

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74VHC540F, TC74VHC540FW, TC74VHC540FT**  
**TC74VHC541F, TC74VHC541FW, TC74VHC541FT**

**OCTAL BUS BUFFER**  
**TC74VHC540 F / FW / FT INVERTED, 3 - STATE OUTPUTS**  
**TC74VHC541 F / FW / FT NON - INVERTED, 3 - STATE OUTPUTS**

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

The TC74VHC540/TC74VHC541 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.

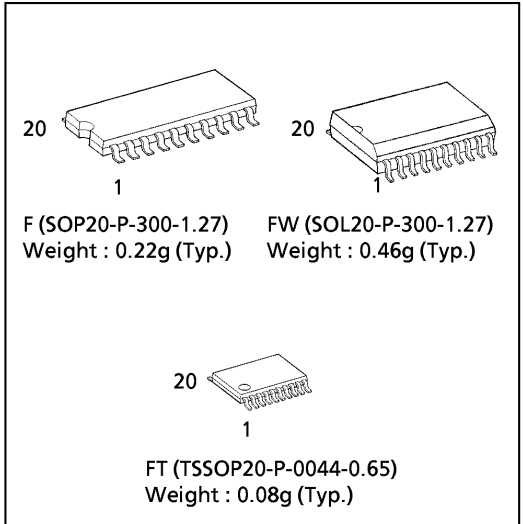
The TC74VHC540 is an inverting type, and the TC74VHC541 is a non-inverting type.

When either  $\bar{G}1$  or  $\bar{G}2$  are high, the terminal outputs are in the high-impedance state.

An input protection circuit ensures that 0 to 5.5V can be applied to the input pins without regard to the supply voltage. This device can be used to interface 5V to 3V systems and two supply systems such as battery back up. This circuit prevents device destruction due to mismatched supply and input voltages.

**FEATURES :**

- High Speed..... $t_{pd} = 3.7ns$ (typ.) at  $V_{CC} = 5V$
- Low Power Dissipation..... $I_{CC} = 4\mu A$ (Max.) at  $T_a = 25^\circ C$
- High Noise Immunity..... $V_{NIH} = V_{NIL} = 28\% V_{CC}$  (Min.)
- Power Down Protection is provided on all inputs.
- Balanced Propagation Delays..... $t_{pLH} \approx t_{pHL}$
- Wide Operating Voltage Range..... $V_{CC} (opr) = 2V \sim 5.5V$
- Low Noise ..... $V_{OLP} = 1.2V$  (Max.)
- Pin and Function Compatible with 74ALS540/541

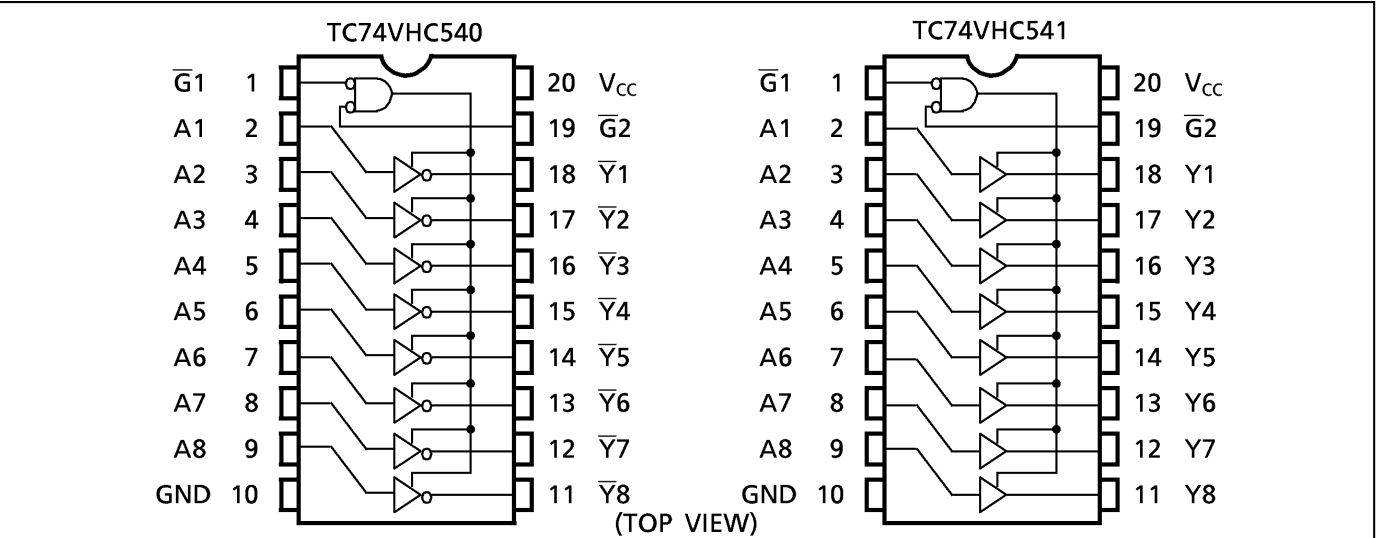


**TRUTH TABLE**

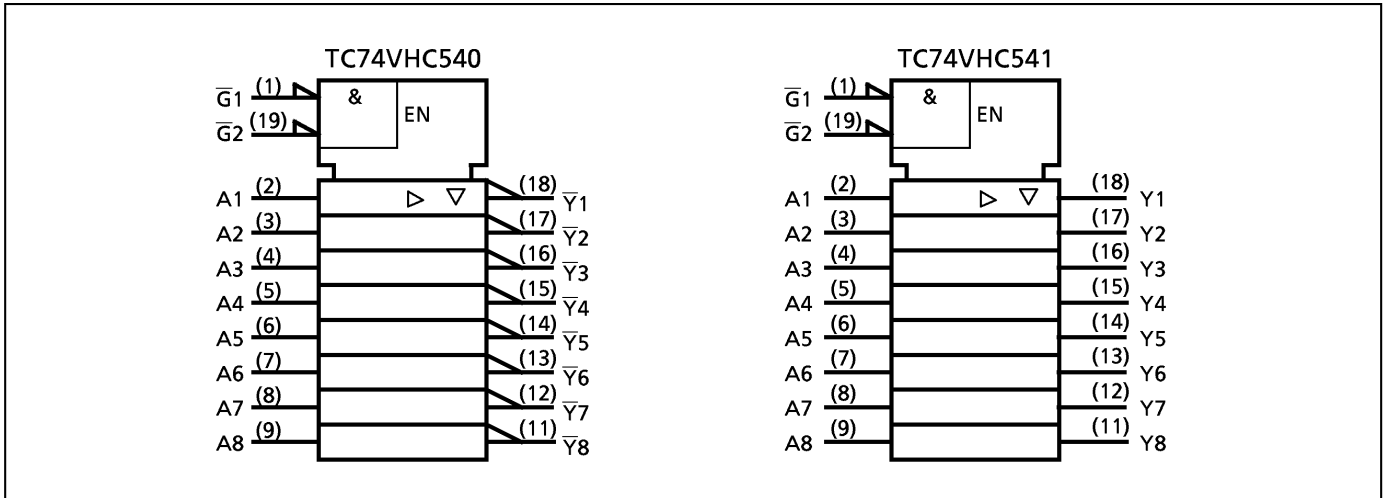
INPUTS			OUTPUTS	
$\bar{G}1$	$\bar{G}2$	$A_n$	$Y_n$	$\bar{Y}_n$
H	X	X	Z	Z
X	H	X	Z	Z
L	L	H	H	L
L	L	L	L	H

X : Don't Care  
 Z : High Impedance  
 $Y_n$  : TC74VHC541  
 $\bar{Y}_n$  : TC74VHC540

**PIN ASSIGNMENT**



**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~ $V_{CC} + 0.5$	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	$I_{CC}$	±75	mA
Power Dissipation	$P_D$	180	mW
Storage Temperature	$T_{stg}$	-65~150	°C

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage	$V_{CC}$	2.0~5.5	V
Input Voltage	$V_{IN}$	0~5.5	V
Output Voltage	$V_{OUT}$	0~ $V_{CC}$	V
Operating Temperature	$T_{opr}$	-40~85	°C
Input Rise and Fall Time	dt / dv	0~100 ( $V_{CC} = 3.3 \pm 0.3V$ ) 0~20 ( $V_{CC} = 5 \pm 0.5V$ )	ns / V

**DC ELECTRICAL CHARACTERISTICS**

PARAMETER	SYMBOL	TEST CONDITION	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>		2.0 3.0~ 5.5	1.50 V <sub>CC</sub> ×0.7	— —	— —	1.50 V <sub>CC</sub> ×0.7	— —	V	
Low - Level Input Voltage	V <sub>IL</sub>		2.0 3.0~ 5.5	— —	— —	0.50 V <sub>CC</sub> ×0.3	— —	0.50 V <sub>CC</sub> ×0.3	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	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
			4.5	4.4	4.5	—	4.4	—		
			3.0	2.58	—	—	2.48	—		
			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	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
			4.5	—	0.0	0.1	—	0.1		
			3.0	—	—	0.36	—	0.44		
			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		

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

PARAMETER	SYMBOL	TEST CONDITION		Ta = 25°C			Ta = -40~85°C		UNIT
		V <sub>CC</sub> (V)	CL (pF)	MIN.	TYP.	MAX.	MIN.	MAX.	
Propagation Delay Time (TC74VHC540)	$t_{pLH}$	3.3 ± 0.3	15	—	4.8	7.0	1.0	8.5	ns
			50	—	7.3	10.5	1.0	12.0	
	$t_{pHL}$	5.0 ± 0.5	15	—	3.7	5.0	1.0	6.0	
			50	—	5.2	7.0	1.0	8.0	
Propagation Delay Time (TC74VHC541)	$t_{pLH}$	3.3 ± 0.3	15	—	5.0	7.0	1.0	8.5	
			50	—	7.5	10.5	1.0	12.0	
	$t_{pHL}$	5.0 ± 0.5	15	—	3.5	5.0	1.0	6.0	
			50	—	5.0	7.0	1.0	8.0	
3-State Output Enable Time	$t_{pZL}$	RL = 1kΩ	3.3 ± 0.3	15	—	6.8	10.5	1.0	12.5
				50	—	9.3	14.0	1.0	16.0
	$t_{pZH}$		5.0 ± 0.5	15	—	4.7	7.2	1.0	8.5
				50	—	6.2	9.2	1.0	10.5
3-State Output Disable Time	$t_{pLZ}$ $t_{pHZ}$	RL = 1kΩ	3.3 ± 0.3	50	—	11.2	15.4	1.0	17.5
			5.0 ± 0.5	50	—	6.0	8.8	1.0	10.0
Output to Output Skew	$t_{osHL}$ $t_{osLH}$	(Note 1)	3.3 ± 0.3	50	—	—	1.5	—	1.5
			5.0 ± 0.5	50	—	—	1.0	—	1.0
Input Capacitance	C <sub>IN</sub>			—	4	10	—	10	pF
Output Capacitance	C <sub>OUT</sub>			—	6	—	—	—	
Power Dissipation Capacitance (Note 2)	C <sub>PD</sub>	TC74VHC540		—	17	—	—	—	
		TC74VHC541		—	18	—	—	—	

Note (1) Parameter guaranteed by design.  $t_{osLH} = |t_{pLHm} - t_{pLHn}|$ ,  $t_{osHL} = |t_{pHLm} - t_{pHLn}|$

Note (2) 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:

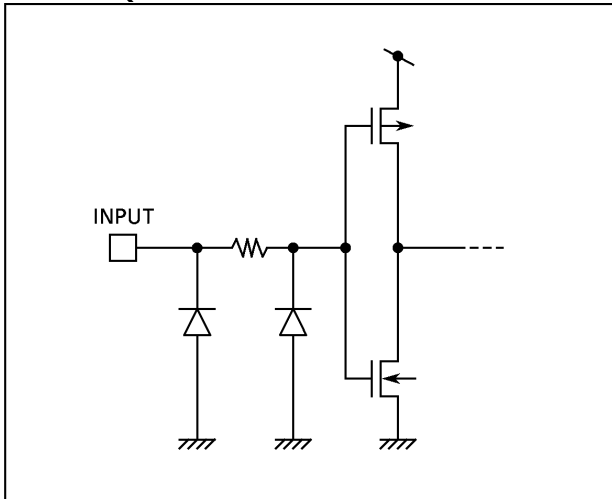
$$I_{CC(opr.)} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC} / 8 \text{ (per bit)}$$

**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 VOL	VOLP	CL = 50pF	5.0	0.7 (0.9)	1.0 (1.2)	V
Quiet Output Minimum Dynamic VOL	VOLV	CL = 50pF	5.0	-0.7 (-0.9)	-1.0 (-1.2)	V
Minimum High Level Dynamic Input Voltage	VIHD	CL = 50pF	5.0	-	3.5	V
Maximum Low Level Dynamic Input Voltage	VILD	CL = 50pF	5.0	-	1.5	V

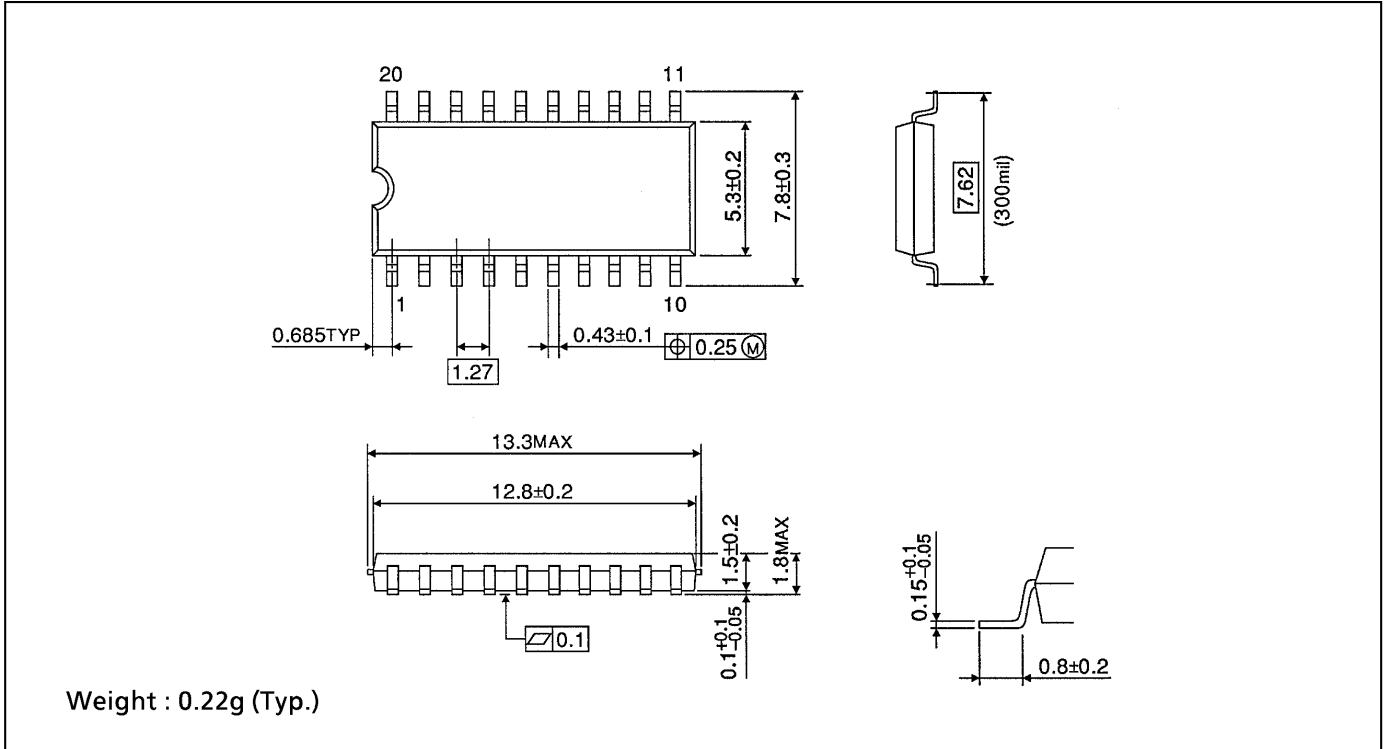
(Note) The value in ( ) only applies to JEDEC SOP (FW) devices.

**INPUT EQUIVALENT CIRCUIT**



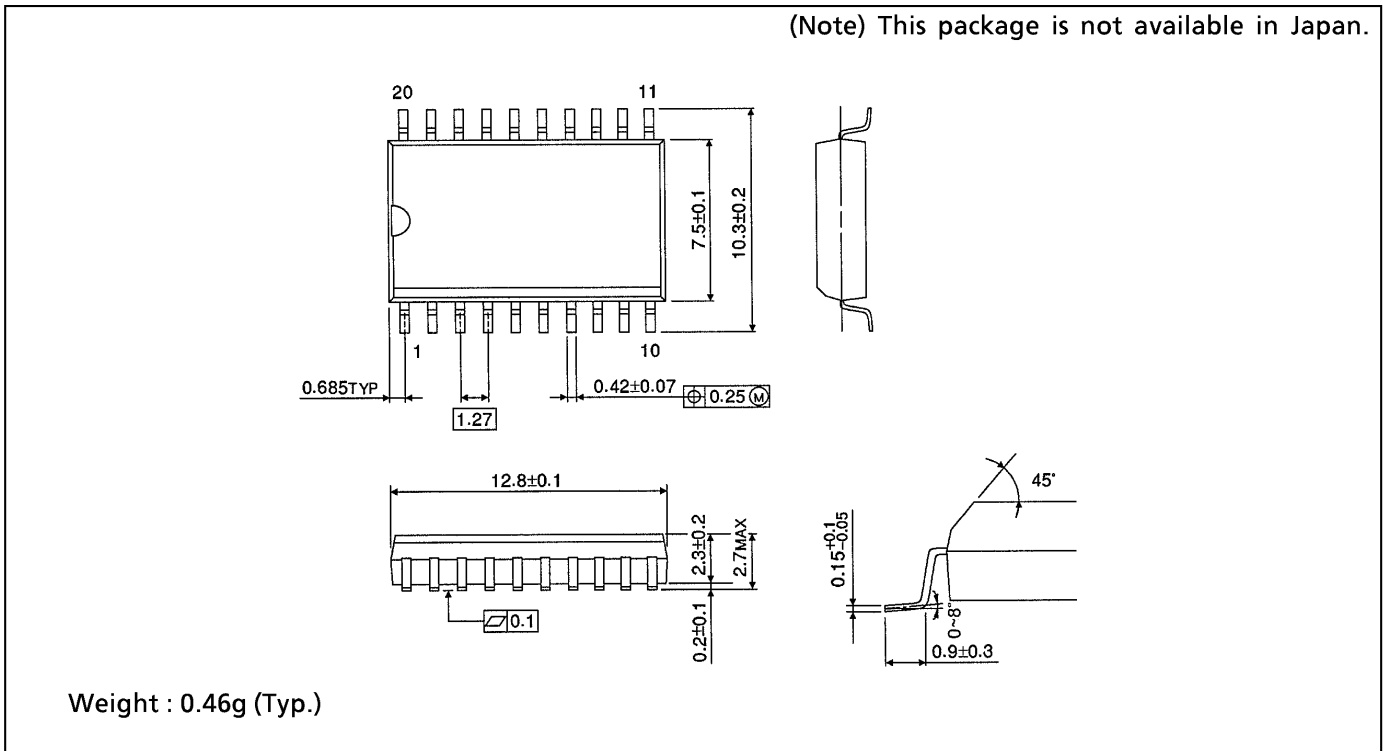
**SOP 20PIN (200mil BODY) PACKAGE DIMENSIONS (SOP20-P-300-1.27)**

Unit in mm



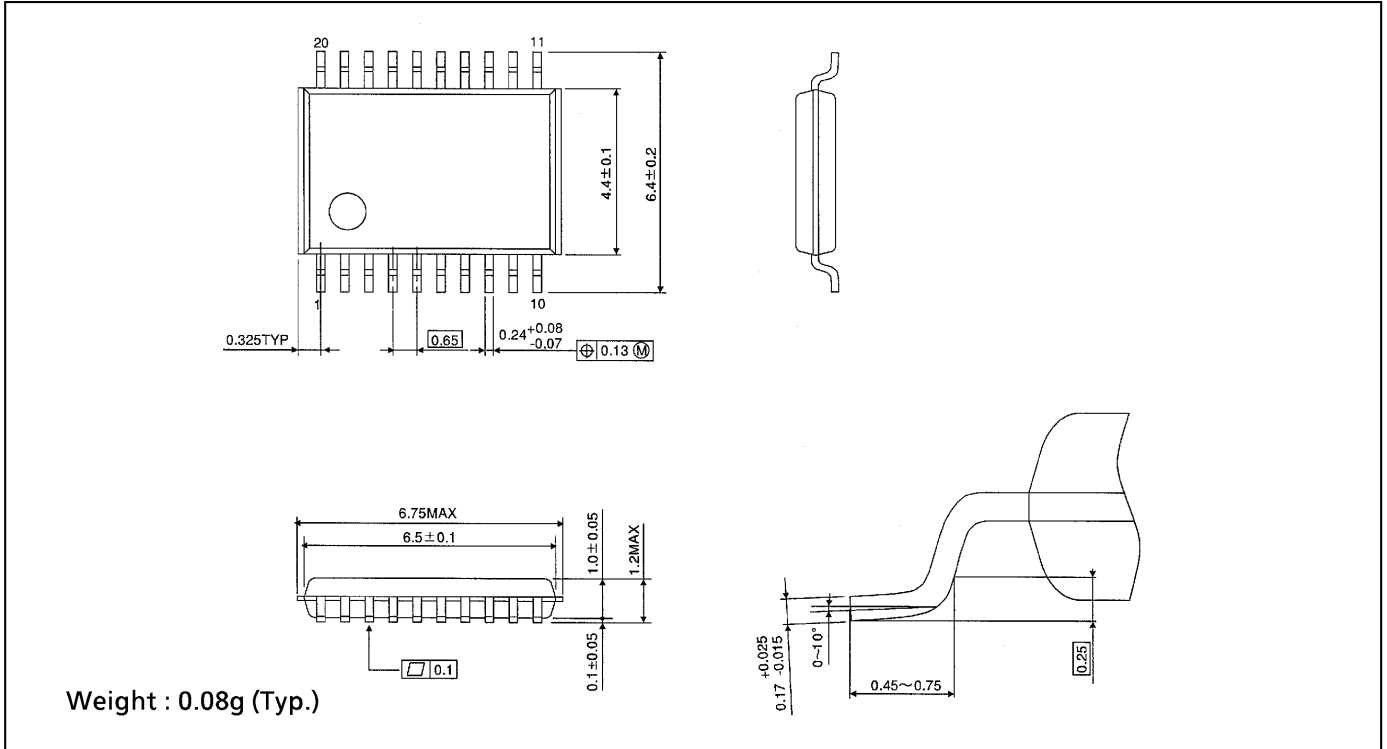
**SOP 20PIN (300mil BODY) PACKAGE DIMENSIONS (SOL20-P-300-1.27)**

Unit in mm



**TSSOP 20PIN PACKAGE DIMENSIONS (TSSOP20-P-0044-0.65)**

Unit in mm



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