

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC74VHCT540AF, TC74VHCT540AFW, TC74VHCT540AFT
TC74VHCT541AF, TC74VHCT541AFW, TC74VHCT541AFT
OCTAL BUS BUFFER**TC74VHCT540AF / AFW / AFT INVERTED, 3 - STATE OUTPUTS****TC74VHCT541AF / AFW / AFT NON - INVERTED, 3 - STATE OUTPUTS**

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

The TC74VHCT540A and 541A are advanced high speed CMOS OCTAL BUS BUFFERS fabricated with silicon gate CMOS 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.

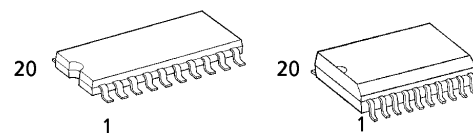
These devices may be used as a level converter for interfacing 3.3V to 5V system.

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

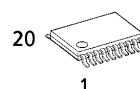
FEATURES:

- 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 ... $V_{IL} = 0.8V (Max.)$
 $V_{IH} = 2.0V (Min.)$
- 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.



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	
$\bar{G}1$	$\bar{G}2$	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

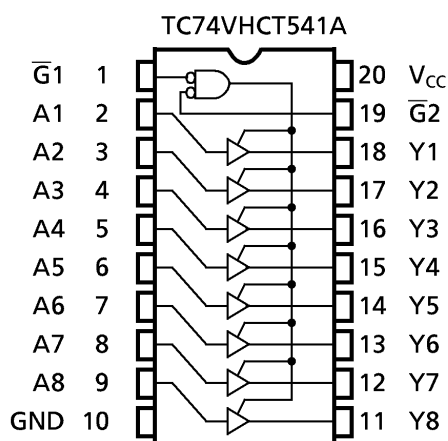
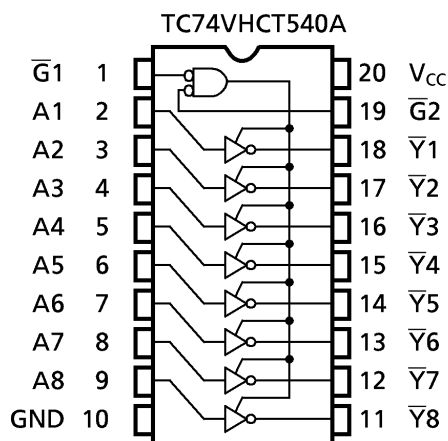
Z : High Impedance

* : Y_n VHCT541A

$\bar{Y}_n$ VHCT540A

PIN ASSIGNMENT

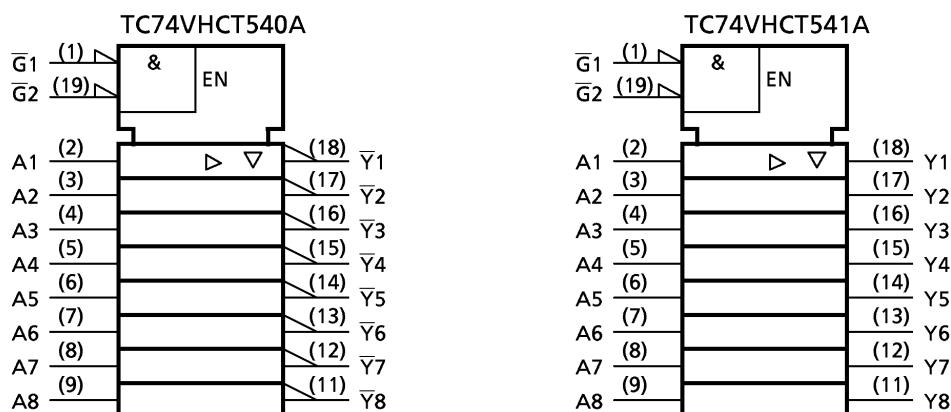
(TOP VIEW)



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IEC LOGIC SYMBOL



ABSOLUTE MAXIMUM RATINGS

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage Range	V_{CC}	$-0.5 \sim 7.0$	V
DC Input Voltage	V_{IN}	$-0.5 \sim 7.0$	V
DC Output Voltage	V_{OUT}	$-0.5 \sim 7.0$ (Note 1)	V
		$-0.5 \sim V_{CC} + 0.5$ (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}	$-65 \sim 150$	$^{\circ}\text{C}$

(Note 1) Output in Off-State

(Note 2) High or Low State. I_{OUT} absolute maximum rating must be observed.(Note 3) $V_{OUT} < \text{GND}$, $V_{OUT} > V_{CC}$

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}	$-40 \sim 85$	$^{\circ}\text{C}$
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		$V_{CC}(V)$	$T_a = 25^\circ C$			$T_a = -40 \sim 85^\circ C$		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}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -50 \mu A$	4.5	4.40	4.50	—	4.40	—	V
			$I_{OH} = -8mA$	4.5	3.94	—	—	3.80	—	
Low - Level Output Voltage	V_{OL}	$V_{IN} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 50 \mu A$	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}	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $V_{OUT} = V_{CC} \text{ or } GND$		5.5	—	—	± 0.25	—	± 2.50	μA
Input Leakage Current	I_{IN}	$V_{IN} = 5.5V \text{ or } GND$		0~5.5	—	—	± 0.1	—	± 1.0	
Quiescent Supply Current	I_{CC}	$V_{IN} = V_{CC} \text{ or } GND$		5.5	—	—	4.0	—	40.0	
	I_{CCT}	PER INPUT : $V_{IN} = 3.4V$ OTHER INPUT : $V_{CC} \text{ or } GND$		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		$T_a = 25^\circ C$			$T_a = -40 \sim 85^\circ C$		UNIT
				$V_{CC}(V)$	$C_L(pF)$	MIN.	TYP.	MAX.	
Propagation Delay Time (TC74VHCT540A)	t_{pLH}		5.0 ± 0.5	15	—	5.4	7.4	1.0	ns
	t_{pHL}		5.0 ± 0.5	50	—	5.9	8.4	1.0	
Propagation Delay Time (TC74VHCT541A)	t_{pLH}		5.0 ± 0.5	15	—	5.0	6.9	1.0	
	t_{pHL}		5.0 ± 0.5	50	—	5.5	7.9	1.0	
3-State Output Enable Time	t_{pZL}	$R_L = 1k\Omega$	5.0 ± 0.5	15	—	8.3	11.3	1.0	
	t_{pZH}			50	—	8.8	12.3	1.0	
3-State Output Disable Time	t_{pLZ} t_{pHZ}	$R_L = 1k\Omega$	5.0 ± 0.5	50	—	9.4	11.9	1.0	13.5
Output to Output Skew	$t_{oS LH}$ $t_{oS HL}$	(Note 6)	5.0 ± 0.5	50	—	—	1.0	—	1.0
Input Capacitance	C_{IN}				—	4	10	—	pF
Output Capacitance	C_{OUT}				—	9	—	—	
Power Dissipation Capacitance	C_{PD}	(Note 7)			—	19	—	—	

(Note 6) Parameter guaranteed by design. $t_{oS LH} = |t_{pLH m} - t_{pLH n}|$, $t_{oS HL} = |t_{pHL m} - t_{pHL n}|$

(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 :

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

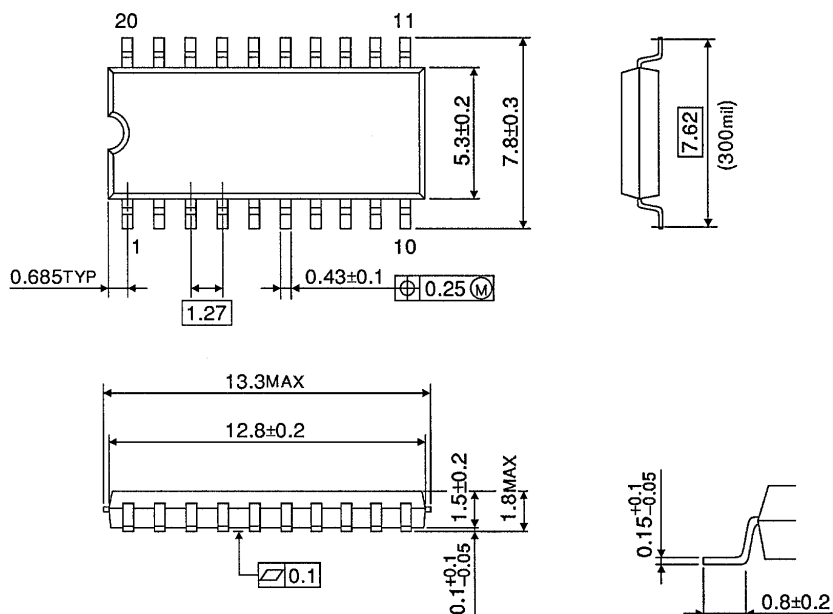
NOISE CHARACTERISTICS (Input $t_r = t_f = 3\text{ns}$)

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	1.1 (1.2)	1.5 (1.6)	V
Quiet Output Minimum Dynamic V _{OL}	V _{OLV}	C _L = 50pF	5.0	− 1.1 (− 1.2)	− 1.5 (− 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

(Note) The value in () only applies to JEDEC SOP (FW) devices.

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

Unit in mm

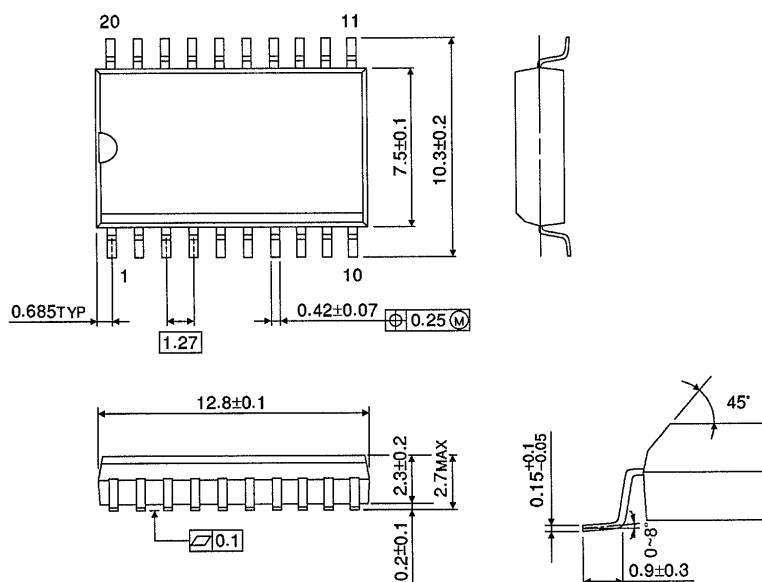


Weight : 0.22g (Typ.)

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

Unit in mm

(Note) This package is not available in Japan.



Weight : 0.46g (Typ.)

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

Unit in mm

