

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC9243P, TC9243F

INFRARED REMOTE CONTROL SIGNAL TRANSMISSION LSI

The TC9243P, TC9243F are infrared remote control signal transmission LSI which is suited for remote control of audio system, TV, VTR, CD player, etc.

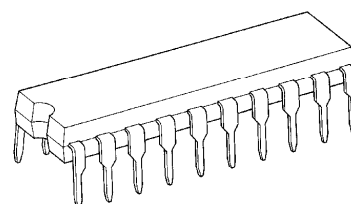
FEATURES

- Wide range of operating supply voltages, enabling low voltage operation.
: $V_{DD} = 2.0 \sim 4.0V$
- 32 functions are basically available.
Up to 112 instructions (28×4) can be output because multiple keying is possible.
- Interference with other equipment is prevented because 7 bits out of 8 bits of system code are presettable.
- With transmission display output pin.
- Low current dissipation. : $I_{QD} \leq 1\mu A$ (at time of standby)
- Packages in two types ; DIP and flat types are available.

DIP20 : TC9243P

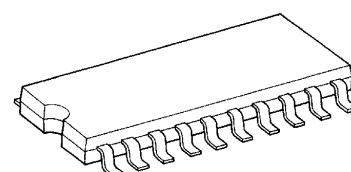
SOP20 : TC9243F

TC9243P



DIP20-P-300-2.54A

TC9243F



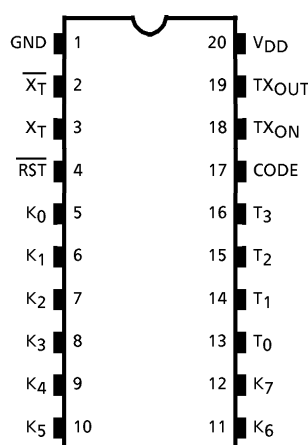
SOP20-P-300-1.27

Weight

DIP20-P-300-2.54A : 1.4g (Typ.)

SOP20-P-300-1.27 : 0.48g (Typ.)

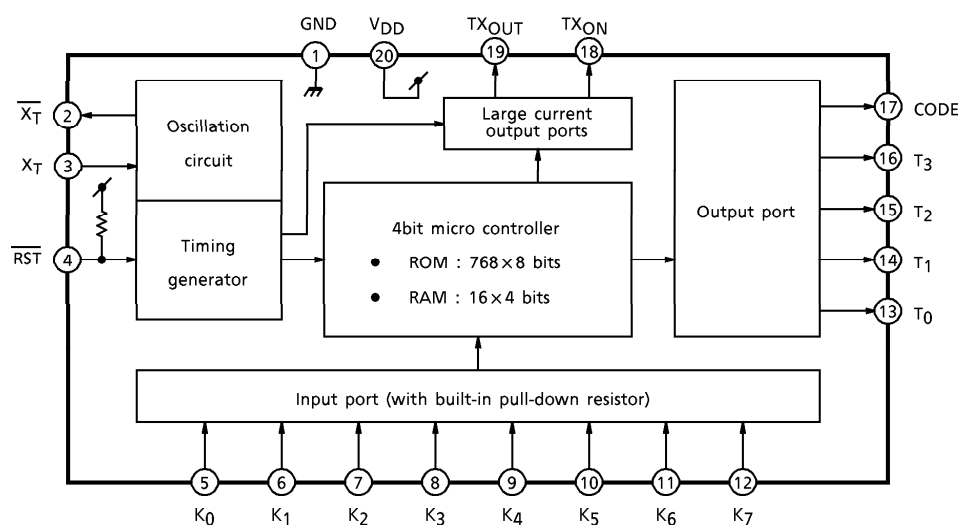
PIN CONNECTION



980508EBA2

● 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.

BLOCK DIAGRAM



PIN FUNCTION

PIN No.	SYMBOL	PIN NAME	FUNCTION AND OPERATION
1	GND	Power Terminal	Applies supply voltage. ($V_{DD} = 2.0 \sim 4.0V$)
20	V_{DD}		
2	$\overline{X_T}$	Oscillator Terminal	Input/output terminals for the ceramic oscillators, with built-in amplifier circuit and feedback resistor.
3	X_T		
4	$\overline{RST}$	Reset Input	When this pin is set at "L" level, the inside is initialized. With a built-in pull-up resistor.
5~12	$K_0 \sim K_7$	Key Inputs	The input terminals for Key Matrix. Each of all the pins has a built-in pull-down resistor.
13~16	$T_0 \sim T_3$	Key Scan Output	The key matrix scan output terminals. CMOS output.
17	CODE	Code Scan Output	The scan output terminals for code setting. Pch open drain output.
18	TX_{ON}	Transmission Display Output	Transmission display LED driving output terminal.
19	TX_{OUT}	Transmission Output	Infrared LED driving output terminal.

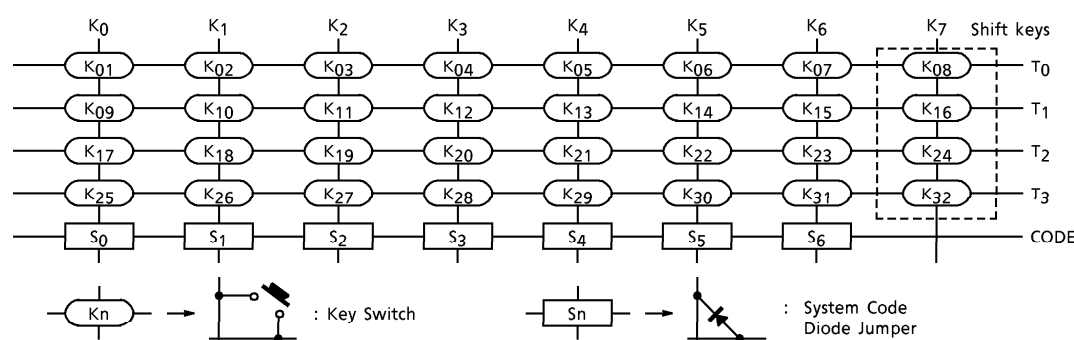
980508EBA2'

- The products described in this document are subject to foreign exchange and foreign trade laws.
- The information contained herein is presented only as a guide for the applications of our products. No responsibility is assumed by TOSHIBA CORPORATION for any infringements of intellectual property or other rights of the third parties which may result from its use. No license is granted by implication or otherwise under any intellectual property or other rights of TOSHIBA CORPORATION or others.
- The information contained herein is subject to change without notice.

OPERATIONS

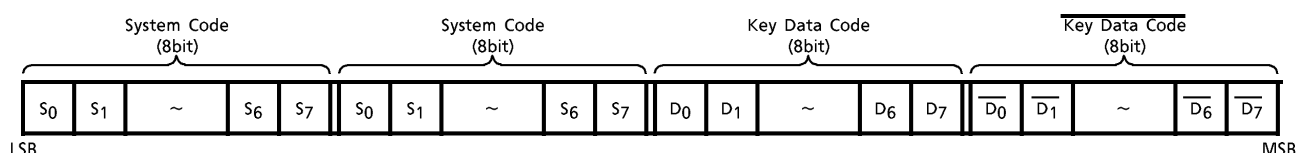
1. Key matrix

The TC9243P, TC9243F enables the setting of maximum 32keys in combination of $K_0 \sim K_7$ and $T_0 \sim T_3$ keys. Further, System Codes are settable in 7bits in combination of $K_0 \sim K_6$ and CODE keys.



- K_{08} , 16, 24 and 32 (the shift key) keys can be pushed simultaneously with other keys (the normal keys).
However, the simultaneous keying of the shift keys and that of the normal keys are prohibited.
- The system code setting is made by the diode jumper between "CODE" lines and " $K_0 \sim K_6$ " lines.
With diode jumper, data code will become "1".
However, if the setting of "CODE" and " $K_0 \sim K_6$ " keys is only at one point, the keys are connectable directly without using the diode jumper.
Further, " S_7 " key is fixed at "1" and cannot be changed.

2. Data format



(Note) "80H~8FH" out of the system codes are free codes.

These codes are freely usable but they might have been used by other equipment and therefore, there is the possibility of occurrence of interference.



Other system codes have been customized and therefore, their general use is prohibited.

TOSHIBA will assume no responsibility for interference and other problems which may result from use of other system coded.

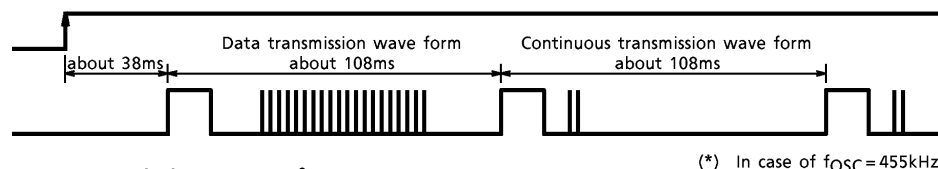
3. Key data code

KEY No.	Tn	Kn	D ₀	D ₁	D ₂	D ₃	D ₄	D ₅	D ₆	D ₇
K ₀₁	T ₀	K ₀	1	0	0	0	0	● Shift key data ● "000" except dual keying.		
K ₀₂		K ₁	0	1	0	0	0			
K ₀₃		K ₂	1	1	0	0	0			
K ₀₄		K ₃	0	0	1	0	0			
K ₀₅		K ₄	1	0	1	0	0			
K ₀₆		K ₅	0	1	1	0	0			
K ₀₇		K ₆	1	1	1	0	0			
K ₀₈		K ₇	● Normal key data ● "00000" except dual keying.					1	0	0
K ₀₉	T ₁	K ₀	1	0	0	1	0	● Shift key data ● "000" except dual keying.		
K ₁₀		K ₁	0	1	0	1	0			
K ₁₁		K ₂	1	1	0	1	0			
K ₁₂		K ₃	0	0	1	1	0			
K ₁₃		K ₄	1	0	1	1	0			
K ₁₄		K ₅	0	1	1	1	0			
K ₁₅		K ₆	1	1	1	1	0			
K ₁₆		K ₇	● Normal key data ● "00000" except dual keying.					1	1	0
K ₁₇	T ₂	K ₀	1	0	0	0	1	● Shift key data ● "000" except dual keying.		
K ₁₈		K ₁	0	1	0	0	1			
K ₁₉		K ₂	1	1	0	0	1			
K ₂₀		K ₃	0	0	1	0	1			
K ₂₁		K ₄	1	0	1	0	1			
K ₂₂		K ₅	0	1	1	0	1			
K ₂₃		K ₆	1	1	1	0	1			
K ₂₄		K ₇	● Normal key data ● "00000" except dual keying.					1	0	1
K ₂₅	T ₃	K ₀	1	0	0	1	1	● Shift key data ● "000" except dual keying.		
K ₂₆		K ₁	0	1	0	1	1			
K ₂₇		K ₂	1	1	0	1	1			
K ₂₈		K ₃	0	0	1	1	1			
K ₂₉		K ₄	1	0	1	1	1			
K ₃₀		K ₅	0	1	1	1	1			
K ₃₁		K ₆	1	1	1	1	1			
K ₃₂		K ₇	● Normal key data ● "00000" except dual keying.					1	1	1

- Normal key : K₀₁~K₀₇, K₀₉~K₁₅, K₁₇~K₂₃, K₂₅~K₃₁
- Shift key : K₀₈, K₁₆, K₂₄, K₃₂

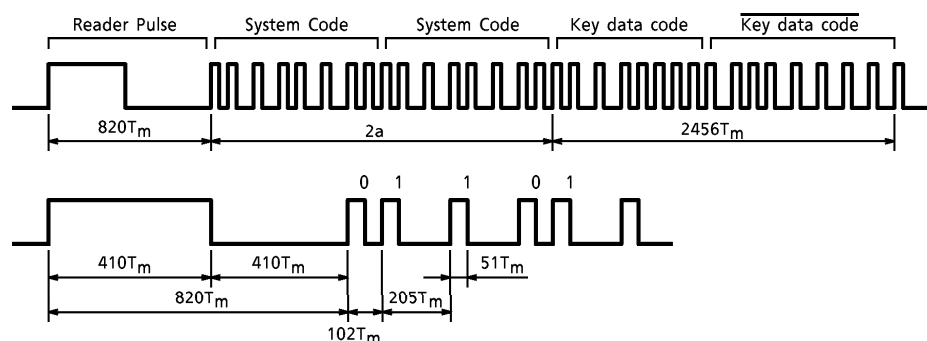
4. TX_{OUT} output wave form

Key ON

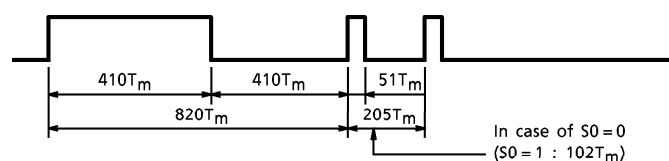


(*) In case of $f_{OSC} = 455kHz$

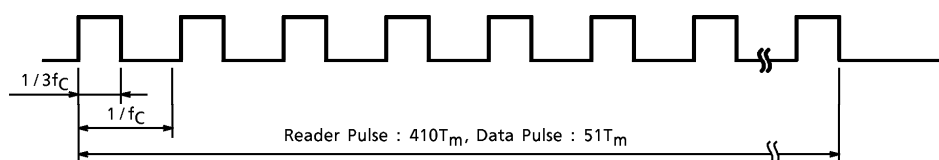
Data transmission wave form



Continuous transmission wave form



Carrier wave form



$T_m = 5/f_{OSC}$: System clock
 a : System code output time
 $f_C = f_{OSC}/12$

When oscillation frequency is 455kHz, signal is output after pulse modulated by 37.9kHz of duty 1/3, which is a 1/12 division by the carrier generation circuit.

(Caution) In preparing a receiving software, strictly follow the following instructions :

- In case of system codes, the same code is transmitted twice and therefore, always decode these 2 codes and judge if they agree with each other.
- In case of key data codes, always decode a key data code and its reversed code and judge if they agree with each other.

MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V _{DD}	- 0.3~5.0	V
Input Voltage	V _{IN}	V _{SS} - 0.3~V _{DD} + 0.3	V
Output Current	I _{OUT}	- 20	mA
Power Dissipation	P _D	350 (300) ※	mW
Operating Temperature	T _{opr}	- 20~75	°C
Storage Temperature	T _{stg}	- 40~125	°C

※ The value shown in parentheses applies to the TC9243F.

ELECTRICAL CHARACTERISTICS

Recommended operating conditions

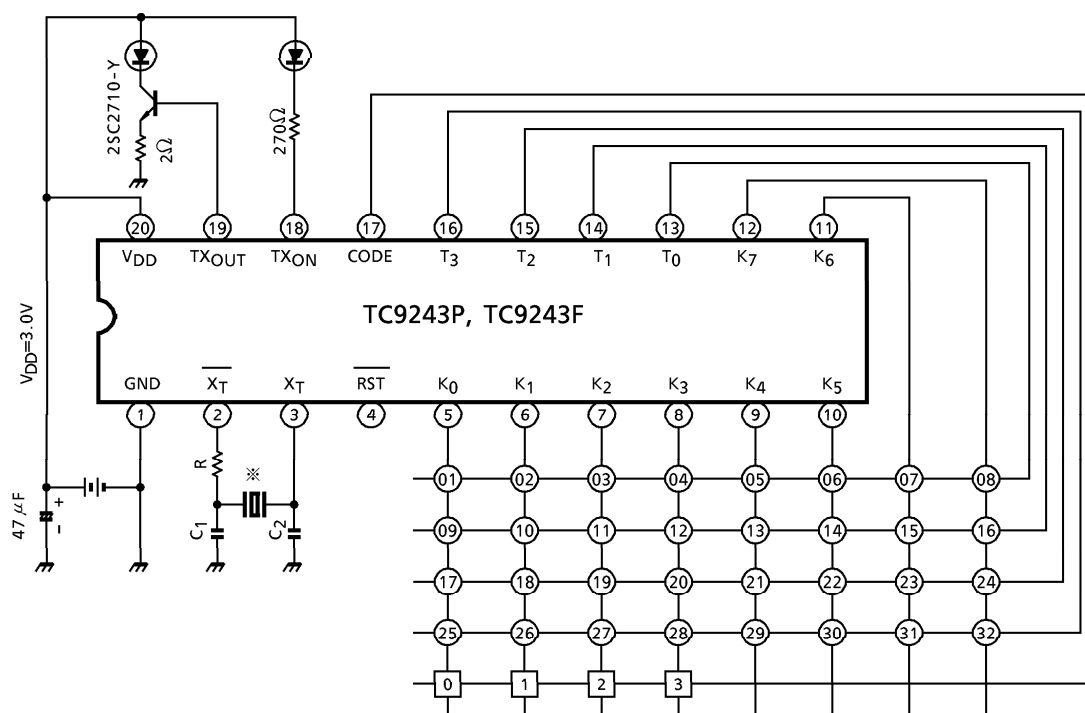
(Unless otherwise specified, V_{DD} = 3.0V, Ta = 25°C, For items with an asterisk ※, Ta = - 20~75°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage ※	V _{DD}	—	—	2.0	—	4.0	V
Oscillation Frequency ※	f _{OSC}	—	—	400	—	800	kHz
Input Voltage	"H" Level	V _{IH1}	(Except $\overline{\text{RST}}$)	V _{DD} × 0.7	—	V _{DD}	V
	"L" Level	V _{IL1}	(Except $\overline{\text{RST}}$)	0	—	V _{DD} × 0.3	
Input Voltage	"H" Level	V _{IH2}	($\overline{\text{RST}}$)	V _{DD} × 0.8	—	V _{DD}	V
	"L" Level	V _{IL2}	($\overline{\text{RST}}$)	0	—	V _{DD} × 0.2	

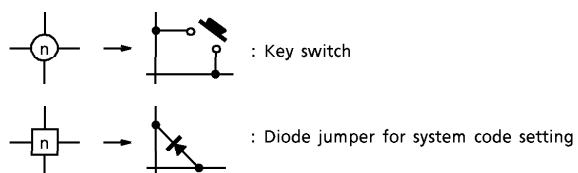
DC characteristics (Unless otherwise specified, V_{DD} = 3.0V, Ta = 25°C)

CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Current	I _{DD}	—	f _{OSC} = 455kHz	—	—	1.0	mA
Static Supply Current	I _{QD}	—	At time of "Hold"	—	—	1.0	μA
Pull-down Resistor	R _D	—	(K ₀ ~K ₇)	100	—	400	kΩ
Pull-up Resistor	R _U	—	($\overline{\text{RST}}$)	25	—	100	kΩ
Output Current	"H" Level	I _{OH}	(TX _{OUT}) V _{OH} = 1.5V	- 10	—	—	mA
	"L" Level	I _{OL}	(TX _{ON}) V _{OL} = 1.5V	5	—	—	
Input Leak Current	I _{LI}	—	V _{IN} = V _{DD} , V _{SS}	- 1.0	—	1.0	μA

APPLICATION CIRCUIT

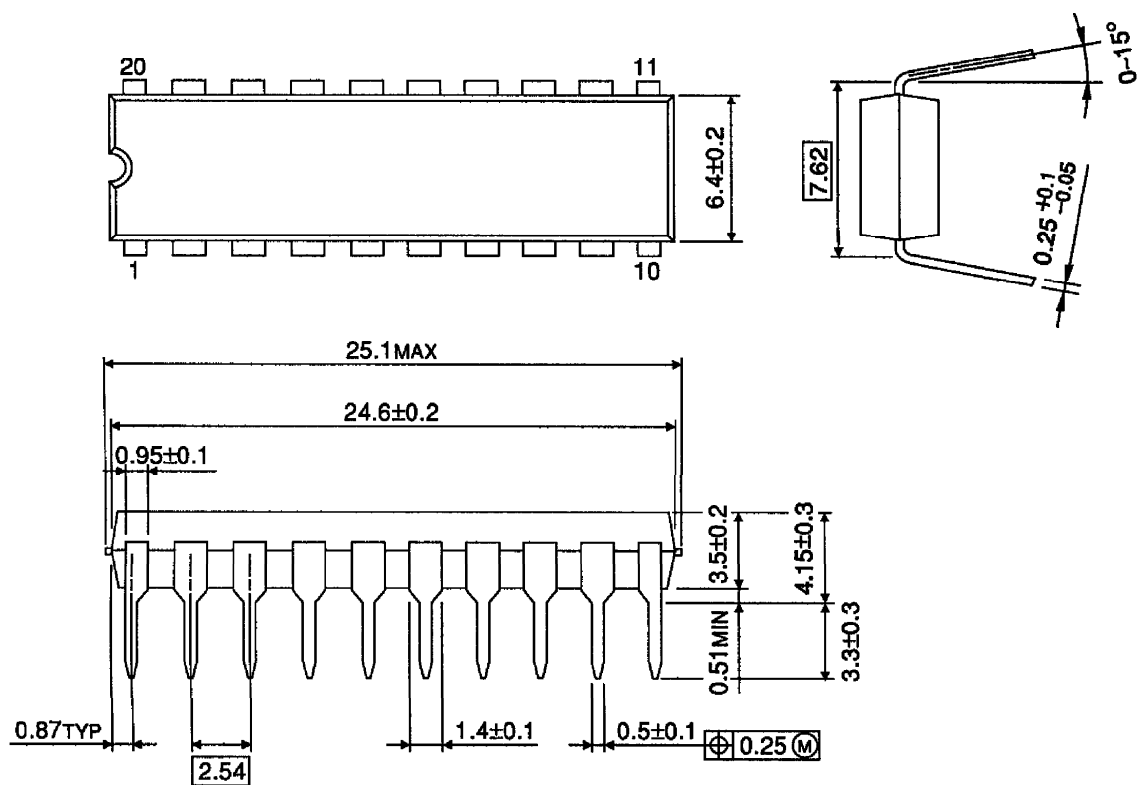


※ Ceramic Oscillator CSB455E (Murata Seisakusho) $C_1 = C_2 = 100\text{pF}$ $R = 6.8\text{k}\Omega$
FCR455K3 (TDK) $C_1 = C_2 = 220\text{pF}$ $R = 2.2\text{k}\Omega$
or equivalent



OUTLINE DRAWING
DIP20-P-300-2.54A

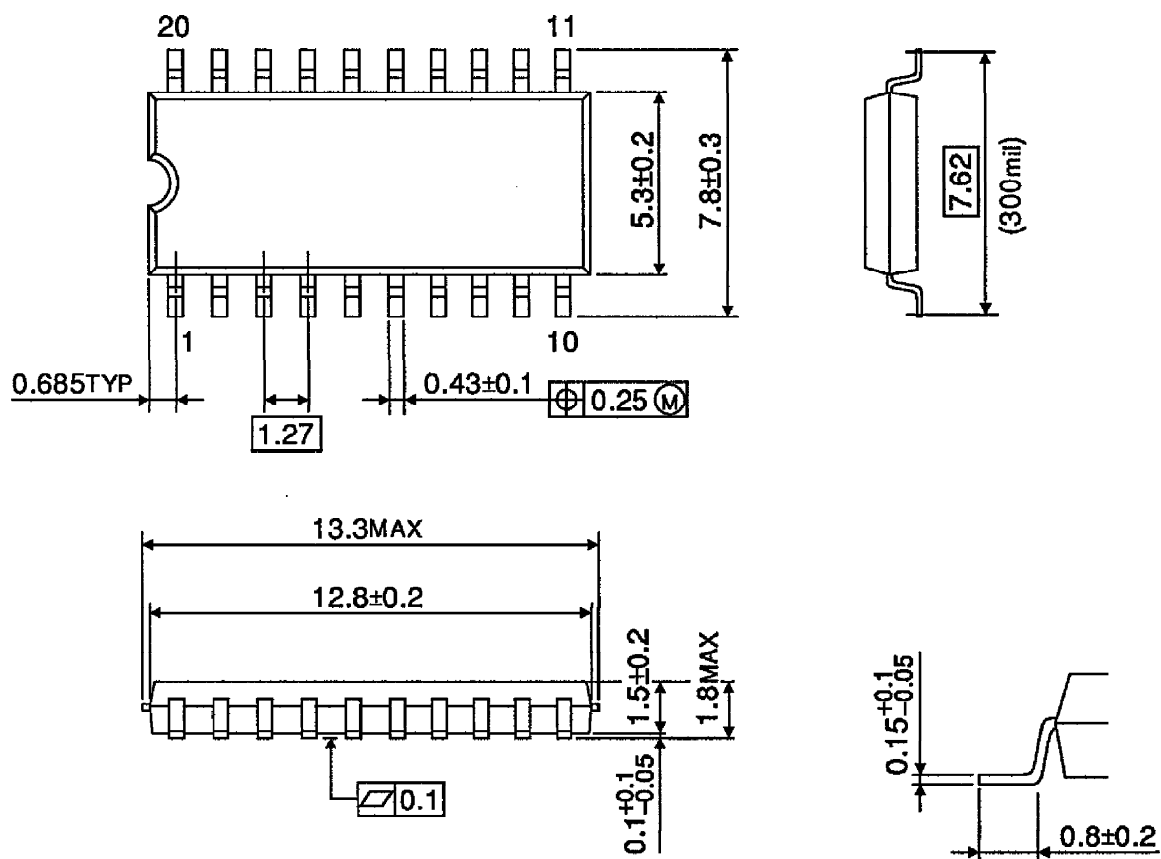
Unit : mm



Weight : 1.4g (Typ.)

OUTLINE DRAWING
SOP20-P-300-1.27

Unit : mm



Weight : 0.48g (Typ.)