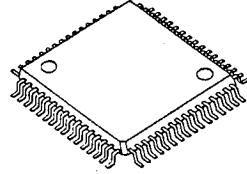


8 × 32 ANALOG CROSS POINT SWITCH■ **GENERAL DESCRIPTION**

The NJU7370 is a 8 × 32 Analog Cross Point Switch which consists of a 8 × 32 analog switch array, an address decoder and a latch circuit.

ON(short mode) or OFF(open mode) of 256 points in a 8 × 32 switch array are easily controlled by setting the address. The power supplies for the logic block and for the switch block are separated, therefore the supply voltage for the switches can be adjusted corresponding to the input signal level.

The small tolerance of the on-resistance of the switches causes to be suitable for a small input selector of audio appliances or other appliances.

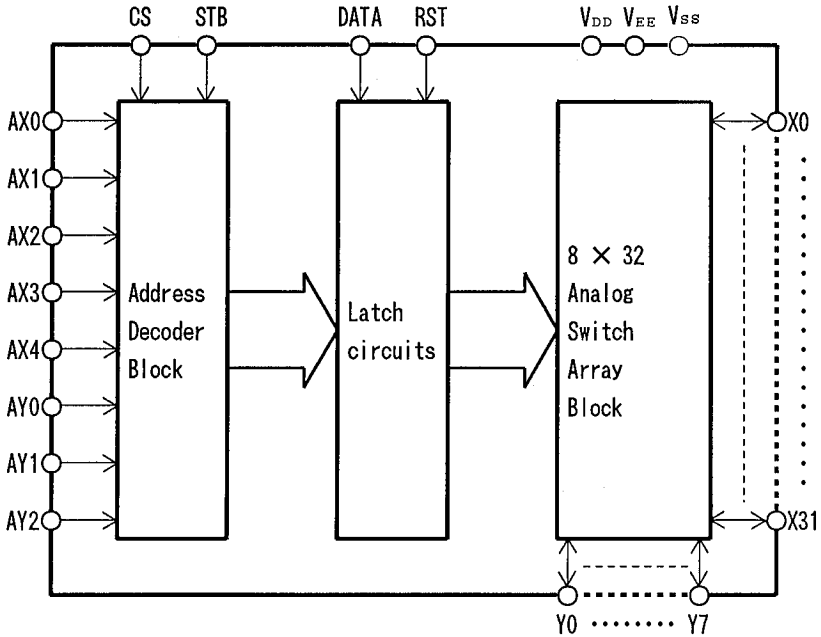
■ **PACKAGE OUTLINE**

NJU7370F

■ **FEATURES**

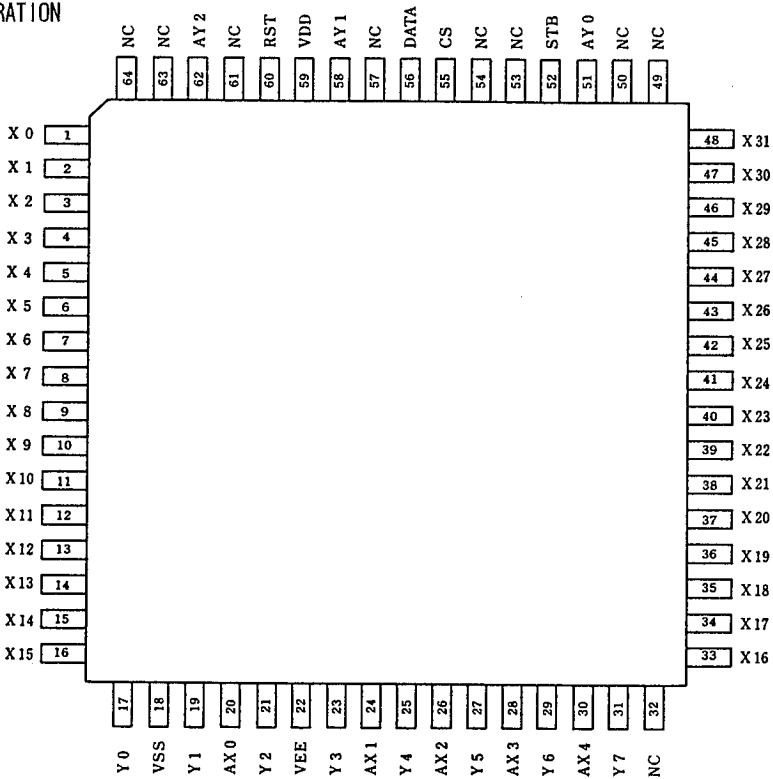
- 8 × 32 Analog Switches Array
- Low On-Resistance of switches 100Ω MAX
 ($V_{EE}-V_{SS}=10V$)
- Tolerance of On-Resistance 20Ω MAX
- Low Distortion (T.H.D) 0.01% TYP
- Address Decoder and Latch circuits on chip
- Wide Operating Voltage Range $V_{DD}-V_{SS}=6V$
 (Logic Block)
 $V_{DD}-V_{EE}=11V$
 (Switch Block)
- Low Operating Current 1μA MAX
 ($V_{IN}=V_{DD}$ OR $V_{IN}=V_{SS}$)
- Package Outline --- QFP64
- C-MOS Technology

■ BLOCK DIAGRAM



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■ PIN CONFIGURATION



■ TERMINAL DESCRIPTION

| No. | SYMBOL | F U N C T I O N |
|-------------------------------|-------------------------|---|
| 59 | V _{DD} | LOGIC/Switch Power Source (+) |
| 18 | V _{SS} | LOGIC Power Source (GND) |
| 22 | V _{EE} | Switch Power Source (-) |
| 55 | CS | Chip Select Signal Input |
| 52 | STB | Strobe Signal Input |
| 56 | DATA | Switch ON/OFF Signal Input |
| 60 | RST | Master Reset Signal Input |
| 20,24 | AX0~AX1 | X0~X1 Address Signal Input |
| 26,28,30 | AX2~AX4 | X2~X4 Address Signal Input |
| 51,58,62 | AY0~AY2 | Y0~Y2 Address Signal Input |
| 1~16 33~48 | X0 ~X15 X16~X31 | X0~X31 Analog Switches Array Input/Output |
| 17,19,21 23,25 27,29,31 | Y0~Y2 Y3~Y4 Y5~Y7 | Y0~Y7 Analog Switches Array Input/Output |

FUNCTIONAL DESCRIPTION
(1) Address Decoder Block

The address decoder block decodes AX0~AX4 of X side and AY0~AY2 of Y side to 32 lines of X side and 8 lines of Y side, then the decoded signals select a switch out of the 8 × 32 analog switches array. The address can be set when an input signal condition to CS terminal is High level.

Following table shows address decoding.

| AX0 | AX1 | AX2 | AX3 | AX4 | AY0 | AY1 | AY2 | Connection |
|-----|-----|-----|-----|-----|-----|-----|-----|------------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X0 - Y0 |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | X1 - Y0 |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | X2 - Y0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | X3 - Y0 |
| 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | X4 - Y0 |
| 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | X5 - Y0 |
| 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | X6 - Y0 |
| 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | X7 - Y0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | X8 - Y0 |
| 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | X9 - Y0 |
| 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | X10 - Y0 |
| 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | X11 - Y0 |
| 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | X12 - Y0 |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | X13 - Y0 |
| 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | X14 - Y0 |
| 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | X15 - Y0 |
| 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | X16 - Y0 |
| 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | X17 - Y0 |
| 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | X18 - Y0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | X19 - Y0 |
| 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | X20 - Y0 |
| 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | X21 - Y0 |
| 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | X22 - Y0 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | X23 - Y0 |
| 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | X24 - Y0 |
| 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | X25 - Y0 |
| 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | X26 - Y0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | X27 - Y0 |
| 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | X28 - Y0 |
| 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | X29 - Y0 |
| 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | X30 - Y0 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | X31 - Y0 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | X0 - Y1 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | X31 - Y1 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | X0 - Y2 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | X31 - Y2 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | X0 - Y3 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | X31 - Y3 |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | X0 - Y4 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | X31 - Y4 |
| 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | X0 - Y5 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | X31 - Y5 |
| 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | X0 - Y6 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | X31 - Y6 |
| 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | X0 - Y7 |
| ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ | ↓ |
| 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | X31 - Y7 |

(2) Latch Circuits

Analog data are loaded when each input signal condition to CS and STB terminals is High level, and their data are latched when an input signal to STB terminal falls from High to Low. The condition of a switch becomes ON when the latched data is High, and it becomes OFF when the latched data is Low. When the input signal condition to RST terminal is High, the latch circuits are reset and all switches become OFF.

(3) 8 × 32 Analog Switch Array Block

The analog switch array consisted of 8 × 32 switches are controlled by the output signals from latch circuits.

■ ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATINGS | UNIT |
|-----------------------------|-----------------|------------------------------|------|
| Supply Voltage | $V_{DD}-V_{SS}$ | - 0.3 ~ +14.0 | V |
| | $V_{DD}-V_{EE}$ | - 0.3 ~ +14.0 | |
| | $V_{SS}-V_{EE}$ | - 0.3 ~ +14.0 | |
| Analog Input Voltage | V_{INA} | $V_{EE}-0.3 \sim V_{DD}+0.3$ | V |
| Digital Input Voltage | V_{IN} | $V_{SS}-0.3 \sim V_{DD}+0.3$ | V |
| Input Current | I_{IN} | ± 15 | mA |
| Power Dissipation | P_D | 300 | mW |
| Operating Temperature Range | T_{OPR} | - 25 ~ + 75 | °C |
| Storage Temperature Range | T_{STG} | - 40 ~ +125 | °C |

■ ELECTRICAL CHARACTERISTICS

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·DC CHARACTERISTICS

 ($V_{DD}=10V, V_{SS}=V_{EE}=0V, T_a=25^\circ C$)

| PARAMETER | SYMBOL | RATINGS | MIN | TYP | MAX | UNIT |
|----------------------------|-----------------|---|--------------|---------|--------------|---------|
| Operating Voltage Range | $V_{DD}-V_{SS}$ | | 4.5 | 5.0 | 6.0 | V |
| | $V_{DD}-V_{EE}$ | | 4.5 | 10.0 | 11.0 | |
| Analog Input Voltage | V_{INA} | | V_{EE} | | V_{DD} | V |
| Digital Input Voltage | V_{IN} | | V_{SS} | | V_{DD} | V |
| Operating Current | I_{DD1} | Digital Input Terminal, $V_{IN}=V_{SS}$ or V_{DD} | | 1 | 100 | μA |
| | I_{DD2} | Digital Input Terminal, $V_{IN}=2.4V+V_{SS}$ $V_{DD}=10V, V_{SS}=5V, V_{EE}=0V$ | | 0.4 | 1.5 | mA |
| | I_{DD3} | Digital Input Terminal, $V_{IN}=3.4V$ | | 5 | 15 | mA |
| Switch OFF Leakage Current | I_{OFF} | $ V_{Xi}-V_{Yj} =V_{DD}-V_{EE}$ | | ± 1 | ± 500 | nA |
| Low-Level Input Voltage | V_{IL} | $V_{DD}=10V, V_{SS}=5V, V_{EE}=0V$ | | | $0.8+V_{SS}$ | V |
| High-Level Input Voltage | V_{IH} | $V_{DD}=10V, V_{SS}=5V, V_{EE}=0V$ | $2.0+V_{SS}$ | | | V |
| Input Leakage Current | I_{LEAK} | | | 0.1 | 10 | μA |

·SWITCH CHARACTERISTICS

 ($V_{DD}=5V, V_{SS}=0V, V_{EE}=-5V, |V_{Xi}-V_{Yj}|=0.4V, T_a=25^\circ C$)

| PARAMETER | SYMBOL | RATINGS | MIN | TYP | MAX | UNIT |
|----------------------------|-----------------|--|-----|-----|-----|----------|
| ON-Resistance | R_{ON1} | $V_{DD}-V_{EE}=10V$ | | 80 | 100 | Ω |
| | R_{ON2} | $V_{DD}-V_{EE}=5V$ | | 200 | 250 | |
| Deviation of ON-Resistance | ΔR_{ON} | $V_{DD}=10V, V_{SS}=V_{EE}=0V,$ $V_{DC}=V_{DD}/2$ | | 10 | 20 | Ω |

SWITCHING CHARACTERISTICS

 $(V_{DD}=5V, V_{SS}=0V, V_{EE}=-5V, T_a=25^\circ C)$

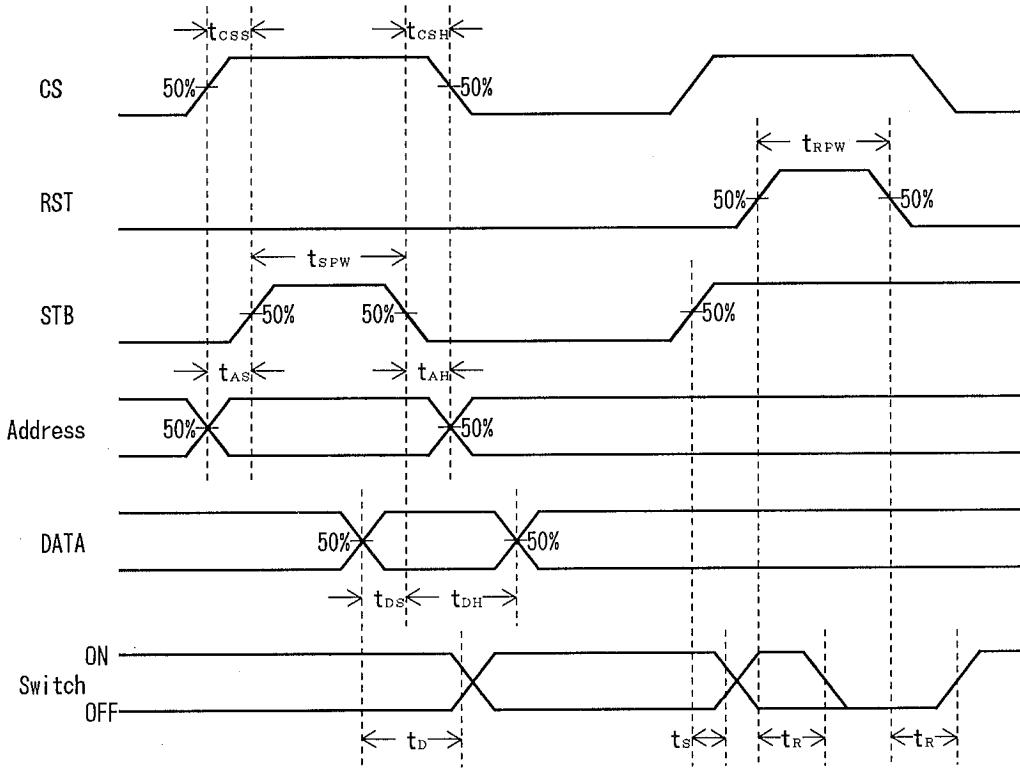
| PARAMETER | SYMBOL | R A T I N G S | | MIN | TYP | MAX | UNIT |
|-------------------------------------|-------------|--|------------------------------------|-----|------|-----|------|
| Input Capacitance | C_s | X, Y Terminal $f=1\text{MHz}$, Switch OFF | | | 15 | | pF |
| Maximum Transmitting Frequency (ON) | F_{MAX} | Switch ON; $V_{INA}=2V_{PP}$ Sign wave; $R_L=1k\Omega$ | | | 45 | | MHz |
| Total Harmonic Distortion Ratio | THD | Switch ON; $V_{INA}=2V_{PP}$ Sign wave; $f=1\text{kHz}$, $R_L=1k\Omega$ | | | 0.01 | | % |
| Feed Threw (OFF) | FDT | All Switch OFF; $V_{INA}=2V_{PP}$ Sign wave; $f=1\text{kHz}$, $R_L=1k\Omega$ | | | -95 | | dB |
| Cross Talk | X_{talk1} | $V_{INA}=2V_{PP}$ | $f=10\text{MHz}$, $R_L=75\Omega$ | | -45 | | dB |
| | X_{talk2} | | $f=10\text{kHz}$, $R_L=600\Omega$ | | -90 | | |
| | X_{talk3} | | $f=10\text{kHz}$, $R_L=1k\Omega$ | | -85 | | |
| | X_{talk4} | | $f=1\text{kHz}$, $R_L=10k\Omega$ | | -80 | | |
| Transmitting Time | tps | $R_L=1k\Omega$; $C_L=50\text{pF}$ | | | | 30 | ns |

AC CHARACTERISTICS

 $(V_{DD}=5V, V_{SS}=0V, V_{EE}=-5V, T_a=25^\circ C)$

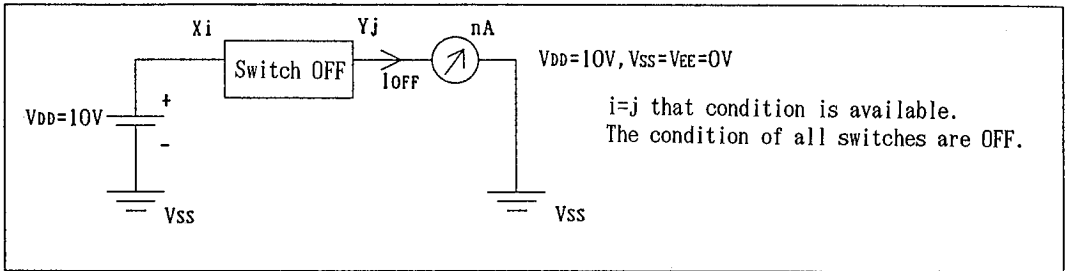
| PARAMETER | SYMBOL | R A T I N G S | | MIN | TYP | MAX | UNIT | |
|------------------------------------|-------------|--|----|-----|-----|-----|------|----|
| Cross Talk on Control Input Signal | CX_{talk} | $V_{IN}=3V$, Square wave $R_{IN}=1k\Omega$, $R_L=10k\Omega$ | | | 30 | | mVpp | |
| Input Capacitance | C_{DI} | $f=1\text{MHz}$, Control Terminals | | | 10 | | pF | |
| Switching Frequency | F_o | | | | | 20 | MHz | |
| Data Setup Time | t_{DS} | $R_L=1k\Omega$, $C_L=50\text{pF}$ | | 0 | | | ns | |
| Data Hold Time | t_{DH} | | | 60 | | | | ns |
| Address Setup Time | t_{AS} | | | 0 | | | | ns |
| Address Hold Time | t_{AH} | | | 60 | | | | ns |
| CS Setup Time | t_{CSS} | | | 0 | | | | ns |
| CS Hold Time | t_{CSH} | | | 60 | | | | ns |
| Strobe Pulse Width | t_{SPW} | | | 30 | | | | ns |
| Reset Pulse Width | t_{RPW} | | | 40 | | | | ns |
| Strobe Transmitting Time | t_s | | | | 80 | | 150 | ns |
| Data Transmitting Time | t_d | | | | 50 | | 100 | ns |
| Latch Reset Time | t_r | | 35 | | 100 | ns | | |

■ Timing Diagram

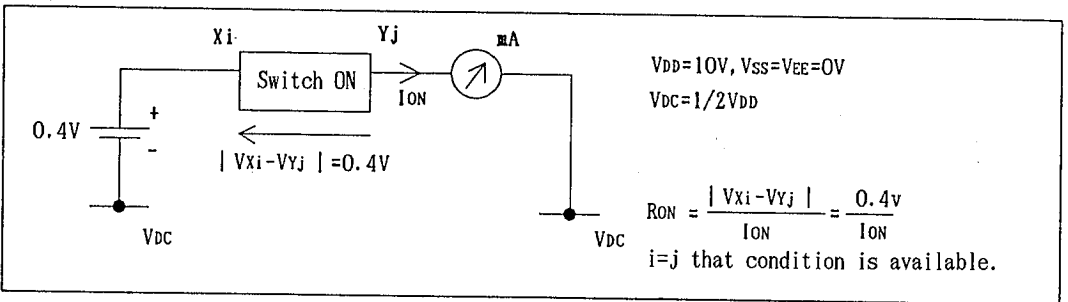


■ MEASUREMENT CIRCUITS

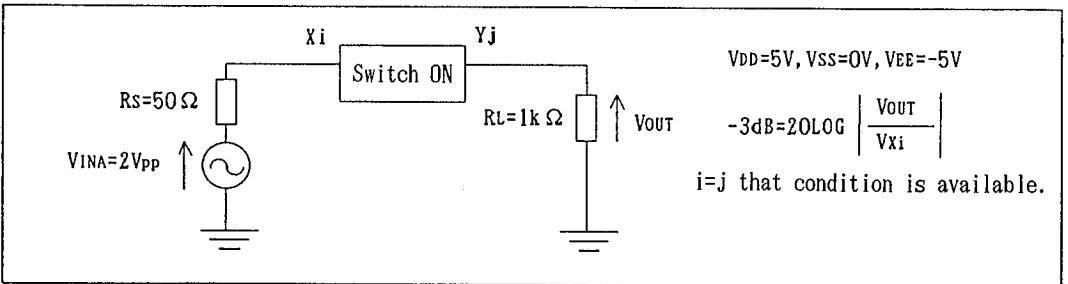
(1) OFF LEAKAGE(I_{OFF}) MEASUREMENT CIRCUIT



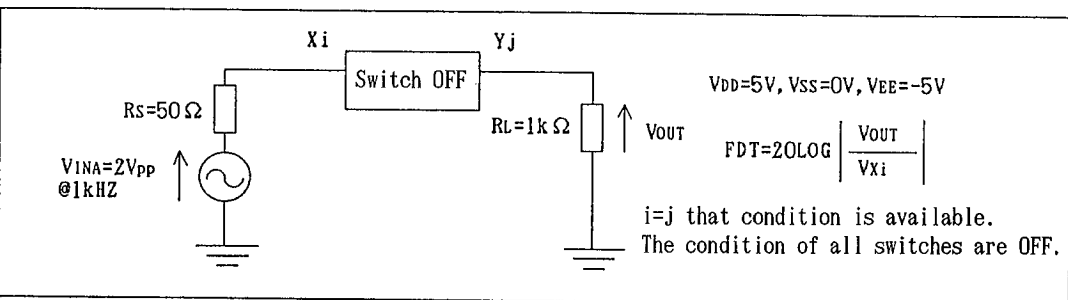
(2) $R_{ON}/\Delta R_{ON}$ MEASUREMENT CIRCUIT



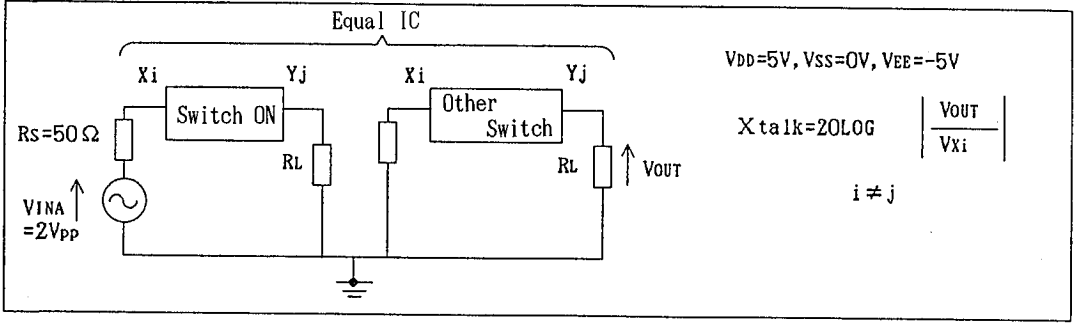
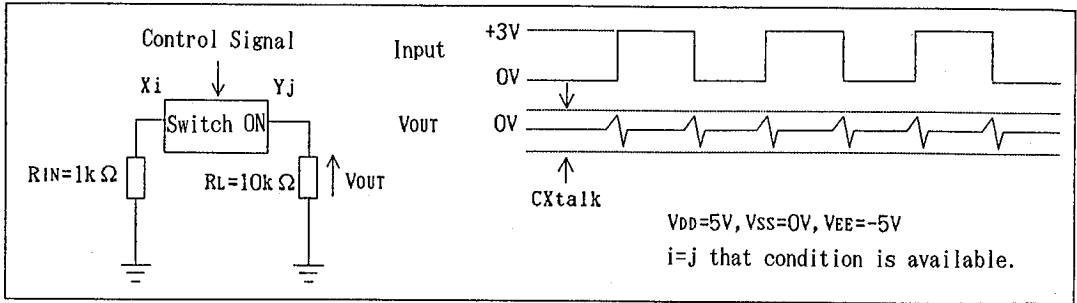
(3) MAXIMUM TRANSMITTING FREQUENCY(F_{MAX}) MEASUREMENT CIRCUIT



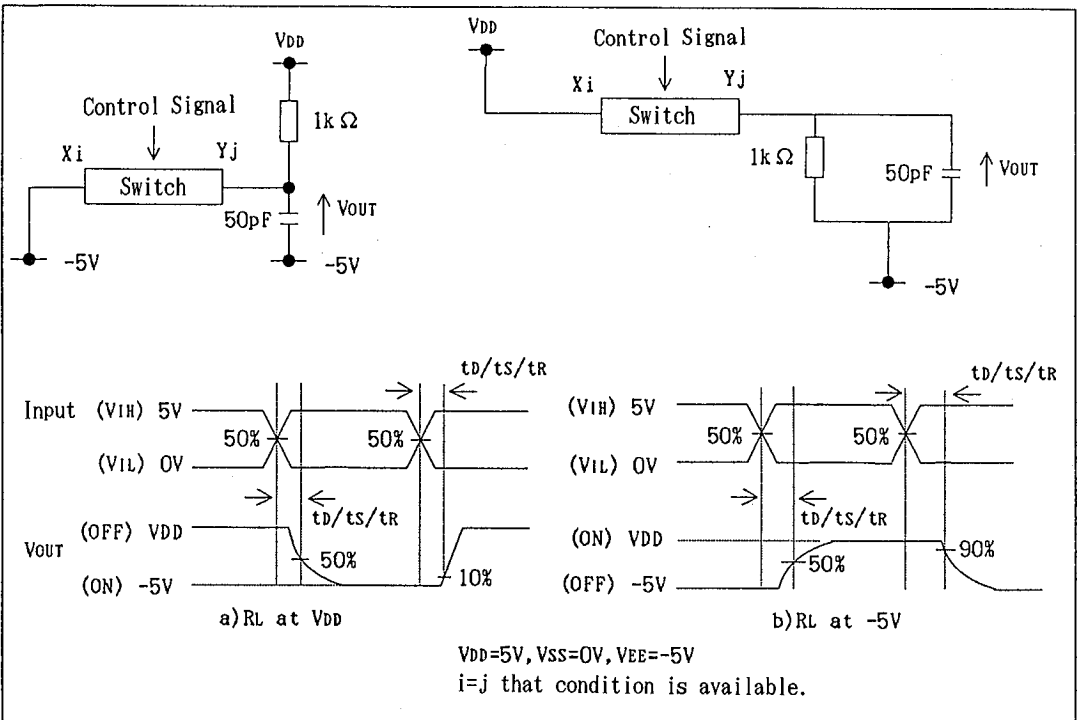
(4) FIELD THREW(FDT) MEASUREMENT CIRCUIT



6

(5) CROSS TALK (X_{talk}) MEASUREMENT CIRCUIT

 (6) CONTROL INPUT CROSS TALK (CX_{talk}) MEASUREMENT CIRCUIT


(7) CONTROL MEMORY TIMING MEASUREMENT CIRCUIT



6

MEMO

[CAUTION]

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