

US Audio Multiplexing Decoder

Description

The CXA2094Q is an IC designed as a decoder for the Zenith TV Multi-channel System and also corresponds with I²C BUS. Functions include stereo demodulation, SAP (Separate Audio Program) demodulation, dbx noise reduction. Various kinds of filters are built in while adjustment and mode control are all executed through I²C BUS.

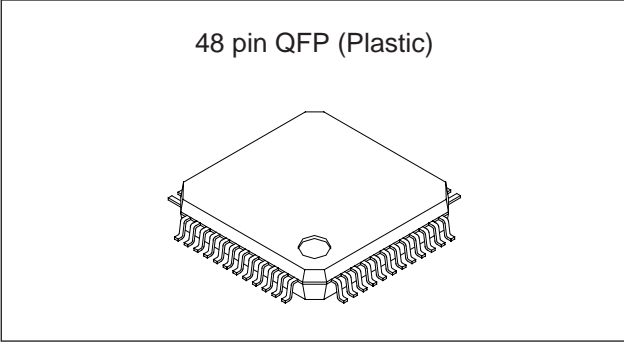
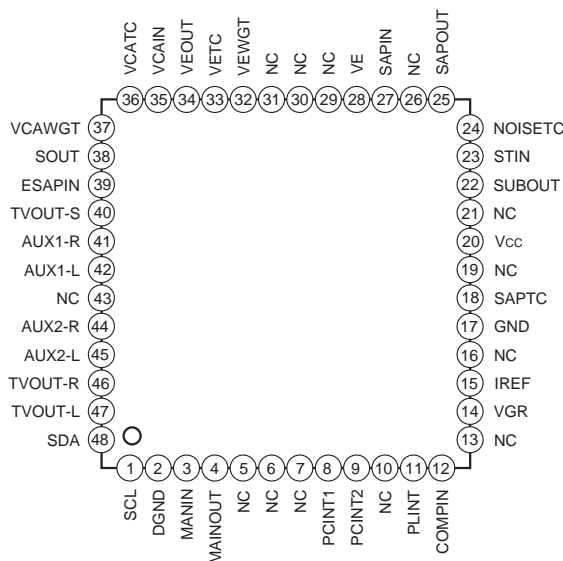
Features

- Adjustment free of VCO and filter.
- Audio multiplexing decoder and dbx noise reduction decoder are all included in a single chip. Almost any sort of signal processing is possible through this IC.
- All adjustments are possible through I²C BUS to allow for automatic adjustment.
- Various built-in filter circuits greatly reduce external parts.
- There are two systems for external inputs.
- There is an additional SAP output.

Standard I/O Level

- Input level
 - COMPIN (Pin 12) 100mVrms
245mVrms (Selected by INSW)
 - AUX1-L/R (Pins 42 and 41) 490mVrms
 - AUX2-L/R (Pins 45 and 44) 490mVrms
- Output level
 - TVOUT-L/R (Pins 47 and 46) 490mVrms

Pin Configuration (Top View)



Absolute Maximum Ratings (Ta = 25°C)

- Supply voltage V_{cc} 11 V
- Operating temperature Topr -20 to +75 °C
- Storage temperature Tstg -65 to +150 °C
- Allowable power dissipation P_D 0.6 W

Range of Operating Supply Voltage

9 ± 0.5 V

Applications

TV, VCR and other decoding systems for US audio multiplexing TV broadcasting

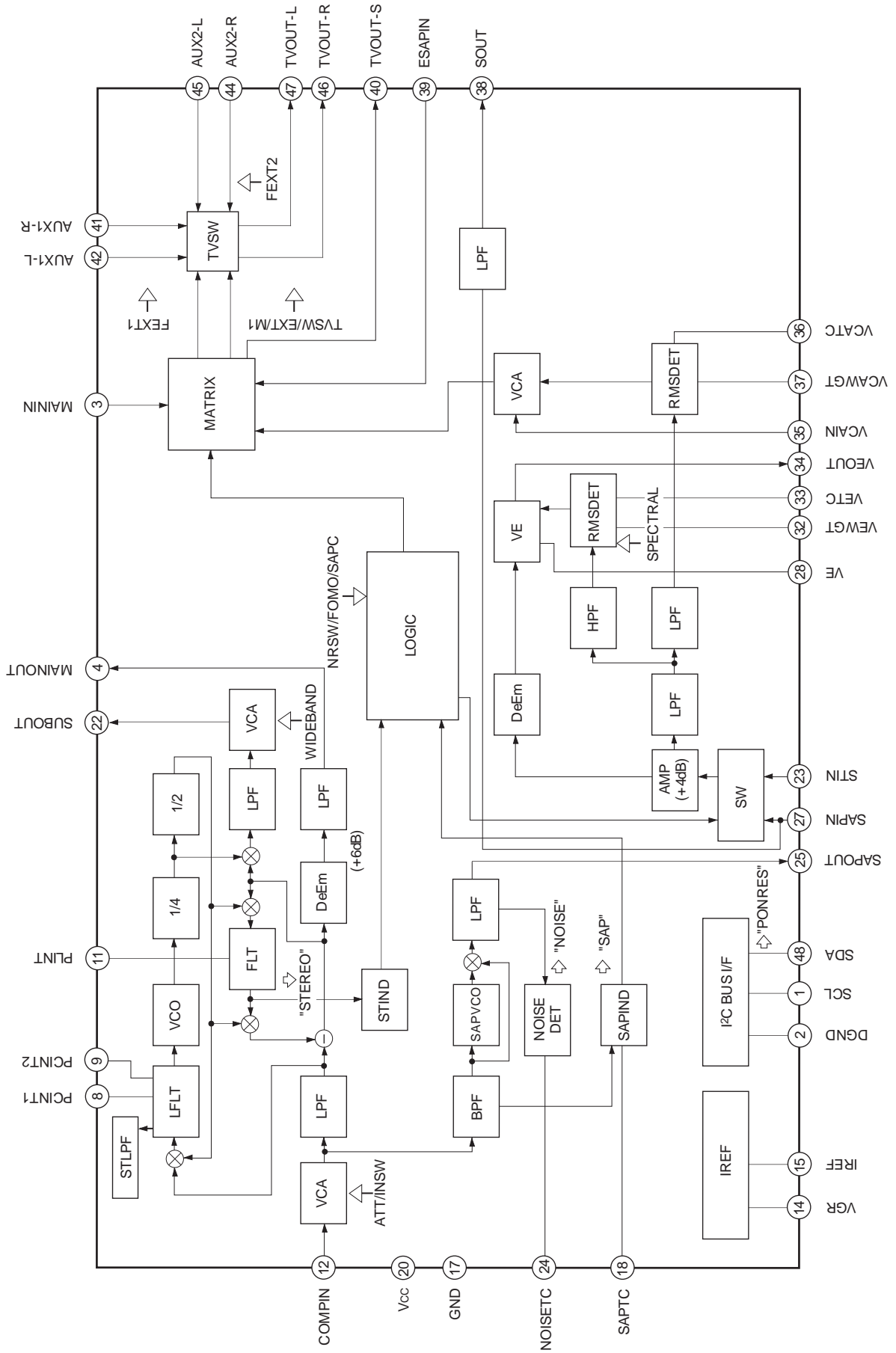
Structure

Bipolar silicon monolithic IC

* A license of the dbx-TV noise reduction system is required for the use of this device.

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Block Diagram



Pin Description

(Ta = 25°C, Vcc = 9V)

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|---------|-------------|--------------------|--|
| 1 | SCL | — | | <p>Serial clock input pin. $V_{IH} > 3.0V$ $V_{IL} < 1.5V$</p> |
| 2 | DGND | — | | Digital block GND. |
| 3 | MAININ | 4.0V | | Input the (L + R) signal from MAINOUT (Pin 4). |
| 4 | MAINOUT | 4.0V | | (L + R) signal output pin. |
| 5 | NC | — | | — |
| 6 | NC | — | | — |
| 7 | NC | — | | — |

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|--------|-------------|--------------------|--|
| 8 | PCINT1 | 4.0V | | Stereo block PLL loop filter integrating pin. |
| 9 | PCINT2 | 4.0V | | |
| 10 | NC | — | | — |
| 11 | PLINT | 5.1V | | Pilot cancel circuit loop filter integrating pin. (Connect a 1µF capacitor between this pin and GND.) |
| 12 | COMPIN | 4.0V | | Audio multiplexing signal input pin. |
| 13 | NC | — | | — |

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|--------|-------------|--------------------|--|
| 14 | VGR | 1.3V | | Band gap reference output pin. (Connect a 10 μ F capacitor between this pin and GND.) |
| 15 | IREF | 1.3V | | Set the filter and VCO reference current. The reference current is adjusted with the BUS DATA based on the current which flows to this pin. (Connect a 62k Ω (\pm 1%) resistor between this pin and GND.) |
| 16 | NC | — | | — |
| 17 | GND | — | | Analog block GND. |
| 18 | SAPTC | 4.5V | | Set the time constant for the SAP carrier detection circuit. (Connect a 4.7 μ F capacitor between this pin and GND.) |
| 19 | NC | — | | — |
| 20 | Vcc | — | | Supply voltage pin. |
| 21 | NC | — | | — |

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|---------|-------------|--------------------|---|
| 22 | SUBOUT | 4.0V | | (L-R) signal output pin. |
| 23 | STIN | 4.0V | | Input the (L-R) signal from SUBOUT (Pin 22). |
| 27 | SAPIN | 4.0V | | Input the (SAP) signal from SAPOUT (Pin 25). |
| 24 | NOISETC | 3.0V | | Set the time constant for the noise detection circuit. (Connect a 4.7μF capacitor between this pin and GND.) |
| 25 | SAPOUT | 4.0V | | SAP FM detector output pin. |

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|--------|-------------|--------------------|---|
| 26 | NC | — | | — |
| 28 | VE | 4.0V | | Variable de-emphasis integrating pin. (Connect a 2700pF capacitor and a 3.3kΩ resistor in series between this pin and GND.) |
| 29 | NC | — | | — |
| 30 | NC | — | | — |
| 31 | NC | — | | — |
| 32 | VEWGT | 4.0V | | Weight the variable de-emphasis control effective value detection circuit. (Connect a 0.047μF capacitor and a 3kΩ resistor in series between this pin and GND.) |
| 33 | VETC | 1.7V | | Determine the restoration time constant of the variable de-emphasis control effective value detection circuit. (The specified restoration time constant can be obtained by connecting a 3.3μF capacitor between this pin and GND.) |

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|--------|-------------|--------------------|--|
| 34 | VEOUT | 4.0V | | <p>Variable de-emphasis output pin. (Connect a 4.7μF non-polar capacitor between Pins 34 and 35.)</p> |
| 35 | VCAIN | 4.0V | | <p>VCA input pin. Input the variable de-emphasis output signal from Pin 34 via a coupling capacitor.</p> |
| 36 | VCATC | 1.7V | | <p>Determine the restoration time constant of the VCA control effective value detection circuit. (The specified restoration time constant can be obtained by connecting a 10μF capacitor between this pin and GND.)</p> |
| 37 | VCAWGT | 4.0V | | <p>Weight the VCA control effective value detection circuit. (Connect a 1μF capacitor and a 3.9kΩ resistor in series between this pin and GND.)</p> |

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|---------|-------------|--------------------|--|
| 38 | SOUT | 4.0V | | Additional SAP output pin. |
| 39 | ESAPIN | 4.0V | | Input the signal from SOUT (Pin 38). |
| 41 | AUX1-R | 4.0V | | Right channel external input 1 pin. |
| 42 | AUX1-L | 4.0V | | Left channel external input 1 pin. |
| 44 | AUX2-R | 4.0V | | Right channel external input 2 pin. |
| 45 | AUX2-L | 4.0V | | Left channel external input 2 pin. |
| 40 | TVOUT-S | 4.0V | | Optional output pin. From this pin monaural or additional SAP is output. |
| 46 | TVOUT-R | 4.0V | | TVOUT right channel output pin. |
| 47 | TVOUT-L | 4.0V | | TVOUT left channel output pin. |
| 43 | NC | — | | — |

| Pin No. | Symbol | Pin voltage | Equivalent circuit | Description |
|---------|--------|-------------|--------------------|---|
| 48 | SDA | — | | <p>Serial data I/O pin. $V_{IH} > 3.0V$ $V_{IL} < 1.5V$</p> |

Electrical Characteristics
COMPIN input level
(100% modulation level)

| | INSW = 0 | INSW = 1 |
|--------------------------------------|------------|------------|
| Main (L + R) (Pre-Emphasis : OFF) | = 245mVrms | = 100mVrms |
| SUB (L - R) (dbx-TV : OFF) | = 490mVrms | = 200mVrms |
| Pilot | = 49mVrms | = 20mVrms |
| SAP Carrier | = 147mVrms | = 60mVrms |

f_H = 15.734kHz

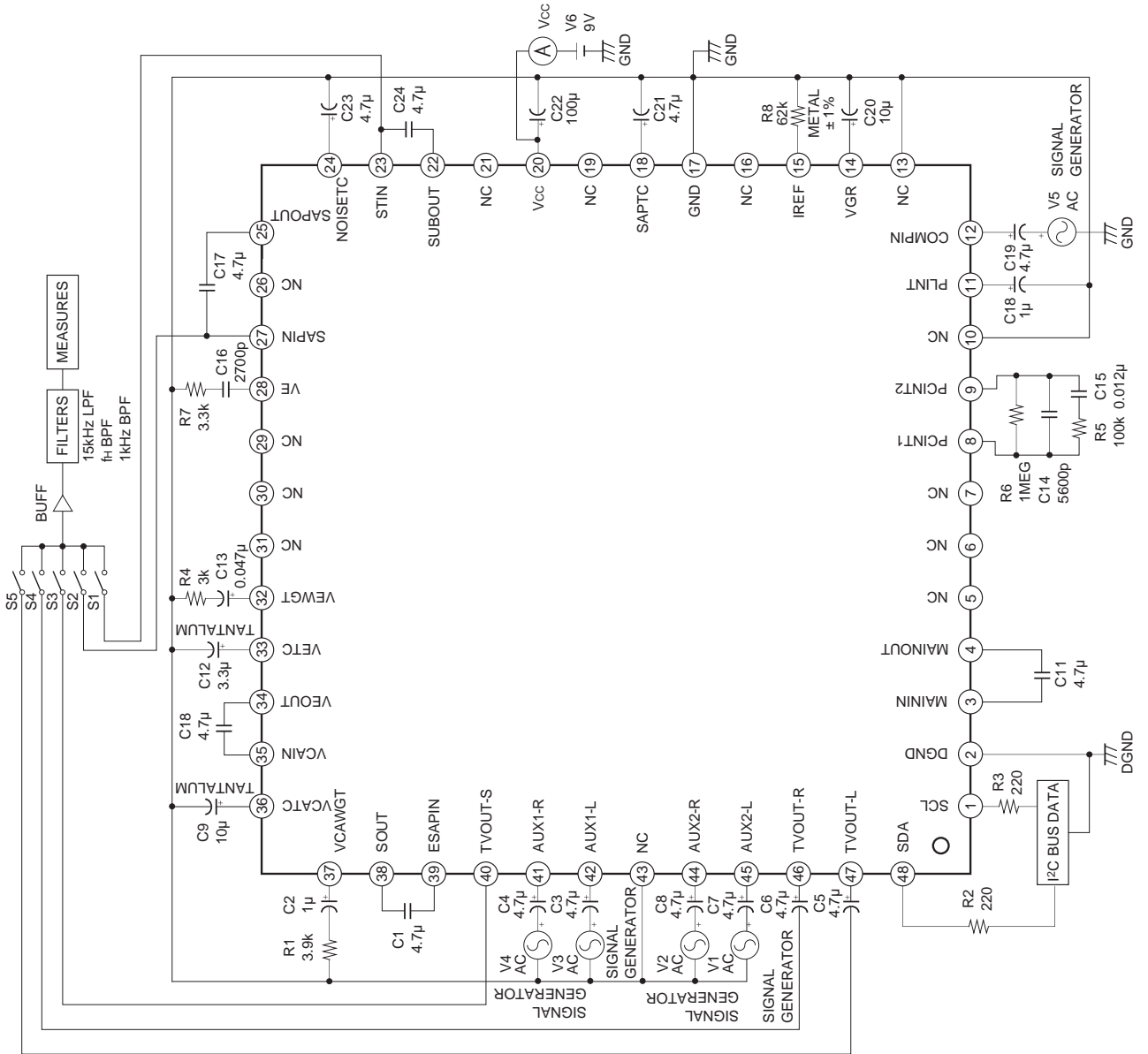
(T_a = 25°C, V_{CC} = 9V)

| No. | Item | Signal | Mode | Input pin | Input signal | Measurement conditions | Filter | Output pin | Min. | Typ. | Max. | Unit |
|-----|---|---------------------|------|-----------|---|--------------------------------------|--------|------------|------|------|------|-------|
| 1 | Current consumption | I _{CC} | | — | No signal | | | | 22 | 32 | 42 | mA |
| 2 | Main output level | V _{main} | MONO | 12 | Mono 1kHz 100% mod. Pre-em. ON | | | 46/47 | 440 | 490 | 540 | mVrms |
| 3 | Main de-emphasis frequency characteristic | FC _{deem} | MONO | 12 | Mono 5kHz 30% mod. Pre-em. ON | 20 log (‘5k/’1k’) | | 46/47 | -1.2 | 0 | 1.0 | dB |
| 4 | Main LPF frequency characteristic | FC _{main} | MONO | 12 | Mono 12kHz 30% mod. Pre-em. ON | 20 log (‘12k/’1k’) | | 46/47 | -3.0 | -1.0 | 1.0 | dB |
| 5 | Main distortion | THD _m | MONO | 12 | Mono 1kHz 100% mod. Pre-em. ON | | 15kLPF | 46/47 | - | 0.1 | 0.5 | % |
| 6 | Main overload distortion | THD _{max} | MONO | 12 | Mono 1kHz 200% mod. Pre-em. OFF | | 15kLPF | 46/47 | - | 0.15 | 0.5 | % |
| 7 | Main S/N | SN _{main} | MONO | 12 | Mono 1kHz Pre-em. ON | 20 log (‘100%/’0%’) | 15kLPF | 46/47 | 61 | 69 | - | dB |
| 8 | Sub output level | V _{sub} | ST | 12 | SUB (L-R) 1kHz, 100% mod., NR OFF | | | 22 | 150 | 190 | 230 | mVrms |
| 9 | Sub LPF frequency characteristic | FC _{sub} | ST | 12 | SUB (L-R) 12kHz, 30% mod., NR OFF | 20 log (‘12k/’1k’) | | 22 | -3.0 | -0.5 | 1.0 | dB |
| 10 | Sub distortion | THD _{sub} | ST | 12 | SUB (L-R) 1kHz, 100% mod., NR OFF | | 15kLPF | 22 | - | 0.1 | 1.0 | % |
| 11 | Sub overload distortion | THD _{smax} | ST | 12 | SUB (L-R) 1kHz, 200% mod., NR OFF | | 15kLPF | 22 | - | 0.2 | 2.0 | % |
| 12 | Sub S/N | SN _{sub} | ST | 12 | SUB (L-R) 1kHz, NR OFF | 20 log (‘100%/’0%’) | 15kLPF | 22 | 56 | 64 | - | dB |
| 13 | ST → SAP Crosstalk | CT _{st} | SAP | 12 | SUB (L-R) 1kHz, 100% mod., NR ON, SAP Carrier (5fh) | 20 log (‘NRSW = 0/ ’NRSW = 1’) | 1kBPf | 47 | 60 | 70 | - | dB |

| No. | Item | Symbol | Mode | Input pin | Input signal | Measurement conditions | Filter | Output pin | Min. | Typ. | Max. | Unit |
|-----|----------------------------------|---------|------|----------------|--------------------------------------|---------------------------------|--------|------------|-------|------|------|-------|
| 14 | Sub pilot leak | PCsub | ST | 12 | PILOT (fH) 0dB | 0dB = 49mVrms | fH BPF | 22 | - | -42 | -30 | dB |
| 15 | Stereo ON level | THst | ST | 12 | Change PILOT (fH) Level | 0dB = 49mVrms | | BUS RETURN | -9.0 | -6.0 | -3.0 | dB |
| 16 | Stereo ON/OFF hysteresis | HYst | | | | 20 log ('on level'/'off level') | | | 2.0 | 6.0 | 10.0 | dB |
| 17 | SAP output level | Vsap | SAP | 12 | SAP 1kHz 100% mod. NR OFF | | | 25 | 150 | 190 | 230 | mVrms |
| 18 | SAP LPF frequency characteristic | FCsap | SAP | 12 | SAP 10kHz 30% mod. NR OFF | 20 log ('10k'/'1k') | | 25 | -3.0 | 0 | 2.5 | dB |
| 19 | SAP distortion | THDsap | SAP | 12 | SAP 1kHz 100% mod. NR OFF | | 15kLPF | 25 | - | 2.5 | 6.0 | % |
| 20 | SAP S/N | SNSap | SAP | 12 | SAP 1kHz, NR OFF | 20 log ('100%'/'0%') | 15kLPF | 25 | 46 | 55 | - | dB |
| 21 | SAP → ST Cross talk | CTSap | ST | 12 | SAP 1kHz 100% mod. NR ON, Pilot (fH) | 20 log (NRSW = 1'/NRSW = 0') | 1kBPF | 47 | 60 | 70 | - | dB |
| 22 | SAP ON level | THsap | SAP | 12 | Change SAP Carrier (5fH) Level | 0dB = 147mVrms | | BUS RETURN | -12.0 | -9.0 | -6.5 | dB |
| 23 | SAP ON/OFF hysteresis | HYsap | | | | 20 log ('on level'/'off level') | 2.0 | | 4.0 | 6.0 | dB | |
| 24 | ST separation 1 L → R | STLsep1 | ST | 12 | ST-L 300Hz 30% mod. NR ON | | 15kLPF | 46/47 | 23 | 35 | - | dB |
| 25 | ST separation 1 R → L | STRsep1 | ST | 12 | ST-R 300Hz 30% mod. NR ON | | 15kLPF | 46/47 | 23 | 35 | - | dB |
| 26 | ST separation 2 L → R | STLsep2 | ST | 12 | ST-L 3kHz 30% mod. NR ON | | 15kLPF | 46/47 | 23 | 35 | - | dB |
| 27 | ST separation 2 R → L | STRsep2 | ST | 12 | ST-R 3kHz 30% mod. NR ON | | 15kLPF | 46/47 | 23 | 35 | - | dB |
| 28 | TVOUT output level | Vtv | EXT | 41/42 44/45 | Sine wave 1kHz, 490mVrms | 0dB = 490mVrms | | 46/47 | -0.5 | 0 | 0.5 | dB |
| 29 | TVOUT cross talk | CTtv1 | INT | 41/42 44/45 | Sine wave 1kHz, 490mVrms | 0dB = 490mVrms EXT → INT | 1kBPF | 46/47 | - | -75 | -60 | dB |
| 30 | | CTtv2 | EXT | 12 | MONO 1kHz 100% mod. Pre-em. ON | 0dB = 490mVrms INT → EXT | 1kBPF | 46/47 | - | -90 | -80 | dB |
| 31 | TVOUT muted amount | MUtv1 | INT | 12 | MONO 1kHz 100% mod. Pre-em. ON | 20 log (M1 = "0"/M1 = "1") | | | - | -85 | -70 | dB |
| 32 | | MUtv2 | EXT | 41/42 44/45 | Sine wave 1kHz, 490mVrms | 20 log (M1 = "0"/M1 = "1") | 1kBPF | 46/47 | - | -90 | -75 | dB |

| No. | Item | Symbol | Mode | Input pin | Input signal | Measurement conditions | Filter | Output pin | Min. | Typ. | Max. | Unit |
|-----|---------------------------|----------|------------|----------------|-----------------------------|---|--------|------------|------|------|------|------|
| 33 | TVOUT DC offset | OSTv | INT EXT | — | No signal | Mute (M1 = 0)/ DC difference when there is no signal | | 46/47 | -25 | 0 | 25 | mV |
| 34 | TVOUT distortion | THDtv | EXT | 41/42 44/45 | Sine wave 1kHz, 490mVrms | | 15kLPF | 46/47 | — | 0.01 | 0.5 | % |
| 35 | TVOUT S/N | SNtv | EXT | 41/42 44/45 | Sine wave 1kHz, 490mVrms | 20 log (490mVrms/ 'No signal') | 15kLPF | 46/47 | 75 | 88 | — | dB |
| 36 | TVOUT overload distortion | THDtvmax | EXT | 41/42 44/45 | Sine wave 1kHz, 2Vrms | | 15kLPF | 46/47 | — | 0.1 | 1.0 | % |

Electrical Characteristics Measurement Circuit



Description of Operation

The US audio multiplexing system possesses the base band spectrum shown in Fig. 1.

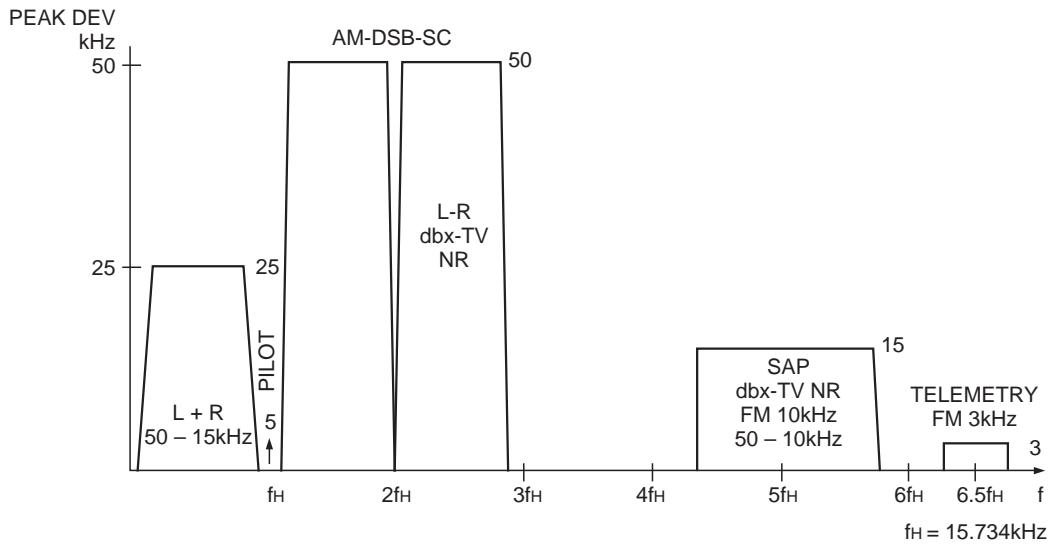


Fig. 1. Base band spectrum

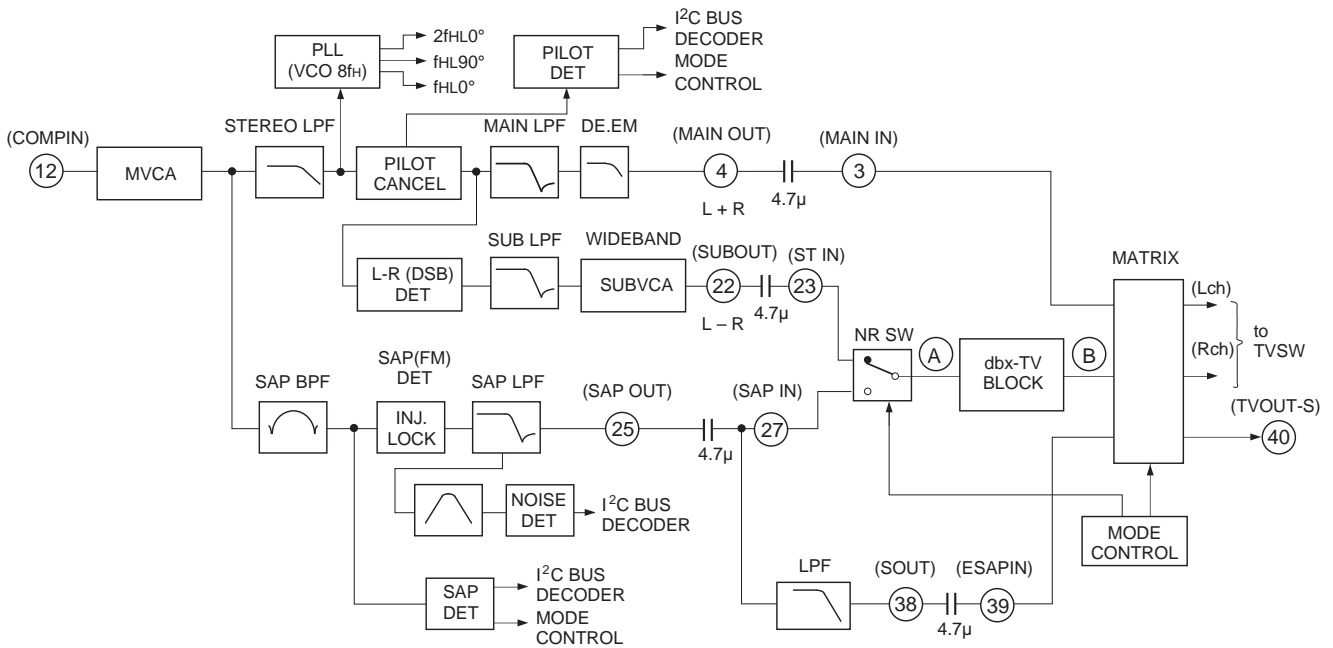


Fig. 2. Overall block diagram (See Fig. 3 for the dbx-TV block)

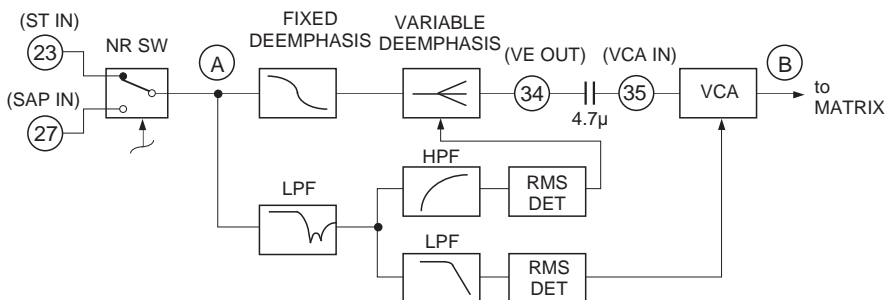


Fig 3. dbx-TV block

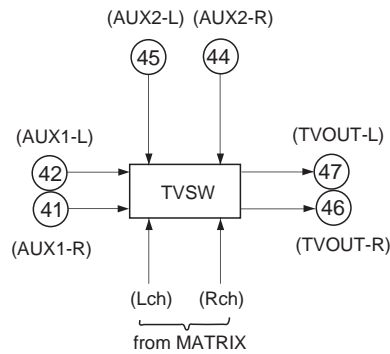


Fig. 4. Switch block

(1) L + R (MAIN)

After the audio multiplexing signal input from COMPIN (Pin 12) passes through MVCA, the SAP signal and telemetry signal are suppressed by STEREO LPF. Next, the pilot signals are canceled. Finally, the L – R signal and SAP signal are removed by MAIN LPF, and frequency characteristics are flattened (de-emphasized) and input to the matrix.

(2) L – R (SUB)

The L – R signal follows the same course as L + R before the pilot signal is canceled. L – R has no carrier signal, as it is a suppressed-carrier double-sideband amplitude modulated signal (DSB-AM modulated). For this reason, the pilot signal is used to regenerate the carrier signal (quasi-sine wave) to be used for the demodulation of the L – R signal. In the last stage, the residual high frequency components are removed by SUB LPF and the L – R signal is input to the dbx-TV block via the NRSW circuit after passing through SUBVCA.

(3) SAP

SAP is an FM signal using 5fH as a carrier as shown in the Fig. 1. First, the SAP signal only is extracted using SAP BPF. Then, this is subjected to FM detection. Finally, residual high frequency components are removed and frequency characteristics flattened using SAP LPF, and the SAP signal is input to the dbx-TV block via the NRSW circuit. When there is no SAP signal, the Pin 25 output is soft muted.

(4) Mode discrimination

Stereo discrimination is performed by detecting the pilot signal amplitude. SAP discrimination is performed by detecting the 5fH carrier amplitude. NOISE discrimination is performed by detecting the noise near 25kHz after FM detection of SAP signal.

(5) dbx-TV block

Either the L – R signal or SAP signal input respectively from ST IN (Pin 23) or SAP IN (Pin 27) is selected by the mode control and input to the dbx-TV block.

The input signal then passes through the fixed de-emphasis circuit and is applied to the variable de-emphasis circuit. The signal output from the variable de-emphasis circuit passes through an external capacitor and is applied to VCA (voltage control amplifier). Finally, the VCA output is converted from a current to a voltage using an operational amplifier and then input to the matrix.

The variable de-emphasis circuit transmittance and VCA gain are respectively controlled by Each of effective value detection circuits. Each of the effective value detection circuits passes the input signal through a predetermined filter for weighting before the effective value of the weighted signal is detected to provide the control signal.

(6) Matrix, TVSW

The signals (L + R, L – R, SAP) input to “MATRIX” become the outputs for the ST-L, ST-R, MONO and SAP signals according to the mode control and whether there is ST / SAP discrimination.

“TVSW” switches the “MATRIX” output signal, external input signal (input to AUX1-L, R (Pins 42 and 41)), external input signal (input to AUX2-L, R (Pins 45 and 44)) and external forced MONO.

(7) Others

“MVCA” is a VCA which adjusts the input signal level to the standard level of this IC.

“Bias” supplies the reference voltage and reference current to the other blocks. The current flowing to the resistor connecting IREF (Pin 15) with GND become the reference current.

Register Specifications

Slave address

| | |
|-----------------|-------------------|
| SLAVE RECEIVER | SLAVE TRANSMITTER |
| 84H (1000 0100) | 85H (1000 0101) |

Register table

| SUB ADDRESS | | DATA | | | | | | | |
|-------------|-----|------|------|--------------|-------|---------|------|-------|-------|
| MSB | LSB | BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
| ****0000 | | * | | TEST-DA | TEST1 | ATT (4) | | | |
| ****0001 | | * | | SPECTRAL (6) | | | | | |
| ****0010 | | * | | WIDEBAND (6) | | | | | |
| ****0011 | | * | | TVSW | EXT | NRSW | FOMO | SAPC | M1 |
| ****0100 | | * | | INSW | SMD | ATTSW | FST | FEXT1 | FEXT2 |

* : Don't Care

Status Registers

| STA1 | STA2 | STA3 | STA4 | STA5 | STA6 | STA7 | STA8 |
|----------------|--------|------|-------|------|------|------|------|
| BIT7 | BIT6 | BIT5 | BIT4 | BIT3 | BIT2 | BIT1 | BIT0 |
| POWER ON RESET | STEREO | SAP | NOISE | — | — | — | — |

Description of Registers

Control registers

| Register | Number of bits | Classification*1 | Standard setting | Contents |
|----------|----------------|------------------|------------------|--|
| ATT | 4 | A | 9 | Input level adjustment |
| SPECTRAL | 6 | A | 1F | Adjustment of stereo separation (3kHz) |
| WIDEBAND | 6 | A | 1F | Adjustment of stereo separation (300Hz) |
| TEST-DA | 1 | T | 0 | Turn to DAC test mode and VCO adjustment mode by means of TEST-DA = 1. |
| TEST1 | 1 | T | 0 | Turn to test mode by means of TEST = 1. (Adjustment of FILTER) |
| FST | 1 | T | 0 | Turn to forced stereo by means of FST = 1. |
| NRSW | 1 | U | — | Selection of the output signal (Stereo mode, SAP mode) |
| FOMO | 1 | U | — | Turn to forced MONO by means of FOMO = 1. (Left channel only is MONO during SAP output.) |
| TVSW | 1 | U | 0 | Selection of TV mode or external input mode for TVOUT output |
| FEXT1 | 1 | U | 0 | External input 1 forced MONO (1: forced MONO ON) |
| FEXT2 | 1 | U | 0 | External input 2 forced MONO (1: forced MONO ON) |
| EXT | 1 | U | 0 | Selection of external input 1 mode or external input 2 mode for TVOUT output. (TVSW = 1) |
| M1 | 1 | U | 1 | Selection of TVOUT mute ON/OFF (0: mute ON, 1: mute OFF) |
| SMD | 1 | U | 0 | Selection of L + R or additional SAP |
| ATTSW | 1 | S | — | Turn the input stage MVCA off when ATTSW = 1. |
| INSW | 1 | S | — | Selection of standard input level |
| SAPC | 1 | S | — | Selection of SAP mode or L + R mode according to the presence of SAP broadcasting |

*1 Classification U: User control
 A: Adjustment
 S: Proper to set
 T: Test

Status registers

| Register | Number of bits | Contents |
|----------|----------------|---|
| PONRES | 1 | POWER ON RESET detection; 1: RESET |
| STEREO | 1 | Stereo discrimination of the COMPIN input signal; 1: Stereo |
| SAP | 1 | SAP discrimination of the COMPIN input signal; 1: SAP |
| NOISE | 1 | Noise level discrimination of the SAP signal; 1: Noise |

Description of Control Registers

ATT (4): Adjust the signal level input to COMPIN (Pin 12) to the standard input level.

Variable range of the input signal: standard input level -5.0dB to $+3.0\text{dB}$

0 = Level min.

F = Level max.

SPECTRAL (6): Perform high frequency ($f_s = 3\text{kHz}$) separation adjustment.

0 = Level max.

3F = Level min.

WIDEBAND (6): Perform low frequency ($f_s = 300\text{Hz}$) separation adjustment.

0 = Level min.

3F = Level max.

TEST-DA (1): Set DAC output test mode.

0 = Normal mode

1 = DAC output test mode

In addition, the following output are present at Pin 47.

TVOUT-L (Pin 47): DA control DC level

TEST1 (1): Monitor SAP BPF and NR BPF output.

0 = Normal mode

1 = SAP BPF and NR BPF output

In addition, the following outputs are present at Pins 47 and 46.

TVOUT-L (Pin 47): SAP BPF OUT

TVOUT-R (Pin 46): NR BPF OUT

FST (1): Select forced STEREO mode

0 = Normal mode

1 = Forced stereo mode

NRSW (1): Select stereo mode or SAP mode

0 = Stereo mode

1 = SAP mode

- FOMO (1): Select forced MONO mode
0 = Normal mode
1 = Forced MONO mode
- FEXT1 (1): Turn external input [1] to forced MONO.
0 = Normal mode
1 = External input [1] is forced MONO.
Input the same signal to both AUX1-L and AUX1-R.
- FEXT2 (1): Turn external input [2] to forced MONO
0 = Normal mode
1 = External input [2] is forced MONO
Input the same signal to both AUX2-L and AUX2-R.
- TVSW (1): Select TV mode or external input mode for TVOUT output.
0 = TV mode
1 = External input mode
- EXT (1): Select external input [1] mode or external input [2] mode for TVOUT output. (TVSW = 1)
0 = External input [1] mode
1 = External input [2] mode
- M1 (1): Mute the TVOUT-L and TVOUT-R output.
0 = Mute ON
1 = Mute OFF
- SMD (1): Select L + R or additional SAP signal
0 = L + R output is selected
1 = additional SAP output is selected
- ATTSW (1): Select BYPASS SW of MVCA
0 = Normal mode
1 = MVCA is passed
- INSW (1): Select standard input level of COMPIN (Pin 12)
0 = 245mVrms
1 = 100mVrms
- SAPC (1): Select the SAP signal output mode
When there is no SAP signal, the conditions for selecting SAP output are selected by SAPC.
0 = L + R output is selected
1 = SAP output is selected

Description of Mode Control

Priority ranking: M1 > TVSW/EXT > (NRSW & FOMO & SAPC)

| Mode control | SAPC = 0 | SAPC = 1 |
|--------------|---|---|
| NRSW | <p>“Select dbx input and TV decoder output” Conditions: FOMO = 0 NRSW = 0 (MONO or ST output)</p> <ul style="list-style-type: none"> • During ST input: left channel: L, right channel: R • During other input: left channel: L + R, right channel: L + R <p>NRSW = 1 (SAP output)</p> <ul style="list-style-type: none"> • When there is “SAP” during SAP discrimination – left channel: SAP, right channel: SAP • When there is “No SAP”, output is the same as when NRSW = 0. | <p>“Select dbx input and TV decoder output” Conditions: FOMO = 0 NRSW = 0 (MONO or ST output)</p> <p>As on the left</p> <p>NRSW = 1 (SAP output)</p> <ul style="list-style-type: none"> • Regardless of the presence of SAP discrimination, dbx input: “SAP” left channel: SAP, right channel: SAP However, when there is no SAP, SAPOUT output is soft muted (–7dB) |
| FOMO | “Forced MONO” | |
| | <p>FOMO = 1</p> <ul style="list-style-type: none"> • During SAP output: left channel: L + R, right channel: SAP • During ST or MONO output: left channel: L + R, right channel: L + R | |
| SAPC | <p>Change the selection conditions for “MONO or ST output” and “SAP output”.</p> <p>SAPC = 0: Switch to SAP output when there is SAP discrimination. Do not switch to SAP output when there is no SAP discrimination.</p> <p>SAPC = 1: Switch to SAP output regardless of whether there is SAP discrimination.</p> | |
| M1 | “MUTE” | |
| | <p>M1 = 0: TVOUT-L, R, S output is muted.</p> | |
| TVSW/EXT | “TV mode/external input mode selection” | |
| | <p>TVSW = 0: Set TVOUT-L, R output to TV mode. TVSW = 1: Set TVOUT-L, R output to external input mode. EXT = 0: Set TVOUT-L, R output to external input [1] mode. (TVSW = 1) EXT = 1: Set TVOUT-L, R output to external input [2] mode. (TVSW = 1)</p> | |

Decoder Output and Mode Control Table 1 (SAPC = 1)

| Input signal mode | Mode detection | | | Mode control | | | dbx input | Output | |
|-------------------|----------------|-----|-------|--------------|------|------|-----------|--------|-------|
| | ST | SAP | NOISE | NRSW | FOMO | SAPC | | Lch | Rch |
| MONO*1 | 0 | 0 | 0 | 0 | * | 1 | MUTE | L + R | L + R |
| | 0 | 0 | 0 | 1 | 0 | 1 | SAP | SAP | SAP |
| | 0 | 0 | 0 | 1 | 1 | 1 | SAP | L + R | SAP |
| | 0 | * | 1 | 0 | * | 1 | MUTE | L + R | L + R |
| | 0 | * | 1 | 1 | 0 | 1 | (SAP) | (SAP) | (SAP) |
| | 0 | * | 1 | 1 | 1 | 1 | (SAP) | L + R | (SAP) |
| STEREO*1 | 1 | 0 | * | 0 | 0 | 1 | L - R | L | R |
| | 1 | 0 | * | 0 | 1 | 1 | MUTE | L + R | L + R |
| | 1 | 1 | 1 | 0 | 0 | 1 | L - R | L | R |
| | 1 | 1 | 1 | 0 | 1 | 1 | MUTE | L + R | L + R |
| | 1 | 0 | 0 | 1 | 0 | 1 | SAP | SAP | SAP |
| | 1 | 0 | 0 | 1 | 1 | 1 | SAP | L + R | SAP |
| | 1 | * | 1 | 1 | 0 | 1 | (SAP) | (SAP) | (SAP) |
| | 1 | * | 1 | 1 | 1 | 1 | (SAP) | L + R | (SAP) |
| MONO & SAP | 0 | 1 | * | 0 | 0 | 1 | MUTE | L + R | L + R |
| | 0 | 1 | * | 0 | 1 | 1 | MUTE | L + R | L + R |
| | 0 | 1 | 0 | 1 | 0 | 1 | SAP | SAP | SAP |
| | 0 | 1 | 0 | 1 | 1 | 1 | SAP | L + R | SAP |
| | 0 | 1 | 1 | 1 | 0 | 1 | (SAP) | (SAP) | (SAP) |
| | 0 | 1 | 1 | 1 | 1 | 1 | (SAP) | L + R | (SAP) |
| STEREO & SAP | 1 | 1 | * | 0 | 0 | 1 | L - R | L | R |
| | 1 | 1 | * | 0 | 1 | 1 | MUTE | L + R | L + R |
| | 1 | 1 | 0 | 1 | 0 | 1 | SAP | SAP | SAP |
| | 1 | 1 | 0 | 1 | 1 | 1 | SAP | L + R | SAP |
| | 1 | 1 | 1 | 1 | 0 | 1 | (SAP) | (SAP) | (SAP) |
| | 1 | 1 | 1 | 1 | 1 | 1 | (SAP) | L + R | (SAP) |

Note

(SAP) : The SAPOUT output signal is soft muted (approximately -7dB).

The signal is soft muted when NOISE = 1.

* : Don't care.

*1 SAP or NOISE discrimination may be made during MONO or STEREO input when the noise is inputted in the weak electric field.

Then microcomputer reads "NOISE" status from IC and decides whether SAP is outputted.

"NOISE" status rises earlier than "SAP" status when the amount of noise is increased to COMPIN.

Decoder Output and Mode Control Table 2 (SAPC = 0)

| Input signal mode | Mode detection | | | Mode control | | | dbx input | Output | |
|-------------------|----------------|-----|-------|--------------|------|------|-----------|--------|-------|
| | ST | SAP | NOISE | NRSW | FOMO | SAPC | | Lch | Rch |
| MONO *1 | 0 | 0 | * | * | * | 0 | MUTE | L + R | L + R |
| | 0 | 1 | 1 | 0 | 0 | 0 | MUTE | L + R | L + R |
| | 0 | 1 | 1 | 0 | 1 | 0 | MUTE | L + R | L + R |
| | 0 | 1 | 1 | 1 | 0 | 0 | (SAP) | (SAP) | (SAP) |
| | 0 | 1 | 1 | 1 | 1 | 0 | (SAP) | L + R | (SAP) |
| STEREO *1 | 1 | 0 | * | 0 | 0 | 0 | L - R | L | R |
| | 1 | 0 | * | 0 | 1 | 0 | MUTE | L + R | L + R |
| | 1 | 0 | * | 1 | 0 | 0 | L - R | L | R |
| | 1 | 0 | * | 1 | 1 | 0 | MUTE | L + R | L + R |
| | 1 | 1 | 1 | 0 | 0 | 0 | L - R | L | R |
| | 1 | 1 | 1 | 0 | 1 | 0 | MUTE | L + R | L + R |
| | 1 | 1 | 1 | 1 | 0 | 0 | (SAP) | (SAP) | (SAP) |
| MONO & SAP | 0 | 1 | 0 | 0 | 0 | 0 | MUTE | L + R | L + R |
| | 0 | 1 | 0 | 0 | 1 | 0 | MUTE | L + R | L + R |
| | 0 | 1 | 0 | 1 | 0 | 0 | SAP | SAP | SAP |
| | 0 | 1 | 0 | 1 | 1 | 0 | SAP | L + R | SAP |
| | 0 | 1 | 1 | 0 | 0 | 0 | MUTE | L + R | L + R |
| | 0 | 1 | 1 | 0 | 1 | 0 | MUTE | L + R | L + R |
| | 0 | 1 | 1 | 1 | 0 | 0 | (SAP) | (SAP) | (SAP) |
| | 0 | 1 | 1 | 1 | 1 | 0 | (SAP) | L + R | (SAP) |
| STEREO & SAP | 1 | 1 | 0 | 0 | 0 | 0 | L - R | L | R |
| | 1 | 1 | 0 | 0 | 1 | 0 | MUTE | L + R | L + R |
| | 1 | 1 | 0 | 1 | 0 | 0 | SAP | SAP | SAP |
| | 1 | 1 | 0 | 1 | 1 | 0 | SAP | L + R | SAP |
| | 1 | 1 | 1 | 0 | 0 | 0 | L - R | L | R |
| | 1 | 1 | 1 | 0 | 1 | 0 | MUTE | L + R | L + R |
| | 1 | 1 | 1 | 1 | 0 | 0 | (SAP) | (SAP) | (SAP) |
| | 1 | 1 | 1 | 1 | 1 | 0 | (SAP) | L + R | (SAP) |

Note

(SAP) : The SAPOUT output signal is soft muted (approximately -7dB).

The signal is soft muted when NOISE = 1.

* : Don't care.

*1 SAP or NOISE discrimination may be made during MONO or STEREO input when the noise is inputted in the weak electric field.

Then microcomputer reads "NOISE" status from IC and decides whether SAP is outputted.

"NOISE" status rises earlier than "SAP" status when the amount of noise is increased to COMPIN.

Mode Control Table 3

| | M1 | TVSW | EXT | FEXT1 | FEXT2 | TVOUT-L | TVOUT-R |
|---|----|------|-----|-------|-------|---------|---------|
| 1 | 0 | — | — | — | — | MUTE | MUTE |
| 2 | 1 | 0 | — | — | — | TV (L) | TV (R) |
| 3 | 1 | 1 | 0 | 0 | — | AUX1-L | AUX1-R |
| 4 | 1 | 1 | 0 | 1 | — | AUX1-L | AUX1-L |
| 5 | 1 | 1 | 1 | — | 0 | AUX2-L | AUX2-R |
| 6 | 1 | 1 | 1 | — | 1 | AUX2-L | AUX2-L |

TV (L) / TV (R) are selected in MATRIX

TV (L): MONO, ST-L, SAP, (SAPBPFout, D/Aout)

TV (R): MONO, ST-R, SAP, (NRBPFout, STVCO freerun (4fh))

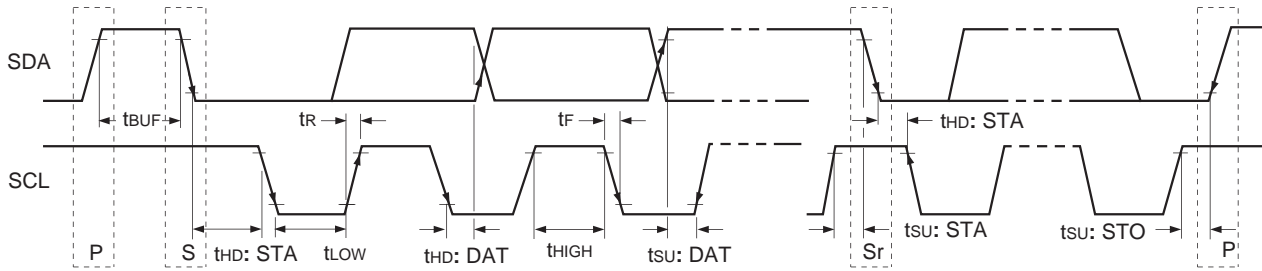
I²C BUS block items (SDA, SCL)

| No. | Item | Symbol | Min. | Typ. | Max. | Unit |
|-----|---|----------------------|------|------|------|------|
| 1 | High level input voltage | V _{IH} | 3.0 | — | 5.0 | V |
| 2 | Low level input voltage | V _{IL} | 0 | — | 1.5 | |
| 3 | High level input current | I _{IH} | — | — | 10 | μA |
| 4 | Low level input current | I _{IL} | — | — | 10 | |
| 5 | Low level output voltage SDA (Pin 48) during 3mA inflow | V _{OL} | 0 | — | 0.4 | V |
| 6 | Maximum inflow current | I _{OL} | 3 | — | — | mA |
| 7 | Input capacitance | C _I | — | — | 10 | pF |
| 8 | Maximum clock frequency | f _{SCL} | 0 | — | 100 | kHz |
| 9 | Minimum waiting time for data change | t _{BUF} | 4.7 | — | — | μs |
| 10 | Minimum waiting time for start of data transfer | t _{HD: STA} | 4.0 | — | — | |
| 11 | Low level clock pulse width | t _{LOW} | 4.7 | — | — | |
| 12 | High level clock pulse width | t _{HIGH} | 4.0 | — | — | |
| 13 | Minimum waiting time for start preparation | t _{SU: STA} | 4.7 | — | — | |
| 14 | Minimum data hold time | t _{HD: DAT} | 0 | — | — | ns |
| 15 | Minimum data preparation time | t _{SU: DAT} | 250 | — | — | |
| 16 | Rise time | t _R | — | — | 1 | μs |
| 17 | Fall time | t _F | — | — | 300 | ns |
| 18 | Minimum waiting time for stop preparation | t _{SU: STO} | 4.7 | — | — | μs |

I²C BUS load conditions: Pull-up resistor 4kΩ (Connect to +5V)

Load capacity 200pF (Connect to GND)

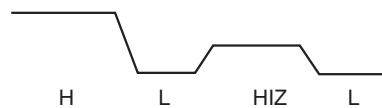
I²C BUS Control Signal



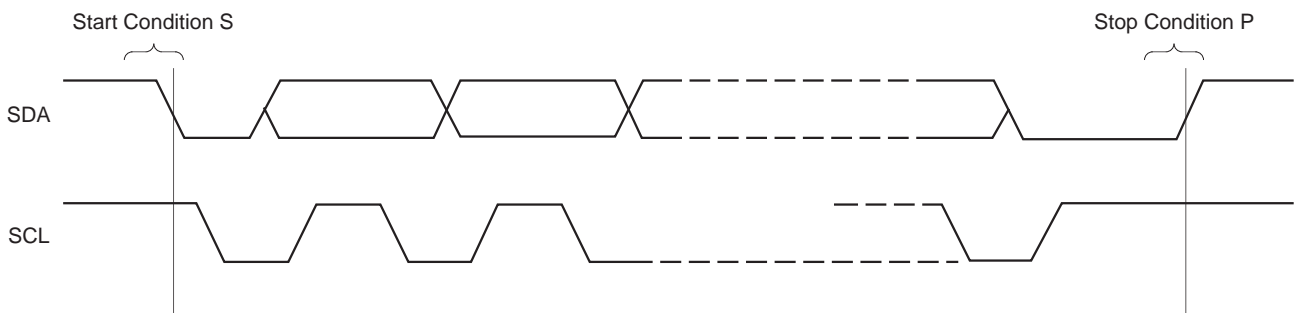
I²C BUS Signal

There are two I²C signals, SDA (Serial DATA) and SCL (Serial CLOCK) signals. SDA is a bidirectional signal.

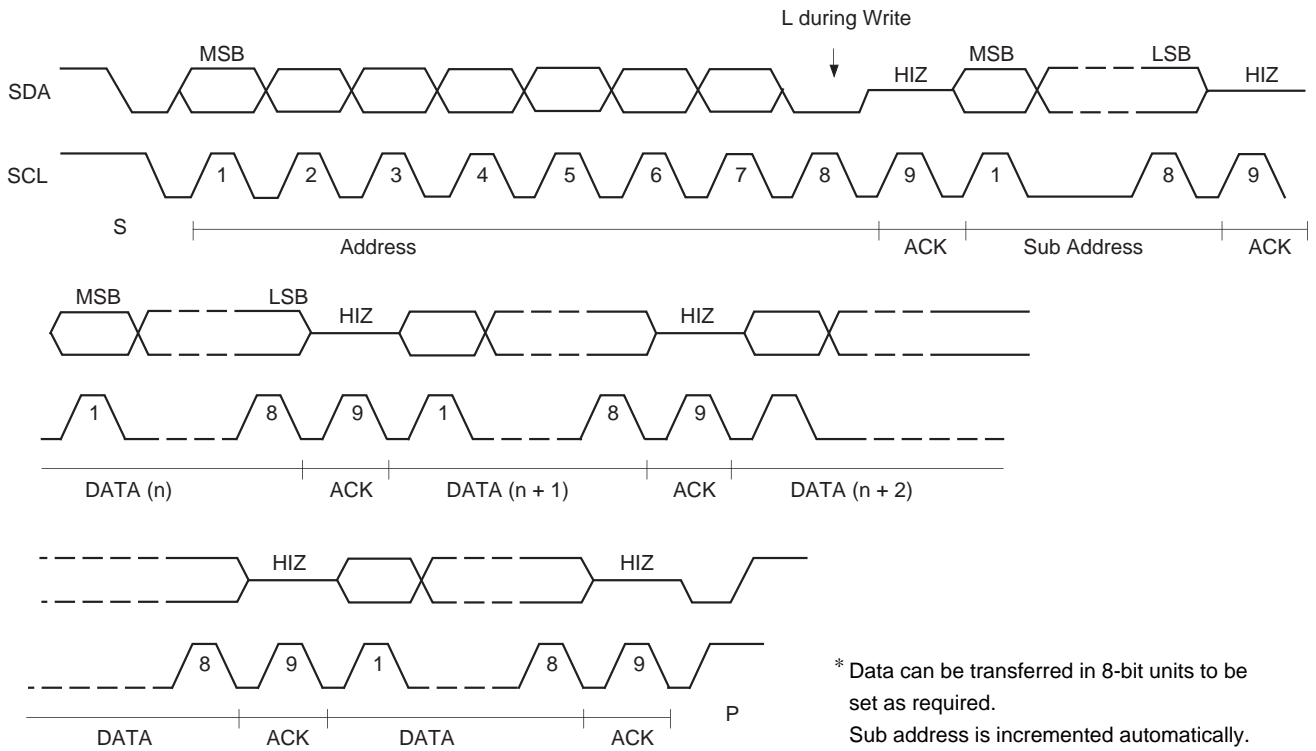
- Accordingly there are 3 values outputs, H, L and HIZ.



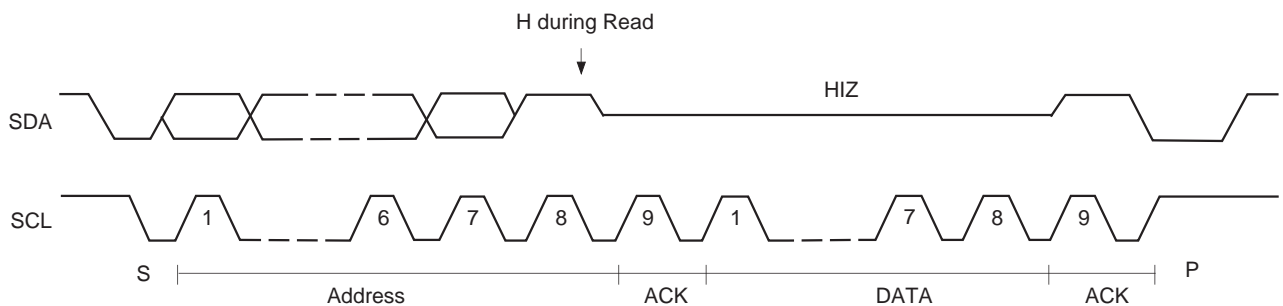
- I²C transfer begins with Start Condition and ends with Stop Condition.



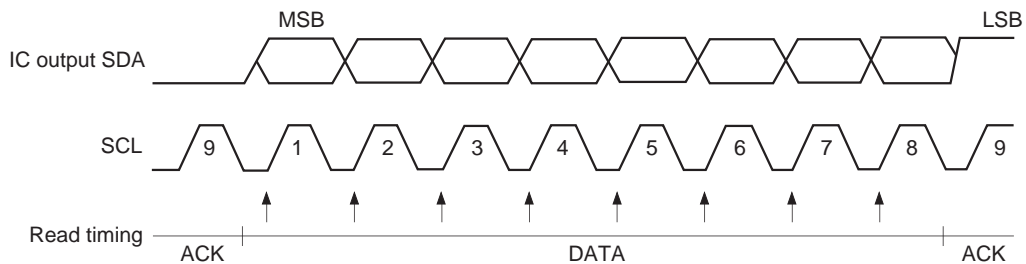
• I²C data Write (Write from I²C controller to the IC)



• I²C data Read (Read from the IC to I²C controller)

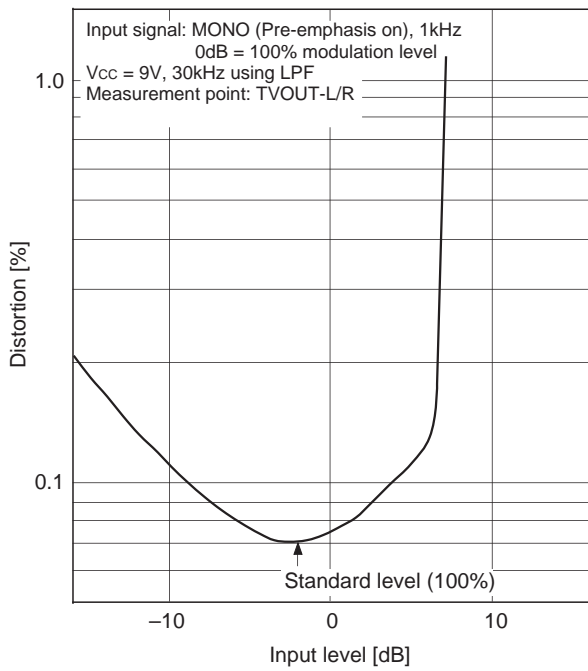


• Read timing

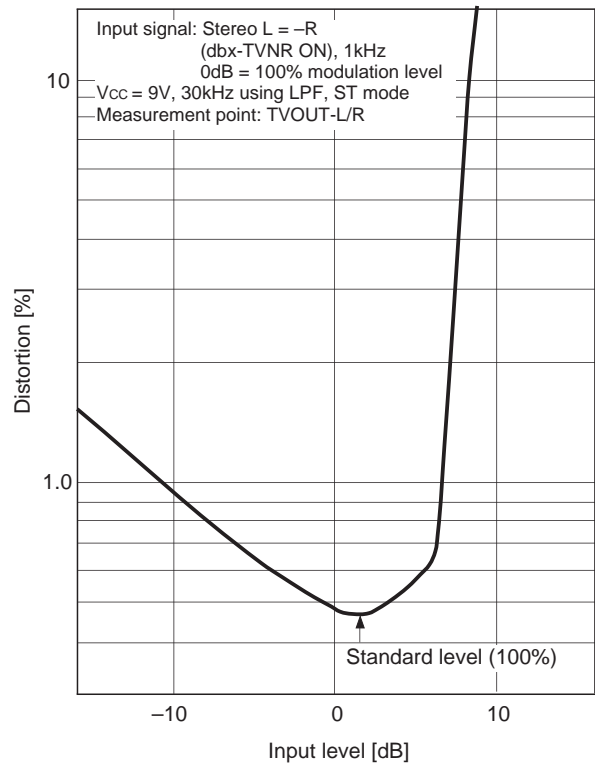


* Data Read is performed during SCL rise.

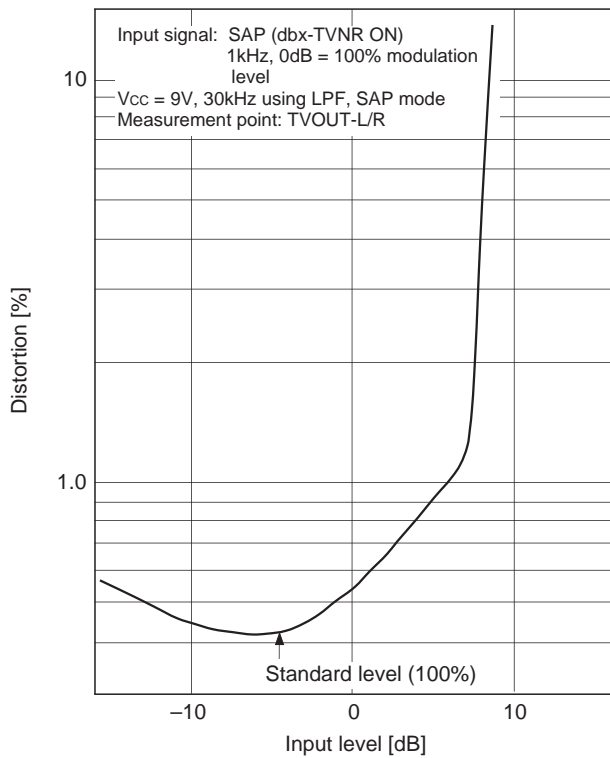
Input level vs. Distortion characteristics 1 (MONO)



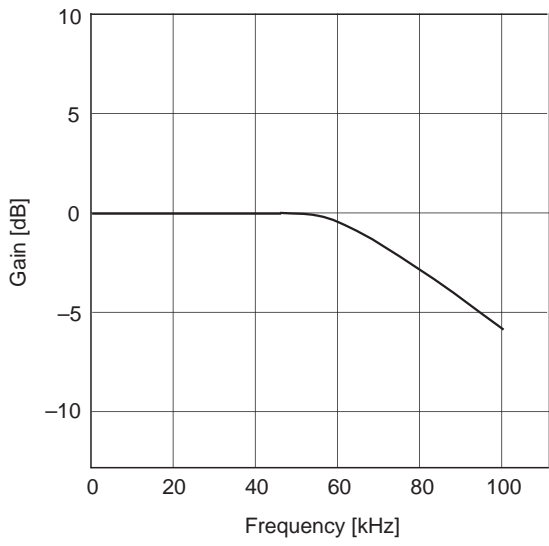
Input level vs. Distortion characteristics 2 (Stereo)



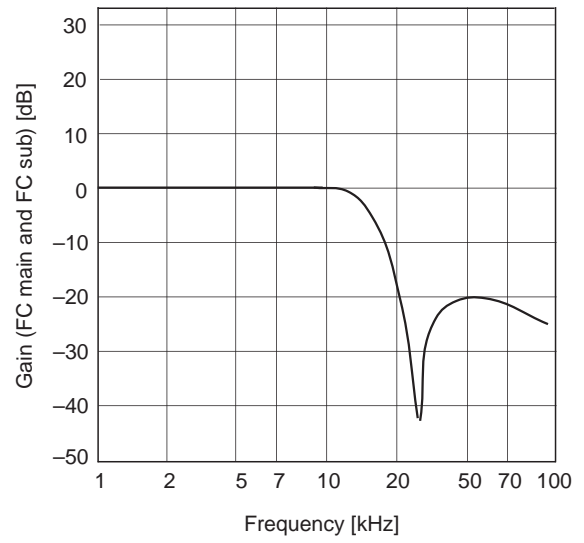
Input level vs. Distortion characteristics 3 (SAP)



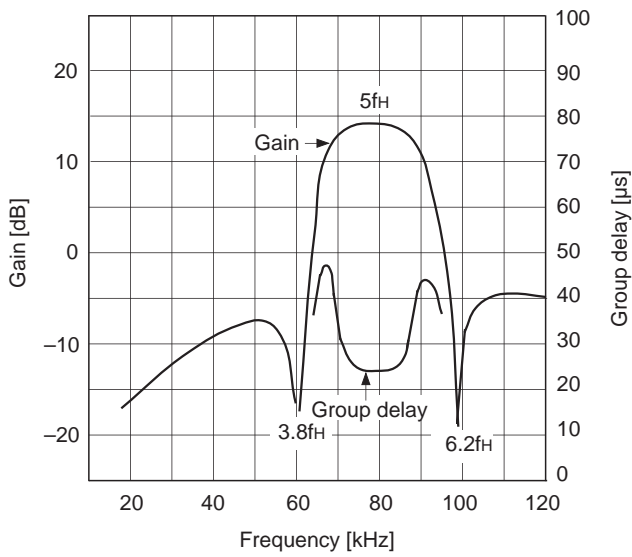
Stereo LPF frequency characteristics



Main LPF and Sub LPF frequency characteristics



SAP frequency characteristics and group delay



Additional SAP frequency characteristics

