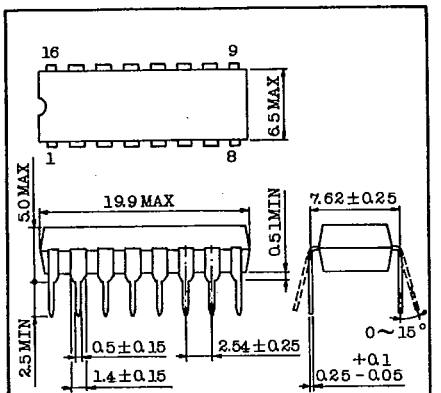
TC9149P, TC9150P

FOR INFRARED RAY REMOTE CONTROL RECEIVER

The TC9149P/TC9150P is LSI designed for use on the infrared ray remote control receiver, and when this LSI is used in combination with LSI TC9148P for transmitter, the remote control system can be constructed. The TC9149P is DIP 16 PIN type and is capable of controlling 10 functions, while the TC9150P is DIP 24 PIN type and is capable of controlling 18 functions.

- Able to output parallely multiple keying signals sent from the transmitter.
  (The TC9149P is able to output parallely up to 5 functions, while the TC9150P is able to output parallely up to 6 functions.)
- Output for single pulse, hold pulse and cyclic pulse are provided.
  (Cyclic pulse is available only for TC9150P.)
- A single terminal type oscillator by means of CR is provided.
- Code detection circuit provided for code check with the transmitter prevents interferences from various types of machines and apparatus.

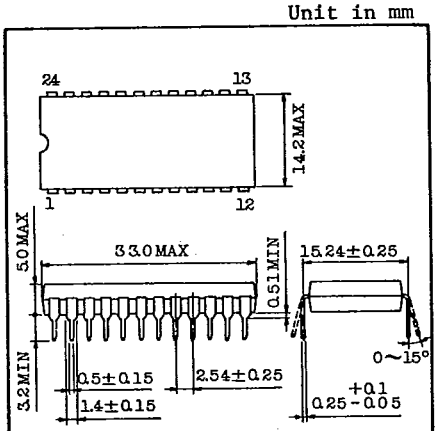
Unit in mm



Lead pitch is 2.54 and tolerance is ±0.25 against theoretical center of each lead that is obtained on the basis of No.1 and No.16 leads.

JEDEC	—
TOSHIBA	3D16A-P

Unit in mm



Lead pitch is 2.54 and tolerance is ±0.25 against theoretical center of each lead that is obtained on the basis of No.24 leads.

JEDEC	—
TOSHIBA	6D24A-P

MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	V_{DD}	0 ∿ 6	V
Input/Output Voltage	V_{IN}, V_{OUT}	V_{SS}-0.3 ∿ V_{DD}+0.3	V
Power Dissipation	P_D	200	mW
Operating Temperature	T_{opr}	-20 ∿ 75	°C
Storage Temperature	T_{stg}	-55 ∿ 125	°C

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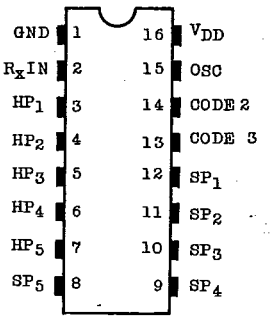
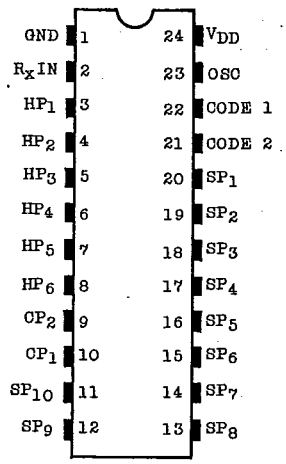
PIN CONNECTIONS

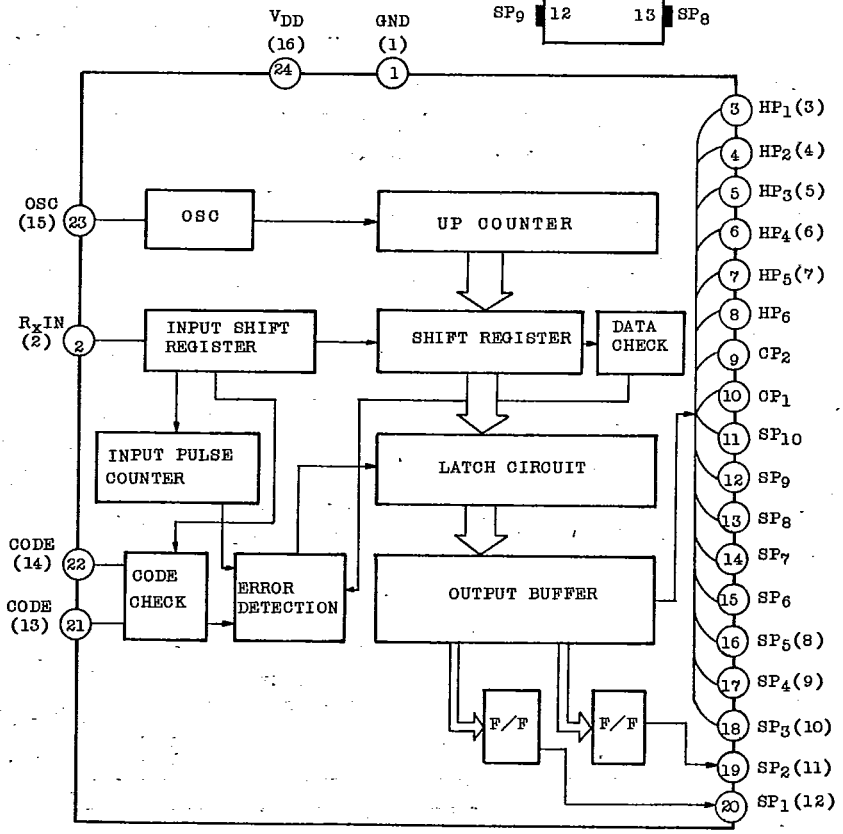
DIP 16 PIN



DIP 24 PIN



BLOCK DIAGRAM



PIN NO. OF TC9149P IS GIVEN IN PARENTHESIS.

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TC9149P, TC9150P

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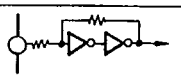
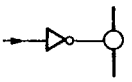
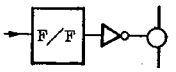
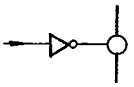
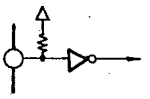
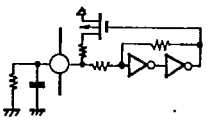
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, Ta=25°C, V_{DD}=5V)

CHARACTERISTIC		SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage		V_{DD}	-	Ta=-20∿75°C	4.5	∿	5.5	V
Operating Supply Current		I_{DD}	-	Output without Load	-	-	1.0	mA
Oscillation Frequency		f_{OSC}	-	Ta=-20∿75°C, V_{DD}=4.5∿5.5V	27	∿	57	kHz
Standard OSC Frequency		Sf_{OSC}	-		-	38	-	kHz
Variance of Oscillation Frequency by V_{DD}		ΔV_{fOSC}	-	Ta=25°C, V_{DD}=4.5∿5.5V	-5	-	5	%
Variance of Oscillation Frequency by Temperature		ΔT_{fOSC}	-	Ta=-30∿75°C	-5	-	5	%
Output Current	"H" Level	I_{OH}	-	all output, V_{OH}=4V	-	-	-1.0	mA
	"L" Level	I_{OL}	-	all output, V_{OL}=1V	1.0	-	-	mA
Input Current	"H" Level	I_{IH}	-	CODE Terminal, V_{IH}=5.0V	-1.0	-	1.0	μA
Pull-up Resistor		R_{up}	-	CODE Terminal	10	20	40	kΩ
Input Circuit Threshold Voltage		V_{IN}	-	R_X Terminal	2.0	2.5	3.0	V
Hysteresis Width		V_{HIS}	-	R_X Terminal	-	0.8	-	V

DESCRIPTION OF TERMINALS

PIN NO. 16 PIN	PIN NO. 24 PIN	SYMBOL	TERMINAL	FUNCTION/OPERATION	INPUT/OUTPUT CONFIGURATION
1	1	GND	GND		
2	2	R_XIN	Receiving signal Input	Instruction signal with carrier signal eliminated is input.	
3∿7	-	HP_1∿HP_5	Continuous signal Input	As long as receiving signal is input, this output is held at "H" level.	
-	3∿8	HP_1∿HP_6			
-	9·10	CP_1·CP_2	Cyclic signal output	When receiving signal is input, output is reversed.	
8∿12	-	SP_1∿SP_5	Single-shot signal output	When receiving signal is input, output is placed at "H" level only for a fixed time. (about 107 msec)	
-	11∿20	SP_1∿SP_{10}			
13·14	21·22	CODE	Code input	Transmitter code is compared with a code set at this terminal and if they agree each other, input is accepted.	 Built-in pull-up resistor
15	23	OSC	Timing oscillation	A resistor and a capacitor are parallely connected between this terminal and GND.	
16	24	V_{DD}	Power Supply		

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TC9149P, TC9150P

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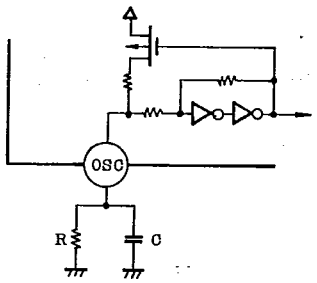
FUNCTIONAL DESCRIPTION

1. OSCILLATION CIRCUIT

Timing with transmitter signal and internal operating clock are all decided by this oscillator.

The oscillator has been so far constructed through a combination of a linear amplifier by means of C MOS inverter in IC and 455 kHz ceramic resonator; however, when TC9149P/TC9150P is used, a stable oscillator can be constructed by parallelly connecting C and R between the oscillator and GND by a single terminal oscillator.

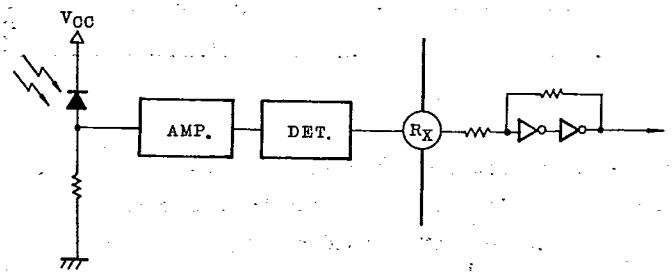


R : 39kΩ ±5%
C : 1000pF ±5%
(POLYPROPYLENE FILM CAPACITOR SHOULD BE USED.)

Oscillation frequency is about 38 kHz ± 5 kHz at R=39kΩ and C=1000pF.
(Refer to Graph 1 Oscillation Frequency Characteristic)

2. RECEIVING SIGNAL INPUT CIRCUIT

Signal received by the light receiving element is sent through the amplifier to the detector where 38 kHz carrier wave is eliminated and is input into the receiving signal input circuit. The reciving signal input circuit (Rx IN) has a built-in Schmitt circuit for shaping receiving signal waveform to eliminate rounding.



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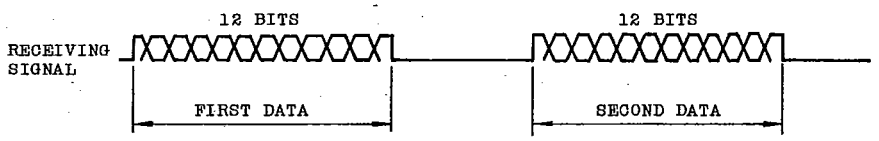
TC9149P, TC9150P

3. RECEIVING SIGNAL CHECK

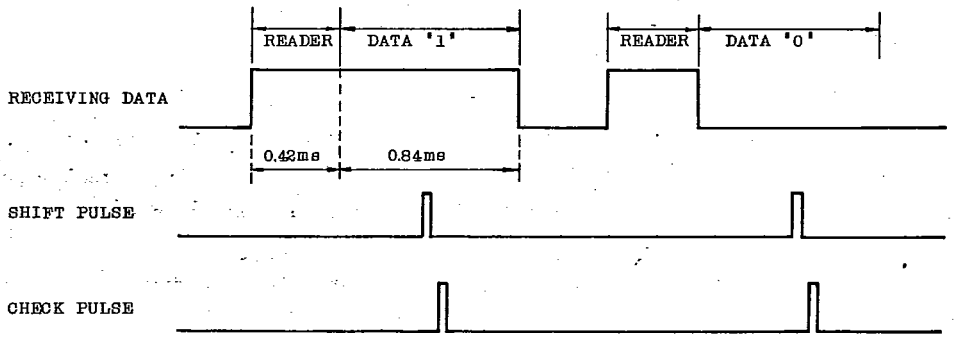
The receiving signal check is to check 2 cycle transmitting signal sent from the transmitter to determine if it is normal signal.



First, the first data is stored in the 12-bits shift register. Then, when the second data is put into the shift register, data is forced out of the shift register by one bit, where the first data has been stored.

Now, pushed out data and incoming data are checked to see if they are same.

If an error is caused in the receiving data 12-bits check, the system is reset at that point of time. Conversely, when all receiving data are OK, output is raised from "L" level to "H" level.



The status of receiving data, shift pulse and check pulse is shown above.

Shift pulse is provided in the data center by taking frequcncy margins of the transmitter and the receiver into consideration.

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TC9149P, TC9150P

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Code Comparison

To prevent interference with other models, C1, C2 and C3 code bits are provided for checking whether the transmitter and receiver codes agree each other.

Only when both codes agreed, internal latch strobe pulse is generated to latch receiving data and output is raised from "L" level to "H" level. If both codes do not agree, no latch strobe pulse is generated and output remains at "L" level.

Code bits used differ depending upon receiver as shown below:

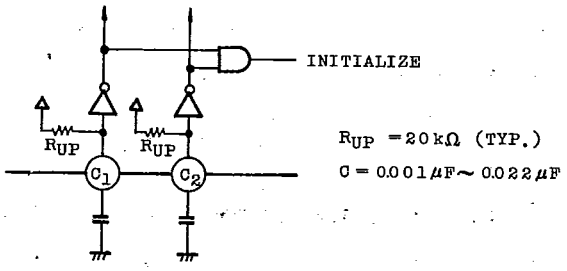
CODE BIT	
C_1	C_2
C_3	C_2
1	0
0	1
1	1

TC9149P .... C2,C3 CODE BIT
TC9150P .... C1,C2 CODE BIT
* CODE BIT '0','0' CANNOT BE USED.

4. INITIALIZATION AT TIME OF POWER ON

In order to initialize the internal status at time of power ON, it is necessary to perform the initialization.

The initialization is carried out when a capacitor is connected to the code bit terminal.



* In case of TC9149P, connect a capacitor to C2 and C3.
* A capacitor for initialization is unnecessary for the terminal for which Code Bit "0" is selected. However, Code Bit "0", "0" cannot be used. Either one terminal must be set at "H".

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TC9149P, TC9150P

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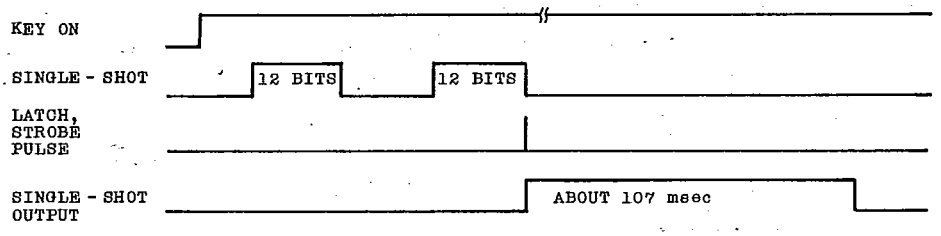
5. EXPLANATION OF OUTPUT PULSE SP, HP, CP

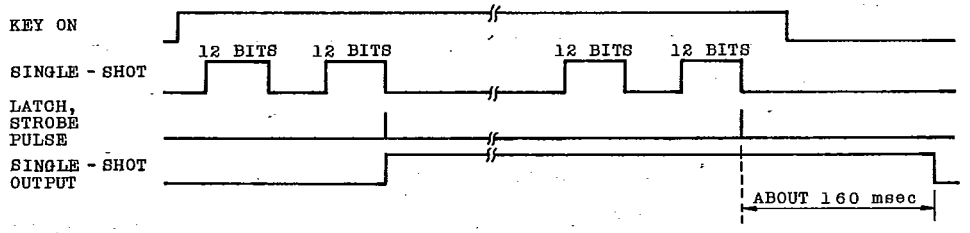
5-1. SP1 - SP10 (Single pulse)



After checking 12-bits receiving data, if data agree and OK, single pulse is output.

Output is raised from "L" level to "H" level and returned again to "L" level after about 107 msec.

5-2. HP1 - HP6 (Hold pulse)



Hold pulse is output by the first latch strobe pulse after key ON.

Output is kept at "H" level as long as Continuous Signal is input.

When the key is released and continuous signal is stopped, about 160 msec later, output is reversed to "L" level by the last latch strobe pulse.

Further, HP1 - HP6 are able to parallelly and simultaneously max sextet outputs at "H" level by continuous signal sent from the transmitter.

These outputs are optimum as outputs of REC-PALY, REC-PAUSE, and CUE/REVIEW of a tape deck.

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TC9149P, TC9150P

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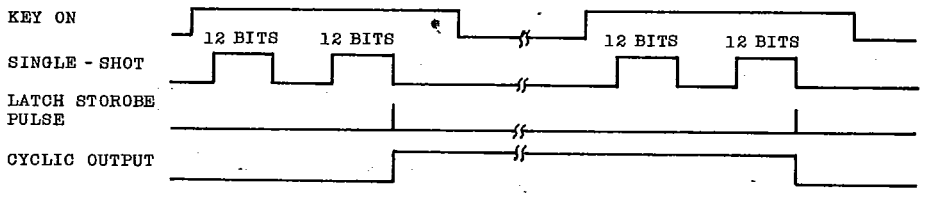
5-3. CP1, CP2 (Cyclic pulse)



When single-shot signal is received, cyclic pulse output is reversed. This cyclic pulse is used for power ON/OFF, MUTE, etc.

6. CODE ALLOCATION (KEY No. is of TC9148P)

KEY No.	DATA BIT									FUNCTION OF INSTRUCTION	
	H	S_1	S_2	K_1	K_2	K_3	K_4	K_5	K_6		
1	1	0	0	1	0	0	0	0	0	CONTINUOUS SIGNAL	HP_1
2	1	0	0	0	1	0	0	0	0	〃	HP_2
3	1	0	0	0	0	1	0	0	0	〃	HP_3
4	1	0	0	0	0	0	1	0	0	〃	HP_4
5	1	0	0	0	0	0	0	1	0	〃	HP_5
6	1	0	0	0	0	0	0	0	1	〃	HP_6
7	0	1	0	1	0	0	0	0	0	SINGLESHOT SIGNAL	SP_1
8	0	1	0	0	1	0	0	0	0	〃	SP_2
9	0	1	0	0	0	1	0	0	0	〃	SP_3
10	0	1	0	0	0	0	1	0	0	〃	SP_4
11	0	1	0	0	0	0	0	1	0	〃	SP_5
12	0	1	0	0	0	0	0	0	1	〃	SP_6
13	0	0	1	1	0	0	0	0	0	〃	SP_7
14	0	0	1	0	1	0	0	0	0	〃	SP_8
15	0	0	1	0	0	1	0	0	0	〃	SP_9
16	0	0	1	0	0	0	1	0	0	〃	SP_{10}
17	0	0	1	0	0	0	0	1	0	CYCLIC SIGNAL	CP_1
18	0	0	1	0	0	0	0	0	1	〃	CP_2

C1 - C3 code bits are available in addition to the above data bits for optional code selection.

TC9150P can use all keys, but TC9149P is able to use KEY$_{1 \sim 5}$ and KEY$_{7 \sim 11}$ only for 10 commands.

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TC9149P, TC9150P

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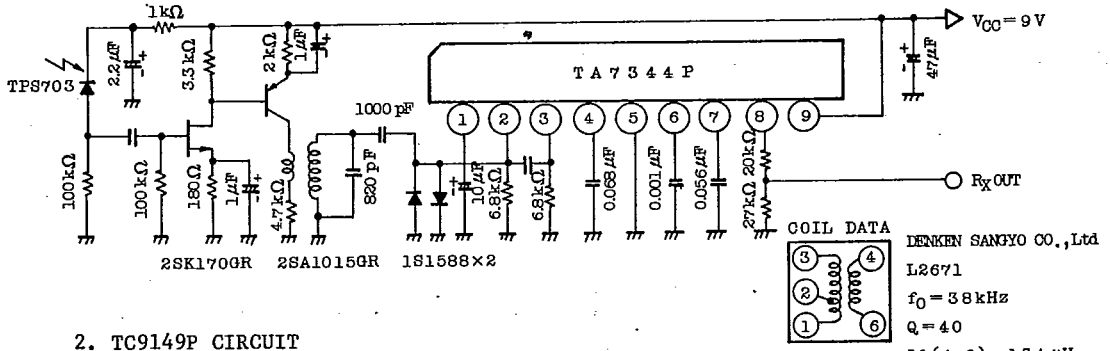
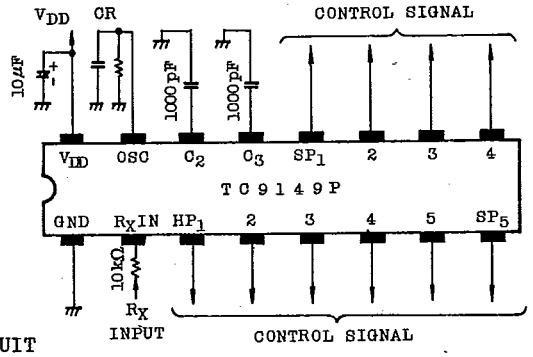
7. APPLICATION CIRCUITS

1. RECEIVING SECTION

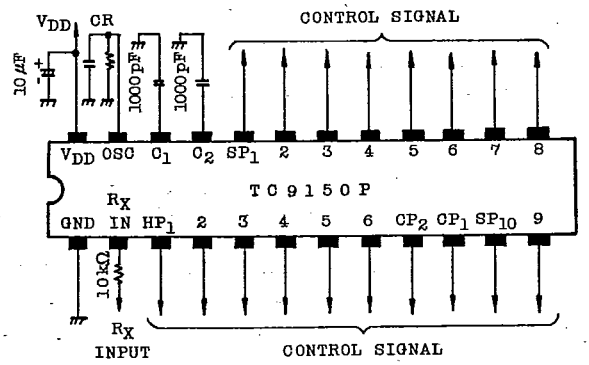


DENKEN SANGYO CO.,Ltd
L2671
f_0 = 38kHz
Q = 40
L1(4-6) = 134μH
L2(1-3) = 17.5mH
L3(1-2) = 16.6mH
4-6 = 43t
3-1 = 600t
3-2 = 103t
2UEW-0.08φ

2. TC9149P CIRCUIT



3. TC9150P CIRCUIT



* R should be 38kΩ ± 5%.

* C should be polypropylene film capacitor having good temperature characteristics 1000 pF ± 5%.

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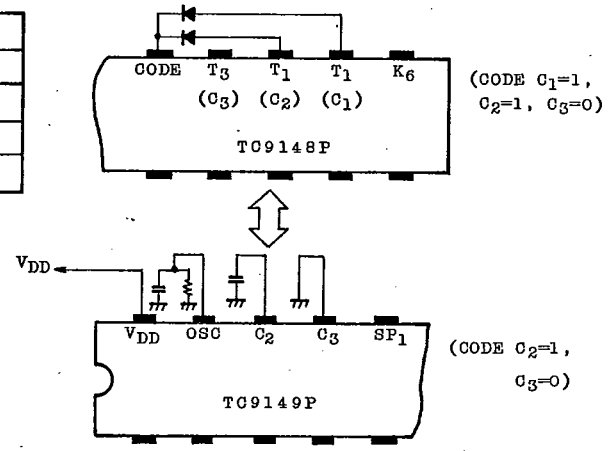
NOTE FOR APPLICATION CIRCUIT

1. COMBINATION OF TC9148P/TC9149P CODE BITS.

(TABLE 1)

TC9148P			TC9149P	
C_1	C_2	C_3	C_2	C_3
1	1	0	1	0
1	0	1	0	1
1	1	1	1	1

(EXAMPLE 1) IN CASE CODE C_2=1 AND C_3=0



The combination of code bits of TC9148P and TC9149P is shown in Table 1

To make Code Bit to "1" on TC9148P, connect diodes to CODE terminal from $T_1 \sim T_3$ Terminals. To set Code Bit at "0", open the circuit.

TC9149P has C2 and C3 code terminals. Code bit of C1 has been pulled up in IC and C1 is always kept at "1" status.

Therefore, on Transmitter TC9148P it is necessary to keep C1 code bit at "1".

Example 1 is the external circuit diagram when Code Bit C2=1, and C3=0.

2. COMBINATION OF TC9148P/50P CODE BITS

(TABLE 2)

TC9148P			TC9150P	
C_1	C_2	C_3	C_1	C_2
1	0	1	1	0
0	1	1	0	1
1	1	1	1	1

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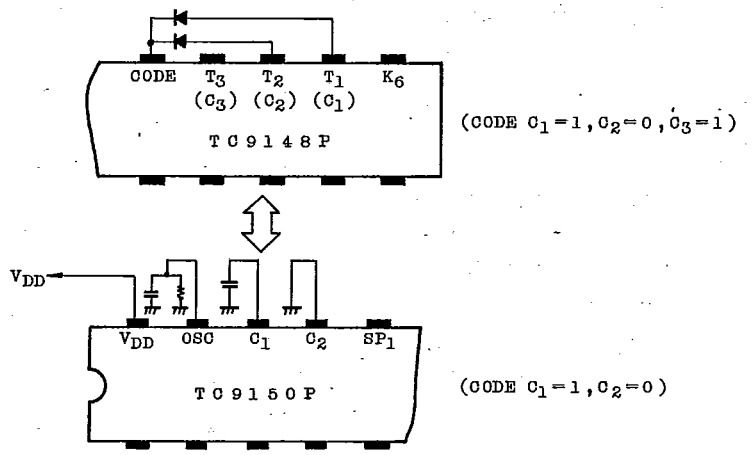
TC9149P, TC9150P

(EXAMPLE 2) IN CASE CODE $C_1=1$ and $C_2=0$

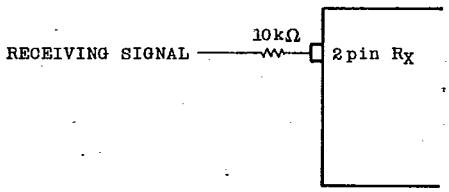


The combination of Code Bits of TC9148P and TC9150P is shown in Table 2

On TC9150P, C3 code has been pulled up in IC and always kept at "1" status. Therefore, it is necessary to keep Code Bit C3 of Transmitter TC9148P at "1". To keep Code Bit C3 at "1", connect a diode to CODE Terminal from T3 Terminal.

Example 2 is an example of the circuit when Code Bit C1=1 and C2=0.

3. If input voltage above V_{DD} + 0.3V may possibly be applied to Rx Input Terminal (2 PIN), connect resistors of about 10kΩ in series to Rx Input Terminal. (This is to prevent latch-up.)



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TC9149P, TC9150P

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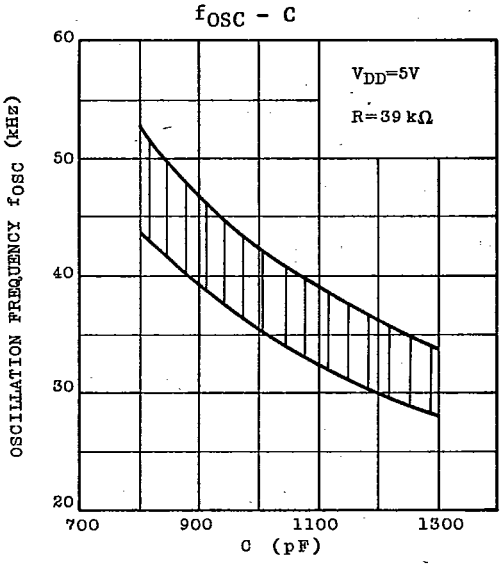
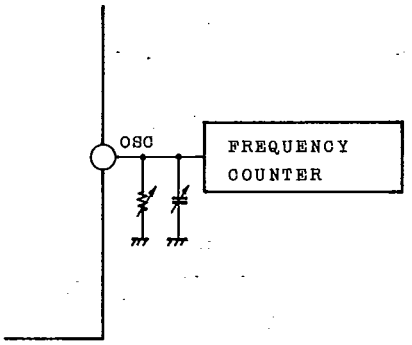
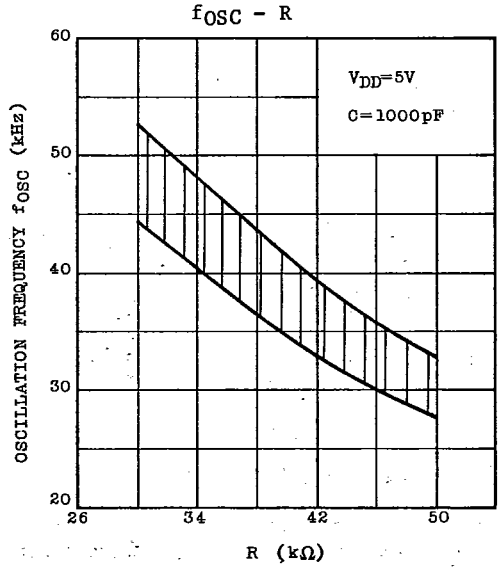
OSCILLATION FREQUENCY CHARACTERISTICS

f_{OSC} - C





f_{OSC} - R



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