

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

# TC7MET139AFK

Dual 2-to-4 Line Decoder

The TC7MET139AFK is an advanced high speed CMOS 2 to 4 line decoder/demultiplexer 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.

The active low enable input can be used for gating or it can be used as a data input for demultiplexing applications.

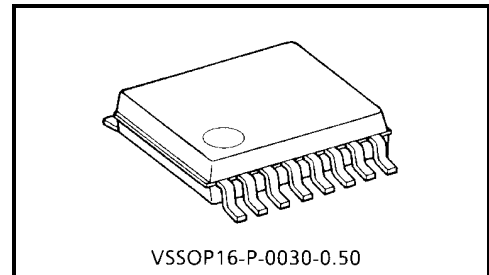
When the enable input is held High, all four outputs are fixed at a high logic level independent of the other inputs.

The input voltage are compatible with TTL output voltage.

This device may be used as a level converter for interfacing 3.3 V to 5 V system.

Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (\*) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

\*: V<sub>CC</sub> = 0 V



VSSOP16-P-0030-0.50

Weight: 0.02 g (typ.)

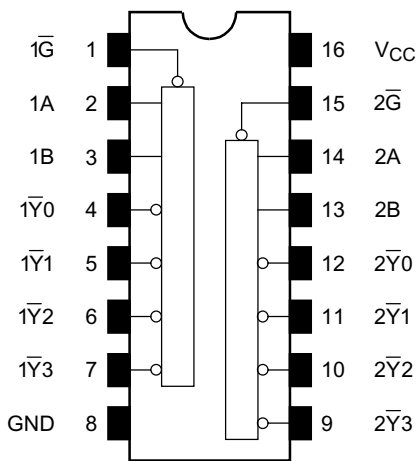
## Features

- High speed:  $t_{pd} = 5.0 \text{ ns (typ.)}$  ( $V_{CC} = 5 \text{ V}$ )
- Low power dissipation:  $I_{CC} = 4 \text{ } \mu\text{A (max)}$  ( $T_a = 25^\circ\text{C}$ )
- Compatible with TTL outputs:  $V_{IL} = 0.8 \text{ V (max)}$   
 $V_{IH} = 2.0 \text{ V (min)}$
- Power down protection is provided on all inputs and outputs.
- Balanced propagation delays:  $t_{pLH} \approx t_{pHL}$
- Low noise:  $V_{OLP} = 0.8 \text{ V (max)}$
- Pin and function compatible with the 74 series (74AC/HC/F/ALS/LS etc.) 139 type.

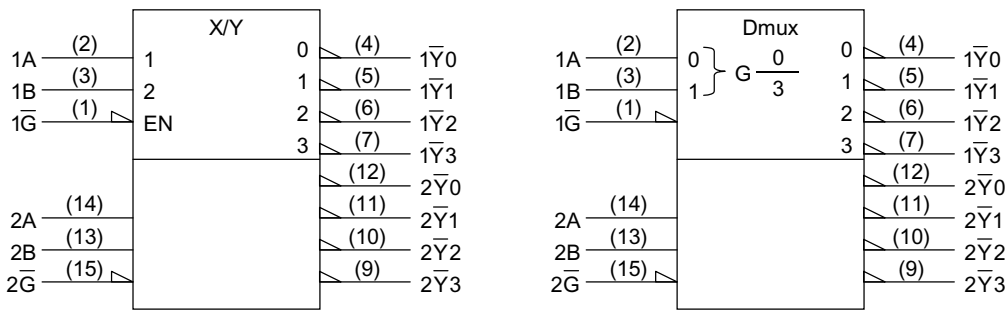
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Pin Assignment (top view)



IEC Logic Symbol

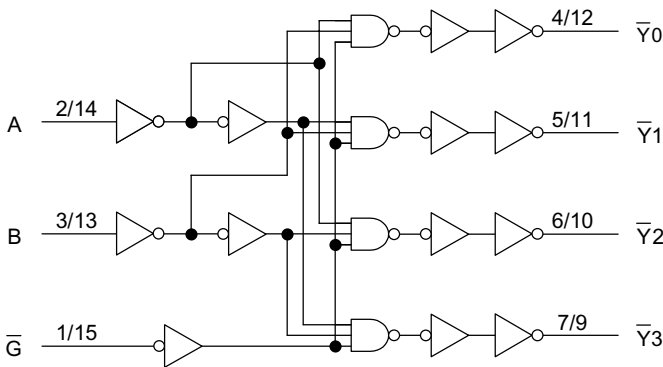


Truth Table

Inputs			Outputs				Selected Output
Enable	Select		$\overline{Y}0$	$\overline{Y}1$	$\overline{Y}2$	$\overline{Y}3$	
$\overline{G}$	B	A					
H	X	X	H	H	H	H	None
L	L	L	L	H	H	H	$\overline{Y}0$
L	L	H	H	L	H	H	$\overline{Y}1$
L	H	L	H	H	L	H	$\overline{Y}2$
L	H	H	H	H	H	L	$\overline{Y}3$

X: Don't care

System Diagram



Maximum Ratings

Characteristics	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	$-0.5 \sim 7.0$	V
DC input voltage	$V_{IN}$	$-0.5 \sim 7.0$	V
DC output voltage	$V_{OUT}$	$-0.5 \sim 7.0$ (Note1)	V
		$-0.5 \sim V_{CC} + 0.5$ (Note2)	
Input diode current	$I_{IK}$	$-20$	mA
Output diode current	$I_{OK}$	$\pm 20$ (Note3)	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	$T_{stg}$	$-65 \sim 150$	$^{\circ}\text{C}$

Note1:  $V_{CC} = 0\text{ V}$

Note2: High or low state.  $I_{OUT}$  absolute maximum rating must be observed.

Note3:  $V_{OUT} < \text{GND}$ ,  $V_{OUT} > V_{CC}$

Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	$4.5 \sim 5.5$	V
Input voltage	$V_{IN}$	$0 \sim 5.5$	V
Output voltage	$V_{OUT}$	$0 \sim 5.5$ (Note4)	V
		$0 \sim V_{CC}$ (Note5)	
Operating temperature	$T_{opr}$	$-40 \sim 85$	$^{\circ}\text{C}$
Input rise and fall time	$dt/dv$	$0 \sim 20$	ns/V

Note4:  $V_{CC} = 0\text{ V}$

Note5: High or low state.

## Electrical Characteristics

### DC Characteristics

Characteristics		Symbol	Test Condition		V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		Unit
						Min	Typ.	Max	Min	Max	
Input voltage	High level	V <sub>IH</sub>	—		4.5~5.5	2.0	—	—	2.0	—	V
	Low level	V <sub>IL</sub>	—		4.5~5.5	—	—	0.8	—	0.8	
Output voltage	High level	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50 μA	4.5	4.4	4.5	—	4.4	—	V
				I <sub>OH</sub> = -8 mA	4.5	3.94	—	—	3.80	—	
	Low level	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50 μA	4.5	—	0	0.1	—	0.1	
				I <sub>OL</sub> = 8 mA	4.5	—	—	0.36	—	0.44	
Input leakage current		I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND		0~5.5	—	—	±0.1	—	±1.0	μA
Quiescent supply current		I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	4.0	—	40.0	μA
		I <sub>CCT</sub>	Per input: V <sub>IN</sub> = 3.4 V Other input: V <sub>CC</sub> or GND		5.5	—	—	1.35	—	1.50	mA
Output leakage current		I <sub>OPD</sub>	V <sub>OUT</sub> = 5.5 V		0	—	—	0.5	—	5.0	μA

### AC Characteristics (Input: t<sub>r</sub> = t<sub>f</sub> = 3 ns)

Characteristics	Symbol	Test Condition	Ta = 25°C		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 (A, B- $\bar{Y}$ )	t <sub>pLH</sub> t <sub>pHL</sub>	—	5.0 ± 0.5	15	—	5.0	7.2	1.0	8.5	ns
				50	—	6.5	9.2	1.0	10.5	
Propagation delay time ( $\bar{G}$ - $\bar{Y}$ )	t <sub>pLH</sub> t <sub>pHL</sub>	—	5.0 ± 0.5	15	—	5.0	7.2	1.0	8.5	ns
				50	—	6.5	9.2	1.0	10.5	
Input capacitance	C <sub>IN</sub>	—			—	4	10	—	10	pF
Power dissipation capacitance	C <sub>PD</sub>	(Note6)			—	32	—	—	—	pF

Note6: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

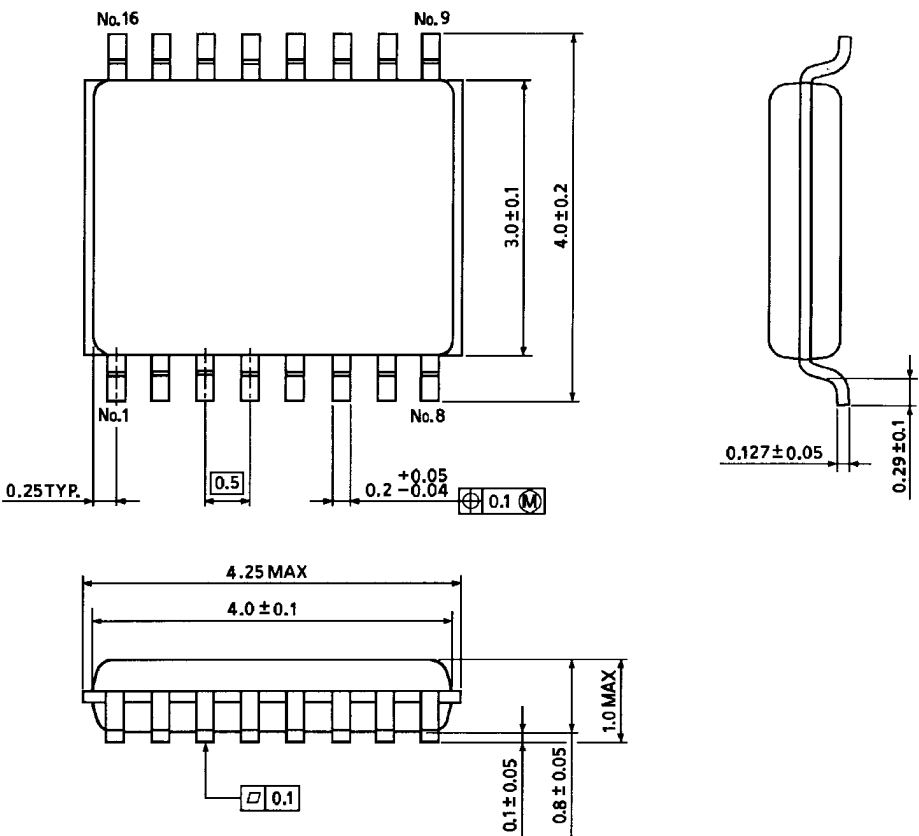
Average operating current can be obtained by the equation:

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

Package Dimensions

VSSOP16-P-0030-0.50

Unit : mm



Weight: 0.02 g (typ.)