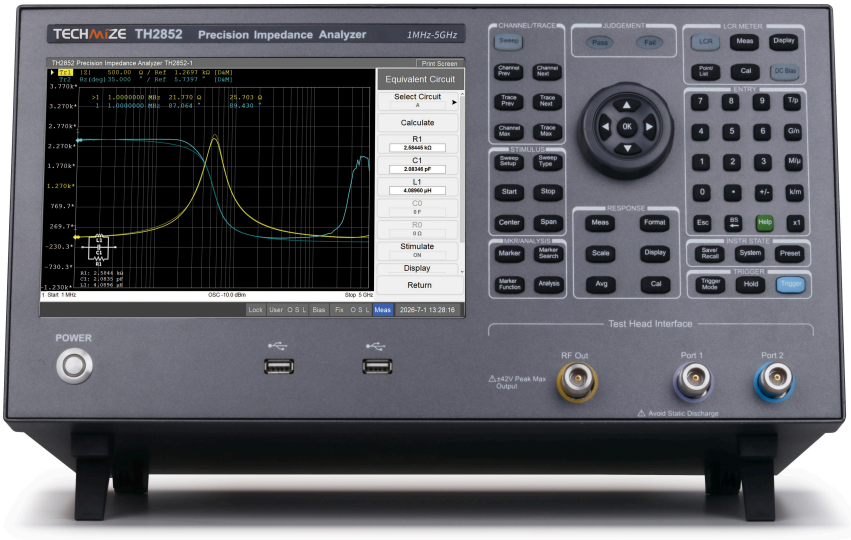
TH2852 / TH2853 Series

RF Precision Impedance Analyzer & RF LCR Tester — Technical & Applications Guide

This guide is the deep-dive companion to the TH2852 / TH2853 Series datasheet. It explains how the RF-IV bridge measurement method holds precision impedance accuracy from 1 MHz up to 5 GHz, walks through each measurement mode and analysis function in both series, and covers the optional dielectric-constant and magnetic-permeability analysis packages in full, including the underlying measurement principles and formulas. For a one-page overview and ordering information, see the TH2852 / TH2853 Series datasheet.



Model	Test frequency
TH2852-050	1 MHz – 500 MHz
TH2852-100	1 MHz – 1 GHz
TH2852-200	1 MHz – 2 GHz
TH2852-350	1 MHz – 3.5 GHz
TH2852-500	**1 MHz – 5 GHz**

Model	Test frequency
TH2853-050	1 MHz – 500 MHz
TH2853-100	1 MHz – 1 GHz
TH2853-200	1 MHz – 2 GHz
TH2853-350	1 MHz – 3.5 GHz
TH2853-500	**1 MHz – 5 GHz**

TH2852 Series = Precision Impedance Analyzer (full analysis suite). TH2853 Series = RF LCR Tester (streamlined). Basic accuracy ±0.3% (typ.), impedance range 100 mΩ–60 kΩ across both series.

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2 Platform highlights — RF-IV measurement & accuracy

A vector network analyzer or reflection-based RF impedance instrument derives impedance indirectly, from a reflection coefficient referenced to a fixed 50 Ω system impedance — accurate deep into the GHz range, but progressively less precise as the device under test's impedance moves away from that reference, particularly at the low-impedance, low-loss end of the passive-component range. The TH2852 / TH2853 Series instead uses the broadband **RF-IV method**, measuring current and voltage directly across the device under test. This is what lets the platform hold **±0.3%** typical accuracy across a **100 mΩ – 60 kΩ** impedance range and 1 MHz–5 GHz frequency span — well beyond the roughly 3 GHz ceiling where RF-IV impedance testing has traditionally stalled.

> **How the 5 GHz ceiling is reached:** an external test head, combined with automatic electrical-length measurement and calibration, removes the cable-length error that normally limits RF-IV accuracy — extending it from the traditional ~3 GHz limit up to 5 GHz and enabling high-precision testing of wafers and PCBs. See §8 for the full test-head architecture.

Short-term stability

Measured with speed level 5, output power −10 dBm (141 mV), a TH2852-1 test head and a 50 Ω standard component as the DUT:

Set frequency	Short-term stability
1 MHz	±0.003%
10 MHz	±0.003%
100 MHz	±0.002%
500 MHz	±0.002%
1 GHz	±0.003%
2 GHz	±0.005%
3 GHz	±0.013%
4 GHz	±0.008%
5 GHz	±0.031%

Five selectable speed / accuracy levels

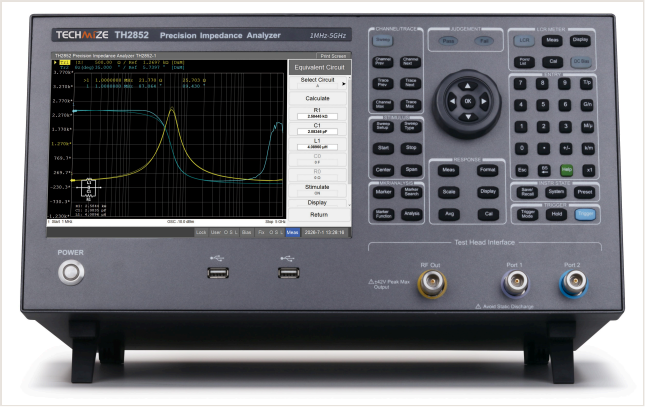
Every measurement mode lets you trade test speed for averaging depth, point by point:

Level	0 — Fast	1	2	3	4	5 — Precise
Typical time	0.4 ms	4 ms	26 ms	65 ms	130 ms	650 ms

> **In practice:** use level 0 for high-throughput production sorting, and level 5 for R&D and incoming-inspection work where reference-grade accuracy on the actual device matters more than throughput.

3 TH2852 vs. TH2853 — choosing the right series

Both series share the same RF-IV measurement core, the same five frequency-range models, and the same 10.1" touch interface. The TH2852 Series precision impedance analyzer adds the full analysis suite — cursor analysis, curve-sweep statistics, data storage, equivalent-circuit fitting and a built-in Smith chart — while the TH2853 Series RF LCR tester is a streamlined platform for point, list and fixed-grid curve-sweep testing where those deeper analysis tools are not required.



TH2852 Series — Precision Impedance Analyzer



TH2853 Series — RF LCR Tester

Function	TH2852 Series	TH2853 Series
Minimum frequency resolution	1 mHz	1 kHz
Test functions	Point, List, Curve Sweep, Smith Chart	Point, List, Curve Sweep (fixed-grid display)
Curve-sweep cursor functions	✓	—
Curve-sweep statistical analysis	✓	—
Curve-sweep data storage	✓	—
Equivalent-circuit analysis	✓	—
Smith chart	✓	—
Permeability / dielectric-constant test	Optional	—

10.1" touch screen & quick-select parameter sets

Both series use the same 10.1" capacitive touch screen (1280×800), which keeps all test parameters, sorting parameters, sorting results and function selections on one screen without crowding. Four measurement parameters can be displayed and freely reassigned at once — for example |Z|, θz, R and X simultaneously — and eight quick-select buttons along the left edge switch between eight saved parameter sets with a single touch. For the European market, the platform runs its Windows-based UI in **English**.

Connectivity

RS232C	USB Host	USB Device	LAN	GPIB	HANDLER	VGA	HDMI
standard	standard	standard	standard	standard	standard	standard	standard

SCPI command set on every model, across both series.

4 Point measurement & list sweep

Point measurement

The default working mode on both series: set a test frequency, AC level and, optionally, DC bias, and the instrument continuously updates up to four selected parameters — for example |Z|, θz, R and X — in large, colour-coded digits. This is the fastest way to characterize a single device under test, verify a calibration standard, or confirm a test-head connection before running a more complex sweep.



Point measurement on a TH2853: four parameters shown at once, each with its own Math/Ref offset

- Each of the four displayed parameters carries its own **Math** (relative) and **Ref** (reference) offset, independent of the others.
- AC/DC monitor readouts confirm the actual signal level reaching the device under test.
- Trigger mode, averaging count, OSC level and speed level can all be changed from the same softkey column without leaving the measurement screen.

List sweep

List sweep supports up to **1,601 points**, with independent configuration of test frequency, test voltage, DC bias and other test conditions for each point — and independent 10-bin sorting per point. Because every point can carry its own AC level and bias, a single list sweep can characterize a component under several different drive conditions in one run, rather than requiring separate point measurements.

5 Graphical sweep & segmented sweep

Both series can display up to **4 channels** simultaneously, with up to **4 curves per channel** — 16 curves in total. Fourteen split-screen layouts are available for arranging channels and curves, from a single channel showing one curve to four channels each showing four curves at once. Each display window supports its own independent sweep condition setup.

Layout element	What it controls
Channel → Display window	Each window can be set up with a different sweep condition (frequency/level/bias range)
Curve → Measurement parameter	Each window can plot up to 4 curves, each assigned to a different measurement parameter

> **TH2852 vs. TH2853:** the TH2852 Series graphical sweep includes cursor analysis, curve statistics, data storage and equivalent-circuit fitting on top of the curve display; the TH2853 Series shows the same multi-channel, multi-curve sweep as a fixed-grid display, without those deeper analysis layers (see §3, §6 and §7).

Typical split-screen layouts

- **Single channel, 1 curve** — the simplest view, for focused single-parameter tracking.
- **Single channel, 4 curves** — compare several parameters of the same DUT on one set of axes.
- **Dual channel, 2 curves each** — compare two different sweep conditions side by side.
- **4 channels, 4 curves each** — the maximum density, for comprehensive multi-condition characterization in a single view.

Segmented frequency sweep

Segmented sweep scans several independently defined frequency segments within a single sweep cycle, with its own AC level and DC bias configurable per segment, and the results shown directly on the graphical display. It is the fastest way to screen a component across multiple frequency bands of interest without sweeping — and paying the time cost of sweeping — the ranges in between that carry no useful information. Each segment is defined by its own start frequency, stop frequency and point count, and the combined result can be sorted, stored and exported the same way as a standard graphical sweep.

> **Typical use case — crystal resonator testing:** a crystal resonator needs its resonant frequency, anti-resonant frequency and any spurious frequencies characterized, but the frequency spans between them are not test-relevant. Segmented sweep measures only the target frequency ranges and skips the unneeded spans in between, cutting total test time compared with a single continuous sweep across the full range.

6 Equivalent circuit analysis

TH2852 Series only — equivalent circuit analysis is part of the TH2852 curve-sweep analysis suite and is not available on the TH2853 Series (see §3).

In practice, different types of real components behave like one of a small set of idealized impedance networks. Equivalent circuit analysis fits a measured impedance curve to one of **7 basic circuit models** — four three-parameter models and three four-parameter models — letting you compare the simulated fitting curve against the actual measured curve, or fit using parameters you enter directly for the selected model. The resulting model can be exported directly as a TXT file for later reuse.

Model	Topology	Typically used for
A	L1 ‖ C1 ‖ R1 (three elements in parallel)	High-leakage inductors
B	C1 in parallel with (L1 in series with R1)	Inductive resistors
C	L1 in series with (C1 ‖ R1)	High-value resistors
D	L1, C1, R1 all in series	Capacitors
E	C0 in parallel with (L1, C1, R1 in series)	Resonators (crystal/piezoelectric devices)
F	R0 in series with (L1 ‖ C1 ‖ R1)	Inductor ESR
G	R0 in series with L1, then in parallel with (C1 in series with R1)	Capacitors

Reading the table: models A–D use three fitting parameters, models E–G use four — choose the model whose topology best matches the physical construction of the device under test for the most meaningful fit.

7 Cursor analysis & curve trace comparison

> **TH2852 Series only** — both functions are part of the TH2852 curve-sweep analysis suite (see §3).

Cursor analysis

The TH2852 Series can display up to **10 cursors per curve**, including a dedicated reference cursor. Each cursor carries an excitation value (its position on the X-axis) and a response value (the corresponding Y-axis reading). Cursors can be used to:

- Read measurement results as absolute values, or as relative values against the reference cursor.
- Locate specific points on the curve via **cursor search** — maximum/minimum value; peak or valley (nearest to the left, nearest to the right, or multiple); or the target value nearest to the cursor on either side, or multiple targets.
- Analyze curve measurement results and calculate statistics.
- Modify the sweep range and vertical-axis scaling directly from cursor values.

Curve trace comparison

Curve trace comparison runs continuous measurements of the device under test, with every curve displayed in the same coordinate system. Two typical applications:

Application	What it shows
Multiple different DUTs	Compares curve traces captured under different measurement conditions; set frequency points to calculate the measured value of every curve at those points
Same DUT, repeated	Compares repeatability across multiple measurements of the same DUT under identical conditions; set frequency points the same way to quantify run-to-run variation

8 Interfaces, dimensions & test-head architecture

Dimensions

428 (W) × 220 (H) × 280 (D) mm · 14 kg — identical across both series and all five frequency-range models.

Rear-panel interfaces

RS232C	USB Host	USB Device	LAN	GPIB	HANDLER	VGA	HDMI
standard	standard	standard	standard	standard	standard	standard	standard

Plus REF IN / REF OUT reference connectors and the RF test-head interface (RF Out, Port 1, Port 2) on the front panel.

External test head & electrical compensation

The RF-IV bridge measures at the test head, not at the analyzer's front panel — so the cable between the two is part of the measurement path. The TH2852-1A / TH2852-1B test heads integrate a front-end sampling circuit that shortens this equivalent cable length to about **10 cm**, whatever the physical cable run (1 m or 2 m). Combined with the automatic electrical-length measurement and calibration described in §2, this is what lets the platform hold RF-IV accuracy out to 5 GHz over a real, practical cable length instead of requiring the DUT to sit directly at the analyzer.

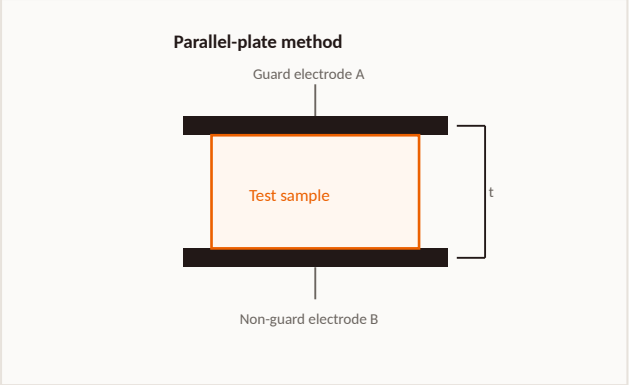
Item	Description
TH2852-1	0 m test head — direct-mount, standard with TH2852 models
TH2852-1A	1 m test head — standard with TH2853 models, optional for TH2852
TH2852-1B	2 m test head — optional, for DUT positions further from the analyzer
APC7mm to SMA female adapter	Connects the test head to customer-supplied SMA test fixtures and cable assemblies

Typical fixture chain: analyzer → TH2852-1A/1B test head → APC7mm-to-SMA adapter → phase-stable SMA cable assembly → customer test-head fixture → device under test. Talk to your Techmize contact about integrating a customer-specific fixture at the end of this chain.

9 Option — dielectric constant analysis

TH2852 Series only — this option is not available on TH2853 (see §3).

With the TH26089 test fixture and dielectric-constant analysis software, a TH2852 measures the dielectric constant and dissipation factor of solid dielectric materials — plastics, ceramics, printed-circuit-board substrates and similar insulating materials — using the parallel-plate method, which eliminates stray capacitance from the result.



Illustrative — test sample held between guard electrode A and non-guard electrode B

Configuration

Item	Mandatory
TH2852 Series main unit	Yes
TH26089 dielectric material test fixture	Yes
TH2852 Series dielectric-constant test software	Yes
TH2852 Series calibration kit	Yes

Basic parameters

Test frequency	DC – 1 GHz
Measured parameters	Capacitance (C), dissipation factor (D), dielectric constant (εr′, εr″)
Test electrodes	Sample diameter ≥13 mm · sample thickness 0.3–3 mm
Test principle	Parallel-plate measurement
Calibration	Open, short, load

Dielectric constant formula

$$\varepsilon r = (ta \times Cp) / (A \times \varepsilon 0) = (ta \times Cp) / (\pi \times (d/2)^2 \times \varepsilon 0)$$

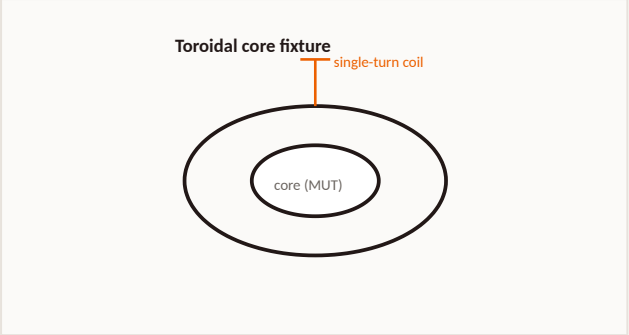
- **Cp** — equivalent parallel capacitance measured by the instrument (F)
- **ta** — average thickness of the test sample (m)
- **A** — area of the test electrode within the guard electrode (m^2)
- **d** — diameter of the test electrode within the guard electrode (m)
- **ε0** — permittivity of free space, 8.854×10^{-12} F/m

Once activated, the software lets you select dielectric-constant parameters directly on the TH2852 touch interface for single measurement, list sweep or curve sweep — the same three workflows used for standard impedance measurement.

10 Option — magnetic permeability analysis

TH2852 Series only — this option is not available on TH2853 (see §3).

With the TH26088 test fixture and magnetic-permeability test software, a TH2852 measures the complex magnetic permeability of toroidal magnetic materials — ferrite, amorphous cores and similar components — using a single-turn toroidal coil fixture that avoids magnetic flux leakage and needs no extra winding wire.



Illustrative — toroidal sample inside the single-turn coil fixture

Configuration

Item	Mandatory
TH2852 Series main unit	Yes
TH26088 permeability test fixture	Yes
TH2852 Series permeability test software	Yes
TH2852 Series calibration kit	Yes

Sample size	Height	Inner Ø	Outer Ø
Small insert	≤3 mm	≥3.1 mm	≤8 mm
Large insert	≤8.5 mm	≥5 mm	≤20 mm

Test frequency: DC – 1 GHz.

Effective permeability (μ′e, μ″e)

Measured by winding the core with a single turn inside the sealed toroidal fixture and reading the inductance at the winding's terminals:

$$\mu'_e = (\ell \times L_{eff}) / (\mu_0 \times N^2 \times A) \qquad \mu''_e = (\ell \times (R_{eff} - R_W)) / (\mu_0 \times N^2 \times \omega \times A)$$

- **Leff** — inductance of the toroidal winding
- **Reff** — equivalent resistance incl. core loss and line resistance
- **RW** — line (winding) resistance
- **N** — number of turns
- **ℓ** — average magnetic-path length of the core (m)
- **A** — cross-sectional area of the toroidal core (m²)
- **ω** — angular frequency, 2πf
- **μ0** — permeability of free space, $4\pi \times 10^{-7}$ H/m

Relative permeability

$$\mu = [(Z'_m - Z'_{sm}) \times 2\pi] / [j\omega\mu_0 h \cdot \ln(c/b)] + 1$$

- **Z'm** — impedance measured without the core
- **Z'sm** — impedance measured with the core in place
- **h, c, b** — sample height, outer diameter, inner diameter

11 Full technical specifications

Common to all ten models (TH2852-050/100/200/350/500 and TH2853-050/100/200/350/500) unless noted.

Parameter	-050	-100	-200	-350	-500
Test frequency	1 MHz–500 MHz	1 MHz–1 GHz	1 MHz–2 GHz	1 MHz–3.5 GHz	1 MHz–5 GHz
Display	10.1" TFT LCD, 1280×RGB×800, capacitive touch screen				
Max. frequency resolution	1 mHz (TH2852 series) · 1 kHz (TH2853 series)				
AC measurement parameters	|Z|, |Y|, θ, R, X, G, B, L, C, D, Q, |Γ|, Γx, Γy, θΓ, Vac, Iac, impedance circle, admittance circle, Smith chart[1], dielectric/magnetic material measurement (optional, TH2852 only)				
DC measurement parameters	VDC, IDC, RDC				
AC test level	Voltage −41 dBm – +1 dBm · Current 80 μA – 10.04 mArms				
DC bias source	Voltage 0–±40 V · Current 0–±100 mA				
Measurement speed (5 levels)	0: 0.4 ms 1: 4 ms 2: 26 ms 3: 65 ms 4: 130 ms 5: 650 ms				
Basic accuracy	±0.3% (typical value)				
Impedance test range	100 mΩ – 60 kΩ				
Measurement display range	Cs,Cp: ±9.99999 aF–9.99999 EF · Ls,Lp: ±1.00000 aH–99.9999 EH · D: ±0.00001–9.99999 · Q: ±0.01–99999.9 · R,X,Z: ±1.00000 aΩ–999.999 EΩ · G,B,Y: ±1.00000 aS–99.9999 ES				
Sorting / binning	LCR mode: 10-grade sorting · Scan mode: independent sorting per curve				
Interfaces	RS232C, USB Host, USB Device, LAN, GPIB, HANDLER, VGA, HDMI — all standard; SCPI command set				
Warm-up time	30 minutes				
Input voltage	100–120 V AC / 198–242 V AC selectable, 47–63 Hz				
Power consumption	Max. 150 VA				
Dimensions (W×H×D)	428 × 220 × 280 mm				
Weight	14 kg				

[1] Smith chart and dielectric/magnetic material measurement are TH2852-series capabilities — see §3 for the full function comparison against TH2853.

12 Accessories & contact

Every TH2852 / TH2853 ships fully calibrated with the standard test head below. The optional test heads, calibration kit and fixtures extend the same platform into SMD, through-hole, magnetic-permeability and dielectric-constant work — talk to your Techmize contact or authorized distributor about test-head length, fixture selection or custom mounting requirements.

Standard accessories

Item	Description
—	EU power cable (Schuko, CEE 7/7)
TH2852-1	0 m test head (standard with TH2852 models)
TH2852-1A	1 m test head (standard with TH2853 models)

Optional test heads & calibration

Item	Description
TH2852-1	0 m test head
TH2852-1A	1 m test head
TH2852-1B	2 m test head
—	APC7mm to SMA female adapter
—	TH2852 calibration kit (open/short/load/capacitance standards)

Optional test fixtures

Item	Description
TH2852-3A	0805 parallel-electrode fixture
TH2852-3B	0603 parallel-electrode fixture
TH2852-3C	0402 parallel-electrode fixture
TH2852-3D	0201 parallel-electrode fixture
TH2852-4	Low-frequency through-hole / parallel-electrode fixture
TH2852-5	Large parallel-electrode fixture
TH2852-6	Small bottom-electrode fixture
TH26088	Permeability test fixture (§10)
TH26089	Dielectric-constant test fixture (§9)

More options in preparation — contact your Techmize sales representative or authorized distributor for details.

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