1-Bit Unidirectional Voltage-Level Translator

Check for Samples: SN74AUP1T34-Q1

FEATURES

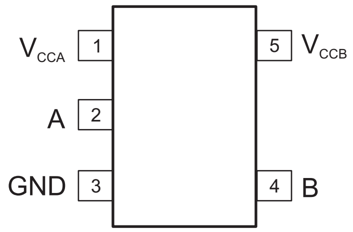
- **Qualified for Automotive Applications**
  - **AEC-Q100 Qualified**
  - **Device Temperature Grade 1: –40°C to 125°C Ambient Operating Temperature**
  - **Device HBM ESD Classification Level 3A**
  - **Device CDM ESD Classification Level C4B**
- **Wide Operating VCC Range of 0.9 V to 3.6 V**
- **Balanced Propagation Delays: $t_{PLH} = t_{PHL}$ (1.8 V to 3.3 V Translation Typical)**
- **Low Static-Power Consumption, 5 μA Max ICC**
- **±6 mA Output Drive at 3 V**
- **I_{off} 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**
- **ESD Protection Exceeds JESD 22**
- **5000-V Human-Body Model (A114-A)**
- **Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II**

DESCRIPTION

The SN74AUP1T34-Q1 is a 1-bit non-inverting translator that uses two separate configurable power-supply rails. It is a uni-directional translator from A to B. The A port is designed to track V_{CCA}. V_{CCA} accepts supply voltages from 0.9 V to 3.6 V. The B port is designed to track V_{CCB}. V_{CCB} accepts supply voltages from 0.9 V to 3.6 V. This allows for low-voltage translation between 1-V, 1.2-V, 1.5-V, 1.8-V, 2.5-V, and 3.3-V voltage nodes. The SN74AUP1T34-Q1 is also fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

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 does not cause the leakage current even floating.

DCK PACKAGE (TOP VIEW)



Ordering Information

For package and ordering information, see the Package Option Addendum at the end of this document.

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

Pin Functions

PIN	FUNCTION
VCCA	Input Port DC Power Supply
VCCB	Output Port DC Power Supply
GND	Ground
A	Input Port
B	Output Port

Function Table

INPUT	OUTPUT
A PORT	**B PORT**
L	L
H	H

Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)

			MIN	MAX	UNIT
V_{CCA}, V_{CCB}	Supply voltage range		–0.3	4.0	V
V_I	Input voltage range		–0.5	4.6	V
			–0.5	4.6	
			–0.5	4.6	
V_O	Voltage range applied to any output in the high-impedance or power-off state		–0.5	4.6	V
			–0.5	4.6	
	Voltage range applied to any output in the high or low state		–0.5	4.6	V
			–0.5	4.6	
I_{IK}	Input clamp current	$V_I < 0$		–50	mA
I_{OK}	Output clamp current	$V_O < 0$		–50	mA
I_O	Continuous output current			±50	mA
	Continuous current through VCCA or GND			±100	mA
T_{stg}	Storage temperature range		–65	150	°C
ESD	Electrostatic discharge (ESD) ratings	Human Body Model (HBM), Classification 3A		5	kV
		Charged Device Model (CDM), Classification C4B		750	V

Thermal Information

THERMAL METRIC[1]		SN74AUP1T34-Q1	UNITS
		DCK	
		5 PINS	
θ_{JA}	Junction-to-ambient thermal resistance	301.9	°C/W
θ_{JCtop}	Junction-to-case (top) thermal resistance	113.0	
θ_{JB}	Junction-to-board thermal resistance	79.1	
ψ_{JT}	Junction-to-top characterization parameter	3.9	
ψ_{JB}	Junction-to-board characterization parameter	78.3	
θ_{JCbot}	Junction-to-case (bottom) thermal resistance	n/a	

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, SPRA953.

Recommended Operating Conditions

		VCCA	VCCB	MIN	MAX	UNIT
V_{CCA}, V_{CCB}	Supply voltage			0.9	3.6	V
V_{IH}	High-level input voltage	0.9 to 1.95V	0.9 to 1.95V	0.65 x V_{CCA}		V
		2.3 to 2.7V	0.9 to 3.6V	1.6		
		3.0 to 3.6V	0.9 to 3.6V	2		
V_{IL}	Low-level input voltage	0.9 V	0.9 to 1.95V		0.3 x V_{CCA}	V
		1 to 1.95V	0.9 to 1.95V		0.35 x V_{CCA}	
		2.3 to 2.7V	0.9 to 3.6V		0.7	
		3.0 to 3.6V	0.9 to 3.6V		0.9	
Δt/Δv	Input transition rise or fall rate	3.0 to 3.6V	0.9 to 3.6V		200	ns/V
T_A	Operating free-air temperature			–40	125	°C

Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		VCCA	VCCB	MIN	MAX	UNIT
V_{OH}		I_{OH} = –100 µA	$V_I = V_{IH}$	0.9 V to 3.6 V	0.9 V to 3.6 V	VCCB – 0.2		V
		I_{OH} = –0.25 mA		0.9 V 1V	0.9 V 1V	0.75 x VCCB		
		I_{OH} = –1.5 mA		1.2 V	1.2 V	1.0		
		I_{OH} = –2 mA		1.65 V	1.65 V	1.32		
		I_{OH} = –3 mA		2.3 V	2.3 V	1.9		
		I_{OH} = –6 mA		3 V	3 V	2.72		
V_{OL}		I_{OL} = 100 µA	$V_I = V_{IL}$	0.9 V to 3.6 V	0.9 V to 3.6 V		0.1	V
		I_{OL} = 0.25 mA		0.9 V 1V	0.9 V 1V		0.1	
		I_{OL} = 1.5 mA		1.2 V	1.2 V		0.3 x VCCB	
		I_{OL} = 2 mA		1.65 V	1.65 V		0.31	
		I_{OL} = 3 mA		2.3 V	2.3 V		0.31	
		I_{OL} = 6 mA		3 V	3 V		0.31	
I_I	Control inputs	V_I = VCCA or GND		0.9 V to 3.6 V	0.9 V to 3.6 V		±1	µA
I_{off}	A or B port	VI or VO = 0 to 3.6 V		0 V	0 V to 3.6 V		±5	µA
				0 V to 3.6 V	0 V		±5	
I_{CCA}		VI = VCCI or GND, IO = 0		0.9 V to 3.6 V	0.9 V to 3.6 V		5	µA
				0.9 V to 3.6 V	VCCA		2	
				0 V	0 V to 3.6 V		1	
				0 V to 3.6 V	0 V		1	
I_{CCB}		VI = VCCI or GND, IO = 0		0.9 V to 3.6 V	0.9 V to 3.6 V		5	µA
				0.9 V to 3.6 V	VCCA		2	
				0 V	0 V to 3.6 V		1	
				0 V to 3.6 V	0 V		1	
$I_{CCA} + I_{CCB}$		VI = VCCI or GND, IO = 0		0.9 V to 3.6 V	0.9 V to 3.6 V		5.2	µA
C_i	Control inputs	VI = 3.3 V or GND		3.3 V	3.3 V		4	pF
C_{io}	A or B port	VO = 3.3 V or GND		0 V	3.3 V		7	pF

AC Electrical Characteristics

over operating free-air temperature range (unless otherwise noted)

PARAMETER	C_L	VCCA	VCCB = 0.9 V		VCCB = 1.2 V		VCCB = 1.65 V		VCCB = 2.3 V		VCCB = 3 V		UNIT
			TYP	MAX	TYP	MAX	TYP	MAX	TYP	MAX	TYP	MAX	
t_{PLH}/t_{PHL}	5 pF	0.9V	25		18		16.2		16.3		16.8		ns
	5 pF	1.2V		42.5		24.9		23.2		22.6		22.5	
	5 pF	1.65V		40		10.7		8.84		8.08		7.88	
	5 pF	2.3V		41.3		8.02		5.73		4.92		4.2	
	5 pF	3V		42.5		7.61		4.5		3.65		3.39	
t_{PLH}/t_{PHL}	10 pF	0.9V	28.9		19.8		17.9		18.0		18.5		ns
	10 pF	1.2V		43.22		12.33		9.57		8.81		8.61	
	10 pF	1.65V		40.44		9.21		6.57		5.5		4.73	
	10 pF	2.3V		41.56		8.3		5.54		4.42		4.01	
	10 pF	3V		42.81		7.87		4.55		3.8		3.36	
t_{PLH}/t_{PHL}	15 pF	0.9V	30.6		21.6		19.6		19.7		20.3		ns
	15 pF	1.2V		43.87		12.98		10.3		9.54		9.34	
	15 pF	1.65V		40.78		9.59		6.95		5.87		5.07	
	15 pF	2.3V		41.79		8.55		5.8		4.68		4.27	
	15 pF	3V		43.09		8.16		4.84		4.09		3.65	
t_{PLH}/t_{PHL}	30 pF	0.9V	32.1		21.3		18.7		18		18.3		ns
	30 pF	1.2V		45.65		14.76		12.37		11.61		11.41	
	30 pF	1.65V		41.72		10.65		8.01		6.94		5.99	
	30 pF	2.3V		42.44		9.26		6.51		5.39		4.97	
	30 pF	3V		43.69		8.8		5.48		4.72		4.28	

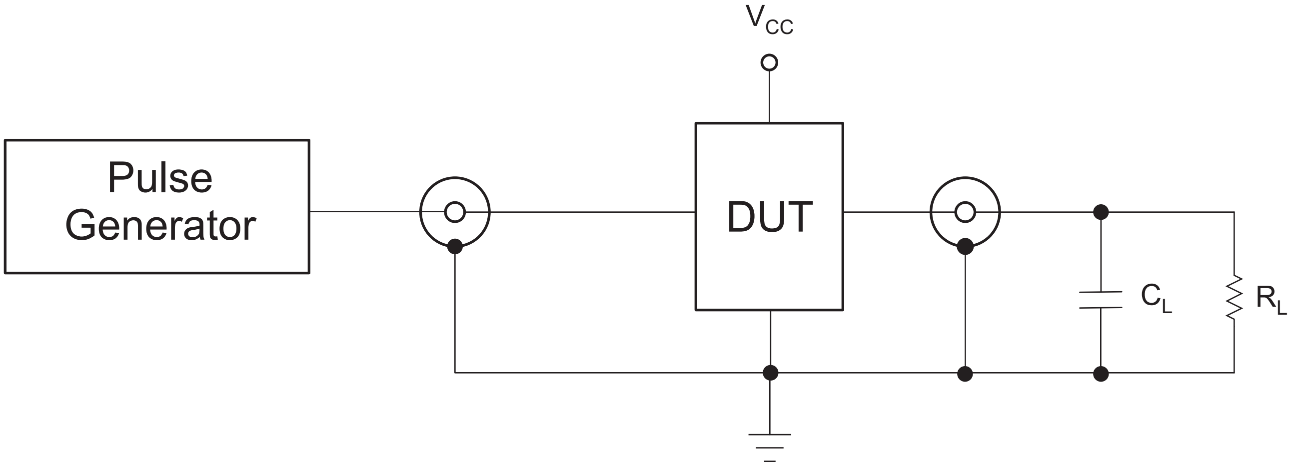
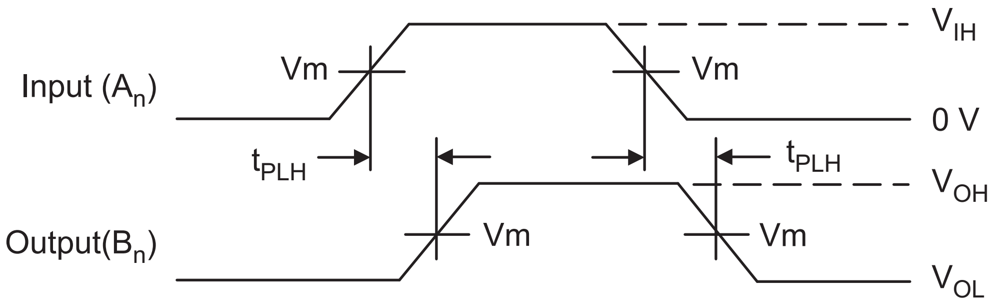


Figure 1. AC (Progagation Delay) Test Circuit

TEST
t_{PLH}, t_{PHL}
C_L = 5 pF, 10 pF, 15 pF, 30 pF or equivalent (includes probe and jig capacitance) R_L = 1 MΩ or equivalent Z_{OUT} of pulse generator = 50 Ω



V_{MI} =V_{IH}/2; V_{MO}= V_{CCB}/2

NOTE: t_R = t_F = 2.0 ns, 10% to 90%; f = 1 MHz; t_W = 500 ns

Figure 2. Waveform 1 - Propagation Delays

PRODUCT PREVIEW

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
SN74AUP1T34QDCKRQ1	PREVIEW	SC70	DCK	5	3000	TBD	Call TI	Call TI	-40 to 125		

[1] The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

[2] Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
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Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

[3] MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

[4] There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

[5] Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

[6] Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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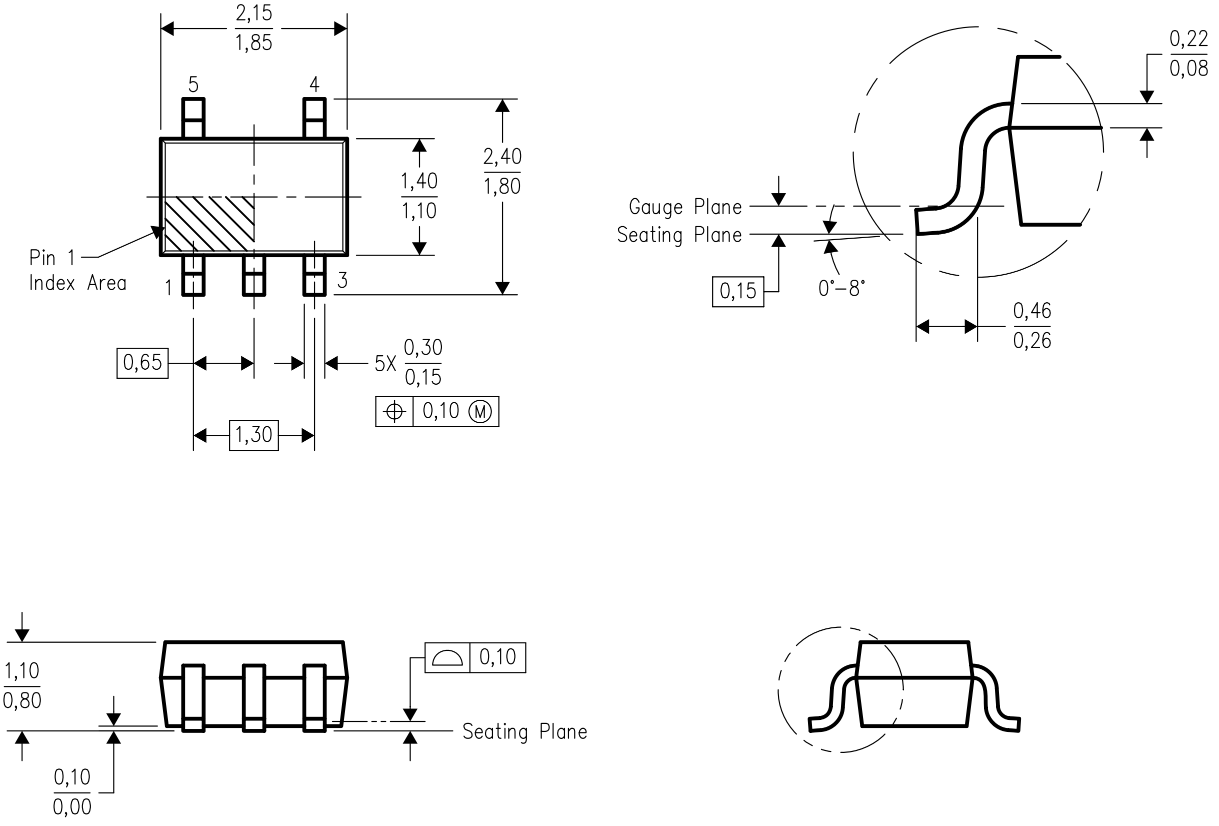
DCK (R-PDSO-G5) PLASTIC SMALL-OUTLINE PACKAGE



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NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
- D. Falls within JEDEC MO-203 variation AA.

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