Independent, accredited testing station · Member laboratory of STL and LOVAG

TEST RECORD

NO. 07385-17-0668

THS Industria e Comercio Ltda. Rua Ernesto Biester, 59 CEP 04777-120 - Sao Paulo BRAZIL		**CLIENT**
THS Industria e Comercio Ltda.		**MANUFACTURER**
Low-voltage fuse-links for the protection of semiconductor devices		**TEST OBJECT**
PROTEC-TRAIN		**TYPE**
Test samples		**SERIAL NO.**
Rated voltage Rated current Rated breaking current I1 Characteristics	1500 V AC 350/500/630/710 A 100 kA aR	**RATED CHARACTERISTICS GIVEN BY THE CLIENT**
IEC 60269-4 Edition 5: 2016-08		**NORMATIVE DOCUMENT**
Verification of breaking capacity I1 at 1500 V		**TEST PERFORMED**
22 September 2017		**DATE OF TEST**
See Sub-clause 3.6		**TEST RESULT**

This test document comprises 24 sheets.

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S. GEORGIAS
Test engineer in charge

Berlin, 28 September 2017

Contents **Sheet**

1. Present at the test

Mr. Georgias IPH test engineer in charge

2. Test performed

Verification of breaking capacity I1 at 1500 V

3. Verification of breaking capacity

3.1 Test laboratory

High-power test laboratory, high-current test cell

3.2 Normative document

IEC 60269-4 Edition 5: 2016-08

3.3 Required test parameters

Test duty	1
Power-frequency recovery voltage	1500 V
Prospective current	100 kA
Making angle after voltage zero	Not applicable
Initiation of arcing after voltage zero	65 … 90° el.
Power factor cos φ	0,1 … 0,2
Test frequency	50 Hz

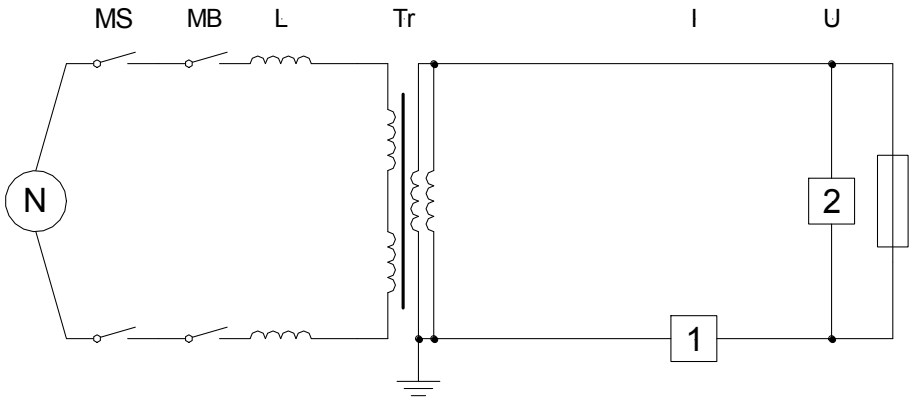
3.4 Test arrangement

According to IEC 60269-1 Edition 4.2: 2014-06

3.5 Test and measuring circuits

Technical data of test circuits

Test requirement		Verification of breaking capacity
Test No.		117 3738 to 117 3750
Number of phases	(Test circuit)	2
Number of poles/phases	(Test object)	1
Test frequency	Hz	50
Power factor cos φ		‹ 0.2
Earthing conditions	Grid	Not earthed
	Short-circuit transformer	Earthed
	Short-circuit point	--



N	Power supply (grid)	Tr	Short-circuit transformer
MS	Master breaker	I	Current measurement
MB	Making switch	U	Voltage measurement
L	Current limiting reactor	1, 2	Measuring points

Figure 1: Test circuits

Technical data of measuring circuits

Measuring point	Symbol	Measured quantity	Measuring sensor/device
1	i	Breaking current	Rogowski measuring system
2	u	Voltage	RC divider
Recording instrument:	AD 3000 transient recorder system		

3.6 Test results

Test requirement: Test duty I1

Condition of test object before test: New

Test No.		1173738	1173738	1173740	1173741	1173742
Test sample No.		-	-	1	2	3
Rated current of fuse-link	A	-	-	350	350	350
Test voltage	V	1500	1511	1500	1500	1500
Prospective peak current	kA	244	-	244	244	244
Prospective breaking current I_p	kA	101	-	101	101	101
Power factor cos φ		0,11	-	0,11	0,11	0,11
Making angle	°el.	-	-	61,6	69,4	76,6
Initiation of arcing after voltage zero	°el.	-	-	68,0	75,6	82,7
Melting current i_s	kA	-	-	14,6	15,3	15,4
Cut-off current	kA	-	-	15,4	15,8	16,2
Melting time	ms	-	-	0,36	0,34	0,34
Arcing time	ms	-	-	4,03	4,15	4,06
Operating time	ms	-	-	4,38	4,49	4,4
Melting integral	10^3 A^2s	-	-	23,4	27,2	25,7
Arcing integral	10^3 A^2s	-	-	107	111	115
Operating integral	10^3 A^2s	-	-	131	139	141
Arcing energy	kWs	-	-	31,4	33,2	31,8
Peak switching voltage	V	-	-	2902	2947	2979
Recovery voltage	V	-	-	1519	1514	1514
Volume resistivity	mΩ	-	-	2,15	2,19	2,19
Note		1)	2)	-	-	-
Evaluation		-	-	OK	OK	OK

Notes:

OK - The fuse is capable of correctly breaking the prospective current

1) Current setting of the prospective test values
2) Voltage operation

Test requirement: Test duty I1

Condition of test object before test: New

Test No.		1173743	1173744	1173745
Test sample No.		4	5	6
Rated current of fuse-link	A	500	500	500
Test voltage	V	1500	1500	1500
Prospective peak current	kA	244	244	244
Prospective breaking current I_p	kA	101	101	101
Power factor cos φ		0,11	0,11	0,11
Making angle	°el.	69,1	75,7	73,1
Initiation of arcing after voltage zero	°el.	76,5	82,9	80,6
Melting current i_s	kA	18,6	18,3	19,1
Cut-off current	kA	19,8	20,7	20,5
Melting time	ms	0,41	0,40	0,42
Arcing time	ms	4,05	4,05	3,97
Operating time	ms	4,46	4,45	4,39
Melting integral 10^3	A^2s	48,7	43,0	50,6
Arcing integral 10^3	A^2s	238	258	254
Operating integral 10^3	A^2s	286	301	305
Arcing energy	kWs	51,3	50,1	51,7
Peak switching voltage	V	2980	3025	2989
Recovery voltage	V	1515	1516	1515
Volume resistivity	mΩ	1,86	1,65	1,64
Note		-	-	-
Evaluation		OK	OK	OK

Notes:

OK - The fuse is capable of correctly breaking the prospective current

Test requirement: Test duty I1

Condition of test object before test: New

Test No.			1173746	1173748
Test sample No.			7	9
Rated current of fuse-link		A	630	630
Test voltage		V	1500	1500
Prospective peak current		kA	244	244
Prospective breaking current I_p		kA	101	101
Power factor cos φ			0,11	0,11
Making angle		°el.	74,0	75,2
Initiation of arcing after voltage zero		°el.	83,6	84,1
Melting current i_s		kA	24,2	23,1
Cut-off current		kA	24,7	23,8
Melting time		ms	0,53	0,50
Arcing time		ms	4,03	4,05
Operating time		ms	4,57	4,55
Melting integral	10^3	A^2s	107	90,8
Arcing integral	10^3	A^2s	394	396
Operating integral	10^3	A^2s	501	492
Arcing energy		kWs	67,3	67,6
Peak switching voltage		V	3043	2918
Recovery voltage		V	1518	1513
Volume resistivity		mΩ	1,51	1,51
Note			-	-
Evaluation			OK	OK

Notes:

OK - The fuse is capable of correctly breaking the prospective current

Test requirement: Test duty I1

Condition of test object before test: New

Test No.		1173749	1173750
Test sample No.		10	11
Rated current of fuse-link	A	500	710
Test voltage	V	1500	1500
Prospective peak current	kA	244	244
Prospective breaking current I_p	kA	101	101
Power factor cos φ		0,11	0,11
Making angle	°el.	75,5	70,0
Initiation of arcing after voltage zero	°el.	84,6	80,5
Melting current i_s	kA	23,3	26,6
Cut-off current	kA	25,3	31,9
Melting time	ms	0,51	0,58
Arcing time	ms	4,00	5,09
Operating time	ms	4,51	5,67
Melting integral	10^3 A^2s	91,2	136
Arcing integral	10^3 A^2s	611	1387
Operating integral	10^3 A^2s	707	1530
Arcing energy	kWs	85,1	138
Peak switching voltage	V	2768	2796
Recovery voltage	V	1518	1516
Volume resistivity	mΩ	0,26	0,20
Note		-	-
Evaluation		OK	OK

Notes:

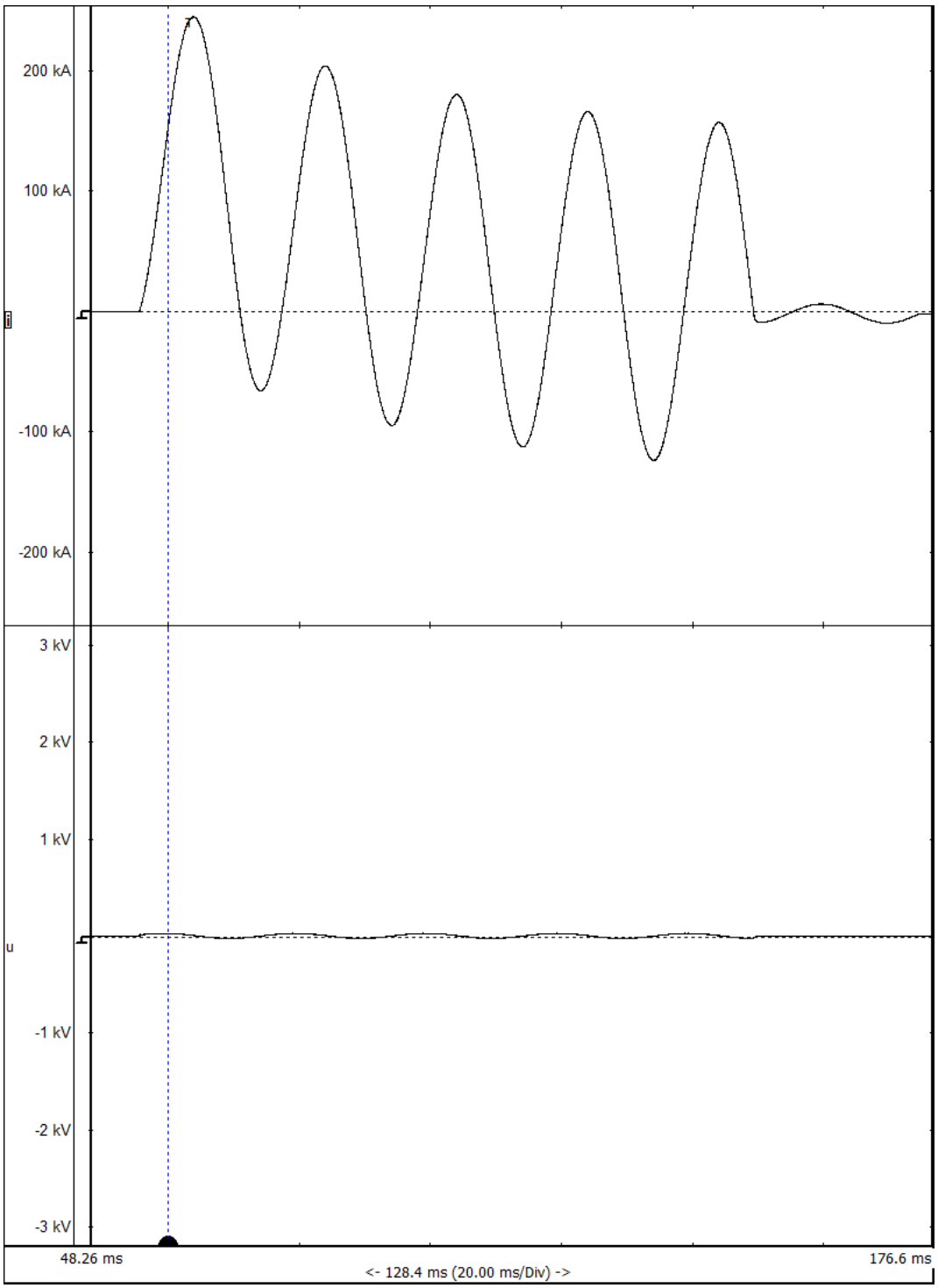
OK - The fuse is capable of correctly breaking the prospective current

4. Photos

Photo 1: Test samples after tests

5. Oscillograms

Test No: 1173738



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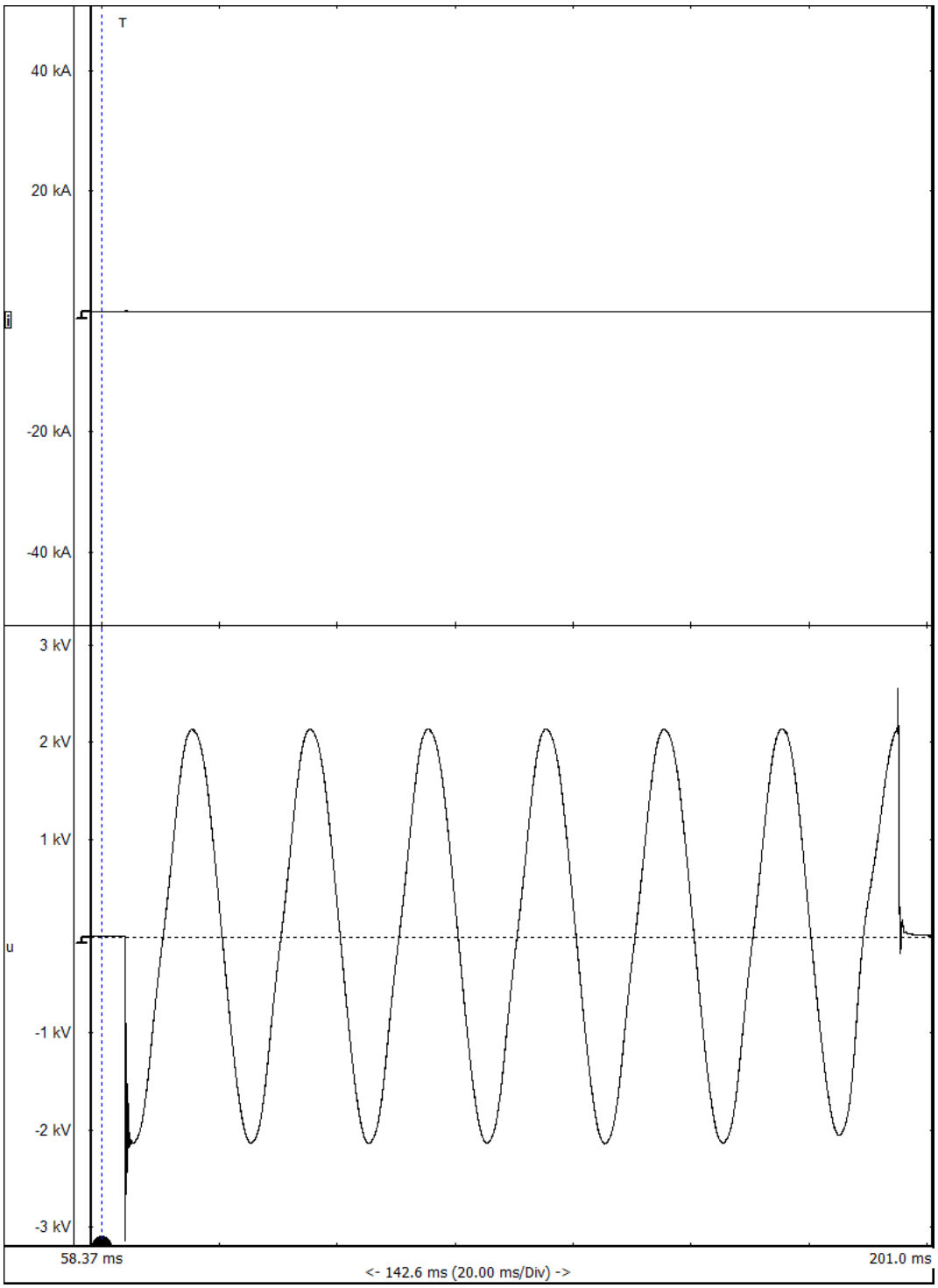

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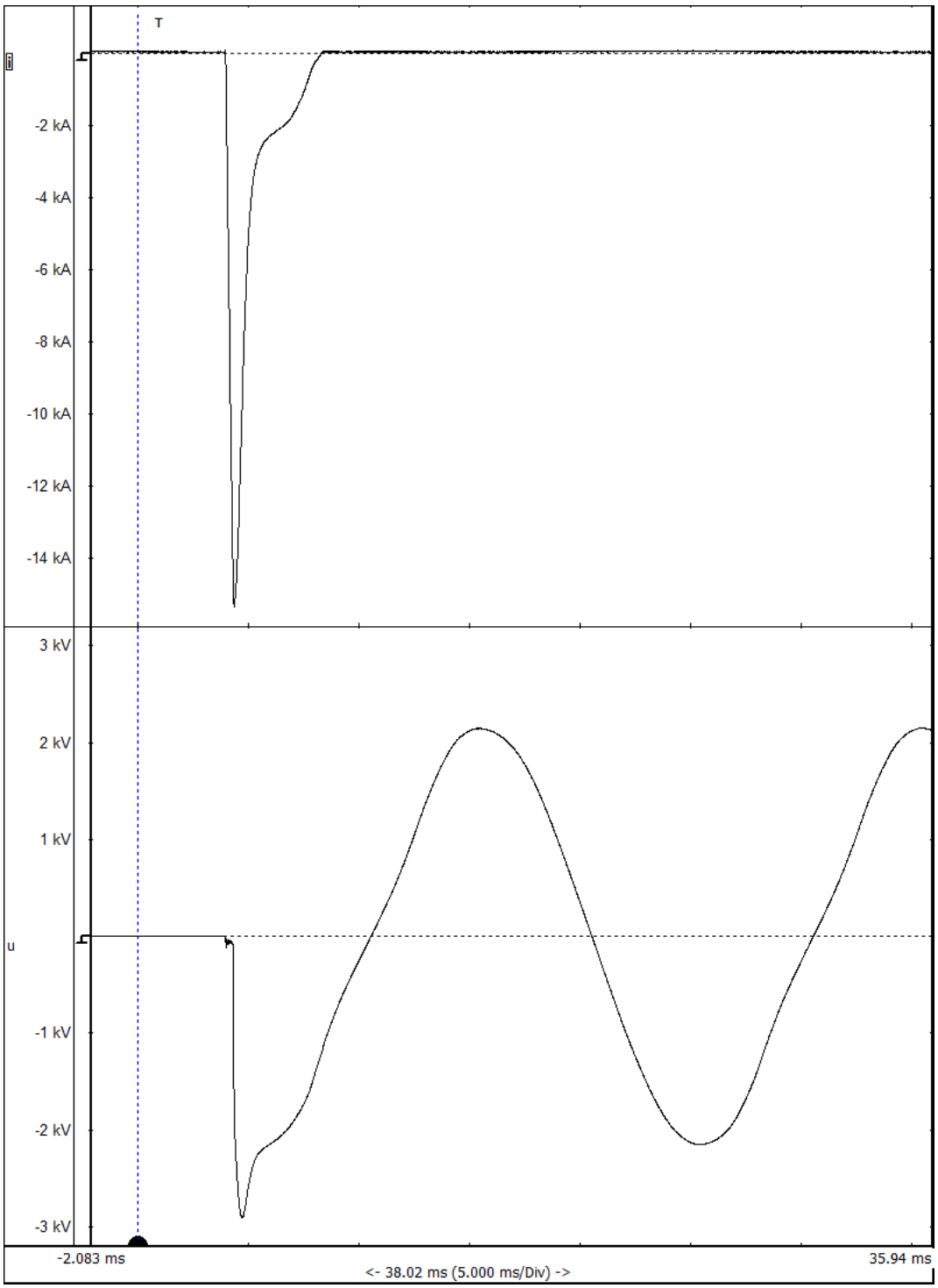

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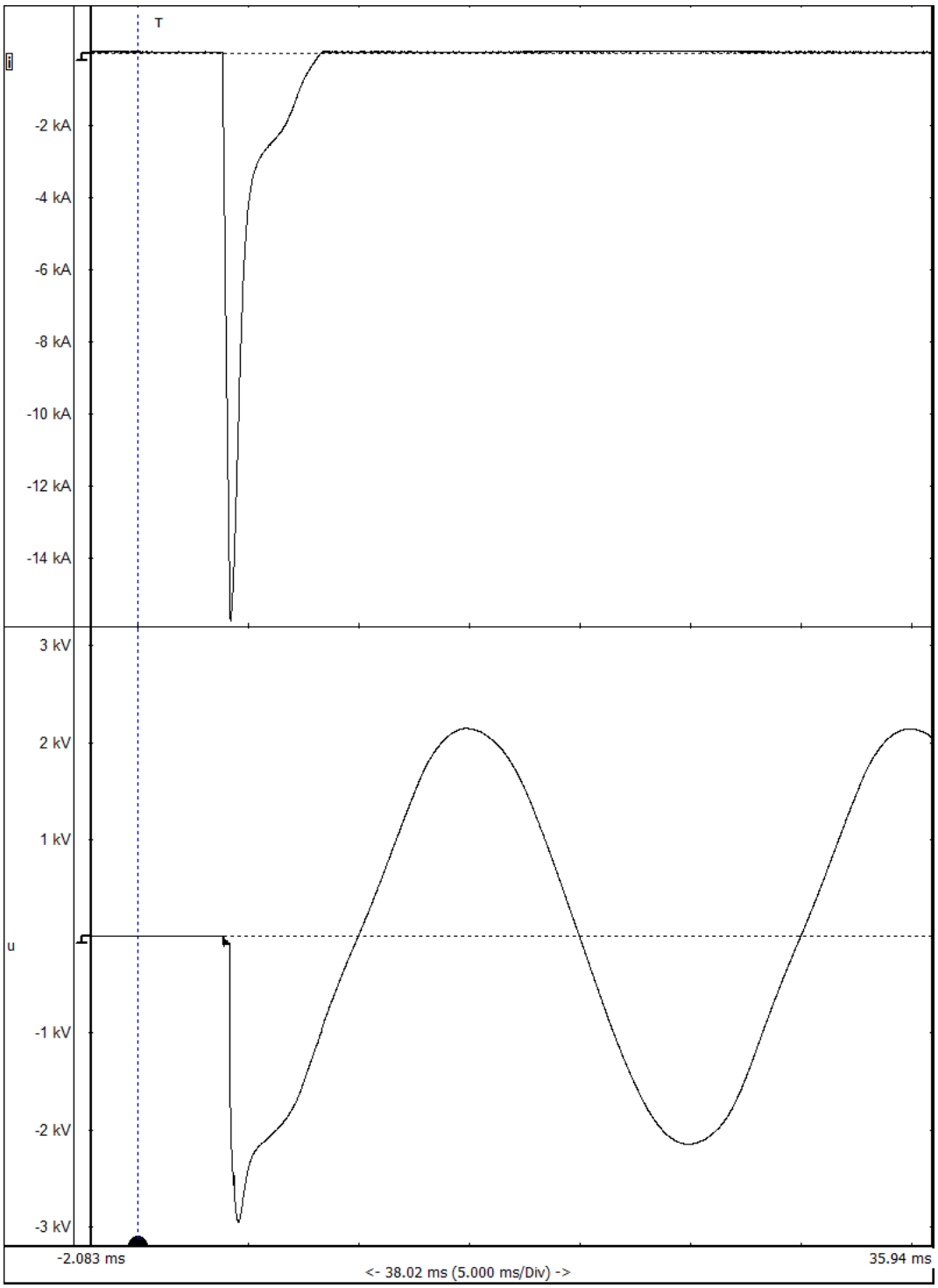

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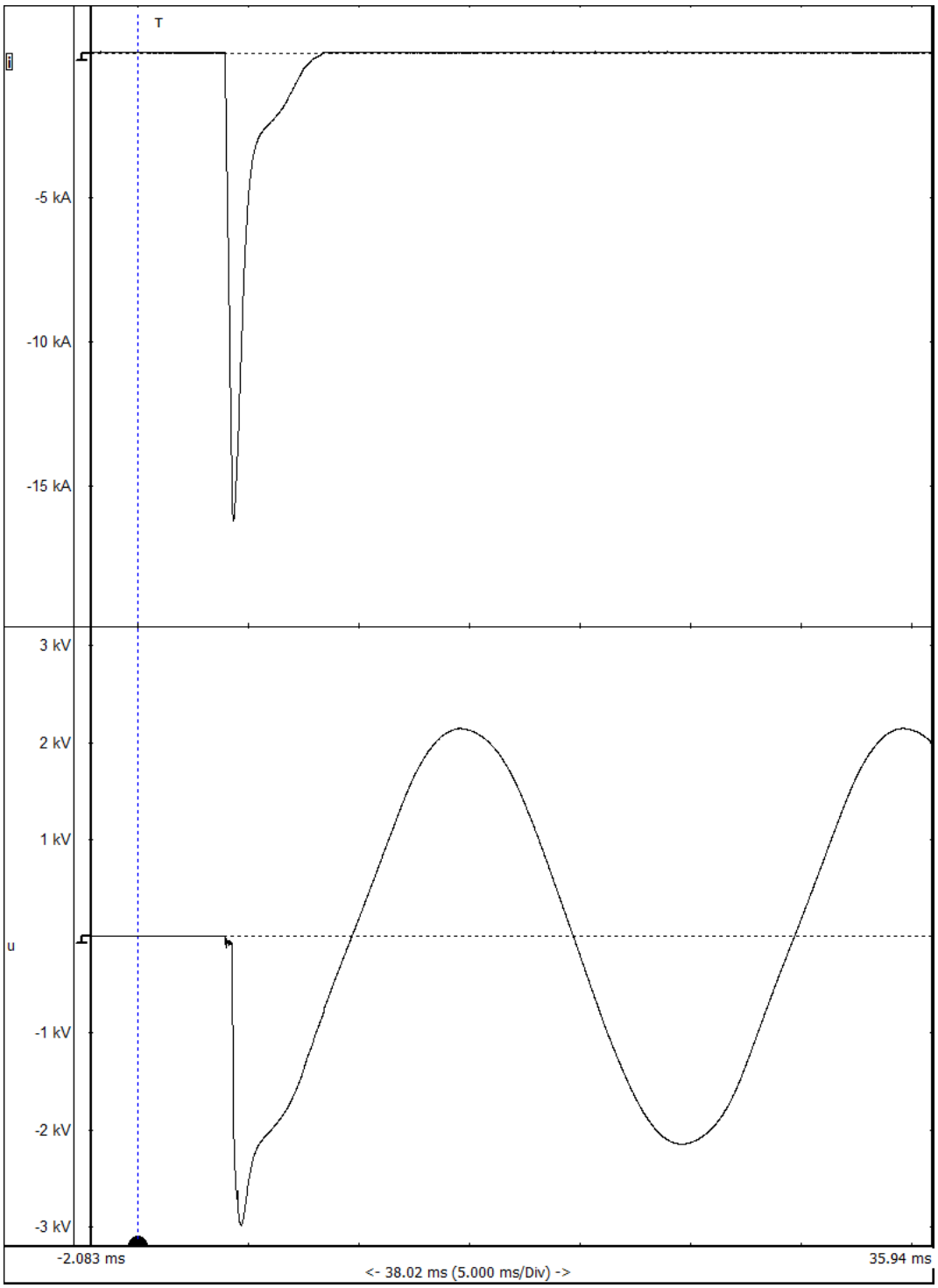

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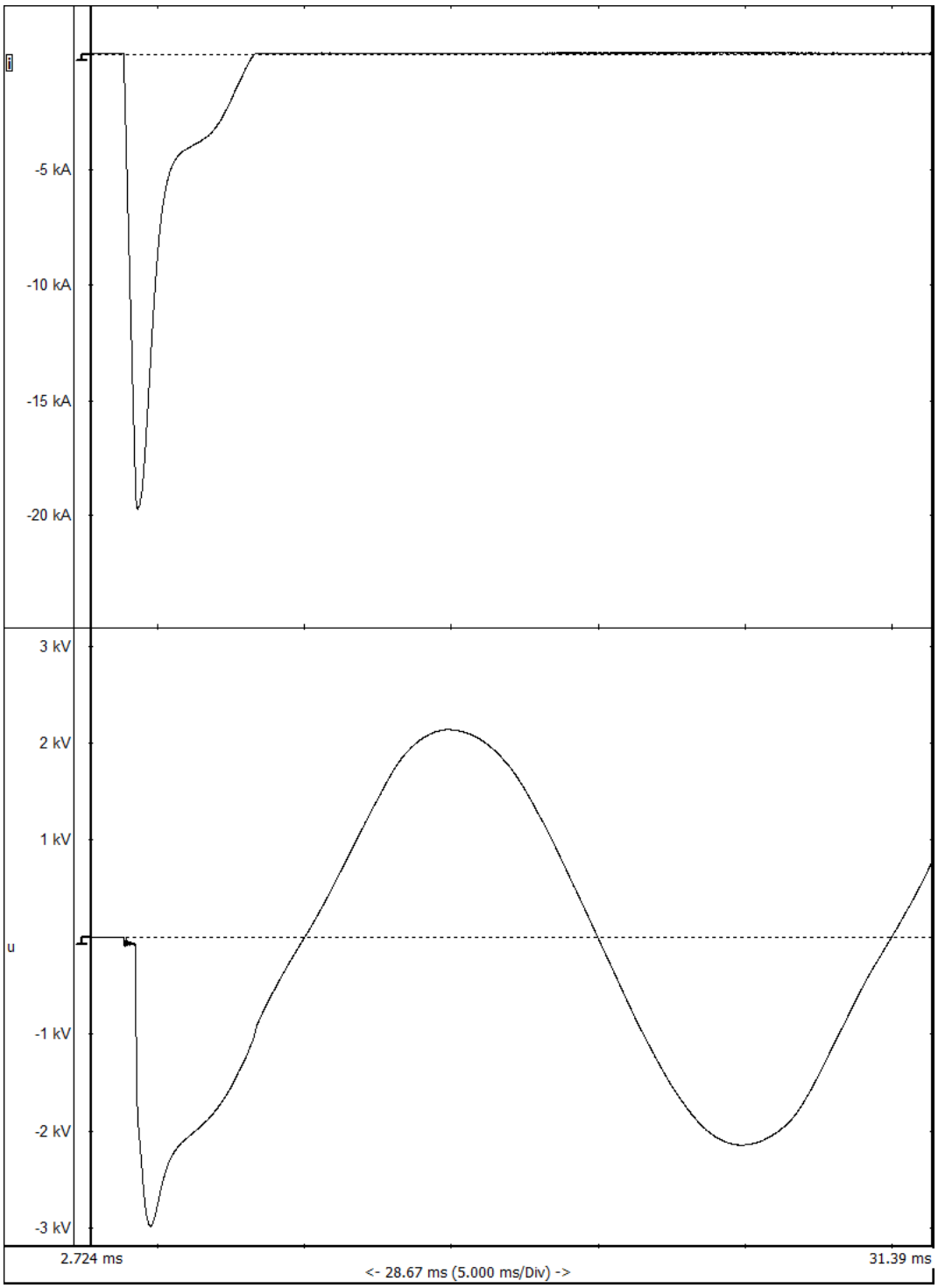

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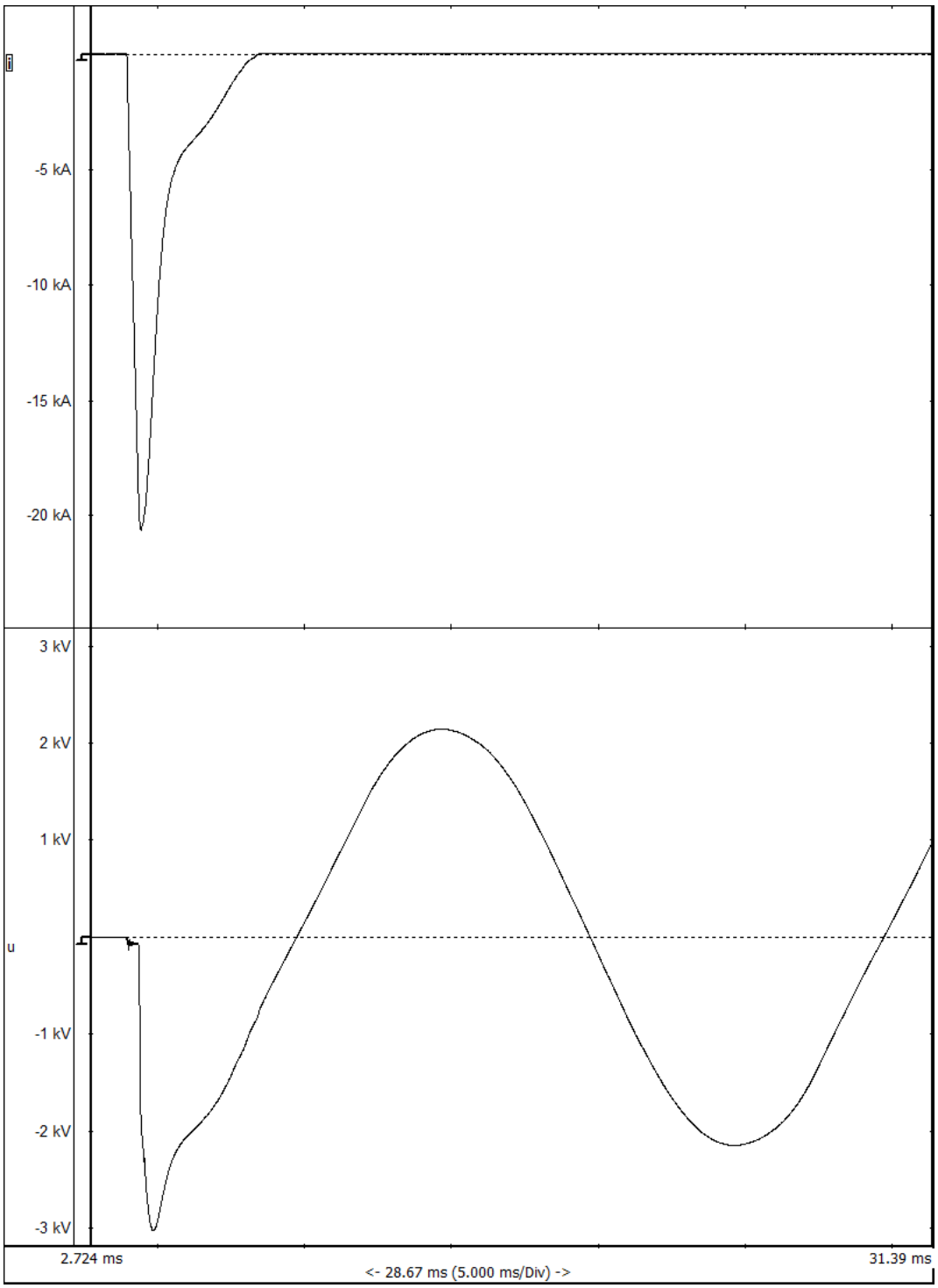

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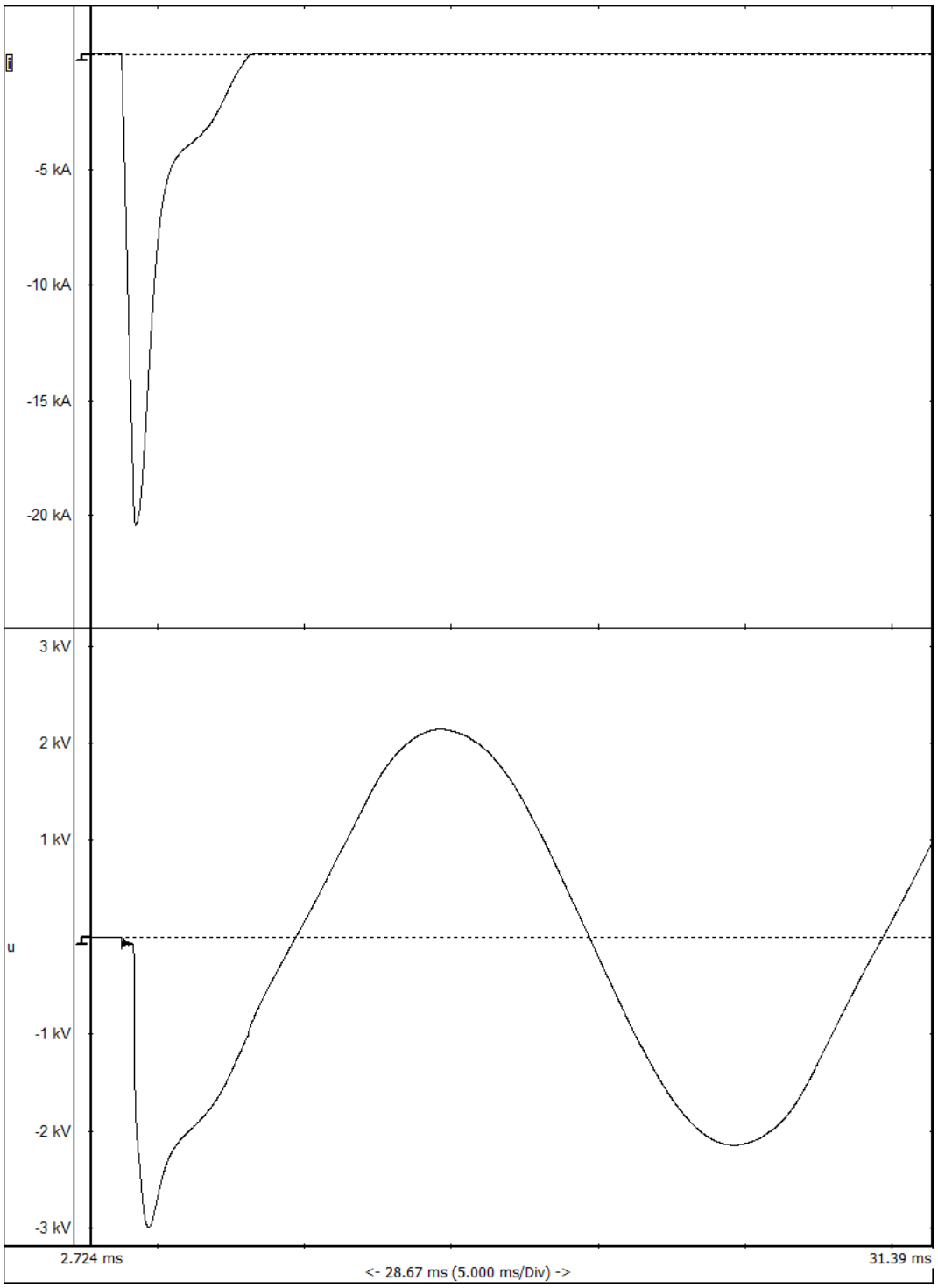

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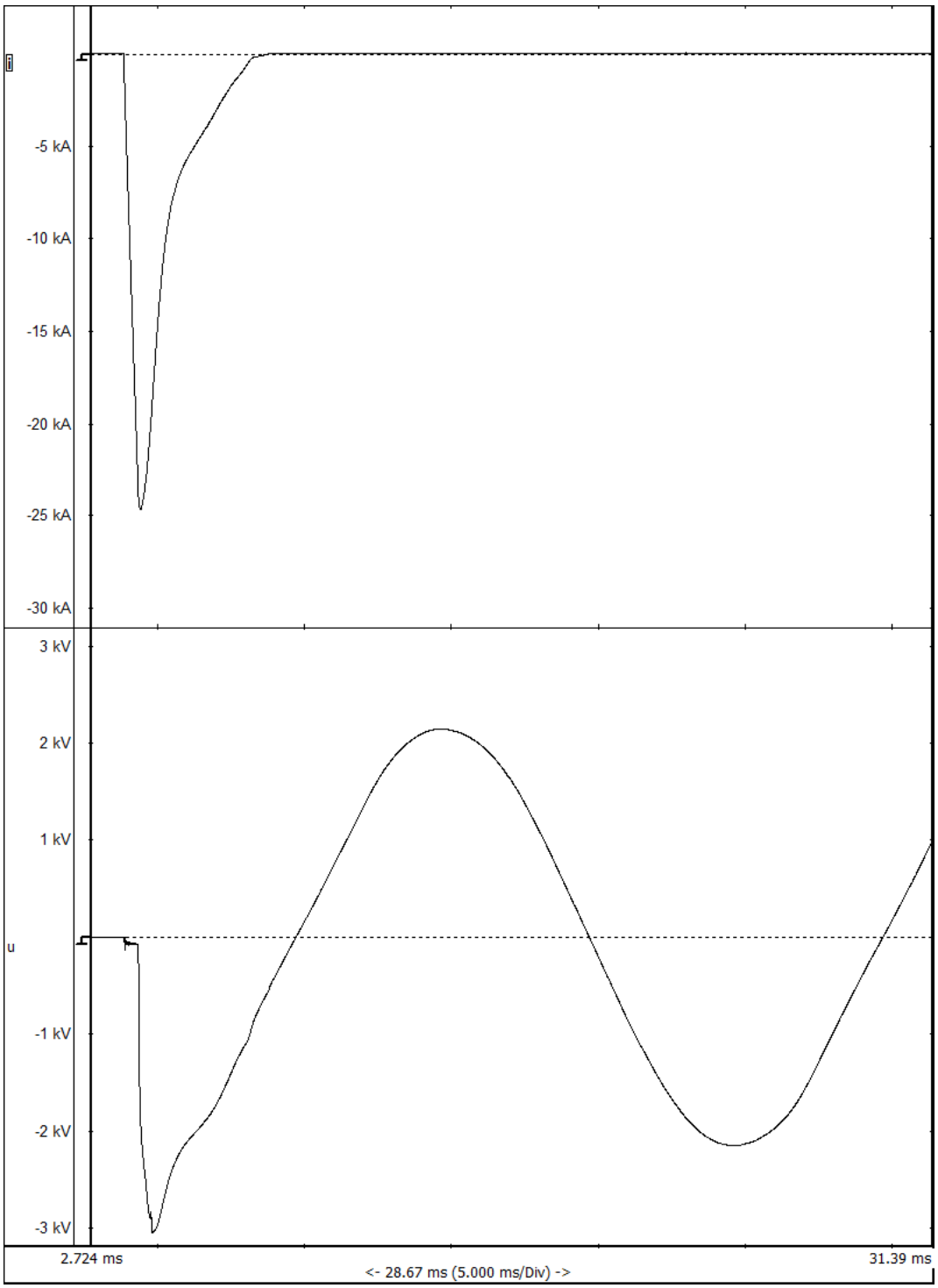

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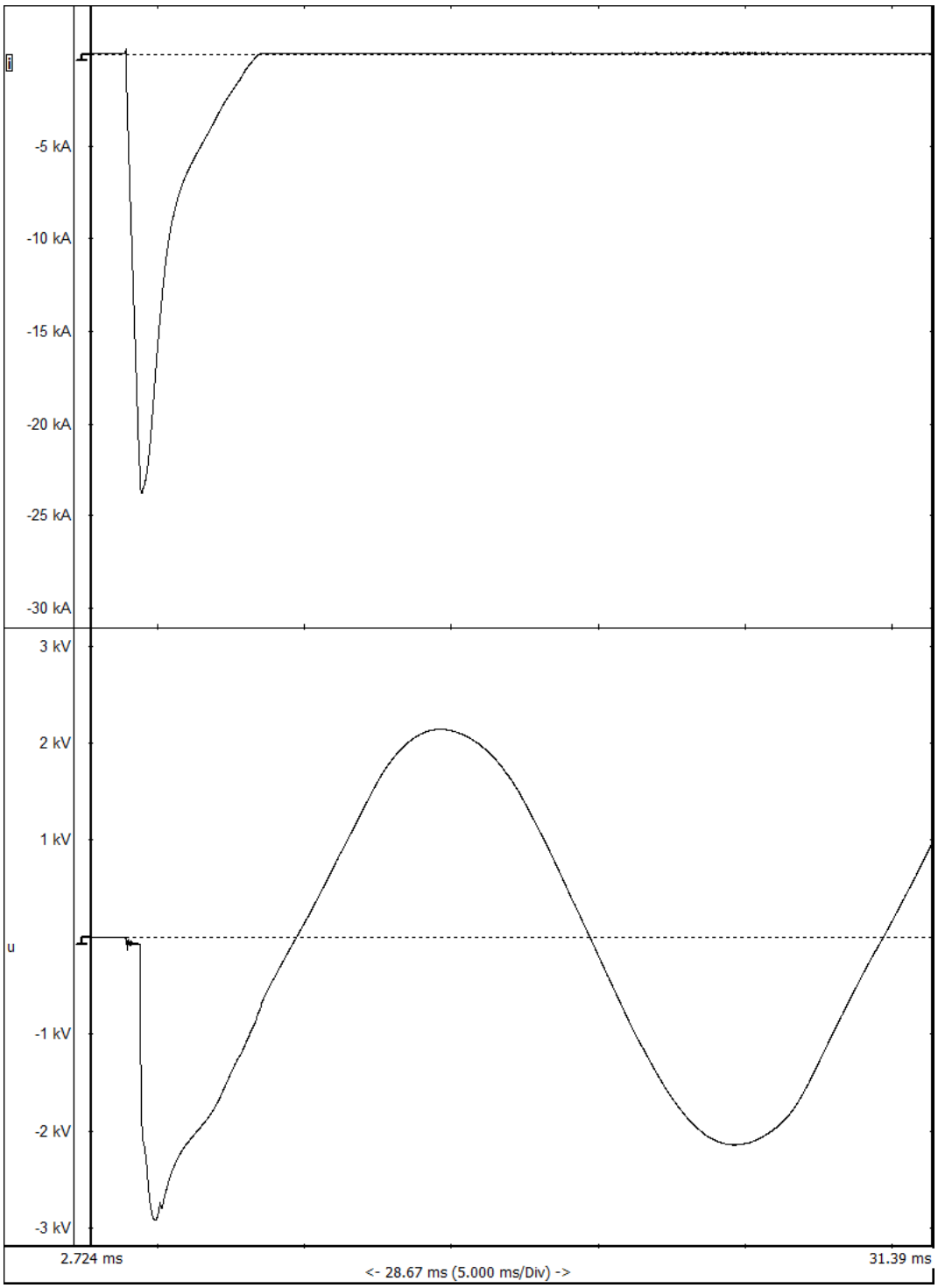

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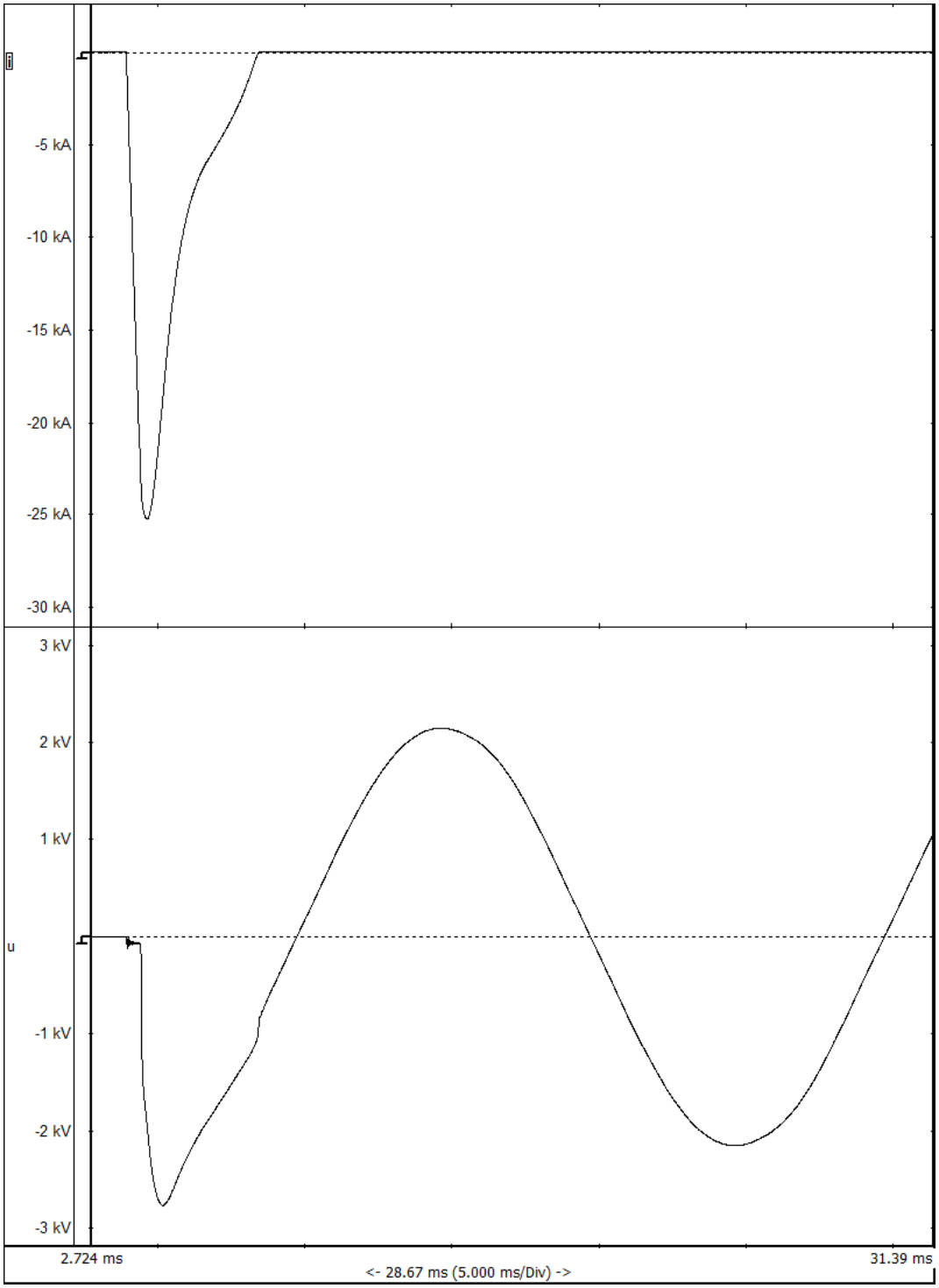

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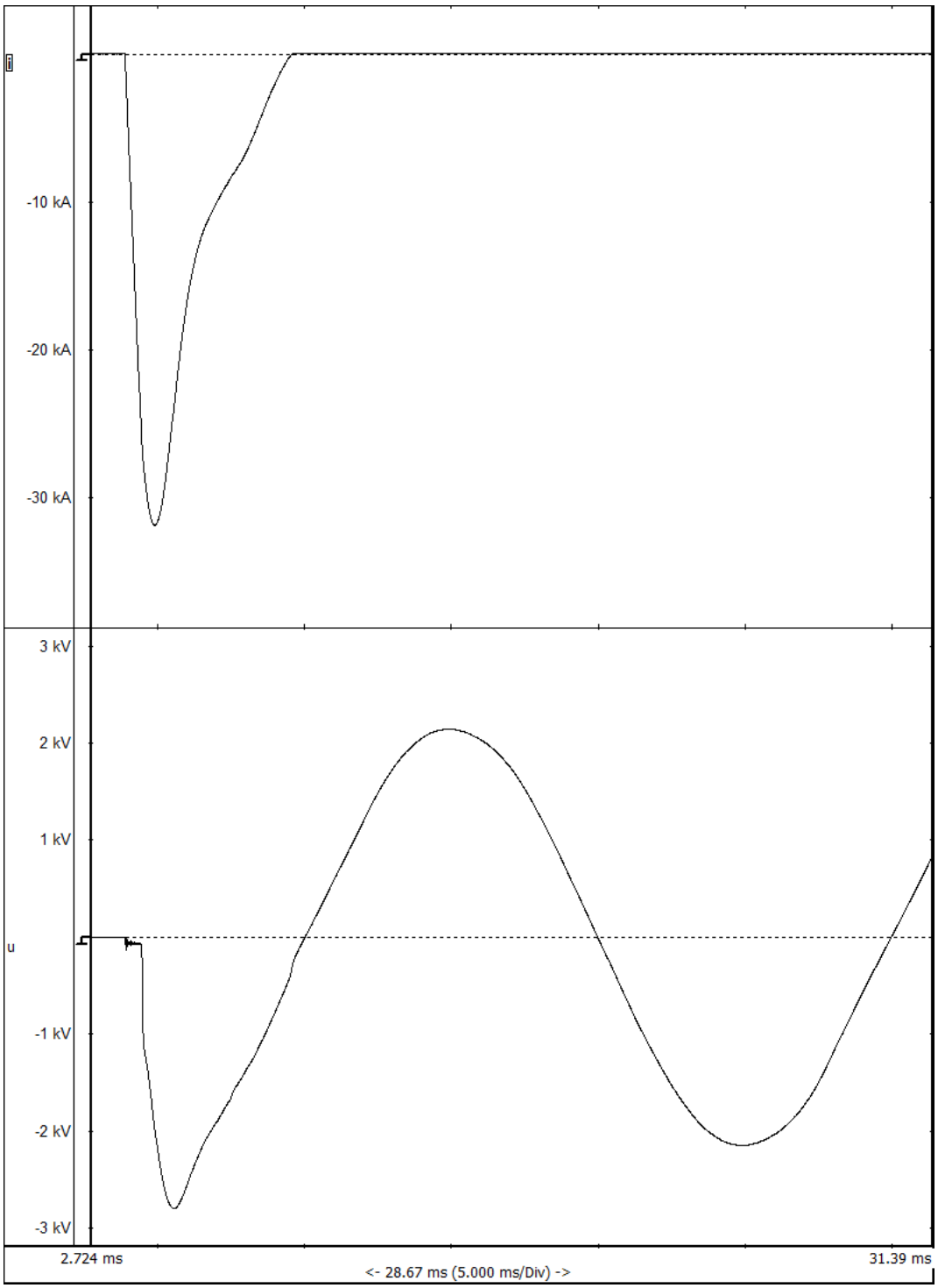
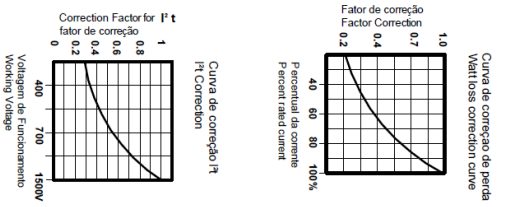
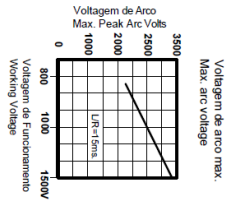


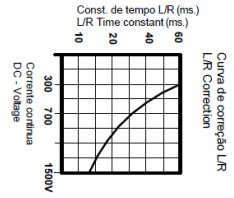
6. Drawings

(Similar Ferraz J076161)

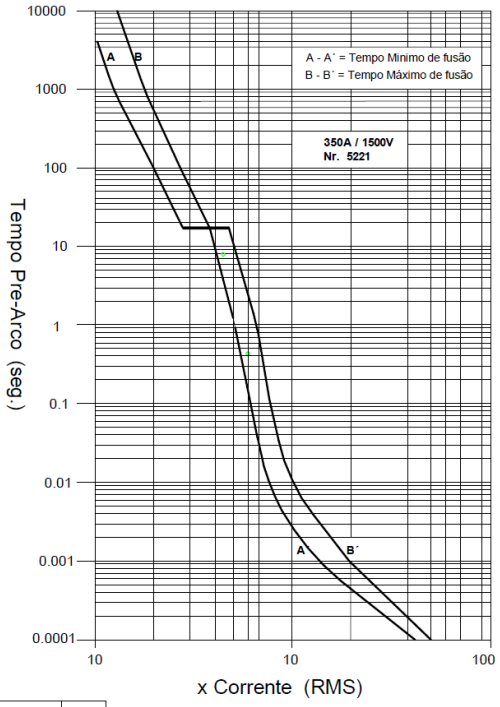
HIGH SPEED FUSES - aR - 1500V / 350A





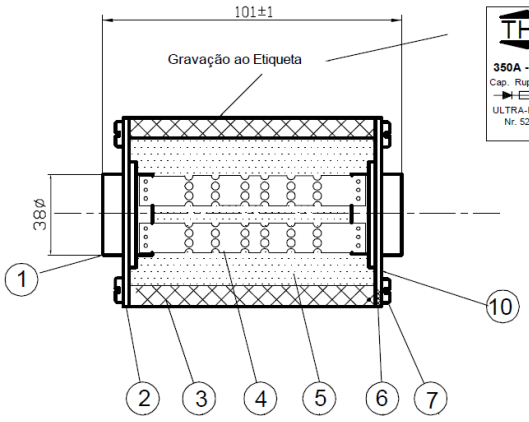


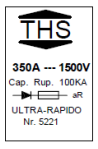
Curva Tempo Corrente



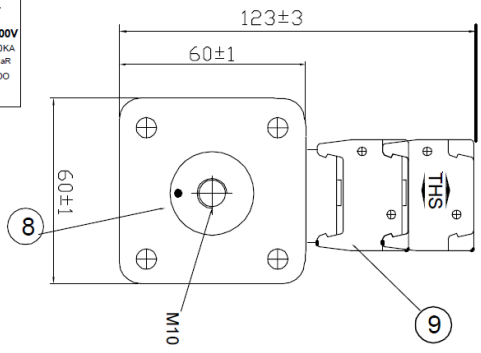
Caracteristicas Eletricas

Amp.	Nr. Pass.	Nr. Lam.	Espessura	R± 10% m. ohm	Perda	I^2t_{total} (A^2s.)	Temperatura	Tam.
350	13	12LA	0.10	0,50 m. ohm	106 W	141.000	133ºC (ELEVAÇÃO)	2





***Fusivel com 2- Micro e 2-Contatos reversivel**
125VCC, 3A, L/R = 25 ms.



ULTRA - RAPIDO - aR

***Similar tipo Ferraz H310024**

IDEM	DESCRIÇAO	MATERIAL	QTD.	Medidas	Nr. Desenho
10	Bucha Fechamento	Latao	1	6Øx3	151226
9	Conjunto Microswitch	-------	1	Tipo "THS F"	1512180
8	Parafuso	Aço Bicr.	4	M4x6 Cap. Philips	---------
7	Parafuso	Aço Bicr.	8	4.2x16 Cap. Philips	---------
6	Guarniçao NH 2	Papelao-Algodao	2	60x60x0.8	151264
5	Silifix	-------	---	---------	---------
4	Elemento	Prata	----	---------	151263
3	Corpo Esteatita	Esteatita	1	---------	441.004
2	Tampa NH 2	Aço Inox	2	60x60x2	-------
1	Terminal	Latao	2	38Øx19	151261

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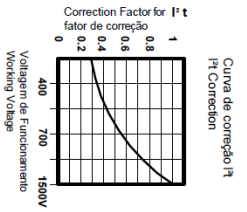
THS Industria e Comercio Ltda.

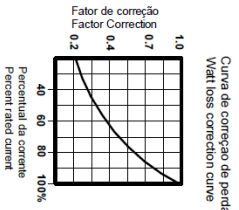
PROTEC - TRAIN 350A, 1500V, (CPTM)

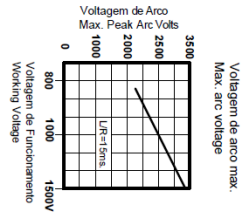
Data	28.01.06	CORRENTE	350 A
Proj.	Hermann		
Ver.	Saulo	VOLTAGEM	1500V
Esc.	1:1		
DESENHO	Nr. de Ref.	Des. Nr.	5221

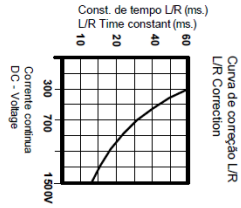
(Similar Ferraz V076194)

HIGH SPEED FUSES - aR - 1500V / 500A

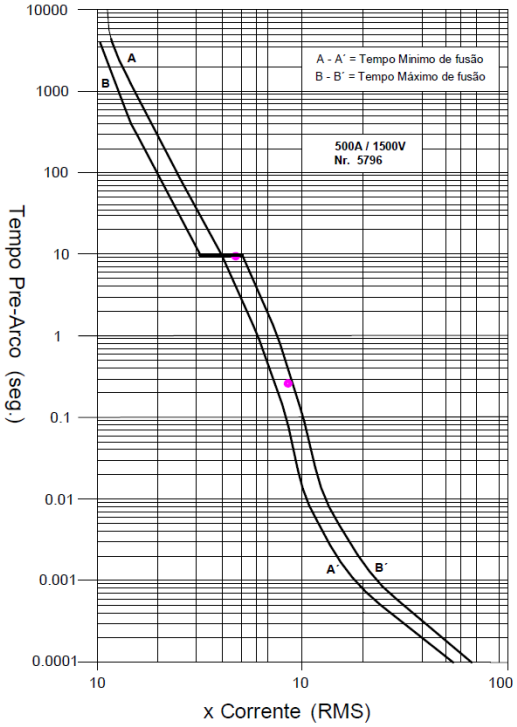






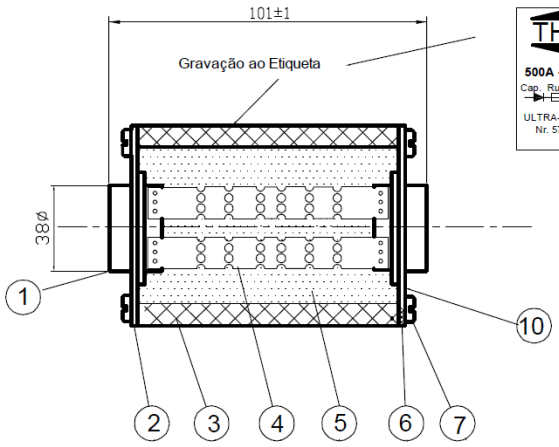


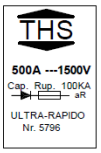
Curva Tempo Corrente



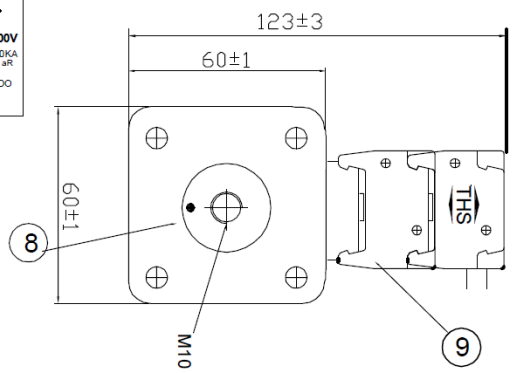
Caracteristicas Eletricas

Amp.	Nr. Pass.	Nr. Lam.	Espessura	R± 10% m. ohm	Perda	I^2t Total (A^2s.)	Temperatura	Tam.
500	10	16LA	0.15	0,240 m. ohm	107 W	305.000	128ºC (ELEVAÇÃO)	2





***Fusivel com 1- Micro e 1-Contatos reversivel**
125VCC, 3A, L/R = 25 ms.



***Sililar Ferraz tipo P310030**

ULTRA - RAPIDO aR

IDEM	DESCRIÇAO	MATERIAL	QTD.	Medidas	Nr. Desenho
10	Bucha Fechamento	Latao	1	6Øx3	151226
9	Conjunto Microswitch	-------	1	Tipo "THS F"	1512180
8	Parafuso	Aço Bicr.	4	M4x6 Cap. Philips	---------
7	Parafuso	Aço Bicr.	8	4.2x16 Cap. Philips	---------
6	Guarniçao NH 2	Papelao-Algodao	2	46x46x0.8	151264
5	Silifix	-------	---	---------	---------
4	Elemento	Prata	---	---------	151263
3	Corpo Esteatita	Esteatita	1	---------	441.004
2	Tampa NH 2	Aço Inox	2	60x60x2	------
1	Terminal	Latao	2	48Øx19	151261

Revisao 1 2 3 4 5

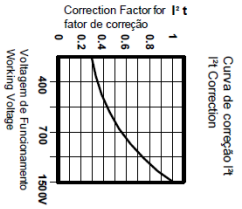
THS Industria e Comercio Ltda.

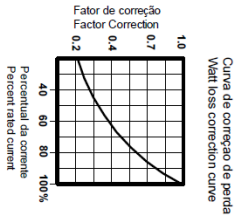
PROTEC - TRAIN 500A, 1500V, (CPTM)

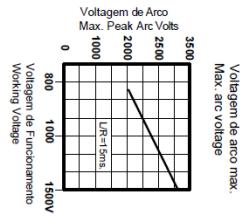
Data	28.01.17	CORRENTE	500 A
Proj.	Hermann		
Ver.	Saulo	VOLTAGEM	1500V
Esc.	1:1		
DIEDRO	Nr. de Ref.	Des. Nr.	5796

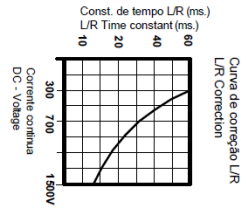
(Similar Ferraz V076171)

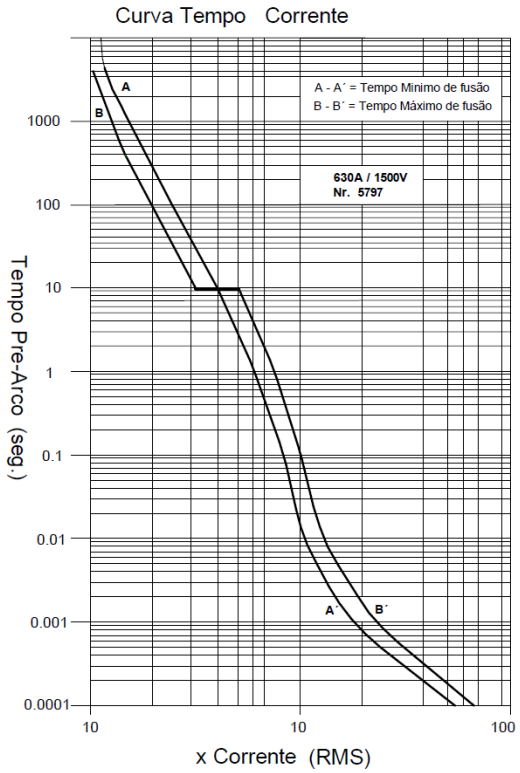
HIGH SPEED FUSES - aR - 1500V / 630A





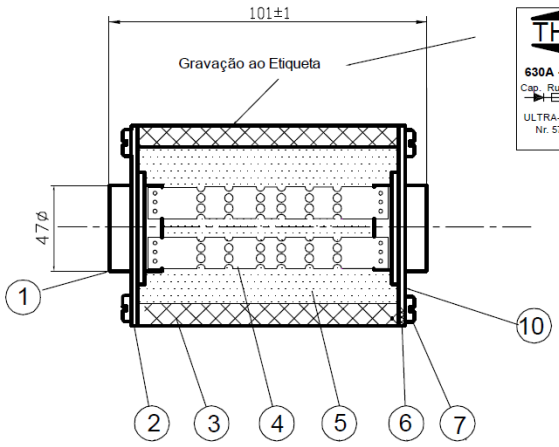


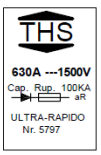




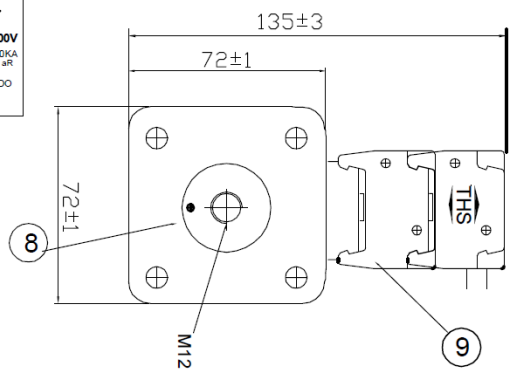
Caracteristicas Eletricas

Amp.	Nr. Pass.	Nr. Lam.	Espessura	R± 10% m. ohm	Perda	I^2t_{total} (A^2s.)	Temperatura	Tam.
630	8	19LA	0.15	0.170 m. ohm	137 W	501.000	156ºC (ELEVAÇÃO)	2





***Fusivel com 2- Micro e 2-Contatos reversivel**
125VCC, 3A, L/R = 25 ms.



***Similar Ferraz tipo H310024**

ULTRA - RAPIDO aR

IDEM	DESCRIÇAO	MATERIAL	QTD.	Medidas	Nr. Desenho
10	Bucha Fechamento	Latao	1	6Øx3	151226
9	Conjunto Microswitch	-------	1	Tipo "THS F"	1512180
8	Parafuso	Aço Bicr.	4	M4x6 Cap. Philips	---------
7	Parafuso	Aço Bicr.	8	4.2x16 Cap. Philips	---------
6	Guarniçao NH 3	Papelao-Algodao	2	46x46x0.8	151264
5	Silifix	-------	---	---------	---------
4	Elemento	Prata	---	---------	151263
3	Corpo Esteatita NH-3X85	Esteatita	1	---------	441.004
2	Tampa NH 3	Aço Inox	2	72x72X2.5	------
1	Terminal	Latao	2	48Øx19	151261

Revisao 1 2 3 4 5

THS Industria e Comercio Ltda.

PROTEC - TRAIN 630A, 1500V, (CPTM)

Data	28.01.17		CORRENTE	630 A
Proj.	Hermann			
Ver.	Saulo		VOLTAGEM	1500V
Esc.	1:1			
DIEDRO		Nr. de Ref.	Des. Nr.	5797