TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

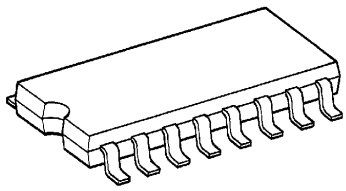
TC74LCX138F, TC74LCX138FN, TC74LCX138FT

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

The TC74LCX138 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 (3.3V) 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.

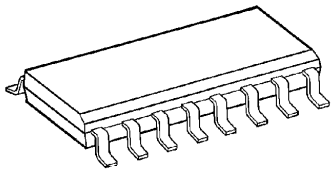
(Note) The JEDEC SOP (FN) is not available in Japan.

TC74LCX138F



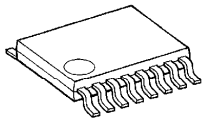
SOP16-P-300-1.27

TC74LCX138FN



SOL16-P-150-1.27

TC74LCX138FT



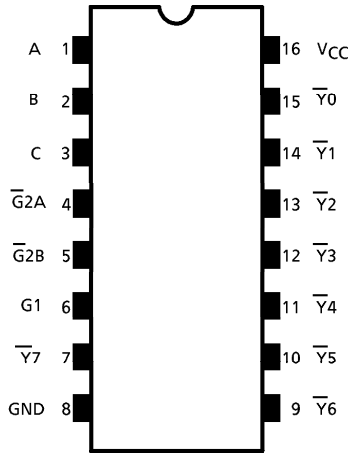
TSSOP16-P-0044-0.65

FEATURES

- Low voltage operation : V_{CC} = 2.0~3.6V
- High speed operation : t_{pd} = 6.0ns (Max.) (V_{CC} = 3.0~3.6V)
- Output current : $|I_{OH}| / I_{OL}$ = 24mA (Min.) (V_{CC} = 3.0V)
- Latch-up performance : ±500mA
- Available in JEDEC SOP, EIAJ SOP and TSSOP
- 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.

Weight
SOP16-P-300-1.27 : 0.18g (Typ.)
SOL16-P-150-1.27 : 0.12g (Typ.)
TSSOP16-P-0044-0.65 : 0.06g (Typ.)

PIN ASSIGNMENT



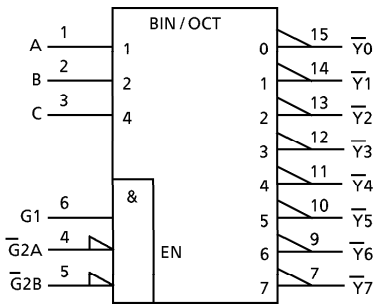
(TOP VIEW)

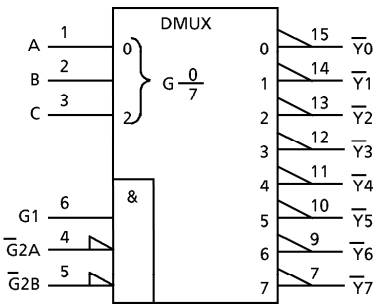
TRUTH TABLE

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





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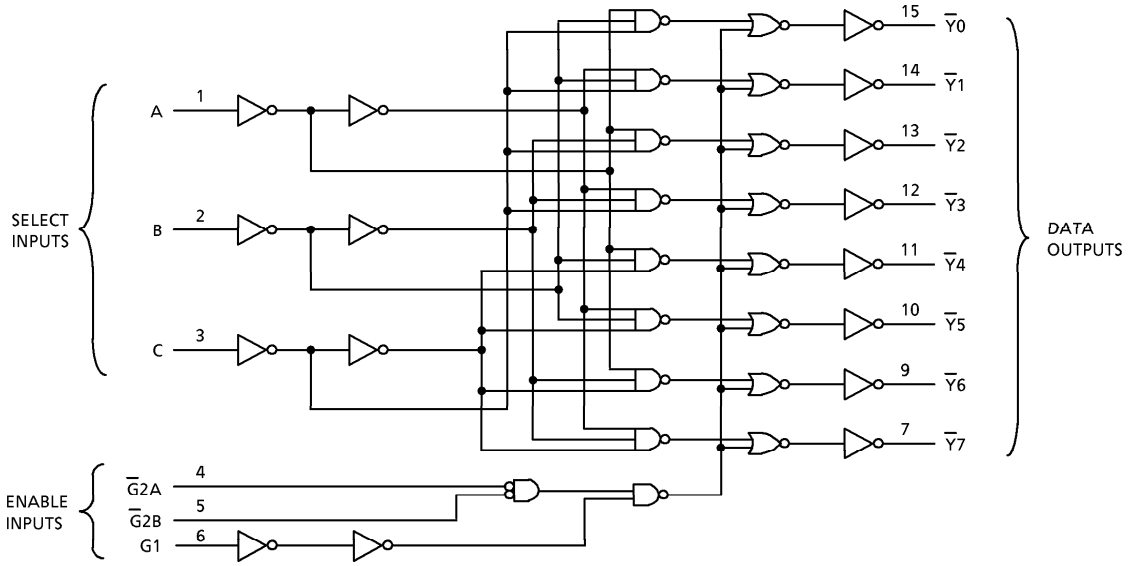
SYSTEM DIAGRAM



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) VCC = 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) VCC = 0V
(Note 6) High or Low State
(Note 7) V_{CC} = 3.0~3.6V
(Note 8) V_{CC} = 2.7~3.0V
(Note 9) V_{IN} = 0.8~2.0V, V_{CC} = 3.0V

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} = −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} = 16mA	3.0	—	0.4	
				I_{OL} = 24mA	3.0	—	0.55	
Input Leakage Current		I_{IN}	V_{IN} = 0~5.5V		2.7~3.6	—	±5.0	μA
Power Off Leakage Cuurent		I_{OFF}	V_{IN} / V_{OUT} = 5.5V		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} = 3.6~5.5V		2.7~3.6	—	±10.0	
Increase In I_{CC} Per Input		ΔI_{CC}	V_{IH} = V_{CC} − 0.6V		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)

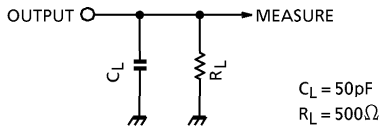
PARAMETER	SYMBOL	TEST CONDITION	V_{CC} (V)	TYP	UNIT
Input Capacitance	C_{IN}	—	3.3	7	pF
Output Capacitance	C_{OUT}		0	8	pF
Power Dissipation Capacitance	C_{PD}	f_{IN} = 10MHz (Note 11)	3.3	25	pF

(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 :

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

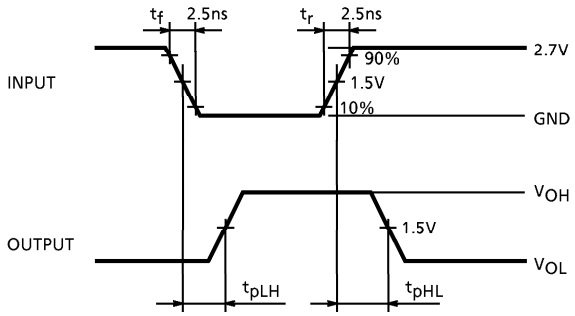
TEST CIRCUIT

Fig.1



AC WAVEFORM

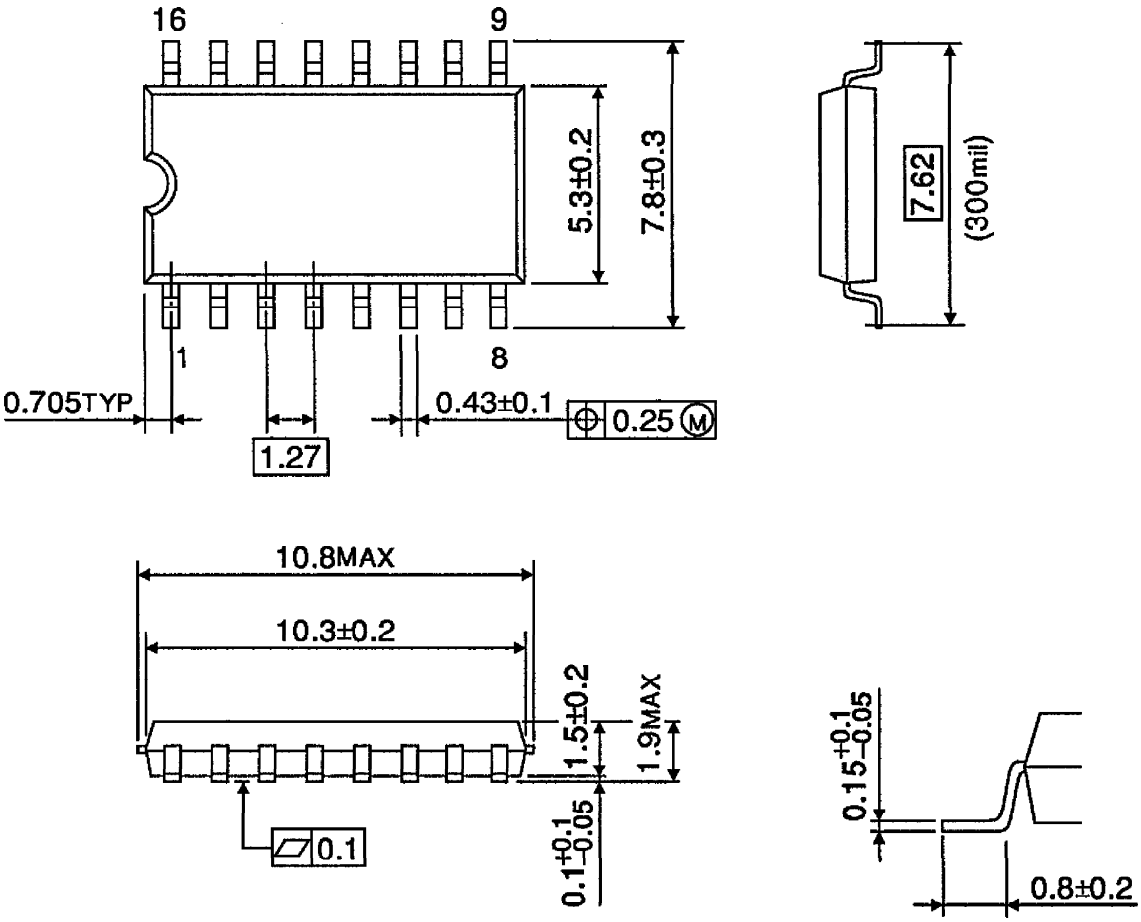
Fig.2 t_{pLH}, t_{pHL}



OUTLINE DRAWING

SOP16-P-300-1.27

Unit : mm

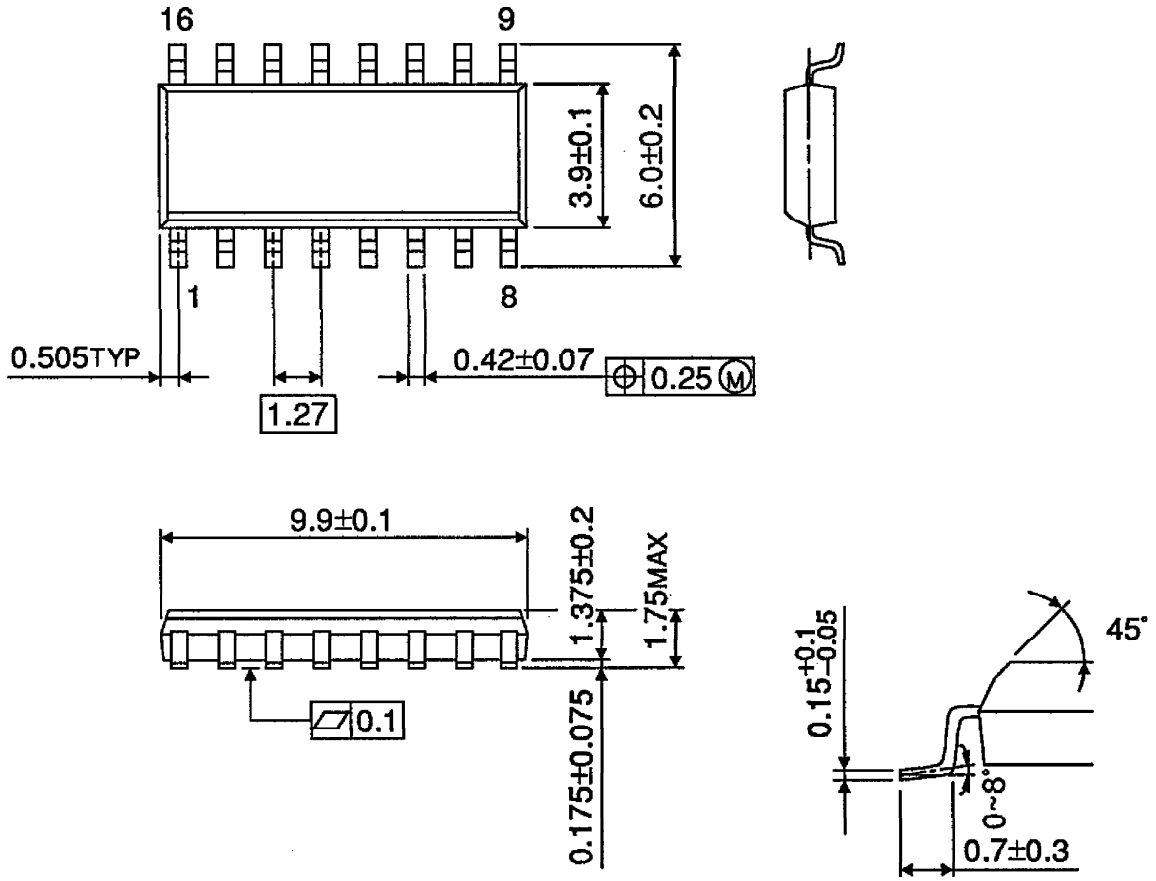


Weight : 0.18g (Typ.)

OUTLINE DRAWING

SOL16-P-150-1.27 Unit : mm

(Note) This package is not available in Japan.

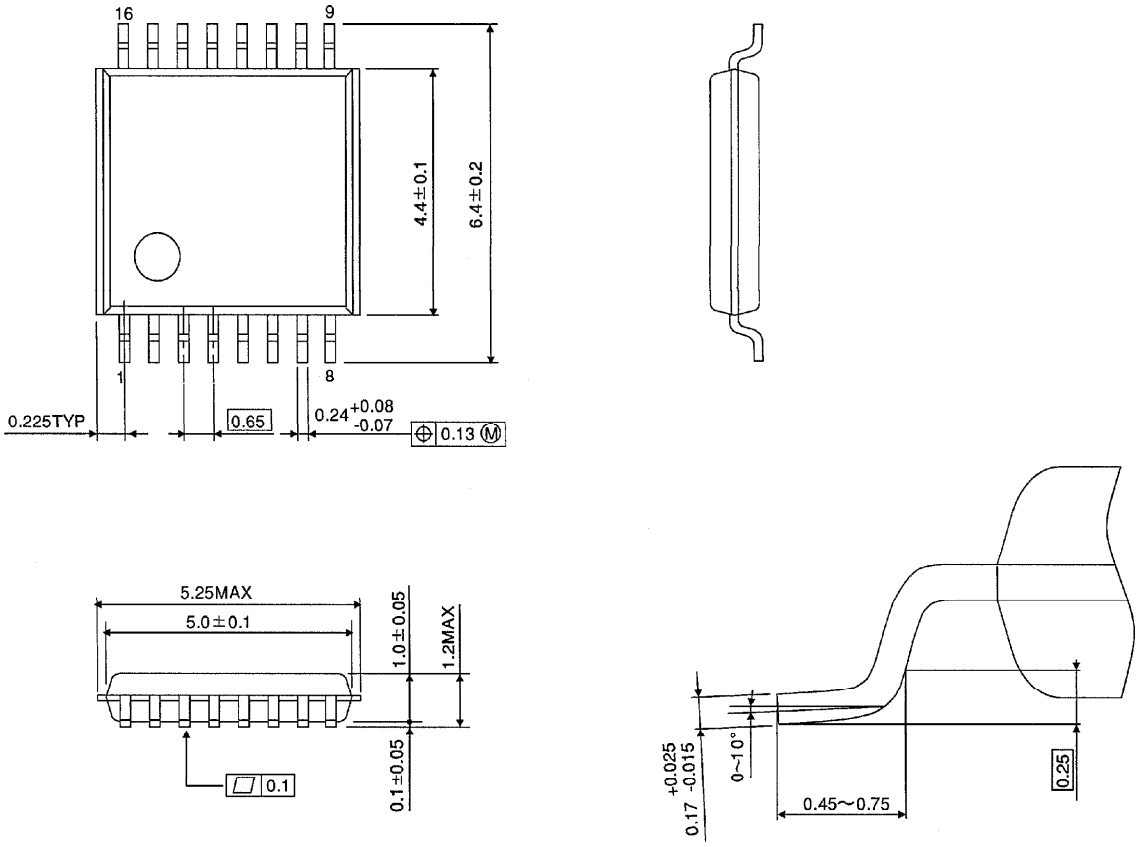


Weight : 0.12g (Typ.)

OUTLINE DRAWING

TSSOP16-P-0044-0.65

Unit : mm



Weight : 0.06g (Typ.)