 <p>MICROELETTRICA SCIENTIFICA MILANO ITALY</p> <hr/> <p>test report nokian.doc</p>	<h1>TEST REPORT</h1>	<p>DOC. NR. : BC DA 04 02 002</p> <hr/> <p>Rev. 0 Pag. 1 di 19</p>
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DAMPING RESISTOR

- Customer : NOKIAN CAPACITORS
- Project : TV61583 Sähköradat
- Purchase order : 340031
- Order acknowledg. : O DA 04 02 002
- Equipment under test : Damping Resistor
22kW - 13A - 130Ω - 250kV
- Test references : 250kV BIL, HV Terminal to Ground

Ortile

0	Issue		G. Coti	Ortile
Rev.	Description	Date	Prepared	Approved



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The test on a complete unit was carried out on 13.04.2004 at MICROELETTRICA SCIENTIFICA.

Test performed by : Mr. M. Cervelli (MICROELETTRICA SCIENTIFICA)

Test witnessed by : Mr T. Ortile (MICROELETTRICA SCIENTIFICA)

Test results : Passed

1 Test object

- One Damping Resistor in module :dimensions and data as per dwg. CDA 04 02 002
- Serial number : O DA 04 02 002 -1 / 001
- Year of construction :2004
- Ohmic value at 20 °C :124 ±5%
- Nominal current :13 A
- Lightning impulse withstand levels
 - High voltage terminal to ground : 250 kV_{crest}

2 Measurement of resistance at d.c. current

2.1.1 Measurement before the “Lightning impulse voltage withstand test”

- Measured total value at ambient temperature R_1 : 122.9 Ohm (limit values are 117.8 to 130.2 Ohm)
- Ambient temperature t_{amb} : 19 °C
- **Test results** : **within acceptance limits**

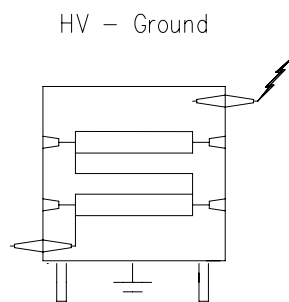
2.1.2 Measurement after the “Lightning impulse voltage withstand test”

- Measured total value at ambient temperature R_1 : 122.9 Ohm
- Ambient temperature t_{amb} : 20 °C
- **Test results** : **within acceptance limits**

3 Lightning impulse voltage withstand test

3.1 Test configuration

- Withstand impulse voltage tests according to the following configuration :



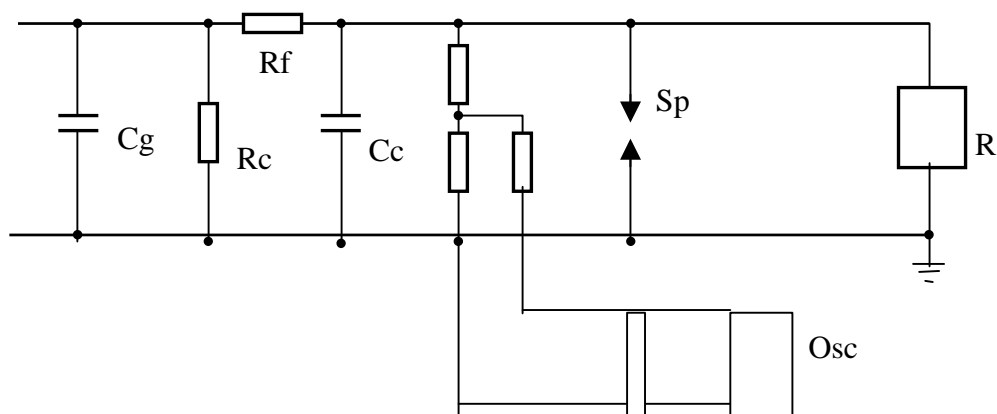
3.2 Lightning impulse withstand level (LIWL)

- HV-G High voltage terminal to ground $250 \text{ kV}_{\text{crest}}$

3.3 Specified tests

- 1 reduced wave, positive and negative polarity
- 15 full waves, positive and 15 negative

3.4 Test circuit



Cg	Capacitors banks	8 x 0.5 μ F - 100 kV (DUCATI)
Rc	Tail resistor	see § 6.5 – 6.6 – 6.7
Rf	Front resistor	see § 6.5 – 6.6 – 6.7
Cc	Capacitor divider	3000 pF - 500 kV (ICAR)
Sp	Sphera gap	No two balls \varnothing 250 mm
Osc	Oscilloscope	HP54645A/D (HEWLETT PACKARD)
R	Test object	



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3.5 High voltage terminal to ground

3.5.1 Calibration (Positive and negative polarity)

Sphere distance	46 mm
Tail resistor (Rc)	4991 Ohm
Front resistor (Rf)	186 Ohm
Atmospheric pressure	1012 hPa
Air temperature	19 °C
Correction factor	0.985
Peak voltage	123 kV
Front time	1.38 μs (diagram nr. 48)
Tail time	80.26 μs (diagram nr. 49)
Voltage divider ratio (kV / V)	8.98

3.5.2 Tests results

Polarity	Crest voltage requested	A: Passed (⊕) Failed (x)															
		B: Oscillogram number															
		C: Crest voltage															
Positive	250 kV	A	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
		B	55	56					57				58				59
		C	135	255	253	251	250	250	242	246	252	253	254	252	251	250	251
Negative	250 kV	A	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
		B	50	51				52				53					54
		C	145	265	261	262	265	265	262	253	250	248	248	250	251	251	247

4 Instruments list used for the above measurements/tests

- Digital ohmmeter CROPICO – Mod. D04A – No. 0090
- Checked on 08.05.2003 - Due date 25.07.1999 8.5.0./8.11/03
- Digital multimeter ABB METRAWATT – Mod. MA5D – No. 0056
Checked on 07.11.2002 - Due date 07.11.2003
- Digital multimeter ABB METRAWATT – Mod. MA5D – No. 0064
Checked on 13.11.2002 - Due date 11.11.2003
- Oscilloscope HEWLETT PACKARD – Mod. 54645A/D – No. 0073
Checked on 08.05.2003 - Due date 08.05.2004

5 Enclosures

- Diagram 48 to 54, *Lightning impulse voltage withstand test – H.V. to Ground – Negative polarity.*
- Diagram 55 to 59, *Lightning impulse voltage withstand test – H.V. to Ground – Positive polarity.*

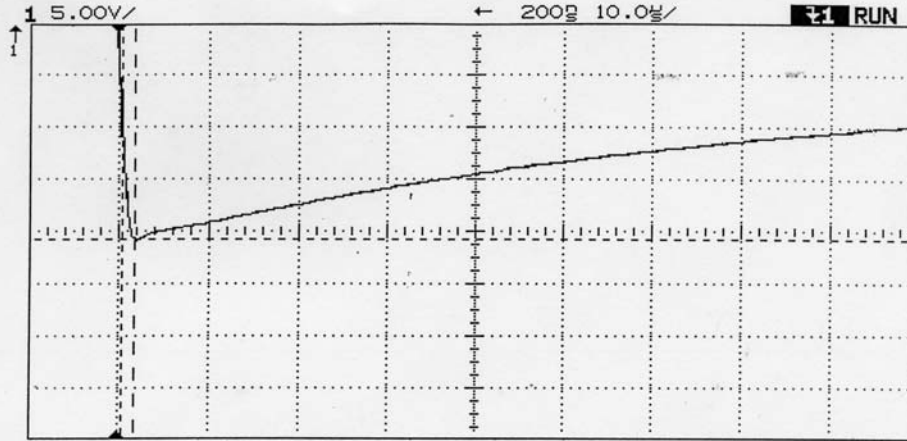


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HP54645A System A.01.01



t1 = 740.0ns t2 = 2.120us Δt = 1.380us 1/Δt = 724.6kHz

Vertical	State	Volts/div	Position	Coupling	BW limit	Invert	Probe
1	on	5.000 V	20.00 V	dc	off	off	1:1 A
2	off	500.0mV	500.0mV	dc	off	off	1:1 A

Horizontal	Mode	Main s/div	Delay	Reference
main	main	10.00us	200.0ns	left

Trigger	Source	Level	Slope	Coupling	Rej	NoiseRej	Holdoff
edge	1	-468.7mV	-	dc	off	off	200.0ns

Display	Mode
normal	normal

Cursors	V1(1)	V2(1)	dV(1)
	-20.78 V	-62.50mV	20.72 V
	t1 = 740.0ns	t2 = 2.120us	dt = 1.380us 1/dt = 724.6kHz

diagramma 48

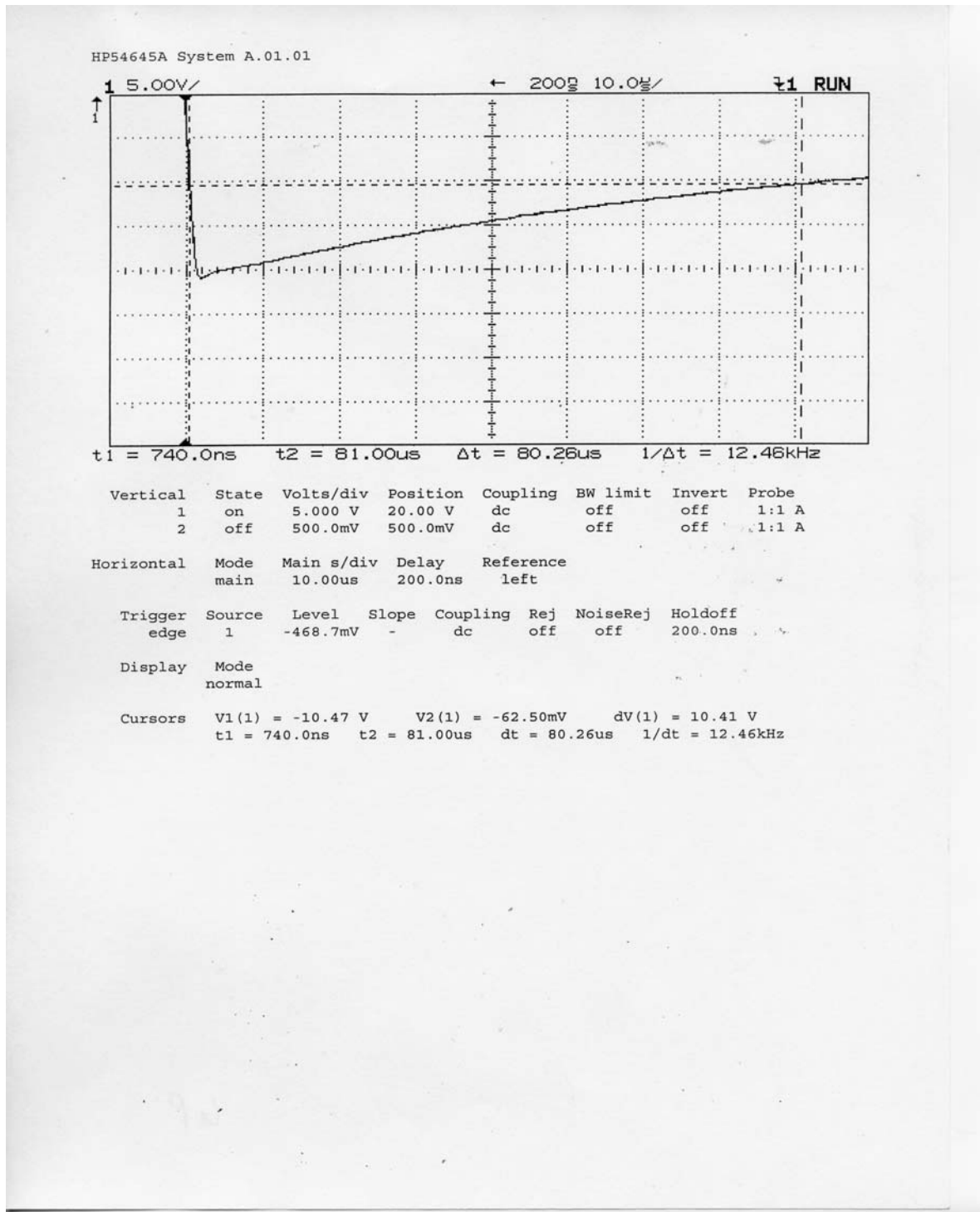


diagramma 49

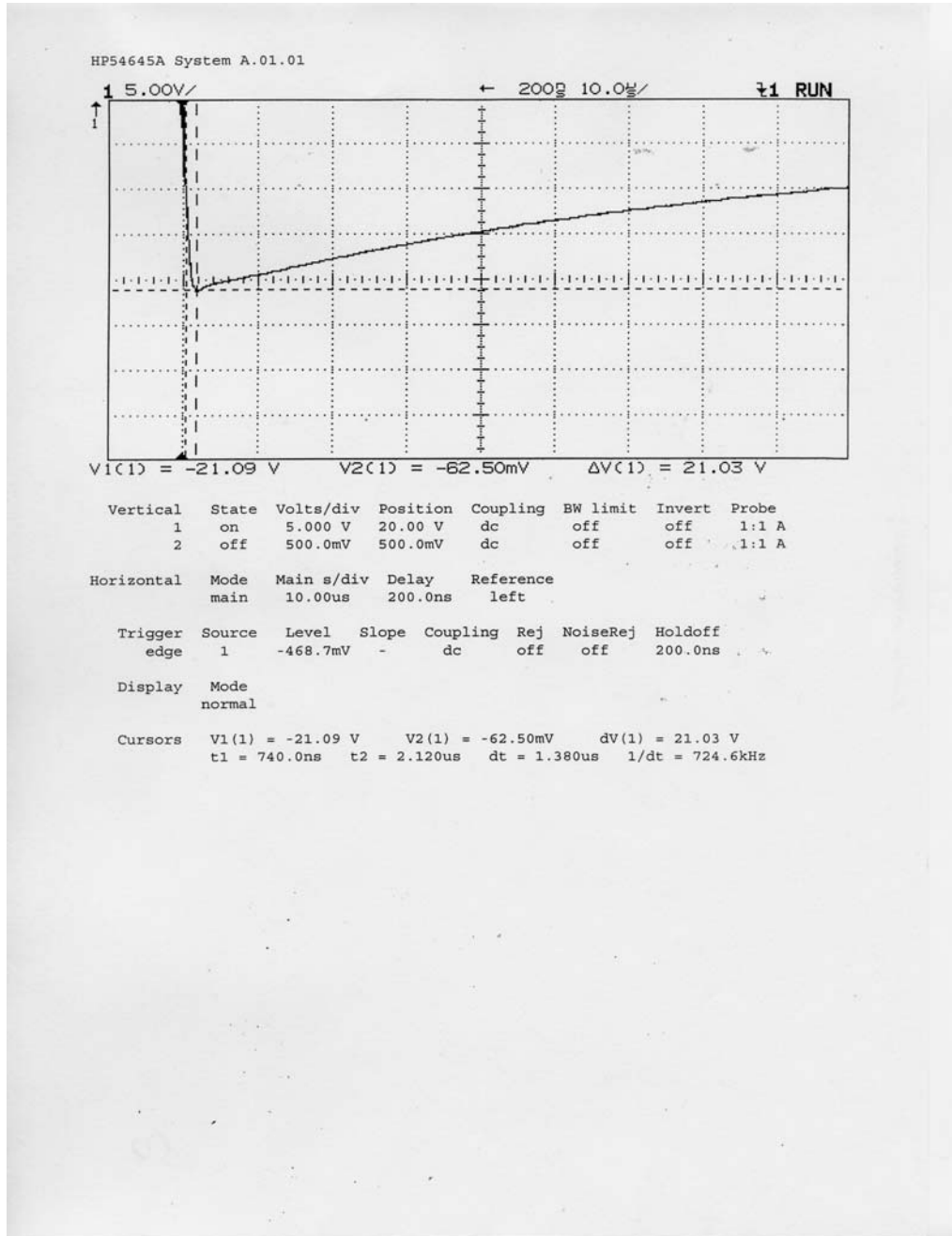


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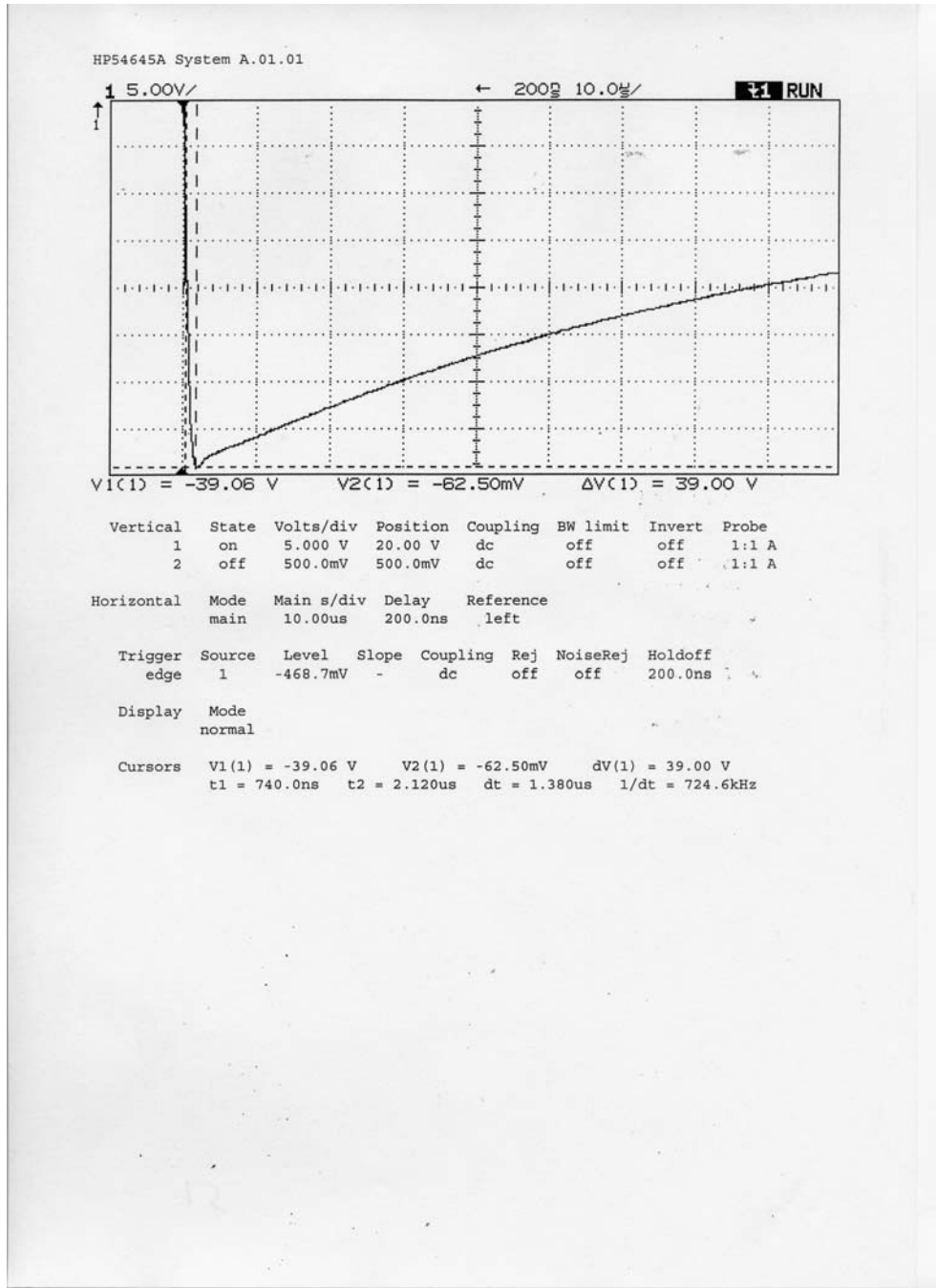


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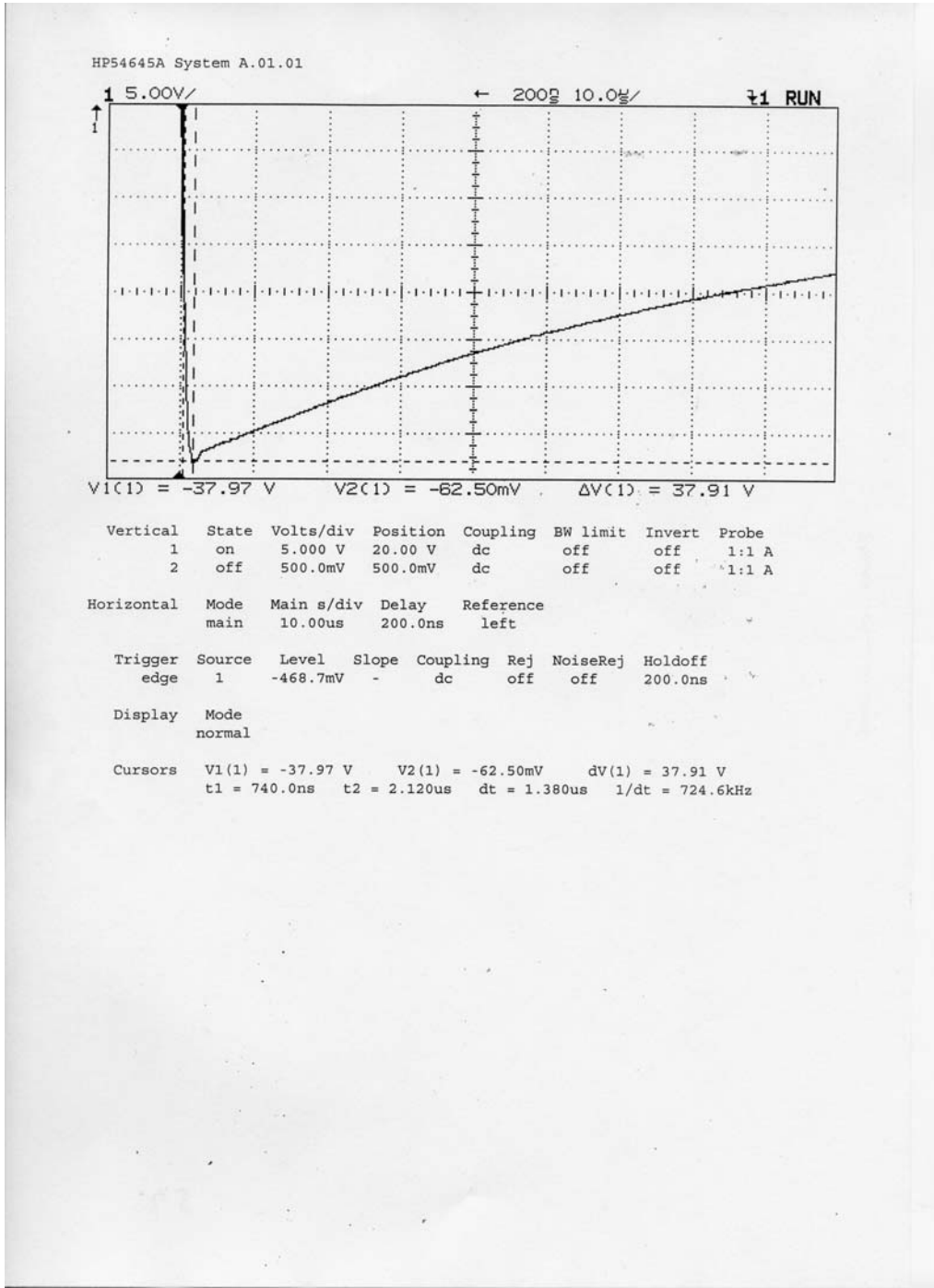


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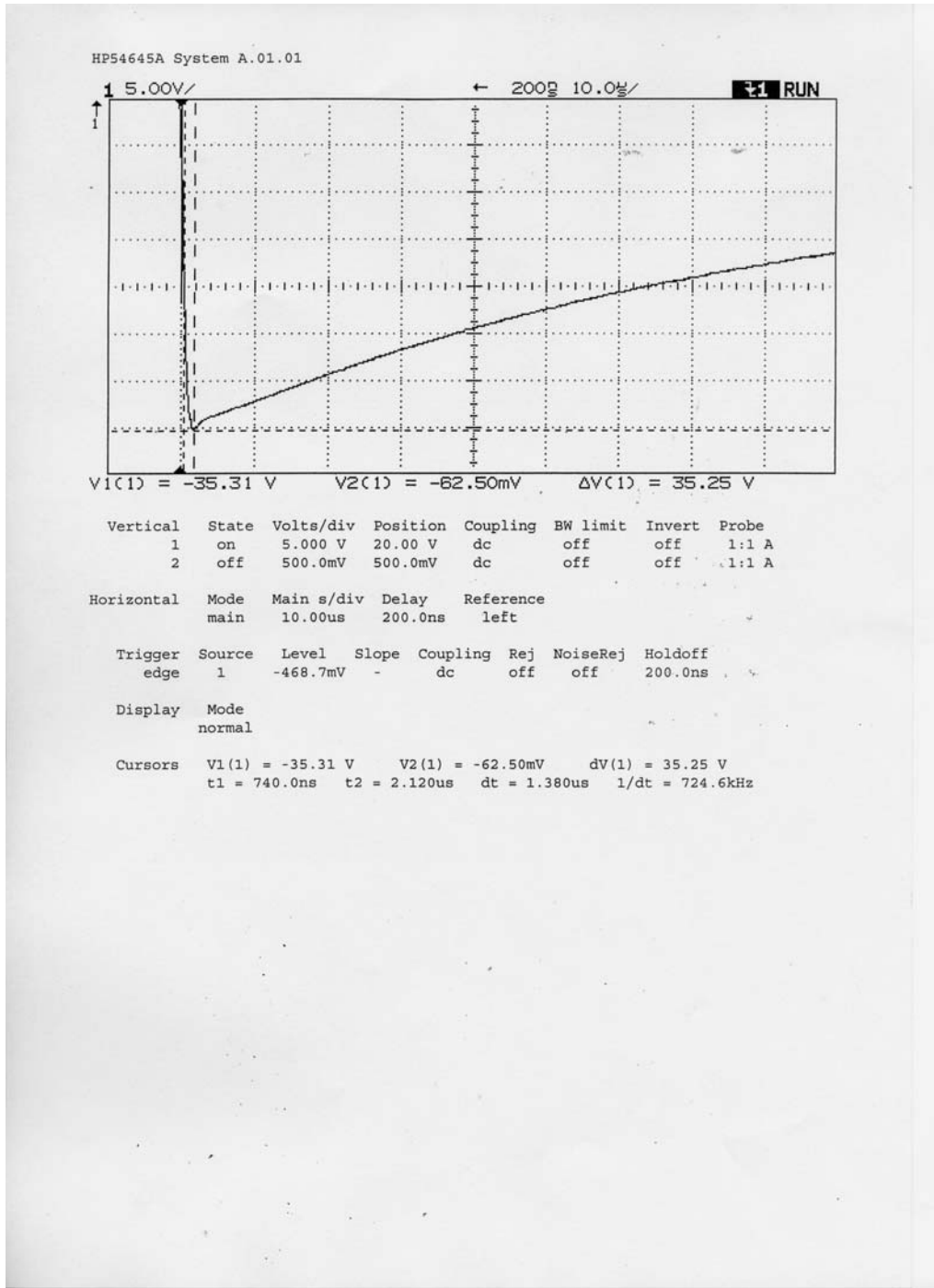


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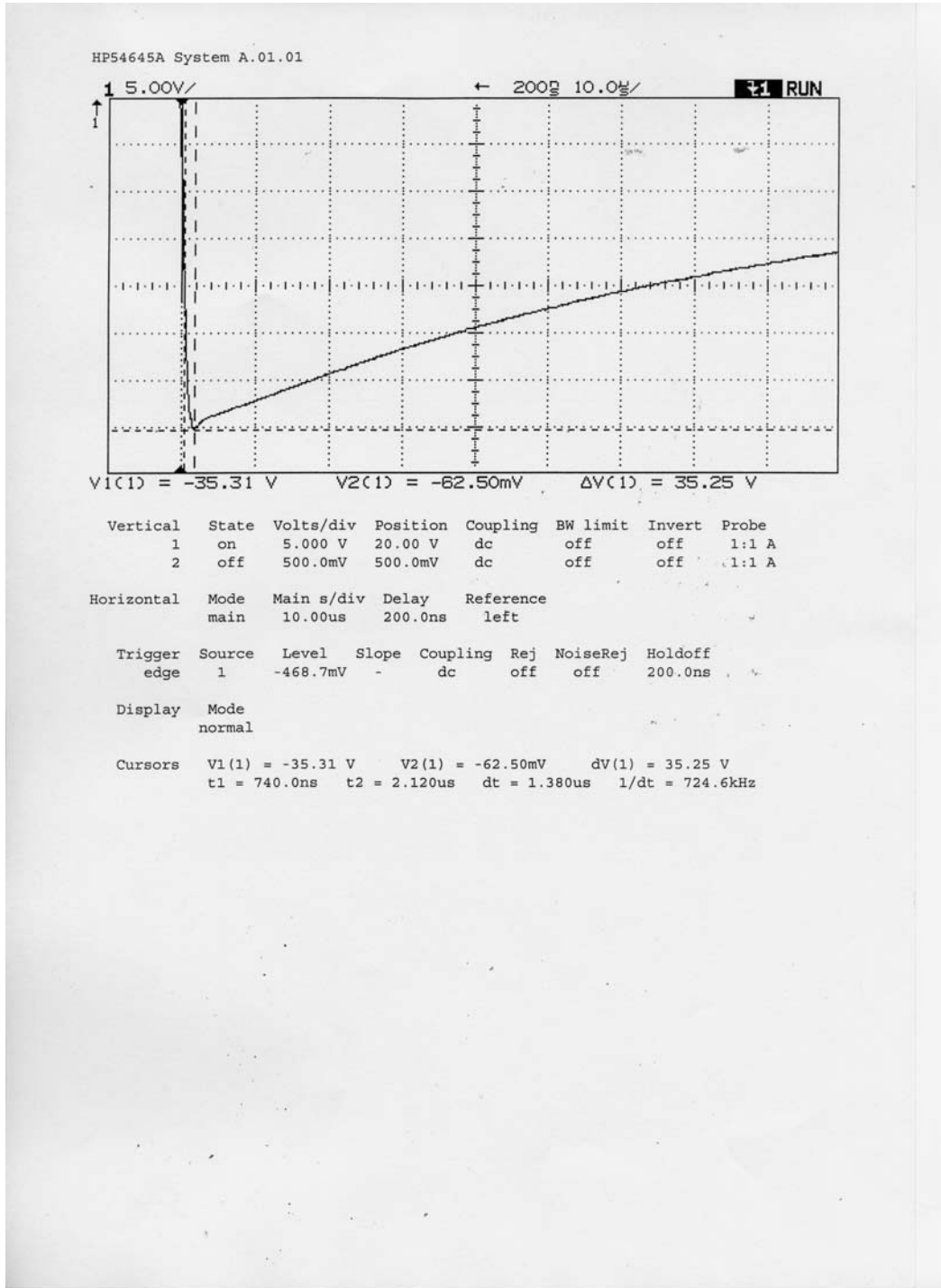


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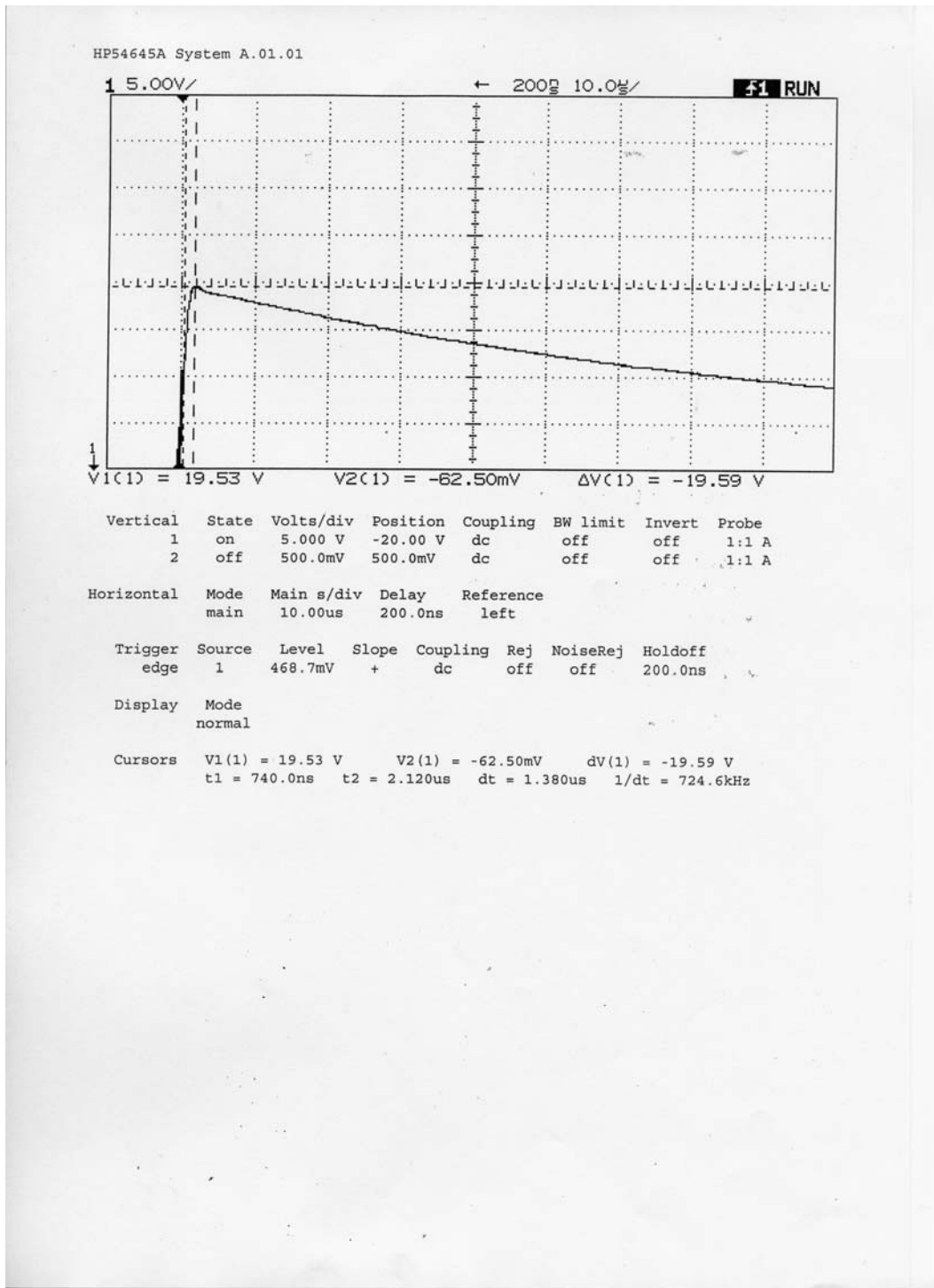


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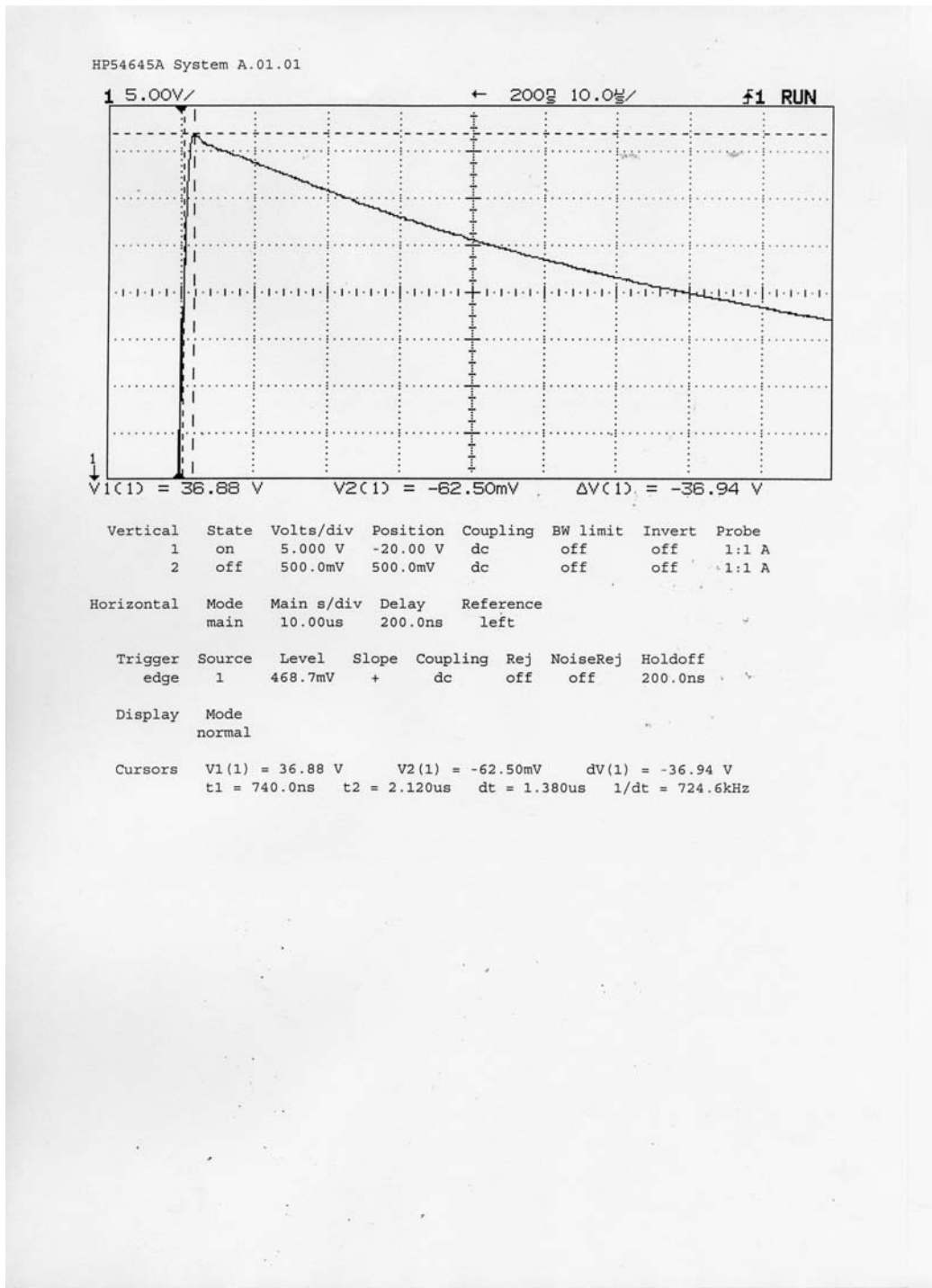


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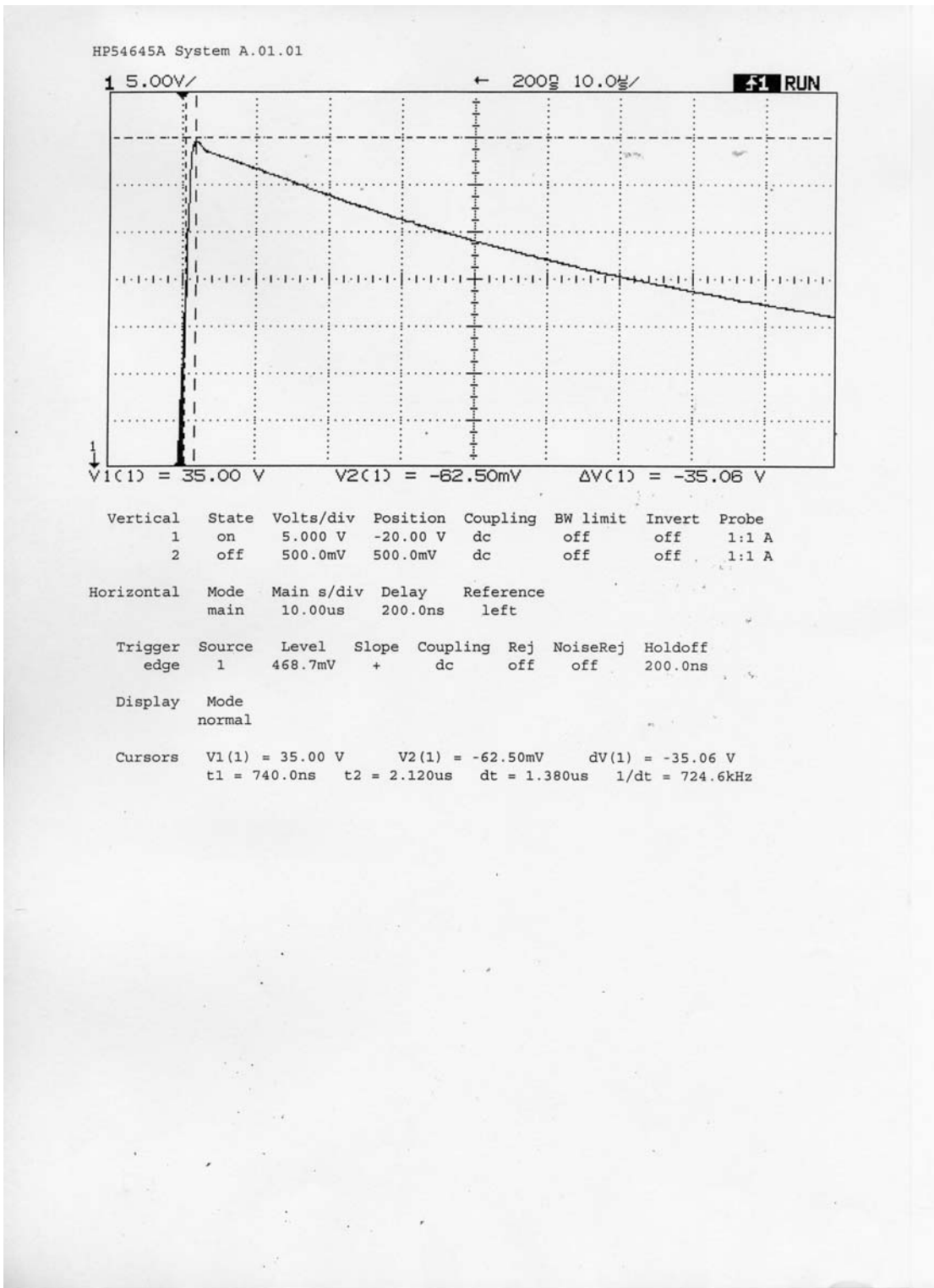


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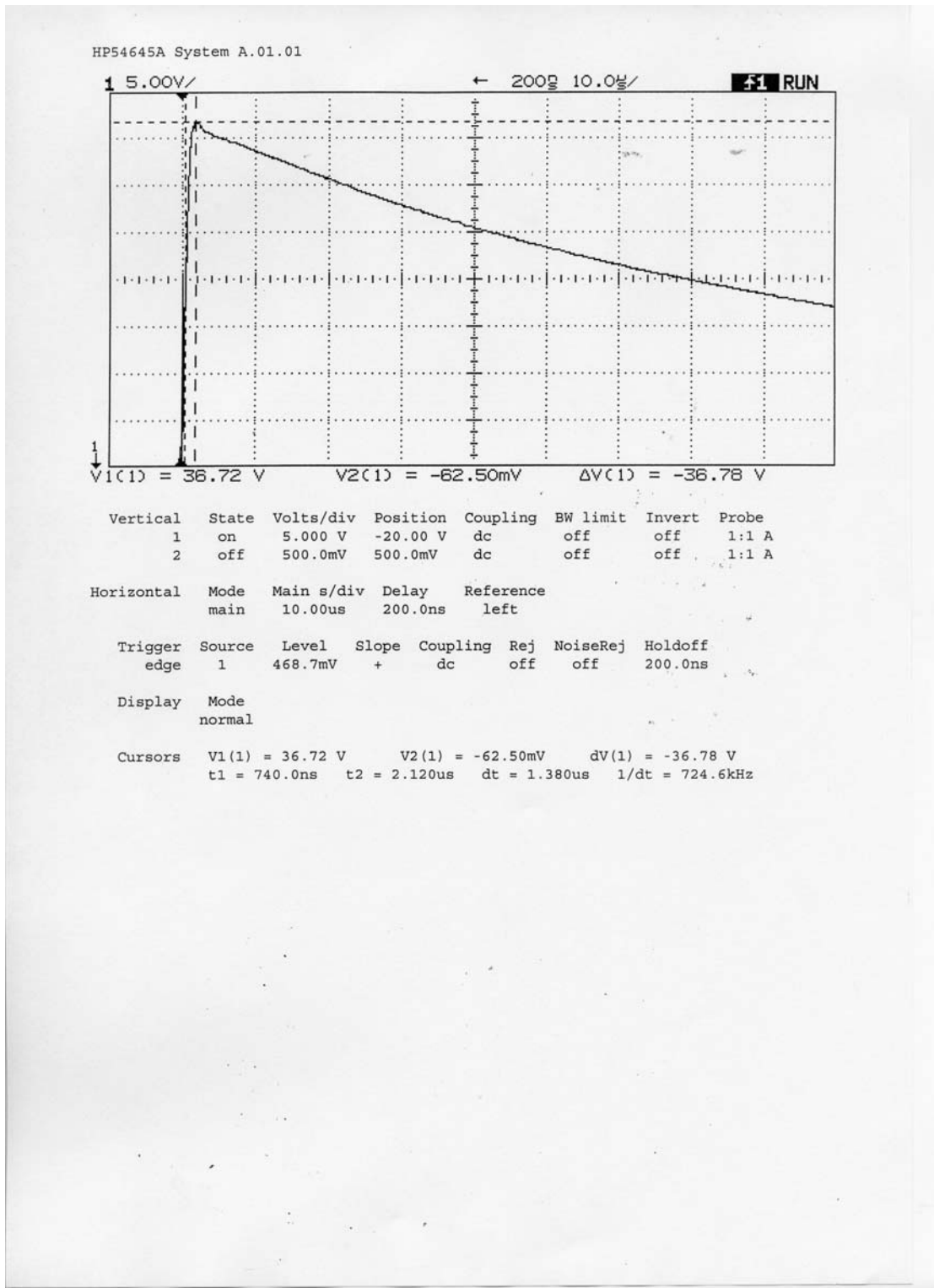


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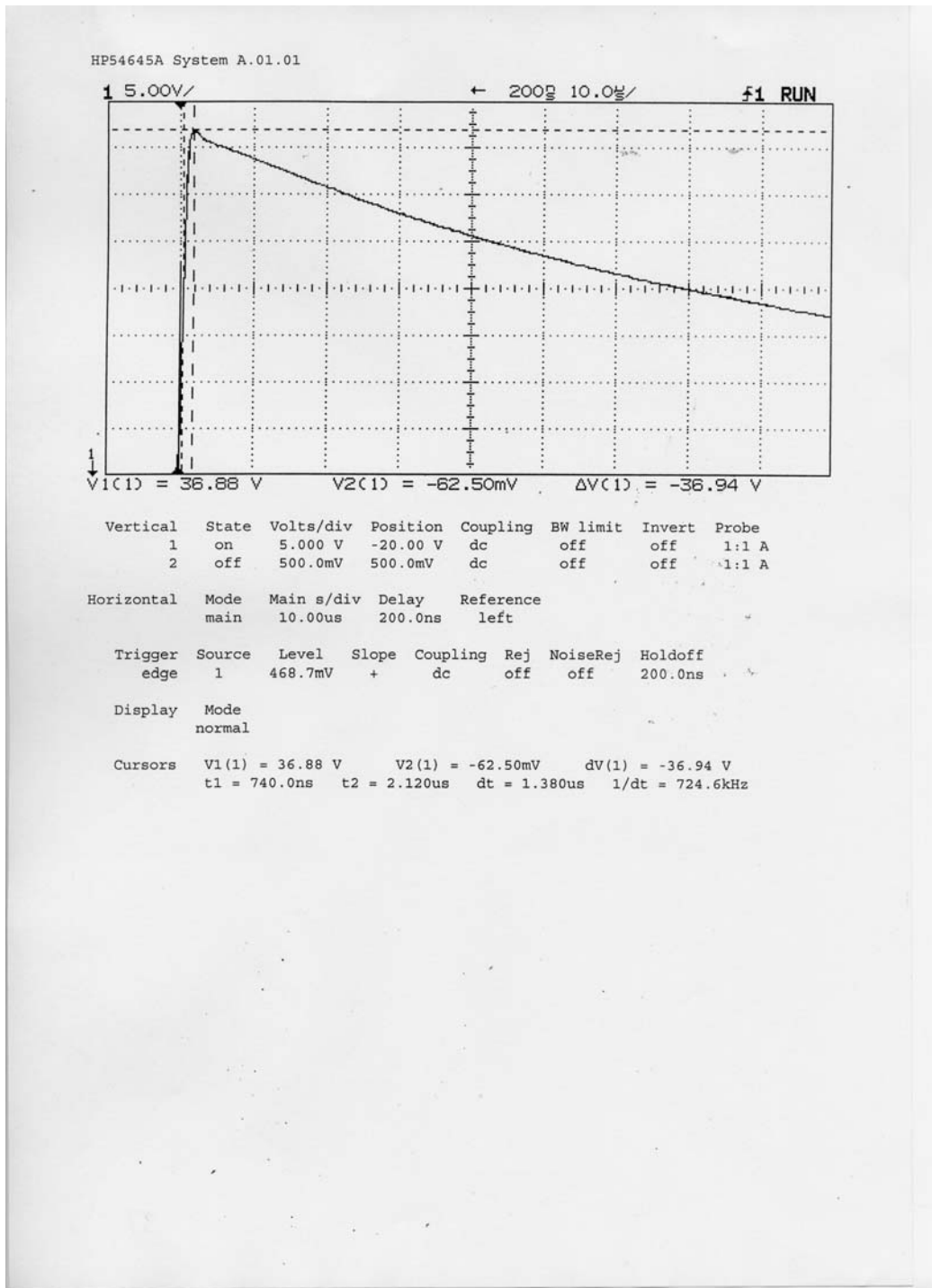


diagramma 59