

TC74VCX138FT**LOW-VOLTAGE 3-TO-8 LINE DECODER
WITH 3.6V TOLERANT INPUTS AND OUTPUTS**

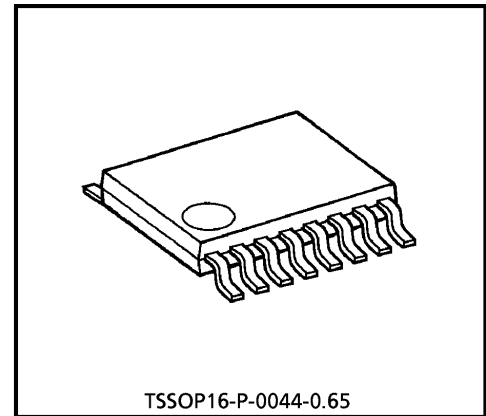
The TC74VCX138FT is a high performance CMOS 3-to-8 DECODER. Designed for use in 1.8 2.5 or 3.3 Volt systems, it achieves high speed operation while maintaining the CMOS low power dissipation. It is also designed with over voltage tolerant nputs and outputs up to 3.6V.

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.



TSSOP16-P-0044-0.65

Weight : 0.06g (Typ.)

PRELIMINARY**FEATURES**

- Low Voltage Operation : $V_{CC} = 1.8 \sim 3.6V$
- High Speed Operation : $t_{pd} = TBD$ (max.) at $V_{CC} = 3.0 \sim 3.6V$
 $t_{pd} = TBD$ (max.) at $V_{CC} = 2.3 \sim 2.7V$
 $t_{pd} = TBD$ (max.) at $V_{CC} = 1.8V$
- 3.6V Tolerant inputs and output.
- Output Current : $I_{OH}/I_{OL} = \pm 24mA$ (min.) at $V_{CC} = 3.0V$
 $I_{OH}/I_{OL} = \pm 18mA$ (min.) at $V_{CC} = 2.3V$
 $I_{OH}/I_{OL} = \pm 6mA$ (min.) at $V_{CC} = 1.8V$
- Latch-up Performance : $\pm 300mA$
- ESD Performance : Human Body Model $> \pm 2000V$
Machine Model $> \pm 200V$
- Package : TSSOP
(Thin Shrink Small Outline Package)
- Power Down Protection is provided on all inputs and outputs.

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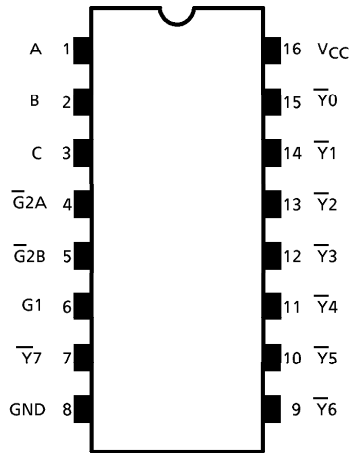
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PIN ASSIGNMENT



(TOP VIEW)

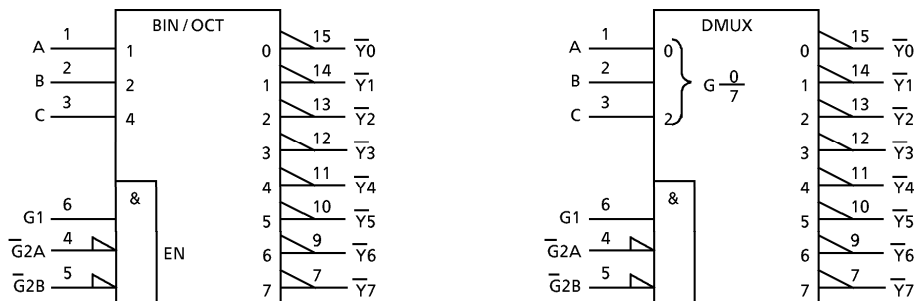
PRELIMINARY

TRUTH TABLE

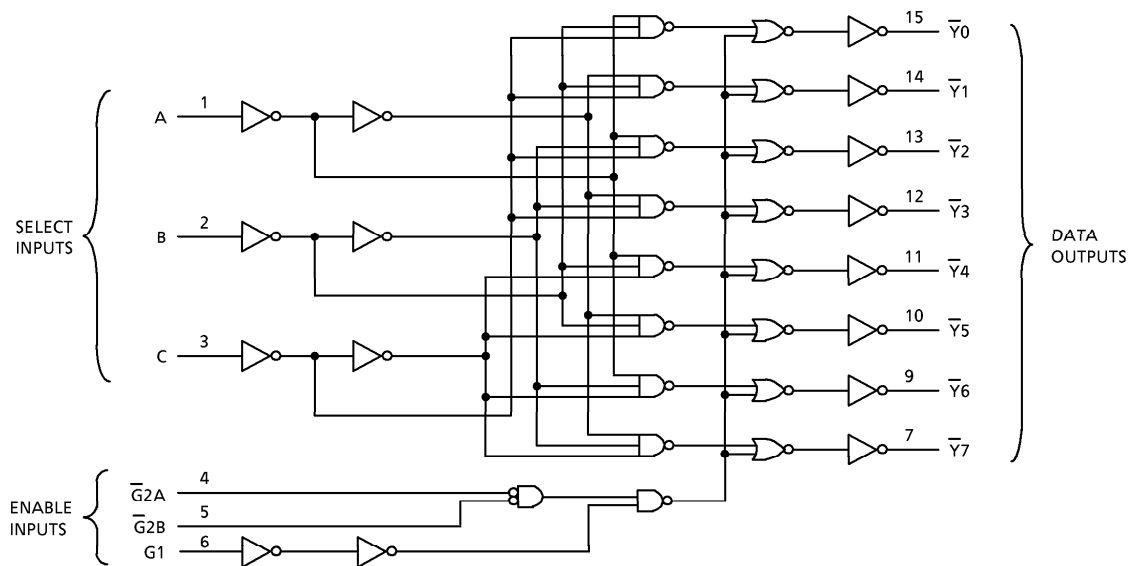
INPUTS						OUTPUTS								SELECTED OUTPUT
ENABLE			SELECT			$\bar{Y}0$	$\bar{Y}1$	$\bar{Y}2$	$\bar{Y}3$	$\bar{Y}4$	$\bar{Y}5$	$\bar{Y}6$	$\bar{Y}7$	
G1	$\bar{G}2A$	$\bar{G}2B$	C	B	A									
L	X	X	X	X	X	H	H	H	H	H	H	H	H	NONE
X	H	X	X	X	X	H	H	H	H	H	H	H	H	NONE
X	X	H	X	X	X	H	H	H	H	H	H	H	H	NONE
H	L	L	L	L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



PRELIMINARY

MAXIMUM RATINGS

PARAMETER	SYMBOL	RATING	UNIT
Power Supply Voltage	V_{CC}	- 0.5~4.6	V
DC Input Voltage	V_{IN}	- 0.5~4.6	V
DC Output Voltage	V_{OUT}	- 0.5~4.6 (Note 1)	V
		- 0.5~ V_{CC} + 0.5 (Note 2)	
Input Diode Current	I_{IK}	- 50	mA
Output Diode Current	I_{OK}	\pm 50 (Note 3)	mA
DC Output Current	I_{OUT}	\pm 50	mA
Power Dissipation	P_D	180	mW
DC V_{CC} / Ground Current	I_{CC} / I_{GND}	\pm 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 RANGE

PARAMETER	SYMBOL	RATING	UNIT
Supply Voltage	V _{CC}	1.8~3.6	V
		1.2~3.6 (Note 4)	
Input Voltage	V _{IN}	-0.3~3.6	V
Output Voltage	V _{OUT}	0~3.6 (Note 5)	V
		0~V _{CC} (Note 6)	
Output Current	I _{OH} /I _{OL}	±24 (Note 7)	mA
		±18 (Note 8)	
		±6 (Note 9)	
Operating Temperature	T _{opr}	-40~85	°C
Input Rise And Fall Time	dt/dv	0~10 (Note 10)	ns/V

(Note 4) Data Retention Only

(Note 5) V_{CC} = 0V

(Note 6) High or Low State

(Note 7) V_{CC} = 3.0~3.6V

(Note 8) V_{CC} = 2.3~2.7V

(Note 9) V_{CC} = 1.8V

(Note 10) V_{IN} = 0.8~2.0V, V_{CC} = 3.0V

PRELIMINARY

ELECTRICAL CHARACTERISTICS

DC characteristics (Ta = -40~85°C, 2.7V < V_{CC} ≤ 3.6V)

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} = -100μA	2.7~3.6	V _{CC} - 0.2	—	V
				I _{OH} = -12mA	2.7	2.2	—	
				I _{OH} = -18mA	3.0	2.4	—	
				I _{OH} = -24mA	3.0	2.2	—	
	"L" Level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100μA	2.7~3.6	—	0.2	
				I _{OL} = 12mA	2.7	—	0.4	
				I _{OL} = 18mA	3.0	—	0.4	
				I _{OL} = 24mA	3.0	—	0.55	
Input Leakage Current	I _{IN}	V _{IN} = 0~3.6V		2.7~3.6	—	±5.0	μA	
Power Off Leakage Current	I _{OFF}	V _{IN} , V _{OUT} = 0~3.6V		0	—	10.0	μA	
Quiescent Supply Current	I _{CC}	V _{IN} = V _{CC} or GND		2.7~3.6	—	20.0	μA	
		V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6V		2.7~3.6	—	±20.0		
Increase In I _{CC} Per Input	ΔI _{CC}	V _{IH} = V _{CC} - 0.6V		2.7~3.6	—	750	μA	

ELECTRICAL CHARACTERISTICS

DC characteristics ($T_a = -40 \sim 85^\circ\text{C}$, $2.3\text{V} \leq V_{CC} \leq 2.7\text{V}$)

PARAMETER		SYMBOL	TEST CONDITION	V_{CC} (V)	MIN.	MAX.	UNIT	
Input Voltage	"H" Level	V_{IH}		2.3~2.7	1.6	—	V	
	"L" Level	V_{IL}		2.3~2.7	—	0.7		
Output Voltage	"H" Level	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -100\mu\text{A}$	2.3~2.7	$V_{CC} - 0.2$	—	V
				$I_{OH} = -6\text{mA}$	2.3	2.0	—	
				$I_{OH} = -12\text{mA}$	2.3	1.8	—	
				$I_{OH} = -18\text{mA}$	2.3	1.7	—	
	"L" Level	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 100\mu\text{A}$	2.3~2.7	—	0.2	
				$I_{OL} = 12\text{mA}$	2.3	—	0.4	
			$I_{OL} = 18\text{mA}$	2.3	—	0.6		
Input Leakage Current		I_{IN}	$V_{IN} = 0 \sim 3.6\text{V}$	2.3~2.7	—	± 5.0	μA	
Power Off Leakage Current		I_{OFF}	$V_{IN}, V_{OUT} = 0 \sim 3.6\text{V}$	0	—	10.0	μA	
Quiescent Supply Current		I_{CC}	$V_{IN} = V_{CC}$ or GND	2.3~2.7	—	20.0	μA	
			$V_{CC} \leq (V_{IN}, V_{OUT}) \leq 3.6V_{CC}$	2.3~2.7	—	± 20.0		

PRELIMINARY

ELECTRICAL CHARACTERISTICS

DC characteristics (Ta = -40~85°C, 1.8V ≤ VCC < 2.3V)

PARAMETER		SYMBOL	TEST CONDITION		VCC (V)	MIN.	MAX.	UNIT
Input Voltage	"H" Level	V _{IH}			1.8~2.3	0.7 × V _{CC}	—	V
	"L" Level	V _{IL}			1.8~2.3	—	0.2 × V _{CC}	
Output Voltage	"H" Level	V _{OH}	V _{IN} = V _{IH} or V _{IL}	I _{OH} = -100 μA	1.8	V _{CC} - 0.2	—	V
				I _{OH} = -6 mA	1.8	1.4	—	
	"L" Level	V _{OL}	V _{IN} = V _{IH} or V _{IL}	I _{OL} = 100 μA	1.8	—	0.2	
				I _{OL} = 6 mA	1.8	—	0.3	
Input Leakage Current		I _{IN}	V _{IN} = 0~3.6V		1.8	—	± 5.0	μA
Power Off Leakage Current		I _{OFF}	V _{IN} , V _{OUT} = 0~3.6V		0	—	10.0	μA
Quiescent Supply Current		I _{CC}	V _{IN} = V _{CC} or GND		1.8	—	20.0	μA
			V _{CC} ≤ (V _{IN} , V _{OUT}) ≤ 3.6V		1.8	—	± 20.0	

PRELIMINARY

AC characteristics (Ta = -40~85°C, Input t_r = t_f = 2.0ns, C_L = 30pF, R_L = 500Ω)

PARAMETER		SYMBOL	TEST CONDITION		VCC (V)	MIN.	MAX.	UNIT
Propagation Delay Time (A, B, C- \bar{Y})	t _{pLH} t _{pHL}	(Fig.1, 2)	1.8	1.5	TBD	ns		
			2.5 ± 0.2	1.0	TBD			
			3.3 ± 0.3	0.8	TBD			
Propagation Delay Time (G1, \bar{Y})	t _{pLH} t _{pHL}	(Fig.1, 2)	1.8	1.5	TBD	ns		
			2.5 ± 0.2	1.0	TBD			
			3.3 ± 0.3	0.8	TBD			
Propagation Delay Time ($\bar{G}2$, \bar{Y})	t _{pLH} t _{pHL}	(Fig.1, 2)	1.8	1.5	TBD	ns		
			2.5 ± 0.2	1.0	TBD			
			3.3 ± 0.3	0.8	TBD			
Output To Output Skew	t _{osLH} t _{osHL}	(Note 11)	1.8	—		ns		
			2.5 ± 0.2	—				
			3.3 ± 0.3	—				

For C_L = 50pF, add approximately 300ps to the AC maximum specification.

(Note 11) 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}		1.8, 2.5, 3.3	TBD	pF
Output Capacitance	C _{OUT}		0	TBD	pF
Power Dissipation Capacitance	C _{PD}	f _{IN} = 10MHz (Note 12)	1.8, 2.5, 3.3	TBD	pF

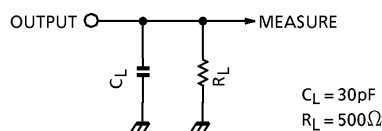
(Note 12) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

Average operating current can be obtained by the equation :

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

TEST CIRCUIT

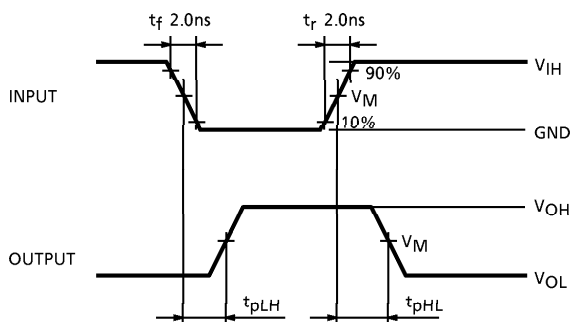
Fig.1



PRELIMINARY

AC WAVEFORM

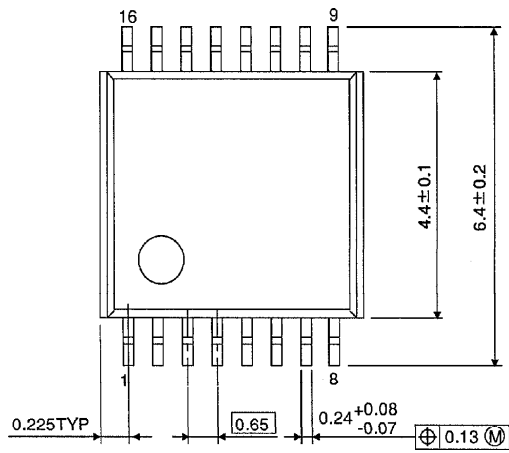
Fig.2 t_{pLH}, t_{pHL}



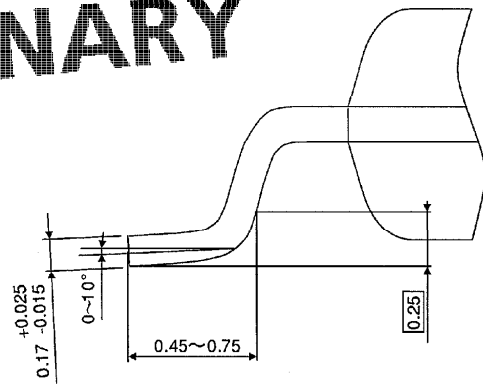
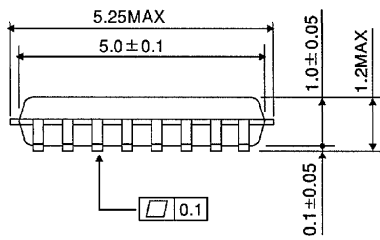
SYMBOL	V _{CC}		
	3.3 ± 0.3V	2.5 ± 0.2V	1.8V
V _{IH}	2.7V	V _{CC}	V _{CC}
V _M	1.5V	V _{CC} /2	V _{CC} /2

OUTLINE DRAWING
TSSOP16-P-0044-0.65

Unit : mm



PRELIMINARY



Weight : 0.06g (Typ.)