

# ARINC 429 Line Drivers



Data Sheet

Model: DD-4107X



The ARINC 429 Line Drivers convert TTL/CMOS serial input data to ARINC specified amplitudes, and are a direct drop-in replacement for Holt and DEI line drivers.

## Applications

- Avionics Data Communication
- ARINC Level to CMOS/TTL Conversion

**Custom Design Capability** - DDC can customize designs for all cards, ranging from simple modifications of standard products to fully customized solutions for commercial, military, aerospace, and industrial applications.

For more information: [www.ddc-web.com/DD-4107X](http://www.ddc-web.com/DD-4107X)

# DDC's Data Networking Solutions

MIL-STD-1553 | ARINC 429 | Fibre Channel | AFDX<sup>®</sup>/ARINC 664 | Ethernet

As the leading global supplier of data bus components, cards, and software solutions for the military, civil, and aerospace markets, DDC's data bus networking solutions encompass the full range of data interface protocols to support the real-time processing demands of field-critical data networking between systems and subsystems on military vehicles. These products, along with our traditional MIL-STD-1553 solutions, represent a wide and flexible array of performance and cost solutions, enabling DDC to support multi-generational programs.

Whether employed in increased bandwidth, high-speed serial communications, or traditional avionics and ground support applications, DDC's data solutions fulfill the expanse of military requirements including reliability, determinism, low CPU utilization, real-time performance, and ruggedness within harsh environments. Our use of in-house intellectual property ensures superior multi-generational support, independent of the life cycles of civil devices. Moreover, we maintain software compatibility between product generations to protect our customers' investments in software development, system testing, and end-product qualification.

## MIL-STD-1553

DDC provides an assortment of quality MIL-STD-1553 rugged embedded and lab grade cards and components to meet your data conversion and data interface needs. Our 1553 data bus board solutions are integral elements of military, aerospace, and industrial applications. Our extensive line of military and space grade components provide MIL-STD-1553 interface solutions for microprocessors, PCI buses, and simple systems. Our 1553 data bus solutions are designed into a global array of aircraft, helicopter, unmanned vehicles, and missile programs.

## ARINC 429

DDC also has a wide assortment of quality ARINC 429 embedded and lab grade cards and components, which will meet your data conversion and data interface needs. DDC's ARINC 429 components ensure the accurate and reliable transfer of flight-critical data. Our 429 interfaces support data bus development, validation, and the transfer of flight-critical data aboard civil aerospace platforms.

## Fibre Channel

DDC has developed its line of high-speed Fibre Channel network access controllers and switches to support the real-time processing demands of field-critical data networking between sensors, computer nodes, data storage, displays, and weapons, for air, sea, and ground military vehicles. Fibre Channel's architecture is optimized to meet the performance, reliability, and demanding environmental requirements of embedded, real time, military applications, and designed to endure the multi-decade life cycle demands of military/aerospace programs.

## AFDX<sup>®</sup>/ARINC 664

DDC provides powerful, field-proven AFDX<sup>®</sup>/ARINC 664 solutions for test, simulation, and system integration. These cards support both Airbus and Boeing AFDX protocols.

## Ethernet

DDC offers a convenient solution to convert MIL-STD-1553, ARINC 429, and Ethernet protocol in any direction, in real-time, without a host computer.

## Extensions to MIL-STD-1553

DDC offers a wide variety of solutions based on extensions of MIL-STD-1553 for emerging aerospace applications. Turbo 1553 increases the data rate of 1553 from 1 Mbps to 5 Mbps while maintaining the architectural features of MIL-STD-1553. Hyper 1553 provides high speed communication (50 to 100+ Mbps) over MIL-STD-1553 buses while operating concurrently with legacy 1 Mbps 1553 (similar to ADSL for telephone networks).

## Form Factors, Software, & Drivers

DDC supplies MIL-STD-1553 and ARINC 429 board level products in a variety of form factors including USB, PCI-Express, PCMCIA, ExpressCard, AMC, PMC, XMC, PCI-104, PC/104-Plus, PC/104, PCI, cPCI, VME, and ISAbus boards. Our laboratory simulation and in-flight products include multi-function and single-function for system integration and production test environments. Our extensive line of military and space grade components provide MIL-STD-1553 interface solutions for microprocessors and simple systems. Our software is supplied in the form of menus, libraries, and drivers. We also offer additional software to expand our data networking range of options.



# SINGLE ARINC-429 LINE DRIVER

## DD-4107X DATA SHEET

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# RECORD OF CHANGE

Revision	Date	Pages	Description
Pre Rev A	Oct., 2014	All	Preliminary release
Rev A	Feb., 2015	All	Initial Release

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# 1 PREFACE

This manual uses typographical conventions to assist the reader in understanding the content. This section will define the text formatting used in the rest of the manual.

## 1.1 Text Usage

- **BOLD**—indicates important information and table, figure, and chapter references.
- `Courier New`—indicates code examples.
- `<...>` - indicates user-entered text or commands.

## 1.2 Standard Definitions

<b>Host</b>	Controller connected to the Host Interface
<b>BIT</b>	Built-In Test
<b>PCB</b>	Printed Circuit Board

## 1.3 Trademarks

All trademarks are the property of their respective owners.

## 1.4 Technical Support

In the event that problems arise beyond the scope of this manual, you can contact DDC by the following:

US Toll Free Technical Support:  
1-800-DDC-5757, ext. 7771

Outside of the US Technical Support:  
1-631-567-5600, ext. 7771

Fax:  
1-631-567-5758 to the attention of DATA BUS Applications

DDC Website:  
[www.ddc-web.com/ContactUs/TechSupport.aspx](http://www.ddc-web.com/ContactUs/TechSupport.aspx)

Please note that the latest revisions of Software and Documentation are available for download at DDC's Web Site, [www.ddc-web.com](http://www.ddc-web.com).

## 2 OVERVIEW

The DD-4107X is a family of ARINC 429 line drivers in an 8 pin package which directly drive the ARINC 429 digital data bus. The ARINC 429 Line Drivers convert TTL/CMOS serial input data to ARINC specified amplitudes. The HI/LO logic input is provided to control the output slew rate for HI speed (100 Kbps) or LOW speed (12.5 Kbps) operation. The Line Driver family offers various output resistor options and output tri-state capability.

### 2.1 Drop-In Replacement

DDC's DD-4107X is a direct pin for pin drop-in replacement for the following Holt and DEI Line Drivers:

- Replacements for Holt Line Drivers:
  - HI-8585
  - HI-8586
- Replacements for DEI Line Drivers:
  - DEI-1070A
  - DEI-1071A
  - DEI-1072A
  - DEI-1073A
  - DEI-1074A
  - DEI-1075A

### 2.2 Features

- TTL/CMOS ARINC 429 Line Driver
- HI/LO Speed Control Pin for Hi (100 Kbps) or Lo (12.5 Kbps) Speed Slew Rates
- $\pm 9.5V$  to  $\pm 16.5V$  Supplies
- Drives Full ARINC Load
- Output Resistor Options: 0, 10 or 37.5 Ohms
- Tri-state Output Options
- 8 Lead SOICN Package with Exposed Pad for Thermal Enhancement
- Cost Effective
- Low Power Consumption
- Pin for Pin Replacement for HI-8585/86 and DEI1070A Family



Figure 1. DD-4107x Single ARINC 429 Line Driver

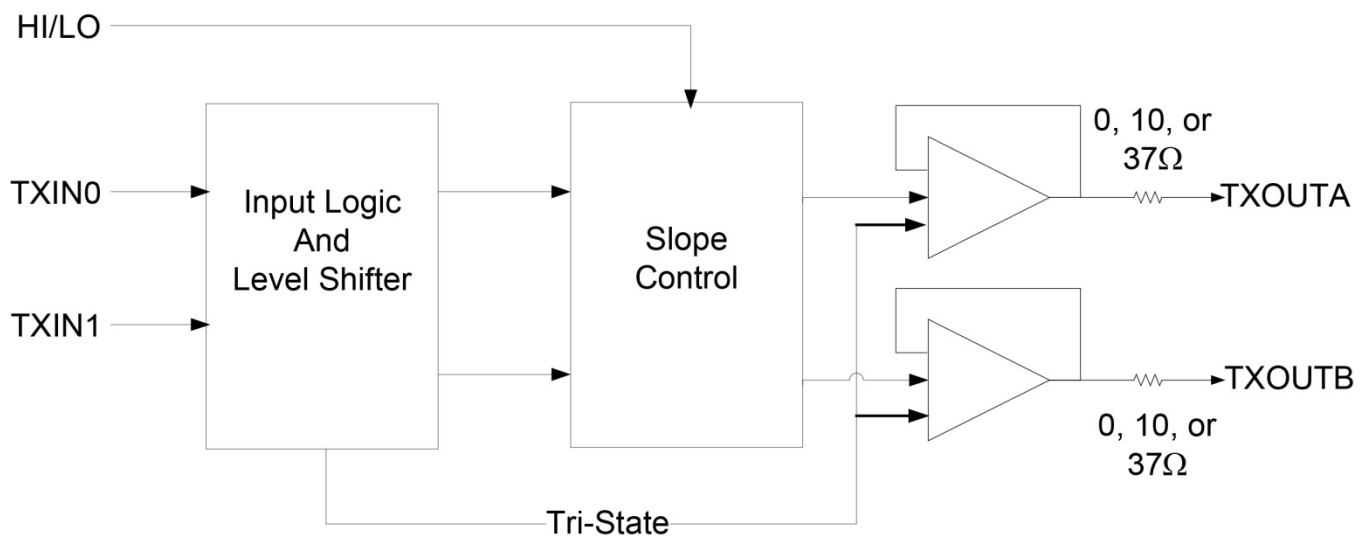


Figure 2. DD-4107x Block Diagram

## 2.3 Specifications

Table 1. DD-4107x Specifications

PARAMETER	MIN	TYP	MAX	UNITS
<b>ABSOLUTE MAXIMUM RATINGS</b>				
V <sub>+</sub>	-0.3		20.0	V
V <sub>-</sub>	-20		0.3	V
Logic Inputs	-0.5		V <sub>+</sub> +0.5	V
Input Voltage 429 OUTPUTS (175uS surge)	-20V		+20V	V
Input Current 429 OUTPUTS (175uS surge)	-0.5		0.5	A
Power Dissipation at T <sub>A</sub> = 85°C			1.2	W

**Table 1. DD-4107x Specifications**

PARAMETER	MIN	TYP	MAX	UNITS
<b>POWER SUPPLY REQUIREMENTS</b>				
Voltages/Tolerances				
• V <sub>+</sub>	9.5		16.5	V
• V <sub>-</sub>	-16.5		-9.5	V
Quiescent Current (Note 1)				
I <sub>cc</sub>		3.2	5.5	mA
I <sub>ee</sub>	-5.5	-3.5		mA
Current Drain (Note 2, 6)				
• Idle		3.2	5.5	mA
• 25% Duty Transmitter Cycle		13.7		mA
• 50% Duty Transmitter Cycle		24.5		mA
• 100% Duty Transmitter Cycle		42		mA
<b>POWER DISSIPATION</b> (Note 2,3)				
• 25% Duty Transmitter Cycle		0.4		W
• 50% Duty Transmitter Cycle		0.7		W
• 100% Duty Transmitter Cycle		1.1		W
<b>ARINC 429 TRANSMITTER</b>				
Single Ended Output Voltage				
• ONE	4.5	5.0	5.5	V
• ZERO	-5.5	-5.0	-4.5	V
• NULL	-0.25	0.0	0.25	V
Output Resistance				
• DD-41070/DD-41073	25	37.5	50	Ω
• DD-41071/DD-41074	7	10	13.5	Ω
• DD-41072/DD-41075	0	0	2	Ω
Slew Rate (Note 4)				
• SPEED logic high	1		2	us
• SPEED logic low	5		15	us
<b>ARINC Output Short Circuit Current (External 37.5 Ω resister)</b>				
Output LO	100		146	mA
Output HI	-146		-100	mA
<b>ARINC Output Tri-state Leakage Current</b> (Note 5) (DD-41073/DD-41074/DD-41075)				
	-200		200	uA
<b>LOGIC INPUTS</b>				
V <sub>IH</sub>	2		V <sub>+</sub>	V

**Table 1. DD-4107x Specifications**

PARAMETER	MIN	TYP	MAX	UNITS
<b>LOGIC INPUTS (Con't)</b>				
V <sub>IL</sub>	-0.3		0.8	V
I <sub>IH</sub> (V <sub>IN</sub> = 5.0V)	0		0.1	mA
I <sub>IL</sub> (V <sub>IN</sub> = 0V)	-0.1		0	mA
<b>THERMAL</b>				
<ul style="list-style-type: none"> <li>Junction Temperature (T<sub>J</sub>)</li> </ul>			150	°C
<ul style="list-style-type: none"> <li>Junction-to-Ambient (θ<sub>JA</sub> via simulation)                             <ul style="list-style-type: none"> <li>- Per JESD 51-2 standard at 25°C</li> </ul> </li> </ul>			49	°C/W
<ul style="list-style-type: none"> <li>Junction-to-case (θ<sub>JC</sub> via simulation)                             <ul style="list-style-type: none"> <li>- Per JESD 51-12 standard at 25°C</li> </ul> </li> </ul>			10	°C/W
<ul style="list-style-type: none"> <li>Operating Case Temperature                             <ul style="list-style-type: none"> <li>- 100</li> </ul> </li> </ul>	-55		+125	°C
<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>- 900</li> </ul> </li> </ul>	-55		+85	°C
<ul style="list-style-type: none"> <li>Storage Temperature</li> </ul>	-65		+150	°C
<b>SOLDERING</b>				
<b>8-LEAD ENHANCED SOIC PACKAGE</b>				
The lead-free reflow profile detailed in IPC/JEDEC J-STD-020 is recommended for this device.				
<b>PHYSICAL CHARACTERISTICS</b>				
Package Body Size				
8-Lead Enhanced SOIC (JEDEC MS-012BA)	0.193 x 0.153 x 0.067  (4.9 x 3.9 x 1.70)			in  (mm)
Moisture and ESD Sensitivity				
<ul style="list-style-type: none"> <li>Moisture Sensitivity Level</li> <li>Electrostatic Discharge Sensitivity</li> </ul>	MSL-1 JEDEC JS-001-2012 Class 2 (2KV, Human Body Model)			
Weight				
8-Lead Enhanced SOIC	0.035  1.0			oz  (g)

Notes:

- V<sub>CC</sub>=15V, V<sub>EE</sub>=-15V, No Load, Idle
- ARINC Load = 30nF/400Ω. Data Rate: 100Kbps
- V<sub>CC</sub>=15V, V<sub>EE</sub>=-15V, 37.5 Ohm external series resistor
- No Load, 10% to 90%, single ended
- Outputs forced to -5V and +5V
- Current values are per V<sub>+</sub> and V<sub>-</sub> supplies

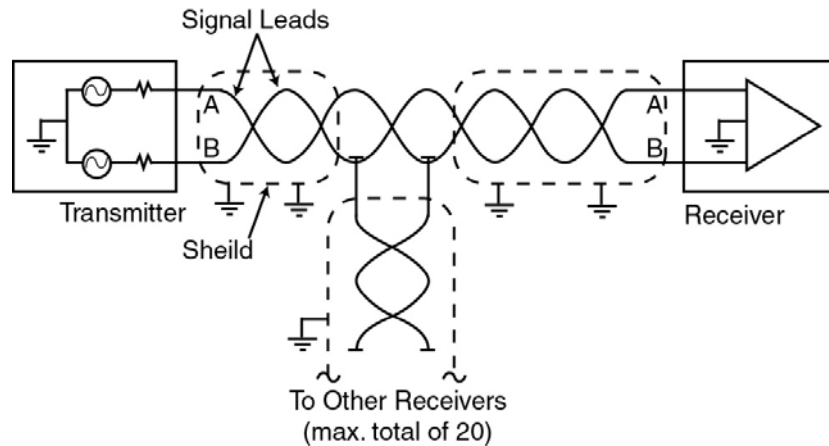
Table 2. Slew Rate Control Function Table	
SPEED	OUTPUT TRANSITION TIME
L	10uS(12.5 Kbps data)
H	1.5uS(100 Kbps data)

Table 3. Function Table				
INA	INB	OUTA	OUTB	NOTES
L	L	0V	0V	Null Output
L	H	-5V	+5V	Zero Output
H	L	+5V	-5V	One Output
H	H	0V	0V	Null Output DD-41070/41071/41072
H	H	Hi-Z	Hi-Z	Hi-Z DD-41073/41074/41075

## 2.4 General

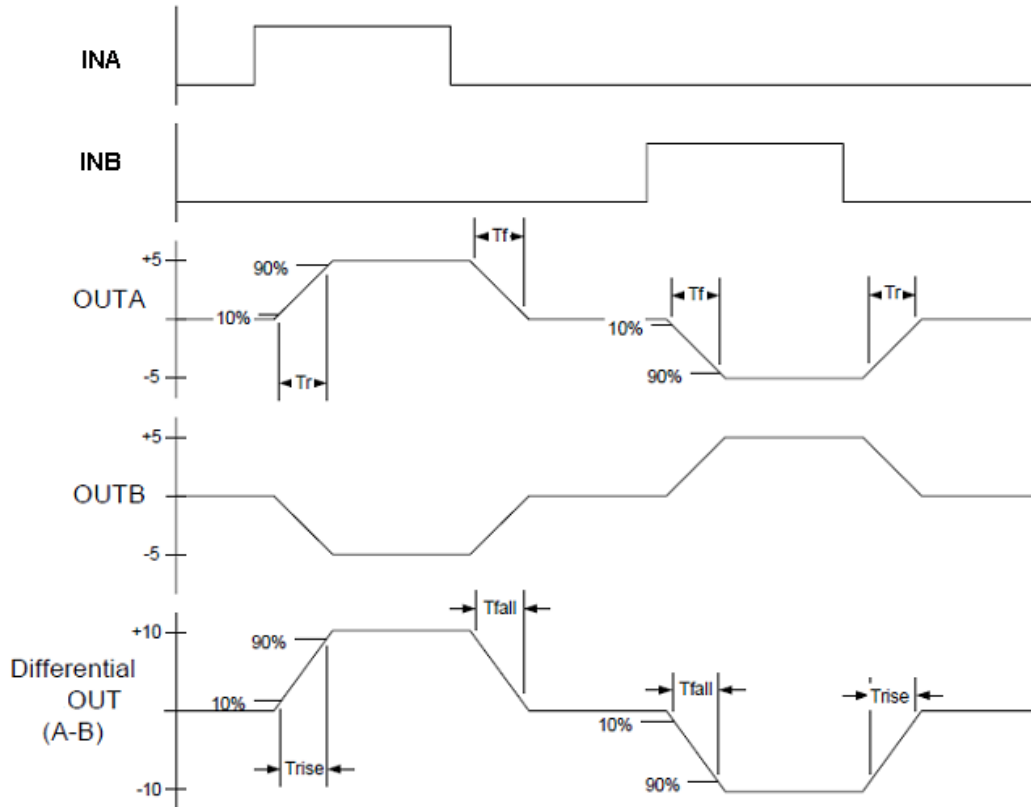
The ARINC 429 standard is widely used in the civil aerospace market (commercial aircraft). ARINC 429 operates at either 12 to 14.5 or 100 Kbps on a simplex bus. A simplex bus is one on which there is only one transmitter but multiple receivers (up to a maximum of 20 in the case of 429). If receipt of a message by a given sink R(n) is required by the source T, a separate bus with R(n) as the source and T as the sink is required. To those designers who focus on military systems, a simplex bus may seem cumbersome, but it can be readily certified for civil aircraft.

Communications on 429 buses use 32-bit words with odd parity. The waveform is a bipolar return to zero with each bit lasting either 70 or 83 $\mu$ s  $\pm$ 2.5 percent, or 10 $\mu$ s,  $\pm$ 2.5 percent, depending on whether the bus is low- or high-speed. A low-speed bus is used for general purpose, low critical applications. A high-speed bus is used for transmitting large quantities of data or flight critical information.



**Figure 3. Generalized ARINC 429 Bus**

ARINC 429 imposes relatively modest and readily achievable performance demands on the hardware. Figure 1 is a general schematic of a 429 bus. The transmitter output impedance should be in the range of 75 to 85 $\Omega$ , equally divided between the two leads. The output voltage,  $V_o$ , is 10 V and is generated by imposing equal but opposite polarity voltages on the two leads. The null voltage is 0.5 V. For the receiver, the input resistance shall be greater than 12,000 $\Omega$  and the input differential capacitance and the capacitance to ground shall, in both cases, be less than 50 pF. The 12,000  $\Omega$  minimum input resistance ensures that up to 20 receivers can be on the bus without overloading it and minimizes receiver interaction under fault conditions. Figure 4 shows the waveforms required by 429 and permissible levels for transmitter and receiver voltages.



**Figure 4. ARINC 429 Waveform**

## 2.5 Function

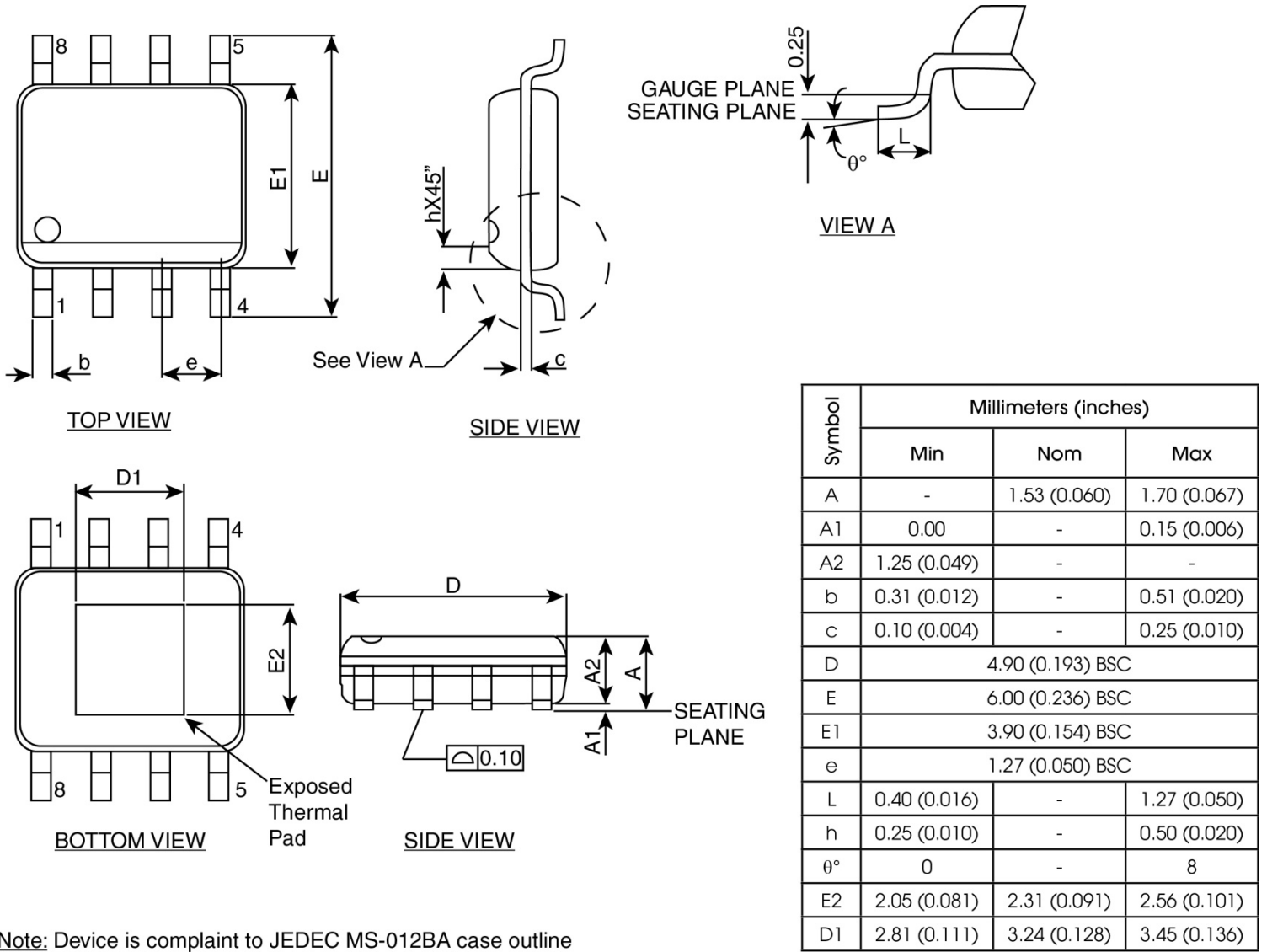
The DD-4107x line driver is designed to take data from a box and place it on the data bus. The serial data is presented on the INA and INB inputs in a dual rail format. If both inputs are driven high, the outputs will be driven to null for DD-41070/DD-41071/DD-41072 versions and high-impedance for DD-41073/DD-41074/DD-41075 versions. Slew rate is controlled with the SPEED input, which is grounded to set the transceiver for low speed operation and driven high to select high-speed operation.

The cable used in 429 buses is a twisted, shielded pair of 20- to 26-gauge conductors. The shield is grounded at both ends of the cable run and at all production breaks. Although there is no specification placed on the cable impedance, it generally falls in the range of 60 to 80  $\Omega$ .

## 2.6 DD-4107x Signals

Table 4. Signal Descriptions and Pinout		
Signal Name	Pin	Description
SPEED	1	Slew rate selection. Drive high for high speed operation or low for low speed operation
INA	2	CMOS/TTL serial data input
INB	3	CMOS/TTL serial data input
GND	4	GND power input
V-	5	Negative power input
OUTA	6	ARINC 429 serial data output
OUTB	7	ARINC 429 serial data output
V+	8	Positive power input

### 3 MECHANICAL OUTLINE

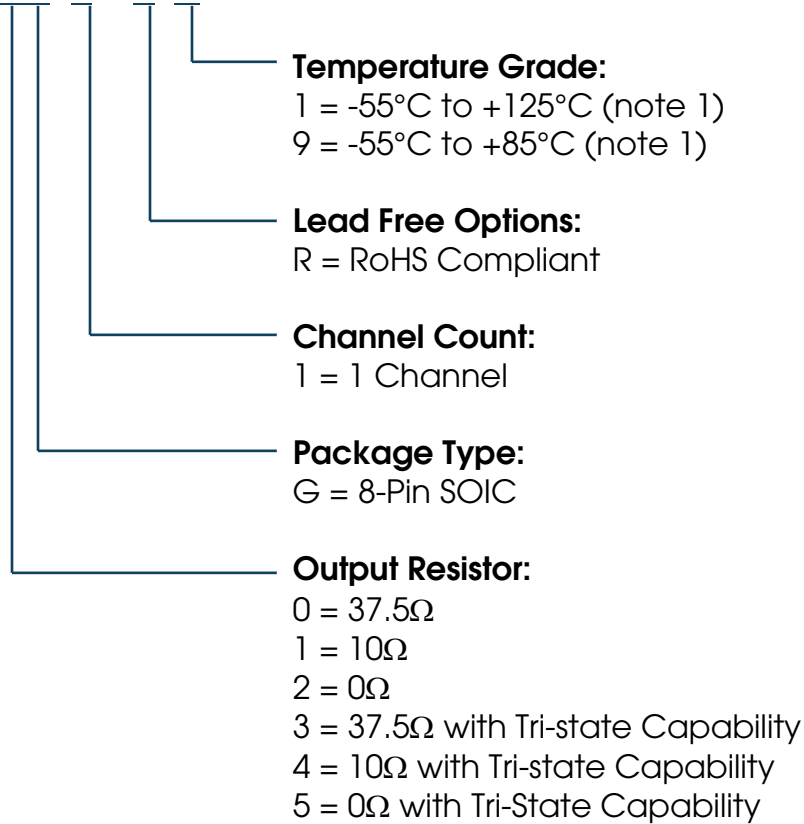


Note: Device is compliant to JEDEC MS-012BA case outline

Figure 5. DD-4107x Mechanical Outline Drawing


## 4 ORDERING INFORMATION

### DD-4107XGP100R-X00 - ARINC 429 Line Driver



Notes:

1. Temperature Range applies to case temperature.

DDC Part Marking				
DDC Product	Line of Part Number	Part Number	Value	Designation
	Line 1	DDC-X	(1,9)	Temperature Grade
	Line 2	DD-4170X	(0 – 5)	Output Resistor/Tri-State Capability
	Line 3	XXXX Y	misc	Date Code; Y for Internal Use

# Data Device Corporation

## Leadership Built on Over 50 Years of Innovation

Military | Commercial Aerospace | Space | Industrial

Data Device Corporation (DDC) is the world leader in the design and manufacture of high-reliability data bus products, motion control, and solid-state power controllers for aerospace, defense, and industrial automation applications. For more than 50 years, DDC has continuously advanced the state of high-reliability data communications and control technology for MIL-STD-1553, ARINC 429, Synchro/Resolver interface, and Solid-State Power Controllers with innovations that have minimized component size and weight while increasing performance. DDC offers a broad product line consisting of advanced data bus technology for Fibre Channel networks; MIL-STD-1553 and ARINC 429 Data Networking cards, components, and software; Synchro/Resolver interface components; and Solid-State Power Controllers and Motor Drives.

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### Product Families

Data Bus | Synchro/Resolver | Power Controllers | Motor Drives

DDC is a leader in the development, design, and manufacture of highly reliable and innovative military data bus solutions. DDC's Data Networking Solutions include MIL-STD-1553, ARINC 429, and Fibre Channel. Each Interface is supported by a complete line of quality MIL-STD-1553 and ARINC 429 commercial, military, and COTS grade cards and components, as well as software that maintain compatibility between product generations. The Data Bus product line has been field proven for the military, commercial and aerospace markets.

DDC is also a global leader in Synchro/Resolver Solutions. We offer a broad line of Synchro/Resolver instrument-grade cards, including angle position indicators and simulators. Our Synchro/Resolver-to-Digital and Digital-to-Synchro/Resolver microelectronic components are the smallest, most accurate converters, and also serve as the building block for our card-level products. All of our Synchro/Resolver line is supported by software, designed to meet today's COTS/MOTS needs. The Synchro/Resolver line has been field proven for military and industrial applications, including radar, IR, and navigation systems, fire control, flight instrumentation/simulators, motor/motion feedback controls and drivers, and robotic systems.

As the world's largest supplier of Solid-State Power Controllers (SSPCs) and Remote Power Controllers (RPCs), DDC was the first to offer commercial and fully-qualified MIL-PRF-38534 and Class K Space-level screening for these products. DDC's complete line of SSPC and RPC boards and components support real-time digital status reporting and computer control, and are equipped with instant trip, and true I<sup>2</sup>T wire protection. The SSPC and RPC product line has been field proven for military markets, and are used in the Bradley fighting vehicles and M1A2 tank.

DDC is the premier manufacturer of hybrid motor drives and controllers for brush, 3-phase brushless, and induction motors operating from 28 Vdc to 270 Vdc requiring up to 18 kilowatts of power. Applications range from aircraft actuators for primary and secondary flight controls, jet or rocket engine thrust vector control, missile flight controls, to pumps, fans, solar arrays and momentum wheel control for space and satellite systems.

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### Certifications

Data Device Corporation is ISO 9001: 2008 and AS 9100, Rev. C certified.

DDC has also been granted certification by the Defense Supply Center Columbus (DSCC) for manufacturing Class D, G, H, and K hybrid products in accordance with MIL-PRF-38534, as well as ESA and NASA approved.

Industry documents used to support DDC's certifications and Quality system are: AS9001 OEM Certification, MIL-STD-883, ANSI/NCSL Z540-1, IPC-A-610, MIL-STD-202, JESD-22, and J-STD-020.





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REGISTERED TO:  
ISO 9001:2008, AS9100C:2009-01  
EN9100:2009, JIS Q9100:2009  
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