TÜV Rheinland

TUV Telecom Services, Inc.
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TEST REPORT NO.

CTR2/071601/98

Date: July 26, 1998

Total Number of Pages: 28

Equipment: **LTC 1343 / LTC 1545 / LTC 1344 Chipset**

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

European Harmonised Standard: **CTR 2**

Authorised Signature:

July 26, 1998	**D. Mueller**	**Chief Engineer**	
Date	Name	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) 954-8400**
Fax	: **+1 (408) 428-9413**
Contact Person	: **David Soo**
Phone	: **+1 (408) 954-8400 ext. 3867**
Fax	: **+1 (408) 428-9413**

1.4 Product

Supplier's name	: **Linear Technology Corporation**
Street	: **1630 McCarthy Blvd.**
City	: **Milpitas, CA 95035**
Country	: **USA**
Phone	: **+1 (408) 954-8400**
Fax	: **+1 (408) 428-9413**

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1.4.1 System under Test (SUT)

SUT Configuration for testing (PC, Bus System, Clock etc.)	**Circuit Board with DTE or DCE Pin name identifiers**
Operating System	--
Version No.	--
Miscellaneous	--

1.4.2 Description of Product

The LTC 1343 / LTC 1545 / LTC 1344 Chipset will support X.21, V.35, V.24, and V.36 interfaces.

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1.4.3 15-pin DTE/DCE interface ISO 4903

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

Name	LTC 1343, LTC 1545, LTC 1344		
Version/Model	--		
Serial No.	--		
minimum speed (bit/s)	--		
maximum speed (bit/s)	8 Mbit/s		
Interface board	--		
Chip set	Transmitter: LTC 1343, LTC 1545	Receiver: LTC 1343	
Cable (name, P/N)	--		
Cable Length	--	shielded	unshielded

Supported Circuits

	supported
(X)	V.11
( )	V.10

T(A)	(X)
C(A)	(X)
R(A)	(X)
I(A)	(X)
S(A)	(X)
B(A)	(X)
G	(X)
T(B)	(X)
C(B)	(X)
R(B)	(X)
I(B)	(X)
S(B)	(X)
B(B)	(X)

Reserved for future international use

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1.4.4 25-pin DTE/DCE interface ISO 2110

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

Name	LTC 1343, LTC 1545, LTC 1344		
Version/Model	--		
Serial No.	--		
minimum speed (bit/s)	--		
maximum speed (bit/s)	19.2 kbit/s		
Interface board	--		
Chip set	Transmitter: LTC 1343, LTC 1545	Receiver: LTC 1343, LTC 1545	
Cable (name, P/N)	--		
Cable Length	--	shielded	unshielded

Supported Circuits

CCITT circuit	supported
102	(X)
103	(X)
104	(X)
105	(X)
106	(X)
107	(X)
108	(X)
109	(X)
114	(X)
115	(X)
140	(X)
141	(X)
142	(X)

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1.4.5 34-pin DTE/DCE interface ISO 2593

(CCITT Recommendation V.35 interface)

Name	LTC 1343, LTC 1545, LTC 1344		
Version/Model	--		
Serial No.	--		
minimum speed (bit/s)	--		
maximum speed (bit/s)	64 kbit/s		
Interface board	--		
Chip set	Transmitter: LTC 1545, LTC 1343	Receiver: LTC 1545, LTC 1343	
Cable (name, P/N)	--		
Cable Length	--	shielded	unshielded

Supported Circuits

CCITT circuit	Electrical characteristics		supported
102a			( )
102			(X)
103	V.35 (X)	V.11 ( )	(X)
104	V.35 (X)	V.11 ( )	(X)
105	V.28 (X)	V.10 ( )	(X)
106	V.28 (X)	V.10 ( )	(X)
107	V.28 (X)	V.10 ( )	(X)
108	V.28 (X)	V.10 ( )	(X)
109	V.28 (X)	V.10 ( )	(X)
114	V.35 (X)	V.11 ( )	(X)
115	V.35 (X)	V.11 ( )	(X)
140	V.28 (X)	V.10 ( )	( )
141	V.28 (X)	V.10 ( )	(X)
142	V.28 (X)	V.10 ( )	( )

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1.4.6 37-pin DTE/DCE interface ISO 4902

(CCITT Recommendation V.36 interface)

Name	LTC 1343, LTC 1545, LTC 1344		
Version/Model	--		
Serial No.	--		
minimum speed (bit/s)	--		
maximum speed (bit/s)	8 Mbit/s		
Interface board	--		
Chip set	Transmitter: LTC 1343, LTC 1545	Receiver: LTC 1343, LTC 1545	
Cable (name, P/N)	--		
Cable Length	--	shielded	unshielded

Supported Circuits

CCITT circuit	Electrical characteristics		supported
102			( )
102a			( )
102b			( )
103	V.11 (X)	V.10 ( )	(X)
104	V.11 (X)	V.10 ( )	(X)
105	V.11 (X)	V.10 ( )	(X)
106	V.11 ( )	V.10 (X)	(X)
107	V.11 (X)	V.10 ( )	(X)
108	V.11 (X)	V.10 ( )	(X)
109	V.11 (X)	V.10 ( )	(X)
114	V.11 (X)	V.10 ( )	(X)
115	V.11 (X)	V.10 ( )	(X)
128	V.11 (X)		(X)
133	V.10 (X)		(X)
140	V.10 (X)		(X)
141	V.10 (X)		(X)
142	V.10 (X)		(X)

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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 25% to 75%	(√) Yes	( )No

2.2 *Power Supply Limitations*

All tests were carried out within +/- 5% of the normal operating voltage of 120 V.

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3 System Report Summary

3.1 *Test Report Summary*

Protocol Standard: *TBR 2 (01.97)*

Protocol Conformance Test Report: *See Section 6*

Abstract Test Suite (ATS) Standard: *TBR 2 (01.97)*

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

Real Test system:

Executable Test Suite (ETS) Identification:

Schnittstellen-Messbox VX
Digital Multimeter HP 34401A
Power Supply HP6235A
Oscilloscope HP 54520A
Frequence Generator HP 33120A
Protocol Tester HP Idacom PT 300
Capacitance/Resistance Decade RCS-500

Conformance Status:

Static Conformance Errors : No
Dynamic Conformance Errors : No

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4 Observations

Date: **July 16, 1998**

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

5 Summary of Compliance

Date: **July 16, 1998**

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 standard. The test campaign did not reveal errors in the SUT/IUT.
Exclusion: the SU/IUT did not provide means of connection, see note 1.

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6 Protocol Conformance Test Report

6.1 *Protocol Conformance Test Report Layer 1*

6.1.1 Dates

Receipt of SUT/IUT: **July 8, 1998**
Date of Test: **July 16, 1998**

6.1.2 Operator

Bill Crannick Bill Crannick
(Signature)

6.1.3 Test System

Schnittstellen-Messbox VX
Digital Multimeter HP 34401A
Power Supply HP6235A
Oscilloscope HP 54520A
Frequence 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 25% to 75%	(√) Yes	( )No

All tests are carried out within +/- 5% of the normal operating voltage of 120V.

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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
7.2.5.1	6.2.5.1	ISO 4903 (15-pole)	NA	
7.2.5.2	6.2.5.2	Table A.24 and A.25	NA	

CCITT V.11 Interchange Circuits

A - C terminated with 3.9 KOhm

Circuit T

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.1	A - B	Vo ≤ 12.0V	4.74 V	pass	
	A - C	Voa ≤ 12.0V	4.75 V	pass	
	B - C	Vob ≤ 12.0V	0.002 V	pass	

Circuit C

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.1	A - B	Vo ≤ 12.0V	4.92 V	pass	
	A - C	Voa ≤ 12.0V	4.95 V	pass	
	B - C	Vob ≤ 12.0V	0.03 V	pass	

Circuit B

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.1	A - B	Vo ≤ 12.0V	4.76 V	pass	
	A - C	Voa ≤ 12.0V	4.75 V	pass	
	B - C	Vob ≤ 12.0V	0.01 V	pass	

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A - B terminated with 2 x 50 Ohm

Binary State 1

Circuit T

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.2	A - B	Vt ≥ 2.0V	2.80 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.28 V	pass	

Circuit C

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.2	A - B	Vt ≥ 2.0V	3.12 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.36 V	pass	

Circuit B

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.2	A - B	Vt ≥ 2.0V	2.79 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.26 V	pass	

Binary State 2

Circuit T

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.2	A - B	Vt ≥ 2.0V	-2.79 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.27 V	pass	

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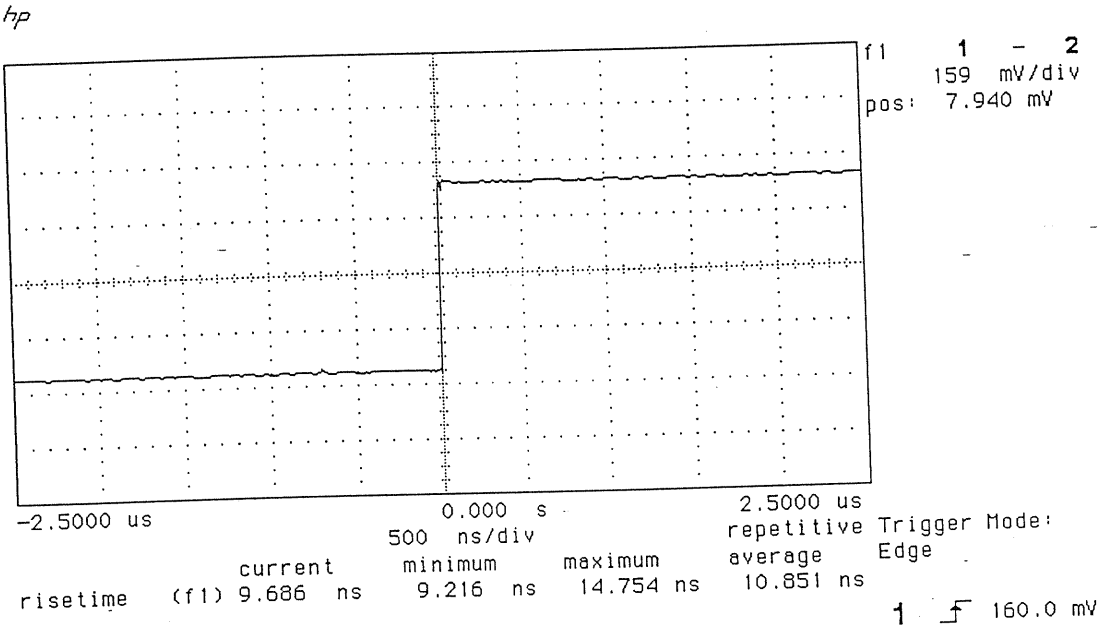
Generator Output Risetime

Circuit T

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.3	A - B	t ≤ 0.3 tb	10.9 ns	pass	



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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	6.2.1.1	ISO 2110 (25-pole)	NA	
7.2.1.2	6.2.1.2	Table A.1 and A.2	NA	

CCITT V.28 Interchange Circuits

A - C unterminated

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.1.1	103	V ≤ 25.0V	9.30 V	pass	
	105	V ≤ 25.0V	9.29 V	pass	
	108	V ≤ 25.0V	9.29 V	pass	
	140	V ≤ 25.0V	9.23 V	pass	
	141	V ≤ 25.0V	9.29 V	pass	

Binary State 1

A - C terminated with 3 KOhm

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.1.2	103	V ≥ 3.0V	8.06 V	pass	
	105	V ≥ 3.0V	8.52 V	pass	
	108	V ≥ 3.0V	8.51 V	pass	
	140	V ≥ 3.0V	8.28 V	pass	
	141	V ≥ 3.0V	8.58 V	pass	

Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.1.2	103	V ≥ 3.0V	-8.38 V	pass	
	105	V ≥ 3.0V	-8.90 V	pass	
	108	V ≥ 3.0V	-8.90 V	pass	
	140	V ≥ 3.0V	-8.65 V	pass	
	141	V ≥ 3.0V	-8.91 V	pass	

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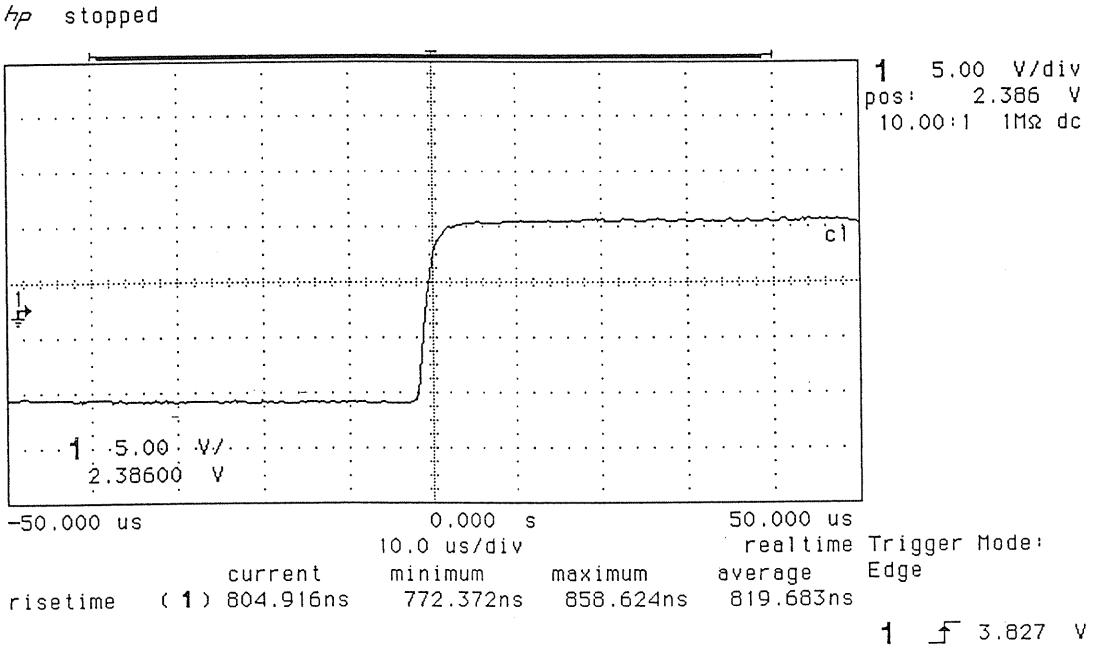
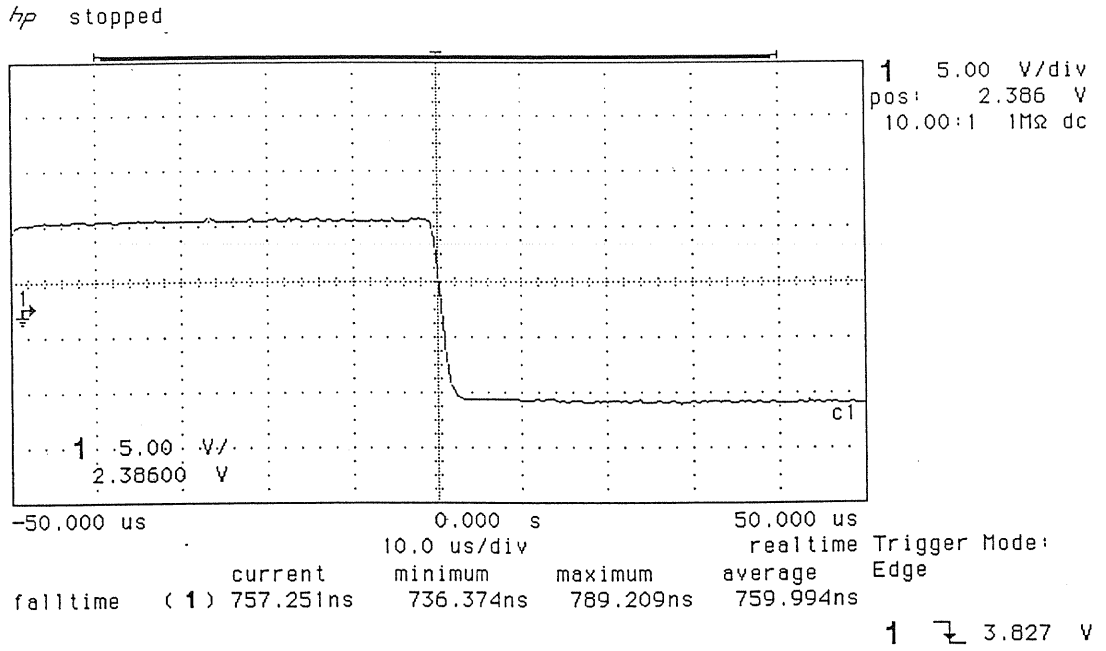
Generator Output Risetime

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.1.3	103	t ≤ 0.03 tb	819.6 ns	pass	





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Receiver Shunt Capacitance

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.2.1	104	C ≤ 2500 pF	< 40 pF	pass	
	114	C ≤ 2500 pF	< 40 pF	pass	
	115	C ≤ 2500 pF	< 40 pF	pass	

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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	6.2.4.1	ISO 2593 (34-pole)	NA	
7.2.4.2	6.2.4.2	Table A.17 and A.18	NA	

CCITT V.35 Interchange Circuits

A - C 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	Vo ≤ 1.2 V	1.03 V	pass	
	A - C	Voa ≤ 1.2 V	0.44 V	pass	
	B - C	Vob ≤ 1.2 V	-0.59 V	pass	

Binary State 2

Test Case	Description	Limits	Result	Verdict	Comment
7.6.1.1	A - B	Vo ≤ 1.2 V	-1.03 V	pass	
	A - C	Voa ≤ 1.2 V	-0.58 V	pass	
	B - C	Vob ≤ 1.2 V	0.45 V	pass	

A - C terminated with 2 x 50 Ohm

Circuit 103 (P/S)

Binary State 1

Test Case	Description	Limits	Result	Verdict	Comment
7.6.1.2	A - B	0.44V ≤ Vt ≤ 0.66V	0.52 V	pass	
	R1/R2 - C	Vos ≤ 0.6 V	0.06 V	pass	

Binary State 2

Test Case	Description	Limits	Result	Verdict	Comment
7.6.1.2	A - B	0.44V ≤ Vt ≤ 0.66V	-0.52 V	pass	
	R1/R2 - C	Vos ≤ 0.6 V	0.06 V	pass	

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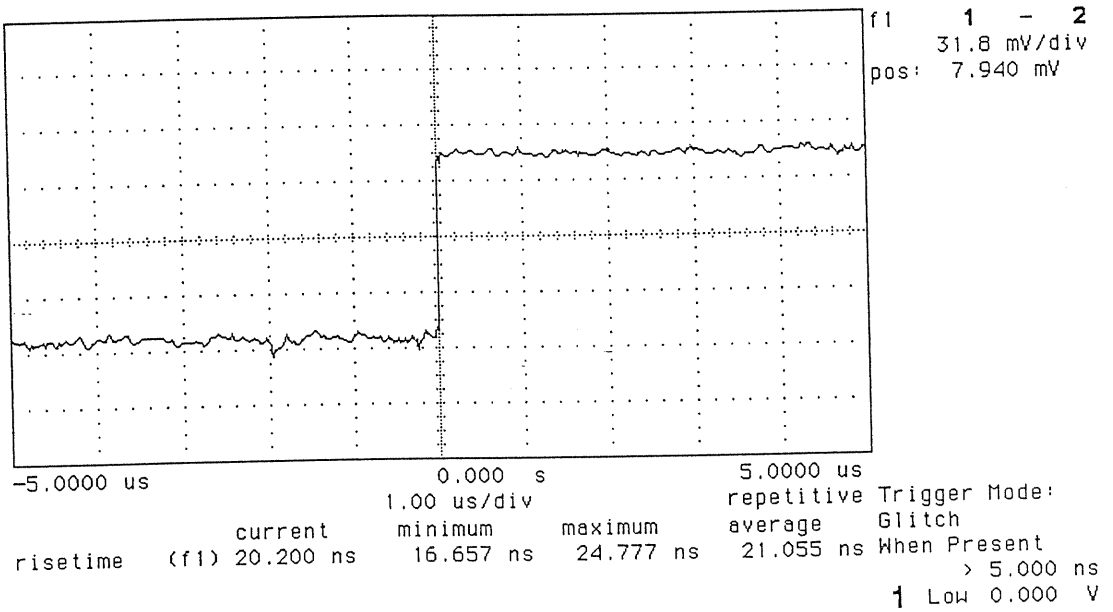
Generator Output Risetime

Test Case	Circuit	Limits	Result	Verdict	Comment
7.6.1.3	103 (P/S)	t ≤ 0.1 tb	21.1 ns	pass	



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CCITT V.28 Interchange Circuits

A - C unterminated

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.1.1	105	V ≤ 25.0V	8.74 V	pass	
	108	V ≤ 25.0V	8.62 V	pass	
	140	V ≤ 25.0V	8.68 V	pass	
	141	V ≤ 25.0V	8.74 V	pass	

Binary State 1

A - C terminated with 3 KOhm

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.1.2	105	V ≥ 3.0V	8.13 V	pass	
	108	V ≥ 3.0V	8.13 V	pass	
	140	V ≥ 3.0V	7.91 V	pass	
	141	V ≥ 3.0V	8.12 V	pass	

Binary State 2

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.1.2	105	V ≥ 3.0V	-7.69 V	pass	
	108	V ≥ 3.0V	-7.68 V	pass	
	140	V ≥ 3.0V	-7.42 V	pass	
	141	V ≥ 3.0V	-7.69 V	pass	

Receiver Shunt Capacitance

Test Case	Circuit	Limits	Result	Verdict	Comment
7.5.2.1	104	C ≤ 2500 pF	< 40 pF	pass	
	114	C ≤ 2500 pF	< 40 pF	pass	
	115	C ≤ 2500 pF	< 40 pF	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	6.2.3.1	ISO 4902 (37-pole)	NA	
7.2.3.2	6.2.3.2	Table A.13 and A.14	NA	

CCITT V.10 Interchange Circuits

Binary State 1

A - C terminated with 3.9 KOhm

Test Case	Circuit	Limits	Result	Verdict	Comment
7.3.1.1	140	V ≤ 12.0V	4.74 V	pass	
	141	V ≤ 12.0V	4.94 V	pass	

A - C terminated with 450 Ohm

Test Case	Circuit	Limits	Result	Verdict	Comment
7.3.1.2	140	Vo ≥ 2.0V	4.41 V	pass	
	141	Vo ≥ 2.0V	4.58 V	pass	

Binary State 2

A - C terminated with 3.9 KOhm

Test Case	Circuit	Limits	Result	Verdict	Comment
7.3.1.1	140	V ≤ 12.0V	-5.48 V	pass	
	141	V ≤ 12.0V	-5.70 V	pass	

A - C terminated with 450 Ohm

Test Case	Circuit	Limits	Result	Verdict	Comment
7.3.1.2	140	Vo ≥ 2.0V	-5.07 V	pass	
	141	Vo ≥ 2.0V	-5.22 V	pass	

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CCITT V.11 Interchange Circuits

A - C terminated with 3.9 KOhm

Circuit 103

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.1	A - B	Vo ≤ 12.0V	4.99 V	pass	
	A - C	Voa ≤ 12.0V	4.75 V	pass	
	B - C	Vob ≤ 12.0V	0.24 V	pass	

Circuit 105

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.1	A - B	Vo ≤ 12.0V	4.99 V	pass	
	A - C	Voa ≤ 12.0V	0.54 V	pass	
	B - C	Vob ≤ 12.0V	4.99 V	pass	

Circuit 108

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.1	A - B	Vo ≤ 12.0V	4.95 V	pass	
	A - C	Voa ≤ 12.0V	4.95 V	pass	
	B - C	Vob ≤ 12.0V	0.72 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
7.4.1.2	A - B	Vt ≥ 2.0V	2.80 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.28 V	pass	

Circuit 105

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.2	A - B	Vt ≥ 2.0V	2.83 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.43 V	pass	

Circuit 108

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.2	A - B	Vt ≥ 2.0V	3.10 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.35 V	pass	

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Binary State 2

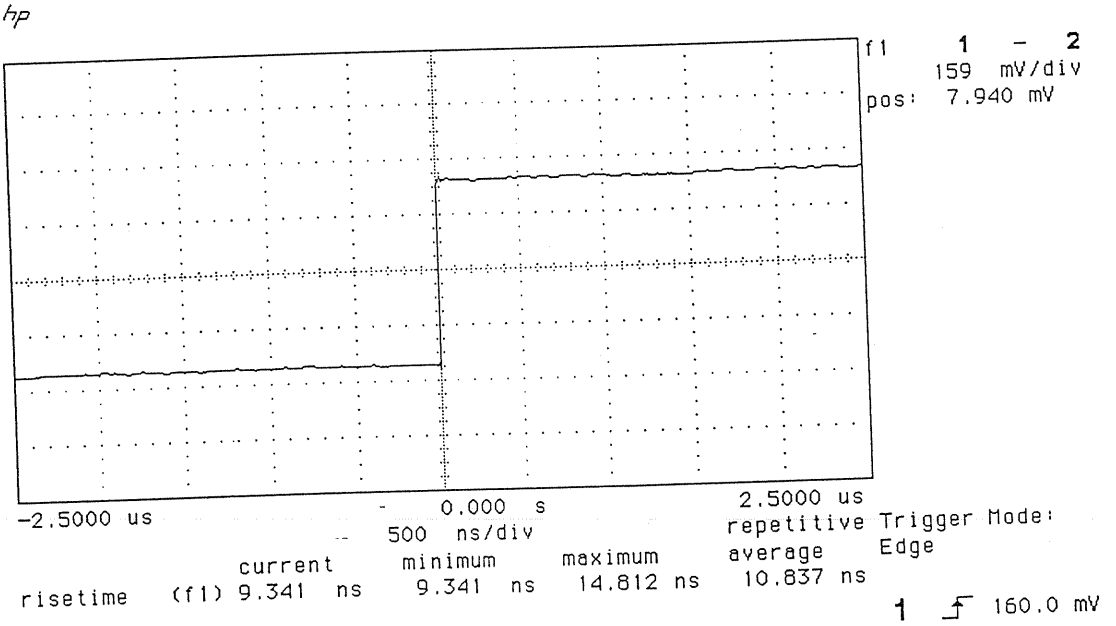
Circuit 103

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.2	A - B	Vt ≥ 2.0V	2.77 V	pass	
	R1/R2 - C	Vos ≤ 3.0V	2.25 V	pass	

Generator Output Risetime

Circuit 103

Test Case	Description	Limits	Result	Verdict	Comment
7.4.1.3	A - B	t ≤ 0.3 tb	10.8 ns	pass	



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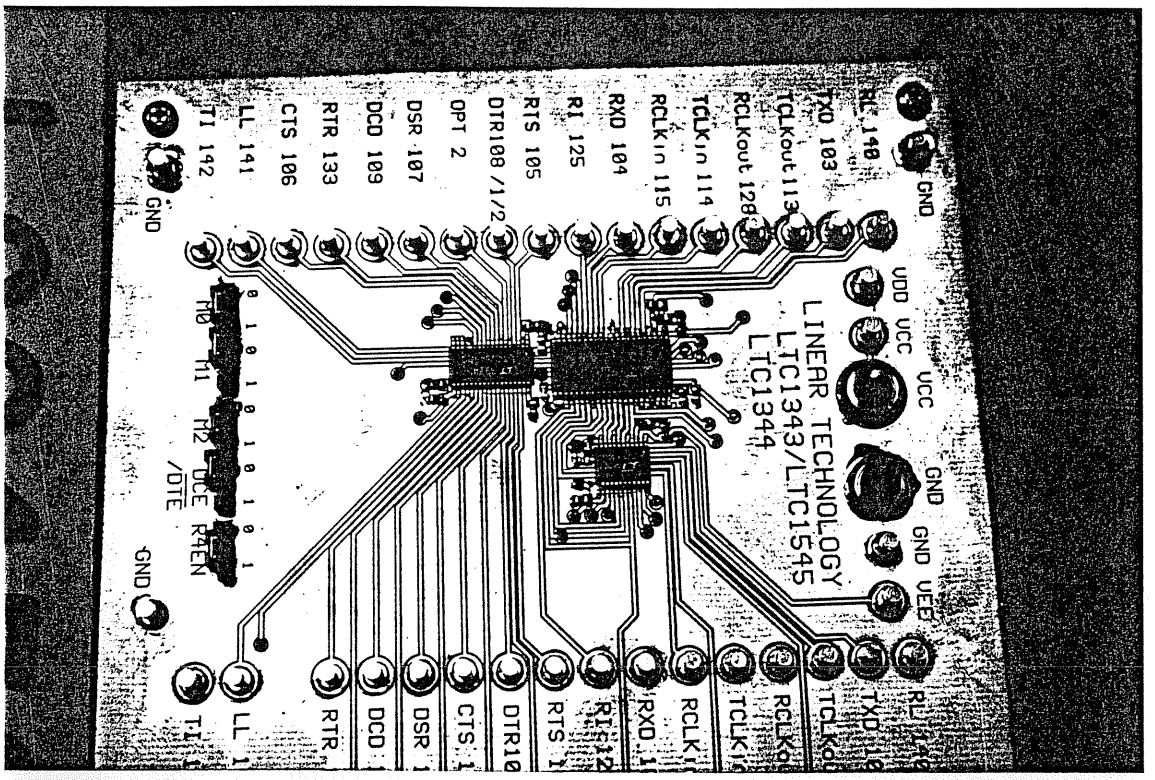
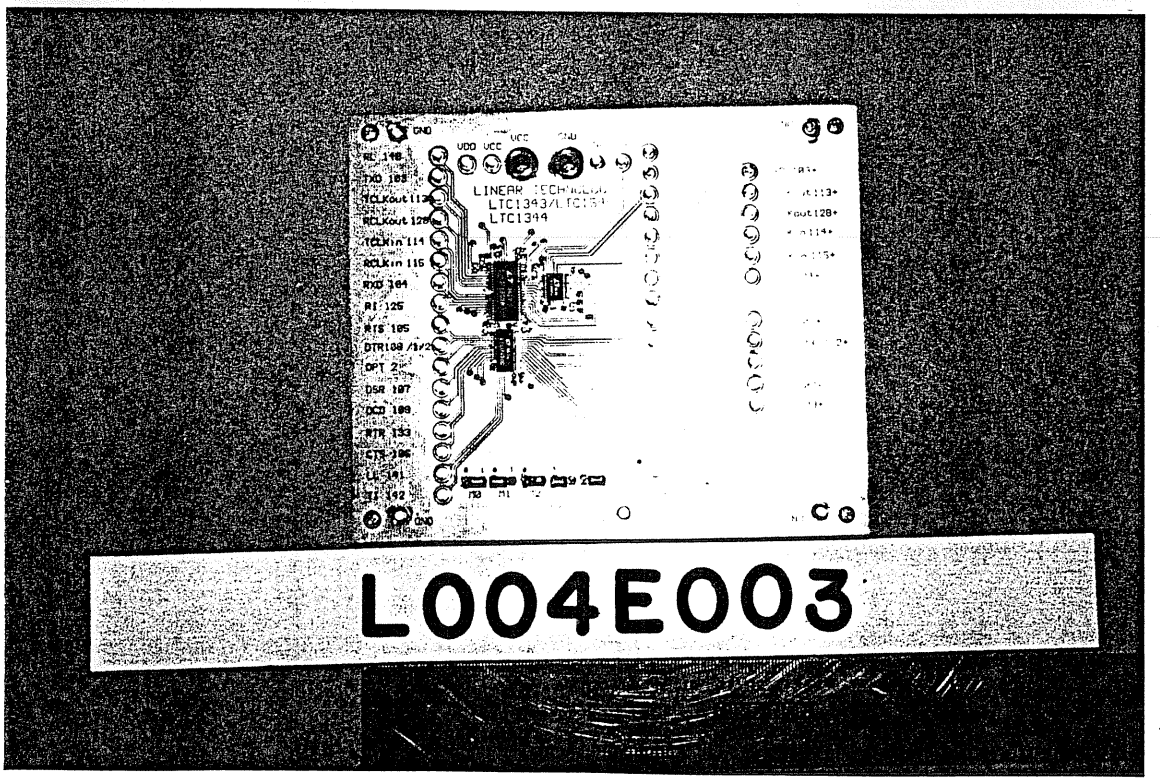
7 Photographs





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