

# 74VHC125FT,74VHC126FT

## 1. Functional Description

- Quad Bus Buffer, Non-Inverted 3-State Outputs
- 74VHC125FT: Quad Bus Buffer  
74VHC126FT: Quad Bus Buffer

## 2. General

The 74VHC125FT,74VHC126FT are high speed CMOS QUAD BUS BUFFERS fabricated with silicon gate CMOS technology.

They achieve the high speed operation similar to equivalent Bipolar Shottky TTL while maintaining the CMOS low power dissipation.

The 74VHC125FT requires the 3-state control input  $\overline{G}$  to be set high to place the output into the high impedance state, whereas the 74VHC126FT requires the control input G to be set low to place the output into high impedance.

An input protection circuit ensures that 0 to 5.5 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up.

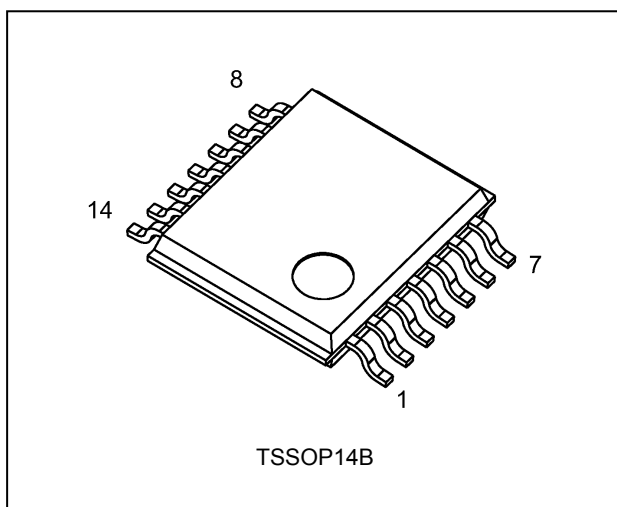
This circuit prevents device destruction due to mismatched supply and input voltages.

## 3. Features

- (1) AEC-Q100 (Rev. H) (Note 1)
- (2) Wide operating temperature:  $T_{opr} = -40$  to  $125$  °C
- (3) High speed: Propagation delay time = 3.8 ns (typ.) at  $V_{CC} = 5$  V
- (4) Low power dissipation:  $I_{CC} = 4.0$   $\mu$ A (max) at  $T_a = 25$  °C
- (5) High noise immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (min)
- (6) Power down protection is provided on all inputs.
- (7) Balanced propagation delays:  $t_{PLH} \approx t_{PHL}$
- (8) Wide operating voltage range:  $V_{CC(opr)} = 2.0$  V to 5.5 V
- (9) Low noise:  $V_{OLP} = 0.8$  V (max)
- (10) Pin and function compatible with 74 series (AC/HC/AHC/LV etc.) 125 or 126 type.

Note 1: This device is compliant with the reliability requirements of AEC-Q100. For details, contact your Toshiba sales representative.

## 4. Packaging

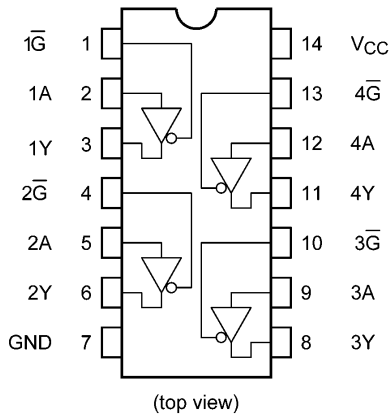


Start of commercial production

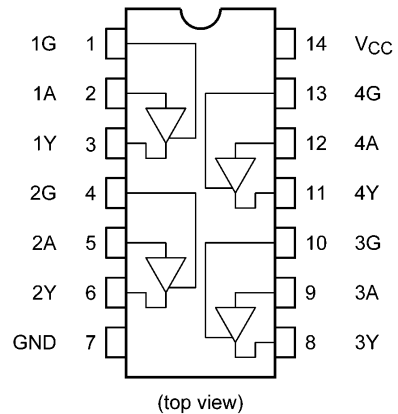
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**5. Pin Assignment**

74VHC125FT

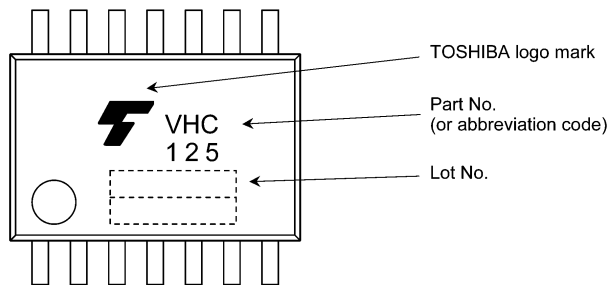


74VHC126FT

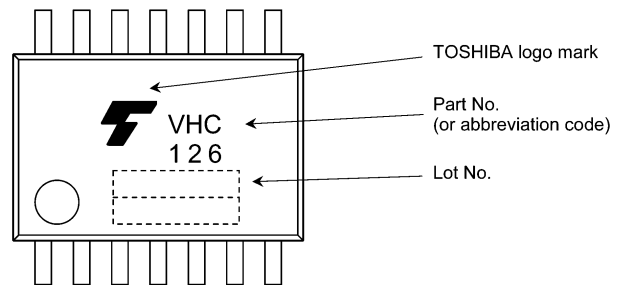


**6. Marking**

74VHC125FT

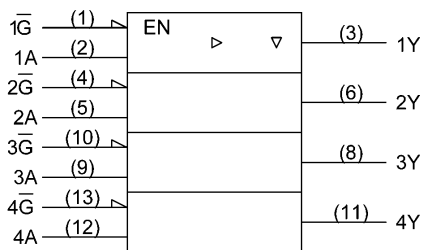


74VHC126FT

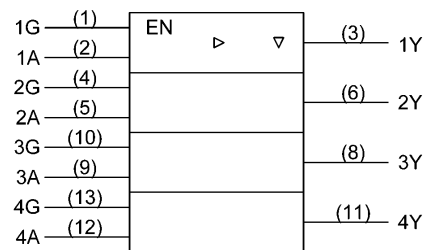


**7. IEC Logic Symbol**

74VHC125FT



74VHC126FT



**8. Truth Table**

Input $\bar{G}$ (74VHC125FT)	Input G (74VHC126FT)	Input An	Output Yn
H	L	X	Z
L	H	L	L
L	H	H	H

X: Don't care  
Z: High impedance

**9. Absolute Maximum Ratings (Note)**

Characteristics	Symbol	Note	Rating	Unit
Supply voltage	$V_{CC}$		-0.5 to 7.0	V
Input voltage	$V_{IN}$		-0.5 to 7.0	V
Output voltage	$V_{OUT}$		-0.5 to $V_{CC} + 0.5$	V
Input diode current	$I_{IK}$		-20	mA
Output diode current	$I_{OK}$		$\pm 20$	mA
Output current	$I_{OUT}$		$\pm 25$	mA
$V_{CC}$ /ground current	$I_{CC}$		$\pm 50$	mA
Power dissipation	$P_D$	(Note 1)	180	mW
Storage temperature	$T_{stg}$		-65 to 150	$^{\circ}C$

Note: Exceeding any of the absolute maximum ratings, even briefly, lead to deterioration in IC performance or even destruction.

Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: 180 mW in the range of  $T_a = -40$  to  $85^{\circ}C$ . From  $T_a = 85$  to  $125^{\circ}C$  a derating factor of  $-3.25$  mW/ $^{\circ}C$  shall be applied until 50 mW.

**10. Operating Ranges (Note)**

Characteristics	Symbol	Test Condition	Rating	Unit
Supply voltage	$V_{CC}$		2.0 to 5.5	V
Input voltage	$V_{IN}$		0 to 5.5	V
Output voltage	$V_{OUT}$		0 to $V_{CC}$	V
Operating temperature	$T_{opr}$		-40 to 125	$^{\circ}C$
Input rise and fall times	dt/dv	$V_{CC} = 3.3 \pm 0.3$ V	0 to 100	ns/V
		$V_{CC} = 5 \pm 0.5$ V	0 to 20	

Note: The operating ranges must be maintained to ensure the normal operation of the device. Unused inputs must be tied to either  $V_{CC}$  or GND.

**11. Electrical Characteristics**

**11.1. DC Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ )**

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Min	Typ.	Max	Unit	
High-level input voltage	$V_{IH}$	—	2.0	1.50	—	—	V	
			3.0 to 5.5	$V_{CC} \times 0.7$	—	—		
Low-level input voltage	$V_{IL}$	—	2.0	—	—	0.50	V	
			3.0 to 5.5	—	—	$V_{CC} \times 0.3$		
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50\text{ }\mu\text{A}$	2.0	1.9	2.0	—	V
				3.0	2.9	3.0	—	
				4.5	4.4	4.5	—	
			$I_{OH} = -4\text{ mA}$	3.0	2.58	—	—	
4.5	3.94	—		—				
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50\text{ }\mu\text{A}$	2.0	—	0.0	0.1	V
				3.0	—	0.0	0.1	
				4.5	—	0.0	0.1	
			$I_{OL} = 4\text{ mA}$	3.0	—	—	0.36	
				4.5	—	—	0.36	
3-state output OFF-state leakage current	$I_{OZ}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = V_{CC}$ or GND	5.5	—	—	$\pm 0.25$	$\mu\text{A}$	
Input leakage current	$I_{IN}$	$V_{IN} = 5.5\text{ V}$ or GND	0 to 5.5	—	—	$\pm 0.1$	$\mu\text{A}$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	4.0	$\mu\text{A}$	

**11.2. DC Characteristics (Unless otherwise specified,  $T_a = -40$  to  $85\text{ }^\circ\text{C}$ )**

Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Min	Max	Unit	
High-level input voltage	$V_{IH}$	—	2.0	1.50	—	V	
			3.0 to 5.5	$V_{CC} \times 0.7$	—		
Low-level input voltage	$V_{IL}$	—	2.0	—	0.50	V	
			3.0 to 5.5	—	$V_{CC} \times 0.3$		
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50\text{ }\mu\text{A}$	2.0	1.9	—	V
				3.0	2.9	—	
				4.5	4.4	—	
			$I_{OH} = -4\text{ mA}$	3.0	2.48	—	
4.5	3.80	—					
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50\text{ }\mu\text{A}$	2.0	—	0.1	V
				3.0	—	0.1	
				4.5	—	0.1	
			$I_{OL} = 4\text{ mA}$	3.0	—	0.44	
				4.5	—	0.44	
3-state output OFF-state leakage current	$I_{OZ}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = V_{CC}$ or GND	5.5	—	$\pm 2.50$	$\mu\text{A}$	
Input leakage current	$I_{IN}$	$V_{IN} = 5.5\text{ V}$ or GND	0 to 5.5	—	$\pm 1.0$	$\mu\text{A}$	
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	40.0	$\mu\text{A}$	

**11.3. DC Characteristics (Unless otherwise specified,  $T_a = -40$  to  $125$  °C)**

Characteristics	Symbol	Test Condition		$V_{CC}$ (V)	Min	Max	Unit
High-level input voltage	$V_{IH}$	—		2.0	1.50	—	V
				3.0 to 5.5	$V_{CC} \times 0.7$	—	
Low-level input voltage	$V_{IL}$	—		2.0	—	0.50	V
				3.0 to 5.5	—	$V_{CC} \times 0.3$	
High-level output voltage	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50$ $\mu$ A	2.0	1.9	—	V
				3.0	2.9	—	
				4.5	4.4	—	
				$I_{OH} = -4$ mA	3.0	2.40	
Low-level output voltage	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50$ $\mu$ A	2.0	—	0.1	V
				3.0	—	0.1	
				4.5	—	0.1	
				$I_{OL} = 4$ mA	3.0	—	
3-state output OFF-state leakage current	$I_{OZ}$	$V_{IN} = V_{IH}$ or $V_{IL}$ $V_{OUT} = V_{CC}$ or GND		5.5	—	$\pm 10.0$	$\mu$ A
Input leakage current	$I_{IN}$	$V_{IN} = 5.5$ V or GND		0 to 5.5	—	$\pm 2.0$	$\mu$ A
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND		5.5	—	80.0	$\mu$ A

**11.4. AC Characteristics (Unless otherwise specified,  $T_a = 25$  °C, Input:  $t_r = t_f = 3$  ns)**

Characteristics	Part Number	Symbol	Note	Test Condition	$V_{CC}$ (V)	$C_L$ (pF)	Min	Typ.	Max	Unit
Propagation delay time	74VHC125FT	$t_{PLH}, t_{PHL}$		—	$3.3 \pm 0.3$	15	—	5.6	8.0	ns
						50	—	8.1	11.5	
					$5.0 \pm 0.5$	15	—	3.8	5.5	
	74VHC126FT	$t_{PLH}, t_{PHL}$		—	$3.3 \pm 0.3$	15	—	5.6	8.0	ns
						50	—	8.1	11.5	
					$5.0 \pm 0.5$	15	—	3.8	5.5	
3-state output enable time		$t_{PZL}, t_{PZH}$		$R_L = 1$ k $\Omega$	$3.3 \pm 0.3$	15	—	5.4	8.0	ns
						50	—	7.9	11.5	
					$5.0 \pm 0.5$	15	—	3.6	5.1	
						50	—	5.1	7.1	
3-state output disable time		$t_{PLZ}, t_{PHZ}$		$R_L = 1$ k $\Omega$	$3.3 \pm 0.3$	50	—	9.5	13.2	ns
					$5.0 \pm 0.5$	50	—	6.1	8.8	
Output skew		$t_{oS LH}, t_{oS HL}$	(Note 1)	—	$3.3 \pm 0.3$	50	—	—	1.5	ns
					$5.0 \pm 0.5$	50	—	—	1.0	
Input capacitance		$C_{IN}$		—			—	4	10	pF
Output capacitance		$C_{OUT}$		—			—	6	—	pF
Power dissipation capacitance	74VHC125FT	$C_{PD}$	(Note 2)	—			—	14	—	pF
	74VHC126FT						—	15	—	

Note 1: Parameter guaranteed by design. ( $t_{oS LH} = |t_{PLHm} - t_{PLHn}|$ ,  $t_{oS HL} = |t_{PHLm} - t_{PHLn}|$ )

Note 2:  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation.

$$I_{CC(opr)} = C_{PD} \times V_{CC} \times f_{IN} + I_{CC}/4 \text{ (per gate)}$$

**11.5. AC Characteristics**

(Unless otherwise specified,  $T_a = -40$  to  $85$  °C, Input:  $t_r = t_f = 3$  ns)

Characteristics	Part Number	Symbol	Note	Test Condition	$V_{CC}$ (V)	$C_L$ (pF)	Min	Max	Unit
Propagation delay time	74VHC125FT	$t_{PLH}, t_{PHL}$		—	$3.3 \pm 0.3$	15	1.0	9.5	ns
						50	1.0	13.0	
					$5.0 \pm 0.5$	15	1.0	6.5	
						50	1.0	8.5	
	74VHC126FT	$t_{PLH}, t_{PHL}$		—	$3.3 \pm 0.3$	15	1.0	9.5	ns
						50	1.0	13.0	
					$5.0 \pm 0.5$	15	1.0	6.5	
						50	1.0	8.5	
3-state output enable time		$t_{PZL}, t_{PZH}$		$R_L = 1$ k $\Omega$	$3.3 \pm 0.3$	15	1.0	9.5	ns
						50	1.0	13.0	
					$5.0 \pm 0.5$	15	1.0	6.0	
						50	1.0	8.0	
3-state output disable time		$t_{PLZ}, t_{PHZ}$		$R_L = 1$ k $\Omega$	$3.3 \pm 0.3$	50	1.0	15.0	ns
					$5.0 \pm 0.5$	50	1.0	10.0	
Output skew		$t_{osLH}, t_{osHL}$	(Note 1)	—	$3.3 \pm 0.3$	50	—	1.5	ns
					$5.0 \pm 0.5$	50	—	1.0	
Input capacitance		$C_{IN}$		—			—	10	pF

Note 1: Parameter guaranteed by design. ( $t_{osLH} = |t_{PLHM} - t_{PLHN}|$ ,  $t_{osHL} = |t_{PHLM} - t_{PHLN}|$ )

**11.6. AC Characteristics**

(Unless otherwise specified,  $T_a = -40$  to  $125$  °C, Input:  $t_r = t_f = 3$  ns)

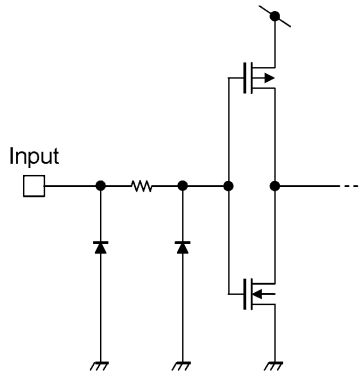
Characteristics	Part Number	Symbol	Note	Test Condition	$V_{CC}$ (V)	$C_L$ (pF)	Min	Max	Unit
Propagation delay time	74VHC125FT	$t_{PLH}, t_{PHL}$		—	$3.3 \pm 0.3$	15	1.0	11.0	ns
						50	1.0	14.5	
					$5.0 \pm 0.5$	15	1.0	7.5	
						50	1.0	9.5	
Propagation delay time	74VHC126FT	$t_{PLH}, t_{PHL}$		—	$3.3 \pm 0.3$	15	1.0	11.0	ns
						50	1.0	14.5	
					$5.0 \pm 0.5$	15	1.0	7.5	
						50	1.0	9.5	
3-state output enable time		$t_{PZL}, t_{PZH}$		$R_L = 1$ k $\Omega$	$3.3 \pm 0.3$	15	1.0	11.0	ns
						50	1.0	14.5	
					$5.0 \pm 0.5$	15	1.0	7.0	ns
						50	1.0	9.0	
3-state output disable time		$t_{PLZ}, t_{PHZ}$		$R_L = 1$ k $\Omega$	$3.3 \pm 0.3$	50	1.0	16.5	ns
					$5.0 \pm 0.5$	50	1.0	11.0	
Output skew		$t_{osLH}, t_{osHL}$	(Note 1)	—	$3.3 \pm 0.3$	50	—	1.5	ns
					$5.0 \pm 0.5$	50	—	1.0	
Input capacitance		$C_{IN}$		—			—	10	pF

Note 1: Parameter guaranteed by design. ( $t_{osLH} = |t_{PLHM} - t_{PLHN}|$ ,  $t_{osHL} = |t_{PHLM} - t_{PHLN}|$ )

**11.7. Noise Characteristics (Unless otherwise specified,  $T_a = 25\text{ }^\circ\text{C}$ , Input:  $t_r = t_f = 3\text{ ns}$ )**

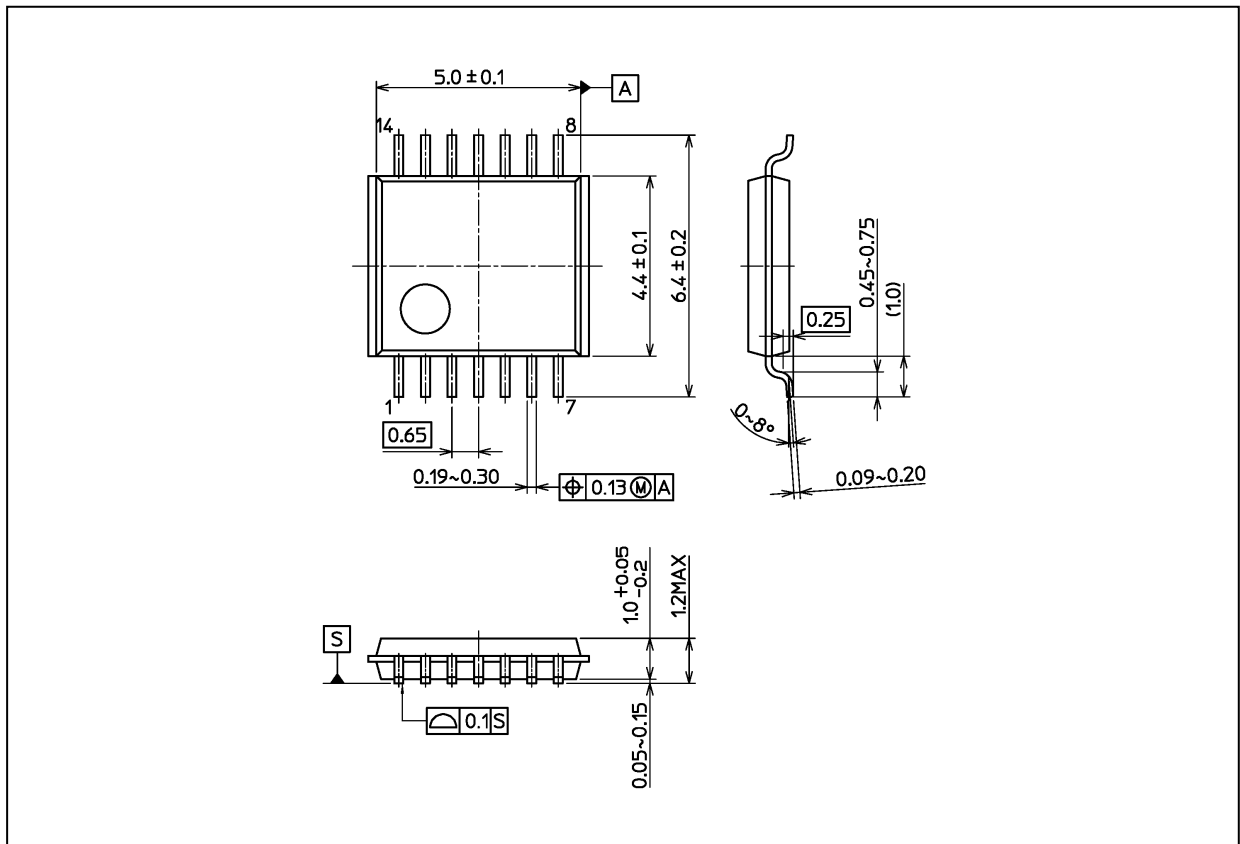
Characteristics	Symbol	Test Condition	$V_{CC}$ (V)	Typ.	Limit	Unit
Quiet output maximum dynamic $V_{OL}$	$V_{OLP}$	$C_L = 50\text{ pF}$	5.0	0.3	0.8	V
Quiet output minimum dynamic $V_{OL}$	$V_{OLV}$	$C_L = 50\text{ pF}$	5.0	-0.3	-0.8	V
Minimum high-level dynamic input voltage	$V_{IHD}$	$C_L = 50\text{ pF}$	5.0	—	3.5	V
Maximum low-level dynamic input voltage	$V_{ILD}$	$C_L = 50\text{ pF}$	5.0	—	1.5	V

**12. Internal Equivalent Circuit**



**Package Dimensions**

Unit: mm



Weight: 0.054 g (typ.)

Package Name(s)
Nickname: TSSOP14B

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