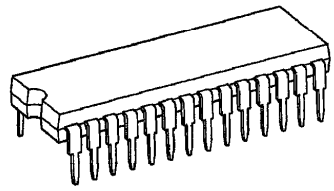
TOSHIBA CMOS DIGITAL INTEGRATED CIRCUIT SILICON MONOLITHIC

TC9208N, TC9209N

HIGH TENSION SUSTAINING ANALOG FUNCTION SWITCH

The TC9208N, TA9209N is a feather touch type function change-over switch incorporating a high-tension sustaining analog switches.



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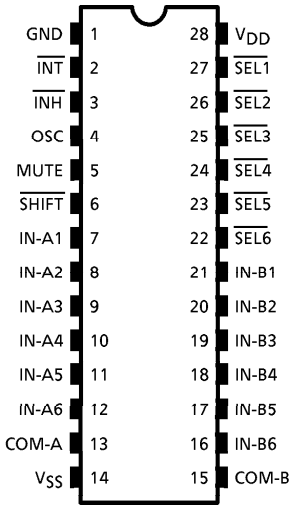
Weight : 2.2g (Typ.)

FEATURES

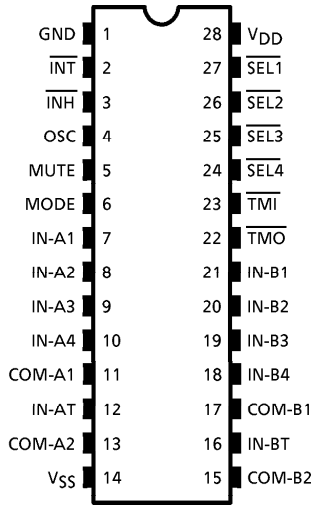
- The construction of the analog switches is as follows :
  TC9208N : 2 circuits 6 contacts
  TC9209N : 2 circuits 4 contacts + tape monitor
- The control system is operable by the (+) power supply and the analog system is operable by the (+) and (−) dual power supplies.
- The built-in buffer transistor enables it to directly drive the function display LED, etc.
- The TC9208N enables sequential change-over of input by the $\overline{\text{SHIFT}}$ input in additions to direct change-over of input.
- If input is changed over when the tape monitor is in operation on the TC9209N, the tape monitor can be released automatically (auto monitor OFF).

PIN CONNECTION

TC9208N



TC9209N

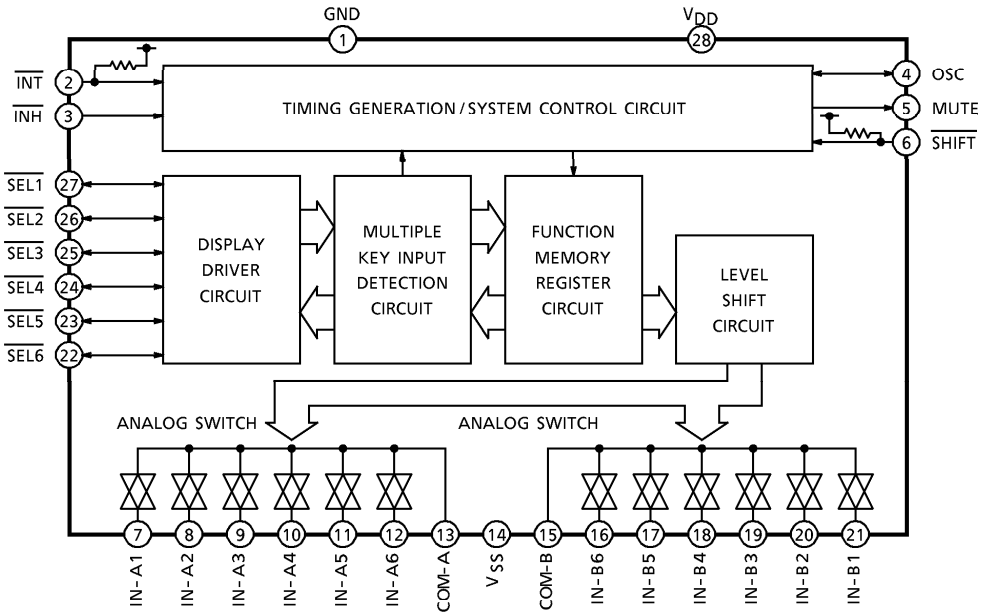


980508EBA2

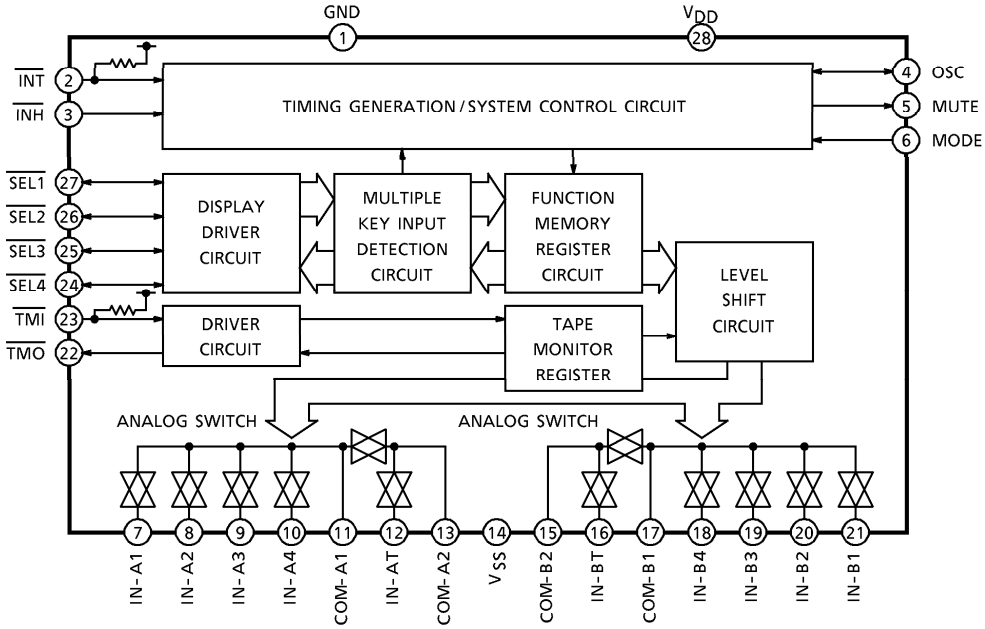
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BLOCK DIAGRAM

TC9208N



TC9209N



980508EBA2'

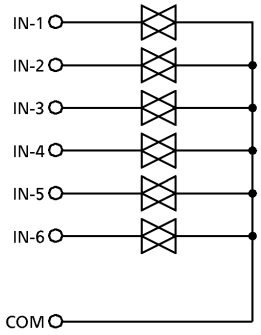
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PIN FUNCTION

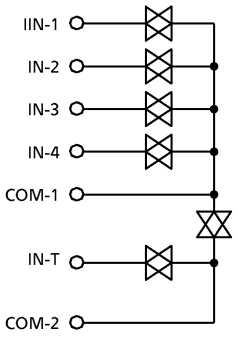
1. TC9208N, TC9209N Common Pins

PIN No.	SYMBOL	PIN NAME	FUNCTIONS AND OPERATIONS	REMARKS
1	GND	Ground pin	In case of the single power supply, use by grounding the GND and V_{SS} pins.	—
14	V_{SS}	(−) Power supply		
28	V_{DD}	(+) Power supply		
2	$\overline{INT}$	Initialize input	When "L" level signal is input, the inside is initialized. The select pin selects $\overline{SEL\ 1}$ and the tape monitor is turned OFF on TC9209N. When "H" level signal is input, the normal operation starts.	With a built-in pull-up resistor.
3	$\overline{INH}$	Inhibit input	When "L" level (GND level) signal in input, all inputs and outputs are inhibited and power dissipation becomes low. When "H" level signal is input, the normal operation starts.	CMOS input pin.
4	OSC	Oscillator input / output	Timings required in the IC are generated by external C and R.	—
5	MUTE	Muting output	When the analog switch is changed over by the select input pins ($\overline{SEL1\ to\ 5}$) and $\overline{SHIFT}$ pins, "H" level muting output is generated for a fixed period of time.	CMOS output pin.

2. TC9208N Pins

PIN No.	SYMBOL	PIN NAME	FUNCTIONS AND OPERATIONS	REMARKS
6	$\overline{\text{SHIFT}}$	Shift select input pin	Whenever this pin is set at "L" level, the shift by one to the upward direction is made from the current $\overline{\text{SEL}}$ position. $\overline{\text{SEL1}}\rightarrow\overline{\text{SEL2}}\rightarrow\overline{\text{SEL3}}\rightarrow\overline{\text{SEL4}}\rightarrow\overline{\text{SEL5}}\rightarrow\overline{\text{SEL6}}\rightarrow\overline{\text{SEL1}}\cdots$	With a built-in pull-down resistor
7	IN-A1	Signal input-1	The analog switch circuit of 2-circuit and 6-contact type. Compatible with $\overline{\text{SEL-N}}$ = IN-N  	—
21	IN-B1			
8	IN-A2	Signal input-2		
20	IN-B2			
9	IN-A3	Signal input-3		
19	IN-B3			
10	IN-A4	Signal input-4		
18	IN-B4			
11	IN-A5	Signal input-5		
17	IN-B5			
12	IN-A6	Signal input-6		
16	IN-B6			
13	COM-A	Signal output pin		
15	COM-B			
27	$\overline{\text{SEL1}}$	Analog switch select input / output	When "L" level signal is input, the selected analog switches are turned ON. As the $\overline{\text{SEL}}$ pins serve as the input / output ports, the selected $\overline{\text{SEL}}$ pin is fixed at "L" level even when the input key is turned OFF.	With a built-in driver transistor and pull-down resistor.
26	$\overline{\text{SEL2}}$			
25	$\overline{\text{SEL3}}$			
24	$\overline{\text{SEL4}}$			
23	$\overline{\text{SEL5}}$			
22	$\overline{\text{SEL6}}$			

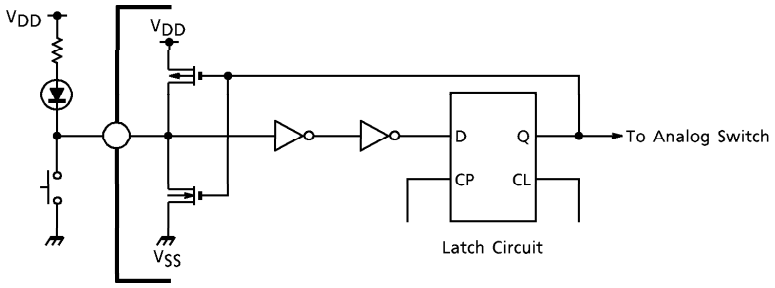
3. TC9209N Pins

PIN No.	SYMBOL	PIN NAME	FUNCTIONS AND OPERATIONS	REMARKS
6	MODE	Tape monitor mode change-over input	The normal operation at "L" level. When this pin is set at "H" level, the tape monitor is automatically turned OFF ($\overline{TMO}$ = "L" level) if the $\overline{SEL}$ input is changed over during the tape monitoring ($\overline{TMO}$ = "H" level). (Auto Monitor OFF Mode)	CMOS input pin.
7	IN-A1	Signal input-1	The analog switch circuit is of 2-circuit and 4-contact type + tape monitor circuit. Compatible with $\overline{SEL}$-N = 1N-N.  	—
21	IN-B1			
8	IN-A2	Signal input-2		
20	IN-B2			
9	IN-A3	Signal input-3		
19	IN-B3			
10	IN-A4	Signal input-4		
18	IN-B4			
11	COM-A1	Recording output pin		
17	COM-B1			
12	IN-AT	Tape monitoring input pin		
16	IN-BT			
13	COM-A2	Signal output pin		
15	COM-B2			
27	$\overline{SEL1}$	Analog switch select input / output	The operation is the same as that of the TC9208N.	With a built-in driver transistor and a pull-down resistor.
26	$\overline{SEL2}$			
25	$\overline{SEL3}$			
24	$\overline{SEL4}$			
23	$\overline{TMI}$	Tape monitor change-over input	Whenever "L" level signal is input, the tape monitor switch is turned ON / OFF repeatedly. When the tape monitor switch is ON, the $\overline{TMO}$ pin becomes "L" level output. The $\overline{TMO}$ pin houses the a driver equivalent to that of the $\overline{SEL}$ pin, LED, etc. can be directly driven.	With a built-in pull-down resistor.
22	$\overline{TMO}$	Tape monitor display output		With a built-in driver transistor.

DESCRIPTION OF OPERATION

1. $\overline{SEL}$ Pins

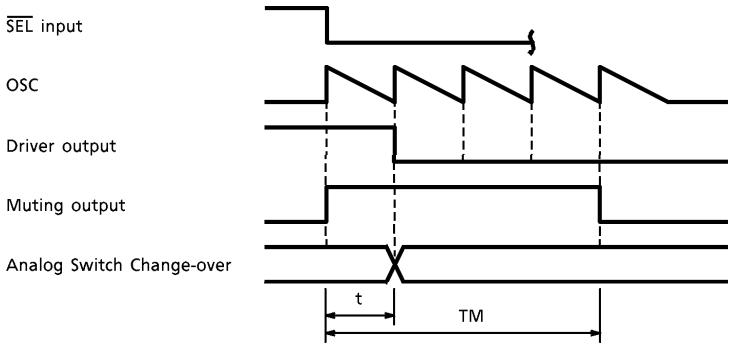
These pin are the analog switch select input and LED driver output I/O pins.
When "L" level signal is input, the driver is turned ON by the internal latch circuit and the pins are fixed at "L" level even when the input key is turned OFF.



As $\overline{SEL1}$ through $\overline{SEL6}$ are mutually reset on the TC9208N and $\overline{SEL1}$ through $\overline{SEL4}$ are mutually reset on the TC9209N, all pins except the input pin are kept OFF.

2. Switch change-over timing and muting output

To prevent abnormal sounds such as pop sound generated when the analog switch is changed over, muting signal is output.
This muting signal output time and $\overline{SEL}$ pin ($\overline{TMI}$ pin and $\overline{SHIFT}$ pin) chattering prevention time are decided by oscillation frequency of the OSC pin.



※ $f_{OSC} = 50Hz$
t : Chattering prevention time = $(1/f_{OSC})$ ≈20ms
TM : Muting time = $(1/f_{OSC}) \times 4 \approx 80ms$

- At time of $\overline{SHIFT}$ input of TC9208N and $\overline{TMI}$ input of TC9209N, the IC operates at the above timings.
- As the multiple input inhibit circuit is built in the $\overline{SEL}$ input pins, if more than 2 $\overline{SEL}$ pins are selected simultaneously, all the analog switches are kept in the OFF state and the muting signal is successively output during the period of that multiple inputs.
Further, if multiple inputs are released, the last input is accepted.
- Oscillation frequency of the OSC pin may vary depending upon fluctuation of IC and supply voltage. (See the attached graph.)

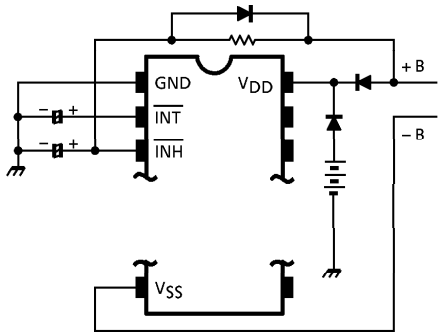
3. Initialization and Backup of Switches

- When the $\overline{INT}$ pin is set at "L" level, the switches are initialized.

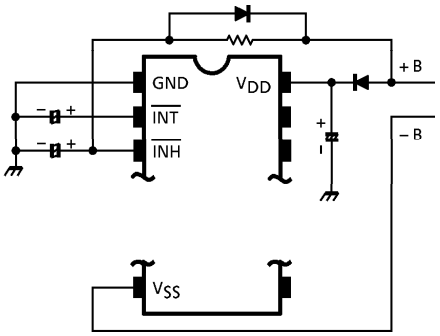
  TC9208N : $\overline{SEL1}$ (IN-1→COM)
  TC9209N : $\overline{SEL1}$ (IN-1→COM1), Tape Monitor OFF

- When the $\overline{INH}$ pin is set at "L" level, all the inputs and outputs are cut off and the IC is placed in the inhibit status. Under this status, the internal circuit scarcely consume current and therefore, the backup for a long time becomes possible. During the backup, it becomes possible to lower V_{DD} to 4.0V.

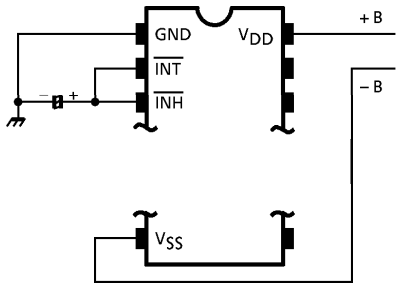
- Backup by Battery, etc.



- Backup by Capacitor

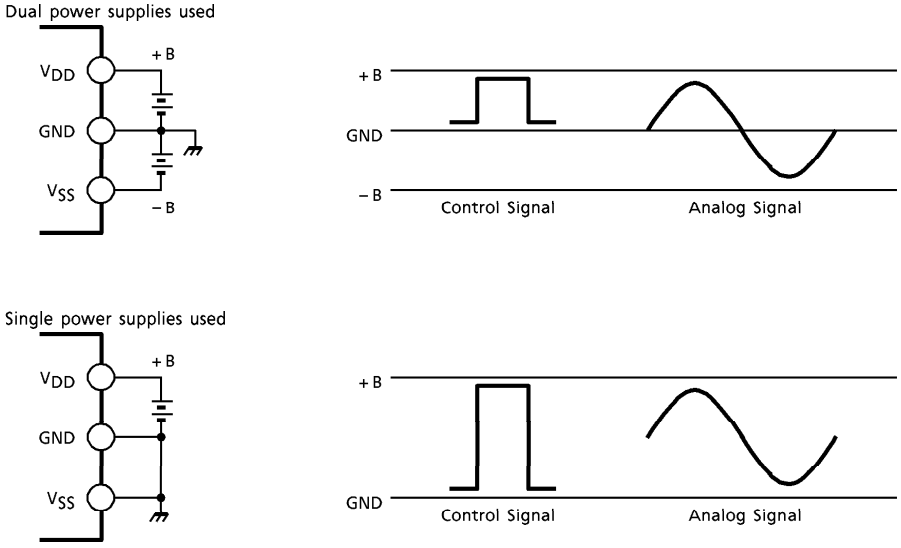


- When no backup is required



4. Power Supply

The separate power supply system is provided for the analog switches and the control unit. The (+) and (−) dual power supplies are used for the analog switches while a single supply is used for the control unit.



(Caution) When a single power supply is used by using the V_{SS} and GND pins commonly, only 1/2 voltage of dual power supplies can be applied as withstanding voltage between V_{DD} and GND is a half of that between V_{DD} and V_{SS}. (V_{DD}-GND≦18V)

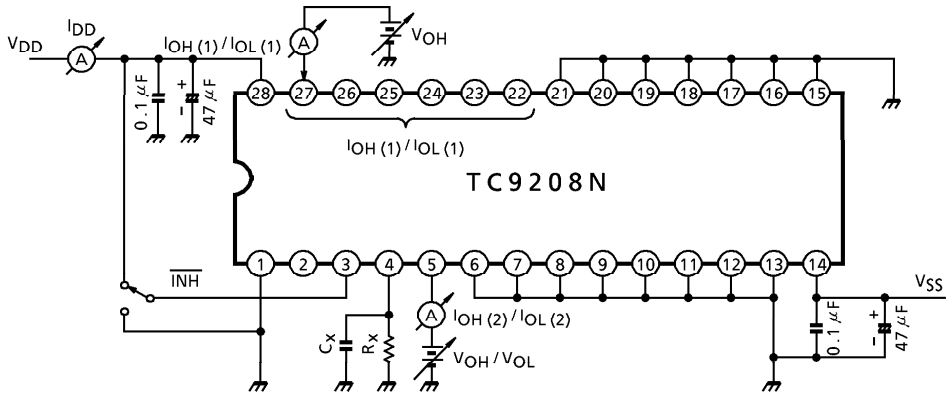
MAXIMUM RATINGS (Ta = 25°C)

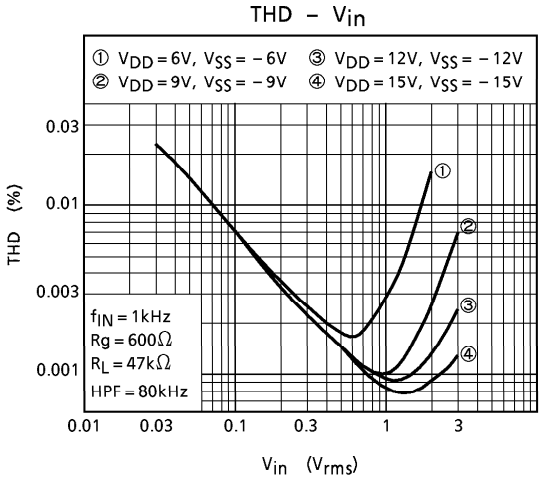
CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage (1)	V_{DD}-V_{SS}	− 0.3~36	V
Supply Voltage (2)	V_{DD}-GND	− 0.3~20	V
Input Voltage	V_{IN}	V_{SS} − 0.3~V_{DD} + 0.3	V
Power Dissipation	P_D	300	mW
Operating Temperature	T_{opr}	− 40~85	°C
Storage Temperature	T_{stg}	− 65~150	°C

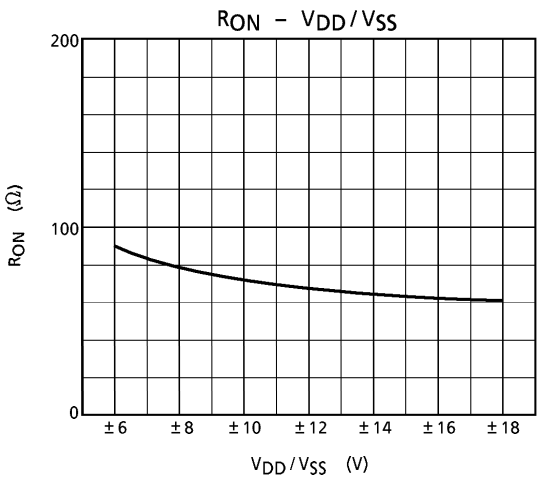
ELECTRICAL CHARACTERISTICS (Unless otherwise specified, V_{DD} = 15V, V_{SS} = -15V, GND = 0V, Ta = 25°C)

CHARACTERISTIC		SYMBOL	TEST CIR-CUIT	TEST CONDITION		MIN.	TYP.	MAX.	UNIT
Operating Supply Voltage (1)		V_{DD}-V_{SS}	—	Dual power supplies operation		16	~	34	V
Operating Supply Voltage (2)		V_{DD}-GND	—	Single power supply operation		8	~	18	V
Operating Supply Current		I_{DD}	1	No Load, No input		—	0.01	1.0	mA
Backup Voltage		V_B	1	Data holding voltage range		4.0	~	18	V
Backup Current		I_B		V_{DD} = 4.0V V_{SS} = GND = 0V		—	1	10	μA
Input Voltage	"H" Level	V_{IH}	—	$\overline{SEL1\sim6}$, ($\overline{TMI}$) $\overline{INT}$, $\overline{INH}$, $\overline{SHIFT}$, (MODE)		V_{DD} × 0.7	~	V_{DD}	V
	"L" Level	V_{IL}				GND	~	V_{DD} × 0.3	
Input Current	"H" Level	I_{IH}	—	$\overline{INH}$ (MODE)	V_{IH} = 15V	− 1.0	—	1.0	μA
	"L" Level	I_{IL}			V_{IL} = 0V	− 1.0	—	1.0	
Input Pull-up Resistance		R_{IN}	—	$\overline{INT}$, $\overline{SHIFT}$		—	47	—	kΩ
Output Current (1)	"H" Level	I_{OH} (1)	1	$\overline{SEL1\sim6}$, ($\overline{TMO}$)	V_{OH} = 14V	—	− 0.3	− 0.1	mA
	"L" Level	I_{OL} (1)			V_{OL} = 5V	15.0	20.0	—	
Output Current (2)	"H" Level	I_{OH} (2)		MUTE	V_{OH} = 14V	—	− 0.3	− 0.1	mA
	"L" Level	I_{OL} (2)			V_{OL} = 5V	0.1	0.3	—	
Operating Frequency		f_{OSC}	—	R_X = 47kΩ, C_X = 0.47μF		—	50	—	Hz
Analog Switch ON Resistance		R_{ON}	—	—		—	80	100	Ω
Analog Switch OFF Leak		I_{OFF}	—	V_{IN} = V_{SS}~V_{DD}		—	—	± 0.1	μA
Overall Harmonic Distortion Factor		THD	—	f_{IN} = 1kHz V_{IN} = 1V_{rms} R_g = 600Ω, R_L = 47kΩ BW = 20Hz~20kHz		—	0.001	—	%
Crosstalk		CT				—	100	—	dB
Noise Output Voltage		V_N				—	1.0	—	μV_{rms}

TEST CIRCUIT-1 (I_{DD}, I_B, I_{OH} / I_{OL})



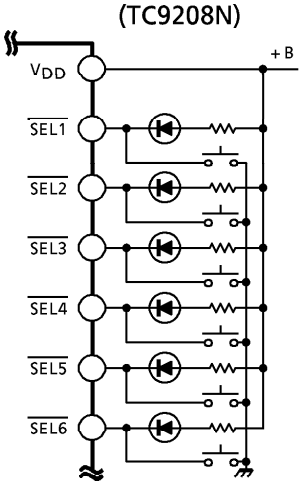




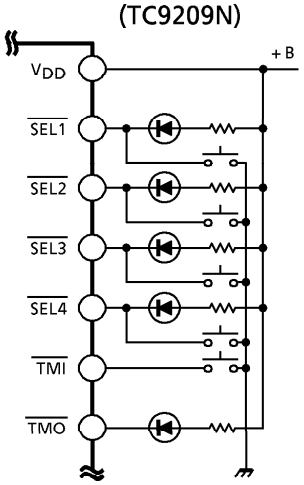
APPLICATION CIRCUIT

1. Example of Direct Select Application Circuit

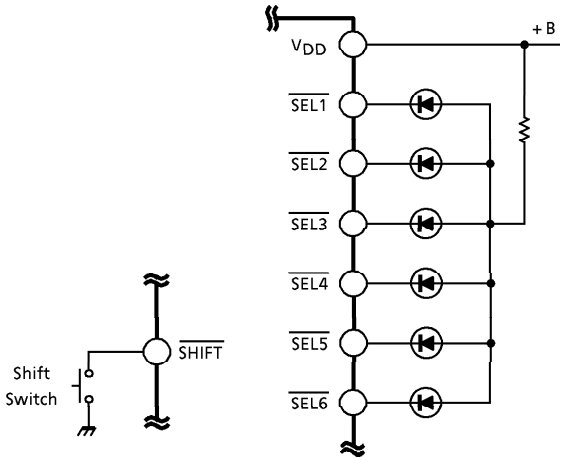
(TC9208N)



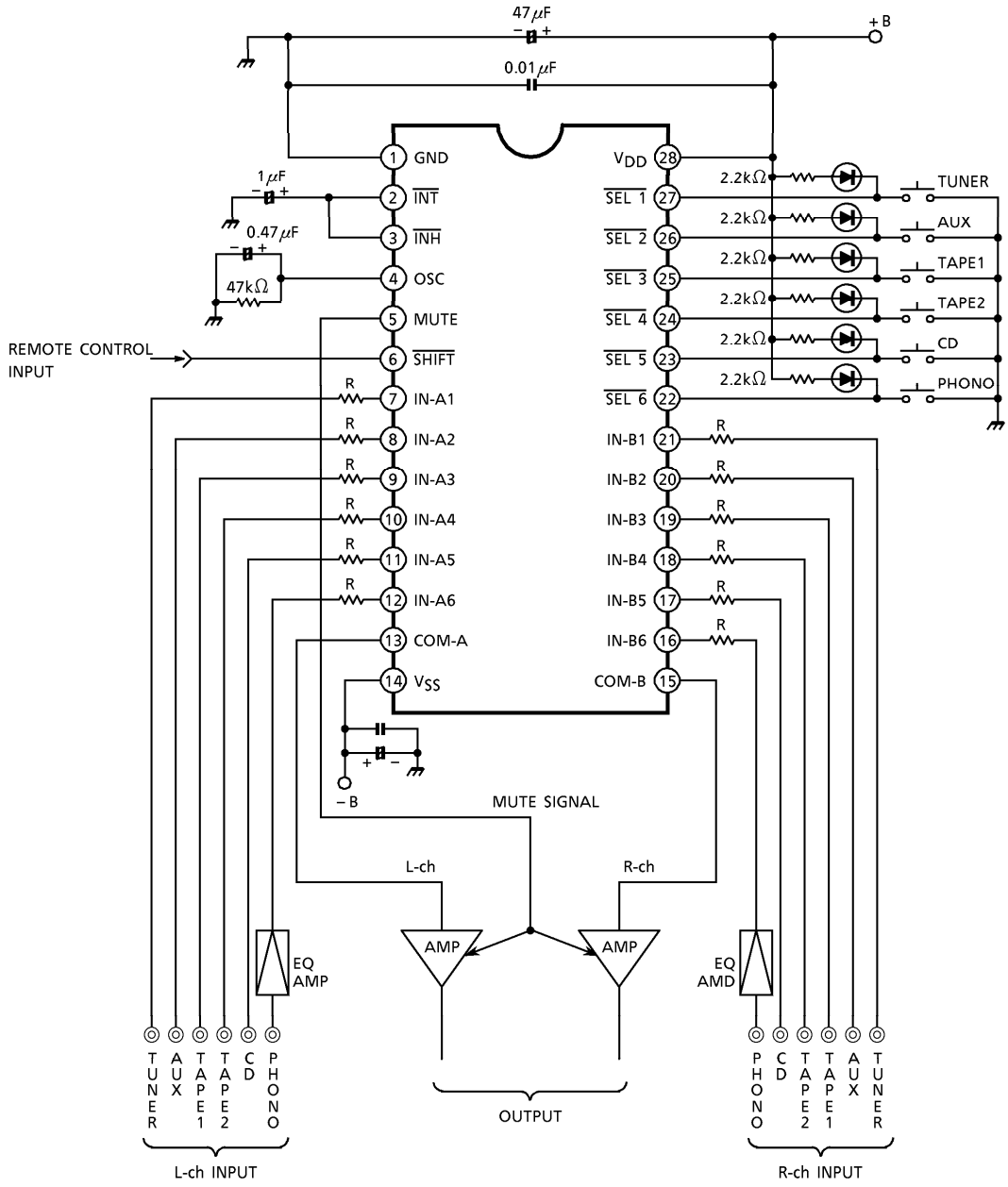
(TC9209N)



2. Example of Application Circuit by $\overline{SHIFT}$ Input (TC9208N)



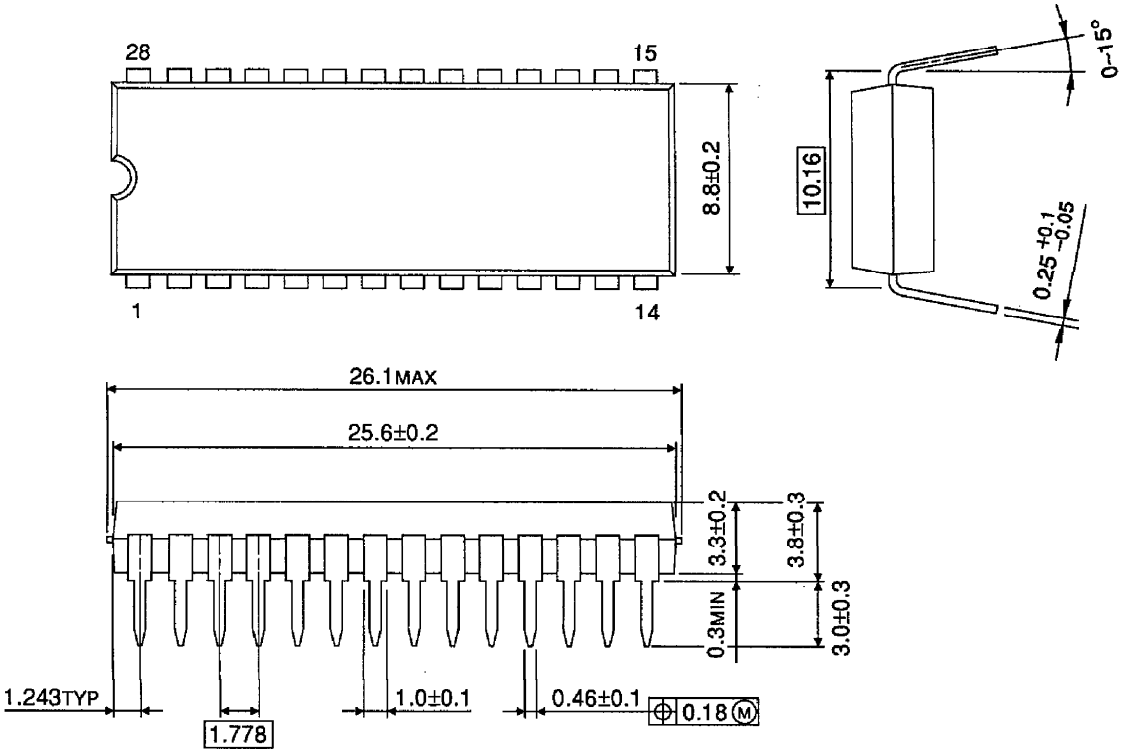
EXAMPLE OF APPLICATION CIRCUIT TC9208N (Not back up mode)



※ This resistor protect IC from over current.
R = 1.2~4.7kΩ

OUTLINE DRAWING

SDIP28-P-400-1.78 Unit : mm



Weight : 2.2g (Typ.)