150 – 1500 Mbps Cable Extender Chipset (DS15BA101/DS15EA101) Evaluation Kit

USER'S MANUAL

Part Number: DriveCable02EVK

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Overview

The DriveCable02EVK is an evaluation kit designed for demonstrating performance of the DS15BA101 and DS15EA101 cable extender chipset. The evaluation kit provides two independent channels to evaluate 100-ohm differential cables such as twin-axial and low cost CAT5e/6/7 twisted pair cables and 50-ohm coaxial cables (with change of launch amplitude).

The purpose of this document is to: familiarize you with the DriveCable02EVK, suggest the test setup procedures and instrumentation, and guide you through some typical measurements that demonstrate performance of the chipset in typical applications.

Evaluation Kit Contents

- **Driver PC Board** – The transmitter board features two independent channels each utilizing a single DS15BA101 to drive the cable.

- **Receiver PC Board** – The receiver board features two independent channels each utilizing a single DS15EA101 to receive a signal and compensate for cable losses.

- **Two SMA-to-RJ45 Adapter Cards** – Each card features two male SMA connectors that directly mate with the female SMA connectors connected to the 100-ohm differential channel.

- **EULA and Introductory Letter Printouts**
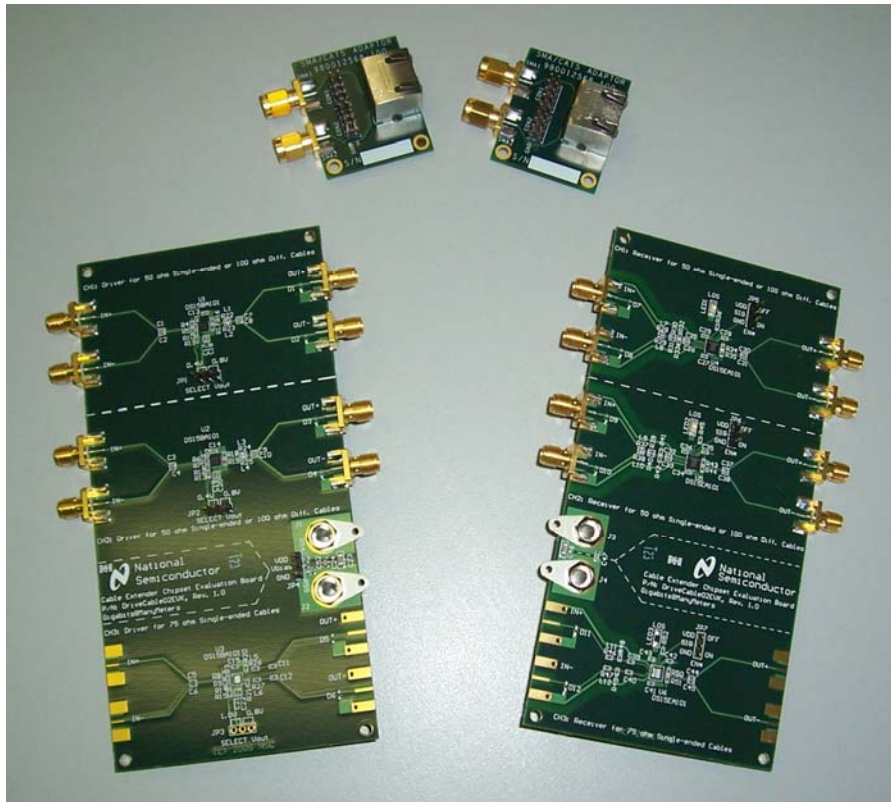
Driver Board Description

Figure 1 shows a drawing of the driver board. The Channels 1 and 2, with U1 and U2, are intended for evaluation of 100-ohm differential cables such as twin-axial and twisted pair cables as well as 50-ohm coaxial cables. The outputs of the DS15BA101 are AC-coupled to a pair of SMA connectors for easy interface to SMA-to-RJ45 Adapter card. The adapter card enables evaluation of twisted pair cable assemblies with RJ45 connectors. Although RJ45 connectors are convenient for evaluation, higher performance connectors are generally recommended for actual systems.

Figure 1. Driver Board

Connector	Device	Function
JP1	U1	Select output amplitude
JP2	U2	Select output amplitude

Table 1. Driver Board Connector-Device-Function Cross Reference

Receiver Board Description

Figure 2 shows a drawing of the receiver board. The channels 1 and 2, with U4 and U5, are intended for evaluation of 100-ohm differential cables such as twin-axial and twisted pair cables as well as 50-ohm coaxial cables. The inputs of the DS15EA101 are AC-coupled to a pair of SMA connectors for easy interface to SMA-to-RJ45 Adapter card. The adapter card enables evaluation of twisted pair cable assemblies with RJ45 connectors. Although RJ45 connectors are convenient for evaluation, higher performance connectors are generally recommended for actual systems.
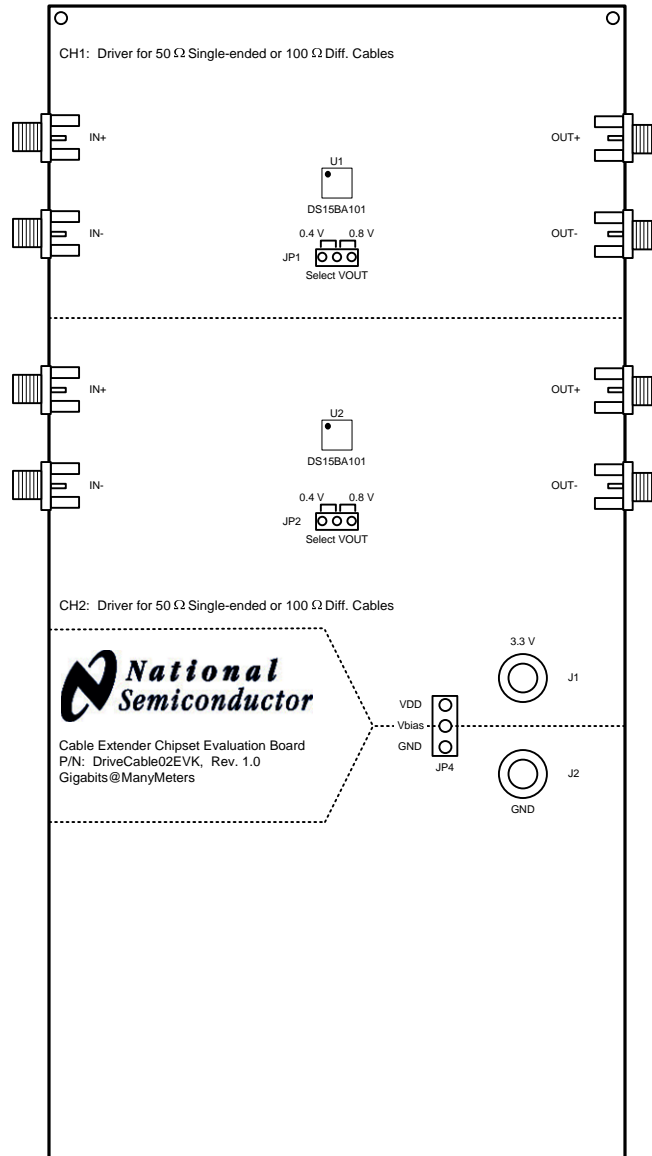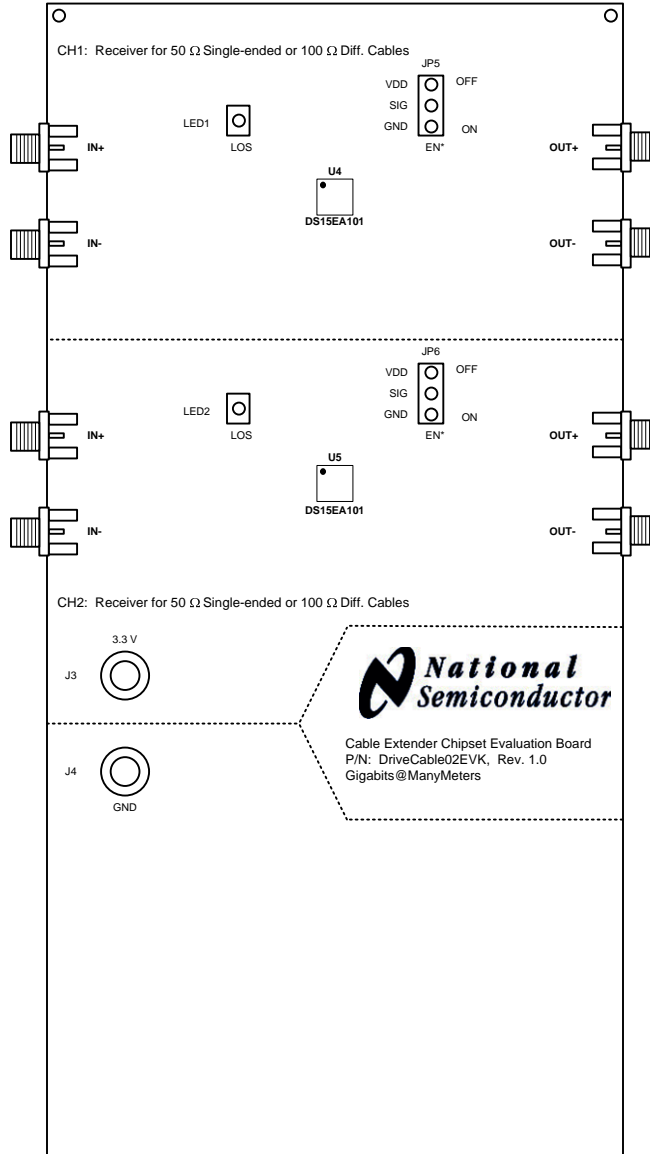
Figure 2. Receiver Board

Connector	Device	Function
JP5	U4	Enable device
JP6	U5	Enable device

Table 2. Receiver Board Connector-Device-Function Cross Reference

Setting Up the DriveCable02EVK Evaluation Kit

This section provides a quick reference for setting up some typical test configurations using the DriveCable02EVK that will enable you to evaluate the solution with 100-ohm differential cables (twin-axial and twisted pair cables) as well as 50-ohm coaxial cables.

Evaluating 100-ohm Differential Cable Assemblies with RJ45 Connectors

The DriveCable02EVK, channels 1 and 2, can be used to evaluate twisted pair cables. Examples are CAT5e/6/7 cable assemblies such as Belden 1500A, Belden 1700A and Siemon Tera. Figure 3 is a simplified block diagram of the configuration.

Figure 3. Test Setup for Twisted Pair Cable Evaluation

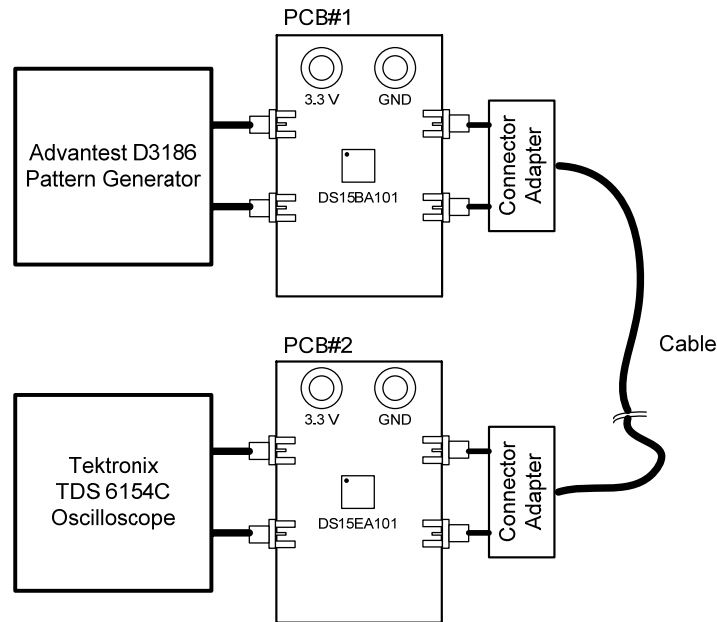Follow these steps to set up the DriveCable02EVK for Twisted Pair cable evaluation:

1. Driver board, Channel 1 or 2:

    a) Provide 3.3 V between the J1 (VDD) and J2 (GND). This powers all devices on the board.
    b) Set output voltage amplitude of U1 (or U2) to 0.4 V by using JP1 (or JP2).
    c) Connect cable driver inputs to a signal source (i.e. Pattern Generator). Note the AC-coupling capacitors on the inputs.

2. Receiver board, Channel 1 or 2:

    a) Provide 3.3 V between the J3 (VDD) and J4 (GND). This powers U4 and U5 devices on the board.
    b) Enable U4 (or U5) outputs by setting its EN* pin to low. This is accomplished by placing a jumper across GND and SIG pins on connector JP5 (or JP6).

3. Attach the SMA-to-RJ45 adapter boards to driver and receiver boards.
4. Connect a twisted pair cable assembly with RJ-45 plugs on its ends.
5. The LEDs, LED1 and LED2, will illuminate if the equalizer (U4 or U5) detects a valid signal.
6. Connect equalizer outputs directly to an oscilloscope or a bit error rate tester (BERT) receiver using good quality coaxial cables. Note that the equalizer outputs have internal 50-ohm pull-ups and that there are on-board AC-coupling capacitors.
7. Observe the results on the oscilloscope or BERT receiver.

Figure 4 presents typical maximum data rate as a function of CAT5e cable length. The data was collected on four chipsets (A, B, C and D). The data in red was taken with the 0.5 UI jitter criteria while the data in blue was taken with the 0.25 UI jitter criteria.

Figure 4. DS15BA101 and DS15EA101 Performance with CAT5e Cable

Evaluating 100-ohm Differential Cable Assemblies without RJ45 Connectors

The DriveCable02EVK can be used to evaluate other 100-ohm differential cables without RJ45 connectors. The only requirement is to develop an adapter card (similar to the SMA-RJ45 adapter card included in this kit) that would accommodate the connector assembled with the cable. The same test setup procedure applies as for the configuration 1. Examples of these cables are Siemon CAT7 Tera, Belden 89207 and Amphenol SKEWCLEAR series of cables.

Figure 5 presents maximum data rate as a function of CAT7 cable length. The data was collected on four chipsets (A, B, C and D). The data in red was taken with the 0.5 UI jitter criteria while the data in blue was taken with the 0.25 UI jitter criteria.
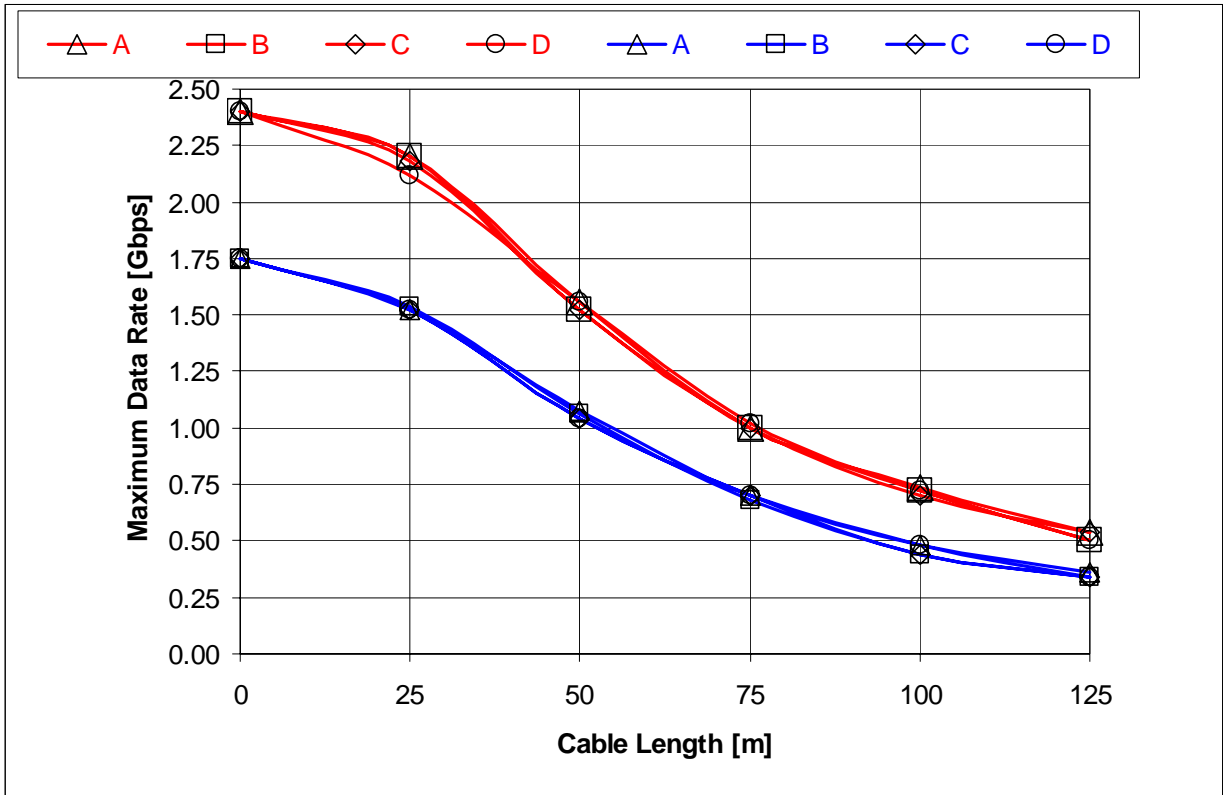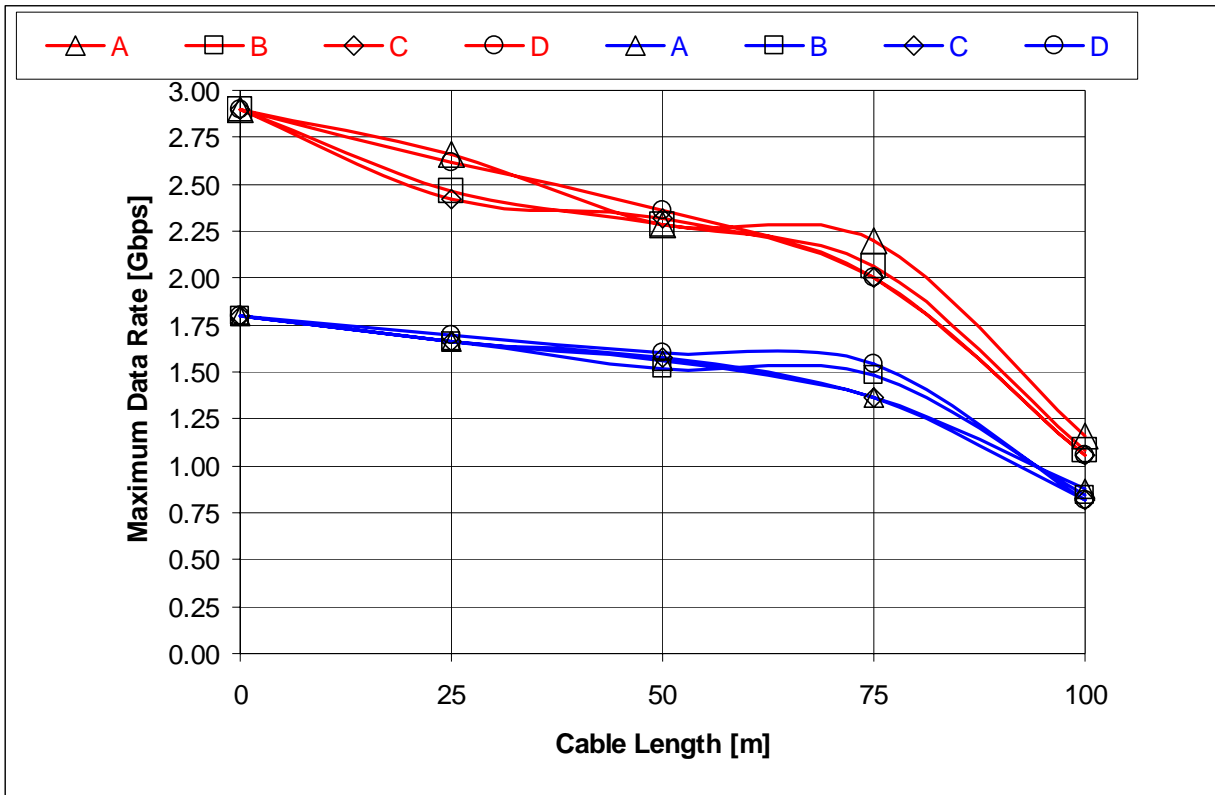

Figure 5. DS15BA101 and DS15EA101 Performance with CAT7 Cable

Evaluating 50-ohm Coaxial Cables

The DriveCable02EVK, channel 1 and 2, can be used to evaluate 50-ohm coaxial cables. Examples of 50-ohm coaxial cables are Belden 9914 and Andrew FSJ-50B.

Follow these steps to set up the DriveCable02EVK for 50-ohm coaxial cable evaluation:

1. Driver board, Channel 1 or 2:

    a) Provide 3.3 V between the J1 (VDD) and J2 (GND). This powers all devices on the board.
    b) Set output voltage amplitude of U1 (or U2) to 0.8 V by using JP1 (or JP2).
    c) Connect cable driver inputs to a signal source (i.e. Pattern Generator). Note the AC-coupling capacitors on the inputs.

2. Receiver board, Channel 1 or 2:

    d) Provide 3.3 V between the J3 (VDD) and J4 (GND). This powers U4 and U5 devices on the board.
    e) Enable U4 (or U5) outputs by setting its EN* pin to low. This is accomplished by placing a jumper across GND and SIG pins on connector JP5 (or JP6).

3. Use SMA-to-BNC Adapters (i.e. PE9074 from www.pasternack.com) if necessary (in case coaxial cable has BNC connectors)
4. Connect a coaxial assembly with either SMA or BNC connectors on its ends.
5. The LEDs, LED1 and LED2, will illuminate if the equalizers (U4 or U5) detects a valid signal.
6. Connect equalizer outputs directly to an oscilloscope or a bit error rate tester (BERT) receiver using good quality coaxial cables. Note that the equalizer outputs have internal 50-ohm pull-ups and that there are on-board AC-coupling capacitors.
7. Observe the results on the oscilloscope or BERT receiver.

Figure 7 presents maximum data rate as a function of Belden 9914 cable length. The data was collected on two chipsets (A and B). The data in red was taken with the 0.5 UI jitter criteria while the data in blue was taken with the 0.25 UI jitter criteria. Obviously, with the tighter jitter criteria, the maximum data rate is lower.
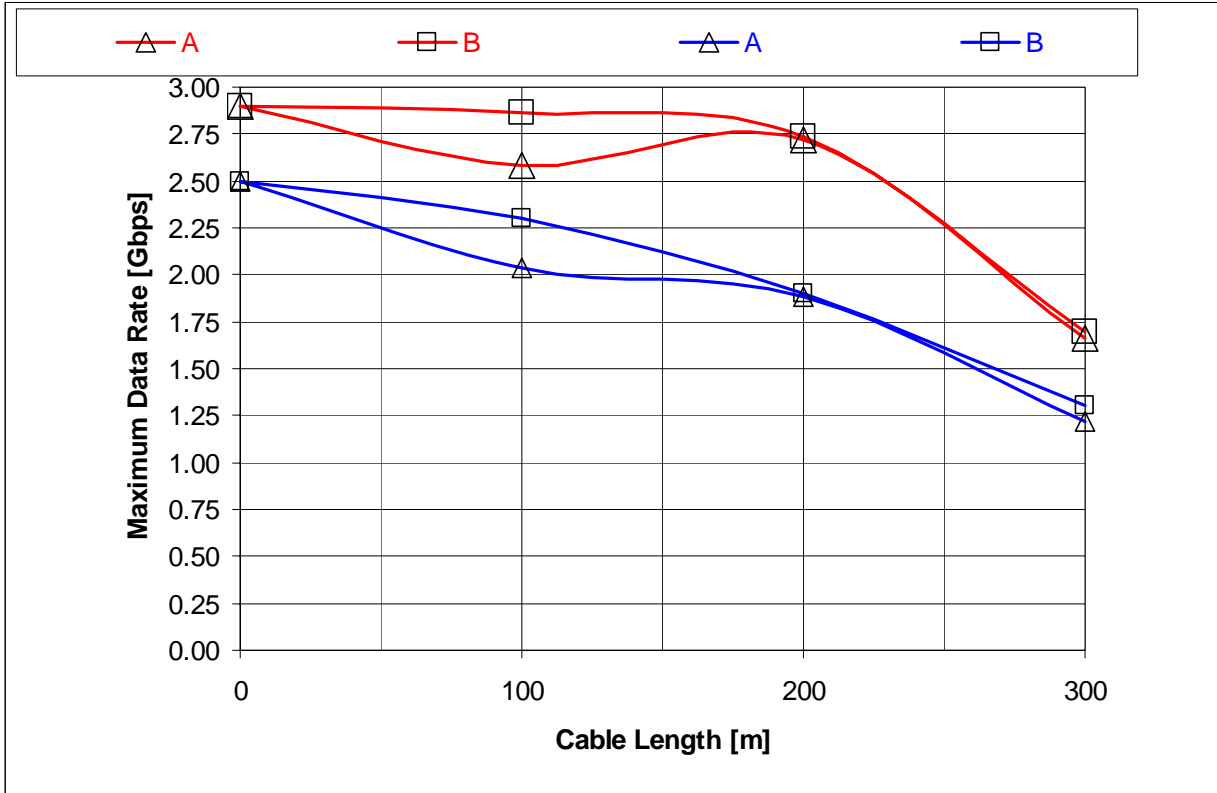

Figure 6. DS15BA101 and DS15EA101 Performance with Belden 9914 Cable

Driver Board Schematic

Receiver Board Schematic

GND_2

L7
6.8nH

SMA11
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

D7
PGB1010603

R28
50

R30
0

R32
50

C25
1uF

SMA12
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

R29
50

R31
0

D8
PGB1010603

L8
6.8nH

R33
50

C26
1uF

GND_2

LED1
LNJ316C8TRA

R36
330

VCC_2

JP5
1
2
3
Molex 22-28-4035

GND_2

VCC_2

C29
0.1uF

U4
GND
IN+
IN-
GND
CAP+
CAP-
GND
GND

VCC
LOS
OE'
VCC

GND
OUT+
OUT-
GND

DS15EA101

VCC_2

C28
0.1uF

GND_2

GND_2

GND_2

C27
1uF

VCC_2

R34

R35

C30
1uF

C31
1uF

SMA15
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

GND_2

SMA16
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

J4
Pomona 3267

J3
Pomona 3267

C46
4.7uF

C47

GND_2

C0.1uF

VCC_2

GND_2

L9
6.8nH

SMA13
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

D9
PGB1010603

R37
50

R39
0

R41
50

C32
1uF

SMA14
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

R38
50

R40
0

D10
PGB1010603

L10
6.8nH

R42
50

C33
1uF

GND_2

LED2
LNJ316C8TRA

R45
330

VCC_2

JP6
1
2
3
Molex 22-28-4035

GND_2

VCC_2

C36
0.1uF

U5
GND
IN+
IN-
GND
CAP+
CAP-
GND
GND

VCC
LOS
OE'
VCC

GND
OUT+
OUT-
GND

DS15EA101

VCC_2

C35
0.1uF

GND_2

GND_2

GND_2

C34
1uF

VCC_2

R43

R44

C37
1uF

C38
1uF

SMA17
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

GND_2

SMA18
GND
GND
SIG
GND
GND
JohnComp 142-0701-801

Notes:

1	Not installed
2	Inductor placed atop resistor
3	100-ohm differential coupled traces
5	50-ohm single-ended traces
6	Optional

Title: DriveCable02 Evaluation Kit - Equalizer Board

Size: B

Document Number: DriveCable02EVK-SCH

Rev: 0.2

Date: Monday, December 04, 2006   Sheet   1   of   1

Layer Stack up

1/2 oz. ------------------- SIG
          10 mill
1 oz.   -------------------GND
           4 mill
1 oz.   -------------------VDD
            tbd
1 oz.   -------------------VDD2
           4 mill
1 oz .   -------------------GND2
          10 mill
1/2 oz. ------------------ SIG

Drive Board BOM

Item	Quantity	Reference	Part	
1	8	C1,C2,C3,C4,C7,C8,C9,C10	1uF	0402
2	4	C13,C14,C17,C19	0.1uF	0402
3	2	C20,C18	0.01uF	0402
4	1	C23	4.7uF	1206
5	2	C24,C520.	1uF	0603
6	4	D1,D2,D3,D4	PGB1010603	
7	3	JP1,JP2,JP4	Molex 22-28-4035	
8	2	J2,J1	Pomona 3267	BJACK
9	4	L1,L2,L3,L4	3.9nH	0402
10	2	R2,R1	100	0402
11	12	R4,R5,R6,R7,R16,R17,R18, R19,R22,R23,R24,R25	50	0402
12	2	R12,R10	487	0402
13	2	R11,R13	953	0402
14	1	R54	910	0603
15	1	R55	2.4k	0603
16	8	SMA1,SMA2,SMA3,SMA4,SMA7, SMA8,SMA9,SMA10	JohnComp 142-0701-801	
17	2	U1,U2	DS15BA101	

Receiver Board BOM

Item	Quantity	Reference	Part		
1	10	C25,C26,C27,C30,C31,C32, C33,C34,C37,C38	1uF	0402	
2	4	C28,C29,C35,C36	0.1uF	0402	
3	1	C46	4.7uF	1206	
4	1	C47	0.1uF	0603	
5	4	D7,D8,D9,D10	PGB1010603		
6	2	JP5,JP6	Molex 22-28-4035		
7	2	J4,J3	Pomona 3267	BJACK	
8	2	LED2,LED1	LNJ316C8TRA		
9	4	L7,L8,L9,L10	6.8nH	0402	
10	8	R28,R29,R32,R33,R37,R38, R41,R42	50	0402	
11	4	R30,R31,R39,R40	0	0402	
12	4	R34,R35,R43,R44	R	0402	
13	2	R36,R45	330	0402	
14	8	SMA11,SMA12,SMA13,SMA14, SMA15,SMA16,SMA17,SMA18	JohnComp 142-0701-801		
15	2	U5,U4	DS15EA101		