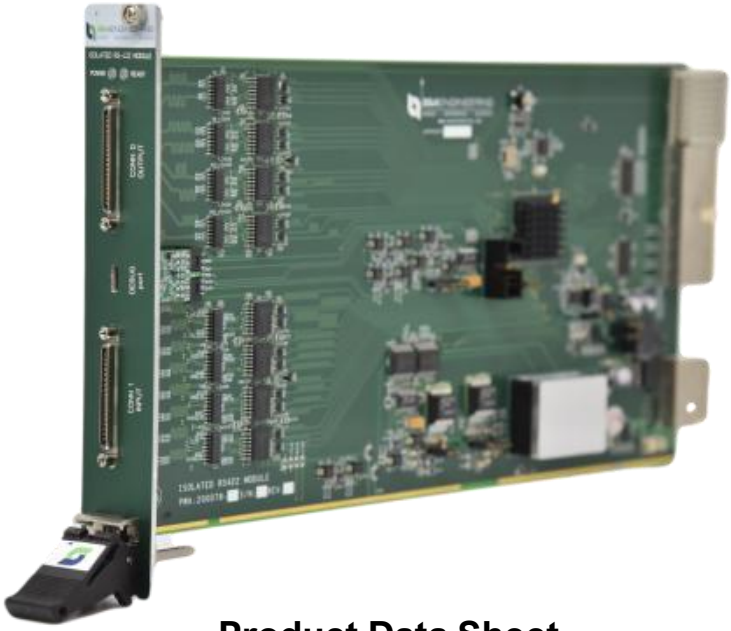
Isolated Tri-State Differential Module



Product Data Sheet
B&A Document 110033_D

Part No.
200146

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INTRODUCTION

This document contains technical specifications for the Isolated Tri-State Differential Module (B&A Part No. 200146). Specifications are shown at 25 °C temperature, unless otherwise noted. The main features of the module are listed below:

- Separate Transmit and Receive Differential (LVDS, M-LVDS, RS-422 / RS-485) tri-state channels
- Configurable grounding
- On-board Isolated voltage regulation
- Internal House Keeping / Health Monitoring
- User-controlled Flight interface power on/off
- Built-in LabVIEW FPGA Debugging Port
- Safe to connect to Flight hardware, FMEA approved
- LabVIEW drivers

SAFETY

The following items must be considered for safety:

- Using the Isolated Tri-State Differential Module in a manner not described within this document may impair the protection of the Isolated Tri-State Differential Module provides.
- The SLSC-12001 chassis and the SLSC Modules **do not support** hot plug-in. The entire chassis must be powered down when a module is installed.
- Always follow ESD procedures for handling.
- If cleaning is required, wipe with dry and clean towel.
- Installation of the Isolated Tri-State Differential Module must be performed in accordance with "B&A SLSC Module User Manual" (Document No. 140040).

INTERFACES

Front panel Connectors	2 x VHDCI (Pages 6 & 7)
Backplane Connectors	3 x Compact PCI (Pages 8 & 9)
Power Up State	Drivers and receivers disabled
I/O Compatibility	Differential Signaling [LVDS, M-LVDS, RS-422 / RS-485]
Number of on-card Temperature Sensors	4
LabVIEW FPGA Debug Interface	Micro-USB
Grounding Configuration	See Page 5
Properties	See Page 11

SPECIFICATIONS(2)

Channels Per Connector(1)	18
Number Of RS-422 TX Channels	16 + 2 Clocks
Number Of RS-422 RX Channels	16 + 2 Clocks
Characteristic Impedance	100 Ω differential nominal
Termination Impedance	100 Ω differential nominal
AC Termination	Optional 100 pF (Can be changed per customer requirements)
Register Mapping	See Page 12
Configuration Option	See Page 13

Note:

(1) All 18 channels (TX and RX) are length-matched and have the same delay on the board.

(2) For further specification details, please contact support@baengineering.com

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STANDARD CONFIGURATIONS

Available Part No.	Physical Protocol	Isolated Domain Voltage	Drive Series Resistance	Receiver Termination Resistance	Receiver Termination Capacitance	Receiver Series Resistance	Ground Scheme
200146-00	RS-422 / RS-485	3.3 V	0 Ω	100 Ω	0 Ω	0 Ω	2.2 MΩ II 100 nF
200146-01	LVDS	3.3 V	0 Ω	100 Ω	0 Ω	0 Ω	2.2 MΩ II 100 nF
200146-02	M-LVDS	3.3 V	0 Ω	100 Ω	0 Ω	0 Ω	2.2 MΩ II 100 nF
200146-04	RS-422 / RS-485	5.0 V	0 Ω	100 Ω	0 Ω	0 Ω	2.2 MΩ II 100 nF
200146-05	RS-422 / RS-485	5.0 V	0 Ω	100 Ω	150 pF	0 Ω	2.2 MΩ II 100 nF
200146-XX	Customizable based on customer requests. (See the last page for ordering instructions)						

Standard Configurations Specifications								
Physical Protocol	RS-422 / RS-485				LVDS		M-LVDS	
Isolated Domain Voltage (V)	3.3		5		3.3		3.3	
	Min	Max	Min	Max	Min	Max	Min	Max
Operational Voltage Range (V)	18	40	18	40	18	40	18	40
TX HL Propagation Delay (ns)	26.9	38.7	26.9	38.7	8.6	21.4	7.9	21.1
TX LH Propagation Delay (ns)	26.9	38.7	26.9	38.7	8.6	21.4	7.9	21.1
RX HL Propagation Delay (ns)	26.9	38.7	26.9	38.7	10.6	23.2	8.9	24.7
RX LH Propagation Delay (ns)	26.9	38.7	26.9	38.7	10.6	23.2	8.9	24.7
Differential Output High Voltage (V)	1.5	2	1.5	2	247	454	480	650
Differential Output Low Voltage (V)	-2	-1.5	-2	-1.5	-454	-247	-650	-480
Maximum Nominal Data Rate of TX and RX Channels (MHz)	40		40		40		40	
Differential Input Voltage (V)	±3.3		±5		±3.3		±3.3	
Maximum Common-Mode Input Voltage (V)	15		15		2.5		3.4	
Differential Input High Voltage (mV)	50 to 200		50 to 200		100		50	
Differential Input Low Voltage (mV)	-200 to -50		-200 to -50		-100		-50	
High Output Current (mA)	-100		-100		-3		-10	
Low Output Current (mA)	100		100		3		10	
Input Capacitance (pF)	50		50		5		2.5	
Rise Time (ns)	3		3		1.5		2.3	
Fall Time (ns)	3		3		1.5		2.3	
Pulse Skew (ns)	1.2		1.2		0.3		0.3	

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NON-STANDARD CONFIGURATIONS

Available Part No.	Physical Protocol	Isolated Domain Voltage	Drive Series Resistance	Receiver Termination Resistance	Receiver Termination Capacitance	Receiver Series Resistance	Ground Scheme
200146-03(1)	AstroWire	3.3 V	0 Ω	100 Ω	0 Ω	0 Ω	2.2 MΩ II 100 nF
200146-06(2)	RS-422 / LVDS	3.3 V	0 Ω	100 Ω	0 Ω	0 Ω	2.2 MΩ II 100 nF
200146-XX	Customizable based on customer requests. (See the last page for ordering instructions)						

(1) This configuration is modified with the intention of being used with AstroWire communication interfaces on all channels.
(2) This configuration is modified to set the physical protocols of channels 0 through 7 as well as clock 0 to be RS-422 and that of channels 8 through 15 as well as clock 1 to be LVDS.

Non-Standard Configurations Specifications						
Part Number	200146-03		200146-06			
Physical Protocol	AstroWire		Channels 0 – 7 & Clock 0 RS-422		Channels 8 – 15 & Clock 1 LVDS	
Isolated Domain Voltage (V)	3.3		3.3		3.3	
	Min	Max	Min	Max	Min	Max
Operational Voltage Range (V)	18	40	18	40	18	40
TX HL Propagation Delay (ns)	26.9	38.7	26.9	38.7	8.6	21.4
TX LH Propagation Delay (ns)	26.9	38.7	26.9	38.7	8.6	21.4
RX HL Propagation Delay (ns)	26.9	38.7	26.9	38.7	10.6	23.2
RX LH Propagation Delay (ns)	26.9	38.7	26.9	38.7	10.6	23.2
Differential Output High Voltage (V)	1.5	2	1.5	2	247	454
Differential Output Low Voltage (V)	-2	-1.5	-2	-1.5	-454	-247
Maximum Nominal Data Rate of TX and RX Channels (MHz)	40		40		40	
Differential Input Voltage (V)	±3.3		±3.3		±3.3	
Maximum Common-Mode Input Voltage (V)	15		15		2.5	
Differential Input High Voltage (mV)	50 to 200		50 to 200		100	
Differential Input Low Voltage (mV)	-200 to -50		-200 to -50		-100	
High Output Current (mA)	-100		-100		-3	
Low Output Current (mA)	100		100		3	
Input Capacitance (pF)	50		50		5	
Rise Time (ns)	3		3		1.5	
Fall Time (ns)	3		3		1.5	
Pulse Skew (ns)	1.2		1.2		0.3	

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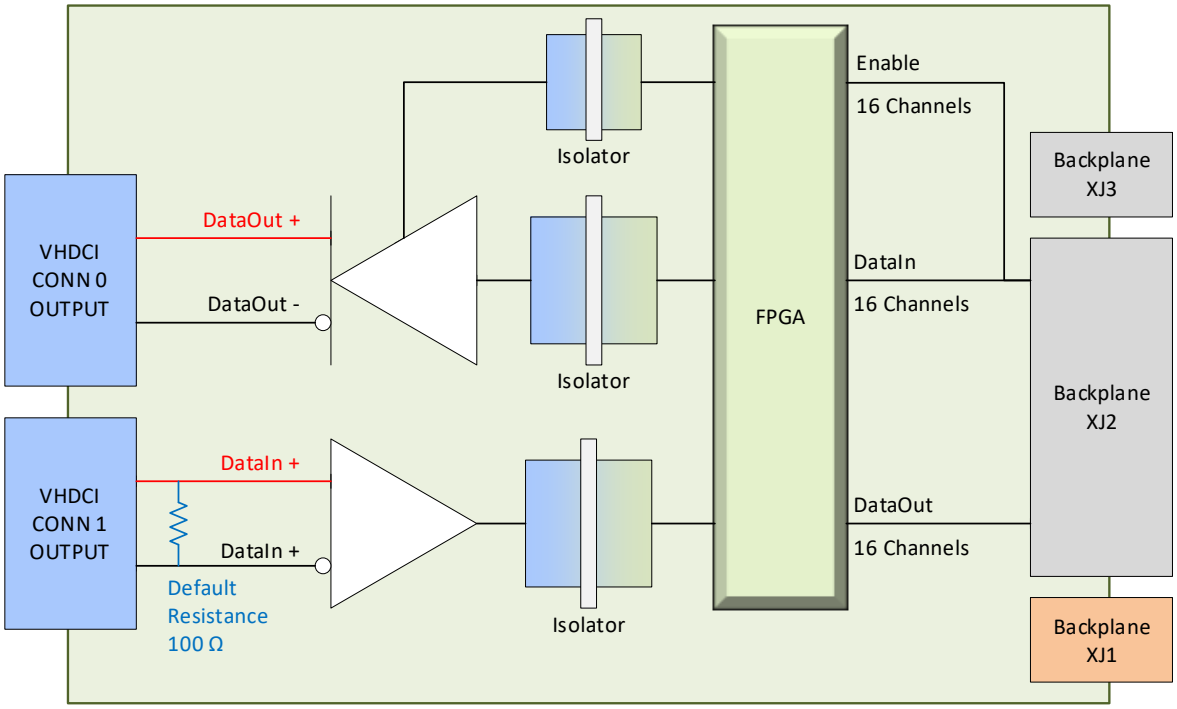
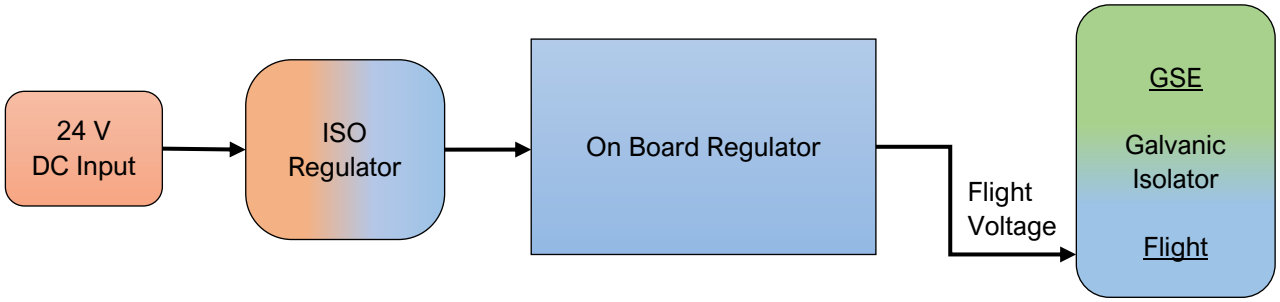
FUNCTIONAL BLOCK DIAGRAM

The functional block diagram is shown below:



ISOLATED VOLTAGE REGULATION

The Isolated Voltage Regulation block diagram is shown below:



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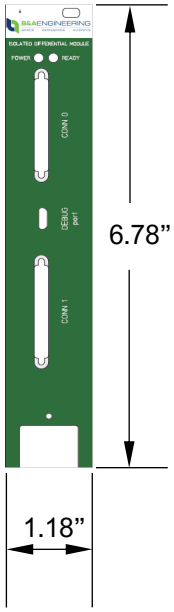
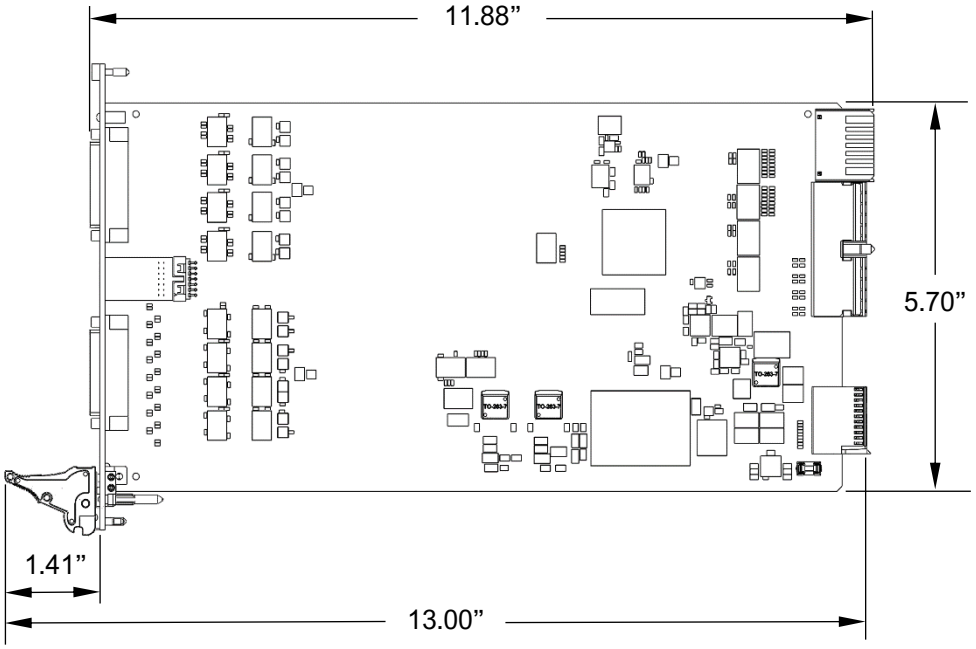
PHYSICAL DIMENSIONS



Front Panel View

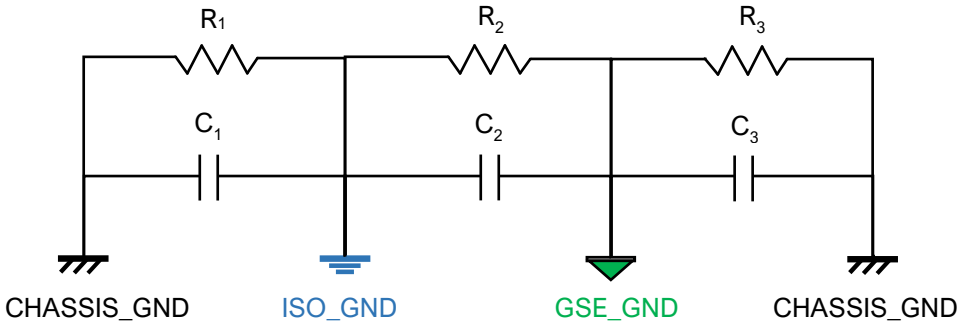


Top View

CONFIGURABLE GROUNDING

Three different groundings are provided: **Chassis Ground**, **ISO Ground**, and **GSE Ground**.

- The module allows customizable grounding schemes by shorting the on-board resistors; R_1, R_2, and R_3.
- Capacitors C_1, C_2, and C_3 are used to implement RC filters.
- Isolated resistors and capacitors are installed on the module by default. ($R_1 = R_2 = R_3 = 2.2$ MΩ, $C_1 = C_2 = C_3 = 100$ nF)
- Resistor and capacitor values can be configured based on users’ requirements upon order. Online customization tools are available on the B&A website.



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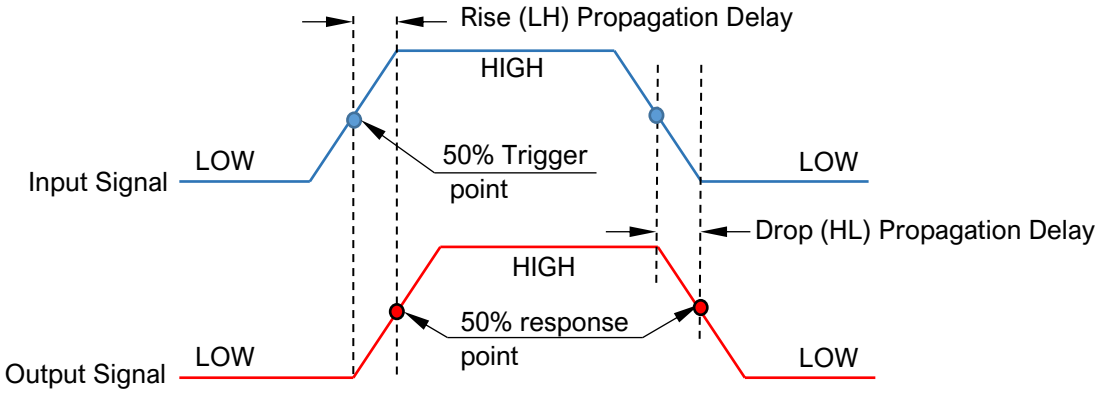
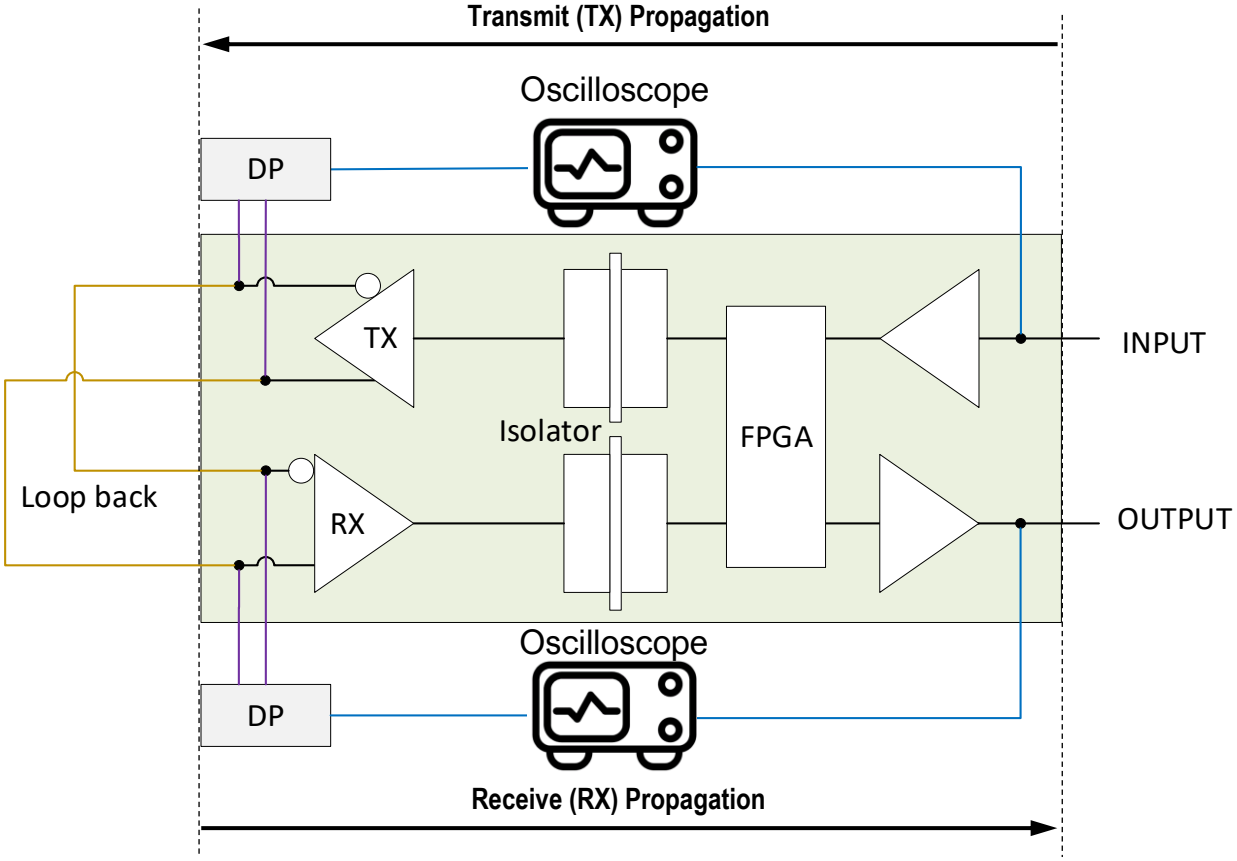
PROPAGATION DELAY

The propagation delay is defined as the delay between the 50% trigger point and the 50% response point. The figure below illustrates two different propagation delays: The LOW to HIGH signal rise phase (LH) and HIGH to LOW signal Drop phase (HL). The signal rise and drop measurement is performed bi-directional for the TX and RX propagation direction. An Oscilloscope and Differential Probe (DP) are required to perform testing. The signal data is measured with the oscilloscope at the board INPUT, TX output, RX input, and board OUTPUT.





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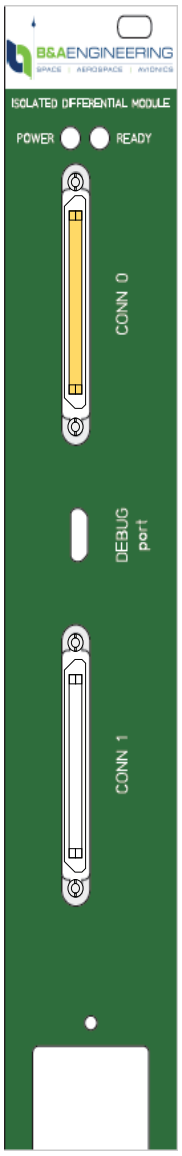
FRONT CONNECTOR 0 PINOUT

CLK_OUT_0+	68	34	CLK_OUT_0-
CLK_IN_0+	67	33	CLK_IN_0-
GND	66	32	GND
CH7_TX+	65	31	CH7_TX-
GND	64	30	GND
CH7_RX+	63	29	CH7_RX-
GND	62	28	GND
CH6_TX+	61	27	CH6_TX-
GND	60	26	GND
CH6_RX+	59	25	CH6_RX-
GND	58	24	GND
CH5_RX+	57	23	CH5_RX-
GND	56	22	GND
CH5_TX+	55	21	CH5_TX-
GND	54	20	GND
CH4_RX+	53	19	CH4_RX-
GND	52	18	GND
CH4_TX+	51	17	CH4_TX-
GND	50	16	GND
CH3_RX+	49	15	CH3_RX-
GND	48	14	GND
CH3_TX+	47	13	CH3_TX-
GND	46	12	GND
CH2_RX+	45	11	CH2_RX-
GND	44	10	GND
CH2_TX+	43	9	CH2_TX-
GND	42	8	GND
CH1_TX+	41	7	CH1_TX-
GND	40	6	GND
CH1_RX+	39	5	CH1_RX-
GND	38	4	GND
CH0_TX+	37	3	CH0_TX-
GND	36	2	GND
CH0_RX+	35	1	CH0_RX-



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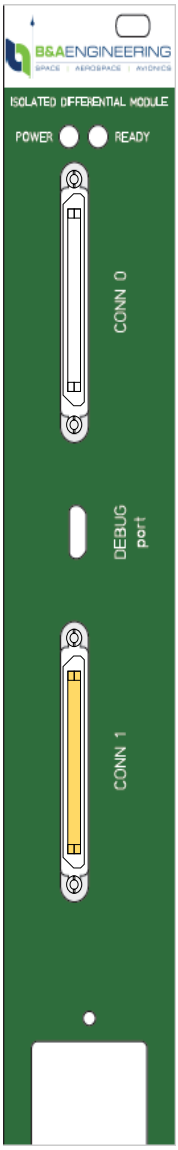
FRONT CONNECTOR 1 PINOUT

CLK_IN_1+	68	34	CLK_IN_1-
CLK_OUT_1+	67	33	CLK_OUT_1-
GND	66	32	GND
CH15_RX+	65	31	CH15_RX-
GND	64	30	GND
CH15_TX+	63	29	CH15_TX-
GND	62	28	GND
CH14_RX+	61	27	CH14_RX-
GND	60	26	GND
CH14_TX+	59	25	CH14_TX-
GND	58	24	GND
CH13_TX+	57	23	CH13_TX-
GND	56	22	GND
CH13_RX+	55	21	CH13_RX-
GND	54	20	GND
CH12_TX+	53	19	CH12_TX-
GND	52	18	GND
CH12_RX+	51	17	CH12_RX-
GND	50	16	GND
CH11_TX+	49	15	CH11_TX-
GND	48	14	GND
CH11_RX+	47	13	CH11_RX-
GND	46	12	GND
CH10_TX+	45	11	CH10_TX-
GND	44	10	GND
CH10_RX+	43	9	CH10_RX-
GND	42	8	GND
CH9_RX+	41	7	CH9_RX-
GND	40	6	GND
CH9_TX+	39	5	CH9_TX-
GND	38	4	GND
CH8_RX+	37	3	CH8_RX-
GND	36	2	GND
CH8_TX+	35	1	CH8_TX-



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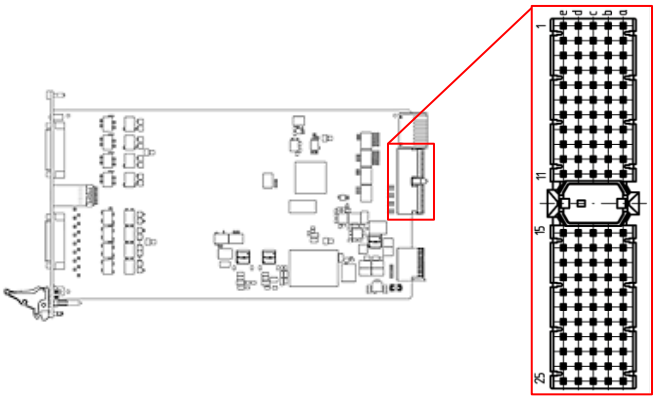
BACKPLANE 110P XJ2 CONNECTOR PINOUT



	e	d	c	b	a
1	OUT_3	OUT_2	CLK_OUT_1	OUT_1	OUT_0
2	OUT_7	OUT_6	N/C	OUT_5	OUT_4
3	GSE_GND	GSE_GND	GSE_GND	GSE_GND	GSE_GND
4	OUT_11	OUT_10	N/C	OUT_9	OUT_8
5	OUT_15	OUT_14	N/C	OUT_13	OUT_12
6	GSE_GND	GSE_GND	GSE_GND	GSE_GND	GSE_GND
7	OUT_19	OUT_18	N/C	OUT_17	OUT_16
8	OUT_23	OUT_22	N/C	OUT_21	OUT_20
9	GSE_GND	GSE_GND	GSE_GND	GSE_GND	GSE_GND
10	OUT_27	OUT_26	N/C	OUT_25	OUT_24
11	OUT_31	OUT_30	N/C	OUT_29	OUT_28
12	GSE_GND	GSE_GND	GSE_GND	GSE_GND	GSE_GND
13	N/C	N/C	N/C	N/C	N/C
14	N/C	N/C	N/C	N/C	N/C
15	IN_3	IN_2	N/C	IN_1	IN_0
16	IN_7	IN_6	N/C	IN_5	IN_4
17	GSE_GND	GSE_GND	GSE_GND	GSE_GND	GSE_GND
18	IN_11	IN_10	N/C	IN_9	IN_8
19	IN_15	IN_14	N/C	IN_13	IN_12
20	GSE_GND	GSE_GND	GSE_GND	GSE_GND	GSE_GND
21	IN_19	IN_18	N/C	IN_17	IN_16
22	IN_23	IN_22	N/C	IN_21	IN_20
23	GSE_GND	GSE_GND	GSE_GND	GSE_GND	GSE_GND
24	IN_27	IN_26	N/C	IN_25	IN_24
25	IN_31	IN_30	CLK_OUT_0	IN_29	IN_28

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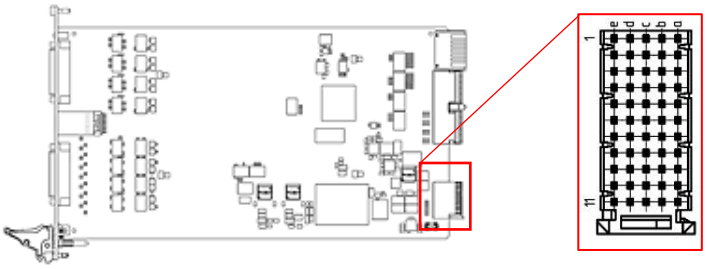
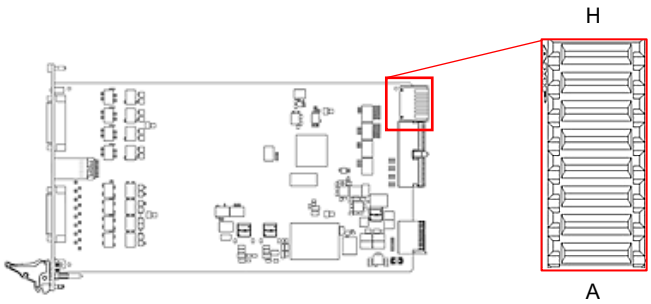
BACKPLANE 55P XJ1 CONNECTOR PINOUT



	e	d	c	b	a
1	N/C	N/C	N/C	N/C	N/C
2	N/C	N/C	N/C	N/C	N/C
3	N/C	N/C	N/C	N/C	N/C
4	N/C	N/C	N/C	N/C	N/C
5	N/C	N/C	N/C	N/C	N/C
6	N/C	N/C	N/C	N/C	N/C
7	GSE_GND	N/C	GSE_GND	N/C	GSE_GND
8	SLSC_SpiMOSI	GSE_GND	SLSC_SpiCLK	GSE_GND	SLSC_IntIn#
9	GSE_GND	SLSC_Trig_To_Mod	GSE_GND	SLSC_Trig_From_Mod	GSE_GND
10	N/C	GSE_GND	SLSC_SpiMISO	GSE_GND	SLSC_ED_SS#
11	24 V	SLSC_Rdy/Rst#	3.3 V	SLSC_ID_SS#	24 V

BACKPLANE XJ3 CONNECTOR PINOUT



H	ISO_GND
G	ISO_GND
F	EXT_CLK_IN
E	EXT_CLK_OUT
D	CHASSIS_GND
C	CHASSIS_GND
B	GSE_GND
A	GSE_GND

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PROPERTIES TABLE
For use with NI SLSC VI package

Signal Name	Description	Documentation	RW
BA.Isolated_Power_Supply_Switch	Output of the Isolated power supply	Lets you control the output of the Isolated power supply	RW
BA.DebugPort_Switch	Output of the Isolated power supply	Lets you control the output of the Isolated power supply	RW
BA.Discrete_Enable	Discrete Mode	Lets you control the Discrete Mode	RW
BA.Discrete_Inputs	Discrete Inputs	Read the Discrete Inputs	R
BA.Discrete_Outputs	Discrete Outputs	Read/Write the Discrete Outputs	RW
BA.ModuleControllerVersion	Module Controller Version	The version is the timestamp, in hexadecimal format, of the time the Module Controller was	R
BA.Isolated_Power_Supply_Stage_2_Voltage	Isolated Power Supply Stage 2 Voltage	Reads Isolated power supply stage two's voltage	R
BA.Isolated_Power_Supply_Stage_2_Current	Isolated Power Supply Stage 2 Current	Reads Isolated power supply stage two's Current	R
BA.Isolated_Power_Supply_Stage_2_Temperature	Isolated Power Supply Stage 2 Temperature	Reads Isolated power supply stage two's temperature	R
BA.Isolated_Power_Supply_Stage_3_Voltage	Isolated Power Supply Stage 3 Voltage	Reads Isolated power supply stage three's voltage	R
BA.Isolated_Power_Supply_Stage_3_Current	Isolated Power Supply Stage 3 Current	Reads Isolated power supply stage three's Current	R
BA.Isolated_Power_Supply_Stage_3_Temperature	Isolated Power Supply Stage 3 Temperature	Reads Isolated power supply stage three's temperature	R
BA.SLSC_3p3_Voltage	Voltage of 3.3V line of SLSC Chassis	Reads the voltage of 3.3V line of SLSC Chassis	R
BA.SLSC_24V_Voltage	Voltage of 24V line of SLSC Chassis	Reads the voltage of 24V line of SLSC Chassis	R
BA.SLSC_24V_Current	Current of 24V line of SLSC Chassis	Reads the current of 24V line of SLSC Chassis	R
BA.GSE_3p3V_Voltage	Voltage of 3.3V line of GSE	Reads the voltage of 3.3V line of GSE	R
BA.GSE_3p3V_Current	Current of 3.3V line of GSE	Reads the current of 3.3V line of GSE	R
BA.GSE_1p5V_Voltage	Voltage of 1.5V line of GSE	Reads the voltage of 1.5V line of GSE	R
BA.GSE_1p5V_Current	Current of 1.5V line of GSE	Reads the current of 1.5V line of GSE	R
BA.GSE_Temperature_Sensor_1	Temperature Sensor 1	Reads the temperature reported by temperature sensor 1	R
BA.GSE_Temperature_Sensor_2	Temperature Sensor 2	Reads the temperature reported by temperature sensor 2	R
BA.GSE_Temperature_Sensor_3	Temperature Sensor 3	Reads the temperature reported by temperature sensor 3	R
BA.GSE_Temperature_Sensor_4	Temperature Sensor 4	Reads the temperature reported by temperature sensor 4	R

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REGISTER MAPPING TABLE

For developing custom SLSC drivers

Signal Name	Addr (x16)	RW	Length	Reset Value	Bits							
General Register	0025	RW	8	0	7	6	5	4	3	2	1	0
					X	X	X	Discrete Mode	Discrete Enable	X	DebugPort Switch	Isolated Power Supply Switch
iDis Register (Input State)	0026	R	32		31	...	17	16	15	...	1	0
					X	X	X	X	Channel 15	Channel *n*	Channel 1	Channel 0
oDis Register	0027	RW	32	0	31	...	17	16	15	...	1	0
					Channel 31 Output Enable	Channel *n* Output Enable	Channel 17 Output Enable	Channel 16 Output Enable	Channel 15 Output State	Channel *n* Output State	Channel 1 Output State	Channel 0 Output State
oDis En Register (Discrete Enable)	0028	RW	32	0	31	...	17	16	15	...	1	0
					Channel 31 Enable Discrete Enable	Channel *n* Enable Discrete Enable	Channel 17 Enable Discrete Enable	Channel 16 Enable Discrete Enable	Channel 15 Discrete Enable	Channel *n* Discrete Enable	Channel 1 Discrete Enable	Channel 0 Discrete Enable
Miscellaneous	0004	RW	8	0	7	6	5	4	3	2	1	0
					X	X	X	X	X	X	X	Flash Write Protect
Version	0000	R	32		31	30	29	...	...	2	1	0
					Timestamp							
Isolated Power Supply Stage_2 Voltage	0015	R	32		31	30	29	...	...	2	1	0
					Voltage							
Isolated Power Supply Stage_2 Current	001F	R	32		31	30	29	...	...	2	1	0
					Current							
Isolated Power Supply Stage_2 Temperature	001D	R	32		31	30	29	...	...	2	1	0
					Temperature							
Isolated Power Supply Stage_3 Voltage	001B	R	32		31	30	29	...	...	2	1	0
					Voltage							
Isolated Power Supply Stage_3 Temperature	0017	R	32		31	30	29	...	...	2	1	0
					Temperature							
Isolated Power Supply Stage_3 Current	0019	R	32		31	30	29	...	...	2	1	0
					Current							
SLSC 24V Voltage	0005	R	32		31	30	29	...	...	2	1	0
					Voltage							
SLSC 24V Current	000D	R	32		31	30	29	...	...	2	1	0
					Current							
SLSC 3p3V Voltage	0007	R	32		31	30	29	...	...	2	1	0
					Voltage							
GSE 3p3V Voltage	0009	R	32		31	30	29	...	...	2	1	0
					Voltage							
GSE 3p3V Current	000E	R	32		31	30	29	...	...	2	1	0
					Current							
GSE 1p5V Voltage	000B	R	32		31	30	29	...	...	2	1	0
					Voltage							
GSE 1p5V Current	000F	R	32		31	30	29	...	...	2	1	0
					Current							
GSE Temperature Sensor_1	0011	R	32		31	30	29	...	...	2	1	0
					Temperature							
GSE Temperature Sensor_2	0012	R	32		31	30	29	...	...	2	1	0
					Temperature							
GSE Temperature Sensor_3	0013	R	32		31	30	29	...	...	2	1	0
					Temperature							
GSE Temperature Sensor_4	0014	R	32		31	30	29	...	...	2	1	0
					Temperature							

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HOW TO ORDER

For ordering the Isolated High-Density Differential Module, please provide the part number by utilizing the information below.
Example is shown for part number: 200146-MR-33SS00LS

Custom Part Number

0		1		2	3	4	5	6	7
200146	-	MR	-	33	S	S	00	L	S
Base Part Number		Physical Protocol		Isolated Domain Voltage	Drive Series Resistance	Receiver Series Resistance	Receiver Termination Capacitance	Receiver Termination Resistance	Ground Scheme

1. Physical Protocol		
RS	=	RS-422
MR	=	RS-422/RS-485
LV	=	LVDS
ML	=	M-LVDS

2. Isolated Domain Voltage		
18	=	1.8 V
33	=	3.3 V
50	=	5 V

3. Drive Series Resistance		
S	=	0 Ω
F	=	25 Ω
H	=	50 Ω
L	=	100 Ω
Q	=	30 Ω
D	=	60 Ω
C	=	120 Ω

4. Receiver Series Resistance		
S	=	0 Ω
F	=	25 Ω
H	=	50 Ω
L	=	100 Ω
Q	=	30 Ω
D	=	60 Ω
C	=	120 Ω

5. Receiver Termination Capacitance		
00	=	0 Ω
10	=	100 pF
15	=	150 pF

6. Receiver Termination Resistance		
Z	=	Open
L	=	100 Ω
C	=	120 Ω

7. Ground Scheme		
S	=	2.2 MΩ ||100 nF All Legs
Z	=	Open All Legs
I	=	0 Ω Iso to Chassis, 2.2 MΩ || 100 nF others
G	=	0 Ω GSE to Chassis, 2.2 MΩ || 100 nF others
C	=	0 Ω Iso to GSE, 2.2MΩ || 100nF others
H	=	0 Ω All Legs

Notes:

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ACCESSORIES

The following accessories are available to complement and extend the capabilities of the Tri-State Differential Module.

- ☑ RTI Module (Part #200121)
- ☑ VHDCI Rugged Breakout Box (Part #180088)
- ☑ Differential VHDCI to IX Industrial Cable (Part #160051)

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