.50 k, 1%, 0.063 W, AEC-Q200 Grade 0, 0402	402	RMCF0402FT1K50	Stackpole Electronics Inc
R7	1	47 Ω	RES, 47, 5%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2GEJ470X	Panasonic
R8, R9	2	4.7 kΩ	RES, 4.70 k, 1%, 0.1 W, 0402	402	ERJ-2RKF4701X	Panasonic
R12	1	110 Ω	RES, 110, 1%, 0.1 W, AEC-Q200 Grade 0, 0402	402	ERJ-2RKF1100X	Panasonic
R13, R14	2	1.0 kΩ	RES, 1.0 k, 5%, 0.1 W, 0603	603	RC0603JR-071KL	Yageo
R15, R18	2	0 Ω	RES, 0, 0%, 0.2 W, AEC-Q200 Grade 0, 0402	402	CRCW04020000Z0EDHP	Vishay-Dale
R16, R17	2	10.5 kΩ	RES, 10.5 k, 1%, 0.063 W, 0402	402	RC0402FR-0710K5L	Yageo America
R20	1	33.0 kΩ	RES, 33.0 k, 1%, 0.063 W, 0402	402	RC0402FR-0733KL	Yageo America
S1	1		Switch, Slide, SPST, Top Slide, SMT	Switch, Single Top Slide, 2.5x8x2.5mm	CHS-01TB	Copal Electronics
SW1	1		Switch, SPST-NO, Off-Mom, 0.05A, 12VDC, SMD	3.9x2.9mm	PTS820 J20M SMTR LFS	C&K Components
U1	1		High accuracy 1°C temperature sensor	VSSOP8	TMP4718ADGKR	Texas Instruments
U2	1		4-Channel ESD Protection Array for High-Speed Data Interfaces, DRY0006A (USON-6)	DRY0006A	TPD4E004DRYR	Texas Instruments
U4	1		Dual Inverter, DCK0006A (SOT-SC70-6)	DCK0006A	SN74LVC2G04DCKR	Texas Instruments
U5, U7	2		Single Output LDO, 200 mA, Fixed 3.3 V Output, 2 to 5.5 V Input, with Low IQ, 5-pin SC70 (DCK), -40 to 125 degC, Green (RoHS & no Sb/Br)	DCK0005A	TLV70033DCKR	Texas Instruments
U6	1		16-Bit Ultra-Low-Power Microcontroller, 96KB Flash, 6KB RAM, USB, 12Bit ADC, 2 USCIs, 32Bit HW MPY, RGC0064B (VQFN-64)	RGC0064B	MSP430F5528IRGCR	Texas Instruments
Y1	1		Crystal, 24 MHz, SMD	2x1.6mm	XRCGB24M000F2P00R0	MuRata
C14	0	1000 pF	CAP, CERM, 1000 pF, 25 V, +/- 5%, X7R, 0402	402	C0402C102J3RACTU	Kemet
J2	0		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec

Table 4-1. Bill of Materials (BOM) (continued)

DESIGNATOR	QUANTITY	VALUE	DESCRIPTION	PACKAGE REFERENCE	PART NUMBER	MANUFACTURER
Q2	0	-40 V	Bipolar (BJT) Transistor PNP 40 V 200 mA 250MHz 150 mW Surface Mount SOT-523	SOT523	MMBT3906T-7-F	Diodes Inc.

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