

TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

# TC9285P

## INFRARED REMOTE CONTROL RECEIVING LSI

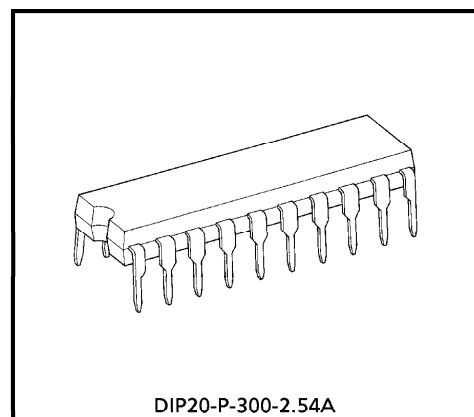
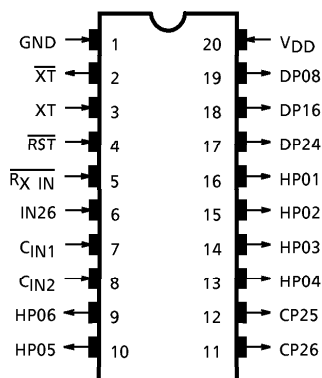
The TC9285P is an infrared Remote Control signal receiving LSI is suited for remote control of audio system, TV, VTR, CD player, etc.

In combination with the transmission LSI : TC9243P, TC9243F, a remote control system can be easily composed.

### FEATURES

- Basic functions : 11 functions
  - Hold pulse : 9 functions
  - Cyclic pulse : 2 functions
- 3 functions out of 7 hold pulse functions are shift key outputs and can be output in parallel with other outputs corresponding to double-pushed signals sent from sending side.
- 1 function out of 2 cyclic pulse functions can be control outputs using an external key in addition to control by remote control signal.
- 8bit system codes are detected. System codes permitting signal receiving can be set up to 4 bits. Interference with other equipment can be thus prevented.

### PIN CONNECTION

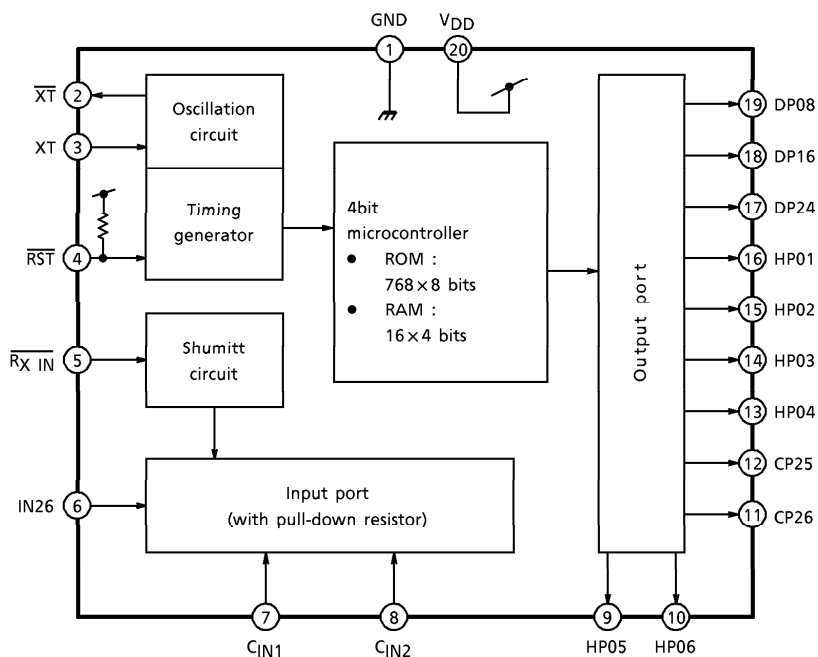


Weight : 1.4g (Typ.)

980910EBA2

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BLOCK DIAGRAM



PIN FUNCTION

PIN No.	SYMBOL	PIN NAME	FUNCTION & OPERATION	
1	GND	Power supply terminal	Applies supply voltage. ( $V_{DD} = 5.0V$ Typ.)	
20	$V_{DD}$			
2	$\overline{XT}$	Oscillator terminal	Input/output terminals for the ceramic oscillators, with built-in amplifier circuit and feedback resistor.	
3	XT			
4	$\overline{RST}$	Reset input	When this pin is set at "L" level, the inside is initialized. With a pull-up resistor.	
5	$\overline{RX\ IN}$	Remote control signal input	Input remote control signal with sub-carrier signal removed.	
6	IN26	Cyclic input	Every time "H" is input, CP26 output is reversed. With a pull-down resistor.	
7, 8	$C_{IN1}, C_{IN2}$	Code input	Input terminal to set system code permitting receiving.	
11, 12	CP26, CP25	Cyclic output	OUTPUT FORM	
9, 10 13~16 17~19	HP01~HP06 DP08, 16, 24	Hold output		
			This pin is kept at "H" level as long as remote control signal is being input.	

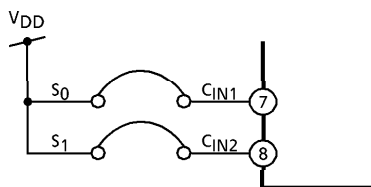
**DESCRIPTION OF OPERATION**

1. Establishment of system code permitting receiving

8bit system code is provided for the transmission format of the transmission LSI : TC9243P, TC9243F to prevent interference with other equipment. When this system code is established for each of various equipment, it is possible to identify equipment and prevent interference.

On the TC9285P, the lower 4 bits of a system code permitting receiving of remote control signal can be set and the upper 4 bits have been fixed at "100000". (Settable range : "80"~"83" HEX)

Once a system code permitting receiving has been set up, only when the system code for the received remote control signal is in accord with the set system code, the following key data code is accepted.



A system code permitting receiving is set by the jumpers provided between C<sub>IN1</sub>~2 pins and V<sub>DD</sub>. Each of the jumpers corresponds to bit 0~1 (S<sub>0</sub>~S<sub>1</sub>) of a system code and when the jumper is connected, the corresponding bit is set at "1".

2. Check of receiving signals

A check code is provided in a single transmission waveform of the transmission format of the transmission LSI : TC9243P, TC9243F to prevent malfunction due to erroneous data take-in.

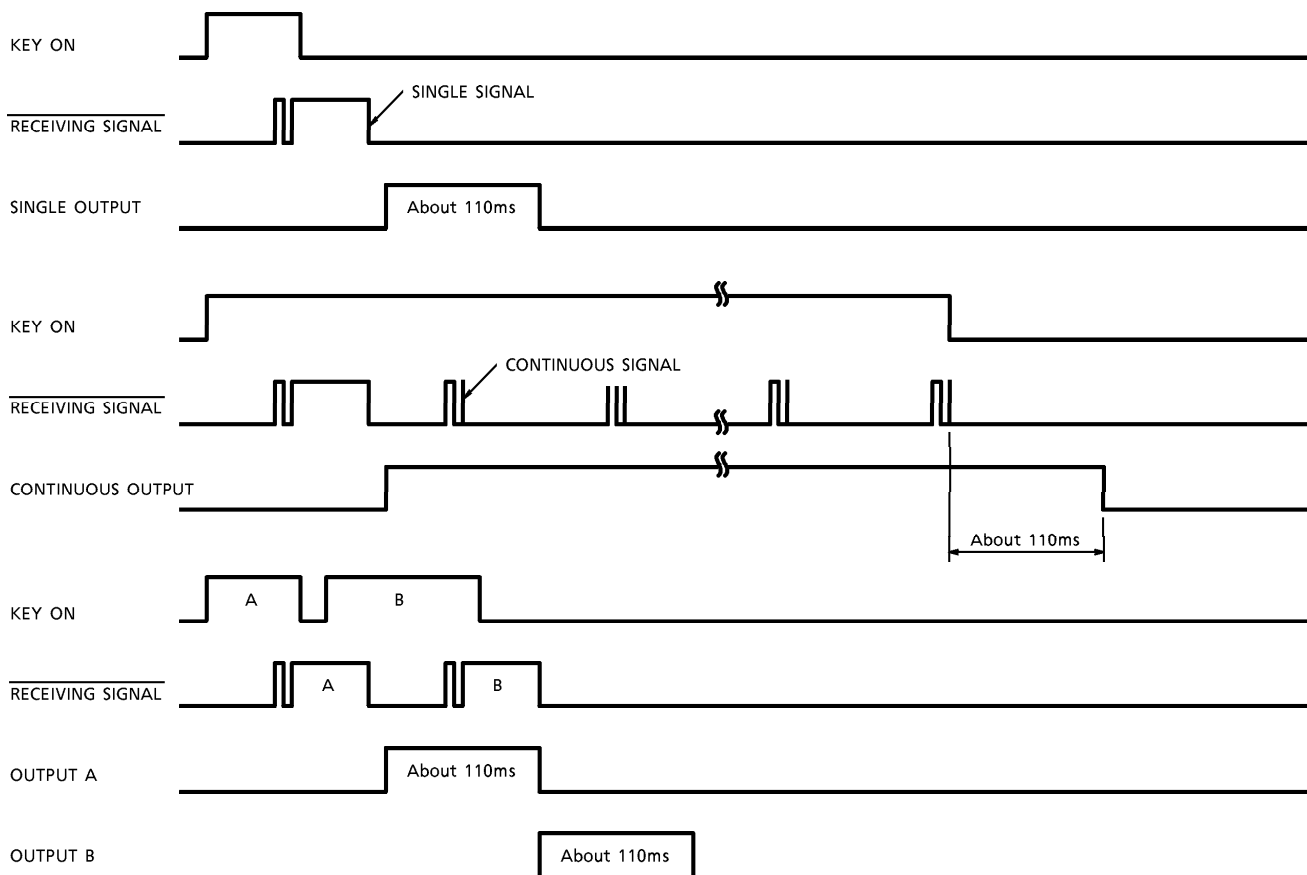
A system code is followed by a forward code and a key data code is followed by a reverse code.

LEADER PULSE	SYSTEM CODE								SYSTEM CODE								KEY DATA CODE								KEY DATA CODE							
	S <sub>0</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	S <sub>5</sub>	S <sub>6</sub>	S <sub>7</sub>	S <sub>0</sub>	S <sub>1</sub>	S <sub>2</sub>	S <sub>3</sub>	S <sub>4</sub>	S <sub>5</sub>	S <sub>6</sub>	S <sub>7</sub>	D <sub>0</sub>	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	D <sub>5</sub>	D <sub>6</sub>	D <sub>7</sub>	$\overline{D_0}$	$\overline{D_1}$	$\overline{D_2}$	$\overline{D_3}$	$\overline{D_4}$	$\overline{D_5}$	$\overline{D_6}$	$\overline{D_7}$

The TC9285P fully decodes all data and regards the data valid only when the first and second codes sent twice agree with each other.

### 3. Output pulses HP, DP and CP

#### 3-1. HP01~HP06, DP08, DP16 and DP24 (Hold pulses)



The hold pulse checks a system code of an initial single signal and a received signal and becomes "H" level only when data is valid.

If a received signal is single signal, the output becomes "L" level about 110ms later.

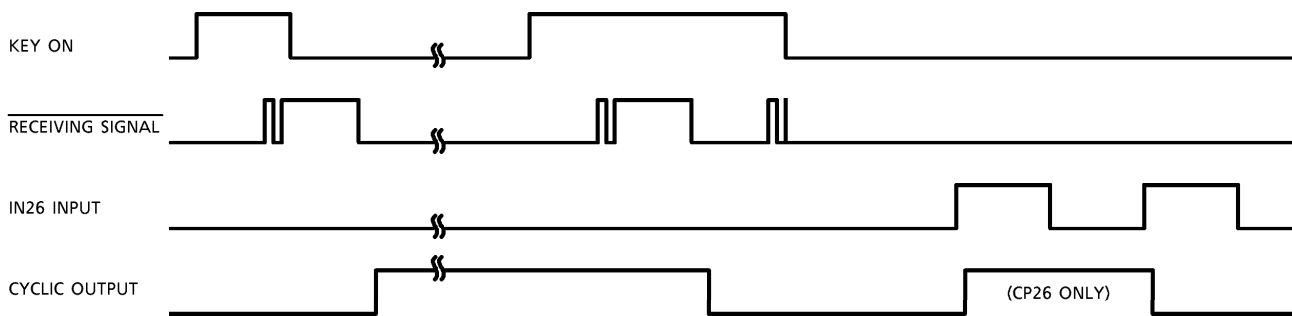
The output is held at "H" level as long as the key is kept pushed continuously after a single signal was output and continuous signals are being input.

If the key was released and the continuous signals have been stopped, it is judged that the key was released about 110ms later from the last continuous signal and the output is set at "L" level.

Further, DP08, DP16 and DP24 are shift key outputs and can be set at "H" level in parallel with other outputs corresponding to the double pushed signals sent from a transmitter.

The output of this LSI is best suited for REC-PLAY, REC-PAUSE and REC-REV outputs of a tape deck.

3-2. CP25, CP26 (Cyclic pulses)



- The cyclic pulse is reversed every time a single signal is received. Further, CP26 can be reversed by setting the IN26 pin at "H" level. Because this input is not valid unless output is stabilized for 4ms, no external part for preventing chattering is required.
- This cyclic pulse is best suited for outputs of power supply ON/OFF, MUTE, etc.
- When output of HP03, HP04 or CP26 is generated, cyclic output of CP25 is cleared.

4. Code assignment (Key No. are transmission key No. of TC9243P, TC9243F.)

KEY No.	KEY DATA CODE								OUTPUT	FUNCTION
	D0	D1	D2	D3	D4	D5	D6	D7		
K01	1	0	0	0	0	※	※	※	HP01	Hold
K02	0	1	0	0	0	※	※	※	HP02	
K03	1	1	0	0	0	※	※	※	HP03	
K04	0	0	1	0	0	※	※	※	HP04	
K05	1	0	1	0	0	※	※	※	HP05	
K06	0	1	1	0	0	※	※	※	HP06	
K08	※	※	※	※	※	1	0	0	DP08	Hold & Shift
K16	※	※	※	※	※	1	1	0	DP16	
K24	※	※	※	※	※	1	0	1	DP32	
K25	1	0	0	1	1	※	※	※	CP25	Cyclic
K26	0	1	0	1	1	※	※	※	CP26	

※ : Don't care (Corresponding outputs change regardless of data.)

## MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V <sub>DD</sub>	-0.3~6.0	V
Input Voltage	V <sub>IN</sub>	GND - 0.3~V <sub>DD</sub> + 0.3	V
Power Dissipation	P <sub>D</sub>	350	mW
Operating Temperature	T <sub>opr</sub>	-40~85	°C
Storage Temperature	T <sub>stg</sub>	-65~150	°C

## ELECTRICAL CHARACTERISTICS

Recommended operating conditions (Unless otherwise specified, V<sub>DD</sub> = 5.0V, Ta = 25°C)

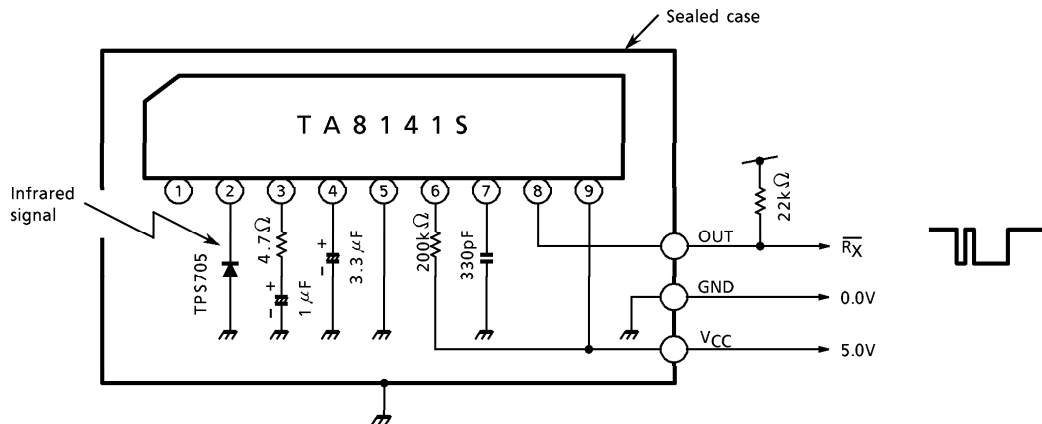
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage	V <sub>DD</sub>	—	Ta = -40~85°C	4.5	—	5.5	V
Oscillation Frequency	f <sub>osc</sub>	—	—	400	—	800	kHz
Input Voltage	"H" Level	V <sub>IH1</sub>	(Except $\overline{RST}$ , $\overline{RX IN}$ )	V <sub>DD</sub> × 0.7	—	V <sub>DD</sub>	V
	"H" Level	V <sub>IH2</sub>	( $\overline{RST}$ , $\overline{RX IN}$ )	V <sub>DD</sub> × 0.8	—	V <sub>DD</sub>	V
	"L" Level	V <sub>IL1</sub>	(Except $\overline{RST}$ , $\overline{RX IN}$ )	0	—	V <sub>DD</sub> × 0.3	V
	"L" Level	V <sub>IL2</sub>	( $\overline{RST}$ , $\overline{RX IN}$ )	0	—	V <sub>DD</sub> × 0.2	V

DC characteristics (Unless otherwise specified, V<sub>DD</sub> = 5.0V, Ta = 25°C)

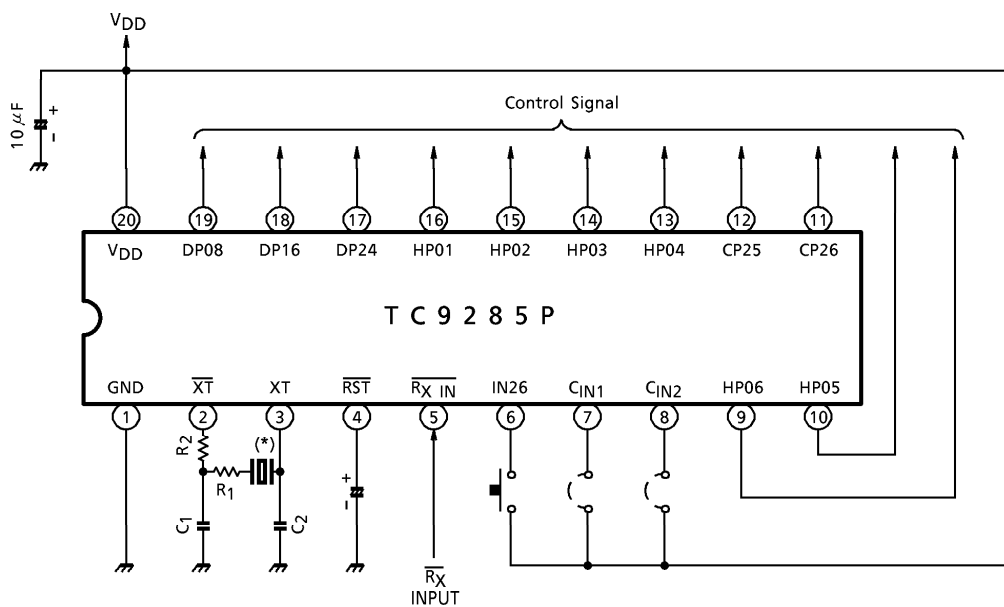
CHARACTERISTIC	SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Current	I <sub>DD</sub>	—	f <sub>osc</sub> = 455kHz	—	1.0	3.0	mA
Pull-down Resistor	R <sub>D</sub>	—	(IN26, C <sub>IN</sub> )	100	200	400	kΩ
Pull-up Resistor	R <sub>U</sub>	—	( $\overline{RST}$ )	25	50	100	kΩ
Output Current	"H" Level	I <sub>OH</sub>	(CP, HP, DP) V <sub>OH</sub> = 4V	-1.0	-4.0	—	mA
	"L" Level	I <sub>OL</sub>	(CP, HP, DP) V <sub>OL</sub> = 1V	1.0	8.0	—	mA
Input Leak Current	I <sub>LI</sub>	—	V <sub>IN</sub> = V <sub>DD</sub> , GND	-1.0	—	1.0	μA

APPLICATION CIRCUIT

1. Receiver circuit example



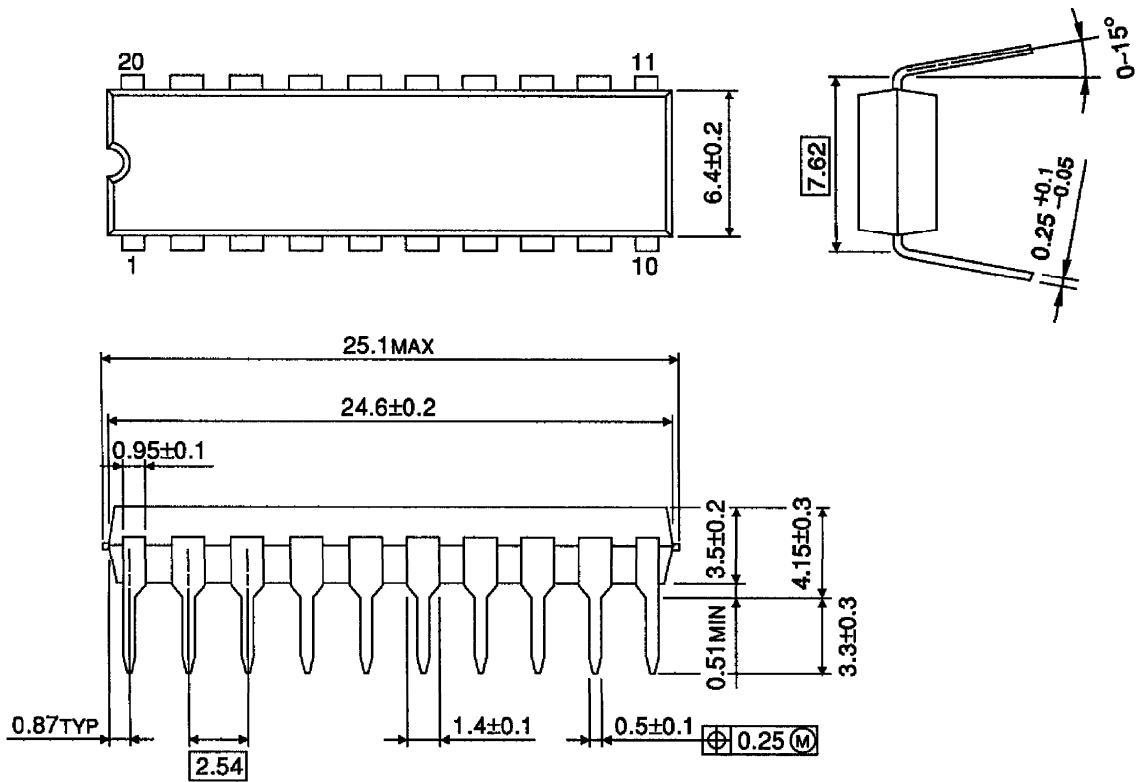
2. TC9285P circuit example



- (\*) Ceramic oscillator  
 CSB455E (Murata Seisakusyo)  $C_1 = C_2 = 100\text{pF}$ ,  $R_2 = \text{unnecessary}$   
 In case of influenced by oscillation noise, add resistor  $R_1$  to  $10\text{k}\Omega$  MAX.  
 FCR455K3 (TDK)  $C_1 = C_2 = 220\text{pF}$ ,  $R_2 = 4.7\text{k}\Omega$ ,  $R_1 = \text{unnecessary}$   
 In case of influenced by oscillation noise, add resistor  $R_2$  to large ( $>4.7\text{k}\Omega$ ).  
 or equivalent

**OUTLINE DRAWING**  
DIP20-P-300-2.54A

Unit : mm



Weight : 1.4g (Typ.)



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