

# **TDSUSBF USB 2.0 Compliance Test Fixture Instructions**

## **Warning**

The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

[www.tektronix.com](http://www.tektronix.com)



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**Tektronix**

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## **Contacting Tektronix**

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USA

For product information, sales, service, and technical support:

- In North America, call 1-800-833-9200.
- Worldwide, visit [www.tektronix.com](http://www.tektronix.com) to find contacts in your area.

## Warranty

Tektronix warrants that this product will be free from defects in materials and workmanship for a period of three (3) months from the date of shipment. If any such product proves defective during the warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product. Parts, modules and replacement products used by Tektronix for warranty work may be new or reconditioned to like new performance. All replaced parts, modules and products become the property of Tektronix.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the respective warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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# General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it. To avoid potential hazards, use this product only as specified.

*Only qualified personnel should perform service procedures.*

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

## **To Avoid Fire or Personal Injury**

**Use Proper Power Cord.** Use only the power cord specified for this product and certified for the country of use.

**Connect and Disconnect Properly.** Connect the probe output to the measurement instrument before connecting the probe to the circuit under test. Disconnect the probe input and the probe ground from the circuit under test before disconnecting the probe from the measurement instrument.

**Observe All Terminal Ratings.** To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

**Use Proper AC Adapter.** Use only the AC adapter specified for this product.

**Use Proper Fuse.** Use only the fuse type and rating specified for this product.

**Do Not Operate With Suspected Failures.** If you suspect there is damage to this product, have it inspected by qualified service personnel.

**Do Not Operate in Wet/Damp Conditions.**

**Do Not Operate in an Explosive Atmosphere.**

**Keep Product Surfaces Clean and Dry.**

**Symbols and Terms**

**Terms in this Manual.** These terms may appear in this manual:



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**WARNING.** *Warning statements identify conditions or practices that could result in injury or loss of life.*

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**CAUTION.** *Caution statements identify conditions or practices that could result in damage to this product or other property.*

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**Terms on the Product.** These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

**Symbols on the Product.** The following symbols may appear on the product:



# Compliance Information

This section lists the EMC (electromagnetic compliance) and environmental standards with which the instrument complies. The Safety Compliance standard is on page.

## EMC Compliance

### EC Declaration of Conformity — EMC

Meets intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:

**EN 61326-1:2006, EN 61326-2-1:2006.** EMC requirements for electrical equipment for measurement, control, and laboratory use. [1](#)[2](#)[3](#)

- CISPR 11:2003. Radiated and conducted emissions, Group 1, Class A
- IEC 61000-4-3:2002. RF electromagnetic field immunity
- IEC 61000-4-4:2004. Electrical fast transient/burst immunity
- IEC 61000-4-5:2001. Power line surge immunity
- IEC 61000-4-6:2003. Conducted RF immunity
- IEC 61000-4-11:2004. Voltage dips and interruptions immunity

**EN 61000-3-2:2006.** AC power line harmonic emissions

**EN 61000-3-3:1995.** Voltage changes, fluctuations, and flicker

### European Contact..

Tektronix UK, Ltd.  
Western Peninsula  
Western Road  
Bracknell, RG12 1RF

- 1 This product is intended for use in nonresidential areas only. Use in residential areas may cause electromagnetic interference.**
- 2 Emissions which exceed the levels required by this standard may occur when this equipment is connected to a test object.**
- 3 This product is intrinsically static sensitive. User must not expose device to static discharge.**

**Australia / New Zealand  
Declaration of Conformity  
— EMC**

Complies with the EMC provision of the Radiocommunications Act per the following standard:

- CISPR 11:2003. Radiated and Conducted Emissions, Group 1, Class A, in accordance with EN 61326-1:2006 and EN 61326-2-1:2006.



# TDSUSBF Test Fixture

The TDSUSBF compliance test fixture is a companion product for use with the TDSUSB Universal Serial Bus (USB 2.0) Compliance Test Package. The TDSUSBF enables high quality compliance level measurements of the USB 2.0 devices, hosts and hubs. The test fixture supports tests that measure high, full and low speed signal quality. It also supports inrush, droop, receiver sensitivity, packet parameter, suspend, resume, reset, and impedance measurements. All are mandatory for USB 2.0 compliance.

The fixture is shipped as a single circuit board and is organized into three sections:

- High Speed Signal Quality and TDR
- Low/Full Speed Signal Quality and Inrush Current
- An active load for droop testing and eight switchable 100 mA/500 mA passive loads and a dynamic 2 Hz switching 100 mA load.

The boundary between these sections is scored so that you can snap these sections apart for convenience.

You can use the TDSUSBF with the Tektronix TDSUSB2 USB Compliance Test fixture which can be ordered either as Option USB for the DPO7000, TDS5000B, TDS6000B/C, or TDS7000B series, or as an upgrade to these oscilloscopes. Refer to the TDSUSB2 data sheet on [www.tektronix.com](http://www.tektronix.com) for specific compatibility information.

## Accessories

The following accessories are included with the fixture. Refer to the *Replaceable Parts List* on page 11 for part numbers when ordering replacement parts.

- Instructions
- Cable: USB, short ~12.7 cm (5 in) USB cable (A receptacle to a B plug) for use with devices with a B receptacle
- Adapter: To adapt an A male receptacle to a mini B male plug

## Test Equipment

The following test equipment is recommended for use with the fixture:

- A DPO7254 or TDS7254B or greater bandwidth oscilloscope is required to test the high-speed USB hosts, devices, or hubs
- A DPO7054 or TDS5034B or greater bandwidth oscilloscope is required to test low-speed and full-speed USB devices and hubs
- A P6248 1.7 GHz differential probe or greater bandwidth probe<sup>1</sup>
- A P6245 1.5 GHz 10X Probe (3 each)<sup>1</sup> or TAP1500 1.5 GHz Active Probe (3 each) for use with the DPO7000 series oscilloscopes
- A TCP202 current probe<sup>1</sup> or TCP0030 current probe for use with the DPO7000 series oscilloscopes

<sup>1</sup>Requires TPA to BNC adapter for use on DPO7000 series oscilloscopes

**Table 1: Probe type and Compatible oscilloscopes**

Probe type	TDS series oscilloscopes	DPO series oscilloscopes
High Bandwidth Differential Probe	P6248 or greater bandwidth probe P7300 series compatible with TDS7254B or greater bandwidth and TDS6000B/C series	The P6248 probe requires TAP BNC adapter. P7000 series probes are not compatible with the DPO7000 series
High Bandwidth Single-Ended Active Probe	P6245	P6245 requires TAP BNC adapter or TAP1500 Active probe.
Current Probe	TCP202	TCP202 requires TAP BNC adapter or TCP0030

- A TDS8200 oscilloscope with an 80E04 TDR sampling module.  
A USB TDR test utility is available at the following link:  
<http://www.tek.com/site/sw/detail/1,1059,2207,00.html>
- An AWG615 or AWG710B Arbitrary Waveform Generator or a DTG5274 or DTG5078 mainframe with optional DTMG21
- High quality SMA cables ~ 30.48 cm (12 in) and 12 dB attenuators (4 each Tekronix part number 011-0069-03). For receiver sensitivity testing, use attenuators to increase the channel amplitude resolution.

## Installation

To use the test fixture, refer to Figure 1 on page 6, and do the following:



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**CAUTION.** To prevent damage to the test fixture, always work at a static-approved workstation when handling the fixture.

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1. Set the fixture on a nonconductive work surface.



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**CAUTION.** To prevent damage to TDR heads, the board must be powered on in the following sequence.

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2. To operate various relays, the TDSUSBF high-speed signal quality section requires a 5-volt power supply. Depending on the jumper selection on the test fixture, you can select one of the following power options:
  - USB host-supplied Vbus power.
  - User-supplied 5-volt power supply. The external power supply must be capable of providing 500 mA.

Recommended or equivalent: ITE Power Supply, Ault Inc., part number PW10DEA0503F01.

To select user-supplied 5-volt power, place the jumper between the center pin and the pin marked JACK of J91. Connect the power supply cable to the DC Power In jack, J35 located at the bottom of the board.

To select USB Vbus power, place the jumper between the center pin and the pin marked USB of J91. Connect a USB cable from the Host supplying Vbus power to J92.

3. Check that either the TEST or INIT LED is on. If it is not, remove the power supply cable from the DC Power In jack or from the USB connector, and check for shorts.
4. Place the switch S6 in the INIT position. The INIT status LED illuminates.
5. Connect the board for specific tests as described in Table 2 on page 7.

6. Set the DUT (Device Under Test) to the proper test state.

For example, in a TDR upstream test, the DUT must be configured to SEO\_NAK test mode. Otherwise, DUT transmissions can damage test equipment connected to the fixture.

For all TDR tests, you should verify with a DMM that the DC bias level is less than 10 mV from D+ to ground and from D- to ground.

7. Place the switch S6 in the TEST position. Verify that the TEST status LED is on.
8. Perform the test steps as required for your specific test.
9. After finished testing, place the switch S6 in the INIT position and disconnect the power supply cable from the DC Power In jack or disconnect the USB cable providing power to the test fixture.

## Connections and Switch Settings

Use Figure 1 on page 6 and Table 2 on page 7 to prepare the fixture for specific tests.

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**NOTE.** *Other Tektronix probes may also be suitable. Refer to the Test Equipment section of this document to verify compatibility of alternative probes.*

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For more tests, the following oscilloscope configuration is recommended:

CH 1—P6248 Differential probe connected to D+ and D- (High speed) or P6245 single-ended probe connected to D+ (Low Speed (LS)/Full Speed (FS))

CH 2—P6245 single-ended probe connected to D- (LS/FS)

CH 3—On the adjacent channel trigger source (LS/FS), P6245 single-ended probe connected to D+ for full speed testing, D- for low speed testing

CH 4—Current probe for Inrush measurements

### Switch S6 (Init/Test)

The Initialize and Test switch (S6) is a two-position switch used to place the test fixture into initialize status or to test configurations for the following tests:

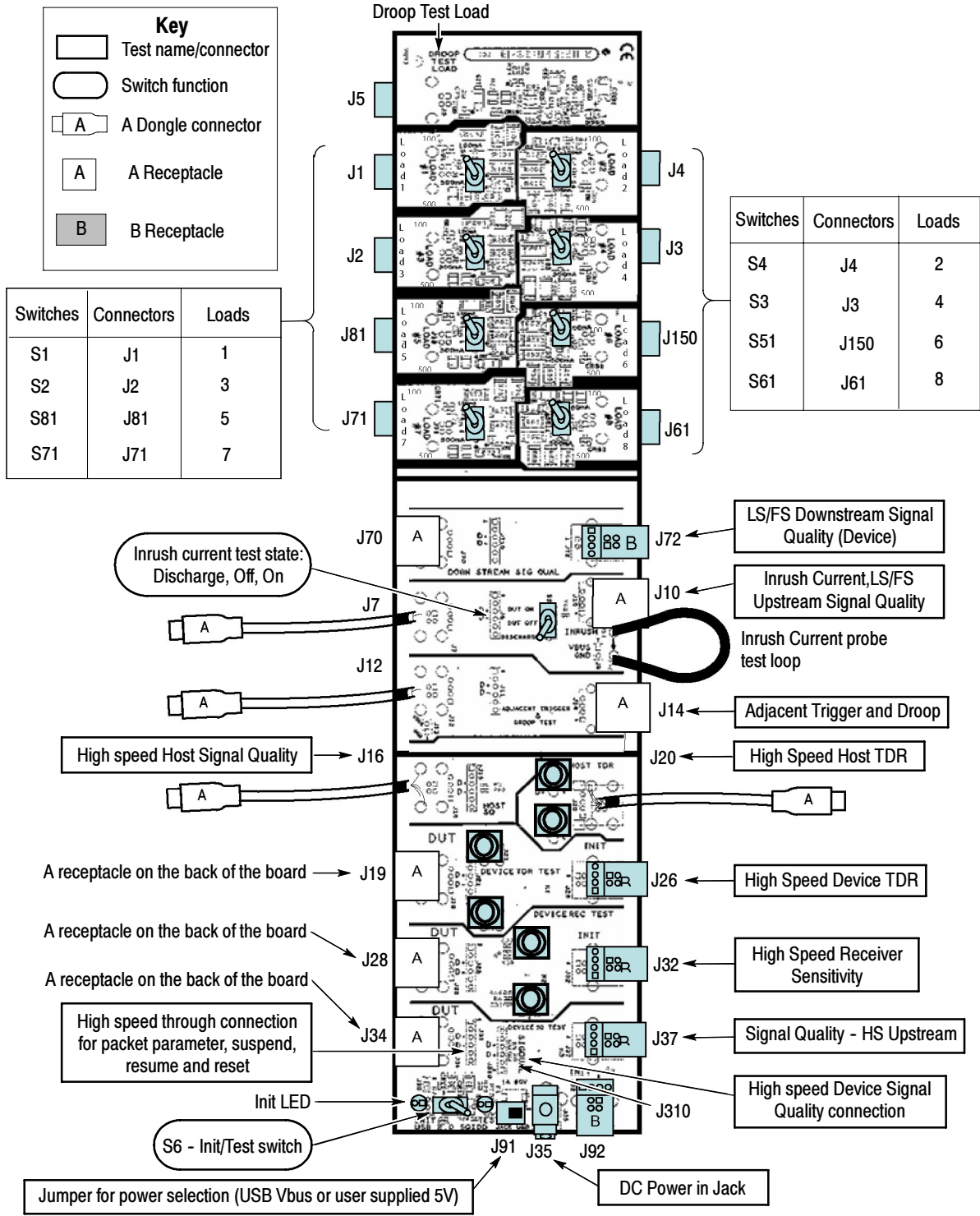
- Device high speed TDR
- Device high speed receiver sensitivity
- Device high speed signal quality

For upstream high speed signal quality testing:

There are two sets of stake pins in the high-speed signal quality segment. The set of stake pins (J310) adjacent to the relay pads are intended for use in Signal Quality testing. The set of stake pins (J34) closest to the A receptacle is intended for use in Packet Parameter, Suspend, Resume and Reset tests.

In the initialize position, the signal is routed through the fixture, from the input to the output connectors to permit placing the DUT into test packet or other test modes. In this mode, the signal is not present on the signal quality pins (J310) next to the relay pads until the INIT/Test switch is placed into the test position. To verify whether the signal is present in INIT mode, place your probe on the set of stake pins (J34) next to the A receptacle. Return the probe to the signal quality pins to conduct the signal quality test.

In the test position, the signal is passed from the DUT and is terminated into precision 45 ohm resistors on the fixture. To probe the signal, connect the middle two header pins located near the relay pads.



**Signal Connections**

Use Table 2 and Figure 1 on page 6 to prepare the fixture for specific tests. Each test fixture circuit (except the active and passive loads) contains a 4-pin header. The outer pins are ground and the inner two pins are labeled D+ and D-.

**Table 2: USB signal connections and switch settings**

Test <sup>1</sup>	Upstream (Host) connector number/type	Downstream (DUT) connector number/type	Switch number and setting
Host TDR <sup>2</sup>	J20 / A dongle	N/A	N/A
Device TDR <sup>2</sup>	J26 / B receptacle	J19 / A receptacle	S6 switch to INIT, and then TEST
Host Signal Quality	J16 / A dongle	N/A	N/A
HS Signal Quality Upstream	J37 / B receptacle	J34 / A receptacle	S6 switch to INIT, and then TEST
LS, FS Signal Quality Upstream, Adjacent Trigger <sup>3</sup>	J10, J14 / A receptacle	J7, J12 / A dongle	S5 switch to On
HS Receiver Sensitivity <sup>2</sup>	J32 / B receptacle	J28 / A receptacle	S6 switch to INIT, and then TEST
LS, FS Downstream	J72 / B receptacle	J70 / A receptacle <sup>3</sup>	N/A
Droop Test Load	J5 / B receptacle		
Inrush Current	J7 / A dongle	J10 / A receptacle	S5 switch between discharge/ off / on

<sup>1</sup> **LS = Low Speed, FS = Full Speed, HS = High Speed**

<sup>2</sup> **See Table 3 for SMA connections**

<sup>3</sup> **Connected to a load using a USB cable**

**SMA Connections**

The SMA connectors on the fixture are used to connect additional test equipment to the test fixture.

Table 3 lists the details of where the SMA connectors are used. See Figure 1 on page 6 for connector locations.

**Table 3: SMA connections**

Test	Connector number and connection	Connector number and connection
High Speed Receiver Sensitivity	J27 (D+) to DTGM21, Ch 0	J24 (D-) to DTG21, Ch 1
High Speed Device TDR	J23 to TDR Sampling Module, Ch 1	J22 to TDR Sampling Module, Ch 2
High Speed Host TDR	J17 to TDR Sampling Module, Ch 1	J18 to TDR Sampling Module, Ch 2



## Load Connections

Two types of loads (passive and active) are provided on the fixture for you to include in different tests and configurations. Eight separate passive loads, #1 to #8, are switchable between 100 mA and 500 mA.



**WARNING.** To avoid personal injury, do not touch the load resistors when using the 500 mA load positions. The load resistors can become very hot.

The droop test load is an active load that switches between an open circuit condition and 100 mA, at approximately a 2 Hz rate.

All loads connect through B-type receptacles that are mounted on the back of the test fixture.

**NOTE.** Switch numbers do not follow load numbers. For example, Switch 4 controls Load #2. See Table 4 for the correct switch/load combinations.

Use Table 4 and Figure 1 on page 6 to configure loads for specific tests.

**Table 4: Load connections and switch settings**

Load number	Connector number/type	Switch number	Switch positions
#1	J1 / B receptacle	S1	100 mA / 500 mA
#2	J4 / B receptacle	S4	100 mA / 500 mA
#3	J2 / B receptacle	S2	100 mA / 500 mA
#4	J3 / B receptacle	S3	100 mA / 500 mA
#5	J81 / B receptacle	S81	100 mA / 500 mA
#6	J150 / B receptacle	S51	100 mA / 500 mA
#7	J 71/ B receptacle	S71	100 mA / 500 mA
#8	J61/ B receptacle	S61	100 mA / 500 mA
Droop test	J5 / B receptacle	N/A	0 mA to 100 mA at ~2 Hz rate

## Specifications

This section contains the specifications of the TDSUSBF Test Fixture. All specifications are guaranteed unless noted as typical. Typical specifications are provided for your convenience, but are not guaranteed.

**Table 5: Specifications**

<b>Specification</b>	<b>Description</b>
Input voltage rating	+5.0 V DC, $\pm 0.25$ V
Power consumption, typical	1 W
Fuse rating	0.5 A, 60 V, Polyswitch resettable fuse
Operating temperature	+15 °C to +35 °C (59 °F to 95 °F)

## Replaceable Parts List

This section contains a list of the replaceable parts for the fixture. Use this list to identify and order replacement parts.

### Replaceable Parts

Part ID	Tektronix part number	Serial no. effective	Serial no. discount'd	Qty	Name & description
A dongle	174-4662-01			5	CABLE ASSY,SP:USB,TYPE A CONN TO STRIPPED END
A receptacle	131-6277-00			3	CONN,RIBBON:PCB,USB,SERIESA,FEMALE,RTANG, 1 X 4,2.5MM CTR,7.01MM H X 2.29MM TAIL,PALLADIUM
B receptacle	131-7307-00			8	CONN:PCB,USB,SERIESB,FEMALE,RTANG, 1 X 4,2.5 MM CTR,0.433" H X 0.110 TAIL,SHLD,GOLD F
S1-4,S6,S51 ,S61,S71,S8 1	260-2769-01			5	SWITCH,TOGGLE:SPDT,ON-NONE-ON,MEDIUM ACTUATOR,THREADED- BUSHING,PCMOUNT V BRACKET, SILVER CONTACT
S5	260-2767-01			1	SWITCH,TOGGLE:SPDT,3A AT 28VDC,ON-OFF-ON,STD 0.370" HIGH ACTUATOR,THREADED BUSHING,PCB MOUNT V BRACKET
F1	159-0412-00			1	FUSE,THRM,CHIP:SELF RESETTING FUSE,0.5A HOLD,1.0A TRIP,60V MAX,SMD050,T&R,
LEDs	150-1049-00			3	DIODE,OPTO:LED;RED/GREEN,232RG80317
K1-3	148-0331-00			3	RELAY, ARMATURE:2FORMC,SINGLE SIDE STABLE,28V,0.25A,COIL5VDC,64OHM
Shunt	131-4356-00			1	CONN,SHUNT; SHUNT/SHORTING,;FEMALE,1 X 2,0.1 CTR,0.63 H,BLK,W/HANDLE,JUMPER,30 GOLD
<b>STANDARD ACCESSORIES</b>					
	071-1832-02			1	INSTRUCTIONS, TDSUSBF USB 2.0 TEST FIXTURE
	174-5634-00			1	CABLE,USB, SHORT 5"
	131-7922-00			1	ADAPTER



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