# AN3664NFB

## Single chip audio signal processing IC for HiFi VCR

### ■ Overview

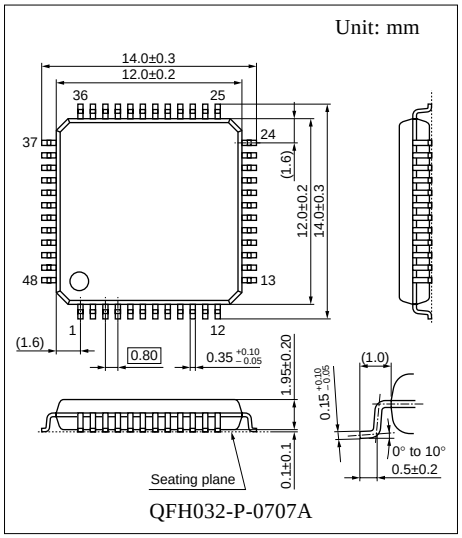
The AN3664FNB is a single chip IC which performs HiFi VCR stereo audio signal processing. It incorporates the PROM to maintain an adjusting value, enabling a complete adjustment-free use.

### ■ Features

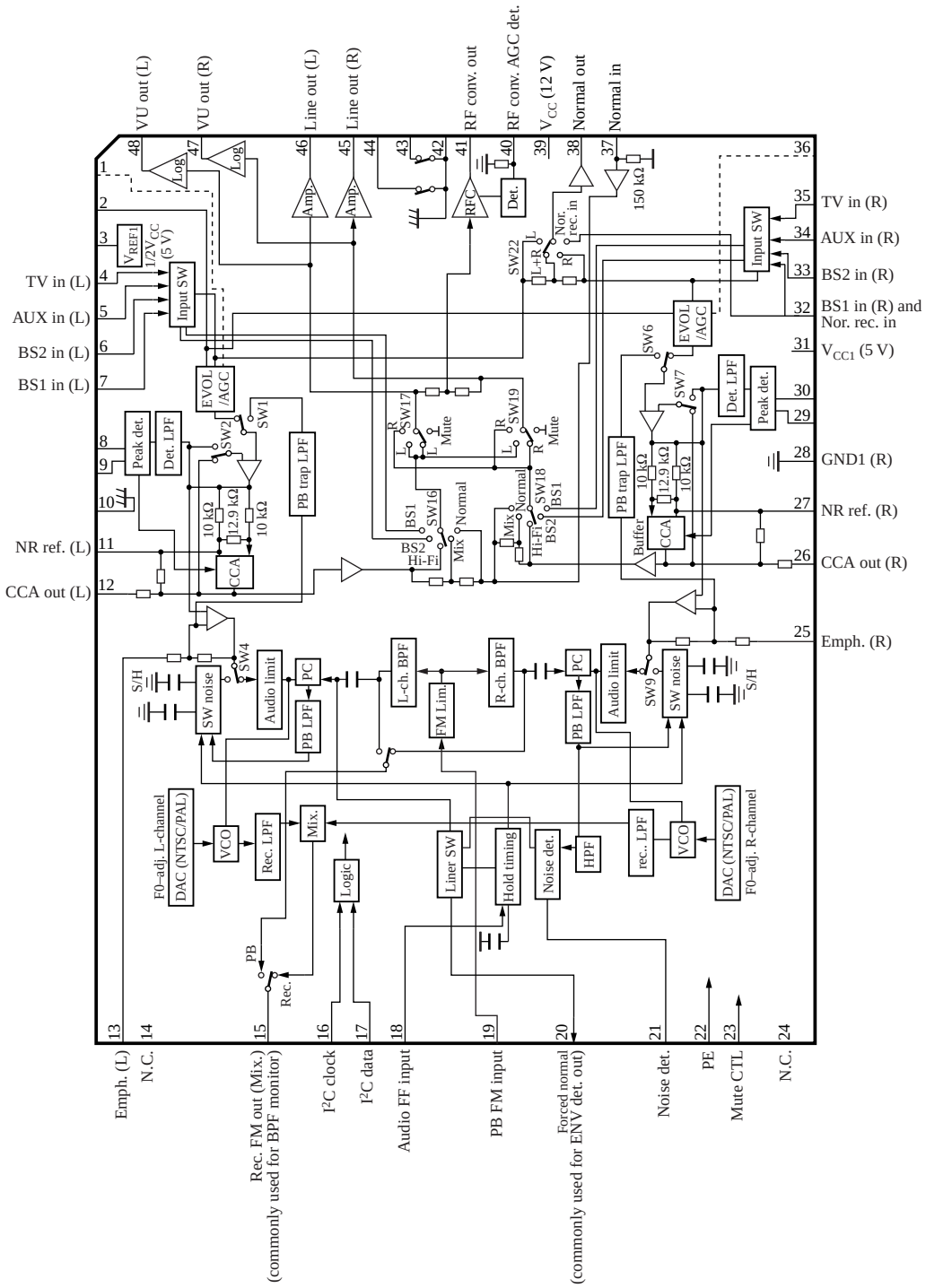
- High precision and adjustment-free $f_O$ , recording/playback level and playback BPF by adoption of built-in Zener zap PROM
- Enhanced cost performance due to incorporating external parts.

### ■ Applications

- HiFi VCR



■ Block Diagram



## ■ Pin Descriptions

| Pin No. | Description | Pin No. | Description |
|---|---|---|---|
| 1 | Recording input volume adjusting pin | 25 | FM emph. / De-emph. (R-channel) |
| 2 | HiFi AGC det. pin | 26 | CCA output pin (R-channel: NR emph.) |
| 3 | $V_{REF1}$ ($1/2V_{CC1}$) | 27 | NR ref. (R-channel) |
| 4 | TV in (L-channel) | 28 | GND (R-channel) |
| 5 | AUX in (L-channel) | 29 | NR det. 2 (R-channel) |
| 6 | BS2 in (L-channel) | 30 | NR det. 1 (R-channel: Weighting) |
| 7 | BS1 in (L-channel) | 31 | $V_{CC}$ ($V_{CC1}$ = 5 V) |
| 8 | NR det. 1 (L-channel: Weighting) | 32 | BS1 in (R-channel) and Normal recording in |
| 9 | NR det. 2 (L-channel) | 33 | BS2 in (R-channel) |
| 10 | GND (L-channel) | 34 | AUX in (R-channel) |
| 11 | NR ref. (L-channel) | 35 | TV in (R-channel) |
| 12 | CCA output pin (L-channel: NR emph.) | 36 | Recording input volume adjusting pin |
| 13 | FM emph. / De-emph. (L-channel) | 37 | Normal audio input |
| 14 | N.C. | 38 | Normal audio output |
| 15 | Rec. FM output / PB BPF monitor | 39 | $V_{CC}$ ($V_{CC2}$ = 12 V) |
| 16 | Serial clock input | 40 | RF conv. AGC det. |
| 17 | Serial data input | 41 | RF conv. amp. output |
| 18 | Head switching pulse input for FM audio | 42 | GND |
| 19 | Playback FM input | 43 | Output mute (R-channel) |
| 20 | Envelope det. and forced normal output | 44 | Output mute (L-channel) |
| 21 | Normal judgement noise detection | 45 | Line amp. output (R-channel) |
| 22 | PE | 46 | Line amp. output (L-channel) |
| 23 | Output mute CTL | 47 | LOG amp. output (R-channel) |
| 24 | Resistor selection pin (or N.C. on use) | 48 | LOG amp. output (L-channel) |

## ■ Absolute Maximum Ratings

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC1}$ | 5.5 | V |
| | $V_{CC2}$ | 13.0 | |
| Power dissipation *1, 2 | $P_D$ | 639 | mW |
| Operating ambient temperature *1 | $T_{opr}$ | −20 to +75 | °C |
| Storage temperature *1 | $T_{stg}$ | −55 to +150 | °C |

Note) 1. The reverse insertion of this IC will cause its breakdown.

2. ∗1: Except for the power dissipation, operating ambient temperature and storage temperature, all ratings are for $T_a$ = 25°C.

∗2: The power dissipation shown is the value for $T_a$ = 75°C.

## ■ Recommended Operating Range

| Parameter | Symbol | Range | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC1}$ | 4.5 to 5.3 | V |
| | $V_{CC2}$ | 8.0 to 12.5 | |

## ■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Circuit current (5 V) at recording | $I_{CCR1}$ | Recording mode<br>Measurement after adjusting $f_O$ | 80 | 95 | 110 | mA |
| Circuit current (12 V) at recording | $I_{CCR2}$ | Recording mode<br>Measurement after adjusting $f_O$ | 7 | 9 | 11 | mA |
| Circuit current (5 V) at playback | $I_{CCP1}$ | Playback mode<br>Measurement after adjusting $f_O$ | 80 | 100 | 120 | mA |
| Circuit current (12 V) at playback | $I_{CCP2}$ | Playback mode<br>Measurement after adjusting $f_O$ | 7 | 9 | 11 | mA |
| ENC out level 1-L | VHRO1L | $V_{IN}$ = –30 dBS, 1 kHz<br>DIN audio, Vol. = 5 V | –12.5 | –11.0 | –9.5 | dBS |
| ENC out level 1-R | VHRO1R | $V_{IN}$ = –30 dBS, 1 kHz<br>DIN audio, Vol. = 5 V | –12.5 | –11.0 | –9.5 | dBS |
| ENC out level 3-L | VHRO3L | $V_{IN}$ = –90 dBS, 1 kHz, DIN audio<br>Vol. = 5 V, VHRO3L/VHRO1L | –33.0 | –30.0 | –27.0 | dB |
| ENC out level 3-R | VHRO3R | $V_{IN}$ = –90 dBS, 1 kHz, DIN audio<br>Vol. = 5 V, VHRO3R/VHRO1R | –33.0 | –30.0 | –27.0 | dB |
| Normal recording out level | VNRO | $V_{IN}$ = –20 dBS, 1 kHz<br>Normal out | –21.5 | –20.0 | –18.5 | dBS |
| Volume level L<br>(Gain = mode 1) | VVOLL | $V_{IN}$ = –20 dBS, 1 kHz<br>L-out, Gain = 1, Vol. = 3 V | –8.0 | –6.0 | –4.0 | dBS |
| Volume level R<br>(Gain = mode 1) | VVOLR | $V_{IN}$ = –20 dBS, 1 kHz<br>L-out, Gain = 1, Vol. = 3 V | –8.0 | –6.0 | –4.0 | dBS |
| Vol. level L/R balance | BVOL | VVOLL – VVOLR | –1.2 | 0.0 | 1.2 | dB |
| Volume maximum level L | VOMAXL | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 5 V | 2.5 | 4.0 | 5.5 | dBS |
| Volume maximum level R | VOMAXR | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 5 V | 2.5 | 4.0 | 5.5 | dBS |
| Volume minimum level L | VOMINL | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 0 V<br>VOMINL/VOMAXL | — | — | –63.0 | dB |
| Volume minimum level R | VOMINR | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 0 V<br>VOMINR/VOMAXR | — | — | –63.0 | dB |
| HiFi AGC mode<br>EE level L | VAGCEL | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 3 V | –8.0 | –6.0 | –4.0 | dBS |
| HiFi AGC mode<br>EE level R | VAGCER | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 3 V | –8.0 | –6.0 | –4.0 | dBS |

■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| HiFi AGC level L | VAGCL | $V_{IN}$ = –2 dBS, 1 kHz<br>Gain = 1, Vol. = 3 V | –2.0 | 0 | 2.0 | dBS |
| HiFi AGC level R | VAGCR | $V_{IN}$ = –2 dBS, 1 kHz<br>Gain = 1, Vol. = 3 V | –2.0 | 0 | 2.0 | dBS |
| Line out<br>Gain = mode 2 level L | VGHL | $V_{IN}$ = –20 dBS, 1 kHz<br>BS1 monitor mode | –9.0 | –7.5 | –6.0 | dBS |
| Line out<br>Gain = mode 2 level R | VGHL | $V_{IN}$ = –20 dBS, 1 kHz<br>BS1 monitor mode | –9.0 | –7.5 | –6.0 | dBS |
| Line out<br>THD L | THRML | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 3 V | — | — | 0.1 | % |
| Line out<br>THD R | THRMR | $V_{IN}$ = –20 dBS, 1 kHz<br>Gain = 1, Vol. = 3 V | — | — | 0.1 | % |
| Line out<br>Vo-maximum L | VMLOL | $f_{IN}$ = 1 kHz, Gain = 1, Vol. = 3 V<br>At output THD 3% | 10.0 | — | — | dBS |
| Line out<br>Vo-maximum R | VMLOR | $f_{IN}$ = 1 kHz, Gain = 1, Vol. = 3 V<br>At output THD 3% | 10.0 | — | — | dBS |
| ENC out<br>Vo-maximum L | VMFEL | $f_{IN}$ = 1 kHz, Vol. = 5 V<br>At output THD 3% | –4.0 | — | — | dBS |
| ENC out<br>Vo-maximum R | VMFER | $f_{IN}$ = 1 kHz, Vol. = 5 V<br>At output THD 3% | –4.0 | — | — | dBS |
| RF conv. out level | VRFC | $V_{IN}$ = –20 dBS, 1 kHz<br>BS2 monitor mode | –9.0 | –6.0 | –3.0 | dBS |
| Line out<br>S/N L | NHLOL | RG = 2.2 kΩ, DIN audio<br>Gain = 1, Vol. = 3 V | 75.0 | — | — | dB |
| Line out<br>S/N R | NHLOR | RG = 2.2 kΩ, DIN audio<br>Gain = 1, Vol. = 3 V | 75.0 | — | — | dB |
| Inter input crosstalk 1 *1<br>(TV-in select) | CTIT | AUX, BS1 and BS2 in = –10 dBS<br>1 kHz, DIN audio, Vol. = 3 V<br>CTIT – VRFC – 10 dB | — | — | –70.0 | dB |
| Inter input crosstalk 2 *1<br>(AUX-in select) | CTIA | TV, BS1 and BS2 in = –10 dBS<br>1 kHz, DIN audio, Vol. = 3 V<br>CTIA – VRFC – 10 dB | — | — | –70.0 | dB |
| Inter input crosstalk 3 *1<br>(BS1-in select) | CTIB1 | TV, AUX and BS2 in = –10 dBS<br>1 kHz, DIN audio, Vol. = 3 V<br>CTIB1 – VRFC – 10 dB | — | — | –70.0 | dB |
| Inter input crosstalk 4 *1<br>(BS2-in select) | CTIB2 | TV, AUX and BS1 in = –10 dBS<br>1 kHz, DIN audio, Vol. = 3 V<br>CTIB2 – VRFC – 10 dB | — | — | –70.0 | dB |
| Crosstalk between channels<br>R → L *1 | CTTRL | TV in R-channel = –10 dBS, 1 kHz<br>DIN audio, Vol. = 3 V<br>CTTRL – VVOLL – 10 dB | — | — | –65.0 | dB |

Note) *1: 10 dB should be reduced from the calculation result because of +10 dB increased input.

■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Crosstalk between channels L → R *1 | CTTRR | TV in L-channel = –10 dBS, 1 kHz DIN audio, Vol. = 3 V CTTLR – VVOLR – 10 dB | — | — | –65.0 | dB |
| Output mode crosstalk 1 *1 (Normal select) | CTHN | TV, BS1 and BS2 in = –10 dBS 1 kHz, DIN audio, Vol. = 3 V CTHN – VRFC – 10 dB | — | — | –65.0 | dB |
| Output mode crosstalk 2 *1 (HiFi select) | CTNH | Pin 37, BS1 and BS2 in = –10 dBS 1 kHz, DIN audio, Vol. = 3 V CTNH – VRFC – 10 dB | — | — | –65.0 | dB |
| Output mode crosstalk 3 *1 (BS1 monitor mode) | CTB1 | Pin 37, TV and BS2 in = –10 dBS 1 kHz, DIN audio, Vol. = 3 V CTB1 – VRFC – 10 dB | — | — | –65.0 | dB |
| Output mode crosstalk 4 *1 (BS2 monitor mode) | CTB2 | Pin 37, TV and BS1 in = –10 dBS 1 kHz, DIN audio, Vol. = 3 V CTB2 – VRFC – 10 dB | — | — | –65.0 | dB |
| Crosstalk between ENC out channels (R → L) | CTENRL | TV in R-channel = –10 dBS, 1 kHz DIN audio, Vol. = 3 V CTENRL – VHRO1L – 5 dB | — | — | –37.0 | dB |
| Crosstalk between ENC out channels (L → R) | CTENLR | TV in R-channel = –10 dBS, 1 kHz DIN audio, Vol. = 3 V CTENLR – VHRO1R – 5 dB | — | — | –37.0 | dB |
| Output muting ratio L *1 | MUTEL | TV in = –10 dBS, 1 kHz Gain = 1, DIN audio, Vol. = 3 V MUTEL – VVOLL – 10 dB | — | — | –65.0 | dB |
| Output muting ratio R *1 | MUTER | TV in = –10 dBS, 1 kHz Gain = 1, DIN audio, Vol. = 3 V MUTER – VVOLR – 10 dB | — | — | –65.0 | dB |
| VCO output frequency L (NTSC) | FNL | NTSC mode, $V_{19}$ = 5 V Non-modulation After PROM adjustment | 1.295 | 1.300 | 1.305 | MHz |
| VCO output frequency R (NTSC) | FNR | NTSC mode, $V_{19}$ = 0 V Non-modulation After PROM adjustment | 1.695 | 1.700 | 1.705 | MHz |
| VCO output frequency L (PAL) | FPL | PAL mode, $V_{19}$ = 5 V Non-modulation After PROM adjustment | 1.395 | 1.400 | 1.405 | MHz |
| VCO output frequency R (PAL) | FPR | PAL mode, $V_{19}$ = 0 V Non-modulation After PROM adjustment | 1.795 | 1.800 | 1.805 | MHz |
| VCO output amplitude L | VOVCOL | NTSC mode, 1.3 MHz Non-modulation | 30 | 53 | 70 | mV[p-p] |

Note) ∗1: 10 dB should be reduced from the calculation result because of +10 dB increased input.

■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VCO output amplitude R | VOVCOR | NTSC mode, 1.7 MHz<br>Non-modulation | 135 | 185 | 235 | mV[p-p] |
| VCO output L/R mix. ratio L | FNLN | NTSC mode<br>Serial control: D05 = 0, D04 = 0 | 9.5 | 11.0 | 12.5 | dB |
| VCO output L/R mix. ratio R | FNRN | NTSC mode<br>Serial control: D05 = 1, D04 = 1 | 6.5 | 8.0 | 9.5 | dB |
| Limiter level 1-L<br>(NTSC mode) | LIMN1L | Pin 19 = 5 V, Pin 13 = 5 V<br>LIMN1L – $f_{OL}$ | –160 | –140 | –120 | kHz |
| Limiter level 1-R<br>(NTSC mode) | LIMN1R | Pin 19 = 0 V, Pin 25 = 5 V<br>LIMN1R – $f_{OR}$ | –160 | –140 | –120 | kHz |
| Limiter level 2-L<br>(NTSC mode) | LIMN2L | Pin 19 = 5 V, Pin 13 = 0 V<br>LIMN2L – $f_{OL}$ | 120 | 140 | 160 | kHz |
| Limiter level 2-R<br>(NTSC mode) | LIMN2R | Pin 19 = 0 V, Pin 25 = 0 V<br>LIMN2R – $f_{OR}$ | 120 | 140 | 160 | kHz |
| FM deviation L | DEVL | $V_{IN}$ = –30 dBS, 1 kHz<br>Vol. = 5 V, Pin 19 = 5 V | 44.0 | 50.0 | 56.0 | kHz |
| FM deviation R | DEVR | $V_{IN}$ = –30 dBS, 1 kHz<br>Vol. = 0 V, Pin 19 = 5 V | 44.0 | 50.0 | 56.0 | kHz |
| FM deviation L/R ratio | DEVLR | DEVR – DEVL | –6.0 | 0.0 | 6.0 | kHz |
| FM modulation distortion L | THFEL | $V_{IN}$ = –20 dBS, 1 kHz<br>Vol. = 3 V, FM RF out | — | — | 0.8 | % |
| FM modulation distortion R | THFER | $V_{IN}$ = –20 dBS, 1 kHz<br>Vol. = 3 V, FM RF out | — | — | 0.8 | % |
| FM modulation S/N L | NHFEL | $R_G$ = 2.2 Ω, DIN audio, Vol. = 3 V<br>FM RF out, DEVL/NHFEL | 35 | — | — | dB |
| FM modulation S/N R | NHFER | $R_G$ = 2.2 Ω, DIN audio, Vol. = 3 V<br>FM RF out, DEVR/NHFER | 35 | — | — | dB |
| 1.3 MHz BPF frequency characteristics 1 *2 | BPF11 | BPF monitor (L-channel)<br>NTSC mode, $f_C$ = 1.3 MHz | 100 | 155 | 190 | mV[p-p] |
| 1.3 MHz BPF frequency characteristics 2 *2 | BPF12 | $f_C$ = 1.45 MHz<br>BPF12/BPF11 | –9.0 | –3.0 | 1.0 | dB |
| 1.3 MHz BPF frequency characteristics 3 *2 | BPF13 | $f_C$ = 1.15 MHz<br>BPF13/BPF11 | –4.0 | –1.0 | 2.0 | dB |
| 1.3 MHz BPF frequency characteristics 5 *2 | BPF15 | V (1.05M) / V (1.45M) | –15.0 | –7.5 | 4.0 | dB |
| 1.7 MHz BPF frequency characteristics 1 *2 | BPF21 | BPF monitor (R-channel)<br>NTSC mode, $f_C$ = 1.7 MHz | 90 | 135 | 170 | mV[p-p] |
| 1.7 MHz BPF frequency characteristics 2 *2 | BPF22 | $f_C$ = 1.85 MHz<br>BPF22/BPF21 | –6.0 | 0.0 | 3.5 | dB |
| 1.7 MHz BPF frequency characteristics 3 *2 | BPF23 | $f_C$ = 1.55 MHz<br>BPF23/BPF21 | –7.0 | –3.0 | 0.5 | dB |

Note) ∗2: PB-FM input level: Single 140 mV[p-p], Mix. 280 mV[p-p]

■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| 1.4 MHz BPF frequency characteristics 1 *2 | BPF31 | BPF monitor (L-channel) PAL mode, $f_C$ = 1.4 MHz | 100 | 155 | 190 | mV[p-p] |
| 1.4 MHz BPF frequency characteristics 2 *2 | BPF32 | $f_C$ = 1.55 MHz BPF32/BPF31 | –9.0 | –3.0 | 1.0 | dB |
| 1.4 MHz BPF frequency characteristics 3 *2 | BPF33 | $f_C$ = 1.25 MHz BPF33/BPF31 | –4.0 | –1.0 | 2.0 | dB |
| 1.4 MHz BPF frequency characteristics 5 *2 | BPF35 | 1.15 MHz/1.55 MHz | –15.0 | –7.5 | 4.0 | dB |
| 1.8 MHz BPF frequency characteristics 1 *2 | BPF41 | BPF monitor (R-channel) PAL mode, $f_C$ = 1.8 MHz | 90 | 135 | 170 | mV[p-p] |
| 1.8 MHz BPF frequency characteristics 2 *2 | BPF42 | $f_C$ = 1.95 MHz BPF42/BPF41 | –6.0 | 0.0 | 3.5 | dB |
| 1.8 MHz BPF frequency characteristics 3 *2 | BPF43 | $f_C$ = 1.65 MHz BPF43/BPF41 | –7.0 | –3.0 | 3.0 | dB |
| Playback out level 1-L *2 | VHPO1L | $V_{IN}$ = 50 kHz Dev, 1 kHz Line out, Gain = 1 | –7.5 | –6.0 | –4.5 | dBS |
| Playback out level 1-R *2 | VHPO1R | $V_{IN}$ = 50 kHz Dev, 1 kHz Line out, Gain = 1 | –7.5 | –6.0 | –4.5 | dBS |
| Playback out level L/R ratio | BHP | VHPO1L – VHPO1R | –1.5 | 0.0 | 1.5 | dB |
| Playback out level 3-L *2 | VHPO3L | FM in = 50 kHz, –30 dB DIN audio, Gain = 1, VHPO3L/VHPO1L | –70.0 | –64.0 | –57.0 | dB |
| Playback out level 3-R *2 | VHPO3R | FM in = 50 kHz, –30 dB DIN audio, Gain = 1, VHPO3R/VHPO1R | –70.0 | –64.0 | –57.0 | dB |
| Playback out frequency characteristics L *2 | VHPFL | In: Dev = 50 kHz, f = 70 kHz DIN audio, Gain = 1, VHPFL/VHPO1L | — | — | –40.0 | dB |
| Playback out frequency characteristics R *2 | VHPFR | In: Dev = 50 kHz, f = 70 kHz DIN audio, Gain = 1, VHPFR/VHPO1R | — | — | –40.0 | dB |
| Playback out distortion L *2 | THPOL | In: Dev = 100 kHz, f = 1 kHz Line out, Gain = 1 | — | — | 0.8 | % |
| Playback out distortion R *2 | THPOR | In: Dev = 100 kHz, f = 1 kHz Line out, Gain = 1 | — | — | 0.8 | % |
| Playback out S/N L *2 | NHPOL | No modulation, Line out, Gain = 1 DIN audio, VHPO1L/NHPOL | 75 | — | — | dB |
| Playback out S/N R *2 | NHPOR | No modulation, Line out, Gain = 1 DIN audio, VHPO1R/NHPOR | 75 | — | — | dB |
| Crosstalk between Playback out channels (R → L) *2 | CTPRL | $V_{IN}$ = 50 kHz Dev, 1 kHz DIN audio, CTPRL/VHPO1L | — | — | –65.0 | dB |
| Crosstalk between Playback out channels (L → R) *2 | CTPLR | $V_{IN}$ = 50 kHz Dev, 1 kHz DIN audio, CTPLR/VHPO1R | — | — | –65.0 | dB |
| DOC on level | DOC1 | $f_{CL}$ = 1.3 MHz $f_{CR}$ = 1.7 MHz ±50 kHz Dev. | 10 | 19 | 30 | mV[p-p] |

Note) ∗2: PB-FM input level: Single 140 mV[p-p], Mix. 280 mV[p-p]

■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C (continued)

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| DOC hysteresis | DOC2 | $f_{CL}$ = 1.3 MHz<br>$f_{CR}$ = 1.7 MHz ±50 kHz Dev. | 0.1 | 2.0 | 6.0 | dB |
| Forced normal on level 1 *2 | ND1 | f = 150 kHz, ND mode = 0<br>Dev. at $V_{20}$ < 0.5 V | 45 | 90 | 135 | kHz Dev |
| VU out level 2-L | VVU2L | Line out = –27 dBS, 1 kHz<br>Gain = 1, HiFi-AGC mode | — | — | 2.0 | V |
| VU out level 2-R | VVU2R | Line out = –27 dBS, 1 kHz<br>Gain = 1, HiFi-AGC mode | — | — | 2.0 | V |
| VU out level 3-L | VVU3L | Line out = –27 dBS, 1 kHz<br>Gain = 1, Normal mode | — | — | 2.6 | V |
| VU out level 3-R | VVU3R | Line out = –27 dBS, 1 kHz<br>Gain = 1, Normal mode | — | — | 2.6 | V |

Note) ∗2: PB-FM input level: Single 140 mV[p-p], Mix. 280 mV[p-p]

• Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Data input (high-level) | $V_{HDATA}$ | At $V_{CC}$ = 5 V | 3.5 | — | 5 | V |
| Data input (low-level) | $V_{LDATA}$ | At $V_{CC}$ = 5 V | 0 | — | 1.5 | V |
| Clock input (high-level) | $V_{HCLOC}$ | At $V_{CC}$ = 5 V | 3.5 | — | 5 | V |
| Clock input (low-level) | $V_{LCLOC}$ | At $V_{CC}$ = 5 V | 0 | — | 1.5 | V |
| Mute CTL input | $V_{IHMUT}$ | Mute on | 3.5 | — | 5 | V |
| Mute CTL input | $V_{ILMUT}$ | Mute off | 0 | — | 1.0 | V |
| Forced normal on level 2 | ND2 | f = 150 kHz, Mode 01<br>Dev. at $V_{20}$ < 0.5 V | — | 80 | — | kHz Dev |
| RF conv. AGC level | VRFCAG | $V_{IN}$ = –10 dBS, f = 1 kHz | — | –4 | — | dBS |
| Normal REC THD | TNRO | $V_{IN}$ = –20 dBS, f = 1 kHz | — | 0.02 | — | % |
| Normal input crosstalk 1<br>(Nor. REC in Select) | CTNNO | TV in = –10 dBS<br>DIN audio | — | –80 | — | dB |
| Normal input crosstalk 2<br>(Line in L/R mix. select) | CTNLR | Nor. rec. in = –10 dBS<br>DIN audio | — | –80 | — | dB |
| Normal input crosstalk 3<br>(Line in R select) | CTNRR | Nor. rec. in & TV in L = –10 dBS<br>DIN audio | — | –80 | — | dB |
| Normal input crosstalk 4<br>(Line in L select) | CTNLL | Nor. rec. in & TV in R = –10 dBS<br>DIN audio | — | –80 | — | dB |
| Carrier 3rd harmonic L | 3HDL | RF recording out | — | –50 | — | dB |
| Carrier 3rd harmonic R | 3HDR | RF recording out | — | –50 | — | dB |
| Limiter level PAL 1-L | LIMP1L | Pin 12 = 5 V, LIMP1L – $f_{OL}$ (PAL) | — | –140 | — | kHz |
| Limiter level PAL 1-R | LIMP1R | Pin 25 = 5 V, LIMP1R – $f_{OR}$ (PAL) | — | –140 | — | kHz |
| Limiter level PAL 2-L | LIMP2L | Pin 12 = 5 V, LIMP2L – $f_{OL}$ (PAL) | — | –140 | — | kHz |
| Limiter level PAL 2-R | LIMP2R | Pin 25 = 5 V, LIMP2R – $f_{OR}$ (PAL) | — | –140 | — | kHz |

■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C (continued)

• Design reference data

Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| 1.3 MHz BPF frequency characteristics 4 | BPF14 | 1.7 MHz/1.3 MHz | — | –32 | — | dB |
| 1.3 MHz BPF frequency characteristics 6 | BPF16 | 1.55 MHz/1.15 MHz | — | –10 | — | dB |
| 1.7 MHz BPF frequency characteristics 4 | BPF24 | 2.1 MHz/1.7 MHz | — | –18 | — | dB |
| 1.7 MHz BPF frequency characteristics 5 | BPF25 | 1.3 MHz/1.7 MHz | — | –30 | — | dB |
| 1.7 MHz BPF frequency characteristics 6 | BPF26 | 1.45 MHz/1.85 MHz | — | –18 | — | dB |
| Envelope out 1 | ENV1 | $V_{IN}$ = 70 mV[p-p], Mix. Measure $V_{21}$ | — | 1.0 | — | V |
| Envelope out 2 | ENV2 | $V_{IN}$ = 280 mV[p-p], Mix. Measure $V_{21}$, ENV2 – ENV1 | — | 1.7 | — | V |
| REC → PB crosstalk | CTRP | $f_C$ = 140 mV[p-p], Mix. TV in = –10 dBS, PB | — | –80 | — | dB |
| 1.4 MHz BPF frequency characteristics 4 | BPF34 | PAL 1.8 MHz/1.4 MHz | — | –32 | — | dB |
| 1.4 MHz BPF frequency characteristics 6 | BPF36 | PAL 1.65 MHz/1.25 MHz | — | –10 | — | dB |
| 1.8 MHz BPF frequency characteristics 4 | BPF44 | PAL 2.2 MHz/1.8 MHz | — | –18 | — | dB |
| 1.8 MHz BPF frequency characteristics 5 | BPF45 | PAL 1.4 MHz/1.8 MHz | — | –30 | — | dB |
| 1.8 MHz BPF frequency characteristics 6 | BPF46 | PAL 1.55 MHz/1.95 MHz | — | –16 | — | dB |
| VU out level L | VUOTL | $V_{IN}$ = –20 dBS, 1 kHz | — | 3.5 | — | V |
| VU out level R | VUOTR | $V_{IN}$ = –20 dBS, 1 kHz | — | 3.5 | — | V |
| BPF group delay difference ($f_O$ ±100 kHz) | GDBPF | Difference of $f_O$ ±100 kHz | — | 500 | — | ns |
| VCO $f_O$ dependence on temperature | TVCO | $f_O$ (T = –10°C) – $f_O$ (T = 75°C) | — | 5 | — | kHz |
| Playback out level 1-L (PAL) | VPO1LP | $V_{IN}$ = 50 kHz, Dev 1 kHz Line out, Gain = high | — | –6.0 | — | dBS |
| Playback out level 1-R (PAL) | VPO1RP | $V_{IN}$ = 50 kHz, Dev 1 kHz Line out, Gain = high | — | –6.0 | — | dBS |
| Normal-off delay time | MON | Defined in FF timing | — | 3 | — | FF |
| ENC attack time | ENAT | f = 5 kHz, $V_{IN}$ = Typ. –20 dB | — | 4 | — | ms |
| ENC recovery time | ENRT | f = 5 kHz, $V_{IN}$ = Typ. –20 dB | — | 65 | — | ms |
| Hold pulse width | HPUL | | — | 10 | — | µs |

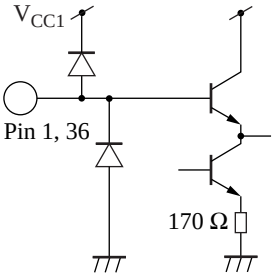
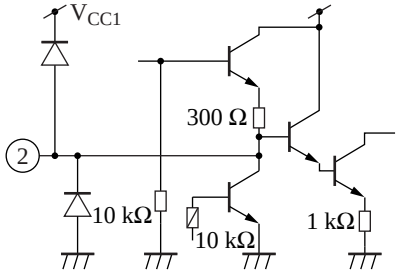
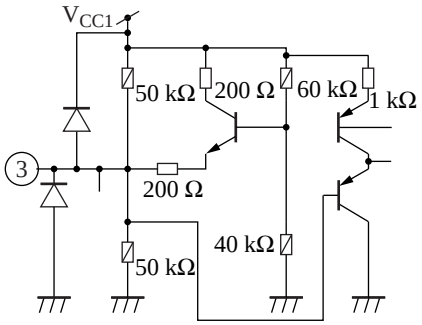
## ■ Electrical Characteristics at $V_{CC1}$ = 5 V, $V_{CC2}$ = 12 V, $T_a$ = 25°C (continued)

• Design reference data

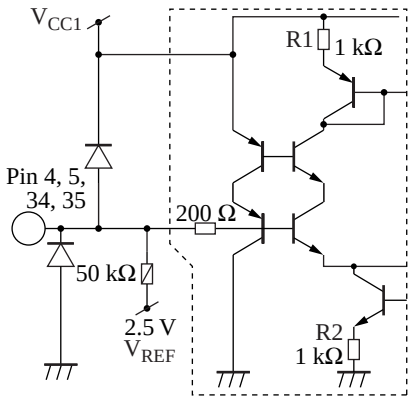
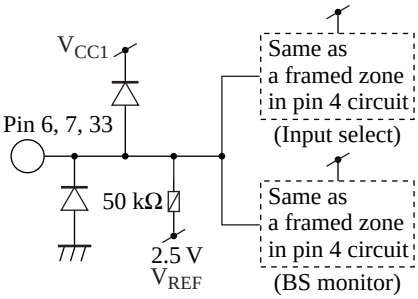
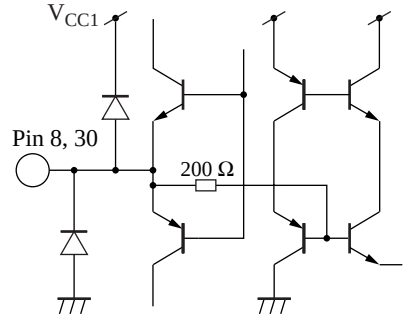
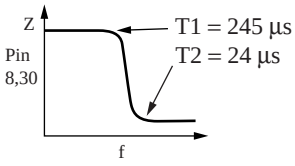
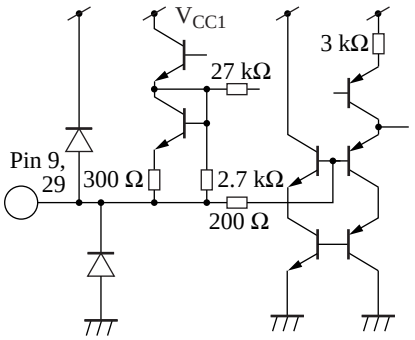
Note) The characteristics listed below are theoretical values based on the IC design and are not guaranteed.

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VCO output R/L mix. ratio 2 | VMIX2 | D05 = 0, D04 = 1 | — | 10 | — | dB |
| VCO output R/L mix. ratio 3 | VMIX3 | D05 = 0, D04 = 1 | — | 9 | — | dB |
| Envelope output DC level in forced normal mode | $V_{ENVN}$ | DC measurement (forced normal) Pin 20 DC potential measurement | — | 0.15 | — | V |
| Envelope output impedance in forced normal mode | $R_{NEFN}$ | DC measurement (forced normal) Pin 20 impedance | — | 400 | — | Ω |
| Output mute on impedance L | $Z_{OML}$ | DC measurement Pin 44 impedance | — | 10 | — | Ω |
| Output mute on impedance R | $Z_{OMR}$ | DC measurement Pin 43 impedance | — | 10 | — | Ω |

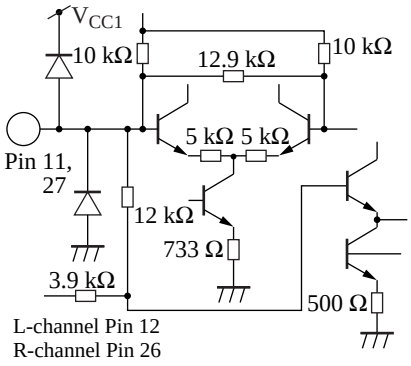
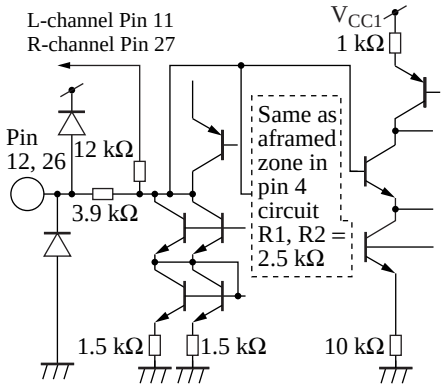
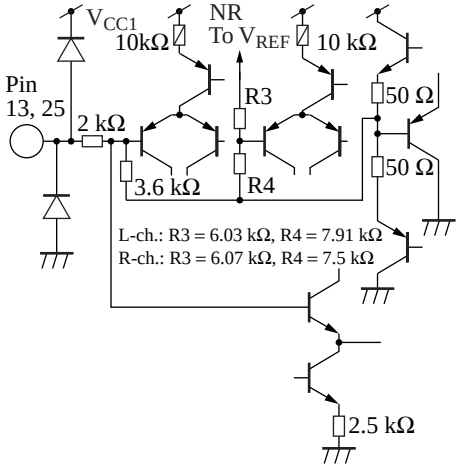
## ■ Terminal Equivalent Circuits

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 1 |  | E-VOL CTL (L-channel) | 3 V |
| 2 |  | HiFi-AGC det. | No fixed |
| 3 |  | 1/2 $V_{CC1}$ $V_{REF1}$:<br>1/2 $V_{CC1}$ pin, but concurrently used for generation of ref. DC shift current of 1/2 $V_{CC2}$ . | 2.5 V |

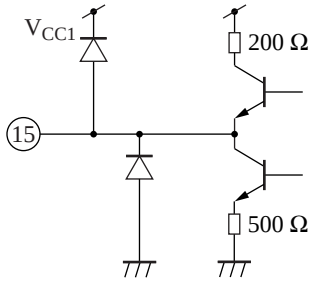
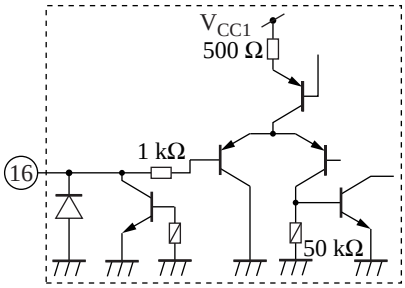
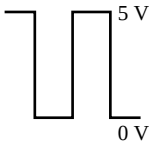
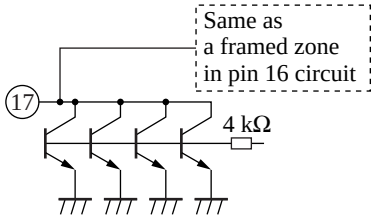
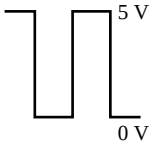
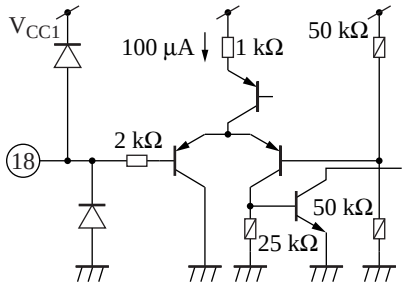
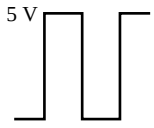
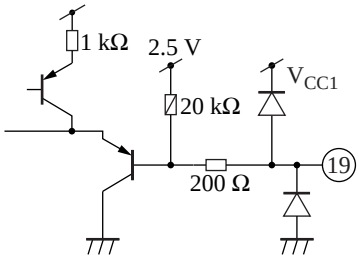
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 4 |  | TV in (L-channel):<br>Audio signal<br>Typical: −20 dBS (1 kHz) | 2.5 V |
| 5 | | AUX in (L-channel):<br>Audio signal<br>Typical: −20 dBS (1 kHz) | |
| 6 |  | BS2 in (L-channel):<br>Audio signal<br>Typical: −20 dBS (1 kHz) | 2.5 V |
| 7 | | BS1 in (L-channel):<br>Audio signal<br>Typical: −20 dBS (1 kHz) | |
| 8 |  | NR det. 1 (L-channel):<br>Sets the weighting time constant for a noise reduction. Shown below is the CR constant setting example in the application circuit model:<br>  | 2.5 V |
| 9 |  | NR det. 2 (L-channel) | 1.35 V at no signal |
| 10 | — | GND1 (L-channel) | 0 V |

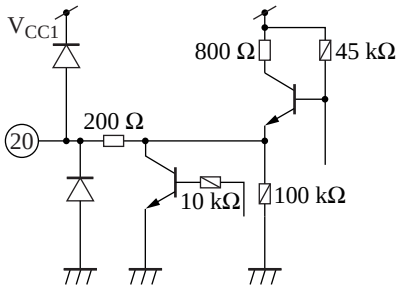
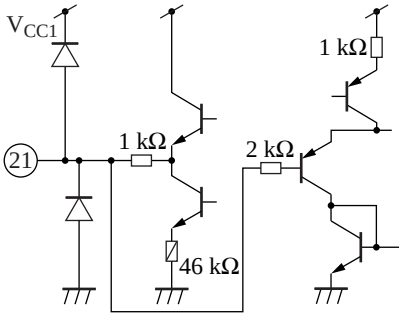
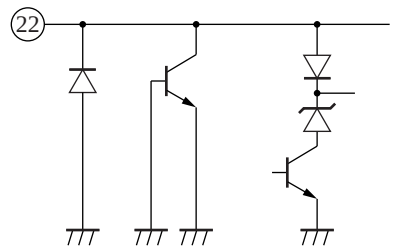
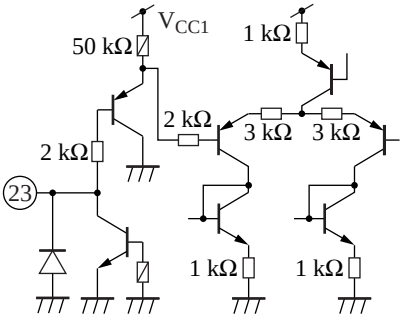
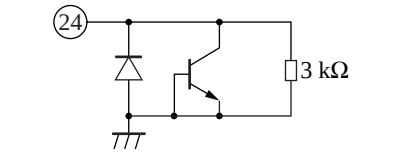
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 11 |  | NR ref. (L-channel):<br>This pin specifies a reference voltage for HiFi signal system. | 2.5 V |
| 12 |  | CCA out (L-channel):<br>Audio signal<br>Typical: −20 dBS (1 kHz) | 2.5 V |
| 13 |  | Emph. NF (L-channel)<br>In recording, it enables you to evaluate without an external capacitor as a monitor pin for encode output.<br>Typical: −11 dBS (1 kHz)<br>The time constant in FM emphasis is determined by an external capacitance and an inside resistor. | 2.5 V |
| 14 | — | N.C. | — |

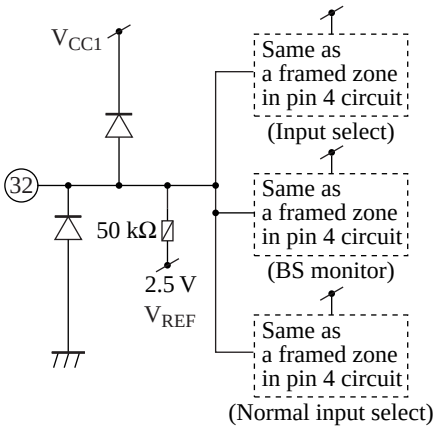
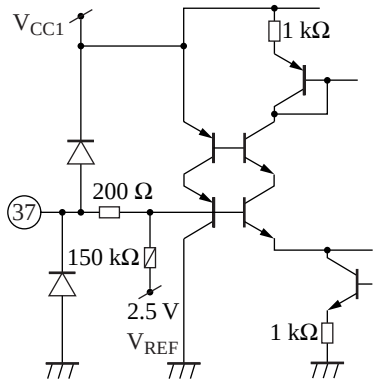
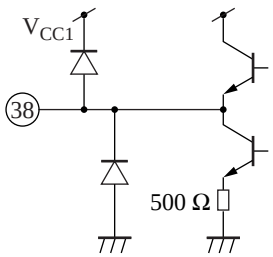
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 15 |  | REC FM out<br>PB BPF monitor:<br>The FM output in recording is an R+L mix output. The mixing ratio can be switched to 4 stages in serial. Pin 19 can output 5 V for L-channel and 0 V for R-channel (before mixing) independently.<br>In playback, the BPF monitor output is linked with output channel switching.<br>The output impedance is about 80 Ω. | 2.5 Vat recording<br>2.5 V<br>at BPF monitor<br>0 V<br>at PB stereo |
| 16 |  | Clock in:<br>High: 3.5 V to 5.0 V<br>Low: 0 V to 1.5 V |  <br>Serial clock |
| 17 |  | Data in:<br>High: 3.5 V to 5.0 V<br>Low: 0 V to 1.5 V |  <br>Serial data |
| 18 |  | Audio FF:<br>(head switching pulse input)<br>High: 3.5 V to 5.0 V<br>Low: 0 V to 1.5 V |  |
| 19 |  | PB FM in:<br>Input impedance: approx. 20 kΩ<br>Typical input carrier level: 140 mV[p-p]<br>(280 mV[p-p] at mixing) | 2.5 V |

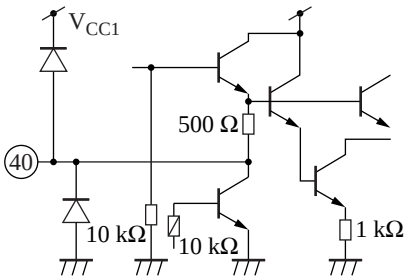
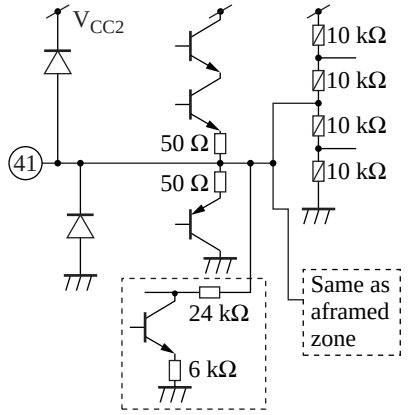
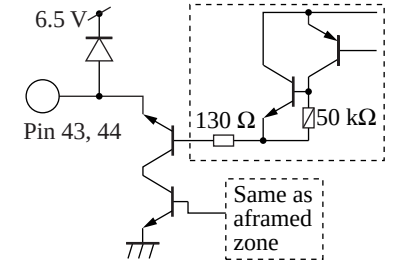
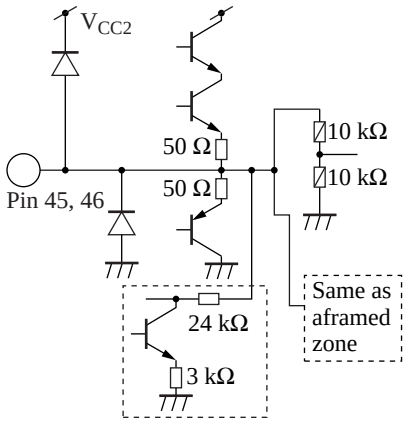
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 20 |  | Envelope det. out<br>Forced normal out:<br>Terminal voltage varies according to L-channel input carrier level.<br>At forced normal, output impedance is approx. 400 Ω. | 1.8 V at typical carrier level input<br>0 V at forced normal |
| 21 |  | Noise det.:<br>Detects the output which is the demodulated R-channel noise output through an built-in second order HPF ($f_C$ = 150K), with an external capacitor. | 1.9 V or more |
| 22 |  | PE | — |
| 23 |  | Mute CTL:<br>Mute on: 3.5 V or more<br>Mute off: 1.0 V or less | No fixed |
| 24 |  | Selective resistor pin:<br>N.C. is possible at normal use. | 0 V |
| 25 | Refer to pin 13 | Emph. NF (R-channel): Refer to pin 13 | Refer to pin 13 |
| 26 | Refer to pin 12 | CCA out (R-channel): Refer to pin 12 | Refer to pin 12 |

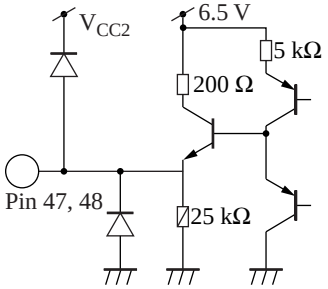
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 27 | Refer to pin 11 | NR ref. (R-channel): Refer to pin 11 | Refer to pin 11 |
| 28 | — | GND1 (R-channel) | Refer to pin 10 |
| 29 | Refer to pin 9 | NR det. 2 (R-channel) | Refer to pin 9 |
| 30 | Refer to pin 8 | NR det. 1 (R-channel): Refer to pin 8 | Refer to pin 8 |
| 31 | — | $V_{CC1}$ (R-channel) | 5 V |
| 32 |  | BS1 in (R-channel) and Nor. rec. in: Audio signal<br>Typical: −20 dBS (1 kHz)<br><br>Note) Because of using the same pin for both R-channel BS1 and Nor. rec. in, HiFi input is 3 input/ch. in using as normal input. | |
| 33 | Refer to pin 6 | BS2 in (R-channel): Refer to pin 6 | Refer to pin 6 |
| 34 | Refer to pin 4 | AUX in (R-channel): Refer to pin 4 | Refer to pin 4 |
| 35 | Refer to pin 4 | TV in (R-channel): Refer to pin 4 | Refer to pin 4 |
| 36 | Refer to pin 1 | E-VOL CTL (R-channel): Refer to pin 1 | Refer to pin 1 |
| 37 |  | Normal in | 2.5 V |
| 38 |  | Normal out | 2.5 V |
| 39 | — | $V_{CC2}$ | 12 V or 9 V |

■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 40 |  | RFC AGC det.:<br>Recovery current source built in | 0 V at no signal<br><br>1 V at standard signal input (+10 dB) |
| 41 |  | RF conv. out:<br>Output impedance: approx. 20 Ω | 6.0 V at using $V_{CC2}$ = 12 V<br><br>4.5 V at using $V_{CC2}$ = 9 V |
| 42 | — | GND2 | 0 V |
| 43 |  | Mute R:<br>Impedance at mute: 20 Ω or less | Not fixed |
| 44 | | Mute L:<br>Impedance at mute: 20 Ω or less | |
| 45 |  | Line out R:<br>Output impedance: approx. 20 Ω | 6.0 V at using $V_{CC2}$ = 12 V<br><br>4.5 V at using $V_{CC2}$ = 9 V |
| 46 | | Line out L:<br>Output impedance: approx. 20 Ω | |

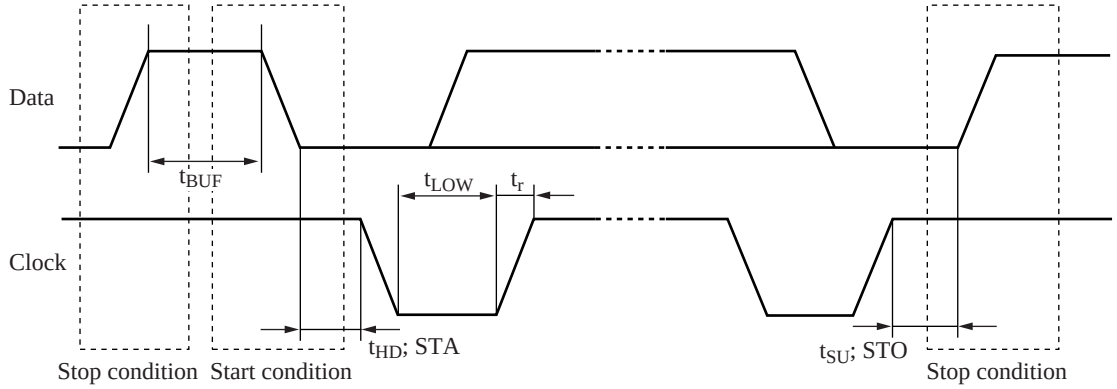
■ Terminal Equivalent Circuits (continued)

| Pin No. | Equivalent circuit | Description | Voltage |
|---|---|---|---|
| 47 |  | VU out R:<br>Half-wave rectification output | 3.5 V at standard signal input (–20 dBS) |
| 48 | | VU out L:<br>Half-wave rectification output | |

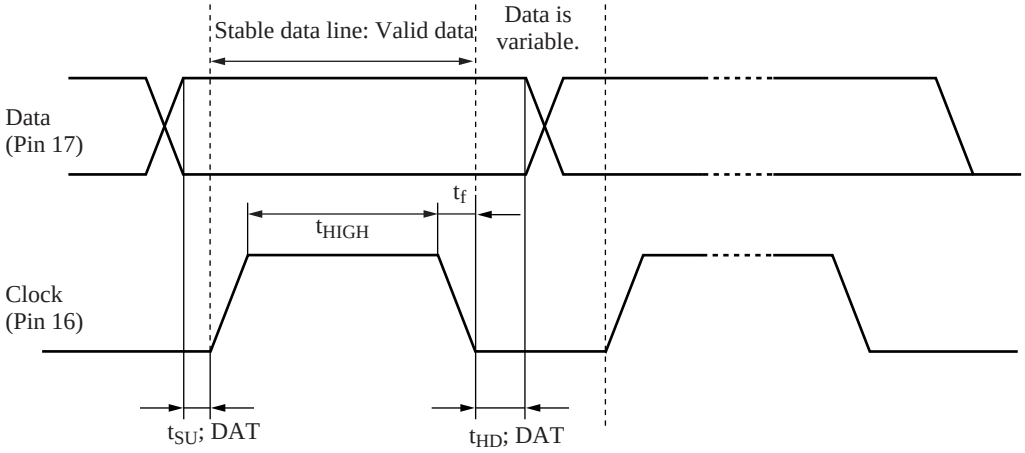
## ■ Application Notes

- Serial control timing specification

1. Start and stop conditions




2. Data recognition condition




3. Recommended operation condition

| Parameter | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| Bus free time between stop and start conditions | $t_{BUF}$ | 4.7 | — | µs |
| Hold time start condition (First clock pulse is generated after this period.) | $t_{HD}$; STA | 4.0 | — | µs |
| Clock low state hold time | $t_{LOW}$ | 4.7 | — | µs |
| Rise time of data and clock signals | $t_r$ | — | 1 000 | ns |
| Setup time of stop condition | $t_{SU}$; STO | 4.0 | — | µs |
| Data setup time | $t_{SU}$; DAT | 250 | — | ns |
| Clock high state hold time | $t_{HIGH}$ | 4.0 | — | µs |
| Fall time of data and clock signals | $t_f$ | — | 300 | ns |
| Data hold time | $t_{HD}$; DAT | 5.0 | — | µs |
| Clock frequency | $f_{SCL}$ | 0 | 100 | kHz |

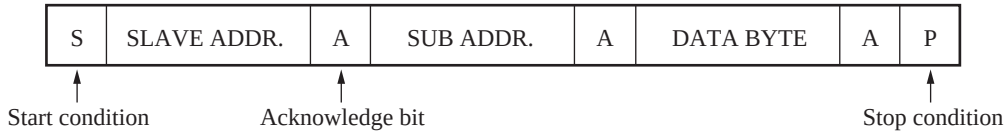
## ■ Application Notes (continued)

• Serial control timing specification (continued)

4. Data specification

1) Slave address: 1 1 1 0 1 0 0 0

2) Slave address format




3) Function (sub-address byte and data byte format)

Note) The underlined values show an initial state at power on.

AN3664NFB serial mode

| Sub-address \ Data byte | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
|---|---|---|---|---|---|---|---|---|
| (HEX) | Recording/ Playback | BS monitor input | Recording FM mix. ratio | | HiFi input select | | Nor. input select | |
| 00 | 0 = Playback<br>1 = Recording | 0 = BS1<br>1 = BS2 | (0, 0) = 11 dB (R/L)<br>(0, 1) = 10 dB<br>(1, 0) = 9 dB<br>(1, 1) = 8 dB | | (0, 0) = TV<br>(0, 1) = AUX<br>(1, 0) = BS2<br>(1, 1) = BS1 | | (0, 0) = Nor. rec. in<br>(0, 1) = R-channel<br>(1, 0) = L-channel<br>(1, 1) = L/R mix. | |
| | NTSC/PAL | Line amp gain setting | DOC select | Nor. detection*1 | Output mode select | | Output channel select (SW 17, 19) | |
| 01 | 0 = NTSC<br>1 = PAL | 0 = –6.0 dBs<br>1 = –7.5 dBs | 0 = On<br>1 = Off | 0 = 2.55 V<br>1 = 2.35 V | (0, 0) = HiFi<br>(0, 1) = Mix.<br>(1, 0) = Normal<br>(1, 1) = BS monitor | | (0, 0) = Stereo<br>(0, 1) = L-channel<br>(1, 0) = R-channel<br>(1, 1) = ×××× | |
| | BPF L-channel adj.*2 | | ND select forced normal on/off | HiFi AGC | Test*2 | Zap mode*2 | $V_{CC2}$ select | Power save |
| 02 | (0, 0) = Prohibition<br>(0, 1) = Low shift<br>(1, 0) = High shift<br>(1, 1) = Typical | | 0 = On<br>1 = Off | 0 = Off<br>1 = On | 0 = Off<br>1 = On | 0 = DAC<br>1 = PROM | 0 = 9 V<br>1 = 12 V | 0 = Off<br>1 = On |
| | BPF R-channel adj.*2 | | D53 | D43 | D33 | D23 | D13 | D03 |
| 03 | (0, 0) = Prohibition<br>(0, 1) = Low shift<br>(1, 0) = High shift<br>(1, 1) = Typical | | DACR(5)*2<br>NTSC | DACR(4)*2<br>NTSC | DACR(3)*2<br>NTSC | DACR(2)*2<br>NTSC | DACR(1)*2<br>NTSC | DACR(0)*2<br>NTSC |
| | PBOUT L-channel adj.*2 | | D54 | D44 | D34 | D24 | D14 | D04 |
| 04 | (0, 0) = Prohibition<br>(0, 1) = High Shift<br>(1, 0) = Low Shift<br>(1, 1) = Typical | | DACL(5)*2<br>NTSC | DACL(4)*2<br>NTSC | DACL(3)*2<br>NTSC | DACL(2)*2<br>NTSC | DACL(1)*2<br>NTSC | DACL(0)*2<br>NTSC |
| | PBOUT R-channel adj.*2 | | D55 | D45 | D35 | D25 | D15 | D05 |
| 05 | (0, 0) = Prohibition<br>(0, 1) = High shift<br>(1, 0) = Low shift<br>(1, 1) = Typical | | DACR(2)*2<br>PAL | DACR(1)*2<br>PAL | DACR(0)*2<br>PAL | DACL(2)*2<br>PAL | DACL(1)*2<br>PAL | DACL(0)*2<br>PAL |

Note) ∗1: Described as 21-pin DC voltage.

∗2: Used for the inspection.

## ■ Application Notes (continued)

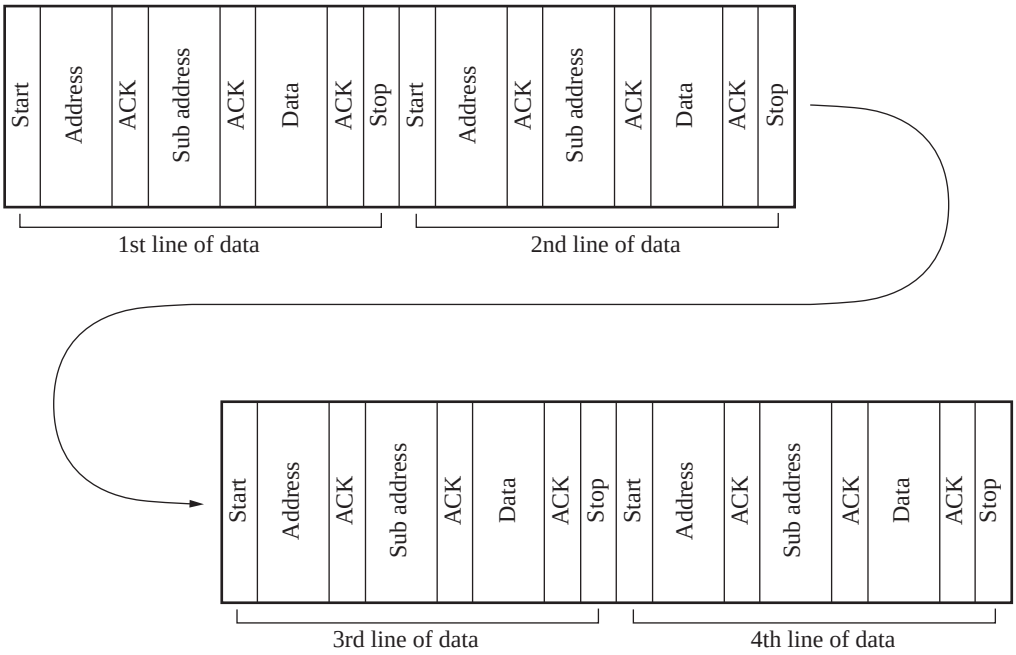
- Serial control timing specification (continued)

5. Usage notes

Serial data transmission

You need to send the start and stop conditions every time you send one line of data.
To change a serial mode setting, you have only to send one line of data on the part to be changed.

<Example: in case of sending all data of four lines>



■ Application Circuit Example