

# CT2593

## User Manual

## Safety Summary

To avoid personal injury and/or product damage, review and comply with the following safety precautions. These precautions apply to both operating and maintenance personnel and must be followed during all phases of operation, service, and repair of this probe.

Only qualified personnel should use this probe. This differential voltage probe is designed to be used by personnel who are trained, experienced, or otherwise qualified to recognize hazardous situations and who are trained in the safety precautions necessary to avoid possible injury when using such a device.

Do not work alone when working with high voltages.

For your own safety, inspect the probe and accessories for cracks and frayed or broken leads before each use. If defects are noted, DO NOT USE the probe.

Hands, shoes, floor and work bench must be dry.

Avoid making measurements under humidity, dampness or other environmental conditions that might affect safety.

The probe should be kept clean and free of any conductive contamination.

Do not remove the probe casing. Removal of the probe's casing may expose you to electric shock.

Do not use the probe with its case open.

Disconnect the inputs and outputs of the probe before opening the case.

### ***Use only in office-type indoor setting***

The probe is designed to be used in office-type indoor environments. Do not operate the probe:

- In the presence of noxious, corrosive, or flammable fumes, gases, vapors, chemicals, or finely-divided particulates.
- In environments where there is a danger of any liquid being

- spilled on the probe.
- In air temperatures exceeding the specified operating temperatures.
- In atmospheric pressures outside the specified altitude limits or where the surrounding gas is not air.

### ***Not for critical applications.***

This probe is not authorized for use in contact with the human body or for use as a component in a life-support device or system.

Hazardous voltages may be present in unexpected locations in circuitry being tested when a fault condition in the circuit exists.

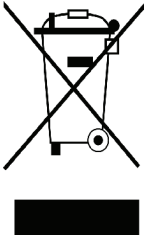
Do not substitute parts that are not approved by Cal Test Electronics or modify this probe. Return the probe to Cal Test Electronics for service and repair to ensure that safety and performance features are maintained.

A **WARNING** statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in injury or death to personnel.

A **CAUTION** statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in damage to or destruction of parts or the entire product.

# Compliance Statements

## *Disposal of Old Electrical & Electronic Equipment*



(Applicable in the European Union and other European countries with separate collection systems). This product is subject to Directive 2012/19/EU of the European Parliament and the Council of the European Union on waste electrical and electronic equipment (WEEE), and in jurisdictions adopting that Directive, is marked as being put on the market after August 13, 2005, and should not be disposed of as unsorted municipal waste. Please utilize your local WEEE collection facilities in the disposition of this product and otherwise observe all applicable requirements.



## 1 Introduction

### 1.1 Overview

Differential probes allow safe, accurate measurement between to voltage points where neither point is referenced to ground. The CT2593 family includes two models: The CT2593-1 and CT2593-2 both offering a 25 MHz bandwidth. Compatible with oscilloscopes from all major manufacturers, the probes can be battery operated, powered by a universal adapter (optional), or powered by USB power lead (optional) if the oscilloscope is so equipped.

Features:

- 25 MHz bandwidth
- Up to  $\pm 1.4$  kV differential and common mode voltage for the CT2593-1. Up to  $\pm 700$  V for CT2593-2.
- Selectable attenuation settings of 20x/200x (CT2593-1) and 10x/100x (CT2593-2)
- Compatible with most oscilloscopes
- Protective rubber boot
- Powered by 4 AA batteries (included)
- Power adapter, CT3723 (optional)
- USB power lead, CT4122 (optional)

## 1.2 Initial Inspection

This probe is tested prior to shipment. It is therefore ready for immediate use upon receipt. An initial physical inspection should be made to ensure that no damage has been sustained during shipment. After the inspection, verify the contents of the shipment. The included accessories for this product are:

- Differential probe
- 2x Hook probes (black & red)
- 4x AA batteries
- Offset adjustment tool
- User manual

## 2 Product Description

### 1.1 Front Panel

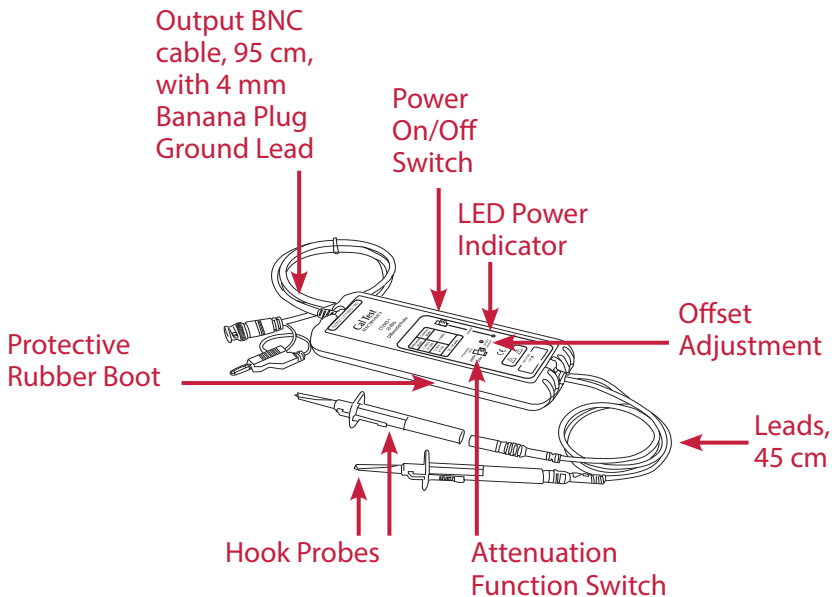


Figure 1 Front Panel Diagram

## 3 Using the Probe

### 1.1 Power Source

The supplied voltage must be greater than 4.4 VDC, and less than 12 VDC, otherwise the probe will not operate properly. When the batteries are low, the power indicator on the panel will flicker.

As an option to the supplied batteries, you may use the CT3723 power adapter (not included) or the CT4122 USB power lead (not included).

### 1.2 Replacing the Batteries

Before using the differential probe for the first time, the batteries supplied with the device must be inserted in the battery compartment (unless you are using the power adapter or USB power lead).

#### **WARNING**

At the time of inserting or replacing the batteries, the input leads must not be connected to an item to be tested. Never operate the probe with the case open.

To insert or replace the batteries, remove the yellow protective rubber boot by peeling it away from the case and then sliding back the battery cover. If necessary, the old AA batteries can then be removed and the new ones inserted into the compartment. Always ensure the batteries are positioned for proper polarity. After inserting the batteries, close the case and replace the boot.

### 1.3 Getting Started

1. Connect the hook probes to the leads.
2. Connect the probe to the oscilloscope with the BNC cable. The input impedance of the oscilloscope must be 1 M $\Omega$ . In view of the high impedance connection, it is not advisable to extend the cable. When using an oscilloscope with a 50  $\Omega$  input, the actual vertical scale on the oscilloscope will be doubled (see Table 1). It should also be noted that battery consumption may increase. As this 50  $\Omega$  input is a low

impedance connection, it is possible to extend the cable without difficulty.

3. Switch the probe “ON.”
4. Switch to the desired attenuation ratio.
5. Use the hook probes to contact the circuit to be tested.

## 1.4 Vertical Scale on Oscilloscope

The actual vertical scale of the oscilloscope is equal to the attenuation factor multiplied by the range of vertical scale selected on the oscilloscope. For example, with the CT2593-1 probe set on attenuation 20x, the oscilloscope on 0.5 V/div, the real vertical scale is  $20 \times 0.5 = 10$  V/div. With the probe on 200x, the real vertical scale is  $200 \times 0.5 = 100$  V/div. These values apply when the oscilloscope is set to the typical 1 M $\Omega$  impedance input. When the oscilloscope is set to 50  $\Omega$  input, the actual vertical scale will be doubled: 20 V/div for the 20x setting and 200 V/div for the 200x setting. See Table 1.

Vertical Scale on Oscilloscope				
(Example using CT2593-1)				
Scope Input Impedance	Probe Attenuation Setting	Actual Attenuation Setting	Vertical Scale Reading on the Oscilloscope	Actual Vertical Scale of the Oscilloscope
1 M $\Omega$	20x	20x	0.5 V/div	10 V/div
1 M $\Omega$	200x	200x	0.5 V/div	100 V/div
50 $\Omega$	20x	40x	0.5 V/div	20 V/div
50 $\Omega$	200x	400x	0.5 V/div	200 V/div

*Table 1 Oscilloscope Readings*

## Offset Zero Procedure

The CT2593-1 and CT2593-2 differential probes can be adjusted to zero the probe's offset voltage using the offset adjustment tool supplied with the probe.

Follow this procedure to perform the offset adjustment.

1. Connect the CT2593-1/CT2593-2 probe to channel 1 of

the scope. Turn on the probe power. You may use the USB power cable or batteries to power the probe. Set the probe attenuation ratio to 10x (CT2593-2) or 20x (CT2593-1)

2. Short the + and - probe inputs together with the hook tips.
3. Turn on power to the oscilloscope. Leave both the scope and the probe on for 30 minutes to stabilize.
4. Press [Default Setup] and [Auto] on the oscilloscope.
5. Press the channel 1 button, then press the Probe softkey and set the attenuation to 10x.
6. Set the scope to DC coupled mode and the scope offset to 0 volts.
7. Set the oscilloscope to average mode (x16) or high-resolution mode to reduce oscilloscope noise.
8. Using the offset adjustment tool (included), adjust the probe offset voltage to 0 volts

## 4 Cleaning

This probe does not require any particular cleaning. If necessary, clean the case with a cloth slightly moistened with soapy water

### **WARNING**

Dry the probe thoroughly before attempting to make voltage measurements.

### **CAUTION**

Do not subject the probe to solvents or solvent fumes as these can cause deterioration of the probe body and cables.



## Specifications

All specifications apply to the unit after a temperature stabilization time of 20 minutes over an ambient temperature range of  $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

Electrical Specifications		
	CT2593-1	CT2593-2
Bandwidth	DC — 25 MHz	
Rise Time (10%-90%)	14 ns	
Attenuation ratio	20x/200x	10x/100x
Accuracy	$\pm 2\%$	
AC CMRR	-80 dB @ 50 Hz -60 dB @ 20 kHz	-86 dB @ 50 Hz -66 dB @ 20 kHz
Maximum Differential Input Voltage (DC + AC peak)	$\pm 140\text{ V @ }20\text{x}$ $\pm 1.4\text{ kV @ }200\text{x}$	$\pm 70\text{ V @ }10\text{x}$ $\pm 700\text{ V @ }100\text{x}$
Maximum Common Mode Input Voltage (DC + AC peak)	$\pm 140\text{ V @ }20\text{x}$ $\pm 1.4\text{ kV @ }200\text{x}$	$\pm 70\text{ V @ }10\text{x}$ $\pm 700\text{ V @ }100\text{x}$
Absolute Maximum Rated Input Voltage (each side to ground)	1000 Vrms CAT II	
Input Resistance // Capacitance	4 M $\Omega$ // 5.5 pF (each side to ground)	
Output Voltage Swing	$\pm 7\text{ V}$ (driving 1 M $\Omega$ oscilloscope input)	
Offset (typical)	$\pm 5\text{ mV}$ (adjustable)	
Noise (typical)	0.7 mVrms	
Source Impedance	50 $\Omega$	
Power Supply	4 AA batteries (included) or CT3723 power adapter (optional) CT4122 USB power lead (optional)	

Mechanical Characteristics	
Weight	400 g (with probe and rubber boot)
Dimensions	170 x 63 x 21 mm
BNC Cable Length	95 cm
Input Leads Length	45 cm each

## Environmental Characteristics

Operating Temp/Humidity	-10°C to 40°C / 25% to 85% RH
Storage Temp/Humidity	-30°C to 70°C / 25% to 85% RH
Pollution Degree	Pollution Degree 2
Altitude	Operating: 3,000 m Nonoperating: 15,300 m

## Safety Specifications

IEC 61010-031 CAT II

Specifications are subject to change without notice. To ensure the most current version of this manual, please download the current version from our website: [caltestelectronics.com](http://caltestelectronics.com).

## 5 Voltage Derating Curve

The derating curve of the absolute maximum input voltage in common mode is show as follows:

CT2593 Maximum Input Voltage Derating Curve

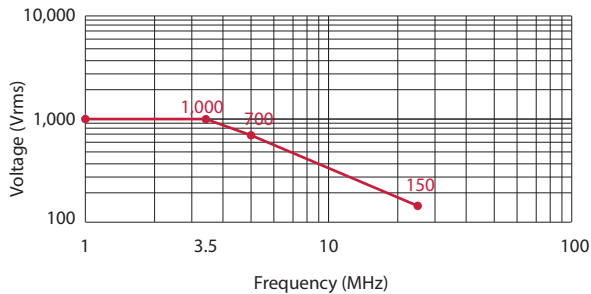


Figure 2 Derating Curve

## 6 Service & Warranty Information

### 1.1 Limited One-Year Warranty

Cal Test Electronics warrants this product to be free from defective material or workmanship for a period of 1 year from the date of original purchase. Under this warranty, Cal Test Electronics is limited to repairing the defective device when returned to the factory, shipping charges prepaid, within the warranty period.

Units returned to Cal Test Electronics that have been subject to abuse, misuse, damage or accident, or have been connected, installed or adjusted contrary to the instructions furnished by Cal Test Electronics, or that have been repaired by unauthorized persons, will not be covered by this warranty.

Cal Test Electronics reserves the right to discontinue models, change specifications, price, or design of this device at any time without notice and without incurring any obligation whatsoever.

The purchaser agrees to assume all liabilities for any damages and/or bodily injury which may result from the use or misuse of this device by the purchaser, his employees, or agents.

This warranty is in lieu of all other representations or warranties expressed or implied and no agent or representative of Cal Test Electronics is authorized to assume any other obligation in connection with the sale and purchase of this device.

### 1.2 Service

If you have a need for calibration or repair services, technical or sales support, please contact us:

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Yorba Linda, CA 92887  
800-572-1028 or 714-221-9330  
caltestelectronics.com

