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DEI1052
High Speed ARINC 429 Line Driver Integrated Circuit

Features:

- ARINC 429 Line Driver for standard and extended data rates.
  - Drives 400Ω and 30,000pf up to 100KBS
  - Drives 8000Ω and 2000pf at 500KBS
- Small, thermally enhanced package
  - 14 Lead exposed pad narrow body SOIC
- Adjustable Slew rates via external capacitors.
- Programmable output differential range via V_{REF} pin.
- -55ºC to +85ºC operating temperature range.
- 100% Final testing.

Functional Description:

The DEI1052 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.

The use of the DEI1052 line driver at frequencies above 100KBPS does not adhere to the ARINC *429 Digital Information Transfer Standard,* however the device has been characterized for operation at frequencies up to 500KBPS with line loads of 8000Ω and 2000pf.

The exposed pad narrow body SOIC package provides enhanced thermal conductivity when the pad is soldered to a heat spreader (at –V potential) on a PCB with internal Power/Ground planes.

Serial data is presented on DATA(A) and DATA(B) inputs in the dual rail format of an industry standard ARINC 429 line driver. 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.

The DEI1052 is configured without internal output resistors or fuses. For normal ARINC applications, a 37.5Ω external resistor is used on each output, along with any required transient voltage protection. For extended data rates, the external resistor values may be reduced to improve waveform fidelity. The output slew rate is controlled by external timing capacitors on C_A and C_B. Typical values are 75pF for 100KBPS, 500pF for 12.5KBPS, and 30pF for 500KBPS yielding 750 nsec rise and fall times.

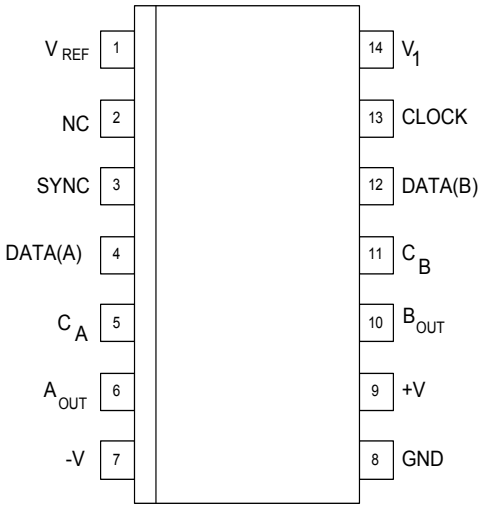

Figure 1: Pinout Diagram

DS-MP-01052 Rev. C
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Table 1: Pin Descriptions		
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 $+V_{REF}$ volts, 0 volts, and $-V_{REF}$ volts.
2	NC	No Connect
3	SYNC	Logic input. Logic 0 forces outputs to NULL state. Logic 1 enables data transmission.
13	CLOCK	Logic input. Logic 0 forces outputs to NULL state. Logic 1 enables data transmission.
4 12	DATA(A) DATA(B)	Logic inputs. These signals contain the Serial Data to be transmitted on the ARINC 429 data bus. Refer to Table 2.
5 11	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 100Kb data, $C_A = C_B = 500pF$ for 12.5Kb data, and $C_A = C_B = 30pF$ for 500Kb data. *
6 10	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.
14	V_1	Logic Supply Input. +5VDC nominal.

*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: Truth Table						
INPUTS				OUTPUTS		
SYNC NOTE 1	CLOCK NOTE 1	DATA(A) NOTE 1	DATA(B) NOTE 1	A_{OUT}	B_{OUT}	COMMENTS
L	X	X	X	0	0	NULL
X	L	X	X	0	0	NULL
H	H	L	L	0	0	NULL
H	H	H	H	0	0	NULL
H	H	H	L	$+V_{REF}$	$-V_{REF}$	LOGIC 1
H	H	L	H	$-V_{REF}$	$+V_{REF}$	LOGIC 0

NOTES:
1. X = Don't care.

MAXIMUM RATINGS:

VOLTAGE BETWEEN PINS:

a) +V and -V 40V
b) V_1 and GND 7V
c) V_{REF} and GND 6V
d) LOGIC INPUTS ..... (GND-0.3V) to (V_1+0.3V)

OUTPUT SHORT CIRCUIT DURATION ..... Note A

OUTPUT OVERVOLTAGE PROTECTION ..... Note B

STORAGE TEMPERATURE ..... -65^{O}C TO +150^{O}C

LEAD TEMPERATURE (soldering, 10 sec.) ..... 275^{O}C

POWER DISSIPATION ..... See POWER DISSIPATION TABLE

NOTES:

A. One output at a time can be shorted to ground indefinitely through a 37.5Ω external resistor.
B. The DEI1052 outputs are not fused. External fusing must be provided to meet the Transmitter Fault Isolation of the ARINC 429 SPECIFICATION.

Operating Range:

Operating Voltage:

a) +V ..... +11.4VDC to +16.5VDC
b) -V ..... -11.4VDC to –16.5VDC
c) V_1 ..... +5VDC ±5%
d) V_{REF} (for ARINC 429) ..... +5VDC ±5%
e) V_{REF} (for other applications) ..... +3V to +6V

Operating Temperature (T_A) ..... -55°C to +85°C
Max. Operating. Junction Temp. (T_J) ..... 145°C

Table 3: Power Dissipation

Full Load = 400Ω/30,000pF Half Load = 800Ω/15,000pF Reduced Load= 8kΩ/ 2000pF

DATA RATE	LOAD	+V @ 15V	-V @ -15V	V_1 + V_{REF} @5V	DEI1052 POWER DISSIPATION	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
500kbps	REDUCED	42.9mA	42.9mA	4.5mA	1300mW	60mW

Notes:
Heat slug must be soldered to heat spreader on PCB. See figure 5.

Table 4: DC Electrical Characteristics						
Conditions: Temperature: -40°C to +85°C; +V = +11.4VDC to +16.5VDC, –V = -11.4VDC to –16.5VDC; $V_1 = V_{REF}$ = +5VDC ±5%						
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.
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	-
C_{IN}	Input Capacitor	-	-	15	pF	-

AC ELECTRICAL CHARACTERISTICS

Figure 2 shows the output waveform for the ARINC 429.

The output slew rates are controlled by timing capacitors C_A and C_B. They are charged by ±200µA (nom.). Slew rate (SR) measured as V/µsec, is calculated by:

SR = 200/C
where C is in pF.

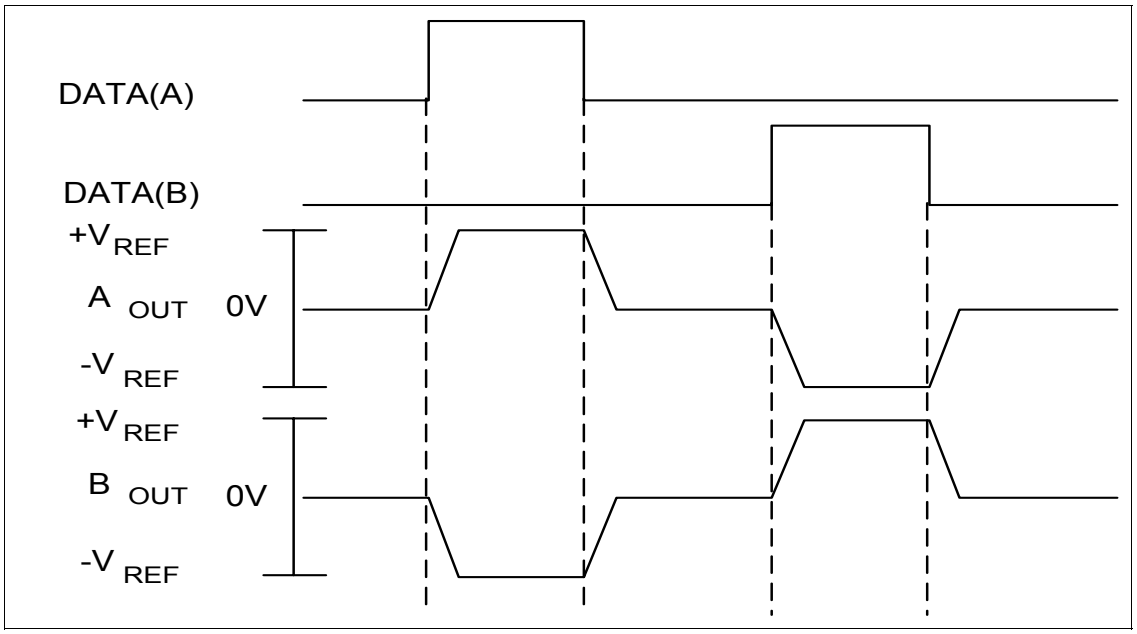
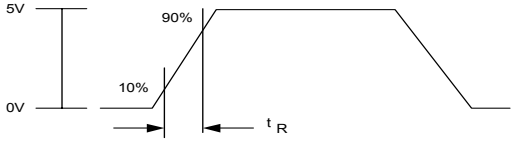
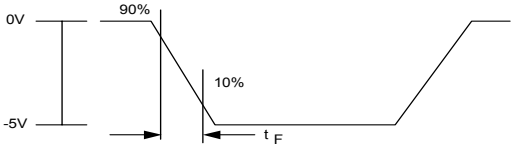


Figure 2: ARINC 429 Waveforms

Table 5: AC Electrical Characteristics

Parameter	Symbol	MIN	TYP	MAX	UNITS	NOTES
Output Rise Time A_{OUT} or B_{OUT} $C_A = C_B = 75pF$ $C_A = C_B = 500pF$ $C_A = C_B = 30pF$	 t_R t_R t_R	 1.0 5.0 	 750	 2.0 15.0 	 µsec µsec nsec	
Output Fall Time A_{OUT} or B_{OUT} $C_A = C_B = 75pF$ $C_A = C_B = 500pF$ $C_A = C_B = 30pF$	 t_F t_F t_F	 1.0 5.0 	 750	 2.0 15.0 	 µsec µsec nsec	
Input to Output Propagation Delay	t_{PNH} t_{PNL}	-		3.0	µsec	See Figure 3
A_{OUT} / B_{OUT} Skew Spec.	-	-		100	nsec	

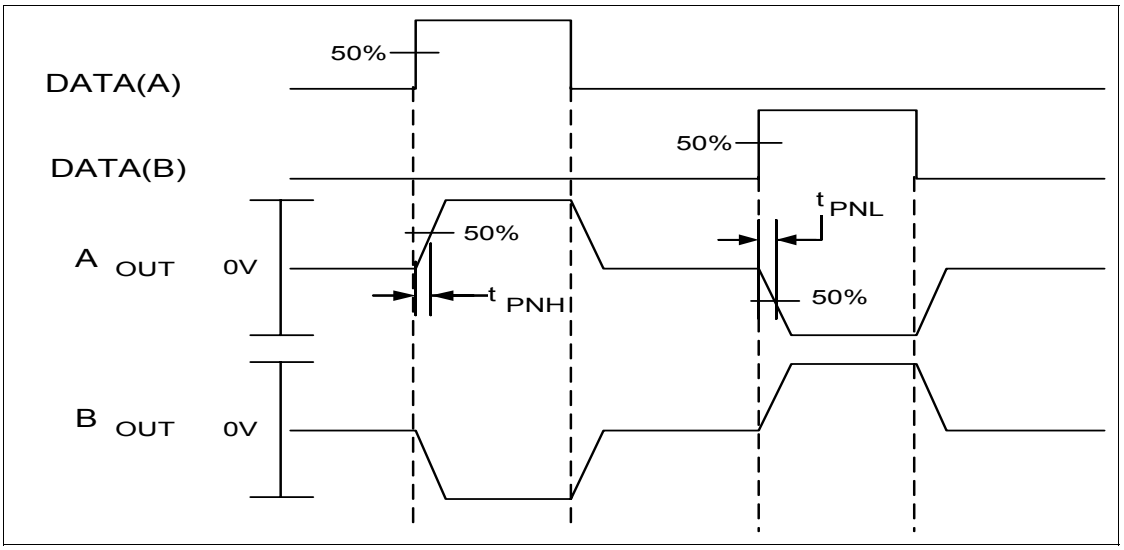


Figure 3: Propagation Delay

Component Screening:

The components shall be screened as follows:

I. DC parametric and functional test:

All components will be tested at room temperature per manufacturer's specification.

Part Marking:

The part will be marked with the following:

DEI1052
Lot Number
Date Code

Package Description:

Package Type: .....14 lead Narrow body SOIC with exposed thermal pad.
Package Dimensions:.....See drawing below.
Thermal Characteristics: .....θ_{JA} = 40°C/W with the exposed pad soldered to a heat spreader (at –V potential) on a PCB with internal Power/Ground planes.

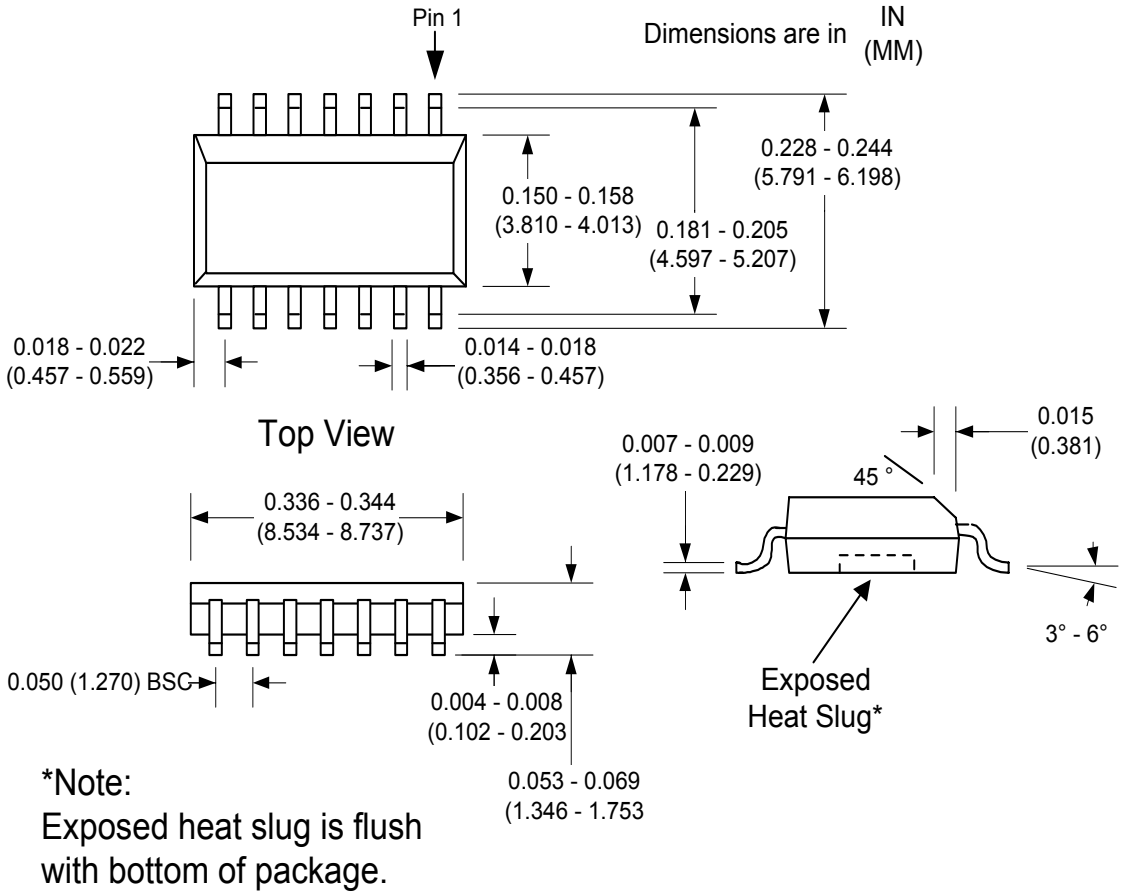


Figure 4: Package Dimensions (14L SOIC NB)

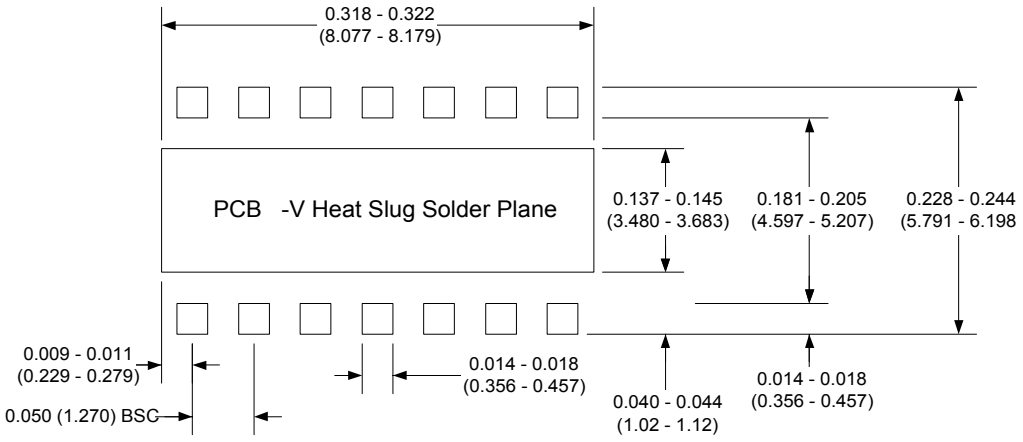


Figure 5: PCB Heat Slug solder plane dimensions (14L SOIC NB)