National Semiconductor
The Sight & Sound of Information

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

USER MANUAL

Part Number: DriveCable02EVK NOPB

For the latest documents concerning these products and evaluation kit, visit lvds.national.com. Schematics and gerber files are also available at lvds.national.com.

January 2008
Rev. 0.3

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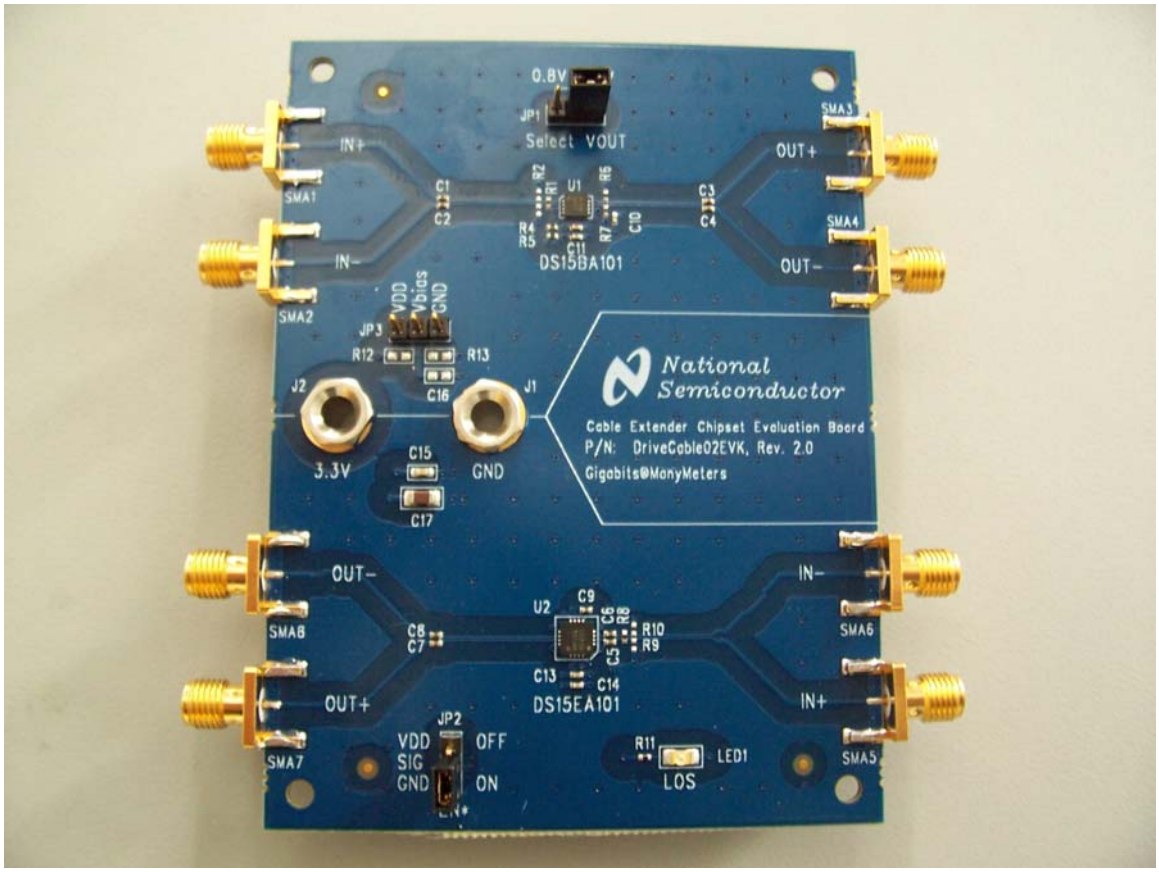
Overview

The DriveCable02EVK is an evaluation kit designed for demonstrating performance of the DS15BA101 and DS15EA101, a cable extender chipset. The kit enables evaluation of the chipset with 100-ohm differential cables such as twin-axial and low cost CAT5e/6/7 twisted pair cables and 50-ohm coaxial cables.

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.



Board Description

Figure 1 shows a drawing of the board. It is a 3 inch x 4 inch 6-layer PCB with a two-device layout that is capable of demonstrating performance and all features of the DS15BA101 and DS15EA101.

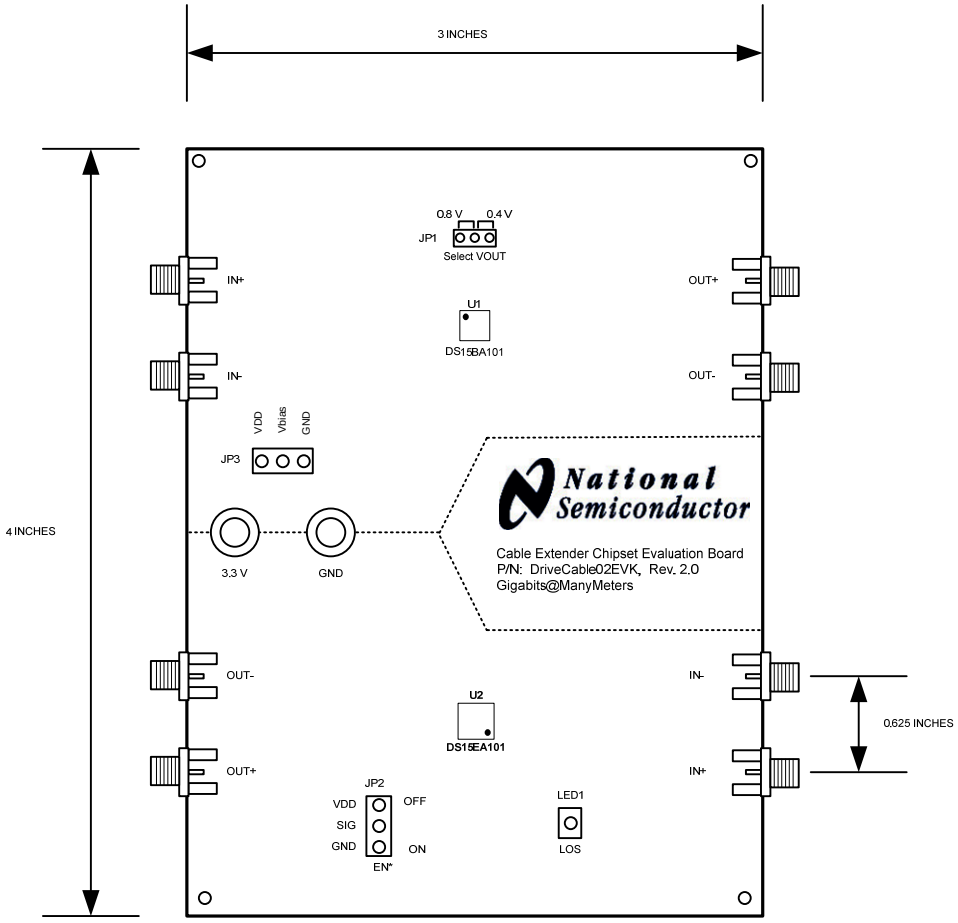


Figure 1. DriveCable02EVK Board

Connector	Device	Function
JP1	U1	Select output amplitude
JP2	U2	Output enable
JP3	U1	Set input common mode voltage (Optional)

Table 1. DriveCable02EVK 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.

Evaluation with 100-ohm Differential Balanced Cables

The DriveCable02EVK can be used to evaluate the chipset with 100-ohm differential cables (twin-axial and twisted pair cables). Examples are CAT5e/6/7 cable assemblies such as Belden 1500A, Belden 1700A, Siemon CAT7 Tera, Belden 89207 and Amphenol SKEWCLEAR series of cables. Figure 2 is a simplified block diagram of the configuration.

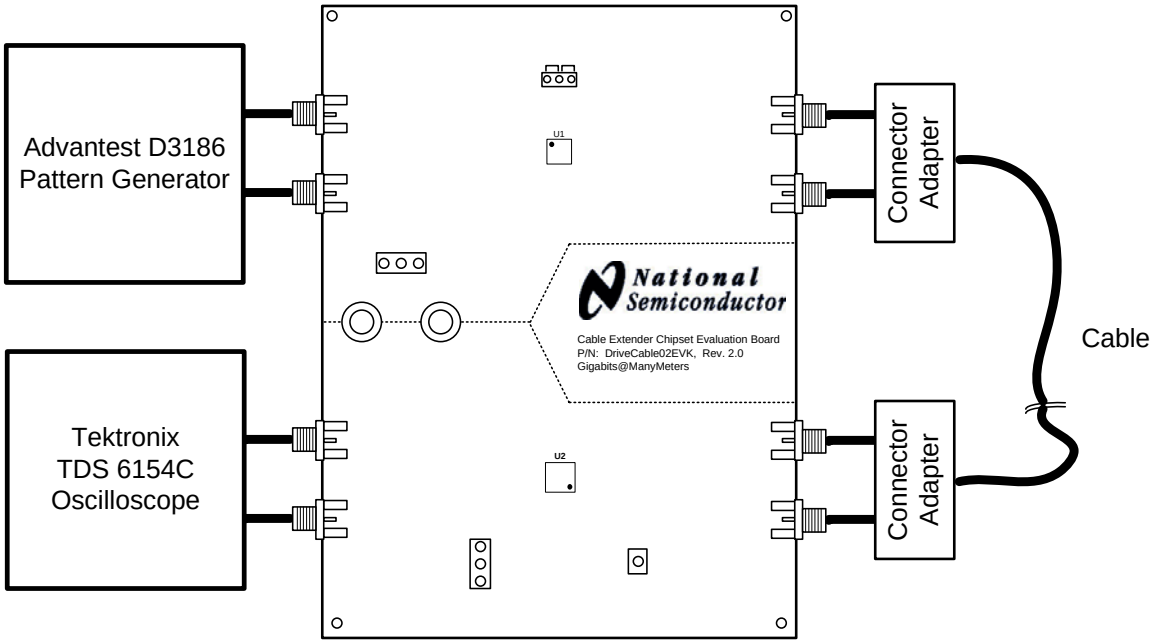


Figure 2. Test Setup for 100-ohm Differential Cable Evaluation

Note: Connector Adapters are NOT included in this kit. Currently, RJ45-SMA adapters are available and can be ordered separately. The part number is *DS91C176EVK NOPB.* If cable assemblies have other than RJ-45 connectors, it is recommended to obtain/develop an adapter board similar to the RJ45-SMA adapter to ensure good impedance control of the signal path. For more information about the RJ45-SMA Adapter check:
http://www.national.com/appinfo/lvds/ds91c176evk.html

Follow these steps to set up the DriveCable02EVK for evaluation with 100-ohm differential balanced cables:

1. Configure DriveCable02EVK board:

    a) Provide 3.3 V between the J2 (VDD) and J1 (GND). This powers all devices on the board.
    b) Set DS15BA101 (U1) output voltage amplitude to 0.4 V by using JP1.
    c) Enable DS15EA101 (U2) outputs by setting its EN* pin to low. This is accomplished by placing a jumper across the GND and SIG pins of the connector JP2.

2. Connect the DS15BA101 inputs to a signal source (e.g. Pattern Generator or Serializer output).

    a) Note the AC-coupling capacitors on the inputs (SMA1 and SMA2)
    b) Adjust the signal parameters (VOH, VOL, VCM) so that they comply with the DS15BA101 input requirements.
    c) If DC-coupled interface is desired, use 0-ohm SM0402 resistors in place of the C1 and C2.
    d) There is a provision to add an optional resistor divider network (R12 and R13) on the DS15BA101 inputs in case one desires biasing the input signal externally (note: there is already an internal biasing network on the DS15BA101 inputs). In addition, the JP3 connector provides signal biasing provision for a voltage source.

3. Attach the connector adapters (if available) to the DS15BA101 outputs (SMA3 and SMA4) and DS15EA101 inputs (SMA5 and SMA6).

4. Connect a 100-ohm cable assembly with corresponding plugs on its ends.

5. The LED1 will illuminate if the DS15EA101 (U2) detects a valid signal.

6. Connect the DS15EA101 (U2) outputs directly to an oscilloscope, a bit error rate tester (BERT) receiver or a deserializer 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 3 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.

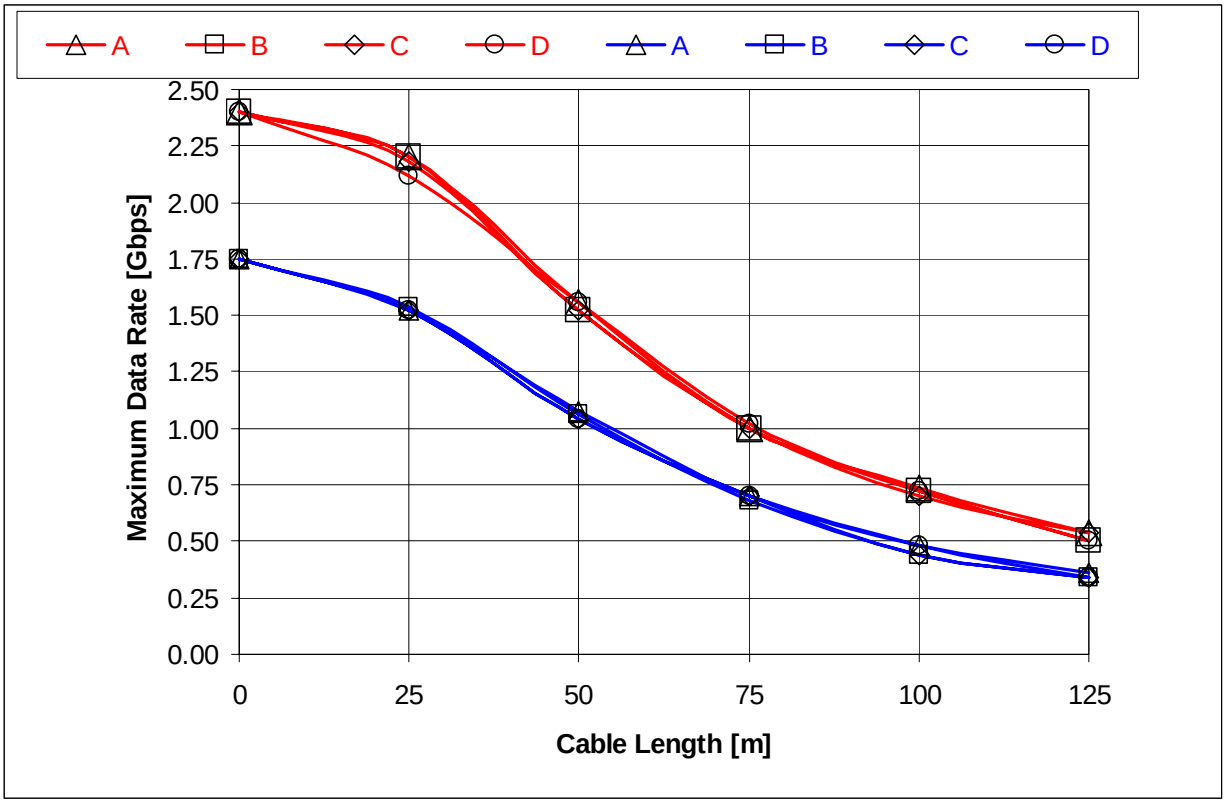


Figure 3. DS15BA101 and DS15EA101 Performance with CAT5e Cable

Figure 4 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.

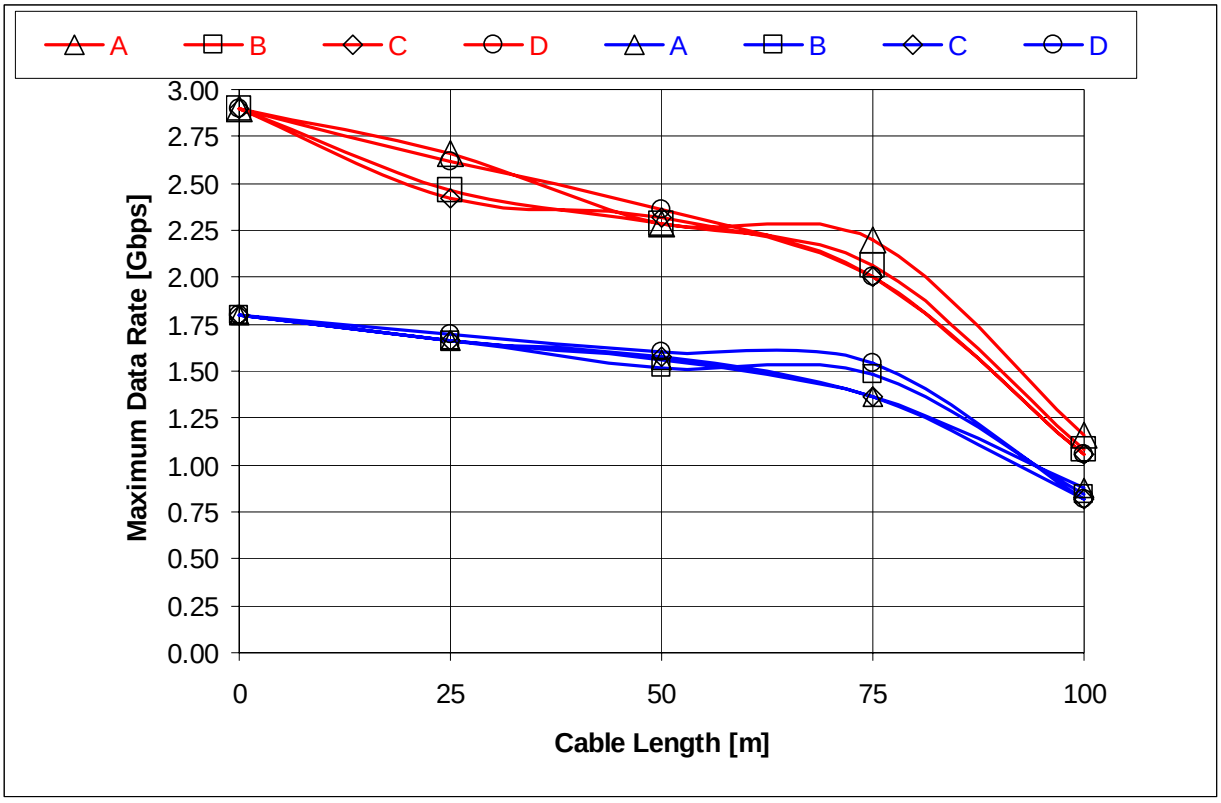


Figure 4. DS15BA101 and DS15EA101 Performance with CAT7 Cable

Evaluating 50-ohm Coaxial Cables

The DriveCable02EVK can be used to evaluate 50-ohm coaxial cables. Examples of 50-ohm coaxial cables are Belden 9914 and Andrew FSJ-50B. Figure 5 is a simplified block diagram of the configuration.

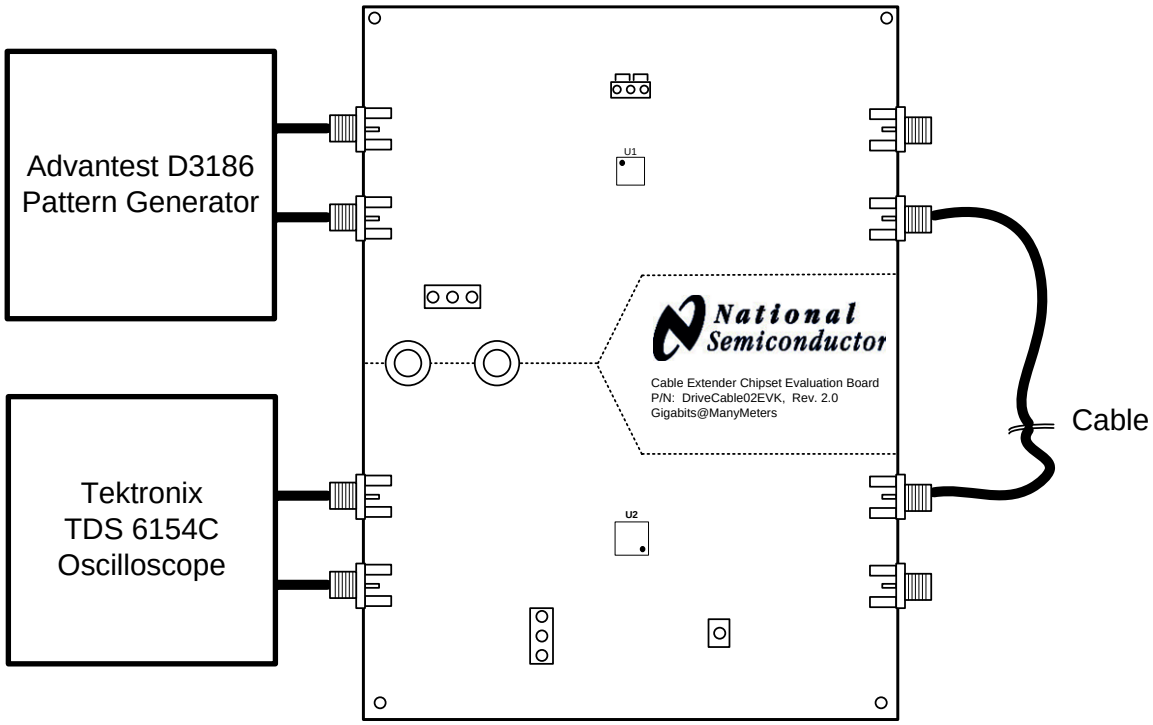


Figure 5. Test Setup for 50-ohm Coaxial Cable Evaluation

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

1. Configure DriveCable02EVK board:

    a) Provide 3.3 V between the J2 (VDD) and J1 (GND). This powers all devices on the board.
    b) Set DS15BA101 (U1) output voltage amplitude to 0.8 V by using JP1.
    c) Enable DS15EA101 (U2) outputs by setting its EN* pin to low. This is accomplished by placing a jumper across the GND and SIG pins of the connector JP2.
    d) Remove R8 and place 50-ohm to GND termination on the DS15EA101 input that will be used (R9 or R10) and 25-ohm to GND termination on the DS15EA101 input that will NOT be used (R9 or R10).

2. Connect the cable driver inputs to a signal source (e.g. Pattern Generator).

    e) Note the AC-coupling capacitors on the inputs (SMA1 and SMA2)
    f) Adjust the signal parameters (VOH, VOL, VCM) so that they comply with the DS15BA101 input requirements.
    g) If DC-coupled interface is desired, use 0-ohm SM0402 resistors in place of the C1 and C2.
    h) There is a provision to add an optional resistor divider network (R12 and R13) on the DS15BA101 inputs in case one desires bias the signal externally (there is an internal biasing network on the DS15BA101 inputs). In addition, the JP3 connector provides signal biasing provision for a voltage source.

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 cable assembly with coresponding connectors on its ends.

5. The LED1 will illuminate if the DS15EA101 (U2) 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 6 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.

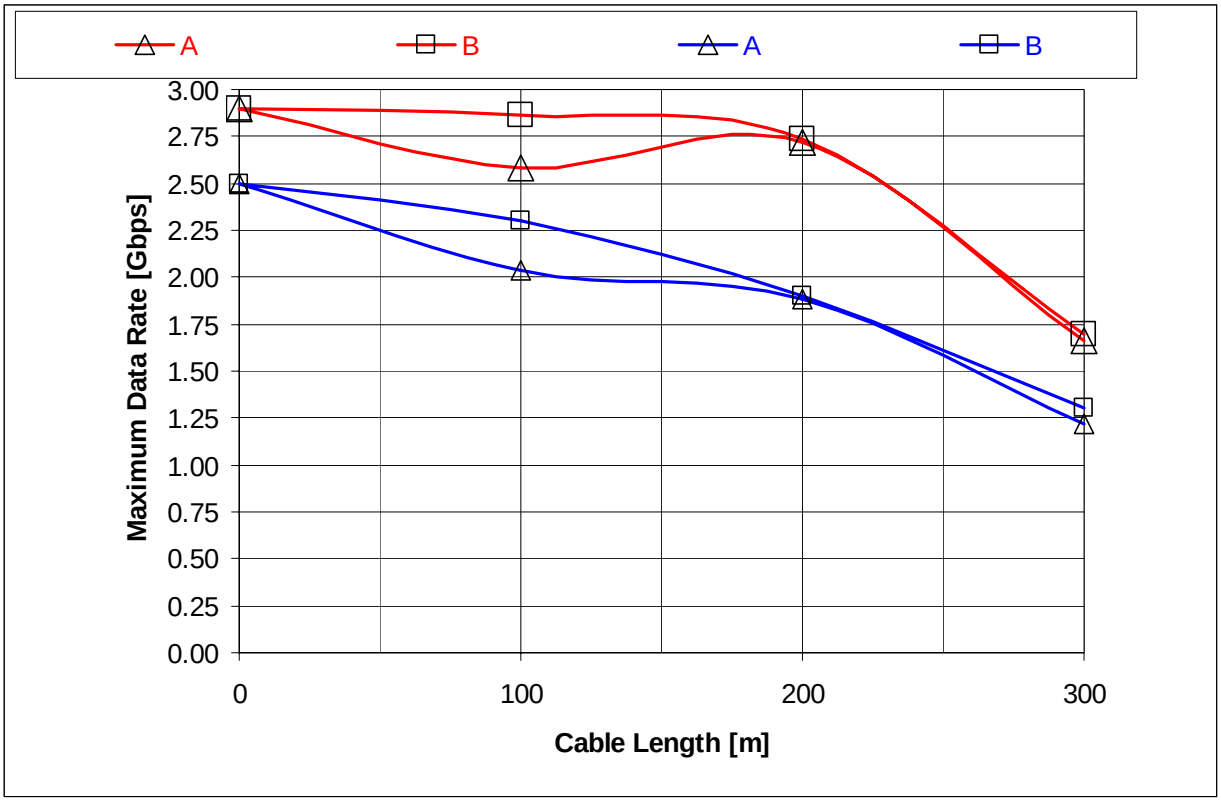


Figure 6. DS15BA101 and DS15EA101 Performance with Belden 9914 Cable

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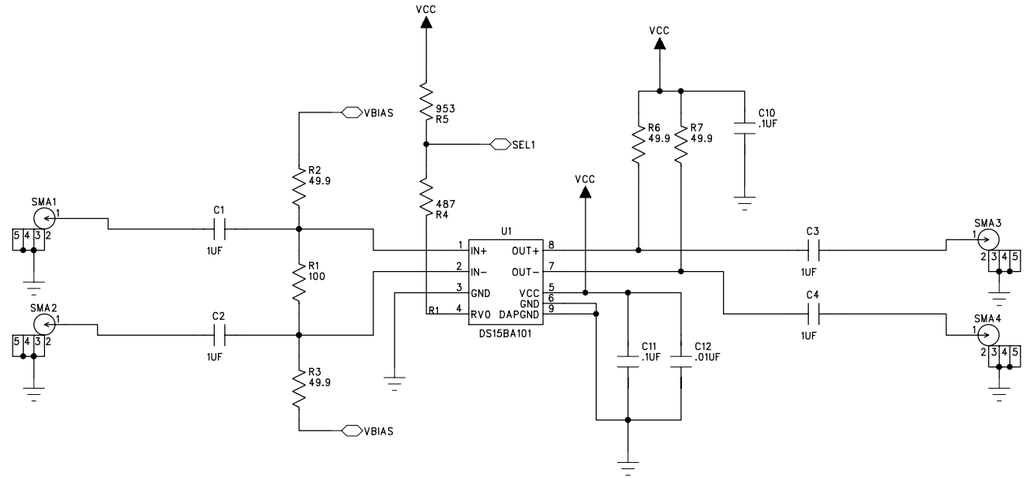
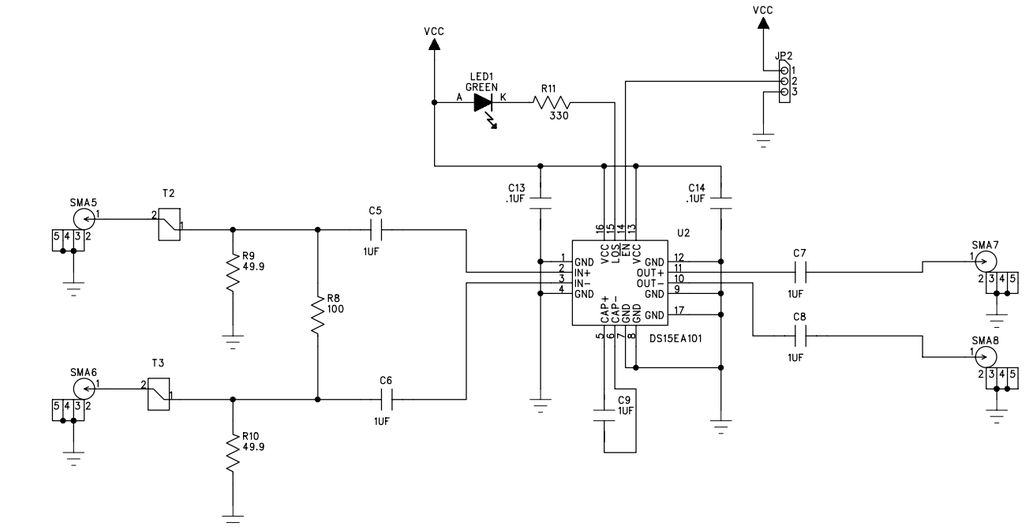
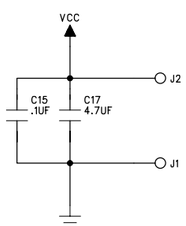
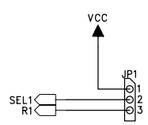
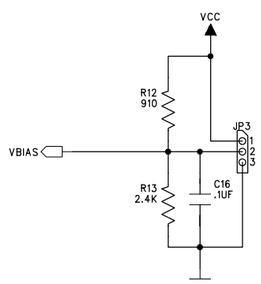
LTR:	ECO NO:	APPROVED:	DATE:
0	INITIAL RELEASE		











COMPANY:	NATIONAL SEMICONDUCTOR		
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DRAWN: ACF	DATED: ???	SCALE:	SHEET: 1 OF 1

ENERCON - BILL OF MATERIALS	TITLE:	PL Number:	Rev:	Rev By:	Rev Date:	PL Status:
Main Product: PCBA, DRIVECABLE02EVK, ROHS	NATIONAL SEMICONDUCTOR PCBA, DRIVECABLE02EVK, ROHS DRIVECABLE02EVK	Z3212-01	0		11/21/2007	Preliminary
		Responsible Eng/Mgr:	Creator: Arlene Fox		Creation Date: 11/21/2007	

Item	Part Type	Part Number/Value	Mfg	NoSub	Description	Qty	SMT	Ref Des	Notes	Rev
1	PCB	P-06379R0	ENERCON		DRIVE: 3.00x4.00x.060in, 6 layer	1			Bd: (76.20x 101.60mm) Panel: (9.20x 8.00in) (233.68x203.20mm) 6 bds/panel	0
2										
3	IC	DS15BA101SD/NOPB	NAT		1.5Gpbs Diff Buffer, LLP8, Pb-Free	1	X	U1	Customer Supplied	0
4	IC	DS15EA101SQ/NOPB	NAT		0.15 to 1.5Gbps Adaptive Cable Equal., LLP16, Pb-F	1	X	U2	Customer Supplied	0
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6	RES	ERJ-2RKF4991	PANA		49.9 Ohm 1/16W ±1% 0402 100ppm, Pb-Free	2	X	R6-7		0
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11										
12	LED	LNJ316C8TRA	PANA		Lamp, Green, 1206, Diffused, Pb-Free	1	X	LED1		0
13										

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ENERCON - BILL OF MATERIALS	TITLE:	PL Number:	Rev:	Rev By:	Rev Date:	PL Status:
Main Product: PCBA, DRIVECABLE02EVK, ROHS	NATIONAL SEMICONDUCTOR PCBA, DRIVECABLE02EVK, ROHS DRIVECABLE02EVK	Z3212-01	0		11/21/2007	Preliminary
		Responsible Eng/Mgr:	Creator: Arlene Fox		Creation Date: 11/21/2007	

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	<ALT>	ECJ-1VB1C104K	PANA		.1µF, 16V, ±10%, 0603, Ceramic, X7R, Pb-Free					
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18	CAP	ECJ-0EB1A105M	PANA		1µF, 10V, ±20%, 0402, Ceramic, X5R, Pb-Free	9	X	C1-8,9		0
19										
20	CONN	142-0701-851	EMERSON		SMA, Jack Receptacle, 50 OHM, Pb-Free	8		SMA1-8		0
21	CONN	15-29-1024	MOLEX		Jumper Shunt, 2p, Gold, Pb-Free	2			JP1,2, Pins 2&3	0
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	<ALT>	SNT-100-BK-H	SAMTEC		Shunt, .100"sp, Gold, Pb-Free					
22	CONN	3267	POMONA		Banana, 1p, Female, Pb-Free	2		J1-2		0
23	CONN	TSW-103-07-G-S	SAMTEC		Header, 3p, Male, .100"sp, Gold, Pb-Free	3		JP1-3		0
24										
25	STENCL	T-06382R0	ENERCON		STENCIL FABRICATION, DRIVECABLE02EVK	1				0
26										
27	REF	C-06380R0	ENERCON		FABRICATION DWG, DRIVECABLE02EVK					0
28	REF	C-06381R0	ENERCON		PALLET DWG, DRIVECABLE02EVK					0

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ENERCON - BILL OF MATERIALS	TITLE:	PL Number:	Rev:	Rev By:	Rev Date:	PL Status:
Main Product: PCBA, DRIVECABLE02EVK, ROHS	NATIONAL SEMICONDUCTOR PCBA, DRIVECABLE02EVK, ROHS DRIVECABLE02EVK	Z3212-01	0		11/21/2007	Preliminary
		Responsible Eng/Mgr:		Creator: Arlene Fox		Creation Date: 11/21/2007

Item	Part Type	Part Number/Value	Mfg	NoSub	Description	Qty	SMT	Ref Des	Notes	Rev
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30										

Notes:

DO NOT STUFF:
R2,3,9,10,12,13
C16

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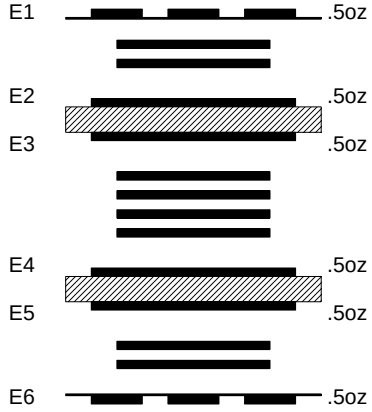
To:	Date: 11/27/2007 Page 1 of __
Company:	From: Gordon Galbraith
Phone:	Phone: (503) 992-4448
Fax:	Fax:

E:\...\06_P-06379R0_370HR_b.zlf - 11/27/2007 2:46:04 PM [CUSTOMER COPY]

soldermask: PSR 4000 Taiyo



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	0.65	(17)	
	10.08	(256)	1652 / 2116 - Polyclad 370 HR
	1.90	(48)	FOIL

Overall Board Thicknesses (Over Conductor)

	inches	(mm)
nom:	0.0604	(1.53)

Customer Notes:

National Semiconductor

Total thickness .060" +/- .006"

Note pitch is equal to center to center spacing, not edge to edge. Pitch = edge to edge spacing plus one trace width.

Impedance Notes 11/26/2007 10:41 AM

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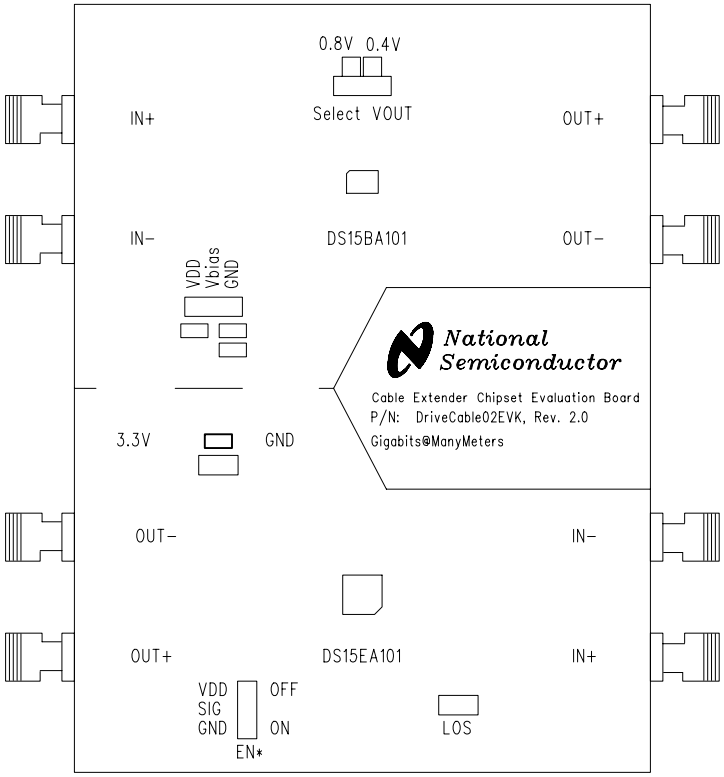
8.50 mil lines/14 mil pitch for 100 ohm differential +/-10% (model 98.9)


0.8V 0.4V
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OUT+
IN-
DS15BA101
OUT-
VDD
Vbias
GND
National Semiconductor
Cable Extender Chipset Evaluation Board
P/N: DriveCable02EVK, Rev. 2.0
Gigabits@ManyMeters
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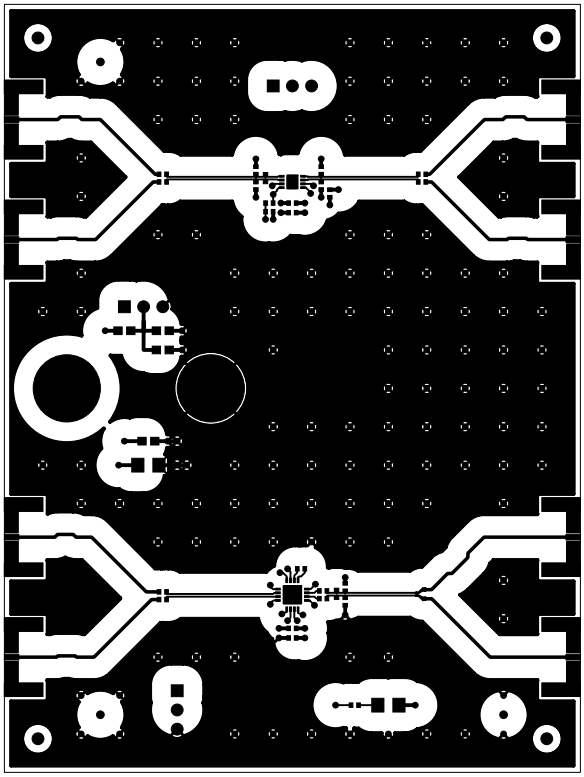

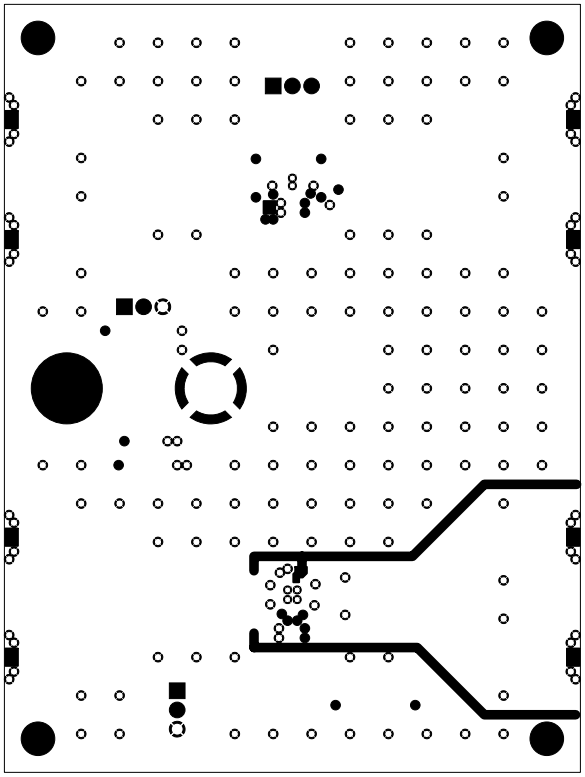

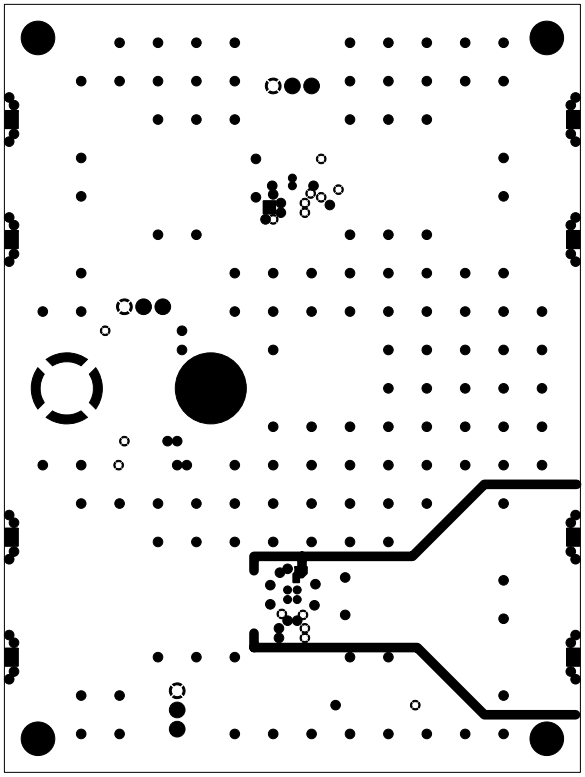

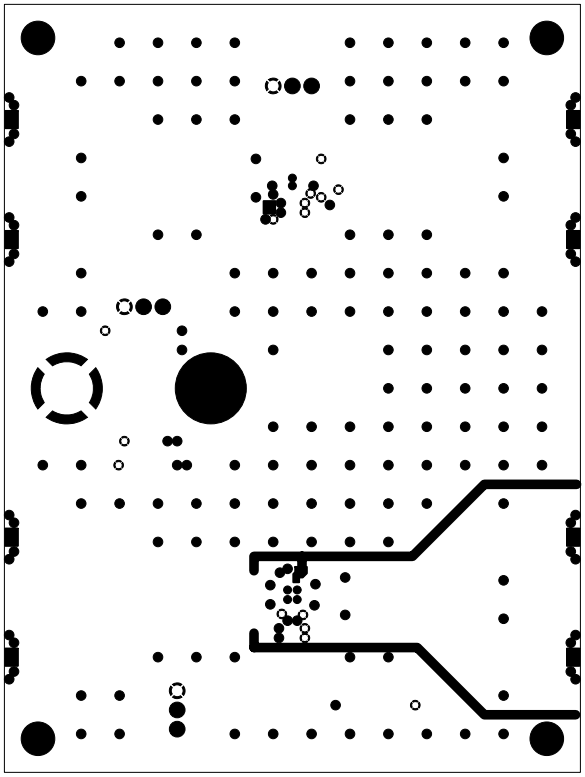

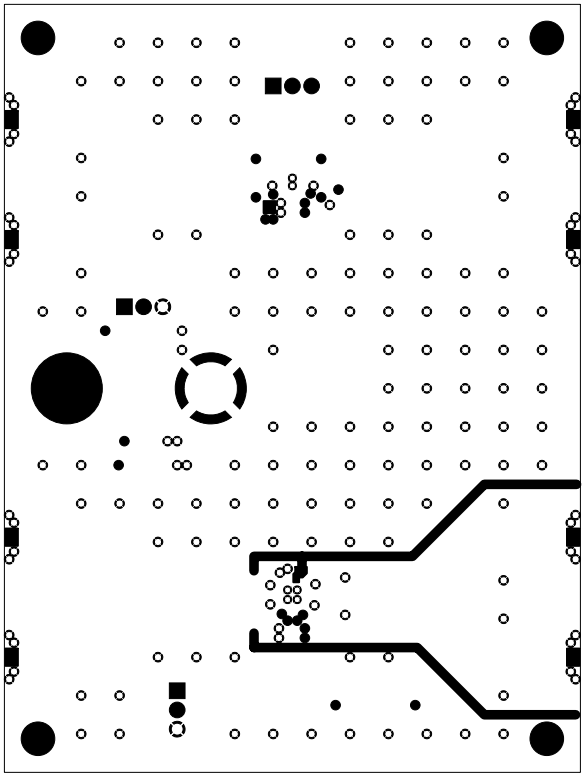

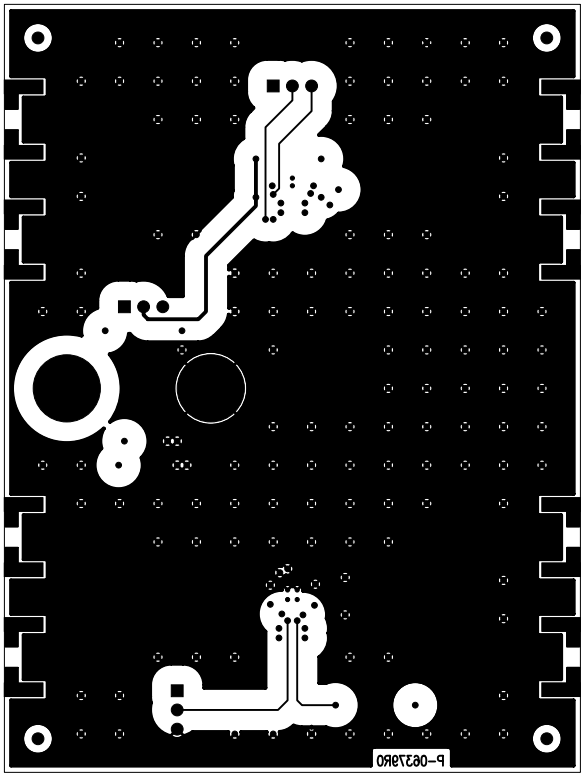
P-06379R0

RoHS
COMPLIANT
2006/95/EC

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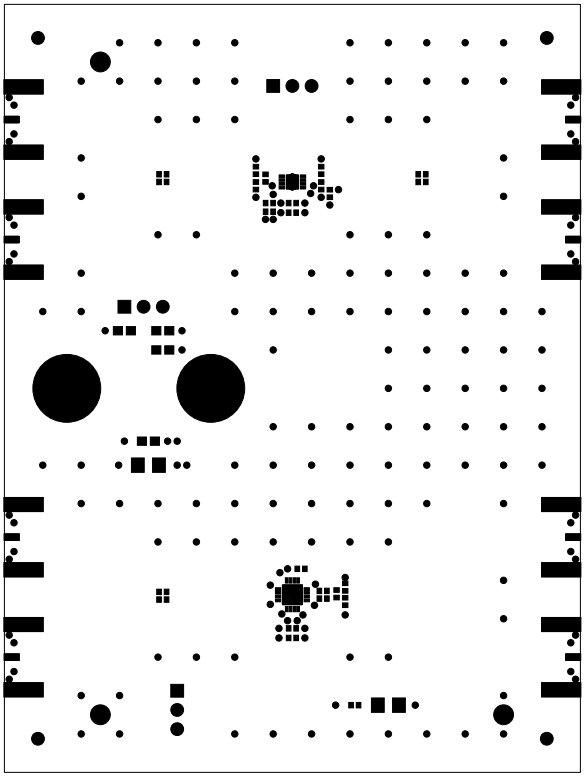

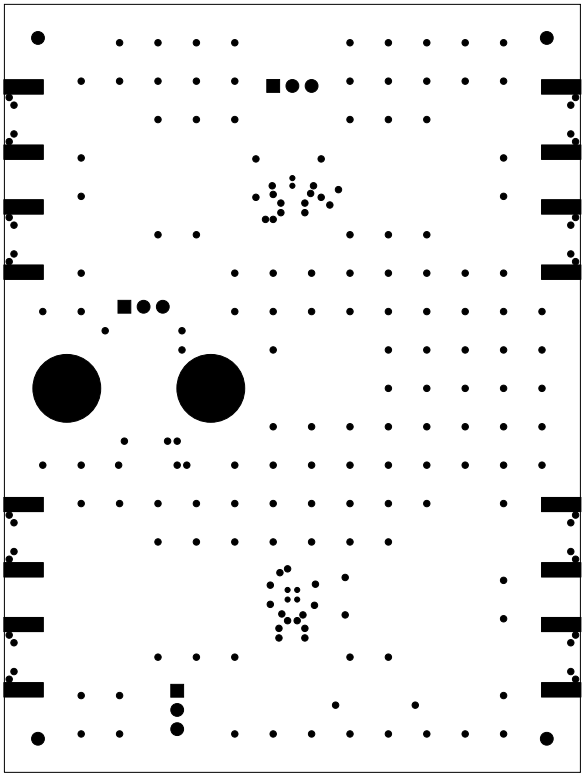

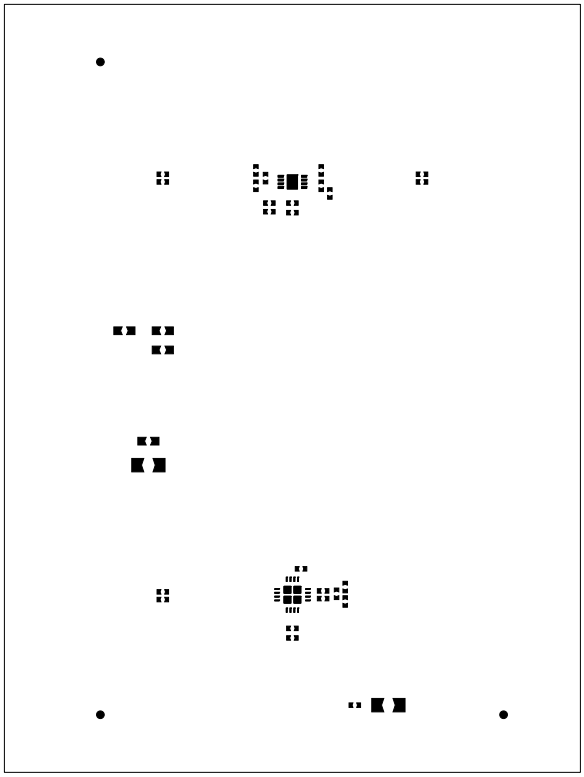

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