Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

NEW

Features

TH521 general characteristics

- Wide operating range up to 3.5kV/1800A
- Fully automatic fast thermal test from -50 °C to +250 °C
- Automatic creation of technical data for power devices (semiconductors and components)
- Automatic recording function prevents data loss
- AI-assisted writing of python test scripts

TH521 IV kit features

- Fully automatic fast IV measurements (Ron, BV, leakage, Vth, Vsat, etc.) for packaged and on-wafer devices
- Narrow IV pulse width (minimum 10 μs) prevents device self-heating and more accurately tests actual device performance
- Oscilloscope view (time domain view) monitors actual voltage/ current pulse waveforms for accurate measurements
- The configuration can be flexibly selected (the current range can be flexibly selected from 20 A to 200 A, 600 A, or 1800 A), and CV (Constant Voltage) and Qg (Gate Charge) are optional.

TH521 Full characterization of the kit

- Full characterization of the IV kit
- Measure the input, output, and reverse transfer capacitances (Ciss, Coss, Crss, Cies, Coes, Cres) of transistors and gate resistance (Rg) for packaged devices within 3.5 kV.
- Measure gate charge (Qg) curves for packaged devices
- Calculate power losses (conduction, drive and switching losses)

RS232	LAN	HANDER	USB HOST
standard	standard	standard	standard

TH521 Series

HOST

Dimension（mm）： 430 (W)x 311 (H)x 600 (D)

Weight：about 34.5 kg / 35kg

EXTENDER

Dimension（mm）： 425 (W)x 365 (H)x 590 (D)

Weight：about 22 kg / 33.5kg

Brief Introduction

The TH521 Series Power Device Analyzer is a comprehensive solution for circuit design, which can help power electronic circuit designers select power devices suitable for their applications and maximize the value of their power electronic products. It can evaluate all relevant parameters of the device under different operating conditions, including IV parameters (breakdown voltage and on-resistance), three-terminal FET capacitance, gate charge and power loss. The TH521 Series Power Device Analyzer for circuit design has a complete curve tracer function and other functions.

Applications

- Semiconductor power devices
  Parasitic capacitance test and C-V characteristic analysis of diodes, triodes, MOSFETs, IGBTs, thyristors, integrated circuits, optoelectronic chips, etc.
- Semiconductor materials
  Wafer cutting, C-V characteristic analysis
- Liquid crystal materials
  Elastic constant analysis, liquid crystal cutting
- Capacitor components
  Capacitor C-V characteristic test and analysis, capacitive sensor test and analysis

Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

Model

TH521-35-20	IV: 3500V/20A
TH521-35-20C	IV: 3500V/20A, CV: 10MHz, Qg
TH521-35-200	IV: 3500V/200A
TH521-35-200C	IV: 3500V/200A, CV: 10MHz, Qg

TH521-35-600	IV: 3500V/600A
TH521-35-600C	IV: 3500V/600A, CV: 10MHz, Qg
TH521-35-1800	IV: 3500V/1800A
TH521-35-1800C	IV: 3500V/1800A, CV: 10MHz, Qg

Measurable parameters and charts of MOSFETs

Parameters

BV_{DSS}： Drain-Source Breakdown Voltage

I_{DSS}： Drain Leakage Current

$I_{GSS(+)}$： Gate Leakage Current (Gate Forward Bias)

$I_{GSS(-)}$： Gate Leakage Current (Gate Reverse Bias)

$V_{GS(th)}$： Gate Threshold Voltage (VGS=VDS)

$V_{GS(th)}$： Gate Threshold Voltage (Constant VDS)

gfs*： Transconductance

$R_{DS(on)}$： Drain-Source On-Resistance

$V_{DS(on)}$： Drain-Source On-Voltage

V_{SD}： Body Diode Forward Voltage Internal Gate Resistance

Rg： Internal Gate Resistance

Ciss： Input Capacitance

Coss： Output Capacitance

Crss： Reverse Transfer Capacitance

Qg： Total Gate Charge

Qgs： Gate-Source Charge

Qgd： Gate-Drain Charge

Vgs(pl)： Gate-Source Plateau Voltage

Curves

I_D-V_{DS}： ID-VDS Curve with VGS Variation

I_D-V_{GS}： ID-VGS Curve at Constant VDS

G_{fs}-V_{Gs}*： Gfs-VGs Curve at Constant VDS

$R_{DS(on)}$-I_D： RDS(on)-ID Curve with VGS Variation

$R_{DS(on)}$-V_{GS}： RDS(on)-VGS Curve with ID Variation

V_{DS}-V_{GS}： VDS-VGS Curve with ID Variation

I_S-V_S： Forward Current Characteristics of Internal Diode

C-V： Capacitance-VDS Curve (Including Ciss, Coss, and Crss)

Qg-Vgs： Gate Charge-VGS Curve

Measurable parameters and charts of IGBTs

Parameters

BV_{CES}： Collector-Emitter Breakdown Voltage

I_{CES}： Collector Leakage Current

$I_{GES(+)}$： Gate-Emitter Leakage Current (Gate Forward Bias)

$I_{GES(-)}$： Gate-Emitter Leakage Current (Gate Reverse Bias)

$V_{GE(th)}$： Gate Threshold Voltage (VGE=VCE)

$V_{GE(th)}$： Gate Threshold Voltage (Constant VCE)

gfs*： Transconductance

VF： Freewheeling Diode Forward Voltage

Rg： Internal Gate Resistance

Cies： Input Capacitance

Coes： Output Capacitance

Cres： Reverse Transfer Capacitance

Qg： Total Gate Charge

Qgs： Gate-Emitter Charge

Qgc： Gate-Collector Charge

Vge(pl)： Gate-Emitter Plateau Voltage

Curves

I_C-V_{CE}： IC-VCE Curve at Constant VGE

I_C-V_{GE}： IC-VGE Curve at Constant VCE

gfs-V_{GE}*： Gfs-VGE Curve at Constant VCE

V_{CE}-V_{GE}： VCE(sat) Collector Saturation Voltage

IF-VF： Freewheeling Diode Forward Characteristics

V_{CE}-V_{GE}： VCE-VGE Curve with IC Variation

C-V： Capacitance-VCE Curve (Including Cies, Coes, and Cres)

Qg-Vge： Gate Charge-VGE Curve

Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

Measurable parameters and charts of BJTs

Parameters

I_{CEO}: Collector-Emitter Cutoff Current

I_{EBO}: Emitter-Base Cutoff Current

hft*: DC Current Gain

$V_{CE(sat)}$: Collector-Emitter Saturation Voltage

$V_{BE(sat)}$: Base-Emitter Saturation Voltage

$V_{BE(on)}$: Base-Emitter Onset Voltage

$V_{(BR)CEO}$: Collector-Emitter Breakdown Voltage

$V_{(BR)EBO}$: Emitter-Base Breakdown Voltage

Curves

I_C-V_{CE}: IC-VCE Curve with Varying IB

hfe-Ic*: hfe-IC Curve at Constant VCE

V_{CE}-I_C*: VBE-IC Curve at Constant VCE

Measurable parameters and charts of diodes

Parameters

V_{DC}: DC Blocking Voltage

V_F: Forward Voltage

IR: Reverse Current

C: Total Capacitance

Curves

I_F-V_F: Forward Characteristics

I_R-V_R: Reverse Characteristics

C-V: Capacitance-Reverse Voltage Characteristics

Measurable parameters and diagrams of components

Inductor

L: Inductance at Zero Bias Current

RDC: DC Resistance

Resistor

R: Resistance at Specified Voltage

Shunt Resistor

R: Resistance at Specified Current

Capacitor

Parameters

C: Capacitance at Zero Bias Voltage

$C_{(biased)}$: Voltage Coefficient Capacitance

Leak: Leakage Current

$R_{(insulation)}$: Insulation Resistance

Curves

C_V: Capacitance-Voltage Characteristic

Connector

Parameters

$R_{(contact)}$: Contact Resistance

BV: Withstand Voltage

Leak: Leakage Current

$R_{(insulation)}$: Insulation Resistance

$C_{(insulation)}$: Insulation Capacitance

Curves

R-I: Contact Resistance and Conduction Current

Cable

Parameters

C: Capacitance

$R_{(insulation)}$: Insulation Resistance

$R_{(conduction)}$: Conduction Resistance

Curves

R-I: Contact Resistance vs. Conduction Current

Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

Measurable parameters and diagrams of components

Relay

Parameters

$R_{(contact)}$: Contact Resistance

$R_{(coil)}$: Coil Resistance

$R_{(open\ contacts)}$: Insulation Resistance Between Open Contacts

$R_{(coil\text{-}contact)}$: Insulation Resistance Between Coil and Contacts

$V_{(pick\text{-}up)}$: Pull-In/Set Voltage

$V_{(drop\text{-}out)}$: Drop-Out/Reset Voltage

$I_{(operating)}$: Operating Current

$C_{(open\ contacts)}$: Capacitance Between Open Contacts

$C_{(coil\text{-}contact)}$: Capacitance Between Coil and Contacts

Curves

R-I: Conduction Resistance vs. Conduction Current

Optocoupler / Photoelectric Coupler

Parameters

VF: LED Forward Voltage

IR: LED Reverse Current

CT: LED Total Capacitance

BV_{CEO}: Detector Collector-Emitter Breakdown Voltage

BV_{ECO}: Detector Emitter-Collector Breakdown Voltage

I_{CEO}: Detector Collector Dark Current

Cce: Detector Collector-Emitter Capacitance

$VCE_{(sat)}$: Detector Collector-Emitter Saturation Voltage

CS: Input-Output Capacitance

RS: Insulation Resistance

B_{VS}: Dielectric Withstand Voltage

Curves

I_F-V_F: Forward Current vs. Forward Voltage

I_{FP}-V_{FP}: Pulse Forward Current vs. Pulse Forward Voltage

I_C-V_{CE}: Collector Current vs. Collector-Emitter Voltage

I_C-I_F: Collector Current vs. Forward Current

C_{ce}-V_{CE}: Collector-Emitter Capacitance vs. Collector-Emitter Voltage

Solid State Relay (SSR)

Parameters

VE : LED Forward Voltage

VR: LED Reverse Voltage

$IF_{(on)}$: LED Operating Current

$IF_{(off)}$: LED Reverse Current

$R_{(on)}$: On-State Resistance

$I_{(leak)}$: Off-State Leakage Current

$C_{(out)}$: Output Capacitance

$C_{(iso)}$: Input-Output Capacitance

$R_{(iso)}$: Input-Output Insulation Resistance

Curves

I_F-V_F: Forward Current vs. Forward Voltage

I_L-V: Output Current vs. Output Voltage

$I_{(off)}$-V_L: Off-State Leakage Current vs. Load Voltage

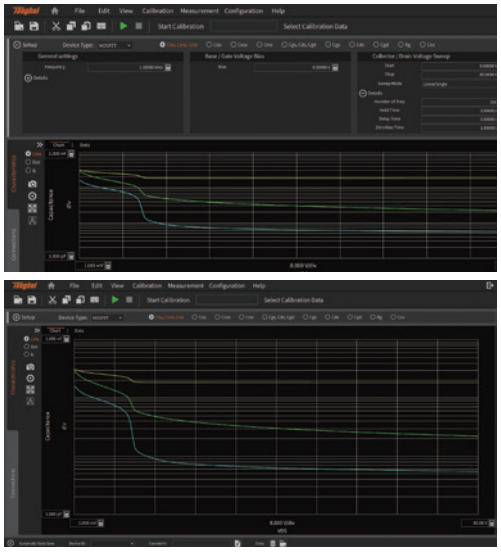
$C_{(out)}$-V_L: Output Capacitance vs. Load Voltage

Component & Device Parameter Test Instruments

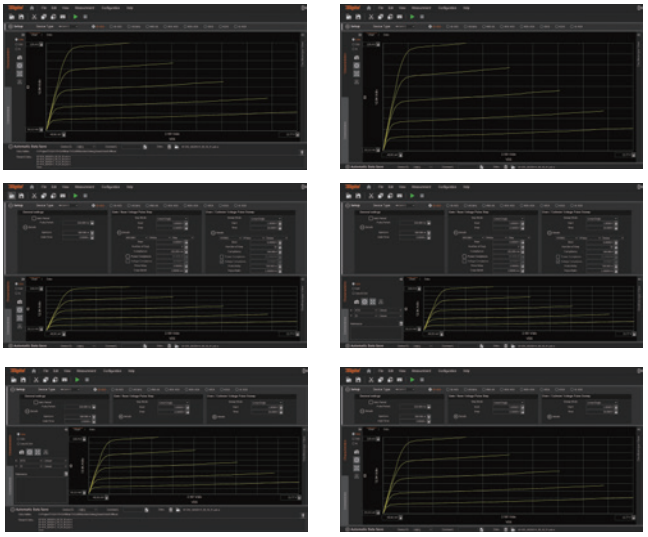
Ⅰ. TH521 Series Power Device Analyzer

The function of the instrument

CV

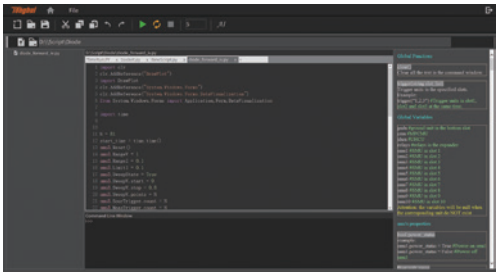


IV



QG

TSP



Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

Specifications

MCSMU			
Voltage range, resolution and accuracy			
Voltage range	Output/measurement resolution	Output/measurement accuracy(% + mV + mV)	Max Current
200mV	200nV	±(0.06 + 0.14 + Io x 0.05)	1A
2V	2μV	±(0.06 + 0.6 + Io x 0.5)	1A
20V	20μV	±(0.06 + 3 + Io x 5)	1A
40V	40μV	±(0.06 + 3 + Io x 10)	1A
Current range, resolution and accuracy	Output/measurement resolutio	Output/measurement accuracy(%+A+A)	Max Voltage
10μA	10pA	±(0.06+ 1E-8 + Vo x 1E-10)	30V
100μA	100pA	±(0.06 + 2E-8 + Vo x 1E-9)	30V
1mA	1nA	±(0.06 + 2E-7 + Vo x 1E-8)	30V
10mA	10nA	±(0.06 + 2E-6 + Vo x 1E-7)	30V
100mA	100nA	±(0.06 + 2E-5 + Vo x 1E-6)	30V
1A	1μA	±(0.4 + 2E-4 + Vo x 1E-5)	30V
Typical resolution	6½ Digits		
Maximum voltage	±30V		
Minimum current	10pA		
Maximum pulse duty cycle	5%(When the peak value exceeds 100mA)		
Minimum pulse width	10μs		
Maximum pulse width	100ms (When the peak value exceeds 100mA)		
Maximum DC current	±100mA		
Maximum pulse peak value	±1A		
Maximum pulse base value	±50mA(When the peak value exceeds 100mA)		

HCSMU			
Voltage range, resolution and accuracy			
Voltage range	Output/measurement resolution	Output/measurement accuracy(% + mV + mV)	Max Current
200mV	200nV	±(0.06 + 0.6 + Io x 0.05)	20A
2V	2μV	±(0.06 + 0.6 + Io x 0.5)	20A
20V	20μV	±(0.06 + 3 + Io x 5)	20A
40V	40μV	±(0.06 + 3 + Io x 10)	1A
Current range, resolution and accuracy	Output/measurement resolution	Output/measurement accuracy(%+A+A)	Max Voltage
10μA	10pA	±(0.06+ 1E-8 + Vo x 1E-10)	40V
100μA	100pA	±(0.06 + 2E-8 + Vo x 1E-9)	40V
1mA	1nA	±(0.06 + 2E-7 + Vo x 1E-8)	40V
10mA	10nA	±(0.06 + 2E-6 + Vo x 1E-7)	40V
100mA	100nA	±(0.06 + 2E-5 + Vo x 1E-6)	40V
1A	1μA	±(0.4 + 2E-4 + Vo x 1E-5)	40V
20A	20μA	±(0.4 + 2E-3+Vo x 1E-4)	20V
Typical resolution	6½ Digits		
Maximum voltage	±40V		
Minimum current	10pA		
Maximum pulse duty cycle	1%(When the peak value exceeds 1A)		
Minimum pulse width	50μs		
Maximum pulse width	1ms(When the peak value exceeds 1A)		
Maximum DC current	±1A		
Maximum pulse peak value	±20A		
Maximum pulse base value	±100mA (When the peak value exceeds 1A)		

Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

MPSMU			
Voltage range, resolution and accuracy			
Voltage range	Output/measurement resolution	Output/measurement accuracy(% + mV + mV)	Max Current
100mV	100nV	±(0.06 + 0.14 + Io x 0.05)	100mA
1V	1μV	±(0.06 + 0.6 + Io x 0.5)	100mA
10V	10μV	±(0.06 + 3 + Io x 5)	100mA
100V	100μV	±(0.012 + 2.5 + Io x 10)	20mA(≥40V) 50mA(≤40V) 100mA(≤20V)
Current range, resolution and accuracy	Output/measurement resolution	Output/measurement accuracy(%+A+A)	Max Voltage
1nA	1fA	±(0.1 + 2E-13 + Vo x 1E-15)	100V
10nA	10fA	±(0.1 + 1E-12 + Vo x 1E-14)	100V
100nA	100fA	±(0.05 + 2E-11 + Vo x 1E-13)	100V
1μA	1pA	±(0.05 + 1E-10 + Vo x 1E-12)	100V
10μA	10pA	±(0.04 + 2E-9 + Vo x 1E-11)	100V
100μA	100pA	±(0.03 + 3E-9 + Vo x 1E-10)	100V
1mA	1nA	±(0.03 + 6E-8 + Vo x 1E-9)	100V
10mA	10nA	±(0.03 + 2E-7 + Vo x 1E-8)	100V
100mA	100nA	±(0.04 + 6E-6 + Vo x 1E-7)	100V(≤20mA) 40V(≤50mA) 20V(≤100mA)
Typical resolution	6½ Digits		
Maximum voltage	±100V		
Minimum current	1fA		

HVSMU			
Voltage range, resolution and accuracy			
Voltage range	Output/measurement resolution	Output/measurement accuracy(% + mV)	Max Current
200V	200μV	±(0.03+40)	8mA
500V	500μV	±(0.03+100)	8mA
1500V	1.5mV	±(0.03+300)	8mA
3500V	3.5mV	±(0.03+600)	4mA
Current range, resolution and accuracy	Output/measurement resolution	Output/measurement accuracy(%+A+A)	Max Voltage
10nA	10fA	±(0.1 + 1E-9 + Vo x 8E-12)	3500V
1μA	1pA	±(0.05 + 1E-9 + Vo x 8E-12)	3500V
100μA	100pA	±(0.03 + 3E-9 + Vo x 1E-11)	3500V
10mA	10nA	±(0.03 + 2E-7+ Vo x 1E-9)	1500V
Typical resolution	6½ Digits		
Maximum voltage	±3500V		
Minimum current	10fA		

Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

MFCMU		
Frequency	Frequency range	1kHz~10MHz
	Minimum frequency resolution	1mHz
	Frequency accuracy	±0.008%
AC level	Level range	0~1V
	Resolution	0.1mVrms
	Precision	±(10% of the set value + 2mV)
DC bias	Range	0~±25V
	Resolution	1mV
	Accuracy	1% of the set voltage + 8mV
Output impedance		100Ω
Test terminal configuration		Four-terminal pair
Test time		0.05plc~100plc(1plc=20ms)
Capacitance	Display range	0.00001pF~9.99999F
	Maximum accuracy	0.1%

UHCU			
Voltage range, resolution and accuracy			
Voltage range	Measurement resolution	Output resolution	Output/measurement accuracy(% + mV)
60V	100μV	200μV	±(0.2+10)
6V(Only measure)	10μV	------	------
Current range, resolution and accuracy	Measurement resolution	Output resolution	Output/measurement accuracy(%+A+A)
200A	200uA	1mA	±(0.6 + 0.3 + 0.01*Vo)
600A	500uA	1mA	±(0.6 + 0.3 + 0.01*Vo)
1800A	2mA	4mA	±(0.8 + 0.9 + 0.02*Vo)
Maximum pulse duty cycle	0.4%(600A range)；0.1%(1800A range)		
Minimum pulse width	10μs		
Maximum pulse width	1ms(600A range)；500μs(1800A range)		
Maximum pulse base value	200A,600A,1800A		
Pulse resolution	2μs		

Component & Device Parameter Test Instruments

Ⅰ. TH521 Series Power Device Analyzer

HVMCU	
Maximum Output Specification	
+ 3500V/4mA	+ 1500V/8mA

Peak Output Specification	
Voltage Range	Peak Power
±2200V	600W
±1500V	900W

Voltage Range，Resolution，Accuracy				
Voltage Range	Setting Resolution	Measurement Resolution	Setting Accuracy[1,2,3]±（%+V）	Measurement Accuracy[1,2]±（%+V）
±2200V	3mV	3mV	±（5+20）	±（0.8+1.8）
±1500V	1.5mV	3mV	±（5+20）	±（0.8+1.8）

1. Measurement Accuracy: ± (6% of Reading + Fixed Voltage Offset)
2. ccuracy Definition Conditions: Tested with 100 μs pulses at the 1.1 A and 2.5 A ranges; tested with 1 ms pulses at the 100 mA range.
3. Setting Accuracy: Defined under open-circuit conditions.

Current Range，Resolution，Accuracy[1, 2]		
Current range	Measurement Resolution	Measurement Accuracy1±（%+A+A）
±2.5A	4μA	±（0.9+4E-3+Vo×3E-7）
±1.1A	4μA	±（0.9+4E-3+Vo×3E-7）
±110mA	200nA	±（0.9+2E-4+Vo×3E-7）

1. When the current exceeds 1.1 A, the manufacturer provides additional performance specifications or parameter limitations.
2. The relevant accuracy or characteristics are valid under the condition of averaging values from 20 sampling points.

Pulse width and resolution		
Output range	Pulse width	Resolution
1500V/2.5A	10μs-100μs	2μs
2200V/1.1A	10μs-100μs	2μs
2200V/110mA	10μs-1ms	2μs

Additional features (HVMCU charge capacitor 0.22 μF)	
Output resistance range	Nominal value
1500V/2.5A	600Ω
2200V/1.1A	2000Ω
2200V/110mA	20000Ω

Model module configuration

Slot number	TH521-35-20	TH521-35-20C	TH521-35-200	TH521-35-200C	TH521-35-600	TH521-35-600C	TH521-35-1800	TH521-35-1800C
0	GNDU	GNDU	GNDU	GNDU	GNDU	GNDU	GNDU	GNDU
1	MPSMU	MPSMU	MPSMU	MPSMU	MPSMU	MPSMU	MPSMU	MPSMU
2	NA	MFCMU	NA	MFCMU	NA	MFCMU	NA	MFCMU
3	MCSMU	MCSMU	MCSMU	MCSMU	MCSMU	MCSMU	MCSMU	MCSMU
4	NA	MCSMU	NA	MCSMU	NA	MCSMU	NA	MCSMU
5	HCSMU	HCSMU	MCSMU	MCSMU	MCSMU	MCSMU	MCSMU	MCSMU
6			MCSMU	MCSMU	MCSMU	MCSMU	MCSMU	MCSMU
7	HVSMU	HVSMU	HVSMU	HVSMU	HVSMU	HVSMU	HVSMU	HVSMU
8								
9	NA / MCSMU (HVMCU as Optional)							
10	NA / MCSMU (HVMCU as Optional)							