TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT   SILICON MONOLITHIC

TC74HCT138AP, TC74HCT138AF, TC74HCT138AFN

3 – TO – 8 LINE DECODER

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

The TC74HCT138A is a high speed CMOS 3 - to - 8 LINE DECODER fabricated with silicon gate C^2MOS technology.

It achieves the high speed operation similar to equivalent LSTTL while maintaining the CMOS low power dissipation.

This device may be used as a level converter for interfacing TTL or NMOS to High Speed CMOS. The inputs are compatible with TTL, NMOS and CMOS output voltage levels.

When the device is enabled, 3 Binary Select inputs (A, B and C) determine which one of the outputs ($\overline{Y0}$ - $\overline{Y7}$) will go low.

When enable input G1 is held low or either $\overline{G2A}$ or $\overline{G2B}$ is held high, decoding function is inhibited and all outputs go high.

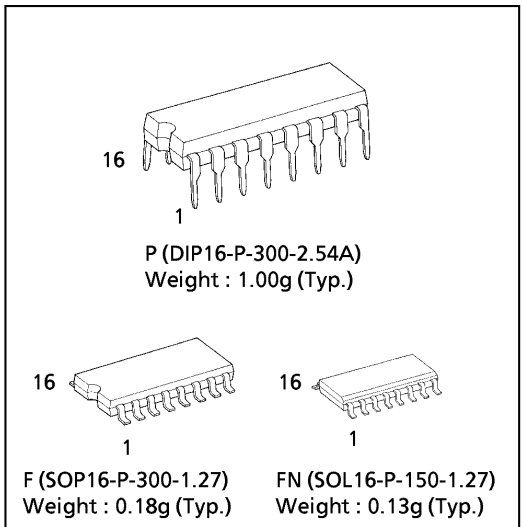G1, $\overline{G2A}$, and $\overline{G2B}$ inputs are provided to ease cascade connection and for use as an address decoder for memory systems.

All inputs are equipped with protection circuits against static discharge or transient excess voltage.
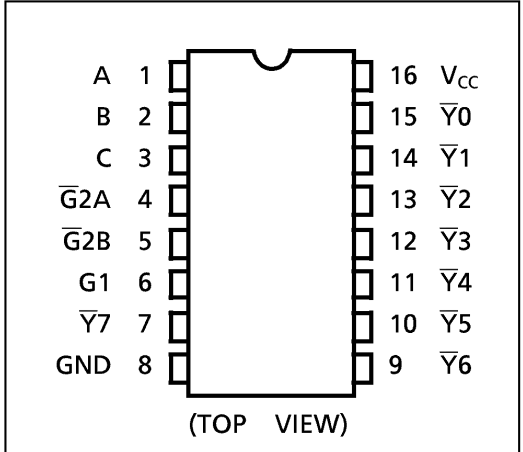
FEATURES :
- High Speed ······························ t_{pd} = 17ns(typ.) at V_{CC} = 5V
- Low Power Dissipation ··············· I_{CC} = 4μA(Max.) at Ta = 25°C
- Compatible with TTL outputs ···· V_{IH} = 2V(Min.)
  V_{IL} = 0.8V(Max.)
- Wide interfacing abilty ·············· LSTTL, NMOS, CMOS
- Output Drive Capability ············· 10 LSTTL Loads
- Symmetrical Output Impedance ··· | I_{OH} | = I_{OL} = 4mA(Min.)
- Balanced Propagation Delays ····· $t_{pLH} \simeq t_{pHL}$
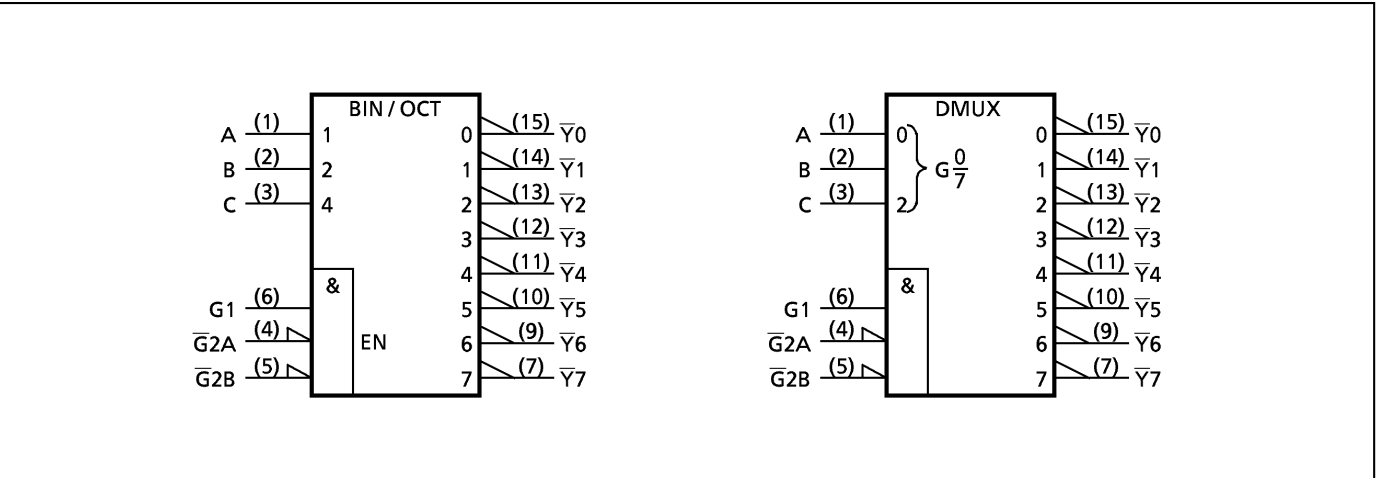- Pin and Function Compatible with 74LS138

P (DIP16-P-300-2.54A)
Weight : 1.00g (Typ.)

F (SOP16-P-300-1.27)
Weight : 0.18g (Typ.)

FN (SOL16-P-150-1.27)
Weight : 0.13g (Typ.)

PIN ASSIGNMENT

A	1		16	V_{CC}
B	2		15	$\overline{Y0}$
C	3		14	$\overline{Y1}$
$\overline{G2A}$	4		13	$\overline{Y2}$
$\overline{G2B}$	5		12	$\overline{Y3}$
G1	6		11	$\overline{Y4}$
$\overline{Y7}$	7		10	$\overline{Y5}$
GND	8		9	$\overline{Y6}$

(TOP   VIEW)

IEC LOGIC SYMBOL

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	$\overline{G2A}$	$\overline{G2B}$	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

LOGIC DIAGRAM
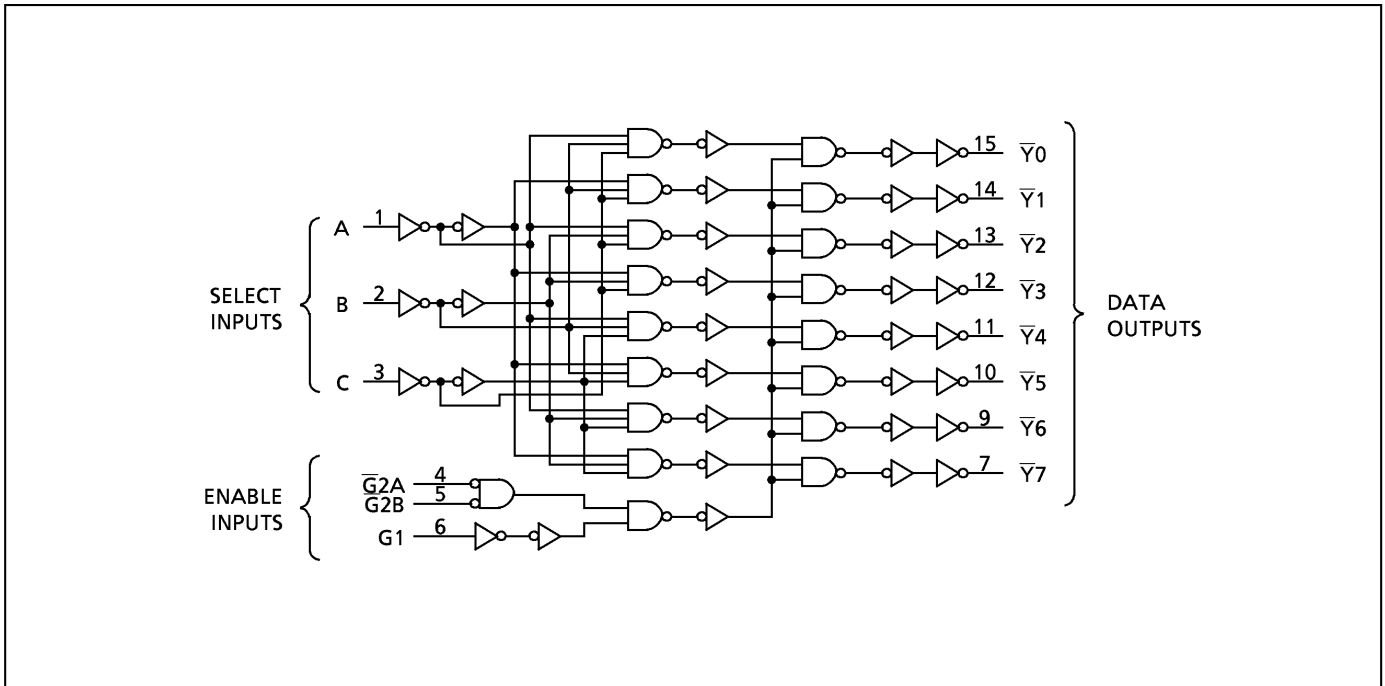
ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7$	V
DC Input Voltage	V_{IN}	$-0.5 \sim V_{CC} + 0.5$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim V_{CC} + 0.5$	V
Input Diode Current	I_{IK}	± 20	mA
Output Diode Current	I_{OK}	± 20	mA
DC Output Current	I_{OUT}	± 25	mA
DC V_{CC} / Ground Current	I_{CC}	± 50	mA
Power Dissipation	P_D	500 (DIP)* / 180 (SOP)	mW
Storage Temperature	T_{stg}	$-65 \sim 150$	°C

*500mW in the range of Ta = −40°C~65°C. From Ta = 65°C to 85 °C a derating factor of −10mW/ °C shall be applied until 300mW.

RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	V_{CC}	$4.5 \sim 5.5$	V
Input Voltage	V_{IN}	$0 \sim V_{CC}$	V
Output Voltage	V_{OUT}	$0 \sim V_{CC}$	V
Operating Temperature	T_{opr}	$-40 \sim 85$	°C
Input Rise and Fall Time	t_r, t_f	$0 \sim 500$	ns

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	TEST CONDITION		V_{CC} (V)	Ta = 25°C			Ta = −40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
High - Level Input Voltage	V_{IH}			4.5 ⟨ 5.5	2.0	—	—	2.0	—	V
Low - Level Input Voltage	V_{IL}			4.5 ⟨ 5.5	—	—	0.8	—	0.8	V
High - Level Output Voltage	V_{OH}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OH} = -20 \mu A$	4.5	4.4	4.5	—	4.4	—	V
			$I_{OH} = -4$ mA	4.5	4.18	4.31	—	4.13	—	
Low - Level Output Voltage	V_{OL}	$V_{IN} = V_{IH}$ or V_{IL}	$I_{OL} = 20 \mu A$	4.5	—	0.0	0.1	—	0.1	V
			$I_{OL} = 4$ mA	4.5	—	0.17	0.26	—	0.33	
Input Leakage Current	I_{IN}	$V_{IN} = V_{CC}$ or GND		5.5	—	—	± 0.1	—	± 1.0	μA
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC}$ or GND		5.5	—	—	4.0	—	40.0	
	I_C	PER INPUT: $V_{IN} = 0.5V$ or 2.4V OTHER INPUT: V_{CC} or GND		5.5	—	—	2.0	—	2.9	mA

AC ELECTRICAL CHARACTERISTICS (C_L = 15pF, V_{CC} = 5V, Ta = 25°C, Input t_r = t_f = 6ns)

PARAMETER	SYMBOL	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}		—	4	8	ns
Propagation Delay Time (A, B, C−$\overline{Y}$)	t_{pLH} t_{pHL}		—	17	28	
Propagation Delay Time (G1−$\overline{Y}$)	t_{pLH} t_{pHL}		—	15	25	
Propagation Delay Time ($\overline{G2}$−$\overline{Y}$)	t_{pLH} t_{pHL}		—	17	28	

AC ELECTRICAL CHARACTERISTICS (C_L = 50pF, Input t_r = t_f = 6ns)

| PARAMETER	SYMBOL	TEST CONDITION	V_{CC}(V)	Ta = 25°C MIN.	Ta = 25°C TYP.	Ta = 25°C MAX.	Ta = −40~85°C MIN.	Ta = −40~85°C MAX.	UNIT
Output Transition Time	t_{TLH} t_{THL}		4.5 5.5	— —	8 7	15 14	— —	19 18	ns
Propagation Delay Time (A, B, C−$\overline{Y}$)	t_{pLH} t_{pHL}		4.5 5.5	— —	21 18	33 30	— —	44 40	
Propagation Delay Time (G1−$\overline{Y}$)	t_{pLH} t_{pHL}		4.5 5.5	— —	19 17	30 27	— —	38 34	
Propagation Delay Time ($\overline{G2}$−$\overline{Y}$)	t_{pLH} t_{pHL}		4.5 5.5	— —	22 20	33 30	— —	41 37	
Input Capacitance	C_{IN}			—	5	10	—	10	pF
Power Dissipation Capacitance	C_{PD} (1)			—	55	—	—	—	

Note (1) 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:

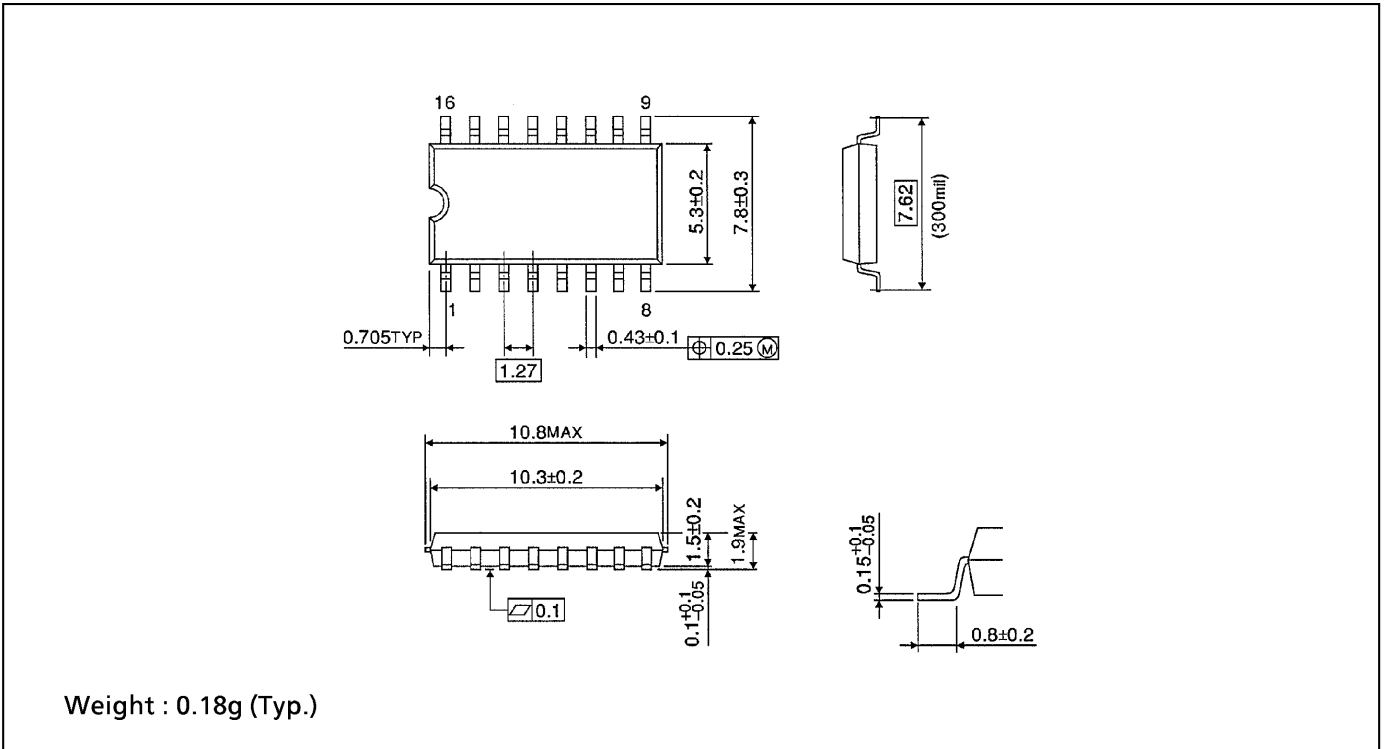$$I_{CC} (opr) = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

2001-05-17

DIP 16PIN PACKAGE DIMENSIONS (DIP16-P-300-2.54A) Unit in mm

Weight : 1.00g (Typ.)
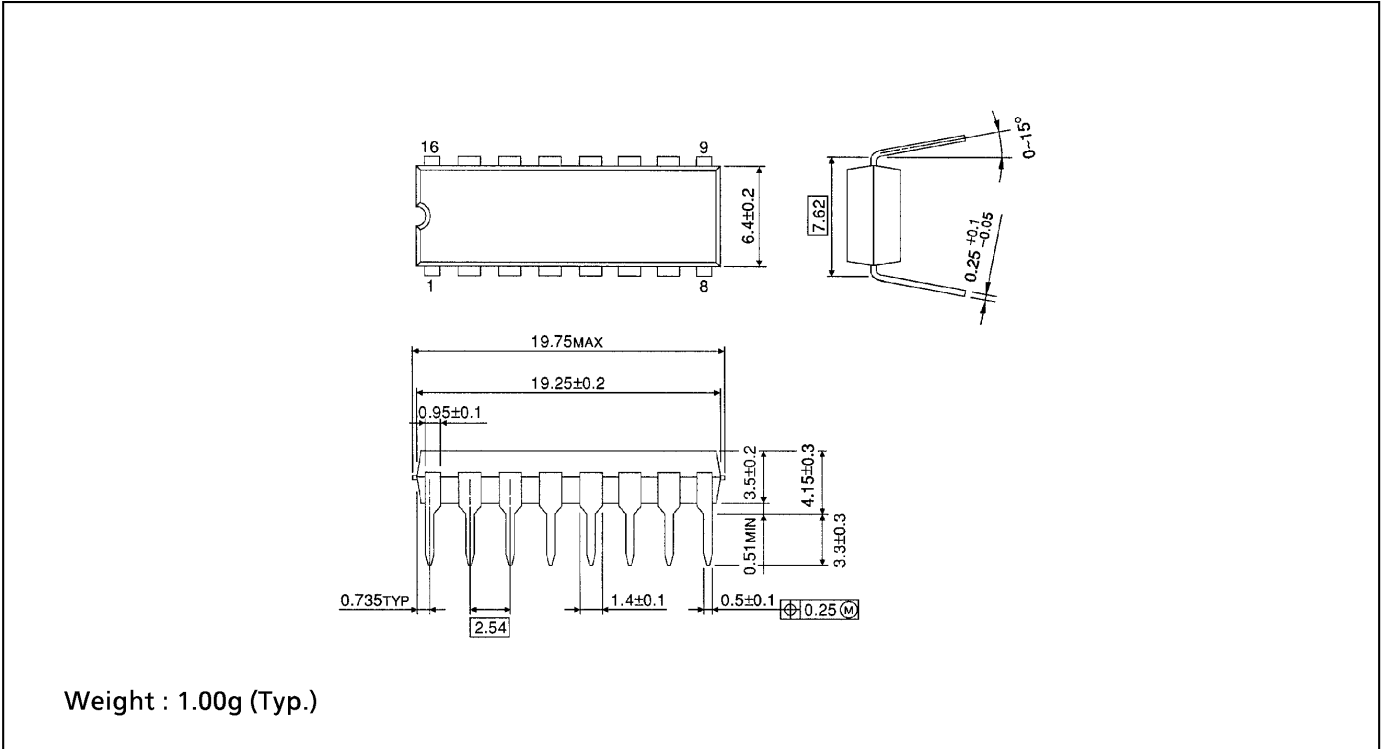
SOP 16PIN (200mil BODY) PACKAGE DIMENSIONS (SOP16-P-300-1.27) Unit in mm

Weight : 0.18g (Typ.)

2001-05-17
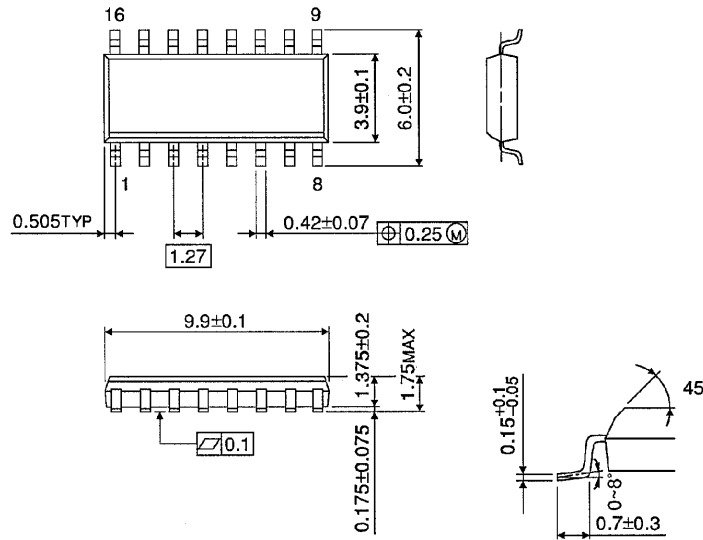
SOP 16PIN (150mil BODY) PACKAGE DIMENSIONS (SOL16-P-150 -1.27)   Unit in mm

(Note) This package is not available in Japan.

Weight : 0.13g (Typ.)

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