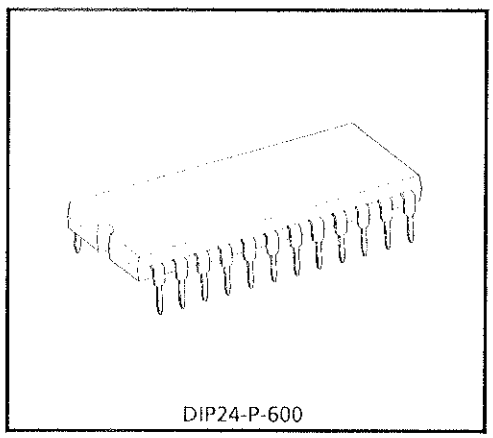
ANALOG FUNCTION SWITCH

The TC9152P is a feather touch function switch with built-in high operation voltage analog switches.

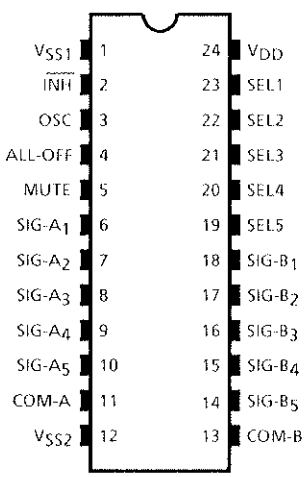


Weight : 3.4g (Typ.)

FEATURES

- The built-in high operation voltage analog switches allow use of wide dynamic range.
- The control system is operated by a single power supply and the analog switch system by dual power supplies of (+) and (−).
- Muting output is available to prevent "POP" noise at time of switching.
- A built-in large current buffer transistor allows direct driving of LEDs for status display, etc.
- The range of operating supply voltage is wide and current consumption is low because of the CMOS structure.

PIN CONNECTION



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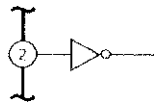
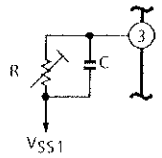
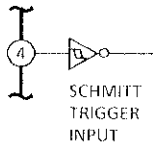
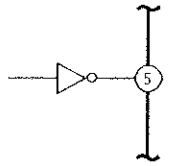
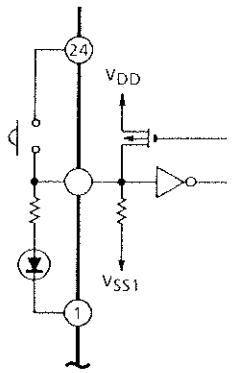
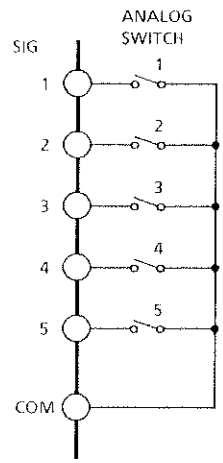
PIN FUNCTION

PIN No.	SYMBOL	FUNCTION	REMARKS
2	$\overline{INH}$	Inhibit input terminal. Normal operation at "H" level, and inhibit operation at "L" level.	
3	OSC	C/R connecting terminal for the oscillator. Muting time and switching timing of the analog switch are set by frequency of this oscillator.	
4	ALL-OFF	Off designation input terminal for all analog switches. All analog switches are turned off when "H" level signal is input to this terminal.	
5	MUTE	Muting signal output terminal. When "H" level input is applied to the select input (SEL-1~SEL-5) terminal, this terminal is placed at "H" level only for a certain period in which the analog switches are changed over. Muting output time can be freely determined according to frequency of OSC.	
23 22 21 20 19	SEL-1 SEL-2 SEL-3 SEL-4 SEL-5	Select input terminals of the analog switches. When SEL-1~SEL-5 terminals are placed at "H" level, respective selected analog switches are turned on. On the TC9152P, all of SEL-1~SEL-5 are of mutual reset type. These terminals are I/O terminals which also serve as the display driver output terminals.	

PIN No.	SYMBOL	FUNCTION	REMARKS
6 / 18	SIG-A_1 SIG-B_1	Signal input terminal 1. When SEL-1 is selected, Analog Switch 1 is turned on and power is conducted to the circuit between this terminal and the COM terminal.	
7 / 17	SIG-A_2 SIG-B_2	Signal input terminal 2. When SEL-2 is selected, Analog Switch 2 is turned on and power is conducted to the circuit between this terminal and the COM terminal.	
8 / 16	SIG-A_3 SIG-B_3	Signal input terminal 3. When SEL-3 is selected, Analog Switch 3 is turned on and power is conducted to the circuit between this terminal and the COM terminal.	
9 / 15	SIG-A_4 SIG-B_4	Signal input terminal 4. When SEL-4 is selected, Analog Switch 4 is turned on and power is conducted to the circuit between this terminal and the COM terminal.	
10 / 14	SIG-A_5 SIG-B_5	Signal input terminal 5. When SEL-5 is selected, Analog Switch 5 is turned on and power is conducted to the circuit between this terminal and COM terminal.	
11 / 13	COM-A COM-B	Analog switch common terminals.	
24 1 12	V_{DD} V_{SS1} V_{SS2}	Supply voltage applying terminals. V_{DD}-V_{SS1} is for the control system. V_{DD}-V_{SS2} is for the analog switch system.	

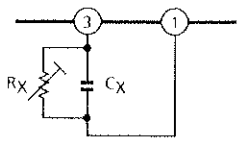


OPERATION

1. Decision of OSC frequency

The OSC terminal is the C/R connecting terminal of a single terminal type oscillator, and muting time, switching timing of the analog switch, etc. are decided by this oscillation frequency.

Oscillation frequency $f_{OSC} \fallingdotseq 1/0.7C_XR_X$

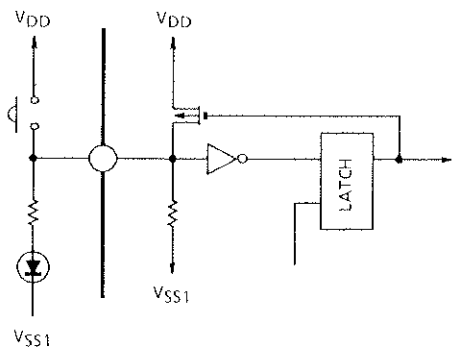


(*) As quality of the oscillator may vary according to production lot, use a (Variable) resistor for R_X.

The oscillator is normally not oscillating but when SEL input is accepted, starts to oscillate and after transmitting 5 clocks, stops to oscillate.

2. SEL terminals

These terminals are the select input for the analog switches and LED driver output I/O terminals. As these terminals are kept pulled down, they are normally kept at "L" level.
When "H" level signal is input, the LED driver is turned on by the internal latch circuit and is kept at "H" level even when returned to "L" level.

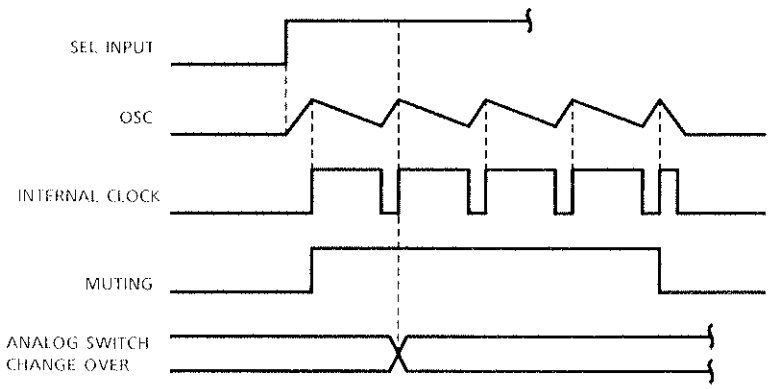


On the TC9152P, SEL-1~SEL-5 are of mutual reset type, and therefore, they are kept off unless selected input is applied.

3. Muting signal output

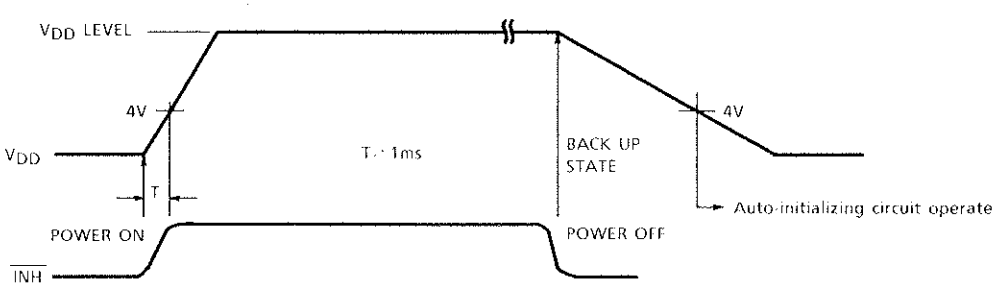
In order to prevent such abnormal sounds as popping sound generating when changing over the analog switches, muting signal is transmitted.
This muting output time is set by OSC frequency.

Muting time $T_{MUTE} = (1/f_{OSC}) \times 4$ (s)



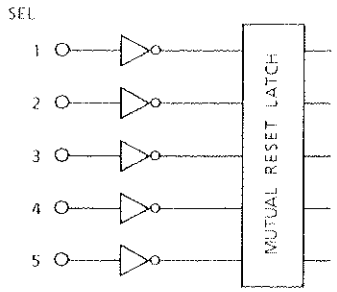
4. Initialization of switches and backup

As the auto-initializing circuit has been built in, SEL-1 (Switch 1) is initialized when power is turned on.
This auto-initializing circuit operates only when the $\overline{INH}$ terminal is at "H" level and potential of V_{DD} is less than about 4V.
Therefore, the inhibit and rise time of V_{DD} should be set as shown below when power turned on.
Further, if V_{DD} drops below 4V at the (backup state), the auto-initializing function is similarly actuated.



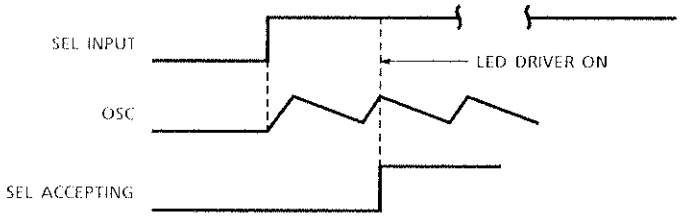
Multiple inputs

When more than two inputs in the mutual reset are simultaneously selected, during the period of this multiple inputs, all analog switches are turned off and muting signal is continuously transmitted. Further, when multiple inputs are released, the finally selected input is accepted.

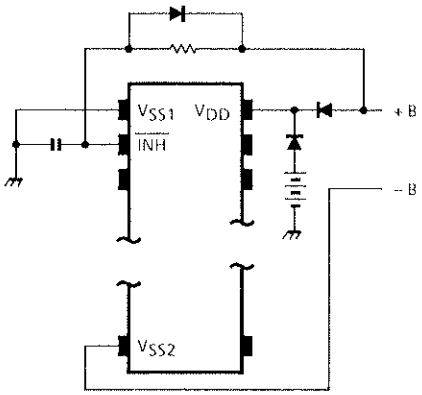


Chattering protection circuit

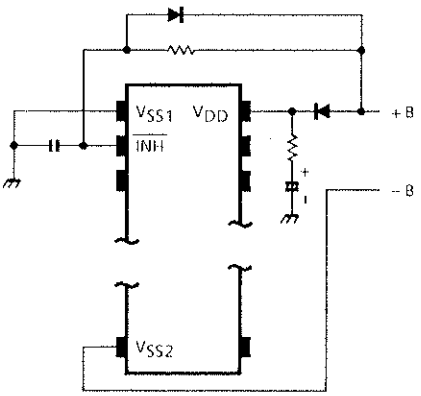
SEL input chatter protecter built in, it is possible to evasion abnormal operation by noise, etc. Signal for selecting SEL input is not accepted unless it is held at "H" level for more than 1 cycle of OSC.



When the inhibit terminal is placed at "L" level, all inputs/outputs are cut off and the inhibit state is resulted.
As current is scarcely consumed under this state, the back-up for a long time becomes possible.
If, however, potential of V_{DD} drops below 4V as stated above, the auto-initializing circuit is actuated and a specific switch is set by force.
Therefore, voltage above 4V is necessary for back-up.



Back-up by battery, etc.

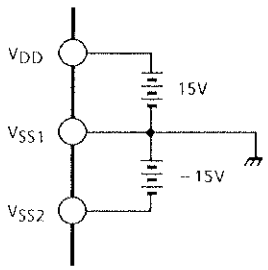


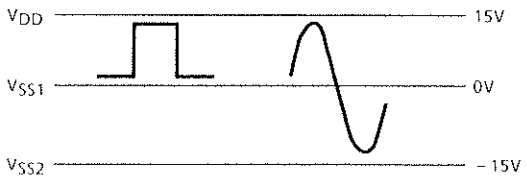
Back-up by condenser

5. Power supply

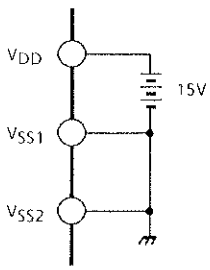
Power to the analog switch unit and the control unit is supplied from separate power supply systems, respectively, and the analog switch unit can be operated by dual power supplies of (+) and (−) and the control unit by a single supply unit.

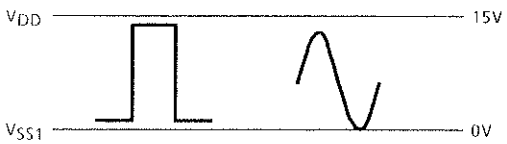
Dual power supplies





Single power supply



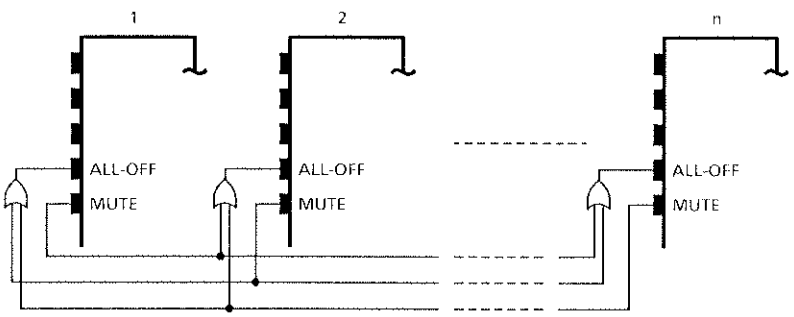


(*) When this switch is used by a single power supply with V_{SS1} and V_{SS2} made common, up to 1/2 of voltage when dual power supplies are used can be applied.

6. Others

Parallel Connection of TC9152P

When switches having more than 5 contact points are required, it is possible to increase number of contact points by using plural number of TC9152P.



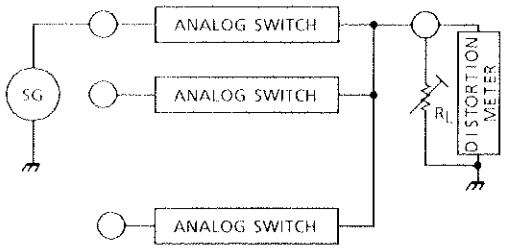
MAXIMUM RATINGS (Ta = 25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage (1)	$V_{DD} - V_{SS1}$	16	V
Supply Voltage (2)	$V_{DD} - V_{SS2}$	32	V
Input Voltage At V_{SS1}	V_{IN} (1)	$-0.3 \sim V_{DD} + 0.3$	V
Input Voltage At V_{SS2}	V_{IN} (2)	$V_{SS} - 0.3 \sim V_{DD} + 0.3$	V
Power Dissipation	P_D	400	mW
Operating Temperature	T_{opr}	$-30 \sim 75$	°C
Storage Temperature	T_{stg}	$-55 \sim 125$	°C

ELECTRICAL CHARACTERISTICS (Unless otherwise specified, $V_{DD} = 15V$, $V_{SS1} = 0V$, $V_{SS2} = -15V$, Ta = 25°C)

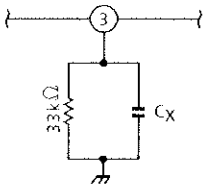
CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage (1)		$V_{DD} - V_{SS1}$	—	—	7.5	~	15	V
Operating Supply Voltage (2)		$V_{DD} - V_{SS2}$	—	—	7.5	~	30	V
Operating Supply Current		I_{DD}	—	$V_{DD} = 15V$, $V_{SS1} = 0V$ $V_{SS2} = 15V$, Driver off	—	1	3	mA
Back Up Voltage		V_B	—	—	4	~	15	V
Back Up Current		I_B	—	—	—	1	10	μA
Input Voltage	"H" Level	V_{IH}	—	SEL-1~SEL-5 ALL-OFF, $\overline{INH}$	$V_{DD} \times 0.7$	~	$V_{DD} + 0.3$	V
	"L" Level	V_{IL}		SEL-1~SEL-5 ALL-OFF, $\overline{INH}$	$V_{SS1} - 0.3$	~	$V_{DD} \times 0.3$	
SEL Input Pulldown Resistor		R_D	—	SEL-1~SEL-5 ALL-OFF, $\overline{INH}$	10	20	30	kΩ
Output Current	"H" Level	I_{OH}	—	SEL-1~SEL-5, $V_{DD} = 15V$ $V_{OH} = 10V$, $V_{SS1} = 0V$	15	20	30	mA
	"H" Level	I_{OH} (MUTE)	—	MUTE, $V_{DD} = 15V$ $V_{SS1} = 0V$, $V_{OH} = 14V$	100	—	—	μA
	"L" Level	I_{OL} (MUTE)		MUTE, $V_{DD} = 15V$ $V_{SS1} = 0V$, $V_{OL} = 1V$	−100	—	—	
OSC Frequency Range		f_{OSC}	—	—	50	~	5k	Hz
Analog Switch On Resistor		R_{ON}	—	—	—	100	300	Ω
Analog Switch Off Leak		I_{OFF}	—	—	—	0.1	—	μA
Analog Switch Total Harmonic Distortion		THD	1	$V_{DD} = 15V$, $V_{SS1} = 0V$ $V_{SS2} = -15V$, $f_{IN} = 1kHz$ $V_{IN} = 1V_{rms}$	—	0.005	0.03	%
Analog Switch Noise Voltage		V_N	—	$R_g = 1k\Omega$, $f_W = 20 \sim 20kHz$	—	2	—	μV_{rms}

TEST CIRCUIT 1

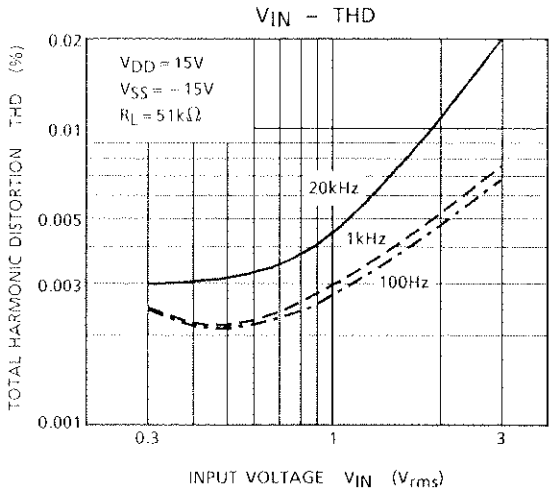


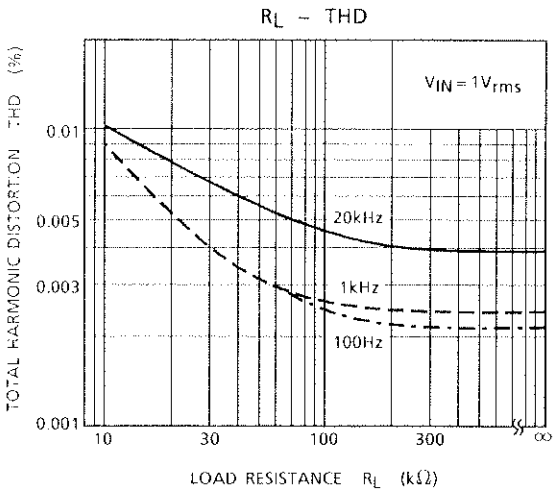
V_{IN} – THD, R_L – THD

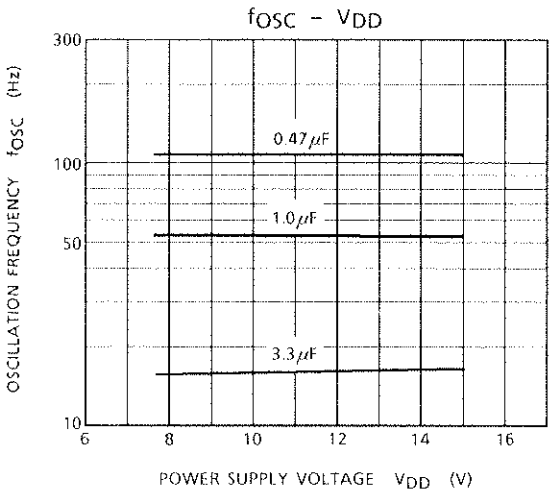
TEST CIRCUIT 2



f_{OSC} – V_{DD}



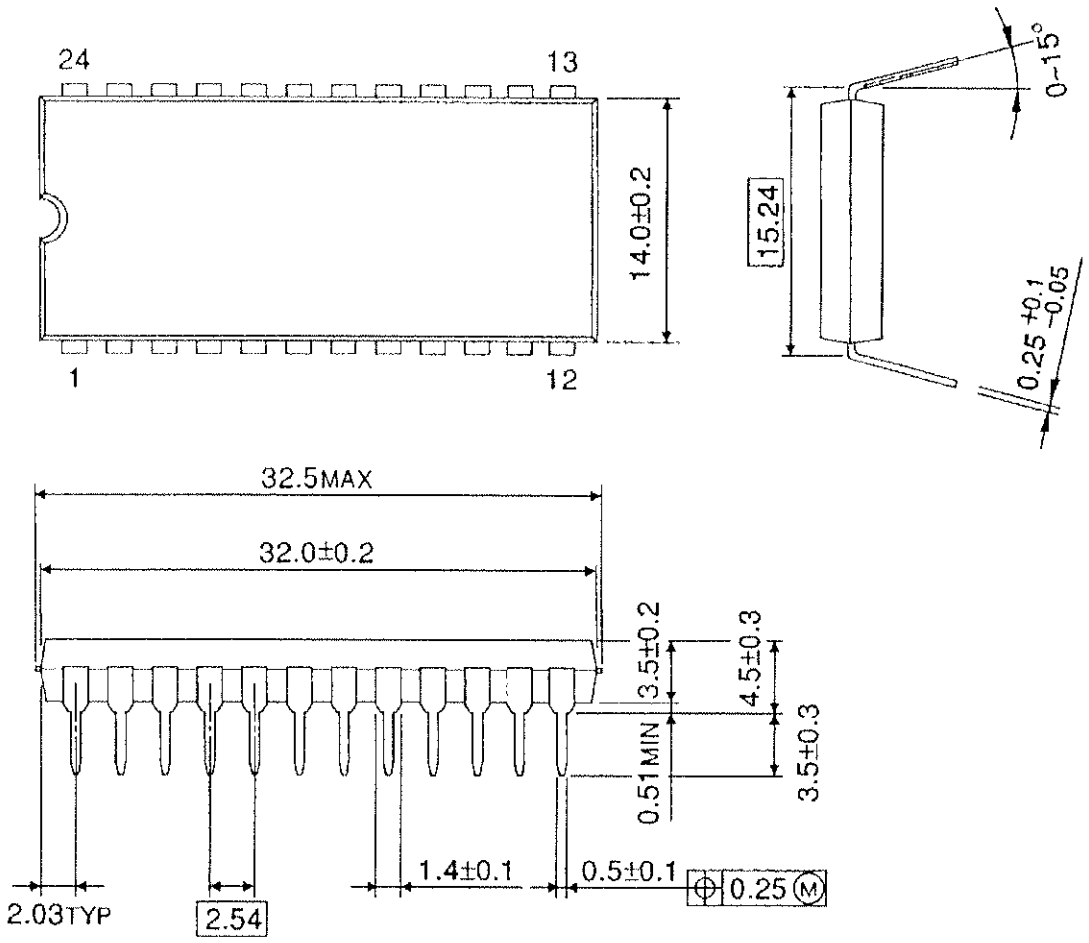




OUTLINE DRAWING

DIP24-P-600

Unit : mm



Weight : 3.4g (Typ.)