3. LC684D, DM, DL & DXL Specifications

3.1 Signal Capture

Acquisition System

Bandwidth (-3 dB):
@ 50Ω: DC to 1.5 GHz
@ 1 MΩ DC: Bandwidth dependant on probe used
No. of Channels: 4
Sample Rate: LC684D/M/L/XL: 2 GS/s (4 ch), 4 GS/s (2 ch), 8GS/s (1 ch)
Sensitivity:
50Ω : 2 mV/div to 1 V/div
1MΩ : 2 mV/div to 2 V/div
Scale factors: Choice of over 12 probe attenuation factors selectable via front panel menus.
Offset Range:
2.0 - 4.99 mV/div: ±400 mV
5.0 - 99 mV/div (50Ω only) : ±1 V
5.0 - 100 mV/div (1 MΩ only) : ±1 V
0.1 - 1.0V/div (50Ω only): ±10 V
102 mv - 2.0V/div (1 MΩ only): ±100 V
±20 V across the whole sensitivity range when using the AP020/AP022 FET probe.
DC Accuracy: typical ± 2% of full scale + 1% offset setting.
Vertical Resolution: 8 bits.
Bandwidth Limiter: 25 MHz, or 200MHz user selectable
Input Coupling: AC (> 10Hz typ.), DC, GND.
Input Impedance: 10MΩ//11pF (system capacitance using PP005) or 50 Ω ±1.25%.
Max Input: 50Ω: ±5V DC (500mW) or 5V RMS.
1MΩ: 100 V (DC+ peak AC ≤10 kHz).

Acquisition System Configuration

Active Channels	Maximum Sample Rate	Maximum Record Length			
		LC684D	LC684DM	LC684DL	LC684DXL
4	2 GS/s	100 K	500 K	2 M	4 M
2	4 GS/s	250 K	1 M	4 M	8 M
1	8 GS/s	500 K	2 M	8 M	16 M

3.2 Acquisition Modes

Random Interleaved Sampling (RIS): 25GS/s.
For repetitive signals from 200 ps/div to 1 µs/div.
Single shot: For transient and repetitive signals from 0.5 ns/div (1 channels).
1 ns/div (2 Ch), 2 ns/div (4Ch)
Sequence: Stores multiple events- each of them time stamped- in segmented acquisition memories.
Dead Time Sequence mode: Typically 30 µs
Number of segments available: LC684D: 2-1000,
LC684DM: 2-1000
LC684DL/XL: 2-6000

3.3 Timebase System

Timebases: Main and up to 4 Zoom Traces.
Time/Div Range: 500 ps/div (at 8GS/s), 1ns/div (at 4 GS/s), 2ns/div (at 2 GS/s) to 1,000 s/div.
Clock Accuracy: ≤10 ppm.
Interpolator resolution: 10 ps.
Roll Mode in normal trigger mode: 500 ms to 1,000 s/div.
External Clock: Optional (CKTRIG) Zero crossing level DC to 500 MHz rear panel fixed frequency clock input (<20 ns rise/falltime)
External Reference: Optional (CKTRIG) 10 MHz rear-panel input.

3.4 Triggering System

Trigger Modes: Normal, Auto, Single, and Stop.
Trigger Sources: CH1, CH2, CH3, CH4, Line, Ext, Ext/5. Slope.
Level and Coupling are unique for each source.
Slope: Positive, Negative, Bi-Slope (Window in & out)
Coupling: AC (-3db at <10Hz), DC, HF (175 MHz to 1GHz), LFREJ (>50KHz), HFREJ (<100MHz).
Pre-trigger recording: 0 to 100% of full scale (adjustable in 1% increments).
Post-trigger delay: 0 to 10,000 divisions (adjustable in 0.1 div increments).
Holdoff by time: 2 ns to 20 s.
Holdoff by events: 1 to 99,999,999.
Internal Trigger Range: ±5 div.
Maximum Trigger Frequency: 1 GHz (DC, AC), > 1.5 GHz (HF)
EXT Trigger Max Input: 1MΩ//20pF: 100V (DC + peak AC≤ 10kHz)
50Ω ±3%: ±5 V DC (500 mW) or 5 V RMS.
EXT Trigger Range: ±0.5 V (±2.5 V with Ext/5).
Trigger Output: Optional ECL rear panel output (option CKTRIG). The calibrator output can provide a trigger status or a Pass/Fail test output.

3.5 Smart Trigger Types

Pattern: Trigger on the logic combination of 5 inputs - CH1, CH2, CH3, CH4 and EXT Trigger, where each source can be defined as High, Low or Don't Care. The Trigger can be defined as the beginning or end of the specified pattern
Signal or Pattern Width: Trigger on glitches as short as 600 ps or on pulse widths Within/outside two limits selectable from 600 ps to 20 s.
Slew Rate: Trigger on rising, falling edges within/outside two time limits selectable from 600 ps to 20 s.
Signal or Pattern Interval: Trigger on an interval between two limits selectable from 2ns to 20s.
Dropout: Trigger if the signal drops out for longer than a time-out from 2 ns to 20s.
Runt: Trigger on positive or negative Runts within/outside two limits selectable from 600 ps to 20 s.
State/Edge Qualified: Trigger on any source only if a given state (or transition) has occurred on another source. The delay between these events can be defined as a number of events on the trigger channel or as a time interval.
TV: Allows selection of up to 1500 lines and field synchronization for PAL, SECAM, NTSC or non-standard video
Exclusion Triggering: Trigger on intermittent faults by specifying the normal width, period, risetime or amplitude of a signal.
The oscilloscope will trigger only on aberrations.

3.6 Autosetup

Automatically sets sensitivity, vertical offset and timebase on all display channels.

Autosetup Time: Approximately 3 seconds.
Vertical Find: Automatically sets sensitivity and offset for selected channel.

3.7 Probes

Model: One PP005 probe is supplied per channel. DC to 500 MHz typical at probe tip, 500 V max.
Optional Probes: 2.5 Ghz FET probe AP022, 1 GHz FET probe (AP020); 1 GHz active differential probe (AP034), 500 MHz active differential probe (AP033).

Probe calibration: Max 1 V into 1 MΩ, 500 mV into 50 Ω, frequency and amplitude programmable, pulse or square wave selectable, rise and fall time 1 ns typical. Alternatively, the Calibrator output can provide a trigger output or a Pass/Fail test output.

3.8 Display

Type: Color 10.4" TFT-LCD.
Resolution: VGA (640X480 pixels)
Display Area: 212mm x 160mm
Controls: Menu controls for brightness and color selection.
Grid Styles: Single, Dual, Octal, XY, Single+XY, Dual+XY, and Full Screen
An enlarged view of each grid style.
Graticules: Internally generated; separate intensity control for grids and waveforms. Selectable blending of grid with displayed traces.
Waveform Style: Dot-joint with optional sample point highlight or Dots-only.
Persistence Modes: Color-graded persistence and Analog Persistence, infinite or variable with decay over time. In color-graded persistence, a color spectrum from red through violet is used to map signal intensity. With Analog Persistence, the brightness level of a single color denotes signal intensity. Each trace's persistence data is stored in 64K levels.
Trace Display: Opaque or transparent mode, with overlap management.
Number of Traces: 8 (supports a mix of channels, memories or math functions).
Real-time Clock: Date, hours, minutes, seconds.
External Monitor: Rear panel 15-pin socket for VGA compatible monitor.
Vertical Zoom: Up to 5x Vertical Expansion (50x with averaging, up to 40 μV/div sensitivity).
Horizontal Zoom: Waveforms can be expanded to 0.4 points/division.
Auto Scroll: Use Auto Scroll to automatically "Play" the captured signal to identify anomalies quickly and easily. With a selectable zoom expansion and scrolling speed, you can set up Auto Scroll to match your signal viewing needs.
The scrolling speed can be adjusted during the scan to focus on the more interesting characteristics of the signal.
"REVERSE" enables you to quickly review any part of the signal.

3.9 Rapid Signal Processing

Microprocessor: 96 MHz PowerPC 603e (LC684D, DM & DL)
192 MHz Power PC 603e (LC684DXL)
System RAM: 16 to 64 Mbytes – See table below.
Video Memory: 1 Mbyte
Persistence Data Map Memory: 16 bits per displayed pixel (64k levels).

System Memory Configurations

LC684D	16 Mbytes
LC684DM	16 Mbytes
LC684DL/DXL	64 Mbytes

3.10 Waveform Processing

Up to four processing functions may be performed simultaneously. Functions available are: Add, Subtract, Multiply, Divide, Negate, Identity, Summation Averaging, Sine x/x, Integral, Derivative, Square Root, Ratio, Absolute Value and the advanced functions listed below.

Average: Summed averaging up to one million sweeps.
Extrema: Roof, Floor, or Envelope values up to one million sweeps.
ERES: Low-Pass digital filters provide up to 11-bit vertical resolution. Sampled data is always available, even when a trace is turned off.
FFT: Spectral Analysis with four windowing functions and FFT averaging.
Statistical Diagnostics: The Parameter Analysis package permits in-depth diagnostics on waveform parameters. Live histogramming and trending of any waveform parameter measurement is possible. The histogram can be autoscaled to display the center and width of the distribution. This package is only standard on the LC584 Series.

Internal Memory

Waveform Memory: Up to four 16-bit memories (M1, M2, M3, M4).
Zoom & Math Memory: Up to four 16-bit Waveform Processing memories (A,B,C,D), whose length corresponds to the length of the channel acquisition memory.
Setup Memory: Four non-volatile memories. The floppy drive and optional cards or disks may also be used for high-capacity waveform and setup storage.

Cursor Measurements

Relative Time: A pair of arrow cursors measures time differences and voltage differences relative to each other.
Relative Voltage: A pair of line cursors measures voltage differences relative to each other.
Absolute Time: A cross-hair marker measures time relative to the trigger and voltage with respect to ground.
Absolute Voltage: A reference bar measures voltage with respect to ground.

PASS/FAIL:
Pass/Fail testing allows any five items (parameters and/or masks) to be tested against selectable thresholds. Waveform Limit Testing is performed using Masks which may be defined either inside the instrument or by downloading templates created on a PC. Any failure will cause pre-programmed actions, such as Hardcopy, Save to Internal Memory, Save to mass storage device (card or disk), GPIB SRQ or Pulse Out.

3.11 Interfacing

Remote Control: All front-panel controls as well as all internal functions are possible by GPIB and RS-232-C.
RS-232-C Port (Standard): Asynchronous up to 115.2 kBaud for computer/terminal control or printer/plotter connection.
GPIB Port (Standard): (IEEE-488.2) Configurable as talker/listener for computer control and fast data transfer.
Centronics Port (Standard): Hard copy parallel interface.
Hard copy: Screen dumps are activated by a front-panel button or via remote control.
Supported printers:
B/W: LaserJet, DeskJet, Epson
Color: DeskJet 550C, Epson Stylus, Canon 200/600/800 series.
An optional, internal high-resolution graphics printer is also available for screen dumps; stripchart output formats up to 2 m/div are achievable.
Hard Copy Formats: TIFF b/w, TIFF color, BMP color and
BMP compressed.
Output Formats:
The ASCII waveform output and is compatible with spreadsheets, MATLAB, MathCad. Binary output is also available.

3.12 General

Auto-calibration Ensures specified DC and timing accuracy.
Recommended Factory Calibration Interval: 1 year
Temperature: 5° to 40°C rated accuracy (41° to 104°F).
0° to 45°C operating (32° to 113°F).
Humidity: <80% non-condensing.
Altitude: Up to 2000 m (operating), 12,000 m (non-operating).
Shock and Vibration: Conforms to selected sections of MIL-PRF-28800F,Class 3.
Power: 90-250 V AC, 45-66 Hz, 350 VA
Battery Backup: Front-panel settings maintained for two years.
Dimensions:(HWD) 10.4" x 15.65" x 17.85", 264 mm x 397 mm x 453 mm
Weight: Typ. 16 kg (35 lbs) net, typ. 24 kg (53 lbs) shipping.
Warranty: Three years.

3.13 CE Approval

EMC: Conforms to EN50081-1 (Emissions) and EN50082-1 (Immunity)
Safety: The oscilloscope has been designed to comply with EN61010-1 Installation Category (Over-voltage category) II, 300V, Pollution degree 2.
UL and cUL approval: UL Standard: UL 3111-1; cUL Canadian Standard CSA-C22.2 No. 1010. 1-92.