

Specifications

This section begins with a general description of the traits of the TDS 500B, 600B and 700A Digitizing Oscilloscopes. Three sections follow, one for each of three classes of traits: *nominal traits*, *warranted characteristics*, and *typical characteristics*.

Product Description

The TDS 500B, 600B and 700A Digitizing Oscilloscopes are portable, four-channel instruments suitable for use in a variety of test and measurement applications and systems. Table 2–1 lists key features.

Table 2–1: Key Features of the TDS 500B, 600B and 700A Oscilloscopes

Feature	TDS 600B	TDS 700A
Digitizing rate, maximum	TDS 684B: 5 GS/s on ea. of 4 ch TDS 680B: 5 GS/s on ea. of 2 ch TDS 644B: 2.5 GS/s on ea. of 4 ch TDS 620B: 2.5 GS/s on ea. of 2 ch simultaneously	TDS 784A: 4 GS/s TDS 540B, 744A: 2 GS/s TDS 520B, 724A: 1 GS/s Opt. 1G, TDS 540B, 744A: 1 GS/s
Analog bandwidth	1 GHz on TDS 680B, 684B, and 784A 500 MHz on TDS 520B, 540B, 620B, 644B, 724A and 744A	
Channels	Four, each with 8-bit resolution	
Record lengths, maximum	15,000 samples	50,000 samples (500,000 with option 1M)
Acquisition modes	Sample, envelope, peak detect and average	Sample, envelope, average, high-resolution, and peak-detect
Trigger modes	Include: edge, logic, and pulse. Video trigger, with option 05, modes include: NTSC, SECAM, PAL, HDTV, and FlexFormat.	
Display	TDS 520B, 540B, 620B, 680B: Monochrome TDS 644B, 684B, 724A, 744A, 784A: Color	
Storage	1.44 Mbyte, 3.5 inch, DOS 3.3-or-later floppy disk (optional on TDS 520B, 540B, 620B & 680B). NVRAM storage for saving waveforms, hardcopies, and setups	
I/O	Full GPIB programmability. Hardcopy output using GPIB, RS-232, or Centronics ports	

Warranted Characteristics

This section lists the various *warranted characteristics* that describe the TDS 500B, 600B, and 700A Digitizing Oscilloscopes. Electrical and environmental characteristics are included.

Warranted characteristics are described in terms of quantifiable performance limits which are warranted.

NOTE. *In these tables, those warranted characteristics that are checked in the procedure Performance Verification appear in **boldface type** under the column Name.*

As stated above, this section lists only warranted characteristics. A list of *typical characteristics* starts on page 2–23.

Performance Conditions

The performance limits in this specification are valid with these conditions:

- The oscilloscope must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The oscilloscope must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The oscilloscope must have had a warm-up period of at least 20 minutes.
- The oscilloscope must have had its signal-path-compensation routine last executed after at least a 20 minute warm-up period at an ambient temperature within $\pm 5^{\circ}$ C of the current ambient temperature.

Table 2–10: Warranted Characteristics — Signal Acquisition System

Name	Description		
Accuracy, DC Gain	TDS 600B: $\pm 1.5\%$ for all sensitivities from 2 mV/div to 10 V/div $\pm 2.0\%$ at 1 mV/div sensitivity TDS 500B, 700A: $\pm 1\%$ for all sensitivities from 1 mV/div to 10 V/div with offset from 0 V to $\pm 100\text{V}$		
Accuracy, DC Voltage Measurement, Averaged (using Average mode)	Measurement Type	DC Accuracy	
	Average of ≥ 16 waveforms Delta volts between any two averages of ≥ 16 waveforms acquired under the same setup and ambient conditions	TDS 600B: $\pm((1.5\% \times \text{reading} - \text{Net Offset}^1) + \text{Offset Accuracy}) + (0.06 \text{ div} \times \text{V/div})$ TDS 500B, 700A: $\pm((1.0\% \times \text{reading} - \text{Net Offset}^1) + \text{Offset Accuracy} + 0.06 \text{ div})$ TDS 600B: $\pm((1.5\% \times \text{reading}) + (0.1 \text{ div} \times \text{V/div}) + 0.3 \text{ mV})$ TDS 500B, 700A: $\pm((1.0\% \times \text{reading}) + 0.1 \text{ div} + 0.3 \text{ mV})$	
Accuracy, Offset	Volts/Div Setting	TDS 600B Offset Accuracy	TDS 500B/700A Offset Accuracy
	1 mV/div – 100 mV/div	$\pm((0.2\% \times \text{Net Offset}^1) + 1.5 \text{ mV} + (0.6 \text{ div} \times \text{V/div}))$	$\pm((0.2\% \times \text{Net Offset}^1) + 1.5 \text{ mV} + (0.1 \text{ div} \times \text{V/div setting}))$
	101 mV/div – 1 V/div	$\pm((0.25\% \times \text{Net Offset}^1) + 15 \text{ mV} + (0.6 \text{ div} \times \text{V/div}))$	$\pm((0.25\% \times \text{Net Offset}^1) + 15 \text{ mV} + (0.1 \text{ div} \times \text{V/div setting}))$
	1.01 V/div – 10 V/div	$\pm((0.25\% \times \text{Net Offset}^1) + 150 \text{ mV} + (0.6 \text{ div} \times \text{V/div}))$	$\pm((0.25\% \times \text{Net Offset}^1) + 150 \text{ mV} + (0.1 \text{ div} \times \text{V/div setting}))$
Analog Bandwidth, DC-50 Ω Coupled and Bandwidth selection is FULL, TDS 600B	Volts/Div	620B & 644B Bandwidth ²	TDS 680B & 684B Bandwidth ²
	10 mV/div – 1 V/div	DC – 500 MHz	DC – 1 GHz
	5 mV/div – 9.95 mV/div	DC – 450 MHz	DC – 750 MHz
	2 mV/div – 4.98 mV/div	DC – 300 MHz	DC – 600 MHz
	1 mV/div – 1.99 mV/div	DC – 250 MHz	DC – 500 MHz

Table 2–10: Warranted Characteristics — Signal Acquisition System (Cont.)

Name	Description			
Analog Bandwidth, DC-50 Ω Coupled and Bandwidth selection is FULL, TDS 500B/700A	Volts/Div	520B, 540B, 724A, 744A Bandwidth²	784A Bandwidth²	
	10 mV/div – 1 V/div	DC – 500 MHz	DC – 1 GHz	
	5 mV/div – 9.95 mV/div	DC – 500 MHz	DC – 750 MHz	
	2 mV/div – 4.98 mV/div	DC – 500 MHz	DC – 600 MHz	
	1 mV/div – 1.99 mV/div	DC – 450 MHz	DC – 500 MHz	
Crosstalk (Channel Isolation)	$\geq 100:1$ at 100 MHz and $\geq 30:1$ at the rated bandwidth for the channel's Volt/Div setting, for any two channels having equal Volts/Div settings			
Delay Between Channels, Full Bandwidth	TDS 600B: ≤ 100 ps for any two channels with equal Volts/Div and Coupling settings and both channels' deskew values set to 0 TDS 500B/700A: ≤ 50 ps for any two channels with equal Volts/Div and Coupling settings			
Input Impedance, DC–1 M Ω Coupled	1 M Ω $\pm 0.5\%$ in parallel with 10 pF ± 3 pF			
Input Impedance, DC–50 Ω Coupled	50 Ω $\pm 1\%$ with VSWR $\leq 1.3:1$ from DC – 500 MHz, $\leq 1.5:1$ from 500 MHz – 1 GHz			
Input Voltage, Maximum, DC–1 M Ω , AC–1 M Ω , or GND Coupled	TDS 600B: ± 400 V (DC + peak AC); derate at 20 dB/decade above 1 MHz TDS 500B/700A: ± 300 V (DC + peak AC), 400 V peak; derate at 20 dB/decade above 1 MHz, category II			
Input Voltage, Maximum, DC-50 Ω or AC–50 Ω Coupled	5 V _{RMS} , with peaks $\leq \pm 30$ V			
Lower Frequency Limit, AC Coupled	≤ 10 Hz when AC–1 M Ω Coupled; ≤ 200 kHz when AC–50 Ω Coupled ³			

¹ **Net Offset = Offset – (Position \times Volts/Div). Net Offset is the nominal voltage level at the oscilloscope input that corresponds to the center of the A-D converter's dynamic range. Offset Accuracy is the accuracy of this voltage level.**

² **The limits given are for the ambient temperature range of 0°C to +30°C. Reduce the upper bandwidth frequencies by 5 MHz for the TDS 600B or by 2.5 MHz for the TDS 500B/700A for each °C above +30°C.**

³ **The AC Coupled Lower Frequency Limits are reduced by a factor of 10 when 10X passive probes are used.**

Table 2–11: Warranted Characteristics — Time Base System

Name	Description
Accuracy, Long Term Sample Rate and Delay Time	TDS 600B: ± 100 ppm over any ≥ 1 ms interval
	TDS 500B/700A: ± 25 ppm over any ≥ 1 ms interval

Table 2–12: Warranted Characteristics — Triggering System

Name	Description	
Sensitivity, Edge-Type Trigger, Coupling set to "DC" ¹	Trigger Source	Sensitivity
	Any Channel	<p>TDS 620B & 644B: 0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz</p> <p>TDS 680B & 684B: 0.35 division from DC to 50 MHz, increasing to 1 division at 1 GHz MHz</p> <p>TDS 500B, 724A, 744A: 0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz</p> <p>TDS 784A: 0.35 division from DC to 50 MHz, increasing to 1 division at 1 GHz</p>
	Auxiliary	<p>TDS 600B or 784A: 250 mV from DC to 50 MHz, increasing to 500 mV at 100 MHz</p> <p>TDS 500B, 724A, 744A: 400 mV from DC to 50 MHz, increasing to 750 mV at 100 MHz</p> <p>TDS 784A: 250 mV from DC to 50 MHz, increasing to 500 mV at 100 MHz</p>
Accuracy (Time) for Pulse-Glitch or Pulse-Width Triggering	Time Range	Accuracy
	1 ns to 1 μ s	$\pm(20\%$ of setting + 0.5 ns)
	1.02 μ s to 1 s	$\pm(100$ ns + 0.01% of Setting)
Input Signal Sync Amplitude for Stable Triggering, NTSC and PAL modes (Option 05 Video Trigger)	Field selection "Odd", "Even", or "All": 0.6 division to 4 divisions	
	Field selection "Numeric": 1 division to 4 divisions (NTSC mode)	
Jitter (Option 05 Video Trigger)	60 ns _{p-p} on NTSC or PAL signal	

¹ The minimum sensitivity for obtaining a stable trigger. A stable trigger results in a uniform, regular display triggered on the selected slope. The trigger point must not switch between opposite slopes on the waveform, and the display must not "roll" across the screen on successive acquisitions. The TRIG'D LED stays constantly lighted when the SEC/DIV setting is 2 ms or faster but may flash when the SEC/DIV setting is 10 ms or slower.

Table 2–13: Warranted Characteristics — Output Ports, Probe Compensator, and Power Requirements

Name	Description	
Logic Levels, Main- and Delayed-Trigger Outputs	Characteristic	Limits
	Vout (HI)	≥ 2.5 V open circuit; ≥ 1.0 V into a 50 Ω load to ground
	Vout (LO)	≤ 0.7 V into a load of ≤ 4 mA; ≤ 0.25 V into a 50 Ω load to ground

Table 2–13: Warranted Characteristics — Output Ports, Probe Compensator, and Power Requirements (Cont.)

Name	Description	
Output Voltage and Frequency, Probe Compensator	Characteristic	Limits
	Output Voltage	0.5 V (base-top) $\pm 1\%$ into a $\geq 50 \Omega$ load
	Frequency	1 kHz $\pm 5\%$
Output Voltage, Signal Out (CH 3 ¹)	For TDS 600B: 20 mV/division $\pm 20\%$ into a 1 M Ω load; 10 mV/division $\pm 20\%$ into a 50 Ω load For TDS 500B/700A: 22 mV/division $\pm 20\%$ into a 1 M Ω load; 11 mV/division $\pm 20\%$ into a 50 Ω load	
Source Voltage	90 to 250 VAC _{RMS} , continuous range TDS 500B/700A: category II	
Source Frequency	45 Hz to 440 Hz	
Power Consumption	≤ 300 W (450 VA)	

¹ CH 3 signal out is present at the rear panel if CH 3 (AUX 1 on the TDS 620B or 680B) is selected as the trigger source for the main and/or delayed trigger systems. It is not available when a channel other than CH3 (AUX 1 on the TDS 620B or 680B) is the source for the Video Trigger when Option 05 is installed.

Table 2–14: Warranted Characteristics — Environmental

Name	Description
Atmospherics	Temperature (no diskette in floppy drive): TDS 600B: Operating: +4° C to +45° C TDS 500B/700A: Operating: +4° C to +50° C Nonoperating: –22° C to +60° C Relative humidity (no diskette in floppy drive): Operating: 20% to 80%, at or below +32° C, upper limit derates to 30% relative humidity at +45° C Nonoperating: 5% to 90%, at or below +41° C, upper limit derates to 30% relative humidity at 60° C Altitude: To 4570 m (15,000 ft.), operating To 12190 m (40,000 ft.), nonoperating
Dynamics	Random vibration (floppy diskette not installed): 0.31 g rms, from 5 to 500 Hz, 10 minutes each axis, operating 3.07 g rms, from 5 to 500 Hz, 10 minutes each axis, nonoperating

Table 2–14: Warranted Characteristics — Environmental (Cont.)

Name	Description
Emissions (TDS 500B/700A) ^{1, 2}	<p>Meets or exceeds the requirements of the following standards:</p> <p>Vfg. 243/1991 Amended per Vfg. 46/1992</p> <p>FCC Code of Federal Regulations, 47 CFR, Part 15, Subpart B, Class A</p> <p>European Community Requirements</p> <p>EN 55011 Class A Radiated Emissions</p> <p>EN 55011 Class A Conducted Emissions</p> <p>EN 50081–1</p> <p>EN60555–2 Power Line Harmonic Emissions</p>
Emissions (TDS 600B) ^{1, 2}	<p>Meets or exceeds the requirements of the following standards:</p> <p>Vfg. 243/1991 Amended per Vfg. 46/1992</p> <p>FCC Code of Federal Regulations, 47 CFR, Part 15, Subpart B, Class A</p> <p>EN 50081–1 European Community Requirements</p> <p>EN 55022 Radiated Emissions Class B</p> <p>EN 55022 Class B Conducted Emissions</p> <p>EN60555–2 Power Line Harmonic Emissions</p>
Susceptibility ^{1, 2}	<p>Meets or exceeds the EMC requirements of the following standards:</p> <p>EN 50082–1 European Community Requirements</p> <p>IEC 801-2 Electrostatic Discharge Performance Criteria B</p> <p>IEC 801-3 Radiated Susceptibility 3 V/meter from 27 MHz to 500 MHz unmodulated</p> <p>IEC 801-4 Fast Transients Performance Criteria B</p> <p>IEC 801-5 AC Surge Performance Criteria B</p>

Table 2–14: Warranted Characteristics — Environmental (Cont.)

Name	Description
Third Party Certification	<p>Conforms to and is certified where appropriate to:</p> <p>TDS 500B/700A: UL 3111–1³</p> <p>TDS 600B: UL 1244</p> <p>TDS 500B/700A: CSA 22.2 no. 1010.1³</p> <p>TDS 600B: CSA–C22.2 No. 231</p>

¹ VGA output cable needs to be terminated, if connected at all, for the Instrument to meet these standards. The test will pass with LCOM part # CTL3VGAMM–5.

² The GPIB cable connected to the instrument for certain of the emissions tests must be "low EMI" having a high-quality outer shield connected through a low impedance to both connector housings. Acceptable cables are Tektronix part numbers 012-0991-00, -01, -02, and -03. In order to maintain the EMI performance conforming to the above regulations, the following cables, or their equivalent, should be used: a shielded Centronics cable, 3 meters in length, part number 012-1214-00, and a shielded RS-232 cable, 2.7 meters in length, CA part number 0294-9.

³ IEC 1010, UL 3111, CSA 1010 Safety Certification Compliance:
 Temperature (operating) 5 to +40 C
 Altitude (maximum operating): 200 meters
 Equipment Type: Test and Measurement
 Safety Class: Class I (as defined in IEC 1010–1, Annex H) – grounded product
 Overvoltage Category: Overvoltage Category II (as defined in IEC 1010–1, Annex J)
 Pollution Degree: Pollution Degree 2 (as defined in IEC 1010–1)
 Note – Rated for indoor use only