

TC74VHC257F, TC74VHC257FT, TC74VHC257FK

Quad 2-Channel Multiplexer (3-state)

The TC74VHC257 is an advanced high speed CMOS MULTIPLEXER fabricated with silicon gate C²MOS technology.

It achieves the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

It is composed of four independent 2-channel multiplexers with common SELECT and OUTPUT ENABLE (OE).

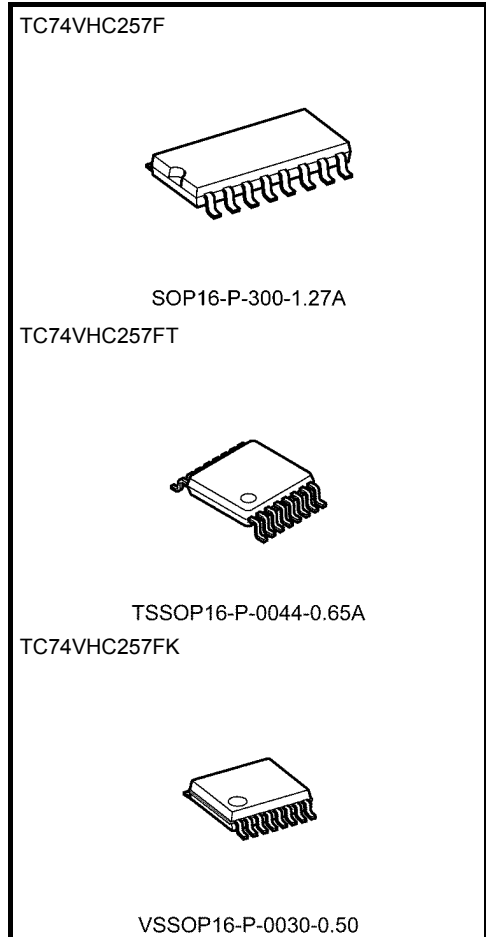
If OE is set low, the outputs are held in a high-impedance state. When SELECT is set low, "A" data inputs are enabled.

Conversely, when SELECT is high, "B" data inputs are enabled.

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.

Features

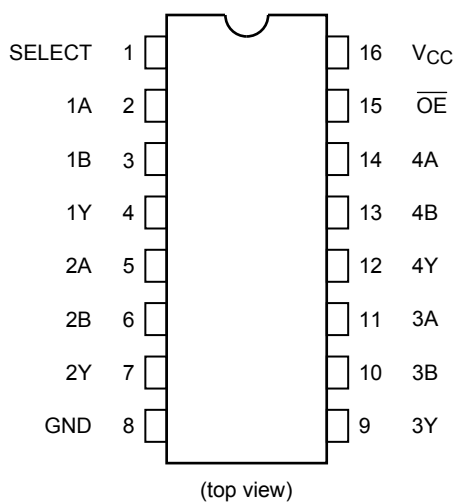
- High speed: $t_{pd} = 3.6 \text{ ns (typ.)}$ at $V_{CC} = 5 \text{ V}$
- Low power dissipation: $I_{CC} = 4 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High noise immunity: $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Power down protection is provided on all inputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range: $V_{CC (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Low noise: $V_{OLP} = 0.8 \text{ V (max)}$
- Pin and function compatible with 74ALS257



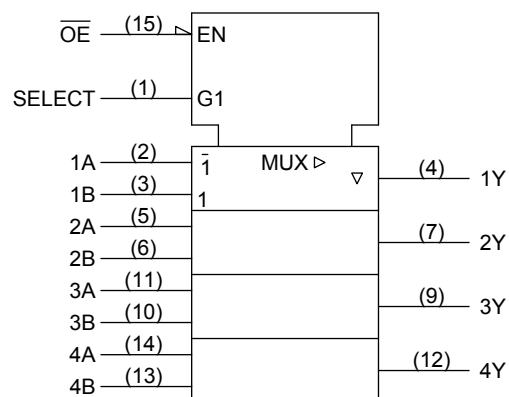
Weight

SOP16-P-300-1.27A	: 0.18 g (typ.)
TSSOP16-P-0044-0.65A	: 0.06 g (typ.)
VSSOP16-P-0030-0.50	: 0.02 g (typ.)

Pin Assignment



IEC Logic Symbol



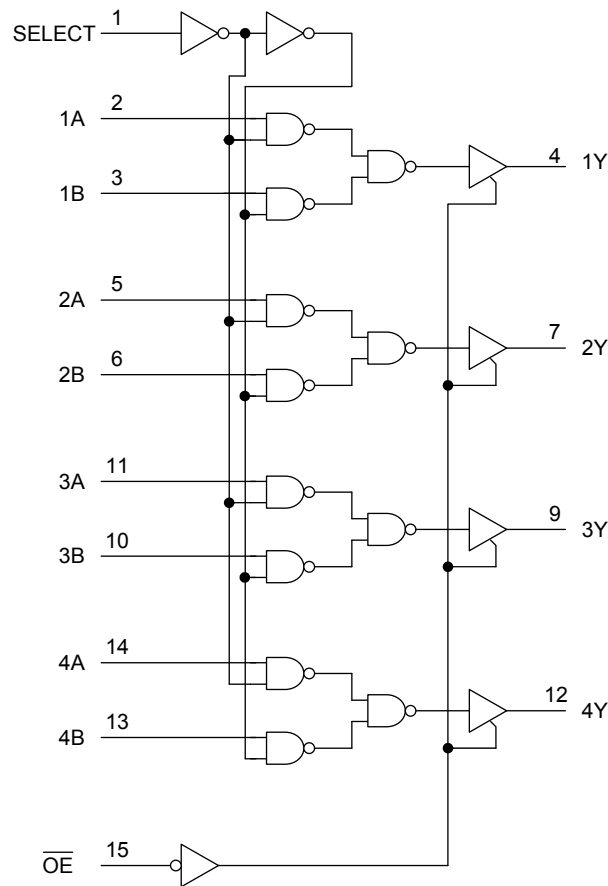
Truth Table

Inputs				Output
\overline{OE}	SELECT	A	B	
H	X	X	X	Z
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

X: Don't care

Z: High impedance

System Diagram



Absolute Maximum Ratings (Note)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5 to 7.0	V
DC input voltage	V_{IN}	-0.5 to 7.0	V
DC output voltage	V_{OUT}	-0.5 to $V_{CC} + 0.5$	V
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	± 20	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /ground current	I_{CC}	± 50	mA
Power dissipation	P_D	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).

Operating Ranges (Note)

Characteristics	Symbol	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 85	°C
Input rise and fall time	dt/dv	0 to 100 ($V_{CC} = 3.3 \pm 0.3$ V) 0 to 20 ($V_{CC} = 5 \pm 0.5$ V)	ns/V

Note 1: 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.

Electrical Characteristics

DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit		
				Min	Typ.	Max	Min	Max			
High-level input voltage	V_{IH}	—	2.0 3.0 to 5.5	1.50 $V_{CC} \times 0.7$	— —	— —	1.50 $V_{CC} \times 0.7$	— —	V		
Low-level input voltage	V_{IL}	—	2.0 3.0 to 5.5	— —	— —	0.50 $V_{CC} \times 0.3$	— —	0.50 $V_{CC} \times 0.3$	V		
High-level output voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -50 \mu A$	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	— — —	V	
			$I_{OH} = -4$ mA	3.0 4.5	2.58 3.94	— —	— —	2.48 3.80	— —		
			$I_{OH} = -8$ mA	3.0 4.5	— —	— —	— —	— —	— —		
				3.0 4.5	— —	— —	0.36 0.36	— —	0.44 0.44		
Low-level output voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 50 \mu A$	2.0 3.0 4.5	— — —	0.0 0.0 0.0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	V	
			$I_{OL} = 4$ mA	3.0 4.5	— —	— —	— —	0.36 0.36	— —		0.44 0.44
			$I_{OL} = 8$ mA	3.0 4.5	— —	— —	— —	— —	— —		— —
				3.0 4.5	— —	— —	— —	— —	— —		— —
3-state output off-state current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = V_{CC}$ or GND	5.5	—	—	± 0.25	—	± 2.50	μA		
Input leakage current	I_{IN}	$V_{IN} = 5.5$ V or GND	0 to 5.5	—	—	± 0.1	—	± 1.0	μA		
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	5.5	—	—	4.0	—	40.0	μA		

AC Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit	
		V _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max		
Propagation delay time (A, B-Y)	t _{pLH}	—	3.3 ± 0.3	15	—	5.8	9.3	1.0	11.0	ns
				50	—	8.3	12.8	1.0	14.5	
	5.0 ± 0.5		15	—	3.6	5.9	1.0	7.0		
			50	—	5.1	7.9	1.0	9.0		
Propagation delay time (SELECT-Y)	t _{pLH}	—	3.3 ± 0.3	15	—	7.0	11.0	1.0	13.0	ns
				50	—	9.5	14.5	1.0	16.5	
	5.0 ± 0.5		15	—	4.0	6.8	1.0	8.0		
			50	—	5.5	8.8	1.0	10.0		
3-state output enable time	t _{pZL}	R _L = 1 kΩ	3.3 ± 0.3	15	—	6.7	10.5	1.0	12.5	ns
				50	—	9.2	14.0	1.0	16.0	
	5.0 ± 0.5		15	—	3.6	6.8	1.0	8.0		
			50	—	5.1	8.8	1.0	10.0		
3-state output disable time	t _{pLZ}	R _L = 1 kΩ	3.3 ± 0.3	50	—	8.6	12.0	1.0	13.5	ns
				50	—	5.7	7.9	1.0	9.0	
t _{pHZ}	5.0 ± 0.5		50	—	5.7	7.9	1.0	9.0		
			50	—	5.7	7.9	1.0	9.0		
Input capacitance	C _{IN}	—		—	4	10	—	10	pF	
Output capacitance	C _{OUT}	—		—	6	—	—	—	pF	
Power dissipation capacitance	C _{PD}	—		(Note)	23	—	—	—	pF	

Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

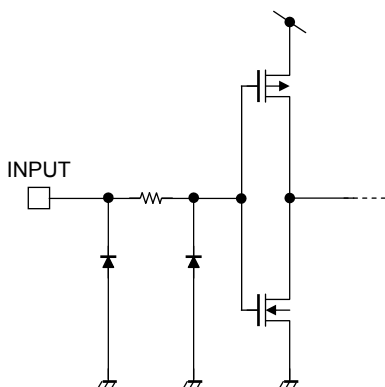
Average operating current can be obtained by the equation:

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

Noise Characteristics (input: $t_r = t_f = 3 \text{ ns}$)

Characteristics	Symbol	Test Condition		Ta = 25°C		Unit
		V _{CC} (V)	C _L (pF)	Typ.	Max	
Quiet output maximum dynamic V _{OL}	V _{OLP}	5.0	C _L = 50 pF	0.3	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	5.0	C _L = 50 pF	-0.3	-0.8	V
Minimum high level dynamic input voltage	V _{IHD}	5.0	C _L = 50 pF	—	3.5	V
Maximum low level dynamic input voltage	V _{ILD}	5.0	C _L = 50 pF	—	1.5	V

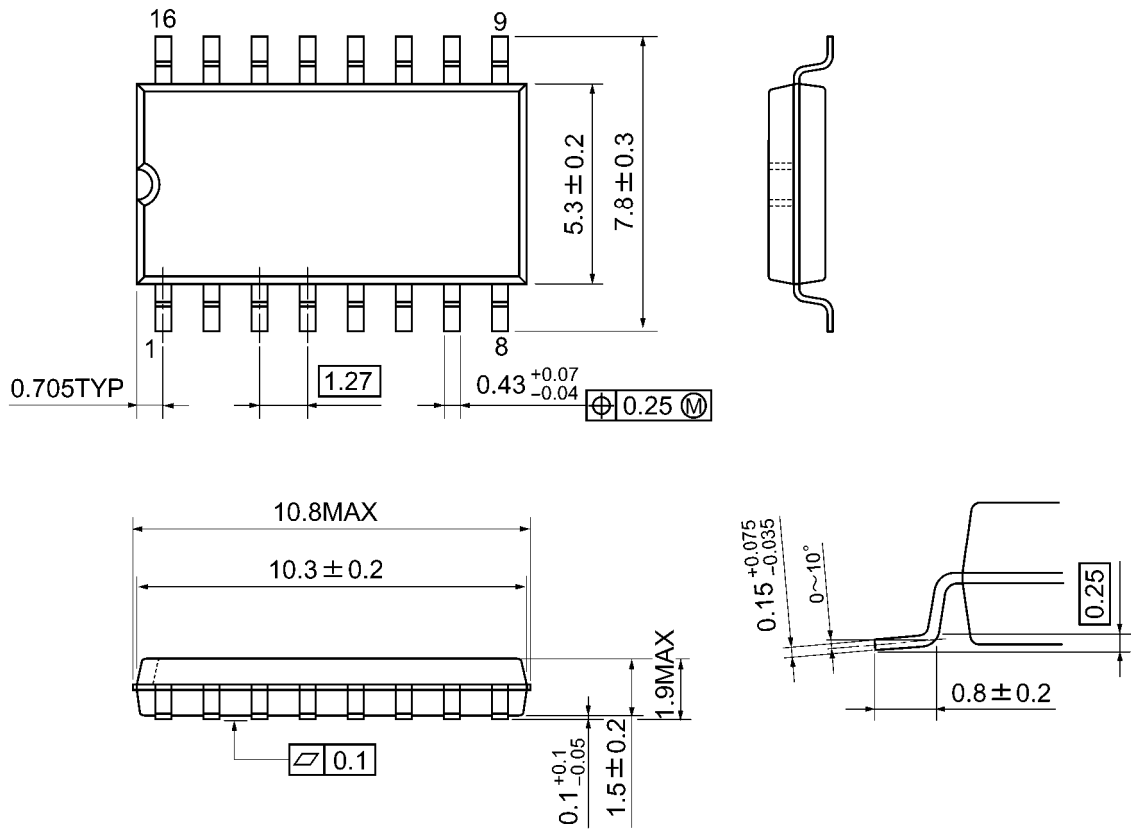
Input Equivalent Circuit



Package Dimensions

SOP16-P-300-1.27A

Unit: mm

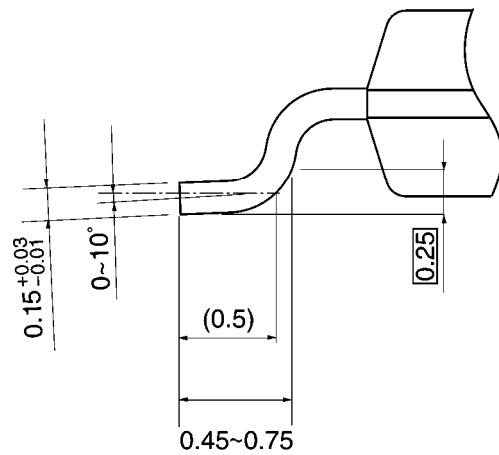
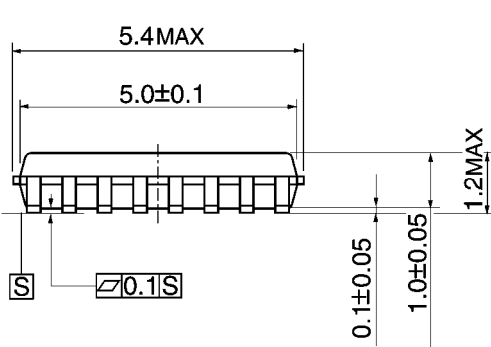
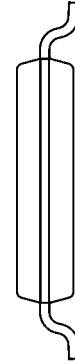
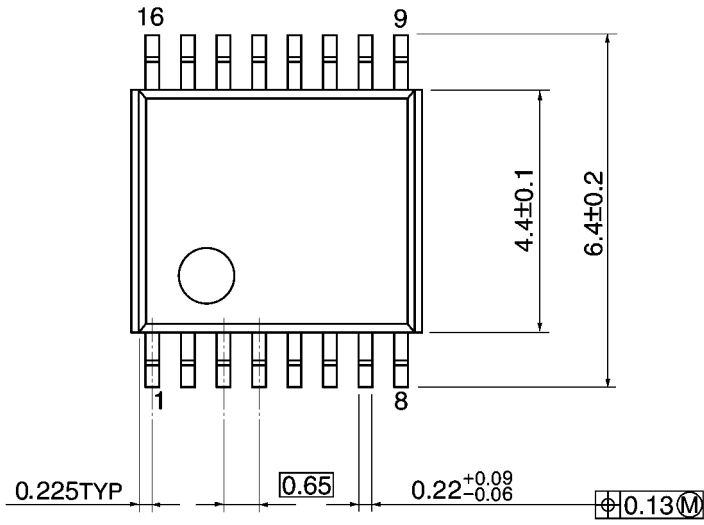


Weight: 0.18 g (typ.)

Package Dimensions

TSSOP16-P-0044-0.65A

Unit: mm

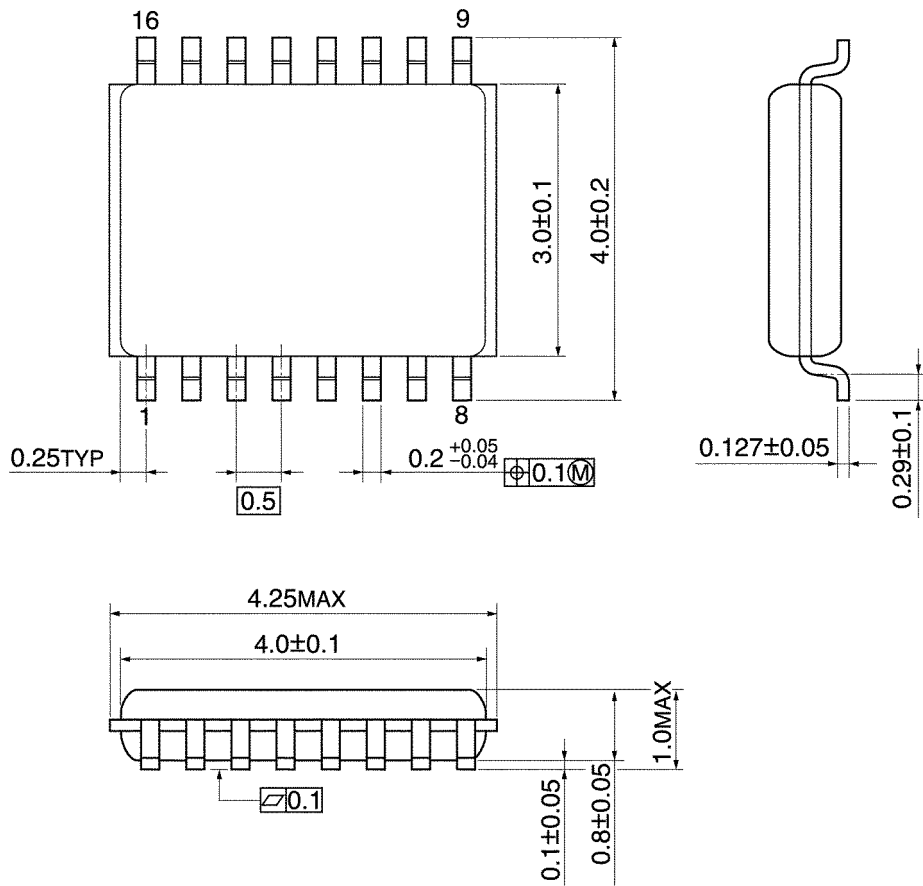


Weight: 0.06 g (typ.)

Package Dimensions

VSSOP16-P-0030-0.50

Unit: mm



Weight: 0.02 g (typ.)

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