No.1509A

LC7815H

CMOS LSI

2-Pole 4-Position Analog Function Switch

General Description

The LC7815H is a 2-pole 4-position analog function switch with 2 built-in C-MOS analog switches (LC4066 type). A soft touch of a button enables switchover of the input signal source of an audio amplifier.

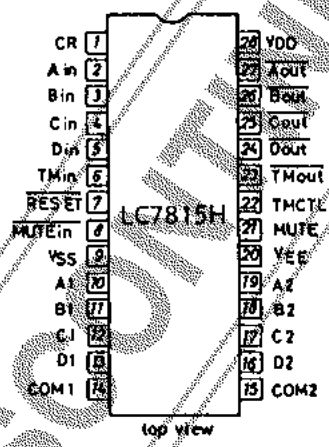
Use

Function switchover of amplifier, receiver, etc. (2 poles 4 positions)

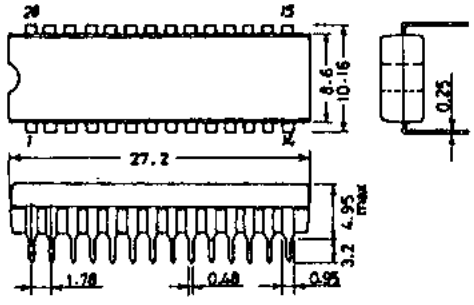
Features

1. Good distortion characteristic because of built-in analog switches of LC4066 type: Distortion 0.01 % max.) V_{in} = 1 Vrms, V_{DD} = 15 to 18V
2. Capable of outputting audio muting control signal to minimize noise to be generated at the time of switchover
3. Built-in controller for tape monitor switchover (using LC4066B together)
4. Built-in driver for LED which displays function mode, tape monitor mode
5. Since control input can be operated from + supply alone when using dual supplies, interface with other circuits can be achieved easily.
6. Since audio muting control signal can be triggered independently from external pin ($\overline{MUTE}_{in}$), audio muting at the time of return from backup can be achieved easily.
7. Control input pin ($\overline{RESET}$) to be used for turning OFF all analog switches
8. Backup can be performed easily because of C-MOS structure. (Backup voltage: 2.4 V min.)
9. Operating voltage: 4.5 to 23 V/single supply, ±4.5 to ±11.5 V/dual supplies.
10. Package: DIP-28S (Shrink type)

Pin Assignment



Case Outline 3029A-D28SIC
(unit: mm)



Specifications and information herein are subject to change without notice.

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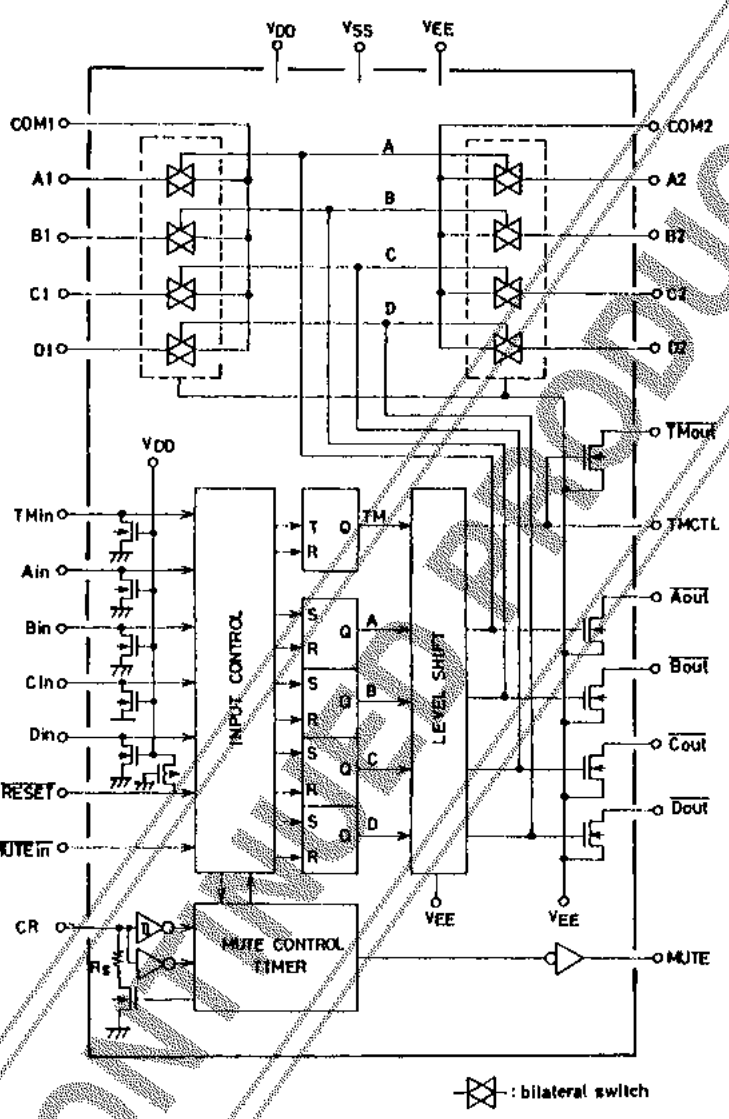
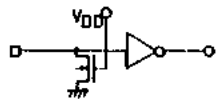
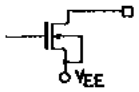
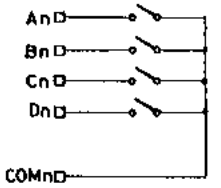
Equivalent Circuit Block Digram

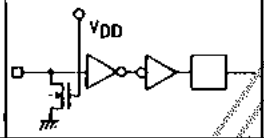
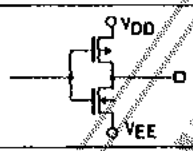
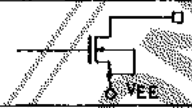
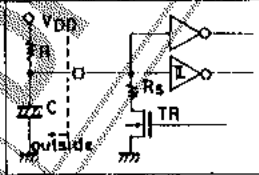
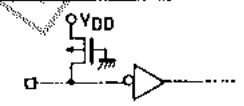


Pin Description

Pin Name	Pin No.	Type of Input/Output	Pin Functions
V_{DD} V_{SS} V_{EE}	28 9 20		• Power supply pins Single supply (+): $V_{SS}=V_{EE}=GND$ Dual supplies (+−): $V_{SS}=GND$, $V_{EE}=(-)V$
A_{in}, B_{in}, C_{in}, D_{in}	2, 3, 4, 5		• Specified input pins for turning ON individual analog switches • Priority order of simultaneous push ($A_{in}>B_{in}>C_{in}>D_{in}$) • Prevention of malfunction attributable to pulse noise (Pulse width is discriminated by muting delay time.)
$\overline{A_{out}}$, $\overline{B_{out}}$, $\overline{C_{out}}$, $\overline{D_{out}}$	27, 26, 25, 24		• Output of driver for LED which displays ON state corresponding to individual analog switches • N channel open drain (Source is connected to V_{EE}.)
A_1, B_1, C_1, D_1 A_2, B_2, C_2, D_2 COM 1 COM 2	10, 11, 12, 13 19, 18, 17, 16 14 15		• A to D: Audio signal input pins • COM: Audio signal output pins • Signal inputs (A to D) conduct according to signal inputs (A_{in} to D_{in}) as follows:

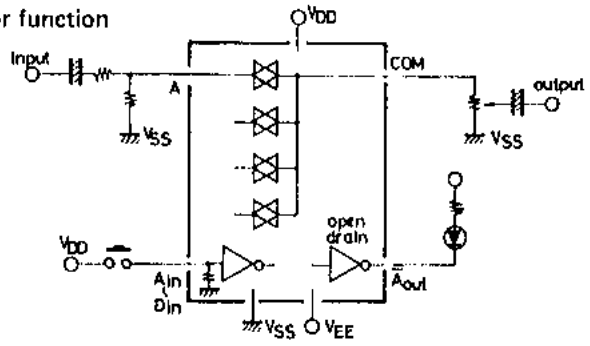
COM output		A_n	B_n	C_n	D_n
Specified input	A_{in}	1	0	0	0
	B_{in}	*	1	0	0
	C_{in}	*	*	1	0
	D_{in}	*	*	*	1

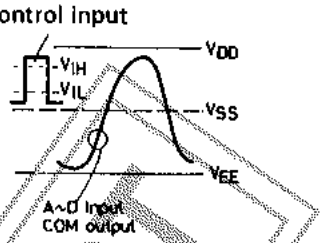
* Don't care.

TM_{in}	6		• Input pin for specifying tape monitor mode ON/OFF • Rise of input signal is detected; monitor mode ON/OFF are inverted to monitor mode OFF/ON respectively.
TMCTL	22		• Output pin for controlling external analog switch (LC4066B) for tape monitor • Source of N channel transistor of complementary buffer output is connected to V_{EE}.
$\overline{TM_{out}}$	23		• Output pin for driver for LED which displays tape monitor state as well as external analog switch (LC4066B) for tape monitor • $\overline{TM_{out}}$ is opposite in polarity to TMCTL.
$\overline{MUTE_{in}}$	8		• Input pin for forcing audio muting control signal (MUTE) to be triggered externally • If fixed at 'L' level, MUTE output becomes 'H' level.
MUTE	21		• Output pin for audio muting control signal • Signal with pulse width to be determined by external constant at CR pin is outputted at the time of function switchover or $\overline{MUTE_{in}}$ input.
CR	1		• CR time constant pin for determining time interval of audio muting control signal • Time lag (muting delay) between muting signal rise and analog switch switchover depends on $C{\cdot}R_S$ time constant at the time of transistor ON.
$\overline{RESET}$	7		• Input pin for turning OFF all analog switches and resetting tape monitor flip-flop ('L' level active)

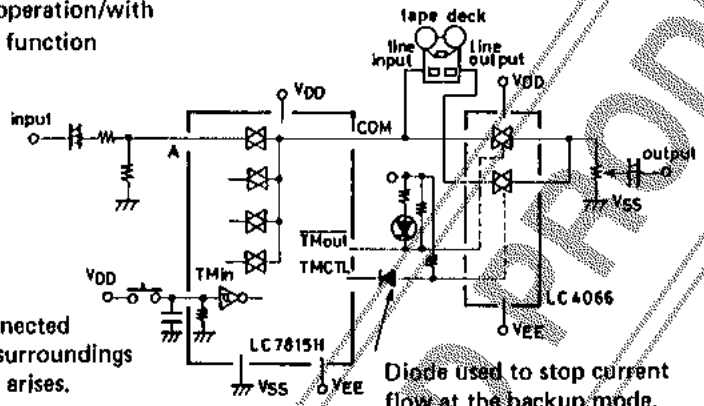
■ Application Circuits

1. Dual-supply operation/without tape monitor function





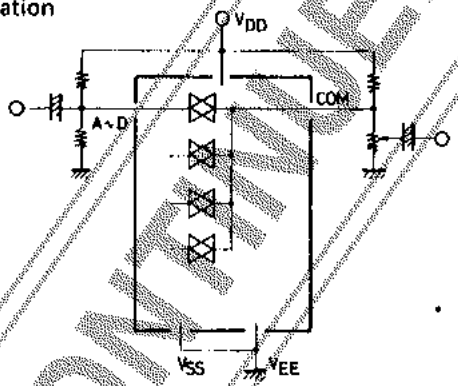
2. Dual-supply operation/with tape monitor function

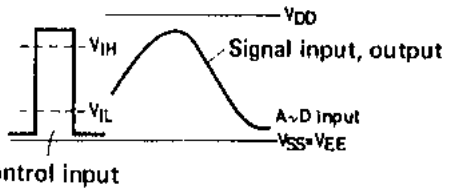


A capacitor is connected when used in the surroundings where much noise arises.

Diode used to stop current flow at the backup mode.

3. Single-supply operation

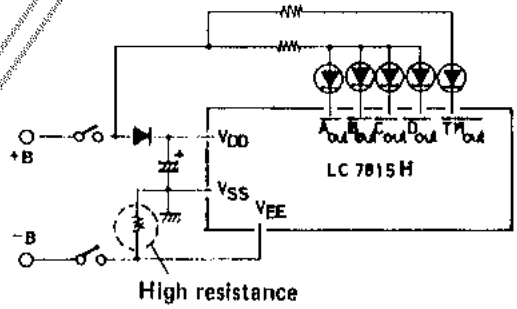




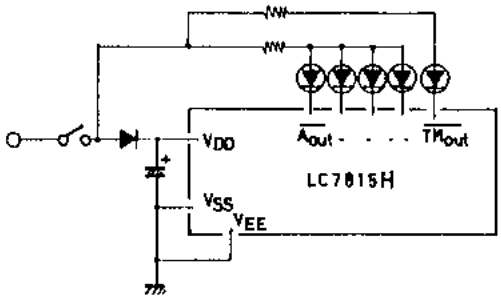
- For using tape monitor function, make connection as shown in 2 above.

4. Backup

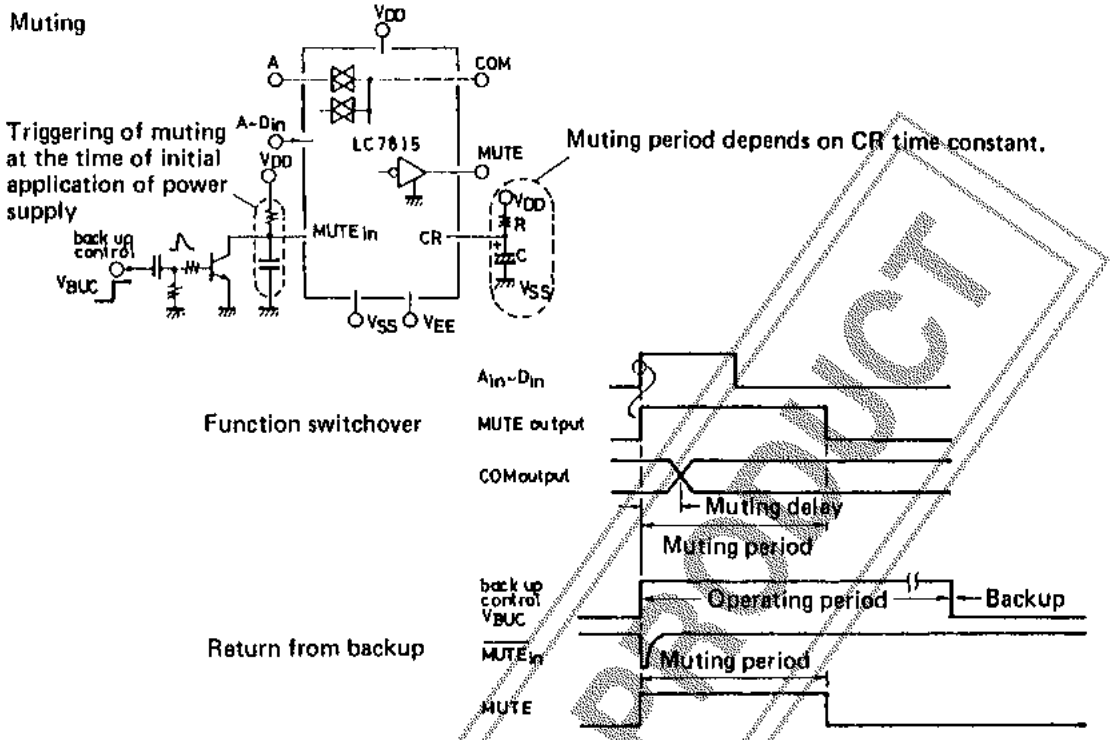
(1) Dual-supply operation



(2) Single-supply operation



5. Muting



Absolute Maximum Ratings/Ta=25 ±2°C

Maximum Supply Voltage	$V_{DD}max$		V_{SS}−0.3 to V_{EE}+25		V
	V_{EE}		V_{DD}−25 to V_{SS}+0.3		V
Output Current	I_{OUT}	$\overline{A_{out}}$, $\overline{B_{out}}$, $\overline{C_{out}}$, $\overline{D_{out}}$, $\overline{TM_{out}}$	30		mA
Output Voltage	V_{OUT}	$\overline{A_{out}}$, $\overline{B_{out}}$, $\overline{C_{out}}$, $\overline{D_{out}}$, $\overline{TM_{out}}$	V_{EE}−0.3 to V_{DD}+0.3		V
Allowable Power Dissipation	$P_d max$	Ta≦85°C	350		mW
Voltage Difference at analog switch ON	ΔV_{on}	Switch ON	0.5		V
Operating Temperature	T_{opg}		−40 to +85		°C
Storage Temperature	T_{stg}		−40 to +125		°C

Allowable Operating Ranges/Ta=−40~+85°C

		Pin No.		min	typ	max	unit
Supply Voltage	V_{DD1}	V_{DD}(28)	V_{EE}≦V_{SS}	V_{SS}+4.5		V_{EE}+23	V
	V_{EE}	V_{EE}(20)	V_{DD}≧V_{SS}+4.5V	V_{DD}−23		V_{SS}	V
	V_{DD2}	V_{DD}(28)	Backup	V_{SS}+2.4		V_{SS}+23	V
'H' Level Input Voltage	V_{IH1}	A_{in}(2) to D_{in}(5), $\overline{RESET}$(7), $\overline{MUTE}_{in}$(8)	V_{EE}≦V_{SS}	0.75V_{DD}		V_{DD}	V
	V_{IH2}	TM_{in}(6)		0.8V_{DD}		V_{DD}	V
'L' Level Input Voltage	V_{IL1}	A_{in}(2) to D_{in}(5), $\overline{RESET}$(7), $\overline{MUTE}_{in}$(8)		V_{SS}		0.25V_{DD}	V
	V_{IL2}	TM_{in}(6)		V_{SS}		0.2V_{DD}	V
Analog Switch Input Voltage	V_{IN}	A_1(10) to D_1(13), A_2(19) to D_2(16)		V_{EE}		V_{DD}	V
External Capacitance for Muting Timer	C	CR(1)				10	μF
External Resistance for Muting Timer	R	CR(1)	V_{DD}−V_{SS}=4.5V	40		100	kΩ
			14>V_{DD}−V_{SS}≧9V	80		300	kΩ
External Resistance for Muting Timer	R	CR(1)	18>V_{DD}−V_{SS}≧14V	90		300	kΩ
			23>V_{DD}−V_{SS}≧18V	100		300	kΩ

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						unit
Input Receiving Pulse Width	T_{IN}	A_{in}(2) to D_{in}(5), TM_{in}(6)	V_{DD}=9V, C=3.3μF, R=220kΩ	120		ms

Electrical Characteristics/Ta=25 ±2°C, V_{SS}=0V

		Pin No.		min	typ	max	unit
'H' Level Output Voltage	V_{OH1}	TMCTL(22)	I_{OH}=−0.1mA V_{DD}=4.5 to 23V	0.8V_{DD}		V_{DD}	V
	V_{OH2}	MUTE(21)	I_{OH}=−0.4mA, V_{DD}=4.5V	V_{DD}−1.5		V_{DD}	V
			I_{OH}=−0.4mA, V_{DD}=9V	V_{DD}−0.5		V_{DD}	V
'L' Level Output Voltage	V_{OL1}	TMCTL(22)	I_{OL}=0.1mA	V_{EE}		0.2 (V_{DD}−V_{EE})	V
	V_{OL2}	MUTE(21)	I_{OL}=0.4mA, V_{DD}=4.5V	0		1.5	V
			I_{OL}=0.4mA, V_{DD}=9V	0		0.5	V
	VOL3	$\overline{A_{out}}$(27), $\overline{B_{out}}$(26), $\overline{C_{out}}$(25), $\overline{D_{out}}$(24), $\overline{TM_{out}}$(23)	I_{OL}=7mA, V_{DD}−V_{EE}=4.5V	V_{EE}		V_{EE}+2	V
			I_{OL}=30mA, V_{DD}−V_{EE}=9V	V_{EE}		V_{EE}+4	V
			I_{OL}=30mA, V_{DD}−V_{EE}=18V	V_{EE}		V_{EE}+2	V
Analog Switch ON Resistance	R_{ON}	A_1(10), B_1(11), C_1(12), D_1(13), COM1(14), A_2(19), B_2(18), C_2(17), D_2(16) COM2(15)	I=1mA, V_{DD}−V_{EE}=4.5V		400	1000	Ω
			I=1mA, V_{DD}−V_{EE}=9V		120	300	Ω
			I=1mA, V_{DD}−V_{EE}=18V		80	200	Ω
			I=1mA, V_{DD}−V_{EE}=23V		70	180	Ω
'H' Level Input Current	I_{IH1}	A_{in}(2), B_{in}(3), C_{in}(4), D_{in}(5), TM_{in}(6)	V_{IN}=V_{DD}, V_{DD}=9V	20		90	μA
			V_{IN}=V_{DD}, V_{DD}=11.5V	40		160	μA
	I_{IH2}	$\overline{MUTE_{in}}$(8)	V_{IN}=V_{DD}=18V			10	μA
'L' Level Input Current	I_{IL1}	$\overline{RESET}$(7)	V_{IN}=V_{DD}, V_{DD}=9V	−90		−20	μA
			V_{IN}=V_{DD}, V_{DD}=11.5V	−160		−40	μA
	I_{IL2}	$\overline{MUTE_{in}}$(8)	V_{IN}=V_{SS}	−10			μA
Input/Output OFF Leak Current	I_{OFF1}	$\overline{A_{out}}$(27) to $\overline{D_{out}}$(24) $\overline{TM_{out}}$(23)	Output transistor OFF Vo=V_{EE}+18V			10	μA
			Output transistor OFF Vo=V_{EE}+23V			20	μA
	I_{OFF2}	CR(1)	Output transistor OFF Vo=V_{SS}+18V			3	μA
			Output transistor OFF Vo=V_{SS}+23V			100	μA
	I_{OFF3}	A_1(10) to D_1(13), COM1(14), A_2(19) to D_2(16), COM2(15)	Analog switch OFF V_{IN}, V_o=V_{EE} to 18V	−10		10	μA
Input Floating Voltage	V_{IF1}	A_{in}(2) to D_{in}(5), TM_{in}(6)	V_{DD}=4.5 to 23V			0.75	V
	V_{IF2}	$\overline{RESET}$(7)	V_{DD}=4.5 to 23V	V_{DD}−0.75			V
Total Harmonic Distortion	THD_1	COM1(14), COM2(15)	V_{IN}=1Vrms, f=1kHz, V_{DD}−V_{EE} =15V to 23V, Refer to Fig. 1			0.01	%
	THD_2	COM1(14), COM2(15)	V_{IN}=0.1Vrms, f=1kHz, V_{DD} −V_{EE}=4.5V, Refer to Fig. 1.			0.05	%
Feedthrough (Switch OFF)	FTH	A_1(10) D_1(13) to COM1(14)	V_{DD}−V_{EE}=18V, F=10kHz V_{in}=0.77Vrms, Refer to Fig. 2, R_L=47kΩ	55			dB
		A_2(19) D_2(16) to COM2(15)					

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				min	typ	max	unit
Crosstalk	CRO	A_1(10), D_1(13) to COM2(15) A_2(19), D_2(16) to COM1(14)	$V_{DD}-V_{EE}$=23V, f=10kHz V_{in}=0.77Vrms, Refer to Fig. 3 R_L=47kΩ		75		dB
Muting period	T_{M1}	MUTE(21)	V_{DD}=9V, Refer to Fig. 4. C=3.3μF ±20%, R=220kΩ ±5%	350	580	1000	ms
	T_{M2}	MUTE(21)	V_{DD}=9V, C=3.3μF ±0%, R=220kΩ ±0%	450	580	800	ms
Switch Switchover Delay Time	T_{SWD}	A_{in}(2) to D_{in}(5), TM_{in}(6)	V_{DD}=9V, Refer to Fig. 5. C=3.3μF, R=220kΩ	30	50	120	ms
Supply Current	I_{DD1}	V_{DD}(28)	Operating, Refer to Fig. 6. $V_{DD}-V_{EE}$=23V			1000	μA
	I_{DD2}	V_{DD}(28)	Backup, V_{DD}=5V, V_{SS}=V_{EE}			3	μA

Fig. 1 Total harmonic distortion

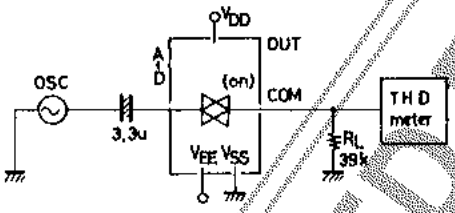
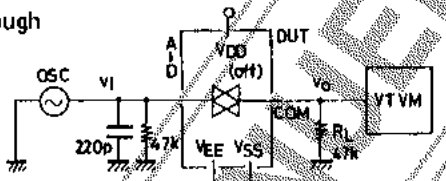


Fig. 2 Feedthrough

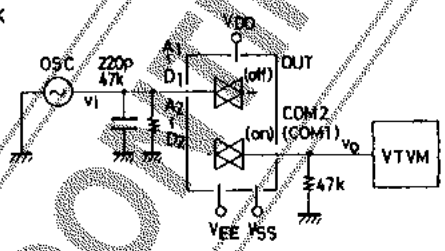


$$FTH = 20 \log \frac{V_O}{V_I} \quad (dB)$$

V_I = 770mVrms

$V_{DD} - V_{EE}$ = 18V

Fig. 3 Crosstalk



$$CT = 20 \log \frac{V_O}{V_I} \quad (dB)$$

V_I = 770mVrms

$V_{DD} - V_{EE}$ = 18V

Fig. 4 Muting period

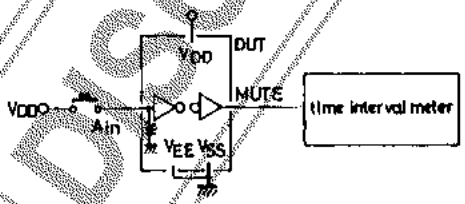
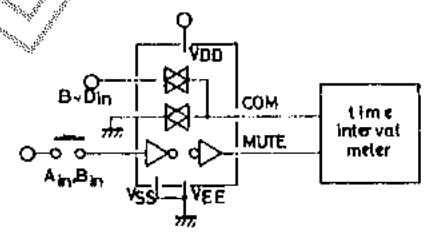
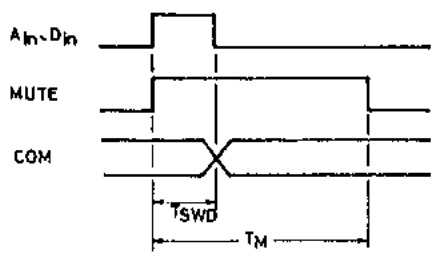


Fig. 5 Switch switchover delay time





T_M: Muting period

T_{SWD}: Switch switchover delay time

Fig. 6 Supply current