

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7MZ157FK

Low Voltage Quad 2-Channel Multiplexer with 5 V Tolerant Inputs and Outputs

The TC7MZ157FK is a high performance CMOS multiplexer. Designed for use in 3.3 V systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

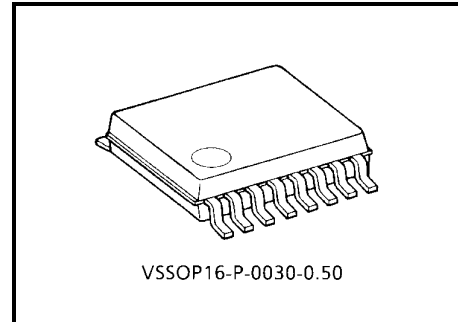
The device is designed for low-voltage (3.3 V) V_{CC} applications, but it could be used to interface to 5 V supply environment for inputs.

It consists of four 2-input digital multiplexers with common select and strobe inputs.

When the strobe input (\overline{ST}) is held "H" level, selection of data is inhibited and all the outputs become "L" level.

The SELECT decoding determines whether the A or B inputs get routed to their corresponding Y outputs.

All inputs are equipped with protection circuits against static discharge.

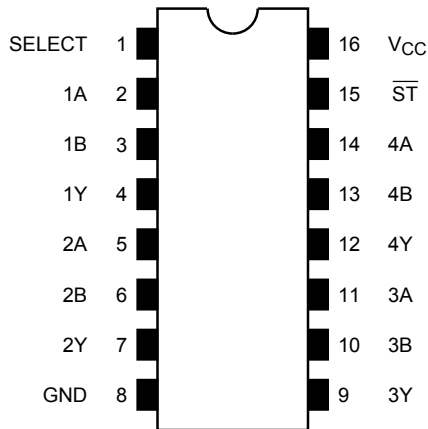


Weight: 0.02 g (typ.)

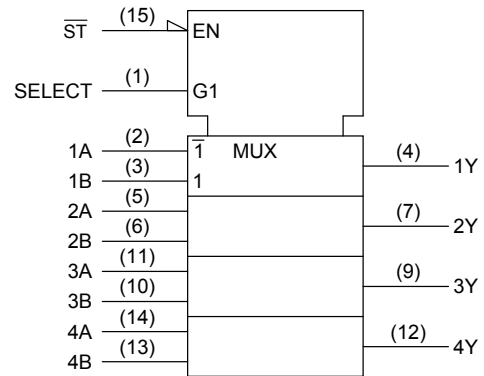
Features

- Low voltage operation: $V_{CC} = 2.0\sim 3.6\text{ V}$
- High speed operation: $t_{pd} = 5.8\text{ ns (max)}$ ($V_{CC} = 3.0\sim 3.6\text{ V}$)
- Output current: $|I_{OH}|/I_{OL} = 24\text{ mA (min)}$ ($V_{CC} = 3.0\text{ V}$)
- Latch-up performance: -500 mA
- Package: VSSOP16 (US16)
- Power down protection is provided on all inputs and outputs.
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 157 type.

Pin Assignment (top view)



IEC Logic Symbol

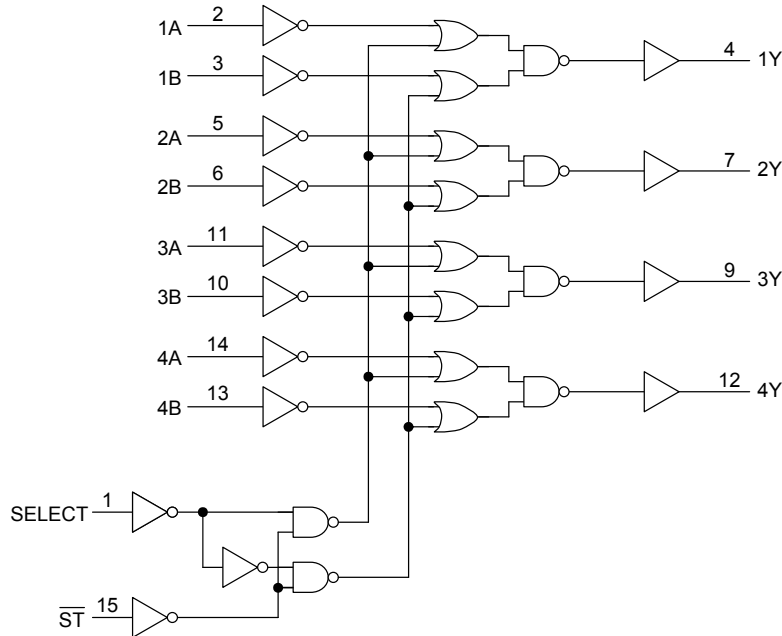


Truth Table

Inputs				Outputs
\overline{ST}	Select	A	B	Y
H	X	X	X	L
L	L	L	X	L
L	L	H	X	H
L	H	X	L	L
L	H	X	H	H

X: Don't care

System Diagram



Absolute Maximum Ratings (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage range	V_{CC}	-0.5~7.0	V
DC input voltage	V_{IN}	-0.5~7.0	V
DC output voltage	V_{OUT}	-0.5~7.0 (Note 2)	V
		-0.5~ $V_{CC} + 0.5$ (Note 3)	
Input diode current	I_{IK}	-50	mA
Output diode current	I_{OK}	± 50 (Note 4)	mA
DC output current	I_{OUT}	± 50	mA
Power dissipation	P_D	180	mW
DC V_{CC} /ground current	I_{CC}/I_{GND}	± 100	mA
Storage temperature	T_{stg}	-65~150	$^{\circ}C$

Note 1: 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 2: $V_{CC} = 0$ V

Note 3: High or low state. I_{OUT} absolute maximum rating must be observed.

Note 4: $V_{OUT} < GND$, $V_{OUT} > V_{CC}$

Operating Ranges (Note 1)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	2.0~3.6	V
		1.5~3.6 (Note 2)	
Input voltage	V_{IN}	0~5.5	V
Output voltage	V_{OUT}	0~5.5 (Note 3)	V
		0~ V_{CC} (Note 4)	
Output current	I_{OH}/I_{OL}	± 24 (Note 5)	mA
		± 12 (Note 6)	
Operating temperature	T_{opr}	-40~85	°C
Input rise and fall time	dt/dv	0~10 (Note 7)	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.

Note 2: Data retention only

Note 3: $V_{CC} = 0$ V

Note 4: High or low state

Note 5: $V_{CC} = 3.0\sim 3.6$ V

Note 6: $V_{CC} = 2.7\sim 3.0$ V

Note 7: $V_{IN} = 0.8\sim 2.0$ V, $V_{CC} = 3.0$ V

Electrical Characteristics

DC Characteristics ($T_a = -40\sim 85^\circ\text{C}$)

Characteristics	Symbol	Test Condition	V_{CC} (V)	Min	Max	Unit		
Input voltage	High level	V_{IH}	—	2.7~3.6	2.0	—	V	
	Low level	V_{IL}	—	2.7~3.6	—	0.8		
Output voltage	High level	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -100 \mu\text{A}$	2.7~3.6	$V_{CC} - 0.2$	—	V
				$I_{OH} = -12 \text{ mA}$	2.7	2.2	—	
				$I_{OH} = -18 \text{ mA}$	3.0	2.4	—	
				$I_{OH} = -24 \text{ mA}$	3.0	2.2	—	
	Low level	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100 \mu\text{A}$	2.7~3.6	—	0.2	
				$I_{OL} = 12 \text{ mA}$	2.7	—	0.4	
				$I_{OL} = 16 \text{ mA}$	3.0	—	0.4	
				$I_{OL} = 24 \text{ mA}$	3.0	—	0.55	
Input leakage current	I_{IN}	$V_{IN} = 0\sim 5.5$ V	2.7~3.6	—	± 5.0	μA		
Power off leakage current	I_{OFF}	$V_{IN}/V_{OUT} = 5.5$ V	0	—	10.0	μA		
Quiescent supply current	I_{CC}	$V_{IN} = V_{CC}$ or GND	2.7~3.6	—	10.0	μA		
		$V_{IN} = 3.6\sim 5.5$ V	2.7~3.6	—	± 10.0			
Increase in I_{CC} per input	ΔI_{CC}	$V_{IH} = V_{CC} - 0.6$ V	2.7~3.6	—	500			

AC Characteristics (Ta = -40~85°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Min	Max	Unit
Propagation delay time (A, B-Y)	t _{pLH}	Figure 1, Figure 2	2.7	—	6.3	ns
	t _{pHL}		3.3 ± 0.3	1.5	5.8	
Propagation delay time (SELECT-Y)	t _{pLH}	Figure 1, Figure 2	2.7	—	8.0	ns
	t _{pHL}		3.3 ± 0.3	1.5	7.0	
Propagation delay time (\overline{ST} -Y)	t _{pLH}	Figure 1, Figure 2	2.7	—	8.0	ns
	t _{pHL}		3.3 ± 0.3	1.5	7.0	
Output to output skew	t _{osLH}	(Note)	2.7	—	—	ns
	t _{osHL}		3.3 ± 0.3	—	1.0	

Note: This parameter is guaranteed by design.

$$(t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)$$

Dynamic Switching Characteristics

(Ta = 25°C, Input: t_r = t_f = 2.5 ns, C_L = 50 pF, R_L = 500 Ω)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit
Quiet output maximum dynamic V _{OL}	V _{OLP}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V
Quiet output minimum dynamic V _{OL}	V _{OLV}	V _{IH} = 3.3 V, V _{IL} = 0 V	3.3	0.8	V

Capacitive Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	V _{CC} (V)	Typ.	Unit	
Input capacitance	C _{IN}	—	3.3	7	pF	
Output capacitance	C _{OUT}	—	0	8	pF	
Power dissipation capacitance	C _{PD}	f _{IN} = 10 MHz	(Note)	3.3	25	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:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

AC Test Circuit

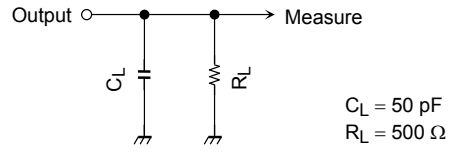


Figure 1

AC Waveform

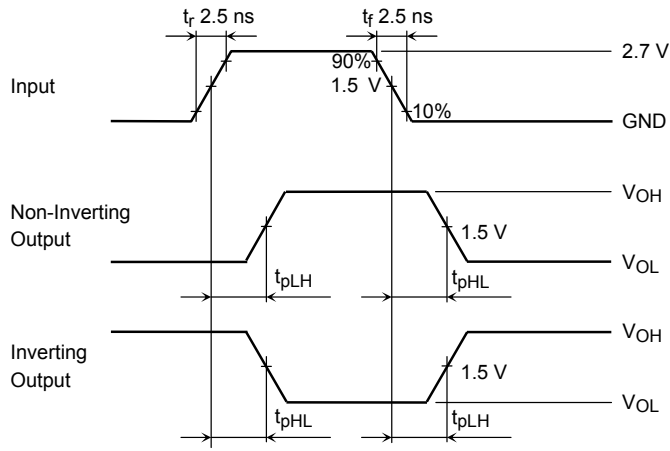
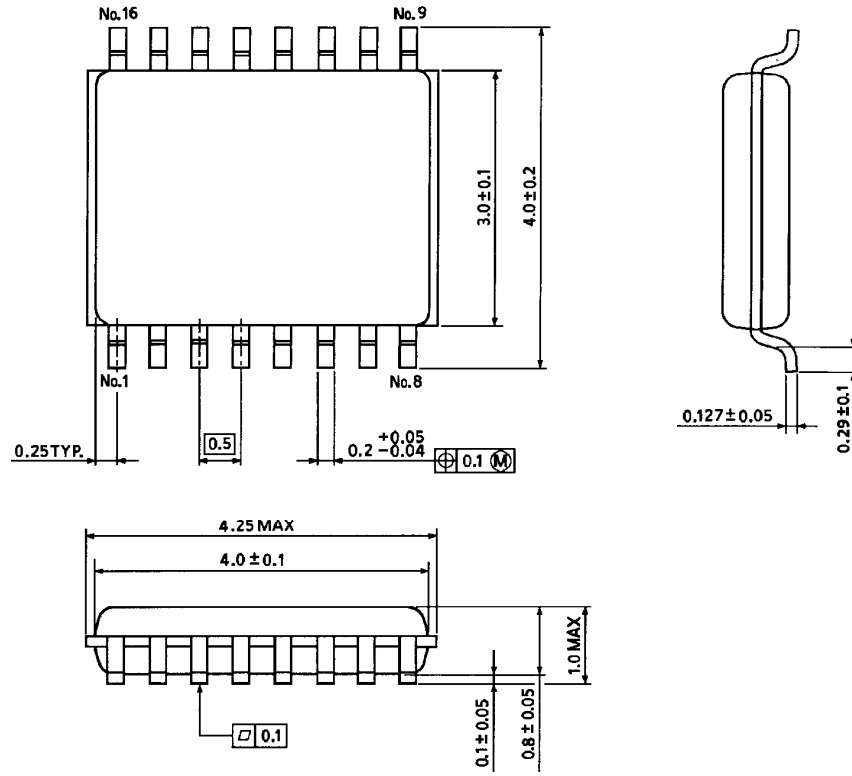


Figure 2 t_{pLH} , t_{pHL}

Package Dimensions

VSSOP16-P-0030-0.50

Unit : mm



Weight: 0.02 g (typ.)

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20070701-EN GENERAL

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