

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

**TC74VHC240F, TC74VHC240FW, TC74VHC240FS, TC74VHC240FT**  
**TC74VHC244F, TC74VHC244FW, TC74VHC244FS, TC74VHC244FT**

**OCTAL BUS BUFFER**  
**TC74VHC240F/FW/FS/FT INVERTED, 3-STATE OUTPUTS**  
**TC74VHC244F/FW/FS/FT NON-INVERTED, 3-STATE OUTPUTS**

The TC74VHC240 and 244 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.

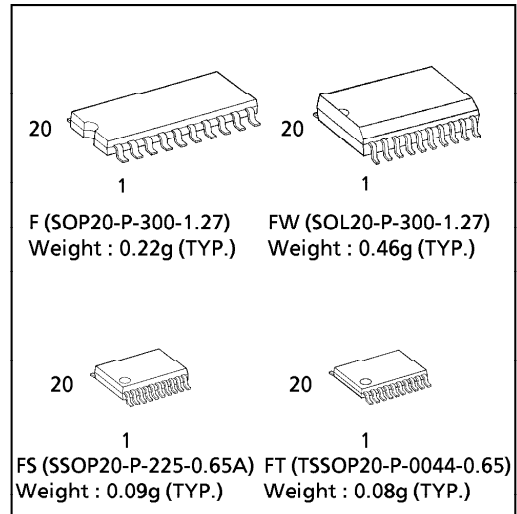
The 74VHC240 is an inverting 3-state buffer having two active-low output enables. The TC74VHC244 is a non-inverting 3-state buffer, and has two active-low output enables.

These devices are designed to be used with 3-state memory address drivers, etc.

An input protection circuit ensures that 0 to 7V 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..... $t_{pd} = 3.9ns$ (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 ..... $V_{OLP} = 0.9V$  (Max.)
- Pin and Function Compatible with 74ALS240/244

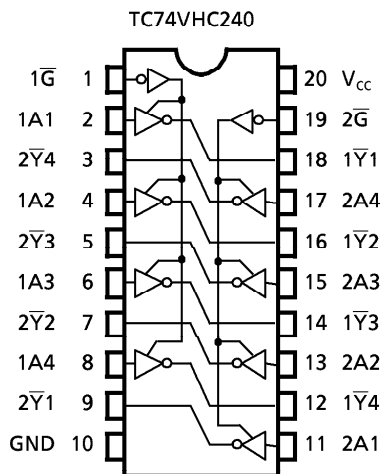


**TRUTH TABLE**

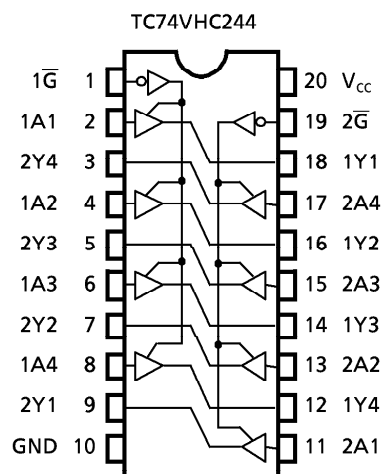
INPUTS		OUTPUTS	
$\bar{G}$	$A_n$	$Y_n$	$\bar{Y}_n$
L	L	L	H
L	H	H	L
H	X	Z	Z

X : Don't Care  
 Z : High Impedance  
 $Y_n$  : TC74VHC244  
 $\bar{Y}_n$  : TC74VHC240

**PIN ASSIGNMENT**



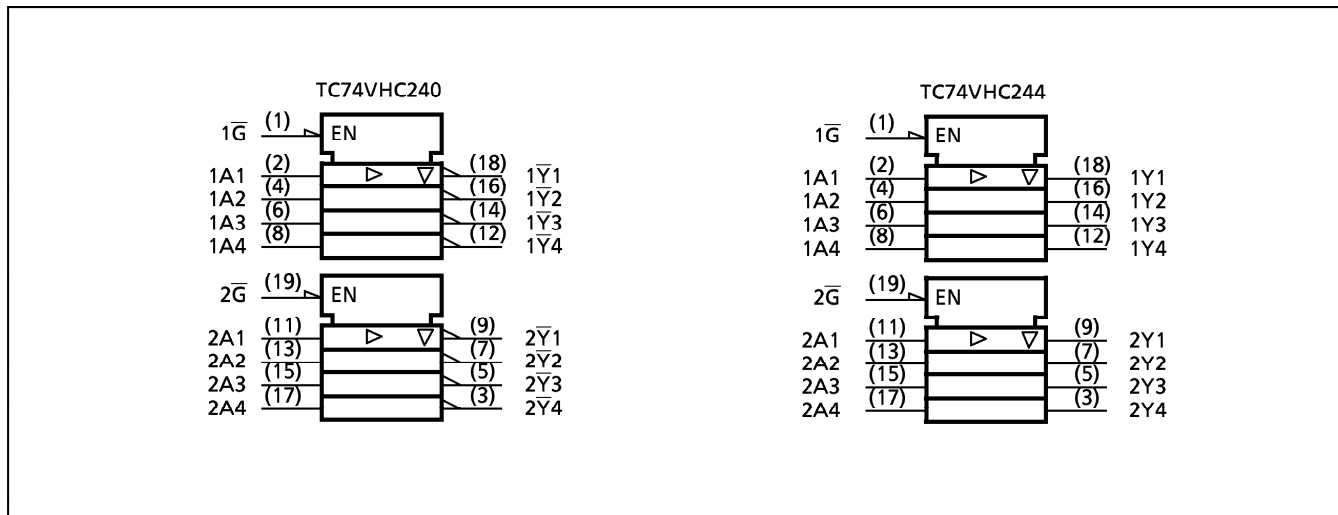
(TOP VIEW)



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● TOSHIBA is continually working to improve the quality and the reliability of its products. Nevertheless, semiconductor devices in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing TOSHIBA products, to observe standards of safety, and to avoid situations in which a malfunction or failure of a TOSHIBA product could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that TOSHIBA products are used within specified operating ranges as set forth in the most recent products specifications. Also, please keep in mind the precautions and conditions set forth in the TOSHIBA Semiconductor Reliability Handbook.

**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

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**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	1.50	—	—	1.50	—	V	
			3.0~5.5	V <sub>CC</sub> × 0.7	—	—	V <sub>CC</sub> × 0.7	—		
Low - Level Input Voltage	V <sub>IL</sub>		2.0	—	—	0.50	—	0.50	V	
			3.0~5.5	—	—	V <sub>CC</sub> × 0.3	—	V <sub>CC</sub> × 0.3		
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> = -50 μA	2.0	1.9	2.0	—	1.9	—	V
				3.0	2.9	3.0	—	2.9	—	
			I <sub>OH</sub> = -4mA I <sub>OH</sub> = -8mA	4.5	4.4	4.5	—	4.4	—	
				3.0	2.58	—	—	2.48	—	
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> = 50 μA	2.0	—	0.0	0.1	—	0.1	V
				3.0	—	0.0	0.1	—	0.1	
			I <sub>OL</sub> = 4mA I <sub>OL</sub> = 8mA	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<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)	CL (pF)	MIN.	TYP.	MAX.		MIN.	MAX.
Propagation Delay Time (TC74VHC240)	t <sub>pLH</sub> t <sub>pHL</sub>		3.3 ± 0.3	15	—	5.3	7.5	1.0	9.0	ns
				50	—	7.8	11.0	1.0	12.5	
			5.0 ± 0.5	15	—	3.6	5.5	1.0	6.5	
				50	—	5.1	7.5	1.0	8.5	
Propagation Delay Time (TC74VHC244)	t <sub>pLH</sub> t <sub>pHL</sub>		3.3 ± 0.3	15	—	5.8	8.4	1.0	10.0	
				50	—	8.3	11.9	1.0	13.5	
			5.0 ± 0.5	15	—	3.9	5.5	1.0	6.5	
				50	—	5.4	7.5	1.0	8.5	
3-State Output Enable Time	t <sub>pZL</sub> t <sub>pZH</sub>	R <sub>L</sub> = 1kΩ	3.3 ± 0.3	15	—	6.6	10.6	1.0	12.5	
				50	—	9.1	14.1	1.0	16.0	
			5.0 ± 0.5	15	—	4.7	7.3	1.0	8.5	
				50	—	6.2	9.3	1.0	10.5	
3-State Output Disable Time	t <sub>pLZ</sub> t <sub>pHZ</sub>	R <sub>L</sub> = 1kΩ	3.3 ± 0.3	50	—	10.3	14.0	1.0	16.0	
			5.0 ± 0.5	50	—	6.7	9.2	1.0	10.5	
			3.3 ± 0.3	50	—	—	1.5	—	1.5	
Output to Output Skew	t <sub>OSLH</sub> t <sub>OSHL</sub>	(Note 1)	3.3 ± 0.3	50	—	—	1.0	—	1.0	
			5.0 ± 0.5	50	—	—	—	—	—	
Input Capacitance	C <sub>IN</sub>				—	4	10	—	pF	
Output Capacitance	C <sub>OUT</sub>				—	6	—	—		
Power Dissipation Capacitance (Note 2)	C <sub>PD</sub>	TC74VHC240			—	17	—	—		—
		TC74VHC244			—	19	—	—		—

Note (1) 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 (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.

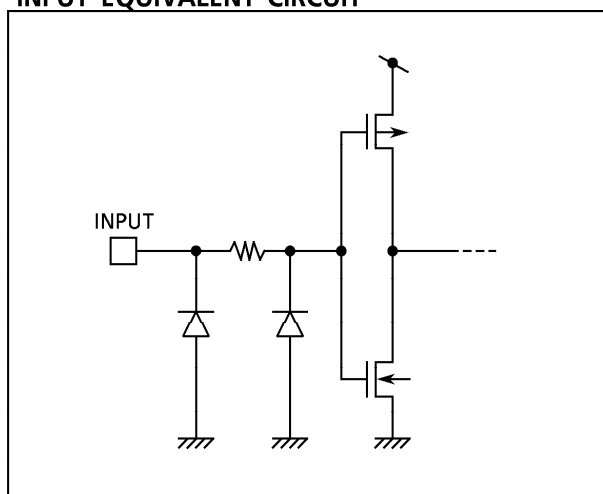
Average operating current can be obtained by the equation :

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

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

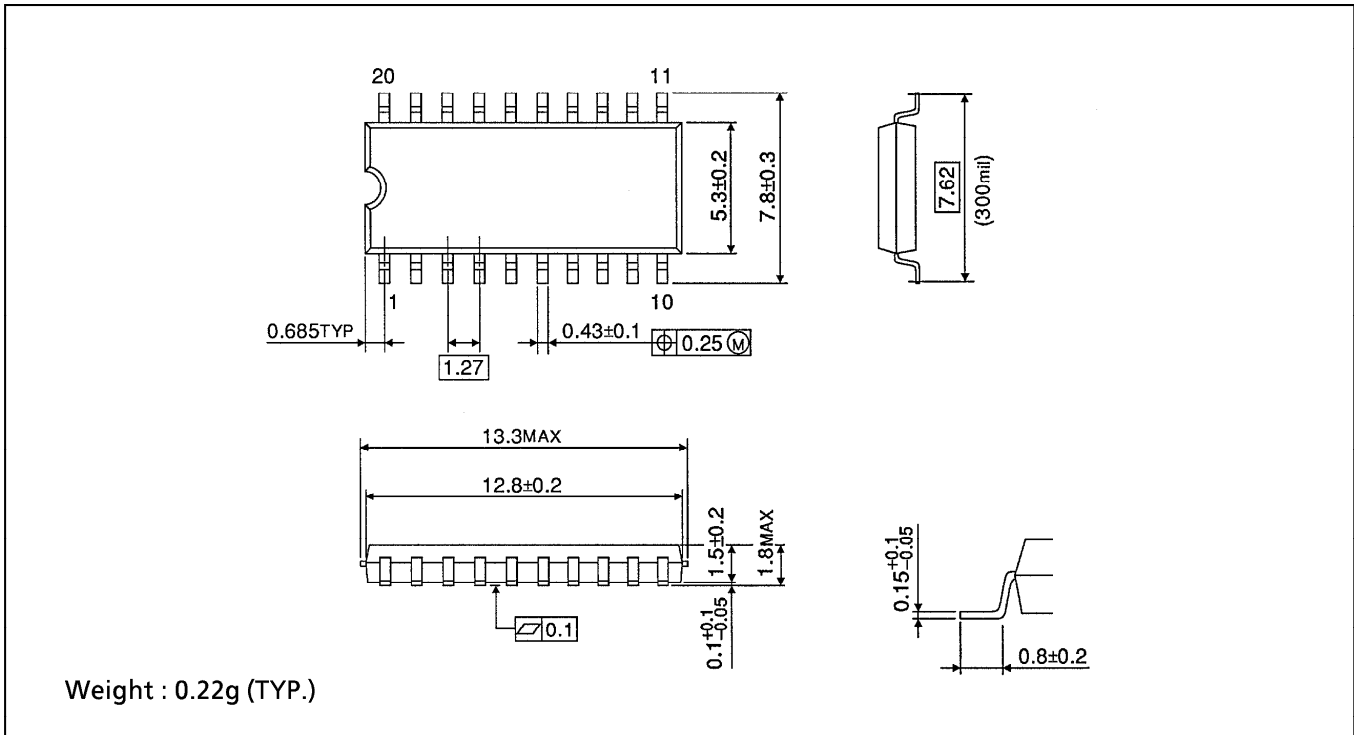
PARAMETER	SYMBOL	TEST CONDITION	Ta = 25°C		UNIT	
			V <sub>CC</sub> (V)	TYP.		LIMIT
Quiet Output Maximum Dynamic VOL	V <sub>OLP</sub>	CL = 50pF	5.0	0.6	0.9	V
Quiet Output Minimum Dynamic VOL	V <sub>OLV</sub>	CL = 50pF	5.0	-0.6	-0.9	V
Minimum High Level Dynamic Input Voltage	V <sub>IHD</sub>	CL = 50pF	5.0	-	3.5	V
Maximum Low Level Dynamic Input Voltage	V <sub>ILD</sub>	CL = 50pF	5.0	-	1.5	V

**INPUT EQUIVALENT CIRCUIT**



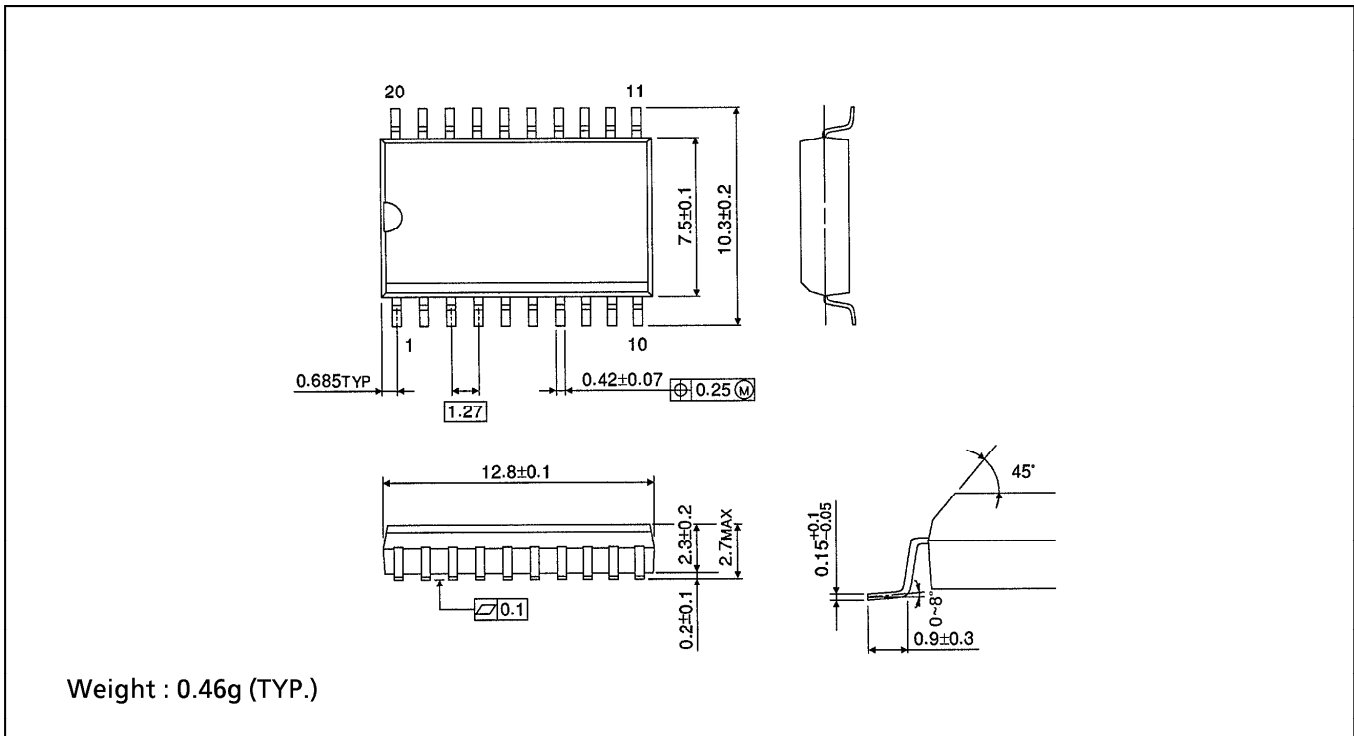
**SOP 20PIN (200mil BODY) OUTLINE DRAWING (SOP20-P-300-1.27)**

Unit in mm



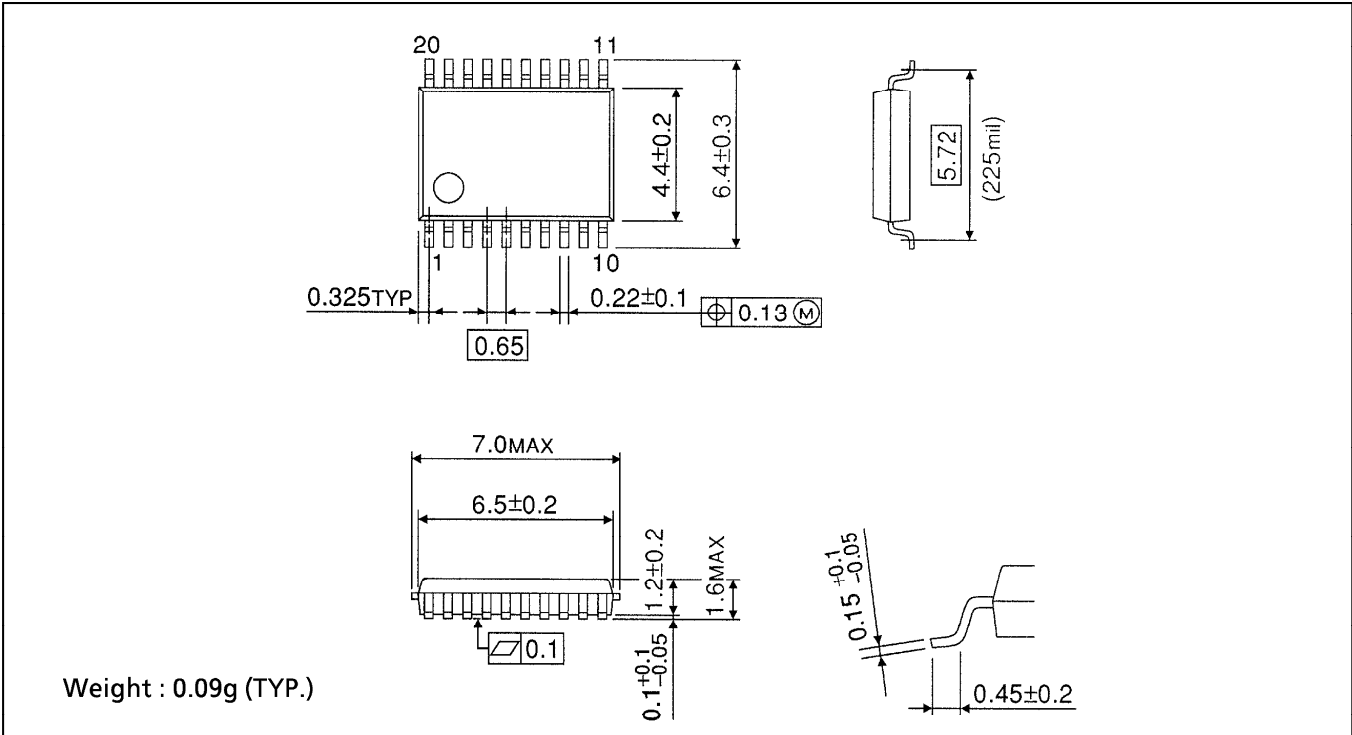
**SOP 20PIN (300mil BODY) OUTLINE DRAWING (SOL20-P-300-1.27)**

Unit in mm



**SSOP 20PIN OUTLINE DRAWING (SSOP20-P-225-0.65A)**

Unit in mm



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

Unit in mm

