TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

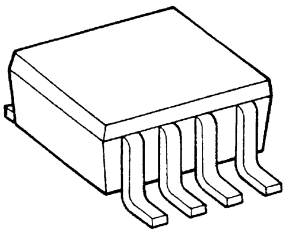
TC7WH245FU, TC7WH245FK

Dual Bus Transceiver

FEATURES

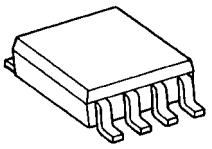
- High Speed : t_{pd} = 4.0 ns (typ.) at V_{CC} = 5 V, C_L = 15pF
- Low Power Dissipation : I_{CC} = 2 μA (Max.) at Ta = 25°C
- High Noise Immunity : $V_{NIH} = V_{NIL}$ = 28% V_{CC} (Min.)
- Balanced Propagation Delays: $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range: $V_{CC\ (opr)}$ = 2 to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

TC7WH245FU



SSOP8-P-0.65 (SM8)

TC7WH245FK



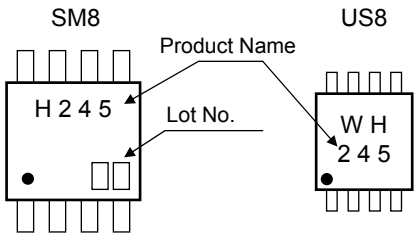
SSOP8-P-0.50A (US8)

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

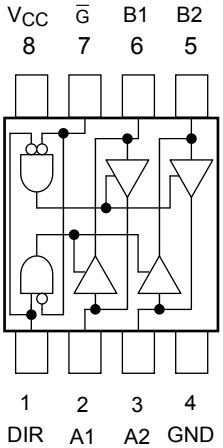
APPLICATION NOTES

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 Vcc terminals. Therefore bus terminal can not be used to interface 5V to 3V systems directly.

Marking



Pin Assignment (top view)



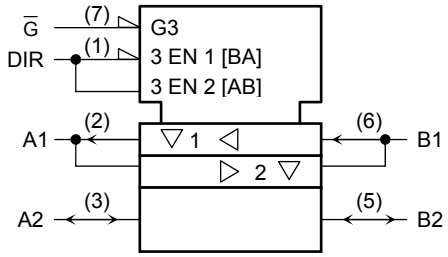
Absolute Maximum Ratings (Ta = 25°C)

Characteristic	Symbol	Rating	Unit
Supply Voltage	V_{CC}	−0.5 to 7	V
DC Input Voltage	V_{IN}	−0.5 tp 7	V
DC Output Voltage	V_{OUT}	−0.5 toV_{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
Strage Temperature	T_{stg}	−65 to 150	°C
LeadTemperature(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
$\overline{G}$	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	d_t/d_v	0 to100 (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		V_{CC} (V)	Ta = 25°C Min.	Ta = 25°C Typ.	Ta = 25°C Max.	Ta = −40 to 85°C Min.	Ta = −40 to 85°C Max.	Unit
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	
				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	—	
			I_{OH} = −8 mA	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	
				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	
			I_{OL} = 8 mA	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 Spply Current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	2.0	—	20.0	μA

AC Characteristics (Input: $t_r = t_f = 3$ ns)

Characteristic	Symbol	Test Condition			Ta = 25°C			Ta = −40 to 85°C		Unit
			V_{CC} (V)	C_L (pF)	Min.	Typ.	Max.	Min.	Max.	
Propagation Delay Time	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	5.8	8.4	1.0	10.0	ns
				50	—	8.3	11.9	1.0	13.5	
			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} t_{pZH}	R_L = 1 kΩ	3.3 ± 0.3	15	—	8.5	13.2	1.0	15.5	ns
				50	—	11.0	16.7	1.0	19.0	
			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} t_{pHZ}	R_L = 1 kΩ	3.3 ± 0.3	50	—	11.5	15.8	1.0	18.0	ns
			5.0 ± 0.5	50	—	7.0	9.7	1.0	11.0	
Output to Output Skew	t_{osLH} t_{osHL}	(Note 2)	3.3 ± 0.3	50	—	—	1.5	—	1.5	ns
			5.0 ± 0.5	50	—	—	1.0	—	1.0	
Input Capacitance	C_{IN}	DIR, $\overline{G}$			—	4	10	—	10	pF
Bus Input Capacitance	$C_{I/O}$	An, Bn			—	8	—	—	—	pF
Power Dissipation Capacitance	C_{PD}	(Note 3)			—	21	—	—	—	pF

Note 2: Parameter guranteed 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 calucurated from the operating current consumption without load.

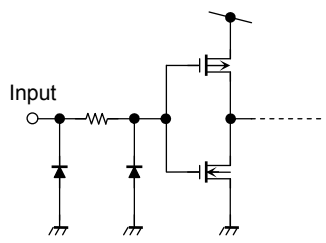
Average iperating current can be obtained by the equation:

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

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

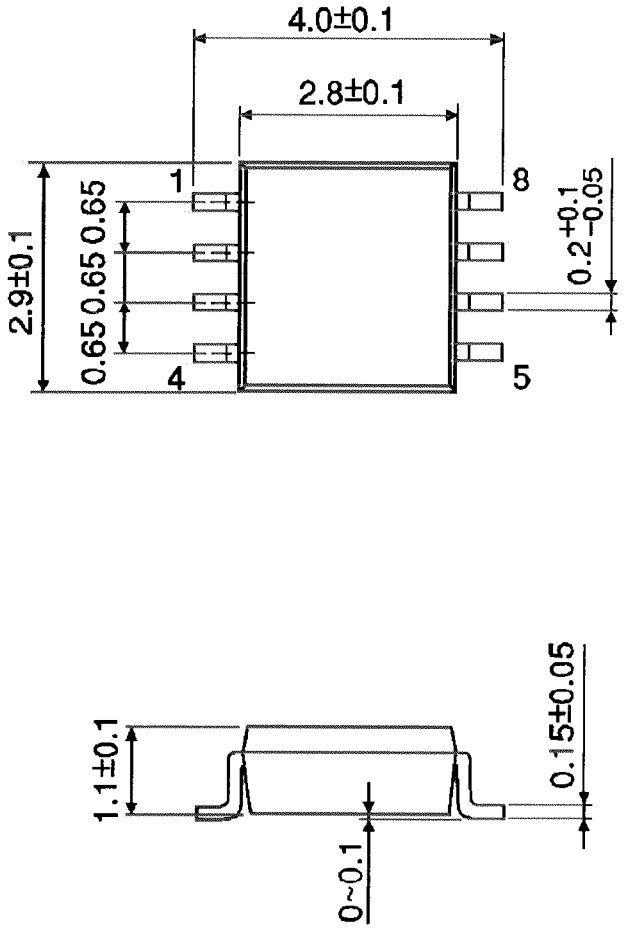
Characteritic	Symbol	Test Condition	V_{CC} (V)	Typ.	Limit	Unit
Quiet Output Maximum Dynamic V_{OL}	V_{OLP}	C_L = 50 pF	5.0	0.5	0.8	V
Quiet Output Minimum Dynamic V_{OL}	V_{OLV}	C_L = 50 pF	5.0	−0.5	−0.8	V
Minimum High Level Dynamic Input Voltage	V_{IHD}	C_L = 50 pF	5.0	—	3.5	V
Maximum Low Level Dynamic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

Input Equivalent Circuit



Package Dimensions

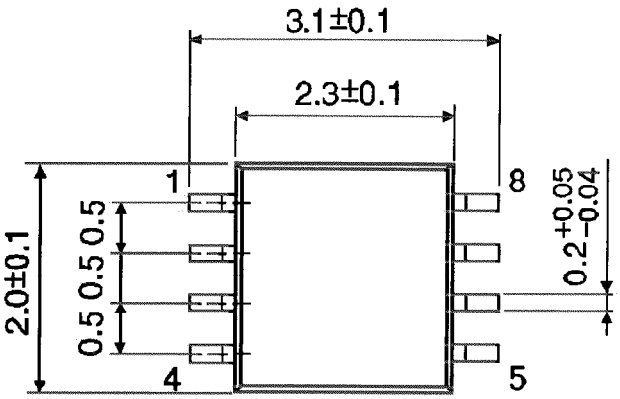
SSOP8-P-0.65 Unit : mm

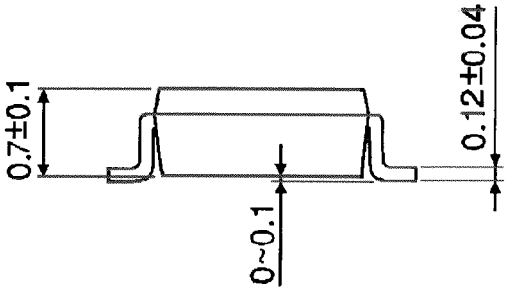


Weight: 0.02 g (Typ.)

Package Dimensions

SSOP8-P-0.50A Unit : mm





Weight: 0.01 g (Typ.)

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