

2-channel PRE / REC amplifier with auto-tracking interface

BA7180AS / BA7180AFS

The BA7180AS and BA7180AFS are PRE / REC amplifiers developed for use in video cassette recorders. They have been designed for use in two-head decks and feature built-in FB damping, two preamplifiers, a chroma output amplifier, an FM output amplifier (with AGC), an envelope detector, a constant-current BTL-drive REC amplifier (with AGC) and built-in channel and REC / PB switches on a single monolithic IC.

●Applications

VCRs

●Features

- 1) The playback amplifier has a total gain of 57dB (Typ.), and has a low-noise preamplifier. Designed for VHS-band operation with low external parts count. The ICs have 2 circuits for 2-head VCR applications.
- 2) Two playback output systems (through output and AGC output). The AGC output level is 300mV_{P-P} (Typ.); suitable for FM brightness signal output.
- 3) Auto-tracking interface for automated tracking adjustment. The detector characteristic is non-linear to improve tracking accuracy during playback of low signal levels.
- 4) The recording amplifier uses constant-current BLT drive that handles load variations (i.e. head impedance) well, and gives stable recording characteristics. A single circuit is provided for 2-head VCR use.
- 5) Built-in recording level AGC means adjustment of FM recording current is not necessary.
- 6) Head switches for 2-channel PRE / REC system provided.
- 7) Operates off a single 5V power supply, with low power dissipation.

●Absolute maximum ratings (Ta = 25°C)

| Parameter | Symbol | Limits | Unit |
|-----------------------|------------------|------------|------|
| Power supply voltage | V _{CC} | 7.0 | V |
| Power dissipation | BA7180AS | 1000*1 | mW |
| | BA7180AFS | 937.5*2 | |
| Operating temperature | T _{opr} | -20 ~ +65 | °C |
| Storage temperature | T _{stg} | -55 ~ +150 | °C |

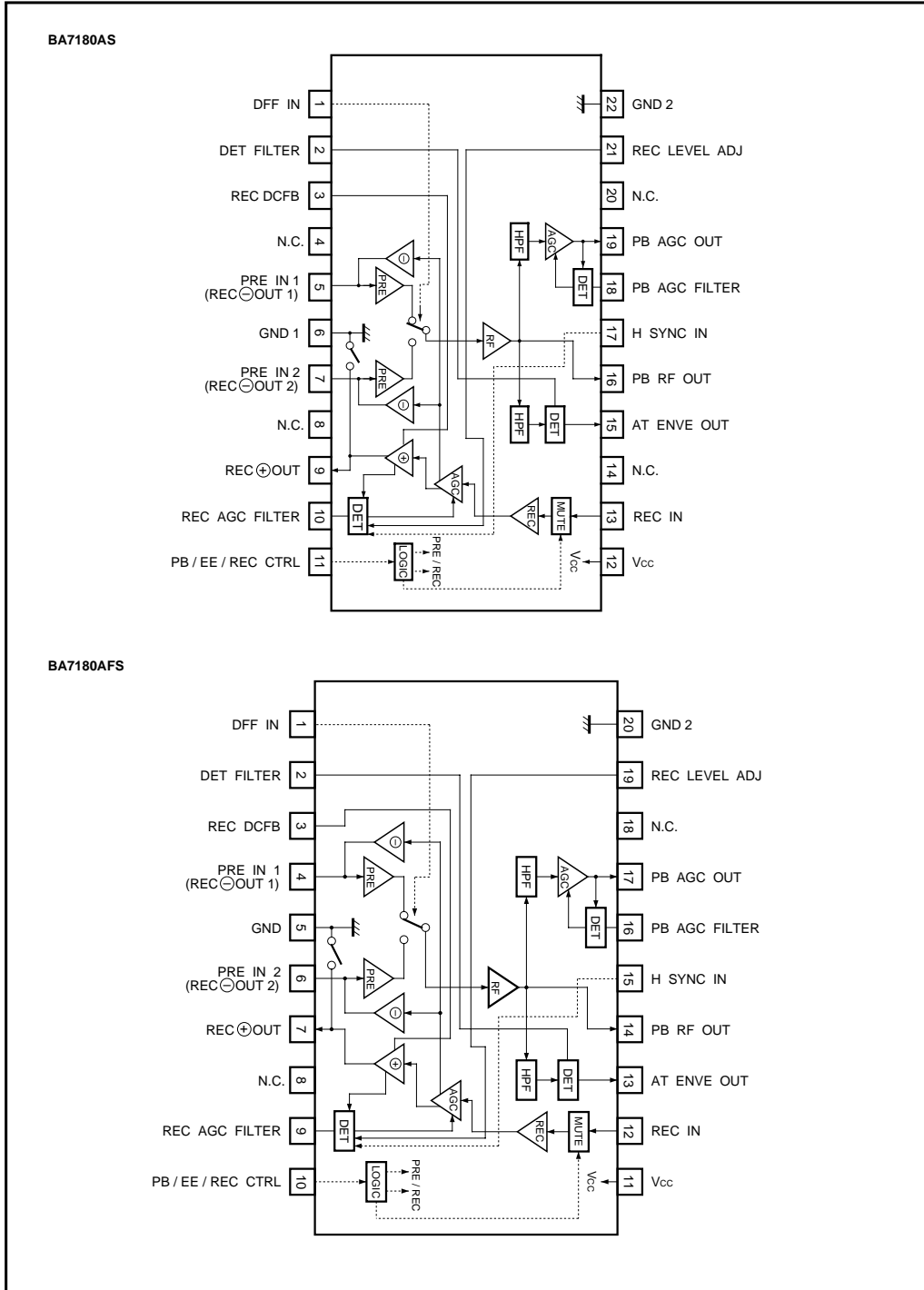
*1 Reduced by 10.0mW for each increase in Ta of 1°C over 25°C (free air).

*2 When mounted on a 90mm × 90mm, t = 1.6mm glass epoxy board, reduced by 7.5mW for each increase in Ta of 1°C over 25°C.

●Recommended operating conditions (Ta = 25°C)

| Parameter | Symbol | Min. | Typ. | Max. | Unit |
|----------------------|-----------------|------|------|------|------|
| Playback / recording | V _{CC} | 4.5 | 5.0 | 5.5 | V |

●Block diagram



●Electrical characteristics (unless otherwise noted, Ta = 25°C, V_{CC} = 5.0V and f = 4.0MHz)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions (BA7180AS) | Measurement circuit |
|--|--------------------|-------|------|-----------------|-------------------|--|---------------------|
| 〈Playback system〉 (Pin 11 in Fig.1 measurement circuit "H") | | | | | | | |
| Quiescent current | I _{q (P)} | — | 18 | 45 | mA | No signal | Fig.1 |
| Voltage gain CH-1 | G _{VP1} | 54 | 57 | 60 | dB | Pin 5 input = 0.3mV _{P-P} , pin 1: L, pin 16 output measurement | Fig.1 |
| Voltage gain CH-2 | G _{VP2} | 54 | 57 | 60 | dB | Pin 7 input = 0.3mV _{P-P} , pin 1: L, pin 16 output measurement | Fig.1 |
| Voltage gain differential | ΔG _{VP} | - 1 | 0 | + 1 | dB | ΔG _{VP} = G _{VP1} - G _{VP2} | Fig.1 |
| Frequency characteristic | ΔG _{VF} | - 7 | - 3 | 0 | dB | Difference in pin 16 output level for f = 8.0 / 1.0MHz, V _{IN} = 0.3mV _{P-P} | Fig.1 |
| 2nd harmonic distortion | 2HDP | — | - 45 | - 38 | dBc | V _{IN} = 0.3mV _{P-P} , 8.0MHz spurious | Fig.1 |
| 3rd harmonic distortion | 3HDP | — | - 45 | - 40 | dBc | V _{IN} = 0.3mV _{P-P} , 12.0MHz spurious, guaranteed design value. | Fig.1 |
| Maximum output level | V _{OMP} | 1.0 | 1.5 | — | V _{P-P} | When pin 16 output 2nd harmonic distortion is -30dBc | Fig.1 |
| Crosstalk | CT _P | — | - 38 | - 32 | dBc | Difference in pin 16 output level for pin 1: H / L. | Fig.1 |
| Output DC offset | ΔV _{ODC} | - 150 | 0 | + 150 | mV _{P-P} | Pin 16 output DC offset for pin 1: H / L. | Fig.1 |
| Input conversion noise | V _{NIN} | — | 0.25 | 1.0 | μV _{rms} | RG = 10Ω, input conversion of pin 14 output noise, guaranteed design value. | Fig.1 |
| AGC output level | V _{AGC} | 250 | 300 | 350 | mV _{P-P} | V _{IN} = 0.3mV _{P-P} , Pin 19 output measurement | Fig.1 |
| AGC control sensitivity | ΔV _{AGC} | — | 0.3 | 2.0 | dB | Pin 19 output level difference for V _{IN} = 0.15 - 0.6mV _{P-P} | Fig.1 |
| AGC amp frequency characteristic | ΔG _{VAF} | - 3 | 0.5 | + 3 | dB | Difference in pin 19 output level for f = 8.0 / 1.0MHz V _{IN} = 0.3mV _{P-P} , guaranteed design value. | Fig.1 |
| PB switch ON resistance | R _{ON9} | — | 4 | 10 | Ω | Pin 9 impedance, guaranteed design value. | Fig.1 |
| PRE CH 2 threshold voltage | V _{TH1H} | 3.5 | — | V _{CC} | V | Pin 1 DC voltage for CH 2 operation | Fig.1 |
| PRE CH 1 threshold voltage | V _{TH1L} | 0 | — | 1.2 | V | Pin 1 DC voltage for CH 1 operation | Fig.1 |
| ENVE output level | V _{ENV2} | 1.9 | 2.4 | 2.9 | V | Pin 15 output measurement when pin 16 output = 100mV _{P-P} | Fig.1 |
| ENVE output level | V _{ENV3} | 3.45 | 3.7 | 3.95 | V | Pin 15 output measurement when pin 16 output = 400mV _{P-P} | Fig.1 |
| ENVE saturation voltage | V _{ENV4} | 4.0 | 4.5 | — | V | Pin 15 output measurement for large signal | Fig.1 |
| PB mode holding voltage | V _{TH10H} | 3.8 | — | V _{CC} | V | Pin 11 DC voltage for PB mode | Fig.1 |
| EE mode holding voltage | V _{TH10M} | 2.2 | — | 2.8 | V | Pin 11 DC voltage for REC MUTE mode | Fig.1 |
| REC mode threshold voltage | V _{TH10L} | 0 | — | 1.2 | V | Pin 11 DC voltage for REC mode | Fig.1 |

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions (BA7180AS) | Measurement circuit |
|---|------------------|------|-------|----------|-------------------|--|---------------------|
| 〈Recording system〉 (Pin 11 in Fig. 2 measurement circuit "L") | | | | | | | |
| Quiescent current | $I_{q(R)}$ | — | 72 | 110 | mA | No signal | Fig.2 |
| Recording AGC level | I_{OAR} | 27 | 30 | 33 | mA _{P-P} | Pin 13 input = 125mV _{P-P} , pin 9 output measurement | Fig.2 |
| AGC control sensitivity | ΔI_{OAR} | — | 0.3 | 1.5 | dB | Pin 9 output level difference for pin 13 input = 62.5mV _{P-P} ~ 250mV _{P-P} | Fig.2 |
| REC amplifier frequency characteristic | ΔI_{OAF} | -4 | -1.5 | — | dB | Pin 9 output level difference for f = 8.0 / 1.0MHz, pin 12 input = 125mV _{P-P} , guaranteed design value. | Fig.2 |
| 2nd harmonic distortion | 2HDR | — | -45 | -38 | dBc | Pin 13 input = 125mV _{P-P} 8MHz spurious | Fig.2 |
| 3rd harmonic distortion | 3HDR | — | -50 | -40 | dBc | Pin 13 input = 125mV _{P-P} 12MHz spurious, guaranteed design value. | Fig.2 |
| Cross modulation distortion | CMDR | — | -50 | -40 | dBc | 4.0MHz ± 630kHz spurious, guaranteed design value. | Fig.2 |
| Maximum output level | I_{OMR} | 40 | 50 | — | mA _{P-P} | When pin 9 output 2nd harmonic distortion is -30dB | Fig.2 |
| Recording current load characteristic | ΔI_{ORL} | -1.5 | -0.35 | — | dB | Pin 9 output level difference for load L: 8.2 ~ 12μH, guaranteed design value. | Fig.2 |
| Mute attenuation ratio | MU_R | — | -45 | -38 | dBc | Pin 9 output level difference for pin 11: M / H. | Fig.2 |
| AGC mode holding voltage | V_{TH15H} | 2.7 | — | V_{CC} | V | Pin 17 DC voltage to maintain recording AGC operation | Fig.2 |
| AGC mode holding voltage | V_{TH15L} | 0 | — | 1.2 | V | Pin 17 DC voltage to maintain recording AGC stopped | Fig.2 |

Note:

dBc: dB below carrier (used to express relative level from carrier reference for convenience sake)

●Reference values (unless otherwise noted, Ta = 25°C, V_{CC} = 4.8V and f = 4.0MHz)

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions (BA7180AS) |
|-------------------|------------|------|------|------|------|---|
| ENVE output level | V_{ENV2} | 1.8 | 2.3 | 2.8 | V | Pin 15 output measurement when pin 16 output = 100mV _{P-P} . |
| ENVE output level | V_{ENV3} | 3.35 | 3.6 | 3.85 | V | Pin 15 output measurement when pin 16 output = 400mV _{P-P} . |

● Measurement circuits

BA7180AS (playback system)

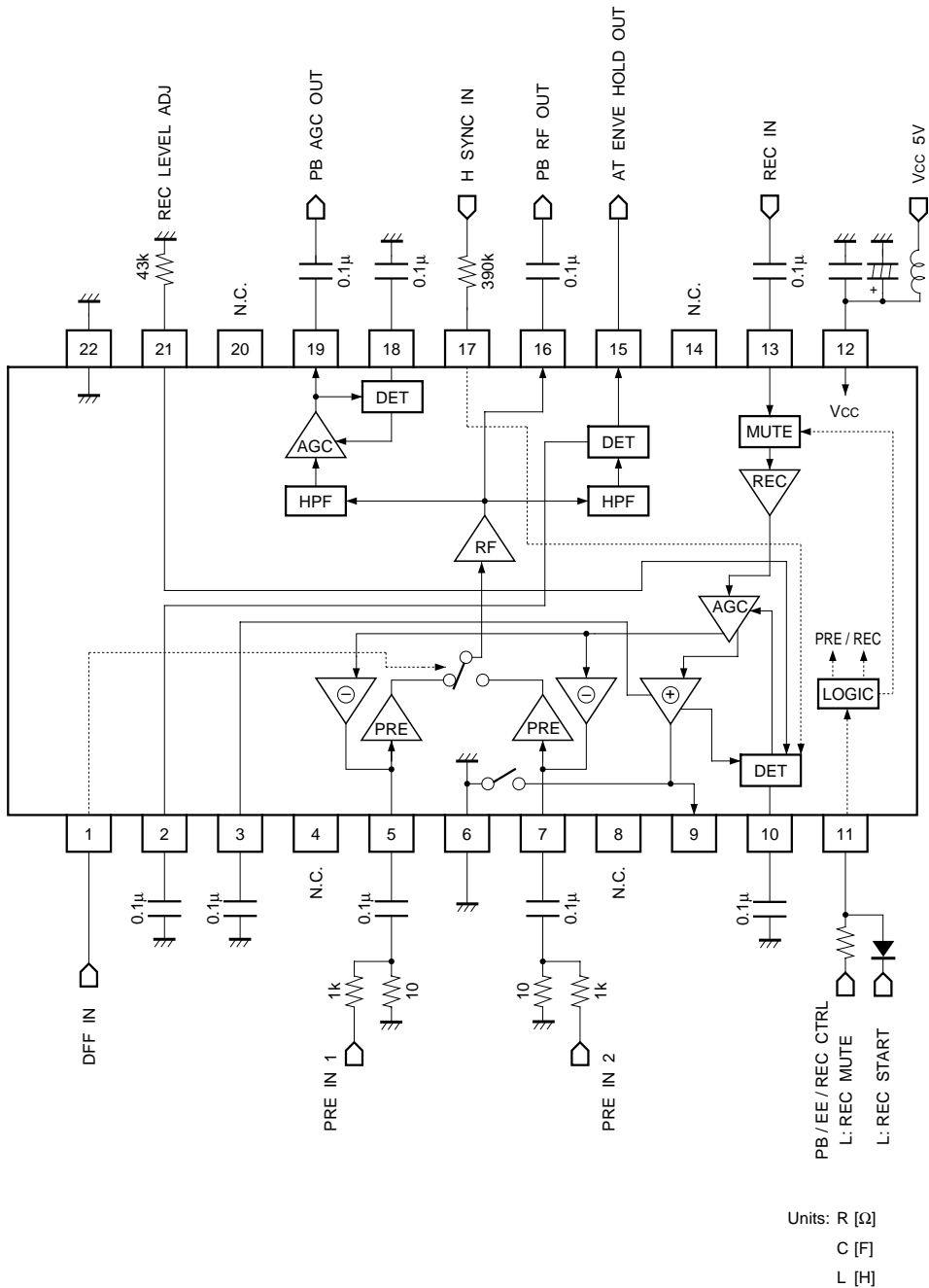


Fig.1

BA7180AS (recording system)

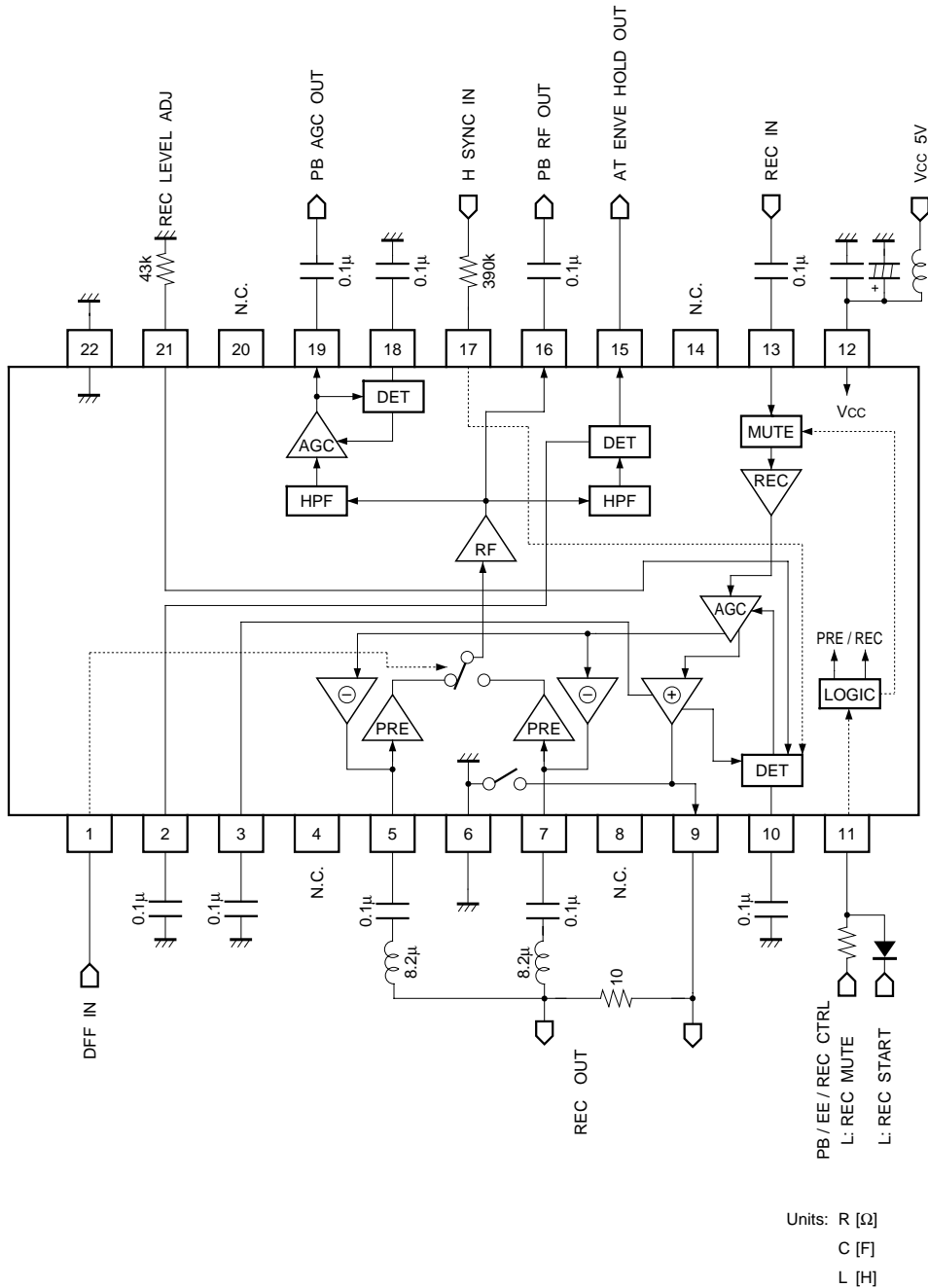
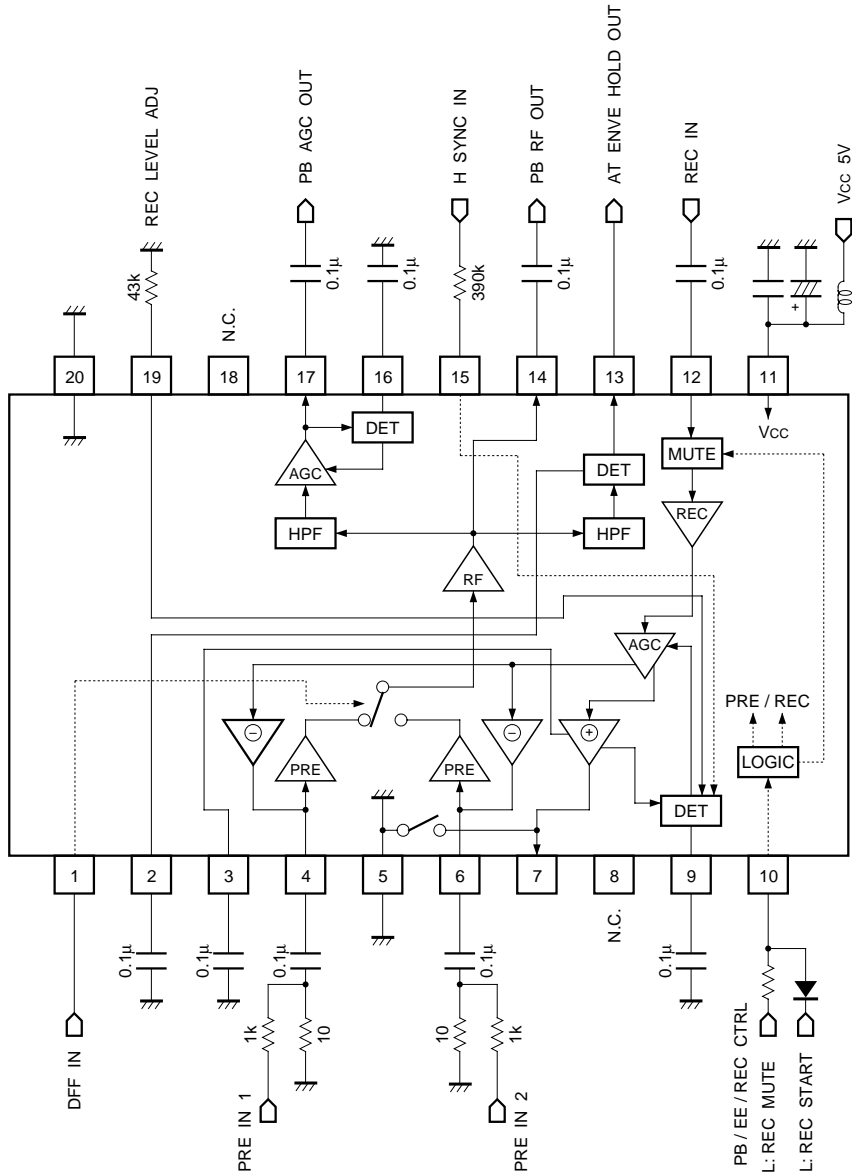


Fig.2

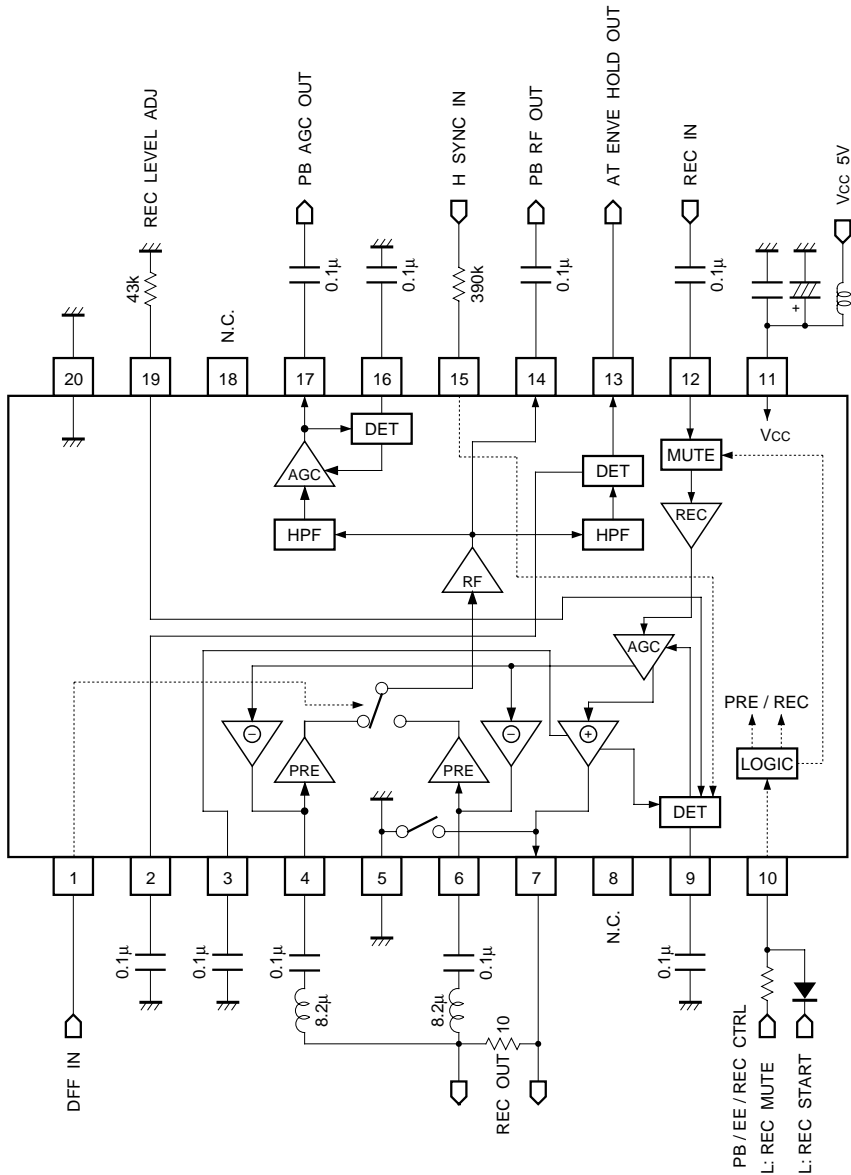
BA7180AFS (playback system)



Units: R [Ω]
 C [F]
 L [H]

Fig.3

BA7180AFS (recording system)



Units: R [Ω]
 C [F]
 L [H]

Fig.4

●Circuit operation

Control system logic table

(1) DFF IN (pin 1)

- Playback input selection (head switching)

| Control pin | Function | Control voltage V_{CTRL1} [V] |
|-------------|-------------------------|------------------------------------|
| DFF IN | Selected playback input | |
| H | Channel 2 (PRE IN2) | 3.5 ~ V_{CC} |
| L | Channel 1 (PRE IN1) | 0.0 ~ 1.2 |

(2) H SYNC IN (BA7180AS: pin 17, BA7180AFS: pin 15)

- Controls recording AGC detector block operation.

| Control pin | Function | Control voltage V_{CTRL1} [V] |
|-------------|--------------|------------------------------------|
| H SYNC | AGC detector | |
| H | ON | 2.7 ~ V_{CC} |
| L | OFF | 0.0 ~ 1.2 |

(3) PB / EE / REC CTRL (BA7180AS: pin 11, BA7180AFS: pin 10)

- Playback / recording mute / recording mode switching

| Control pin PB / EE / REC | Mode | Function | | | | Control voltage V_{CTRL1} [V] |
|------------------------------|----------|----------|---------|----------|---------|------------------------------------|
| | | PRE AMP | AT ENVE | REC MUTE | REC AMP | |
| H | PB | ON | ON | OFF | OFF | 3.8 ~ V_{CC} |
| M | REC MUTE | OFF | OFF | ON | ON | 2.2 ~ 2.8 |
| L | REC | OFF | OFF | OFF | ON | 0.0 ~ 1.2 |

• The PB / EE / REC CTRL pin is pulled up to V_{CC} via a 33k Ω resistor.

●Operation notes

N.C. pins can be connected to GND.

●Application examples

BA7180AS

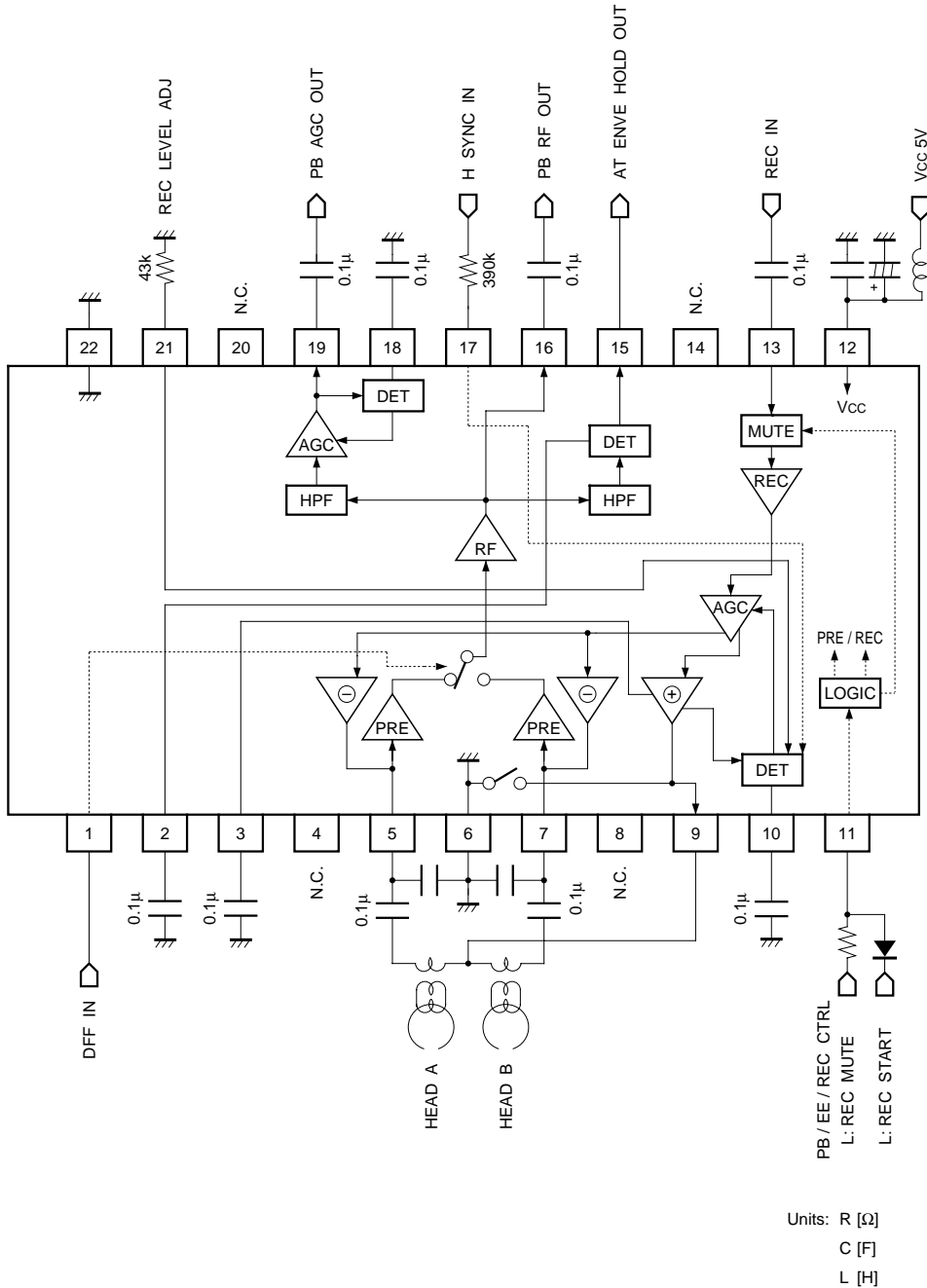
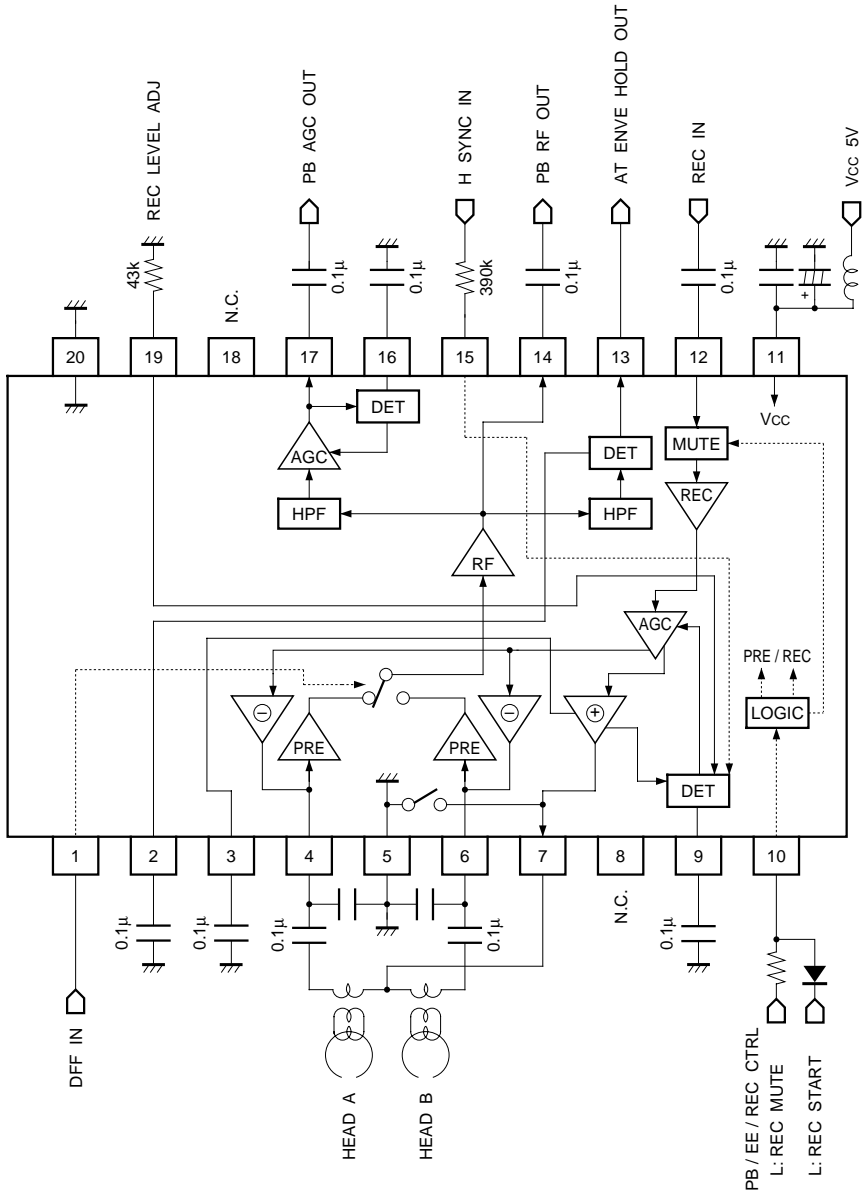


Fig.5

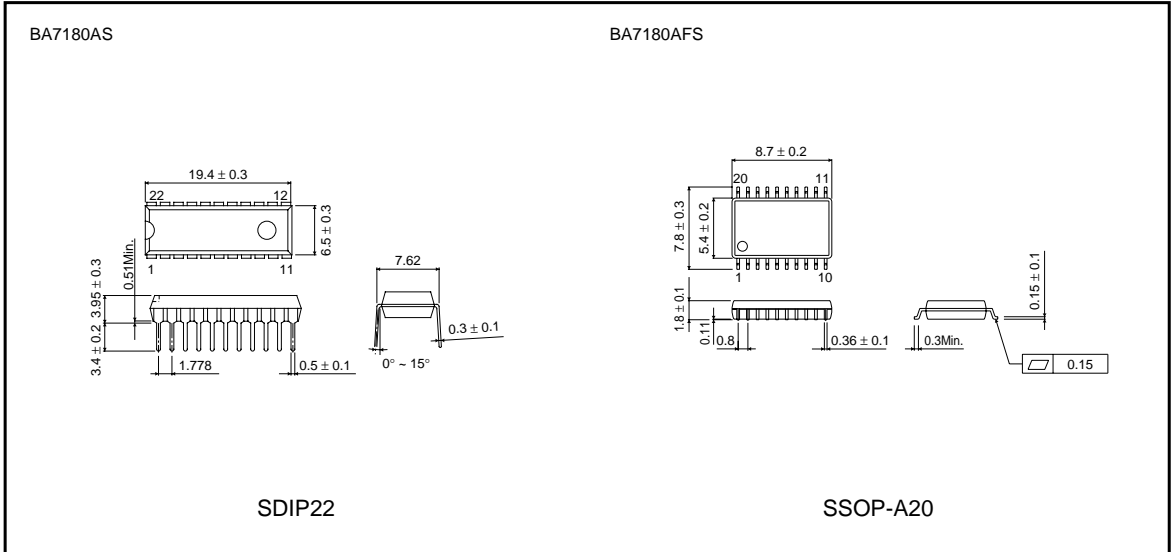
BA7180AFS



Units: R [Ω]
 C [F]
 L [H]

Fig.6

●External dimensions (Units: mm)



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