

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC7MZ138FK**LOW VOLTAGE 3-TO-8 LINE DECODER
WITH 5V TOLERANT INPUTS AND OUTPUTS**

The TC7MZ138 is a high performance CMOS 3-to-8 DECODER. Designed for use in 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation.

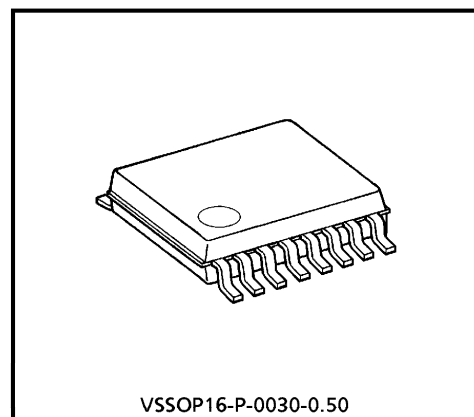
The device is designed for low-voltage (3.3 V) V_{CC} applications, but it could be used to interface to 5V supply environment for inputs.

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

When enable input G1 is held low or either $\bar{G}2A$ or $\bar{G}2B$ is held high, decoding function is inhibited and all outputs go high.

G1, $\bar{G}2A$, and $\bar{G}2B$ inputs are provided to ease cascade connection and for use as an address decoder for memory systems.

All inputs are equipped with protection circuits against static discharge.



VSSOP16-P-0030-0.50

Weight : 0.02 g (typ.)

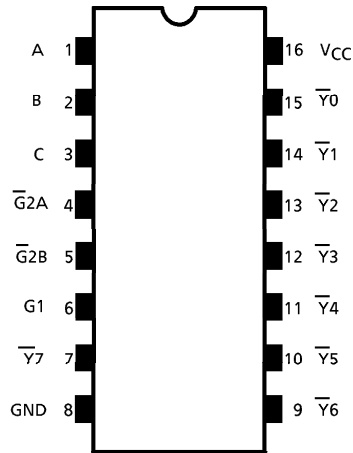
Features

- Low voltage operation : $V_{CC} = 2.0\sim 3.6\text{ V}$
- High speed operation : $t_{pd} = 6.0\text{ ns (max)}$ ($V_{CC} = 3.0\sim 3.6\text{ V}$)
- Output current : $|I_{OH}|/I_{OL} = 24\text{ mA (min)}$ ($V_{CC} = 3.0\text{ V}$)
- Latch-up performance : $\pm 500\text{ mA}$
- Available in VSSOP (US16)
- Power down protection is provided on all inputs and outputs.
- Pin and function compatible with the 74 series (74AC/VHC/HC/F/ALS/LS etc.) 138 type.

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Pin Assignment



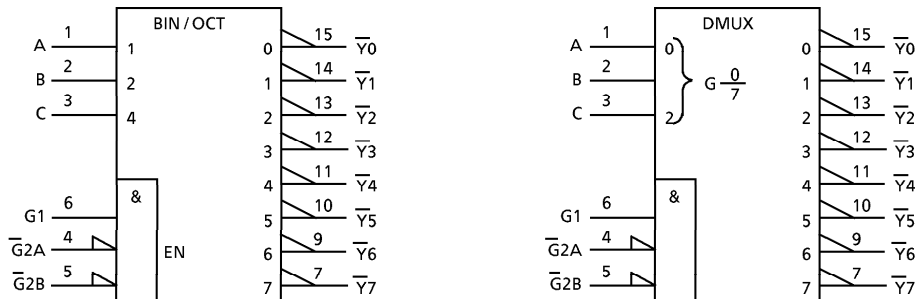
(TOP VIEW)

Truth Table

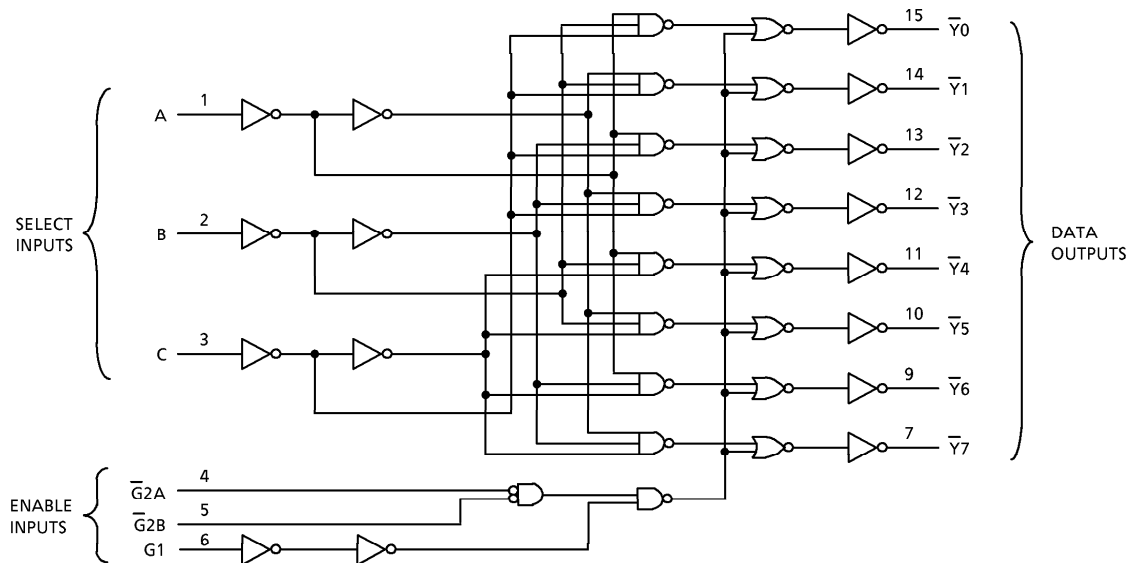
INPUTS						OUTPUTS								SELECTED OUTPUT
ENABLE			SELECT			$\bar{Y}0$	$\bar{Y}1$	$\bar{Y}2$	$\bar{Y}3$	$\bar{Y}4$	$\bar{Y}5$	$\bar{Y}6$	$\bar{Y}7$	
G1	$\bar{G}2A$	$\bar{G}2B$	C	B	A									
L	X	X	X	X	X	H	H	H	H	H	H	H	H	NONE
X	H	X	X	X	X	H	H	H	H	H	H	H	H	NONE
X	X	H	X	X	X	H	H	H	H	H	H	H	H	NONE
H	L	L	L	L	L	L	H	H	H	H	H	H	H	$\bar{Y}0$
H	L	L	L	L	H	H	L	H	H	H	H	H	H	$\bar{Y}1$
H	L	L	L	H	L	H	H	L	H	H	H	H	H	$\bar{Y}2$
H	L	L	L	H	H	H	H	H	L	H	H	H	H	$\bar{Y}3$
H	L	L	H	L	L	H	H	H	H	L	H	H	H	$\bar{Y}4$
H	L	L	H	L	H	H	H	H	H	H	L	H	H	$\bar{Y}5$
H	L	L	H	H	L	H	H	H	H	H	H	L	H	$\bar{Y}6$
H	L	L	H	H	H	H	H	H	H	H	H	H	L	$\bar{Y}7$

X : Don't Care

IEC Logic Symbol



System Diagram



Maximum Ratings

PARAMETER	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 (Note 1)	V
		-0.5~ $V_{CC} + 0.5$ (Note 2)	
Input Diode Current	I_{IK}	-50	mA
Output Diode Current	I_{OK}	± 50 (Note 3)	mA
DC Output Current	I_{OUT}	± 50	mA
Power Dissipation	P_D	180	mW
DC V_{CC} /Ground Current	I_{CC}/I_{GND}	± 100	mA
Storage Temperature	T_{stg}	-65~150	$^{\circ}C$

(Note 1): $V_{CC} = 0V$

(Note 2): High or Low State. I_{OUT} absolute maximum rating must be observed.

(Note 3): $V_{OUT} < GND, V_{OUT} > V_{CC}$

Recommended Operating Conditions

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V _{CC}	2.0~3.6	V
		1.5~3.6 (Note 4)	
Input Voltage	V _{IN}	0~5.5	V
Output Voltage	V _{OUT}	0~5.5 (Note 5)	V
		0~V _{CC} (Note 6)	
Output Current	I _{OH} /I _{OL}	±24 (Note 7)	mA
		±12 (Note 8)	
Operating Temperature	T _{opr}	-40~85	°C
Input Rise And Fall Time	dt/dv	0~10 (Note 9)	ns/V

- (Note 4): Data Retention Only
- (Note 5): V_{CC} = 0 V
- (Note 6): High or Low State
- (Note 7): V_{CC} = 3.0~3.6 V
- (Note 8): V_{CC} = 2.7~3.0 V
- (Note 9): V_{IN} = 0.8~2.0 V, V_{CC} = 3.0 V

Electrical Characteristics

DC Characteristics (T_a = -40~85°C)

PARAMETER		SYMBOL	TEST CONDITION	V _{CC} (V)	Min	Max	UNIT	
Input Voltage	"H" Level	V _{IH}		2.7~3.6	2.0	—	V	
	"L" Level	V _{IL}		2.7~3.6	—	0.8		
Output Voltage	"H" Level	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -100 μA	2.7~3.6	V _{CC} - 0.2	—	V
				I _{OH} = -12 mA	2.7	2.2	—	
				I _{OH} = -18 mA	3.0	2.4	—	
				I _{OH} = -24 mA	3.0	2.2	—	
	"L" Level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA	2.7~3.6	—	0.2	
				I _{OL} = 12 mA	2.7	—	0.4	
				I _{OL} = 16 mA	3.0	—	0.4	
				I _{OL} = 24 mA	3.0	—	0.55	
Input Leakage Current	I _{IN}	V _{IN} = 0~5.5 V	2.7~3.6	—	±5.0	μA		
Power Off Leakage Current	I _{OFF}	V _{IN} / V _{OUT} = 5.5 V	0	—	10.0	μA		
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND	2.7~3.6	—	10.0	μA		
		V _{IN} / V _{OUT} = 3.6~5.5 V	2.7~3.6	—	±10.0			
Increase In I _{CC} Per Input	ΔI _{CC}	V _{IH} = V _{CC} - 0.6 V	2.7~3.6	—	500	μA		

AC Characteristics (Ta = -40~85°C)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	Min	Max	UNIT
Propagation Delay Time (A, B, C- \bar{Y})	t _{pLH} t _{pHL}	(Fig.1, 2)	2.7	—	7.0	ns
			3.3 ± 0.3	1.5	6.0	
Propagation Delay Time (G1- \bar{Y})	t _{pLH} t _{pHL}	(Fig.1, 2)	2.7	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
Propagation Delay Time ($\bar{G}2$ - \bar{Y})	t _{pLH} t _{pHL}	(Fig.1, 2)	2.7	—	7.0	ns
			3.3 ± 0.3	1.5	6.0	
Output To Output Skew	t _{osLH} t _{osHL}	(Note 10)	2.7	—	—	ns
			3.3 ± 0.3	—	1.0	

(Note 10): Parameter guaranteed by design.
 (t_{osLH} = |t_{pLHm} - t_{pLHn}|, t_{osHL} = |t_{pHLm} - t_{pHLn}|)

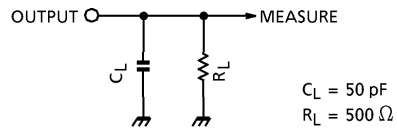
Capacitive Characteristics (Ta = 25°C)

PARAMETER	SYMBOL	TEST CONDITION	V _{CC} (V)	Typ.	UNIT
Input Capacitance	C _{IN}	—	3.3	7	pF
Output Capacitance	C _{OUT}		0	8	pF
Power Dissipation Capacitance	C _{PD}	f _{IN} = 10 MHz (Note 11)	3.3	25	pF

(Note 11): 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 :
 $I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$

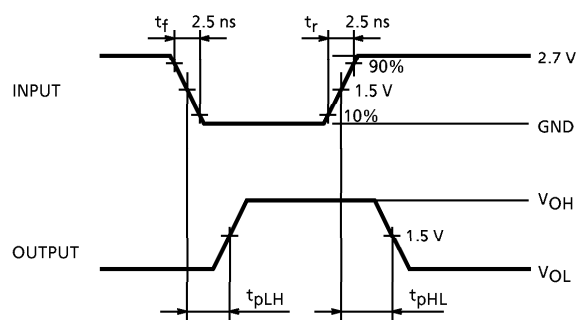
Test Circuit

Fig.1



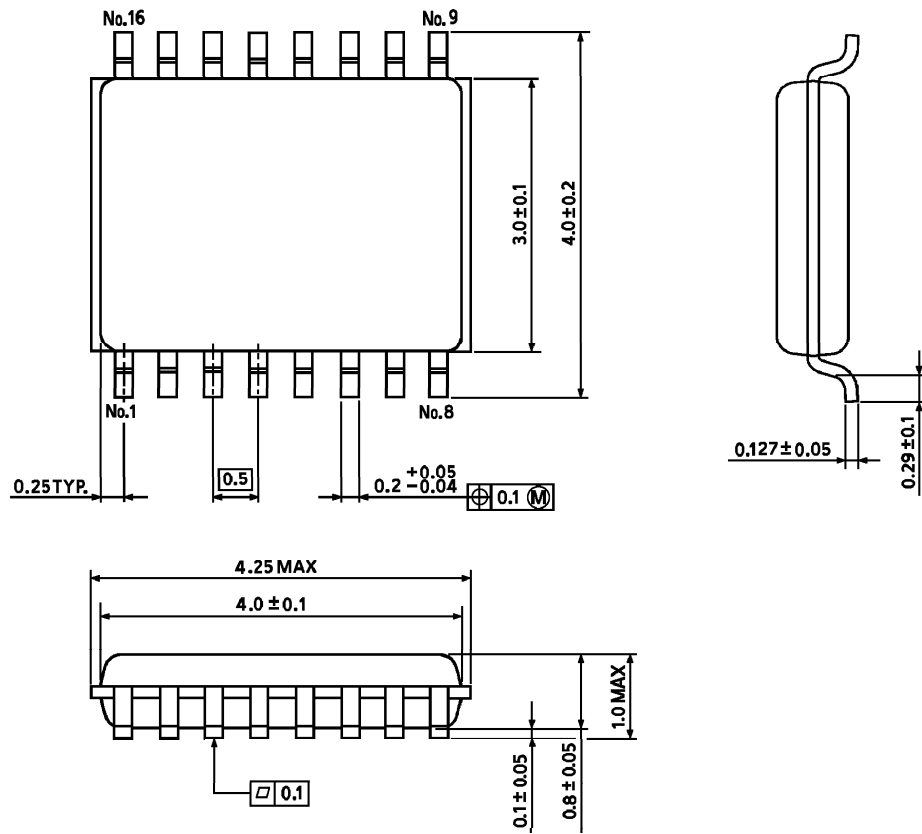
AC Waveform

Fig.2 t_{pLH} , t_{pHL}



Outline Drawing
VSSOP16-P-0030-0.50

Unit : mm



Weight : 0.02 g (typ.)