TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74VHCT540AF, TC74VHCT540AFW, TC74VHCT540AFT
TC74VHCT541AF, TC74VHCT541AFW, TC74VHCT541AFT

OCTAL BUS BUFFER
TC74VHCT540AF / AFW / AFT INVERTED, 3 - STATE OUTPUTS
TC74VHCT541FA / AFW / AFT NON - INVERTED, 3 - STATE OUTPUTS

The TC74VHCT540A and 541A are advanced high speed CMOS OCTAL BUS BUFFFERs fabricated with silicon gate C²MOS technology. They achieve the high speed operation similar to equivalent Bipolar Schottky TTL while maintaining the CMOS low power dissipation.

The TC74VHCT540A is an inverting type and, the TC74VHCT541A is a non - inverting type.

When either $\overline{G1}$ or $\overline{G2}$ are high , the terminal outputs are in the high - impedance state.

The input voltage are compatible with TTL output voltage.

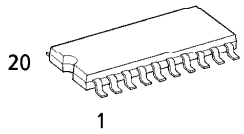
These devices may be used as a level converter for interfacing 3.3V to 5V system.

Input protection and output circuit ensure that 0 to 5.5V can be applied to the input and output*1 pins without regard to the supply voltage. These structure prevents device destruction due to mismatched supply and input / output voltages such as battery back up, hot board insertion, etc.

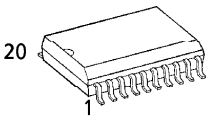
*1: output in off-state

FEATURES :

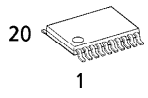
- High Speed ..... t_{pd} = 5.4ns(typ.) at V_{CC} = 5V
- Low Power Dissipation ..... I_{CC} = 4μA(Max.) at Ta = 25°C
- Compatible with TTL outputs ... V_{IL} = 0.8 V (Max.)
  V_{IH} = 2.0 V (Min.)
- Power Down Protection is provided on all inputs and outputs
- Balanced Propagation Delays ..... $t_{pLH} \simeq t_{pHL}$
- Low Noise ..... V_{OLP} = 1.6V (Max.)
- Pin and Function Compatible with the 74 series (74AC / HC / F / ALS / LS etc.) 540 / 541 type.



F (SOP20-P-300-1.27)
Weight : 0.22g (TYP.)



FW (SOL20-P-300-1.27)
Weight : 0.46g (TYP.)



FT (TSSOP20-P-0044-0.65)
Weight : 0.08g (TYP.)

TRUTH TABLE

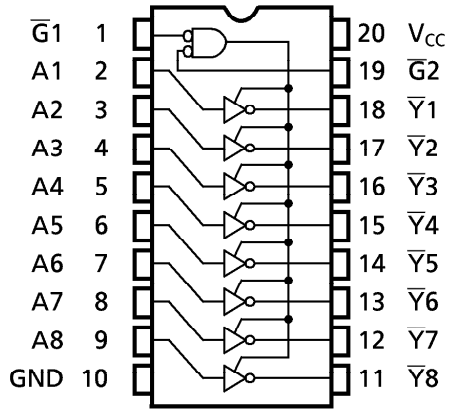
INPUTS			OUTPUTS	
$\overline{G1}$	$\overline{G2}$	An	Yn *	$\overline{Yn}$ *
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	H	L
L	L	L	L	H

X : Don't Care
Z : High Impedance
* : Yn VHCT541A
$\overline{Yn}$ VHCT540A

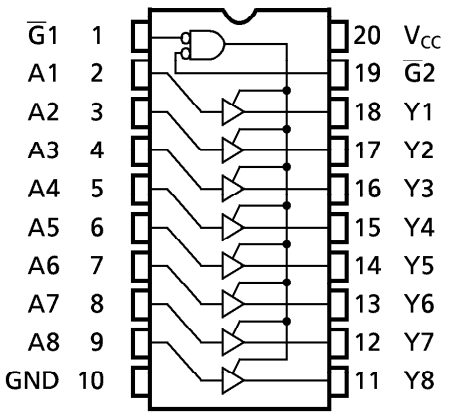
PIN ASSIGNMENT

(TOP VIEW)

TC74VHCT540A

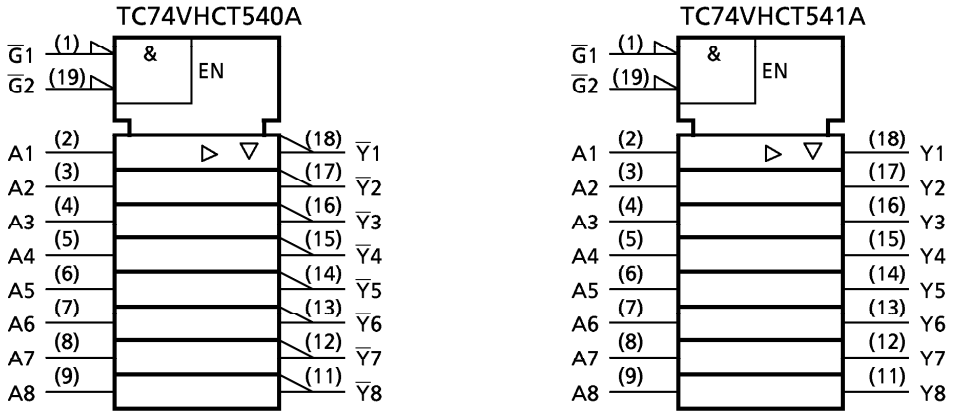


TC74VHCT541A



961001EBA2

IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	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~VCC + 0.5 (Note 2)	
Input Diode Current	I_{IK}	−20	mA
Output Diode Current	I_{OK}	±20 (Note 3)	mA
DC Output Current	I_{OUT}	±25	mA
DC Vcc/Ground Current	I_{CC}	±75	mA
Power Dissipation	P_D	180	mW
Storage Temperature	T_{stg}	−65~150	°C

(Note 1) Output in Off-State
(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	VALUE	UNIT
Supply Voltage	V_{CC}	4.5~5.5	V
Input Voltage	V_{IN}	0~5.5	V
Output Voltage	V_{OUT}	0~5.5 (Note 4)	V
		0~VCC (Note 5)	
Operating Temperature	T_{opr}	−40~85	°C
Input Rise and Fall Time	dt / dV	0~20	ns / V

(Note 4) Output in Off-State
(Note 5) High or Low State

DC ELECTRICAL CHARACTERISTICS

PARAMETER	SYMBOL	CONDITON		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} = −50μA	4.5	4.40	4.50	—	4.40	—	V
			I_{OH} = −8mA	4.5	3.94	—	—	3.80	—	
Low - Level Output Voltage	V_{OL}	V_{IN} = V_{IH} or V_{IL}	I_{OL} = 50μA	4.5	—	0.0	0.10	—	0.10	V
			I_{OL} = 8mA	4.5	—	—	0.36	—	0.44	
3 - State Output Off - State Current	I_{OZ}	V_{IN} = V_{IH} or V_{IL} V_{OUT} = V_{CC} or GND		5.5	—	—	±0.25	—	±2.50	μA
Input Leakage Current	I_{IN}	V_{IN} = 5.5V or GND		0~5.5	—	—	±0.1	—	±1.0	
Quiescent Supply Current	I_{CC}	V_{IN} = V_{CC} or GND		5.5	—	—	4.0	—	40.0	
	I_{CCT}	PER INPUT : VIN = 3.4V OTHER INPUT : VCC or GND		5.5	—	—	1.35	—	1.50	mA
Output Leakage Current	I_{OPD}	V_{OUT} = 5.5V		0	—	—	+0.5	—	+5.0	μA

AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f$ = 3ns)

PARAMETER	SYMBOL	TEST CONDITION			Ta = 25°C			Ta = −40~85°C		UNIT
			V_{CC} (V)	C_L (pF)	MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time (TC74VHCT540A)	t_{pLH} t_{pHL}		5.0 ± 0.5	15	—	5.4	7.4	1.0	8.5	ns
				50	—	5.9	8.4	1.0	9.5	
Propagation Delay Time (TC74VHCT541A)	t_{pLH} t_{pHL}		5.0 ± 0.5	15	—	5.0	6.9	1.0	8.0	
				50	—	5.5	7.9	1.0	9.0	
3-State Output Enable Time	t_{pZL} t_{pZH}	R_L = 1kΩ	5.0 ± 0.5	15	—	8.3	11.3	1.0	13.0	
				50	—	8.8	12.3	1.0	14.0	
3-State Output Disable Time	t_{pLZ} t_{pHZ}	R_L = 1kΩ	5.0 ± 0.5	50	—	9.4	11.9	1.0	13.5	
Output to Output Skew	t_{osLH} t_{osHL}	(Note 6)	5.0 ± 0.5	50	—	—	1.0	—	1.0	
Input Capacitance	C_{IN}				—	4	10	—	10	pF
Output Capacitance	C_{OUT}				—	9	—	—	—	
Power Dissipation Capacitance	C_{PD}	(Note 7)			—	19	—	—	—	

(Note 6) Parameter guaranteed by design. $t_{osLH} = |t_{pLHm} - t_{pLHn}|$, $t_{osHL} = |t_{pHLm} - t_{pHLn}|$

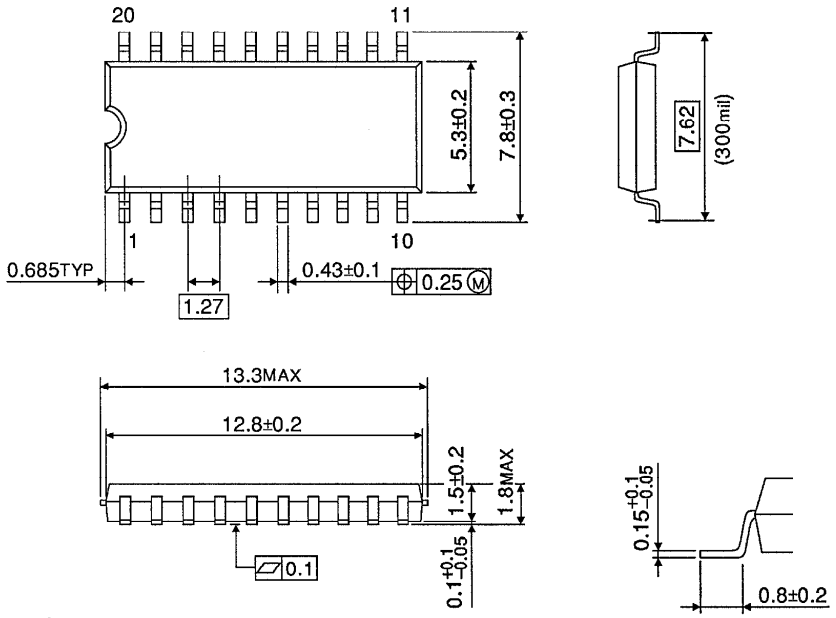
(Note 7) C_{PD} is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.
Average operating current can be obtained by the equation :

$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}/8 \text{ (per bit)}$$

NOISE CHARACTERISTICS (Input $t_r = t_f = 3ns$)

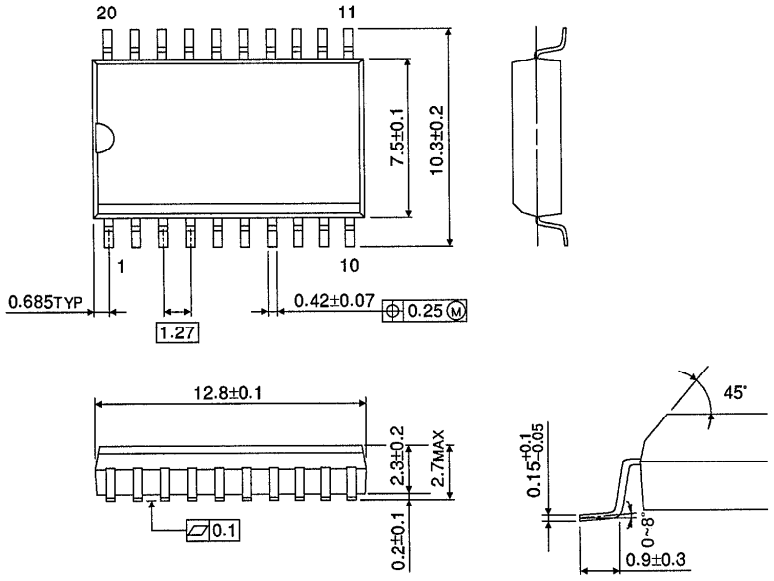
PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C		UNIT
			V_{CC} (V)	TYP.	LIMIT	
Quiet Output Maximum Dynamic V_{OL}	V_{OLP}	$C_L = 50pF$	5.0	1.2	1.6	V
Quiet Output Minimum Dynamic V_{OL}	V_{OLV}	$C_L = 50pF$	5.0	− 1.2	− 1.6	V
Minimum High Level Dynamic Input Voltage	V_{IHD}	$C_L = 50pF$	5.0	−	2.0	V
Maximum Low Level Dynamic Input Voltage	V_{ILD}	$C_L = 50pF$	5.0	−	0.8	V

SOP 20PIN (200mil BODY) OUTLINE DRAWING (SOP20-P-300-1.27) Unit in mm



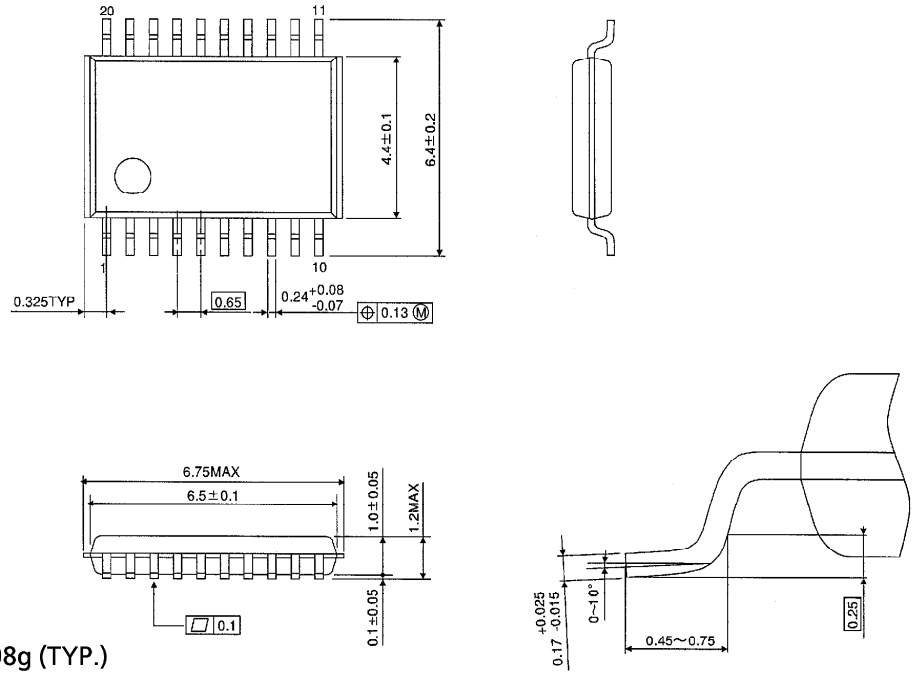
Weight : 0.22g (TYP.)

SOP 20PIN (300mil BODY) OUTLINE DRAWING (SOL20-P-300-1.27) Unit in mm



Weight : 0.46g (TYP.)

TSSOP 20PIN OUTLINE DRAWING (TSSOP20-P-0044-0.65) Unit in mm



Weight : 0.08g (TYP.)