TOSHIBA CMOS Didital 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^2MOS technology.

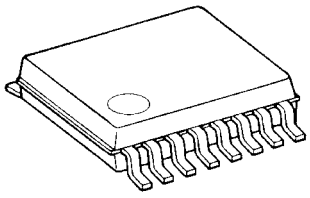
It achieves the high speed operation similar to equivalent bipolar schottky TTL while maintaining the CMOS low power dissipation.

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.



VSSOP16-P-0030-0.50

Weight: 0.02 g (typ.)

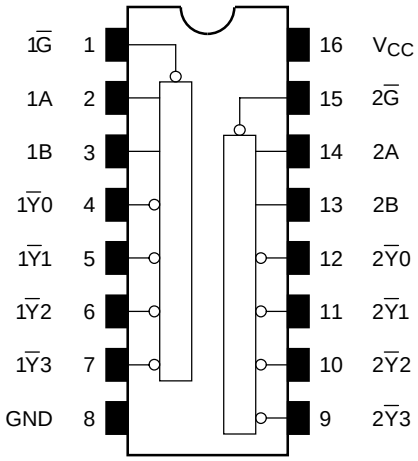
Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (*) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

*: V_{CC} = 0 V

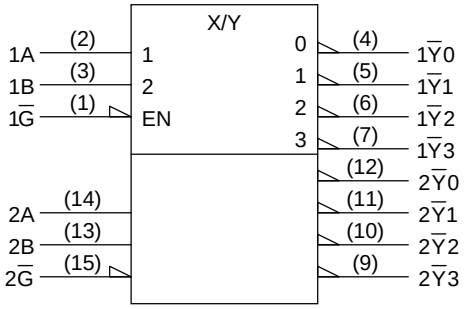
Features

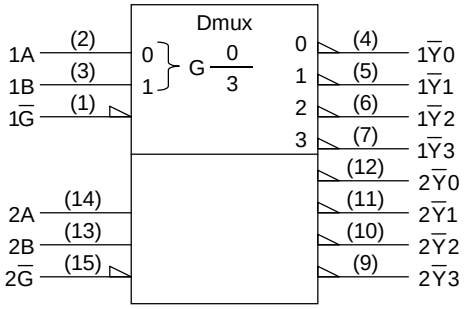
- High speed: t_{pd} = 5.0 ns (typ.) (V_{CC} = 5 V)
- Low power dissipation: I_{CC} = 4 μA (max) (Ta = 25°C)
- Compatible with TTL outputs: V_{IL} = 0.8 V (max)
  V_{IH} = 2.0 V (min)
- Power down protection is provided on all inputs and outputs.
- Balanced propagation delays: $t_{pLH} \approx t_{pHL}$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

Pin Assignment (top view)



IEC Logic Symbol



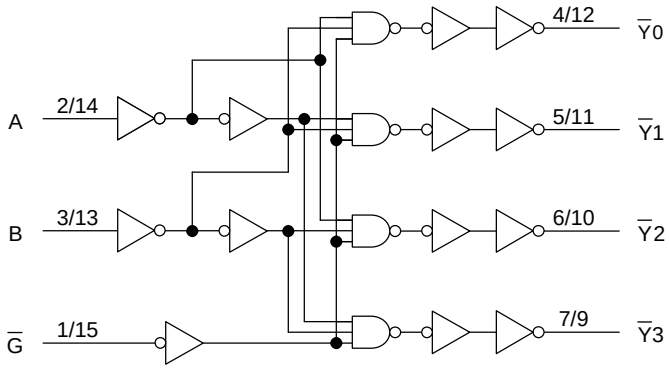


Truth Table

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}	−0.5~7.0	V
DC input voltage	V_{IN}	−0.5~7.0	V
DC output voltage	V_{OUT}	−0.5~7.0 (Note1)	V
		−0.5~V_{CC} + 0.5 (Note2)	
Input diode current	I_{IK}	−20	mA
Output diode current	I_{OK}	±20 (Note3)	mA
DC output current	I_{OUT}	±25	mA
DC V_{CC}/ground current	I_{CC}	±50	mA
Power dissipation	P_D	180	mW
Storage temperature	T_{stg}	−65~150	°C

Note1: V_{CC} = 0 V

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

Note3: V_{OUT} < GND, V_{OUT} > V_{CC}

Recommended Operating Conditions

Characteristics	Symbol	Rating	Unit
Supply voltage	V_{CC}	4.5~5.5	V
Input voltage	V_{IN}	0~5.5	V
Output voltage	V_{OUT}	0~5.5 (Note4)	V
		0~V_{CC} (Note5)	
Operating temperature	T_{opr}	−40~85	°C
Input rise and fall time	dt/dv	0~20	ns/V

Note4: V_{CC} = 0 V

Note5: High or low state.

Electrical Characteristics

DC Characteristics

Characteristics		Symbol	Test Condition		V_{CC} (V)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
Input voltage	High level	V_{IH}	—		4.5~5.5	2.0	—	—	2.0	—	V
	Low level	V_{IL}	—		4.5~5.5	—	—	0.8	—	0.8	
Output voltage	High level	V_{OH}	V_{IN} = V_{IH} or V_{IL}	I_{OH} = −50 μA	4.5	4.4	4.5	—	4.4	—	V
				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	4.5	—	0	0.1	—	0.1	
				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
		I_{CCT}	Per input: V_{IN} = 3.4 V Other input: V_{CC} or GND		5.5	—	—	1.35	—	1.50	mA
Output leakage current		I_{OPD}	V_{OUT} = 5.5 V		0	—	—	0.5	—	5.0	μA

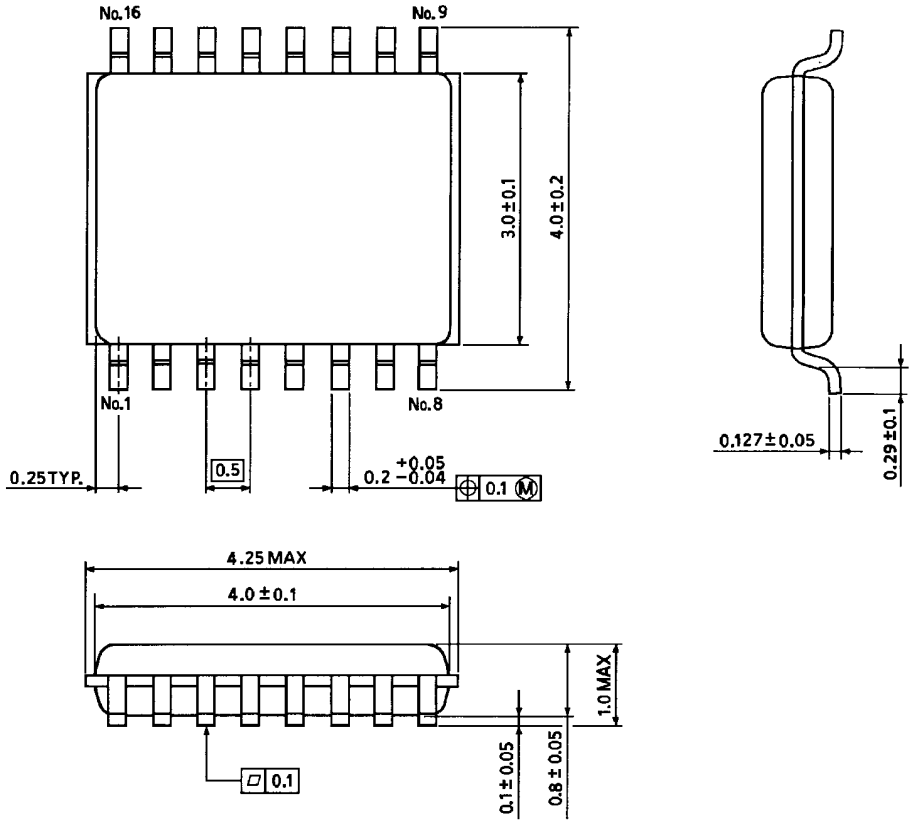
AC Characteristics (Input: $t_r = t_f = 3$ ns)

Characteristics	Symbol	Test Condition	V_{CC} (V)	C_L (pF)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
Propagation delay time (A, B- $\overline{Y}$)	t_{pLH} t_{pHL}	—	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 ($\overline{G}$ - $\overline{Y}$)	t_{pLH} t_{pHL}	—	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_{IN}	—			—	4	10	—	10	pF
Power dissipation capacitance	C_{PD}	(Note6)			—	32	—	—	—	pF

Note6: 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:
$I_{CC\ (opr)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/2$ (per decoder)

Package Dimensions

VSSOP16-P-0030-0.50 Unit : mm



Weight: 0.02 g (typ.)

RESTRICTIONS ON PRODUCT USE

000707EBA

- TOSHIBA is continually working to improve the quality and reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such TOSHIBA products could cause loss of human life, bodily injury or damage to property.
  In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent TOSHIBA products specifications. Also, please keep in mind the precautions and conditions set forth in the “Handling Guide for Semiconductor Devices,” or “TOSHIBA Semiconductor Reliability Handbook” etc..
- The TOSHIBA products listed in this document are intended for usage in general electronics applications (computer, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These TOSHIBA products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury (“Unintended Usage”). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of TOSHIBA products listed in this document shall be made at the customer’s own risk.
- The products described in this document are subject to the foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.