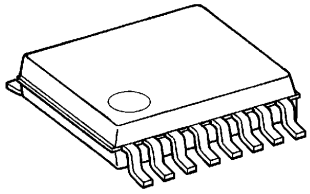
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

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 ($\overline{Y}0$-$\overline{Y}7$) 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.
All inputs are equipped with protection circuits against static discharge.



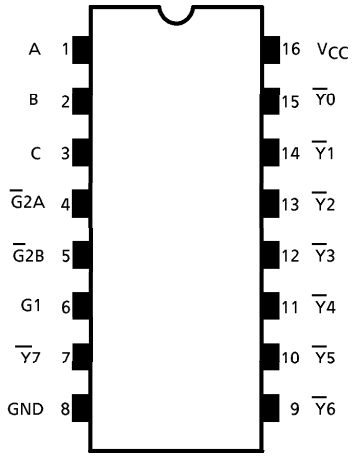
VSSOP16-P-0030-0.50

Weight : 0.02 g (typ.)

Features

- Low voltage operation : V_{CC} = 2.0~3.6 V
- High speed operation : t_{pd} = 6.0 ns (max) (V_{CC} = 3.0~3.6 V)
- Output current : $|I_{OH}| / I_{OL}$ = 24 mA (min) (V_{CC} = 3.0 V)
- Latch-up performance : ± 500 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.

Pin Assignment



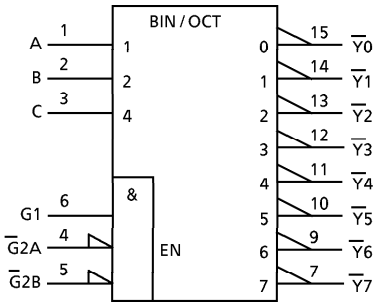
(TOP VIEW)

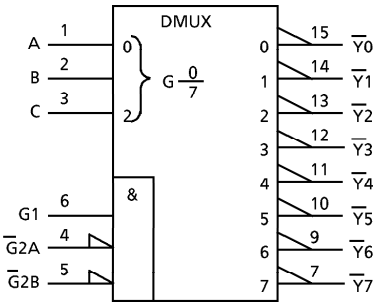
Truth Table

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

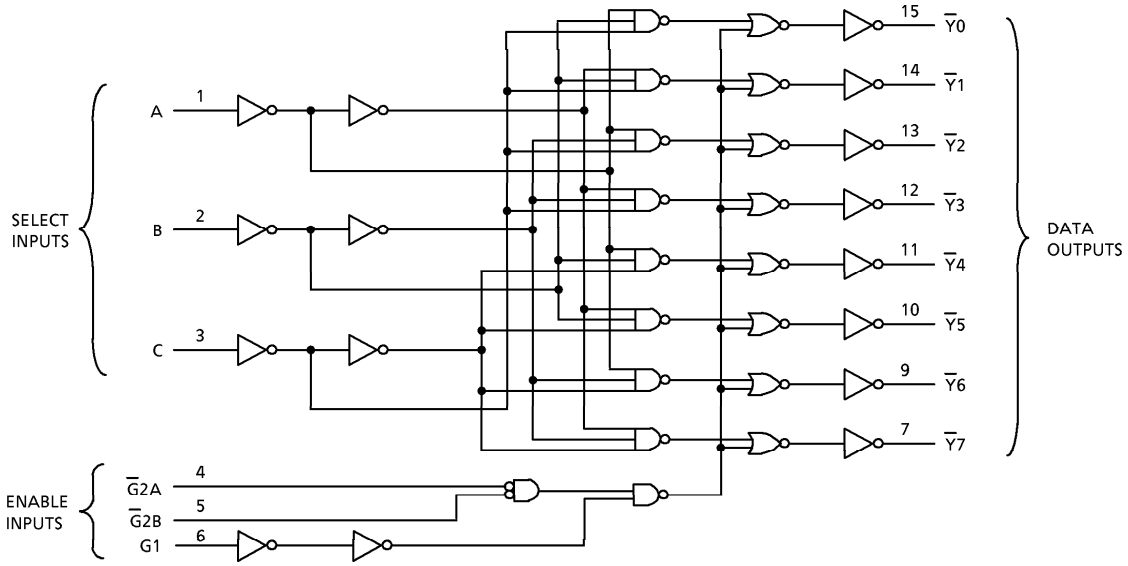
X : Don't Care

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	°C

(Note 1): V_{CC} = 0 V
(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 (Ta = −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 Cuurent		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-$\overline{Y}$)	t_{pLH} t_{pHL}	(Fig.1, 2)	2.7	—	7.0	ns
			3.3 ± 0.3	1.5	6.0	
Propagation Delay Time (G1-$\overline{Y}$)	t_{pLH} t_{pHL}	(Fig.1, 2)	2.7	—	8.0	ns
			3.3 ± 0.3	1.5	7.0	
Propagation Delay Time ($\overline{G}$2-$\overline{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)

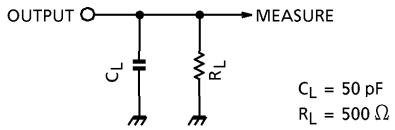
PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	Typ.	UNIT
Input Capacitance	C_{IN}	—	3.3	7	pF
Output Capacitance	C_{OUT}		0	8	pF
Power Dissipation Capacitance	C_{PD}	f_{IN} = 10 MHz (Note 11)	3.3	25	pF

(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 :

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

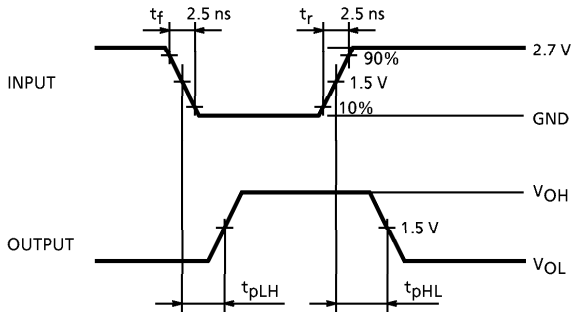
Test Circuit

Fig.1



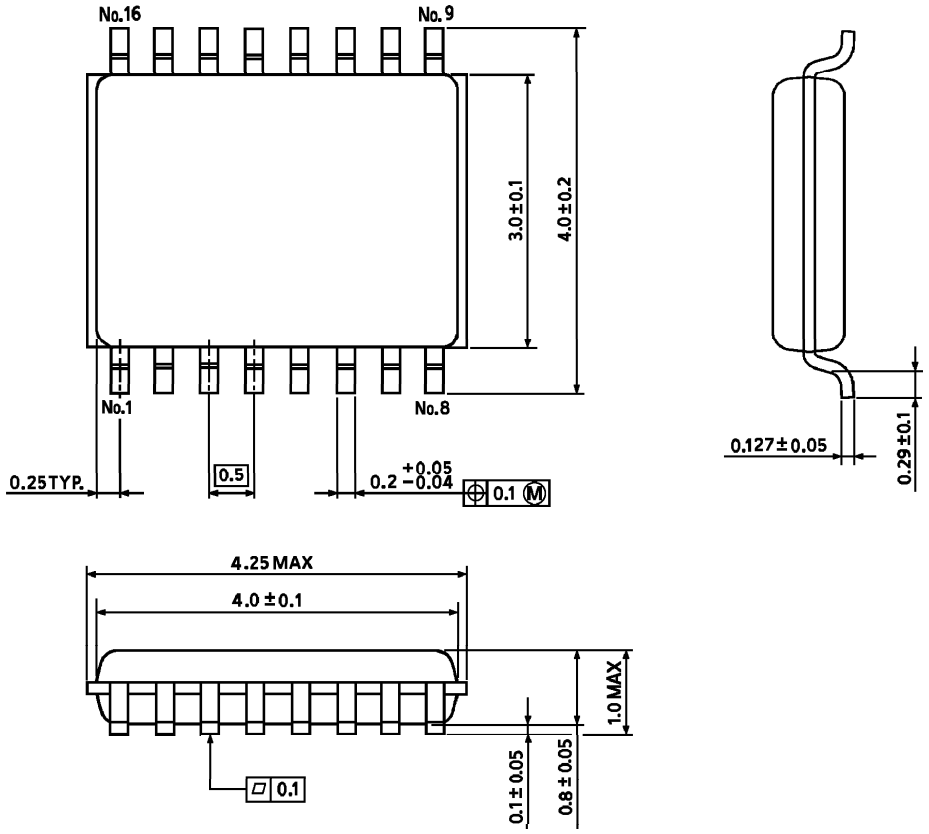
AC Waveform

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



Outline Drawing

VSSOP16-P-0030-0.50 Unit : mm



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