

**Over Temperature Detection IC
Thermoflagger™ Application Circuit
(TCTH021AE version)**

Reference Guide

RD225-RGUIDE-01

TOSHIBA ELECTRONIC DEVICES & STORAGE CORPORATION

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1. Introduction

In recent years, the management and control of the heat generated by electronic components in equipment has become a major issue, and onboard over temperature monitoring and temperature protection solutions have become increasingly important.

We have launched an Over Temperature Detection IC Thermoflagger™ (TCTH Series) as a new solution for over temperature monitoring in electronic equipment. We have also developed an Over Temperature Detection IC Thermoflagger™ application circuit example using this product as a reference design (hereinafter referred to as "this Design"), which is capable of detecting over temperature with a simple configuration; that is done by only combining it with a PTC thermistor. This design has a simple configuration which detects the rise of temperature above alert temperature. This Reference Guide describes this specification and operation procedure.

This design uses an Over Temperature Detection IC Thermoflagger™ [TCTH021AE](#). In addition, small-package MOSFETs [SSM3K35MFV](#) and [SSM3J35AMFV](#) are used to drive LED.

Thermoflagger™ can be used with various sensors which utilize change in resistance for detection. Other application circuits including light detection circuit (using CdS sensor) and pressure detection circuit (using pressure sensor) are also described in this document.

2. Specifications and Appearance

2.1. Specifications

Table 2.1 lists the main specifications of this circuit.

Table 2.1 Circuit Specifications

Circuit Name	Thermoflagger™	Onboard Sensor	Power Supply	Operation
AE1	TCTH021AE (Push-pull type)	PTC thermistor	USB Type-C®	Red LED turns ON if the temperature of either PTC thermistor exceeds its alert temperature.

Table 2.2 Specifications of Other Application Circuits

Circuit Name	Thermoflagger™	Onboard Sensor	Power Supply	Operation
AE2	TCTH021AE (Push-pull type)	CdS sensor	USB Type-C®	<ul style="list-style-type: none"> ● Blue LED turns ON if the sensor's surrounding is bright ● Red LED turns ON if the sensor's surrounding is dark
AE3		Pressure sensor		<ul style="list-style-type: none"> ● Blue LED turns ON if pressure sensor is pressed ● Red LED turns ON if pressure sensor is not pressed

2.2. Circuit Block Diagram

Fig. 2.1 shows the block diagram of over temperature detection circuit. Fig. 2.2 and Fig. 2.3 show the block diagrams of other application circuits.

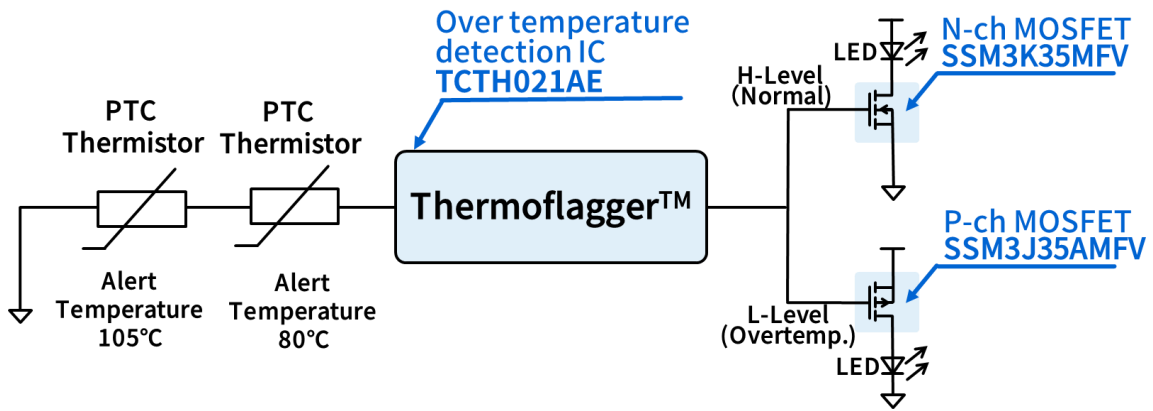


Fig. 2.1 Over Temperature Detection Circuit Block Diagram (AE1)

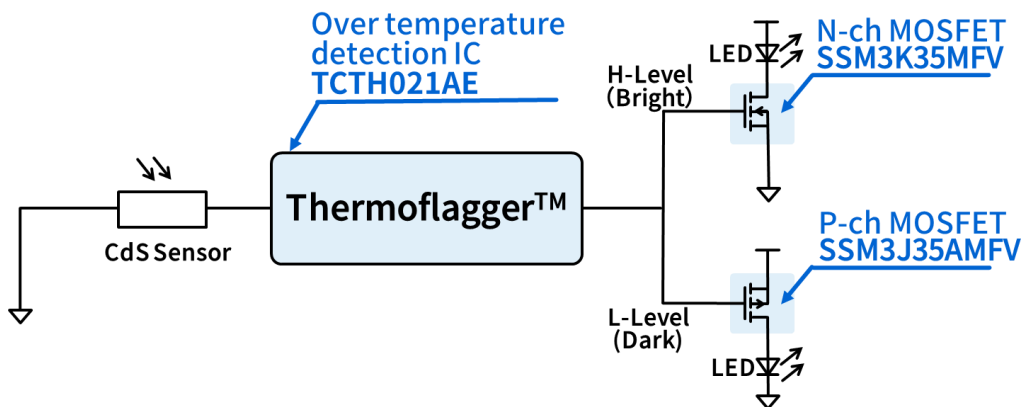


Fig. 2.2 Light Detection Circuit Block Diagram (AE2)

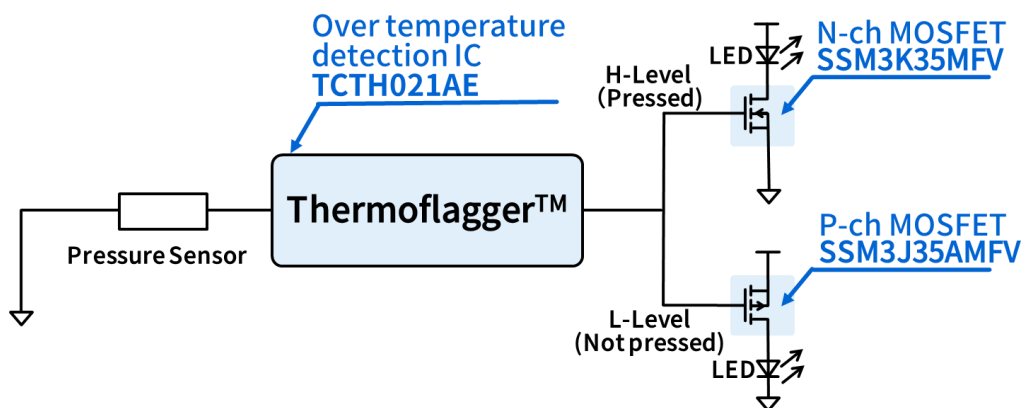


Fig. 2.3 Pressure Detection Circuit Block Diagram (AE3)

2.3. External View and Component Layout

Fig. 2.4 to Fig. 2.6 show the external view of this design and Fig. 2.7 shows the layout of the main components.

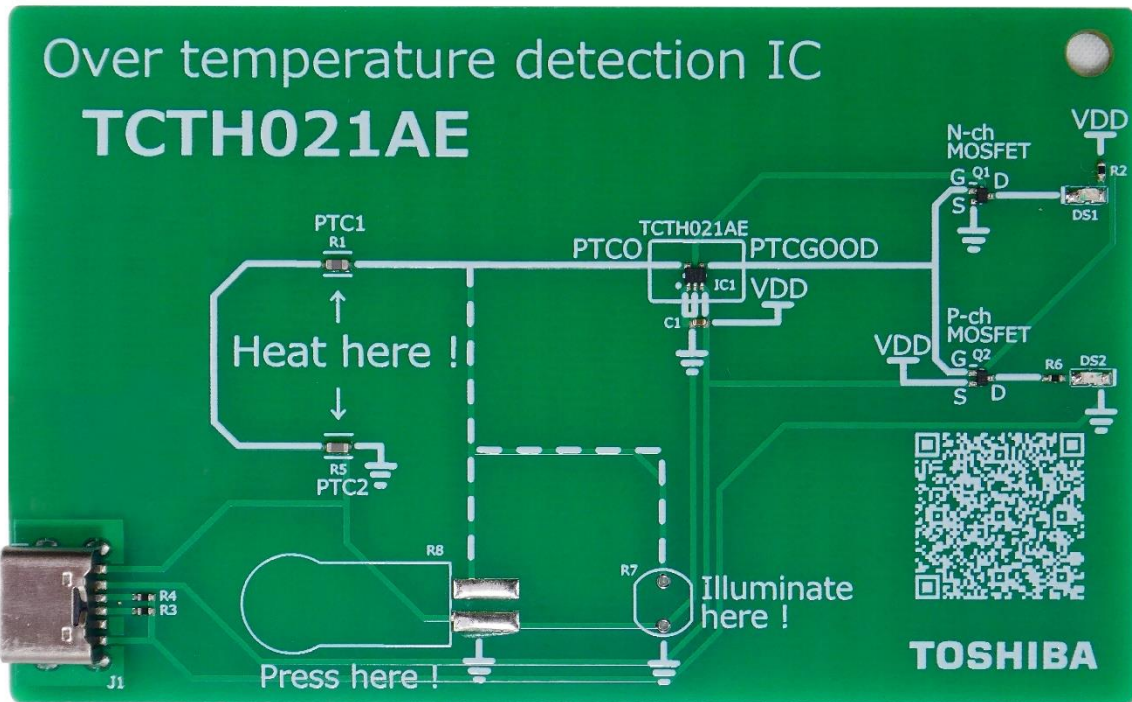


Fig. 2.4 PCB Front View (Circuit AE1, Over Temperature Detection Circuit)

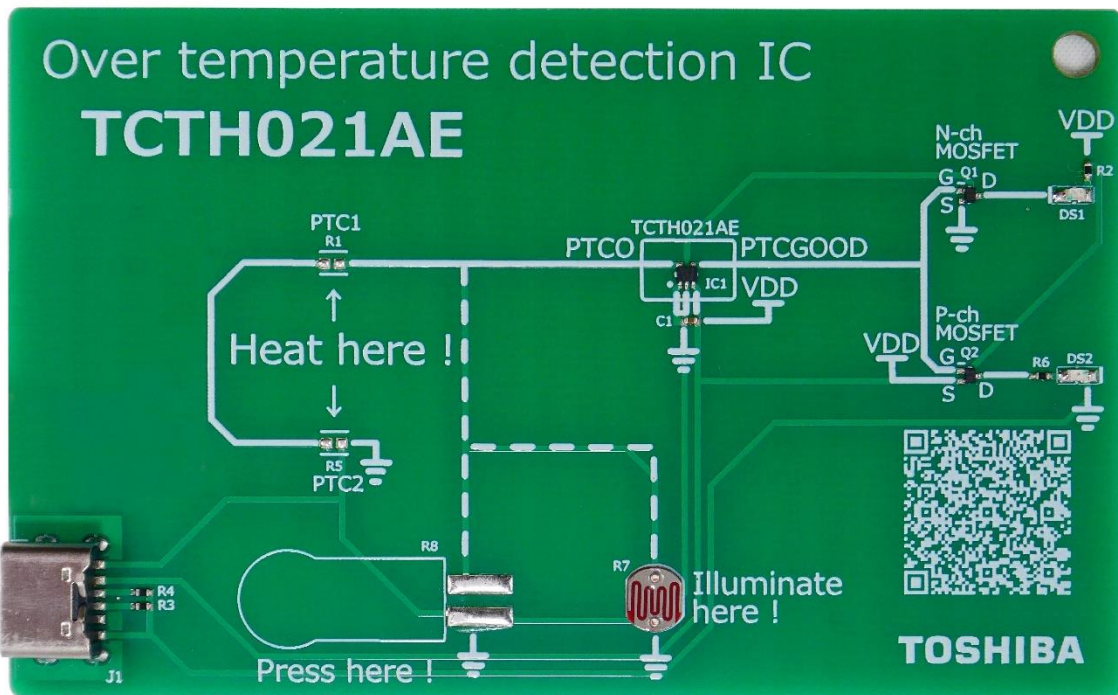


Fig. 2.5 PCB Front View (Circuit AE2, Light Detection Circuit)

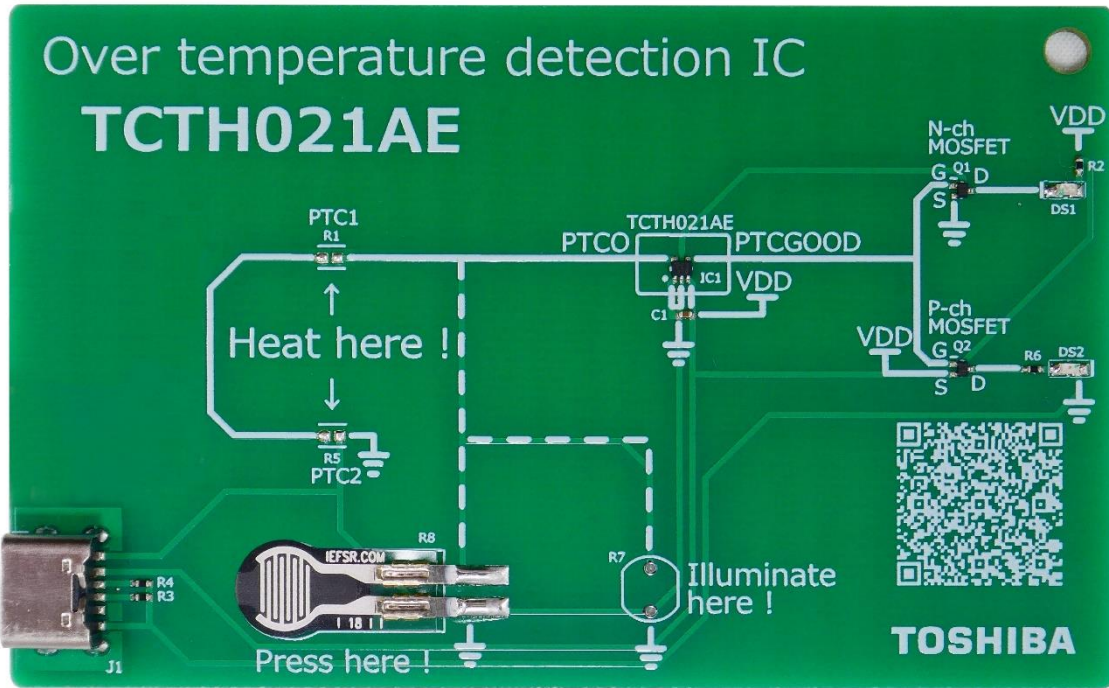


Fig. 2.6 PCB Front View (Circuit AE3, Pressure Detection Circuit)

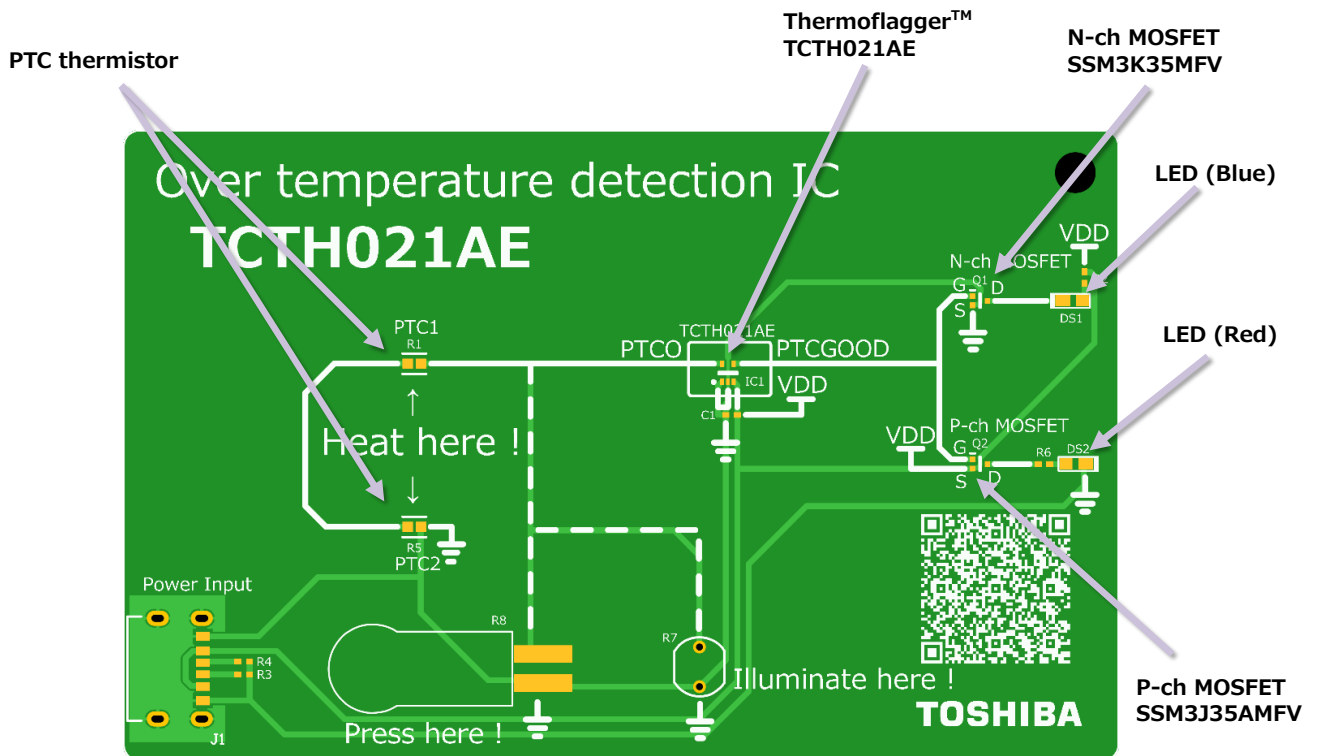


Fig. 2.7 PCB Component Layout (Front View)

3. Schematic, Bill of Material, and PCB Pattern

3.1. Schematic

Refer to the following file:

Over Temperature Detection Circuit (Circuit AE1) RD225-SCHEMATIC2-xx.pdf

Light Detection Circuit (Circuit AE2) RD225-SCHEMATIC3-xx.pdf

Pressure Detection Circuit (Circuit AE3) RD225-SCHEMATIC4-xx.pdf

(xx is the revision number.)

3.2. Bill of Material

Refer to the following file:

Over Temperature Detection Circuit (Circuit AE1) RD225-BOM2-xx.pdf

Light Detection Circuit (Circuit AE2) RD225-BOM3-xx.pdf

Pressure Detection Circuit (Circuit AE3) RD225-BOM4-xx.pdf

(xx is the revision number.)

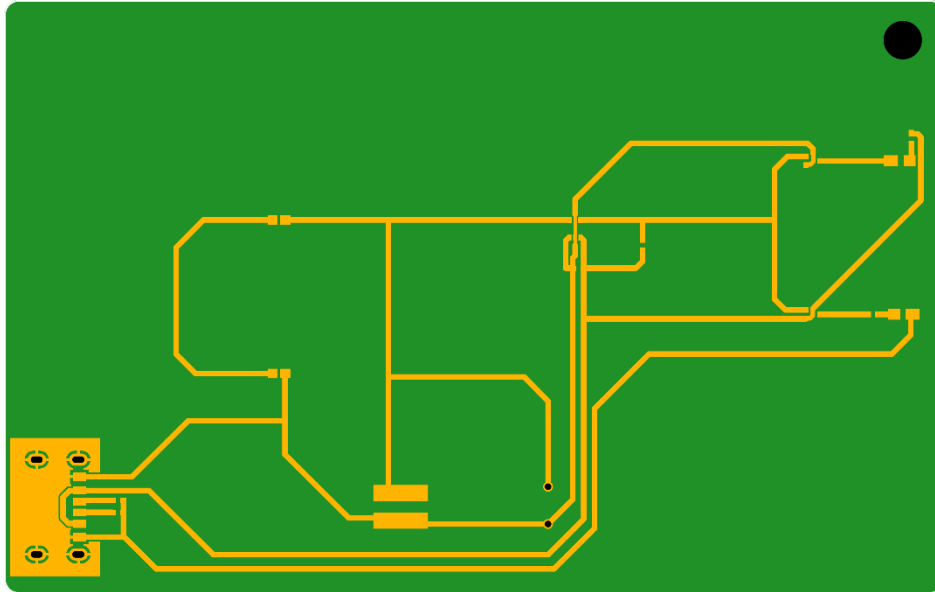
3.3. PCB Pattern

Fig. 3.1 shows the pattern of the PCB.

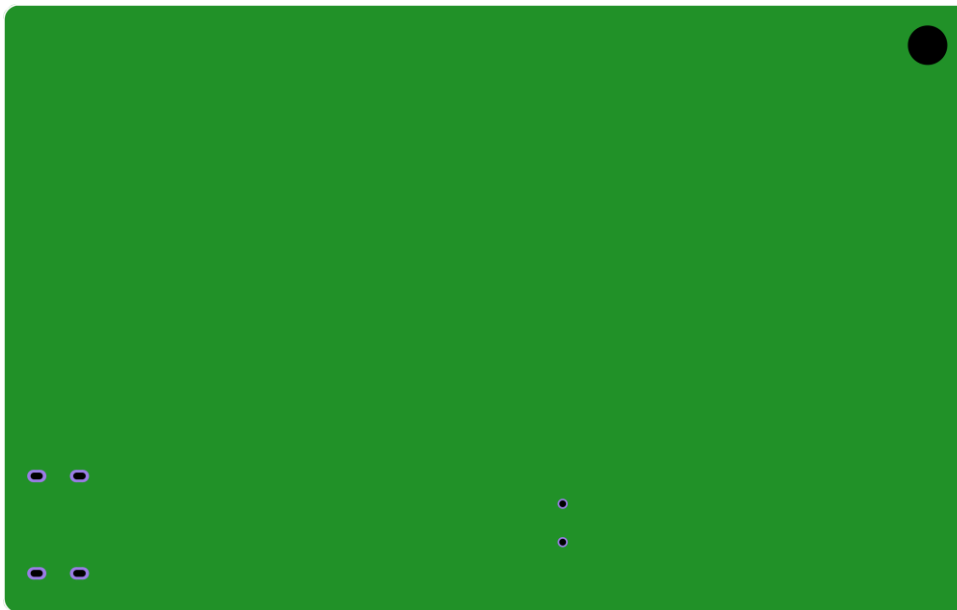
Also refer to the following file:

RD225-LAYER-xx.pdf

(xx is the revision number.)



<LAYER1 >



<LAYER2>

Fig. 3.1 PCB Pattern (Front View)

4. Operation

4.1. Operation Procedure

4.1.1. Circuit AE1

The standard procedure for starting circuit AE1 is as follows.

- Connect a USB charger to USB Type-C[®] connector (J1). The blue LED turns on at normal temperature.
- If PTC thermistor 1 (alert temperature: approx. 80 °C) or PTC thermistor 2 (alert temperature: approx. 105 °C) is heated, and if its temperature exceeds its alert temperature, Thermoflagger™ will detect over temperature and turn on the red LED. Thermoflagger™ is able to detect the over temperature of any of the PTC thermistor irrespective of the temperature of other PTC thermistor.

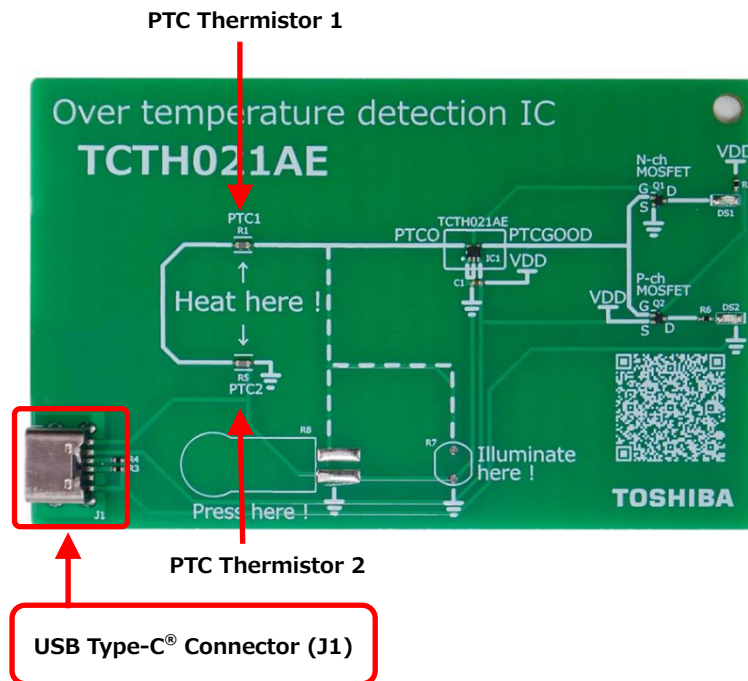


Fig. 4.1 PCB Front View (Over Temperature Detection Circuit Example)

4.1.2. Circuit AE2

The standard procedure for starting circuit AE2 is as follows.

- Connect a USB charger to USB Type-C[®] connector (J1). If the surrounding of the CdS sensor is bright, the resistance of the CdS sensor is low, therefore the blue LED is on.
- If the surrounding of the CdS sensor becomes dark, the resistance of the CdS sensor increases, therefore the red LED turns on.

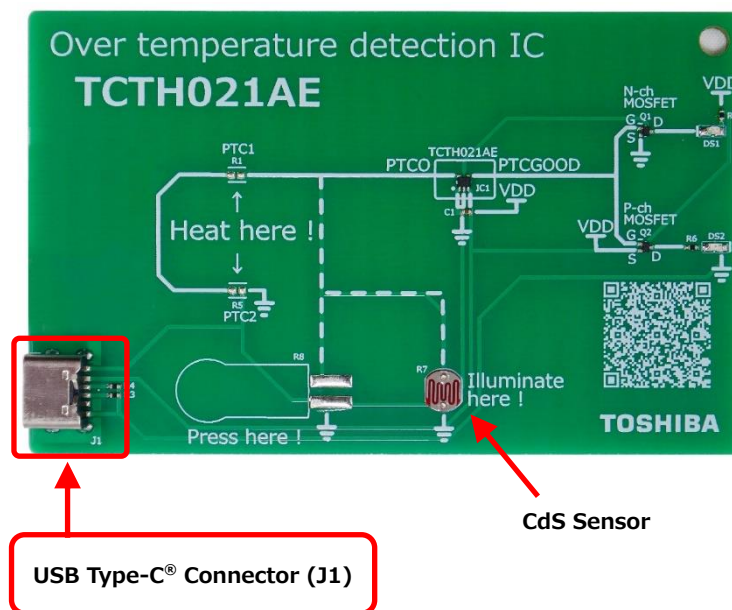


Fig. 4.2 PCB Front View (Light Detection Circuit Example)

4.1.3. Circuit AE3

The standard procedure for starting circuit AE3 is as follows.

- Connect a USB charger to USB Type-C[®] connector (J1). If the pressure sensor is not pressed, the resistance of the CdS sensor is high, therefore the red LED is on.
- If the pressure sensor is pressed, the resistance of the pressure sensor decreases, therefore the blue LED turns on.

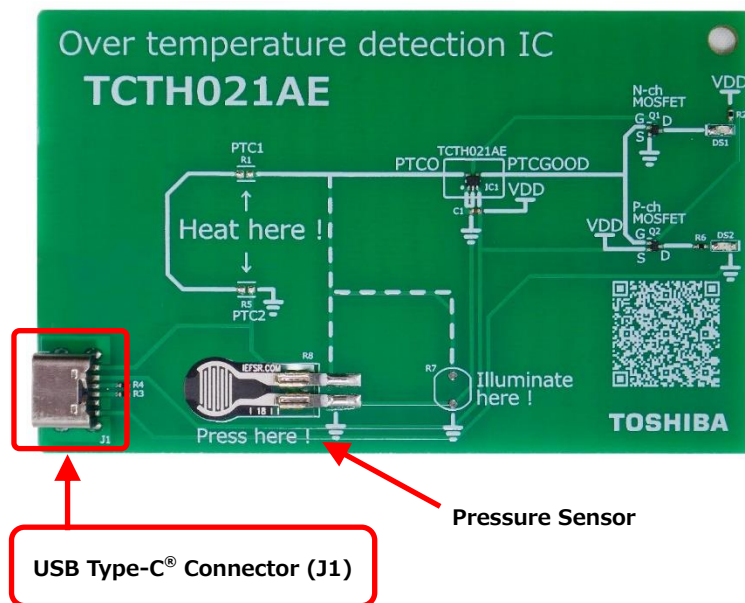


Fig. 4.3 PCB Front View (Pressure Detection Circuit Example)

4.2. External Connector Specifications

The external connector specifications of this circuit are as follows.

Table 4.1 Input Connector Specifications

Input Connector	Input Voltage
J1 (USB Type-C [®])	5 V

5. Precautions

- Be careful not to touch any part of the PCB other than the sensor, as it may get destroyed by static electricity.
- Do not apply excessive voltage to USB Type-C[®] connector.
- When disposing of this PCB, follow the instructions of your local authorities.

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