DP83950 Twisted Pair Parametric Evaluation

National Semiconductor
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TWISTED PAIR PARAMETRIC EVALUATION

The following information lists the results of the Twisted Pair Parametric tests performed on the DP83950 Repeater Interface Controller (RIC™). The DP83950EB-AT Repeater Kit was used to perform the measurements. Four parts were evaluated at room temperature and 5V power supply, except where indicated.

The test results are divided into three areas; transmit, receive and miscellaneous. The tabular format used shows the parameter tested, the reference section and *Figures* of the ''IEEE 802.3 10Base-T CSMA/CD Access Method and Physical Layer Specifications'' document, and the values measured on the RIC. No details for the tests/setups are provided as they follow the IEEE document specifications for each test. Additional notes and tables are included for clarification where necessary.

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Transmitter Specifications

Test #	Parameter	IEEE Ref. Spec.	RIC Value/Comment
1	Peak differential output voltage: at TD± circuits terminated with a 100Ω load directly ±2.2V to ±2.8V	14.3.1.2.1	2.5V Peak (Note 1)
2	Harmonic contents with 10 MHz signal through the transmitter All harmonics should be ≥27 dB below the fundamental 10 MHz	14.3.1.2.1	Tested with a random signal, all harmonics were >30 dB below the fundamental signal
3	Output waveform with scaling Within *Figure 14-9* template	14.3.1.2.1	Waveforms are within template Measured values are shown in Tables Ia, Ib, Ic
4	Start of TP__IDL waveform with specified load in *Figure 14-11* and with or without cable model. The readings include idle high time and idle setting time Within *Figure 4-10* template	14.3.1.2.1	Waveforms are within template Measured values are shown in Table II
5	Link test pulse waveform, with specified load in *Figure 14-11* and with or without cable model. Readings include amplitude and pulse width Within *Figure 4-12* template	14.3.1.2.1	Waveforms are within template Measured values are shown in Table III
6	TD circuit differential output impedance or Return Loss spec. Reflection ≥15 dB below incident for all power on states and for impedances of 85Ω to 111Ω	14.3.1.2.2	Within spec. Measured values are shown in Table IV
7	TD output jitter: random signal through a 100m cable model terminated with a 100Ω load Equalized for max ±3.5 ns jitter at the end of cable model and with this equalization max ±8 ns while TD circuit is directly terminated with a 100Ω load	14.3.1.2.3	Within spec. Measured values are shown in Table V
8	Common mode to differential mode conversion. Test circuit as in *Figure 14-13* ≥29 − 17 log 10 (f/10) dB 1 < f < 20 MHz	14.3.1.2.4	Within spec. Measured values are shown in Table VI
9	TD circuit common mode output voltage. Test circuit is shown in *Figure 14-14* <50 mV peak	14.3.1.2.5	Within spec. (Note 2)

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Transmitter Specifications (Continued)

Test #	Parameter	IEEE Ref. Spec.	RIC Value/Comment
10	TD short circuit current 300 mA max	14.3.1.2.7	Within spec. Approximately 0 mA
11	TD circuit common mode impulse withstand. Test circuit as in *Figure 14-15* Impulse E_{cm} applied 1000V min	14.3.1.2.7	Filter test—Guaranteed by filter manufacturer
12	TD silence voltage $\leq \pm 50$ mV	14.2.1.1	Within spec. 6 mV
13	Period of link pulses 16 ms ± 8 ms	14.2.1.1	16 ms
14	Transmit settling time	14.2.1.1	Within spec. Meets amplitude and jitter specifications (2nd bit on)
15	Power cycle behavior No extraneous signal on TD circuit	14.3.2.3	No extraneous signal on TD circuit where noticed

Note 1: The circuit used is shown in *Figure 1*. Three filters/transformer packages from three vendors were evaluated, and all of them met the amplitude required by this spec. The packages evaluated were: 1) Valor FL1012, 2) Pulse Engineering PE65431, 3) Bel Fuse 0556-3392-00

Note 2: The measurements were done on Valor FL1012, Valor PT3877, and Pulse Engineering PE65431. For all of these packages a 0.01 μF capacitor is required from the center tap to ground, as shown in *Figure 2*, to reduce common mode to within 50 mV.

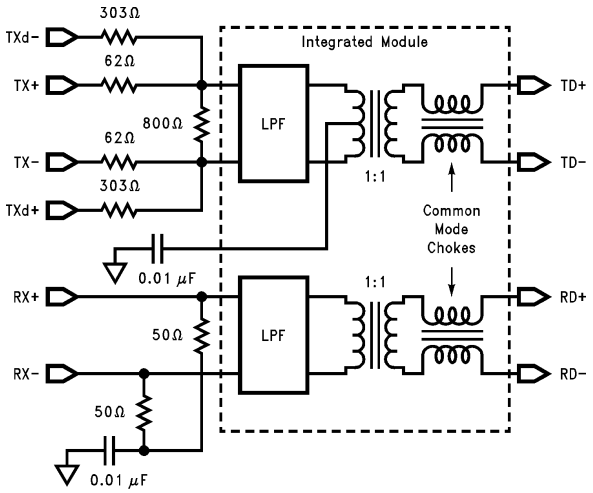

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FIGURE 2

Receiver Specifications

Test #	Parameter	IEEE Ref. Spec.	RIC Value/Comment
1	Signals accepted by RD circuits *Figures 14-16* and *14-17* templates	14.3.1.3.1	Test signals used did not include jitter Signals accepted met *14-17* and *14-16* templates
2	Jitter accepted by receiver $\geq \pm 13.5$ ns	14.3.1.3.1	Guaranteed by 1 above
3	Jitter added by the receiver $\leq \pm 1.5$ ns	14.3.1.3.1	Within spec. Approximatley 1.44 ns
4	RD circuit link test pulse acceptance *Figure 14-12* template	14.3.1.3.2	Within spec. Rejects $<$480 mV amplitude Accepts down to 35 ns width
5	Signals REJECTED by the receiver: a) Signals that will produce 300 mV peak signal at the output of a 3 pole test filter described in A.4.2 b) All sinusoidal signals of amplitude less than 6.2 V_{p-p} and frequency less than 2 MHz c) All sinusoidal single cycles of amplitude 6.2 V_{p-p} with 0° or 180° phase where the frequency is between 2 MHz to 15 MHz	14.3.1.3.2	Within the spec. Measured values are shown in Table VII
6	Idle detection by RD circuits Within 2.3 BT	14.3.1.3.3	Within spec. Within 2.05 BT
7	REC circuits differential input impedance or return loss Reflection $\geq$15 dB below incident for an impedance of 85Ω to 111Ω	14.3.1.3.4	Within spec. Measured values are shown in Table IV
8	RD short circuit fault tolerance Indefinite short shall be tolerable	14.3.1.3.6	RD short caused no faults
9	Receive delay	None*	40 ns
10	Bit loss and receive delay	None*	2.3 BT (270 ns − 40 ns)

*These are extra tests not specified in the standard.

Miscellaneous

Test #	Parameter	IEEE Ref. Spec.	RIC Value/Comment
1	Jabber timer	14.2.1.6	5 ms
2	Unjab time	14.2.1.6	Approx. 100 BT
3	Link loss timer 50 ms−150 ms (RIC set at 60 ms)	14.2.1.7	56 ms
4	Polarity correction: a) Inverted link pulses, b) Packets with inverted TP__IDL For both cases check if link pass state	None*	Functional
5	TX output at link fail No output data but link pulses	14.2.1.7	Functional
6	Receiver squelch level 300 mV−585 mV	Data Sheet	Within spec. (Note 1)
7	Receiver frequency acceptance: Input signal on RX± of 1.2V to 6.2V and sweep the frequency from 0 MHz to 30 MHz or higher	None*	Within spec. Accepts >3.61 MHz and up to 20 MHz (generator limit)
8	Power consumption	Data Sheet	I_{CC} max = 350 mA (Approx.)
9	Receive link__test__max timer 25 ms−150 ms (RIC: 32 ms)	14.2.1.7	Within spec. 32 ms
10	Receive link__test__ min timer 2 ms−7 ms	14.2.1.7	Within spec. 5.75 ms
11	Link count: lc__max (RIC: 7 consecutive link counts	14.2.1.7	Functional

Note 1: With a SIN wave input:
Normal mode: Guaranteed on at 520 mV, guaranteed off at 460 mV.
Low squelch mode: Guaranteed on at 360 mV, guaranteed off at 260 mV. (For use with shielded TP and extended distances.)

* These are extra tests not specified in the standard.

TABLE Ia. Data at Different Points of the Transmit Signal at the End of the Cable Model

RIC#	Spec.		Port #2		Port #6		Port #13	
	Point	Value (V)	+ve TMPLT	−ve TMPLT	+ve TMPLT	−ve TMPLT	+ve TMPLT	−ve TMPLT
20	A	0	0	0	0	0	0	0
	B	1.0						
	C	0.4	0.75	0.6	0.58	0.66	0.75	0.78
	D	0.55	0.88	0.85	0.72	0.8	0.9	0.9
	E	0.45	0.74	0.83	0.58	0.86	0.83	0.78
	F	0	0.3	0.5	0.13	0.16	0.43	0.35
	G	−1.0	−0.45	−0.37	−0.7	−0.62	−0.46	−0.54
	H	0.7						
	I	0.6						
	J	0						
	K	−0.55	−0.96	−0.9	−1.024	−0.9	−0.97	−0.94
	L	−0.55	−0.96	−0.9	−1.024	−0.9	−0.97	−0.94
	M	0						
	N	1.0	0.8	0.9	1.0	0.9	0.78	0.78
	O	0.4						
	P	0.75						
	Q	0.15						
	R	0						
	S	−0.15						
	T	−1.0						
	U	−0.3	0	−0.13	0.26	−0.3	0.032	−0.06
	V	−0.7						
	W	−0.7	−0.6	−0.64	0.5	−0.43	−0.97	−0.58

TABLE Ib. Data at Different Points of the Transmit Signal at the End of the Cable Model

RIC #	Spec.		Port #2		Port #6	
	Point	Value (V)	+ve TMPLT	−ve TMPLT	+ve TMPLT	−ve TMPLT
22	A	0	0	0	0	0
	B	1.0				
	C	0.4	0.62	0.6	0.62	0.62
	D	0.55	0.74	0.85	0.62	0.62
	E	0.45	0.64	0.62	0.5	0.5
	F	0	0.26	0.18	0.04	0.04
	G	−1.0	−0.6	−0.7	−0.78	−0.78
	H	0.7				
	I	0.6				
	J	0				
	K	−0.55	−1.1	−1.024	−1.0	−1.0
	L	−0.55	−1.1	−1.024	−1.0	−1.0
	M	0				
	N	1.0	0.8	0.75	0.9	0.9
	O	0.4				
	P	0.75				
	Q	0.15				
	R	0				
	S	−0.15				
	T	−1.0				
	U	−0.3	0	0	0.14	0.14
	V	−0.7				
	W	−0.7	−0.62	−0.59	−0.38	−0.38

TABLE II. Start of TP__IDL Waveform

Test Load	Amplitude (V_P)	Width (ns)	Undershoot mV	@4.5 BT (mV)
155Ω // 180 μH with Cable Model	1.28	425	−220	−44
115Ω // 180 μH without Cable Model	1.5	431	−500	−36
76.8Ω // 229 μH with Cable Model	1.05	428	−120	−40
76.8Ω // 229 μH without Cable Model	1.27	438	−336	−32

TABLE III. Measurements of Different Corners of Link Pulses

Test Load	Amplitude (V)	Width at 0 to 0 Crossing (ns)	Width at 0/300 mV to 300 mV (ns)	Under-shoot (mV)	Amplitude at 4 BT (mV)	Amplitude at 42 BT (mV)
115Ω // 180 μH with Cable Model	1.6	333	176 ns at 300 mV to 300 mV	−80	−48	−12
115Ω // 180 μH without Cable Model	2.79	142.5	140 ns at 0 mV to 300 mV	−320	−100	−20
76.8Ω // 220 μH with Cable Model	1.32	340	164 ns at 300 mV to 300 mV	−56	−40	−14
7608Ω // 220 μH without Cable Model	2.26	158	152.5 ns at 0 mV to 300 mV	−240	−60	−16

TABLE IV. Return Loss on the Network

Port #	Receive		Transmit (Powered Up)	
	@ 5 MHz (dB)	@ 10 MHz (dB)	@ 5 MHz (dB)	@ 10 MHz (dB)
2	−31.9	−26.3	−34.3	−23.5
3	−39.5	−26.3	−32.5	−24.8
4	−31.3	−22.2	−33.3	−23.0
5	−35.4	−24.6	−38.9	−26.6
6	−35.2	−24.3	−34.0	−22.6
7	−30.1	−20.5	−36.0	−23.4
8	−29.7	−20.0	−26.8	−22.5
9	−30.7	−20.8	−31.5	−21.4
10	−30.6	−20.9	−31.7	−21.6
11	−32.0	−22.7	−36.1	−23.9
12	−34.5	−24.0	−31.7	−22.0
13	−30.5	−21.1	−34.0	−22.1

TABLE V. Transmit Signal Jitter at the End of a Cable Model

Filter	Jitter
Valor FL1012	±1.65 ns
Pulse Engineering PE65431	±1.60 ns
Bel Fuse 0556-3392-00	±2.05 ns

TABLE VI. Data for Transmitter Impedance Balance Test

Frequency MHz	29−17 $\log_{10}$ (f/10) dB	E_{cm} V_{p-p}	E_{diff} V_{p-p}	20 $\log_{10}$ (E_{cm}/E_{diff}) dB
1.0	46.0	10.2	28.8m	50.98
2.0	40.88	10.2	32.0m	50.0
3.0	37.88	10.2	35.0m	49.29
4.0	35.76	10.2	38.4m	48.48
5.0	34.18	10.0	41.6m	47.6
6.0	32.77	9.6	44.0m	46.7
7.0	31.63	9.4	46.4m	46.13
8.0	30.64	9.0	48.0m	45.46
9.0	29.72	8.4	48.0m	44.86
10.0	29.0	8.2	47.2m	44.79
11.0	28.29	8.8	84.8m	40.32
12.0	27.65	9.0	66.0m	42.69
13.0	27.06	8.6	38.0m	47.09
14.0	26.51	8.4	32.8	48.16
15.0	26.00	8.2	28.8m	49.0
16.0	25.52	8.0	26.8m	49.49
17.0	25.08	7.8	30.8m	48.07
18.0	24.66	7.6	29.6m	48.19
19.0	24.26	7.6	26.4m	49.18
20.0	23.88	7.4	21.6m	50.69

TABLE VII. Receiver Rejection Test Data

Test #	RIC #20		RIC #21		RIC #22	
	Port #5	Port #6	Port #5	Port #6	Port #5	Port #6
5 (a) @ 5 MHz	456 mVp	450 mVp	470 mVp	480 mVp	490 mVp	500 mVp
5 (a) @ 10 MHz	504 mVp	505 mVp	590 mVp	540 mVp	590 mVp	540 mVp
5 (b)	3.6 MHz	3.59 MHz	3.62 MHz	3.60 MHz	3.60 MHz	3.59 MHz

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