

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

TC7MH238FK**3-to-8 Line Decoder**

The TC7MH238FK is an advanced high speed CMOS 3-to-8 decoder fabricated with silicon gate C²MOS technology.

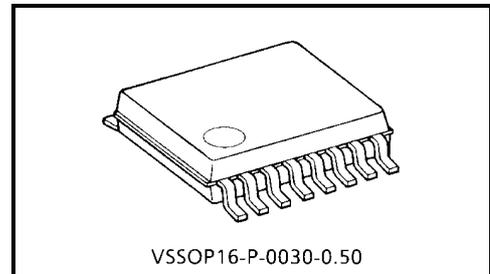
It achieves the high speed operation similar to equivalent bipolar schottky TTL while maintaining the CMOS low power dissipation.

When the device is enabled, 3 binary select inputs (A, B and C) determine which one of the outputs (Y0-Y7) will go high.

When enable input G1 is held low or either $\overline{G2A}$ or $\overline{G2B}$ is held high, decoding function is inhibited and all outputs go low.

G1, $\overline{G2A}$ and $\overline{G2B}$ inputs are provided to ease cascade connection and for use as an address decoder for memory systems.

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.



Weight: 0.02 g (typ.)

Features

- High speed: $t_{pd} = 5.5$ ns (typ.) ($V_{CC} = 5$ V)
- Low power dissipation: $I_{CC} = 4$ μ A (max) ($T_a = 25^\circ\text{C}$)
- 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: $V_{CC (opr)} = 2\sim 5.5$ V
- Pin and function compatible with 74ALS238

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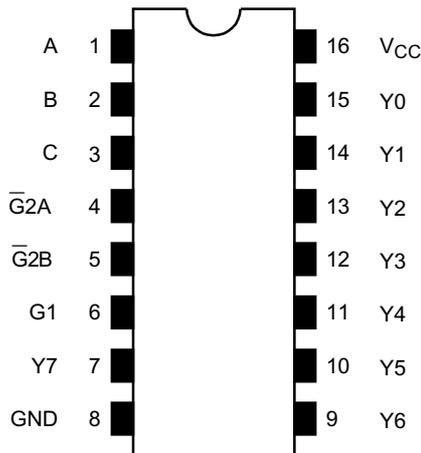
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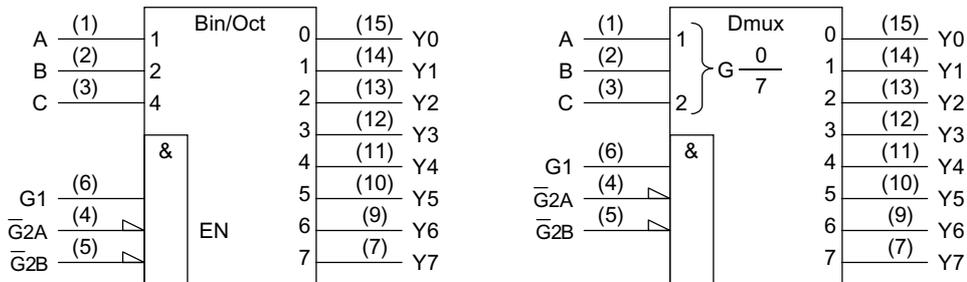
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Pin Assignment (top view)



IEC Logic Symbol

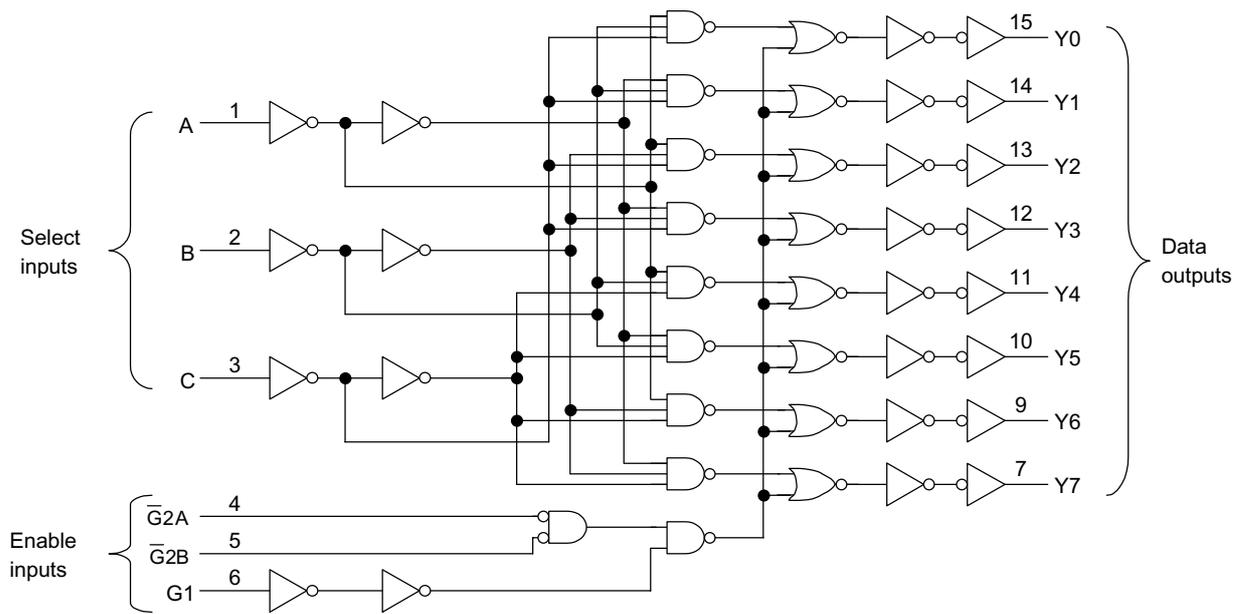


Truth Table

Inputs						Outputs								Selected Output
Enable			Select			Y0	Y1	Y2	Y3	Y4	Y5	Y6	Y7	
G1	$\bar{G}2A$	$\bar{G}2B$	C	B	A									
L	X	X	X	X	X	L	L	L	L	L	L	L	L	None
X	H	X	X	X	X	L	L	L	L	L	L	L	L	None
X	X	H	X	X	X	L	L	L	L	L	L	L	L	None
H	L	L	L	L	L	H	L	L	L	L	L	L	L	Y0
H	L	L	L	L	H	L	H	L	L	L	L	L	L	Y1
H	L	L	L	H	L	L	L	H	L	L	L	L	L	Y2
H	L	L	L	H	H	L	L	L	H	L	L	L	L	Y3
H	L	L	H	L	L	L	L	L	L	H	L	L	L	Y4
H	L	L	H	L	H	L	L	L	L	L	H	L	L	Y5
H	L	L	H	H	L	L	L	L	L	L	L	H	L	Y6
H	L	L	H	H	H	L	L	L	L	L	L	L	H	Y7

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}	±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	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		Ta = 25°C			Ta = -40~85°C		Unit	
					V _{CC} (V)	Min	Typ.	Max	Min		Max
Input voltage	High level	V _{IH}	—	2.0 3.0~5.5	1.50 V _{CC} × 0.7	— —	— —	1.50 V _{CC} × 0.7	— —	V	
	Low level	V _{IL}	—	2.0 3.0~5.5	— —	— —	0.50 V _{CC} × 0.3	— —	0.50 V _{CC} × 0.3		
Output voltage	High level	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -50 μA	2.0 3.0 4.5	1.9 2.9 4.4	2.0 3.0 4.5	— — —	1.9 2.9 4.4	— — —	V
				I _{OH} = -4 mA	3.0	2.58	—	—	2.48	—	
				I _{OH} = -8 mA	4.5	3.94	—	—	3.80	—	
	Low level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 50 μA	2.0 3.0 4.5	— — —	0 0 0	0.1 0.1 0.1	— — —	0.1 0.1 0.1	
				I _{OL} = 4 mA	3.0	—	—	0.36	—	0.44	
				I _{OL} = 8 mA	4.5	—	—	0.36	—	0.44	
Input leakage current		I _{IN}	V _{IN} = 5.5 V or GND	0~5.5	—	—	±0.1	—	±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)

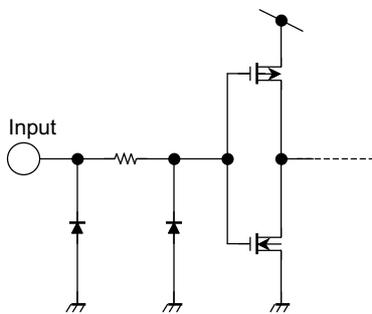
Characteristics	Symbol	Test Condition			Ta = 25°C			Ta = -40~85°C		Unit
			V _{CC} (V)	C _L (pF)	Min	Typ.	Max	Min	Max	
Propagation delay time (A, B, C-Y)	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	8.0	12.3	1.0	14.5	ns
				50	—	10.5	15.8	1.0	18.0	
			5.0 ± 0.5	15	—	5.5	8.1	1.0	9.5	
				50	—	7.0	10.1	1.0	11.5	
Propagation delay time (G1-Y)	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	8.1	12.8	1.0	15.0	ns
				50	—	10.6	16.3	1.0	18.5	
			5.0 ± 0.5	15	—	5.4	8.1	1.0	9.5	
				50	—	6.9	10.1	1.0	11.5	
Propagation delay time ($\bar{G}2$ -Y)	t_{pLH} t_{pHL}	—	3.3 ± 0.3	15	—	8.1	12.3	1.0	14.5	ns
				50	—	10.6	15.8	1.0	18.0	
			5.0 ± 0.5	15	—	5.7	8.1	1.0	9.5	
				50	—	7.2	10.1	1.0	11.5	
Input capacitance	C _{IN}	—	—	—	4	—	—	10	pF	
Power dissipation capacitance	C _{PD}	(Note)			—	37	—	—	—	pF

Note: 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:

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

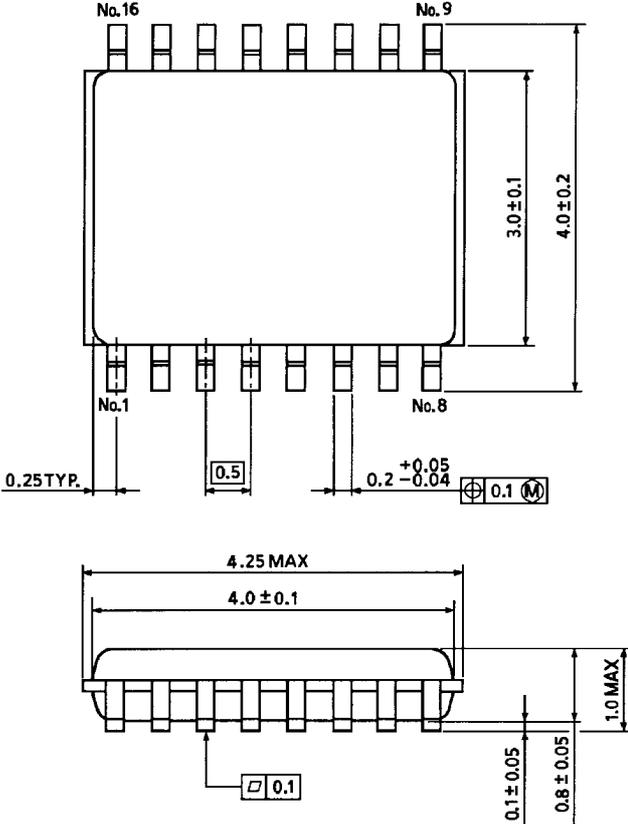
Input Equivalent Circuit



Package Dimensions

VSSOP16-P-0030-0.50

Unit : mm



Weight: 0.02 g (typ.)