

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7MH245FK

## Octal Bus Transceiver

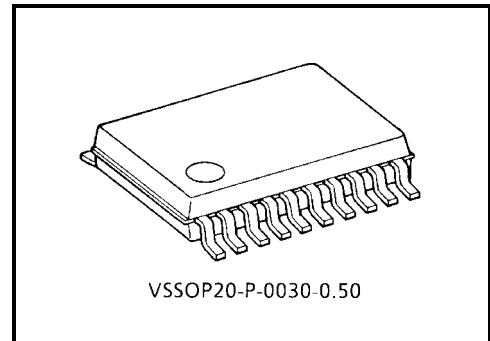
The TC7MH245FK is an advanced high speed CMOS octal bus transceiver fabricated with silicon gate C<sup>2</sup>MOS technology.

It achieves the high speed operation similar to equivalent bipolar schottky TTL while maintaining the CMOS low power dissipation.

It is intended for two-way asynchronous communication between data busses. The direction of data transmission is determined by the level of the DIR input.

The enable input ( $\bar{G}$ ) can be used to disable the device so that the busses are effectively isolated.

All inputs are equipped with protection circuits against static discharge.



Weight: 0.03 g (typ.)

## Features

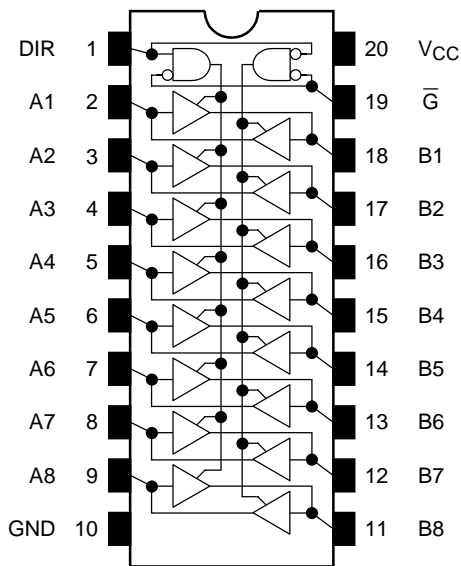
- High speed:  $t_{pd} = 4.0$  ns (typ.) ( $V_{CC} = 5$  V)
- Low power dissipation:  $I_{CC} = 4$   $\mu$ A (max) ( $T_a = 25^\circ$ C)
- High noise immunity:  $V_{NIH} = V_{NIL} = 28\%$   $V_{CC}$  (min)
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} (opr) = 2\sim 5.5$  V
- Low noise:  $V_{OLP} = 1.0$  V (max)
- Pin and function compatible with 74ALS245

Note: Do not apply a signal to any bus terminal when it is in the output mode. Damage may result.

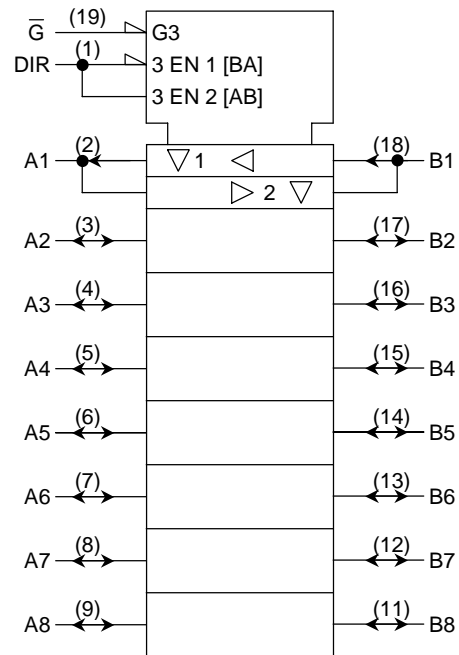
All floating (high impedance) bus terminals must have their input levels fixed by means of pull up or pull down resistors.

A parasitic diode is formed between the bus and  $V_{CC}$  terminals. Therefore bus terminal can not be used to interface 5 V to 3 V systems directly.

## Pin Assignment (top view)



## IEC Logic Symbol



## Truth Table

Inputs		Outputs	Function	
$\bar{G}$	DIR		A-Bus	B-Bus
L	L	A = B	Output	Input
L	H	B = A	Input	Output
H	X	Z	Z	

X: Don't care

Z: High impedance

## Maximum Ratings

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5~7.0	V
DC input voltage (DIR, $\bar{G}$ )	$V_{IN}$	-0.5~7.0	V
DC bus I/O voltage	$V_{I/O}$	-0.5~ $V_{CC} + 0.5$	V
Input diode current (DIR, $\bar{G}$ )	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	±20	mA
DC output current	$I_{OUT}$	±25	mA
DC $V_{CC}$ /ground current	$I_{CC}$	±75	mA
Power dissipation	$P_D$	180	mW
Storage temperature	$T_{stg}$	-65~150	°C

## Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	2.0~5.5	V
Input voltage (DIR, $\bar{G}$ )	$V_{IN}$	0~5.5	V
Bus I/O voltage	$V_{I/O}$	0~ $V_{CC}$	V
Operating temperature	$T_{opr}$	-40~85	°C
Input rise and fall time	dt/dv	0~100 ( $V_{CC} = 3.3 \pm 0.3$ V)	ns/V
		0~20 ( $V_{CC} = 5 \pm 0.5$ V)	

## Electrical Characteristics

### DC Characteristics

Characteristics		Symbol	Test Condition		$T_a = 25^\circ\text{C}$			$T_a = -40\sim 85^\circ\text{C}$		Unit		
					$V_{CC}$ (V)	Min	Typ.	Max	Min		Max	
Input voltage	High level	$V_{IH}$	—	2.0	1.50	—	—	1.50	—	V		
				3.0~5.5	$V_{CC} \times 0.7$	—	—	$V_{CC} \times 0.7$	—			
	Low level	$V_{IL}$	—	2.0	—	—	0.50	—	0.50			
				3.0~5.5	—	—	$V_{CC} \times 0.3$	—	$V_{CC} \times 0.3$			
Output voltage	High level	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50 \mu\text{A}$	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	—		
					$I_{OH} = -4 \text{ mA}$	3.0	2.58	—	—	2.48		—
					$I_{OH} = -8 \text{ mA}$	4.5	3.94	—	—	3.80		—
	Low level	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50 \mu\text{A}$	2.0	—	0	0.1	—	0.1		
					3.0	—	0	0.1	—	0.1		
					4.5	—	0	0.1	—	0.1		
					$I_{OL} = 4 \text{ mA}$	3.0	—	—	0.36	—		0.44
					$I_{OL} = 8 \text{ mA}$	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	—	—	$\pm 0.25$	—	$\pm 2.50$	$\mu\text{A}$			
Input leakage current	$I_{IN}$	$V_{IN} = 5.5 \text{ V}$ or GND	0~5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu\text{A}$			
Quiescent supply current	$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	4.0	—	40.0	$\mu\text{A}$			

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

Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40~85°C		Unit	
			V <sub>CC</sub> (V)	C <sub>L</sub> (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 <sub>L</sub> = 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 <sub>L</sub> = 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	$t_{osLH}$ $t_{osHL}$	(Note1)	3.3 ± 0.3	50	—	—	1.5	—	1.5	ns	
			5.0 ± 0.5	50	—	—	1.0	—	1.0		
Input capacitance	C <sub>IN</sub>	DIR, $\bar{G}$				—	4	10	—	10	pF
Bus input capacitance	C <sub>I/O</sub>	A <sub>n</sub> , B <sub>n</sub>				—	8	—	—	—	pF
Power dissipation capacitance	C <sub>PD</sub>		(Note2)			—	21	—	—	—	pF

Note1: This parameter is guaranteed by design.

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

Note2: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

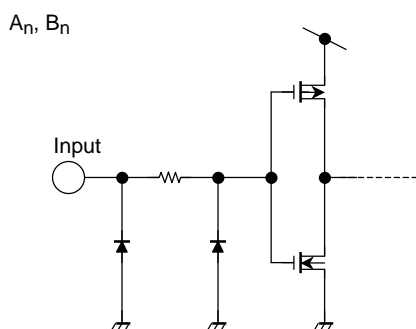
Average operating current can be obtained by the equation:

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

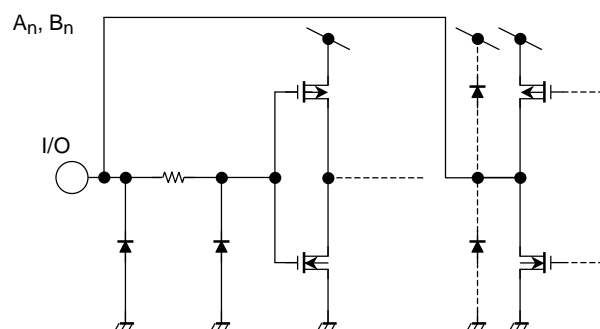
## Noise Characteristics (Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	Ta = 25°C			Unit
			V <sub>CC</sub> (V)	Typ.	Limit	
Quiet output maximum dynamic V <sub>OL</sub>	V <sub>OLP</sub>	C <sub>L</sub> = 50 pF	5.0	0.7	1.0	V
Quiet output minimum dynamic V <sub>OL</sub>	V <sub>OLV</sub>	C <sub>L</sub> = 50 pF	5.0	-0.7	-1.0	V
Minimum high level dynamic input voltage V <sub>IH</sub>	V <sub>IHD</sub>	C <sub>L</sub> = 50 pF	5.0	—	3.5	V
Maximum low level dynamic input voltage V <sub>IL</sub>	V <sub>ILD</sub>	C <sub>L</sub> = 50 pF	5.0	—	1.5	V

### Input Equivalent Circuit



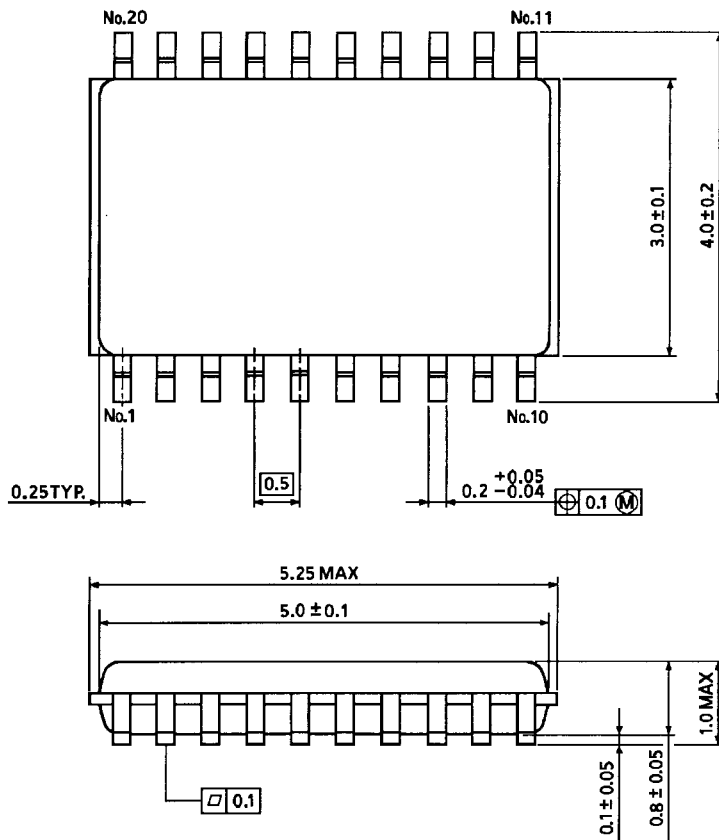
### Bus Terminal Equivalent Circuit



**Package Dimensions**

VSSOP20-P-0030-0.50

Unit : mm



Weight: 0.03 g (typ.)

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