TOSHIBA CMOS Didital Integrated Circuit Silicon Monolithic

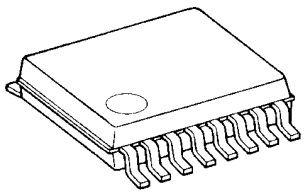
T C 7 M E T 1 3 8 A F K

3-to-8 Line Decoder

The TC7MET138AFK is an advanced high speed CMOS 3-to-8 line decoder 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.

When the device is enabled, 3 binary select inputs (A, B and C) determine which one of the outputs ($\overline{Y}0$ - $\overline{Y}7$) will go low.

When enable input G1 is held low or either $\overline{G}2A$ or $\overline{G}2B$ is held high, decoding function is inhibited and all outputs go high. G1, $\overline{G}2A$, and $\overline{G}2B$ inputs are provided to ease cascade connection and for use as an address decoder for memory systems.



VSSOP16-P-0030-0.50

Weight: 0.02 g (typ.)

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.

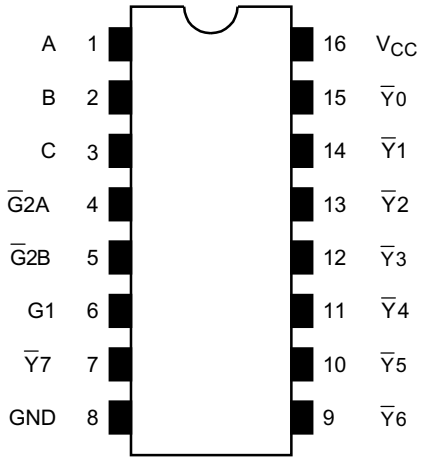
Input protection and output circuit ensure that 0 to 5.5 V can be applied to the input and output (*) pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input/output voltages such as battery back up, hot board insertion, etc.

*: V_{CC} = 0 V

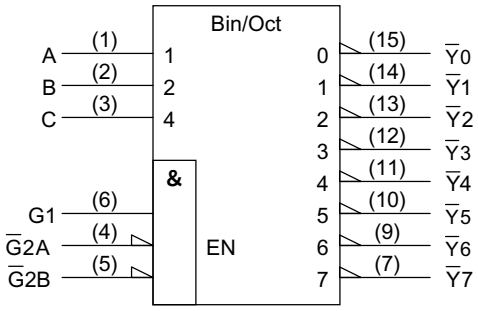
Features

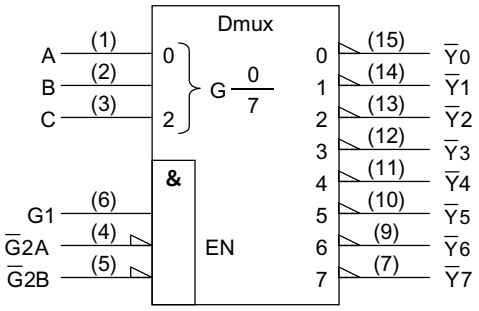
- High speed: t_{pd} = 5.7 ns (typ.) (V_{CC} = 5 V)
- Low power dissipation: I_{CC} = 4 μA (max) (Ta = 25°C)
- Compatible with TTL outputs: V_{IL} = 0.8 V (max)
  V_{IH} = 2.0 V (min)
- Power down protection is provided on all inputs and outputs.
- Balanced propagation delays: $t_{pLH} \simeq t_{pHL}$
- Pin and function compatible with the 74 series (74AC/HC/ALS/LS etc.) 138 type.

Pin Assignment (top view)



IEC Logic Symbol



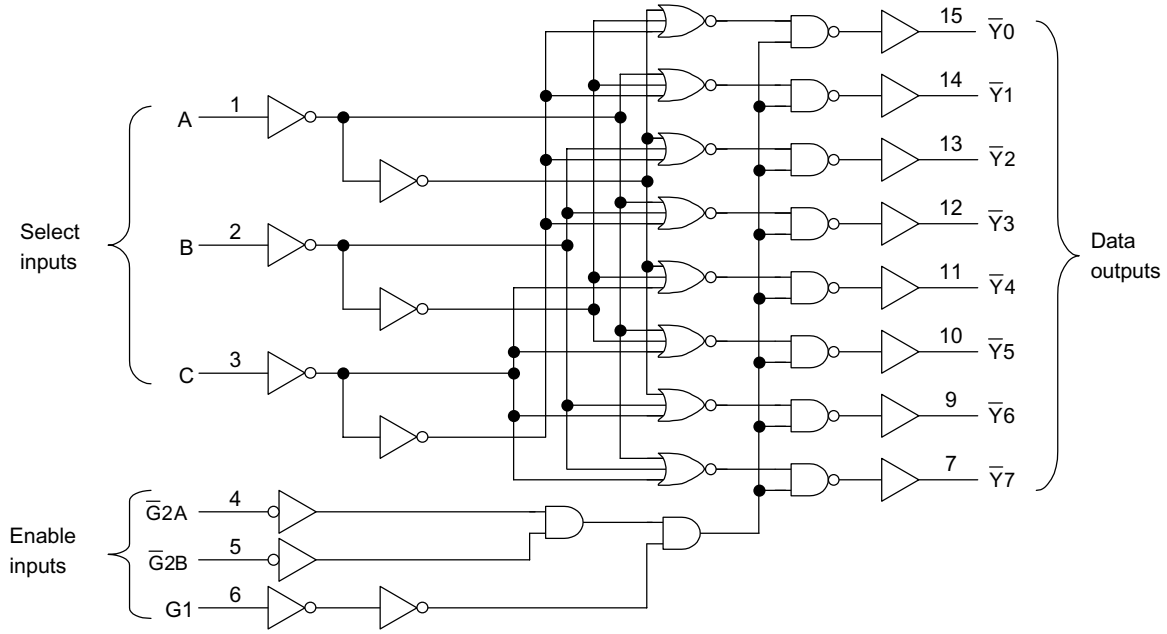


Truth Table

Inputs						Outputs								Selected Output
Enable			Select			$\overline{Y}$0	$\overline{Y}$1	$\overline{Y}$2	$\overline{Y}$3	$\overline{Y}$4	$\overline{Y}$5	$\overline{Y}$6	$\overline{Y}$7	
G1	$\overline{G}$2A	$\overline{G}$2B	C	B	A									
L	X	X	X	X	X	H	H	H	H	H	H	H	H	None
X	H	X	X	X	X	H	H	H	H	H	H	H	H	None
X	X	H	X	X	X	H	H	H	H	H	H	H	H	None
H	L	L	L	L	L	L	H	H	H	H	H	H	H	$\overline{Y}$0
H	L	L	L	L	H	H	L	H	H	H	H	H	H	$\overline{Y}$1
H	L	L	L	H	L	H	H	L	H	H	H	H	H	$\overline{Y}$2
H	L	L	L	H	H	H	H	H	L	H	H	H	H	$\overline{Y}$3
H	L	L	H	L	L	H	H	H	H	L	H	H	H	$\overline{Y}$4
H	L	L	H	L	H	H	H	H	H	H	L	H	H	$\overline{Y}$5
H	L	L	H	H	L	H	H	H	H	H	H	L	H	$\overline{Y}$6
H	L	L	H	H	H	H	H	H	H	H	H	H	L	$\overline{Y}$7

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}	±75	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)

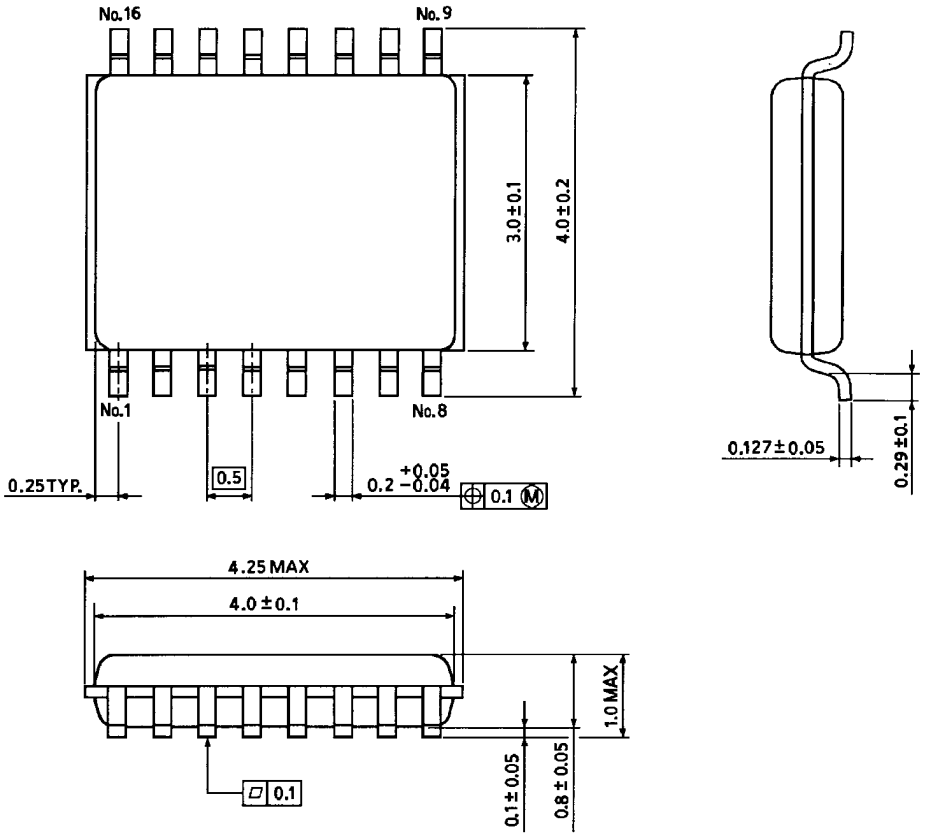
Characteristics	Symbol	Test Condition	V_{CC} (V)	C_L (pF)	Ta = 25°C Min	Ta = 25°C Typ.	Ta = 25°C Max	Ta = −40~85°C Min	Ta = −40~85°C Max	Unit
Propagation delay time (A, B, C- $\overline{Y}$)	t_{pLH} t_{pHL}	—	5.0 ± 0.5	15	—	7.6	10.4	1.0	12.0	ns
				50	—	8.1	11.4	1.0	13.0	
Propagation delay time (G1- $\overline{Y}$)	t_{pLH} t_{pHL}	—	5.0 ± 0.5	15	—	6.6	9.1	1.0	10.5	ns
				50	—	7.1	10.1	1.0	11.5	
Propagation delay time ($\overline{G2}$ - $\overline{Y}$)	t_{pLH} t_{pHL}	—	5.0 ± 0.5	15	—	7.0	9.6	1.0	11.0	ns
				50	—	7.5	10.6	1.0	12.0	
Input capacitance	C_{IN}	—			—	4	10	—	10	pF
Power dissipation capacitance	C_{PD}	(Note6)			—	49	—	—	—	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:

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

Package Dimensions

VSSOP16-P-0030-0.50 Unit : mm



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