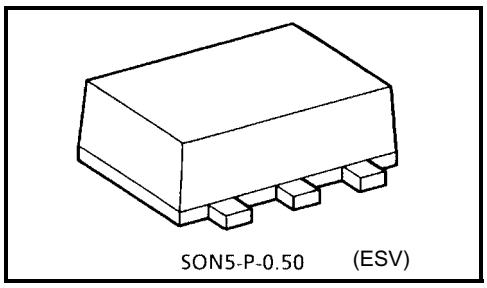
TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

T C 7 S Z 1 2 5 A F E

Dual Bus Buffer 3-State Output

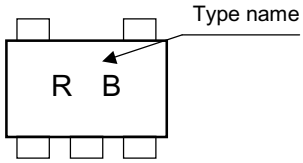
Features

- High output drive: ±24 mA (min) @V_{CC} = 3 V
- Super high speed operation: t_{pd} 2.6 ns (typ.) @V_{CC} = 5 V, 50 pF
- Operation voltage range: $V_{CC\ (opr)}$ = 1.8~5.5 V
- Latch-up performance: ±500 mA or more
- ESD performance: ±200 V or more (JEITA)
  ±2000 V or more (MIL)
- Power down protection is provided on all inputs and outputs.
- Matches the performance of TC74LCX series when operated at 3.3 V V_{CC}.

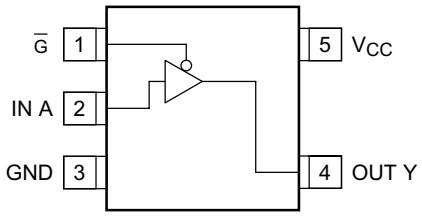


Weight: 0.003 g (typ.)

Marking



Pin Assignment (top view)



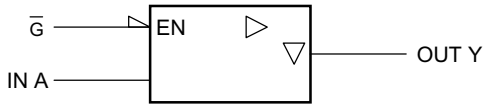
Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Rating	Unit
Power supply voltage	V_{CC}	−0.5~6	V
DC input voltage	V_{IN}	−0.5~6	V
DC output voltage	V_{OUT}	−0.5~V_{CC} + 0.5	V
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	±20	mA
DC output current	I_{OUT}	±50	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	150	mW
Storage temperature	T_{stg}	−65~150	°C
Lead temperature (10s)	T_L	260	°C

Truth Table

A	$\overline{G}$	Y
X	H	Z
L	L	L
H	L	H

Logic Diagram



Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	1.8~5.5	V
		1.5~5.5 (Note)	
Input voltage	V_{IN}	0~5.5	V
Output voltage	V_{OUT}	0~V_{CC}	V
Operating temperature	T_{opr}	−40~85	°C
Input rise and fall time	dt/dv	0~20 (V_{CC} = 1.8 V, 2.5 V ± 0.2 V)	ns/V
		0~10 (V_{CC} = 3.3 V ± 0.3 V)	
		0~5 (V_{CC} = 5.5 V ± 0.5 V)	

Note: Data retention only

Electrical Characteristics

DC Characteristics

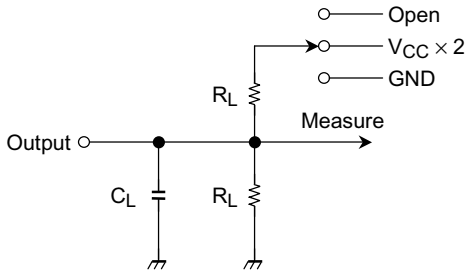
Characteristics		Symbol	Test Condition			Ta = 25°C			Ta = −40~85°C		Unit
					V_{CC} (V)	Min	Typ.	Max	Min	Max	
Input voltage	High level	V_{IH}	—		1.8	0.75 × V_{CC}	—	—	0.75 × V_{CC}	—	V
					2.3~5.5	0.7 × V_{CC}	—	—	0.7 × V_{CC}	—	
	Low level	V_{IL}	—		1.8	—	—	0.25 × V_{CC}	—	0.25 × V_{CC}	
					2.3~5.5	—	—	0.3 × V_{CC}	—	0.3 × V_{CC}	
Output voltage	High level	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −100 μA	1.8	1.7	1.8	—	1.7	—	V
					2.3	2.2	2.3	—	2.2	—	
					3.0	2.9	3.0	—	2.9	—	
					4.5	4.4	4.5	—	4.4	—	
				I_{OH} = −8 mA	2.3	1.9	2.15	—	1.9	—	
				I_{OH} = −16 mA	3.0	2.4	2.8	—	2.4	—	
				I_{OH} = −24 mA	3.0	2.3	2.68	—	2.3	—	
				I_{OH} = −32 mA	4.5	3.8	4.2	—	3.8	—	
	Low level	V_{OL}	V_{IN} = V_{IH}	I_{OL} = 100 μA	1.8	—	0	0.1	—	0.1	
					2.3	—	0	0.1	—	0.1	
					3.0	—	0	0.1	—	0.1	
					4.5	—	0	0.1	—	0.1	
				I_{OL} = 8 mA	2.3	—	0.1	0.3	—	0.3	
				I_{OL} = 16 mA	3.0	—	0.15	0.4	—	0.4	
				I_{OL} = 24 mA	3.0	—	0.22	0.55	—	0.55	
				I_{OL} = 32 mA	4.5	—	0.22	0.55	—	0.55	
Input leakage current		I_{IN}	V_{IN} = 5.5 V or GND		0~5.5	—	—	±1	—	±10	μA
3-state output off-state current		I_{OZ}	V_{IN} = V_{IH} or V_{IL}, V_{OUT} = 0~5.5 V		1.8~5.5	—	—	±1	—	±10	μA
Power off leakage current		I_{OFF}	V_{IN} or V_{OUT} = 5.5 V		0.0	—	—	1	—	10	μA
Quiescent supply current		I_{CC}	V_{IN} = 5.5 V or GND		5.5	—	—	2	—	20	μA

AC Characteristics (unless otherwise specified, Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = −40~85°C		Unit
			V_{CC} (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	t_{pLH} t_{pHL}	C_L = 15 pF, R_L = 1 MΩ	1.8	2.0	5.3	11.0	2.0	11.5	ns
			2.5 ± 0.2	0.8	3.4	7.5	0.8	8.0	
			3.3 ± 0.3	0.5	2.5	5.2	0.5	5.5	
			5.0 ± 0.5	0.5	2.1	4.5	0.5	4.8	
		C_L = 50 pF, R_L = 500 Ω	3.3 ± 0.3	1.5	3.2	5.7	1.5	6.0	
			5.0 ± 0.5	0.8	2.6	5.0	0.8	5.3	
Output enable time	t_{pZL} t_{pZH}	C_L = 50 pF, R_L = 500 Ω	1.8	2.0	7.0	12.5	2.0	13.0	ns
			2.5 ± 0.2	1.5	4.6	8.5	1.5	9.0	
			3.3 ± 0.3	1.5	3.5	6.2	1.5	6.5	
			5.0 ± 0.5	0.8	2.8	5.5	0.8	5.8	
Output disable time	t_{pLZ} t_{pHZ}	C_L = 50 pF, R_L = 500 Ω	1.8	2.0	5.4	11.0	2.0	12.0	ns
			2.5 ± 0.2	1.5	3.5	8.0	1.5	8.5	
			3.3 ± 0.3	1.0	2.8	5.7	1.0	6.0	
			5.0 ± 0.5	0.5	2.1	4.7	0.5	5.0	
Input capacitance	C_{IN}	—	0~5.5	—	4	—	—	—	pF
Power dissipation capacitance	C_{PD}	(Note)	3.3	—	20	—	—	—	pF
			5.5	—	27	—	—	—	

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

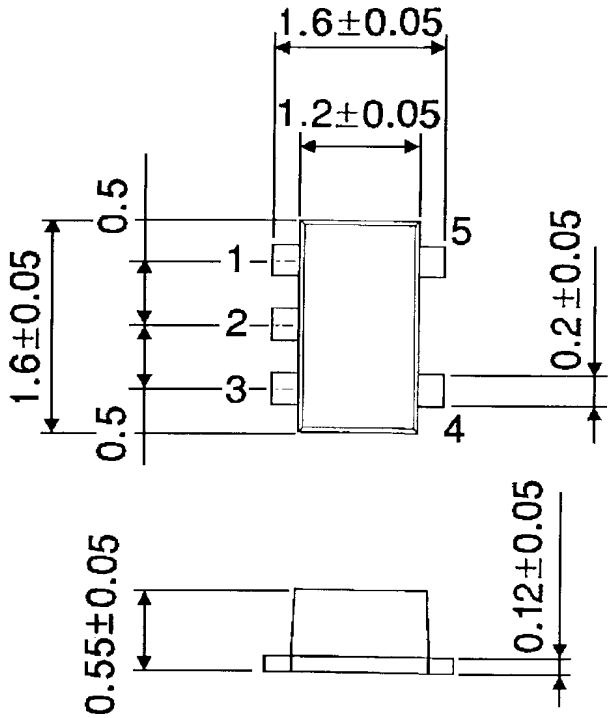
AC Characteristics Measurement Circuit



Characteristics	Switch
t_{pLH}, t_{pHL}	Open
t_{pLZ}, t_{pZL}	$V_{CC} \times 2$
t_{pHZ}, t_{pZH}	GND

Package Dimensions

SON5-P-0.50 Unit : mm



Weight: 0.003 g (typ.)

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