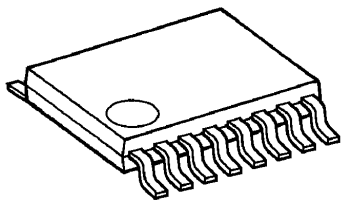
ADVANCE INFORMATION

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

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 ($\overline{Y}0$-$\overline{Y}7$) 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.



TSSOP16-P-0044-0.65

Weight : 0.06g (Typ.)

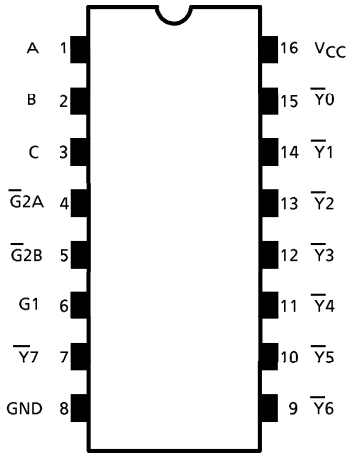
PRELIMINARY

FEATURES

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

980508EBA1

PIN ASSIGNMENT



(TOP VIEW)

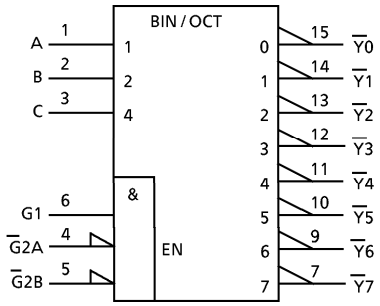
PRELIMINARY

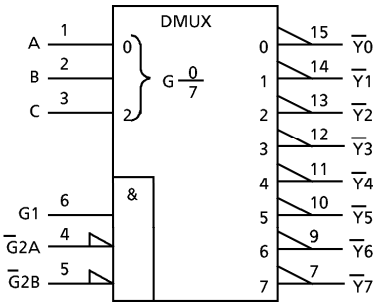
TRUTH TABLE

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

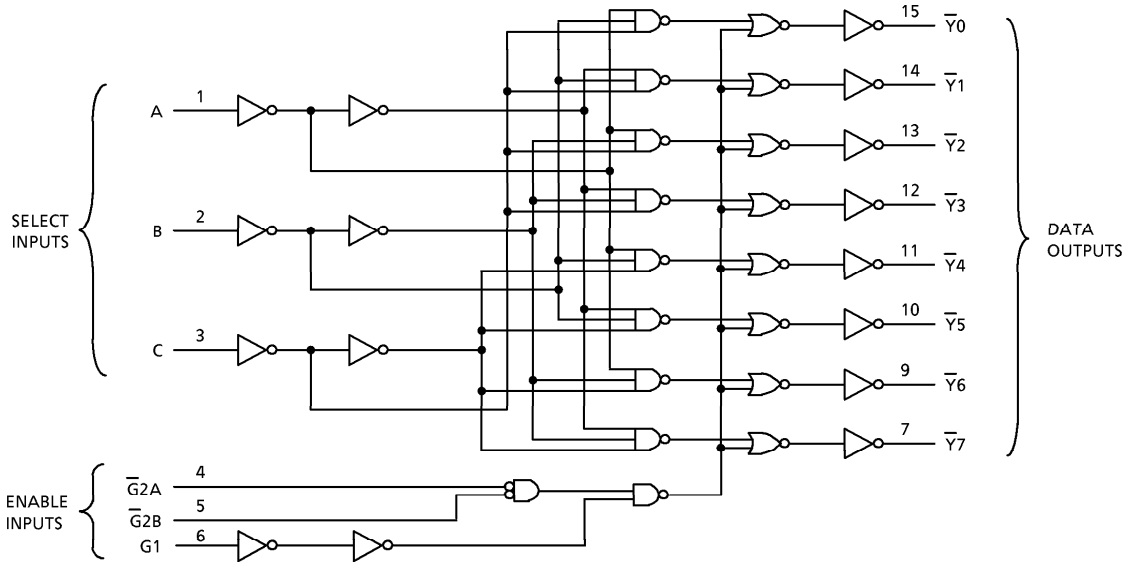
X : Don't Care

IEC LOGIC SYMBOL





SYSTEM DIAGRAM



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}	±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} = 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 (Ta = −40~85°C, 2.3V≦V_{CC}≦2.7V)

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} = −100μA	2.3~2.7	V_{CC} −0.2	—	V
				I_{OH} = −6mA	2.3	2.0	—	
				I_{OH} = −12mA	2.3	1.8	—	
				I_{OH} = −18mA	2.3	1.7	—	
	"L" Level	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 100μA	2.3~2.7	—	0.2	
				I_{OL} = 12mA	2.3	—	0.4	
				I_{OL} = 18mA	2.3	—	0.6	
Input Leakage Current		I_{IN}	V_{IN} = 0~3.6V		2.3~2.7	—	±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		2.3~2.7	—	20.0	μA
			V_{CC}≦(V_{IN}, V_{OUT})≦3.6V_{CC}		2.3~2.7	—	±20.0	

PRELIMINARY

ELECTRICAL CHARACTERISTICS

DC characteristics (Ta = −40~85°C, 1.8V ≦ V_{CC} < 2.3V)

PARAMETER		SYMBOL	TEST CONDITION		V_{CC} (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} = −100μA	1.8	V_{CC} −0.2	—	V
				I_{OH} = −6mA	1.8	1.4	—	
	"L" Level	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 100μA	1.8	—	0.2	
				I_{OL} = 6mA	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	V_{CC} (V)	MIN.	MAX.	UNIT
Propagation Delay Time (A, B, C-$\overline{Y}$)	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, $\overline{Y}$)	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 ($\overline{G}$2, $\overline{Y}$)	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)

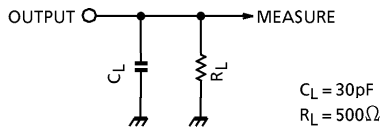
PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	TYP.	UNIT
Input Capacitance	C_{IN}		1.8, 2.5, 3.3	TBD	pF
Output Capacitance	C_{OUT}		0	TBD	pF
Power Dissipation Capacitance	C_{PD}	f_{IN} = 10MHz (Note 12)	1.8, 2.5, 3.3	TBD	pF

(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 :

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

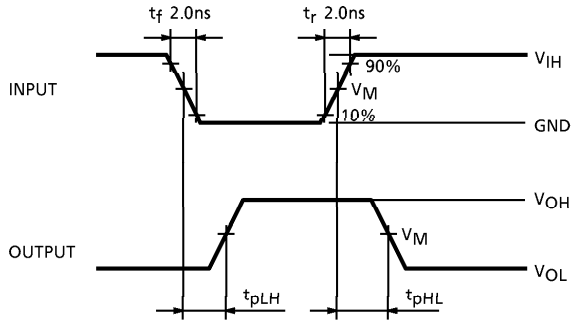
TEST CIRCUIT

Fig.1



AC WAVEFORM

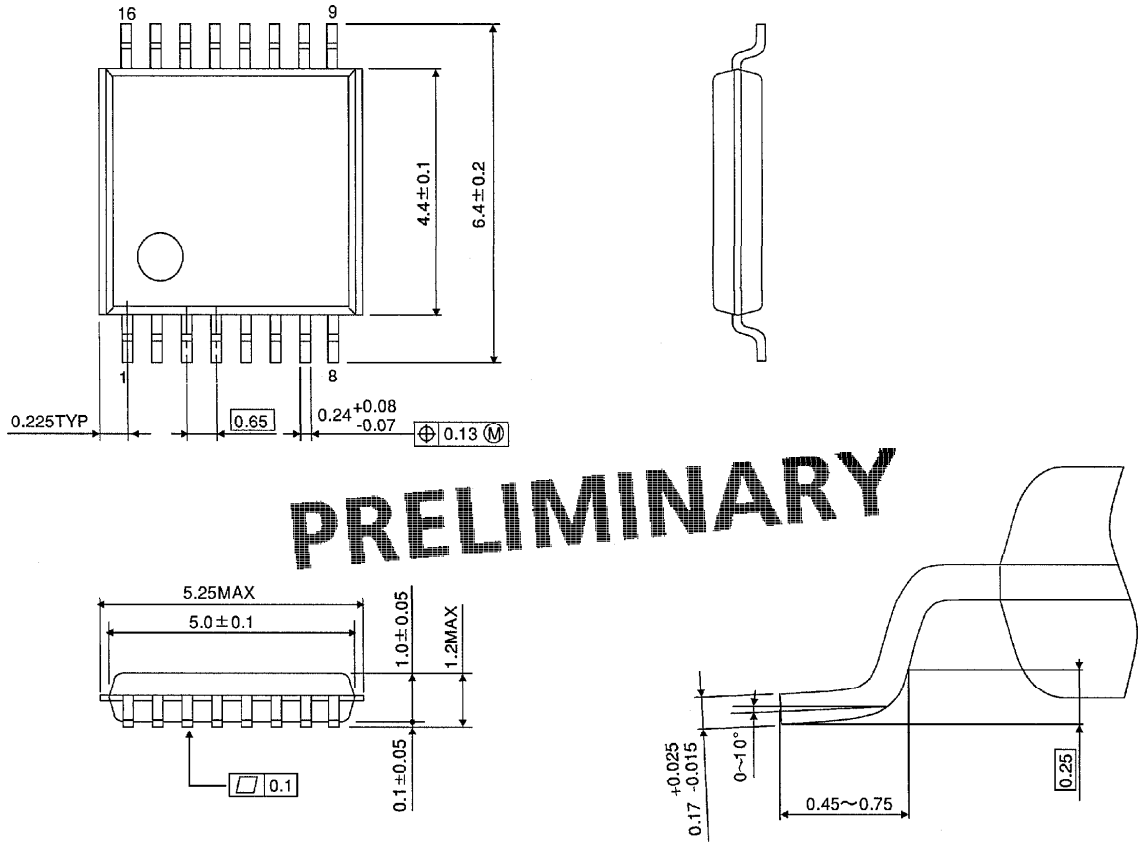
Fig.2 t_{pLH}, t_{pHL}



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



Weight : 0.06g (Typ.)