

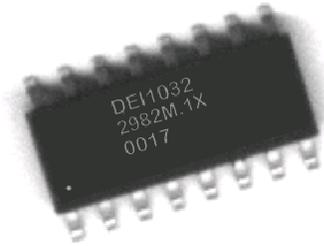
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**DEI1032
ARINC 429 Line Driver
Integrated Circuit**

Features:

- ARINC 429 Line Driver for high speed (100KHz) and low speed (12.5KHz) data rates.
- Low EMI RS-422 Line Driver mode for data rates up to 100 KHz.
- Adjustable Slew rates via external capacitors.
- Inputs TTL and CMOS Compatible.
- Low Quiescent Power of 125mW (typical)
- Programmable output differential range via V_{REF} pin.
- Outputs have no internal source resistor and fuse.
- Drives full ARINC load of 400 Ω and 0.03 μ F.
- -55°C to +85°C operating temperature range.
- 100% Final testing.



Functional Description:

The ARINC 429 Line Driver Circuit is a bipolar monolithic IC designed to meet the requirements of several general aviation serial data bus standards. These include the differential bipolar RZ types such as ARINC 429, ARINC 571, and ARINC 575 as well as the differential NRZ types such as RS-422.

The DEI1032 operates in either ARINC 429 mode or RS-422 mode as Controlled by the 429/422' pin. In 429 mode, the serial data is presented on DATA(A) and DATA(B) inputs in the dual rail format of the DEI1016. The driver is enabled by the SYNC and CLOCK inputs. The output voltage level is programmed by the V_{REF} input and is normally tied to +5VDC along with V_1 to produce output levels of +5 volts, 0 volts, and -5 volts on each output for ± 10 volts differential outputs.

In 422 mode, the serial data is presented on DATA(A) input. The driver is Enabled by the SYNC and CLOCK inputs. The outputs swing between 0 volts and +5 volts if V_{REF} is at +5VDC. See Table 2 – DEI1032 Truth Table for description of input and output logic states.

The DEI1032 A_{OUT} and B_{OUT} outputs have 0 Ω of series resistance and require external series resistors which are typically used to implement a transient voltage protection network. The outputs are not fused. The output slew rate is controlled by external timing capacitors on C_A and C_B . Typical values are 75pF for 100KHz data and 500pF for 12.5KHz data.

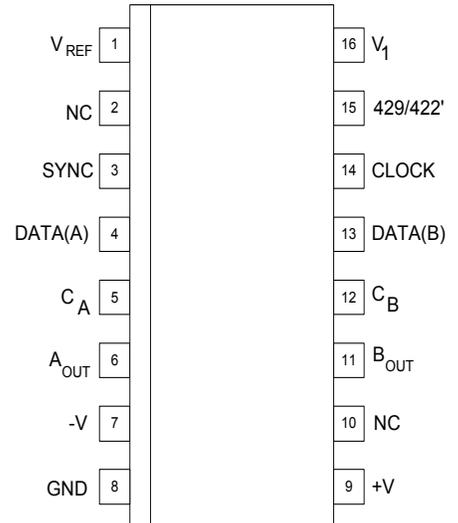


Figure 1: DEI1032 Pinout

Table 1: DEI1032 Pin Description

| Pin # | Pin Name | Description |
|---------|--------------------------------------|---|
| 1 | V _{REF} | Analog Input. The voltage on V _{REF} sets the output voltage levels on A _{OUT} and B _{OUT} . The output logic levels swing between +V _{REF} , 0 volts, and -V _{REF} volts. |
| 3 | SYNC | Logic input. Logic 0 forces outputs to NULL state. Logic 1 enables data transmission. |
| 14 | CLOCK | Logic input. Logic 0 forces outputs to NULL state. Logic 1 enables data transmission. |
| 4 13 | DATA(A) DATA(B) | Logic inputs. These signals contain the Serial Data to be transmitted on the ARINC 429 data bus. Refer to Figure 3. |
| 5 12 | C _A C _B | Analog Nodes. External timing capacitors are tied from these points to ground to establish the output signal slew rate. Typical C _A = C _B = 75pF for 100 kHz data and C _A = C _B = 500pF for 12.5 kHz data. * |
| 6 11 | A _{OUT} B _{OUT} | Outputs. These are the line driver outputs which are connected to the aircraft serial data bus. |
| 7 | -V | Negative Supply Input. -15VDC nominal. |
| 8 | GND | Ground. |
| 9 | +V | Positive Supply Input. +15VDC nominal. |
| 15 | 429/422' | Logic Input. Mode control for ARINC 429 and RS-422 modes. An internal 10KΩ pull up resistor keeps the chip in ARINC 429 mode when there is no external connection. This creates a default logic 1, enabling the ARINC 429 mode. A forced logic 0 enables the RS-422 mode. |
| 16 | V ₁ | Logic Supply Input. +5VDC nominal. |
| 2,10 | NC | No Connect |

*C_A and C_B pin voltages swing between ±5 volts. Any electronic switching of the capacitor on the pins must not inhibit the full voltage swings.

Table 2: Logic Function

| | 429/422' (1) | SYNC (2) | CLOCK (2) | DATA(A) (2) | DATA(B) (2) | A _{OUT} | B _{OUT} | COMMENTS |
|---------------------------------|-----------------|-------------|--------------|----------------|----------------|-------------------|-------------------|----------|
| 4 2 9 M O D E | H | L | X | X | X | 0 | 0 | NULL |
| | H | X | L | X | X | 0 | 0 | NULL |
| | H | H | H | L | L | 0 | 0 | NULL |
| | H | H | H | H | H | 0 | 0 | NULL |
| | H | H | H | H | L | +V _{REF} | -V _{REF} | LOGIC 1 |
| | H | H | H | L | H | -V _{REF} | +V _{REF} | LOGIC 0 |
| 4 2 2 M O D E | L | L | X | X | X | +V _{REF} | 0 | NULL |
| | L | X | L | X | X | +V _{REF} | 0 | NULL |
| | L | H | H | L | X | 0 | +V _{REF} | LOGIC 0 |
| | L | H | H | H | X | +V _{REF} | 0 | LOGIC 1 |

NOTES:

- The 429/422' pin is internally pulled up to V₁ through a 10kΩ resistor. If no external connection is made to this pin, it will default to the 429 mode.
- X = Don't care.

Electrical Description:

Table 3: Maximum Ratings

| PARAMETER | MIN | MAX | UNITS |
|--|-------------------|------------------------|-------|
| VOLTAGE BETWEEN PINS: | | | |
| V+ and GND | 0 | +20.0 | V |
| V- and GND | 0 | -20.0 | V |
| V ₁ and GND | -0.3 | +7.0 | V |
| V _{REF} and GND | -0.3 | +6.0 | V |
| LOGIC INPUTS and GND | -0.3 | (V ₁ + 0.3) | V |
| Storage Temperature | -65 | +150 | °C |
| Peak Body Temperature, - G Package | | 260 | °C |
| Output Short Circuit Duration | See Note 1 | | |
| Output Over Voltage Protection | See Note 2 | | |
| Power Dissipation | See Table 5 below | | |
| NOTES: | | | |
| 1. One output at a time can be shorted to ground indefinitely. | | | |
| 2. The outputs are not fused. External fusing must be provided to meet the Transmitter Fault Isolation of the ARINC 429 SPECIFICATION. | | | |

Table 4: Recommended Operating Range

| PARAMETER | MIN | TYP | MAX | UNITS |
|---|-------|------|-------|-------|
| +V | +11.4 | | +16.5 | VDC |
| -V | -11.4 | | -16.5 | VDC |
| V ₁ | +4.5 | +5.0 | +5.5 | VDC |
| V _{REF} (for ARINC 429) | +4.5 | +5.0 | +5.5 | VDC |
| V _{REF} (for other applications) | +3.0 | | +6.0 | V |
| Operating Temperature (T _A) | -55 | | +85 | °C |
| Max Junction Temperature (T _{J MAX1}) Die Limit (short term operation) | | | +175 | °C |
| Max Junction Temperature (T _{J MAX2}) Plastic Package Limit (prolonged operation) | | | +145 | °C |

Table 5: DE1032 Power Dissipation Table

| 100% Duty Cycle Full Load = 400Ω/30,000pF Half Load = 4,000Ω/10,000pF | | | | | | |
|---|------|----------|-----------|--|----------|------------|
| DATA RATE | LOAD | +V = 15V | -V = -15V | V ₁ , V _{REF} = 5V | Pd POWER | LOAD POWER |
| 0 to 100kbps | NONE | 2.0mA | -5.0mA | 4mA | 125mW | 0.0mW |
| 12.5kbps | FULL | 16.0mA | 19.0mA | 4mA | 485mW | 60.0mW |
| 100kbps | FULL | 48.0mA | 51.0mA | 4mA | 1194mW* | 325.0mW |
| 12.5kbps | HALF | 6.0mA | 8.0mW | 4mA | 196mW | 30.0mW |
| 100kbps | HALF | 22.0mA | 25.0mA | 4mA | 561mW | 162.5mW |

*May require heat sink at T_A = +85°C

Table 6: DC Electrical Characteristics

Conditions: Temperature = -55°C to +85°C; +V = +11.4VDC to +16.5VDC, -V = -11.4VDC to -16.5VDC;
 $V_1 = V_{REF} = +5VDC \pm 5\%$, 429/422¹ = Open Circuit (unless otherwise noted.)

| SYMBOL | PARAMETER | MIN | TYP | MAX | UNIT | TEST CONDITIONS |
|---------------------------|---|---------------------------|-------------------|---------------------------|----------|--|
| IQ+V | Quiescent +V supply current | - | 2 | - | mA | No Load. 429 mode. DATA = CLOCK = SYNC = LOW |
| IQ-V | Quiescent -V supply current | - | 5 | - | mA | No Load. 429 mode. DATA = CLOCK = SYNC = LOW |
| IQV ₁ | Quiescent V ₁ supply current | - | 4 | - | mA | No Load. 429 mode. DATA = CLOCK = SYNC = LOW |
| IQV _{REF} | Quiescent V _{REF} supply current | - | 10 | - | μA | No Load. 429 mode. DATA = CLOCK = SYNC = LOW |
| V _{IH} | Logic 1 In. V | 2.0 | - | - | V | No Load. |
| V _{IL} | Logic 0 In. V | - | - | 0.6 | V | No Load. |
| I _{IH} | Logic 1 In. I | - | - | 10 | μA | No Load. |
| I _{IL} | Logic 0 In. I | - | - | -20 | μA | No Load. (Pin 15 I _{IL} = -2mA max) |
| I _{OHSC} | Output Short Circuit Current (Output High) | -80 | - | - | mA | Short to Ground |
| I _{OLSC} | Output Short Circuit Current (Output Low) | 80 | - | - | mA | Short to Ground |
| V _{OH} | Output Voltage HIGH. (+1) | V _{REF} - 250mV | V _{REF} | V _{REF} + 250mV | V | No Load. 429 Mode. |
| V _{NULL} | Output Voltage NULL. (0) | -250 | - | +250 | mV | No Load. 429 Mode. |
| V _{OL} | Output Voltage LOW. (-1) | -V _{REF} - 250mV | -V _{REF} | -V _{REF} + 250mV | V | No Load. 429 Mode. |
| I _{CT} + - | Timing Capacitor Charge Current C _A (+1) C _B (-1) C _A (-1) C _B (+1) | - | +200 -200 | - | μA μA | No Load. 429 Mode. SYNC = CLOCK = HIGH C _A and C _B held at zero volts. |
| ISC (+V) | +V Short Circuit Supply Current | - | - | +150 | mA | Output short to ground |
| ISC (-V) | -V Short Circuit Supply Current | - | - | -150 | mA | Output short to ground |
| R _{OUT} | Resistance on each output | - | 0 | - | Ohms | Room Temp Only |
| C _{IN} | Input Capacitor | - | - | 15 | pF | - |

AC Characteristics:

Figures 2 and 3 show the output waveforms for the ARINC 429 and RS-422 modes of operation.

The output slew rates are controlled by timing capacitors C_A and C_B . They are charged by $\pm 200\mu\text{A}$ (nom.).

Slew rate (SR) measured as $\text{V}/\mu\text{sec}$, is calculated by:

$$\text{SR} = 200/C$$

where C is in pF.

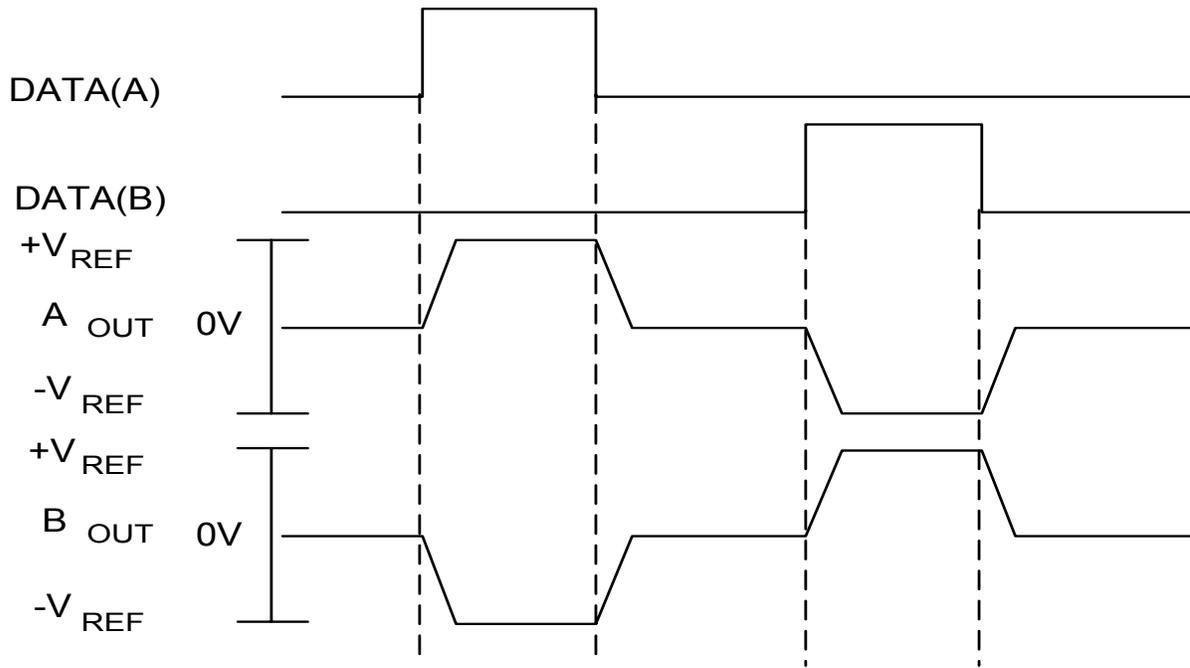


Figure 2: ARINC 429 Waveforms

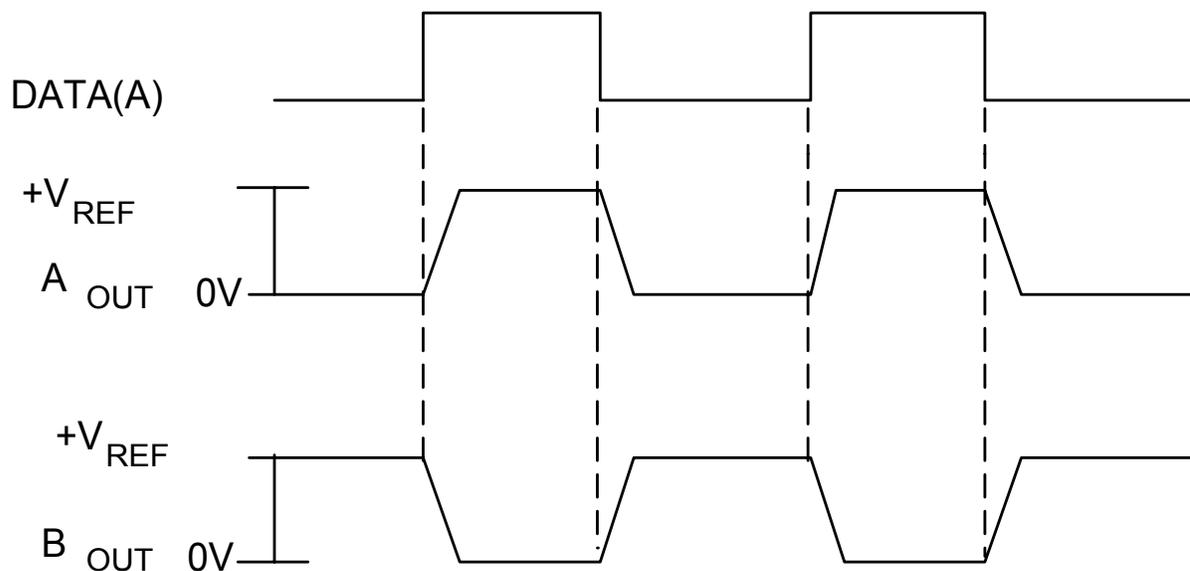
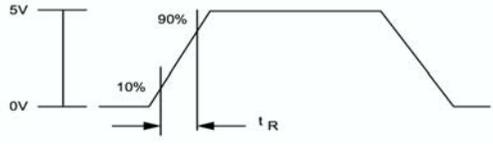
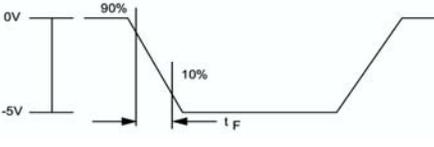


Figure 3: RS-422 Waveforms

Table 7: DEI1032 AC Electrical Characteristics

| PARAMETER | SYMBOL | MIN | MAX | UNITS | NOTES |
|---|--------------------------------------|------------|-------------|--------------|--|
| Output Rise Time A _{OUT} or B _{OUT} C _A = C _B = 75pF C _A = C _B = 500pF | t _R t _R | 1.0 5.0 | 2.0 15.0 | μsec μsec |  |
| Output Fall Time A _{OUT} or B _{OUT} C _A = C _B = 75pF C _A = C _B = 500pF | t _F t _F | 1.0 5.0 | 2.0 15.0 | μsec μsec |  |
| Input to Output Propagation Delay | t _{PNH} t _{PNL} | - | 3.0 | μsec | See Figure 4 below |
| A _{OUT} / B _{OUT} Skew Spec. | - | - | 500 | nsec | |

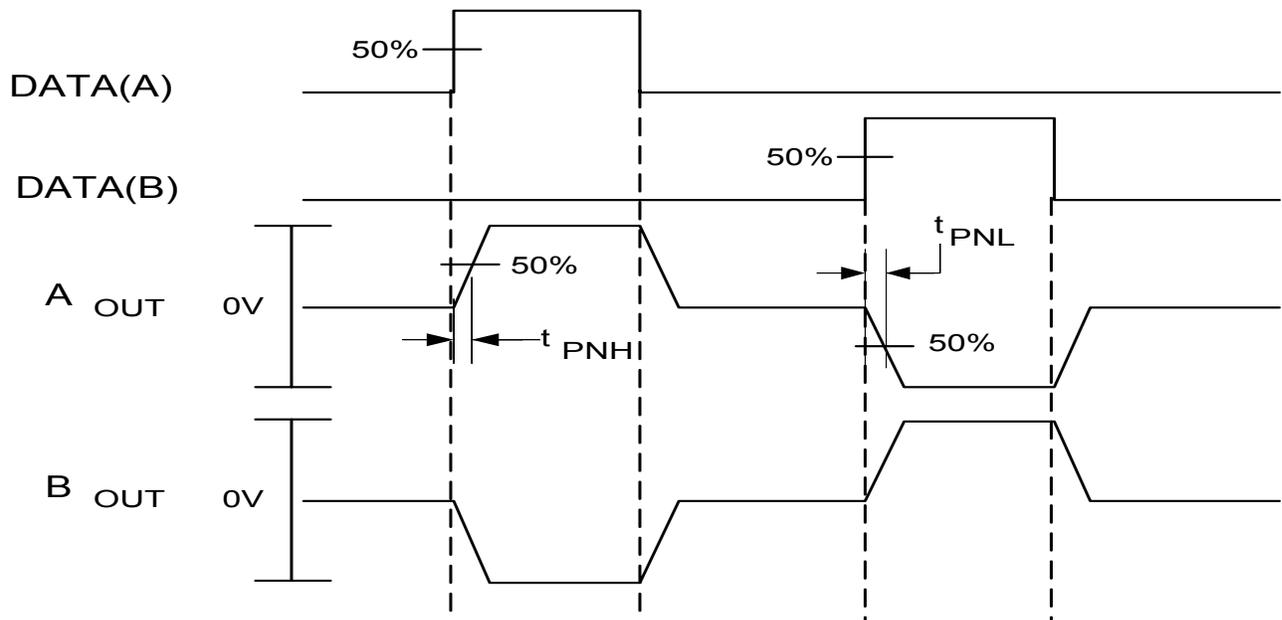


Figure 4: Propagation Delay

Component Screening:

| Table 8: Screening Process | |
|----------------------------|------------------|
| SCREENING | STANDARD PLASTIC |
| ELECTRICAL TEST: | |
| ROOM TEMPERATURE | 100% |
| HIGH TEMPERATURE | 100% @ +125 °C |
| LOW TEMPERATURE | 0.65% AQL@-55°C |

Ordering Information:

| Table 9: Ordering Information | | | | |
|-------------------------------|---------------|--------------|-------------------|-----------|
| DEI PART NUMBER | MARKING (1) | PACKAGE | TEMPERATURE RANGE | SCREENING |
| DEI1032-G | DEI1032 E4 | 16 NB SOIC G | -55 / +85 °C | STANDARD |

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Package Description:

| Table 10: Package Characteristics | |
|---|------------------------------------|
| PACKAGE TYPE | 16 Lead SOIC Narrow Body, Green |
| REFERENCE | 16L NB SOIC G |
| THERMAL RESISTANCE: θ_{JA} (4 layer PCB with Power Planes) θ_{JC} | 55 °C/W 24 °C/W |
| JEDEC MOISTURE SENSITIVITY LEVEL (MSL) | MSL 1 / 260°C |
| LEAD FINISH MATERIAL / JEDEC Pb-free CODE | NiPdAu e4 |
| Pb-Free DESIGNATION | RoHS Compliant |
| JEDEC REFERENCE | MS-012-AC |

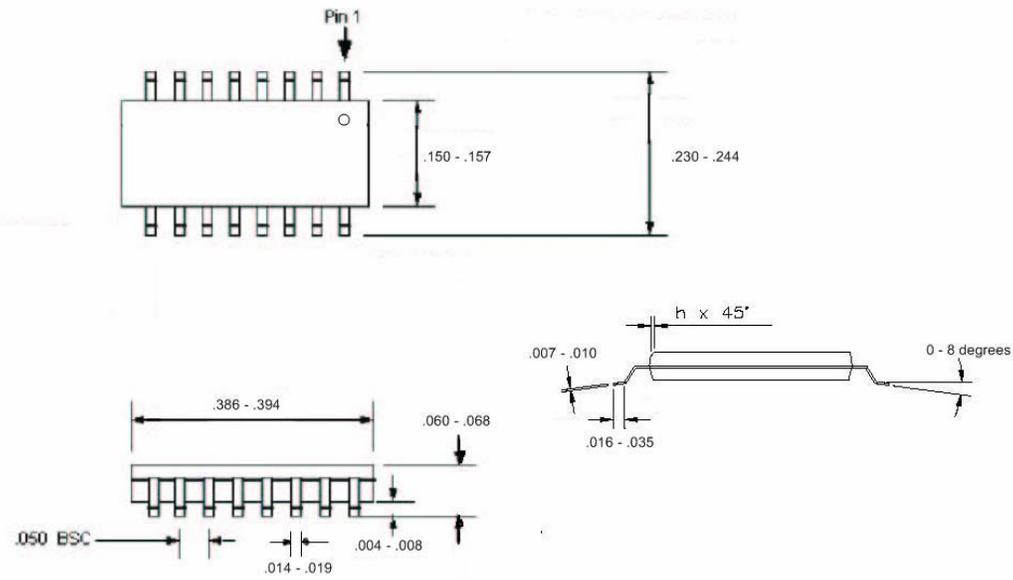


Figure 5: Mechanical Outline - 16L NB SOIC -G Package