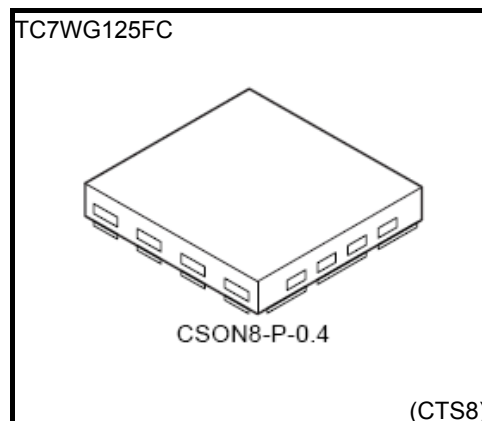


TC7WG125FC

Dual Bus Buffer with 3-STATE Output

Features

- High output current: ± 8 mA (min) at $V_{CC} = 3$ V Super high speed operation: $t_{pd} = 2.5$ ns (typ.) at $V_{CC} = 3.3$ V, 15 pF
- Operating voltage range: $V_{CC} = 0.9$ to 3.6 V
- 5.5-V tolerant inputs
- 3.6-V power down protection outputs



Weight: 0.002 g (typ.)

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	-0.5 to 4.6	V
DC input voltage	V_{IN}	-0.5 to 7.0	V
DC output voltage	V_{OUT}	-0.5 to 4.6 (Note 1)	V
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	I_{IK}	-20	mA
Output diode current	I_{OK}	-20 (Note 3)	mA
DC output current	I_{OUT}	± 25	mA
DC V_{CC} /GND current	I_{CC}	± 100	mA
Power dissipation	P_D	150 (Note 4)	mW
Storage temperature	T_{stg}	-65 to 150	$^\circ\text{C}$

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

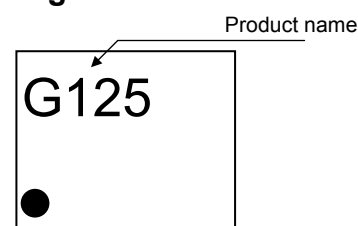
Note 2: High or Low state.

Do not exceed I_{OUT} of absolute maximum ratings.

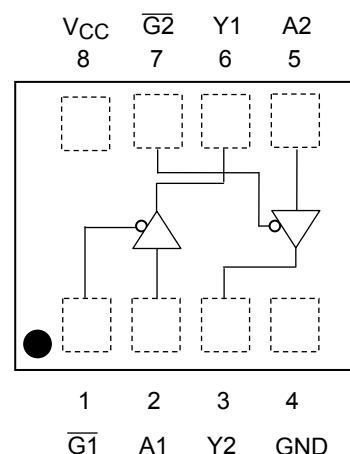
Note 3: $V_{OUT} < \text{GND}$

Note 4: Mounted on an FR4 board.
(25.4 mm $\times$ 25.4 mm $\times$ 1.6 t, Cu Pad: 11.56 mm²)

Marking



Pin Assignment (top view)

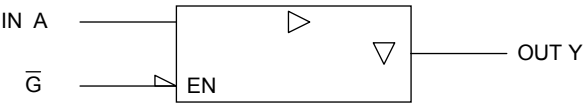


Truth Table

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

X: Don't Care
Z: High impedance

IEC Logic Symbol



Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	0.9 to 3.6	V
Input voltage	V_{IN}	0 to 5.5	V
Output voltage	V_{OUT}	0 to 3.6 (Note 5) 0 to V_{CC} (Note 6)	V
Output Current	I_{OH}/I_{OL}	± 8.0 (Note 7) ± 4.0 (Note 8) ± 3.0 (Note 9) ± 1.7 (Note 10) ± 0.3 (Note 11) ± 0.02 (Note 12)	mA
Operating temperature	T_{opr}	-40 to 85	$^{\circ}C$
Input rise and fall time	dt/dv	0 to 10 (Note 13)	ns/V

- Note 5: $V_{CC} = 0$ V
Note 6: High or Low state.
Note 7: $V_{CC} = 3.0$ to 3.6 V
Note 8: $V_{CC} = 2.3$ to 2.7 V
Note 9: $V_{CC} = 1.65$ to 1.95 V
Note 10: $V_{CC} = 1.4$ to 1.6 V
Note 11: $V_{CC} = 1.1$ to 1.3 V
Note 12: $V_{CC} = 0.9$ V
Note 13: $V_{IN} = 0.8$ to 2.0 V, $V_{CC} = 3.0$ V

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		Ta = 25°C				Ta = -40 to 85°C		Unit
					VCC (V)	Min	Typ.	Max	Min	Max	
Input voltage	High level	VIH	—	0.9	VCC	—	—	VCC	—	V	
				1.1 to 1.3	VCC × 0.7	—	—	VCC × 0.7	—		
				1.4 to 1.6	VCC × 0.65	—	—	VCC × 0.65	—		
				1.65 to 1.95	VCC × 0.65	—	—	VCC × 0.65	—		
				2.3 to 2.7	1.7	—	—	1.7	—		
				3.0 to 3.6	2.0	—	—	2.0	—		
	Low level	VIL	—	0.9	—	—	GND	—	GND		
				1.1 to 1.3	—	—	VCC × 0.3	—	VCC × 0.3		
				1.4 to 1.6	—	—	VCC × 0.35	—	VCC × 0.35		
				1.65 to 1.95	—	—	VCC × 0.35	—	VCC × 0.35		
				2.3 to 2.7	—	—	0.7	—	0.7		
				3.0 to 3.6	—	—	0.8	—	0.8		
Output voltage	High level	VOH	VIN=VIL or VIH	IOH=-0.02 mA	0.9	0.75	—	—	0.75	—	V
				IOH = -0.3 mA	1.1 to 1.3	VCC × 0.75	—	—	VCC × 0.75	—	
				IOH = -1.7 mA	1.4 to 1.6	VCC × 0.75	—	—	VCC × 0.75	—	
				IOH = -3.0 mA	1.65 to 1.95	VCC -0.45	—	—	VCC -0.45	—	
				IOH = -4.0 mA	2.3 to 2.7	2.0	—	—	2.0	—	
				IOH = -8.0 mA	3.0 to 3.6	2.48	—	—	2.48	—	
	Low level	VOL	VIN= VIL	IOL = 0.02 mA	0.9	—	—	0.1	—	0.1	
				IOL = 0.3 mA	1.1 to 1.3	—	—	VCC × 0.25	—	VCC × 0.25	
				IOL = 1.7 mA	1.4 to 1.6	—	—	VCC × 0.25	—	VCC × 0.25	
				IOL = 3.0 mA	1.65 to 1.95	—	—	0.45	—	0.45	
				IOL = 4.0 mA	2.3 to 2.7	—	—	0.4	—	0.4	
				IOL = 8.0 mA	3.0 to 3.6	—	—	0.4	—	0.4	
Input leakage current		IIN	VIN = 0 to 5.5V	0 to 3.6	—	—	±0.1	—	±1.0	μA	
3-state output off-state current		IOZ	VIN = VIH or VIL VOUT = 0 to 3.6V	0.9 to 3.6	—	—	1.0	—	10.0	μA	
Power off leakage current		IOFF	VIN = 0 to 5.5V VOUT = 0 to 3.6V	0.0	—	—	1.0	—	10.0	μA	
Quiescent supply current		ICC	VIN = VCC or GND	3.6	—	—	1.0	—	10.0	μA	

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

Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	Min	Typ.	Max	Min	Max
Propagation delay time	t_{pLH} t_{pHL}	$C_L = 10$ pF, $R_L = 1$ M Ω	0.9	—	18.3	—	—	—
			1.1 to 1.3	—	9.4	18.4	1.0	34.9
			1.4 to 1.6	—	5.5	8.5	1.0	10.7
			1.65 to 1.95	—	4.2	6.2	1.0	6.7
			2.3 to 2.7	—	2.8	3.9	1.0	4.4
			3.0 to 3.6	—	2.3	3.1	1.0	3.7
		$C_L = 15$ pF, $R_L = 1$ M Ω	0.9	—	21.2	—	—	—
			1.1 to 1.3	—	10.7	21.5	1.0	38.0
			1.4 to 1.6	—	6.1	9.3	1.0	11.9
			1.65 to 1.95	—	4.7	6.9	1.0	7.1
			2.3 to 2.7	—	3.1	4.4	1.0	5.0
			3.0 to 3.6	—	2.5	3.4	1.0	3.9
		$C_L = 30$ pF, $R_L = 1$ M Ω	0.9	—	30.5	—	—	—
			1.1 to 1.3	—	14.9	30.0	1.0	58.1
			1.4 to 1.6	—	8.2	13.2	1.0	16.6
			1.65 to 1.95	—	6.1	9.2	1.0	9.9
			2.3 to 2.7	—	4.1	5.7	1.0	6.1
			3.0 to 3.6	—	3.4	4.4	1.0	4.8
Output enable time	t_{pZL} t_{pZH}	$C_L = 10$ pF, $R_L = 100$ k Ω	0.9	—	24.0	—	—	—
		$C_L = 10$ pF, $R_L = 5$ k Ω	1.1 to 1.3	—	11.8	22.5	1.0	35.8
			1.4 to 1.6	—	6.8	10.4	1.0	12.0
			1.65 to 1.95	—	5.1	7.3	1.0	8.1
			2.3 to 2.7	—	3.4	4.6	1.0	5.3
			3.0 to 3.6	—	2.5	3.4	1.0	3.9
		$C_L = 15$ pF, $R_L = 100$ k Ω	0.9	—	26.6	—	—	—
		$C_L = 15$ pF, $R_L = 5$ k Ω	1.1 to 1.3	—	13.0	25.0	1.0	41.9
			1.4 to 1.6	—	7.4	11.4	1.0	13.4
			1.65 to 1.95	—	5.5	7.9	1.0	8.5
			2.3 to 2.7	—	3.7	4.9	1.0	5.5
			3.0 to 3.6	—	3.0	4.1	1.0	4.6
		$C_L = 30$ pF, $R_L = 100$ k Ω	0.9	—	36.4	—	—	—
		$C_L = 30$ pF, $R_L = 5$ k Ω	1.1 to 1.3	—	17.9	35.8	1.0	59.1
			1.4 to 1.6	—	9.8	15.3	1.0	17.8
			1.65 to 1.95	—	7.2	10.5	1.0	11.2
			2.3 to 2.7	—	4.5	5.9	1.0	6.6
			3.0 to 3.6	—	3.6	4.6	1.0	5.3

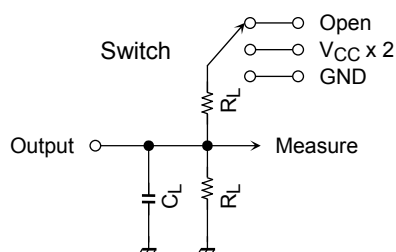
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit
			V _{CC} (V)	Min	Typ.	Max	Min	Max
Output disable time	t _{pLZ} t _{pHZ}	C _L = 10 pF, R _L = 100 kΩ	0.9	—	168.6	—	—	—
		C _L = 10 pF, R _L = 5 kΩ	1.1 to 1.3	—	9.5	18.4	1.0	25.2
			1.4 to 1.6	—	7.5	9.5	1.0	10.6
			1.65 to 1.95	—	7.1	8.7	1.0	9.6
			2.3 to 2.7	—	6.8	7.9	1.0	8.8
			3.0 to 3.6	—	6.5	7.5	1.0	8.4
		C _L = 15 pF, R _L = 100 kΩ	0.9	—	201.8	—	—	—
		C _L = 15 pF, R _L = 5 kΩ	1.1 to 1.3	—	10.5	19.8	1.0	27.6
			1.4 to 1.6	—	9.0	10.4	1.0	12.3
			1.65 to 1.95	—	8.5	9.7	1.0	10.6
			2.3 to 2.7	—	7.9	8.8	1.0	10.3
			3.0 to 3.6	—	7.6	8.3	1.0	9.5
		C _L = 30 pF, R _L = 100 kΩ	0.9	—	251.5	—	—	—
		C _L = 30 pF, R _L = 5 kΩ	1.1 to 1.3	—	14.1	23.8	1.0	31.9
			1.4 to 1.6	—	13.5	14.5	1.0	16.0
			1.65 to 1.95	—	12.7	14.3	1.0	15.0
			2.3 to 2.7	—	12.2	14.1	1.0	14.7
			3.0 to 3.6	—	11.9	13.8	1.0	14.4
Input capacitance	C _{IN}	—	3.6	—	3	—	—	pF
Power dissipation capacitance	C _{PD}	(Note 14)	0.9 to 3.6	—	10	—	—	pF

Note 14: 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:

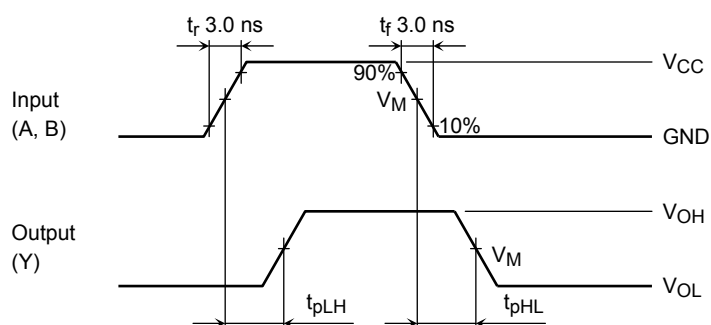
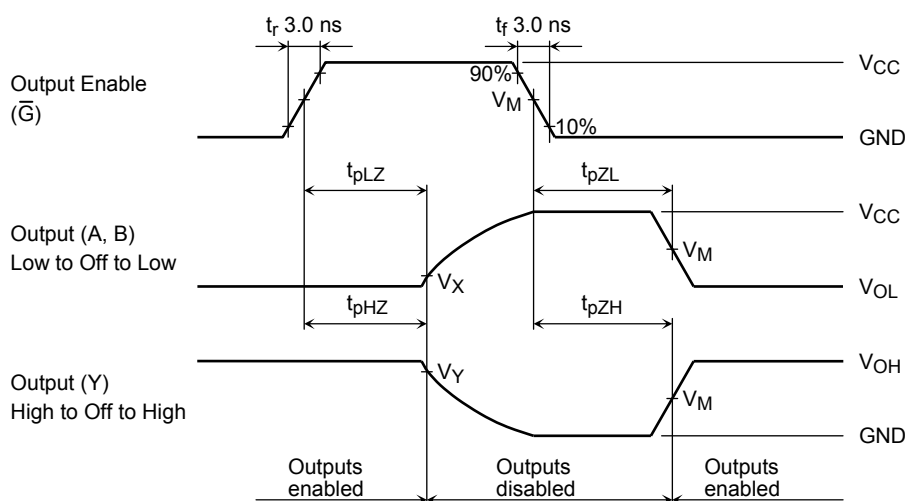
$$I_{CC}(\text{opr.}) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$$

AC Characteristics Measurement Circuit



Characteristics	Switch
t _{pLH} , t _{pHL}	Open
t _{pLZ} , t _{pZL}	V _{CC} x 2
t _{pHZ} , t _{pZH}	GND

Figure1

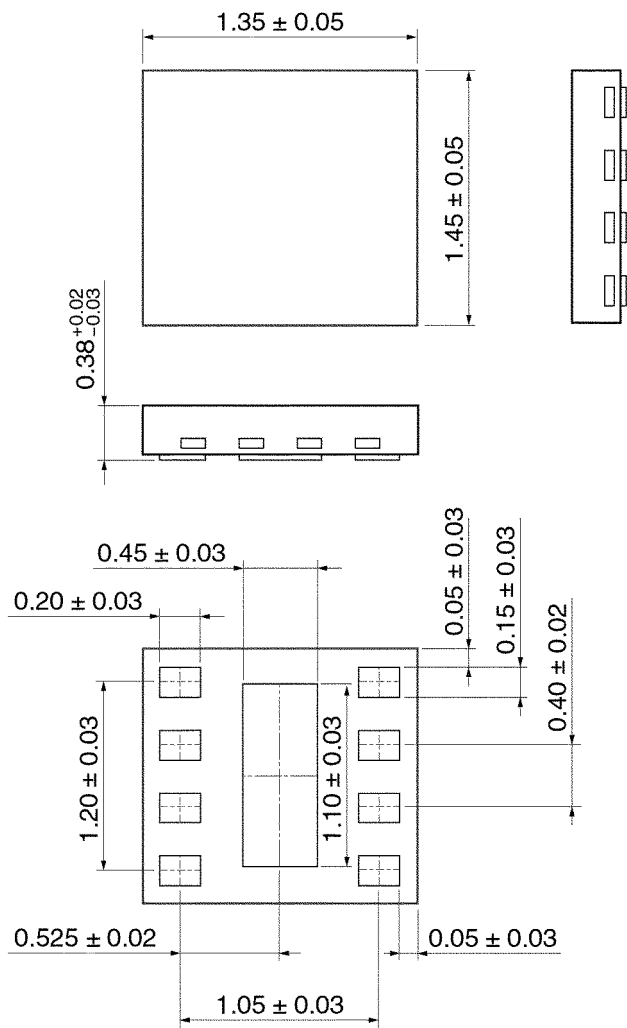
AC Characteristics Measurement Waveforms

Figure2 t_{pLH} , t_{pHL}

Figure3 t_{pLZ} , t_{pHZ} , t_{pZL} , t_{pZH}

SYMBOL	V_{CC}					
	$3.3 \pm 0.3 \text{ V}$	$2.5 \pm 0.2 \text{ V}$	$1.8 \pm 0.15 \text{ V}$	$1.5 \pm 0.1 \text{ V}$	$1.2 \pm 0.1 \text{ V}$	0.9 V
V_M	$V_{CC} / 2$	$V_{CC} / 2$	$V_{CC} / 2$	$V_{CC} / 2$	$V_{CC} / 2$	$V_{CC} / 2$
V_X	$V_{OL} + 0.3 \text{ V}$	$V_{OL} + 0.15 \text{ V}$	$V_{OL} + 0.15 \text{ V}$	$V_{OL} + 0.1 \text{ V}$	$V_{OL} + 0.1 \text{ V}$	$V_{OL} + 0.1 \text{ V}$
V_Y	$V_{OH} - 0.3 \text{ V}$	$V_{OH} - 0.15 \text{ V}$	$V_{OH} - 0.15 \text{ V}$	$V_{OH} - 0.1 \text{ V}$	$V_{OH} - 0.1 \text{ V}$	$V_{OH} - 0.1 \text{ V}$

Package Dimensions

CSO8-P-0.4

Unit: mm



Weight : 0.002 g (Typ.)

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