

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 BUFFERS fabricated with silicon gate C<sup>2</sup>MOS 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  $\bar{G}1$  or  $\bar{G}2$  are high, the terminal outputs are in the high - impedance state.

The input voltage are compatible with TTL output voltage.

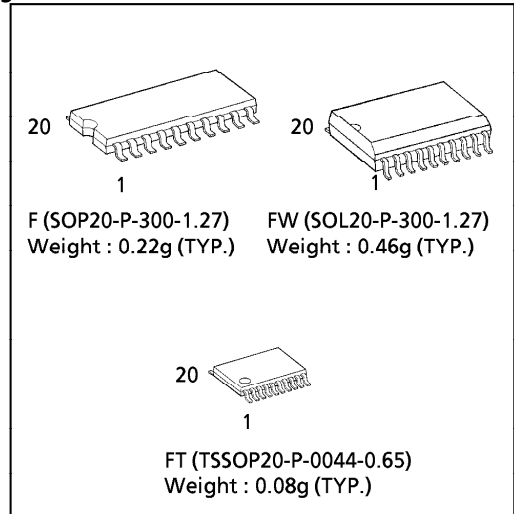
These devices may be used as a level converter for interfacing 3.3V to 5V system.

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..... $I_{CC} = 4\mu A$ (Max.) at  $T_a = 25^\circ C$
- 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.....  $t_{pLH} \approx t_{pHL}$
- Low Noise .....  $V_{OLP} = 1.6V$  (Max.)
- Pin and Function Compatible with the 74 series (74AC / HC / F / ALS / LS etc.) 540 / 541 type.

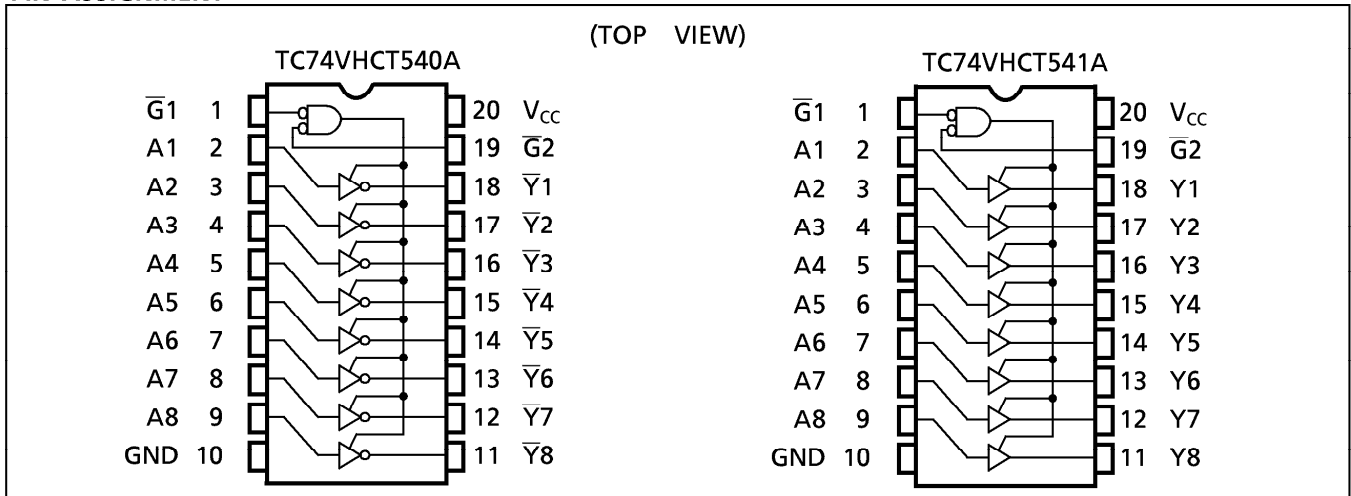


**TRUTH TABLE**

INPUTS			OUTPUTS	
$\bar{G}1$	$\bar{G}2$	$A_n$	$Y_n^*$	$\bar{Y}_n^*$
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  
 \* :  $Y_n$  ..... VHCT541A  
 $\bar{Y}_n$  ..... VHCT540A

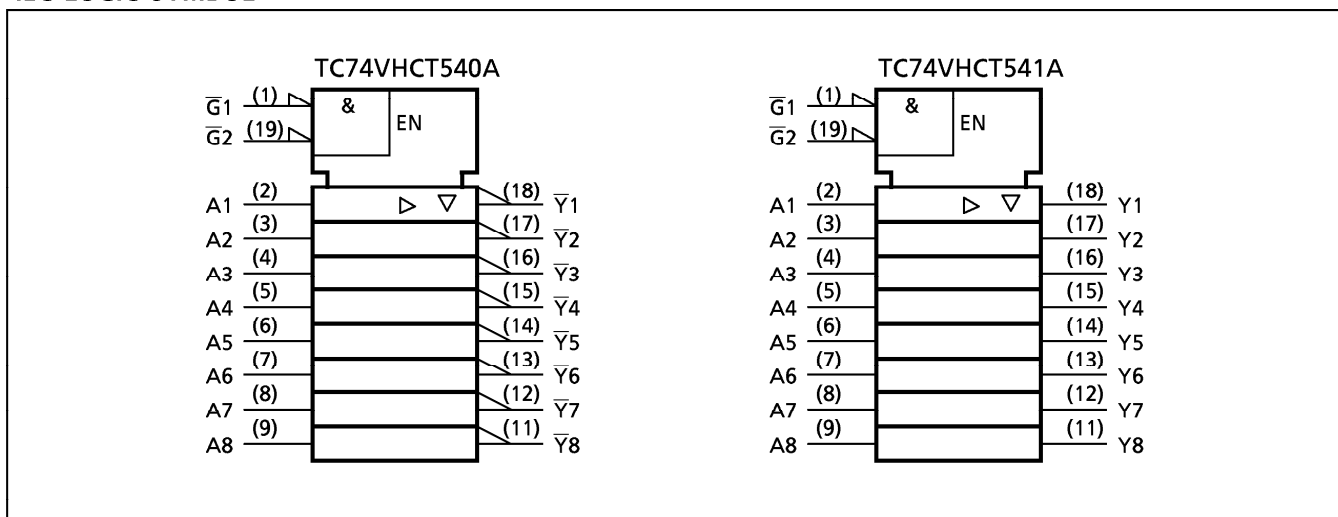
**PIN ASSIGNMENT**



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**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~ $V_{CC} + 0.5$ (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~ $V_{CC}$ (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

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**DC ELECTRICAL CHARACTERISTICS**

PARAMETER	SYMBOL	CONDITON		V <sub>CC</sub> (V)	Ta = 25°C			Ta = -40~85°C		UNIT
					MIN.	TYP.	MAX.	MIN.	MAX.	
High - Level Input Voltage	V <sub>IH</sub>			4.5~5.5	2.0	—	—	2.0	—	V
Low - Level Input Voltage	V <sub>IL</sub>			4.5~5.5	—	—	0.8	—	0.8	V
High - Level Output Voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -50μA	4.5	4.40	4.50	—	4.40	—	V
			I <sub>OH</sub> = -8mA	4.5	3.94	—	—	3.80	—	
Low - Level Output Voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 50μA	4.5	—	0.0	0.10	—	0.10	V
			I <sub>OL</sub> = 8mA	4.5	—	—	0.36	—	0.44	
3 - State Output Off - State Current	I <sub>OZ</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> V <sub>OUT</sub> = V <sub>CC</sub> or GND		5.5	—	—	±0.25	—	±2.50	μA
Input Leakage Current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5V or GND		0~5.5	—	—	±0.1	—	±1.0	
Quiescent Supply Current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND		5.5	—	—	4.0	—	40.0	
	I <sub>CCT</sub>	PER INPUT : V <sub>IN</sub> = 3.4V OTHER INPUT : V <sub>CC</sub> or GND		5.5	—	—	1.35	—	1.50	mA
Output Leakage Current	I <sub>OPD</sub>	V <sub>OUT</sub> = 5.5V		0	—	—	+0.5	—	+5.0	μA

**AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3ns)**

PARAMETER	SYMBOL	TEST CONDITION			Ta = 25°C			Ta = -40~85°C		UNIT
		V <sub>CC</sub> (V)	C <sub>L</sub> (pF)		MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time (TC74VHCT540A)	t <sub>pLH</sub>	5.0 ± 0.5	15	—	5.4	7.4	1.0	8.5	ns	
	t <sub>pHL</sub>									50
Propagation Delay Time (TC74VHCT541A)	t <sub>pLH</sub>	5.0 ± 0.5	15	—	5.0	6.9	1.0	8.0		
	t <sub>pHL</sub>									50
3-State Output Enable Time	t <sub>pZL</sub>	R <sub>L</sub> = 1kΩ	5.0 ± 0.5	15	—	8.3	11.3	1.0		13.0
	t <sub>pZH</sub>									
3-State Output Disable Time	t <sub>pLZ</sub>	R <sub>L</sub> = 1kΩ	5.0 ± 0.5	50	—	9.4	11.9	1.0		13.5
	t <sub>pHZ</sub>									
Output to Output Skew	t <sub>osLH</sub> t <sub>osHL</sub>	(Note 6)	5.0 ± 0.5	50	—	—	1.0	—		1.0
Input Capacitance	C <sub>IN</sub>				—	4	10	—		10
Output Capacitance	C <sub>OUT</sub>				—	9	—	—	—	
Power Dissipation Capacitance	C <sub>PD</sub>	(Note 7)			—	19	—	—	—	

(Note 6) Parameter guaranteed by design. t<sub>osLH</sub> = |t<sub>pLHm</sub> - t<sub>pLHn</sub>|, t<sub>osHL</sub> = |t<sub>pHLm</sub> - t<sub>pHLn</sub>|

(Note 7) C<sub>PD</sub> 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 :

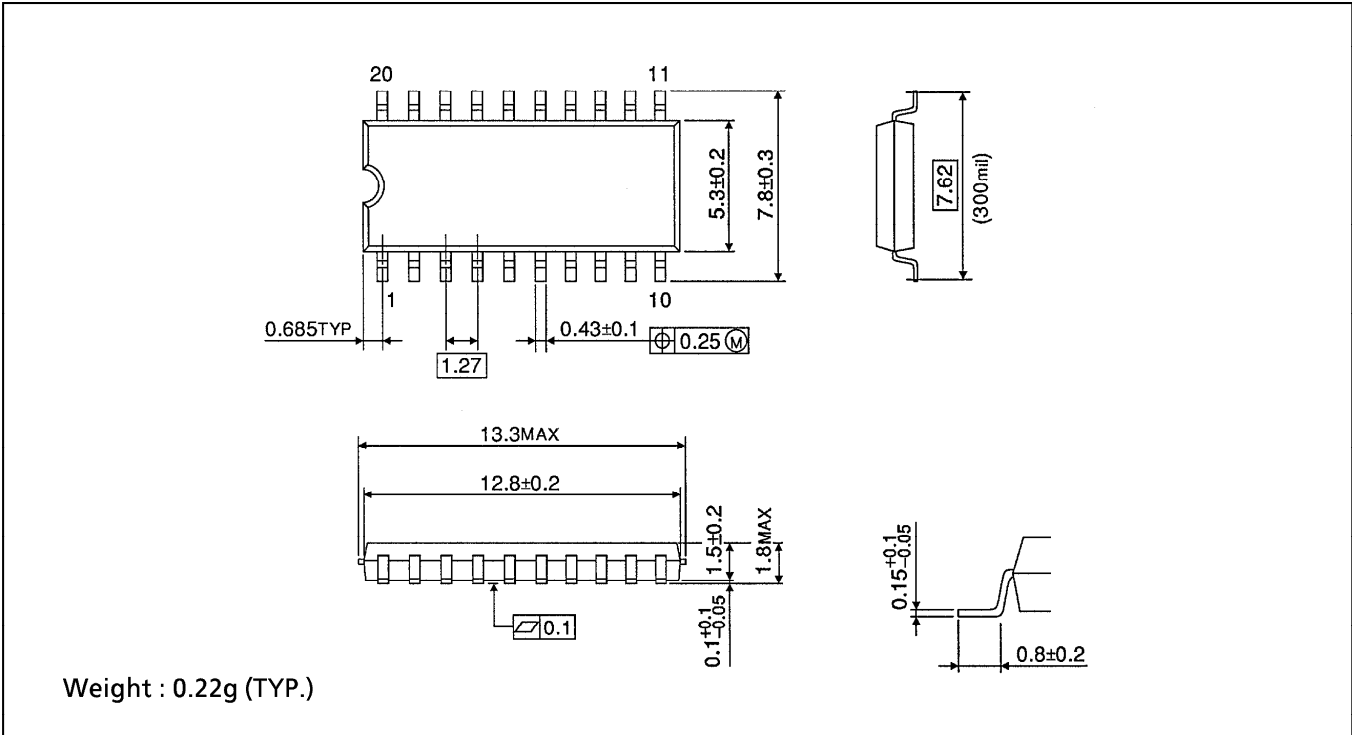
$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8 \text{ (per bit)}$$

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

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C		UNIT
			V <sub>CC</sub> (V)	TYP.	LIMIT	
Quiet Output Maximum Dynamic V <sub>OL</sub>	V <sub>OLP</sub>	C <sub>L</sub> = 50pF	5.0	1.2	1.6	V
Quiet Output Minimum Dynamic V <sub>OL</sub>	V <sub>OLV</sub>	C <sub>L</sub> = 50pF	5.0	-1.2	-1.6	V
Minimum High Level Dynamic Input Voltage	V <sub>IHD</sub>	C <sub>L</sub> = 50pF	5.0	-	2.0	V
Maximum Low Level Dynamic Input Voltage	V <sub>ILD</sub>	C <sub>L</sub> = 50pF	5.0	-	0.8	V

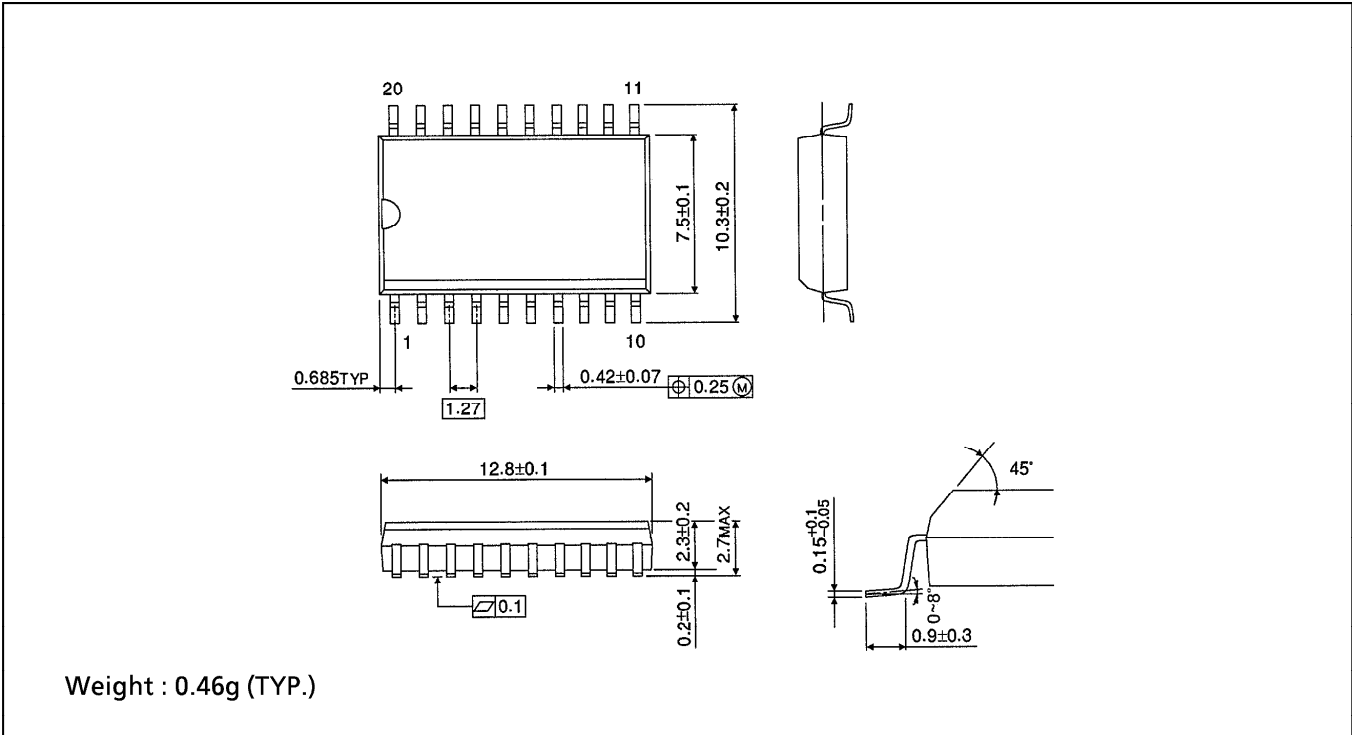
**SOP 20PIN (200mil BODY) OUTLINE DRAWING (SOP20-P-300-1.27)**

Unit in mm



**SOP 20PIN (300mil BODY) OUTLINE DRAWING (SOL20-P-300-1.27)**

Unit in mm



**TSSOP 20PIN OUTLINE DRAWING (TSSOP20-P-0044-0.65)**

Unit in mm

