

# Warranted Characteristics

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

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

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

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As stated above, this section lists only warranted characteristics. A list of *typical characteristics* starts on page 2–25.

## 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 500C, 700C: $\pm 1\%$ for all sensitivities from 1 mV/div to 10 V/div with offset from 0 V to $\pm 100$ V		
Accuracy, DC Voltage Measurement, Averaged (using Average mode)	Measurement type	DC Accuracy	
	Average of $\geq 16$ waveforms          Delta volts between any two averages of $\geq 16$ 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 500C, 700C: $\pm((1.0\% \times   \text{reading} - \text{Net Offset}^1  ) + \text{Offset Accuracy}) + (0.06 \text{ div} \times \text{V/div})$  TDS 600B: $\pm((1.5\% \times   \text{reading}  ) + (0.1 \text{ div} \times \text{V/div}) + 0.3 \text{ mV})$  TDS 500C, 700C: $\pm((1.0\% \times   \text{reading}  ) + (0.1 \text{ div} \times \text{V/div}) + 0.3 \text{ mV})$	
Accuracy, Offset	Volts/Div setting	TDS 600B Offset accuracy	TDS 500C/700C Offset accuracy
	1 mV/div – 100 mV/div	$\pm((0.2\% \times   \text{Net Offset}^1  ) + 1.5 \text{ mV} + (0.6 \text{ div} \times \text{V/div}))$	$\pm((0.2\% \times   \text{Net Offset}^1  ) + 1.5 \text{ mV} + (0.1 \text{ div} \times \text{V/div}))$
	101 mV/div – 1 V/div	$\pm((0.25\% \times   \text{Net Offset}^1  ) + 15 \text{ mV} + (0.6 \text{ div} \times \text{V/div}))$	$\pm((0.25\% \times   \text{Net Offset}^1  ) + 15 \text{ mV} + (0.1 \text{ div} \times \text{V/div}))$
	1.01 V/div – 10 V/div	$\pm((0.25\% \times   \text{Net Offset}^1  ) + 150 \text{ mV} + (0.6 \text{ div} \times \text{V/div}))$	$\pm((0.25\% \times   \text{Net Offset}^1  ) + 150 \text{ mV} + (0.1 \text{ div} \times \text{V/div}))$
Analog Bandwidth, DC-50 $\Omega$ Coupled and Bandwidth selection is FULL, TDS 600B	Volts/Div	TDS 620B & 644B Bandwidth <sup>2</sup>	TDS 680B & 684B Bandwidth <sup>2</sup>
	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
Analog Bandwidth, DC-50 $\Omega$ Coupled and Bandwidth selection is FULL, TDS 500C/700C	Volts/Div	TDS 520C, 540C, 724C & 754C Bandwidth <sup>2</sup>	TDS 784C Bandwidth <sup>2</sup>
	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		

**Table 2-10: Warranted characteristics — Signal acquisition system (cont.)**

Name	Description
<b>Delay Between Channels, Full Bandwidth</b>	TDS 600B: $\leq 100$ ps for any two channels with equal Volts/Div and Coupling settings and both channels' deskew values set to 0  TDS 500C/700C: $\leq 50$ ps for any two channels with equal Volts/Div and Coupling settings and both channel deskew values set to 0.0 $\mu$ s.
Input Impedance, DC-1 M $\Omega$ Coupled	1 M $\Omega$ $\pm 0.5\%$ in parallel with 10 pF $\pm 3$ pF
Input Impedance, DC-50 $\Omega$ Coupled	50 $\Omega$ $\pm 1\%$ 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 $\Omega$ , AC-1 M $\Omega$ , or GND Coupled	TDS 600B: $\pm 300$ V CAT II, 400 V peak; derate at 20 dB/decade above 1 MHz  TDS 500C/700C: $\pm 300$ V CAT II, 400 V peak; derate at 20 dB/decade above 1 MHz
Input Voltage, Maximum, DC-50 $\Omega$ or AC-50 $\Omega$ Coupled	5 V <sub>RMS</sub> , with peaks $\leq \pm 30$ V
Lower Frequency Limit, AC Coupled	$\leq 10$ Hz when AC-1 M $\Omega$ Coupled; $\leq 200$ kHz when AC-50 $\Omega$ Coupled <sup>3</sup>

<sup>1</sup> **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.**

<sup>2</sup> **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 500C/700C for each °C above +30°C.**

<sup>3</sup> **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
<b>Accuracy, Long Term Sample Rate and Delay Time</b>	TDS 600B: $\pm 100$ ppm over any $\geq 1$ ms interval  TDS 500C/700C: $\pm 25$ ppm over any $\geq 1$ ms interval

Table 2–12: Warranted characteristics — Triggering system

Name	Description	
Sensitivity, Edge-Type Trigger, Coupling set to "DC" <sup>1</sup>	Trigger source	Sensitivity
	Any Channel	<p>TDS 620B &amp; 644B: 0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz</p> <p>TDS 680B &amp; 684B: 0.35 division from DC to 50 MHz, increasing to 1 division at 1 GHz MHz</p> <p>TDS 500C, 724C, &amp; 754C: 0.35 division from DC to 50 MHz, increasing to 1 division at 500 MHz</p> <p>TDS 784C: 0.35 division from DC to 50 MHz, increasing to 1 division at 1 GHz</p>
	Auxiliary	<p>TDS 600B: 250 mV from DC to 50 MHz, increasing to 500 mV at 100 MHz</p> <p>TDS 500C, 724C, &amp; 754C: 400 mV from DC to 50 MHz, increasing to 750 mV at 100 MHz</p> <p>TDS 784C: 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 $\mu$ s	$\pm(20\%$ of setting + 0.5 ns)
	1.02 $\mu$ 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 <sub>p-p</sub> on NTSC or PAL signal	

<sup>1</sup> 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)	$\geq 2.5$ V open circuit; $\geq 1.0$ V into a 50 $\Omega$ load to ground
	Vout (LO)	$\leq 0.7$ V into a load of $\leq 4$ mA; $\leq 0.25$ V into a 50 $\Omega$ 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 <sup>1</sup> )	For TDS 600B: 20 mV/division $\pm 20\%$ into a 1 M $\Omega$ load; 10 mV/division $\pm 20\%$ into a 50 $\Omega$ load  For TDS 500C/700C: 22 mV/division $\pm 20\%$ into a 1 M $\Omega$ load; 11 mV/division $\pm 20\%$ into a 50 $\Omega$ load	
Source Voltage	90 to 250 VAC <sub>RMS</sub> , continuous range, CAT II	
Source Frequency	45 Hz to 440 Hz	
Power Consumption	$\leq 300\text{ W}$ (450 VA)	

<sup>1</sup> 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	<p>Temperature (no disk in floppy drive):</p> <p>TDS 600B:            Operating: +4° C to +45° C</p> <p>Floppy disk drive:   Operating: +10° C to +45° C</p> <p>                             Nonoperating: –22° C to +60° C</p> <p>TDS 500C/700C:    Operating: +0° C to +50° C</p> <p>Floppy disk drive:   Operating: +10° C to +50° C</p> <p>                             Nonoperating: –22° C to +60° C</p> <p>Relative humidity (no disk in floppy drive):</p> <p>Operating: 20% to 80%, at or below +32° C, upper limit derates to 30% relative humidity at +45° C</p> <p>Nonoperating: 5% to 90%, at or below +31° C, upper limit derates to 20% relative humidity at 60° C</p> <p>Altitude:</p> <p>To 4570 m (15,000 ft.), operating (excluding hard disk drive)</p> <p>To 3048 m (10,000 ft.), operating (including hard disk drive)</p> <p>To 12190 m (40,000 ft.), nonoperating</p>
Dynamics	<p>Random vibration (floppy disk not installed):</p> <p>0.31 g rms, from 5 to 500 Hz, 10 minutes each axis, operating</p> <p>3.07 g rms, from 5 to 500 Hz, 10 minutes each axis, nonoperating</p>
Emissions (TDS 500C/700C) <sup>1, 2</sup>	<p>Meets or exceeds the requirements of the following standards:</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) <sup>1, 2</sup>	<p>Meets or exceeds the requirements of the following standards:</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>

**Table 2–14: Warranted characteristics — Environmental (cont.)**

Name	Description										
Susceptibility <sup>1, 2</sup>	<p>Meets or exceeds the EMC requirements of the following standards:</p> <table> <tr> <td>EN 50082-1</td><td>European Community Requirements</td></tr> <tr> <td>IEC 801-2</td><td>Electrostatic Discharge Performance Criteria B</td></tr> <tr> <td>IEC 801-3</td><td>Radiated Susceptibility 3 V/meter from 27 MHz to 500 MHz unmodulated</td></tr> <tr> <td>IEC 801-4</td><td>Fast Transients Performance Criteria B</td></tr> <tr> <td>IEC 801-5</td><td>AC Surge Performance Criteria B</td></tr> </table>	EN 50082-1	European Community Requirements	IEC 801-2	Electrostatic Discharge Performance Criteria B	IEC 801-3	Radiated Susceptibility 3 V/meter from 27 MHz to 500 MHz unmodulated	IEC 801-4	Fast Transients Performance Criteria B	IEC 801-5	AC Surge Performance Criteria B
EN 50082-1	European Community Requirements										
IEC 801-2	Electrostatic Discharge Performance Criteria B										
IEC 801-3	Radiated Susceptibility 3 V/meter from 27 MHz to 500 MHz unmodulated										
IEC 801-4	Fast Transients Performance Criteria B										
IEC 801-5	AC Surge Performance Criteria B										
Approvals	<p>Conforms to and is certified where appropriate to:</p> <p>UL 3111-1<sup>3</sup> – Standard for electrical measuring and test equipment</p> <p>CAN/CSA C22.2 no. 1010.1<sup>3</sup> – Safety requirements for electrical equipment for measurement, control and laboratory use</p>										

<sup>1</sup> **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.**

<sup>2</sup> **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.**

<sup>3</sup> **UL 3111, CSA 22.2 no.1010 Safety Certification Compliance:**  
**Temperature (operating) 5 to +40 C**  
**Altitude (maximum operating): 2000 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**

**Table 2–15: Certifications and compliances**

EC Declaration of Conformity (TDS 500C and TDS 700C)	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EMC Directive 89/336/EEC:  EN 55011                      Class A Radiated and Conducted Emissions  EN 50081-1 Emissions:              EN 60555-2              AC Power Line Harmonic Emissions  EN 50082-1 Immunity:              IEC 801-2              Electrostatic Discharge Immunity              IEC 801-3              RF Electromagnetic Field Immunity              IEC 801-4              Electrical Fast Transient/Burst Immunity              IEC 801-5              Power Line Surge Immunity</p>
Australian Declaration of Conformity – EMC (TDS 500C and TDS 700C)	<p>Conforms with the following standards in accordance with the Electromagnetic Compatibility Framework:</p> <p>AS/NZS 2064.1/2              Class A radiated and Conducted Emissions</p>
EC Declaration of Conformity (TDS 600B)	<p>Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:</p> <p>EMC Directive 89/336/EEC:  EN 50081-1 Emissions:              EN 55022              Class B Radiated and Conducted Emissions              EN 60555-2              AC Power Line Harmonic Emissions  EN 50082-1 Immunity:              IEC 801-2              Electrostatic Discharge Immunity              IEC 801-3              RF Electromagnetic Field Immunity              IEC 801-4              Electrical Fast Transient/Burst Immunity              IEC 801-5              Power Line Surge Immunity</p>
EC Declaration of Conformity – Low Voltage	<p>Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities:</p> <p>Low Voltage Directive 73/23/EEC  EN 61010-1:1993              Safety requirements for electrical equipment for measurement, control, and laboratory use</p>