

TC7WH245FU, TC7WH245FK

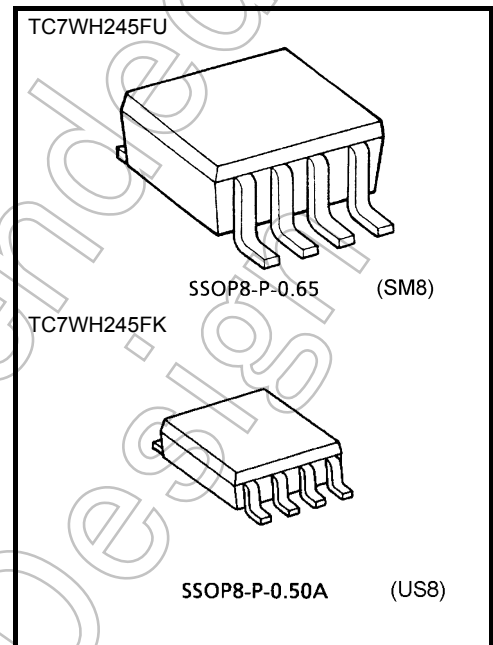
Dual Bus Transceiver

FEATURES

- High Speed : $t_{pd} = 4.0 \text{ ns (typ.)}$
at $V_{CC} = 5 \text{ V}$, $C_L = 15\text{pF}$
- Low Power Dissipation : $I_{CC} = 2 \mu\text{A (max)}$ at $T_a = 25^\circ\text{C}$
- High Noise Immunity : $V_{NIH} = V_{NIL} = 28\% V_{CC}$ (min)
- Balanced Propagation Delays: $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range: $V_{CC} \text{ (opr)} = 2 \text{ to } 5.5 \text{ V}$
- Low Noise : $V_{OLP} = 0.8 \text{ V (max)}$

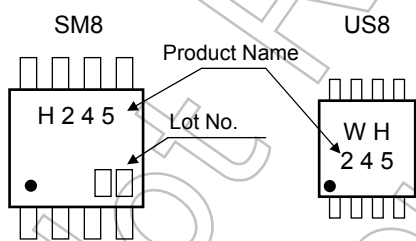
APPLICATION NOTES

- 1) Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.
- 2) All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.
- 3) A parasitic diode is formed between the bus and V_{CC} terminals. Therefore bus terminal can not be used to interface 5V to 3V systems directly.

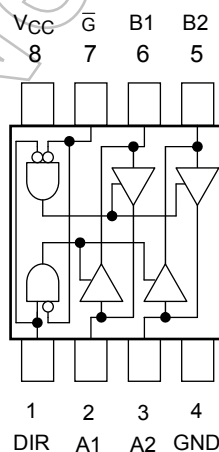


Weight
 SSOP8-P-0.65 : 0.02 g (typ.)
 SSOP8-P-0.50A : 0.01 g (typ.)

Marking



Pin Assignment (top view)



Start of commercial production
 1999-12

Absolute Maximum Ratings (Ta = 25°C)

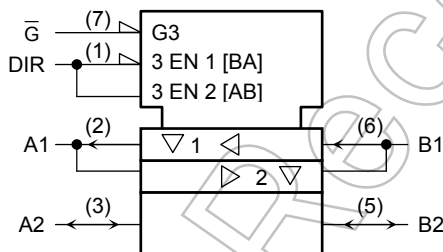
Characteristic	Symbol	Rating	Unit
Supply Voltage	V _{CC}	-0.5 to 7	V
DC Input Voltage	V _{IN}	-0.5 to 7	V
DC Output Voltage	V _{OUT}	-0.5 to V _{CC} + 0.5	V
Input Diode Current	I _{IK}	-20	mA
Output Diode Current	I _{OK}	±20 (Note 1)	mA
DC Output Current	I _{OUT}	±25	mA
DC Vcc/Ground Current	I _{CC}	±50	mA
Power Dissipation	P _D	300(SM8) 200(US8)	mW
Storage Temperature	T _{stg}	-65 to 150	°C
Lead Temperature(10s)	T _L	260	°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_{OUT} < GND, V_{OUT} > V_{CC}

IEC Logic Symbol



Truth Table

Input		Function		Output
\bar{G}	DIR	A BUS	B BUS	
L	L	OUTPUT	INPUT	A = B
L	H	INPUT	OUTPUT	B = A
H	X	High impedance		Z

X: Don't care

Z: High impedance

Operating Ranges

Characteristic	Symbol	Rating	Unit
Supply Voltage	V _{CC}	2 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 ± 0.3 V)	ns/V
		0 to 20 (V _{CC} = 5.0 ± 0.5 V)	

Electrical Characteristics

DC Characteristics

Characteristic	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit		
				V _{CC} (V)	Min	Typ.	Max	Min		Max	
High-Level Input Voltage	V _{IH}	—		2.0	1.5	—	—	1.5	—	V	
				3.0 to 5.5	V _{CC} × 0.7	—	—	V _{CC} × 0.7	—		
Low-Level Input Voltage	V _{IL}	—		2.0	—	—	0.5	—	0.5	V	
				3.0 to 5.5	—	—	V _{CC} × 0.3	—	V _{CC} × 0.3		
High-Level Output Voltage	V _{OH}	V _{IN} = V _{IH} or V _{IL}		I _{OH} = -50 μA	2.0	1.9	2.0	—	1.9	—	V
					3.0	2.9	3.0	—	2.9	—	
					4.5	4.4	4.5	—	4.4	—	
				I _{OH} = -4 mA	3.0	2.58	—	—	2.48	—	
					4.5	3.94	—	—	3.80	—	
Low-Level Output Voltage	V _{OL}	V _{IN} = V _{IH} or V _{IL}		I _{OL} = 50 μA	2.0	—	0.0	0.1	—	0.1	V
					3.0	—	0.0	0.1	—	0.1	
					4.5	—	0.0	0.1	—	0.1	
				I _{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
					4.5	—	—	0.36	—	0.44	
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 Sply Current	I _{CC}	V _{IN} = V _{CC} or GND		5.5	—	—	2.0	—	20.0	μA	

Not Recommended for New

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

Characteristic	Symbol	Test Condition	Ta = 25°C			Ta = -40 to 85°C		Unit		
			VCC (V)	CL (pF)	Min	Typ.	Max		Min	Max
Propagation Delay Time	t_{pLH}	—	3.3 ± 0.3	15	—	5.8	8.4	1.0	10.0	ns
				50	—	8.3	11.9	1.0	13.5	
	t_{pHL}		5.0 ± 0.5	15	—	4.0	5.5	1.0	6.5	
				50	—	5.5	7.5	1.0	8.5	
3-State Output Enable Time	t_{pZL}	$R_L = 1 \text{ k}\Omega$	3.3 ± 0.3	15	—	8.5	13.2	1.0	15.5	ns
				50	—	11.0	16.7	1.0	19.0	
	t_{pZH}		5.0 ± 0.5	15	—	5.8	8.5	1.0	10.0	
				50	—	7.3	10.6	1.0	12.0	
3-State Output Disable Time	t_{pLZ}	$R_L = 1 \text{ k}\Omega$	3.3 ± 0.3	50	—	11.5	15.8	1.0	18.0	ns
	t_{pHZ}		5.0 ± 0.5	50	—	7.0	9.7	1.0	11.0	
Output to Output Skew	t_{osLH}	(Note 2)	3.3 ± 0.3	50	—	—	1.5	—	1.5	ns
	t_{osHL}		5.0 ± 0.5	50	—	—	1.0	—	1.0	
Input Capacitance	C_{IN}	DIR, \bar{G}	—	—	—	4	10	—	—	pF
Bus Input Capacitance	$C_{I/O}$	An, Bn	—	—	—	8	—	—	—	pF
Power Dissipation Capacitance	C_{PD}	—	—	(Note 3)	—	21	—	—	—	pF

Note 2: Parameter guaranteed by design.

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

Note 3: C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

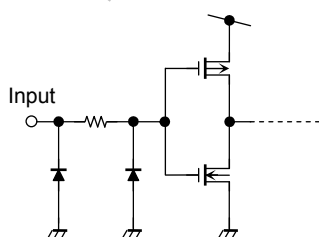
Average operating current can be obtained by the equation:

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

Noise Characteristics (Ta = 25°C, Input: $t_r = t_f = 3 \text{ ns}$)

Characteristic	Symbol	Test Condition	VCC (V)	Typ.	Limit	Unit
			5.0			
Quiet Output Maximum Dynamic V_{OL}	V_{OLP}	$C_L = 50 \text{ pF}$	5.0	0.5	0.8	V
Quiet Output Minimum Dynamic V_{OL}	V_{OLV}	$C_L = 50 \text{ pF}$	5.0	-0.5	-0.8	V
Minimum High Level Dynamic Input Voltage	V_{IHD}	$C_L = 50 \text{ pF}$	5.0	—	3.5	V
Maximum Low Level Dynamic Input Voltage	V_{ILD}	$C_L = 50 \text{ pF}$	5.0	—	1.5	V

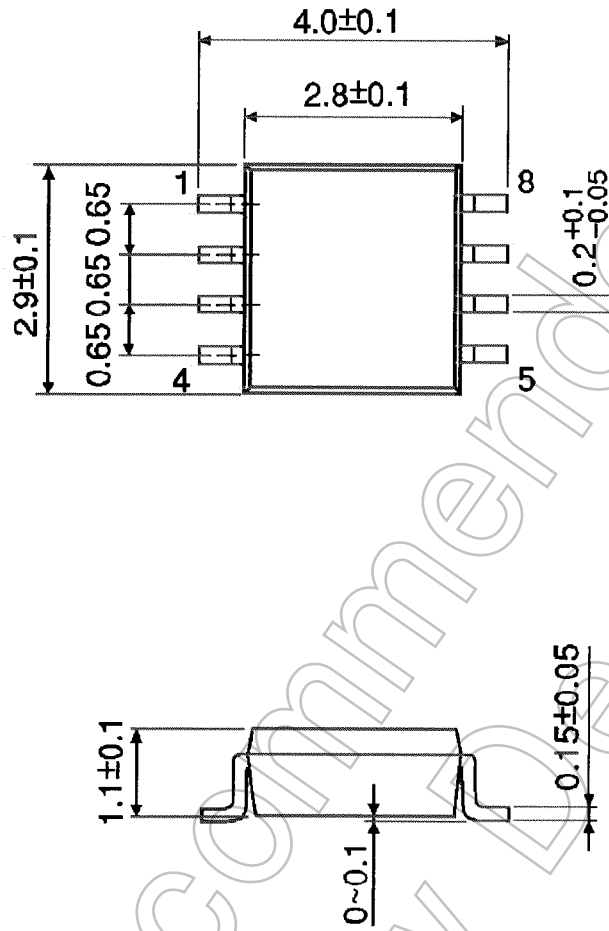
Input Equivalent Circuit



Package Dimensions

SSOP8-P-0.65

Unit : mm



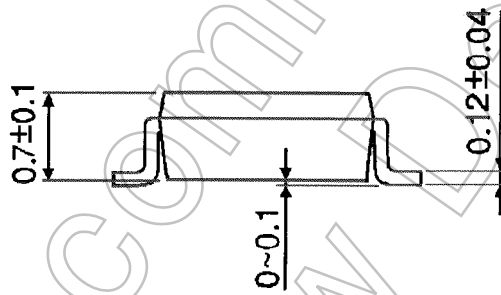
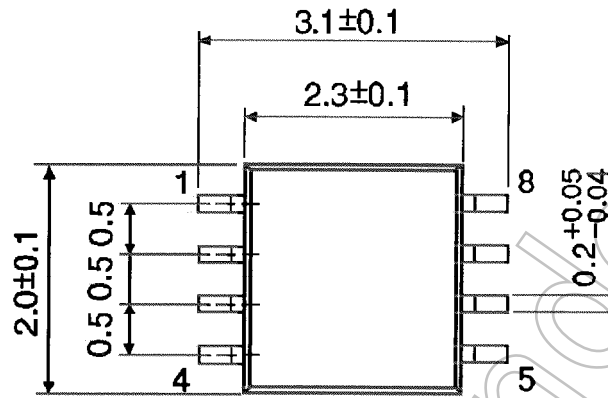
Weight: 0.02 g (Typ.)

Not Recommended for New Design

Package Dimensions

SSOP8-P-0.50A

Unit : mm



Weight: 0.01 g (Typ.)

Not Recommended for New Design

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