

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7MH153FK

## Dual 4-Channel Multiplexer

The TC7MH153FK is an advanced high speed CMOS dual 4-channel multiplexers 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.

Each of these data (1C0-1C3, 2C0-2C3) is selected by the two address inputs A and B.

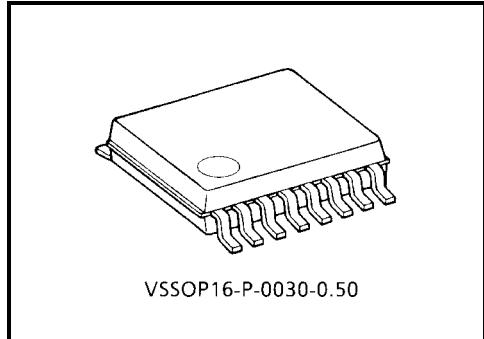
Separate strobe inputs (1 $\bar{G}$ , 2 $\bar{G}$ ) are provided for each of the two four-line sections.

The strobe input ( $\bar{G}$ ) can be used to inhibit the data output; the output is fixed in low level while the strobe input is held high.

An input protection circuit ensures that 0 to 7 V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5 V to 3 V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

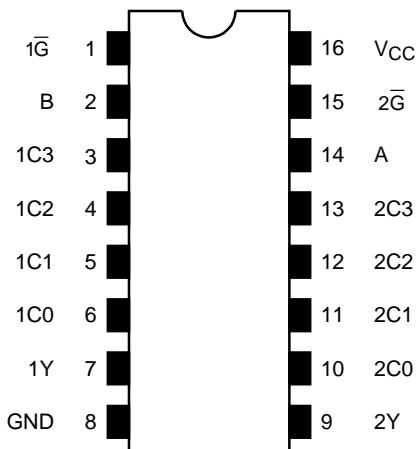
## Features

- High speed:  $t_{pd} = 5.0$  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)
- Power down protection is provided on all inputs.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Wide operating voltage range:  $V_{CC} (\text{opr}) = 2 \sim 5.5$  V
- Pin and function compatible with 74ALS153

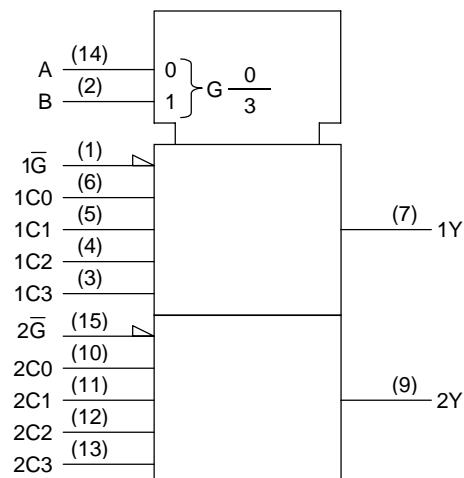


Weight: 0.02 g (typ.)

## Pin Assignment (top view)



## IEC Logic Symbol

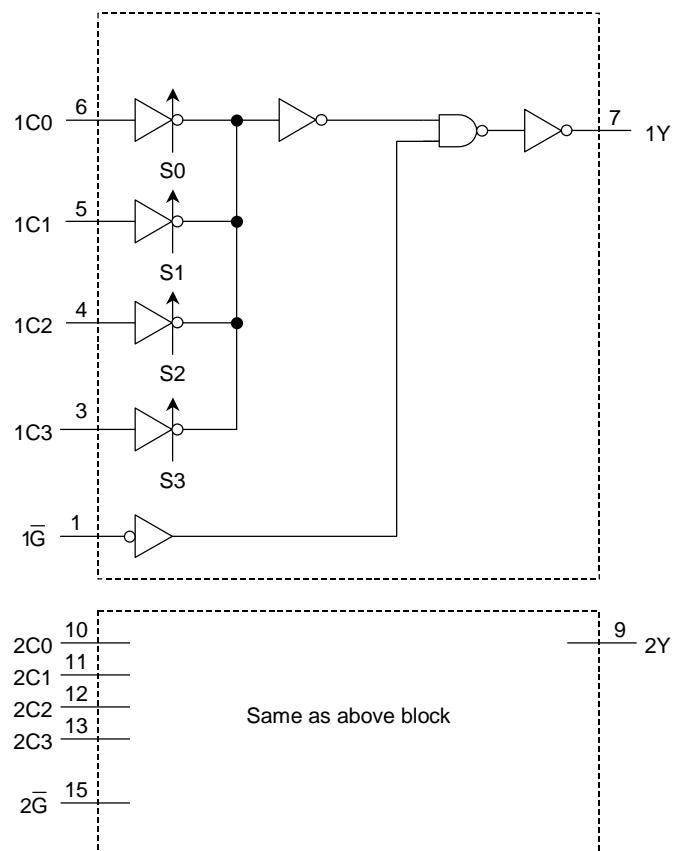
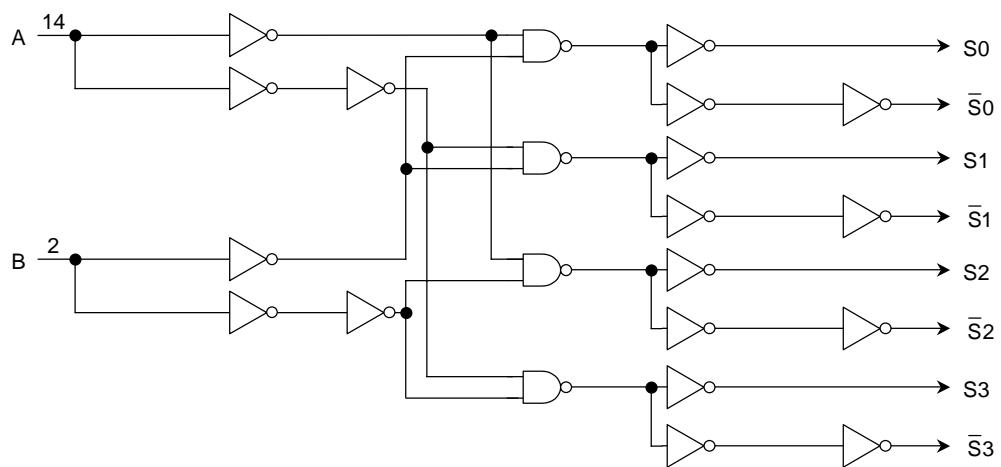


## Truth Table

Select Inputs		Data Inputs				Strobe	Output
B	A	C0	C1	C2	C3	$\bar{G}$	Y
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
L	H	X	L	X	X	L	L
L	H	X	H	X	X	L	H
H	L	X	X	L	X	L	L
H	L	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

X: Don't care

## System Diagram



## Maximum Ratings

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5~7.0	V
DC input voltage	$V_{IN}$	-0.5~7.0	V
DC output voltage	$V_{OUT}$	-0.5~ $V_{CC}$ + 0.5	V
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	$\pm 20$	mA
DC output current	$I_{OUT}$	$\pm 25$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	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	$V_{IN}$	0~5.5	V
Output voltage	$V_{OUT}$	0~ $V_{CC}$	V
Operating temperature	$T_{opr}$	-40~85	°C
Input rise and fall time	$dt/dv$	0~100 ( $V_{CC} = 3.3 \pm 0.3$ V) 0~20 ( $V_{CC} = 5 \pm 0.5$ V)	ns/V

## Electrical Characteristics

## DC Characteristics

Characteristics		Symbol	Test Condition	$V_{CC}$ (V)	Ta = 25°C			Ta = -40~85°C		Unit	
					Min	Typ.	Max	Min	Max		
Input voltage	High level	$V_{IH}$	—	2.0	1.50	—	—	1.50	—	V	
				3.0~5.5	$V_{CC} \times 0.7$	—	—	$V_{CC} \times 0.7$	—		
				2.0	—	—	0.50	—	0.50		
	Low level	$V_{IL}$	—	3.0~5.5	—	—	$V_{CC} \times 0.3$	—	$V_{CC} \times 0.3$		
				2.0	1.9	2.0	—	1.9	—		
				3.0	2.9	3.0	—	2.9	—		
Output voltage	High level	$V_{OH}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -50 \mu A$	2.0	4.5	4.5	—	4.4	V	
					3.0	4.4	4.5	—	4.4		
					3.0	2.58	—	—	2.48		
				$I_{OH} = -4 mA$	3.0	—	—	—	—		
				$I_{OH} = -8 mA$	4.5	3.94	—	—	3.80		
	Low level	$V_{OL}$	$V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 50 \mu A$	2.0	—	0	0.1	—		
					3.0	—	0	0.1	—		
					4.5	—	0	0.1	—		
				$I_{OL} = 4 mA$	3.0	—	—	0.36	—		
				$I_{OL} = 8 mA$	4.5	—	—	0.36	—		
Input leakage current		$I_{IN}$	$V_{IN} = 5.5$ V or GND	0~5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	μA	
Quiescent supply current		$I_{CC}$	$V_{IN} = V_{CC}$ or GND	5.5	—	—	4.0	—	40.0	μA	

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

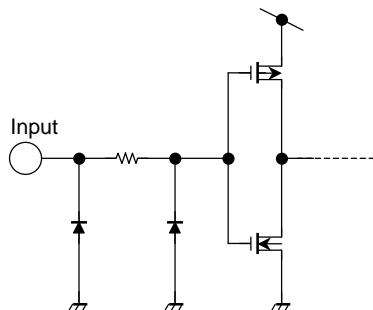
Characteristics	Symbol	Test Condition	Ta = 25°C			Ta = -40~85°C		Unit
			V <sub>CC</sub> (V)	C <sub>L</sub> (pF)	Min	Typ.	Max	
Propagation delay time (C <sub>n</sub> -Y)	t <sub>pLH</sub> t <sub>pHL</sub>	—	3.3 ± 0.3	15	—	7.7	11.9	1.0 14.0
				50	—	10.2	15.4	1.0 17.5
			5.0 ± 0.5	15	—	5.0	7.7	1.0 9.0
				50	—	6.5	9.7	1.0 11.0
Propagation delay time (A, B-Y)	t <sub>pLH</sub> t <sub>pHL</sub>	—	3.3 ± 0.3	15	—	10.8	16.7	1.0 19.5
				50	—	13.3	20.2	1.0 23.0
			5.0 ± 0.5	15	—	6.8	9.9	1.0 11.5
				50	—	8.3	11.9	1.0 13.5
Propagation delay time ( $\bar{G}$ -Y)	t <sub>pLH</sub> t <sub>pHL</sub>	—	3.3 ± 0.3	15	—	6.3	10.1	1.0 12.0
				50	—	8.8	13.6	1.0 15.5
			5.0 ± 0.5	15	—	4.4	6.4	1.0 7.5
				50	—	5.9	8.4	1.0 9.5
Input capacitance	C <sub>IN</sub>	—	—	—	4	10	—	10 pF
Power dissipation capacitance	C <sub>PD</sub>	(Note)		—	20	—	—	— pF

Note: 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:

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

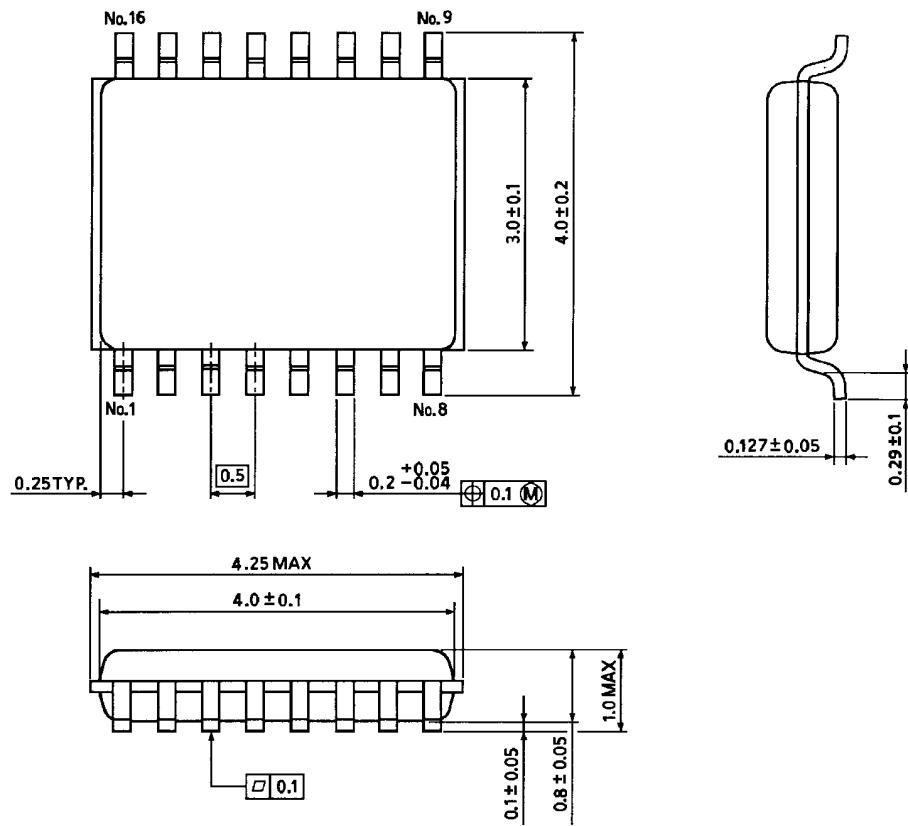
## Input Equivalent Circuit



**Package Dimensions**

VSSOP16-P-0030-0.50

Unit : mm



Weight: 0.02 g (typ.)

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