

DIO74134

1-Bit Unidirectional Voltage-Level Translator

Features

- Operating VCC Range : 1.08V to 3.6V
- Balanced Propagation Delays: $t_{PLH} = t_{PHL}$ (1.8V to 3.3V Translation Typical)
- Output Drive current: $\pm 6\text{mA}$ at 3V
- Low Static-Power Consumption: Maximum of $20\mu\text{A}$ ICC
- Supports Partial Power-Down-Mode Operation
- VCC Isolation Feature: If V_{CCA} Input is at GND, B Port Is in the High-Impedance state
- Input Hysteresis Allows Slow Input Transition and Better Switching Noise Immunity at Input
- Packaged in SC70-5, DFN1.45*1-6 and DFN1*1-6

Descriptions

DIO74134 is a 1-bit level conversion device with two independent configurable power rails. As a uni-directional translator from A to B, the A port is designed to track V_{CCA} , and the B port is designed to track V_{CCB} . Both V_{CCA} and V_{CCB} accept a power supply voltage of 1.08V to 3.6V. This allows for low-voltage translation between 1.08V, 1.2V, 1.5V, 1.8V, 2.5V, and 3.3V Voltage nodes. Also DIO74134 is fully designated for partial power-off applications using I_{off} . The I_{off} circuit disables the output, preventing destructive current flow back when the device is powered off.

The VCC isolation feature ensures that if V_{CCA} input is at GND, the B port is in the high-impedance state. If V_{CCB} input is at GND, any input to the A side will not cause the leakage current even floating.

Applications

- Enterprise
- Industrial
- Personal Electronics
- Telecommunications

Ordering Information

Order Part Number	Top Marking		T_A	Package	
DIO74134SC5	YW3D	Green	-40 to 105°C	SC70-5	Tape & Reel, 3000
DIO74134QN6	W3D	Green	-40 to 105°C	DFN1.45*1-6	Tape & Reel, 5000
DIO74134TN6	WF	Green	-40 to 105°C	DFN1*1-6	Tape & Reel, 5000

Pin Assignment

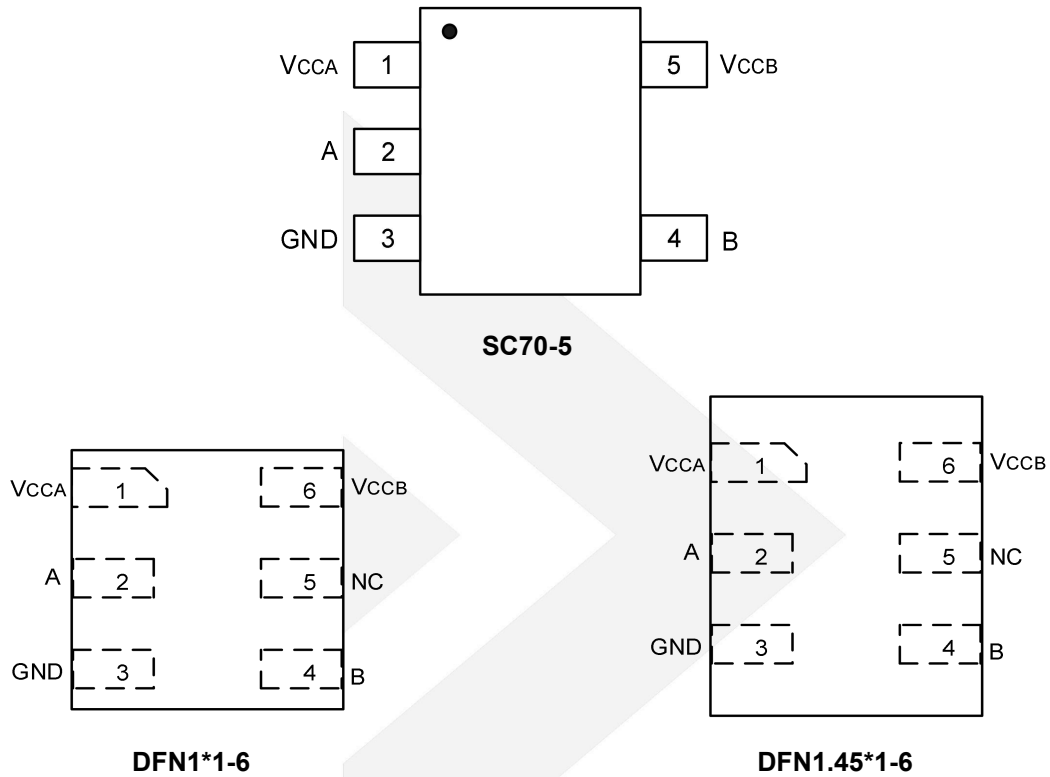


Figure 1. Top View

Pin Descriptions

Name	I/O	Description
A	I	Input Port
B	O	Output Port
GND	/	Ground
V _{CCA}	/	Input Port DC Power Supply
V _{CCB}	/	Output Port DC Power Supply
NC	/	No Connect. Leave floating.

Absolute Maximum Ratings

Stresses beyond those listed under “Absolute Maximum Rating” may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other condition beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Rating	Unit
V_{CCA}, V_{CCB}	Supply Voltage	-0.3 to 4	V
V_I	Input Voltage	-0.5 to 4.6	V
V_O	Voltage applied to any output in the high-impedance or power-off state	-0.5 to 4.6	V
V_O	Voltage applied to any output in the high or low state	-0.5 to 4.6	V
I_{IK}	Input clamp current, $V_I < 0V$	-50	mA
I_{OK}	Output clamp current, $V_O < 0V$	-50	mA
I_O	Continuous output current	± 50	mA
Continuous current through V_{CCA} or GND		± 100	mA
T_{stg}	Storage temperature	-65 to 150	°C
T_J	Operating junction temperature	150	°C
ESD	Human Body Mode	8000	V
	Latch-up	400	mA

Recommend Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended Operating conditions are specified to ensure optimal performance to the datasheet specifications. DIOO does not Recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	V_{CCA}	V_{CCB}	Min.	Typ.	Max.	Unit
V_{CCA}	Supply Voltage			1.08		3.6	V
V_{CCB}	Supply Voltage			1.08		3.6	V
V_{IH}	High-level input Voltage	1.08V to 1.95V	1.08V to 3.6V	0.65* V_{CCA}			V
		2.3V to 2.7V	1.08V to 3.6V	1.6			
		3V to 3.6V	1.08V to 3.6V	2			
V_{IL}	Low-level input Voltage	1.08V to 1.95V	1.08V to 3.6V			0.35* V_{CCA}	V
		2.3V to 2.7V	1.08V to 3.6V			0.7	
		3V to 3.6V	1.08V to 3.6V			0.9	
$\Delta t/\Delta v$	Input transition rise or fall rate	3V to 3.6V	1.08V to 3.6V			200	ns/V
T_A	Operating free-air temperature			-40		105	°C

DC Electrical Characteristics

$T_A = -40^{\circ}\text{C}$ to 105°C , $1.08\text{V} \leq V_{CCA} \leq 3.6\text{V}$, $1.08\text{V} \leq V_{CCB} \leq 3.6\text{V}$; (unless otherwise noted)

Symbol	Parameter	Conditions	VCCA	VCCB	Min.	Typ.	Max.	Unit
V_{OH}	High-level output Voltage	$V_I = V_{IH}$ $I_{OH} = -100\mu\text{A}$	1.08V to 3.6V	1.08V to 3.6V	$V_{CCB} - 0.2$			V
		$V_I = V_{IH}$ $I_{OH} = -0.25\text{mA}$	1.08V	1.08V	$0.75 * V_{CCB}$			V
		$V_I = V_{IH}$ $I_{OH} = -1.5\text{mA}$	1.2V	1.2V	1			V
		$V_I = V_{IH}$ $I_{OH} = -2\text{mA}$	1.65V	1.65V	1.32			V
		$V_I = V_{IH}$ $I_{OH} = -3\text{mA}$	2.3V	2.3V	1.9			V
		$V_I = V_{IH}$ $I_{OH} = -6\text{mA}$	3V	3V	2.72			V
V_{OL}	Low-level output Voltage	$V_I = V_{IL}$ $I_{OL} = 100\mu\text{A}$	1.08V to 3.6V	1.08V to 3.6V			0.1	V
		$V_I = V_{IL}$ $I_{OL} = 0.25\text{mA}$	1.08V	1.08V			0.1	V
		$V_I = V_{IL}$ $I_{OL} = 1.5\text{mA}$	1.2V	1.2V			$0.3 * V_{CCB}$	V
		$V_I = V_{IL}$ $I_{OL} = 2\text{mA}$	1.65V	1.65V			0.31	V
		$V_I = V_{IL}$ $I_{OL} = 3\text{mA}$	2.3V	2.3V			0.31	V
		$V_I = V_{IL}$ $I_{OL} = 6\text{mA}$	3V	3V			0.31	V
I_I	Input leakage current	$V_I = V_{CCA}$ or GND	1.08V to 3.6V	1.08V to 3.6V			± 1	μA
I_{off}	Off-state current	A or B port	0V	0V to 3.6V			± 5	μA
		V_I or $V_O = 0$ to 3.6V	0V to 3.6V	0V			± 5	μA
$I_{CCA} + I_{CCB}$	Combined supply current	$V_I = V_{CC1}$ or GND, $I_O = 0$ mA	25°C	1.08V to 3.6V	1.08V to 3.6V		3.7	μA
			Full				20	μA
I_{CCA}	V_{CCA} supply current	$V_I = V_{CC1}$ or GND, $I_O = 0$ mA	1.08V to 3.6V	1.08V to 3.6V			5	μA
			1.08V to 3.6V	V_{CCA}			2	μA
			0V	0V to 3.6V			1	μA
			0V to 3.6V	0V			1	μA

I _{CCB}	V _{CCB} supply current	V _I = V _{CC1} or GND, I _O = 0 mA	25°C	1.08V to 3.6V	1.08V to 3.6V			3.5	μA
			Full					20	μA
			25°C	1.08V to 3.6V	V _{CCA}			0.3	μA
			Full					20	μA
			25°C	0V	0V to 3.6V			0.3	μA
			Full					20	μA
			25°C	0V to 3.6V	0V			0.3	μA
			Full					1	μA
C _i	Input capacitance	V _I = 3.3V or GND	3.3V	3.3V			4	pF	
C _i	Input capacitance	V _I = 3.3V or GND	0V	3.3V			4	pF	
C _o	Output capacitance	V _O = 3.3V or GND	0V	3.3V			7	pF	

d i o o

AC Electrical Characteristics

$T_A = -40^{\circ}\text{C}$ to 105°C , $1.08\text{V} \leq V_{CCA} \leq 3.6\text{V}$, $1.08\text{V} \leq V_{CCB} \leq 3.6\text{V}$; (unless otherwise noted). The max value of the item is guaranteed by design.

Symbol	Parameter	Conditions	VCCA	VCCB	Min	Typ	Max	Unit	
$T_{PLH}/$ T_{PHL}	Propagation delay time low-to-high output /high-to-low output	$C_L = 5\text{pF}$	1.08V	1.08V		17.5		ns	
				1.2V		13.4			
				1.65V		10.1			
				2.3V		8.8			
				3V		8.4			
			1.2V	1.08V			24.6		
				1.2V			17.3		
				1.65V			11.1		
				2.3V			9.3		
				3V			8.8		
			1.65V	1.08V			23.1		
				1.2V			15.8		
				1.65V			9.6		
				2.3V			7.8		
				3V			7.1		
			2.3V	1.08V			22.5		
				1.2V			15.2		
				1.65V			9.1		
				2.3V			7.1		
				3V			6.4		
3V	1.08V			22.3					
	1.2V			14.7					
	1.65V			8.8					
	2.3V			6.9					
	3V			6.2					

AC Electrical Characteristics (continued)

$T_A = -40^{\circ}\text{C}$ to 105°C , $1.08\text{V} \leq V_{CCA} \leq 3.6\text{V}$, $1.08\text{V} \leq V_{CCB} \leq 3.6\text{V}$; (unless otherwise noted). The max value of the item is guaranteed by design.

Symbol	Parameter	Conditions	VCCA	VCCB	Min	Typ	Max	Unit	
$T_{PLH}/$ T_{PHL}	Propagation delay time low-to-high output /high-to-low output	$C_L = 10\text{pF}$	1.08V	1.08V		18.1		ns	
				1.2V		13.8			
				1.65V		10.4			
				2.3V		9.1			
				3V		8.5			
			1.2V	1.08V			25.6		
				1.2V			18.1		
				1.65V			11.5		
				2.3V			9.5		
				3V			8.9		
			1.65V	1.08V					24.2
				1.2V					16.5
				1.65V			10.1		
				2.3V			7.9		
				3V			7.3		
			2.3V	1.08V					23.6
				1.2V					15.9
				1.65V			9.3		
				2.3V			7.3		
				3V			6.6		
3V	1.08V				23.4				
	1.2V				15.8				
	1.65V			9.1					
	2.3V			7.1					
	3V			6.3					

AC Electrical Characteristics (continued)

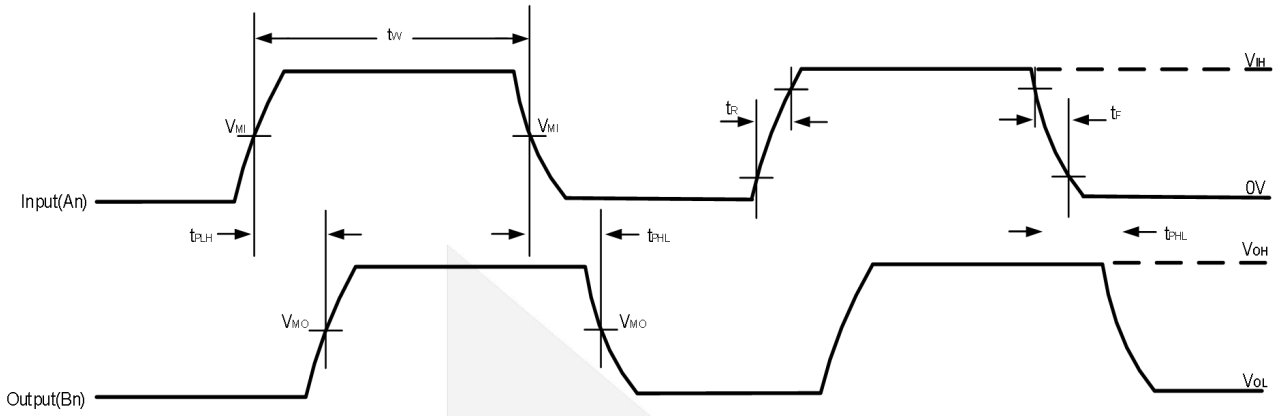
$T_A = -40^{\circ}\text{C}$ to 105°C , $1.08\text{V} \leq V_{CCA} \leq 3.6\text{V}$, $1.08\text{V} \leq V_{CCB} \leq 3.6\text{V}$; (unless otherwise noted). The max value of the item is guaranteed by design.

Symbol	Parameter	Conditions	VCCA	VCCB	Min	Typ	Max	Unit	
$T_{PLH}/$ T_{PHL}	Propagation delay time low-to-high output /high-to-low output	$C_L = 15\text{pF}$	1.08V	1.08V		18.4		ns	
				1.2V		14.1			
				1.65V		10.6			
				2.3V		9.1			
				3V		8.6			
			1.2V	1.08V			26.6		
				1.2V			18.6		
				1.65V			11.8		
				2.3V			9.6		
				3V			9.1		
			1.65V	1.08V					25.2
				1.2V					17.1
				1.65V			10.2		
				2.3V			8.1		
				3V			7.4		
			2.3V	1.08V					24.5
				1.2V					16.5
				1.65V			9.6		
				2.3V			7.5		
				3V			6.7		
3V	1.08V				24.4				
	1.2V				16.3				
	1.65V			9.4					
	2.3V			7.2					
	3V			6.5					

AC Electrical Characteristics (continued)

$T_A = -40^{\circ}\text{C}$ to 105°C , $1.08\text{V} \leq V_{CCA} \leq 3.6\text{V}$, $1.08\text{V} \leq V_{CCB} \leq 3.6\text{V}$; (unless otherwise noted). The max value of the item is guaranteed by design.

Symbol	Parameter	Conditions	VCCA	VCCB	Min	Typ	Max	Unit	
$T_{PLH}/$ T_{PHL}	Propagation delay time low-to-high output /high-to-low output	$C_L = 30\text{pF}$	1.08V	1.08V		19.6			
				1.2V		15.1			
				1.65V		11.3			
				2.3V		9.6			
				3V		9.1			
			1.2V	1.08V			29.5		
				1.2V			20.2		
				1.65V			15.6		
				2.3V			10.1		
				3V			9.4		
			1.65V	1.08V			28.1		
				1.2V			18.8		
				1.65V			11.1		
				2.3V			8.5		
				3V			7.7		
			2.3V	1.08V			27.5		
				1.2V			18.1		
				1.65V			10.4		
				2.3V			7.9		
				3V			7.1		
3V	1.08V			27.3					
	1.2V			18.1					
	1.65V			10.2					
	2.3V			7.7					
	3V			6.8					

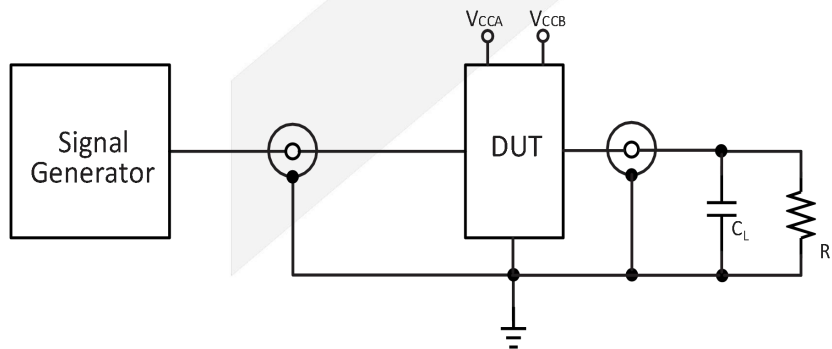


$V_{MI} = V_{IH}/2; V_{MO} = (V_{OH} + V_{OL})/2$

$t_R = t_F = 2.0ns, 10\% \text{ to } 90\%; f = 1MHz; t_W = 500ns$

Figure 2. Waveform 1 – Propagation Delays

Parameter Measurement Information



$C_L = 5 \text{ pF}, 10\text{pF}, 15\text{pF}, 30\text{pF}$ loading (includes probe and jig capacitance) $R_L = 1M\Omega$ or equivalent

Z_{OUT} of signal generator = 50Ω

Figure 3. AC (Propagation Delay, t_{PLH} , t_{PHL}) Test Circuit

Block Diagram

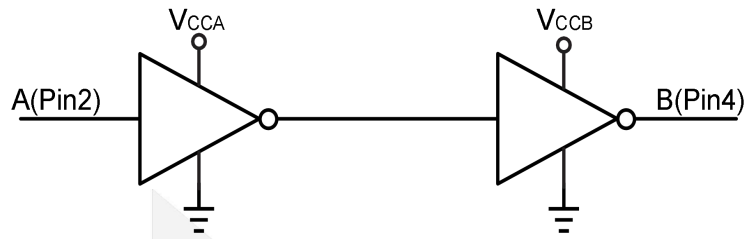


Figure 4. Block Diagram

Typical Applications

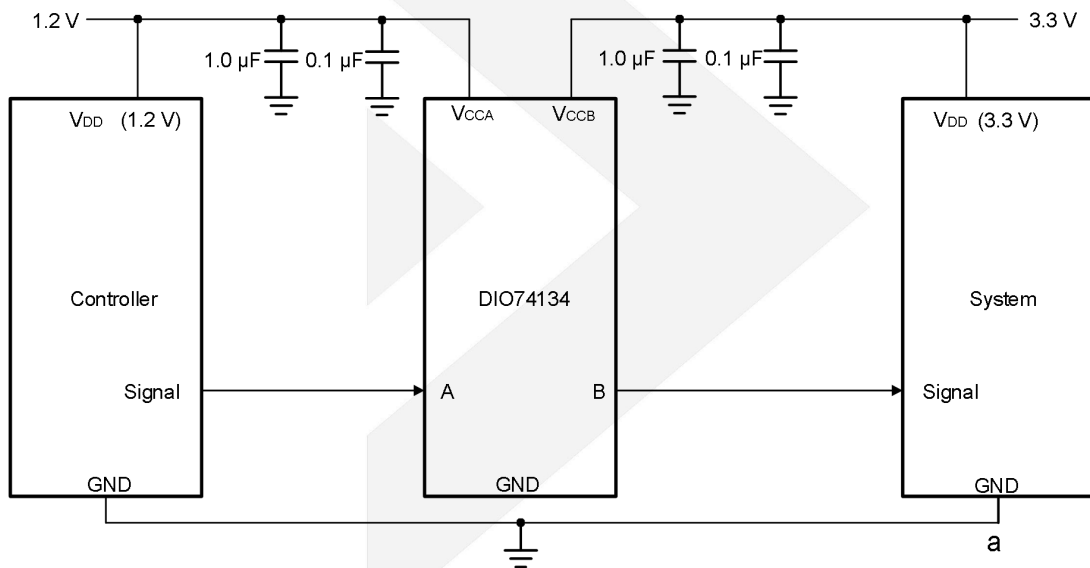


Figure 5. Typical Application Example

Application Information

The DIO74134 can be used in level conversion applications for interfacing devices or systems operating under different interface voltages.

Design Requirements

Table 1 lists the design requirements of the DIO74134.

Table 1. Design Parameters

DESIGN PARAMETER	EXAMPLE VALUE
Input Voltage Range	1.08V to 3.6V
Output Voltage Range	1.08V to 3.6V

Detailed Design Procedure

To begin the design process, determine the following:

- Input voltage range
Use the power supply voltage of the device driving the DIO74134 device to determine the input voltage range. For a valid logic-high, the value must exceed the V_{IH} of the input port. For a valid logic low the value must be less than the V_{IL} of the input port.
- Output Voltage range
Use the power supply voltage of the device driven by the DIO74134 device to determine the output voltage range.

Detailed Description

Overview

The DIO74134 is a unidirectional, single-bit, dual-supply, noninverting Voltage-level translator. Refer to the pin A of V_{CCA} to receive the signal that will be translated. Refer to the pin B of V_{CCB} to receive the signal that will be translated. Both supply pins V_{CCA} and V_{CCB} support a Voltage range from 1.08V to 3.6V.

Fully Configurable Dual-Rail Design

Both V_{CCA} and V_{CCB} can be power at any Voltage from 1.08V to 3.6V, making the device suitable for switching between any of the Voltage nodes (1.08V, 1.2V, 1.8V, 2.5V, and 3.3V).

Partial-Power-Down Mode Operation

The I_{off} circuit disables the output, preventing destructive current flow back when the device is powered off. This may happen in applications where the system is partially powered down to reduce power consumption.

VCC Isolation

The VCC isolation feature ensures that if either V_{CCA} or V_{CCB} are at GND (or $< 0.4V$), both ports A and B are set to a high-impedance state, thereby preventing the wrong logic level from appearing on any bus.

Device Functional Modes

Table 2 lists the functional modes of the DIO74134.

Table 2. Function Table

INPUT	OUTPUT
A PORT	B PORT
L	L
H	H

Power Supply Recommendations

Connect ground before applying either V_{CCA} or V_{CCB} . There is no specific power sequence requirement for the DIO74134. V_{CCA} or V_{CCB} may be powered up first, and V_{CCA} or V_{CCB} may be powered down first.



CONTACT US

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