

TC7MZ541FK

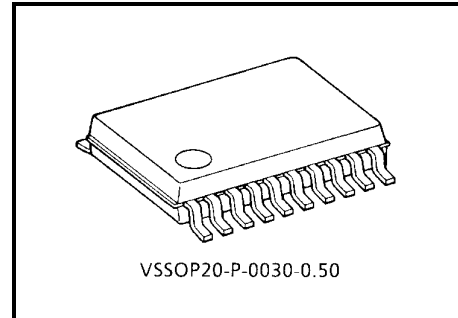
Low Voltage Octal Bus Buffer with 5 V Tolerant Inputs and Outputs

The TC7MZ541FK is a high performance CMOS octal bus buffer. 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 both inputs and outputs.

The TC7MZ541FK is a non-inverting 3-state buffer having two active-low output enables. When either $\overline{OE}1$ or $\overline{OE}2$ are high, the terminal outputs are in the high-impedance state. This device is designed to be used with 3-state memory address drivers, etc.

All inputs are equipped with protection circuits against static discharge.

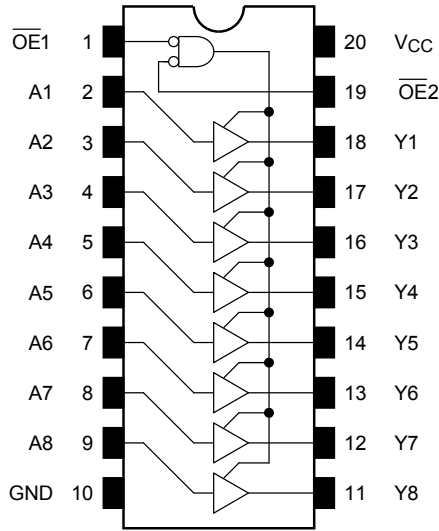


Weight: 0.03 g (typ.)

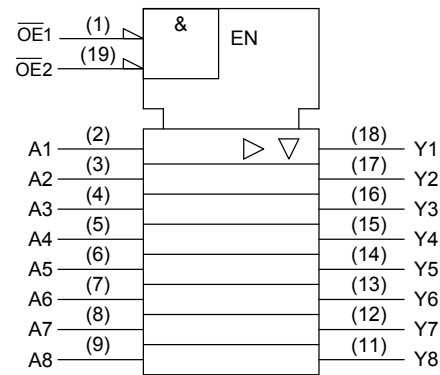
Features

- Low voltage operation: $V_{CC} = 2.0\sim 3.6$ V
- High speed operation: $t_{pd} = 6.5$ ns (max) ($V_{CC} = 3.0\sim 3.6$ V)
- Output current: $|I_{OH}|/I_{OL} = 24$ mA (min) ($V_{CC} = 3.0$ V)
- Latch-up performance: -500 mA
- Package: VSSOP (US20)
- 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.) 541 type.

Pin Assignment (top view)



IEC Logic Symbol



Truth Table

Inputs			Outputs
OE1	OE2	A _n	
H	X	X	Z
X	H	X	Z
L	L	H	H
L	L	L	L

X: Don't care
Z: High impedance

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	°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: Output in off-state

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: Output in off-state

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
3-state output off-state current	I_{OZ}	$V_{IN} = V_{IH}$ or V_{IL} $V_{OUT} = 0\sim 5.5$ 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
		$V_{IN}/V_{OUT} = 3.6\sim 5.5$ 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	t _{pLH}	Figure 1, Figure 2	2.7	—	7.5	ns
	t _{pHL}		3.3 ± 0.3	1.5	6.5	
Output enable time	t _{pZL}	Figure 1, Figure 3	2.7	—	9.5	ns
	t _{pZH}		3.3 ± 0.3	1.5	8.5	
Output disable time	t _{pLZ}	Figure 1, Figure 3	2.7	—	8.5	ns
	t _{pHZ}		3.3 ± 0.3	1.5	7.5	
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}	—	3.3	8	pF	
Power dissipation capacitance	C _{PD}	f _{IN} = 10 MHz	(Note)	3.3	40	pF

Note: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption.

Average operating current can be obtained by the equation:

$$I_{CC (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

AC Test Circuit

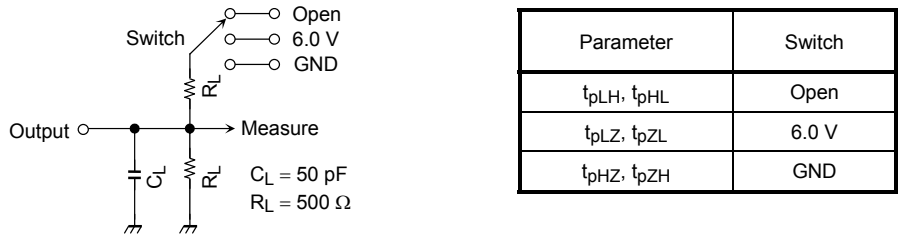


Figure 1

AC Waveform

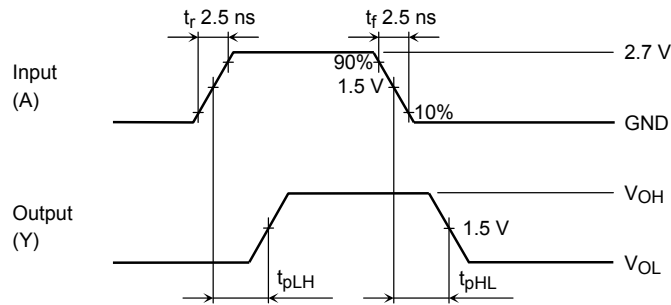


Figure 2 t_{pLH} , t_{pHL}

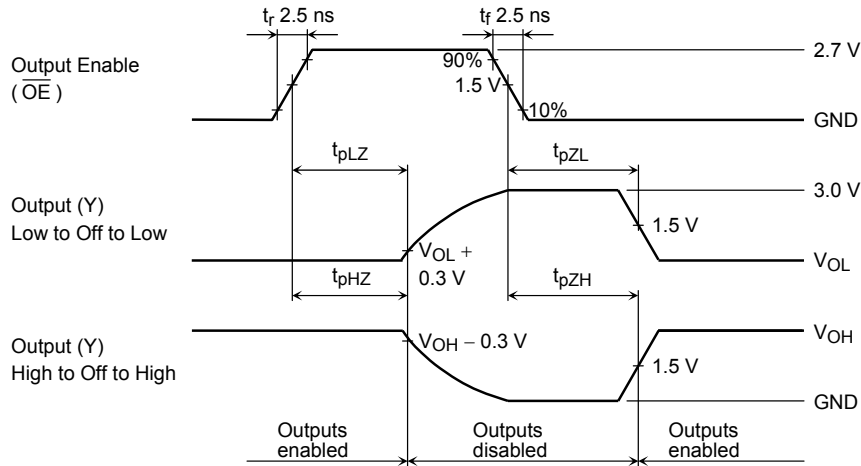
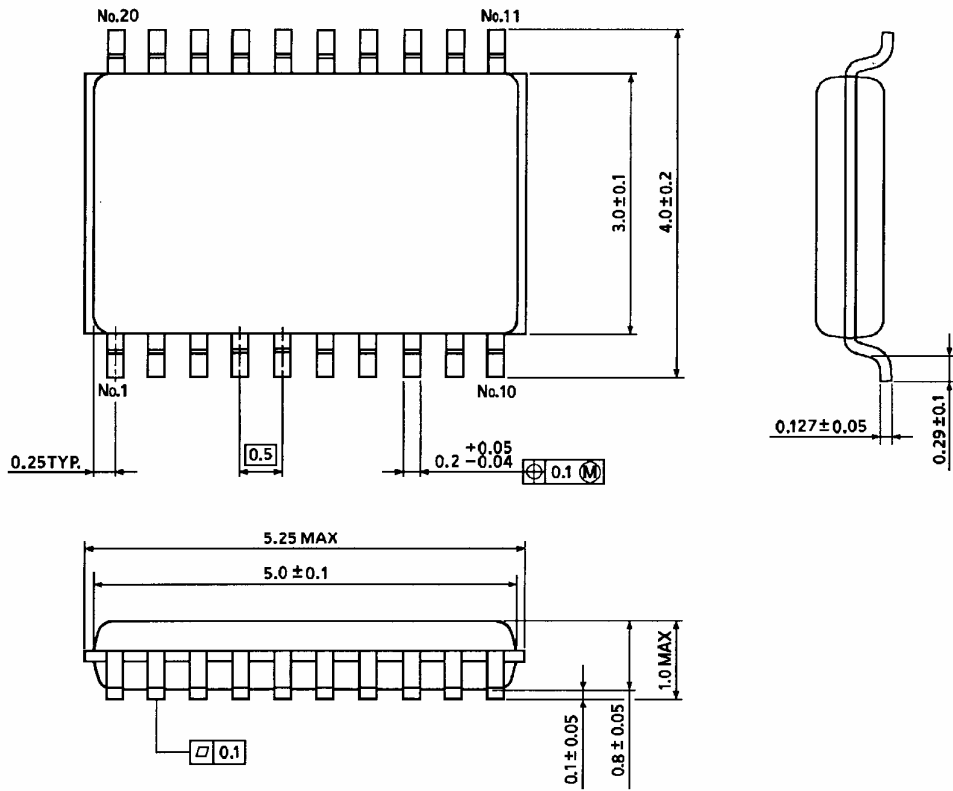


Figure 3 t_{pLZ} , t_{pHZ} , t_{pZL} , t_{pZH}

Package Dimensions

VSSOP20-P-0030-0.50

Unit : mm



Weight: 0.03 g (typ.)

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