

# TUV Rheinland of North America

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## TEST REPORT NO.

**TBR2/050101/02**

Date: May 1, 2002

Total Number of Pages: 88

Equipment: **LTC2846CG / LTC2845CG**

Client: **Linear Technology Corporation**  
Address: **1630 McCarthy Blvd.**  
**Milpitas, CA 95035**

European Technical Standards: **TBR1 / TBR2**  
**NET1 / NET2**

### Authorised Signature:

**May 1, 2002**

Date

**William Crannick**

Name

**Area Manager**

Title



Signature

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## 1 IDENTIFICATION SUMMARY

### 1.1 Test Laboratory

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**UKAS accredited testing laboratory, no. 1845**

### 1.2 Limits and Reservations

This test report satisfies European Standard EN 45001 (1989), ISO Guide 25, NIST Handbook 150 and NAMAS accreditation standard M10. The test results in this test report apply only to the particular System under Test (SUT) and component Implementations under Test (IUTs) declared in this test report.

### 1.3 Client Information

Name : **Linear Technology Corporation**  
Street : **1630 McCarthy Blvd.**  
City : **Milpitas, CA 95035**  
Country : **USA**  
Phone : **+1 408 432-1900**  
Fax : **+1 408 434-6441**

Contact Person : **Todd Nelson**  
Phone : **+1 408 432-1900**  
Fax : **+1 408 434-6441**

### 1.4 Product

Supplier's name : **Linear Technology Corporation**  
Street : **1630 McCarthy Blvd.**  
City : **Milpitas, CA 95035**  
Country : **USA**  
Phone : **+1 408 432-1900**  
Fax : **+1 408 434-6441**



### 1.4.1 System under Test (SUT)

SUT Hardware Configuration for testing (PC, Bus System, Clock etc.)	<b>Stand Alone device.</b>
Operating System	---
Version No.	---
Miscellaneous	---

### 1.4.2 Type of Product

Multiprotocol Transceiver.

### 1.4.3 Description of Product

This device is a multiprotocol transceiver with software selectable transceiver support. This device is a demo circuit that provides chip level interfacing to the components that support the varied protocols.



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**1.4.4 15-pin DTE/DCE interface ISO 4903**

(CCITT Recommendation X.21/V.10/V.11 interface)

Name	<b>Demo Circuit</b>		
Version/Model	<b>513A</b>		
Serial No.	<b>NA</b>		
Minimum speed (bit/s)	<b>NA</b>		
Maximum speed (bit/s)	<b>8 Mbps</b>		
Interface board	<b>NA</b>		
Chip set	<b>V.11 Transmitter: LTC2845, LTC2846</b>	<b>Receiver: LTC2845, LTC2846</b>	
	<b>V.10 Transmitter: LTC2845</b>		
Cable (name, P/N)	<b>NA</b>		
Cable Length	<b>NA</b>		

**Supported Circuits**

Circuit	<u>supported</u>		(X)	V.10
	(X)	V.11		
1	----			
103 TxD	T(A)	(X)	( )	
105 RTS	C(A)	(X)	( )	
104 RxD	R(A)	(X)	( )	
106 CTS	I(A)	(X)	( )	
115 RxC	S(A)	(X)	( )	
113 TxCE	B(A)	(X)	( )	
8	G	( )	( )	
103 TxD	T(B)	(X)	( )	
105 RTS	C(B)	(X)	( )	
104 RxD	R(B)	(X)	( )	
106 CTS	I(B)	(X)	( )	
115 RxC	S(B)	(X)	( )	
113 TxCE	B(B)	(X)	( )	
15	Reserved for future international use			
107 DSR	(A/B)	(X)	( )	
108 DTR	(A/B)	(X)	( )	
109 DCD	(A/B)	(X)	( )	
114 TxC	(A/B)	(X)	( )	
140 RL		( )	(X)	
141 LL		( )	(X)	



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### 1.4.5 25-pin DTE/DCE interface ISO 2110

(CCITT Recommendation V.24/V.28 (RS232) interface)

Name	<b>Demo Circuit</b>		
Version/Model	<b>513A</b>		
Serial No.	<b>NA</b>		
Minimum speed (bit/s)	<b>NA</b>		
Maximum speed (bit/s)	<b>120 kbps</b>		
Interface board	<b>NA</b>		
Chip set	V.28 Transmitter: <b>LTC2846, LTC2845</b>	V.28 Receivers: <b>LTC2846, LTC2845</b>	
Cable (name, P/N)	<b>NA</b>		
Cable Length	<b>NA</b>		

#### Supported Circuits

CCITT circuit

supported

102	7	( ) gnd
103	TxD	(X)
104	RxD	(X)
105	RTS	(X)
106	CTS	(X)
107	DSR	(X)
108	DTR	(X)
109	DCD	(X)
113	TxCE	(X)
114	TxC	(X)
115	RxC	(X)
125	RI	(X)
140	RL	(X)
141	LL	(X)
142	TM	(X)

### 1.4.6 34-pin DTE/DCE interface ISO 2593

(CCITT Recommendation V.35 interface)

Name	<b>Demo Circuit</b>		
Version/Model	<b>513A</b>		
Serial No.	<b>NA</b>		
Minimum speed (bit/s)	<b>NA</b>		
Maximum speed (bit/s)	<b>8 Mbps</b>		
Interface board	<b>NA</b>		
Chip set	V.35 Transmitter: <b>LTC2846</b> V.28 Transmitter: <b>LTC2845</b>	V.35 Receivers: <b>LTC2846</b> V.28 Receivers: <b>LTC2845</b>	
Cable (name, P/N)			
Cable Length			

#### Supported Circuits

<u>CCITT circuit</u>	<u>A-wire</u>	<u>B-wire</u>	<u>Electrical characteristics</u>		<u>supported</u>
102a	A				( ) gnd
102	B				( ) gnd
103 TxD	P	S	V.35 (X)	V.11 ( )	(X)
104 RxD	R	T	V.35 (X)	V.11 ( )	(X)
105 RTS	C		V.28 (X)	V.10 ( )	(X)
106 CTS	D		V.28 (X)	V.10 ( )	(X)
107 DSR	E		V.28 (X)	V.10 ( )	(X)
108 DTR	H		V.28 (X)	V.10 ( )	(X)
109 DCD	F		V.28 (X)	V.10 ( )	(X)
113 TxCE	U	W	V.35 (X)	V.11 ( )	(X)
114 TxC	Y	AA	V.35 (X)	V.11 ( )	(X)
115 RxC	V	X	V.35 (X)	V.11 ( )	(X)
125 RI	J		V.28 (X)	V.10 ( )	(X)
140 RL	N		V.28 (X)	V.10 ( )	(X)
141 LL	L		V.28 (X)	V.10 ( )	(X)
142 TM	NN		V.28 (X)	V.10 ( )	(X)

### 1.4.7 37-pin DTE/DCE interface ISO 4902

(CCITT Recommendation V.36 interface)

Name	<b>Demo Circuit</b>		
Version/Model	<b>513A</b>		
Serial No.	<b>NA</b>		
Minimum speed (bit/s)	<b>NA</b>		
Maximum speed (bit/s)	<b>8 Mbps</b>		
Interface board	<b>NA</b>		
Chip set	V.11 Transmitter: <b>LTC2846, LTC2845</b> V.10 Transmitter: <b>LTC2845</b>	V.11 Receivers: <b>LTC2846, LTC2845</b> V.10 Receivers: <b>LTC2845</b>	
Cable (name, P/N)	<b>NA</b>		
Cable Length	<b>NA</b>		

#### Supported Circuits

<u>CCITT circuit</u>	<u>A-wire</u>	<u>B-wire</u>	<u>Electrical characteristics</u>		<u>supported</u>
102	19				( ) gnd
102a	37				( ) gnd
102b	20				( ) gnd
103 TxD	4	22	V.11 (X)	V.10 ( )	(X)
104 RxD	6	24	V.11 (X)	V.10 ( )	(X)
105 RTS	7	25	V.11 (X)	V.10 ( )	(X)
106 CTS	9	27	V.11 (X)	V.10 ( )	(X)
107 DSR	11	29	V.11 (X)	V.10 ( )	(X)
108 DTR	12	30	V.11 (X)	V.10 ( )	(X)
109 DCD	13	31	V.11 (X)	V.10 ( )	(X)
113 TxCE	17	35	V.11 (X)	V.10 ( )	(X)
114 TxC	5	23	V.11 (X)	V.10 ( )	(X)
115 RxC	8	26	V.11 (X)	V.10 ( )	(X)
125 RI	15		V.10 (X)		(X)
140 RL	14		V.10 (X)		(X)
141 LL	10		V.10 (X)		(X)
142 TM	18		V.10 (X)		(X)





## **1.5 Nature of Conformance Testing**

The purpose of Conformance Testing is to increase the probability that different implementations can interwork. However, the complexity of OSI protocols makes exhaustive testing impractical on both technical and economic grounds. Furthermore, there is no guarantee that an IUT which has passed all the relevant tests conforms to a specification. Neither is there any guarantee that such an IUT will interwork with other real open systems. Rather, the passing of the tests gives confidence that the IUT has the stated capabilities and that its behaviour conforms consistently in representative instances of communication.

## **2 Test Conditions**

### **2.1 Environmental Conditions**

Temperature : In the range of 15°C to 35°C  Yes  No  
Relative humidity : In the range of 5% to 75%  Yes  No

### **2.2 Power Supply Limitations**

All tests were carried out within +/- 5% of the normal operating voltage of 3.3 Vdc.



## 3 System Report Summary

### 3.1 Test Report Summary

Protocol Standards: TBR 1 (01.97)  
TBR 2 (01.97)  
NET 1, second edition 1994  
NET 2, second edition 1994

Protocol Conformance Test Report: *See Section 6*

Abstract Test Suite (ATS) Standard: *TBR 1 (01.97)*  
*TBR 2 (01.97)*  
NET 1, second edition 1994  
NET 2, second edition 1994

Abstract Test Method: *Remote Single Layer Embedded (RSE)*

#### Real Test system:

#### **Executable Test Suite (ETS) Identification:**

	Serial-No.
Digital Multimeter HP 34401A	3146A25410
Digital Multimeter HP 34401A	3146A34621
Power Supply HP6235A	2450A08776
Oscilloscope HP 54520A	3415A00472
Frequency Generator HP 33120A	US34014718
Capacitance/Resistance Decade RCS-500	A0010

#### Conformance Status:

Static Conformance Errors : **No**  
Dynamic Conformance Errors : **No**

Passed : ALL  
Failed : 0

### 3.2 Parameterized Executable Test Suite (PETS) Layer 1

The selection of the tests is limited by the implemented capabilities.

#### 3.1.1 Clause X.21/V.11

NET 1 Clause	Selected	Run	Verdict	Observation
8.1.1.2, CCITT V.11, 5.2	Yes	Yes	Pass	
8.1.1.2, CCITT V.11, 5.3	Yes	Yes	Pass	
8.1.1.2.2a	Yes	Yes	Pass	
8.1.1.2.2b	Yes	Yes	Pass	
8.1.1.2.2c	no			
8.1.2	no			Note 1
8.1.3	no			

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.



### 3.1.2 Clause V.24/V.28

NET 2 Clause	Selected	Run	Verdict	Observation
8.2.1.1	no			Note 1
8.2.1.2	no			
8.2.2.1, Annex A, Table A-1	no			Note 1
8.2.4.1, Annex B.1.1	yes	yes	pass	
8.2.4.1, Annex B.1.2	yes	yes	pass	
8.2.4.1, Annex B.1.3	yes	yes	pass	
8.2.4.1, Annex B.1.4	yes	yes	pass	
8.2.4.1, Annex B.1.5	yes	yes	pass	
8.2.4.1, Annex B.1.6	yes	yes	pass	
8.2.4.1, Annex B.2.1	yes	yes	pass	
8.2.4.1, Annex B.2.2	yes	yes	pass	
8.2.4.1, Annex B.2.3	yes	yes	pass	
8.2.4.1, Annex B.2.4	yes	yes	pass	
8.2.4.1, Annex B.3.1	yes	yes	pass	
8.2.4.1, Annex B.3.2	no			
8.2.4.1, Annex B.3.3	yes	yes	pass	
8.2.4.1, Annex B.3.4	yes	yes	pass	
8.2.4.1, Annex B.4	yes	yes	pass	
8.2.4.1, Annex B.5	yes	yes	pass	
8.2.4.1, Annex B.7	no			

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.



### 3.1.3 Clause V.35

NET 2 Clause	Selected	Run	Verdict	Observation
8.2.1.1	no			Note 1
8.2.1.2	no			
8.2.2.2, Annex A, Table A-2	no			Note 1
8.2.4.2, Annex C.1.1	yes	yes	pass	
8.2.4.2, Annex C.1.2	yes	yes	pass	
8.2.4.2, Annex C.1.3	yes	yes	pass	
8.2.4.2, Annex C.1.4	yes	yes	pass	
8.2.4.2, Annex C.2	no			Note 1
8.2.4.2, Annex C.3.1	yes	yes	pass	
8.2.4.2, Annex C.3.2	yes	yes	pass	
8.2.4.2, Annex C.4	yes	yes	pass	
8.2.4.1, Annex B.1.2	yes	yes	pass	
8.2.4.1, Annex B.1.3	yes	yes	pass	
8.2.4.1, Annex B.1.4	yes	yes	pass	
8.2.4.1, Annex B.1.5	yes	yes	pass	
8.2.4.1, Annex B.2.1	yes	yes	pass	
8.2.4.1, Annex B.2.2	yes	yes	pass	
8.2.4.1, Annex B.4	yes	yes	pass	
8.2.4.1, Annex B.5	yes	yes	pass	

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.



### 3.1.4 Clause V.36/V.10

NET 2 Clause	Selected	Run	Verdict	Observation
8.2.2.3, Annex A, Table A-3	no			Note 1
8.2.4.4, CCITT V.10, 5.2.1	yes	yes	pass	
8.2.4.4, CCITT V.10, 5.2.2	yes	yes	pass	
8.2.4.4, CCITT V.10, 5.2.3	yes	yes	pass	
NET 1 8.1.1.1.2	yes	yes	pass	

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.

### 3.1.5 Clause V.36/V.11

NET 2 Clause	Selected	Run	Verdict	Observation
8.2.1.1	no			Note 1
8.2.1.2	no			
8.2.2.3, Annex A, Table A-3	no			Note 1
8.2.4.5, CCITT V.11, 5.2	yes	yes	pass	
8.2.4.5, CCITT V.11, 5.3	yes	yes	pass	
NET 1 8.1.1.2.2a	yes	yes	pass	
NET 1 8.1.1.2.2b	yes	yes	pass	
NET 1 8.1.1.2.2c	no			

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.



## 4 Observations

Date: **March 09, 2001**

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.

Note 2 : Testing is only applied to chipset. No connections leads were used.

Measurements associated with different binary states of a circuit are noted with the inclusion of their polarity for the sake of clarity. Measurement limits for compliance are based on the absolute value of the measurements.

## 5 Summary of Compliance

Date: **March 09, 2001**

The test results in this test report apply only to the particular System under Test (SUT) and component Implementations under Test (IUTs) declared in this test report.

The SUT/IUT has not been shown by the conformance assessment to be non-conforming to the specified protocol standards. The test campaign did not reveal errors in the SUT/IUT.

Exclusion: the SUT/IUT did not include means of connection (cables) to DCE. See note 1.



## 6 Protocol Conformance Test Report

### 6.1 Protocol Conformance Test Report Layer 1

#### 6.1.1 Dates

Receipt of SUT/IUT: **April 22, 2002**

Date of Test: **April 26, 2002**

#### 6.1.2 Operator

Timothy Langeslay

A handwritten signature in black ink, appearing to read 'Timothy Langeslay', written over a horizontal line.

(Signature)

#### 6.1.3 Test System

Digital Multimeter HP 34401A

Power Supply HP6235A

Oscilloscope HP 54520A

Frequency Generator HP 33120A

Protocol Tester HP Idacom PT 300

Capacitance/Resistance Decade RCS-500

#### 6.1.4 Test Environment

Temperature : In the range of 15°C to 35°C  Yes  No

Relative humidity : In the range of 5% to 75%  Yes  No

All tests are carried out within +/- 5% of the normal operating voltage of 3.3 Vdc.





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## 6.2 Test Results

### 6.2.1 15-pin DTE/DCE interface ISO 4903

(CCITT Recommendation X.21/V.10/V.11 interface)

Test Case	Requirement	Result	Verdict	Comment
	TBR NET			
7.2.5.1	6.2.5.1 8.1.2	ISO 4903 (15-pole)	NT	Note 1
7.2.5.2	6.2.5.2 8.1.2	Pin out designations	NT	Note 1

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.

### CCITT V.11 Interchange Circuits

A - B terminated with 3.9 Kohm

#### Binary State 1

Circuit TxD 103

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	0.037 V	pass	

Circuit RTS 105

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	0.034 V	pass	

Circuit DTR 108

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	0.035 V	pass	

Circuit TxCE 113

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	0.037 V	pass	



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**Binary State 2**  
 Circuit TxD 103

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	-4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	0.039 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	

Circuit RTS 105

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	-4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	0.035 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	

Circuit DTR 108

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	-4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	0.036 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	

Circuit TxCE 113

Test Case	Description	Limits TBR / NET	Result	Verdict	Comment
TBR - 7.4.1.1	A - B	$V_o \leq 12.0V / \leq 6.0V$	-4.9 V	pass	
NET - 5.2.1	A - C	$V_o \leq 12.0V / \leq 6.0V$	0.037 V	pass	
	B - C	$V_o \leq 12.0V / \leq 6.0V$	5.0 V	pass	



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A - B terminated with 2 x 50 Ohm

**Binary State 1**

Circuit TxD 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	2.9 V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.3 V	pass	

Circuit RTS 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	3.0 V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

Circuit DTR 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	3.0 V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

Circuit TxCE 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	2.9 V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	



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**Binary State 2**

## Circuit TxD 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-2.9 V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

## Circuit RTS 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-3.0 V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

## Circuit DTR 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-3.0 V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

## Circuit TxCE 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-2.9V	pass	
NET - 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	



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### Short Circuit Measurement

#### Circuit TxD 103

Description	Limits	Results	Verdict	Observation
NET – 5.2.3				
A – C	$I_{sa} \leq 150 \text{ mA}$	99.4 mA	pass	
B – C	$I_{sb} \leq 150 \text{ mA}$	0.009 mA	pass	

#### Circuit RTS 105

Description	Limits	Results	Verdict	Observation
NET – 5.2.3				
A – C	$I_{sa} \leq 150 \text{ mA}$	103.5 mA	pass	
B – C	$I_{sb} \leq 150 \text{ mA}$	0.022 mA	pass	

#### Circuit DTR 108

Description	Limits	Results	Verdict	Observation
NET – 5.2.3				
A - C	$I_{sa} \leq 150 \text{ mA}$	102.9 mA	pass	
B - C	$I_{sb} \leq 150 \text{ mA}$	0.034 mA	pass	

#### Circuit TxCE 113

Description	Limits	Results	Verdict	Observation
NET – 5.2.3				
A - C	$I_{sa} \leq 150 \text{ mA}$	99.3 mA	pass	
B - C	$I_{sb} \leq 150 \text{ mA}$	0.009 mA	pass	



## Power-off Measurement

### Circuit TxD 103

Description	Limits	Results	Verdict	Observation
NET – 5.2.4				
+0.25V applied	$I_{xa} \leq 100 \mu A$	0.6 $\mu A$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu A$	0.6 $\mu A$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	

### Circuit RTS 105

Description	Limits	Results	Verdict	Observation
+0.25V applied	$I_{xa} \leq 100 \mu A$	0.6 $\mu A$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu A$	0.5 $\mu A$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	

### Circuit DTR 108

Description	Limits	Results	Verdict	Observation
+0.25V applied	$I_{xa} \leq 100 \mu A$	0.6 $\mu A$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu A$	0.6 $\mu A$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	

### Circuit TxCE 113

Description	Limits	Results	Verdict	Observation
+0.25V applied	$I_{xa} \leq 100 \mu A$	0.6 $\mu A$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu A$	0.6 $\mu A$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu A$	0.1 $\mu A$	pass	



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### Generator Output Risetime

#### Circuit TxD 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3 \text{ tb}$	8.8 ns	pass	
NET - 5.3		NET - $20\text{ns} \geq t \text{ or } t \leq 0.1\text{tb}$	8.4 ns	pass	

#### Circuit RTS 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3 \text{ tb}$	8.0 ns	pass	
NET - 5.3		NET - $20\text{ns} \geq t \text{ or } t \leq 0.1\text{tb}$	7.8 ns	pass	

#### Circuit DTR 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3 \text{ tb}$	8.4 ns	pass	
NET - 5.3		NET - $20\text{ns} \geq t \text{ or } t \leq 0.1\text{tb}$	7.9 ns	pass	

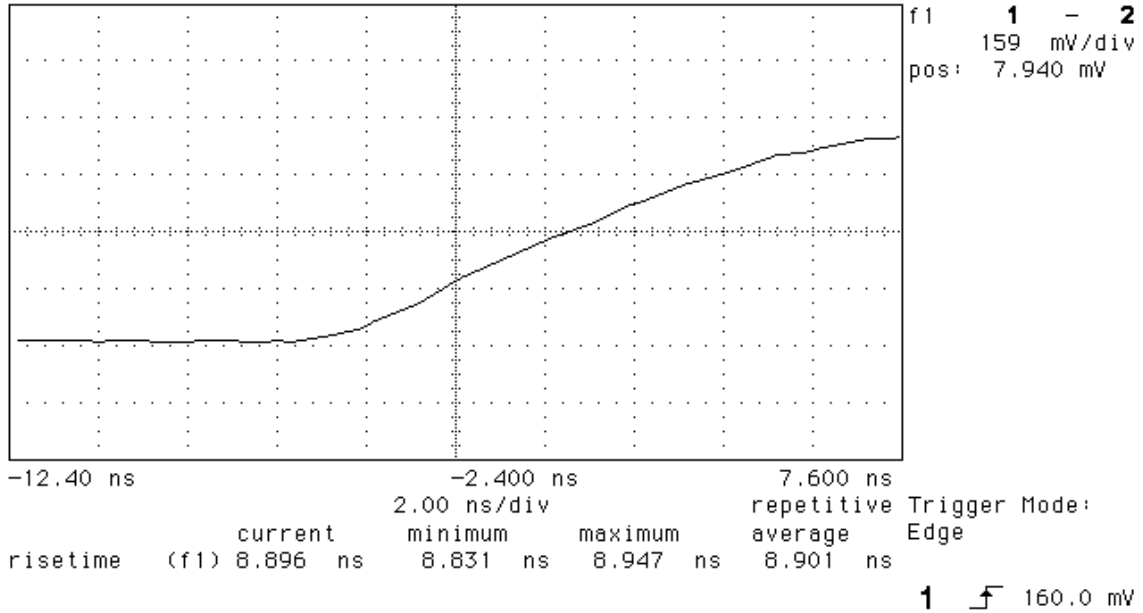
#### Circuit TxCE 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3 \text{ tb}$	8.7 ns	pass	
NET - 5.3		NET - $20\text{ns} \geq t \text{ or } t \leq 0.1\text{tb}$	8.0 ns	pass	

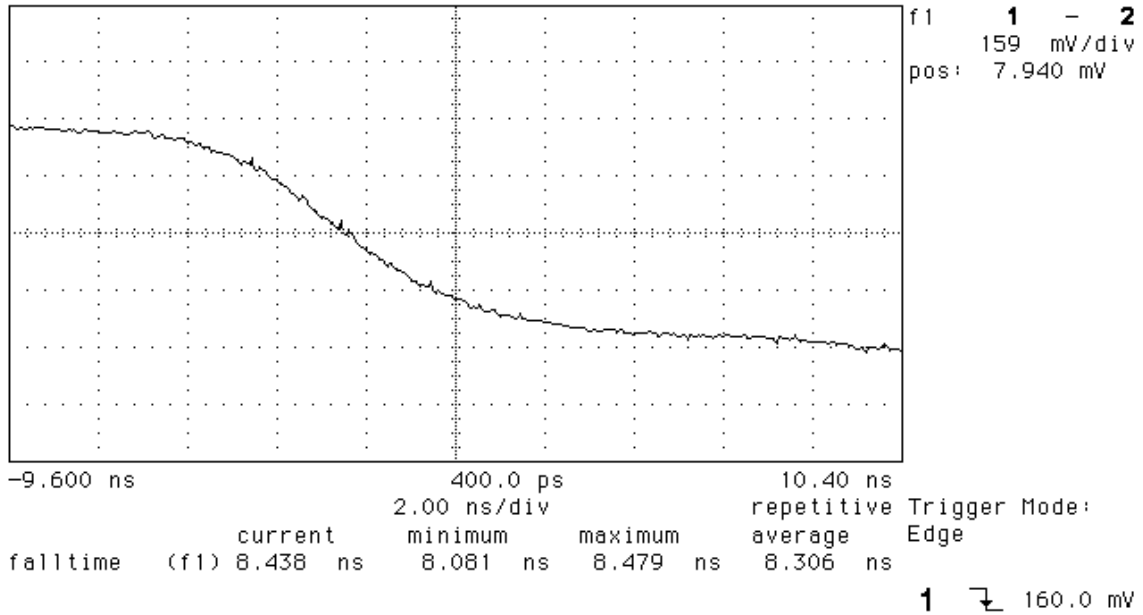


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hp stopped



hp stopped

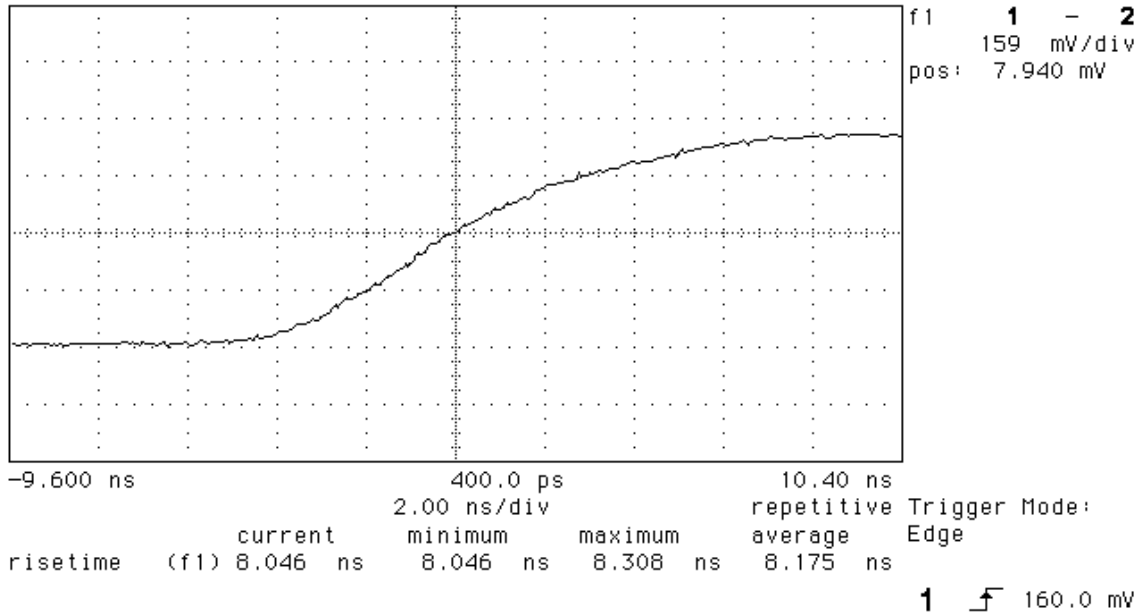




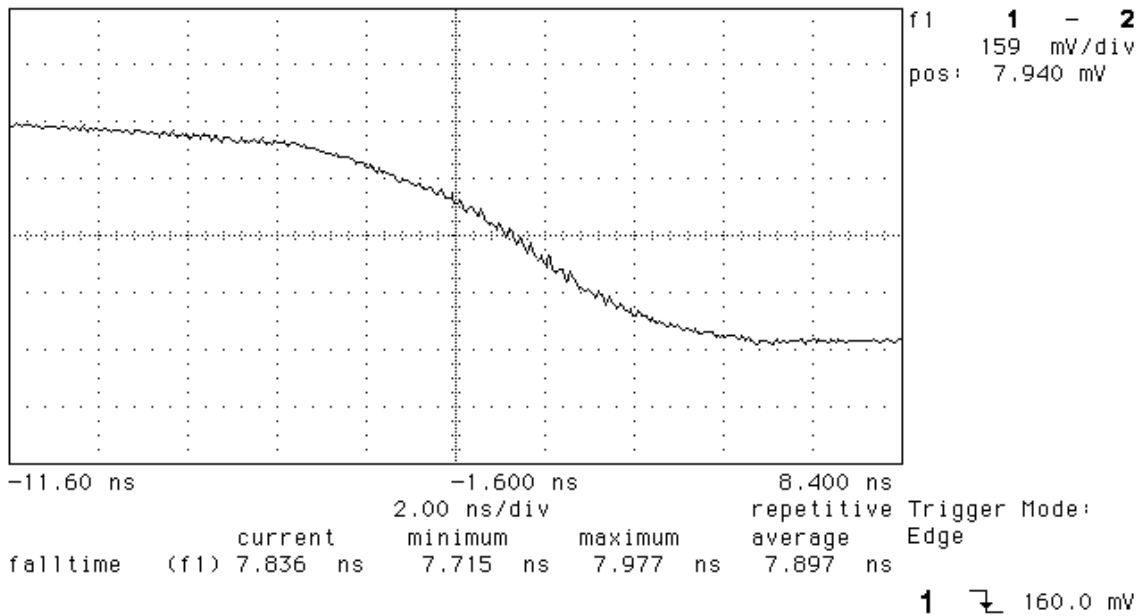


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hp stopped



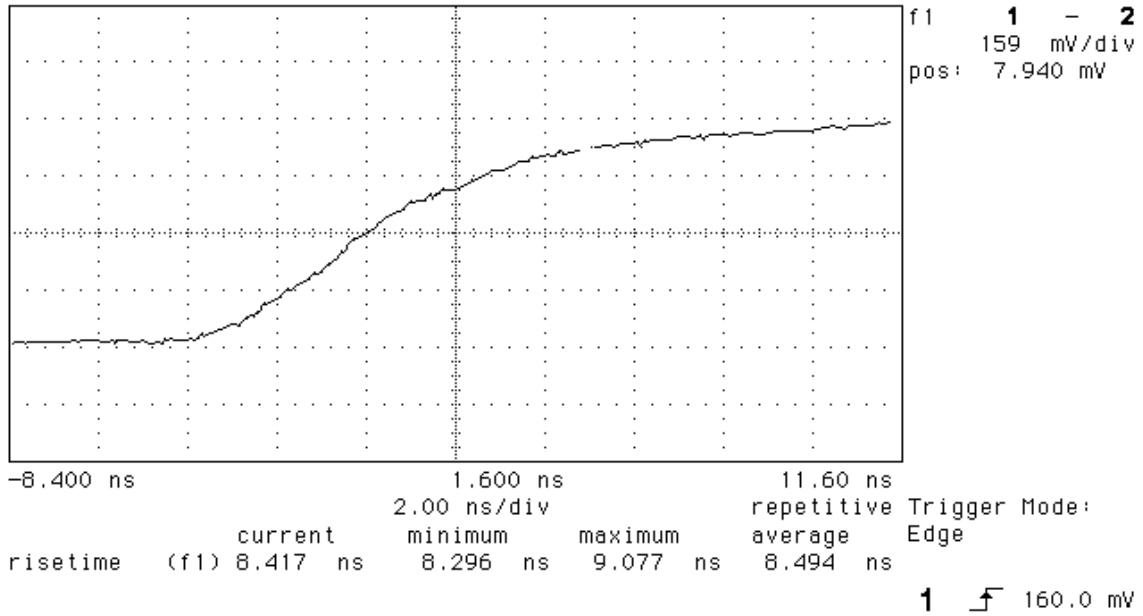
hp stopped



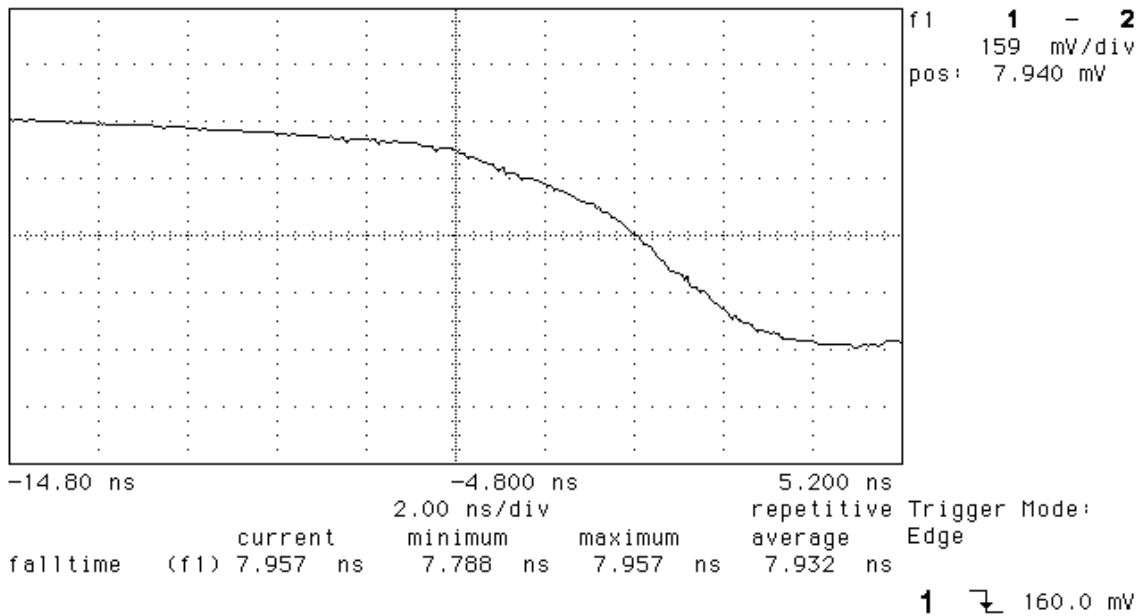


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hp stopped



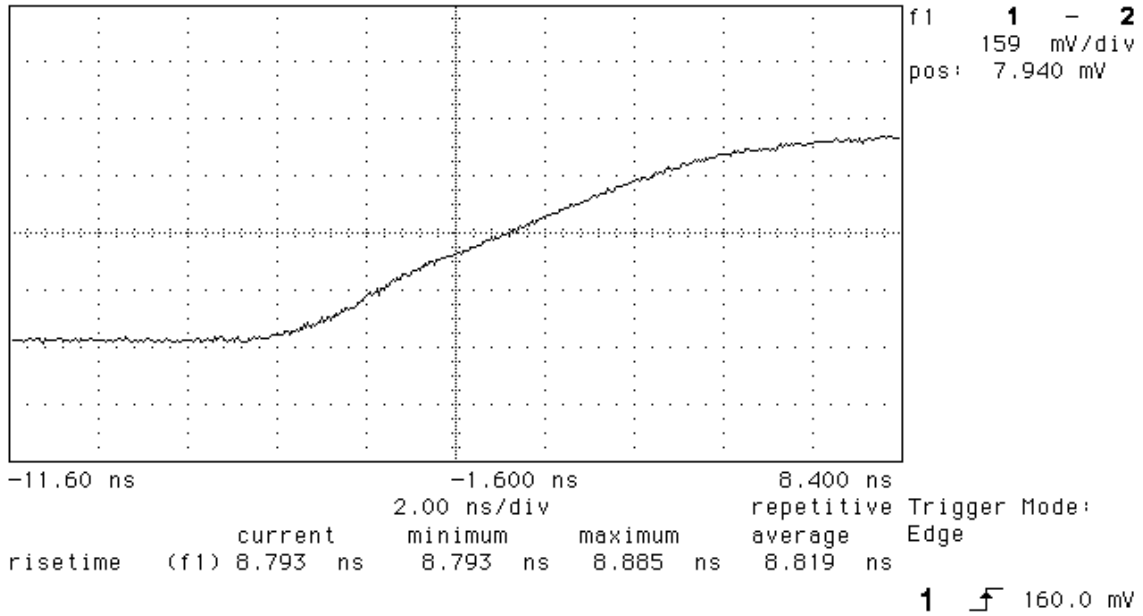
hp stopped



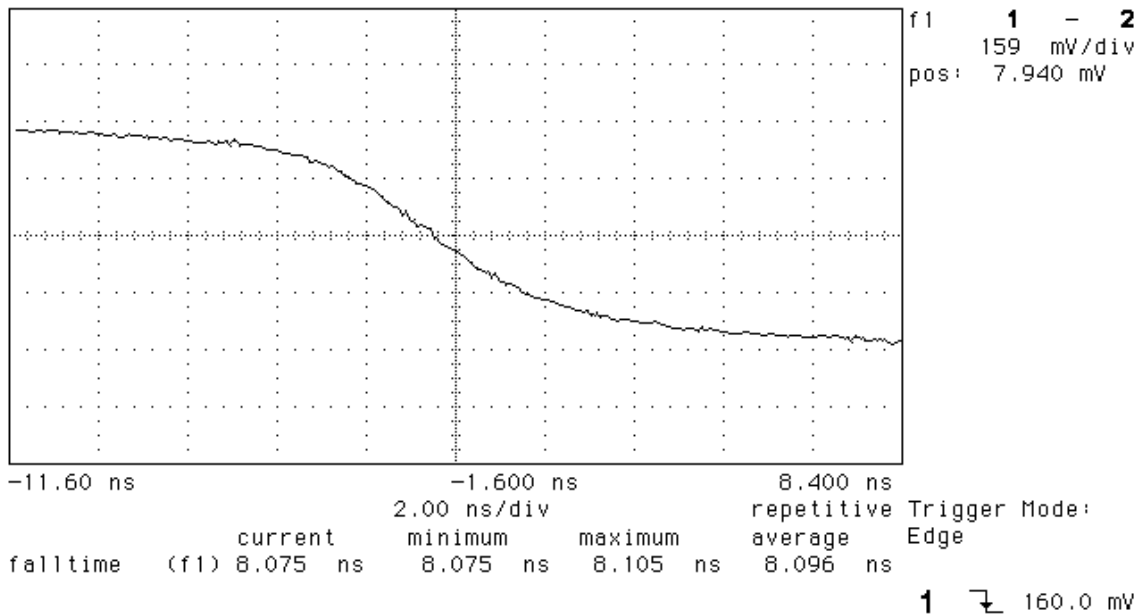


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hp stopped



hp stopped





## Receiver Characteristics NET - 6.1

Circuit RxD 104

The receiver *is* terminated with an optional cable resistance.

Limits according to NET 1, Revision 1, Figure 1

Description	Limits	Results	Verdict	Observation
Via = 6V	$I \leq 60.75 \text{ mA}$	56.7 mA	pass	
Via = 3V	$I \leq 30.75 \text{ mA}$	27.6 mA	pass	
Via = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.2 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.1 mA	pass	
Via = -6V	$I \leq 60.75 \text{ mA}$	-56.7 mA	pass	
Via = -3V	$I \leq 30.75 \text{ mA}$	-27.6 mA	pass	
Via = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.2 mA	pass	
Vib = 6V	$I \leq 60.75 \text{ mA}$	56.6 mA	pass	
Vib = 3V	$I \leq 30.75 \text{ mA}$	27.6 mA	pass	
Vib = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.2 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.1 mA	pass	
Vib = -6V	$I \leq 60.75 \text{ mA}$	-56.6 mA	pass	
Vib = -3V	$I \leq 30.75 \text{ mA}$	-27.6 mA	pass	
Vib = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.2 mA	pass	



## Circuit 106 CTS

The receiver *is not* terminated with an optional cable resistance.

Limits according to CCITT Recommendation V.11, Figure 6

Description	Limits	Results	Verdict	Observation
Via = 10V	$I \leq 3.25 \text{ mA}$	0.30 mA	pass	
Via = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Via = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Via = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	
Vib = 10V	$I \leq 3.25 \text{ mA}$	0.30 mA	pass	
Vib = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Vib = -3V	$I \leq 1.5 \text{ mA}$	-0.08mA	pass	

## Circuit 107 DSR

The receiver *is not* terminated with an optional cable resistance.

Limits according to CCITT Recommendation V.11, Figure 6

Description	Limits	Results	Verdict	Observation
Via = 10V	$I \leq 3.25 \text{ mA}$	0.30 mA	pass	
Via = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Via = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Via = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	
Vib = 10V	$I \leq 3.25 \text{ mA}$	0.30 mA	pass	
Vib = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Vib = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	



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## Circuit 109 DCD

The receiver *is not* terminated with an optional cable resistance.

Limits according to CCITT Recommendation V.11, Figure 6

Description	Limits	Results	Verdict	Observation
Via = 10V	$I \leq 3.25 \text{ mA}$	0.29 mA	pass	
Via = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Via = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Via = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	
Vib = 10V	$I \leq 3.25 \text{ mA}$	0.30 mA	pass	
Vib = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Vib = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	

## Circuit 114 TxC

The receiver *is* terminated with an optional cable resistance.

Limits according to NET 1, Revision 1, Figure 1

Description	Limits	Results	Verdict	Observation
Via = 6V	$I \leq 60.75 \text{ mA}$	53.4 mA	pass	
Via = 3V	$I \leq 30.75 \text{ mA}$	26.7 mA	pass	
Via = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	8.9 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Via = -6V	$I \leq 60.75 \text{ mA}$	-52.9 mA	pass	
Via = -3V	$I \leq 30.75 \text{ mA}$	-26.5 mA	pass	
Via = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-8.9 mA	pass	
Vib = 6V	$I \leq 60.75 \text{ mA}$	53.6 mA	pass	
Vib = 3V	$I \leq 30.75 \text{ mA}$	26.7 mA	pass	
Vib = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	8.9 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -6V	$I \leq 60.75 \text{ mA}$	-52.9 mA	pass	
Vib = -3V	$I \leq 30.75 \text{ mA}$	-26.5 mA	pass	
Vib = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-8.9 mA	pass	



## Circuit 115 RxC

The receiver is terminated with an optional cable resistance.

Limits according to NET 1, Revision 1, Figure 1

Description	Limits	Results	Verdict	Observation
Via = 6V	$I \leq 60.75 \text{ mA}$	55.4 mA	pass	
Via = 3V	$I \leq 30.75 \text{ mA}$	27.5 mA	pass	
Via = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.2 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.1 $\mu\text{A}$	pass	
Via = -6V	$I \leq 60.75 \text{ mA}$	-55.4 mA	pass	
Via = -3V	$I \leq 30.75 \text{ mA}$	-27.5 mA	pass	
Via = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.2 mA	pass	
Vib = 6V	$I \leq 60.75 \text{ mA}$	55.4 mA	pass	
Vib = 3V	$I \leq 30.75 \text{ mA}$	27.5 mA	pass	
Vib = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.2 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.1 $\mu\text{A}$	pass	
Vib = -6V	$I \leq 60.75 \text{ mA}$	-55.4 mA	pass	
Vib = -3V	$I \leq 30.75 \text{ mA}$	-27.5 mA	pass	
Vib = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.2 mA	pass	



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## CCITT V.10 Interchange Circuits

A - C terminated with 3.9 KOhm

### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.1	140	TBR $V \leq 12.0V$ NET $4V \leq V_o \leq 6V$	5.0 V	pass	
NET - 8.2.4.4	141		5.0 V	pass	

### Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.1	140	TBR $V \leq 12.0V$ NET $4V \leq V_o \leq 6V$	-5.8 V	pass	
NET - 8.2.4.4	141		-5.8 V	pass	

A - C terminated with 450 Ohm

### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.2	140	TBR $V_o \geq 2.0V$ NET $V_t \geq 0.9 * V_o$	4.6 V	pass	
NET - 8.2.4.4	141		4.6 V	pass	

### Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.2	140	TBR $V_o \geq 2.0V$ NET $V_t \geq 0.9 * V_o$	-5.3 V	pass	
NET - 8.2.4.4	141		-5.1 V	pass	





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Reference	Description	Limits	Results	Verdict	Observation
NET -					
V.10 140 5.2.3	Short Circuit	$I_s \leq 150\text{mA}$	90.0 mA	pass	
V.10 141 5.2.3	Short Circuit	$I_s \leq 150\text{mA}$	84.1 mA	pass	
V.10 140 5.2.4	Power off 0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	
V.10 141 5.2.4	Power off -0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	
V.10 140 5.2.4	Power off 0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	
V.10 141 5.2.4	Power off -0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	

### Generator Output Risetime

#### Circuit 140

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.3.1.3	A - C	$t \leq 0.3 \text{ tb}$	586 ns pos	pass	
NET - 8.2.4.4		$t \leq 0.3 \text{ tb}$	919 ns neg	pass	

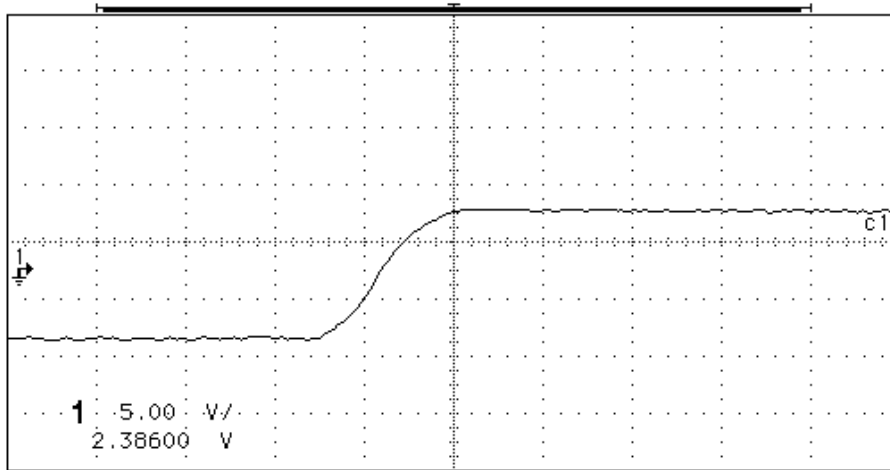
#### Circuit 141

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.3.1.3	A - C	$t \leq 0.3 \text{ tb}$	721 ns pos	pass	
NET - 8.2.4.4		$t \leq 0.3 \text{ tb}$	1239 ns neg	pass	



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hp



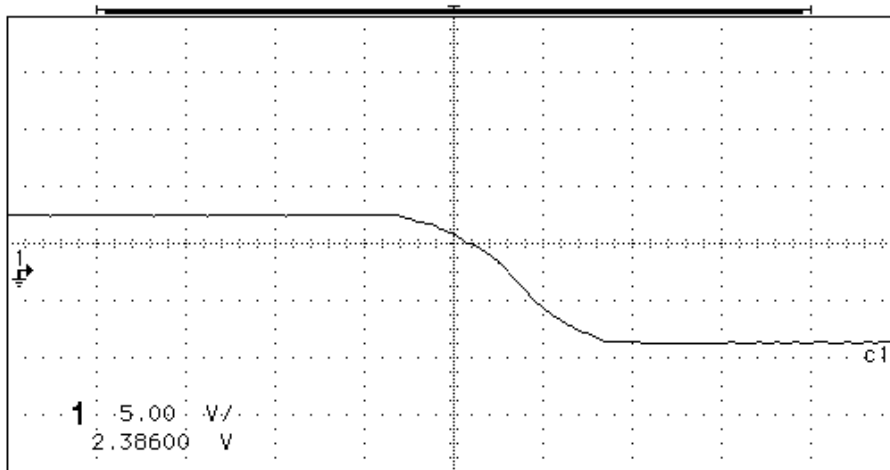
1 5.00 V/div  
pos: 2.386 V  
10.00:1 1MΩ dc

-5.0000 us 0.000 s 5.0000 us  
1.00 us/div realtime  
current minimum maximum average  
risetime (1) 585.925ns 561.875ns 600.175ns 584.944ns

Trigger Mode:  
Edge

1  $\int$  3.827 V

hp stopped



1 5.00 V/div  
pos: 2.386 V  
10.00:1 1MΩ dc

-5.0000 us 0.000 s 5.0000 us  
1.00 us/div realtime  
current minimum maximum average  
falltime (1) 919.688ns 887.238ns 945.438ns 920.851ns

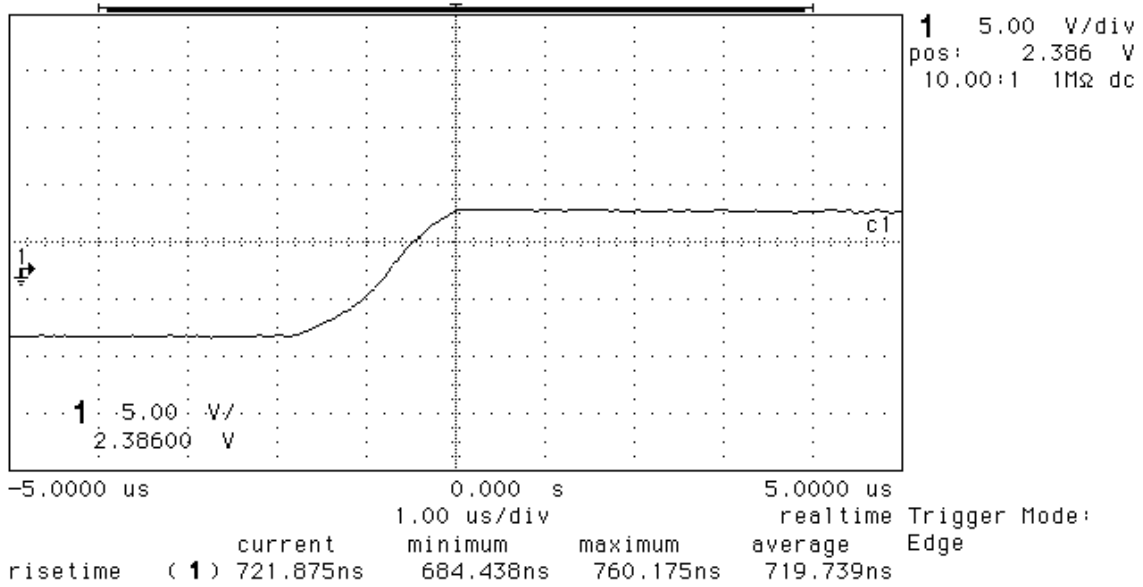
Trigger Mode:  
Edge

1  $\int$  3.827 V



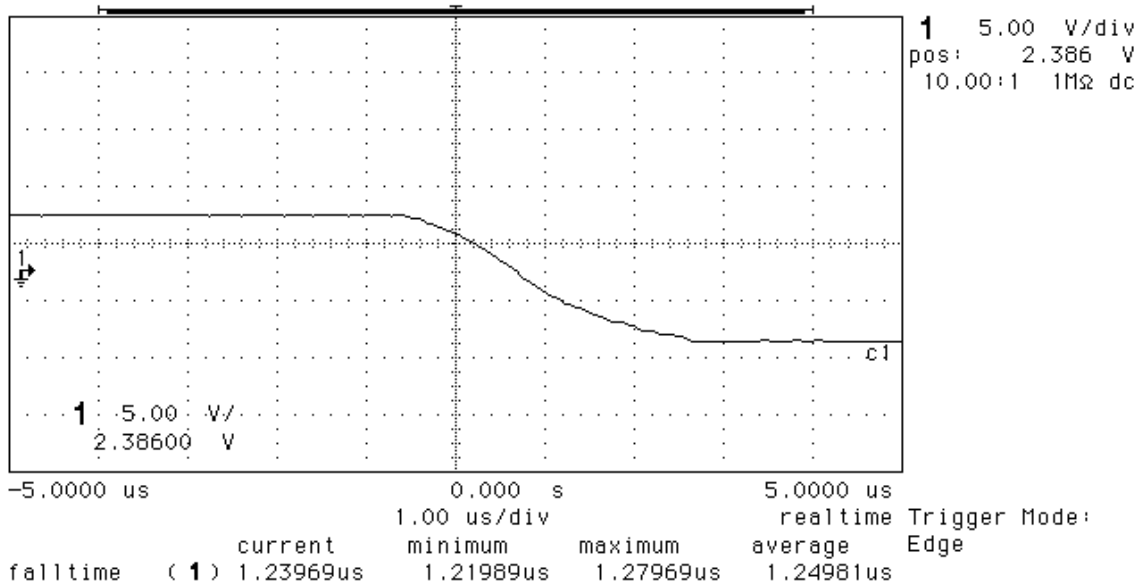
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hp stopped



1  $\int$  3.827 V

hp stopped



1  $\int$  3.827 V



## 6.2.2 25-pin DTE/DCE interface ISO 2110

(CCITT Recommendation V.24/V.28 (RS232) interface)

Test Case	Requirement	Result	Verdict	Comment
7.2.1.1	TBR - 6.2.1.1 NET - 8.2.2.1	ISO 2110 (25-pole)	NT	Note 1
7.2.1.2	TBR - 6.2.1.2 NET - 8.2.2.1	Table A.1 and A.2	NT	Note 1

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.

### Generator Characteristics

#### Protection against short circuit conditions (NET - Annex B.1.1)

Circuit	Limits	Results	Verdict	Observation
103	no damage	no damage	pass	
105	no damage	no damage	pass	
108	no damage	no damage	pass	
113	no damage	no damage	pass	
140	no damage	no damage	pass	
141	no damage	no damage	pass	

#### Generator Output Current Limit (NET - Annex B.1.2)

Circuit	Limits	Results		Verdict	Observation
		Binary State 1	Binary State 2		
103	$I \leq 0.5A$	27.0 mA	40.2 mA	pass	
105	$I \leq 0.5A$	31.1 mA	88.0 mA	pass	
108	$I \leq 0.5A$	31.0 mA	89.0 mA	pass	
113	$I \leq 0.5A$	27.8 mA	43.0 mA	pass	
140	$I \leq 0.5A$	31.6 mA	76.5 mA	pass	
141	$I \leq 0.5A$	32.4 mA	87.1 mA	pass	



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## CCITT V.28 Interchange Circuits

### A - C unterminated

#### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.1 NET - B.1.3	103	$V \leq 25.0V$	9.4 V	pass	
	105	$V \leq 25.0V$	9.4 V	pass	
	108	$V \leq 25.0V$	9.4 V	pass	
	113	$V \leq 25.0V$	9.4 V	pass	
	140	$V \leq 25.0V$	9.4 V	pass	
	141	$V \leq 25.0V$	9.4 V	pass	

#### Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.1 NET - B.1.3	103	$V \leq 25.0V$	-9.3 V	pass	
	105	$V \leq 25.0V$	-9.3 V	pass	
	108	$V \leq 25.0V$	-9.3 V	pass	
	113	$V \leq 25.0V$	-9.3 V	pass	
	140	$V \leq 25.0V$	-9.3 V	pass	
	141	$V \leq 25.0V$	-9.3 V	pass	



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A - C terminated with 3 KOhm  
**Binary State 1**

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.2 NET - B.1.4	103	TBR $\geq$ 3.0V NET $\geq$ 5.0V	8.6 V	pass	
	105	TBR $\geq$ 3.0V NET $\geq$ 5.0V	8.6 V	pass	
	108	TBR $\geq$ 3.0V NET $\geq$ 5.0V	8.6 V	pass	
	113	TBR $\geq$ 3.0V NET $\geq$ 5.0V	8.6 V	pass	
	140	TBR $\geq$ 3.0V NET $\geq$ 5.0V	8.7 V	pass	
	141	TBR $\geq$ 3.0V NET $\geq$ 5.0V	8.7 V	pass	

**Binary State 2**

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.2 NET - B.1.4	103	TBR $\geq$ 3.0V NET $\geq$ 5.0V	-8.8 V	pass	
	105	TBR $\geq$ 3.0V NET $\geq$ 5.0V	-9.0 V	pass	
	108	TBR $\geq$ 3.0V NET $\geq$ 5.0V	-9.0 V	pass	
	113	TBR $\geq$ 3.0V NET $\geq$ 5.0V	-8.8 V	pass	
	140	TBR $\geq$ 3.0V NET $\geq$ 5.0V	-9.0 V	pass	
	141	TBR $\geq$ 3.0V NET $\geq$ 5.0V	-8.7 V	pass	

A - C terminated with 7 KOhm

**Generator Output Voltage limit under minimum load (NET - Annex B.1.5)**

**Binary State 1**

Test Case	Circuit	Limits	Result	Verdict	Comment
NET - B.1.5	103	$\leq$ 15V	9.1 V	pass	
	105	$\leq$ 15V	9.1 V	pass	
	108	$\leq$ 15V	9.1 V	pass	
	113	$\leq$ 15V	9.1 V	pass	
	140	$\leq$ 15V	9.1 V	pass	
	141	$\leq$ 15V	9.1 V	pass	



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### Generator Output Risetime

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.3	103	$t \leq 0.03$ tb	518 ns pos	pass	
NET - B.3.2 & B.3.3	Pin 2	$t \leq 0.03$ tb	828 ns neg	pass	

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.3	105	$t \leq 0.03$ tb	524 ns pos	pass	
NET - B.3.2 & B.3.3	Pin 4	$t \leq 0.03$ tb	708 ns neg	pass	

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.3	108	$t \leq 0.03$ tb	540 ns pos	pass	
NET - B.3.2 & B.3.3	Pin 20	$t \leq 0.03$ tb	719 ns neg	pass	

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.3	113	$t \leq 0.03$ tb	492 ns pos	pass	
NET - B.3.2 & B.3.3	Pin 24	$t \leq 0.03$ tb	788 ns neg	pass	

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.3	140	$t \leq 0.03$ tb	502 ns pos	pass	
NET - B.3.2 & B.3.3	Pin 21	$t \leq 0.03$ tb	801 ns neg	pass	

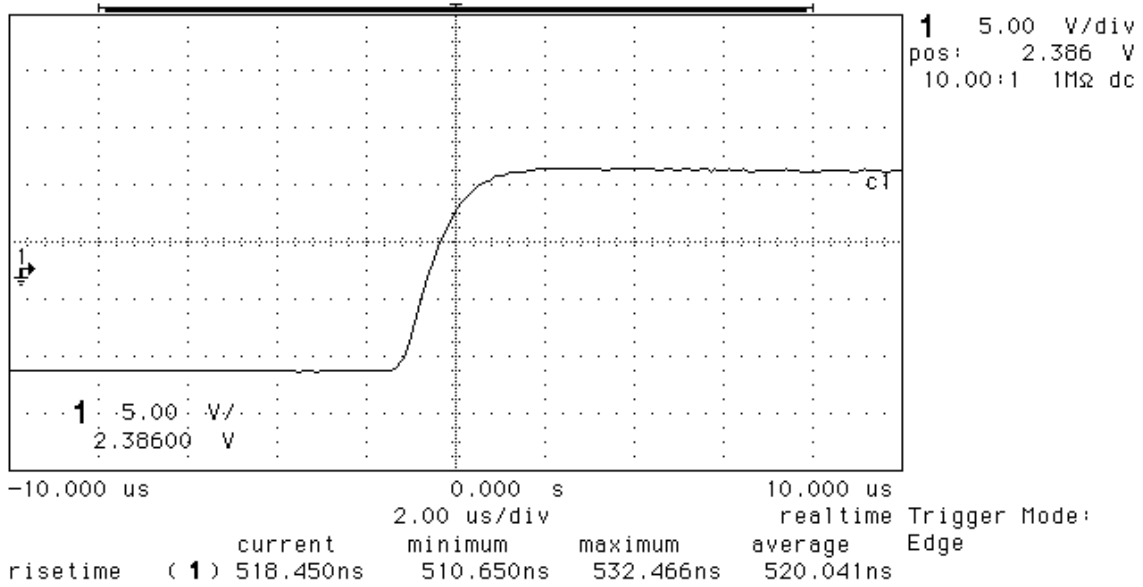
Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.3	141	$t \leq 0.03$ tb	501 ns pos	pass	
NET - B.3.2 & B.3.3	Pin 25	$t \leq 0.03$ tb	797 ns neg	pass	

(X) B7 no: The generator was terminated with 3000 Ohms and 2500pF



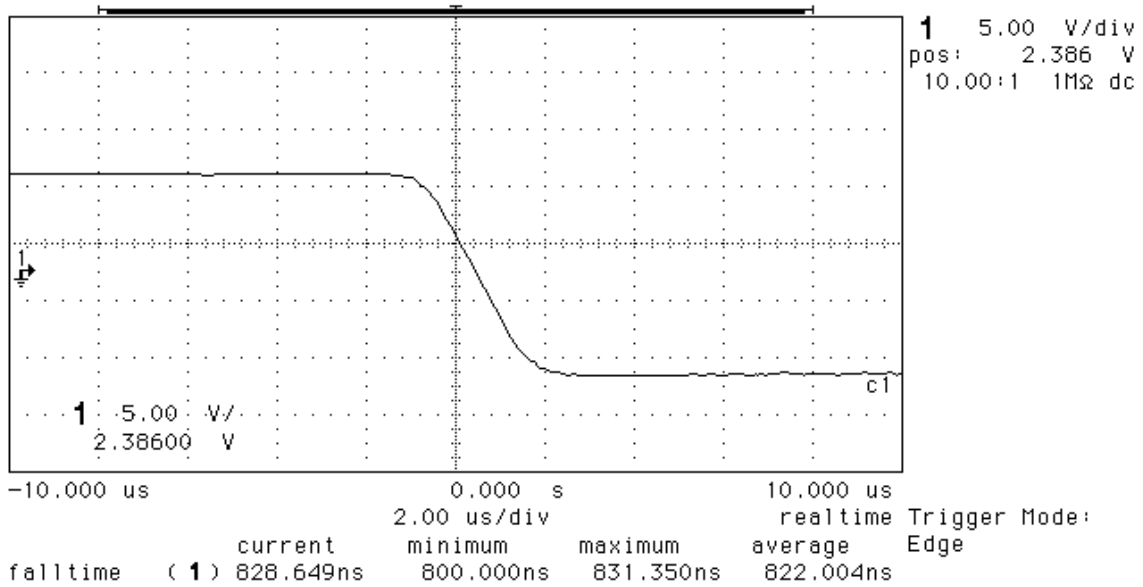
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hp stopped



1  $\int$  3.827 V

hp stopped



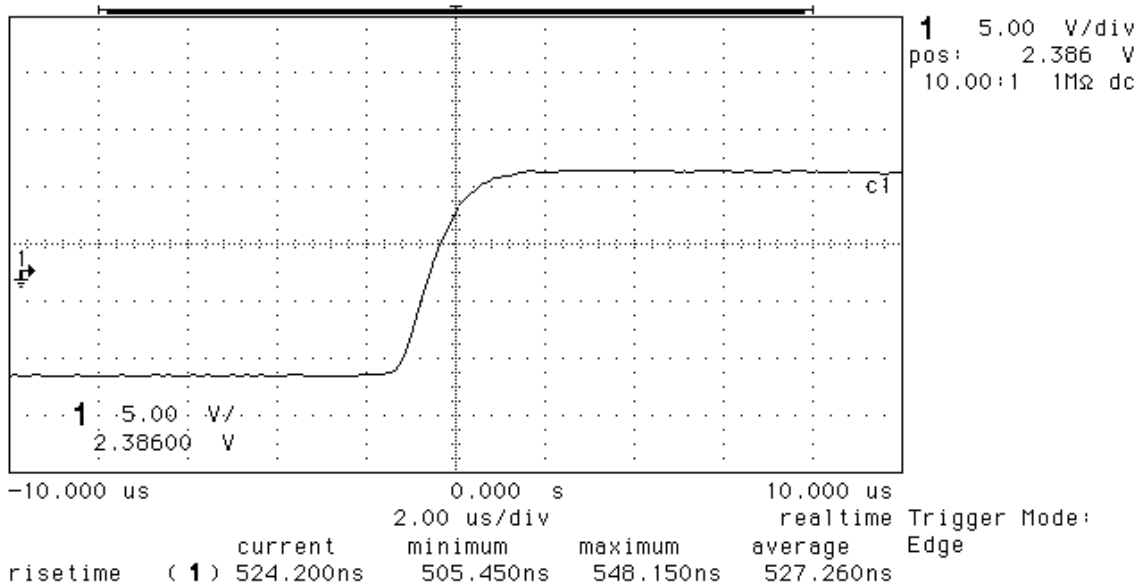
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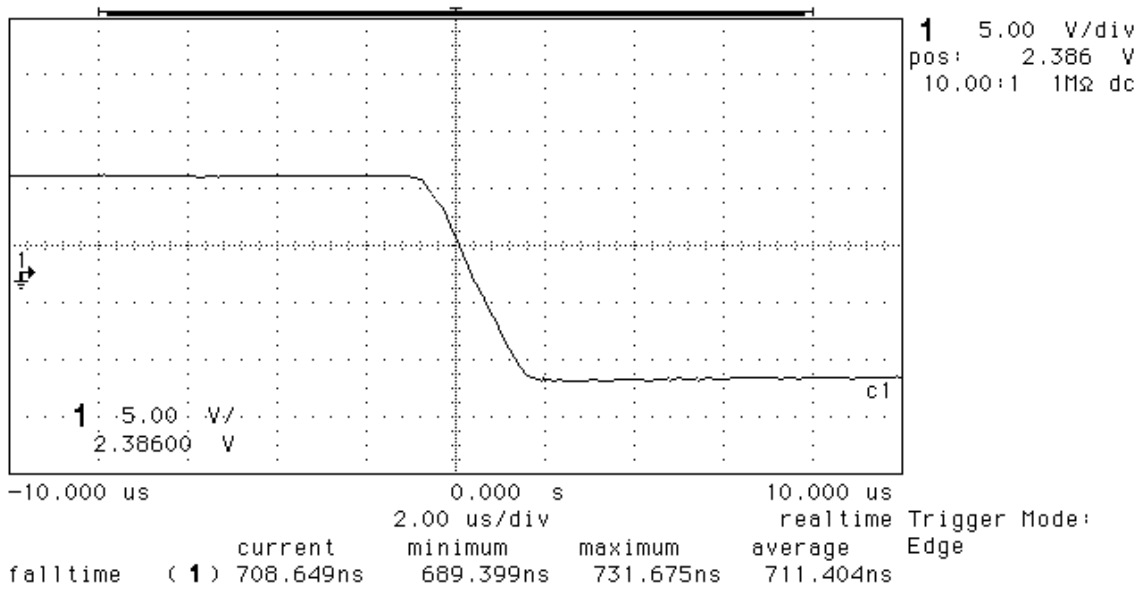
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hp stopped



1 3.827 V

hp stopped

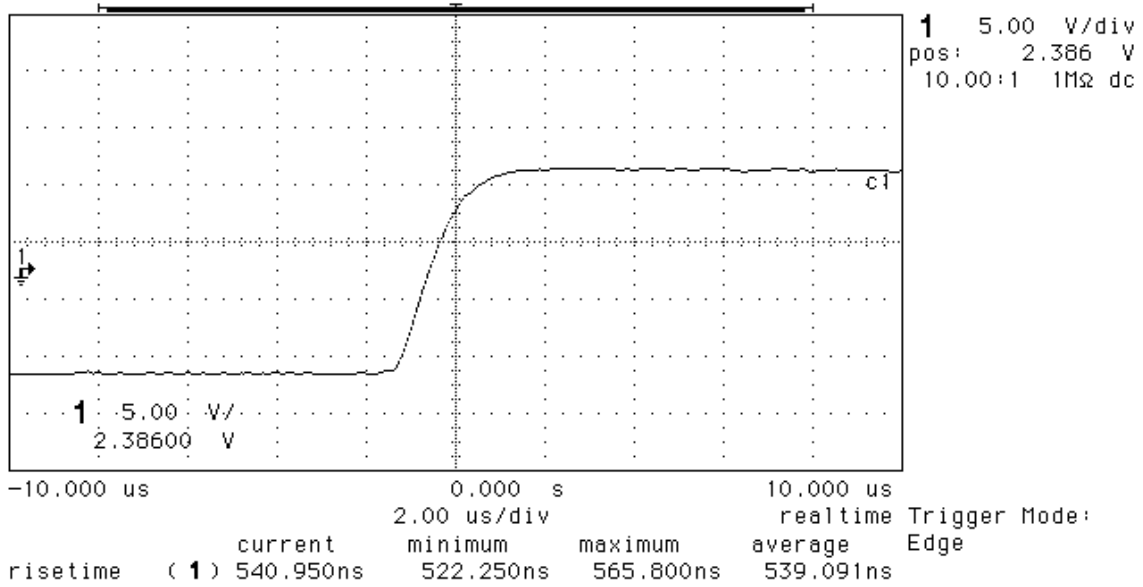


1 3.827 V



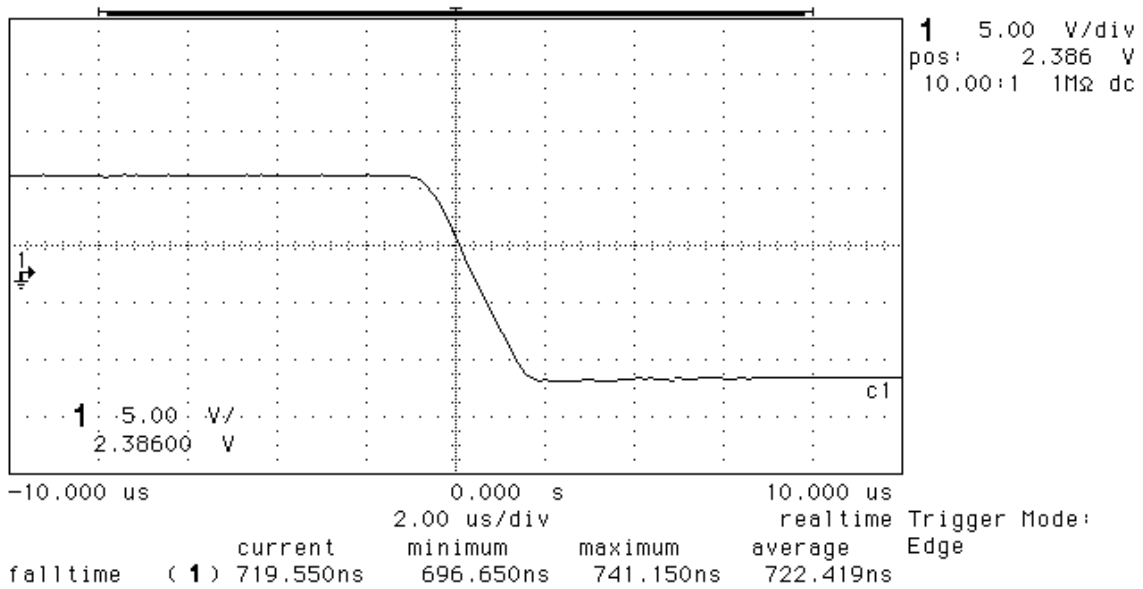
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hp stopped



1 3.827 V

hp stopped

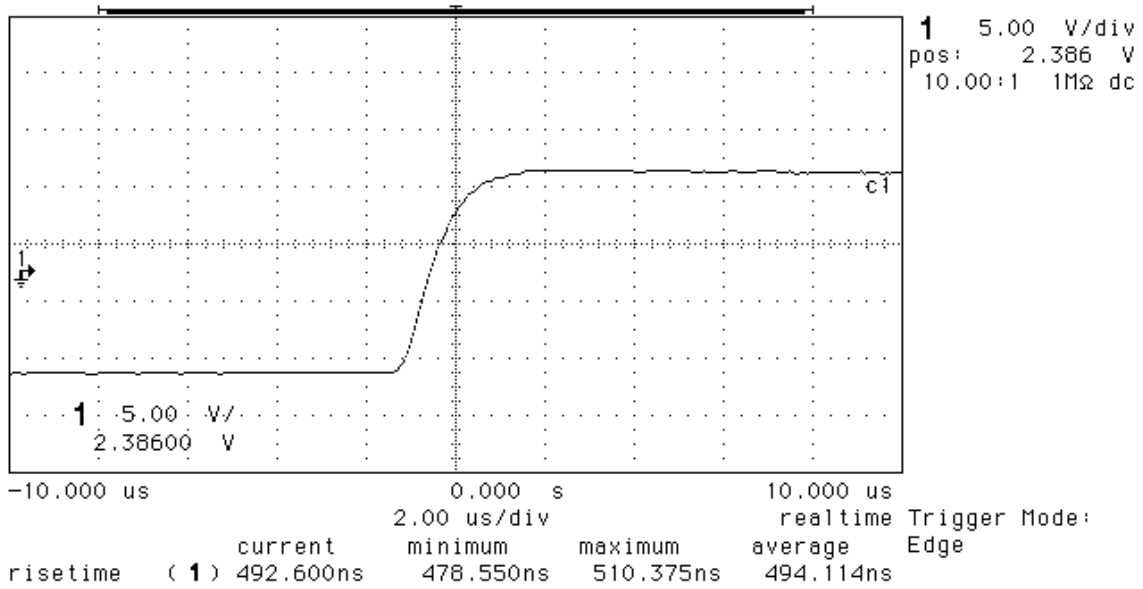


1 3.827 V



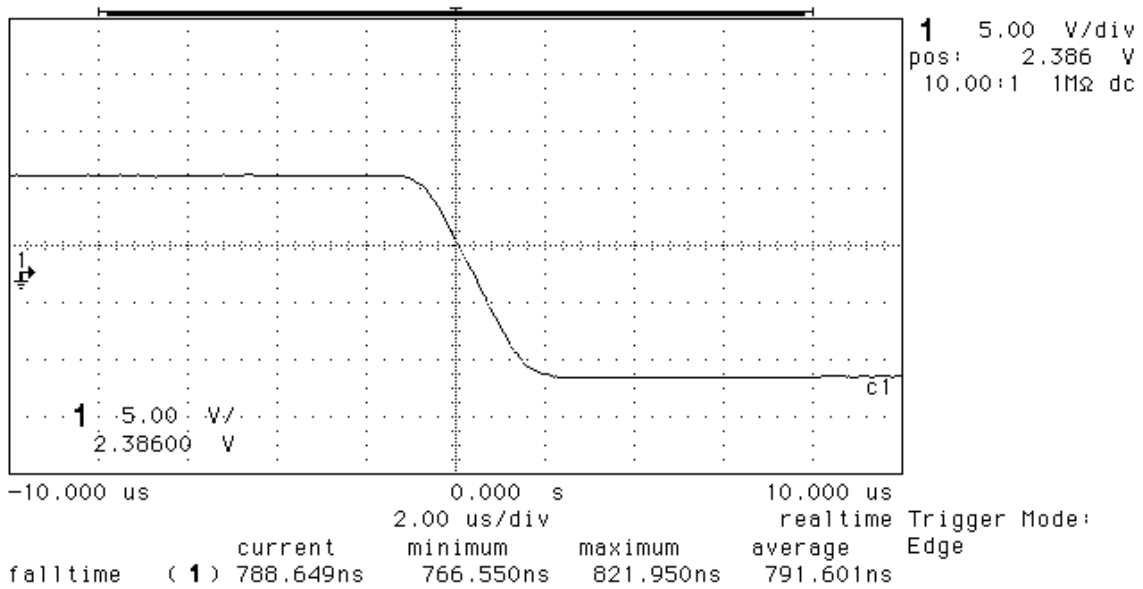
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hp stopped



1 3.827 V

hp stopped

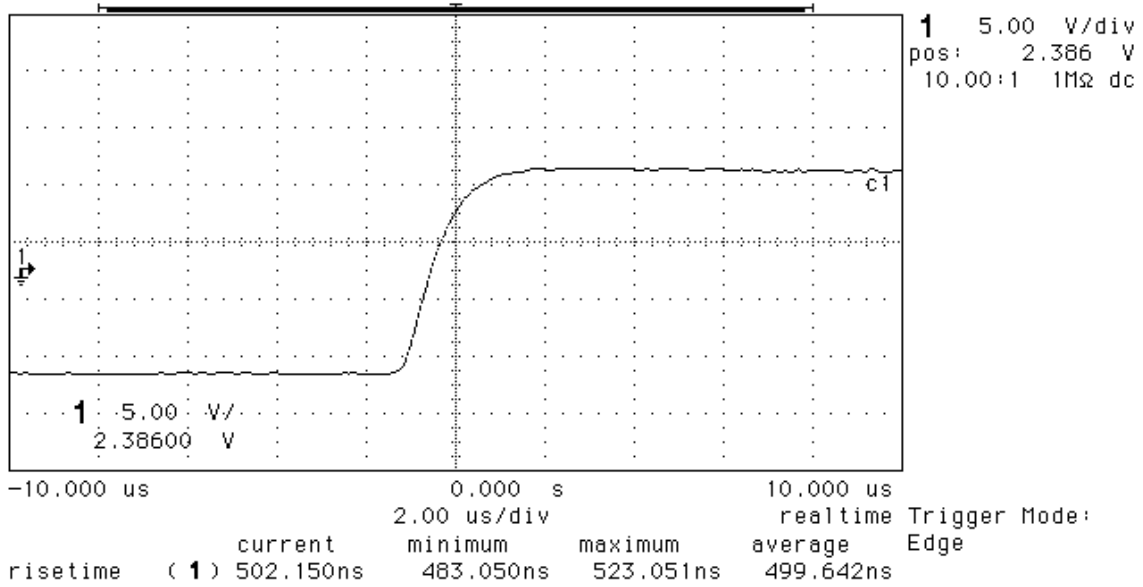


1 3.827 V



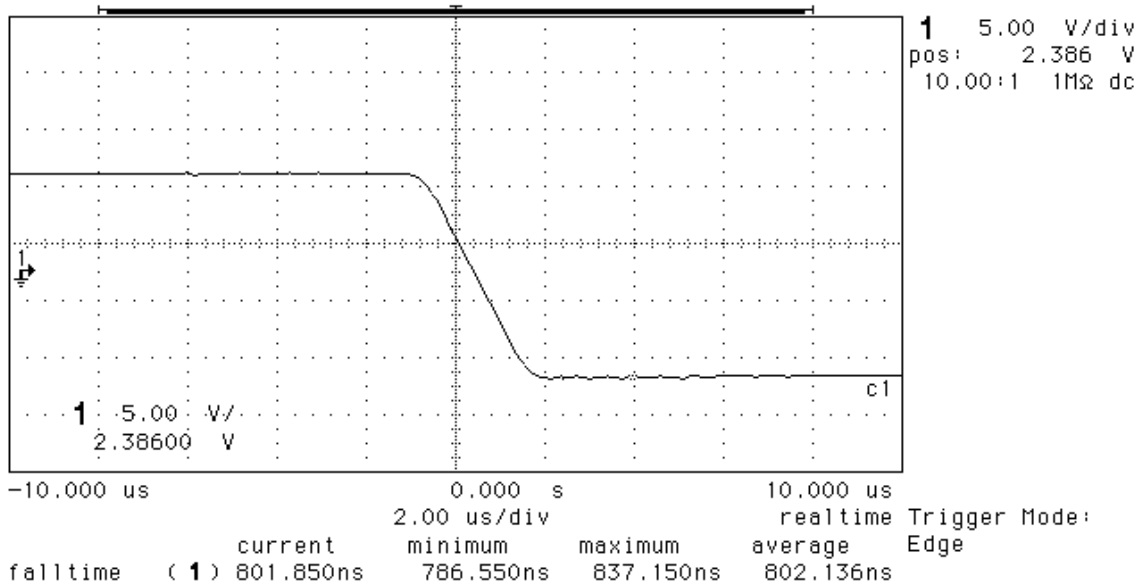
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hp stopped



1 3.827 V

hp stopped

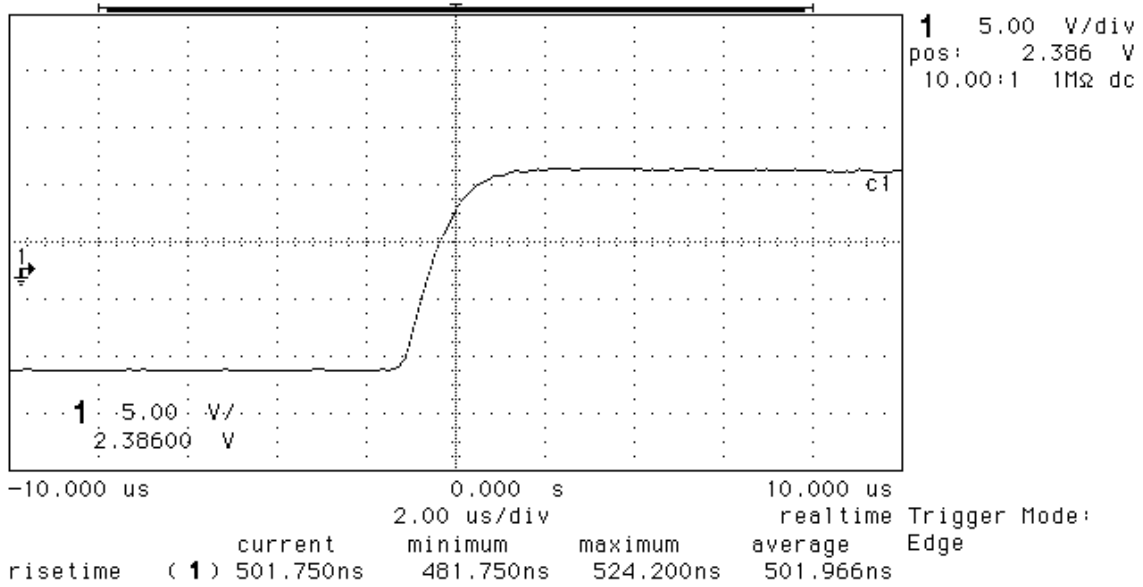


1 3.827 V



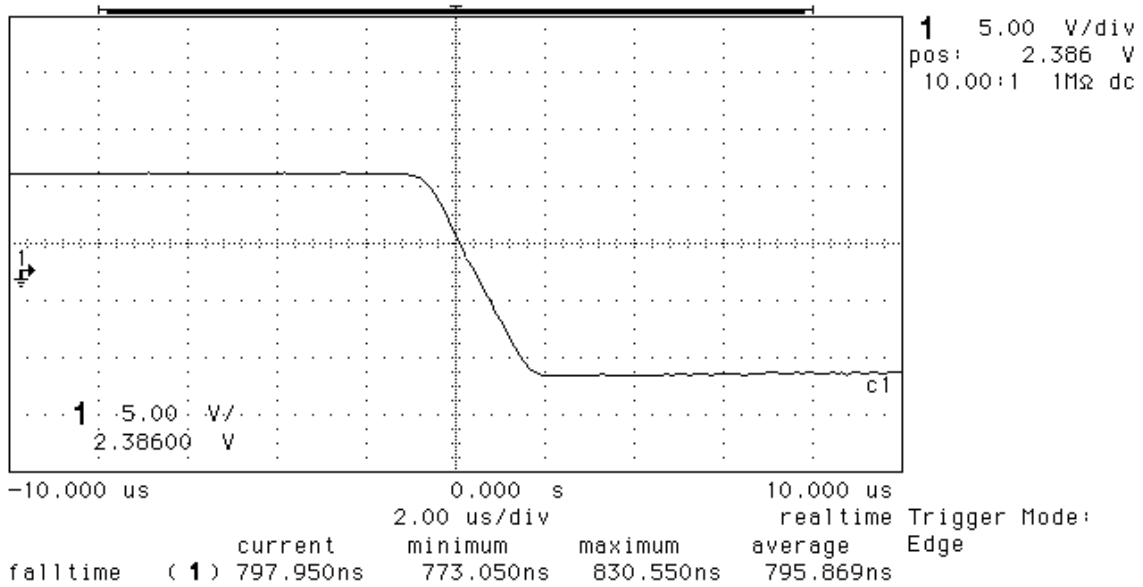
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hp stopped



1 3.827 V

hp stopped



1 3.827 V



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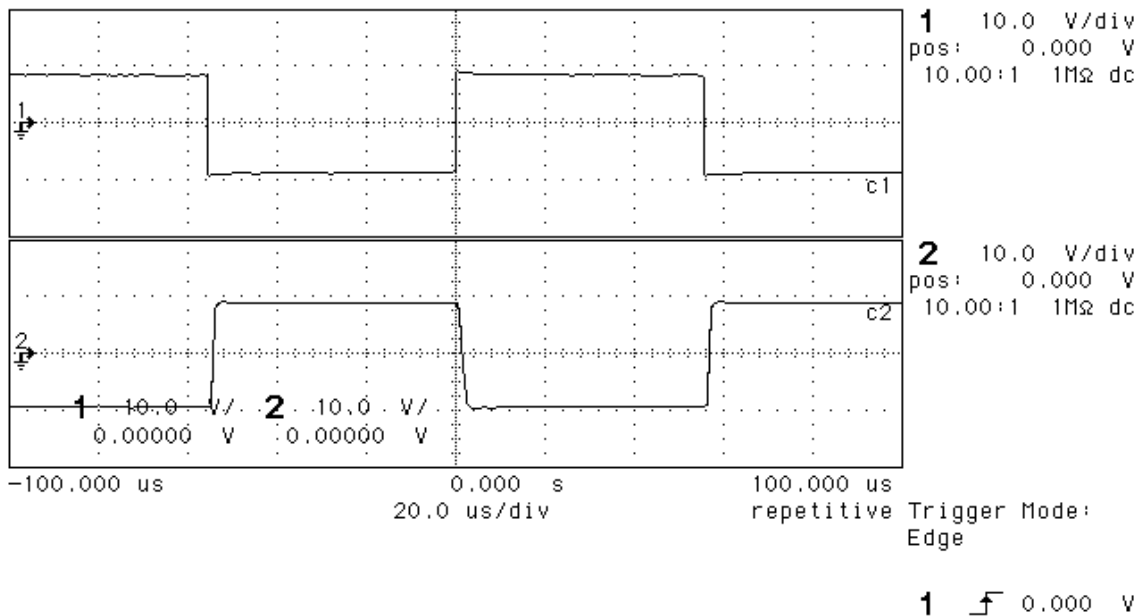
**Generator Output Power (NET - Annex B.1.6)**

(x) o.k. - see test NET - Annex B.3.1 b

**Wave Form (NET - Annex B.3.1)**

Circuit	Limits	Results	Verdict	Observation
103 slope positive	monotone, no negative components	monotone, no negative components	pass	
103 slope negative	monotone, no negative components	monotone, no negative components	pass	

*hp* stopped



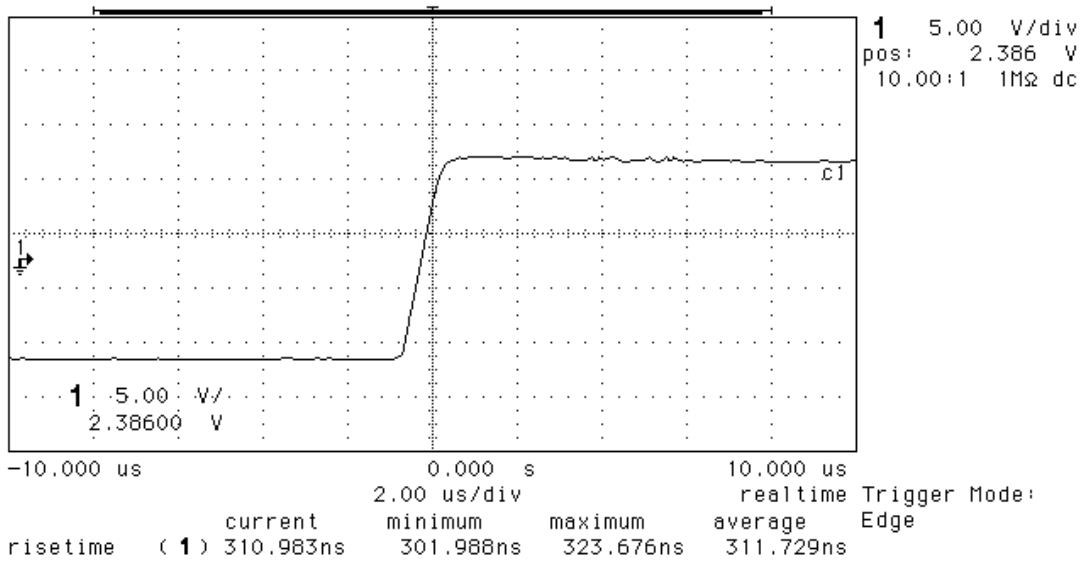


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**Maximum Instantaneous Rate of Voltage Change (NET - Annex B.3.4)**

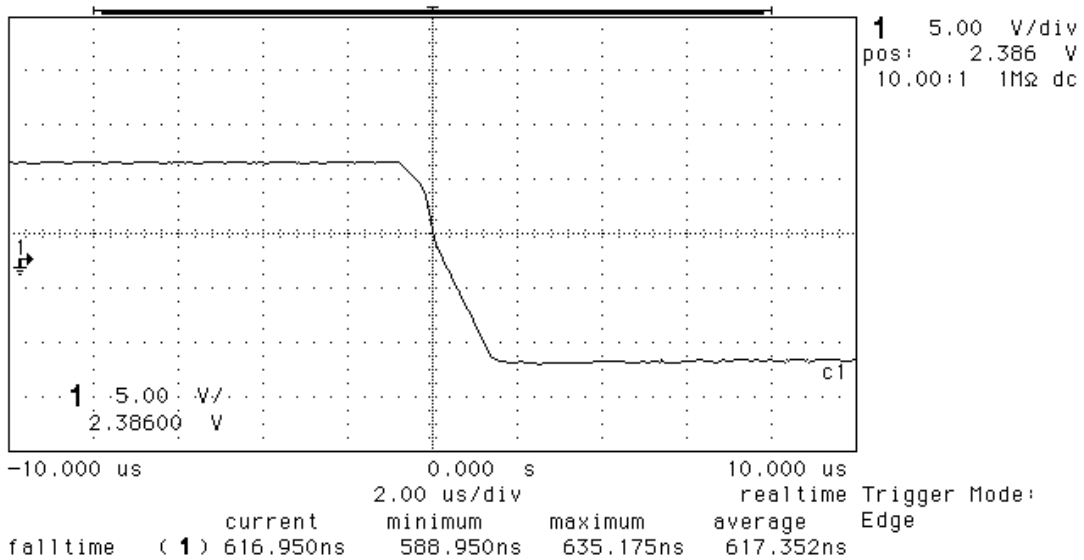
Circuit	Limits	Results	Verdict	Observation
103	$t \geq 200\text{ns}$	310 ns	pass	

hp



1 3.827 V

hp stopped



1 3.827 V



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**Receiver Shunt Capacitance**

Test Case	Circuit	Limits	Result t3= 3.5 μsec		Verdict	Comment
			t1	t2		
TBR - 7.5.2.1 NET - B.2.3	104	t1 and t2 ≤ t3	t1= 50 nsec	t2= 45 nsec	pass	
	106	t1 and t2 ≤ t3	t1= 30 nsec	t2= 28 nsec	pass	
	107	t1 and t2 ≤ t3	t1= 31 nsec	t2= 29 nsec	pass	
	109	t1 and t2 ≤ t3	t1= 37 nsec	t2= 34 nsec	pass	
	114	t1 and t2 ≤ t3	t1= 73 nsec	t2= 47 nsec	pass	
	115	t1 and t2 ≤ t3	t1= 36 nsec	t2= 46 nsec	pass	
	125	t1 and t2 ≤ t3	t1= 33 nsec	t2= 31 nsec	pass	
	142	t1 and t2 ≤ t3	t1= 27 nsec	t2= 31 nsec	pass	

**Load Impedance (NET - Annex B.2.4)**

Circuit	Limits	Results	Verdict	Observation
104	capacitive	capacitive	pass	
106	capacitive	capacitive	pass	
107	capacitive	capacitive	pass	
109	capacitive	capacitive	pass	
114	capacitive	capacitive	pass	
115	capacitive	capacitive	pass	
125	capacitive	capacitive	pass	
142	capacitive	capacitive	pass	





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### Load Resistance Conditions (NET - Annex B.2.1)

Measurement with 3V applied

Circuit	Limits	Results	Verdict	Observation
104	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	4477 $\Omega$	pass	
106	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6382 $\Omega$	pass	
107	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6382 $\Omega$	pass	
109	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6382 $\Omega$	pass	
114	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	5357 $\Omega$	pass	
115	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	4411 $\Omega$	pass	
125	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6521 $\Omega$	pass	
142	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6521 $\Omega$	pass	

Measurement with 15V applied

Circuit	Limits	Results	Verdict	Observation
104	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	4437 $\Omega$	pass	
106	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6382 $\Omega$	pass	
107	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6410 $\Omega$	pass	
109	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	5952 $\Omega$	pass	
114	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	4901 $\Omega$	pass	
115	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	4437 $\Omega$	pass	
125	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6465 $\Omega$	pass	
142	$3 \text{ k}\Omega \leq R \leq 7 \text{ k}\Omega$	6521 $\Omega$	pass	

### Maximum Load open circuit voltage (NET - Annex B.2.2)

Circuit	Limits	Results	Verdict	Observation
104	$U \leq 2\text{V}$	0.0309 V	pass	
106	$U \leq 2\text{V}$	0.0361 V	pass	
107	$U \leq 2\text{V}$	0.0163 V	pass	
109	$U \leq 2\text{V}$	0.0363 V	pass	
114	$U \leq 2\text{V}$	0.0307 V	pass	
115	$U \leq 2\text{V}$	0.0316 V	pass	
125	$U \leq 2\text{V}$	0.010 V	pass	
142	$U \leq 2\text{V}$	0.0180 V	pass	



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#### Power off Measurement (NET - Annex B.4)

Circuit	Limits	Results	Verdict	Observation
103	$R \geq 300\Omega$	$> 30\text{ k}\Omega$	pass	
105	$R \geq 300\Omega$	$> 30\text{ k}\Omega$	pass	
107	$R \geq 300\Omega$	$> 30\text{ k}\Omega$	pass	
108	$R \geq 300\Omega$	$> 30\text{ k}\Omega$	pass	
113	$R \geq 300\Omega$	$> 30\text{ k}\Omega$	pass	
140	$R \geq 300\Omega$	$> 30\text{ k}\Omega$	pass	
141	$R \geq 300\Omega$	$> 30\text{ k}\Omega$	pass	

#### Short Circuit Test (NET - Annex B.5)

A binary state 0

Connected to common return

Circuit	Limits	Results	Verdict	Observation
103	no damage	no damage	pass	
105	no damage	no damage	pass	
108	no damage	no damage	pass	
113	no damage	no damage	pass	
140	no damage	no damage	pass	
141	no damage	no damage	pass	

Connected to a load of 3000 Ohms where the open circuit voltage is -2V

Circuit	Limits	Results	Verdict	Observation
103	no damage	no damage	pass	
105	no damage	no damage	pass	
108	no damage	no damage	pass	
113	no damage	no damage	pass	
140	no damage	no damage	pass	
141	no damage	no damage	pass	



## B binary state 1

### Connected to common return

Circuit	Limits	Results	Verdict	Observation
103	no damage	no damage	pass	
105	no damage	no damage	pass	
108	no damage	no damage	pass	
113	no damage	no damage	pass	
140	no damage	no damage	pass	
141	no damage	no damage	pass	

### Connected to a load of 3000 Ohms where the open circuit voltage is +2V

Circuit	Limits	Results	Verdict	Observation
103	no damage	no damage	pass	
105	no damage	no damage	pass	
108	no damage	no damage	pass	
113	no damage	no damage	pass	
140	no damage	no damage	pass	
141	no damage	no damage	pass	

### Allowance for Capacitance of Connections Leads (Annex B.7)

Circuit	Limits	Results	Verdict	Observation
All Leads	$C \leq 2500\text{pF}$	--	N/A	Note 2

Note 2 : Testing is only applied to chipset. No connections leads were used.



### 6.2.3 34-pin DTE/DCE interface ISO 2593

(CCITT Recommendation V.35 interface)

Test Case	Requirement	Result	Verdict	Comment
7.2.4.1	TBR - 6.2.4.1 NET - 8.2.2.2	ISO 2593 (34-pole)	NT	Note 1
7.2.4.2	TBR - 6.2.4.2 NET - 8.2.2.2	Table A.17 and A.18	NT	Note 1

Note 1: The SUT was an evaluation board. Measurements were taken at test points on the board.

### CCITT V.35 Interchange Circuits

A - B terminated with 3.9 KOhm

Circuit 103 (P/S)

#### Binary State 1

Test Case	Description	Limits	Result	Verdict	Comment
7.6.1.1	A - B	$V_o \leq 1.2 \text{ V}$	1.0 V	pass	
	A - C	$V_{oa} \leq 1.2 \text{ V}$	0.54 V	pass	
	B - C	$V_{ob} \leq 1.2 \text{ V}$	-0.50 V	pass	

#### Binary State 2

Test Case	Description	Limits	Result	Verdict	Comment
7.6.1.1	A - B	$V_o \leq 1.2 \text{ V}$	-1.0 V	pass	
	A - C	$V_{oa} \leq 1.2 \text{ V}$	-0.58 V	pass	
	B - C	$V_{ob} \leq 1.2 \text{ V}$	0.46 V	pass	

Circuit 113 (U/W)

#### Binary State 1

Test Case	Description	Limits	Result	Verdict	Comment
7.6.1.1	A - B	$V_o \leq 1.2 \text{ V}$	1.0 V	pass	
	A - C	$V_{oa} \leq 1.2 \text{ V}$	0.57 V	pass	
	B - C	$V_{ob} \leq 1.2 \text{ V}$	-0.47 V	pass	

#### Binary State 2

Test Case	Description	Limits	Result	Verdict	Comment
7.6.1.1	A - B	$V_o \leq 1.2 \text{ V}$	-1.0 V	pass	
	A - C	$V_{oa} \leq 1.2 \text{ V}$	-0.49 V	pass	
	B - C	$V_{ob} \leq 1.2 \text{ V}$	0.55 V	pass	



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### Source Impedance (Annex C.1.1)

Circuit	Limits	Results	Verdict	Observation
103	$100 \pm 50 \Omega$	101 $\Omega$	Pass	
113	$100 \pm 50 \Omega$	100 $\Omega$	Pass	

### 4.2.2.2 Resistance A&B-C (Annex C.1.2)

Circuit	Limits	Results	Verdict	Observation
103 2V applied	$150 \pm 15 \Omega$	161 $\Omega$	Pass	
103 -2V applied	$150 \pm 15 \Omega$	164 $\Omega$	Pass	
113 2V applied	$150 \pm 15 \Omega$	163 $\Omega$	Pass	
113 -2V applied	$150 \pm 15 \Omega$	156 $\Omega$	Pass	



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A - C terminated with 2 x 50 Ohm

Circuit 103 (P/S)

**Binary State 1**

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.6.1.2	A - B	$0.44V \leq V_t \leq 0.66V$	0.54 V	pass	
NET - C.1.3	R1/R2 - C	$V_{os} \leq 0.6 V$	0.003 V	pass	

**Binary State 2**

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.6.1.2	A - B	$0.44V \leq V_t \leq 0.66V$	-0.54 V	pass	
NET - C.1.3	R1/R2 - C	$V_{os} \leq 0.6 V$	-0.047 V	pass	

Circuit 113 (U/W)

**Binary State 1**

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.6.1.2	A - B	$0.44V \leq V_t \leq 0.66V$	0.54 V	pass	
NET - C.1.3	R1/R2 - C	$V_{os} \leq 0.6 V$	0.046 V	pass	

**Binary State 2**

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.6.1.2	A - B	$0.44V \leq V_t \leq 0.66V$	-0.54 V	pass	
NET - C.1.3	R1/R2 - C	$V_{os} \leq 0.6 V$	0.033 V	pass	



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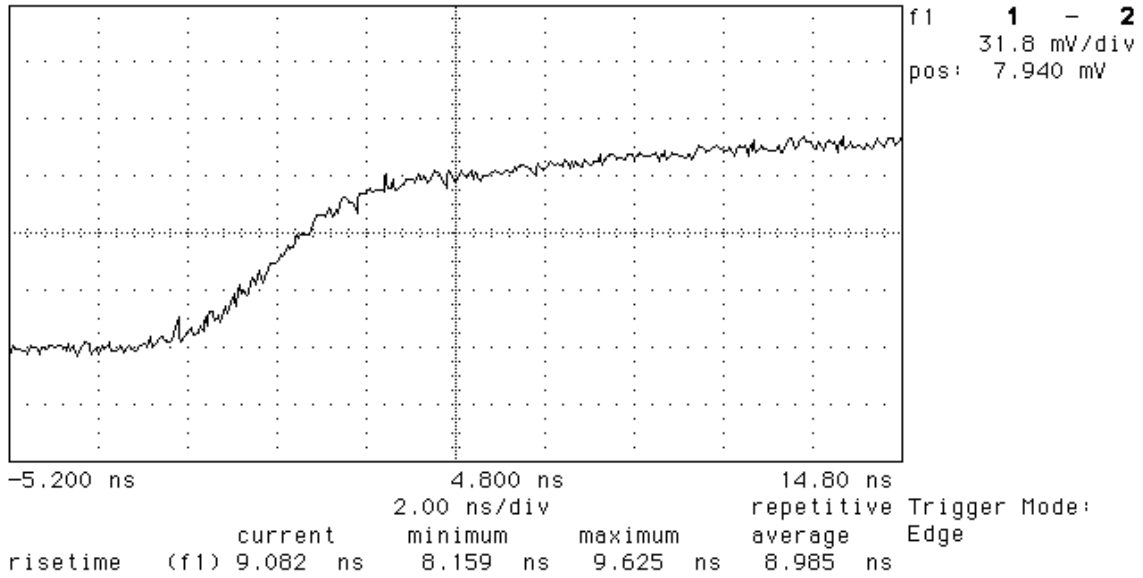
### Generator Output Risetime

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.6.1.3 NET - C.1.4	103 (P/S)	$t \leq 0.1 \text{ tb}$	9.0 ns pos	pass	
		$t \leq 0.1 \text{ tb}$	9.2 ns neg	pass	
	113 (U/W)	$t \leq 0.1 \text{ tb}$	8.9 ns pos	pass	
		$t \leq 0.1 \text{ tb}$	9.0 ns neg	pass	



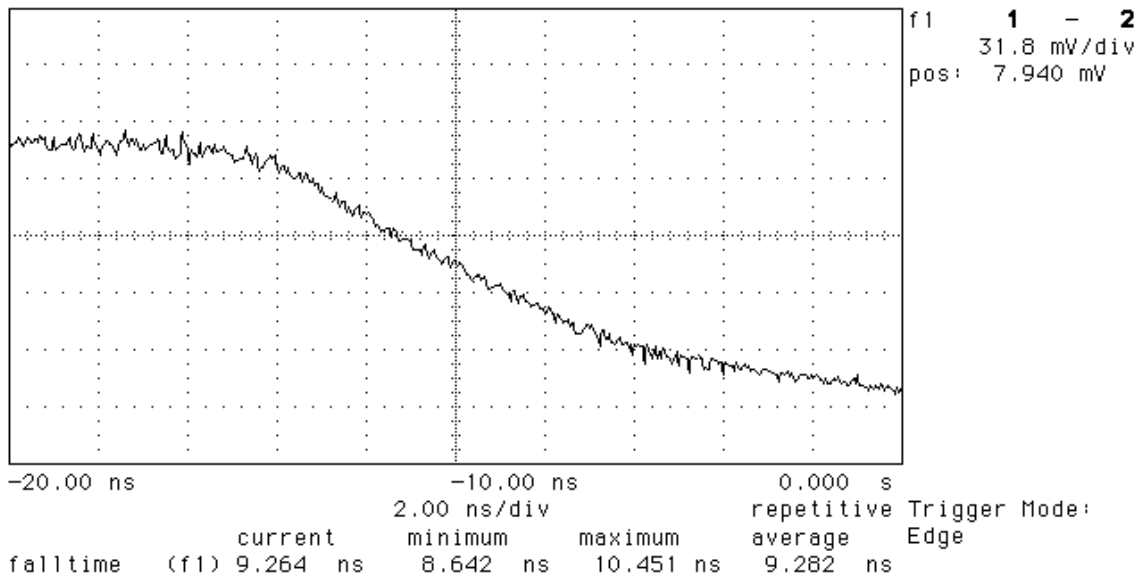
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hp



1 -16.08 mV

hp stopped



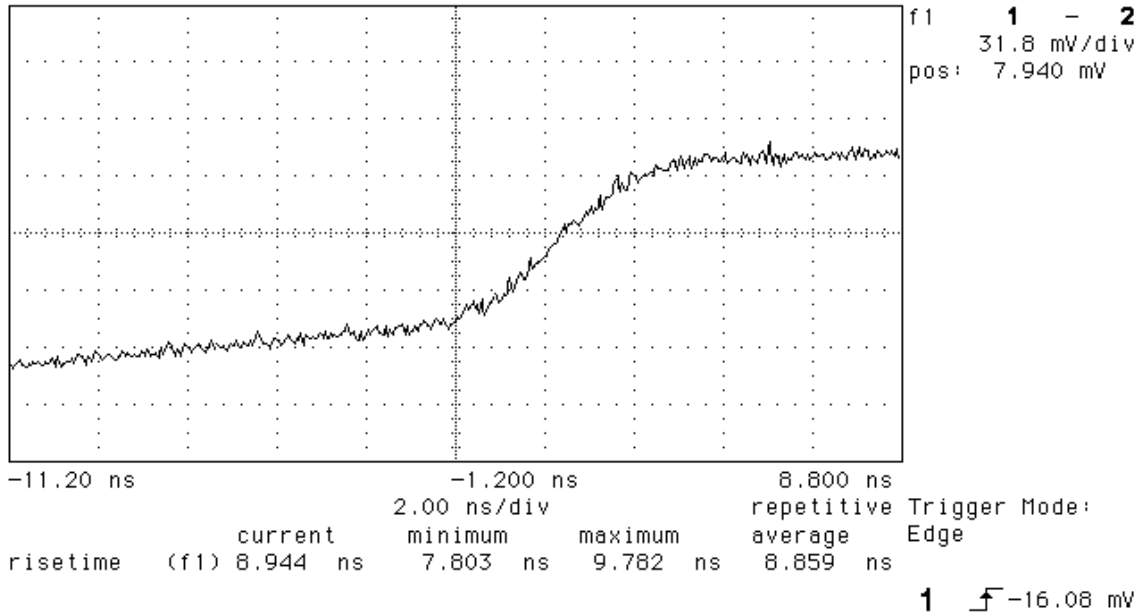
1 -16.08 mV



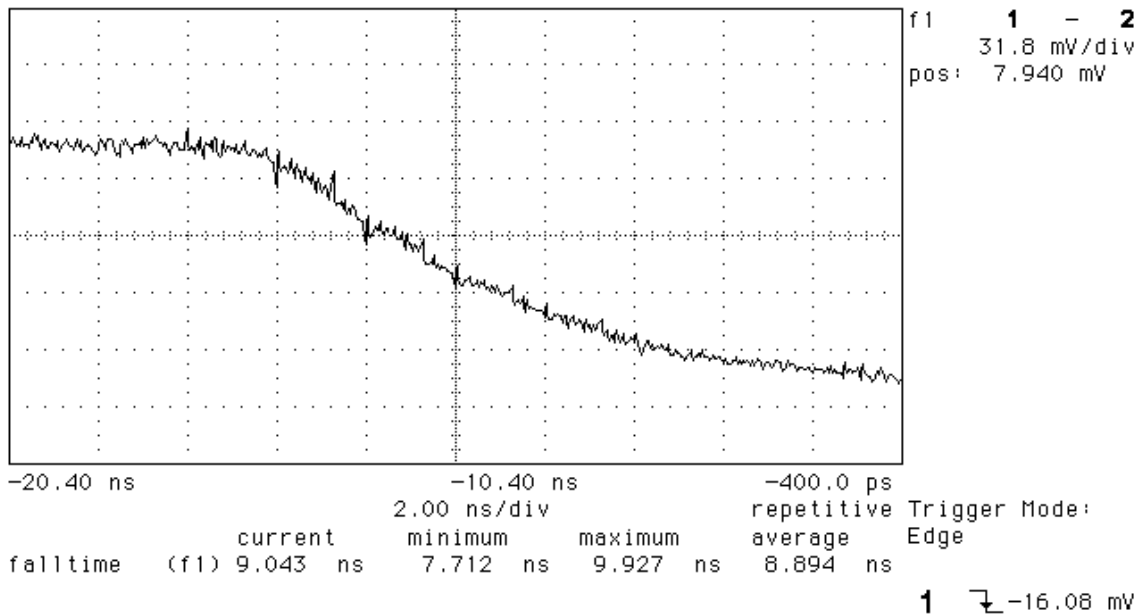


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hp stopped



hp stopped





### Impedance of Interconnecting Cable (NET - Annex C.2)

Circuit	Limits	Results	Verdict	Observation
P/S	$100 \pm 20 \Omega$	NA	--	Note 1

### Load Characteristics

#### Impedance (NET - Annex C.3.1)

Circuit	Limits	Results	Verdict	Observation
104	$100 \pm 10 \Omega$	103 $\Omega$	pass	
114	$100 \pm 10 \Omega$	100 $\Omega$	pass	
115	$100 \pm 10 \Omega$	103 $\Omega$	pass	

#### Resistance A&B-C (NET - Annex C.3.2)

Circuit	Limits	Results	Verdict	Observation
104 +2V applied	$150 \pm 15 \Omega$	156 $\Omega$	pass	
104 -2V applied	$150 \pm 15 \Omega$	156 $\Omega$	pass	
114 +2V applied	$150 \pm 15 \Omega$	156 $\Omega$	pass	
114 -2V applied	$150 \pm 15 \Omega$	156 $\Omega$	pass	
115 +2V applied	$150 \pm 15 \Omega$	155 $\Omega$	pass	
115 -2V applied	$150 \pm 15 \Omega$	155 $\Omega$	pass	

#### Generator/Load Protection (NET - Annex C.4)

Circuit	Limits	Results	Verdict	Observation
104	no damage	no damage	pass	
114	no damage	no damage	pass	
115	no damage	no damage	pass	



## CCITT V.28 Interchange Circuits

### A - C unterminated

#### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.1 NET - B.1.3	105	$V \leq 25.0V$	8.7 V	pass	
	108	$V \leq 25.0V$	8.7 V	pass	
	140	$V \leq 25.0V$	8.7 V	pass	
	141	$V \leq 25.0V$	8.7 V	pass	

#### Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.1 NET - B.1.3	105	$V \leq 25.0V$	-7.6 V	pass	
	108	$V \leq 25.0V$	-7.6 V	pass	
	140	$V \leq 25.0V$	-7.7 V	pass	
	141	$V \leq 25.0V$	-7.6 V	pass	

### A - C terminated with 3 KOhm

#### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.2 NET - B.1.4	105	$V \geq 3.0V$	7.9 V	pass	
	108	$V \geq 3.0V$	7.9 V	pass	
	140	$V \geq 3.0V$	7.9 V	pass	
	141	$V \geq 3.0V$	7.9 V	pass	

#### Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.2 NET - B.1.4	105	$V \geq 3.0V$	-7.4 V	pass	
	108	$V \geq 3.0V$	-7.4 V	pass	
	140	$V \geq 3.0V$	-7.4 V	pass	
	141	$V \geq 3.0V$	-7.1 V	pass	



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A - C terminated with 7 KOhm

### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
NET - B.1.5	105	$V \geq 3.0V$	8.3 V	pass	
	108	$V \geq 3.0V$	8.3 V	pass	
	140	$V \geq 3.0V$	8.3 V	pass	
	141	$V \geq 3.0V$	8.3 V	pass	

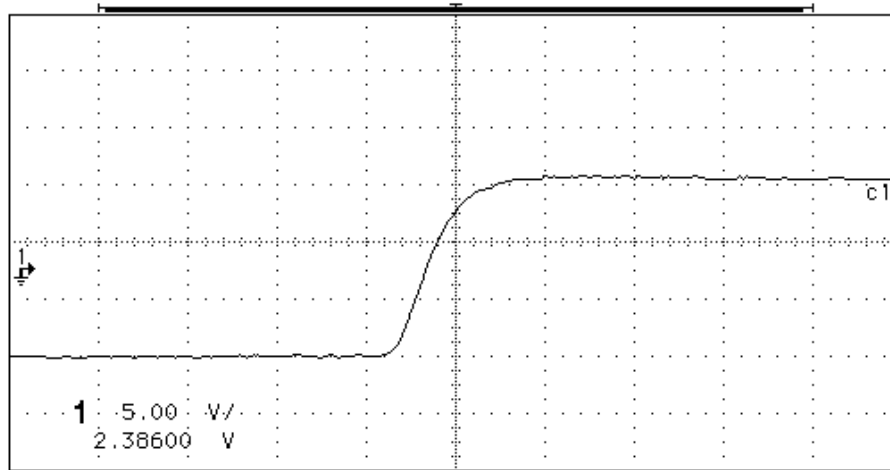
### Generator Output Risetime

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.5.1.3	105	$t \leq 0.03$ tb	600 ns pos	pass	
		$t \leq 0.03$ tb	759 ns neg	pass	
	108	$t \leq 0.03$ tb	613 ns pos	pass	
		$t \leq 0.03$ tb	769 ns neg	pass	
	140	$t \leq 0.03$ tb	596 ns pos	pass	
		$t \leq 0.03$ tb	829 ns neg	pass	
	141	$t \leq 0.03$ tb	594 ns pos	pass	
		$t \leq 0.03$ tb	835 ns neg	pass	



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hp



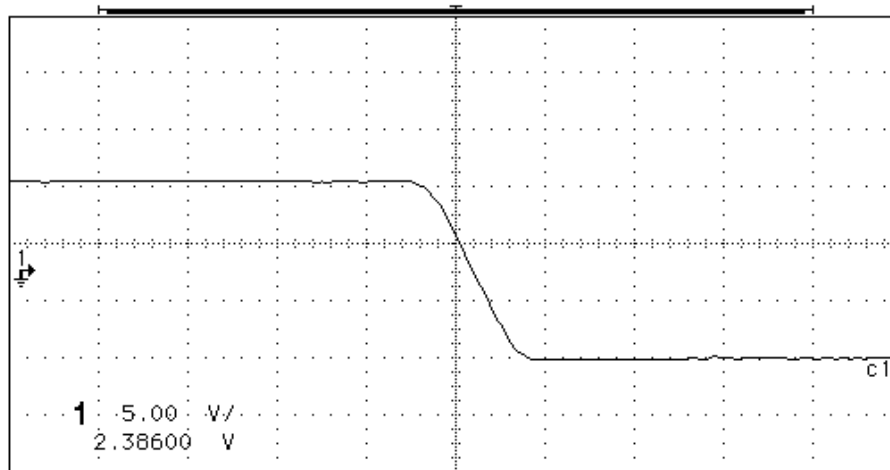
1 5.00 V/div  
pos: 2.386 V  
10.00:1 1MΩ dc

-10.000 us 0.000 s 10.000 us  
2.00 us/div realtime  
risetime (1) 600.650ns 576.950ns 623.850ns 600.570ns

Trigger Mode:  
Edge

1  $\int$  3.827 V

hp stopped



1 5.00 V/div  
pos: 2.386 V  
10.00:1 1MΩ dc

-10.000 us 0.000 s 10.000 us  
2.00 us/div realtime  
falltime (1) 759.550ns 729.399ns 781.950ns 757.771ns

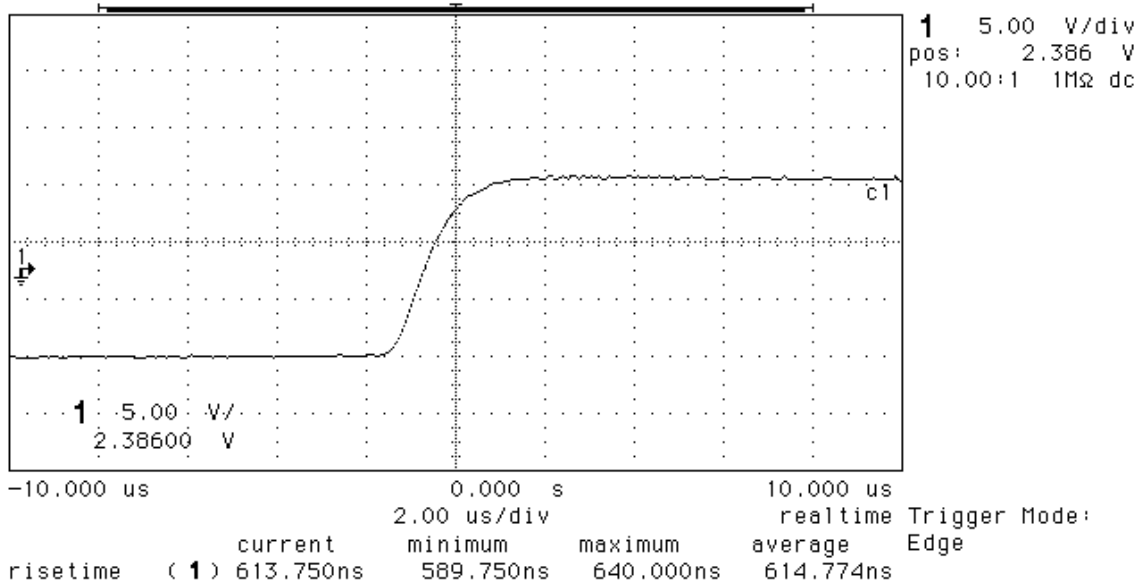
Trigger Mode:  
Edge

1  $\int$  3.827 V



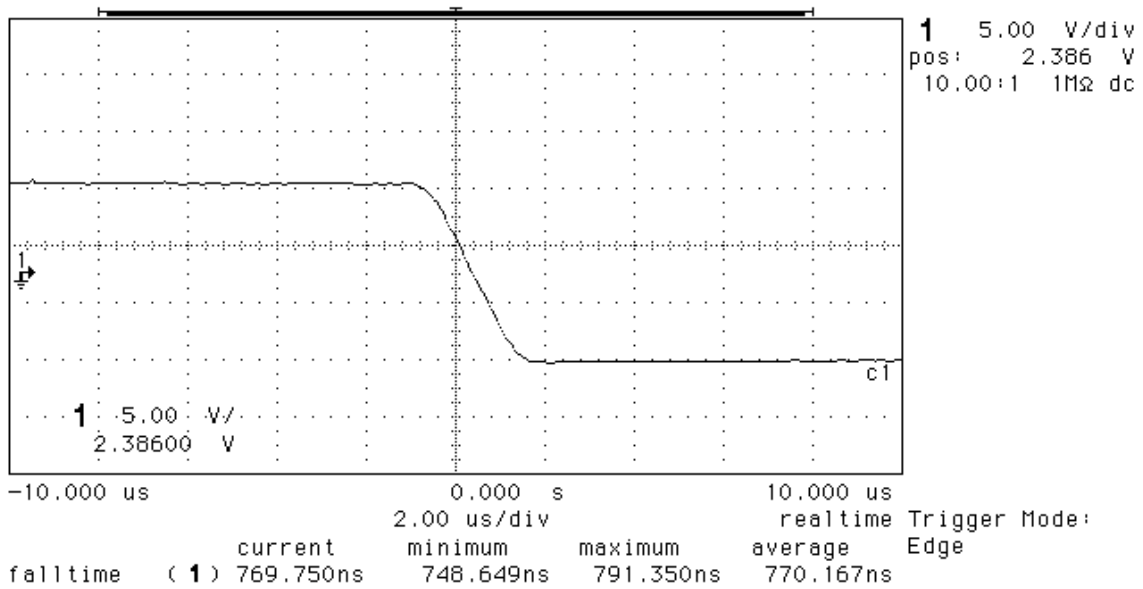
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hp stopped



1 3.827 V

hp stopped

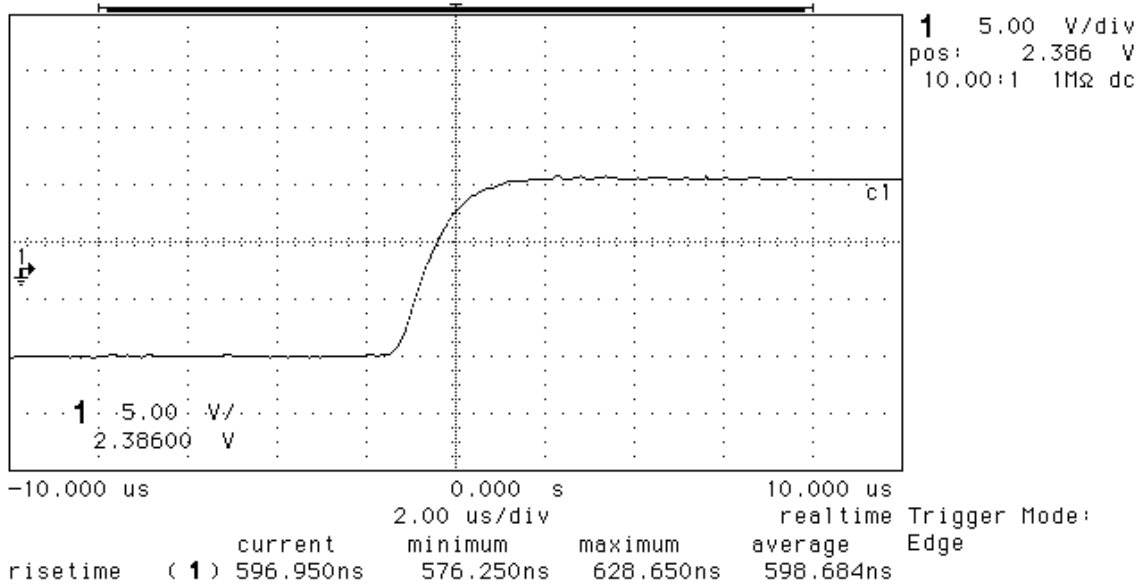


1 3.827 V



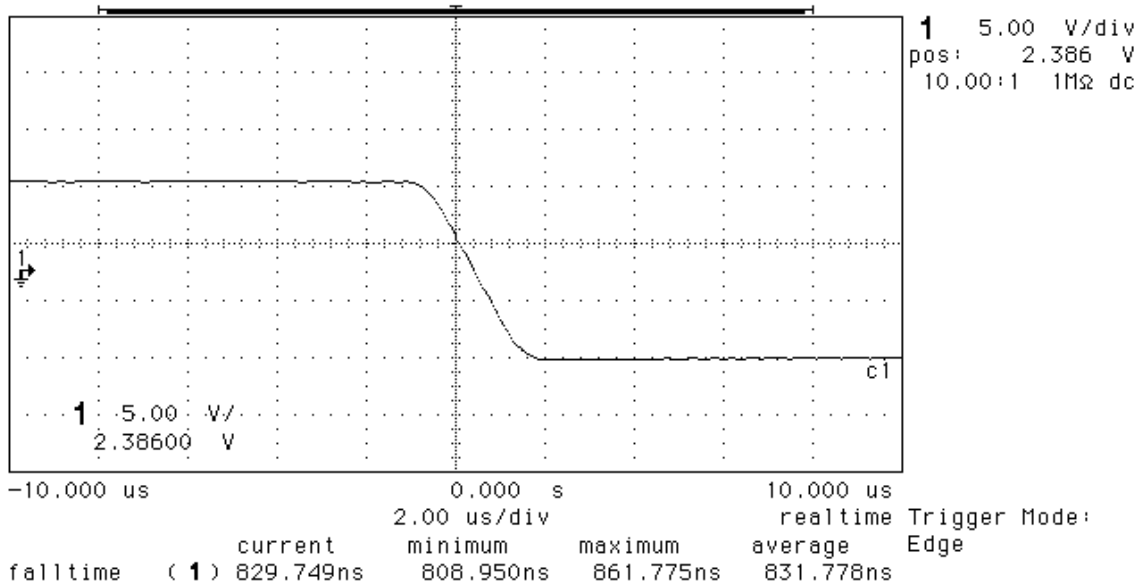
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hp stopped



1 3.827 V

hp stopped

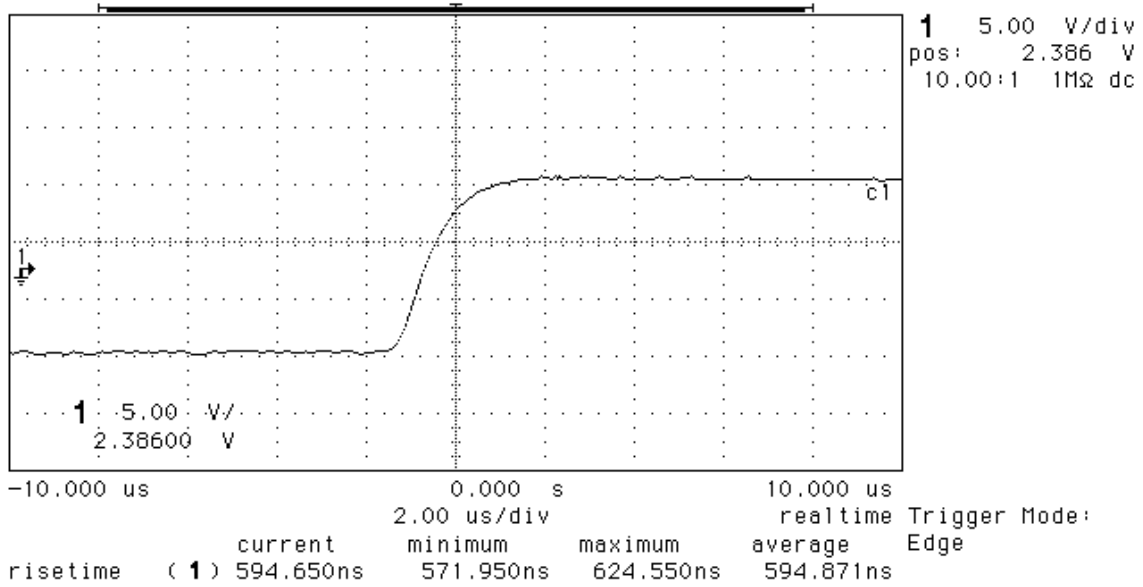


1 3.827 V



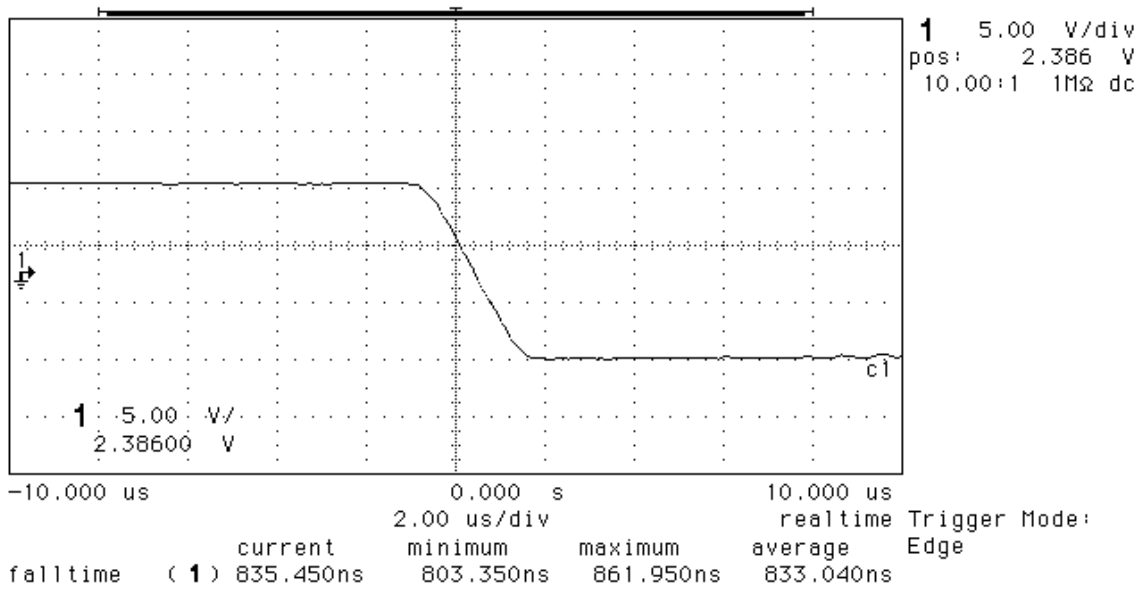
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hp stopped



1 3.827 V

hp stopped



1 3.827 V





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## Generators

Circuit	Description	Limits	Results		Verdict	Observation
NET – Annex B.1.2			Binary State 1	Binary State 2		
C	Short Circuit	$I_k \leq 500\text{mA}$	26.2 mA	71.5 mA	pass	
H	Short Circuit	$I_k \leq 500\text{mA}$	23.0 mA	72.8 mA	pass	
N	Short Circuit	$I_k \leq 500\text{mA}$	23.7 mA	70.2 mA	pass	
L	Short Circuit	$I_k \leq 500\text{mA}$	26.2 mA	61.6 mA	pass	
NET – Annex B.4						
H 2volt	Resistance power off	$R \geq 300\Omega$	> 100 k $\Omega$		pass	



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### Receiver Shunt Capacitance

Test Case	Circuit	Limits	Result t3=		Verdict	Comment
			t1	t2		
TBR 7.5.2.1	106	$t1 \text{ and } t2 \leq t3$	t1= 30 nsec	t2= 28 nsec	pass	
	107	$t1 \text{ and } t2 \leq t3$	t1= 30 nsec	t2= 29 nsec	pass	
	109	$t1 \text{ and } t2 \leq t3$	t1= 37 nsec	t2= 34 nsec	pass	
	125	$t1 \text{ and } t2 \leq t3$	t1= 32 nsec	t2= 30 nsec	pass	
	142	$t1 \text{ and } t2 \leq t3$	t1= 33 nsec	t2= 31 nsec	pass	

### Receivers

Circuit	Description	Limits	Results	Verdict	Observation
NET – B.2.2					
D 106	Voltage without Terminator	$EL \leq 2V$	0.038 V	pass	
E 107	Voltage without Terminator	$EL \leq 2V$	0.018 V	pass	
F 109	Voltage without Terminator	$EL \leq 2V$	0.038 V	pass	
NN 142	Voltage without Terminator	$EL \leq 2V$	0.020 V	pass	
J 125	Voltage without Terminator	$EL \leq 2V$	0.022 V	pass	
NET – B.2.1.a					
D	Rmin, 3V applied	$7k\Omega \geq R \geq 3k\Omega$	6383 $\Omega$	pass	
E	Rmin, 3V applied	$7k\Omega \geq R \geq 3k\Omega$	6383 $\Omega$	pass	
F	Rmin, 3V applied	$7k\Omega \geq R \geq 3k\Omega$	6383 $\Omega$	pass	
NN	Rmin, 3V applied	$7k\Omega \geq R \geq 3k\Omega$	6521 $\Omega$	pass	
J	Rmin, 3V applied	$7k\Omega \geq R \geq 3k\Omega$	6521 $\Omega$	pass	
NET – B.2.1.b					
D	Rmax, 15V applied	$7k\Omega \geq R \geq 3k\Omega$	6521 $\Omega$	pass	
E	Rmax, 15V applied	$7k\Omega \geq R \geq 3k\Omega$	6521 $\Omega$	pass	
F	Rmax, 15V applied	$7k\Omega \geq R \geq 3k\Omega$	6224 $\Omega$	pass	
NN	Rmax, 15V applied	$7k\Omega \geq R \geq 3k\Omega$	6550 $\Omega$	pass	
J	Rmax, 15V applied	$7k\Omega \geq R \geq 3k\Omega$	6493 $\Omega$	pass	



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## 6.2.4 37-pin DTE/DCE interface ISO 4902

(CCITT Recommendation V.36 interface)

Test Case	Requirement	Result	Verdict	Comment
7.2.3.1	TBR - 6.2.3.1 NET - 8.2.2.3	ISO 4902 (37-pole)	NT	Note 1
7.2.3.2	TBR - 6.2.3.2 NET - 8.2.2.3	Table A.13 and A.14	NT	Note 1

## CCITT V.10 Interchange Circuits

A - C terminated with 3.9 KOhm

### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.1	140	TBR $V \leq 12.0V$	5.0 V	pass	
NET - 8.2.4.4	141	NET $4V \leq V_o \leq 6V$	5.0 V	pass	

### Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.1	140	TBR $V \leq 12.0V$	-5.8 V	pass	
NET - 8.2.4.4	141	NET $4V \leq V_o \leq 6V$	-5.5 V	pass	

A - C terminated with 450 Ohm

### Binary State 1

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.2	140	TBR - $V_o \geq 2.0V$	4.6 V	pass	
NET - 8.2.4.4	141	NET - $V_t \geq 0.9 * V_o$	4.6 V	pass	

### Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
TBR - 7.3.1.2	140	TBR - $V_o \geq 2.0V$	-5.3 V	pass	
NET - 8.2.4.4	141	NET - $V_t \geq 0.9 * V_o$	-5.1 V	pass	



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Reference	Description	Limits	Results	Verdict	Observation
NET -					
V.10 140 5.2.3	Short Circuit	$I_s \leq 150\text{mA}$	90.0 mA	pass	
V.10 141 5.2.3	Short Circuit	$I_s \leq 150\text{mA}$	83.6 mA	pass	
V.10 140 5.2.4	Power off 0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	
V.10 141 5.2.4	Power off -0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	
V.10 140 5.2.4	Power off 0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	
V.10 141 5.2.4	Power off -0.25 V applied	$I_x \leq 100\mu\text{A}$	< 0.1 $\mu\text{A}$	pass	

### Generator Output Risetime

#### Circuit 140

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.3.1.3	A - C	$t \leq 0.3 \text{ tb}$	668 ns pos	pass	
NET - 8.2.4.4		$t \leq 0.3 \text{ tb}$	1039 ns neg	pass	

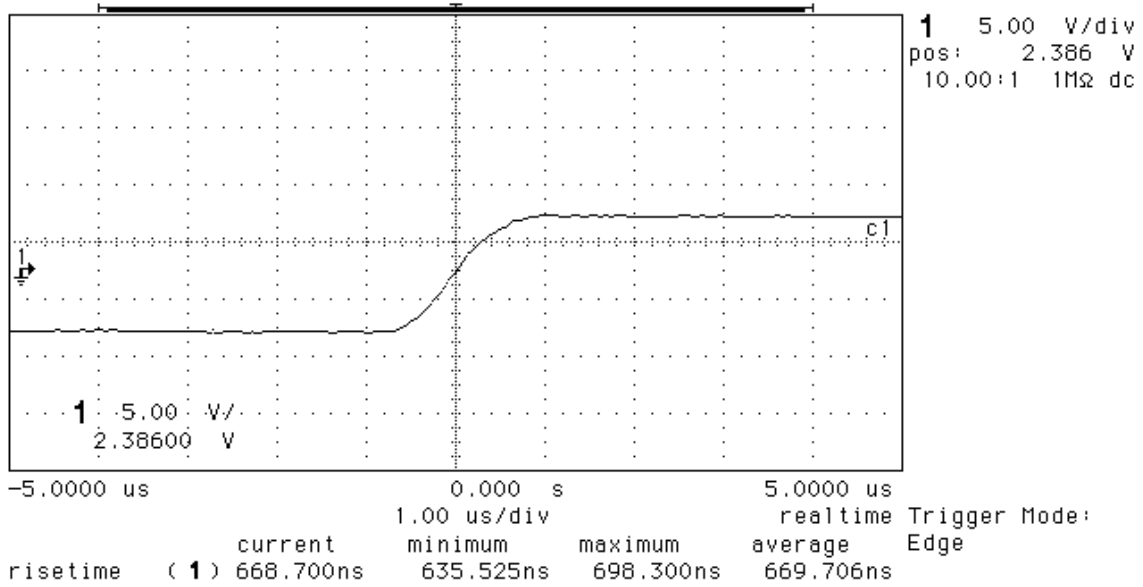
#### Circuit 141

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.3.1.3	A - C	$t \leq 0.3 \text{ tb}$	821 ns pos	pass	
NET - 8.2.4.4		$t \leq 0.3 \text{ tb}$	1419 ns neg	pass	



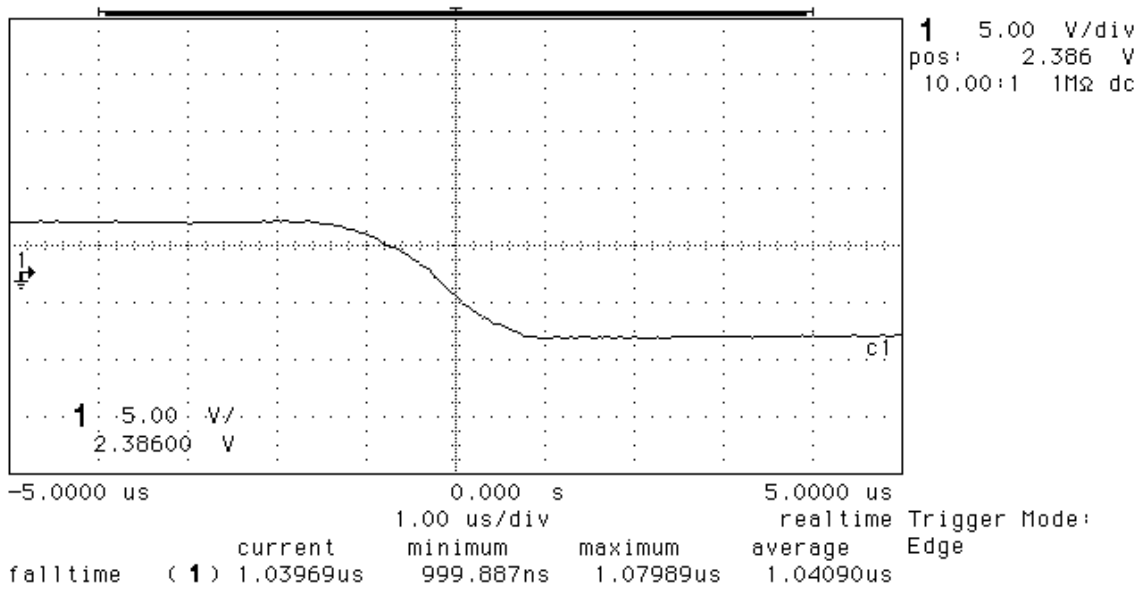
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hp stopped



1  $\int$  -1.250 V

hp stopped

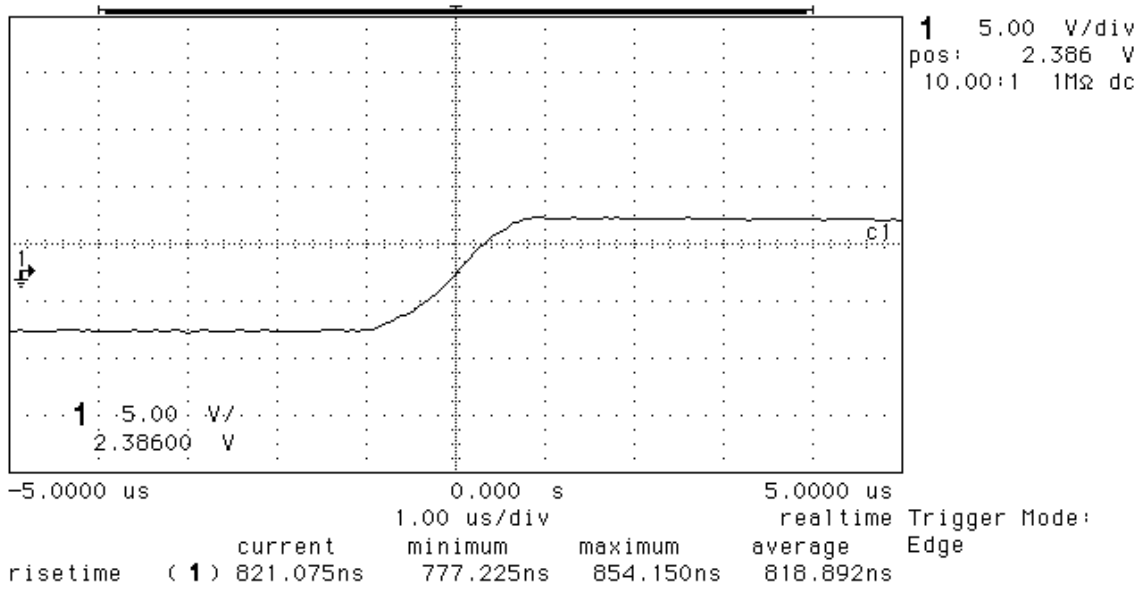


1  $\int$  -1.250 V



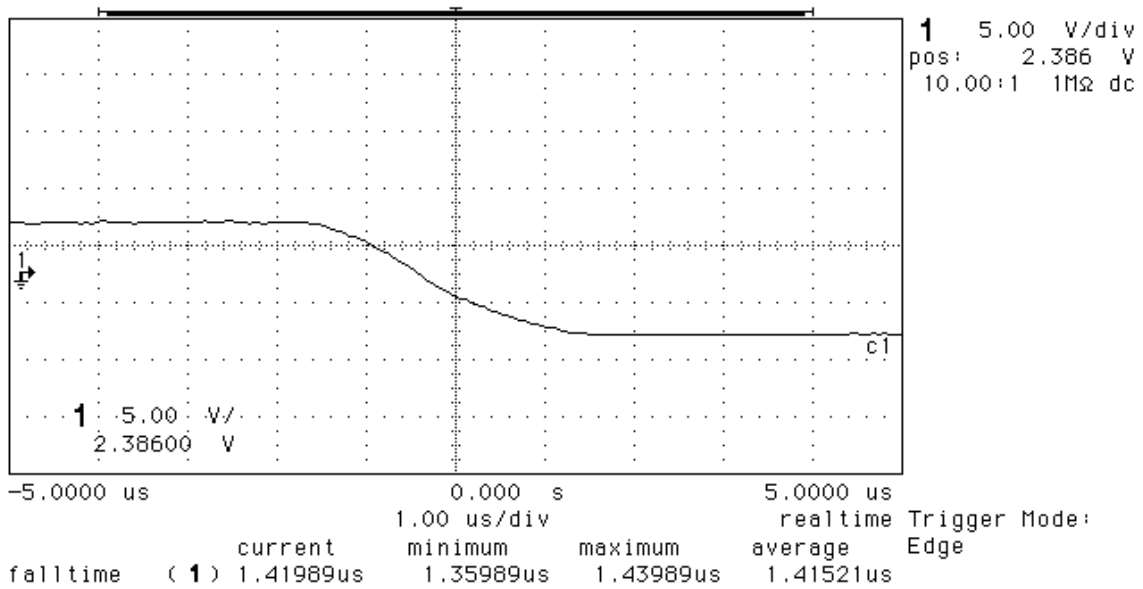
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hp stopped



1  $\bar{f}$  -1.250 V

hp stopped



1  $\bar{f}$  -1.250 V



## CCITT V.11 Interchange Circuits

A - B terminated with 3.9 Kohm

### Binary State 1

#### Circuit 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.037 V	pass	

#### Circuit 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.035 V	pass	

#### Circuit 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.035 V	pass	

#### Circuit 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.037 V	pass	



## Binary State 2

### Circuit 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	-4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.039 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	

### Circuit 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	-4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.035 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	

### Circuit 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	-4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.036 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	

### Circuit 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.1 NET - V11 5.2.1	A - B	$TBR \leq 12.0V$ $NET \leq 6.0V$	-4.9 V	pass	
	A - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	0.038 V	pass	
	B - C	$TBR \leq 12.0V$ $NET \leq 6.0V$	5.0 V	pass	





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A - B terminated with 2 x 50 Ohm

### Binary State 1

#### Circuit 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	2.9 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

#### Circuit 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	3.0 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

#### Circuit 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	3.0 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

#### Circuit 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	2.9 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	



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**Binary State 2**

## Circuit 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-2.9 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

## Circuit 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-3.0 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

## Circuit 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-3.0 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	

## Circuit 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.2	A - B	$V_t \geq 2.0V$	-2.9 V	pass	
NET - V11, 5.2.2	R1/R2 - C	$V_{os} \leq 3.0V$	2.4 V	pass	



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### Generator Output Risetime

#### Circuit TxD 103

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3$ tb	8.8 ns	pass	
NET - V11 5.3		NET - $20\text{ns} \geq t$ or $t \leq 0.1\text{tb}$	8.3 ns	pass	

#### Circuit RTS 105

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3$ tb	8.0 ns	pass	
NET - V11 5.3		NET - $20\text{ns} \geq t$ or $t \leq 0.1\text{tb}$	7.8 ns	pass	

#### Circuit DTR 108

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3$ tb	8.3 ns	pass	
NET - V11 5.3		NET - $20\text{ns} \geq t$ or $t \leq 0.1\text{tb}$	7.9 ns	pass	

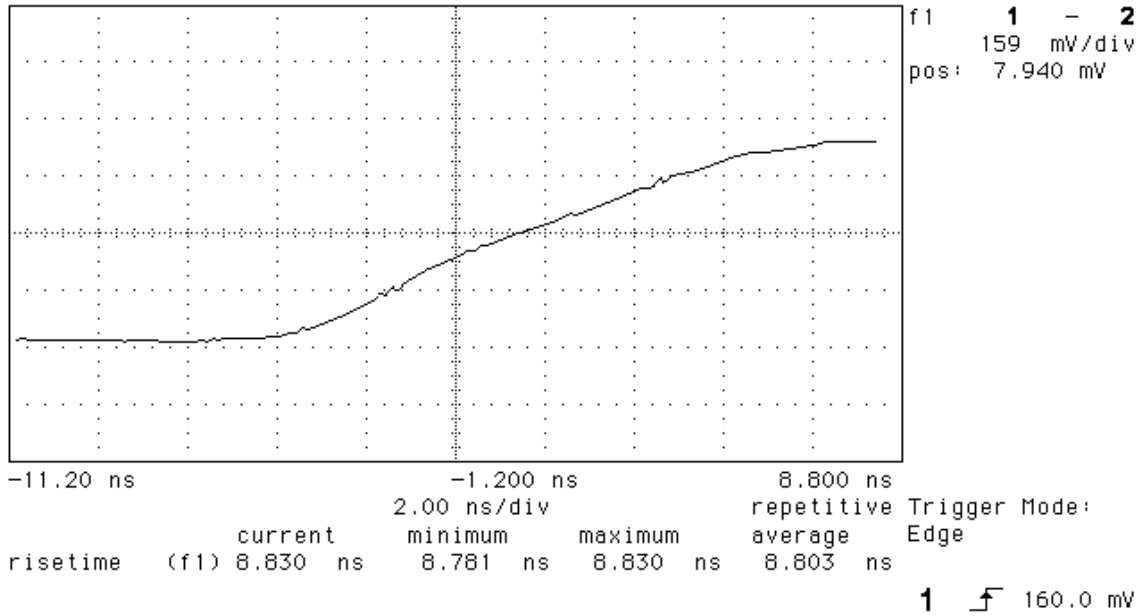
#### Circuit TxCE 113

Test Case	Description	Limits	Result	Verdict	Comment
TBR - 7.4.1.3	A - B	TBR - $t \leq 0.3$ tb	8.8 ns	pass	
NET - V11 5.3		NET - $20\text{ns} \geq t$ or $t \leq 0.1\text{tb}$	8.2 ns	pass	

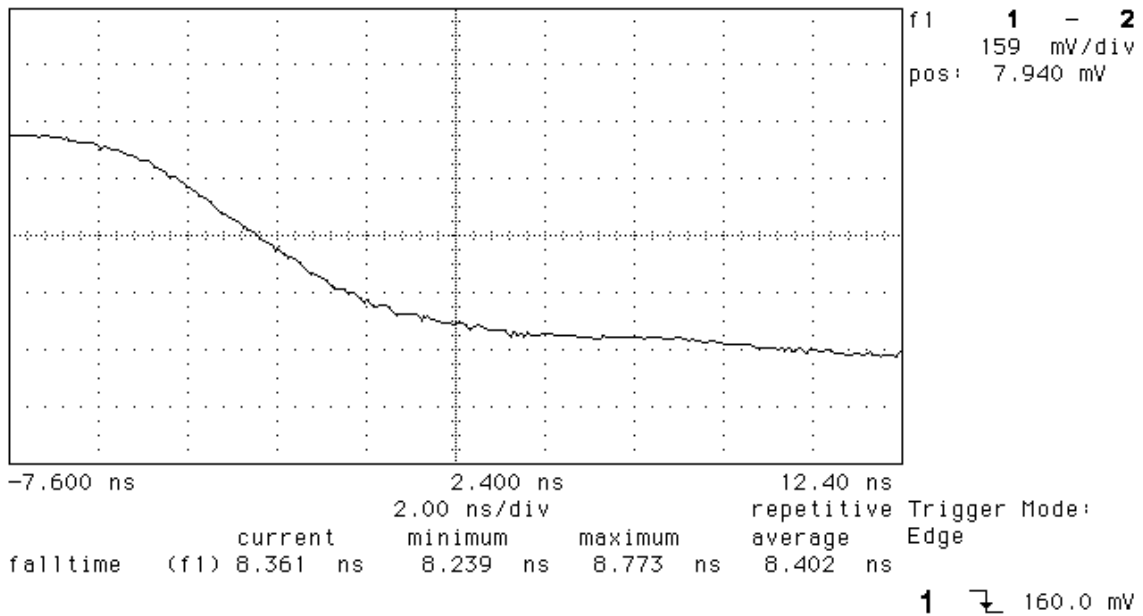


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hp stopped



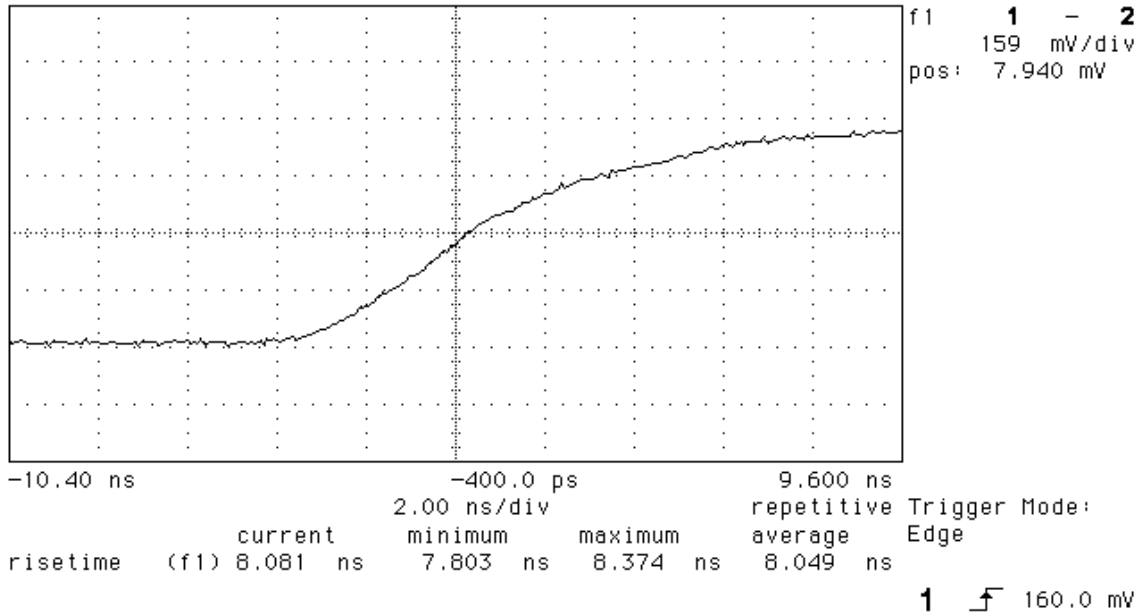
hp stopped



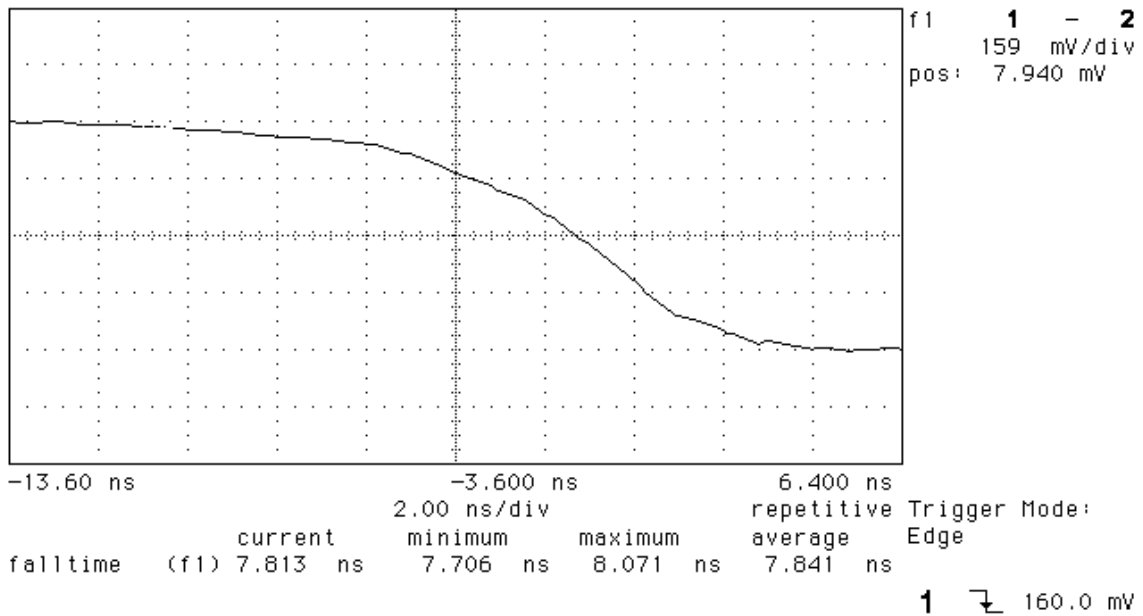


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hp stopped



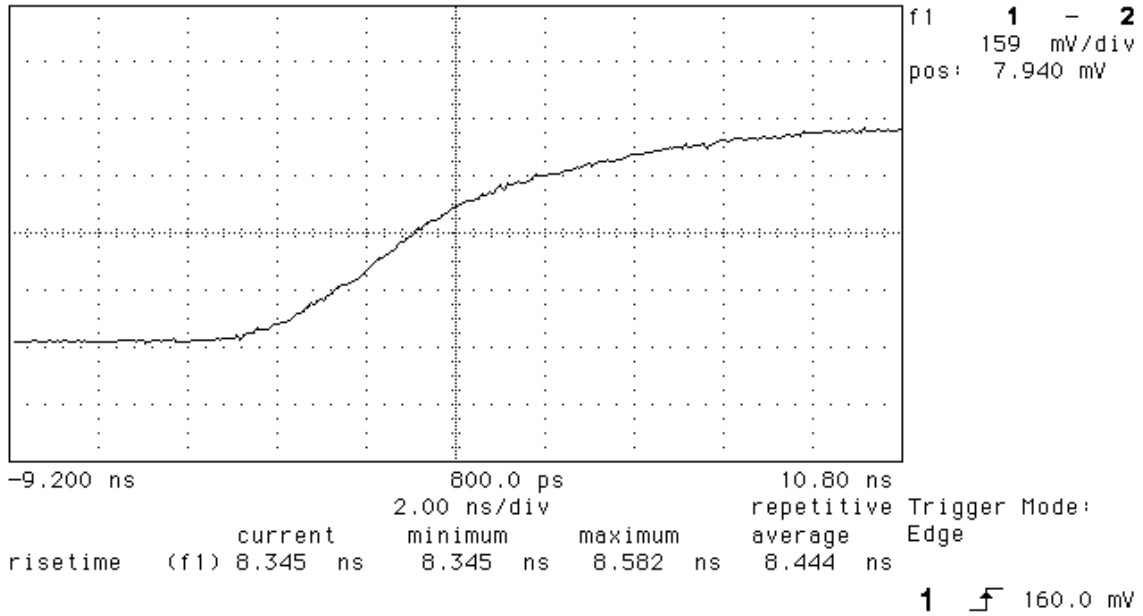
hp stopped



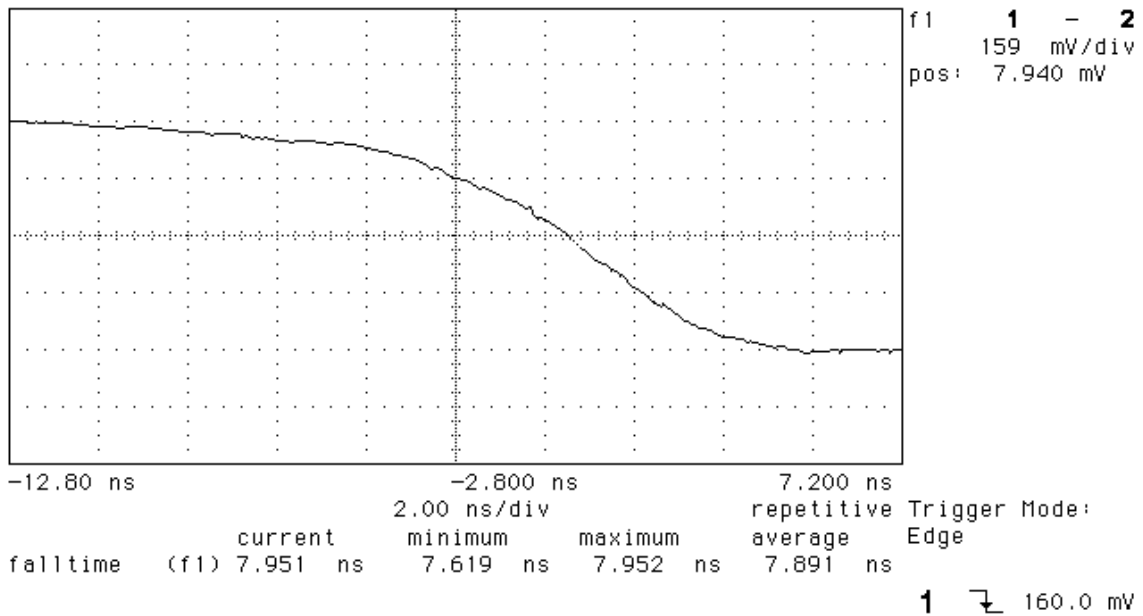


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hp stopped



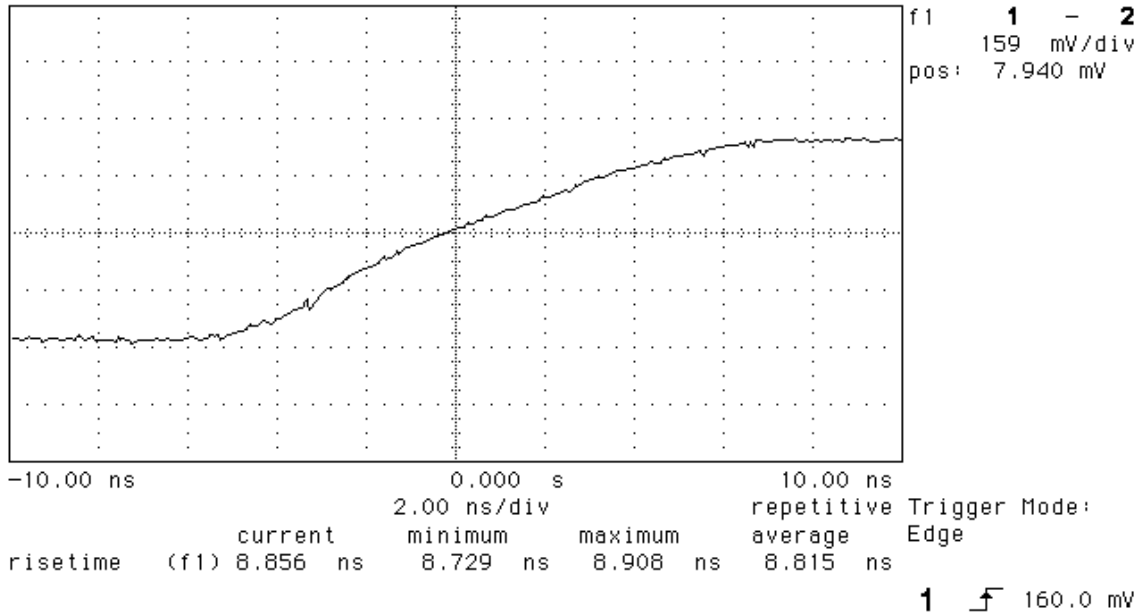
hp stopped



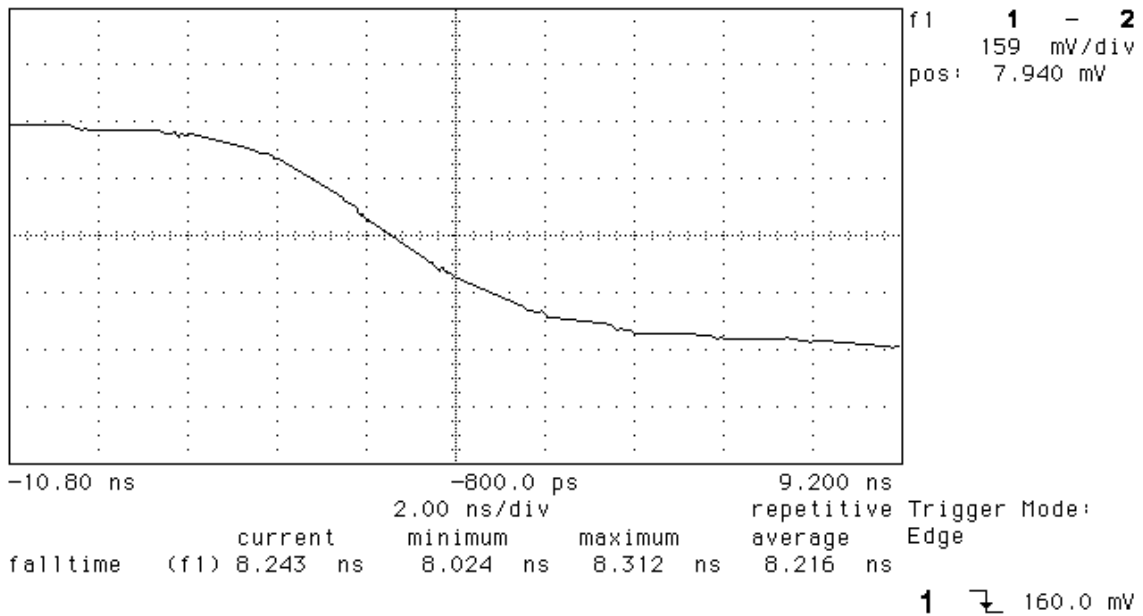


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hp stopped



hp stopped



**Short Circuit Measurement (NET - 5.2.3)**

## Circuit TxD 103

Description	Limits	Results	Verdict	Observation
NET - 5.2.3				
A - C	$I_{sa} \leq 150 \text{ mA}$	99.0 mA	pass	
B - C	$I_{sb} \leq 150 \text{ mA}$	0.008 mA	pass	

## Circuit RTS 105

Description	Limits	Results	Verdict	Observation
NET - 5.2.3				
A - C	$I_{sa} \leq 150 \text{ mA}$	103.7 mA	pass	
B - C	$I_{sb} \leq 150 \text{ mA}$	0.017 mA	pass	

## Circuit DTR 108

Description	Limits	Results	Verdict	Observation
NET - 5.2.3				
A - C	$I_{sa} \leq 150 \text{ mA}$	103.8 mA	pass	
B - C	$I_{sb} \leq 150 \text{ mA}$	0.030 mA	pass	

## Circuit TxCE 113

Description	Limits	Results	Verdict	Observation
NET - 5.2.3				
A - C	$I_{sa} \leq 150 \text{ mA}$	100.2 mA	pass	
B - C	$I_{sb} \leq 150 \text{ mA}$	0.008 mA	pass	





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### Power-off Measurement (NET - 5.2.4)

Power-off applied voltage  $\pm 0.25\text{V}$

Circuit TxD 103

Description	Limits	Results	Verdict	Observation
NET - 5.2.4				
+0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.7 $\mu\text{A}$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.6 $\mu\text{A}$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	

Circuit RTS 105

Description	Limits	Results	Verdict	Observation
NET - 5.2.4				
+0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.6 $\mu\text{A}$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.5 $\mu\text{A}$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	

Circuit DTR 108

Description	Limits	Results	Verdict	Observation
NET - 5.2.4				
+0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.7 $\mu\text{A}$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.6 $\mu\text{A}$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	

Circuit TxCE 113

Description	Limits	Results	Verdict	Observation
+0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.7 $\mu\text{A}$	pass	
+0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	
-0.25V applied	$I_{xa} \leq 100 \mu\text{A}$	0.6 $\mu\text{A}$	pass	
-0.25V applied	$I_{xb} \leq 100 \mu\text{A}$	0.1 $\mu\text{A}$	pass	



## Receiver Characteristics NET - 6.1

Circuit RxD 104

The receiver *is* terminated with an optional cable resistance.

Limits according to NET 1, Revision 1, Figure 1

Description	Limits	Results	Verdict	Observation
Via = 6V	$I \leq 60.75 \text{ mA}$	55.7 mA	pass	
Via = 3V	$I \leq 30.75 \text{ mA}$	27.5 mA	pass	
Via = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.3 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0002 mA	pass	
Via = -6V	$I \leq 60.75 \text{ mA}$	-55.8 mA	pass	
Via = -3V	$I \leq 30.75 \text{ mA}$	-27.5 mA	pass	
Via = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.3 mA	pass	
Vib = 6V	$I \leq 60.75 \text{ mA}$	55.9 mA	pass	
Vib = 3V	$I \leq 30.75 \text{ mA}$	27.5 mA	pass	
Vib = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.3 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -6V	$I \leq 60.75 \text{ mA}$	-55.8 mA	pass	
Vib = -3V	$I \leq 30.75 \text{ mA}$	-27.5 mA	pass	
Vib = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.3 mA	pass	



## Circuit 106 CTS

The receiver *is not* terminated with an optional cable resistance.

Limits according to CCITT Recommendation V.11, Figure 6

Description	Limits	Results	Verdict	Observation
Via = 10V	$I \leq 3.25 \text{ mA}$	0.27 mA	pass	
Via = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Via = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Via = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	
Vib = 10V	$I \leq 3.25 \text{ mA}$	0.27 mA	pass	
Vib = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Vib = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	

## Circuit 107 DSR

The receiver *is not* terminated with an optional cable resistance.

Limits according to CCITT Recommendation V.11, Figure 6

Description	Limits	Results	Verdict	Observation
Via = 10V	$I \leq 3.25 \text{ mA}$	0.27 mA	pass	
Via = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Via = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Via = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	
Vib = 10V	$I \leq 3.25 \text{ mA}$	0.27 mA	pass	
Vib = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Vib = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	



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## Circuit 109 DCD

The receiver *is not* terminated with an optional cable resistance.

Limits according to CCITT Recommendation V.11, Figure 6

Description	Limits	Results	Verdict	Observation
Via = 10V	$I \leq 3.25 \text{ mA}$	0.27 mA	pass	
Via = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Via = -10V	$I \leq 3.25 \text{ mA}$	-0.28 mA	pass	
Via = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	
Vib = 10V	$I \leq 3.25 \text{ mA}$	0.27 mA	pass	
Vib = 3V	$I \leq 1.5 \text{ mA}$	0.08 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0001 mA	pass	
Vib = -10V	$I \leq 3.25 \text{ mA}$	-0.27 mA	pass	
Vib = -3V	$I \leq 1.5 \text{ mA}$	-0.08 mA	pass	

## Circuit 114 TxC

The receiver *is* terminated with an optional cable resistance.

Limits according to NET 1, Revision 1, Figure 1

Description	Limits	Results	Verdict	Observation
Via = 6V	$I \leq 60.75 \text{ mA}$	53.9 mA	pass	
Via = 3V	$I \leq 30.75 \text{ mA}$	26.6 mA	pass	
Via = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.0 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	-0.3 mA	pass	
Via = -6V	$I \leq 60.75 \text{ mA}$	-53.7 mA	pass	
Via = -3V	$I \leq 30.75 \text{ mA}$	-26.6 mA	pass	
Via = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.0 mA	pass	
Vib = 6V	$I \leq 60.75 \text{ mA}$	54.0 mA	pass	
Vib = 3V	$I \leq 30.75 \text{ mA}$	26.6 mA	pass	
Vib = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.0 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	-0.4 mA	pass	
Vib = -6V	$I \leq 60.75 \text{ mA}$	-53.7 mA	pass	
Vib = -3V	$I \leq 30.75 \text{ mA}$	-26.6 mA	pass	
Vib = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.0 mA	pass	



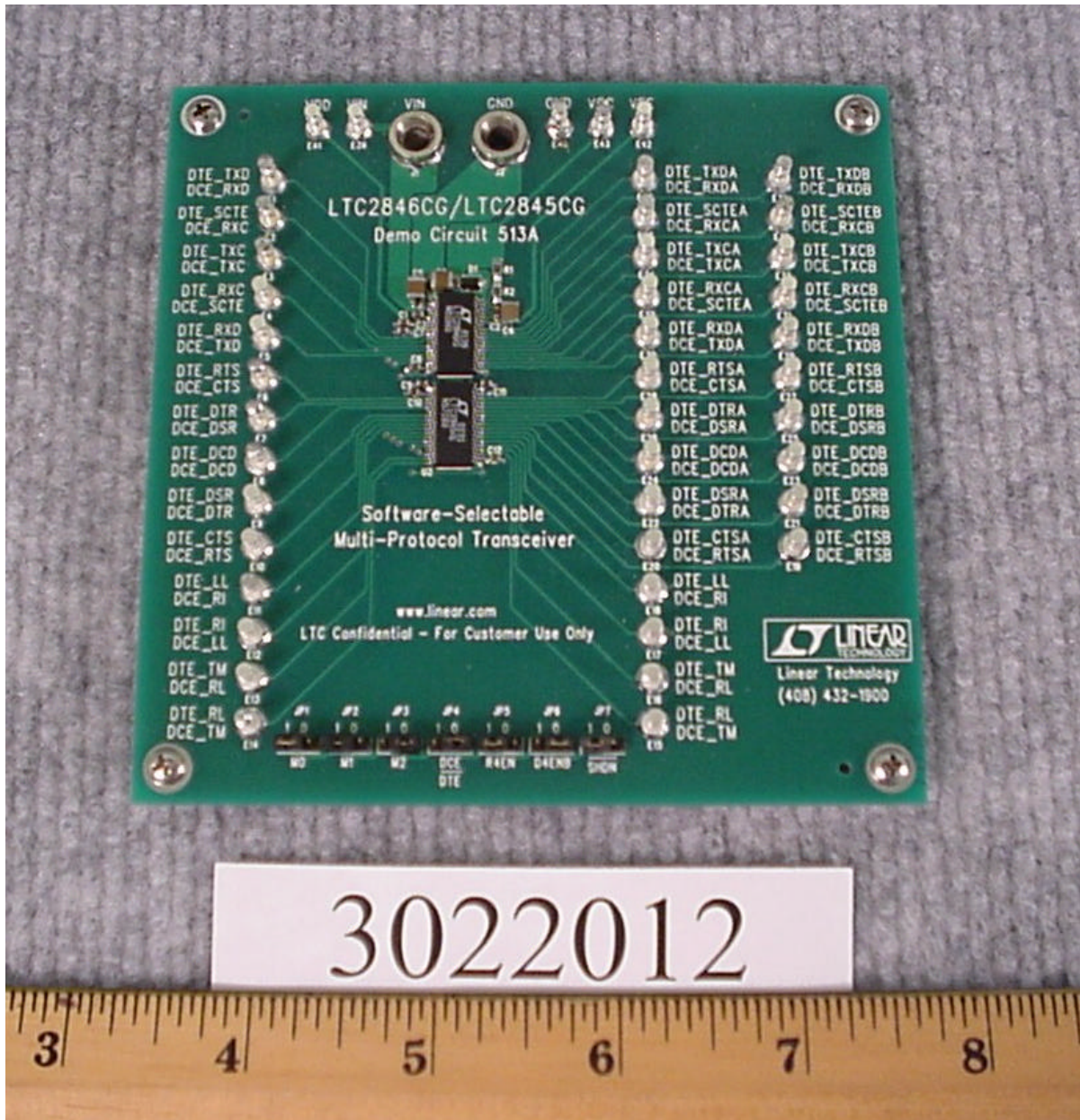
## Circuit 115 RxC

The receiver is terminated with an optional cable resistance.

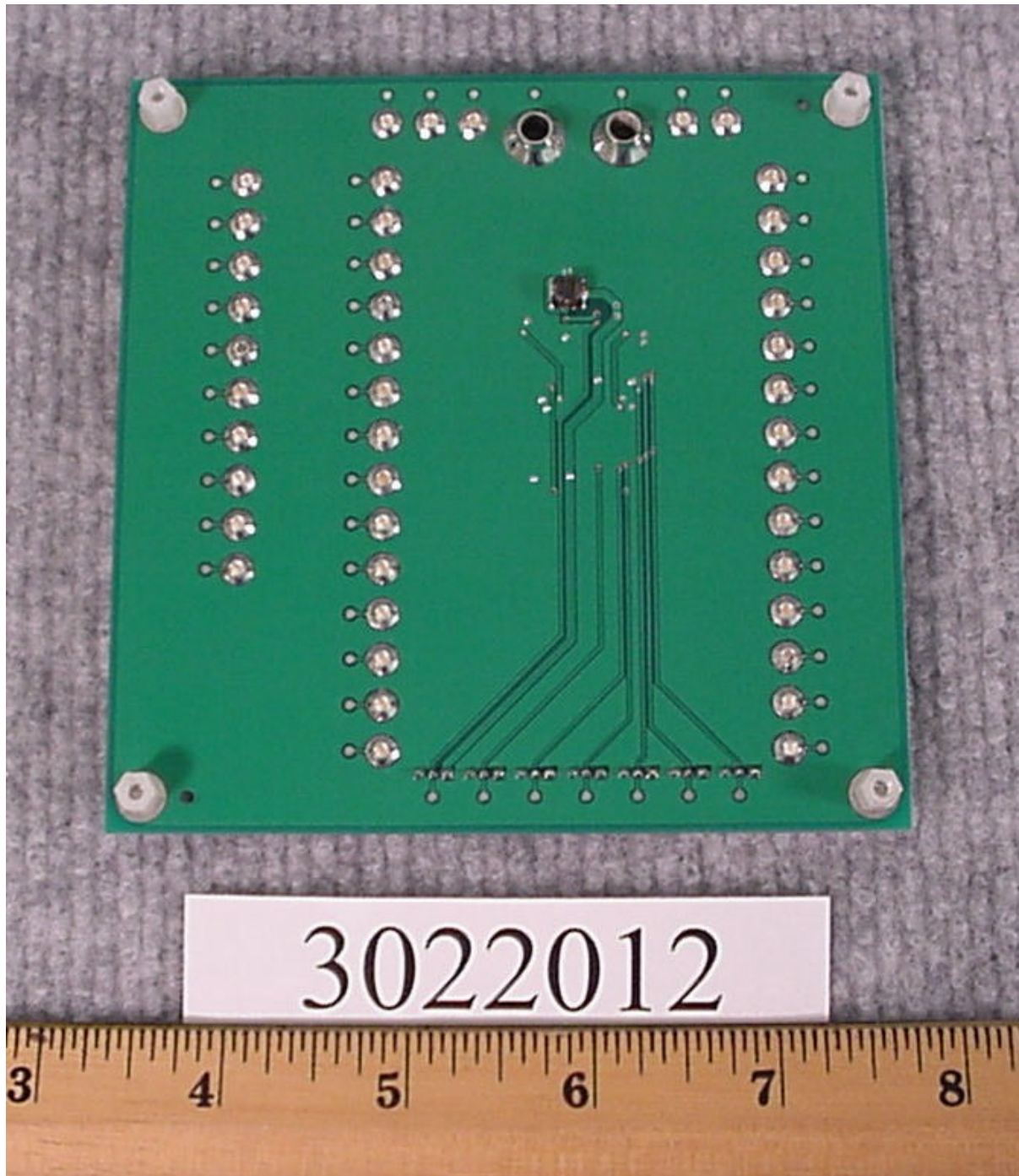
Limits according to NET 1, Revision 1, Figure 1

Description	Limits	Results	Verdict	Observation
Via = 6V	$I \leq 60.75 \text{ mA}$	55.8 mA	pass	
Via = 3V	$I \leq 30.75 \text{ mA}$	27.7 mA	pass	
Via = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.3 mA	pass	
Via = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0002 mA	pass	
Via = -6V	$I \leq 60.75 \text{ mA}$	-55.8 mA	pass	
Via = -3V	$I \leq 30.75 \text{ mA}$	-27.7 mA	pass	
Via = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.3 mA	pass	
Vib = 6V	$I \leq 60.75 \text{ mA}$	55.7 mA	pass	
Vib = 3V	$I \leq 30.75 \text{ mA}$	27.7 mA	pass	
Vib = 1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	9.3 mA	pass	
Vib = 0V	$-0.75 \leq I \leq 0.75 \text{ mA}$	0.0002 mA	pass	
Vib = -6V	$I \leq 60.75 \text{ mA}$	-55.7 mA	pass	
Vib = -3V	$I \leq 30.75 \text{ mA}$	-27.7 mA	pass	
Vib = -1V	$-0.5 \leq I \leq 10.75 \text{ mA}$	-9.3 mA	pass	

## 7 Photographs







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