• Features

- Bidirectional bus transceivers
- Incorporates receiver noise immunity
- Input and output levels compatible with UNIBUS and Q-bus
- Provides three-state TTL outputs to interface
- Open-collector bus drivers

• Description

The DC021 is an octal bus transceiver contained in a 20-pin dual-inline package (DIP) and is compatible with both the UNIBUS and Q-bus. The DC021 provides eight bidirectional channels that transfer information between a wired-OR bus and a user interface. It provides high-impedance receiver inputs and high-current, open-collector driver outputs. The DC021 transfers TTL-level signals between the device logic and the bus. The Select and Enable inputs to the DC021 are used to control the direction of information transfer. The simplified logic diagram of the DC021 is shown in Figure 1.

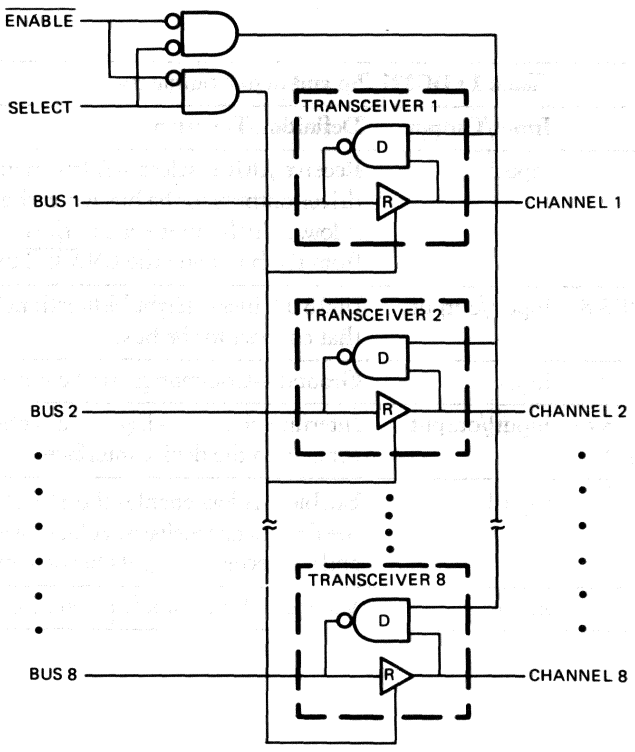


Figure 1 • DC021 Simplified Logic Diagram

▪ Pin and Signal Definitions

This section provides a brief description of the input and output signals and power and ground connections of the DC021 20-pin DIP. The pin assignments are shown in Figure 2 and the signals are summarized in Table 1.

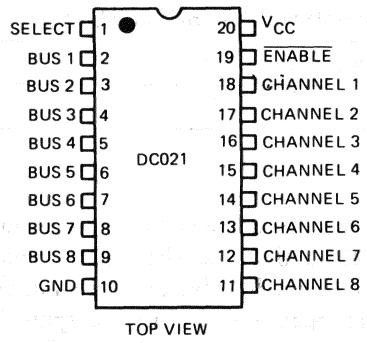


Figure 2 ▪ DC021 Pin Assignments

Table 1 ▪ DC021 Pin and Signal Summary

Pin	Signal	Input/Output	Definition/Function
1	SELECT	input[1]	Receiver/driver select—A low input enables the driver outputs to the bus wnen the $\overline{\text{ENABLE}}$ input is low. A high input enables the receiver inputs from the bus when the $\overline{\text{ENABLE}}$ input is low.
2-9	BUS 1 to BUS 8	input[2]/output[3]	UNIBUS lines—Eight bidirectional line receivers that connect to the bus.
10	GND	input	Ground—Common ground connection.
11-18	CHANNEL 8 to CHANNEL 1	input[1]/output[1]	Interface channel—Eight bidirectional lines that connect to the device interface.
19	$\overline{\text{ENABLE}}$	input[1]	Enable—A low enables the SELECT input to select the drivers or receivers. A high disables the drivers and the receiver outputs become high impedance.
20	V_{CC}	input	Voltage—Power supply dc voltage.

[1]TTL level
[2]high-impedance
[3]open-collector

Enable and Select Function

Table 2 lists the function of the transceiver as related to the $\overline{\text{ENABLE}}$ and SELECT control inputs.

Table 2 • DC021 Control Signal Functions

Signal Inputs*		Function	Driver	Receiver
$\overline{\text{ENABLE}}$	SELECT			
L	L	TTL-to-bus	enabled	high impedance
L	H	bus-to-TTL	disabled	enabled
H	X	no transfer	disabled	high impedance

*H = high level
L = low level
X = high or low level

• Specifications

The mechanical, electrical, and environmental characteristics and specifications for the DC021 are described in the following paragraphs. The test conditions for the electrical values are as follows unless specified otherwise.

- Ambient temperature (T_A): 0°C to 70°C
- Supply voltage (V_{CC}): 5.0 V ±5%

Absolute Maximum Ratings

Stresses greater than the absolute maximum ratings may cause permanent damage to the device. Exposure to the absolute maximum ratings for extended periods may adversely affect the reliability of the device.

- Supply voltage (V_{CC}): 7.0 V
- Input voltage (V_{in}) and output voltage (V_{out}): 5.5 V
- Ambient temperature (T_A): 0°C to 70°C
- Storage temperature (T_S): −65°C to 150°C

Recommended Operating Conditions

- Power supply voltage (V_{CC}): 5.0 V ±5%
- Supply current (I_{CC}): 240 mA (maximum)
- Ambient temperature (T_A): 0°C to 70°C
- Relative humidity: 10% to 95% (noncondensing)

dc Electrical Characteristics

The dc electrical specifications of the DC021 for the operating voltage and temperature ranges specified are listed in Tables 3 through 5. Table 3 lists the dc parameters for the bus-to-channel receiver input and outputs. Table 4 lists the dc parameters for the channel-to-bus driver inputs and outputs. Table 5 lists the dc parameters for the enable and select inputs. Refer to Appendix C for the test circuit configurations referenced in Tables.

Table 3 • DC021 Receiver Input and Output dc Parameters

Parameter	Symbol	Test Condition	Requirements Min.	Max.	Units	Test Circuit
High-level input voltage	V_{IH}	Enable/Select[1] Receiver out = 20 mA Receiver out < 0.5 V				C1,C2
		V_{CC} = 4.75 V	1.72	—	V	
		V_{CC} = 5.25 V	1.9	—	V	
Low-level input voltage	V_{IL}	Enable/Select[1] Receiver out = −2.0 mA Receiver out > 2.4 V				C1,C2
		V_{CC} = 4.75 V	—	1.50	V	
		V_{CC} = 5.25 V	—	1.66	V	
High-level output voltage	V_{OH}	Enable/Select[2] Receiver in = 0.4 mA Receiver out = −2.0 mA				C1
		V_{CC} = 4.75 V	2.4	—	V	
Low-level output voltage	V_{OL}	Enable/Select[2] Receiver in = 0.4 V Receiver out = 20 mA				C2
		V_{CC} = 4.75 V	—	0.5	V	
Short-circuit output current	I_{OS}	Enable/Select[3] Receiver in = 0.5 V Receiver out = 0 V				C6
		V_{CC} = 5.25 V	−40	−100	mA	
Three-state output leakage current	I_{OZL}	Enable/Select[4] Receiver in = 0.8 V Receiver out = 0.4 V	—	50	μA	

[1]Enable = 0.8 V, Select = 2.0 V
[2]Enable = 0.8 V, Select = 2.4 V
[3]Enable = 0 V, Select = 2.0 V
[4]Enable = 2.0 V, Select = 2.0 V

Table 4 • DC021 Driver Input and Output dc Parameters

Parameter	Symbol	Test Condition	Requirements Min.	Requirements Max.	Units	Test Circuit
High-level output leakage current	I_{OZH}	Enable/Select[1] Driver in = 0.8 V Driver out = 4.0 V V_{CC} = 5.25 V	—	100	µA	C9
		Enable/Select[2] Driver in = 0.8 V Driver out = 4.0 V V_{CC} = 5.25 V	—	100	µA	
		Enable/Select[1] Driver in = 0.8 V Driver out = 0.4 V V_{CC} = 0 V	—	100	µA	
		Enable/Select[2] Driver in = 0.8 V Driver out = 4.0 V V_{CC} = 0 V	—	100	µA	
High-level input current and receiver output leakage current	I_{IH} I_{OZH}[7]	Enable/Select[3] Driver in = 0.4 V Receiver in = 5.5 V V_{CC} = 5.25 V	—	200	µA	C4 C9
		Enable/Select[4] Driver in = 2.0 V Receiver in = 4.75 V	—	60	µA	
Low-level output leakage current	I_{OZL}	Enable/Select[1] Driver in = 0.8 V Driver out = 0.4 V V_{CC} = 5.25 V	—	−85	mA	C8
		Enable/Select[5] Driver in = 2.0 V Driver out = 0.4 V V_{CC} = 5.25 V	—	−85	mA	
Low-level output voltage	V_{OL}	Enable/Select[5] Driver in = 2.0 V Driver out = 100 mA V_{CC} = 4.75 V	—	0.7	V	C9
		Driver out = 130 mA	—	0.75	V	
Low-level input current	I_{IL}	Enable/Select[6] Driver in = 0.4 V Receiver in = 0.8 V V_{CC} = 5.25 V	—	−1.6	mA	C5

Parameter	Symbol	Test Condition	Requirements Min.	Max.	Units	Test Circuit
High-level input voltage	V_{IH}	[8]	2.0	—	V	C1,C2
Low-level input voltage	V_{IL}	[8]	—	0.8	V	C1,C2

[1]Enable = 0.8 V, Select = 0.8 V
[2]Enable = 2.0 V, Select = 2.0 V
[3]Enable = 5.5 V, Select = 5.5 V
[4]Enable = 2.0 V, Select = 2.4 V
[5]Enable = 0.8 V, Select = 2.0 V
[6]Enable = 0.4 V, Select = 0.4 V
[7]I_{IH} total consists of 40 μA (maximum) and I_{OZ} 20 μA (maximum) leakage current in the high-impedance state.
[8]Applies to all possible combinations of V_{IH} and V_{IL} at 0.8 V or 2.0 V

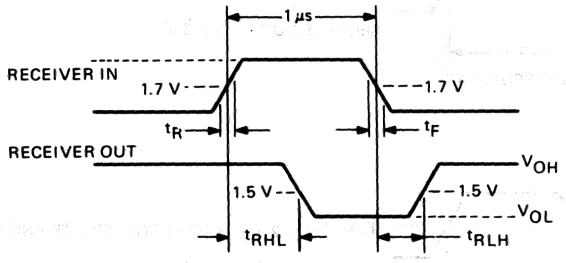
Table 5 • DC021 Enable and Select Input dc Parameters

Parameter	Symbol	Test Condition	Requirements Min.	Max.	Units	Test Circuit
High-level input voltage	V_{IH}	Enable or Select input[1]	2.0	—	V	C1,C2
Low-level input voltage	V_{IL}	Enable or Select input[1]	—	0.8	V	C1,C2
High-level input current	I_{IH}	V_{CC} = 5.25 V Enable = 2.4 V Enable input	—	80	mA	C4
		Enable = 5.5 V Enable input	—	100	mA	
		Select = 2.4 V Select Input	—	80	mA	
		Select = 5.5 V Select input	—	100	mA	
Low-level input current	I_{IL}	V_{CC} = 5.25 V Enable or Select input = 0.4 V	—	−0.4	mA	C5
Input diode-clamp voltage	V_I	V_{CC} = 5.0 V ±5%[2] Enable = − 18 mA Select = − 18 mA Driver in = − 18 mA	—	−1.2	V	C3

[1]Applies to all possible combinations of V_{IH} and V_{IL} at 0.8 V or 2.0 V.
[2]Ambient temperature is 25°C. One input at a time.

ac Electrical Characteristics

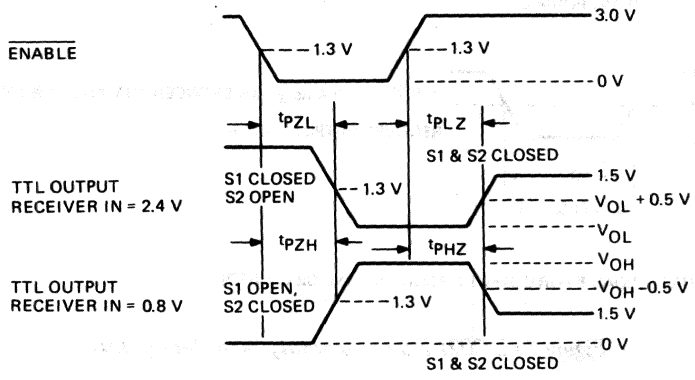
The propagation delays for the receiver input and output signals are listed in Table 6 and the waveforms referenced in the table are shown in Figures 3 and 4. The load circuits referenced in the table and used in the delay measurements are shown in Figure 8.



t_R AND t_F = 10 ns BETWEEN 10% AND 90% LEVELS.

REFER TO FIGURE 8, LOAD A FOR OUTPUT CIRCUIT.

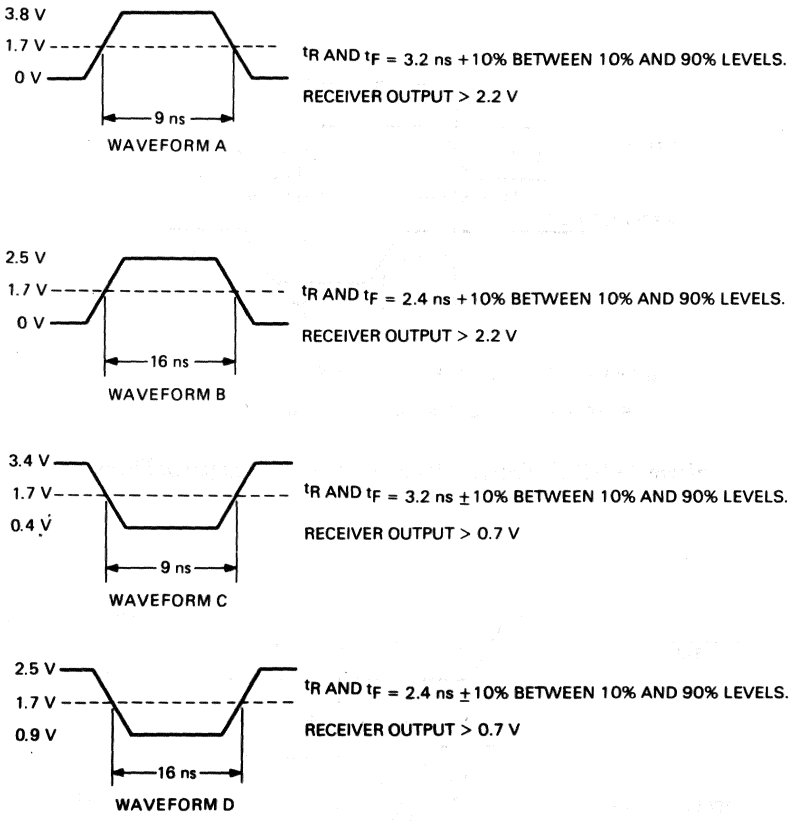
Figure 3 • DC021 Receiver Input to Output Propagation Delays



REFER TO FIGURE 8, LOAD B FOR OUTPUT CIRCUIT

Figure 4 • DC021 Receiver Enable and Disable Propagation Delays

The receiver input waveforms for the noise immunity test are shown in Figure 5. The values indicated are for no response at the output. The load circuit referenced in Figure 5 and used in the delay measurements is shown in Figure 8.



REFER TO FIGURE 8, LOAD B FOR OUTPUT CIRCUIT. (S1 AND S2 CLOSED)

Figure 5 • DC021 Noise Immunity Input Waveforms

Table 6 • DC021 Receiver ac Propagation Delays

Symbol	Voltage Waveform	Test Condition	Requirements Min.	Requirements Max.	Units	Load Circuit
t_{RLH}	Figure 3	V_{CC} = 4.75 V Enable = 0.8 V Select = 2.0 V V_{in} = 0.8 V to 2.6 V V_{in} = 1.2 V to 2.2 V	 — —	 35 39	 ns ns	Figure 8A
t_{RHL}	Figure 3	V_{CC} = 4.75 V Enable = 0.8 V Select = 2.0 V V_{in} = 0.8 V to 2.6 V V_{in} = 1.2 V to 2.2 V	 — —	 35 39	 ns ns	Figure 8A
t_{PZL}	Figure 4	V_{CC} = 4.75 V Enable = 0 V to 3.0 V Select = 2.0 V Receiver in = 2.2 V	 —	 37	 ns	Figure 8B
t_{PZH}	Figure 4	V_{CC} = 4.75 V Enable = 0 V to 3.0 V Select = 2.0 V Receiver in = 2.6 V	 —	 30	 ns	Figure 8B
t_{PLZ}	Figure 4	V_{CC} = 4.75 V Enable = 0 V to 3.0 V Select = 2.0 V Receiver in = 2.2 V	 —	 30	 ns	Figure 8B
t_{PHZ}	Figure 4	V_{CC} = 4.75 V Enable = 0 V to 3.0 V Select = 2.0 V Receiver in = 2.2 V	 —	 30	 ns	Figure 8B

The propagation delays for the input signals to output signals are listed in Table 7 and the delay waveforms referenced in the table are shown in Figures 6 and 7. The load circuit referenced in the table and used in the delay measurements are shown in Figure 8.

Table 7 • DC021 Driver ac Propagation Delays

Symbol	Voltage Waveform	Test Condition	Requirements Min.	Max.	Units	Load Circuit
t_{PLH}	Figure 6	V_{CC} = 4.75 V Select = 0.8 V Receiver in = 0.5 V	—	35	ns	Figure 8C
t_{PHL}	Figure 6	V_{CC} = 4.75 V Select = 0.8 V Receiver in = 2.4 V	—	35	ns	Figure 8C
t_{DLH}	Figure 7	V_{CC} = 4.75 V Enable = 0.8 V Select = 0.8 V	—	25	ns	Figure 8C
t_{DHL}	Figure 7	V_{CC} = 4.75 V Enable = 0.8 V Select = 0.8 V	—	25	ns	Figure 8C
t_R/t_F	Figure 7	[1]	8.0		ns	Figure 8C
C_{DO} [2]		0 V ≤ V_{DO} ≤ 4.0 V	—	20	pF	

[1] C_L = 15 pF including probe and jig capacitance.
[2] Driver output node capacitance.

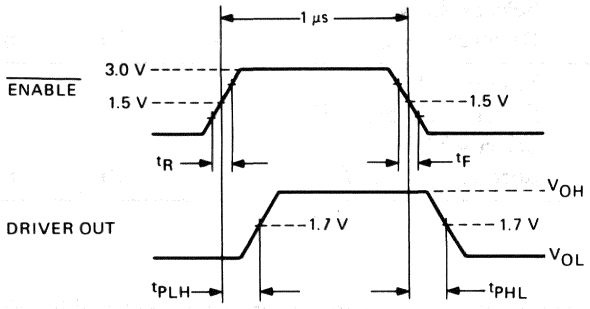
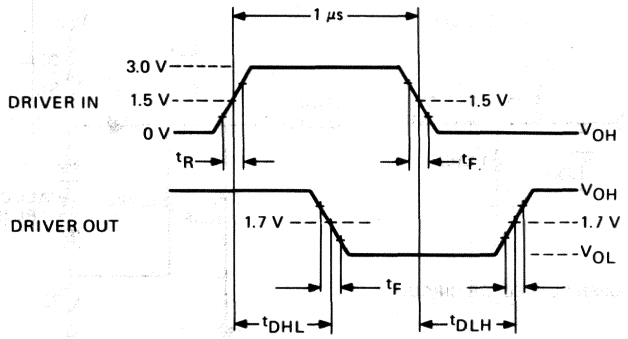


Figure 6 • DC021 Enable Input to Driver Output Propagation Delays



t_R AND t_F = 2.5 ns BETWEEN 10% AND 90% LEVELS.

REFER TO FIGURE 8, LOAD C FOR OUTPUT CIRCUIT.

Figure 7 • DC021 Driver Input-to-Output Propagation Delays

Table 8 lists the current requirements of the DC021 for various input signal conditions.

Table 8 • DC021 Current Requirements

Test Condition*	Function	Requirements Min.	Requirements Max.	Units
Select = 0.8 V Enable = 0.8 V Driver in = 3.0 V	TTL-to-bus	—	240	mA
Select = 0.8 V Enable = 0.8 V Driver in = 0 V	TTL-to-bus	—	150	mA
Select = 2.0 V Enable = 0.8 V Receiver in = 2.4 V	bus-to-TTL	—	165	mA
Select = 2.0 V Enable = 0.8 V Receiver in = 0.5 V	bus-to-TTL	—	110	mA
Select = 2.0 V Enable = 2.0 V Receiver in = 2.4 V Driver in = 0.8 V	disabled	—	165	mA

*V_{cc} = 5.25 V

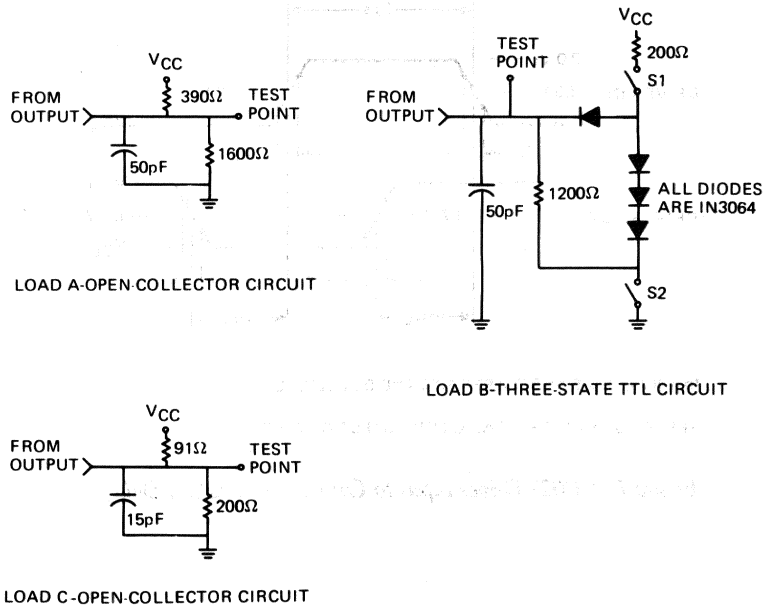


Figure 8 ▪ DC021 Output Load Circuits

Mechanical Configuration

The physical dimensions of the DC021 20-pin DIP are shown in Appendix E.